



RADIO TEST REPORT

Test Report No. : 11640275S-A-R1

Applicant : RICOH COMPANY, LTD.
Type of Equipment : Digital Camera
Model No. : RICOH THETA V
FCC ID : BBP-RR214
Test regulation : FCC Part 15 Subpart C: 2017
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 11640275S-A.

Date of test: May 17 to June 15, 2017

Representative test engineer:

Hikaru Shirasawa

Engineer

Consumer Technology Division

Approved by:

Toyokazu Imamura

Leader

Consumer Technology Division



JAB
Testing
RTL02610

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

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Shonan EMC Lab.

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13-EM-F0429

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SECTION 1: Customer information

Company Name : RICOH COMPANY, LTD.
Address : 1-3-6 Nakamagome, Ohta-ku, Tokyo, 143-8555 Japan
Telephone Number : +81-50-3534-5213
Contact Person : Kenji Daigo

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

2.1 Identification of E.U.T.

Type of Equipment : Digital Camera
Model No. : RICOH THETA V
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 5.0 V (USB)
DC 3.6 V (Battery)
Receipt Date of Sample : April 27, 2017
Country of Mass-production : China
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: RICOH THETA V (referred to as the EUT in this report) is a Digital Camera.

Clock frequencies:

Clock	Oscillation Source	Frequency
Power Management IC (Main Clock)	Crystal Unit	19.2 MHz
Power Management IC (SPMI)	ASIC	19.2 MHz
ASIC (Main Clock)	Power Management IC	19.2 MHz
ASIC (Sleep Clock)	Power Management IC	32.766 kHz
eMMC (Main Clock)	ASIC	200 MHz
LPDDR3 (Main Clock)	ASIC	806.4 MHz
Audio IC (Main Clock)	Power Management IC	9.6 MHz
Audio IC (SlimBus Clock)	ASIC	24.576 MHz
Speaker Amp. (Main Clock)	Audio IC	9.6 MHz
CMOS Image Sensor (Main Clock)	ASIC	12 MHz/ 24 MHz
CMOS Image Sensor (MIPI Clock)	ASIC	200 MHz
Wireless IC (Main Clock)	Crystal Unit	48 MHz
Wireless IC (Command Clock)	ASIC	30 MHz/ 60 MHz

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Radio Specification

Equipment type	:	Transceiver
Frequency of operation	:	2.4 GHz: 2402 MHz -2480 MHz (Bluetooth BDR/EDR/Low Energy (LE)) 2412 MHz -2462 MHz (IEEE 802.11b, 11g, 11n (HT20)) 2412 MHz -2462 MHz (Wireless LAN) W52: 5180 MHz -5240 MHz (IEEE 802.11a, 11n (HT20), 11ac (VHT20)) 5190 MHz -5230 MHz (IEEE 802.11n (HT40), 11ac (VHT40)) 5210 MHz (IEEE 802.11ac (VHT80))
Bandwidth	:	20 MHz (IEEE 802.11a/b/g/n/ac), 40 MHz (IEEE 802.11n/ac), 80 MHz(IEEE 802.11ac) , 1 MHz (Bluetooth BDR/EDR), 2MHz (Bluetooth LE)
Channel spacing	:	5 MHz (Wi-Fi 2.4 GHz), 20 MHz/40 MHz/80 MHz (Wi-Fi 5 GHz), 1 MHz (Bluetooth BDR/EDR), 2MHz (Bluetooth LE)
Type of modulation	:	DSSS (IEEE 802.11b), OFDM (IEEE 802.11a/g/n/ac), FHSS (Bluetooth BDR/EDR/ Low Energy (LE))
Antenna type	:	PCB Antenna
Antenna connector type	:	None
Antenna gain	:	[2.4 GHz] 0.119 dBi [5 GHz] -3.8 dBi
ITU code	:	F1D, G1D (Bluetooth BDR/EDR/Low Energy (LE)) D1D, G1D (IEEE802.11b/g/n/a/ac)
Operation temperature range	:	0 deg. C to +40 deg. C

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on June 14, 2017 and effective July 14, 2017

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

* The revision on June 14, 2017, does not affect the test specification applied to the EUT.

* 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	13.9 dB, 0.15000 MHz, N Tx IEEE802.11g 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	5.9 dB 7440.00 MHz, AV, Vert. Tx BT LE 2480 MHz	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

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

*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)

This EUT provides stable voltage (DC 1.3 V/1.8 V/3.0 V) constantly to RF Module 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.

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	No. 5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.6 dB	2.5 dB	2.6 dB	2.5 dB	2.5 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.1 dB	3.1 dB	3.1 dB	-	-
	30 MHz-200 MHz	4.6 dB	4.4 dB	4.6 dB	-	-
	200 MHz-1 GHz	5.8 dB	5.7 dB	5.8 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-13 GHz	4.9 dB	4.9 dB	4.9 dB	-	-
	13 GHz-18 GHz	4.6 dB	4.6 dB	4.6 dB	-	-
	18 GHz-40 GHz	4.9 dB	4.9 dB	4.9 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-4	0.72 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.85 dB
Power Measurement above 1 GHz (Average Detector)_SPM-6	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.91 dB
Spurious emission (Conducted) below 1 GHz	1.6 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.3 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.2 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.3 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.4 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 test report has enough margin, more than the site margin.

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3.5 Test Location

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JAB Accreditation No. RTL02610

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)

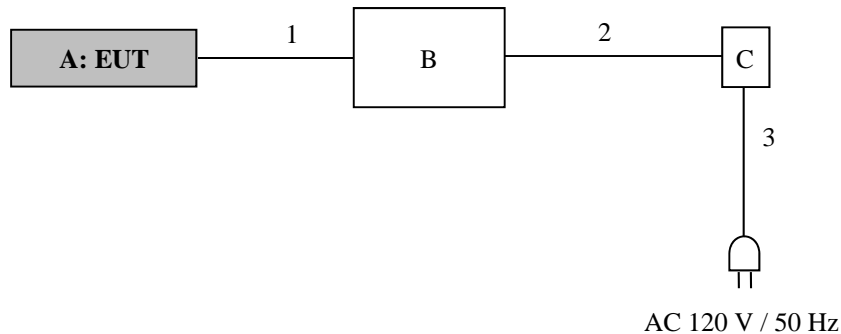
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009 and also was judged the necessity of 802.11ac mode by the pre-test.

Mode	Remarks*									
IEEE 802.11b (11b)	11 Mbps short, PN9									
IEEE 802.11g (11g)	48 Mbps, PN9									
IEEE 802.11n SISO 20 MHz BW (11n-20)	MCS 7, PN9									
Bluetooth Low Energy	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: WLAN: 12 dBm BLE: 0 dBm Software: RICOH_WLAN_RF_test4 (for IEEE 802.11b/g/n) RICOH_BT_RF_test4 (for Bluetooth Low Energy)										
<table border="1"> <thead> <tr> <th>Camera Serial number</th> <th>Firmware Ver.</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>YL00000192</td> <td>00500000</td> <td>(Antenna Terminal conducted test)</td> </tr> <tr> <td>YL00000259</td> <td>00500000</td> <td>(Conducted Emission test and Radiated Emission test)</td> </tr> </tbody> </table>		Camera Serial number	Firmware Ver.	Remarks	YL00000192	00500000	(Antenna Terminal conducted test)	YL00000259	00500000	(Conducted Emission test and Radiated Emission test)
Camera Serial number	Firmware Ver.	Remarks								
YL00000192	00500000	(Antenna Terminal conducted test)								
YL00000259	00500000	(Conducted Emission test and Radiated Emission test)								
*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	2402 MHz
		2440 MHz
		2480 MHz
Spurious Emission 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



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Digital Camera	RICOH THETA V	YL00000192 *1) YL00000259 *2)	RICOH	EUT
B	Laptop PC	PC-VJ23LLZGR	66000071A	NEC	-
C	AC Adaptor	ADP-45TD E	0115924DB	NEC	-

*1) Used for Antenna Terminal conducted test

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

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	0.5+1.0	Shielded	Shielded	Extension Manufacturer: RICOH Supplied with EUT
2	DC	1.8	Unshielded	Unshielded	-
3	AC	0.9	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

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

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

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

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

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 "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 table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity. 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	3.98 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		3.98 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: $20 \times \log(3.98 \text{ m} / 3.0 \text{ m}) = 2.45 \text{ dB}$

*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.

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz -13 GHz)	Spurious (13 GHz -26.5 GHz)
Horizontal	Y	X	Y	X
Vertical	Z	Z	Z	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 for IEEE 802.11 10 MHz for 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	Sample	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

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APPENDIX 1: Test data

Conducted Emission

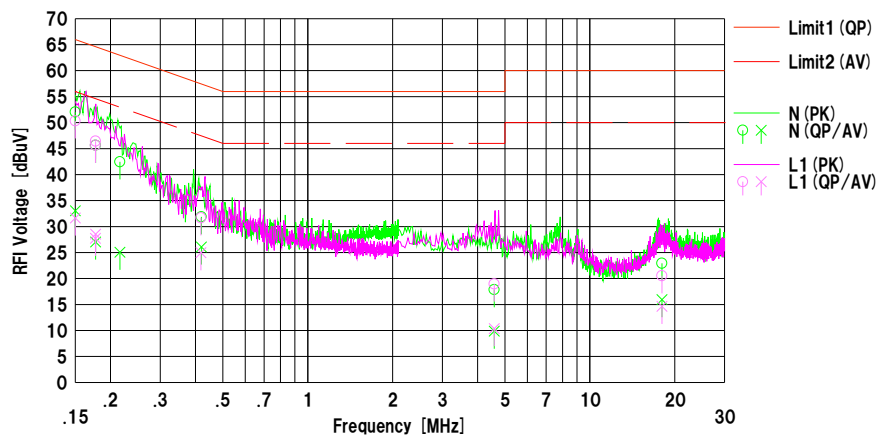
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2017/05/24

Mode : Tx IEEE802.11g 2462 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 22 deg.C / 50 %RH

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

Engineer : Hikaru Shirasawa



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	0.15000	39.30	20.30	12.74	52.04	33.04	66.00	56.00	13.9	22.9	N	
2	0.17700	32.90	14.30	12.74	45.64	27.04	64.63	54.63	18.9	27.5	N	
3	0.21600	29.70	12.30	12.76	42.46	25.06	62.97	52.97	20.5	27.9	N	
4	0.42000	19.10	13.30	12.78	31.88	26.08	57.45	47.45	25.5	21.3	N	
5	4.58400	4.80	-3.20	13.07	17.87	9.87	56.00	46.00	38.1	36.1	N	
6	18.00700	9.20	2.20	13.75	22.95	15.95	60.00	50.00	37.0	34.0	N	
7	0.15000	37.60	18.90	12.74	50.34	31.64	66.00	56.00	15.6	24.3	L1	
8	0.17678	32.90	15.00	12.74	45.64	27.74	64.64	54.64	19.0	26.9	L1	
9	0.17700	33.70	15.80	12.74	46.44	28.54	64.63	54.63	18.1	26.0	L1	
10	0.41840	18.90	12.20	12.78	31.68	24.98	57.48	47.48	25.8	22.5	L1	
11	4.58400	5.90	-2.70	13.07	18.97	10.37	56.00	46.00	37.0	35.6	L1	
12	18.00700	6.80	0.90	13.75	20.55	14.65	60.00	50.00	39.4	35.3	L1	

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

Conducted Emission

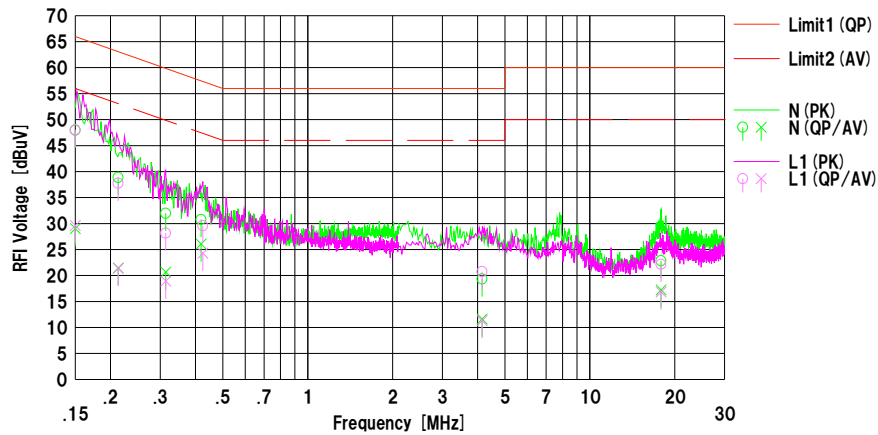
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2017/05/24

Mode : Tx BLE 2402 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 22 deg.C / 50 %RH

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

Engineer : Hikaru Shirasawa



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]				
1	0.15000	35.20	16.30	12.74	47.94	29.04	66.00	56.00	18.0	26.9	N	
2	0.21300	26.10	8.70	12.76	38.86	21.46	63.09	53.09	24.2	31.6	N	
3	0.31400	19.20	7.90	12.76	31.96	20.66	59.86	49.86	27.9	29.2	N	
4	0.41900	18.00	13.30	12.78	30.78	26.08	57.47	47.47	26.6	21.3	N	
5	4.15000	6.30	-1.40	13.04	19.34	11.64	56.00	46.00	36.6	34.3	N	
6	17.88600	9.10	3.50	13.75	22.85	17.25	60.00	50.00	37.1	32.7	N	
7	0.15000	35.30	16.90	12.74	48.04	29.64	66.00	56.00	17.9	26.3	L1	
8	0.21300	25.00	8.60	12.76	37.76	21.36	63.09	53.09	25.3	31.7	L1	
9	0.31400	15.40	6.20	12.76	28.16	18.96	59.86	49.86	31.7	30.9	L1	
10	0.42489	16.80	11.50	12.78	29.58	24.28	57.35	47.35	27.7	23.0	L1	
11	4.15000	7.70	-1.70	13.04	20.74	11.34	56.00	46.00	35.2	34.6	L1	
12	17.88600	8.40	3.10	13.75	22.15	16.85	60.00	50.00	37.8	33.1	L1	

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

Conducted Emission

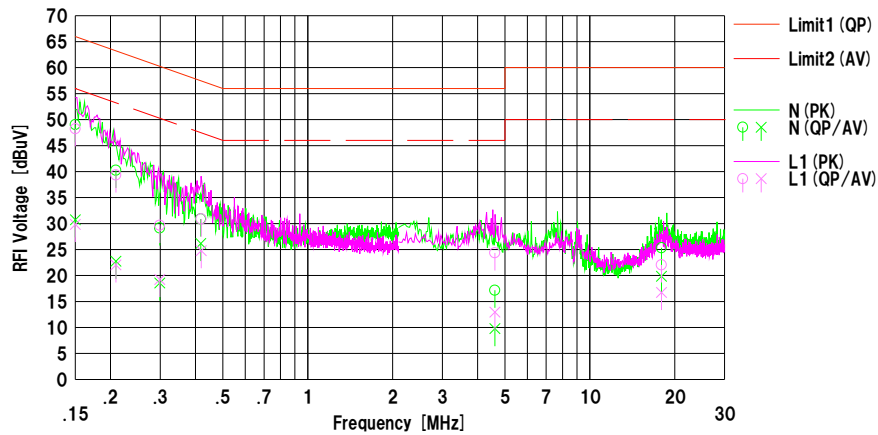
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2017/05/24

Mode : Tx BLE 2440 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 22 deg.C / 50 %RH

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

Engineer : Hikaru Shirasawa



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]				
1	0.15000	36.30	18.00	12.74	49.04	30.74	66.00	56.00	16.9	25.2	N	
2	0.20900	27.50	10.00	12.75	40.25	22.75	63.24	53.24	22.9	30.4	N	
3	0.29900	16.40	5.80	12.76	29.16	18.56	60.27	50.27	31.1	31.7	N	
4	0.41780	18.10	13.40	12.78	30.88	26.18	57.49	47.49	26.6	21.3	N	
5	4.60800	4.10	-3.30	13.07	17.17	9.77	56.00	46.00	38.8	36.2	N	
6	17.94300	11.60	6.10	13.75	25.35	19.85	60.00	50.00	34.6	30.1	N	
7	0.15000	35.50	17.10	12.74	48.24	29.84	66.00	56.00	17.7	26.1	L1	
8	0.20900	26.60	9.30	12.75	39.35	22.05	63.24	53.24	23.8	31.1	L1	
9	0.29900	16.90	6.50	12.76	29.66	19.26	60.27	50.27	30.6	31.0	L1	
10	0.41930	18.10	12.00	12.78	30.88	24.78	57.46	47.46	26.5	22.6	L1	
11	4.60800	11.30	-0.10	13.07	24.37	12.97	56.00	46.00	31.6	33.0	L1	
12	17.94300	8.30	3.00	13.75	22.05	16.75	60.00	50.00	37.9	33.2	L1	

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

Conducted Emission

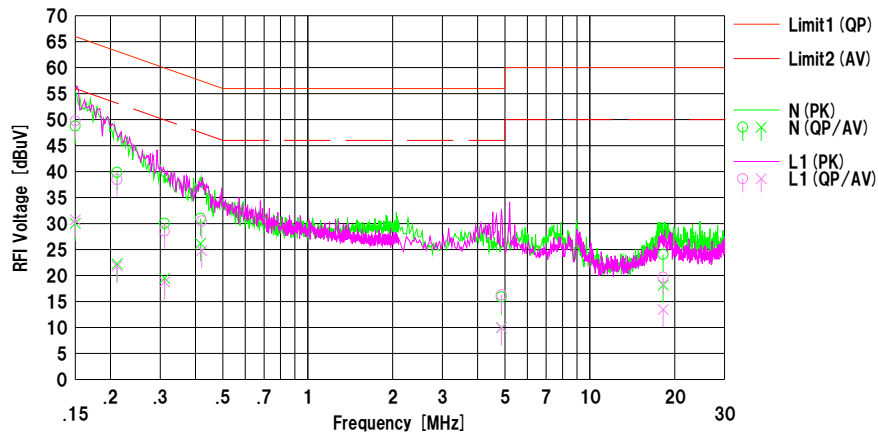
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2017/05/24

Mode : Tx BLE 2480 MHz
Power : AC 120 V / 60 Hz
Temp./Humi. : 22 deg.C / 50 %RH

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

Engineer : Hikaru Shirasawa



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]		
1	0.15000	36.00	17.30	12.74	48.74	30.04	66.00	56.00	17.2	25.9	N	
2	0.21100	27.10	9.50	12.75	39.85	22.25	63.17	53.17	23.3	30.9	N	
3	0.31100	17.30	6.70	12.76	30.06	19.46	59.94	49.94	29.8	30.4	N	
4	0.41719	18.20	13.40	12.78	30.98	26.18	57.50	47.50	26.5	21.3	N	
5	4.86100	2.80	-3.10	13.08	15.88	9.98	56.00	46.00	40.1	36.0	N	
6	18.19100	10.30	4.40	13.76	24.06	18.16	60.00	50.00	35.9	31.8	N	
7	0.15000	37.00	18.00	12.74	49.74	30.74	66.00	56.00	16.2	25.2	L1	
8	0.21100	25.70	9.10	12.75	38.45	21.85	63.17	53.17	24.7	31.3	L1	
9	0.31100	15.80	6.00	12.76	28.56	18.76	59.94	49.94	31.3	31.1	L1	
10	0.42100	17.70	12.00	12.78	30.48	24.78	57.43	47.43	26.9	22.6	L1	
11	4.86100	3.20	-3.10	13.08	16.28	9.98	56.00	46.00	39.7	36.0	L1	
12	18.19100	5.90	-0.30	13.76	19.66	13.46	60.00	50.00	40.3	36.5	L1	

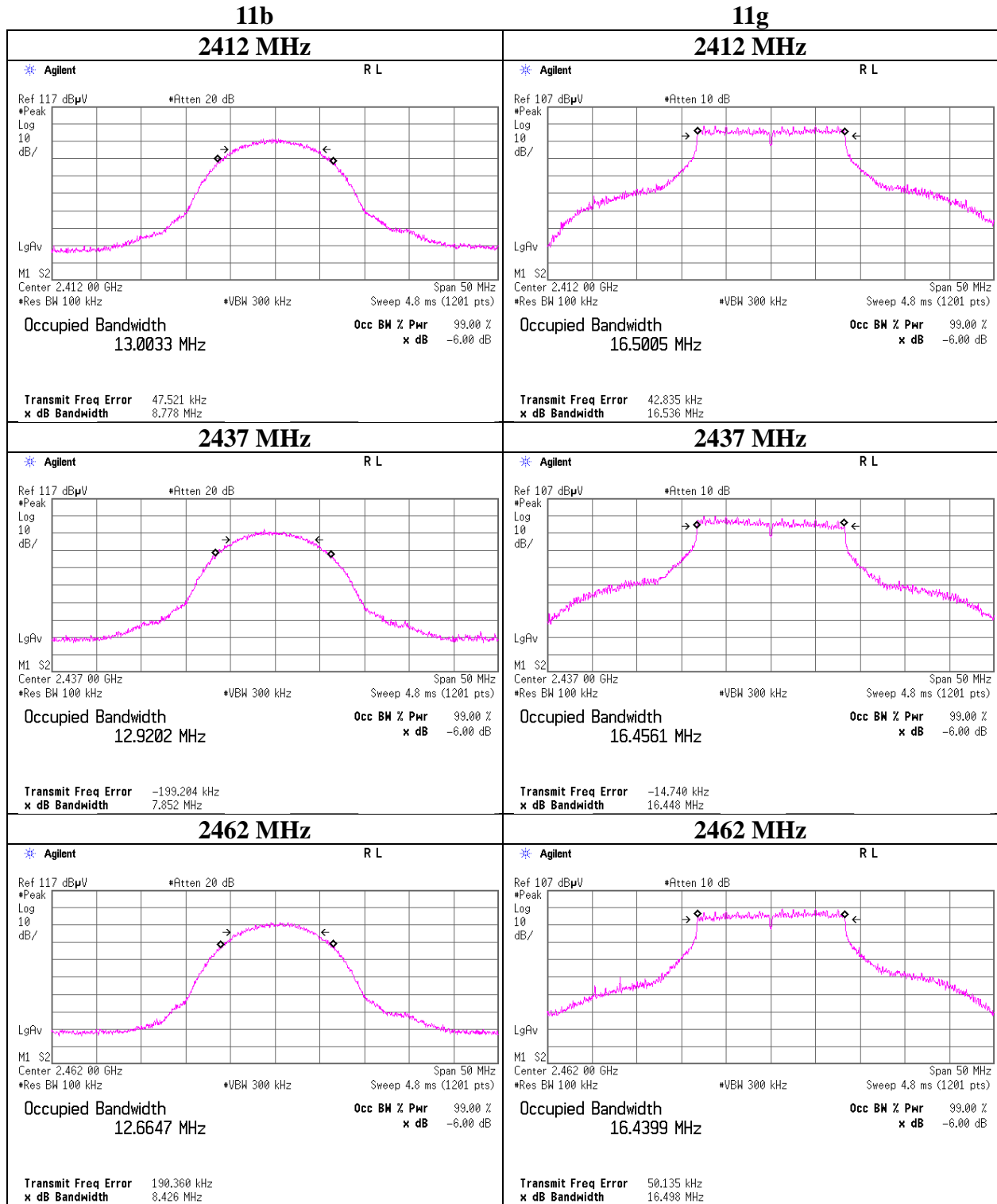
Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN-SLS-03

6dB Bandwidth

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11640275S-A-R1
Date May 19, 2017
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Hikaru Shirasawa
Mode Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	8.778	> 500
	2437	7.852	> 500
	2462	8.426	> 500
11g	2412	16.536	> 500
	2437	16.448	> 500
	2462	16.498	> 500
11n-20	2412	17.764	> 500
	2437	17.269	> 500
	2462	17.630	> 500

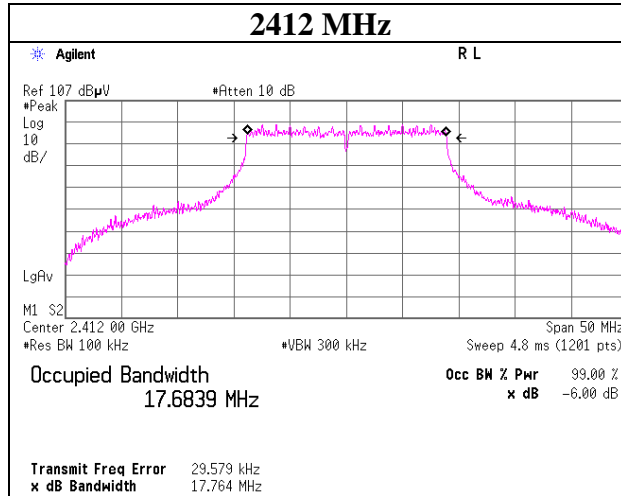
6dB Bandwidth



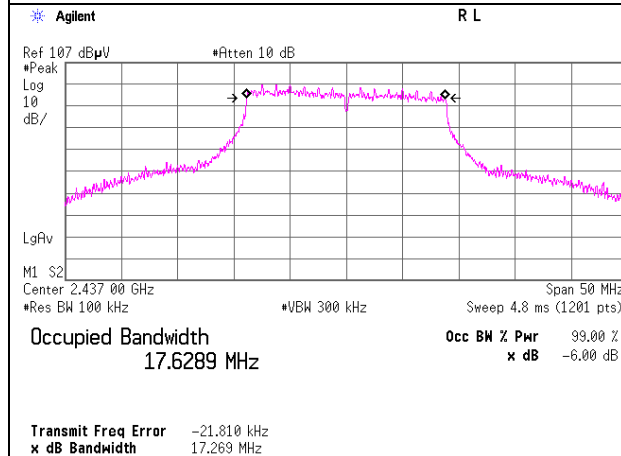
6dB Bandwidth

11n-20

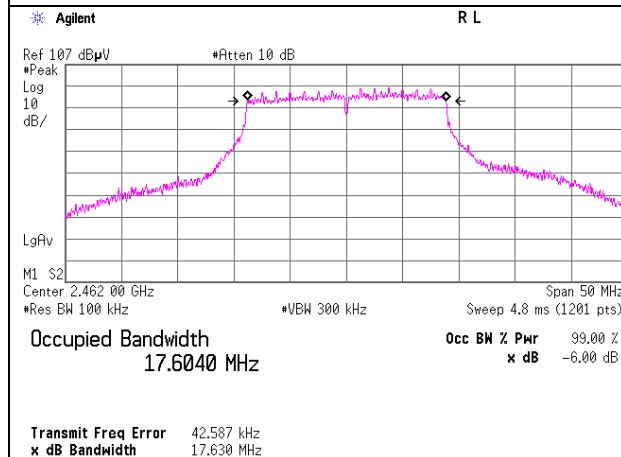
2412 MHz



2437 MHz



2462 MHz



6dB Bandwidth

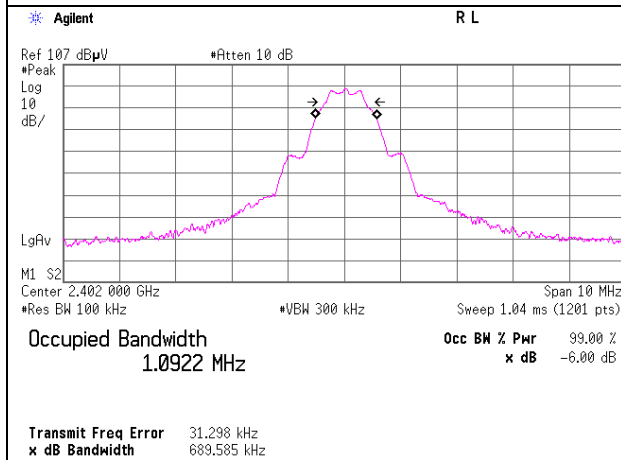
Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11640275S-A-R1
Date May 18, 2017
Temperature / Humidity 25 deg. C / 52 % RH
Engineer Hikaru Shirasawa
Mode Tx BT LE

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
Tx	2402	0.690	> 500
	2440	0.695	> 500
	2480	0.708	> 500

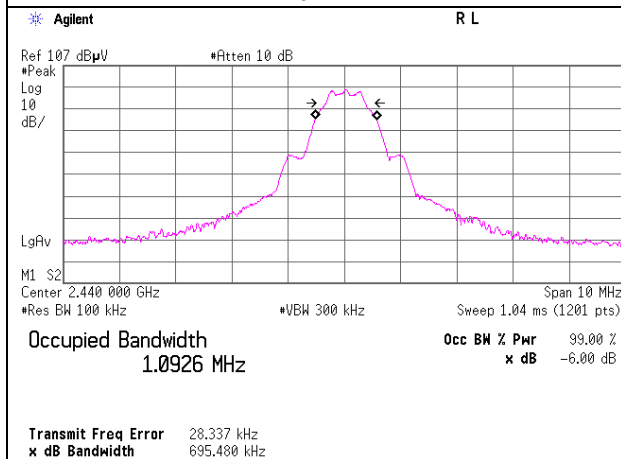
6dB Bandwidth

BT LE

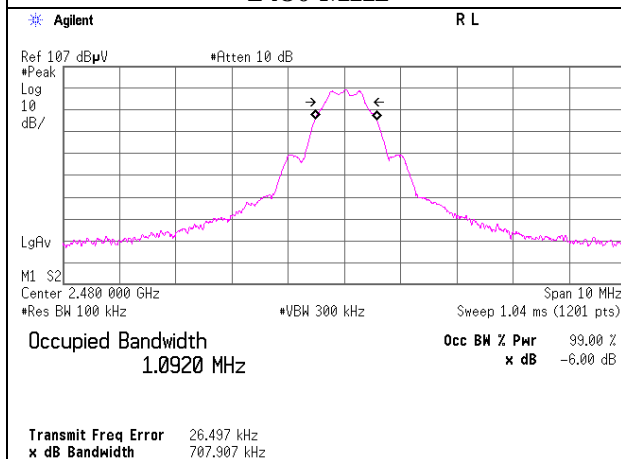
2402 MHz



2440 MHz



2480 MHz



Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11640275S-A-R1
Date : May 17, 2017
Temperature / Humidity : 25 deg. C / 45 % RH
Engineer : Hikaru Shirasawa
Mode : Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	2.39	2.11	9.85	14.35	27.23	30.00	1000	15.65
2437	2.43	2.11	9.85	14.39	27.48	30.00	1000	15.61
2462	2.47	2.12	9.84	14.43	27.73	30.00	1000	15.57

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.

2437MHz

Rate [Mbps]	Reading [dBm]	Remark
1 (long)	2.32	
2 (long)	2.35	
5.5 (long)	2.34	
11 (long)	2.41	
2 (short)	2.36	
5.5 (short)	2.39	
11 (short)	2.43	*

*: 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.	11640275S-A-R1
Date	May 17, 2017
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Hikaru Shirasawa
Mode	Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	8.55	2.11	9.85	20.51	112.46	30.00	1000	9.49
2437	8.67	2.11	9.85	20.63	115.61	30.00	1000	9.37
2462	8.71	2.12	9.84	20.67	116.68	30.00	1000	9.33

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.

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	8.45	
9	8.55	
12	8.56	
18	8.51	
24	8.63	
36	8.50	
48	8.67	*
54	8.61	

*: 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. : 11640275S-A-R1
Date : May 17, 2017
Temperature / Humidity : 25 deg. C / 45 % RH
Engineer : Hikaru Shirasawa
Mode : Tx 11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	8.01	2.11	9.85	19.97	99.31	30.00	1000	10.03
2437	8.20	2.11	9.85	20.16	103.75	30.00	1000	9.84
2462	7.93	2.12	9.84	19.89	97.50	30.00	1000	10.11

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.

2437 MHz

MCS Number	Reading [dBm]	Remark
0	8.19	
1	8.14	
2	8.19	
3	8.09	
4	8.13	
5	8.12	
6	8.11	
7	8.20	*

* 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. 11640275S-A-R1
Date May 18, 2017
Temperature / Humidity 25 deg. C / 52 % RH
Engineer Hikaru Shirasawa
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-11.04	2.10	9.85	0.91	1.23	30.00	1000	29.09
2440	-10.76	2.11	9.84	1.19	1.32	30.00	1000	28.81
2480	-10.48	2.12	9.84	1.48	1.41	30.00	1000	28.52

Sample Calculation:

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

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

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

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11640275S-A-R1
Date : May 17, 2017
Temperature / Humidity : 25 deg. C / 45 % RH
Engineer : Hikaru Shirasawa
Mode : Tx

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	0.00	2.00	10.00	12.00	15.85	0.00	12.00	15.85
2437	0.00	2.00	10.00	12.00	15.85	0.00	12.00	15.85
2462	0.00	2.00	10.00	12.00	15.85	0.00	12.00	15.85

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	0.00	2.00	10.00	12.00	15.85	0.00	12.00	15.85
2437	0.00	2.00	10.00	12.00	15.85	0.00	12.00	15.85
2462	0.00	2.00	10.00	12.00	15.85	0.00	12.00	15.85

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	-0.39	2.11	9.85	11.57	14.35	0.02	11.59	14.42
2437	-0.38	2.11	9.85	11.58	14.39	0.02	11.60	14.45
2462	-0.31	2.12	9.84	11.65	14.62	0.02	11.67	14.69

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.**

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

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11640275S-A-R1
Date May 17, 2017
Temperature / Humidity 25 deg. C / 45 % RH
Engineer Hikaru Shirasawa
Mode Tx 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	-13.01	2.10	9.85	-1.06	0.78	1.84	0.78	1.20
2440	-12.73	2.11	9.84	-0.78	0.84	1.84	1.06	1.28
2480	-12.45	2.12	9.84	-0.49	0.89	1.84	1.35	1.36

Sample Calculation:

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

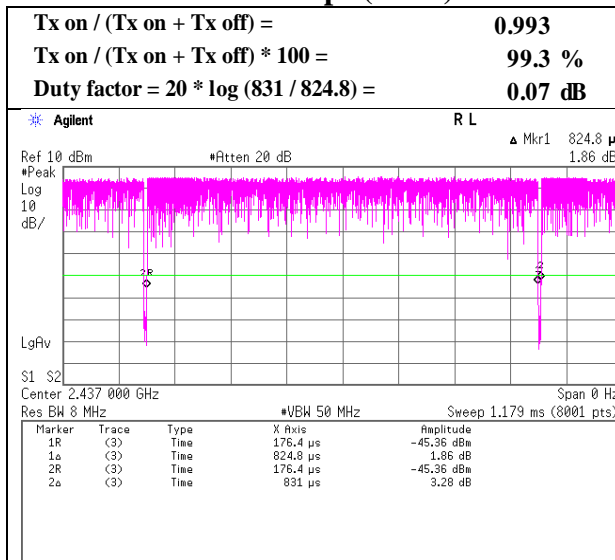
Result (Burst power average) = Time average + Duty factor

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

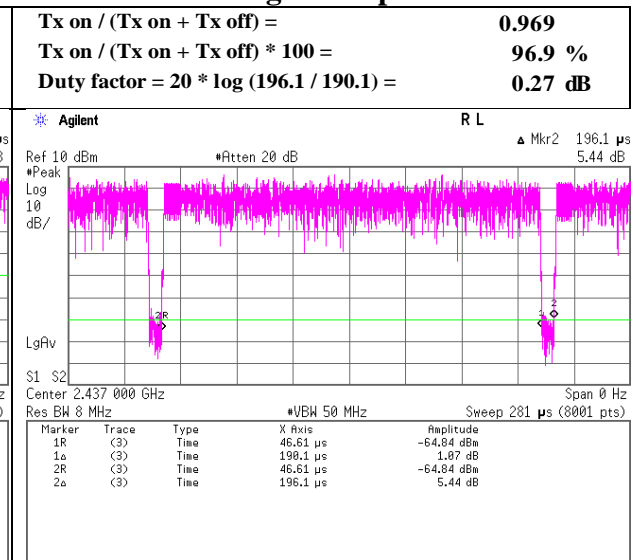
Burst rate confirmation

Test place : Shonan EMC Lab. No.5 Shielded Room
 Report No. : 11640275S-A-R1
 Date : May 17, 2017
 Temperature / Humidity : 25 deg. C / 45 % RH
 Engineer : Hikaru Shirasawa
 Mode : Tx

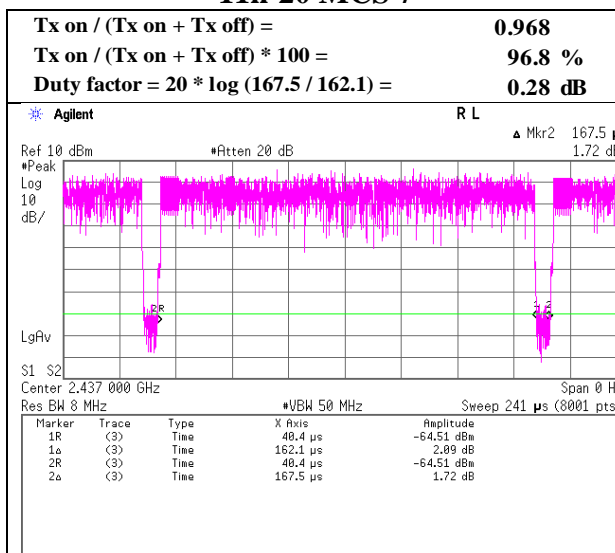
11b 11 Mbps (short)



11g 48 Mbps



11n-20 MCS 7



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

UL Japan, Inc.

Shonan EMC Lab.

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

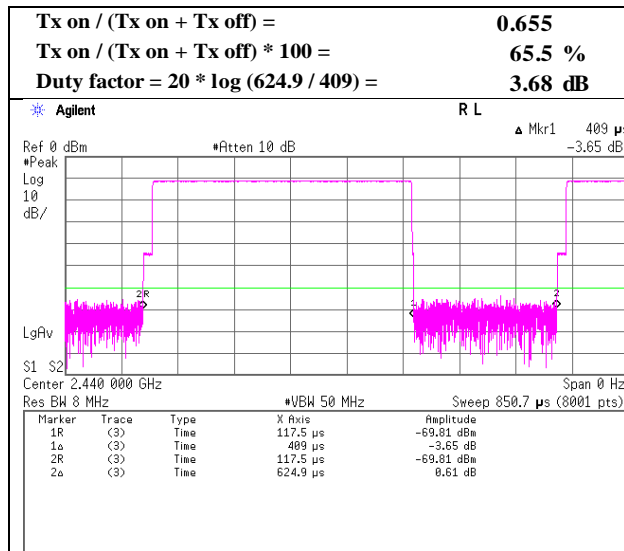
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Burst rate confirmation

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11640275S-A-R1
Date	May 18, 2017
Temperature / Humidity	25 deg. C / 52 % RH
Engineer	Hikaru Shirasawa
Mode	Tx

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. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017 May 18, 2017
Temperature / Humidity : 25 deg. C / 50 % RH 24 deg. C / 52 % RH
Engineer : Hiroyuki Morikawa Hiroyuki Morikawa
 (1 GHz – 13 GHz) (13 – 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	43.68	27.17	14.15	36.83	2.45	50.62	73.90	23.3	194	74	
Hori.	4824.000	PK	43.50	31.17	6.57	37.00	2.45	46.69	73.90	27.2	150	0	
Hori.	7236.000	PK	43.98	36.49	7.88	37.83	2.45	52.97	73.90	20.9	150	0	
Hori.	9648.000	PK	44.49	38.34	8.87	38.53	2.45	55.62	73.90	18.3	150	0	
Hori.	2390.000	AV	34.47	27.17	14.15	36.83	2.45	41.41	53.90	12.5	194	74	
Hori.	4824.000	AV	34.52	31.17	6.57	37.00	2.45	37.71	53.90	16.2	150	0	
Hori.	7236.000	AV	35.08	36.49	7.88	37.83	2.45	44.07	53.90	9.8	150	0	
Hori.	9648.000	AV	35.74	38.34	8.87	38.53	2.45	46.87	53.90	7.0	150	0	
Vert.	2390.000	PK	43.88	27.17	14.15	36.83	2.45	50.82	73.90	23.1	223	109	
Vert.	4824.000	PK	43.45	31.17	6.57	37.00	2.45	46.64	73.90	27.3	150	0	
Vert.	7236.000	PK	44.17	36.49	7.88	37.83	2.45	53.16	73.90	20.7	150	0	
Vert.	9648.000	PK	44.39	38.34	8.87	38.53	2.45	55.52	73.90	18.4	150	0	
Vert.	2390.000	AV	34.51	27.17	14.15	36.83	2.45	41.45	53.90	12.5	223	109	
Vert.	4824.000	AV	34.53	31.17	6.57	37.00	2.45	37.72	53.90	16.2	150	0	
Vert.	7236.000	AV	35.12	36.49	7.88	37.83	2.45	44.11	53.90	9.8	150	0	
Vert.	9648.000	AV	35.81	38.34	8.87	38.53	2.45	46.94	53.90	7.0	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 dB

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	88.73	27.24	14.16	36.82	2.45	95.76	-	-	Carrier
Hori.	2400.000	PK	41.14	27.20	14.15	36.83	2.45	48.11	75.76	27.7	
Vert.	2400.000	PK	41.03	27.20	14.15	36.83	2.45	48.00	75.33	27.3	
Vert.	2412.000	PK	88.30	27.24	14.16	36.82	2.45	95.33	-	-	Carrier

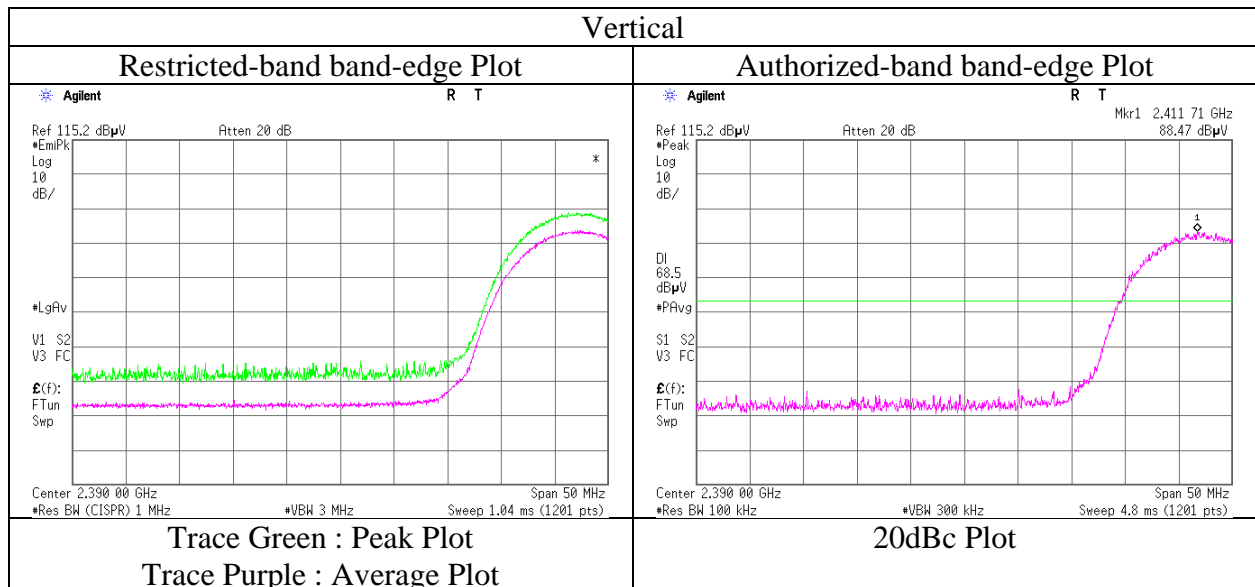
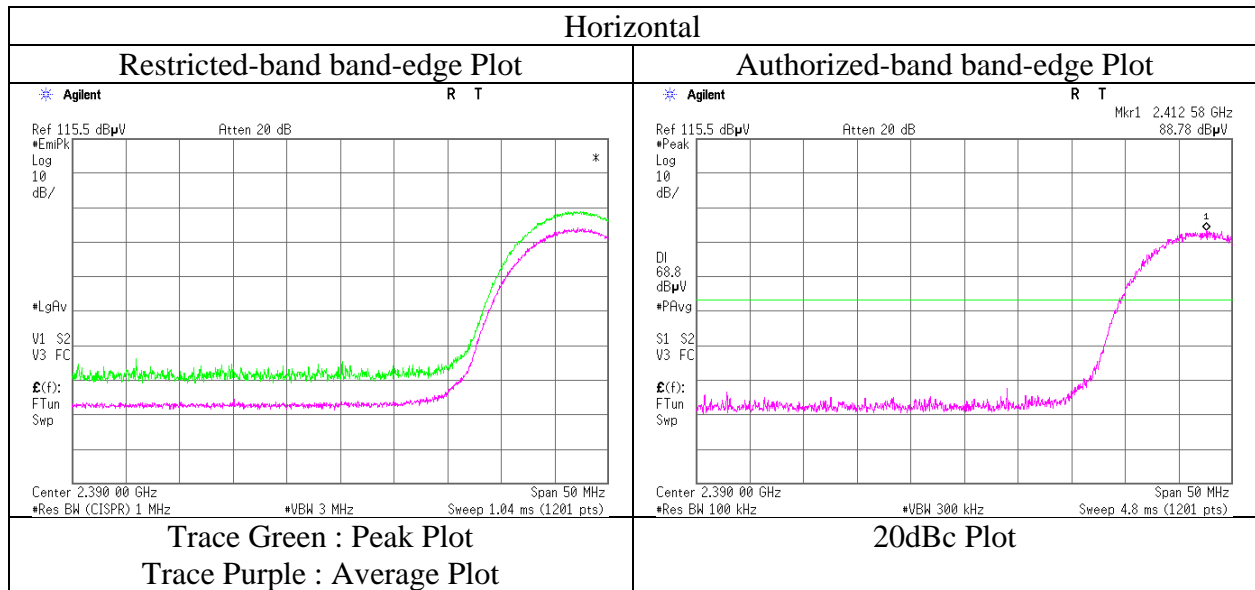
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 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.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017
Temperature / Humidity : 25 deg. C / 50 % 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. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017 May 18, 2017
Temperature / Humidity : 25 deg. C / 50 % RH 24 deg. C / 52 % RH
Engineer : Hiroyuki Morikawa Hiroyuki Morikawa
(1 GHz – 13 GHz) (13 – 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	43.41	31.28	6.58	37.03	2.45	46.69	73.90	27.2	150	0	
Hori.	7311.000	PK	44.11	36.62	7.88	37.87	2.45	53.19	73.90	20.7	150	0	
Hori.	9748.000	PK	45.62	38.50	8.89	38.65	2.45	56.81	73.90	17.1	150	0	
Hori.	4874.000	AV	34.09	31.28	6.58	37.03	2.45	37.37	53.90	16.5	150	0	
Hori.	7311.000	AV	34.89	36.62	7.88	37.87	2.45	43.97	53.90	9.9	150	0	
Hori.	9748.000	AV	36.00	38.50	8.89	38.65	2.45	47.19	53.90	6.7	150	0	
Vert.	4874.000	PK	43.13	31.28	6.58	37.03	2.45	46.41	73.90	27.5	150	0	
Vert.	7311.000	PK	45.15	36.62	7.88	37.87	2.45	54.23	73.90	19.7	150	0	
Vert.	9748.000	PK	45.18	38.50	8.89	38.65	2.45	56.37	73.90	17.5	150	0	
Vert.	4874.000	AV	34.54	31.28	6.58	37.03	2.45	37.82	53.90	16.1	150	0	
Vert.	7311.000	AV	35.19	36.62	7.88	37.87	2.45	44.27	53.90	9.6	150	0	
Vert.	9748.000	AV	36.18	38.50	8.89	38.65	2.45	47.37	53.90	6.5	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.45\text{ dB}$

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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
 Report No. : 11640275S-A-R1
 Date : May 17, 2017 May 18, 2017
 Temperature / Humidity : 25 deg. C / 50 % RH 24 deg. C / 52 % RH
 Engineer : Hiroyuki Morikawa Hiroyuki Morikawa
 (1 GHz – 13 GHz) (13 – 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	44.08	27.49	14.22	36.79	2.45	51.45	73.90	22.5	156	109	
Hori.	4924.000	PK	43.51	31.38	6.59	37.05	2.45	46.88	73.90	27.0	150	0	
Hori.	7386.000	PK	44.12	36.75	7.88	37.92	2.45	53.28	73.90	20.6	150	0	
Hori.	9848.000	PK	44.60	38.65	8.92	38.78	2.45	55.84	73.90	18.1	150	0	
Hori.	2483.500	AV	34.37	27.49	14.22	36.79	2.45	41.74	53.90	12.2	156	109	
Hori.	4924.000	AV	34.25	31.38	6.59	37.05	2.45	37.62	53.90	16.3	150	0	
Hori.	7386.000	AV	35.31	36.75	7.88	37.92	2.45	44.47	53.90	9.4	150	0	
Hori.	9848.000	AV	35.49	38.65	8.92	38.78	2.45	46.73	53.90	7.2	150	0	
Vert.	2483.500	PK	43.79	27.49	14.22	36.79	2.45	51.16	73.90	22.7	122	101	
Vert.	4924.000	PK	43.10	31.38	6.59	37.05	2.45	46.47	73.90	27.4	150	0	
Vert.	7386.000	PK	44.72	36.75	7.88	37.92	2.45	53.88	73.90	20.0	150	0	
Vert.	9848.000	PK	45.14	38.65	8.92	38.78	2.45	56.38	73.90	17.5	150	0	
Vert.	2483.500	AV	34.04	27.49	14.22	36.79	2.45	41.41	53.90	12.5	122	101	
Vert.	4924.000	AV	33.90	31.38	6.59	37.05	2.45	37.27	53.90	16.6	150	0	
Vert.	7386.000	AV	34.97	36.75	7.88	37.92	2.45	44.13	53.90	9.8	150	0	
Vert.	9848.000	AV	35.47	38.65	8.92	38.78	2.45	46.71	53.90	7.2	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.45\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

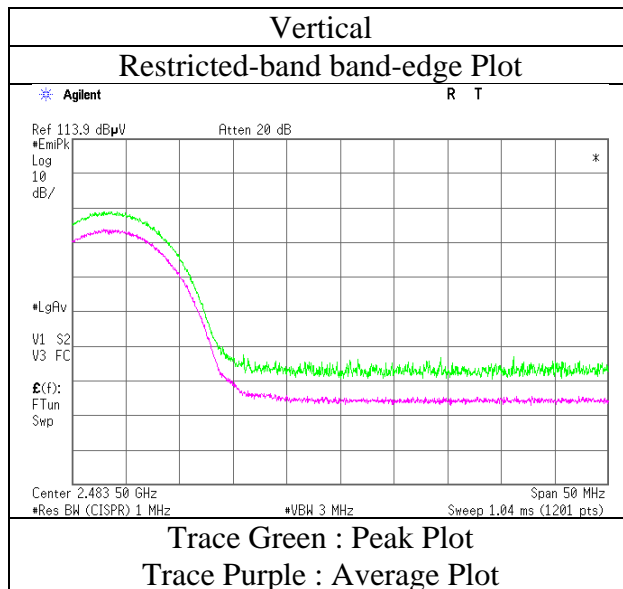
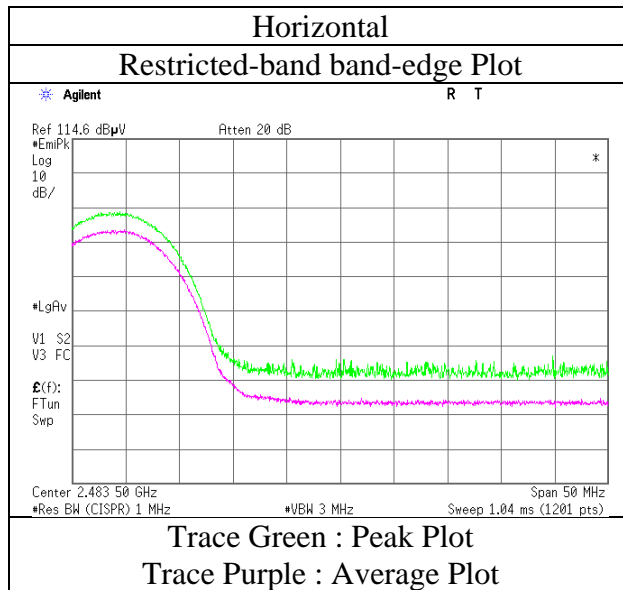
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017
Temperature / Humidity : 25 deg. C / 50 % 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. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017 May 18, 2017
Temperature / Humidity : 25 deg. C / 50 % RH 24 deg. C / 52 % RH
Engineer : Hiroyuki Morikawa Hiroyuki Morikawa
 (1 GHz – 13 GHz) (13 – 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	51.26	27.17	14.15	36.83	2.45	58.20	73.90	15.7	190	77	
Hori.	4824.000	PK	43.23	31.17	6.57	37.00	2.45	46.42	73.90	27.5	150	0	
Hori.	7236.000	PK	44.36	36.49	7.88	37.83	2.45	53.35	73.90	20.6	150	0	
Hori.	9648.000	PK	44.88	38.34	8.87	38.53	2.45	56.01	73.90	17.9	150	0	
Vert.	2390.000	PK	51.81	27.17	14.15	36.83	2.45	58.75	73.90	15.2	227	103	
Vert.	4824.000	PK	43.03	31.17	6.57	37.00	2.45	46.22	73.90	27.7	150	0	
Vert.	7236.000	PK	44.85	36.49	7.88	37.83	2.45	53.84	73.90	20.1	150	0	
Vert.	9648.000	PK	44.54	38.34	8.87	38.53	2.45	55.67	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 : 20log (3.98 m / 3.0 m) = 2.45 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	38.27	27.17	14.15	36.83	0.21	2.45	45.42	53.90	8.5	*1)
Hori.	4824.000	AV	34.16	31.17	6.57	37.00	0.21	2.45	37.56	53.90	16.3	
Hori.	7236.000	AV	34.92	36.49	7.88	37.83	0.21	2.45	44.12	53.90	9.8	
Hori.	9648.000	AV	35.75	38.34	8.87	38.53	0.21	2.45	47.09	53.90	6.8	
Vert.	2390.000	AV	36.75	27.17	14.15	36.83	0.21	2.45	43.90	53.90	10.0	*1)
Vert.	4824.000	AV	34.06	31.17	6.57	37.00	0.21	2.45	37.46	53.90	16.4	
Vert.	7236.000	AV	34.79	36.49	7.88	37.83	0.21	2.45	43.99	53.90	9.9	
Vert.	9648.000	AV	35.78	38.34	8.87	38.53	0.21	2.45	47.12	53.90	6.8	

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 (3.98 m / 3.0 m) = 2.45 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)

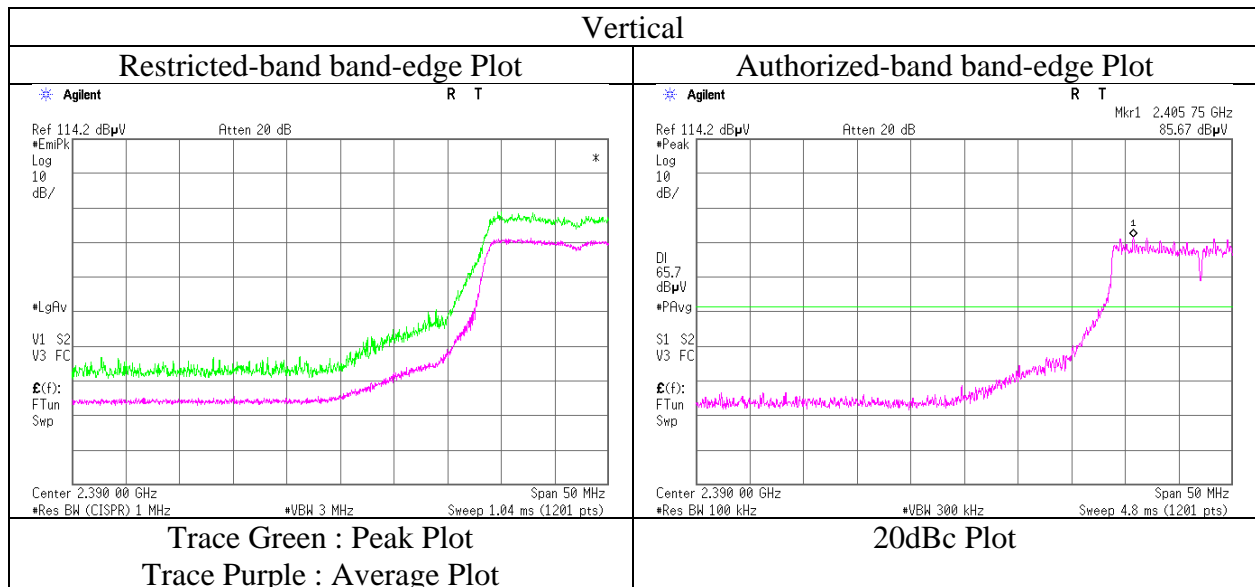
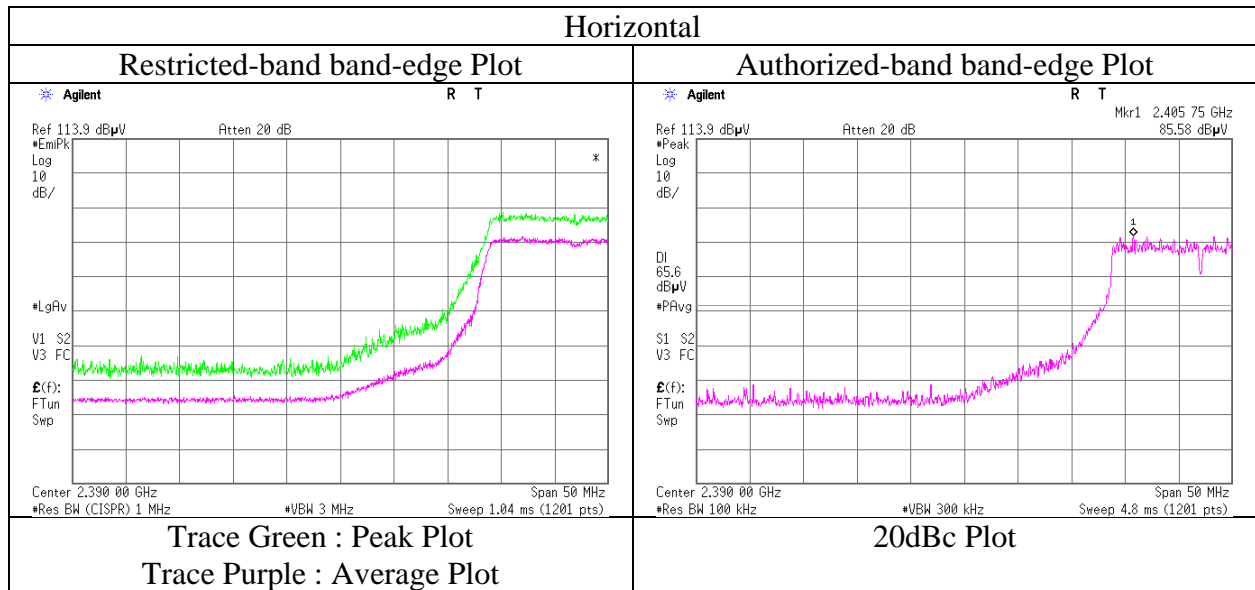
20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

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.	2412.000	PK	85.59	27.24	14.16	36.82	2.45	92.62	-	-	Carrier
Hori.	2400.000	PK	53.86	27.20	14.15	36.83	2.45	60.83	72.62	11.8	
Vert.	2412.000	PK	85.56	27.24	14.16	36.82	2.45	92.59	-	-	Carrier
Vert.	2400.000	PK	51.96	27.20	14.15	36.83	2.45	58.93	72.59	13.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 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.2 Semi Anechoic Chamber
 Report No. : 11640275S-A-R1
 Date : May 17, 2017
 Temperature / Humidity : 25 deg. C / 50 % RH
 Engineer : Hiroyuki Morikawa
 Mode : Tx 11g 2412 MHz



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

Radiated Spurious Emission

Test place Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. 11640275S-A-R1
Date May 17, 2017 May 18, 2017
Temperature / Humidity 25 deg. C / 50 % RH 24 deg. C / 52 % RH
Engineer Hiroyuki Morikawa Hiroyuki Morikawa
 (1 GHz – 13 GHz) (13 – 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	43.41	31.28	6.58	37.03	2.45	46.69	73.90	27.2	150	0	
Hori.	7311.000	PK	43.90	36.62	7.88	37.87	2.45	52.98	73.90	20.9	150	0	
Hori.	9748.000	PK	45.00	38.50	8.89	38.65	2.45	56.19	73.90	17.7	150	0	
Vert.	4874.000	PK	43.69	31.28	6.58	37.03	2.45	46.97	73.90	26.9	150	0	
Vert.	7311.000	PK	43.77	36.62	7.88	37.87	2.45	52.85	73.90	21.1	150	0	
Vert.	9748.000	PK	45.37	38.50	8.89	38.65	2.45	56.56	73.90	17.3	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.45\text{ dB}$

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	33.97	31.28	6.58	37.03	0.21	2.45	37.46	53.90	16.4	
Hori.	7311.000	AV	35.14	36.62	7.88	37.87	0.21	2.45	44.43	53.90	9.5	
Hori.	9748.000	AV	36.12	38.50	8.89	38.65	0.21	2.45	47.52	53.90	6.4	
Vert.	4874.000	AV	33.81	31.28	6.58	37.03	0.21	2.45	37.30	53.90	16.6	
Vert.	7311.000	AV	35.12	36.62	7.88	37.87	0.21	2.45	44.41	53.90	9.5	
Vert.	9748.000	AV	36.13	38.50	8.89	38.65	0.21	2.45	47.53	53.90	6.4	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.45\text{ dB}$

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. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 22, 2017 May 17, 2017 May 18, 2017
Temperature / Humidity : 23 deg. C / 54 % RH 25 deg. C / 50 % RH 24 deg. C / 52 % RH
Engineer : Hikaru Shirasawa Hiroyuki Morikawa Hiroyuki Morikawa
 (30 MHz – 1 GHz) (1 GHz – 13 GHz) (13 – 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.	827.964	QP	35.40	21.27	9.50	31.18	0.00	34.99	46.00	11.0	101	277	
Hori.	863.958	QP	37.60	21.79	9.67	31.03	0.00	38.03	46.00	7.9	100	162	
Hori.	931.160	QP	35.30	22.43	9.99	30.61	0.00	37.11	46.00	8.8	100	141	
Hori.	2483.500	PK	53.61	27.49	14.22	36.79	2.45	60.98	73.90	12.9	158	112	
Hori.	4924.000	PK	43.21	31.38	6.59	37.05	2.45	46.58	73.90	27.3	150	0	
Hori.	7386.000	PK	44.08	36.75	7.88	37.92	2.45	53.24	73.90	20.7	150	0	
Hori.	9848.000	PK	44.81	38.65	8.92	38.78	2.45	56.05	73.90	17.9	150	0	
Vert.	47.533	QP	40.70	11.68	7.22	31.89	0.00	27.71	40.00	12.2	100	359	
Vert.	99.551	QP	35.40	10.03	8.04	31.85	0.00	21.62	43.50	21.8	100	230	
Vert.	191.751	QP	30.40	16.25	8.84	31.77	0.00	23.72	43.50	19.7	100	280	
Vert.	750.447	QP	21.34	20.37	9.15	31.46	0.00	19.40	46.00	26.6	100	0	
Vert.	2483.500	PK	54.11	27.49	14.22	36.79	2.45	61.48	73.90	12.4	150	110	
Vert.	4924.000	PK	43.31	31.38	6.59	37.05	2.45	46.68	73.90	27.2	150	0	
Vert.	7386.000	PK	44.61	36.75	7.88	37.92	2.45	53.77	73.90	20.1	150	0	
Vert.	9848.000	PK	44.61	38.65	8.92	38.78	2.45	55.85	73.90	18.1	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 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	38.97	27.49	14.22	36.79	0.21	2.45	46.55	53.90	7.4	*1)
Hori.	4924.000	AV	34.03	31.38	6.59	37.05	0.21	2.45	37.61	53.90	16.3	
Hori.	7386.000	AV	35.20	36.75	7.88	37.92	0.21	2.45	44.57	53.90	9.3	
Hori.	9848.000	AV	35.97	38.65	8.92	38.78	0.21	2.45	47.42	53.90	6.5	
Vert.	2483.500	AV	37.61	27.49	14.22	36.79	0.21	2.45	45.19	53.90	8.7	*1)
Vert.	4924.000	AV	33.90	31.38	6.59	37.05	0.21	2.45	37.48	53.90	16.4	
Vert.	7386.000	AV	35.03	36.75	7.88	37.92	0.21	2.45	44.40	53.90	9.5	
Vert.	9848.000	AV	35.73	38.65	8.92	38.78	0.21	2.45	47.18	53.90	6.7	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 dB

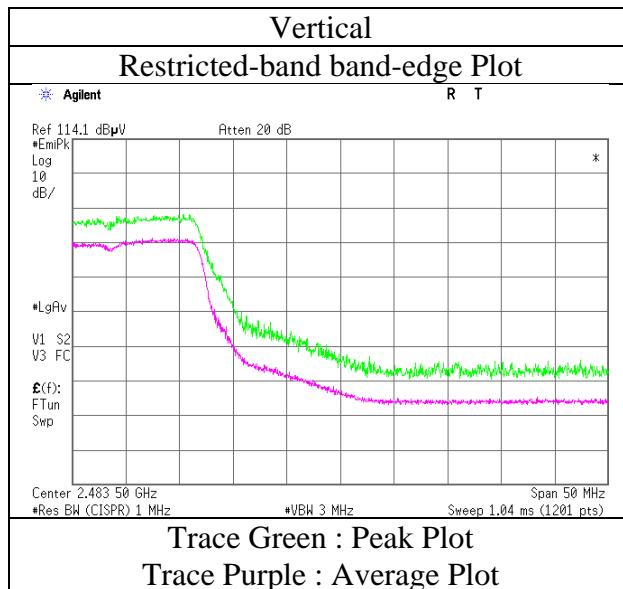
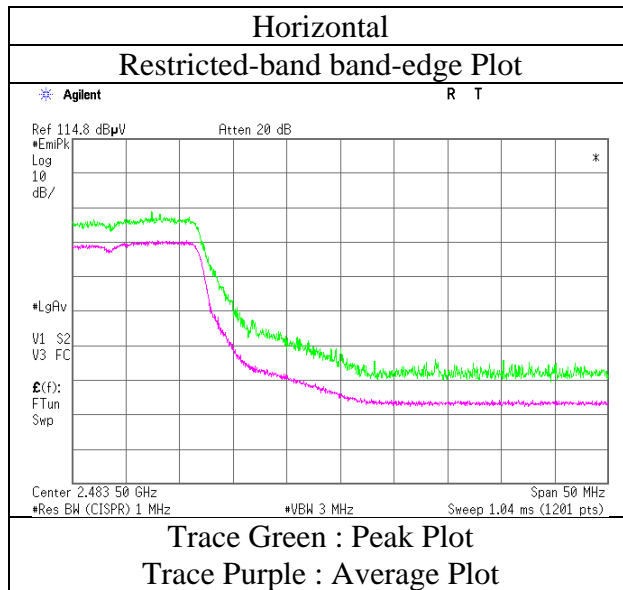
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017
Temperature / Humidity : 25 deg. C / 50 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx 11g 2462 MHz



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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017 May 18, 2017
Temperature / Humidity : 25 deg. C / 50 % RH 24 deg. C / 52 % RH
Engineer : Hiroyuki Morikawa Hiroyuki Morikawa
 (1 GHz – 13 GHz) (13 – 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	54.68	27.17	14.15	36.83	2.45	61.62	73.90	12.3	159	74	
Hori.	4824.000	PK	44.06	31.17	6.57	37.00	2.45	47.25	73.90	26.7	150	0	
Hori.	7236.000	PK	44.33	36.49	7.88	37.83	2.45	53.32	73.90	20.6	150	0	
Hori.	9648.000	PK	44.63	38.34	8.87	38.53	2.45	55.76	73.90	18.1	150	0	
Vert.	2390.000	PK	53.69	27.17	14.15	36.83	2.45	60.63	73.90	13.3	155	107	
Vert.	4824.000	PK	44.17	31.17	6.57	37.00	2.45	47.36	73.90	26.5	150	0	
Vert.	7236.000	PK	43.91	36.49	7.88	37.83	2.45	52.90	73.90	21.0	150	0	
Vert.	9648.000	PK	45.15	38.34	8.87	38.53	2.45	56.28	73.90	17.6	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.45\text{ dB}$

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	38.48	27.17	14.15	36.83	0.26	2.45	45.68	53.90	8.2	*1)
Hori.	4824.000	AV	34.17	31.17	6.57	37.00	0.26	2.45	37.62	53.90	16.3	
Hori.	7236.000	AV	34.63	36.49	7.88	37.83	0.26	2.45	43.88	53.90	10.0	
Hori.	9648.000	AV	36.04	38.34	8.87	38.53	0.26	2.45	47.43	53.90	6.5	
Vert.	2390.000	AV	37.81	27.17	14.15	36.83	0.26	2.45	45.01	53.90	8.9	*1)
Vert.	4824.000	AV	34.01	31.17	6.57	37.00	0.26	2.45	37.46	53.90	16.4	
Vert.	7236.000	AV	34.86	36.49	7.88	37.83	0.26	2.45	44.11	53.90	9.8	
Vert.	9648.000	AV	35.93	38.34	8.87	38.53	0.26	2.45	47.32	53.90	6.6	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.45\text{ dB}$

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	85.74	27.24	14.16	36.82	2.45	92.77	-	-	Carrier
Hori.	2400.000	PK	51.98	27.20	14.15	36.83	2.45	58.95	72.77	13.8	
Vert.	2412.000	PK	85.19	27.24	14.16	36.82	2.45	92.22	-	-	Carrier
Vert.	2400.000	PK	52.69	27.20	14.15	36.83	2.45	59.66	72.22	12.6	

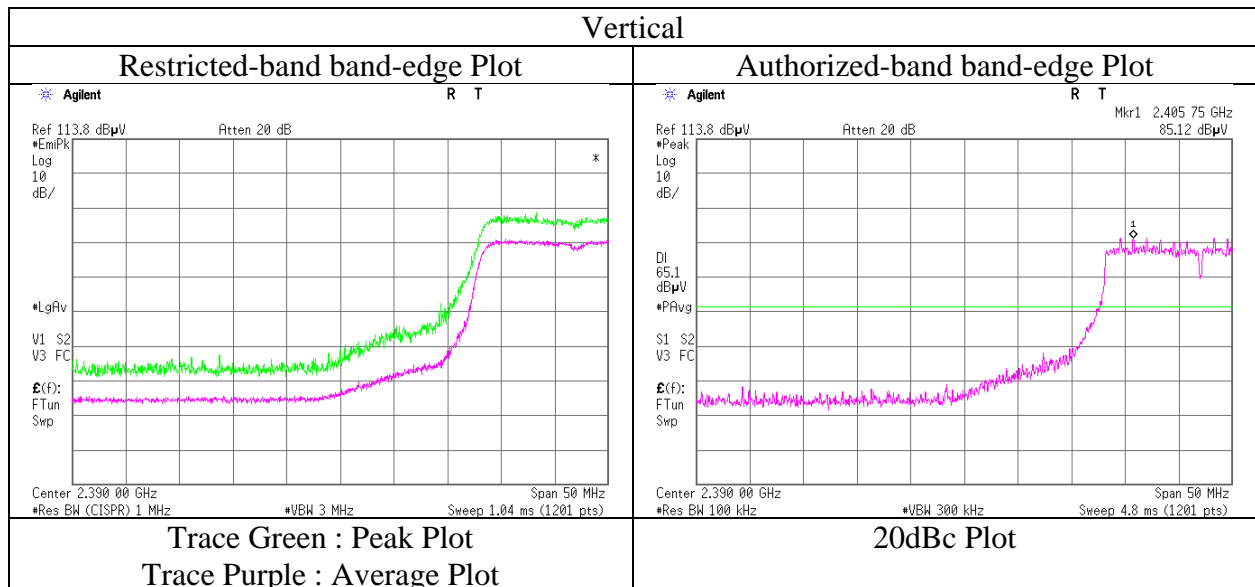
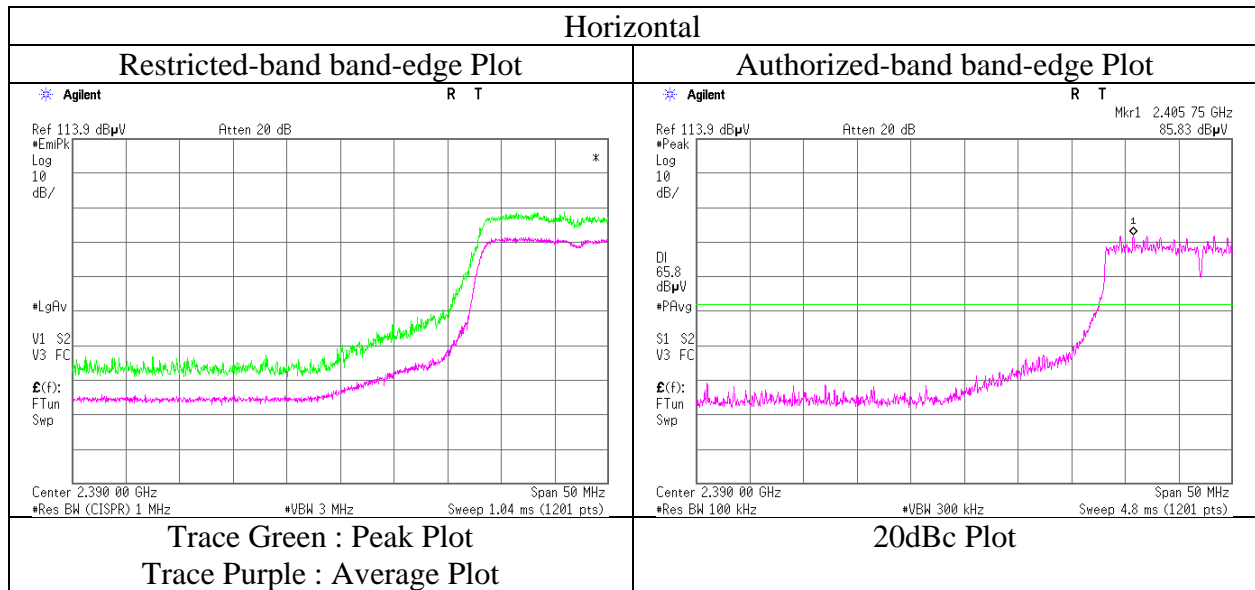
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.45\text{ dB}$

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. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017
Temperature / Humidity : 25 deg. C / 50 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx 11n-20 2412 MHz



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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017 May 18, 2017
Temperature / Humidity : 25 deg. C / 50 % RH 24 deg. C / 52 % RH
Engineer : Hiroyuki Morikawa Hiroyuki Morikawa
(1 GHz – 13 GHz) (13 – 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	43.52	31.28	6.58	37.03	2.45	46.80	73.90	27.1	150	0	
Hori.	7311.000	PK	45.46	36.62	7.88	37.87	2.45	54.54	73.90	19.4	150	0	
Hori.	9748.000	PK	44.81	38.50	8.89	38.65	2.45	56.00	73.90	17.9	150	0	
Vert.	4874.000	PK	43.27	31.28	6.58	37.03	2.45	46.55	73.90	27.4	150	0	
Vert.	7311.000	PK	44.77	36.62	7.88	37.87	2.45	53.85	73.90	20.1	150	0	
Vert.	9748.000	PK	45.39	38.50	8.89	38.65	2.45	56.58	73.90	17.3	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(3.98 m / 3.0 m) = 2.45 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.	4874.000	AV	34.05	31.28	6.58	37.03	0.26	2.45	37.59	53.90	16.3	
Hori.	7311.000	AV	35.12	36.62	7.88	37.87	0.26	2.45	44.46	53.90	9.4	
Hori.	9748.000	AV	36.11	38.50	8.89	38.65	0.26	2.45	47.56	53.90	6.3	
Vert.	4874.000	AV	33.95	31.28	6.58	37.03	0.26	2.45	37.49	53.90	16.4	
Vert.	7311.000	AV	35.15	36.62	7.88	37.87	0.26	2.45	44.49	53.90	9.4	
Vert.	9748.000	AV	36.01	38.50	8.89	38.65	0.26	2.45	47.46	53.90	6.4	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.98 m / 3.0 m) = 2.45 dB

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

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

Radiated Spurious Emission

Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	11640275S-A-R1	
Date	May 17, 2017	May 18, 2017
Temperature / Humidity	25 deg. C / 50 % RH	24 deg. C / 52 % RH
Engineer	Hiroyuki Morikawa	Hiroyuki Morikawa
	(1 GHz – 13 GHz)	(13 – 26.5 GHz)
Mode	Tx 11n-20 2462 MHz	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	55.85	27.49	14.22	36.79	2.45	63.22	73.90	10.7	156	110	
Hori.	4924.000	PK	43.33	31.38	6.59	37.05	2.45	46.70	73.90	27.2	150	0	
Hori.	7386.000	PK	44.29	36.75	7.88	37.92	2.45	53.45	73.90	20.5	150	0	
Hori.	9848.000	PK	44.94	38.65	8.92	38.78	2.45	56.18	73.90	17.7	150	0	
Vert.	2483.500	PK	54.22	27.49	14.22	36.79	2.45	61.59	73.90	12.3	151	109	
Vert.	4924.000	PK	43.46	31.38	6.59	37.05	2.45	46.83	73.90	27.1	150	0	
Vert.	7386.000	PK	43.82	36.75	7.88	37.92	2.45	52.98	73.90	20.9	150	0	
Vert.	9848.000	PK	44.69	38.65	8.92	38.78	2.45	55.93	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 : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.45\text{ dB}$
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

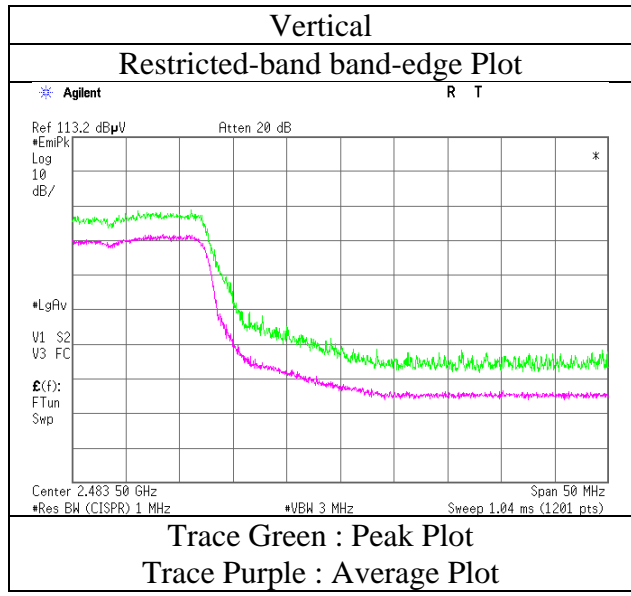
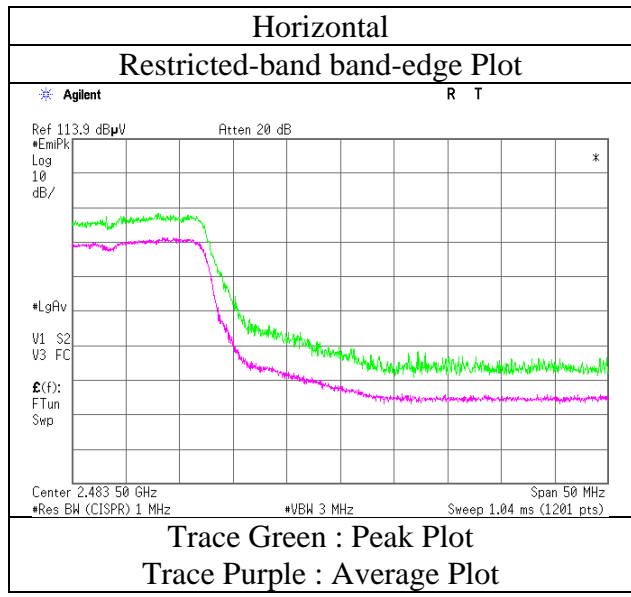
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	40.12	27.49	14.22	36.79	0.26	2.45	47.75	53.90	6.2	*1)
Hori.	4924.000	AV	34.25	31.38	6.59	37.05	0.26	2.45	37.88	53.90	16.0	
Hori.	7386.000	AV	35.44	36.75	7.88	37.92	0.26	2.45	44.86	53.90	9.0	
Hori.	9848.000	AV	36.03	38.65	8.92	38.78	0.26	2.45	47.53	53.90	6.4	
Vert.	2483.500	AV	39.25	27.49	14.22	36.79	0.26	2.45	46.88	53.90	7.0	*1)
Vert.	4924.000	AV	34.13	31.38	6.59	37.05	0.26	2.45	37.76	53.90	16.1	
Vert.	7386.000	AV	35.27	36.75	7.88	37.92	0.26	2.45	44.69	53.90	9.2	
Vert.	9848.000	AV	35.90	38.65	8.92	38.78	0.26	2.45	47.40	53.90	6.5	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.45\text{ dB}$
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)

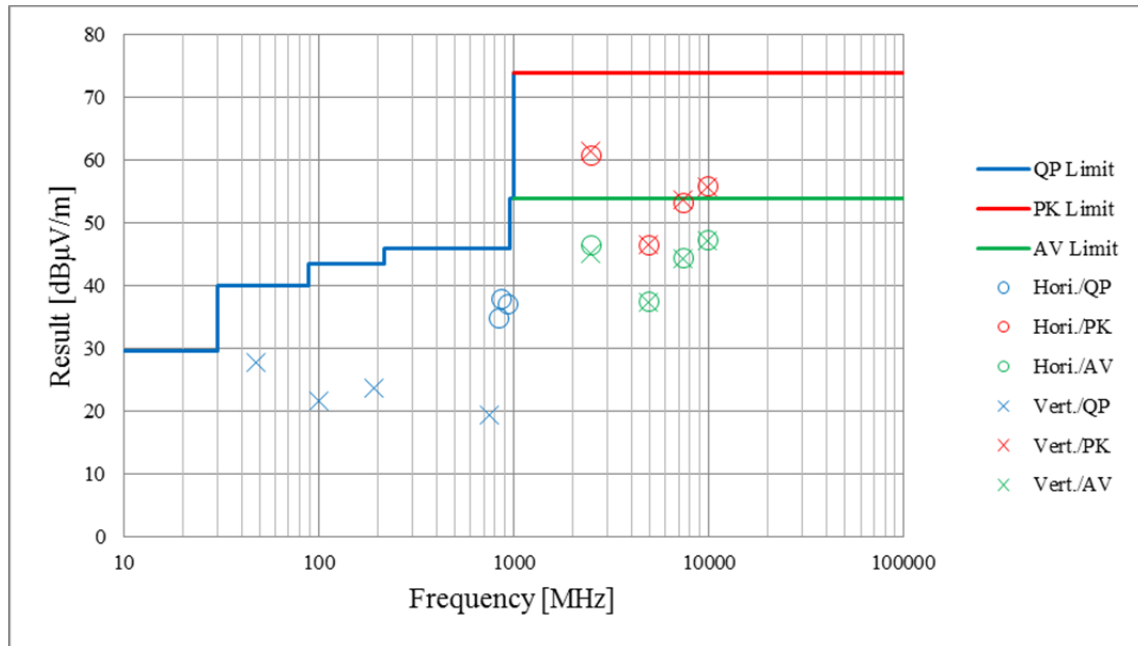
Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 17, 2017
Temperature / Humidity : 25 deg. C / 50 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx 11n-20 2462 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber		
Report No.	11640275S-A-R1		
Date	May 22, 2017	May 17, 2017	May 18, 2017
Temperature / Humidity	23 deg. C / 54 % RH	25 deg. C / 50 % RH	24 deg. C / 52 % RH
Engineer	Hikaru Shirasawa (30 MHz – 1 GHz)	Hiroyuki Morikawa (1 GHz – 13 GHz)	Hiroyuki Morikawa (13 – 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

Test place	Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber		
Test Place(AC No)	3AC	2AC	2AC
Report No.	11640275S-A-R1		
Date	June 15, 2017	May 15, 2017	May 18, 2017
Temperature / Humidity	22 deg. C / 53 % RH	23 deg. C / 58 % RH	24 deg. C / 52 % RH
Engineer	Yasumasa Owaki	Hiroyuki Morikawa	Hiroyuki Morikawa
	(30 MHz – 1 GHz)	(1 GHz – 13 GHz)	(13 – 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.	755.972	QP	34.07	20.13	10.57	31.64	0.00	33.13	46.00	12.8	100	266	
Hori.	827.967	QP	35.27	20.96	10.81	31.33	0.00	35.71	46.00	10.2	100	236	
Hori.	863.964	QP	37.92	21.45	10.93	31.14	0.00	39.16	46.00	6.8	100	151	
Hori.	931.164	QP	33.45	22.04	11.15	30.64	0.00	36.00	46.00	10.0	100	293	
Hori.	2390.000	PK	44.11	27.17	14.19	36.83	2.45	51.09	73.90	22.8	126	65	
Hori.	4804.000	PK	43.96	31.13	6.57	36.99	2.45	47.12	73.90	26.8	150	0	
Hori.	7206.000	PK	44.83	36.43	7.87	37.81	2.45	53.77	73.90	20.1	150	0	
Vert.	47.607	QP	41.89	11.47	6.93	32.12	0.00	28.17	40.00	11.8	100	251	
Vert.	193.234	QP	31.23	16.25	7.98	32.00	0.00	23.46	43.50	20.0	100	356	
Vert.	576.007	QP	29.58	18.64	9.92	31.85	0.00	26.29	46.00	19.7	100	57	
Vert.	844.765	QP	30.78	21.19	10.86	31.25	0.00	31.58	46.00	14.4	100	154	
Vert.	931.164	QP	32.35	22.04	11.15	30.64	0.00	34.90	46.00	11.1	109	316	
Vert.	2390.000	PK	44.27	27.17	14.19	36.83	2.45	51.25	73.90	22.7	198	109	
Vert.	4804.000	PK	43.23	31.13	6.57	36.99	2.45	46.39	73.90	27.5	150	0	
Vert.	7206.000	PK	43.97	36.43	7.87	37.81	2.45	52.91	73.90	21.0	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 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	34.04	27.17	14.19	36.83	3.70	2.45	44.72	53.90	9.2	*1)
Hori.	4804.000	AV	34.37	31.13	6.57	36.99	3.70	2.45	41.23	53.90	12.7	
Hori.	7206.000	AV	34.82	36.43	7.87	37.81	3.70	2.45	47.46	53.90	6.4	
Vert.	2390.000	AV	32.50	27.17	14.19	36.83	3.70	2.45	43.18	53.90	10.7	*1)
Vert.	4804.000	AV	34.25	31.13	6.57	36.99	3.70	2.45	41.11	53.90	12.8	
Vert.	7206.000	AV	35.24	36.43	7.87	37.81	3.70	2.45	47.88	53.90	6.0	

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 (3.98 m / 3.0 m) = 2.45 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	84.13	27.21	14.20	36.83	2.45	91.16	-	-	Carrier
Hori.	2400.000	PK	34.32	27.20	14.19	36.83	2.45	41.33	71.16	29.8	
Vert.	2402.000	PK	84.32	27.21	14.20	36.83	2.45	91.35	-	-	Carrier
Vert.	2400.000	PK	34.83	27.20	14.19	36.83	2.45	41.84	71.35	29.5	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 dB

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

UL Japan, Inc.

Shonan EMC Lab.

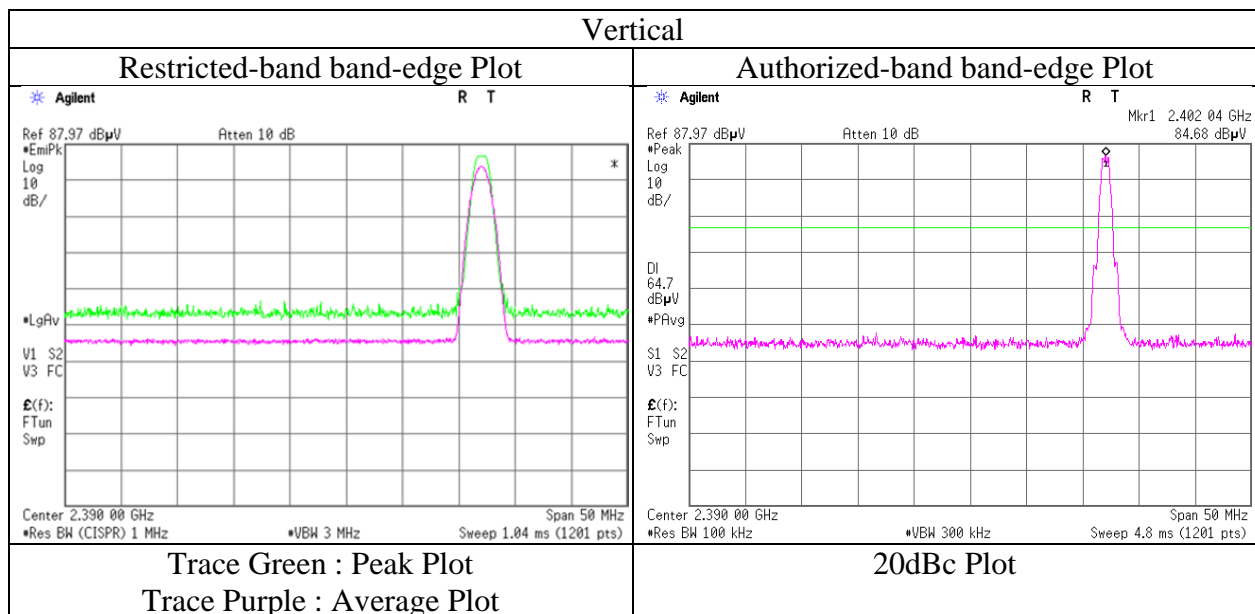
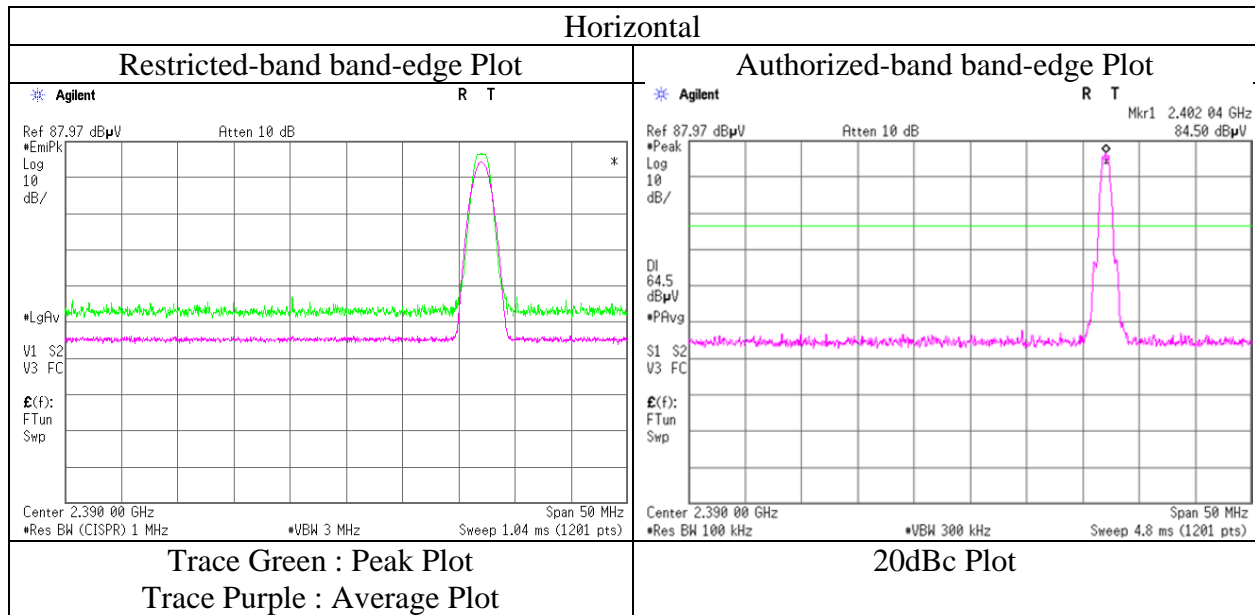
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission
(Reference Plot for band-edge)

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11640275S-A-R1
Date : May 15, 2017
Temperature / Humidity : 23 deg. C / 58 % RH
Engineer : Hiroyuki Morikawa
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.2 and 3 Semi Anechoic Chamber		
Test Place(AC No)	3AC	2AC	2AC
Report No.	11640275S-A-R1		
Date	June 15, 2017	May 15, 2017	May 18, 2017
Temperature / Humidity	22 deg. C / 53 % RH	23 deg. C / 58 % RH	24 deg. C / 52 % RH
Engineer	Yasumasa Owaki	Hiroyuki Morikawa	Hiroyuki Morikawa
	(30 MHz – 1 GHz)	(1 GHz – 13 GHz)	(13 – 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.	755.973	QP	34.84	20.13	10.57	31.64	0.00	33.90	46.00	12.1	119	249	
Hori.	827.969	QP	38.18	20.96	10.81	31.33	0.00	38.62	46.00	7.3	100	135	
Hori.	863.968	QP	38.03	21.45	10.93	31.14	0.00	39.27	46.00	6.7	100	139	
Hori.	4880.000	PK	43.45	31.29	6.59	37.03	2.45	46.75	73.90	27.2	150	0	
Hori.	7320.000	PK	44.73	36.63	7.87	37.88	2.45	53.80	73.90	20.1	150	0	
Vert.	47.679	QP	42.31	11.44	6.93	32.12	0.00	28.56	40.00	11.4	100	277	
Vert.	78.947	QP	32.25	6.20	7.65	32.10	0.00	14.00	40.00	26.0	100	58	
Vert.	93.525	QP	34.64	8.85	7.65	32.09	0.00	19.05	43.50	24.4	100	82	
Vert.	103.484	QP	36.01	10.48	7.47	32.08	0.00	21.88	43.50	21.6	100	126	
Vert.	931.157	QP	30.12	22.04	11.15	30.64	0.00	32.67	46.00	13.3	114	304	
Vert.	4880.000	PK	43.70	31.29	6.59	37.03	2.45	47.00	73.90	26.9	150	0	
Vert.	7320.000	PK	44.76	36.63	7.87	37.88	2.45	53.83	73.90	20.1	150	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 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	35.86	31.29	6.59	37.03	3.70	2.45	42.86	53.90	11.0	
Hori.	7320.000	AV	35.12	36.63	7.87	37.88	3.70	2.45	47.89	53.90	6.0	
Vert.	4880.000	AV	33.91	31.29	6.59	37.03	3.70	2.45	40.91	53.90	13.0	
Vert.	7320.000	AV	34.86	36.63	7.87	37.88	3.70	2.45	47.63	53.90	6.3	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 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.2 and 3 Semi Anechoic Chamber		
Test Place(AC No)	3AC	2AC	2AC
Report No.	11640275S-A-R1		
Date	June 15, 2017	May 15, 2017	May 18, 2017
Temperature / Humidity	22 deg. C / 53 % RH	23 deg. C / 58 % RH	24 deg. C / 52 % RH
Engineer	Yasumasa Owaki	Hiroyuki Morikawa	Hiroyuki Morikawa
	(30 MHz – 1 GHz)	(1 GHz – 13 GHz)	(13 – 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.	791.971	QP	29.53	20.49	10.68	31.49	0.00	29.21	46.00	16.7	115	243	
Hori.	827.972	QP	37.55	20.96	10.81	31.33	0.00	37.99	46.00	8.0	100	149	
Hori.	863.970	QP	37.27	21.45	10.93	31.14	0.00	38.51	46.00	7.4	100	129	
Hori.	931.164	QP	33.98	22.04	11.15	30.64	0.00	36.53	46.00	9.4	100	130	
Hori.	2483.500	PK	45.02	27.49	14.27	36.79	2.45	52.44	73.90	21.5	123	102	
Hori.	4960.000	PK	43.72	31.46	6.61	37.07	2.45	47.17	73.90	26.7	150	0	
Hori.	7440.000	PK	44.91	36.84	7.89	37.95	2.45	54.14	73.90	19.8	150	0	
Vert.	42.203	QP	34.14	13.41	6.86	32.12	0.00	22.29	40.00	17.7	100	205	
Vert.	47.406	QP	42.63	11.53	6.94	32.12	0.00	28.98	40.00	11.0	100	264	
Vert.	93.616	QP	36.58	8.86	7.65	32.09	0.00	21.00	43.50	22.5	100	350	
Vert.	937.504	QP	30.62	22.06	11.17	30.59	0.00	33.26	46.00	12.7	100	265	
Vert.	2483.500	PK	44.29	27.49	14.27	36.79	2.45	51.71	73.90	22.2	125	96	
Vert.	4960.000	PK	43.10	31.46	6.61	37.07	2.45	46.55	73.90	27.4	150	0	
Vert.	7440.000	PK	45.21	36.84	7.89	37.95	2.45	54.44	73.90	19.5	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 (3.98 m / 3.0 m) = 2.45 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	34.13	27.49	14.27	36.79	3.70	2.45	45.25	53.90	8.6	*1)
Hori.	4960.000	AV	33.86	31.46	6.61	37.07	3.70	2.45	41.01	53.90	12.9	
Hori.	7440.000	AV	35.00	36.84	7.89	37.95	3.70	2.45	47.93	53.90	6.0	
Vert.	2483.500	AV	34.41	27.49	14.27	36.79	3.70	2.45	45.53	53.90	8.4	*1)
Vert.	4960.000	AV	34.03	31.46	6.61	37.07	3.70	2.45	41.18	53.90	12.7	
Vert.	7440.000	AV	35.08	36.84	7.89	37.95	3.70	2.45	48.01	53.90	5.9	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.45 dB

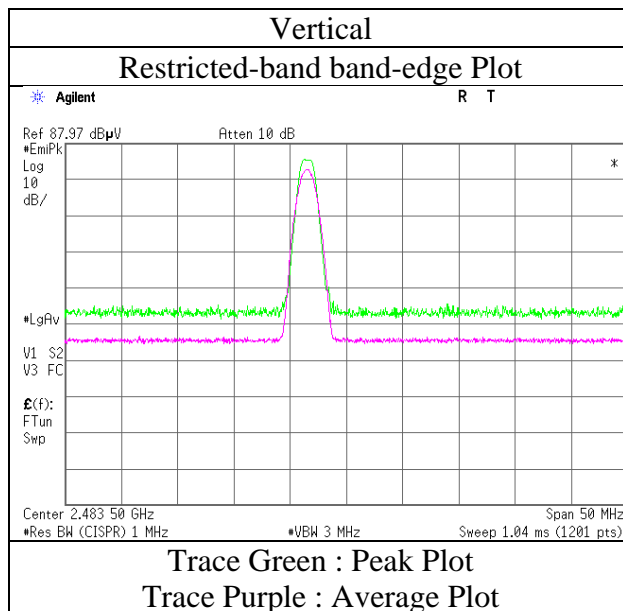
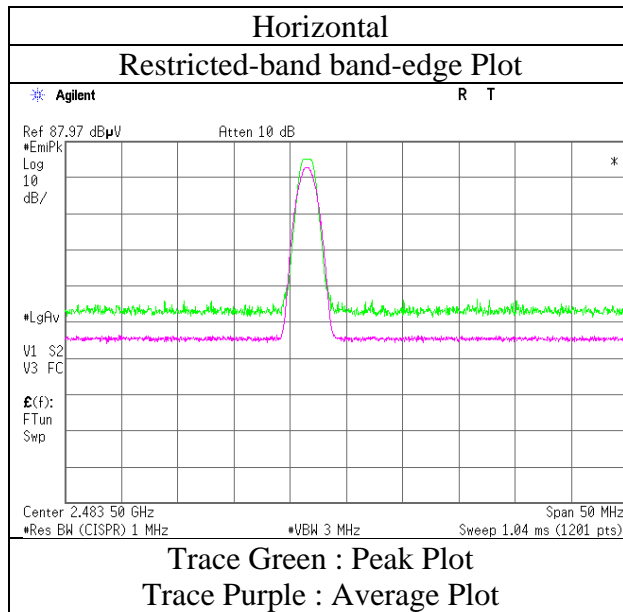
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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)

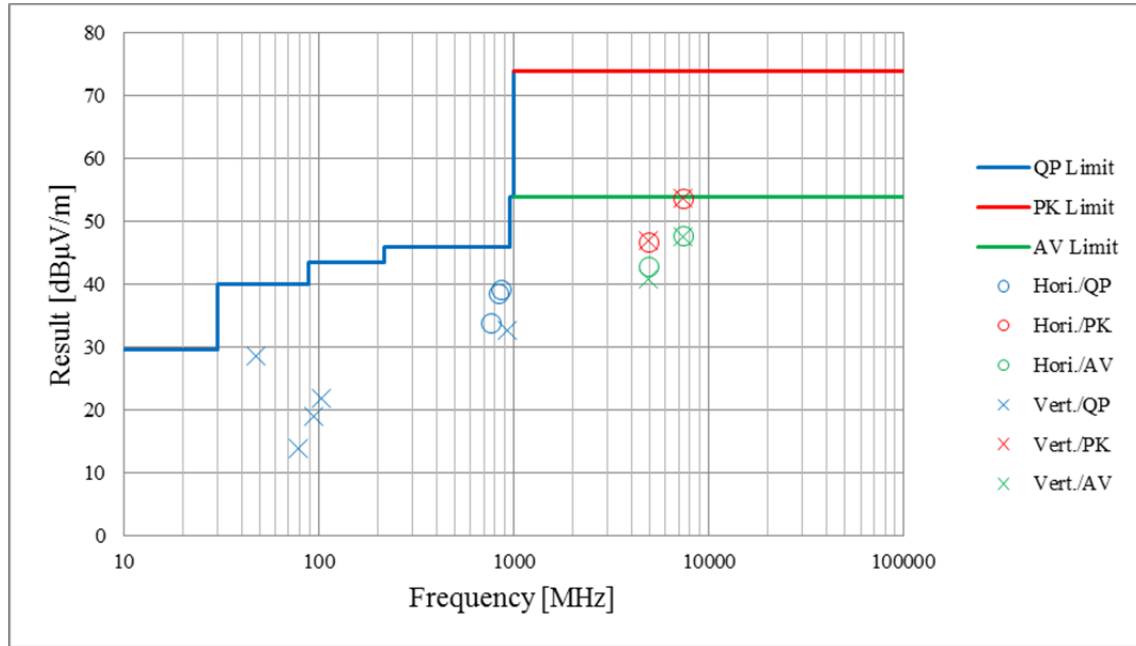
Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11640275S-A-R1
Date	May 15, 2017
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx BT LE 2480 MHz



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

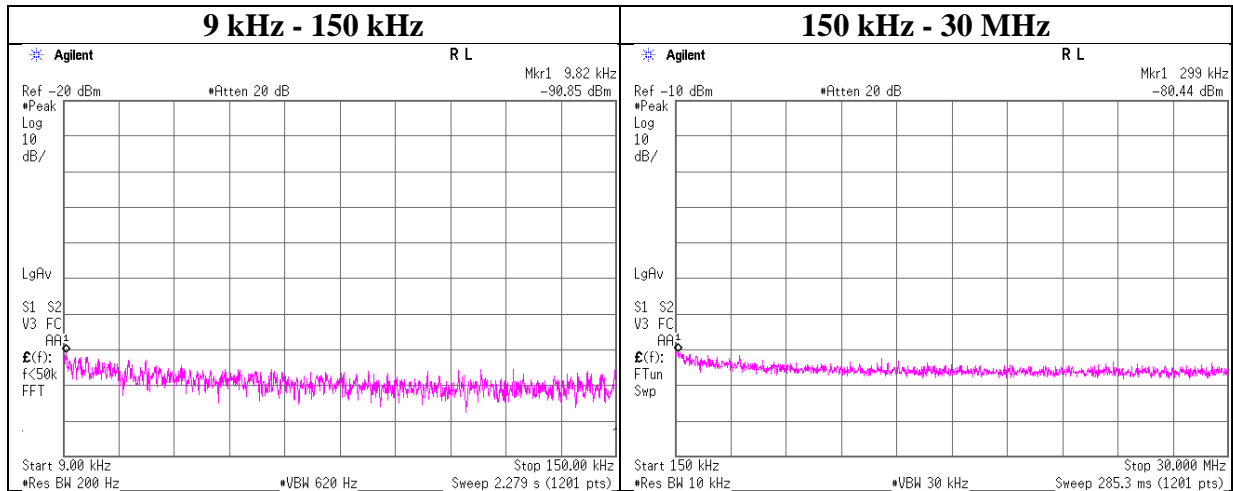
Radiated Spurious Emission
(Plot data, Worst case)

Test place	Shonan EMC Lab. No.2 and 3 Semi Anechoic Chamber		
Test Place(AC No)	3AC	2AC	2AC
Report No.	11640275S-A-R1		
Date	June 15, 2017	May 15, 2017	May 18, 2017
Temperature / Humidity	22 deg. C / 53 % RH	23 deg. C / 58 % RH	24 deg. C / 52 % RH
Engineer	Yasumasa Owaki (30 MHz – 1 GHz)	Hiroyuki Morikawa (1 GHz – 13 GHz)	Hiroyuki Morikawa (13 – 26.5 GHz)
Mode	Tx BT LE 2440 MHz		



Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11640275S-A-R1
Date	May 19, 2017
Temperature / Humidity	25 deg. C / 46 % RH
Engineer	Hikaru Shirasawa
Mode	Tx 11g 2462 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.82	-90.9	0.01	9.8	2.0	1	-79.0	300	6.0	-17.7	47.7	65.4	
299.00	-80.4	0.01	9.8	2.0	1	-68.6	300	6.0	-7.3	18.0	25.3	

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

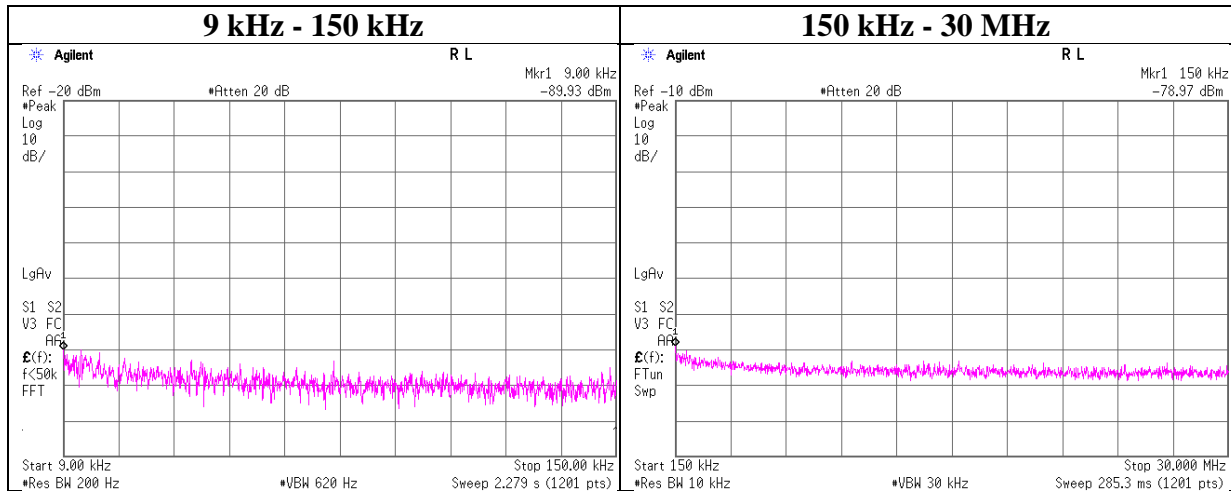
$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$$

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. : 11640275S-A-R1
Date : May 18, 2017
Temperature / Humidity : 25 deg. C / 52 % RH
Engineer : Hikaru Shirasawa
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
9.00	-89.9	0.01	9.8	2.0	1	-78.1	300	6.0	-16.8	48.5	65.3	
150.00	-79.0	0.01	9.8	2.0	1	-67.1	300	6.0	-5.9	24.0	29.9	

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

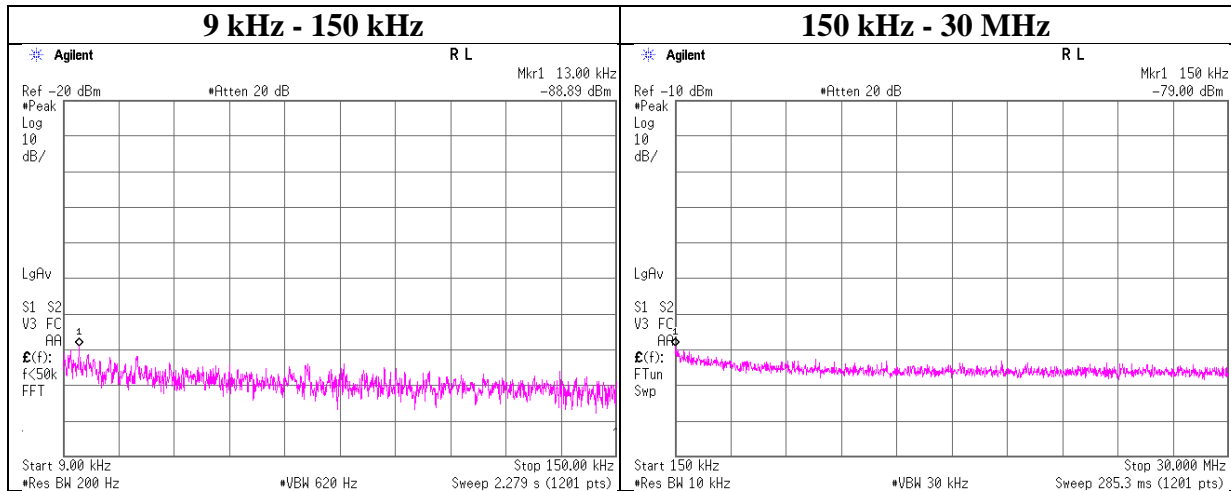
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

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.

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11640275S-A-R1
Date : May 18, 2017
Temperature / Humidity : 25 deg. C / 52 % RH
Engineer : Hikaru Shirasawa
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
13.00	-88.9	0.01	9.8	2.0	1	-77.0	300	6.0	-15.8	45.3	61.1	
150.00	-79.0	0.01	9.8	2.0	1	-67.1	300	6.0	-5.9	24.0	29.9	

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

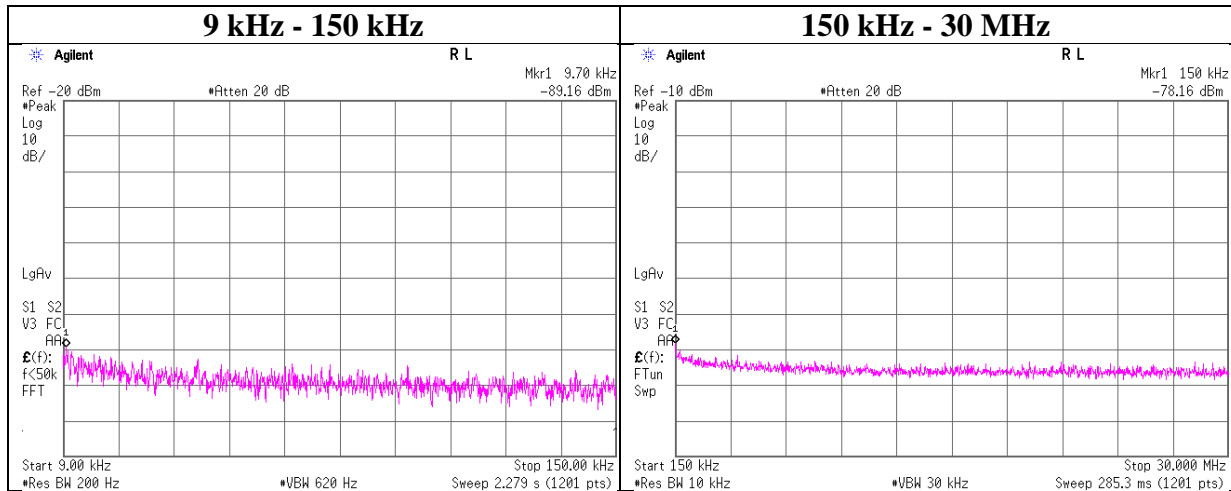
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

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.

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11640275S-A-R1
Date : May 18, 2017
Temperature / Humidity : 25 deg. C / 52 % RH
Engineer : Hikaru Shirasawa
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
9.70	-89.2	0.01	9.8	2.0	1	-77.3	300	6.0	-16.1	47.8	63.9	
150.00	-78.2	0.01	9.8	2.0	1	-66.3	300	6.0	-5.1	24.0	29.1	

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

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

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.

Power Density

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11640275S-A-R1
Date : May 19, 2017
Temperature / Humidity : 25 deg. C / 46 % RH
Engineer : Hikaru Shirasawa
Mode : Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-22.74	2.11	9.85	-10.78	8.00	18.78
2437.00	-22.22	2.11	9.85	-10.26	8.00	18.26
2462.00	-21.81	2.12	9.84	-9.85	8.00	17.85

11g

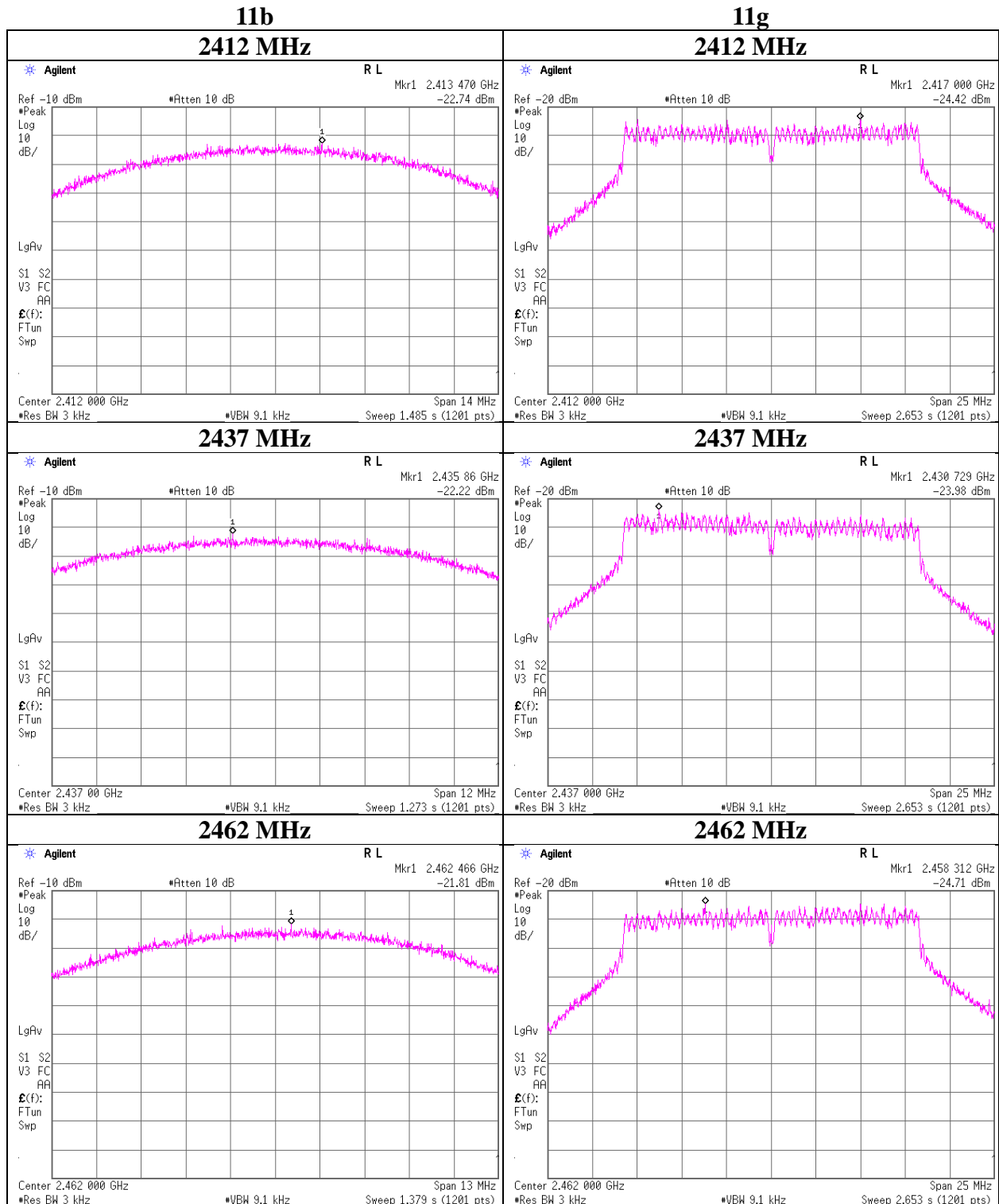
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-24.42	2.11	9.85	-12.46	8.00	20.46
2437.00	-23.98	2.11	9.85	-12.02	8.00	20.02
2462.00	-24.71	2.12	9.84	-12.75	8.00	20.75

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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Power Density

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11640275S-A-R1
Date May 19, 2017
Temperature / Humidity 25 deg. C / 46 % RH
Engineer Hikaru Shirasawa
Mode Tx

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-23.47	2.11	9.85	-11.51	8.00	19.51
2437.00	-24.28	2.11	9.85	-12.32	8.00	20.32
2462.00	-23.88	2.12	9.84	-11.92	8.00	19.92

Sample Calculation:

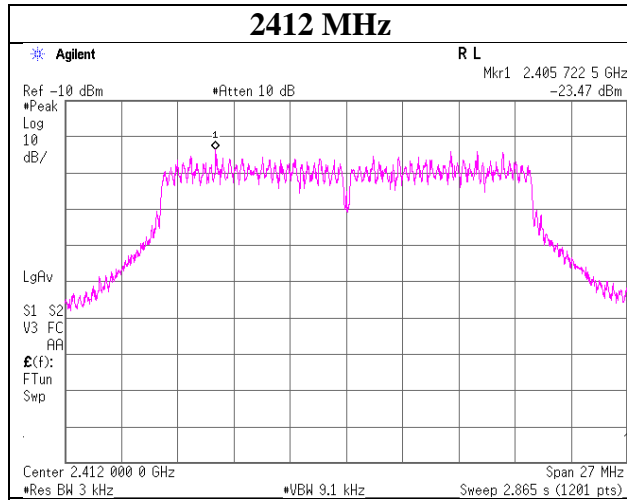
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

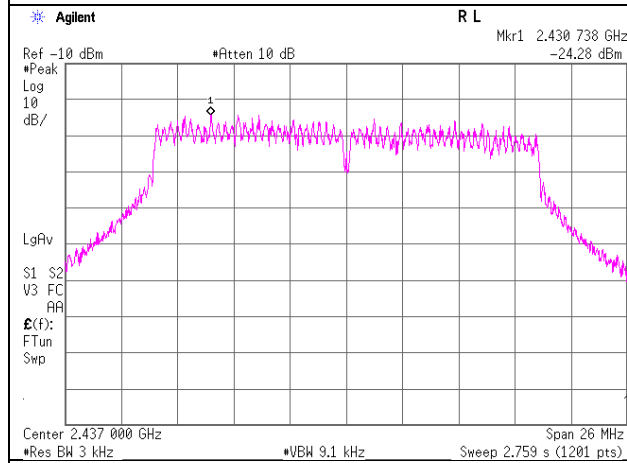
Power Density

11n-20

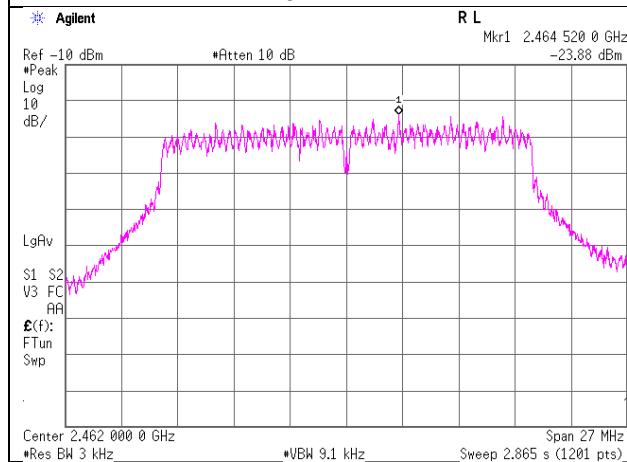
2412 MHz



2437 MHz



2462 MHz



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Power Density

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11640275S-A-R1
Date May 18, 2017
Temperature / Humidity 25 deg. C / 52 % RH
Engineer Hikaru Shirasawa
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-26.40	2.10	9.85	-14.45	8.00	22.45
2437.00	-26.28	2.11	9.84	-14.33	8.00	22.33
2462.00	-25.77	2.12	9.84	-13.81	8.00	21.81

Sample Calculation:

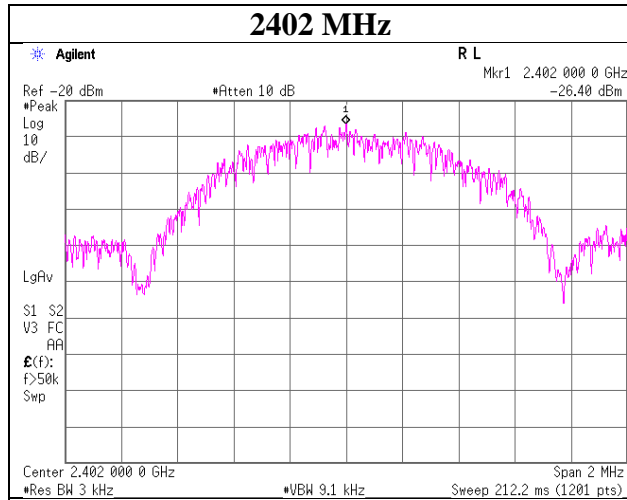
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

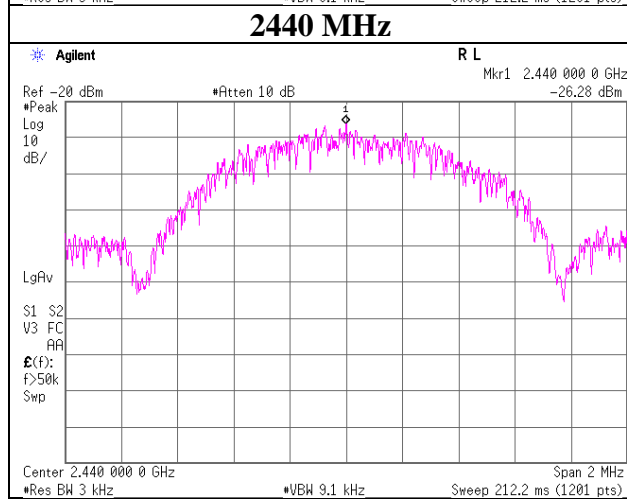
Power Density

BT LE

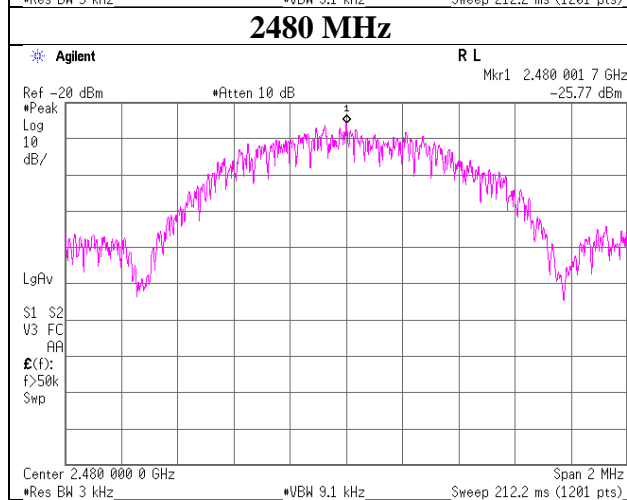
2402 MHz



2440 MHz

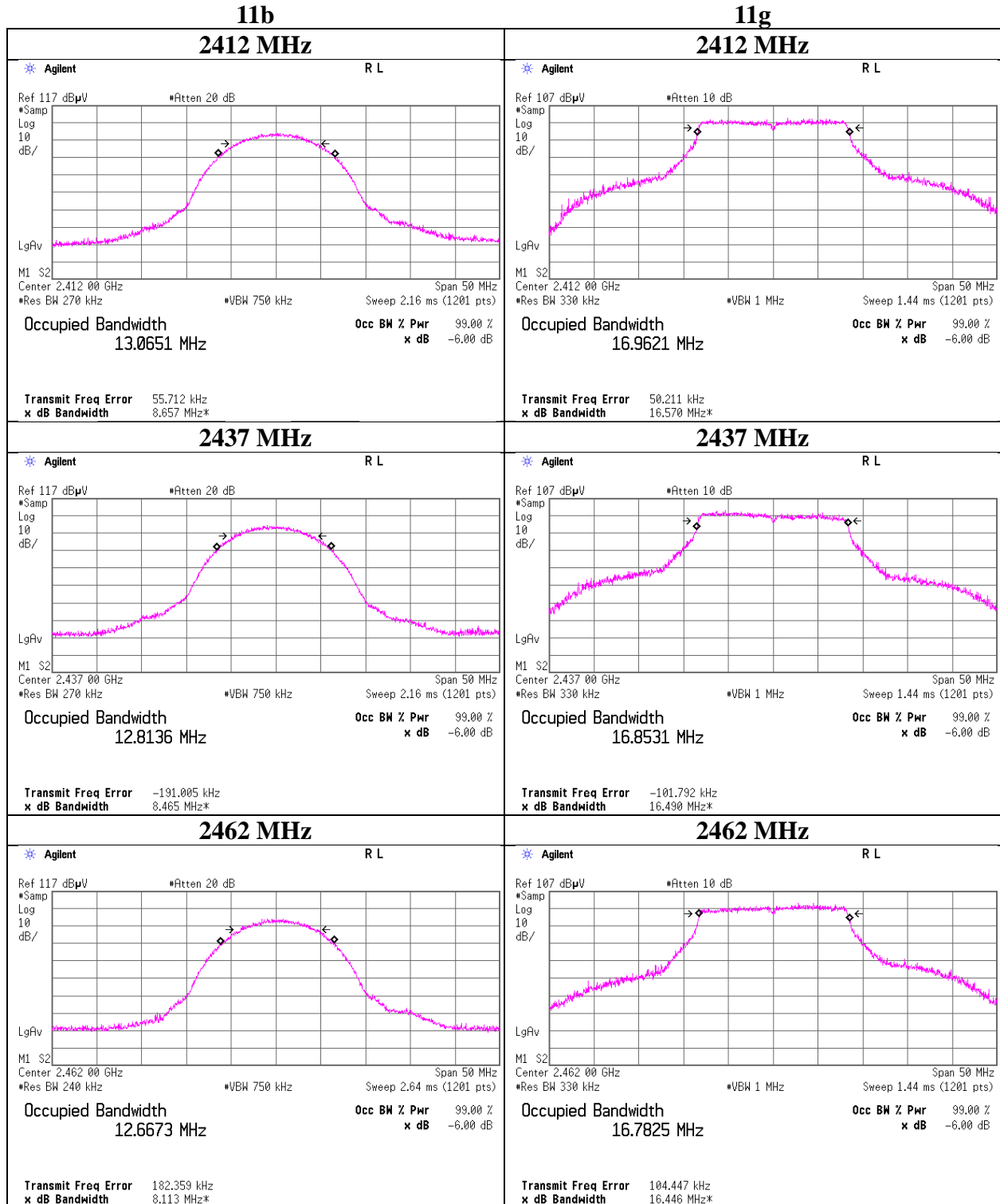


2480 MHz



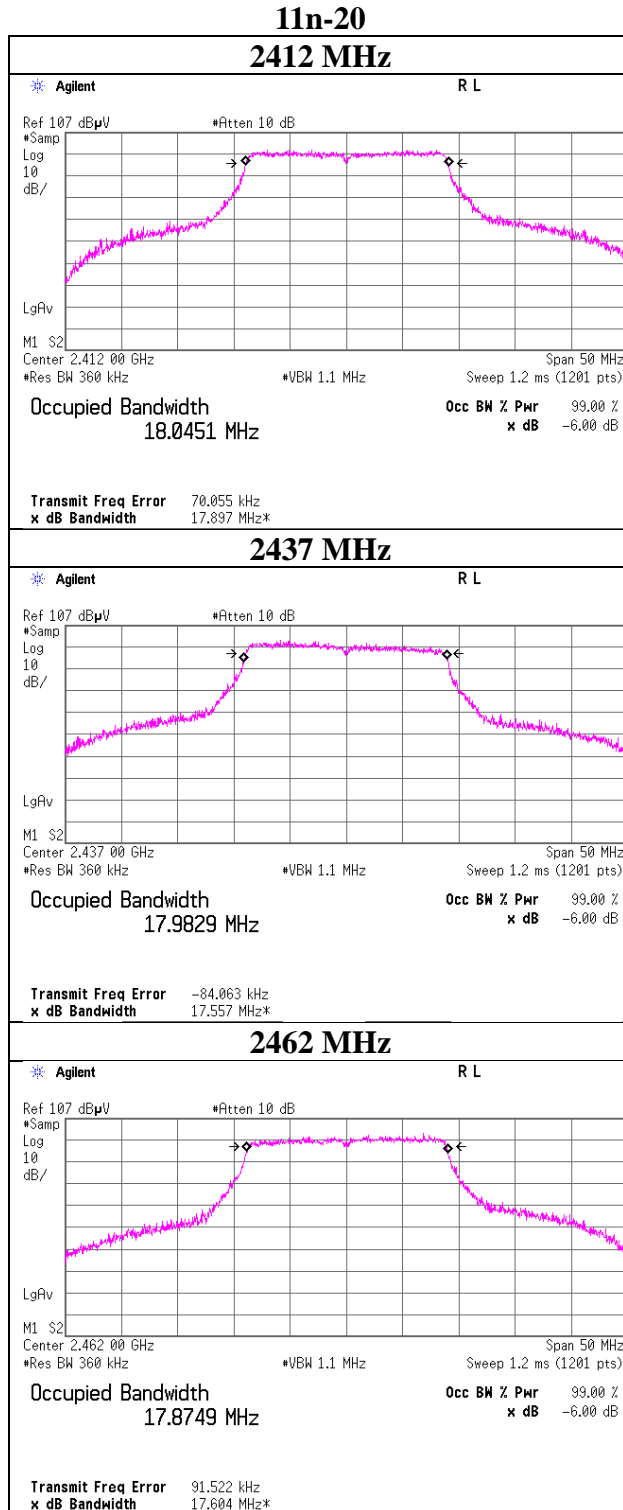
99%Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11640275S-A-R1
Date	May 19, 2017
Temperature / Humidity	25 deg. C / 46 % RH
Engineer	Hikaru Shirasawa
Mode	Tx



99% Occupied Bandwidth

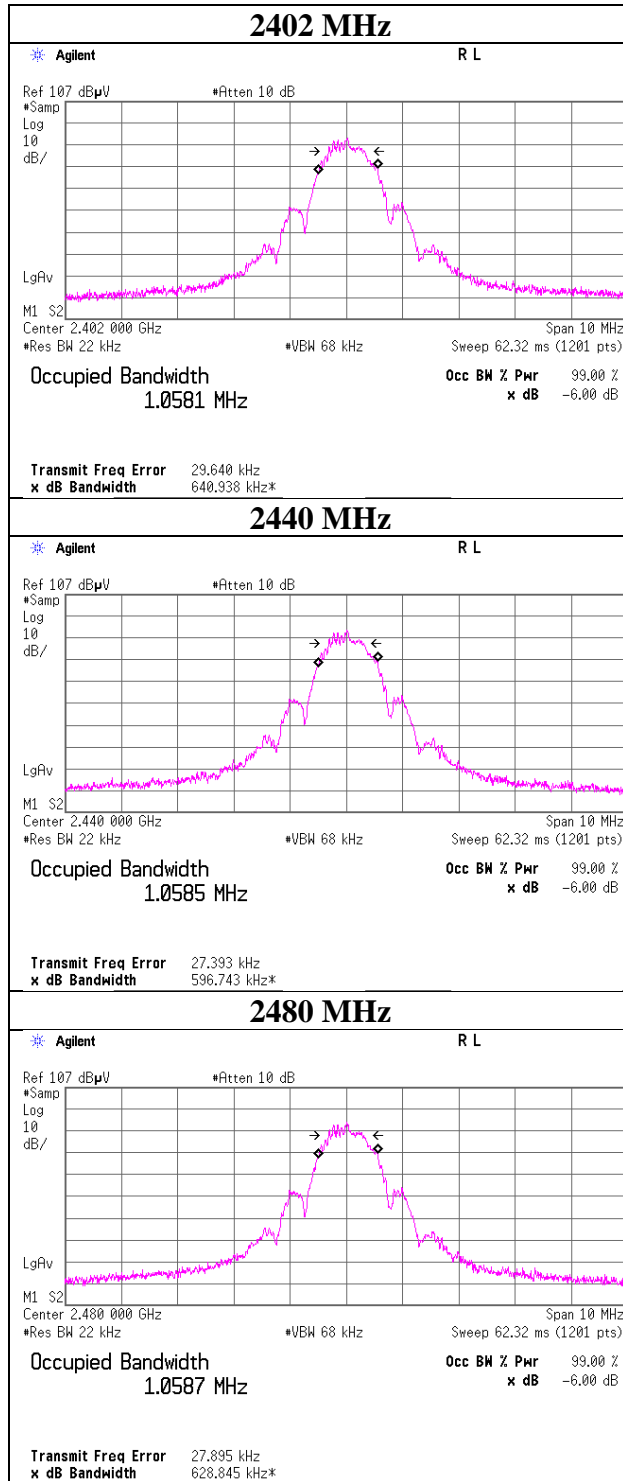
Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11640275S-A-R1
Date	May 19, 2017
Temperature / Humidity	25 deg. C / 46 % RH
Engineer	Hikaru Shirasawa
Mode	Tx



99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11640275S-A-R1
Date	May 19, 2017
Temperature / Humidity	25 deg. C / 46 % RH
Engineer	Hikaru Shirasawa
Mode	Tx BT LE

BT LE



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APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2017/02/17 * 12
SCC-G05	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	RE	2017/01/08 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE *1)	2016/05/11 * 12
SCC-G41	Coaxial Cable	Junkosha	MWX221-01000NF SNMS/B	1612S006	RE	2017/01/08 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2016/08/09 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2016/10/12 * 12
SRENT-08	Spectrum Analyzer	Agilent	E4448A	MY50180019	RE	2016/10/24 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE,CE	-
SAEC-02(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-02(SVSWR)	2	RE	2016/07/22 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFI,MF)	-	RE,CE	-
STS-02	Digital Hitester	Hioki	3805-50	080997819	RE,CE	2017/03/08 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2017/04/20 * 12
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2016/11/07 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2016/11/07 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2017/03/15 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2016/09/27 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000K MSKMS	-	RE	2017/04/20 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2017/03/23 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2017/02/09 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2017/02/09 * 12
KAT3-10	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2016/07/26 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2016/11/23 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2017/04/07 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2017/04/07 * 12
SLA-06	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	RE	2017/01/05 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE	2017/04/12 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2016/07/13 * 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	2016/10/18 * 12
SLA-07	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	RE	2017/01/26 * 12
SAT6-08	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2016/08/04 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271 (RF Selector)	RE	2017/04/07 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2017/02/09 * 12
STR-08	Test Receiver	Rohde & Schwarz	ESW44	101581	RE	2016/11/08 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2016/10/12 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2016/10/17 * 12

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SCC-B12/B13/S RSE-02	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS 4906	-/0901-270(RF Selector)	CE	2017/04/07 * 12
SLS-03	LISN	Rohde & Schwarz	ENV216	100513	CE	2017/02/27 * 12
SAT3-06	Attenuator	JFW	50HF-003N	-	CE	2017/02/09 * 12
SOS-04	Humidity Indicator	A&D	AD-5681	4061512	CE	2016/12/13 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	CE	2016/09/28 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2016/09/26 * 12
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2017/03/23 * 12
SAT10-12	Attenuator	Weinschel Corp.	54A-10	81601	AT	2017/03/23 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2017/04/25 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2017/04/25 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2016/12/13 * 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**