




Prüfbericht-Nr.: <i>Test Report No.:</i>	50219127 001	Auftrags-Nr.: <i>Order No.:</i>	158100749	Seite 1 von 15 <i>Page 1 of 15</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	18.01.2019		
Auftraggeber: <i>Client:</i>	HUANG BO TOYS FACTORY 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>	07.01.2019				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000863526-004				
Prüfzeitraum: <i>Testing period:</i>	08.01.2019 - 17.01.2019				
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland Hong Kong Ltd.				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Hong Kong Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von / tested by:		kontrolliert von / reviewed by:			
 18.01.2019 Mika Chan / Project Manager		 18.01.2019 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>
Sonstiges / Other: FCC ID: ZY3-HB-NB2801-24					
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>			
<p>* 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</p> <p>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</p>					
<p>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.</p> <p><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></p>					

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Product information

Manufacturers declarations

	Transmitter
Operating frequency range	2404 - 2480MHz
Type of modulation	GFSK
Number of channels	77
Type of antenna	Wire Antenna
Power level	fix
Connection to public utility power line	No
Nominal voltage	V _{nor} : 3.0 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: ZY3-HB-NB2801-24

Models	Product description
HB-NB2801, HB-NB2802, HB-NB2803, HB-NB2804, HB-NB2805, HB-NB2806, HB-NB2807, HB-NB2808, HB NB2801B, HB-NB2802B, HB-NB2803B, HB-NB2804B, HB-NB2805B, HB-NB2806B, HB-NB2807B, HB NB2808B, HB-NB1601, HB-NB1602, HB-NB1603, HB NB1604, HB-NB1605, HB-NB1606, HB-NB1607, HB-NB1608	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:

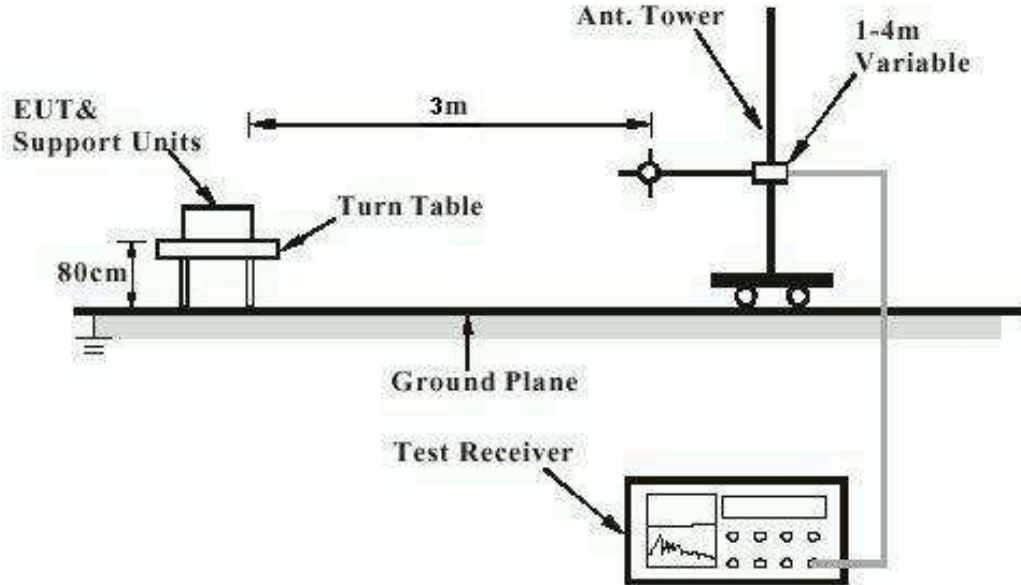
$$FS = R + AF + CF + FA - PA$$

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.

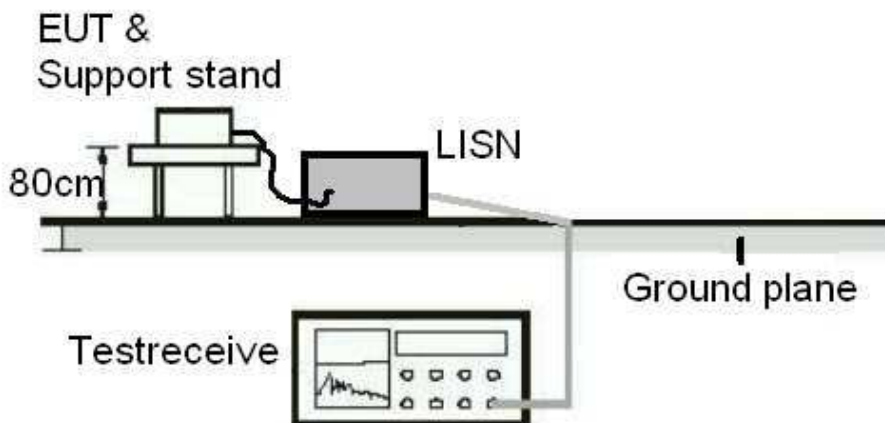
Test Setup Diagram

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	12-Jun-18	12-Jun-19
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
Coaxial cable	Huber+Suhner	CNM-NMCMILX800-473	11-Dec-17	11-Dec-19
High Frequency Cable	Huber+Suhner	CNM-NMCMILX800-473	11-Dec-17	11-Dec-19
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	18-Jul-17	18-Jul-19
Preamplifier 18GHz to 40GHz with cable	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 ± 4.81 dB (9kHz to 30MHz) and ± 4.62 dB (30MHz to 200MHz) and ± 5.67 dB (200MHz to 1000MHz) and is ± 5.07 dB (1GHz to 8.2GHz) and ± 4.58 dB (8.2GHz to 12.4GHz) and ± 4.78 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:	Fixed Integral antenna
	b) Manufacturer and model no:	N/A
	c) Peak Gain:	0 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:	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 : 17.01.2019 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.0 VDC 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)
2404	2401.48	> 2400	2407.51	< 2483.5
2440	2437.69	> 2400	2441.44	< 2483.5
2480	2478.02	> 2400	2481.32	< 2483.5

Subclause 15.249 (a) – Field Strength of Fundamental and Harmonics		Pass
Test Specification : ANSI C63.10 – 2013 Test date : 15.01.2019 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 3.0 VDC 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 2404MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2404.490	82.5	114.0 / PK
2404.490	56.5	94.0 / AV
Fundamental Frequency 2404MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2404.102	86.7	114.0 / PK
2404.102	60.3	94.0 / AV
Harmonics 2404MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4808.269	54.5	74.0 / PK
4808.269	32.6	54.0 / AV
7212.403	50.8	74.0 / PK
7212.403	32.3	54.0 / AV
Harmonics 2404MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4808.205	54.7	74.0 / PK
4808.205	32.6	54.0 / AV
7212.307	50.5	74.0 / PK
7212.307	32.2	54.0 / AV
Fundamental Frequency 2440MHz		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2440.134	82.6	114.0 / PK
2440.134	58.0	94.0 / AV
Fundamental Frequency 2440MHz		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2440.487	84.4	114.0 / PK

	58.3	94.0 / AV
Harmonics 2440MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4880.326	53.2	74.0 / PK
4880.326	31.8	54.0 / AV
7320.490	51.9	74.0 / PK
7320.490	33.1	54.0 / AV
Harmonics 2440MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4879.999	55.4	74.0 / PK
4879.999	32.6	54.0 / AV
7320.131	54.2	74.0 / PK
7320.131	34.0	54.0 / AV
Fundamental Frequency 2480MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2480.096	81.7	114.0 / PK
2480.096	56.8	94.0 / AV
Fundamental Frequency 2480MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2480.000	82.3	114.0 / PK
2480.000	56.9	94.0 / AV
Harmonics 2480MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4959.996	57.4	74.0 / PK
4959.996	33.9	54.0 / AV
7439.794	52.3	74.0 / PK
7439.794	33.2	54.0 / AV
Harmonics 2480MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4959.996	54.1	74.0 / PK
4959.996	32.1	54.0 / AV
7439.997	54.7	74.0 / PK
7439.997	34.3	54.0 / AV

Subclause 15.249 (d), 15.205 – Out Of Band Radiated Emission		Pass
Test Specification : ANSI C63.10 – 2013 Test date : 30.10.2018 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 3.0 VDC 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 2404MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2400.000	56.6	74.0 / PK
2400.000	23.5	54.0 / AV
Tx frequency 2404MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2400.000	59.1	74.0 / PK
2400.000	24.4	54.0 / AV
Tx frequency 2440MHz 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 2440MHz 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 2480MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2483.500	49.9	74.0 / PK
2483.500	23.8	54.0 / AV
Tx frequency 2480MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2483.500	51.2	74.0 / PK
2483.500	23.8	54.0 / AV