



RADIO TEST REPORT

Test Report No. : 12212627S-H-R1

Applicant : RICOH IMAGING COMPANT LTD.
Type of Equipment : DIGITAL CAMERA
Model No. : R02010
FCC ID : 2ACZS-R02010
Test regulation : FCC Part 15 Subpart C: 2018
Test Result : Complied

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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 above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
7. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
8. This report is a revised version of 12212627S-H. 12212627S-H is replaced with this report.

Date of test: April 17 to May 16, 2018

Representative test engineer:

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Makoto Hosaka

Engineer

Consumer Technology Division

Approved by:

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Leader

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- ☐ 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

REVISION HISTORY

Original Test Report No.: 12212627S-H

[illegible]

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SECTION 1: Customer information

Company Name	:	RICOH IMAGING COMPANT LTD.
Address	:	1-3-6 Nakamagome Ohta-ku Tokyo, 143-8555, Japan
Telephone Number	:	+81-50-3534-5408
Facsimile Number	:	+81-3-3775-8531
Contact Person	:	Takafumi Okuma

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

2.1 Identification of E.U.T.

Type of Equipment	:	DIGITAL CAMERA
Model No.	:	R02010
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 5 V (USB) DC 3.6 V (Battery)
Receipt Date of Sample	:	April 17, 2018
Country of Mass-production	:	Vietnam
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: R02010 (referred to as the EUT in this report) is a DIGITAL CAMERA.

Radio Specification

WLAN

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS, OFDM
Antenna type	:	$\lambda/4$ Monopole
Antenna Gain	:	-2.1 dBi
Clock frequency (Maximum)	:	200 MHz

Bluetooth Low Energy

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz – 2480 MHz
Modulation	:	GFSK
Antenna type	:	$\lambda/4$ Monopole
Antenna Gain	:	-2.1 dBi
Clock frequency (Maximum)	:	200 MHz

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

* Also the EUT complies with FCC Part 15 Subpart B.

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	QP 24.0 dB, 0.15000 MHz, N Tx 11g 2462 MHz	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: -	FCC: Section 15.247(a)(2) ----- IC: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ----- IC: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: -	FCC: Section 15.247(e) ----- IC: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section15.247(d) ----- IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	3.7 dB 2390.000 MHz, AV, Vert. Tx 11g 2412 MHz	Complied#	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 DTS Meas Guidance v04 12.2.7.

Symbols:

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

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

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

FCC Part 15.31 (e)

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

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	Complied	Conducted

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.

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

3.4 Uncertainty

EMI

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	-	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 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
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 %

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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.

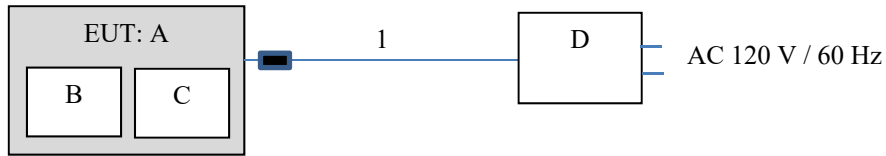
Mode	Remarks*
IEEE 802.11b (11b)	11 Mbps, PN9
IEEE 802.11g (11g)	6 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 1, PN9
Bluetooth Low Energy (BT LE)	PRBS9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 11b, 11g, 11n-20 : 9.5 dBm BT LE : Fixed Software: CPU Ver.00.21.00.05 DSP Ver.00.93.21.02 *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)

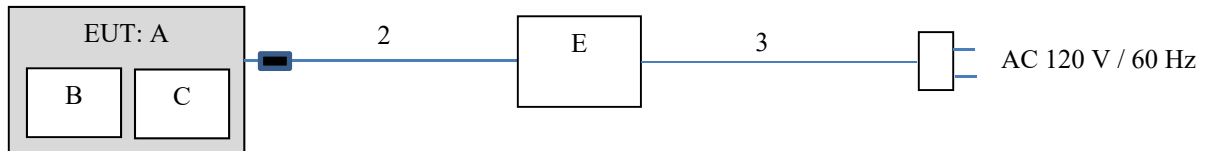
Test Item	Operating Mode	Tested frequency
Conducted Emission	11g Tx	2462 MHz
	BT LE Tx	2402 MHz
		2440 MHz
		2480 MHz
Spurious Emission	11b Tx	2412 MHz
	11g Tx	2437 MHz
	11n-20 Tx	2462 MHz
	BT LE Tx	2402 MHz
2440 MHz		
2480 MHz		
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth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

4.2 Configuration and peripherals

Conducted Emission

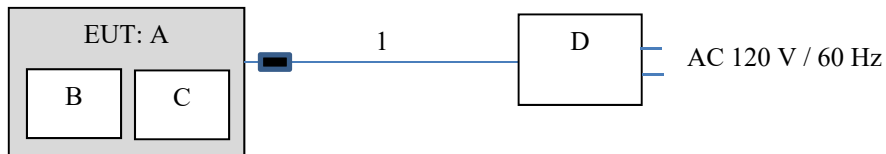


Conducted Emission



* The core is a standard ferrite core attached to DC and USB cable and not used to reduce the noise from the EUT. The core is equivalent to the one which is attached to the DC and USB cable of host device the EUT is installed.

Radiated Spurious Emission, Antenna terminal conducted



 : Standard ferrite core

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

* 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	DIGITAL CAMERA	R02010	0000010 *1) 0000031 *2) 0000020 *3)	RICOH IMAGING COMPANY, LTD.	EUT
B	SDHC Memory Card	SD-K08G	1422UL3928T	TOSHIBA	-
C	LI-ION BATTERY PACK	DB-110	-	RICOH IMAGING COMPANY, LTD.	-
D	USB Power Adapter	AC-U2	U2-11	RICOH IMAGING COMPANY, LTD.	-
E	AC Adapter	D-AC166	PP-11	RICOH IMAGING COMPANY, LTD.	-

*1) Used for Antenna Terminal conducted test (Wireless LAN)

*2) Used for Antenna Terminal conducted test (Bluetooth LE)

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

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	0.7	Shielded	Shielded	-
2	DC	1.0	Shielded	Shielded	-
3	AC	1.8	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT was aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm 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.

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

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 "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]

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

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 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	Average Power Method: <u>12.2.5.2</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3.95 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		3.95 m *2) (1 GHz – 13 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

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

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

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- 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.

Combinations of the worst case

Antenna polarization \ Frequency	Carrier	Spurious			
		Below 1 GHz	1 GHz - 13 GHz	13 GHz – 18 GHz	18 GHz – 26.5 GHz
Horizontal	X	Y	X	X	X
Vertical	Y	X	Y	X	X

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

Measurement range : 30 MHz - 26.5 GHz

Test data : APPENDIX

Test result : Pass

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 (WLAN) 10 MHz (BT LE)	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)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04". *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)							

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

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

DATA OF CONDUCTED EMISSION TEST

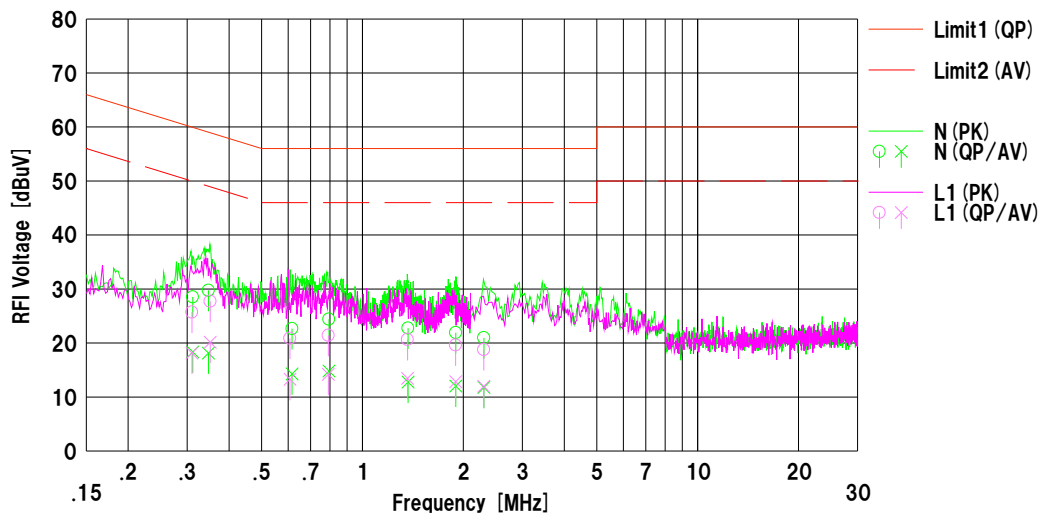
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2018/04/22

Mode : Tx 11g 2462 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 24 deg.C / 41 %RH

Remarks : (AC Adapter) M/N: AC-U2, S/N: U2-11

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Yasumasa Owaki



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.31157	16.00	5.80	12.53	28.53	18.33	59.93	49.93	31.4	31.6	N	
2	0.34723	17.20	5.60	12.54	29.74	18.14	59.03	49.03	29.2	30.8	N	
3	0.61654	10.10	1.70	12.57	22.67	14.27	56.00	46.00	33.3	31.7	N	
4	0.79449	11.80	2.20	12.61	24.41	14.81	56.00	46.00	31.5	31.1	N	
5	1.36798	10.10	0.10	12.66	22.76	12.76	56.00	46.00	33.2	33.2	N	
6	1.89881	9.20	-0.70	12.72	21.92	12.02	56.00	46.00	34.0	33.9	N	
7	2.30334	8.20	-1.00	12.77	20.97	11.77	56.00	46.00	35.0	34.2	N	
8	0.30992	13.20	5.60	12.53	25.73	18.13	59.97	49.97	34.2	31.8	L1	
9	0.35162	15.20	7.60	12.54	27.74	20.14	58.92	48.92	31.1	28.7	L1	
10	0.60780	8.30	0.70	12.56	20.86	13.26	56.00	46.00	35.1	32.7	L1	
11	0.79141	8.80	1.60	12.61	21.41	14.21	56.00	46.00	34.5	31.7	L1	
12	1.36270	8.00	0.80	12.66	20.66	13.46	56.00	46.00	35.3	32.5	L1	
13	1.89680	6.90	0.10	12.72	19.62	12.82	56.00	46.00	36.3	33.1	L1	
14	2.30142	6.00	-0.80	12.77	18.77	11.97	56.00	46.00	37.2	34.0	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) = SLS-02

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DATA OF CONDUCTED EMISSION TEST

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Date : 2018/04/22

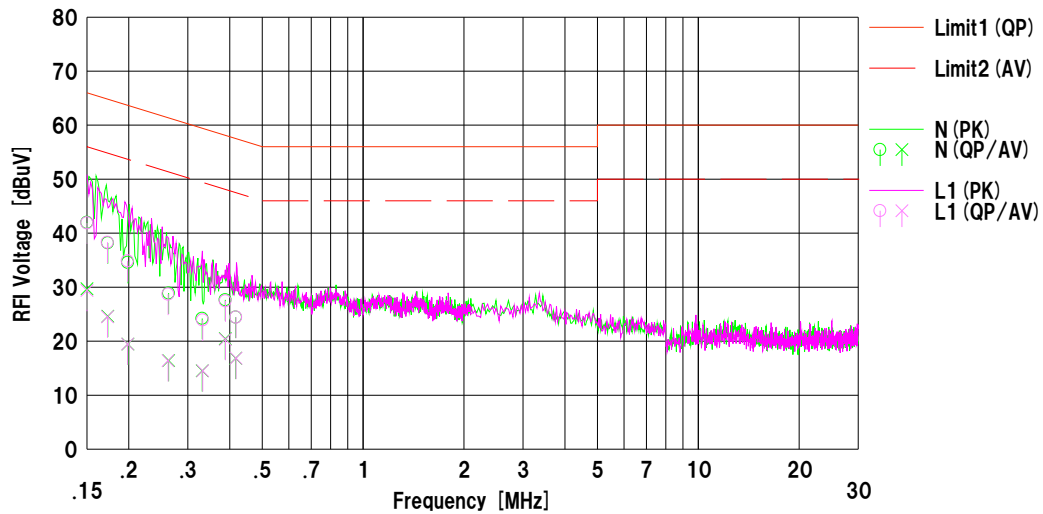
Mode : Tx 11g 2462 MHz

Power : AC 120 V / 60 Hz
Temp./Humi. : 24 deg.C / 41 %RH

Remarks : (AC Adapter) M/N: D-AC166, S/N: PP-11

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Yasumasa Owaki



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	29.60	17.30	12.40	42.00	29.70	66.00	56.00	24.0	26.3	N	
2	0.17303	25.80	12.20	12.41	38.21	24.61	64.81	54.81	26.6	30.2	N	
3	0.19871	22.20	7.10	12.38	34.58	19.48	63.66	53.66	29.0	34.1	N	
4	0.26292	16.50	4.00	12.41	28.91	16.41	61.34	51.34	32.4	34.9	N	
5	0.33121	11.80	2.10	12.42	24.22	14.52	59.42	49.42	35.2	34.9	N	
6	0.38803	15.20	8.00	12.45	27.65	20.45	58.11	48.11	30.4	27.6	N	
7	0.41694	12.00	4.40	12.45	24.45	16.85	57.51	47.51	33.0	30.6	N	
8	0.15000	29.50	17.00	12.40	41.90	29.40	66.00	56.00	24.1	26.6	L1	
9	0.17272	25.90	12.10	12.42	38.32	24.52	64.83	54.83	26.5	30.3	L1	
10	0.19832	22.50	7.10	12.38	34.88	19.48	63.68	53.68	28.8	34.2	L1	
11	0.26197	16.30	4.00	12.40	28.70	16.40	61.37	51.37	32.6	34.9	L1	
12	0.33216	11.50	2.10	12.42	23.92	14.52	59.40	49.40	35.4	34.8	L1	
13	0.38819	15.00	7.90	12.45	27.45	20.35	58.10	48.10	30.6	27.7	L1	
14	0.41758	12.00	4.40	12.45	24.45	16.85	57.50	47.50	33.0	30.6	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) = SLS-02

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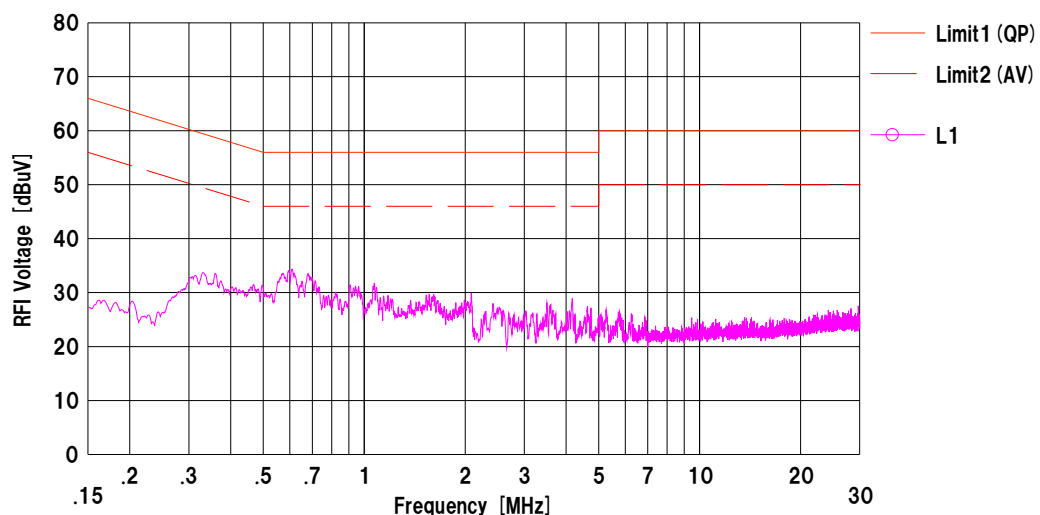
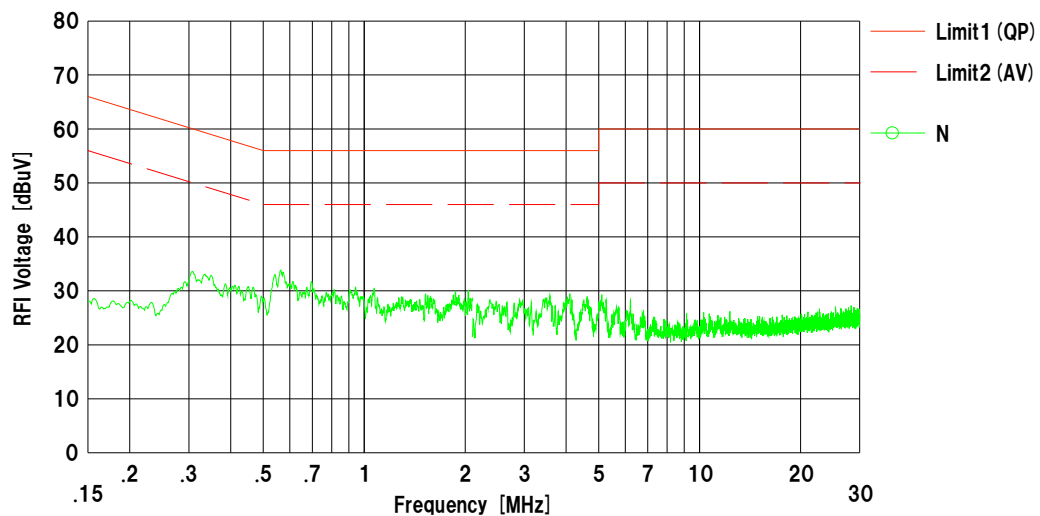
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/05/15

Mode : Tx_BLE_2402MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 25 deg.C / 43 %RH
Remarks : AC Adapter: AC-U2

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Makoto Hosaka



Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) : SLS-02

DATA OF CONDUCTED EMISSION TEST

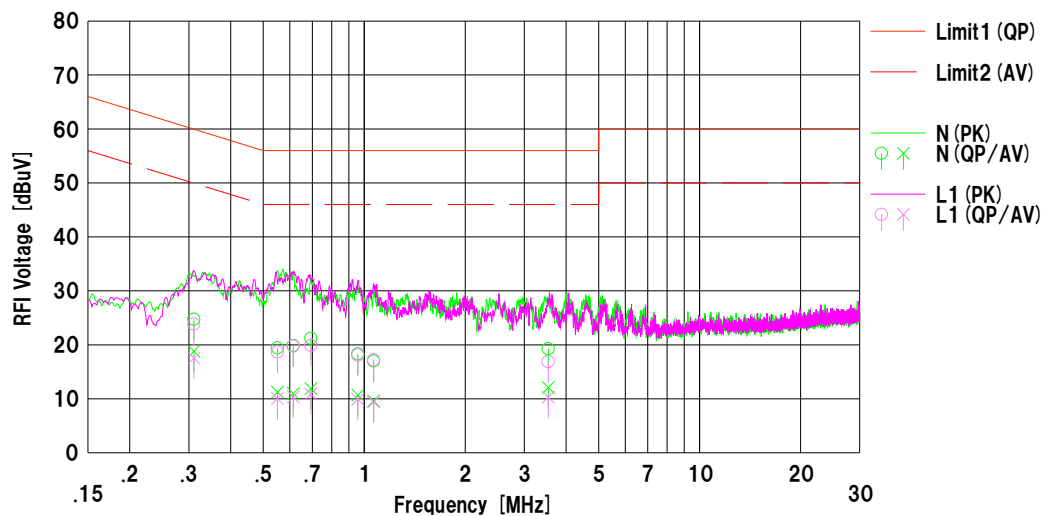
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/05/15

Mode : Tx_BLE_2440MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 25 deg.C / 43 %RH

Remarks : AC Adapter: AC-U2

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Makoto Hosaka



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.31064	12.20	6.30	12.52	24.72	18.82	59.95	49.95	35.2	31.1	N	
2	0.55123	6.90	-1.30	12.54	19.44	11.24	56.00	46.00	36.5	34.7	N	
3	0.61440	7.30	-1.60	12.56	19.86	10.96	56.00	46.00	36.1	35.0	N	
4	0.69365	8.60	-0.70	12.59	21.19	11.89	56.00	46.00	34.8	34.1	N	
5	0.95688	5.70	-1.90	12.60	18.30	10.70	56.00	46.00	37.7	35.3	N	
6	1.06745	4.40	-3.00	12.60	17.00	9.60	56.00	46.00	39.0	36.4	N	
7	3.53777	6.40	-0.80	12.88	19.28	12.08	56.00	46.00	36.7	33.9	N	
8	0.31064	11.30	5.00	12.52	23.82	17.52	59.95	49.95	36.1	32.4	L1	
9	0.55123	6.10	-2.50	12.54	18.64	10.04	56.00	46.00	37.3	35.9	L1	
10	0.61440	7.20	-2.20	12.56	19.76	10.36	56.00	46.00	36.2	35.6	L1	
11	0.69365	7.30	-1.70	12.59	19.89	10.89	56.00	46.00	36.1	35.1	L1	
12	0.95688	5.50	-2.70	12.60	18.10	9.90	56.00	46.00	37.9	36.1	L1	
13	1.06745	4.60	-3.20	12.60	17.20	9.40	56.00	46.00	38.8	36.6	L1	
14	3.53777	4.00	-2.60	12.88	16.88	10.28	56.00	46.00	39.1	35.7	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) : SLS-02

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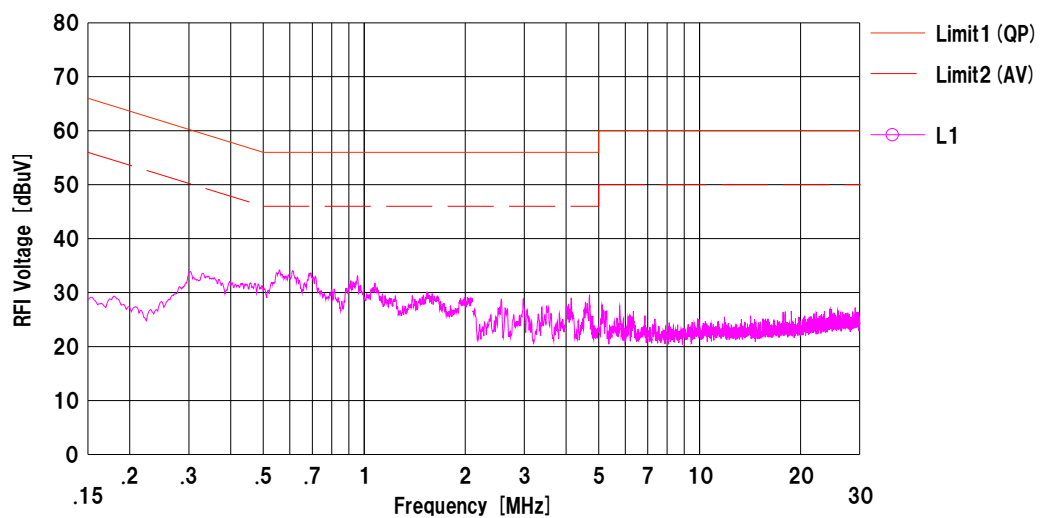
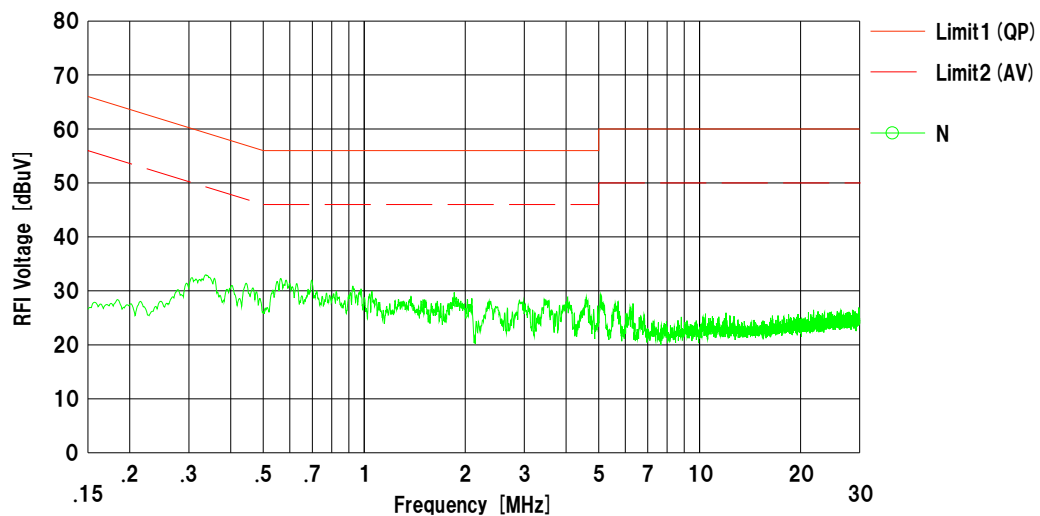
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/05/15

Mode : Tx_BLE_2480MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 25 deg.C / 43 %RH
Remarks : AC Adapter: AC-U2

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Makoto Hosaka



Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) : SLS-02

DATA OF CONDUCTED EMISSION TEST

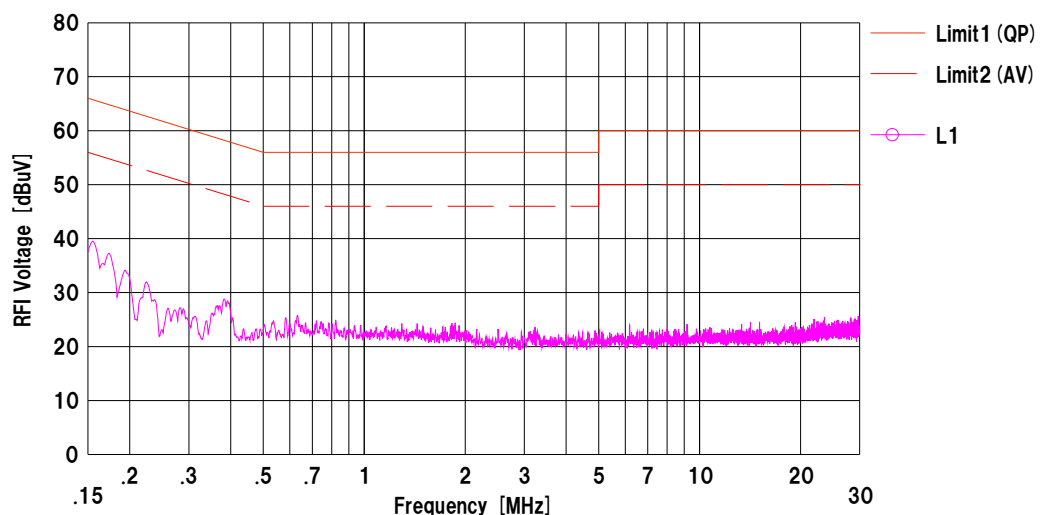
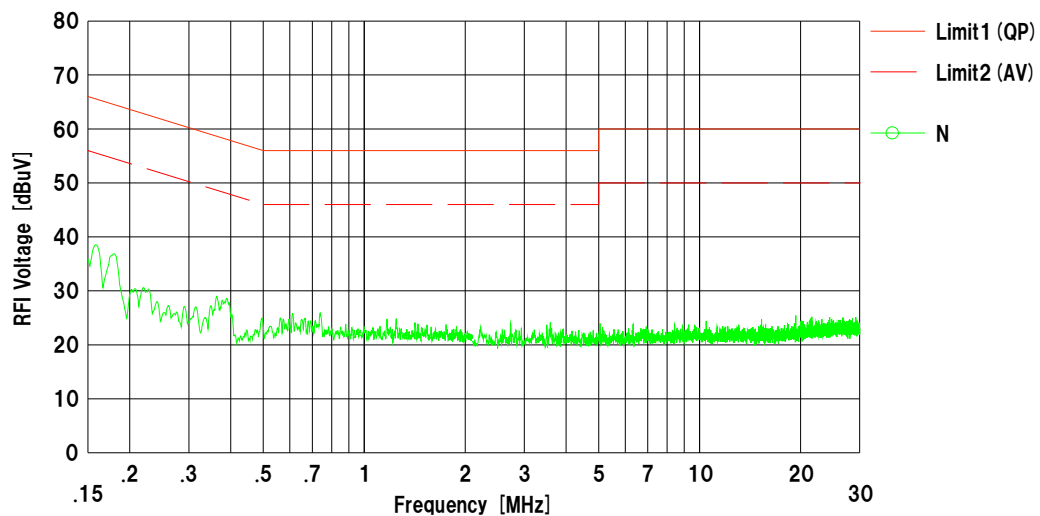
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/05/15

Remarks : AC Adapter: D-AC166

Mode : Tx_BLE_2402MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 25 deg.C / 43 %RH

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Makoto Hosaka



Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) : SLS-02

DATA OF CONDUCTED EMISSION TEST

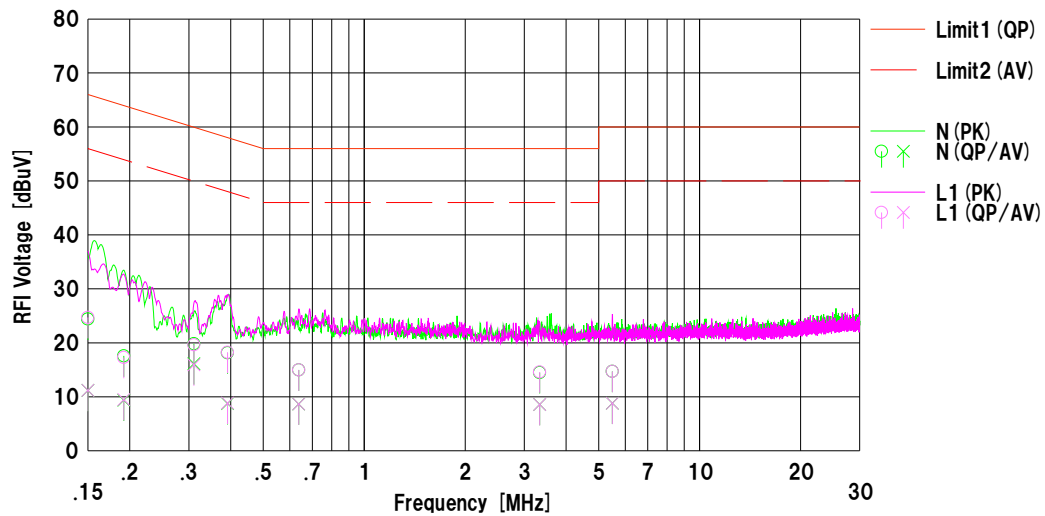
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/05/15

Mode : Tx_BLE_2440MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 25 deg.C / 43 %RH

Remarks : AC Adapter: D-AC166

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Makoto Hosaka



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	12.00	-1.20	12.40	24.40	11.20	66.00	56.00	41.6	44.8	N	
2	0.19191	5.20	-3.00	12.38	17.58	9.38	63.95	53.95	46.3	44.5	N	
3	0.31046	7.40	3.70	12.42	19.82	16.12	59.96	49.96	40.1	33.8	N	
4	0.39128	5.70	-3.70	12.44	18.14	8.74	58.04	48.04	39.9	39.3	N	
5	0.63786	2.50	-3.80	12.46	14.96	8.66	56.00	46.00	41.0	37.3	N	
6	3.33568	1.90	-4.00	12.59	14.49	8.59	56.00	46.00	41.5	37.4	N	
7	5.49345	2.00	-3.90	12.71	14.71	8.81	60.00	50.00	45.2	41.1	N	
8	0.15000	12.30	-1.20	12.40	24.70	11.20	66.00	56.00	41.3	44.8	L1	
9	0.19191	4.90	-2.90	12.38	17.28	9.48	63.95	53.95	46.6	44.4	L1	
10	0.31046	7.20	3.50	12.42	19.62	15.92	59.96	49.96	40.3	34.0	L1	
11	0.39128	5.80	-3.60	12.44	18.24	8.84	58.04	48.04	39.8	39.2	L1	
12	0.63786	2.50	-3.80	12.46	14.96	8.66	56.00	46.00	41.0	37.3	L1	
13	3.33568	2.00	-4.00	12.59	14.59	8.59	56.00	46.00	41.4	37.4	L1	
14	5.49345	2.00	-3.90	12.71	14.71	8.81	60.00	50.00	45.2	41.1	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) : SLS-02

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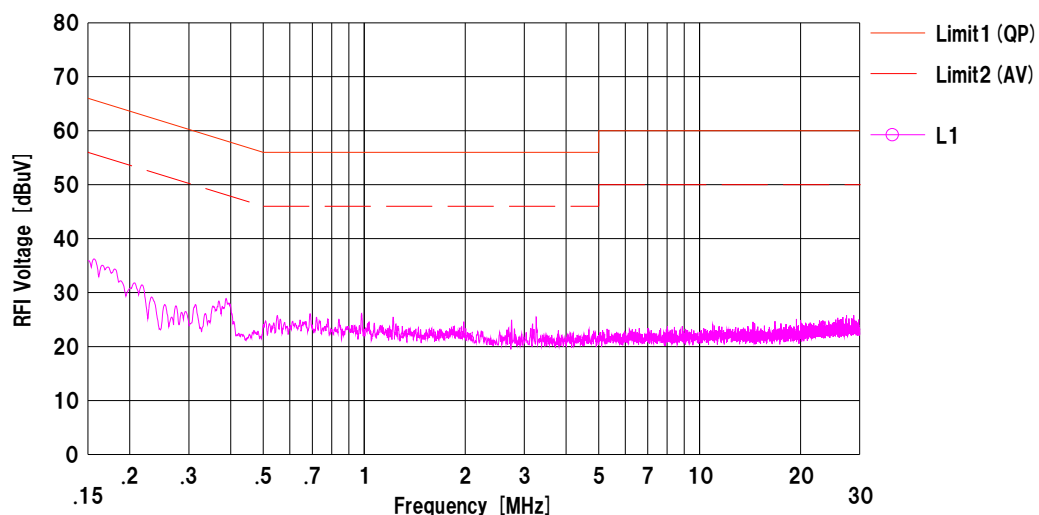
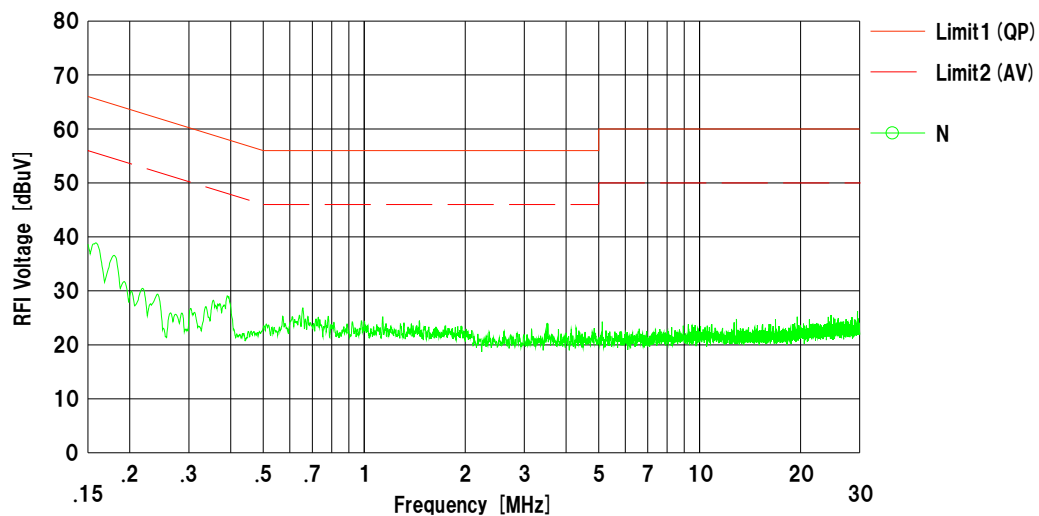
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/05/15

Mode : Tx_BLE_2480MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 25 deg.C / 43 %RH
Remarks : AC Adapter: D-AC166

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Makoto Hosaka



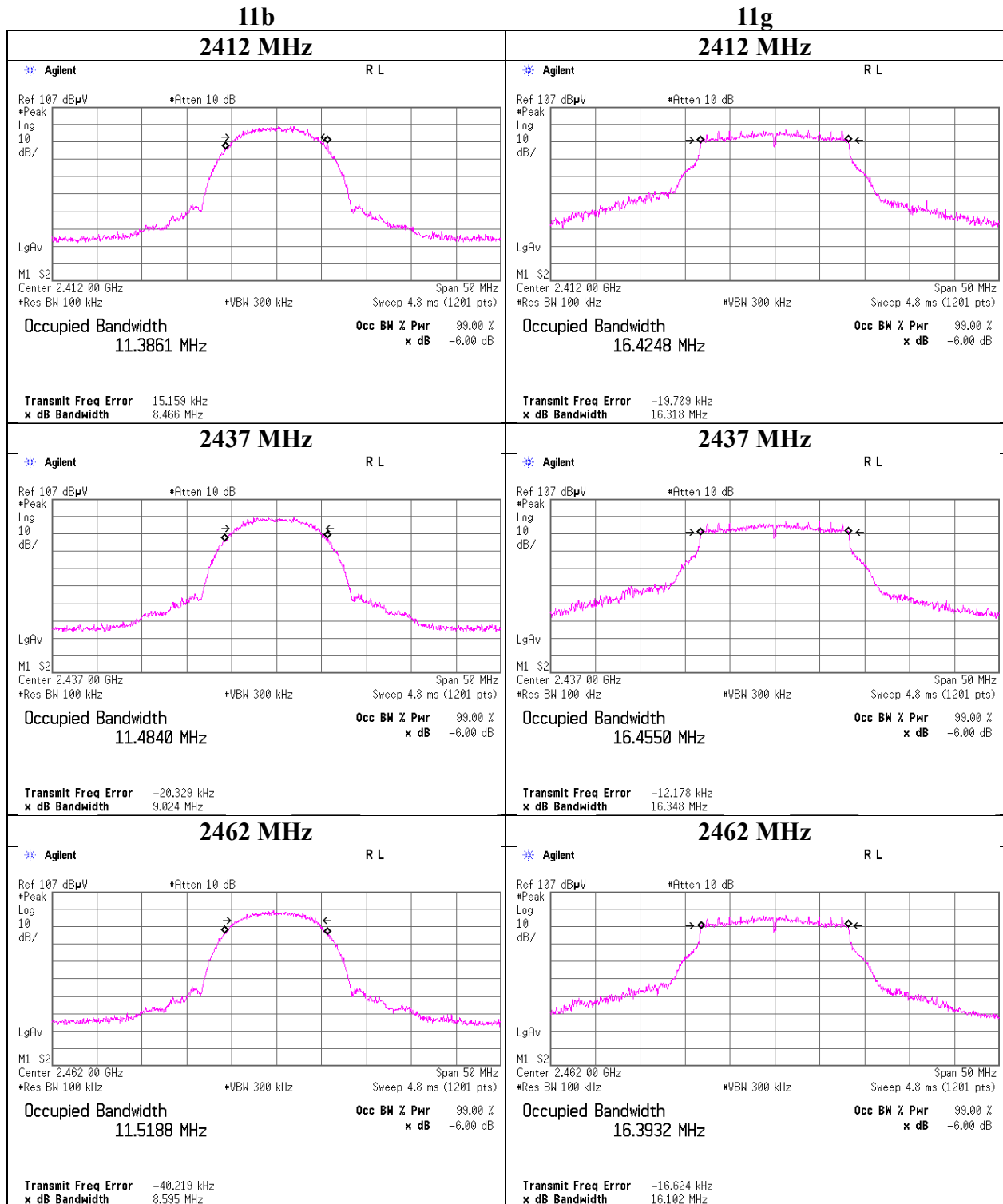
Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) : SLS-02

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	12212627S-H-R1	
Test place	Shonan EMC Lab. No.1 Measurement Room	No.5 Shielded room
Date	April 17, 2018	May 15, 2018
Temperature / Humidity	26 deg. C / 31 % RH	25 deg. C / 37 % RH
Engineer	Yosuke Ishikawa	Makoto Hosaka
Mode	Tx	

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	11362.9	8.466	> 0.5000
	2437	11494.2	9.024	> 0.5000
	2462	11515.6	8.595	> 0.5000
11g	2412	16931.0	16.318	> 0.5000
	2437	17006.2	16.348	> 0.5000
	2462	16891.7	16.102	> 0.5000
11n-20	2412	17889.7	17.166	> 0.5000
	2437	18010.3	17.000	> 0.5000
	2462	17897.9	15.743	> 0.5000
BT LE	2402	1066.0	0.715	> 0.5000
	2440	1065.0	0.736	> 0.5000
	2480	1068.6	0.734	> 0.5000

6dB Bandwidth



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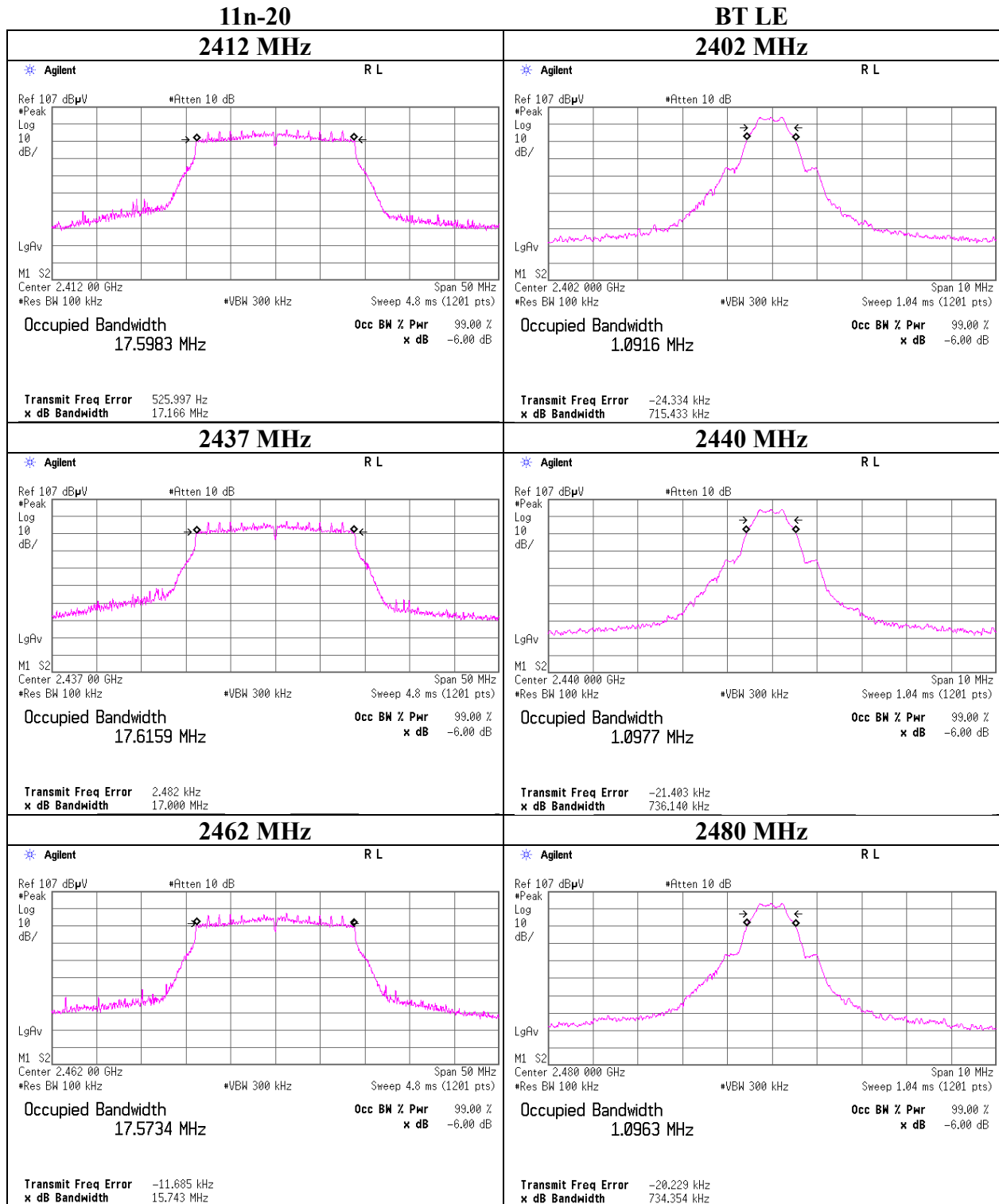
Shonan EMC Lab.

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6dB Bandwidth



UL Japan, Inc.

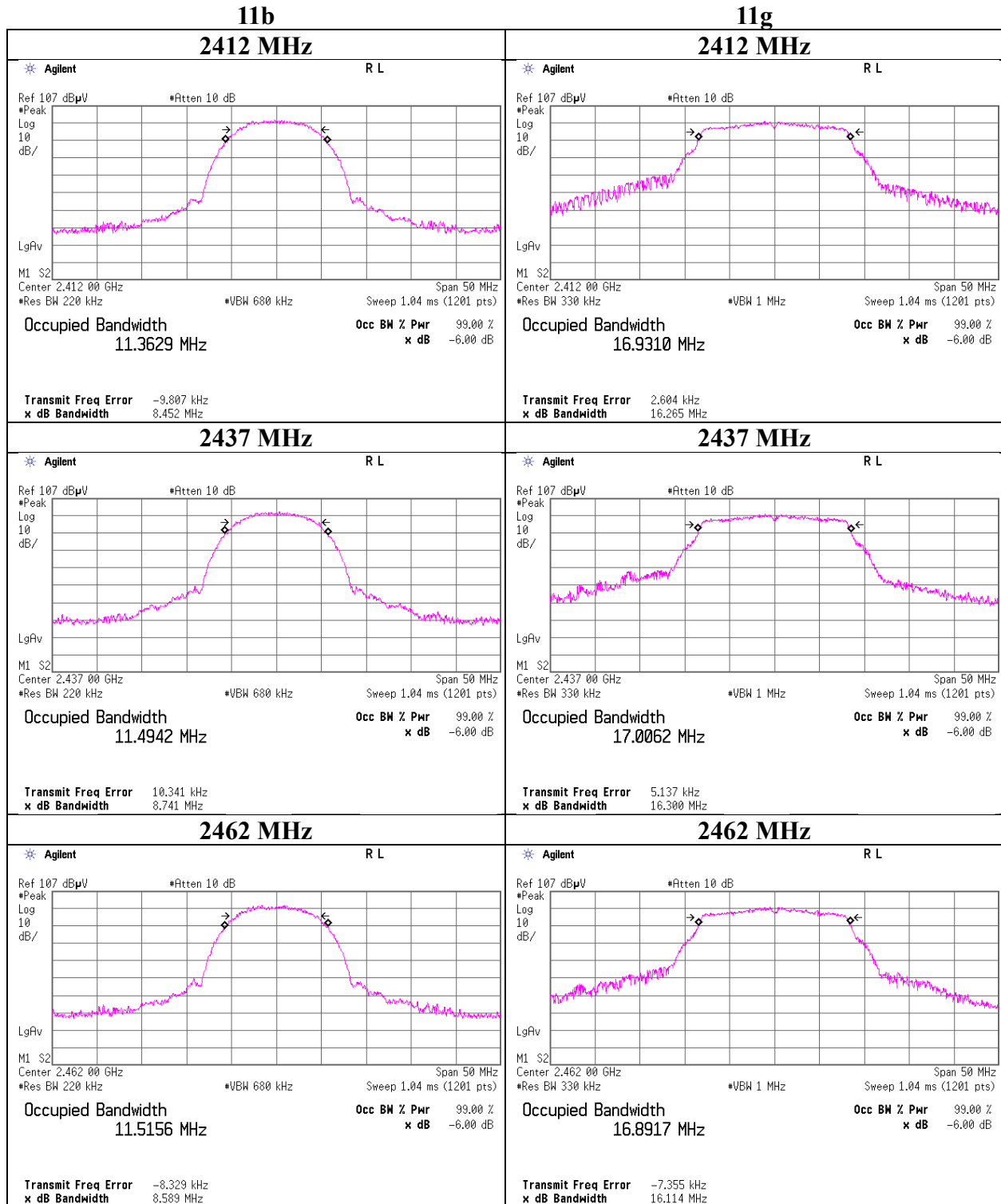
Shonan EMC Lab.

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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99%Occupied Bandwidth



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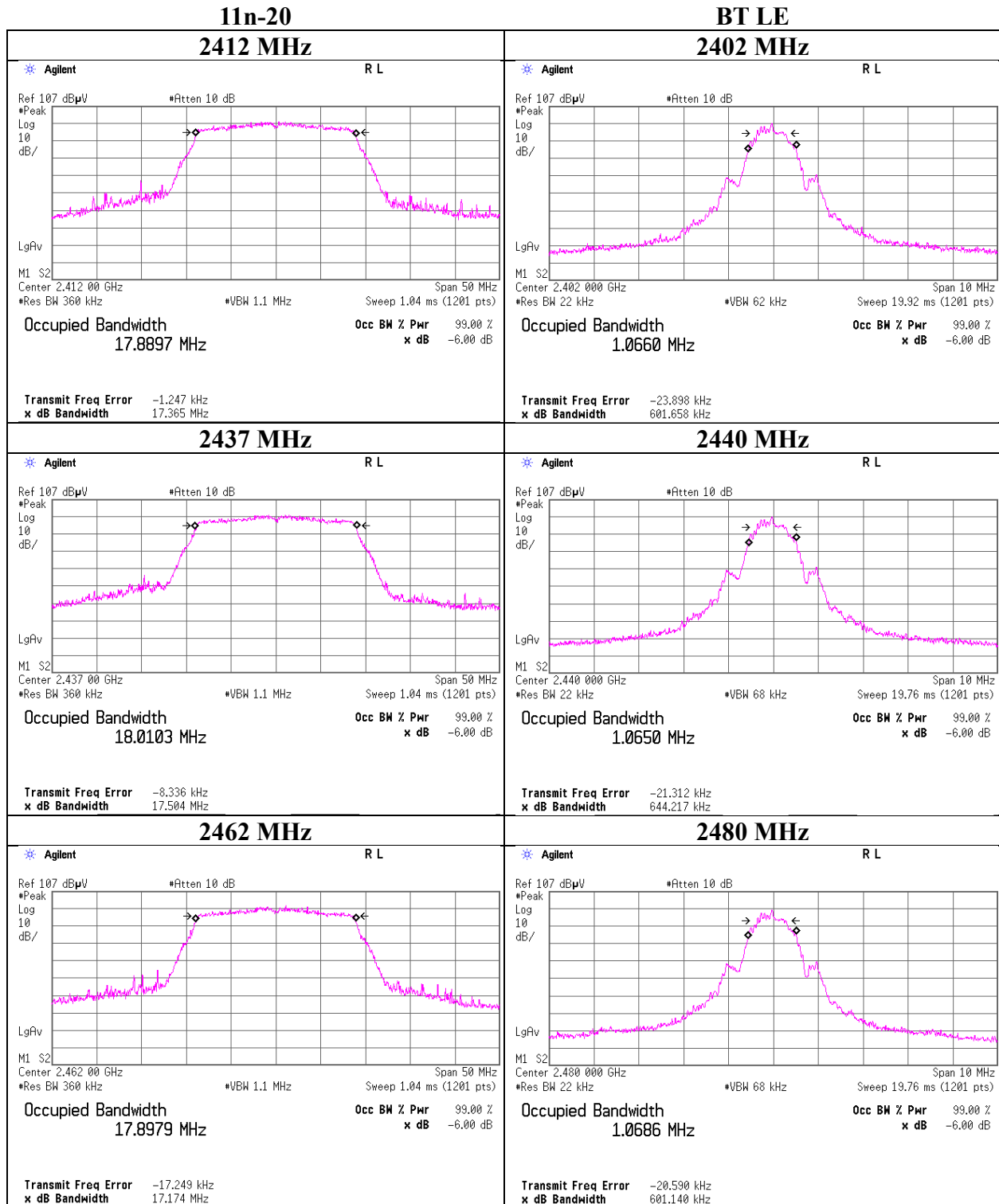
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Facsimile : +81 463 50 6401

99% Occupied Bandwidth



Maximum Peak Output Power

Report No.	12212627S-H-R1		
Test place	Shonan EMC Lab. No.1 Measurement Room		
Date	April 17, 2018	April 18, 2018	
Temperature / Humidity	26 deg. C / 31 % RH	23 deg. C / 44 % RH	
Engineer	Yosuke Ishikawa	Yosuke Ishikawa	
Mode	Tx 11b		

				Conducted Power				
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	1.64	1.48	9.86	12.98	19.86	30.00	1000	17.02
2437	1.87	1.48	9.86	13.21	20.94	30.00	1000	16.79
2462	1.58	1.49	9.85	12.92	19.59	30.00	1000	17.08

Sample Calculation:

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

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

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	0.95	
2	1.65	
5.5	1.66	
11	1.87	*

*: Worst Rate

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

Maximum Peak Output Power

Report No.	12212627S-H-R1
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	April 17, 2018 April 18, 2018
Temperature / Humidity	26 deg. C / 31 % RH 23 deg. C / 44 % RH
Engineer	Yosuke Ishikawa Yosuke Ishikawa
Mode	Tx 11g

				Conducted Power				
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	
2412	10.47	1.48	9.86	21.81	151.71	30.00	1000	8.19
2437	10.61	1.48	9.86	21.95	156.68	30.00	1000	8.05
2462	10.64	1.49	9.85	21.98	157.76	30.00	1000	8.02

Sample Calculation:

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

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

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

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	10.61	*
9	9.99	
12	9.31	
18	9.31	
24	9.46	
36	8.65	
48	10.51	
54	8.07	

*: Worst Rate

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

Maximum Peak Output Power

Report No.	12212627S-H-R1
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	April 17, 2018 April 18, 2018
Temperature / Humidity	26 deg. C / 31 % RH 23 deg. C / 44 % RH
Engineer	Yosuke Ishikawa Yosuke Ishikawa
Mode	Tx 11n-20

				Conducted Power				
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	10.48	1.48	9.86	21.82	152.05	30.00	1000	8.18
2437	10.62	1.48	9.86	21.96	157.04	30.00	1000	8.04
2462	10.45	1.49	9.85	21.79	151.01	30.00	1000	8.21

Sample Calculation:

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

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

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

2437 MHz

MCS Number	Reading [dBm]	Remark
0	10.30	
1	10.62	*
2	10.22	
3	9.62	
4	9.95	
5	10.56	
6	9.99	
7	9.71	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12212627S-H-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date May 15, 2018
Temperature / Humidity 25 deg. C / 37 % RH
Engineer Makoto Hosaka
Mode Tx BT LE

				Conducted Power				
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	
2402	-5.56	1.48	10.18	6.10	4.07	30.00	1000	23.90
2440	-5.45	1.48	10.18	6.21	4.18	30.00	1000	23.79
2480	-6.15	1.49	10.18	5.52	3.56	30.00	1000	24.48

Sample Calculation:

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

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

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

Average Output Power
(Reference data for RF Exposure / SAR testing)

Report No. 12212627S-H-R1
Test place Shonan EMC Lab. No.1 Measurement Room No.5 Shielded room
Date April 17, 2018 May 15, 2018
Temperature / Humidity 26 deg. C / 31 % RH 25 deg. C / 37 % RH
Engineer Yosuke Ishikawa Makoto Hosaka
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	-2.36	1.48	9.86	8.98	7.91	0.04	9.02	7.98
2437	-2.48	1.48	9.86	8.86	7.69	0.04	8.90	7.76
2462	-2.85	1.49	9.85	8.49	7.06	0.04	8.53	7.13

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-1.76	1.48	9.86	9.58	9.08	0.30	9.88	9.73
2437	-1.66	1.48	9.86	9.68	9.29	0.30	9.98	9.95
2462	-1.78	1.49	9.85	9.56	9.04	0.30	9.86	9.68

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	-2.60	1.48	9.86	8.74	7.48	0.31	9.05	8.04
2437	-1.88	1.48	9.86	9.46	8.83	0.31	9.77	9.48
2462	-2.21	1.49	9.85	9.13	8.18	0.31	9.44	8.79

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	-7.79	1.48	10.18	3.87	2.44	1.93	5.80	3.80
2440	-7.67	1.48	10.18	3.99	2.51	1.93	5.92	3.91
2480	-8.42	1.49	10.18	3.25	2.11	1.93	5.18	3.30

Sample Calculation:

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

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

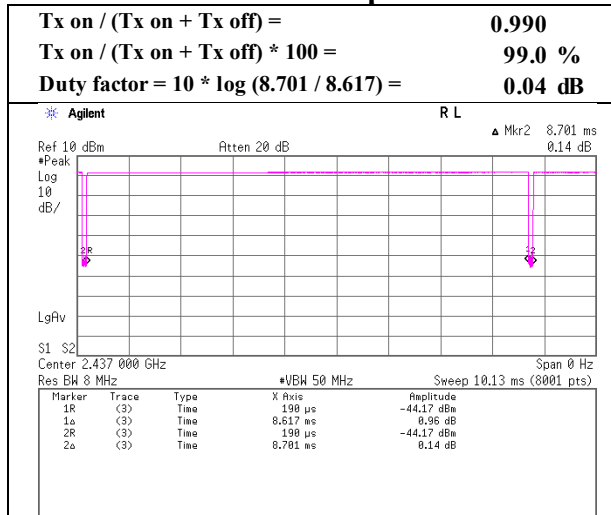
*The equipment and cables were not used for factor 0 dB of the data sheets.

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.

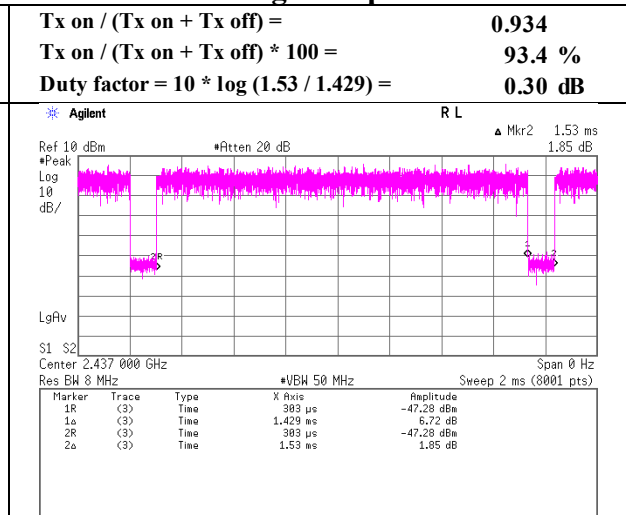
Burst rate confirmation (for Average Output Power)

Report No.	12212627S-H-R1	No.5 Shielded room
Test place	Shonan EMC Lab. No.1 Measurement Room	May 15, 2018
Date	April 17, 2018	25 deg. C / 37 % RH
Temperature / Humidity	26 deg. C / 31 % RH	Makoto Hosaka
Engineer	Yosuke Ishikawa	
Mode	Tx	

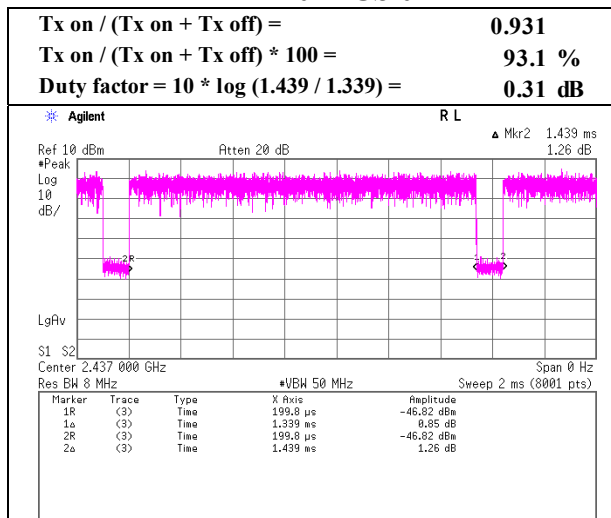
11b 1 Mbps



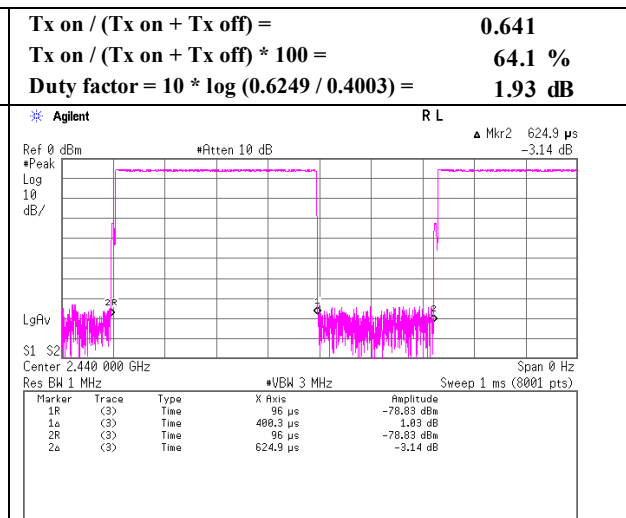
11g 6 Mbps



11n-20 MCS 0



BT LE



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

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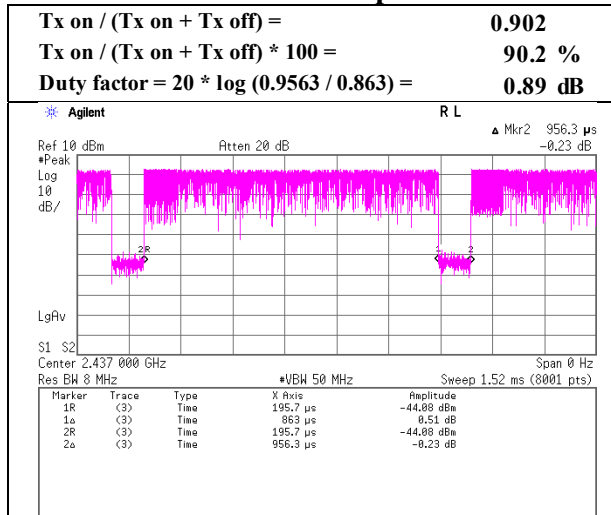
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

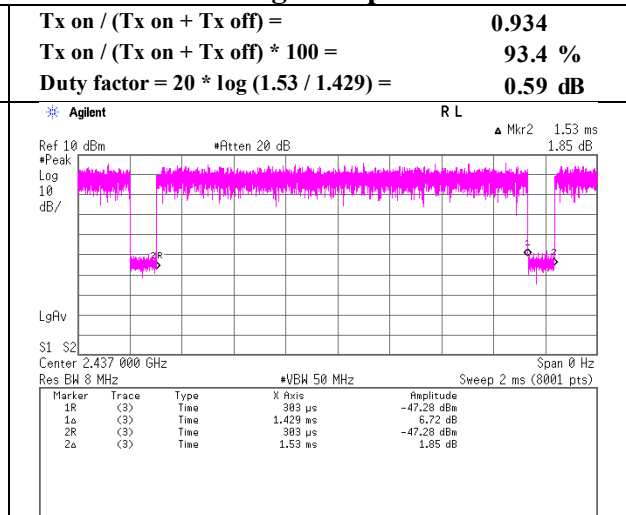
Burst rate confirmation (for Radiated Spurious Emission)

Report No.	12212627S-H-R1	No.5 Shielded room
Test place	Shonan EMC Lab. No.1 Measurement Room	May 15, 2018
Date	April 17, 2018	25 deg. C / 37 % RH
Temperature / Humidity	26 deg. C / 31 % RH	Makoto Hosaka
Engineer	Yosuke Ishikawa	
Mode	Tx	

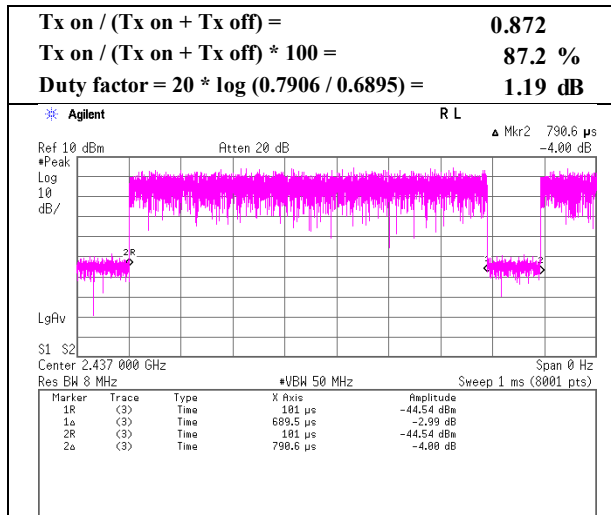
11b 11 Mbps



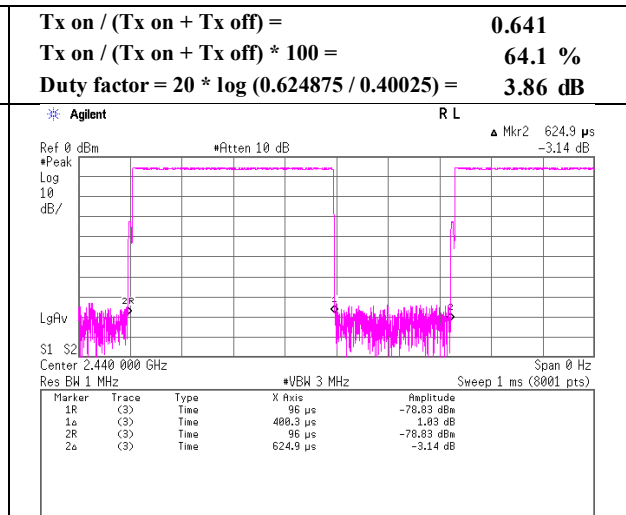
11g 6 Mbps



11n-20 MCS 1



BT LE



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

Radiated Spurious Emission

Report No.	12212627S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	2	2
Date	April 25, 2018	April 21, 2018	April 22, 2018
Temperature / Humidity	25 deg. C / 48 % RH	23 deg. C / 50 % RH	21 deg. C / 51 % RH
Engineer	Kazuya Noda	Yosuke Ishikawa	Yasumasa Owaki
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11b 2412 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	49.38	27.26	14.15	44.13	2.39	49.05	73.90	24.8	200	223	
Hori.	4824.000	PK	44.23	31.19	6.56	36.88	2.39	47.49	73.90	26.4	100	0	
Hori.	7236.000	PK	44.56	36.53	7.61	37.30	2.39	53.79	73.90	20.1	100	0	
Hori.	9648.000	PK	46.10	38.28	8.72	38.52	2.39	56.97	73.90	16.9	100	0	
Vert.	2390.000	PK	50.03	27.26	14.15	44.13	2.39	49.70	73.90	24.2	366	315	
Vert.	4824.000	PK	44.71	31.19	6.56	36.88	2.39	47.97	73.90	25.9	100	0	
Vert.	7236.000	PK	45.43	36.53	7.61	37.30	2.39	54.66	73.90	19.2	100	0	
Vert.	9648.000	PK	45.62	38.28	8.72	38.52	2.39	56.49	73.90	17.4	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.	2390.000	AV	39.92	27.26	14.15	44.13	0.89	2.39	40.48	53.90	13.4	*1)
Hori.	4824.000	AV	34.91	31.19	6.56	36.88	0.89	2.39	39.06	53.90	14.8	
Hori.	7236.000	AV	36.28	36.53	7.61	37.30	0.89	2.39	46.40	53.90	7.5	
Hori.	9648.000	AV	37.60	38.28	8.72	38.52	0.89	2.39	49.36	53.90	4.5	
Vert.	2390.000	AV	39.95	27.26	14.15	44.13	0.89	2.39	40.51	53.90	13.4	*1)
Vert.	4824.000	AV	35.15	31.19	6.56	36.88	0.89	2.39	39.30	53.90	14.6	
Vert.	7236.000	AV	36.38	36.53	7.61	37.30	0.89	2.39	46.50	53.90	7.4	
Vert.	9648.000	AV	37.77	38.28	8.72	38.52	0.89	2.39	49.53	53.90	4.4	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.

*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.	2412.000	PK	95.15	27.33	14.16	44.14	2.39	94.89	-	-	Carrier
Hori.	2400.000	PK	44.55	27.29	14.15	44.14	2.39	44.24	74.89	30.7	
Vert.	2412.000	PK	95.56	27.33	14.16	44.14	2.39	95.30	-	-	Carrier
Vert.	2400.000	PK	45.45	27.29	14.15	44.14	2.39	45.14	75.30	30.2	

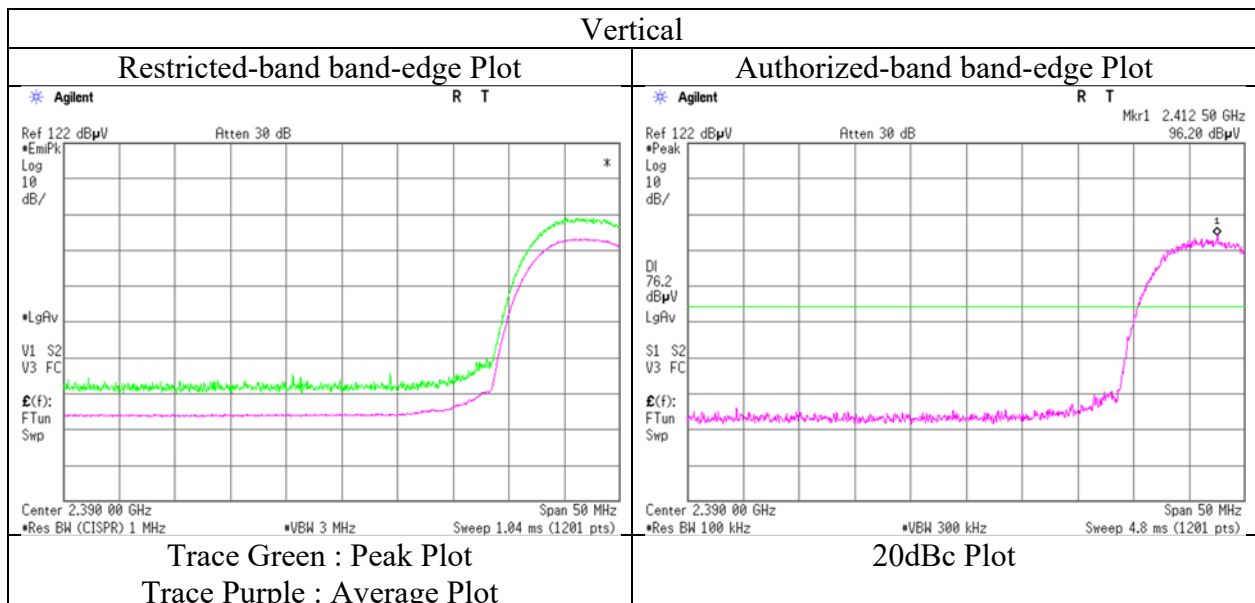
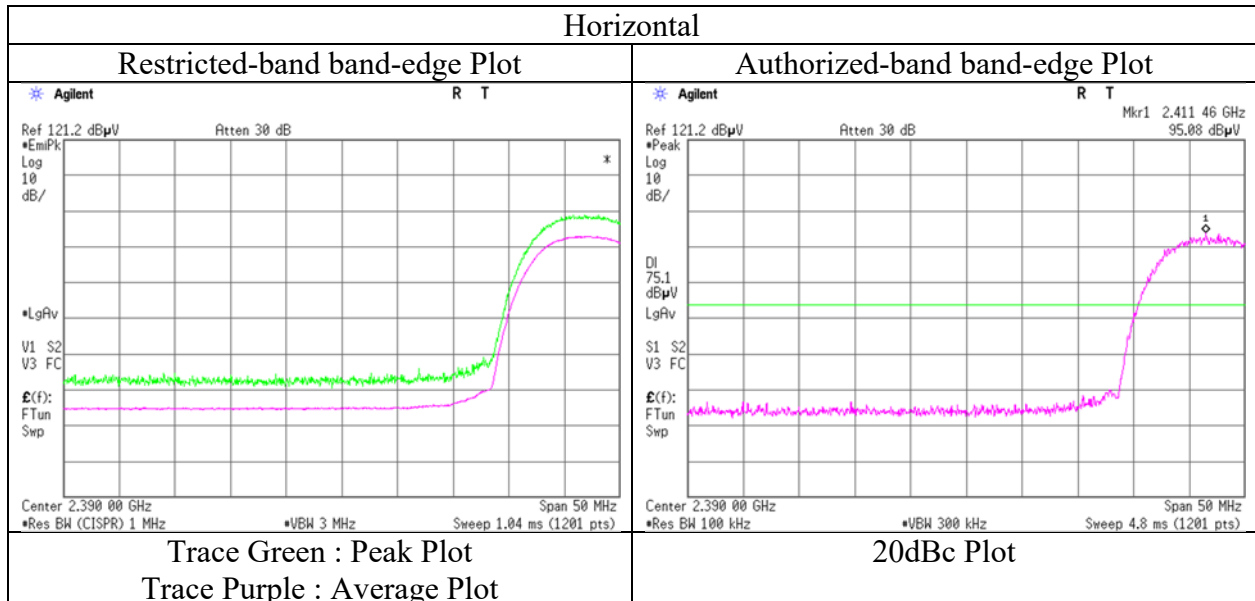
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12212627S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	April 25, 2018
Temperature / Humidity	25 deg. C / 48 % RH
Engineer	Kazuya Noda
	(1 GHz – 2.8 GHz)
Mode	Tx 11b 2412 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12212627S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	2	2
Date	April 25, 2018	April 21, 2018	April 22, 2018
Temperature / Humidity	25 deg. C / 48 % RH	23 deg. C / 50 % RH	21 deg. C / 51 % RH
Engineer	Kazuya Noda	Yosuke Ishikawa	Yasumasa Owaki
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 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	42.95	31.30	6.54	36.90	2.39	46.28	73.90	27.6	100	0	
Hori.	7311.000	PK	44.12	36.63	7.62	37.42	2.39	53.34	73.90	20.5	100	0	
Hori.	9748.000	PK	45.28	38.48	8.77	38.64	2.39	56.28	73.90	17.6	100	0	
Vert.	4874.000	PK	43.04	31.30	6.54	36.90	2.39	46.37	73.90	27.5	100	0	
Vert.	7311.000	PK	43.95	36.63	7.62	37.42	2.39	53.17	73.90	20.7	100	0	
Vert.	9748.000	PK	45.58	38.48	8.77	38.64	2.39	56.58	73.90	17.3	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.	4874.000	AV	34.84	31.30	6.54	36.90	0.89	2.39	39.06	53.90	14.8	
Hori.	7311.000	AV	36.05	36.63	7.62	37.42	0.89	2.39	46.16	53.90	7.7	
Hori.	9748.000	AV	37.18	38.48	8.77	38.64	0.89	2.39	49.07	53.90	4.8	
Vert.	4874.000	AV	35.12	31.30	6.54	36.90	0.89	2.39	39.34	53.90	14.6	
Vert.	7311.000	AV	35.58	36.63	7.62	37.42	0.89	2.39	45.69	53.90	8.2	
Vert.	9748.000	AV	37.15	38.48	8.77	38.64	0.89	2.39	49.04	53.90	4.9	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.

Radiated Spurious Emission

Report No. 12212627S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 2 2
Date April 25, 2018 April 21, 2018 April 22, 2018
Temperature / Humidity 25 deg. C / 48 % RH 23 deg. C / 50 % RH 21 deg. C / 51 % RH
Engineer Kazuya Noda Yosuke Ishikawa Yasumasa Owaki
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 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	49.53	27.55	14.25	44.16	2.39	49.56	73.90	24.3	193	232	
Hori.	4924.000	PK	43.98	31.40	6.53	36.92	2.39	47.38	73.90	26.5	100	0	
Hori.	7386.000	PK	42.97	36.73	7.62	37.54	2.39	52.17	73.90	21.7	100	0	
Hori.	9848.000	PK	44.47	38.68	8.83	38.76	2.39	55.61	73.90	18.2	100	0	
Vert.	2483.500	PK	49.84	27.55	14.25	44.16	2.39	49.87	73.90	24.0	393	313	
Vert.	4924.000	PK	43.12	31.40	6.53	36.92	2.39	46.52	73.90	27.3	100	0	
Vert.	7386.000	PK	43.09	36.73	7.62	37.54	2.39	52.29	73.90	21.6	100	0	
Vert.	9848.000	PK	44.77	38.68	8.83	38.76	2.39	55.91	73.90	17.9	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.	2483.500	AV	39.80	27.55	14.25	44.16	0.89	2.39	40.72	53.90	13.2	*1)
Hori.	4924.000	AV	34.73	31.40	6.53	36.92	0.89	2.39	39.02	53.90	14.9	
Hori.	7386.000	AV	35.35	36.73	7.62	37.54	0.89	2.39	45.44	53.90	8.5	
Hori.	9848.000	AV	37.06	38.68	8.83	38.76	0.89	2.39	49.09	53.90	4.8	
Vert.	2483.500	AV	39.72	27.55	14.25	44.16	0.89	2.39	40.64	53.90	13.3	*1)
Vert.	4924.000	AV	35.18	31.40	6.53	36.92	0.89	2.39	39.47	53.90	14.4	
Vert.	7386.000	AV	35.58	36.73	7.62	37.54	0.89	2.39	45.67	53.90	8.2	
Vert.	9848.000	AV	36.91	38.68	8.83	38.76	0.89	2.39	48.94	53.90	5.0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

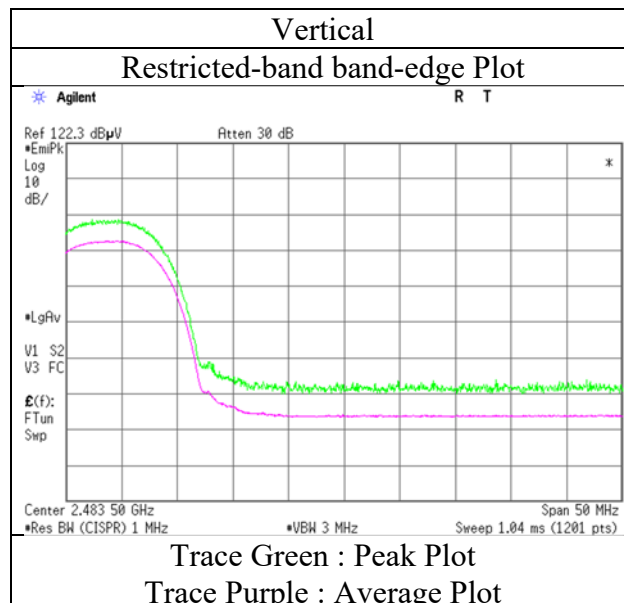
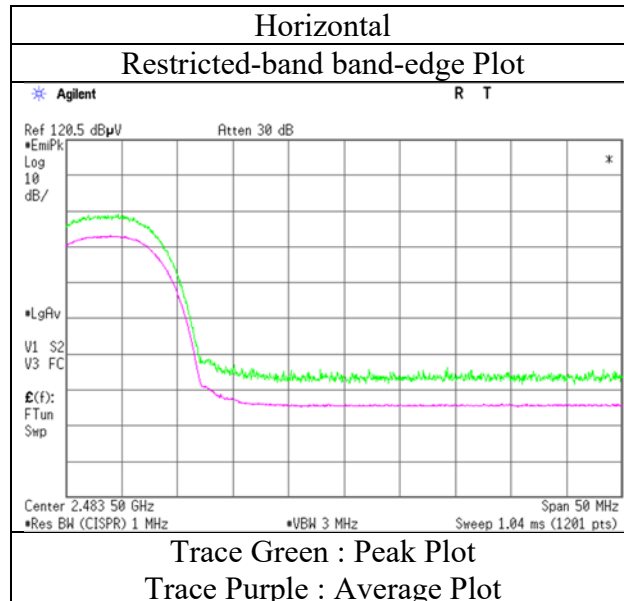
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12212627S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	April 25, 2018
Temperature / Humidity	25 deg. C / 48 % RH
Engineer	Kazuya Noda
	(1 GHz – 2.8 GHz)
Mode	Tx 11b 2462 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12212627S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	2	2
Date	April 25, 2018	April 21, 2018	April 22, 2018
Temperature / Humidity	25 deg. C / 48 % RH	23 deg. C / 50 % RH	21 deg. C / 51 % RH
Engineer	Kazuya Noda	Yosuke Ishikawa	Yasumasa Owaki
	(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.	2390.000	PK	66.70	27.26	14.15	44.13	2.39	66.37	73.90	7.5	201	220	
Hori.	4824.000	PK	42.98	31.19	6.56	36.88	2.39	46.24	73.90	27.6	100	0	
Hori.	7236.000	PK	44.41	36.53	7.61	37.30	2.39	53.64	73.90	20.2	100	0	
Hori.	9648.000	PK	45.76	38.28	8.72	38.52	2.39	56.63	73.90	17.2	100	0	
Vert.	2390.000	PK	66.69	27.26	14.15	44.13	2.39	66.36	73.90	7.5	365	312	
Vert.	4824.000	PK	43.25	31.19	6.56	36.88	2.39	46.51	73.90	27.3	100	0	
Vert.	7236.000	PK	44.64	36.53	7.61	37.30	2.39	53.87	73.90	20.0	100	0	
Vert.	9648.000	PK	45.70	38.28	8.72	38.52	2.39	56.57	73.90	17.3	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.	2390.000	AV	48.66	27.26	14.15	44.13	0.59	2.39	48.92	53.90	5.0	*1)
Hori.	4824.000	AV	35.19	31.19	6.56	36.88	0.59	2.39	39.04	53.90	14.9	
Hori.	7236.000	AV	36.36	36.53	7.61	37.30	0.59	2.39	46.18	53.90	7.7	
Hori.	9648.000	AV	37.77	38.28	8.72	38.52	0.59	2.39	49.23	53.90	4.7	
Vert.	2390.000	AV	49.93	27.26	14.15	44.13	0.59	2.39	50.19	53.90	3.7	*1)
Vert.	4824.000	AV	35.28	31.19	6.56	36.88	0.59	2.39	39.13	53.90	14.8	
Vert.	7236.000	AV	36.33	36.53	7.61	37.30	0.59	2.39	46.15	53.90	7.8	
Vert.	9648.000	AV	37.72	38.28	8.72	38.52	0.59	2.39	49.18	53.90	4.7	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.

*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.	2412.000	PK	91.71	27.33	14.16	44.14	2.39	91.45	-	-	Carrier
Hori.	2400.000	PK	62.37	27.29	14.15	44.14	2.39	62.06	71.45	9.4	
Vert.	2412.000	PK	92.45	27.33	14.16	44.14	2.39	92.19	-	-	Carrier
Vert.	2400.000	PK	64.32	27.29	14.15	44.14	2.39	64.01	72.19	8.2	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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

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Shonan EMC Lab.

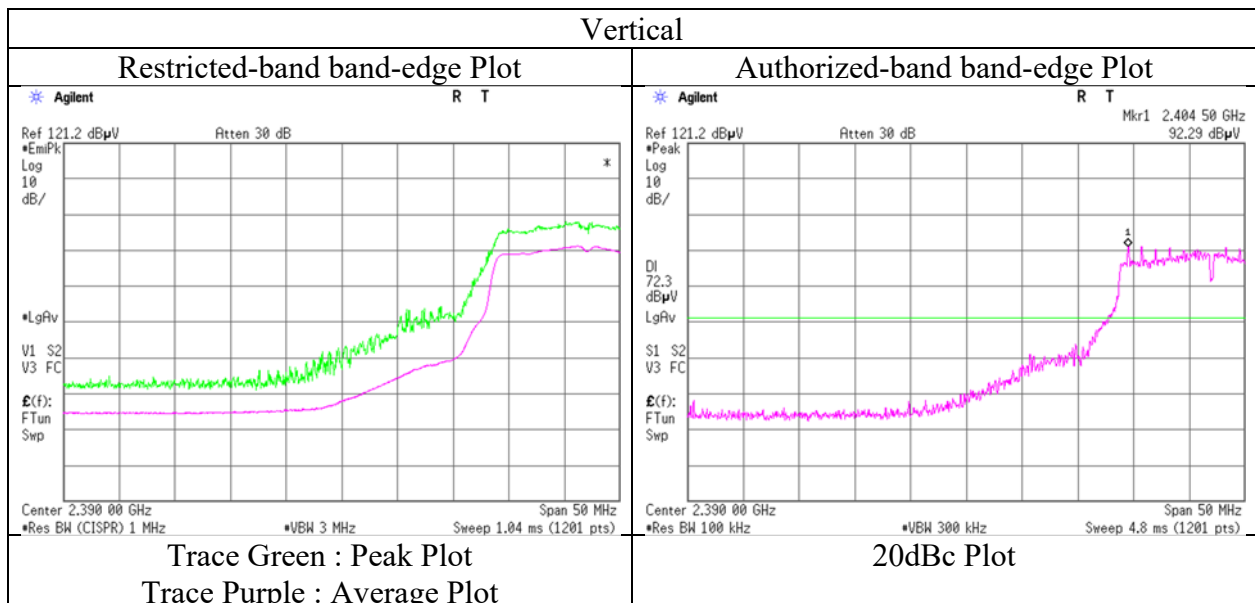
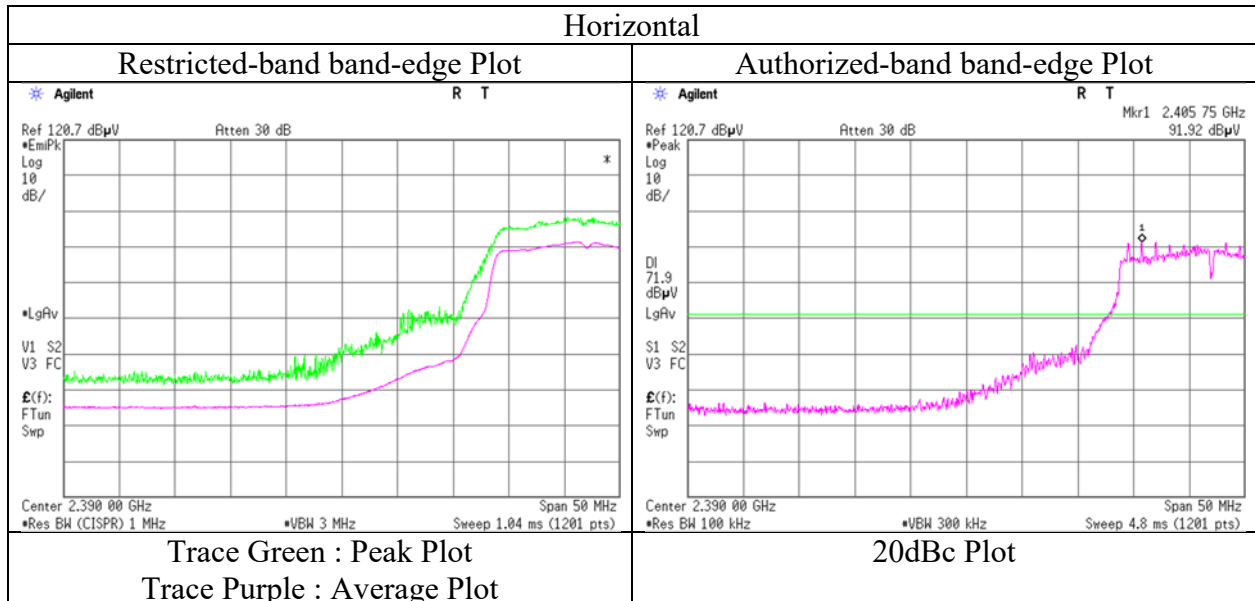
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12212627S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	April 25, 2018
Temperature / Humidity	25 deg. C / 48 % RH
Engineer	Kazuya Noda
	(1 GHz – 2.8 GHz)
Mode	Tx 11g 2412 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12212627S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	2	2
Date	April 25, 2018	April 21, 2018	April 22, 2018
Temperature / Humidity	25 deg. C / 48 % RH	23 deg. C / 50 % RH	21 deg. C / 51 % RH
Engineer	Kazuya Noda	Yosuke Ishikawa	Yasumasa Owaki
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(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.	4874.000	PK	43.00	31.30	6.54	36.90	2.39	46.33	73.90	27.5	100	0	
Hori.	7311.000	PK	44.53	36.63	7.62	37.42	2.39	53.75	73.90	20.1	100	0	
Hori.	9748.000	PK	45.55	38.48	8.77	38.64	2.39	56.55	73.90	17.3	100	0	
Vert.	4874.000	PK	43.12	31.30	6.54	36.90	2.39	46.45	73.90	27.4	100	0	
Vert.	7311.000	PK	43.58	36.63	7.62	37.42	2.39	52.80	73.90	21.1	100	0	
Vert.	9748.000	PK	45.34	38.48	8.77	38.64	2.39	56.34	73.90	17.5	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$

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.	4874.000	AV	35.04	31.30	6.54	36.90	0.59	2.39	38.96	53.90	14.9	
Hori.	7311.000	AV	35.83	36.63	7.62	37.42	0.59	2.39	45.64	53.90	8.3	
Hori.	9748.000	AV	37.39	38.48	8.77	38.64	0.59	2.39	48.98	53.90	4.9	
Vert.	4874.000	AV	34.84	31.30	6.54	36.90	0.59	2.39	38.76	53.90	15.1	
Vert.	7311.000	AV	35.74	36.63	7.62	37.42	0.59	2.39	45.55	53.90	8.4	
Vert.	9748.000	AV	37.24	38.48	8.77	38.64	0.59	2.39	48.83	53.90	5.1	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$

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. 12212627S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 2 2
Date April 25, 2018 April 21, 2018 April 22, 2018
Temperature / Humidity 25 deg. C / 48 % RH 23 deg. C / 50 % RH 21 deg. C / 51 % RH
Engineer Kazuya Noda Yosuke Ishikawa Yasumasa Owaki
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (30 MHz – 1 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.	200.000	QP	32.00	11.33	5.67	31.78	0.00	17.22	43.50	26.2	160	22	
Hori.	324.001	QP	29.50	13.92	6.63	31.68	0.00	18.37	46.00	27.6	100	357	
Hori.	377.999	QP	31.30	15.03	7.00	31.66	0.00	21.67	46.00	24.3	100	4	
Hori.	400.001	QP	29.30	15.49	7.14	31.67	0.00	20.26	46.00	25.7	100	18	
Hori.	432.001	QP	34.90	16.14	7.36	31.67	0.00	26.73	46.00	19.2	100	3	
Hori.	600.000	QP	35.70	19.06	8.24	31.64	0.00	31.36	46.00	14.6	152	23	
Hori.	999.999	QP	31.90	22.38	10.12	30.11	0.00	34.29	53.90	19.6	153	36	
Hori.	2483.500	PK	55.57	27.55	14.25	44.16	2.39	55.60	73.90	18.3	194	229	
Hori.	4924.000	PK	43.70	31.40	6.53	36.92	2.39	47.10	73.90	26.8	100	0	
Hori.	7386.000	PK	44.07	36.73	7.62	37.54	2.39	53.27	73.90	20.6	100	0	
Hori.	9848.000	PK	45.67	38.68	8.83	38.76	2.39	56.81	73.90	17.0	100	0	
Vert.	200.000	QP	38.00	11.33	5.67	31.78	0.00	23.22	43.50	20.2	100	84	
Vert.	432.000	QP	34.50	16.14	7.36	31.67	0.00	26.33	46.00	19.6	217	30	
Vert.	600.000	QP	35.80	19.06	8.24	31.64	0.00	31.46	46.00	14.5	100	16	
Vert.	999.999	QP	29.60	22.38	10.12	30.11	0.00	31.99	53.90	21.9	113	84	
Vert.	2483.500	PK	56.43	27.55	14.25	44.16	2.39	56.46	73.90	17.4	390	320	
Vert.	4924.000	PK	43.38	31.40	6.53	36.92	2.39	46.78	73.90	27.1	100	0	
Vert.	7386.000	PK	43.61	36.73	7.62	37.54	2.39	52.81	73.90	21.0	100	0	
Vert.	9848.000	PK	45.06	38.68	8.83	38.76	2.39	56.20	73.90	17.7	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.	2483.500	AV	41.77	27.55	14.25	44.16	0.59	2.39	42.39	53.90	11.5	*1)
Hori.	4924.000	AV	35.30	31.40	6.53	36.92	0.59	2.39	39.29	53.90	14.6	
Hori.	7386.000	AV	35.32	36.73	7.62	37.54	0.59	2.39	45.11	53.90	8.8	
Hori.	9848.000	AV	37.03	38.68	8.83	38.76	0.59	2.39	48.76	53.90	5.1	
Vert.	2483.500	AV	41.91	27.55	14.25	44.16	0.59	2.39	42.53	53.90	11.4	*1)
Vert.	4924.000	AV	35.57	31.40	6.53	36.92	0.59	2.39	39.56	53.90	14.3	
Vert.	7386.000	AV	35.67	36.73	7.62	37.54	0.59	2.39	45.46	53.90	8.4	
Vert.	9848.000	AV	36.73	38.68	8.83	38.76	0.59	2.39	48.46	53.90	5.4	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.

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

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Shonan EMC Lab.

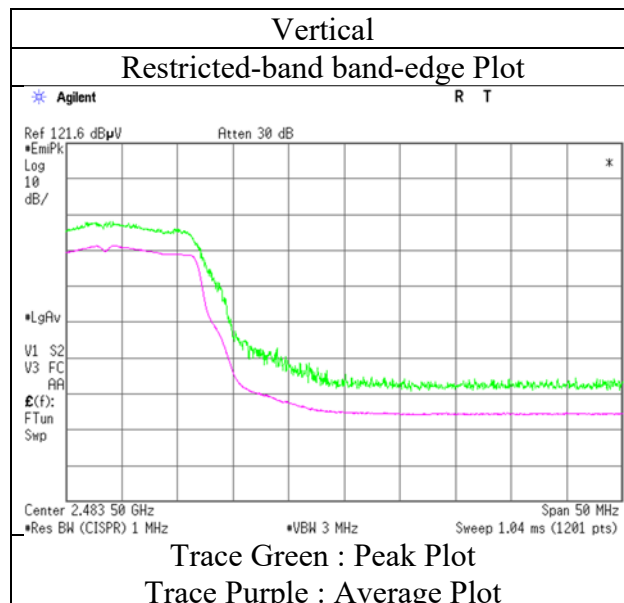
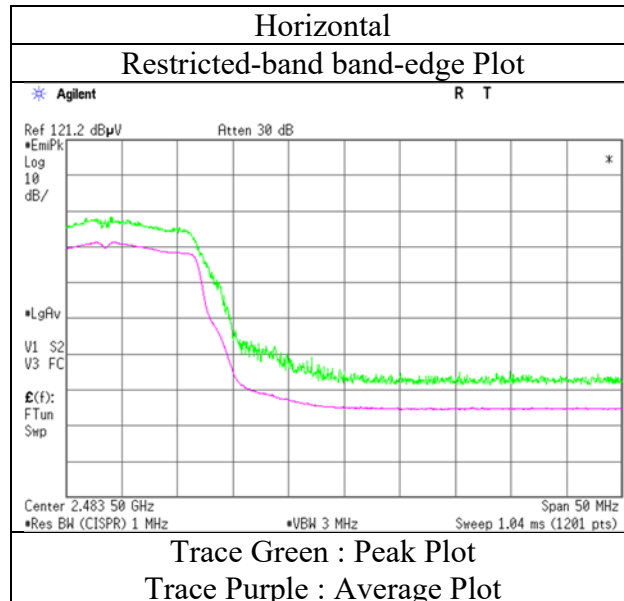
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12212627S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	April 25, 2018
Temperature / Humidity	25 deg. C / 48 % RH
Engineer	Kazuya Noda
	(1 GHz – 2.8 GHz)
Mode	Tx 11g 2462 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12212627S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 2 2
Date April 25, 2018 April 21, 2018 April 22, 2018
Temperature / Humidity 25 deg. C / 48 % RH 23 deg. C / 50 % RH 21 deg. C / 51 % RH
Engineer Kazuya Noda Yosuke Ishikawa Yasumasa Owaki
(1 GHz – 2.8 GHz) (2.8 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.	2390.000	PK	65.18	27.26	14.15	44.13	2.39	64.85	73.90	9.0	199	223	
Hori.	4824.000	PK	42.64	31.19	6.56	36.88	2.39	45.90	73.90	28.0	100	0	
Hori.	7236.000	PK	44.38	36.53	7.61	37.30	2.39	53.61	73.90	20.2	100	0	
Hori.	9648.000	PK	45.17	38.28	8.72	38.52	2.39	56.04	73.90	17.8	100	0	
Vert.	2390.000	PK	65.28	27.26	14.15	44.13	2.39	64.95	73.90	8.9	371	314	
Vert.	4824.000	PK	43.15	31.19	6.56	36.88	2.39	46.41	73.90	27.4	100	0	
Vert.	7236.000	PK	44.74	36.53	7.61	37.30	2.39	53.97	73.90	19.9	100	0	
Vert.	9648.000	PK	45.55	38.28	8.72	38.52	2.39	56.42	73.90	17.4	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.	2390.000	AV	45.94	27.26	14.15	44.13	1.19	2.39	46.80	53.90	7.1	*1)
Hori.	4824.000	AV	35.42	31.19	6.56	36.88	1.19	2.39	39.87	53.90	14.0	
Hori.	7236.000	AV	36.48	36.53	7.61	37.30	1.19	2.39	46.90	53.90	7.0	
Hori.	9648.000	AV	37.54	38.28	8.72	38.52	1.19	2.39	49.60	53.90	4.3	
Vert.	2390.000	AV	46.55	27.26	14.15	44.13	1.19	2.39	47.41	53.90	6.5	*1)
Vert.	4824.000	AV	35.24	31.19	6.56	36.88	1.19	2.39	39.69	53.90	14.2	
Vert.	7236.000	AV	36.50	36.53	7.61	37.30	1.19	2.39	46.92	53.90	7.0	
Vert.	9648.000	AV	37.77	38.28	8.72	38.52	1.19	2.39	49.83	53.90	4.1	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.

*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.	2412.000	PK	91.56	27.33	14.16	44.14	2.39	91.30	-	-	Carrier
Hori.	2400.000	PK	59.33	27.29	14.15	44.14	2.39	59.02	71.30	12.3	
Vert.	2412.000	PK	92.72	27.33	14.16	44.14	2.39	92.46	-	-	Carrier
Vert.	2400.000	PK	61.09	27.29	14.15	44.14	2.39	60.78	72.46	11.7	

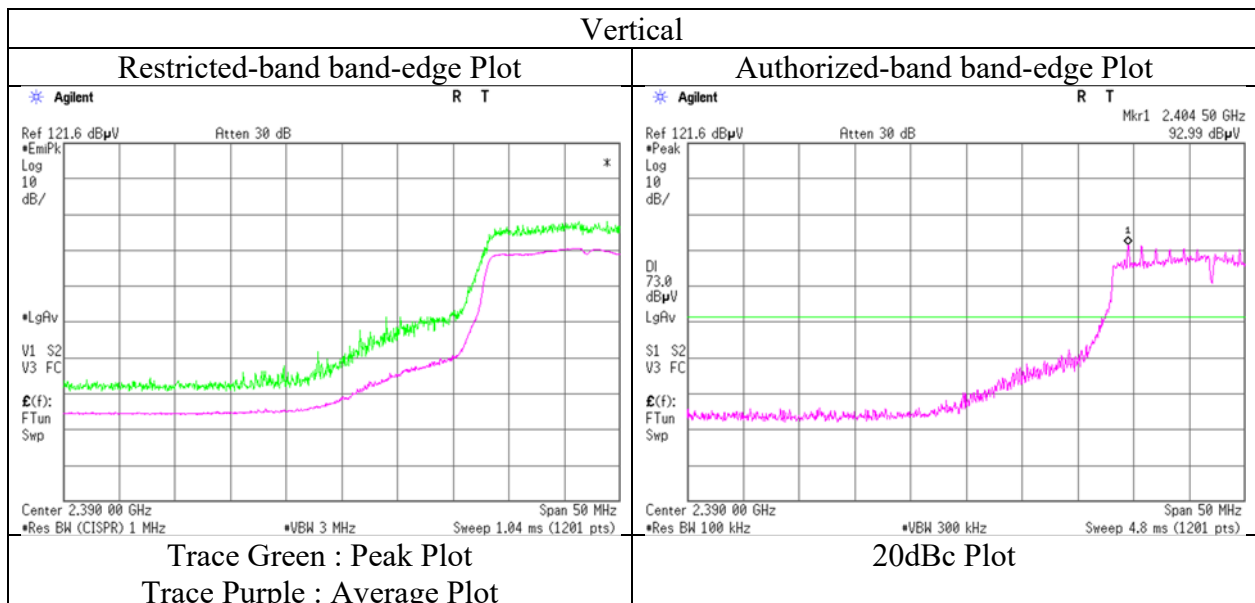
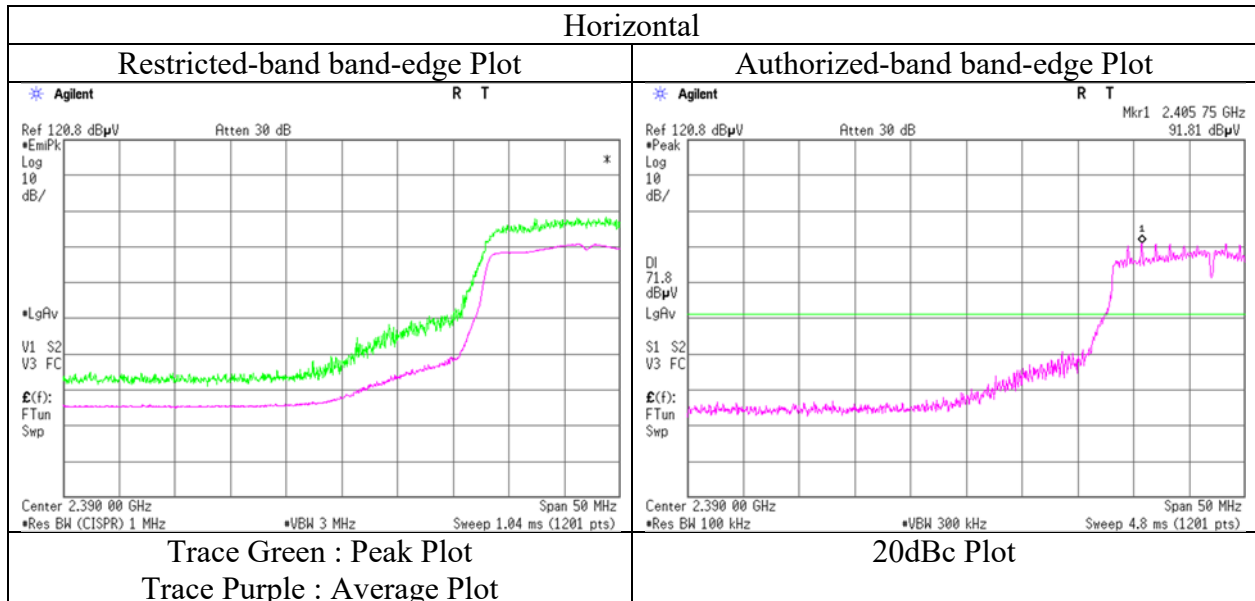
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12212627S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	April 25, 2018
Temperature / Humidity	25 deg. C / 48 % RH
Engineer	Kazuya Noda
	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2412 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12212627S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	2	2
Date	April 25, 2018	April 21, 2018	April 22, 2018
Temperature / Humidity	25 deg. C / 48 % RH	23 deg. C / 50 % RH	21 deg. C / 51 % RH
Engineer	Kazuya Noda	Yosuke Ishikawa	Yasumasa Owaki
	(1 GHz – 2.8 GHz)	(2.8 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.	4874.000	PK	43.71	31.30	6.54	36.90	2.39	47.04	73.90	26.8	100	0	
Hori.	7311.000	PK	43.87	36.63	7.62	37.42	2.39	53.09	73.90	20.8	100	0	
Hori.	9748.000	PK	44.74	38.48	8.77	38.64	2.39	55.74	73.90	18.1	100	0	
Vert.	4874.000	PK	43.43	31.30	6.54	36.90	2.39	46.76	73.90	27.1	100	0	
Vert.	7311.000	PK	44.22	36.63	7.62	37.42	2.39	53.44	73.90	20.4	100	0	
Vert.	9748.000	PK	45.27	38.48	8.77	38.64	2.39	56.27	73.90	17.6	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.	4874.000	AV	34.95	31.30	6.54	36.90	1.19	2.39	39.47	53.90	14.4	
Hori.	7311.000	AV	35.78	36.63	7.62	37.42	1.19	2.39	46.19	53.90	7.7	
Hori.	9748.000	AV	37.49	38.48	8.77	38.64	1.19	2.39	49.68	53.90	4.2	
Vert.	4874.000	AV	35.21	31.30	6.54	36.90	1.19	2.39	39.73	53.90	14.2	
Vert.	7311.000	AV	35.81	36.63	7.62	37.42	1.19	2.39	46.22	53.90	7.7	
Vert.	9748.000	AV	37.27	38.48	8.77	38.64	1.19	2.39	49.46	53.90	4.4	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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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Radiated Spurious Emission

Report No. 12212627S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 2 2
Date April 25, 2018 April 21, 2018 April 22, 2018
Temperature / Humidity 25 deg. C / 48 % RH 23 deg. C / 50 % RH 21 deg. C / 51 % RH
Engineer Kazuya Noda Yosuke Ishikawa Yasumasa Owaki
(1 GHz – 2.8 GHz) (2.8 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.	2483.500	PK	60.05	27.55	14.25	44.16	2.39	60.08	73.90	13.8	223	227	
Hori.	4924.000	PK	43.31	31.40	6.53	36.92	2.39	46.71	73.90	27.1	100	0	
Hori.	7386.000	PK	43.89	36.73	7.62	37.54	2.39	53.09	73.90	20.8	100	0	
Hori.	9848.000	PK	45.27	38.68	8.83	38.76	2.39	56.41	73.90	17.4	100	0	
Vert.	2483.500	PK	59.07	27.55	14.25	44.16	2.39	59.10	73.90	14.8	356	317	
Vert.	4924.000	PK	44.39	31.40	6.53	36.92	2.39	47.79	73.90	26.1	100	0	
Vert.	7386.000	PK	43.79	36.73	7.62	37.54	2.39	52.99	73.90	20.9	100	0	
Vert.	9848.000	PK	45.01	38.68	8.83	38.76	2.39	56.15	73.90	17.7	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.	2483.500	AV	41.09	27.55	14.25	44.16	1.19	2.39	42.31	53.90	11.6	*1)
Hori.	4924.000	AV	35.19	31.40	6.53	36.92	1.19	2.39	39.78	53.90	14.1	
Hori.	7386.000	AV	35.66	36.73	7.62	37.54	1.19	2.39	46.05	53.90	7.9	
Hori.	9848.000	AV	36.95	38.68	8.83	38.76	1.19	2.39	49.28	53.90	4.6	
Vert.	2483.500	AV	41.01	27.55	14.25	44.16	1.19	2.39	42.23	53.90	11.7	*1)
Vert.	4924.000	AV	35.20	31.40	6.53	36.92	1.19	2.39	39.79	53.90	14.1	
Vert.	7386.000	AV	35.45	36.73	7.62	37.54	1.19	2.39	45.84	53.90	8.1	
Vert.	9848.000	AV	36.80	38.68	8.83	38.76	1.19	2.39	49.13	53.90	4.8	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

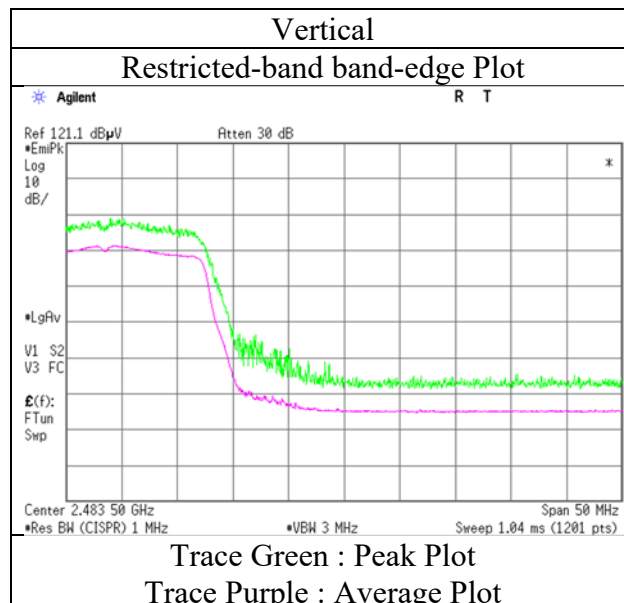
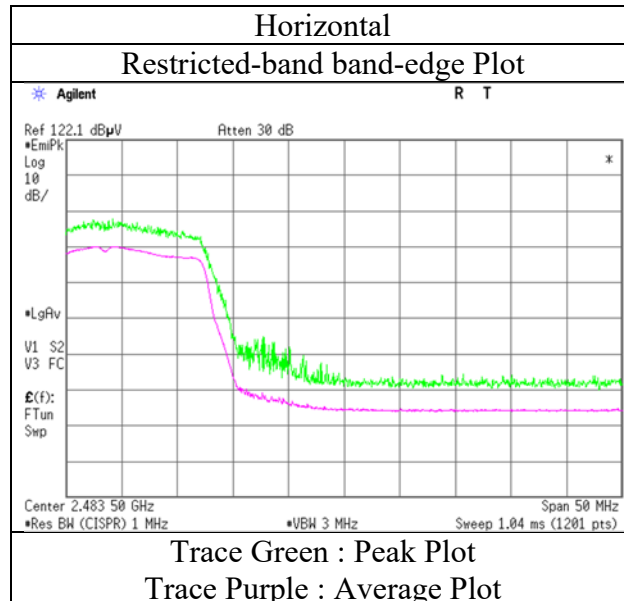
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12212627S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	April 25, 2018
Temperature / Humidity	25 deg. C / 48 % RH
Engineer	Kazuya Noda
	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2462 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12212627S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3
Date May 15, 2018 May 16, 2018
Temperature / Humidity 25 deg. C / 43 % RH 22 deg. C / 51 % RH
Engineer Makoto Hosaka Makoto Hosaka
(30 MHz – 1 GHz) (1 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.	240.000	QP	25.50	11.57	8.49	32.03	0.00	13.53	46.02	32.4	387	0	
Hori.	324.000	QP	25.00	13.82	9.05	31.98	0.00	15.89	46.02	30.1	340	308	
Hori.	360.000	QP	25.80	14.57	9.27	31.95	0.00	17.69	46.02	28.3	200	1	
Hori.	378.000	QP	28.20	14.94	9.35	31.96	0.00	20.53	46.02	25.4	100	336	
Hori.	432.000	QP	33.00	16.06	9.57	31.97	0.00	26.66	46.02	19.3	228	335	
Hori.	600.000	QP	24.00	19.03	10.21	31.95	0.00	21.29	46.02	24.7	152	1	
Hori.	2390.000	PK	48.50	27.26	14.14	44.13	2.39	48.16	73.97	25.8	206	208	
Hori.	4804.000	PK	48.89	31.40	6.71	44.45	2.39	44.94	73.97	29.0	150	0	
Hori.	7206.000	PK	48.62	36.56	8.33	43.99	2.39	51.91	73.97	22.0	150	0	
Vert.	210.991	QP	21.80	11.53	8.29	32.06	0.00	9.56	43.52	33.9	100	355	
Vert.	432.004	QP	29.30	16.06	9.57	31.97	0.00	22.96	46.02	23.0	148	211	
Vert.	540.003	QP	26.50	18.09	9.98	32.00	0.00	22.57	46.02	23.4	152	338	
Vert.	2390.000	PK	49.25	27.26	14.14	44.13	2.39	48.91	73.97	25.0	148	282	
Vert.	4804.000	PK	49.78	31.40	6.71	44.45	2.39	45.83	73.97	28.1	150	0	
Vert.	7206.000	PK	47.35	36.56	8.33	43.99	2.39	50.64	73.97	23.3	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 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	38.70	27.26	14.14	44.13	3.86	2.39	42.22	53.97	11.8	*1)
Hori.	4804.000	AV	38.68	31.40	6.71	44.45	3.86	2.39	38.59	53.97	15.4	
Hori.	7206.000	AV	38.08	36.56	8.33	43.99	3.86	2.39	45.23	53.97	8.7	
Vert.	2390.000	AV	38.77	27.26	14.14	44.13	3.86	2.39	42.29	53.97	11.7	*1)
Vert.	4804.000	AV	38.57	31.40	6.71	44.45	3.86	2.39	38.48	53.97	15.5	
Vert.	7206.000	AV	38.07	36.56	8.33	43.99	3.86	2.39	45.22	53.97	8.8	

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 (3.95 m / 3.0 m) = 2.39 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	96.16	27.29	14.15	44.14	2.39	95.85	-	-	Carrier
Hori.	2400.000	PK	42.15	27.29	14.14	44.14	2.39	41.83	75.85	34.0	
Vert.	2402.000	PK	97.71	27.29	14.15	44.14	2.39	97.40	-	-	Carrier
Vert.	2400.000	PK	44.14	27.29	14.14	44.14	2.39	43.82	77.40	33.6	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 dB

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

UL Japan, Inc.

Shonan EMC Lab.

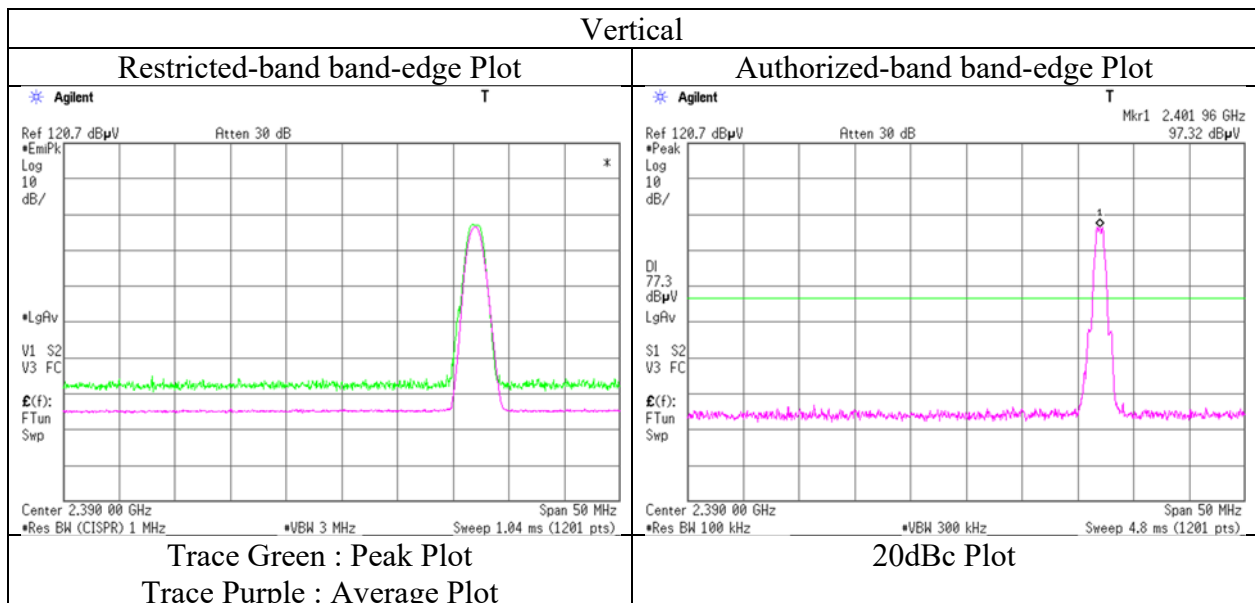
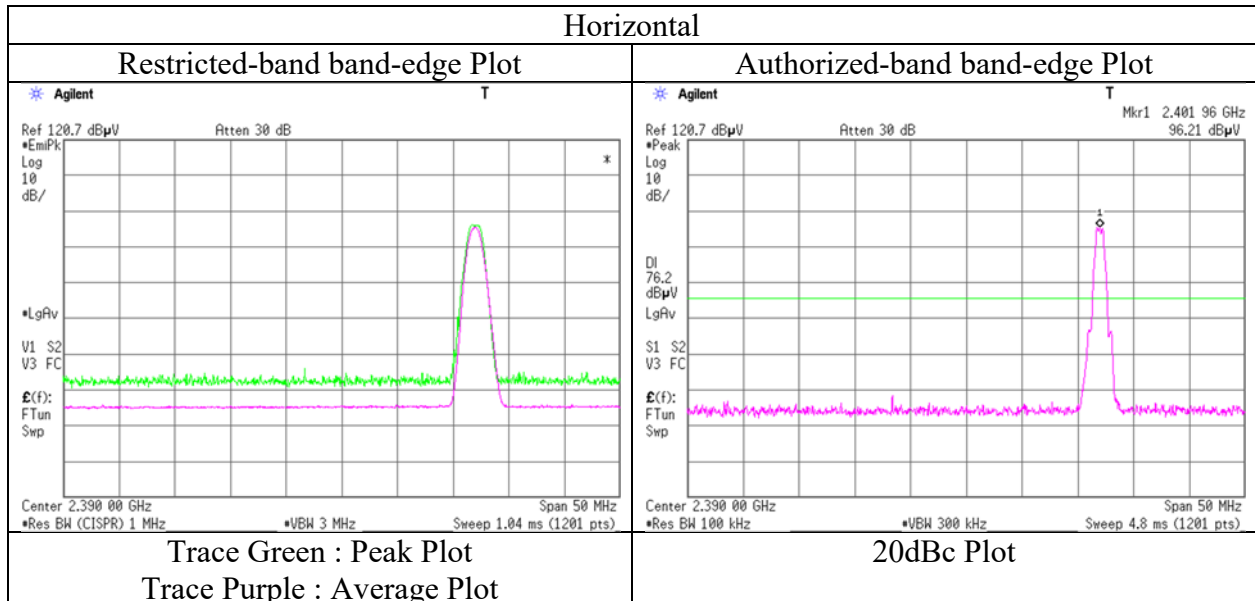
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12212627S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	May 16, 2018
Temperature / Humidity	22 deg. C / 51 % RH
Engineer	Makoto Hosaka
	(1 GHz – 2.8 GHz)
Mode	Tx BT LE 2402 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12212627S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3
Date May 15, 2018 May 16, 2018
Temperature / Humidity 25 deg. C / 43 % RH 22 deg. C / 51 % RH
Engineer Makoto Hosaka Makoto Hosaka
(30 MHz – 1 GHz) (1 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.	240.000	QP	25.60	11.57	8.49	32.03	0.00	13.63	46.02	32.3	384	0	
Hori.	324.000	QP	24.20	13.82	9.05	31.98	0.00	15.09	46.02	30.9	350	333	
Hori.	360.000	QP	25.90	14.57	9.27	31.95	0.00	17.79	46.02	28.2	199	1	
Hori.	378.000	QP	29.50	14.94	9.35	31.96	0.00	21.83	46.02	24.1	100	339	
Hori.	432.000	QP	32.90	16.06	9.57	31.97	0.00	26.56	46.02	19.4	226	341	
Hori.	600.000	QP	23.60	19.03	10.21	31.95	0.00	20.89	46.02	25.1	156	0	
Hori.	4880.000	PK	48.66	31.61	6.79	44.48	2.39	44.97	73.97	29.0	150	0	
Hori.	7320.000	PK	47.57	36.76	8.44	44.03	2.39	51.13	73.97	22.8	150	0	
Vert.	210.991	QP	21.80	11.53	8.29	32.06	0.00	9.56	43.52	33.9	100	350	
Vert.	432.000	QP	32.40	16.06	9.57	31.97	0.00	26.06	46.02	19.9	190	328	
Vert.	539.999	QP	25.70	18.09	9.98	32.00	0.00	21.77	46.02	24.2	144	350	
Vert.	4880.000	PK	48.83	31.61	6.79	44.48	2.39	45.14	73.97	28.8	150	0	
Vert.	7320.000	PK	47.55	36.76	8.44	44.03	2.39	51.11	73.97	22.8	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.95 m / 3.0 m) = 2.39 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.	4880.000	AV	38.31	31.61	6.79	44.48	3.86	2.39	38.48	53.97	15.5	
Hori.	7320.000	AV	37.10	36.76	8.44	44.03	3.86	2.39	44.52	53.97	9.4	
Vert.	4880.000	AV	38.30	31.61	6.79	44.48	3.86	2.39	38.47	53.97	15.5	
Vert.	7320.000	AV	36.78	36.76	8.44	44.03	3.86	2.39	44.20	53.97	9.8	

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 (3.95 m / 3.0 m) = 2.39 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)

Radiated Spurious Emission

Report No. 12212627S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3 3
Date May 15, 2018 May 16, 2018
Temperature / Humidity 25 deg. C / 43 % RH 22 deg. C / 51 % RH
Engineer Makoto Hosaka Makoto Hosaka
(30 MHz – 1 GHz) (1 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.	240.000	QP	25.40	11.57	8.49	32.03	0.00	13.43	46.02	32.5	384	0	
Hori.	324.000	QP	24.30	13.82	9.05	31.98	0.00	15.19	46.02	30.8	345	338	
Hori.	360.000	QP	26.20	14.57	9.27	31.95	0.00	18.09	46.02	27.9	192	1	
Hori.	378.000	QP	29.70	14.94	9.35	31.96	0.00	22.03	46.02	23.9	100	336	
Hori.	432.000	QP	32.60	16.06	9.57	31.97	0.00	26.26	46.02	19.7	228	338	
Hori.	600.000	QP	23.50	19.03	10.21	31.95	0.00	20.79	46.02	25.2	153	0	
Hori.	2483.500	PK	49.37	27.55	14.24	44.16	2.39	49.39	73.97	24.5	249	232	
Hori.	4960.000	PK	48.93	31.83	6.87	44.51	2.39	45.51	73.97	28.4	150	0	
Hori.	7440.000	PK	48.64	36.97	8.56	44.08	2.39	52.48	73.97	21.4	150	0	
Vert.	210.991	QP	21.80	11.53	8.29	32.06	0.00	9.56	43.52	33.9	100	358	
Vert.	432.000	QP	32.30	16.06	9.57	31.97	0.00	25.96	46.02	20.0	193	314	
Vert.	539.999	QP	25.90	18.09	9.98	32.00	0.00	21.97	46.02	24.0	114	169	
Vert.	2483.500	PK	49.15	27.55	14.24	44.16	2.39	49.17	73.97	24.8	181	310	
Vert.	4960.000	PK	49.19	31.83	6.87	44.51	2.39	45.77	73.97	28.2	150	0	
Vert.	7440.000	PK	48.00	36.97	8.56	44.08	2.39	51.84	73.97	22.1	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

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.	2483.500	AV	38.80	27.55	14.24	44.16	3.86	2.39	42.68	53.97	11.3	*1)
Hori.	4960.000	AV	38.75	31.83	6.87	44.51	3.86	2.39	39.19	53.97	14.8	
Hori.	7440.000	AV	37.54	36.97	8.56	44.08	3.86	2.39	45.24	53.97	8.7	
Vert.	2483.500	AV	38.97	27.55	14.24	44.16	3.86	2.39	42.85	53.97	11.1	*1)
Vert.	4960.000	AV	38.72	31.83	6.87	44.51	3.86	2.39	39.16	53.97	14.8	
Vert.	7440.000	AV	37.55	36.97	8.56	44.08	3.86	2.39	45.25	53.97	8.7	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$

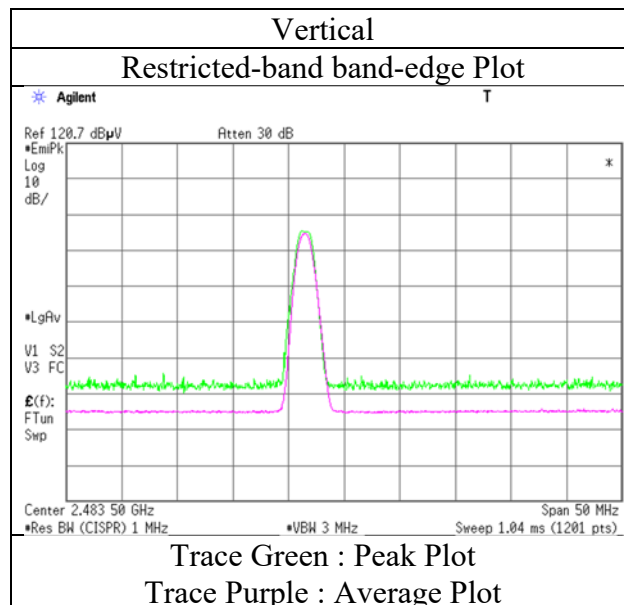
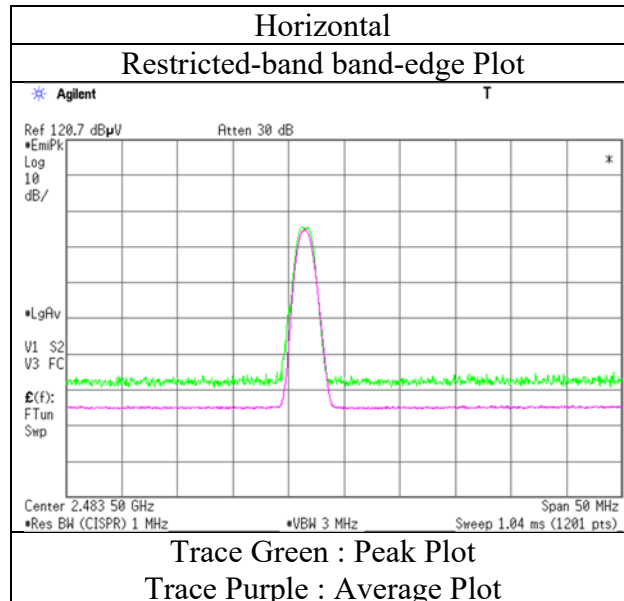
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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

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

Radiated Spurious Emission (Reference Plot for band-edge)

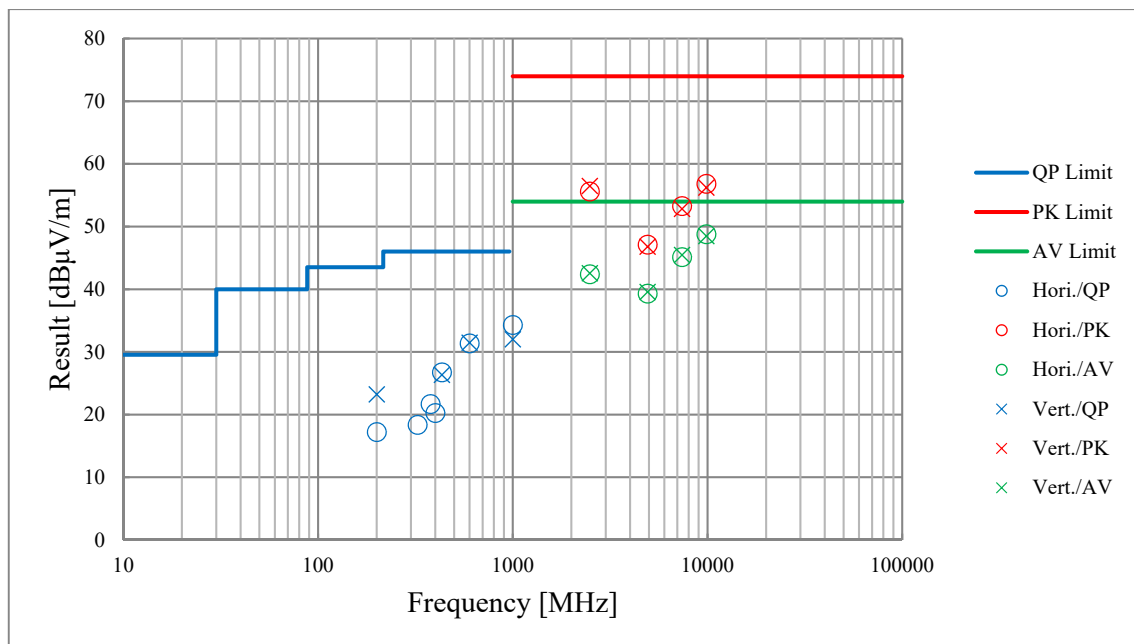
Report No.	12212627S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	May 16, 2018
Temperature / Humidity	22 deg. C / 51 % RH
Engineer	Makoto Hosaka (1 GHz – 2.8 GHz)
Mode	Tx BT LE 2480 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission **(Plot data, Worst case)**

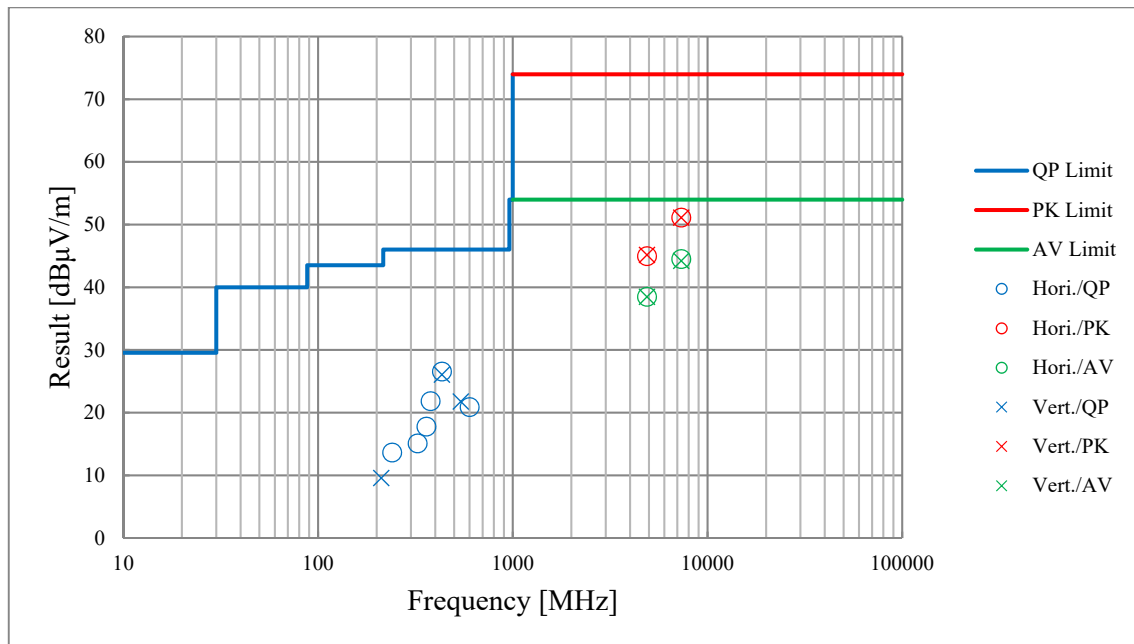
Report No.	12212627S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	3	2	2
Date	April 25, 2018	April 21, 2018	April 22, 2018
Temperature / Humidity	25 deg. C / 48 % RH	23 deg. C / 50 % RH	21 deg. C / 51 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)	Yosuke Ishikawa (2.8 GHz – 13 GHz)	Yasumasa Owaki (30 MHz – 1 GHz) (13 GHz – 26.5 GHz)
Mode	Tx 11g 2462 MHz		



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

Radiated Spurious Emission
(Plot data, Worst case)

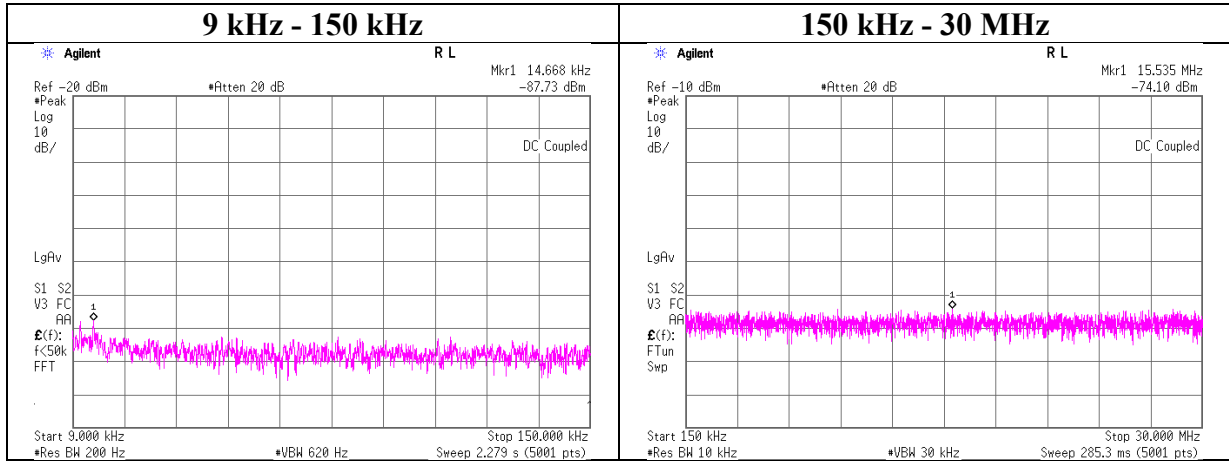
Report No.	12212627S-H-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	3	3
Date	May 15, 2018	May 16, 2018
Temperature / Humidity	25 deg. C / 43 % RH	22 deg. C / 51 % RH
Engineer	Makoto Hosaka (30 MHz – 1 GHz)	Makoto Hosaka (1 GHz – 26.5 GHz)
Mode	Tx BT LE 2440 MHz	



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

Conducted Spurious Emission

Report No. 12212627S-H-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date April 17, 2018
Temperature / Humidity 26 deg. C / 31 % RH
Engineer Yosuke Ishikawa
Mode Tx 11g 2462 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
14.67	-87.7	0.01	9.83	2.0	1	-75.9	300	6.0	-14.6	44.2	58.8	
15000.54	-74.1	0.05	9.84	2.0	1	-62.2	30	6.0	19.0	29.5	10.5	

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

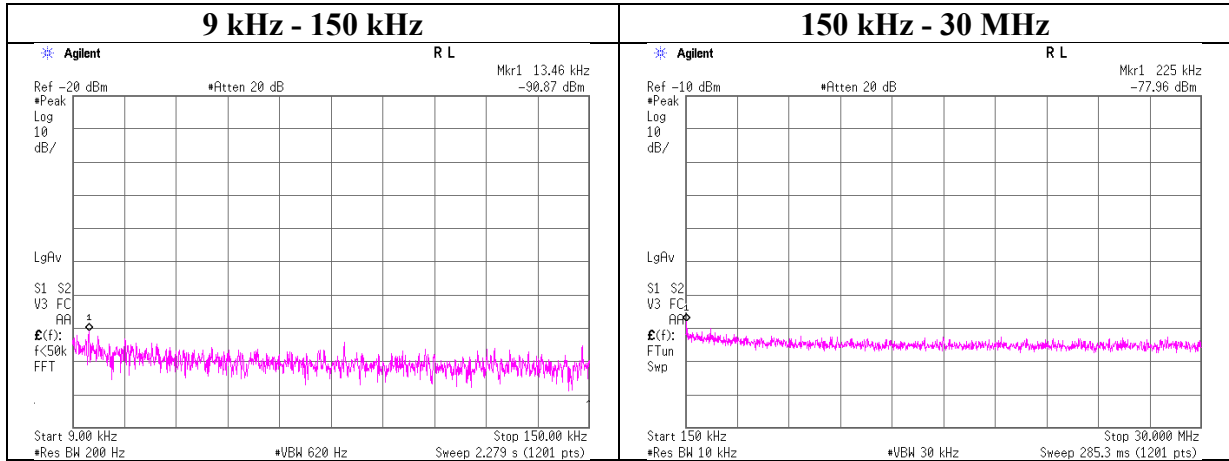
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

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. 12212627S-H-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date May 15, 2018
Temperature / Humidity 25 deg. C / 37 % RH
Engineer Makoto Hosaka
Mode Tx BT LE 2402 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
13.46	-90.9	0.01	10.11	2.0	1	-78.8	300	6.0	-17.5	45.0	62.5	
225.00	-78.0	0.01	10.11	2.0	1	-65.8	300	6.0	-4.6	20.5	25.1	

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

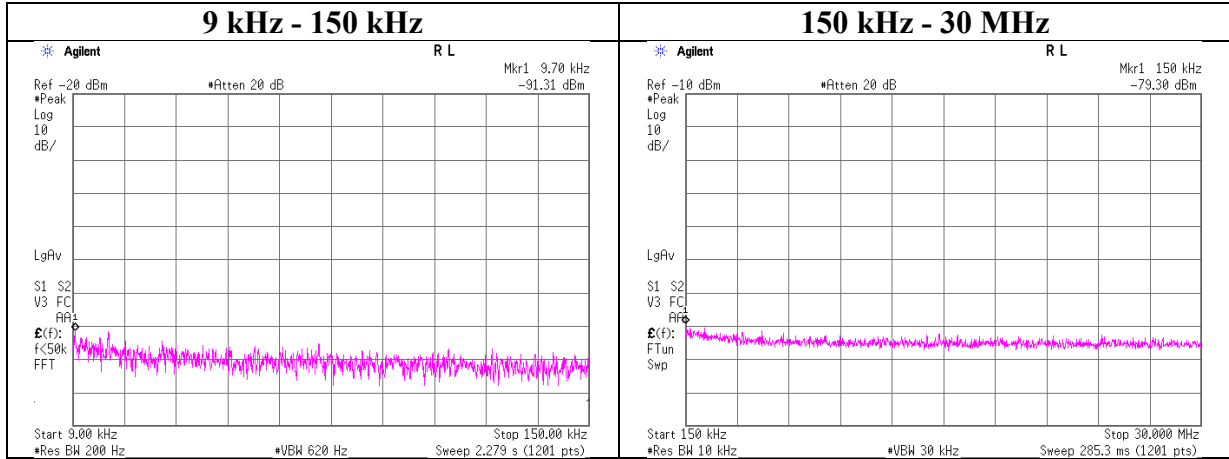
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

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. 12212627S-H-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date May 15, 2018
Temperature / Humidity 25 deg. C / 37 % RH
Engineer Makoto Hosaka
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
9.70	-91.3	0.01	10.11	2.0	1	-79.2	300	6.0	-17.9	47.8	65.7	
150.00	-79.3	0.01	10.11	2.0	1	-67.2	300	6.0	-5.9	24.0	29.9	

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

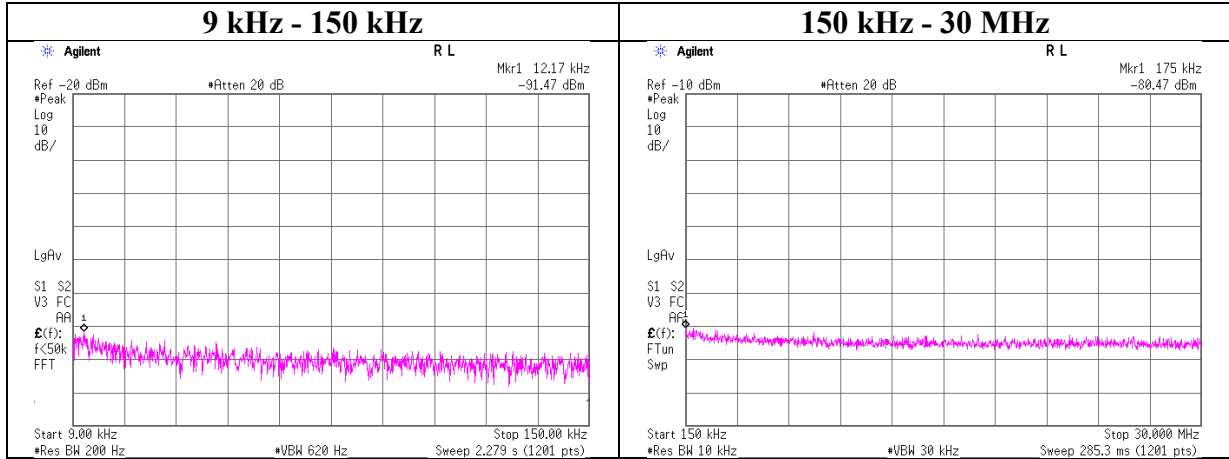
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

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.

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Test place Shonan EMC Lab. No.5 Shielded Room
Date May 15, 2018
Temperature / Humidity 25 deg. C / 37 % RH
Engineer Makoto Hosaka
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
12.17	-91.5	0.01	10.11	2.0	1	-79.4	300	6.0	-18.1	45.8	63.9	
175.00	-80.5	0.01	10.11	2.0	1	-68.4	300	6.0	-7.1	22.7	29.8	

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

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

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.	12212627S-H-R1	
Test place	Shonan EMC Lab. No.1 Measurement Room	No.5 Shielded room
Date	April 17, 2018	May 15, 2018
Temperature / Humidity	26 deg. C / 31 % RH	25 deg. C / 37 % RH
Engineer	Yosuke Ishikawa	Makoto Hosaka
Mode	Tx	

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-25.01	1.48	9.86	-13.67	8.00	21.67
2437.00	-24.73	1.48	9.86	-13.39	8.00	21.39
2462.00	-25.37	1.49	9.85	-14.03	8.00	22.03

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-25.64	1.48	9.86	-14.30	8.00	22.30
2437.00	-25.89	1.48	9.86	-14.55	8.00	22.55
2462.00	-25.86	1.49	9.85	-14.52	8.00	22.52

11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-26.71	1.48	9.86	-15.37	8.00	23.37
2437.00	-26.15	1.48	9.86	-14.81	8.00	22.81
2462.00	-25.40	1.49	9.85	-14.06	8.00	22.06

BT LE

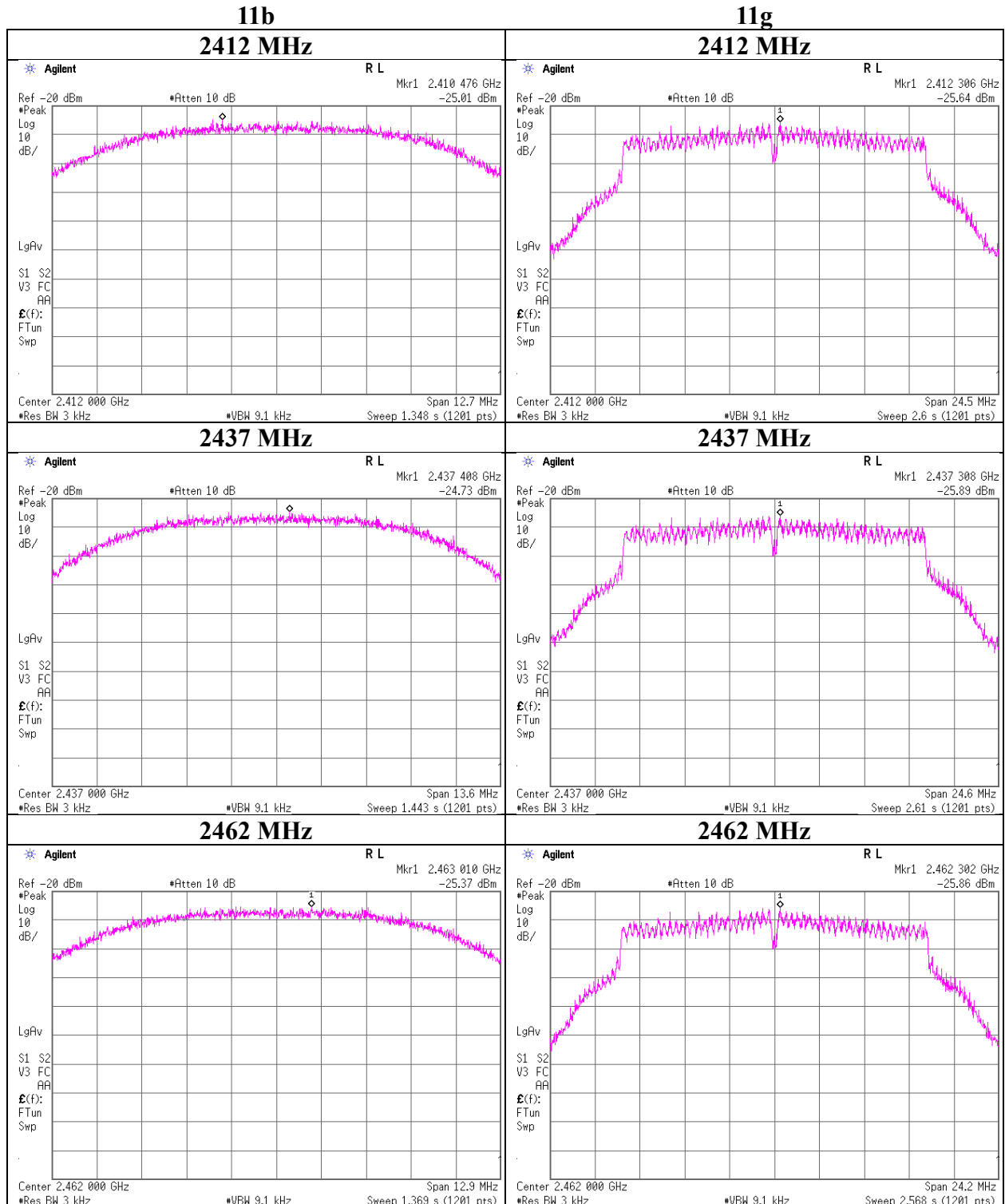
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-19.70	1.48	10.18	-8.04	8.00	16.04
2440.00	-19.67	1.48	10.18	-8.01	8.00	16.01
2480.00	-20.60	1.49	10.18	-8.93	8.00	16.93

Sample Calculation:

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

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

Power Density



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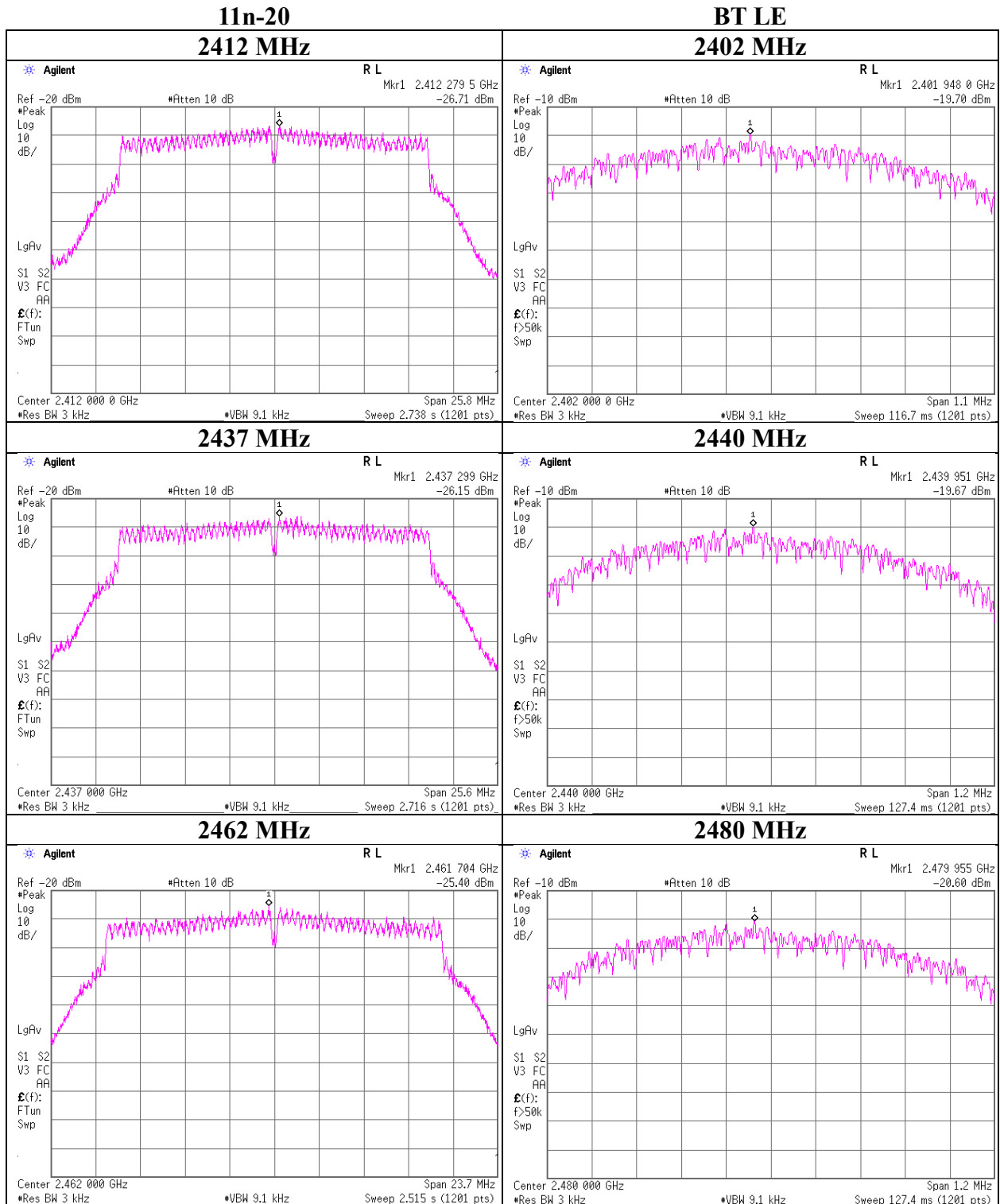
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Power Density



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APPENDIX 2: Test instruments

Test Instruments (WLAN test)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SRENT-09	Spectrum Analyzer	Agilent	E4440A	MY46186392	AT	2017/11/08 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2017/05/01 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2017/05/01 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2018/03/19 * 12
SAT10-12	Attenuator	Weinschel Corp.	54A-10	81601	AT	2018/03/22 * 12
SOS-13	Humidity Indicator	Custom	CTH-202	Q.C.17	AT	2017/12/21 * 12
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2017/06/09 * 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2018/02/15 * 12
SCC-G41	Coaxial Cable	Junkosha	MWX221-01000 NFSNMS/B	1612S006	RE	2018/01/29 * 12
SCC-G43	Coaxial Cable	HUBER+SUHNER	SUCOFLEX_10 4 E	SN MY 13406/4E	RE	2017/07/10 * 12
SCC-G44	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 104	800070/4A	RE	2018/03/28 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2017/08/14 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2017/10/30 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE,CE	2017/09/26 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE,CE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE, CE,RFI,MF)	-	RE,CE	-
STS-02	Digital Hitester	Hioki	3805-50	080997819	RE,CE	2018/03/08 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2018/03/05 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2018/04/20 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2017/09/22 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2018/03/20 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KMSKMS	-	RE	2018/04/20 * 12
SCC-G45	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102 E	800137/2EA	RE	2018/03/28 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2018/02/16 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2018/02/16 * 12
SAT3-11	Attenuator	JFW	50HF-003N	-	RE	2018/02/22 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2017/11/23 * 12
SCC-B1/B3/B5/ B7/B8/B13/SRS E-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/ 141PE/141PE/14 1PE/141PE/NS4 906	-/0901-270(RF Selector)	RE	2018/04/07 * 12
SCC-B2/B4/B6/ B7/B8/B13/SRS E-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/ 141PE/141PE/14 1PE/141PE/NS4 906	-/0901-270(RF Selector)	RE	2018/04/07 * 12
SLA-06	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	RE	2018/01/30 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2017/06/08 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	2046104	RE	2017/09/22 * 12
SCC-G06	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-091	RE	2017/06/13 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2017/05/08 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2017/08/23 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2017/10/30 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2017/10/10 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
SAEC-03(SVS WR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSW R)	3	RE	2017/07/17 * 12
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2017/10/16 * 12
SAT10-05	Attenuator(above 1 GHz)	Agilent	8493C-010	74864	RE	2017/11/22 * 12
SCC-G40	Coaxial Cable	Junkosha	MWX221-01000 NFSNMS/B	1612S005	RE	2018/01/29 * 12

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Test Instruments (BT LE test)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
KPM-08	Power meter	Anritsu	ML2495A	6K00003356	AT	2017/09/19 * 12
KPSS-04	Power sensor	Anritsu	MA2411B	012088	AT	2017/09/19 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2017/10/10 * 12
SAT10-15	Attenuator	Weinschel Corp.	54A-10	83406	AT	2017/12/08 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2018/03/19 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2017/12/21 * 12
SCC-C9/C10/S RSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS 4906	-/0901-271(RF Selector)	CE	2018/04/09 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2018/02/26 * 12
SAT3-10	Attenuator	JFW	50HF-003N	-	CE	2017/08/24 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2017/12/21 * 12
STR-08	Test Receiver	Rohde & Schwarz	ESW44	101581	CE,RE	2017/11/24 * 12
SJM-02	Measure	KOMELON	KMC-36	-	CE,RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RF,LF)	-	CE,RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	CE,RE	2017/10/16 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2017/06/11 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2017/10/02 * 12
SLA-07	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	RE	2018/01/30 * 12
SAT6-08	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2017/08/24 * 12
SCC-C1/C2/C3/ C4/C5/C10/SRS E-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/ Suhner/Suhner/Suhner/ TOYO	8D2W/12DSFA/141 PE/141PE/141PE/14 1PE/NS4906	-/0901-271(RF Selector)	RE	2018/04/09 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2018/02/16 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2017/10/30 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	2046104	RE	2017/09/22 * 12
SCC-G06	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-09 1	RE	2017/06/13 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2018/05/11 * 12
SCC-G40	Coaxial Cable	Junkosha	MWX221-01000NF SNMS/B	1612S005	RE	2018/01/29 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2017/08/23 * 12
SAT10-05	Attenuator(above 1GHz)	Agilent	8493C-010	74864	RE	2017/11/22 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2017/11/16 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2018/03/05 * 12
SAEC-03(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2017/07/17 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM9861	RE	2017/07/11 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2018/03/27 * 12
SCC-G45	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102 E	800137/2EA	RE	2018/03/28 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000K MSKMS	-	RE	2018/04/20 * 12

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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