



RADIO TEST REPORT

Test Report No. : 10007806H-F-R1

Applicant : FUJITSU TEN LIMITED
Type of Equipment : Car Navigation
Model No. : FT0054A
FCC ID : BABFT0054A
Test regulation : FCC Part 15 Subpart C: 2013
*WLAN part
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. 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 report is a revised version of 10007806H-F. 10007806H-F is replaced with this report.

Date of test: April 23 to May 16 and September 4, 2013

Representative test engineer:

Kazuya Yoshioka
Engineer of WiSE Japan,
UL Verification Service

Approved by:

Takahiro Hatakeda
Leader of WiSE Japan,
UL Verification Service



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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<http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

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13-EM-F0429

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SECTION 1: Customer information

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

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

2.1 Identification of E.U.T.

Type of Equipment : Car Navigation
Model No. : FT0054A
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 12.0V
Rated range : DC 10.5 to 16.0V
Receipt Date of Sample : April 20, 2013
Country of Mass-production : Mexico
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

General Specification

Clock frequency(ies) in the system : 792MHz

Radio Specification

[WLAN (IEEE802.11b/g/n-20)]

Radio Type : Transceiver
Frequency of Operation : 2412-2462MHz
Modulation : DSSS
Power Supply (radio part input) : DC 3.3V
Antenna type : Inverted F type Antenna
Antenna Gain : 0.49dBi

[Bluetooth (Ver. 3.0 with EDR function)]

Radio Type : Transceiver
Frequency of Operation : 2402-2480MHz
Modulation : FHSS
Power Supply (radio part input) : DC 3.3V
Antenna type : Inverted F type Antenna
Antenna Gain : 1.23dBi

[GPS]

Radio Type : Receiver
Frequency of Operation : 1575.42MHz
Modulation : CDMA
Power Supply (radio part input) : DC 4.5V
Antenna type : Dome Antenna
Antenna Gain : 26.5dBi

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2013, final revised on June 11, 2013 and effective July 11, 2013

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

* The revision on June 11, 2013 does not affect the test specification applied to the EUT.

*The EUT complies with FCC Part 15 Subpart B: 2012, final revised on December 27, 2012 and effective January 28, 2013.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.4:2003 7. AC powerline Conducted Emission measurements ----- IC: RSS-Gen 7.2.4	FCC: Section 15.207 IC: RSS-Gen 7.2.4	N/A	N/A *1)	-
6dB Bandwidth	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.6.2	FCC: Section 15.247(a)(2) IC: RSS-210 A8.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.8	FCC: Section 15.247(b)(3) IC: RSS-210 A8.4(4)		Complied	Conducted
Power Density	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: -	FCC: Section 15.247 (e) IC: RSS-210 A8.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.9	FCC: Section15.247(d) IC: RSS-210 A8.5 RSS-Gen 7.2.3	1.0dB 40.501MHz, QP, Vert.	Complied	Conducted/ Radiated

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.

* In case any questions arise about test procedure, ANSI C63.4: 2003 is also referred.

FCC 15.31 (e)

The EUT is a battery-operated device and test was performed with the full-charged battery. 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.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	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.

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(+dB)				(1m*)(+dB)		(0.5m*)(+dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.3dB	5.0dB	5.1dB	4.9dB	5.8dB	4.4dB	4.3dB
No.2	4.3dB	5.2dB	5.1dB	5.0dB	5.7dB	4.3dB	4.2dB
No.3	4.6dB	5.0dB	5.1dB	5.0dB	5.7dB	4.5dB	4.2dB
No.4	4.8dB	5.2dB	5.0dB	5.0dB	5.7dB	5.2dB	4.2dB

*3m/1m/0.5m = Measurement distance

Power meter (+dB)	
Below 1GHz	Above 1GHz
0.7dB	1.5dB

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.5dB	1.7dB	2.8dB	2.8dB	2.9dB	2.6dB

Radiated emission test(3m)

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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	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	313583	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.75 x 5.4 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 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 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

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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)	11Mbps, PN9
IEEE 802.11g (11g)	12Mbps, PN9
IEEE 802.11n 20MHz BW (11n-20)	MCS 2, 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: Same as production model Software: Diag. mode(Wi-Fi Auth mode) *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
6dB Bandwidth	11b Tx	2412MHz
Maximum Peak Output Power	11g Tx	2437MHz
Power Density	11n-20 Tx	2462MHz
99% Occupied Bandwidth		
Spurious Emission (Radiated above 1GHz)	11b Tx 11n-20 Tx *1)	2412MHz 2437MHz 2462MHz
Spurious Emission (Band Edge)	11b Tx 11n-20 Tx	2412MHz 2462MHz
Spurious Emission (Radiated below 1 GHz) Spurious Emission (Conducted)	11n-20 Tx *2)	2462MHz
*1) Since the 11g and 11n-20 has the same modulation, test was performed on 11g Tx mode which had the higher antenna conducted power. *2) The mode was tested as a representative, because it had the highest power at antenna terminal test.		

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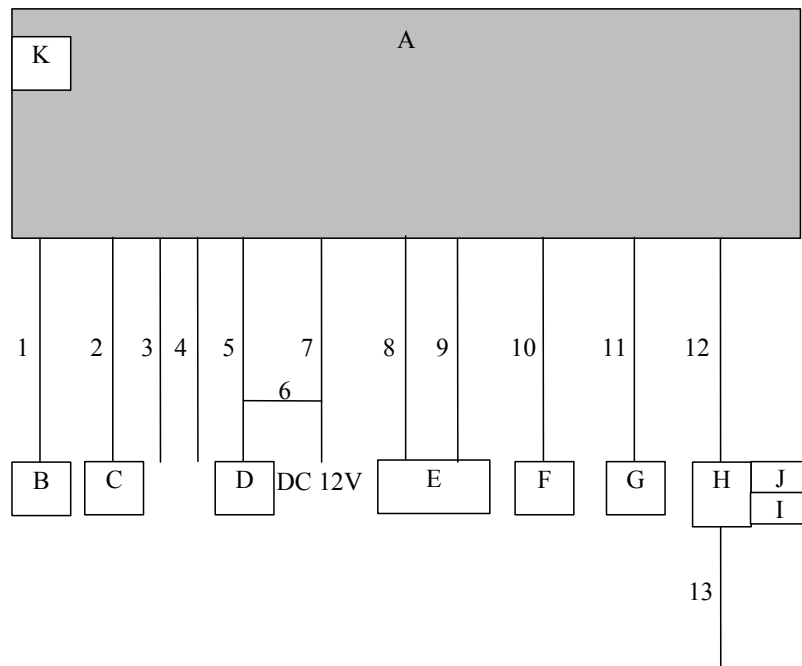
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4.2 Configuration and peripherals



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

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Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Car Navigation	FT0054A	22 *1) ----- 13 *2) ----- 21 *3)	FUJITSU TEN	EUT
B	GPS Antenna	86277AJ411	11310004	FUJITSU TEN	-
C	75Ω Dummy load	-	-	-	-
D	Mic	-	-	FUJITSU TEN	-
E	Dummy load	-	-	-	-
F	75Ω Dummy load	-	-	-	-
G	Camera	-	-	FUJITSU TEN	-
H	USB connector box	-	-	-	-
I	USB memory	MB-RUF2-4GB	3	BUFFALO	-
J	USB memory	MB-RUF2-4GB	4	BUFFALO	-
K	MicroSD Card	-	-	Panasonic	-

*1) Used for Spurious Emission (Radiated) test only

*2) Used for Band Edge measurement (2483.5MHz) of Spurious Emission (Radiated) test

*3) Used for all tests except for Spurious Emission (Radiated) test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	3.0	Shielded	Shielded	-
2	Signal Cable	5.2	Unshielded	Unshielded	-
3	Signal Cable	3.0	Unshielded	Unshielded	-
4	Signal Cable	3.0	Unshielded	Unshielded	-
5	Signal Cable	3.2	Unshielded	Unshielded	-
6	Signal Cable	1.3	Unshielded	Unshielded	-
7	DC Cable	4.0	Unshielded	Unshielded	-
8	Audio Cable	3.3	Unshielded	Unshielded	-
9	Audio Cable	3.3	Unshielded	Unshielded	-
10	Audio Cable	1.7	Unshielded	Unshielded	-
11	Signal Cable	12.0	Shielded	Shielded	-
12	Signal Cable	0.6	Unshielded	Unshielded	-
13	Signal Cable	1.5	Unshielded	Unshielded	-

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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 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)".

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

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

The height of the measuring antenna varied between 1 and 4m 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	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20dBc was applied to the frequency over the limit of FCC 15.209 / Table 5 of RSS-Gen 7.2.5(IC) and outside the restricted band of FCC15.205 / Table 3 of RSS-Gen 7.2.2 (IC).

Frequency	Below 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	Average Power Method: *2) RBW: 1MHz VBW: 3MHz Detector: Power Averaging (RMS) *3) Trace: Free Run	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m *1) (above 10GHz)		3m (below 10GHz), 1m *1) (above 10GHz)

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

*2) Average Power Measurement was performed based on 6.0 & 12.2.5 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)"

*3) Signal gating was used for testing on 11n-20 mode.

The test was made on EUT at the normal use position.

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

Measurement range : 30M-26.5GHz
Test data : APPENDIX
Test result : Pass

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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	20MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak / Average *1)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	1.5 times the 6dB bandwidth	3kHz	10kHz	Auto	Peak	Max Hold	Spectrum Analyzer *2)
Conducted Spurious Emission	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				
*1) Reference data							
*2) Section 10.2 Method PKPSD (peak PSD) of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)".							

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: Data of EMI test

6dB Bandwidth

Test place Head Office EMC Lab. No.6 Measurement Room
Report No. 10007806H
Date 05/02/2013
Temperature/ Humidity 18 deg. C / 43% RH
Engineer Takumi Shimada
Mode Tx

11b

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	9.604	>500
2437	9.604	>500
2462	9.606	>500

11g

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	16.301	>500
2437	16.320	>500
2462	16.374	>500

11n-20

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	16.897	>500
2437	16.908	>500
2462	16.979	>500

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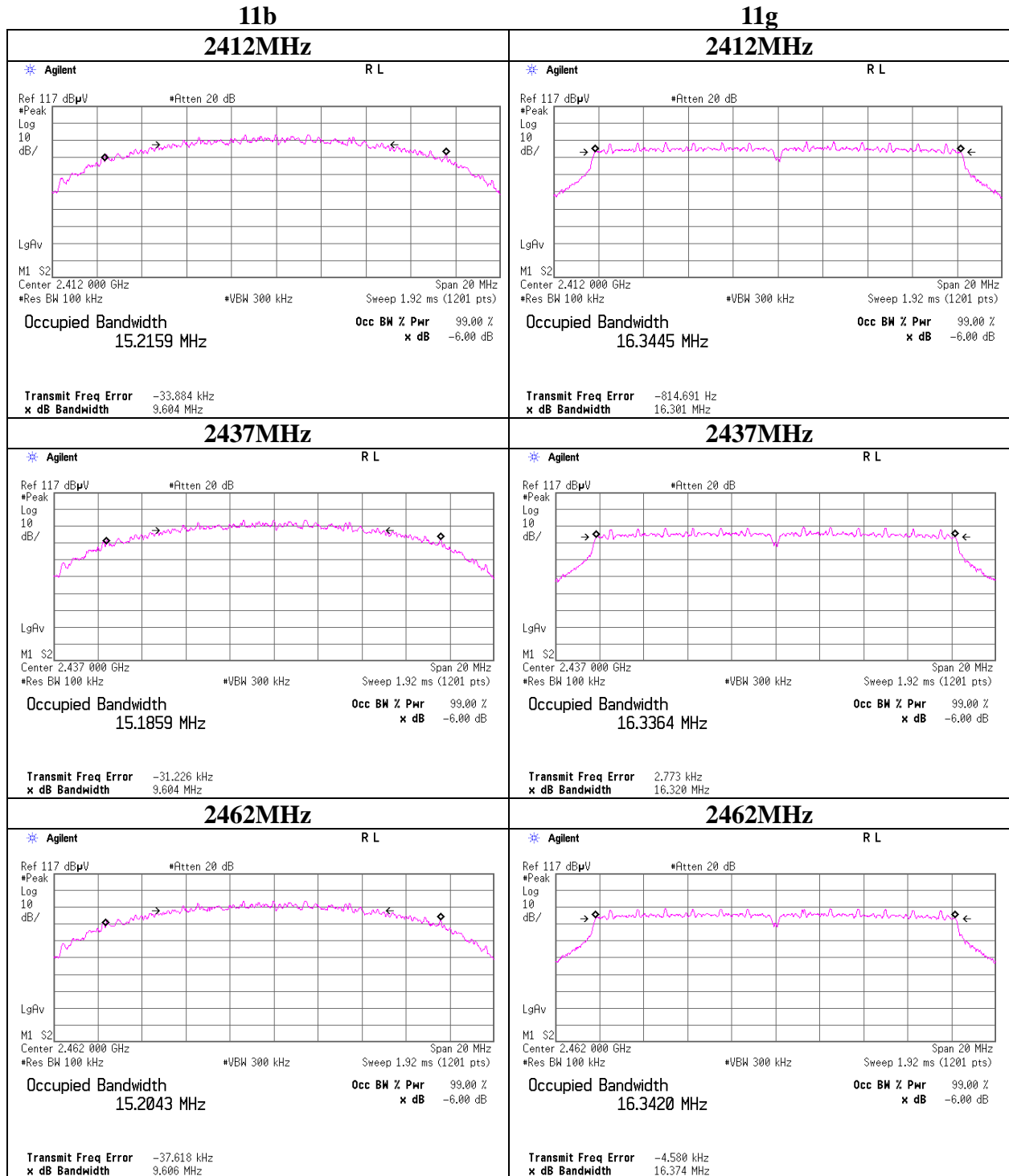
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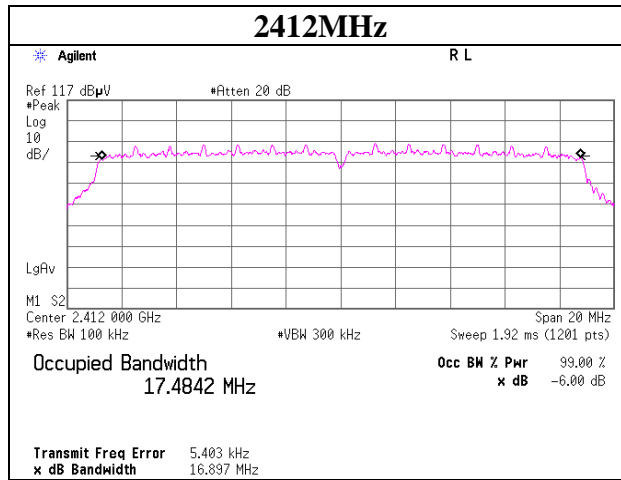
6dB Bandwidth



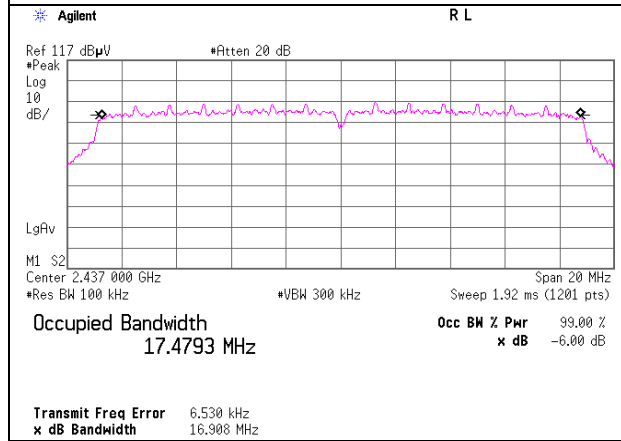
6dB Bandwidth

11n-20

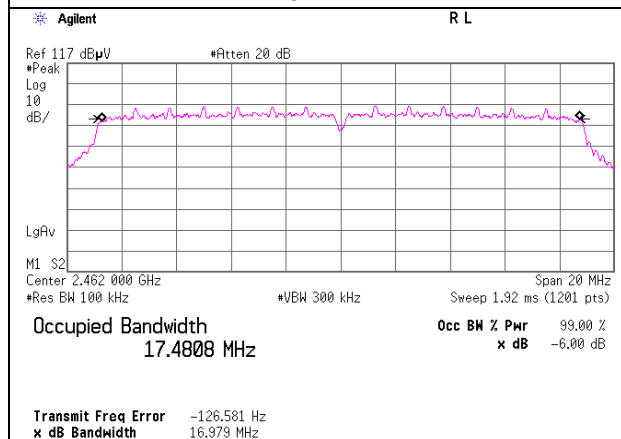
2412MHz



2437MHz



2462MHz



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Maximum Peak Output Power

Test place : Head Office EMC Lab. No.11 Measurement Room
Report No. : 10007806H
Date : 04/23/2013
Temperature/ Humidity : 25 deg. C / 37% RH
Engineer : Kazuya Yoshioka
Mode : 11n-20 Tx

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	9.28	1.59	9.95	20.82	120.89	30.00	1000	9.18
2437	9.54	1.59	9.95	21.08	128.35	30.00	1000	8.92
2462	9.81	1.59	9.95	21.35	136.58	30.00	1000	8.65

Sample Calculation:

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

11n-20, 2437MHz

Rate [MCS]	Guard Interval	Reading [dBm]	Remark
0	Long	9.44	
1	Long	9.30	
2	Long	9.54	*
3	Long	9.17	
4	Long	9.21	
5	Long	8.24	
6	Long	8.58	
7	Long	8.45	
0	Shrot	9.43	
1	Shrot	9.32	
2	Shrot	9.51	
3	Shrot	9.15	
4	Shrot	8.96	
5	Shrot	8.34	
6	Shrot	8.51	
7	Shrot	8.48	

*: Worst Rate

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

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Average Output Power
 (for reporting purpose only)

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10007806H
Date	04/23/2013
Temperature/ Humidity	25 deg. C / 37% RH
Engineer	Kazuya Yoshioka
Mode	11b / 11g Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	2.90	1.59	9.95	14.44	27.82	30.00	1000	15.56
2437	3.15	1.59	9.95	14.69	29.47	30.00	1000	15.31
2462	3.05	1.59	9.95	14.59	28.80	30.00	1000	15.41

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	1.03	1.59	9.95	12.57	18.09	30.00	1000	17.43
2437	1.25	1.59	9.95	12.79	19.03	30.00	1000	17.21
2462	1.31	1.59	9.95	12.85	19.29	30.00	1000	17.15

11n20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	0.80	1.59	9.95	12.34	17.15	30.00	1000	17.66
2437	0.97	1.59	9.95	12.51	17.84	30.00	1000	17.49
2462	1.14	1.59	9.95	12.68	18.55	30.00	1000	17.32

Sample Calculation:

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

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Radiated Spurious Emission

Test place : Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10007806H
Date : 05/15/2013
Temperature/ Humidity : 26 deg. C / 37% RH
Engineer : Satofumi Matsuyama
(Above 1GHz)
Mode : 11b Tx 2412MHz

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	66.7	26.8	2.4	35.7	-	60.2	73.9	13.7	
Hori	4824.000	PK	55.0	30.7	4.3	34.9	-	55.1	73.9	18.8	
Hori	7236.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	9648.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	2390.000	AV	49.2	26.8	2.4	35.7	-	42.7	53.9	11.2	
Hori	4824.000	AV	48.0	30.7	4.3	34.9	-	48.1	53.9	5.8	
Hori	7236.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	9648.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	2390.000	PK	65.7	26.8	2.4	35.7	-	59.2	73.9	14.7	
Vert	4824.000	PK	54.2	30.7	4.3	34.9	-	54.3	73.9	19.6	
Vert	7236.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	9648.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	2390.000	AV	48.2	26.8	2.4	35.7	-	41.7	53.9	12.2	
Vert	4824.000	AV	46.7	30.7	4.3	34.9	-	46.8	53.9	7.1	
Vert	7236.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	9648.000	AV	NS	-	-	-	-	-	53.9	-	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

NS: No Signal Detect

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

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	101.0	26.8	2.4	35.7	94.5	-	-	Carrier
Hori	2400.000	PK	57.4	26.8	2.4	35.7	50.9	74.5	23.6	
Vert	2412.000	PK	99.5	26.8	2.4	35.7	93.0	-	-	Carrier
Vert	2400.000	PK	55.6	26.8	2.4	35.7	49.1	73.0	23.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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Radiated Spurious Emission

Test place : Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10007806H
Date : 05/15/2013
Temperature/ Humidity : 26 deg. C / 37% RH
Engineer : Satofumi Matsuyama
(Above 1GHz)
Mode : 11b Tx 2437MHz

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	51.6	30.8	4.2	34.9	-	51.7	73.9	22.2	
Hori	7311.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	9748.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	4874.000	AV	44.3	30.8	4.2	34.9	-	44.4	53.9	9.5	
Hori	7311.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	9748.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	4874.000	PK	50.2	30.8	4.2	34.9	-	50.3	73.9	23.6	
Vert	7311.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	9748.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	4874.000	AV	42.9	30.8	4.2	34.9	-	43.0	53.9	10.9	
Vert	7311.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	9748.000	AV	NS	-	-	-	-	-	53.9	-	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

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

NS: No Signal Detect

UL Japan, Inc.

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Radiated Spurious Emission

Test place Head Office EMC Lab. No.2 and 1 Semi Anechoic Chamber
Report No. 10007806H
Date 05/15/2013 09/04/2013
Temperature/ Humidity 26 deg. C / 37% RH 24 deg. C / 53% RH
Engineer Satofumi Matsuyama Satofumi Matsuyama
(Above 1GHz) (Band Edge)
Mode 11b Tx 2462MHz

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	72.4	26.5	2.6	37.0	-	64.5	73.9	9.4	
Hori	4924.000	PK	48.6	31.0	4.2	34.9	-	48.9	73.9	25.0	
Hori	7386.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	9848.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	2483.500	AV	55.7	26.5	2.6	37.0	-	47.8	53.9	6.1	
Hori	4924.000	AV	40.7	31.0	4.2	34.9	-	41.0	53.9	12.9	
Hori	7386.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	9848.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	2483.500	PK	70.9	26.5	2.6	37.0	-	63.0	73.9	10.9	
Vert	4924.000	PK	47.4	31.0	4.2	34.9	-	47.7	73.9	26.2	
Vert	7386.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	9848.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	2483.500	AV	50.1	26.5	2.6	37.0	-	42.2	53.9	11.7	
Vert	4924.000	AV	39.7	31.0	4.2	34.9	-	40.0	53.9	13.9	
Vert	7386.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	9848.000	AV	NS	-	-	-	-	-	53.9	-	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m) = 9.5dB$

NS: No Signal Detect

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Radiated Spurious Emission

Test place : Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10007806H
Date : 05/15/2013
Temperature/ Humidity : 26 deg. C / 37% RH
Engineer : Satofumi Matsuyama
(Above 1GHz)
Mode : 11n-20 Tx 2412MHz

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	65.8	26.8	2.4	35.7	-	59.3	73.9	14.6	
Hori	4824.000	PK	51.3	30.7	4.3	34.9	-	51.4	73.9	22.5	
Hori	7236.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	9648.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	2390.000	AV	55.1	26.8	2.4	35.7	-	48.6	53.9	5.3	
Hori	4824.000	AV	42.3	30.7	4.3	34.9	-	42.4	53.9	11.5	
Hori	7236.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	9648.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	2390.000	PK	65.1	26.8	2.4	35.7	-	58.6	73.9	15.3	
Vert	4824.000	PK	50.7	30.7	4.3	34.9	-	50.8	73.9	23.1	
Vert	7236.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	9648.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	2390.000	AV	52.5	26.8	2.4	35.7	-	46.0	53.9	7.9	
Vert	4824.000	AV	41.7	30.7	4.3	34.9	-	41.8	53.9	12.1	
Vert	7236.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	9648.000	AV	NS	-	-	-	-	-	53.9	-	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

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

NS: No Signal Detect

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	96.0	26.8	2.4	35.7	89.5	-	-	Carrier
Hori	2400.000	PK	62.0	26.8	2.4	35.7	55.5	69.5	14.0	
Vert	2412.000	PK	95.3	26.8	2.4	35.7	88.8	-	-	Carrier
Vert	2400.000	PK	60.6	26.8	2.4	35.7	54.1	68.8	14.7	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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Radiated Spurious Emission

Test place : Head Office EMC Lab. No.2 and 1 Semi Anechoic Chamber
Report No. : 10007806H
Date : 05/15/2013 05/16/2013 09/04/2013
Temperature/ Humidity : 26 deg. C / 37% RH 23 deg. C / 52% RH 24 deg. C / 53% RH
Engineer : Satofumi Matsuyama Katsunori Okai Satofumi Matsuyama
(Above 1GHz) (30-1000MHz) (Band Edge)
Mode : 11n-20 Tx 2462MHz

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	98.998	QP	33.3	9.9	7.4	28.3	-	22.3	43.5	21.2	
Hori	111.025	QP	34.2	11.7	7.6	28.3	-	25.2	43.5	18.3	
Hori	296.996	QP	29.2	19.6	8.8	27.6	-	30.0	46.0	16.0	
Hori	336.060	QP	24.9	15.3	9.0	27.9	-	21.3	46.0	24.7	
Hori	395.995	QP	33.8	17.3	9.3	28.4	-	32.0	46.0	14.0	
Hori	399.813	QP	30.7	17.4	9.3	28.4	-	29.0	46.0	17.0	
Hori	408.369	QP	32.7	17.4	9.3	28.4	-	31.0	46.0	15.0	
Hori	2483.500	PK	66.9	26.5	2.6	37.0	-	59.0	73.9	14.9	
Hori	4924.000	PK	45.8	31.0	4.2	34.9	-	46.1	73.9	27.8	
Hori	7386.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	9848.000	PK	NS	-	-	-	-	-	73.9	-	
Hori	2483.500	AV	57.3	26.5	2.6	37.0	-	49.4	53.9	4.5	
Hori	4924.000	AV	37.3	31.0	4.2	34.9	-	37.6	53.9	16.3	
Hori	7386.000	AV	NS	-	-	-	-	-	53.9	-	
Hori	9848.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	40.501	QP	46.4	14.3	6.9	28.6	-	39.0	40.0	1.0	
Vert	60.000	QP	35.8	8.0	7.1	28.6	-	22.3	40.0	17.7	
Vert	111.025	QP	35.4	11.7	7.6	28.3	-	26.4	43.5	17.1	
Vert	185.044	QP	31.7	16.3	8.1	27.9	-	28.2	43.5	15.3	
Vert	199.906	QP	32.1	16.6	8.1	27.8	-	29.0	43.5	14.5	
Vert	296.996	QP	28.3	19.6	8.8	27.6	-	29.1	46.0	16.9	
Vert	333.078	QP	34.7	15.2	9.0	27.9	-	31.0	46.0	15.0	
Vert	383.620	QP	29.2	16.9	9.2	28.3	-	27.0	46.0	19.0	
Vert	408.370	QP	31.4	17.4	9.3	28.4	-	29.7	46.0	16.3	
Vert	481.113	QP	33.3	17.9	9.6	28.7	-	32.1	46.0	13.9	
Vert	2483.500	PK	67.4	26.5	2.6	37.0	-	59.5	73.9	14.4	
Vert	4924.000	PK	44.4	31.0	4.2	34.9	-	44.7	73.9	29.2	
Vert	7386.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	9848.000	PK	NS	-	-	-	-	-	73.9	-	
Vert	2483.500	AV	58.1	26.5	2.6	37.0	-	50.2	53.9	3.7	
Vert	4924.000	AV	38.1	31.0	4.2	34.9	-	38.4	53.9	15.5	
Vert	7386.000	AV	NS	-	-	-	-	-	53.9	-	
Vert	9848.000	AV	NS	-	-	-	-	-	53.9	-	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

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

NS: No Signal Detect

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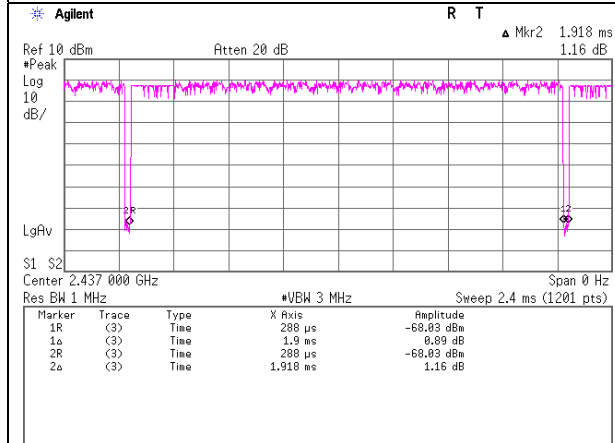
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Burst rate confirmation

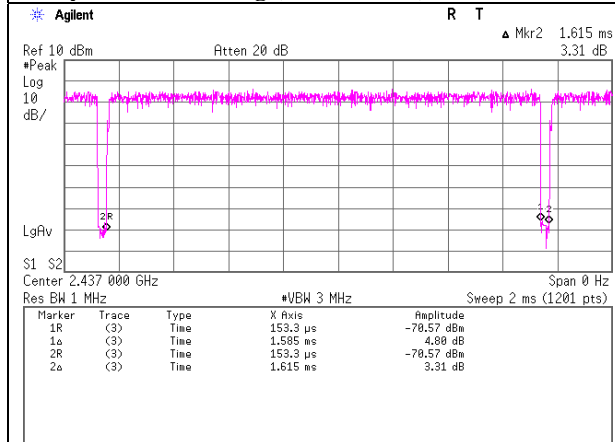
11b 11Mbps

Tx on / (Tx on + Tx off) = 0.991
Tx on / (Tx on + Tx off) * 100 = 99.1 %
Duty factor = 10 * log (1.918 / 1.9) = 0.04 dB



11g 12Mbps

Tx on / (Tx on + Tx off) = 0.981
Tx on / (Tx on + Tx off) * 100 = 98.1 %
Duty factor = 10 * log (1.615 / 1.585) = 0.08 dB



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Head Office EMC Lab.

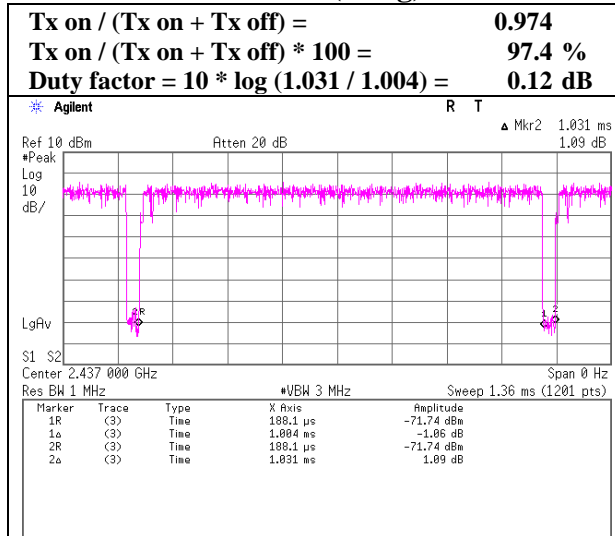
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Burst rate confirmation

11n MCS2(Long)



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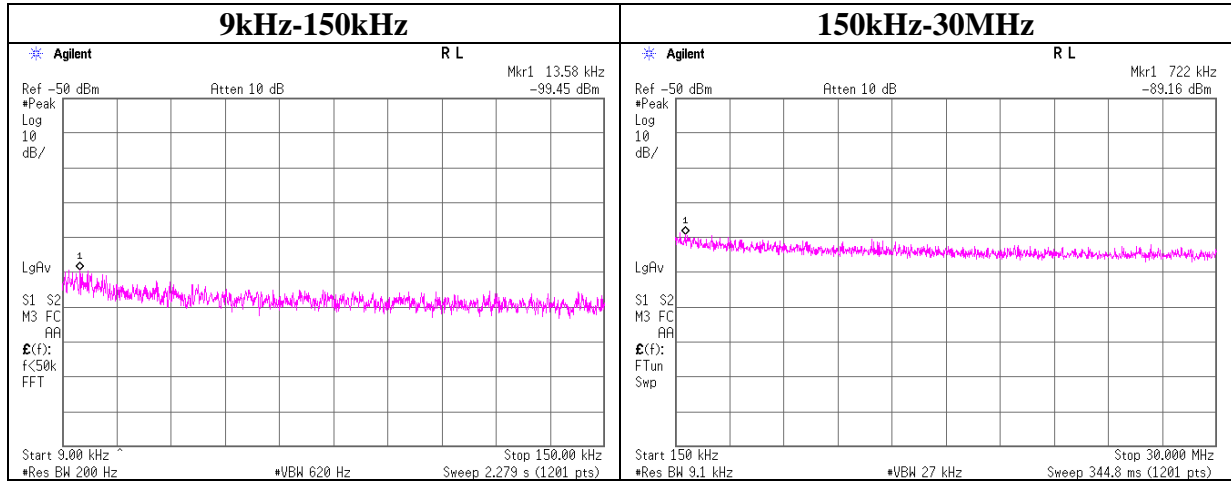
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Conducted Spurious Emission

11n-20 Tx 2462MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
13.58	-99.5	0.01	10.0	0.5	-89.0	300.0	6.0	-27.7	44.9
722	-89.2	0.01	10.0	0.5	-78.7	30.0	6.0	2.6	29.5

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$
 $\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain}$

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Power Density

Test place Head Office EMC Lab. No.6 shielded room
Report No. 10007806H
Date 05/02/2013
Temperature/ Humidity 18 deg. C / 43% RH
Engineer Takumi Shimada
Mode 11b Tx / 11g Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-20.58	2.60	9.95	-8.03	8.00	16.03
2437.00	-20.11	2.60	9.95	-7.56	8.00	15.56
2462.00	-20.23	2.61	9.95	-7.67	8.00	15.67

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-26.40	2.60	9.95	-13.85	8.00	21.85
2437.00	-27.50	2.60	9.95	-14.95	8.00	22.95
2462.00	-25.74	2.61	9.95	-13.18	8.00	21.18

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

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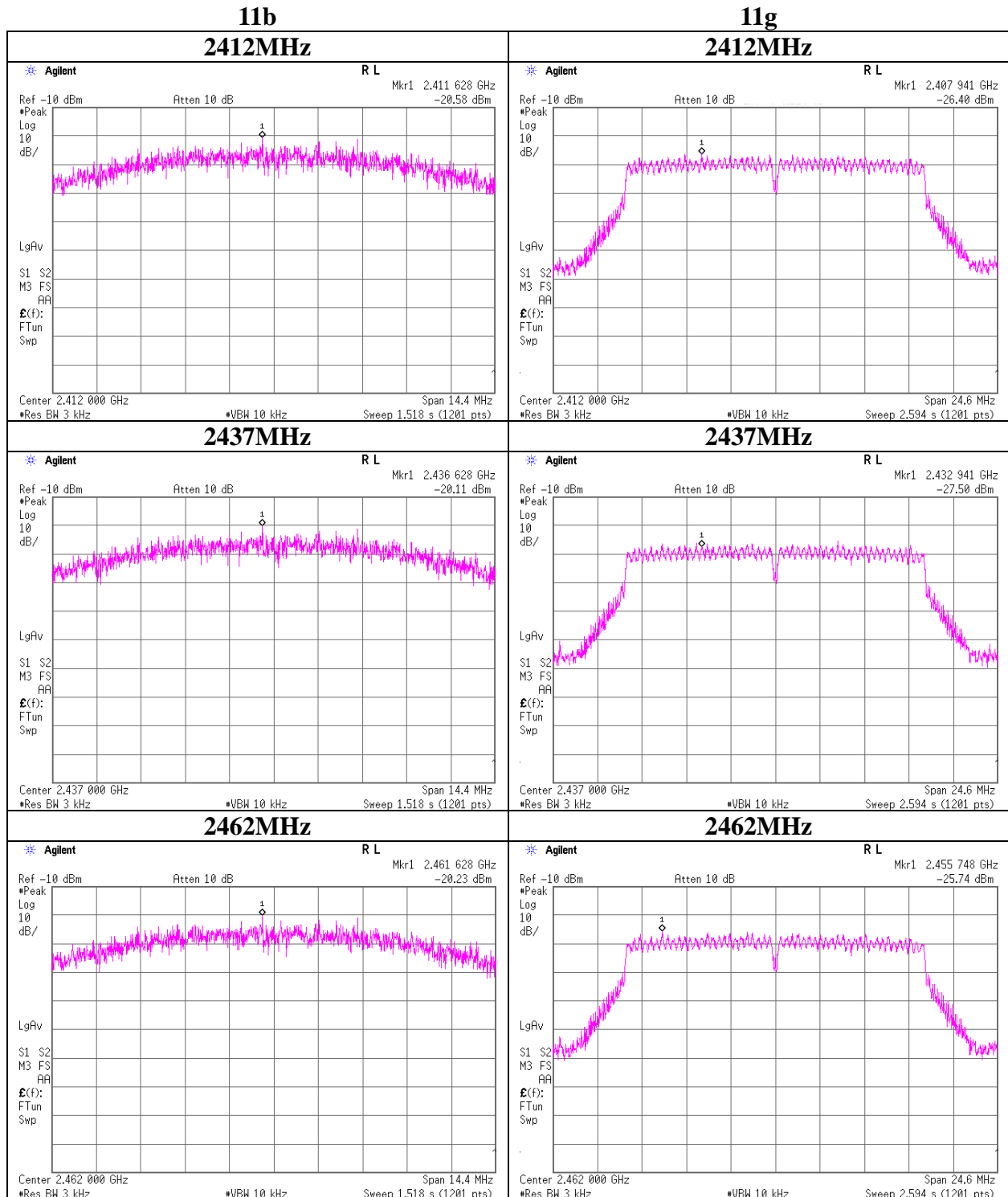
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Power Density



Power Density

Test place Head Office EMC Lab. No.6 shielded room
Report No. 10007806H
Date 05/02/2013
Temperature/ Humidity 18 deg. C / 43% RH
Engineer Takumi Shimada
Mode 11n-20 Tx

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-27.01	2.60	9.95	-14.46	8.00	22.46
2437.00	-26.31	2.60	9.95	-13.76	8.00	21.76
2462.00	-26.00	2.61	9.95	-13.44	8.00	21.44

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

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Head Office EMC Lab.

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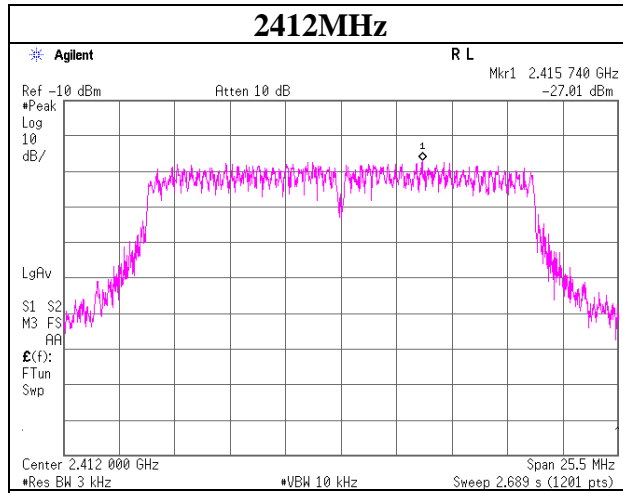
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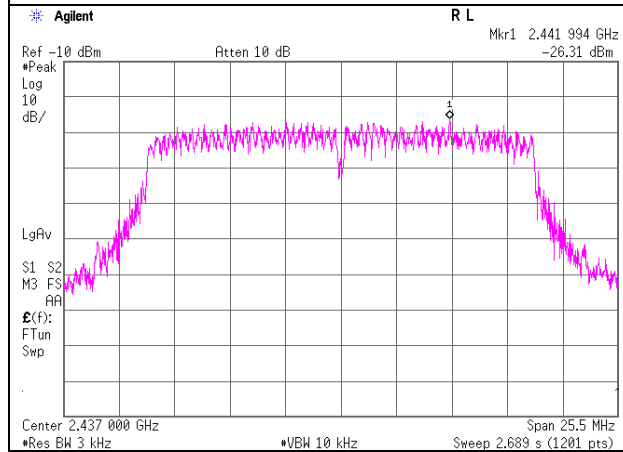
Power Density

11n-20

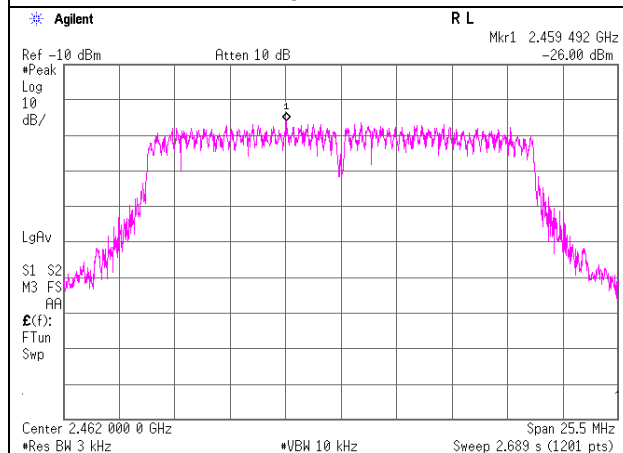
2412MHz



2437MHz



2462MHz



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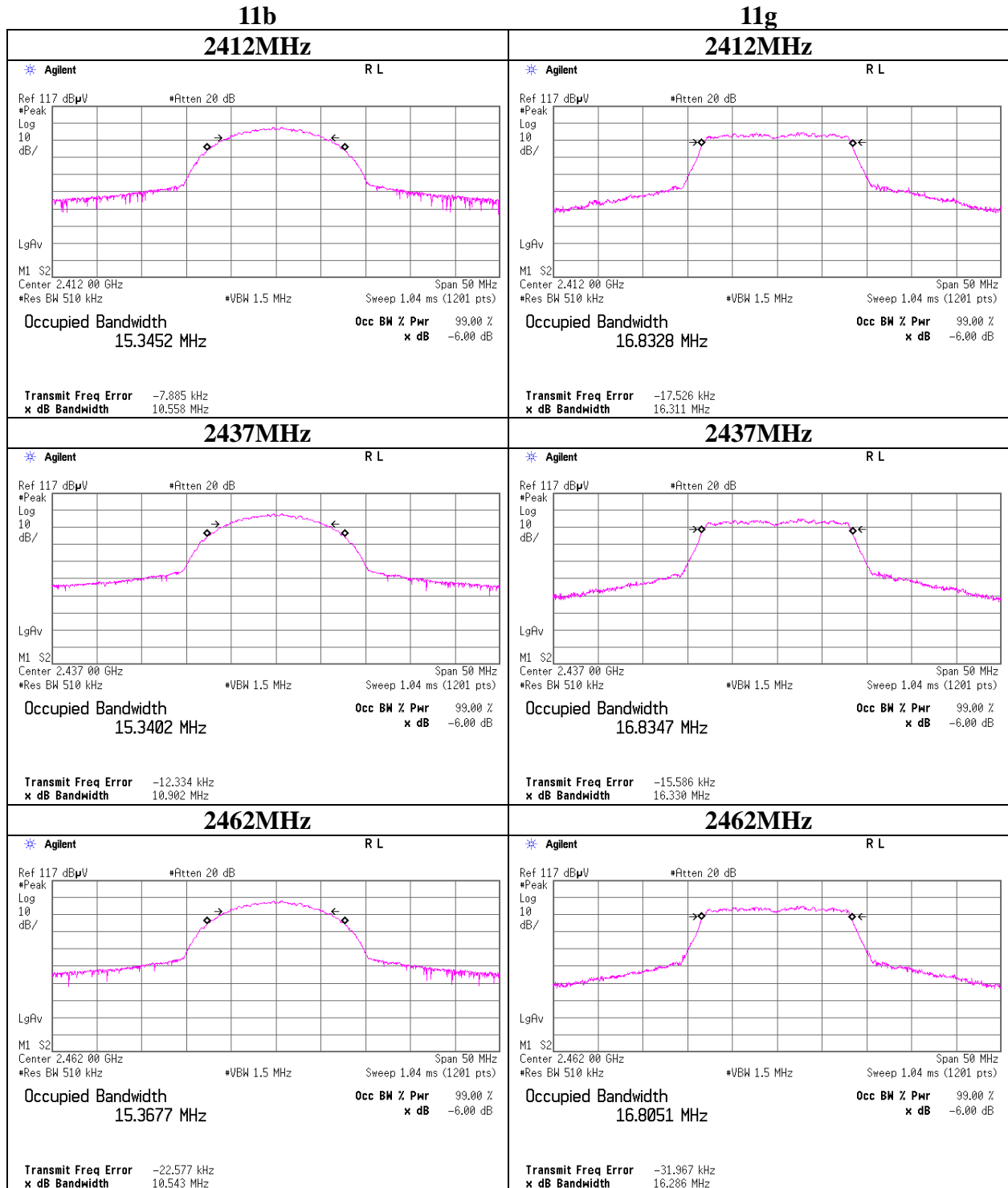
Head Office EMC Lab.

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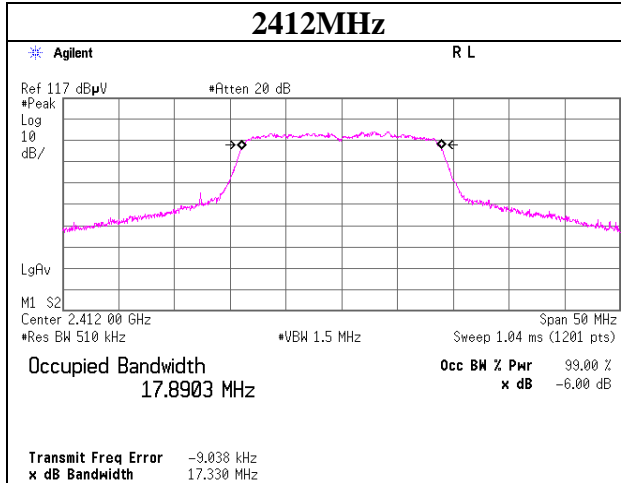
99%Occupied Bandwidth



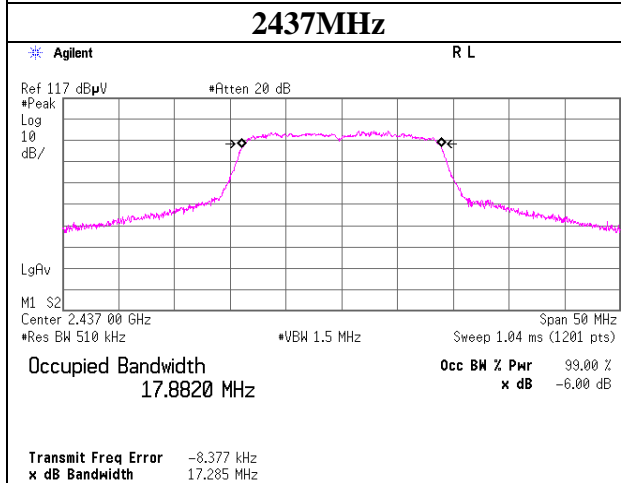
99% Occupied Bandwidth

11n-20

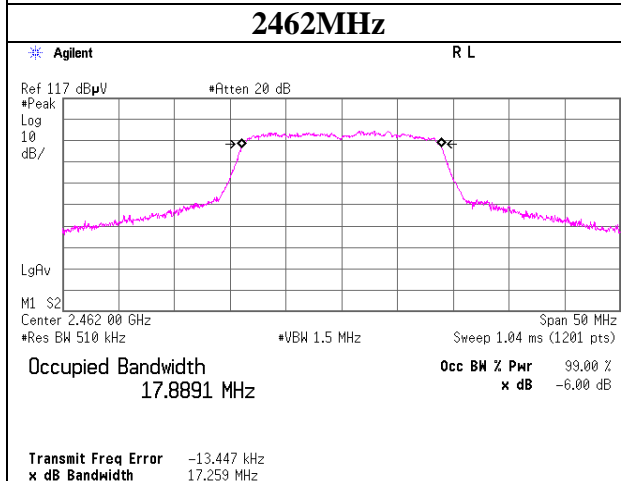
2412MHz



2437MHz



2462MHz



APPENDIX 2: Test instruments

EMI test equipment (1/2) (Used for April 23 to May 16, 2013)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MRENT-95	Spectrum Analyzer	Agilent	E4440A	MY46185823	AT	2012/06/19 * 12
MCC-99	Microwave Cable 1G-40GHz	Schner	SUCOFLEX102	30820/2	AT	2012/05/09 * 12
MAT-24	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71389	AT	2012/06/27 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2012/12/25 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2012/06/01 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2012/06/01 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	-	AT	2013/02/26 * 12
MCC-137	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37954/2	AT	2012/10/19 * 12
MAT-24	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71389	AT	2012/06/27 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2013/02/22 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2012/06/29 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2013/02/26 * 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	2012/11/20 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2013/02/15 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2013/01/10 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2013/02/15 * 12
MCC-132	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336161/4(1m) / 340639(5m)	RE	2012/09/05 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2012/05/30 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2013/04/10 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2012/10/08 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2012/10/08 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2013/02/06 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2012/11/06 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2012/09/11 * 12

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EMI test equipment (2/2) (Used for September 4, 2013)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2013/08/01 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2013/02/26 * 12
MJM-01	Measure	KDS	ES19-55	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MHA-05	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	253	RE	2013/05/13 * 12
MCC-142	Microwave Cable	Junkosha	MWX221	1203S213(1m) / 1204S063(5m)	RE	2013/04/19 * 12
MPA-01	Pre Amplifier	Agilent	8449B	3008A01671	RE	2013/02/22 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2013/04/03 * 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

AT: Antenna Terminal Conducted test

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