

Prüfbericht-Nr.: <i>Test Report No.:</i>	60373621 001	Auftrags-Nr.: <i>Order No.:</i>	158208805	Seite 1 von 17 <i>Page 1 of 17</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	16.04.2020		
Auftraggeber: <i>Client:</i>	BRIO AB Skeppshbron 1A, Malmo, Skane 201 23, Sweden				
Prüfgegenstand: <i>Test item:</i>	Short Range Device - Radio Control Toy Transmitter (2.4GHz)				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	30408				
Auftrags-Inhalt: <i>Order content:</i>	FCC Test				
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C, ANSI C63.10-2013 RSS-210 Issue 9, RSS Gen-Issue 5				
Wareneingangsdatum: <i>Date of receipt:</i>	16.04.2020				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A002810257-008				
Prüfzeitraum: <i>Testing period:</i>	17.04.2020 - 21.04.2020				
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:			
 18.05.2020 Mika Chan / Project Manager		 18.05.2020 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: 2AITT30408 IC: 21632-30408			
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.....	4
Manufacturers declarations	4
Product function and intended use	4
Submitted documents.....	4
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	9
Test Laboratory Information	9
List of Test and Measurement Instruments.....	10
Measurement Uncertainty	11
Results FCC Part 15 – Subpart C / RSS-210 Issue 9.....	12
FCC 15.203 – Antenna Requirement 1.....	Pass..... 12
FCC 15.204 – Antenna Requirement 2.....	Pass..... 12
RSS-Gen 6.3 – External Control.....	Pass..... 12
RSS-Gen 8.3 – Antenna Requirement	Pass..... 12
Subclause 15.215 (c) – 20 dB Bandwidth.....	Pass..... 13
RSS-Gen 6.6 – Occupied Bandwidth.....	Pass..... 13
Subclause 15.249 (a) / RSS-210 B.10 (a) – Field Strength of Fundamental and Harmonics	Pass..... 14
Subclause 15.249 (d), 15.205 / RSS-210 B.10 (b) – Out Of Band Radiated Emission .	Pass..... 16

Appendix 1 – Test protocols	5 pages
Appendix 2 – Test setup	2 pages
Appendix 3 – EUT External Photos	3 pages
Appendix 4 – EUT Internal Photos	4 pages
Appendix 5 – RF exposure information.....	2 pages

Product information

Manufacturers declarations

	Transmitter
Operating frequency range	2423 - 2458MHz
Type of modulation	GFSK
Number of channels	3
Type of antenna	Integral Antenna
Power level	fix
Connection to public utility power line	No
Nominal voltage	V _{nom} : 4.5 V

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.

FCC ID: 2AITT30408/ IC: 21632-30408

Models	Product description
30408	Short Range Device - Radio Control Toy Transmitter (2.4GHz)

Submitted documents

User manual

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:

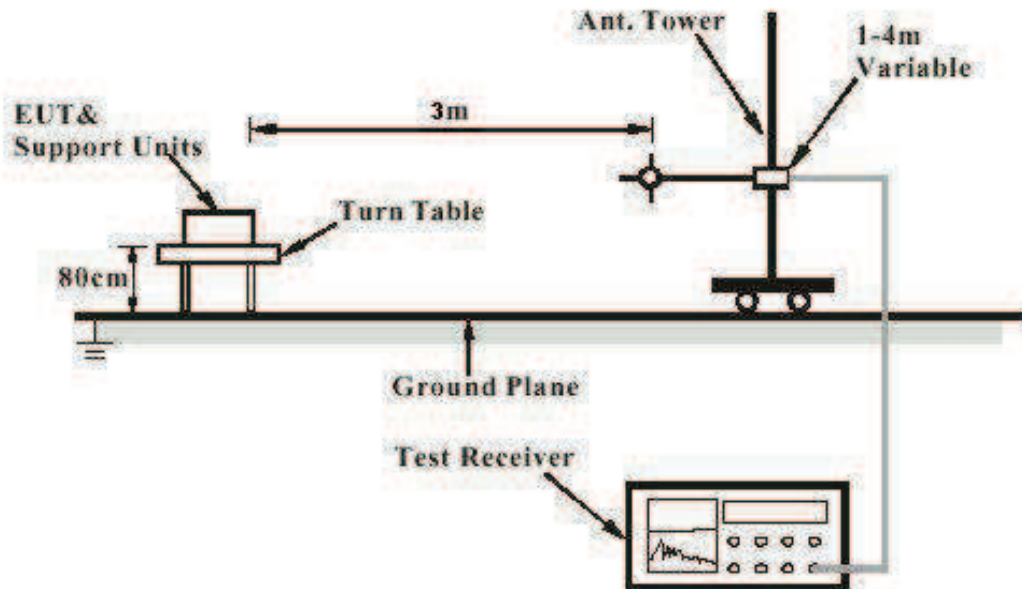
$$FS = R + AF + CF + FA - PA$$

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)

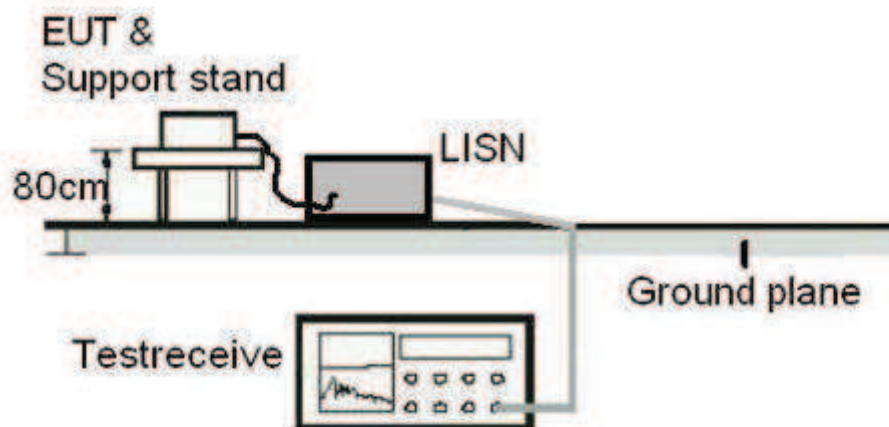
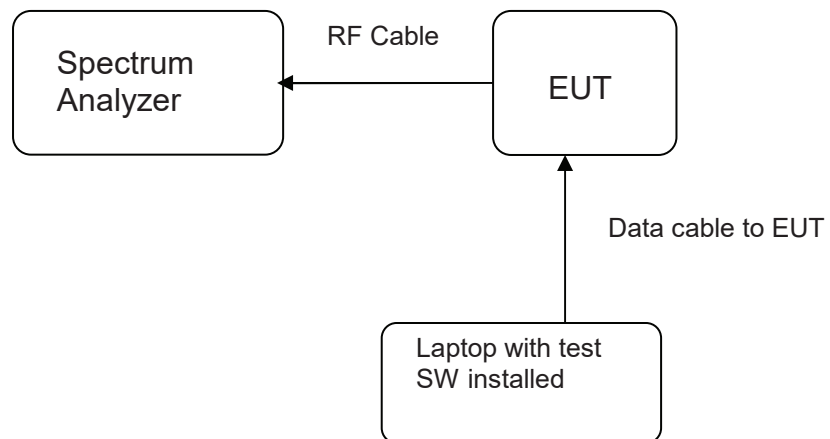


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)

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

Industry Canada

The 10m Semi-anechoic chamber used by TÜV Rheinland Hong Kong Ltd at Hong Kong Productivity Council has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

Test Site Registration Number : 4780A-1

List of Test and Measurement Instruments

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	23 Apr 2019	23 Apr 2020
Test Receiver	R & S	ESU26	21 Jun 2019	21 Jun 2020
Bi-conical Antenna	R & S	HK116	07 Mar 2019	07 Mar 2021
Log Periodic Antenna	R & S	HL223	06 Mar 2019	06 Mar 2021
Standard Gain Horn	ETS-Lindgren	3160-07	04 Sep 2018	04 Sep 2020
Standard Gain Horn	ETS-Lindgren	3160-08	26 Sep 2018	26 Sep 2020
Standard Gain Horn	ETS-Lindgren	3160-10	03 Oct 2018	03 Oct 2020
Double-Ridged Waveguide Horn	EMCO	3116	5 Oct 2018	5 Oct 2020
Double-Ridged Waveguide Horn	EMCO	3117	30 Aug 2018	30 Aug 2020
Coaxial cable	Huber+Suhner	CNM-NMCMILX800-473	04 Oct 2018	04 Oct 2020
High Frequency Cable	Pasternack	PE3VNA4001-3M	29 Jan 2019	29 Jan 2021
Microwave Preamplifier	COM-POWER Corporation	PAM-118A	25 Jun 2019	25 Jun 2020
Preamplifier 18GHz to 40GHz with cable (EMC656)	A.H. Systems, Inc.	PAM-1840VH	30 Jan 2019	30 Jan 2021
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	30 Oct 2019	30 Oct 2021

Radio Test

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

Measurement Uncertainty

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 estimated combined standard uncertainty for antenna conducted emission is $\pm 2.1\text{dB}$

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 / RSS-210 Issue 9

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: 0dBi	
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	

RSS-Gen 6.3 – External Control		Pass
IC Requirement:	The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the limits prescribed in the applicable RSS.	
Results:	The device does not have any transmitter external controls accessible to the user that can be adjusted and operated in violation of the limits of this standard.	
Verdict:	Pass	

RSS-Gen 8.3 – Antenna Requirement		Pass
IC Requirement:	When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer.	
Results:	a) Antenna type: Fixed Integral wire antenna b) Manufacturer: N/A c) model no: N/A d) Gain with reference to an isotropic radiator: 0 dBi	
Verdict:	Pass	

Subclause 15.215 (c) – 20 dB Bandwidth				Pass
Test Specification : ANSI C63.10 – 2013 Test date : 22.04.2020 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 4.5VDC 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)
2423	2421.22	> 2400	2424.26	< 2483.5
2436	2434.24	> 2400	2437.16	< 2483.5
2458	2456.34	> 2400	2459.12	< 2483.5

RSS-Gen 6.6 – Occupied Bandwidth				Pass
FCC/ IC Requirement : N/A				
Test Specification : RSS-Gen Test date : 22.04.2020 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 4.5VDC Temperature : 23°C Humidity : 50%				
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)	Left (MHz)	Right (MHz)	99% bandwidth (MHz)	
2423	2421.26	2424.10	2.84	
2436	2434.32	2437.06	2.74	
2458	2456.40	2458.98	2.58	

Subclause 15.249 (a) / RSS-210 B.10 (a) – Field Strength of Fundamental and Harmonics **Pass**

Test Specification : ANSI C63.10 – 2013
 Test date : 21.04.2020
 Mode of operation : Tx mode
 Port of testing : Enclosure
 Frequency range : 9kHz – 25GHz
 Supply voltage : 4.5VDC
 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 2423MHz Vertical Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2423.269	78.7	114.0 / PK
2423.269	59.6	94.0 / AV

Fundamental Frequency 2423MHz Horizontal Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2423.250	85.6	114.0 / PK
2423.250	66.7	94.0 / AV

Harmonics 2423MHz Vertical Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4845.487	58.6	74.0 / PK
4845.487	39.0	54.0 / AV
7268.134	51.7	74.0 / PK
7268.134	34.2	54.0 / AV

Harmonics 2423MHz Horizontal Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4845.487	63.8	74.0 / PK
4845.487	43.5	54.0 / AV
7268.102	50.2	74.0 / PK
7268.102	33.2	54.0 / AV

Fundamental Frequency 2436MHz Vertical Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2435.750	78.7	114.0 / PK
2435.750	60.2	94.0 / AV

Fundamental Frequency 2436MHz Horizontal Polarization

Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2435.987	86.6	114.0 / PK
2435.987	69.2	94.0 / AV

Harmonics 2436MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4872.541	59.7	74.0 / PK
4872.541	38.8	54.0 / AV
7308.788	50.7	74.0 / PK
7308.788	33.2	54.0 / AV
Harmonics 2436MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4871.480	63.1	74.0 / PK
4871.480	42.9	54.0 / AV
7307.455	49.9	74.0 / PK
7307.455	33.2	54.0 / AV
Fundamental Frequency 2458MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2458.262	78.5	114.0 / PK
2458.262	59.4	94.0 / AV
Fundamental Frequency 2458MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2458.250	89.2	114.0 / PK
2458.250	70.2	94.0 / AV
Harmonics 2458MHz Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4915.487	58.7	74.0 / PK
4915.487	39.0	54.0 / AV
7374.785	47.8	74.0 / PK
7374.785	31.9	54.0 / AV
Harmonics 2458MHz Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
4916.544	62.0	74.0 / PK
4916.544	40.7	54.0 / AV
7374.192	45.0	74.0 / PK
7374.192	30.8	54.0 / AV

Subclause 15.249 (d), 15.205 / RSS-210 B.10 (b) – Out Of Band Radiated Emission			Pass
Test Specification : ANSI C63.10 – 2013 Test date : 21.04.2020 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 4.5VDC 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 2423MHz		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2390.000	35.1	74.0 / PK	
2390.000	21.2	54.0 / AV	
2400.000	37.6	74.0 / PK	
2400.000	21.1	54.0 / AV	
Tx frequency 2423MHz		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2390.000	35.8	74.0 / PK	
2390.000	21.1	54.0 / AV	
2400.000	38.6	74.0 / PK	
2400.000	21.3	54.0 / AV	
Tx frequency 2436MHz		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 2436MHz		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 2458MHz			Vertical Polarization		
Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m	
2483.500		36.7		74.0 / PK	
2483.500		21.3		54.0 / AV	
Tx frequency 2458MHz			Horizontal Polarization		
Freq MHz		Level dBuV/m		Limit/ Detector dBuV/m	
2483.500		39.9		74.0 / PK	
2483.500		21.2		54.0 / AV	