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TEST REPORT

Report No.: 17040084HKG-002

Sphero HK Limited

Application
For
Certification
(Original Grant)
(FCC ID: SXO-C001)
(IC: 10016A-C001)

Transceiver

This report contains the data of Bluetooth portion only

Prepared and Checked by:

Approved by:

Signed On File
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Date: April 24, 2017

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GENERAL INFORMATION

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Manufacturer:	Sphero, Inc.
Manufacturer Address:	4772 Walnut Street, Suite 206 Boulder, CO 80301, USA
Brand Name:	Sphero
Model / HVIN:	C001
Type of EUT:	Transceiver
Description of EUT:	Ultimate Lightning McQueen
Serial Number:	N/A
FCC ID / IC:	SXO-C001 / 10016A-C001
Date of Sample Submitted:	April 03, 2017
Date of Test:	April 03, 2017 to April 07, 2017
Report No.:	17040084HKG-002
Report Date:	April 24, 2017
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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SUMMARY OF TEST RESULT

TEST SPECIFICATION	REFERENCE	RESULTS
Transmitter Power Line Conducted Emissions	15.207 / RSS-Gen 8.8	Pass
Radiated Emission Radiated Emission on the Bandedge	15.249, 15.209 / RSS-210 B.10, RSS-210 4.4	Pass
Radiated Emission in Restricted Bands	15.205 / RSS-210 4.1	Pass

The equipment under test is found to be complying with the following standards:
FCC Part 15, October 1, 2015 Edition
RSS-210 Issue 9, August 2016
RSS-Gen Issue 4, November 2014

- Note: 1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the provisions of this section.
2. Pursuant to FCC part 15 Section 15.215(c), the 20 dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered.

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1.0 General Description

1.1 Product Description

The SXO-C001 (April 03, 2017) is an Ultimate Lightning McQueen. The EUT contains both WLAN (WiFi) and Bluetooth (Bluetooth 4.0) modules. An iOS/Android App installed in Smartphone can connect with the EUT via Bluetooth and WiFi. It has sound and light during normal play. It is installed with light and touch sensor. It can be controlled to move forward/ backward and turn left/ right by the App. The EUT is power by a 120VAC to 15VDC 1000mA adaptor and/ or a 12V rechargeable battery.

For WLAN (WiFi) module:

The Equipment Under Test (EUT) operates at frequency range of 2412MHz to 2462MHz with 11 channels.

For 802.11b mode, it operates at frequency range of 2412.000MHz to 2462.000MHz with 11 channels. It transmits via Direct-sequence spread spectrum (DSSS) modulation. Maximum bit rate can be up to 11Mbps.

For 802.11g mode, it operates at frequency range of 2412.000MHz to 2462.000MHz with 11 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can be up to 54Mbps.

For 802.11n (with 20MHz bandwidth) mode, it operates at frequency range of 2412.000MHz to 2462.000MHz with 11 channels. It transmits via Orthogonal Frequency Division Multiplexing (OFDM) modulation. Maximum bit rate can support up to 65Mbps.

For Bluetooth module:

For Bluetooth 4.0 BLE mode, it occupies a frequency range from 2402MHz to 2480MHz (40 channels with channel spacing of 2MHz). It transmits via GFSK modulation.

Antenna Type: Internal, Integral

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.

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1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). 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 and conducted measurement facility 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 and IC No. 2042V-1.

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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 ANSI C63.10 (2013).

The EUT was powered by a 120VAC to 15V 1000mA adaptor and/ or a 12V rechargeable battery.

For maximizing emissions, 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 reported in Exhibit 3.0.

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.

For simultaneous transmission, both WiFi and Bluetooth portions are also switched on when taking radiated emission for determining worst-case spurious emission.

2.2 EUT Exercising Software

There EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

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.

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

2.5 Support Equipment List and Description

1. iPod Touch (Model: A1509, FCC ID: BCG-A1421, Brand: Apple)
(Provided by Client)

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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), Average Factor (optional) from the measured reading. The basic equation with a sample calculation is as follows:

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

where FS = Field Strength in dB μ V/m
 RA = Receiver Amplitude (including preamplifier) in dB μ V
 CF = Cable Attenuation Factor in dB
 AF = Antenna Factor in dB
 AG = Amplifier Gain in dB
 AV = Average Factor in dB

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 dB μ V/m
 RR = RA - AG - AV in dB μ V
 LF = CF + AF in dB

Assume a receiver reading of 52.0 dB μ V 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 average factor of 5 dB are subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$\begin{aligned} RA &= 52.0 \text{ dB}\mu\text{V/m} \\ AF &= 7.4 \text{ dB} & RR &= 18.0 \text{ dB}\mu\text{V} \\ CF &= 1.6 \text{ dB} & LF &= 9.0 \text{ dB} \\ AG &= 29.0 \text{ dB} \\ AV &= 5.0 \text{ dB} \\ FS &= RR + LF \\ FS &= 18 + 9 = 27 \text{ dB}\mu\text{V/m} \end{aligned}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(27 \text{ dB}\mu\text{V/m})/20] = 22.4 \mu\text{V/m}$$

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 51.340 MHz

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: config 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 6.4 dB

3.4 Conducted Emission Configuration Photograph

The worst case in line-conducted emission was found at 4.767 MHz

For electronic filing, the worst case line-conducted configuration photographs are saved with filename: config photo.pdf.

3.5 Conducted Emission Data

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

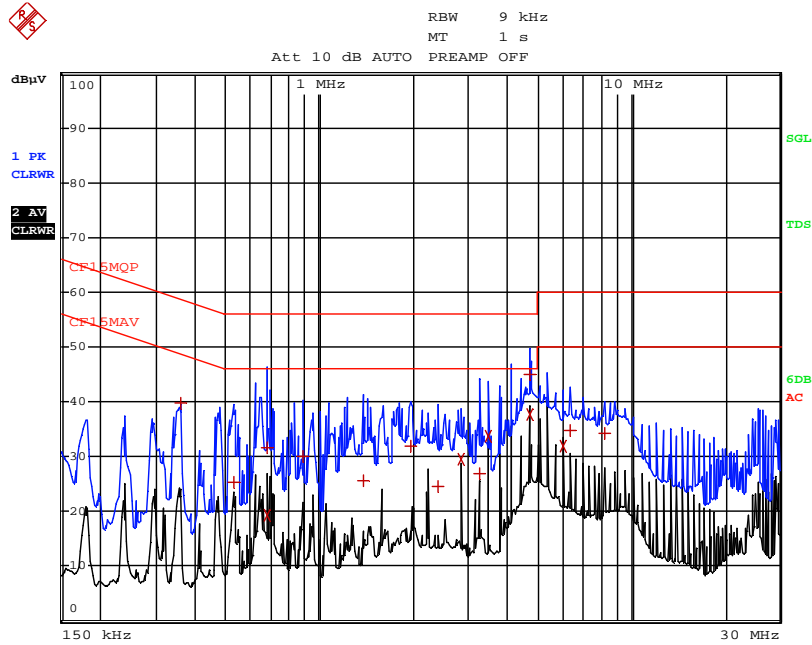
Judgment: Pass by 8.31 dB

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Applicant: Sphero HK Limited
 Model: C001

Date of Test: April 12, 2017

Worst-Case Operating Mode: Charging & Touch Sensor



EDIT PEAK LIST (Final Measurement Results)				
TRACE	FREQUENCY	LEVEL dBμV	DELTA	LIMIT dB
Trace1:	CF15MQP			
Trace2:	CF15MAV			
Trace3:	---			
1	Quasi Peak 357 kHz	39.74 N		-19.05
1	Quasi Peak 532.5 kHz	25.38 L1		-30.61
1	Quasi Peak 676.5 kHz	31.58 L1		-24.41
2	CISPR Average 676.5 kHz	19.26 N		-26.73
1	Quasi Peak 883.5 kHz	30.07 L1		-25.93
1	Quasi Peak 1.383 MHz	25.62 N		-30.37
1	Quasi Peak 1.9725 MHz	31.85 L1		-24.14
1	Quasi Peak 2.409 MHz	24.62 N		-31.37
2	CISPR Average 2.859 MHz	29.44 L1		-16.55
1	Quasi Peak 3.282 MHz	27.02 L1		-28.98
2	CISPR Average 3.4935 MHz	33.61 N		-12.38
1	Quasi Peak 4.767 MHz	45.08 L1		-10.91
2	CISPR Average 4.767 MHz	37.68 N		-8.31
2	CISPR Average 6.036 MHz	31.96 N		-18.03
1	Quasi Peak 6.3555 MHz	34.68 N		-25.31
1	Quasi Peak 8.259 MHz	34.26 N		-25.73

Note: Measurement Uncertainty is ± 4.2 dB at a level of confidence of 95%.

INTERTEK TESTING SERVICES

Applicant: Sphero HK Limited
 Model: C001

Date of Test: April 12, 2017

Worst-Case Operating Mode: Transmitting (Bluetooth 4.0 BLE)

Table 1
Radiated Emissions
 Pursuant to FCC Part 15 Section 15.249 / RSS-210 B10.0 Requirement

Lowest Channel

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Average Factor (dB)	Calculated at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
V	2402.000	86.8	33	29.4	83.2	48.3	34.9	94.0	-59.1
H	4804.000	41.1	33	34.9	43.0	48.3	-5.3	54.0	-59.3
H	7206.000	51.3	33	37.9	56.2	48.3	7.9	54.0	-46.1
H	9608.000	44.4	33	40.4	51.8	48.3	3.5	54.0	-50.5
V	12010.000	45.7	33	40.5	53.2	48.3	4.9	54.0	-49.1
V	14412.000	47.7	33	40.0	54.7	48.3	6.4	54.0	-47.6

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
V	2402.000	86.8	33	29.4	83.2	114.0	-30.8
H	4804.000	41.1	33	34.9	43.0	74.0	-31.0
H	7206.000	51.3	33	37.9	56.2	74.0	-17.8
H	9608.000	44.4	33	40.4	51.8	74.0	-22.2
V	12010.000	45.7	33	40.5	53.2	74.0	-20.8
V	14412.000	47.7	33	40.0	54.7	74.0	-19.3

- NOTES: 1. Peak Detector Data unless otherwise stated.
2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-210 4.1.
6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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Applicant: Sphero HK Limited
 Model: C001

Date of Test: April 06, 2017

Worst-Case Operating Mode: Transmitting (Bluetooth 4.0 BLE)

Table 2
Radiated Emissions
 Pursuant to FCC Part 15 Section 15.249 / RSS-210 B10.0 Requirement

Middle Channel

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Average Factor (dB)	Calculated at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
V	2440.000	86.5	33	29.4	82.9	48.3	34.6	94.0	-59.4
H	4880.000	40.9	33	34.9	42.8	48.3	-5.5	54.0	-59.5
H	7320.000	51.5	33	37.9	56.4	48.3	8.1	54.0	-45.9
H	9760.000	44.0	33	40.4	51.4	48.3	3.1	54.0	-50.9
V	12200.000	45.4	33	40.5	52.9	48.3	4.6	54.0	-49.4
V	14640.000	49.2	33	38.4	54.6	48.3	6.3	54.0	-47.7

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
V	2440.000	86.5	33	29.4	82.9	114.0	-31.1
H	4880.000	40.9	33	34.9	42.8	74.0	-31.2
H	7320.000	51.5	33	37.9	56.4	74.0	-17.6
H	9760.000	44.0	33	40.4	51.4	74.0	-22.6
V	12200.000	45.4	33	40.5	52.9	74.0	-21.1
V	14640.000	49.2	33	38.4	54.6	74.0	-19.4

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-210 4.1.
6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

INTERTEK TESTING SERVICES

Applicant: Sphero HK Limited
 Model: C001

Date of Test: April 12, 2017

Worst-Case Operating Mode: Transmitting (Bluetooth 4.0 BLE)

Table 3
Radiated Emissions
 Pursuant to FCC Part 15 Section 15.249 / RSS-210 B10.0 Requirement

Highest Channel

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Average Factor (dB)	Calculated at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
V	2480.000	84.9	33	29.4	81.3	48.3	33.0	94.0	-61.0
H	4960.000	40.8	33	34.9	42.7	48.3	-5.6	54.0	-59.6
H	7440.000	51.1	33	37.9	56.0	48.3	7.7	54.0	-46.3
H	9920.000	44.1	33	40.4	51.5	48.3	3.2	54.0	-50.8
V	12400.000	45.3	33	40.5	52.8	48.3	4.5	54.0	-49.5
V	14880.000	49.0	33	38.4	54.4	48.3	6.1	54.0	-47.9

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
V	2480.000	84.9	33	29.4	81.3	114.0	-32.7
H	4960.000	40.8	33	34.9	42.7	74.0	-31.3
H	7440.000	51.1	33	37.9	56.0	74.0	-18.0
H	9920.000	44.1	33	40.4	51.5	74.0	-22.5
V	12400.000	45.3	33	40.5	52.8	74.0	-21.2
V	14880.000	49.0	33	38.4	54.4	74.0	-19.6

- NOTES: 1. Peak Detector Data unless otherwise stated.
2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. Emission (the row indicated by **bold italic**) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-210 4.1.
6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

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Applicant: Sphero HK Limited
Model: C001

Date of Test: April 07, 2017

Worst-Case Operating Mode: Charging & Playing

Table 4
Radiated Emissions
Pursuant to FCC Part 15 Section 15.209 / RSS-210 4.4 Requirement

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
V	35.456	36.0	16	10.0	30.0	40.0	-10.0
V	44.792	38.0	16	10.0	32.0	40.0	-8.0
V	51.340	38.6	16	11.0	33.6	40.0	-6.4
V	200.720	35.1	16	16.0	35.1	43.5	-8.4
V	204.721	35.5	16	16.0	35.5	43.5	-8.0
V	212.723	33.7	16	17.0	34.7	43.5	-8.8
H	360.042	25.8	16	24.0	33.8	46.0	-12.2

NOTES: 1. Peak Detector Data unless otherwise stated.

- All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
- Negative sign in the column shows value below limit.
- Horn antenna is used for the emission over 1000MHz.
- Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-210 4.1.
- 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 Miscellaneous Information

The miscellaneous information includes details of the test procedure and measured bandwidth / calculation of factor such as pulse desensitization and averaging factor (calculation and timing diagram).

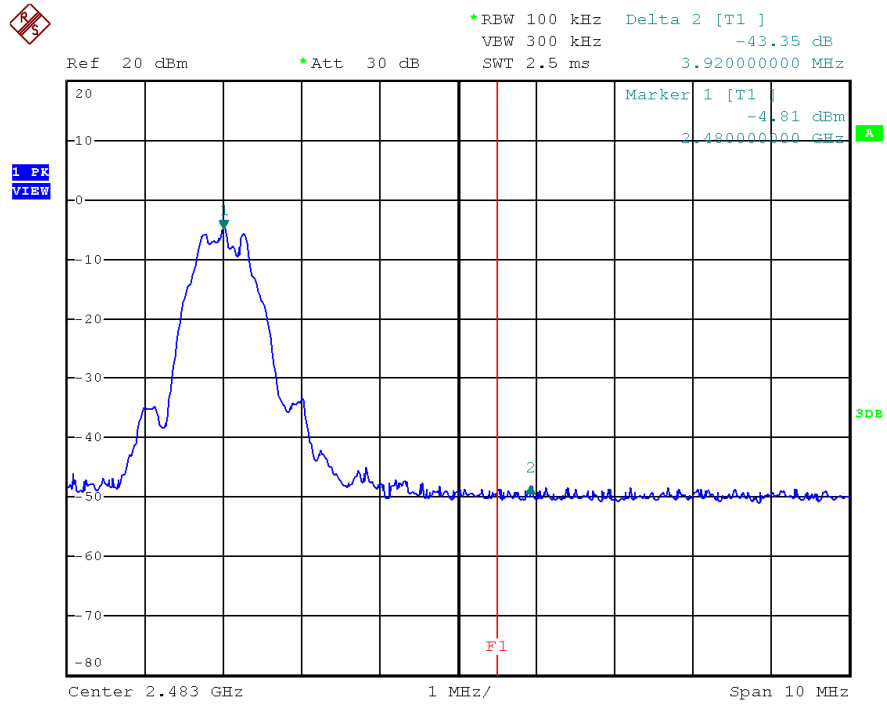
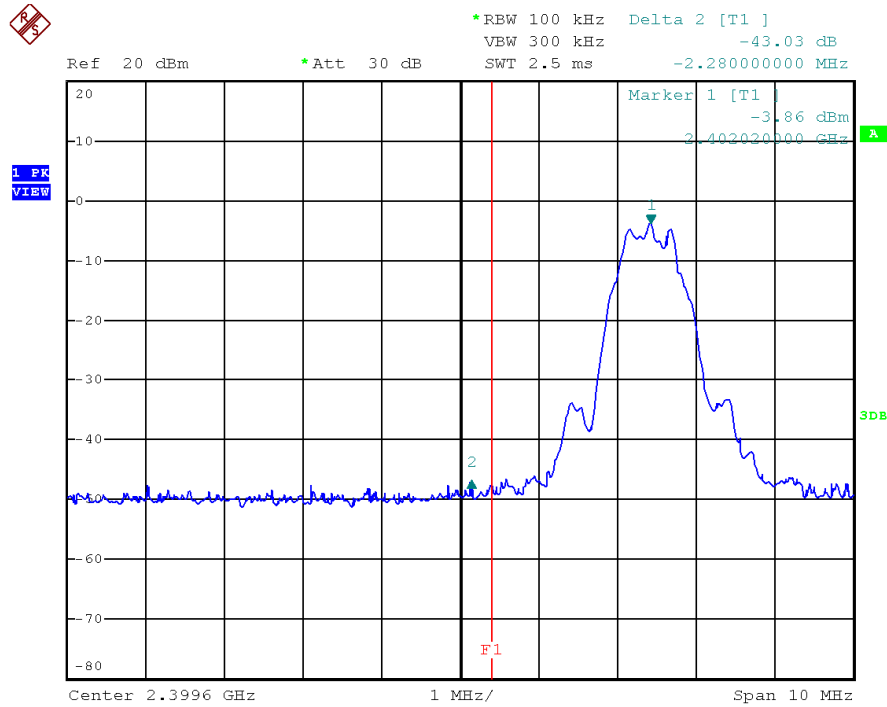
8.1 Radiated Emission on the Bandedge

From the following plots, they show that the fundamental emissions are confined in the specified band (2400MHz to 2483.5MHz). In case of the fundamental emissions are within two standard bandwidths from the bandedge, the delta measurement technique is used for determining bandedge compliance. Standard bandwidth is the bandwidth specified by ANSI C63.10 (2013) for frequency being measured.

Emissions radiated outside of the specified frequency bands, except harmonics, are attenuated by 50dB below the level of the fundamental or to the general radiated emissions limits in Section 15.209 / RSS-210 4.4, whichever is the lesser attenuation, which meet the requirement of part 15.249(d) / RSS-210 B.10.

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Peak Measurement (Bluetooth 4.0 BLE)



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Peak Measurement (Bluetooth 4.0 BLE)

Bandedge compliance is determined by applying marker-delta method, i.e. (Bandedge Plot).

Lower bandedge

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the plot

$$=83.2 \text{ dB}\mu\text{V/m} - 43.03 \text{ dB}$$

$$=40.17 \text{ dB}\mu\text{V/m}$$

Average Resultant field strength = Fundamental emissions (average value) – delta from the plot

$$=34.9 \text{ dB}\mu\text{V/m} - 43.03 \text{ dB}$$

$$=-8.13 \text{ dB}\mu\text{V/m}$$

Upper bandedge

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the plot

$$=81.3 \text{ dB}\mu\text{V/m} - 43.35 \text{ dB}$$

$$=37.95 \text{ dB}\mu\text{V/m}$$

Average Resultant field strength = Fundamental emissions (average value) – delta from the plot

$$=33.0 \text{ dB}\mu\text{V/m} - 43.35 \text{ dB}$$

$$=-10.35 \text{ dB}\mu\text{V/m}$$

The resultant field strength meets the general radiated emission limit in Section 15.209 / RSS-210 4.4, which does not exceed 74 dB μ V/m (Peak Limit) and 54 dB μ V/m (Average Limit).

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8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (Teff) is approximately 0.384ms for a digital "1" bit which illustrated on technical specification, with a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

8.3 Calculation of Average Factor

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 100ms

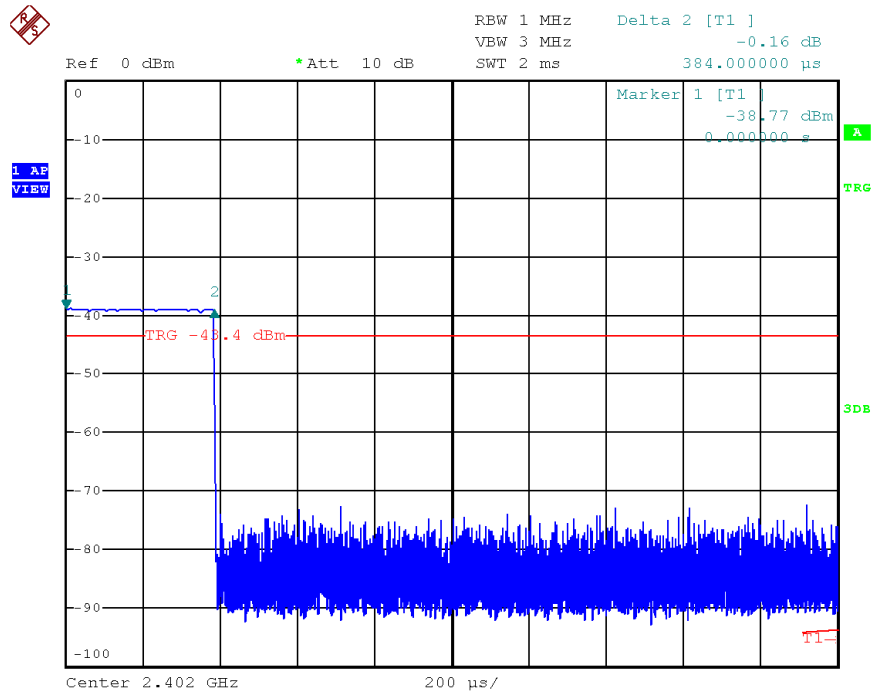
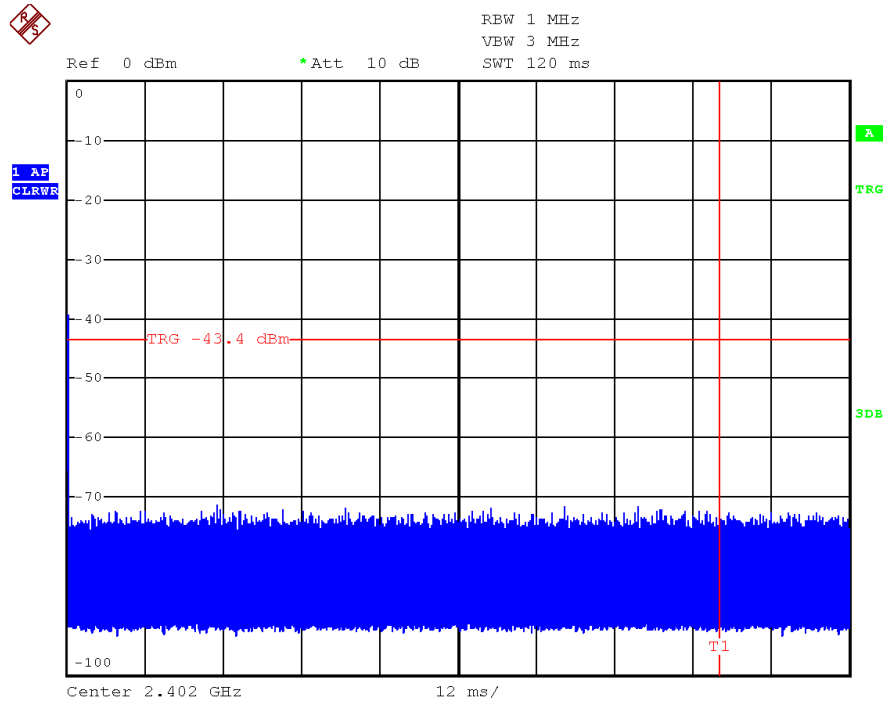
Effective period of the cycle = 0.384ms

DC = $0.384/100 = 0.00384$

Therefore, the averaging factor is found by $20\log 0.00384 = -48.3\text{dB}$.

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Average Factor (Bluetooth 4.0 BLE)



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8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of transmitter operating under the Part 15, Subpart C rules.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately 0.8m in height above the ground plane for emission measurement at or below 1GHz and 1.5m in height above the ground plane for emission measurement above 1GHz. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 150 kHz to 30 MHz.

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8.4 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.10 (2013).

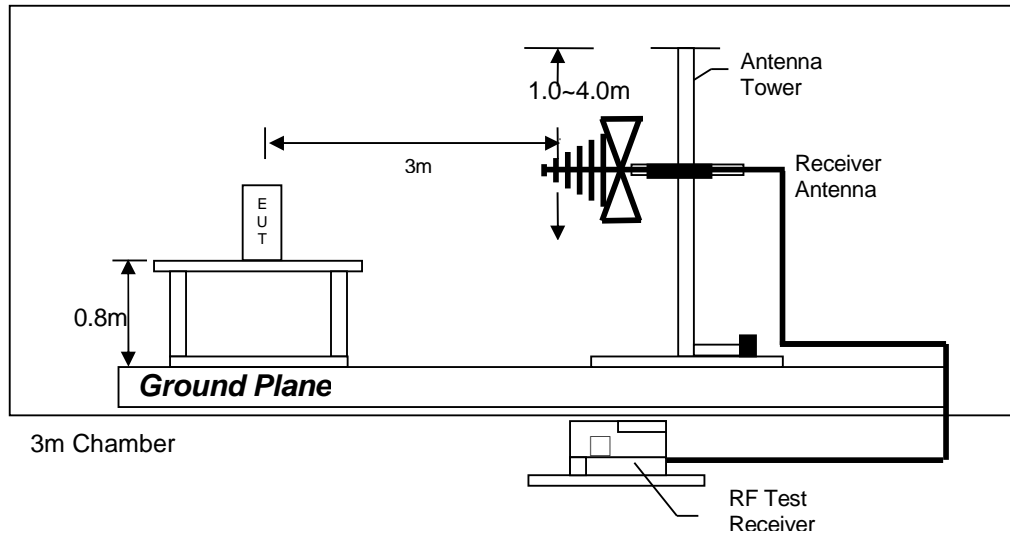
The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 3 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.

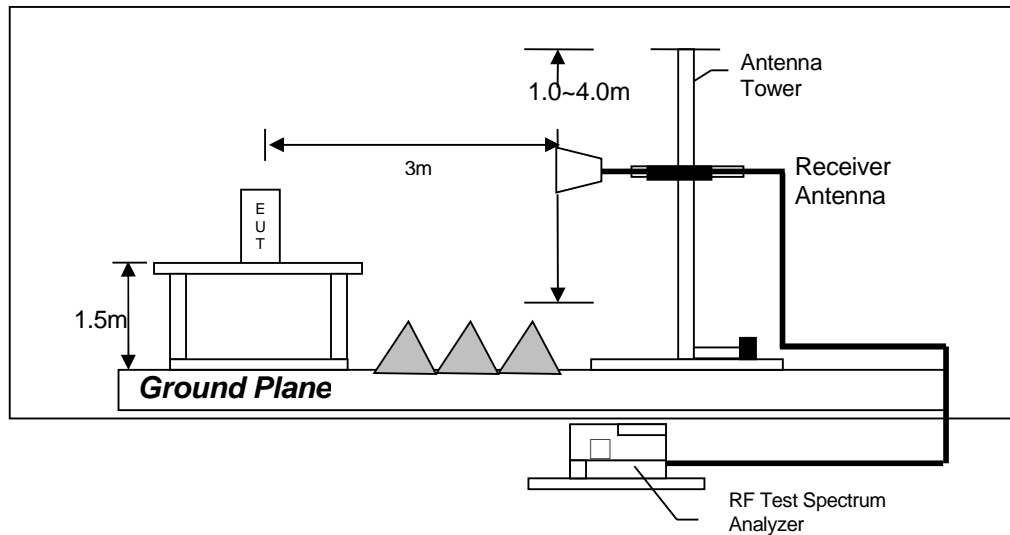
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8.4.1 Radiated Emission Test Setup

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



Test setup of radiated emissions up to 1GHz



Test setup of radiated emissions above 1GHz

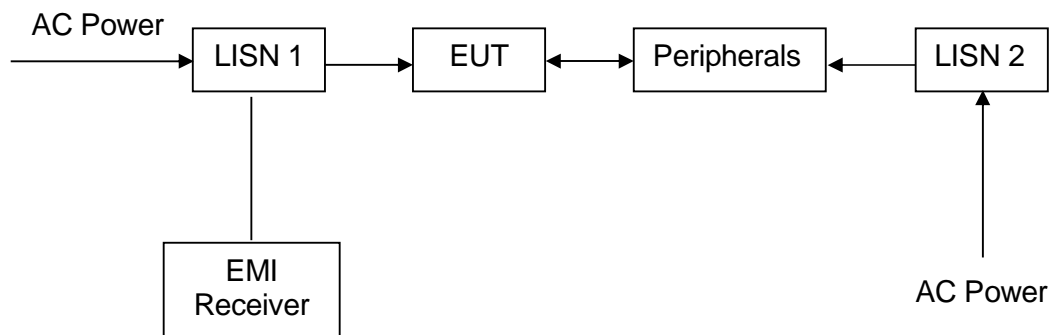
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8.4.2 Conducted Emission Test Procedures

For tabletop equipment, the EUT along with its peripherals were placed on a 1.0m(W)×1.5m(L) and 0.8m in height wooden table. For floor-standing equipment, the EUT and all cables were insulated, if required, from the ground plane by up to 12 mm of insulating material. The EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. The excess power cable between the EUT and the LISN was bundled.

All connecting cables of EUT and peripherals were moved to find the maximum emission.

8.4.3 Conducted Emission Test Setup



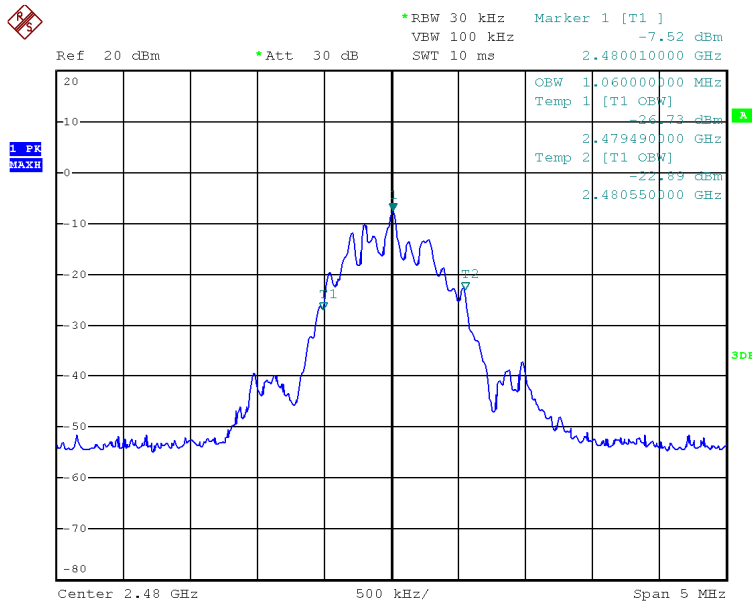
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8.5 Occupied Bandwidth

Occupied Bandwidth Results: (Bluetooth 4.0 BLE)

Bluetooth (MHz)	Occupied Bandwidth (MHz)
Low Channel: 2402	1.05
Middle Channel: 2440	1.05
High Channel: 2480	1.06

The worst case is shown as below



9.0 Confidentiality Request

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

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10.0 Equipment List

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Spectrum Analyzer	BiConiLog Antenna - 26MHz to 6000MHz
Registration No.	EW-3156	EW-2253	EW-3061
Manufacturer	R&S	R&S	EMCO
Model No.	ESR26	FSP40	3142E
Calibration Date	Dec. 06, 2016	Jun. 15, 2016	Sep. 23, 2016
Calibration Due Date	Dec. 06, 2017	Jun. 15, 2017	Sep. 23, 2017

Equipment	Double Ridged Guide Antenna	Broad-Band Horn Antenna
Registration No.	EW-1133	EW-1679
Manufacturer	EMCO	SCHWARZBECK
Model No.	3115	BBHA9170
Calibration Date	Nov. 05, 2015	Jun. 28, 2016
Calibration Due Date	May 05, 2017	Jun. 28, 2017

2) Conducted Emissions Test

Equipment	EMI Test Receiver (9kHz to 26.5GHz)	Artificial Mains	Pulse Limiter
Registration No.	EW-3156	EW-0192	EW-3248
Manufacturer	R&S	R&S	R&S
Model No.	ESR26	ESH3-Z5	E3H3-Z2
Calibration Date	Dec. 06, 2016	Aug. 26, 2016	Oct. 12, 2016
Calibration Due Date	Dec. 06, 2017	Aug. 26, 2017	Oct. 12, 2017

3) Conductive Measurement Test

Equipment	Spectrum Analyzer
Registration No.	EW-2249
Manufacturer	R&S
Model No.	FSP30
Calibration Date	Dec. 13, 2016
Calibration Due Date	Nov. 27, 2017

END OF TEST REPORT