



RADIO TEST REPORT

Test Report No. : 10329809H-B-R1

Applicant : Panasonic Corporation
Type of Equipment : Smart ECU
Model No. : EMU470712
FCC ID : ACJ932EMU47071
Test regulation : FCC Part 15 Subpart C: 2014
Test Result : Complied

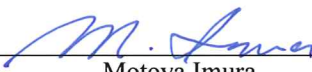
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6. This report is a revised version of 10329809H-B. 10329809H-B is replaced with this report.

Date of test: May 8 to 10, 2014

Representative test engineer:


Masatoshi Nishiguchi
Engineer
Consumer Technology Division

Approved by:


Motoya Imura
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10329809H-B

[illegible]

CONTENTS	PAGE
SECTION 1: Customer information	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results	6
SECTION 4: Operation of E.U.T. during testing.....	9
SECTION 5: Radiated emission (Fundamental and Spurious Emission).....	11
SECTION 6: -26dB Bandwidth.....	13
SECTION 7: 99% Occupied Bandwidth.....	13
APPENDIX 1: Data of EMI test.....	14
Radiated Emission below 30MHz (Fundamental and Spurious Emission)	14
Radiated Emission above 30MHz (Spurious Emission).....	17
-26dB Bandwidth and 99% Occupied Bandwidth	20
APPENDIX 2: Test instruments	22
APPENDIX 3: Photographs of test setup	23
Radiated Emission.....	23
Worst Case Position	26

SECTION 1: Customer information

Company Name : Panasonic Corporation
Address : 1006 Kadoma, Kadoma City, Osaka 571-8506, Japan
Telephone Number : +81-6-6906-4726
Contact Person : Hirohumi Oosawa

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

2.1 Identification of E.U.T.

Type of Equipment : Smart ECU
Model No. : EMU470712
Serial No. : Refer to Section 4, Clause 4.2
Receipt Date of Sample : March 25, 2014
Country of Mass-production : Thailand
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: EMU470712 (referred to as the EUT in this report) is the Smart ECU.

[LF part]

General Specification

Clock frequencies in the system : 20MHz, 16MHz, 30kHz

Radio Specification

Radio Type : Transmitter
Frequency of Operation : 125kHz
Type of Modulation : ASK
Antenna Type : Loop Antenna
Method of Frequency Generation : Xtal oscillator
Operating voltage (inner) : DC 12.0V
Operating Temperature : -40 deg. C to +85 deg. C

*Tested model (EMU470712) has variant model (EMU470711).

The difference between EMU470711 and EMU470712 is the number of LF Antenna, and it has no influence on radio specification.

- EMU470711: three LF Antennas
- EMU470712: five LF Antennas

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[Immobilizer part]

General Specification

Clock frequencies in the system : 4MHz

Radio Specification

Radio Type : Transmitter
Frequency of Operation : 125kHz
Type of Modulation : ASK
Antenna Type : Loop Antenna
Method of Frequency Generation : Ceramic Oscillation
Operating voltage (inner) : DC 12.0V
Operating Temperature : -40 deg. C to +85 deg. C

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2014, final revised on May 1, 2014 and effective June 2, 2014

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 May 1, 2014 does not affect the test specification applied to the EUT.

FCC 15.31 (e)

This test was performed with the New Battery (DC 12V) and the constant voltage was supplied to this EUT during the tests. 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.

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3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted Emission	<FCC> ANSI C63.4:2003 7. AC powerline conducted emission measurements <IC> RSS-Gen 7.2.4	<FCC> Section 15.207 <IC> RSS-Gen 7.2.4	-	N/A *1)	N/A	N/A
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.8, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	4.2dB 0.12500MHz, 0 deg., PK with Duty factor	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.9, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	0.1dB 39.001MHz, Vertical, QP Vertical, QP	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2003 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 4.6.1	RSS-Gen 4.6.1	Radiated	N/A	N/A	N/A

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

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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	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

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

Radiated emission test(3m)

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

3.5 Test Location

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	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 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Modes

The mode(s) : Transmitting (Tx) mode

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

The Smart ECU has 2 types: EMU470711 and EMU470712.

EMU470711 has 3 types of LF antennas (RR1 Antenna, CTR Antenna, DR Antenna).

EMU470712 has 5 types of LF antennas (TG Antenna, RR1 Antenna, RR2 Antenna, CTR Antenna, DR Antenna).

LF Antennas are same type, but these model numbers are different.

The test was performed with EMU470712, the following antennas were used for it as the representative:

- DR Antenna has maximum carrier level
- RR2 Antenna has minimum carrier level
- Push Switch (including Immobilizer Antenna)

*The Smart ECU does not transmit simultaneously from multiple antennas.

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

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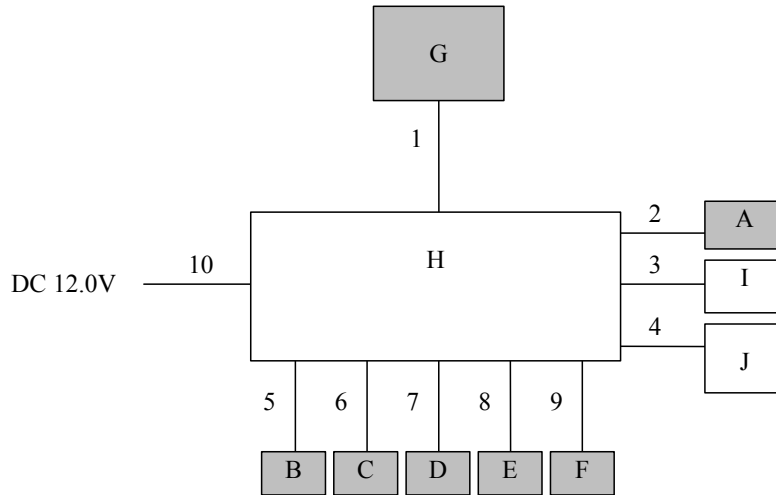
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4.2 Configuration and peripherals



* 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	Remark
A	Smart ECU	EMU470712	628	Panasonic Corporation	EUT
B	LF Antenna (TG)	EMU7117102A	001	Panasonic Corporation	EUT
C	LF Antenna (RR2)	EMU7117204	001	Panasonic Corporation	EUT
D	LF Antenna (RR1)	EMU7117204	001	Panasonic Corporation	EUT
E	LF Antenna (CTR)	EMU7117203	001	Panasonic Corporation	EUT
F	LF Antenna (DR)	EMU7117101A	001	Panasonic Corporation	EUT
G	Push Switch	EMU470601	1	Panasonic Corporation	EUT (including Immobilizer Antenna)
H	Switch Box	-	-	Panasonic Corporation	-
I	Dummy ECU	-	-	Panasonic Corporation	-
J	RFU	EMU370502	8980763370	Panasonic Corporation	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Immobilizer Cable	1.7	Unshielded	Unshielded	-
2	Signal Cable	1.9	Unshielded	Unshielded	-
3	Signal Cable	1.4	Unshielded	Unshielded	-
4	Signal Cable	1.8	Unshielded	Unshielded	-
5	Antenna Cable (TG)	2.8	Unshielded	Unshielded	-
6	Antenna Cable (RR2)	2.8	Unshielded	Unshielded	-
7	Antenna Cable (RR1)	2.8	Unshielded	Unshielded	-
8	Antenna Cable (CTR)	2.8	Unshielded	Unshielded	-
9	Antenna Cable (DR)	2.8	Unshielded	Unshielded	-
10	DC Cable	1.3	Unshielded	Unshielded	-

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SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

The Radiated Electric Field Strength intensity has been measured on No 4 semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9kHz to 30MHz at distance 3m

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: 0deg., 45deg., 90deg., 135 deg., and 180deg.)

and horizontal polarization.

*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency : From 30MHz to 1GHz at distance 3m

The measuring antenna height 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.

Measurements were performed with a QP and PK detector.

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

	From 9kHz to 90kHz and From 110kHz to 150kHz	From 90kHz to 110kHz	From 150kHz to 490kHz	From 490kHz to 30MHz	From 30MHz to 1GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz
Distance factor *1)	-80dB	-80dB	-80dB	-40dB	-

*1) $-80\text{dB} = 40 \times \log (3\text{m}/300\text{m})$

$-40\text{dB} = 40 \times \log (3\text{m}/30\text{m})$

- The carrier level (or, noise levels) was (or were) measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined.

With the position, the noise levels of all the frequencies were measured.

As for Immobilizer antenna, the worst case was confirmed with and without transponder, as a result, the test without transponder was the worst case. Therefore the test without transponder was performed only.

Test data : **APPENDIX 1**

Test result : **Pass**

Date: May 8, 9 and 10, 2014

Test engineer: Masatoshi Nishiguchi

UL Japan, Inc.

Ise EMC Lab.

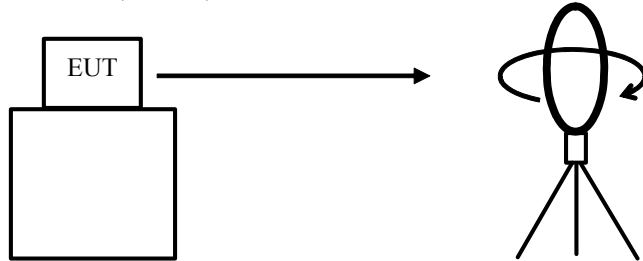
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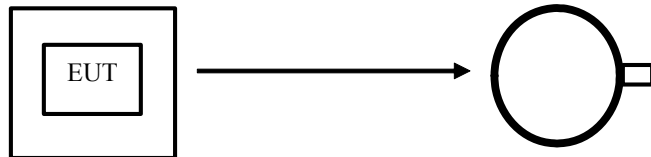
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Figure 1: Direction of the Loop Antenna

Side View (Vertical)

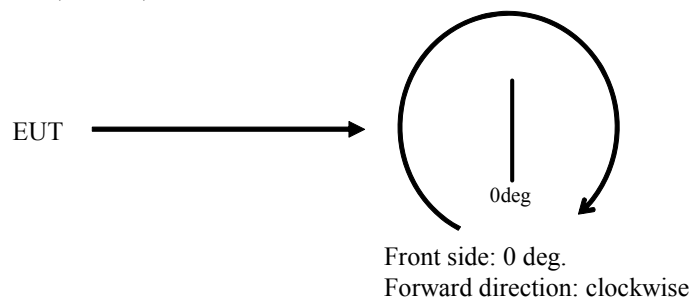


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



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
-26dB Bandwidth	100kHz	1kHz	3kHz	Auto	Sample	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 20dB Bandwidth	1 % of Span	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%.

Test data : APPENDIX 1

Test result : Pass

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APPENDIX 1: Data of EMI test

Radiated Emission below 30MHz (Fundamental and Spurious Emission) (LF Antenna(DR))

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 10329809H
Date : 05/08/2014 05/09/2014
Temperature/ Humidity : 24 deg. C / 42% RH 23 deg. C / 45% RH
Engineer : Masatoshi Nishiguchi Masatoshi Nishiguchi
Mode : Tx 125kHz

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	0.12500	PK	107.5	20.0	-73.9	32.2	-	21.4	45.6	24.2	Fundamental
0	0.25000	PK	85.3	19.9	-73.9	32.1	-	-0.8	39.6	40.4	
0	0.37500	PK	82.9	19.8	-73.9	32.1	-	-3.3	36.1	39.4	
0	0.50000	QP	68.6	19.8	-33.8	32.1	-	22.5	33.6	11.1	
0	0.62500	QP	57.2	19.8	-33.8	32.1	-	11.1	31.7	20.6	
0	0.75000	QP	53.4	19.8	-33.8	32.1	-	7.3	30.1	22.8	
0	0.87500	QP	58.0	19.8	-33.8	32.1	-	11.9	28.7	16.8	
0	1.00000	QP	53.1	19.8	-33.8	32.1	-	7.0	27.6	20.6	
0	1.12500	QP	47.7	19.8	-33.8	32.1	-	1.6	26.5	24.9	
0	1.25000	QP	43.5	19.8	-33.8	32.1	-	-2.6	25.6	28.2	

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

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	0.12500	PK	107.5	20.0	-73.9	32.2	0.0	21.4	25.6	4.2	
0	0.25000	PK	85.3	19.9	-73.9	32.1	0.0	-0.8	19.6	20.4	
0	0.37500	PK	82.9	19.8	-73.9	32.1	0.0	-3.3	16.1	19.4	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor

* Since the peak emission result satisfied the average limit, the peak emission result with Duty Factor was calculated as Duty 100%.

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	0.12500	PK	107.5	20.0	6.1	32.2	-	101.4	-	-	Fundamental

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

* All spurious emissions lower than this result.

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Radiated Emission below 30MHz (Fundamental and Spurious Emission) (LF Antenna(RR2))

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 10329809H
Date : 05/08/2014 05/09/2014
Temperature/ Humidity : 24 deg. C / 42% RH 23 deg. C / 45% RH
Engineer : Masatoshi Nishiguchi Masatoshi Nishiguchi
Mode : Tx 125kHz

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	0.12500	PK	94.4	20.0	-73.9	32.2	-	8.3	45.6	37.3	Fundamental
0	0.25000	PK	62.7	19.9	-73.9	32.1	-	-23.4	39.6	63.0	
0	0.37500	PK	66.1	19.8	-73.9	32.1	-	-20.1	36.1	56.2	
0	0.50000	QP	40.6	19.8	-33.8	32.1	-	-5.5	33.6	39.1	
0	0.62500	QP	54.0	19.8	-33.8	32.1	-	7.9	31.7	23.8	
0	0.75000	QP	35.6	19.8	-33.8	32.1	-	-10.5	30.1	40.6	
0	0.87500	QP	40.0	19.8	-33.8	32.1	-	-6.1	28.7	34.8	
0	1.00000	QP	35.0	19.8	-33.8	32.1	-	-11.1	27.6	38.7	
0	1.12500	QP	43.3	19.8	-33.8	32.1	-	-2.8	26.5	29.3	
0	1.25000	QP	34.7	19.8	-33.8	32.1	-	-11.4	25.6	37.0	

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

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	0.12500	PK	94.4	20.0	-73.9	32.2	0.0	8.3	25.6	17.3	
0	0.25000	PK	62.7	19.9	-73.9	32.1	0.0	-23.4	19.6	43.0	
0	0.37500	PK	66.1	19.8	-73.9	32.1	0.0	-20.1	16.1	36.2	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor

* Since the peak emission result satisfied the average limit, the peak emission result with Duty Factor was calculated as Duty 100%.

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	0.12500	PK	94.4	20.0	6.1	32.2	-	88.3	-	-	Fundamental

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

* All spurious emissions lower than this result.

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Radiated Emission below 30MHz (Fundamental and Spurious Emission) (Immobilizer Antenna)

Test place : Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 10329809H
Date : 05/08/2014 05/09/2014
Temperature/ Humidity : 24 deg. C / 42% RH 23 deg. C / 45% RH
Engineer : Masatoshi Nishiguchi Masatoshi Nishiguchi
Mode : Tx 125kHz

PK or QP

Ant Deg [deg]	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Duty Factor	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
0	0.12500	PK	84.0	20.0	-73.9	32.2	-	-2.1	45.6	47.7	Fundamental
0	0.25000	PK	46.2	19.9	-73.9	32.1	-	-39.9	39.6	79.5	
0	0.37500	PK	54.2	19.8	-73.9	32.1	-	-32.0	36.1	68.1	
0	0.50000	QP	36.2	19.8	-33.8	32.1	-	-9.9	33.6	43.5	
0	0.62500	QP	43.9	19.8	-33.8	32.1	-	-2.2	31.7	33.9	
0	0.75000	QP	35.4	19.8	-33.8	32.1	-	-10.7	30.1	40.8	
0	0.87500	QP	40.1	19.8	-33.8	32.1	-	-6.0	28.7	34.7	
0	1.00000	QP	34.9	19.8	-33.8	32.1	-	-11.2	27.6	38.8	
0	1.12500	QP	38.4	19.8	-33.8	32.1	-	-7.7	26.5	34.2	
0	1.25000	QP	34.8	19.8	-33.8	32.1	-	-11.3	25.6	36.9	

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

PK with Duty factor

Ant Deg [deg]	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Duty Factor	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
0	0.12500	PK	84.0	20.0	-73.9	32.2	0.0	-2.1	25.6	27.7	
0	0.25000	PK	46.2	19.9	-73.9	32.1	0.0	-39.9	19.6	59.5	
0	0.37500	PK	54.2	19.8	-73.9	32.1	0.0	-32.0	16.1	48.1	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor

* Since the peak emission result satisfied the average limit, the peak emission result with Duty Factor was calculated as Duty 100%.

Result of the fundamental emission at 3m without Distance factor

PK or QP

Ant Deg [deg]	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Duty Factor	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
0	0.12500	PK	84.0	20.0	6.1	32.2	-	77.9	-	-	Fundamental

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

* All spurious emissions lower than this result.

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Radiated Emission above 30MHz (Spurious Emission) (LF Antenna(DR))

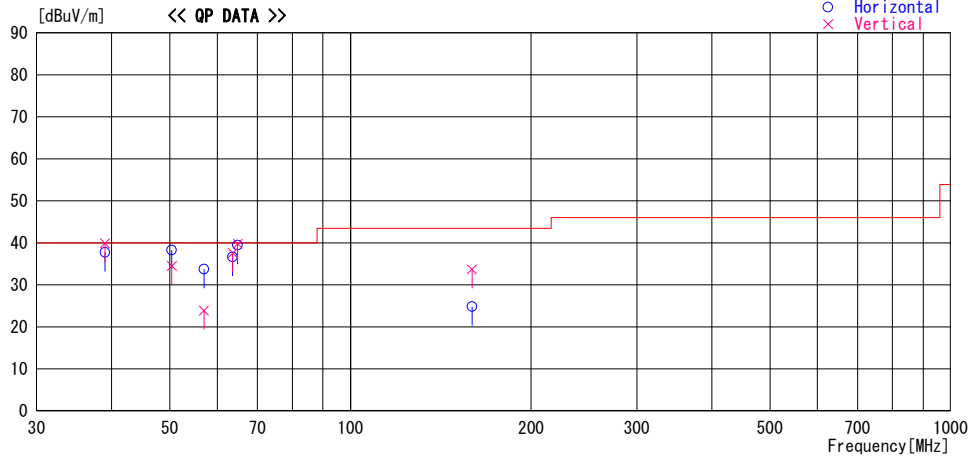
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date: 2014/05/10

Report No. : 10329809H
Temp./Humi. : 23deg. C / 45% RH
Engineer : Masatoshi Nishiguchi

Mode / Remarks : LF Tx 125kHz, DR Ant Worst-axis(Immobl: Hori-X/Vert-X Ant: Hori-X/Vert-X)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:AV
All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
63.670	53.7	QP	7.4	-24.5	36.6	3	341	Hori.	40.0	3.4	
64.877	56.7	QP	7.2	-24.4	39.5	4	324	Hori.	40.0	0.5	
63.670	54.7	QP	7.4	-24.5	37.6	104	100	Vert.	40.0	2.4	
64.877	57.0	QP	7.2	-24.4	39.8	92	100	Vert.	40.0	0.2	
39.001	47.7	QP	14.9	-24.9	37.7	1	374	Hori.	40.0	2.3	
39.001	49.9	QP	14.9	-24.9	39.9	87	100	Vert.	40.0	0.1	
50.375	52.2	QP	10.8	-24.7	38.3	168	364	Hori.	40.0	1.7	
50.375	48.4	QP	10.8	-24.7	34.5	72	100	Vert.	40.0	5.5	
57.005	49.5	QP	8.8	-24.6	33.7	348	397	Hori.	40.0	6.3	
57.005	39.7	QP	8.8	-24.6	23.9	280	100	Vert.	40.0	16.1	
159.362	32.8	QP	15.3	-23.3	24.8	320	322	Hori.	43.5	18.7	
159.362	41.7	QP	15.3	-23.3	33.7	127	100	Vert.	43.5	9.8	

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

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

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Radiated Emission above 30MHz (Spurious Emission)
(LF Antenna(RR2))

DATA OF RADIATED EMISSION TEST

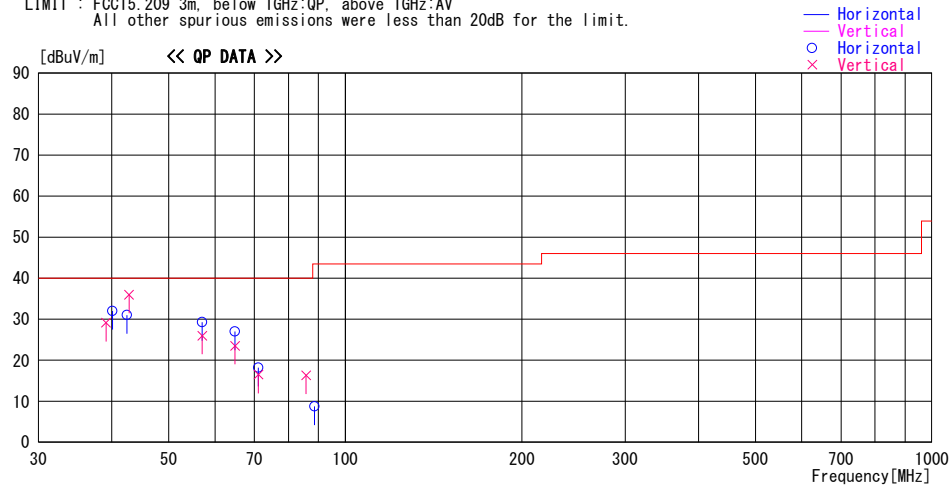
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date: 2014/05/10

Report No. : 10329809H

Temp./Humi. : 23deg. C / 45% RH
Engineer : Masatoshi Nishiguchi

Mode / Remarks : LF Tx 125kHz,RR2 Ant Worst-axis(Immobi:Hori-X/Vert-X Ant:Hori-X/Vert-X)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:AV
All other spurious emissions were less than 20dB for the limit.



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]	
39.126	39.1	QP	14.9	-24.9	29.1	81	100	Vert.	40.0	10.9	
40.139	42.3	QP	14.5	-24.8	32.0	353	332	Hori.	40.0	8.0	
42.445	42.3	QP	13.5	-24.8	31.0	182	359	Hori.	40.0	9.0	
42.816	47.4	QP	13.4	-24.8	36.0	29	100	Vert.	40.0	4.0	
57.054	45.1	QP	8.8	-24.6	29.3	351	332	Hori.	40.0	10.7	
57.054	41.8	QP	8.8	-24.6	26.0	309	100	Vert.	40.0	14.0	
64.890	44.2	QP	7.2	-24.4	27.0	347	342	Hori.	40.0	13.0	
64.890	40.7	QP	7.2	-24.4	23.5	77	100	Vert.	40.0	16.5	
71.122	36.1	QP	6.5	-24.4	18.2	352	398	Hori.	40.0	21.8	
71.122	34.4	QP	6.5	-24.4	16.5	105	105	Vert.	40.0	23.5	
85.731	33.0	QP	7.5	-24.2	16.3	111	100	Vert.	40.0	23.7	
88.626	24.8	QP	8.0	-24.1	8.7	271	386	Hori.	43.5	34.8	

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

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

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Radiated Emission above 30MHz (Spurious Emission) (Immobilizer Antenna)

DATA OF RADIATED EMISSION TEST

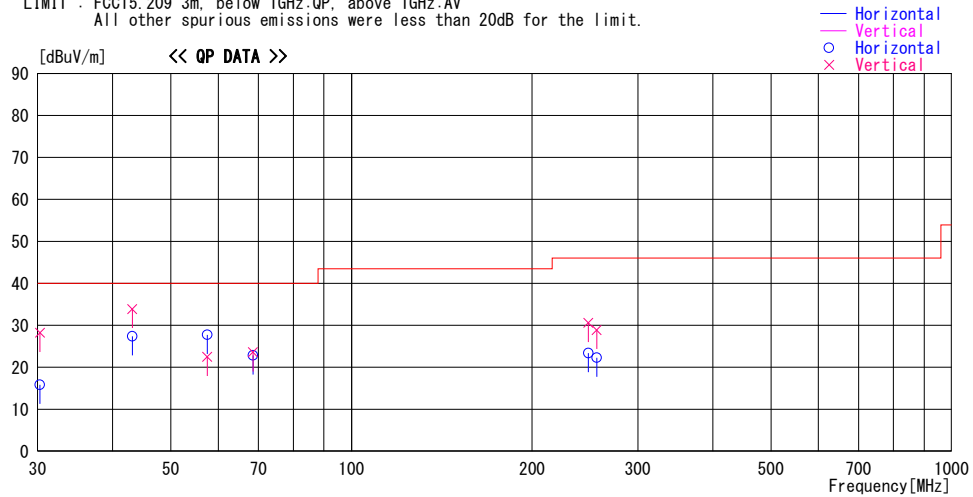
UL Japan, Inc. Ise EMC Lab. No. 4 Semi Anechoic Chamber
Date: 2014/05/09

Report No. : 10329809H

Temp./Humi. : 23deg. C / 45% RH
Engineer : Masatoshi Nishiguchi

Mode / Remarks : Immbi Tx 125kHz Worst-axis(Immobi:Hori-X/Vert-X Ant:Hori-X/Vert-X)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:AV
All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
30.278	23.5	QP	17.3	-25.0	15.8	80	107	Hori.	40.0	24.2	
30.278	35.9	QP	17.3	-25.0	28.2	275	104	Vert.	40.0	11.8	
43.130	38.8	QP	13.3	-24.8	27.3	354	342	Hori.	40.0	12.7	
43.130	45.4	QP	13.3	-24.8	33.9	46	100	Vert.	40.0	6.1	
57.525	43.8	QP	8.6	-24.6	27.8	358	340	Hori.	40.0	12.2	
57.525	38.5	QP	8.6	-24.6	22.5	282	100	Vert.	40.0	17.5	
68.548	41.3	QP	6.7	-24.4	23.6	89	100	Vert.	40.0	16.4	
68.548	40.6	QP	6.7	-24.4	22.9	352	260	Hori.	40.0	17.1	
248.181	28.6	QP	17.2	-22.4	23.4	0	385	Hori.	46.0	22.6	
248.181	35.8	QP	17.2	-22.4	30.6	183	100	Vert.	46.0	15.4	
256.190	27.0	QP	17.6	-22.3	22.3	219	372	Hori.	46.0	23.7	
256.190	33.6	QP	17.6	-22.3	28.9	177	100	Vert.	46.0	17.1	

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

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

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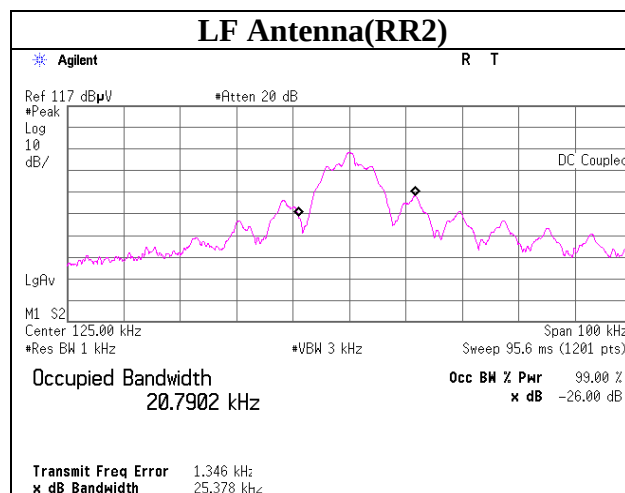
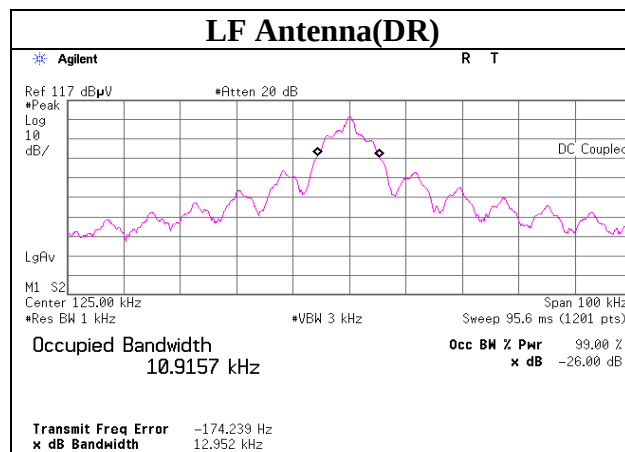
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-26dB Bandwidth and 99% Occupied Bandwidth (LF Antenna(DR) / LF Antenna(RR2))

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	10329809H
Date	05/08/2014
Temperature/ Humidity	24 deg. C / 42% RH
Engineer	Masatoshi Nishiguchi
Mode	Tx 125kHz

	-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
LF Antenna (DR)	12.952	10.916
LF Antenna (RR2)	25.378	20.790



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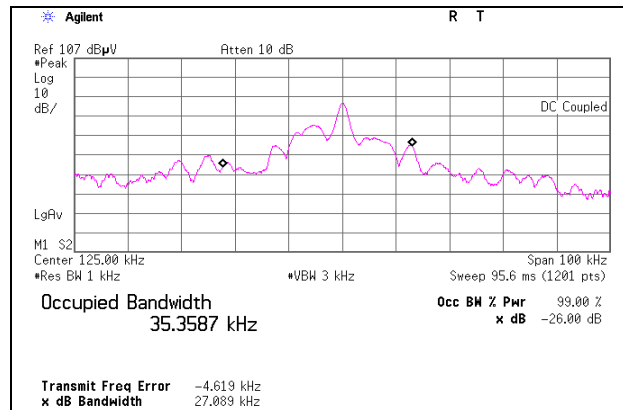
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-26dB Bandwidth and 99% Occupied Bandwidth (Immobilizer Antenna)

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	10329809H
Date	05/08/2014
Temperature/ Humidity	24 deg. C / 42% RH
Engineer	Masatoshi Nishiguchi
Mode	Tx 125kHz

-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
27.089	35.359



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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	2014/02/28 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2014/02/20 * 12
MJM-09	Measure	KDS	E19-55	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-01	Test Receiver	Rohde & Schwarz	ES140	100084	RE	2013/11/12 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2013/10/30 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(5m)/ 421-010(1m)/ sucoform141- PE(1m)/RFM- E121(Switcher)	-/04178	RE	2013/07/23 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2013/07/22 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2014/03/14 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2013/11/26 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2013/11/24 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2013/11/24 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2013/06/18 * 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

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