



Underwriters
Laboratories UL Japan, Inc.

FCC ID : MMFMB400I-B2
Test report No. : 29AE0053-YK-02-A-R2
Page : 1 of 83
Issued date : December 5, 2008

RADIO TEST REPORT

Test Report No. : 29AE0053-YK-02-A-R2

Applicant : SATO CORPORATION

Type of Equipment : BARCODE PRINTER

Model No. : MB410i-B#

FCC ID : MMFMB400I-B2

Test regulation : FCC Part15 Subpart C: 2008

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. Original test report number of this report is 29AE0053-YK-02-A-R1.

Date of test: October 3, 21, 24 and November 25, 2008

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1 Applicant information

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Contact Person : Yoshimitu Maeda

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

2.1 Identification of E.U.T.

Type of Equipment : BARCODE PRINTER
Model No. : MB410i-B2
Serial No. : ES0000007 (Conducted emission and Radiated emission test),
ES0000009 (other test)
Rating : DC9V (AC Adaptor: AC100-240V, 50/60Hz)
DC7.4V (Li-ion Battery Pac)
Country of Mass-production : Malaysia, Vietnam
Receipt Date of Sample : September 19, 2008
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: MB410i-B2 (referred to as the EUT in this report) is a BARCODE PRINTER.

*Model No. MB410i-B2 has series model (MB400i-B2). The difference does not affect on EMC testing result.

The EUT has some series models:

Item	MB410i-B2	MB400i-B2
Head density	12 dot/mm (305dpi)	8 dot/mm (203dpi)

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Clock frequency : CPU: 14.7456MHz
Internal Clock: 14.7456 x 4 =58.9824MHz
Bluetooth X'tal: 16MHz
Bandwidth & channel spacing : 79MHz & 1MHz
Type of modulation : FHSS
Antenna type : Chip antenna (Model No. ANT8030-2R4-01A)
Antenna connector type : None
Antenna gain : 2.0dBi
ITU code : F1D, G1D
Operation temperature range : -15 to +50 deg.C.

FCC Part15.31 (e)

The Bluetooth module is provided with stable power supply (DC 3.3 V), therefore, the equipment complies power supply regulation.

FCC Part15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the module. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3 Test specification, procedures and results

3.1 Test specification

Test specification : FCC Part15 Subpart C: 2008, final revised on May 19, 2008
 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

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	Section 15.207	-	N/A	14.7dB (1.7850MHz, QP, L1, DH5) (1.6940MHz, QP, L1, 3DH5)	Complied
Carrier frequency separation	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	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	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	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	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	Section15.247 (b)(1)	Conducted	N/A		Complied
Band Edge Compliance	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (d)	Radiated	N/A		Complied
Spurious emission	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.209 Section15.247 (d)	Conducted / Radiated	N/A	7.7dB (58.99MHz, QP, Vertical, Tx 2441MHz, 3DH5)	Complied

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

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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

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NVLAP Lab. code : 200441-0

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	10.0 x 7.5 x 5.7
No.2 shielded room	5.0 x 4.0 x 2.5	Semi-anechoic chamber	
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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4 System test configuration

4.1 Operating mode

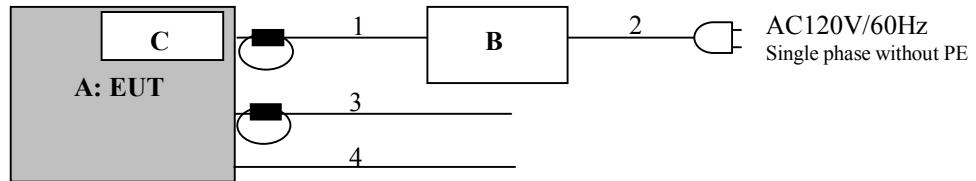
The system was configured in typical fashion (as a customer would normally use it) for testing.

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

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

*2: 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.

4.2 Configuration and peripherals



■ : Ferrite core

* Test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	BARCODE PRINTER	MB410i-B2	*1)	SATO CORPORATION	EUT
B	AC Adaptor	PAH7020-19	08061923	Analog Vision Co., Ltd.	-
C	Li-ion Battery Pac	PT/MB200-BAT	-	SATO CORPORATION	-

*1) ES0000007 (Conducted emission and Radiated emission test), ES0000009 (other test)

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC power cable	1.9	Unshielded	Unshielded	* Ferrite Core: Attach the accompanying ferrite core (Type: ZCAT2035-0930 made by TDK) around the cables that are connected with the DC power terminals.
2	AC power cable	2.0	Unshielded	Unshielded	-
3	RS-232C cable	0.7	Shielded	Shielded	* Ferrite Core: Attach the accompanying ferrite core (Type: RFC-8 made by KITAGAWA KOGYO) around the cables that are connected with the RS-232C terminals.
4	USB cable (HI SPEED)	1.9	Shielded	Shielded	-

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5 Conducted Emissions

5.1 Operating environment

The test was carried out in No.1 shielded room.

5.2 Test configuration

EUT was placed on a wooden platform of nominal size, 1m by 1.8m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of peripherals was aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN) and excess AC cable was bundled in center. Photographs of the set up are shown in Appendix 1.

5.3 Test conditions

Frequency range : 0.15 - 30MHz
EUT operation mode : Transmitting

5.4 Test procedure

The EUT was connected to a LISN (AMN). An overview sweep with peak detection has been performed. The Conducted emission measurements were made with the following detector function of the test receiver.

Detector: QP/AV
IF Bandwidth: 9kHz

5.5 Results

Summary of the test results : Pass

Date : October 21, 2008

Test engineer : Makoto Hosaka

6 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

Date: October 3, 2008

Test engineer: Tatsuya Arai

7 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

Date: October 3, 2008

Test engineer: Tatsuya Arai

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8 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

Date: October 3, 2008

Test engineer: Tatsuya Arai

9 Dwell time

Test procedure

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

Summary of the test results: Pass

Date: October 24, 2008

Test engineer: Makoto Hosaka

10 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

Date: October 3, 2008

Test engineer: Tatsuya Arai

11 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

Date: October 3, 2008

Test engineer: Makoto Hosaka

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, 0.5m by 0.5m, 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 and Spectrum analyzer.

Frequency	Below 1GHz	Above 1GHz *1)
Instrument used	Test Receiver	Spectrum Analyzer
Detector IF Bandwidth	QP: BW 120kHz	PK: RBW: 1MHz/VBW: 1MHz, AV (Except pulse emission) *2): RBW: 1MHz/VBW: 10Hz
Measuring antenna	Biconical (30-300MHz) Logperiodic (300MHz-1GHz)	Horn

*1) The test above 1GHz was performed with PK DETECT. Average emission values were calculated with PK DETECT and Duty cycle factor. Duty cycle was within 100msec. See Appendix 4.

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

The equipment was previously checked at each position of three axes X, Y and Z. The position in which the maximum noise occurred was chosen to put into measurement. See the table below and photographs in page 14. With the position, the noise levels of all the frequencies were measured.

	Below 1GHz	Above 1GHz
Horizontal	X	Z
Vertical	Z	Z

12.5 Band edge

Band edge level at 2400MHz is less than 20dB of peak point of the carrier. Refer to the data of out of band emissions (Antenna port conducted). Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209. Refer to the data of radiated emission.

12.6 Results

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

Date : October 21, 2008 Test engineer : Makoto Hosaka and Go Ishiwata

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APPENDIX 1: Photographs of test setup

Page 12 : Conducted emission
Page 13 : Radiated emission
Page 14 : Pre-check of the worst position

APPENDIX 2: Test data

Page 15 : Conducted emission
Page 24 : Carrier frequency separation
Page 25 - 26 : 20dB bandwidth
Page 27 - 30 : Number of hopping frequency
Page 31 - 42 : Dwell time
Page 43 : Maximum peak output power
Page 44 - 59 : Out of band emissions (Antenna port conducted)
Page 60 - 77 : Out of band emissions (Radiated)
Page 78 - 80 : Occupied bandwidth

APPENDIX 3: Test instruments

Page 81 - 82 : Test instruments

APPENDIX 4: Duty factor calculation

Page 83 : Duty factor calculation

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