

Prüfbericht - Nr.: 14035686 001

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Test Report No.:

Auftraggeber: Stadlbauer Marketing + Vertrieb GmbH
Client: Rennbahn Allee1
5412 Puch, Salzburg
Austria

Gegenstand der Prüfung: Short Range Device - Radio Control Toy Transceiver (2.4GHz)
Test Item:

Bezeichnung: 20042013 **Serien-Nr.:** Engineering sample
Identification: *Serial No.:*

Wareneingangs-Nr.: A000055299-001 **Eingangsdatum:** 28.04.2014
Receipt No.: *Date of Receipt:*

Zustand des Prüfgegenstandes bei Anlieferung: Test sample(s) is/are not damaged and
Condition of test item at delivery: suitable for testing.

Prüfort: Hong Kong Productivity Council
Testing Location: HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong

Prüfgrundlage: FCC Part 15 Subpart C
Test Specification: ANSI C63.4-2009

Prüfergebnis: Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben
Test Results: genannter Prüfgrundlage.
The above mentioned product was tested and **passed**.

Prüflaboratorium: TÜV Rheinland Hong Kong Ltd.
Testing Laboratory: 8 - 10/F., Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong

geprüft/ tested by:

kontrolliert/ reviewed by:

10.10.2014	Hugo Wan Senior Project Manager		10.10.2014	Benny Lau Project Manager	
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>

Sonstiges: FCC ID YFA201242013
Other Aspects

Abkürzungen:	P(ass) = entspricht Prüfgrundlage	Abbreviations:	P(ass) = passed
F(ail) = entspricht nicht Prüfgrundlage		F(ail) = failed	
N/A = nicht anwendbar		N/A = not applicable	
N/T = nicht getestet		N/T = not tested	

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.

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Product information

Manufacturers declarations

	Transmitter
Operating frequency range	2410 - 2472 MHz
Type of modulation	GFSK
Number of channels	32
Channel Frequency (MHz)	2410, 2412, 2414, 2416, 2418, 2420, 2422, 2424, 2426, 2428, 2430, 2432, 2434, 2436, 2438, 2440, 2442, 2444, 2446, 2448, 2450, 2452, 2454, 2456, 2458, 2460, 2462, 2464, 2466, 2468, 2470, 2472
Type of antenna	Integral
Power level	fix
Connection to public utility power line	Yes
Nominal voltage	V _{nom} : 14.8 V DC

Product function and intended use

The equipment under test (EUT) is a slot car track which is a radio control transmitter operating at 2.4GHz. The EUT is powered by AC/DC power adaptor only. It is part of a system which is used to control up to three cars in a digital slotcar racing environment. The system consists of a track and 3 hand throttle controllers for total of 3 players.

Submitted documents

Circuit Diagram
Block Diagram
Bill of material
User manual
Label Artwork

Independent Operation Modes

The basic operation modes are:

- Radio communication link maintained with data transfer.
- Charging to throttle controllers.

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transmitter.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The EUT was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- 1) First EUT was programmed with test mode for radiated emission test. EUT stand alone can exercise the test mode.
- 2) Second EUT with temporary antenna port for conducted radio testing.
- 3) Third EUT is a normal operating sample for AC port conducted emission test.

Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

AC/DC adaptor
Model: STAD-CAMAY-005D
Input: 120 VAC, 60Hz, 0.3A
Output: 14.8 VDC, 700mA, 10.36VA

Countermeasures to achieve EMC Compliance

- none

Test Methodology

Radiated Emission

The radiated emission measurements were performed according to the procedures in ANSI C63.4-2009.

The equipment under test (EUT) was placed at the middle of the 80 cm height turntable, and the turntable is 3 meters far from the measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360 °, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

List of Test and Measurement Instruments

Hong Kong Productivity Council (FCC Registration number: 90656)

Radiated Emission

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Semi-anechoic Chamber	Frankonia	Nil	Nil	14 Apr 2014	14 Apr 2015
Cable	Hubersuhner	SUCOFLEX 104	72799 /6	31 Mar 2014	31 Mar 2016
Test Receiver	R & S	ESU40	100190	20 Jun 2014	20 Jun 2015
Bi-conical Antenna	R & S	HK116	100241	11 Jun 2013	11 Jun 2015
Log Periodic Antenna	R & S	HL223	841516/017	10 Jun 2013	10 Jun 2015
Coaxial cable	Harbour	LL335	N/A	10 Jun 2014	10 Jun 2016
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	3950M00241	17 Jul 2014	17 Jul 2016
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	28 Oct 2013	28 Oct 2015
Horn Antenna	EMCO	3115	9002-3347	11 Jun 2013	11 Jun 2015
Active Loop Antenna	EMCO	6502	9107-2651	17 May 2014	17 May 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	100007	03 Dec 2012	03 Dec 2014

Conducted Emission on AC Mains Terminals

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Test Receiver	Rohde & Schwarz	ESCS30	100201	28 Feb 2014	28 Feb 2015
LISN	Rohde & Schwarz	ENV216	100273	26 Feb 2014	26 Feb 2015
EMC32	Rohde & Schwarz	v8.53	N/A	N/A	N/A

Results FCC Part 15 – Subpart C

Subclause 15.207 – Disturbance Voltage on AC Mains						Pass
Test Port: AC mains input port of the AC/DC adaptor Applied Voltage: 120VAC Adaptor Model: Please refer to page 4 Mode of operation: 1) receiving signal from controller 2) charging with 2 controllers						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.434	44.7	36.7	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.426	40.9	27.7	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass
Results: The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1, page 2-3.						

Subclause 15.205 – Restricted Bands Next to The Band Edge		Pass
Test Specification : ANSI C63.4 – 2009 Mode of operation : Tx mode Port of testing : Enclosure Detector : Peak RBW/VBW : 1 MHz / 3 MHz Supply voltage : 14.8 VDC, AC/DC adaptor Temperature : 23°C Humidity : 50%		
Requirement	: Radiated emissions which fall in the restricted bans, as defined in 15.205 (a), must also comply with the radiated emission limits specified in 15.209(a).	
Results	: The emissions found in the restricted bands were below the limit more than 20dB.	

Subclause 15.215 (c) – 20 dB Bandwidth			Pass	
Requirement: The intentional radiators must be designed to ensure that the 20dB bandwidth of the emission, is contained within the frequency band designated in the rule section under which the equipment is operated.				
Test Specification : ANSI C63.4 – 2009 Mode of operation : Tx mode Port of testing : Temporary antenna port RBW/VBW : 100 kHz / 300 kHz Supply voltage : 14.8 VDC, AC/DC adaptor Temperature : 23°C Humidity : 50%				
Results : For test protocols refer to Appendix 1, page 4-5.				
Frequency (MHz)	20 dB left (MHz)	Limit (MHz)	20 dB right (MHz)	Limit (MHz)
2410	2409.050	> 2400	2411.270	< 2483.5
2440	2438.730	> 2400	2441.280	< 2483.5
2472	2471.100	> 2400	2473.210	< 2483.5

Subclause 15.249 (a) – Radiated Emission (Fundamental and Harmonics)		Pass
Test Specification : ANSI C63.4 – 2009 Mode of operation : Tx mode Port of testing : Enclosure RBW/VBW : 120 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 14.8 VDC, AC/DC adaptor Temperature : 23°C Humidity : 50%		
Requirement : The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following limit.		
Results : PASS		
Fundamental Frequency 2410MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2410.978	94.33	114.0 / P
2409.599	30.25	94.0 / A
Fundamental Frequency 2410MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2409.760	99.60	114.0 / P
2409.792	30.51	94.0 / A
Harmonics 2410MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4819.760	52.08	74.0 / P
4820.112	32.16	54.0 / A
7230.369	57.49	74.0 / P
7230.048	35.92	54.0 / A
Harmonics 2410MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4819.728	55.36	74.0 / P
4820.160	32.29	54.0 / A
7230.288	58.55	74.0 / P
7230.032	35.89	54.0 / A
Fundamental Frequency 2440MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2439.872	92.87	114.0 / P
2440.048	29.98	94.0 / A

Fundamental Frequency 2440MHz		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2439.728	99.75	114.0 / P	
2439.872	30.40	94.0 / A	
Harmonics 2440MHz		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4879.631	52.09	74.0 / P	
4879.888	32.32	54.0 / A	
7320.577	62.64	74.0 / P	
7319.872	36.12	54.0 / A	
Harmonics 2440MHz		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4880.272	54.52	74.0 / P	
4879.871	32.32	54.0 / A	
7319.872	57.55	74.0 / P	
7319.712	35.79	54.0 / A	
Fundamental Frequency 2472MHz		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2471.827	93.44	114.0 / P	
2472.307	30.81	94.0 / A	
Fundamental Frequency 2472MHz		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2471.856	97.65	114.0 / P	
2471.872	30.36	94.0 / A	
Harmonics 2472MHz		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4944.260	52.52	74.0 / P	
4943.891	32.05	54.0 / A	
7415.779	60.36	74.0 / P	
7416.244	36.28	54.0 / A	
Harmonics 2472MHz		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4944.256	52.73	74.0 / P	
4944.272	32.03	54.0 / A	
7415.455	60.75	74.0 / P	
7416.288	36.20	54.0 / A	

Subclause 15.249 (d) – Spurious Radiated Emissions			Pass
Test Specification : ANSI C63.4 - 2009 Mode of operation : Tx mode Port of testing : Enclosure Detector : Peak RBW/VBW : 120 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 14.8 VDC, AC/DC adaptor Temperature : 23°C Humidity : 50%			
Requirement : Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.			
Results : All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.			
Tx frequency 2410MHz			Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
33.960	20.0	46.0 / QP	
Tx frequency 2410MHz			Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
No peak found	--	46.0 / QP	
Tx frequency 2440MHz			Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
34.080	20.1	46.0 / QP	
Tx frequency 2440MHz			Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
No peak found	--	46.0 / QP	
Tx frequency 2472MHz			Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
34.440	20.5	46.0 / QP	
Tx frequency 2472MHz			Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
No peak found	--	46.0 / QP	

Safety Human Exposure – Radio Frequency Exposure Compliance	Pass
Please refer to Appendix 5 for details.	