EMC Test Report

Project Number: 4076029

Report Number: 4076029EMC08 **Revision Level:** 1

Client: Social Bicycles Inc.

Equipment Under Test: Smart Bike Share System

Model: SB3

FCC ID: 2ADEK22017SB3

IC ID: 12433A-22017SB3

Applicable Standards: FCC Part 15 Subpart C, § 15.247
RSS-247, Issue 1, May 2015
ANSI C63.10: 2013
RSS-GEN, Issue 4, November 2014

Report issued on: 07 March 2017

Test Result: Compliant

Tested by: _____
Jeremy O. Pickens, Senior EMC Engineer

Reviewed by: _____
David Schramm, EMC/RF/SAR/HAC Manager

Remarks:
This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

Table of Contents

1 Summary of Test Results

Test Description	Test Specification		Test Result
Bandwidth	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant
Transmitter Output Power	15.247(b)(3)	RSS-247 S5.4 (4)	Compliant
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant
Conducted Spurious Emissions / Band edge	15.247(d)	RSS-247 S5.5	Compliant
Radiated Spurious Emissions / Restricted Bands	15.35(b),15.209	RSS-GEN S6.13 RSS-GEN S8.10	Compliant
AC Powerline Conducted Emission	15.107, 15.207	RSS-GEN S8.8	N/A(1)

1) Not Applicable – The device is powered from internal battery.

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Social Bicycles Inc.
Address:	55 Prospect Street, Ste 304
City, State, Zip, Country:	Brooklyn, NY 11201, USA

2.1 *Test Laboratory*

Name:	SGS North America, Inc.
Address:	620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country:	Suwanee, GA 30024, USA
Accrediting Body:	A2LA
Type of lab:	Testing Laboratory
Certificate Number:	3212.01

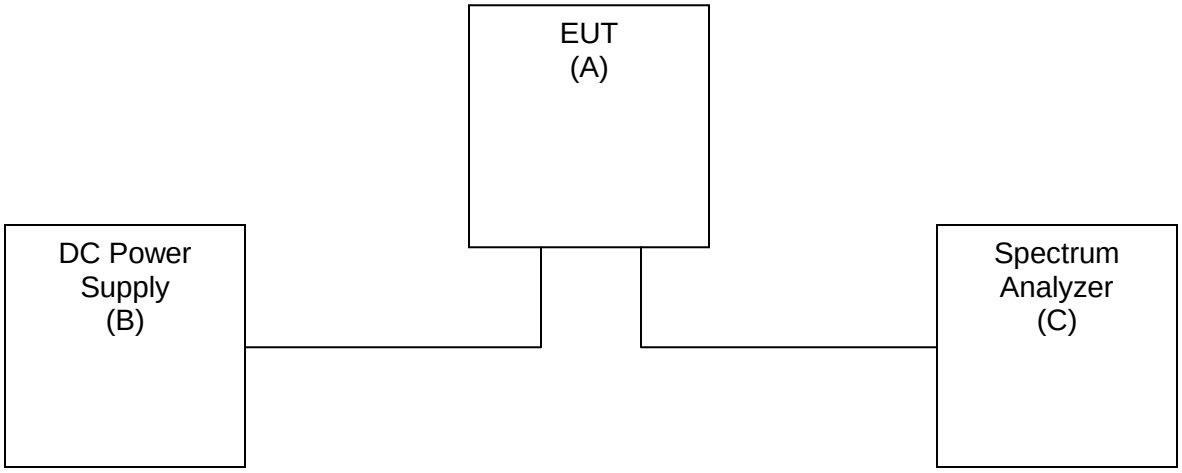
2.2 *General Information of EUT*

Type of Product:	Smart Bike Share System
Model:	SB3
Serial Number:	SC2-0139F-EBMW-0715-P03
Frequency Range:	2402 to 2480 MHz
Data Modes:	Bluetooth LE
Antenna:	Molex, P/N: 0479500001 (3dBi)
Rated Voltage:	3.7 Vdc Li-Ion Battery
Sample Received Date:	17 January 2017
Dates of testing:	17 – 18 January 2017

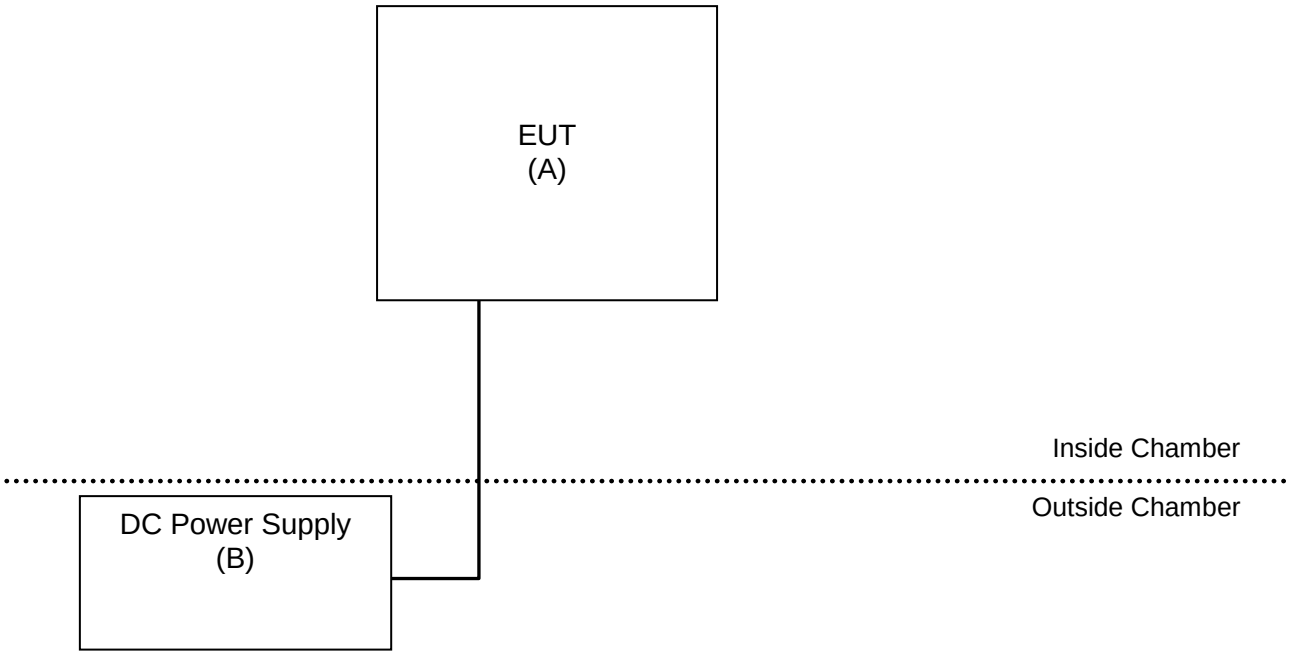
2.3 *Operating Modes and Conditions*

Continuous traffic was generated using updated firmware within the device which allowed the operator to toggle among Channels 0, 19, and 39 providing a constant modulated transmission. Where the duty cycle measured below 99% and an RMS detector was employed, corrections of 10*LOG(1/D) were applied according to KDB publication 558074 D01 DTS Meas Guidance v03r05.

2.4 *EUT Connection Block Diagram – Conducted Measurements*



2.5 *EUT Connection Block Diagram – Radiated Measurements*



2.6 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Social Bicycles	Smart Bike Share System	SB3	SC2-0139F-EBMW-0715-P03
B	Dr. Meter	DC Power Supply	PS-305DM	020210411
C	Rohde & Schwarz	Spectrum Analyzer	FSV	101595

3 Bandwidth

3.1 *Test Result*

Test Description	Test Specification		Test Result
6 dB bandwidth / 99% OBW	15.247(d)	RSS-247 S5.2 (1) RSS-GEN S6.6	Compliant

3.2 *Test Method*

The procedures from ANSI C63.10: 2013 clause 11.8 and 558074 D01 DTS Meas Guidance v03r05 were used to determine the 6 dB bandwidth and 99% OBW.

3.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 24.5 °C
Relative Humidity: 43.7 %

3.4 *Test Equipment*

Test Date: 17-Jan-2017 Tester: JOP

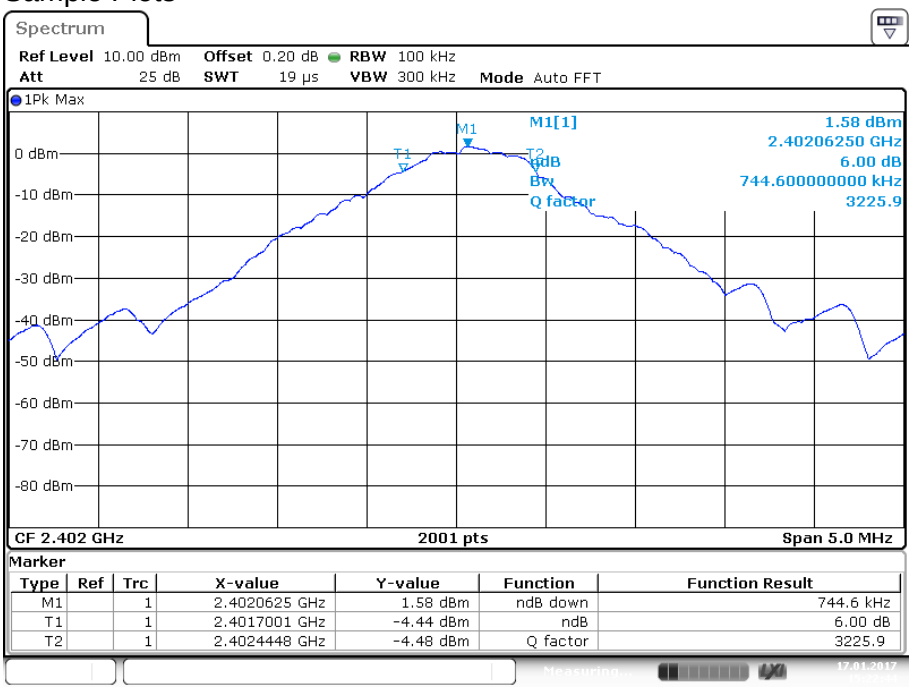
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

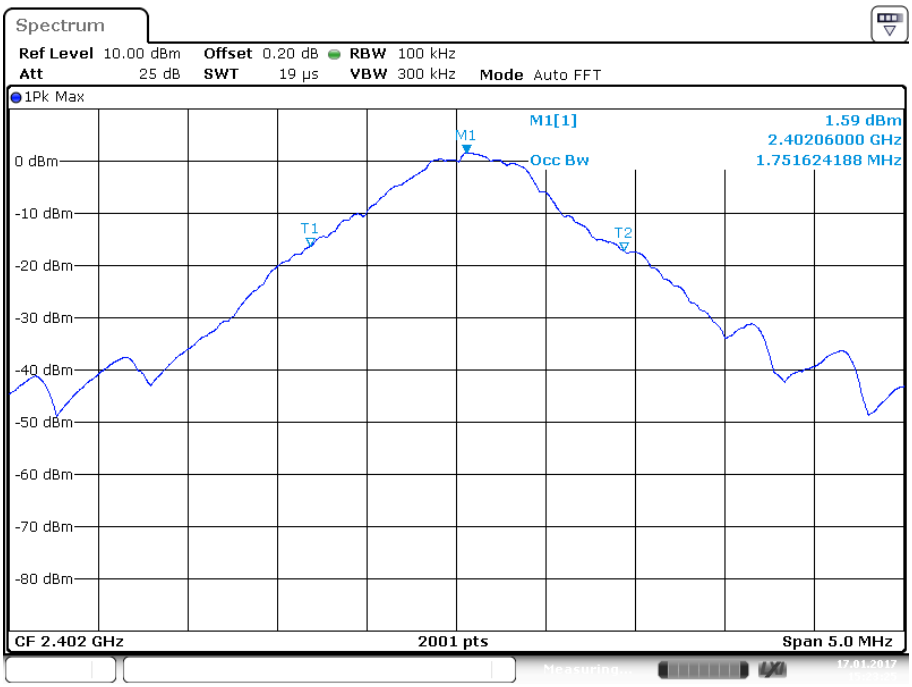
3.5 *Test Data*

Protocol	Channel	6dB Bandwidth (MHz)	Occupied Bandwidth (99%) (MHz)
BLE	0	0.745	1.752
BLE	19	0.817	1.789
BLE	39	0.835	1.729

Sample Plots



Date: 17.JAN.2017 15:22:45



Date: 17.JAN.2017 15:23:26

4 Output Power

4.1 *Test Result*

Test Description	Test Specification		Test Result
Peak Output Power	15.247(b) (3)	RSS-247 S5.4 (4)	Compliant

4.2 *Test Method*

Fundamental peak power measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.9 and KDB 558074 D01 Measurement Guidance v03r05.

Limit
(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. For using antennas with greater than 6dBi of gain, the limit is reduced in dB by the amount the gain exceeds 6dBi (e.g. for a 7.4dBi antenna, the limit is reduced from 30dBm to 28.6dBm)

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 24.5 °C
Relative Humidity: 43.7 %

4.4 *Test Equipment*

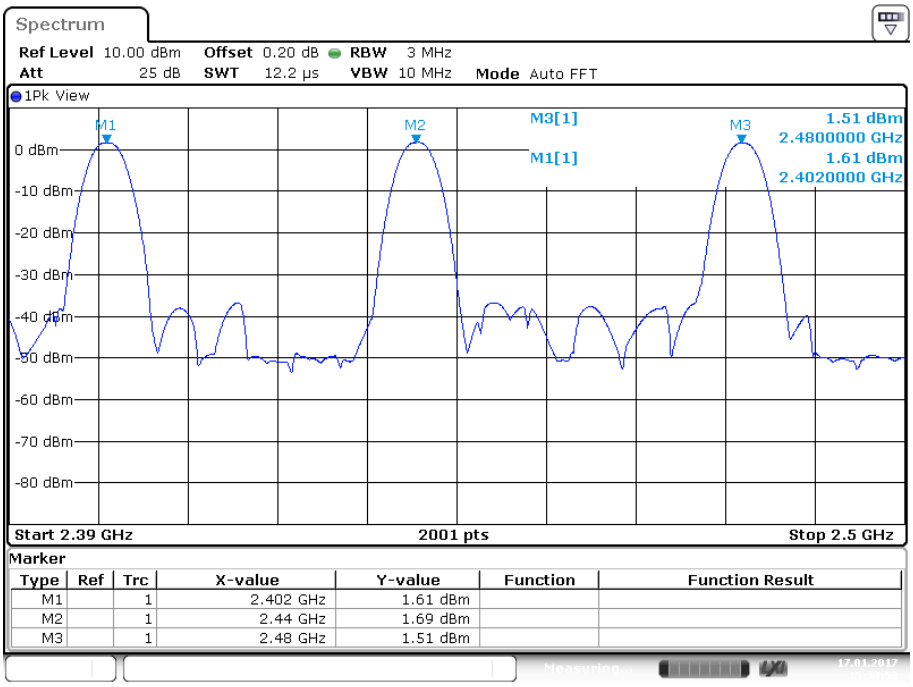
Test Date: 17-Jan-2017 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

4.5 *Test Data*

Protocol	Channel	Peak Power (dBm)	Limit (dBm)	Margin (dB)
BLE	0	1.6	30	-28.4
BLE	19	1.7	30	-28.3
BLE	39	1.5	30	-28.5



Date: 17.JAN.2017 15:34:54

5 Power Spectral Density

5.1 *Test Result*

Test Description	Test Specification		Test Result
Power Spectral Density	15.247(e)	RSS-247 S5.2 (2)	Compliant

5.2 *Test Method*

Power spectral density measurements were recorded using the procedures from ANSI C63.10: 2013 clause 11.10 and KDB 558074 D01 Measurement Guidance v03r05. The lowest data rate for each modulation was determined to be the worst-case.

Limit
The limit is 8 dBm.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 24.5 °C
Relative Humidity: 43.7 %

5.4 *Test Equipment*

Test Date: 17-Jan-2017 Tester: JOP

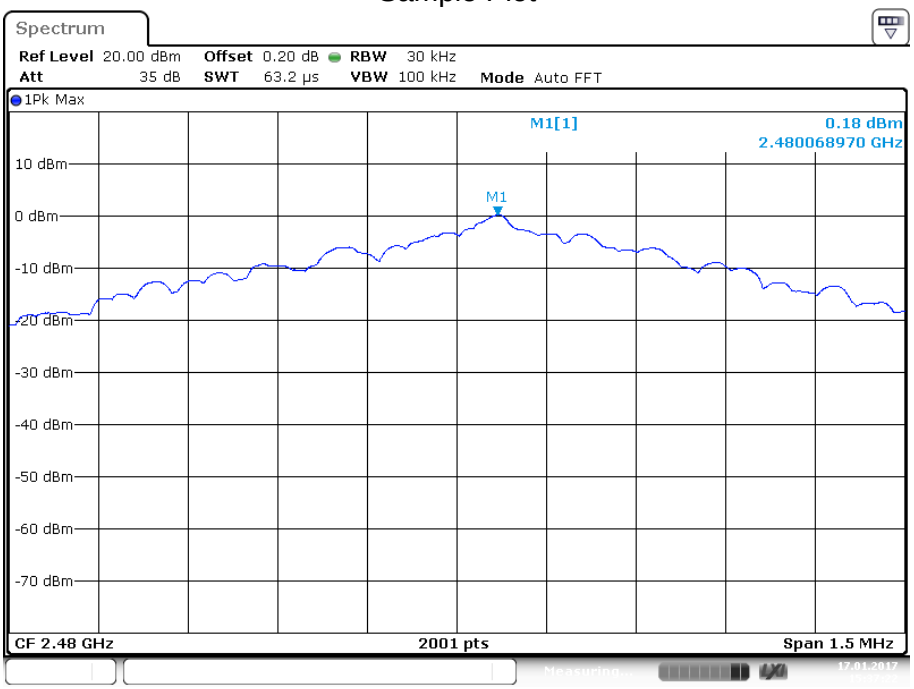
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

5.5 *Test Data*

Protocol	Channel	Peak PSD (dBm)	Limit (dBm)	Margin (dB)
BLE	0	0.02	8	-8.0
BLE	19	-0.16	8	-8.2
BLE	39	0.18	8	-7.8

Sample Plot



Date: 17.JAN.2017 15:37:22

6 Conducted Spurious Emissions

6.1 *Test Result*

Test Description	Test Specification		Test Result
Conducted Spurious Emissions	15.247(d)	RSS-247 S5.5	Compliant

6.2 *Test Method*

Spurious emissions in non-restricted frequency bands were recorded using the methods defined in ANSI C63.10: 2013 clause 11.11 and KDB 558074 D01 Measurement Guidance v03r05.

Lowest, middle, and highest channels were investigated.

Because the maximum conducted peak output power was used to determine compliance with the output power limits, the limit in any 100 kHz band outside of the authorized band is 20 dB below the maximum in-band peak level.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.5 °C
Relative Humidity: 43.7 %

6.4 *Test Equipment*

Test Date: 17-Jan-2017 Tester: JOP

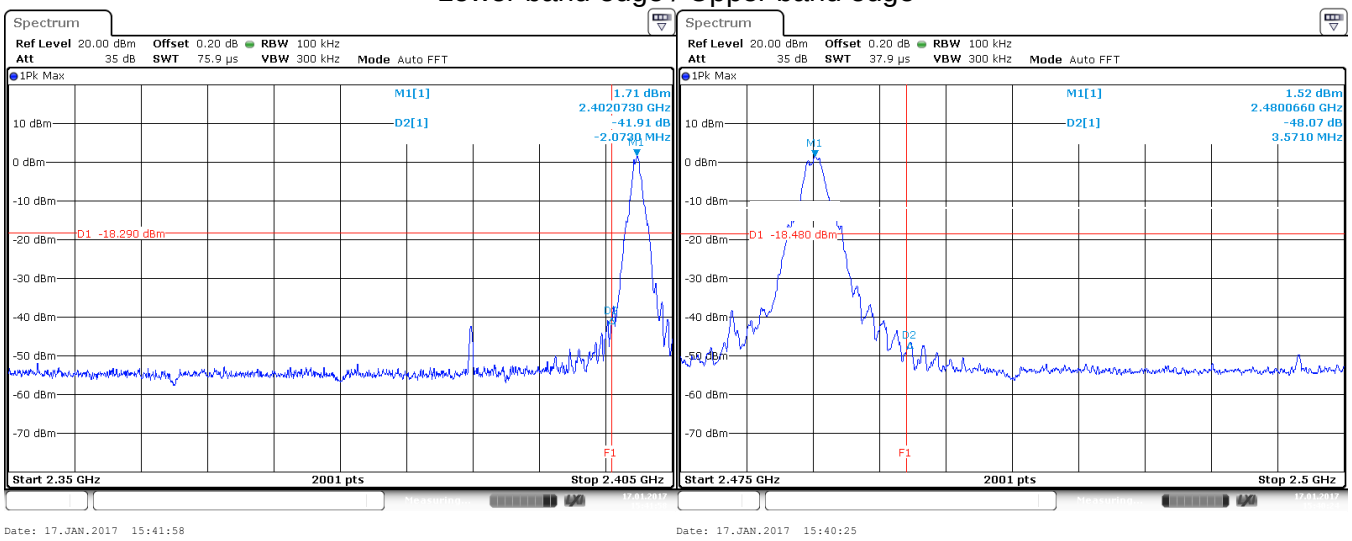
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

6.5 *Test Data – DTS Bandedge*

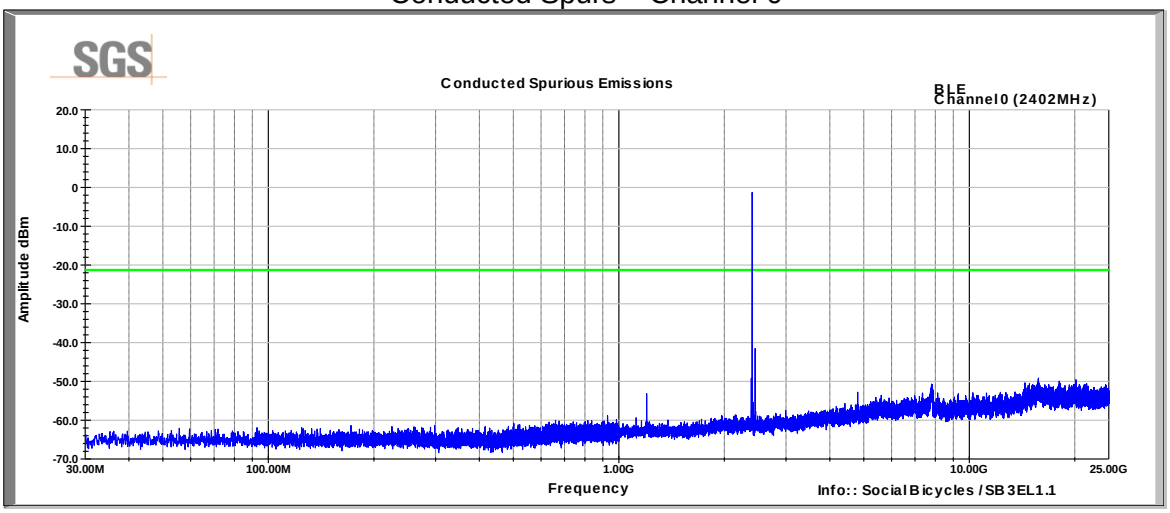
BLE

Lower band edge / Upper band edge

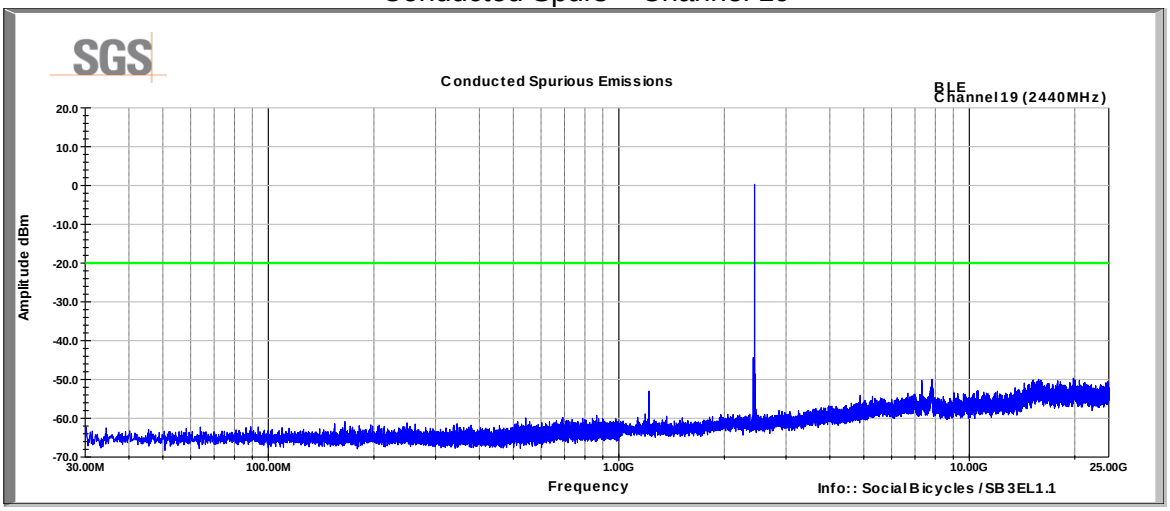


6.6 *Test Data – Conducted Spurious Emissions*

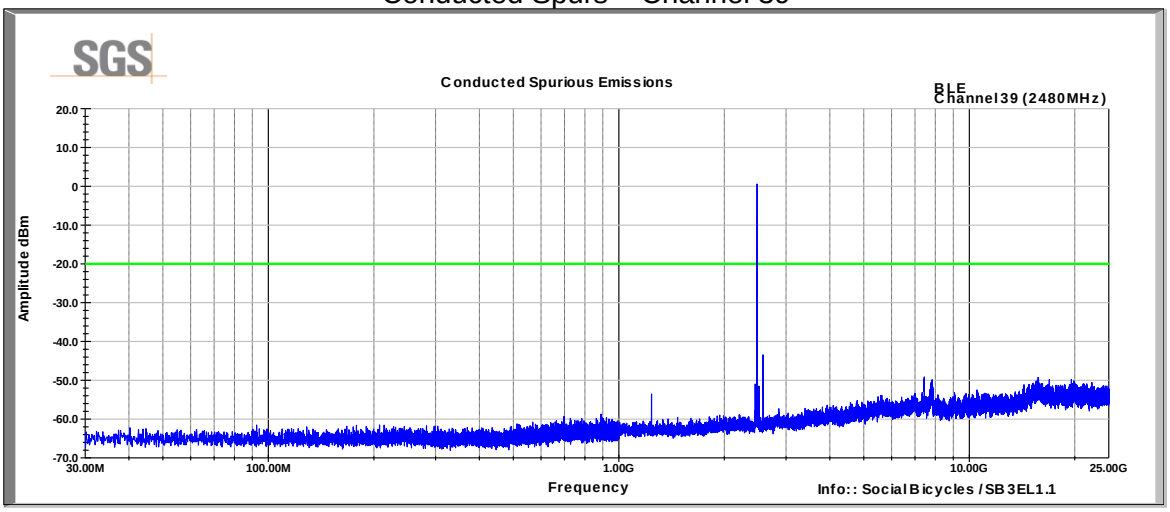
Conducted Spurs – Channel 0



Conducted Spurs – Channel 19



Conducted Spurs – Channel 39



7 Field Strength of Spurious Radiation

7.1 *Test Result*

Test Description	Test Specification		Test Result
Spurious Emissions	15.247 (d) and 15.209	RSS-247 S5.5	Compliant

7.2 *Test Method*

The measurement methods defined in ANSI C63.4: 2014 were used.

Lowest, middle, and highest channels were investigated.

Test distance:

9k to 30 MHz – Near field prescan to determine if there were any emissions.
30 to 1000 MHz - The EUT to measurement antenna distance was 3 meters
1 to 18 GHz - The EUT to measurement antenna distance was 3 meters
18 to 26 GHz - The EUT to measurement antenna distance was 1 meter

Limits within restricted bands of operation:

Frequency	Limits(1)		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
30 - 88 MHz	100	40 (2)	--
88 - 216 MHz	150	43.5 (2)	--
216 - 960 MHz	200	46 (2)	--
960 - 1000 MHz	500	54 (2)	--
1 - 40 GHz	500	54 (3)	74

(1) These limits are applicable to emissions outside of the intentional transmit frequency band.
(2) Quasi-peak limit
(3) Average limit

7.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.4 °C
Relative Humidity: 49.5 %

7.4 *Test Equipment*

Test Date: 20-Jan-2017 Tester: JOP

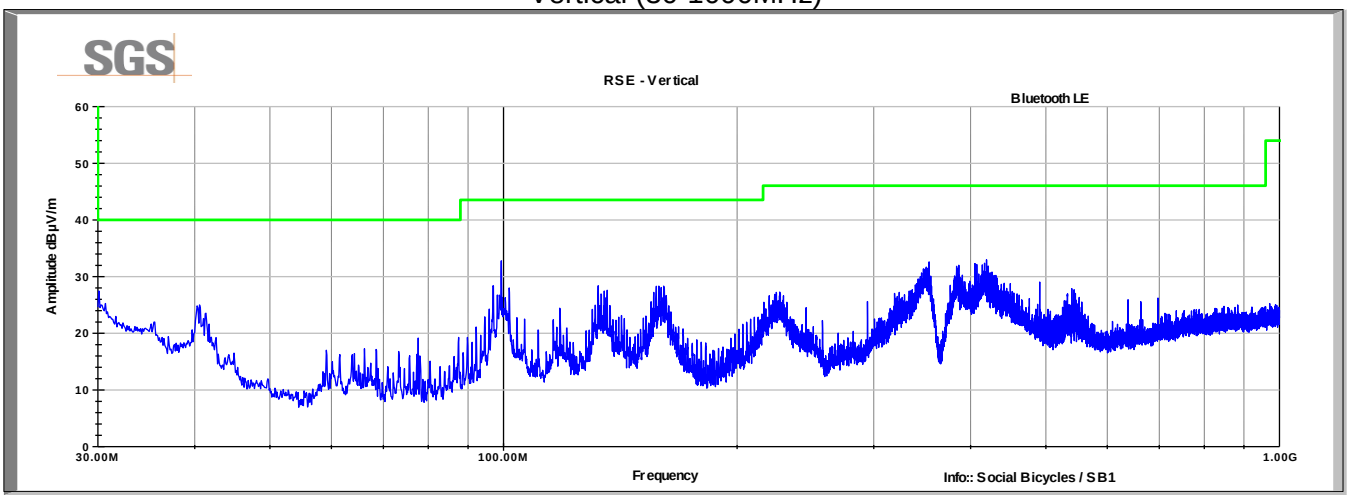
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017
ANTENNA, BILOG	JB6	SUNOL	B079690	10-Nov-2017
RF CABLE	SF106	HUBER & SUHNER	B079712	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B079713	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B079716	27-Jul-2017
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2017
RF CABLE	SF102	HUBER & SUHNER	B079824	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B085892	27-Jul-2017
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	4-Aug-2017
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	27-Jul-2017
ANTENNA, DRG HORN (SMALL)	3116B	ETS LINDGREN	B079697	29-Mar-2017
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	29-Jul-2017

Note: The equipment calibration period is 1 year.

7.5 *Test Data – Peak Plots*

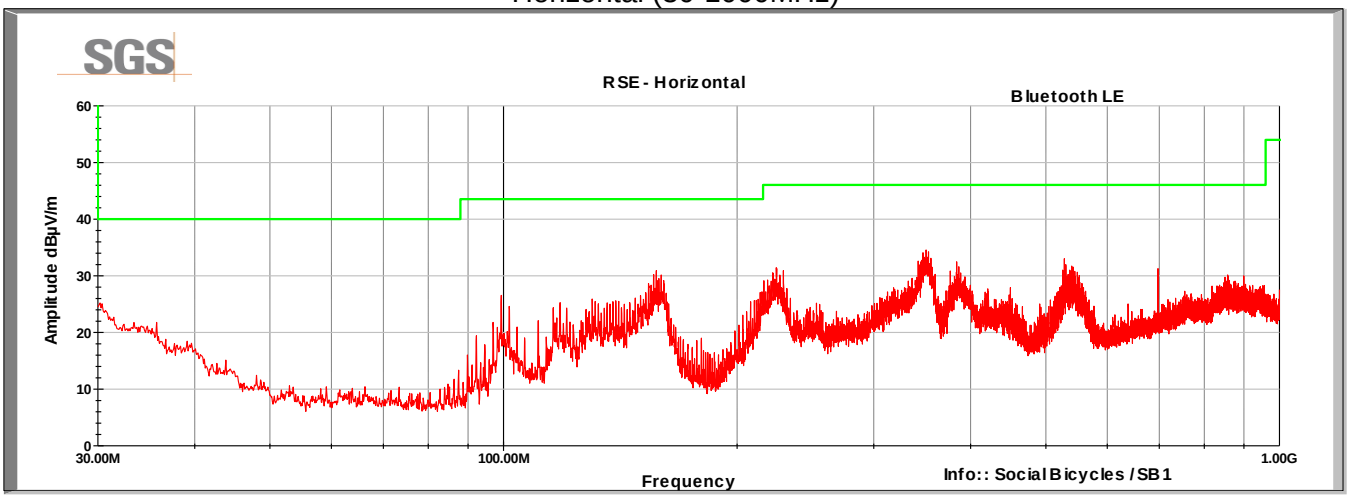
No emissions detected below 30MHz

BLE Channels 0, 19, 39
Vertical (30-1000MHz)



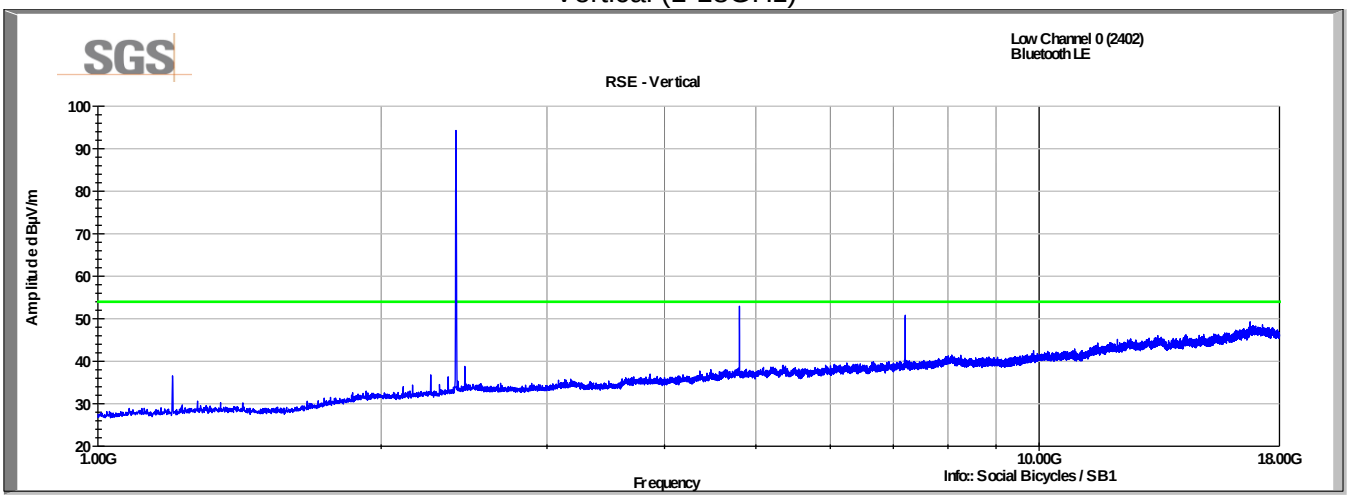
No emissions detected within 10dB of the limit

BLE Channels 0, 19, 39
Horizontal (30-1000MHz)

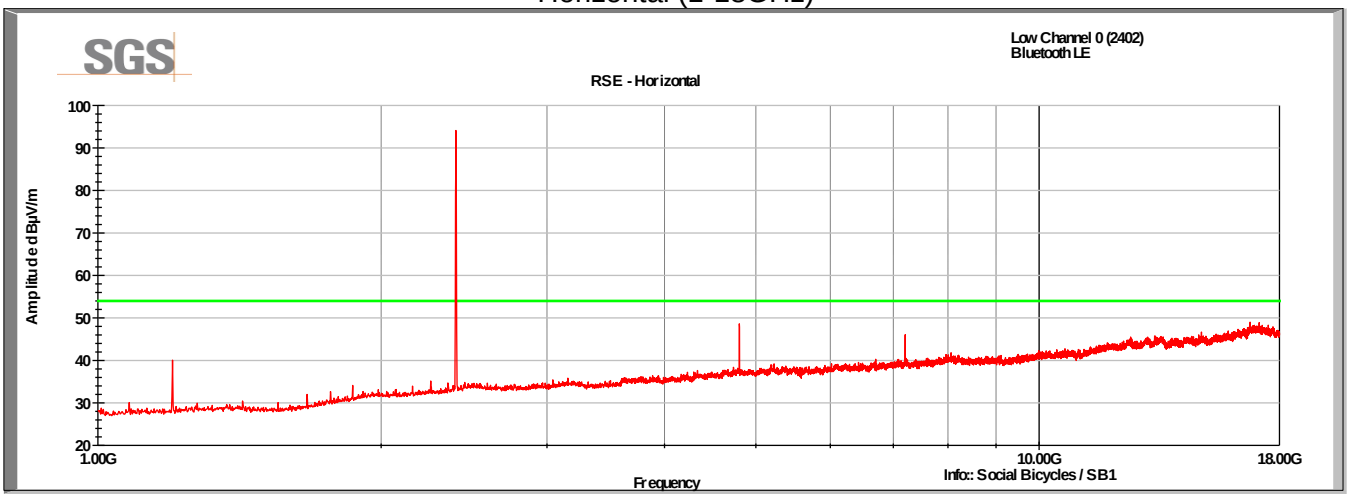


No emissions detected within 10dB of the limit

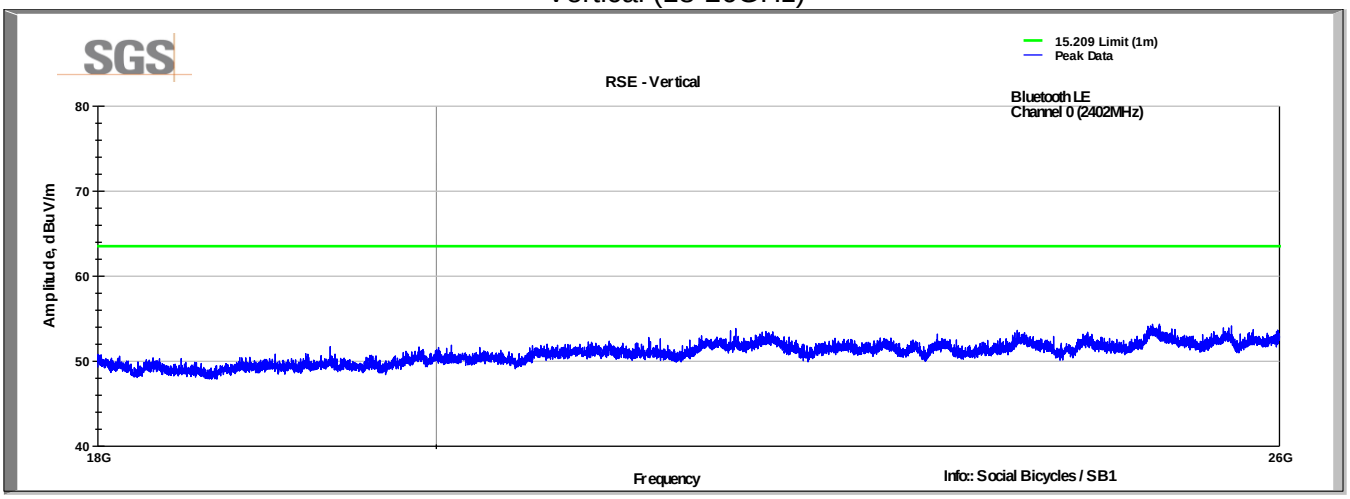
BLE Channel 0
Vertical (1-18GHz)



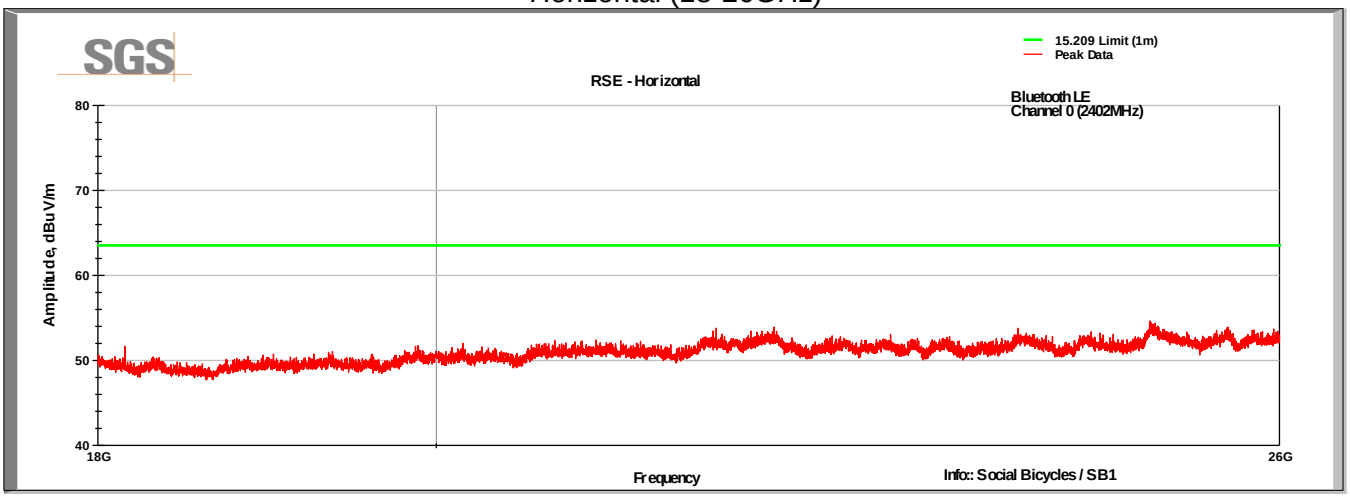
BLE Channel 0
Horizontal (1-18GHz)



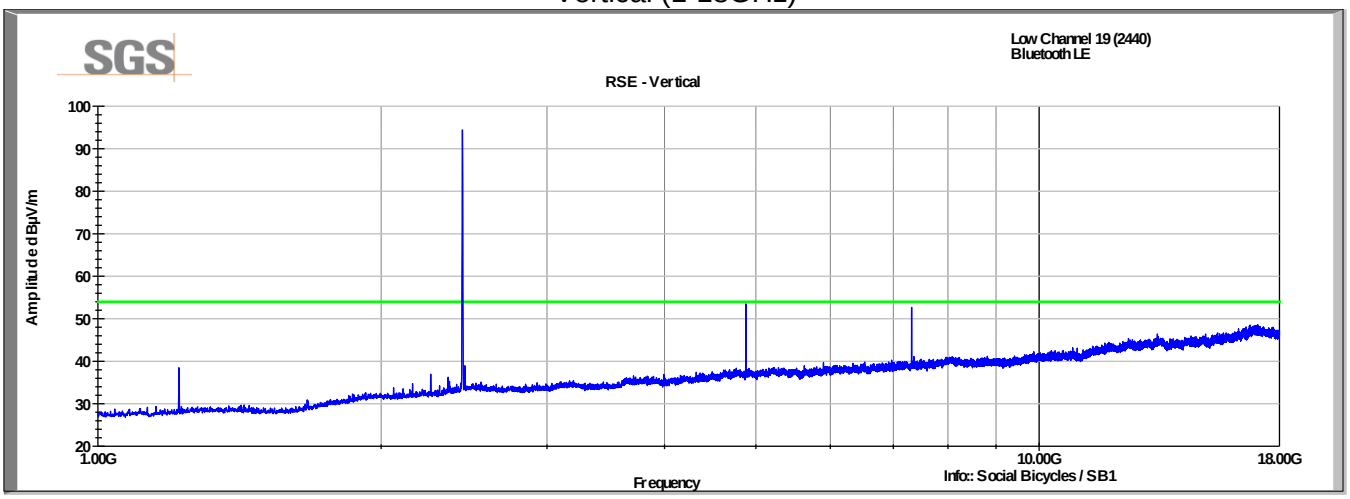
BLE Channel 0
Vertical (18-26GHz)



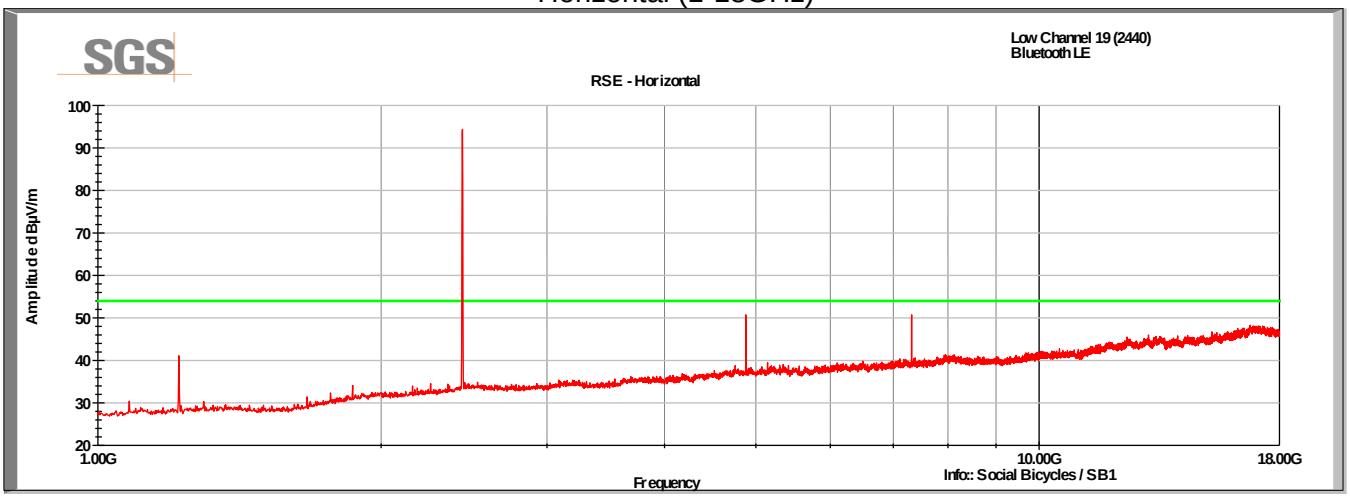
BLE Channel 0
Horizontal (18-26GHz)



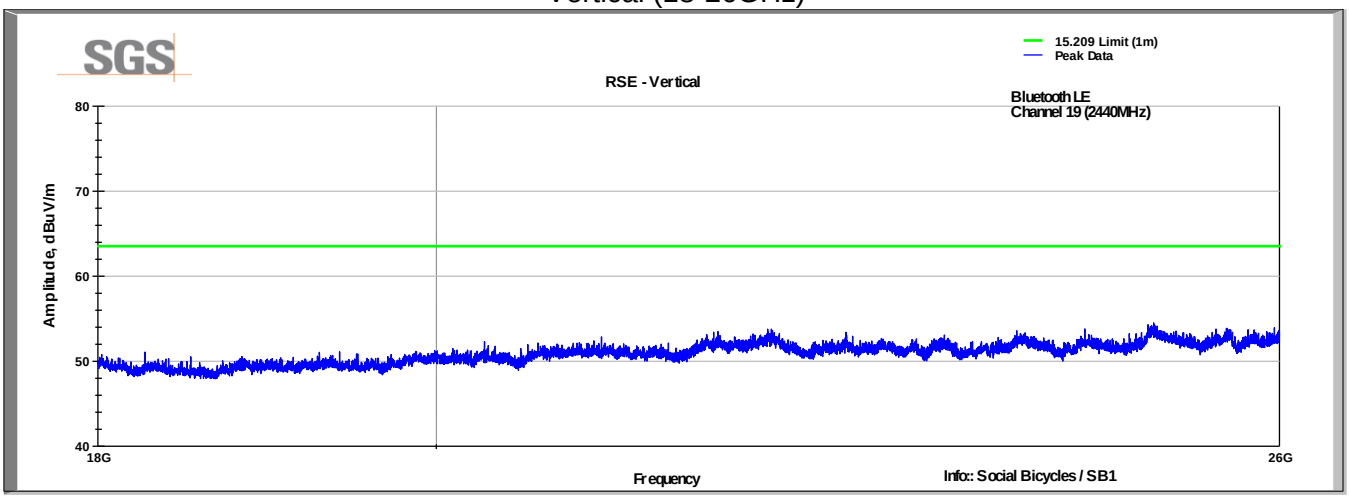
BLE Channel 19
Vertical (1-18GHz)



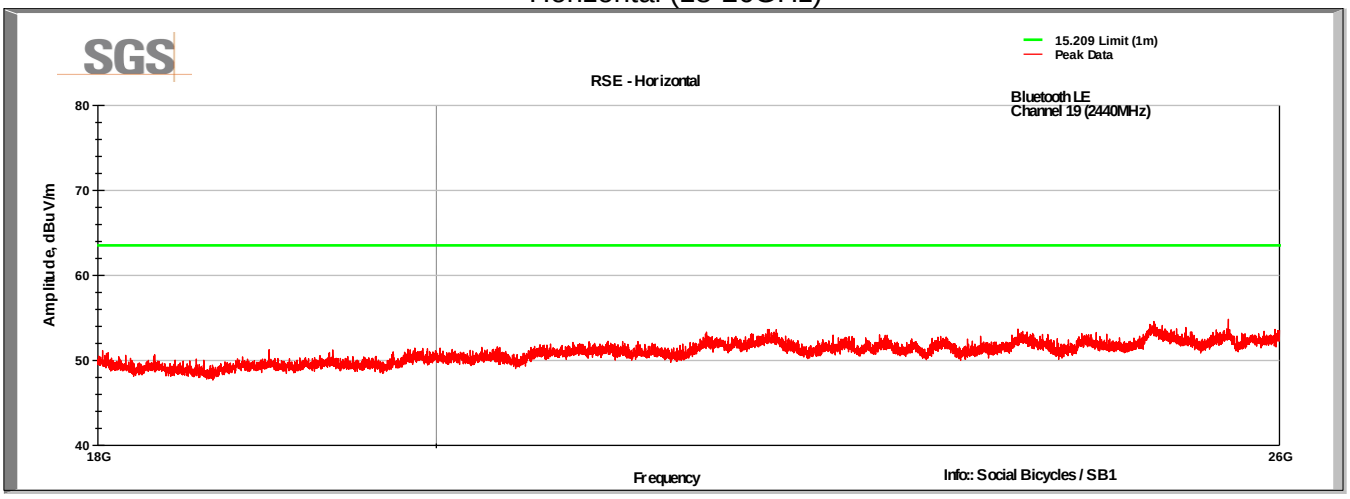
BLE Channel 19
Horizontal (1-18GHz)



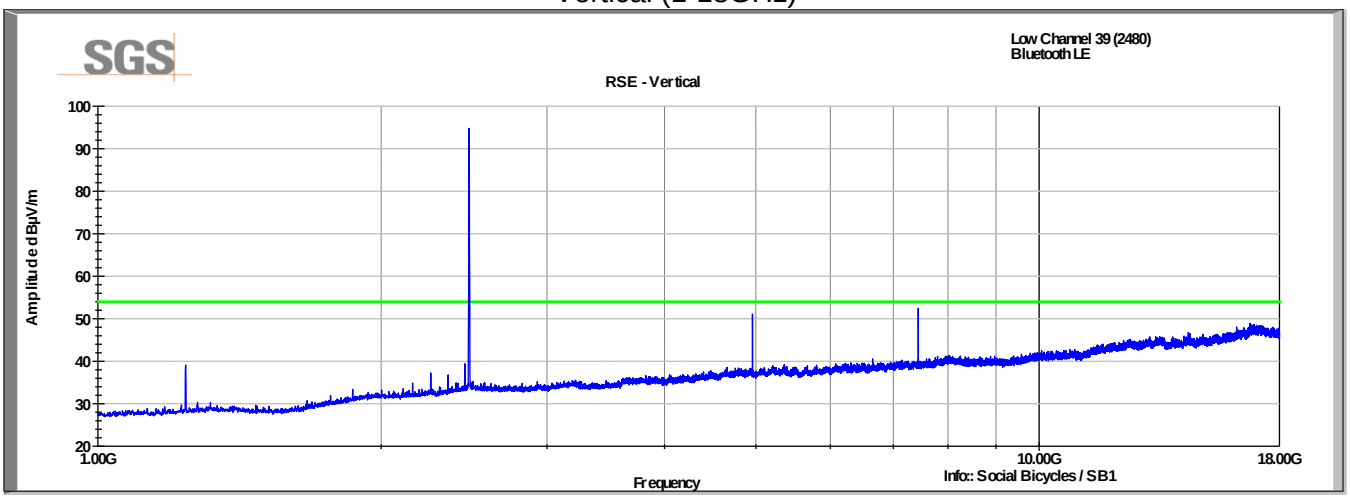
BLE Channel 19
Vertical (18-26GHz)



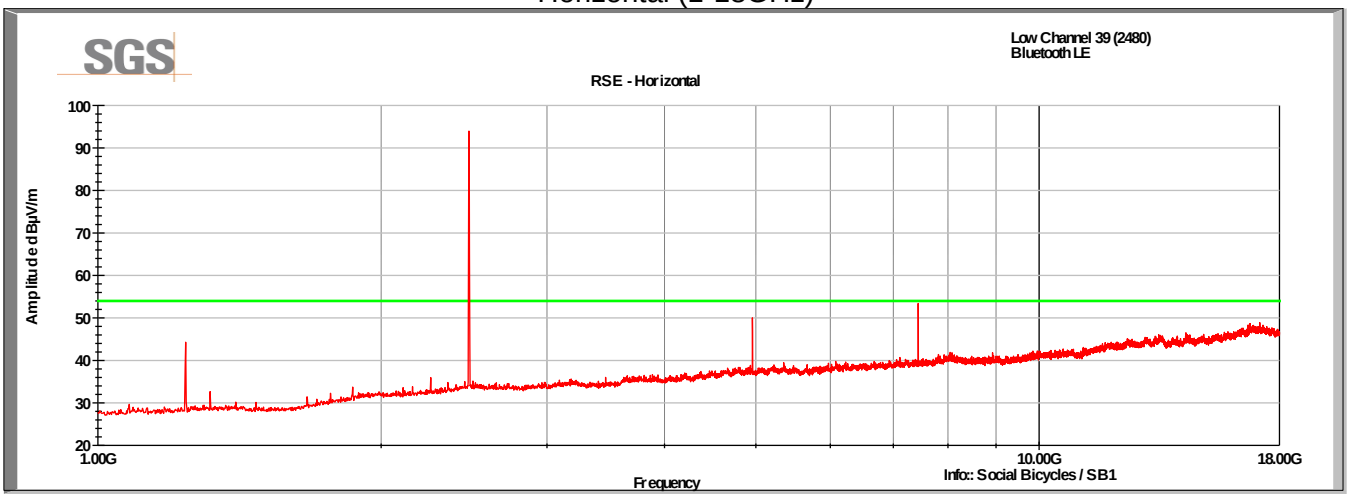
BLE Channel 19
Horizontal (18-26GHz)



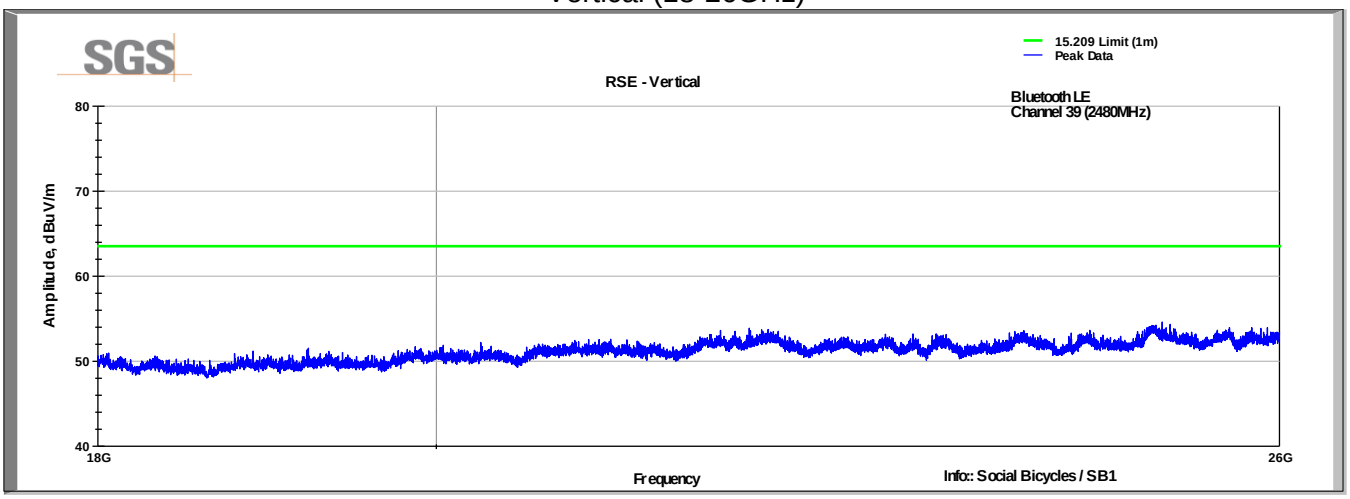
BLE Channel 39
Vertical (1-18GHz)



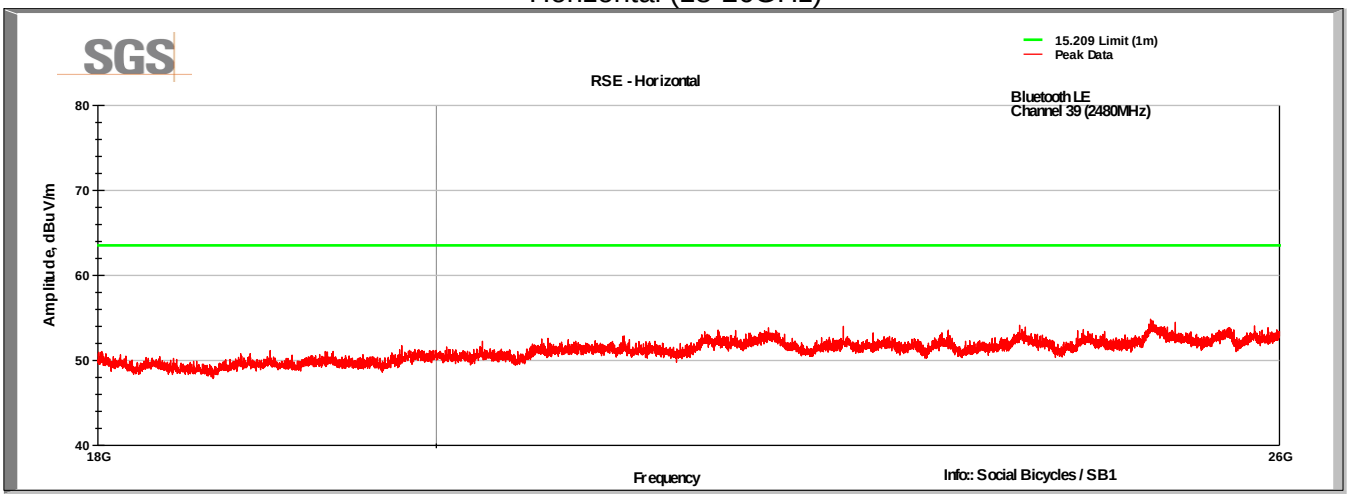
BLE Channel 39
Horizontal (1-18GHz)



BLE Channel 39
Vertical (18-26GHz)



BLE Channel 39
Horizontal (18-26GHz)



7.6 *Test Data – Tabular Data*

Frequency MHz	Raw Meas (dBuV)	Polarity (V/H)	Correction (dB/m)	Corr Value dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector
Channel 0 (2402MHz)							
4804.00	48.8	V	4.1	52.9	74.0	-21.1	Peak
4804.00	47.3	V	4.1	51.4	54.0	-2.6	Average
4804.00	44.5	H	4.1	48.6	74.0	-25.4	Peak
4804.00	43.0	H	4.1	47.1	54.0	-6.9	Average
7206.00	47.0	V	3.8	50.8	NA	NA	Peak
Channel 19 (2440MHz)							
4880.00	49.4	V	4.1	53.5	74.0	-20.5	Peak
4880.00	47.9	V	4.1	52.0	54.0	-2.0	Average
4880.00	46.6	H	4.1	50.7	74.0	-23.3	Peak
4880.00	45.1	H	4.1	49.2	54.0	-4.8	Average
7320.00	46.1	V	6.5	52.6	74.0	-21.4	Peak
7320.00	44.6	V	6.5	51.1	54.0	-2.9	Average
7320.00	44.2	H	6.5	50.7	74.0	-23.3	Peak
7320.00	42.7	H	6.5	49.2	54.0	-4.8	Average
Channel 39 (2480MHz)							
4960.00	46.8	V	4.3	51.1	74.0	-22.9	Peak
4960.00	45.3	V	4.3	49.6	54.0	-4.4	Average
4960.00	45.7	H	4.3	50.0	74.0	-24.0	Peak
4960.00	44.2	H	4.3	48.5	54.0	-5.5	Average
7440.00	45.8	V	6.6	52.4	74.0	-21.6	Peak
7440.00	44.3	V	6.6	50.9	54.0	-3.1	Average
7440.00	46.8	H	6.6	53.4	74.0	-20.6	Peak
7440.00	45.3	H	6.6	51.9	54.0	-2.1	Average

* These harmonics do not lie within restricted bands, so the 15.209 limits are not applicable at these frequencies.

8 Radiated Emissions at Band Edge / Restricted Band

8.1 *Test Result*

Test Description	Test Specification		Test Result
Spurious Emissions	15.205 / 15.209	RSS-GEN S8.9 / 8.10	Compliant

8.2 *Test Method*

Radiated field strength measurements were performed at the restricted band edges of 2390MHz and 2483.5MHz for each modulation. Measurements were made using the conducted methods defined in Section 12 of FCC publication D01 DTS Meas Guidance v03r05.

Offset Calculations:
Offset calculations so that conducted measurements on the spectrum analyzer in dBµV represent field strength measurements in dBµV/m.

Offset = -20Log(D) + 104.8 - 107 + CL + DC + AG
$Offset_{3m}$ = -11.7 + CL + DC + AG

D = 3m	Distance
CL = 0.2 dB	Cable Loss
DC = 0.3 dB (93.7%)	Duty Cycle Correction Factor
AG = 3 dBi	Antenna Gain

Offset = -8.2 dB

8.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 24.5 °C
Relative Humidity: 43.7 %

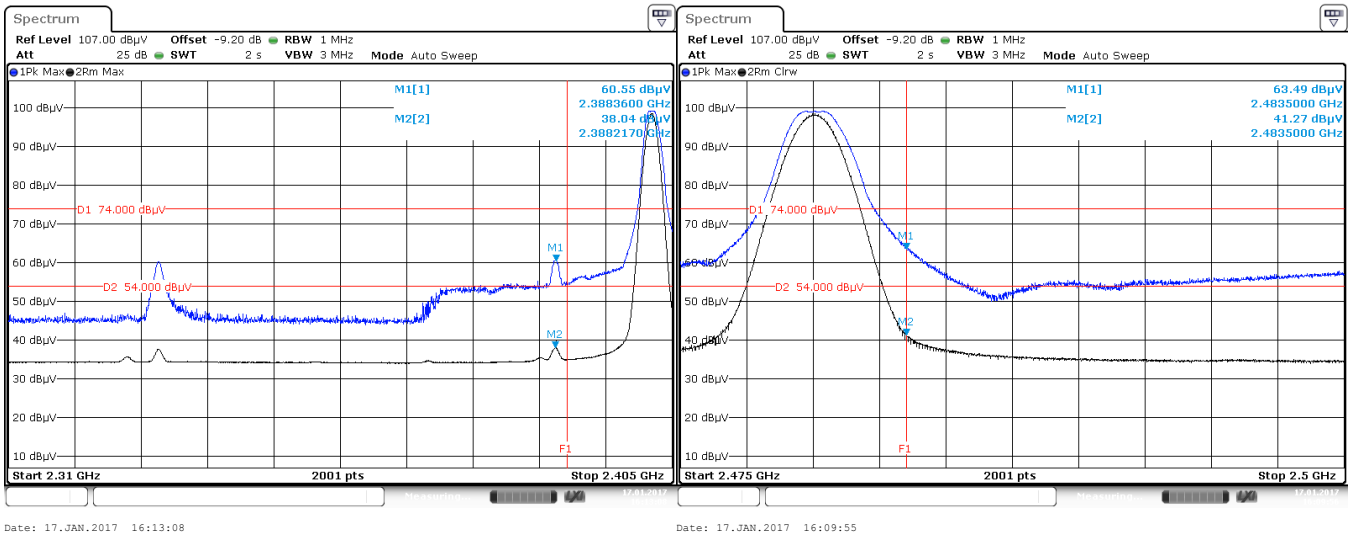
8.4 *Test Equipment*

Test Date: 17-Jan-2017 Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

Note: The equipment calibration period is 1 year except for the FSV30 which is on a 2-year cycle.

8.5 *Test Data – Restricted Band Edge*



Channel	Frequency (MHz)	Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measuremnt Detector
0	2388	61.55	74	-12.45	Peak
0	2388	39.04	54	-14.96	RMS
39	2483.5	64.99	74	-9.01	Peak
39	2483.5	42.27	54	-11.73	RMS

*Note: original plots taken assuming a 2dBi antenna gain. Tables adjusted by 1dB to reflect actual 3dBi gain.

9 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	31 January 2017
1	Changed references from “SB1” to “SB3” Corrected FCC and IC IDs	07 March 2017