EMC Test Report

Project Number: 4076029

Report Number: 4076029EMC02 **Revision Level:** 1

Client: Social Bicycles Inc.

Equipment Under Test: Smart Bike Share System

Model: SB3

FCC ID: 2ADEK22017SB3

IC ID: 12433A-22017SB3

FCC Rule Parts: Part 2, Part 22(H), Part 24(E)

Industry Canada: RSS-GEN, Issue 4: 2014

RSS-132, Issue 3: 2013

RSS-133, Issue 6: 2013

Report issued on: 07 March 2017

Test Result: Compliant

Tested by: Martin Taylor, Project Engineer

Reviewed by: Jeremy Pickens, Senior EMC Engineer

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

Reference Sections		Test Description	Test Limit	Test Condition	Test Result
FCC	IC				
2.1046	RSS-GEN (6.12)	Conducted Output Power	N/A	Conducted	Reported
24.232(d)	RSS-132 (5.4) RSS-133 (6.4)	Peak-to-Average Ratio	<13 dB		Pass
2.1049 22.917(a) 24.238(a)	RSS-GEN(6.6) RSS-133 (2.3)	Occupied Bandwidth	N/A		Reported
2.1051 22.917(a) 24.238(a)	RSS-132 (5.5) RSS-133 (6.5.1)	Band Edge / Conducted Spurious Emissions	< 43 +10log$_{10}$ ($P_{[Watts]}$) at band edge and for all out of band emissions		Pass
22.913(a)(2)	--	Effective Radiated Power	< 7 Watts max ERP	Radiated	Pass
--	RSS-132 (5.4)	Equivalent Isotropically Radiated Power	< 11.5 Watts max ERP		Pass
24.232(c)	RSS-133 (6.4) SRSP-510 (5.1.2)		< 2 Watts max EIRP		Pass
2.1053 22.917(a) 24.238(a)	RSS-GEN (6.13) RSS-132 (5.5) RSS-133 (6.5.1)	Radiated Spurious Emissions	< 43 +10log$_{10}$ ($P_{[Watts]}$) at band edge and for all out of band emissions		Pass
2.1055 22.917(a) 24.238(a)	RSS-GEN (6.11) RSS-132 (5.3) RSS-133 (6.3)	Frequency Stability	<2.5 ppm		Pass

1.1 Modifications Required to 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

2.2 Test Laboratory

Name:	SGS North America, Inc.
Address:	620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country:	Suwanee, GA 30024, USA

2.3 General Information of EUT

Type of Product:	Smart Bike Share System
Model Number:	SB3
Serial Number:	SC2-02AD5-EBMW-0716-P09 (Conducted) SC2-02B6E-EBMW-0716-P09 (Radiated)
IMEI Number:	356118040855322 (Conducted) 356118040981078 (Radiated)
Rated Voltage:	3.7 Vdc
Test Voltage:	3.7 Vdc
Tx Frequency Range:	826.4– 846.6 MHz (WCDMA Band V) 1852.4– 1907.6 MHz (WCDMA Band II)
Antenna:	Antenova, P/N: A10340, Peak Gain: 1.7 / 3.0 dBi (850/1900 Bands)
FCC Classification:	PCS Licensed Transmitter PCB
Type:	Pre Production
Sample Received Date:	05 December 2016
Dates of testing:	07 – 23 December 2016

2.4 Operating Modes and Conditions

The EUT was exercised by connecting a CMW communications tester to the device. The CMW was used to control signaling and channel during testing.

3 RF Output Power

3.1 Test Result

Test Description	Basic Standards	Test Result
RF Output Power	FCC Part 2.1046 RSS-GEN (6.12)	Reported

3.2 Test Method

A radio link was established between EUT and Radio Communication Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester. The CMW500 was used to measure the output power.

The measurements were conducted at the low, middle, and high channel.

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	23.0 °C
Relative Humidity:	38.8 %
Atmospheric Pressure:	97.9 kPa

3.4 Test Equipment

Test Date: 7-Dec-2016 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2017

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 2 year calibration cycle.

3.5 Test Data

Band	UpLink Channel	UL Frequency (MHz)	Subtest	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
Band 2	9262	1852.4	Subtest1	20.10	1.08	21.18
Band 2	6400	1880	Subtest1	20.16	1.08	21.24
Band 2	9538	1907.6	Subtest1	20.14	1.12	21.26
Band 2	9262	1852.4	Subtest2	20.44	1.08	21.52
Band 2	6400	1880	Subtest2	20.11	1.08	21.19
Band 2	9538	1907.6	Subtest2	20.20	1.12	21.32
Band 2	9262	1852.4	Subtest3	19.82	1.08	20.9
Band 2	6400	1880	Subtest3	19.04	1.08	20.12
Band 2	9538	1907.6	Subtest3	18.98	1.12	20.1
Band 2	9262	1852.4	Subtest4	18.05	1.08	19.13
Band 2	6400	1880	Subtest4	18.03	1.08	19.11
Band 2	9538	1907.6	Subtest4	17.93	1.12	19.05
Band 5	4132	826.4	Subtest1	22.05	0.7	22.75
Band 5	4175	835	Subtest1	21.45	0.7	22.15
Band 5	4233	846.6	Subtest1	21.25	0.7	21.95
Band 5	4132	826.4	Subtest2	21.97	0.7	22.67
Band 5	4175	835	Subtest2	21.42	0.7	22.12
Band 5	4233	846.6	Subtest2	21.71	0.7	22.41
Band 5	4132	826.4	Subtest3	20.59	0.7	21.29
Band 5	4175	835	Subtest3	20.51	0.7	21.21
Band 5	4233	846.6	Subtest3	20.75	0.7	21.45
Band 5	4132	826.4	Subtest4	20.04	0.7	20.74
Band 5	4175	835	Subtest4	19.47	0.7	20.17
Band 5	4233	846.6	Subtest4	19.75	0.7	20.45

Band II Max: 21.52dBm (0.142W)
Band V Max: 22.75dBm (0.188W)

4 Peak to Average Ratio

4.1 Test Result

Test Description	Basic Standards	Test Result
Peak to Average Ratio	FCC 24.232(d) RSS-132 (5.4) RSS-133 (6.4)	Pass

4.2 Test Method

KDB document 971168 D01 Power Meas License Digital Systems v02r02 was used to determine peak-to-average ratio. For the measurements, Clause 5.7.1 was used which defined the measurement method using the CCDF function of the spectrum analyzer. Measurements were recorded at the mid channels at the highest power.

4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	21.9 °C
Relative Humidity:	40.5 %
Atmospheric Pressure:	97.8 kPa

4.4 Test Equipment

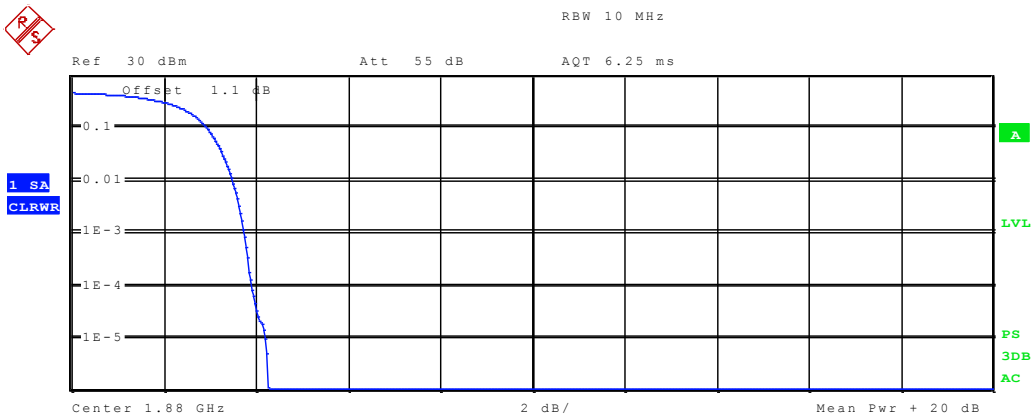
Test Date: 7-Dec-2016 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2017
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 2 year calibration cycle

4.5 Test Data

WCDMA – Band II CH 9400

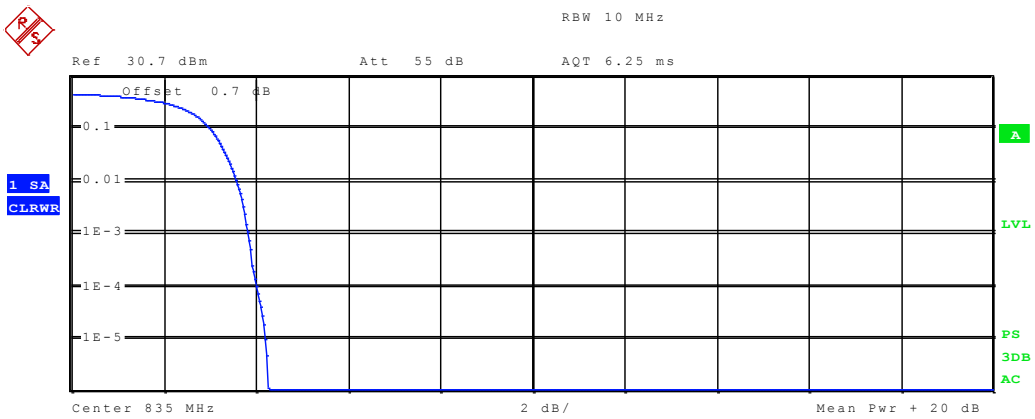


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	16.00 dBm
Peak	20.26 dBm
Crest	4.26 dB
10 %	2.92 dB
1 %	3.46 dB
.1 %	3.72 dB
.01 %	3.91 dB

Date: 8.DEC.2016 15:45:51

WCDMA – Band V CH 4175



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	19.27 dBm
Peak	23.53 dBm
Crest	4.26 dB
10 %	2.98 dB
1 %	3.56 dB
.1 %	3.81 dB
.01 %	4.01 dB

Date: 7.DEC.2016 14:03:59

5 Occupied Bandwidth

5.1 Test Result

Test Description	Basic Standards	Test Result
Occupied Bandwidth	FCC Part 2.1049 FCC Part 22.917(a) FCC Part 24.238(a) RSS-GEN(6.6) RSS-133 (2.3)	Reported

5.2 Test Method

KDB document 971168 D01 Power Meas License Digital Systems v02r02, Clause 4 was used to determine the occupied measurement.

The 99% measurement function of the spectrum analyzer was used.

The measurement was conducted at the center channel of each band.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	21.9 °C
Relative Humidity:	40.5 %
Atmospheric Pressure:	97.8 kPa

5.4 Test Equipment

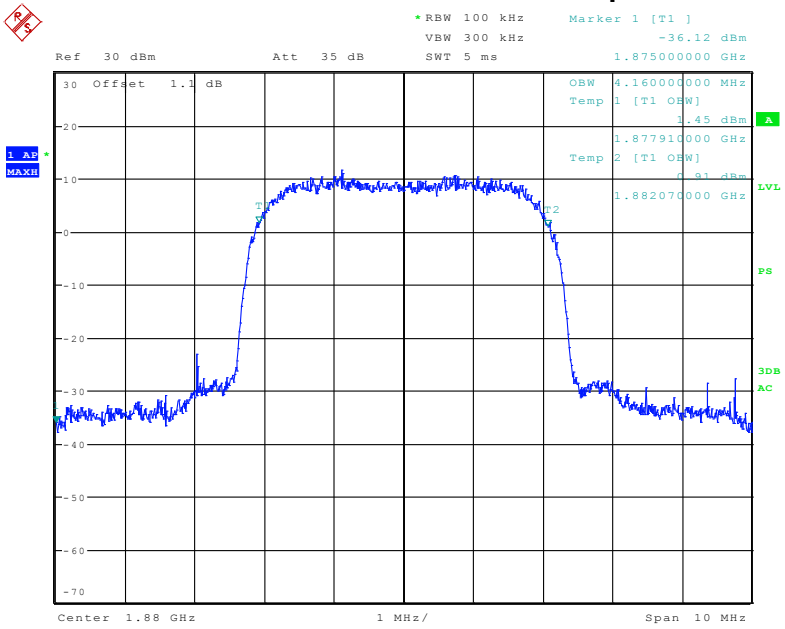
Test Date: 7-Dec-2016 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2017
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 2 year calibration cycle

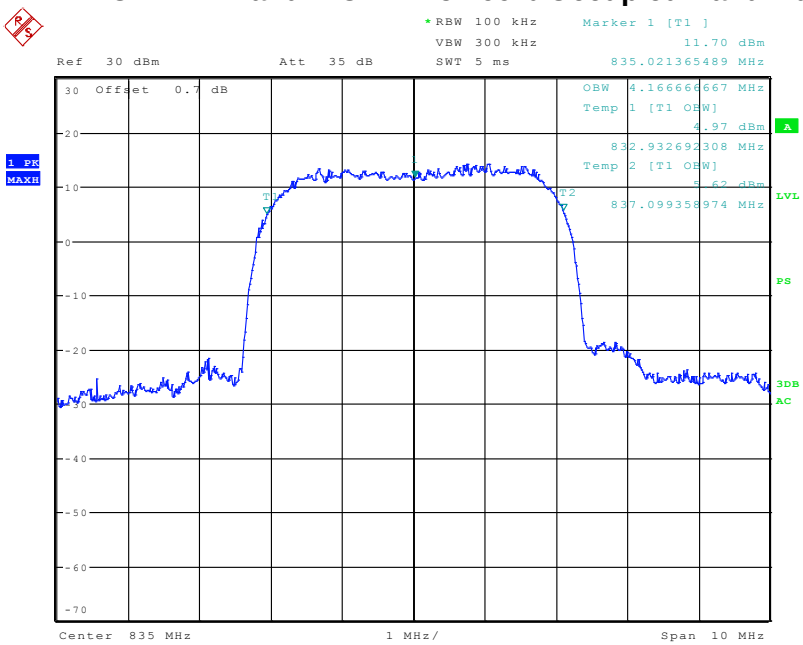
5.5 Test Data

WCDMA – Band II CH 9400 - 99% Occupied Bandwidth



Date: 8.DEC.2016 15:32:29

WCDMA – Band V CH 4175 - 99% Occupied Bandwidth



Date: 7.DEC.2016 18:18:28

6 Band Edge and Conducted Spurious Emissions

6.1 Test Result

Test Description	Basic Standards	Test Result
Conducted spurious emissions and Band Edge	2.1051 22.917(a) 24.238(a) RSS-132 (5.5) RSS-133 (6.5.1)	Pass

6.2 Test Method

KDB document 971168 D01 Power Meas License Digital Systems v02r02, Clause 6 was used to measure spurious emissions at the antenna terminals.

6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	22.5 °C
Relative Humidity:	32.5 %
Atmospheric Pressure:	98.2 kPa

6.4 Test Equipment

Test Date: 7-Dec-2016 Tester: MT

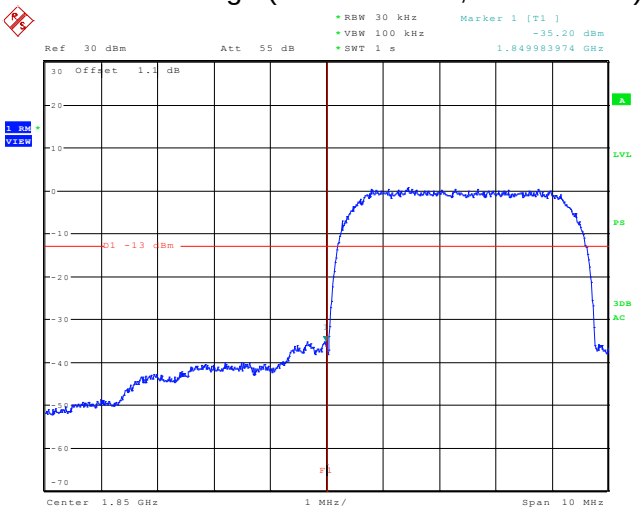
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2017
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 2 year calibration cycle

6.5 Test Data

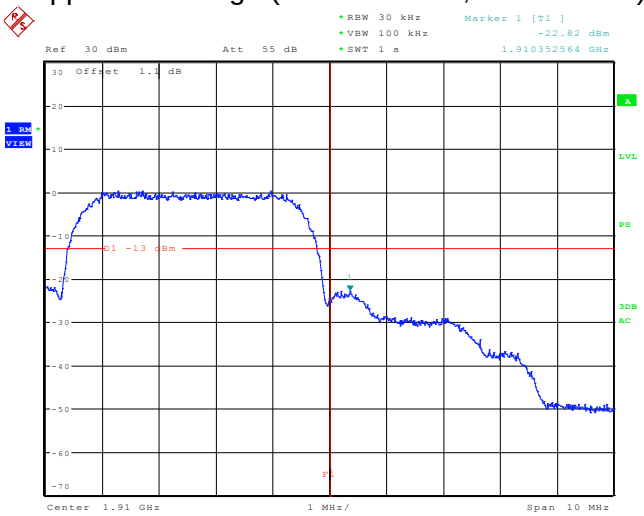
WCDMA, Band II

Lower Band Edge (Channel 9262, 1852.4 MHz)



Date: 8.DEC.2016 13:21:14

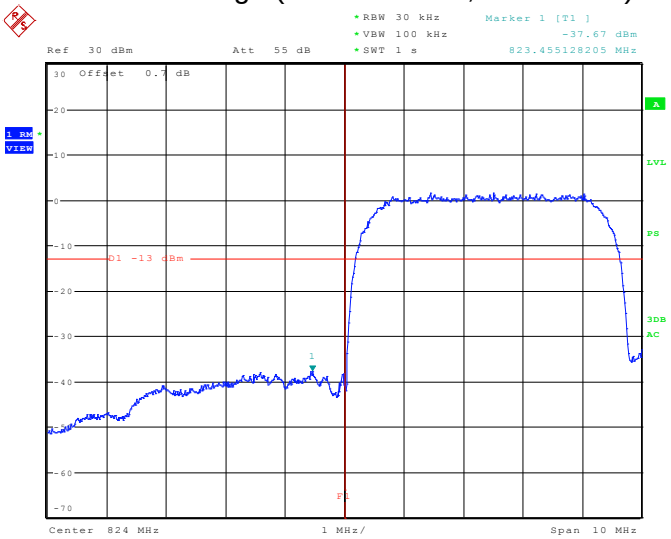
Upper Band Edge (Channel 9538, 1907.6 MHz)



Date: 8.DEC.2016 13:24:34

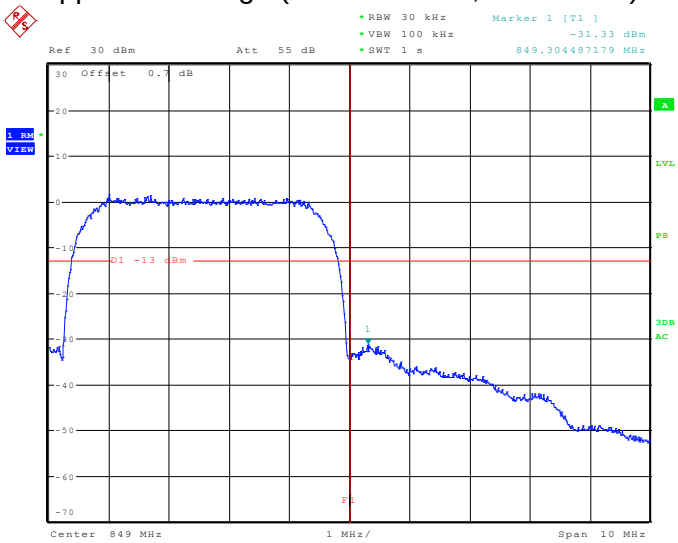
WCDMA, Band V

Lower Band Edge (Channel 4132, 826.4 MHz)



Date: 8.DEC.2016 14:32:23

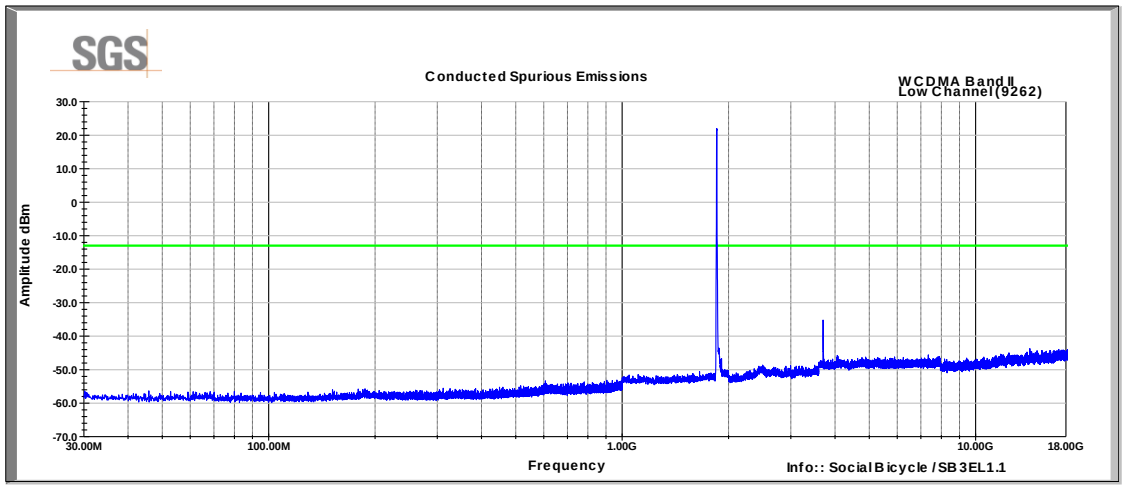
Upper Band Edge (Channel 4233, 846.6 MHz)



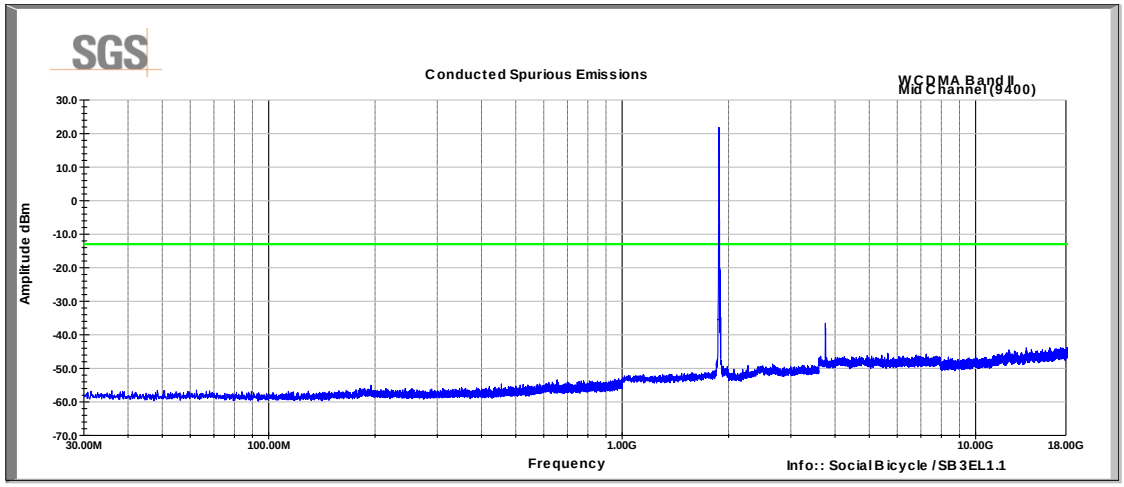
Date: 8.DEC.2016 14:25:18

6.6 *Conducted Spurious Emissions Plot*

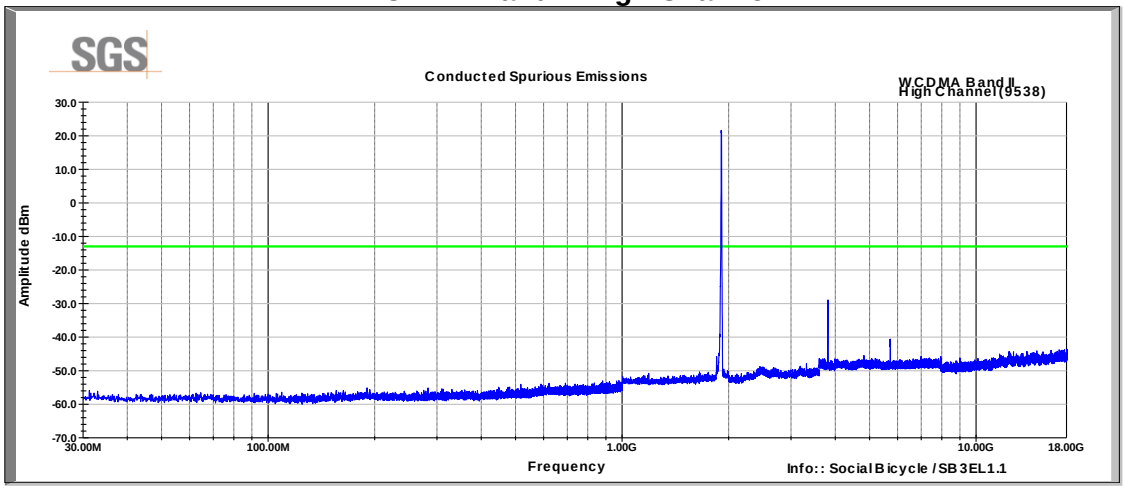
WCDMA Band II Low Channel



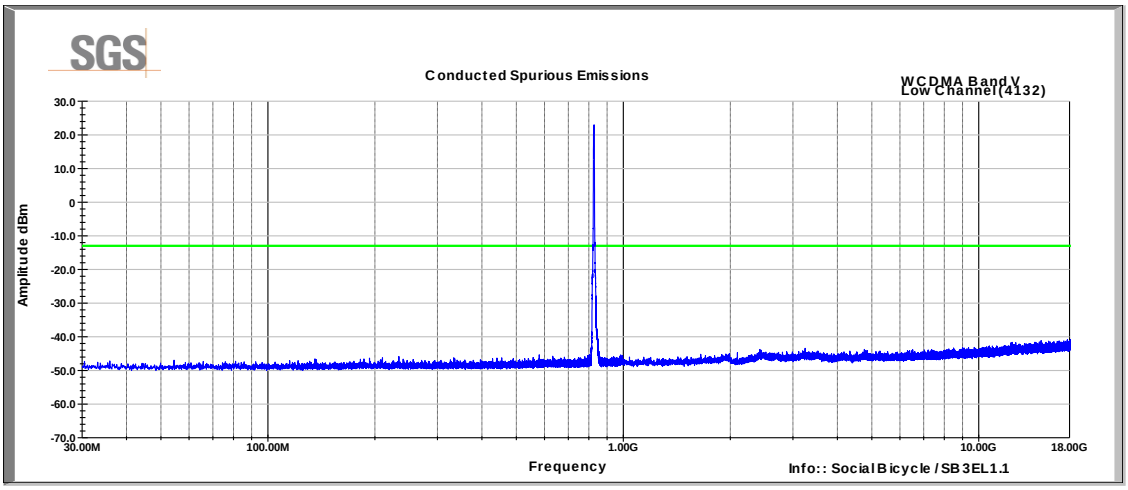
WCDMA Band II Mid Channel



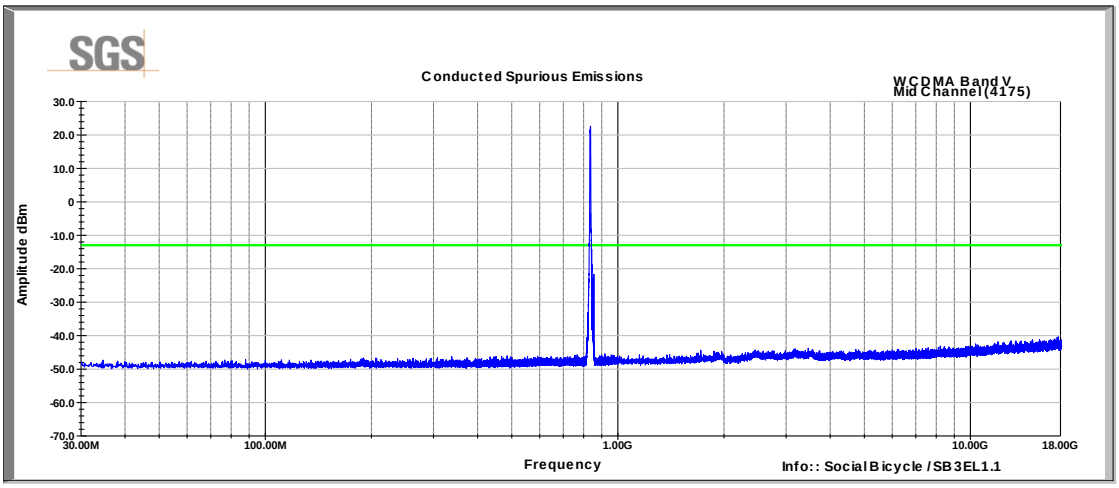
WCDMA Band II High Channel



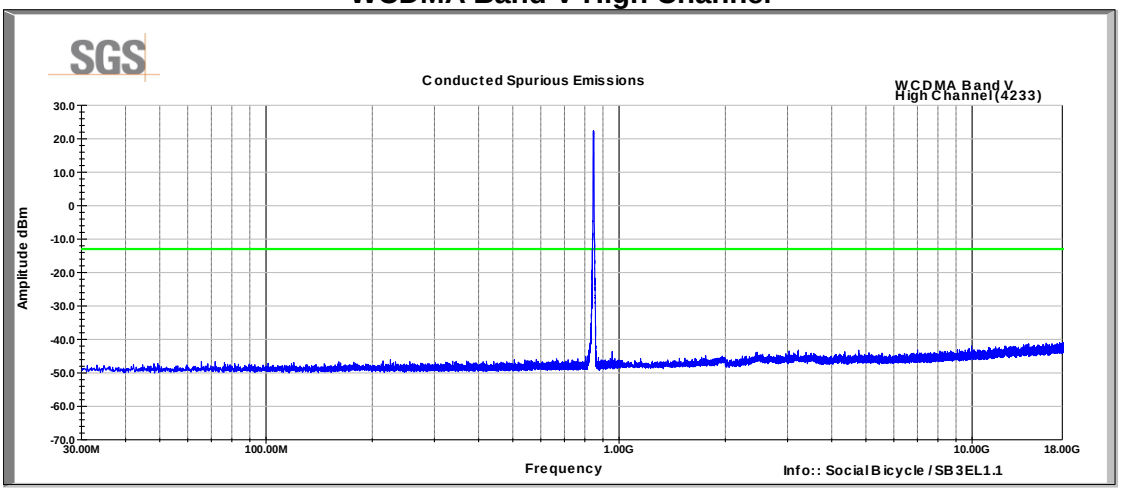
WCDMA Band V Low Channel



WCDMA Band V Mid Channel



WCDMA Band V High Channel



7 Effective Radiated Power

7.1.1 Test Result

Test Description	Basic Standards	Test Result
Effective Radiated Power	FCC Part 22.913(a)(2) RSS-132 5.4	Pass
Effective Isotropic Radiated Power	24.232(c) RSS-133 6.4	Pass

7.1.2 Test Method

For ERP/EIRP calculations, the peak antenna gains obtained from the antenna datasheet were used for each band.

7.2 Test Site

SGS EMC Laboratory, Suwanee, GA

7.3 Test Equipment

None

7.4 Test Data

Band	Max Power dBm	Antenna Gain dBd/dBi	Cable Loss, dB	ERP/EIRP (dBm)	ERP/EIRP Limit, dBm		Result	
					FCC	IC	FCC	IC
WCDMA Band 5 / 826.4	22.75	1.7	0	24.45	38.5	40.6	PASS	PASS
WCDMA Band 5 / 835	22.15	1.7	0	23.85	38.5	40.6	PASS	PASS
WCDMA Band 5 / 846.6	22.41	1.7	0	24.11	38.5	40.6	PASS	PASS
WCDMA Band 2 / 1852.4	21.52	3	0	24.52	33	33	PASS	PASS
WCDMA Band 2 / 1880	21.24	3	0	24.24	33	33	PASS	PASS
WCDMA Band 2 / 1907.6	21.32	3	0	24.32	33	33	PASS	PASS

8 Radiated Spurious Emissions

8.1 Test Result

Test Description	Basic Standards		Test Result
Radiated Spurious Emissions	FCC Part 2.1053 FCC Part 22.917(a) FCC Part 24.238(a) ANSI/TIA-603-D-2009	RSS-GEN (6.13) RSS-132 5.5 RSS-133 6.5	Pass

8.2 Test Method

The levels of the carrier and the various conducted spurious and harmonics frequencies are measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB. Compliance is based on the use of a spectrum analyzer employing a resolution bandwidth of 1 MHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of a least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emissions bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

The EUT was manipulated in 30° increments from 0 to 330°.

A radio link was established between EUT and Radio Communications Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester. The measurements were conducted at the low, middle, and high channels in RC3/SO55 which was determined to be the worst case operating mode.

8.3 Test Site

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature:	26.5 °C
Relative Humidity:	21.3 %
Atmospheric Pressure:	99.1 kPa

8.4 Test Equipment

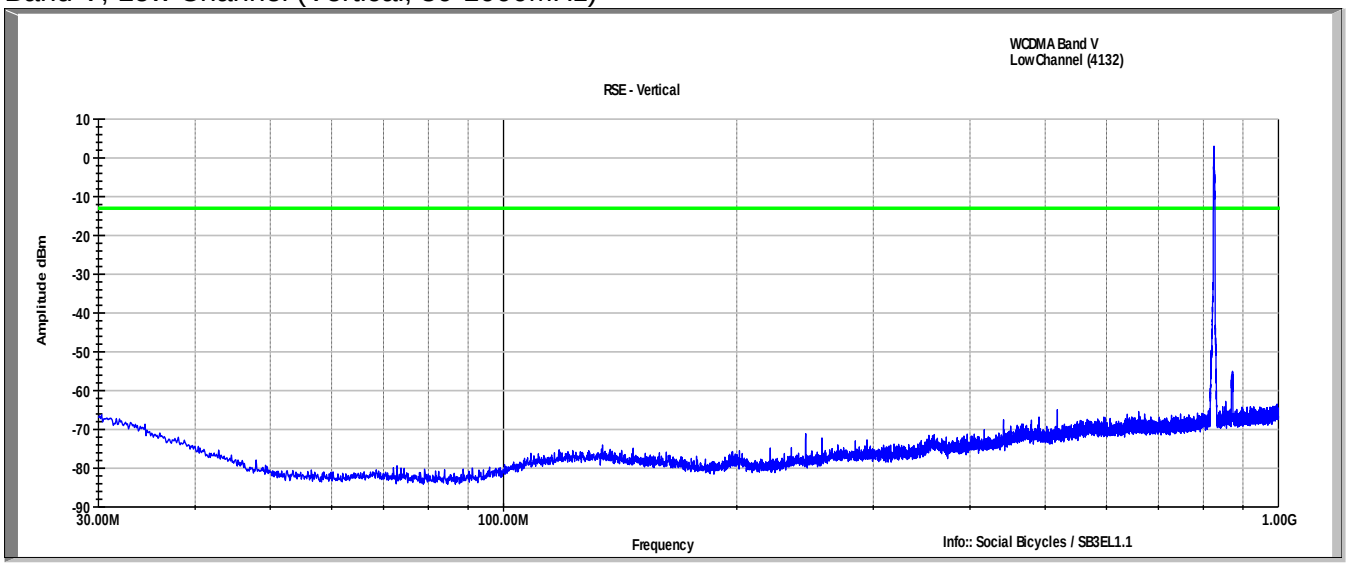
Test Date: 20-Dec-2016 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	10-Nov-2017
DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	27-Jul-2017
HORN(SMALL)	LB-180400-20-C-KF	A-INFO	15007	29-Mar-2017
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B085757	27-Oct-2018
RF CABLE	SF106	HUBER & SUHNER	B079712	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B079716	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B079713	27-Jul-2017
RF CABLE	SF106	HUBER & SUHNER	B085892	27-Jul-2017
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	4-Aug-2017
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2017
RF CABLE	SF102	HUBER & SUHNER	B079824	27-Jul-2017
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	29-Jul-2017
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017
FILTER, BAND REJECT (835MHZ)	4N45 836/E26.4	K&L MICROWAVE	B101738	28-Jul-2017
FILTER, BAND REJECT	BRC50720	MICRO-TRONICS	B079784	28-Jul-2017
FILTER, HIGH PASS	HPM50108	MICRO-TRONICS	B079802	28-Jul-2017
FILTER, HIGH PASS	HPM50110	MICRO-TRONICS	B079792	28-Jul-2017

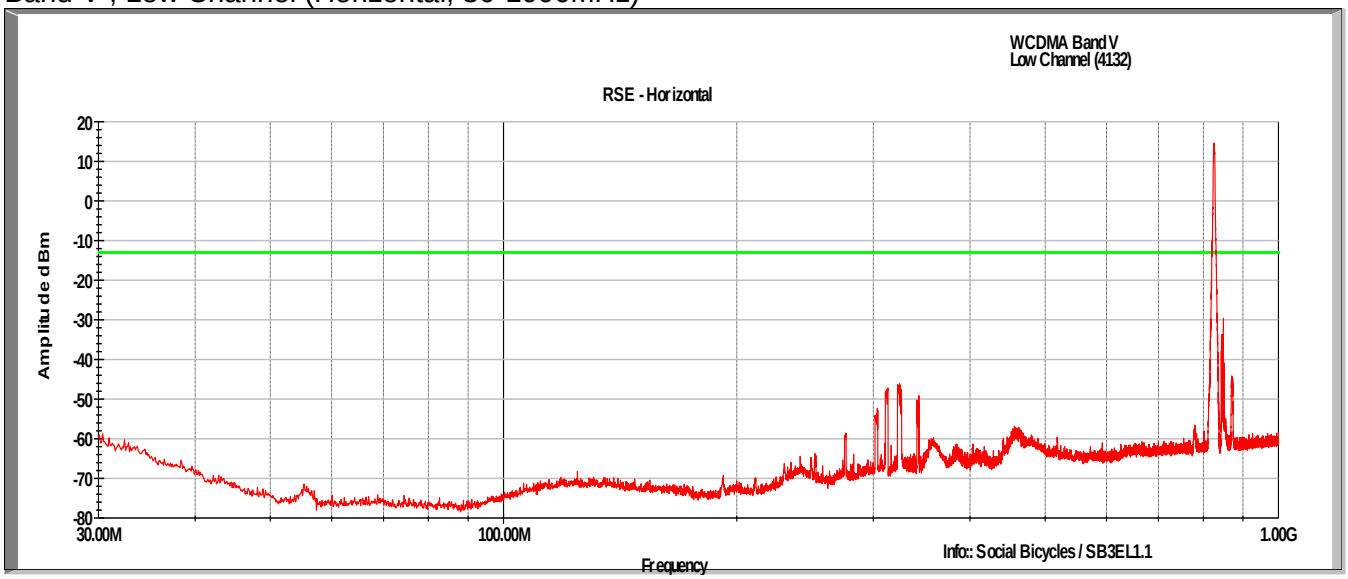
- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 2 year calibration cycle.

8.5 Test Data – Band V

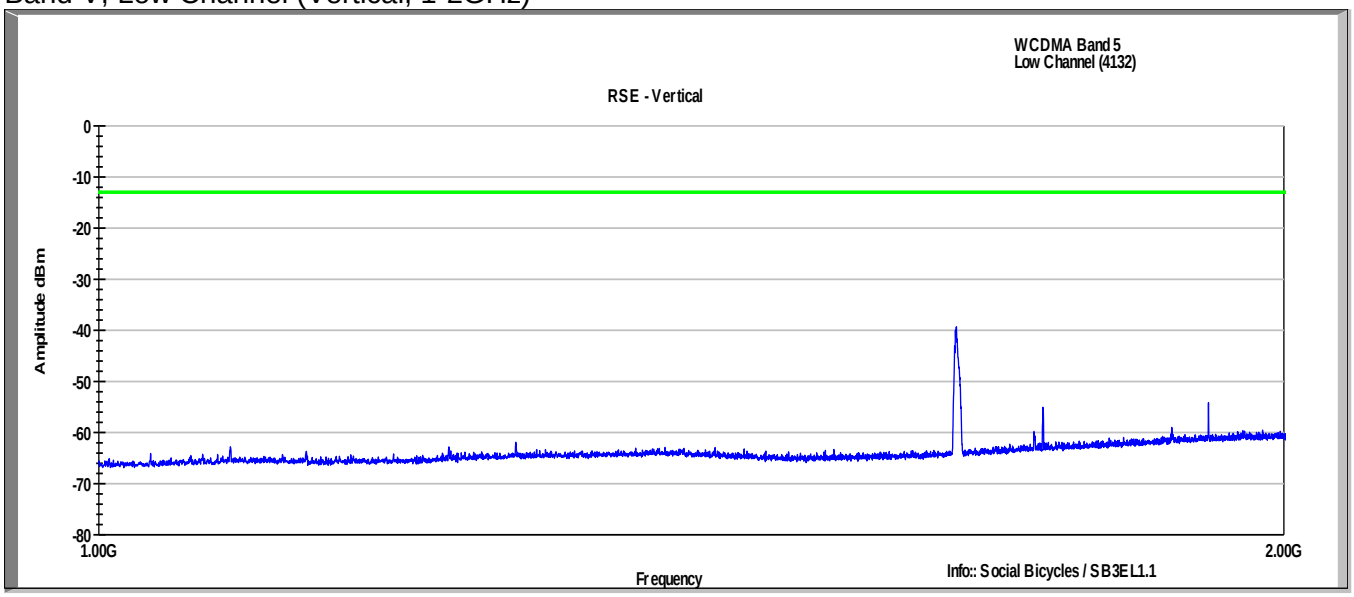
Band V, Low Channel (Vertical, 30-1000MHz)



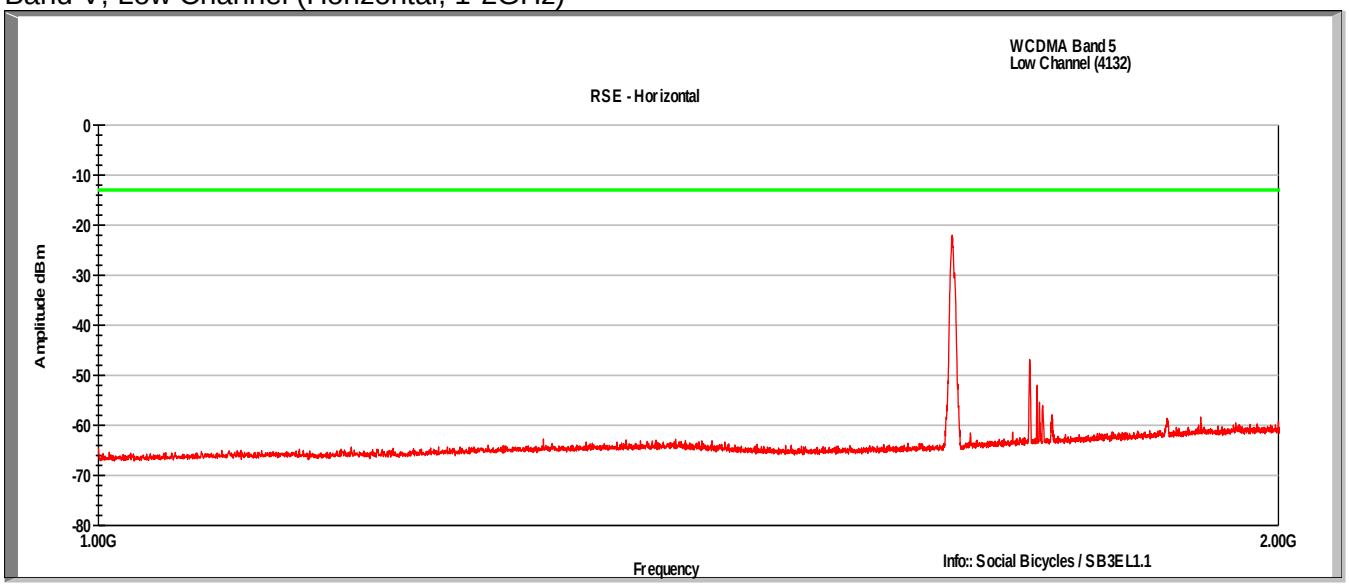
Band V , Low Channel (Horizontal, 30-1000MHz)



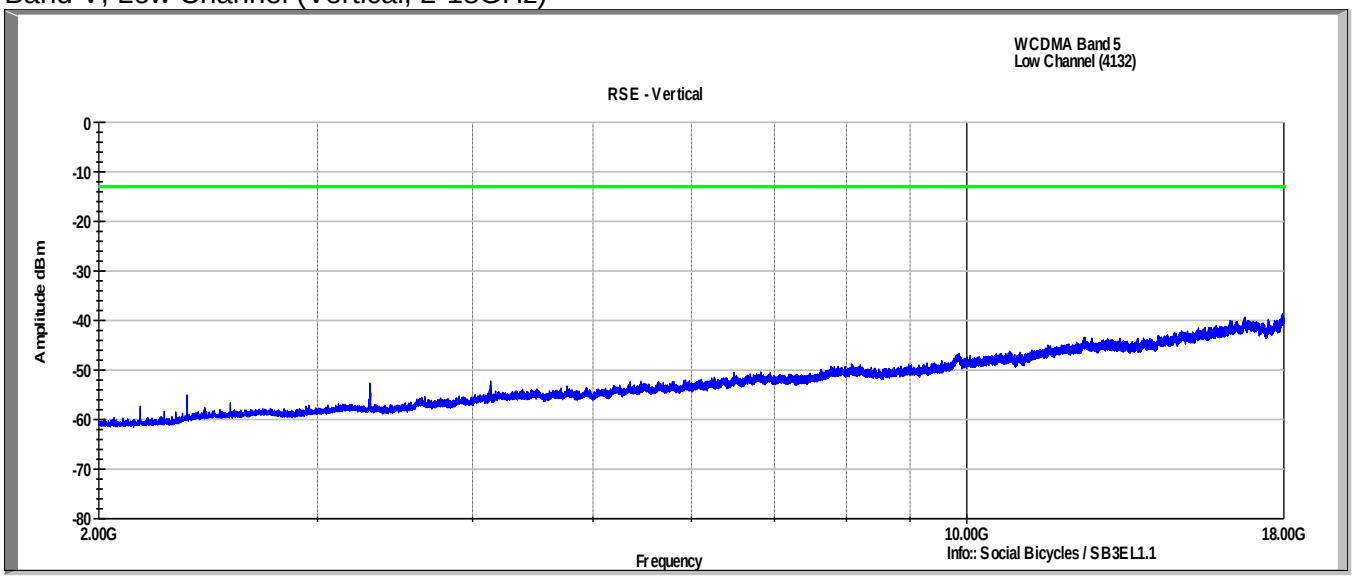
Band V, Low Channel (Vertical, 1-2GHz)



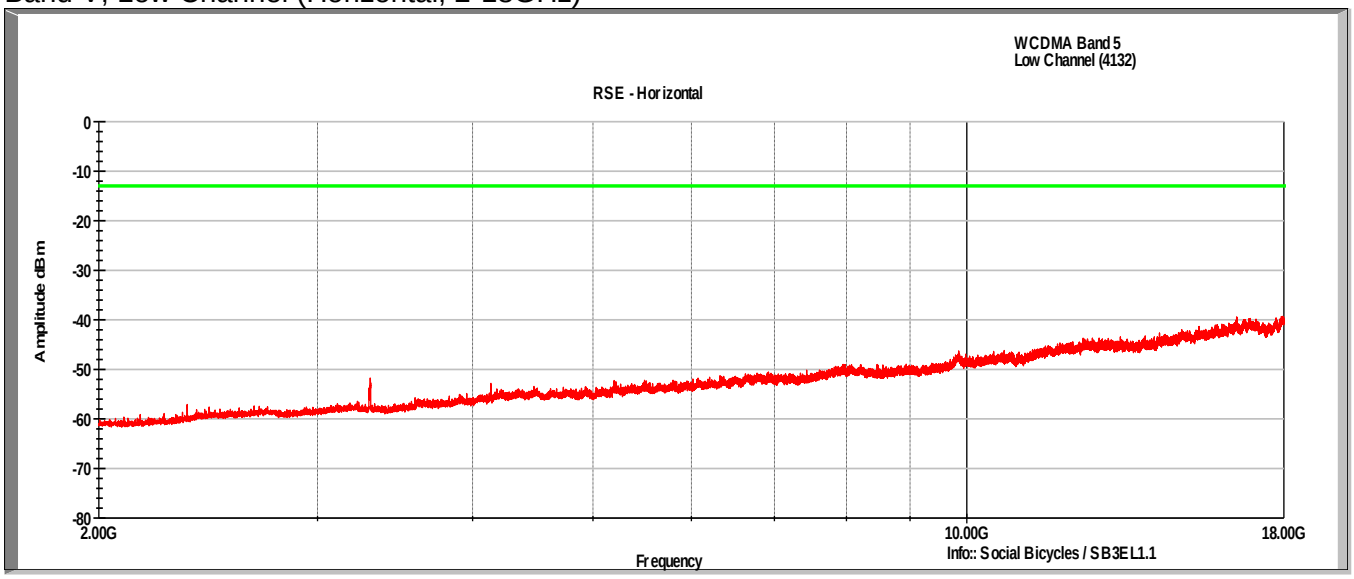
Band V, Low Channel (Horizontal, 1-2GHz)



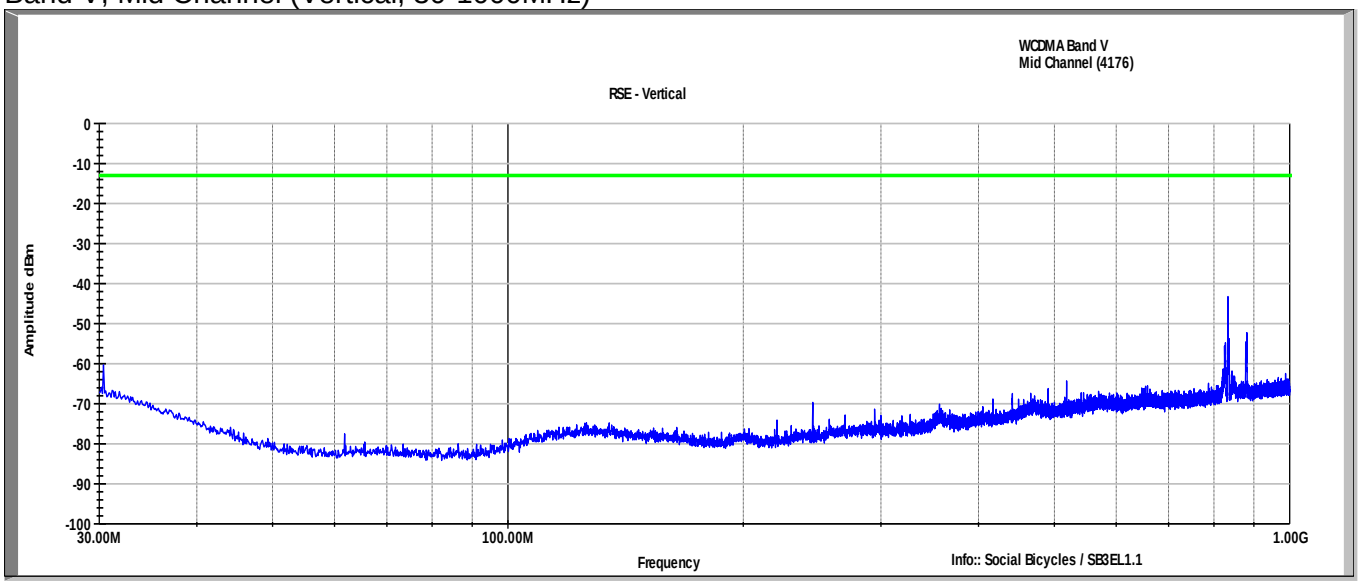
Band V, Low Channel (Vertical, 2-18GHz)



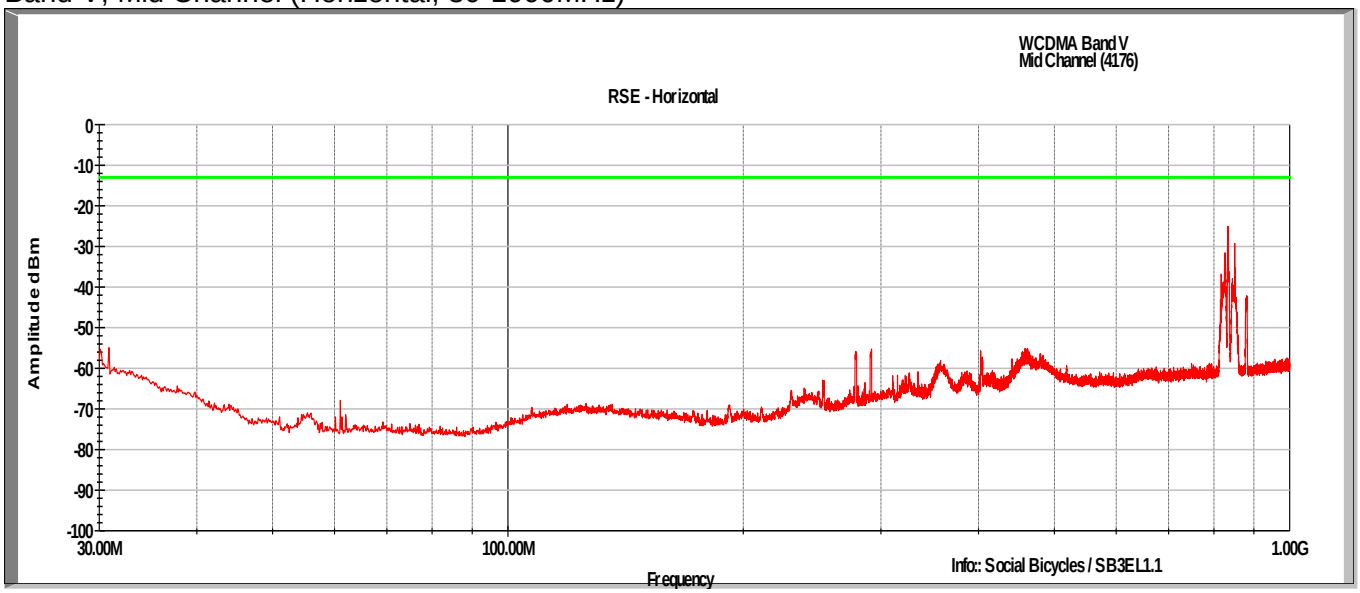
Band V, Low Channel (Horizontal, 2-18GHz)



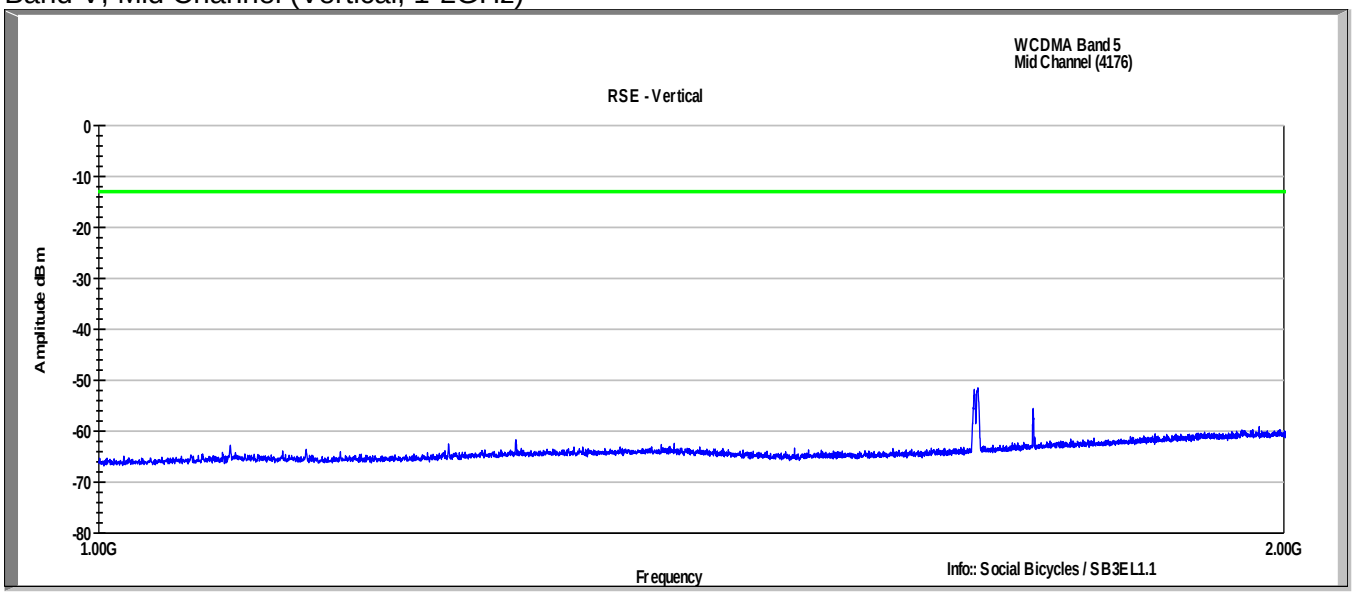
Band V, Mid Channel (Vertical, 30-1000MHz)



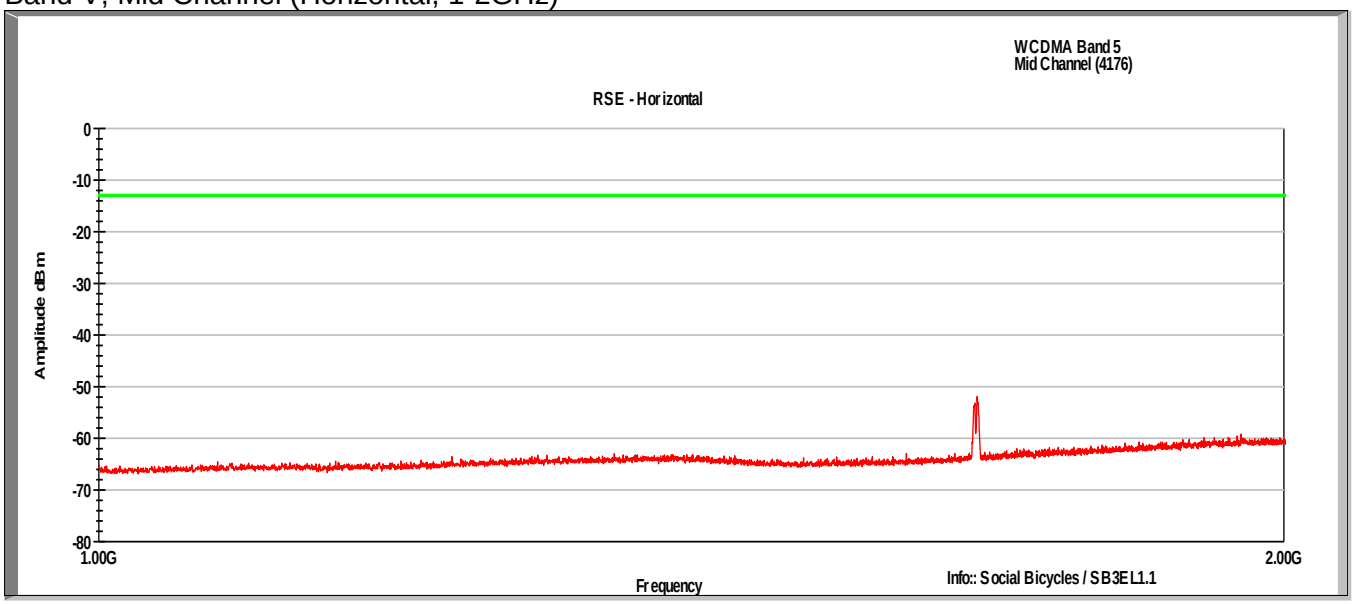
Band V, Mid Channel (Horizontal, 30-1000MHz)



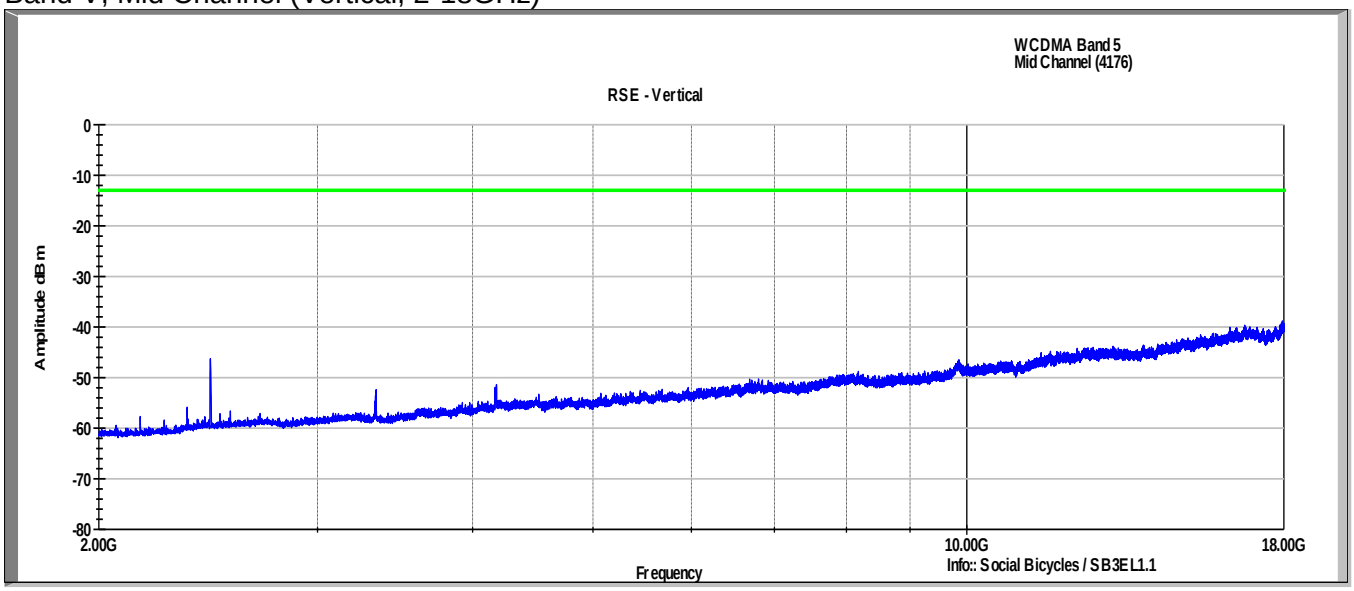
Band V, Mid Channel (Vertical, 1-2GHz)



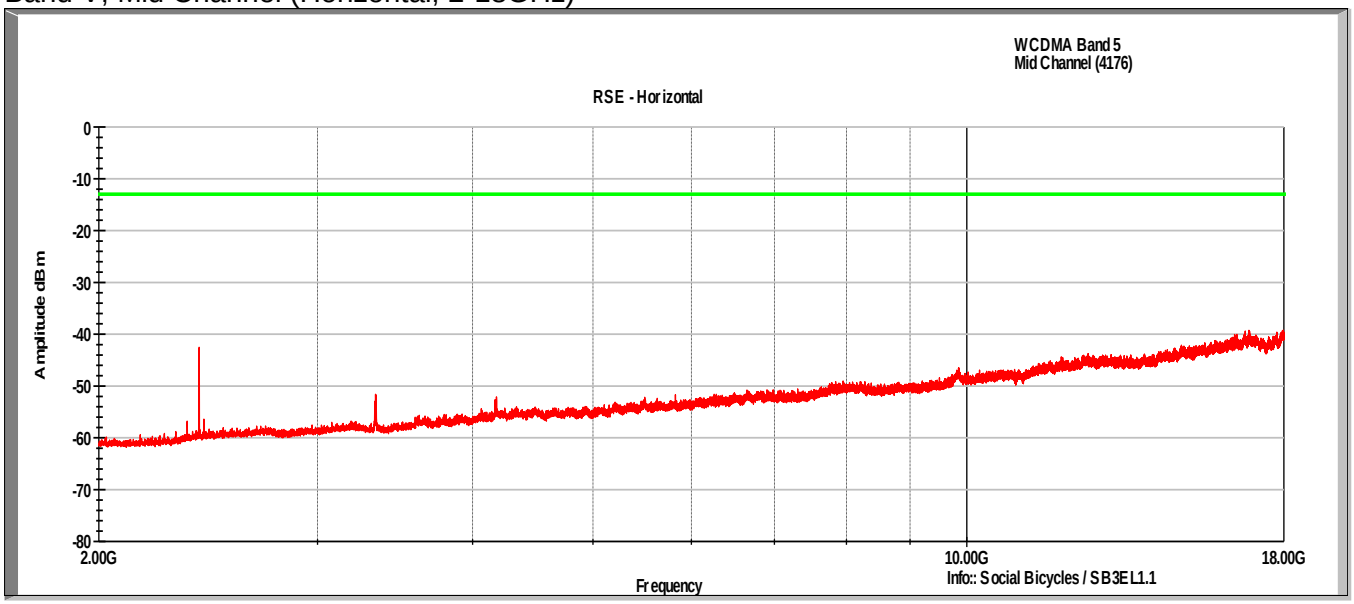
Band V, Mid Channel (Horizontal, 1-2GHz)



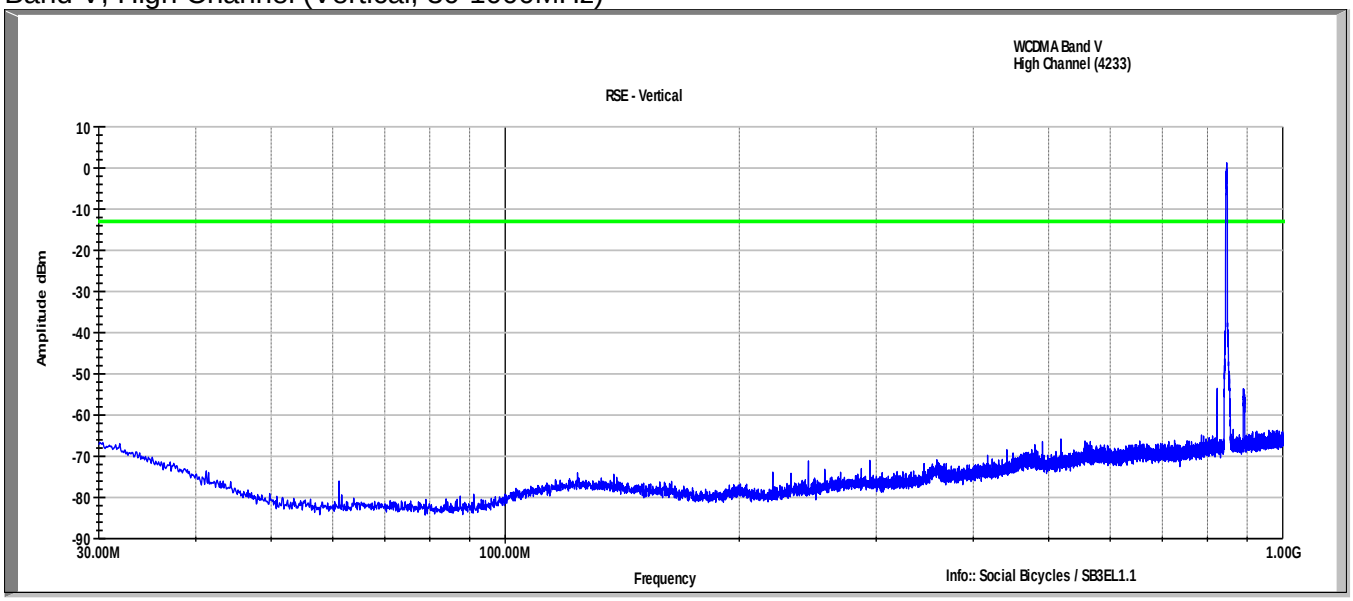
Band V, Mid Channel (Vertical, 2-18GHz)



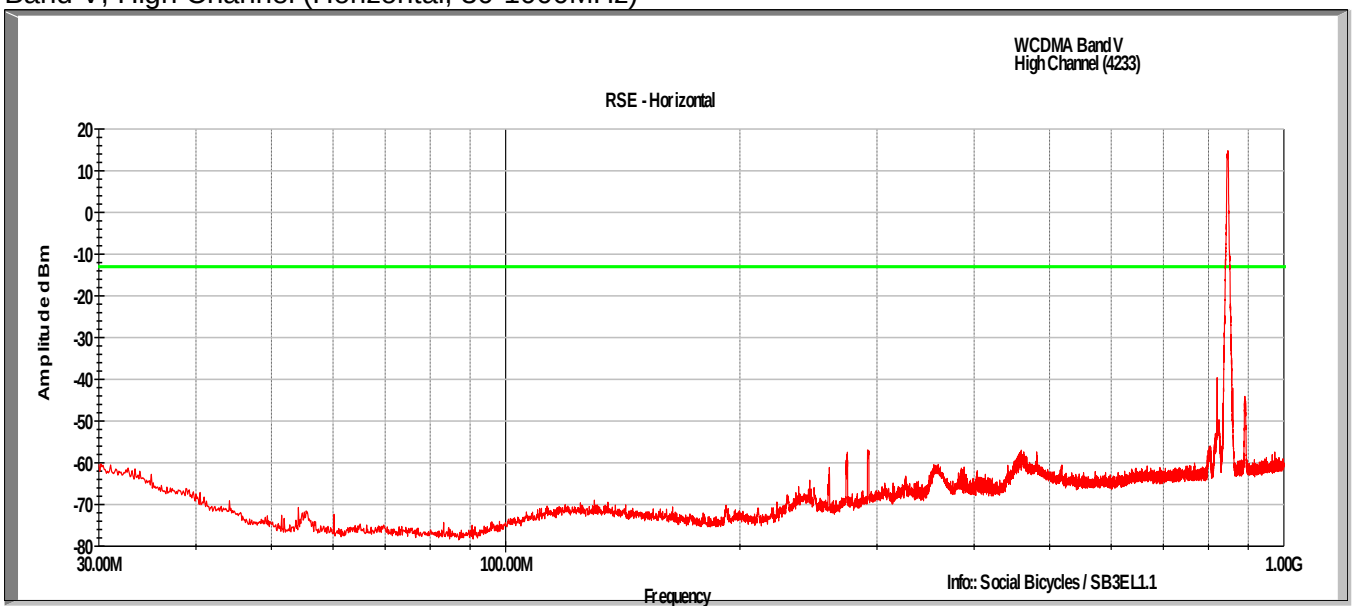
Band V, Mid Channel (Horizontal, 2-18GHz)



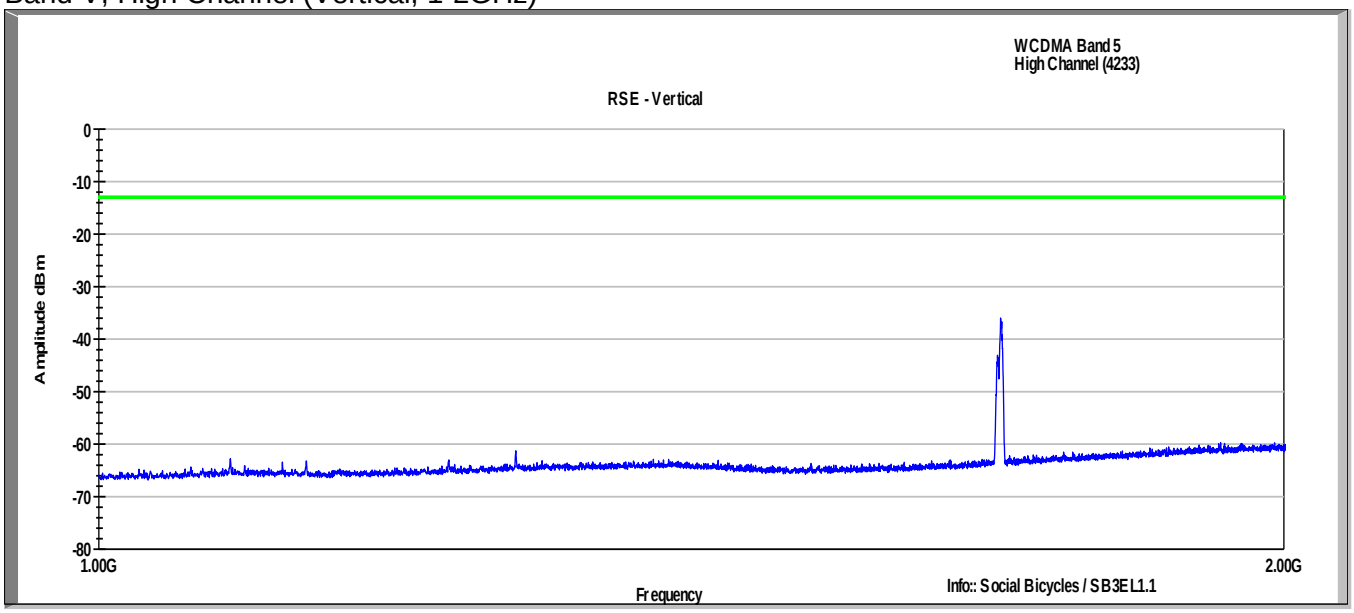
Band V, High Channel (Vertical, 30-1000MHz)



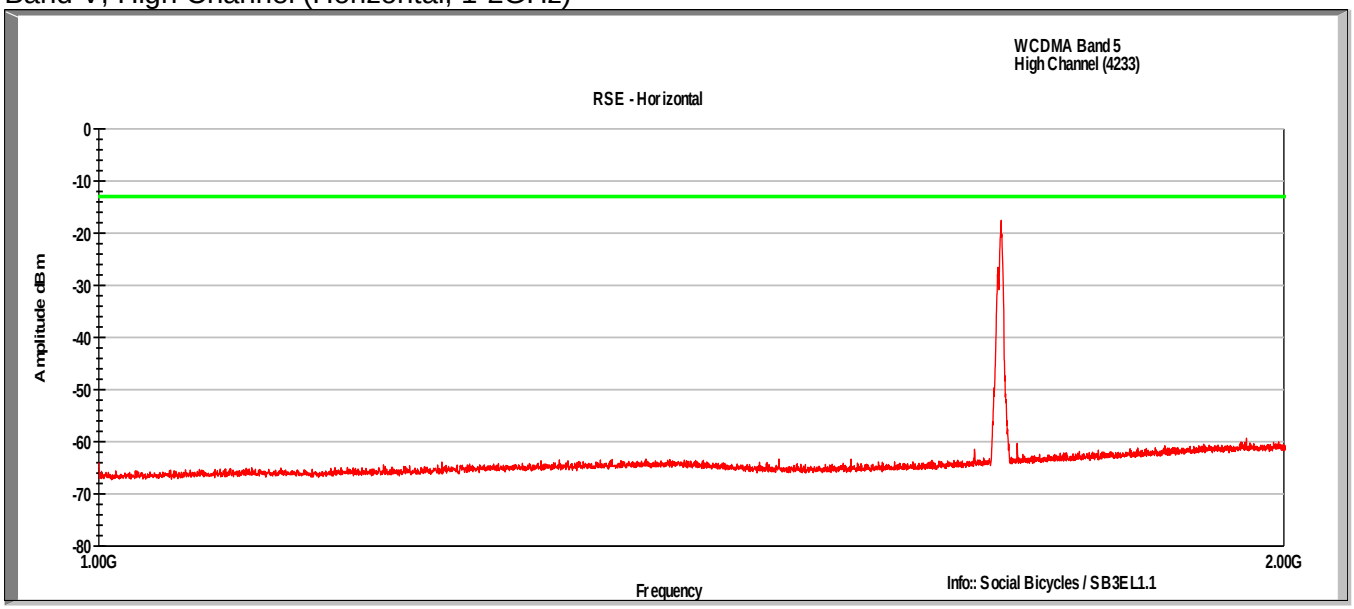
Band V, High Channel (Horizontal, 30-1000MHz)



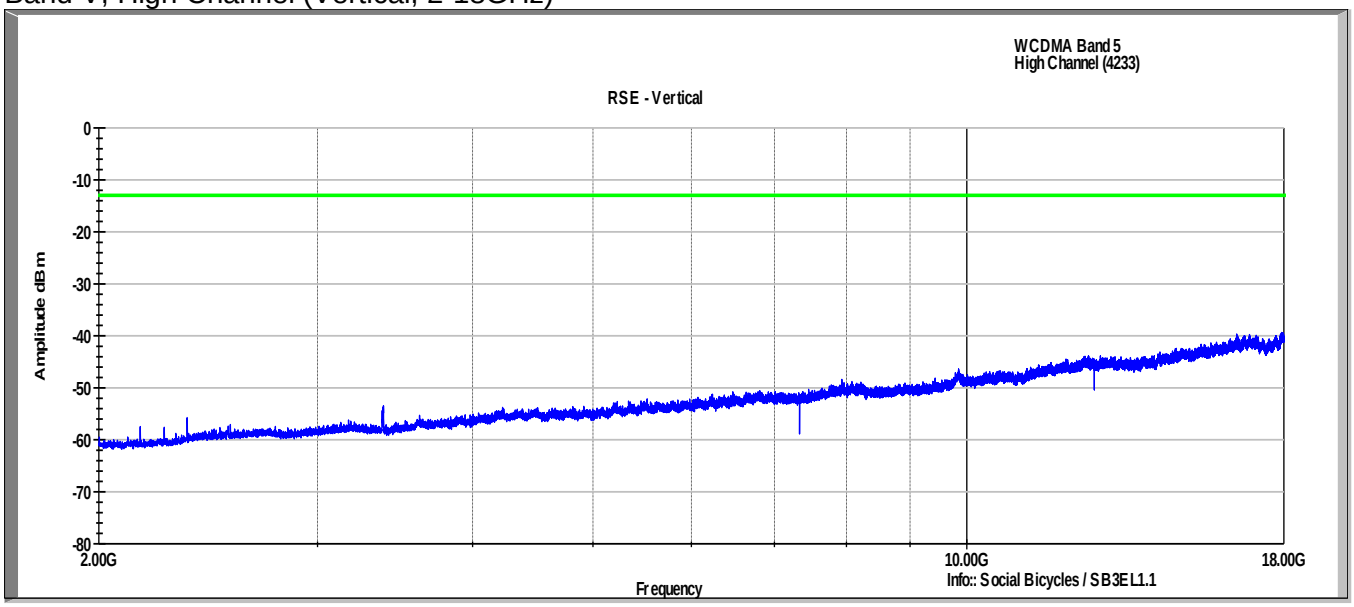
Band V, High Channel (Vertical, 1-2GHz)



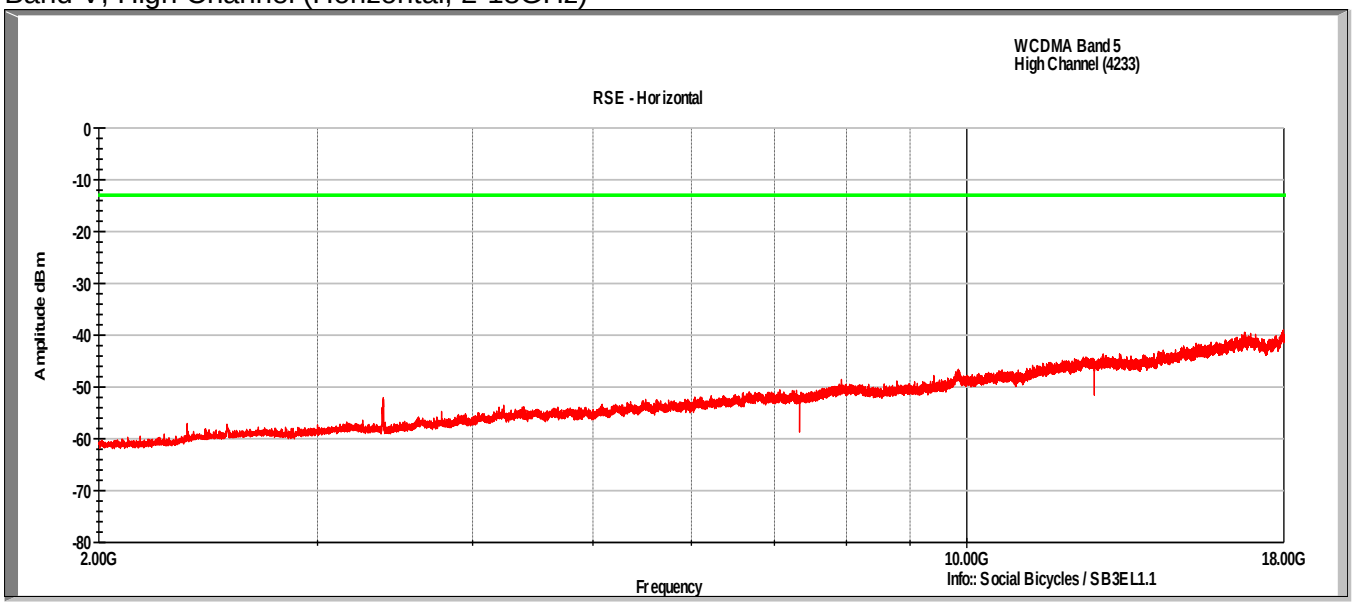
Band V, High Channel (Horizontal, 1-2GHz)



Band V, High Channel (Vertical, 2-18GHz)

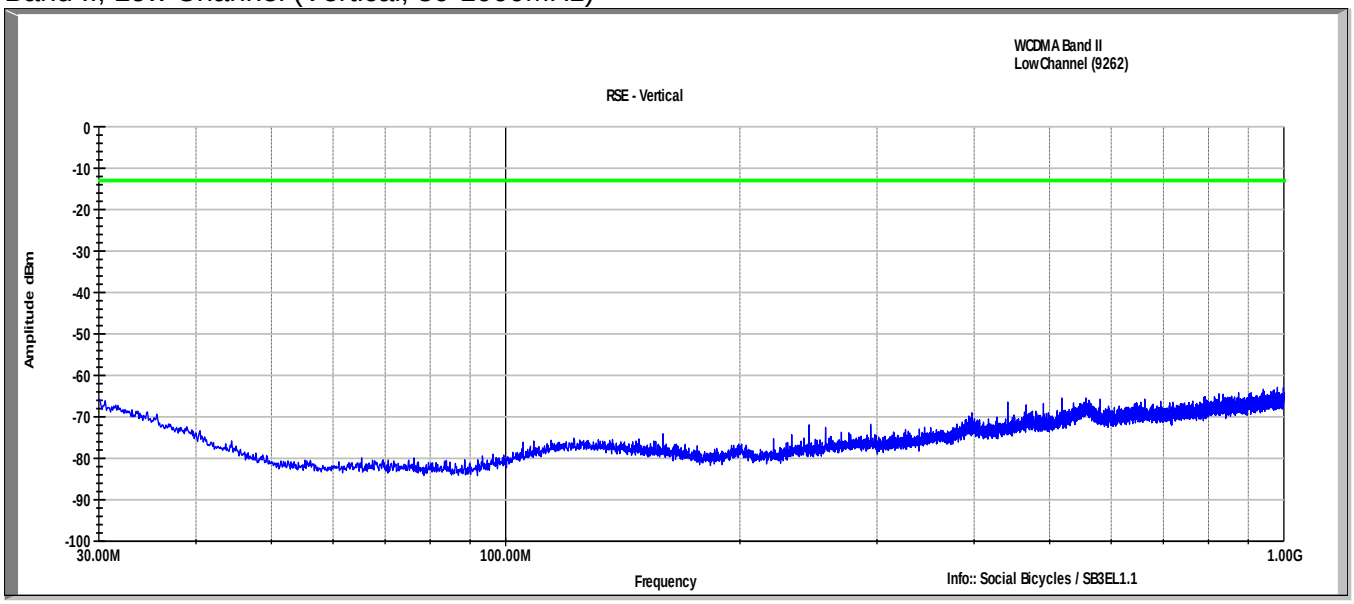


Band V, High Channel (Horizontal, 2-18GHz)

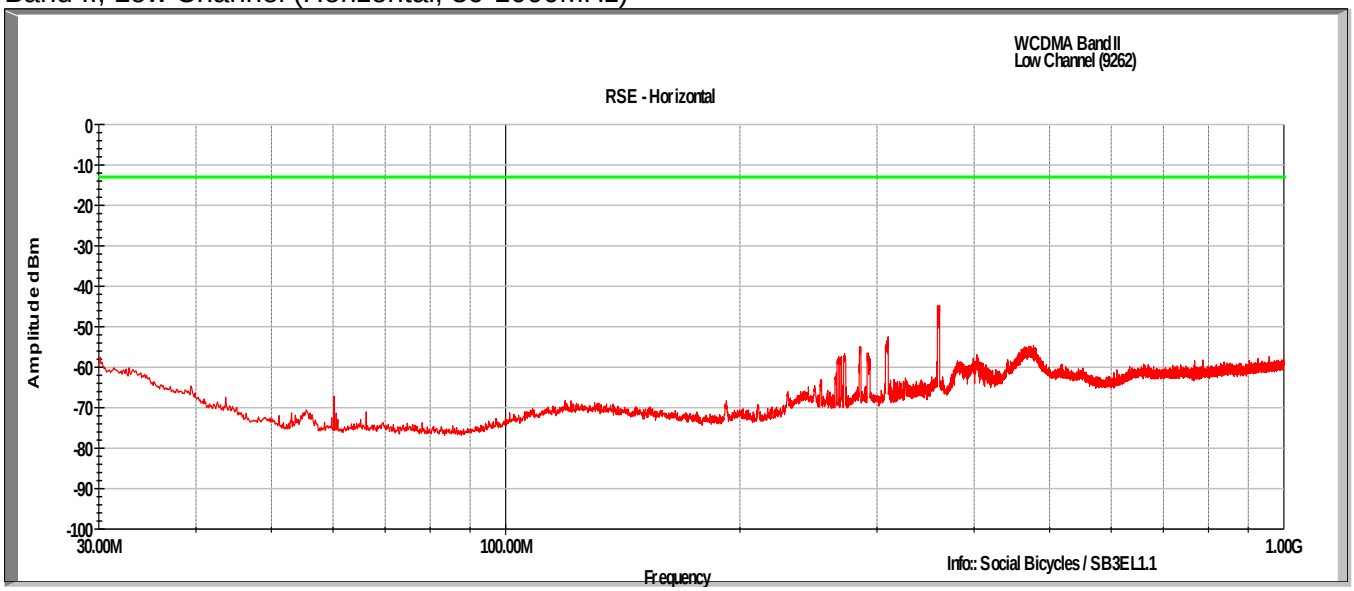


8.6 *Test Data – Band II*

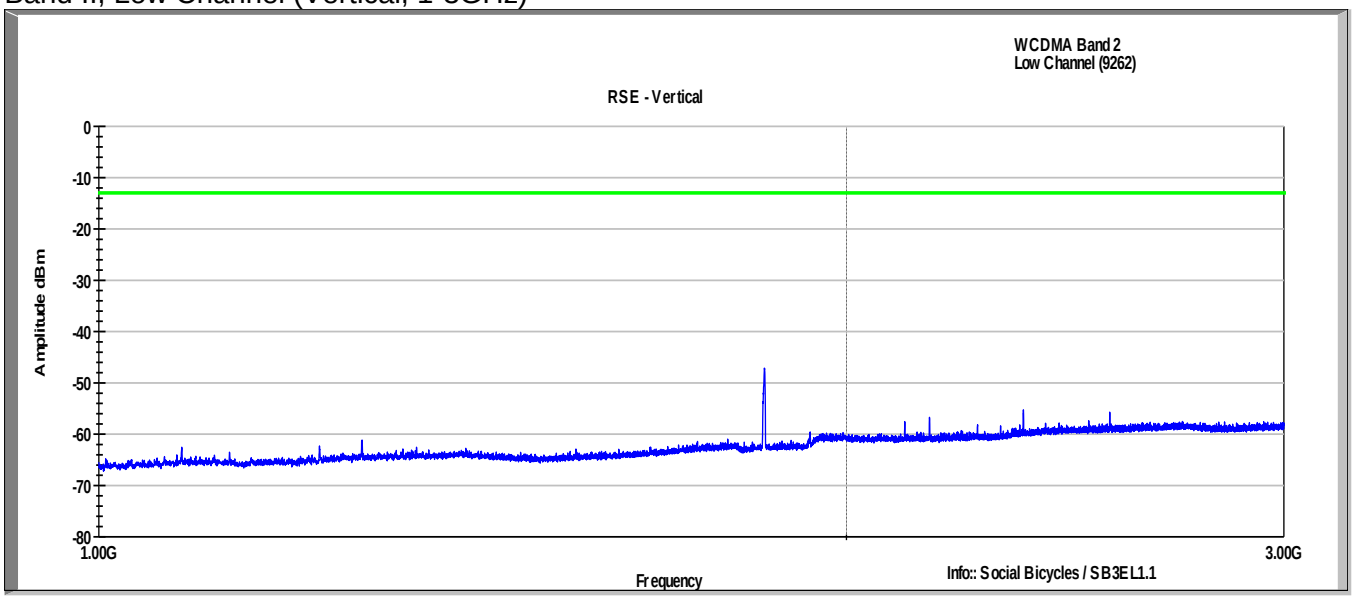
Band II, Low Channel (Vertical, 30-1000MHz)



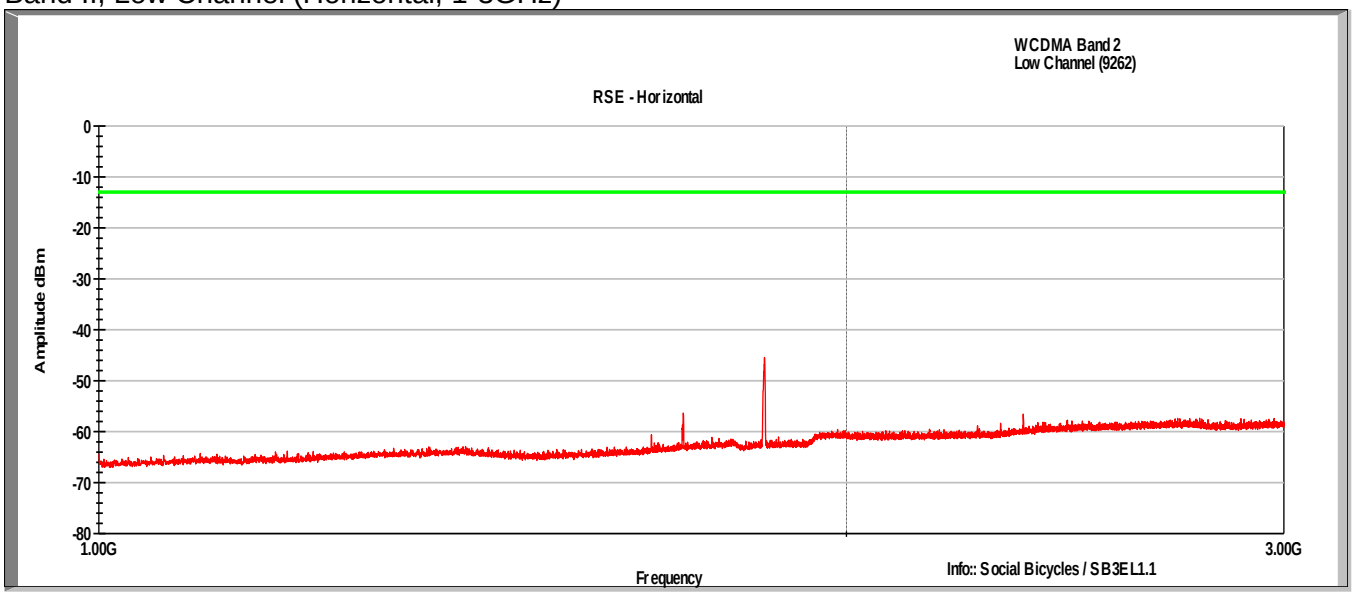
Band II, Low Channel (Horizontal, 30-1000MHz)



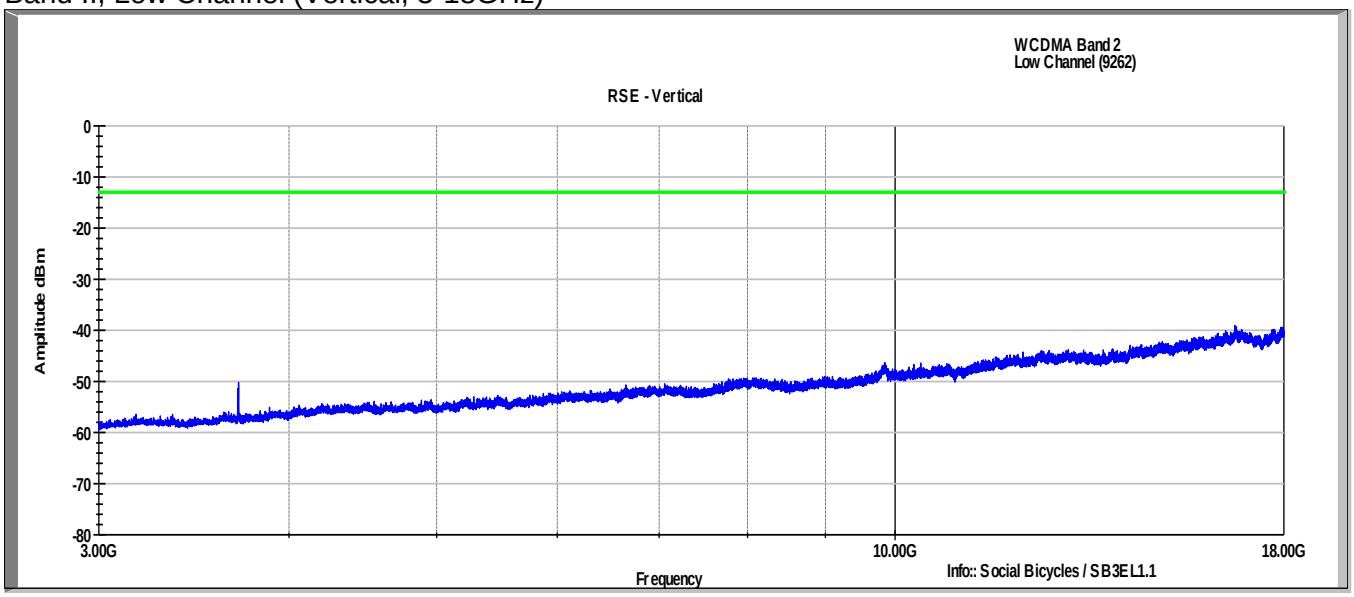
Band II, Low Channel (Vertical, 1-3GHz)



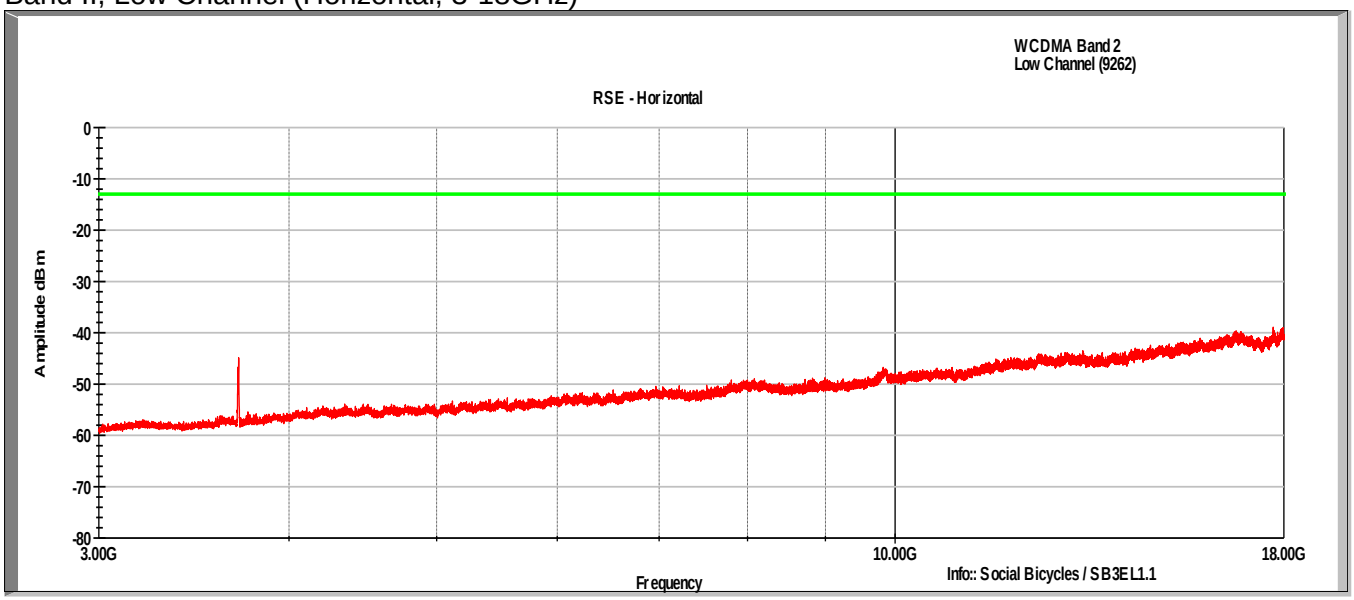
Band II, Low Channel (Horizontal, 1-3GHz)



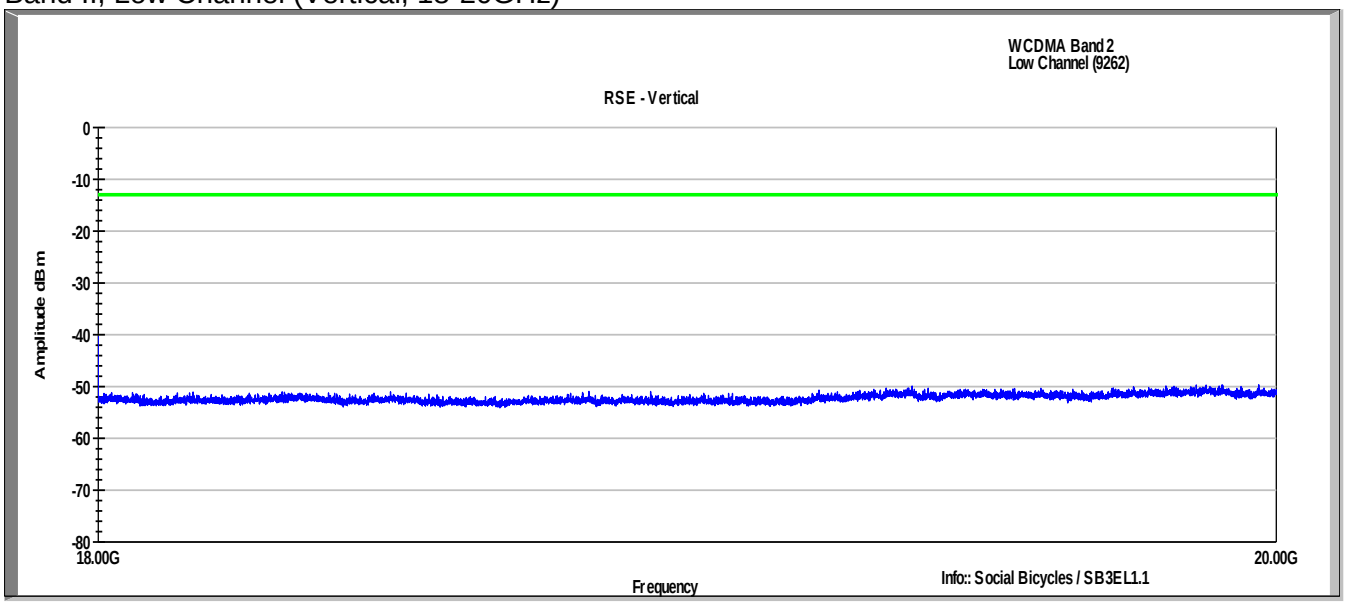
Band II, Low Channel (Vertical, 3-18GHz)



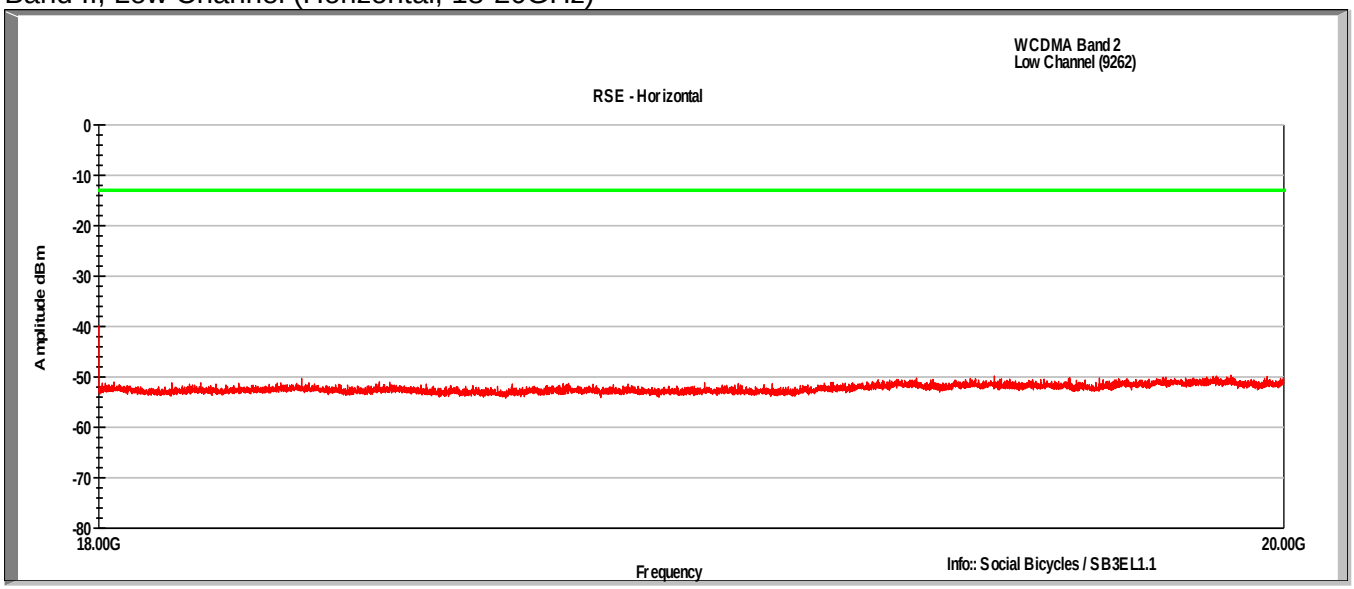
Band II, Low Channel (Horizontal, 3-18GHz)



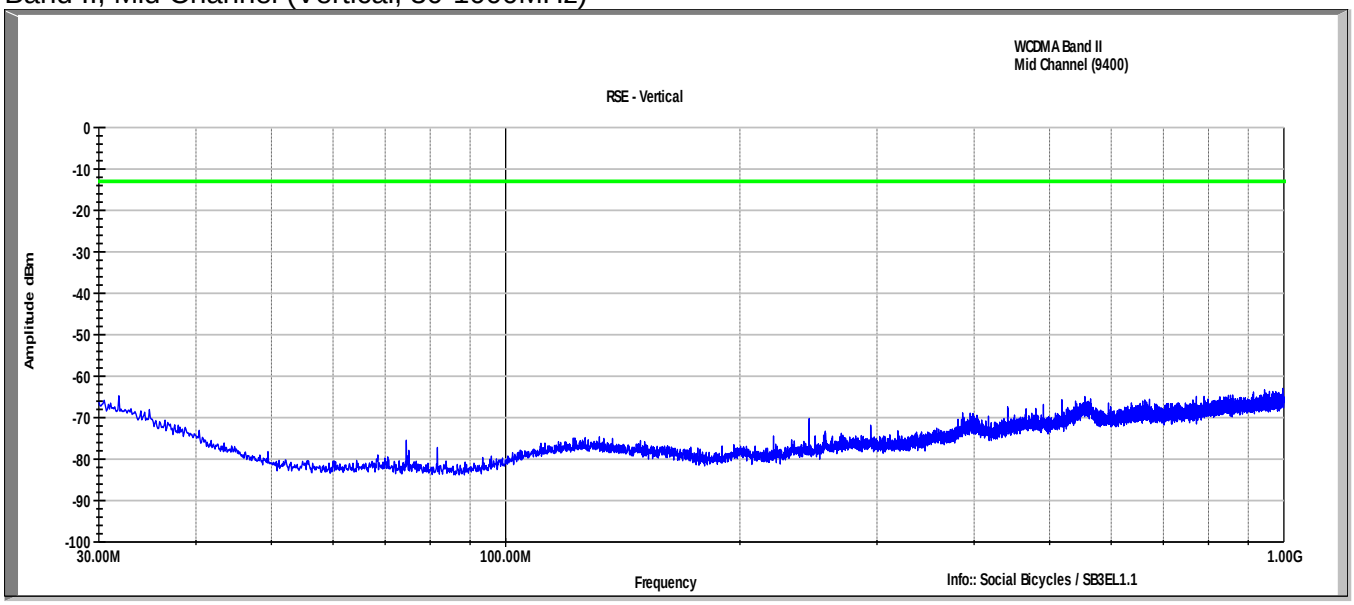
Band II, Low Channel (Vertical, 18-20GHz)



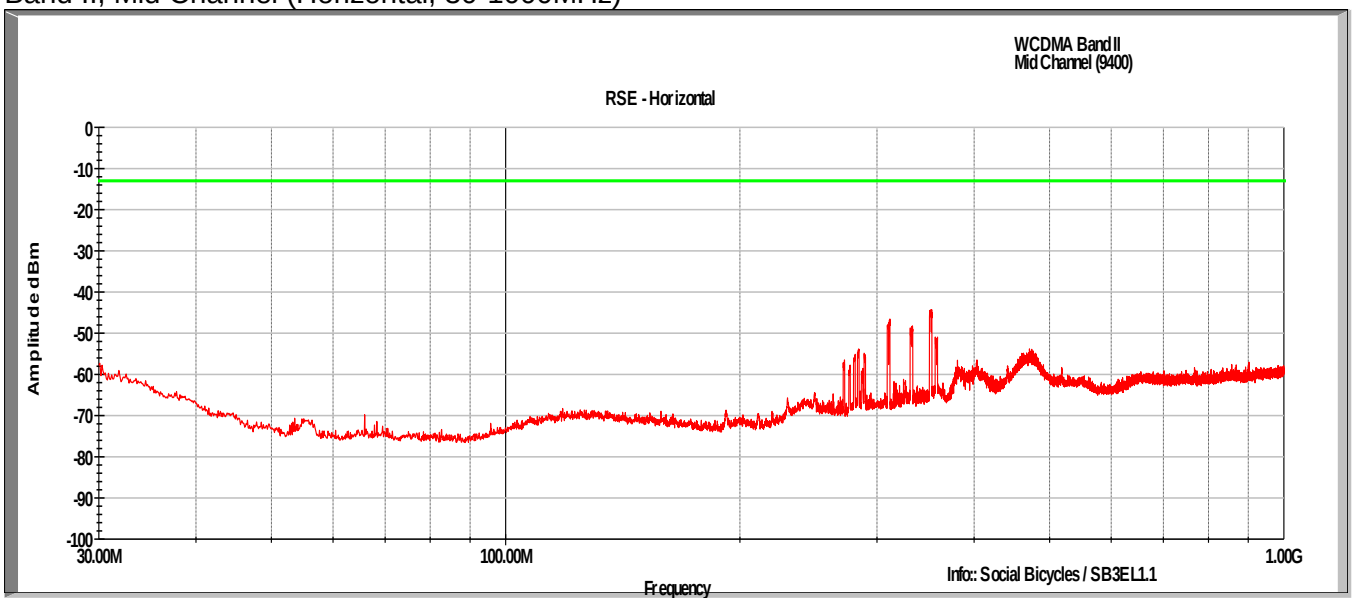
Band II, Low Channel (Horizontal, 18-20GHz)



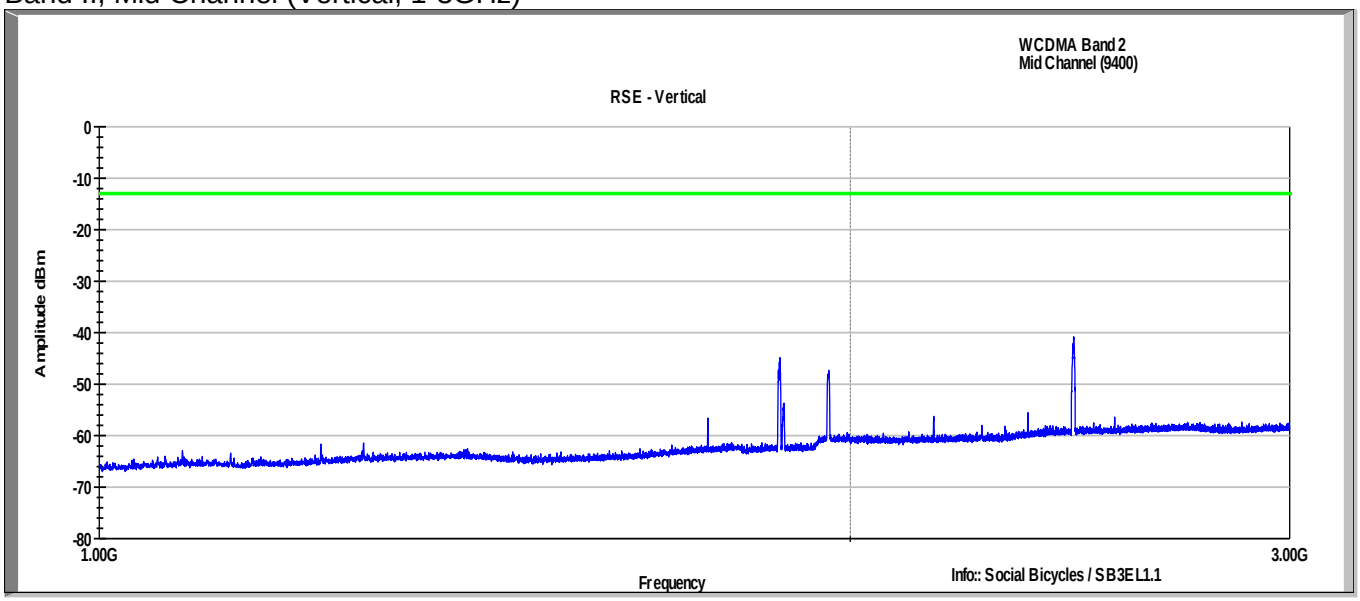
Band II, Mid Channel (Vertical, 30-1000MHz)



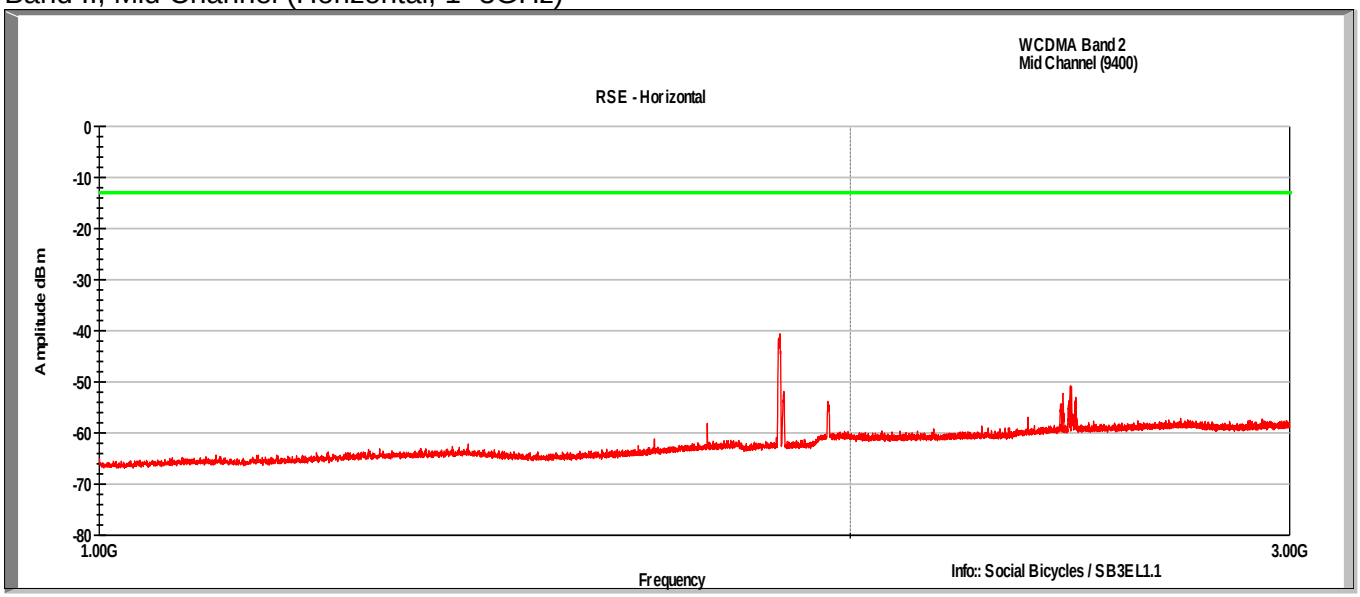
Band II, Mid Channel (Horizontal, 30-1000MHz)



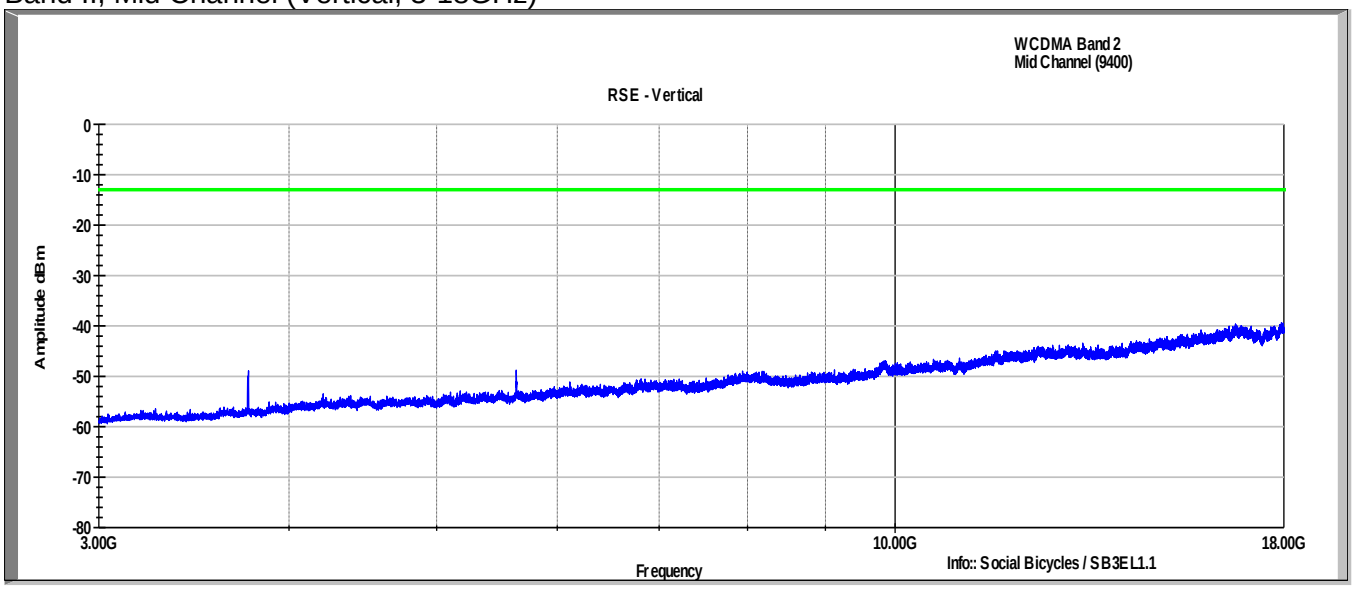
Band II, Mid Channel (Vertical, 1-3GHz)



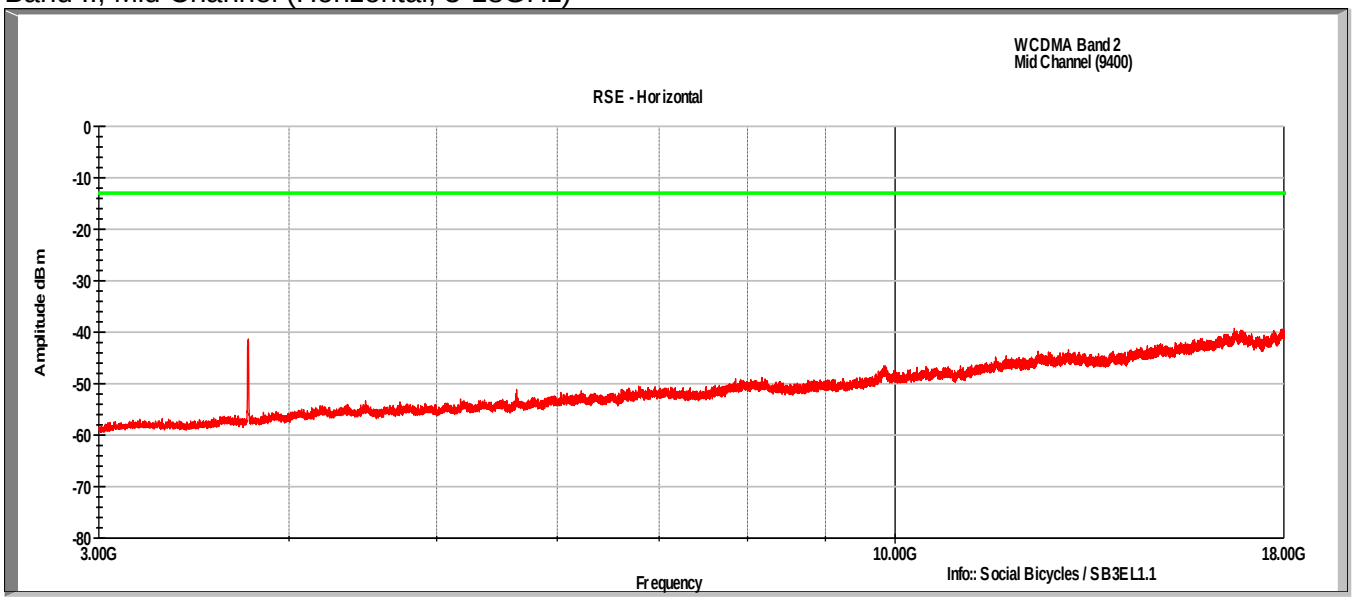
Band II, Mid Channel (Horizontal, 1- 3GHz)



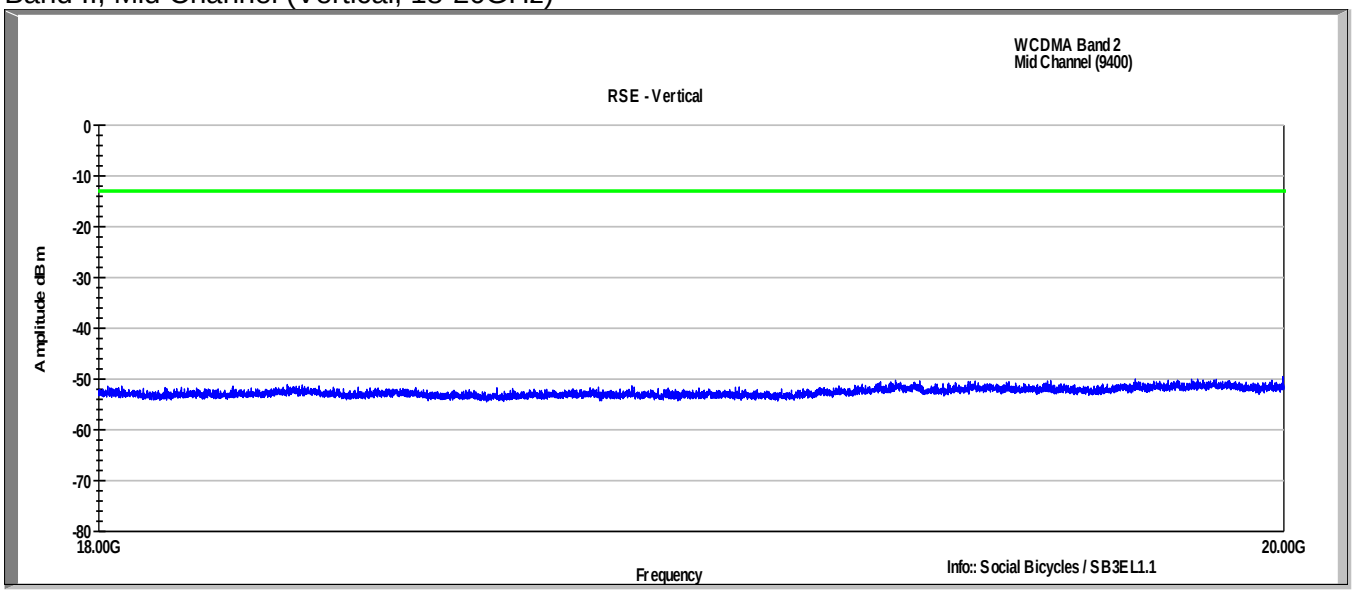
Band II, Mid Channel (Vertical, 3-18GHz)



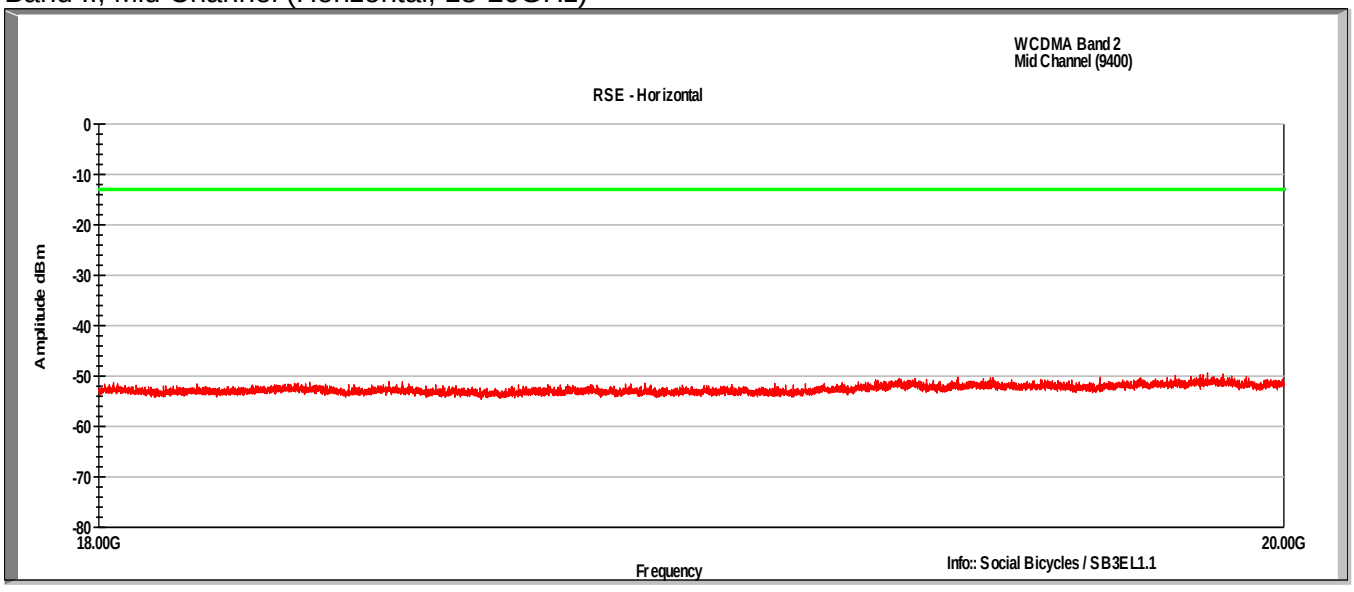
Band II, Mid Channel (Horizontal, 3-18GHz)



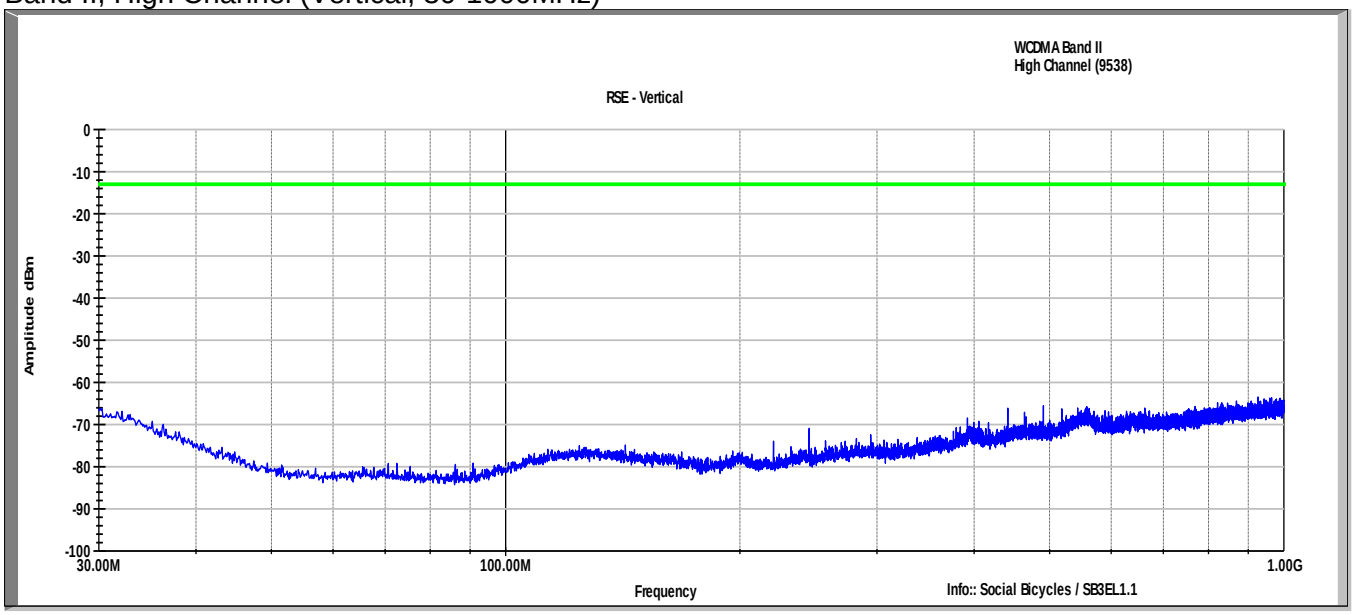
Band II, Mid Channel (Vertical, 18-20GHz)



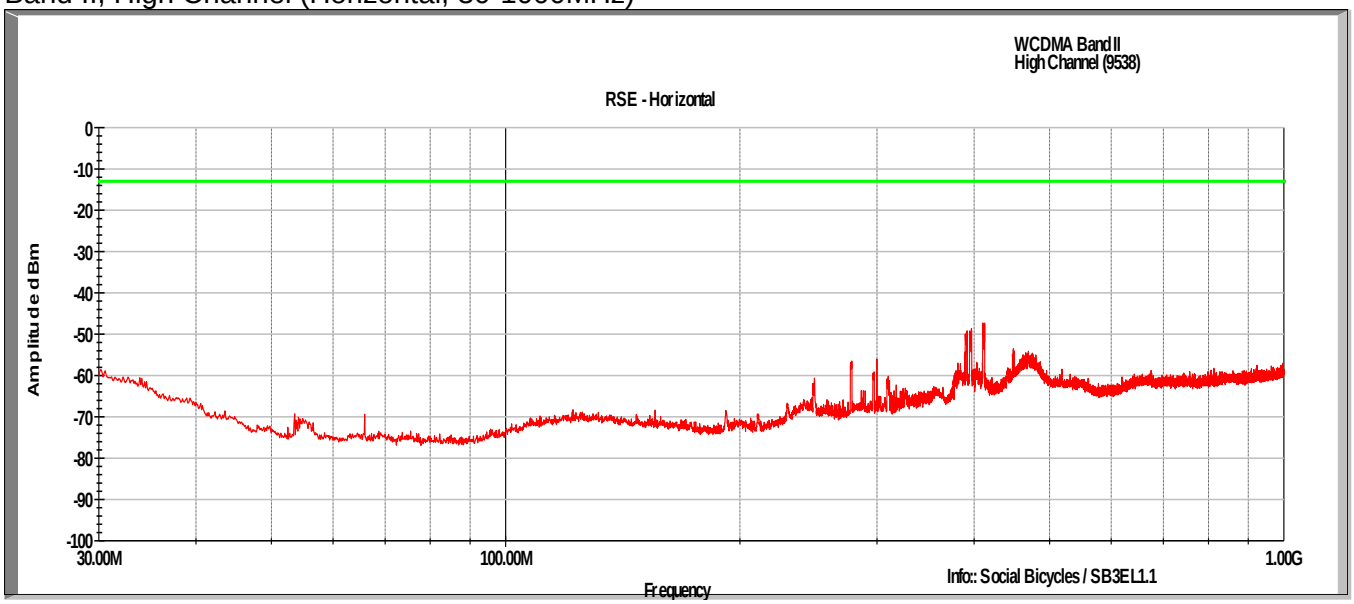
Band II, Mid Channel (Horizontal, 18-20GHz)



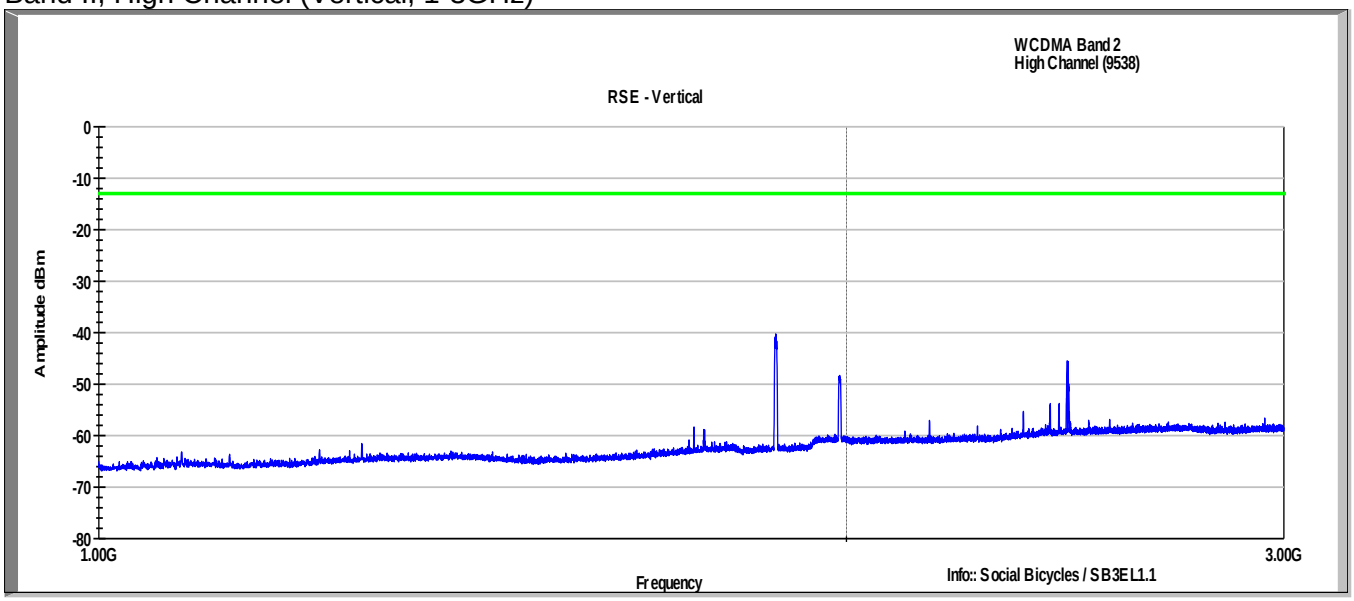
Band II, High Channel (Vertical, 30-1000MHz)



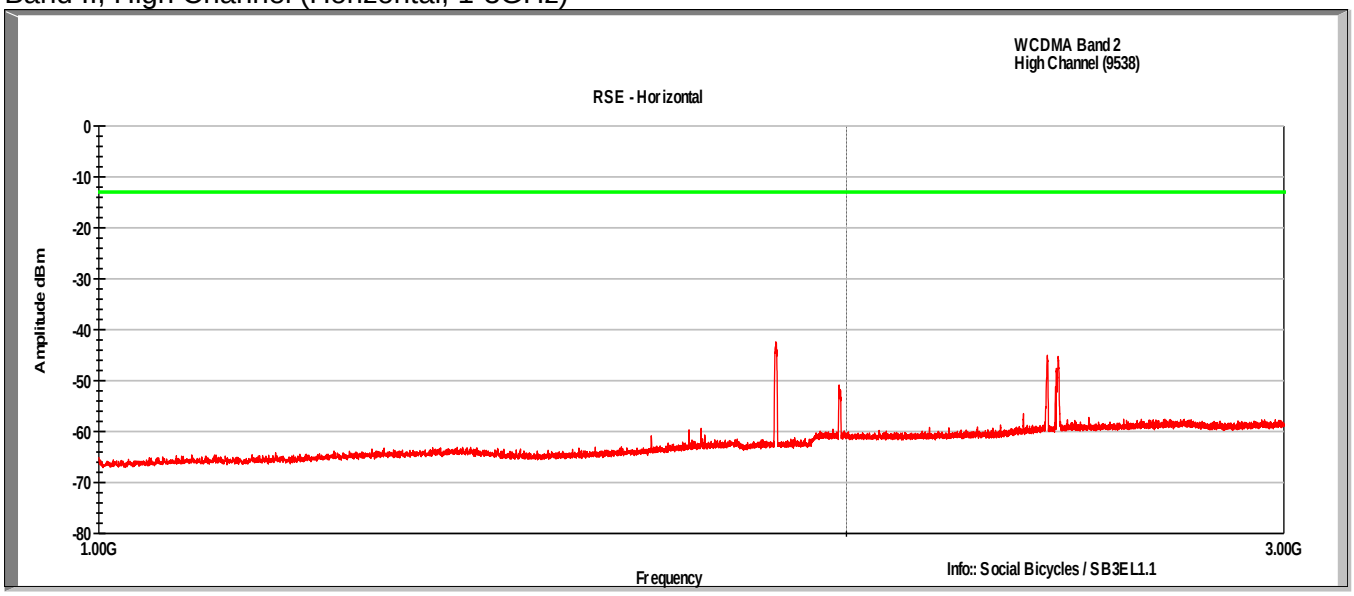
Band II, High Channel (Horizontal, 30-1000MHz)



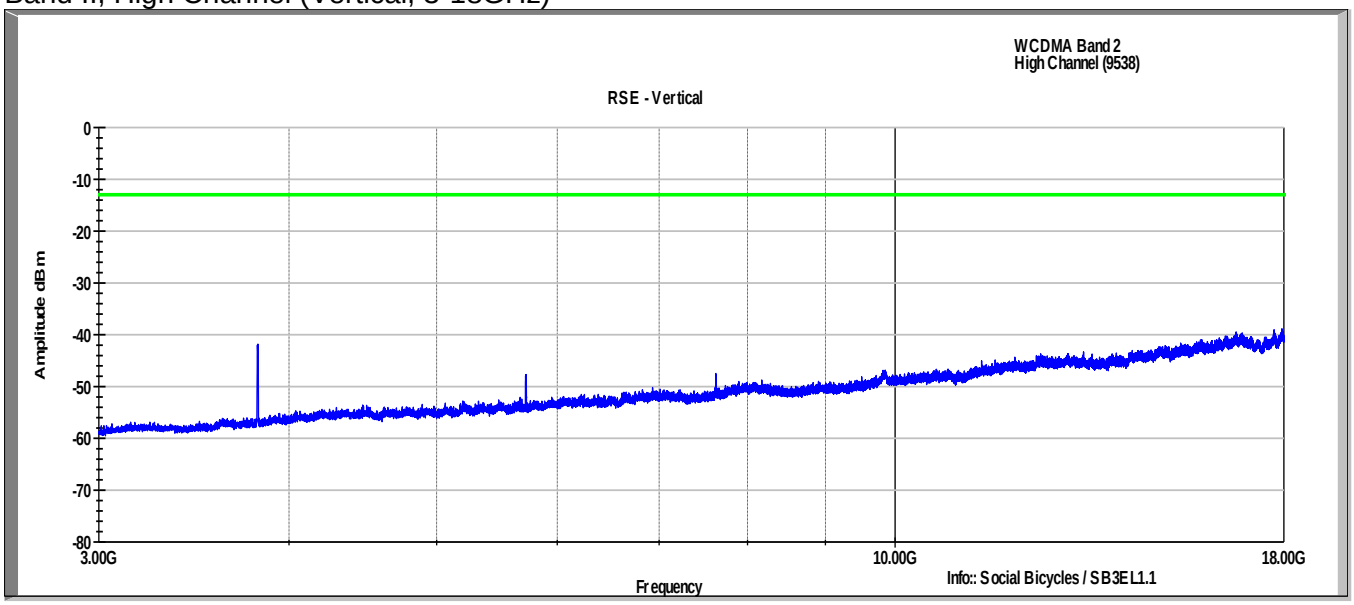
Band II, High Channel (Vertical, 1-3GHz)



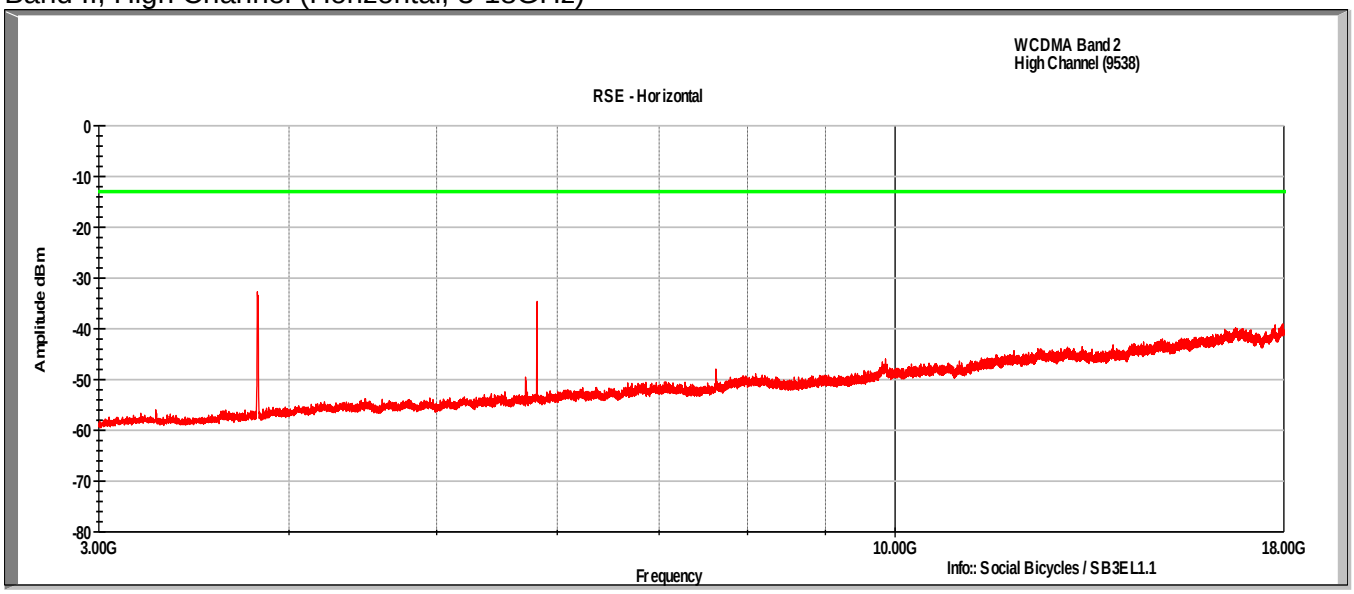
Band II, High Channel (Horizontal, 1-3GHz)



Band II, High Channel (Vertical, 3-18GHz)

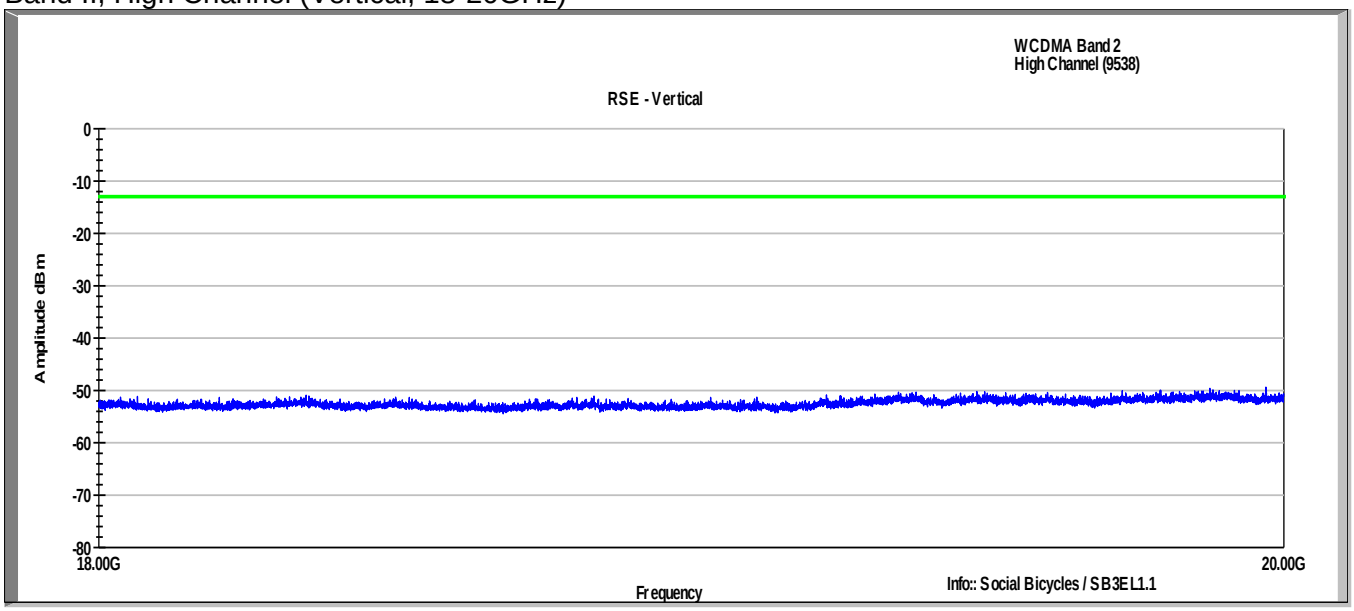


Band II, High Channel (Horizontal, 3-18GHz)

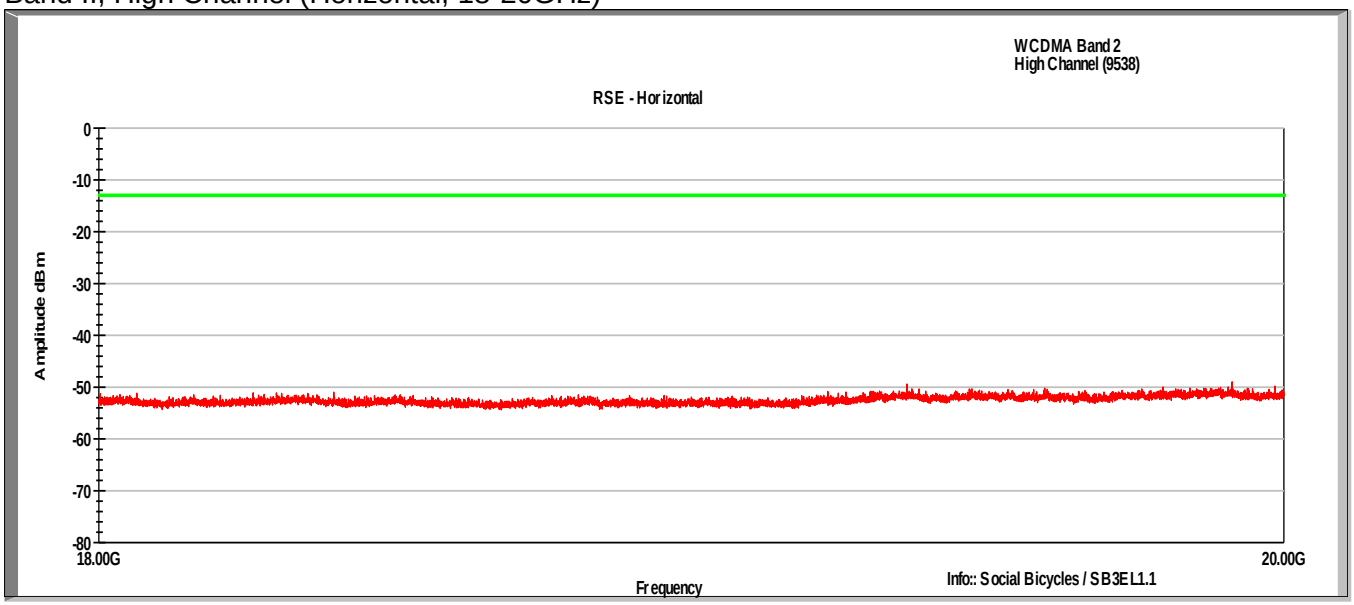


Worst-case spurious emission: -32.7 @ 3.813GHz (19.3dB of Margin)

Band II, High Channel (Vertical, 18-20GHz)



Band II, High Channel (Horizontal, 18-20GHz)



9 Frequency Stability

9.1 Test Result

Test Description	Basic Standards	Test Result
Frequency Stability	FCC Part 2.1055 FCC Part 22.917(a) FCC Part 24.238(a) RSS-GEN (6.11) RSS-132 5.3 RSS-132 6.3	Pass

9.2 Test Method

The EUT was placed inside the Environmental Chamber and was left inside chamber to stabilize to set temperature for minimum of thirty minutes before any measurements were made. The EUT was tested at Band II Channel 9400 and Band V Channel 4175.

9.3 Test Site

SGS EMC Laboratory, Suwanee, GA

9.4 Test Equipment

Test Date: 23-Dec-2016 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ENVIRONMENTAL TEST CHAMBER	T2RC	TENNEY ENVIRONMENTAL	B094877	CNR
HANDHELD MULTIMETER	87V	FLUKE	B079677	29-Jul-2017
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
ATTENUATOR, 10DB	10DB	ROHDE & SCHWARZ	B095594	27-Jul-2017
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2017

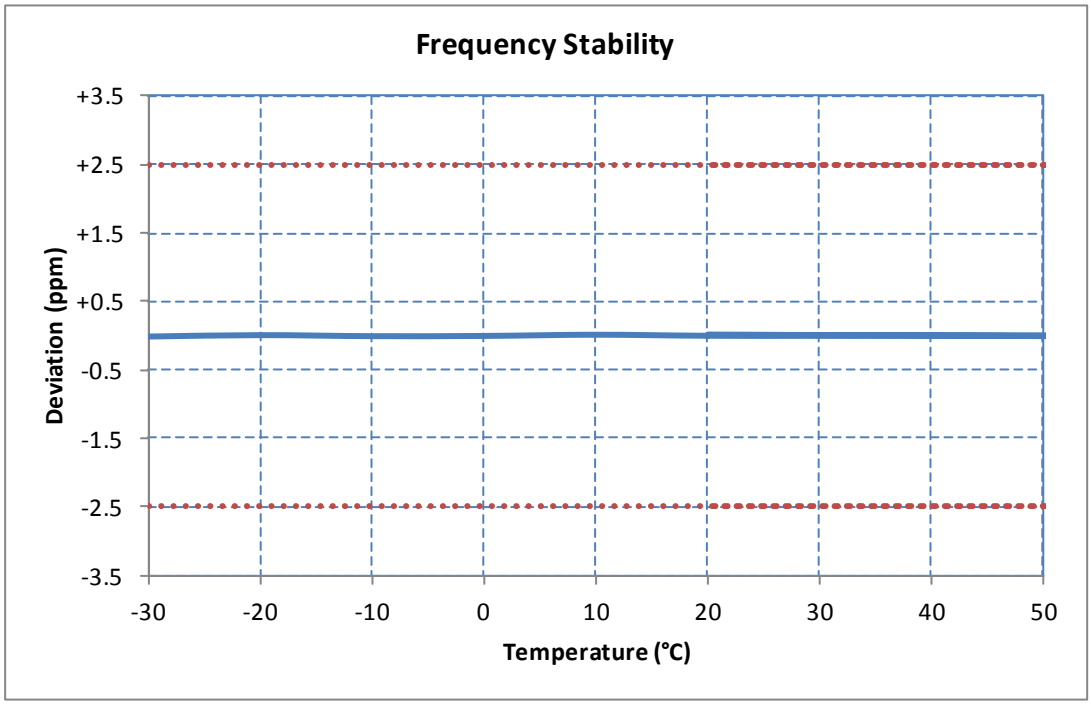
- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 2 year calibration cycle.

9.5 Test Data

Test Date: 23 December 2016

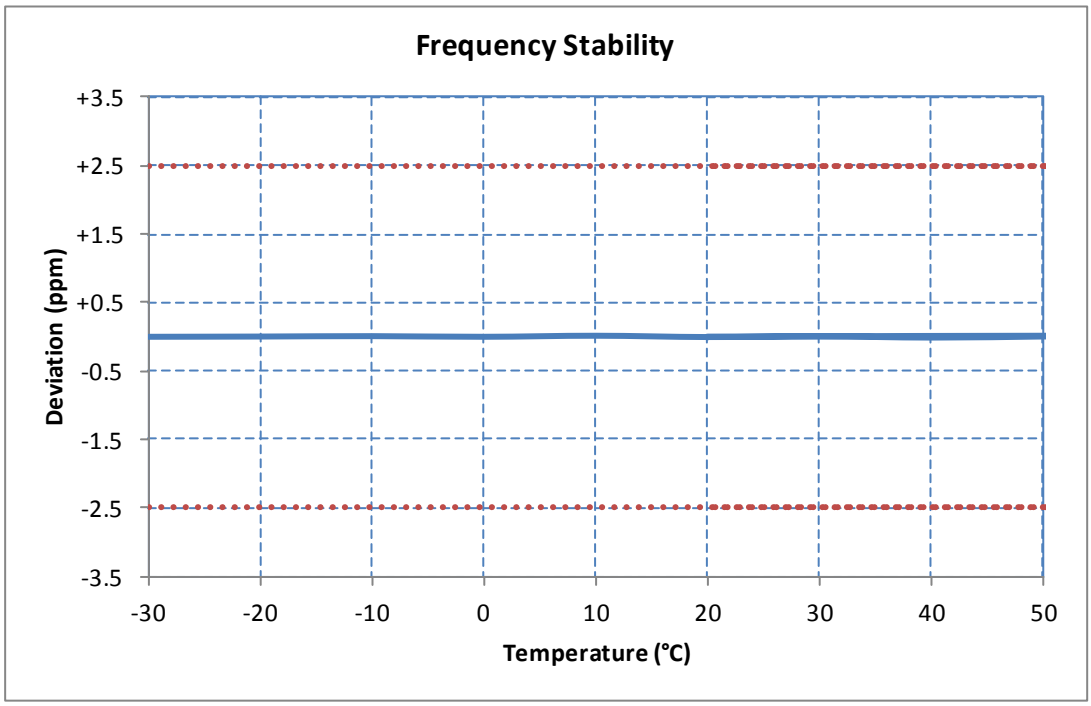
WCDMA Band 2, Channel 9400 (1880MHz)

Voltage %	Power V_{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	1,879,999,998	-2	-0.00	-0.000000
100%	3.70	-30	1,879,999,991	-9	-0.00	-0.000000
100%	3.70	-20	1,880,000,004	+4	+0.00	+0.000000
100%	3.70	-10	1,879,999,994	-6	-0.00	-0.000000
100%	3.70	0	1,879,999,997	-4	-0.00	-0.000000
100%	3.70	+10	1,880,000,008	+8	+0.00	+0.000000
100%	3.70	+20	1,879,999,998	-2	-0.00	-0.000000
100%	3.70	+30	1,879,999,998	-2	-0.00	-0.000000
100%	3.70	+40	1,880,000,002	+2	+0.00	+0.000000
100%	3.70	+50	1,880,000,002	+2	+0.00	+0.000000
100%	3.70	+55	1,879,999,992	-8	-0.00	-0.000000
114%	4.20	+20	1,880,000,010	+10	+0.01	+0.000001
85%	3.15	+20	1,879,999,999	-1	-0.00	-0.000000



WCDMA, Band 5, Channel 4175 (835MHz)

Voltage %	Power V_{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	834,999,997	-3	-0.00	-0.000000
100%	3.70	-30	834,999,998	-2	-0.00	-0.000000
100%	3.70	-20	834,999,999	-1	-0.00	-0.000000
100%	3.70	-10	835,000,001	+1	+0.00	+0.000000
100%	3.70	0	834,999,998	-2	-0.00	-0.000000
100%	3.70	+10	835,000,003	+3	+0.00	+0.000000
100%	3.70	+20	834,999,997	-3	-0.00	-0.000000
100%	3.70	+30	835,000,000	-0	-0.00	-0.000000
100%	3.70	+40	834,999,994	-6	-0.01	-0.000001
100%	3.70	+50	834,999,999	-1	-0.00	-0.000000
100%	3.70	+55	835,000,003	+3	+0.00	+0.000000
114%	4.20	+20	834,999,999	-1	-0.00	-0.000000
85%	3.15	+20	834,999,995	-5	-0.01	-0.000001



10 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