



RADIO TEST REPORT

Test Report No. : 31LE0213-SH-01

Applicant : TAMIYA, INC.

Type of Equipment : Controller

Model No. : TTU-08

FCC ID : GHL0003

Test regulation : FCC Part15 Subpart B: 2011
FCC Part15 Subpart C: 2011

Test result : Complied

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Date of test: September 1 to 2, 2011

Representative test engineer:

Akio Hayashi
Engineer of WiSE Japan,
UL Verification Service

Approved by :

Go Ishiwata
Manager of WiSE Japan,
UL Verification Service



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13-EM-F0429

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SECTION 1: Customer information

Company Name : TAMIYA, INC.
Brand Name : TAMIYA
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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 : Controller
Model No. : TTU-08
Serial No. : 3
Rating : DC6V
Receipt Date of Sample : September 1, 2011
Country of Mass-production : China
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: TTU-08 (referred to as the EUT in this report) is a Controller.

General specification

Clock frequency(ies) in the system : 16MHz

Radio specification

Equipment type : Transceiver
Frequency of operation : 2404.5MHz – 2452.0MHz
Channel spacing : 1.5MHz
Type of modulation : FHSS
Antenna type : Pattern Antenna by the copper foils (P.C.B. (MSA Antenna))
Antenna gain with cable loss : 2.14dBi
ITU code : F1D
Operation temperature range : +0 to +50 deg.C.

FCC Part 15.31 (e)

The wireless transmitter is provided with stable power supply DC 3.3V from the host device, therefore, the equipment complies power supply regulation.

FCC Part 15.203

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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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart B: 2011, final revised on July 8, 2011 and effective August 8, 2011
 FCC Part 15 Subpart C: 2011, final revised on July 8, 2011 and effective August 8, 2011

Title : FCC 47CFR Part15 Radio Frequency Device
 Subpart B Unintentional Radiators
 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 Section 15.107 (a) Section 15.207	-	N/A *1)	N/A	N/A
Carrier frequency separation	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section 15.247 (a)(1)	Conducted	N/A		Complied
20dB bandwidth	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section 15.247 (a)(1)	Conducted	N/A		-
Number of hopping frequency	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section 15.247 (a)(1)(iii)	Conducted	N/A	*See data.	Complied
Dwell time	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section 15.247 (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	FCC Section 15.247 (b)(1)	Conducted	N/A		Complied
Band edge compliance & Spurious emission	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section 15.109 (a) Section 15.247 (d) Section 15.209	Conducted/ Radiated	N/A	0.2dB Freq.: 7285.500MHz Detector: Peak Polarization: Horizontal Mode: Tx 2428.5MHz	Complied

*1) The test is not applicable since the EUT has no AC mains.

Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422

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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	-	-

Note: UL Japan's EMI Work Procedures No.13-EM-W0420 and 13-EM-W0422.

* 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.

Item	Frequency range	No.1 SAC ^{*1} /SR ^{*2} (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Conducted emission (AC Mains) AMN/LISN	150kHz-30MHz	3.0 dB	2.7 dB	3.1 dB
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.3 dB	2.7 dB	3.4 dB
	30MHz-300MHz	4.7 dB	4.5 dB	4.7 dB
	300MHz-1GHz	4.5 dB	4.6 dB	4.6 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	4.4 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.

Antenna port conducted test

Power Measurement uncertainty above 1GHz for this test was: (±) 1.3dB

Conducted emissions Measurement (below 1GHz) uncertainty for this test was: (±) 1.9dB

Conducted emissions Measurement (1G-3GHz) uncertainty for this test was: (±) 2.5dB

Conducted emissions Measurement (3G-18GHz) uncertainty for this test was: (±) 3.8dB

Conducted emissions Measurement (18G-26.5GHz) uncertainty for this test was: (±) 4.1dB

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

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3.5 Test location

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JAB Accreditation No. : RTL02610

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
<input type="checkbox"/> No.1 Semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input type="checkbox"/> No.2 Semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input checked="" type="checkbox"/> No.3 Semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
<input type="checkbox"/> No.4 Full-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
<input type="checkbox"/> No.1 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.2 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.3 shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
<input type="checkbox"/> No.4 shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
<input checked="" type="checkbox"/> No.5 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.6 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-

3.6 Test setup, Data of test & 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

Test item	Operating mode	Tested frequency
Carrier frequency separation	Transmitting (Hopping ON)	Hopping pattern 1
20dB bandwidth	Transmitting (Hopping OFF)	2404.5MHz, 2428.5MHz, 2452MHz
Number of hopping frequency	Transmitting (Hopping ON)	Hopping pattern 1
Dwell time	Transmitting (Hopping ON)	Hopping pattern 1
Maximum peak output power	Transmitting (Hopping OFF)	2404.5MHz, 2428.5MHz, 2452MHz
Band edge compliance & Spurious emission (Conducted)	Transmitting -Hopping ON -Hopping OFF	Band edge compliance: 2404.5MHz, 2452MHz (Hopping pattern 1, 5) Spurious emission: 2404.5MHz, 2428.5MHz, 2452MHz
(Radiated)	Transmitting	2404.5MHz, 2428.5MHz, 2452MHz
99% occupied bandwidth	Transmitting -Hopping ON -Hopping OFF	2404.5MHz, 2428.5MHz, 2452MHz

* Payload data pattern was [10101010 10101010 10101010 10101010] (4 bytes) was used at all tests.
 Because this data pattern became the maximum radiated emissions.

The operation program of EUT was operated by the firmware for the test in EUT.

(This firmware's name is TTU-08-TX. This firmware's version is 1.00.)

The EUT's output power setting cannot be changed.

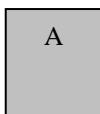
Hopping patterns of this EUT:

Hopping pattern 1: 2404.5MHz to 2448.0MHz	Hopping pattern 6: 2404.5MHz to 2448.0MHz
Hopping pattern 2: 2405.0MHz to 2448.5MHz	Hopping pattern 7: 2405.0MHz to 2448.5MHz
Hopping pattern 3: 2407.5MHz to 2451.0MHz	Hopping pattern 8: 2407.5MHz to 2451.0MHz
Hopping pattern 4: 2408.0MHz to 2451.5MHz	Hopping pattern 9: 2408.0MHz to 2451.5MHz
Hopping pattern 5: 2408.5MHz to 2452.0MHz	

There are 9 hopping stream patterns in this product. When defined stream pattern, random hopping will start within 30ch with 1.5MHz channel spacing. There is no random hopping between hopping stream patterns. The specification of one channel of each pattern is the same. The hopping pattern was using the pattern 1 as a representative.

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

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Controller	TTU-08	3	TAMIYA, INC.	EUT

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SECTION 5: 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

Refer to APPENDIX 2

SECTION 6: 20dB 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 7: 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

Refer to APPENDIX 2

SECTION 8: Dwell time

Test procedure

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

Summary of the test results: Pass

Refer to APPENDIX 2

SECTION 9: 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 10: Spurious 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.

In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=10kHz)

Summary of the test results: Pass

Refer to APPENDIX 2

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SECTION 11: Radiated emission

11.1 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)

11.2 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. 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.

11.3 Test conditions

Frequency range : 30MHz to 26GHz
Test distance : 3m (below 13GHz) / 1m (above 13GHz)
EUT position : Table top

11.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m (below 13GHz) / 1m (above 13GHz). 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 and Spectrum Analyzer.

Frequency	: 30-1000MHz	1000-26000MHz	
Detection Type	: Quasi-Peak	Peak	* Average
IF Bandwidth	: 120kHz	RBW:1MHz/VBW:3MHz	RBW:1MHz/10Hz

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

* The VBW was used 10Hz, because this EUT's radio signals were continuous signal and the off timing was nothing.

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.

Worst position:

	Below 1GHz	1G-2.8GHz	2.8G-13GHz	13G-18GHz	18G-26GHz
Horizontal	X	X	Z	X	Y
Vertical	Z	Z	Z	Y	Z

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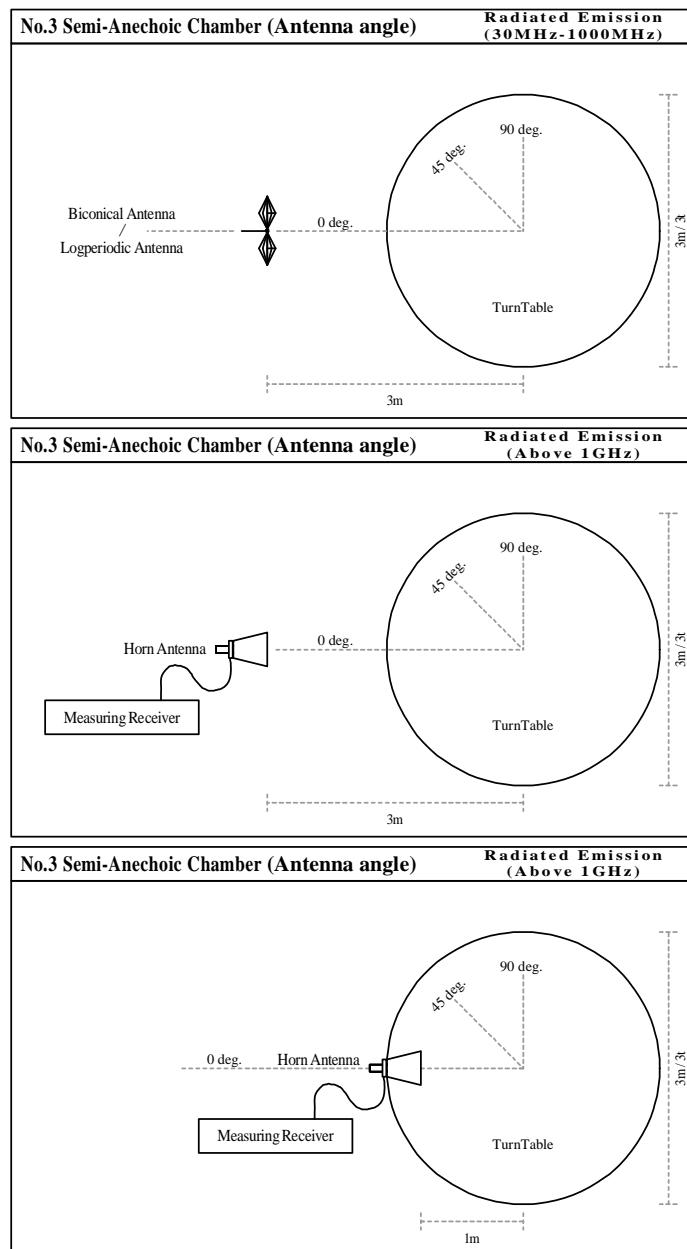


Figure 1. Antenna angle

11.5 Band edge

Band edge level at 2400MHz is less than 20dB of peak point of the carrier. Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209. Refer to the data.

11.6 Results

Summary of the test results : Pass
 Refer to APPENDIX 2

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Contents of APPENDIXES

APPENDIX 1: Photographs of test setup

Radiated emission
Pre-check of the worst position

APPENDIX 2: Test data

20dB bandwidth and Carrier frequency separation
Number of hopping frequency
Dwell time
Maximum peak output power
Radiated emission
Spurious emission (Antenna port conducted)
99% Occupied bandwidth

APPENDIX 3: Test instruments

Test instruments

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