



**Underwriters  
Laboratories UL Japan, Inc.**

Test report No. : 28JE0085-HO-01-R2  
Page : 1 of 29  
Issued date : July 22, 2008  
Revised date : September 9, 2008  
FCC ID : WB2MH-5870

## **RADIO TEST REPORT**

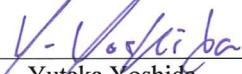
**Test Report No. : 28JE0085-HO-01-R2**

**Applicant** : AMANO Corporation  
**Type of Equipment** : 13.56MHz RFID Unit for Parking Management Equipment  
**Model No.** : MH-5870  
**Test regulation** : FCC Part 15 Subpart C : 2008  
Section 15.207 and 15.225  
**FCC ID** : WB2MH-5870  
**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 above regulation.
4. The test results in this 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. Original test report number of this report is 28JE0085-HO-01.

**Date of test:** July 7 to September 4, 2008

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\*As for the range of Accreditation in NVLAP, you may refer to the WEB address, <http://uljapan.co.jp/emc/nvlap.htm>

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## **SECTION 1: Customer information**

Company Name : AMANO Corporation  
Brand name : AMANO  
Address : 275 Mamedo-cho, Kohoku-ku, Yokohama, Kanagawa-ken, 222-8558 Japan  
Telephone Number : +81-45-439-1557  
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Contact Person : Akihiro Ebe

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

### **2.1 Identification of E.U.T.**

Type of Equipment : 13.56MHz RFID Unit for Parking Management Equipment  
Model No. : MH-5870  
Serial No. :  
1) 9999-1  
2) 9999-2  
Rating : AC 120V/60Hz  
Receipt Date of Sample : May 29, 2008  
Country of Mass-production : Japan  
Condition of EUT : Engineering 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: MH-5870 is the 13.56MHz RFID Unit for Parking Management Equipment.  
This is Mifare-Card reading device used in the parking lot.  
The clock frequency of EUT is 4.9152MHz, 13.56MHz.

MH-5870 is an embedded Reader / Writer Module for Mifare card Type-A.

#### **[Specifications]**

Interface: Serial (CMOS/RS-232C)  
Reading/Writing distance: 30mm (Standard)

Equipment Type : Transceiver  
Frequency of Operation : 13.56 MHz  
Type of modulation : ASK  
Antenna Type : Loop antenna  
Method of Frequency Generation : Crystal  
Operating voltage : DC 5.0V

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## **SECTION 3: Test specification, procedures & 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 15.225 : Operation within the band 13.110-14.010MHz

#### **FCC 15.31 (e)**

This EUT provides stable voltage (DC5.0V) 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	ANSI C63.4:2003 7. AC powerline conducted emission measurements	Section 15.207	Conducted	N/A	[QP] 9.7dB, 0.20078MHz, N [AV] 7.6dB, 13.55969MHz, N	Complied
2	Electric Field Strength of Fundamental Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(a)	Radiated	N/A	See data	Complied
3	Spectrum Mask	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(b)(c)	Radiated	N/A		Complied
4	20dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.215(c)	Radiated	N/A		Complied
5	Electric Field Strength of Spurious Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.209, Section 15.225 (d)	Radiated	N/A	4.9dB, 176.274MHz, Horizontal, QP	Complied
6	Frequency Tolerance	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(e)	Radiated	N/A	See data	Complied

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

\*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 4.6.1	RSS-Gen 4.6.1	Radiated	N/A	See data	Complied

### 3.4 Uncertainty

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

Test room	Conducted emission	Radiated emission (10m*)			Radiated emission (3m*)			Radiated emission (3m*)	
		150kHz-30MHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	1GHz-18GHz
No.1 semi-anechoic chamber (±)	3.7dB	3.1dB	4.4dB	4.2dB	3.2dB	3.8dB	3.9dB	5.9dB	6.1dB
No.2 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.4dB	4.0dB	5.9dB	6.1dB
No.3 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.6dB	4.0dB	5.9dB	6.1dB
No.4 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	3.9dB	3.9dB	5.9dB	6.1dB

\*10m/3m = Measurement distance

#### Conducted emission test

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

#### Radiated emission test (3m)

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 for this test is ±3.0dB.

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

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### 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	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	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	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	134570	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	4.75 x 5.4 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	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

\* 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.3 and No.4 shielded rooms.

### 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 EUT was operated in a manner similar to typical use during the tests.

The mode is used :

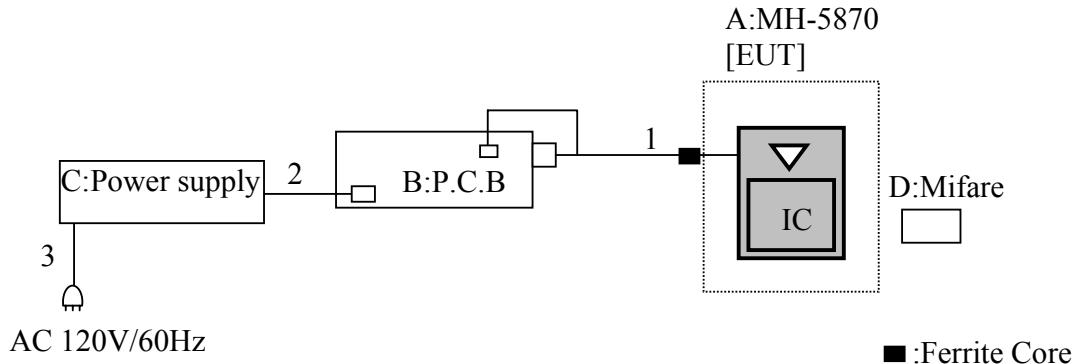
- 1) Modulated continuous transmitting mode With Tag (13.56MHz)
- 2) Modulated continuous transmitting mode Without Tag (13.56MHz)
- \* Refer to clause 4.3 about specification of transmitting data.
- 3) Continuous Transmitting mode (No Modulation)

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

Frequency Tolerance:

Temperature for the extreme tests : -20 deg.C.(minimum) to + 50deg.C.(maximum)  
 Voltage for the extreme tests : Normal: AC 120V, Vlow: 102V, Vhigh: 138V

### 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	13.56MHz RFID Unit for Parking Management Equipment	MH-5870	9999-1 *1) 9999-2 *2)	AMANO Corporation	EUT
B	P.C.B	EPC211800	9999	AMANO Corporation	-
C	Power supply	LDA10F-12	-	COSEL	-
D	Mifare Card	-	-	-	*1)

\*1) Used for Radiated emission test

\*2) Used for Conducted emission test

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Communication Cable	2.4	Shielded	Shielded	Ferritecore 1turn 6cm from EUT
2	DC Power Cable	1.0	Unshielded	Unshielded	-
3	AC Power Cable	2.0	Unshielded	Unshielded	-

### 4.3 Specification of transmitting data

Fig 1) : It is a train of impulses when "0x26" is transmitted to tag by the ReqA command.

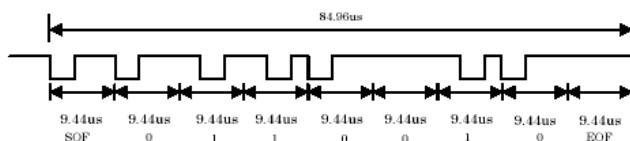
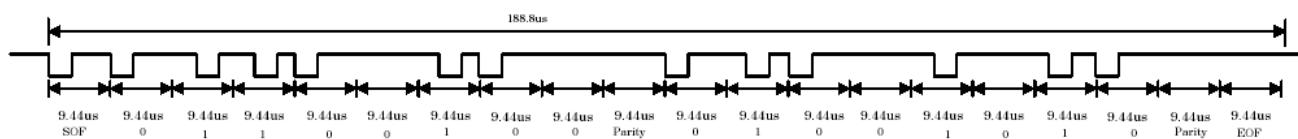


Fig 2) : It is a train of impulses when "0x26" and "0x52" is transmitted by other commands.



\* These data are from the customer.

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## **SECTION 5: Conducted emission**

### **5.1 Operating environment**

Test place : No.3 semi anechoic chamber  
Temperature : See data  
Humidity : See data

### **5.2 Test configuration**

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT and its 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 LISN/AMN and excess AC cable was bundled in center. I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN/ an AMN to the input power source. All unused 50ohm connectors of the LISN/ AMN were resistively terminated in 50ohm when not connected to the measuring equipment.  
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT on a horizontal conducting plane 4.0 x 4.0m and a vertical conducting plane 2.0 x 2.0m in a semi Anechoic Chamber.  
Photographs of the set up are shown in Appendix 1.

### **5.3 Test conditions**

Frequency range : 0.15MHz-30MHz  
EUT position : Table top  
EUT operation mode : See Clause 4.1

### **5.4 Test procedure**

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT in the semi Anechoic Chamber. The EUT was connected to a Line Impedance Stabilization Network (LISN)/ Artificial Mains Network (AMN). An overview sweep with peak detection has been performed.

The measurements had been performed with a quasi-peak detector and if required, with an average detector. The conducted emission measurements were made with the following detector function of the test receiver.

Detector Type : QP and AV  
IF Bandwidth : 9kHz

### **5.5 Test result**

Summary of the test results : Pass

## **SECTION 6: Radiated emission (Fundamental, Spurious Emission and Spectrum Mask )**

### **6.1 Operating environment**

The test was carried out in a No.1 semi Anechoic Chamber.

Temperature : See data

Humidity : See data

### **6.2 Test Procedure**

The Radiated Electric Field Strength intensity has been measured in a semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency: From 9kHz to 30MHz at distance 3m, Used antenna: Loop

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for each antenna angle 0deg. , 45deg. and 90deg.

Frequency: From 30MHz to 1GHz at distance 3m, Used antenna: Biconical (30-300MHz), Logperiodic (300-1000MHz)

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 a QP, PK, and AV detector.

The radiated emission measurements were made with the following detector function of the test receiver.

	From 9kHz to 90kHz and From 110kHz to 150kHz	From 90kHz to 110kHz	From 150kHz to 490kHz	From 490kHz to 30MHz	From 30MHz to 1GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz

- 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.

\* FCC Part 15 Section 15.31 (f)(2) / IC RSS-Gen 4.11 (9kHz-30MHz)

9kHz – 490kHz [Limit at 3m]=[Limit at 300m]-40log (3[m]/300[m])

490kHz – 30MHz[Limit at 3m]=[Limit at 30m]-40log (3[m]/30[m])

### **6.3 Test result**

Summary of the test results : Pass

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## **SECTION 7: 20dB Bandwidth**

### **Test Procedure**

The measurement was performed under the condition which has the maximum Electric field strength.

Test data	: APPENDIX 2
Test result	: Pass

## **SECTION 8: Frequency Tolerance**

### **Test Procedure**

The measurement was performed with Electric field strength using a spectrum analyzer.

Test data	: APPENDIX 2
Test result	: Pass

## **SECTION 9: 99% Occupied Bandwidth**

### **Test Procedure**

The measurement was performed under the condition which has the maximum Electric field strength.

Test data	: APPENDIX 2
Test result	: Pass