RADIO TEST REPORT

Test Report No.: 30EE0036-SH-01-A-R2

Applicant	:	**Panasonic Corporation Automotive Systems Company**
Type of Equipment	:	**Bluetooth Module Assy**
Model No.	:	**YEAP01A046**
FCC ID	:	**ACJ932CQ-US70G0**
Test regulation	:	**FCC Part15 Subpart C: 2010**
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 any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. Original test report number of this report is 30EE0036-SH-01-A-R1

Date of test: December 8 and 9, 2009 and August 6, 2010

Tested by: Makoto Hosaka, Engineer of EMC Service & Hikaru Shirasawa, Engineer of EMC Service

Approved by: Ichiro Isozaki, Leader of EMC Service

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

JAB Testing RTL02610

UL Japan, Inc.
Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone: +81 463 50 6400
Facsimile: +81 463 50 6401

Table of Contents Page

1 Applicant information 3

2 Equipment under test (E.U.T.) 3

3 Test specification, procedures and results 4

4 System test configuration 7

5 Carrier frequency separation 9

6 20dB bandwidth & Occupied bandwidth (99%) 9

7 Number of hopping frequency 9

8 Dwell time 9

9 Maximum peak output power 9

10 Out of band emissions (Antenna port conducted) 9

11 Out of band emissions (Radiated) 10

Contents of Appendixes 12

APPENDIX 1: Photographs of test setup 13

APPENDIX 2: Test data 17

APPENDIX 3: Test instruments 55

1 Applicant information

Company Name	:	Panasonic Corporation Automotive Systems Company
Address	:	4261 Ikonobe-cho, Tsuzuki-ku, Yokohama-shi, Kanagawa, Japan
Telephone Number	:	+81-45-939-6111
Facsimile Number	:	+81-45-939-6119
Contact Person	:	Kimito Terai

*Panasonic Corporation Automotive Systems Company is on behalf of the applicant: Panasonic Corporation of North America

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

2.1 Identification of E.U.T.

Type of Equipment	:	Bluetooth Module Assy
Model No.	:	YEAP01A046
Serial No.	:	1S-13 for Radiated measurements, 1S-14 for Conducted measurements
Rating	:	DC3.3V/1A
Country of Mass-production	:	Thailand, China, Czechoslovakia
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.
Receipt Date of Sample	:	December 8, 2009

2.2 Product description

Model: YEAP01A046 (referred to as the EUT in this report) is a Bluetooth Module Assy.

Equipment type	:	Transceiver
Frequency of operation	:	2402-2480MHz
Clock frequency	:	1.5MHz/ 25.8048MHz/ 26MHz
Bandwidth & channel spacing	:	1MHz
Type of modulation	:	FHSS
Antenna model & type	:	Monopole antenna
Antenna gain with cable loss	:	2.63dBi
Antenna connector type	:	U.FL (Coaxial connector)
ITU code	:	F1D, G1D
Operation temperature range	:	-30 to +85 deg.C.

The EUT has similar model, YEAP01A049 and YEAP01A112.
Each model No. of YEAP01A049, YEAP01A112 or YEAP01A046 is distributed with the device in which each Bluetooth Module Assy is installed.
YEAP01A046: base model
YEAP01A049: Addition of circuit (AUX, USB power)
YEAP01A112: Change of circuit (Display)
*The component placement of the wireless segment and the pattern are the same.
For the antenna, each model No. of N1KYYYY00001 or N1KYYYY00005 is also distributed by the installation of the module. The antenna shape and the length of coaxial cable are different.

FCC Part15.31 (e)
The Bluetooth transmitter is provided with stable power supply (DC 3.3 V), therefore, the equipment complies power supply regulation.

FCC Part15.203 Antenna requirement
The EUT has a unique coupling antenna connector. Therefore the equipment complies with the requirement of 15.203.

3 Test specification, procedures and results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2010, final revised on January 22, 2010 and effective March 1, 2010

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits, general requirements
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

*The revision on February 27, 2009 does not influence the test specification applied to the EUT.

3.2 Procedures & Results

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.4:2003 7. AC power line conducted emission measurements	FCC Section 15.207	-	N/A *1)	N/A	N/A
Carrier frequency separation	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (a)(1)	Conducted	N/A	*See data.	Complied
20dB bandwidth	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (a)(1)	Conducted	N/A		Complied
Number of hopping frequency	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (a)(1)(iii)	Conducted	N/A		Complied
Dwell time	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (a)(1)(iii)	Conducted	N/A		Complied
Maximum peak output power	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (b)(1)	Conducted	N/A		Complied
Band edge compliance & Spurious emission	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (d) Section15.209	Conducted/ Radiated	N/A	6.1dB (2400.00MHz, Horizontal and Vertical, Tx 2402MHz, 3DH5)	Complied

Note: UL Japan's EMI Work Procedures No.QPM05 and QPM15.
*1) The test is not applicable since the EUT has no AC mains.

3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied bandwidth (99%)	ANSI C63.4:2003 13. Measurement of intentional radiators RSS-Gen 4.6.1	RSS-Gen 4.6.1	Conducted	-	Complied

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

3.4 Uncertainty

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

	No.1 Semi-anechoic chamber (±)	No.2 Semi-anechoic chamber (±)	No.3 Semi-anechoic chamber (±)
Radiated emission (3m)			
30-300MHz	4.4 dB	4.3 dB	4.5 dB
300-1000MHz	4.3 dB	4.2 dB	4.5 dB
1GHz<	5.7 dB	5.6 dB	5.6 dB

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

Conducted emissions, Power Density Measurement (below 1GHz) uncertainty (with a 95% confidence level) for this test was: (±) 1.1dB
Conducted emissions, Power Density Measurement (1G-3GHz) uncertainty (with a 95% confidence level) for this test was: (±) 1.2dB
Conducted emissions, Power Density Measurement (3G-18GHz) uncertainty (with a 95% confidence level) for this test was: (±) 2.9dB
Conducted emissions Measurement (18G-26.5GHz) uncertainty (with a 95% confidence level) for this test was: (±) 3.4dB

Power Measurement uncertainty above 1GHz (with a 95% confidence level) for this test was: (±) 0.8dB
Frequency Measurement uncertainty (with a 95% confidence level) for this test was: (±) 2.1%
Bandwidth Measurement uncertainty (with a 95% confidence level) for this test was: (±) 5.4%

3.5 Test location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone number : +81 463 50 6400
Facsimile number : +81 463 50 6401
JAB Accreditation No. : RTL02610

No.1/ No.2/ No.3 anechoic chamber has been fully described in a report submitted to FCC office, and accepted on April 17, 2009 (Registration No.: 697847).
IC Registration No. : 2973D-1 (No1 anechoic chamber)
2973D-2 (No2 anechoic chamber)
2973D-3 (No3 anechoic chamber)

Test room	Width x Depth x Height (m)	Test room	Width x Depth x Height (m)
No.1 Semi-anechoic chamber	20.6 x 11.3 x 7.65 Maximum measurement distance: 10m	No.1 Shielded room	6.8 x 4.1 x 2.7
No.2 Semi-anechoic chamber	20.6 x 11.3 x 7.65 Maximum measurement distance: 10m	No.2 Shielded room	6.8 x 4.1 x 2.7
No.3 Semi-anechoic chamber	12.7 x 7.7 x 5.35 Maximum measurement distance: 5m	No.3 Shielded room	6.3 x 4.7 x 2.7
No.4 Full-anechoic chamber	8.1 x 5.1 x 3.55	No.4 Shielded room	4.4 x 4.7 x 2.7
		No.5 Shielded room	7.8 x 6.4 x 2.7
		No.6 Shielded room	7.8 x 6.4 x 2.7

3.6 Test setup, Data of EMI & Test instruments

Refer to Appendix 1 to 3.

4 System test configuration

4.1 Justification

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

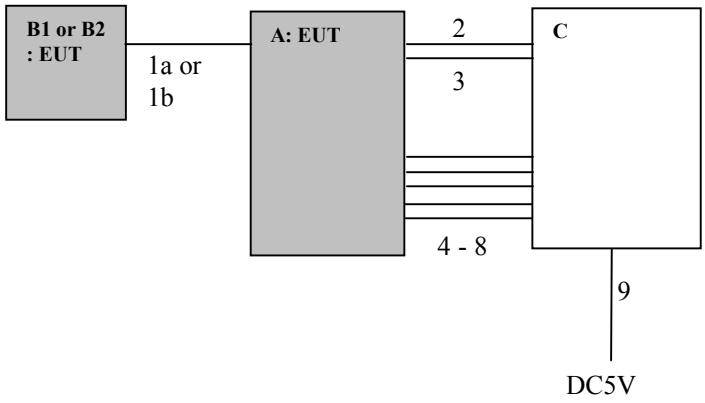
Test item	Operating mode	Tested frequency
Conducted emission	-	-
Carrier frequency separation	Transmitting Hopping ON (DH5/3-DH5)/Inquiry, Payload: PRBS9	-
20dB bandwidth	Transmitting Hopping OFF (DH5/3-DH5)/Inquiry, Payload: PRBS9	2402MHz, 2441MHz, 2480MHz
Number of hopping frequency	Transmitting Hopping ON (DH5/3-DH5)/Inquiry, Payload: PRBS9	-
Dwell time	Transmitting (Hopping ON) -DH1, -DH3, -DH5 -3-DH1, -3-DH3, -3-DH5	-
	-Inquiry	
Maximum peak output power	Transmitting Hopping OFF (DH5/3-DH5)/Inquiry, Payload: PRBS9 -DH5 -2-DH5 -3-DH5	2402MHz, 2441MHz, 2480MHz
Band edge compliance & Spurious emission (Conducted)	Transmitting (DH5/3-DH5), Payload: PRBS9 -Hopping ON/Inquiry -Hopping OFF	Band edge compliance: 2402MHz, 2480MHz Spurious emission: 2402MHz, 2441MHz, 2480MHz(Tx)
(Radiated)	Transmitting (DH5/3-DH5), Payload: PRBS9	
99% occupied bandwidth	Transmitting (DH5/3-DH5), Payload: PRBS9 -Hopping ON -Hopping OFF	2402MHz, 2441MHz, 2480MHz

*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload (except Dwell time test)

* Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.
However, the limit level 125mWof AFH mode was used due to the overlap of the bandwidth.

*Software for testing: HCITester2 (Rev: 0.99ld)
Power settings: Fixed (The setting is not controlled by the software and it is equivalent to that of mass-produced items.)
Above setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Module Assy	YEAP01A046	*1)	Panasonic Corporation Automotive Systems Company	EUT
B1	Bluetooth Antenna Assy	N1KYYYY00001	-	NISSEI ELECTRIC CO., LTD.	EUT
B2	Bluetooth Antenna Assy	N1KYYYY00005	-	NISSEI ELECTRIC CO., LTD.	EUT
C	Test jig	T41786	*2)	MURATA	

*1) Radiated measurements: 1S-13, Conducted measurements: 1S-14
*2) Radiated measurements: MB0208010, Conducted measurements: MB0208007

List of cables used

No.	Name	Length (m)	Shield	
			Cable	Connector
1a	U-FL Cable (Antenna Type: N1KYYYY00001)	0.1	Shielded	Shielded
1b	U-FL Cable (Antenna Type: N1KYYYY00005)	0.45	Shielded	Shielded
2	Lead wire	0.1	Unshielded	Unshielded
3	Lead wire	0.1	Unshielded	Unshielded
4	Lead wire	0.1	Unshielded	Unshielded
5	Lead wire	0.1	Unshielded	Unshielded
6	Lead wire	0.1	Unshielded	Unshielded
7	Lead wire	0.1	Unshielded	Unshielded
8	Lead wire	0.1	Unshielded	Unshielded
9	DC Cable	0.8	Unshielded	Unshielded

5 Carrier frequency separation

Test procedure
The carrier frequency separation was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass

6 20dB bandwidth & Occupied bandwidth (99%)

Test procedure
The bandwidth was measured with a spectrum analyzer connected to the antenna port.
The channel separation in Hopping mode and Inquiry mode was separated by 25kHz and 2/3 of the 20dB bandwidth.

Summary of the test results: Pass

7 Number of hopping frequency

Test procedure
The Number of Hopping Frequency was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass

8 Dwell time

Test procedure
The Dwell time was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass

9 Maximum peak output power

Test procedure
The Maximum Peak Output Power was measured with a power meter connected to the antenna port.

Summary of the test results: Pass

10 Out of band emissions (Antenna port conducted)

Test procedure
The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port.

In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a conducted measurement.

Summary of the test results: Pass

11 Out of band emissions (Radiated)

11.1 Operating environment

The test was carried out in No.3 Semi-anechoic chamber.

11.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane. The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.
The configuration was set in accordance with ANSI C63.4: 2003. Photographs of the set up are shown in Appendix 1.

11.3 Test conditions

Frequency range	:	30MHz - 18GHz	18GHz-26GHz
Test distance	:	3m	1m

11.4 Test procedure

The Radiated Electric Field Strength intensity has been measured with a ground plane and at a distance of 3m.
The measuring antenna height was 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 QP, PK, and AV detector.
The radiated emission measurements were made with the following detector function of the test receiver.

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver	Spectrum Analyzer
Detector IF Bandwidth	QP: BW 120kHz	PK: RBW: 1MHz/VBW: 1MHz, AV*1): RBW: 1MHz VBW: 300Hz
Measuring antenna	Biconical (30-300MHz) Logperiodic (300MHz-1GHz)	Horn

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

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.

Combinations of the worst position

Model	Worst position	
	Below 1GHz	Above 1GHz
Module	Horizontal: X, Vertical: X	Horizontal: Y, Vertical: Y
Antenna	Horizontal: X, Vertical: X	Horizontal: Y, Vertical: Z

The carrier level and noise levels were confirmed at each case of Antenna N1KYYYY00001and N1KYYYY00005of EUT to see the case of maximum noise, and the test was made at the case that has the maximum noise.

Combinations of the worst case

Model	Worst case
Antenna	N1KYYYY00001

11.5 Band edge

Band edge level at 2390MHz, 2400MHz and 2483.5MHz is below the limits of FCC 15.209. Refer to the data.

11.6 Results

Summary of the test results : Pass *No noise was detected above the 5th order harmonics.

APPENDIX 1: Photographs of test setup

Page 13 : Radiated emission

Page 14 - 16 : Pre-check of the worst position

APPENDIX 2: Test data

Page 17 - 20 : 20dB bandwidth and Carrier frequency separation

Page 21 - 23 : Number of hopping frequency

Page 24 - 27 : Dwell time

Page 28 : Maximum peak output power

Page 29 - 39 : Out of band emissions (Antenna Port Conducted)

Page 40 - 52 : Out of band emissions (Radiated)

Page 53 - 54 : Occupied bandwidth (99%)

APPENDIX 3: Test instruments

Page 55 : Test instruments