RADIO TEST REPORT

Test Report No. : 11597547H-A-R1

Applicant	:	**Omron Corporation**
Type of Equipment	:	**RFID READER/WRITER**
Model No.	:	**V780-HMD68-ETN-US**
FCC ID	:	**E4EV78068**
Test regulation	:	**FCC Part 15 Subpart C: 2016**
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 test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11597547H-A. 11597547H-A is replaced with this report.

Date of test: January 18 to February 9, 2017

Representative test engineer:

Hironobu Ohnishi
Engineer
Consumer Technology Division

Approved by:

Tsubasa Takayama
Engineer
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://japan.ul.com/resources/emc_accredited/

REVISION HISTORY

Original Test Report No.: 11597547H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11597547H-A	February 15, 2017	-	-
1	11597547H-A-R1	March 3, 2017	P.6	Correction of frequency range of Uncertainty in Clause 3.4
1	11597547H-A-R1	March 3, 2017	P. 9	Correction of note in Clause 4.2.
1	11597547H-A-R1	March 3, 2017	P.16	Deletion of “No limit applies to 20dB Bandwidth.” from test data of 20dB Bandwidth and Carrier Frequency Separation.
1	11597547H-A-R1	March 3, 2017	P.41	Addition of note *1) in APPENDIX 2.

UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

CONTENTS **PAGE**

SECTION 1: Customer information....4
SECTION 2: Equipment under test (E.U.T.)....4
SECTION 3: Test specification, procedures & results....5
SECTION 4: Operation of E.U.T. during testing....8
SECTION 5: Conducted Emission....10
SECTION 6: Radiated Spurious Emission....11
SECTION 7: Antenna Terminal Conducted Tests....12
APPENDIX 1: Test data....13
Conducted Emission....13
20dB Bandwidth and Carrier Frequency Separation....16
Number of Hopping Frequency....18
Dwell time....19
Maximum Peak Output Power....22
Average Output Power....24
Radiated Spurious Emission....27
Conducted Spurious Emission....35
Conducted Emission Band Edge compliance....38
99%Occupied Bandwidth....39
APPENDIX 2: Test instruments....41
APPENDIX 3: Photographs of test setup....41
Conducted Emission....42
Radiated Spurious Emission....43
Worst Case Position....45

SECTION 1: Customer information

Company Name	:	Omron Corporation
Address	:	Automation Development Dept. 2-2-1, Nishikusatsu, Kusatsu-city, Shiga-pref., 525-0035, Japan
Telephone Number	:	+81-77-565-5287
Facsimile Number	:	+81-77-565-5569
Contact Person	:	Yoshito Okuno

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

2.1 Identification of E.U.T.

Type of Equipment	:	RFID READER/WRITER
Model No.	:	V780-HMD68-ETN-US
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 24 V
Receipt Date of Sample	:	January 17, 2017
Country of Mass-production	:	Japan
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: V780-HMD68-ETN-US (referred to as the EUT in this report) is a RFID READER/WRITER.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	902.75 MHz - 927.25 MHz
Modulation	:	FHSS
Power Supply (radio part input)	:	DC 3.3 V
Antenna type	:	Patch antenna
Antenna Gain	:	8 dBi
Clock frequency (Maximum)	:	CPU: 50 MHz, RF: 20 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016
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

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods **IC:** RSS-Gen 8.8	**FCC:** Section 15.207 **IC:** RSS-Gen 8.8	**QP** 10.6 dB, 0.55076 MHz, L **AV** 5.7 dB, 0.55000 MHz, L	Complied	-
Carrier Frequency Separation	**FCC:** FCC Public Notice DA 00-705 **IC:** -	**FCC:** Section15.247(a)(1) **IC:** RSS-247 5.1 (b)	See data.	Complied	Conducted
20dB Bandwidth	**FCC:** FCC Public Notice DA 00-705 **IC:** -	**FCC:** Section15.247(a)(1) **IC:** RSS-247 5.1 (a)		Complied	Conducted
Number of Hopping Frequency	**FCC:** FCC Public Notice DA 00-705 **IC:** -	**FCC:** Section15.247(a)(1)(i) **IC:** RSS-247 5.1 (d)		Complied	Conducted
Dwell time	**FCC:** FCC Public Notice DA 00-705 **IC:** -	**FCC:** Section15.247(a)(1)(i) **IC:** RSS-247 5.1 (d)		Complied	Conducted
Maximum Peak Output Power	**FCC:** FCC Public Notice DA 00-705 **IC:** RSS-Gen 6.12	**FCC:** Section15.247(b)(2) **IC:** RSS-247 5.4 (b)		Complied	Conducted
Spurious Emission & Band Edge Compliance	**FCC:** FCC Public Notice DA 00-705 **IC:** RSS-Gen 6.13	**FCC:** Section15.247(d) **IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	6.2 dB 51.550 MHz, QP, Vertical 3611.000 MHz, AV, Horizontal/Vertical	Complied	Conducted/ Radiated (above 30 MHz) *1)
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) Radiated test was selected over 30 MHz based on section 15.247(d).					

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

FCC Part 15.31 (e)

This EUT provides stable voltage (DC 3.3 V) constantly to RF Module 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 6.6	**IC:** -	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.
Ise EMC Lab.

Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz - 3 GHz	3 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.5 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz - 0.15 MHz	3.5 dB
0.15 MHz - 30 MHz	3.0 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3 m	3.8 dB
10 m	3.7 dB

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1 GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 GHz - 6 GHz	6 GHz - 18 GHz	10 GHz - 26.5 GHz	26.5 GHz - 40 GHz	1 GHz - 18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

*Measurement distance

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

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

3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

RFID: Transmitting (Tx)

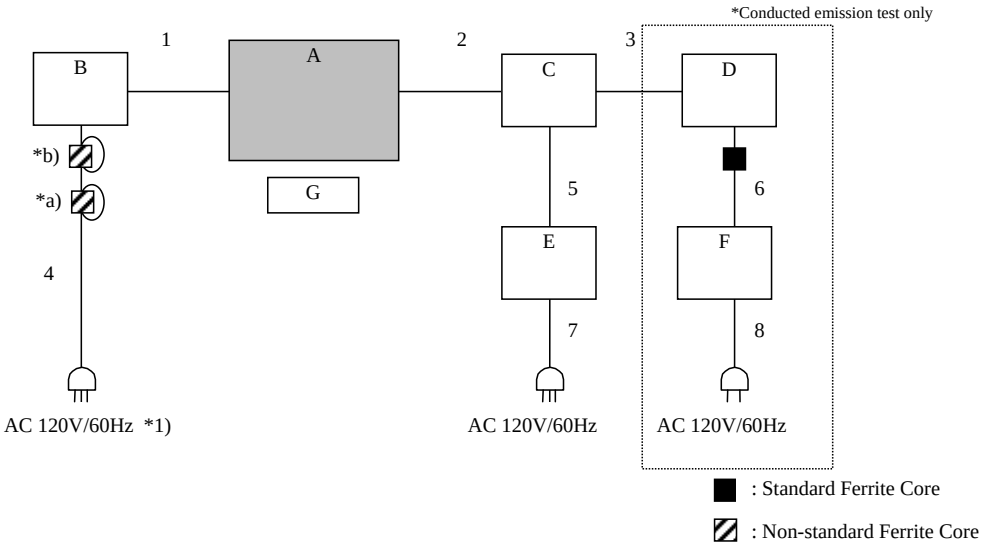
Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping Off)	902.75 MHz 914.75 MHz 927.25 MHz
Carrier Frequency Separation	Tx (Hopping On)	902.75 MHz 914.75 MHz 927.25 MHz
20dB Bandwidth	Tx (Hopping Off)	902.75 MHz 914.75 MHz 927.25 MHz
Number of Hopping Frequency	Tx (Hopping On)	-
Dwell time	Tx (Hopping On)	902.75 MHz 914.75 MHz 927.25 MHz
Maximum Peak Output Power	Tx (Hopping Off)	902.75 MHz 914.75 MHz 927.25 MHz
Band Edge Compliance (Conducted)	Tx -Hopping On -Hopping Off	902.75 MHz 927.25 MHz
99% Occupied Bandwidth	Tx -Hopping On -Hopping Off	902.75 MHz 914.75 MHz 927.25 MHz

*EUT has the power settings by the software as follows;
Power settings: 27dBm, 15dBm
Software: V780_ETN Ver.2.00.14

*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.

4.2 Configuration and peripherals



*1) Conducted emission test was performed on this port.

*For the ferrite cores, used for Radiated emission and Antenna Terminal Conducted emission tests only.
Those Ferrite Core did not affect Radiated emission from EUT.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	RFID READER/WRITER	V780-HMD68-ETN -US	No.5	Omron Corporation	EUT
B	Power Supply	S8VK-G03024	AJ283-2	Omron Corporation	-
C	SWITCHING HUB	W4S1-05B	27Y15K	Omron Corporation	-
D	Laptop PC	CF-N8HWCDPS	0BKSA08723	Panasonic	*for CE
E	Power Supply	S8VK-G03024	AJ283-26	Panasonic	-
F	AC Adapter	CF-AA637213	6372BM409X18054B	Panasonic	*for CE
G	RFID Tag	JIME-Z3BL159R	AJ283-No.9	Panasonic	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Power Cable	2.00	Shielded	Shielded	-
2	ETN Cable	2.00	Shielded	Shielded	-
3	LAN Cable	2.00	Shielded	Shielded	*for CE
4	AC Cable	1.70	Shielded	Shielded	-
5	DC Cable	0.45	Unshielded	Unshielded	-
6	DC Cable	1.10	Unshielded	Unshielded	*for CE
7	AC Cable	1.90	Unshielded	Unshielded	-
8	AC Cable	0.90	Unshielded	Unshielded	*for CE

* CE: Conducted emission test

<Notes for Ferrite cores>*
*a) 1 Ferrite Core, Model No. ZCAT 3035-1330 (Manufacturer: TDK), 5 cm from Item B, 2 turns
*b) 1 Ferrite Core, Model No. ZCAT 3035-1330 (Manufacturer: TDK), 0.8 cm from Item B, 2 turns

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The rear of tabletop was located 40 cm 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 80 cm from any other grounded conducting surface. EUT was located 80 cm 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 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50 ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm 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 CISPR AV**
Measurement range	**: 0.15 MHz - 30 MHz**
Test data	**: APPENDIX**
Test result	**: Pass**

SECTION 6: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m 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	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz *1)	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	4 m*2) (1 GHz – 10 GHz)		3 m

*1) Although DA 00-705 accepts VBW = 10 Hz for AV measurements, it was confirmed that superfluous smoothing was not performed.
*2) Distance Factor: 20 x log (4.0 m/3.0 m) = 2.5 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.
Also, carrier level and noise levels were confirmed with and without RFID tag, and the test was made at either states that has maximum noise and carrier levels.

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

Measurement range : 30 MHz - 10 GHz
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
20dB Bandwidth	300 kHz	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	2 MHz	150 kHz	430 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	13 MHz	62 kHz	180 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz	300 kHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
	30 MHz to 10 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) The measurement was performed with Max Hold since the duty cycle was not 100 % for the hopping mode. Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

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: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

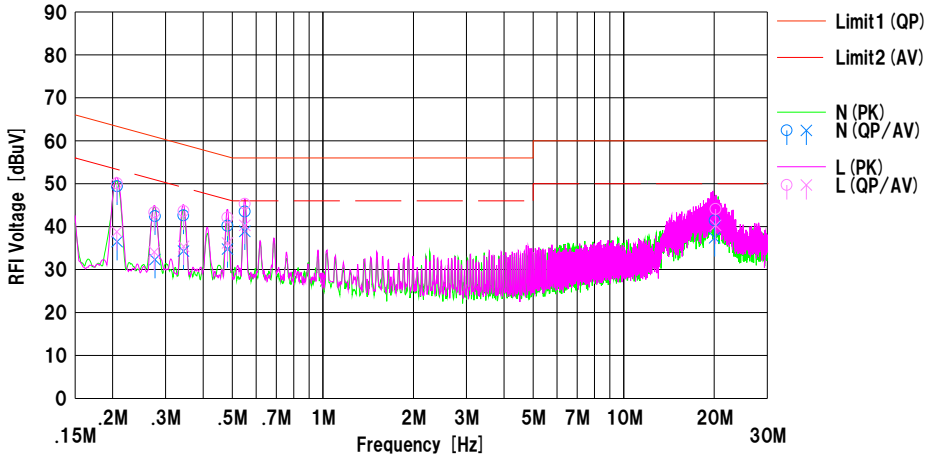
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2017/02/04

Report No. : 11597547H

Temp./Humi. : 22deg. C / 34% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : Tx 902.75MHz without Tag

Limit1 : FCC15.207 QP
Limit2 : FCC15.207 AV



No.	Freq.	Reading <QP>	Reading <AV>	C.Fac	Results <QP>	Results <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.20685	36.2	23.3	13.2	49.4	36.5	63.3	53.3	13.9	16.8	N	
2	0.27655	29.2	19.1	13.2	42.4	32.3	60.9	50.9	18.5	18.6	N	
3	0.34400	29.4	21.1	13.2	42.6	34.3	59.1	49.1	16.5	14.8	N	
4	0.48194	27.0	21.6	13.2	40.2	34.8	56.3	46.3	16.1	11.5	N	
5	0.55009	30.3	25.7	13.2	43.5	38.9	56.0	46.0	12.5	7.1	N	
6	20.07410	26.6	22.6	14.8	41.4	37.4	60.0	50.0	18.6	12.6	N	
7	0.20647	36.9	25.6	13.2	50.1	38.8	63.3	53.3	13.2	14.5	L	
8	0.27515	30.1	20.9	13.2	43.3	34.1	60.9	50.9	17.6	16.8	L	
9	0.34448	30.4	22.2	13.2	43.6	35.4	59.0	49.0	15.4	13.6	L	
10	0.48198	28.9	23.0	13.2	42.1	36.2	56.3	46.3	14.2	10.1	L	
11	0.55000	32.1	27.1	13.2	45.3	40.3	56.0	46.0	10.7	5.7	L	
12	20.21480	29.3	25.5	14.8	44.1	40.3	60.0	50.0	15.9	9.7	L	

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

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

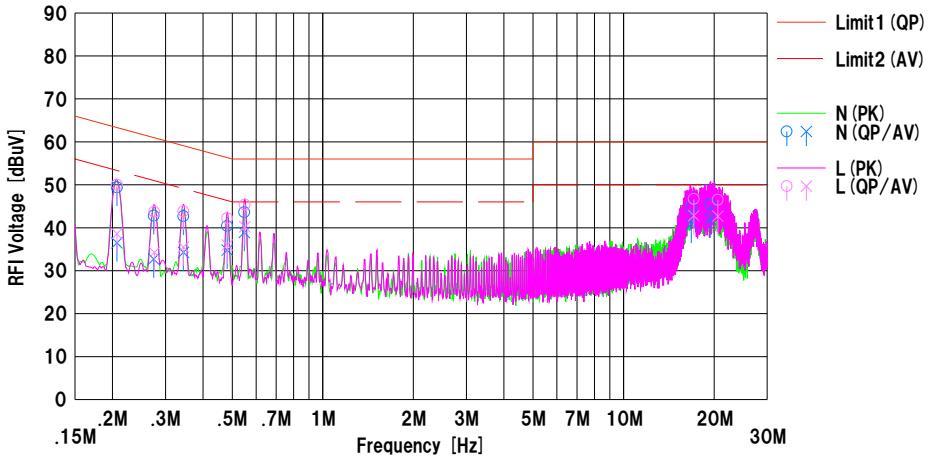
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2017/02/04

Report No. : 11597547H

Temp./Humi. : 22deg. C / 34% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : Tx 902.75MHz with Tag

Limit1 : FCC15.207 QP
Limit2 : FCC15.207 AV



No.	Freq.	Reading <QP>	Reading <AV>	C.Fac	Results <QP>	Results <AV>	Limit <QP>	Limit <AV>	Margin <QP>	Margin <AV>	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.20704	36.2	23.3	13.2	49.4	36.5	63.3	53.3	13.9	16.8	N	
2	0.27427	29.6	19.5	13.2	42.8	32.7	60.9	50.9	18.1	18.2	N	
3	0.34420	29.5	21.1	13.2	42.7	34.3	59.1	49.1	16.4	14.8	N	
4	0.48114	27.2	21.6	13.2	40.4	34.8	56.3	46.3	15.9	11.5	N	
5	0.54837	30.4	25.7	13.2	43.6	38.9	56.0	46.0	12.4	7.1	N	
6	16.78290	30.1	26.2	14.6	44.7	40.8	60.0	50.0	15.3	9.2	N	
7	19.39090	30.7	27.2	14.8	45.5	42.0	60.0	50.0	14.5	8.0	N	
8	0.20704	36.8	25.4	13.2	50.0	38.6	63.3	53.3	13.3	14.7	L	
9	0.27540	30.5	21.1	13.2	43.7	34.3	60.9	50.9	17.2	16.6	L	
10	0.34416	30.6	22.3	13.2	43.8	35.5	59.1	49.1	15.3	13.6	L	
11	0.48164	29.0	22.8	13.2	42.2	36.0	56.3	46.3	14.1	10.3	L	
12	0.55076	32.2	27.0	13.2	45.4	40.2	56.0	46.0	10.6	5.8	L	
13	17.12600	32.1	28.2	14.6	46.7	42.8	60.0	50.0	13.3	7.2	L	
14	20.56660	31.7	27.9	14.8	46.5	42.7	60.0	50.0	13.5	7.3	L	

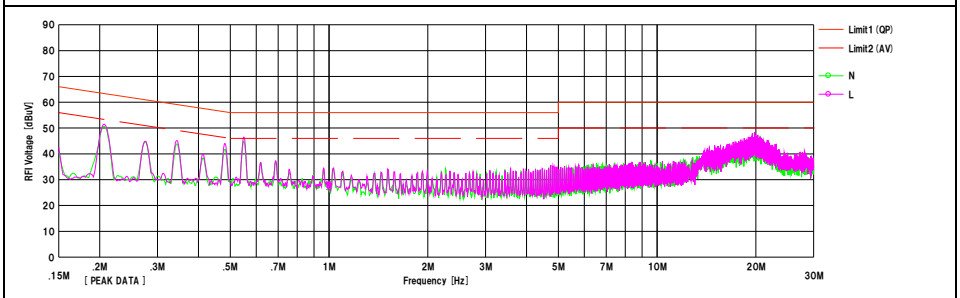
CHART:WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN + CABLE)
Except for the above table : adequate margin data below the limits.

UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

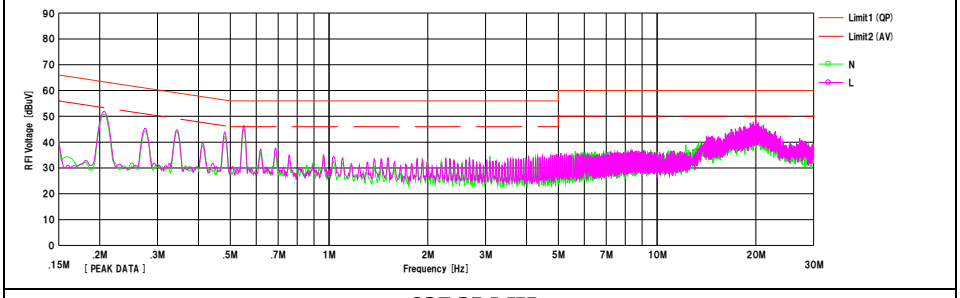
Conducted Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11597547H
Date	February 4, 2017
Temperature / Humidity	22 deg. C / 34 % RH
Engineer	Hiroyuki Furutaka
Mode	Tx, Hopping Off

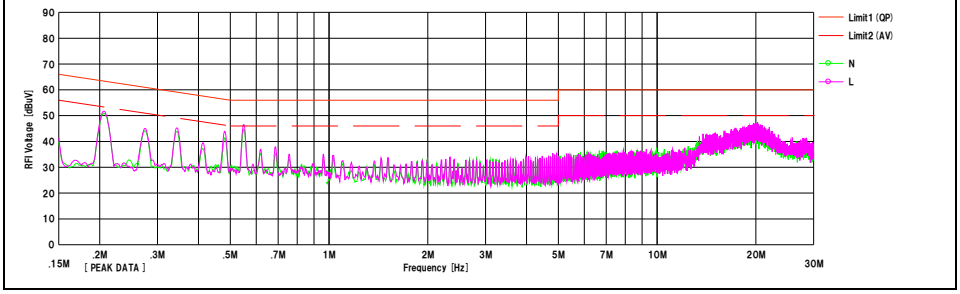
902.75 MHz



914.75 MHz



927.25 MHz



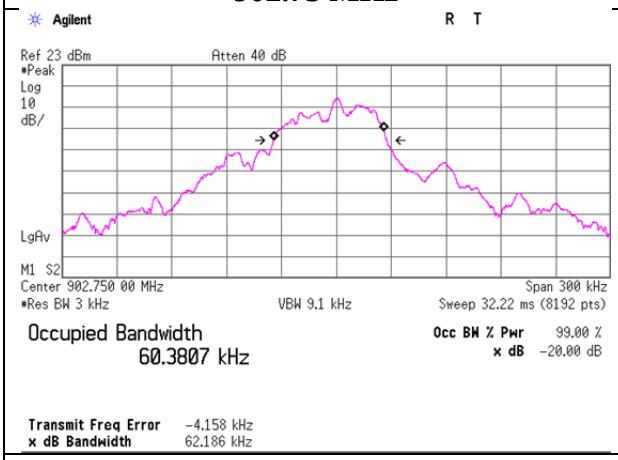
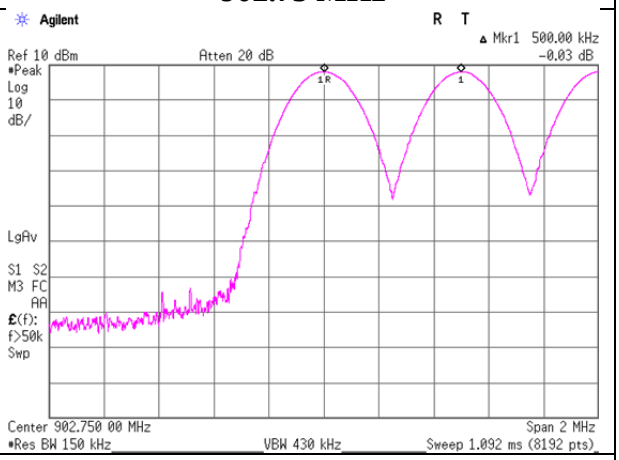
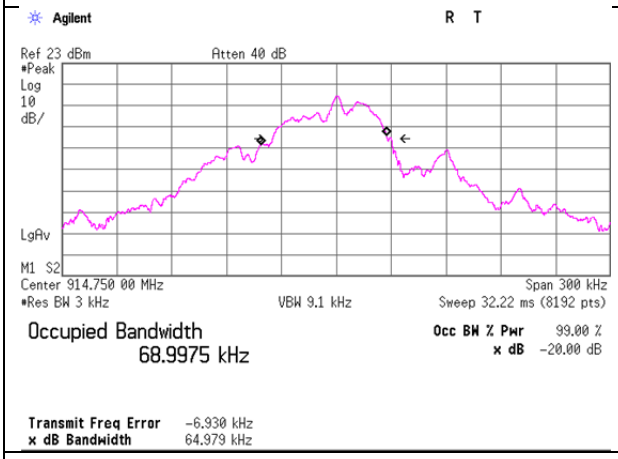
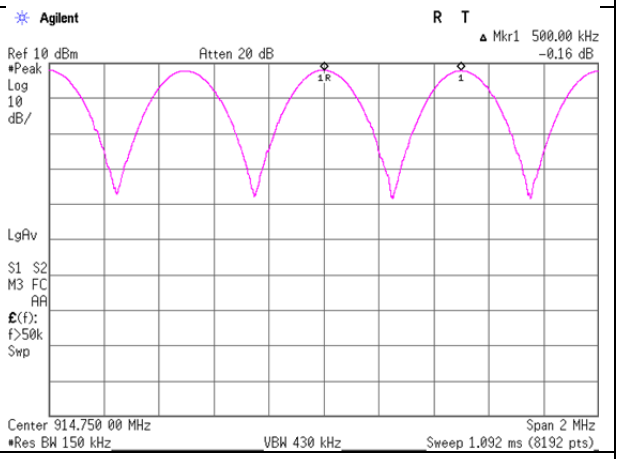
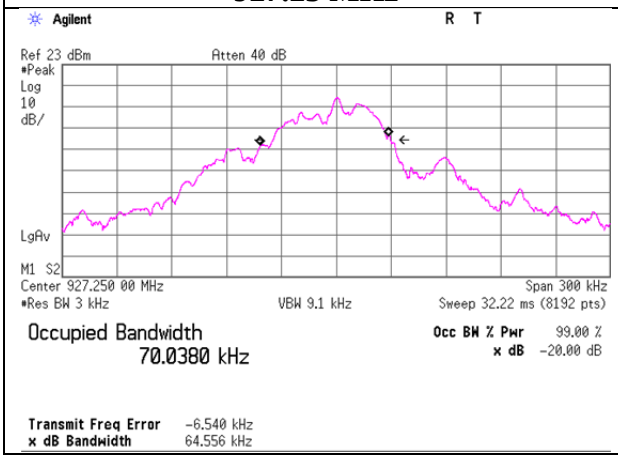
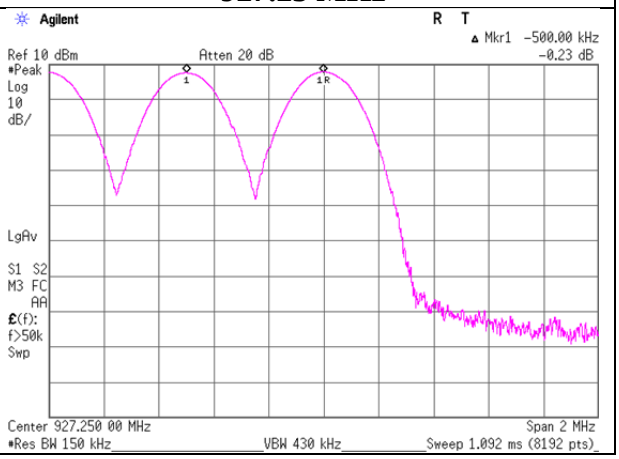
20dB Bandwidth and Carrier Frequency Separation

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx, Hopping Off / On

Freq. [MHz]	20dB Bandwidth [kHz]	Carrier Frequency Separation [kHz]	Limit for Carrier Frequency separation [kHz]
902.75	62.186	500.00	>= 62.186
914.75	64.979	500.00	>= 64.979
927.25	64.556	500.00	>= 64.556

Limit: 20dB Bandwidth or 25kHz (whichever is greater).

20dB Bandwidth and Carrier Frequency Separation

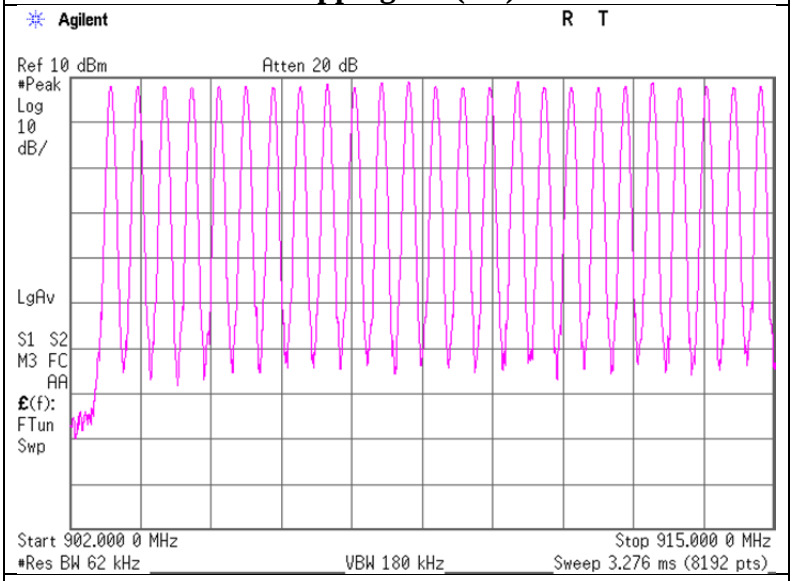
20 dB Bandwidth	Carrier Frequency Separation
902.75 MHz	**902.75 MHz**
	
914.75 MHz	**914.75 MHz**
	
927.25 MHz	**927.25 MHz**
	

Number of Hopping Frequency

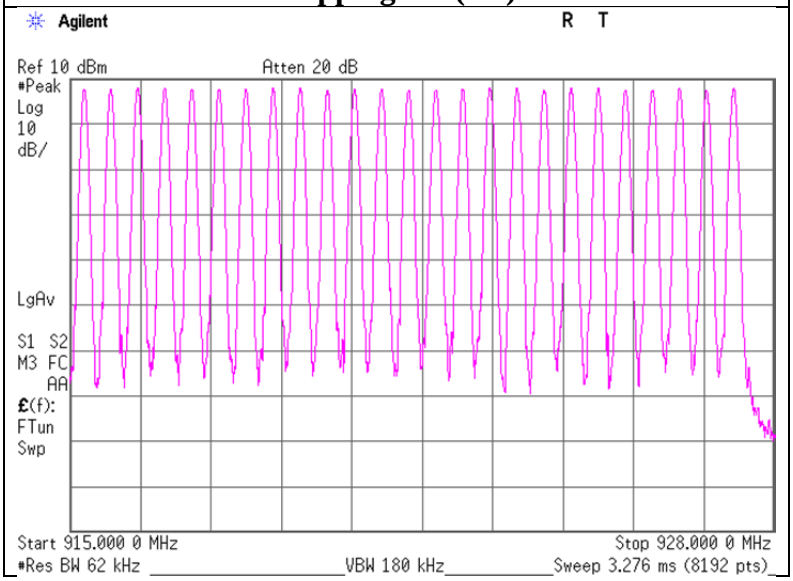
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx, Hopping On

Number of channel [channels]	Limit [channels]
50	>= 50

Hopping On (1/2)



Hopping On (2/2)



Dwell time

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx, Hopping On

Average times in 300 second	Analyzer sweep time	Period specified in the requirements	Number of transmission in 20 second	Length of one transmission [sec]	Average occupancy time in 20 second Result [sec]	Limit [sec]
20.7 times /	300 sec. x	20 sec. =	1.38 times	0.2367	0.327	0.4
21.0 times /	300 sec. x	20 sec. =	1.40 times	0.2367	0.331	0.4
20.0 times /	300 sec. x	20 sec. =	1.34 times	0.2367	0.317	0.4

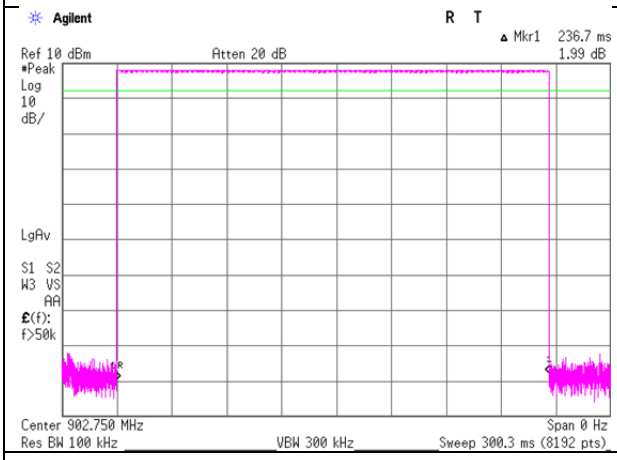
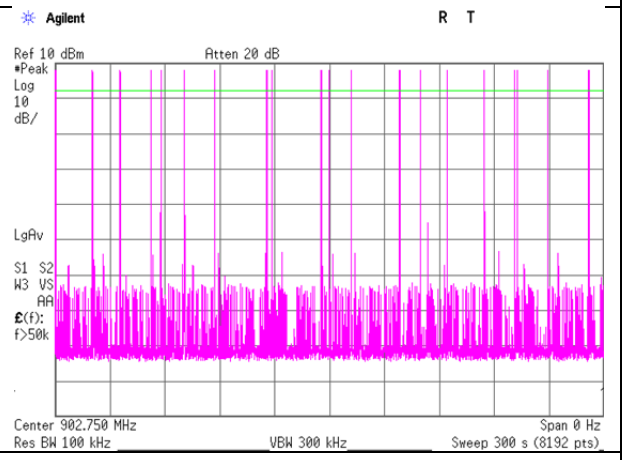
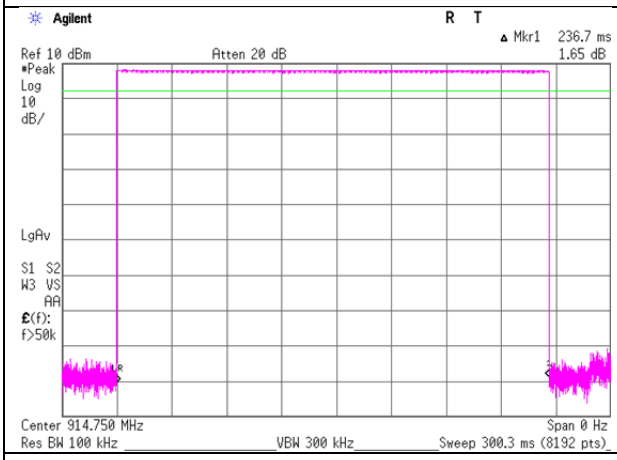
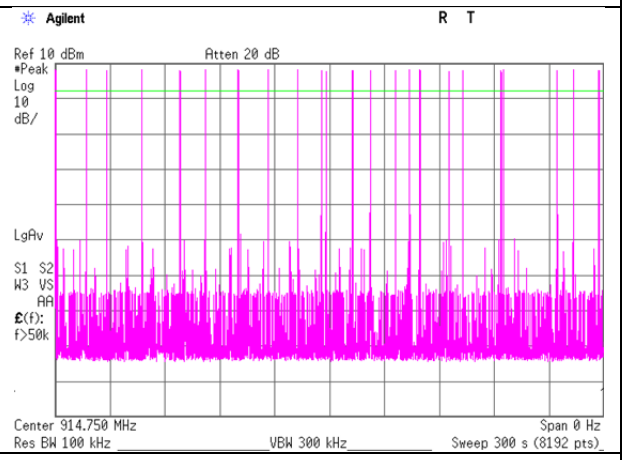
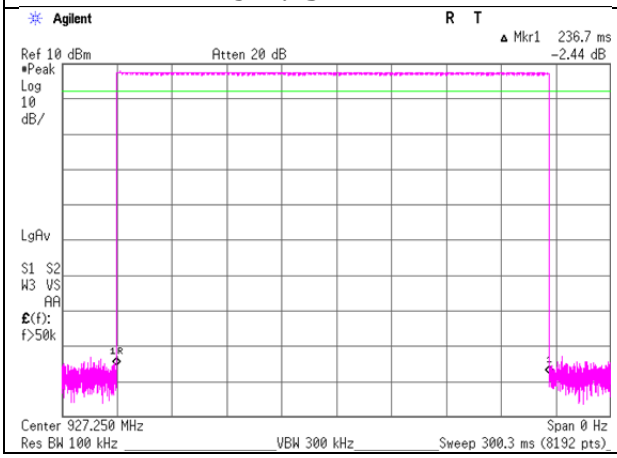
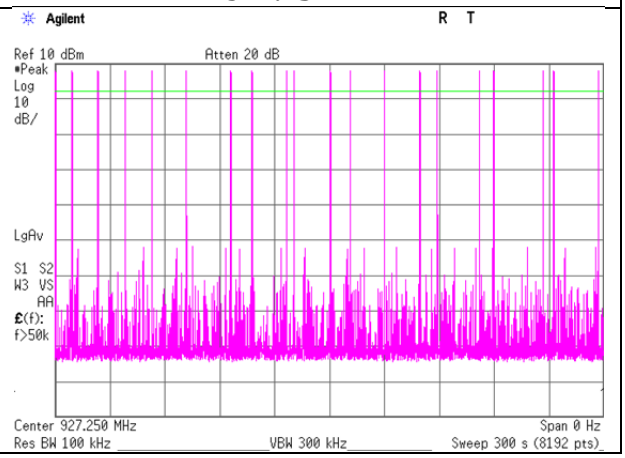
Sample Calculation
Result = Number of transmission x Length of one transmission

Number of hops on spectrum analyzer in observation period

Sampling [times] 1	2	3	Average times in 300 second
20	21	21	20.7
23	20	20	21.0
20	20	20	20.0

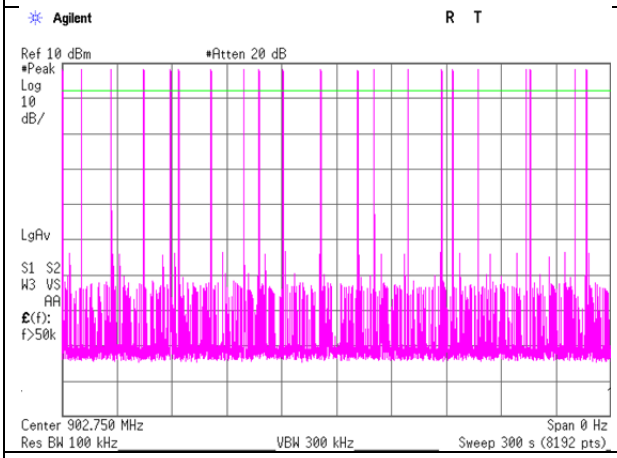
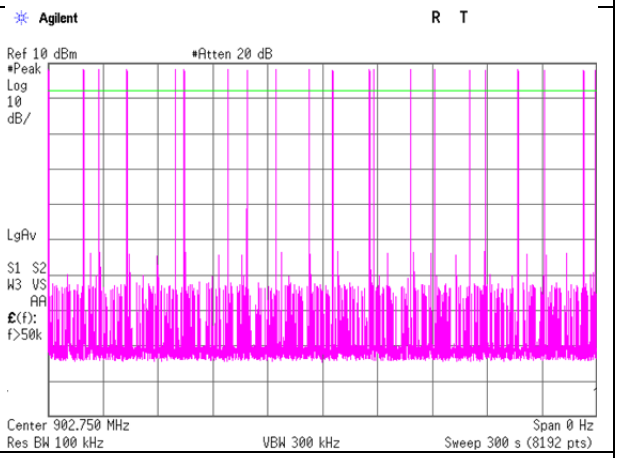
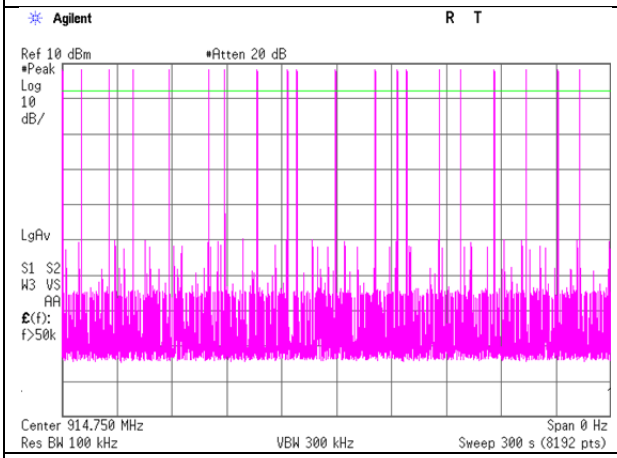
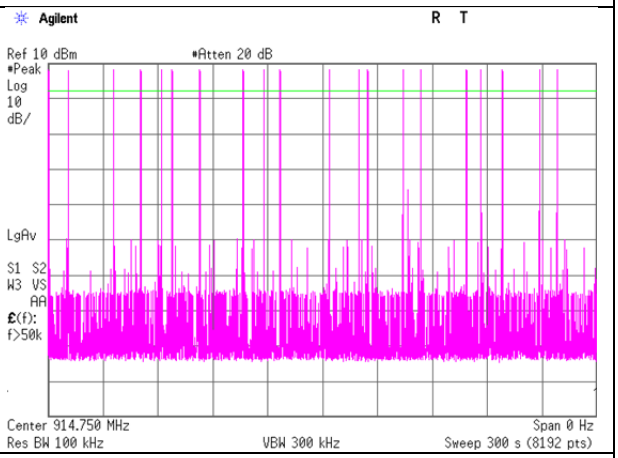
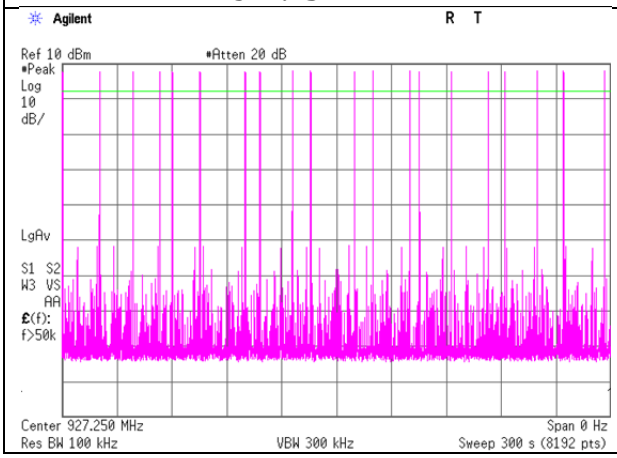
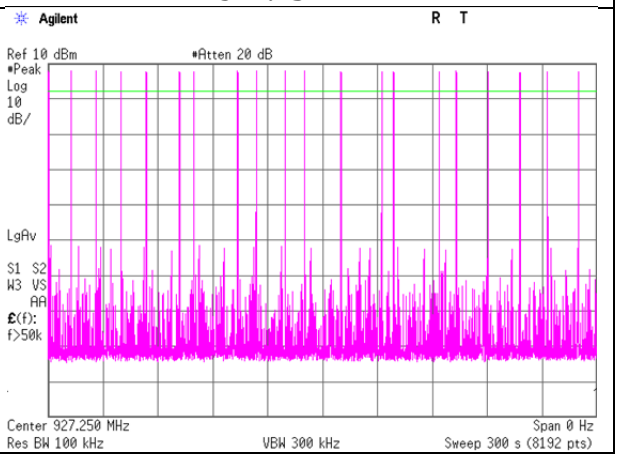
Sample Calculation
Average = Summation (Sampling 1 to 3) / 3

Dwell time

Transmit time per hop	Sampling 1/3
902.75 MHz	**902.75 MHz**
	
914.75 MHz	**914.75 MHz**
	
927.25 MHz	**927.25 MHz**
	

UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Dwell time

Sampling 2/3	Sampling 3/3
902.75 MHz	**902.75 MHz**
	
914.75 MHz	**914.75 MHz**
	
927.25 MHz	**927.25 MHz**
	

UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Maximum Peak Output Power

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx, Hopping Off Power Setting 27

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	EIRP
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]
902.75	7.47	0.32	19.42	27.21	526.02	28.00	630.96	0.79	8.00	35.21
914.75	7.53	0.32	19.42	27.27	533.33	28.00	630.96	0.73	8.00	35.27
927.25	7.37	0.32	19.42	27.11	514.04	28.00	630.96	0.89	8.00	35.11

Sample Calculation:
Result = Reading + Cable Loss (the cable customer supplied) + Attenuator Loss
EIRP = Result + Antenna Gain

*The equipment and cables were not used for factor 0 dB of the data sheets.

The conducted power limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Conducted power limit = 1 W – (Antenna gain – 6 dBi) = 30 dBm – (8 dBi – 6 dBi) = 28 dBm

Maximum Peak Output Power

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	February 9, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Tomoki Matsui
Mode	Tx, Hopping Off Power Setting 15

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	EIRP
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]
902.75	-4.01	0.32	19.42	15.73	37.41	28.00	630.96	12.27	8.00	23.73
914.75	-4.27	0.32	19.42	15.47	35.24	28.00	630.96	12.53	8.00	23.47
927.25	-4.24	0.32	19.42	15.50	35.48	28.00	630.96	12.50	8.00	23.50

Sample Calculation:
Result = Reading + Cable Loss (the cable customer supplied) + Attenuator Loss
EIRP = Result + Antenna Gain

*The equipment and cables were not used for factor 0 dB of the data sheets.

The conducted power limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Conducted power limit = 1 W – (Antenna gain – 6 dBi) = 30 dBm – (8 dBi – 6 dBi) = 28 dBm

Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx, Hopping Off Power Setting 27

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
902.75	5.80	0.32	19.42	25.54	358.10
914.75	5.87	0.32	19.42	25.61	363.92
927.25	5.74	0.32	19.42	25.48	353.18

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

	Reading	Cable Loss	Atten. Loss	Result (Time average)	
	[dBm]	[dB]	[dB]	[dBm]	[mW]
Hopping	5.54	0.32	19.42	25.28	337.29

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	February 9, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Tomoki Matsui
Mode	Tx, Hopping Off Power Setting 15

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
902.75	-5.64	0.32	19.42	14.10	25.70
914.75	-5.88	0.32	19.42	13.86	24.32
927.25	-5.91	0.32	19.42	13.83	24.15

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

	Reading	Cable Loss	Atten. Loss	Result (Time average)	
	[dBm]	[dB]	[dB]	[dBm]	[mW]
Hopping	-5.95	0.32	19.42	13.79	23.93

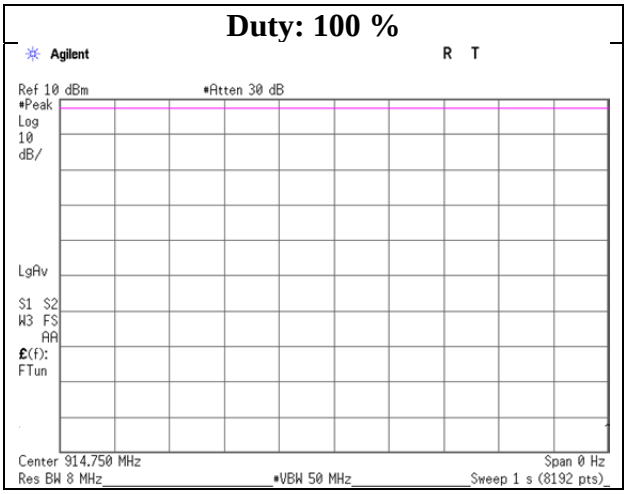
Sample Calculation:
Result (Time average) = Reading + Cable Loss (the cable customer supplied) + Attenuator Loss

*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst Rate Confirmation

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx, Hopping Off

Duty: 100 %



Radiated Spurious Emission

Test place	Ise EMC Lab.	
Report No.	11597547H	
Semi Anechoic Chamber	No.4	No.1
Date	January 18, 2017	January 19, 2017
Temperature / Humidity	20 deg. C / 28 % RH	22 deg. C / 26 % RH
Engineer	Tomoki Matsui	Tomoki Matsui
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx, Hopping Off 902.75 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	35.000	QP	21.8	15.8	27.3	32.1	-	32.8	40.0	7.2	
Hori.	51.550	QP	22.1	10.3	27.5	32.1	-	27.8	40.0	12.2	
Hori.	60.000	QP	21.8	7.4	27.7	32.1	-	24.8	40.0	15.2	
Hori.	88.000	QP	21.7	8.1	28.0	32.1	-	25.7	40.0	14.3	
Hori.	100.000	QP	21.8	10.0	28.1	32.1	-	27.8	43.5	15.7	
Hori.	150.000	QP	21.5	15.0	28.6	32.0	-	33.1	43.5	10.4	
Hori.	1805.500	PK	50.3	25.7	5.5	36.2	-	45.3	73.9	28.6	
Hori.	2708.250	PK	52.9	27.3	5.9	36.3	-	49.8	73.9	24.1	
Hori.	3611.000	PK	53.6	28.5	6.3	35.9	-	52.5	73.9	21.4	
Hori.	4513.750	PK	47.1	30.2	6.7	35.6	-	48.4	73.9	25.5	
Hori.	5416.500	PK	45.1	31.2	7.1	35.4	-	48.0	73.9	25.9	
Hori.	6319.250	PK	43.5	33.5	7.4	35.7	-	48.7	73.9	25.2	Floor noise
Hori.	7222.000	PK	44.3	35.7	7.7	35.8	-	51.9	73.9	22.0	Floor noise
Hori.	8124.750	PK	44.6	36.3	8.2	35.9	-	53.2	73.9	20.7	Floor noise
Hori.	9027.500	PK	44.2	36.7	8.3	36.1	-	53.1	73.9	20.8	Floor noise
Hori.	1805.500	AV	44.0	25.7	5.5	36.2	-	39.0	53.9	14.9	
Hori.	2708.250	AV	47.4	27.3	5.9	36.3	-	44.3	53.9	9.6	
Hori.	3611.000	AV	48.8	28.5	6.3	35.9	-	47.7	53.9	6.2	
Hori.	4513.750	AV	39.0	30.2	6.7	35.6	-	40.3	53.9	13.6	
Hori.	5416.500	AV	35.7	31.2	7.1	35.4	-	38.6	53.9	15.3	
Hori.	6319.250	AV	31.3	33.5	7.4	35.7	-	36.5	53.9	17.4	Floor noise
Hori.	7222.000	AV	32.1	35.7	7.7	35.8	-	39.7	53.9	14.2	Floor noise
Hori.	8124.750	AV	32.8	36.3	8.2	35.9	-	41.4	53.9	12.5	Floor noise
Hori.	9027.500	AV	31.9	36.7	8.3	36.1	-	40.8	53.9	13.1	Floor noise
Vert.	35.000	QP	21.8	15.8	27.3	32.1	-	32.8	40.0	7.2	
Vert.	51.550	QP	28.0	10.3	27.5	32.1	-	33.7	40.0	6.3	
Vert.	60.000	QP	22.0	7.4	27.7	32.1	-	25.0	40.0	15.0	
Vert.	88.000	QP	22.3	8.1	28.0	32.1	-	26.3	40.0	13.7	
Vert.	100.000	QP	23.5	10.0	28.1	32.1	-	29.5	43.5	14.0	
Vert.	150.000	QP	21.6	15.0	28.6	32.0	-	33.2	43.5	10.3	
Vert.	1805.500	PK	50.2	25.7	5.5	36.2	-	45.2	73.9	28.7	
Vert.	2708.250	PK	50.6	27.3	5.9	36.3	-	47.5	73.9	26.4	
Vert.	3611.000	PK	53.7	28.5	6.3	35.9	-	52.6	73.9	21.3	
Vert.	4513.750	PK	46.9	30.2	6.7	35.6	-	48.2	73.9	25.7	
Vert.	5416.500	PK	43.2	31.2	7.1	35.4	-	46.1	73.9	27.8	Floor noise
Vert.	6319.250	PK	43.5	33.5	7.4	35.7	-	48.7	73.9	25.2	Floor noise
Vert.	7222.000	PK	44.3	35.7	7.7	35.8	-	51.9	73.9	22.0	Floor noise
Vert.	8124.750	PK	44.6	36.3	8.2	35.9	-	53.2	73.9	20.7	Floor noise
Vert.	9027.500	PK	44.2	36.7	8.3	36.1	-	53.1	73.9	20.8	Floor noise
Vert.	1805.500	AV	43.8	25.7	5.5	36.2	-	38.8	53.9	15.1	
Vert.	2708.250	AV	45.0	27.3	5.9	36.3	-	41.9	53.9	12.0	
Vert.	3611.000	AV	48.8	28.5	6.3	35.9	-	47.7	53.9	6.2	
Vert.	4513.750	AV	38.2	30.2	6.7	35.6	-	39.5	53.9	14.4	
Vert.	5416.500	AV	31.9	31.2	7.1	35.4	-	34.8	53.9	19.1	Floor noise
Vert.	6319.250	AV	31.3	33.5	7.4	35.7	-	36.5	53.9	17.4	Floor noise
Vert.	7222.000	AV	32.1	35.7	7.7	35.8	-	39.7	53.9	14.2	Floor noise
Vert.	8124.750	AV	32.8	36.3	8.2	35.9	-	41.4	53.9	12.5	Floor noise
Vert.	9027.500	AV	31.9	36.7	8.3	36.1	-	40.8	53.9	13.1	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB

Radiated Spurious Emission

Test place	Ise EMC Lab.
Report No.	11597547H
Semi Anechoic Chamber	No.4
Date	January 18, 2017
Temperature / Humidity	20 deg. C / 28 % RH
Engineer	Tomoki Matsui
	(Below 1 GHz)
Mode	Tx, Hopping Off 902.75 MHz

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	902.750	PK	103.9	21.8	32.9	31.2	127.4	-	-	Carrier
Hori	902.000	PK	44.5	21.8	32.9	31.2	68.0	107.4	39.4	
Vert	902.750	PK	104.2	21.8	32.9	31.2	127.7	-	-	Carrier
Vert	902.000	PK	43.8	21.8	32.9	31.2	67.3	107.7	40.4	

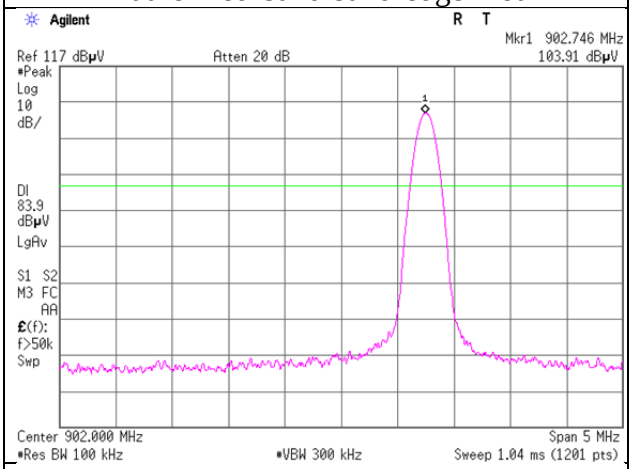
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab.
Report No.	11597547H
Semi Anechoic Chamber	No.4
Date	January 18, 2017
Temperature / Humidity	20 deg. C / 28 % RH
Engineer	Tomoki Matsui
	(Below 1 GHz)
Mode	Tx, Hopping Off 902.75 MHz

Horizontal

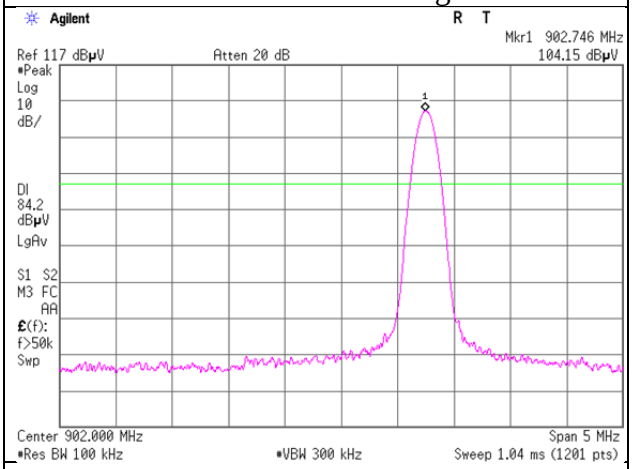
Authorized-band band-edge Plot



20dBc Plot

Vertical

Authorized-band band-edge Plot



20dBc Plot

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place	Ise EMC Lab.	
Report No.	11597547H	
Semi Anechoic Chamber	No.4	No.1
Date	January 18, 2017	January 19, 2017
Temperature / Humidity	20 deg. C / 28 % RH	22 deg. C / 26 % RH
Engineer	Tomoki Matsui (Below 1 GHz)	Tomoki Matsui (Above 1 GHz)
Mode	Tx, Hopping Off 914.75 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	35.000	QP	21.8	15.8	27.3	32.1	-	32.8	40.0	7.2	
Hori.	51.550	QP	21.9	10.3	27.5	32.1	-	27.6	40.0	12.4	
Hori.	60.000	QP	21.8	7.4	27.7	32.1	-	24.8	40.0	15.2	
Hori.	88.000	QP	21.7	8.1	28.0	32.1	-	25.7	40.0	14.3	
Hori.	100.000	QP	21.9	10.0	28.1	32.1	-	27.9	43.5	15.6	
Hori.	150.000	QP	21.6	15.0	28.6	32.0	-	33.2	43.5	10.3	
Hori.	1829.500	PK	50.6	25.8	5.5	36.2	-	45.7	73.9	28.2	
Hori.	2744.250	PK	51.0	27.4	5.9	36.3	-	48.0	73.9	25.9	
Hori.	3659.000	PK	50.0	28.5	6.3	35.9	-	48.9	73.9	25.0	
Hori.	4573.750	PK	46.5	30.3	6.8	35.6	-	48.0	73.9	25.9	
Hori.	5488.500	PK	43.5	31.2	7.2	35.4	-	46.5	73.9	27.4	Floor noise
Hori.	6403.250	PK	43.3	33.9	7.5	35.7	-	49.0	73.9	24.9	Floor noise
Hori.	7318.000	PK	43.1	35.6	7.8	35.8	-	50.7	73.9	23.2	Floor noise
Hori.	8232.750	PK	44.4	36.2	8.2	35.9	-	52.9	73.9	21.0	Floor noise
Hori.	9147.500	PK	43.2	36.8	8.4	36.1	-	52.3	73.9	21.6	Floor noise
Hori.	1829.500	AV	44.3	25.8	5.5	36.2	-	39.4	53.9	14.5	
Hori.	2744.250	AV	45.2	27.4	5.9	36.3	-	42.2	53.9	11.7	
Hori.	3659.000	AV	42.1	28.5	6.3	35.9	-	41.0	53.9	12.9	
Hori.	4573.750	AV	36.6	30.3	6.8	35.6	-	38.1	53.9	15.8	
Hori.	5488.500	AV	31.7	31.2	7.2	35.4	-	34.7	53.9	19.2	Floor noise
Hori.	6403.250	AV	31.5	33.9	7.5	35.7	-	37.2	53.9	16.7	Floor noise
Hori.	7318.000	AV	32.0	35.6	7.8	35.8	-	39.6	53.9	14.3	Floor noise
Hori.	8232.750	AV	32.1	36.2	8.2	35.9	-	40.6	53.9	13.3	Floor noise
Hori.	9147.500	AV	32.2	36.8	8.4	36.1	-	41.3	53.9	12.6	Floor noise
Vert.	35.000	QP	21.8	15.8	27.3	32.1	-	32.8	40.0	7.2	
Vert.	51.550	QP	28.1	10.3	27.5	32.1	-	33.8	40.0	6.2	
Vert.	60.000	QP	22.1	7.4	27.7	32.1	-	25.1	40.0	14.9	
Vert.	88.000	QP	22.2	8.1	28.0	32.1	-	26.2	40.0	13.8	
Vert.	100.000	QP	23.9	10.0	28.1	32.1	-	29.9	43.5	13.6	
Vert.	150.000	QP	21.7	15.0	28.6	32.0	-	33.3	43.5	10.2	
Vert.	1829.500	PK	48.5	25.8	5.5	36.2	-	43.6	73.9	30.3	
Vert.	2744.250	PK	50.9	27.4	5.9	36.3	-	47.9	73.9	26.0	
Vert.	3659.000	PK	49.7	28.5	6.3	35.9	-	48.6	73.9	25.3	
Vert.	4573.750	PK	46.2	30.3	6.8	35.6	-	47.7	73.9	26.2	
Vert.	5488.500	PK	43.5	31.2	7.2	35.4	-	46.5	73.9	27.4	Floor noise
Vert.	6403.250	PK	43.3	33.9	7.5	35.7	-	49.0	73.9	24.9	Floor noise
Vert.	7318.000	PK	43.1	35.6	7.8	35.8	-	50.7	73.9	23.2	Floor noise
Vert.	8232.750	PK	44.4	36.2	8.2	35.9	-	52.9	73.9	21.0	Floor noise
Vert.	9147.500	PK	43.2	36.8	8.4	36.1	-	52.3	73.9	21.6	Floor noise
Vert.	1829.500	AV	40.9	25.8	5.5	36.2	-	36.0	53.9	17.9	
Vert.	2744.250	AV	45.0	27.4	5.9	36.3	-	42.0	53.9	11.9	
Vert.	3659.000	AV	43.6	28.5	6.3	35.9	-	42.5	53.9	11.4	
Vert.	4573.750	AV	37.6	30.3	6.8	35.6	-	39.1	53.9	14.8	
Vert.	5488.500	AV	31.7	31.2	7.2	35.4	-	34.7	53.9	19.2	Floor noise
Vert.	6403.250	AV	31.5	33.9	7.5	35.7	-	37.2	53.9	16.7	Floor noise
Vert.	7318.000	AV	32.0	35.6	7.8	35.8	-	39.6	53.9	14.3	Floor noise
Vert.	8232.750	AV	32.1	36.2	8.2	35.9	-	40.6	53.9	13.3	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB

Radiated Spurious Emission

Test place	Ise EMC Lab.	
Report No.	11597547H	
Semi Anechoic Chamber	No.4	No.1
Date	January 18, 2017	January 19, 2017
Temperature / Humidity	20 deg. C / 28 % RH	22 deg. C / 26 % RH
Engineer	Tomoki Matsui	Tomoki Matsui
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx, Hopping Off 927.25 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	35.000	QP	21.8	15.8	27.3	32.1	-	32.8	40.0	7.2	
Hori.	51.550	QP	22.0	10.3	27.5	32.1	-	27.7	40.0	12.3	
Hori.	60.000	QP	21.9	7.4	27.7	32.1	-	24.9	40.0	15.1	
Hori.	88.000	QP	21.7	8.1	28.0	32.1	-	25.7	40.0	14.3	
Hori.	100.000	QP	21.9	10.0	28.1	32.1	-	27.9	43.5	15.6	
Hori.	150.000	QP	21.6	15.0	28.6	32.0	-	33.2	43.5	10.3	
Hori.	1854.500	PK	54.5	25.9	5.5	36.2	-	49.7	73.9	24.2	
Hori.	2781.750	PK	52.1	27.4	5.9	36.3	-	49.1	73.9	24.8	
Hori.	3709.000	PK	46.1	28.6	6.3	35.8	-	45.2	73.9	28.7	
Hori.	4636.250	PK	45.3	30.5	6.8	35.6	-	47.0	73.9	26.9	
Hori.	5563.500	PK	43.3	31.3	7.2	35.4	-	46.4	73.9	27.5	Floor noise
Hori.	6490.750	PK	43.7	34.3	7.5	35.7	-	49.8	73.9	24.1	Floor noise
Hori.	7418.000	PK	43.6	35.6	7.8	35.8	-	51.2	73.9	22.7	Floor noise
Hori.	8345.250	PK	43.7	36.1	8.2	35.9	-	52.1	73.9	21.8	Floor noise
Hori.	9272.500	PK	44.2	37.1	8.4	36.1	-	53.6	73.9	20.3	Floor noise
Hori.	1854.500	AV	49.9	25.9	5.5	36.2	-	45.1	53.9	8.8	
Hori.	2781.750	AV	47.3	27.4	5.9	36.3	-	44.3	53.9	9.6	
Hori.	3709.000	AV	36.6	28.6	6.3	35.8	-	35.7	53.9	18.2	
Hori.	4636.250	AV	35.5	30.5	6.8	35.6	-	37.2	53.9	16.7	
Hori.	5563.500	AV	31.8	31.3	7.2	35.4	-	34.9	53.9	19.0	Floor noise
Hori.	6490.750	AV	31.7	34.3	7.5	35.7	-	37.8	53.9	16.1	Floor noise
Hori.	7418.000	AV	32.1	35.6	7.8	35.8	-	39.7	53.9	14.2	Floor noise
Hori.	8345.250	AV	32.2	36.1	8.2	35.9	-	40.6	53.9	13.3	Floor noise
Hori.	9272.500	AV	32.1	37.1	8.4	36.1	-	41.5	53.9	12.4	Floor noise
Vert.	35.000	QP	21.8	15.8	27.3	32.1	-	32.8	40.0	7.2	
Vert.	51.550	QP	28.0	10.3	27.5	32.1	-	33.7	40.0	6.3	
Vert.	60.000	QP	22.1	7.4	27.7	32.1	-	25.1	40.0	14.9	
Vert.	88.000	QP	22.1	8.1	28.0	32.1	-	26.1	40.0	13.9	
Vert.	100.000	QP	23.7	10.0	28.1	32.1	-	29.7	43.5	13.8	
Vert.	150.000	QP	21.8	15.0	28.6	32.0	-	33.4	43.5	10.1	
Vert.	150.000	QP	21.7	15.0	28.6	32.0	-	33.3	43.5	10.2	
Vert.	1854.500	PK	50.9	25.9	5.5	36.2	-	46.1	73.9	27.8	
Vert.	2781.750	PK	52.2	27.4	5.9	36.3	-	49.2	73.9	24.7	
Vert.	3709.000	PK	46.2	28.6	6.3	35.8	-	45.3	73.9	28.6	
Vert.	4636.250	PK	45.6	30.5	6.8	35.6	-	47.3	73.9	26.6	
Vert.	5563.500	PK	43.3	31.3	7.2	35.4	-	46.4	73.9	27.5	Floor noise
Vert.	6490.750	PK	43.7	34.3	7.5	35.7	-	49.8	73.9	24.1	Floor noise
Vert.	7418.000	PK	43.6	35.6	7.8	35.8	-	51.2	73.9	22.7	Floor noise
Vert.	8345.250	PK	43.7	36.1	8.2	35.9	-	52.1	73.9	21.8	Floor noise
Vert.	9272.500	PK	44.2	37.1	8.4	36.1	-	53.6	73.9	20.3	Floor noise
Vert.	1854.500	AV	45.1	25.9	5.5	36.2	-	40.3	53.9	13.6	
Vert.	2781.750	AV	47.0	27.4	5.9	36.3	-	44.0	53.9	9.9	
Vert.	3709.000	AV	38.4	28.6	6.3	35.8	-	37.5	53.9	16.4	
Vert.	4636.250	AV	34.3	30.5	6.8	35.6	-	36.0	53.9	17.9	
Vert.	5563.500	AV	31.8	31.3	7.2	35.4	-	34.9	53.9	19.0	Floor noise
Vert.	6490.750	AV	31.7	34.3	7.5	35.7	-	37.8	53.9	16.1	Floor noise
Vert.	7418.000	AV	32.1	35.6	7.8	35.8	-	39.7	53.9	14.2	Floor noise
Vert.	8345.250	AV	32.2	36.1	8.2	35.9	-	40.6	53.9	13.3	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB

Radiated Spurious Emission

Test place	Ise EMC Lab.
Report No.	11597547H
Semi Anechoic Chamber	No.4
Date	January 18, 2017
Temperature / Humidity	20 deg. C / 28 % RH
Engineer	Tomoki Matsui
	(Below 1 GHz)
Mode	Tx, Hopping Off 927.25 MHz

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	927.250	PK	103.7	22.0	33.0	31.1	127.6	-	-	Carrier
Hori	928.000	PK	52.7	22.0	33.1	31.0	76.8	107.6	30.8	
Vert	927.250	PK	104.1	22.0	33.0	31.1	128.0	-	-	Carrier
Vert	928.000	PK	53.3	22.0	33.1	31.0	77.4	108.0	30.6	

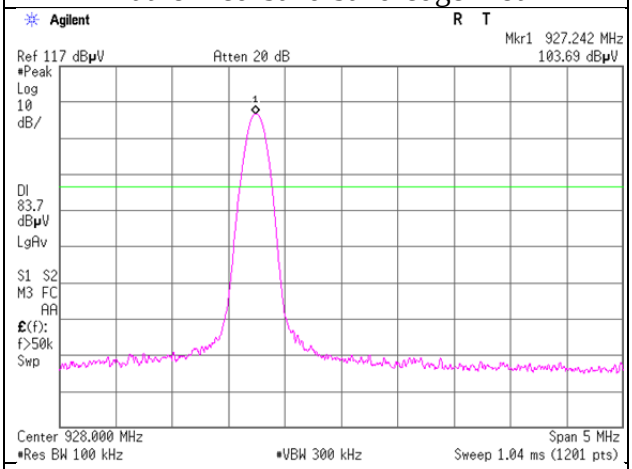
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab.
Report No.	11597547H
Semi Anechoic Chamber	No.4
Date	January 18, 2017
Temperature / Humidity	20 deg. C / 28 % RH
Engineer	Tomoki Matsui (Below 1 GHz)
Mode	Tx, Hopping Off 927.25 MHz

Horizontal

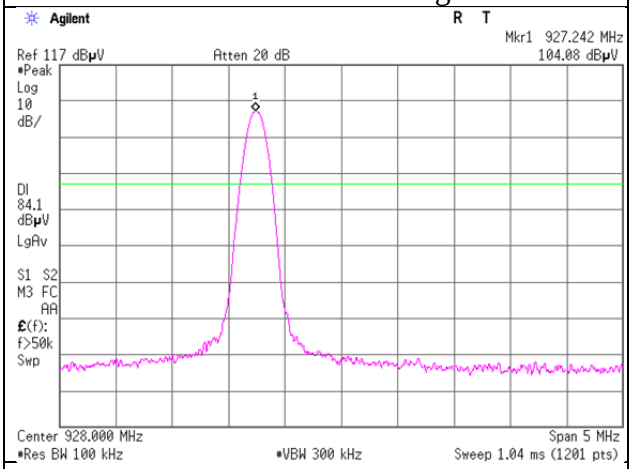
Authorized-band band-edge Plot



20dBc Plot

Vertical

Authorized-band band-edge Plot

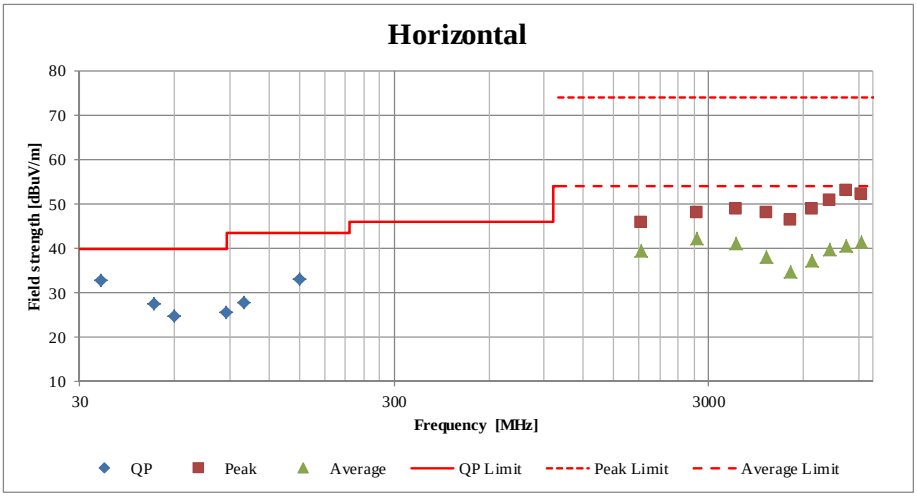


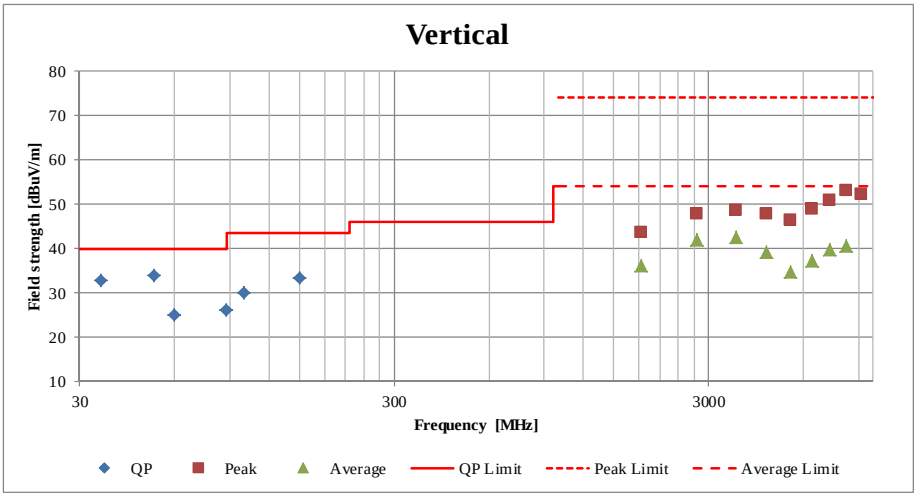
20dBc Plot

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Ise EMC Lab.	
Report No.	11597547H	
Semi Anechoic Chamber	No.4	No.1
Date	January 18, 2017	January 19, 2017
Temperature / Humidity	20 deg. C / 28 % RH	22 deg. C / 26 % RH
Engineer	Tomoki Matsui (Below 1GHz)	Tomoki Matsui (Above 1GHz)
Mode	Tx, Hopping Off 914.75MHz	





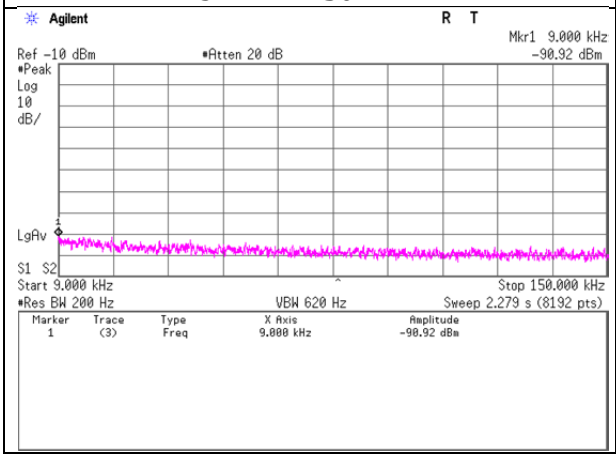
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

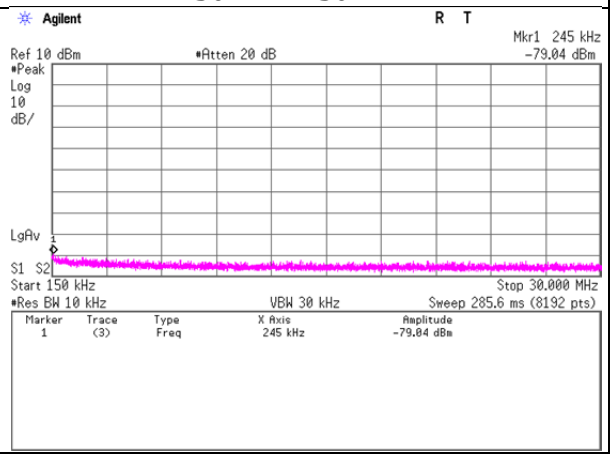
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx, Hopping Off

902.75 MHz

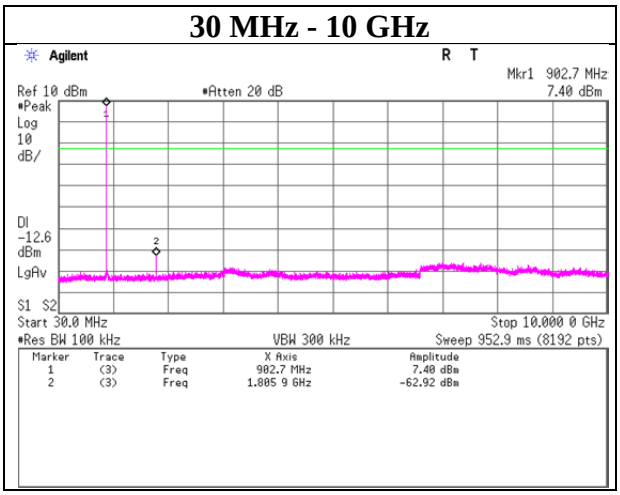
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 10 GHz

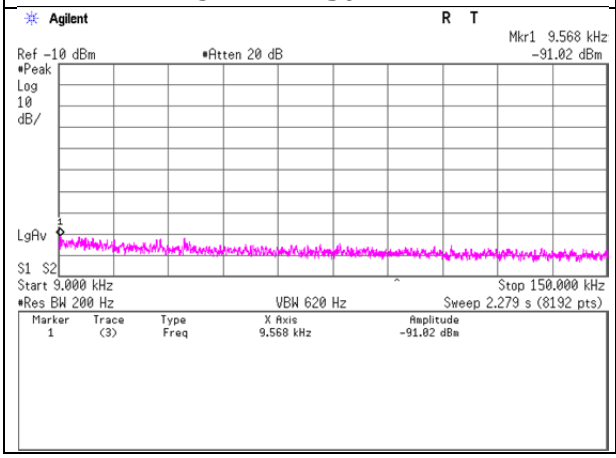


Conducted Spurious Emission

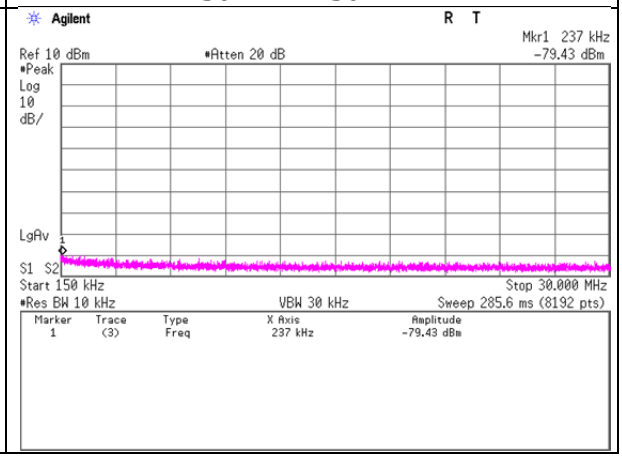
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx, Hopping Off

914.75 MHz

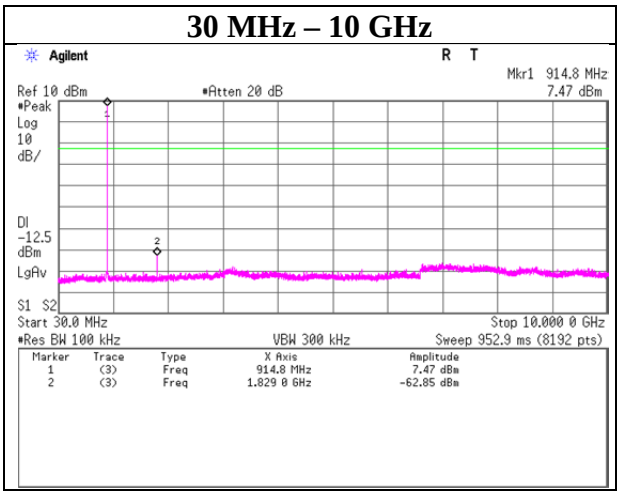
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 10 GHz

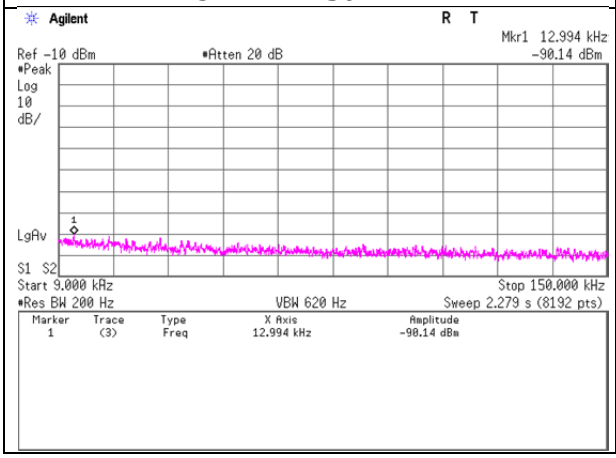


Conducted Spurious Emission

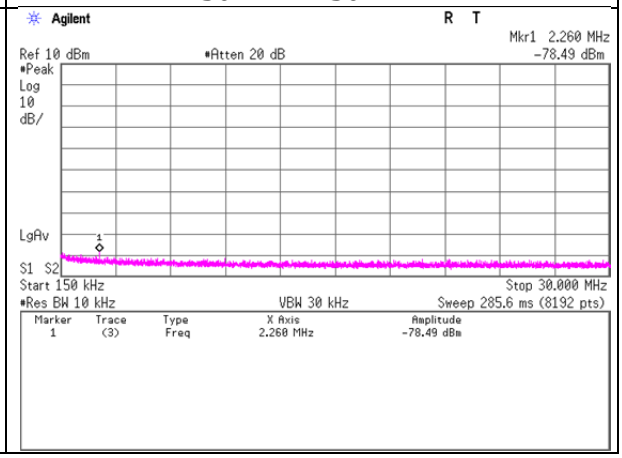
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx, Hopping Off

927.25 MHz

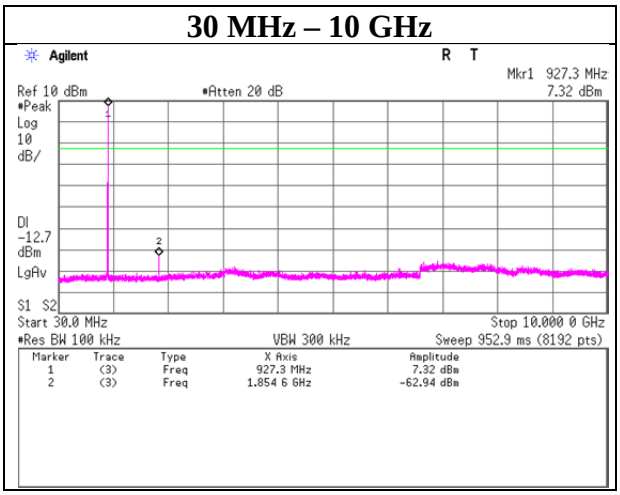
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 10 GHz

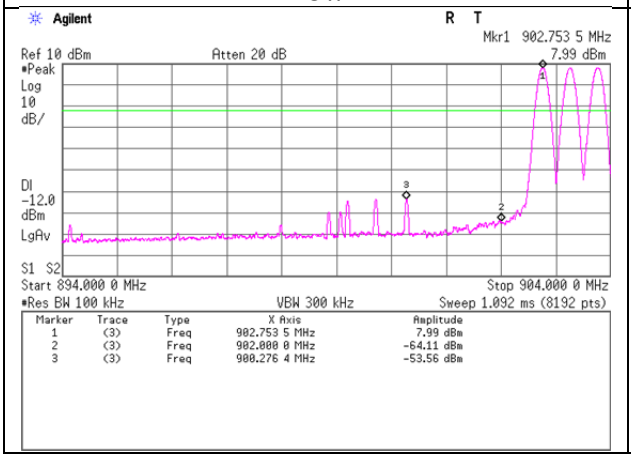


Conducted Emission Band Edge compliance

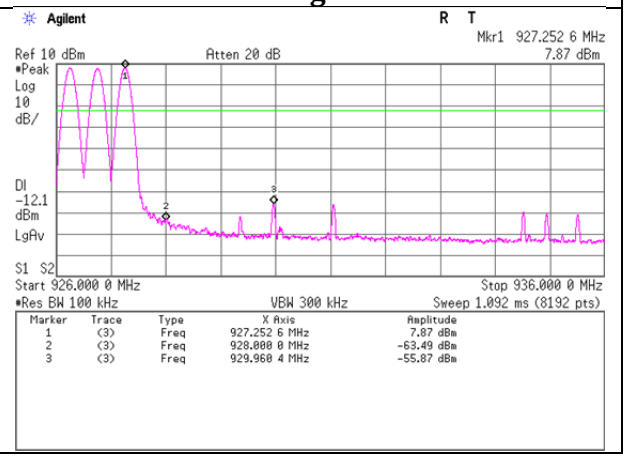
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx

Hopping On

Low

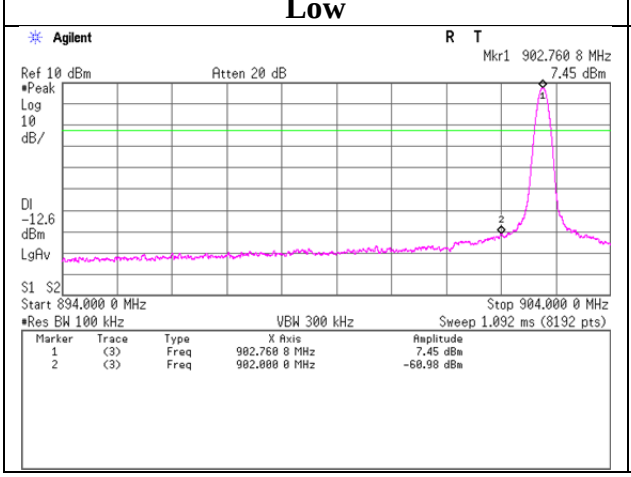


High

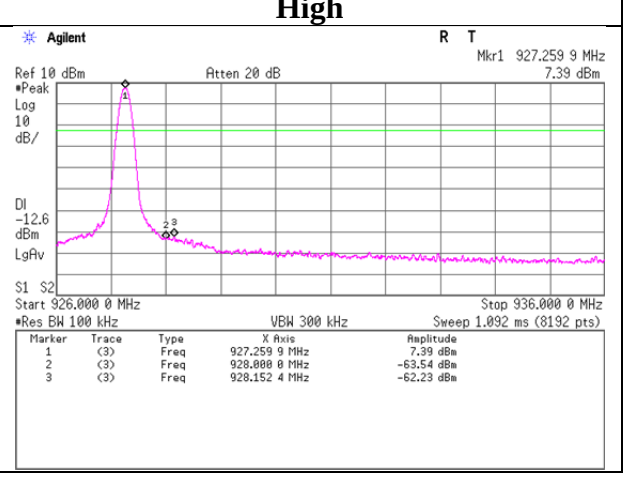


Hopping Off

Low



High

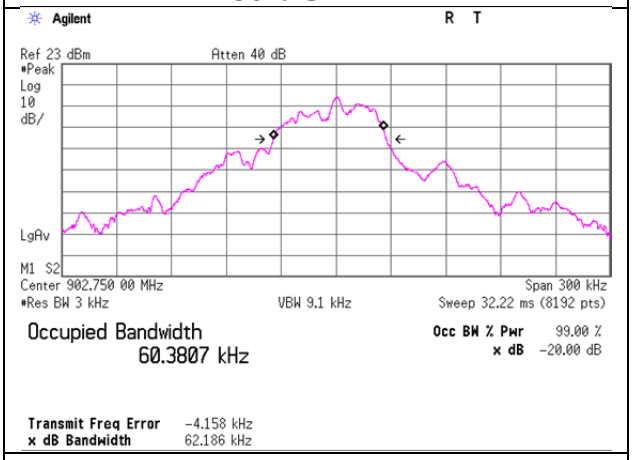


99%Occupied Bandwidth

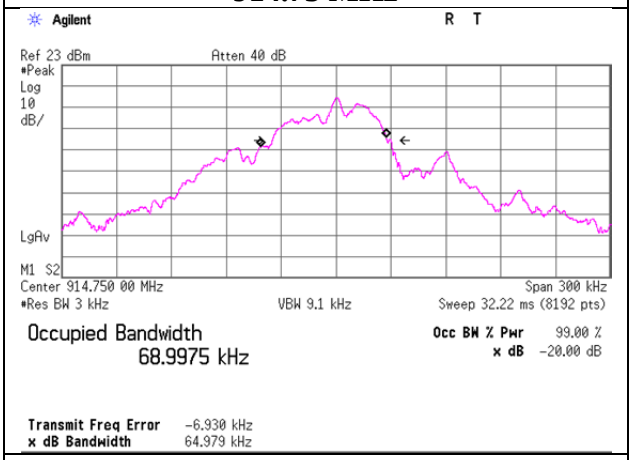
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx Hopping Off

Hopping Off

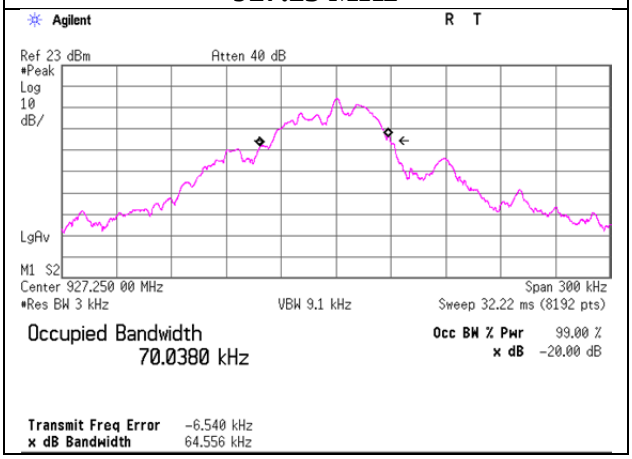
902.75 MHz



914.75 MHz



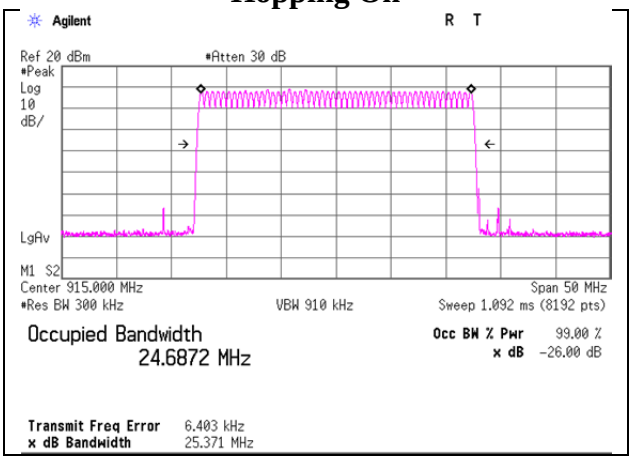
927.25 MHz



99% Occupied Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11597547H
Date	January 25, 2017
Temperature / Humidity	23 deg. C / 27 % RH
Engineer	Hironobu Ohnishi
Mode	Tx Hopping On

Hopping On



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	CE	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	CE	2016/12/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	CE/RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	CE	2016/05/19 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE	2016/10/21 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2016/07/07 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(AE)	2016/07/11 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2016/12/24 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2016/02/08 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/12/21 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	CE	2016/08/23 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2016/10/19 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2016/01/21 * 12 *1)
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	RE	2016/01/29 * 12 *1)
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2016/11/23 * 12
MLA-23	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	RE	2016/01/30 * 12 *1)
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2016/06/20 * 12
MAT-97	Attenuator	KEYSIGHT	8491A	MY52462282	RE	2016/10/31 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2016/03/18 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2016/01/18 * 12 *1)
MAT-17	Attenuator(20dB)_DC-1 GHz_N	Weinschel Corp	MODEL 1	BG0143	RE	2016/12/24 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2016/09/30 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2016/01/21 * 12 *1)
MJM-25	Measure	KOMELON	KMC-36	-	RE	-
MHA-05	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	253	RE	2016/05/29 * 12
MPA-01	Pre Amplifier	Agilent	8449B	3008A01671	RE	2016/02/26 * 12
MCC-217	Microwave Cable	Junkosha	MWX221	1604S254(1 m) / 1608S088(5 m)	RE	2016/08/29 * 12
MMM-03	Digital Tester	Fluke	FLUKE 26-3	78030621	RE	2016/08/23 * 12
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE	2016/10/14 * 12
MHF-27	High Pass Filter(1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	RE	2017/01/16 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2017/01/20 * 12
MMM-12	DIGITAL HiTESTER	Hioki	3805	060500120	AT	2016/02/23 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2016/06/06 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2016/06/06 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2016/08/17 * 12
MAT-79	Attenuator	RF-LAMBDA	RFS50G26B20MF	14011401	AT	2016/02/23 * 12

***1) This test equipment was used for the tests before the expiration date of the calibration.**

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 test,
RE: Radiated Emission test,
AT: Antenna Terminal Conducted test