Prüfbericht-Nr.: *Test Report No.*:	**60373626 001**	**Auftrags-Nr.:** *Order No.*:	**158208932**	**Seite 1 von 15** *Page 1 of 15*
Kunden-Referenz-Nr.: *Client Reference No.*:	**N/A**	**Auftragsdatum:** *Order date*:	**08.05.2020**	
Auftraggeber: *Client*:	**BRIO AB** **Skeppsbron 1 BOX 305 211 20 MALMÖ Sweden**			
Prüfgegenstand: *Test item*:	**Smart Engine**			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	**3971**			
Auftrags-Inhalt: *Order content*:	**FCC and ISED Certification**			
Prüfgrundlage: *Test specification*:	**FCC Part 15 Subpart C, ANSI C63.10-2013** **RSS-210 Issue 10, RSS-Gen Issue 5**			
Wareneingangsdatum: *Date of receipt*:	**27.04.2020**			
Prüfmuster-Nr.: *Test sample No.*:	**A001076284-001**			
Prüfzeitraum: *Testing period*:	**28.04.2020 - 15.05.2020**			
Ort der Prüfung: *Place of testing*:	**Hong Kong**			
Prüflaboratorium: *Testing laboratory*:	**TÜV Rheinland Hong Kong Ltd.**			
Prüfergebnis*: *Test result**:	**Pass**			

geprüft von / *tested by*:

Datum *Date*	Name / Stellung *Name / Position*	Unterschrift *Signature*
08.06.2020	Benny Lau Senior Project Manager	

kontrolliert von / *reviewed by*:

Datum *Date*	Name / Stellung *Name / Position*	Unterschrift *Signature*
08.06.2020	Sharon Li Unit Senior Manager	

Sonstiges / *Other*: **FCC ID: 2AITT3971**
IC: 21632-3971

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*

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Product information

Manufacturers declarations

	Transmitter
Operating frequency range	13.56 MHz
Type of modulation	ASK
Number of channels	1
Channel separation	N/A
Type of antenna	Integral PCB Antenna
Antenna gain (dBi)	N/A
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	3.0VDC
Independent Operation Modes	Transmitting

Product function and intended use

The equipment under test (EUT) is a toy engine which support Bluetooth Low Energy and 13.56 MHz RFID.

FCC ID: 2AITT3971/ IC: 21632-3971

Models	Product description
3971	Smart Engine

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

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 13.56MHz RFID transmitter.
- The Bluetooth Transmitter is authorized under the certification procedure (refer to test report 60373627 001).

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.

Special Accessories and Auxiliary Equipment

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

- Nil

Countermeasures to achieve EMC Compliance

- Nil

Test Methodology

Radiated Emission

The radiated emission measurements 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:

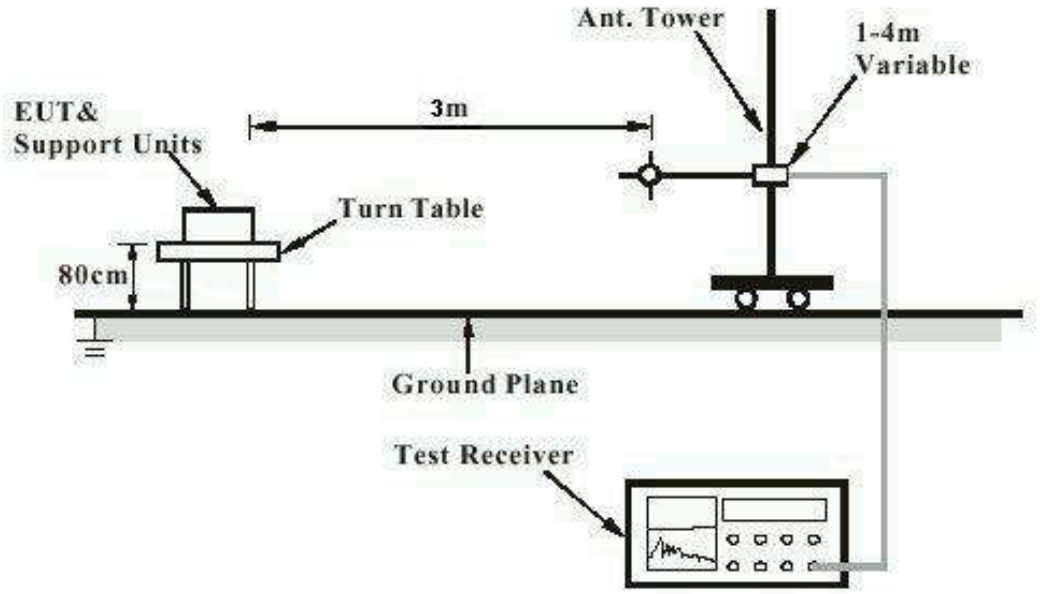
FS = R + AF + CF + FA – PA

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)

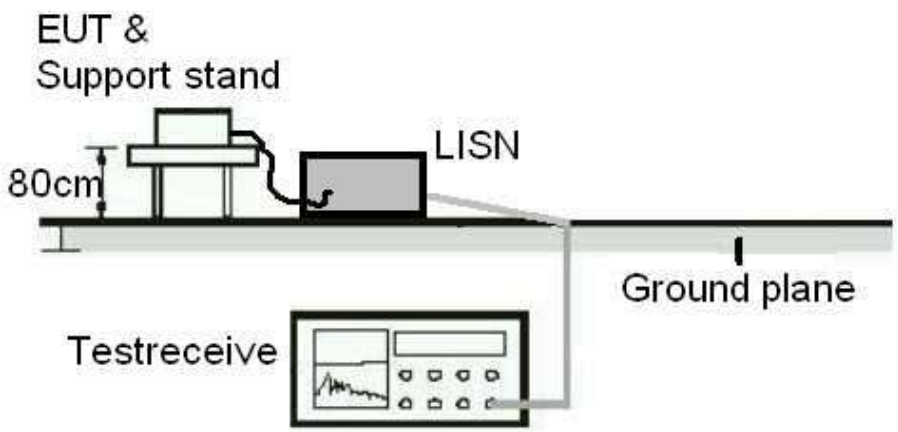
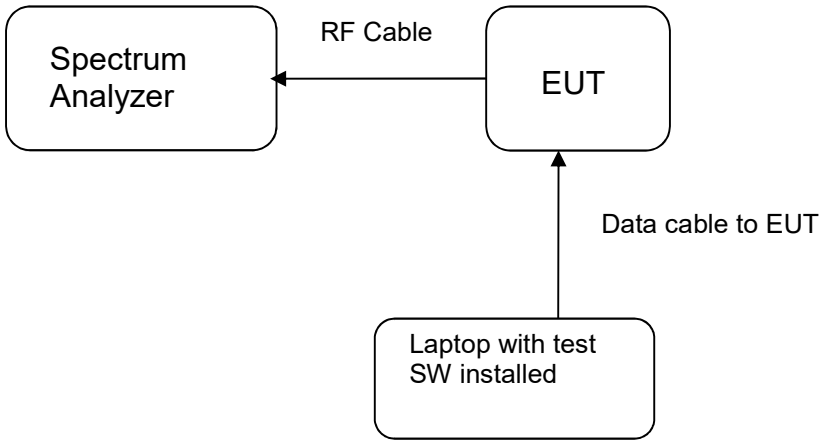


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)


Spectrum Analyzer
RF Cable
EUT
Data cable to EUT
Laptop with test SW installed

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

Type	: Accredited Test Firm
CAB identifier	: HK0013
Scope	: RSS-Gen, RSS-210, RSS-247

List of Test and Measurement Instruments

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	23-Apr-20	23-Apr-21
Test Receiver	R & S	ESU26	21-Jun-19	21-Jun-20
Bi-conical Antenna	R & S	HK116	7-Mar-19	7-Mar-21
Log Periodic Antenna	R & S	HL223	6-Mar-19	6-Mar-21
Active Loop Antenna	EMCO	6502	25-Oct-18	25-Oct-20
Coaxial cable	Huber+Suhner	CNM-NMCMILX800-473	4-Oct-18	4-Oct-20

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	26-June-19	26-June-20
Temperature Chamber	Binder	MK 240	08-July-19	08-July-20

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is ±2.42dB.

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 / 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: 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

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: b) Manufacturer c) model no d) Gain with reference to an isotropic radiator:	Fixed Integral wire antenna N/A N/A 0 dBi
Verdict:	Pass	

FCC 15.207/ RSS-Gen 8.8 – Conducted Emission on AC Mains	N/A
There is no AC power input or output ports on the EUT.	

FCC 15.215 (c) – 20 dB Bandwidth	Pass
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.

Test Specification : ANSI C63.10-2013
Test date : 13.05.2020
Mode of operation : TX Mode
Supply voltage : 3.0Vdc
Temperature : 23ºC
Humidity : 50%

Results: For test protocols refer to Appendix 1.

Frequency (MHz)	20 dB left (MHz)	Limit (MHz)	20 dB right (MHz)	Limit (MHz)
13.56088	13.560496	> 13.110	13.561148	< 14.010

RSS-Gen 6.6 – Occupied Bandwidth	Pass

FCC/ IC Requirement : N/A

Test Specification : RSS-Gen
Test date : 13.05.2020
Mode of operation : TX Mode
Supply voltage : 3.0Vdc
Temperature : 23ºC
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 (kHz)
13.56084	13.560272	13.561380	1.108

FCC 15.225 / RSS-210 B.6 (a)(b)(c) – Radiated Emission	**Pass**

Test Specification : ANSI C63.10-2013
Test date : 13.05.2020
Mode of operation : TX Mode
Supply voltage : 3.0Vdc
Temperature : 22ºC
Humidity : 55%

Requirement: (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

Results: For test protocols refer to Appendix 1.

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
13.560	23.96	84.0 / PK
No peak found	---	50.5 / PK
No peak found	---	40.5 / PK

FCC 15.225 / RSS-210 B.6 (d) – Radiated Emissions	**Pass**

Test Specification : ANSI C63.10-2013
Test date : 13.05.2020
Mode of operation : TX Mode
Supply voltage : 3.0Vdc
Temperature : 22ºC
Humidity : 55%

Requirement: The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

Simultaneous transmission was investigated and no new emissions were found.

All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.

Vertical Polarization

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
No peak found	---	43.5 / QP
No peak found	---	46.0 / QP
No peak found	---	46.0 / QP

Horizontal Polarization

Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
No peak found	---	43.5 / QP

256.700	14.5	46.0 / QP
No peak found	---	46.0 / QP

FCC 15.225 (e) / RSS-210 B.6 – Frequency Tolerance **Pass**

Test Specification : ANSI C63.10-2013
Test date : 13.05.2020
Mode of operation : TX Mode

Requirement: The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C in 10 degrees C steps at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage or battery end point at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Results: Pass

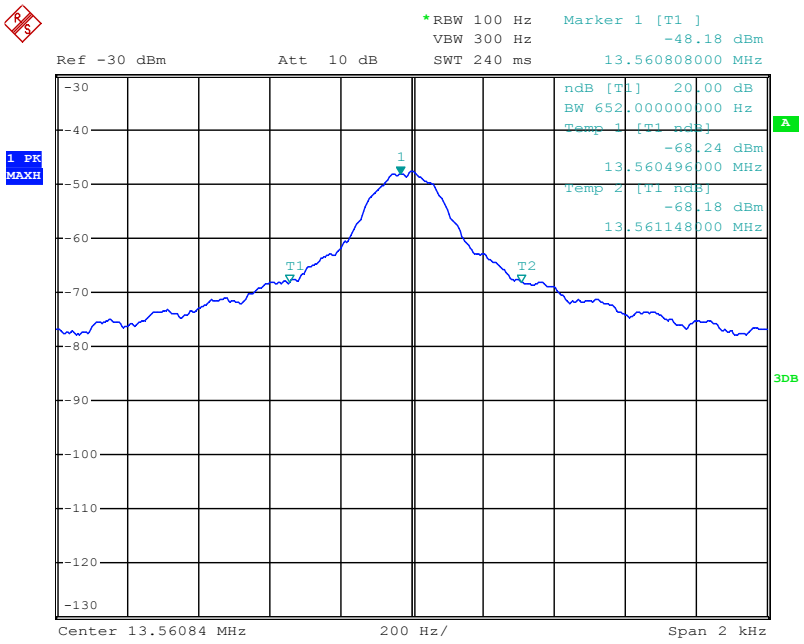
Frequency stability with respect to ambient tempeature

Temp. (°C)	Supply Voltage (VDC)	Frequency (MHz)	Frequency error (%)	Limit (%)	Verdict
50	3.0	13.56062	-0.001327355	+/- 0.01	Pass
40	3.0	13.56078	-0.000147484	+/- 0.01	Pass
30	3.0	13.56082	0.000147484	+/- 0.01	Pass
20	3.0	13.56080	0	+/- 0.01	Reference
20	2.0	13.56083	0.000221226	+/- 0.01	Pass
10	3.0	13.56084	0.000294968	+/- 0.01	Pass
0	3.0	13.56092	0.000884904	+/- 0.01	Pass
-10	3.0	13.56100	0.001474839	+/- 0.01	Pass
-20	3.0	13.56104	0.001769807	+/- 0.01	Pass

Appendix 1

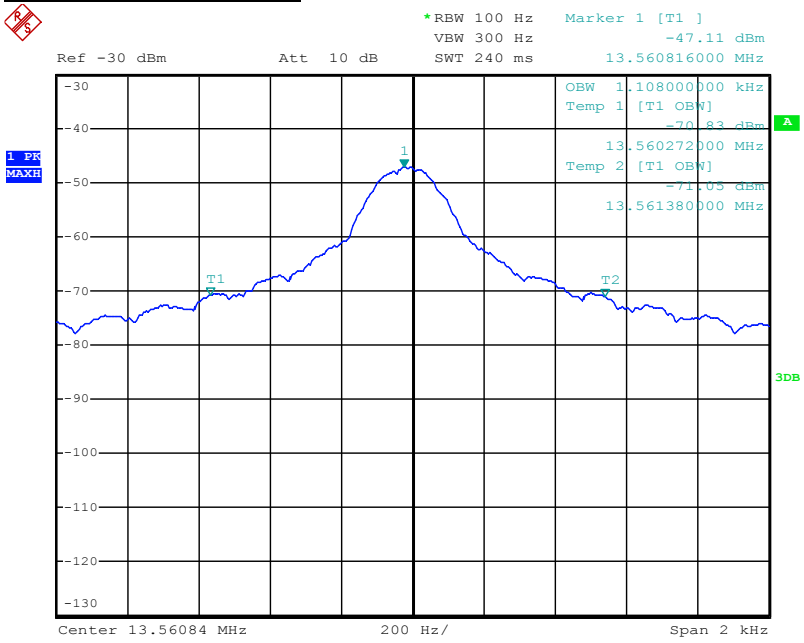
Test Results

20dB Bandwidth



Date: 13.MAY.2020 04:28:39

99% Bandwidth



Date: 13.MAY.2020 04:30:04