

Prüfbericht - Nr.: 14031380 001		Seite 1 von 15	
<i>Test Report No.:</i>		<i>Page 1 of 15</i>	
Auftraggeber: <i>Client:</i>		Stadlbauer Marketing + Vertrieb GmbH Rennbahn Allee1 5412 Puch, Salzburg Austria	
Gegenstand der Prüfung: <i>Test Item:</i>		Short Range Device - Radio Control Toy Receiver (2.4GHz Transceiver)	
Bezeichnung: <i>Identification:</i>	10112	Serien-Nr.: <i>Serial No.:</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	00120925042-001	Eingangsdatum: <i>Date of Receipt:</i>	25.09.2012
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of test item at delivery:</i>		Test sample(s) is/are not damaged and suitable for testing.	
Prüfört: <i>Testing Location:</i>		Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong TÜV Rheinland Hong Kong Ltd. 8/F., First Group Centre, 14 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong	
Prüfgrundlage: <i>Test Specification:</i>		FCC Part 15 Subpart C ANSI C63.4-2003 CISPR 22:1997	
Prüfergebnis: <i>Test Results:</i>		Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage. The above mentioned product was tested and passed .	
Prüflaboratorium: <i>Testing Laboratory:</i>		TÜV Rheinland Hong Kong Ltd. 8 - 10/F., Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong	
geprüft/ tested by:		kontrolliert/ reviewed by:	
25.10.2012	Mika Chan Senior Project Engineer	25.10.2012	Sharon Li Section Manager
<i>Datum</i> <i>Date</i>	<i>Name/Stellung</i> <i>Name/Position</i>	<i>Unterschrift</i> <i>Signature</i>	<i>Datum</i> <i>Date</i>
Sonstiges: <i>Other Aspects</i>		FCCID: YFA200201210112	
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations:	P(ass) = passed F(ail) = failed N/A = not applicable 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. <i>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.</i>			

Table of Content

	Page
Cover Page	1
Table of Content	2
Product information	4
Manufacturers declarations.....	4
Product function and intended use	5
Submitted documents.....	5
Remark.....	5
Special accessories and auxiliary equipment	5
List of Test and Measurement Instruments	6
Results FCC Part 15 – Subpart C	7
Subclause 15.203 – Antenna Information.....	Pass 7
Subclause 15.204 – Antenna Information.....	Pass 7
Subclause 15.207 – Disturbance Voltage on AC Mains	Pass 7
Subclause 15.247 (a)(1) – Carrier Frequency Separation	Pass 8
Subclause 15.247 (a)(1)(iii) – Number of hopping channels	Pass 8
Subclause 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time).....	Pass 9
Subclause 15.247 (a) – 20 dB Bandwidth.....	Pass 9
Subclause 15.247 (a) – Hopping Sequence.....	Pass 10
Subclause 15.247 (a) – Equal Hopping Frequency Use	Pass 10
Subclause 15.247 (a) – Receiver Input Bandwidth.....	Pass 10
Subclause 15.247 (a) – Receiver Hopping Capability	Pass 11
Subclause 15.247 (b)(1) – Peak Output Power.....	Pass 11
Subclause 15.247 (d) – Band edge compliance of conducted emissions	Pass 12
Subclause 15.205 – Band edge compliance of radiated emissions	Pass 12
Subclause 15.247 (d) – Spurious Conducted Emissions.....	Pass 13
Subclause 15.247 (c) – Spurious Radiated Emissions	Pass 14

Appendix 1 – Test protocols	22 pages
Appendix 2 – Test setup	3 pages
Appendix 3 – Photo documentation	5 pages
Appendix 4 – Product documentation	11 pages

Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2410 - 2472 MHz
Type of modulation	FHSS modulation
Number of channels	32
Channel separation	2 MHz
Type of antenna	PCB Antenna
Antenna gain (dBi)	2.3
Power level	fix
Type of equipment	Plug in radio device
Connection to public utility power line	No
Nominal voltage	V_{nor} : 5.0VDC from control unit
Independent Operation Modes	Page scan Inquiry scan Connection state - Data Link

Product function and intended use

The submitted sample is a radio control toy receiver operating at 2.4GHz based on the WIRELESS+ technology.

WIRELESS+ is the latest new cordless racetrack delight for Carrera DIGITAL124 and Carrera DIGITAL 132. The 2.4 GHz radio technology with frequency-hopping is free of interference and offers a range of up to 15 metres. WIRELESS+ offers cordless freedom for up to six drivers at the racetrack.

Submitted documents

Circuit Diagram
Block Diagram
Bill of material
User Manual
Label Artwork

Remark

Special accessories and auxiliary equipment

AC/DC Adaptor :



Control Unit:



List of Test and Measurement Instruments

Hong Kong Productivity Council (Registration number: 90656)

Equipment	Manufacturer	Type	S/N	Due Date
Semi-anechoic Chamber	Frankonia	Nil	Nil	25-May-13
Test Receiver	R & S	ESU40	100190	26-May-13
Bi-conical Antenna	R & S	HK116	100242	05-May-13
Log Periodic Antenna	R & S	HL223	841516/020	06-May-13
Coaxial cable 50ohm	Rosenberger	RTK081-05S-05S-10m	LA2-001-10M / 001	15-Nov-13
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	3950M00241	03-Oct-13
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	28-Oct-13
Horn Antenna	EMCO	3115	9002-3351	11-May-13
Active Loop Antenna	EMCO	6502	9107-2651	21-Jun-13
FSP 30 Spectrum Analyzer	R & S	FSP 30	100007	17-Sep-13

Results FCC Part 15 – Subpart C

Subclause 15.203 – Antenna Information						Pass
Requirement:	No antenna other than that furnished by the responsible party shall be used with the device					
Results:	Permanent attached antenna					
Verdict:	Pass					
Subclause 15.204 – Antenna Information						Pass
Requirement:	Provide information for every antenna proposed for the use with the EUT					
Results:	a) Antenna type:					PCB antenna
	b) Manufacturer and model no:					N.A.
	c) Gain with reference to an isotropic radiator:					2.3 dBi
Verdict:	Pass					
Subclause 15.207 – Disturbance Voltage on AC Mains						Pass
Test Port: AC/DC Adaptor Model: STAD-CAMAY-002A Applied voltage: 120VAC Mode of operation: Transmitting						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak (dBµV)	Average (dBµV)	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.158	42.0	25.0	66 - 56	56 - 46	Pass
	0.178	39.6	22.9	66 - 56	56 - 46	Pass
	0.202	36.8	22.5	66 - 56	56 - 46	Pass
	0.222	34.6	20.4	66 - 56	56 - 46	Pass
	0.242	32.6	18.4	66 - 56	56 - 46	Pass
> 0,5 - 5	---	---	---	56	46	Pass
> 5 - 30	---	---	---	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	0.162	42.2	27.9	66 - 56	56 - 46	Pass
	0.182	39.7	25.8	66 - 56	56 - 46	Pass
	0.202	37.2	23.7	66 - 56	56 - 46	Pass
	0.218	35.4	20.3	66 - 56	56 - 46	Pass
	0.234	32.7	16.7	66 - 56	56 - 46	Pass
> 0,5 - 5	---	---	---	56	46	Pass
> 5 - 30	---	---	---	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 15.247 (a)(1) – Carrier Frequency Separation		Pass
Requirement:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.	
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31	
Mode of operation	: Tx mode (hopping on), GFSK	
Port of testing	: Temporary antenna port	
Detector	: Peak	
RBW/VBW	: 100 KHz / 300 KHz	
Supply voltage	: 5.0VDC from control unit	
Temperature	: 23°C	
Humidity	: 50%	
Results:	Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. The centre frequencies of the hopping channels are separated by more than the 2/3*20dB bandwidth. For test Results plots refer to Appendix 1, page 4.	
Verdict:	Pass	

Subclause 15.247 (a)(1)(iii) – Number of hopping channels		Pass
Requirement:	Frequency hopping systems operating in the 2400MHz-2483.5MHz bands shall use at least 15 hopping frequencies.	
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31	
Mode of operation	: Tx mode (hopping on), GFSK	
Port of testing	: Temporary antenna port	
Detector	: Peak	
RBW/VBW	: 1 MHz / 3 MHz	
Supply voltage	: 5.0VDC from control unit	
Temperature	: 23°C	
Humidity	: 50%	
Results:	The total number of hopping frequencies is more than 15. For test Results plots refer to Appendix 1, page 5.	
Verdict:	Pass	

Subclause 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time)		Pass
Requirement:	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.	
Test Specification :	FCC Part 15 Subpart A – Subclause 15.31	
Mode of operation :	Tx mode (hopping on)	
Port of testing :	Temporary antenna port	
Detector :	Peak	
RBW/VBW :	1 MHz / 3 MHz	
Supply voltage :	5.0VDC from control unit	
Temperature :	23°C	
Humidity :	50%	
Results:	Time period calculation = $0.4 \times 32 = 12.8\text{s}$ Dwell time = $21 \times 0.570 \times 10^{-3} = 11.97 \times 10^{-3} \text{ s}$ $\leq 400 \times 10^{-3} \text{ s}$	
For test protocols please refer to Appendix 1, page 6.		
Verdict:	Pass	

Subclause 15.247 (a) – 20 dB Bandwidth		Pass	
Requirement:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the $\frac{2}{3} \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.		
Test Specification :	FCC Part 15 Subpart A – Subclause 15.31		
Mode of operation :	Tx mode (2410MHz, 2440MHz, 2472MHz)		
Port of testing :	Temporary antenna port		
Detector :	Peak		
RBW/VBW :	30 kHz / 100 kHz		
Supply voltage :	5.0VDC from control unit		
Temperature :	23°C		
Humidity :	50%		
Results:	Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test protocols refer to Appendix 1, page 7-8.		
GFSK Modulation			
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2410	0.846	0.906	1.752
2440	0.690	1.032	1.722
2472	0.936	0.558	1.494

Subclause 15.247 (a) – Hopping Sequence	Pass
Requirement: The hopping sequence is generated and provided with an example.	
Hopping sequence	
The Receiver sends every 16 milliseconds a beacon telegram to the hand throttles. The telegram includes the frequencies for the next four hopping steps.	
The hand throttles receive this telegram and after a time, depends on the address, every throttle sends a telegram back to the receiver. The telegram consists in each case a value for the position of the throttle and the status of the lane switch button.	
The time slots for the six addresses are:	
Address 1: + 2 milliseconds	
Address 2: + 4 milliseconds	
Address 3: + 6 milliseconds	
Address 4: + 8 milliseconds	
Address 5: + 10 milliseconds	
Address 6: + 12 milliseconds	
The frequencies for the hopping process are 2410, 2412, 2414 ... 2472 MHz. This produces a total of 32 several frequencies. The frequency for the next hopping step is generated from a true random number generator.	
Subclause 15.247 (a) – Equal Hopping Frequency Use	Pass
Requirement: Each of the transmitter's hopping channels is used equally on average.	
Equal hopping frequency use	
In a fixed period, the probability for each available channel to be chosen is equal.	
Subclause 15.247 (a) – Receiver Input Bandwidth	Pass
Requirement: The associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal.	
Receiver input bandwidth	
The receiver bandwidth is equal to the transmitter bandwidth in the 32 hopping channel mode, which is 2MHz. The receiver bandwidth was verified during RF conformance testing.	

Subclause 15.247 (a) – Receiver Hopping Capability	Pass
Requirement: The associated receiver has the ability to shift frequencies in synchronisation with the transmitted signals.	
Receiver hopping Capability The Receiver sends every 16 milliseconds a beacon telegram to the hand throttles. The telegram includes the frequencies for the next four hopping steps.	

Subclause 15.247 (b)(1) – Peak Output Power	Pass
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2410MHz, 2440MHz, 2472MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 3 MHz / 10 MHz Supply voltage : 5.0VDC from control unit Temperature : 23°C Humidity : 50%	
Requirement: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 Watt. For all other frequency hopping systems in the 2400 – 2483.5 MHz band: 0.125 Watts.	
Results: For test protocols please refer to Appendix 1, page 9-10.	

GFSK Modulation					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2410	-0.07	0.00	-0.070	0.125 / 21.0	Pass
2440	-0.53	0.00	-0.530	0.125 / 21.0	Pass
2472	-1.32	0.00	-1.320	0.125 / 21.0	Pass

Subclause 15.247 (d) – Band edge compliance of conducted emissions		Pass
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31	
Mode of operation	: Tx mode (2410MHz, 2472MHz), GFSK	
Port of testing	: Temporary antenna port	
Detector	: Peak	
RBW/VBW	: 100 kHz / 300 kHz	
Supply voltage	: 5.0VDC from control unit	
Temperature	: 23°C	
Humidity	: 50%	
Requirement:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.	
Results:	Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. There is no peak found outside any 100 kHz bandwidth of the operating frequency band. For test protocols refer to Appendix 1, page 11-12.	

Subclause 15.205 – Band edge compliance of radiated emissions		Pass
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31	
Mode of operation	: Tx mode (2410MHz, 2472MHz), GFSK	
Port of testing	: Temporary antenna port	
Detector	: Peak	
RBW/VBW	: 1 MHz / 1 MHz	
Supply voltage	: 5.0VDC from control unit	
Temperature	: 23°C	
Humidity	: 50%	
Requirement:	Radiated emissions which fall in the restricted bands, as defined in 15.205 (a), must also comply with the radiated emission limits specified in 15.209(a).	
Results:	There is no peak found in the restricted bands. For test protocols refer to Appendix 1, page 13-20.	

Subclause 15.247 (d) – Spurious Conducted Emissions				Pass	
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2410MHz, 2440MHz, 2472MHz), GFSK Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 5.0VDC from control unit Temperature : 23 °C Humidity : 50 %					
Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.					
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. There is no peak found outside any 100kHz bandwidth of the operating frequency band in the three transmit frequency. All three transmit frequency modes comply with the limit stated in subclause 15.247(d). For test protocols refer to Appendix 1, page 21-22.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2410	1200	-43.90	-0.75	-43.15	Pass
2440	1200	-50.06	-0.73	-49.33	Pass
2472	1200	-43.43	-4.10	-39.33	Pass

Subclause 15.247 (c) – Spurious Radiated Emissions		Pass
Test Specification : ANSI C63.4 – 2003 Mode of operation : Tx mode (2410MHz, 2440MHz, 2472MHz), GFSK Port of testing : Enclosure Detector : Peak RBW/VBW : 100 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 5.0VDC from control unit Temperature : 23°C Humidity : 50%		
Requirement: In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).		
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. 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
46.811	23.8	40 / QP
4819.775	52.76	74.0 / PK
4819.807	33.27	54.0 / AV
7230.929	62.28	74.0 / PK
7230.192	36.67	54.0 / AV
Tx frequency 2410MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
119.955	32.1	43.5 / QP
327.867	33.2	46 / QP
4819.911	51.32	74.0 / PK
4819.799	32.97	54.0 / AV
Tx frequency 2440MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
46.740	22.7	40 / QP
119.954	31.3	43.5 / QP
4880.016	52.0	74.0 / PK
4880.208	32.54	54.0 / AV
Tx frequency 2440MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
327.874	33.3	46 / QP
4880.464	50.15	74.0 / PK
4880.160	32.59	54.0 / AV

Tx frequency 2472MHz			Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
46.620	23.6	40 /QP			
4944.695	50.55	74.0 / PK			
4944.262	32.79	54.0 / AV			
7416.041	67.45	74.0 / PK			
7416.378	36.94	54.0 / AV			
Tx frequency 2472MHz			Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
119.955	31.2	43.5 / QP			
327.875	33.3	46 / QP			
4944.054	50.70	74.0 / PK			
4944.310	32.97	54.0 / AV			
7416.410	64.73	74.0 / PK			
7416.298	36.83	54.0 / AV			