



RADIO TEST REPORT

Test Report No. : 11085508M-A-R1

Applicant : PIONEER CORPORATION
Type of Equipment : Car Audio with Bluetooth / WLAN
Model No. : PVH-5248
FCC ID : AJDK095
Test regulation : FCC Part 15 Subpart C: 2015 (WLAN)
Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
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 11085508M-A. 11085508M-A is replaced with this report.

Date of test: January 5-7, 11-14, 2016

Representative test engineer:

Kazuhiro Ando
Engineer
Consumer Technology Division

Approved by:

Masanori Nishiyama
Manager
Consumer Technology Division



CERTIFICATE 1266.01

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

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

REVISION HISTORY

Original Test Report No.: 11085508M-A

[illegible]

CONTENTS	PAGE
SECTION 1: Customer information.....	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results.....	5
SECTION 4: Operation of E.U.T. during testing.....	8
SECTION 5: Radiated Spurious Emission	12
SECTION 6: Antenna Terminal Conducted Tests.....	14
APPENDIX 1: Test data	15
6dB Bandwidth	15
Maximum Peak Output Power	18
Average Output Power	22
Radiated Spurious Emission	25
Conducted Spurious Emission	36
Power Density	37
99%Occupied Bandwidth	40
APPENDIX 2: Test instruments	42
APPENDIX 3: Photographs of test setup	43
Radiated Spurious Emission	43
Worst Case Position (Angle : 30 deg.).....	45

SECTION 1: Customer information

Company Name	: PIONEER CORPORATION
Address	: 25-1 Aza-Nishimachi, Yamada, Kawagoe-shi, Saitama, 350-8555, Japan
Telephone Number	: +81-49-228-6415
Facsimile Number	: +81-49-228-6493
Contact Person	: Tomoyuki Tanaka

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

2.1 Identification of E.U.T.

Type of Equipment	: Car Audio with Bluetooth / WLAN
Model No.	: PVH-5248
Serial No.	: Refer to Section 4, Clause 4.2
Rating	: DC 13.2 V
Receipt Date of Sample	: December 25, 2015
Country of Mass-production	: Thailand
Condition of EUT	: Engineering prototype (Not for sale: This sample is not mass-produced items.)
Modification of EUT	: No Modification by the test lab

2.2 Product Description

Model: PVH-5248 (referred to as the EUT in this report) is a Car Audio with Bluetooth / WLAN.

General Specification

Clock frequency(ies) in the system	: CPU: 26 MHz
------------------------------------	---------------

Radio specification

<Bluetooth part>

Equipment type	: Transceiver
Frequency of operation	: 2402-2480MHz
Bandwidth & channel spacing	: 79MHz & 1MHz
Type of modulation	: GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna type	: Pattern inverted F type
Antenna gain	: -2.51dBi
Operation temperature range	: -20 to +65 deg.C.

<WLAN part>

Equipment type	: Transceiver
Frequency of operation	: 2412-2462MHz
Bandwidth & channel spacing	: 5MHz
Type of modulation	: DSSS, OFDM
Antenna type	: Pattern inverted F type
Antenna gain	: -2.78dBi
Antenna connector type	: U.FL-LP-066
Operation temperature range	: -20 to +65 deg.C.

*This test report applies for WLAN part.

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on November 23, 2015
 *Some parts are effective on and after December 17, 2015 or December 23, 2015. The revision does not affect the test specification applied to the EUT.

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	N/A	N/A *1)	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r04 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	1.9 dB 4824.000 MHz, AV, Vertical.	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

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

*1) The test is not applicable since the EUT has no AC mains.

*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r04 12.2.7.

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

FCC Part 15.31 (e)

The EUT provides stable voltage (DC 3.3 V) constantly to the wireless transmitter regardless of input voltage. Instead of a new battery, DC power supply was used for the test. That does not affect the test result. 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 of Section 15.203.

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

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 $k = 2$.
Kashima EMC Lab.

Item	Frequency range	Uncertainty (+/-)
		No. 1 SAC / SR
Radiated emission (Measurement distance: 3m)	30MHz - 300MHz	4.7dB
	300MHz - 1GHz	3.6dB
	1GHz - 13GHz	5.1dB
Radiated emission (Measurement distance: 1m)	13GHz - 18GHz	5.7dB
	18GHz - 26.5GHz	5.1dB

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1GHz	0.7dB
Spurious emission (Conducted) below 1GHz	1.6dB
Spurious emission (Conducted) 1GHz - 3GHz	1.4dB
Spurious emission (Conducted) 3GHz - 18GHz	2.8dB
Spurious emission (Conducted) 18GHz - 26.5GHz	2.5dB
Bandwidth Measurement	5.4%

Radiated emission test

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

3.5 Test Location

UL Japan, Inc. Kashima EMC Lab.
 1614 Mushihata, Katori-shi, Chiba-ken, 289-0341 JAPAN
 Telephone: +81 478 88 6500, Facsimile: +81 478 82 3373
 A2LA Accreditation No. 1266.01

Test site	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Open site	90558	4659A-1	6.0 x 5.5 x 2.5	20 x 40	10 m
No.2 Open site	510504	4659A-2	4.4 x 4.4 x 2.15	18 x 20	10 m
No.5 Open site	99356	4659A-5	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	90558	4659A-1	5.4 x 4.5 x 2.3	-	-
No.2 Shielded room	510504	4659A-2	3.6 x 2.7 x 2.3	-	-
No.3 Shielded room	-	-	5.4 x 3.6 x 2.3	-	-
No.4 Shielded Room	-	-	6.1 x 6.1 x 3.1	-	-
No.5 Shielded Room	99356	4659A-5	4.2 x 3.1 x 2.5	-	-
No.3 Fully Anechoic Chamber	-	-	7.0 x 3.5 x 3.5	-	-
No.6 Semi-anechoic Chamber	372431	4659A-6	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	682397	4659A-10	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	718605	4659A-7	9.0 x 6.5 x 5.2	-	3 m
No.1 Measurement room	-	-	5.0 x 3.7 x 2.6	-	-
No.2 Measurement room	-	-	4.3 x 4.4 x 2.7	-	-
No.3 Measurement room	-	-	4.3 x 4.4 x 2.7	-	-

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)	5.5 Mbps, PN9
IEEE 802.11g (11g)	6 Mbps, PN9
IEEE 802.11n GI=400ns (11n (GI=400ns))	MCS 0 , PN9
IEEE 802.11n GI=800ns (11n (GI=800ns))	MCS 0 , PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
Power setting : Fixed Firmware version: 1.001410 *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
Spurious Emission	11b Tx	2412 MHz
	11n (GI=800ns) Tx	2437 MHz
		2462 MHz
6dB Bandwidth	11b Tx	2412 MHz
Maximum Peak Output Power	11g Tx	2437 MHz
Power Density	11n (GI=400ns) Tx	2462 MHz
99% Occupied Bandwidth	11n (GI=800ns) Tx	

UL Japan, Inc.

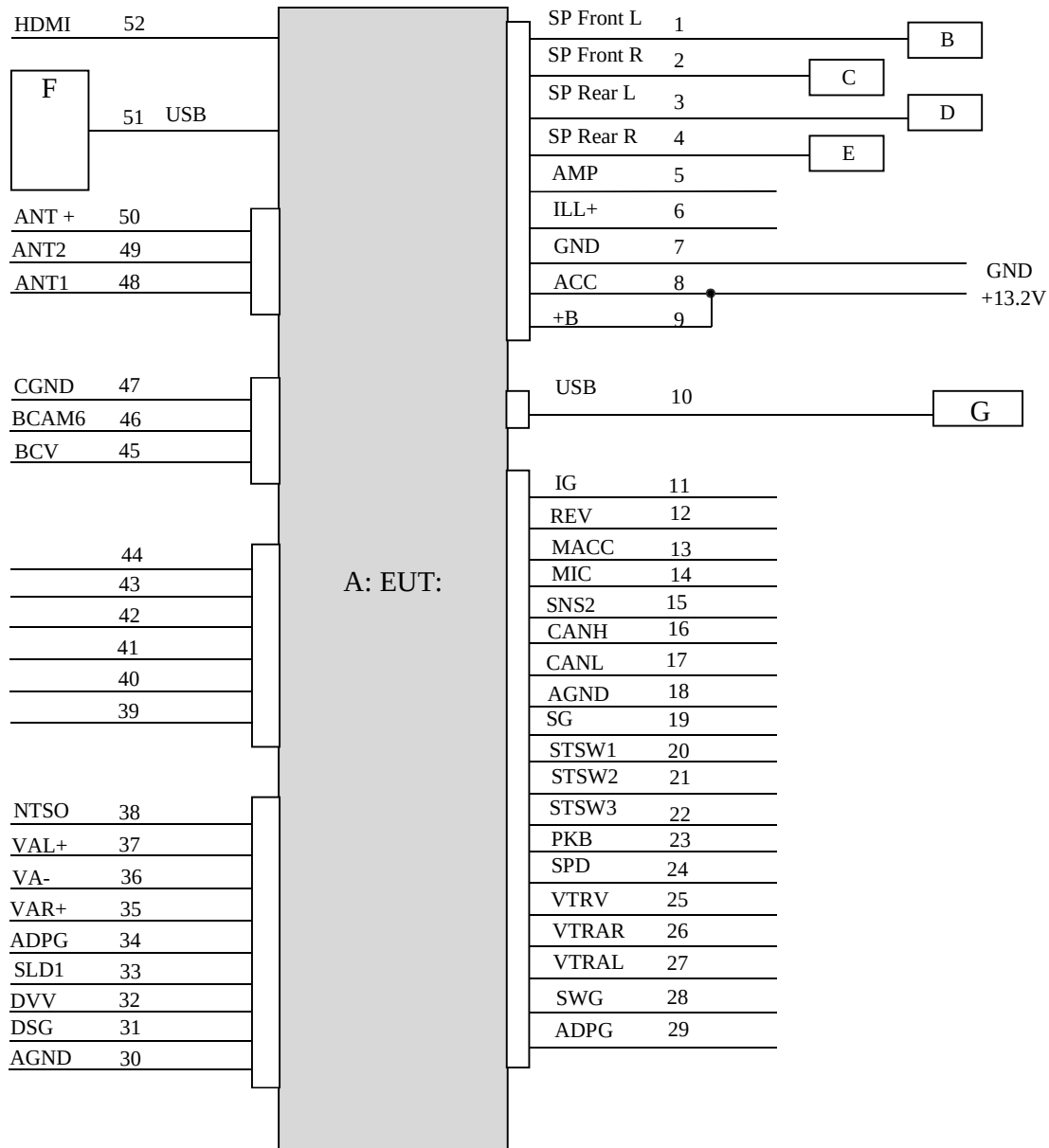
Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

4.2 Configuration and peripherals



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

* The testing was performed with DC 13.2 V only.

The voltage which the car battery mounted in the car outputs was selected as a test voltage according to the customer's request.

As the stable voltage (DC3.3V) is provided to RF module via the internal regulator, it does not influence on the test result.

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Car Audio with Bluetooth/WLAN	PVH-5248	OETM000220ID *1) OETM000431ID *2)	PIONEER	EUT
B	Speaker	KFC-RS101	-	KENWOOD	-
C	Speaker	KFC-RS101	-	KENWOOD	-
D	Speaker	KFC-RS101	-	KENWOOD	-
E	Speaker	KFC-RS101	-	KENWOOD	-
F	iPod nano	A1446	DCYMM6W5F0GT	Apple	-
G	USB memory	BUF-C128M/U2	B4111613725	BUFFALO	-

*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	SP Front L	0.5 + 1.0	Unshielded	Unshielded	10 P + 6 P connector
2	SP Front R	0.5 + 1.0	Unshielded	Unshielded	10 P + 6 P connector
3	SP Rear L	0.5 + 1.0	Unshielded	Unshielded	10 P + 6 P connector
4	SP Rear R	0.5 + 1.0	Unshielded	Unshielded	10 P + 6 P connector
5	AMP	0.5	Unshielded	Unshielded	10 P + 6 P connector
6	ILL +	0.5	Unshielded	Unshielded	10 P + 6 P connector
7	GND	0.5 + 2.0	Unshielded	Unshielded	10 P + 6 P connector
8	ACC	0.5 + 2.0	Unshielded	Unshielded	10 P + 6 P connector
9	+B	0.5	Unshielded	Unshielded	10 P + 6 P connector
10	USB	1.0	Shielded	Shielded	-
11	IG	0.5	Unshielded	Unshielded	28 P connector
12	REV	0.5	Unshielded	Unshielded	28 P connector
13	MACC	0.5	Unshielded	Unshielded	28 P connector
14	MIC	0.5	Unshielded	Unshielded	28 P connector
15	SNS2	0.5	Unshielded	Unshielded	28 P connector
16	CANH	0.5	Unshielded	Unshielded	28 P connector
17	CANL	0.5	Unshielded	Unshielded	28 P connector
18	AGND	0.5	Unshielded	Unshielded	28 P connector
19	SG	0.5	Unshielded	Unshielded	28 P connector
20	STSW1	0.5	Unshielded	Unshielded	28 P connector
21	STSW2	0.5	Unshielded	Unshielded	28 P connector
22	STSW3	0.5	Unshielded	Unshielded	28 P connector
23	PKB	0.5	Unshielded	Unshielded	28 P connector
24	SPD	0.5	Unshielded	Unshielded	28 P connector
25	VTRV	0.5	Unshielded	Shielded	28 P connector
26	VTRAR	0.5	Unshielded	Shielded	28 P connector
27	VTRAL	0.5	Unshielded	Shielded	28 P connector
28	SWG	0.5	Unshielded	Unshielded	28 P connector
29	ADPG	0.5	Unshielded	Unshielded	28 P connector

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
30	AGND	0.5	Unshielded	Unshielded	12 P connector
31	DSG	0.5	Unshielded	Unshielded	12 P connector
32	DVV	0.5	Unshielded	Unshielded	12 P connector
33	SLD1	0.5	Unshielded	Unshielded	12 P connector
34	ADPG	0.5	Unshielded	Unshielded	12 P connector
35	VAR+	0.5	Unshielded	Unshielded	12 P connector
36	VA-	0.5	Unshielded	Unshielded	12 P connector
37	VAL+	0.5	Unshielded	Unshielded	12 P connector
38	NTSO	0.5	Unshielded	Unshielded	12 P connector
39	IG	0.35	Unshielded	Unshielded	6 P connector
40	SS-IN	0.35	Unshielded	Unshielded	6 P connector
41	SS+IN	0.35	Unshielded	Unshielded	6 P connector
42	TRIG	0.35	Unshielded	Unshielded	6 P connector
43	SS-OUT	0.35	Unshielded	Unshielded	6 P connector
44	SS+OUT	0.35	Unshielded	Unshielded	6 P connector
45	BCV	0.5	Unshielded	Unshielded	24 P connector
46	BCAM6	0.5	Unshielded	Unshielded	24 P connector
47	CGND	0.5	Unshielded	Unshielded	24 P connector
48	ANT 1	0.2	Shielded	Shielded	-
49	ANT 2	0.2	Shielded	Shielded	-
50	ANT+	0.2	Unshielded	Unshielded	-
51	USB	1.0	Shielded	Shielded	-
52	HDMI	2.0	Shielded	Shielded	-

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r04".

[For below 1GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1GHz]

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

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

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

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	Below 1 GHz	Above 1 GHz
Antenna Type	Hybrid	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 *3)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: <u>12.2.5.1</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces	RBW: 100 kHz VBW: 300kHz
Test Distance	3m	3.8 m *1) (below 10 GHz), 1 m *2) (above 10 GHz)		3.8 m *1) (below 10 GHz), 1 m *2) (above 10 GHz)

*1) Distance Factor: $20 \times \log (3.8 \text{ m} / 3.0 \text{ m}) = 2.1 \text{ dB}$

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

*3) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r04"

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

The carrier level and noise levels were confirmed at angle of 0 to 30 deg. based on the product specification to see the position of maximum noise, and the test was made at the position (30 deg.) that has the maximum noise.

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

Measurement range	: 30 M - 26 GHz
Test data	: APPENDIX
Test result	: Pass

SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
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 v03r04".							
*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

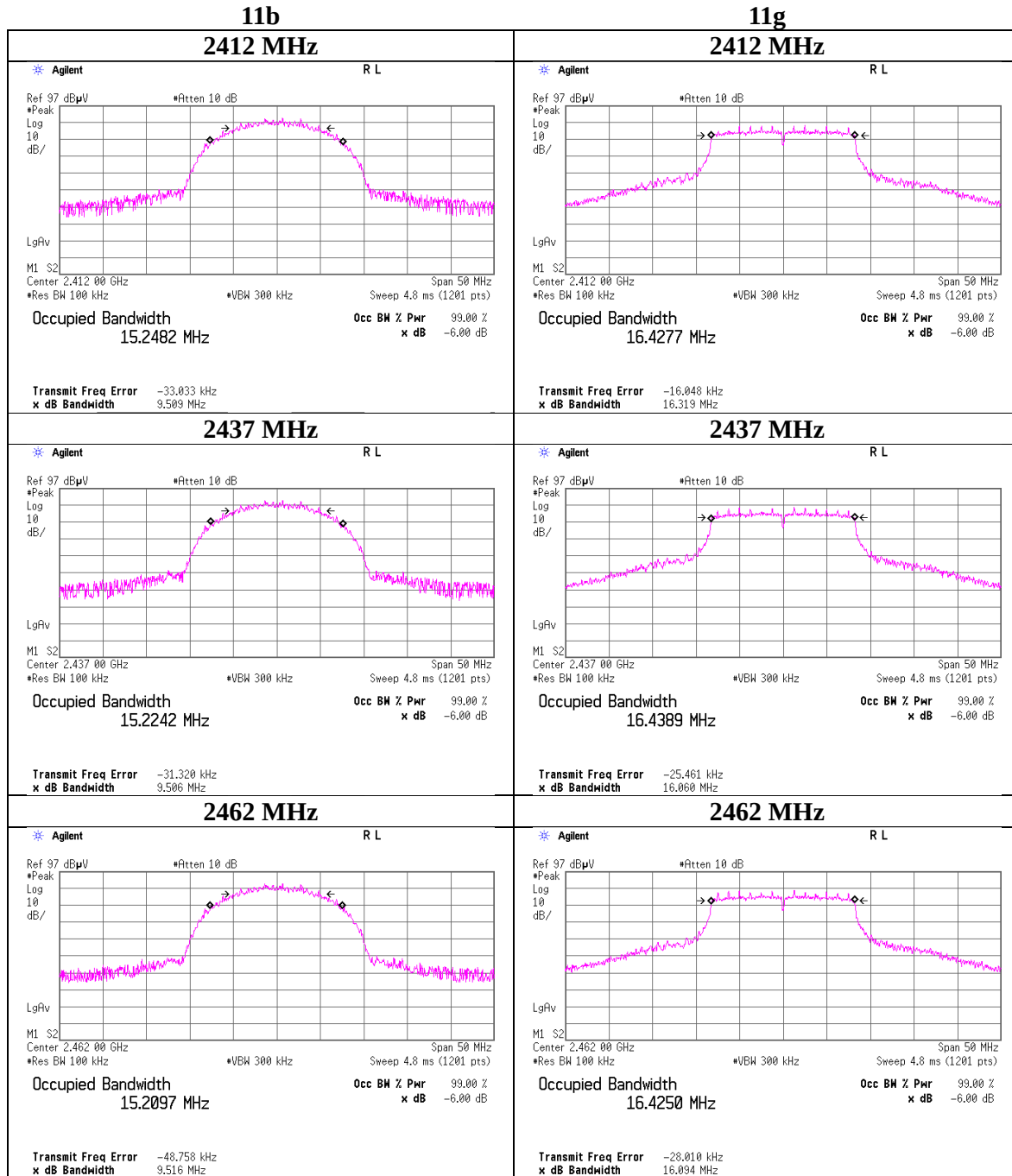
APPENDIX 1: Test data

6dB Bandwidth

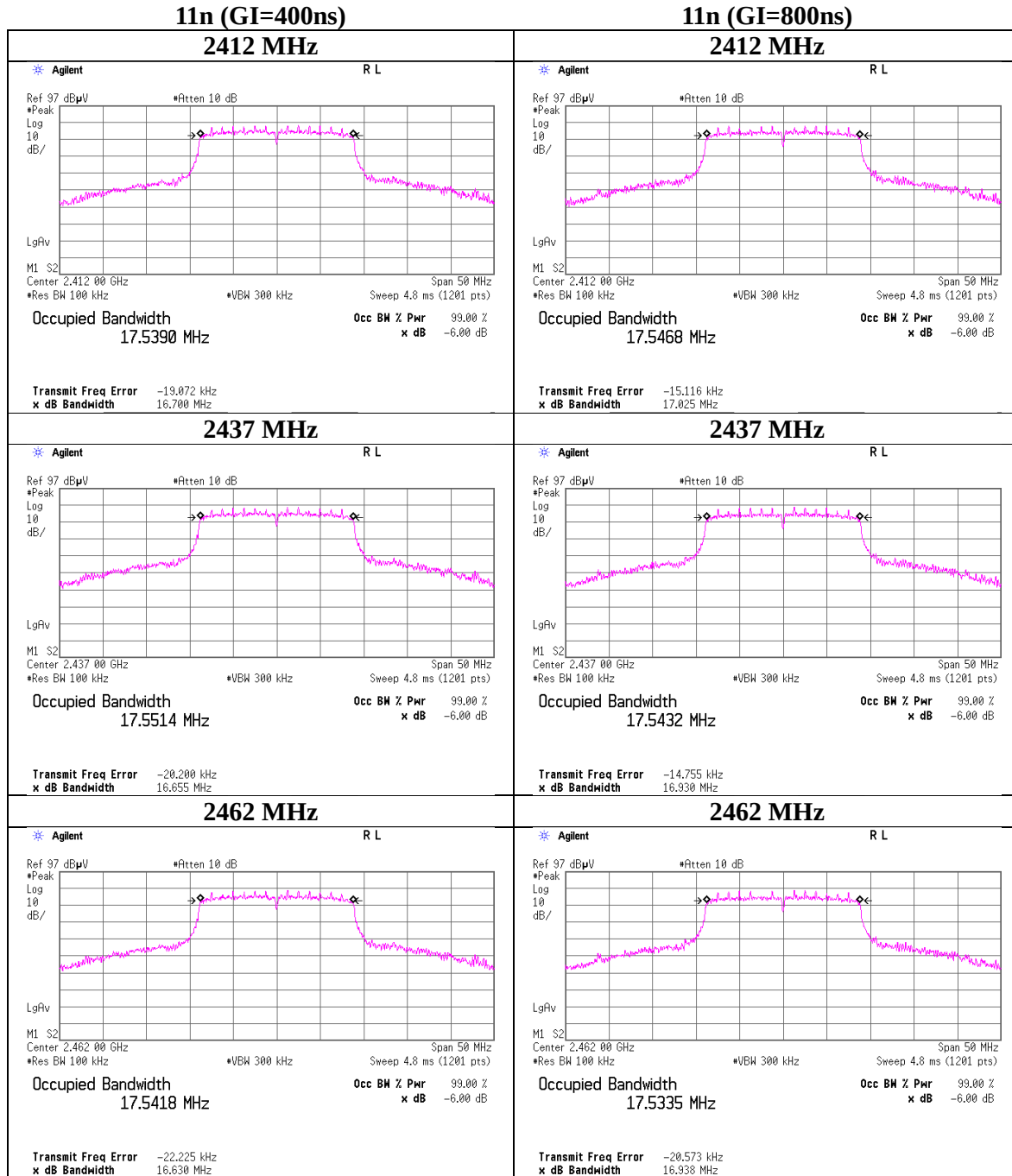
Test place Kashima EMC Lab. No.2 Measurement Room
Report No. 11085508M
Date January 7, 2016
Temperature / Humidity 22 deg. C / 38 % RH
Engineer Kazuhiro Ando
Mode Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	9.509	> 500
	2437	9.506	> 500
	2462	9.516	> 500
11g	2412	16.319	> 500
	2437	16.060	> 500
	2462	16.094	> 500
11n (GI=400ns)	2412	16.700	> 500
	2437	16.655	> 500
	2462	16.630	> 500
11n (GI=800ns)	2412	17.025	> 500
	2437	16.930	> 500
	2462	16.938	> 500

6dB Bandwidth



6dB Bandwidth



Maximum Peak Output Power

Test place Kashima EMC Lab. No.2 Measurement Room
Report No. 11085508M
Date January 5, 2016
Temperature / Humidity 22 deg. C / 42 % RH
Engineer Kazuhiro Ando
Mode Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-6.53	1.72	20.28	15.47	35.24	30.00	1000	14.53
2437	-6.20	1.73	20.28	15.81	38.11	30.00	1000	14.19
2462	-6.18	1.73	20.28	15.83	38.28	30.00	1000	14.17

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	Reading	Remark
[Mbps]	[dBm]	
1	-6.30	
2	-6.35	
5.5	-6.20	*
11	-6.23	

*: Worst Rate

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

Maximum Peak Output Power

Test place Kashima EMC Lab. No.2 Measurement Room
Report No. 11085508M
Date January 5, 2016
Temperature / Humidity 22 deg. C / 42 % RH
Engineer Kazuhiro Ando
Mode Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-2.83	1.72	20.28	19.17	82.60	30.00	1000	10.83
2437	-2.80	1.73	20.28	19.21	83.37	30.00	1000	10.79
2462	-2.68	1.73	20.28	19.33	85.70	30.00	1000	10.67

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	-2.80	*
9	-2.91	
12	-2.83	
18	-2.89	
24	-2.83	
36	-2.87	
48	-2.83	
54	-2.81	

*: Worst Rate

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

Maximum Peak Output Power

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11085508M
Date : January 5, 2016
Temperature / Humidity : 22 deg. C / 42 % RH
Engineer : Kazuhiro Ando
Mode : Tx 11n (GI=400ns)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-2.80	1.72	20.28	19.20	83.18	30.00	1000	10.80
2437	-2.78	1.73	20.28	19.23	83.75	30.00	1000	10.77
2462	-2.72	1.73	20.28	19.29	84.92	30.00	1000	10.71

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

MCS Number	Reading [dBm]	Remark
0	-2.78	*
1	-2.84	
2	-2.79	
3	-2.84	
4	-2.85	
5	-3.00	
6	-2.83	
7	-3.01	

*: Worst Rate

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

Maximum Peak Output Power

Test place Kashima EMC Lab. No.2 Measurement Room
Report No. 11085508M
Date January 5, 2016
Temperature / Humidity 22 deg. C / 42 % RH
Engineer Kazuhiro Ando
Mode Tx 11n (GI=800ns)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-2.82	1.72	20.28	19.18	82.79	30.00	1000	10.82
2437	-2.72	1.73	20.28	19.29	84.92	30.00	1000	10.71
2462	-2.66	1.73	20.28	19.35	86.10	30.00	1000	10.65

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

MCS Number	Reading [dBm]	Remark
0	-2.72	*
1	-2.87	
2	-2.75	
3	-2.86	
4	-2.93	
5	-3.12	
6	-2.85	
7	-3.12	

*: Worst Rate

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

Average Output Power
(Reference data for RF Exposure)

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11085508M
Date : January 5, 2016
Temperature / Humidity : 22 deg. C / 42 % RH
Engineer : Kazuhiro Ando
Mode : Tx

11b 5.5 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-8.85	1.72	20.28	13.15	20.65	0.03	13.18	20.80
2437	-8.55	1.73	20.28	13.46	22.18	0.03	13.49	22.34
2462	-8.53	1.73	20.28	13.48	22.28	0.03	13.51	22.44

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-10.69	1.72	20.28	11.31	13.52	0.04	11.35	13.65
2437	-10.59	1.73	20.28	11.42	13.87	0.04	11.46	14.00
2462	-10.35	1.73	20.28	11.66	14.66	0.04	11.70	14.79

11n (GI=400ns) MCS 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-10.69	1.72	20.28	11.31	13.52	0.05	11.36	13.68
2437	-10.63	1.73	20.28	11.38	13.74	0.05	11.43	13.90
2462	-10.53	1.73	20.28	11.48	14.06	0.05	11.53	14.22

11n (GI=800ns) MCS 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-10.90	1.72	20.28	11.10	12.88	0.04	11.14	13.00
2437	-10.56	1.73	20.28	11.45	13.96	0.04	11.49	14.09
2462	-10.52	1.73	20.28	11.49	14.09	0.04	11.53	14.22

Sample Calculation:

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

Result (Burst power) = Frame power + Duty factor

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

The test was performed with condition that obtained the maximum frame power in pre-check.

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Average Output Power
(Reference data for RF Exposure)

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11085508M
Date : January 5, 2016
Temperature / Humidity : 22 deg. C / 42 % RH
Engineer : Kazuhiro Ando
Mode : Tx

2437 MHz

Mode	Rate Mbps	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11b	1	-8.63	0.00	-8.63	
	2	-8.67	0.01	-8.66	
	5.5	-8.55	0.03	-8.52	*
	11	-8.58	0.05	-8.53	
11g	6	-10.59	0.04	-10.55	
	9	-10.45	0.06	-10.39	
	12	-10.53	0.08	-10.45	
	18	-10.52	0.12	-10.40	
	24	-10.60	0.16	-10.44	
	36	-10.72	0.24	-10.48	
	48	-11.32	1.03	-10.29	*
	54	-11.78	1.46	-10.32	

* Worst rate

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

2437 MHz

Mode	Rate MCS	Reading [dBm]	Duty factor [dB]	Burst power [dBm]	Remarks
11n (GI=400ns)	0	-10.63	0.05	-10.58	
	1	-10.63	0.09	-10.54	
	2	-10.70	0.14	-10.56	
	3	-10.75	0.19	-10.56	
	4	-10.95	0.44	-10.51	*
	5	-13.67	1.50	-12.17	
	6	-14.07	1.99	-12.08	
11n (GI=800ns)	7	-14.54	2.48	-12.06	
	0	-10.56	0.04	-10.52	
	1	-10.84	0.09	-10.75	
	2	-10.67	0.12	-10.55	
	3	-10.73	0.17	-10.56	
	4	-10.71	0.24	-10.47	*
	5	-13.30	1.06	-12.24	
	6	-13.65	1.68	-11.97	
	7	-14.13	1.99	-12.14	

* Worst rate

Sample Calculation:

Burst power = Reading (timed average) + Duty factor

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

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan

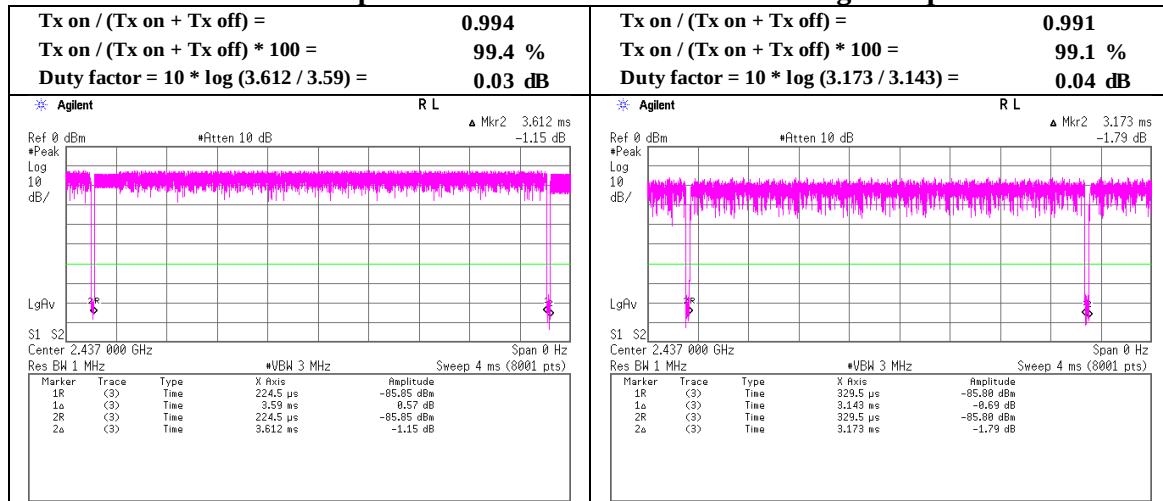
Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

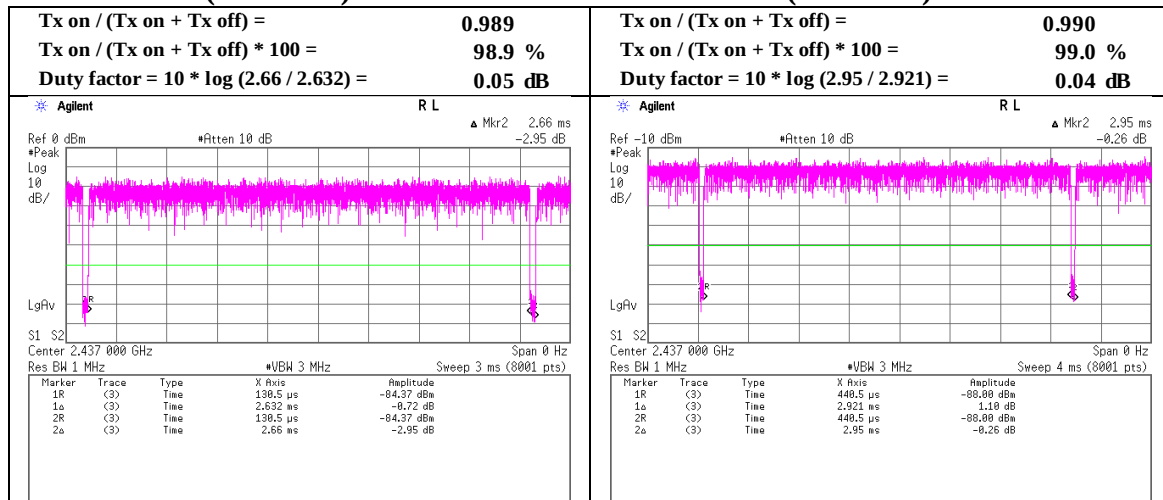
Burst rate confirmation

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11085508M
Date : January 6, 2016
Temperature / Humidity : 23 deg. C / 40 % RH
Engineer : Kazuhiro Ando
Mode : Tx

11b 5.5 Mbps



11n (GI=400ns) MCS 0



Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No. : 11085508M
Date : January 12, 2016 January 13, 2016 January 14, 2016
Temperature / Humidity : 20 deg. C / 35 % RH 21 deg. C / 36 % RH 20 deg. C / 36 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(1 - 10 GHz) (10 - 18 GHz) (18 - 26 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.	1980.000	PK	48.3	25.8	13.6	38.1	2.1	51.7	73.9	22.2	186	354	
Hori.	2390.000	PK	59.1	27.6	14.0	38.3	2.1	64.5	73.9	9.4	141	208	
Hori.	3360.150	PK	48.9	28.2	5.7	38.8	2.1	46.1	73.9	27.8	143	153	
Hori.	4824.000	PK	55.7	31.3	6.1	39.3	2.1	55.9	73.9	18.0	103	203	
Hori.	7236.000	PK	42.2	36.3	7.5	38.4	2.1	49.7	73.9	24.2	100	0	
Hori.	1980.000	AV	41.5	25.8	13.6	38.1	2.1	44.9	53.9	9.0	186	354	
Hori.	2390.000	AV	34.2	27.6	14.0	38.3	2.1	39.6	53.9	14.3	141	208	
Hori.	3360.150	AV	43.7	28.2	5.7	38.8	2.1	40.9	53.9	13.0	143	153	
Hori.	4824.000	AV	47.3	31.3	6.1	39.3	2.1	47.5	53.9	6.4	103	203	
Hori.	7236.000	AV	31.0	36.3	7.5	38.4	2.1	38.5	53.9	15.4	100	0	
Vert.	1980.000	PK	46.0	25.8	13.6	38.1	2.1	49.4	73.9	24.5	141	20	
Vert.	2390.000	PK	60.1	27.6	14.0	38.3	2.1	65.5	73.9	8.4	168	323	
Vert.	3360.150	PK	46.8	28.2	5.7	38.8	2.1	44.0	73.9	29.9	134	121	
Vert.	4824.000	PK	59.8	31.3	6.1	39.3	2.1	60.0	73.9	13.9	171	215	
Vert.	7236.000	PK	42.8	36.3	7.5	38.4	2.1	50.3	73.9	23.6	100	0	Floor Noise
Vert.	1980.000	AV	38.0	25.8	13.6	38.1	2.1	41.4	53.9	12.5	141	20	
Vert.	2390.000	AV	34.7	27.6	14.0	38.3	2.1	40.1	53.9	13.8	168	323	
Vert.	3360.150	AV	39.2	28.2	5.7	38.8	2.1	36.4	53.9	17.5	134	121	
Vert.	4824.000	AV	51.8	31.3	6.1	39.3	2.1	52.0	53.9	1.9	171	215	
Vert.	7236.000	AV	31.0	36.3	7.5	38.4	2.1	38.5	53.9	15.4	100	0	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.1\text{ dB}$

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	91.6	27.6	14.1	38.3	2.1	97.1	-	-	Carrier
Hori.	2400.000	PK	50.0	27.6	14.0	38.3	2.1	55.4	77.1	21.7	
Vert.	2412.000	PK	92.1	27.6	14.1	38.3	2.1	97.6	-	-	Carrier
Vert.	2400.000	PK	51.5	27.6	14.0	38.3	2.1	56.9	77.6	20.7	

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.1\text{ dB}$

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

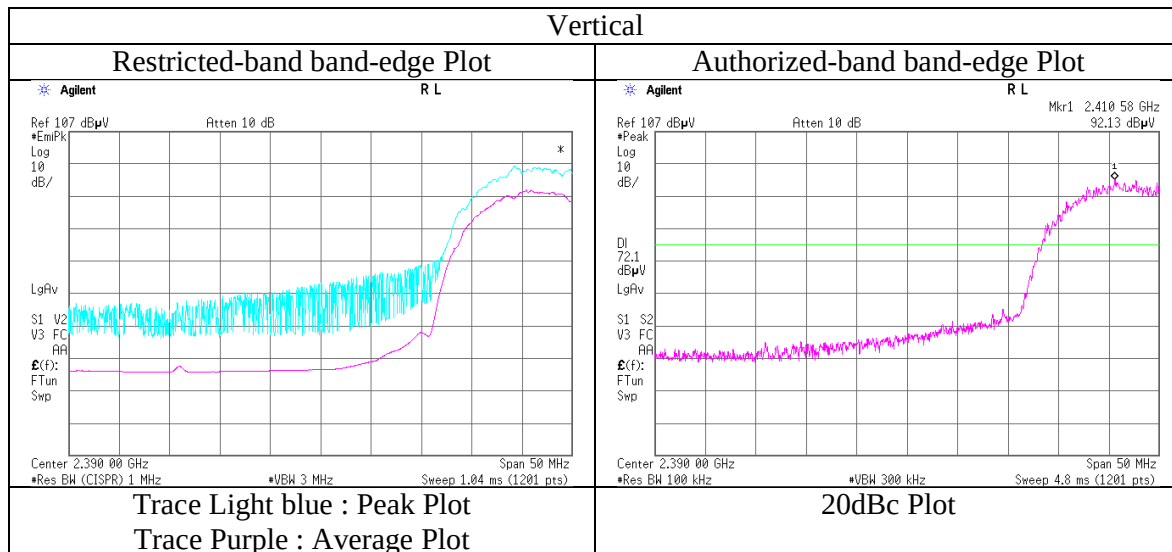
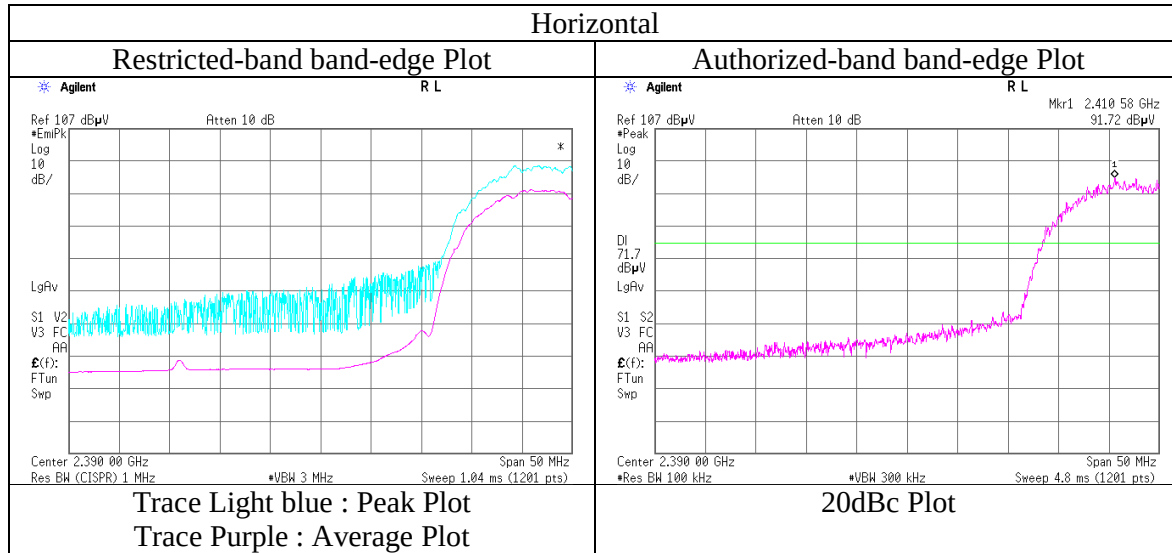
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No.	11085508M
Date	January 12, 2016
Temperature / Humidity	20 deg. C / 35 % RH
Engineer	Kazuhiro Ando
Mode	Tx 11b 2412 MHz



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

Radiated Spurious Emission

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber		
Report No.	11085508M		
Date	January 12, 2016	January 13, 2016	January 14, 2016
Temperature / Humidity	20 deg. C / 35 % RH	21 deg. C / 36 % RH	20 deg. C / 36 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(1 - 10 GHz)	(10 - 18 GHz)	(18 - 26 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.	1980.000	PK	47.7	25.8	13.6	38.1	2.1	51.1	73.9	22.8	181	352	
Hori.	3360.150	PK	48.5	28.2	5.7	38.8	2.1	45.7	73.9	28.2	147	154	
Hori.	4874.000	PK	54.2	31.2	6.2	39.3	2.1	54.4	73.9	19.5	167	0	
Hori.	7311.000	PK	42.0	36.4	7.8	38.4	2.1	49.9	73.9	24.0	100	0	Floor Noise
Hori.	1980.000	AV	41.4	25.8	13.6	38.1	2.1	44.8	53.9	9.1	181	352	
Hori.	3360.150	AV	43.3	28.2	5.7	38.8	2.1	40.5	53.9	13.4	147	154	
Hori.	4874.000	AV	45.2	31.2	6.2	39.3	2.1	45.4	53.9	8.5	167	0	
Hori.	7311.000	AV	31.0	36.4	7.8	38.4	2.1	38.9	53.9	15.0	100	0	Floor Noise
Vert.	1980.000	PK	46.5	25.8	13.6	38.1	2.1	49.9	73.9	24.0	150	18	
Vert.	3360.150	PK	46.8	28.2	5.7	38.8	2.1	44.0	73.9	29.9	132	127	
Vert.	4874.000	PK	58.1	31.2	6.2	39.3	2.1	58.3	73.9	15.6	168	211	
Vert.	7311.000	PK	41.2	36.4	7.8	38.4	2.1	49.1	73.9	24.8	100	0	Floor Noise
Vert.	1980.000	AV	38.8	25.8	13.6	38.1	2.1	42.2	53.9	11.7	150	18	
Vert.	3360.150	AV	39.6	28.2	5.7	38.8	2.1	36.8	53.9	17.1	132	127	
Vert.	4874.000	AV	50.9	31.2	6.2	39.3	2.1	51.1	53.9	2.8	168	211	
Vert.	7311.000	AV	30.8	36.4	7.8	38.4	2.1	38.7	53.9	15.2	100	0	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.1\text{ dB}$

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Radiated Spurious Emission

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber			
Report No.	11085508M			
Date	January 11, 2016	January 12, 2016	January 13, 2016	January 14, 2016
Temperature / Humidity	19 deg. C / 40 % RH	20 deg. C / 35 % RH	21 deg. C / 36 % RH	20 deg. C / 36 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(30 - 1000 MHz)	(1 - 10 GHz)	(10 - 18 GHz)	(18 - 26 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.	99.898	QP	46.4	8.9	4.4	32.4	0.0	27.3	43.5	16.2	208	183	
Hori.	396.001	QP	41.2	15.5	6.2	32.3	0.0	30.6	46.0	15.4	100	228	
Hori.	720.957	QP	33.9	21.2	7.7	32.3	0.0	30.5	46.0	15.5	125	10	
Hori.	792.010	QP	30.8	22.3	7.9	32.1	0.0	28.9	46.0	17.1	100	230	
Hori.	900.011	QP	30.2	23.4	8.3	31.5	0.0	30.4	46.0	15.6	100	247	
Hori.	960.000	QP	41.0	23.9	8.5	31.1	0.0	42.3	46.0	3.7	100	256	
Hori.	1980.000	PK	47.5	25.8	13.6	38.1	2.1	50.9	73.9	23.0	160	355	
Hori.	2483.500	PK	55.3	27.5	14.1	38.4	2.1	60.6	73.9	13.3	143	203	
Hori.	3360.150	PK	49.5	28.2	5.7	38.8	2.1	46.7	73.9	27.2	108	156	
Hori.	4924.000	PK	51.3	31.3	6.2	39.3	2.1	51.6	73.9	22.3	143	0	
Hori.	7386.000	PK	42.0	36.7	7.8	38.3	2.1	50.3	73.9	23.6	100	0	Floor Noise
Hori.	1980.000	AV	41.0	25.8	13.6	38.1	2.1	44.4	53.9	9.5	160	355	
Hori.	2483.500	AV	33.9	27.5	14.1	38.4	2.1	39.2	53.9	14.7	143	203	
Hori.	3360.150	AV	44.0	28.2	5.7	38.8	2.1	41.2	53.9	12.7	108	156	
Hori.	4924.000	AV	41.0	31.3	6.2	39.3	2.1	41.3	53.9	12.6	143	0	
Hori.	7386.000	AV	31.4	36.7	7.8	38.3	2.1	39.7	53.9	14.2	100	0	Floor Noise
Vert.	79.394	QP	38.6	9.6	4.2	32.5	0.0	19.9	40.0	20.1	100	76	
Vert.	143.373	QP	37.7	12.9	4.8	32.4	0.0	23.0	43.5	20.5	100	106	
Vert.	189.000	QP	42.3	10.9	5.1	32.4	0.0	25.9	43.5	17.6	100	113	
Vert.	499.495	QP	35.1	17.9	6.7	32.3	0.0	27.4	46.0	18.6	112	0	
Vert.	663.548	QP	34.3	20.6	7.5	32.3	0.0	30.1	46.0	15.9	100	15	
Vert.	960.000	QP	40.5	23.9	8.5	31.1	0.0	41.8	46.0	4.2	109	203	
Vert.	1980.000	PK	46.2	25.8	13.6	38.1	2.1	49.6	73.9	24.3	147	24	
Vert.	2483.500	PK	55.5	27.5	14.1	38.4	2.1	60.8	73.9	13.1	154	328	
Vert.	3360.150	PK	46.2	28.2	5.7	38.8	2.1	43.4	73.9	30.5	120	118	
Vert.	4924.000	PK	55.2	31.3	6.2	39.3	2.1	55.5	73.9	18.4	160	213	
Vert.	7386.000	PK	41.9	36.7	7.8	38.3	2.1	50.2	73.9	23.7	100	0	Floor Noise
Vert.	1980.000	AV	38.3	25.8	13.6	38.1	2.1	41.7	53.9	12.2	147	24	
Vert.	2483.500	AV	34.1	27.5	14.1	38.4	2.1	39.4	53.9	14.5	154	328	
Vert.	3360.150	AV	38.8	28.2	5.7	38.8	2.1	36.0	53.9	17.9	120	118	
Vert.	4924.000	AV	46.0	31.3	6.2	39.3	2.1	46.3	53.9	7.6	160	213	
Vert.	7386.000	AV	31.1	36.7	7.8	38.3	2.1	39.4	53.9	14.5	100	0	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.1\text{ dB}$

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

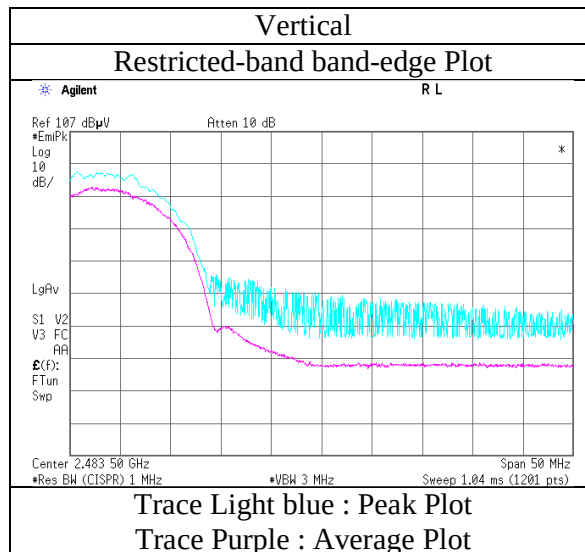
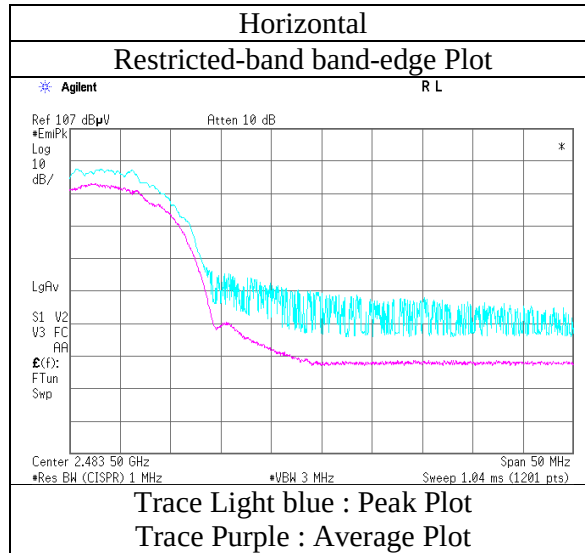
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No.	11085508M
Date	January 12, 2016
Temperature / Humidity	20 deg. C / 35 % RH
Engineer	Kazuhiro Ando
Mode	Tx 11b 2462 MHz



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

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No. : 11085508M
Date : January 13, 2016 January 13, 2016 January 14, 2016
Temperature / Humidity : 21 deg. C / 36 % RH 21 deg. C / 36 % RH 20 deg. C / 36 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(1 - 10 GHz) (10 - 18 GHz) (18 - 26 GHz)
Mode : Tx 11n (GI=800ns) 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.	1980.000	PK	48.0	25.8	13.6	38.1	2.1	51.4	73.9	22.5	182	46	
Hori.	2390.000	PK	59.4	27.6	14.0	38.3	2.1	64.8	73.9	9.1	142	210	
Hori.	3360.150	PK	47.9	28.2	5.7	38.8	2.1	45.1	73.9	28.8	147	159	
Hori.	4824.000	PK	53.2	31.3	6.1	39.3	2.1	53.4	73.9	20.5	167	343	
Hori.	7236.000	PK	41.3	36.3	7.5	38.4	2.1	48.8	73.9	25.1	100	0	Floor Noise
Hori.	1980.000	AV	41.6	25.8	13.6	38.1	2.1	45.0	53.9	8.9	182	46	
Hori.	2390.000	AV	41.3	27.6	14.0	38.3	2.1	46.7	53.9	7.2	142	210	
Hori.	3360.150	AV	42.0	28.2	5.7	38.8	2.1	39.2	53.9	14.7	147	159	
Hori.	4824.000	AV	39.4	31.3	6.1	39.3	2.1	39.6	53.9	14.3	167	343	
Hori.	7236.000	AV	30.6	36.3	7.5	38.4	2.1	38.1	53.9	15.8	100	0	Floor Noise
Vert.	1980.000	PK	46.2	25.8	13.6	38.1	2.1	49.6	73.9	24.3	157	326	
Vert.	2390.000	PK	60.5	27.6	14.0	38.3	2.1	65.9	73.9	8.0	172	324	
Vert.	3360.150	PK	46.5	28.2	5.7	38.8	2.1	43.7	73.9	30.2	141	128	
Vert.	4824.000	PK	56.3	31.3	6.1	39.3	2.1	56.5	73.9	17.4	160	208	
Vert.	7236.000	PK	42.0	36.3	7.5	38.4	2.1	49.5	73.9	24.4	100	0	Floor Noise
Vert.	1980.000	AV	38.9	25.8	13.6	38.1	2.1	42.3	53.9	11.6	157	326	
Vert.	2390.000	AV	43.2	27.6	14.0	38.3	2.1	48.6	53.9	5.3	172	324	
Vert.	3360.150	AV	39.8	28.2	5.7	38.8	2.1	37.0	53.9	16.9	141	128	
Vert.	4824.000	AV	43.0	31.3	6.1	39.3	2.1	43.2	53.9	10.7	160	208	
Vert.	7236.000	AV	30.6	36.3	7.5	38.4	2.1	38.1	53.9	15.8	100	0	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.1\text{ dB}$

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	87.3	27.6	14.1	38.3	2.1	92.8	-	-	Carrier
Hori.	2400.000	PK	55.8	27.6	14.0	38.3	2.1	61.2	72.8	11.6	
Vert.	2412.000	PK	88.2	27.6	14.1	38.3	2.1	93.7	-	-	Carrier
Vert.	2400.000	PK	56.5	27.6	14.0	38.3	2.1	61.9	73.7	11.8	

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.1\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

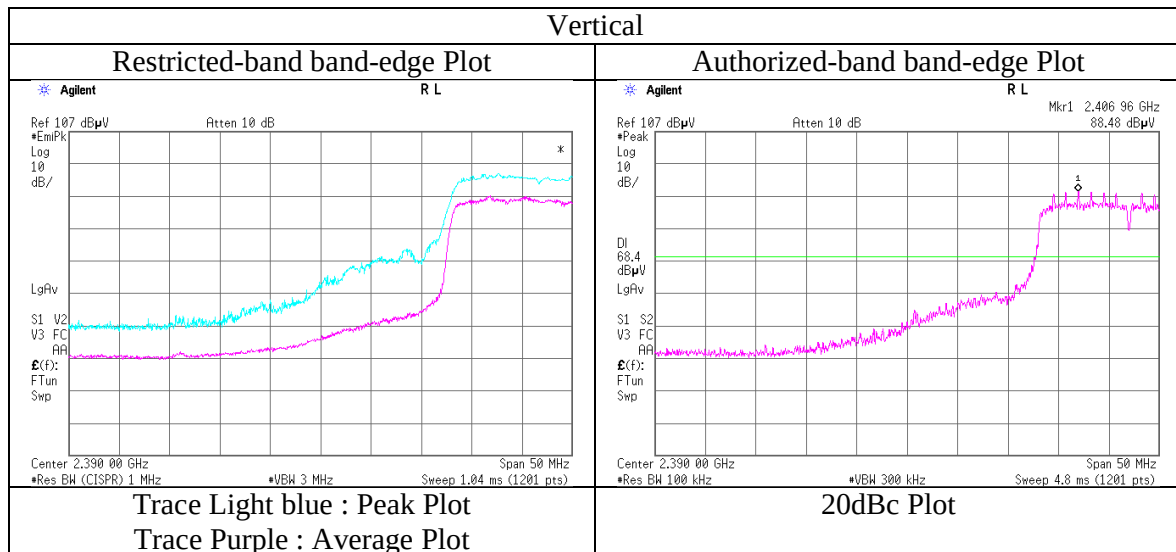
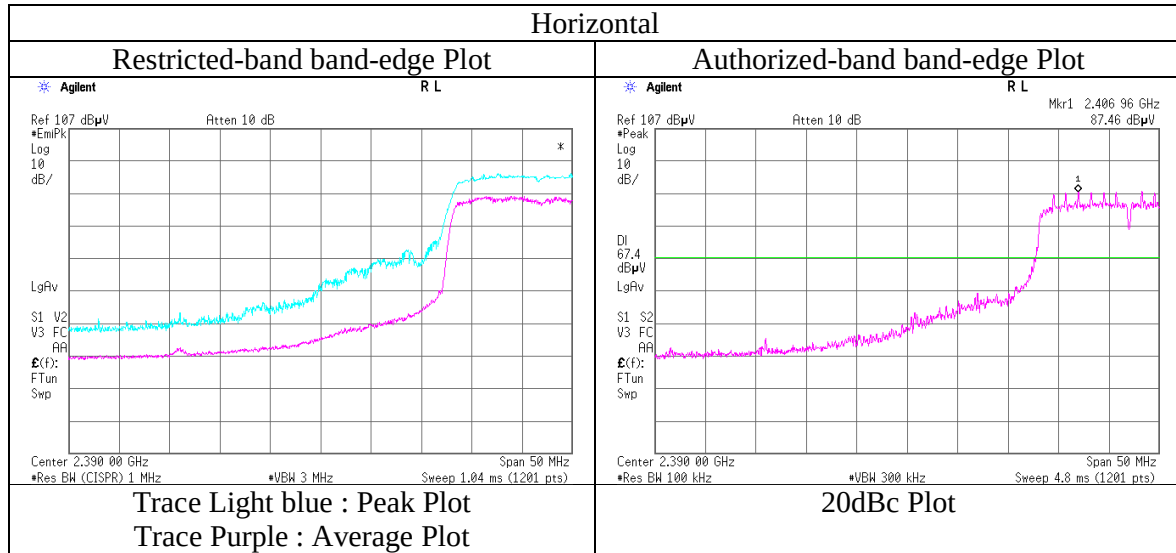
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No.	11085508M
Date	January 13, 2016
Temperature / Humidity	21 deg. C / 36 % RH
Engineer	Kazuhiro Ando
Mode	Tx 11n (GI=800ns) 2412 MHz



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

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber
 Report No. : 11085508M
 Date : January 12, 2016 January 13, 2016 January 14, 2016
 Temperature / Humidity : 20 deg. C / 35 % RH 21 deg. C / 36 % RH 20 deg. C / 36 % RH
 Engineer : Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
 (1 - 10 GHz) (10 - 18 GHz) (18 - 26 GHz)
 Mode : Tx 11n (GI=800ns) 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.	1980.000	PK	48.1	25.8	13.6	38.1	2.1	51.5	73.9	22.4	157	355	
Hori.	3360.150	PK	49.0	28.2	5.7	38.8	2.1	46.2	73.9	27.7	134	147	
Hori.	4874.000	PK	51.3	31.2	6.2	39.3	2.1	51.5	73.9	22.4	100	202	
Hori.	7311.000	PK	41.5	36.4	7.8	38.4	2.1	49.4	73.9	24.5	100	0	Floor Noise
Hori.	1980.000	AV	41.8	25.8	13.6	38.1	2.1	45.2	53.9	8.7	157	355	
Hori.	3360.150	AV	44.1	28.2	5.7	38.8	2.1	41.3	53.9	12.6	134	147	
Hori.	4874.000	AV	37.8	31.2	6.2	39.3	2.1	38.0	53.9	15.9	100	202	
Hori.	7311.000	AV	30.7	36.4	7.8	38.4	2.1	38.6	53.9	15.3	100	0	Floor Noise
Vert.	1980.000	PK	47.3	25.8	13.6	38.1	2.1	50.7	73.9	23.2	145	321	
Vert.	3360.150	PK	46.7	28.2	5.7	38.8	2.1	43.9	73.9	30.0	170	140	
Vert.	4874.000	PK	55.5	31.2	6.2	39.3	2.1	55.7	73.9	18.2	167	207	
Vert.	7311.000	PK	42.0	36.4	7.8	38.4	2.1	49.9	73.9	24.0	100	0	Floor Noise
Vert.	1980.000	AV	39.2	25.8	13.6	38.1	2.1	42.6	53.9	11.3	145	321	
Vert.	3360.150	AV	40.2	28.2	5.7	38.8	2.1	37.4	53.9	16.5	170	140	
Vert.	4874.000	AV	41.5	31.2	6.2	39.3	2.1	41.7	53.9	12.2	167	207	
Vert.	7311.000	AV	30.7	36.4	7.8	38.4	2.1	38.6	53.9	15.3	100	0	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.1\text{ dB}$

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Radiated Spurious Emission

Test place : Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No. : 11085508M
Date : January 11, 2016 January 13, 2016 January 13, 2016 January 14, 2016
Temperature / Humidity : 19 deg. C / 40 % RH 21 deg. C / 36 % RH 21 deg. C / 36 % RH 20 deg. C / 36 % RH
Engineer : Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando Kazuhiro Ando
(30 - 1000 MHz) (1 - 10 GHz) (10 - 18 GHz) (18 - 26 GHz)
Mode : Tx 11n (GI=800ns) 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.	99.902	QP	46.6	8.9	4.4	32.4	0.0	27.5	43.5	16.0	202	194	
Hori.	396.000	QP	41.2	15.5	6.2	32.3	0.0	30.6	46.0	15.4	100	227	
Hori.	720.016	QP	34.4	21.2	7.7	32.3	0.0	31.0	46.0	15.0	130	12	
Hori.	792.003	QP	30.7	22.3	7.9	32.1	0.0	28.8	46.0	17.2	100	234	
Hori.	900.020	QP	30.2	23.4	8.3	31.5	0.0	30.4	46.0	15.6	100	242	
Hori.	960.000	QP	41.0	23.9	8.5	31.1	0.0	42.3	46.0	3.7	100	255	
Hori.	1980.000	PK	47.0	25.8	13.6	38.1	2.1	50.4	73.9	23.5	185	352	
Hori.	2983.500	PK	58.2	28.5	5.6	38.6	2.1	55.8	73.9	18.1	125	208	
Hori.	3360.150	PK	48.0	28.2	5.7	38.8	2.1	45.2	73.9	28.7	104	157	
Hori.	4924.000	PK	50.0	31.3	6.2	39.3	2.1	50.3	73.9	23.6	158	0	
Hori.	7386.000	PK	41.4	36.7	7.8	38.3	2.1	49.7	73.9	24.2	100	0	Floor Noise
Hori.	1980.000	AV	41.4	25.8	13.6	38.1	2.1	44.8	53.9	9.1	185	352	
Hori.	2983.500	AV	42.1	28.5	5.6	38.6	2.1	39.7	53.9	14.2	125	208	
Hori.	3360.150	AV	43.1	28.2	5.7	38.8	2.1	40.3	53.9	13.6	104	157	
Hori.	4924.000	AV	36.3	31.3	6.2	39.3	2.1	36.6	53.9	17.3	158	0	
Hori.	7386.000	AV	30.5	36.7	7.8	38.3	2.1	38.8	53.9	15.1	100	0	Floor Noise
Vert.	79.415	QP	39.3	9.6	4.2	32.5	0.0	20.6	40.0	19.4	100	71	
Vert.	143.448	QP	36.7	12.9	4.8	32.4	0.0	22.0	43.5	21.5	100	96	
Vert.	189.003	QP	43.5	10.9	5.1	32.4	0.0	27.1	43.5	16.4	100	126	
Vert.	499.495	QP	34.6	17.9	6.7	32.3	0.0	26.9	46.0	19.1	112	0	
Vert.	663.547	QP	34.4	20.6	7.5	32.3	0.0	30.2	46.0	15.8	100	18	
Vert.	960.000	QP	40.5	23.9	8.5	31.1	0.0	41.8	46.0	4.2	110	201	
Vert.	1980.000	PK	46.3	25.8	13.6	38.1	2.1	49.7	73.9	24.2	174	20	
Vert.	2483.500	PK	58.0	27.5	14.1	38.4	2.1	63.3	73.9	10.6	150	324	
Vert.	3360.150	PK	47.1	28.2	5.7	38.8	2.1	44.3	73.9	29.6	174	145	
Vert.	4924.000	PK	53.7	31.3	6.2	39.3	2.1	54.0	73.9	19.9	156	211	
Vert.	7386.000	PK	41.3	36.7	7.8	38.3	2.1	49.6	73.9	24.3	100	0	Floor Noise
Vert.	1980.000	AV	38.2	25.8	13.6	38.1	2.1	41.6	53.9	12.3	174	20	
Vert.	2483.500	AV	42.0	27.5	14.1	38.4	2.1	47.3	53.9	6.6	150	324	
Vert.	3360.150	AV	41.0	28.2	5.7	38.8	2.1	38.2	53.9	15.7	174	145	
Vert.	4924.000	AV	40.0	31.3	6.2	39.3	2.1	40.3	53.9	13.6	156	211	
Vert.	7386.000	AV	30.8	36.7	7.8	38.3	2.1	39.1	53.9	14.8	100	0	Floor Noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.8\text{ m} / 3.0\text{ m}) = 2.1\text{ dB}$

10 GHz - 26 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Kashima EMC Lab.

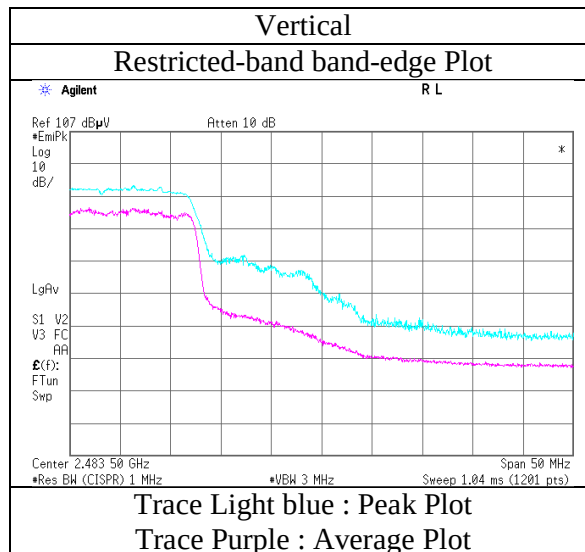
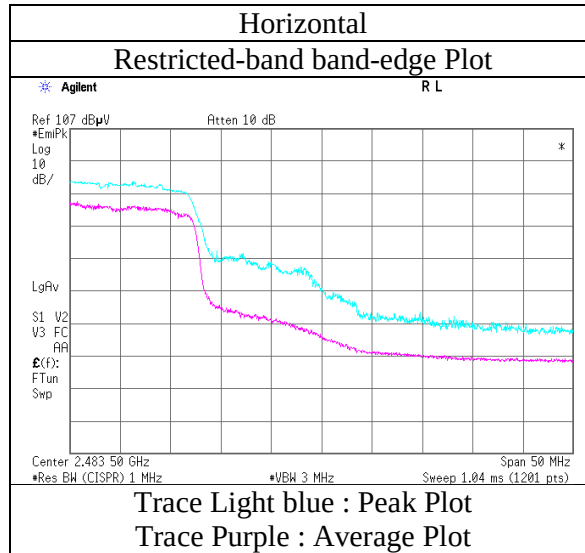
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Radiated Spurious Emission (Reference Plot for band-edge)

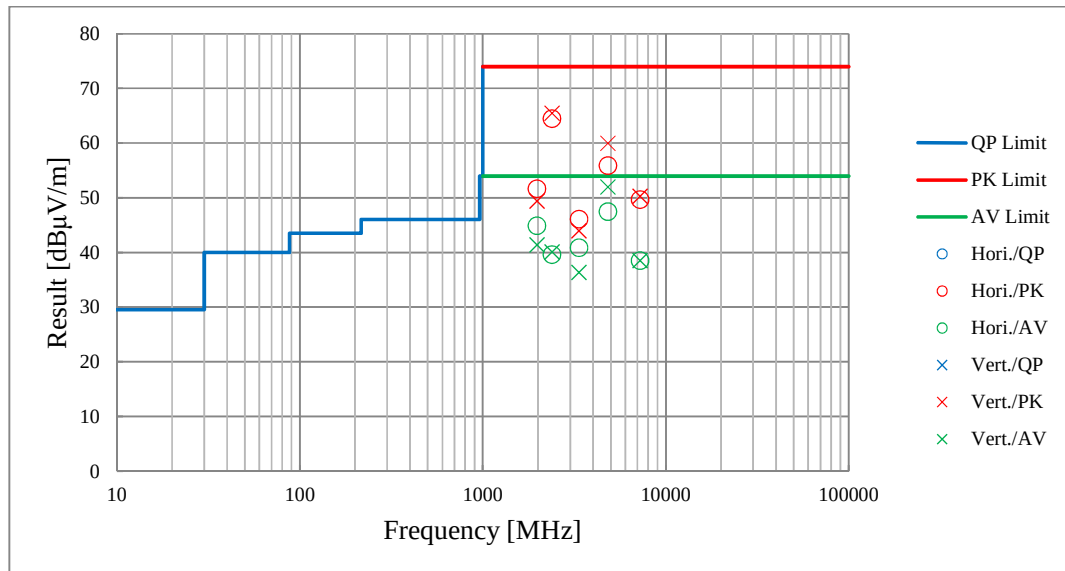
Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber
Report No.	11085508M
Date	January 13, 2016
Temperature / Humidity	21 deg. C / 36 % RH
Engineer	Kazuhiro Ando
Mode	Tx 11n (GI=800ns) 2462 MHz



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

Radiated Spurious Emission (Plot data, Worst case)

Test place	Kashima EMC Lab. No.6 Semi Anechoic Chamber		
Report No.	11085508M		
Date	January 12, 2016	January 13, 2016	January 14, 2016
Temperature / Humidity	20 deg. C / 35 % RH	21 deg. C / 36 % RH	20 deg. C / 36 % RH
Engineer	Kazuhiro Ando	Kazuhiro Ando	Kazuhiro Ando
	(1 - 10 GHz)	(10 - 18 GHz)	(18 - 26 GHz)
Mode	Tx 11b 2412 MHz		



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

UL Japan, Inc.

Kashima EMC Lab.

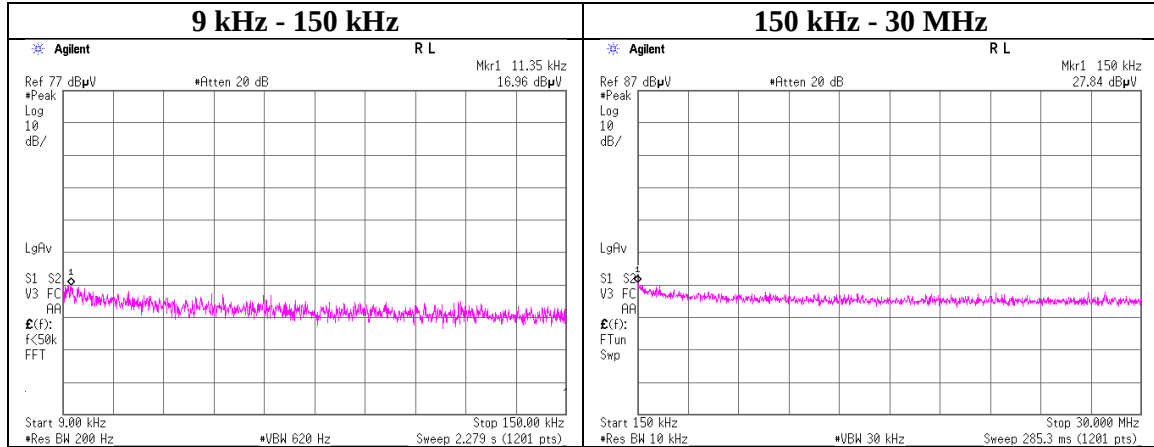
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Conducted Spurious Emission

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11085508M
Date : January 7, 2016
Temperature / Humidity : 22 deg. C / 38 % RH
Engineer : Kazuhiro Ando
Mode : Tx 11b 2462 MHz



Frequency [kHz]	Reading [dBuV]	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
11.35	16.96	1.19	20.23	-2.78	1	-71.4	300	6.0	-10.1	46.5	56.6	
150.00	27.84	1.19	20.23	-2.78	1	-60.5	300	6.0	0.7	24.0	23.3	

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

$$\text{EIRP} = (\text{Reading} - 107) + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$$

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

Power Density

Test place : Kashima EMC Lab. No.2 Measurement Room
Report No. : 11085508M
Date : January 7, 2016
Temperature / Humidity : 22 deg. C / 38 % RH
Engineer : Kazuhiro Ando
Mode : Tx

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-17.54	1.72	20.28	4.46	8.00	3.54
2437.00	-17.24	1.73	20.28	4.77	8.00	3.23
2462.00	-17.27	1.73	20.28	4.74	8.00	3.26

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-36.69	1.72	20.28	-14.69	8.00	22.69
2437.00	-37.11	1.73	20.28	-15.10	8.00	23.10
2462.00	-36.78	1.73	20.28	-14.77	8.00	22.77

11n (GI=400ns)

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-37.63	1.72	20.28	-15.63	8.00	23.63
2437.00	-36.55	1.73	20.28	-14.54	8.00	22.54
2462.00	-36.64	1.73	20.28	-14.63	8.00	22.63

11n (GI=800ns)

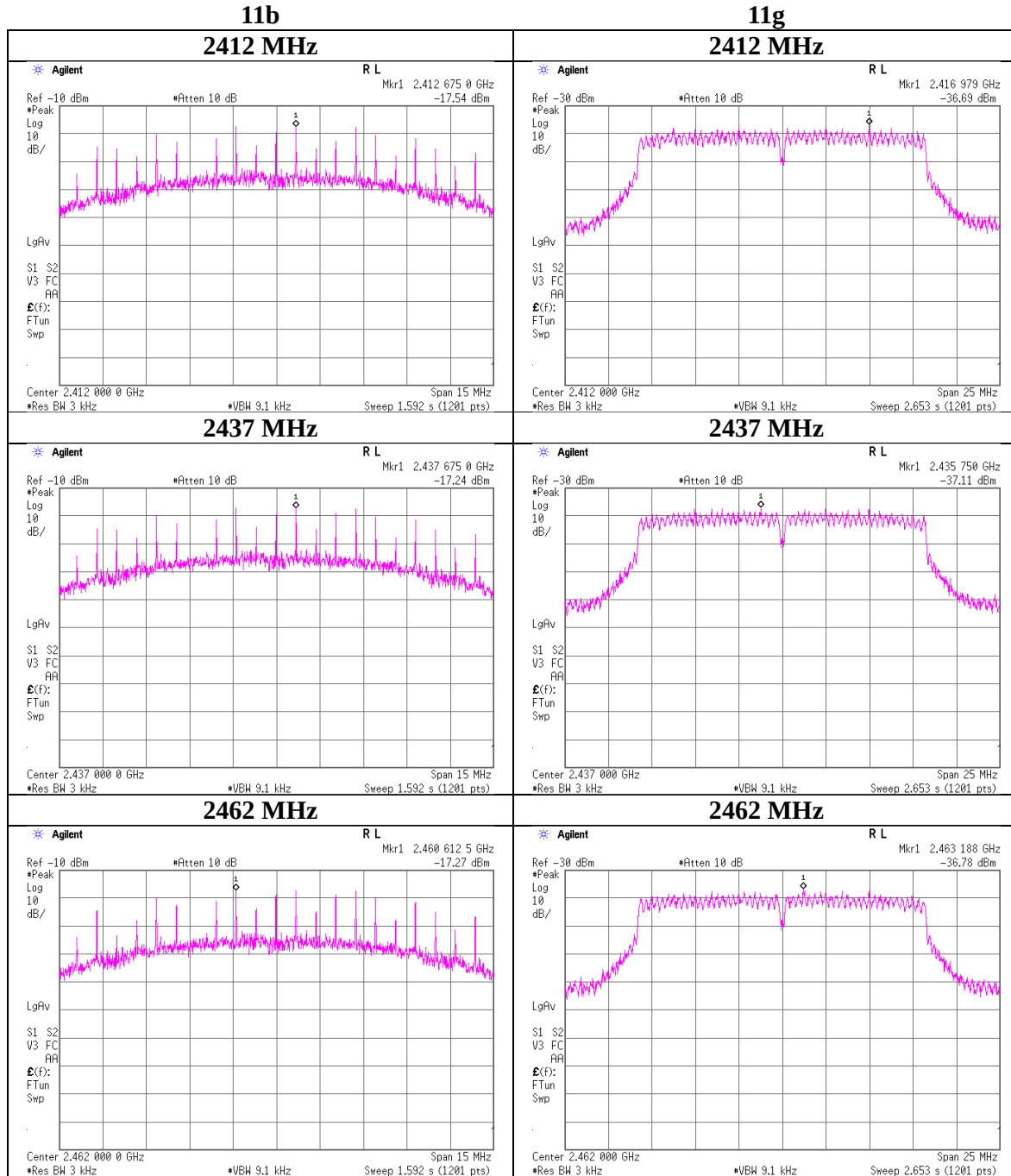
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-36.60	1.72	20.28	-14.60	8.00	22.60
2437.00	-37.52	1.73	20.28	-15.51	8.00	23.51
2462.00	-35.27	1.73	20.28	-13.26	8.00	21.26

Sample Calculation:

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

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

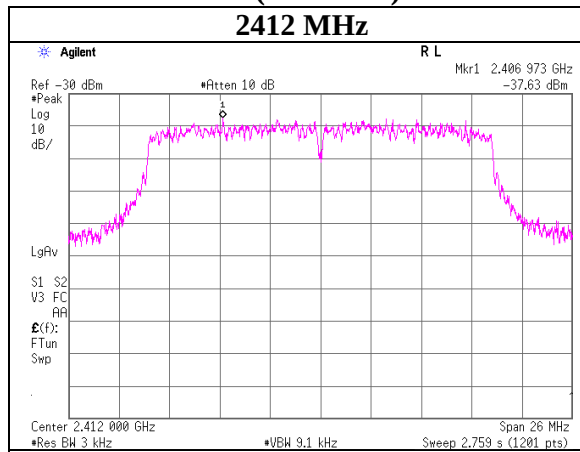
Power Density



Power Density

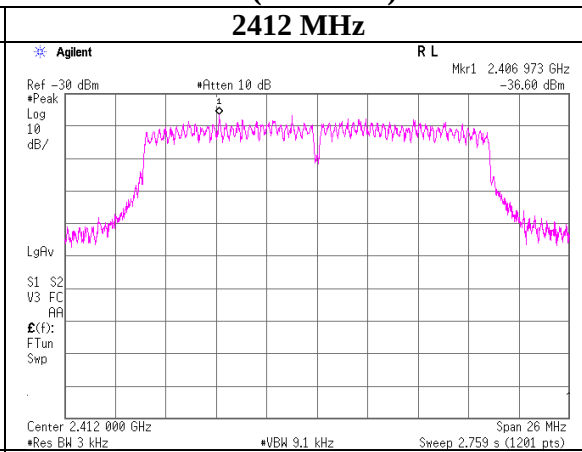
11n (GI=400ns)

2412 MHz

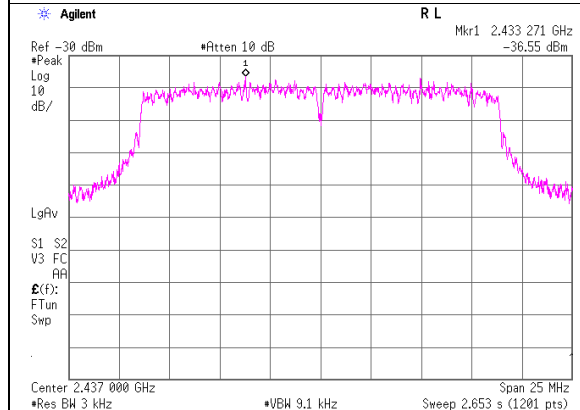


11n (GI=800ns)

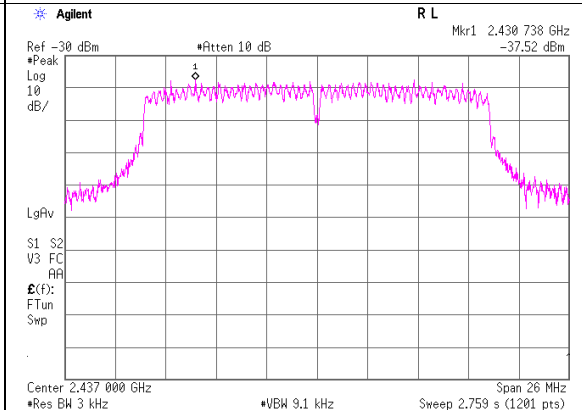
2412 MHz



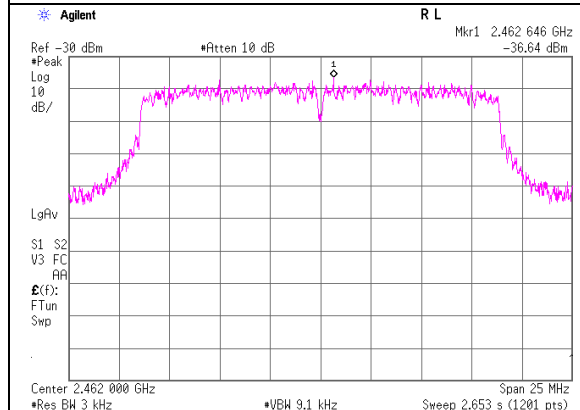
2437 MHz



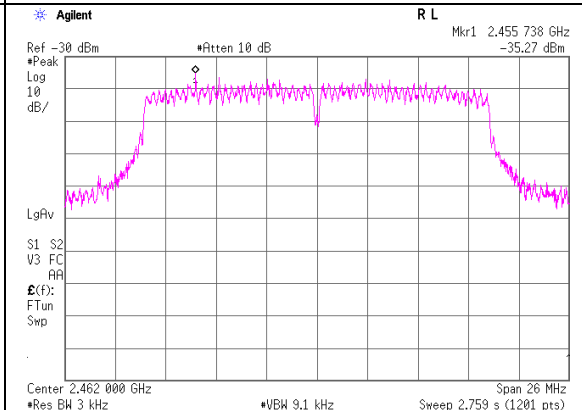
2437 MHz



2462 MHz



2462 MHz



UL Japan, Inc.

Kashima EMC Lab.

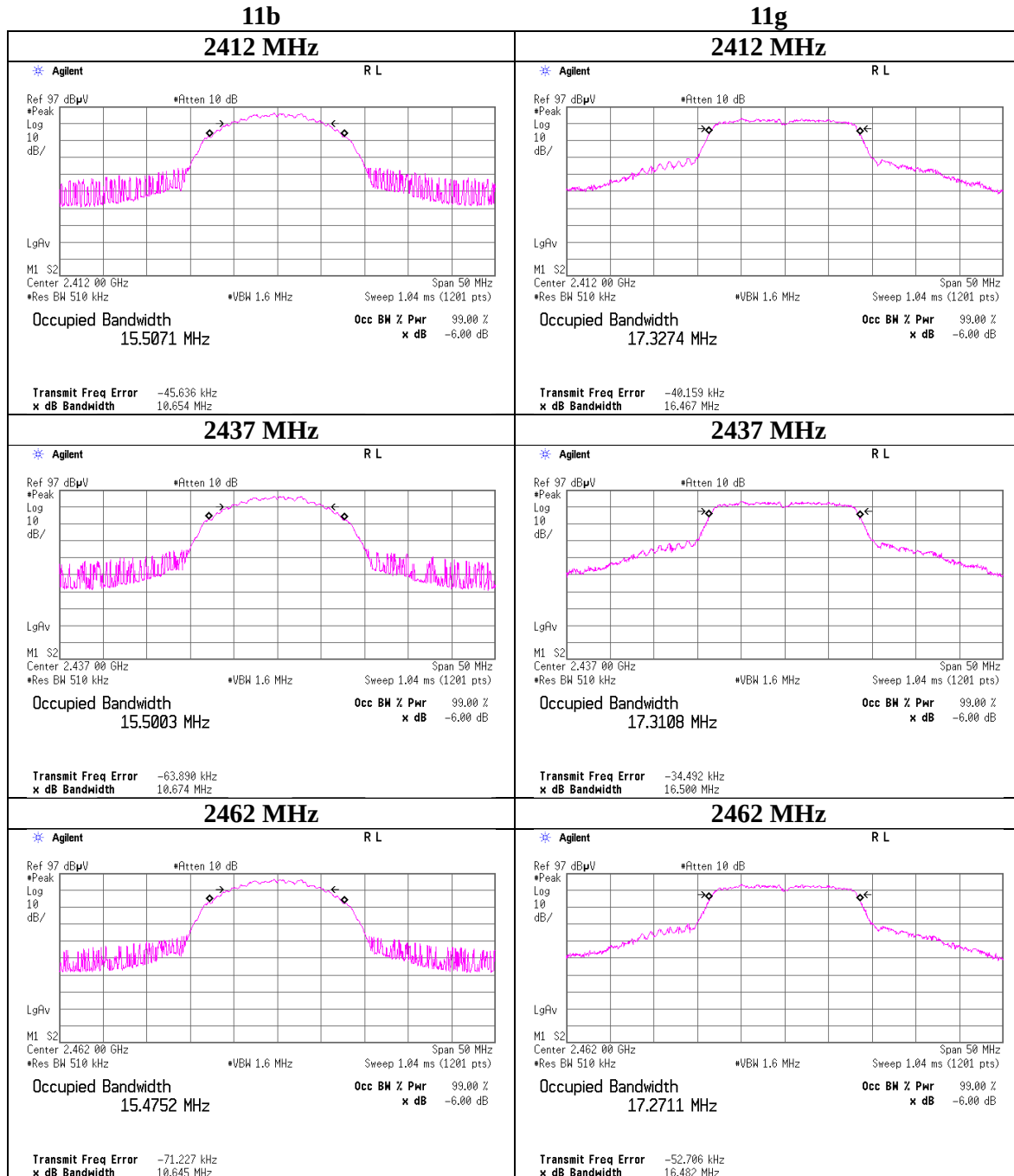
1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373

99%Occupied Bandwidth

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11085508M
Date	January 7, 2016
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Kazuhiro Ando
Mode	Tx

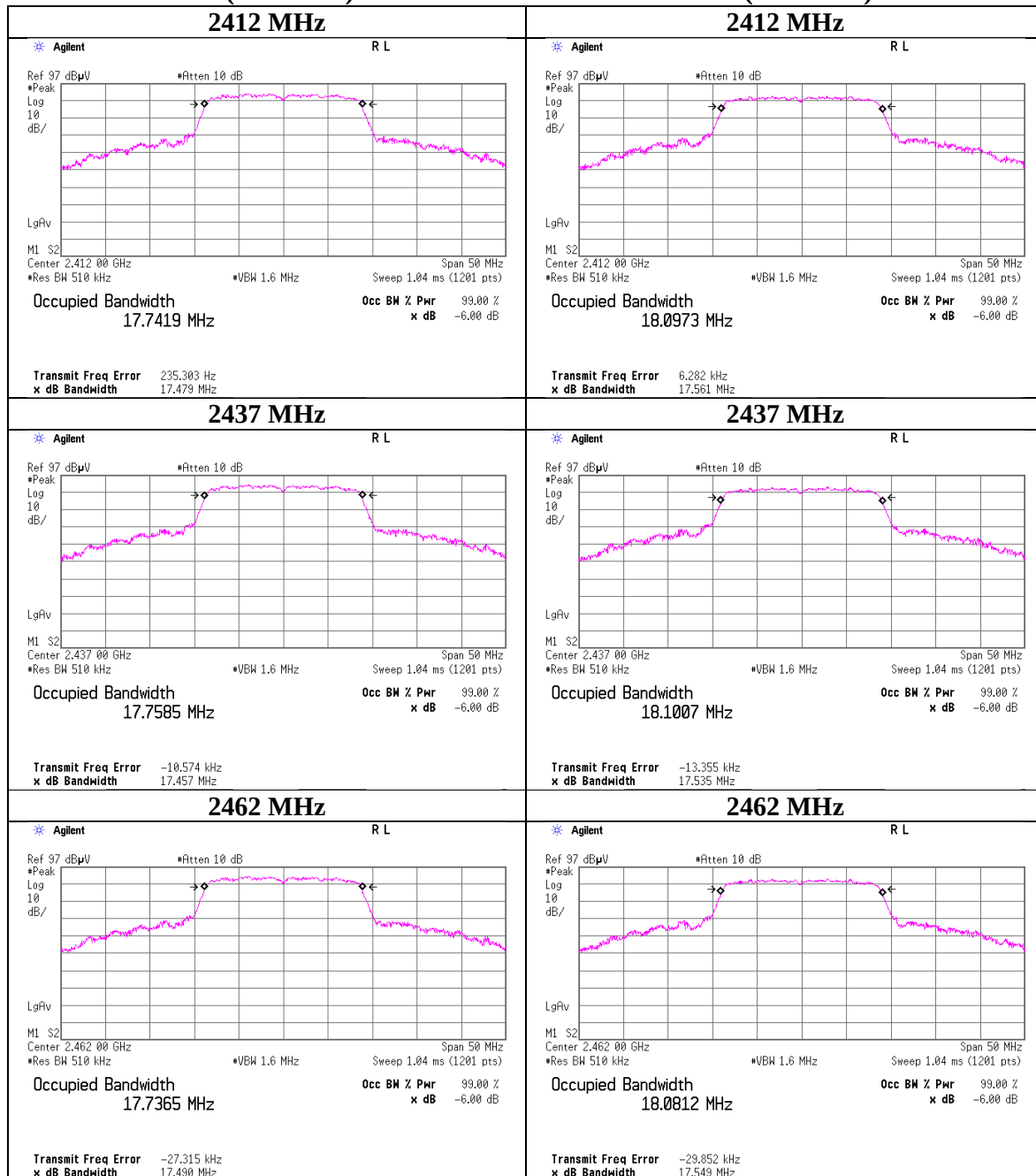


99% Occupied Bandwidth

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11085508M
Date	January 7, 2016
Temperature / Humidity	22 deg. C / 38 % RH
Engineer	Kazuhiro Ando
Mode	Tx

11n (GI=400ns)

11n (GI=800ns)



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
CTR-04	Test Receiver	Rohde & Schwarz	ESCI	100053 Rev 4.32	RE	2015/10/01 * 12
CCC-S6-R(1/9/ 10/CATS-07-08 /11/12/13)	Coaxial Cable	Fujikura, Suhner, Suhner, Agilent, Suhner, -, Suhner	15DSFA, SF106, SF104, 8496B+8494B, SF104, -, SF104	MY41110308, 2550 A11724(Step Att)	RE	2015/12/22 * 12
CBL-07	LOGBICON	Schwarzbeck	VULB 9168	166	RE	2015/04/09 * 12
CAT3-19	3dB Fixed Atten.	JFW	50HF-003N	none	RE	2015/06/03*12
CAF-07	Pre-Amplifier	Sonoma Instrument	310N	240505	RE	2015/11/02 * 12
CSCL-08	Ruler	Tajima	L25-55	none	RE	2015/02/18 * 12
COS-06	Temperature & Humidity Indicator	HIOKI	3641/9680-50	070727010/070799296	RE	2015/05/17 * 12
COTS-CEMI-02	EMI Software	TSJ	TEPTO-DV(RE, CE, MF, PE)	Ver, RE: 2.5.0131, CE: 2.5.0131, ME: 2.5.0129, PE: 2.5.0129	RE	-
CSA-06	Spectrum Analyzer	Agilent	N9030A	MY53310670 Version A.13.12	RE	2015/05/28 * 12
CHA-20	Broad Band Horn	Schwarzbeck	BBHA 9120D	9120D-1270	RE	2015/07/31 * 12
CHA-07	Double Ridged Horn	ETS-Lindgren	3160-09	00166043	RE	2015/06/28 * 12
CAF-19	Pre-Amplifier	TOYO	HAP18-26W	00000035	RE	2015/06/28 * 12
CAF-18	Pre-Amplifier	TOYO	TPA0118-36	A-1001	RE	2015/07/15 * 12
CAT10-16	10dB Fixed Atten.	Weinschel	54A-10	56246	RE	2015/05/26 * 12
CHF-03	HPF	Micro-Tronics	HPM50111-02	008	RE	2015/05/25 * 12
CCC-W05	Micro Wave Cable	Junkosha	MWX241	MRA-12-14-145	RE	2015/05/26 * 12
CCC-W07	Micro Wave Cable	Junkosha	MWX221	MRA-12-14-148	RE	2015/05/26 * 12
CCC-W09	Micro Wave Cable	SUHNER	SUCOFLEX104	MY588/4	RE	2015/07/13 * 12
CSA-07	Spectrum Analyzer	Agilent	E4448A	MY52490024 Version A.11.21	AT	2015/05/28 * 12
CAT20-04	20dB Fixed Atten.	Weinschel	54A-20	41994	AT	2015/05/26 * 12
CCC-W06	Micro Wave Cable	Junkosha	MWX241	MRA-12-14-146	AT	2015/05/26 * 12
CPM-16	Peak Power Analyzer	Agilent	8990B	MY51000276	AT	2015/06/16 * 12
CPSO-24	Power Sensor	Agilent	N1923A	MY54070024	AT	2015/06/16 * 12
COS-12	Temperature & Humidity Indicator	A&D	AD-5681	6876017	AT	2015/07/13 * 12

The expiration date of the calibration is the end of the expired month.

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

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

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

UL Japan, Inc.

Kashima EMC Lab.

1614, Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan

Telephone : +81-478-88-6500

Facsimile : +81-478-82-3373