



# RADIO TEST REPORT

Test Report No. : 10291834H-A-R1

**Applicant** : Audio-Technica Corp.  
**Type of Equipment** : WIRELESS MICROPHONE RECEIVER  
**Model No.** : ATW-R1700  
**FCC ID** : JFZR1700  
**Test regulation** : FCC Part 15 Subpart C: 2014  
**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 10291834H-A. 10291834H-A is replaced with this report.

**Date of test:** April 22 to May 2, 2014

**Representative test engineer:**

Shinya Watanabe  
Engineer  
Consumer Technology Division

**Approved by:**

Takahiro Hatakeda  
Leader  
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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

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13-EM-F0429

## REVISION HISTORY

**Original Test Report No.: 10291834H-A**

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10291834H-A	May 15, 2014	-	-
1	10291834H-A-R1	May 30, 2014	P8	Correction of Power setting: 8dBm → 10dBm (Peak)

<b>CONTENTS</b>	<b>PAGE</b>
<b>SECTION 1: Customer information</b> .....	<b>4</b>
<b>SECTION 2: Equipment under test (E.U.T.)</b> .....	<b>4</b>
<b>SECTION 3: Test specification, procedures &amp; results</b> .....	<b>5</b>
<b>SECTION 4: Operation of E.U.T. during testing</b> .....	<b>8</b>
<b>SECTION 5: Conducted Emission</b> .....	<b>10</b>
<b>SECTION 6: Radiated Spurious Emission</b> .....	<b>11</b>
<b>SECTION 7: Antenna Terminal Conducted Tests</b> .....	<b>12</b>
<b>APPENDIX 1: Data of EMI test</b> .....	<b>13</b>
Conducted Emission .....	13
6dB Bandwidth .....	15
Maximum Peak Output Power .....	16
Average Output Power .....	17
Radiated Spurious Emission .....	18
Conducted Spurious Emission .....	22
Power Density .....	24
99%Occupied Bandwidth .....	26
<b>APPENDIX 2: Test instruments</b> .....	<b>27</b>
<b>APPENDIX 3: Photographs of test setup</b> .....	<b>28</b>
Conducted Emission .....	28
Radiated Spurious Emission .....	29
Worst Case Position .....	30

## **SECTION 1: Customer information**

Company Name : Technica Fukui Co.,Ltd.\*  
Address : 87-1, Totani, Echizen-shi, Fukui, 915-0003 Japan  
Telephone Number : +81-778-25-6715  
Facsimile Number : +81-778-25-6705  
Contact Person : HIROKI TAKEICHI

\* Technica Fukui Co.,Ltd. is on behalf of the applicant: Audio-Technica Corp.

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

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

Type of Equipment : WIRELESS MICROPHONE RECEIVER  
Model No. : ATW-R1700  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 3.7V  
Receipt Date of Sample : April 22, 2014  
Country of Mass-production : 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**

Model No: ATW-R1700, referred to as the EUT in this report, is the WIRELESS MICROPHONE RECEIVER.

#### **General Specification**

Clock frequency(ies) in the system : 24MHz

#### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : 2403-2481MHz  
Modulation : GFSK  
Power Supply (inner) : DC 1.8V  
Antenna type : Sleeve Antenna  
Antenna Gain : 1.1dBi

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C: 2014, final revised on March 6, 2014 and effective April 7, 2014

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

\* The EUT complies with FCC Part 15 Subpart B: 2014, final revised on March 6, 2014 and effective April 7, 2014.

### **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	FCC: Section 15.207	<b>QP</b> 23.9dB, 0.28251MHz, N	Complied	-
	IC: RSS-Gen 7.2.4	IC: RSS-Gen 7.2.4	25.1dB, 0.28948MHz, L		
6dB Bandwidth	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on October 4, 2012)" IC: RSS-Gen 4.6.2	FCC: Section 15.247(a)(2) IC: RSS-210 A8.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on October 4, 2012)" IC: RSS-Gen 4.8	FCC: Section 15.247(b)(3) IC: RSS-210 A8.4(4)		Complied	Conducted
Power Density	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on October 4, 2012)" IC: -	FCC: Section 15.247 (e) IC: RSS-210 A8.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on October 4, 2012)" IC: RSS-Gen 4.9	FCC: Section15.247(d) IC: RSS-210 A8.5 RSS-Gen 7.2.3		4.1dB, 2483.5MHz, AV, Horizontal	Complied

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 (DC1.8V) constantly to RF Part regardless of input voltage. Therefore, this EUT complies with the requirement.

**FCC Part 15.203 Antenna requirement**

The EUT has a unique coupling/antenna connector (inverted SMA connector). Therefore the equipment complies with the requirement of 15.203.

**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	3.5dB
No.3	3.6dB
No.4	3.5dB

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	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

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

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

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

Conducted Emission test

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

Radiated emission test (3m)

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

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### 3.5 Test Location

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	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	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	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	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	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	4.0 x 4.5 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 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

\* 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)**

Transmitting mode (Tx):

Details of Operating Mode(s)

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested antenna</b>	<b>Tested Frequency</b>
Maximum Peak Output Power	Tx	Ant 1, Ant 2	2403MHz 2441MHz 2481MHz
Conducted Emission, 6dB Bandwidth, Power Density, Spurious Emission (Conducted), 99% Occupied Bandwidth Spurious Emission (Radiated)	Tx	Ant 1 *1)	2403MHz 2441MHz 2481MHz
Power of the EUT was set by the software as follows: -Power setting: 10dBm (Peak) -Hardware Version: TP -Software Version: CM V0010 *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.			
*1) After the comparison between Ant 1 and Ant 2, test was performed with the antenna that had higher power as a representative.			

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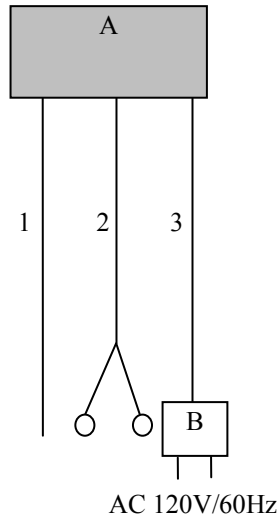
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## 4.2 Configuration and peripherals



\* 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	Remark
A	WIRELESS MICROPHONE RECEIVER	ATW-R1700	2	Technica Fukui Co.,Ltd.	EUT
B	AC Adaptor	KSAS0060500050D5U	-	Ktec	-

### List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Line out Cable	1.5	Shielded	Shielded	-
2	Headphones Cable	1.0	Unshielded	Unshielded	-
3	USB Cable	1.6	Shielded	Shielded	-

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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.

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

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

### **Test Procedure**

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	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Biconical	Logperiodic	Horn

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

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

Frequency	Below 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	Average Power Method: Alternative Method 3 RBW: 1MHz VBW: 12kHz Trace: Max hold Detector: Peak (linear voltage detector)	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m *2) (above 10GHz)		3m (below 10GHz), 1m *2) (above 10GHz)

\*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)"

\*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.

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

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## **SECTION 7: Antenna Terminal Conducted Tests**

### **Test Procedure**

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

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep time</b>	<b>Detector</b>	<b>Trace</b>	<b>Instrument used</b>
6dB Bandwidth	10MHz	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*1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3kHz	10kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				

\*1) The measurement was performed with Peak and Max Hold since the duty cycle was not 100%.

\*2) Reference data

\*3) Section 10.2 Method PKPSD (peak PSD) of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)".

\*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz)

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

**Test data** : APPENDIX  
**Test result** : Pass

**APPENDIX 1: Data of EMI test**

**Conducted Emission**

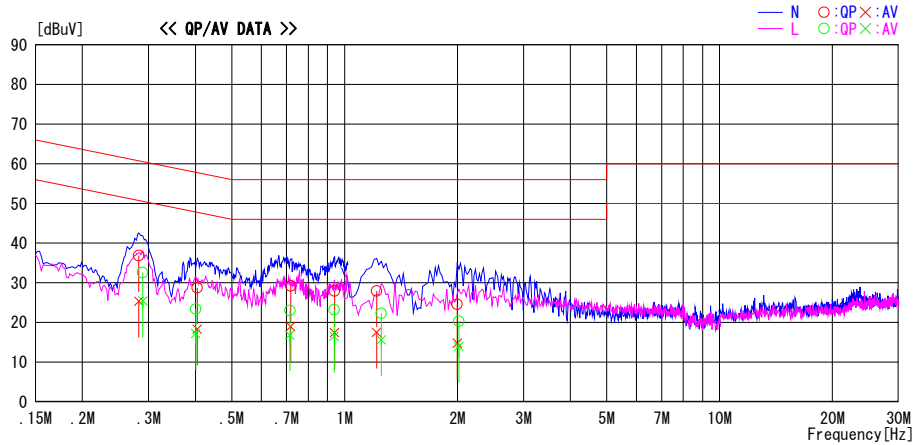
**DATA OF CONDUCTED EMISSION TEST**

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber  
 Date: 2014/05/02

Report No. : 10291834H  
 Temp./Humi. : 23deg. C / 57% RH  
 Engineer : Shinya Watanabe

Mode / Remarks : Tx 2441MHz Ant1

LIMIT : FCC15.207 QP  
 FCC15.207 AV



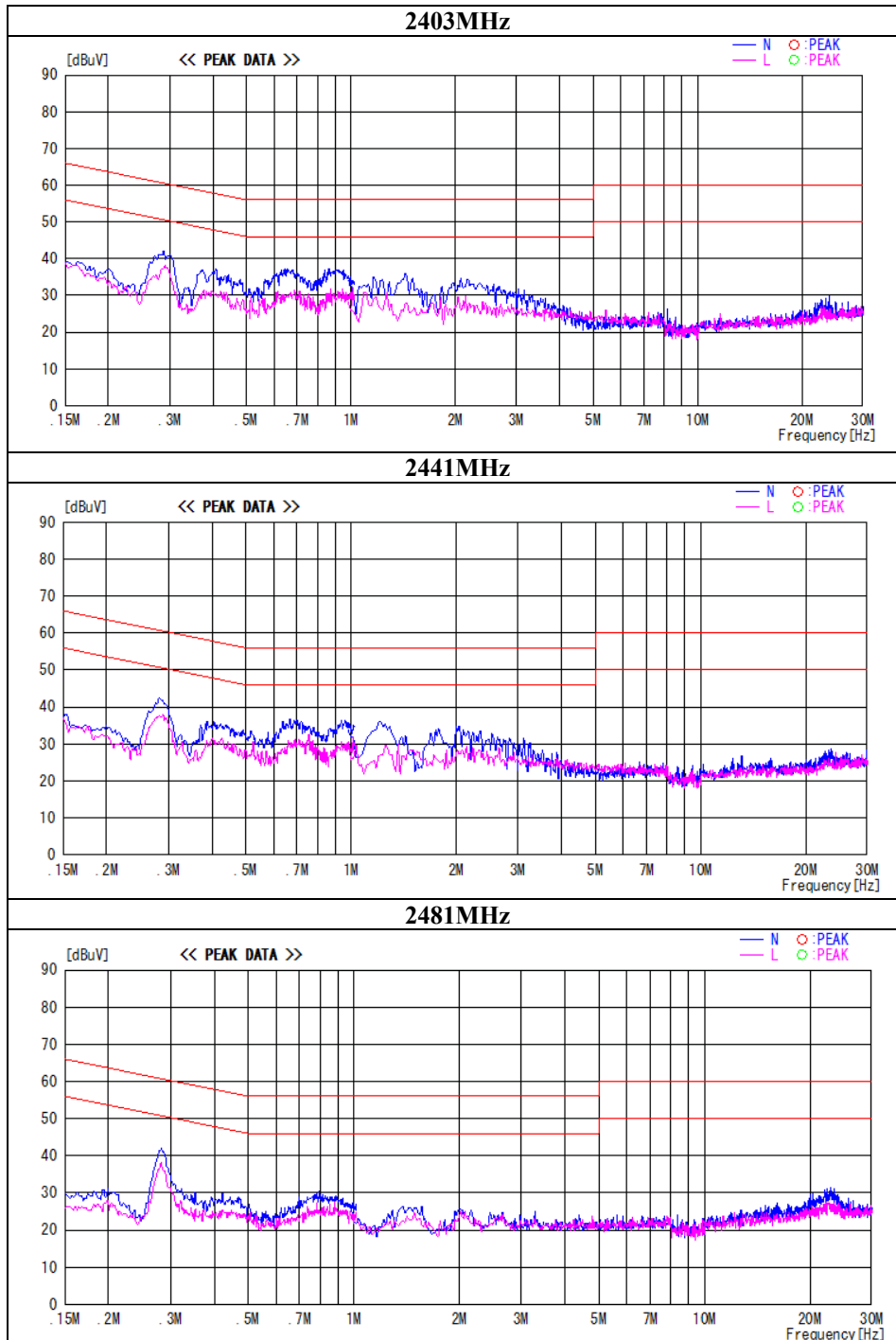
Frequency [MHz]	Reading		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.28251	23.4	11.9	13.4	36.8	25.3	60.7	50.7	23.9	25.4	N	
0.40455	15.3	4.9	13.4	28.7	18.3	57.8	47.8	29.1	29.5	N	
0.71838	15.7	5.5	13.5	29.2	19.0	56.0	46.0	26.8	27.0	N	
0.93980	14.4	3.9	13.5	27.9	17.4	56.0	46.0	28.1	28.6	N	
1.21629	14.3	3.9	13.6	27.9	17.5	56.0	46.0	28.1	28.5	N	
1.99787	11.0	1.2	13.6	24.6	14.8	56.0	46.0	31.4	31.2	N	
0.28948	19.2	12.0	13.4	32.6	25.4	60.5	50.5	27.9	25.1	L	
0.40106	10.0	3.8	13.4	23.4	17.2	57.8	47.8	34.4	30.6	L	
0.71489	9.5	3.3	13.5	23.0	16.8	56.0	46.0	33.0	29.2	L	
0.93806	9.7	3.0	13.5	23.2	16.5	56.0	46.0	32.8	29.5	L	
1.25265	8.7	2.0	13.6	22.3	15.6	56.0	46.0	33.7	30.4	L	
2.01605	6.7	0.4	13.6	20.3	14.0	56.0	46.0	35.7	32.0	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.

\*The limit is rounded down to one decimal place.  
 \*The test result is rounded off to one or two decimal places, so some differences might be observed.

## Conducted Emission

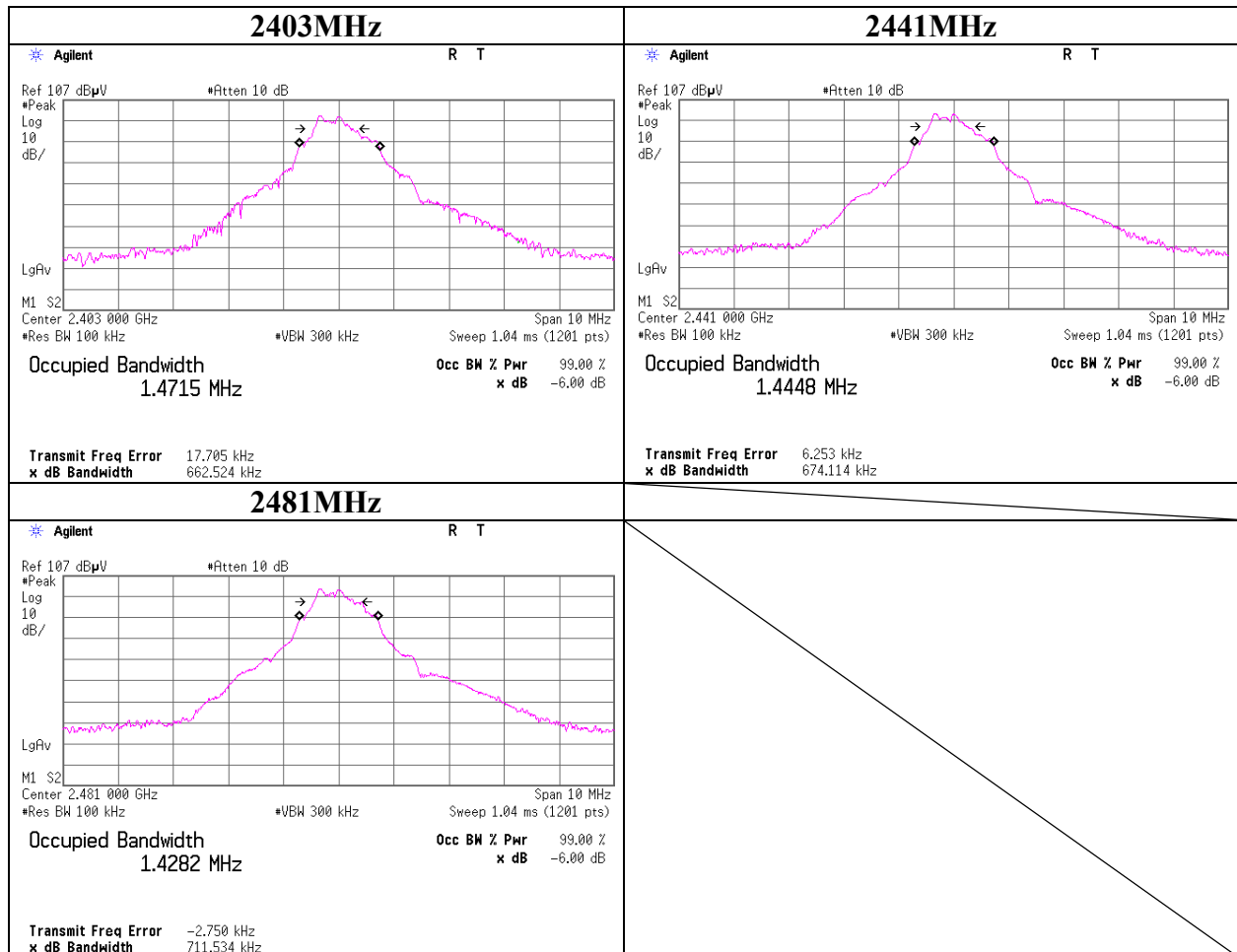
Test place	Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10291834H
Date	05/02/2014
Temperature/ Humidity	23 deg. C / 57% RH
Engineer	Shinya Watanabe
Mode	Tx



## 6dB Bandwidth

Test place	Ise HQ EMC Lab. No.6 Measurement Room
Report No.	10291834H
Date	04/23/2014
Temperature/ Humidity	20deg. C / 48% RH
Engineer	Keisuke Kawamura
Mode	Tx

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2403	0.663	>500
2441	0.674	>500
2481	0.712	>500



### Maximum Peak Output Power

Test place Ise HQ EMC Lab. No.6 Measurement Room  
Project No. 10291834H  
Date 04/22/2014  
Temperature/ Humidity 21deg. C / 63% RH  
Engineer Shinya Watanabe  
Mode Tx

Ant1

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2403	-1.84	1.28	10.08	9.52	8.95	30.00	1000	20.48
2441	-1.46	1.29	10.08	9.91	9.79	30.00	1000	20.09
2481	-1.84	1.30	10.08	9.54	8.99	30.00	1000	20.46

Sample Calculation:

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

Ant2

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2403	-1.84	1.28	10.08	9.52	8.95	30.00	1000	20.48
2441	-1.49	1.29	10.08	9.88	9.73	30.00	1000	20.12
2481	-2.41	1.30	10.08	8.97	7.89	30.00	1000	21.03

Sample Calculation:

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

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**Average Output Power**  
(Reference data)

Test place : Ise HQ EMC Lab. No.6 Measurement Room  
Project No. : 10291834H  
Date : 04/22/2014  
Temperature/ Humidity : 21deg. C / 63% RH  
Engineer : Shinya Watanabe  
Mode : Tx

Ant 1

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2403	-24.96	1.28	10.08	-13.60	0.04	30.00	1000	43.60
2441	-24.49	1.29	10.08	-13.12	0.05	30.00	1000	43.12
2481	-24.31	1.30	10.08	-12.93	0.05	30.00	1000	42.93

Sample Calculation:

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

Ant 2

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2403	-24.39	1.28	10.08	-13.03	0.05	30.00	1000	43.03
2441	-23.56	1.29	10.08	-12.19	0.06	30.00	1000	42.19
2481	-24.46	1.30	10.08	-13.08	0.05	30.00	1000	43.08

Sample Calculation:

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

## Radiated Spurious Emission

Test place : Ise HQ EMC Lab. No.3 Semi Anechoic Chamber  
 Report No. : 10291834H  
 Date : 04/30/2014      05/02/2014  
 Temperature/ Humidity : 21 deg. C / 68% RH      23 deg. C / 57% RH  
 Engineer : Hironobu Ohnishi      Shinya Watanabe  
                  (1 - 26.5GHz)      (30 - 1000MHz)  
 Mode : Tx 2403MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	120.000	QP	22.4	12.8	8.3	32.1	11.4	43.5	32.1	No signal.
Hori	245.760	QP	22.0	17.2	9.5	32.0	16.7	46.0	29.3	No signal.
Hori	2390.000	PK	51.8	28.2	3.1	32.7	50.4	73.9	23.5	
Hori	4806.000	PK	42.6	30.5	5.3	31.8	46.6	73.9	27.3	
Hori	7209.000	PK	43.2	35.8	6.7	32.7	53.0	73.9	20.9	No signal.
Hori	9612.000	PK	44.1	39.0	7.3	33.3	57.1	73.9	16.8	No signal.
Hori	2390.000	AV	42.3	28.2	3.1	32.7	40.9	53.9	13.0	
Hori	4806.000	AV	35.6	30.5	5.3	31.8	39.6	53.9	14.3	
Hori	7209.000	AV	30.3	35.8	6.7	32.7	40.1	53.9	13.8	No signal.
Hori	9612.000	AV	30.7	39.0	7.3	33.3	43.7	53.9	10.2	No signal.
Vert	120.000	QP	22.6	12.8	8.3	32.1	11.6	43.5	31.9	No signal.
Vert	245.760	QP	22.2	17.2	9.5	32.0	16.9	46.0	29.1	No signal.
Vert	2390.000	PK	51.2	28.2	3.1	32.7	49.8	73.9	24.1	
Vert	4806.000	PK	42.9	30.5	5.3	31.8	46.9	73.9	27.0	
Vert	7209.000	PK	43.8	35.8	6.7	32.7	53.6	73.9	20.3	No signal.
Vert	9612.000	PK	43.6	39.0	7.3	33.3	56.6	73.9	17.3	No signal.
Vert	2390.000	AV	42.4	28.2	3.1	32.7	41.0	53.9	12.9	
Vert	4806.000	AV	37.4	30.5	5.3	31.8	41.4	53.9	12.5	
Vert	7209.000	AV	30.4	35.8	6.7	32.7	40.2	53.9	13.7	No signal.
Vert	9612.000	AV	30.7	39.0	7.3	33.3	43.7	53.9	10.2	No signal.

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

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

\*The 10th harmonic was not seen so the result was its base noise level.  
 Distance factor:    10GHz-26.5GHz     $20\log(3.0\text{m}/1.0\text{m})= 9.5\text{dB}$   
                           26.5GHz-40GHz     $20\log(3.0\text{m}/0.5\text{m})=15.6\text{dB}$

### 20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2403.000	PK	108.1	28.2	3.1	32.7	106.7	-	-	Carrier
Hori	2400.000	PK	48.9	28.2	3.1	32.7	47.5	86.7	39.2	
Vert	2403.000	PK	108.1	28.2	3.1	32.7	106.7	-	-	Carrier
Vert	2400.000	PK	49.1	28.2	3.1	32.7	47.7	86.7	39.0	

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

## Radiated Spurious Emission

Test place	Ise HQ EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	10291834H	
Date	04/30/2014	05/02/2014
Temperature/ Humidity	21 deg. C / 68% RH	23 deg. C / 57% RH
Engineer	Hironobu Ohnishi	Shinya Watanabe
	(1 - 26.5GHz)	(30 - 1000MHz)
Mode	Tx 2441MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	120.000	QP	22.4	12.8	8.3	32.1	11.4	43.5	32.1	No signal.
Hori	245.760	QP	22.1	17.2	9.5	32.0	16.8	46.0	29.2	No signal.
Hori	4882.000	PK	43.2	30.6	5.3	31.7	47.4	73.9	26.5	
Hori	7323.000	PK	43.1	36.0	6.8	32.7	53.2	73.9	20.7	No signal.
Hori	9764.000	PK	43.2	39.4	7.3	33.4	56.5	73.9	17.4	No signal.
Hori	4882.000	AV	37.1	30.6	5.3	31.7	41.3	53.9	12.6	
Hori	7323.000	AV	30.1	36.0	6.8	32.7	40.2	53.9	13.7	No signal.
Hori	9764.000	AV	30.0	39.4	7.3	33.4	43.3	53.9	10.6	No signal.
Vert	120.000	QP	22.7	12.8	8.3	32.1	11.7	43.5	31.8	No signal.
Vert	245.760	QP	22.2	17.2	9.5	32.0	16.9	46.0	29.1	No signal.
Vert	4882.000	PK	43.3	30.6	5.3	31.7	47.5	73.9	26.4	
Vert	7323.000	PK	43.8	36.0	6.8	32.7	53.9	73.9	20.0	No signal.
Vert	9764.000	PK	43.7	39.4	7.3	33.4	57.0	73.9	16.9	No signal.
Vert	4882.000	AV	38.5	30.6	5.3	31.7	42.7	53.9	11.2	
Vert	7323.000	AV	30.1	36.0	6.8	32.7	40.2	53.9	13.7	No signal.
Vert	9764.000	AV	30.0	39.4	7.3	33.4	43.3	53.9	10.6	No signal.

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

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

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

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

## Radiated Spurious Emission

Test place Ise HQ EMC Lab. No.3 Semi Anechoic Chamber  
Report No. 10291834H  
Date 04/30/2014 05/02/2014  
Temperature/ Humidity 21 deg. C / 68% RH 23 deg. C / 57% RH  
Engineer Hironobu Ohnishi Shinya Watanabe  
(1 - 26.5GHz) (30 - 1000MHz)  
Mode Tx 2481MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	120.000	QP	22.5	12.8	8.3	32.1	11.5	43.5	32.0	No signal.
Hori	245.760	QP	22.2	17.2	9.5	32.0	16.9	46.0	29.1	No signal.
Hori	4962.000	PK	44.0	30.7	5.4	31.7	48.4	73.9	25.5	
Hori	7443.000	PK	43.4	36.2	6.7	32.7	53.6	73.9	20.3	No signal.
Hori	9924.000	PK	43.5	39.8	7.4	33.5	57.2	73.9	16.7	No signal.
Hori	4962.000	AV	38.7	30.7	5.4	31.7	43.1	53.9	10.8	
Hori	7443.000	AV	30.1	36.2	6.7	32.7	40.3	53.9	13.6	No signal.
Hori	9924.000	AV	30.1	39.8	7.4	33.5	43.8	53.9	10.1	No signal.
Vert	120.000	QP	22.6	12.8	8.3	32.1	11.6	43.5	31.9	No signal.
Vert	245.760	QP	22.2	17.2	9.5	32.0	16.9	46.0	29.1	No signal.
Vert	4962.000	PK	44.8	30.7	5.4	31.7	49.2	73.9	24.7	
Vert	7443.000	PK	44.1	36.2	6.7	32.7	54.3	73.9	19.6	No signal.
Vert	9924.000	PK	43.8	39.8	7.4	33.5	57.5	73.9	16.4	No signal.
Vert	4962.000	AV	38.7	30.7	5.4	31.7	43.1	53.9	10.8	
Vert	7443.000	AV	30.0	36.2	6.7	32.7	40.2	53.9	13.7	No signal.
Vert	9924.000	AV	30.0	39.8	7.4	33.5	43.7	53.9	10.2	No signal.

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

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

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

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

### Marker-Delta Method Data Sheet (RBW:30kHz)

FREQ [MHz]	Field strength of band-edge*		ANT Factor [dB/m]	AMP GAIN [dB]	CABLE LOSS [dB]	ATT [dB]	RESULT [dBuV/m]		Limit [dBuV/m]	MARGIN [dB]	
	HOR	VER					HOR	VER		HOR	VER
2483.5	54.5	53.7	28.4	32.7	3.1	0.0	53.3	52.5	73.9	20.6	21.4
2483.5	51.0	50.0	28.4	32.7	3.1	0.0	49.8	48.8	53.9	4.1	5.1

\*Field Strength of band-edge

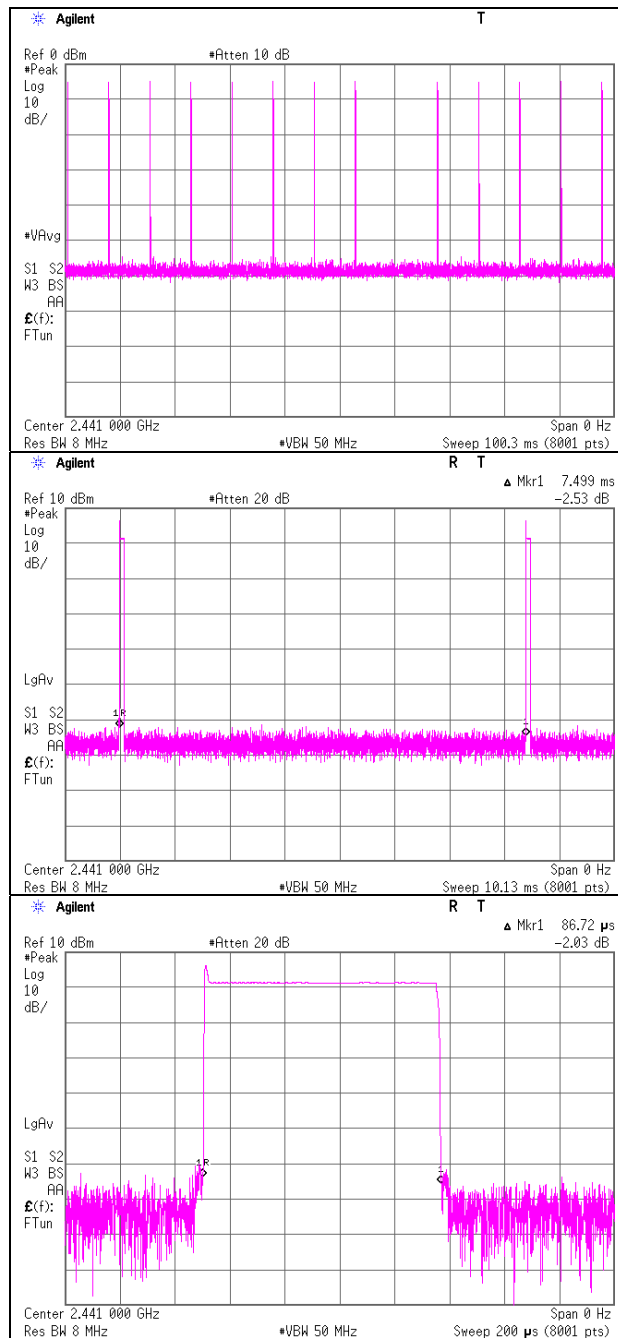
Spectrum Analyzer Reading

Step 1)	Fundamental(2481MHz)	Polarity	Hor [dBuV]			Ver [dBuV]					
			Detector	PK	AV	PK	PK	AV	PK		
				RBW	VBW	3MHz	3MHz	100kHz	3MHz	3MHz	100kHz
			1MHz		111.6	108.1	-	110.7	107.0	-	
Step 2)	Fundamental(2481MHz)				-	-	106.9	-	-	105.8	
	Band-edge(2483.5MHz)				-	-	49.8	-	-	48.8	
	Amplitude delta *1				-	-	57.1	-	-	57.0	
Step 3)	Field strength of band-edge *2				-	54.5	51.0	-	53.7	50.0	-

\*1 Amplitude delta = Fundamental(RBW:30kHz) - Band-edge(RBW:30kHz)

\*2 Field strength of band-edge = Fundamental(RBW:1MHz) - Amplitude delta

### Duty rate confirmation

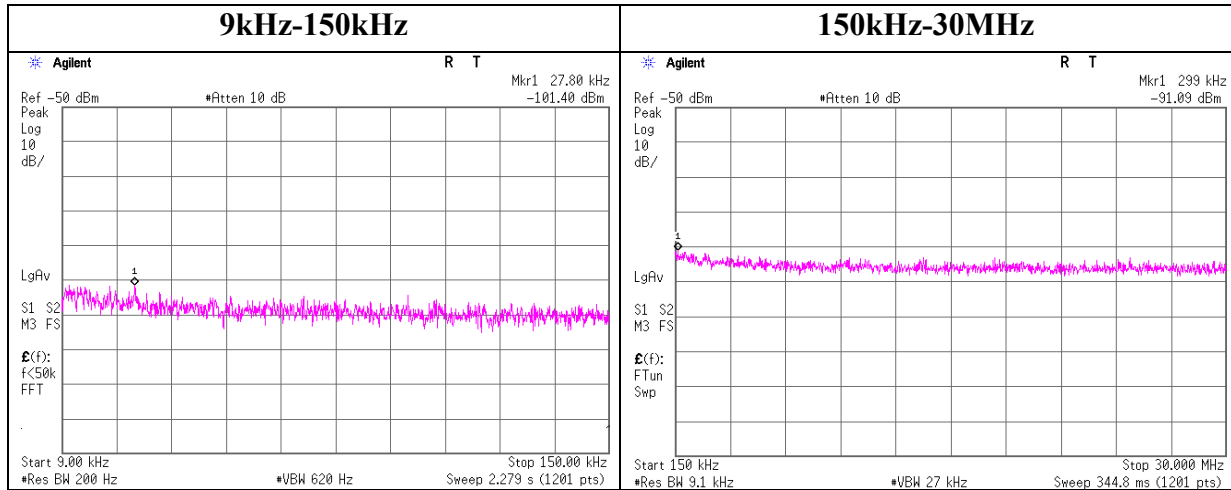


The duty cycle is not constant. Tx on time is same for all. ( $T = 86.72\mu s$ ,  $VBW = 1/T = 12kHz$ )

### Conducted Spurious Emission

Test place : Ise HQ EMC Lab. No.6 Measurement Room  
 Project No. : 10291834H  
 Date : 04/23/2014  
 Temperature/ Humidity : 20deg. C / 48% RH  
 Engineer : Keisuke Kawamura  
 Mode : Tx

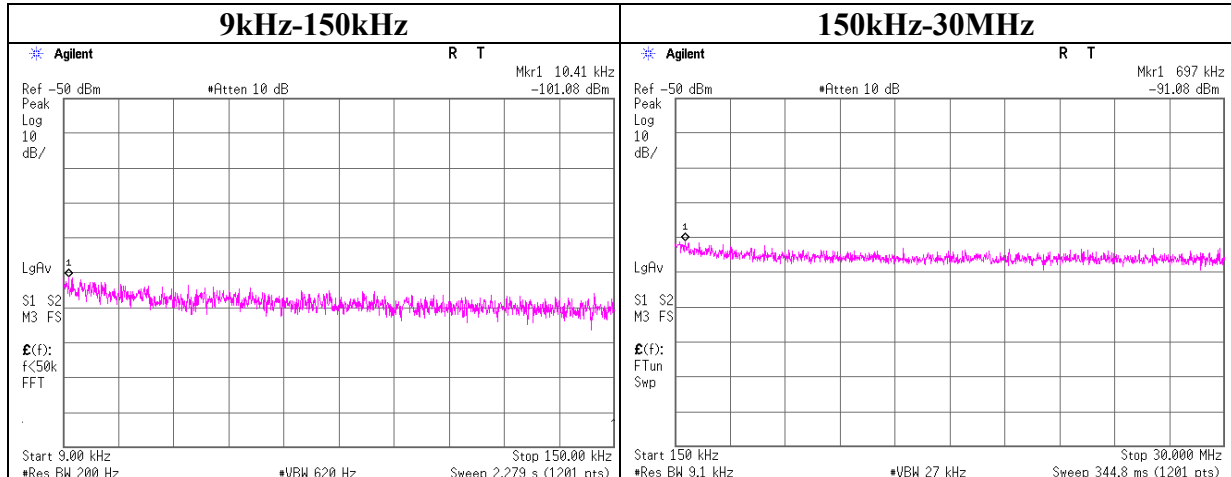
#### Ant 1 Tx 2403MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
27.800	-101.4	0.01	9.9	2.0	-89.5	300.0	6.0	-28.2	38.7
299.000	-91.1	0.01	9.9	2.0	-79.2	300.0	6.0	-17.9	18.1

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

#### Tx 2441MHz



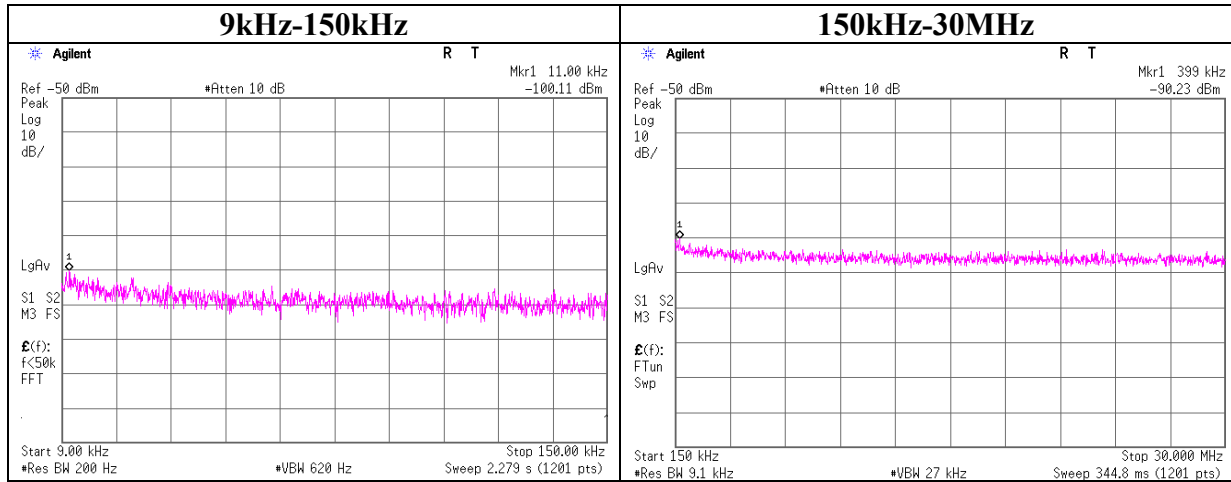
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
10.410	-101.1	0.01	9.9	2.0	-89.2	300.0	6.0	-27.9	47.3
697.000	-91.1	0.01	9.9	2.0	-79.2	30.0	6.0	2.1	30.7

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

## Conducted Spurious Emission

Test place	Ise HQ EMC Lab. No.6 Measurement Room
Project No.	10291834H
Date	04/23/2014
Temperature/ Humidity	20deg. C / 48% RH
Engineer	Keisuke Kawamura
Mode	Tx

### Ant 1 Tx 2481MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	EIRP	Distance	Ground bounce	E (field strength)	Limit
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]
11.000	-100.1	0.01	9.9	2.0	-88.2	300.0	6.0	-27.0	46.8
399.000	-90.2	0.01	9.9	2.0	-78.4	300.0	6.0	-17.1	15.6

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

## Power Density

Test place : Ise HQ EMC Lab. No.6 Measurement Room  
Report No. : 10291834H  
Date : 04/23/2014  
Temperature/ Humidity : 20deg. C / 48% RH  
Engineer : Keisuke Kawamura  
Mode : Tx

Ant1

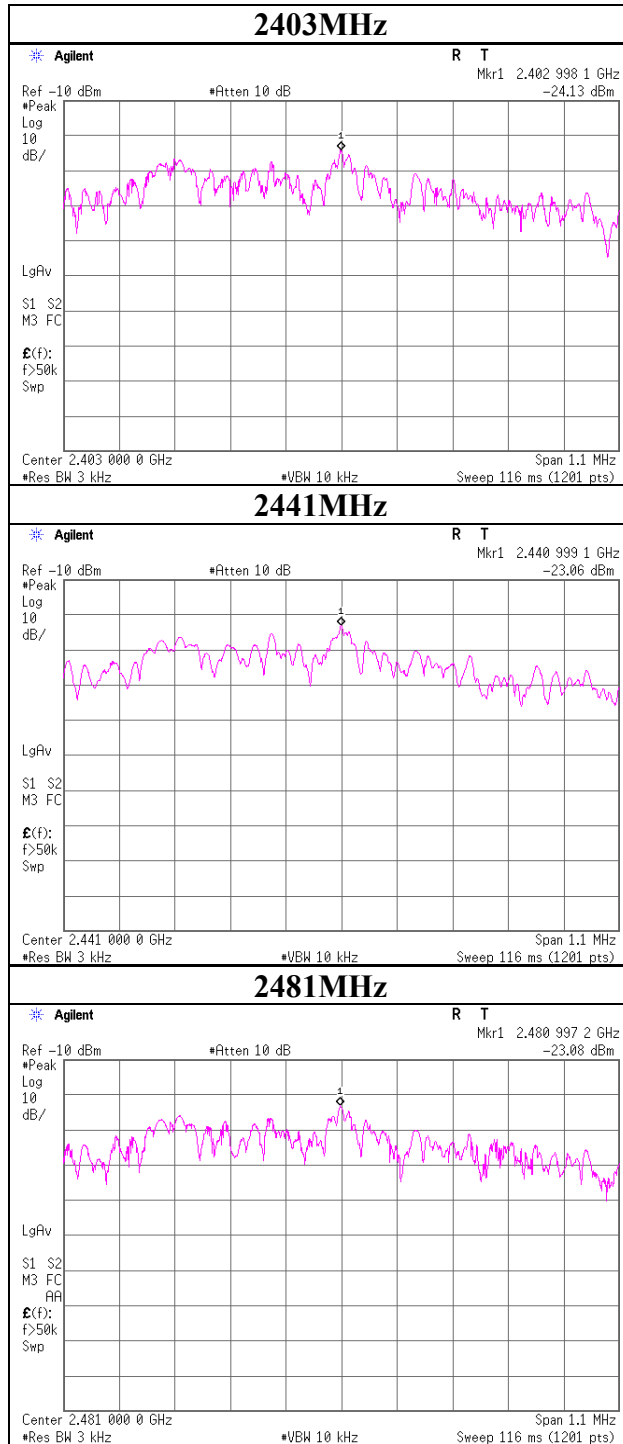
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2403.00	-24.13	1.28	10.08	-12.77	8.00	20.77
2441.00	-23.06	1.29	10.08	-11.69	8.00	19.69
2481.00	-23.08	1.30	10.08	-11.70	8.00	19.70

Sample Calculation:

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

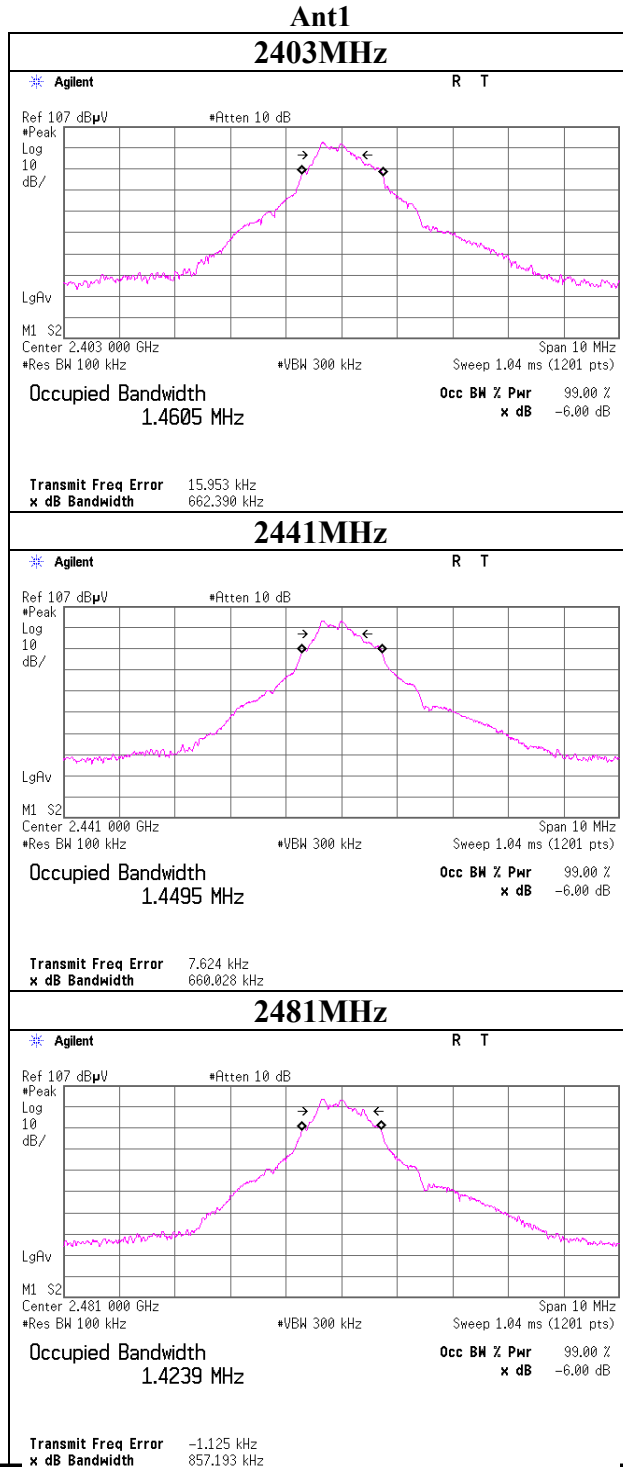


**Power Density**  
**Ant 1**



### 99%Occupied Bandwidth

Test place	Ise HQ EMC Lab. No.6 Measurement Room
Report No.	10291834H
Date	04/23/2014
Temperature/ Humidity	20deg. C / 48% RH
Engineer	Keisuke Kawamura
Mode	Tx



## **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	1401	AT	2014/02/20 * 12
MCC-138	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37953/2	AT	2013/10/18 * 12
MAT-20	Attenuator(10dB)(above1 GHz)	HIROSE ELECTRIC CO.,LTD.	AT-110	-	AT	2014/01/29 * 12
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	AT	2013/06/14 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2013/11/15 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2013/11/15 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2014/02/20 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2014/02/27 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE/CE	2014/02/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2014/04/08 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2013/05/17 * 12
MCC-133	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336164/4(1m) / 340640(5m)	RE	2013/09/27 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2014/03/24 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2013/05/17 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2013/09/01 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	CE/RE	2013/08/20 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(3m)/sucofor m141-PE(1m)/421- 010(1.5m)/RFM- E321(Switcher)	-/00640	CE	2013/07/23 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	8127364	CE	2014/01/27 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2014/01/29 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2013/10/13 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2013/10/13 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2014/04/14 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2013/07/23 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2014/03/14 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

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

**UL Japan, Inc.**

**Ise HQ EMC Lab.**

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