
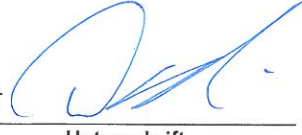


Produkte  
 Products

<b>Prüfbericht - Nr.:</b> 14031101 001		Seite 1 von 13	
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<b>Auftraggeber:</b> <i>Client:</i>	<b>Stadlbauer Marketing + Vertrieb GmbH</b> Rennbahn Allee1 5412 Puch, Salzburg Austria		
<b>Gegenstand der Prüfung:</b> <i>Test Item:</i>	<b>Short Range Device - Radio Control Toy Transmitter (2.4GHz Transceiver)</b>		
<b>Bezeichnung:</b> <i>Identification:</i>	10111	<b>Serien-Nr.:</b> <i>Serial No.:</i>	Engineering sample
<b>Wareneingangs-Nr.:</b> <i>Receipt No.:</i>	00120925040-001	<b>Eingangsdatum:</b> <i>Date of Receipt:</i>	25.09.2012
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of test item at delivery:</i>	Test sample(s) is/are not damaged and suitable for testing.		
<b>Prüfört:</b> <i>Testing Location:</i>	<b>Hong Kong Productivity Council</b> HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong  <b>TÜV Rheinland Hong Kong Ltd.</b> 8/F., First Group Centre, 14 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong		
<b>Prüfgrundlage:</b> <i>Test Specification:</i>	<b>FCC Part 15 Subpart C</b> <b>ANSI C63.4-2003</b> <b>CISPR 22:1997</b>		
<b>Prüfergebnis:</b> <i>Test Results:</i>	<b>Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage.</b>  The above mentioned product was tested and <b>passed</b> .		
<b>Prüflaboratorium:</b> <i>Testing Laboratory:</i>	<b>TÜV Rheinland Hong Kong Ltd.</b> 8 - 10/F., Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong		
<b>geprüft/ tested by:</b>	<b>kontrolliert/ reviewed by:</b>		
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>
			
<b>Sonstiges:</b> <i>Other Aspects</i>	<b>FCCID: YFA200201210111</b>		
<b>Abkürzungen:</b>	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	<b>Abbreviations:</b>	P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested
<b>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.</b> <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>			

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## Product information

### Manufacturers declarations

	<b>Transceiver</b>
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	stand alone radio device
Connection to public utility power line	No
Nominal voltage	$V_{nor}$ : 3.7V
Independent Operation Modes	Page scan Inquiry scan Connection state - Data Link

### Product function and intended use

The submitted sample is a radio control toy transmitter 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. Thanks to powerful lithium polymer rechargeable battery, continuous play for up to eight hours is possible and standby operation for over 80 days. 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

Nil

## 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

<b>Subclause 15.203 – Antenna Information</b>		<b>Pass</b>
<b>Requirement:</b>	No antenna other than that furnished by the responsible party shall be used with the device	
<b>Results:</b>	Permanent attached antenna	
<b>Verdict:</b>	Pass	
<b>Subclause 15.204 – Antenna Information</b>		<b>Pass</b>
<b>Requirement:</b>	Provide information for every antenna proposed for the use with the EUT	
<b>Results:</b>	a) Antenna type:	PCB antenna
	b) Manufacturer and model no:	N.A.
	c) Gain with reference to an isotropic radiator:	2.3 dBi
<b>Verdict:</b>	Pass	
<b>Subclause 15.207 – Disturbance Voltage on AC Mains</b>		<b>N/A</b>
The EUT cannot operate during battery charging.		
<b>Subclause 15.247 (a)(1) – Carrier Frequency Separation</b>		<b>Pass</b>
<b>Requirement:</b>	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the $2/3 \cdot 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.	
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31	
Mode of operation	: Tx mode (hopping on), GFSK	
Port of testing	: Temporary antenna port	
Detector	: Peak	
RBW/VBW	: 100 KHz / 300 KHz	
Supply voltage	: 3.7VDC, internal battery	
Temperature	: 23°C	
Humidity	: 50%	
<b>Results:</b>	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 $2/3 \cdot 20\text{dB}$ bandwidth. For test Results plots refer to Appendix 1, page 2.	
<b>Verdict:</b>	Pass	

<b>Subclause 15.247 (a)(1)(iii) – Number of hopping channels</b>		<b>Pass</b>
<b>Requirement:</b>	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 :	3.7VDC, internal battery	
Temperature :	23°C	
Humidity :	50%	
<b>Results:</b>	The total number of hopping frequencies is more than 15. For test Results plots refer to Appendix 1, page 3.	
<b>Verdict:</b>	Pass	

<b>Subclause 15.247 (a)(1)(iii) – Time of Occupancy (Dwell Time)</b>		<b>Pass</b>
<b>Requirement:</b>	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 :	3.7VDC, internal battery	
Temperature :	23°C	
Humidity :	50%	
<b>Results:</b>	Time period calculation = $0.4 \times 32 = 12.8\text{s}$ Dwell time = $19 \times 0.566 \times 10^{-3} = 10.754 \times 10^{-3} \text{ s}$ $\leq 400 \times 10^{-3} \text{ s}$	
	For test protocols please refer to Appendix 1, page 4.	
<b>Verdict:</b>	Pass	

<b>Subclause 15.247 (a) – 20 dB Bandwidth</b>		<b>Pass</b>	
Requirement:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the $\frac{2}{3} \cdot 20\text{dB}$ 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 :	3.7VDC, internal battery		
Temperature :	23°C		
Humidity :	50%		
<b>Results:</b>	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 5-6.		
<b>GFSK Modulation</b>			
<b>Frequency (MHz)</b>	<b>20 dB left (MHz)</b>	<b>20 dB right (MHz)</b>	<b>20dB bandwidth (MHz)</b>
2410	0.448	0.240	0.688
2440	0.440	0.124	0.564
2472	0.260	0.304	0.564

<b>Subclause 15.247 (a) – Hopping Sequence</b>		<b>Pass</b>
Requirement:	The hopping sequence is generated and provided with an example.	
Hopping sequence	<p>The Receiver sends every 16 milliseconds a beacon telegram to the hand throttles. The telegram includes the frequencies for the next four hopping steps.</p> <p>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.</p> <p>The time slots for the six addresses are:</p> <p>Address 1: + 2 milliseconds</p> <p>Address 2: + 4 milliseconds</p> <p>Address 3: + 6 milliseconds</p> <p>Address 4: + 8 milliseconds</p> <p>Address 5: + 10 milliseconds</p> <p>Address 6: + 12 milliseconds</p> <p>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.</p>	



<b>Subclause 15.247 (a) – Equal Hopping Frequency Use</b>	<b>Pass</b>
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.	
<b>Subclause 15.247 (a) – Receiver Input Bandwidth</b>	<b>Pass</b>
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.	
<b>Subclause 15.247 (a) – Receiver Hopping Capability</b>	<b>Pass</b>
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.	
<b>Subclause 15.247 (b)(1) – Peak Output Power</b>	<b>Pass</b>
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 : 3.7VDC, internal battery 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.
<b>Results:</b>	For test protocols please refer to Appendix 1, page 7-8.
<b>GFSK Modulation</b>	

Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2410	-2.88	0.00	-2.880	0.125 / 21.0	Pass
2440	-4.41	0.00	-4.410	0.125 / 21.0	Pass
2472	-6.33	0.00	-6.330	0.125 / 21.0	Pass

<b>Subclause 15.247 (d) – Band edge compliance of conducted emissions</b>		<b>Pass</b>
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 : 3.7VDC, internal battery 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.	
<b>Results:</b>	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 9-10.	

<b>Subclause 15.205 – Band edge compliance of radiated emissions</b>		<b>Pass</b>
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 : 3.7VDC, internal battery 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).	
<b>Results:</b>	There is no peak found in the restricted bands. For test protocols refer to Appendix 1, page 11-14.	

<b>Subclause 15.247 (d) – Spurious Conducted Emissions</b>				<b>Pass</b>	
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 : 3.7VDC, internal battery Temperature : 23 °C Humidity : 50 %					
<b>Requirement:</b> 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.					
<b>Results:</b> 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 15-16.					
<b>Operating frequency (MHz)</b>	<b>Spurious frequency (MHz)</b>	<b>Spurious Level (dBm)</b>	<b>Reference value (dBm)</b>	<b>Delta (dB)</b>	<b>Verdict</b>
2410	4800.00	-41.63	-3.19	-38.44	Pass
2440	4850.00	-39.03	-4.98	-34.05	Pass
2472	4950.00	-39.44	-6.49	-32.95	Pass

<b>Subclause 15.247 (c) – Spurious Radiated Emissions</b>		<b>Pass</b>
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 : 3.7VDC, internal battery Temperature : 23°C Humidity : 50%		
<b>Requirement:</b> 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).		
<b>Results:</b> 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
432.011	29.30	46 / QP
1205.112	43.87	74.0 / PK
1205.096	23.24	54.0 / AV
4819.784	69.89	74.0 / PK
4819.800	34.15	54.0 / AV
Tx frequency 2410MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4820.176	66.04	74.0 / PK
4819.743	33.70	54.0 / AV
7229.829	59.29	74.0 / PK
7230.085	36.16	54.0 / AV
Tx frequency 2440MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
432.011	29.30	46 / QP
4880.048	69.36	74.0 / PK
4879.919	33.63	54.0 / AV
Tx frequency 2440MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4880.176	65.65	74.0 / PK
4879.711	33.21	54.0 / AV

Tx frequency 2472MHz		Vertical Polarization	
<b>Freq MHz</b>	<b>Level dBuV/m</b>	<b>Limit/ Detector dBuV/m</b>	
416.012	29.00	46 / QP	
4944.398	69.11	74.0 / PK	
4944.189	33.95	54.0 / AV	
Tx frequency 2472MHz		Horizontal Polarization	
<b>Freq MHz</b>	<b>Level dBuV/m</b>	<b>Limit/ Detector dBuV/m</b>	
4944.230	64.33	74.0 / PK	
4943.990	33.71	54.0 / AV	
7146.080	55.83	74.0 / PK	
7416.433	35.79	54.0 / AV	