

RADIO TEST REPORT

Test Report No.: 30HE0215-SH-A-R1

Applicant : TAMIYA, INC.

Type of Equipment : 2.4GHz Transceiver unit for control model

Model No. : 2.4GTU-01

FCC ID : GHL0001

Test regulation : FCC Part15 Subpart C: 2010

Test result : Complied

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3. This sample tested is in compliance with the limits of the above regulation.
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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. Original test report number of this report is 30HE0215-SH-A.

Date of test: April 27 to 28, 2010

Tested by:



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SECTION 1: Customer information

Company Name : Tamiya, Inc.
Brand Name : TAMIYA
Address : 3-7 Ondawara, Suruga-ku, Shizuoka 422-8610 Japan
Telephone Number : +81-54-286-5105
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Contact Person : Yasuhiko Osa

* Tamiya, Inc. is on behalf of the applicant: Tamiya America, Inc.

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

2.1 Identification of E.U.T.

Type of Equipment : 2.4GHz Transceiver unit for control model
Model Number : 2.4GTU-01
Serial Number : 003 (for Radiated emission tests)
Rating : 001 (for antenna terminal voltage tests)
Rating : DC 9V (input voltage for host equipment)
Country of Mass-production : China
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : April 27, 2010
Modification of EUT : The test lab did not make the modification to the EUT supplied from the customer to have it pass the tests.

2.2 Product description

Model: 2.4GTU-01 (referred to as the EUT in this report) is a 2.4GHz Transceiver unit to control model.

The clock frequencies used in EUT: 12MHz

<Radio part>

Equipment type : Transceiver
Frequency of operation : 2405MHz to 2477MHz
Radio part clock frequency : 12MHz
Channel spacing : 1MHz
Type of modulation : GFSK
Antenna type : PCB pattern antenna (PCB Wiggle antenna)
Antenna connector type : -
Antenna gain : 1.16 dBi max
ITU code : G1D
Operating Voltage : 3.3V
Operation temperature range : 0-50deg.C.

FCC 15.31 (e)/212

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC3.3V) through its own regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212

The Antenna is made as pattern and built it to PCB board which means user can't replace the antenna. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2010, final revised on January 22, 2010 and effective March 1, 2010
 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	FCC 15.207	-	N/A	-	N/A *1)
6dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (a)(2) & 15.209	Conducted	N/A	-	Complied
Maximum Peak Output Power	ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (b)(3) & 15.209	Conducted	N/A	-	Complied
Out of Band Emission & Restricted Band Edges	ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	Tx: 0.3dB (7308.000MHz, Horizontal, AV, [Tx 2436MHz])	Complied
Power Density	ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (e) & 15.209	Conducted	N/A	-	Complied

Note: UL Japan's EMI Work Procedures No.QPM05 and QPM15.
 These tests were also referred to "Guidance on Measurement for Digital Transmission Systems Section15.247".
 *1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line (used battery).

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

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

* Other than above, no addition, exclusion nor deviation has been made from the standard.

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3.4 Uncertainty

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

Item	Frequency range	No.1 SAC ^{*1} /SR ^{*2} (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.4 dB	2.7 dB	3.4 dB
	30MHz-300MHz	4.6 dB	4.5 dB	4.9 dB
	300MHz-1GHz	4.5 dB	4.6 dB	5.1 dB
	1GHz-13GHz	3.9 dB	3.9 dB	4.0 dB
Radiated emission (Measurement distance: 1m)	13GHz-18GHz	4.8 dB	4.8 dB	4.8 dB
	18GHz-40GHz	4.2 dB	4.2 dB	4.2 dB

*1: SAC=Semi-Anechoic Chamber

*2: SR= Shielded Room is applied besides radiated emission

Radiated emission test

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

Power Measurement uncertainty above 1GHz for this test was: (±) 0.8dB

Conducted emissions Measurement (below 1GHz) uncertainty for this test was: (±) 1.1dB

Conducted emissions, Power Density Measurement (1G-3GHz) uncertainty for this test was: (±) 1.2dB

Conducted emissions Measurement (3G-18GHz) uncertainty for this test was: (±) 2.9dB

Conducted emissions Measurement (18G-26.5GHz) uncertainty for this test was: (±) 3.4dB

Frequency Measurement uncertainty for this test was: (±) 2.1%

Bandwidth Measurement uncertainty for this test was: (±) 5.4%

3.5 Test location

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JAB Accreditation No. : RTL02610

No.1/ No.2/ No.3 anechoic chamber has been fully described in a report submitted to FCC office, and accepted on April 17, 2009 (Registration No.: 697847).

IC Registration No. : 2973D-1 (No1 Semi-Anechoic Chamber)

2973D-2 (No2 Semi-Anechoic Chamber)

2973D-3 (No3 Semi-Anechoic Chamber)

Test room	Width x Depth x Height (m)	Test room	Width x Depth x Height (m)
No.1 Semi-Anechoic Chamber	20.6 x 11.3 x 7.65 Maximum measurement distance: 10m	No.1 Shielded room	6.8 x 4.1 x 2.7
No.2 Semi-Anechoic Chamber	20.6 x 11.3 x 7.65 Maximum measurement distance: 10m	No.2 Shielded room	6.8 x 4.1 x 2.7
No.3 Semi-Anechoic Chamber	12.7 x 7.7 x 5.35 Maximum measurement distance: 5m	No.3 Shielded room	6.3 x 4.7 x 2.7
No.4 Semi-Anechoic Chamber	8.1 x 5.1 x 3.55	No.4 Shielded room	4.4 x 4.7 x 2.7
		No.5 Shielded room	7.8 x 6.4 x 2.7
		No.6 Shielded room	7.8 x 6.4 x 2.7

3.6 Test setup, Data of EMI & Test instruments

Refer to Appendix 1 to 3.

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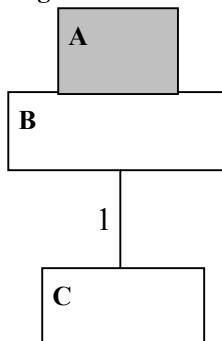
SECTION 4: Operation of E.U.T. during testing

4.1 Operating mode

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

Test sequence is used : Transmitting (Tx) 2405MHz (with normal modulation, Continuous Transmittting)
 Transmitting (Tx) 2436MHz (with normal modulation, Continuous Transmittting) *1)
 Transmitting (Tx) 2477MHz (with normal modulation, Continuous Transmittting)
 *1) Middle channel frequency was setting by customer.

4.2 Configuration of tested system



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	FCC ID (Remarks)
A	Radio module	2.4GTU-01	003 *1, 001 *2	TAMIYA	GHL0001
B	Radio controller Print Wired Board (Test jig)	TX_MAIN1_00	-	TAMIYA	-
C	Battery (9V)	6LR61Y(XJ)	-	Panasonic	-

*1: Used for Radiated emission tests.

*2: Used for Antenna terminal conducted tests.

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC cable	0.1	Unshield	Unshield	-

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SECTION 5: Radiated emission

5.1 Operating environment

The test was carried out in No.3 Semi-Anechoic Chamber.

Temperature : See test data (APPENDIX 2)
 Humidity : See test data (APPENDIX 2)

5.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane. The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

The configuration was set in accordance with ANSI C63.4: 2003.

The rear of EUT, including its peripherals was aligned and flushed with rear of tabletop. I/O cables that were connected to the peripherals were bundled in center. They were folded back and for the forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength. Photographs of the set up are shown in Appendix 1.

5.3 Test conditions

Frequency range : 30MHz to 26GHz
 Test distance : 3m(below 13GHz) / 1m(above13GHz)
 EUT position : Table top
 EUT operation mode : Refer to SECTION 4.1

5.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground reference plane and at a distance of 3m(below 13GHz) / 1m(above 13GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. 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.

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

Frequency	30M-1000MHz	1000M-26500MHz		
Detection Type	Quasi-Peak	Peak	Average	*1)
IF Bandwidth	120kHz	RBW:1MHz/VBW:1MHz	RBW:1MHz/VBW:10Hz or 500Hz	*2)

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

*2) When it was not a pulse emissions, the setting of VBW of spectrum analyzer was setting to 10Hz and it measured it.

When it is a pulse emissions, the setting of VBW of spectrum analyzer was measured deciding it as follows:

This purpose of the Duty Cycle calculation measures the pulse timing that we ensure Spectrum Analyzer can detect the pulse emission correctly. If a pulse emission has the intervals during which the transmitter is off for the burst rate, we need to avoid the overlooking at the average value measurement as the similarly when the pulse is less than 20Hz. So if pulse cycle is every 2.78 msec, we set VBW=500Hz (359.7Hz=1000/2.78) in order not to overlook a pulse unexpectedly.

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.

Combinations of the worst case

Model	Worst position	
	Below 1GHz	Above 1GHz
Module	Horizontal: X, Vertical: X	Horizontal: Y, Vertical: Z

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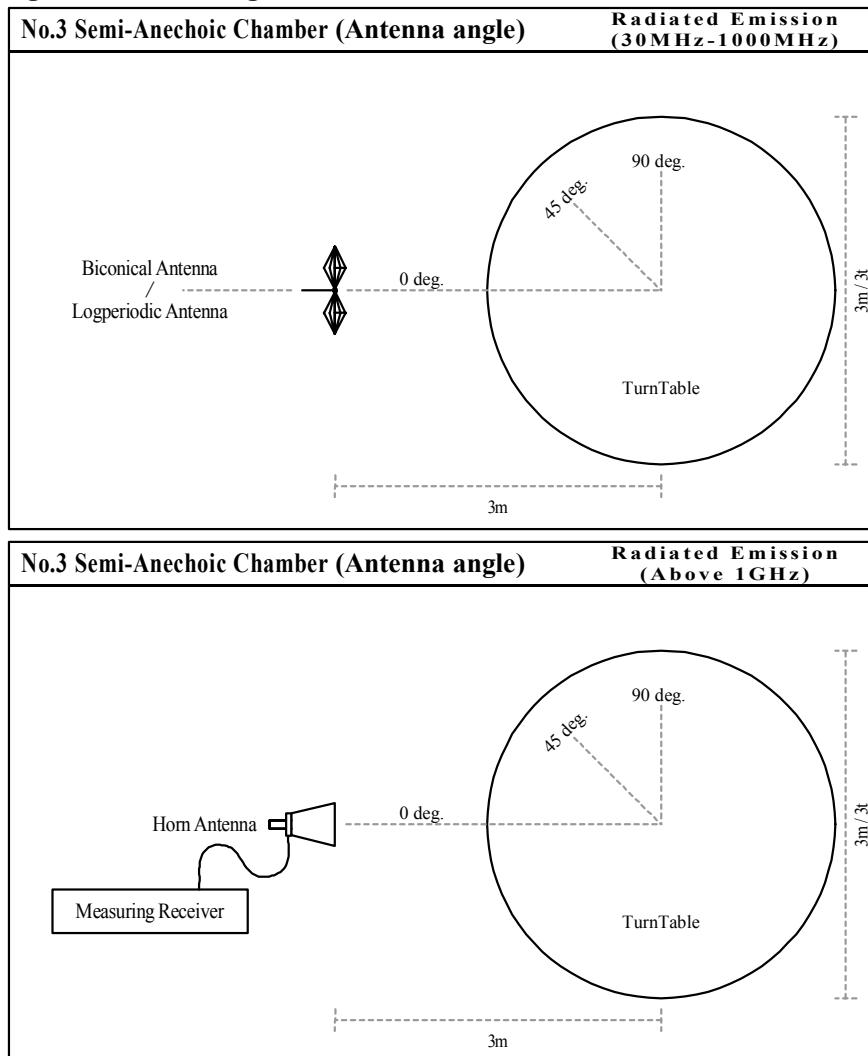
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Figure 1. Antenna angle



5.5 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.

5.6 Results

Summary of the test results : Pass *No noise was detected above the 5th order harmonics.
 Refer to APPENDIX 2

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SECTION 6: 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 radiated measurement.

Summary of the test results: Pass

Refer to APPENDIX 2

SECTION 7: 6dB bandwidth & Occupied bandwidth (99%)

Test procedure

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

Summary of the test results: Pass

Refer to APPENDIX 2

SECTION 8: 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

Refer to APPENDIX 2

SECTION 9: Peak power density

Test procedure

The peak power density was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass

Refer to APPENDIX 2

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