



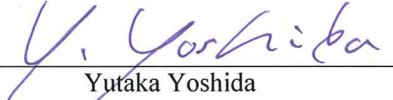
# RADIO TEST REPORT

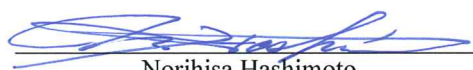
Test Report No. : 32LE0012-HO-01-A-R2

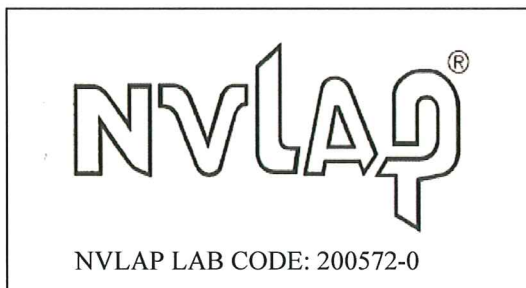
**Applicant** : Murata Manufacturing Co., Ltd.  
**Type of Equipment** : Communication Module  
**Model No.** : VZ  
**FCC ID** : VPYLBVZ  
**Test regulation** : FCC Part 15 Subpart C: 2012  
**Test Result** : Complied

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 32LE0012-HO-01-A-R1.  
32LE0012-HO-01-A-R1 is replaced with this report.

**Date of test:** July 30 to September 3, 2012

**Representative test engineer:**   
Yutaka Yoshida  
Engineer of WiSE Japan,  
UL Verification Service

**Approved by:**   
Norihisa Hashimoto  
Leader of WiSE Japan,  
UL Verification Service



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>

<b>CONTENTS</b>	<b>PAGE</b>
<b>SECTION 1: Customer information.....</b>	<b>3</b>
<b>SECTION 2: Equipment under test (E.U.T.).....</b>	<b>3</b>
<b>SECTION 3: Test specification, procedures &amp; results.....</b>	<b>4</b>
<b>SECTION 4: Operation of E.U.T. during testing.....</b>	<b>7</b>
<b>SECTION 5: Conducted Emission.....</b>	<b>9</b>
<b>SECTION 6: Radiated Spurious Emission .....</b>	<b>10</b>
<b>SECTION 7: Antenna Terminal Conducted Tests.....</b>	<b>11</b>
<b>APPENDIX 1: Data of EMI test.....</b>	<b>12</b>
Conducted Emission .....	12
6dB Bandwidth .....	14
Maximum Peak Output Power .....	15
Average Output Power.....	15
Radiated Spurious Emission .....	16
Conducted Spurious Emission .....	20
Conducted Emission Band Edge compliance .....	26
Power Density .....	27
99% Occupied Bandwidth .....	29
<b>APPENDIX 2: Test instruments .....</b>	<b>30</b>
<b>APPENDIX 3: Photographs of test setup .....</b>	<b>32</b>
Conducted Emission .....	32
Radiated Spurious Emission .....	33
Worst Case Position (Horizontal: X-axis/ Vertical:Y-axis).....	34

## **SECTION 1: Customer information**

Company Name : Murata Manufacturing Co., Ltd.  
Address : 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto, 617-8555, Japan  
Telephone Number : +81-75-955-6375  
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. : VZ  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 3.0V  
Receipt Date of Sample : July 30, 2012  
Country of Mass-production : Japan, China  
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**

#### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : 2402-2480MHz  
Modulation : GFSK  
Power Supply (radio part input) : DC 1.75V  
Antenna type : Monopole (Chip Antenna)  
Antenna Gain : 1.3dBi(max)

---

**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

## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C: 2012, final revised on May 17, 2012 and effective June 18, 2012

Title : FCC 47CFR Part 15 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 32.2dB, 0,1500MHz, L AV 37.4dB, 1.00000MHz, N/L	Complied	-
6dB Bandwidth	FCC: "Guidance on Measurement of Digital Transmission Systems Operating under Section 15.247" ----- 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 Section 15.247" ----- 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 Section 15.247" ----- 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 Section 15.247" ----- IC: RSS-Gen 4.9	FCC: Section 15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 7.2.3	4.6dB 4960.000MHz, AV, Hori.	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)**

This EUT provides stable voltage(DC1.75V) constantly to RF Module 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 the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

**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

### 3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	N/A	-	Conducted

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

### 3.4 Uncertainty

#### EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Test room (semi-anechoic chamber)	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.

**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

### 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)**

<b>Mode</b>	<b>Remarks*</b>
Bluetooth Low Energy(LE)	Continuous Tx / Rx
*Transmitting duty was 100% on all tests. Software: Murata HostEmulator Rev:281	
*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)

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested frequency</b>
Conducted Emission	BT LE	2402MHz
Spurious Emission		2440MHz
6dB Bandwidth		2480MHz
Maximum Peak Output Power		
Power Density		
99% Occupied Bandwidth		

---

**UL Japan, Inc.**

**Head Office EMC Lab.**

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

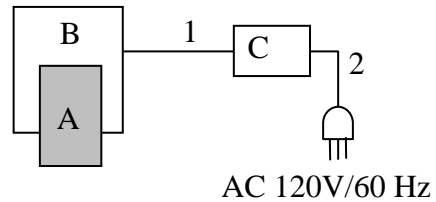
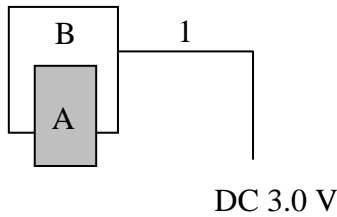
Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

## 4.2 Configuration and peripherals

[Radiated emission,  
Antenna terminal conducted]

[Conducted emission]



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

### Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Communication module	VZ	001831E42CFD00 *1) 90D7EBB3184F00 *2)	Murata MFG. Co., Ltd.	EUT
B	Jig board	-	-	Murata MFG. Co., Ltd.	-
C	DC Power Supply	PMC35-2A	13090501	KIKUSUI	-

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Power Cable	2.3	Unshielded	Unshielded	-
2	AC Power Cable	3.0	Unshielded	Unshielded	-

\*1) Used for Antenna terminal conducted test only.

\*2) Used for other tests except for Antenna terminal conducted test.

**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



## **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>

---

**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

## **SECTION 6: Radiated Spurious Emission**

### **Test Procedure**

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

Frequency	Below 1GHz	Above 1GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	PK	AV
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz
Test Distance	3m	3m (below 10GHz), 1m*1) (above 10GHz),	

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

- 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

**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

## **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	3MHz	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	Sample	Clear Write	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *3)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	1.5MHz	3kHz	10kHz	500sec	Peak	Max Hold	Spectrum Analyzer *1)
Conducted Spurious Emission *2)	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 Section 15.247".

\*2) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart. (9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz).

\*3) 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.

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**

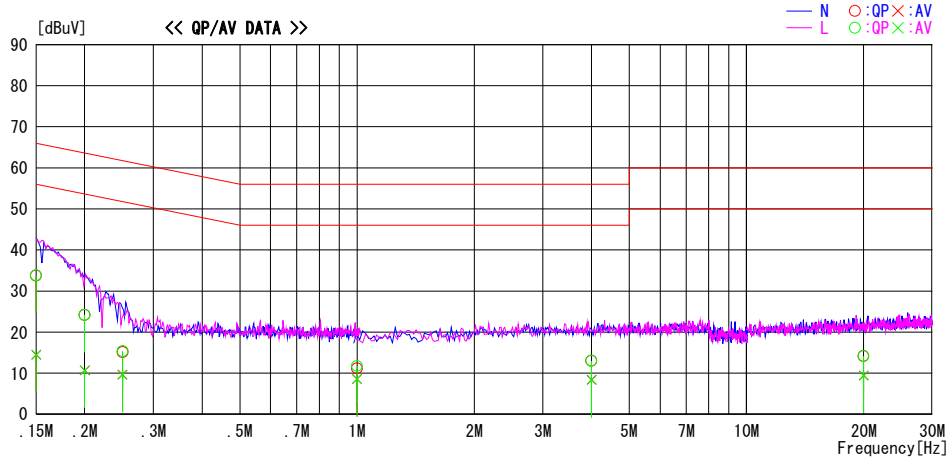
**DATA OF CONDUCTED EMISSION TEST**

UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber  
 Date : 2012/07/31

Report No. : 32LE0012-HO-01  
 Temp./Humi. : 26deg. C / 58% RH  
 Engineer : Takumi Shimada

Mode / Remarks : BT Low Energy 2440MHz

LIMIT : FCC15.207 QP  
 FCC15.207 AV

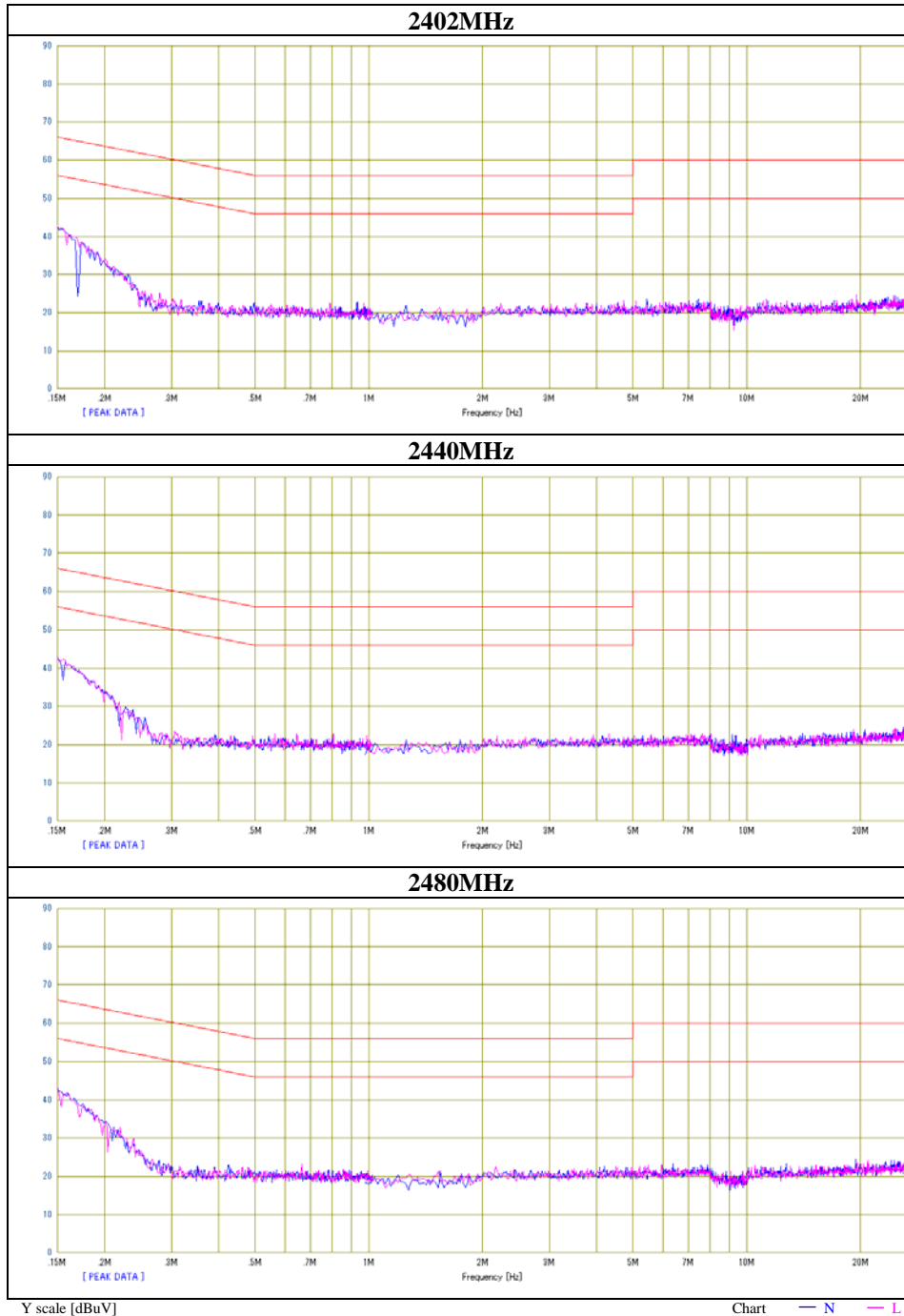


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	20.5	1.3	13.2	33.7	14.5	66.0	56.0	32.3	41.5	N	
0.20000	11.0	-2.5	13.2	24.2	10.7	63.6	53.6	39.4	42.9	N	
0.25000	1.8	-3.6	13.3	15.1	9.7	61.8	51.8	46.7	42.1	N	
1.00000	-2.1	-4.7	13.3	11.2	8.6	56.0	46.0	44.8	37.4	N	
4.00000	-0.6	-5.2	13.6	13.0	8.4	56.0	46.0	43.0	37.6	N	
20.00000	-0.5	-5.3	14.7	14.2	9.4	60.0	50.0	45.8	40.6	N	
0.15000	20.6	1.3	13.2	33.8	14.5	66.0	56.0	32.2	41.5	L	
0.20000	11.0	-2.5	13.2	24.2	10.7	63.6	53.6	39.4	42.9	L	
0.25000	2.1	-3.7	13.3	15.4	9.6	61.8	51.8	46.4	42.2	L	
1.00000	-1.6	-4.7	13.3	11.7	8.6	56.0	46.0	44.3	37.4	L	
4.00000	-0.6	-5.3	13.6	13.0	8.3	56.0	46.0	43.0	37.7	L	
20.00000	-0.6	-5.3	14.7	14.1	9.4	60.0	50.0	45.9	40.6	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

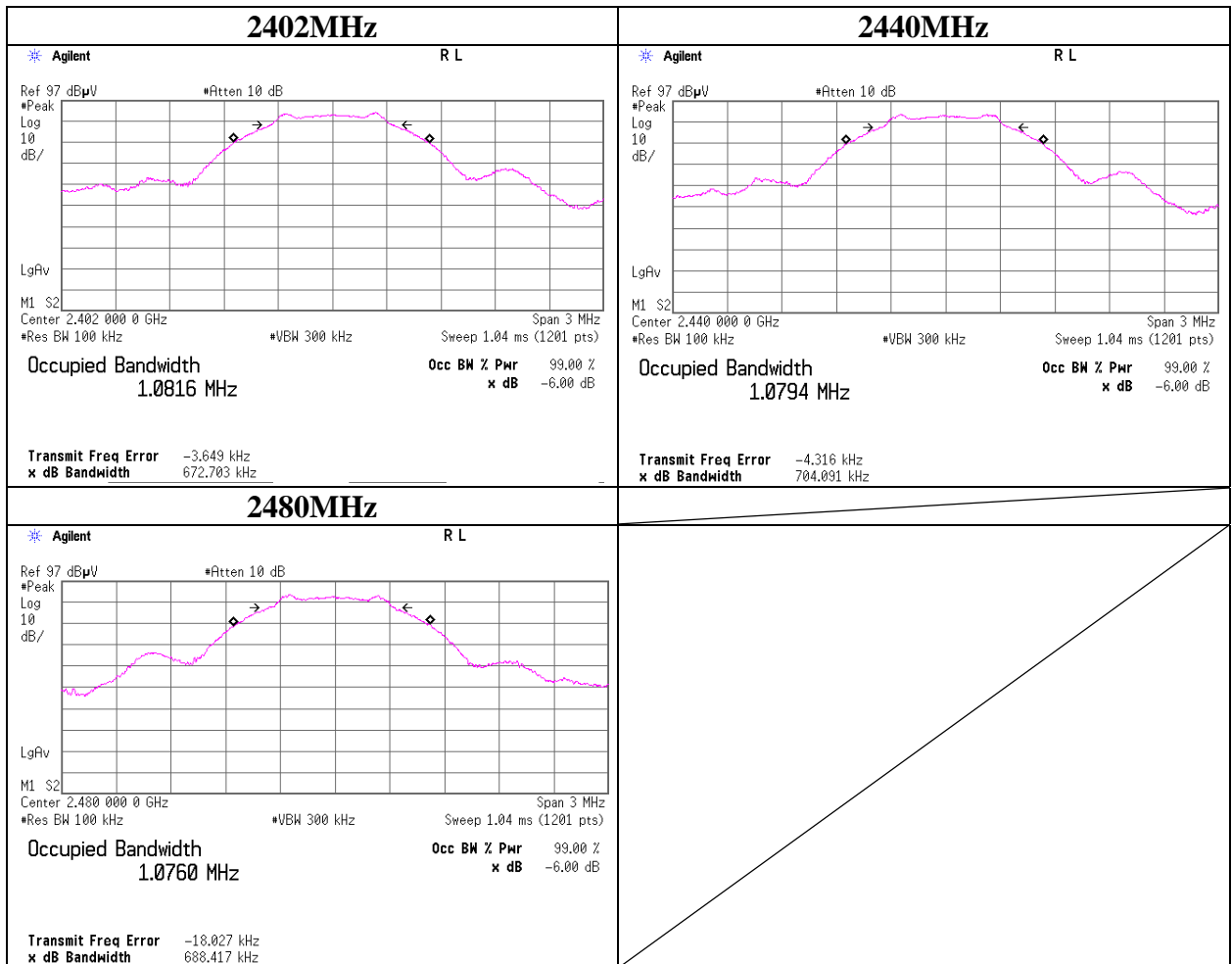
Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	32LE0012-HO-01
Date	07/30/2012
Temperature/ Humidity	26 deg.C./ 58%
Engineer	Takumi Shimada
Mode	Bluetooth Low Energy



## 6dB Bandwidth

Test place	Head Office EMC Lab. No.7 Shielded Room
Report No.	32LE0012-HO-01
Date	08/01/2012
Temperature/ Humidity	27deg. C / 64% RH
Engineer	Yutaka Yoshida
Mode	Tx Bluetooth Low Energy

Frequency [MHz]	6dB Bandwidth [kHz]	Limit [kHz]
2402	672.703	>500
2440	704.091	>500
2480	688.417	>500



### Maximum Peak Output Power

Test place Head Office EMC Lab. No.7 Shielded Room  
Report No. 32LE0012-HO-01  
Date 08/01/2012  
Temperature/ Humidity 27deg. C / 64% RH  
Engineer Yutaka Yoshida  
Mode Tx Bluetooth Low Energy

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-14.85	2.23	10.08	-2.54	0.56	30.00	1000	32.54
2440	-15.04	2.24	10.08	-2.72	0.53	30.00	1000	32.72
2480	-15.09	2.25	10.09	-2.75	0.53	30.00	1000	32.75

Sample Calculation:

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

### Average Output Power (for reporting purpose only)

Test place Head Office EMC Lab. No.7 Shielded Room  
Report No. 32LE0012-HO-01  
Date 08/01/2012  
Temperature/ Humidity 27deg. C / 64% RH  
Engineer Yutaka Yoshida  
Mode Tx Bluetooth Low Energy

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-15.86	2.23	10.08	-3.55	0.44	30.00	1000	33.55
2440	-16.12	2.24	10.08	-3.80	0.42	30.00	1000	33.80
2480	-16.51	2.25	10.09	-4.17	0.38	30.00	1000	34.17

Sample Calculation:

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

## Radiated Spurious Emission

Test place : Head Office EMC Lab. No.4 Semi Anechoic Chamber  
Report No. : 32LE0012-HO-01  
Date : 07/30/2012                      09/03/2012  
Temperature/ Humidity : 24 deg. C / 61% RH      23 deg. C / 65% RH  
Engineer : Takumi Shimada                      Takumi Shimada  
(Above 1GHz)                      (Below 1GHz)  
Mode : Tx 2402MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	31.600	QP	23.0	18.1	7.1	32.0	16.2	40.0	23.8	
Hori	64.000	QP	22.9	7.4	7.6	32.1	5.8	40.0	34.2	
Hori	127.800	QP	22.5	13.6	8.4	32.0	12.5	43.5	31.0	
Hori	2390.000	PK	50.3	28.1	2.4	32.3	48.5	73.9	25.5	
Hori	4804.000	PK	49.3	31.2	4.3	31.5	53.3	73.9	20.6	
Hori	7206.000	PK	45.4	35.6	5.0	32.5	53.5	73.9	20.4	
Hori	9608.000	PK	42.5	38.3	5.8	32.9	53.7	73.9	20.2	
Hori	2390.000	AV	39.7	28.1	2.4	32.3	37.9	53.9	16.1	
Hori	4804.000	AV	43.5	31.2	4.3	31.5	47.5	53.9	6.4	
Hori	7206.000	AV	33.7	35.6	5.0	32.5	41.8	53.9	12.1	
Hori	9608.000	AV	29.8	38.3	5.8	32.9	41.0	53.9	12.9	
Vert	31.600	QP	22.9	18.1	7.1	32.0	16.1	40.0	23.9	
Vert	64.000	QP	23.0	7.4	7.6	32.1	5.9	40.0	34.1	
Vert	127.800	QP	22.6	13.6	8.4	32.0	12.6	43.5	30.9	
Vert	2390.000	PK	48.2	28.1	2.4	32.3	46.4	73.9	27.5	
Vert	4804.000	PK	47.6	31.2	4.3	31.5	51.6	73.9	22.3	
Vert	7206.000	PK	43.8	35.6	5.0	32.5	51.9	73.9	22.1	
Vert	9608.000	PK	42.3	38.3	5.8	32.9	53.5	73.9	20.4	
Vert	2390.000	AV	37.3	28.1	2.4	32.3	35.5	53.9	18.4	
Vert	4804.000	AV	41.6	31.2	4.3	31.5	45.6	53.9	8.3	
Vert	7206.000	AV	32.6	35.6	5.0	32.5	40.7	53.9	13.2	
Vert	9608.000	AV	29.9	38.3	5.8	32.9	41.1	53.9	12.8	

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	2402.000	PK	96.2	28.1	2.4	32.3	94.4	-	-	Carrier
Hori	2399.263	PK	58.6	28.1	2.4	32.3	56.8	74.4	17.6	
Hori	2400.000	PK	56.0	28.1	2.4	32.3	54.2	74.4	20.2	
Vert	2402.000	PK	92.4	28.1	2.4	32.3	90.6	-	-	Carrier
Vert	2399.263	PK	58.6	28.1	2.4	32.3	56.8	70.6	13.8	
Vert	2400.000	PK	54.7	28.1	2.4	32.3	52.9	70.6	17.7	

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. : 32LE0012-HO-01  
Date : 07/30/2012                      09/03/2012  
Temperature/ Humidity : 24 deg. C / 61% RH      23 deg. C / 65% RH  
Engineer : Takumi Shimada                      Takumi Shimada  
(Above 1GHz)                      (Below 1GHz)  
Mode : Tx 2440MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	31.600	QP	23.1	18.1	7.1	32.0	16.2	40.0	23.7	
Hori	64.000	QP	23.0	7.4	7.6	32.1	5.8	40.0	34.1	
Hori	127.800	QP	22.5	13.6	8.4	32.0	12.5	43.5	31.0	
Hori	4880.000	PK	49.5	31.4	4.3	31.5	53.7	73.9	20.2	
Hori	7320.000	PK	43.3	35.7	5.0	32.5	51.5	73.9	22.4	
Hori	9760.000	PK	41.9	38.5	5.9	32.9	53.4	73.9	20.5	
Hori	4880.000	AV	43.8	31.4	4.3	31.5	48.0	53.9	5.9	
Hori	7320.000	AV	32.8	35.7	5.0	32.5	41.0	53.9	12.9	
Hori	9760.000	AV	29.8	38.5	5.9	32.9	41.3	53.9	12.6	
Vert	31.600	QP	22.9	18.1	7.1	32.0	16.1	40.0	23.9	
Vert	64.000	QP	22.9	7.4	7.6	32.1	5.9	40.0	34.2	
Vert	127.800	QP	22.6	13.6	8.4	32.0	12.6	43.5	30.9	
Vert	4880.000	PK	48.3	31.4	4.3	31.5	52.5	73.9	21.4	
Vert	7320.000	PK	43.0	35.7	5.0	32.5	51.2	73.9	22.7	
Vert	9760.000	PK	42.4	38.5	5.9	32.9	53.9	73.9	20.0	
Vert	4880.000	AV	42.4	31.4	4.3	31.5	46.6	53.9	7.3	
Vert	7320.000	AV	30.5	35.7	5.0	32.5	38.7	53.9	15.2	
Vert	9760.000	AV	29.8	38.5	5.9	32.9	41.3	53.9	12.7	

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).

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

## Radiated Spurious Emission

Test place : Head Office EMC Lab. No 4 Semi Anechoic Chamber  
Report No. : 32LE0012-HO-01  
Date : 07/30/2012                      09/03/2012  
Temperature/ Humidity : 24 deg. C / 61% RH      23 deg. C / 65% RH  
Engineer : Takumi Shimada                      Takumi Shimada  
(Above 1GHz)                      (Below 1GHz)  
Mode : Tx 2480MHz

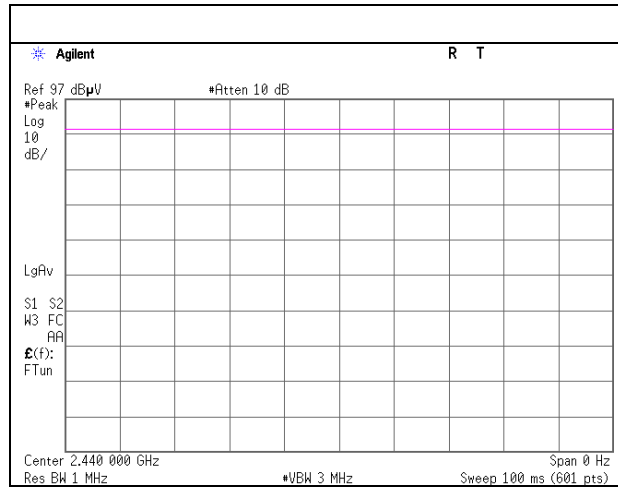
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	31.600	QP	23.1	18.1	7.1	32.0	16.2	40.0	23.7	
Hori	64.000	QP	22.9	7.4	7.6	32.1	5.8	40.0	34.2	
Hori	127.800	QP	22.5	13.6	8.4	32.0	12.5	43.5	31.0	
Hori	2483.500	PK	57.4	28.5	2.4	32.2	56.1	73.9	17.9	
Hori	2485.673	PK	58.4	28.5	2.4	32.2	57.1	73.9	16.8	
Hori	4960.000	PK	50.2	31.6	4.3	31.5	54.6	73.9	19.3	
Hori	7440.000	PK	43.3	35.8	5.1	32.6	51.6	73.9	22.4	
Hori	9920.000	PK	42.2	38.6	5.9	33.0	53.7	73.9	20.2	
Hori	2483.500	AV	47.9	28.5	2.4	32.2	46.6	53.9	7.4	
Hori	2485.673	AV	49.9	28.5	2.4	32.2	48.6	53.9	5.3	
Hori	4960.000	AV	44.9	31.6	4.3	31.5	49.3	53.9	4.6	
Hori	7440.000	AV	31.0	35.8	5.1	32.6	39.3	53.9	14.6	
Hori	9920.000	AV	30.2	38.6	5.9	33.0	41.7	53.9	12.2	
Vert	31.600	QP	23.0	18.1	7.1	32.0	16.1	40.0	23.8	
Vert	64.000	QP	23.0	7.4	7.6	32.1	5.9	40.0	34.1	
Vert	127.800	QP	22.7	13.6	8.4	32.0	12.6	43.5	30.8	
Vert	2483.500	PK	53.0	28.5	2.4	32.2	51.7	73.9	22.2	
Vert	2485.673	PK	54.4	28.5	2.4	32.2	53.1	73.9	20.9	
Vert	4960.000	PK	46.8	31.6	4.3	31.5	51.2	73.9	22.7	
Vert	7440.000	PK	42.7	35.8	5.1	32.6	51.0	73.9	22.9	
Vert	9920.000	PK	42.5	38.6	5.9	33.0	54.0	73.9	19.9	
Vert	2483.500	AV	43.1	28.5	2.4	32.2	41.8	53.9	12.1	
Vert	2485.673	AV	45.1	28.5	2.4	32.2	43.8	53.9	10.1	
Vert	4960.000	AV	40.0	31.6	4.3	31.5	44.4	53.9	9.5	
Vert	7440.000	AV	31.1	35.8	5.1	32.6	39.4	53.9	14.5	
Vert	9920.000	AV	30.3	38.6	5.9	33.0	41.8	53.9	12.1	

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).

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

### Burst rate confirmation



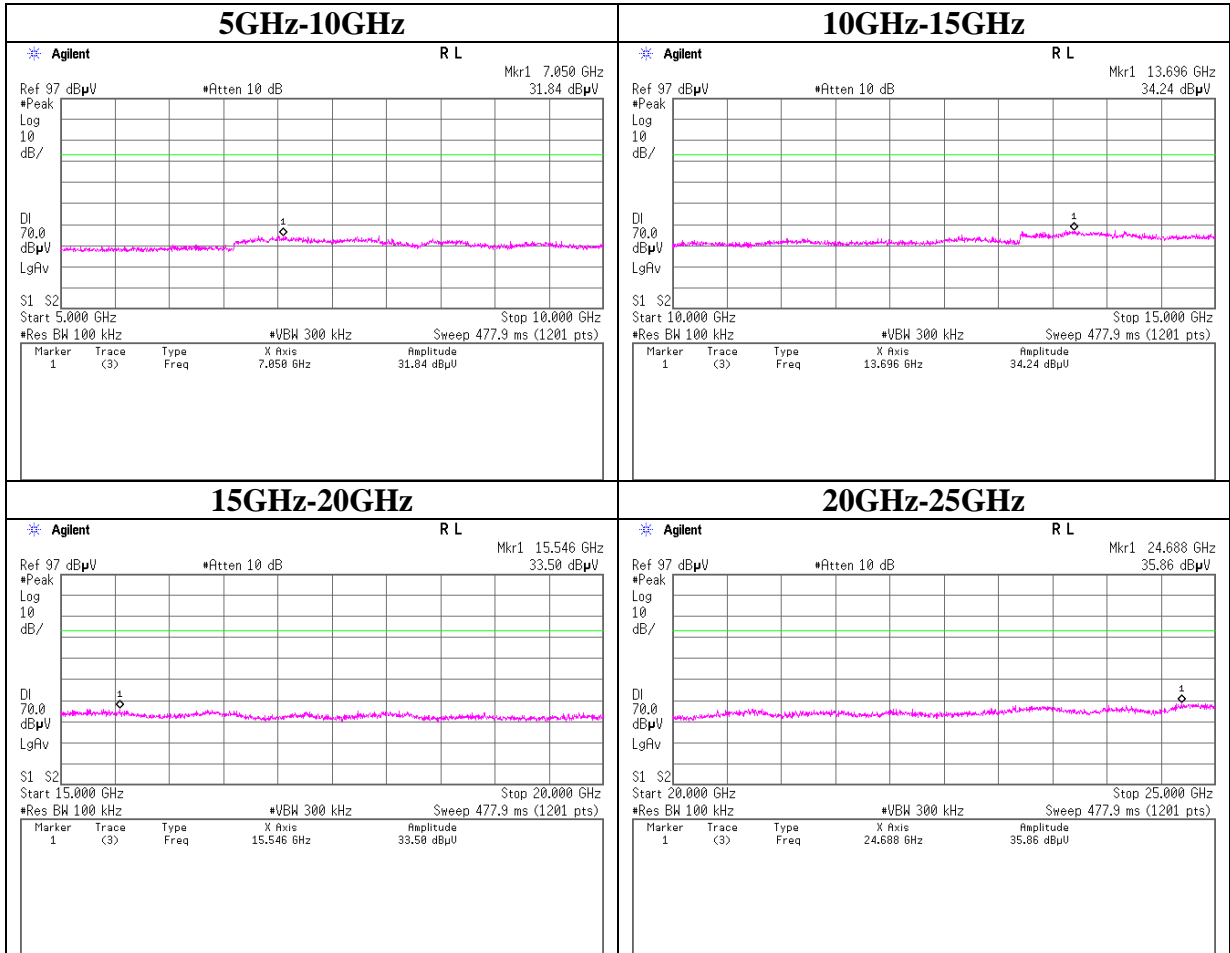
## Conducted Spurious Emission

### Tx 2402MHz



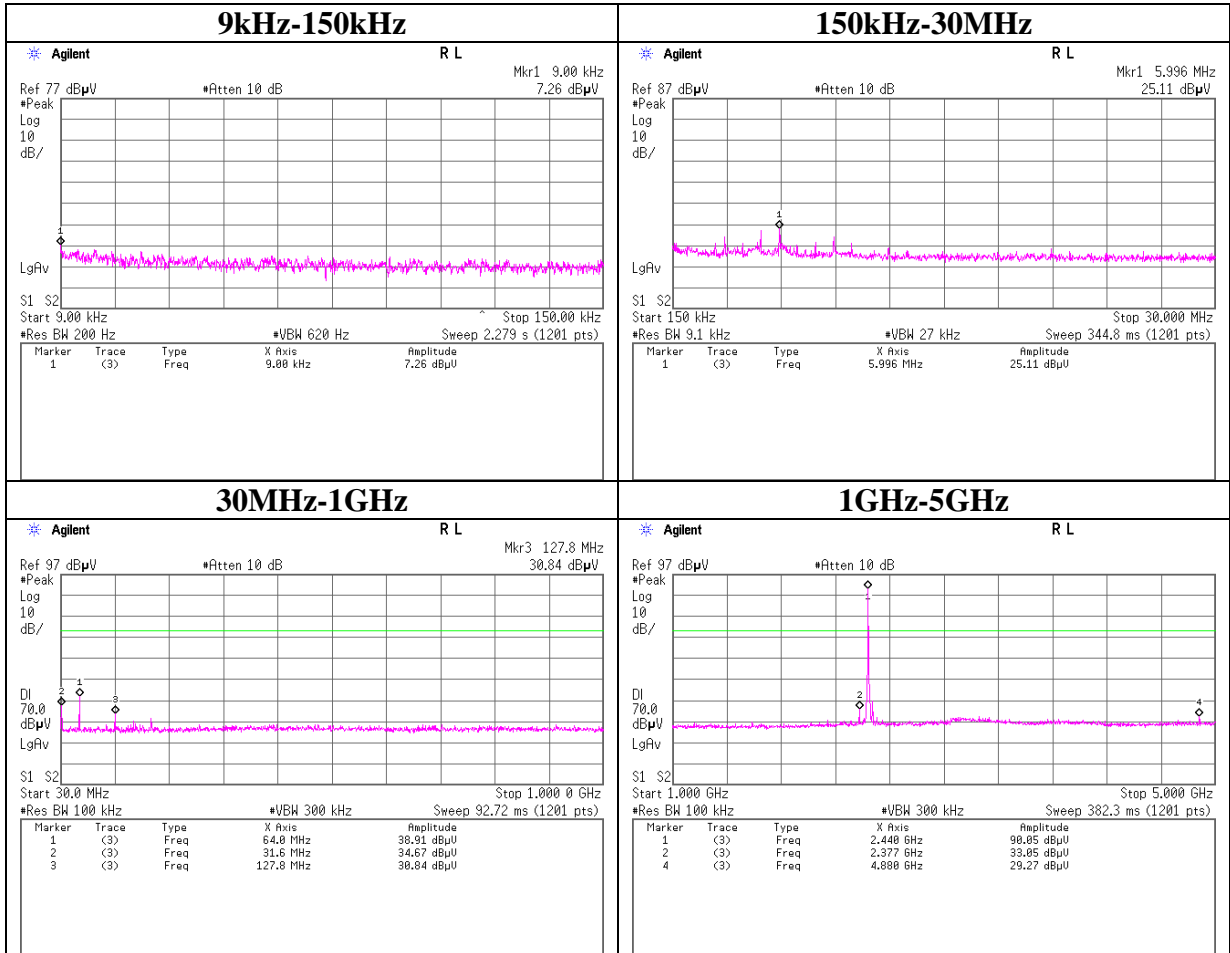
## Conducted Spurious Emission

### Tx 2402MHz



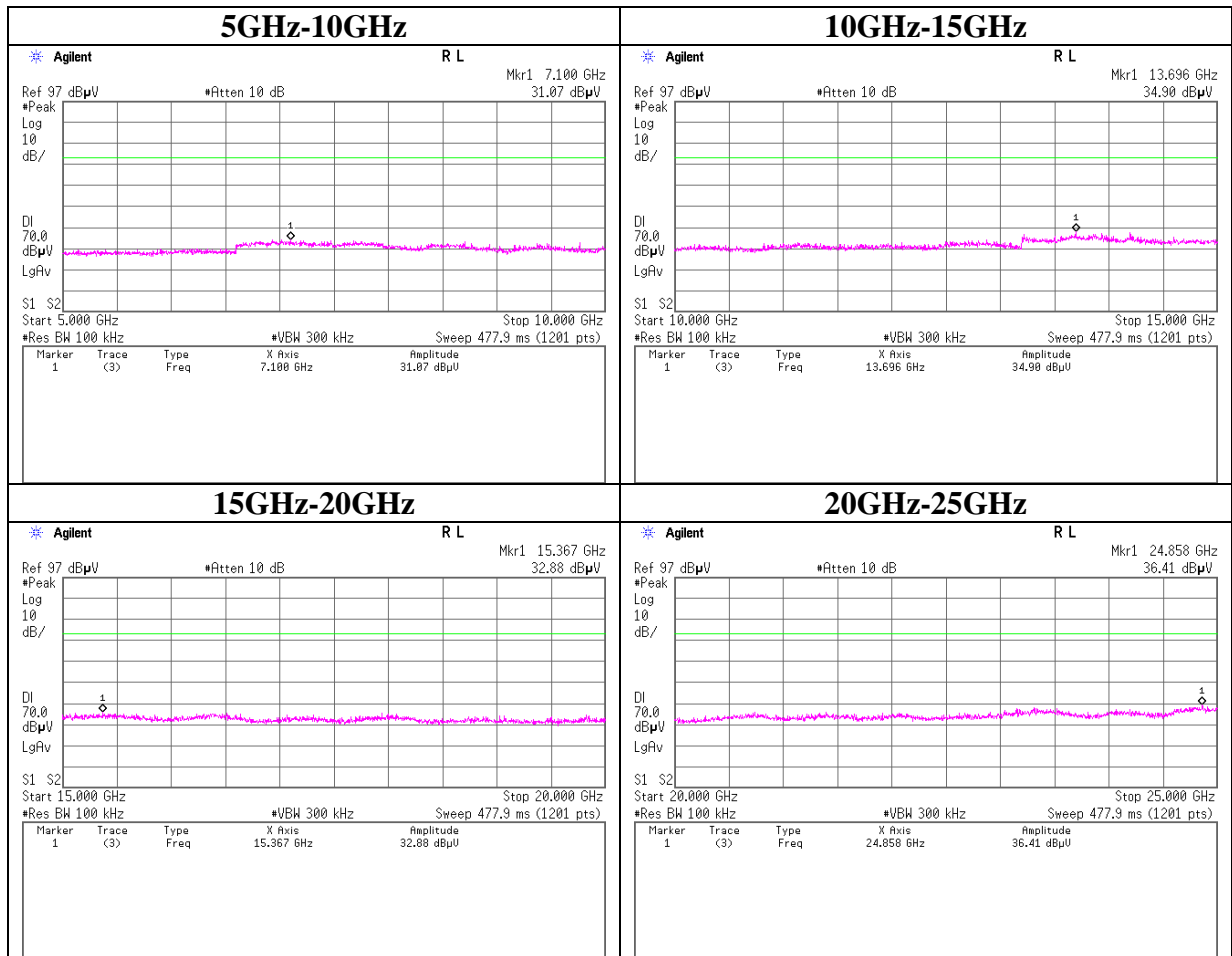
## Conducted Spurious Emission

### Tx 2440MHz



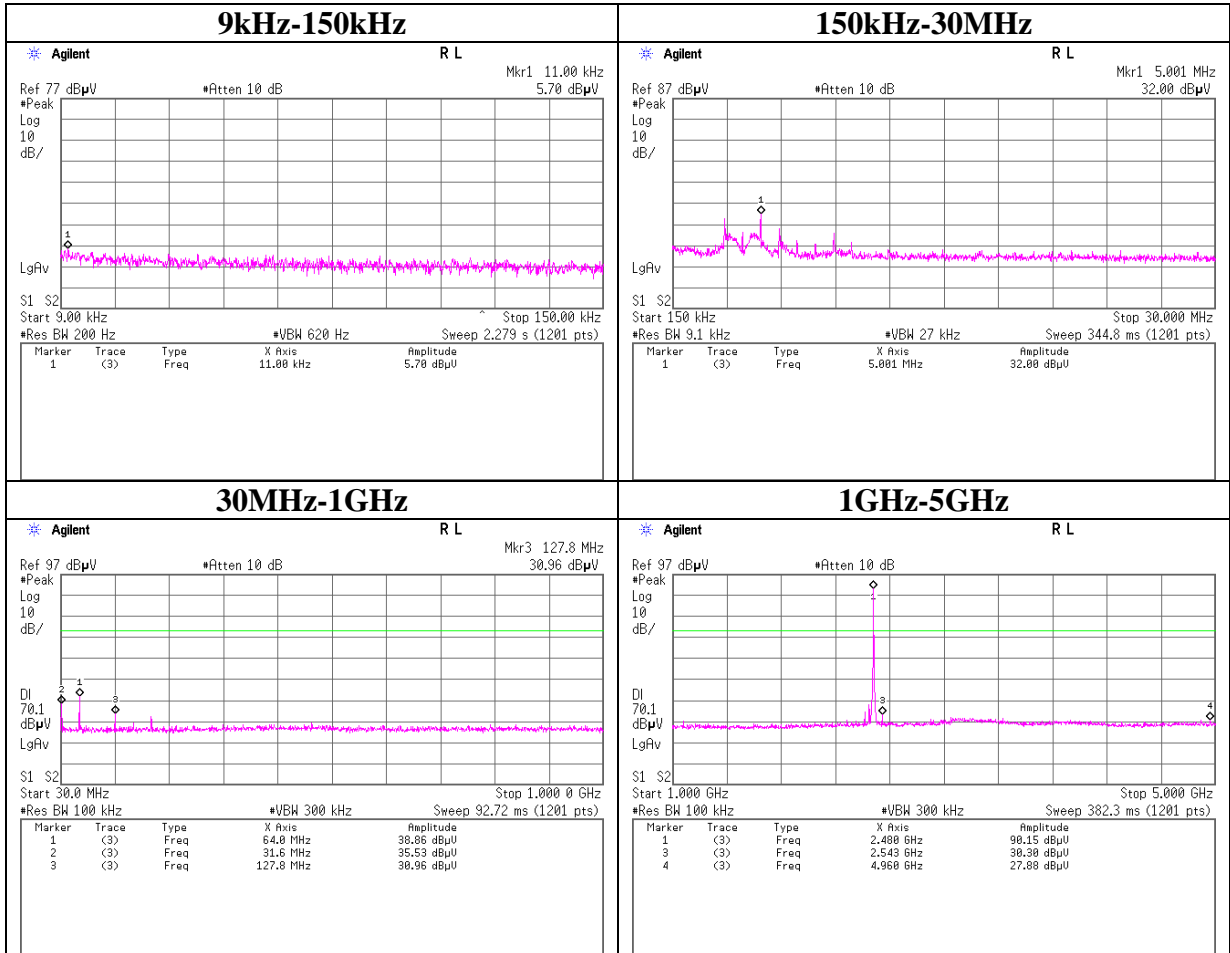
## Conducted Spurious Emission

### Tx 2440MHz



## Conducted Spurious Emission

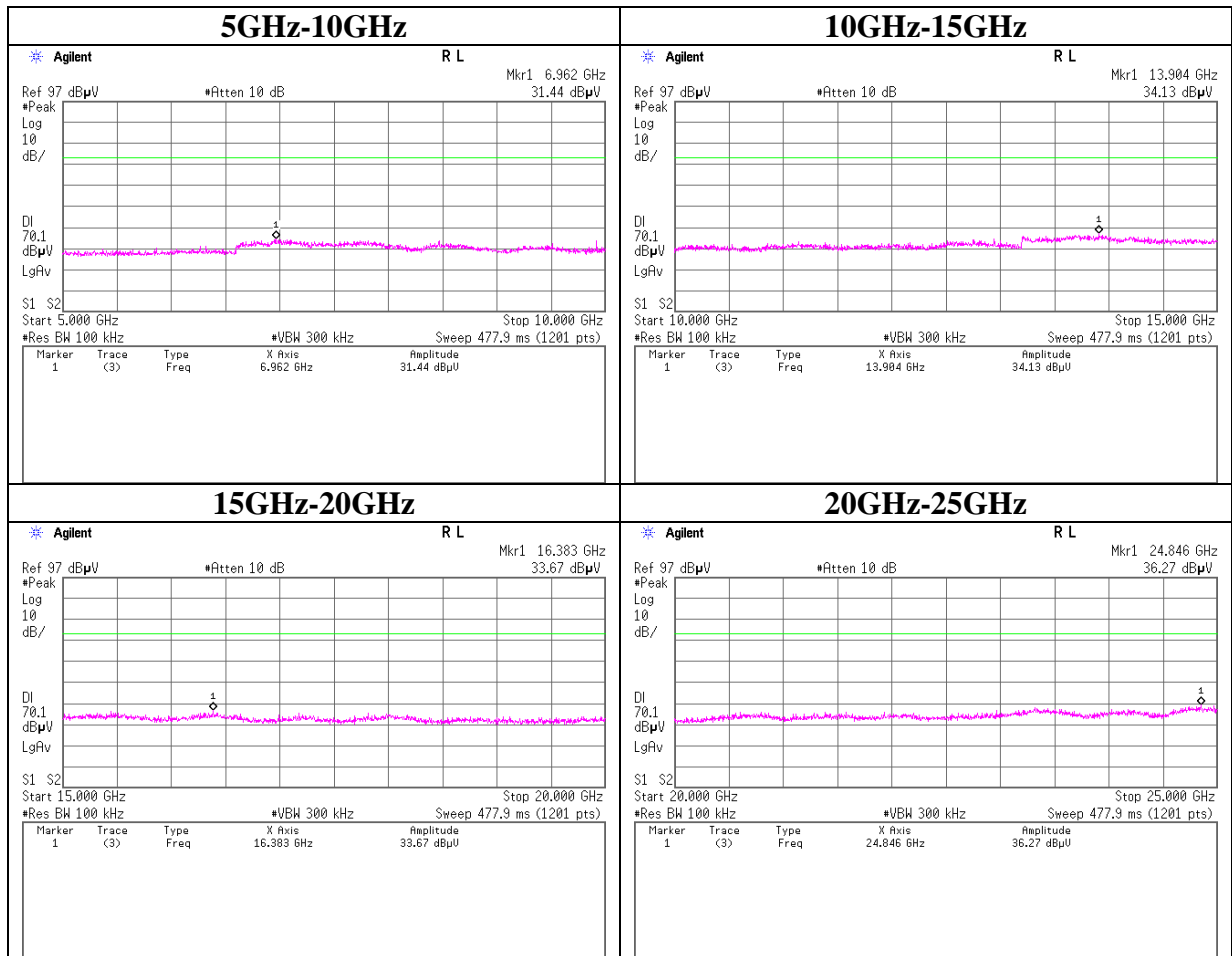
### Tx 2480MHz



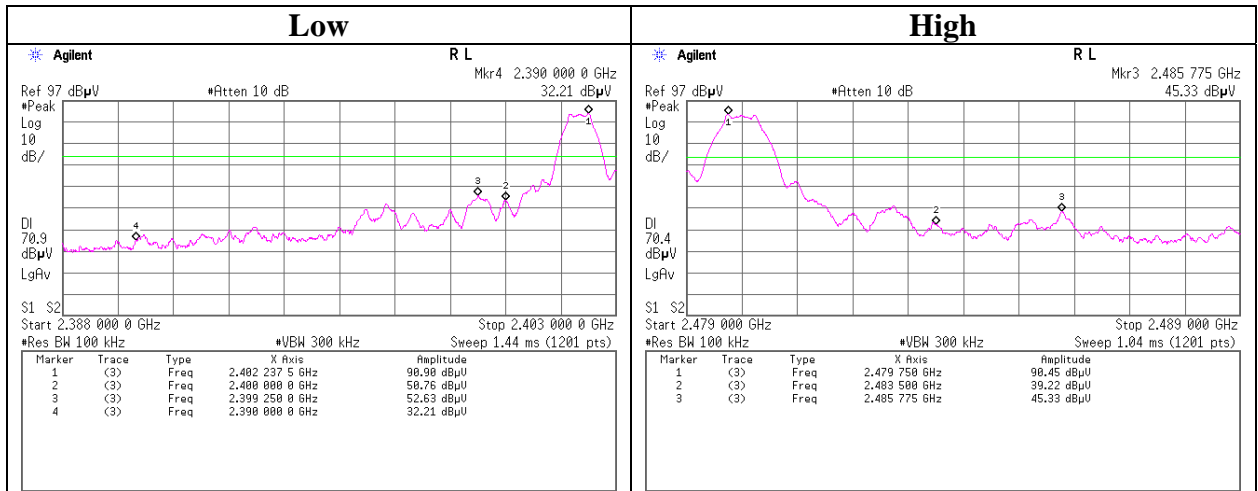


## Conducted Spurious Emission

### Tx 2480MHz



### Conducted Emission Band Edge compliance



### Power Density

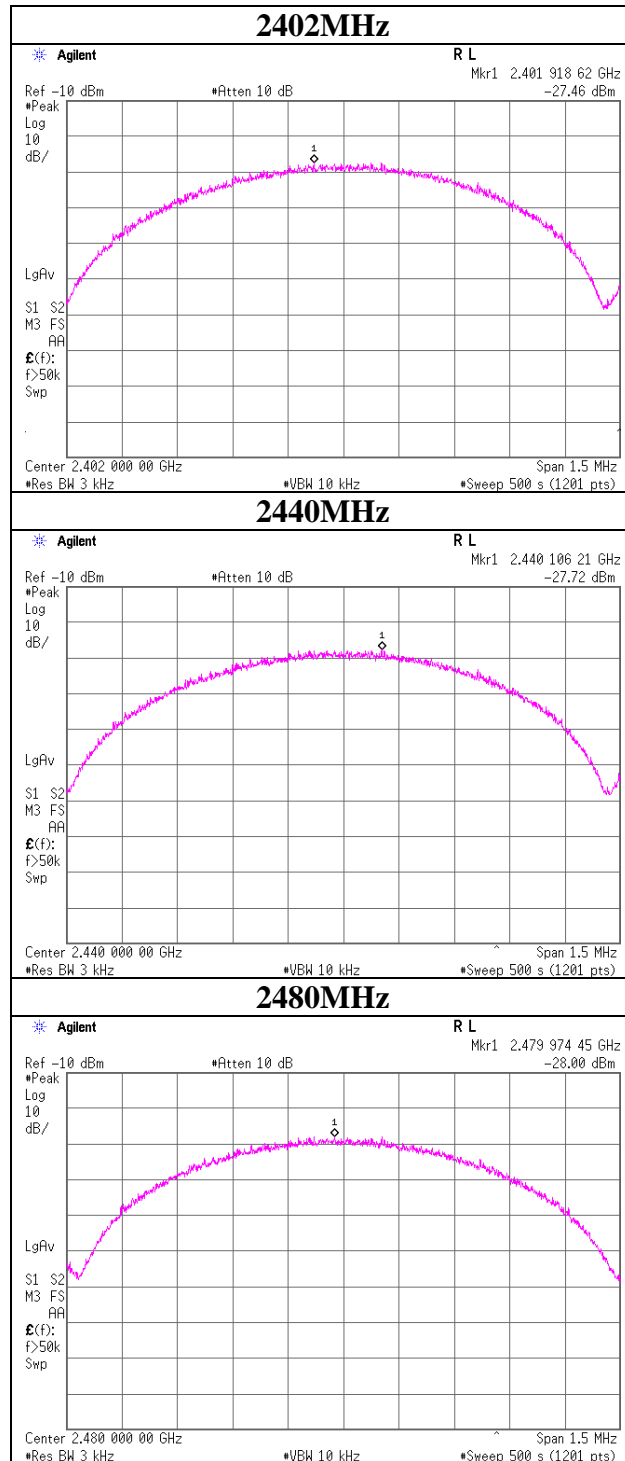
Test place Head Office EMC Lab. No.7 Shielded Room  
Report No. 32LE0012-HO-01  
Date 08/01/2012  
Temperature/ Humidity 27deg. C / 64% RH  
Engineer Yutaka Yoshida  
Mode Tx Bluetooth Low Energy

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-27.46	2.23	10.08	-15.15	8.00	23.15
2440.00	-27.72	2.24	10.08	-15.40	8.00	23.40
2480.00	-28.00	2.25	10.09	-15.66	8.00	23.66

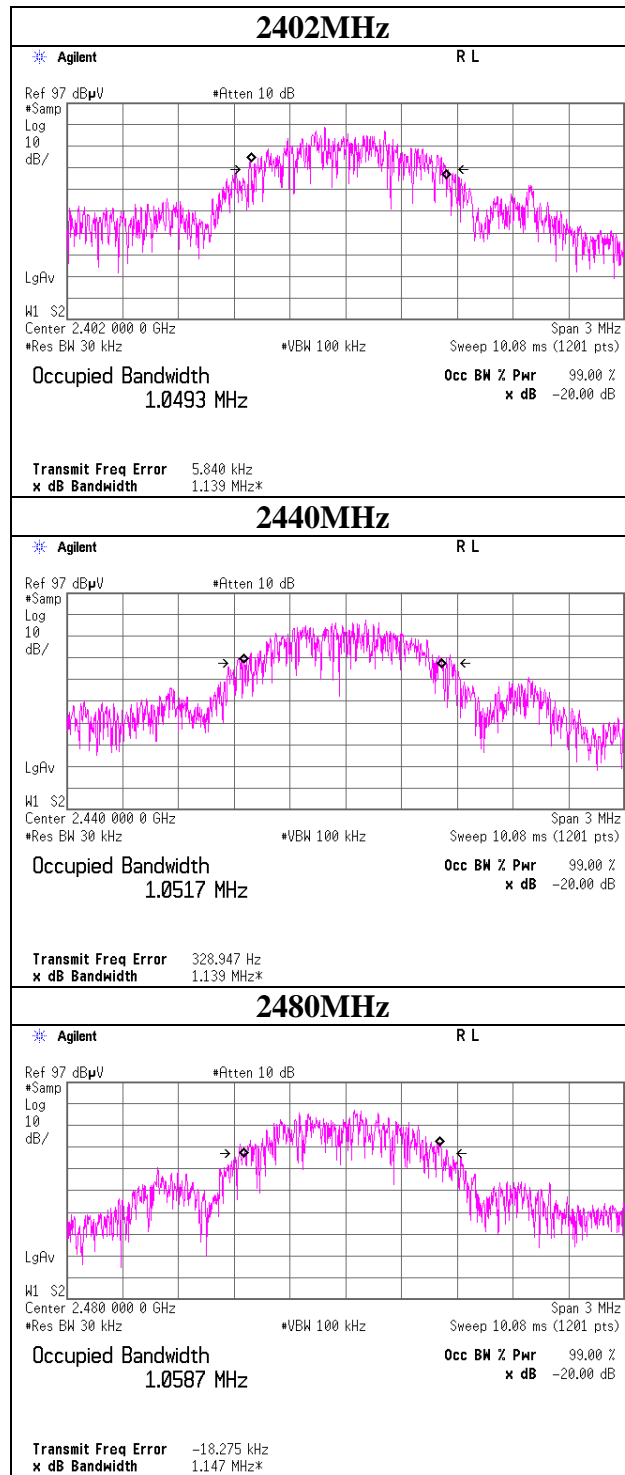
Sample Calculation:

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	2012/02/29 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2012/02/06 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2011/11/23 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2012/08/23 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	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	2012/06/01 * 12
AT-38	Attenuator	Anritsu	MP721B	6200961025	RE	2011/12/08 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2012/03/05 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	CE	2012/02/24 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	CE	2012/02/06 * 12
MJM-06	Measure	PROMART	SEN1955	-	CE	
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	CE	2012/04/05 * 12
MLS-02	LISN(AMN)	Schwarzbeck	NSLK8127	8127383	CE(EUT)	2012/07/17 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2012/01/11 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/suciform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher)	-/00640	CE	2012/07/12 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2012/01/28 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2011/08/11 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1203S212(1m)/1204S062(5m)	RE	2012/04/23 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2012/03/28 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2012/06/27 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2012/05/30 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2012/02/03 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2011/09/13 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2011/09/13 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2012/04/25 * 12
MAT-20	Attenuator(10dB)(above 1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-110	-	AT	2012/01/12 * 12
MMM-16	DIGIITAL HiTESTER	Hioki	3805	070900532	AT	2012/01/13 * 12
MOS-04	Digital Humidity Indicator	N.T	NT-1800	MOS04	AT	2012/02/06 * 12

**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

**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**