



Test report No. : 10837078H-B-R1
Page : 1 of 15
Issued date : July 10, 2015
Revised date : August 3, 2015
FCC ID : Y8PFJ14-1

EMI TEST REPORT

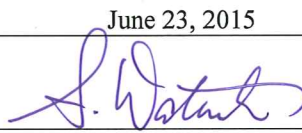
Test Report No. : 10837078H-B-R1

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

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)
7. This report is a revised version of 10837078H-B. 10837078H-B is replaced with this report.

Date of test: June 23, 2015

Representative test engineer:


Shinya Watanabe
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.: 10837078H-B

[illegible]

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SECTION 1: Customer information

Company Name	:	FUJI HEAVY INDUSTRIES LTD.
Address	:	1-1, Subaru-cho, ota-shi, Gunma-ken, 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	:	DC12.0V
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] *4)

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
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* The EUT does not transmit simultaneously from multiple antennas.

[Receiver]

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 transmitter part was performed separately from this test report, and the conformability is confirmed.

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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart B: 2015, final revised on June 12, 2015 and effective July 13, 2015

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

* The revision on June 12, 2015 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: 2009 7. AC powerline conducted emission measurements	FCC: Part 15 Subpart B 15.107(a)	N/A *1)	N/A	N/A
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
Radiated emission	FCC: ANSI C63.4: 2009 8. Radiated emission measurements	FCC: Part 15 Subpart B 15.109(a)	N/A	8.4 dB 73.004 MHz Horizontal, QP	Complied
	IC: RSS-Gen 7	IC: RSS-Gen 7.1.2			
*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						
	(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

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

Radiated emission test(3 m)

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

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3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
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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	-	8.8 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0 m 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.

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

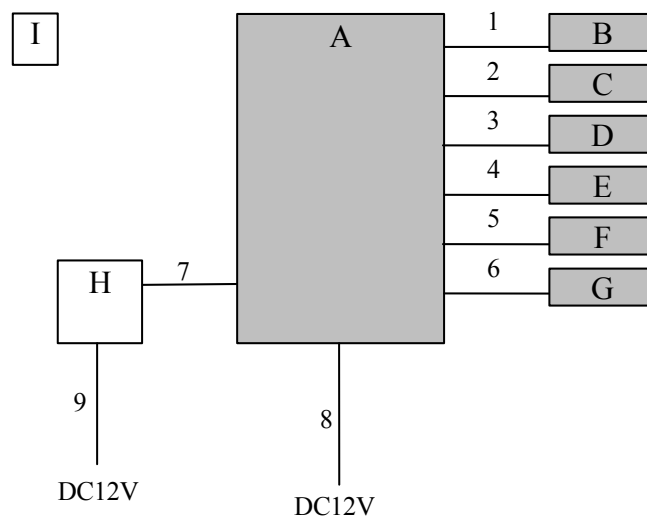
4.1 Operating Modes

The mode is used: Receiving mode (Rx) 433.92 MHz

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

*It was confirmed by using LED of Jig that the EUT receives the signal from the transmitter (pair of EUT).

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Smart ECU	-	10018674-1	-	EUT
B	Antenna (TYPE 1)	-	1	-	EUT
C	Antenna (TYPE 1)	-	2	-	EUT
D	Antenna (TYPE 2 INSIDE)	-	1	-	EUT
E	Antenna (TYPE 2 INSIDE)	-	2	-	EUT
F	Antenna (TYPE 2 INSIDE)	-	3	-	EUT
G	Antenna (TYPE 2 OUTSIDE)	-	4	-	EUT
H	Jig	-	-	-	-
I	Smart key	-	-	-	-

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	-

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SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No.1 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The EUT was set on the edge of the tabletop.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

Photographs of the set up are shown in Appendix 3.

5.3 Test conditions

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

5.4 Test procedure

The height of the measuring antenna varied between 1 and 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 with the Test Receiver.

The radiated emission measurements were made with the following detector function of the Test Receiver.

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

- The 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.

5.5 Test result

Summary of the test results: Pass

Date: June 23, 2015

Test engineer: Yuta Moriya

APPENDIX 1: Test data

Radiated Emission

DATA OF RADIATED EMISSION TEST

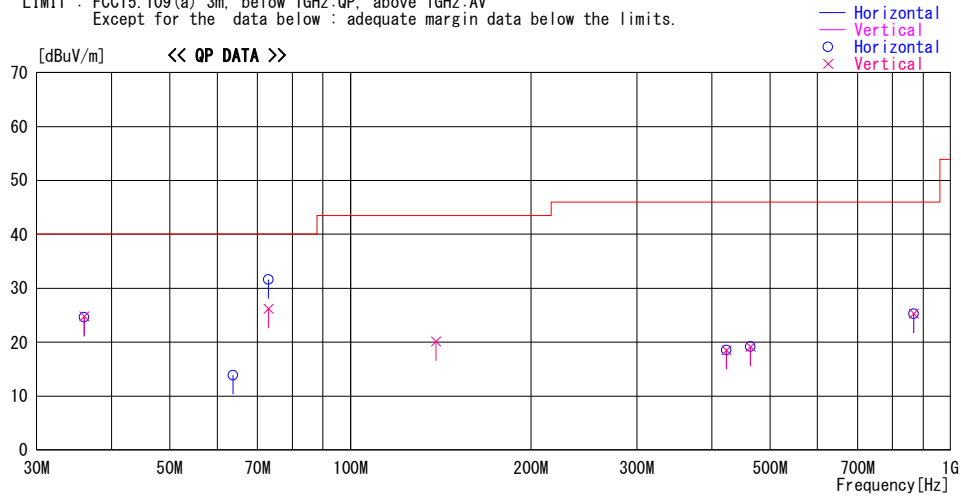
UL Japan, Inc. Ise EMC Lab. No.1 Semi Anechoic Chamber
Date : 2015/06/23

Report No. : 10837078H

Temp./Humi. : 25deg. C / 65% RH
Engineer : Yuta Moriya

Mode / Remarks : Rx 433.92MHz Worst Axis X

LIMIT : FCC15.109(a) 3m, below 1GHz:QP, above 1GHz:AV
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]	
36.020	40.7	QP	15.5	-31.4	24.8	0	100	Vert.	40.0	15.2	
36.025	40.5	QP	15.5	-31.4	24.6	359	100	Hori.	40.0	15.4	
63.716	37.9	QP	6.9	-30.9	13.9	183	298	Hori.	40.0	26.1	
73.012	50.6	QP	6.4	-30.8	26.2	78	100	Vert.	40.0	13.8	
73.004	56.0	QP	6.4	-30.8	31.6	179	257	Hori.	40.0	8.4	
138.854	35.8	QP	14.2	-29.9	20.1	311	100	Vert.	43.5	23.4	
423.220	28.0	QP	17.6	-27.1	18.5	0	100	Vert.	46.0	27.5	
423.220	28.0	QP	17.6	-27.1	18.5	0	100	Hori.	46.0	27.5	
463.920	28.0	QP	17.8	-26.6	19.2	0	100	Hori.	46.0	26.8	
463.920	27.9	QP	17.8	-26.6	19.1	0	100	Vert.	46.0	26.9	
867.840	27.4	QP	22.0	-24.1	25.3	0	100	Vert.	46.0	20.7	
867.840	27.3	QP	22.0	-24.1	25.2	0	100	Hori.	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 + 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

DATA OF RADIATED EMISSION TEST

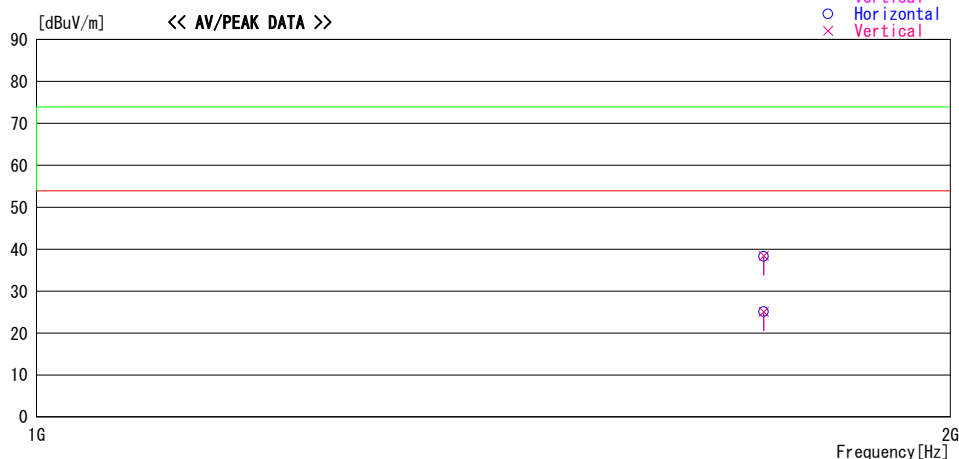
UL Japan, Inc. Ise EMC Lab. No.1 Semi Anechoic Chamber
Date : 2015/06/23

Report No. : 10837078H

Temp./Humi. : 25deg. C / 65% RH
Engineer : Yuta Moriya

Mode / Remarks : Rx 433.92MHz

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



Frequency	Reading	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor	Gain							
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
1735.680	46.4	PK	25.9	-34.0	38.3	0	100	Hori.	53.9	15.6	
1735.680	33.2	AV	25.9	-34.0	25.1	0	100	Hori.	73.9	48.8	
1735.680	46.5	PK	25.9	-34.0	38.4	0	100	Vert.	53.9	15.5	
1735.680	33.2	AV	25.9	-34.0	25.1	0	100	Vert.	73.9	48.8	

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

*The limit is rounded down to one decimal place.

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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-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2014/09/01 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2015/01/13 * 12
MJM-21	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	RE	2014/06/06 * 12
KBA-05	Biconical Antenna	Schwarzbeck	BBA9106	2513	RE	2014/11/22 * 12
KLA-04	Logperiodic Antenna	Schwarzbeck	USLP9143	361	RE	2014/11/22 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2014/11/20 * 12
MCC-02	Coaxial Cable	Suhner/storm/Agilent /TSJ	-	-	RE	2014/09/12 * 12
MPA-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2015/02/03 * 12
MHA-05	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	253	RE	2015/05/18 * 12
MPA-01	Pre Amplifier	Agilent	8449B	3008A01671	RE	2015/02/04 * 12
MCC-165	Microwave Cable	Junkosha	MWX221	1203S213(1m) / 1311S166(5m)	RE	2014/11/11 * 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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