



RADIO TEST REPORT

Test Report No.: 29LE0246-YK-01-B

Applicant : Alpine Electronics, Inc.
Type of Equipment : Bluetooth Module
Model No. : IAM2.1 BT PWB US
FCC ID : A269ZUA130
Test regulation : FCC Part15 Subpart C: 2009
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.

Date of test: September 7, 8 and 9, 2009

Tested by: *A. Sato*
Akira Sato

M. Nakatake
Minoru Nakatake

Y. Owaki
Yasumasa Owaki

Approved by: *T. Imamura*
Toyokazu Imamura
Manager of Yamakita EMC lab.

UL Japan, Inc.

Yamakita EMC Lab.

907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

Telephone: +81 465 77 1011
Facsimile: +81 465 77 2112

MF060b (06.08.09)

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UL Japan, Inc.

Yamakita EMC Lab.

907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

Telephone: +81 465 77 1011

Facsimile: +81 465 77 2112

1 Applicant information

Company Name : Alpine Electronics, Inc.
Address : 20-1 Yoshima kogyo-danchi, Iwaki-shi, Fukushima, 970-1192 Japan
Telephone Number : +81-246-36-4111
Facsimile Number : +81-246-36-6090
Contact Person : Shinichi Asuke

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

2.1 Identification of E.U.T.

Type of Equipment : Bluetooth Module
Model No. : IAM2.1 BT PWB US
Serial No. : 6
Rating : DC9-16V
Country of Mass-production : Japan
Condition of EUT : Production model
Modification of EUT : No modification by the test lab.
Receipt Date of Sample : September 7, 2009

2.2 Product description

Model: IAM2.1 BT PWB US (referred to as the EUT in this report) is a Bluetooth Module.

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth & channel spacing : 79MHz & 1MHz
Type of modulation : FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
Antenna type : $\lambda/8$ Inverted-F
Antenna gain with cable loss : 0.38dBi
Antenna connector type : U.FL
ITU code : F1D, G1D
Operation temperature range : -40 to +85 deg.C.

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Clock frequency list

Signal Source Description	Frequency
Main Microprocessor	24.000 MHz
	192 MHz
	96 MHz
	48 MHz
SUB Microprocessor	24.576 MHz
	49.152 MHz
	491.52 MHz
	122.88 MHz
APPLE DRM	32.768 kHz
AUDIO DSP	16.9344 MHz
	84.672 MHz
	120 MHz
	6.144 MHz
MAIN TUNER	20.8 MHz
SUB TUNER	20.8 MHz
TMC TUNER	20.5 MHz
RDS DECODER	4.332 MHz
HD RADIO (US Only)	28.22 MHz
Bluetooth	25.8048 MHz
	67.7376 MHz
	73.728 MHz
IEEE1394 Controller	24.576 MHz
	16.9344 MHz
	400 MHz
SCALER	42.00 MHz
	33.231 MHz
	66.462 MHz
	8.31 MHz

Signal Source Description	Frequency
I ² C Bus	80 kHz
	400 kHz
	100 kHz
DDR BUS	96.00 MHz
SD RAM	100.0 MHz
EXT BUS	96.00 MHz
	124.75 MHz
	17.64 MHz
MOST	49.152 MHz
Media Local BUS (MLB)	24.576 MHz
UART	921 kHz
USB2.0	240 MHz
IS BUS	38.4 kHz
SPI BUS	1 MHz
	100 kHz
Tuner IF	300 kHz
EPF-III BUS	1 MHz
SPDIF	12.288 MHz (Max)
I ² S Bus	3.072 MHz
	24.576 MHz
	1.024 MHz
Compressed AC3 (I ² S)	3.072 MHz
Digital RGB	33.231 MHz

FCC Part15.31 (e)

This module provides the Bluetooth part with regulated power supply (DC3.3V and DC1.5V). Therefore, the equipment complies with 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.

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Yamakita EMC Lab.

907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

Telephone: +81 465 77 1011

Facsimile: +81 465 77 2112

3 Test specification, procedures and results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2009, final revised on February 27, 2009
 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 EUT complies with FCC Part 15 Subpart B: 2009, final revised on February 27, 2009. The test has been performed by the customer.

3.2 Procedures & Results

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.4:2003 7. AC powerline 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		0.7dB (614.40MHz, Horizontal, Tx 2402MHz, DH5)

Note: UL Japan's EMI Work Procedures No.QPM05 and QPM15.

*1) The test is not applicable since the EUT has no AC mains.

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Yamakita EMC Lab.

907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

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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 open site (±)	No.2 open site (±)	No.1 anechoic chamber (±)
Radiated emission (3m)			
30-300MHz	4.3 dB	4.3 dB	4.6 dB
300-1000MHz	4.3 dB	4.3 dB	4.5 dB
1GHz<	5.7 dB	5.8 dB	5.7 dB

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

Antenna port conducted test	(±)
Below 1GHz	0.4dB
1GHz and above	0.7dB

3.5 Test location

UL Japan, Inc. Yamakita EMC Lab.

907, Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken 258-0124 JAPAN

Telephone number : +81 465 77 1011

Facsimile number : +81 465 77 2112

JAB Accreditation No. : RTL02610

No. 1 test site has been fully described in a report submitted to FCC office, and accepted on July 23, 2008 (Registration No.: 95486).

IC Registration No. : 2973B-1

No. 2 test site has been fully described in a report submitted to FCC office, and accepted on February 27, 2008 (Registration No.: 466226).

IC Registration No. : 2973B-3

No. 1 anechoic chamber has been fully described in a report submitted to FCC office, and accepted on October 22, 2008 (Registration No.: 95967).

IC Registration No. : 2973B-2

Test room	Width x Depth x Height (m)	Test room	Width x Depth x Height (m)
No.1 shielded room	8.0 x 5.0 x 2.5	No.1 Semi-anechoic chamber	10.0 x 7.5 x 5.7
No.2 shielded room	5.0 x 4.0 x 2.5		
No.3 shielded room	4.0 x 5.0 x 2.7		

Open test site	Maximum measurement distance
No.1 open test site	30m
No.2 open test site	10m

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Yamakita EMC Lab.

907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

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

*Remarks: 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 125mW of AFH mode was used for the test.

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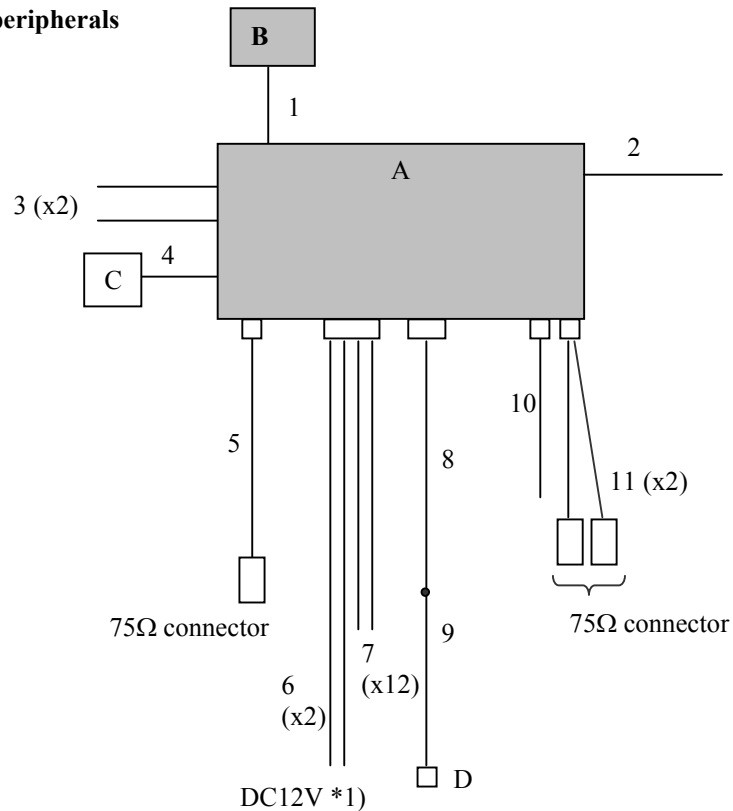
Yamakita EMC Lab.

907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

Telephone: +81 465 77 1011

Facsimile: +81 465 77 2112

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	IAM2.1 BT PWB US	6	ALPINE	EUT
B	Antenna	-	-	-	EUT
C	Fan	MF40J-12A	903138L6	-	-
D	Earphone	BSHSBE04	08215352	BUFFALO	-

*1) DC power supply (Model No.: PAN35-10A) was used for DC 12V input.

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Antenna cable	0.12	Unshielded	Unshielded	-
2	Flexible cable	0.17	Unshielded	Unshielded	-
3	Flexible cable	0.2	Unshielded	Unshielded	-
4	Fan cable	0.04	Unshielded	Unshielded	-
5	RCA cable	1.1	Shielded	Shielded	-
6	DC cable (+, -)	1.0	Unshielded	Unshielded	(x2)
7	Signal cable	1.0	Unshielded	Unshielded	(x12)
8	USB cable	1.7	Shielded	Shielded	-
9	USB cable	0.4	Shielded	Shielded	-
10	Signal cable	0.5	Shielded	Shielded	-
11	BNC cable	0.3	Shielded	Shielded	-

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Yamakita EMC Lab.

907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

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Facsimile: +81 465 77 2112

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

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907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

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12 Out of band emissions (Radiated)

12.1 Operating environment

The test was carried out in No.1 anechoic chamber.

12.2 Test configuration

EUT was placed on a urethane platform of nominal size, 1.8m by 0.9m, raised 80cm above the conducting ground plane to prevent the reflection influence. The configuration was set in accordance with ANSI C63.4: 2003. Photographs of the set up are shown in Appendix 1.

12.3 Test conditions

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

12.4 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: See data
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 and its antenna to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Combinations of the worst case

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

12.5 Band edge

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

12.6 Results

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

The frequency of 614MHz is not a clock frequency of the Bluetooth part but of BlackFin (BF539F). It is considered that the antenna wave synchronized with BlackFin part in BDR mode (Tx 2402MHz) and the high-intensity radiation was observed.

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Yamakita EMC Lab.

907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

Telephone: +81 465 77 1011

Facsimile: +81 465 77 2112

APPENDIX 1: Photographs of test setup

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APPENDIX 2: Test data

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APPENDIX 3: Test instruments

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UL Japan, Inc.

Yamakita EMC Lab.

907 Kawanishi, Yamakita-machi, Ashigarakami-gun, Kanagawa-ken, 258-0124 JAPAN

Telephone: +81 465 77 1011
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