



RADIO TEST REPORT

Test Report No. : 11834855S-A-R2

Applicant : OLYMPUS CORPORATION
Type of Equipment : Wireless LAN/Bluetooth Module
Model No. : S080WIFI-PCA
FCC ID : YSKW80
Test regulation : FCC Part 15 Subpart C: 2018
*Wireless LAN/ Bluetooth Low Energy part
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. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11834855S-A-R1. 11834855S-A-R1 is replaced with this report.

Date of test: September 7, 2017 to March 5, 2018

Representative test engineer:

Shiro Kobayashi

Engineer

Consumer Technology Division

Approved by:

Toyokazu Imamura

Leader

Consumer Technology Division



- ☐ 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.: 11834855S-A

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SECTION 1: Customer information

Company Name	:	OLYMPUS CORPORATION
Address	:	2951 Ishikawa-machi Hachioji-shi Tokyo 192-8507 Japan
Telephone Number	:	+81-42-642-2283
Facsimile Number	:	+81-42-642-2398
Contact Person	:	Kazuma Tajiri

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

2.1 Identification of E.U.T.

Type of Equipment	:	Wireless LAN/Bluetooth Module
Model No.	:	S080WIFI-PCA
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.35 V - 4.2 V
Receipt Date of Sample	:	June 24, 2017
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: S080WIFI-PCA (referred to as the EUT in this report) is a Wireless LAN/Bluetooth Module.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2.4 GHz: 2402 MHz - 2480 MHz (Bluetooth BDR/EDR, Bluetooth Low Energy) 2412 MHz - 2462 MHz (Wireless LAN) U-NII-1 / 5180 MHz - 5320 MHz (IEEE 802.11a/n-20) U-NII-2A: 5190 MHz - 5310 MHz (IEEE 802.11n-40/ac-40) 5210 MHz - 5290 MHz (IEEE 802.11ac-80) U-NII-2C: 5500 MHz - 5700 MHz (IEEE 802.11a/n-20) 5510 MHz - 5670 MHz (IEEE 802.11n-40/ac-40) 5530 MHz (IEEE 802.11ac-80) U-NII-3: 5745 MHz - 5825 MHz (IEEE 802.11a/n-20) 5755 MHz - 5795 MHz (IEEE 802.11n-40/ac-40) 5775 MHz (IEEE 802.11ac-80)
Modulation	:	DSSS (IEEE 802.11b), OFDM (IEEE 802.11g/n/a/ac) FHSS (Bluetooth BDR/EDR), GFSK (Bluetooth Low Energy)
Power Supply (inner)	:	VBAT: DC 3.8 V (3.35 V - 4.2 V), VIO: DC 1.8 V, DC 3.3 V (1.62 V - 3.63 V)
Antenna type	:	Pattern Antenna
Antenna Gain	:	2.4 GHz: -2.9 dBi 5 GHz: +1.3 dBi
Operating Temperature	:	-10 deg. C to +40 deg. C
Clock frequency (Maximum)	:	37.4 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on February 2, 2018 and effective March 5, 2018

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

* The revisions made after testing date do not affect the test specification applied to the EUT.

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	24.5 dB 19.66492 MHz, L1, AV BLE 2402 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: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	0.4 dB 2483.500 MHz, AV, Hori. Tx 11g 2462 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.

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

FCC Part 15.31 (e)

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC 3.8 V) through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

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3.3 Addition to standard

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

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
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.5 dB	2.5 dB	2.6 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	30 MHz-200 MHz	4.3 dB	4.3 dB	4.3 dB	-
	200 MHz-1 GHz	5.9 dB	5.9 dB	5.9 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 %

Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

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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.

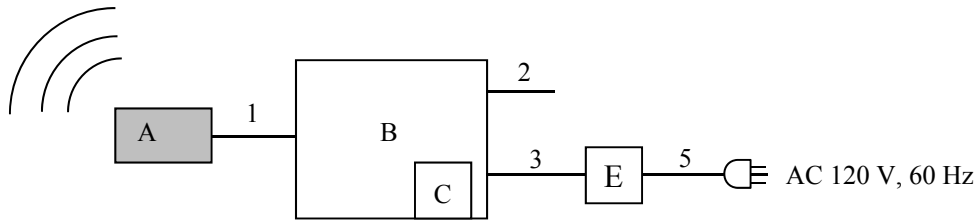
Mode	Remarks*
IEEE 802.11b (11b)	11 Mbps, PN9
IEEE 802.11g (11g)	48 Mbps, PN9
IEEE 802.11n SISO 20 MHz BW (11n-20)	MCS 0, PN9
Bluetooth Low Energy (BT LE)	PRBS9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 11b, 11g, 11n-20 : 11 dBm BT LE : Fixed Software: TeraTerm.exe version 4.83 for IEEE 802.11 Bluetool version 1.9.6.5 *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)

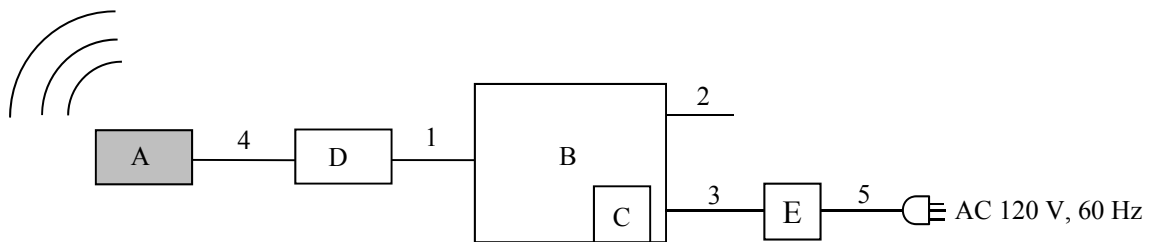
Test Item	Operating Mode	Tested frequency
Conducted Emission	11g Tx	2437 MHz
	BT LE	2402 MHz
Spurious Emission	11b Tx	2412 MHz
	11g Tx	2437 MHz
	11n-20 Tx	2462 MHz
	BT LE	2402 MHz
		2440 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx	2412 MHz
	11g Tx	2437 MHz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

4.2 Configuration and peripherals

WLAN



BLE



* 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	Remark
A	Wireless LAN/Bluetooth Module	S080WIFI-PCA	2 *1) 5 *2)	OLYMPUS CORPORATION	EUT
B	Jig Board	T3050TB	-	OLYMPUS CORPORATION	-
C	SD Card	SD-K08G	1572 CS00156	TOSHIBA	-
D	UART – USB Conversion Board	T3050 UART - USB	-	OLYMPUS CORPORATION	-
E	Power Supply(DC)	PAN35-10A	NA000955	Kikusui	-

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Signal	0.2	Unshielded	Unshielded	-
2	DC	0.3	Unshielded	Unshielded	-
3	DC	1.5	Unshielded	Unshielded	-
4	Signal	0.2	Unshielded	Unshielded	-
5	AC	1.8	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

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

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded room. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "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, 0.5 m by 0.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

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

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

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

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

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

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

Test Antennas are used as below;

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

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: 12.2.5.2 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	3.99 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		3.99 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 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: $20 \times \log(3.99 \text{ m} / 3.0 \text{ m}) = 2.47 \text{ dB}$

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

- 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.

Wireless LAN

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz -2.8 GHz)	Spurious (2.8 GHz -13 GHz)	Spurious (13 GHz -26.5 GHz)
Horizontal	X	Z	X	X	X
Vertical	Y	Z	Y	Y	X

Bluetooth Low Energy (BT LE)

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz -2.8 GHz)	Spurious (2.8 GHz -13 GHz)	Spurious (13 GHz -26.5 GHz)
Horizontal	Z	Z	Z	Z	X
Vertical	Y	Z	Y	Y	X

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

Measurement range : 30 MHz – 26.5 GHz

Test data : APPENDIX

Test result : Pass

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SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	50 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 160 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

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

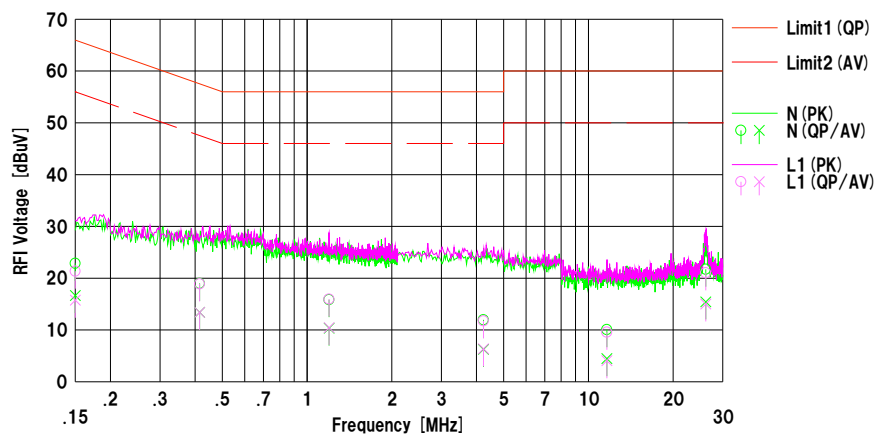
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2017/11/22

Mode : IEEE802.11-20, Tx 2437 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 21 deg.C / 38 %RH

Remarks : -

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

Engineer : Kazutaka Takeyama



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	10.40	4.20	12.46	22.86	16.66	66.00	56.00	43.1	39.3	N	
2	0.41500	6.50	0.90	12.50	19.00	13.40	57.55	47.55	38.5	34.1	N	
3	1.19800	3.30	-2.20	12.56	15.86	10.36	56.00	46.00	40.1	35.6	N	
4	4.23900	-0.80	-6.50	12.76	11.96	6.26	56.00	46.00	44.0	39.7	N	
5	11.63000	-3.10	-8.70	13.17	10.07	4.47	60.00	50.00	49.9	45.5	N	
6	26.13700	7.90	1.60	13.83	21.73	15.43	60.00	50.00	38.2	34.5	N	
7	0.15000	8.90	3.30	12.46	21.36	15.76	66.00	56.00	44.6	40.2	L1	
8	0.41500	6.40	0.90	12.50	18.90	13.40	57.55	47.55	38.6	34.1	L1	
9	1.19800	3.40	-2.10	12.56	15.96	10.46	56.00	46.00	40.0	35.5	L1	
10	4.23900	-1.00	-6.40	12.76	11.76	6.36	56.00	46.00	44.2	39.6	L1	
11	11.63000	-3.60	-9.10	13.17	9.57	4.07	60.00	50.00	50.4	45.9	L1	
12	26.13700	7.20	1.20	13.83	21.03	15.03	60.00	50.00	38.9	34.9	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) = SLS-03

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Conducted Emission

DATA OF CONDUCTED EMISSION TEST

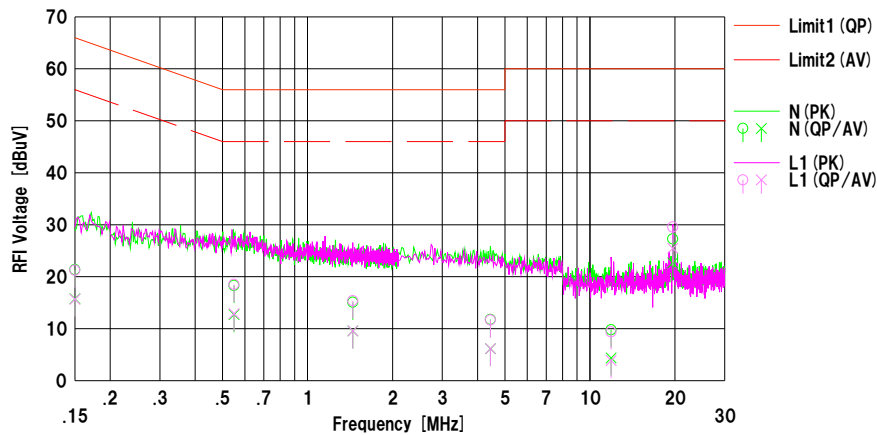
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2017/11/22

Mode : BLE_2402MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 20 deg.C / 42 %RH

Remarks : -

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

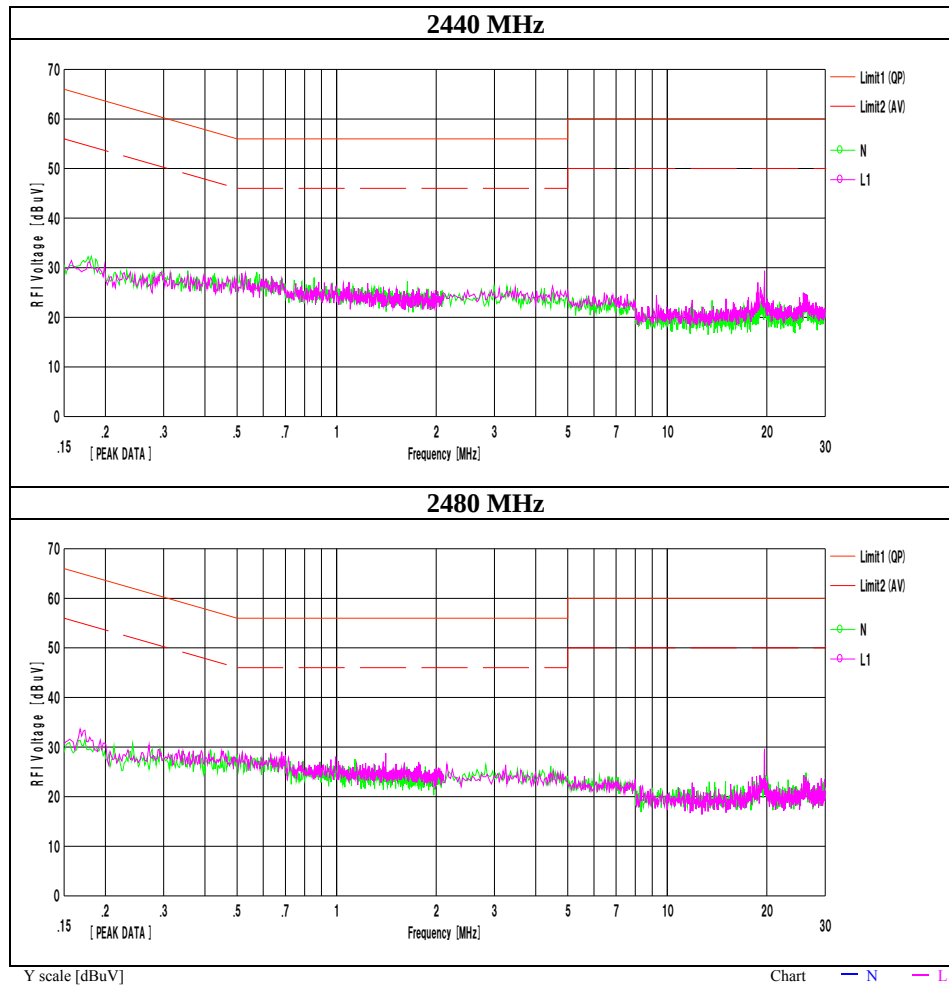
Engineer : Kazutaka Takeyama



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	8.90	3.30	12.46	21.36	15.76	66.00	56.00	44.6	40.2	N	
2	0.54900	5.80	0.20	12.51	18.31	12.71	56.00	46.00	37.6	33.2	N	
3	1.44700	2.50	-3.00	12.58	15.08	9.58	56.00	46.00	40.9	36.4	N	
4	4.44400	-1.00	-6.60	12.77	11.77	6.17	56.00	46.00	44.2	39.8	N	
5	11.89300	-3.40	-8.80	13.18	9.78	4.38	60.00	50.00	50.2	45.6	N	
6	19.66492	13.70	9.10	13.56	27.26	22.66	60.00	50.00	32.7	27.3	N	
7	0.15000	8.80	3.20	12.46	21.26	15.66	66.00	56.00	44.7	40.3	L1	
8	0.54900	6.00	0.40	12.51	18.51	12.91	56.00	46.00	37.4	33.0	L1	
9	1.44700	2.80	-3.00	12.58	15.38	9.58	56.00	46.00	40.6	36.4	L1	
10	4.44400	-1.10	-6.60	12.77	11.67	6.17	56.00	46.00	44.3	39.8	L1	
11	11.89300	-3.80	-9.30	13.18	9.38	3.88	60.00	50.00	50.6	46.1	L1	
12	19.66492	16.00	11.90	13.56	29.56	25.46	60.00	50.00	30.4	24.5	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) = SLS-03

Conducted Emission



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Shonan EMC Lab

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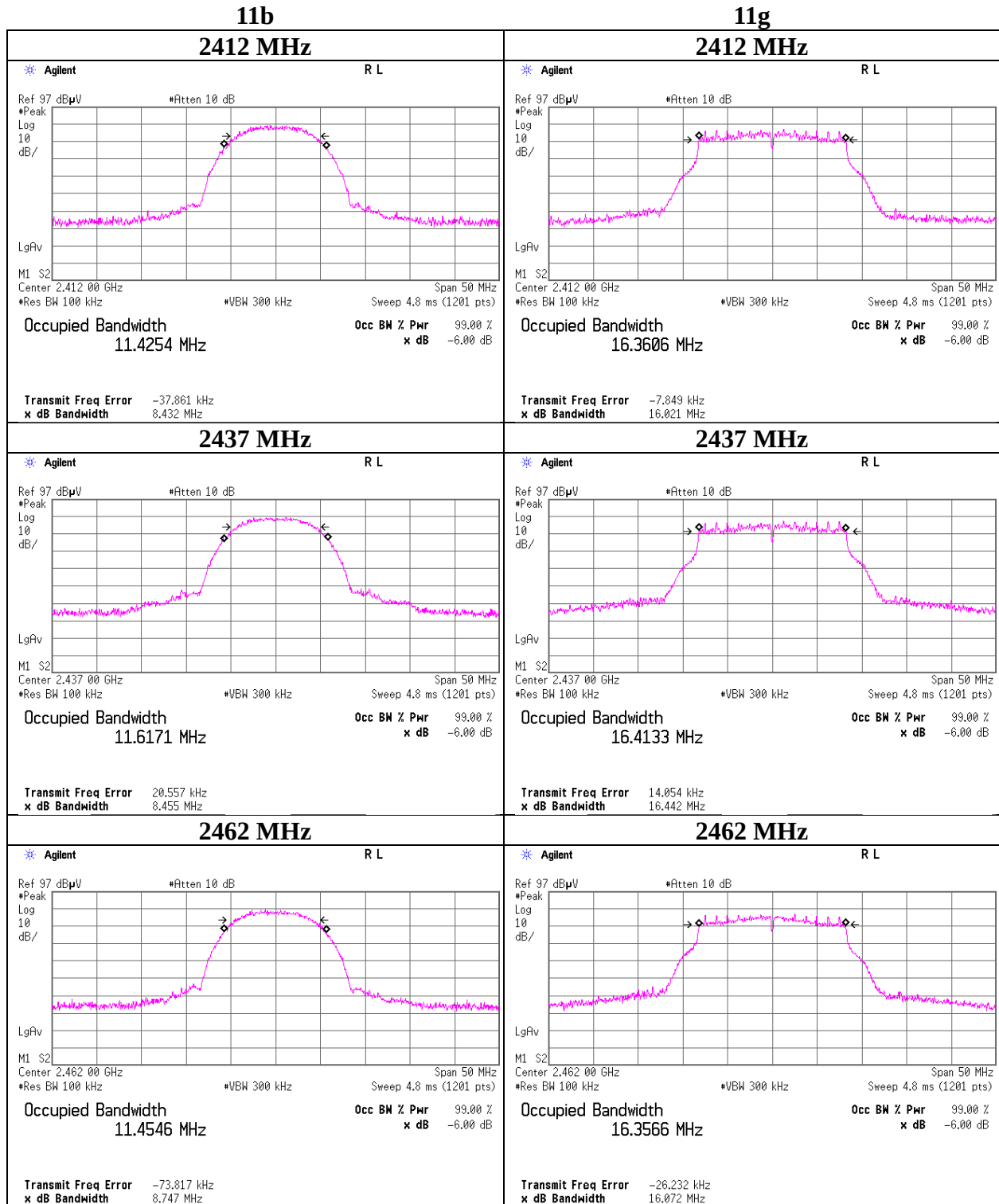
Facsimile : +81 463 50 6401

6 dB Bandwidth and 99 % Occupied Bandwidth

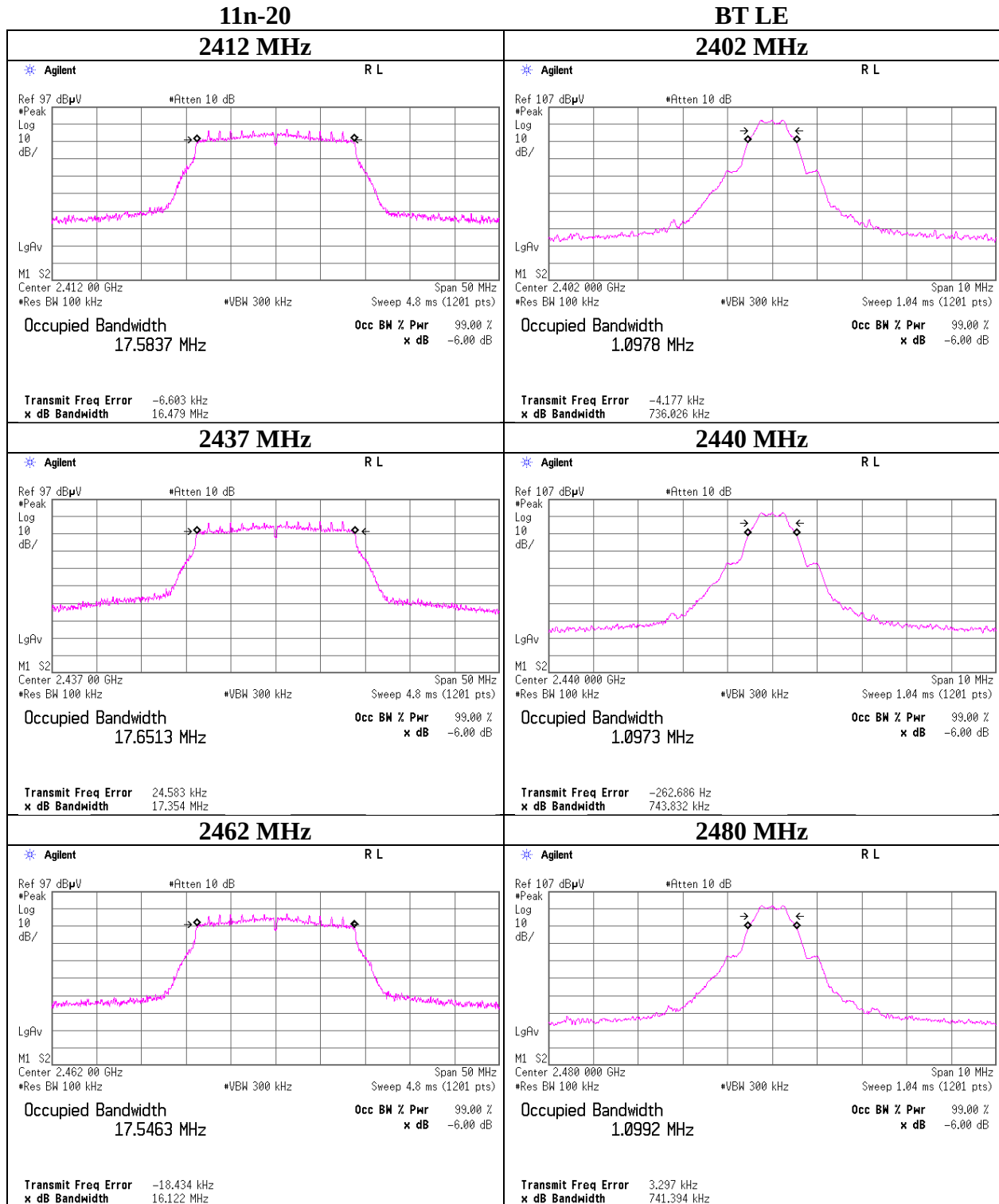
Test place	Shonan EMC Lab No.6 Shielded Room		
Report No.	11834855S-A-R2		
Date	January 19, 2018	January 22, 2018	
Temperature / Humidity	22 deg. C / 38 %RH	25 deg. C / 24 % RH	
Engineer	Kazuya Noda	Kazuya Noda	
Mode	Tx		

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	11391.5	8.432	> 0.5000
	2437	11614.8	8.455	> 0.5000
	2462	11564.8	8.747	> 0.5000
11g	2412	16715.7	16.021	> 0.5000
	2437	16844.7	16.442	> 0.5000
	2462	16841.0	16.072	> 0.5000
11n-20	2412	18049.7	16.479	> 0.5000
	2437	18174.4	17.354	> 0.5000
	2462	17988.0	16.122	> 0.5000
BT LE	2402	1065.4	0.736	> 0.5000
	2440	1067.1	0.744	> 0.5000
	2480	1066.8	0.741	> 0.5000

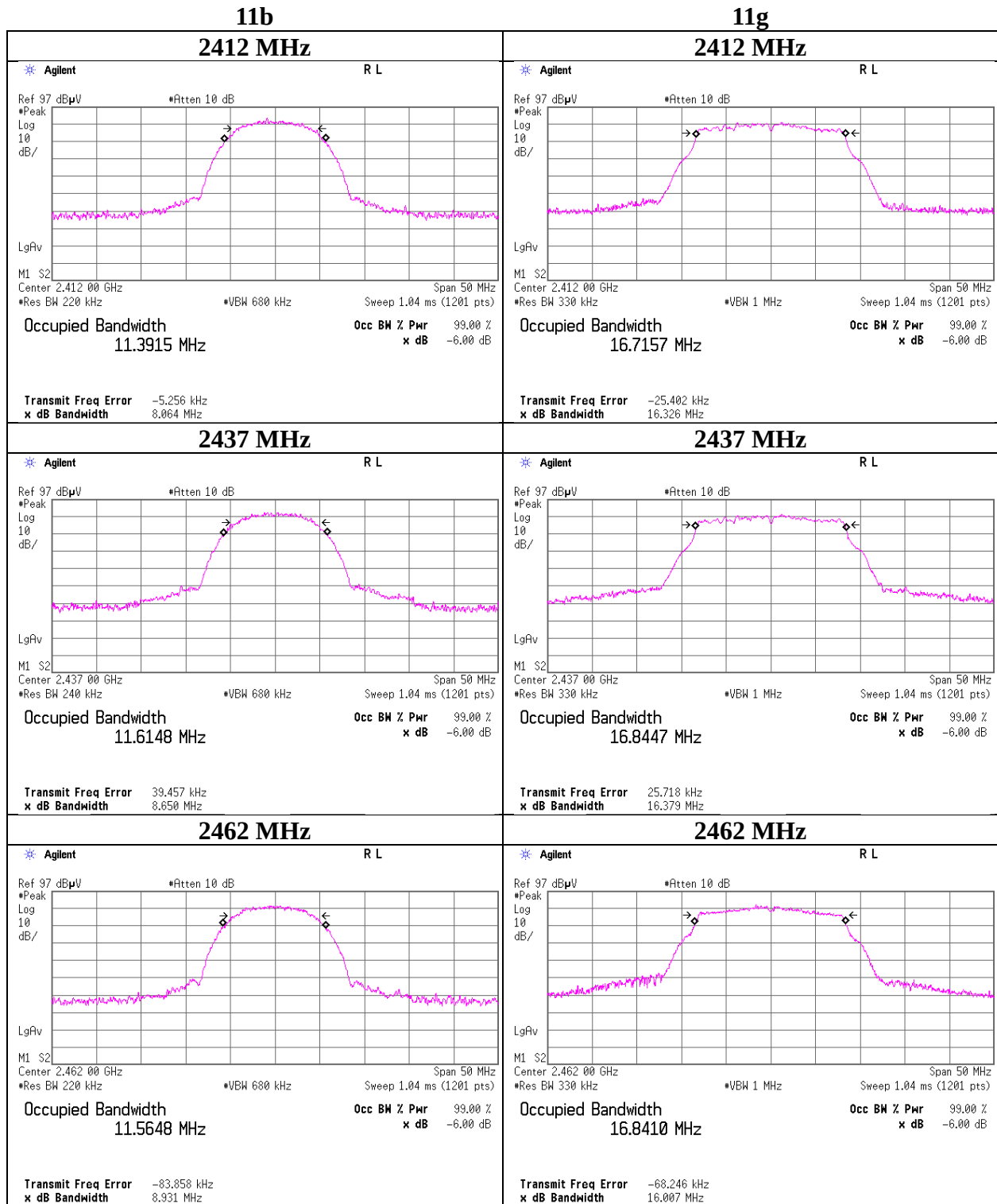
6dB Bandwidth



6dB Bandwidth



99% Occupied Bandwidth



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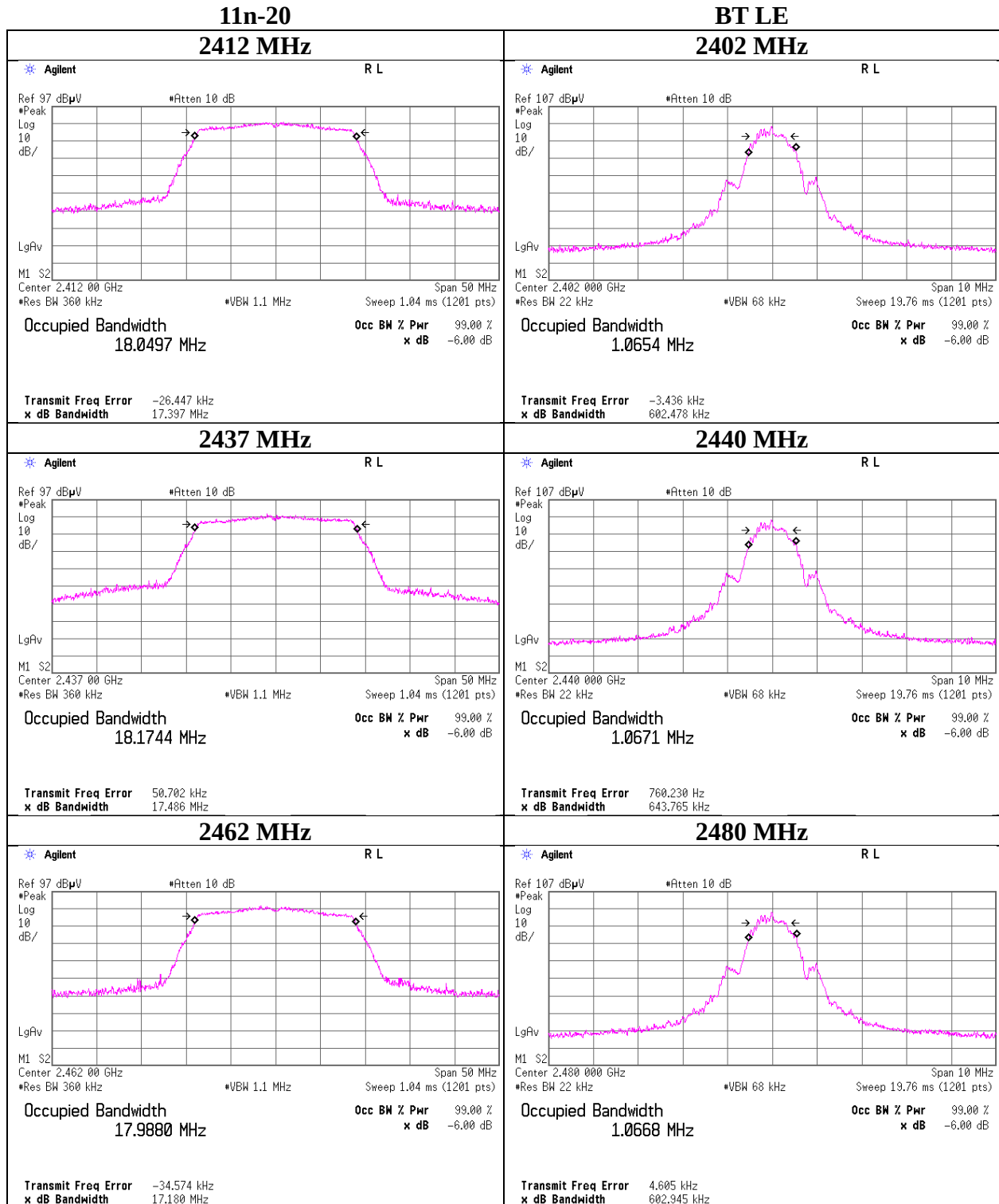
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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99% Occupied Bandwidth



Maximum Peak Output Power

Test place Shonan EMC Lab No.5 Shielded Room
Report No. 11834855S-A-R2
Date March 5, 2018
Temperature / Humidity 24 deg. C / 42 % RH
Engineer Makoto Hosaka
Mode Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-7.10	1.63	20.09	14.62	28.97	30.00	1000	15.38
2437	-7.46	1.64	20.09	14.27	26.73	30.00	1000	15.73
2462	-7.26	1.65	20.09	14.48	28.05	30.00	1000	15.52

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.

Rate	Reading	Remark
[Mbps]	[dBm]	
1	-8.92	
2	-8.53	
5.5	-7.62	
11	-7.46	*

*: Worst Rate

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

Maximum Peak Output Power

Test place	Shonan EMC Lab No.5 Shielded Room
Report No.	11834855S-A-R2
Date	March 5, 2018
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Makoto Hosaka
Mode	Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	0.81	1.63	20.09	22.53	179.06	30.00	1000	7.47
2437	0.78	1.64	20.09	22.51	178.24	30.00	1000	7.49
2462	0.79	1.65	20.09	22.53	179.06	30.00	1000	7.47

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.

Rate	Reading	Remark
[Mbps]	[dBm]	
6	0.31	
9	0.21	
12	0.17	
18	0.31	
24	-0.18	
36	-0.03	
48	0.78	*
54	-1.01	

*: Worst Rate

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

Maximum Peak Output Power

Test place	Shonan EMC Lab No.5 Shielded Room
Report No.	11834855S-A-R2
Date	March 5, 2018
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Makoto Hosaka
Mode	Tx 11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	0.74	1.63	20.09	22.46	176.20	30.00	1000	7.54
2437	0.73	1.64	20.09	22.46	176.20	30.00	1000	7.54
2462	0.80	1.65	20.09	22.54	179.47	30.00	1000	7.46

Sample Calculation:

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

*The equipment and cables were not used for factor 0.0 dB of the data sheets.

MCS Number	Reading [dBm]	Remark
0	0.73	*
1	-0.10	
2	0.45	
3	-0.24	
4	0.37	
5	0.37	
6	0.15	
7	0.25	

* Worst MCS

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

Maximum Peak Output Power

Test place Shonan EMC Lab No.5 Shielded Room
Report No. 11834855S-A-R2
Date November 20, 2017
Temperature / Humidity 24 deg. C / 31 % RH
Engineer Shiro Kobayashi
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-5.49	1.60	9.96	6.07	4.05	30.00	1000	23.93
2440	-5.70	1.61	9.97	5.88	3.87	30.00	1000	24.12
2480	-6.14	1.62	9.97	5.45	3.51	30.00	1000	24.55

Sample Calculation:

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

*The equipment and cables were not used for factor 0.0 dB of the data sheets.

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

Test place	Shonan EMC Lab No.5 Shielded Room	
Report No.	11834855S-A-R2	
Date	March 5, 2018	November 20, 2017
Temperature / Humidity	24 deg. C / 42 % RH	24 deg. C / 31 % RH
Engineer	Makoto Hosaka	Shiro Kobayashi
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	-10.97	1.63	20.09	10.75	11.89	0.05	10.80	12.02
2437	-10.85	1.64	20.09	10.88	12.25	0.05	10.93	12.39
2462	-10.92	1.65	20.09	10.82	12.08	0.05	10.87	12.22

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	-10.46	1.63	20.09	11.26	13.37	0.30	11.56	14.32
2437	-10.53	1.64	20.09	11.20	13.18	0.30	11.50	14.13
2462	-10.31	1.65	20.09	11.43	13.90	0.30	11.73	14.89

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	-10.57	1.63	20.09	11.15	13.03	0.31	11.46	14.00
2437	-10.07	1.64	20.09	11.66	14.66	0.31	11.97	15.74
2462	-10.70	1.65	20.09	11.04	12.71	0.31	11.35	13.65

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	-7.76	1.60	9.96	3.80	2.40	1.94	5.74	3.75
2440	-7.95	1.61	9.97	3.63	2.31	1.94	5.57	3.61
2480	-8.42	1.62	9.97	3.17	2.07	1.94	5.11	3.24

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.

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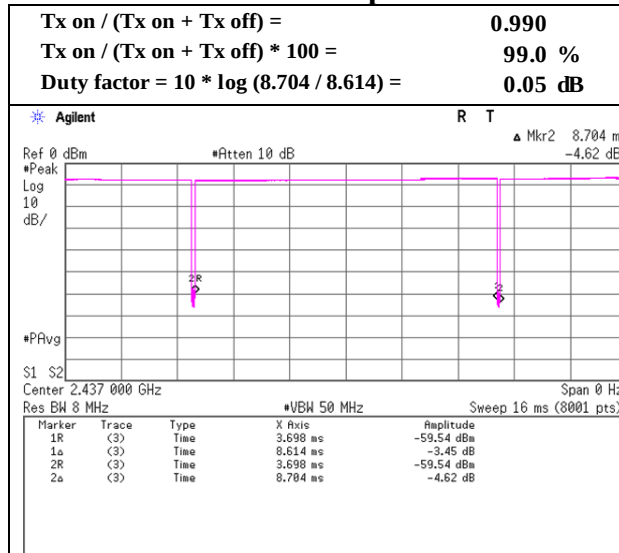
Facsimile : +81 463 50 6401

Burst rate confirmation

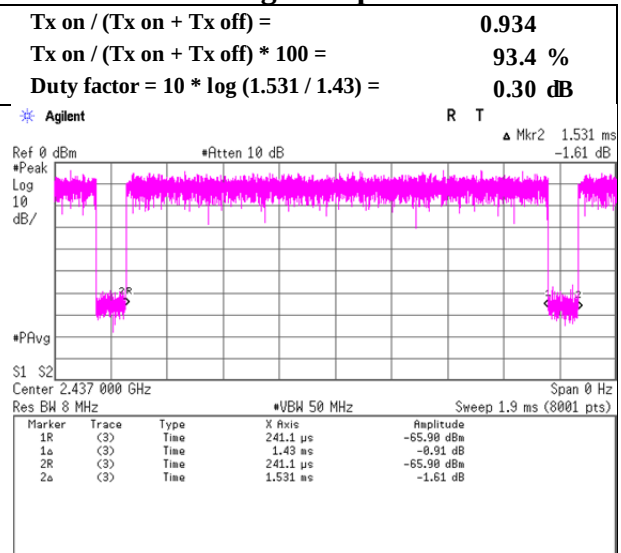
Test place	Shonan EMC Lab No.1 Measurement Room	
Report No.	11834855S-A-R2	
Date	January 22, 2018	November 20, 2017
Temperature / Humidity	21 deg. C / 30 % RH	24 deg. C / 31 % RH
Engineer	Kazuya Noda	Shiro Kobayashi
Mode	Tx	

Lowest Rate

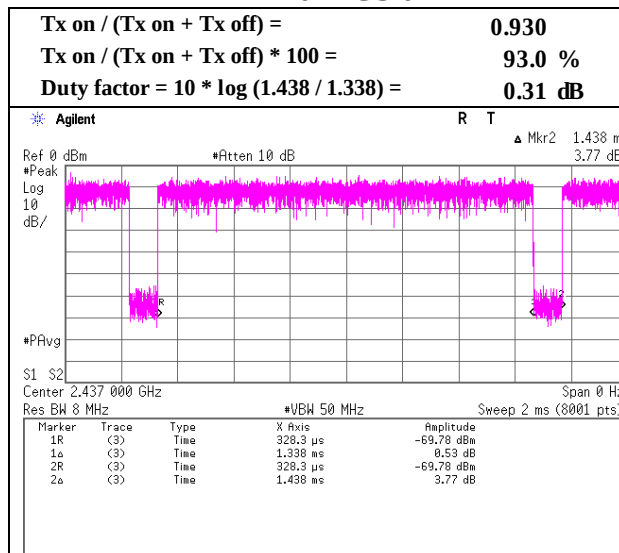
11b 1 Mbps



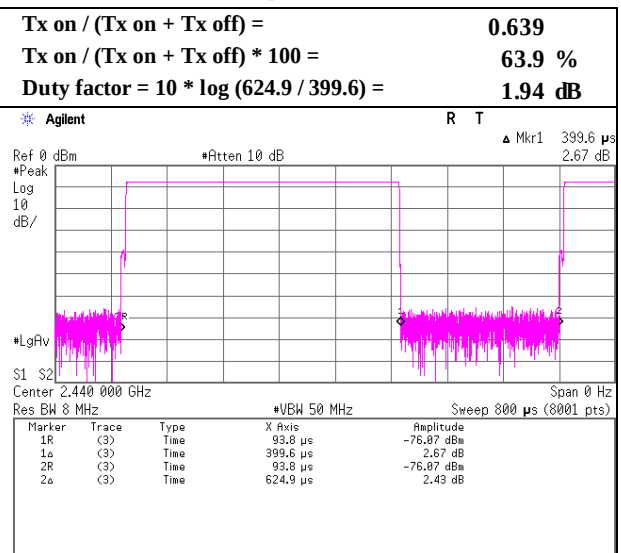
11g 6 Mbps



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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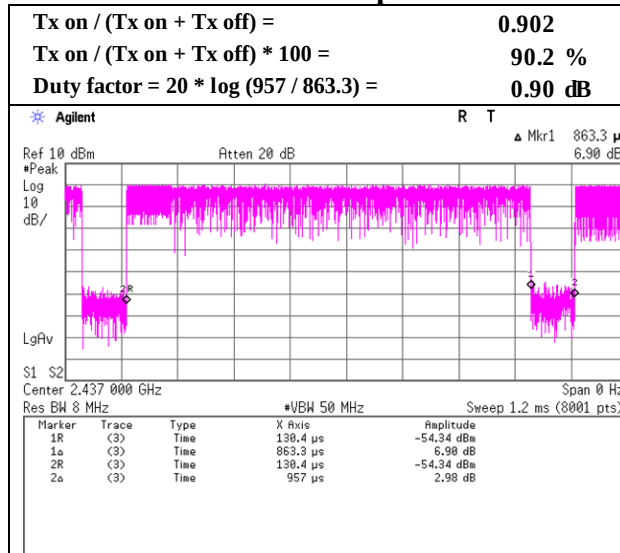
Facsimile : +81 463 50 6401

Burst rate confirmation

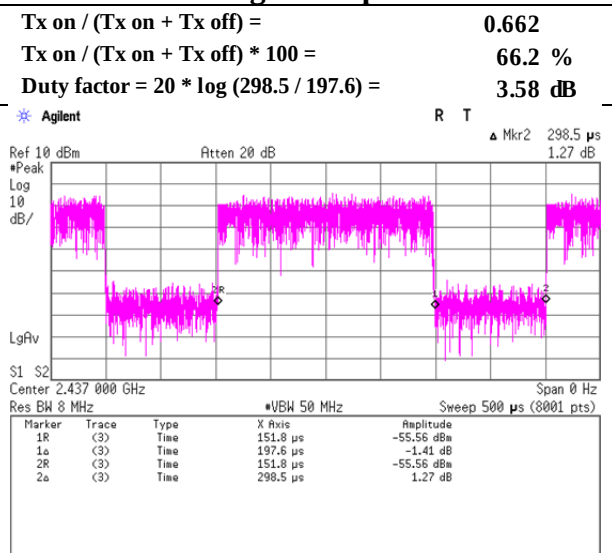
Test place : Shonan EMC Lab No.1 Measurement Room
Report No. : 11834855S-A-R2
Date : January 22, 2018
Temperature / Humidity : 21 deg. C / 30 % RH
Engineer : Kazuya Noda
Mode : Tx
November 20, 2017
24 deg. C / 31 % RH
Shiro Kobayashi

Worst peak power Rate

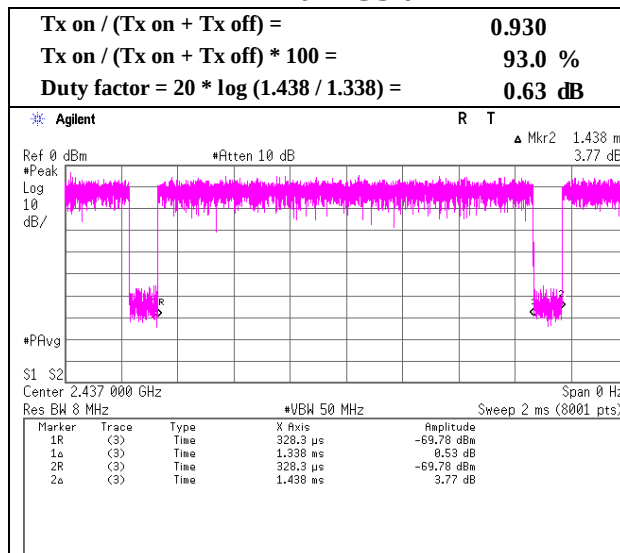
11b 11 Mbps



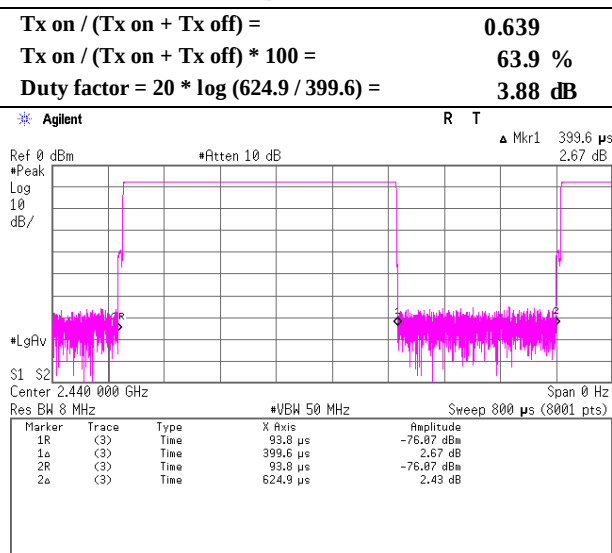
11g 48 Mbps



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.

Radiated Spurious Emission

Test place	Shonan EMC Lab	
Report No.	11834855S-A-R2	
Semi Anechoic Chamber	No.3	No.1
Date	September 28, 2017	September 30, 2017
Temperature / Humidity	25 deg. C / 57 % RH	23 deg. C / 54 % RH
Engineer	Hiroyuki Morikawa	Hikaru Shirasawa
	(1 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	59.57	27.26	14.15	44.13	2.47	59.32	73.90	14.5	105	47	
Hori.	4824.000	PK	48.86	31.46	6.68	44.46	2.47	45.01	73.90	28.8	135	0	
Hori.	7236.000	PK	48.10	36.62	8.29	44.00	2.47	51.48	73.90	22.4	104	323	
Hori.	9648.000	PK	48.91	38.66	9.25	43.83	2.47	55.46	73.90	18.4	150	0	
Vert.	2390.000	PK	55.80	27.26	14.15	44.13	2.47	55.55	73.90	18.3	344	217	
Vert.	4824.000	PK	48.70	31.46	6.68	44.46	2.47	44.85	73.90	29.0	152	58	
Vert.	7236.000	PK	48.12	36.62	8.29	44.00	2.47	51.50	73.90	22.4	150	0	
Vert.	9648.000	PK	47.67	38.66	9.25	43.83	2.47	54.22	73.90	19.6	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	49.05	27.26	14.15	44.13	0.90	2.47	49.70	53.90	4.2	*1)
Hori.	4824.000	AV	40.37	31.46	6.68	44.46	0.90	2.47	37.42	53.90	16.5	
Hori.	7236.000	AV	39.28	36.62	8.29	44.00	0.90	2.47	43.56	53.90	10.3	
Hori.	9648.000	AV	39.39	38.66	9.25	43.83	0.90	2.47	46.84	53.90	7.1	
Vert.	2390.000	AV	44.33	27.26	14.15	44.13	0.90	2.47	44.98	53.90	8.9	*1)
Vert.	4824.000	AV	40.02	31.46	6.68	44.46	0.90	2.47	37.07	53.90	16.8	
Vert.	7236.000	AV	39.22	36.62	8.29	44.00	0.90	2.47	43.50	53.90	10.4	
Vert.	9648.000	AV	39.55	38.66	9.25	43.83	0.90	2.47	47.00	53.90	6.9	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	106.99	27.33	14.16	44.14	2.47	106.81	-	-	Carrier
Hori.	2398.810	PK	72.73	27.28	14.15	44.14	2.47	72.49	86.81	14.3	
Hori.	2400.000	PK	69.35	27.29	14.15	44.14	2.47	69.12	86.81	17.7	
Vert.	2412.000	PK	105.10	27.33	14.16	44.14	2.47	104.92	-	-	Carrier
Vert.	2398.535	PK	66.41	27.28	14.15	44.14	2.47	66.17	84.92	18.8	
Vert.	2400.000	PK	63.10	27.29	14.15	44.14	2.47	62.87	84.92	22.1	

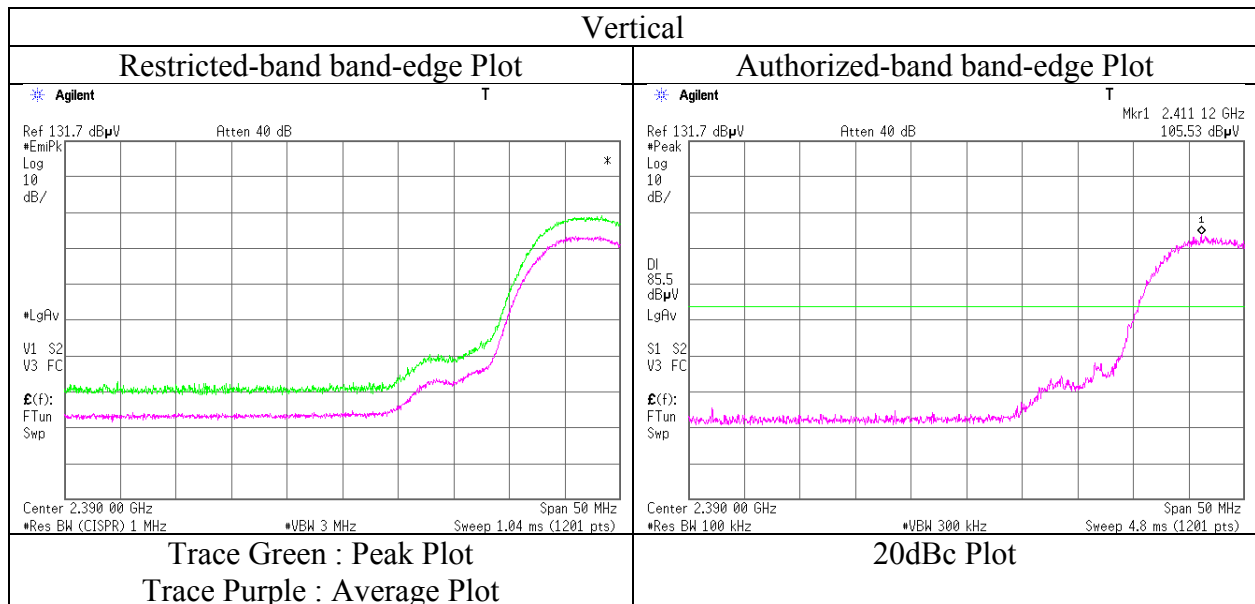
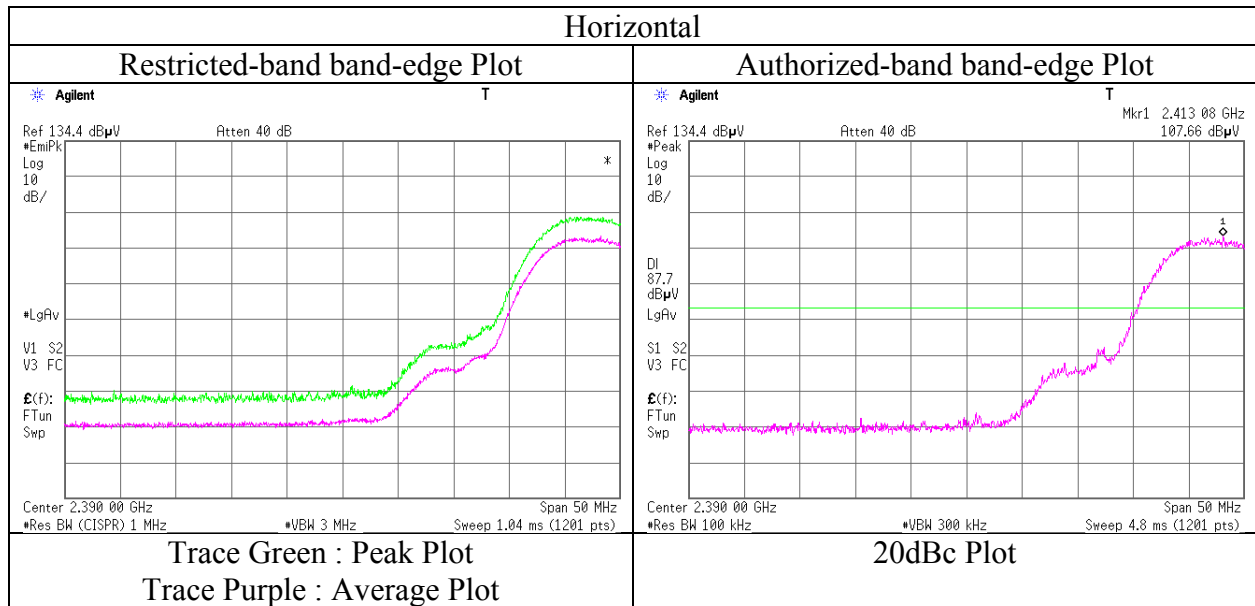
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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)

Test place	Shonan EMC Lab
Report No.	11834855S-A-R2
Semi Anechoic Chamber	No.3
Date	September 28, 2017
Temperature / Humidity	25 deg. C / 57 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx 11b 2412 MHz



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

Radiated Spurious Emission

Test place	Shonan EMC Lab		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	September 28, 2017	September 29, 2017	September 30, 2017
Temperature / Humidity	25 deg. C / 57 % RH	22 deg. C / 62 % RH	23 deg. C / 54 % RH
Engineer	Hiroyuki Morikawa (1 GHz -2.8 GHz)	Hikaru Shirasawa (2.8 GHz -13 GHz)	Hikaru Shirasawa (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	48.95	31.59	6.72	44.47	2.47	45.26	73.90	28.6	150	0	
Hori.	7311.000	PK	47.72	36.75	8.37	44.03	2.47	51.28	73.90	22.6	150	0	
Hori.	9748.000	PK	47.36	38.78	9.31	43.84	2.47	54.08	73.90	19.8	150	0	
Vert.	4874.000	PK	48.66	31.59	6.72	44.47	2.47	44.97	73.90	28.9	150	0	
Vert.	7311.000	PK	47.21	36.75	8.37	44.03	2.47	50.77	73.90	23.1	150	0	
Vert.	9748.000	PK	47.13	38.78	9.31	43.84	2.47	53.85	73.90	20.0	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	39.28	31.59	6.72	44.47	0.90	2.47	36.49	53.90	17.4	
Hori.	7311.000	AV	38.24	36.75	8.37	44.03	0.90	2.47	42.70	53.90	11.2	
Hori.	9748.000	AV	38.57	38.78	9.31	43.84	0.90	2.47	46.19	53.90	7.7	
Vert.	4874.000	AV	39.43	31.59	6.72	44.47	0.90	2.47	36.64	53.90	17.3	
Vert.	7311.000	AV	38.51	36.75	8.37	44.03	0.90	2.47	42.97	53.90	10.9	
Vert.	9748.000	AV	38.30	38.78	9.31	43.84	0.90	2.47	45.92	53.90	8.0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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

Test place	Shonan EMC Lab		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	September 28, 2017	September 29, 2017	September 30, 2017
Temperature / Humidity	25 deg. C / 57 % RH	22 deg. C / 62 % RH	23 deg. C / 54 % RH
Engineer	Hiroyuki Morikawa (1 GHz -2.8 GHz)	Hikaru Shirasawa (2.8 GHz -13 GHz)	Hikaru Shirasawa (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	51.83	27.55	14.24	44.16	2.47	51.93	73.90	21.9	136	227	
Hori.	4924.000	PK	50.84	31.73	6.79	44.49	2.47	47.34	73.90	26.5	154	357	
Hori.	7386.000	PK	49.56	36.88	8.45	44.06	2.47	53.30	73.90	20.6	159	323	
Hori.	9848.000	PK	48.40	38.90	9.39	43.86	2.47	55.30	73.90	18.6	150	0	
Vert.	2483.500	PK	57.02	27.55	14.24	44.16	2.47	57.12	73.90	16.7	327	216	
Vert.	4924.000	PK	49.64	31.73	6.79	44.49	2.47	46.14	73.90	27.7	150	0	
Vert.	7386.000	PK	49.25	36.88	8.45	44.06	2.47	52.99	73.90	20.9	150	0	
Vert.	9848.000	PK	49.02	38.90	9.39	43.86	2.47	55.92	73.90	17.9	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	41.32	27.55	14.24	44.16	0.90	2.47	42.32	53.90	11.6	*1)
Hori.	4924.000	AV	40.68	31.73	6.79	44.49	0.90	2.47	38.08	53.90	15.8	
Hori.	7386.000	AV	39.06	36.88	8.45	44.06	0.90	2.47	43.70	53.90	10.2	
Hori.	9848.000	AV	38.70	38.90	9.39	43.86	0.90	2.47	46.50	53.90	7.4	
Vert.	2483.500	AV	47.11	27.55	14.24	44.16	0.90	2.47	48.11	53.90	5.8	*1)
Vert.	4924.000	AV	39.98	31.73	6.79	44.49	0.90	2.47	37.38	53.90	16.5	
Vert.	7386.000	AV	38.93	36.88	8.45	44.06	0.90	2.47	43.57	53.90	10.3	
Vert.	9848.000	AV	38.95	38.90	9.39	43.86	0.90	2.47	46.75	53.90	7.2	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

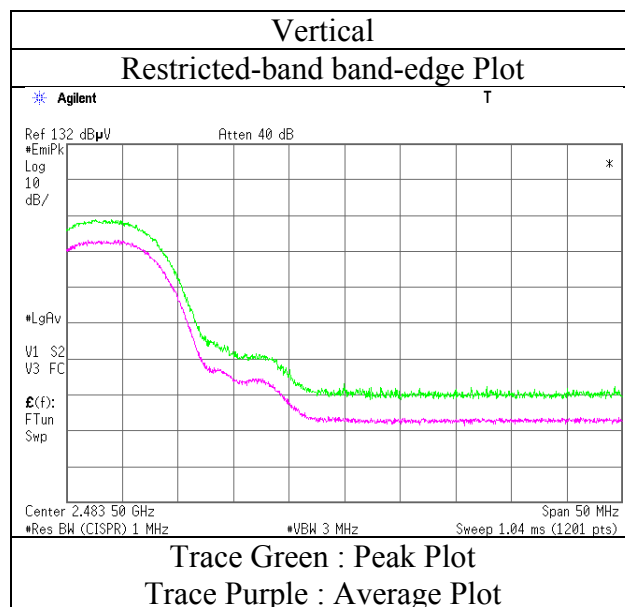
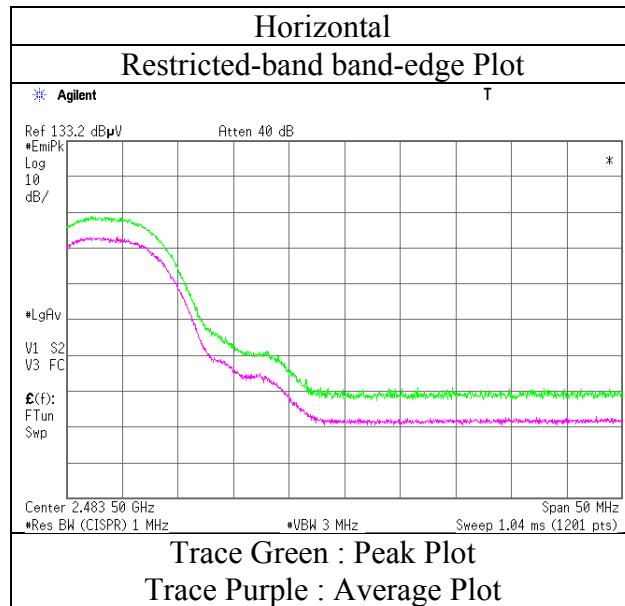
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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)

Test place	Shonan EMC Lab
Report No.	11834855S-A-R2
Semi Anechoic Chamber	No.3
Date	September 28, 2017
Temperature / Humidity	25 deg. C / 57 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx 11b 2462 MHz



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

Radiated Spurious Emission

Test place	Shonan EMC Lab		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	September 7, 2017	September 29, 2017	September 30, 2017
Temperature / Humidity	20 deg. C / 65 % RH	22 deg. C / 62 % RH	23 deg. C / 54 % RH
Engineer	Shiro Kobayashi	Hikaru Shirasawa	Hikaru Shirasawa
	(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	56.49	27.26	13.48	36.83	2.47	62.87	73.90	11.0	151	24	
Hori.	4824.000	PK	49.77	31.46	6.68	44.46	2.47	45.92	73.90	27.9	150	0	
Hori.	7236.000	PK	48.33	36.62	8.29	44.00	2.47	51.71	73.90	22.1	150	0	
Hori.	9648.000	PK	48.38	38.66	9.25	43.83	2.47	54.93	73.90	18.9	150	0	
Vert.	2390.000	PK	57.70	27.26	13.48	36.83	2.47	64.08	73.90	9.8	307	199	
Vert.	4824.000	PK	49.20	31.46	6.68	44.46	2.47	45.35	73.90	28.5	150	0	
Vert.	7236.000	PK	48.84	36.62	8.29	44.00	2.47	52.22	73.90	21.6	150	0	
Vert.	9648.000	PK	48.57	38.66	9.25	43.83	2.47	55.12	73.90	18.7	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	40.21	27.26	13.48	36.83	3.58	2.47	50.17	53.90	3.7	*1)
Hori.	4824.000	AV	38.43	31.46	6.68	44.46	3.58	2.47	38.16	53.90	15.7	
Hori.	7236.000	AV	37.87	36.62	8.29	44.00	3.58	2.47	44.83	53.90	9.1	
Hori.	9648.000	AV	39.42	38.66	9.25	43.83	3.58	2.47	49.55	53.90	4.3	
Vert.	2390.000	AV	42.49	27.26	13.48	36.83	3.58	2.47	52.45	53.90	1.4	*1)
Vert.	4824.000	AV	39.95	31.46	6.68	44.46	3.58	2.47	39.68	53.90	14.2	
Vert.	7236.000	AV	39.33	36.62	8.29	44.00	3.58	2.47	46.29	53.90	7.6	
Vert.	9648.000	AV	39.28	38.66	9.25	43.83	3.58	2.47	49.41	53.90	4.5	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	92.81	27.33	13.50	36.82	2.47	99.29	-	-	Carrier
Hori.	2400.000	PK	53.16	27.29	13.49	36.83	2.47	59.58	79.29	19.7	
Vert.	2412.000	PK	94.30	27.33	13.50	36.82	2.47	100.78	-	-	Carrier
Vert.	2400.000	PK	53.38	27.29	13.49	36.83	2.47	59.80	80.78	21.0	

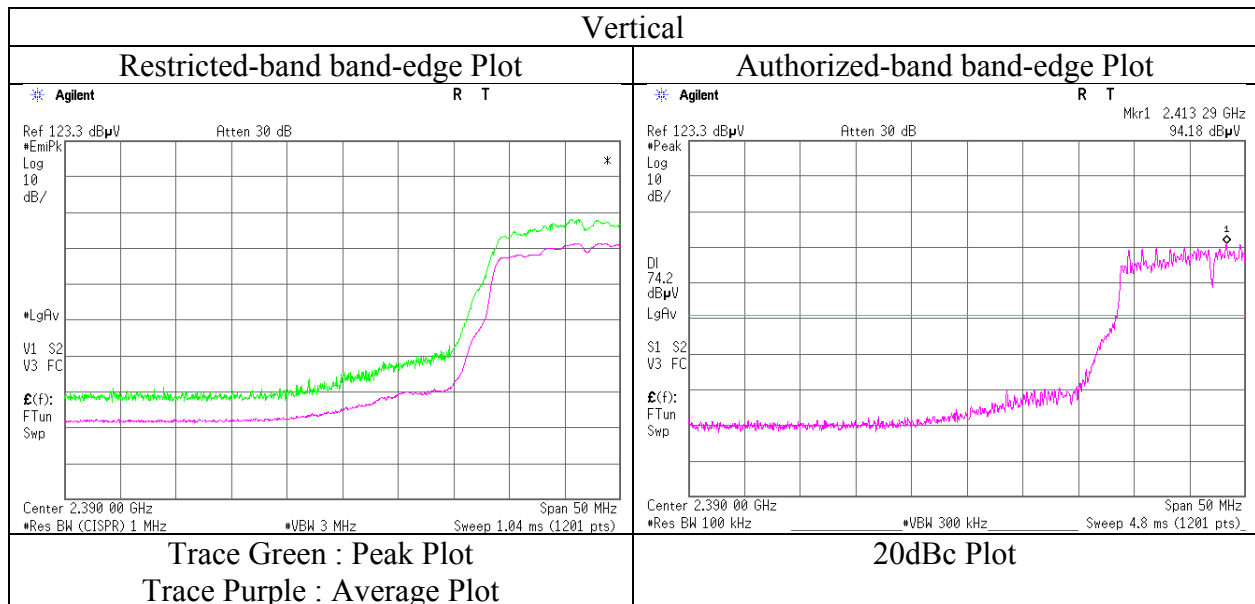
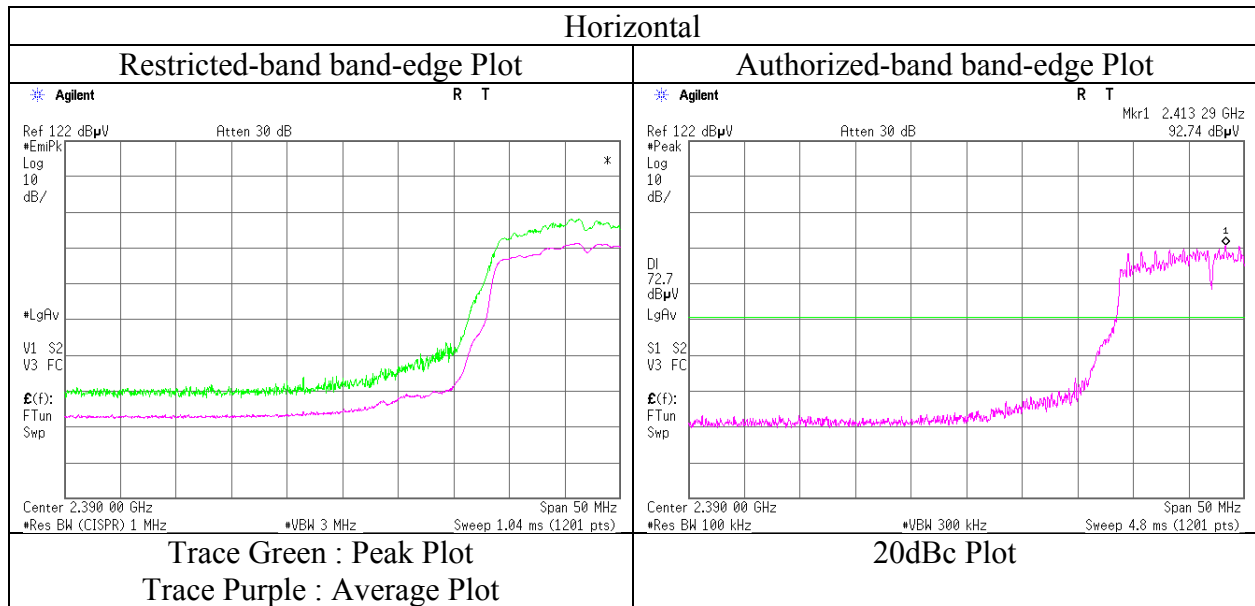
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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)

Test place	Shonan EMC Lab
Report No.	11834855S-A-R2
Semi Anechoic Chamber	No.3
Date	September 7, 2017
Temperature / Humidity	20 deg. C / 65 % RH
Engineer	Shiro Kobayashi
Mode	Tx 11g 2412 MHz



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

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Shonan EMC Lab

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Radiated Spurious Emission

Test place	Shonan EMC Lab		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	September 28, 2017	September 29, 2017	September 30, 2017
Temperature / Humidity	25 deg. C / 57 % RH	22 deg. C / 62 % RH	23 deg. C / 54 % RH
Engineer	Hiroyuki Morikawa (1 GHz -2.8 GHz)	Hikaru Shirasawa (2.8 GHz -13 GHz)	Hikaru Shirasawa (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	48.70	31.59	6.72	44.47	2.47	45.01	73.90	28.8	150	0	
Hori.	7311.000	PK	47.93	36.75	8.37	44.03	2.47	51.49	73.90	22.4	150	0	
Hori.	9748.000	PK	48.31	38.78	9.31	43.84	2.47	55.03	73.90	18.8	150	0	
Vert.	4874.000	PK	49.17	31.59	6.72	44.47	2.47	45.48	73.90	28.4	150	0	
Vert.	7311.000	PK	47.85	36.75	8.37	44.03	2.47	51.41	73.90	22.4	150	0	
Vert.	9748.000	PK	47.96	38.78	9.31	43.84	2.47	54.68	73.90	19.2	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99 \text{ m} / 3.0 \text{ m}) = 2.47 \text{ dB}$

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	38.83	31.59	6.72	44.47	3.58	2.47	38.72	53.90	15.2	
Hori.	7311.000	AV	38.04	36.75	8.37	44.03	3.58	2.47	45.18	53.90	8.7	
Hori.	9748.000	AV	37.67	38.78	9.31	43.84	3.58	2.47	47.97	53.90	5.9	
Vert.	4874.000	AV	39.17	31.59	6.72	44.47	3.58	2.47	39.06	53.90	14.8	
Vert.	7311.000	AV	37.58	36.75	8.37	44.03	3.58	2.47	44.72	53.90	9.2	
Vert.	9748.000	AV	37.48	38.78	9.31	43.84	3.58	2.47	47.78	53.90	6.1	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99 \text{ m} / 3.0 \text{ m}) = 2.47 \text{ dB}$

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

Test place	Shonan EMC Lab		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	September 7, 2017	September 29, 2017	September 30, 2017
Temperature / Humidity	20 deg. C / 65 % RH	22 deg. C / 62 % RH	23 deg. C / 54 % RH
Engineer	Shiro Kobayashi (1 GHz -2.8 GHz)	Hikaru Shirasawa (2.8 GHz -13 GHz)	Hikaru Shirasawa (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.	2483.500	PK	58.48	27.55	13.55	36.79	2.47	65.26	73.90	8.6	143	220	
Hori.	4924.000	PK	48.78	31.73	6.79	44.49	2.47	45.28	73.90	28.6	150	0	
Hori.	7386.000	PK	47.79	36.88	8.45	44.06	2.47	51.53	73.90	22.3	150	0	
Hori.	9848.000	PK	47.85	38.90	9.39	43.86	2.47	54.75	73.90	19.1	150	0	
Vert.	2483.500	PK	57.10	27.55	13.55	36.79	2.47	63.88	73.90	10.0	285	201	
Vert.	4924.000	PK	49.44	31.73	6.79	44.49	2.47	45.94	73.90	27.9	150	0	
Vert.	7386.000	PK	47.63	36.88	8.45	44.06	2.47	51.37	73.90	22.5	150	0	
Vert.	9848.000	PK	48.75	38.90	9.39	43.86	2.47	55.65	73.90	18.2	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	43.15	27.55	13.55	36.79	3.58	2.47	53.51	53.90	0.4	*1)
Hori.	4924.000	AV	38.63	31.73	6.79	44.49	3.58	2.47	38.71	53.90	15.2	
Hori.	7386.000	AV	38.94	36.88	8.45	44.06	3.58	2.47	46.26	53.90	7.6	
Hori.	9848.000	AV	38.57	38.90	9.39	43.86	3.58	2.47	49.05	53.90	4.8	
Vert.	2483.500	AV	42.86	27.55	13.55	36.79	3.58	2.47	53.22	53.90	0.7	*1)
Vert.	4924.000	AV	40.06	31.73	6.79	44.49	3.58	2.47	40.14	53.90	13.8	
Vert.	7386.000	AV	38.93	36.88	8.45	44.06	3.58	2.47	46.25	53.90	7.7	
Vert.	9848.000	AV	38.73	38.90	9.39	43.86	3.58	2.47	49.21	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 : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

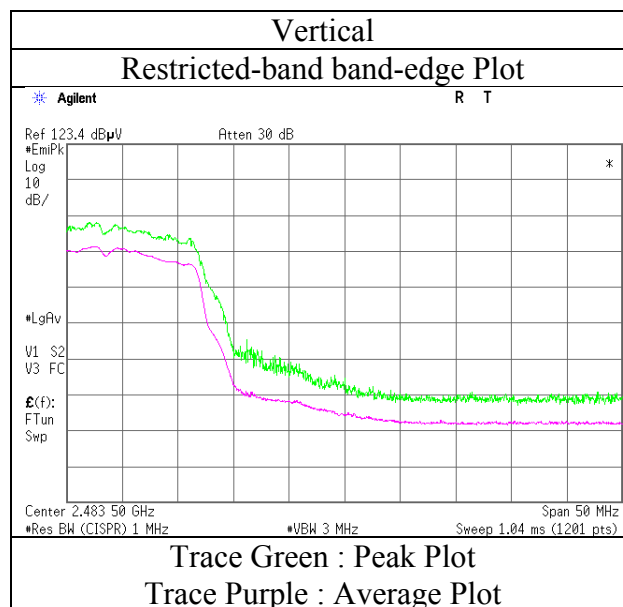
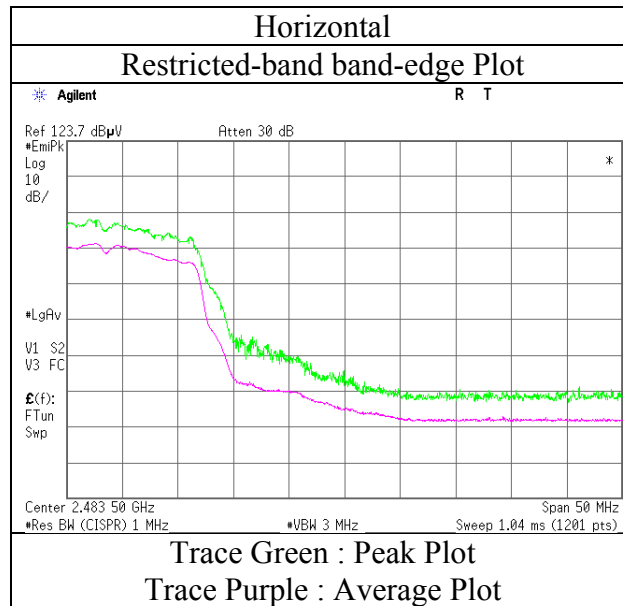
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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)

Test place	Shonan EMC Lab
Report No.	11834855S-A-R2
Semi Anechoic Chamber	No.3
Date	September 7, 2017
Temperature / Humidity	20 deg. C / 65 % RH
Engineer	Shiro Kobayashi
Mode	Tx 11g 2462 MHz



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

Radiated Spurious Emission

Test place	Shonan EMC Lab		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.3	No.3	No.1
Date	September 7, 2017	September 29, 2017	September 30, 2017
Temperature / Humidity	20 deg. C / 65 % RH	22 deg. C / 62 % RH	23 deg. C / 54 % RH
Engineer	Shiro Kobayashi	Hikaru Shirasawa	Hikaru Shirasawa
	(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	59.57	27.26	13.48	36.83	2.47	65.95	73.90	7.9	151	23	
Hori.	4824.000	PK	49.68	31.46	6.68	44.46	2.47	45.83	73.90	28.0	150	0	
Hori.	7236.000	PK	49.49	36.62	8.29	44.00	2.47	52.87	73.90	21.0	150	0	
Hori.	9648.000	PK	49.31	38.66	9.25	43.83	2.47	55.86	73.90	18.0	150	0	
Vert.	2390.000	PK	62.89	27.26	13.48	36.83	2.47	69.27	73.90	4.6	307	202	
Vert.	4824.000	PK	48.92	31.46	6.68	44.46	2.47	45.07	73.90	28.8	150	0	
Vert.	7236.000	PK	48.56	36.62	8.29	44.00	2.47	51.94	73.90	21.9	150	0	
Vert.	9648.000	PK	49.27	38.66	9.25	43.83	2.47	55.82	73.90	18.0	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	42.03	27.26	13.48	36.83	0.63	2.47	49.04	53.90	4.9	*1)
Hori.	4824.000	AV	39.43	31.46	6.68	44.46	0.63	2.47	36.21	53.90	17.7	
Hori.	7236.000	AV	39.18	36.62	8.29	44.00	0.63	2.47	43.19	53.90	10.7	
Hori.	9648.000	AV	39.17	38.66	9.25	43.83	0.63	2.47	46.35	53.90	7.5	
Vert.	2390.000	AV	45.31	27.26	13.48	36.83	0.63	2.47	52.32	53.90	1.6	*1)
Vert.	4824.000	AV	39.90	31.46	6.68	44.46	0.63	2.47	36.68	53.90	17.2	
Vert.	7236.000	AV	39.63	36.62	8.29	44.00	0.63	2.47	43.64	53.90	10.3	
Vert.	9648.000	AV	39.45	38.66	9.25	43.83	0.63	2.47	46.63	53.90	7.3	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	92.95	27.33	13.50	36.82	2.47	99.43	-	-	Carrier
Hori.	2400.000	PK	56.35	27.29	13.49	36.83	2.47	62.77	79.43	16.7	
Vert.	2412.000	PK	94.55	27.33	13.50	36.82	2.47	101.03	-	-	Carrier
Vert.	2400.000	PK	56.76	27.29	13.49	36.83	2.47	63.18	81.03	17.9	

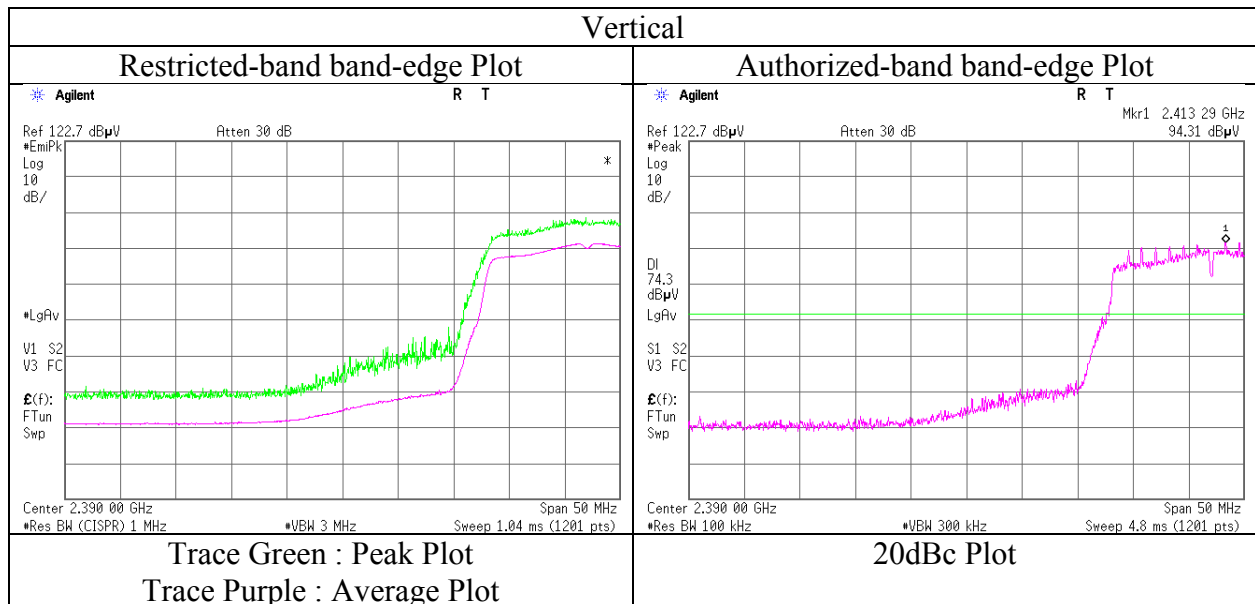
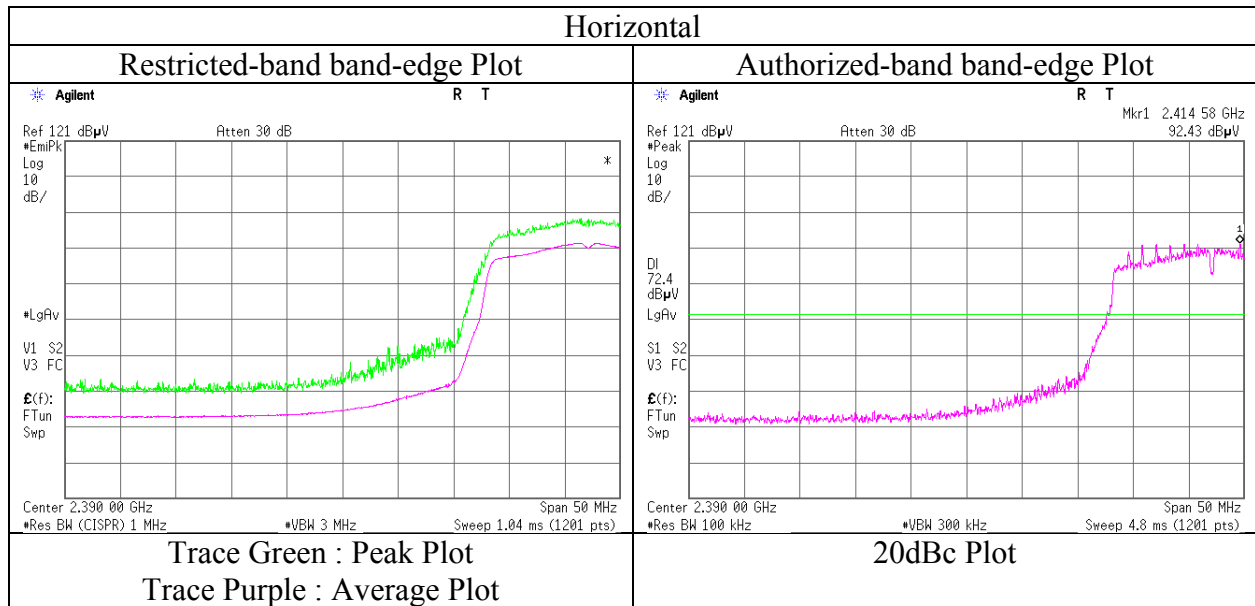
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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)

Test place	Shonan EMC Lab
Report No.	11834855S-A-R2
Semi Anechoic Chamber	No.3
Date	September 7, 2017
Temperature / Humidity	20 deg. C / 65 % RH
Engineer	Shiro Kobayashi
Mode	Tx 11n-20 2412 MHz



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

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Shonan EMC Lab

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Radiated Spurious Emission

Test place	Shonan EMC Lab		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.1	No.3	No.1
Date	November 17, 2017	September 28, 2017	September 30, 2017
Temperature / Humidity	21 deg. C / 38 % RH	25 deg. C / 57 % RH	23 deg. C / 54 % RH
Engineer	Kazutaka Takeyama (30 MHz - 1GHz)	Hiroyuki Morikawa (1 GHz -2.8 GHz)	Hikaru Shirasawa (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.	30.713	QP	28.74	17.27	7.04	31.83	0.00	21.22	40.00	18.7	141	133	
Hori.	74.046	QP	35.95	6.15	7.90	31.81	0.00	18.19	40.00	21.8	151	359	
Hori.	337.516	QP	33.00	14.36	7.10	31.75	0.00	22.71	46.00	23.2	100	129	
Hori.	4874.000	PK	46.30	31.29	6.73	41.77	2.47	45.02	73.90	28.8	127	321	
Hori.	7311.000	PK	46.49	36.50	8.25	41.26	2.47	52.45	73.90	21.4	150	0	
Hori.	9748.000	PK	43.99	38.34	9.39	40.62	2.47	53.57	73.90	20.3	150	0	
Vert.	42.954	QP	36.72	13.53	7.33	31.82	0.00	25.76	40.00	14.2	100	178	
Vert.	46.592	QP	37.76	12.27	7.41	31.82	0.00	25.62	40.00	14.3	100	1	
Vert.	54.018	QP	37.53	9.72	7.43	31.82	0.00	22.86	40.00	17.1	100	336	
Vert.	73.941	QP	42.47	6.15	7.89	31.81	0.00	24.70	40.00	15.3	100	178	
Vert.	617.006	QP	22.54	19.25	8.67	31.98	0.00	18.48	46.00	27.5	100	0	
Vert.	4874.000	PK	45.19	31.29	6.73	41.77	2.47	43.91	73.90	29.9	150	0	
Vert.	7311.000	PK	46.88	36.50	8.25	41.26	2.47	52.84	73.90	21.0	150	0	
Vert.	9748.000	PK	44.57	38.34	9.39	40.62	2.47	54.15	73.90	19.7	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	37.41	31.29	6.73	41.77	0.63	2.47	36.76	53.90	17.1	
Hori.	7311.000	AV	37.38	36.50	8.25	41.26	0.63	2.47	43.97	53.90	9.9	
Hori.	9748.000	AV	35.25	38.34	9.39	40.62	0.63	2.47	45.46	53.90	8.4	
Vert.	4874.000	AV	36.95	31.29	6.73	41.77	0.63	2.47	36.30	53.90	17.6	
Vert.	7311.000	AV	37.02	36.50	8.25	41.26	0.63	2.47	43.61	53.90	10.3	
Vert.	9748.000	AV	35.42	38.34	9.39	40.62	0.63	2.47	45.63	53.90	8.3	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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

Test place	Shonan EMC Lab	
Report No.	11834855S-A-R2	
Semi Anechoic Chamber	No.3	No.1
Date	September 7, 2017	September 30, 2017
Temperature / Humidity	20 deg. C / 65 % RH	23 deg. C / 54 % RH
Engineer	Shiro Kobayashi	Hikaru Shirasawa
	(1 GHz -2.8 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	61.26	27.55	13.55	36.79	2.47	68.04	73.90	5.8	150	225	
Hori.	4924.000	PK	46.23	31.40	6.74	41.70	2.47	45.14	73.90	28.7	150	0	
Hori.	7386.000	PK	44.90	36.60	8.27	41.32	2.47	50.92	73.90	22.9	150	0	
Hori.	9848.000	PK	43.91	38.51	9.43	40.64	2.47	53.68	73.90	20.2	150	0	
Vert.	2483.500	PK	61.22	27.55	13.55	36.79	2.47	68.00	73.90	5.9	327	204	
Vert.	4924.000	PK	45.96	31.40	6.74	41.70	2.47	44.87	73.90	29.0	150	0	
Vert.	7386.000	PK	44.96	36.60	8.27	41.32	2.47	50.98	73.90	22.9	150	0	
Vert.	9848.000	PK	44.25	38.51	9.43	40.64	2.47	54.02	73.90	19.8	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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	44.12	27.55	13.55	36.79	0.63	2.47	51.53	53.90	2.4	*1)
Hori.	4924.000	AV	37.26	31.40	6.74	41.70	0.63	2.47	36.80	53.90	17.1	
Hori.	7386.000	AV	37.10	36.60	8.27	41.32	0.63	2.47	43.75	53.90	10.2	
Hori.	9848.000	AV	35.19	38.51	9.43	40.64	0.63	2.47	45.59	53.90	8.3	
Vert.	2483.500	AV	43.69	27.55	13.55	36.79	0.63	2.47	51.10	53.90	2.8	*1)
Vert.	4924.000	AV	37.51	31.40	6.74	41.70	0.63	2.47	37.05	53.90	16.8	
Vert.	7386.000	AV	36.54	36.60	8.27	41.32	0.63	2.47	43.19	53.90	10.7	
Vert.	9848.000	AV	35.22	38.51	9.43	40.64	0.63	2.47	45.62	53.90	8.3	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

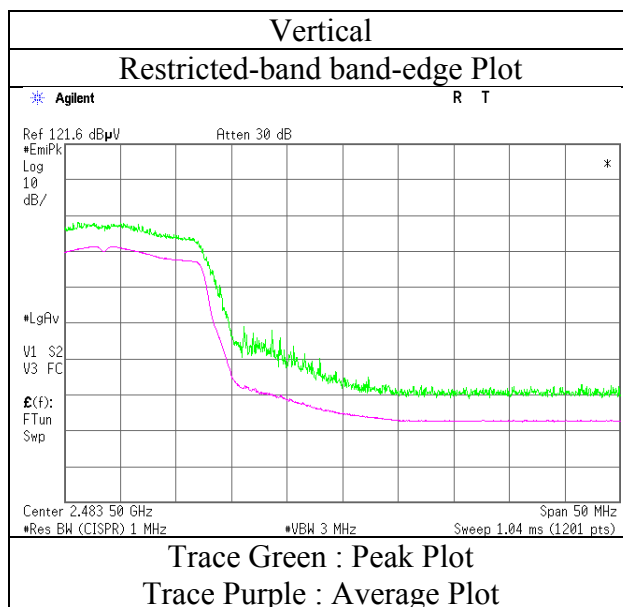
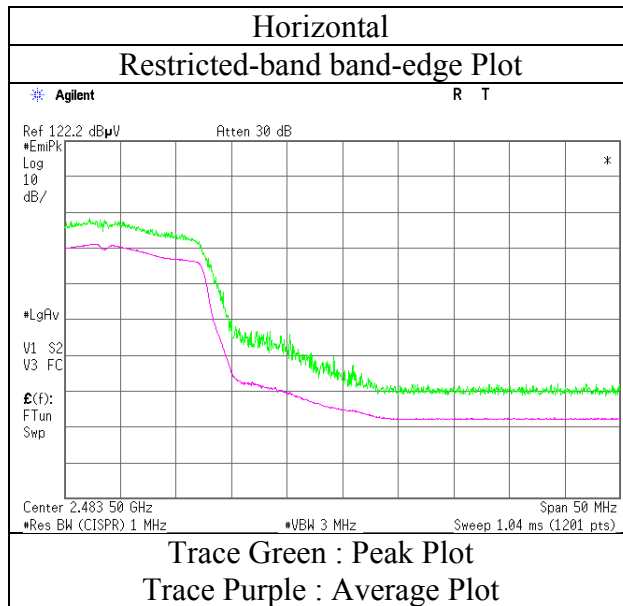
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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)

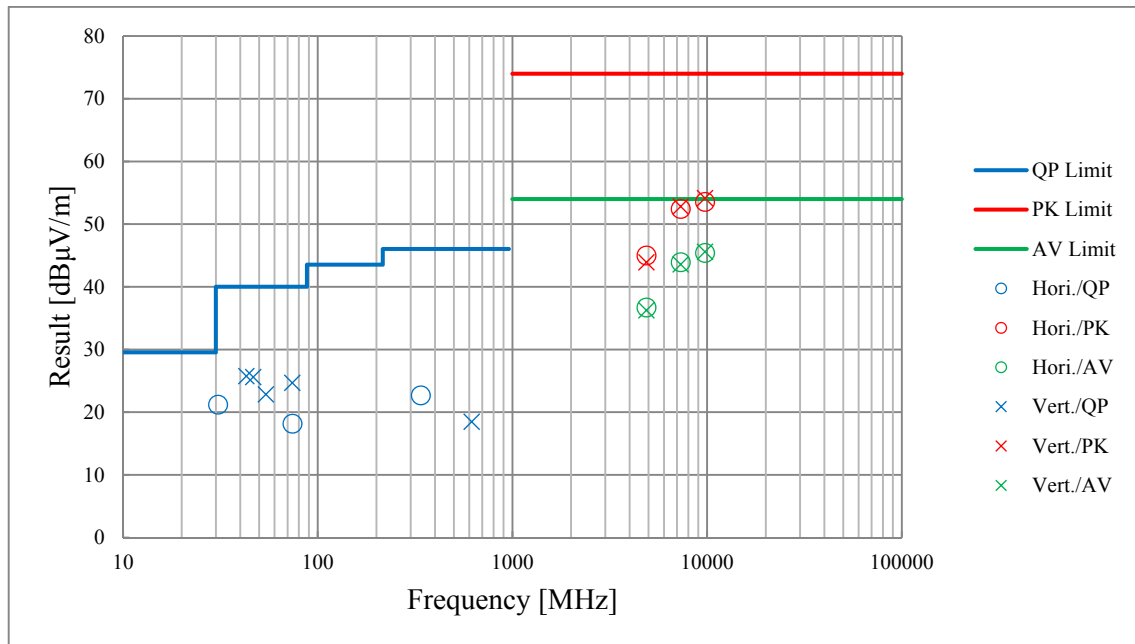
Test place	Shonan EMC Lab
Report No.	11834855S-A-R2
Semi Anechoic Chamber	No.3
Date	September 7, 2017
Temperature / Humidity	20 deg. C / 65 % RH
Engineer	Shiro Kobayashi
Mode	Tx 11n-20 2462 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Shonan EMC Lab		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.1	No.3	No.1
Date	November 17, 2017	September 28, 2017	September 30, 2017
Temperature / Humidity	21 deg. C / 38 % RH	25 deg. C / 57 % RH	23 deg. C / 54 % RH
Engineer	Kazutaka Takeyama (30 MHz - 1GHz)	Hiroyuki Morikawa (1 GHz -2.8 GHz)	Hikaru Shirasawa (13 GHz -26.5 GHz)
Mode	Tx 11n-20 2437 MHz		



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

Radiated Spurious Emission

Test place	Shonan EMC Lab No.1 Semi Anechoic Chamber		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	November 19, 2017	November 17, 2017	November 18, 2017
Temperature / Humidity	20 deg. C / 42 % RH	23 deg. C / 39 % RH	21 deg. C / 30 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Yosuke Ishikawa (1 GHz -13 GHz)	Shiro Kobayashi (13 GHz -26.5 GHz)
Mode	Tx BT LE 2402 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	307.214	QP	25.50	13.67	6.84	31.76	0.00	14.25	46.00	31.7	100	122	
Hori.	337.516	QP	31.20	14.36	7.10	31.75	0.00	20.91	46.00	25.0	100	182	
Hori.	376.319	QP	23.50	15.23	7.43	31.77	0.00	14.39	46.00	31.6	100	166	
Hori.	533.022	QP	29.40	18.18	8.33	31.93	0.00	23.98	46.00	22.0	201	221	
Hori.	2390.000	PK	45.31	27.14	14.23	40.85	2.47	48.30	73.90	25.6	142	92	
Hori.	4804.000	PK	45.80	31.13	6.79	41.86	2.47	44.33	73.90	29.6	152	356	
Hori.	7206.000	PK	45.95	36.35	8.41	41.18	2.47	52.00	73.90	21.9	150	0	
Hori.	9608.000	PK	45.53	38.11	9.48	40.59	2.47	55.00	73.90	18.9	150	0	
Vert.	337.516	QP	26.60	14.36	7.10	31.75	0.00	16.31	46.00	29.6	151	224	
Vert.	463.650	QP	22.90	17.00	7.98	31.85	0.00	16.03	46.00	29.9	100	99	
Vert.	533.025	QP	27.80	18.18	8.33	31.93	0.00	22.38	46.00	23.6	100	149	
Vert.	2390.000	PK	45.64	27.14	14.23	40.85	2.47	48.63	73.90	25.3	250	137	
Vert.	4804.000	PK	45.79	31.13	6.79	41.86	2.47	44.32	73.90	29.6	149	6	
Vert.	7206.000	PK	45.28	36.35	8.41	41.18	2.47	51.33	73.90	22.6	150	0	
Vert.	9608.000	PK	45.21	38.11	9.48	40.59	2.47	54.68	73.90	19.2	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 (3.99 m / 3.0 m) = 2.47 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	36.76	27.14	14.23	40.85	3.88	2.47	43.63	53.90	10.3	*1)
Hori.	4804.000	AV	37.52	31.13	6.79	41.86	3.88	2.47	39.93	53.90	14.0	
Hori.	7206.000	AV	37.65	36.35	8.41	41.18	3.88	2.47	47.58	53.90	6.3	
Hori.	9608.000	AV	36.33	38.11	9.48	40.59	3.88	2.47	49.68	53.90	4.2	
Vert.	2390.000	AV	36.70	27.14	14.23	40.85	3.88	2.47	43.57	53.90	10.3	*1)
Vert.	4804.000	AV	37.50	31.13	6.79	41.86	3.88	2.47	39.91	53.90	14.0	
Vert.	7206.000	AV	36.95	36.35	8.41	41.18	3.88	2.47	46.88	53.90	7.0	
Vert.	9608.000	AV	35.95	38.11	9.48	40.59	3.88	2.47	49.30	53.90	4.6	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.47 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	97.62	27.18	14.24	40.84	2.47	100.67	-	-	Carrier
Hori.	2400.000	PK	40.79	27.17	14.23	40.84	2.47	43.82	80.67	36.9	
Vert.	2402.000	PK	92.42	27.18	14.24	40.84	2.47	95.47	-	-	Carrier
Vert.	2400.000	PK	39.15	27.17	14.23	40.84	2.47	42.18	75.47	33.3	

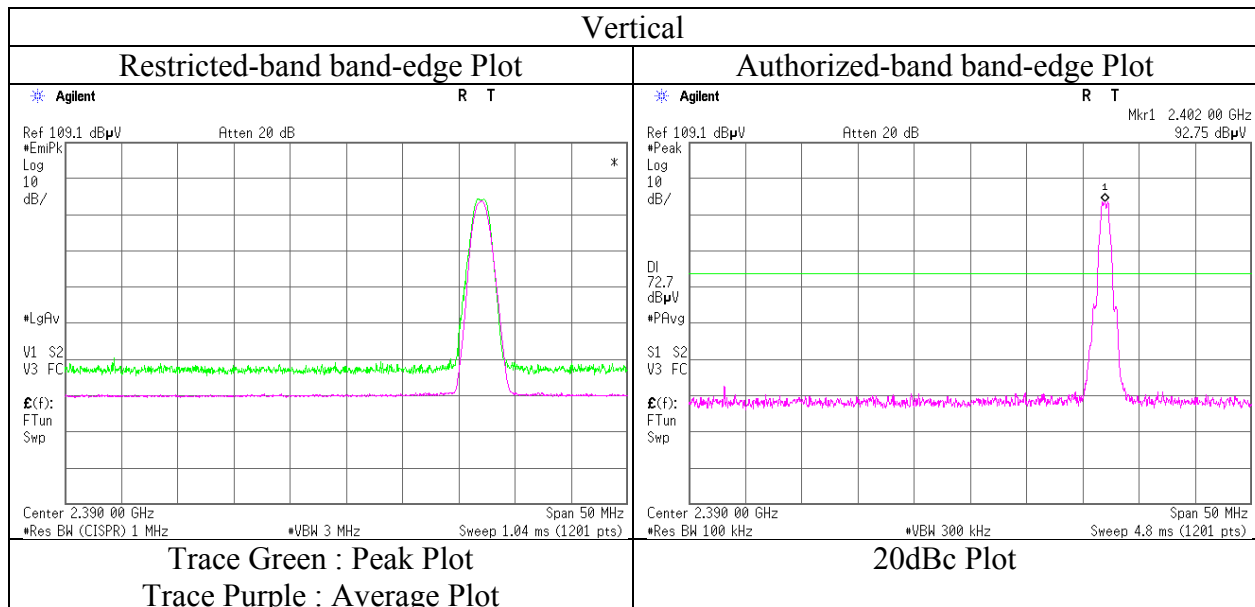
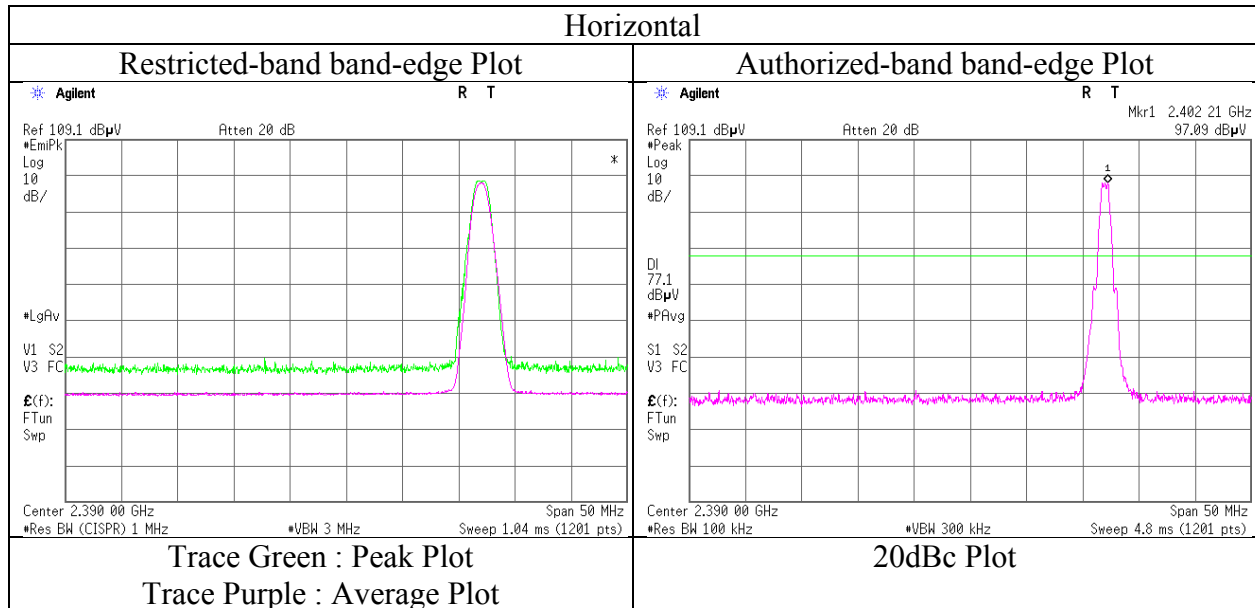
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.47 dB

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

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab No.1 Semi Anechoic Chamber
Report No.	11834855S-A-R2
Semi Anechoic Chamber	No.1
Date	November 17, 2017
Temperature / Humidity	23 deg. C / 39 % RH
Engineer	Yosuke Ishikawa (1 GHz -13 GHz)
Mode	Tx BT LE 2402 MHz



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

Radiated Spurious Emission

Test place	Shonan EMC Lab No.1 Semi Anechoic Chamber		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	November 19, 2017	November 17, 2017	November 18, 2017
Temperature / Humidity	20 deg. C / 42 % RH	23 deg. C / 39 % RH	21 deg. C / 30 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Yosuke Ishikawa (1 GHz -13 GHz)	Shiro Kobayashi (13 GHz -26.5 GHz)
Mode	Tx BT LE 2440 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	307.684	QP	25.50	13.68	6.85	31.76	0.00	14.27	46.00	31.7	100	121	
Hori.	337.517	QP	31.30	14.36	7.10	31.75	0.00	21.01	46.00	24.9	100	177	
Hori.	376.311	QP	23.40	15.23	7.43	31.77	0.00	14.29	46.00	31.7	100	163	
Hori.	533.026	QP	28.90	18.18	8.33	31.93	0.00	23.48	46.00	22.5	195	230	
Hori.	4880.000	PK	45.40	31.30	6.87	41.76	2.47	44.28	73.90	29.6	147	345	
Hori.	7320.000	PK	45.86	36.51	8.57	41.27	2.47	52.14	73.90	21.8	150	0	
Hori.	9760.000	PK	44.83	38.36	9.60	40.62	2.47	54.64	73.90	19.3	150	0	
Vert.	337.518	QP	26.80	14.36	7.10	31.75	0.00	16.51	46.00	29.4	151	220	
Vert.	463.617	QP	22.90	17.00	7.98	31.85	0.00	16.03	46.00	29.9	100	99	
Vert.	533.029	QP	28.00	18.18	8.33	31.93	0.00	22.58	46.00	23.4	100	147	
Vert.	4880.000	PK	45.21	31.30	6.87	41.76	2.47	44.09	73.90	29.8	154	7	
Vert.	7320.000	PK	45.71	36.51	8.57	41.27	2.47	51.99	73.90	21.9	150	0	
Vert.	9760.000	PK	45.31	38.36	9.60	40.62	2.47	55.12	73.90	18.8	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 (3.99 m / 3.0 m) = 2.47 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	37.32	31.30	6.87	41.76	3.88	2.47	40.08	53.90	13.8	
Hori.	7320.000	AV	37.13	36.51	8.57	41.27	3.88	2.47	47.29	53.90	6.6	
Hori.	9760.000	AV	36.07	38.36	9.60	40.62	3.88	2.47	49.76	53.90	4.1	
Vert.	4880.000	AV	37.33	31.30	6.87	41.76	3.88	2.47	40.09	53.90	13.8	
Vert.	7320.000	AV	37.02	36.51	8.57	41.27	3.88	2.47	47.18	53.90	6.7	
Vert.	9760.000	AV	36.19	38.36	9.60	40.62	3.88	2.47	49.88	53.90	4.0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.47 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

Test place	Shonan EMC Lab No.1 Semi Anechoic Chamber		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	November 19, 2017	November 17, 2017	November 18, 2017
Temperature / Humidity	20 deg. C / 42 % RH	23 deg. C / 39 % RH	21 deg. C / 30 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Yosuke Ishikawa (1 GHz -13 GHz)	Shiro Kobayashi (13 GHz -26.5 GHz)
Mode	Tx BT LE 2480 MHz		

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	307.885	QP	25.50	13.69	6.85	31.76	0.00	14.28	46.00	31.7	100	122	
Hori.	337.519	QP	31.30	14.36	7.10	31.75	0.00	21.01	46.00	24.9	100	182	
Hori.	376.381	QP	23.50	15.24	7.43	31.77	0.00	14.40	46.00	31.6	100	163	
Hori.	533.029	QP	29.10	18.18	8.33	31.93	0.00	23.68	46.00	22.3	201	219	
Hori.	2483.500	PK	48.60	27.45	14.32	40.81	2.47	52.03	73.90	21.9	140	90	
Hori.	4960.000	PK	45.82	31.48	6.94	41.65	2.47	45.06	73.90	28.8	152	350	
Hori.	7440.000	PK	46.04	36.68	8.75	41.36	2.47	52.58	73.90	21.3	150	0	
Hori.	9920.000	PK	44.67	38.63	9.72	40.66	2.47	54.83	73.90	19.1	150	0	
Vert.	337.513	QP	26.60	14.36	7.10	31.75	0.00	16.31	46.00	29.6	154	221	
Vert.	463.579	QP	22.90	17.00	7.98	31.85	0.00	16.03	46.00	29.9	100	99	
Vert.	533.027	QP	27.60	18.18	8.33	31.93	0.00	22.18	46.00	23.8	100	150	
Vert.	2483.500	PK	46.58	27.45	14.32	40.81	2.47	50.01	73.90	23.9	225	210	
Vert.	4960.000	PK	46.24	31.48	6.94	41.65	2.47	45.48	73.90	28.4	148	4	
Vert.	7440.000	PK	45.96	36.68	8.75	41.36	2.47	52.50	73.90	21.4	150	0	
Vert.	9920.000	PK	44.84	38.63	9.72	40.66	2.47	55.00	73.90	18.9	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 (3.99 m / 3.0 m) = 2.47 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	37.15	27.45	14.32	40.81	3.88	2.47	44.46	53.90	9.4	*1)
Hori.	4960.000	AV	37.51	31.48	6.94	41.65	3.88	2.47	40.63	53.90	13.3	
Hori.	7440.000	AV	37.36	36.68	8.75	41.36	3.88	2.47	47.78	53.90	6.1	
Hori.	9920.000	AV	35.80	38.63	9.72	40.66	3.88	2.47	49.84	53.90	4.1	
Vert.	2483.500	AV	36.45	27.45	14.32	40.81	3.88	2.47	43.76	53.90	10.1	*1)
Vert.	4960.000	AV	36.94	31.48	6.94	41.65	3.88	2.47	40.06	53.90	13.8	
Vert.	7440.000	AV	37.51	36.68	8.75	41.36	3.88	2.47	47.93	53.90	6.0	
Vert.	9920.000	AV	36.03	38.63	9.72	40.66	3.88	2.47	50.07	53.90	3.8	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.99 m / 3.0 m) = 2.47 dB

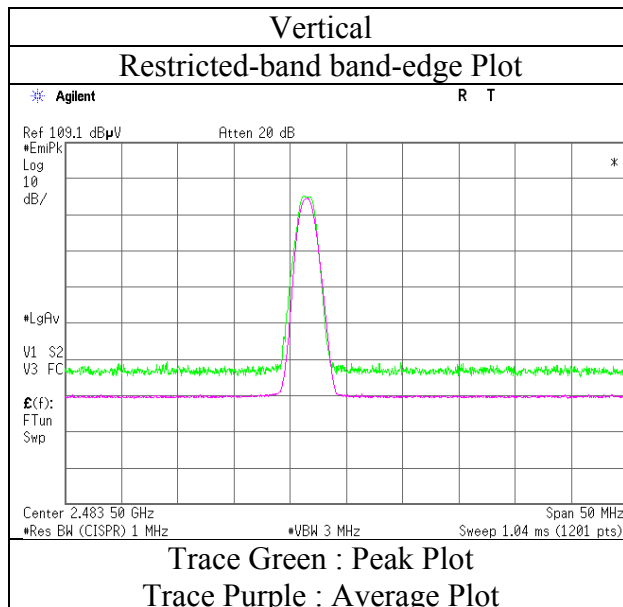
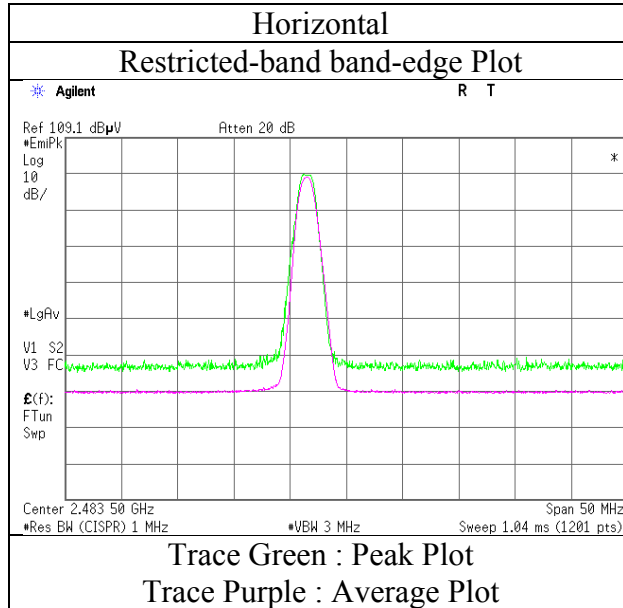
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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

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

Radiated Spurious Emission (Reference Plot for band-edge)

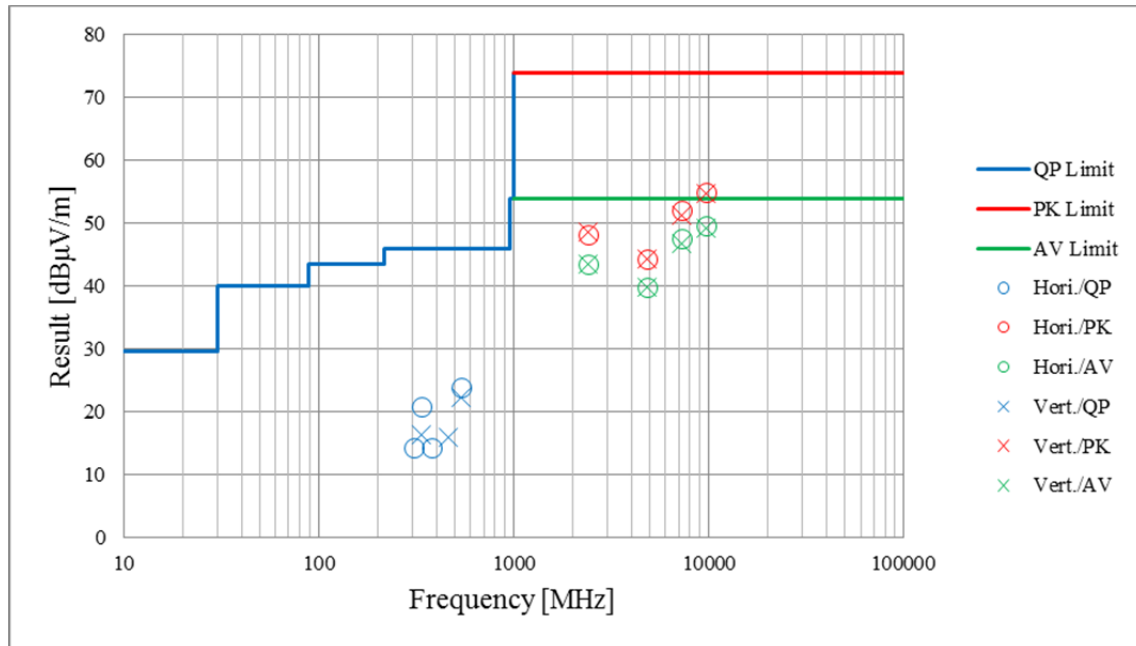
Test place	Shonan EMC Lab No.1 Semi Anechoic Chamber
Report No.	11834855S-A-R2
Semi Anechoic Chamber	No.1
Date	November 17, 2017
Temperature / Humidity	23 deg. C / 39 % RH
Engineer	Yosuke Ishikawa (1 GHz -13 GHz)
Mode	Tx BT LE 2480 MHz



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

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

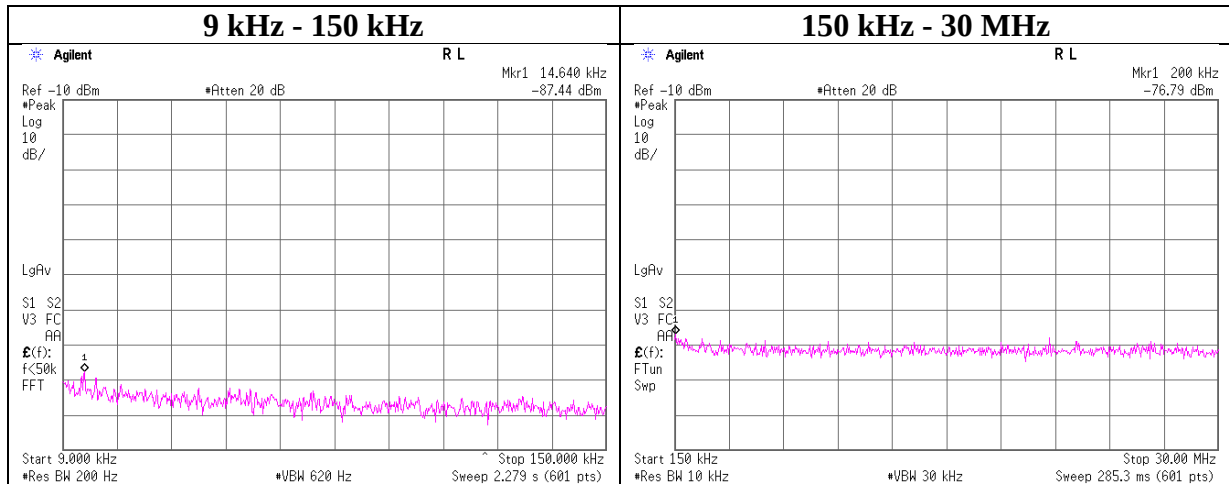
Test place	Shonan EMC Lab No.1 Semi Anechoic Chamber		
Report No.	11834855S-A-R2		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	November 19, 2017	November 17, 2017	November 18, 2017
Temperature / Humidity	20 deg. C / 42 % RH	23 deg. C / 39 % RH	21 deg. C / 30 % RH
Engineer	Hiroyuki Morikawa (30 MHz -1 GHz)	Yosuke Ishikawa (1 GHz -13 GHz)	Shiro Kobayashi (13 GHz -26.5 GHz)
Mode	Tx BT LE 2402 MHz		



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

Conducted Spurious Emission

Test place	Shonan EMC Lab No.5 Shielded Room
Report No.	11834855S-A-R2
Date	January 19, 2018
Temperature / Humidity	22 deg. C / 37 % RH
Engineer	Kazuya Noda
Mode	Tx 11n-20 2437 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
14.64	-87.4	0.01	20.1	2.0	1	-65.3	300	6.0	-4.1	44.2	48.3	
200.00	-76.8	0.02	20.1	2.0	1	-54.7	300	6.0	6.6	21.5	14.9	

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

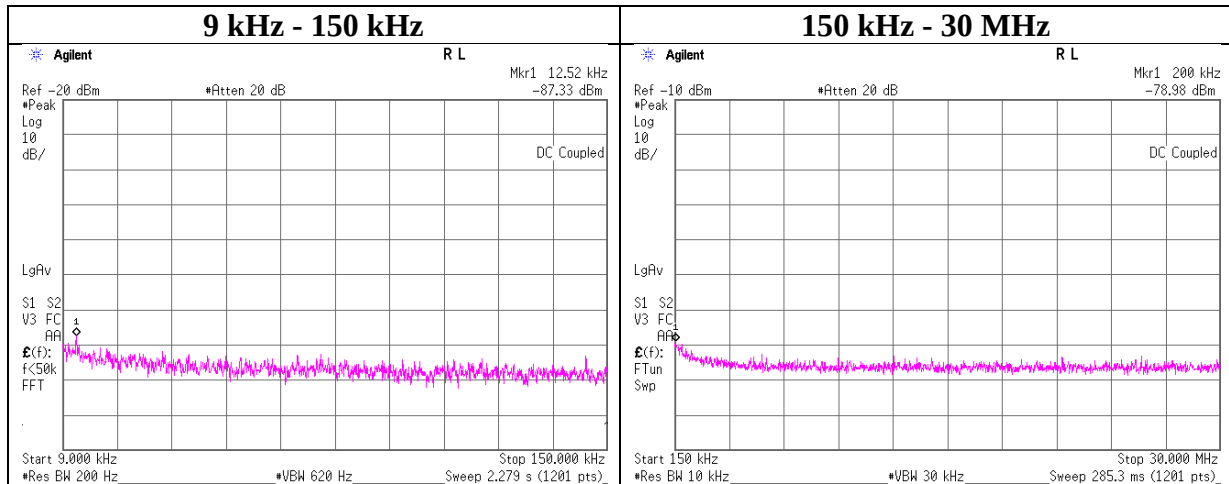
$\text{EIRP[dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

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.

Conducted Spurious Emission

Test place	Shonan EMC Lab No.5 Shielded Room
Report No.	11834855S-A-R2
Date	November 20, 2017
Temperature / Humidity	24 deg. C / 31 % RH
Engineer	Shiro Kobayashi
Mode	Tx BT LE 2402 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
12.52	-87.3	0.01	9.8	2.0	1	-75.5	300	6.0	-14.2	45.6	59.8	
200.00	-79.0	0.02	9.8	2.0	1	-67.1	300	6.0	-5.9	21.5	27.4	

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

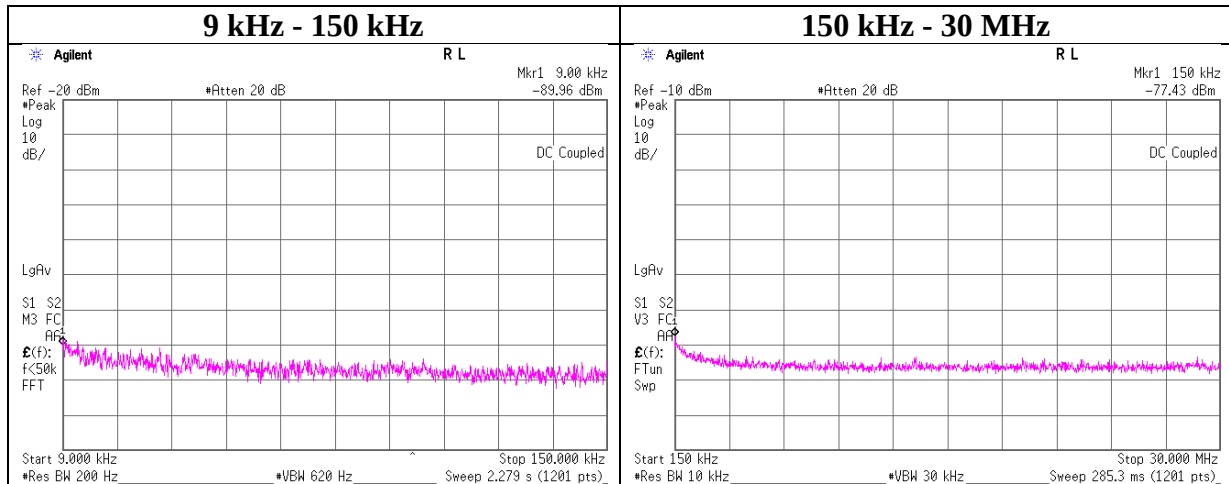
$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

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

Conducted Spurious Emission

Test place	Shonan EMC Lab No.5 Shielded Room
Report No.	11834855S-A-R2
Date	November 20, 2017
Temperature / Humidity	24 deg. C / 31 % RH
Engineer	Shiro Kobayashi
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
9.00	-90.0	0.01	9.8	2.0	1	-78.1	300	6.0	-16.9	48.5	65.4	
150.00	-77.4	0.02	9.8	2.0	1	-65.6	300	6.0	-4.3	24.0	28.3	

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

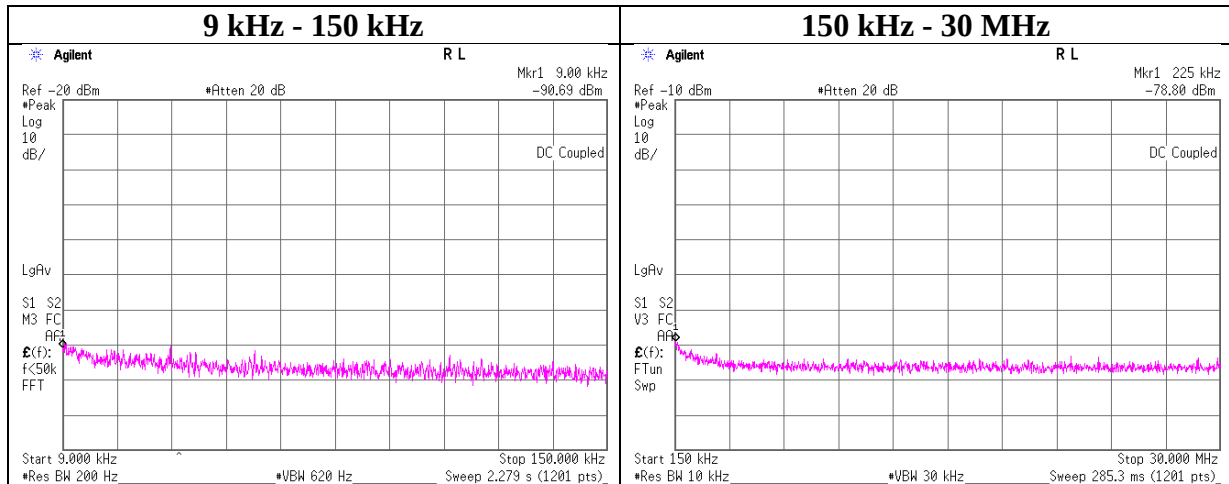
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

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

Test place : Shonan EMC Lab No.5 Shielded Room
Report No. : 11834855S-A-R2
Date : November 20, 2017
Temperature / Humidity : 24 deg. C / 31 % RH
Engineer : Shiro Kobayashi
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
9.00	-90.7	0.01	9.8	2.0	1	-78.9	300	6.0	-17.6	48.5	66.1	
225.00	-78.8	0.02	9.8	2.0	1	-67.0	300	6.0	-5.7	20.5	26.2	

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

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

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

Test place	Shonan EMC Lab No.5 Shielded Room	
Report No.	11834855S-A-R2	
Date	March 5, 2018	November 20, 2017
Temperature / Humidity	24 deg. C / 42 % RH	24 deg. C / 31 % RH
Engineer	Makoto Hosaka	Shiro Kobayashi
Mode	Tx	

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-33.37	1.63	20.09	-11.65	8.00	19.65
2437.00	-33.50	1.64	20.09	-11.77	8.00	19.77
2462.00	-33.41	1.65	20.09	-11.67	8.00	19.67

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-35.70	1.63	20.09	-13.98	8.00	21.98
2437.00	-35.94	1.64	20.09	-14.21	8.00	22.21
2462.00	-35.53	1.65	20.09	-13.79	8.00	21.79

11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-34.44	1.63	20.09	-12.72	8.00	20.72
2437.00	-34.06	1.64	20.09	-12.33	8.00	20.33
2462.00	-34.16	1.65	20.09	-12.42	8.00	20.42

BT LE

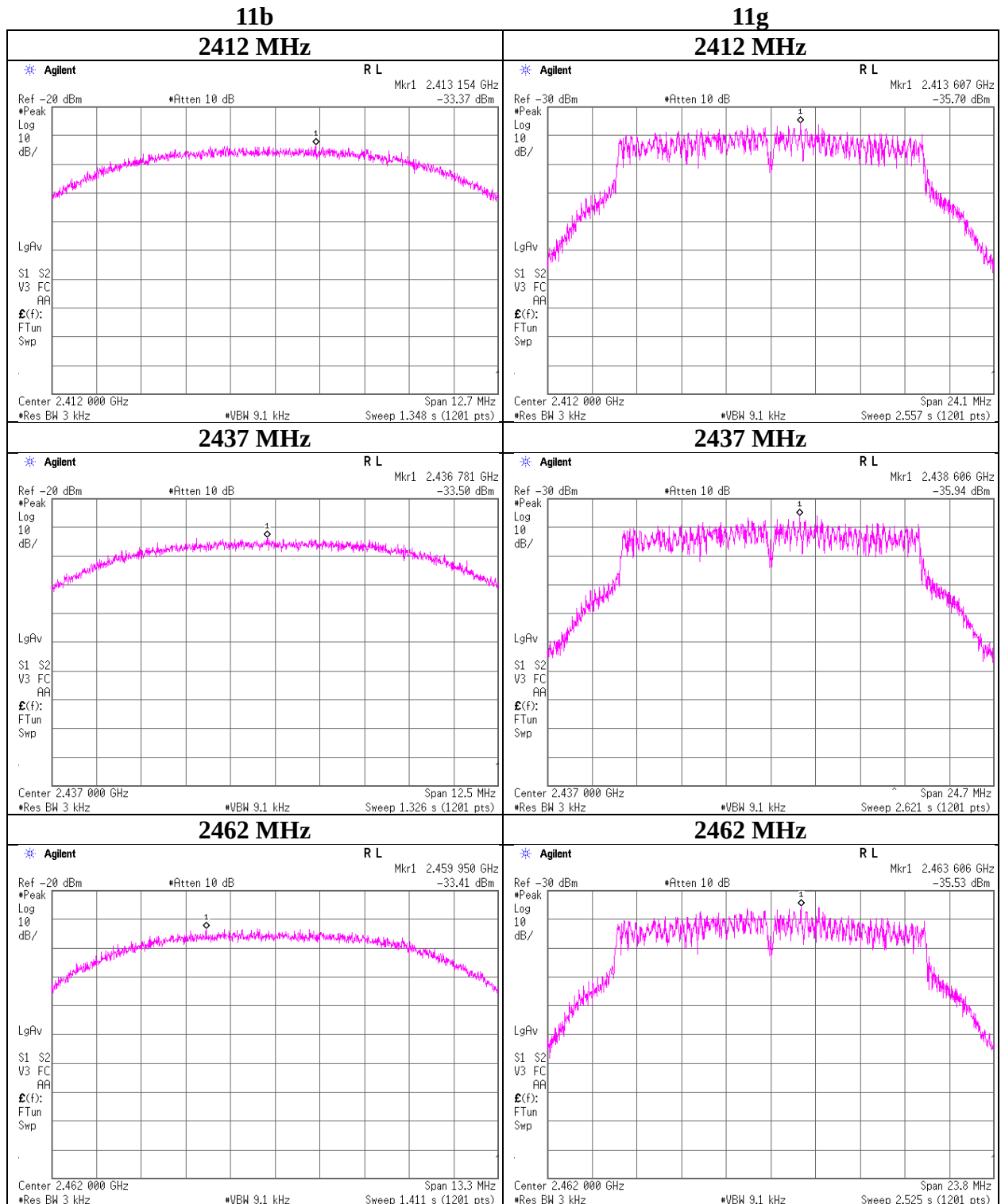
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-18.91	1.60	9.96	-7.35	8.00	15.35
2440.00	-19.24	1.61	9.97	-7.66	8.00	15.66
2480.00	-19.91	1.62	9.97	-8.32	8.00	16.32

Sample Calculation:

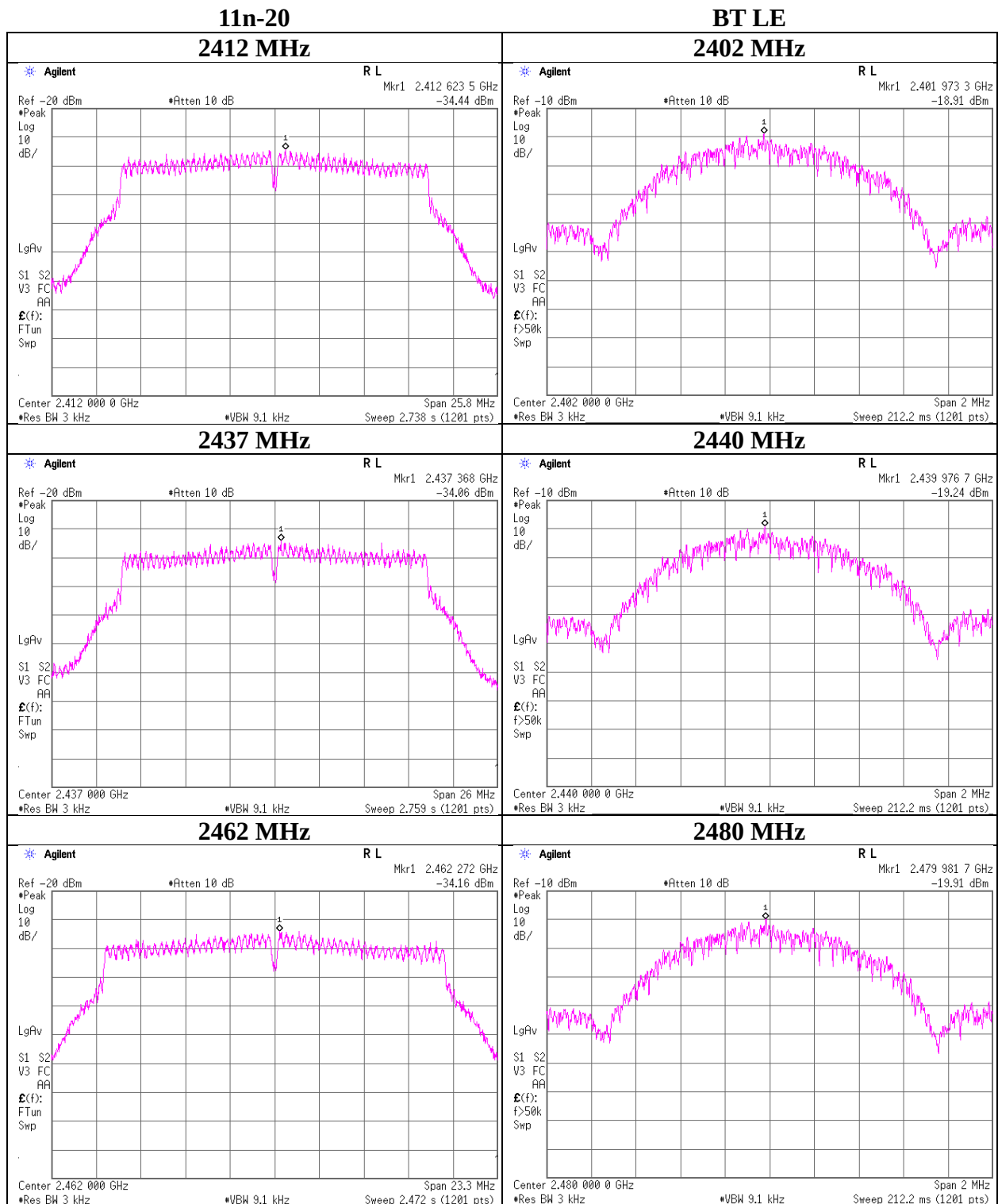
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

Power Density



Power Density



APPENDIX 2: Test instruments

Test equipment (1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2017/12/21 * 12
KTS-07	Digital Tester	SANWA	PC500	7019232	AT	2017/10/11 * 12
SCC-G14	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	AT	2017/03/23 * 12
SAT10-13	Attenuator	Weinschel Corp.	54A-10	81626	AT	2017/03/23 * 12
SRENT-10	Spectrum Analyzer	Agilent	E4440A	US41421511	AT, RE	2016/12/05 * 12 *1)
SRENT-08	Spectrum Analyzer	Agilent	E4448A	MY50180019	AT, RE	2017/10/12 * 12
SCC-G32	Coaxial Cable	Junkosha	MWX241-0200 0KMSKMS	OCT-09-13-0 05	AT	2017/11/22 * 12
SAT20-13	Attenuator	Weinschel Corp.	54A-20	87636	AT	2017/12/08 * 12
SAT20-12	Attenuator	Weinschel Corp.	54A-20	86752	AT	2017/12/08 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2017/10/10 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2017/05/01 * 12
SPSS-05	Power sensor	Agilent	N1923A	MY5349008	AT	2017/05/01 * 12
STS-06	Digital Hitester	Hioki	3805-50	080997830	AT	2017/03/08 * 12
SOS-10	Humidity Indicator	A&D	AD-5681	4064561	AT	2017/10/30 * 12
SAT20-12	Attenuator	Weinschel Corp.	54A-20	86752	AT	2017/12/08 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2017/05/01 * 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2017/02/17 * 12
SCC-G07	Coaxial Cable	Junkosha	J12J103316-00	MAY-25-17- 008	RE	2017/06/13 * 12
SCC-G43	Coaxial Cable	HUBER+SUHNER	SUCOFLEX_1 04 E	SN MY 13406/4E	RE	2017/07/10 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2017/08/23 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2016/10/12 * 12 *1)
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
SAEC-03(SVSW R)	Semi-Anechoic Chamber	TDK	SAEC-03(SVS WR)	3	RE	2017/07/17 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE _CE,RFI,MF)	-	RE, CE	-
STS-03	Digital Hitester	Hioki	3805-50	80997823	RE	2016/10/17 * 12 *1)
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2016/11/07 * 12 *1)
SCC-G41	Coaxial Cable	Junkosha	MWX221-0100 0NFSNMS/B	1612S006	RE	2017/01/08 * 12 *1)
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
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2017/03/07 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	51	RE	2016/11/29 * 12 *1)
SAF-04	Pre Amplifier	TOYO Corporation	TPA0118-36	1440489	RE	2017/03/17 * 12
SCC-G05	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-0 37	RE	2017/01/08 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2017/05/08 * 12
SHA-01	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	RE	2017/08/14 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2017/10/30 * 12
KJM-09	Measure	KOMELON	KMC-36	-	RE	-
SAEC-01(SVSW R)	Semi-Anechoic Chamber	TDK	SAEC-01(SVS WR)	1	RE	2017/07/20 * 12
STS-01	Digital Hitester	Hioki	3805-50	80997812	RE	2017/10/16 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2017/04/20 * 12
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2017/02/09 * 12
KAT6-04	Attenuator	INMET	18N-6dB	-	RE	2016/12/15 * 12 *1)
SAT3-09	Attenuator	JFW	50HF-003N	-	RE	2017/08/24 * 12
SBA-01	Biconical Antenna	Schwarzbeck	BBA9106	91032664	RE	2017/10/21 * 12
SCC-A1/A3/A5/ A7/A8/A13/S RSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhne r/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA /141PE/141PE/ 141PE/141PE/ NS4906	-/0901-269(R FSelector)	RE	2017/04/07 * 12

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Test equipment (2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SCC-A2/A4/A6/A7/A8/A13/SRSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RFSelector)	RE	2017/04/07 * 12
SLA-05	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	193	RE	2017/01/05 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE	2017/04/12 * 12
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2017/06/09 * 12
SCC-G40	Coaxial Cable	Junkosha	MWX221-0100NFSNMS/B	1612S005	RE	2017/01/08 * 12
SHA-05	Horn Antenna	ETS LINDGREN	Sep-60	LM4210	RE	2017/03/15 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	18	RE	2017/09/22 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-0100KMSKMS	-	RE	2017/04/20 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2017/03/23 * 12
SCC-B12/B13/SRSE-02	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-270(RF Selector)	CE	2017/04/07 * 12
SLS-03	LISN	Rohde & Schwarz	ENV216	100513	CE	2017/02/27 * 12
KAT3-12	Attenuator	JFW IND. INC.	50HF-003N	-	CE	2017/07/24 * 12
SOS-04	Humidity Indicator	A&D	AD-5681	4061512	CE	2016/12/13 * 12 *1)
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	CE	2017/09/26 * 12
SJM-09	Measure	PROMART	SEN1935	-	CE	-
STS-02	Digital Hitester	Hioki	3805-50	080997819	CE	2017/03/08 * 12

*1) This test equipment was used for the tests before the expiration date of the calibration.

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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