RADIO TEST REPORT

Test Report No. : 10837078H-A-R1

Applicant	:	**FUJI HEAVY INDUSTRIES LTD.**
Type of Equipment	:	**Smart system**
Model No.	:	**FJ14-1**
FCC ID	:	**Y8PFJ14-1**
Test regulation	:	**FCC Part 15 Subpart C: 2015**
Test Result	:	**Complied**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 10837078H-A. 10837078H-A is replaced with this report.

Date of test: June 17 to 24, 2015

Representative test engineer:

Shinya Watanabe
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.
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REVISION HISTORY

Original Test Report No.: 10837078H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10837078H-A	July 10, 2015	-	-
1	10837078H-A-R1	August 3, 2015	P.5	Update to FCC version
1	10837078H-A-R1	August 3, 2015	P.8	Addition of following sentence in Clause 4.1; *During testing, transmitting antenna was fixed to one of six antennas.
1	10837078H-A-R1	August 3, 2015	P.8	Addition of following sentence in Clause 4.2; - The difference between INSIDE Antenna and OUTSIDE Antenna is output power only.

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SECTION 1: Customer information

Company Name	:	FUJI HEAVY INDUSTRIES LTD.
Address	:	1-1 SUBARU-CHO, OTA, GUNMA, 373-8555, JAPAN
Telephone Number	:	+81-276-26-2771
Facsimile Number	:	+81-276-26-3069
Contact Person	:	Yuji Kobayashi

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

2.1 Identification of E.U.T.

Type of Equipment	:	Smart system
Model No.	:	FJ14-1
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12.0V
Receipt Date of Sample	:	June 11, 2015
Country of Mass-production	:	United States of America, Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model No: FJ14-1 (referred to as the EUT in this report) is the Smart system.

General Specification

Clock frequencies in the system	:	4.000 MHz (CPU)

Radio Specification

[Transmitter]

Radio Type	:	Transmitter
Frequency of Operation	:	134.2 kHz
Oscillator Frequency	:	4.2944 MHz (IC)
Type of Modulation	:	OOK (A1D)
Oscillation circuit	:	Crystal
Power Supply	:	DC 12.0 V
Antenna	:	Antenna (TYPE 1) (*1) (*3) / (TYPE 2) (*2) *1: Maximum number of this antenna is 2. *2: Maximum number of this antenna is 4.
Antenna Specification	:	Ferrite antenna coil

* The EUT does not transmit simultaneously from multiple antennas.

[Receiver] *4)

Radio Type	:	Receiver
Frequency of Operation	:	433.92 MHz
Oscillator frequency	:	52.9025 MHz (Crystal)
Type of Modulation	:	FSK (F1D)
Type of receiving system	:	Super-heterodyne
Power Supply	:	DC 5.0 V
Antenna Type	:	Internal antenna (Inverted F antenna)

*3) The Antenna (TYPE 1) of this system has variations of model 1 and model 2.
The difference of these variations is only the outer shell, and the test was performed with the representative model 1.
*4) The test of receiver part was performed separately from this test report, and the conformability is confirmed.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2015, final revised on June 12, 2015 and effective July 13, 2015
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted Emission Section 15.209 Radiated emission limits, general requirements

* The revision on June 12, 2015 does not affect the test specification applied to the EUT.

FCC Part 15.31 (e)
The EUT is a battery-operated device and test was performed with the full-charged battery. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	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 *1)	N/A	N/A
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.4:2009 13. Measurement of intentional radiators <IC> RSS-Gen 6.4, 6.12	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 8.9	Radiated	N/A	6.7 dB 0.13420 MHz PK (PK with Duty factor) Antenna Type 2 (OUTSIDE)	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.4:2009 13. Measurement of intentional radiators <IC> RSS-Gen 6.4, 6.13	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 8.9	Radiated	N/A	6.8 dB 68.722 MHz, Vertical, QP	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2009 13. Measurement of intentional radiators <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	N/A

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*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.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99 % Occupied Band Width	RSS-Gen 6.6	-	Radiated	N/A	N/A	N/A

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						
	(3 m*)(±dB)				(1 m*)(±dB)		(0.5 m*)(±dB)
	9 kHz - 30 MHz	30 MHz - 300 MHz	300 MHz - 1 GHz	1 GHz - 10 GHz	10 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz
No.1	4.3 dB	5.5 dB	6.3 dB	5.5 dB	5.8 dB	5.8 dB	4.3 dB
No.2	4.2 dB	5.4 dB	6.3 dB	5.4 dB	5.7 dB	5.9 dB	5.6 dB
No.3	4.4 dB	5.4 dB	6.4 dB	5.2 dB	5.5 dB	5.8 dB	5.5 dB
No.4	4.7 dB	5.6 dB	6.4 dB	5.3 dB	5.7 dB	5.9 dB	5.5 dB

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

Radiated emission test(3 m)
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	-	8.0 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

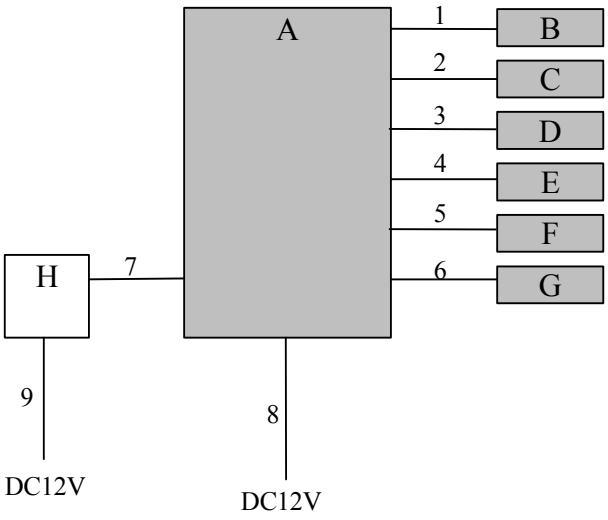
4.1 Operating Modes

The mode is used: Transmitting mode (Tx) 134.2kHz

Justification : The system was configured in typical fashion (as a customer would normally use it) for testing.

*During testing, transmitting antenna was fixed to one of six antennas.

4.2 Configuration and peripherals



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

*This system has three kinds of antenna ports.
- Two ports where Antenna (TYPE 1) is connected
- three ports where Antenna (TYPE 2) is connected (TYPE 2, INSIDE)
- one ports where Antenna (TYPE 2) is connected (TYPE 2, OUTSIDE)
- The difference between INSIDE Antenna and OUTSIDE Antenna is output power only.
The test was performed with each representative one of above three kinds of antenna ports.

* Antenna (Type 1) and Antenna (Type 2) were evaluated with the worst duty respectively.
Worst duty does not change due to the difference in number of connected antenna.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Smart ECU	-	10018674-1	-	EUT
B	Antenna (TYPE 1)	-	001	-	EUT
C	Antenna (TYPE 1)	-	002	-	EUT
D	Antenna (TYPE 2 INSIDE)	-	001	-	EUT
E	Antenna (TYPE 2 INSIDE)	-	002	-	EUT
F	Antenna (TYPE 2 INSIDE)	-	003	-	EUT
G	Antenna (TYPE 2 OUTSIDE)	-	004	-	EUT
H	Jig	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna (TYPE 1) Cable	3.0	Unshielded	Unshielded	-
2	Antenna (TYPE 1) Cable	3.0	Unshielded	Unshielded	-
3	Antenna (TYPE 2 INSIDE) Cable	3.0	Unshielded	Unshielded	-
4	Antenna (TYPE 2 INSIDE) Cable	3.0	Unshielded	Unshielded	-
5	Antenna (TYPE 2 INSIDE) Cable	3.0	Unshielded	Unshielded	-
6	Antenna (TYPE 2 OUTSIDE) Cable	3.0	Unshielded	Unshielded	-
7	Signal Cable	3.0	Unshielded	Unshielded	-
8	DC Cable	3.0	Unshielded	Unshielded	-
9	DC Cable	3.0	Unshielded	Unshielded	-

SECTION 5: Radiated emission (Fundamental and Spurious Emission)

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

Frequency : From 9 kHz to 30 MHz
The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., 135 deg., and 180 deg.) and horizontal polarization.
*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency : From 30 MHz to 1 GHz
The measuring antenna height varied between 1 and 4 m 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.

The test was made with the detector (RBW / VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

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

Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

*1) Distance Factor: 40 x log (3 m / 300 m) = -80 dB
*2) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.
However test results were confirmed to pass against standard limit.

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

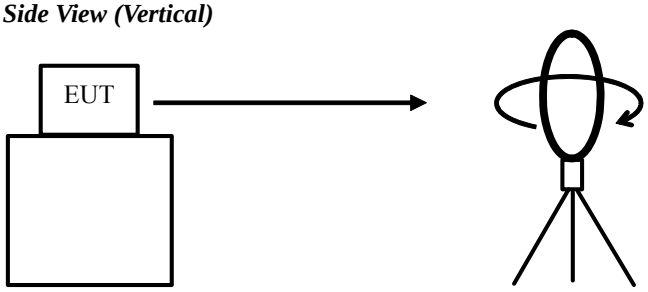
The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 9 kHz - 1 GHz
Test data : APPENDIX 1
Test result : Pass

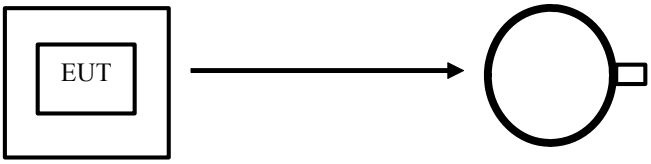
Date: June 17, 2015 Test engineer: Kenshi Shimomura
June 24, 2015 Yuta Moriya

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

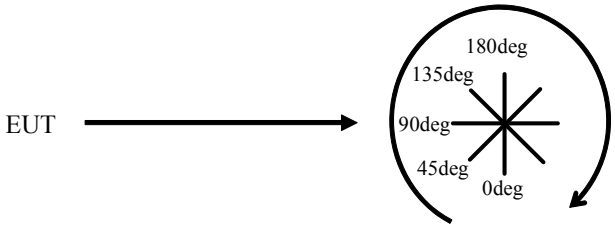


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

SECTION 6: -26dB Bandwidth

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
-26 dB Bandwidth	100 kHz	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1
Test result : Pass

SECTION 7: 99% Occupied Bandwidth

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
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement.							

Test data : APPENDIX 1
Test result : Pass

APPENDIX 1: Test data

Radiated Emission below 30MHz (Fundamental and Spurious Emission)

Antenna (TYPE 1)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Order No.	10837078H
Date	06/17/2015
Temperature/ Humidity	25 deg. C / 40% RH
Engineer	Kenshi Shimomura
Mode	Tx 134.2kHz, Antenna (TYPE 1)

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	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
0	0.13420	PK	69.7	19.6	-74.0	0.0	-	15.3	45.0	29.7	Fundamental
0	0.26840	PK	60.1	19.6	-74.0	32.1	-	-26.4	39.0	65.4	
0	0.40260	PK	76.1	19.6	-73.9	32.1	-	-10.3	35.5	45.8	
0	0.53680	QP	42.0	19.5	-33.9	32.1	-	-4.5	33.0	37.5	
0	0.67100	QP	62.6	19.5	-33.8	32.1	-	16.2	31.1	14.9	
0	0.80520	QP	40.0	19.5	-33.8	32.1	-	-6.4	29.5	35.9	
0	0.93940	QP	50.8	19.5	-33.8	32.1	-	4.4	28.1	23.7	
0	1.07360	QP	39.7	19.5	-33.8	32.1	-	-6.7	26.9	33.6	
0	1.20780	QP	44.0	19.5	-33.8	32.1	-	-2.4	25.9	28.3	
0	1.34200	QP	39.6	19.5	-33.7	32.1	-	-6.7	25.0	31.7	

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

PK with Duty factor

Ant Deg [deg]	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
0	0.13420	PK	69.7	19.6	-74.0	0.0	0.0	15.3	25.0	9.7	Fundamental
0	0.26840	PK	60.1	19.6	-74.0	32.1	0.0	-26.4	19.0	45.4	
0	0.40260	PK	76.1	19.6	-73.9	32.1	0.0	-10.3	15.5	25.8	

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

* Gain 0.0 dB shows that the pre amplifier was not used to avoid the influence of carrier power.
* Since the peak emission result satisfied the average limit, duty factor was omitted.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	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
0	0.13420	PK	69.7	19.6	6.0	0.0	-	95.3	-	-	Fundamental

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

* All spurious emissions lower than this result.

*The test result is rounded off to one or two decimal

Radiated Emission below 30MHz (Fundamental and Spurious Emission)

Antenna (TYPE 2, INSIDE)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Order No.	10837078H
Date	06/17/2015
Temperature/ Humidity	25 deg. C / 40% RH
Engineer	Kenshi Shimomura
Mode	Tx 134.2kHz, Antenna (TYPE 2, INSIDE)

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	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
0	0.13420	PK	69.9	19.6	-74.0	0.0	-	15.5	45.0	29.5	Fundamental
0	0.26840	PK	60.3	19.6	-74.0	32.1	-	-26.2	39.0	65.2	
0	0.40260	PK	66.4	19.6	-73.9	32.1	-	-20.0	35.5	55.5	
0	0.53680	QP	46.5	19.5	-33.9	32.1	-	0.0	33.0	33.0	
0	0.67100	QP	48.8	19.5	-33.8	32.1	-	2.4	31.1	28.7	
0	0.80520	QP	39.8	19.5	-33.8	32.1	-	-6.6	29.5	36.1	
0	0.93940	QP	47.3	19.5	-33.8	32.1	-	0.9	28.1	27.2	
0	1.07360	QP	39.7	19.5	-33.8	32.1	-	-6.7	26.9	33.6	
0	1.20780	QP	44.3	19.5	-33.8	32.1	-	-2.1	25.9	28.0	
0	1.34200	QP	39.8	19.5	-33.7	32.1	-	-6.5	25.0	31.5	
0	1.47620	QP	41.6	19.6	-33.7	32.1	-	-4.6	24.2	28.8	

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

PK with Duty factor

Ant Deg [deg]	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
0	0.13420	PK	69.9	19.6	-74.0	0.0	0.0	15.5	25.0	9.5	Fundamental
0	0.26840	PK	60.3	19.6	-74.0	32.1	0.0	-26.2	19.0	45.2	
0	0.40260	PK	66.4	19.6	-73.9	32.1	0.0	-20.0	15.5	35.5	

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

* Gain 0.0 dB shows that the pre amplifier was not used to avoid the influence of carrier power.
* Since the peak emission result satisfied the average limit, duty factor was omitted.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	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
0	0.13420	PK	69.9	19.6	6.0	0.0	-	95.5	-	-	Fundamental

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

* All spurious emissions lower than this result.

*The test result is rounded off to one or two decimal

Radiated Emission below 30MHz (Fundamental and Spurious Emission)

Antenna (TYPE 2, OUTSIDE)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Order No.	10837078H
Date	06/17/2015
Temperature/ Humidity	25 deg. C / 40% RH
Engineer	Kenshi Shimomura
Mode	Tx 134.2kHz, Antenna (TYPE 2, OUTSIDE)

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	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
0	0.13420	PK	80.0	19.6	-74.0	0.0	-	25.6	45.0	19.4	Fundamental
0	0.26840	PK	78.9	19.6	-74.0	32.1	-	-7.6	39.0	46.6	
0	0.40260	PK	63.6	19.6	-73.9	32.1	-	-22.8	35.5	58.3	
0	0.53680	QP	42.0	19.5	-33.9	32.1	-	-4.5	33.0	37.5	
0	0.67100	QP	49.8	19.5	-33.8	32.1	-	3.4	31.1	27.7	
0	0.80520	QP	39.8	19.5	-33.8	32.1	-	-6.6	29.5	36.1	
0	0.93940	QP	50.7	19.5	-33.8	32.1	-	4.3	28.1	23.8	
0	1.07360	QP	40.2	19.5	-33.8	32.1	-	-6.2	26.9	33.1	
0	1.20780	QP	48.1	19.5	-33.8	32.1	-	1.7	25.9	24.2	
0	1.34200	QP	39.7	19.5	-33.7	32.1	-	-6.6	25.0	31.6	
0	1.47620	QP	45.0	19.6	-33.7	32.1	-	-1.2	24.2	25.4	

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

PK with Duty factor

Ant Deg [deg]	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
0	0.13420	PK	80.0	19.6	-74.0	0.0	-7.3	18.3	25.0	6.7	Fundamental
0	0.26840	PK	78.9	19.6	-74.0	32.1	-7.3	-14.9	19.0	33.9	
0	0.40260	PK	63.6	19.6	-73.9	32.1	-7.3	-30.1	15.5	45.6	

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

* Gain 0.0 dB shows that the pre amplifier was not used to avoid the influence of carrier power.
* Since the peak emission result satisfied the average limit, duty factor was omitted.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	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
0	0.13420	PK	80.0	19.6	6.0	0.0	-	98.3	-	-	Fundamental

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

* All spurious emissions lower than this result.

*The test result is rounded off to one or two decimal

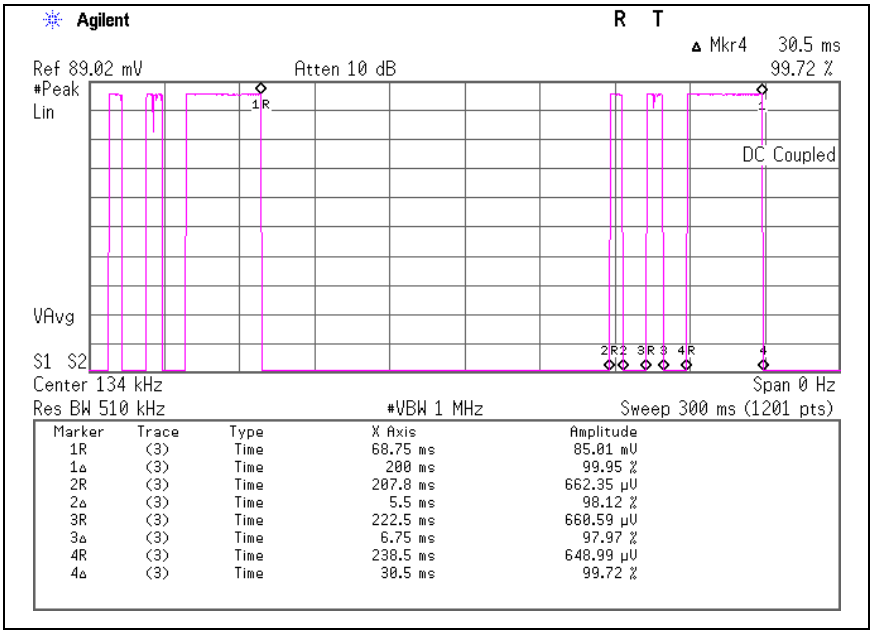
Duty Cycle

Antenna (TYPE 2, OUTSIDE)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Order No.	10837078H
Date	06/17/2015
Temperature/ Humidity	25 deg. C / 40% RH
Engineer	Kenshi Shimomura
Mode	Tx 134.2kHz, Antenna (TYPE 2, OUTSIDE)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
42.75	100.00	0.43	-7.3

ON time[ms]=5.5+6.75+30.5=42.75
Duty[dB]=20log(On time/Cycle)



Radiated Emission above 30MHz (Spurious Emission)

Antenna (TYPE 1)

DATA OF RADIATED EMISSION TEST

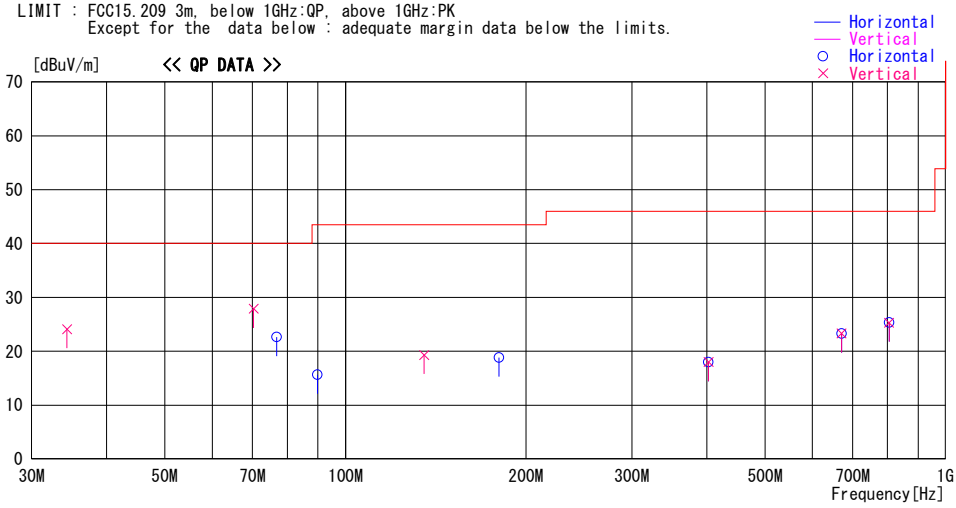
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/06/24

Report No. : 10837078H

Temp./Humi. : 23deg. C / 60% RH
Engineer : Yuta Moriya

Mode / Remarks : Tx 134.2kHz Antenna Type1 (Antenna X ECU X)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
34.359	39.5	QP	16.1	-31.5	24.1	79	100	Vert.	40.0	15.9	
70.290	52.9	QP	6.1	-31.1	27.9	188	100	Vert.	40.0	12.1	
76.864	47.0	QP	6.6	-31.0	22.6	180	239	Hori.	40.0	17.4	
89.825	38.0	QP	8.4	-30.8	15.6	188	239	Hori.	43.5	27.9	
135.283	35.6	QP	14.0	-30.3	19.3	278	100	Vert.	43.5	24.2	
180.360	32.7	QP	16.1	-30.0	18.8	359	206	Hori.	43.5	24.7	
402.600	27.8	QP	18.2	-28.0	18.0	0	100	Hori.	46.0	28.0	
402.600	27.8	QP	18.2	-28.0	18.0	0	100	Vert.	46.0	28.0	
671.000	27.6	QP	21.8	-26.1	23.3	0	100	Hori.	46.0	22.7	
671.000	27.6	QP	21.8	-26.1	23.3	0	100	Vert.	46.0	22.7	
805.200	27.4	QP	23.2	-25.3	25.3	0	100	Hori.	46.0	20.7	
805.200	27.4	QP	23.2	-25.3	25.3	0	100	Vert.	46.0	20.7	

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

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

Radiated Emission above 30MHz (Spurious Emission)

Antenna (TYPE 2, INSIDE)

DATA OF RADIATED EMISSION TEST

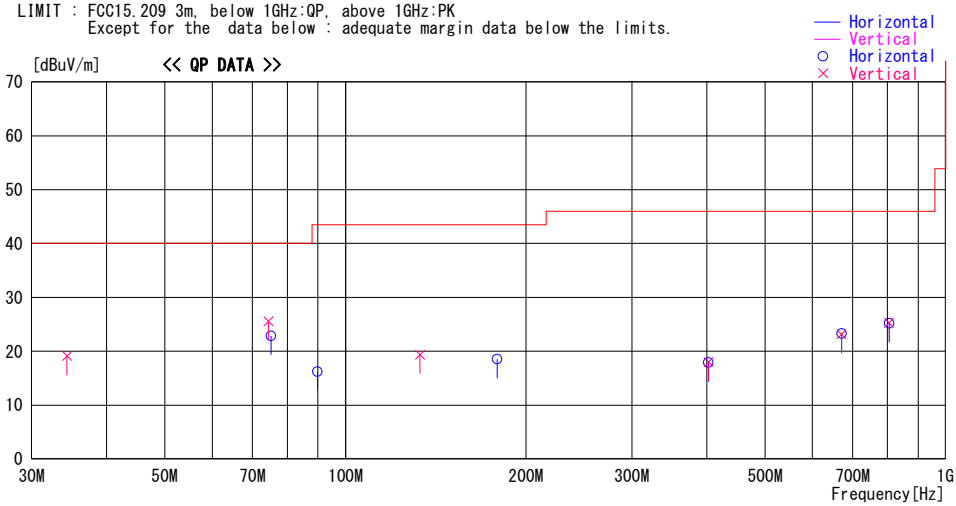
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/06/24

Report No. : 10837078H

Temp./Humi. : 23deg. C / 60% RH
Engineer : Yuta Moriya

Mode / Remarks : Tx 134.2kHz Antenna Type2 inside (Antenna Y ECU X)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
34.366	34.5	QP	16.1	-31.5	19.1	86	100	Vert.	40.0	20.9	
74.436	50.2	QP	6.4	-31.0	25.6	75	100	Vert.	40.0	14.4	
75.152	47.4	QP	6.5	-31.0	22.9	188	235	Hori.	40.0	17.2	
89.831	38.6	QP	8.4	-30.8	16.2	187	239	Hori.	43.5	27.3	
133.123	35.9	QP	13.8	-30.3	19.4	258	100	Vert.	43.5	24.2	
178.944	32.4	QP	16.1	-30.0	18.5	359	188	Hori.	43.5	25.0	
402.600	27.7	QP	18.2	-28.0	17.9	0	100	Hori.	46.0	28.1	
402.600	27.8	QP	18.2	-28.0	18.0	0	100	Vert.	46.0	28.0	
671.000	27.6	QP	21.8	-26.1	23.3	0	100	Hori.	46.0	22.7	
671.000	27.5	QP	21.8	-26.1	23.2	0	100	Vert.	46.0	22.8	
805.200	27.3	QP	23.2	-25.3	25.2	0	100	Hori.	46.0	20.8	
805.200	27.4	QP	23.2	-25.3	25.3	0	100	Vert.	46.0	20.7	

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

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

Radiated Emission above 30MHz (Spurious Emission)

Antenna (TYPE 2, OUTSIDE)

DATA OF RADIATED EMISSION TEST

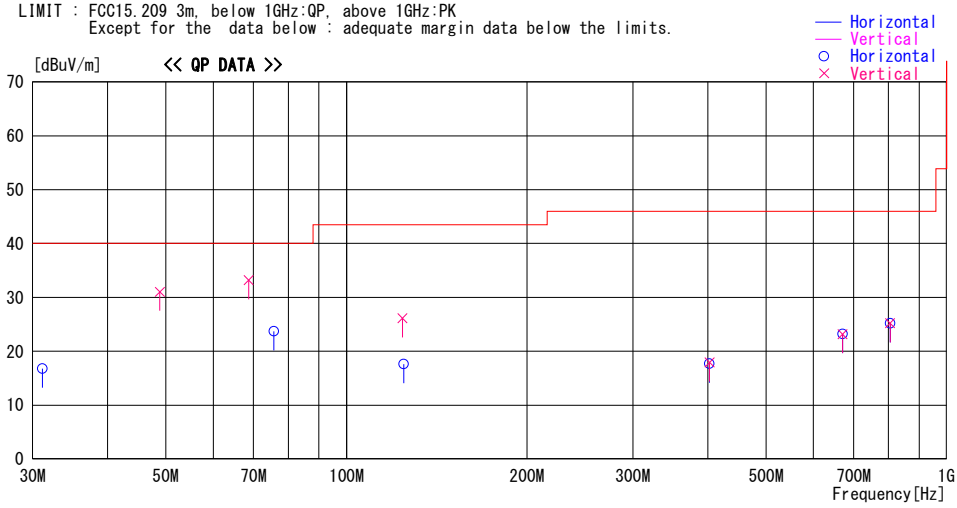
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/06/24

Report No. : 10837078H

Temp./Humi. : 23deg. C / 60% RH
Engineer : Yuta Moriya

Mode / Remarks : Tx 134.2kHz Antenna Type2 outside (Antenna Y ECU X)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
Except for the data below : adequate margin data below the limits.



Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
48.853	51.4	QP	11.0	-31.4	31.0	134	100	Vert.	40.0	9.0	
68.722	58.0	QP	6.3	-31.1	33.2	219	100	Vert.	40.0	6.8	
75.695	48.2	QP	6.5	-31.0	23.7	174	213	Hori.	40.0	16.3	
124.541	34.9	QP	13.1	-30.4	17.6	200	288	Hori.	43.5	25.9	
124.010	43.4	QP	13.1	-30.4	26.1	290	100	Vert.	43.5	17.4	
31.141	31.5	QP	16.9	-31.6	16.8	230	341	Hori.	40.0	23.2	
402.600	27.5	QP	18.2	-28.0	17.7	0	100	Hori.	46.0	28.3	
402.600	27.7	QP	18.2	-28.0	17.9	0	100	Vert.	46.0	28.1	
671.000	27.5	QP	21.8	-26.1	23.2	0	100	Hori.	46.0	22.8	
671.000	27.5	QP	21.8	-26.1	23.2	0	100	Vert.	46.0	22.8	
805.200	27.3	QP	23.2	-25.3	25.2	0	100	Hori.	46.0	20.8	
805.200	27.3	QP	23.2	-25.3	25.2	0	100	Vert.	46.0	20.8	

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

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

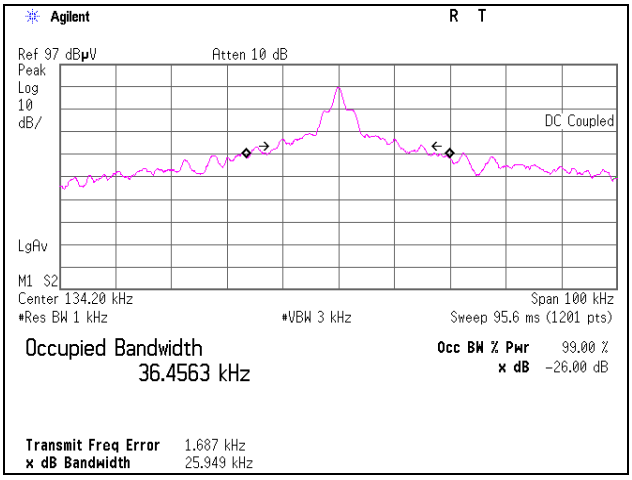
-26dB Bandwidth and 99% Occupied Bandwidth

Antenna (TYPE 1)

Report No.	10837078H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.1
Date	06/23/2015
Temperature / Humidity	24 deg. C / 60 % RH
Engineer	Yuta Moriya
Mode	Tx 134.2 kHz

-26 dB Bandwidth [kHz]
25.949

99% Occupied Bandwidth [kHz]
36.4563



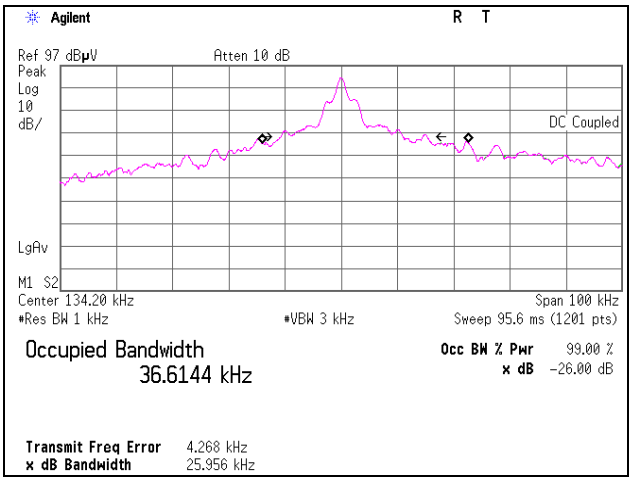
-26dB Bandwidth and 99% Occupied Bandwidth

Antenna (TYPE 2, INSIDE)

Report No.	10837078H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.1
Date	06/23/2015
Temperature / Humidity	24 deg. C / 60 % RH
Engineer	Yuta Moriya
Mode	Tx 134.2 kHz

-26 dB Bandwidth [kHz]
25.956

99% Occupied Bandwidth [kHz]
36.6144



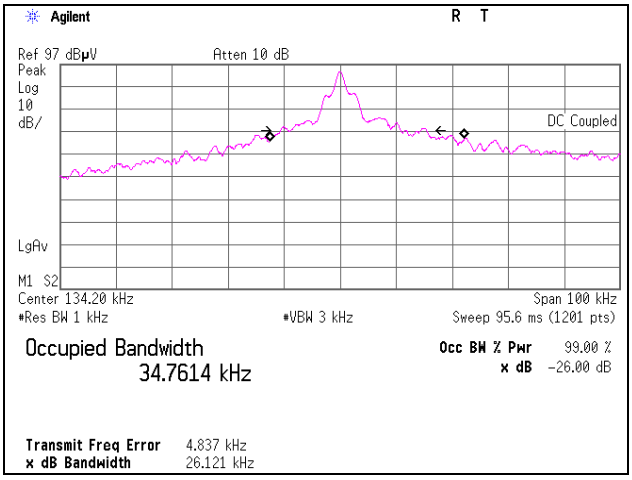
-26dB Bandwidth and 99% Occupied Bandwidth

Antenna (TYPE 2, OUTSIDE)

Report No.	10837078H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.1
Date	06/23/2015
Temperature / Humidity	24 deg. C / 60 % RH
Engineer	Yuta Moriya
Mode	Tx 134.2 kHz

-26 dB Bandwidth [kHz]
26.121

99% Occupied Bandwidth [kHz]
34.7614



APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2014/06/25 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2015/01/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE	2014/10/17 * 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-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	RE	2015/02/06 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2015/06/24 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2015/03/09 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2014/11/11 * 12
MLPA-07	Loop Antenna	UL Japan	-	-	RE	Pre Check
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	-
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-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2015/02/03 * 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: Spurious emission