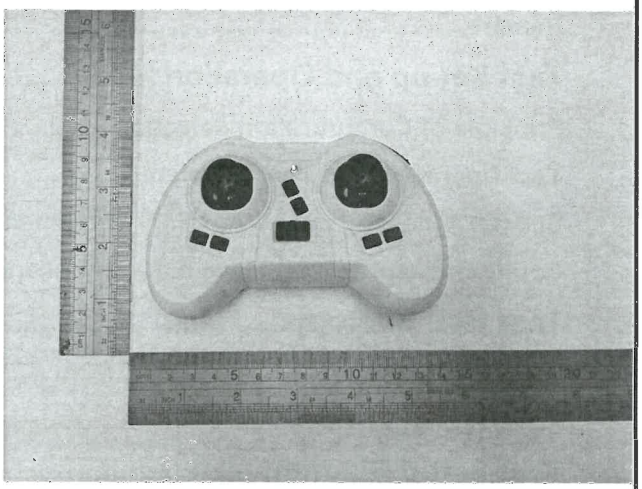
Prüfbericht-Nr.: *Test Report No.:*	**50147144 001**	**Auftrags-Nr.:** *Order No.:*	**144184117**	**Seite 1 von 15** *Page 1 of 15*
Kunden-Referenz-Nr.: *Client Reference No.:*	N/A	**Auftragsdatum:** *Order date:*	**17.05.2018**	
Auftraggeber: *Client:*	**Shantou Helicute Model Aircraft Industrial Co., Ltd. Jiangbei Road,Longtian,Guangyi Street,Chenghai District,Shantou City,Guangdong Province,China**			
Prüfgegenstand: *Test item:*	**Short Range Device - Radio Controlled Toy Transmitter (2.4GHz)**			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	**Please refer to "Models" on page 4**			
Auftrags-Inhalt: *Order content:*	FCC Certification			
Prüfgrundlage: *Test specification:*	**FCC Part 15 Subpart C ANSI C63.10-2013**			

Wareneingangsdatum: *Date of receipt:*	14.05.2018
Prüfmuster-Nr.: *Test sample No.:*	A000739907-001~003
Prüfzeitraum: *Testing period:*	17.05.2018 - 25.05.2018
Ort der Prüfung: *Place of testing:*	TÜV Rheinland Hong Kong Ltd.
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland Hong Kong Ltd.
Prüfergebnis*: *Test result*:*	Pass



geprüft von / *tested by*:

Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*
31.05.2018	Tung Chan / Test Engineer	

kontrolliert von / *reviewed by*:

Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*
31.05.2018	Mika Chan / Project Manager	

Sonstiges / *Other*: **FCC ID: 2AKPPHELICUTE1**

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* 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*

Table of Content

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Product information

Manufacturers declarations

	Transmitter
Operating frequency range	2440 - 2471MHz
Type of modulation	GFSK
Number of channels	32
Type of antenna	Wire Antenna
Power level	fix
Connection to public utility power line	No
Nominal voltage	V_{nor}: 4.5 V

Product function and intended use

The equipment under test (EUT) is a remote controller of toy operating at 2.4GHz. It is powered by battery only. The manufacturer declares that the models listed below are all identical in electrical, PCB layout and components used except the model number and packaging only.

FCC ID: 2AKPPHELICUTE1

Models	Product description
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, H818HC, H818HW, 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

Independent Operation Modes

The basic operation modes are:

- Transmitting mode.
- Normal operation 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, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

Special Accessories and Auxiliary Equipment

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

- None

Countermeasures to achieve EMC Compliance

- None

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:

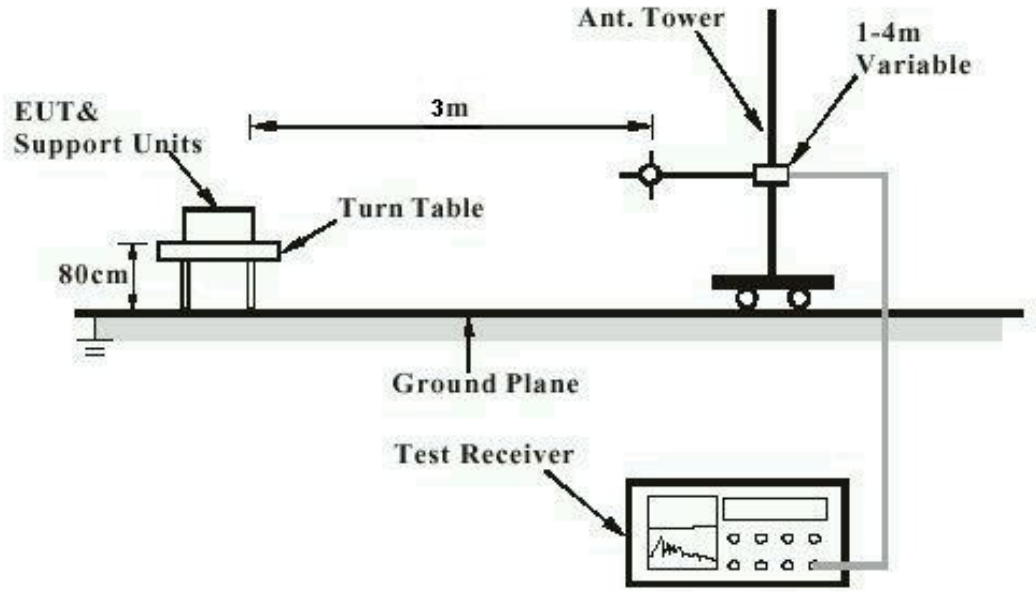
FS = R + AF + CF + FA – PA

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.

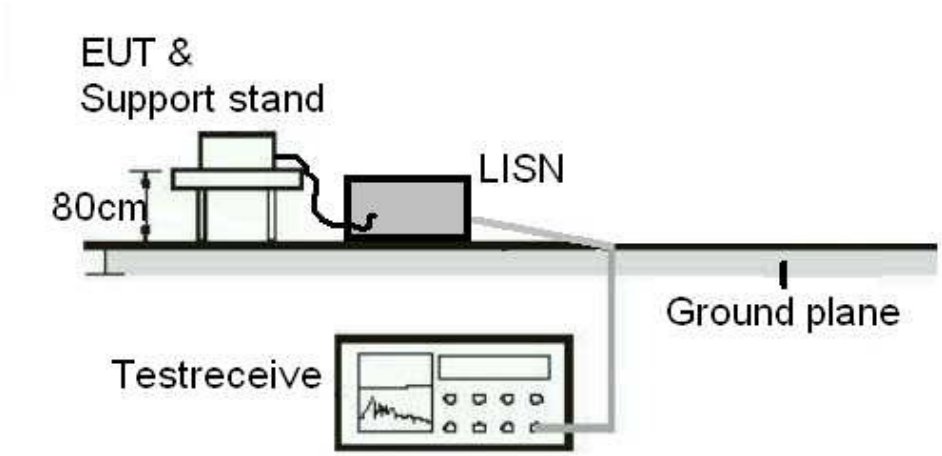
Test Setup Diagram

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)



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

TÜV Rheinland Hong Kong Ltd

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	23-Apr-18	23-Apr-19
Test Receiver	R & S	ESU40	7-Sep-17	7-Sep-18
Active Loop Antenna	EMCO	6502	30-Oct-17	30-Oct-18
Bi-conical Antenna	R & S	HK116	21-Mar-18	21-Mar-20
Log Periodic Antenna	R & S	HL223	22-Mar-18	22-Mar-20
Horn Antenna	EMCO	3115	28-Mar-18	28-Mar-20
Double-Ridged Waveguide Horn	EMCO	3116	17-Jun-16	17-Jun-18
Double-Ridged Waveguide Horn	EMCO	3117	22-Jun-16	22-Jun-18
Coaxial cable	Harbour	LL335	10-Jun-16	10-Jun-18
High Frequency Cable	Pasternack	PE3VNA4001-3M	29-Jan-18	29-Jan-19
Microwave amplifer 0.5-26.5GHz, 25dB gain	HP	83017A	18-Jul-16	18-Jul-18
Preamplifier 18GHz to 40GHz with cable (EMC656)	A.H. Systems, Inc.	PAM-1840VH	29-Jan-18	29-Jan-19
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	30-Oct-17	30-Oct-19

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	03-May-18	02-May-19

Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions measurements is ±4.81dB (9kHz to 30MHz) and ±4.62dB (30MHz to 200MHz) and ±5.67dB (200MHz to 1000MHz) and is ±5.07dB (1GHz to 8.2GHz) and ±4.58dB (8.2GHz to 12.4GHz) and ±4.78dB (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: b) Manufacturer and model no: c) Peak Gain:	Fixed Integral antenna N/A N/A
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:	N/A

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 : 25.05.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 4.5 VDC Temperature : 23ºC 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)**
2440	2437.952	> 2400	2441.920	< 2483.5
2455	2453.752	> 2400	2456.200	< 2483.5
2471	2469.112	> 2400	2472.616	< 2483.5

Subclause 15.249 (a) – Field Strength of Fundamental and Harmonics **Pass**

Test Specification : ANSI C63.10 – 2013
Test Specification : 22.05.2018
Mode of operation : Tx mode
Port of testing : Enclosure
Frequency range : 9kHz – 25GHz
Supply voltage : 4.5 VDC
Temperature : 23ºC
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 2440MHz Vertical Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2440.003	92.6	114.0 / PK
2440.003	70.4	94.0 / AV

Fundamental Frequency 2440MHz Horizontal Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2440.000	93.7	114.0 / PK
2440.000	71.0	94.0 / AV

Harmonics 2440MHz Vertical Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4880.006	63.2	74.0 / PK
4880.006	44.0	54.0 / AV

Harmonics 2440MHz Horizontal Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4879.993	65.3	74.0 / PK
4879.993	45.3	54.0 / AV

Fundamental Frequency 2455MHz Vertical Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2455.000	97.8	114.0 / PK
2455.000	75.7	94.0 / AV

Fundamental Frequency 2455MHz Horizontal Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2455.001	99.7	114.0 / PK
2455.001	77.6	94.0 / AV

Harmonics 2455MHz Vertical Polarization

Freq	Level	Limit/ Detector

MHz	dBuV/m	dBuV/m
4910.000	61.9	74.0 / PK
4910.000	43.0	54.0 / AV
Harmonics 2455MHz	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
4910.002	65.6	74.0 / PK
4910.002	45.5	54.0 / AV
Fundamental Frequency 2471MHz	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2470.990	97.8	114.0 / PK
2470.990	75.7	94.0 / AV
Fundamental Frequency 2471MHz	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2470.990	100.6	114.0 / PK
2470.990	78.5	94.0 / AV
Harmonics 2471MHz	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
4941.980	64.5	74.0 / PK
4941.980	44.8	54.0 / AV
Harmonics 2471MHz	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
4941.980	67.6	74.0 / PK
4941.980	47.0	54.0 / AV

Subclause 15.249 (d), 15.205 – Out Of Band Radiated Emission	**Pass**

Test Specification : ANSI C63.10 – 2013
Test Specification : 22.05.2018
Mode of operation : Tx mode
Port of testing : Enclosure
Frequency range : 9kHz – 25GHz
Supply voltage : 4.5 VDC
Temperature : 23ºC
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 2440MHz Vertical Polarization

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2400.000	46.1	74.0 / PK
2400.000	32.4	54.0 / AV

Tx frequency 2440MHz Horizontal Polarization

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2400.000	47.9	74.0 / PK
2400.000	32.4	54.0 / AV

Tx frequency 2455MHz 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 2455MHz 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 2475MHz Vertical Polarization

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2483.500	56.4	74.0 / PK
2483.500	32.2	54.0 / AV

Tx frequency 2475MHz Horizontal Polarization

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
2483.500	57.3	74.0 / PK
2483.500	32.2	54.0 / AV