

Produkte
Products



Prüfbericht - Nr.: 14023635 001 <i>Test Report No.:</i>		Seite 1 von 14 <i>Page 1 of 14</i>
Auftraggeber: <i>Client:</i>	Mun Ah Plastic Electronic Toys Co., Ltd. 21/F, Kingsway Industrial Building, Phase 2, 173-175 Wo Yi Hop Road Kwai Chung, N.T., Hong Kong	
Gegenstand der Prüfung: <i>Test Item:</i>	2.4GHz Transmitter	
Bezeichnung: <i>Identification:</i>	CTX-2810	Serien-Nr.: <i>Serial No.:</i> Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	00100428037-001	Eingangsdatum: <i>Date of Receipt:</i> 28.04.2010
Prüfört: <i>Testing Location:</i>	TÜV Rheinland (Guangdong) Ltd. EMC Laboratory Guangzhou Auto Market, Yuan Gang Section of Guangshan Road, Guangzhou, 510650, P.R. China Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, 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. 9-10/F., Emperor International Square , 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong	
geprüft/ tested by:	kontrolliert/ reviewed by:	
26.05.2010	Ryan Chen Engineer	
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Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>
Sonstiges: Other Aspects		FCCID: YDTMTM28HP
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>		

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Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2406 - 2477 MHz
Type of modulation	FHSS modulation
Number of channels	72
Channel separation	1 MHz
Type of antenna	Permanent external
Antenna gain (dBi)	2
Power level	fix
Type of equipment	stand alone
Connection to public utility power line	No
Nominal voltage	V_{nor} : 6.0 V
Independent Operation Modes	Sending out control signal to corresponding receiver for the application of model control Standby

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Product function and intended use

The EUT is a remote model control system which consists of a transmitter and a receiver module using wide band data transmission technology. The transmitter consists of 1 button for synchronization, 3 slide switches for power ON/OFF, channel 1 & channel 2 forward/reverse function & 9 control wheels for channel 1, channel 2 & their trimming.

Submitted documents

Circuit Diagram
Block Diagram
Bill of material
User manual

Remark

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases.

Special accessories and auxiliary equipment

N/A

List of Test and Measurement Instruments

	Equipment used	Manufacturer	Model No.	S/N	Due Date
<input checked="" type="checkbox"/>	Semi-anechoic Chamber	Frankonia	Nil	Nil	27-Apr-11
<input checked="" type="checkbox"/>	Test Receiver	R & S	ESU8	100141	08-Sep-10
<input checked="" type="checkbox"/>	Bi-conical Antenna	R & S	HK116	100242	13-Apr-12
<input checked="" type="checkbox"/>	Log Periodic Antenna	R & S	HL223	841516/020	13-Apr-12
<input checked="" type="checkbox"/>	Coaxial cable 50ohm	Rosenberger	RTK081-05S-05S-10m	LA2-001-10M / 002	07-Dec-10
<input checked="" type="checkbox"/>	Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	3950M00241	03-Oct-11
<input checked="" type="checkbox"/>	High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	30-Oct-11
<input checked="" type="checkbox"/>	Horn Antenna	EMCO	3115	9002-3351	16-Apr-12
<input checked="" type="checkbox"/>	FSP 30 Spectrum Analyser	R & S	FSP 30	100286	16-Mar-11
<input checked="" type="checkbox"/>	Active Loop Antenna	EMCO	6502	9107-2651	06-Feb-11

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 External 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:	External
	b) Manufacturer and model no:	N.A.
	c) Gain with reference to an isotropic radiator:	2 dBi
Verdict:	Pass	
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 $2/3 \cdot 20\text{dB}$ 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),	
Port of testing	: Temporary antenna port	
Detector	: Peak	
RBW/VBW	: 100 kHz / 300 kHz	
Supply voltage	: 6.0VDC from DC power supply	
Temperature	: 23°C	
Humidity	: 50%	
Results:	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.	
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),	
Port of testing	: Temporary antenna port	
Detector	: Peak	
RBW/VBW	: 1 MHz / 3 MHz	
Supply voltage	: 6.0VDC from DC power supply	
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 3-4.	
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	: 3.7VDC from DC power supply	
Temperature	: 23°C	
Humidity	: 50%	
Results:	Time period calculation = $0.4 \times 72 = 29.6\text{s}$ Dwell time = $20 \times 10 \times 0.536 \times 10^{-3} = 107.2 \times 10^{-3}$ $\leq 400 \times 10^{-3} \text{ s}$	
	For test protocols please refer to Appendix 1, page 5-6.	
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 $2/3 \cdot 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.		
Test Specification :	FCC Part 15 Subpart A – Subclause 15.31		
Mode of operation :	Tx mode (2406MHz, 2444MHz, 2477MHz),		
Port of testing :	Temporary antenna port		
Detector :	Peak		
RBW/VBW :	30 kHz / 100 kHz		
Supply voltage :	6.0VDC from DC power supply		
Temperature :	23°C		
Humidity :	50%		
Results:	For test protocols refer to Appendix 1, page 7-8.		
Frequency (MHz)	20 dB left (MHz)	20 dB right (MHz)	20dB bandwidth (MHz)
2406	0.228	0.452	0.680
2444	0.108	0.456	0.564
2477	0.100	0.452	0.552

Subclause 15.247 (a) – Hopping Sequence		Pass	
Requirement:	The hopping sequence is generated and provided with an example.		
The description of the hopping sequence:			
<ol style="list-style-type: none"> 1. A random table is generated according to the device address of the TX (24 bit) 2. Frequency channel is separated into 3 group 3. Every 2 ms, hop to next group of freq, when group 3 is reached, it will based on the random table to select next frequency in group 1. 			

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 receiver bandwidth in the 72 hopping channel mode, which is 1 MHz.	

Subclause 15.247 (b)(1) – Peak Output Power	Pass				
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2406MHz, 2444MHz, 2477MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 3 MHz / 10 MHz Supply voltage : 6.0VDC from DC power supply 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.					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2406	15.20	3.52	18.720	0.125 / 21.0	Pass
2444	15.63	3.65	19.280	0.125 / 21.0	Pass
2477	15.93	3.60	19.530	0.125 / 21.0	Pass

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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 (2406MHz, 2477MHz), Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 6.0VDC from DC power supply 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:	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 (2406MHz, 2477MHz), Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 1 MHz / 3 MHz Supply voltage : 3.7VDC from DC power supply 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:	There is no peak found in the restricted bands. For test protocols refer to Appendix 1, page 13-16.	

Subclause 15.247 (d) – Spurious Conducted Emissions		Pass			
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : Tx mode (2406MHz, 2444MHz, 2477MHz), Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 3.7VDC from DC power supply 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: 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 17-18.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2406	9600.000	-32.54	15.13	-47.67	Pass
2444	9600.000	-32.78	15.10	-47.88	Pass
2477	9900.000	-29.03	15.90	-44.93	Pass

Subclause 15.247 (c) – Spurious Radiated Emissions		Pass
Test Specification : ANSI C63.4 – 2003 Mode of operation : Tx mode (2406MHz, 2444MHz, 2477MHz), 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 : internal batteries has been activated 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: All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.		
Tx frequency 2406MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4812.388	64.8	74.0 / P
4812.388	39.5	54.0 / A
7217.506	58.8	74.0 / P
7217.506	39.3	54.0 / A
Tx frequency 2406MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4811.987	64.5	74.0 / P
4811.987	39.4	54.0 / A
7217.532	60.0	74.0 / P
7217.532	39.6	54.0 / A
Tx frequency 2444MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4887.708	70.2	74.0 / P
4887.708	42.8	54.0 / A
7331.615	58.2	74.0 / P
7331.615	40.5	54.0 / A
9775.502	59.4	74.0 / P
9775.502	42.3	54.0 / A
Tx frequency 2444MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
3665.979	50.6	74.0 / P
3665.979	33.7	54.0 / A

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4887.792	61.2	74.0 / P
4887.792	38.6	54.0 / A
7331.390	57.4	74.0 / P
7331.390	39.1	54.0 / A
Tx frequency 2477MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4953.830	71.1	74.0 / P
4953.830	41.8	54.0 / A
7430.513	57.5	74.0 / P
7430.513	39.2	54.0 / A
9908.035	61.7	74.0 / P
9908.035	41.7	54.0 / A
Tx frequency 2477MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4953.974	62.6	74.0 / P
4953.974	39.3	54.0 / A
7430.609	58.7	74.0 / P
7430.609	39.4	54.0 / A

Subclause 1.1310 – Maximum Permissive Exposure		Pass			
Requirement:	According to 1.1310 of the FCC rules, the power density limit for General Population/Uncontrolled Exposure is 1.0mW/cm ² .				
$S = 1/4 * \pi * 10^{(P+G)/10} / (d^2)$ Where, D = MPE distance in cm P = Power in dBm G = Antenna Gain in dBi S = Power Density Limit in mW/cm ²					
Results:					
Frequency	MPE Distance(cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm²)	Limit (mW/cm²)
2477	20	19.530	0	0.028	1