



Test report No. : 33AE0057-HO-01-A-R1  
Page : 1 of 68  
Issued date : November 12, 2012  
Revised date : November 27, 2012  
FCC ID : VPYLBXN604

# RADIO TEST REPORT


**Test Report No. : 33AE0057-HO-01-A-R1**

**Applicant** : Murata Manufacturing Co., Ltd.  
**Type of Equipment** : Communication Module  
**Model No.** : Type XN  
**FCC ID** : VPYLBXN604  
**Test regulation** : FCC Part 15 Subpart C: 2012  
**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 33AE0057-HO-01-A. 33AE0057-HO-01-A is replaced with this report.

**Date of test:** October 19 to 26, 2012

**Representative test engineer:**

  
Satofumi Matsuyama  
Engineer of WiSE Japan,  
UL Verification Service

**Approved by:**

  
Masanori Nishiyama  
Manager 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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## **SECTION 1: Customer information**

Company Name	:	Murata Manufacturing Co., Ltd.
Address	:	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number	:	+81-75-955-6735
Facsimile Number	:	+81-75-955-6634
Contact Person	:	TAKAHARU KAWAKATSU

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

### **2.1 Identification of E.U.T.**

Type of Equipment	:	Communication Module
Model No.	:	Type XN
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.8V
Receipt Date of Sample	:	October 17, 2012
Country of Mass-production	:	China/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**

#### **General Specification**

The EUT is Communication Module which is installed in Compact Digital camera.

#### **Specification of WLAN (IEEE802.11b/g/n)**

Type of radio	Wireless LAN (IEEE802.11b/g)	Wireless LAN (IEEE802.11n) 2.4G Band SISO (20M Band)
Equipment Type	Transceiver	
Frequency of Operation	2412MHz - 2462MHz	
Bandwidth & Channel spacing	Bandwidth : 20MHz Ch spacing : 5MHz	
Type of Modulation	11b: DSSS 11g: OFDM	OFDM
Antenna Type / Antenna Gain	Chip Antenna: +0.4dBi FPC Antenna with short cable: -0.1 dBi * FPC Antenna with long cable: -1.3 dBi *	
Power Supply (inner)	DC 3.8V	
Operating temperature range	-20 to +55 deg. C.	

\*Radiated Emission (carrier frequency) was checked with both antennas, and it was found that there were no difference between the two, so Conducted Emission and Radiated Emission tests in this report were performed only with FPC Antenna with short cable.

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## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2012, final revised on August 13, 2012 and effective September 12, 2012

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	[Chip antenna] QP 24.4dB, 24.94896MHz, N AV 14.4dB, 24.94896MHz, N [FPC Antenna] QP 24.1dB, 24.94916MHz, N AV 14.1dB, 24.94916MHz, 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	[Chip antenna] 9.8dB 336.833MHz, QP, Vertical [FPC Antenna] 4.7dB 4824.000MHz, AV, 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 the power supply regulator. However one of the input voltages to RF part doesn't go through the regulator. The stable voltage will be supplied by the end product, which will be required to have a power supply regulator.

Therefore the 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 antenna requirement of Section 15.203/212.

**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.

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### 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	4.3dB	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
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.

### 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.

## **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.

<b>Mode</b>	<b>Remarks*</b>
IEEE 802.11b (11b)	2Mbps, PN9
IEEE 802.11g (11g)	6Mbps, PN9
IEEE 802.11n SISO 20MHz BW (11n-20)	MCS 0, 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: 5dBm Software: wifitest, Version: 0.5 *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.	

\*Details of Operating mode(s)

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested frequency</b>
Conducted Emission	11b Tx	2412MHz
Spurious Emission (Radiated)	11n-20 Tx *1)	2437MHz 2462MHz
6dB Bandwidth	11b Tx	2412MHz
Maximum Peak Output Power	11g Tx	2437MHz
Spurious Emission (Conducted)	11n-20 Tx	2462MHz
Power Density		
99% Occupied Bandwidth		
*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 higher peak output power.		

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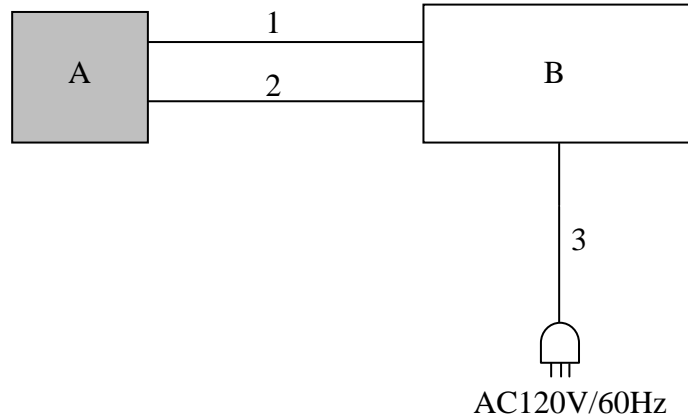
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## 4.2 Configuration and peripherals



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

### Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Communication Module	Type XN	[FPC Antenna] 1 *1) 2 *2)	Murata Manufacturing Co., Ltd.	EUT
			[Chip Antenna] 3		
B	DC Power supply	PW18-1.3AT	08016530	JVC KENWOOD	-

\*1) Used for Conducted Emission test and Radiated Emission test

\*2) Used for Antenna Terminal conducted test

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.2	Unshielded	Unshielded	-
2	DC Cable	1.2	Unshielded	Unshielded	-
3	AC Cable	2.2	Unshielded	Unshielded	-

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## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, 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.

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

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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 (issued on March 23, 2005)".

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		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz *1)	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m*2) (above 10GHz),		3m (below 10GHz), 1m*2) (above 10GHz),

\*1) The test was performed with VBW 10Hz since the EUT had no intervals during which the transmitter was off (see Appendix).

\*2) 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.

<b>Measurement range</b>	<b>: 30M-26.5GHz</b>
<b>Test data</b>	<b>: APPENDIX</b>
<b>Test result</b>	<b>: Pass</b>

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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/ Average *1)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	18MHz 20MHz	30kHz	100kHz	600sec 667sec	Peak	Max Hold	Spectrum Analyzer *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) Testing using an average detector was performed in order to confirm that the output power of the EUT met the exclusion limits stated in FCC Part 2 Section 2.1093 and FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET 65 and the EUT was exempt from RF exposure SAR evaluation.  
\*2) PSD Option 1 of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247 (issued on March 23, 2005)".  
\*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  
Chip Antenna

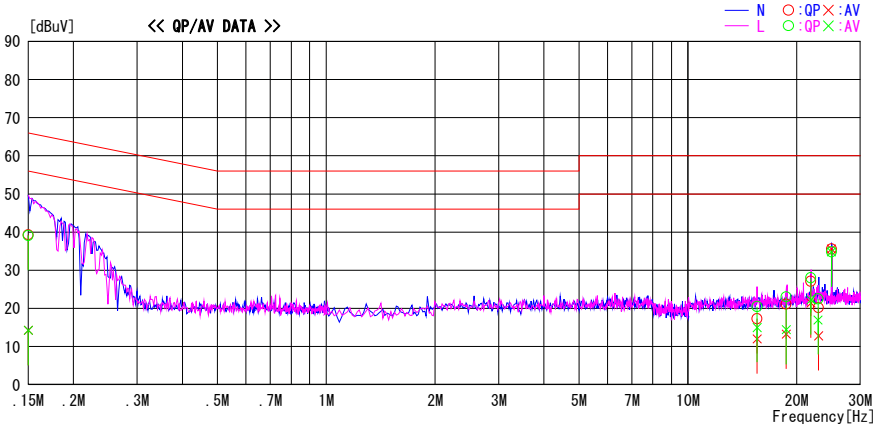
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber  
Date : 2012/10/26

Report No. : 33AE0057-H0-01  
Temp./Humi. : 25deg. C / 51% RH  
Engineer : Satofumi Matsuyama

Mode / Remarks : WLAN 11n20 Tx 2462MHz / MCS0

LIMIT : FCC15. 207 QP  
FCC15. 207 AV

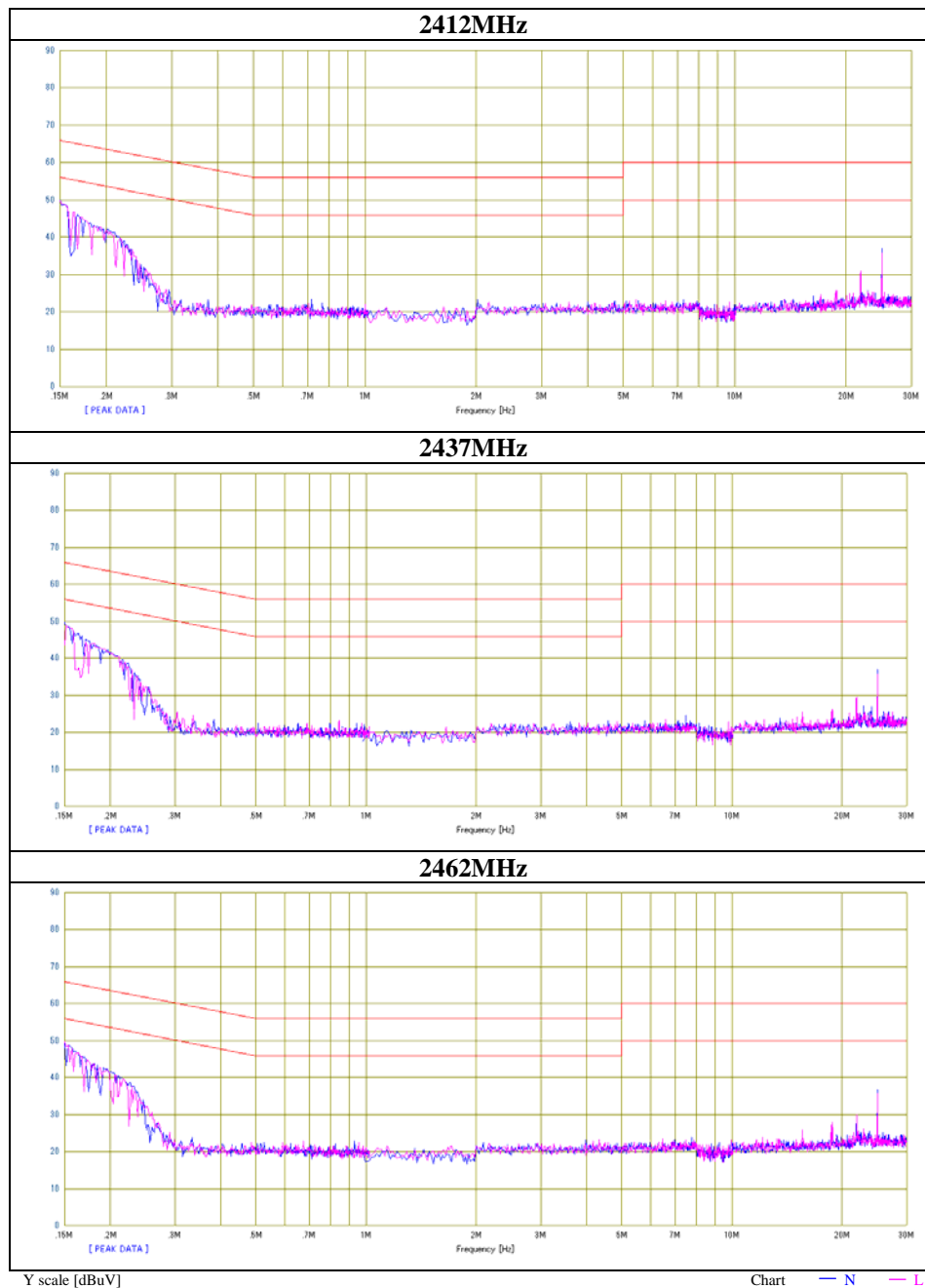


Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	26.1	1.0	13.2	39.3	14.2	66.0	56.0	26.7	41.8	N	
15.54188	2.5	-2.8	14.8	17.3	12.0	60.0	50.0	42.7	38.0	N	
18.71216	6.0	-1.9	15.1	21.1	13.2	60.0	50.0	38.9	36.8	N	
21.88088	11.9	6.2	15.2	27.1	21.4	60.0	50.0	32.9	28.6	N	
22.96880	5.0	-2.4	15.2	20.2	12.8	60.0	50.0	39.8	37.2	N	
24.94896	20.3	20.3	15.3	35.6	35.6	60.0	50.0	24.4	14.4	N	
0.15000	25.9	1.0	13.2	39.1	14.2	66.0	56.0	26.9	41.8	L	
15.54272	5.7	0.2	14.8	20.5	15.0	60.0	50.0	39.5	35.0	L	
18.71222	7.9	-0.7	15.1	23.0	14.4	60.0	50.0	37.0	35.6	L	
21.88168	12.8	7.0	15.2	28.0	22.2	60.0	50.0	32.0	27.8	L	
22.90324	7.3	1.8	15.2	22.5	17.0	60.0	50.0	37.5	33.0	L	
24.94961	19.5	19.5	15.3	34.8	34.8	60.0	50.0	25.2	15.2	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT=READING+C.F (L1SN LOSS+ATT LOSS +CABLE LOSS)  
Except for the above table : adequate margin data below the limits.

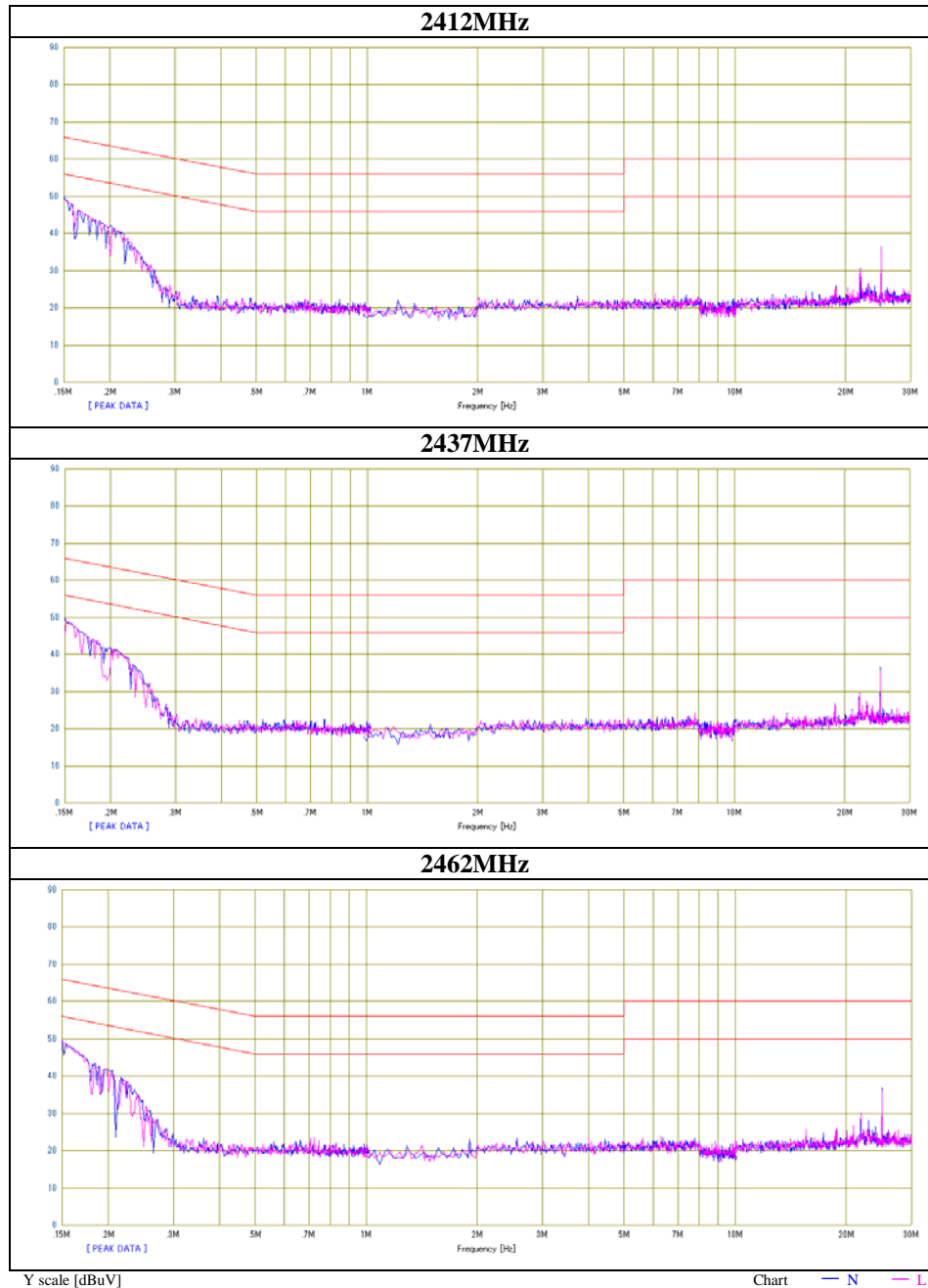
## Conducted Emission Chip Antenna

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	33AE0057-HO-01
Date	10/25/2012
Temperature/ Humidity	25 deg. C / 51% RH
Engineer	Satofumi Matsuyama
Mode	11b Tx



## Conducted Emission Chip Antenna

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	33AE0057-HO-01
Date	10/25/2012
Temperature/ Humidity	25 deg. C / 51% RH
Engineer	Satofumi Matsuyama
Mode	11n-20 Tx



## Conducted Emission FPC Antenna

### DATA OF CONDUCTED EMISSION TEST

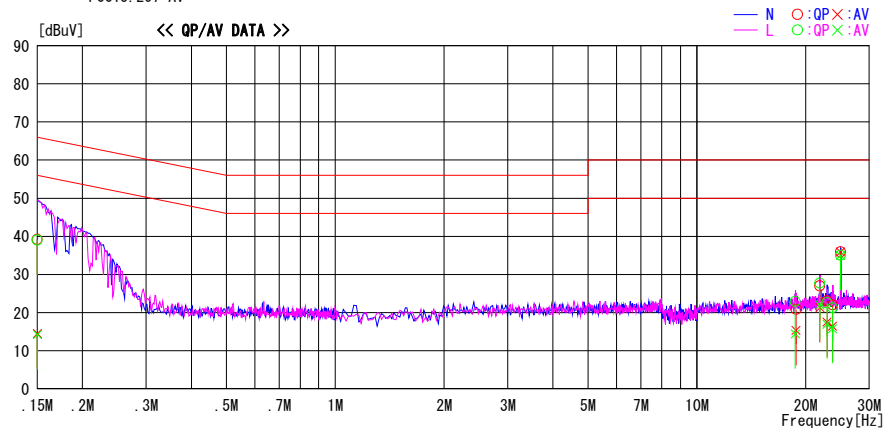
UL Japan, Inc. Head Office EMC Lab. No.2 Semi Anechoic Chamber  
Date : 2012/10/26

Report No. : 33AE0057-HO-01

Temp./Humi. : 25deg. C / 51% RH  
Engineer : Satofumi Matsuyama

Mode / Remarks : WLAN 11n20 Tx 2462MHz / MCS0

LIMIT : FCC15.207 QP  
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	26.0	1.3	13.2	39.2	14.5	66.0	56.0	26.8	41.5	N	
18.81372	5.7	0.2	15.1	20.8	15.3	60.0	50.0	39.2	34.7	N	
21.88216	11.8	6.1	15.2	27.0	21.3	60.0	50.0	33.0	28.7	N	
22.90392	7.9	2.3	15.2	23.1	17.5	60.0	50.0	36.9	32.5	N	
23.72276	6.8	1.2	15.2	22.0	16.4	60.0	50.0	38.0	33.6	N	
24.94916	20.6	20.6	15.3	35.9	35.9	60.0	50.0	24.1	14.1	N	
0.15000	25.8	1.0	13.2	39.0	14.2	66.0	56.0	27.0	41.8	L	
18.71196	7.8	-0.7	15.1	22.9	14.4	60.0	50.0	37.1	35.6	L	
21.88182	12.5	6.8	15.2	27.7	22.0	60.0	50.0	32.3	28.0	L	
22.90484	7.4	1.8	15.2	22.6	17.0	60.0	50.0	37.4	33.0	L	
23.72256	6.1	0.6	15.2	21.3	15.8	60.0	50.0	38.7	34.2	L	
24.94891	19.7	19.7	15.3	35.0	35.0	60.0	50.0	25.0	15.0	L	

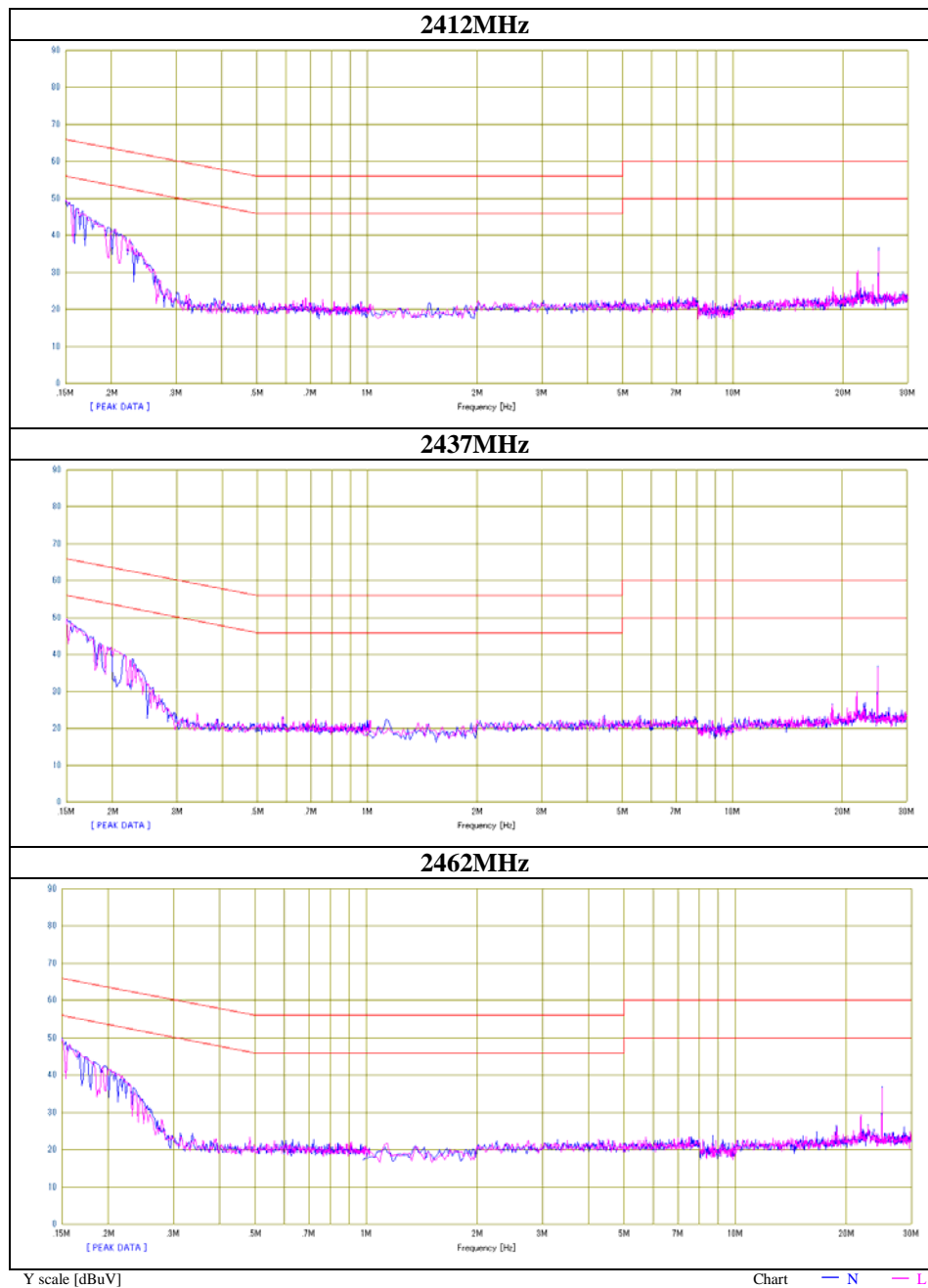
CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT=READING+C.F (LISN LOSS+ATT LOSS +CABLE LOSS)  
Except for the above table : adequate margin data below the limits.



## Conducted Emission

### FPC Antenna

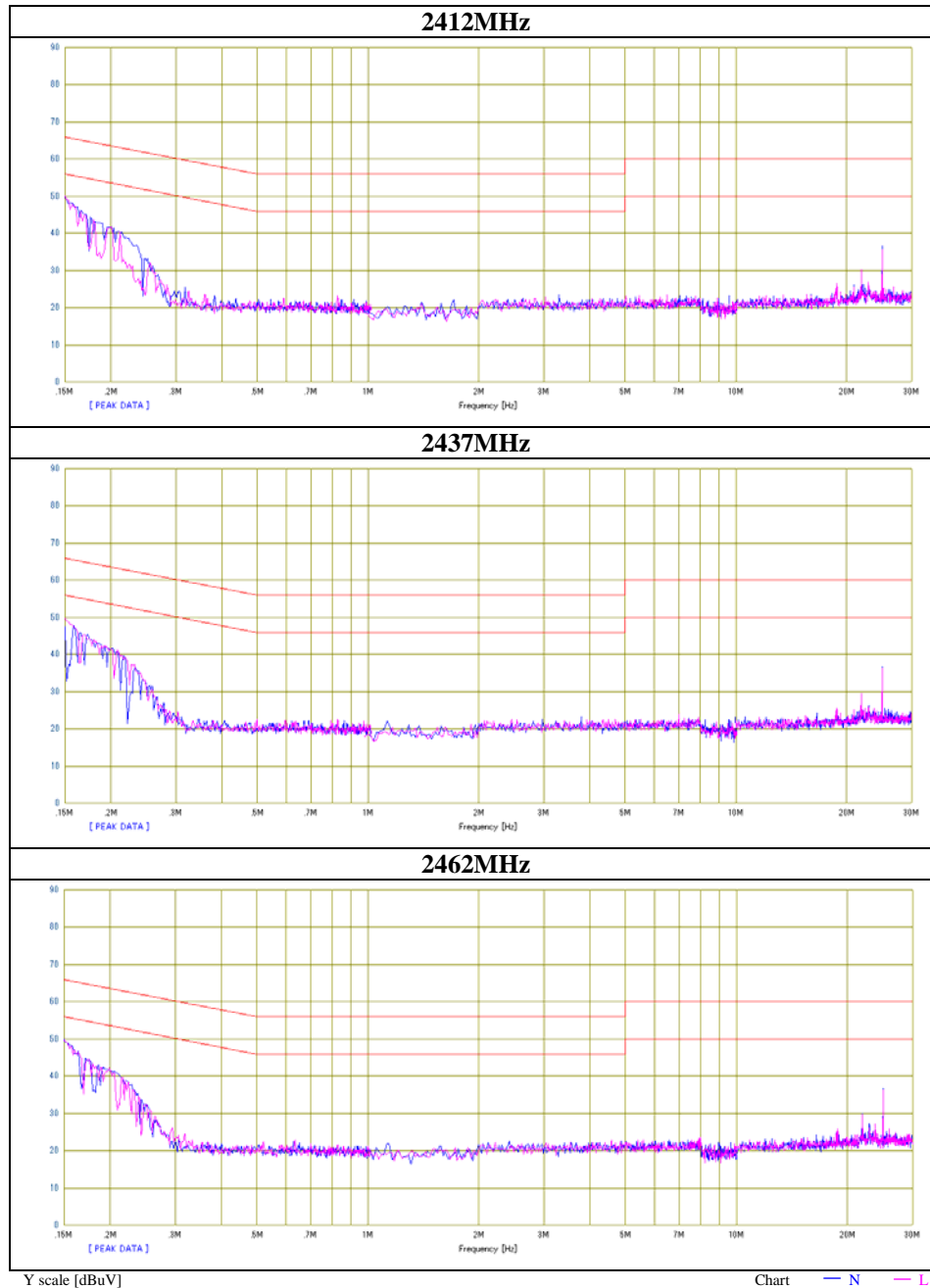
Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	33AE0057-HO-01
Date	10/25/2012
Temperature/ Humidity	25 deg. C / 51% RH
Engineer	Satofumi Matsuyama
Mode	11b Tx



## Conducted Emission

### FPC Antenna

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	33AE0057-HO-01
Date	10/25/2012
Temperature/ Humidity	25 deg. C / 51% RH
Engineer	Satofumi Matsuyama
Mode	11n-20 Tx



### **6dB Bandwidth**

Test place Head Office EMC Lab. No.6 Measurement Room  
Report No. 33AE0057-HO-01  
Date 10/24/2012  
Temperature/ Humidity 23 deg. C / 46% RH  
Engineer Kazuya Yoshioka  
Mode Tx

11b

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	9.291	>500
2437	9.433	>500
2462	9.478	>500

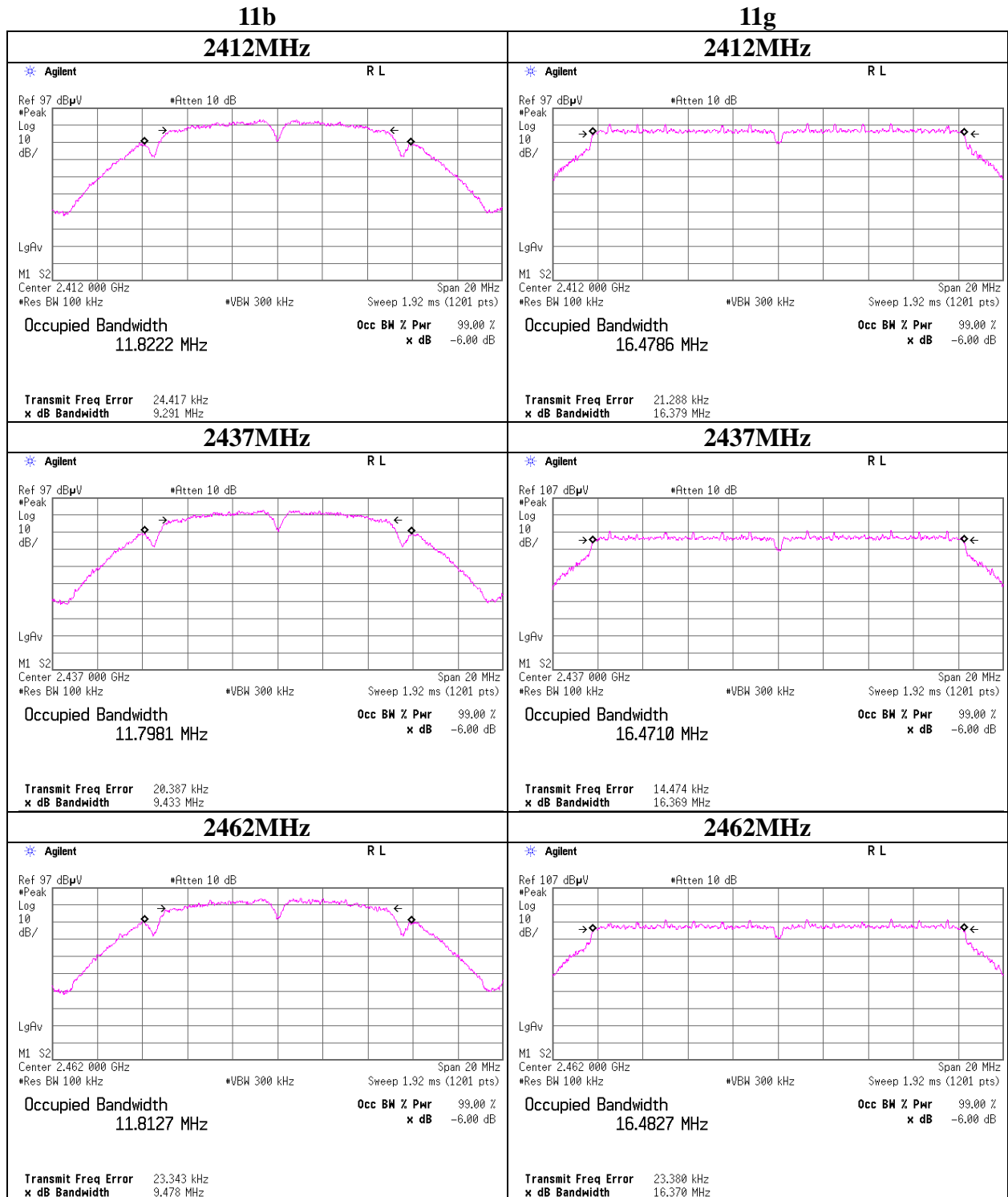
11g

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	16.379	>500
2437	16.369	>500
2462	16.370	>500

11n-20

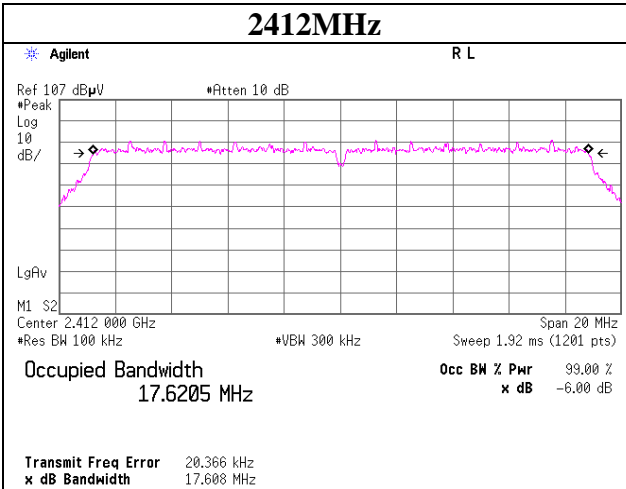
Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	17.608	>500
2437	17.604	>500
2462	17.609	>500

## 6dB Bandwidth

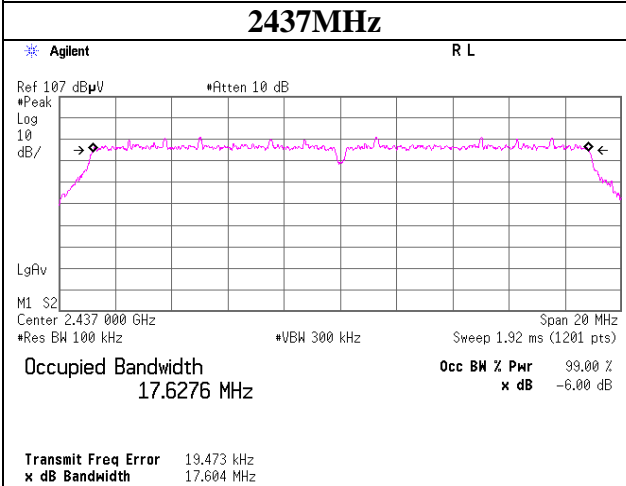


6dB Bandwidth

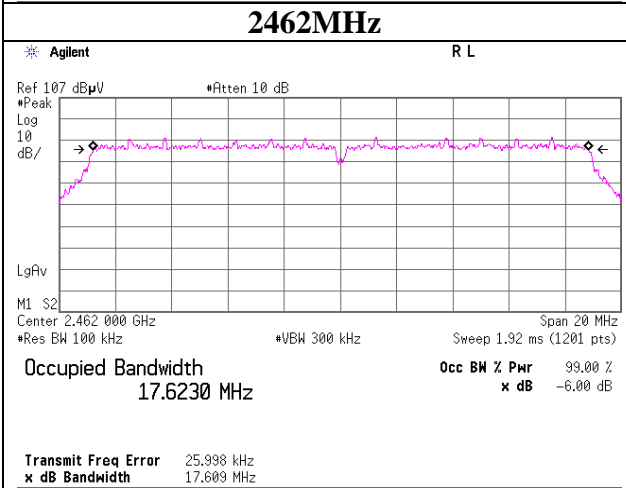
11n-20  
2412MHz



2437MHz



2462MHz



### Maximum Peak Output Power

Test place Head Office EMC Lab. No.11 Measurement Room  
Report No. 33AE0057-HO-01  
Date 10/19/2012  
Temperature/ Humidity 23 deg. C / 41% RH  
Engineer Hironobu Ohnishi  
Mode 11b Tx

Test voltage: Typical (VBAT: 3.80V)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-2.89	1.13	10.03	8.27	6.71	30.00	1000	21.73
2437	-2.91	1.13	10.03	8.25	6.68	30.00	1000	21.75
2462	-2.49	1.13	10.03	8.67	7.36	30.00	1000	21.33

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	-2.33	
2	-1.94	*
5.5	-2.21	
11	-2.21	

\*: Worst Rate

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

\*Difference between worst rate check data and formal test result is due to the different test condition.

### Maximum Peak Output Power

Test place Head Office EMC Lab. No.11 Measurement Room  
Report No. 33AE0057-HO-01  
Date 10/19/2012  
Temperature/ Humidity 23 deg. C / 41% RH  
Engineer Hironobu Ohnishi  
Mode 11g Tx

Test voltage: Typical (VBAT: 3.80V)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	3.86	1.13	10.03	15.02	31.77	30.00	1000	14.98
2437	3.90	1.13	10.03	15.06	32.06	30.00	1000	14.94
2462	4.25	1.13	10.03	15.41	34.75	30.00	1000	14.59

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	5.91	*
9	5.75	
12	5.78	
18	5.87	
24	5.78	
36	5.71	
48	5.78	
54	5.89	

\*: Worst Rate

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

\*Difference between worst rate check data and formal test result is due to the different test condition.

### Maximum Peak Output Power

Test place Head Office EMC Lab. No.11 Measurement Room  
Report No. 33AE0057-HO-01  
Date 10/19/2012  
Temperature/ Humidity 23 deg. C / 41% RH  
Engineer Hironobu Ohnishi  
Mode 11n-20 Tx

Test voltage: Typical (VBAT: 3.80V)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	4.37	1.13	10.03	15.53	35.73	30.00	1000	14.47
2437	4.44	1.13	10.03	15.60	36.31	30.00	1000	14.40
2462	4.82	1.13	10.03	15.98	39.63	30.00	1000	14.02

2437MHz

Rate	Reading	Remark
MCS	[dBm]	
0	6.07	*
1	5.78	
2	5.81	
3	5.71	
4	5.69	
5	5.72	
6	5.51	
7	5.64	

\*: Worst Rate

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

\*Difference between worst rate check data and formal test result is due to the different test condition.



## Maximum Average Output Power (Reference data for RF EXposure)

Test place Head Office EMC Lab. No.6 Measurement Room  
Report No. 33AE0057-HO-01  
Date 10/24/2012  
Temperature/ Humidity 23 deg. C / 46% RH  
Engineer Kazuya Yoshioka  
Mode 11b / g / n-20 Tx

[AV]

11b 2Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-7.95	1.52	10.03	3.60	2.29	30.00	1000	26.40
2437	-7.94	1.53	10.03	3.62	2.30	30.00	1000	26.38
2462	-7.94	1.54	10.03	3.63	2.31	30.00	1000	26.37

11g 6Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-7.99	1.52	10.03	3.56	2.27	30.00	1000	26.44
2437	-7.92	1.53	10.03	3.64	2.31	30.00	1000	26.36
2462	-7.39	1.54	10.03	4.18	2.62	30.00	1000	25.82

11n-20 MCS0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	-7.94	1.52	10.03	3.61	2.30	30.00	1000	26.39
2437	-8.06	1.53	10.03	3.50	2.24	30.00	1000	26.50
2462	-7.46	1.54	10.03	4.11	2.58	30.00	1000	25.89

Sample Calculation:

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

## Radiated Spurious Emission

### Chip Antenna

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	33AE0057-HO-01	
Date	10/24/2012	10/25/2012
Temperature/ Humidity	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Satofumi Matsuyama (1-10GHz)	Satofumi Matsuyama (Above 10GHz)
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	2390.000	PK	48.2	27.4	2.4	34.8	43.2	73.9	30.7	
Hori	4824.000	PK	47.7	31.3	4.3	34.0	49.3	73.9	24.6	
Hori	2390.000	AV	35.1	27.4	2.4	34.8	30.1	53.9	23.8	
Hori	4824.000	AV	39.9	31.3	4.3	34.0	41.5	53.9	12.4	
Vert	2390.000	PK	46.8	27.4	2.4	34.8	41.8	73.9	32.1	
Vert	4824.000	PK	47.6	31.3	4.3	34.0	49.2	73.9	24.7	
Vert	2390.000	AV	33.9	27.4	2.4	34.8	28.9	53.9	25.0	
Vert	4824.000	AV	39.6	31.3	4.3	34.0	41.2	53.9	12.7	

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

\*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

#### 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	99.7	27.5	2.4	34.8	94.8	-	-	Carrier
Hori	2400.000	PK	47.1	27.5	2.4	34.8	42.2	74.8	32.6	
Hori	6429.303	PK	49.8	34.1	4.7	34.0	54.6	74.8	20.2	
Vert	2412.000	PK	97.0	27.5	2.4	34.8	92.1	-	-	Carrier
Vert	2400.000	PK	43.5	27.5	2.4	34.8	38.6	72.1	33.5	
Vert	6432.053	PK	49.3	34.1	4.7	34.0	54.1	72.1	18.0	

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

## Radiated Spurious Emission

### Chip Antenna

Test place	Head Office EMC Lab. No.3 and 2 Semi Anechoic Chamber		
Report No.	33AE0057-HO-01		
Date	10/21/2012	10/24/2012	10/25/2012
Temperature/ Humidity	22 deg. C / 52% RH	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Hiroshi Kukita	Satofumi Matsuyama	Satofumi Matsuyama
	(1-10GHz)	(1-10GHz)	(Above 10GHz)
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	4874.000	PK	43.0	31.5	5.2	31.5	48.2	73.9	25.7	
Hori	4874.000	AV	34.0	31.5	5.2	31.5	39.2	53.9	14.7	
Vert	4874.000	PK	42.8	31.5	5.2	31.5	48.0	73.9	25.9	
Vert	4874.000	AV	36.1	31.5	5.2	31.5	41.3	53.9	12.6	

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

\*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

#### 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	2437.000	PK	94.6	27.5	2.4	32.2	92.3	-	-	Carrier
Hori	6498.688	PK	46.1	35.1	5.6	32.0	54.8	72.3	17.5	
Vert	2437.000	PK	95.1	27.5	2.4	32.2	92.8	-	-	Carrier
Vert	6498.688	PK	49.3	35.1	5.6	32.0	58.0	72.8	14.8	

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

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## Radiated Spurious Emission

### Chip Antenna

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	33AE0057-HO-01	
Date	10/24/2012	10/25/2012
Temperature/ Humidity	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Satofumi Matsuyama (1-10GHz)	Satofumi Matsuyama (Above 10GHz)
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	2483.500	PK	48.5	27.5	2.4	34.8	43.6	73.9	30.3	
Hori	4924.000	PK	46.0	31.5	4.2	34.0	47.7	73.9	26.2	
Hori	2483.500	AV	35.8	27.5	2.4	34.8	30.9	53.9	23.0	
Hori	4924.000	AV	39.0	31.5	4.2	34.0	40.7	53.9	13.2	
Vert	2483.500	PK	47.5	27.5	2.4	34.8	42.6	73.9	31.3	
Vert	4924.000	PK	43.9	31.5	4.2	34.0	45.6	73.9	28.3	
Vert	2483.500	AV	34.6	27.5	2.4	34.8	29.7	53.9	24.2	
Vert	4924.000	AV	34.1	31.5	4.2	34.0	35.8	53.9	18.1	

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

\*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

#### 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	2462.000	PK	100.2	27.5	2.4	34.8	95.3	-	-	Carrier
Hori	6565.423	PK	50.8	34.4	4.8	34.0	56.0	75.3	19.3	
Vert	2462.000	PK	97.7	27.5	2.4	34.8	92.8	-	-	Carrier
Vert	6565.410	PK	49.2	34.4	4.8	34.0	54.4	72.8	18.4	

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

## Radiated Spurious Emission

### Chip Antenna

Test place	Head Office EMC Lab. No.3 and 2 Semi Anechoic Chamber		
Report No.	33AE0057-HO-01		
Date	10/21/2012	10/24/2012	10/25/2012
Temperature/ Humidity	22 deg. C / 52% RH	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Hiroshi Kukita	Satofumi Matsuyama	Satofumi Matsuyama
	(1-10GHz)	(1-10GHz)	(Above 10GHz)
Mode	11n-20 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	2390.000	PK	54.2	27.5	2.4	32.3	51.8	73.9	22.1	
Hori	4824.000	PK	46.4	31.3	4.3	34.0	48.0	73.9	25.9	
Hori	2390.000	AV	41.0	27.5	2.4	32.3	38.6	53.9	15.3	
Hori	4824.000	AV	38.9	31.3	4.3	34.0	40.5	53.9	13.4	
Vert	2390.000	PK	52.4	27.5	2.4	32.3	50.0	73.9	23.9	
Vert	4824.000	PK	45.5	31.3	4.3	34.0	47.1	73.9	26.8	
Vert	2390.000	AV	41.0	27.5	2.4	32.3	38.6	53.9	15.3	
Vert	4824.000	AV	38.3	31.3	4.3	34.0	39.9	53.9	14.0	

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

\*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

#### 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	96.8	27.5	2.4	34.8	91.9	-	-	Carrier
Hori	2400.000	PK	50.2	27.5	2.4	32.3	47.8	71.9	24.1	
Hori	6432.027	PK	47.7	34.1	4.7	34.0	52.5	71.9	19.4	
Vert	2412.000	PK	95.5	27.5	2.4	34.8	90.6	-	-	Carrier
Vert	2400.000	PK	46.9	27.5	2.4	32.3	44.5	70.6	26.1	
Vert	6432.033	PK	46.7	34.1	4.7	34.0	51.5	70.6	19.1	

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

## Radiated Spurious Emission

### Chip Antenna

Test place	Head Office EMC Lab. No.3 and 2 Semi Anechoic Chamber		
Report No.	33AE0057-HO-01		
Date	10/21/2012	10/24/2012	10/25/2012
Temperature/ Humidity	22 deg. C / 52% RH	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Hiroshi Kukita	Satofumi Matsuyama	Satofumi Matsuyama
	(1-10GHz)	(1-10GHz)	(Above 10GHz)
Mode	11n-20 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	4874.000	PK	42.8	31.5	5.2	31.5	48.0	73.9	25.9	
Hori	4874.000	AV	36.0	31.5	5.2	31.5	41.2	53.9	12.7	
Vert	4874.000	PK	43.0	31.5	5.2	31.5	48.2	73.9	25.7	
Vert	4874.000	AV	36.2	31.5	5.2	31.5	41.4	53.9	12.5	

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

\*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

#### 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	2437.000	PK	95.3	27.5	2.4	32.2	93.0	-	-	Carrier
Hori	6498.635	PK	47.8	35.1	5.6	32.0	56.5	73.0	16.5	
Vert	2437.000	PK	94.1	27.5	2.4	32.2	91.8	-	-	Carrier
Vert	6498.695	PK	51.3	35.1	5.6	32.0	60.0	71.8	11.8	

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

## Radiated Spurious Emission

### Chip Antenna

Test place	Head Office EMC Lab. No.3 and 2 Semi Anechoic Chamber		
Report No.	33AE0057-HO-01		
Date	10/21/2012	10/24/2012	10/25/2012
Temperature/ Humidity	22 deg. C / 52% RH	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Hiroshi Kukita	Satofumi Matsuyama	Satofumi Matsuyama
	(1-10GHz)	(1-10GHz)	(Below 1GHz, Above 10GHz)
Mode	11n-20 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	174.650	QP	28.4	15.9	8.0	28.0	24.3	43.5	19.2	
Hori	249.508	QP	35.1	17.2	8.5	27.5	33.3	46.0	12.7	
Hori	311.879	QP	36.1	14.4	8.9	27.7	31.7	46.0	14.3	
Hori	324.358	QP	35.1	14.9	9.0	27.8	31.2	46.0	14.8	
Hori	336.831	QP	36.9	15.4	9.1	27.9	33.5	46.0	12.5	
Hori	349.308	QP	34.6	15.8	9.1	28.0	31.5	46.0	14.5	
Hori	2483.500	PK	50.6	27.5	2.4	32.2	48.3	73.9	25.6	
Hori	4924.000	PK	46.3	31.5	4.2	34.0	48.0	73.9	25.9	
Hori	2483.500	AV	40.0	27.5	2.4	32.2	37.7	53.9	16.2	
Hori	4924.000	AV	39.9	31.5	4.2	34.0	41.6	53.9	12.3	
Vert	174.659	QP	34.0	15.9	8.0	28.0	29.9	43.5	13.6	
Vert	249.510	QP	34.1	17.2	8.5	27.5	32.3	46.0	13.7	
Vert	311.882	QP	38.3	14.4	8.9	27.7	33.9	46.0	12.1	
Vert	324.354	QP	38.2	14.9	9.0	27.8	34.3	46.0	11.7	
Vert	336.833	QP	39.6	15.4	9.1	27.9	36.2	46.0	9.8	
Vert	349.307	QP	34.3	15.8	9.1	28.0	31.2	46.0	14.8	
Vert	2483.500	PK	49.8	27.5	2.4	32.2	47.5	73.9	26.4	
Vert	4924.000	PK	43.5	31.5	4.2	34.0	45.2	73.9	28.7	
Vert	2483.500	AV	39.0	27.5	2.4	32.2	36.7	53.9	17.2	
Vert	4924.000	AV	33.5	31.5	4.2	34.0	35.2	53.9	18.7	

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

\*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

#### 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	2462.000	PK	97.0	27.5	2.4	34.8	92.1	-	-	Carrier
Hori	6565.432	PK	49.7	34.4	4.8	34.0	54.9	72.1	17.2	
Vert	2462.000	PK	94.2	27.5	2.4	34.8	89.3	-	-	Carrier
Vert	6565.354	PK	49.4	34.4	4.8	34.0	54.6	69.3	14.7	

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

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## Radiated Spurious Emission

FPC Antenna

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	33AE0057-HO-01	
Date	10/24/2012	10/25/2012
Temperature/ Humidity	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Satofumi Matsuyama (1-10GHz)	Satofumi Matsuyama (Above 10GHz)
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	2390.000	PK	45.3	27.4	2.4	34.8	40.3	73.9	33.6	
Hori	4824.000	PK	52.3	31.3	4.3	34.0	53.9	73.9	20.0	
Hori	2390.000	AV	33.0	27.4	2.4	34.8	28.0	53.9	25.9	
Hori	4824.000	AV	46.5	31.3	4.3	34.0	48.1	53.9	5.8	
Vert	2390.000	PK	46.2	27.4	2.4	34.8	41.2	73.9	32.7	
Vert	4824.000	PK	53.4	31.3	4.3	34.0	55.0	73.9	18.9	
Vert	2390.000	AV	33.7	27.4	2.4	34.8	28.7	53.9	25.2	
Vert	4824.000	AV	47.6	31.3	4.3	34.0	49.2	53.9	4.7	

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

\*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

### 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	94.8	27.5	2.4	34.8	89.9	-	-	Carrier
Hori	2400.000	PK	43.2	27.5	2.4	34.8	38.3	69.9	31.6	
Hori	6432.028	PK	52.5	34.1	4.7	34.0	57.3	69.9	12.6	
Vert	2412.000	PK	96.7	27.5	2.4	34.8	91.8	-	-	Carrier
Vert	2400.000	PK	44.4	27.5	2.4	34.8	39.5	71.8	32.3	
Vert	6432.035	PK	51.6	34.1	4.7	34.0	56.4	71.8	15.4	

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



## Radiated Spurious Emission

FPC Antenna

Test place	Head Office EMC Lab. No.3 and 2 Semi Anechoic Chamber		
Report No.	33AE0057-HO-01		
Date	10/21/2012	10/24/2012	10/25/2012
Temperature/ Humidity	22 deg. C / 52% RH	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Hiroshi Kukita	Satofumi Matsuyama	Satofumi Matsuyama
	(1-10GHz)	(1-10GHz)	(Above 10GHz)
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	4874.000	PK	46.6	31.5	5.2	31.5	51.8	73.9	22.1	
Hori	4874.000	AV	40.8	31.5	5.2	31.5	46.0	53.9	7.9	
Vert	4874.000	PK	45.3	31.5	5.2	31.5	50.5	73.9	23.4	
Vert	4874.000	AV	40.4	31.5	5.2	31.5	45.6	53.9	8.3	

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

### 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	2437.000	PK	95.4	27.5	2.4	32.2	93.1	-	-	Carrier
Hori	6498.708	PK	52.4	35.1	5.6	32.0	61.1	73.1	12.0	
Vert	2437.000	PK	97.4	27.5	2.4	32.2	95.1	-	-	Carrier
Vert	6498.700	PK	50.2	35.1	5.6	32.0	58.9	75.1	16.2	

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

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## Radiated Spurious Emission

FPC Antenna

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	33AE0057-HO-01	
Date	10/24/2012	10/25/2012
Temperature/ Humidity	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Satofumi Matsuyama (1-10GHz)	Satofumi Matsuyama (Above 10GHz)
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	2483.500	PK	47.3	27.5	2.4	34.8	42.4	73.9	31.5	
Hori	4924.000	PK	47.4	31.5	4.2	34.0	49.1	73.9	24.8	
Hori	2483.500	AV	33.0	27.5	2.4	34.8	28.1	53.9	25.8	
Hori	4924.000	AV	40.4	31.5	4.2	34.0	42.1	53.9	11.8	
Vert	2483.500	PK	47.9	27.5	2.4	34.8	43.0	73.9	30.9	
Vert	4924.000	PK	45.4	31.5	4.2	34.0	47.1	73.9	26.8	
Vert	2483.500	AV	35.1	27.5	2.4	34.8	30.2	53.9	23.7	
Vert	4924.000	AV	36.0	31.5	4.2	34.0	37.7	53.9	16.2	

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

\*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

### 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	2462.000	PK	94.3	27.5	2.4	34.8	89.4	-	-	Carrier
Hori	6565.364	PK	56.8	34.4	4.8	34.0	62.0	69.4	7.4	
Vert	2462.000	PK	97.1	27.5	2.4	34.8	92.2	-	-	Carrier
Vert	6565.376	PK	49.7	34.4	4.8	34.0	54.9	72.2	17.3	

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

## Radiated Spurious Emission

FPC Antenna

Test place	Head Office EMC Lab. No.3 and 2 Semi Anechoic Chamber		
Report No.	33AE0057-HO-01		
Date	10/21/2012	10/24/2012	10/25/2012
Temperature/ Humidity	22 deg. C / 52% RH	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Hiroshi Kukita	Satofumi Matsuyama	Satofumi Matsuyama
	(1-10GHz)	(1-10GHz)	(Above 10GHz)
Mode	11n-20 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	2390.000	PK	64.1	27.5	2.4	32.3	61.7	73.9	12.2	
Hori	4824.000	PK	48.3	31.3	4.3	34.0	49.9	73.9	24.0	
Hori	2390.000	AV	41.8	27.5	2.4	32.3	39.4	53.9	14.5	
Hori	4824.000	AV	38.4	31.3	4.3	34.0	40.0	53.9	13.9	
Vert	2390.000	PK	67.7	27.5	2.4	32.3	65.3	73.9	8.6	
Vert	4824.000	PK	51.3	31.3	4.3	34.0	52.9	73.9	21.0	
Vert	2390.000	AV	44.4	27.5	2.4	32.3	42.0	53.9	11.9	
Vert	4824.000	AV	38.6	31.3	4.3	34.0	40.2	53.9	13.7	

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

\*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

### 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	91.5	27.5	2.4	34.8	86.6	-	-	Carrier
Hori	2400.000	PK	57.6	27.5	2.4	32.3	55.2	66.6	11.4	
Hori	6432.047	PK	54.5	34.1	4.7	34.0	59.3	66.6	7.3	
Vert	2412.000	PK	95.4	27.5	2.4	34.8	90.5	-	-	Carrier
Vert	2400.000	PK	57.6	27.5	2.4	32.3	55.2	70.5	15.3	
Vert	6432.043	PK	51.4	34.1	4.7	34.0	56.2	70.5	14.3	

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

## Radiated Spurious Emission

FPC Antenna

Test place	Head Office EMC Lab. No.3 and 2 Semi Anechoic Chamber		
Report No.	33AE0057-HO-01		
Date	10/21/2012	10/24/2012	10/25/2012
Temperature/ Humidity	22 deg. C / 52% RH	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Hiroshi Kukita	Satofumi Matsuyama	Satofumi Matsuyama
	(1-10GHz)	(1-10GHz)	(Above 10GHz)
Mode	11n-20 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	4874.000	PK	45.3	31.5	5.2	31.5	50.5	73.9	23.4	
Hori	4874.000	AV	37.8	31.5	5.2	31.5	43.0	53.9	10.9	
Vert	4874.000	PK	44.3	31.5	5.2	31.5	49.5	73.9	24.4	
Vert	4874.000	AV	35.2	31.5	5.2	31.5	40.4	53.9	13.5	

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

\*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

### 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	2437.000	PK	92.0	27.5	2.4	32.2	89.7	-	-	Carrier
Hori	6498.709	PK	52.1	35.1	5.6	32.0	60.8	69.7	8.9	
Vert	2437.000	PK	94.2	27.5	2.4	32.2	91.9	-	-	Carrier
Vert	6498.700	PK	49.5	35.1	5.6	32.0	58.2	71.9	13.7	

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

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## Radiated Spurious Emission

FPC Antenna

Test place	Head Office EMC Lab. No.3 and 2 Semi Anechoic Chamber		
Report No.	33AE0057-HO-01		
Date	10/21/2012	10/24/2012	10/25/2012
Temperature/ Humidity	22 deg. C / 52% RH	24 deg. C / 55% RH	25 deg. C / 51% RH
Engineer	Hiroshi Kukita	Satofumi Matsuyama	Satofumi Matsuyama
	(1-10GHz)	(1-10GHz)	(Below 1GHz, Above 10GHz)
Mode	11n-20 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	174.649	QP	27.8	15.9	8.0	28.0	23.7	43.5	19.8	
Hori	249.503	QP	35.7	17.2	8.5	27.5	33.9	46.0	12.1	
Hori	311.881	QP	36.6	14.4	8.9	27.7	32.2	46.0	13.8	
Hori	324.356	QP	36.4	14.9	9.0	27.8	32.5	46.0	13.5	
Hori	336.826	QP	38.5	15.4	9.1	27.9	35.1	46.0	10.9	
Hori	349.307	QP	35.9	15.8	9.1	28.0	32.8	46.0	13.2	
Hori	2483.500	PK	58.7	27.5	2.4	32.2	56.4	73.9	17.5	
Hori	4924.000	PK	46.5	31.5	4.2	34.0	48.2	73.9	25.7	
Hori	2483.500	AV	43.9	27.5	2.4	32.2	41.6	53.9	12.3	
Hori	4924.000	AV	38.5	31.5	4.2	34.0	40.2	53.9	13.7	
Vert	174.654	QP	33.5	15.9	8.0	28.0	29.4	43.5	14.1	
Vert	249.505	QP	35.0	17.2	8.5	27.5	33.2	46.0	12.8	
Vert	311.882	QP	38.0	14.4	8.9	27.7	33.6	46.0	12.4	
Vert	324.356	QP	38.0	14.9	9.0	27.8	34.1	46.0	11.9	
Vert	336.831	QP	40.6	15.4	9.1	27.9	37.2	46.0	8.8	
Vert	349.308	QP	36.6	15.8	9.1	28.0	33.5	46.0	12.5	
Vert	2483.500	PK	59.0	27.5	2.4	32.2	56.7	73.9	17.2	
Vert	4924.000	PK	44.8	31.5	4.2	34.0	46.5	73.9	27.4	
Vert	2483.500	AV	43.3	27.5	2.4	32.2	41.0	53.9	12.9	
Vert	4924.000	AV	36.0	31.5	4.2	34.0	37.7	53.9	16.2	

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

\*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

### 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	2462.000	PK	91.6	27.5	2.4	34.8	86.7	-	-	Carrier
Hori	6565.377	PK	56.1	34.4	4.8	34.0	61.3	66.7	5.4	
Vert	2462.000	PK	94.5	27.5	2.4	34.8	89.6	-	-	Carrier
Vert	6565.375	PK	56.2	34.4	4.8	34.0	61.4	69.6	8.2	

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

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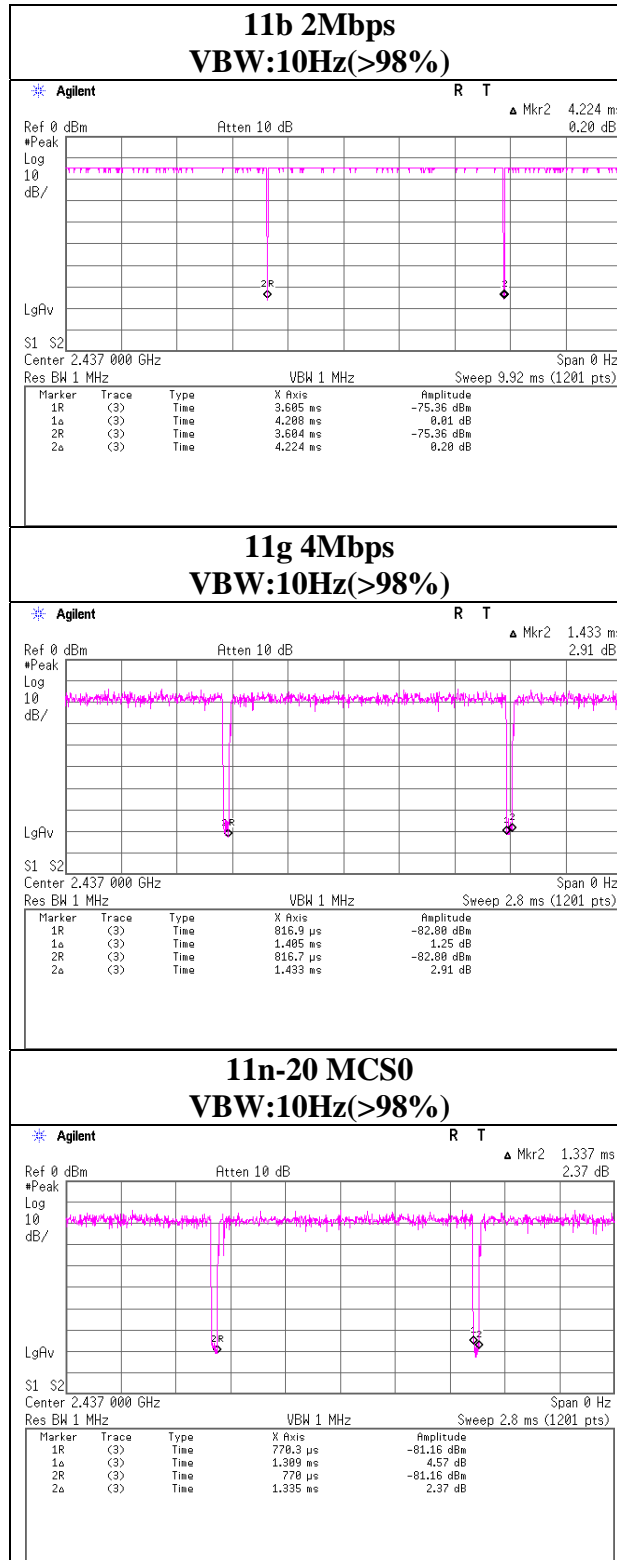
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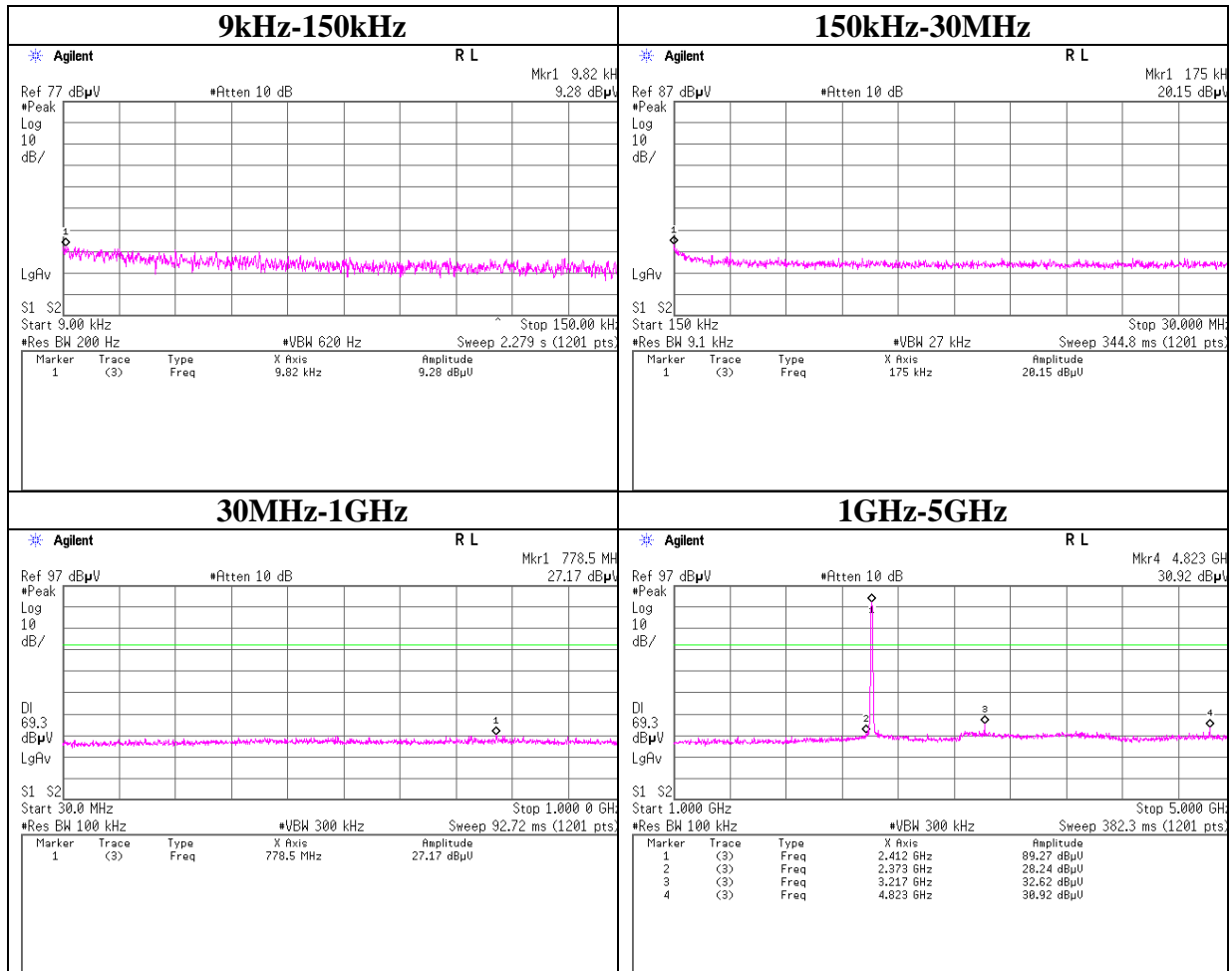
**Facsimile : +81 596 24 8124**

### Burst rate confirmation



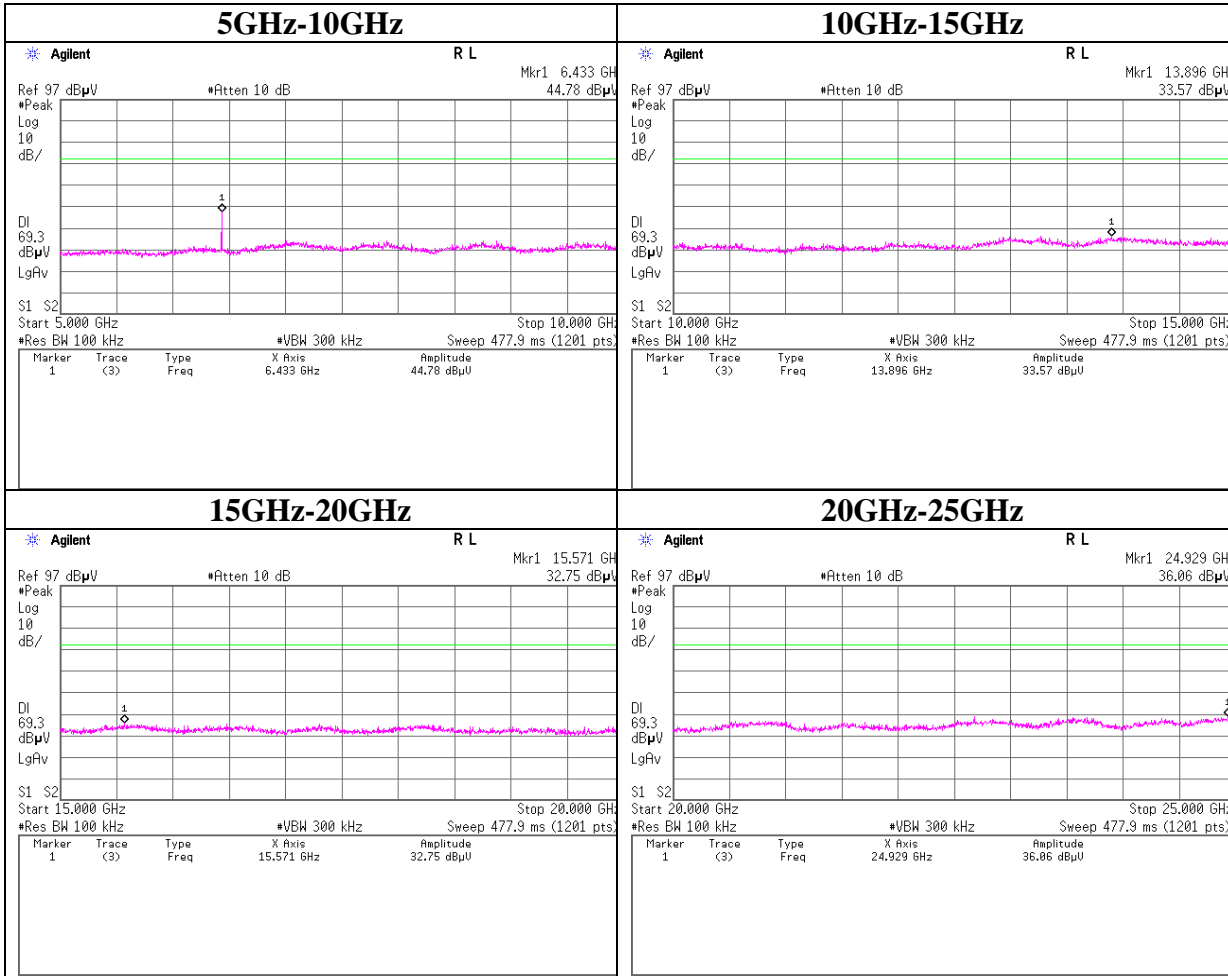
## Conducted Spurious Emission

### 11b Tx 2412MHz



Conducted Spurious Emission

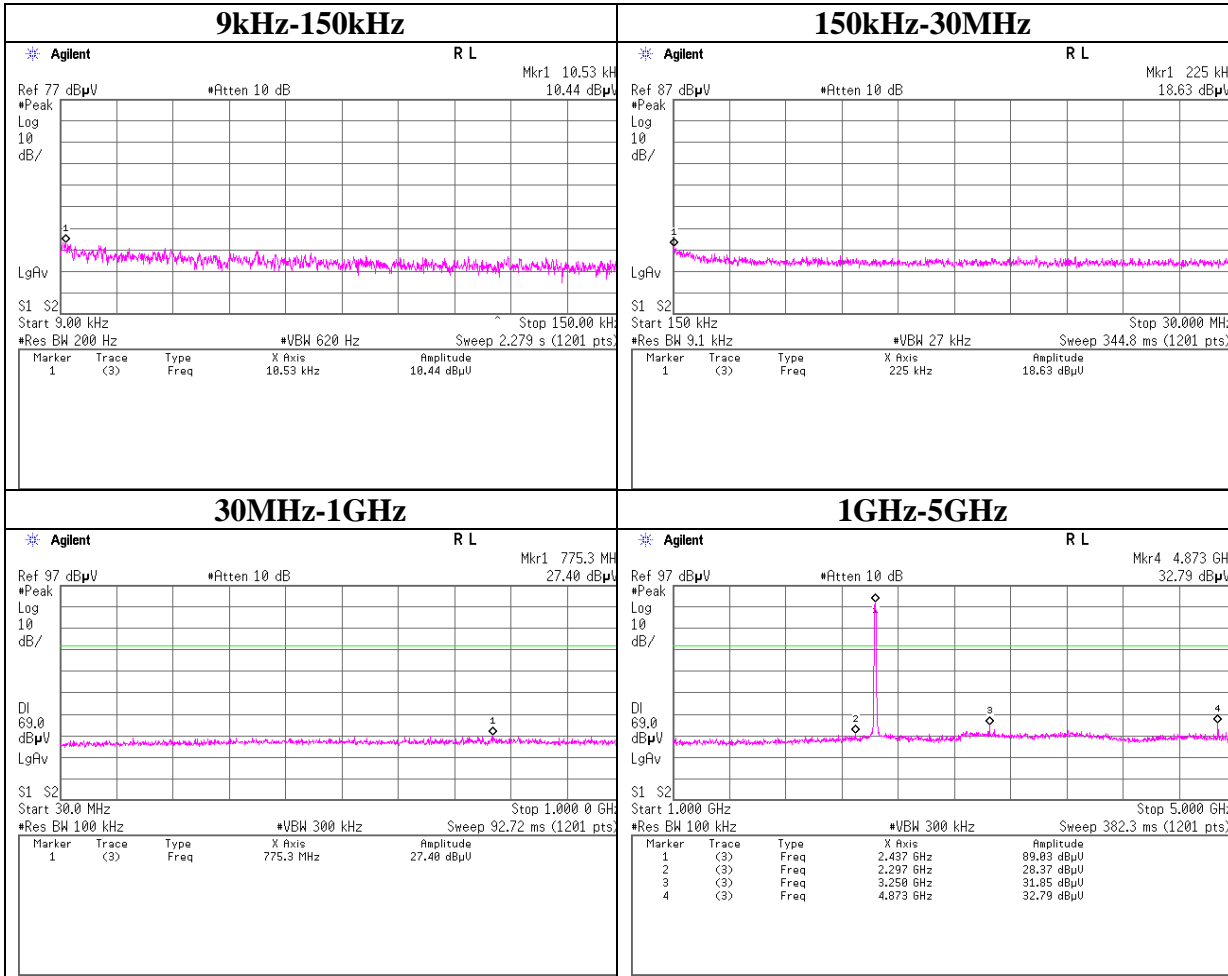
11b Tx 2412MHz





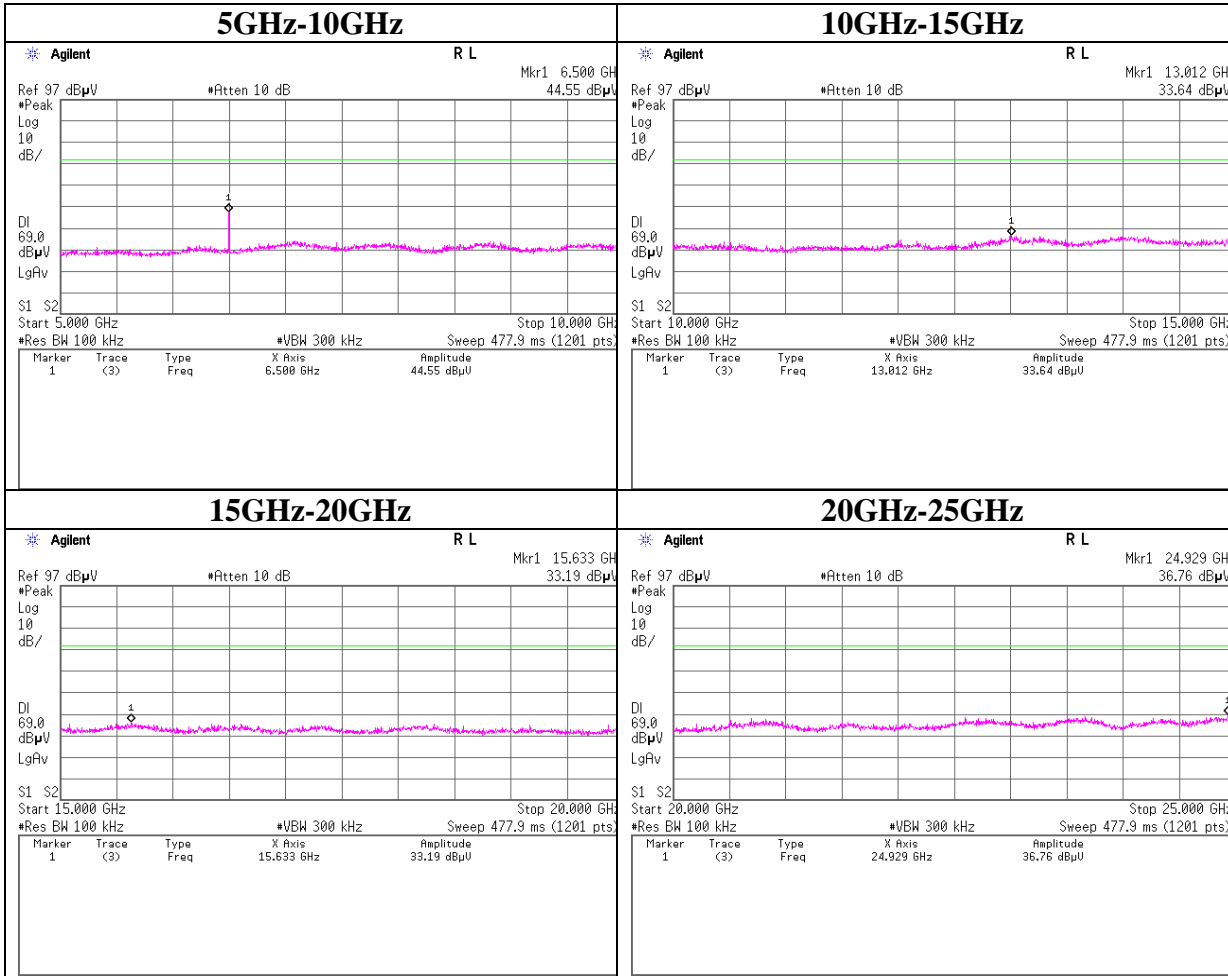
Conducted Spurious Emission

11b Tx 2437MHz



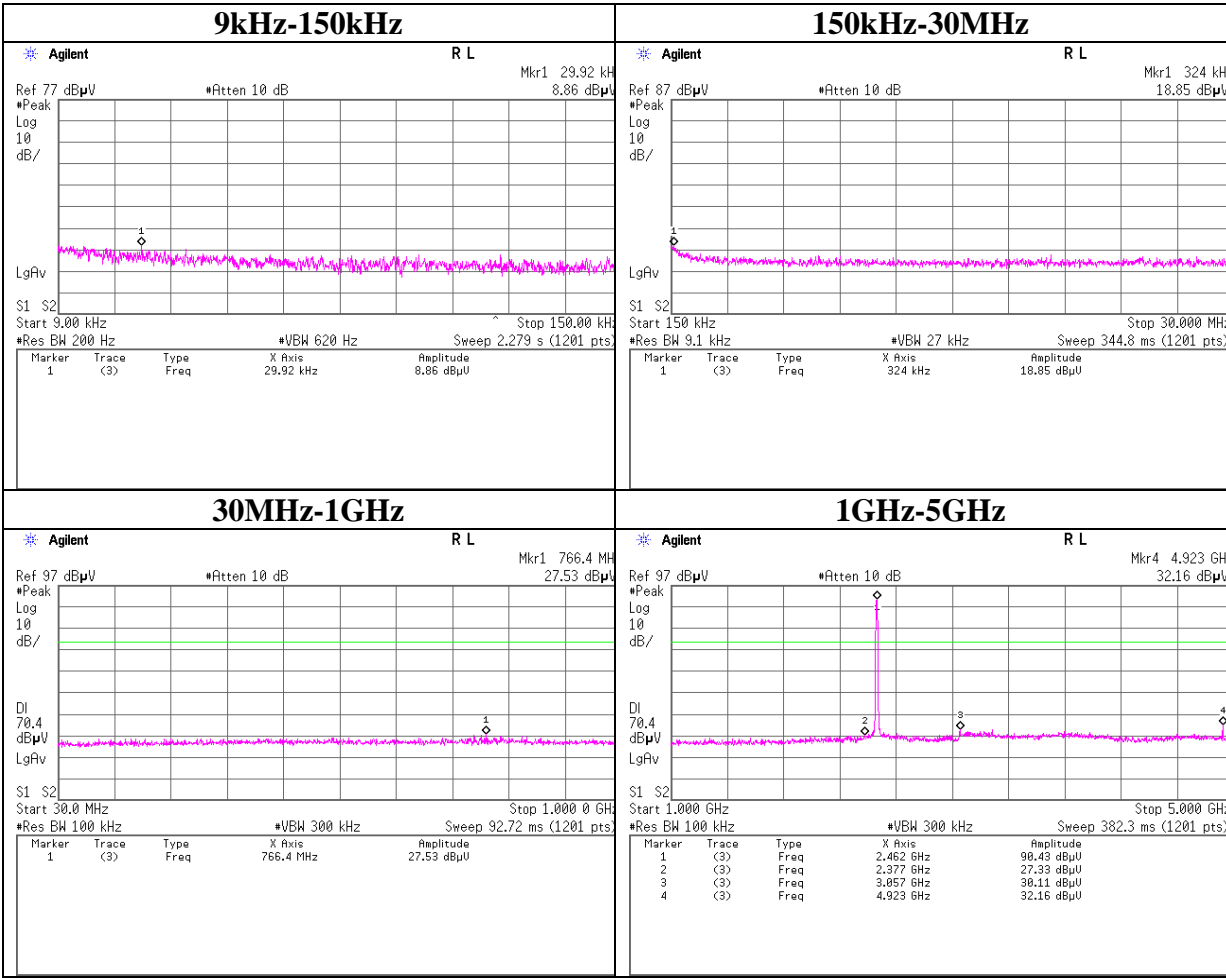
Conducted Spurious Emission

11b Tx 2437MHz



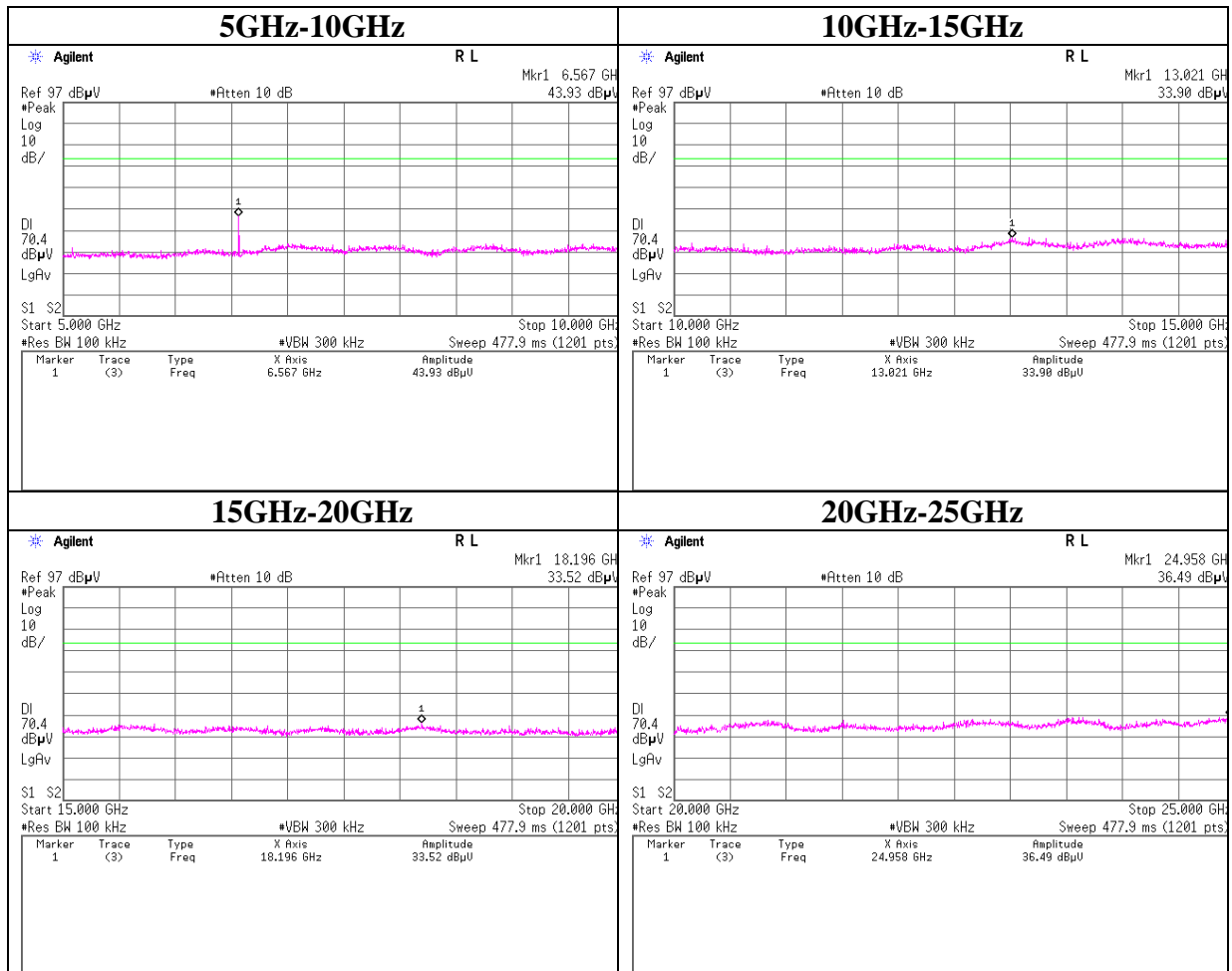
Conducted Spurious Emission

11b Tx 2462MHz



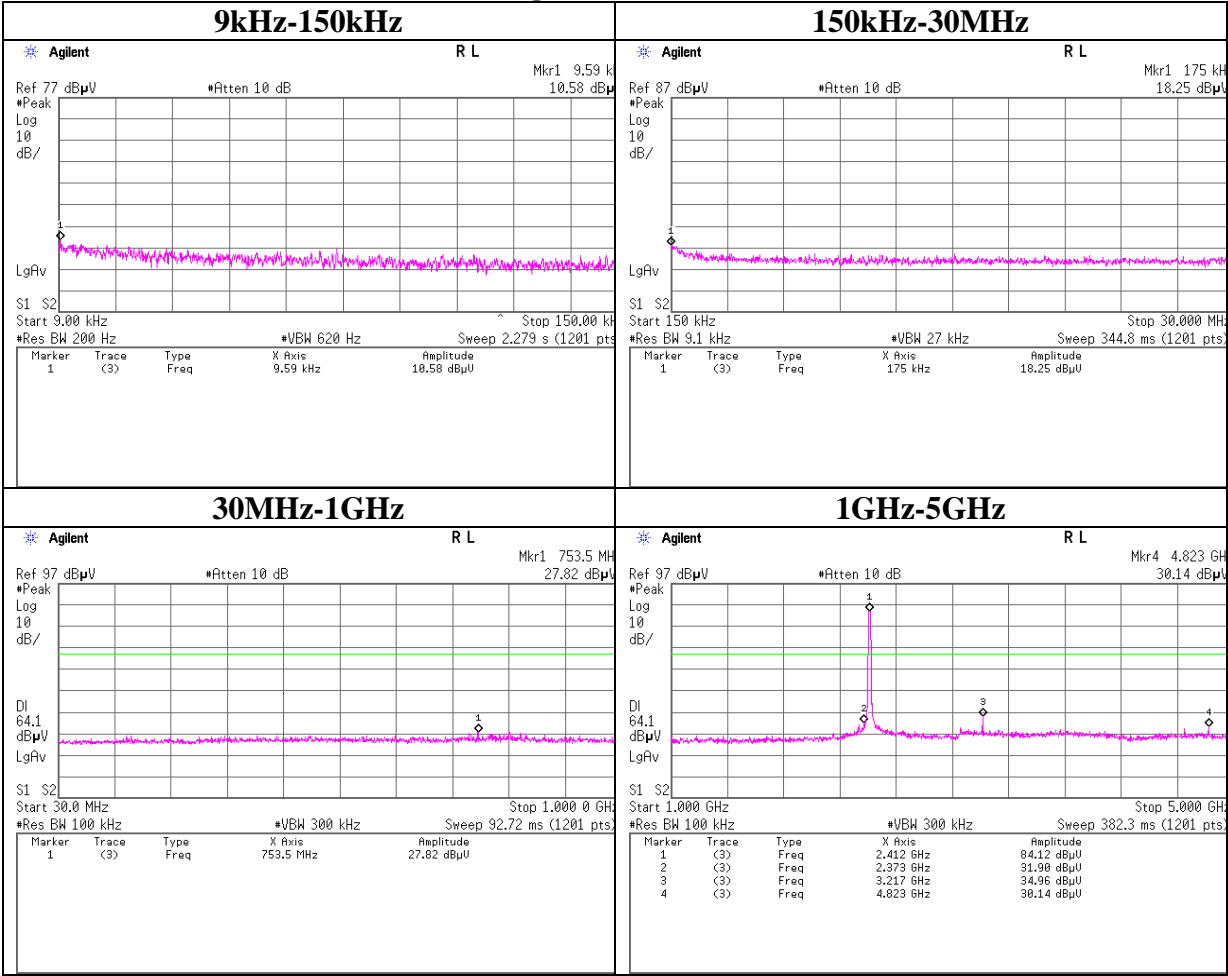
## Conducted Spurious Emission

### 11b Tx 2462MHz



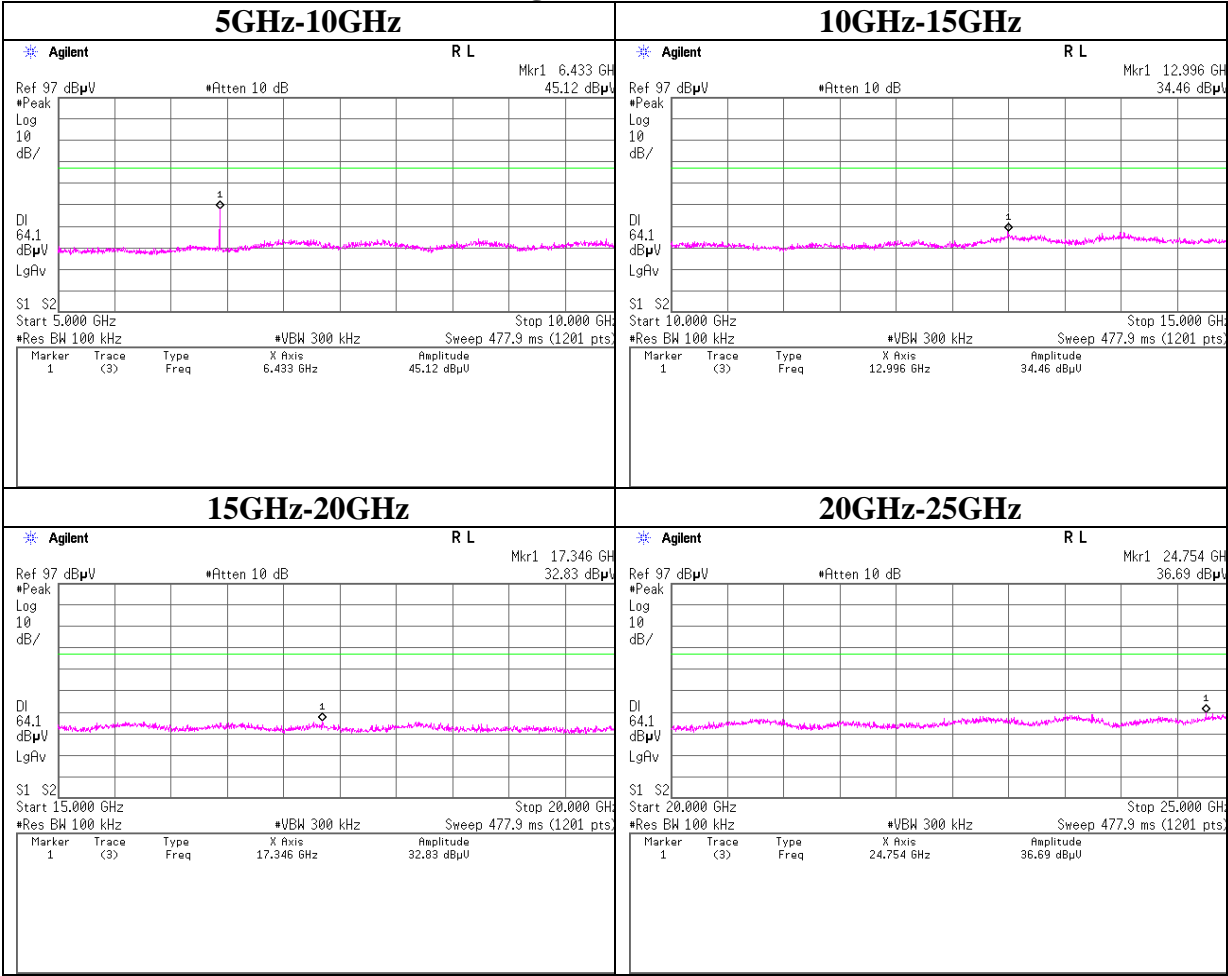
Conducted Spurious Emission

11g Tx 2412MHz



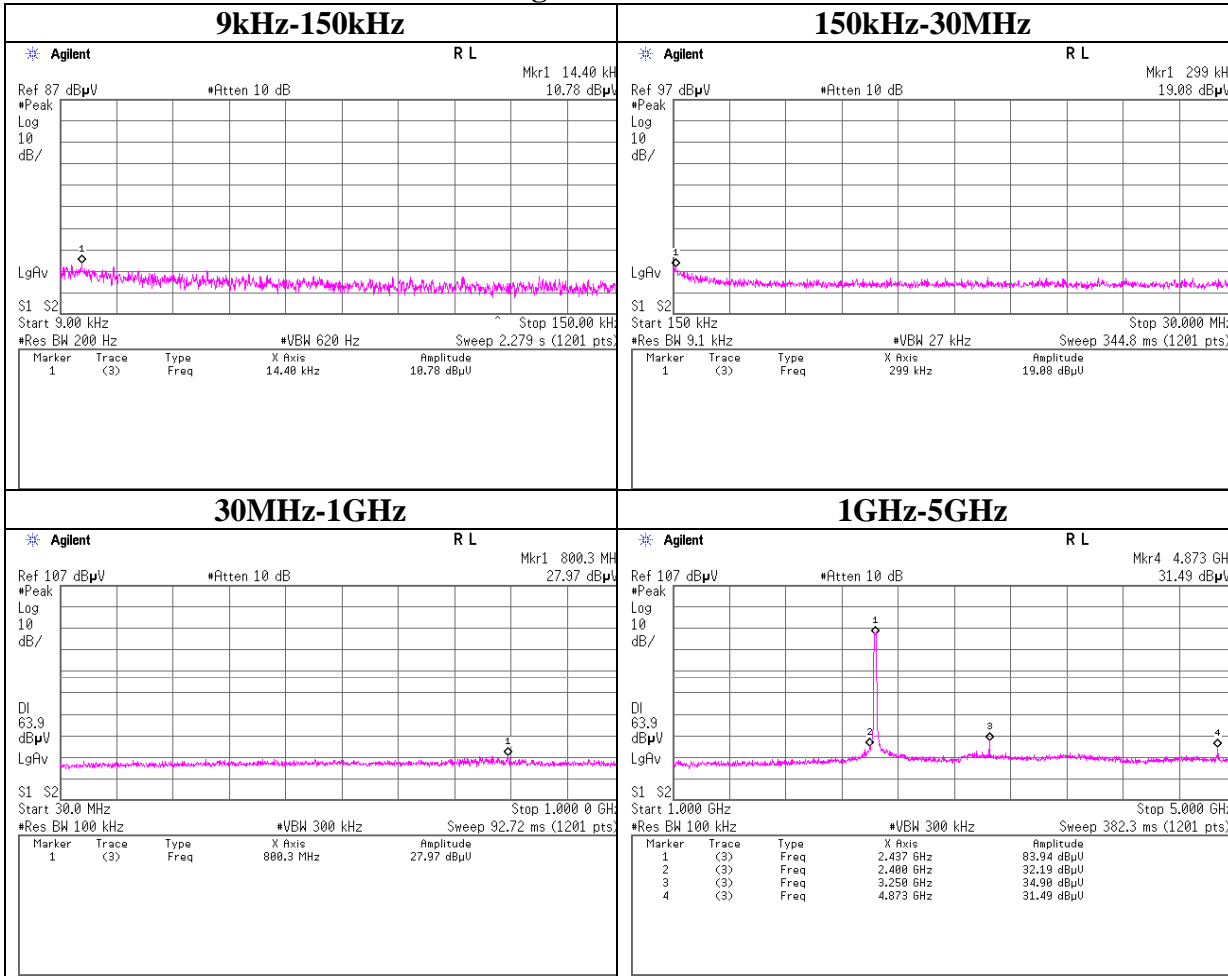
Conducted Spurious Emission

11g Tx 2412MHz



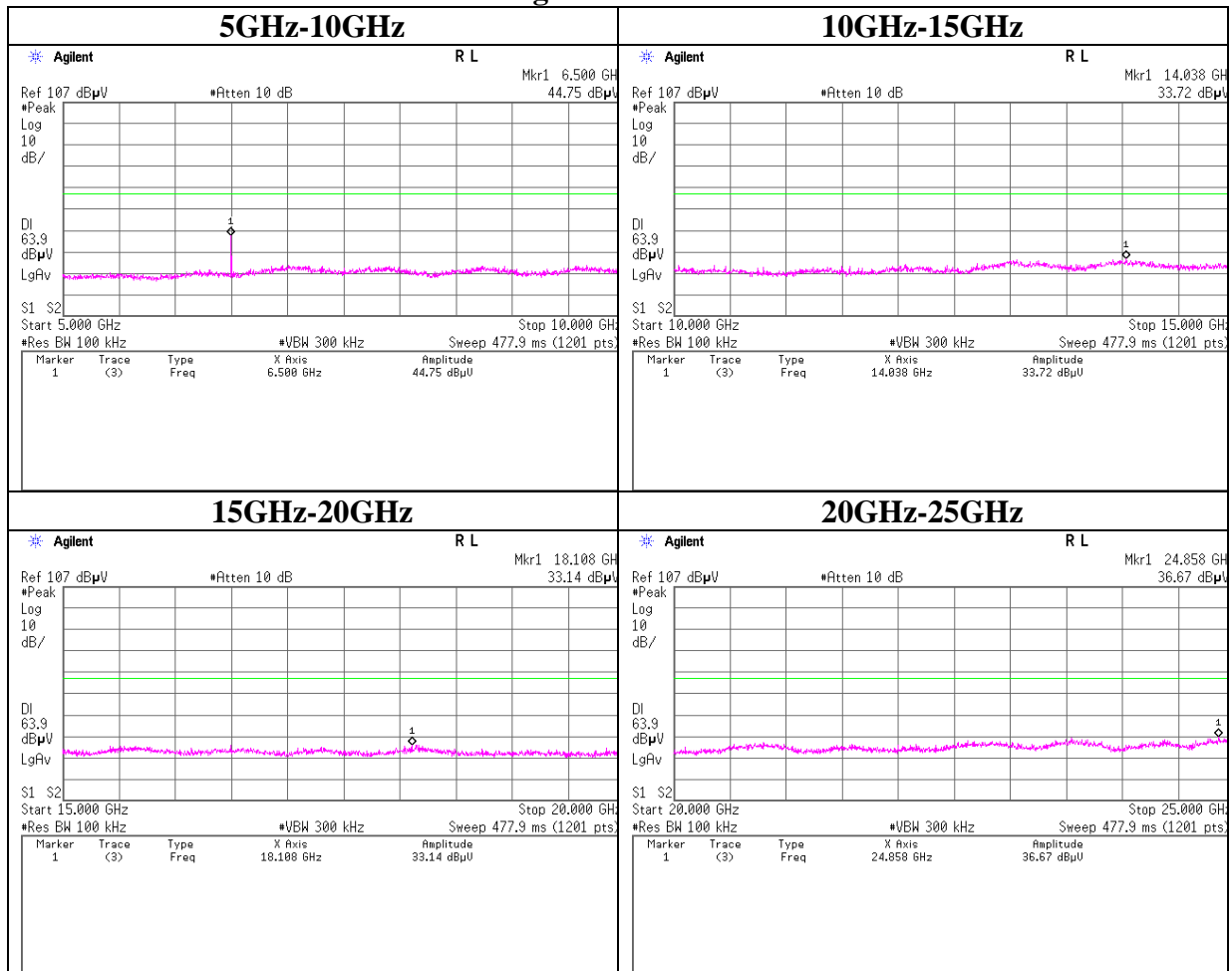
Conducted Spurious Emission

11g Tx 2437MHz



## Conducted Spurious Emission

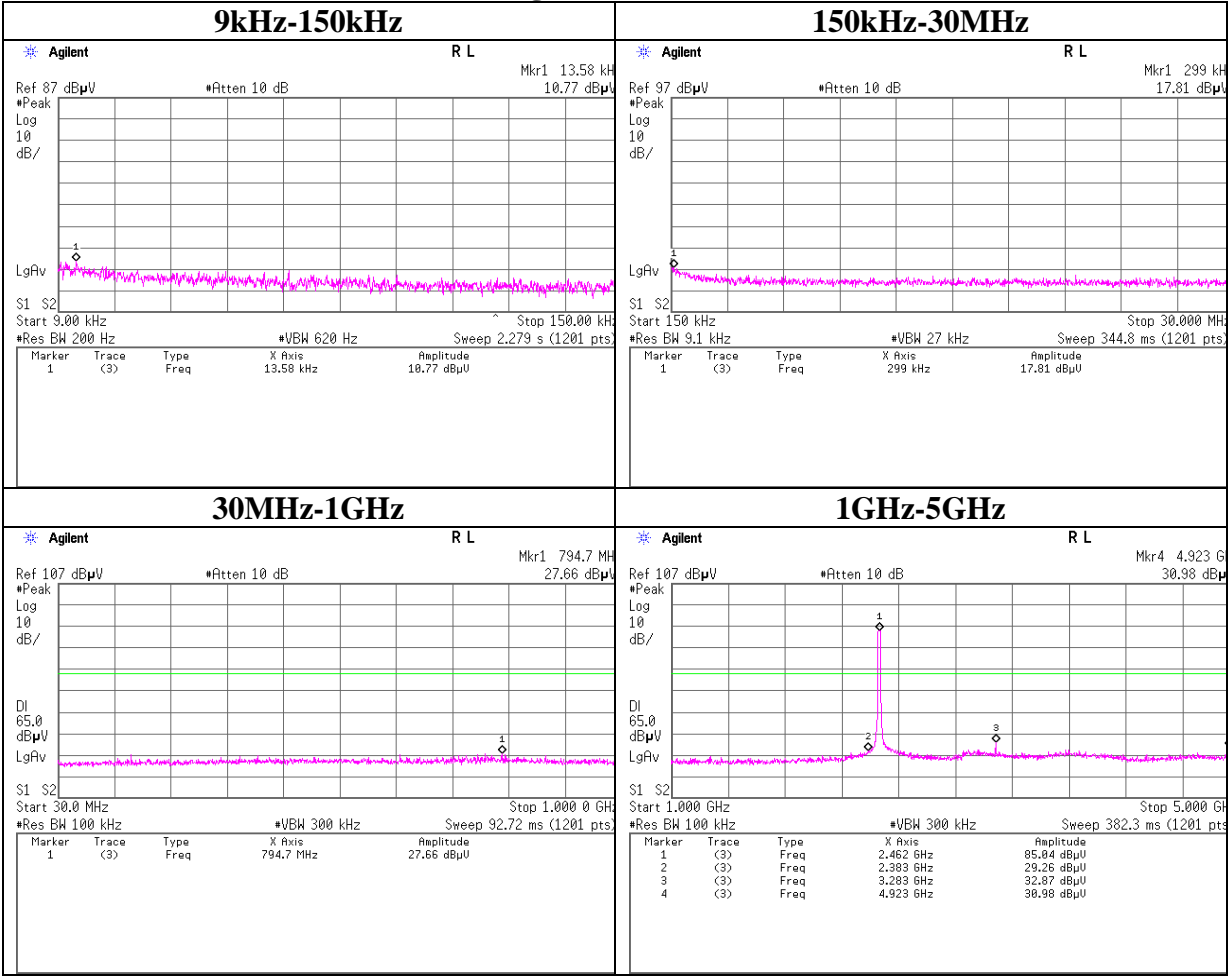
### 11g Tx 2437MHz





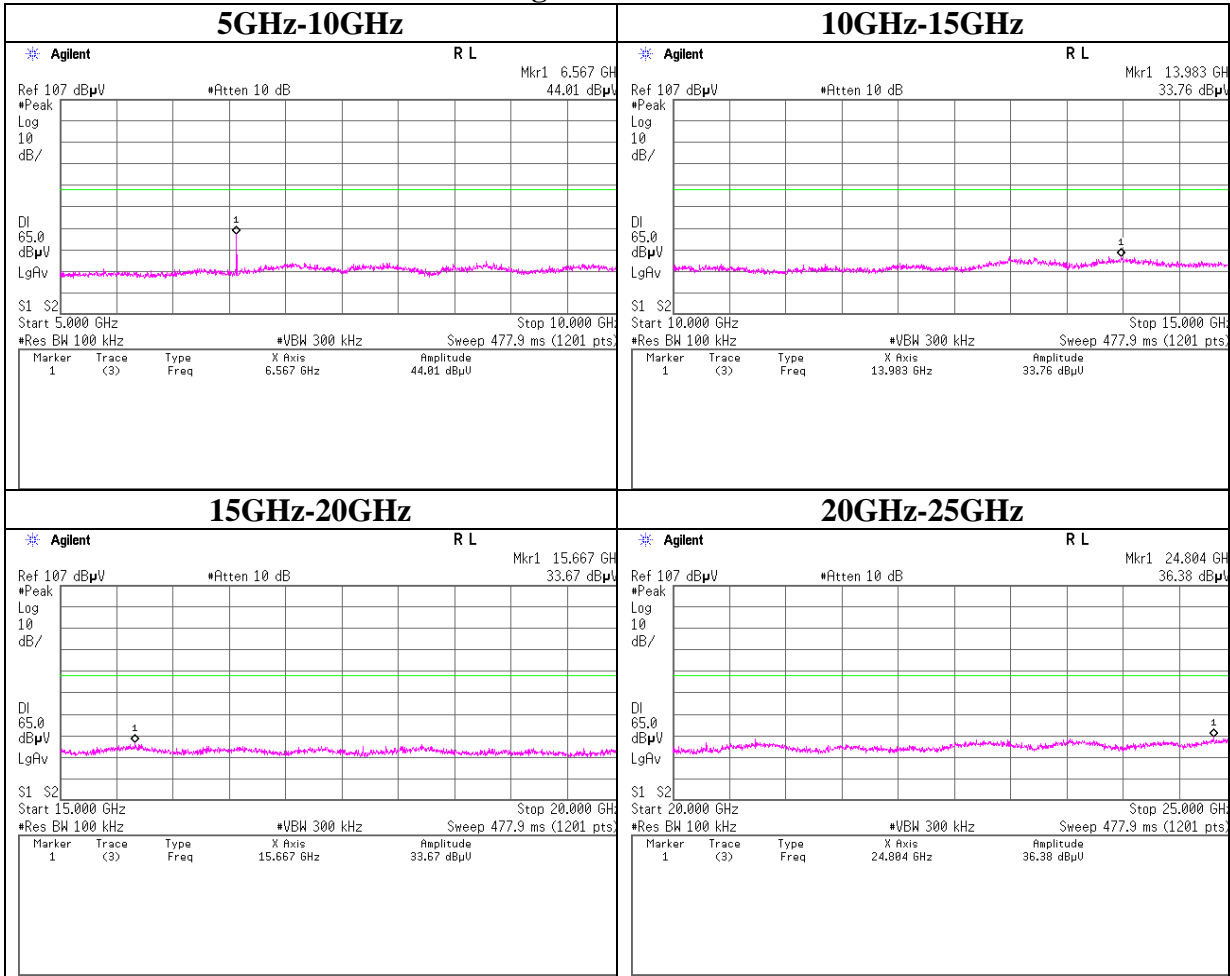
Conducted Spurious Emission

11g Tx 2462MHz



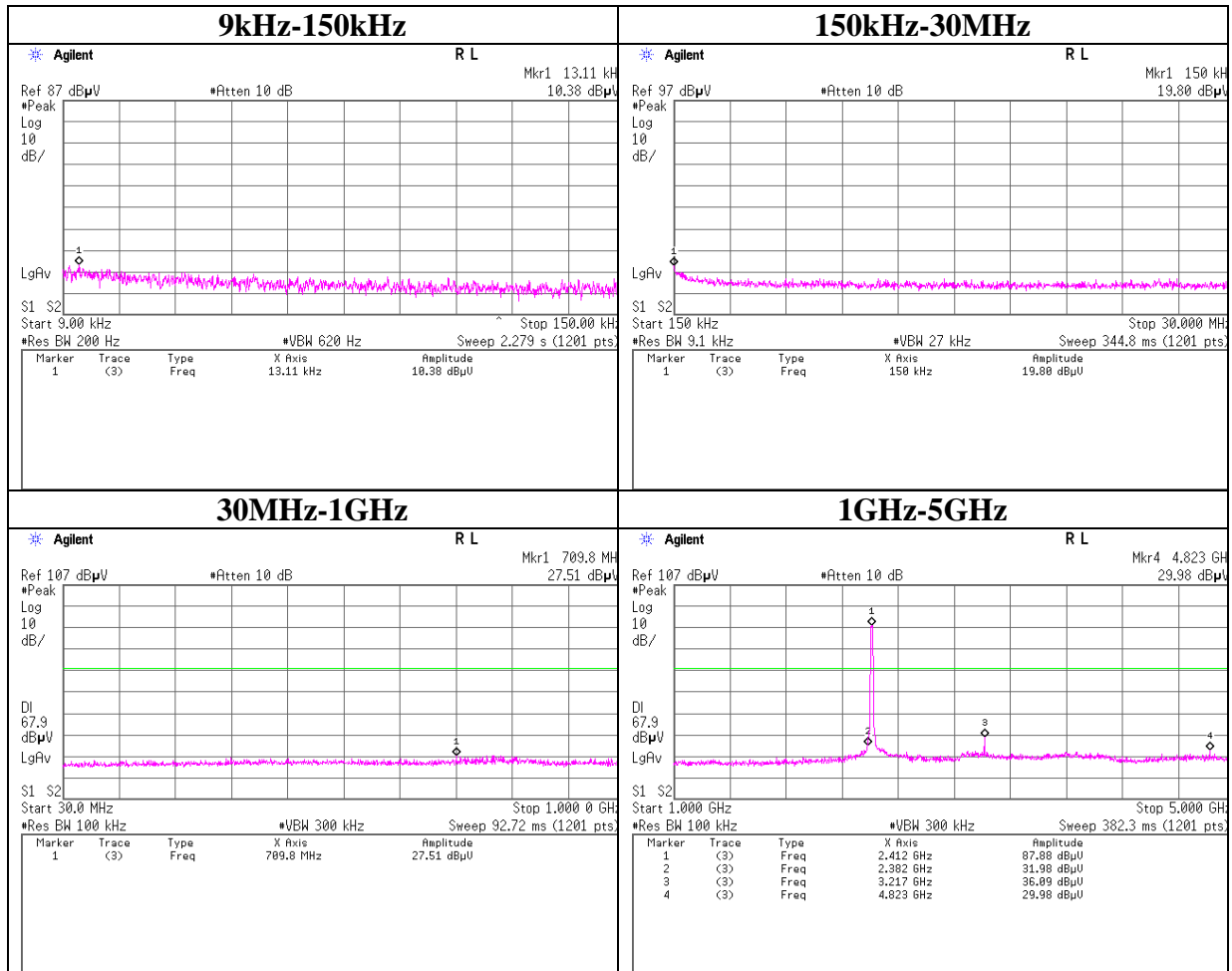
Conducted Spurious Emission

11g Tx 2462MHz



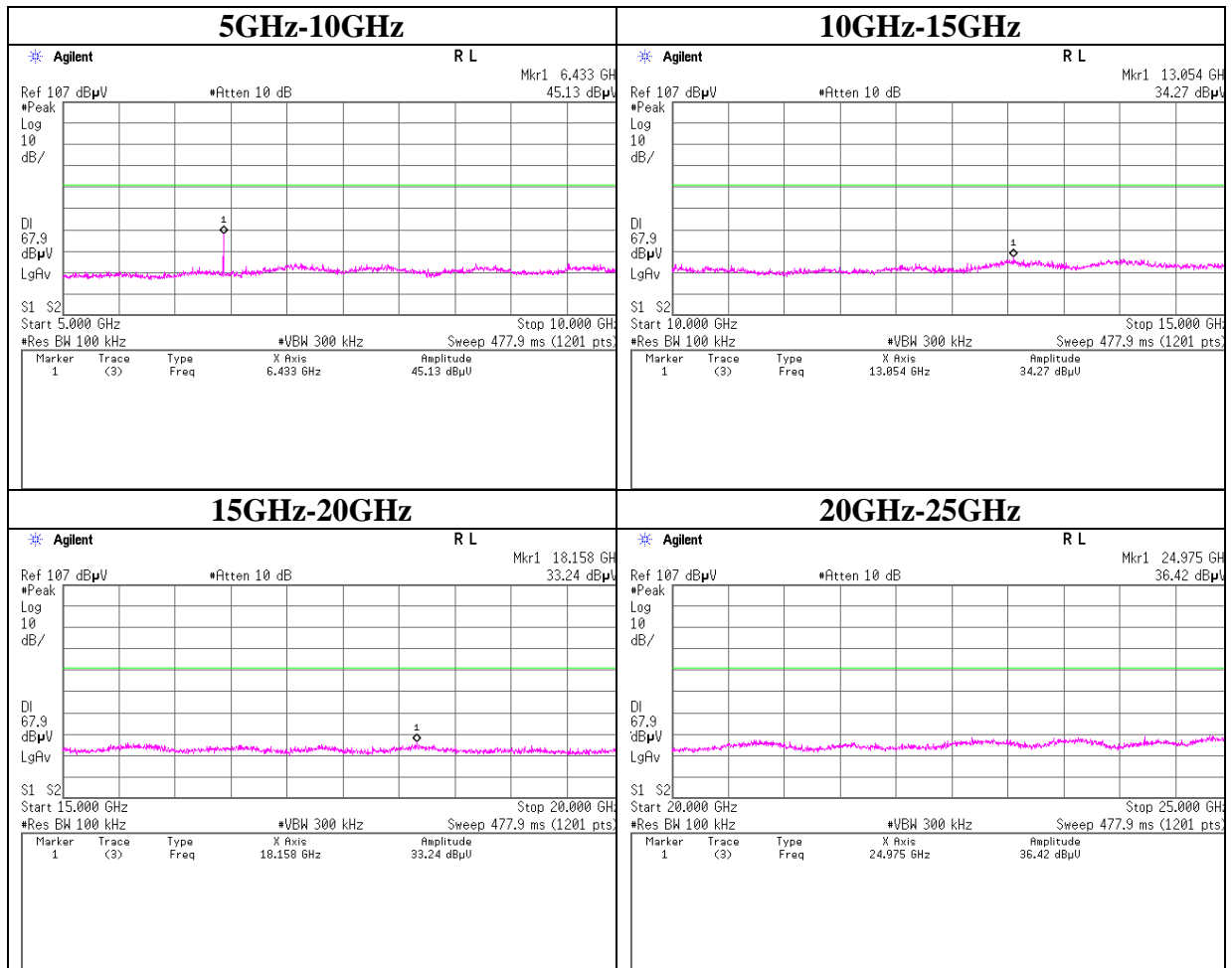
## Conducted Spurious Emission

### 11n-20 Tx 2412MHz



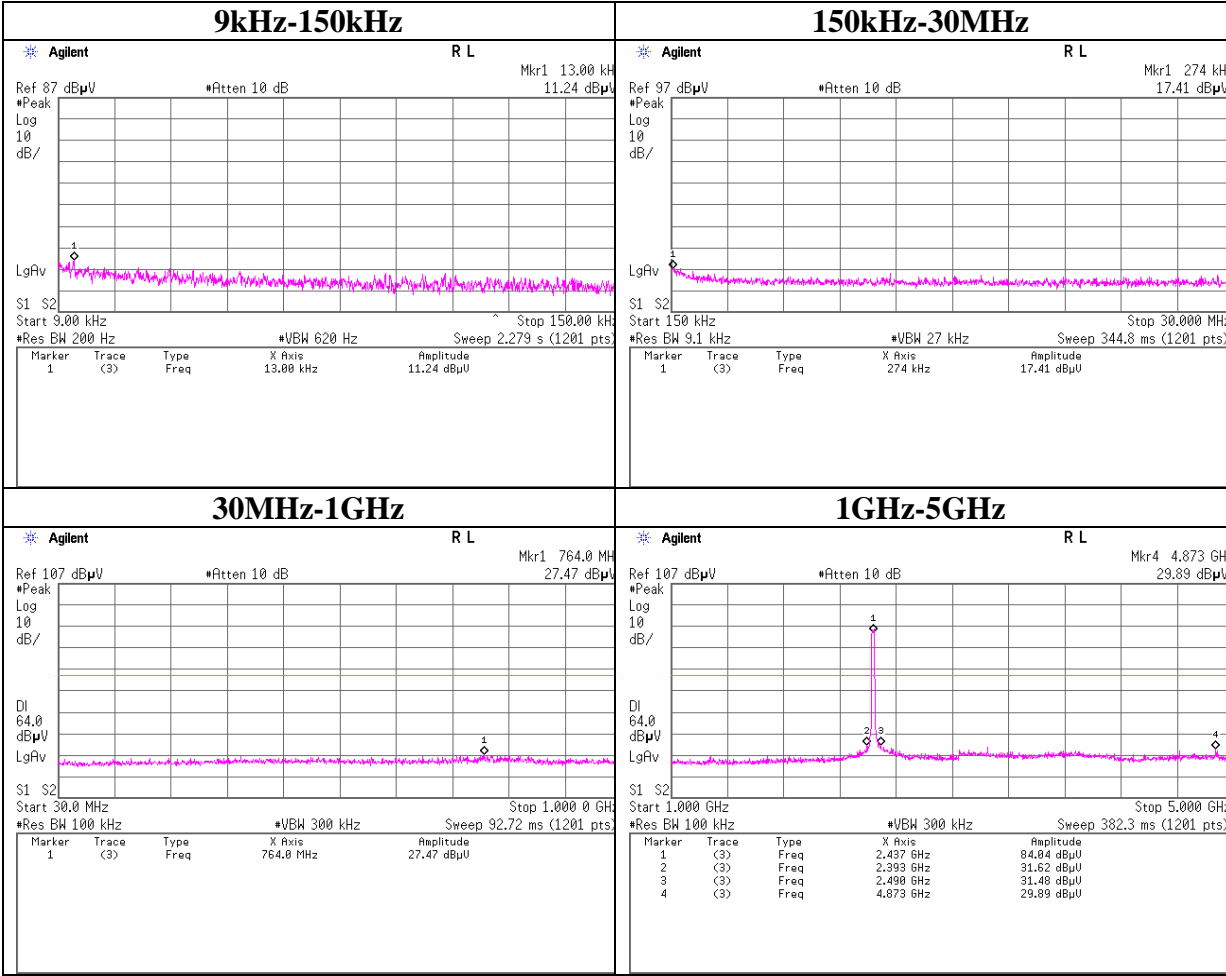
## Conducted Spurious Emission

### 11n-20 Tx 2412MHz



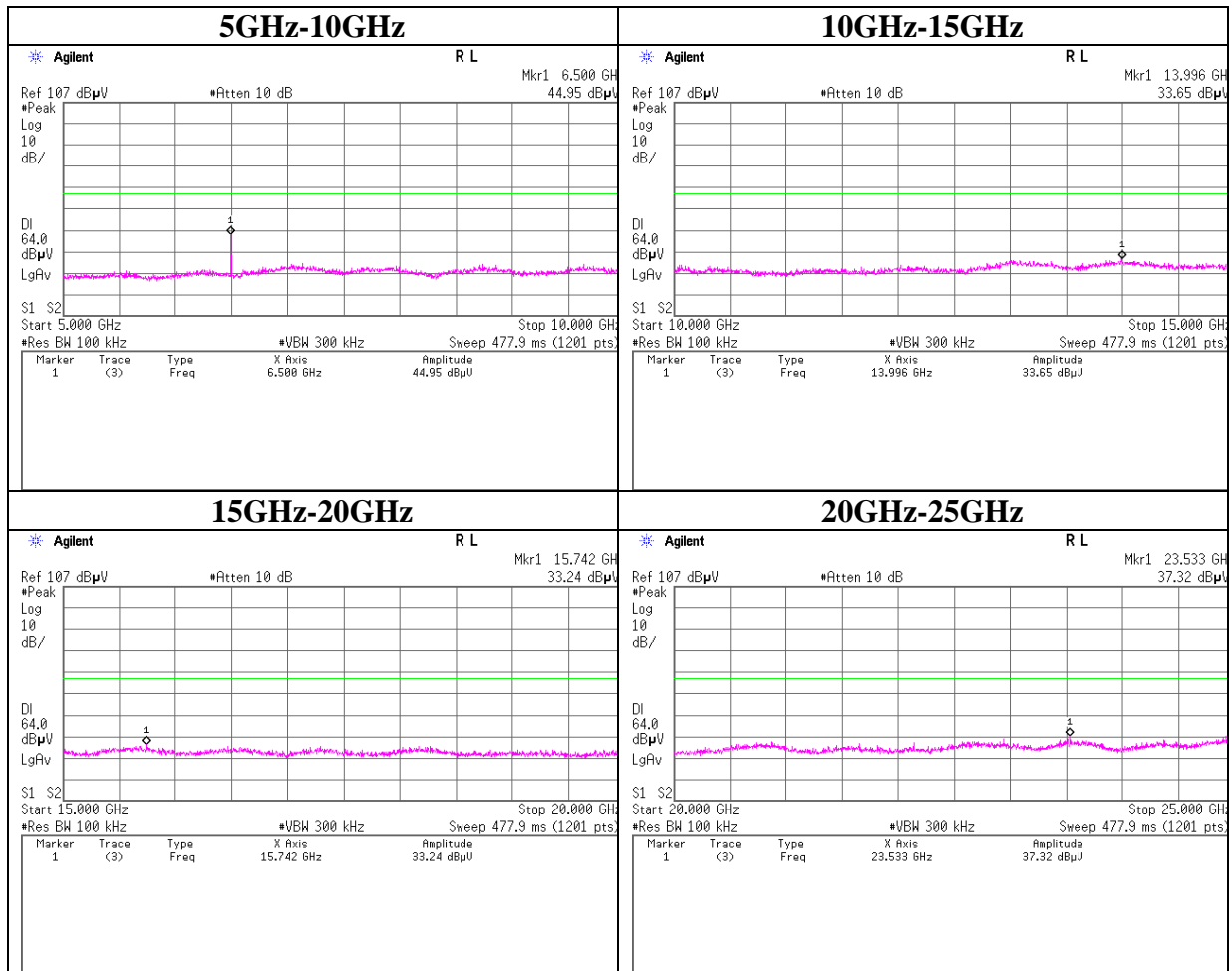
Conducted Spurious Emission

11n-20 Tx 2437MHz



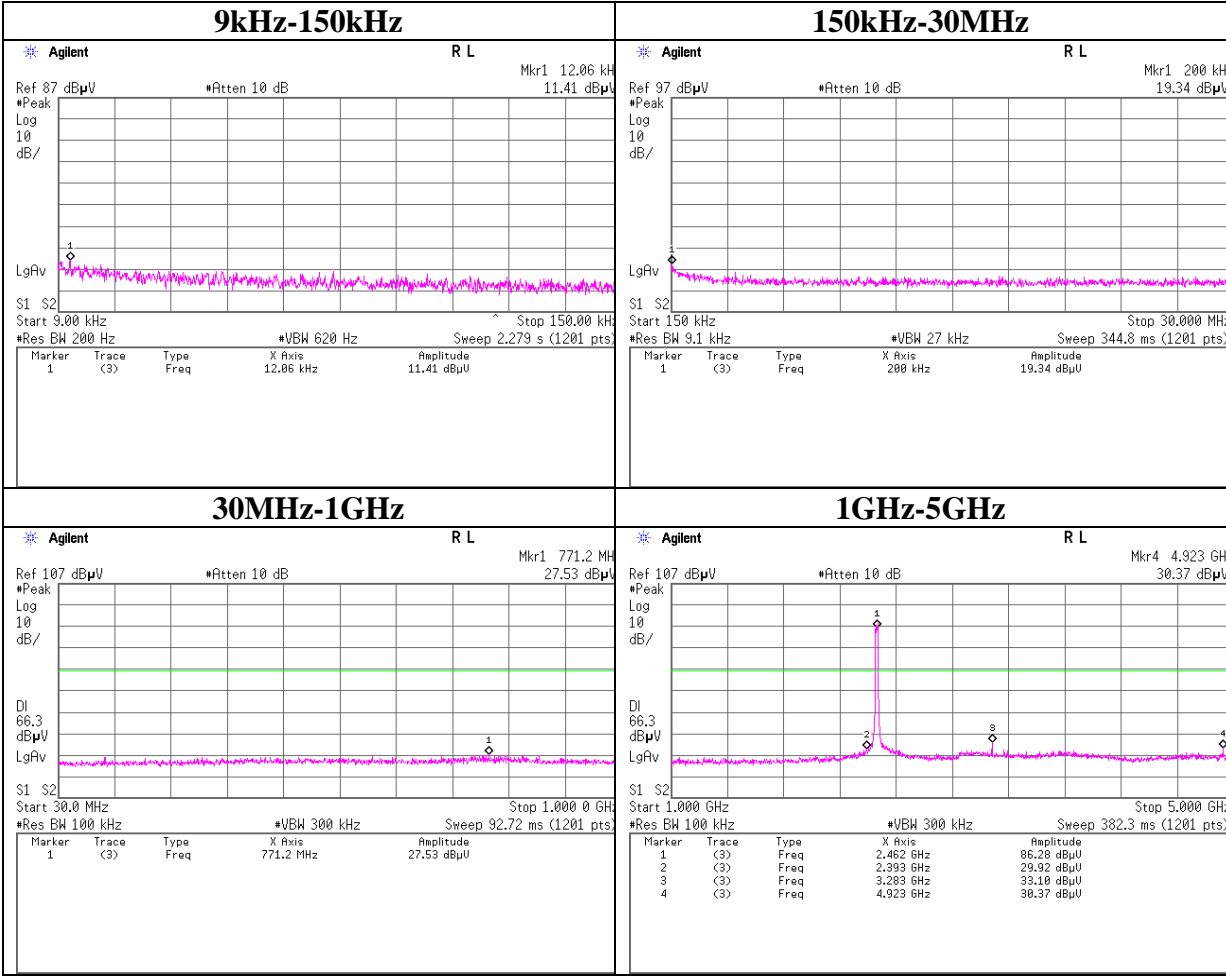
## Conducted Spurious Emission

### 11n-20 Tx 2437MHz



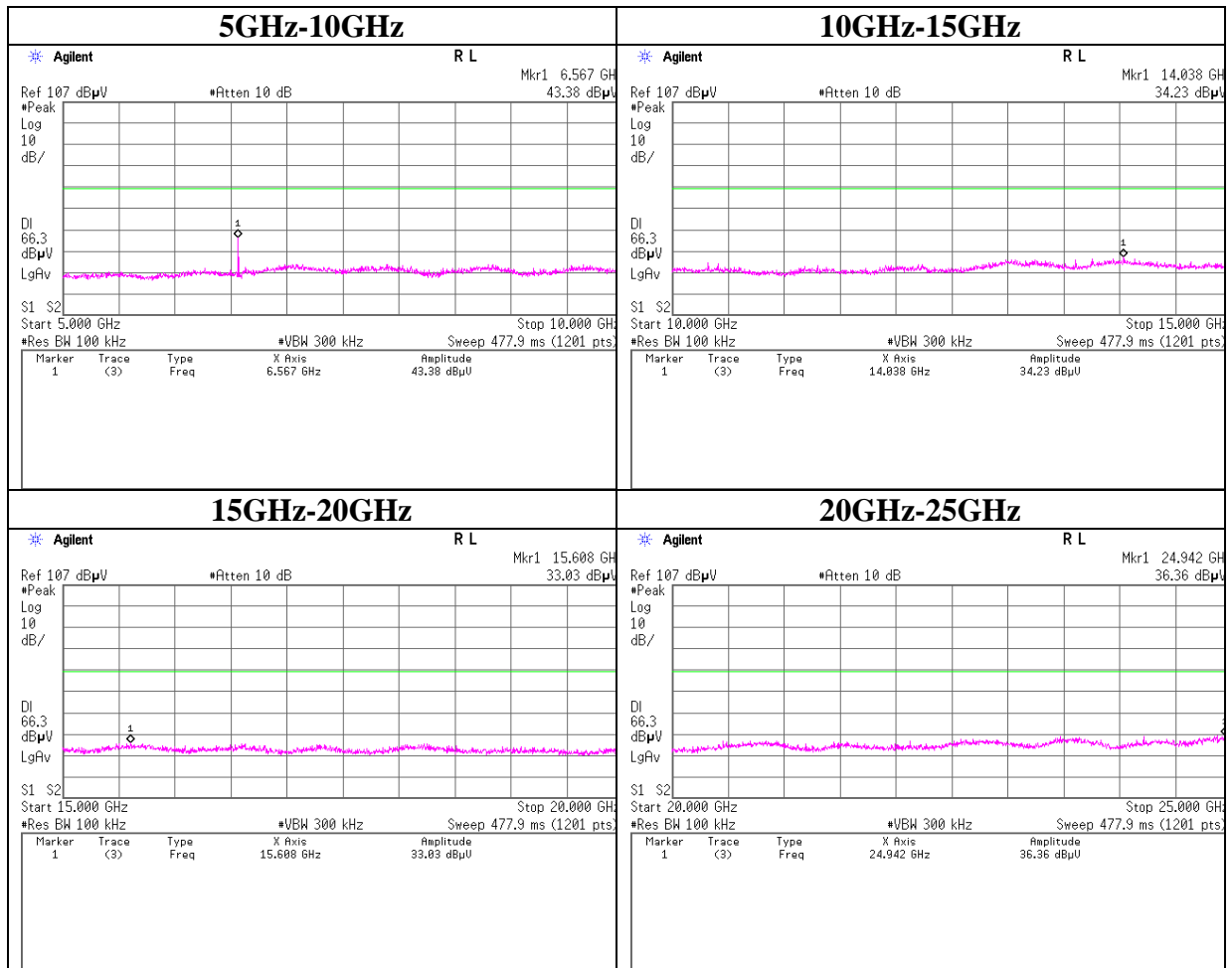
Conducted Spurious Emission

11n-20 Tx 2462MHz



## Conducted Spurious Emission

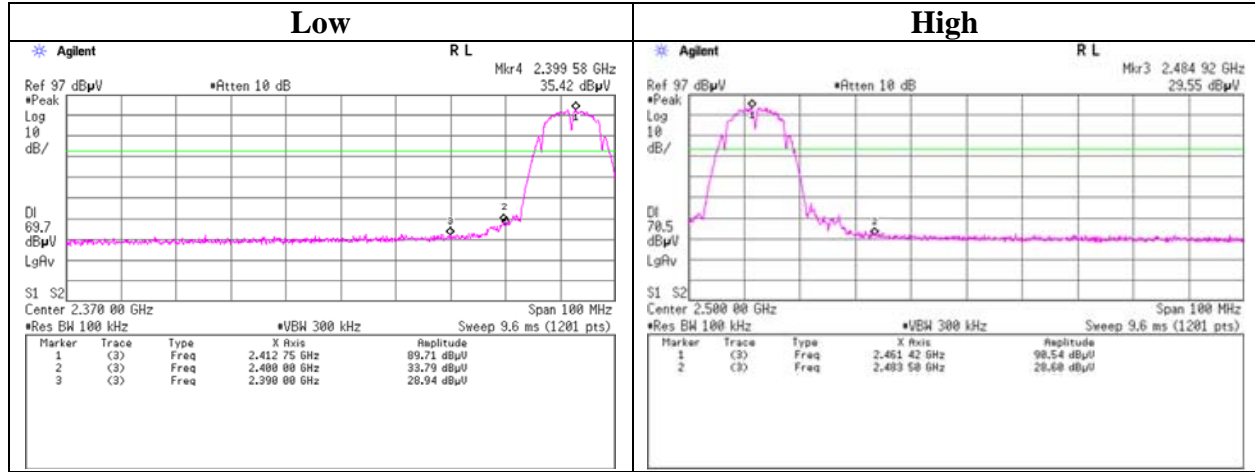
### 11n-20 Tx 2462MHz



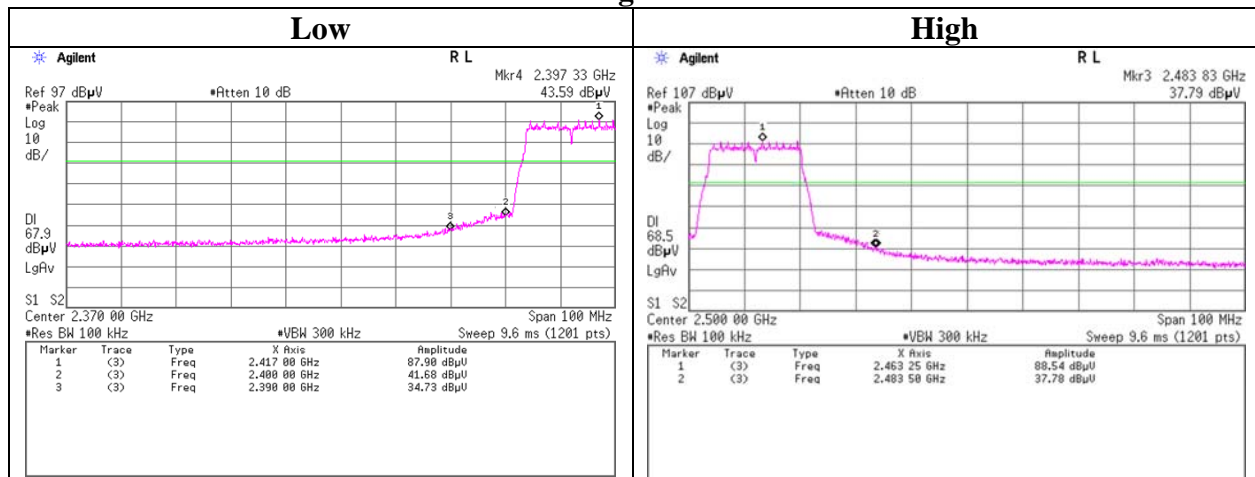


## Conducted Emission Band Edge compliance

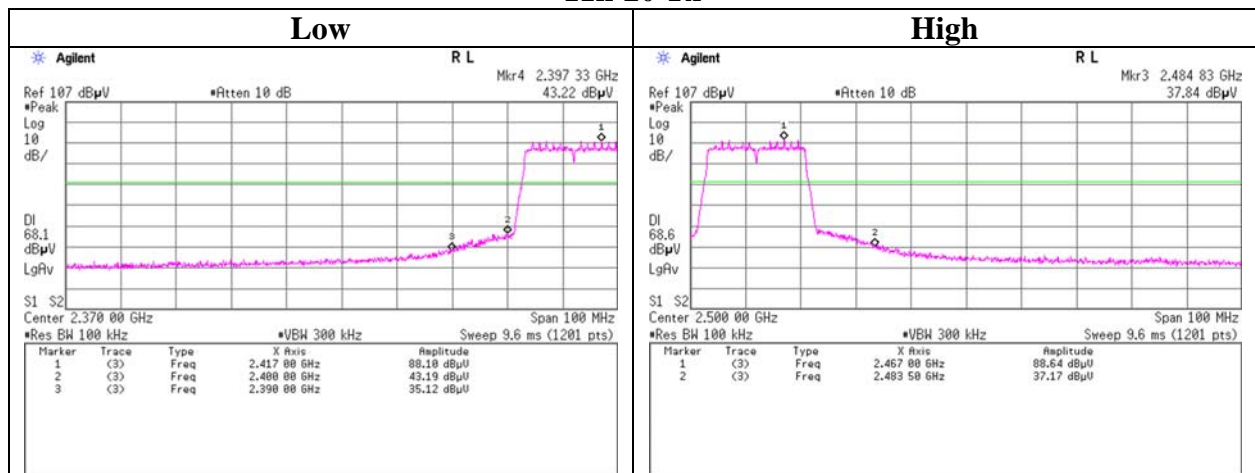
### 11b Tx



### 11g Tx



### 11n-20 Tx



### Power Density

Test place Head Office EMC Lab. No.6 Measurement Room  
Report No. 33AE0057-HO-01  
Date 10/24/2012  
Temperature/ Humidity 23 deg. C / 68% RH  
Engineer Kazuya Yoshioka  
Mode 11b Tx, 11g Tx 11n-20 Tx

#### 11b

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-20.15	1.52	10.03	-8.60	8.00	16.60
2437.00	-20.31	1.53	10.03	-8.75	8.00	16.75
2462.00	-16.71	1.54	10.03	-5.14	8.00	13.14

#### 11g

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-23.23	1.52	10.03	-11.68	8.00	19.68
2437.00	-23.24	1.53	10.03	-11.68	8.00	19.68
2462.00	-22.25	1.54	10.03	-10.68	8.00	18.68

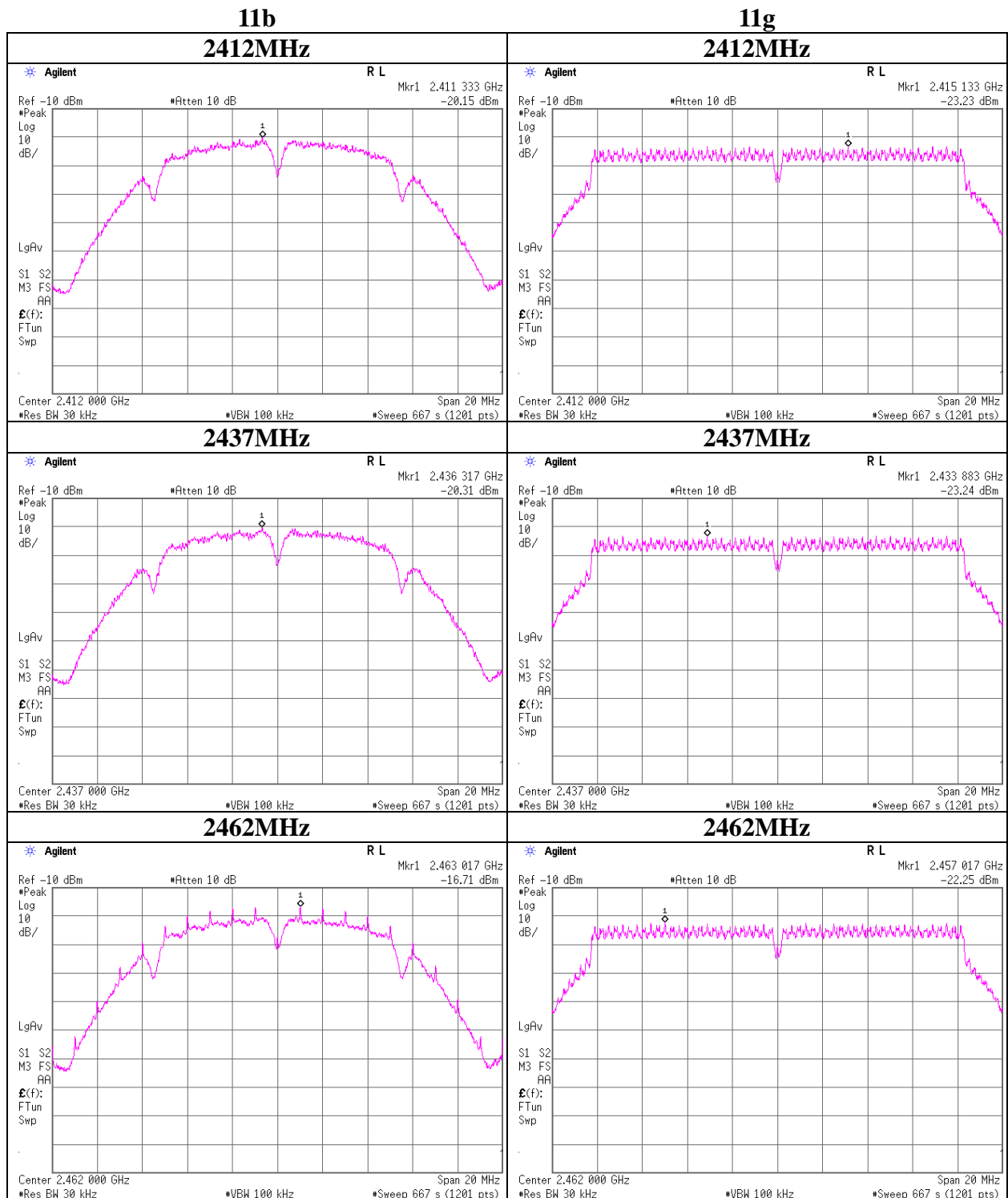
#### 11n-20

Freq.	Reading	Cable Loss	Atten.	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412.00	-23.44	1.52	10.03	-11.89	8.00	19.89
2437.00	-23.25	1.53	10.03	-11.69	8.00	19.69
2462.00	-23.04	1.54	10.03	-11.47	8.00	19.47

Sample Calculation:

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

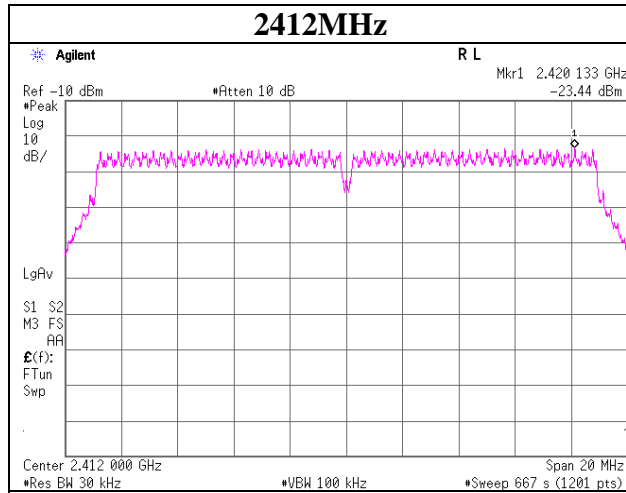
## Power Density



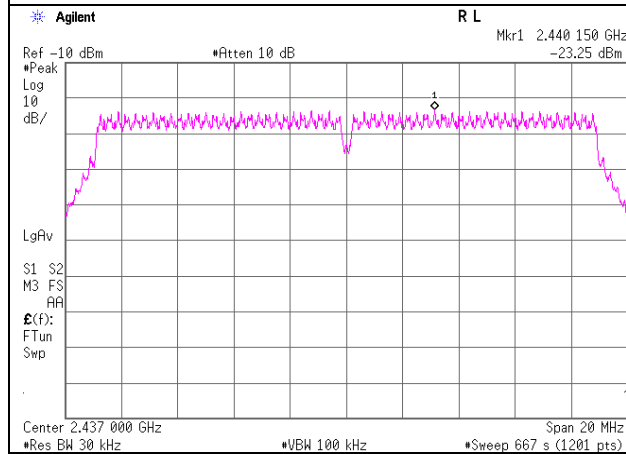
## Power Density

11n-20

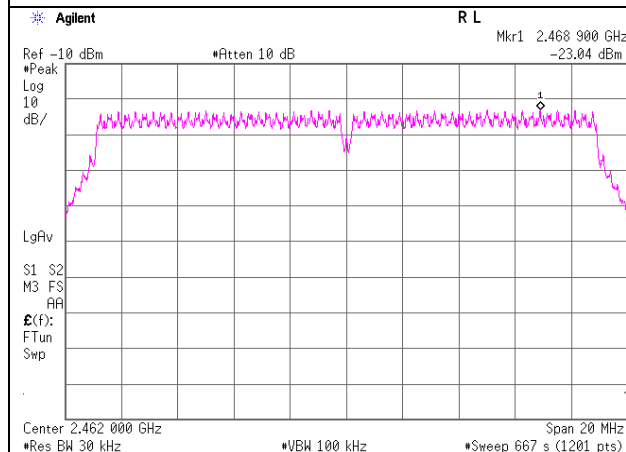
2412MHz



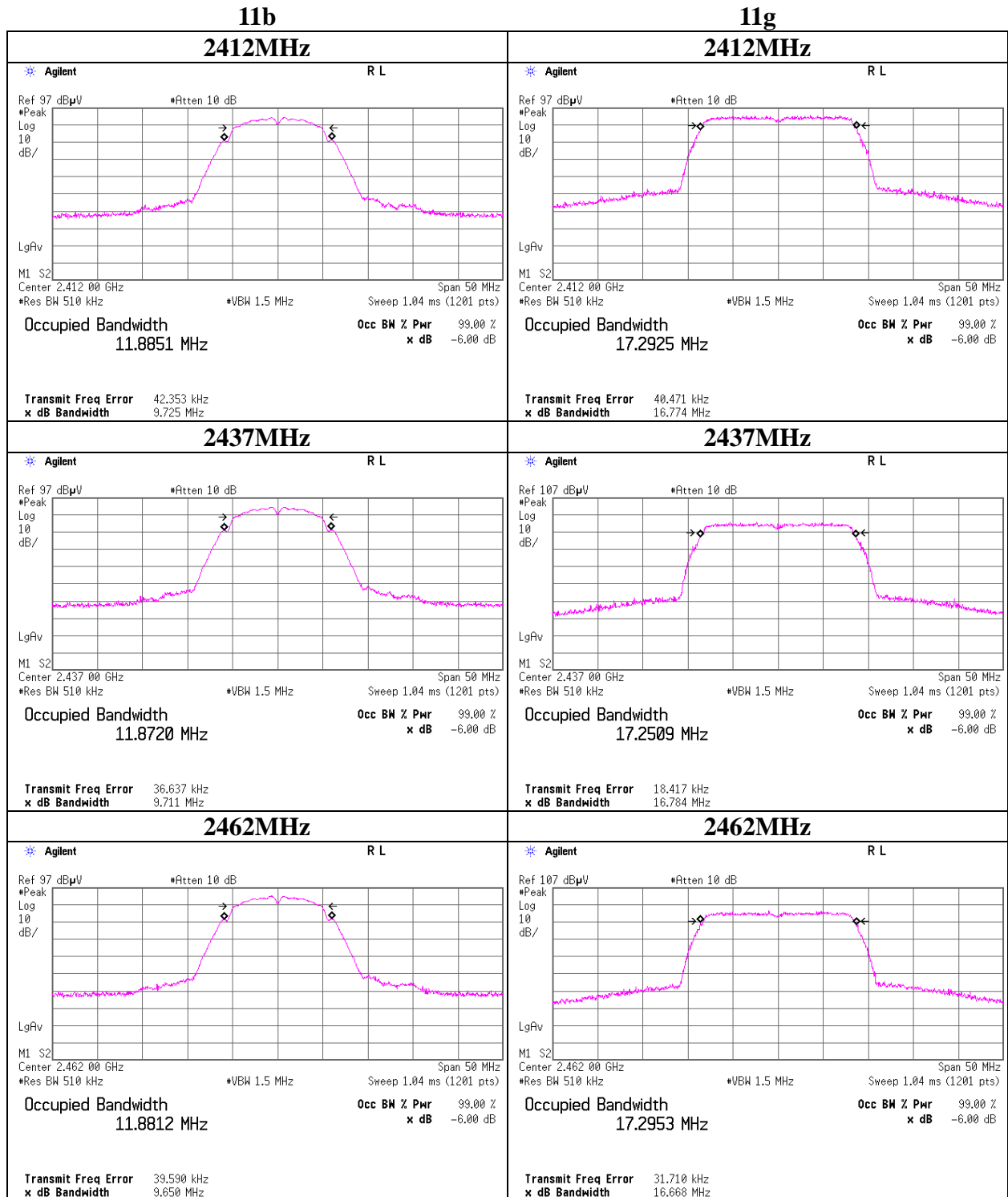
2437MHz



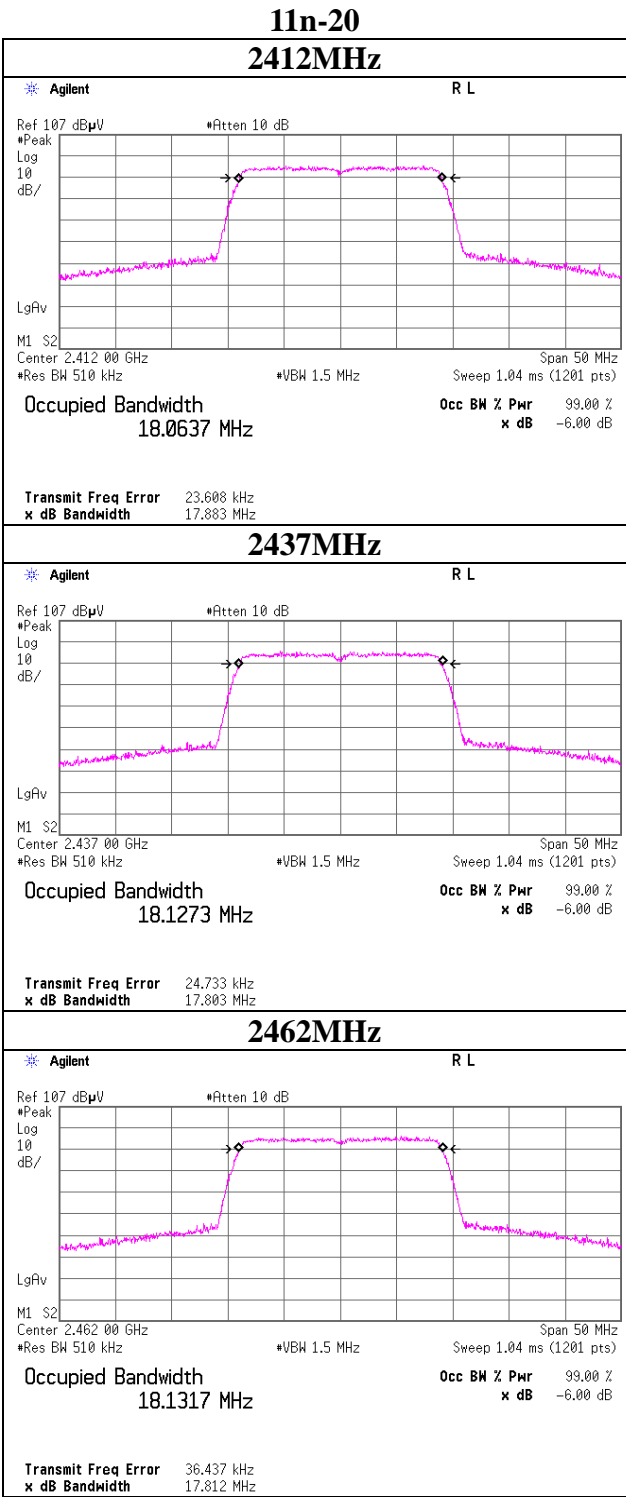
2462MHz



**99%Occupied Bandwidth**



99% Occupied Bandwidth



## **APPENDIX 2: Test instruments**

### **EMI test equipment**

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOS-14	Thermo-Hygrometer	Custom	CTH-201	-	AT	2012/02/06 * 12
MAT-25	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71642	AT	2012/06/27 * 12
MCC-67	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	AT	2012/04/25 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	AT/RE	2012/04/06 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2011/11/07 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2011/11/07 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2012/06/29 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE	2012/02/06 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2012/02/22 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2012/01/25 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2012/02/22 * 12
MCC-132	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336161/4(1m) / 340639(5m)	RE	2012/09/05 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2012/02/03 * 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	CE	2012/04/03 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	8127364	CE	2012/02/09 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2012/01/11 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2012/02/16 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2012/01/28 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA9103200 8	RE	2012/10/08 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2012/10/08 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2012/02/16 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2011/11/02 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2012/09/11 * 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.

**UL Japan, Inc.**

**Head Office EMC Lab.**

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