



RADIO TEST REPORT

Test Report No. : 10903739H-A

Applicant : **DENSO CORPORATION**
Type of Equipment : **Blind Spot Monitor Sensor**
Model No. : **DNSRR001**
FCC ID : **HYQDNSRR001**
Test regulation : **FCC Part 15 Subpart C: 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 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)

Date of test: August 6 to September 3, 2015

Representative test engineer:

Hironobu Ohnishi
Engineer
Consumer Technology Division

Approved by:

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

13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10903739H-A

[illegible]

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: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)	10
SECTION 6: 20dB Bandwidth, 99% Occupied Bandwidth and Duty Cycle	12
APPENDIX 1: Test data	13
Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)	13
20dB Bandwidth, 99% Occupied Bandwidth	20
Duty Cycle	23
APPENDIX 2: Test Instruments	25
APPENDIX 3: Photographs of test setup	27
Radiated Emission (Fundamental emission)	27
Radiated Emission (Spurious emission)	28

SECTION 1: Customer information

Company Name	:	DENSO CORPORATION
Address	:	1-1, Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan
Telephone Number	:	+81-566-61-4724
Facsimile Number	:	+81-566-25-4683
Contact Person	:	Junshi Utsu

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

2.1 Identification of E.U.T.

Type of Equipment	:	Blind Spot Monitor Sensor
Model No.	:	DNSRR001
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12 V (Car battery)
Receipt Date of Sample	:	August 6, 2015
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

This Radar Sensor (DNSRR001) is a vehicle-mounted field disturbance sensor which uses millimeter wave for detecting obstacles located diagonally backward.

General Specification

Clock frequency(ies) in the system	:	Microcomputer: 240 MHz
------------------------------------	---	------------------------

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	24.15 GHz
Modulation	:	Frequency modulation
Antenna Type	:	Internal Antenna
Antenna Connector	:	None
Antenna Gain	:	9.3dBi (Broad beam), 12.5dBi (Narrow beam)
Steerable Antenna	:	Electronically
Usage location	:	Vehicle-mounted
Power Supply (inner)	:	DC 3.3 V

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

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on September 8, 2015

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.249 Operation within the bands 902-928MHz,
2400-2483.5MHz, 5725-5875MHz and 24.0-24.25GHz

* The revision on September 8, 2015 does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Deviation	Worst margin	Results
Conducted Emission	FCC: ANSI C63.4-2009 7. AC powerline conducted emission measurements IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	N/A	-	N/A *1)
Electric Field Strength of Fundamental Emission	ANSI C63.4:2009 13. Measurement of intentional radiators IC: RSS-Gen 6.12	FCC: Section 15.249(a)(c)(e) IC: RSS-310 3.10	N/A	8.3 dB 24150.00 MHz, Horizontal, (Peak with Duty factor) Narrow beam (Left / Right)	Complied
Electric Field Strength of Spurious Emission	ANSI C63.4:2009 13. Measurement of intentional radiators IC: RSS-Gen 6.13	FCC: Section 15.205(a)(b)(d) Section 15.209(a) Section 15.249(a)(c)(d)(e) IC: RSS-310 3.10 RSS-Gen 8.9	N/A	3.0 dB 24250.00 MHz, Horizontal, (Peak with Duty factor) Narrow beam (Right)	Complied
20 dB Bandwidth	ANSI C63.4:2009 13. Measurement of intentional radiators IC: -	FCC: Section 15.215 IC: Reference data	N/A	See data.	Complied
Frequency Tolerance	ANSI C63.4:2009 13. Measurement of intentional radiators IC: -	FCC: Section 15.249(b) IC: -	N/A	-	N/A *2)
99 % Occupied Bandwidth	FCC: - IC: RSS-Gen 6.6	FCC: Reference data IC: -	N/A	See data.	Complied

*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.

*2) The test is not applicable since the EUT does not operate with Fixed point-to-point operation within 24.05 GHz to 24.25 GHz.

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

Millimeter wave measurement was performed accordance with FCC KDB 200443 (MILLIMETER WAVE TEST PROCEDURES).

*In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

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

FCC Part 15.31 (e)

The EUT provides stable voltage (DC 3.3 V) constantly to the RF part regardless of input voltage. Instead of a new battery, DC power supply was used for the test.

That does not affect to the test result, therefore the 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

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

3.4 Uncertainty

EMI

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

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(+dB)				(1m*)(+dB)		(0.5m*)(+dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.3dB	5.1 dB	6.2 dB	5.5dB	5.8dB	5.8dB	4.3dB
No.2	4.2dB	5.1 dB	6.2 dB	5.4dB	5.7dB	5.9dB	5.6dB
No.3	4.4dB	5.1 dB	6.3 dB	5.2dB	5.5dB	5.8dB	5.5dB
No.4	4.7dB	5.3 dB	6.3 dB	5.3dB	5.7dB	5.9dB	5.5dB

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

Radiated emission (+dB)	
40 GHz - 50 GHz	4.0 dB
50 GHz - 75 GHz	5.2 dB
75 GHz - 110 GHz	5.6 dB

Radiated emission test (1m and 3m)

[Electric Field Strength of Fundamental Emission]

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

[Electric Field Strength of Spurious Emission]

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

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

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	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

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

3.6 Test data, Test instruments, and Test set up.

Refer to APPENDIX.

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

4.1 Operating Modes

Test Item	Mode	Tested frequency
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission 20 dB Bandwidth 99 % Occupied Bandwidth	Transmitting mode (Tx) Beam setting *1) - Broad beam - Narrow beam (Left) - Narrow beam (Right)	24.15 GHz FSK setting *2) - 24.06 GHz - 24.15 GHz - 24.24 GHz
*1) This EUT has three transmission beam patterns. The tests were performed in these three patterns. *2) There are FM and FSK modulation part in one transmission burst. The FSK modulation hopped to any frequencies per 80 ms in actual operation. The FSK frequency was fixed to lowest (24.06 GHz), middle (24.15 GHz) or highest (24.24 GHz) for the purpose of bandwidth measurement. The FSK frequency was fixed to lowest or highest for the purpose of band-edge measurement. As for other tests, it was fixed to middle frequency. The system was configured in typical fashion (as a customer would normally use it) for testing. *EUT has the power settings by the software as follows; Power Settings: Same as Production model Software: mwr_denso_24g_t739 *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.		

UL Japan, Inc.

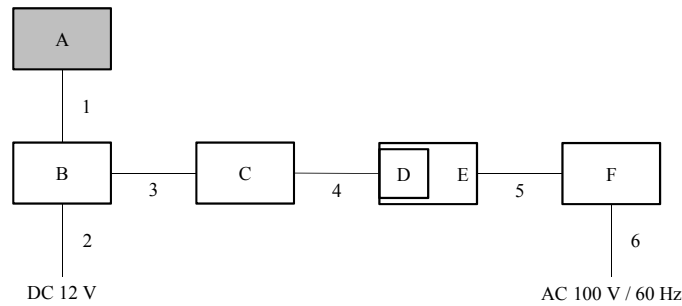
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

4.2 Configuration and peripherals



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Blind Spot Monitor Sensor	DNSRR001	3200	DENSO CORPORATION	EUT
B	Jig Box	-	-	DENSO CORPORATION	-
C	CAN Cab	251	-	Vector	-
D	CANCardXL	007100	046663	Vector	-
E	Laptop	PSSESN-0G301R	2E061592H	TOSHIBA	-
F	AC Adapter	PA3755U-1ACA	G71C000A5410	TOSHIBA	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal and DC Cable	3.0	Unshielded	Unshielded	-
2	DC cable	1.0	Unshielded	Unshielded	-
3	Signal cable	0.4	Unshielded	Unshielded	-
4	Signal cable	0.3	Shielded	Shielded	-
5	DC cable	1.8	Unshielded	Unshielded	-
6	AC cable	0.9	Unshielded	Unshielded	-

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

SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)

Test Procedure and conditions

[Up to 40 GHz]

EUT was placed on an urethane platform of nominal size, 0.5 m by 1.0 m raised 0.8 m (9 kHz - 10 GHz), 0.5 m by 0.5 m raised 1.5 m (10 GHz - 40 GHz) above the conducting ground plane.

The EUT was set on the center 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 1.

The Radiated Electric Field Strength has been measured on Semi anechoic chamber with a ground plane and at a distance of 3 m.

The measuring antenna height was varied between 1 m and 4 m (frequency 9 kHz – 30 MHz: loop antenna was fixed height at 1.0 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.

The radiated emission measurements were made with the following detector function of the test receiver/spectrum analyzer.

Test Antennas are used as below;

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

Frequency	9 kHz – 150 kHz	150 kHz – 30 MHz	30 MHz – 1 GHz	1 GHz – 40 GHz	
Instrument used	Test Receiver	Test Receiver	Test Receiver	Spectrum Analyzer	
Detector	QP, Average	QP, Average	QP	Peak	Average *1)
IF Bandwidth	BW 200 Hz	BW 9 kHz	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Pulsed emission - RBW: 1 MHz - Peak with duty Other than above - RBW: 1 MHz - VBW: 10 Hz
Test Distance	3 m	3 m	3 m	3 m (below 10 GHz), 1 m*2) (10 GHz-26.5 GHz), 0.5 m*3) (26.5 GHz-40 GHz)	

*1) For Pulsed emission (Fundamental and band-edge): The Average value was calculated by reducing Duty factor from Peak (Peak value – Duty factor). For Duty factor, please refer to page Duty factor measurement. Other than pulsed emission, aVBW was set to 10 Hz and linear voltage average mode was used.

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

*3) Distance Factor: $20 \times \log(3.0 \text{ m} / 0.5 \text{ m}) = 15.6 \text{ dB}$

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

[About fundamental measurement]

The carrier levels were confirmed at maximum direction of transmission. The maximum direction was searched under carefully since beam-widths are narrow.

The carrier levels were measured in the far field. The distance of the far field was calculated from follow equation.

$$r = \frac{2D^2}{\lambda}$$

where

r is the distance from the radiating element of the EUT to the edge of the far field, in m
 D is the largest dimension of both the radiating element and the test antenna (horn), in m
(The antenna aperture size of test antenna was used for this calculation.)
 λ is the wavelength of the emission under investigation [$300 / f$ (MHz)], in m

Frequency	Lambda	Maximum Dimension	Far Field Boundary
[GHz]	[m]	[m]	r [m]
24.250	0.012	0.058	0.544

[Above 40 GHz]

The test was performed based on “MILLIMETER WAVE TEST PROCEDURES”. The EUT was placed on an urethane platform, raised 1.5 m above the conducting ground plane. The measurements were performed on handheld method.

Set spectrum analyzer RBW, VBW, span, etc., to the proper values. Note these values. Enable two traces—one set to “clear write,” and the other set to “max hold.” Begin hand-held measurements with the test antenna (horn) at a distance of 1 m from the EUT in a horizontally polarized position. Slowly adjust its position, entirely covering the plane 1 m from the EUT. Observation of the two active traces on the spectrum analyzer will allow refined horn positioning at the point(s) of maximum field intensity. Repeat with the horn in a vertically polarized position. If the emission cannot be detected at 1 m, reduce the RBW to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.

Note the maximum level indicated on the spectrum analyzer. Adjust this level, if necessary, by the antenna gain, conversion loss of the external mixer and gain of LNA used, at the frequency under investigation. Calculate the field strength of the emission at the measurement distance from the Friis’ transmission equation.

Frequency	40 GHz – 50 GHz	50 GHz – 75 GHz	75 GHz – 100 GHz
Final measurement distance with 1 MHz Peak detector	0.5 m	0.05 m	0.05 m

Detector	Peak	Average *1)	
IF Bandwidth	RBW: 1 MHz VBW: 3 MHz	Pulsed emission - RBW: 1 MHz - Peak with duty	Other than pulsed - RBW: 1 MHz - VBW: 10 Hz

*1) For Pulsed emission (2nd harmonics): The Average value was calculated by reducing Duty factor from Peak (Peak value – Duty factor). For Duty factor, please refer to page Duty factor measurement. Other than pulsed emission, a VBW was set to 10 Hz and linear voltage average mode was used.

The test was made on EUT at the normal use position.

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

Measurement range : 9 kHz – 100 GHz
Test data : APPENDIX
Test result : Pass

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

SECTION 6: 20dB Bandwidth, 99% Occupied Bandwidth and Duty Cycle

Test Procedure

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	600 MHz	2 MHz	6 MHz	70 sec	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	600 MHz, Enough width to display emission skirts	2 MHz, 1 % to 5 % of OBW	6 MHz, Three times of RBW	70 sec	Peak *1)	Max Hold *2)	Spectrum Analyzer
Duty Cycle	-	-	-	50 msec / 200 msec	-	Single	Oscilloscope

*1) Peak detector was applied as Worst-case measurement.

*2) The measurement was performed with Max Hold since the duty cycle was not 100 %.

Test data : APPENDIX

Test result : Pass

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

APPENDIX 1: Test data

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Report No.	10903739H				
Test place	Ise EMC Lab.				
	No. 4 Semi Anechoic Chamber	No. 4 Semi Anechoic Chamber	No. 3 Semi Anechoic Chamber	No. 3 Semi Anechoic Chamber	No. 3 Semi Anechoic Chamber
Date	08/06/2015	08/24/2015	08/31/2015	09/02/2015	09/03/2015
Temperature /	24 deg. C /	25 deg. C /	24 deg. C /	24 deg. C /	24 deg. C /
Humidity	59 % RH	64 % RH	71 % RH	66 % RH	69 % RH
	18 GHz - 26.5 GHz	30 MHz - 18 GHz	26.5 GHz - 50 GHz	50 GHz - 100 GHz	9 kHz - 30 MHz
Engineer	Hironobu Ohnishi				
Mode	Tx 24.15 GHz, Broad beam				

[Fundamental, band-edge and 2nd harmonics]

Peak

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result (3 m) [dBuV/m]		Limit (3 m) [dBuV/m]	Margin [dB]		Remark Inside or Outside of Restricted Bands
		Hor	Ver					Hor	Ver		Hor	Ver	
24000.00	PK	47.9	46.9	39.1	-0.3	30.6	-	56.1	55.1	73.9	17.8	18.8	Inside
24150.00	PK	97.9	68.9	39.0	-0.2	30.5	-	106.2	77.2	127.9	21.7	50.7	Fundamental
24250.00	PK	49.2	47.6	39.0	-0.2	30.4	-	57.6	56.0	73.9	16.3	17.9	Outside
48300.72	PK	44.8	44.9	40.4	-7.6	18.4	-	59.2	59.3	87.9	28.7	28.6	Inside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

Peak with Duty factor

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]		Limit [dBuV/m]	Margin [dB]		Remark
		Hor	Ver					Hor	Ver		Hor	Ver	
24000.00	PK	47.9	46.9	39.1	-0.3	30.6	-6.8	49.3	48.3	53.9	4.6	5.6	Inside
24150.00	PK	97.9	68.9	39.0	-0.2	30.5	-6.8	99.4	70.4	107.9	8.5	37.5	Fundamental
24250.00	PK	49.2	47.6	39.0	-0.2	30.4	-6.8	50.8	49.2	53.9	3.1	4.7	Outside
48300.72	PK	44.8	44.9	40.4	-7.6	18.4	-6.8	52.4	52.5	67.9	15.5	15.4	Inside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

[Spurious emissions other than above]

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	38.00	QP	22.8	14.9	7.2	32.1	12.8	40.0	27.2	
Hori	120.00	QP	23.3	12.9	8.3	32.0	12.5	43.5	31.0	
Hori	240.00	QP	22.7	17.1	9.4	31.8	17.4	46.0	28.6	
Hori	480.00	QP	23.0	19.2	11.1	31.9	21.4	46.0	24.6	
Hori	720.00	QP	23.2	22.5	12.4	32.1	26.0	46.0	20.0	
Hori	960.00	QP	23.0	25.9	13.6	30.9	31.6	46.0	14.4	
Hori	72451.00	PK	12.6	41.7	13.6	4.9	63.0	87.9	24.9	NS
Hori	96601.44	PK	15.7	45.6	8.2	28.9	40.6	73.9	33.3	NS
Hori	72451.00	AV	-0.1	41.7	13.6	4.9	50.3	67.9	17.6	NS, VBW 10 Hz
Hori	96601.44	AV	2.6	45.6	8.2	28.9	27.5	53.9	26.4	NS, VBW 10 Hz
Vert	38.00	QP	22.8	14.9	7.2	32.1	12.8	40.0	27.2	
Vert	120.00	QP	23.3	12.9	8.3	32.0	12.5	43.5	31.0	
Vert	240.00	QP	22.7	17.1	9.4	31.8	17.4	46.0	28.6	
Vert	480.00	QP	23.0	19.2	11.1	31.9	21.4	46.0	24.6	
Vert	720.00	QP	23.1	22.5	12.4	32.1	25.9	46.0	20.1	
Vert	960.00	QP	23.0	25.9	13.6	30.9	31.6	46.0	14.4	
Vert	72451.00	PK	13.1	41.7	13.6	4.9	63.5	87.9	24.4	NS
Vert	96601.44	PK	15.1	45.6	8.2	28.9	40.0	73.9	33.9	NS
Vert	72451.00	AV	-0.1	41.7	13.6	4.9	50.3	67.9	17.6	NS, VBW 10 Hz
Vert	96601.44	AV	2.6	45.6	8.2	28.9	27.5	53.9	26.4	NS, VBW 10 Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Mixer(above 50 GHz)-Distance factor(above 10 GHz)) - Gain(Amplifier)

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

*NS: No signal detected.

Distance factor:
10 GHz - 26.5 GHz $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$
26.5 GHz - 40 GHz $20\log(3.0\text{ m} / 0.5\text{ m}) = 15.6\text{ dB}$
Above 50 GHz $20\log(3.0\text{ m} / 0.05\text{ m}) = 35.6\text{ dB}$

There are FM and FSK modulation part in one transmission burst. The FSK modulation hops to any frequencies per 80 ms in actual operation. The FSK frequency was fixed to lowest (24.06 GHz) or highest (24.24 GHz) for the purpose of band-edge measurement.

UL Japan, Inc.

Ise EMC Lab.

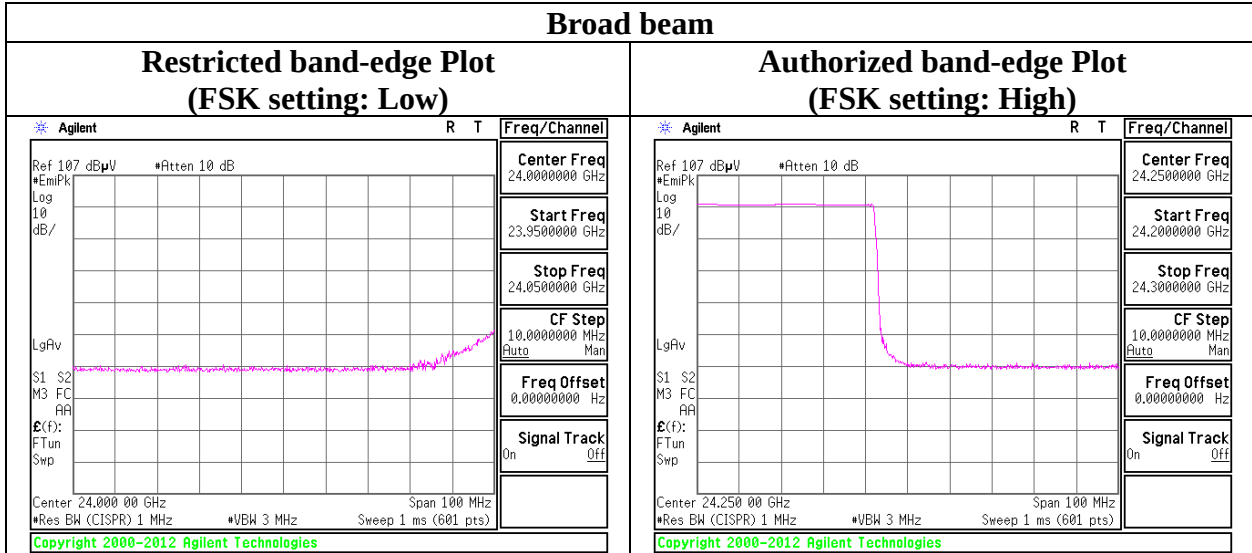
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No. 4 Semi Anechoic Chamber
Report No.	10903739H
Date	08/07/2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Hironobu Ohnishi
Mode	Tx 24.15 GHz, Broad beam



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

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Report No. 10903739H
Test place Ise EMC Lab.
No. 4 Semi Anechoic Chamber No. 4 Semi Anechoic Chamber No. 3 Semi Anechoic Chamber No. 3 Semi Anechoic Chamber No. 3 Semi Anechoic Chamber
Date 08/06/2015 08/24/2015 08/31/2015 09/02/2015 09/03/2015
Temperature / 24 deg. C / 25 deg. C / 24 deg. C / 24 deg. C / 24 deg. C /
Humidity 59 % RH 64 % RH 71 % RH 66 % RH 69 % RH
18 GHz - 26.5 GHz 30 MHz - 18 GHz 26.5 GHz - 50 GHz 50 GHz - 100 GHz 9 kHz - 30 MHz
Engineer Hironobu Ohnishi
Mode Tx 24.15 GHz, Narrow beam (Left)

[Fundamental, band-edge and 2nd harmonics]

Peak

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result (3 m) [dBuV/m]		Limit (3 m) dBuV/m	Margin [dB]		Remark Inside or Outside of Restricted Bands
		Hor	Ver					Hor	Ver		Hor	Ver	
24000.00	PK	47.5	47.0	39.1	-0.3	30.6	-	55.7	55.2	73.9	18.2	18.7	Inside
24150.00	PK	98.1	71.0	39.0	-0.2	30.5	-	106.4	79.3	127.9	21.5	48.6	Fundamental
24250.00	PK	48.7	48.0	39.0	-0.2	30.4	-	57.1	56.4	73.9	16.8	17.5	Outside
48300.72	PK	44.9	44.2	40.4	-7.6	18.4	-	59.3	58.6	87.9	28.6	29.3	Inside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

Peak with Duty factor

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]		Limit dBuV/m	Margin [dB]		Remark
		Hor	Ver					Hor	Ver		Hor	Ver	
24000.00	PK	47.5	47.0	39.1	-0.3	30.6	-6.8	48.9	48.4	53.9	5.0	5.5	Inside
24150.00	PK	98.1	71.0	39.0	-0.2	30.5	-6.8	99.6	72.5	107.9	8.3	35.4	Fundamental
24250.00	PK	48.7	48.0	39.0	-0.2	30.4	-6.8	50.3	49.6	53.9	3.6	4.3	Outside
48300.72	PK	44.9	44.2	40.4	-7.6	18.4	-6.8	52.5	51.8	67.9	15.4	16.1	Inside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

[Spurious emissions other than above]

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	38.00	QP	22.9	14.9	7.2	32.1	12.9	40.0	27.1	
Hori	120.00	QP	23.2	12.9	8.3	32.0	12.4	43.5	31.1	
Hori	240.00	QP	22.7	17.1	9.4	31.8	17.4	46.0	28.6	
Hori	480.00	QP	23.0	19.2	11.1	31.9	21.4	46.0	24.6	
Hori	720.00	QP	23.1	22.5	12.4	32.1	25.9	46.0	20.1	
Hori	960.00	QP	23.0	25.9	13.6	30.9	31.6	46.0	14.4	
Hori	72451.00	PK	12.1	41.7	13.6	4.9	62.5	87.9	25.4	NS
Hori	96601.44	PK	15.0	45.6	8.2	28.9	39.9	73.9	34.0	NS
Hori	72451.00	AV	-0.1	41.7	13.6	4.9	50.3	67.9	17.6	NS, VBW 10Hz
Hori	96601.44	AV	2.6	45.6	8.2	28.9	27.5	53.9	26.4	NS, VBW 10Hz
Vert	38.00	QP	22.8	14.9	7.2	32.1	12.8	40.0	27.2	
Vert	120.00	QP	23.3	12.9	8.3	32.0	12.5	43.5	31.0	
Vert	240.00	QP	22.7	17.1	9.4	31.8	17.4	46.0	28.6	
Vert	480.00	QP	22.9	19.2	11.1	31.9	21.3	46.0	24.7	
Vert	720.00	QP	23.1	22.5	12.4	32.1	25.9	46.0	20.1	
Vert	960.00	QP	23.1	25.9	13.6	30.9	31.7	46.0	14.3	
Vert	72451.00	PK	12.5	41.7	13.6	4.9	62.9	87.9	25.0	NS
Vert	96601.44	PK	15.5	45.6	8.2	28.9	40.4	73.9	33.5	NS
Vert	72451.00	AV	-0.1	41.7	13.6	4.9	50.3	67.9	17.6	NS, VBW 10Hz
Vert	96601.44	AV	2.6	45.6	8.2	28.9	27.5	53.9	26.4	NS, VBW 10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Mixer(above 50 GHz)-Distance factor(above 10 GHz)) - Gain(Amplifier)

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

*NS: No signal detected.

Distance factor:
10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = 9.5 dB
26.5 GHz - 40 GHz 20log (3.0 m / 0.5 m) = 15.6 dB
Above 50 GHz 20log (3.0 m / 0.05 m) = 35.6 dB

There are FM and FSK modulation part in one transmission burst. The FSK modulation hops to any frequencies per 80 ms in actual operation. The FSK frequency was fixed to lowest (24.06 GHz) or highest (24.24 GHz) for the purpose of band-edge measurement.

UL Japan, Inc.

Ise EMC Lab.

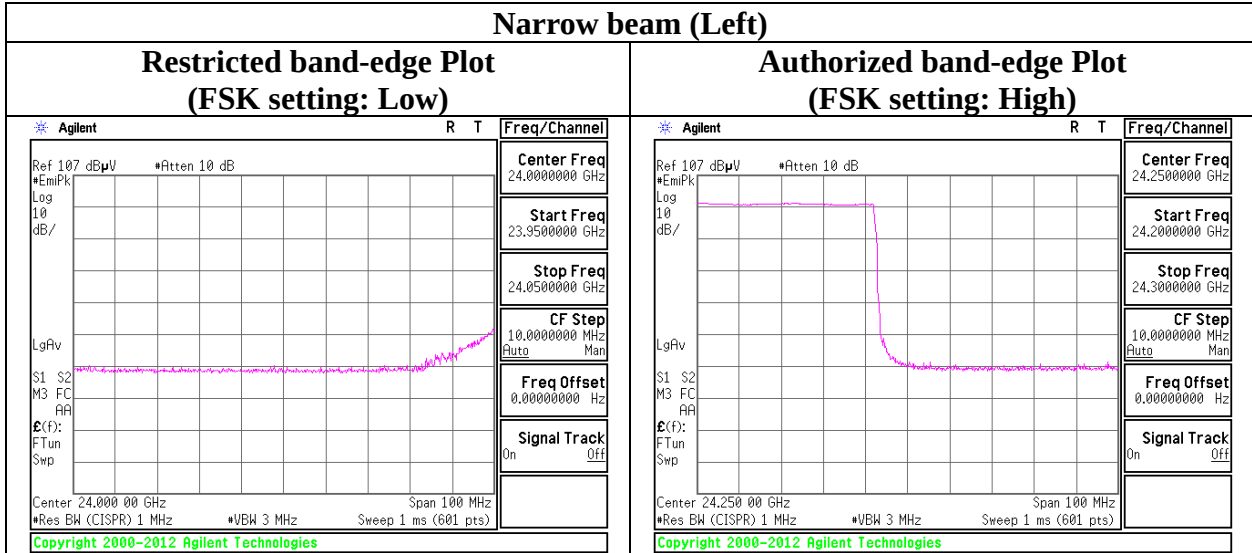
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No. 4 Semi Anechoic Chamber
Report No.	10903739H
Date	08/07/2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Hironobu Ohnishi
Mode	Tx 24.15 GHz, Narrow beam (Left)



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

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Report No. 10903739H
Test place Ise EMC Lab.
No. 4 Semi Anechoic Chamber No. 4 Semi Anechoic Chamber No. 3 Semi Anechoic Chamber No. 3 Semi Anechoic Chamber No. 3 Semi Anechoic Chamber
Date 08/06/2015 08/24/2015 08/31/2015 09/02/2015 09/03/2015
Temperature / 24 deg. C / 25 deg. C / 24 deg. C / 24 deg. C / 24 deg. C /
Humidity 59 % RH 64 % RH 71 % RH 66 % RH 69 % RH
18 GHz - 26.5 GHz 30 MHz - 18 GHz 26.5 GHz - 50 GHz 50 GHz - 100 GHz 9 kHz - 30 MHz
Engineer Hironobu Ohnishi
Mode Tx 24.15 GHz, Narrow beam (Right)

[Fundamental, band-edge and 2nd harmonics]

Peak

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result (3 m) [dBuV/m]		Limit (3 m) dBuV/m	Margin [dB]		Remark Inside or Outside of Restricted Bands
		Hor	Ver					Hor	Ver		Hor	Ver	
24000.00	PK	47.1	46.6	39.1	-0.3	30.6	-	55.3	54.8	73.9	18.6	19.1	Inside
24150.00	PK	98.1	73.1	39.0	-0.2	30.5	-	106.4	81.4	127.9	21.5	46.5	Fundamental
24250.00	PK	49.3	47.6	39.0	-0.2	30.4	-	57.7	56.0	73.9	16.2	17.9	Outside
48300.72	PK	44.1	44.7	40.4	-7.6	18.4	-	58.5	59.1	87.9	29.4	28.8	Inside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

Peak with Duty factor

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]		Limit dBuV/m	Margin [dB]		Remark
		Hor	Ver					Hor	Ver		Hor	Ver	
24000.00	PK	47.1	46.6	39.1	-0.3	30.6	-6.8	48.5	48.0	53.9	5.4	5.9	Inside
24150.00	PK	98.1	73.1	39.0	-0.2	30.5	-6.8	99.6	74.6	107.9	8.3	33.3	Fundamental
24250.00	PK	49.3	47.6	39.0	-0.2	30.4	-6.8	50.9	49.2	53.9	3.0	4.7	Outside
48300.72	PK	44.1	44.7	40.4	-7.6	18.4	-6.8	51.7	52.3	67.9	16.2	15.6	Inside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

[Spurious emissions other than above]

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	38.00	QP	23.0	14.9	7.2	32.1	13.0	40.0	27.0	
Hori	120.00	QP	23.3	12.9	8.3	32.0	12.5	43.5	31.0	
Hori	240.00	QP	22.6	17.1	9.4	31.8	17.3	46.0	28.7	
Hori	480.00	QP	23.1	19.2	11.1	31.9	21.5	46.0	24.5	
Hori	720.00	QP	23.1	22.5	12.4	32.1	25.9	46.0	20.1	
Hori	960.00	QP	23.0	25.9	13.6	30.9	31.6	46.0	14.4	
Hori	72451.00	PK	12.0	41.7	13.6	4.9	62.4	87.9	25.5	NS
Hori	96601.44	PK	15.7	45.6	8.2	28.9	40.6	73.9	33.3	NS
Hori	72451.00	AV	-0.1	41.7	13.6	4.9	50.3	67.9	17.6	NS, VBW 10Hz
Hori	96601.44	AV	2.6	45.6	8.2	28.9	27.5	53.9	26.4	NS, VBW 10Hz
Vert	38.00	QP	23.0	14.9	7.2	32.1	13.0	40.0	27.0	
Vert	120.00	QP	23.3	12.9	8.3	32.0	12.5	43.5	31.0	
Vert	240.00	QP	22.7	17.1	9.4	31.8	17.4	46.0	28.6	
Vert	480.00	QP	23.0	19.2	11.1	31.9	21.4	46.0	24.6	
Vert	720.00	QP	23.1	22.5	12.4	32.1	25.9	46.0	20.1	
Vert	960.00	QP	23.0	25.9	13.6	30.9	31.6	46.0	14.4	
Vert	72451.00	PK	11.6	41.7	13.6	4.9	62.0	87.9	25.9	NS
Vert	96601.44	PK	15.1	45.6	8.2	28.9	40.0	73.9	33.9	NS
Vert	72451.00	AV	-0.1	41.7	13.6	4.9	50.3	67.9	17.6	NS, VBW 10Hz
Vert	96601.44	AV	2.6	45.6	8.2	28.9	27.5	53.9	26.4	NS, VBW 10Hz

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Mixer(above 50 GHz)-Distance factor(above 10 GHz)) - Gain(Amplifier)

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

*NS: No signal detected.

Distance factor:
10 GHz - 26.5 GHz 20log(3.0 m / 1.0 m) = 9.5 dB
26.5 GHz - 40 GHz 20log(3.0 m / 0.5 m) = 15.6 dB
Above 50 GHz 20log(3.0 m / 0.05 m) = 35.6 dB

There are FM and FSK modulation part in one transmission burst. The FSK modulation hops to any frequencies per 80 ms in actual operation. The FSK frequency was fixed to lowest (24.06 GHz) or highest (24.24 GHz) for the purpose of band-edge measurement.

UL Japan, Inc.

Ise EMC Lab.

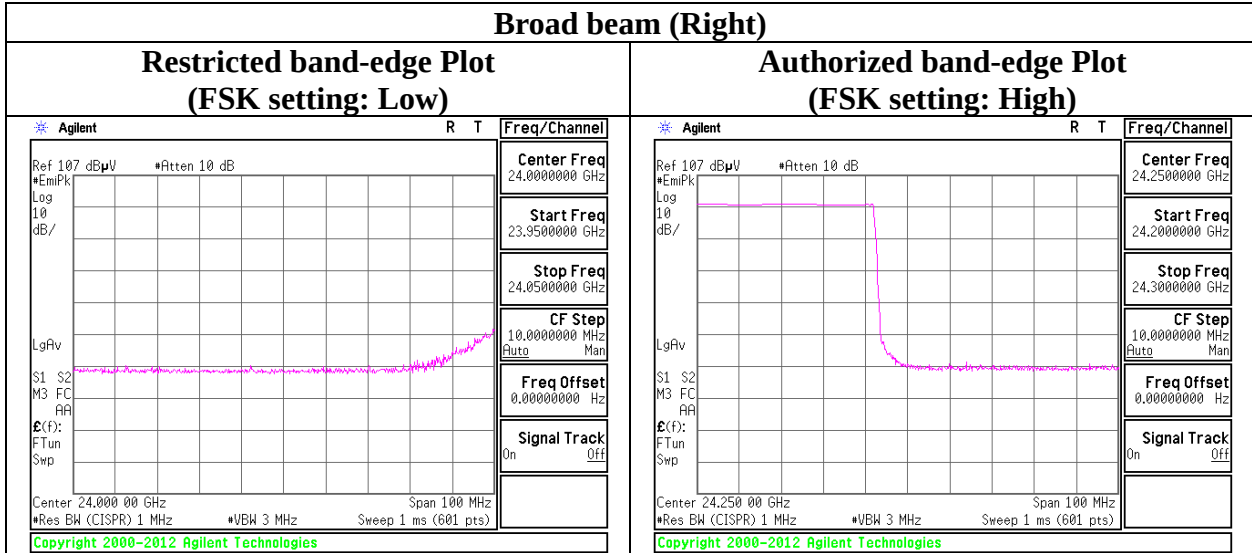
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

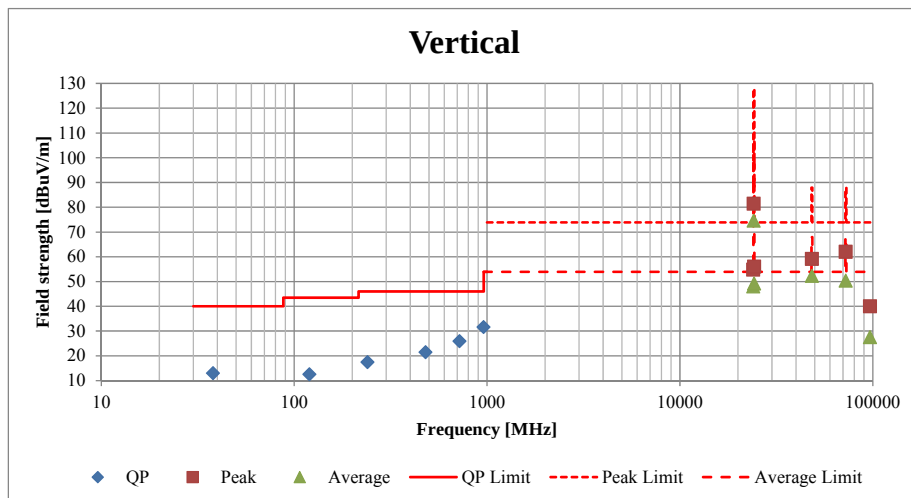
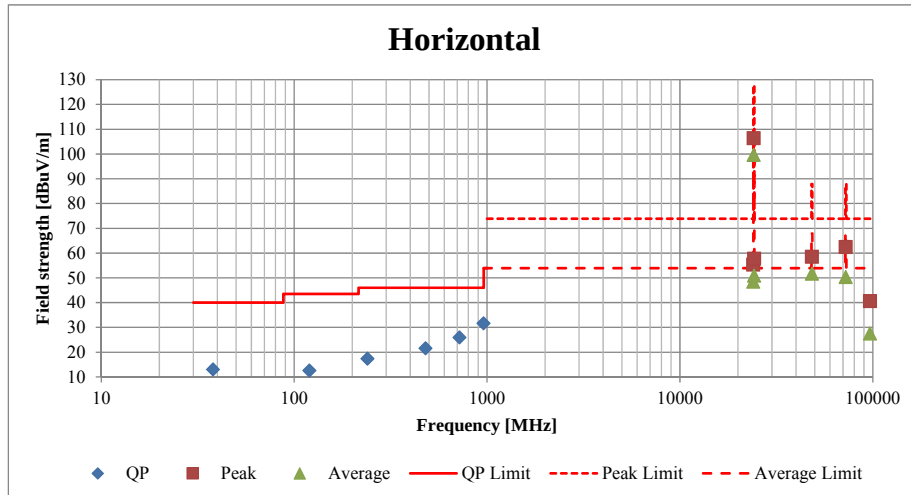
Test place	Ise EMC Lab. No. 4 Semi Anechoic Chamber
Report No.	10903739H
Date	08/07/2015
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Hironobu Ohnishi
Mode	Tx 24.15 GHz, Narrow beam (Right)



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

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

Report No.	10903739H				
Test place	Ise EMC Lab.				
	No. 4 Semi	No. 4 Semi	No. 3 Semi	No. 3 Semi	No. 3 Semi
	Anechoic Chamber	Anechoic Chamber	Anechoic Chamber	Anechoic Chamber	Anechoic Chamber
Date	08/06/2015	08/24/2015	08/31/2015	09/02/2015	09/03/2015
Temperature /	24 deg. C /	25 deg. C /	24 deg. C /	24 deg. C /	24 deg. C /
Humidity	59 % RH	64 % RH	71 % RH	66 % RH	69 % RH
	18 GHz - 26.5 GHz	30 MHz - 18 GHz	26.5 GHz - 50 GHz	50 GHz - 100 GHz	9 kHz - 30 MHz
Engineer	Hironobu Ohnishi				
Mode	Tx 24.15 GHz, Narrow beam (Right)				



UL Japan, Inc.

Ise EMC Lab.

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

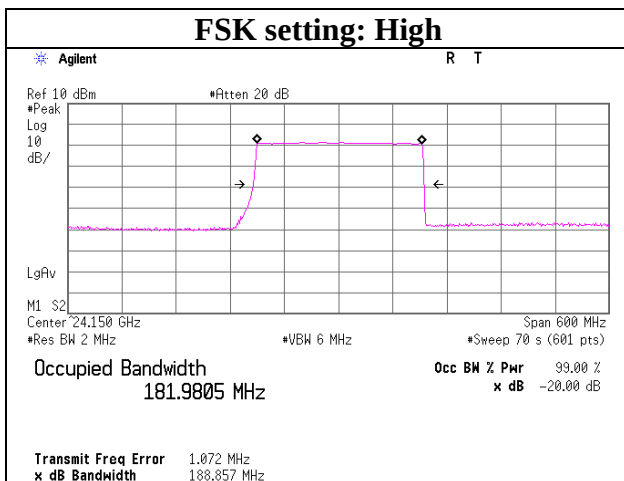
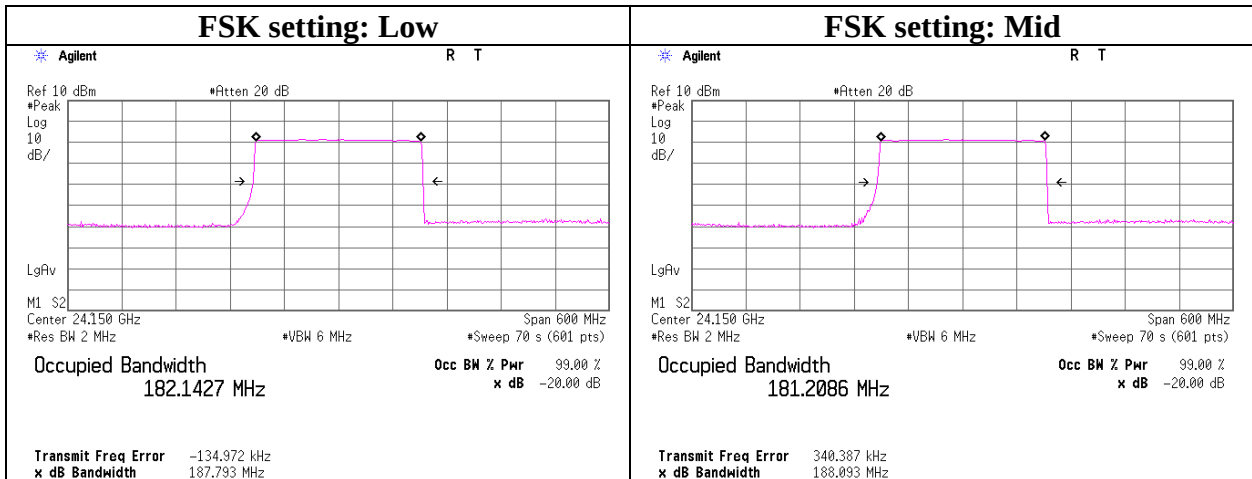
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

20dB Bandwidth, 99% Occupied Bandwidth

Test place : Ise EMC Lab. No. 4 Semi Anechoic Chamber
Report No. : 10903739H
Date : 08/07/2015
Temperature/ Humidity : 24 deg. C / 57 % RH
Engineer : Hironobu Ohnishi
Mode : Tx 24.15 GHz, Broad beam

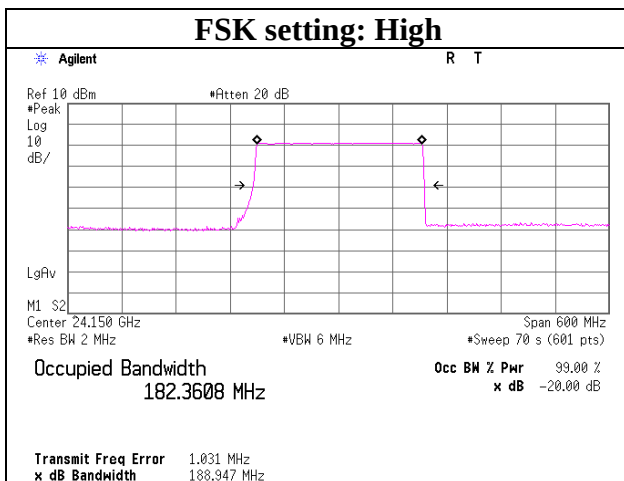
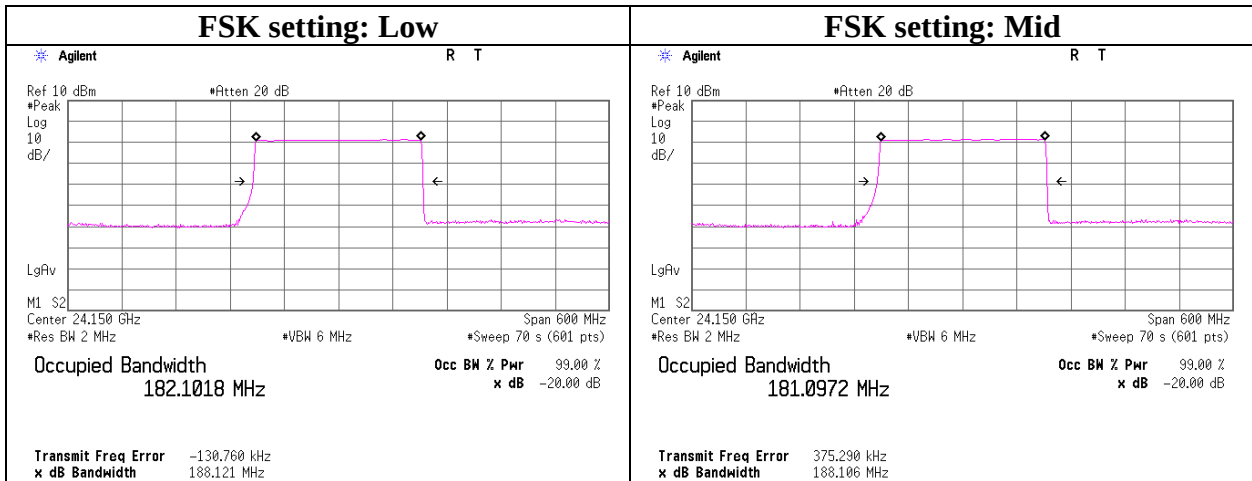
Frequency [GHz]	FSK setting [GHz]	20 dB Bandwidth [MHz]	99% Occupied Bandwidth [MHz]
24.15	24.06	187.793	182.1427
24.15	24.15	188.093	181.2086
24.15	24.24	188.857	181.9805



20dB Bandwidth, 99% Occupied Bandwidth

Test place : Ise EMC Lab. No. 4 Semi Anechoic Chamber
Report No. : 10903739H
Date : 08/07/2015
Temperature/ Humidity : 24 deg. C / 57 % RH
Engineer : Hironobu Ohnishi
Mode : Tx 24.15 GHz, Narrow beam (Left)

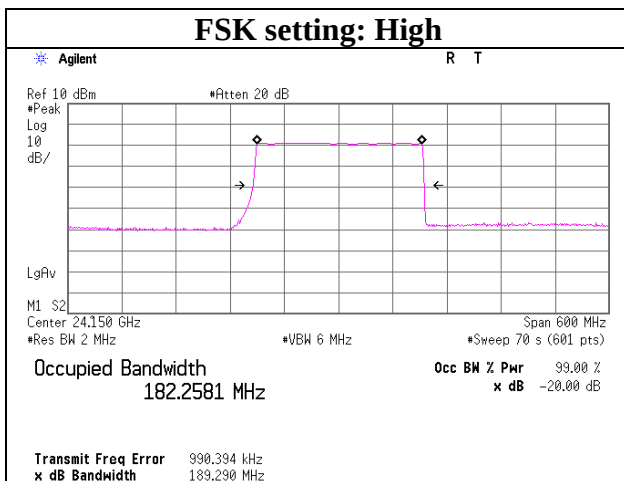
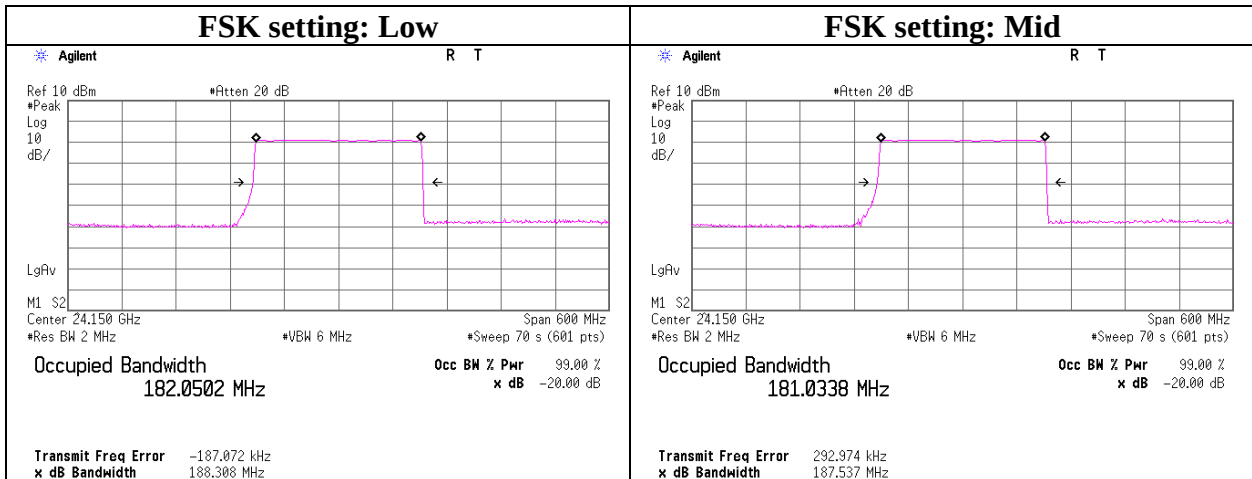
Frequency [GHz]	FSK setting [GHz]	20 dB Bandwidth [MHz]	99% Occupied Bandwidth [MHz]
24.15	24.06	188.121	182.1018
24.15	24.15	188.106	181.0972
24.15	24.24	188.947	182.3608



20dB Bandwidth, 99% Occupied Bandwidth

Test place : Ise EMC Lab. No. 4 Semi Anechoic Chamber
Report No. : 10903739H
Date : 08/07/2015
Temperature/ Humidity : 24 deg. C / 57 % RH
Engineer : Hironobu Ohnishi
Mode : Tx 24.15 GHz, Narrow beam (Right)

Frequency [GHz]	FSK setting [GHz]	20 dB Bandwidth [MHz]	99% Occupied Bandwidth [MHz]
24.15	24.06	188.308	182.0502
24.15	24.15	187.537	181.0338
24.15	24.24	189.290	182.2581



Duty Cycle

Test place Ise EMC Lab. No. 4 Semi Anechoic Chamber
Report No. 10903739H
Date 08/07/2015
Temperature/ Humidity 24 deg. C / 57 % RH
Engineer Hironobu Ohnishi
Mode Tx 24.15 GHz

Mode	Tx On time [ms]	Tx On + Off time [ms]	Duty factor [dB]
Broad beam	36.4	80.0	-6.8
Narrow beam (Left)	36.4	80.0	-6.8
Narrow beam (Right)	36.4	80.0	-6.8

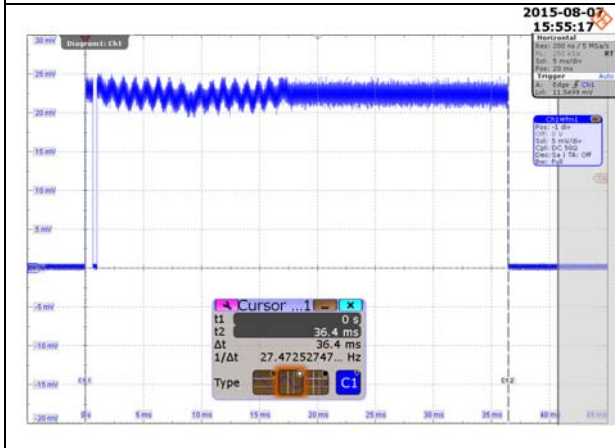
Duty factor = $20 * \log (\text{Tx On time} / \text{Tx On} + \text{Off time})$

This Duty Cycle is the worst case. Transmitting time does not exceed it.

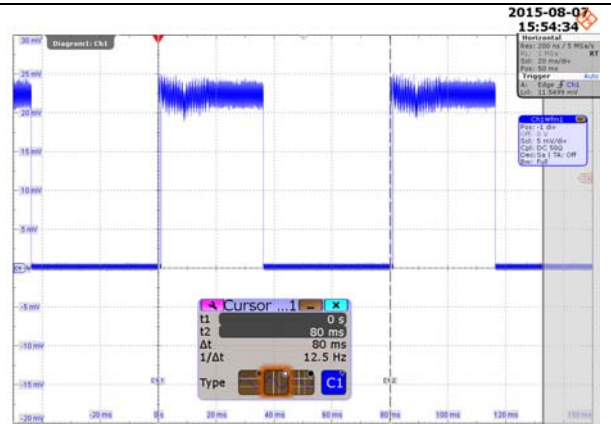
Duty Cycle

Broad beam

Tx On time

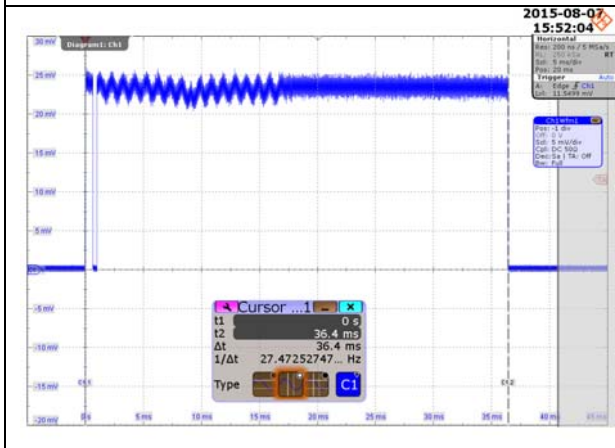


Tx On + Off time

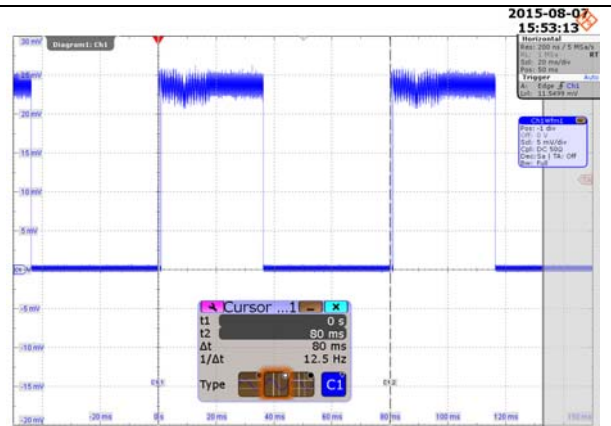


Narrow beam (Left)

Tx On time

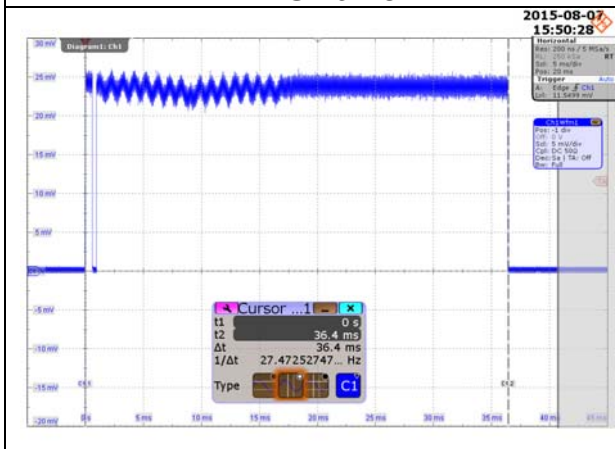


Tx On + Off time

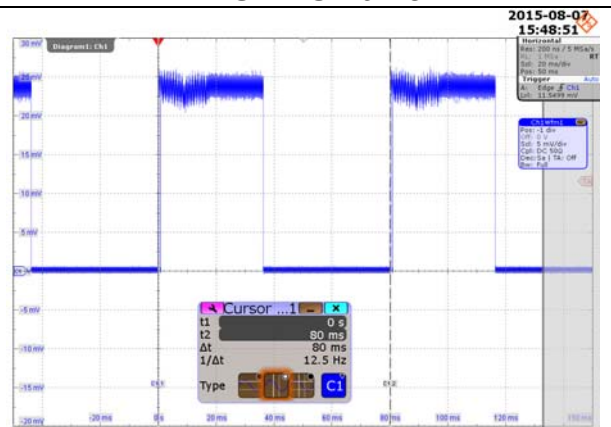


Narrow beam (Right)

Tx On time



Tx On + Off time



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

APPENDIX 2: Test Instruments

EMI test equipment (1/2)

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	2015/02/26 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2015/01/13 * 12
MJM-23	Measure	ASKUL	-	-	RE	-
MLDM-04	Digital laser distance meter	BOSCH	DLE 50	781422774	RE	2013/06/26 * 36
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2015/01/16 * 12
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2014/11/12 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2015/06/22 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2015/03/19 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2015/06/06 * 12
MDO-07	Digital Oscilloscope	Rohde & Schwarz	RTO1004	200354	RE	2015/07/10 * 12
MDT-05	Detector	HEROTEK, INC.	DT1840P	484823	RE	Pre Check
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2014/11/10 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2014/11/22 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2014/11/22 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2015/06/19 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2014/11/11 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2015/03/09 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2015/02/05 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2015/03/12 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/02/19 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2015/01/13 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2015/01/16 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2015/02/26 * 12
MCC-140	Microwave Cable	Junkosha	J12J101596-00	JAN-31-12-001	RE	2015/02/23 * 12
MPA-03	Microwave System Power Amplifier	Agilent	83050A	3950M00205	RE	2015/06/02 * 12
MHA-03	Horn Antenna 26.5-40GHz	EMCO	3160-10	1150	RE	2015/06/06 * 12
MPA-07	Pre Amplifier	UNITEK ELECTROBICS INC.	Amp1G	20040901	RE	2015/06/25 * 12
MHA-09	Horn Antenna	WiseWave	ARH1523-02	10766-01	RE	2014/10/31 * 12
MPA-08	Pre Amplifier	WiseWave	ALN-61226028-51	11576-01-071	RE	2015/08/25 * 12
MMX-01	Preselected Millimeter Mixer	Agilent	11974V-E01	3001A00412	RE	2015/06/29 * 12
MHA-11	Horn Antenna	WiseWave	ARH1023-02	10766-01	RE	2014/10/31 * 12
MPA-18	Pre Amplifier	AmTechs Corporation	LNA-7511025	9601	RE	2015/08/25 * 12
MMX-02	Harmonic Mixer	Agilent	11970W	2521 A01909	RE	2015/06/29 * 12

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

EMI test equipment (2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MCC-135	Microwave Cable	HUBER+SUHNER	SUCOFLEX102	37511/2	RE	2015/08/04 * 12
MCC-136	Microwave Cable	HUBER+SUHNER	SUCOFLEX102	37512/2	RE	2015/08/04 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2015/06/08 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2014/10/04 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(3m)/ sucoform141-PE(1m)/ 421-010(1.5m)/ RFM-E321(Switcher)	-/00640	RE	2015/07/02 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2015/06/24 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2015/03/10 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2015/04/08 * 12

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

[Below 40 GHz]

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

[Above 40 GHz]

Acceptance criteria for untraceable equipment was formulated according to ISO/IEC 17025 5.6.2.2.2, and the regular inspection was performed based on it annually.

For 40 GHz – 110 GHz, power sensor is calibrated by manufacturer, and the measured calibration data is used as in-house reference. The calibration data by manufacturer is checked for acceptance by a calorie meter except for some frequency bands. Electric power is checked with the calorie meter by measuring resistance and voltage of reference resistor.

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, Bandwidth and Duty cycle tests

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