

Produkte
Products

Prüfbericht - Nr.: 14049428 001		Seite 1 von 18	
<i>Test Report No.:</i>		<i>Page 1 of 18</i>	
Auftraggeber: <i>Client:</i>	Sphero HK Limited 4/F, 299 QRC, 287-299, Queen's Road Central, Sheung Wan, Hong Kong		
Gegenstand der Prüfung: <i>Test Item:</i>	Sphero Mini with Bluetooth Low Energy connectivity		
Bezeichnung: <i>Identification:</i>	M001	Serien-Nr.: <i>Serial No.:</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	A000556816 (001-003)	Eingangsdatum: <i>Date of Receipt:</i>	31.05.2017
Prüfört: <i>Testing Location:</i>	TÜV Rheinland Hong Kong Ltd. 3/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: <i>Condition of test item at delivery:</i>	Test samples are not damaged and suitable for testing.		
Prüfgrundlage: <i>Test Specification:</i>	FCC Part 15 Subpart C RSS-247 Issue 2 ANSI C63.10-2013		
Prüfergebnis: <i>Test Results:</i>	Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage. The above mentioned product was tested and passed .		
Prüflaboratorium: <i>Testing Laboratory:</i>	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:	
07.07.2017	Joey Leung Project Manager	07.07.2017	Benny Lau Senior Project Manager
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>
	Unterschrift <i>Signature</i>		Unterschrift <i>Signature</i>
Sonstiges: Other Aspects		FCC ID: SXO-M001 IC: 10016A-M001 Manufacturer: Sphero Inc. 4772 Walnut Street, Suite 206, Boulder, CO 80301 USA	
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations:	P(ass) = passed F(ail) = failed 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 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 safety mark on this or similar products.</i>			

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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	Integral Wire Antenna
Antenna gain (dBi)	0.09 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V _{nom} : 3.7 VDC
Independent Operation Modes	Transmitting

Product function and intended use

The equipment under test (EUT) is a Bluetooth Low Energy device. It is powered by Li-Ion rechargeable battery and the battery is charged by dedicated USB charging cable. The EUT can connect with Bluetooth enabled Smartphone. With a dedicated Apps, end user can control the movement of EUT.

FCC ID: SXO-M001/ IC: 10016A-M001

Models	Product description
M001	Sphero Mini with Bluetooth Low Energy connectivity

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

Independent Operation Modes

The basic operation mode are:

- 1) Transmitting mode,
- 2) Receiving mode,
- 3) Charging 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 controlling software provided by the customer was used to control the operating channel. The RF output power was set by the manufacturer. The setting of the RF output power shall be fixed on the firmware of the final end product.

Special Accessories and Auxiliary Equipment

- Smartphone
Brand: Apple Inc
Model: iPhone4S
S/N: C8VJ8PUWDTC0
- AC-DC Power Adaptor (Provided by TÜV Rheinland Hong Kong Ltd.)
Brand: Apple Inc.
Model: A1357 W010A0S1
Input: 100-240VAC, 0.45A, 50-60Hz
Output: 5.1VDC, 2A

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:

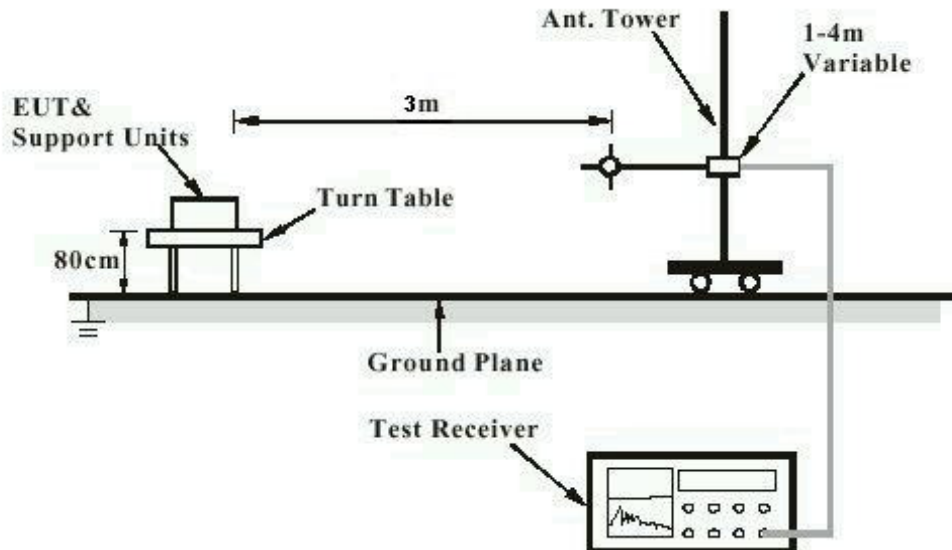
$$FS = R + AF + CF + FA - PA$$

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)

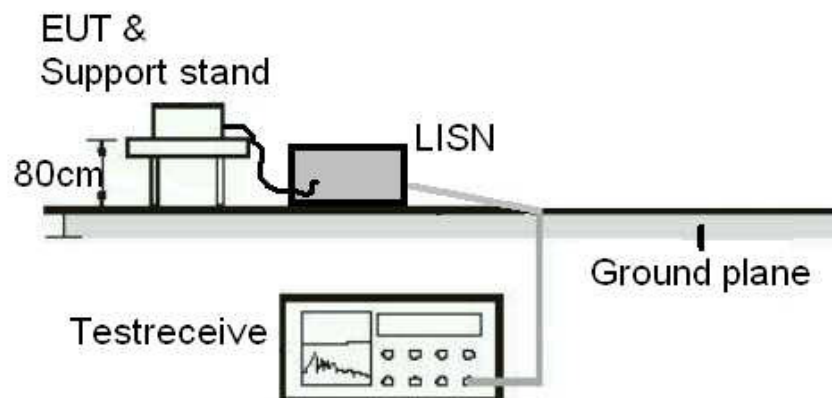
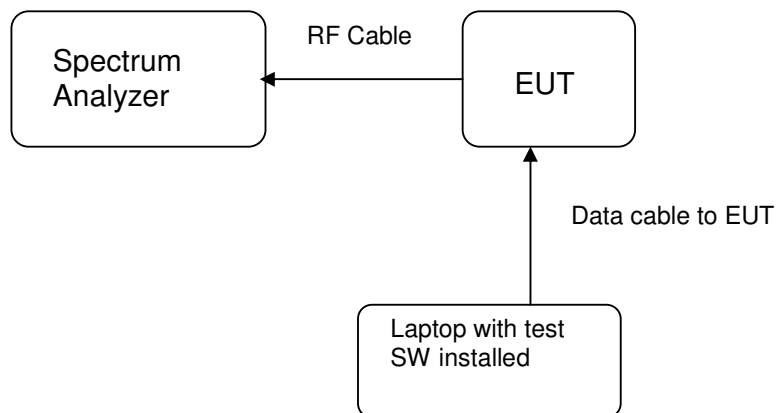


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



List of Test and Measurement Instruments

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

Conducted Emission

Equipment	Manufacturer	Type	S/N	Last Cal. Date	Cal. Due Date
Test Receiver	R & S	ESU26	100050	25 Jan 2017	25 Jan 2018
RF Voltage Probe	Schwarzbeck	TK9416	None	11 Feb 2017	11 Feb 2018
LISN	R&S	ESH3-Z5	849876/027	15 Sep 2016	15 Sep 2017
Double Shield Cable	Radiall	RG142	Nil	14 Sep 2015	14 Sep 2017
Pulse Limiter	R&S	ESH3-Z2	Nil	03 Jun 2017	03 Jun 2018

Radiated Emission

Equipment	Manufacturer	Type	S/N	Last Cal. Date	Cal. Due Date
Semi anechoic Chamber	Frankonia	Nil	Nil	25 Apr 2017	25 Apr 2018
Test Receiver	R & S	ESU40	100190	26 Jul 2016	26 Jul 2017
Bi conical Antenna	R & S	HK116	100241	01 Sep 2016	01 Sep 2017
Log Periodic Antenna	R & S	HL223	841516/017	01 Sep 2016	01 Sep 2017
Coaxial cable	Harbour	LL335	N/A	10 Jun 2017	10 Jun 2018
Microwave amplifier 0.5 26.5GHz, 25dB gain	HP	83017A	3950M00241	18 Jul 2016	18 Jul 2017
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	28 Oct 2016	28 Oct 2017
Horn Antenna	EMCO	3115	9002 3347	26 Aug 2016	26 Aug 2017
Active Loop Antenna	EMCO	6502	9107-2651	27 Oct 2016	27 Oct 2017

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Radio Frequency Test

Equipment	Manufacturer	Type	S/N	Last Cal. Date	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSP30	100610	15 Oct 2016	15 Oct 2017

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 2.42\text{dB}$.

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-247 Issue 2

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: Integral wire antenna b) Manufacturer and model no: N/A c) Peak Gain: 0.09 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	

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: Integral wire antenna b) Manufacturer: N/A c) model no: N/A d) Gain with reference to an isotropic radiator: 0.09 dBi	
Verdict:	Pass	

FCC 15.207/ RSS-Gen 8.8 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : AC Mains input port of power supply indicated in page 5 Detector : Quasi-peak and Average RBW : 9 kHz Supply voltage : 120Vac 60Hz Temperature : 23°C Humidity : 50%						
Requirement: 15.207(a)						
Results: Pass						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dB μ V	Average dB μ V	Limit QP (dB μ V)	Limit AV (dB μ V)	Verdict
0.15 – 0.5	No peak found	---	---	66 - 56	56 - 46	Pass
> 0.5 - 5	0.581	27.4	16.9	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dB μ V	Average dB μ V	Limit QP (dB μ V)	Limit AV (dB μ V)	Verdict
0.15 – 0.5	No peak found	---	---	66 - 56	56 - 46	Pass
> 0.5 - 5	0.618	32.9	27.0	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1, page 2.						

FCC 15.247 (a)(2) / RSS-247 5.2 – 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 : 3.7VDC Temperature : 23°C 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	2401.640	2402.336	696.0
2440	2439.640	2440.336	696.0
2480	2479.640	2480.336	696.0

RSS-Gen 6.6 – Occupied Bandwidth			Pass
FCC / IC Requirement : N/A			
Test Specification : RSS-Gen Mode of operation : Tx mode Port of testing : Temporary antenna port Detector : Peak Supply voltage : 3.7VDC 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)
2402	2401.490	2402.528	1.038
2440	2439.484	2440.528	1.044
2480	2479.484	2480.528	1.044

FCC 15.247(b)(3) / RSS-247 5.4 – 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 : 3.7VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1			
Frequency (MHz)	Measured Output Power (dBm)	Limit (W/dBm)	Verdict
2402	-4.71	1 / 30.0	Pass
2440	-4.90	1 / 30.0	Pass
2480	-5.21	1 / 30.0	Pass

FCC 15.247(e) / RSS-247 5.2 – 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 8dBm 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 : 3.7VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1.			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	-5.10	8.0	Pass
2440	-5.36	8.0	Pass
2480	-5.65	8.0	Pass

FCC 15.247(d) / RSS-247 5.5 – Spurious Conducted Emissions					Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak Supply voltage : 3.7VDC Temperature : 23 °C Humidity : 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	7200.000	-31.05	-5.10	-25.95	Pass
2440	7320.000	-36.58	-5.36	-31.22	Pass
2480	7440.000	-33.47	-5.65	-27.82	Pass

FCC 15.205/ RSS-Gen 8.9 – 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 : 3.7VDC Temperature : 23°C 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	
65.130	34.80	40.0 / QP	
2389.872	43.52	74.0 / PK	
2389.872	31.46	54.0 / AV	
7319.940	65.73	74.0 / PK	
7319.449	47.86	54.0 / AV	
Mode: 2402 MHz TX Horizontal Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
67.772	26.80	40.0 / QP	
2388.718	44.33	74.0 / PK	
2390.000	31.56	54.0 / AV	
7320.030	66.44	74.0 / PK	
7205.449	49.60	54.0 / AV	
Mode: 2440 MHz TX Vertical Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
67.080	32.60	40.0 / QP	
7205.959	63.98	74.0 / PK	
7205.434	46.80	54.0 / AV	
Mode: 2440 MHz TX Horizontal Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
58.765	26.00	40.0 / QP	
7205.344	67.94	74.0 / PK	
7319.424	48.62	54.0 / AV	

Mode: 2480MHz TX Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
67.050	33.10	40.0 / QP
2483.500	48.78	74.0 / PK
2483.500	31.47	54.0 / AV
7440.060	66.23	74.0 / PK
7439.474	48.46	54.0 / AV
Mode: 2480 MHz TX Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
59.490	26.80	40.0 / QP
2483.500	51.95	74.0 / PK
2483.500	31.63	54.0 / AV
7439.259	65.96	74.0 / PK
7439.404	48.08	54.0 / AV