

TEST REPORT

Report No.: 17052048HKG-004

Sphero HK Limited

Application For Certification
(Original Grant)

FCC ID: SXO-VD01

Transceiver

PREPARED AND CHECKED BY:

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Date: July 17, 2017

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TEST REPORT**GENERAL INFORMATION**

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Manufacturer:	Sphero, Inc.
Manufacturer Address:	4772 Walnut Street, Suite 206, Boulder, CO 80301, USA
Brand Name:	sphero
Model:	VD01
Type of EUT:	Consumer ISM Device
Description of EUT:	BB-9E App-Enabled Droid
Serial Number:	N/A
FCC ID:	SXO-VD01
Date of Sample Submitted:	May 26, 2017
Date of Test:	May 26, 2017 to June 15, 2017
Report No.:	17052048HKG-004
Report Date:	July 17, 2017
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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SUMMARY OF TEST RESULT

TEST SPECIFICATION	REFERENCE	RESULTS
Field Strength Limit	18.305	Pass

The equipment under test is found to be complying with the following standards:
FCC Part 18, October 1, 2015 Edition

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1.0 GENERAL DESCRIPTION

1.1 Product Description

The Equipment Under Test (EUT) is a 2.4GHz toy (Bluetooth 4.0 BLE), which is operating from 2402MHz to 2480MHz with 2MHz channel spacing and there is a 211kHz to 258kHz (shown in this report) sending out for the LED on the hand unit. The EUT is powered by 2 x 3.7VDC lithium batteries. After switched on the EUT and paired with the smartphone, the EUT can be controlled to move forward, backward, left and right.

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

This is a single application for certification of a transceiver.

1.3 Test Methodology

Radiated emission measurement was performed according to the FCC procedures in MP-5, "Methods of Measurements of Radio Noise Emissions form ISM equipment" 1986". All radiated measurements were performed in an 3m Chamber. Preliminary scans were performed in the 3m Chamber only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Justification Section"** of this Application.

1.4 Test Facility

The 3m Chamber used to collect the radiated data is located at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong. This test facility and site measurement data have been placed on file with the FCC.

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2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in FCC/OST MP-5 (1986).

The device was powered by new DC 7.4VDC (2 x 3.7V Lithium batteries).

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emission at and above 30 MHz, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data report in Exhibit 3.0.

The rear of unit shall be flushed with the rear of the table.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the wooden turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

There was no special software to exercise the device.

2.3 Special Accessories

There are no special accessories necessary for compliance of this product.

2.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

2.5 Support Equipment List and Description

N/A.

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3.0 EMISSION RESULTS

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any), Distance Factor from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG - DF$$

where FS = Field Strength in dBμV/m

RA = Receiver Amplitude (including preamplifier) in dBμV

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

DF = Distance Factor in dB = $20 \log 3/300 = -40\text{dB}$ (3m to 300m)

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where

FS = Field Strength in dBμV/m

RR = RA - AG - DF in dBμV

LF = CF + AF in dB

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and distance factor of 20 dB are subtracted, giving a field strength of 12 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(12 \text{ dB}\mu\text{V/m})/20] = 3.98 \mu\text{V/m}$$

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 232.193 kHz

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 9.9 dB

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RADIATED EMISSIONS

Model: VD01

Date of Test: June 15, 2017

Worst-Case Operating Mode: Transmitting

Table 1
Pursuant to FCC Part 18 Section 18.305 Requirement

Frequency (kHz)	Reading at 3m (dBμV)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Calculated at 300m (dBμV/m)	Limit at 300m (dBμV/m)	Margin (dB)
232.193	41.9	11.7	53.6	13.6	23.5	-9.9
649.917	34.1	11.5	45.6	5.6	23.5	-17.9

Frequency (MHz)	Reading at 3m (dBμV)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Calculated at 300m (dBμV/m)	Limit at 300m (dBμV/m)	Margin (dB)
1.083	27.4	11.3	38.7	-1.3	23.5	-24.8
1.516	25.8	11.1	36.9	-3.1	23.5	-26.6
1.950	24.4	10.8	35.2	-4.8	23.5	-28.3
2.385	21.8	10.9	32.7	-7.3	23.5	-30.8

- NOTES:
1. Average detector data unless otherwise stated.
 2. Frequency range scanned: 9kHz to 30MHz.
 3. Only emissions significantly above equipment noise floor are reported.
 4. Loop antenna was used for emission below 30MHz.
 5. Reading at 3m data includes the cable factor.
 6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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4.0 EQUIPMENT PHOTOGRAPHS

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

5.0 PRODUCT LABELLING

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

6.0 TECHNICAL SPECIFICATIONS

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

7.0 INSTRUCTION MANUAL

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States and Canada.

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8.0 EMISSIONS TEST PROCEDURES

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of Industrial, Scientific and Medical equipment operating under FCC methods of measurements of radio noise emissions from industrial, scientific and medical equipment.

Radiated emissions measurement

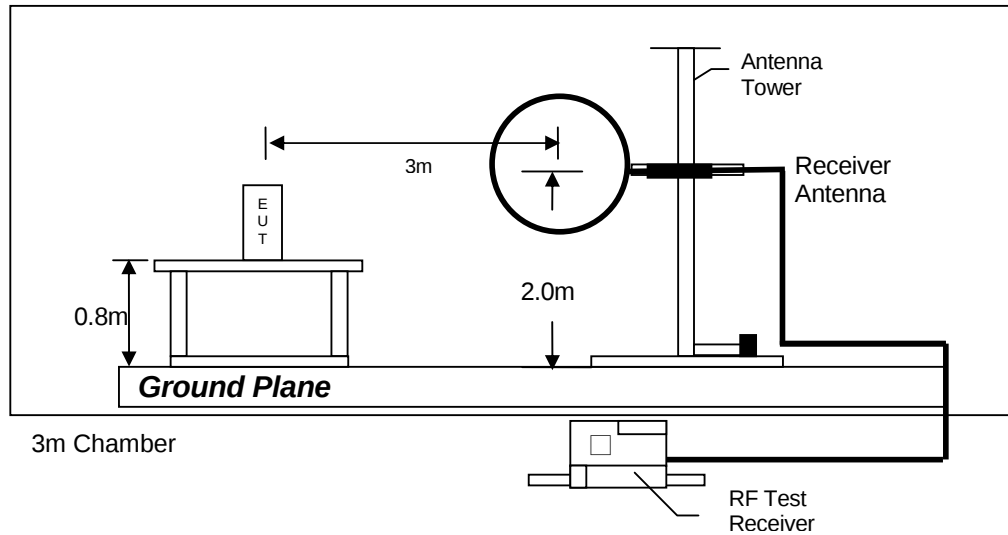
The equipment under test (EUT) is placed on a wooden turntable which is 1.5 x 1 meter dimension and approximately 1 meter in height above the ground plane. During the radiated emissions test, the turntable is rotated to resulting in maximum emissions. The antenna polarization is varied during the testing to search for maximum signal levels. For loop antenna, the height of the antenna is set at 2 meters. For bi-conical and log-periodic antenna, the antenna height is varied from one to four meters.

According to FCC/OCT MP-5 (1986), the frequency range scanned is 9 kHz to 400MHz in field strength emission. The detector function of the measurement is set to average. For line conducted emission, the frequency range scanned is from 0.15MHz to 30MHz in quasi peak and average measurement.

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8.1 Radiated Emission Test Setup

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions below 30MHz

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9.0 CONFIDENTIALITY REQUEST

For electronic filing, a preliminary copy of the confidentiality request is saved with filename: request.pdf.

10.0 EQUIPMENT LIST

1) Radiated Emissions Test

EQUIPMENT	EMI TEST RECEIVER
Registration No.	EW-2666
Manufacturer	R&S
Model No.	ESCI7
Calibration Date	Jun. 17, 2016
Calibration Due Date	Jun. 17, 2017

EQUIPMENT	SPECTRUM ANALYZER	SIGNAL GENERATOR
Registration No.	EW-2253	EW-0423
Manufacturer	R&S	IFR
Model No.	FSP40	2023B
Calibration Date	Jun. 15, 2016	Nov. 17, 2016
Calibration Due Date	Jun. 15, 2017	Nov. 17, 2017

EQUIPMENT	ACTIVE LOOP H-FIELD (9KHZ TO 30MHZ)
Registration No.	EW-2313
Manufacturer	ELECTROMETRI
Model No.	EM-6876
Calibration Date	Jun. 27, 2016
Calibration Due Date	Dec. 27, 2017

END OF TEST REPORT