EMI TEST REPORT

Test Report No. : 11158941H-A

Applicant	:	**DENSO CORPORATION**
Type of Equipment	:	**Remote Keyless Entry System and TPMS (Receiver)**
Model No.	:	**23AAY**
FCC ID	:	**HYQ23AAY**
Test regulation	:	**FCC Part 15 Subpart B: 2015**
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 limits of the above regulation.
4. The test results in this test 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 EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)

Date of test: February 24 to 25, 2016

Representative test engineer: T. Shimada
Takumi Shimada
Engineer
Consumer Technology Division

Approved by: M. Imura
Motoya Imura
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/

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

REVISION HISTORY

Original Test Report No.: 11158941H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11158941H-A	March 11, 2016	-	-

CONTENTS PAGE

SECTION 1: Customer information

Company Name	:	DENSO CORPORATION
Address	:	1-1, Showa-cho, Kariya-shi, Aichi-ken, 448-8661, Japan
Telephone Number	:	+81-566-20-3953
Facsimile Number	:	+81-566-25-4837
Contact Person	:	MASASHI URABE

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

2.1 Identification of E.U.T.

Type of Equipment	:	Remote Keyless Entry System and TPMS (Receiver)
Model No.	:	23AAY
Serial No.	:	Refer to Section 4, Clause 4.2
Receipt Date of Sample	:	February 8, 2016
Country of Mass-production	:	Japan, United States of America
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 No: 23AAY (referred to as the EUT in this report) is the Remote Keyless Entry System and TPMS (Receiver). 23AAY has 15 variations. For details of variations, see “Theory of Operation”.

Feature of EUT:
<RKES mode>
RKE System is mainly used for locking or unlocking the doors of the vehicle. The transmitter sends a radio wave signal, while the button is pushed. The receiver becomes active in response to the signal from the transmitter.

<TPMS mode>
Tire Pressure Monitoring System is used for monitoring and indicating information of air pressure in vehicle’s tires.
Transmitter sends receiver the data that informs air pressure in vehicle’s tire to the receiver.
The data also includes the information of temperature, battery voltage and identity code of transmitter.
The receiver judges the data, and if the data of air pressure and others is not in a normal condition, the receiver sends signal to a warning lamp. Then, the warning lamp warns drivers.

Type of receiving system	:	Super-heterodyne
Frequency of Operation	:	RKES (CH1): 314.35 MHz RKES (CH2): 312.10 MHz TPMS: 314.98 MHz
Oscillator Frequency	:	25.2 MHz (Crystal)
Type of Modulation	:	RKES: FSK (F1D) TPMS: FSK (F1D)
Power Supply	:	DC 12.0 V
Antenna Type	:	ANT1: Internal antenna (Inverse F antenna / Inverse L antenna) ANT2: External antenna (Connector)

Note:
RKES: Remote Keyless Entry System
TPMS: Tire Pressure Monitoring System

SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart B: 2015, final revised on November 23, 2015
*Some parts are effective on and after December 17, 2015 or December 23, 2015.
The revision does not affect the test specification applied to the EUT.

Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result
Conducted emission	**FCC:** ANSI C63.4: 2014 7. AC powerline conducted emission measurements **IC:** RSS-Gen 8.8	Class B	N/A *1)	N/A	N/A
Radiated emission	**FCC:** ANSI C63.4: 2014 8. Radiated emission measurements **IC:** RSS-Gen 7	Class B	N/A	15.4 dB 608.160 MHz Vertical, QP	Complied
Antenna Terminal	**FCC:** ANSI C63.4: 2014 12. Measurement of unintentional radiators other than ITE **IC:** RSS-Gen 7	Receiver	N/A	32.8 dB 304.080 MHz PK	Complied
*Note: UL Japan, Inc's EMI Work Procedure 13-EM-W0420. *1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.					

3.3 Addition to standard

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

*Measurement distance

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(±dB)		(10 m*)(±dB)	
	30 – 300 MHz	300 – 1000MHz	30 – 300 MHz	300 – 1000MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	4.5 dB	5.9 dB	4.8 dB	5.1 dB

Radiated emission				
(3 m*)(±dB)		(1 m*)(±dB)	(0.5 m*)(±dB)	(10 m*)(±dB)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.1 dB	5.3 dB	5.1 dB	5.1 dB	5.3 dB

Antenna terminal conducted emission and Power density (±dB)			Antenna terminal conducted emission (±dB)	
Below 1 GHz	1 GHz - 3 GHz	3 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz- 40 GHz
1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB

Radiated emission test(3m)
The data listed in this test report has enough margin, more than the site margin.

Antenna terminal conducted 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

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

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

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating modes

The mode used: 1. RKES Receiving mode (314.35 MHz)
2. RKES Receiving mode (312.10 MHz)
3. TPMS Receiving mode (314.98 MHz)

* Refer to the table in "Theory of Operation_Variation_23AAY" for test mode.

Regarding RKES Receiving mode (314.35 MHz / 312.10 MHz), internal antenna receiving was tested with Variation No. 2, because Variation No. 2 had the highest emission level compared to the other representative variants (Variation No. 2, 3, 5, 8, 11 and 14) of the table in "Theory of Operation".

Regarding TPMS Receiving mode (314.98 MHz), internal antenna receiving was tested with Variation No. 2 which was the worst-variation of RKES Receiving mode.

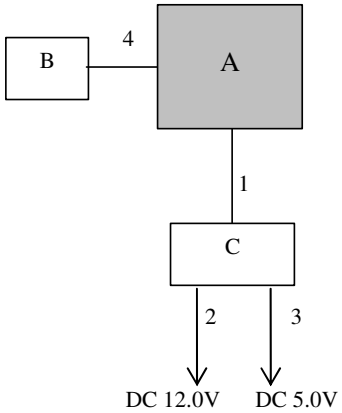
Also, external antenna receiving (Test mode 1, 2, 3) was tested with Variation No. 3 as representative, because there was no difference in circuit construction by variations.

Among Variation No.1 to 15,

- the difference due to the feeding point and antenna variation of the internal antenna was confirmed with Variation No. 2, 3, 5, 8, 11, and 14.
- regarding External antenna, variants with External antenna were tested, which were the worst condition for EMI.

As a result, enough margin for the limit was observed.

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Remote Keyless Entry System and TPMS (Receiver)	23AAY	001 (Variation No. 2) *1)	DENSO CORPORATION	EUT
			002 (Variation No. 3)		
			003 (Variation No. 5)		
			004 (Variation No. 8)		
			005 (Variation No. 11)		
			006 (Variation No. 14)		
B	External Antenna	-	4G26	DENSO CORPORATION	-
C	Checker	-	3	DENSO CORPORATION	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	1.0	Unshielded	Unshielded	-
2	DC Cable	1.1	Unshielded	Unshielded	-
3	DC Cable	2.5	Unshielded	Unshielded	-
4	Antenna Cable	1.8	Shielded	Shielded	-

*1) **Variations owing to antenna matching (Inverse F Antenna Type)** *See " Theory of Operation" for details.
TYPE1 which was used for the tests has 306 "Nothing" and 307 "Nothing".
The result of Radiated emission test was mainly from characteristics of Local Oscillator.
If the range of 306, 307, 308 and 309 becomes "Capacitor 0.1 - 1000pF", or "Inductor 1 - 100nH", there is no influence on the result of Radiated emission test.

SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No. 4 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

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 EUT was set on the edge of the tabletop.
Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.
Photographs of the set up are shown in Appendix 3.

5.3 Test conditions

Frequency range : 30 MHz - 300 MHz (Biconical antenna) / 300 MHz - 1000 MHz (Logperiodic antenna)
1000 MHz - 2000 MHz (Horn antenna)
Test distance : 3 m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

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 intensity.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver.
The radiated emission measurements were made with the following detector function of the Test Receiver.

Frequency	Below 1 GHz	Above 1 GHz
Instrument used	Test Receiver	Test Receiver
IF Bandwidth	QP: BW 120 kHz	PK: BW 1 MHz, CISPR AV: BW 1 MHz

- The 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.

5.5 Test result

Summary of the test results: Pass

Date:	February 23, 2016	Test engineer:	Takumi Shimada
	February 24, 2016		Satofumi Matsuyama and Hiroyuki Furutaka
	February 25, 2016		Satofumi Matsuyama

SECTION 6: Antenna Terminal

6.1 Operating environment

Test place : No.3 semi anechoic chamber
Temperature : See data
Humidity : See data

6.2 Test configuration

EUT was placed on a wooden table of nominal size, 1.0 m by 1.5 m, raised 0.8 m from the ground.

6.3 Test conditions

Frequency range : 30 MHz - 1000 MHz / 1000 MHz - 2000 MHz
Test distance : N/A
EUT position : Table top
EUT operation mode : See Clause 4.1

6.4 Test procedure

The Antenna Terminal was measured with a spectrum analyzer connected to the antenna port.

Frequency	Below 1 GHz	Above 1 GHz
Instrument used	Spectrum Analyzer	Spectrum Analyzer
IF Bandwidth	PK: RBW:100 kHz/VBW: 100 kHz	PK: RBW:1 MHz/VBW: 3 MHz

6.5 Test result

Summary of the test results: Pass

Date: February 25, 2016 Test engineer: Hiroyuki Furutaka

APPENDIX 1: Test data

Radiated Emission

RKES (314.35MHz) Variation No. 2 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

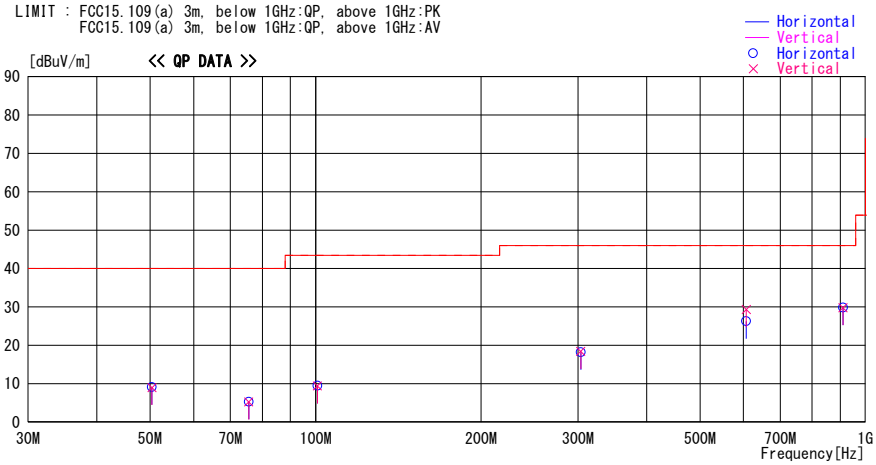
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 25deg. C / 40% RH
Engineer : Satofumi Matsuyama

Mode / Remarks : RKES Rx 314.35MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
50.400	23.1	QP	10.5	-24.6	9.0	0	100	Vert.	40.0	31.0	No Signal
50.400	23.2	QP	10.5	-24.6	9.1	0	300	Hori.	40.0	30.9	No Signal
75.600	23.0	QP	6.4	-24.2	5.2	0	100	Vert.	40.0	34.8	No Signal
75.600	23.1	QP	6.4	-24.2	5.3	0	300	Hori.	40.0	34.7	No Signal
100.800	23.3	QP	10.1	-24.0	9.4	0	100	Vert.	43.5	34.1	No Signal
100.800	23.4	QP	10.1	-24.0	9.5	0	300	Hori.	43.5	34.0	No Signal
303.450	22.6	QP	17.7	-21.9	18.4	0	100	Vert.	46.0	27.6	No Signal
303.450	22.4	QP	17.7	-21.9	18.2	0	100	Hori.	46.0	27.8	No Signal
606.900	26.0	QP	20.6	-20.3	26.3	139	100	Hori.	46.0	19.7	
606.900	29.0	QP	20.6	-20.3	29.3	188	100	Vert.	46.0	16.7	
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Hori.	46.0	16.2	No Signal
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Vert.	46.0	16.2	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

RKES (314.35MHz) Variation No. 2 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

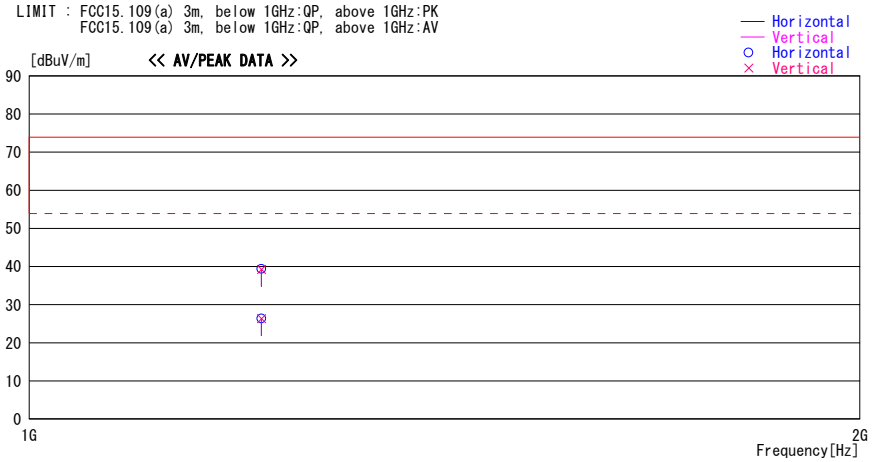
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/23

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 314.35MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1213.800	44.0	PK	24.9	-29.5	39.4	0	100	Hori.	73.9	34.5	
1213.800	43.8	PK	24.9	-29.5	39.2	0	100	Vert.	73.9	34.7	
1213.800	31.0	AV	24.9	-29.5	26.4	0	100	Hori.	53.9	27.5	
1213.800	31.0	AV	24.9	-29.5	26.4	0	100	Vert.	53.9	27.5	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

RKES (312.10MHz) Variation No. 2 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

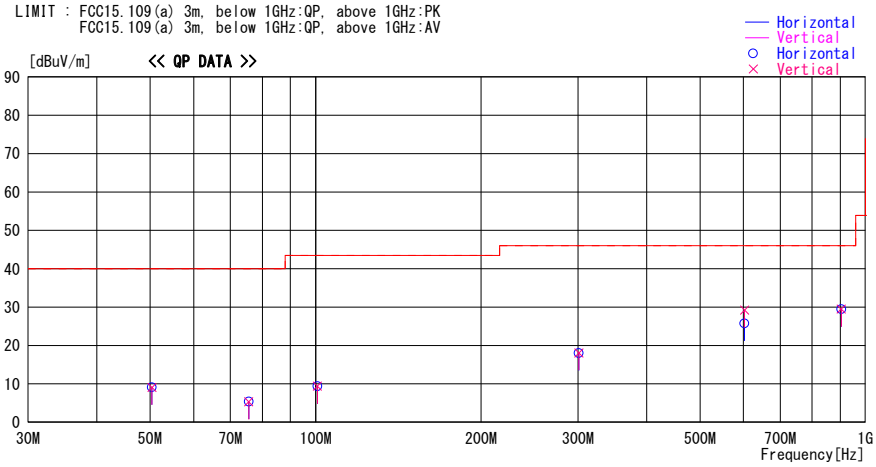
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 40% RH
Engineer : Satofumi Matsuyama

Mode / Remarks : RKES Rx312.10MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
50.400	23.2	QP	10.5	-24.6	9.1	0	100	Vert.	40.0	30.9	No Signal
50.400	23.2	QP	10.5	-24.6	9.1	0	300	Hori.	40.0	30.9	No Signal
75.600	23.1	QP	6.4	-24.2	5.3	0	100	Vert.	40.0	34.7	No Signal
75.600	23.2	QP	6.4	-24.2	5.4	0	300	Hori.	40.0	34.6	No Signal
100.800	23.3	QP	10.1	-24.0	9.4	0	100	Vert.	43.5	34.1	No Signal
100.800	23.3	QP	10.1	-24.0	9.4	0	300	Hori.	43.5	34.1	No Signal
301.200	22.4	QP	17.6	-21.9	18.1	0	100	Vert.	46.0	27.9	No Signal
301.200	22.3	QP	17.6	-21.9	18.0	0	100	Hori.	46.0	28.0	No Signal
602.400	25.5	QP	20.5	-20.3	25.7	143	100	Hori.	46.0	20.3	
602.400	29.0	QP	20.5	-20.3	29.2	187	100	Vert.	46.0	16.8	
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Hori.	46.0	16.5	No Signal
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Vert.	46.0	16.5	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

RKES (312.10MHz) Variation No. 2 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

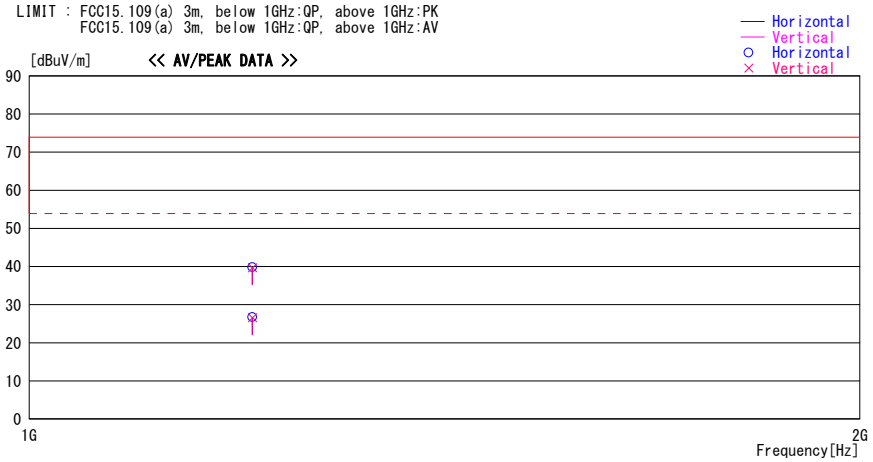
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/23

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 312.10MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1204.800	44.5	PK	24.8	-29.5	39.8	0	100	Hori.	73.9	34.1	
1204.800	44.4	PK	24.8	-29.5	39.7	0	100	Vert.	73.9	34.2	
1204.800	31.4	AV	24.8	-29.5	26.7	0	100	Hori.	53.9	27.2	
1204.800	31.3	AV	24.8	-29.5	26.6	0	100	Vert.	53.9	27.3	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

TPMS (314.98MHz) Variation No. 2 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

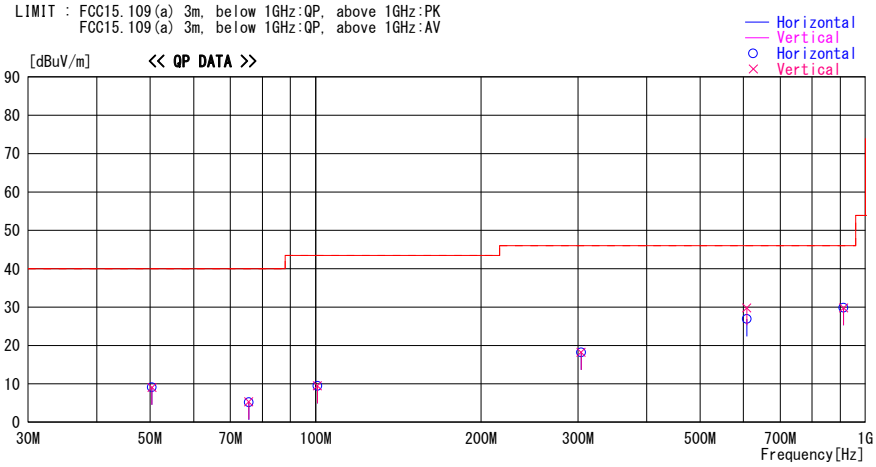
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 25deg. C / 40% RH
Engineer : Satofumi Matsuyama

Mode / Remarks : TPMS Rx 314.98MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
50.400	23.2	QP	10.5	-24.6	9.1	0	100	Vert.	40.0	30.9	No Signal
50.400	23.2	QP	10.5	-24.6	9.1	0	300	Hori.	40.0	30.9	No Signal
75.600	23.1	QP	6.4	-24.2	5.3	0	100	Vert.	40.0	34.7	No Signal
75.600	23.0	QP	6.4	-24.2	5.2	0	300	Hori.	40.0	34.8	No Signal
100.800	23.4	QP	10.1	-24.0	9.5	0	100	Vert.	43.5	34.0	No Signal
100.800	23.4	QP	10.1	-24.0	9.5	0	300	Hori.	43.5	34.0	No Signal
304.080	22.4	QP	17.7	-21.9	18.2	0	100	Vert.	46.0	27.8	No Signal
304.080	22.4	QP	17.7	-21.9	18.2	0	100	Hori.	46.0	27.8	No Signal
608.160	26.6	QP	20.6	-20.3	26.9	135	100	Hori.	46.0	19.1	
608.160	29.5	QP	20.6	-20.3	29.8	190	103	Vert.	46.0	16.2	
912.240	23.0	QP	24.5	-17.7	29.8	0	100	Hori.	46.0	16.2	No Signal
912.240	23.0	QP	24.5	-17.7	29.8	0	100	Vert.	46.0	16.2	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

TPMS (314.98MHz) Variation No. 2 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

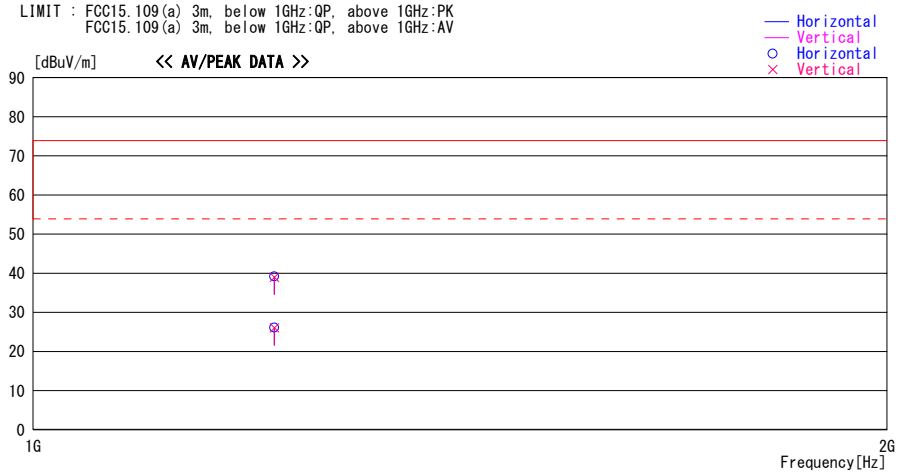
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 25deg. C / 33% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : TPMS Rx 314.98MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1216.320	43.7	PK	24.9	-29.4	39.2	0	100	Hori.	73.9	34.7	
1216.320	30.6	AV	24.9	-29.4	26.1	0	100	Hori.	53.9	27.8	
1216.320	43.5	PK	24.9	-29.4	39.0	0	100	Vert.	73.9	34.9	
1216.320	30.6	AV	24.9	-29.4	26.1	0	100	Vert.	53.9	27.8	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

RKES (314.35MHz) Variation No. 3 External Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

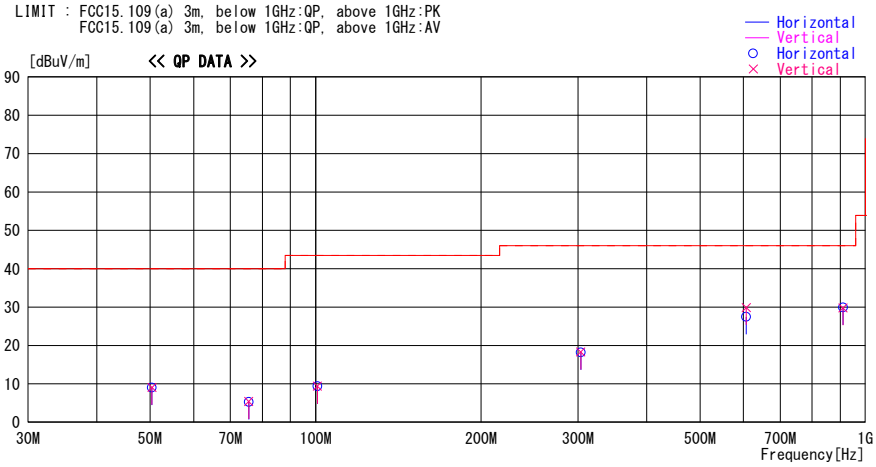
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 40% RH
Engineer : Satofumi Matsuyama

Mode / Remarks : RKES Rx 314.35MHz Ext-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
50.400	23.2	QP	10.5	-24.6	9.1	0	100	Vert.	40.0	30.9	No Signal
50.400	23.1	QP	10.5	-24.6	9.0	0	300	Hori.	40.0	31.0	No Signal
75.600	23.2	QP	6.4	-24.2	5.4	0	100	Vert.	40.0	34.6	No Signal
75.600	23.1	QP	6.4	-24.2	5.3	0	300	Hori.	40.0	34.7	No Signal
100.800	23.3	QP	10.1	-24.0	9.4	0	100	Vert.	43.5	34.1	No Signal
100.800	23.3	QP	10.1	-24.0	9.4	0	300	Hori.	43.5	34.1	No Signal
303.450	22.5	QP	17.7	-21.9	18.3	0	100	Vert.	46.0	27.7	No Signal
303.450	22.4	QP	17.7	-21.9	18.2	0	100	Hori.	46.0	27.8	No Signal
606.900	27.2	QP	20.6	-20.3	27.5	144	100	Hori.	46.0	18.5	
606.900	29.6	QP	20.6	-20.3	29.9	205	100	Vert.	46.0	16.1	
910.350	23.1	QP	24.5	-17.7	29.9	0	100	Hori.	46.0	16.1	No Signal
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Vert.	46.0	16.2	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

RKES (314.35MHz) Variation No. 3 External Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

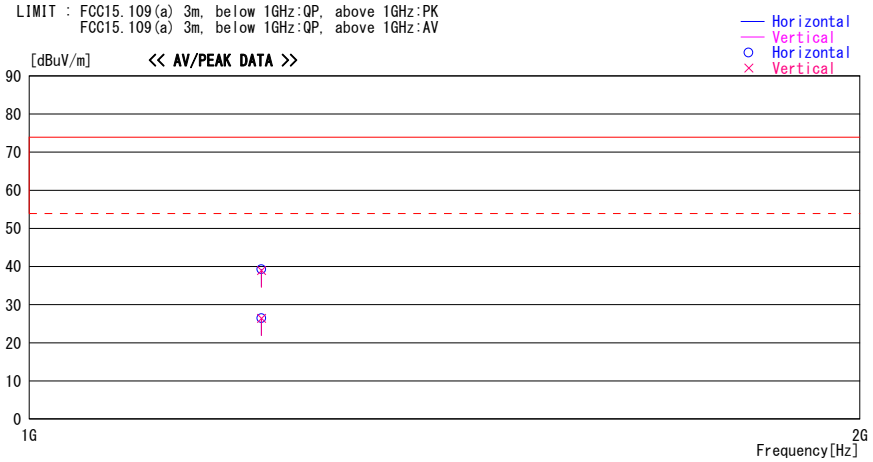
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 314.35MHz EXT-ANT Worst axis (Hori:X, Ver:X) EXT-ANT (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1213.800	43.9	PK	24.9	-29.5	39.3	0	100	Hori.	73.9	34.6	
1213.800	43.6	PK	24.9	-29.5	39.0	0	100	Vert.	73.9	34.9	
1213.800	31.1	AV	24.9	-29.5	26.5	0	100	Hori.	53.9	27.4	
1213.800	31.0	AV	24.9	-29.5	26.4	0	100	Vert.	53.9	27.5	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

RKES (312.10MHz) Variation No. 3 External Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

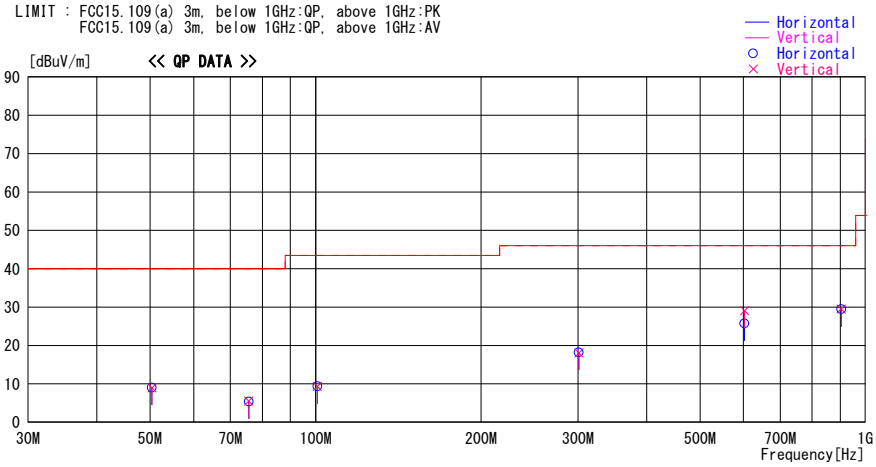
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 40% RH
Engineer : Satofumi Matsuyama

Mode / Remarks : RKES Rx312.10MHz Ext-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
50.400	23.1	QP	10.5	-24.6	9.0	0	100	Vert.	40.0	31.0	No Signal
50.400	23.1	QP	10.5	-24.6	9.0	0	300	Hori.	40.0	31.0	No Signal
75.600	23.3	QP	6.4	-24.2	5.5	0	100	Vert.	40.0	34.5	No Signal
75.600	23.2	QP	6.4	-24.2	5.4	0	300	Hori.	40.0	34.6	No Signal
100.800	23.2	QP	10.1	-24.0	9.3	0	100	Vert.	43.5	34.2	No Signal
100.800	23.3	QP	10.1	-24.0	9.4	0	300	Hori.	43.5	34.1	No Signal
301.200	22.4	QP	17.6	-21.9	18.1	0	100	Vert.	46.0	27.9	No Signal
301.200	22.5	QP	17.6	-21.9	18.2	0	100	Hori.	46.0	27.8	No Signal
602.400	25.5	QP	20.5	-20.3	25.7	150	100	Hori.	46.0	20.3	
602.400	28.9	QP	20.5	-20.3	29.1	192	100	Vert.	46.0	16.9	
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Hori.	46.0	16.5	No Signal
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Vert.	46.0	16.5	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

RKES (312.10MHz) Variation No. 3 External Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

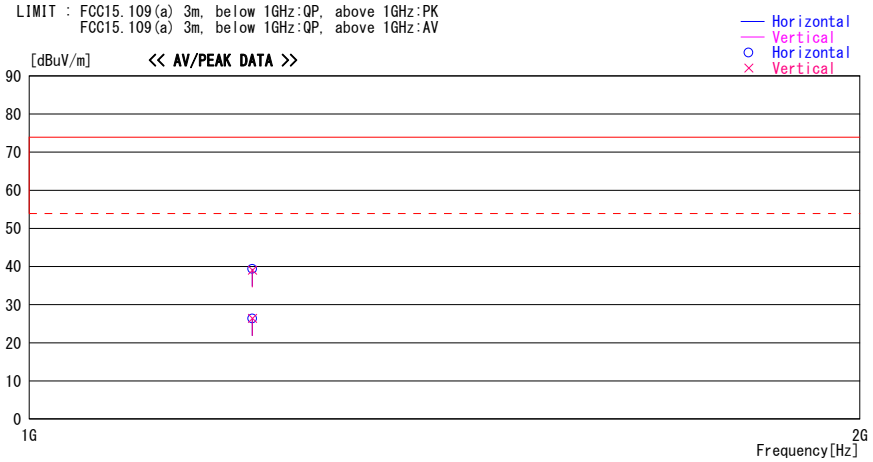
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 312.10MHz EXT-ANT Worst axis (Hori:X, Ver:X) EXT-ANT (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1204.800	44.1	PK	24.8	-29.5	39.4	0	100	Hori.	73.9	34.5	
1204.800	43.8	PK	24.8	-29.5	39.1	0	100	Vert.	73.9	34.8	
1204.800	31.1	AV	24.8	-29.5	26.4	0	100	Hori.	53.9	27.5	
1204.800	31.1	AV	24.8	-29.5	26.4	0	100	Vert.	53.9	27.5	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

TPMS (314.98MHz) Variation No. 3 External Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

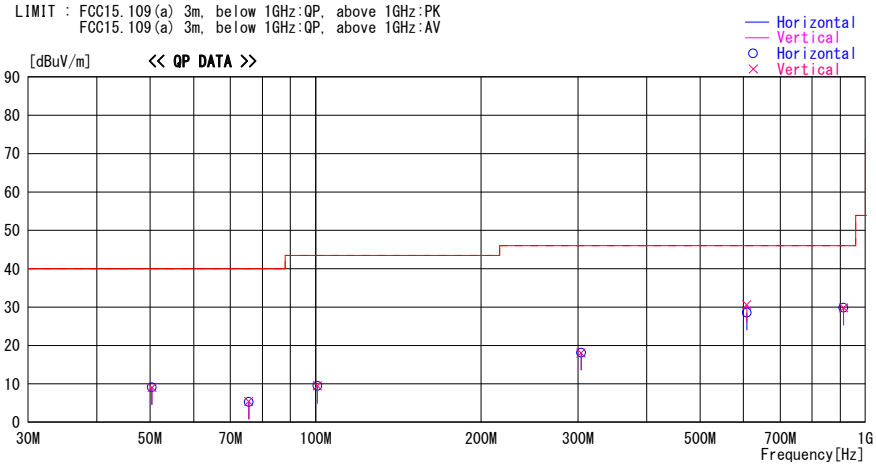
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 25deg. C / 40% RH
Engineer : Satofumi Matsuyama

Mode / Remarks : TPMS Rx 314.98MHz Ext-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
50.400	23.2	QP	10.5	-24.6	9.1	0	100	Vert.	40.0	30.9	No Signal
50.400	23.2	QP	10.5	-24.6	9.1	0	300	Hori.	40.0	30.9	No Signal
75.600	23.2	QP	6.4	-24.2	5.4	0	100	Vert.	40.0	34.6	No Signal
75.600	23.1	QP	6.4	-24.2	5.3	0	300	Hori.	40.0	34.7	No Signal
100.800	23.4	QP	10.1	-24.0	9.5	0	100	Vert.	43.5	34.0	No Signal
100.800	23.4	QP	10.1	-24.0	9.5	0	300	Hori.	43.5	34.0	No Signal
304.080	22.3	QP	17.7	-21.9	18.1	0	100	Vert.	46.0	27.9	No Signal
304.080	22.3	QP	17.7	-21.9	18.1	0	100	Hori.	46.0	27.9	No Signal
608.160	28.3	QP	20.6	-20.3	28.6	148	100	Hori.	46.0	17.4	
608.160	30.3	QP	20.6	-20.3	30.6	202	106	Vert.	46.0	15.4	
912.240	23.0	QP	24.5	-17.7	29.8	0	100	Hori.	46.0	16.2	No Signal
912.240	23.0	QP	24.5	-17.7	29.8	0	100	Vert.	46.0	16.2	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission

TPMS (314.98MHz) Variation No. 3 External Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

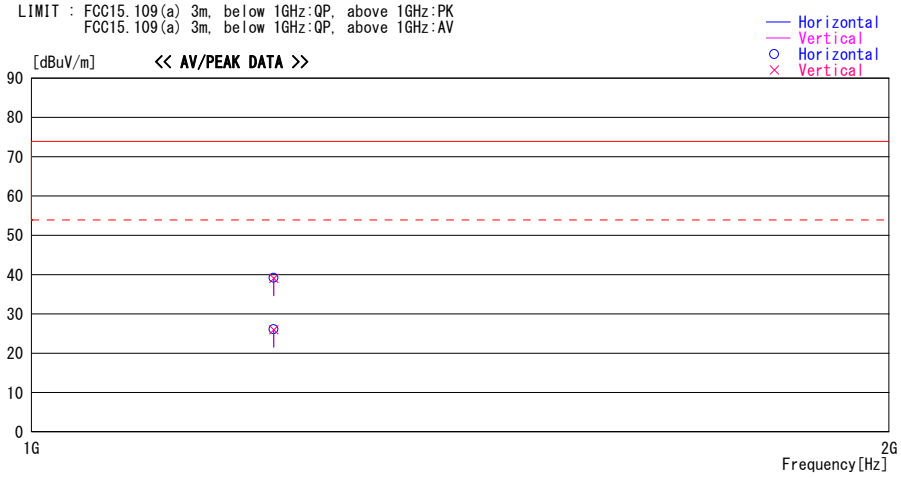
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 25deg. C / 33% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : TPMS Rx 314.98MHz EXT-ANT Worst axis (Hori:X, Ver:X) EXT-ANT (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1216.320	43.7	PK	24.9	-29.4	39.2	0	100	Hori.	73.9	34.7	
1216.320	30.6	AV	24.9	-29.4	26.1	0	100	Hori.	53.9	27.8	
1216.320	43.6	PK	24.9	-29.4	39.1	0	100	Vert.	73.9	34.8	
1216.320	30.5	AV	24.9	-29.4	26.0	0	100	Vert.	53.9	27.9	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Antenna Terminal Conducted Emission

RKES (314.35MHz) Variation No. 3 External Antenna
(Below 1GHz)

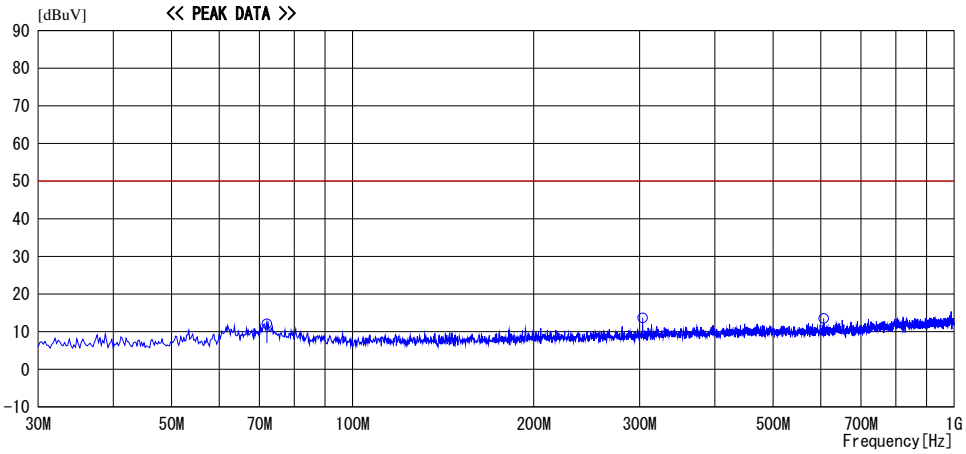
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 02/25/2016

Report No. : 11158941H

Temp./Humi. : 24deg. C / 36% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : RKES Rx 314.35MHz External Antenna

LIMIT : FCC15.111 Antenna terminal measurement
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV]	Angle [Deg]	Height [cm]	Polar.	Limit *1) [dBuV]	Margin [dB]	Comment
72.000	32.3	PK	0.0	-20.2	12.1	0	100	-	50.0	37.9	
303.450	31.7	PK	0.0	-18.0	13.7	0	100	-	50.0	36.4	
606.900	29.7	PK	0.0	-16.2	13.5	0	100	-	50.0	36.5	

*1) 2nW = -57dBm = 50dBuV

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION: RESULT = READING + LOSS & GAIN(CABLE+ATTEN. - GAIN (AMP))

Antenna Terminal Conducted Emission

RKES (314.35MHz) Variation No. 3 External Antenna
(Above 1GHz)

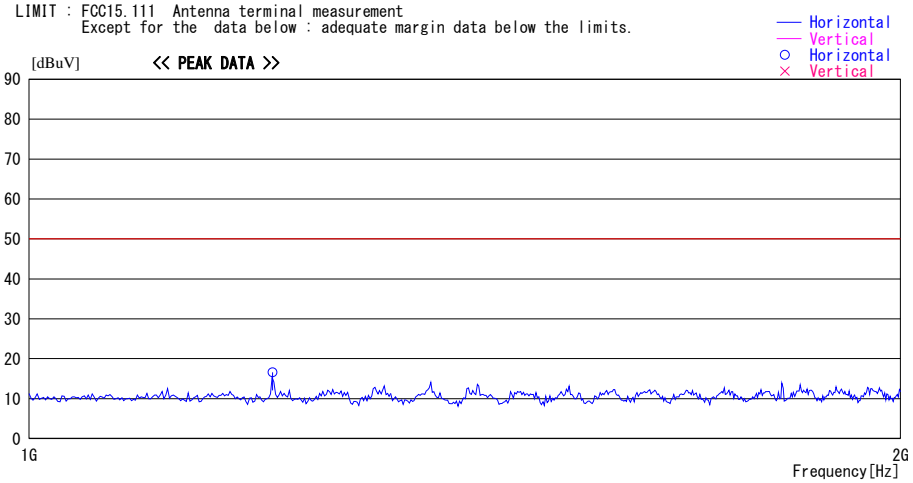
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 24deg. C / 36% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : RKES Rx 314.35MHz External Antenna

LIMIT : FCC15.111 Antenna terminal measurement
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV]	Angle [Deg]	Height [cm]	Polar.	Limit *1) [dBuV]	Margin [dB]	Comment
1213.800	50.0	PK	0.0	-33.4	16.6	0	100	- - -	50.0	33.4	

*1) 2nW = -57dBm = 50dBuV

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION: RESULT = READING + LOSS & GAIN(CABLE+ATTEN. - GAIN (AMP))

Antenna Terminal Conducted Emission

RKES (312.10MHz) Variation No. 3 External Antenna
(Below 1GHz)

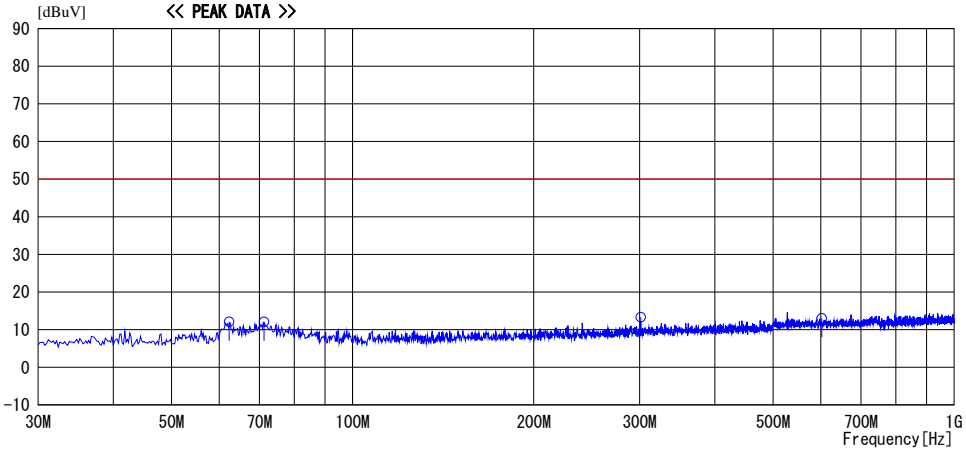
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 02/25/2016

Report No. : 11158941H

Temp./Humi. : 24deg. C / 36% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : RKES Rx 312.10MHz External Antenna

LIMIT : FCC15.111 Antenna terminal measurement
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV]	Angle [Deg]	Height [cm]	Polar.	Limit *1) [dBuV]	Margin [dB]	Comment
62.330	32.5	PK	0.0	-20.4	12.1	0	100	-	50.0	37.9	
71.230	32.4	PK	0.0	-20.3	12.1	0	100	-	50.0	37.9	
301.200	31.4	PK	0.0	-18.1	13.3	0	100	-	50.0	36.7	
602.400	29.2	PK	0.0	-16.2	13.0	0	100	-	50.0	37.0	

*1) 2nW = -57dBm = 50dBuV

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP. 30-300MHz:BICONICAL. 300MHz-1000MHz:LOGPERIODIC. 1000MHz-:HORN
CALCULATION: RESULT = READING + LOSS & GAIN(CABLE+ATTEN. - GAIN (AMP))

Antenna Terminal Conducted Emission

RKES (312.10MHz) Variation No. 3 External Antenna
(Above 1GHz)

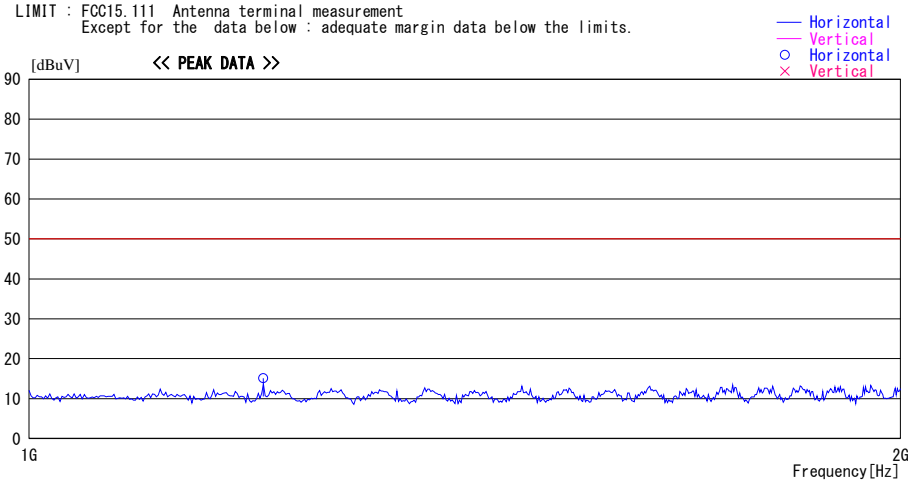
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 24deg. C / 36% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : RKES Rx 312.1MHz External Antenna

LIMIT : FCC15.111 Antenna terminal measurement
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV]	Angle [Deg]	Height [cm]	Polar.	Limit *1) [dBuV]	Margin [dB]	Comment
1204.800	48.5	PK	0.0	-33.4	15.1	0	100	-	50.0	34.9	

*1) 2nW = -57dBm = 50dBuV

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION: RESULT = READING + LOSS & GAIN(CABLE+ATTEN. - GAIN (AMP))

Antenna Terminal Conducted Emission

TPMS (314.98MHz) Variation No. 3 External Antenna
(Below 1GHz)

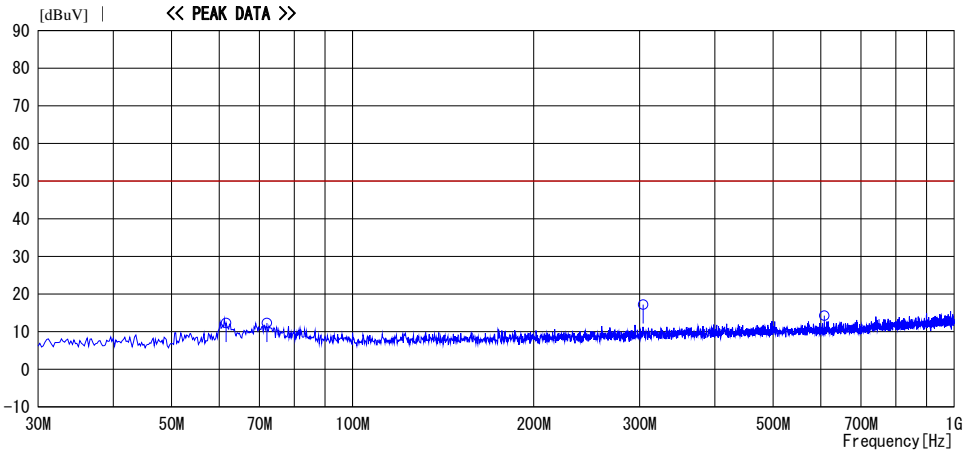
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 02/25/2016

Report No. : 11158941H

Temp./Humi. : 24deg. C / 36% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : TPMS Rx 314.98MHz External Antenna

LIMIT : FCC15.111 Antenna terminal measurement
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV]	Angle [Deg]	Height [cm]	Polar.	Limit *1) [dBuV]	Margin [dB]	Comment
72.000	32.5	PK	0.0	-20.2	12.3	0	100	-	50.0	37.7	
61.600	32.7	PK	0.0	-20.4	12.3	0	100	-	50.0	37.7	
304.080	35.2	PK	0.0	-18.0	17.2	0	100	-	50.0	32.8	
608.160	30.5	PK	0.0	-16.2	14.3	0	100	-	50.0	35.8	

*1) 2nW = -57dBm = 50dBuV

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP. 30-300MHz:BICONICAL. 300MHz-1000MHz:LOGPERIODIC. 1000MHz-:HORN
CALCULATION: RESULT = READING + LOSS & GAIN(CABLE+ATTEN. - GAIN (AMP))

Antenna Terminal Conducted Emission

TPMS (314.98MHz) Variation No. 3 External Antenna
(Above 1GHz)

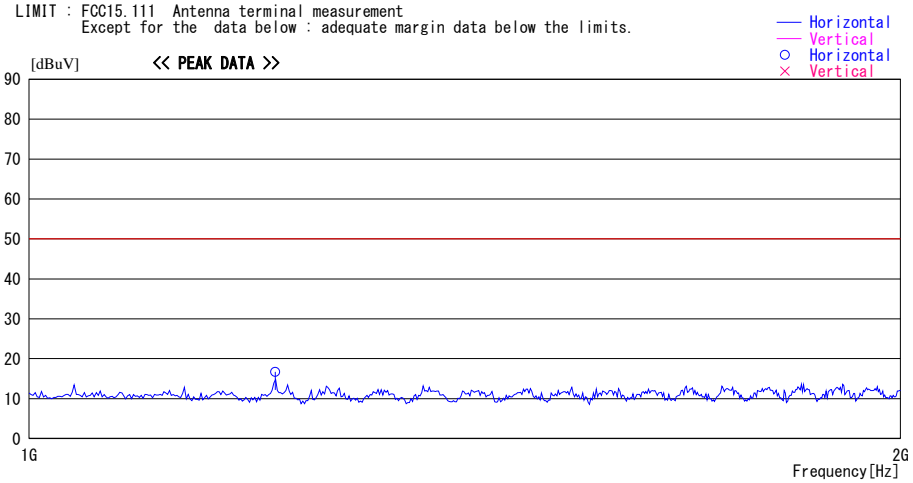
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 24deg. C / 36% RH
Engineer : Hiroyuki Furutaka

Mode / Remarks : TPMS Rx 314.98MHz External Antenna

LIMIT : FCC15.111 Antenna terminal measurement
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV]	Angle [Deg]	Height [cm]	Polar.	Limit *1) [dBuV]	Margin [dB]	Comment
1216.320	50.0	PK	0.0	-33.3	16.7	0	100	-	50.0	33.3	

*1) 2nW = -57dBm = 50dBuV

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION: RESULT = READING + LOSS & GAIN(CABLE+ATTEN. - GAIN (AMP))

Radiated Emission (Reference data)

RKES (314.35MHz) Variation No. 5 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

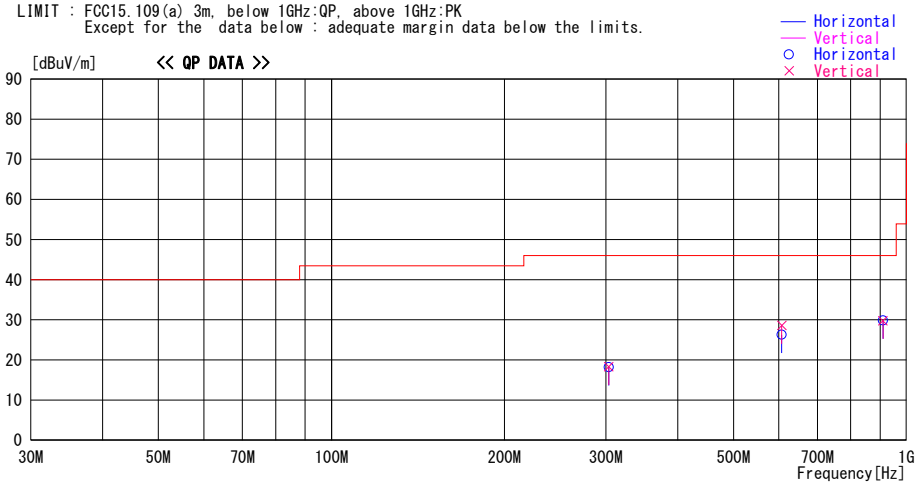
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 35% RH
Engineer : Shuichi Ohyama

Mode / Remarks : RKES Rx 314.35MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
303.450	22.4	QP	17.7	-21.9	18.2	0	100	Hori.	46.0	27.8	No Signal
303.450	22.5	QP	17.7	-21.9	18.3	0	100	Vert.	46.0	27.7	No Signal
606.900	26.0	QP	20.6	-20.3	26.3	142	100	Hori.	46.0	19.7	
606.900	28.3	QP	20.6	-20.3	28.6	193	100	Vert.	46.0	17.4	
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Vert.	46.0	16.2	No Signal
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Hori.	46.0	16.2	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (314.35MHz) Variation No. 5 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

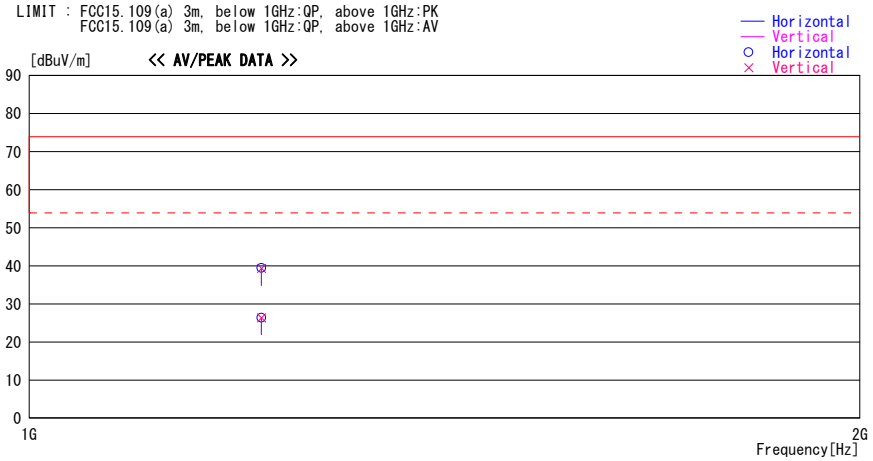
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 314.35MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1213.800	44.1	PK	24.9	-29.5	39.5	0	100	Hori.	73.9	34.4	
1213.800	43.9	PK	24.9	-29.5	39.3	0	100	Vert.	73.9	34.6	
1213.800	31.0	AV	24.9	-29.5	26.4	0	100	Hori.	53.9	27.5	
1213.800	31.0	AV	24.9	-29.5	26.4	0	100	Vert.	53.9	27.5	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (312.10MHz) Variation No. 5 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

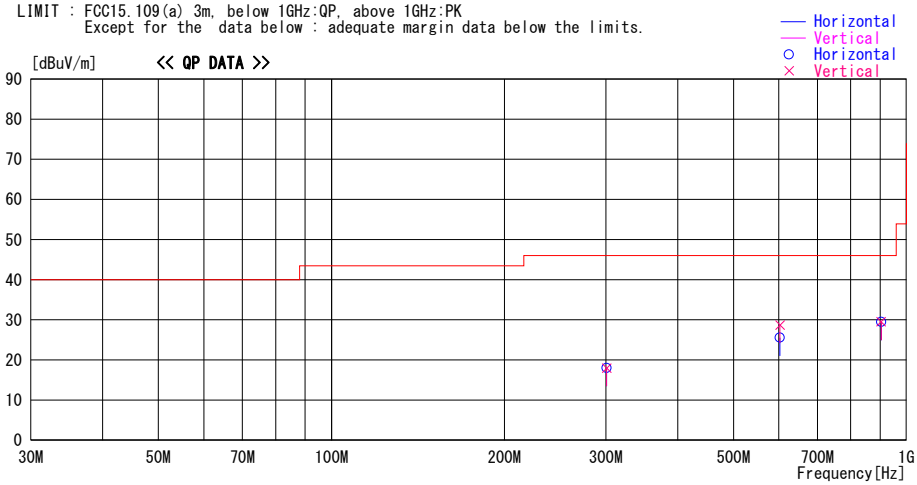
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 35% RH
Engineer : Shuichi Ohyama

Mode / Remarks : RKES Rx 312.10MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
301.200	22.3	QP	17.6	-21.9	18.0	0	100	Hori.	46.0	28.0	No Signal
301.200	22.3	QP	17.6	-21.9	18.0	0	100	Vert.	46.0	28.0	No Signal
602.400	25.4	QP	20.5	-20.3	25.6	142	100	Hori.	46.0	20.4	
602.400	28.5	QP	20.5	-20.3	28.7	171	100	Vert.	46.0	17.3	
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Vert.	46.0	16.5	No Signal
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Hori.	46.0	16.5	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (312.10MHz) Variation No. 5 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

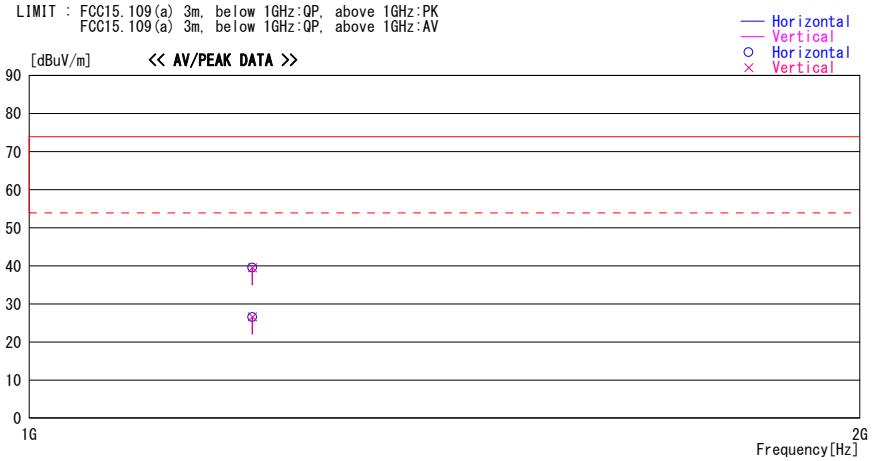
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 312.10MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1204.800	44.3	PK	24.8	-29.5	39.6	0	100	Hori.	73.9	34.3	
1204.800	44.2	PK	24.8	-29.5	39.5	0	100	Vert.	73.9	34.4	
1204.800	31.3	AV	24.8	-29.5	26.6	0	100	Hori.	53.9	27.3	
1204.800	31.3	AV	24.8	-29.5	26.6	0	100	Vert.	53.9	27.3	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (314.35MHz) Variation No. 8 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

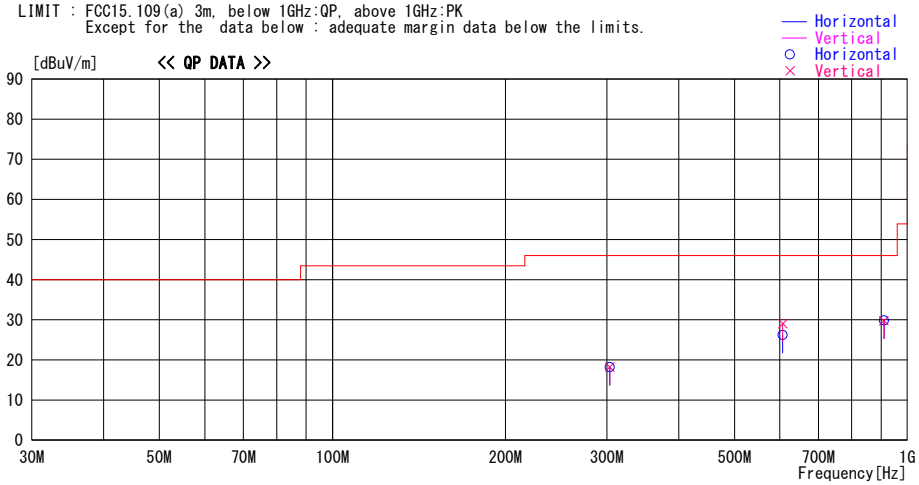
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 35% RH
Engineer : Shuichi Ohyama

Mode / Remarks : RKES Rx 314.35MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
303.450	22.4	QP	17.7	-21.9	18.2	0	100	Hori.	46.0	27.8	No Signal
303.450	22.4	QP	17.7	-21.9	18.2	0	100	Vert.	46.0	27.8	No Signal
606.900	25.9	QP	20.6	-20.3	26.2	143	100	Hori.	46.0	19.8	
606.900	28.8	QP	20.6	-20.3	29.1	188	100	Vert.	46.0	16.9	
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Vert.	46.0	16.2	No Signal
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Hori.	46.0	16.2	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (314.35MHz) Variation No. 8 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

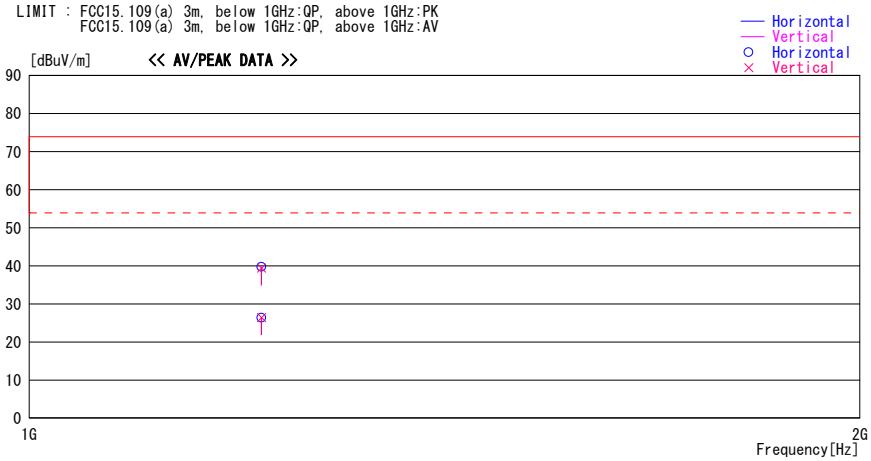
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 314.35MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1213.800	44.3	PK	24.9	-29.5	39.7	0	100	Hori.	73.9	34.2	
1213.800	44.0	PK	24.9	-29.5	39.4	0	100	Vert.	73.9	34.5	
1213.800	31.0	AV	24.9	-29.5	26.4	0	100	Hori.	53.9	27.5	
1213.800	31.0	AV	24.9	-29.5	26.4	0	100	Vert.	53.9	27.5	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (312.10MHz) Variation No. 8 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

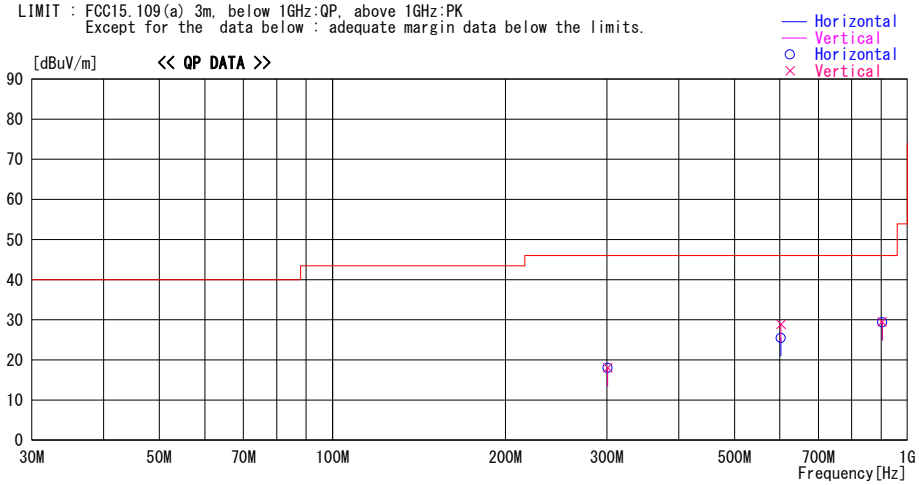
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 35% RH
Engineer : Shuichi Ohyama

Mode / Remarks : RKES Rx 312.10MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
301.200	22.3	QP	17.6	-21.9	18.0	0	100	Hori.	46.0	28.0	No Signal
301.200	22.4	QP	17.6	-21.9	18.1	0	100	Vert.	46.0	27.9	No Signal
602.400	25.3	QP	20.5	-20.3	25.5	144	100	Hori.	46.0	20.5	
602.400	28.7	QP	20.5	-20.3	28.9	183	100	Vert.	46.0	17.1	
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Vert.	46.0	16.5	No Signal
903.600	22.9	QP	24.3	-17.8	29.4	0	100	Hori.	46.0	16.6	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (312.10MHz) Variation No. 8 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

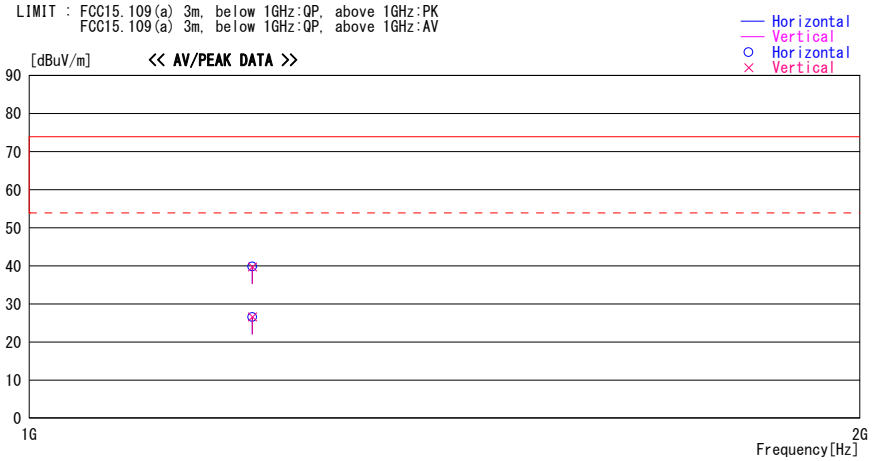
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 312.10MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1204.800	44.5	PK	24.8	-29.5	39.8	0	100	Hori.	73.9	34.1	
1204.800	44.4	PK	24.8	-29.5	39.7	0	100	Vert.	73.9	34.2	
1204.800	31.3	AV	24.8	-29.5	26.6	0	100	Hori.	53.9	27.3	
1204.800	31.3	AV	24.8	-29.5	26.6	0	100	Vert.	53.9	27.3	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (314.35MHz) Variation No. 11 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

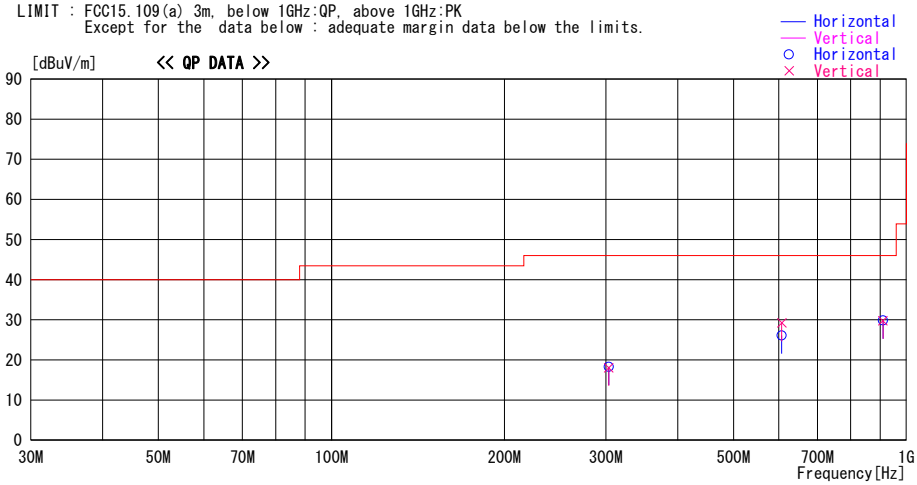
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 35% RH
Engineer : Shuichi Ohyama

Mode / Remarks : RKES Rx 314.35MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
303.450	22.5	QP	17.7	-21.9	18.3	0	100	Hori.	46.0	27.7	No Signal
303.450	22.3	QP	17.7	-21.9	18.1	0	100	Vert.	46.0	27.9	No Signal
606.900	25.8	QP	20.6	-20.3	26.1	144	100	Hori.	46.0	19.9	
606.900	28.9	QP	20.6	-20.3	29.2	187	100	Vert.	46.0	16.8	
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Vert.	46.0	16.2	No Signal
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Hori.	46.0	16.2	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (314.35MHz) Variation No. 11 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

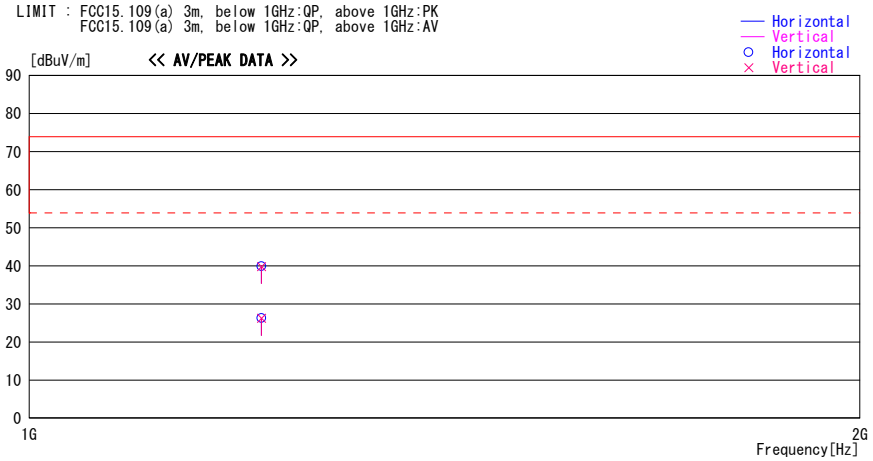
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 314.35MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1213.800	44.5	PK	24.9	-29.5	39.9	0	100	Hori.	73.9	34.0	
1213.800	44.4	PK	24.9	-29.5	39.8	0	100	Vert.	73.9	34.1	
1213.800	30.9	AV	24.9	-29.5	26.3	0	100	Hori.	53.9	27.6	
1213.800	30.8	AV	24.9	-29.5	26.2	0	100	Vert.	53.9	27.7	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (312.10MHz) Variation No. 11 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

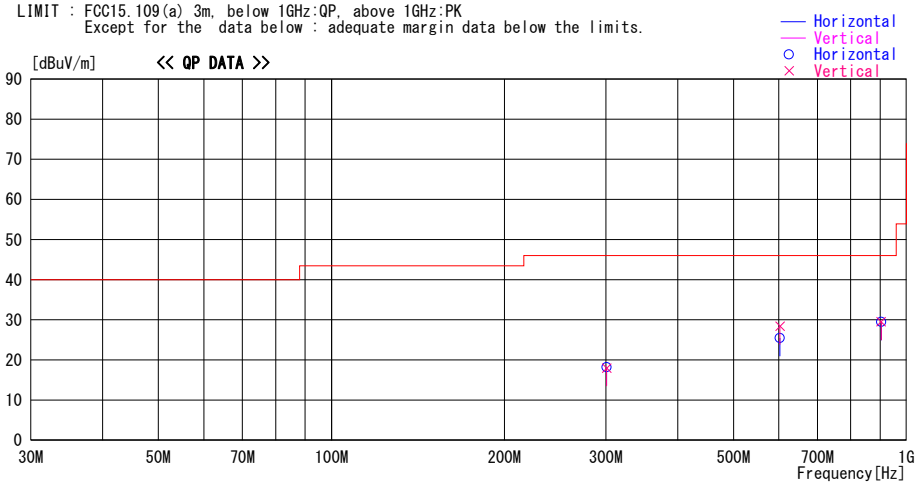
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 35% RH
Engineer : Shuichi Ohyama

Mode / Remarks : RKES Rx 312.10MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
301.200	22.5	QP	17.6	-21.9	18.2	0	100	Hori.	46.0	27.8	No Signal
301.200	22.3	QP	17.6	-21.9	18.0	0	100	Vert.	46.0	28.0	No Signal
602.400	25.3	QP	20.5	-20.3	25.5	142	100	Hori.	46.0	20.5	
602.400	28.2	QP	20.5	-20.3	28.4	183	100	Vert.	46.0	17.6	
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Vert.	46.0	16.5	No Signal
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Hori.	46.0	16.5	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (312.10MHz) Variation No. 11 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

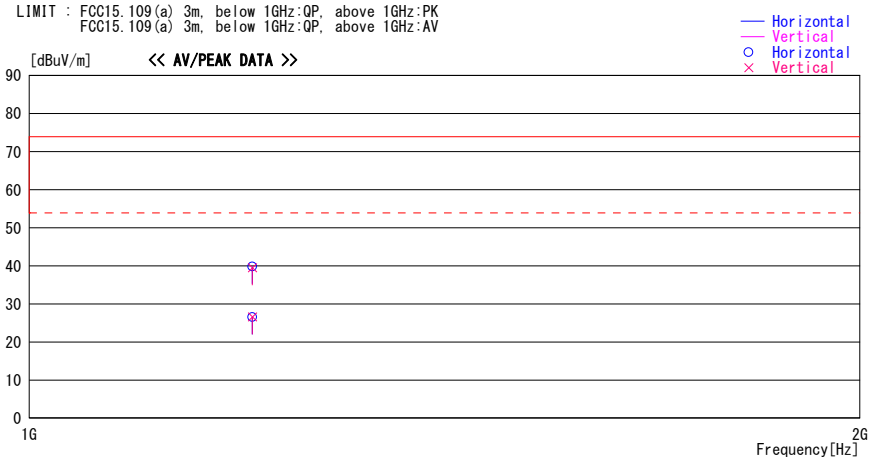
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 312.10MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1204.800	44.5	PK	24.8	-29.5	39.8	0	100	Hori.	73.9	34.1	
1204.800	44.2	PK	24.8	-29.5	39.5	0	100	Vert.	73.9	34.4	
1204.800	31.3	AV	24.8	-29.5	26.6	0	100	Hori.	53.9	27.3	
1204.800	31.3	AV	24.8	-29.5	26.6	0	100	Vert.	53.9	27.3	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (314.35MHz) Variation No. 14 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

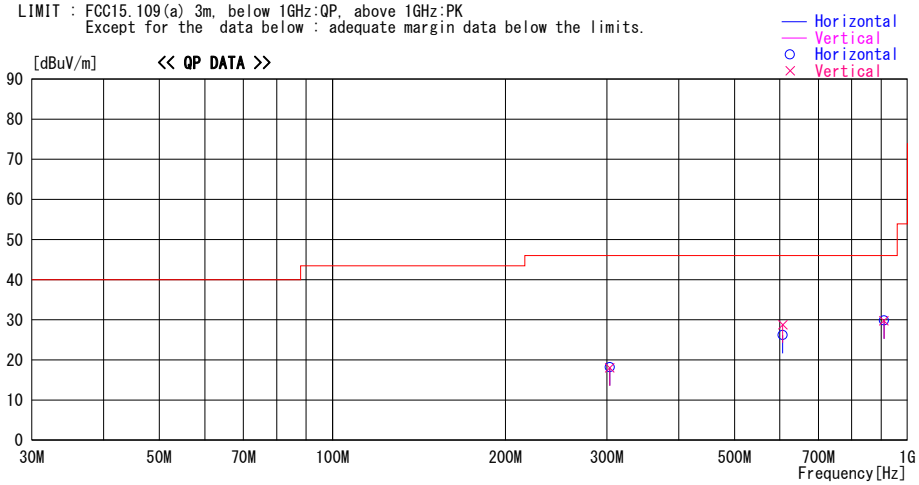
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 35% RH
Engineer : Shuichi Ohyama

Mode / Remarks : RKES Rx 314.35MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
303.450	22.4	QP	17.7	-21.9	18.2	0	100	Hori.	46.0	27.8	No Signal
303.450	22.3	QP	17.7	-21.9	18.1	0	100	Vert.	46.0	27.9	No Signal
606.900	25.9	QP	20.6	-20.3	26.2	143	100	Hori.	46.0	19.8	
606.900	28.5	QP	20.6	-20.3	28.8	188	100	Vert.	46.0	17.2	
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Vert.	46.0	16.2	No Signal
910.350	23.0	QP	24.5	-17.7	29.8	0	100	Hori.	46.0	16.2	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (314.35MHz) Variation No. 14 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

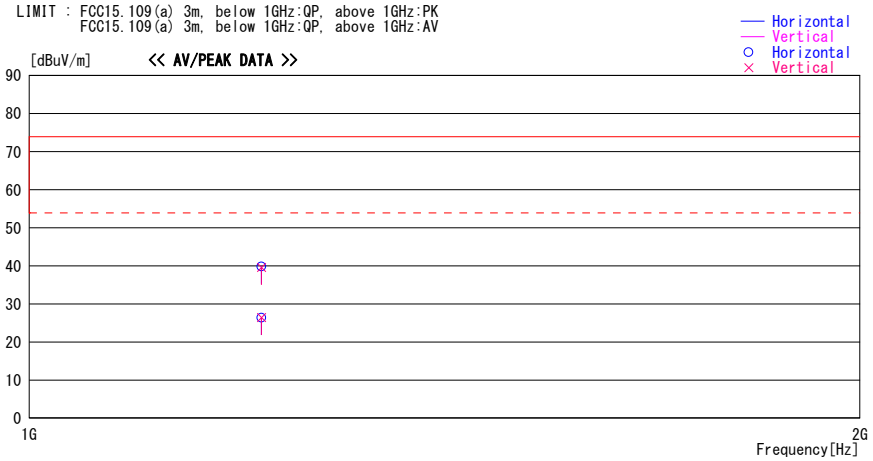
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 314.35MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1213.800	44.4	PK	24.9	-29.5	39.8	0	100	Hori.	73.9	34.1	
1213.800	44.2	PK	24.9	-29.5	39.6	0	100	Vert.	73.9	34.3	
1213.800	31.0	AV	24.9	-29.5	26.4	0	100	Hori.	53.9	27.5	
1213.800	31.0	AV	24.9	-29.5	26.4	0	100	Vert.	53.9	27.5	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (312.10MHz) Variation No. 14 Internal Antenna
(Below 1GHz)

DATA OF RADIATED EMISSION TEST

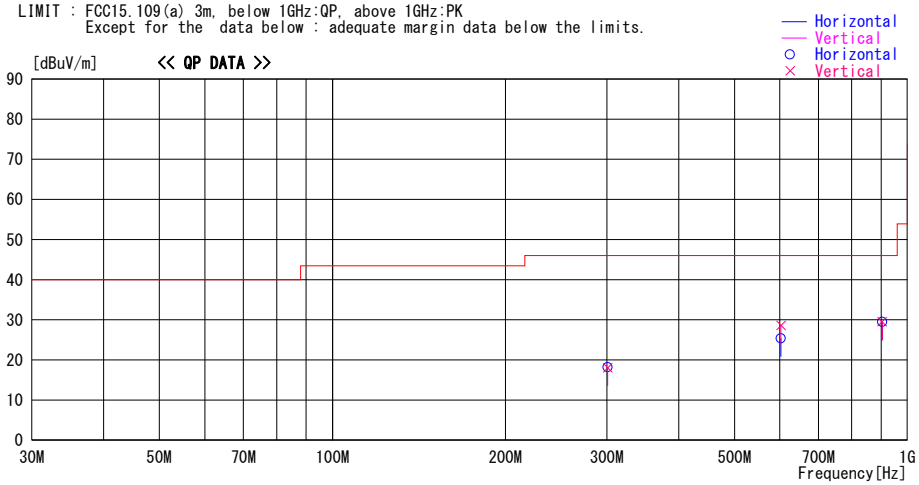
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/25

Report No. : 11158941H

Temp./Humi. : 25deg. C / 35% RH
Engineer : Shuichi Ohyama

Mode / Remarks : RKES Rx 312.10MHz Int-ANT Worst Axis Hori X Vert X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
301.200	22.5	QP	17.6	-21.9	18.2	0	100	Hori.	46.0	27.8	No Signal
301.200	22.4	QP	17.6	-21.9	18.1	0	100	Vert.	46.0	27.9	No Signal
602.400	25.2	QP	20.5	-20.3	25.4	144	100	Hori.	46.0	20.6	
602.400	28.4	QP	20.5	-20.3	28.6	178	100	Vert.	46.0	17.4	
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Vert.	46.0	16.5	No Signal
903.600	23.0	QP	24.3	-17.8	29.5	0	100	Hori.	46.0	16.5	No Signal

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

Radiated Emission (Reference data)

RKES (312.10MHz) Variation No. 14 Internal Antenna
(Above 1GHz)

DATA OF RADIATED EMISSION TEST

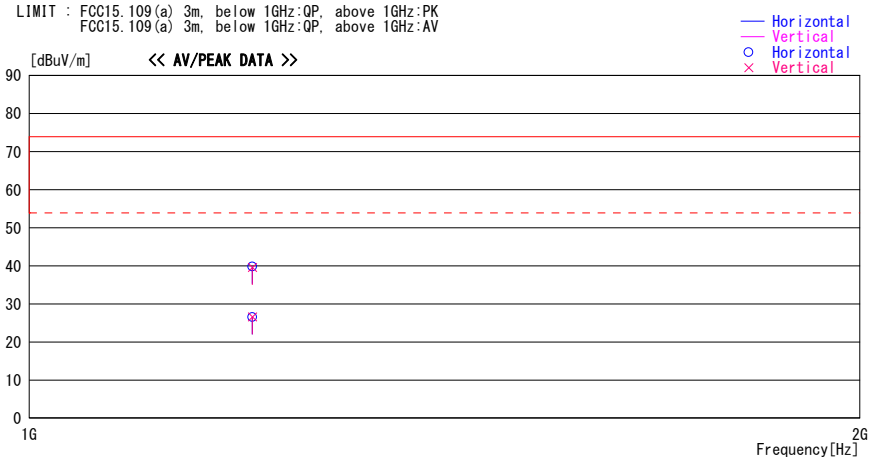
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2016/02/24

Report No. : 11158941H

Temp./Humi. : 22deg. C / 33% RH
Engineer : Takumi Shimada

Mode / Remarks : RKES Rx 312.10MHz INT-ANT Worst axis (Hori:X, Ver:X)

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:PK
FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1204.800	44.5	PK	24.8	-29.5	39.8	0	100	Hori.	73.9	34.1	
1204.800	44.3	PK	24.8	-29.5	39.6	0	100	Vert.	73.9	34.3	
1204.800	31.3	AV	24.8	-29.5	26.6	0	100	Hori.	53.9	27.3	
1204.800	31.3	AV	24.8	-29.5	26.6	0	100	Vert.	53.9	27.3	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE - GAIN(AMP)) + D.FACTOR

*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.

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/02 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2016/01/21 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2015/11/28 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2015/08/10 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2015/06/22 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2015/10/01 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2016/01/18 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2015/11/02 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2015/11/03 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2015/06/19 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2015/11/12 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2015/03/09 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	AT	2015/10/01 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	AT	2016/01/21 * 12
MJM-16	Measure	KOMELON	KMC-36	-	AT	-
MSA-15	Spectrum Analyzer	Agilent	E4440A	MY46187105	AT	2015/11/11 * 12
MCC-51	Coaxial cable	UL Japan	-	-	AT	2015/07/13 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2015/11/10 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	AT	2015/03/10 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	AT	2016/01/13 * 12
MCC-92	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	30813/2	AT	2015/05/01 * 12
MCC-172	Microwave Cable	Junkosha	MWX221	1409S495	AT	2015/03/04 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	AT	2015/10/01 * 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:

RE: Radiated emission
AT: Antenna Terminal