Produkte
Products

Prüfbericht - Nr.: *Test Report No.:*	**14046374 001**	**Seite 1 von 16** *Page 1 of 16*
Auftraggeber: *Client:*	**AIBRAIN, INC.** **511, INSTITUTE OF COMPUTER TECHNOLOGY** **SNU 1, GWANAK-RO, GWANAK-GU, SEOUL** **South Korea**	
Gegenstand der Prüfung: *Test Item:*	**Bluetooth Low Energy Toy Car**	
Bezeichnung: *Identification:*	**TYCHE Classic 1.0**	**Serien-Nr.:** *Serial No.:* **Engineering sample**
Wareneingangs-Nr.: *Receipt No.:*	**A000521160-001**	**Eingangsdatum:** *Date of Receipt:* **28.03.2017**
Prüfort: *Testing Location:*	**TÜV Rheinland Hong Kong Ltd.** 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong **Hong Kong Productivity Council** HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong	
Zustand des Prüfgegenstandes bei Anlieferung: *Condition of test item at delivery:*	Test samples are not damaged and suitable for testing.	
Prüfgrundlage: *Test Specification:*	**FCC Part 15 Subpart C** **ANSI C63.10-2013**	
Prüfergebnis: *Test Results:*	**Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage.** The above mentioned product was tested and **passed**.	
Prüflaboratorium: *Testing Laboratory:*	**TÜV Rheinland Hong Kong Ltd.** 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong	

geprüft/ *tested by:*			**kontrolliert/** *reviewed by:*		
13.04.2017	Mika Chan Project Manager		13.04.2017	Sharon Li Department Manager	
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges: Other Aspects **FCC ID: 2AJ3Z-TYCHEV10**

Abkürzungen:				*Abbreviations:*			
	P(ass)	=	*entspricht Prüfgrundlage*		*P(ass)*	=	*passed*
	F(ail)	=	*entspricht nicht Prüfgrundlage*		*F(ail)*	=	*failed*
	N/A	=	*nicht anwendbar*		*N/A*	=	*not applicable*
	N/T	=	*nicht getestet*		*N/T*	=	*not tested*

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Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK
Number of channels	40
Channel separation	2 MHz
Type of antenna	Chip Antenna
Antenna gain (dBi)	3.5 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V_{nor}: 6 VDC
Independent Operation Modes	Transmitting

Product function and intended use

The equipment under test (EUT) is a Bluetooth low energy device.

FCC ID: 2AJ3Z-TYCHEV10

Models	**Product description**
TYCHE Classic 1.0	Bluetooth Low Energy Toy Car

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 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

- 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:

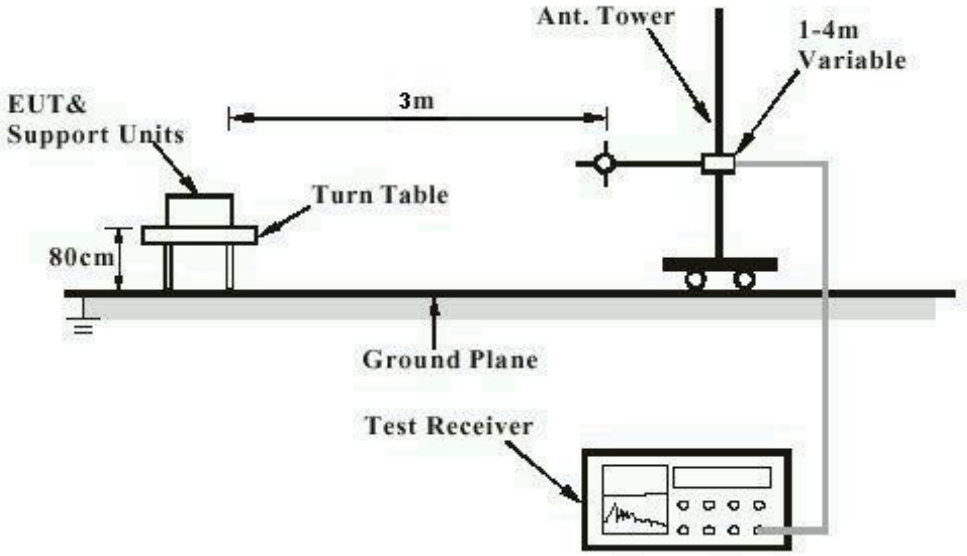
FS = R + AF + CF + FA – PA

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)

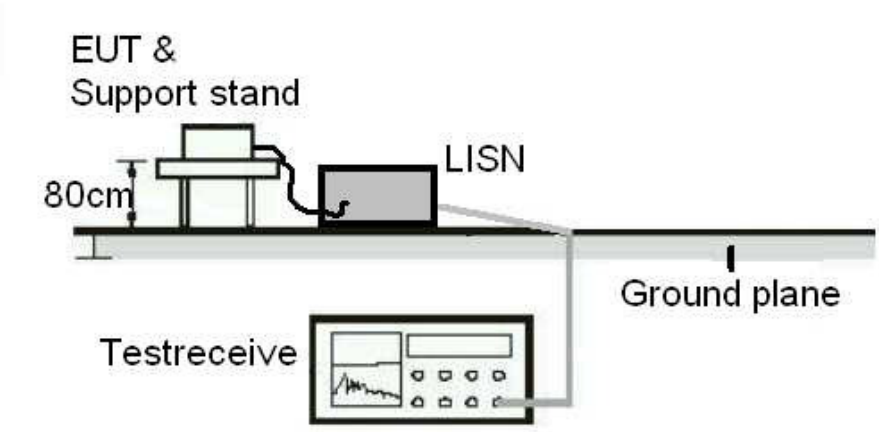
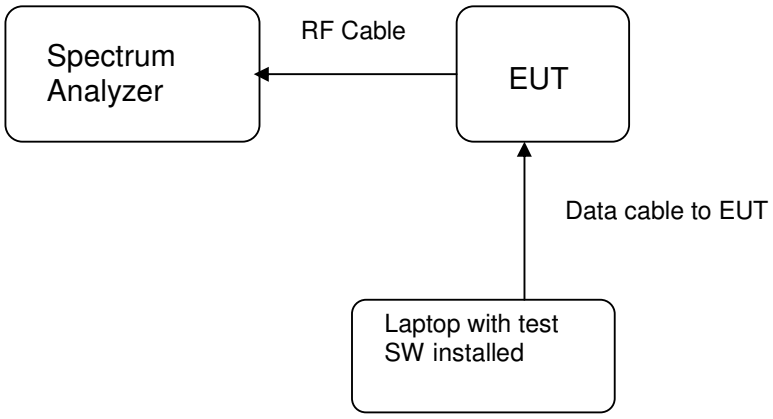


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



List of Test and Measurement Instruments

Hong Kong Productivity Council (FCC/ IC Registration number: 90656/ 4780A-1)

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	25-Apr-16	25-Apr-17
Test Receiver	R & S	ESU40	26-Jul-16	26-Jul-17
Active Loop Antenna	EMCO	6502	27-Oct-16	27-Oct-17
Bi-conical Antenna	R & S	HK116	1-Sep-15	1-Sep-17
Log Periodic Antenna	R & S	HL223	1-Sep-15	1-Sep-17
Standard Gain Horn	ETS-Lindgren	3160-07	3-Mar-16	3-Mar-18
Standard Gain Horn	ETS-Lindgren	3160-08	3-Mar-16	3-Mar-18
Standard Gain Horn	ETS-Lindgren	3160-10	3-Mar-16	3-Mar-18
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	27-Jan-17	27-Jan-18
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	27-Jan-17	27-Jan-18
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	28-Oct-15	28-Oct-17

TÜV Rheinland Hong Kong Ltd

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	12-Oct-16	12-Oct-17

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 estimated combined standard uncertainty for antenna conducted emission is ±2.1dB

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:	Integral Chip antenna N/A 3.5 dBi
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2	**N/A**
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	**Pass**
There is no AC power input or output ports on the EUT.	

FCC 15.247 (a)(2) – 6dB Bandwidth Measurement	**Pass**
FCC Requirement:	Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.

Test Specification : ANSI C63.10 – 2013
Mode of operation : TX mode
Port of testing : Temporary antenna port
Detector : Peak
Supply voltage : 6.0 Vdc
Temperature : 23ºC
Humidity : 50%

Results: For test protocols please refer to Appendix 1

Channel frequency (MHz)	6 dB left (MHz)	6 dB right (MHz)	6dB bandwidth (kHz)
2402	2401.634	2402.354	720.0
2440	2439.628	2440.360	732.0
2480	2479.628	2480.366	738.0

FCC 15.247(b)(3) – Maximum Peak Conducted Output Power	Pass
FCC Requirement: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt (30dBm)	
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak Supply voltage : 6.0 Vdc Temperature : 23ºC Humidity : 50%	
Results: For test protocols please refer to Appendix 1	

Frequency (MHz)	Measured Output Power (dBm)	Limit (W/dBm)	Verdict
2402	-8.44	1 / 30.0	Pass
2440	-8.41	1 / 30.0	Pass
2480	-8.45	1 / 30.0	Pass

FCC 15.247(e) – Power Spectral Density	Pass
FCC Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.	
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak Supply voltage : 6.0 Vdc Temperature : 23ºC Humidity : 50%	
Results: For test protocols please refer to Appendix 1.	

Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	-8.80	8.0	Pass
2440	-8.78	8.0	Pass
2480	-8.84	8.0	Pass

FCC 15.247(d) – Spurious Conducted Emissions		Pass
Test Specification Mode of operation Port of testing Detector Supply voltage Temperature Humidity	: : : : : : :	ANSI C63.10 – 2013 TX mode Temporary antenna port Peak 6.0 Vdc 23 ºC 50 %
FCC Requirement:		In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Results:		Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Only the worst cases is shown below. For test protocols refer to Appendix 1

Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	9280	-41.91	-8.80	-33.11	Pass
2440	7440	-41.48	-8.78	-32.70	Pass
2480	8200	-42.22	-8.84	-33.38	Pass

FCC 15.205 – Radiated Emissions in Restricted Frequency Bands		**Pass**
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Enclosure Detector : Peak Supply voltage : 6.0 Vdc Temperature : 23ºC Humidity : 50%		
FCC Requirement:	In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).	
Results:	Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.	
Mode: 2402MHz TX	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
4804.391	46.79	74.0 / PK
4804.487	38.10	54.0 / AV
Mode: 2402 MHz TX	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
4804.198	45.79	74.0 / PK
4804.551	32.37	54.0 / AV
Mode: 2440 MHz TX	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
4887.564	45.14	74.0 / PK
4887.564	30.42	54.0 / AV
Mode: 2440 MHz TX	Horizontal Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
No Peak Found	-	74.0 / PK
No Peak Found	-	54.0 / AV
Mode: 2480MHz TX	Vertical Polarization	
Freq MHz	**Level dBuV/m**	**Limit/ Detector dBuV/m**
4960.589	45.08	74.0 / PK
4960.493	33.18	54.0 / AV
Mode: 2480 MHz TX	Horizontal Polarization	
Freq	**Level**	**Limit/ Detector**

MHz	dBuV/m	dBuV/m
4960.320	47.19	74.0 / PK
4960.576	32.23	54.0 / AV