



UL Apex Co., Ltd.

Test report No. : 27DE0137-HO-A-1
Page : 1 of 66
Issued date : March 14, 2007
Revised date : March 22, 2007
FCC ID : PZWBHT400SLBWB

RADIO TEST REPORT

Test Report No. : 27DE0137-HO-A-1

Applicant : DENSO WAVE INCORPORATED
Type of Equipment : Barcode Handy Terminal
Model No. : BHT-470BWB-CE
FCC ID : PZWBHT400SLBWB
Test standard : FCC Part 15 Subpart C
Section 15.207, Section 15.247: 2006
Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.

Date of test:

November 27, 2006 to February 10, 2007

Tested by:


Makoto Kosaka

EMC Services

Approved by :


Naoki Sakamoto

Assistant Manager of EMC Services

NVLAP[®]
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://ulapex.jp/emc/nvlap.htm>

UL Apex Co., Ltd.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8116

Facsimile : +81 596 24 8124

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SECTION 1: Client information

Company Name : DENSO WAVE INCORPORATED
 Address : 1-1 Showa-cho Kariya-shi Aichi, 448-8661 Japan

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

2.1 Identification of E.U.T.

Type of Equipment : Barcode Handy Terminal
 Model No. : BHT-470BWB-CE
 Serial No. : 5496310346600007
 Rating : DC3.7V (Li-ion Battery)
 Country of Manufacture : Japan
 Receipt Date of Sample : November 16, 2006
 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: BHT-470BWB-CE is the Barcode Handy Terminal with IEEE802.11b/g Wireless LAN and Bluetooth. The Barcode Handy Terminal scans the barcode, sends and receives the data of barcode by radio. BHT-470BWB-CE has a variant model, BHT-420BWB-CE. The difference of BHT-470BWB-CE and BHT-420BWB-CE is number of keypads as follows, and the radio and electric parts of the both models are identical.

Model No.	Key type		Radio module type	
	50-key	31-key	IEEE802.11b/g Wireless LAN	Bluetooth
BHT-470BWB-CE	○	-	○	○
BHT-420BWB-CE	-	○	○	○

The distance of IEEE802.11b/g Wireless LAN antenna and Bluetooth antenna is within 20cm. IEEE802.11b/g Wireless LAN and Bluetooth modules can transmit simultaneously.

Clock frequency in the system : [CPU] 32.768kHz, 13MHz (13MHz x 40 = 520MHz: Max Speed)
 [Sub-CPU] 32.768kHz, 12.288MHz
 [RTC] 32.768kHz
 [IEEE802.11b/g Wireless LAN] 40MHz
 [Bluetooth] 16MHz

Equipment Type : Transceiver

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		IEEE802.11b/g Wireless LAN
Frequency band	Lower limit	2412MHz
	Upper limit	2462MHz
Type of Modulation		DSSS, OFDM
Antenna Type		Multi-layer Mono Pole
Antenna Connector Type		Coaxial Connector
Antenna Gain		3.3dBi
ITU code		G1D(DSSS), D1D(OFDM)
Power Supply (Inner)		DC 3.3V

		Bluetooth
Frequency band	Lower limit	2402MHz
	Upper limit	2480MHz
Bandwidth & Channel spacing		1MHz & 1MHz / CH
Type of Modulation		FHSS
Antenna Type		Multi-layer Mono Pole
Antenna Connector Type		Coaxial Connector
Antenna Gain		3.3dBi
ITU code		F1D
Power Supply (Inner)		DC 3.0V

* For Bluetooth module test, please see UL Apex Test Report No. 27DE0137-HO-C

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part15 Subpart C : 2006

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits : 2006
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz : 2006

FCC 15.31 (e)

This EUT provides stable voltage(DC3.3V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

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3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted emission	FCC: ANSI C63.4:2003 7. AC powerline conducted emission measurements IC: RSS-Gen 7.2.2	FCC: Section 15.207 IC: RSS-Gen 7.2.2	-	N/A	11.5dB 0.15000MHz QP, N	Complied
2	6dB Bandwidth	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: RSS-Gen 4.4.2	FCC: Section 15.247(a)(2) IC: RSS-210 A8.2(1)	Conducted	N/A		Complied
3	Maximum Peak Output Power	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: RSS-Gen 4.6	FCC: Section 15.247(b)(3) IC: RSS-210 A8.4(4)	Conducted	N/A		Complied
4	Restricted Band Edges	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: -	FCC: Section 15.247 (d) IC: RSS-210 A8.5	Conducted/ Radiated	N/A	See data.	Complied
5	Power Density	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: -	FCC: Section 15.247 (e) IC: RSS-210 A8.2(2)	Conducted	N/A		Complied
6	Spurious Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators IC: RSS-Gen 4.7 RSS-Gen 4.8	FCC: Section15.247(d) IC: RSS-210 A8.5 RSS-Gen 7.2.1 and 7.2.3	Conducted/ Radiated	N/A	[Tx] 0.9dB 280.223MHz Horizontal [Rx] 5.1dB 935.974MHz Horizontal	Complied

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

*0) The result is rounded off to the second decimal place. Therefore, there may be 0.1 difference for the result.

*These tests were also referred to "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247".

*These tests were performed without any deviations from test procedure except for additions or exclusions.

3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 4.4.1	-	Conducted	N/A	N/A	N/A
2	Co-location & Co-operation (Confirmation testing for Radiated Spurious Emission at simultaneous transmission)	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.247(d) RSS-210 A8.5	Radiated	N/A	0.5dB 277.340MHz Horizontal	Complied

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3.4 Uncertainty

Conducted Emission

The measurement uncertainty (with a 95% confidence level) for this test is ± 2.66 dB.
 The data listed in this test report has enough margin, more than the site margin.

Spurious Emission (Radiated)

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is ± 4.59 dB(3m).
 The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is ± 4.62 dB(3m).
 The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is ± 5.27 dB.
 [Tx] The data listed in this report meets the limits unless the uncertainty is taken into consideration.
 [Rx] The data listed in this test report has enough margin, more than the site margin.

Other test except Conducted Emission and Spurious Emission (Radiated)

The measurement uncertainty (with a 95% confidence level) for this test is ± 3.0 dB.

3.5 Test Location

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	FCC Registration Number	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	313583	IC4247A	19.2 x 11.2 x 7.7m	7.0 x 6.0m	Preparation room
No.2 semi-anechoic chamber	655103	IC4247A-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	IC4247A-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	IC4247A-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	-
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	N/A	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	2.0 x 2.0 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 5.4 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	-

* 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.7 shielded room.

3.6 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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

4.1 Operating Modes

The mode used for test : Transmitting mode 11b (CCK, Packet type: Maximum, Payload: PN9)

- Low Channel : 2412MHz(Ch1)
- Mid Channel : 2437MHz(Ch6)
- High Channel : 2462MHz(Ch11)

Transmitting mode 11g (OFDM, Packet type: Maximum, Payload: PN9)

- Low Channel : 2412MHz(Ch1)
- Mid Channel : 2437MHz(Ch6)
- High Channel : 2462MHz(Ch11)

Receiving mode

- Mid Channel : 2437MHz

Co-location & Co-operation

- Transmitting mode 11b/g 2437MHz & Bluetooth hopping mode

*As a result of preliminary test, the formal test was performed with the above modes, which had the max power rate.

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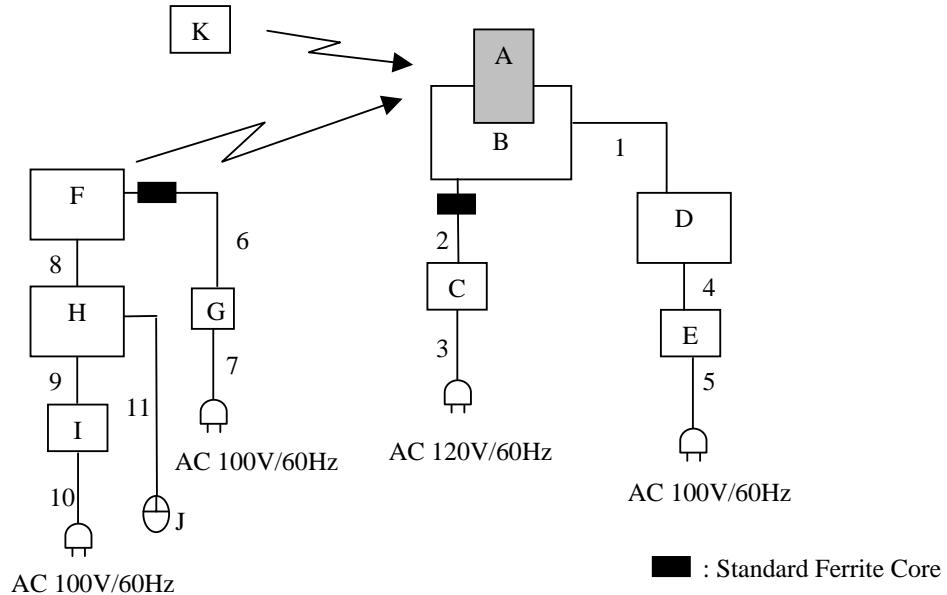
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4.2 Configuration and peripherals

1) Used for Conducted emissions test



2) Used for Radiated emissions test



* 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	Barcode Handy Terminal	BHT-470BWB-CE	5496310346600 007	DENSO WAVE INCORPORATED	EUT
B	Optical Communication Unit	CU-421	1	DENSO WAVE INCORPORATED	-
C	AC Adapter	AWW0515NE-001	0701	DENSO WAVE INCORPORATED	-
D	Note PC	Type 2366	97-99D4L	IBM	-
E	AC Adapter	02K6750	11S02K6750Z1 Z2uP29A0TJ	IBM	-
F	Access Point	A1R-A1131AG-J-K9	FHK0907C03L	Cisco System	-
G	AC Adapter	PSA18U-480C	I41001664A3	Cisco System	-
H	Note PC	PS460N-004YH0	31013015J	TOSHIBA	-
I	AC Adapter	PA3048U-1ACA	0150538P	TOSHIBA	
J	Mouse	M-S8a	HCA43506420	Logitech	-
K	Barcode Handy Terminal	BHT-420-BB-CE	5496310346600 009	DENSO WAVE INCORPORATED	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	USB Cable	1.0	Shielded	Shielded	-
2	DC Power Cable	1.9	Unshielded	Unshielded	-
3	AC Power Cable	2.0	Unshielded	Unshielded	-
4	DC Cable	1.8	Unshielded	Unshielded	-
5	AC Cable	1.8	Unshielded	Unshielded	-
6	DC Cable	1.5	Unshielded	Unshielded	-
7	AC Cable	2.0	Unshielded	Unshielded	-
8	LAN Cable	2.0	Unshielded	Unshielded	-
9	DC Cable	1.8	Unshielded	Unshielded	-
10	AC Cable	2.0	Unshielded	Unshielded	-
11	Mouse Cable	1.4	Shielded	Shielded	-

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0m by 0.5m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals 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)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT itself (as a stand alone equipment)

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN (AMN) to the input power source. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber or a Measurement Room.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

Detector	: CISPR quasi-peak and average detector (IF BW 9 kHz)
Measurement range	: 0.15-30MHz
Test data	: APPENDIX 2
Test result	: Pass

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SECTION 6: Spurious Emission

[Conducted]

Test Procedure

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

Test data : APPENDIX 2

Test result : Pass

[Radiated]

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0m by 0.5m, raised 80cm above the conducting ground plane. The Radiated Electric Field Strength intensity has been measured in a Semi Anechoic Chamber with a ground plane and at a distance of 3m(Below 10GHz) and 1m(Upper 10GHz).

The height of the measuring 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 (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

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

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 radiated measurement.

20dBc was applied to the frequency over the limit of FCC 15.209 and outside the restricted band of FCC15.205.

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver / Spectrum Analyzer	Spectrum Analyzer
Detector IF Bandwidth	QP: BW 120kHz(T/R) 20dBc : RBW: 100kHz VBW: 300kHz (S/A)	PK: RBW:1MHz/VBW: 1MHz AV: RBW:1MHz/VBW:10Hz 20dBc : RBW:100kHz/VBW:300kHz

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.

Test data : APPENDIX 2
Test result : Pass

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SECTION 7: Bandwidth

Test Procedure

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

Test data : APPENDIX 2
Test result : Pass

SECTION 8: Maximum Peak Output Power

Test Procedure

The Maximum Peak Output Power was measured with a power meter (tested bandwidth: 50MHz) connected to the antenna port.

Test data : APPENDIX 2
Test result : Pass

SECTION 9: Power Density

[Conducted]

Test Procedure

The Peak Power Density was measured with a spectrum analyzer connected to the antenna port.

It was measured based on "PSD option 1" of "Guidance on Measurement of Digital Transmission Systems Operating under Section15.247".

Test data : APPENDIX 2
Test result : Pass

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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