

Produkte
Products

Prüfbericht-Nr.: <i>Test Report No.:</i>	50274568 001	Auftrags-Nr.: <i>Order No.:</i>	158113631	Seite 1 von 14 <i>Page 1 of 14</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	19.07.2019	
Auftraggeber: <i>Client:</i>	Shantou Helicute Model Aircraft Industrial Co., Ltd. Jiangbei Road, Longtian, Guangyi Street, Chenghai District, Shantou City, Guangdong Province, China			
Prüfgegenstand: <i>Test item:</i>	Short Range Device - Radio Controlled Toy Transmitter (2.4GHz)			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	Please refer to "Models" on page 4			
Auftrags-Inhalt: <i>Order content:</i>	FCC Certification			
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C; ANSI C63.10-2013			
Wareneingangsdatum: <i>Date of receipt:</i>	18.07.2019			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000960137-001			
Prüfzeitraum: <i>Testing period:</i>	23.07.2019 – 30.08.2019			
Ort der Prüfung: <i>Place of testing:</i>	Hong Kong			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Hong Kong Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
06.09.2019	Joey Leung Project Manager		06.09.2019	Sharon Li Unit Senior 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>			Unterschrift <i>Signature</i>	
Sonstiges <i>Other:</i>	FCC ID: 2AKPPFLTHH827			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) 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 only 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 test mark.</i>				

Table of Content

	Page
Cover Page	1
Table of Content	2
Product information.....	3
Manufacturers declarations	3
Product function and intended use.....	3
Submitted documents	3
Independent Operation Modes	4
Related Submittal(s) Grants.....	4
Remark	4
Test Set-up and Operation Mode.....	5
Principle of Configuration Selection.....	5
Test Operation and Test Software	5
Special Accessories and Auxiliary Equipment	5
Countermeasures to achieve EMC Compliance	5
Test Methodology	6
Radiated Emission.....	6
Field Strength Calculation	6
Test Setup Diagram	7
Test Facility	8
Test Laboratory Information	8
List of Test and Measurement Instruments.....	9
Measurement Uncertainty	10
Results FCC Part 15 – Subpart C	11
FCC 15.203 – Antenna Requirement 1	Pass 11
FCC 15.204 – Antenna Requirement 2	Pass 11
FCC 15.207 – Conducted Emission on AC Mains	N/A..... 11
Subclause 15.215 (c) – 20 dB Bandwidth	Pass 11
Subclause 15.249 (a) – Field Strength of Fundamental and Harmonics	Pass 12
Subclause 15.249 (d), 15.205 – Out Of Band Radiated Emission	Pass 14
Appendix 1 – Test protocols	3 pages
Appendix 2 – Test setup	3 pages
Appendix 3 – EUT External Photos	4 pages
Appendix 4 – EUT Internal Photos	7 pages
Appendix 5 – RF exposure information	2 pages

Product information

Manufacturers declarations

	Transmitter
Operating frequency range	2407 - 2478MHz
Type of modulation	GFSK
Number of channels	72
Type of antenna	Copper Tubed Antenna
Power level	fix
Connection to public utility power line	No
Nominal voltage	6.0V, 4 x 1.5V AA size battery

Product function and intended use

The equipment under test (EUT) is a radio control toy transmitter operating at 2.4GHz. It is powered by battery only.

The manufacturer declares that the models as listed below are all identical in electrical, PCB layout, components used except the packaging and model number only. Due to the manufacturer declaration of equivalence, the model DRC-445 was randomly selected as a representative for testing and construction photo taking.

FCC ID: 2AKPPFLTH827

Models	Product description
DRC-445, H823HW, H05NL, H05NCL, H07NL, H07NCL, H09NL, H09NCL, M801R, M803R, H805, H805C, H805W, H806, H806C, H806W, H809H, H809HC, H809HW, H809S, H809SC, H809SW, H811C, H811W, H812, H812R, S812, H815H, H815HW, H815HC, H815S, H815SC, H815SW, H816H, H816HC, H816HW, H817, H817C, H817W, H817H, H817HC, H817HW, H818H, H818HW, H818HC, H818S, H818SC, H818SW, H818HP, H818HPC, H818HPW, H819, H819C, H819W, H819HC, H819HW, H820H, H820HC, H820HW, H821H, H821HC, H821HW, H822HW, H823, H823C, H823W, H823H, H823HC, H802G, H802W, H02G, H01C, H825, H825G, H825W, H826H, H826HC, H826HW, H826HP, H826HPC, H826HPW, H827S, H827SC, H827SW, H828P, H828PC, H828PW, H829S, H829SC, H829SW	Short Range Device - Radio Controlled Toy Transmitter (2.4GHz)

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

www.tuv.com

Independent Operation Modes

The basic operation modes are:

- Transmitting mode.

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transmitter.

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The equipment under test (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.

- During test, RF channel & power was set and loaded into the RF IC by the customer. These settings shall be fixed on the firmware of the final end product.

Special Accessories and Auxiliary Equipment

- Nil.

Countermeasures to achieve EMC Compliance

- Nil.

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and 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.

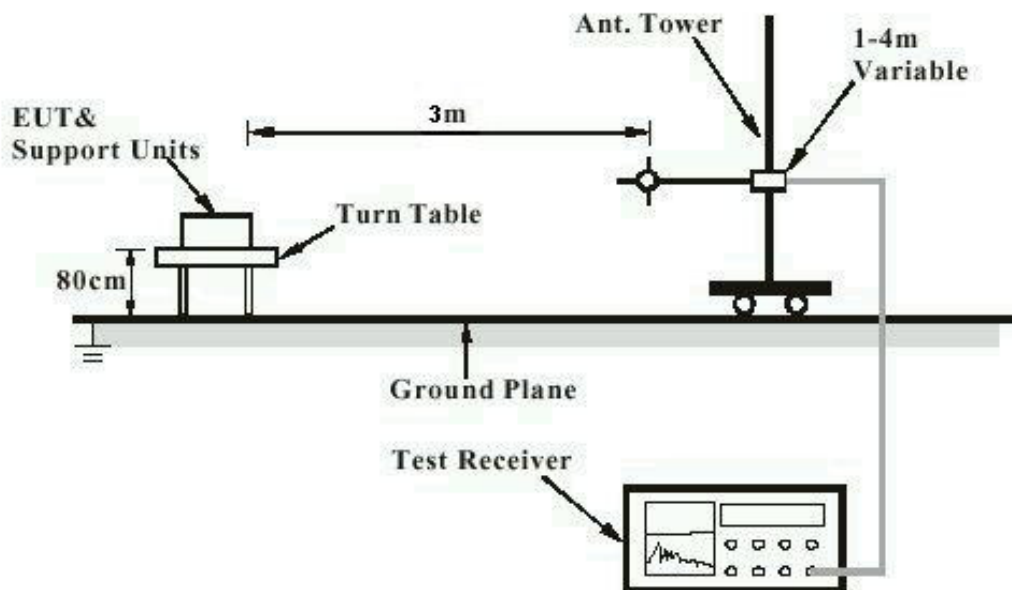
FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

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

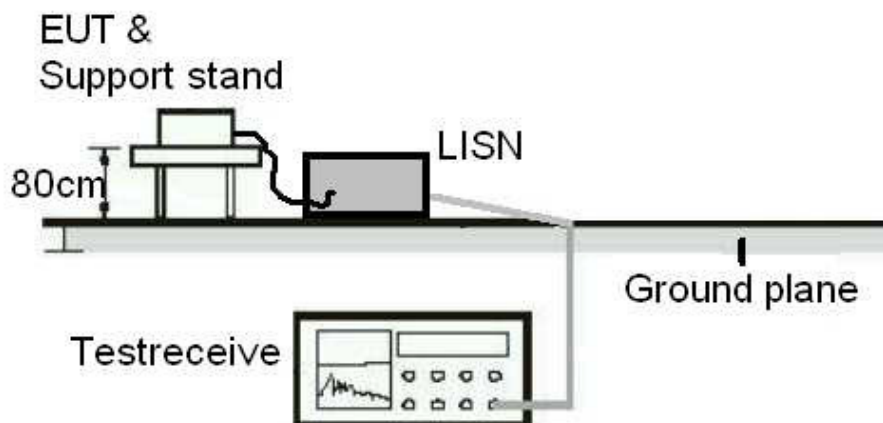
Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)



www.tuv.com

Test Facility

Test Laboratory Information

TÜV Rheinland Hong Kong Ltd.

Address: 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong

Tel.: +852 2192 1000

Fax: +852 2192 1001

Email service-gc@tuv.com

Web: www.tuv.com

The test facility is recognized or accredited by the following organizations:

FCC

Type	: Accredited Test Firm
Designation Number	: HK0013
Test Firm Registration Number	: 371735
Scope	: Intentional Radiators

List of Test and Measurement Instruments

Hong Kong Productivity Council

Radiated Emission

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Semi-anechoic Chamber	Frankonia	Nil	Nil	23 Apr 2019	23 Apr 2020
Test Receiver	R & S	ESU26	100050	11 Jun 2019	11 Jun 2020
Bi-conical Antenna	R & S	HK116	100241	21 Mar 2018	21 Mar 2020
Log Periodic Antenna	R & S	HL223	841516/017	22 Mar 2018	22 Mar 2020
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	A2803 #0001	04 Oct 2018	04 Oct 2020
Active Loop Antenna	EMCO	6502	9107-2651	25 Oct 2018	25 Oct 2019
Semi-anechoic Chamber (SiteVSWR)	Frankonia	Nil	Nil	16 May 2019	16 May 2020
Double-Ridged Waveguide Horn	EMCO	3116	00109210	05 Oct 2018	05 Oct 2019
Double-Ridged Waveguide Horn	EMCO	3117	00094998	30 Aug 2018	30 Aug 2020
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	A2803 #0001	04 Oct 2018	04 Oct 2020
Microwave Preamplifier	COM-POWER Corporation	PAM-118A	551091	25 Jun 2019	25 Jun 2020
Preamplifier 18GHz to 40GHz with cable (EMC656)	A.H. Systems, Inc.	PAM-1840VH	168	30 Jan 2019	30 Jan 2020
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	30 Oct 2017	30 Oct 2019
High Frequency Cable	Pasternack	PE3VNA4001-3M	20160707C02493	29 Jan 2019	29 Jan 2020
Horn Antenna	EMCO	3115	9002-3347	28 Mar 2018	28 Mar 2020

TÜV Rheinland Hong Kong Ltd

Radio Test

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Spectrum Analyzer	R & S	FSP30	100610	26 Jun 2019	25 Jun 2020

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 2.42\text{dB}$.

The estimated combined standard uncertainty for radiated emissions measurements is $\pm 4.81\text{dB}$ (9kHz to 30MHz) and $\pm 4.62\text{dB}$ (30MHz to 200MHz) and $\pm 5.67\text{dB}$ (200MHz to 1000MHz) and is $\pm 5.07\text{dB}$ (1GHz to 8.2GHz) and $\pm 4.58\text{dB}$ (8.2GHz to 12.4GHz) and $\pm 4.78\text{dB}$ (12.4GHz to 18GHz)

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		Pass
FCC requirement:	No antenna other than that furnished by the responsible party shall be used with the device	
Results:	a) Antenna type: Copper tubed antenna b) Manufacturer and model no: N/A c) Peak Gain: 3 dBi	
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2		Pass
FCC requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.	
Results:	Only one integral antenna can be used.	
Verdict:	Pass	

FCC 15.207 – Conducted Emission on AC Mains		N/A
There is no AC power input or output ports on the EUT.		

Subclause 15.215 (c) – 20 dB Bandwidth			Pass	
Test specification : ANSI C63.10 – 2013 Test date : 30.08.2019 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 6.0V, 4 x 1.5V AA size battery Temperature : 23°C Humidity : 50%				
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.		
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.		
Frequency (MHz)	20 dB left (MHz)	Limit (MHz)	20 dB right (MHz)	Limit (MHz)
2407	2406.400	> 2400	2407.600	< 2483.5
2442	2441.620	> 2400	2442.376	< 2483.5
2478	2477.632	> 2400	2478.380	< 2483.5

Subclause 15.249 (a) – Field Strength of Fundamental and Harmonics		Pass
Test specification : ANSI C63.10 – 2013 Test date : 27.08.2019 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 6.0V, 4 x 1.5V AA size battery 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 2407MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2407.020	72.1	114.0 / PK
2407.020	62.4	94.0 / AV
Fundamental Frequency 2407MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2407.000	79.5	114.0 / PK
2407.000	69.8	94.0 / AV
Harmonics 2407MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4814.000	50.1	74.0 / PK
4814.000	38.6	54.0 / AV
Harmonics 2407MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4814.000	52.0	74.0 / PK
4814.000	41.0	54.0 / AV
Fundamental Frequency 2442MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2441.999	72.9	114.0 / PK
2441.999	63.3	94.0 / AV

Fundamental Frequency 2442MHz			Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2442.000	79.4	114.0 / PK	2442.000	69.8	94.0 / AV
2442.000					
Harmonics 2442MHz			Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4884.000	50.2	74.0 / PK	4884.000	38.8	54.0 / AV
4884.000					
Harmonics 2442MHz			Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4884.000	52.2	74.0 / PK	4884.000	41.2	54.0 / AV
4884.000					
Fundamental Frequency 2478MHz			Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2478.000	71.7	114.0 / PK	2478.000	62.1	94.0 / AV
2478.000					
Fundamental Frequency 2478MHz			Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2478.000	79.1	114.0 / PK	2478.000	69.5	94.0 / AV
2478.000					
Harmonics 2478MHz			Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4956.000	52.1	74.0 / PK	4956.000	40.9	54.0 / AV
4956.000					
Harmonics 2478MHz			Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4956.000	50.7	74.0 / PK	4956.000	39.7	54.0 / AV
4956.000					

Subclause 15.249 (d), 15.205 – Out Of Band Radiated Emission			Pass
Test specification : ANSI C63.10 – 2013 Test date : 27.08.2019 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 6.0V, 4 x 1.5V AA size battery 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 limit of section 15.209. There is no spurious found below 30MHz.	
Tx frequency 2407MHz Vertical Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2400.000	41.3	74.0 / PK	
2400.000	22.5	54.0 / AV	
Tx frequency 2407MHz Horizontal Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2400.000	47.4	74.0 / PK	
2400.000	22.6	54.0 / AV	
Tx frequency 2442MHz Vertical Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
No peak found	---	74.0 / PK	
No peak found	---	54.0 / AV	
Tx frequency 2442MHz Horizontal Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
No peak found	---	74.0 / PK	
No peak found	---	54.0 / AV	
Tx frequency 2478MHz Vertical Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2483.500	44.8	74.0 / PK	
2483.500	22.8	54.0 / AV	
Tx frequency 2478MHz Horizontal Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2483.500	51.0	74.0 / PK	
2483.500	23.0	54.0 / AV	