RADIO TEST REPORT

Test Report No. : 33AE0207-HO-02-R1

Applicant	:	**YAMAHA FINE TECHNOLOGIES CO., LTD.**
Type of Equipment	:	**RFID-Unit (4ch type)**
Model No.	:	**RF001-4**
Test regulation	:	**FCC Part 15 Subpart C: 2012 Section 15.207 and 15.225**
FCC ID	:	**PU8RF001-4**
Test Result	:	**Complied**

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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.
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6. This report is a revised version of 33AE0207-HO-02. 33AE0207-HO-02 is replaced with this report.

Date of test: October 27 to 29, 2008

Representative test engineer:
Motoya Imura
Engineer of WiSE Japan,
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Approved by:
Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service

NVLAP LAB CODE: 200572-0

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http://uljapan.co.jp/emc/nvlap.html

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SECTION 1: Customer information

Company Name	:	YAMAHA FINE TECHNOLOGIES CO., LTD.
Brand or Trade name	:	YAMAHA FINE TECHNOLOGIES
Address	:	283 Aoya-cho, Minami-ku, Hamamatsu, 435-8568 Japan
Telephone Number	:	+81-53-467-3604
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Contact Person	:	Keiichiro Sasamine

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

2.1 Identification of E.U.T.

Type of Equipment	:	RFID-Unit(4ch type)
Model No.	:	RF001-4
Serial No.	:	1071
Receipt Date of Sample	:	October 17, 2008
Rating	:	DC 5.0V
Country of Mass-production	:	Japan
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model No: RF001-4 (referred to as the EUT in this report) is the RFID-Unit(4ch type).
A "RF-Tag Read/Write unit" designed for use in FA equipment.
RF-Tag can be read and written by an external equipment with command control via serial communication.
Up to a maximum of 4 antennas can be connected. I/O control enables to select an antenna to use.

The clock frequency of EUT is 13.56 MHz.

Equipment Type	:	Transceiver
Frequency of Operation	:	13.56 MHz
Type of modulation	:	ASK
Antenna type	:	PWB loop antenna
Antenna connector type	:	nylon connector
Method of frequency generation	:	Crystal
Operating voltage (inner)	:	DC3.2V

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	Test specification: FCC Part 15 Subpart C: 2012, final revised on August 13, 2012 and effective September 12, 2012
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

* The revision on August 13, 2012 does not affect the test specification applied to the EUT.

FCC 15.31 (e)
This EUT provides stable voltage(DC3.2V) 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 end product in which the EUT is installed. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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	-	N/A	[QP] 13.5dB 0.61792MHz, N 0.61860MHz, N [AV] 3.7dB 13.55930MHz, L 13.56000MHz, 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	81.4dB 13.56000MHz QP, 90 deg.	Complied
3	Spectrum Mask	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(b)(c)	Radiated	N/A	45.6dB 14.01000MHz QP, 90deg. 14.50164MHz QP, 90deg. (Modulated wave transmission mode; High power) 14.01000MHz QP, 90deg. (RF-Tag read test mode; Low power) 14.01000MHz QP, 90deg. (RF-Tag read test mode; High power)	Complied
4	20dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.215(c)	Radiated	N/A	N/A	N/A
5	Electric Field Strength of Spurious Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.209, Section 15.225 (d)	Radiated	N/A	6.1dB 189.831MHz QP, Vertical	Complied
6	Frequency Tolerance	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.225(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 Additions or deviations to standards

No addition, deviation, nor exclusion has been made from standards.

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	18GHz-40GHz
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 report meets the limits unless the uncertainty is taken into consideration.

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.

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.

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

4.1 Operating Modes

Test	Mode	Tag
Conducted emission	Modulated wave transmission mode, Ant 1 -Low power -High power	Without Tag
	RF-Tag read test mode Ant 1 -Low power -High power	With Tag
Radiated emission, 20dB Bandwidth	Modulated wave transmission mode, Ant 1 -Low power -High power	Without Tag
	RF-Tag read test mode Ant 1 -Low power -High power	With Tag
Frequency Tolerance	Continuous Transmitting (No Modulation)	Without Tag
*The test was confirmed with and without a tag in the preliminary test. As a result of preliminary test, since the worst levels for each test were as mentioned above, the formal test was performed under the above conditions. *For Conducted emission, Radiated emission, 20dB Bandwidth tests, Ant 1 had a worst noise level among 4 antennas at the preliminary test, and therefore the tests were performed with Ant 1. In addition, the EUT has three power settings of Low power, Middle power and High power. Since end users can arbitrarily change the settings of the output power of the product, the tests were performed with Low power and High power.		

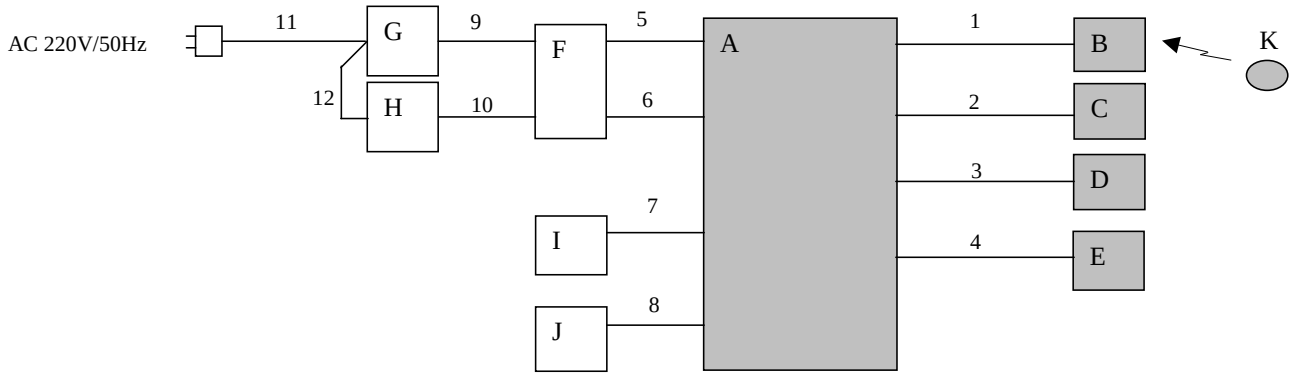
Justification: The system was configured in typical fashion (as a customer would normally use it) for testing.

Frequency Tolerance:

Temperature for the extreme tests : -20 deg. C (minimum) to + 50deg. C (maximum)
(Step 10deg. C / Standby time: 30 minutes)

Voltage for the extreme tests : DC4.25V(min) to DC5.75V(max) for Tnom
DC5.0V for Tmin and Tmax

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	RFID-Unit (4ch type)	RF001-4	1071	YAMAHA FINE TECHNOLOGIES CO., LTD.	EUT
B	Antenna	CB-094A	1	YAMAHA FINE TECHNOLOGIES CO., LTD.	EUT
C	Anetnna	CB-094A	2	YAMAHA FINE TECHNOLOGIES CO., LTD.	EUT
D	Antenna	CB-094A	3	YAMAHA FINE TECHNOLOGIES CO., LTD.	EUT
E	Antenna	CB-094A	4	YAMAHA FINE TECHNOLOGIES CO., LTD.	EUT
F	I/O-Board	-	-	-	-
G	Power Supply (DC 5V)	PBA10F-5-N	8224414HR	COSEL CO., LTD.	-
H	Power Supply (DC 24V)	PBA10F-24-N	8254846HR	COSEL CO., LTD.	-
I	LED	-	-	-	-
J	Mode Set Plug	-	-	-	-
K	Tag	-	E00401000F737BDE	-	EUT

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Antenna Cable	2.5	Unshielded	Unshielded	-
2	Antenna Cable	2.5	Unshielded	Unshielded	-
3	Antenna Cable	2.5	Unshielded	Unshielded	-
4	Antenna Cable	2.5	Unshielded	Unshielded	-
5	DC Cable	0.1	Unshielded	Unshielded	-
6	DC/Signal Cable	0.1	Unshielded	Unshielded	-
7	Signal Cable	0.1	Unshielded	Unshielded	-
8	Signal Cable	0.1	Unshielded	Unshielded	-
9	DC Cable	0.15	Unshielded	Unshielded	-
10	DC Cable	0.15	Unshielded	Unshielded	-
11	AC Cable	1.0	Unshielded	Unshielded	-
12	AC Cable	0.05	Unshielded	Unshielded	-

SECTION 5: Conducted emission

5.1 Operating environment

Test place : No.4 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 0.8m 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. 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.
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 data

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.3 and No.4 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., 90deg., and 135deg.
* Refer to Figure 1 about Direction of the Loop Antenna.

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

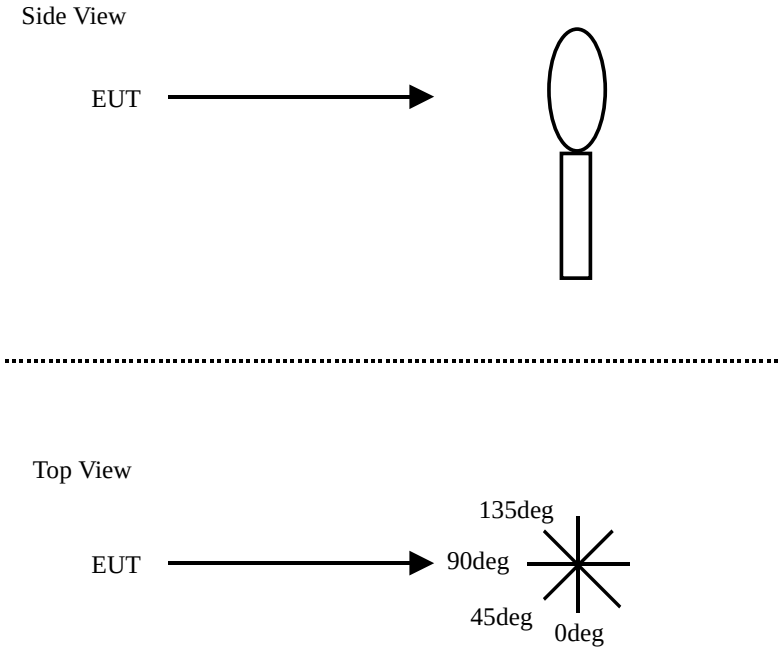
- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

* FCC Part 15 Section 15.31 (f)(2)
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

Figure 1: Direction of the Loop Antenna



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 Universal Counter.

Test data **: APPENDIX 2**
Test result **: Pass**