



TEST REPORT

Report Number: 101518599MIN-001

Project Number: G101518599

Testing performed on the
SAT-0003

FCC ID: 2AB7IREMOTE01
Industry Canada ID: 11848A-REMOTE01

to
47 CFR Part 15. 249:2013
RSS- 210, Issue 8, 2010
RSS-Gen, Issue 3, 2010
47 CFR, Part 15:2013, §15.107 and §15.109, Class / ICES-003, Issue 5:2012

For
Smart Animal Training Systems, LLC

Test Performed by:
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Oakdale, MN 55128 USA

Test Authorized by:
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Date: March 17, 2014

Reviewed by: Richard Blonigen
Richard Blonigen

Date: March 17, 2014

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1.0 GENERAL DESCRIPTION

Model:	SAT-0003
Type of EUT:	Remote Control (Smart Animal Trainer)
Serial Number:	B0023
FCC ID:	2AB7IREMOTE01
Industry Canada ID:	11848A- REMOTE01
Related Submittal(s) Grants:	None
Company:	Smart Animal Training Systems, LLC
Customer:	Mr. Wes Anderson
Address:	133 W. Market Street Indianapolis, IN 46204 USA
Phone:	317-721-4001
E-mail:	Wes@SmartAnimalTraining.com
Test Standards:	<input checked="" type="checkbox"/> 47 CFR, Part 15:2013, §15.249 <input checked="" type="checkbox"/> RSS-210, Issue 8, 20010 <input checked="" type="checkbox"/> RSS-Gen, Issue 3, 2010 <input checked="" type="checkbox"/> 47 CFR, Part 15:2013, §15.107 and §15.109, Class <input checked="" type="checkbox"/> ICES-003, Issue 5:2012 <input type="checkbox"/> Other
Type of radio:	<input checked="" type="checkbox"/> Stand -alone <input type="checkbox"/> Module <input type="checkbox"/> Hybrid
Date Sample Submitted:	February 28, 2014
Test Work Started:	March 7, 2014
Test Work Completed:	March 14, 2014
Test Sample Conditions:	<input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good



1.1 Product Description; Test Facility

Product Description:	Remote Control Transceiver
Operating Frequency	2405 MHz
Modulation:	QPSK
Emission Designator:	2M64GXW
Antenna(s) Info:	Integral Antenna
Antenna Installation:	<input type="checkbox"/> User <input type="checkbox"/> Professional <input checked="" type="checkbox"/> Factory
Transmitter Power Configuration:	<input checked="" type="checkbox"/> Internal battery <input type="checkbox"/> External power source <input type="checkbox"/> 120VAC <input type="checkbox"/> 230VAC <input type="checkbox"/> 400VAC <input type="checkbox"/> VDC <input type="checkbox"/> Other: Amp. <input type="checkbox"/> 50Hz <input type="checkbox"/> 60Hz
Special Test Arrangement:	As a hand-held device the EUT was rotated through three orthogonal axes to determine and tested with the maximum emissions
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2009

1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

- ☒ - Standby
- ☒ - Continuous
- ☐ - Continuous un-modulated
- ☐ - Test program (customer specific)
- ☒ - Charging

Operating modes of the EUT:

No.	Description
1	In Continuous mode the EUT was transmitted data packages every 1 second.
2	Normal mode with manually transmissions activation
3	Standby/Receive mode

Cables:

No.	Type	Length	Designation	Note
1	Shielded, USB to mini-USB	0.3 m	USB port	

Support equipment/Services:

No.	Item	Description
1	HP EliteBook model 6930p Laptop	Local PC to control continuous transmissions.

1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☒ **Normal**

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

1.4 Measurement uncertainty

The expanded uncertainty ($k = 2$) for radiated emissions from 30 to 1000 MHz has been determined to be: ± 4 dB at 10m and ± 5.4 dB at 3m

The expanded uncertainty ($k = 2$) for conducted emissions from 150 kHz to 30 MHz has been determined to be:
 ± 2.6 dB

1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.

The basic equation with a sample calculation is as follows:

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

Where: FS = Field Strength in dB(μ V/m)

RA = Receiver Amplitude in dB(μ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB(m^{-1})

AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(μ V) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(μ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

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

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/\text{m})$$

General notes:

2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST SPECIFICATION	TEST PARAMETERS	RESULT
15.249(a) / RSS-210 A2.9(a)	Field strength of fundamental	Pass
15.249(a) / RSS-210 A2.9(a)	Field strength of harmonics	Pass
15.249(d) / RSS-210 A2.9(b)	Field strength of spurious emissions	Pass
15.215(c) / RSS- Gen 4.6.1	Bandwidth of the emission	Pass
15.207/RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	Pass
15.109/ICES-003	Receiver/digital device radiated emissions	Pass
15.107/ ICES-003	Digital device conducted emissions	Pass



3.0 TEST CONDITIONS AND RESULTS

3.1 Field strength of fundamental

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Max. Emissions margin at fundamental: 10.6dB below the limits

Notes: None

Date:	March 13, 2014	Result: Pass
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Fundamental	

Table 3.1.1

Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Peak Reading dBμV	Total @ 3m dBμV/m	Ave Limit dBμV/m	Margin dB
	Polarity	Hts(cm)							
2405.14	V	100	28.4	2.9	0.0	52.1	83.4	94.0	-10.6
2405.14	H	100	28.4	2.9	0.0	45.8	77.1	94.0	-16.9



3.2 Field strength of harmonics and spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-26000MHz

Test result: Pass

Max. margin of harmonics and spurious emissions: 3.2dB below the limits

Notes: None

Date:	March 13, 2014	Result: Pass
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Frequency Range 30-1000MHz Measurements were taken using a Peak detector or CISPR Quasi-peak detector (marked *)	

Table 3.2.1

Frequency	Ant. Polarity	Reading dB μ V	Total C.F. dB1/m	Total at 3m dB μ V/m	Limit dB μ V/m	Margin dB
31.105 MHz	V	8.5	19.6	28.2	40.0	-11.8
48.103 MHz	V	22.7	10.5	33.1	40.0	-6.9
99.554 MHz	V	15.3	12.2	27.5	43.5	-16.0
126.42 MHz	V	17.4	13.7	31.1	43.5	-12.4
161.0 MHz	V	18.5	11.7	30.2	43.5	-13.3
168.4 MHz	V	18.9	11.5	30.3	43.5	-13.2
486.04 MHz	V	12.1	19.6	31.6	46.0	-14.4
810.0 MHz	V	17.6	23.5	41.2	46.0	-4.9
138.73 MHz	H	17.9	13.1	31.0	43.5	-12.6
161.59 MHz	H	21.6	11.7	33.3	43.5	-10.2
225.09 MHz	H	20.4	12.2	32.6	46.0	-13.5
299.84 MHz	H	17.0	15.5	32.5	46.0	-13.5
480.09 MHz	H	13.1	19.5	32.6	46.0	-13.4
810.08 MHz*	H	19.3	23.5	42.8	46.0	-3.2

Date:	March 13, 2014	Result: Pass
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Frequency Range 1.0 – 26.0 GHz	

Table 3.2.2

Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
3.869 GHz	V	38.6	37.1	41.9	33.8	54.0	-20.2
4.808 GHz	H	46.7	37.2	42.1	41.7	54.0	-12.3



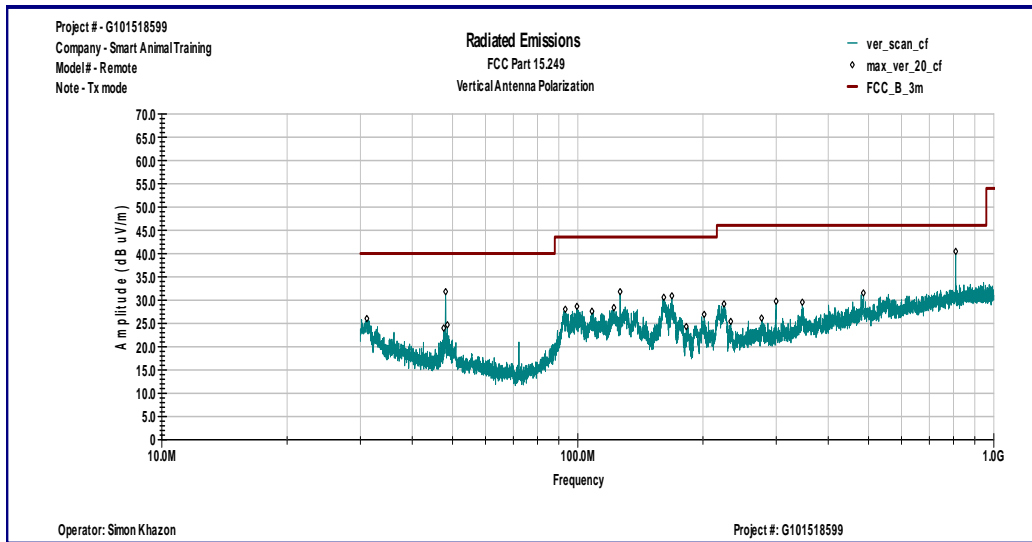
Date:	March 13, 2014	Result: Pass
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Tested by:	Simon Khazon	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Band edge Compliance	

Table 3.2.3

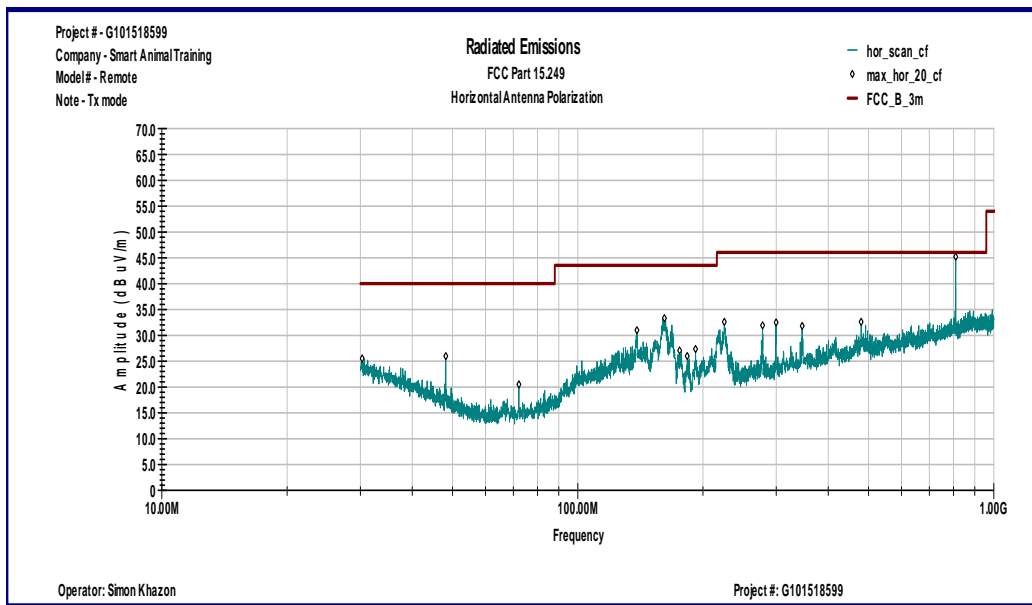
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Peak Reading dBμV	Total @ 3m dBμV/m	Ave Limit dBμV/m	Margin dB
	Polarity	Hts(cm)							
2400.00	V	100	28.4	2.9	0.0	5.7	37.0	54.0	-17.0
2400.00	H	100	28.4	2.9	0.0	3.0	34.3	54.0	-19.7
2483.50	V	100	28.6	2.9	0.0	5.7	37.2	54.0	-16.8
2483.50	H	100	28.6	2.9	0.0	3.0	34.5	54.0	-19.5

Graph 3.2.1

Vertical antenna polarization

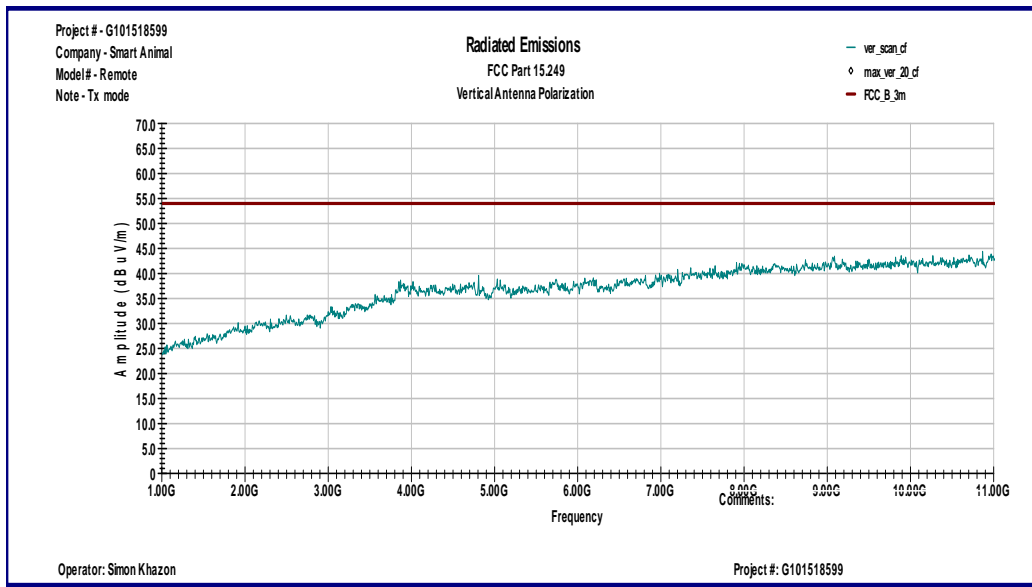


Horizontal antenna polarization

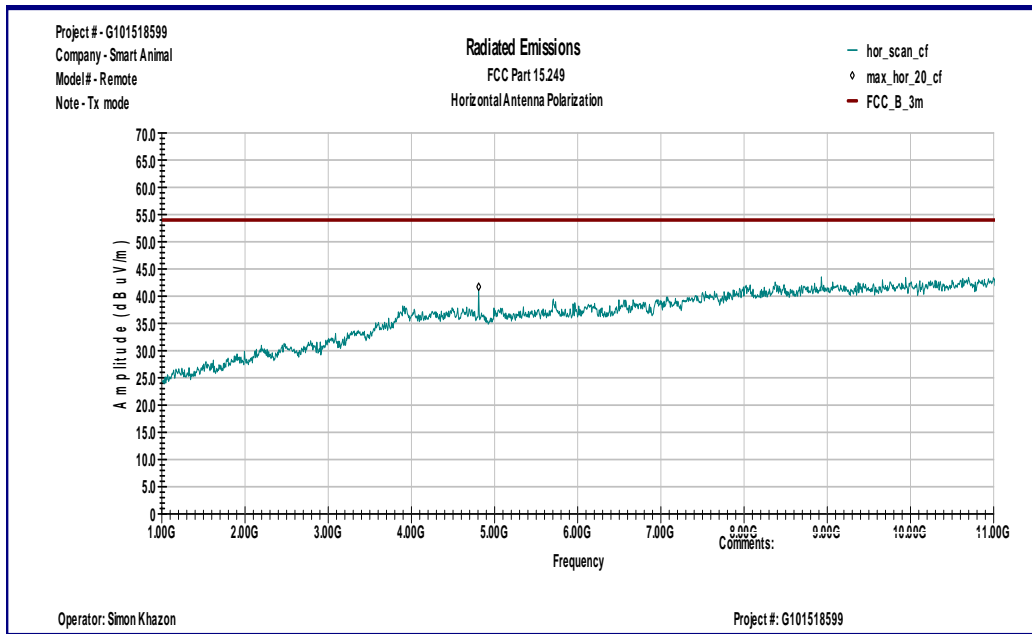


Graph 3.2.2

Vertical antenna polarization

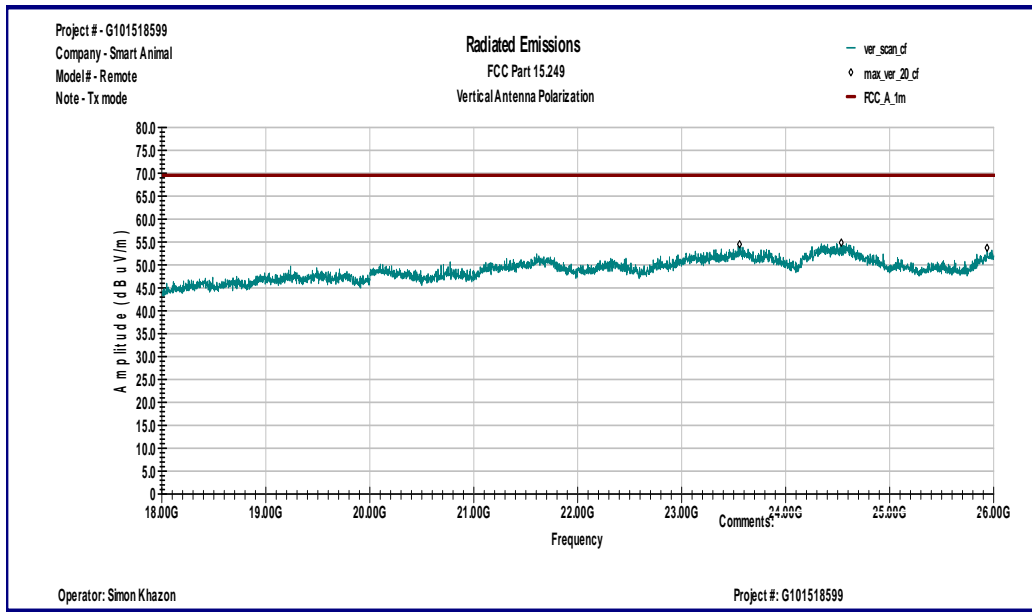


Horizontal antenna polarization

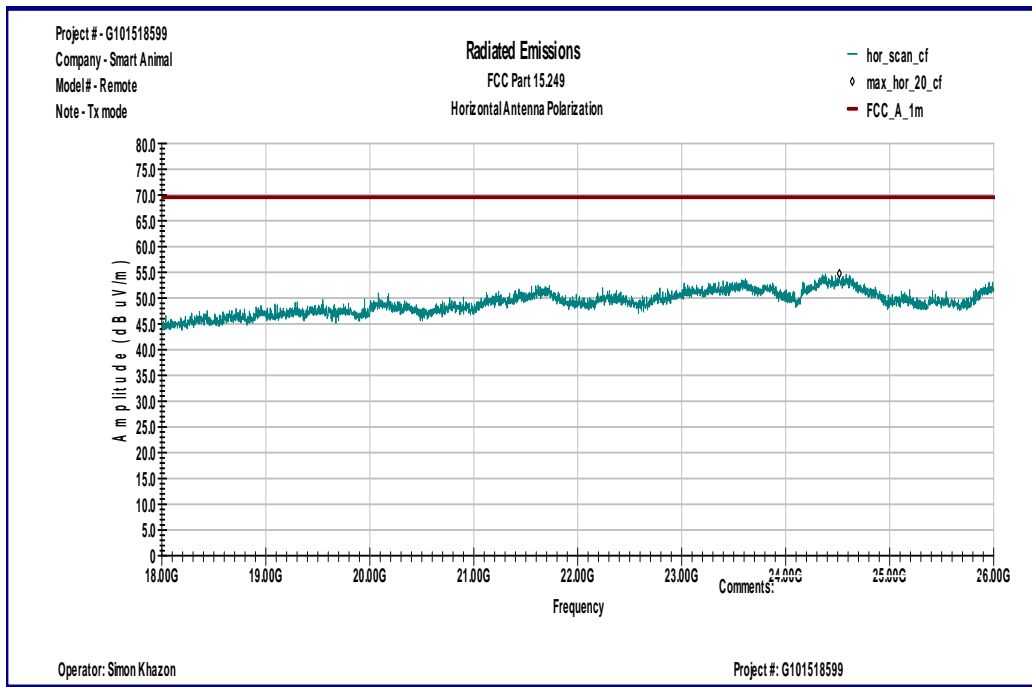


Graph 3.2.3

Vertical antenna polarization



Horizontal antenna polarization



3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz
2405.14	2636.2	2620

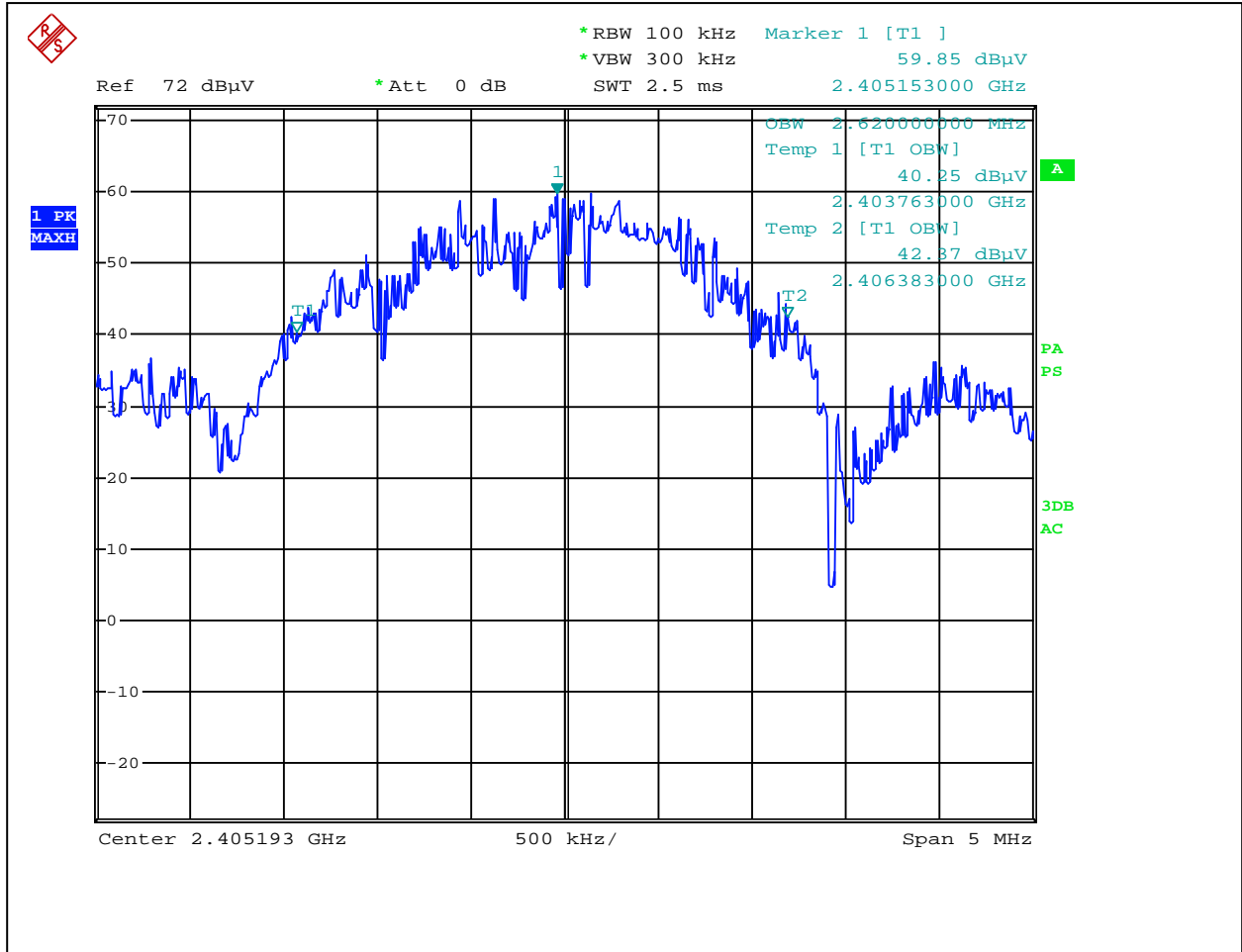
Graphs 3-3-1 and 3-3-2 are show bandwidth of emissions

Notes: The bandwidth of emissions is contained within the frequency band of operation

Graph 3.3.1



Graph 3.3.2





3.4 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 9.9dB below the limits

Notes: The EUT was connected to USB port of the Laptop.
Test was performed at the Laptop AC Port.

Date:	March 13, 2014	Result: Pass
Standard:	FCC 15.207	
Tested by:	Simon Khazon	
Test Point:	Power Line	
Operation mode:	See Page 5	
Note:	Charging / Transmitting mode	

Table 3.4.1

Line 1

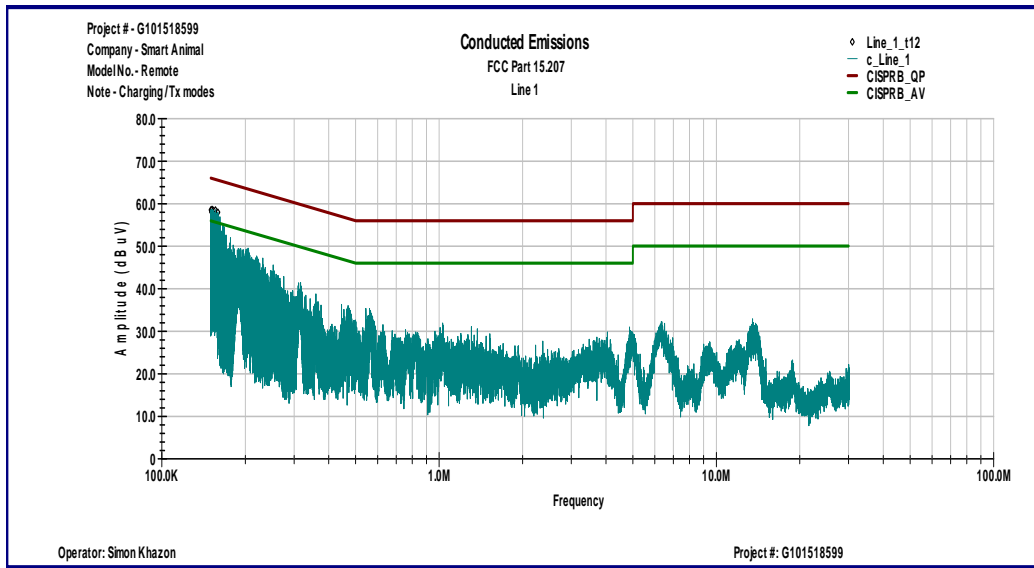
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.68 KHz	56.1	42.6	66.0	56.0	-9.9	-13.4
151.94 KHz	55.7	42.3	65.9	55.9	-10.2	-13.6
153.66 KHz	55.9	42.3	65.8	55.8	-9.9	-13.5
153.9 KHz	55.2	41.5	65.8	55.8	-10.6	-14.3
158.5 KHz	50.8	32.2	65.5	55.5	-14.7	-23.3
160.16 KHz	52.9	30.2	65.5	55.5	-12.6	-25.3

Line 2

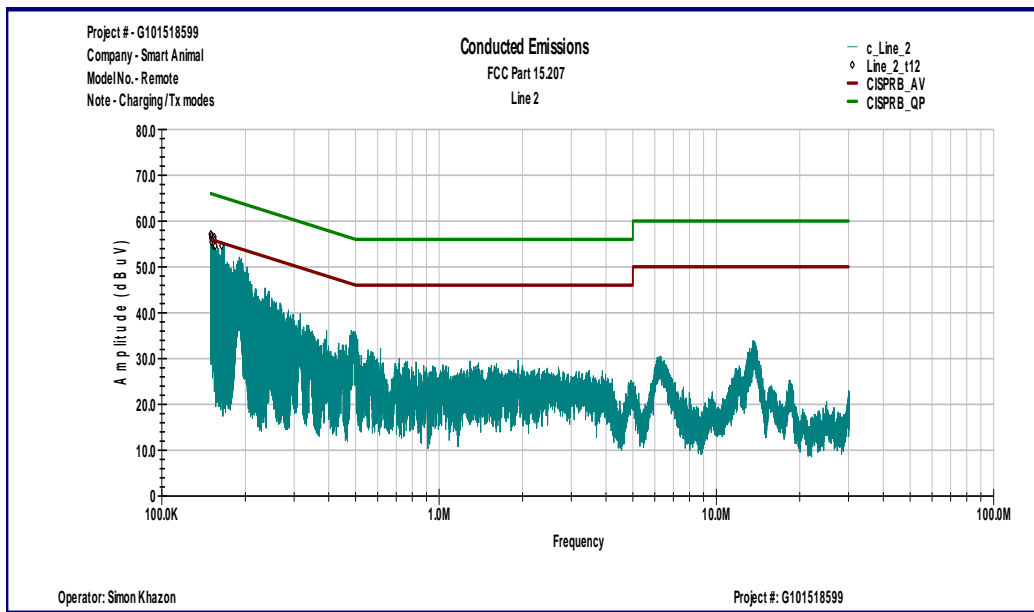
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.3 KHz	54.3	39.1	66.0	56.0	-11.7	-16.8
150.68 KHz	53.3	39.7	66.0	56.0	-12.7	-16.2
150.8 KHz	53.7	38.9	66.0	56.0	-12.3	-17.0
151.36 KHz	51.9	37.6	65.9	55.9	-14.0	-18.4
153.6 KHz	51.0	33.8	65.8	55.8	-14.9	-22.0
159.8 KHz	48.4	25.1	65.5	55.5	-17.1	-30.4

Graph 3.4.1

Line 1



Line 2





3.5 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-12000MHz

Max. Emissions margin: 11.5dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Table 3.11.1 and Graphs 3.11.1 and 3.11.2)

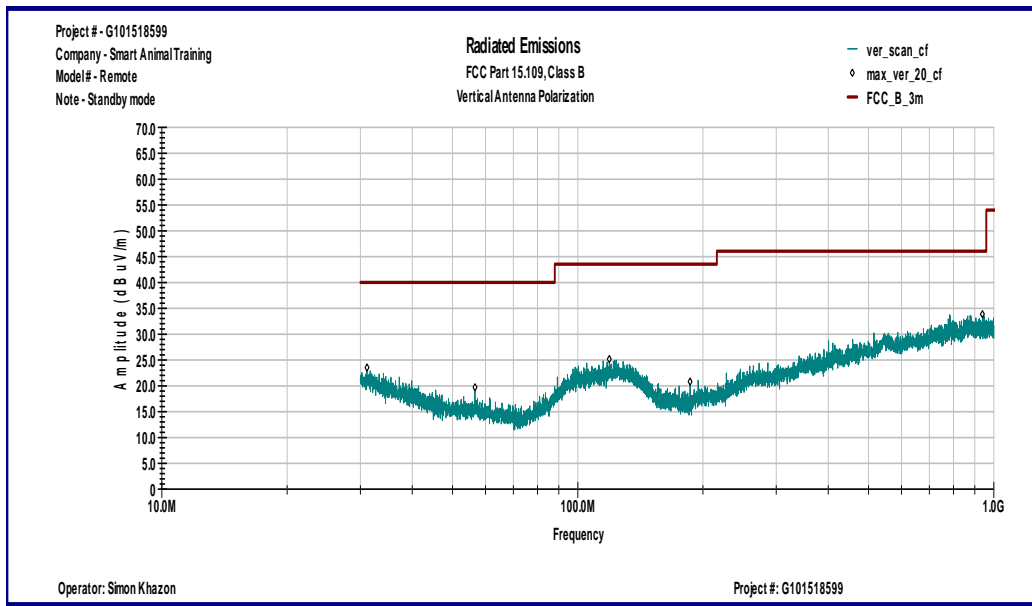
Date:	March 11, 2014	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Simon Khazon	
Test Point:	Enclosure	
Operation mode:	Standby mode	
Note:		

Table 3.5.1

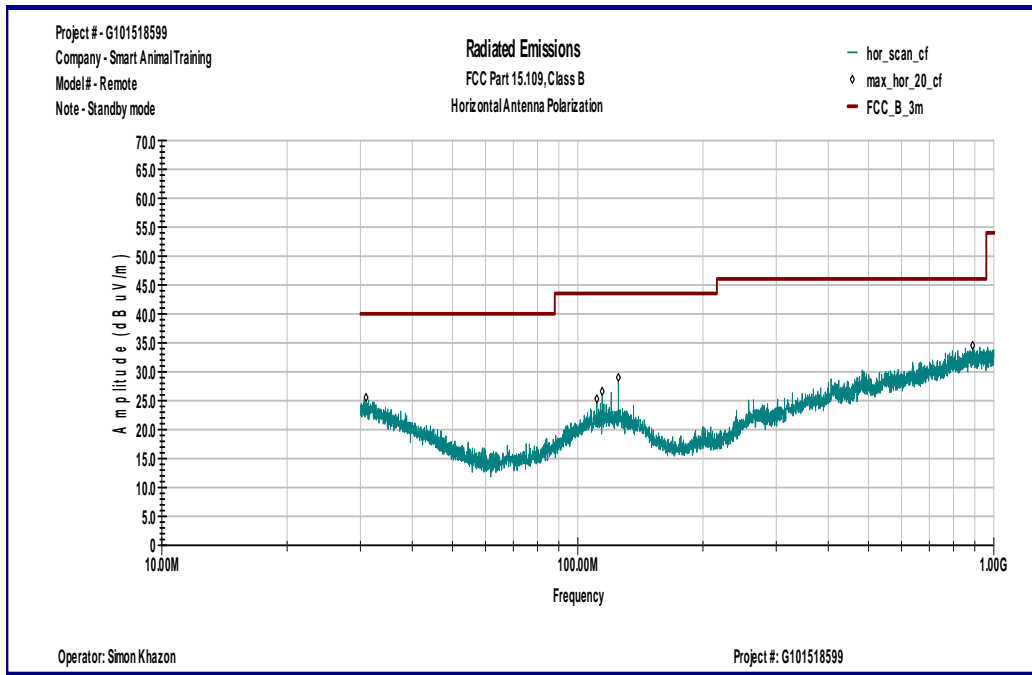
Frequency	Ant. Polarity	Peak Reading dB μ V	Total C.F. dB1/m	Total at 3m dB μ V/m	Limit dB μ V/m	Margin dB
31.123 MHz	V	6.0	19.6	23.5	40.0	-16.5
56.585 MHz	V	11.9	7.6	19.7	40.0	-20.3
119.08 MHz	V	10.9	13.7	25.2	43.5	-18.4
186.21 MHz	V	9.7	11.0	20.8	43.5	-22.7
939.38 MHz	V	10.2	24.7	33.8	46.0	-12.2
30.97 MHz	H	5.8	19.7	25.5	40.0	-14.5
111.12 MHz	H	11.9	13.4	25.3	43.5	-18.2
114.48 MHz	H	13.0	13.6	26.6	43.5	-16.9
125.22 MHz	H	15.3	13.7	29.0	43.5	-14.5
890.01 MHz	H	10.1	24.5	34.5	46.0	-11.5

Graph 3.5.1

Vertical antenna polarization

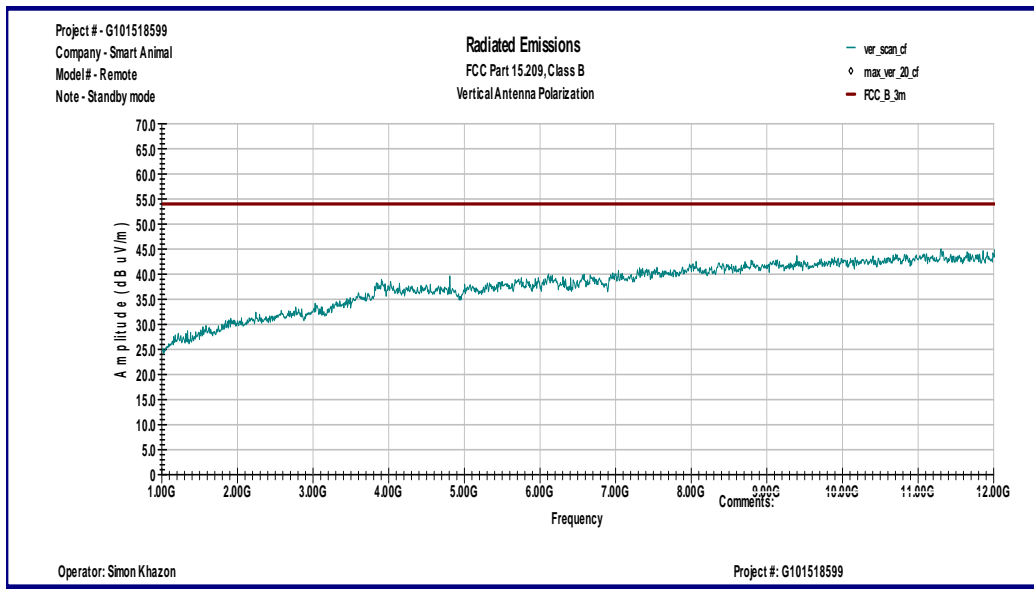


Horizontal antenna polarization

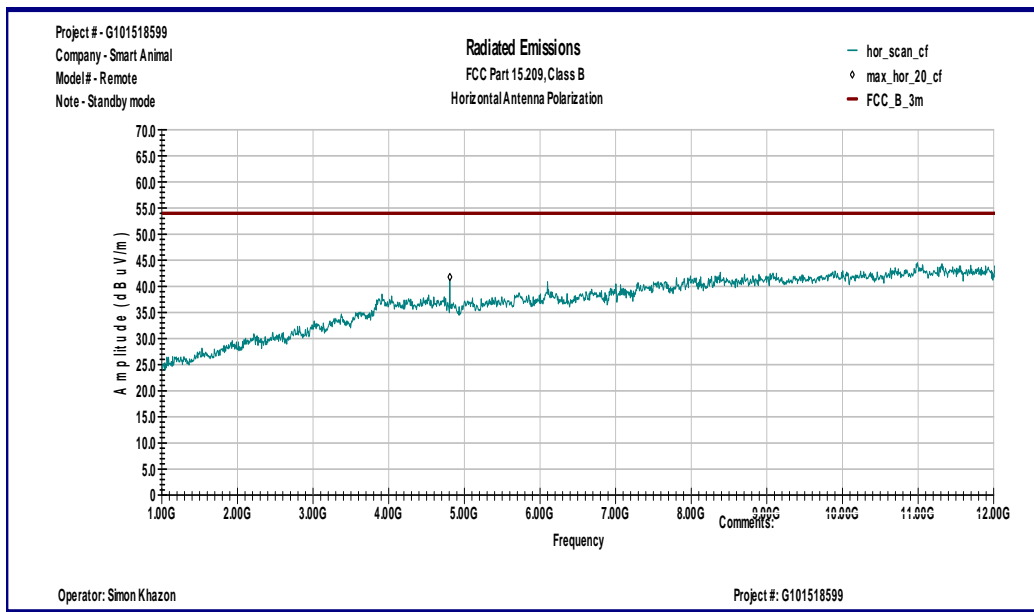


Graph 3.5.2

Vertical antenna polarization



Horizontal antenna polarization





3.6 Digital device conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 16.3dB below the limits

Notes: The EUT was connected to USB port of the Laptop.
Test was performed at the Laptop AC Port.

Date:	March 13, 2014	Result: Pass
Standard:	FCC 15.107, Class B	
Tested by:	Simon Khazon	
Test Point:	Power Line	
Operation mode:	Standby / Charging	
Note:		

Table 3.6.1

Line 1

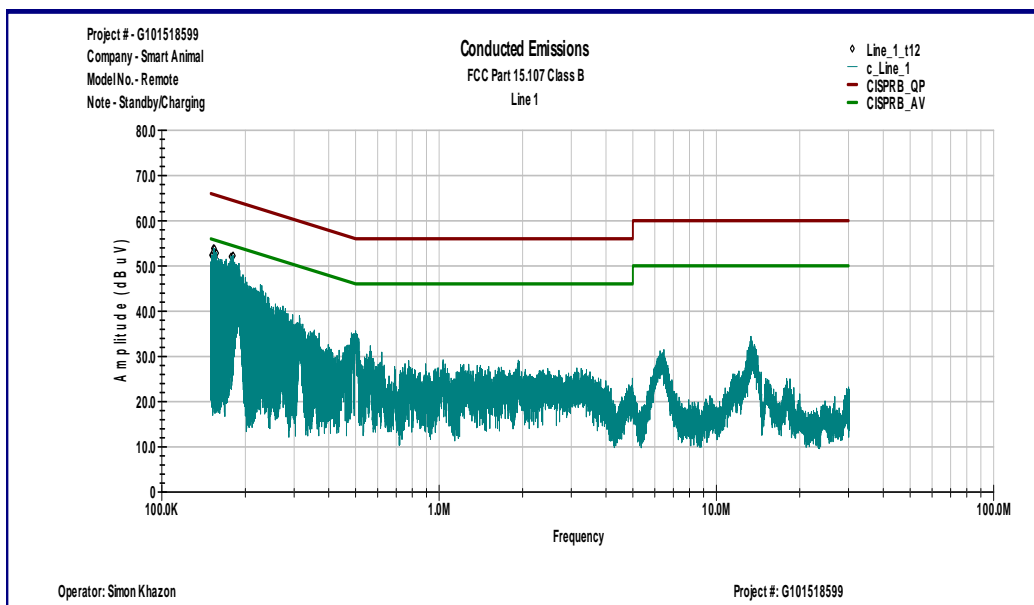
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.97 KHz	48.7	27.4	66.0	56.0	-17.2	-28.5
151.06 KHz	49.0	29.2	65.9	55.9	-17.0	-26.7
153.6 KHz	48.4	25.6	65.8	55.8	-17.4	-30.3
156.09 KHz	46.3	24.4	65.7	55.7	-19.4	-31.3
172.52 KHz	43.4	26.9	64.8	54.8	-21.4	-28.0
175.83 KHz	45.9	34.5	64.7	54.7	-18.8	-20.2

Line 2

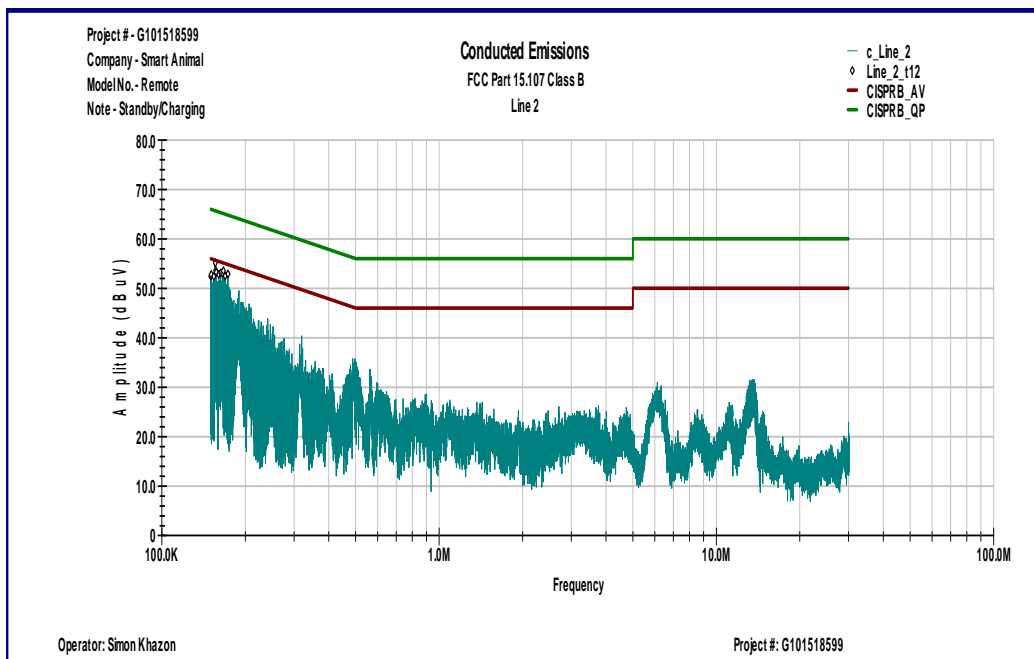
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
152.86 KHz	46.2	25.9	65.8	55.8	-19.7	-29.9
156.53 KHz	47.5	32.2	65.7	55.7	-18.2	-23.4
159.15 KHz	49.2	34.7	65.5	55.5	-16.3	-20.8
165.77 KHz	48.9	35.0	65.2	55.2	-16.3	-20.2
169.36 KHz	46.6	31.9	65.0	55.0	-18.4	-23.1
169.72 KHz	48.2	31.3	65.0	55.0	-16.8	-23.7

Graph 3.6.1

Line 1



Line 2



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	12/12/2014	<input checked="" type="checkbox"/>
Spectrum Analyzer	R & S	ESU	100398	25283	01/07/2015	<input checked="" type="checkbox"/>
Bicono-Log Antenna	Schaffner-Teseq	CBL6112B	2468	9734	12/12/2014	<input checked="" type="checkbox"/>
Horn Antenna	EMCO	3115	6579	15580	07/18/2014	<input checked="" type="checkbox"/>
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	11/12/2014	<input checked="" type="checkbox"/>
LISN	Solar Electronics	9252-50-R-24-BNC	068545	MIN-0060	02/19/2015	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1402232	172081	11/12/2014	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	11/12/2014	<input checked="" type="checkbox"/>
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	<input checked="" type="checkbox"/>