RADIO TEST REPORT

Test Report No. : 10146657H-A-R1

Applicant	:	**Audio Technica Corp**
Type of Equipment	:	**WIRELESS MICROPHONE RECEIVER**
Model No.	:	**ATW-R1500**
FCC ID	:	**JFZR1500**
Test regulation	:	**FCC Part 15 Subpart C: 2013**
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 10146657H-A. 10146657H-A is replaced with this report.

Date of test: December 9 to 19, 2013

Representative test engineer:
S. Matsuyama
Satofumi Matsuyama
Engineer of WiSE Japan,
UL Verification Service

Approved by:
T. Hatakeda
Takahiro Hatakeda
Leader of WiSE Japan,
UL Verification Service

NVLAP LAB CODE: 200572-0

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

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

REVISION HISTORY

Original Test Report No.: 10146657H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10146657H-A	January 9, 2014	-	-
1	10146657H-A-R1	January 10, 2014	P.9	Addition of explanatory note for Configuration and peripherals
1	10146657H-A-R1	January 10, 2014	P.18,20	Correction of test data

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	Technica Fukui Co.,Ltd.*
Address	:	87-1, Totani, Echizen-shi, Fukui, 915-0003Japan
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-R1500
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC12V
Receipt Date of Sample	:	December 9, 2013
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-R1500, (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	:	PIFA Antenna
Antenna Gain	:	Peak: -3.74dBi (Antenna 1), -0.46dBi (Antenna 2)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2013, final revised on September 30, 2013 and effective October 30, 2013
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

* The EUT complies with FCC Part 15 Subpart B: 2013, final revised on September 30, 2013 and effective October 30, 2013.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.4:2003 7. AC powerline Conducted Emission measurements	**FCC:** Section 15.207	**QP** 14.4dB, 0.32286MHz, L **AV** 5.9dB, 0.32286MHz, L	Complied	-
	IC: RSS-Gen 7.2.4	**IC:** RSS-Gen 7.2.4			
6dB Bandwidth	**FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on October 4, 2012)"	**FCC:** Section 15.247(a)(2)	See data.	Complied	Conducted
	IC: RSS-Gen 4.6.2	**IC:** RSS-210 A8.2(a)			
Maximum Peak Output Power	**FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on October 4, 2012)"	**FCC:** Section 15.247(b)(3)		Complied	Conducted
	IC: RSS-Gen 4.8	**IC:** RSS-210 A8.4(4)			
Power Density	**FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on October 4, 2012)"	**FCC:** Section 15.247 (e)		Complied	Conducted
	IC: -	**IC:** RSS-210 A8.2(b)			
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)"	**FCC:** Section15.247(d)	7.9dB 2483.500MHz, PK, Vertical	Complied	Conducted/ Radiated
	IC: RSS-Gen 4.9	**IC:** RSS-210 A8.5 RSS-Gen 7.2.3			
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
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.

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 test report has enough margin, more than the site margin.

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

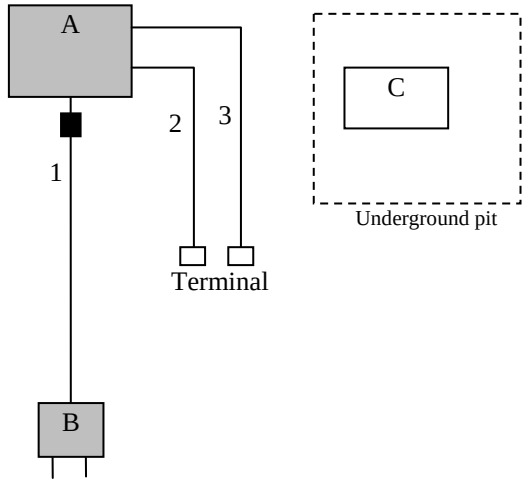
4.1 Operating Mode(s)

Transmitting mode (Tx):

Details of Operating Mode(s)

Test Item	Operating Mode	Tested antenna	Tested Frequency
Maximum Peak Output Power	Tx	Ant 1, Ant 2	2403MHz 2441MHz 2481MHz
6dB Bandwidth, Power Density, Spurious Emission (Conducted), 99% Occupied Bandwidth	Tx	Ant 1 *1)	2403MHz 2441MHz 2481MHz
Conducted Emission, Spurious Emission (Radiated)	Tx	Ant 2 *2)	2403MHz 2441MHz 2481MHz
Power of the EUT was set by the software as follows: -Power setting: 12dBm -Hardware Version: Version TP -Software Version: SB V0005 *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. *2) Test was performed with the antenna that had higher radiated carrier emission level.			

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
* Transmitter was set in Underground pit during Radiated spurious emission test only.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	WIRELESS MICROPHONE RECEIVER	ATW-R1500	131100031	Technica Fukui Co.,Ltd.	EUT
B	AC Adaptor	KSAS0061200050VUD	-	Technica Fukui Co.,Ltd.	EUT
C	Transmitter	ATW-T1002	13233002	Technica Fukui Co.,Ltd.	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	1.8	Unshielded	Unshielded	-
2	Audio Cable	2.0	Unshielded	Unshielded	-
3	Audio Cable	2.0	Shielded	Shielded	-

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

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 Method1 RBW: 1MHz VBW: 3MHz Trace: Free Run Detector: Power Averaging (RMS)	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 x log (3.0m/1.0m) = 9.5dB

- 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

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*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 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

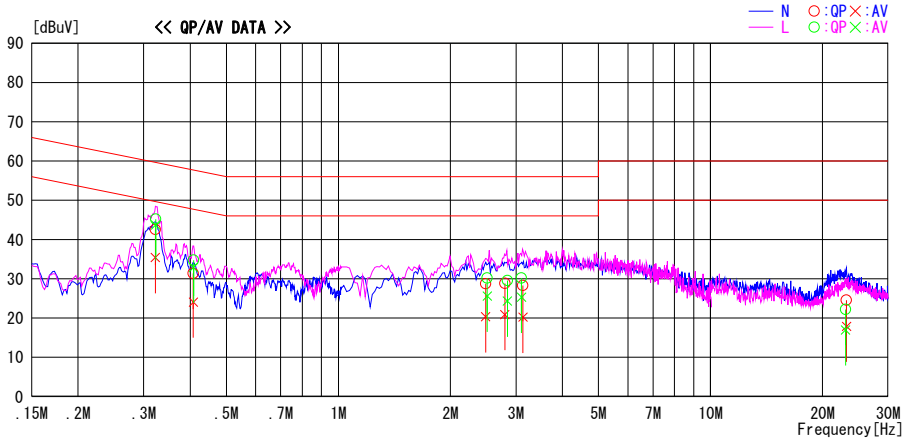
UL Japan, Inc. Head Office EMC Lab. No.3 Semi Anechoic Chamber
Date : 2013/12/19

Report No. : 10146657H

Temp./Humi. : 26deg. C / 31% RH
Engineer : Satofumi Matsuyama

Mode / Remarks : Tx 2481MHz, Ant2

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.32221	29.2	22.0	13.4	42.6	35.4	59.6	49.6	17.0	14.2	N	
0.40763	18.0	10.7	13.4	31.4	24.1	57.7	47.7	26.3	23.6	N	
2.48649	15.1	6.7	13.6	28.7	20.3	56.0	46.0	27.3	25.7	N	
2.80318	15.2	7.3	13.6	28.8	20.9	56.0	46.0	27.2	25.1	N	
3.13128	14.5	6.4	13.8	28.3	20.2	56.0	46.0	27.7	25.8	N	
23.19047	7.2	0.5	17.4	24.6	17.9	60.0	50.0	35.4	32.1	N	
0.32286	31.8	30.3	13.4	45.2	43.7	59.6	49.6	14.4	5.9	L	
0.40796	21.3	19.5	13.4	34.7	32.9	57.7	47.7	23.0	14.8	L	
2.51324	16.6	12.0	13.6	30.2	25.6	56.0	46.0	25.8	20.4	L	
2.84643	16.0	10.7	13.6	29.6	24.3	56.0	46.0	26.4	21.7	L	
3.10483	16.4	11.5	13.8	30.2	25.3	56.0	46.0	25.8	20.7	L	
23.06075	4.8	-0.4	17.4	22.2	17.0	60.0	50.0	37.8	33.0	L	

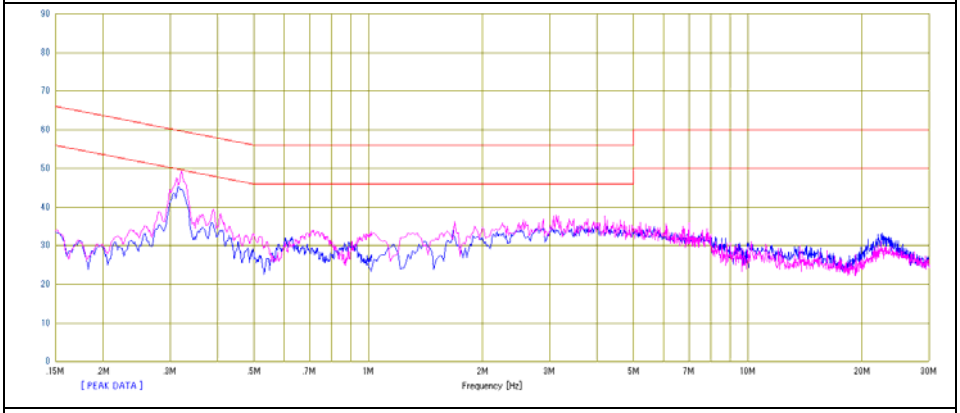
CHART:WITH FACTOR,Peak hold data. CALCULATION:RESULT=READING+C.F(LISN LOSS + ATT LOSS + CABLE LOSS)
Except for the above table : adequate margin data below the limits.

*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.

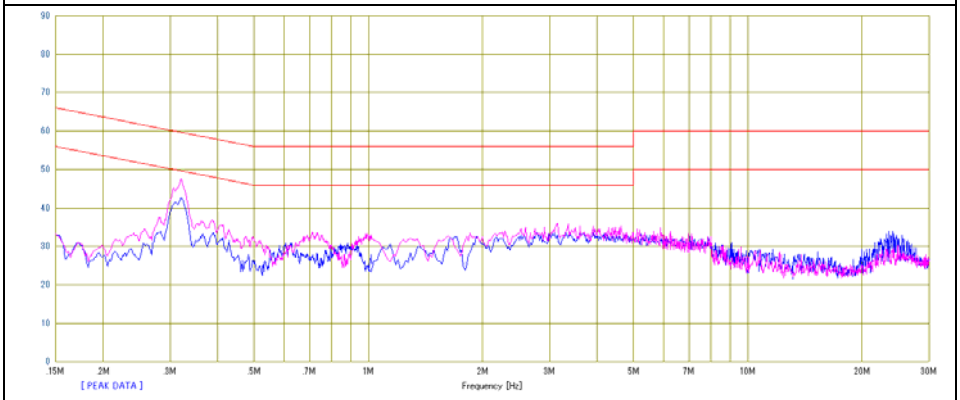
Conducted Emission

Test place	Head Office EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10146657H
Date	12/19/2012
Temperature/ Humidity	26 deg. C / 31% RH
Engineer	Satofumi Matsuyama
Mode	Tx

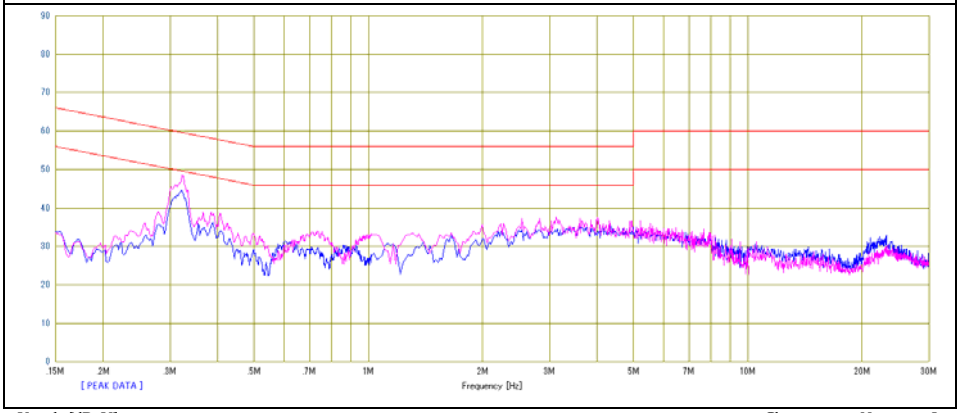
2403MHz



2441MHz



2481MHz



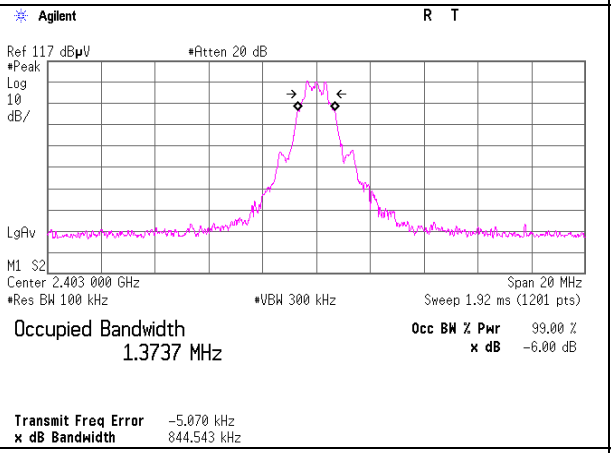
Y scale [dBuV] Chart — N — L

6dB Bandwidth

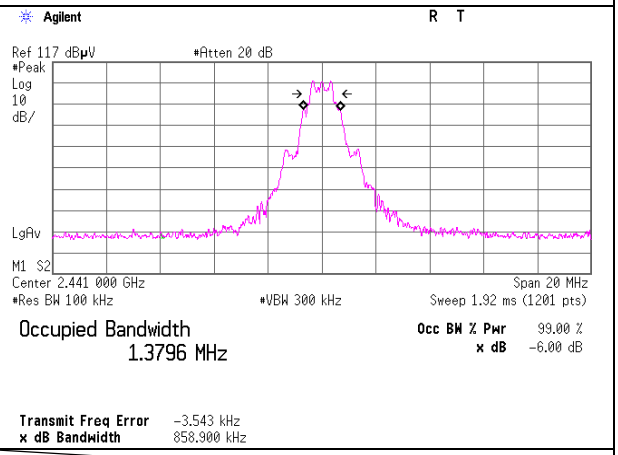
Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10146657H
Date	12/09/2013
Temperature/ Humidity	23deg. C / 47% RH
Engineer	Shinya Watanabe
Mode	Tx

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2403	0.845	>500
2441	0.859	>500
2481	0.861	>500

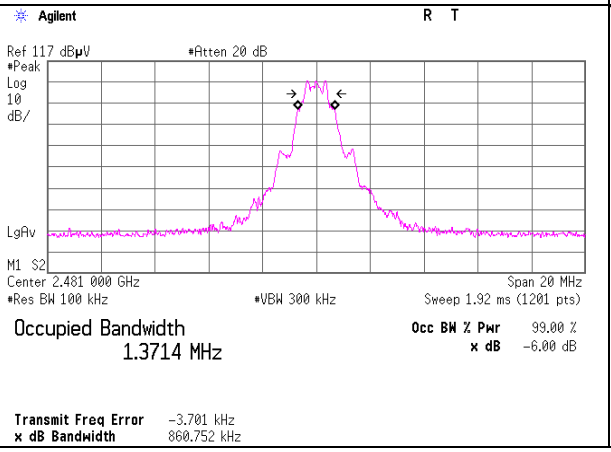
2403MHz



2441MHz



2481MHz



Maximum Peak Output Power

Test place	Head Office EMC Lab. No.11 Measurement Room
Project No.	10146657H
Date	12/18/2013
Temperature/ Humidity	23deg. C / 35% RH
Engineer	Hiroshi Kukita
Mode	Tx

Ant1

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2403	2.38	0.74	10.08	13.20	20.89	30.00	1000	16.80
2441	2.47	0.74	10.08	13.29	21.33	30.00	1000	16.71
2481	1.94	0.75	10.08	12.77	18.92	30.00	1000	17.23

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

Ant2

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2403	2.15	0.74	10.08	12.97	19.82	30.00	1000	17.03
2441	2.33	0.74	10.08	13.15	20.65	30.00	1000	16.85
2481	1.90	0.75	10.08	12.73	18.75	30.00	1000	17.27

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

Average Output Power

Test place	Head Office EMC Lab. No.11 Measurement Room
Project No.	10146657H
Date	12/18/2013
Temperature/ Humidity	23deg. C / 35% RH
Engineer	Hiroshi Kukita
Mode	Tx

[AV]

Ant 1

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2403	-18.81	0.74	10.08	-7.99	0.16	30.00	1000	37.99
2441	-18.40	0.74	10.08	-7.58	0.17	30.00	1000	37.58
2481	-18.70	0.75	10.08	-7.87	0.16	30.00	1000	37.87

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

Ant 2

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2403	-19.09	0.74	10.08	-8.27	0.15	30.00	1000	38.27
2441	-18.53	0.74	10.08	-7.71	0.17	30.00	1000	37.71
2481	-19.46	0.75	10.08	-8.63	0.14	30.00	1000	38.63

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

Radiated Spurious Emission

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10146657H
Date	12/16/2013
Temperature/ Humidity	23 deg. C / 32% RH
Engineer	Tsubasa Takayama (30MHz-26.5GHz)
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	56.100	QP	24.3	9.0	7.0	28.5	11.8	40.0	28.2	
Hori	124.050	QP	23.8	13.2	7.7	28.3	16.4	43.5	27.1	
Hori	144.750	QP	23.8	14.7	7.8	28.3	18.0	43.5	25.5	
Hori	217.199	QP	24.0	16.8	8.3	27.8	21.3	46.0	24.7	
Hori	498.332	QP	24.2	18.1	9.8	28.8	23.3	46.0	22.7	
Hori	772.503	QP	26.2	21.4	10.8	28.3	30.1	46.0	15.9	
Hori	2390.000	PK	53.1	26.8	2.4	35.7	46.6	73.9	27.3	Not Out of band emission(Leakage Power)
Hori	4806.000	PK	NS	30.6	4.4	34.9	-	73.9	-	
Hori	7209.000	PK	NS	35.5	5.2	34.9	-	73.9	-	
Hori	9612.000	PK	NS	38.2	6.0	35.4	-	73.9	-	
Hori	2390.000	AV	38.6	26.8	2.4	35.7	32.1	53.9	21.8	Not Out of band emission(Leakage Power) *1)
Hori	4806.000	AV	NS	30.6	4.4	34.9	-	53.9	-	
Hori	7209.000	AV	NS	35.5	5.2	34.9	-	53.9	-	
Hori	9612.000	AV	NS	38.2	6.0	35.4	-	53.9	-	
Vert	55.650	QP	24.5	9.1	7.0	28.5	12.1	40.0	27.9	
Vert	98.400	QP	23.9	9.7	7.4	28.5	12.5	43.5	31.0	
Vert	148.350	QP	23.8	14.8	7.8	28.2	18.2	43.5	25.3	
Vert	202.349	QP	23.2	16.6	8.2	27.8	20.2	43.5	23.3	
Vert	382.833	QP	23.8	16.8	9.2	28.2	21.6	46.0	24.4	
Vert	588.000	QP	29.8	19.4	10.2	28.8	30.6	46.0	15.4	
Vert	2390.000	PK	52.4	26.8	2.4	35.7	45.9	73.9	28.0	Not Out of band emission(Leakage Power)
Vert	4806.000	PK	NS	30.6	4.4	34.9	-	73.9	-	
Vert	7209.000	PK	NS	35.5	5.2	34.9	-	73.9	-	
Vert	9612.000	PK	NS	38.2	6.0	35.4	-	73.9	-	
Vert	2390.000	AV	38.9	26.8	2.4	35.7	32.4	53.9	21.5	Not Out of band emission(Leakage Power) *1)
Vert	4806.000	AV	NS	30.6	4.4	34.9	-	53.9	-	
Vert	7209.000	AV	NS	35.5	5.2	34.9	-	53.9	-	
Vert	9612.000	AV	NS	38.2	6.0	35.4	-	53.9	-	

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

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

*NS : Not suprious emission detected

*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

*1) Gate Function was used.

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

Radiated Spurious Emission

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10146657H
Date	12/16/2013
Temperature/ Humidity	23 deg. C / 32% RH
Engineer	Tsubasa Takayama
	(30MHz-26.5GHz)
Mode	Tx 2403MHz

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	111.9	26.8	2.4	35.7	105.4	-	-	Carrier
Hori	2400.000	PK	45.8	26.8	2.4	35.7	39.3	85.4	46.1	
Vert	2403.000	PK	113.4	26.8	2.4	35.7	106.9	-	-	Carrier
Vert	2400.000	PK	44.9	26.8	2.4	35.7	38.4	86.9	48.5	

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

Radiated Spurious Emission

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10146657H
Date	12/16/2013
Temperature/ Humidity	23 deg. C / 32% RH
Engineer	Tsubasa Takayama
	(30MHz-26.5GHz)
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	55.650	QP	24.5	9.2	7.4	32.1	9.0	40.0	31.0	
Hori	114.600	QP	25.3	12.2	8.2	32.1	13.6	43.5	29.9	
Hori	152.850	QP	25.3	15.1	8.6	32.1	16.9	43.5	26.6	
Hori	198.299	QP	24.3	16.5	9.0	32.1	17.7	43.5	25.8	
Hori	443.499	QP	23.4	17.8	10.8	32.0	20.0	46.0	26.0	
Hori	772.610	QP	26.1	21.4	10.8	28.3	30.0	46.0	16.0	
Hori	4882.000	PK	NS	30.9	4.4	34.9	-	73.9	-	
Hori	7323.000	PK	NS	35.7	5.3	34.9	-	73.9	-	
Hori	9764.000	PK	NS	38.4	6.1	35.4	-	73.9	-	
Hori	4882.000	AV	NS	30.9	4.4	34.9	-	53.9	-	
Hori	7323.000	AV	NS	35.7	5.3	34.9	-	53.9	-	
Hori	9764.000	AV	NS	38.4	6.1	35.4	-	53.9	-	
Vert	55.650	QP	25.6	9.2	7.4	32.1	10.1	40.0	29.9	
Vert	98.400	QP	24.9	9.8	8.0	32.1	10.6	43.5	32.9	
Vert	224.399	QP	24.9	16.9	9.3	32.1	19.0	46.0	27.0	
Vert	287.400	QP	25.2	19.2	9.8	32.0	22.2	46.0	23.8	
Vert	535.665	QP	25.4	18.6	11.4	32.1	23.3	46.0	22.7	
Vert	588.000	QP	28.2	19.4	10.2	28.8	29.0	46.0	17.0	
Vert	4882.000	PK	NS	30.9	4.4	34.9	-	73.9	-	
Vert	7323.000	PK	NS	35.7	5.3	34.9	-	73.9	-	
Vert	9764.000	PK	NS	38.4	6.1	35.4	-	73.9	-	
Vert	4882.000	AV	NS	30.9	4.4	34.9	-	53.9	-	
Vert	7323.000	AV	NS	35.7	5.3	34.9	-	53.9	-	
Vert	9764.000	AV	NS	38.4	6.1	35.4	-	53.9	-	

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

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

*NS : Not suprious emission detected

*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

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

Radiated Spurious Emission

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10146657H
Date	12/16/2013
Temperature/ Humidity	23 deg. C / 32% RH
Engineer	Tsubasa Takayama
	(30MHz-26.5GHz)
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	55.650	QP	24.2	9.2	7.4	32.1	8.7	40.0	31.3	
Hori	88.500	QP	23.9	7.9	7.9	32.2	7.5	43.5	36.0	
Hori	107.850	QP	23.7	11.3	8.1	32.1	11.0	43.5	32.5	
Hori	476.165	QP	23.7	18.0	11.0	32.0	20.7	46.0	25.3	
Hori	587.000	QP	25.9	19.3	11.7	32.1	24.8	46.0	21.2	
Hori	610.333	QP	27.2	19.6	10.2	28.8	28.2	46.0	17.8	
Hori	2483.500	PK	71.0	26.7	2.5	35.7	64.5	73.9	9.4	Not Out of band emission(Leakage Power)
Hori	4962.000	PK	NS	31.1	4.4	34.9	-	73.9	-	
Hori	7443.000	PK	NS	35.9	5.3	34.9	-	73.9	-	
Hori	9924.000	PK	NS	38.7	6.1	35.4	-	73.9	-	
Hori	2483.500	AV	50.1	26.7	2.5	35.7	43.6	53.9	10.3	Not Out of band emission(Leakage Power) *1)
Hori	4962.000	AV	NS	31.1	4.4	34.9	-	53.9	-	
Hori	7443.000	AV	NS	35.9	5.3	34.9	-	53.9	-	
Hori	9924.000	AV	NS	38.7	6.1	35.4	-	53.9	-	
Vert	55.200	QP	24.5	9.3	7.4	32.1	9.1	40.0	30.9	
Vert	98.400	QP	24.3	9.8	8.0	32.1	10.0	43.5	33.5	
Vert	199.649	QP	23.9	16.6	9.1	32.1	17.5	43.5	26.0	
Vert	396.833	QP	23.7	17.4	10.5	32.0	19.6	46.0	26.4	
Vert	588.000	QP	28.2	19.4	10.2	28.8	29.0	46.0	17.0	
Vert	823.837	QP	23.3	22.1	12.9	31.4	26.9	46.0	19.1	
Vert	2483.500	PK	72.5	26.7	2.5	35.7	66.0	73.9	7.9	Not Out of band emission(Leakage Power)
Vert	4962.000	PK	NS	31.1	4.4	34.9	-	73.9	-	
Vert	7443.000	PK	NS	35.9	5.3	34.9	-	73.9	-	
Vert	9924.000	PK	NS	38.7	6.1	35.4	-	73.9	-	
Vert	2483.500	AV	50.2	26.7	2.5	35.7	43.7	53.9	10.2	Not Out of band emission(Leakage Power) *1)
Vert	4962.000	AV	NS	31.1	4.4	34.9	-	53.9	-	
Vert	7443.000	AV	NS	35.9	5.3	34.9	-	53.9	-	
Vert	9924.000	AV	NS	38.7	6.1	35.4	-	53.9	-	

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

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

*NS : Not suprious emission detected

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

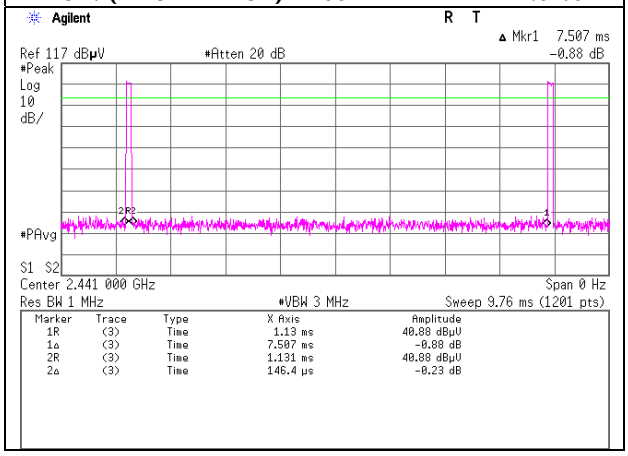
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB

*1) Gate Function was used.

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

Duty rate confirmation

Tx on / (Tx on + Tx off) = 0.020
Tx on / (Tx on + Tx off) * 100 = 2.0 %

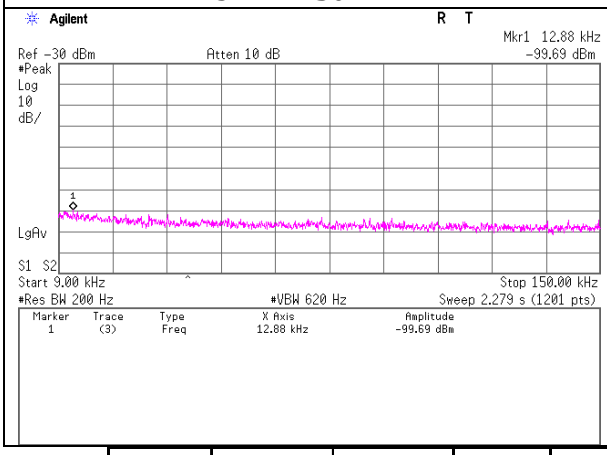


Conducted Spurious Emission

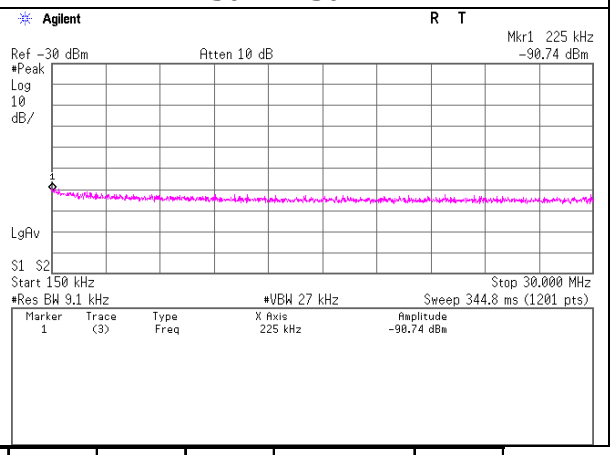
Test place	Head Office EMC Lab. No.11 Measurement Room
Project No.	10146657H
Date	12/18/2013
Temperature/ Humidity	23deg. C / 35% RH
Engineer	Hiroshi Kukita
Mode	Tx

Ant 1
Tx 2403MHz

9kHz-150kHz



150kHz-30MHz

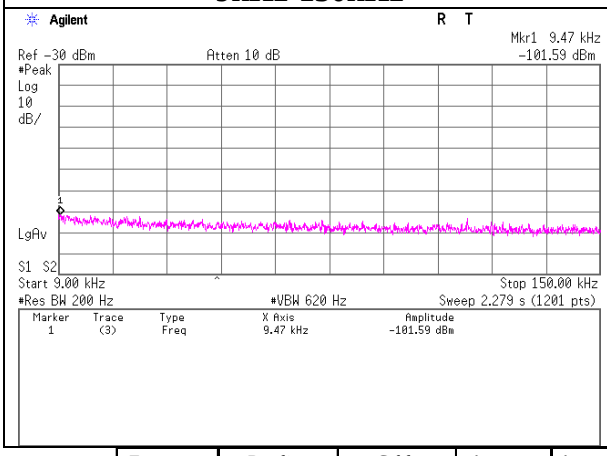


Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
12.880	-99.7	0.01	9.9	-3.7	-93.5	300.0	6.0	-32.3	45.4
225.000	-90.7	0.01	9.9	-3.7	-84.6	300.0	6.0	-23.3	20.6

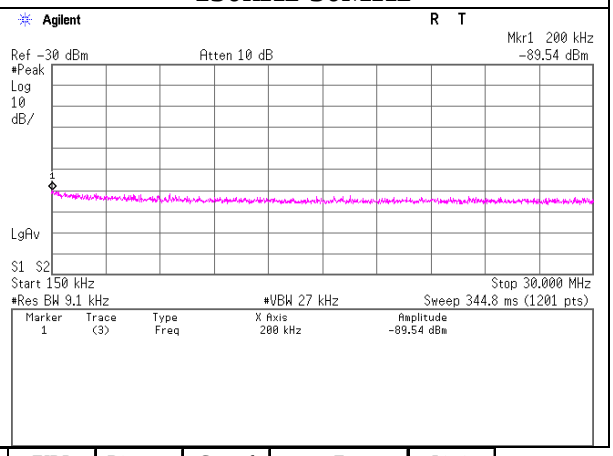
E=EIRP-20log(D)+104.8[dBuV/m]+Ground bounce
EIRP=Reading+Cable Loss+Attenator+Antenna Gain

Tx 2441MHz

9kHz-150kHz



150kHz-30MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
9.470	-101.6	0.01	9.9	-3.7	-95.4	300.0	6.0	-34.2	48.1
200.000	-89.5	0.01	9.9	-3.7	-83.4	300.0	6.0	-22.1	21.6

E=EIRP-20log(D)+104.8[dBuV/m]+Ground bounce
EIRP=Reading+Cable Loss+Attenator+Antenna Gain

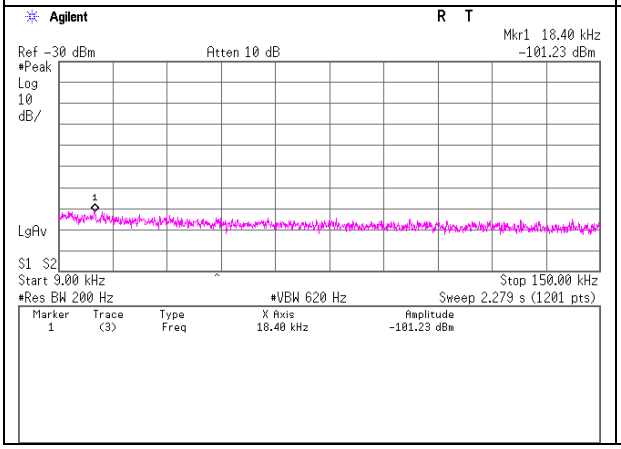
UL Japan, Inc.
Head Office EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116
Facsimile : +81 596 24 8124

Conducted Spurious Emission

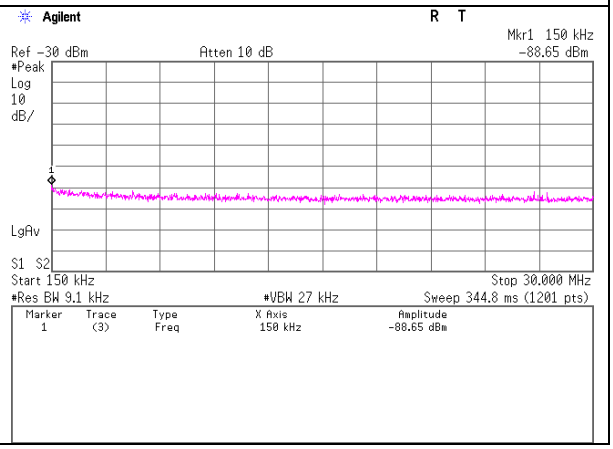
Test place	Head Office EMC Lab. No.11 Measurement Room
Project No.	10146657H
Date	12/18/2013
Temperature/ Humidity	23deg. C / 35% RH
Engineer	Hiroshi Kukita
Mode	Tx

Tx 2481MHz

9kHz-150kHz



150kHz-30MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
18.400	-101.2	0.01	9.9	-3.7	-95.1	300.0	6.0	-33.8	42.3
150.000	-88.7	0.01	9.9	-3.7	-82.5	300.0	6.0	-21.3	24.1

E=EIRP-20log(D)+104.8[dBuV/m]+Ground bounce

EIRP=Reading+Cable Loss+Attenator+Antenna Gain

Power Density

Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10146657H
Date	12/09/2013
Temperature/ Humidity	23deg. C / 47% RH
Engineer	Shinya Watanabe
Mode	Tx

Ant1

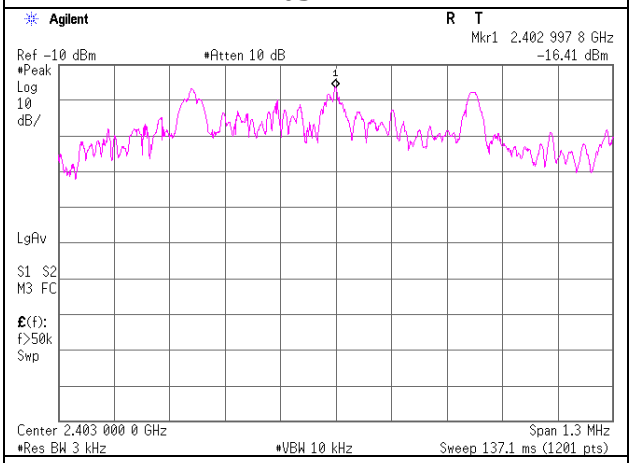
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2403.00	-16.41	2.00	9.97	-4.44	8.00	12.44
2441.00	-15.96	2.02	9.97	-3.97	8.00	11.97
2481.00	-15.88	2.03	9.97	-3.88	8.00	11.88

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

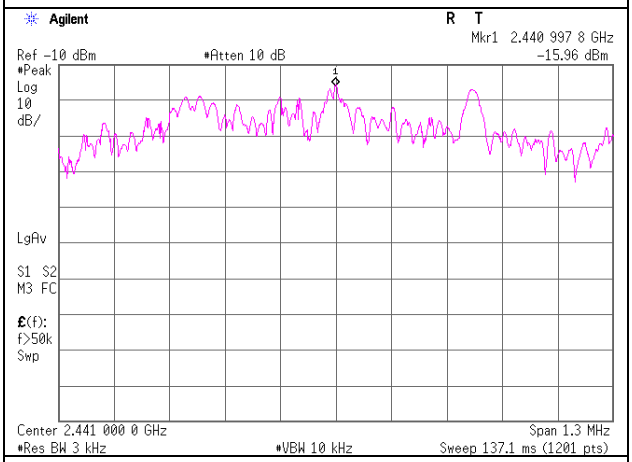
Power Density

Ant 1

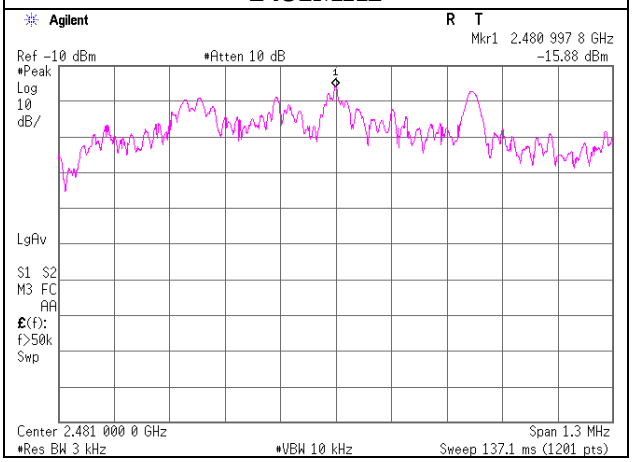
2403MHz



2441MHz



2481MHz

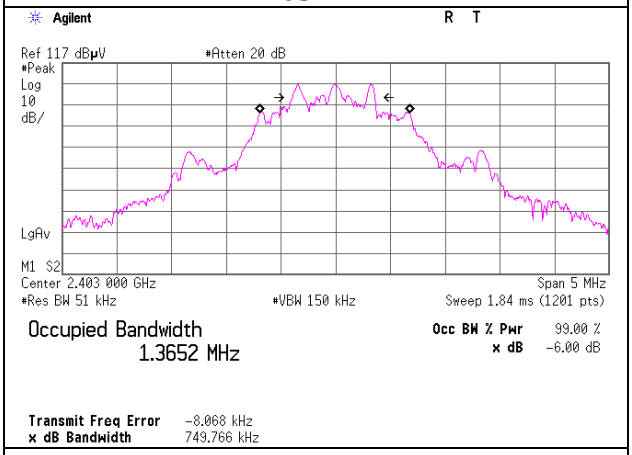


99%Occupied Bandwidth

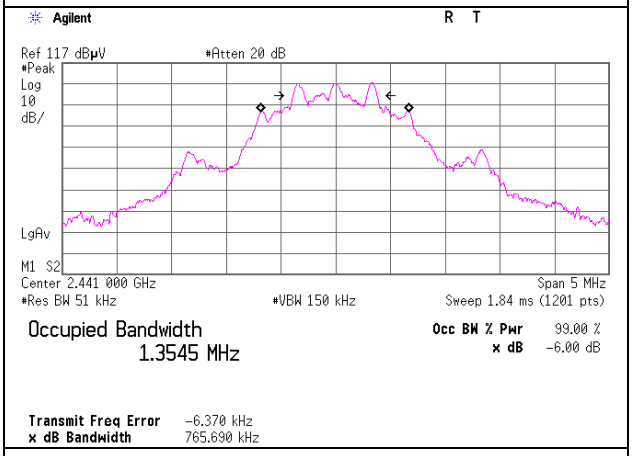
Test place	Head Office EMC Lab. No.11 Measurement Room
Report No.	10146657H
Date	12/09/2013
Temperature/ Humidity	23deg. C / 47% RH
Engineer	Shinya Watanabe
Mode	Tx

Ant1

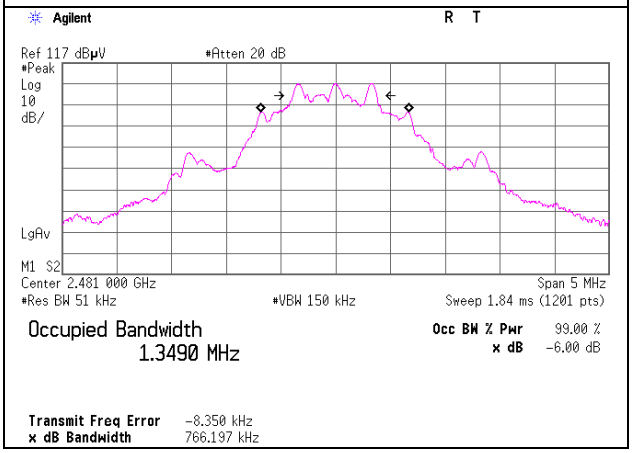
2403MHz



2441MHz



2481MHz



APPENDIX 2: Test instruments

EMI test equipment (1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2013/12/17 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2013/06/12 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2013/06/12 * 12
MRENT-112	Spectrum Analyzer	Agilent	E4440A	MY48250080	AT	2013/10/04 * 12
MAT-24	Attenuator(10dB) (above1GHz)	Agilent	8493C	71389	AT	2013/06/05 * 12
MCC-102	Microwave Cable	Hirose Electric	U.FL-2LP-066J1-A(200)	-	AT	2013/06/24 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2013/12/17 * 12
MBM-12	Barometer	Sunoh	SBR121	873	AT	2012/02/20 * 36
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2013/11/15 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2013/11/15 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2013/03/21 * 12
MCC-102	Microwave Cable	Hirose Electric	U.FL-2LP-066J1-A(200)	-	AT	2013/06/24 * 12
MCC-137	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37954/2	AT	2013/10/18 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2013/03/22 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2013/11/26 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2013/06/30 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2013/02/26 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2013/11/25 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2013/06/11 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2013/10/13 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2013/10/13 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2013/02/06 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2013/11/26 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2013/09/12 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2013/02/15 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2013/01/10 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2013/05/17 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2013/11/27 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2013/05/30 * 12

EMI test equipment (2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	CE	2013/02/28 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	-	CE	2013/02/26 * 12
MJM-16	Measure	KOMELON	KMC-36	-	CE	-
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	CE	2013/08/20 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE	2013/01/07 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/sucoform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher)	-/00640	CE	2013/07/23 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2013/01/22 * 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