



Test report No. : 10329809H-C-R1  
Page : 1 of 14  
Issued date : August 25, 2014  
Revised date : August 29, 2014  
FCC ID : ACJ932EMU370502

## EMI TEST REPORT

**Test Report No. : 10329809H-C-R1**

**Applicant** : Panasonic Corporation

**Type of Equipment** : RFU

**Model No.** : EMU370502

**FCC ID** : ACJ932EMU370502

**Test regulation** : FCC Part 15 Subpart B: 2014

**Test Result** : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This report is a revised version of 10329809H-C. 10329809H-C is replaced with this report.

**Date of test:** May 10, 2014

**Representative test engineer:**

Masatoshi Nishiguchi  
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://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

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13-EM-F0429

## REVISION HISTORY

## Original Test Report No.: 10329809H-C

<u>CONTENTS</u>	<u>PAGE</u>
<b>SECTION 1: Customer information .....</b>	<b>4</b>
<b>SECTION 2: Equipment under test (E.U.T.) .....</b>	<b>4</b>
<b>SECTION 3: Test specification, procedures &amp; results .....</b>	<b>5</b>
<b>SECTION 4: Operation of E.U.T. during testing .....</b>	<b>7</b>
<b>SECTION 5: Radiated Emission .....</b>	<b>9</b>
<b>APPENDIX 1: Data of EMI test .....</b>	<b>10</b>
Radiated Emission.....	10
<b>APPENDIX 2: Test instruments .....</b>	<b>12</b>
<b>APPENDIX 3: Photographs of test setup.....</b>	<b>13</b>
Radiated Emission.....	13
Worst Case Position .....	14

## **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 : RFU  
Model No. : EMU370502  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 4.5 to 5.5V  
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: EMU370502 (referred to as the EUT in this report) are the Passive Entry and Start System for Vehicles.

#### **General Specification**

Clock frequencies in the system : 40.65933MHz (Oscillator circuit)  
Operating temperature : -40 to +85 deg. C

#### **Radio Specification**

Radio Type : Receiver  
Frequency of operation : 433.92MHz  
Oscillator Frequency : 40.65933MHz  
Local Oscillator Frequency : 433.7MHz  
Intermediate Frequency : 220kHz  
Type of modulation : FSK  
Operating voltage : DC 4.5 to 5.5V  
Antenna Type : Internal Antenna (Monopole)

The receiving antenna of this EUT is installed inside the EUT and cannot be removed (permanently attached).  
Therefore, Radiated emission test was performed.

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## **SECTION 3: Test specification, procedures & results**

### **3.1 Test specification**

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

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

\* The revision on May 1, 2014 does not affect the test specification applied to the EUT.

### **3.2 Procedures and results**

Item	Test Procedure	Limits	Deviation	Worst margin	Result
Conducted emission	FCC: ANSI C63.4: 2003 7. AC powerline conducted emission measurements	FCC:Part 15 Subpart B 15.107(a)	N/A *1)	N/A	N/A
	IC: RSS-Gen 7.2.4	IC: RSS-Gen 7.2.4			
Radiated emission	FCC: ANSI C63.4: 2003 8. Radiated emission measurements	FCC: Part 15 Subpart B 15.109(a)	N/A	19.5dB 867.400MHz, Vertical, QP	Complied
	IC: RSS-Gen 4.10	IC: RSS-Gen 6.1			

\*Note: UL Japan, Inc's EMI Work Procedure 13-EM-W0420.

\*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

### **3.3 Addition to standard**

No addition, exclusion nor deviation has been made from the standard.

### **3.4 Uncertainty**

#### **EMI**

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

Test 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 test report has enough margin, more than the site margin.

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### 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	4.75 x 5.4 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.8 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	3.1 x 3.4 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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## UL Japan, Inc. Ise EMC Lab.

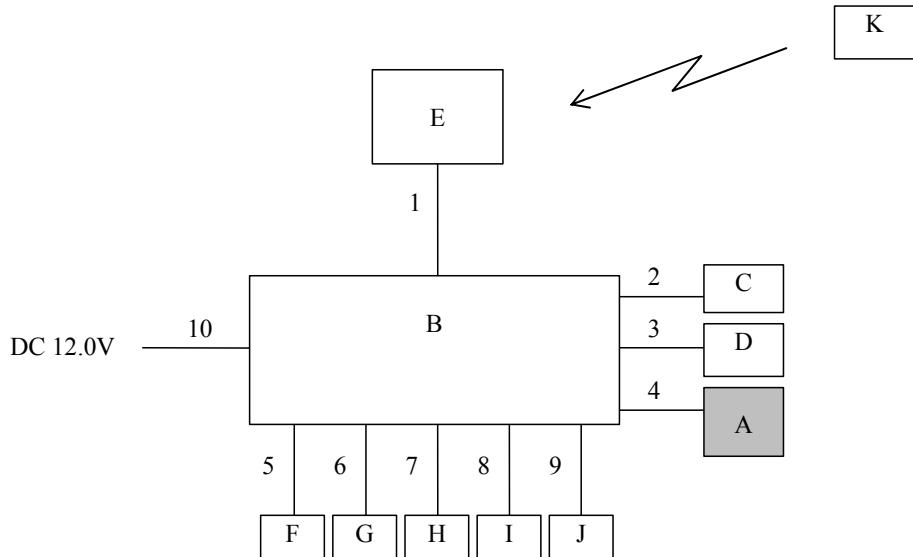
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## **SECTION 4: Operation of E.U.T. during testing**

### **4.1 Operating modes**

The mode(s) : Receiving mode

### **4.2 Configuration and peripherals**



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

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**Description of EUT and Support equipment**

No.	Item	Model number	Serial number	Manufacturer	Remark
A	RFU	EMU370502	262J-0027	Panasonic Corporation	EUT
B	Switch Box	-	-	Panasonic Corporation	-
C	Smart ECU	EMU470712	628	Panasonic Corporation	-
D	Dummy ECU	-	-	Panasonic Corporation	-
E	Push Switch	EMU470601	1	Panasonic Corporation	-
F	LF Antenna (TG)	EMU7117102A	-	Panasonic Corporation	-
G	LF Antenna (RR2)	EMU7117204	-	Panasonic Corporation	-
H	LF Antenna (RR1)	EMU7117204	-	Panasonic Corporation	-
I	LF Antenna (CTR)	EMU7117203	-	Panasonic Corporation	-
J	LF Antenna (DR)	EMU7117101A	-	Panasonic Corporation	-
K	FOB	EMU470102	18	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	1.0	Unshielded	Unshielded	-

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## **SECTION 5: Radiated Emission**

### **5.1 Operating environment**

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

### **5.2 Test configuration**

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane. The EUT was set on the edge of the tabletop. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength. Photographs of the set up are shown in Appendix 3.

### **5.3 Test conditions**

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

### **5.4 Test procedure**

The height of the measuring antenna varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

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

The height of the measuring antenna varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

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

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver	Spectrum Analyzer
IF Bandwidth	QP: BW 120kHz	PK: RBW:1MHz/VBW: 3MHz AV *1): RBW:1MHz/VBW:10Hz

\*1) When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

The noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at representative X-axis since no difference was found among each position.

### **5.5 Test result**

Summary of the test results: Pass

Date: May 10, 2014

Test engineer: Masatoshi Nishiguchi

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## APPENDIX 1: Data of EMI test

### Radiated Emission (Below 1GHz)

#### DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber  
Date : 2014/05/10

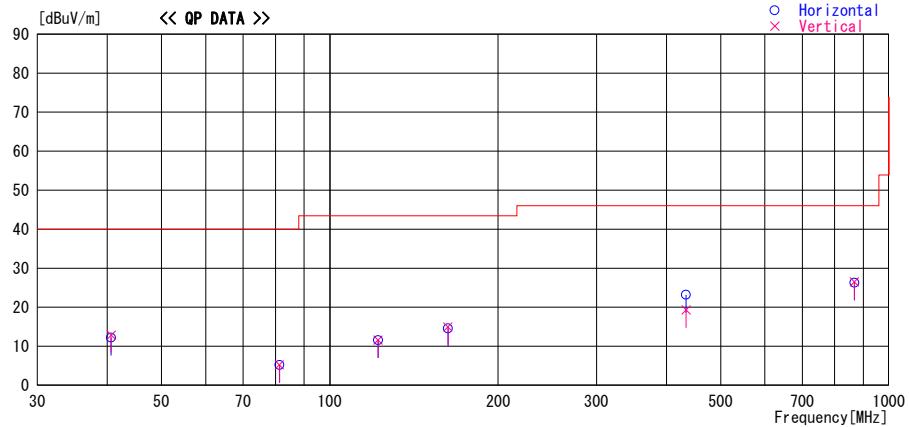
Report No. : 10329809H

Temp. /Humi. : 24deg. C / 45% RH  
Engineer : Masatoshi Nishiguchi

Mode / Remarks : Rx 433.92MHz Worst-Axis(Hori:X / Vert:X)

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

— Horizontal  
— Vertical  
○ Horizontal  
× Vertical



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
40.659	22.9	QP	14.3	-25.0	12.2	359	300	Hori.	40.0	27.8	
40.659	23.6	QP	14.3	-25.0	12.9	252	100	Vert.	40.0	27.1	
81.318	22.9	QP	6.6	-24.3	5.2	51	100	Vert.	40.0	34.8	
81.318	22.9	QP	6.6	-24.3	5.2	359	300	Hori.	40.0	34.8	
121.977	22.3	QP	13.1	-23.8	11.6	359	300	Hori.	43.5	31.9	
121.977	22.3	QP	13.1	-23.8	11.6	359	100	Vert.	43.5	31.9	
162.636	22.5	QP	15.5	-23.4	14.6	359	300	Hori.	43.5	28.9	
162.636	22.9	QP	15.5	-23.4	15.0	359	100	Vert.	43.5	28.5	
433.700	22.8	QP	17.7	-21.2	19.3	216	110	Vert.	46.0	26.7	
433.700	26.7	QP	17.7	-21.2	23.2	187	100	Hori.	46.0	22.8	
867.400	22.3	QP	22.2	-18.0	26.5	259	100	Vert.	46.0	19.5	
867.400	22.1	QP	22.2	-18.0	26.3	359	100	Hori.	46.0	19.7	

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 limit is rounded down to one decimal place.

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

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## Radiated Emission

(Above 1GHz)

### DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber  
Date : 2014/05/10

Report No. : 10329809H

Temp. /Humi. : 24deg. C / 45% RH  
Engineer : Masatoshi Nishiguchi

Mode / Remarks : Rx 433.92MHz Worst-Axis(Hori:X / Vert:X)

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

— Horizontal  
— Vertical  
○ Horizontal  
× Vertical



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit		Margin [dB]	Comment
									[dBuV/m]	[dB]		
1301.100	42.0	PK	25.0	-32.6	34.4	359	100	Vert.	73.9	39.5		
1301.100	43.9	PK	25.0	-32.6	36.3	359	100	Hori.	73.9	37.6		
1301.100	31.0	AV	25.0	-32.6	23.4	359	100	Hori.	53.9	30.5		
1301.100	31.0	AV	25.0	-32.6	23.4	359	100	Vert.	53.9	30.5		
1734.800	42.8	PK	26.4	-31.4	37.8	359	100	Hori.	73.9	36.1		
1734.800	29.6	AV	26.4	-31.4	24.6	359	100	Hori.	53.9	29.3		
1734.800	29.6	AV	26.4	-31.4	24.6	359	100	Vert.	53.9	29.3		
1734.800	41.8	PK	26.4	-31.4	36.8	359	100	Vert.	73.9	37.1		

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 limit is rounded down to one decimal place.

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

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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-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2014/02/27 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2014/02/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2014/04/08 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2013/08/20 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2013/10/13 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2013/10/13 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2013/07/23 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2014/04/14 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2014/03/14 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2013/05/17 * 12
MCC-133	Microwave Cable	HUBER+SUHNER	SUCOFLEX104	336164/4(1m) / 340640(5m)	RE	2013/09/27 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2014/03/24 * 12

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

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

**As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.**

### **Test Item:**

**RE: Radiated emission**

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