



RADIO TEST REPORT

Test Report No. : 11434432H-A-R2

Applicant : FUJITSU TEN LIMITED
Type of Equipment : Dash Camera
Model No. : FT0112A
FCC ID : BABFT0112A
Test regulation : FCC Part 15 Subpart C: 2016
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
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 11434432H-A-R1. 11434432H-A-R1 is replaced with this report.

Date of test: October 18 to 21, 2016

Representative test engineer:

Hiroyuki Furutaka
Engineer
Consumer Technology Division

Approved by:

Tsubasa Takayama
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11434432H-A

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SECTION 1: Customer information

Company Name	:	FUJITSU TEN LIMITED
Address	:	2-28, Gosho-dori 1-Chome, Hyogo-ku, Kobe 652-8510 JAPAN
Telephone Number	:	+81-78-682-2159
Facsimile Number	:	+81-78-671-7160
Contact Person	:	FUKII DAISUKE

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

2.1 Identification of E.U.T.

Type of Equipment	:	Dash Camera
Model No.	:	FT0112A
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12 V
Receipt Date of Sample	:	October 17, 2016
Country of Mass-production	:	Japan
Condition of EUT	:	Engineering 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: FT0112A (referred to as the EUT in this report) is a Dash Camera.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS, OFDM
Power Supply (radio part input)	:	DC 1.6 V
Antenna type	:	Inverted F antenna(pattern antenna)
Antenna Gain	:	-2.63 dBi
Clock frequency (Maximum)	:	26 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016

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 November 14, 2016, 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	-	N/A *1)	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r05 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 v03r05 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 v03r05 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 v03r05 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	3.5 dB 2483.500 MHz, AV, Hori.	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 is not the device that is designed to be connected to the public utility (AC) power line.

*2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r05 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 1.6 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

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3.3 Addition to standard

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

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

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.
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Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz - 3 GHz	3 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3m	3.8 dB
10m	3.7 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 - 200 MHz	200 - 1000MHz	30 - 200 MHz	200 - 1000MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 - 6GHz	6 - 18GHz	10 - 26.5 GHz	26.5 - 40GHz	1 - 18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

*Measurement distance

Radiated emission test

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

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3.5 Test Location

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Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

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)	1 Mbps, PN9
IEEE 802.11g (11g)	54 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 6 (Long GI), PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 11b: 14.0 dBm 11g: 12.0 dBm 11n-20: 12.0 dBm Software: SSC_MT5931_MP_Linux_P2P_W1233_V1.5.1 *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
Radiated Spurious Emission (Above 1GHz)	11b Tx 11n-20 Tx *1)	2412 MHz 2437 MHz 2462 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz
Conducted Spurious Emission, Radiated Spurious Emission (Below 1GHz)	11n-20 Tx *2)	2462 MHz
*1) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power.		
*2) The mode was tested as a representative, because it had the highest power at antenna terminal test.		

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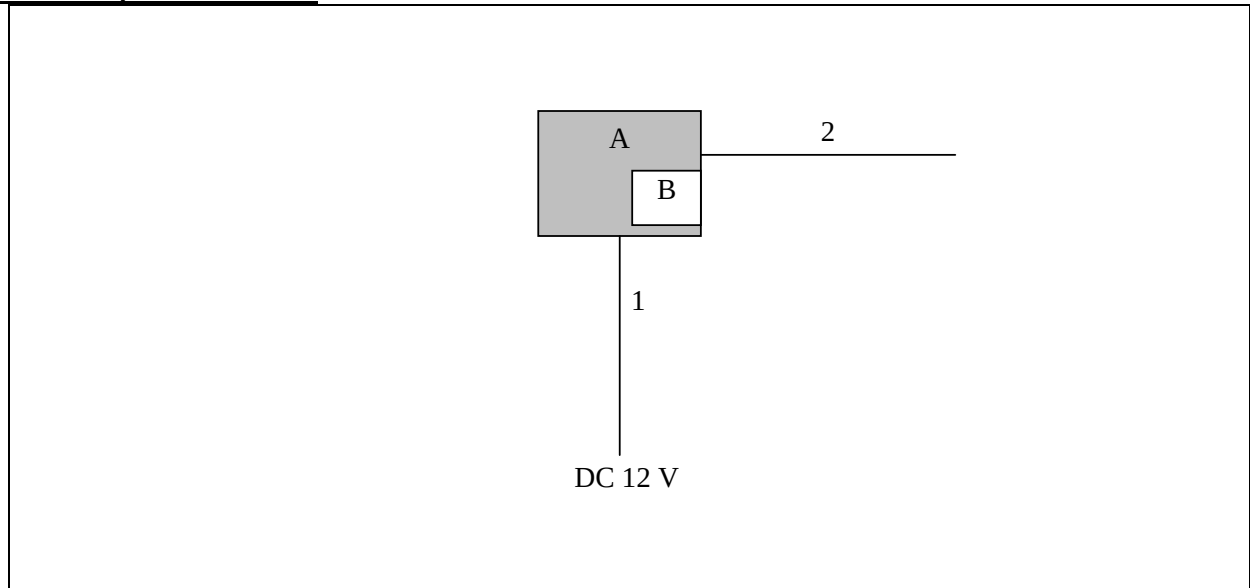
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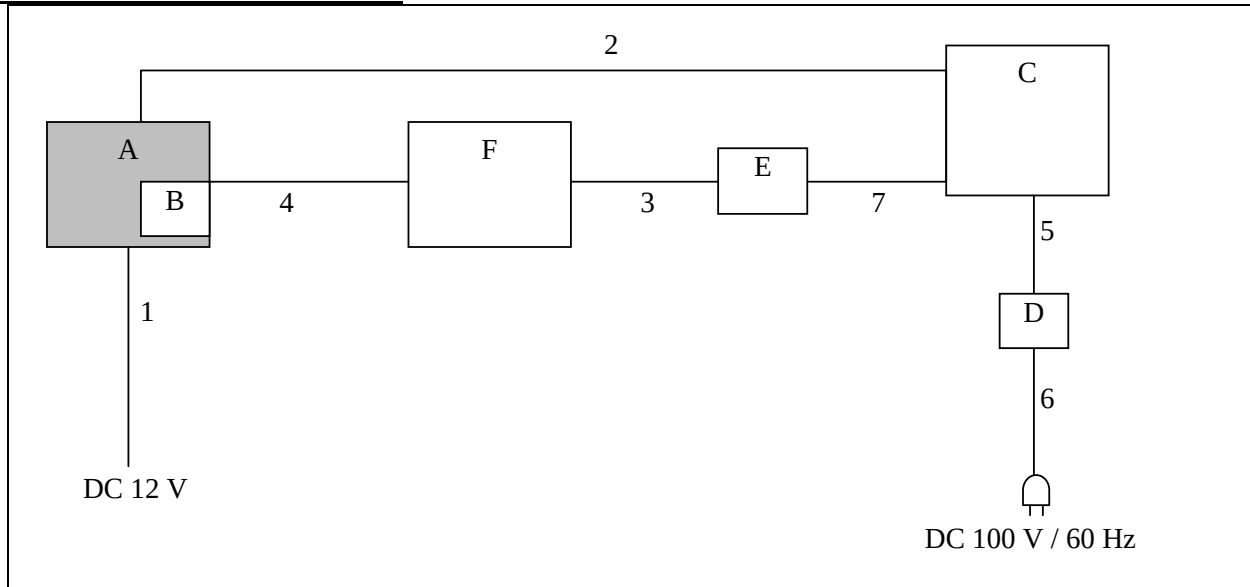
Facsimile : +81 596 24 8124

4.2 Configuration and peripherals

Radiated Spurious Emission



Antenna Terminal Conducted Tests



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Dash Camera	FT0112A	2M-13 for RE* 2M-12 for AT*	FUJITSU TEN LIMITED	EUT
B	Micro SD Card	086A4-00060	TF8KE62074A01	-	-
C	Personal Computer	CF-N8HWCDPS	0BKSA07449	Panasonic	-
D	AC Adapter	CF-AA6372B	6372BBM409X17298B	Panasonic	-
E	USB-Serial convert Jig	BSUSRC0610BS	0280822	BUFFALO	-
F	Jig	-	-	FUJITSU TEN LIMITED	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	5.3	Unshielded	Unshielded	-
2	Signal Cable	0.4	Shielded	Shielded	*1)
3	Serial Cable	1.0	Shielded	Shielded	-
4	FFT Cable	0.03	Unshielded	Unshielded	*1)
5	DC Cable	1.1	Unshielded	Unshielded	-
6	AC Cable	0.9	Unshielded	Unshielded	-
7	USB Cable	0.5	Shielded	Shielded	-

*RE: Radiated Spurious Emission test, AT: Antenna Terminal Conducted Tests

*1) This cable is used only for the test. The end product does not have this cable.

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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 v03r05".

[For below 1 GHz]

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

[For above 1 GHz]

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

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

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

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

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

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

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

Test Antennas are used as below;

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

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces If duty cycle was less than 98%, a duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	3 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)		3 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r05".

*2) Distance Factor: $20 \times \log(3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$

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

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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.

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 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	20 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 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	9.1 kHz	27 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 v03r05". *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 low enough as shown in the chart. (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 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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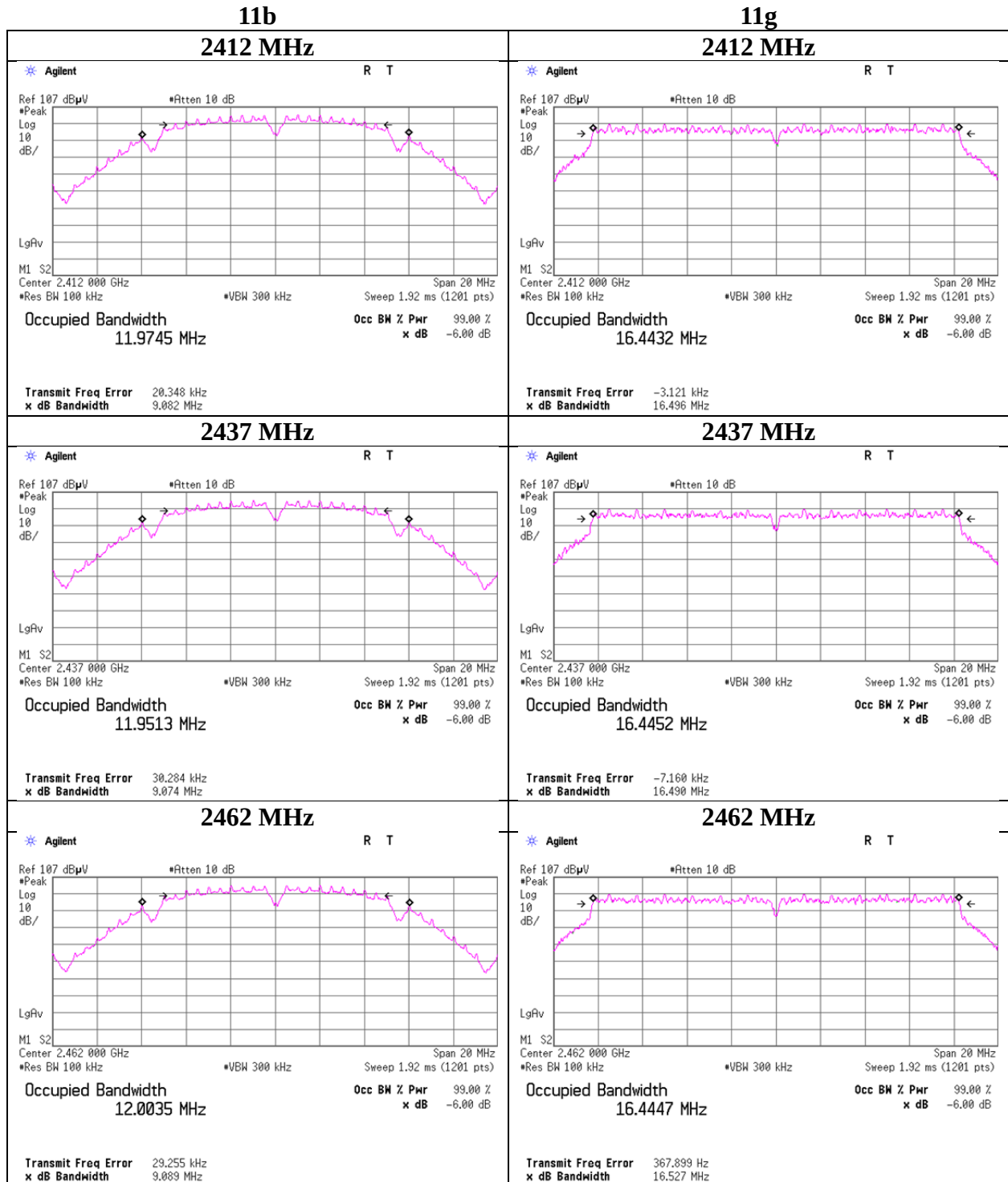
APPENDIX 1: Test data

6dB Bandwidth

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11434432H
Date	October 19, 2016
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	9.082	> 500
	2437	9.074	> 500
	2462	9.089	> 500
11g	2412	16.496	> 500
	2437	16.490	> 500
	2462	16.527	> 500
11n-20	2412	17.739	> 500
	2437	17.758	> 500
	2462	17.729	> 500

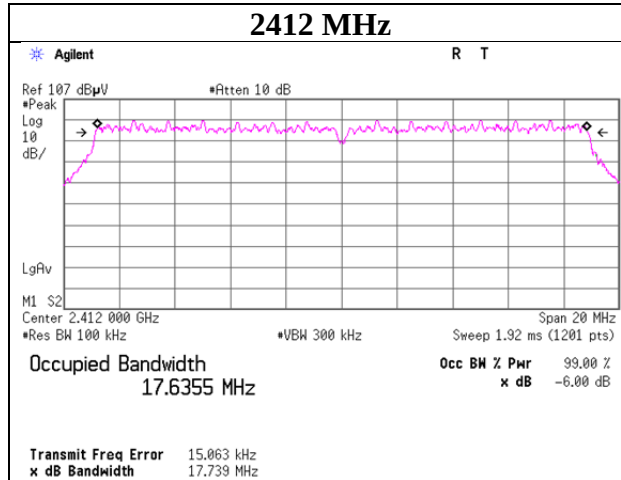
6dB Bandwidth



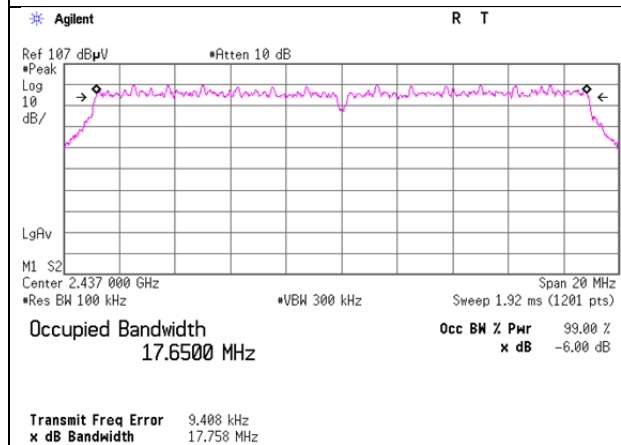
6dB Bandwidth

11n-20

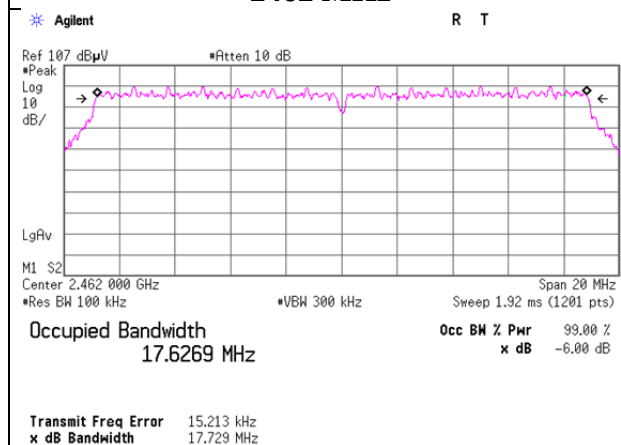
2412 MHz



2437 MHz



2462 MHz



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Maximum Peak Output Power

Test place Ise EMC Lab. No.7 Shielded Room
Report No. 11434432H
Date October 18, 2016
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Hiroyuki Furutaka
Mode Tx 11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	7.09	2.24	10.09	19.42	87.50	30.00	1000	10.58
2437	6.99	2.27	10.09	19.35	86.10	30.00	1000	10.65
2462	7.17	2.28	10.09	19.54	89.95	30.00	1000	10.46

Sample Calculation:

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	6.99	*
2	6.94	
5.5	6.72	
11	6.79	

*: Worst Rate

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

Maximum Peak Output Power

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11434432H
Date	October 18, 2016
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	10.30	2.24	10.09	22.63	183.23	30.00	1000	7.37
2437	10.34	2.27	10.09	22.70	186.21	30.00	1000	7.30
2462	10.37	2.28	10.09	22.74	187.93	30.00	1000	7.26

Sample Calculation:

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

2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	10.18	
9	10.14	
12	10.19	
18	10.21	
24	10.24	
36	10.29	
48	10.32	
54	10.34	*

*: Worst Rate

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

Maximum Peak Output Power

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11434432H
Date	October 18, 2016
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx 11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	10.15	2.24	10.09	22.48	177.01	30.00	1000	7.52
2437	10.37	2.27	10.09	22.73	187.50	30.00	1000	7.27
2462	10.38	2.28	10.09	22.75	188.36	30.00	1000	7.25

Sample Calculation:

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

11n-20, 2437 MHz, Long GI

MCS Number	Reading [dBm]	Remark
0	10.14	
1	10.22	
2	10.30	
3	10.32	
4	10.29	
5	10.24	
6	10.37	*
7	10.34	

* Worst MCS

MCS Number	Reading [dBm]	GI	Remark
6	10.37	Long	*
6	10.36	Short	

* Worst Condition

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

Average Output Power
(Reference data for RF Exposure)

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11434432H
Date : October 18, 2016
Temperature / Humidity : 23 deg. C / 68 % RH
Engineer : Hiroyuki Furutaka
Mode : Tx

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	3.34	2.24	10.09	15.67	36.90	0.04	15.71	37.24
2437	3.39	2.27	10.09	15.75	37.58	0.04	15.79	37.93
2462	3.62	2.28	10.09	15.99	39.72	0.04	16.03	40.09

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	0.59	2.24	10.09	12.92	19.59	0.28	13.20	20.89
2437	0.44	2.27	10.09	12.80	19.05	0.28	13.08	20.32
2462	0.67	2.28	10.09	13.04	20.14	0.28	13.32	21.48

11n-20, Long-GI 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	-1.50	2.24	10.09	10.83	12.11	0.33	11.16	13.06
2437	-1.39	2.27	10.09	10.97	12.50	0.33	11.30	13.49
2462	-1.22	2.28	10.09	11.15	13.03	0.33	11.48	14.06

Sample Calculation:

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

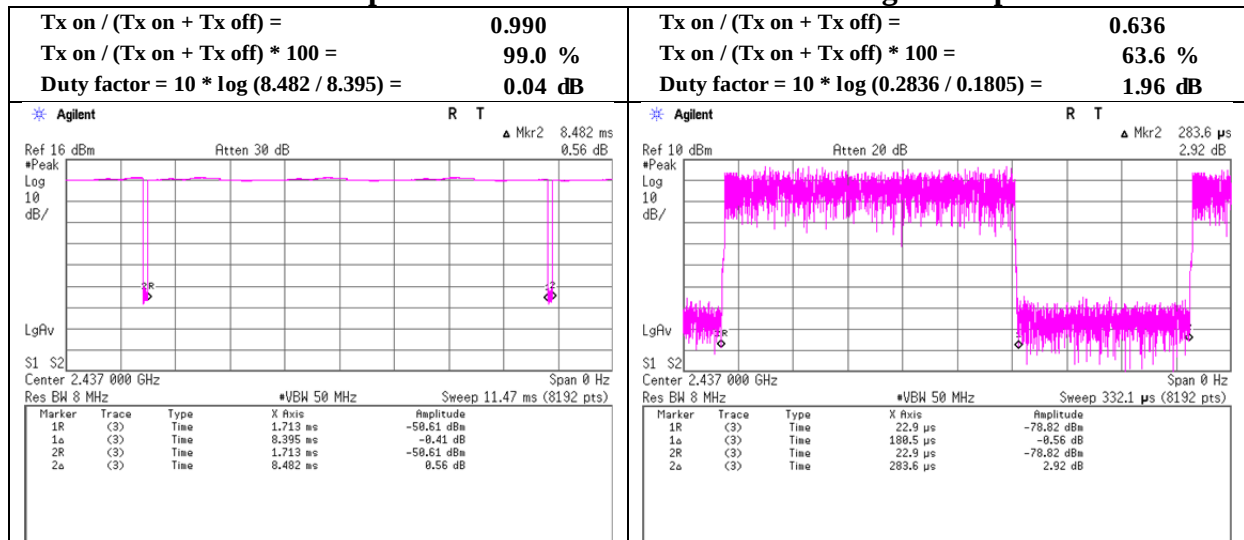
Result (Burst power average) = Time average + Duty factor

The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01 v02r02.

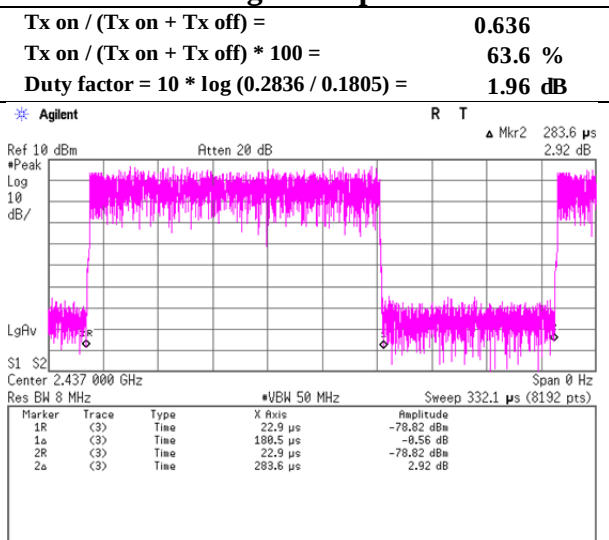
Burst rate confirmation

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11434432H
Date : October 18, 2016
Temperature / Humidity : 23 deg. C / 68 % RH
Engineer : Hiroyuki Furutaka
Mode : Tx

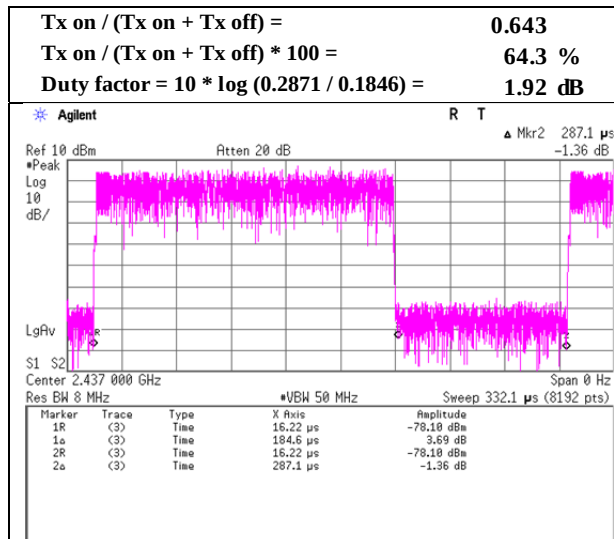
11b 1 Mbps



11g 54 Mbps



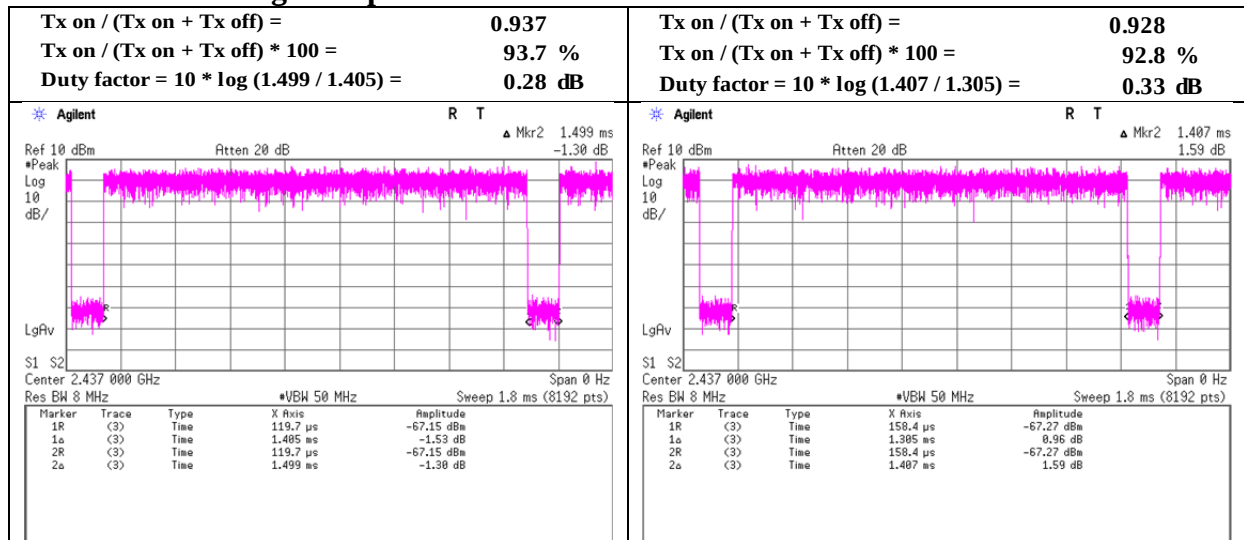
11n-20 MCS 6



Burst rate confirmation

Test place : Ise EMC Lab. No.7 Shielded Room
Report No. : 11434432H
Date : October 18, 2016
Temperature / Humidity : 23 deg. C / 68 % RH
Engineer : Hiroyuki Furutaka
Mode : Tx

11g 6 Mbps



Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11434432H
Date	October 20, 2016
Temperature / Humidity	22 deg. C / 73 % RH
Engineer	Hiroyuki Furutaka
	(1 GHz - 10 GHz)
Mode	Tx 11b 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	47.4	27.6	4.9	34.8	-	45.1	73.9	28.8	
Hori	4824.000	PK	43.0	31.6	7.6	34.1	-	48.1	73.9	25.8	Floor noise
Hori	7236.000	PK	44.0	36.2	8.4	34.1	-	54.5	73.9	19.4	Floor noise
Hori	9648.000	PK	43.8	38.5	9.3	34.8	-	56.8	73.9	17.1	Floor noise
Hori	2390.000	AV	38.5	27.6	4.9	34.8	-	36.2	53.9	17.7	
Hori	4824.000	AV	34.7	31.6	7.6	34.1	-	39.8	53.9	14.1	Floor noise
Hori	7236.000	AV	34.8	36.2	8.4	34.1	-	45.3	53.9	8.6	Floor noise
Hori	9648.000	AV	34.8	38.5	9.3	34.8	-	47.8	53.9	6.1	Floor noise
Vert	2390.000	PK	45.8	27.6	4.9	34.8	-	43.5	73.9	30.4	
Vert	4824.000	PK	43.9	31.6	7.6	34.1	-	49.0	73.9	24.9	Floor noise
Vert	7236.000	PK	43.3	36.2	8.4	34.1	-	53.8	73.9	20.1	Floor noise
Vert	9648.000	PK	43.7	38.5	9.3	34.8	-	56.7	73.9	17.2	Floor noise
Vert	2390.000	AV	37.8	27.6	4.9	34.8	-	35.5	53.9	18.4	
Vert	4824.000	AV	35.3	31.6	7.6	34.1	-	40.4	53.9	13.5	Floor noise
Vert	7236.000	AV	34.9	36.2	8.4	34.1	-	45.4	53.9	8.5	Floor noise
Vert	9648.000	AV	34.8	38.5	9.3	34.8	-	47.8	53.9	6.1	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log(3.75 m / 3.0 m) = 1.94 dB
 10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	98.5	27.6	5.1	34.7	96.5	-	-	Carrier
Hori	2400.000	PK	46.6	27.6	5.0	34.8	44.4	76.5	32.1	
Vert	2412.000	PK	97.1	27.6	5.1	34.7	95.1	-	-	Carrier
Vert	2400.000	PK	45.3	27.6	5.0	34.8	43.1	75.1	32.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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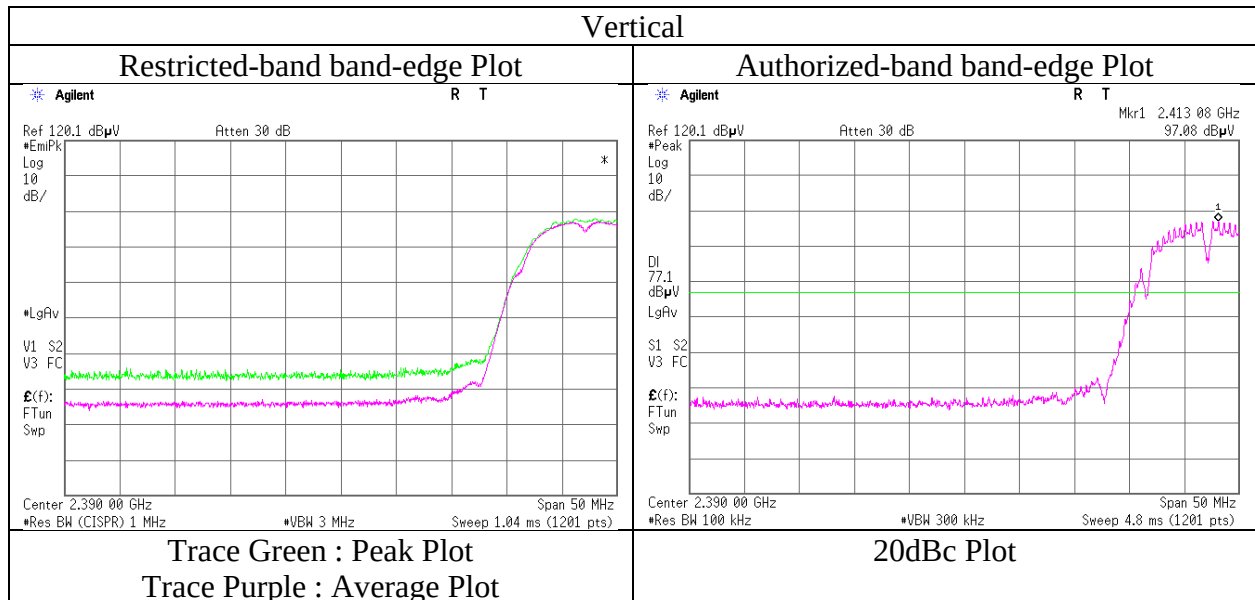
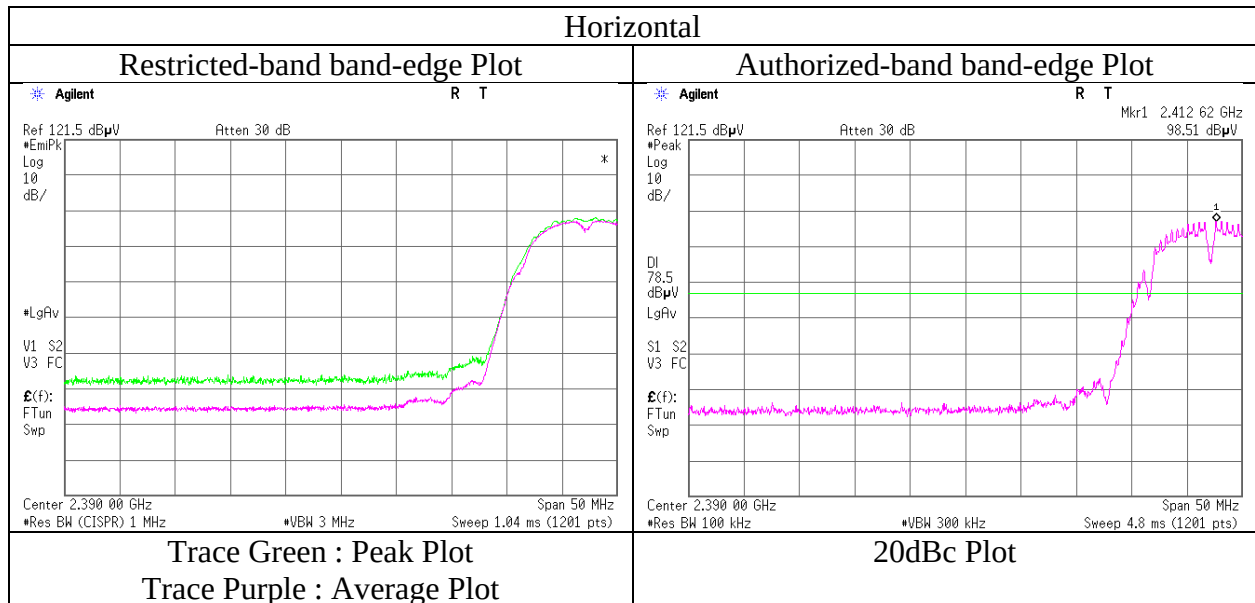
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11434432H
Date	October 20, 2016
Temperature / Humidity	22 deg. C / 73 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx 11b 2412 MHz



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

UL Japan, Inc.

Ise EMC Lab.

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Telephone : +81 596 24 8999

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Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11434432H
Date	October 20, 2016
Temperature / Humidity	22 deg. C / 73 % RH
Engineer	Hiroyuki Furutaka
	(1 GHz - 10 GHz)
Mode	Tx 11b 2437 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	4874.000	PK	43.3	31.7	7.6	34.1	-	48.5	73.9	25.4	Floor noise
Hori	7311.000	PK	42.8	36.3	8.5	34.1	-	53.5	73.9	20.4	Floor noise
Hori	9748.000	PK	43.6	38.5	9.2	34.8	-	56.5	73.9	17.4	Floor noise
Hori	4874.000	AV	34.7	31.7	7.6	34.1	-	39.9	53.9	14.0	Floor noise
Hori	7311.000	AV	34.9	36.3	8.5	34.1	-	45.6	53.9	8.3	Floor noise
Hori	9748.000	AV	35.0	38.5	9.2	34.8	-	47.9	53.9	6.0	Floor noise
Vert	4874.000	PK	44.0	31.7	7.6	34.1	-	49.2	73.9	24.7	Floor noise
Vert	7311.000	PK	43.2	36.3	8.5	34.1	-	53.9	73.9	20.0	Floor noise
Vert	9748.000	PK	43.5	38.5	9.2	34.8	-	56.4	73.9	17.5	Floor noise
Vert	4874.000	AV	34.9	31.7	7.6	34.1	-	40.1	53.9	13.8	Floor noise
Vert	7311.000	AV	34.4	36.3	8.5	34.1	-	45.1	53.9	8.8	Floor noise
Vert	9748.000	AV	34.7	38.5	9.2	34.8	-	47.6	53.9	6.3	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11434432H
Date : October 20, 2016 October 20, 2016
Temperature / Humidity : 22 deg. C / 73 % RH 22 deg. C / 71 % RH
Engineer : Hiroyuki Furutaka Shinichi Miyazono
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode : Tx 11b 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	50.0	27.7	5.1	34.7	-	48.1	73.9	25.8	
Hori	4924.000	PK	42.9	31.9	7.5	34.1	-	48.2	73.9	25.7	Floor noise
Hori	7386.000	PK	42.7	36.4	8.5	34.1	-	53.5	73.9	20.4	Floor noise
Hori	9848.000	PK	43.0	38.5	9.2	34.9	-	55.8	73.9	18.1	Floor noise
Hori	2483.500	AV	42.5	27.7	5.1	34.7	-	40.6	53.9	13.3	
Hori	4924.000	AV	33.8	31.9	7.5	34.1	-	39.1	53.9	14.8	Floor noise
Hori	7386.000	AV	34.5	36.4	8.5	34.1	-	45.3	53.9	8.6	Floor noise
Hori	9848.000	AV	34.5	38.5	9.2	34.9	-	47.3	53.9	6.6	Floor noise
Vert	2483.500	PK	46.9	27.7	5.1	34.7	-	45.0	73.9	28.9	
Vert	4924.000	PK	43.5	31.9	7.5	34.1	-	48.8	73.9	25.1	Floor noise
Vert	7386.000	PK	43.2	36.4	8.5	34.1	-	54.0	73.9	19.9	Floor noise
Vert	9848.000	PK	42.5	38.5	9.2	34.9	-	55.3	73.9	18.6	Floor noise
Vert	2483.500	AV	39.8	27.7	5.1	34.7	-	37.9	53.9	16.0	
Vert	4924.000	AV	34.0	31.9	7.5	34.1	-	39.3	53.9	14.6	Floor noise
Vert	7386.000	AV	34.6	36.4	8.5	34.1	-	45.4	53.9	8.5	Floor noise
Vert	9848.000	AV	34.7	38.5	9.2	34.9	-	47.5	53.9	6.4	Floor noise

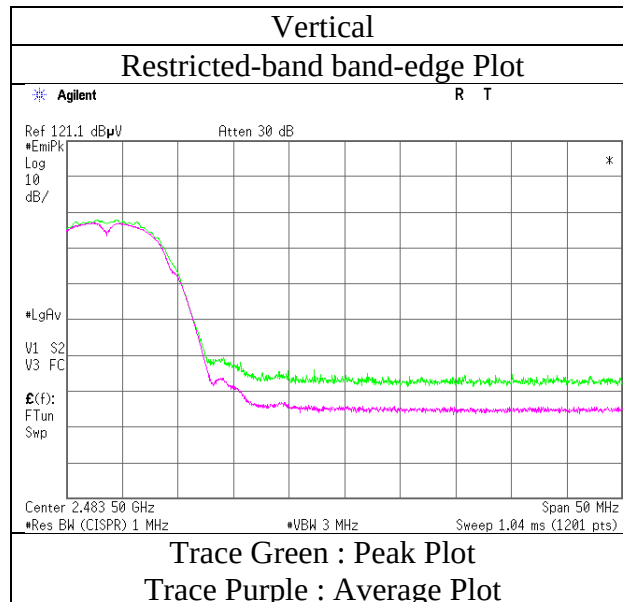
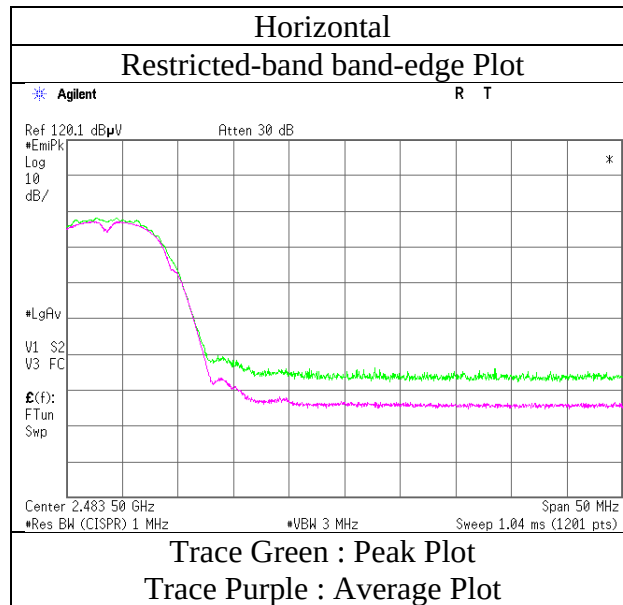
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission **(Reference Plot for band-edge)**

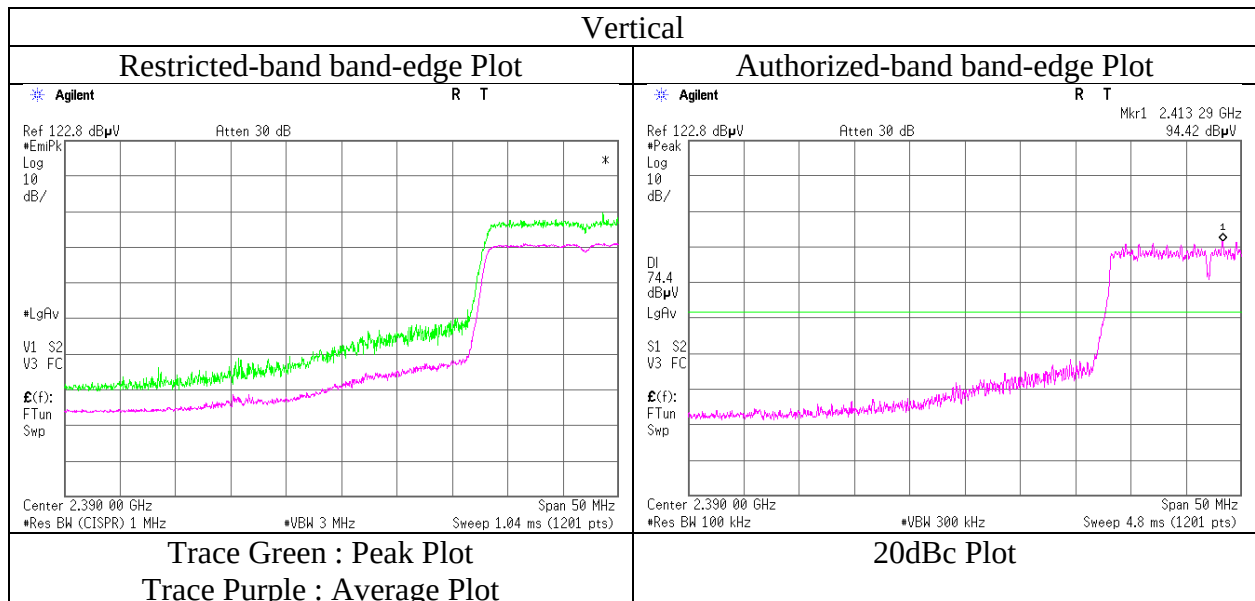
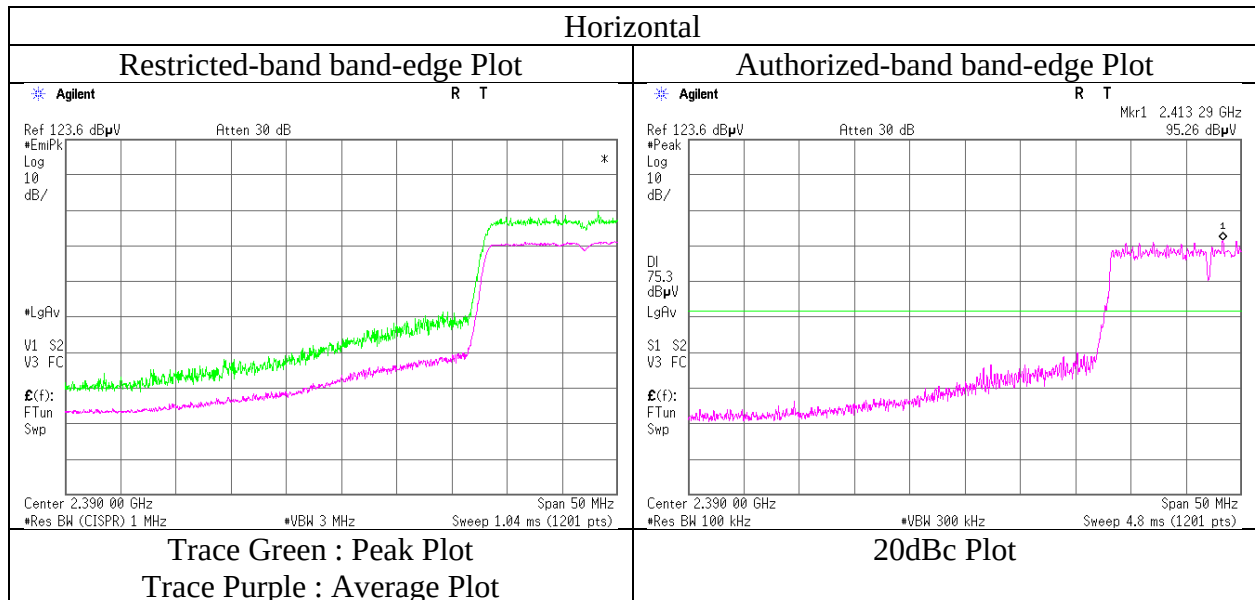
Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11434432H
Date : October 20, 2016
Temperature / Humidity : 22 deg. C / 73 % RH
Engineer : Hiroyuki Furutaka
Mode : Tx 11b 2462 MHz



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

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11434432H
Date	October 20, 2016
Temperature / Humidity	22 deg. C / 73 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx 11n-20 2412 MHz



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

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Ise EMC Lab.

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Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 11434432H
Date : October 20, 2016 October 20, 2016
Temperature / Humidity : 22 deg. C / 73 % RH 22 deg. C / 71 % RH
Engineer : Hiroyuki Furutaka Shinichi Miyazono
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode : Tx 11n-20 2437 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	4874.000	PK	42.8	31.7	7.6	34.1	-	48.0	73.9	25.9	Floor noise
Hori	7311.000	PK	43.2	36.3	8.5	34.1	-	53.9	73.9	20.0	Floor noise
Hori	9748.000	PK	43.9	38.5	9.2	34.8	-	56.8	73.9	17.1	Floor noise
Hori	4874.000	AV	34.7	31.7	7.6	34.1	-	39.9	53.9	14.0	Floor noise
Hori	7311.000	AV	34.8	36.3	8.5	34.1	-	45.5	53.9	8.4	Floor noise
Hori	9748.000	AV	35.0	38.5	9.2	34.8	-	47.9	53.9	6.0	Floor noise
Vert	4874.000	PK	42.8	31.7	7.6	34.1	-	48.0	73.9	25.9	Floor noise
Vert	7311.000	PK	43.3	36.3	8.5	34.1	-	54.0	73.9	19.9	Floor noise
Vert	9748.000	PK	43.6	38.5	9.2	34.8	-	56.5	73.9	17.4	Floor noise
Vert	4874.000	AV	35.2	31.7	7.6	34.1	-	40.4	53.9	13.5	Floor noise
Vert	7311.000	AV	34.6	36.3	8.5	34.1	-	45.3	53.9	8.6	Floor noise
Vert	9748.000	AV	34.8	38.5	9.2	34.8	-	47.7	53.9	6.2	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

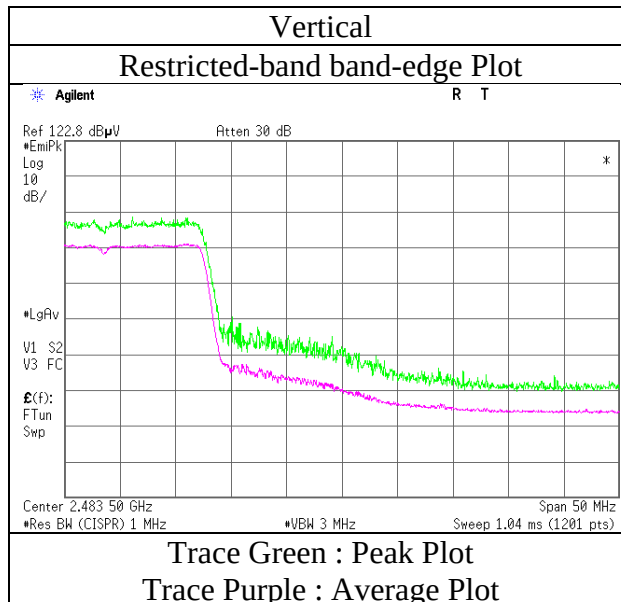
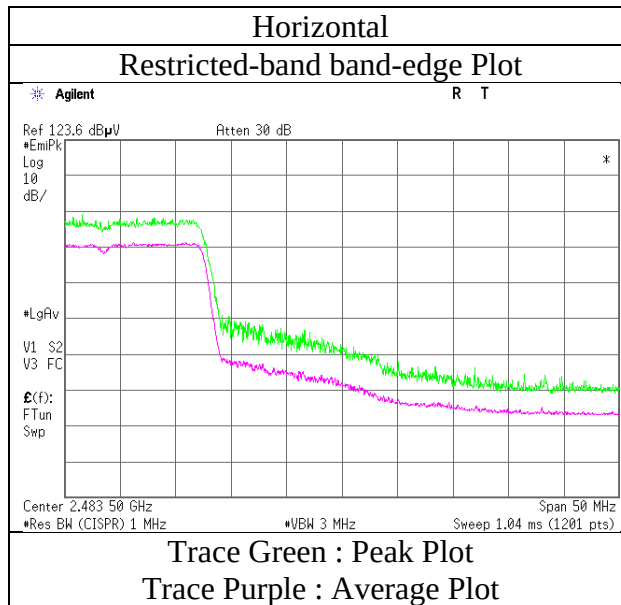
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Distance factor: 1 GHz - 10 GHz $20\log(3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$
 *1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11434432H
Date	October 20, 2016
Temperature / Humidity	22 deg. C / 73 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx 11n-20 2462 MHz



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

UL Japan, Inc.

Ise EMC Lab.

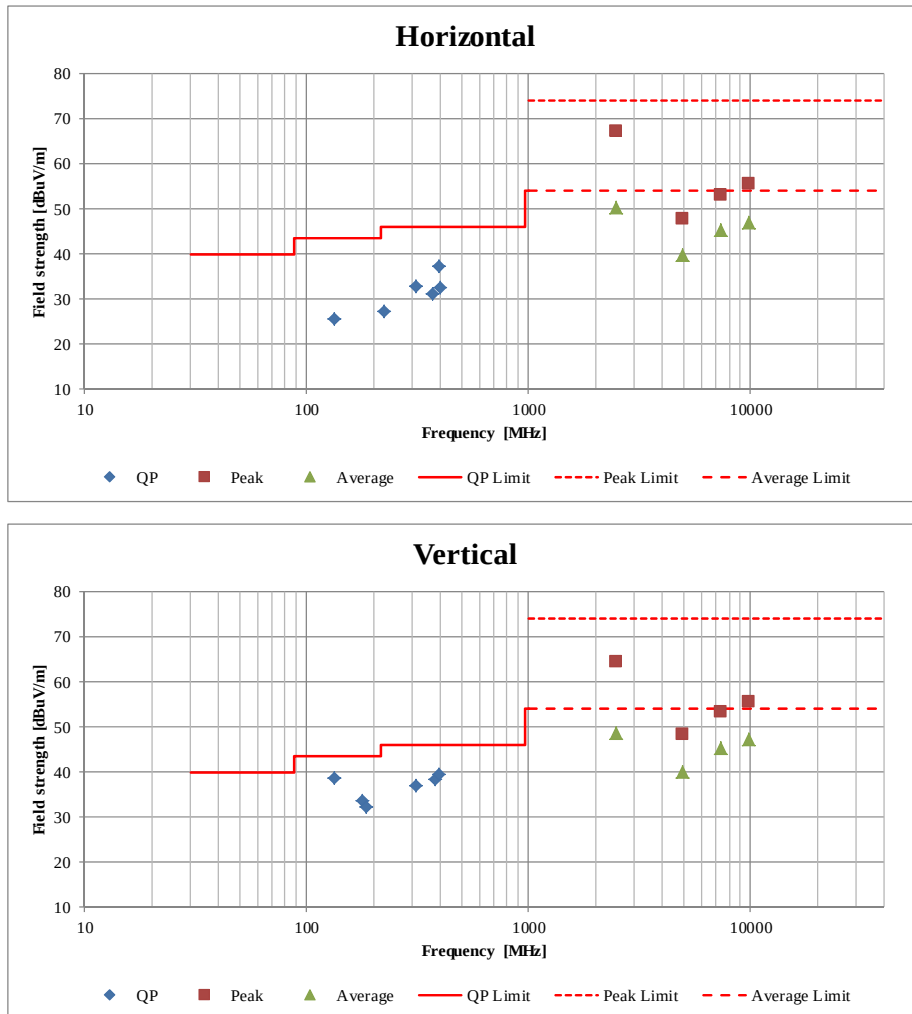
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Radiated Spurious Emission (Plot data, Worst case)

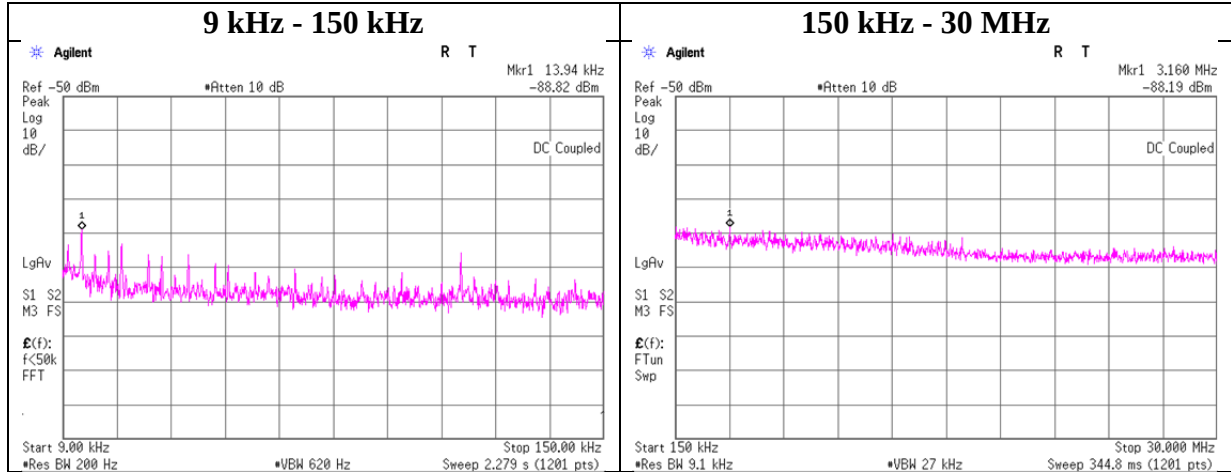
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber		
Report No.	11434432H		
Date	October 20, 2016	October 20, 2016	
Temperature / Humidity	22 deg. C / 73 % RH	22 deg. C / 71 % RH	
Engineer	Hiroyuki Furutaka	Shinichi Miyazono	
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	
Mode	Tx 11n-20 2462 MHz		



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

Conducted Spurious Emission

Test place	Ise EMC Lab. No.7 Shielded Room
Report No.	11434432H
Date	October 19, 2016
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx 11n-20 2462MHz



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
13.94	-88.8	0.86	9.8	2.0	1	-76.1	300	6.0	-14.9	44.7	59.6	
3160.00	-88.2	0.88	9.9	2.0	1	-77.4	30	6.0	3.9	29.5	25.7	

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

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

* N :Number of output

*If antenna gain is less than 2.0 dBi, 2.0 dBi is applied to the test result based on KDB 558074 12.2.6.

Power Density

Test place Ise EMC Lab. No.7 Shielded Room
Report No. 11434432H
Date October 19, 2016
Temperature / Humidity 23 deg. C / 56 % RH
Engineer Hiroyuki Furutaka
Mode Tx

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-19.00	2.24	10.09	-6.67	8.00	14.67
2437.00	-20.69	2.27	10.09	-8.33	8.00	16.33
2462.00	-20.38	2.28	10.09	-8.01	8.00	16.01

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-26.06	2.24	10.09	-13.73	8.00	21.73
2437.00	-25.90	2.27	10.09	-13.54	8.00	21.54
2462.00	-25.06	2.28	10.09	-12.69	8.00	20.69

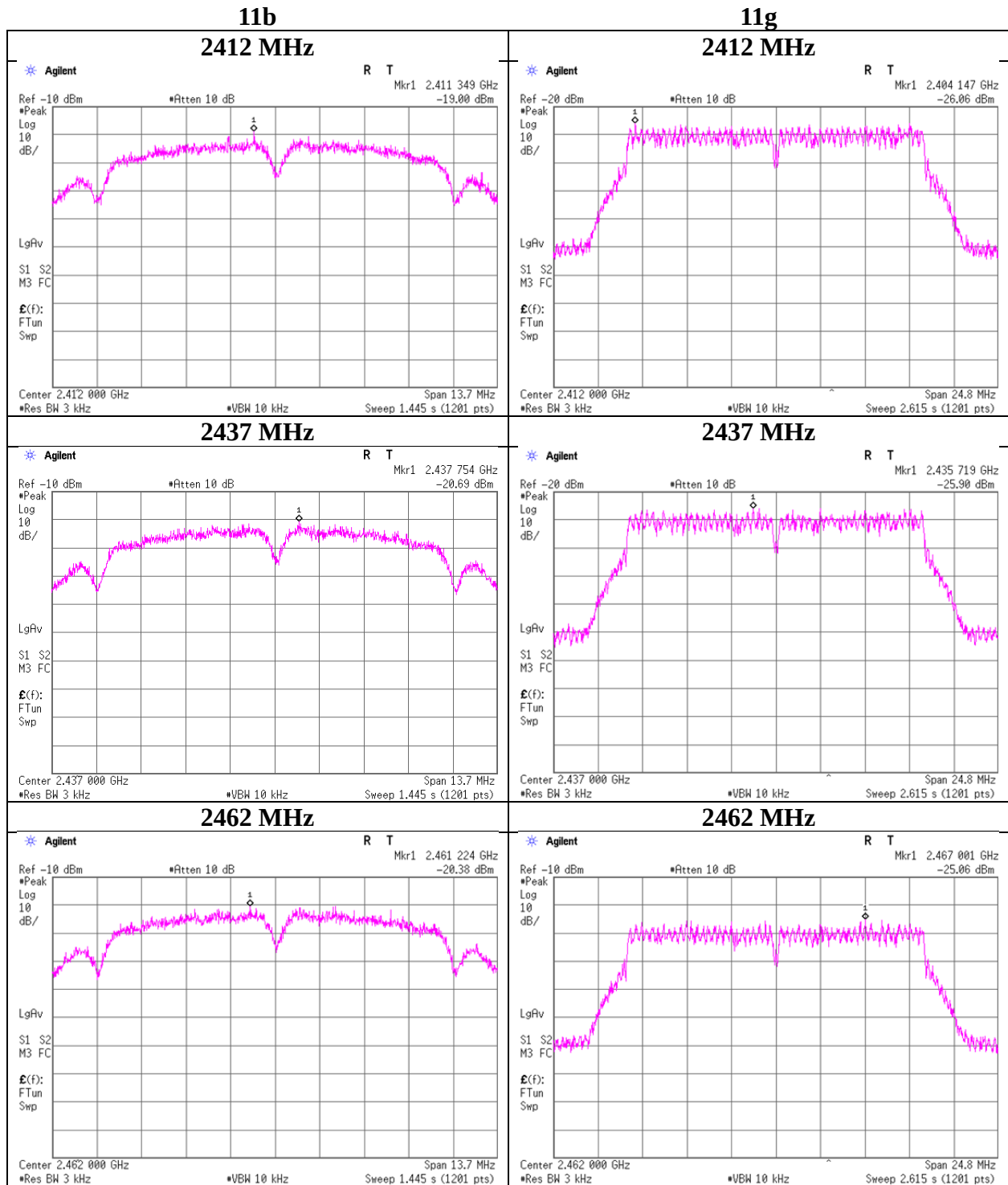
11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-25.81	2.24	10.09	-13.48	8.00	21.48
2437.00	-25.94	2.27	10.09	-13.58	8.00	21.58
2462.00	-25.34	2.28	10.09	-12.97	8.00	20.97

Sample Calculation:

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

Power Density



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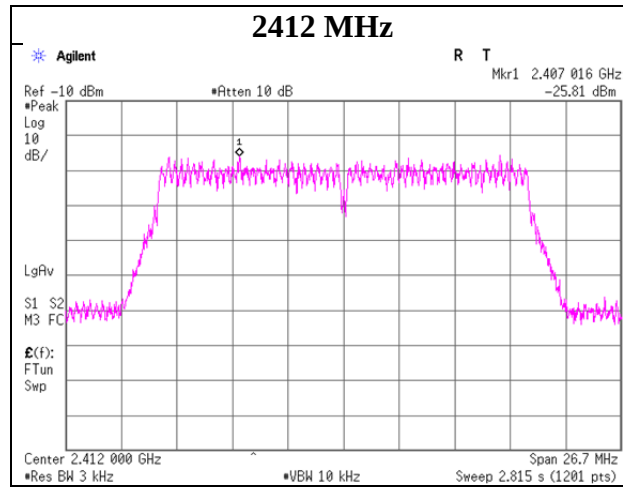
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

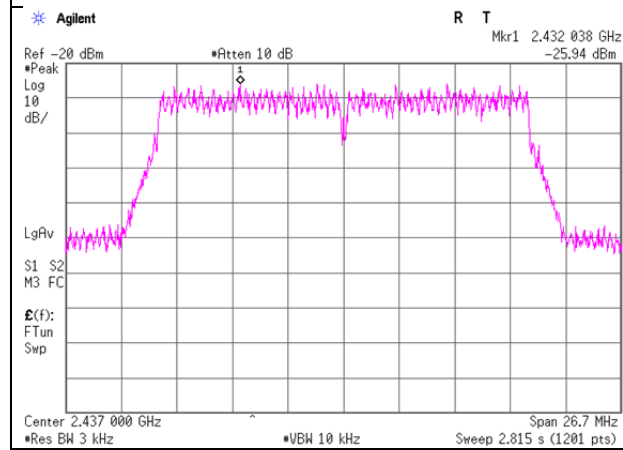
Power Density

11n-20

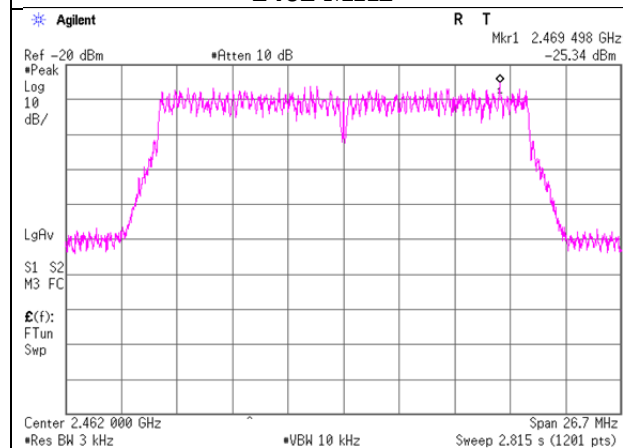
2412 MHz



2437 MHz



2462 MHz



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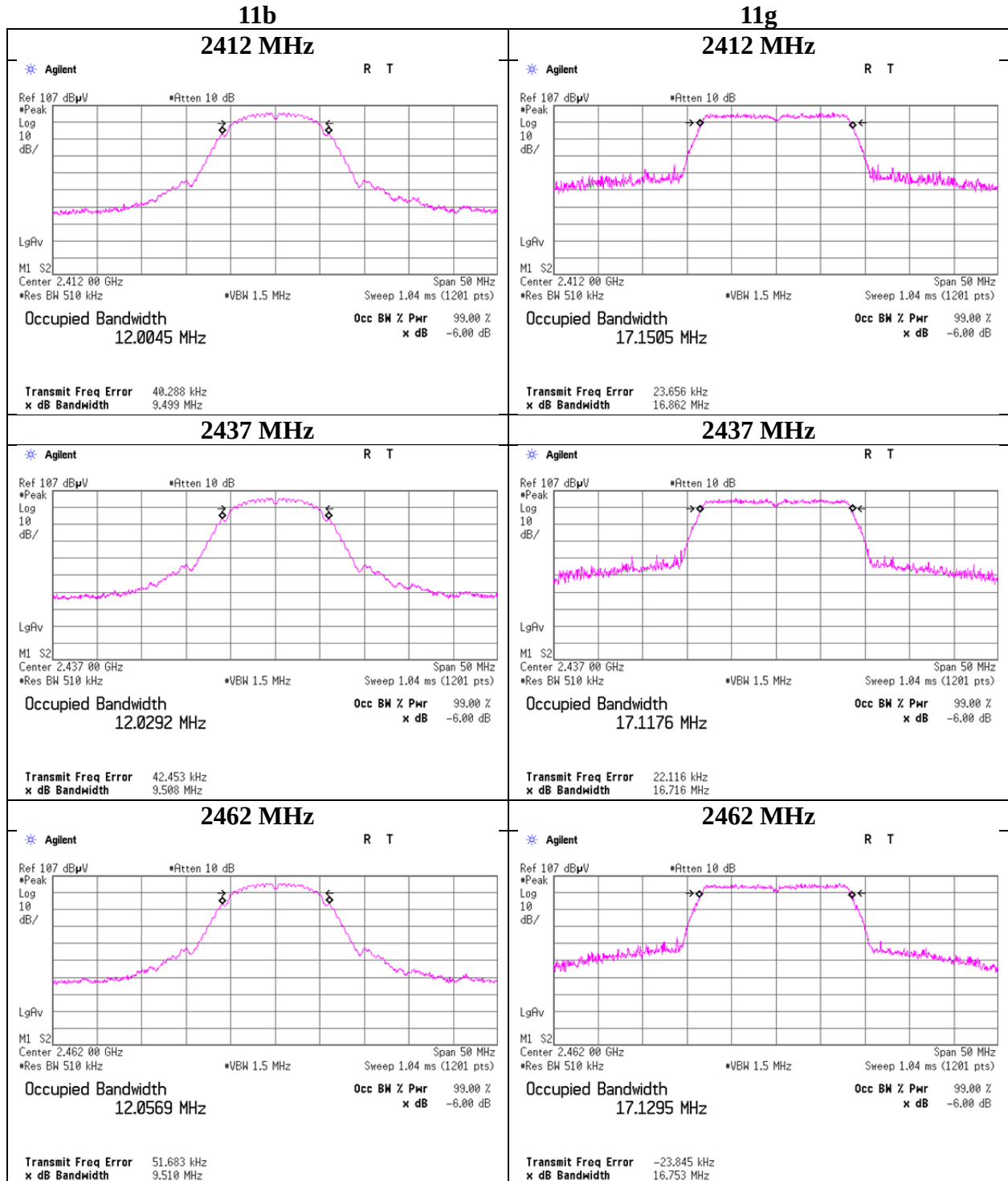
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99%Occupied Bandwidth

Test place
Report No.
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab. No.7 Shielded Room
11434432H
October 19, 2016
23 deg. C / 56 % RH
Hiroyuki Furutaka
Tx



UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

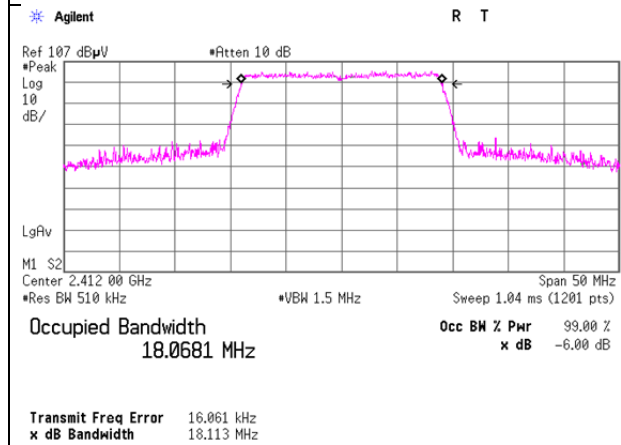
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

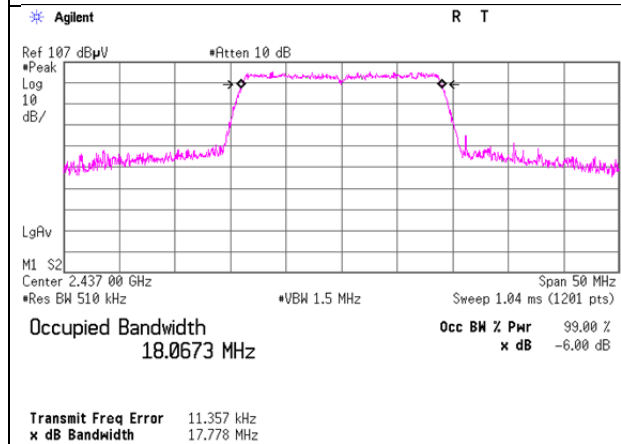
99% Occupied Bandwidth

11n-20

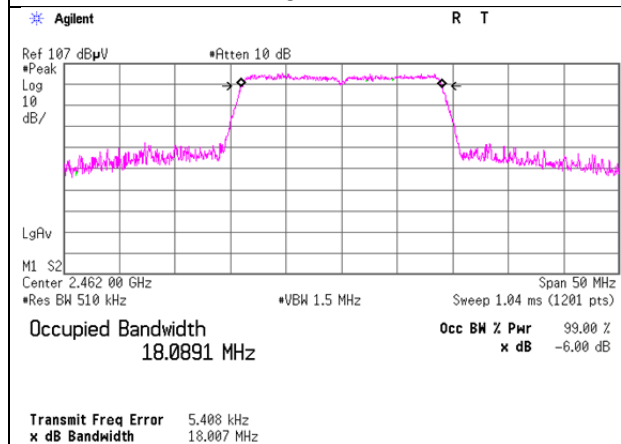
2412 MHz



2437 MHz



2462 MHz



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APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MPSE-22	Power sensor	Agilent	N1923A	MY54070003	AT	2016/04/07 * 12
MPM-16	Power Meter	Agilent	8990B	MY51000271	AT	2016/04/07 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2016/04/18 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2016/03/18 * 12
MRENT-126	Spectrum Analyzer	KEYSIGHT	E4440A	MY46185516	AT	2016/07/01 * 12
MOS-34	Thermo-Hygrometer	Custom	CTH-201	3401	AT	2016/01/21 * 12
MMM-16	DIGITAL HiTESTER	Hioki	3805	070900532	AT	2016/01/13 * 12
MCC-38	Coaxial Cable	UL Japan	-	-	AT	2015/12/07 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2015/11/10 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2016/01/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2016/05/19 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2016/02/29 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2016/08/29 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2016/01/19 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2016/08/23 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2016/09/19 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2016/02/29 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2016/09/15 * 12
MBA-08	Biconical Antenna	Schwarzbeck	VHA9103B	08031	RE	2016/09/29 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2016/01/30 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2016/02/08 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2015/11/10 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2016/09/13 * 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: RE: Radiated Emission test
AT: Antenna Terminal Conducted test**

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