



RADIO TEST REPORT

Test Report No. : 32EE0038-HO-A-R1

Applicant : **Furuno USA Inc**
Type of Equipment : **Wireless LAN module**
Model No. : **WLAN-USB-01**
FCC ID : **ADB9ZW19P1079**
Test regulation : **FCC Part 15 Subpart C: 2011**
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. 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 32EE0038-HO-A. 32EE0038-HO-A is replaced with this report.

Date of test: November 28 to December 8, 2011

Representative test engineer:

T. Shimada

Takumi Shimada
Engineer of WiSE Japan,
UL Verification Service

Approved by:

T. Hatakeda

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. *As for the range of Accreditation in NVLAP, you may refer to the WEB address, <http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

UL Japan, Inc.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

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SECTION 1: Customer information

Company Name : Furuno Electric Co.,LTD
Address : 9-52 Ashihara-cho, Nishinomiya, Hyogo, 662-8580, Japan
Telephone Number : +81-798-63-1052
Contact Person : Norimasa Michiue

*Remarks: Furuno USA Inc designates Furuno Electric Co., LTD as manufacturer of Wireless LAN module (WLAN-USB-01).

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

2.1 Identification of E.U.T.

Type of Equipment : Wireless LAN module
Model No. : WLAN-USB-01
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC5.0V
Receipt Date of Sample : November 24, 2011
Country of Mass-production : Japan
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 : XTAL: 40MHz

Radio Specification

WLAN 11b/g/n-20

Radio Type : Transceiver
Frequency of Operation : 2412-2462MHz
Modulation : 11b:DSSS, 11g/n-20: OFDM
Power Supply (radio part input) : DC 3.3V
Antenna type : Chip antenna
Antenna Gain : 1.9dBi

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2011, final revised on July 8, 2011 and effective August 8, 2011

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 C63.4:2003 7. AC powerline Conducted Emission measurements IC: RSS-Gen 7.2.4	FCC: Section 15.207 IC: RSS-Gen 7.2.4	QP 15.6dB, 0.18963MHz, N AV 19.0dB, 13.16030MHz, N	Complied	-
6dB Bandwidth	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" 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 on Measurement of Digital Transmission Systems Operating under Section15.247" IC: RSS-Gen 4.8	FCC: Section 15.247(b)(3) IC: RSS-210 A8.4(4)		Complied	Conducted
Power Density	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" IC: -	FCC: Section 15.247 (e) IC: RSS-210 A8.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247" IC: RSS-Gen 4.9	FCC: Section15.247(d) IC: RSS-210 A8.5 RSS-Gen 7.2.3	1.6dB 2400.000MHz, PK, Vertical	Complied	Conducted/ Radiated

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

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

FCC 15.31 (e)

The EUT has its own regulator.

The stable voltage (DC3.3V) is constantly provided to the RF module through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

It is impossible for end users to replace the antenna, because it is soldered on the circuit board. Therefore the equipment complies with the requirement of 15.203/212.

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

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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
Receiver Spurious Emission	IC: RSS-Gen 4.10	IC: RSS-Gen 6	9.8dB 959.993MHz, QP, Vert.	Complied	Radiated

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)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.6dB
No.3	3.6dB
No.4	3.6dB

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	4.2dB	5.0dB	5.1dB	5.6dB	5.9dB	4.4dB	4.3dB
No.2	4.1dB	5.2dB	5.1dB	5.7dB	5.8dB	4.3dB	4.2dB
No.3	4.5dB	5.0dB	5.2dB	5.7dB	5.8dB	4.5dB	4.2dB
No.4	4.7dB	5.2dB	5.2dB	5.7dB	5.8dB	5.1dB	4.2dB

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

Power meter (+dB)	
Below 1GHz	Above 1GHz
1.0dB	1.0dB

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	
1.0dB	1.1dB	2.7dB	3.2dB	3.3dB	1.5dB

Conducted Emission test

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

Radiated emission test(3m)

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

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Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116 Facsimile : +81 596 24 8124

	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.

SECTION 4: Operation of E.U.T. during testing

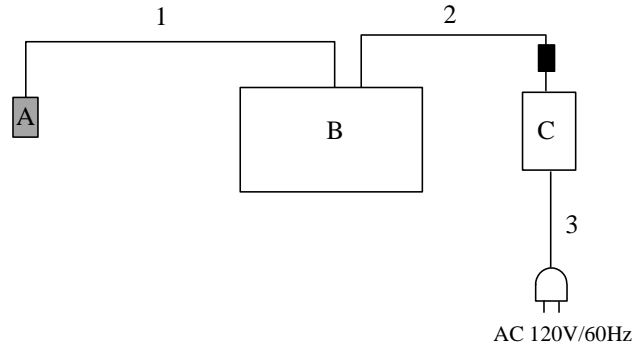
4.1 Operating Mode(s)

Mode	Remarks*
IEEE 802.11b (11b)	2Mbps, PN9
IEEE 802.11n 20MHz BW (11n-20)	MCS 6, 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: 12.0 Software: ART(Atheros Radio Test), ver. 08 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission Spurious Emission	11b Tx 11n-20 Tx *1)	2412MHz 2437MHz 2462MHz
	Rx	2437MHz
6dB Bandwidth	11b Tx 11g Tx 11n-20 Tx	2412MHz 2437MHz 2462MHz
Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx 11n-20 Tx *1)	2412MHz 2437MHz 2462MHz
Conducted Emission Band Edge compliance	11b Tx 11n-20 Tx *1)	2412MHz 2462MHz
*1) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode (11n-20) that had the highest peak output power.		

4.2 Configuration and peripherals



■ : Standard Ferrite Core

*Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
*It was preliminary confirmed that there was no difference in emission level due to a standard ferrite core.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless LAN module	WLAN-USB-01	19 *1) 20 *2)	FURUNO ELECTRIC CO., LTD.	EUT
B	Laptop PC	T61	L3R2056	Lenovo	-
C	AC Adaptor	92P1160	11S92P1160Z1ZBGH7B 99A8	Lenovo	-

*1) Used for Antenna Terminal conducted test

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

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	3.0	Shielded	Shielded	-
2	DC Cable	1.8	Unshielded	Unshielded	-
3	AC Cable	0.9	Unshielded	Unshielded	-

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Head Office EMC Lab.

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

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Facsimile : +81 596 24 8124

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.

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

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

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

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SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "2. Radiated emission test" of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247".

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, 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	Below 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	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 *1)		Spectrum Analyzer *1)
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz *2)	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m*3) (above 10GHz)		3m (below 10GHz), 1m*3) (above 10GHz)

*1) The Spectrum Analyzer was used in 3dB resolution bandwidth.

*2) As both cycle and off duration were short enough, 10Hz video bandwidth was used. (See Appendix)

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

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	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	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	20MHz	30kHz	100kHz	667sec	Peak	Max Hold	Spectrum Analyzer *1) *2)
Conducted Spurious Emission *3)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				
	30MHz to 25GHz (Less or equal to 5GHz)	100kHz	300kHz				

*1) PSD Option 1 of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247".
*2) The test was not performed at RBW:3kHz however the measurement is to be performed with RBW:3kHz in the regulation, because, the measurement value with RBW:3kHz is less than the value of RBW:30kHz and the test data met the limit with RBW:30kHz.
*3) 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.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz)

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: Data of EMI test

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

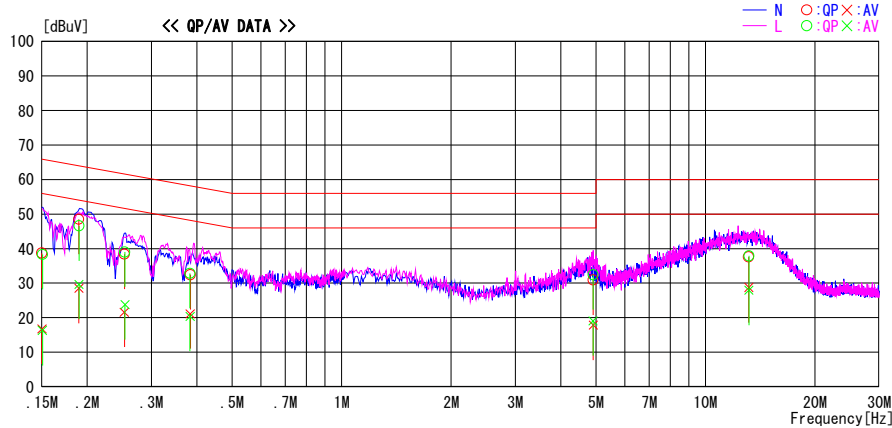
UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber
Date : 2011/12/07

Report No. : 32EE0038-H0

Temp./Humi. : 24deg. C / 39% RH
Engineer : Takumi Shimada

Mode / Remarks : 11b Tx 2437MHz 2Mbps

LIMIT : FCC15.207 QP
FCC15.207 AV

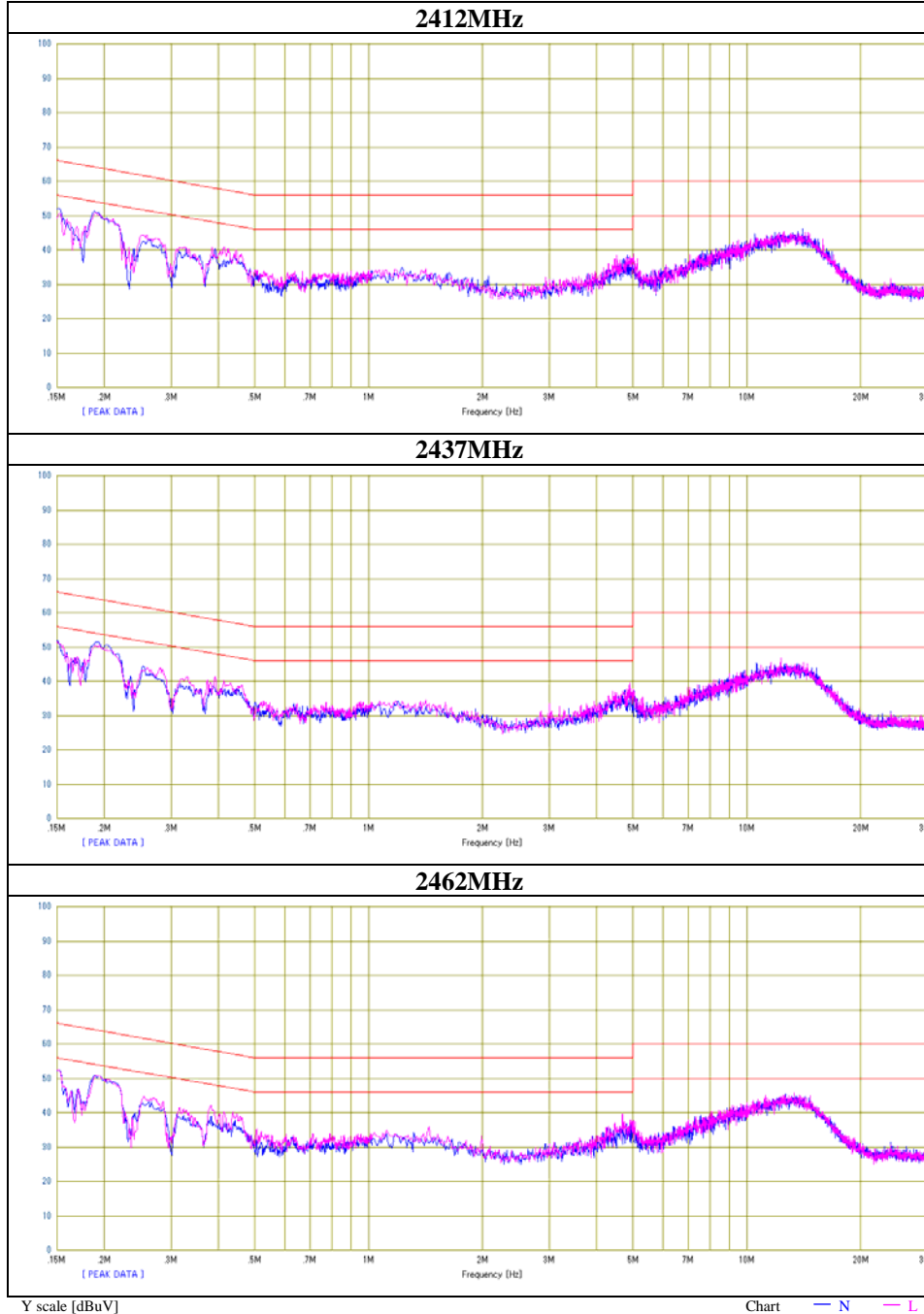


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	25.4	3.4	13.3	38.7	16.7	66.0	56.0	27.3	39.3	N	
0.18963	35.2	15.2	13.3	48.5	28.5	64.1	54.1	15.6	25.6	N	
0.25290	25.1	8.3	13.3	38.4	21.6	61.7	51.7	23.3	30.1	N	
0.38351	19.1	7.8	13.3	32.4	21.1	58.2	48.2	25.8	27.1	N	
4.91230	17.2	4.1	13.7	30.9	17.8	56.0	46.0	25.1	28.2	N	
13.14548	23.3	14.4	14.3	37.6	28.7	60.0	50.0	22.4	21.3	N	
0.15056	25.0	3.0	13.3	38.3	16.3	66.0	56.0	27.7	39.7	L	
0.18977	33.3	16.4	13.3	46.6	29.7	64.0	54.0	17.4	24.3	L	
0.25371	25.7	10.5	13.3	39.0	23.8	61.6	51.6	22.6	27.8	L	
0.38310	19.5	7.1	13.3	32.8	20.4	58.2	48.2	25.4	27.8	L	
4.90952	18.7	5.4	13.7	32.4	19.1	56.0	46.0	23.6	26.9	L	
13.16188	23.6	13.6	14.3	37.9	27.9	60.0	50.0	22.1	22.1	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT [dBuV]=READING [dBuV]+C.F [dB] (L ISN LOSS+CABLE LOSS)
Except for the above table : adequate margin data below the limits.

Conducted Emission

Test place : Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 32EE0038-HO
Date : 12/07/2011
Temperature/ Humidity : 24 deg.C / 39% RH
Engineer : Takumi Shimada
Mode : 11b Tx



Conducted Emission

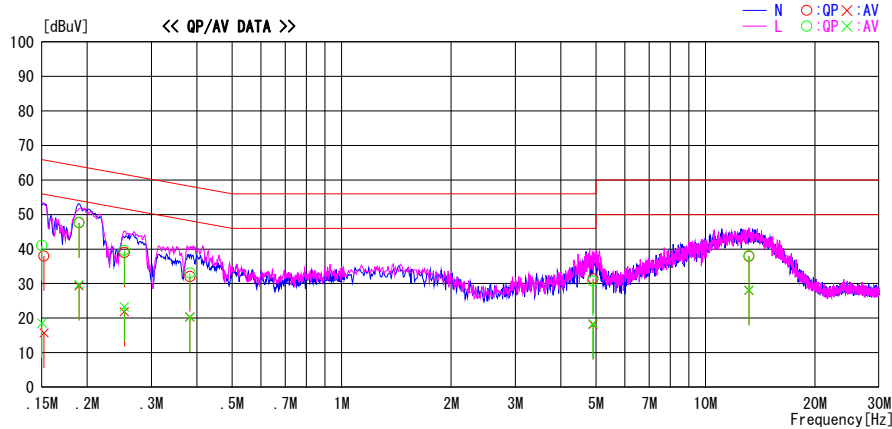
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
 Date : 2011/12/07

Report No. : 32EE0038-H0
 Temp./Humi. : 24deg. C / 39% RH
 Engineer : Takumi Shimada

Mode / Remarks : 11n Tx 2437MHz MCS6

LIMIT : FCC15.207 QP
 FCC15.207 AV

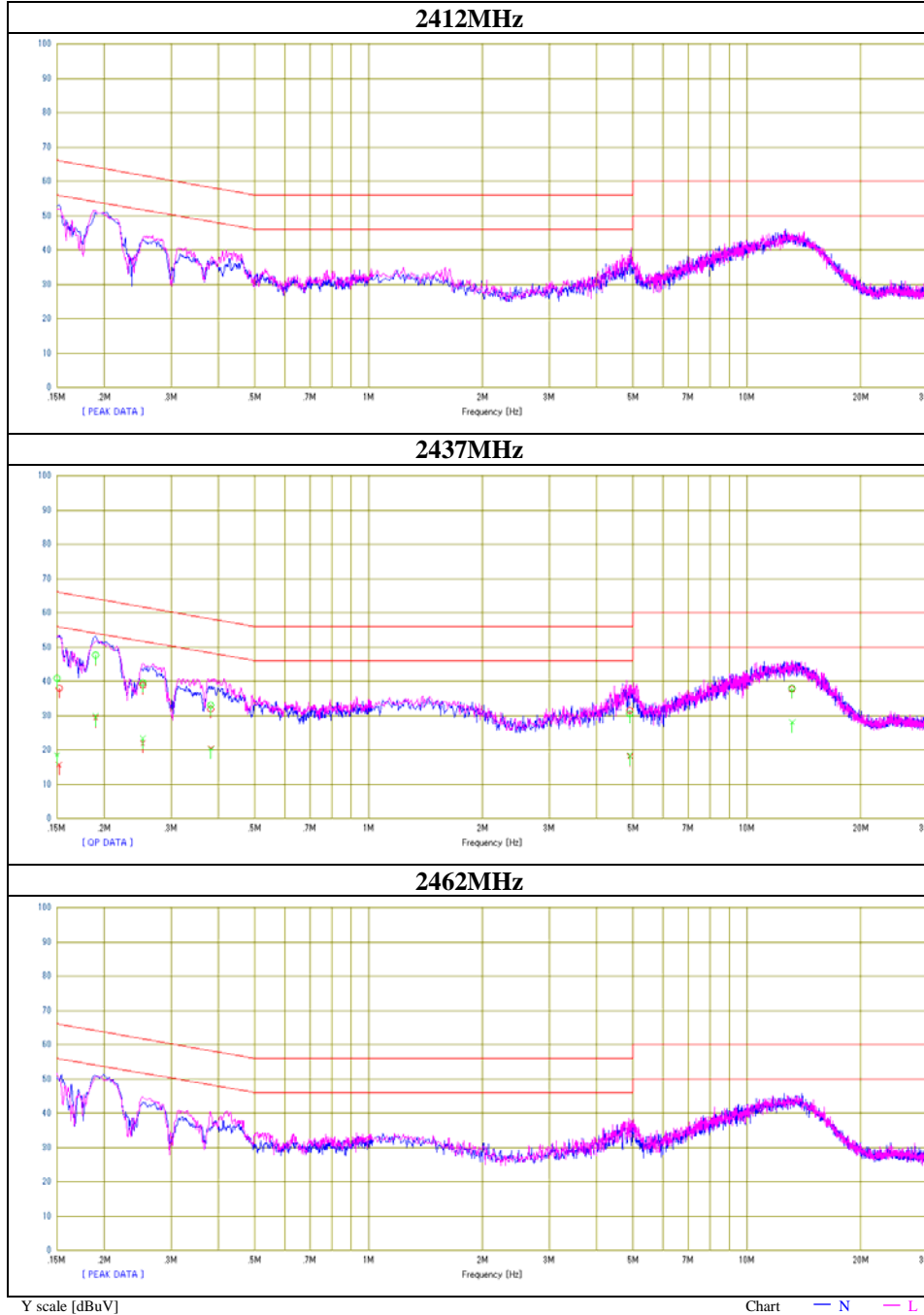


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15197	24.7	2.4	13.3	38.0	15.7	65.9	55.9	27.9	40.2	N	
0.18984	34.3	16.1	13.3	47.6	29.4	64.0	54.0	16.4	24.6	N	
0.25289	25.7	8.6	13.3	39.0	21.9	61.7	51.7	22.7	29.8	N	
0.38295	18.7	7.1	13.3	32.0	20.4	58.2	48.2	26.2	27.8	N	
4.91040	17.7	4.4	13.7	31.4	18.1	56.0	46.0	24.6	27.9	N	
13.15977	23.6	13.7	14.3	37.9	28.0	60.0	50.0	22.1	22.0	N	
0.15001	27.7	5.2	13.3	41.0	18.5	66.0	56.0	25.0	37.5	L	
0.18981	34.4	16.5	13.3	47.7	29.8	64.0	54.0	16.3	24.2	L	
0.25265	26.3	10.0	13.3	39.6	23.3	61.7	51.7	22.1	28.4	L	
0.38284	19.7	7.0	13.3	33.0	20.3	58.2	48.2	25.2	27.9	L	
4.90220	17.0	4.7	13.7	30.7	18.4	56.0	46.0	25.3	27.6	L	
13.15954	23.8	13.8	14.3	38.1	28.1	60.0	50.0	21.9	21.9	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT [dBuV] = READING [dBuV] + C. F [dB] (LISN LOSS + CABLE LOSS)
 Except for the above table : adequate margin data below the limits.

Conducted Emission

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32EE0038-HO
Date	12/07/2011
Temperature/ Humidity	24 deg.C / 39% RH
Engineer	Takumi Shimada
Mode	11n-20 Tx



Conducted Emission

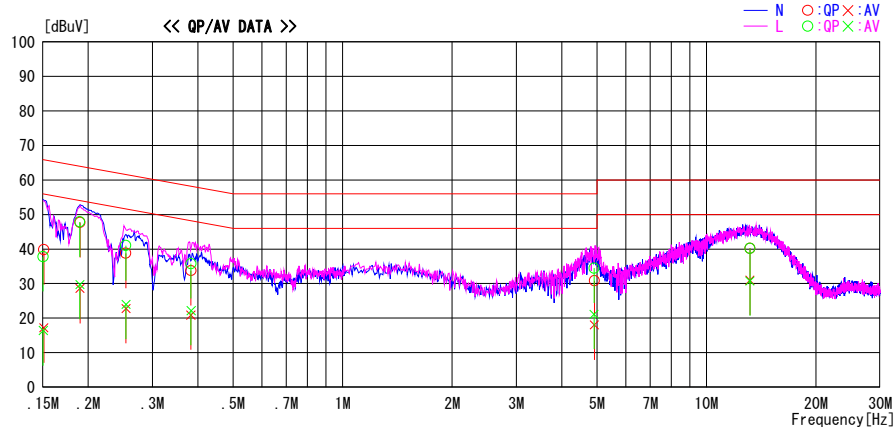
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2011/12/07

Report No. : 32EE0038-HO
 Temp./Humi. : 24deg. C / 39% RH
 Engineer : Takumi Shimada

Mode / Remarks : 11b/g/n Rx 2437MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15082	26.5	3.9	13.3	39.8	17.2	66.0	56.0	26.2	38.8	N	
0.18978	34.4	15.3	13.3	47.7	28.6	64.0	54.0	16.3	25.4	N	
0.25361	25.5	9.5	13.3	38.8	22.8	61.6	51.6	22.8	28.8	N	
0.38267	20.5	7.6	13.3	33.8	20.9	58.2	48.2	24.4	27.3	N	
4.91848	17.1	4.3	13.7	30.8	18.0	56.0	46.0	25.2	28.0	N	
13.16030	25.9	16.7	14.3	40.2	31.0	60.0	50.0	19.8	19.0	N	
0.15042	24.5	3.1	13.3	37.8	16.4	66.0	56.0	28.2	39.6	L	
0.18965	34.6	16.5	13.3	47.9	29.8	64.1	54.1	16.2	24.3	L	
0.25361	27.7	10.7	13.3	41.0	24.0	61.6	51.6	20.6	27.6	L	
0.38319	22.5	8.9	13.3	35.8	22.2	58.2	48.2	22.4	26.0	L	
4.90640	20.8	7.4	13.7	34.5	21.1	56.0	46.0	21.5	24.9	L	
13.16235	25.9	16.5	14.3	40.2	30.8	60.0	50.0	19.8	19.2	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT [dBuV] = READING [dBuV] + C.F [dB] (LISN LOSS + CABLE LOSS)
 Except for the above table : adequate margin data below the limits.

6dB Bandwidth

Test place Head Office EMC Lab. No.7 Measurement Room /
Report No. 32EE0038-HO
Date 12/01/2011
Temperature/ Humidity 24 deg.C / 54% RH
Engineer Tomotaka Sasagawa
Mode Tx

11b

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	12.721	>500
2437	12.668	>500
2462	11.426	>500

11g

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	16.514	>500
2437	16.499	>500
2462	16.481	>500

11n-20

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	17.702	>500
2437	17.724	>500
2462	17.718	>500

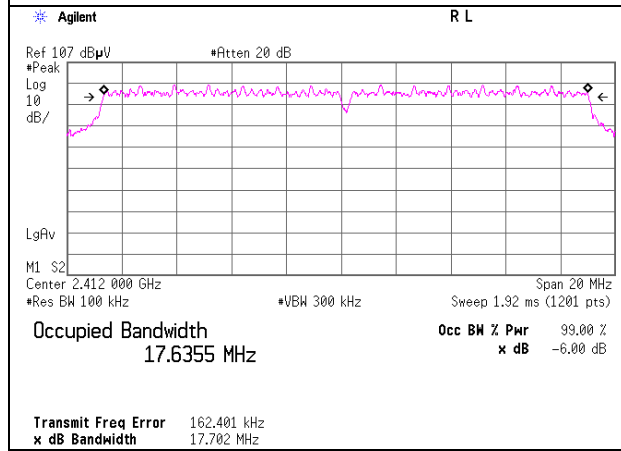
6dB Bandwidth



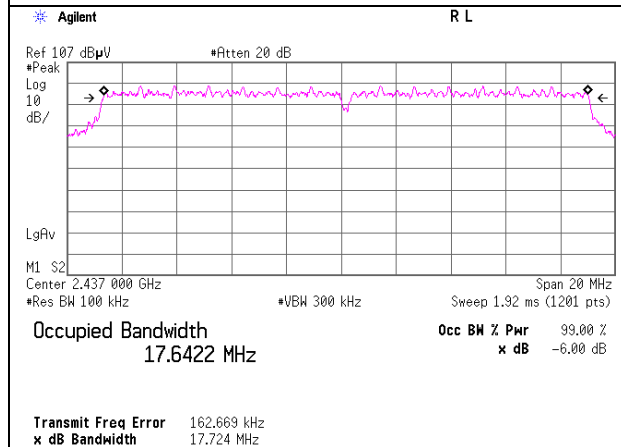
6dB Bandwidth

11n-20

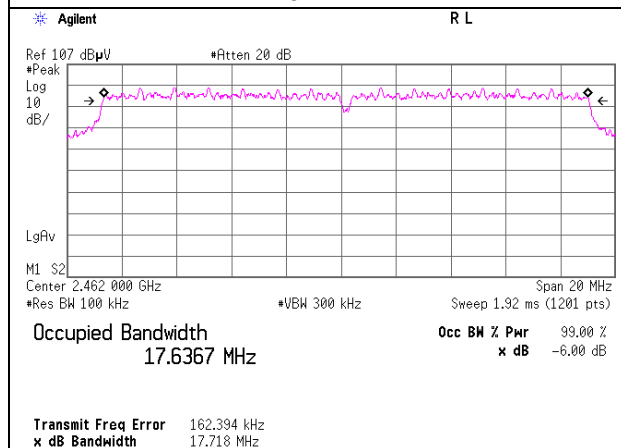
2412MHz



2437MHz



2462MHz



Maximum Peak Output Power

Test place : Head Office EMC Lab. No.7 Measurement Room /
Report No. : 32EE0038-HO
Date : 12/01/2011
Temperature/ Humidity : 24 deg.C / 54% RH
Engineer : Tomotaka Sasagawa
Mode : Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-5.26	0.77	19.97	15.48	35.32	30.00	1000	14.52
2437	-5.83	0.77	19.97	14.91	30.97	30.00	1000	15.09
2462	-5.67	0.77	19.97	15.07	32.14	30.00	1000	14.93

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	2.23	0.77	19.97	22.97	198.15	30.00	1000	7.03
2437	1.43	0.77	19.97	22.17	164.82	30.00	1000	7.83
2462	2.19	0.77	19.97	22.93	196.34	30.00	1000	7.07

Sample Calculation:

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

11b

Rate [Mbps]	Reading [dBm]	Remark
1	-5.91	
2	-5.83	*
6	-5.85	
11	-5.91	

*: Worst Rate

11g / 11n-20

Rate [Mbps]	Reading [dBm]	Remark
6	0.57	
9	0.77	
12	0.89	
18	1.14	
24	1.09	
36	0.87	
48	0.75	
54	1.22	
MCS 0	1.03	
MCS 1	1.06	
MCS 2	1.15	
MCS 3	1.07	
MCS 4	1.21	
MCS 5	1.32	
MCS 6	1.43	*
MCS 7	1.08	

*: Worst Rate

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

UL Japan, Inc.

Head Office EMC Lab.

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

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Test place	Head Office EMC Lab. No.3 and 4 Semi Anechoic Chamber	
Report No.	32EE0038-HO	
Date	11/28/2011	12/06/2011
Temperature/ Humidity	21 deg.C / 44%	24 deg.C / 39%
Engineer	Hiroshi Kukita	Takumi Shimada
	(Above 1GHz)	(Below 1GHz)
Mode	11b Tx 2412MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	105.712	QP	34.8	11.0	8.0	32.1	21.7	43.5	21.8	
Hori	164.020	QP	32.6	15.5	8.7	32.1	24.7	43.5	18.8	
Hori	240.000	QP	32.4	17.1	9.3	32.1	26.7	46.0	19.3	
Hori	666.000	QP	22.6	21.5	12.0	32.3	23.8	46.0	22.2	
Hori	959.997	QP	27.5	25.6	13.3	31.0	35.4	46.0	10.6	
Hori	995.934	QP	21.0	26.4	13.5	30.9	30.0	53.9	23.9	
Hori	2390.000	PK	50.0	26.4	2.2	32.6	46.0	73.9	27.9	
Hori	2397.417	PK	68.1	26.4	2.2	32.6	64.1	-	-	- See 20dBc Data Sheet
Hori	2400.000	PK	66.5	26.4	2.2	32.6	62.5	-	-	- See 20dBc Data Sheet
Hori	4824.000	PK	42.9	30.4	4.7	31.9	46.1	73.9	27.8	
Hori	7236.000	PK	42.0	35.2	5.6	32.4	50.4	73.9	23.5	
Hori	9648.000	PK	42.6	38.1	6.5	32.9	54.3	73.9	19.6	
Hori	24120.000	PK	44.2	38.7	-0.9	31.6	50.4	73.9	23.5	
Hori	2390.000	AV	37.1	26.4	2.2	32.6	33.1	53.9	20.8	
Hori	2397.417	AV	65.0	26.4	2.2	32.6	61.0	-	-	- See 20dBc Data Sheet
Hori	2400.000	AV	59.4	26.4	2.2	32.6	55.4	-	-	- See 20dBc Data Sheet
Hori	4824.000	AV	32.2	30.4	4.7	31.9	35.4	53.9	18.5	
Hori	7236.000	AV	29.4	35.2	5.6	32.4	37.8	53.9	16.1	
Hori	9648.000	AV	29.3	38.1	6.5	32.9	41.0	53.9	12.9	
Hori	24120.000	AV	32.2	38.7	-0.9	31.6	38.4	53.9	15.6	
Vert	105.649	QP	38.6	11.0	8.0	32.1	25.5	43.5	18.0	
Vert	164.460	QP	28.2	15.6	8.7	32.1	20.4	43.5	23.1	
Vert	240.000	QP	29.8	17.1	9.3	32.1	24.1	46.0	21.9	
Vert	666.130	QP	29.2	21.5	12.0	32.3	30.4	46.0	15.6	
Vert	959.994	QP	28.8	25.6	13.3	31.0	36.7	46.0	9.3	
Vert	996.020	QP	33.5	26.4	13.5	30.9	42.5	53.9	11.4	
Vert	2390.000	PK	46.3	26.4	2.2	32.6	42.3	73.9	31.6	
Vert	2397.723	PK	66.2	26.4	2.2	32.6	62.2	-	-	- See 20dBc Data Sheet
Vert	2400.000	PK	64.2	26.4	2.2	32.6	60.2	-	-	- See 20dBc Data Sheet
Vert	4924.000	PK	41.6	30.5	4.6	31.9	44.8	73.9	29.1	
Vert	7236.000	PK	42.0	35.2	5.6	32.4	50.4	73.9	23.5	
Vert	9648.000	PK	42.2	38.1	6.5	32.9	53.9	73.9	20.0	
Vert	24120.000	PK	44.4	38.7	-0.9	31.6	50.6	73.9	23.3	
Vert	2390.000	AV	35.6	26.4	2.2	32.6	31.6	53.9	22.3	
Vert	2397.723	AV	62.8	26.4	2.2	32.6	58.8	-	-	- See 20dBc Data Sheet
Vert	2400.000	AV	58.4	26.4	2.2	32.6	54.4	-	-	- See 20dBc Data Sheet
Vert	4924.000	AV	28.4	30.5	4.6	31.9	31.6	53.9	22.3	
Vert	7236.000	AV	29.2	35.2	5.6	32.4	37.6	53.9	16.3	
Vert	9648.000	AV	29.2	38.1	6.5	32.9	40.9	53.9	13.0	
Vert	24120.000	AV	32.1	38.7	-0.9	31.6	38.3	53.9	15.6	

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).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
 26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 32EE0038-HO
Date 11/28/2011
Temperature/ Humidity 21 deg.C / 44%
Engineer Hiroshi Kukita
(Above 1GHz)
Mode 11b Tx 2412MHz

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	98.4	26.4	2.2	32.6	94.4	-	-	Carrier
Hori	2397.417	PK	65.1	26.4	2.2	32.6	61.1	74.4	13.3	
Hori	2400.000	PK	61.4	26.4	2.2	32.6	57.4	74.4	17.0	
Vert	2412.000	PK	95.3	26.4	2.2	32.6	91.3	-	-	Carrier
Vert	2397.723	PK	63.8	26.4	2.2	32.6	59.8	71.3	11.5	
Vert	2400.000	PK	58.2	26.4	2.2	32.6	54.2	71.3	17.1	

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

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 and 4 Semi Anechoic Chamber
Report No. 32EE0038-HO
Date 11/28/2011 12/06/2011
Temperature/ Humidity 21 deg.C / 44% 24 deg.C / 39%
Engineer Hiroshi Kukita Takumi Shimada
(Above 1GHz) (Below 1GHz)
Mode 11b Tx 2437MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	105.623	QP	34.5	11.0	8.0	32.1	21.4	43.5	22.1	
Hori	164.031	QP	32.4	15.5	8.7	32.1	24.5	43.5	19.0	
Hori	240.000	QP	32.5	17.1	9.3	32.1	26.8	46.0	19.2	
Hori	666.000	QP	22.8	21.5	12.0	32.3	24.0	46.0	22.0	
Hori	959.997	QP	27.7	25.6	13.3	31.0	35.6	46.0	10.4	
Hori	995.912	QP	21.1	26.4	13.5	30.9	30.1	53.9	23.8	
Hori	4874.000	PK	43.2	30.5	4.7	31.9	46.5	73.9	27.4	
Hori	7311.000	PK	43.9	35.2	5.6	32.4	52.3	73.9	21.6	
Hori	9748.000	PK	44.3	38.3	6.5	32.9	56.2	73.9	17.7	
Hori	24370.000	PK	43.9	38.6	-0.9	31.6	50.0	73.9	23.9	
Hori	4874.000	AV	31.3	30.5	4.7	31.9	34.6	53.9	19.3	
Hori	7311.000	AV	31.1	35.2	5.6	32.4	39.5	53.9	14.4	
Hori	9748.000	AV	30.3	38.3	6.5	32.9	42.2	53.9	11.7	
Hori	24370.000	AV	32.1	38.6	-0.9	31.6	38.2	53.9	15.7	
Vert	105.643	QP	38.6	11.0	8.0	32.1	25.5	43.5	18.0	
Vert	164.433	QP	28.1	15.6	8.7	32.1	20.3	43.5	23.2	
Vert	240.000	QP	29.9	17.1	9.3	32.1	24.2	46.0	21.8	
Vert	666.126	QP	29.5	21.5	12.0	32.3	30.7	46.0	15.3	
Vert	959.995	QP	29.1	25.6	13.3	31.0	37.0	46.0	9.0	
Vert	996.004	QP	33.7	26.4	13.5	30.9	42.7	53.9	11.2	
Vert	4874.000	PK	42.7	30.5	4.7	31.9	46.0	73.9	27.9	
Vert	7311.000	PK	43.9	35.2	5.6	32.4	52.3	73.9	21.6	
Vert	9748.000	PK	43.0	38.3	6.5	32.9	54.9	73.9	19.0	
Vert	24370.000	PK	43.5	38.6	-0.9	31.6	49.6	73.9	24.3	
Vert	4874.000	AV	20.9	30.5	4.7	31.9	24.2	53.9	29.7	
Vert	7311.000	AV	31.1	35.2	5.6	32.4	39.5	53.9	14.4	
Vert	9748.000	AV	30.9	38.3	6.5	32.9	42.8	53.9	11.1	
Vert	24370.000	AV	32.1	38.6	-0.9	31.6	38.2	53.9	15.7	

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).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 and 4 Semi Anechoic Chamber
Report No. 32EE0038-HO
Date 11/28/2011 12/06/2011
Temperature/ Humidity 21 deg.C./ 44% 24 deg.C./ 39%
Engineer Hiroshi Kukita Takumi Shimada
(Above 1GHz) (Below 1GHz)
Mode 11b Tx 2462MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	105.693	QP	34.9	11.0	8.0	32.1	21.8	43.5	21.7	
Hori	164.032	QP	32.4	15.5	8.7	32.1	24.5	43.5	19.0	
Hori	240.000	QP	32.6	17.1	9.3	32.1	26.9	46.0	19.1	
Hori	666.000	QP	22.5	21.5	12.0	32.3	23.7	46.0	22.3	
Hori	959.998	QP	27.7	25.6	13.3	31.0	35.6	46.0	10.4	
Hori	995.938	QP	21.1	26.4	13.5	30.9	30.1	53.9	23.8	
Hori	2483.500	PK	49.1	26.5	2.2	32.6	45.2	73.9	28.7	
Hori	4924.000	PK	42.5	30.5	4.6	31.9	45.7	73.9	28.2	
Hori	7386.000	PK	44.5	35.2	5.6	32.4	52.9	73.9	21.0	
Hori	9848.000	PK	43.7	38.5	6.5	32.9	55.8	73.9	18.1	
Hori	24620.000	PK	44.5	38.6	-0.9	31.6	50.6	73.9	23.3	
Hori	2483.500	AV	34.8	26.5	2.2	32.6	30.9	53.9	23.0	
Hori	4924.000	AV	30.7	30.5	4.6	31.9	33.9	53.9	20.0	
Hori	7386.000	AV	31.2	35.2	5.6	32.4	39.6	53.9	14.3	
Hori	9848.000	AV	31.3	38.5	6.5	32.9	43.4	53.9	10.5	
Hori	24620.000	AV	32.7	38.6	-0.9	31.6	38.8	53.9	15.1	
Vert	105.651	QP	39.1	11.0	8.0	32.1	26.0	43.5	17.5	
Vert	164.423	QP	28.3	15.6	8.7	32.1	20.5	43.5	23.0	
Vert	240.000	QP	29.9	17.1	9.3	32.1	24.2	46.0	21.8	
Vert	666.114	QP	29.4	21.5	12.0	32.3	30.6	46.0	15.4	
Vert	959.991	QP	28.6	25.6	13.3	31.0	36.5	46.0	9.5	
Vert	996.018	QP	33.3	26.4	13.5	30.9	42.3	53.9	11.6	
Vert	2483.500	PK	46.0	26.5	2.2	32.6	42.1	73.9	31.8	
Vert	4924.000	PK	42.8	30.5	4.6	31.9	46.0	73.9	27.9	
Vert	7386.000	PK	44.5	35.2	5.6	32.4	52.9	73.9	21.0	
Vert	9848.000	PK	44.3	38.5	6.5	32.9	56.4	73.9	17.5	
Vert	24620.000	PK	45.2	38.6	-0.9	31.6	51.3	73.9	22.6	
Vert	2483.500	AV	34.0	26.5	2.2	32.6	30.1	53.9	23.8	
Vert	4924.000	AV	29.8	30.5	4.6	31.9	33.0	53.9	20.9	
Vert	7386.000	AV	31.1	35.2	5.6	32.4	39.5	53.9	14.4	
Vert	9848.000	AV	31.4	38.5	6.5	32.9	43.5	53.9	10.4	
Vert	24620.000	AV	32.7	38.6	-0.9	31.6	38.8	53.9	15.1	

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).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 and 4 Semi Anechoic Chamber
Report No. 32EE0038-HO
Date 11/28/2011 12/06/2011
Temperature/ Humidity 21 deg.C./ 44% 24 deg.C./ 39%
Engineer Hiroshi Kukita Takumi Shimada
(Above 1GHz) (Below 1GHz)
Mode 1In Tx 2412MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	105.690	QP	33.9	11.0	8.0	32.1	20.8	43.5	22.7	
Hori	164.021	QP	32.4	15.5	8.7	32.1	24.5	43.5	19.0	
Hori	240.000	QP	32.1	17.1	9.3	32.1	26.4	46.0	19.6	
Hori	666.000	QP	22.8	21.5	12.0	32.3	24.0	46.0	22.0	
Hori	959.996	QP	27.7	25.6	13.3	31.0	35.6	46.0	10.4	
Hori	995.935	QP	20.9	26.4	13.5	30.9	29.9	53.9	24.0	
Hori	1716.530	PK	66.7	25.7	1.8	33.5	60.7	73.9	13.2	
Hori	2390.000	PK	75.7	26.4	2.2	32.6	71.7	73.9	2.2	
Hori	2399.831	PK	85.5	26.4	2.2	32.6	81.5	-	-	- See 20dBc Data Sheet
Hori	2400.000	PK	85.6	26.4	2.2	32.6	81.6	-	-	- See 20dBc Data Sheet
Hori	4824.000	PK	41.2	30.4	4.7	31.9	44.4	73.9	29.5	
Hori	7236.000	PK	43.1	35.2	5.6	32.4	51.5	73.9	22.4	
Hori	9648.000	PK	42.0	38.1	6.5	32.9	53.7	73.9	20.2	
Hori	24120.000	PK	43.7	38.7	-0.9	31.6	49.9	73.9	24.0	
Hori	1716.530	AV	41.0	25.7	1.8	33.5	35.0	53.9	18.9	
Hori	2390.000	AV	48.3	26.4	2.2	32.6	44.3	53.9	9.6	
Hori	2399.831	AV	60.7	26.4	2.2	32.6	56.7	-	-	- See 20dBc Data Sheet
Hori	2400.000	AV	60.9	26.4	2.2	32.6	56.9	-	-	- See 20dBc Data Sheet
Hori	4824.000	AV	28.3	30.4	4.7	31.9	31.5	53.9	22.4	
Hori	7236.000	AV	29.7	35.2	5.6	32.4	38.1	53.9	15.8	
Hori	9648.000	AV	29.6	38.1	6.5	32.9	41.3	53.9	12.6	
Hori	24120.000	AV	32.2	38.7	-0.9	31.6	38.4	53.9	15.6	
Vert	105.637	QP	38.3	11.0	8.0	32.1	25.2	43.5	18.3	
Vert	164.449	QP	28.5	15.6	8.7	32.1	20.7	43.5	22.8	
Vert	240.000	QP	30.0	17.1	9.3	32.1	24.3	46.0	21.7	
Vert	666.115	QP	29.4	21.5	12.0	32.3	30.6	46.0	15.4	
Vert	959.996	QP	29.0	25.6	13.3	31.0	36.9	46.0	9.1	
Vert	996.006	QP	33.4	26.4	13.5	30.9	42.4	53.9	11.5	
Vert	1713.370	PK	68.4	25.7	1.8	33.5	62.4	73.9	11.5	
Vert	2390.000	PK	71.5	26.4	2.2	32.6	67.5	73.9	6.4	
Vert	2399.833	PK	79.7	26.4	2.2	32.6	75.7	-	-	- See 20dBc Data Sheet
Vert	2400.000	PK	80.0	26.4	2.2	32.6	76.0	-	-	- See 20dBc Data Sheet
Vert	4824.000	PK	41.2	30.4	4.7	31.9	44.4	73.9	29.5	
Vert	7236.000	PK	43.4	35.2	5.6	32.4	51.8	73.9	22.1	
Vert	9648.000	PK	42.8	38.1	6.5	32.9	54.5	73.9	19.4	
Vert	24120.000	PK	44.3	38.7	-0.9	31.6	50.5	73.9	23.4	
Vert	1713.370	AV	42.2	25.7	1.8	33.5	36.2	53.9	17.7	
Vert	2390.000	AV	45.0	26.4	2.2	32.6	41.0	53.9	12.9	
Vert	2399.833	AV	56.4	26.4	2.2	32.6	52.4	-	-	- See 20dBc Data Sheet
Vert	2400.000	AV	56.9	26.4	2.2	32.6	52.9	-	-	- See 20dBc Data Sheet
Vert	4824.000	AV	28.2	30.4	4.7	31.9	31.4	53.9	22.5	
Vert	7236.000	AV	28.7	35.2	5.6	32.4	37.1	53.9	16.8	
Vert	9648.000	AV	28.8	38.1	6.5	32.9	40.5	53.9	13.4	
Vert	24120.000	AV	32.2	38.7	-0.9	31.6	38.4	53.9	15.6	

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).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Radiated Spurious Emission
20dBc Data Sheet

Test place Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No. 32EE0038-HO
Date 11/28/2011
Temperature/ Humidity 21 deg.C./ 44%
Engineer Hiroshi Kukita
 (Above 1GHz)
Mode 1 In Tx 2412MHz

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	98.7	26.4	2.2	32.6	94.7	-	-	Carrier
Hori	2399.831	PK	72.6	26.4	2.2	32.6	68.6	74.7	6.1	
Hori	2400.000	PK	72.7	26.4	2.2	32.6	68.7	74.7	6.0	
Vert	2412.000	PK	91.6	26.4	2.2	32.6	87.6	-	-	Carrier
Vert	2399.833	PK	69.9	26.4	2.2	32.6	65.9	67.6	1.7	
Vert	2400.000	PK	70.0	26.4	2.2	32.6	66.0	67.6	1.6	

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

Radiated Spurious Emission

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. 32EE0038-HO
Date 12/06/2011
Temperature/ Humidity 24 deg.C./ 39%
Engineer Takumi Shimada

Mode 1In Tx 2437MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	105.695	QP	33.9	11.0	8.0	32.1	20.8	43.5	22.7	
Hori	164.005	QP	33.1	15.5	8.7	32.1	25.2	43.5	18.3	
Hori	240.000	QP	33.2	17.1	9.3	32.1	27.5	46.0	18.5	
Hori	666.000	QP	22.6	21.5	12.0	32.3	23.8	46.0	22.2	
Hori	959.993	QP	27.7	25.6	13.3	31.0	35.6	46.0	10.4	
Hori	995.939	QP	21.1	26.4	13.5	30.9	30.1	53.9	23.8	
Hori	4874.000	PK	40.6	31.4	5.3	31.4	45.9	73.9	28.0	
Hori	7311.000	PK	42.4	35.7	6.2	32.5	51.8	73.9	22.1	
Hori	9748.000	PK	43.4	38.4	7.3	33.2	55.9	73.9	18.0	
Hori	24370.000	PK	43.7	38.6	-0.9	31.6	49.8	73.9	24.1	
Hori	4874.000	AV	28.2	31.4	5.3	31.4	33.5	53.9	20.4	
Hori	7311.000	AV	29.6	35.7	6.2	32.5	39.0	53.9	14.9	
Hori	9748.000	AV	30.3	38.4	7.3	33.2	42.8	53.9	11.1	
Hori	24370.000	AV	32.1	38.6	-0.9	31.6	38.2	53.9	15.7	
Vert	105.646	QP	38.8	11.0	8.0	32.1	25.7	43.5	17.8	
Vert	164.404	QP	28.3	15.6	8.7	32.1	20.5	43.5	23.0	
Vert	240.000	QP	29.5	17.1	9.3	32.1	23.8	46.0	22.2	
Vert	666.114	QP	28.4	21.5	12.0	32.3	29.6	46.0	16.4	
Vert	959.992	QP	28.6	25.6	13.3	31.0	36.5	46.0	9.5	
Vert	996.030	QP	33.1	26.4	13.5	30.9	42.1	53.9	11.8	
Vert	4874.000	PK	40.1	31.4	5.3	31.4	45.4	73.9	28.5	
Vert	7311.000	PK	41.6	35.7	6.2	32.5	51.0	73.9	22.9	
Vert	9748.000	PK	41.5	38.4	7.3	33.2	54.0	73.9	19.9	
Vert	24370.000	PK	43.7	38.6	-0.9	31.6	49.8	73.9	24.1	
Vert	4874.000	AV	28.3	31.4	5.3	31.4	33.6	53.9	20.3	
Vert	7311.000	AV	29.7	35.7	6.2	32.5	39.1	53.9	14.8	
Vert	9748.000	AV	30.4	38.4	7.3	33.2	42.9	53.9	11.0	
Vert	24370.000	AV	32.1	38.6	-0.9	31.6	38.2	53.9	15.7	

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).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Radiated Spurious Emission

Test place Head Office EMC Lab. No.3 and 4 Semi Anechoic Chamber
Report No. 32EE0038-HO
Date 11/28/2011 12/06/2011
Temperature/ Humidity 21 deg.C./ 44% 24 deg.C./ 39%
Engineer Hiroshi Kukita Takumi Shimada
(Above 1GHz) (Below 1GHz)
Mode 1In Tx 2462MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	105.693	QP	34.3	11.0	8.0	32.1	21.2	43.5	22.3	
Hori	163.996	QP	32.9	15.5	8.7	32.1	25.0	43.5	18.5	
Hori	240.000	QP	32.2	17.1	9.3	32.1	26.5	46.0	19.5	
Hori	666.000	QP	22.3	21.5	12.0	32.3	23.5	46.0	22.5	
Hori	959.950	QP	27.6	25.6	13.3	31.0	35.5	46.0	10.5	
Hori	995.933	QP	20.9	26.4	13.5	30.9	29.9	53.9	24.0	
Hori	2483.500	PK	67.4	26.5	2.2	32.6	63.5	73.9	10.4	
Hori	2483.750	PK	67.4	26.5	2.2	32.6	63.5	73.9	10.4	
Hori	4924.000	PK	42.0	30.5	4.6	31.9	45.2	73.9	28.7	
Hori	7386.000	PK	42.2	35.2	5.6	32.4	50.6	73.9	23.3	
Hori	9848.000	PK	43.4	38.5	6.5	32.9	55.5	73.9	18.4	
Hori	24620.000	PK	44.6	38.6	-0.9	31.6	50.7	73.9	23.2	
Hori	2483.500	AV	49.6	26.5	2.2	32.6	45.7	53.9	8.2	
Hori	2483.750	AV	49.3	26.5	2.2	32.6	45.4	53.9	8.5	
Hori	4924.000	AV	28.6	30.5	4.6	31.9	31.8	53.9	22.1	
Hori	7386.000	AV	29.5	35.2	5.6	32.4	37.9	53.9	16.0	
Hori	9848.000	AV	29.7	38.5	6.5	32.9	41.8	53.9	12.1	
Hori	24620.000	AV	32.7	38.6	-0.9	31.6	38.8	53.9	15.1	
Vert	105.642	QP	38.4	11.0	8.0	32.1	25.3	43.5	18.2	
Vert	164.452	QP	28.3	15.6	8.7	32.1	20.5	43.5	23.0	
Vert	240.000	QP	30.1	17.1	9.3	32.1	24.4	46.0	21.6	
Vert	666.114	QP	28.8	21.5	12.0	32.3	30.0	46.0	16.0	
Vert	959.995	QP	28.9	25.6	13.3	31.0	36.8	46.0	9.2	
Vert	996.194	QP	33.1	26.4	13.5	30.9	42.1	53.9	11.8	
Vert	2483.500	PK	60.3	26.5	2.2	32.6	56.4	73.9	17.5	
Vert	2483.755	PK	60.2	26.5	2.2	32.6	56.3	73.9	17.6	
Vert	4924.000	PK	40.0	30.5	4.6	31.9	43.2	73.9	30.7	
Vert	7386.000	PK	42.2	35.2	5.6	32.4	50.6	73.9	23.3	
Vert	9848.000	PK	42.3	38.5	6.5	32.9	54.4	73.9	19.5	
Vert	24620.000	PK	45.1	38.6	-0.9	31.6	51.2	73.9	22.7	
Vert	2483.500	AV	42.5	26.5	2.2	32.6	38.6	53.9	15.3	
Vert	2483.755	AV	42.3	26.5	2.2	32.6	38.4	53.9	15.5	
Vert	4924.000	AV	28.2	30.5	4.6	31.9	31.4	53.9	22.5	
Vert	7386.000	AV	29.4	35.2	5.6	32.4	37.8	53.9	16.1	
Vert	9848.000	AV	29.4	38.5	6.5	32.9	41.5	53.9	12.4	
Vert	24620.000	AV	32.7	38.6	-0.9	31.6	38.8	53.9	15.1	

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).

*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Radiated Spurious Emission

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. 32EE0038-HO
Date 12/06/2011
Temperature/ Humidity 24 deg.C./ 39%
Engineer Takumi Shimada
Mode 11b/g/n Rx 2437MHz

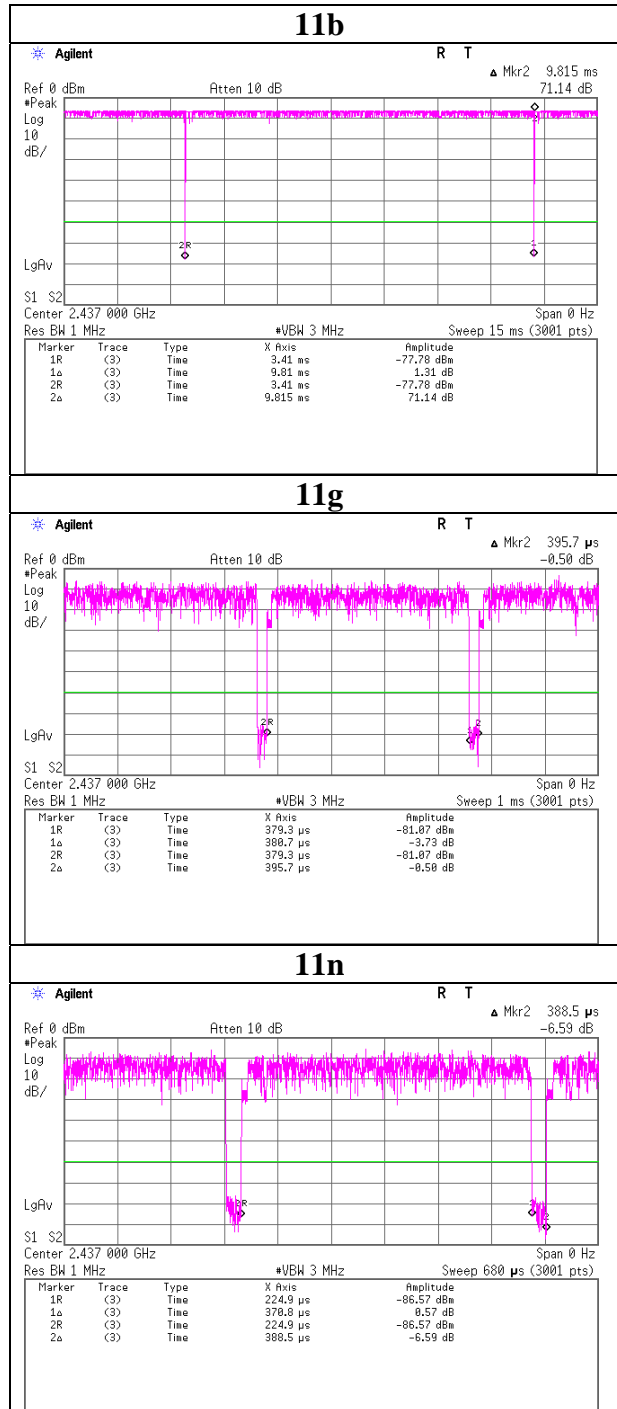
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	105.693	QP	34.4	11.0	8.0	32.1	21.3	43.5	22.2	
Hori	164.019	QP	32.8	15.5	8.7	32.1	24.9	43.5	18.6	
Hori	240.000	QP	32.3	17.1	9.3	32.1	26.6	46.0	19.4	
Hori	666.000	QP	22.5	21.5	12.0	32.3	23.7	46.0	22.3	
Hori	959.996	QP	27.7	25.6	13.3	31.0	35.6	46.0	10.4	
Hori	995.915	QP	21.1	26.4	13.5	30.9	30.1	53.9	23.8	
Hori	2437.000	PK	41.5	28.3	2.5	32.2	40.1	73.9	33.8	
Hori	2437.000	AV	29.4	28.3	2.5	32.2	28.0	53.9	25.9	
Vert	105.662	QP	37.9	11.0	8.0	32.1	24.8	43.5	18.7	
Vert	164.527	QP	28.4	15.6	8.7	32.1	20.6	43.5	22.9	
Vert	240.000	QP	29.7	17.1	9.3	32.1	24.0	46.0	22.0	
Vert	666.133	QP	29.4	21.5	12.0	32.3	30.6	46.0	15.4	
Vert	959.993	QP	28.3	25.6	13.3	31.0	36.2	46.0	9.8	
Vert	996.059	QP	32.8	26.4	13.5	30.9	41.8	53.9	12.1	
Vert	2437.000	PK	41.9	28.3	2.5	32.2	40.5	73.9	33.4	
Vert	2437.000	AV	29.4	28.3	2.5	32.2	28.0	53.9	25.9	

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).

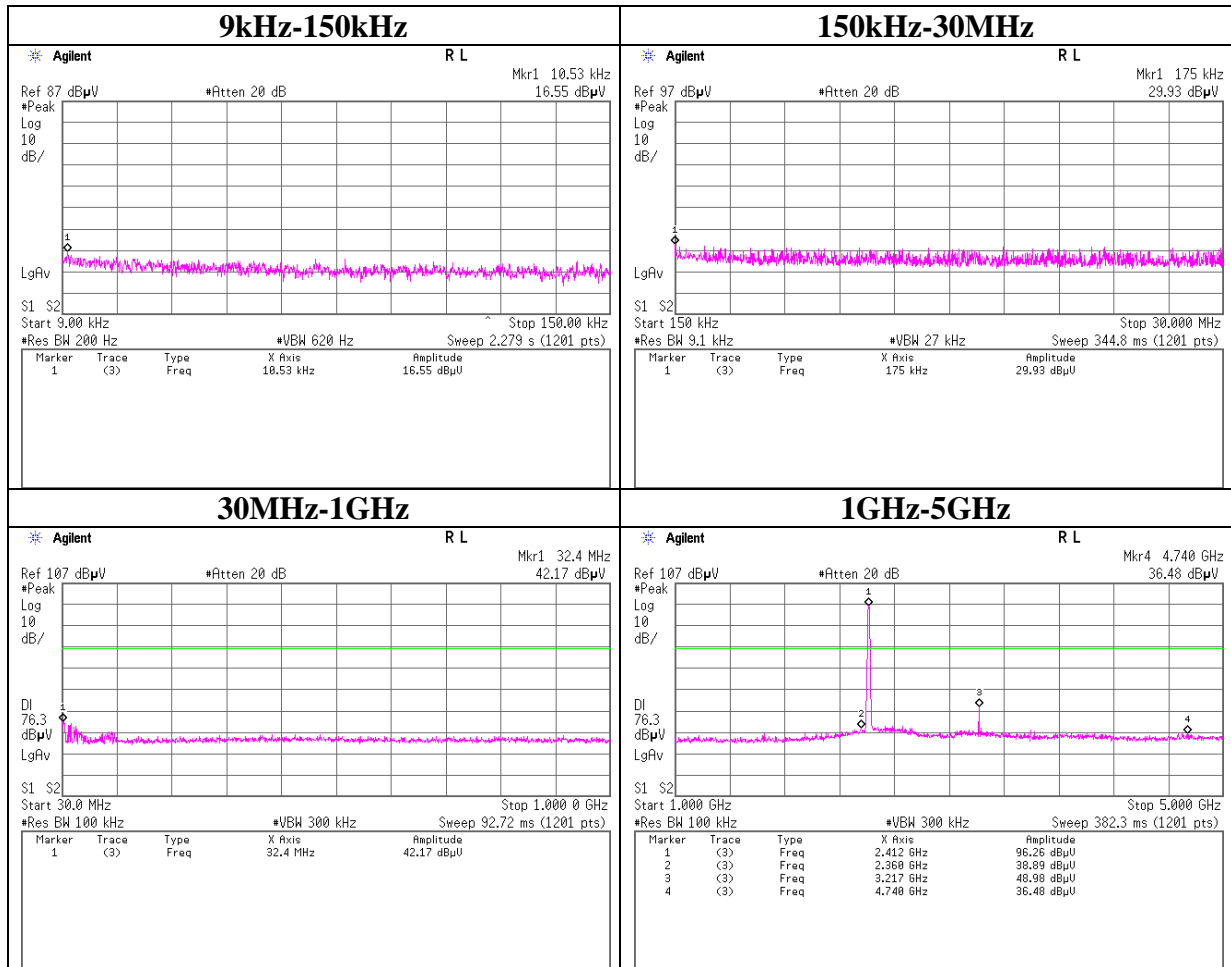
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
 26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

The tested burst timing



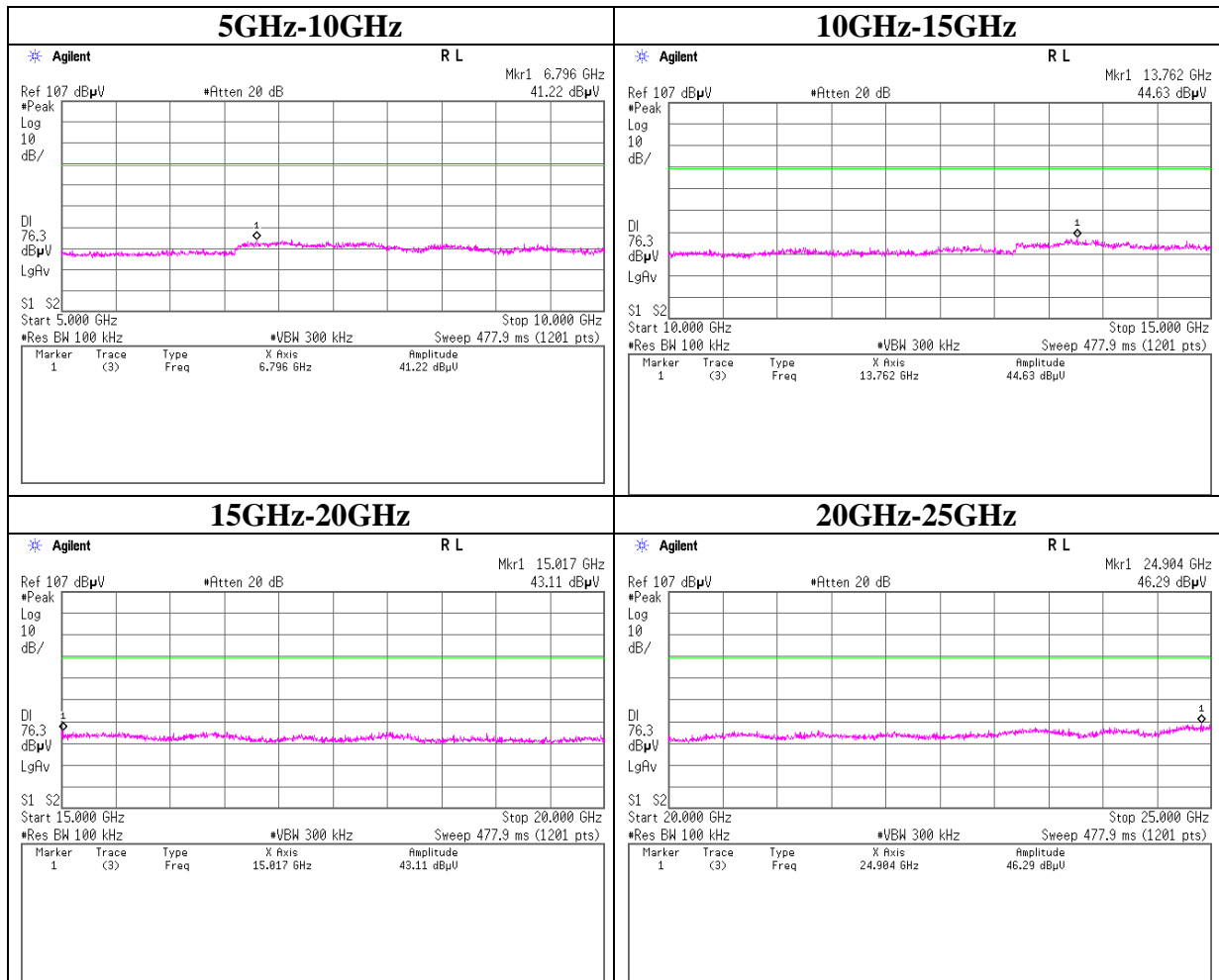
Conducted Spurious Emission

11b Tx 2412MHz



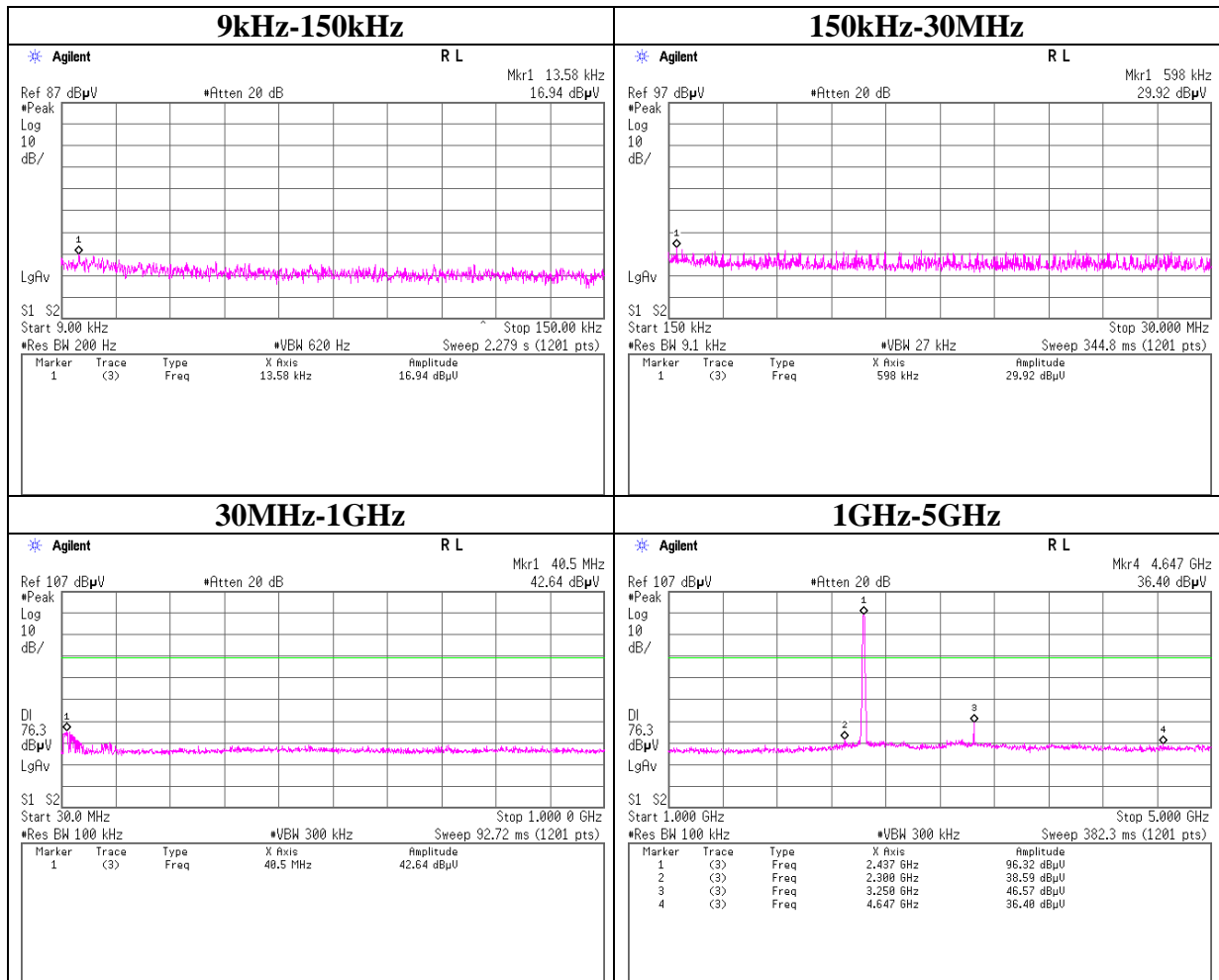
Conducted Spurious Emission

11b Tx 2412MHz



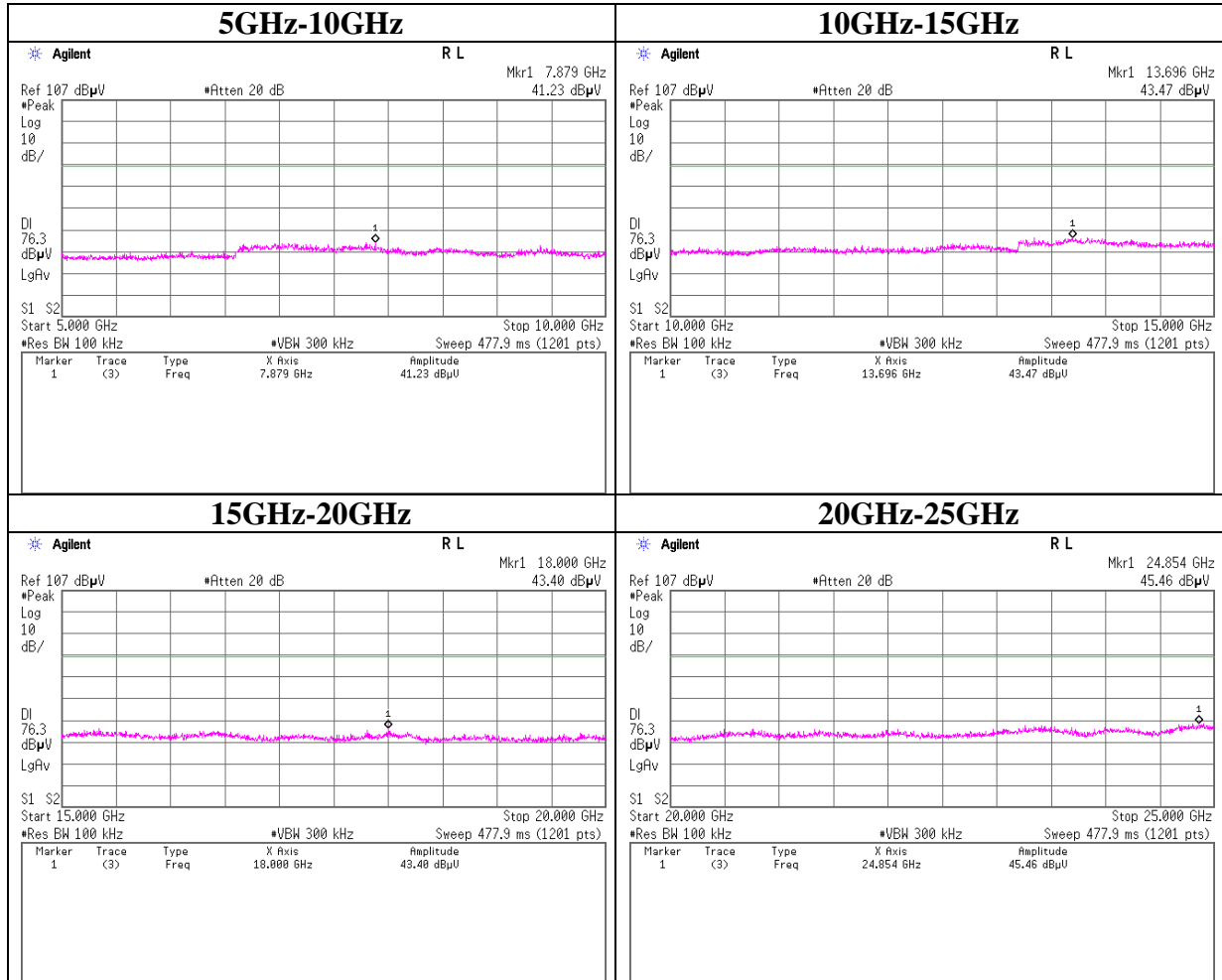
Conducted Spurious Emission

11b Tx 2437MHz



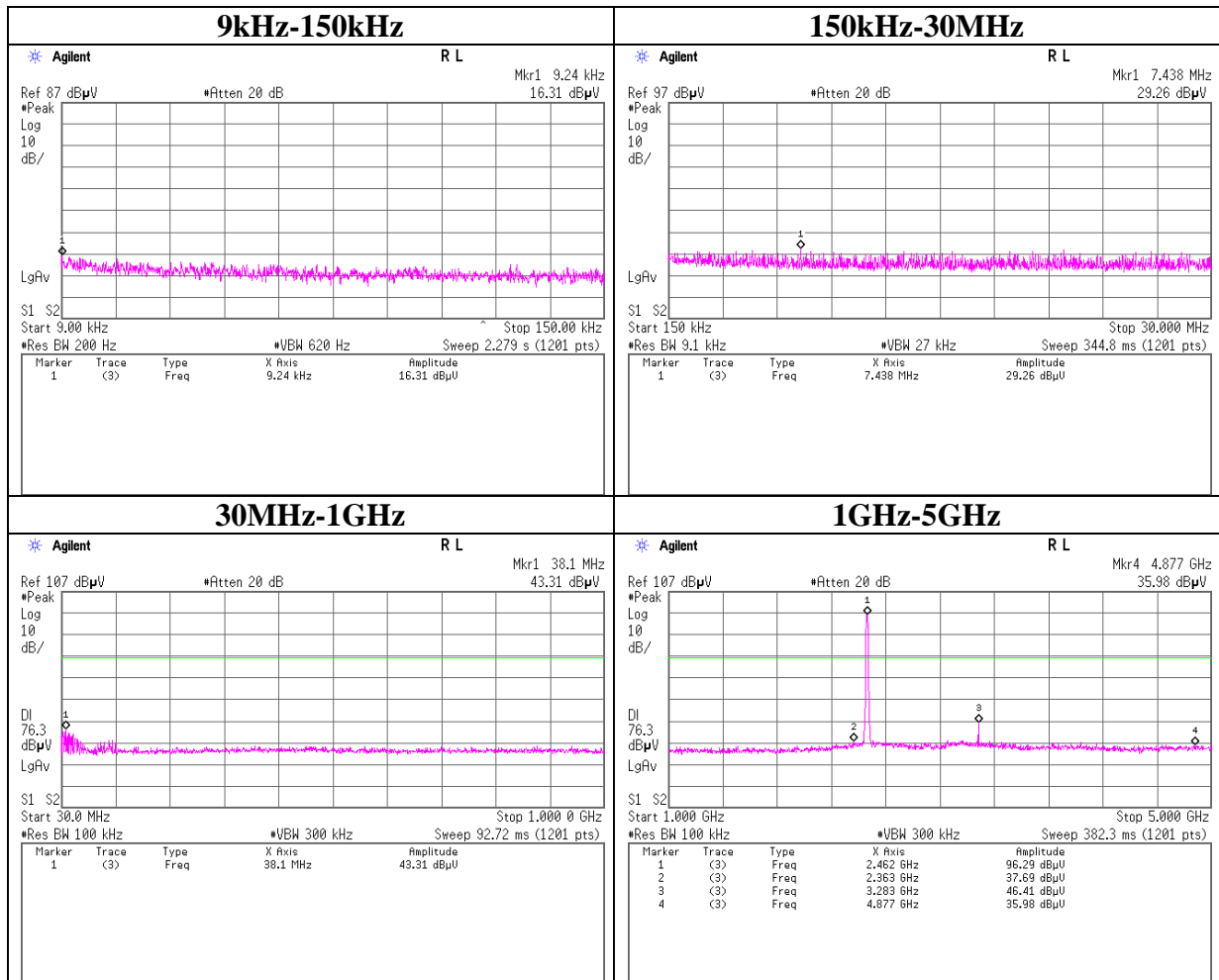
Conducted Spurious Emission

11b Tx 2437MHz



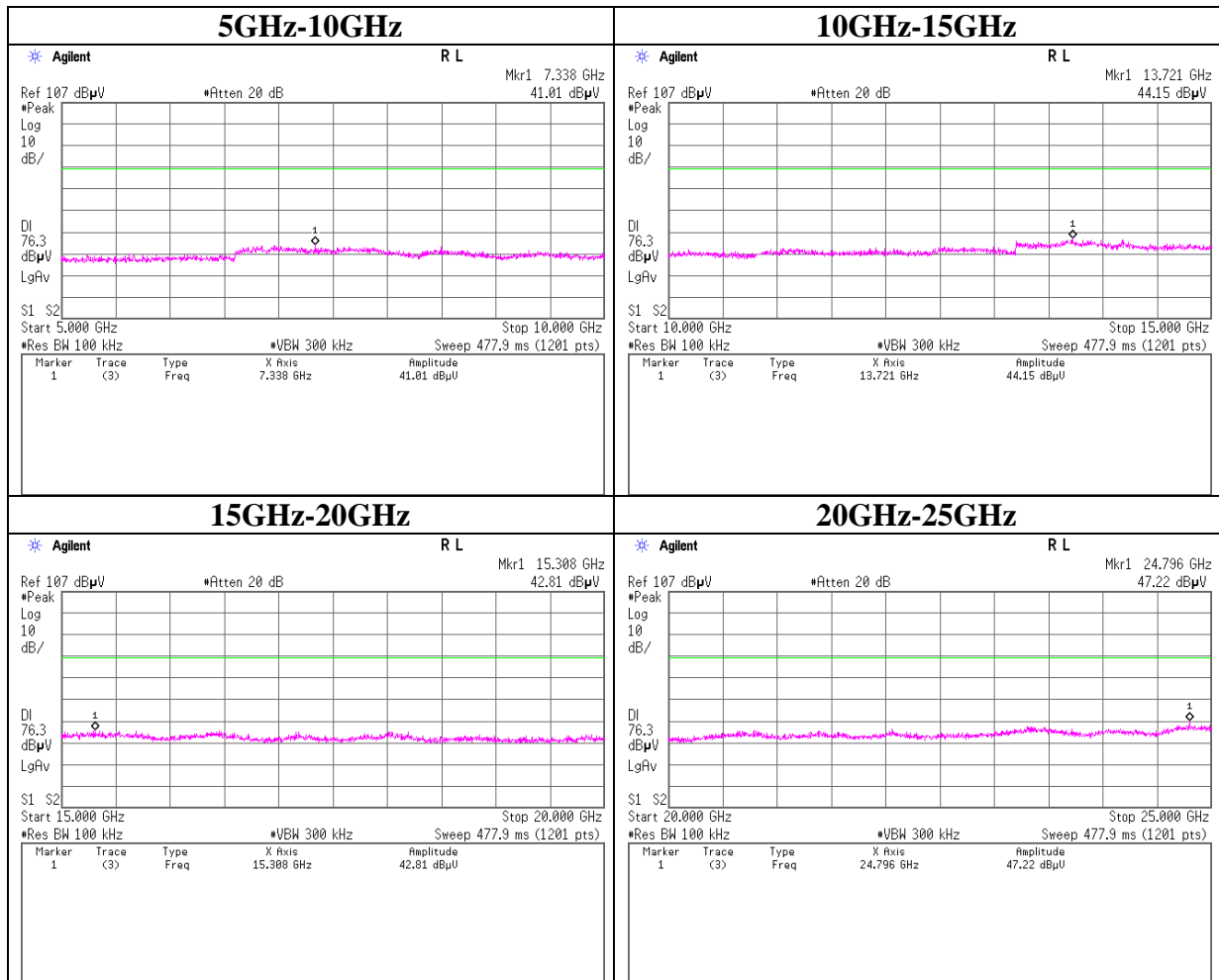
Conducted Spurious Emission

11b Tx 2462MHz



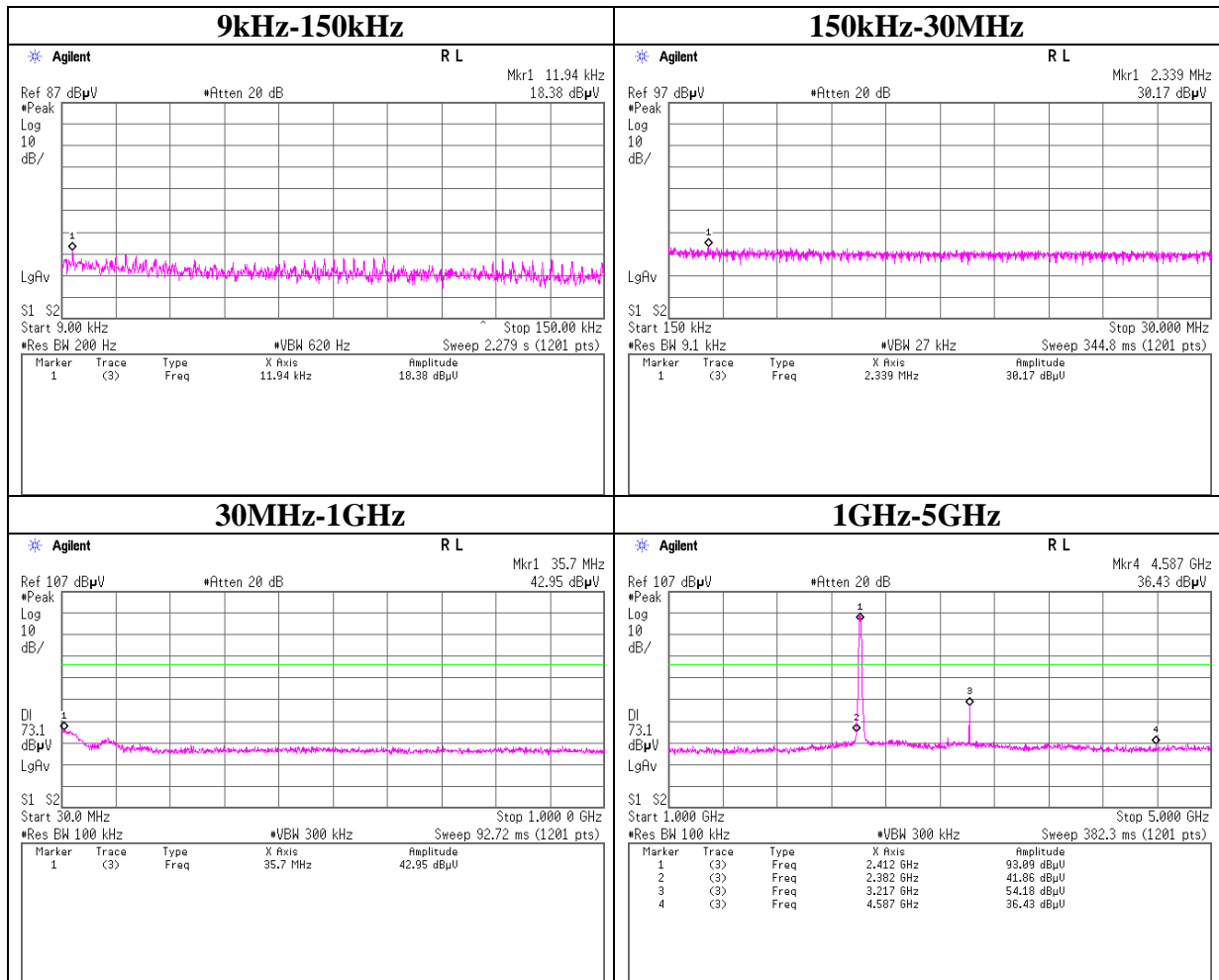
Conducted Spurious Emission

11b Tx 2462MHz



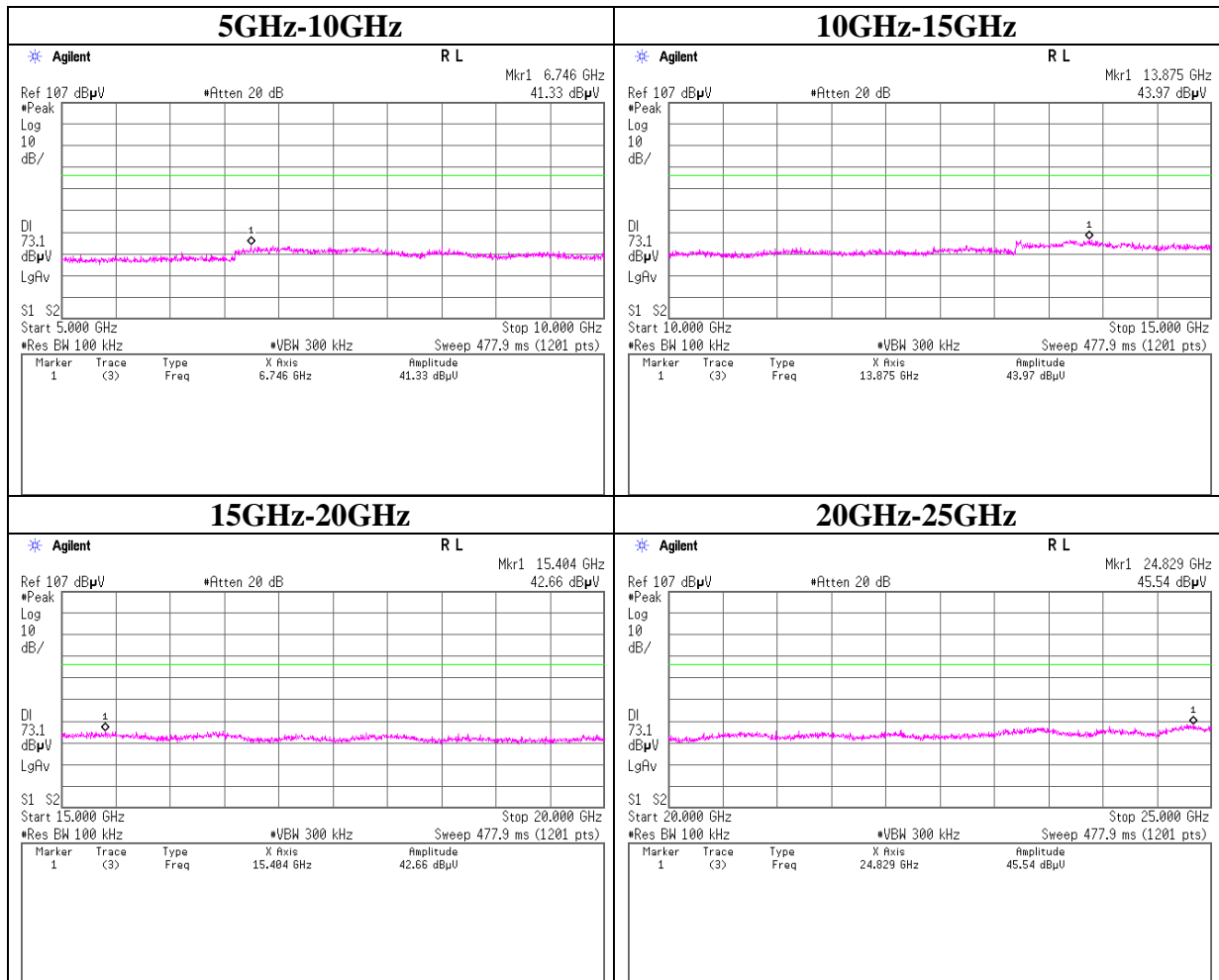
Conducted Spurious Emission

11n-20 Tx 2412MHz



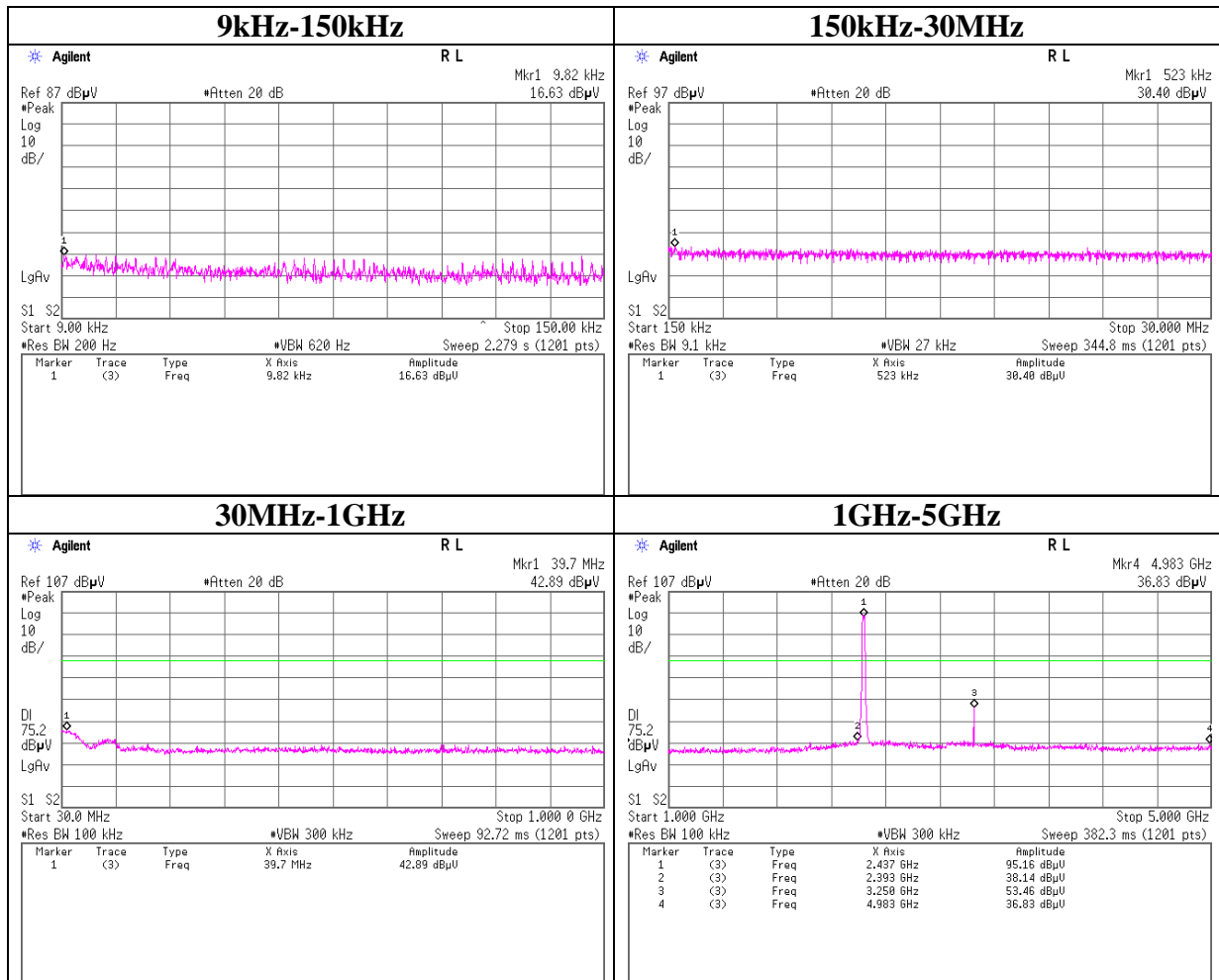
Conducted Spurious Emission

11n-20 Tx 2412MHz



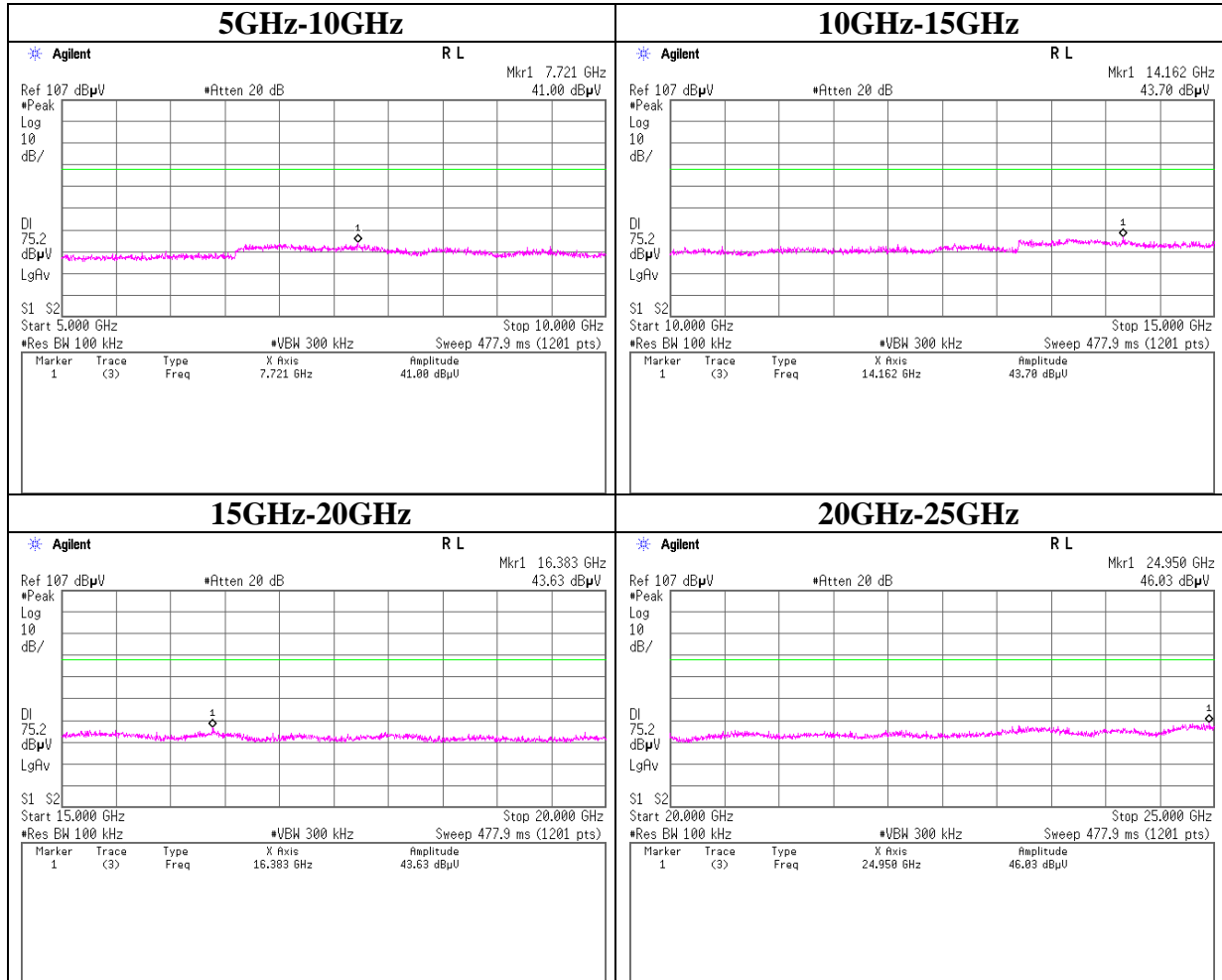
Conducted Spurious Emission

11n-20 Tx 2437MHz



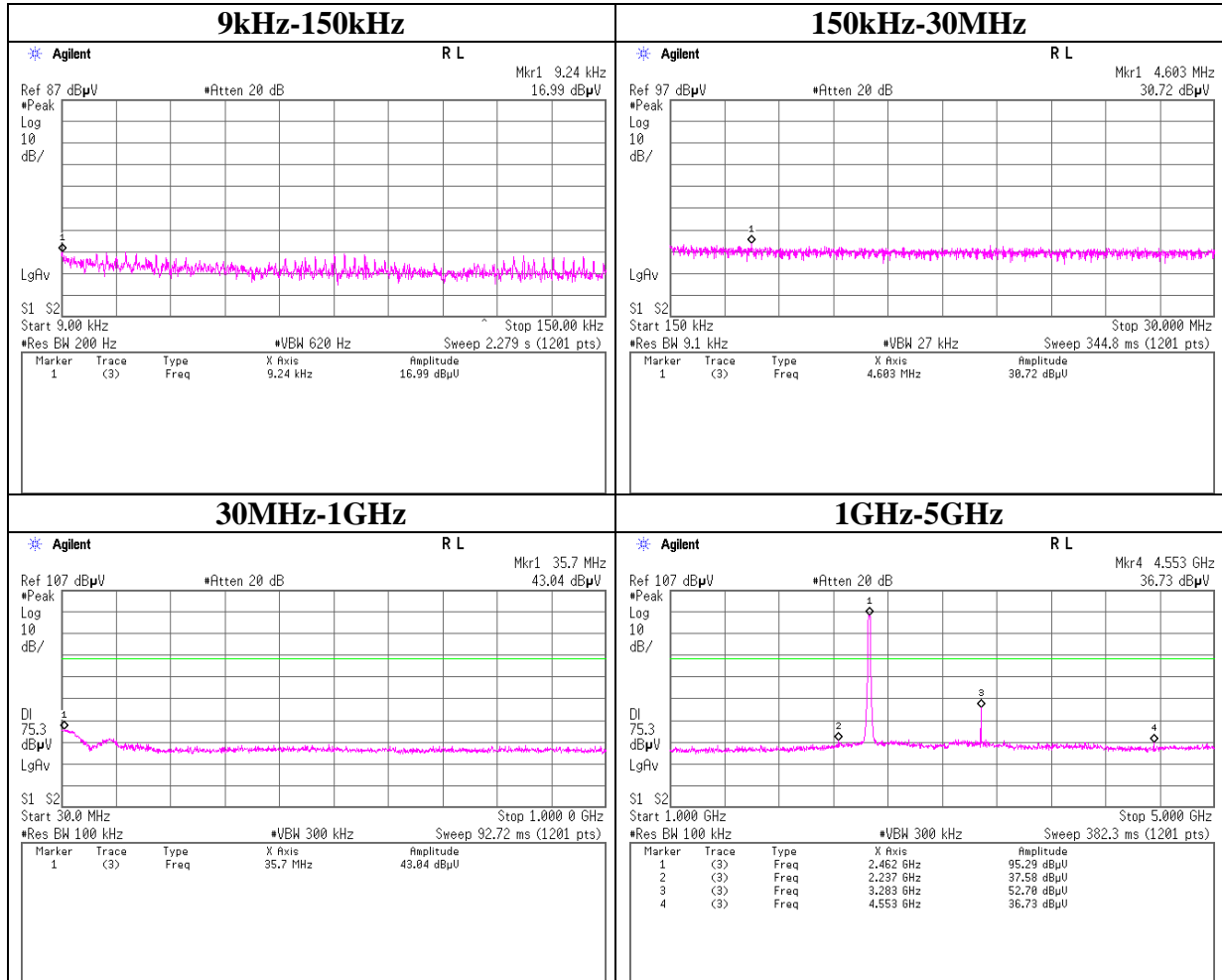
Conducted Spurious Emission

11n-20 Tx 2437MHz



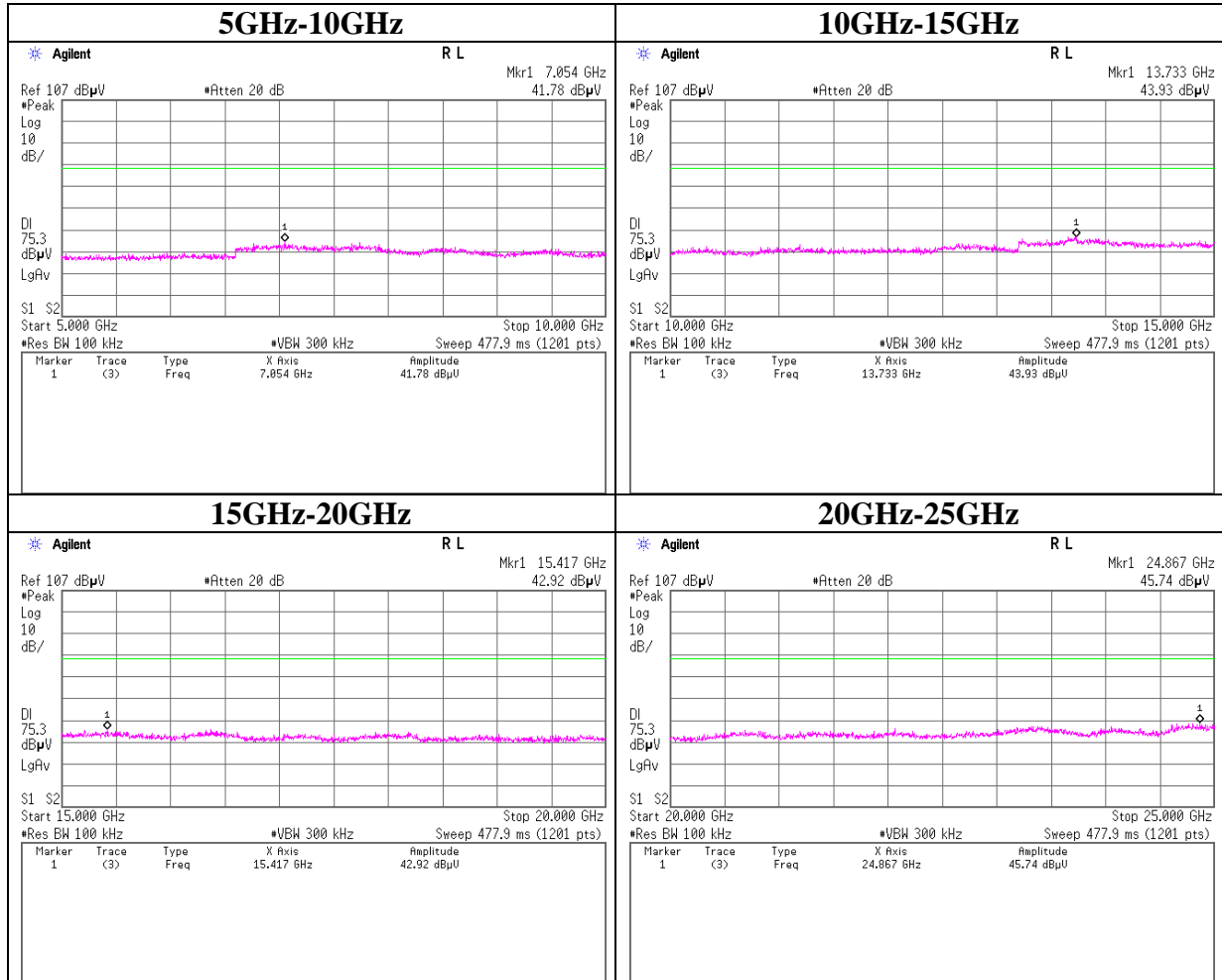
Conducted Spurious Emission

11n-20 Tx 2462MHz



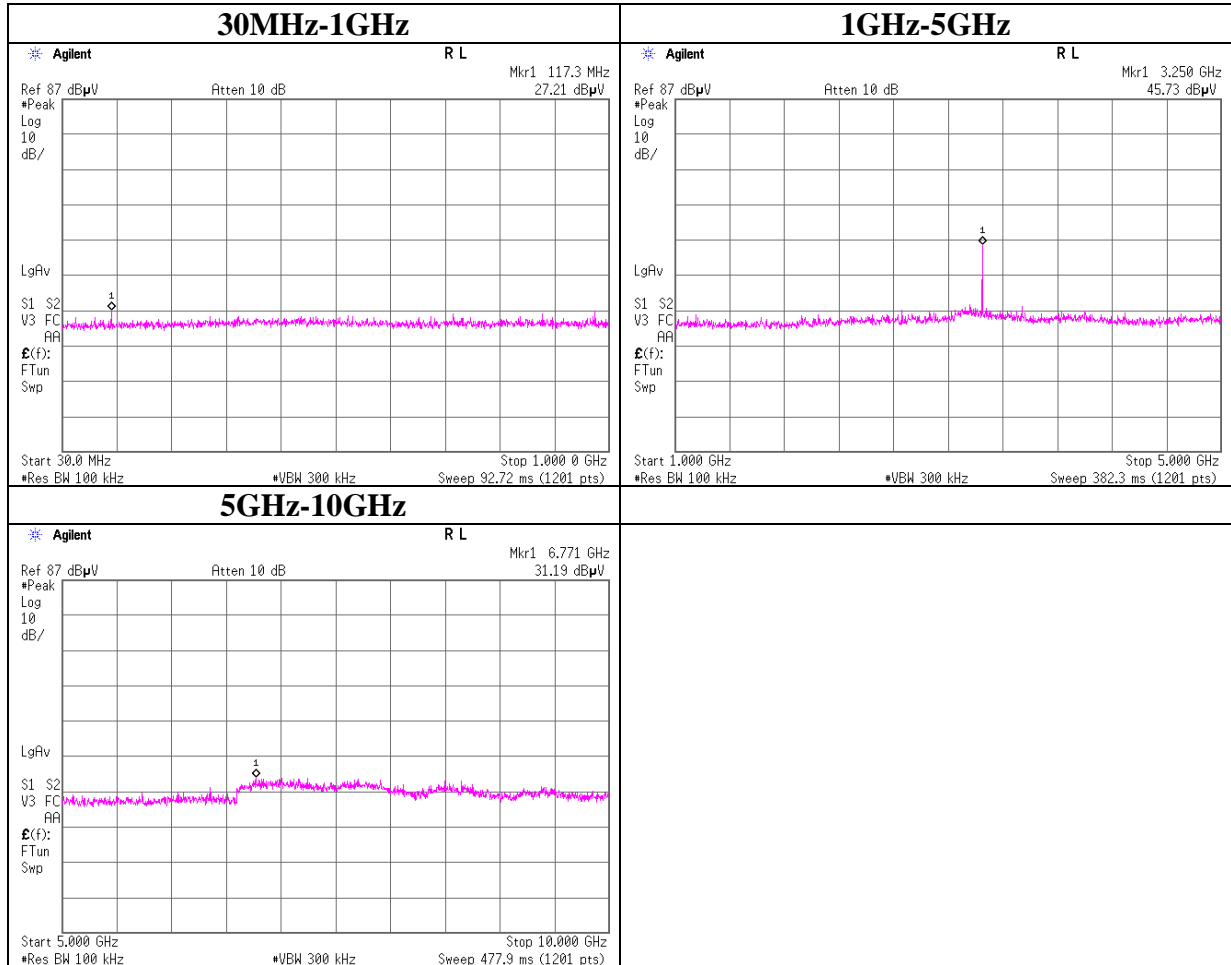
Conducted Spurious Emission

11n-20 Tx 2462MHz



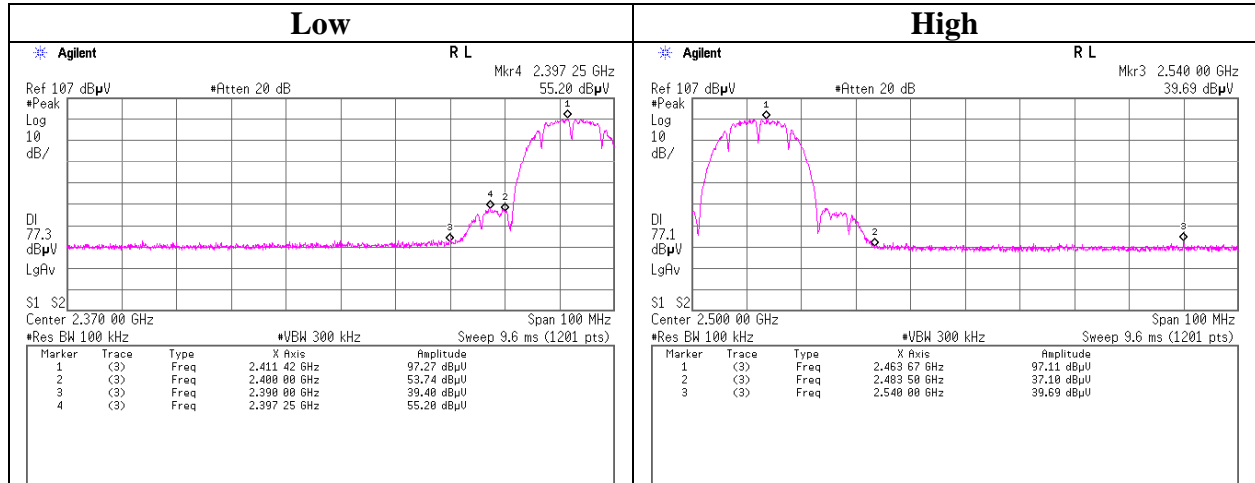
Conducted Spurious Emission

Rx 2437MHz

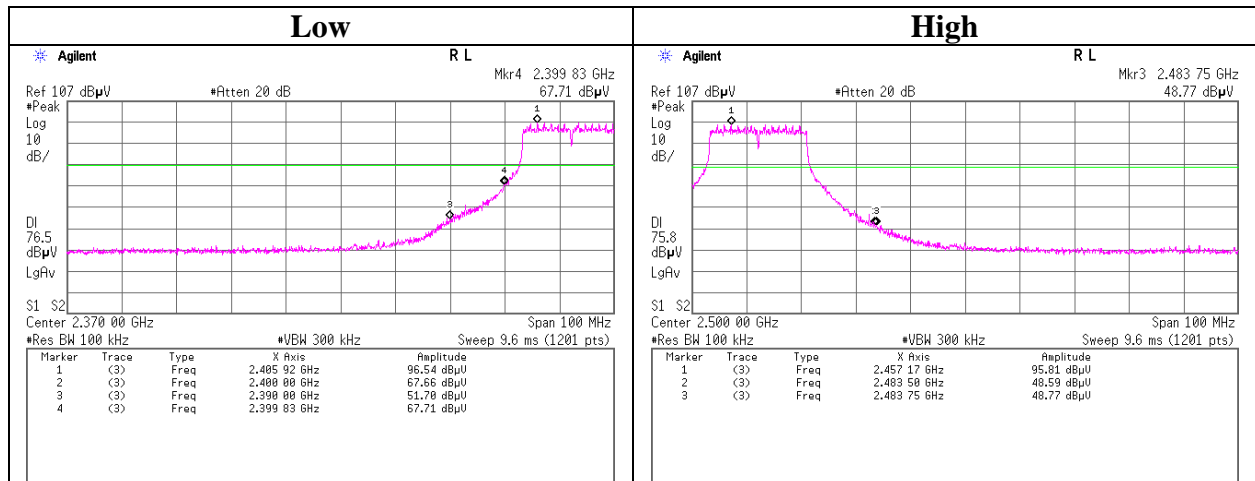


Conducted Emission Band Edge compliance

11b Tx



11n-20 Tx



Power Density

Test place Head Office EMC Lab. No.7 Measurement Room
Report No. 32EE0038-HO
Date 12/01/2011
Temperature/ Humidity 24 deg.C./ 54%
Engineer Tomotaka Sasagawa
Mode Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2411.23	-11.93	2.70	10.00	0.77	8.00	7.23
2436.23	-12.19	2.70	10.00	0.51	8.00	7.49
2461.23	-12.46	2.70	10.00	0.24	8.00	7.76

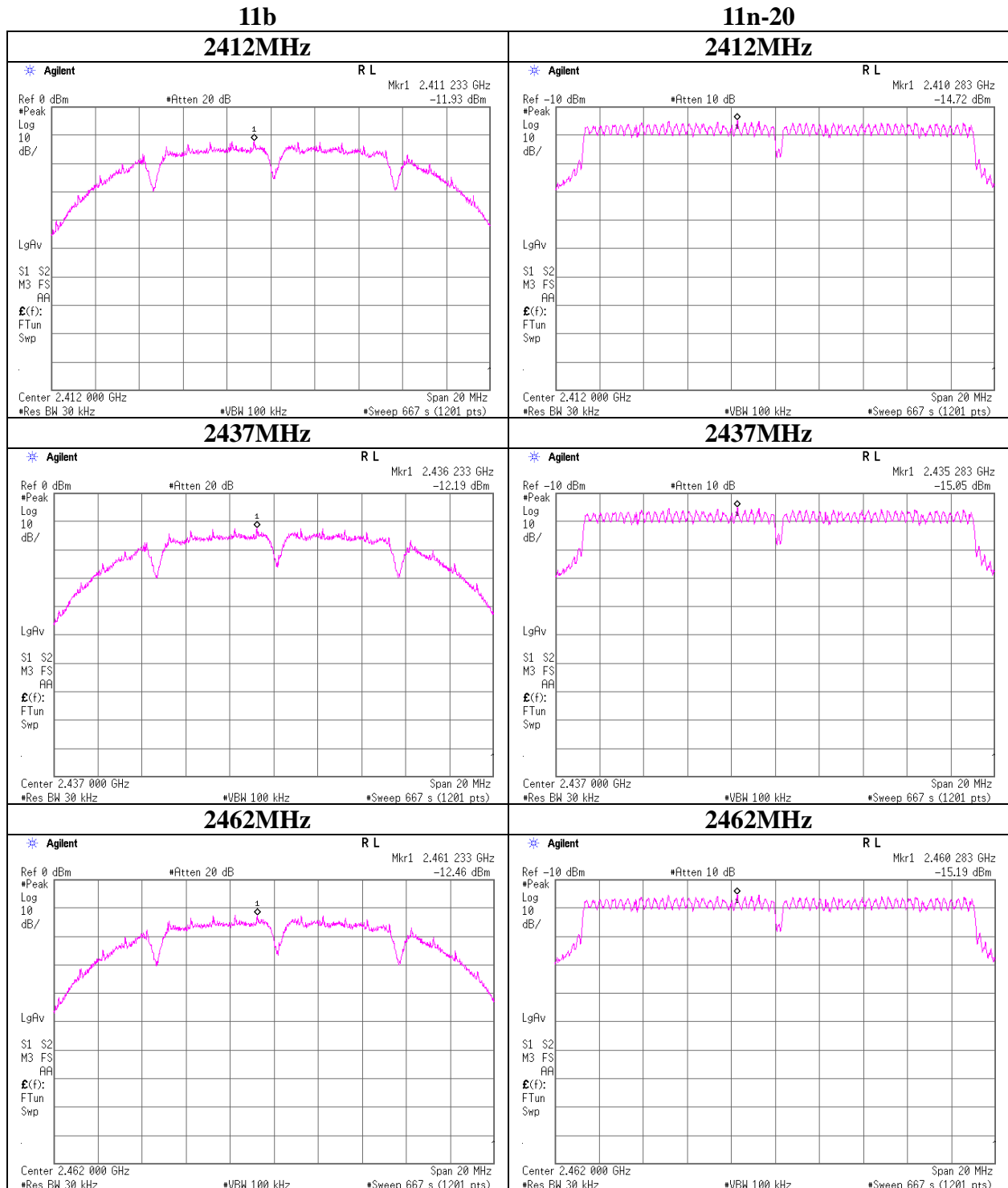
11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2410.28	-14.72	2.70	10.00	-2.02	8.00	10.02
2435.28	-15.05	2.70	10.00	-2.35	8.00	10.35
2460.28	-15.19	2.70	10.00	-2.49	8.00	10.49

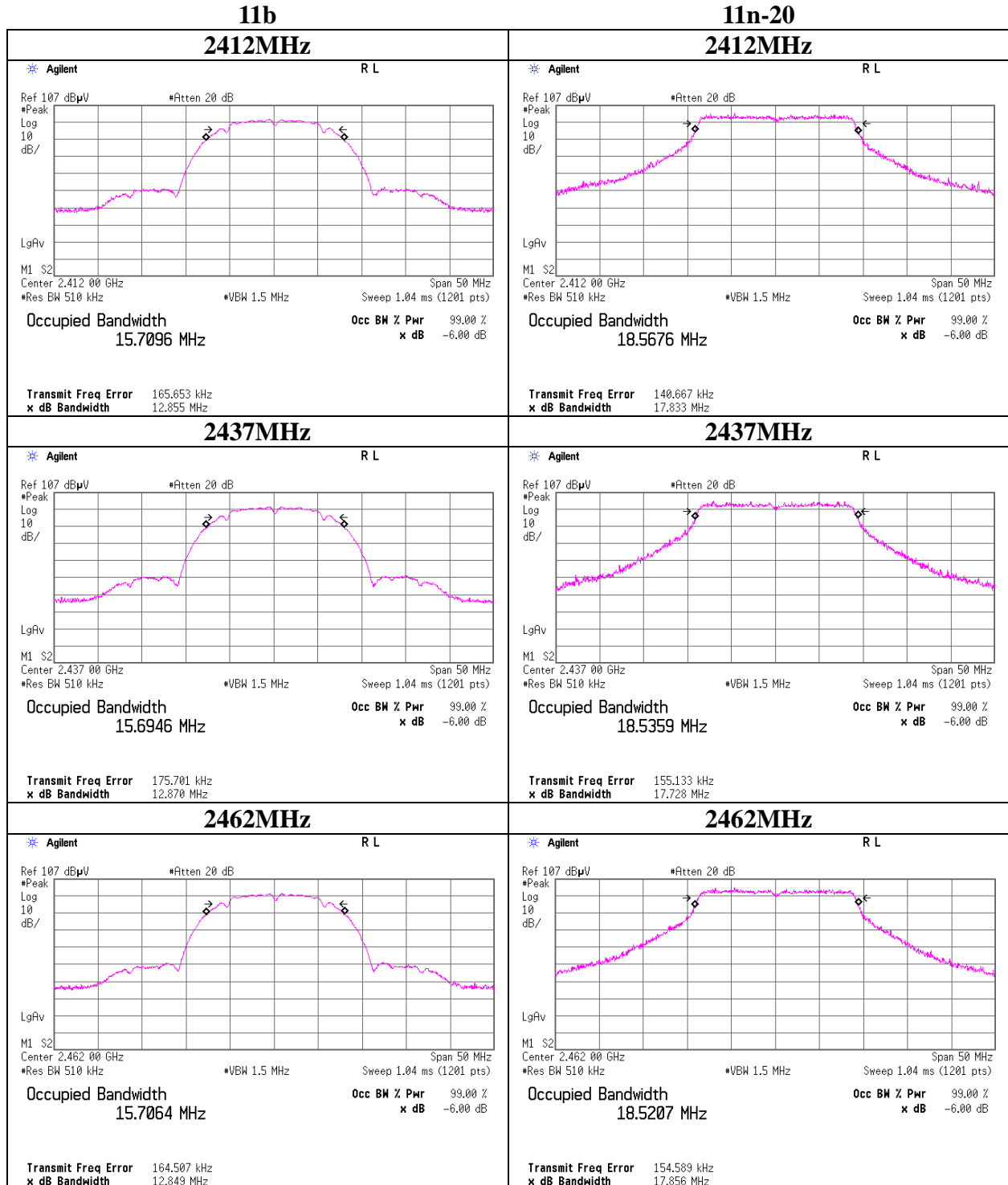
Sample Calculation:

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

Power Density



99% Occupied Bandwidth



APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2011/03/01 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE/CE	2011/02/23 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE/CE	2011/11/23 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2011/10/19 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE/CE	2011/11/16 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2011/11/16 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2011/03/25 * 12
MAT-51	Attenuator(6dB)	Weinschel	2	AS3557	RE	2011/01/14 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2011/03/04 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2011/08/11 * 12
MCC-56	Microwave Cable	Suhner	SUCOFLEX104	270875/4(1m) / 284655(5m)	RE	2011/03/02 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2011/03/10 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2011/06/17 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE(EUT)	2011/02/20 * 12
MAT-67	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2011/02/22 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	CE	2011/07/04 * 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
RE: Radiated Emission
AT: Antenna Terminal Conducted test**