TEST REPORT

Report Number: 3137903MIN-001
Project Number: 3137903

Testing performed on the
ZRW103I RF Controlled Wall Mounted Switch
FCC ID: QIE0763-0X
Industry Canada ID: 4436A-07630X

to
47 CFR Part 15. 249:2006
RSS- 210, Issue 7, 2007

For
Advanced Control Technologies Inc.

Test Performed by:	Test Authorized by:
Intertek Testing Services NA, Inc.	Advanced Control Technologies Inc.
7250 Hudson Blvd., Suite 100	8076 Woodland Drive
Oakdale, MN 55128	Indianapolis, IN 46278

Prepared by: _____ Date: December 12, 2007
Uri Spector

Reviewed by: _____ Date: December 12, 2007
Norman Shpilsher

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1.0 GENERAL DESCRIPTION

Model:	ZRW103I
Type of EUT:	RF Controlled Wall Mounted Switch
Serial Number:	N/A
FCC ID:	QIE0763-0X
Industry Canada ID:	4436A-07630X
Related Submittal(s) Grants:	None
Company:	Advanced Control Technologies Inc.
Customer:	Mr. Mark Scott
Address:	8076 Woodland Drive Indianapolis, IN 46278
Phone:	(317) 337-0100 ext. 214
Fax:	(317) 337-0200
Test Standards:	☒ FCC Part 15.249 ☒ RSS–210, Issue 7, 2007 ☒ RSS-Gen, Issue 1, 2005 ☒ 47 CFR, Part 15:2005, §15.107 and §15.109, Class B ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	November 27, 2007
Test Work Started:	November 27, 2007
Test Work Completed:	December 12, 2007
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Product Description:	ZRW103I
Operating Frequency	908.39 MHz
Modulation:	FSK
Emission Designator:	
Antenna(s) Info:	Integral Antenna
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☐ Internal rechargeable battery ☐ External power source ☒ 120VAC ☐ 230VAC ☐ 400VAC ☐ 3.6 VDC ☐ Other: Amp. ☐ 50Hz ☒ 60Hz
Test Methodology:	Emission measurements were performed according to the procedures in ANSI C63.4-2003. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application
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:	The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been accredited by A2LA (Certificate No. 1427.01)
Justification:	None

1.2 EUT Configuration

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

☐ - Standby
☐ - Continuous
☒ - Continuous transmission (see below)
☐ - Test program (customer specific)
☐ -

Operating modes of the EUT:

No.	Description
1	The special test mode which allowed transmit continuously was used and load light was ON
2	

Cables:

No.	Type	Length	Designation	Note
1	Load wires	3 ft.	Not shielded	
2				

Support equipment/Services:

No.	Item	Description
1	Light Bulb	
2		

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(μV/m)
RA = Receiver Amplitude in dB(μV)
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(μV) 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(μV/m).

RA = 48.1 dB(μV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(μV/m)

General notes: None

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)(b) / RSS-210 A2.9(1)	Field Strength of Fundamental	Pass
15.249(a)(b), 15.205 / RSS-210 A2.9(2)	Field Strength of Harmonics	Pass
15.249(c), 15.209 / RSS-210 A2.9(2)	Out of Band Spurious, 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 Transmitter field strength of emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-1000MHz

Test result: **Pass**

Max. Emissions margin at fundamental: 9.5 dB below the limits

Max. Margin of harmonics and spurious emissions: 11.5 dB below the limits

Notes: None

Date:	December 10, 2007	**Result:** **Pass**
Standard:	FCC 15.249(a)(b) / RSS-210 A2.9(1)(2)	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	See Page 5	
Note:	Field Strength of Fundamental and Harmonics Emissions measurements were made with Fundamental frequency at 908.39MHz. The Harmonics emissions were tested up to 10th harmonic. Measurements were taken using Peak detector The Tables 1 and 2 show the Field Strength of Fundamental Radiation and Restricted Band Harmonics Emissions. No emissions above the floor noise were found above 2ed harmonic (see Graphs 1, 2).	

Table # 1

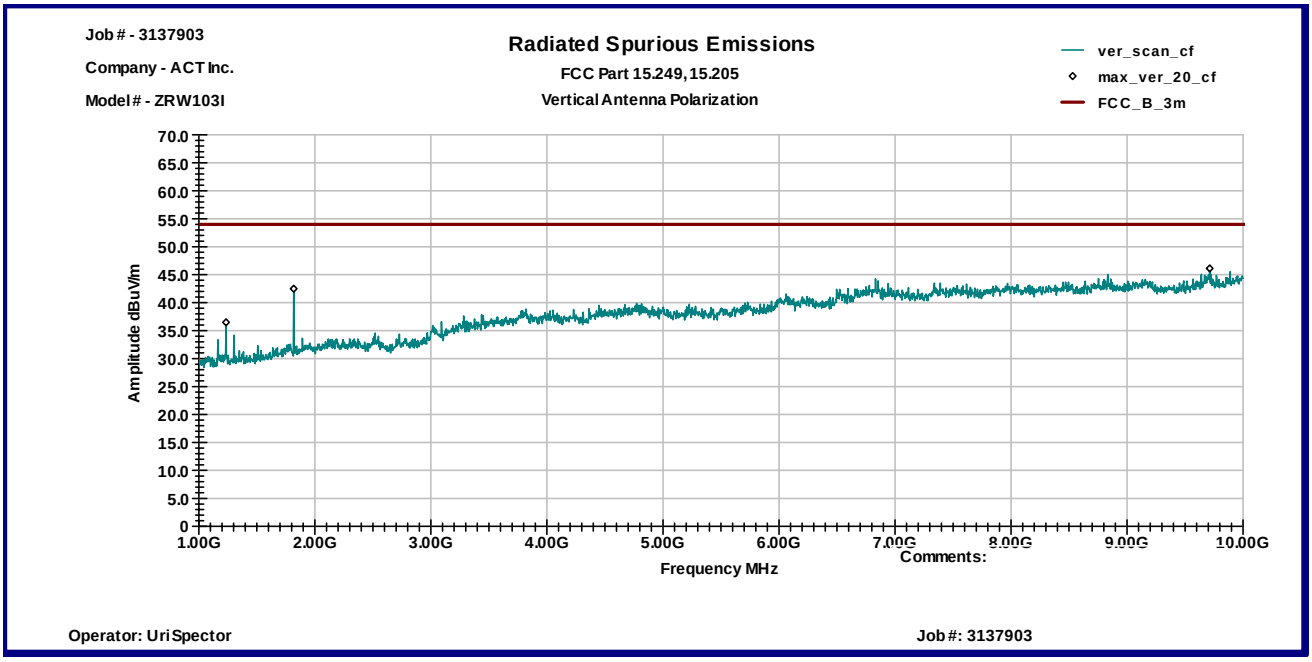
Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
908.39	V	133	21.1	3.6	0.0	59.7	84.5	94.0	-9.5	
908.39	H	208	21.1	3.6	0.0	55.7	80.5	94.0	-13.5	

Table # 2

Frequency MHz	Antenna Polarity	Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	Avg Limit dBµV/m	Margin dB
1.234 GHz	V	48.6	27.5	39.6	36.5	54.0	-17.5
1.8172 GHz	V	51.7	29.6	38.9	42.5	54.0	-11.5
1.234 GHz	H	44.3	27.5	39.6	32.2	54.0	-21.8
1.8172 GHz	H	48.8	29.6	38.9	39.5	54.0	-14.5

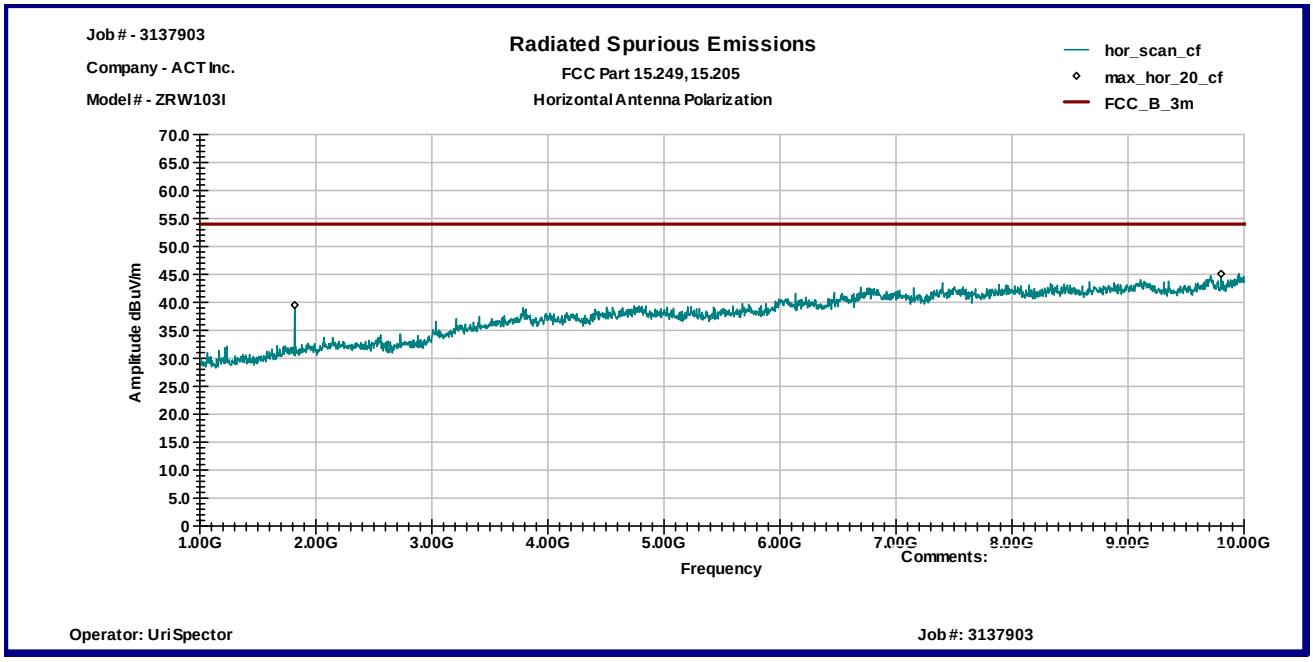
Graph 1

Vertical antenna polarization



Graph 2

Horizontal antenna polarization



3.2 Out of Band Spurious Emissions

Date:	December 10, 2007	**Result:** **Pass**
Standard:	FCC 15.249(c), 15.205 / RSS-210 A2.9(2)	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	See Page 5	
Note:	Out-of-band measurements were made for frequencies: - 902MHz - 928MHz. Output frequency of the EUT is 908.39MHz	

Table # 3

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
902.00	V	100	21.1	3.6	0.0	13.4	38.1	46.0	-7.9	
902.00	H	100	21.1	3.6	0.0	14.3	39.0	46.0	-7.0	
928.00	V	100	21.3	3.7	0.0	14.5	39.5	46.0	-6.5	
928.00	H	100	21.3	3.7	0.0	13.5	38.5	46.0	-7.5	

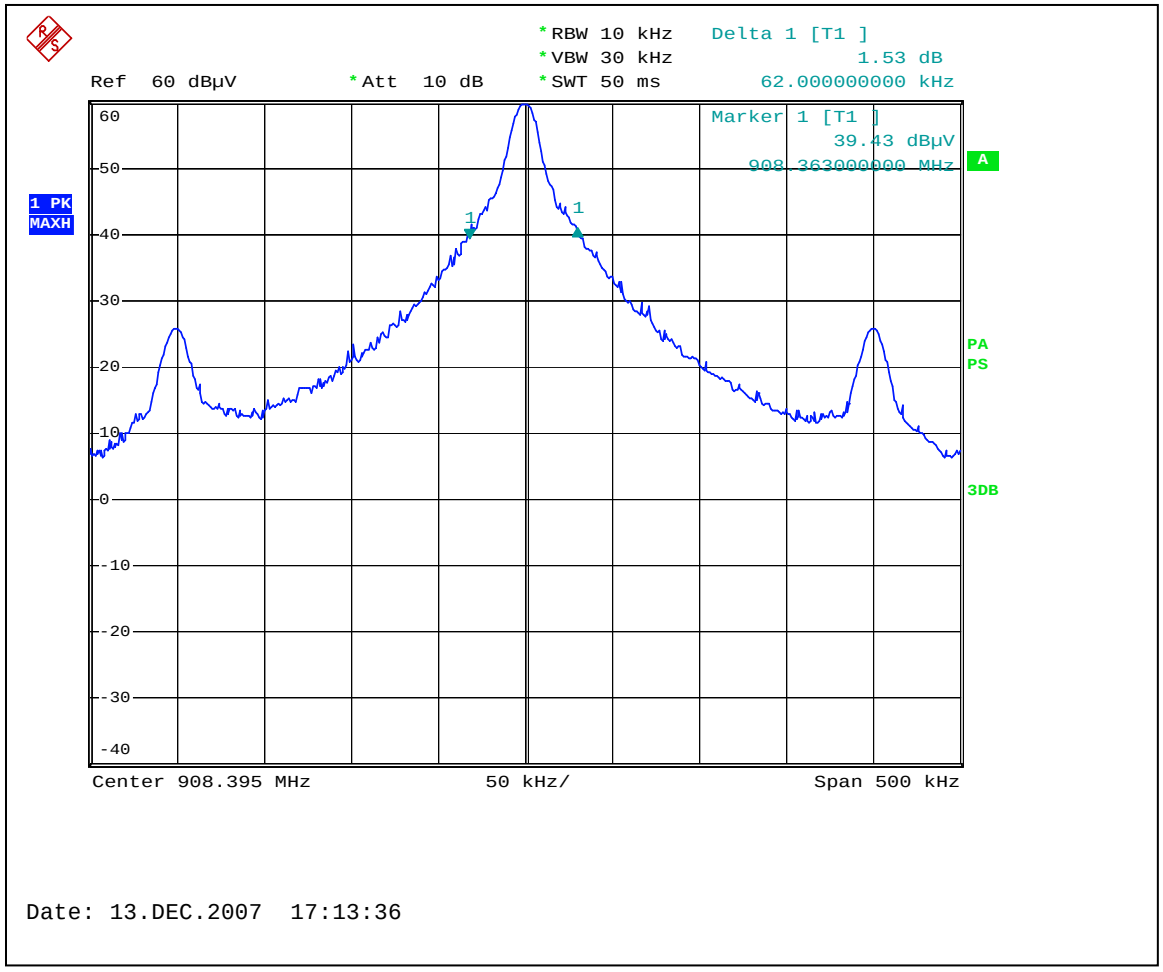
3.3 Bandwidth of Emissions

Center Frequency of operation MHz	Maximum allowed bandwidth kHz	Measured 20dB bandwidth kHz	Measured 99% bandwidth kHz	Result
908.39	2270.97	62	77	**Pass**

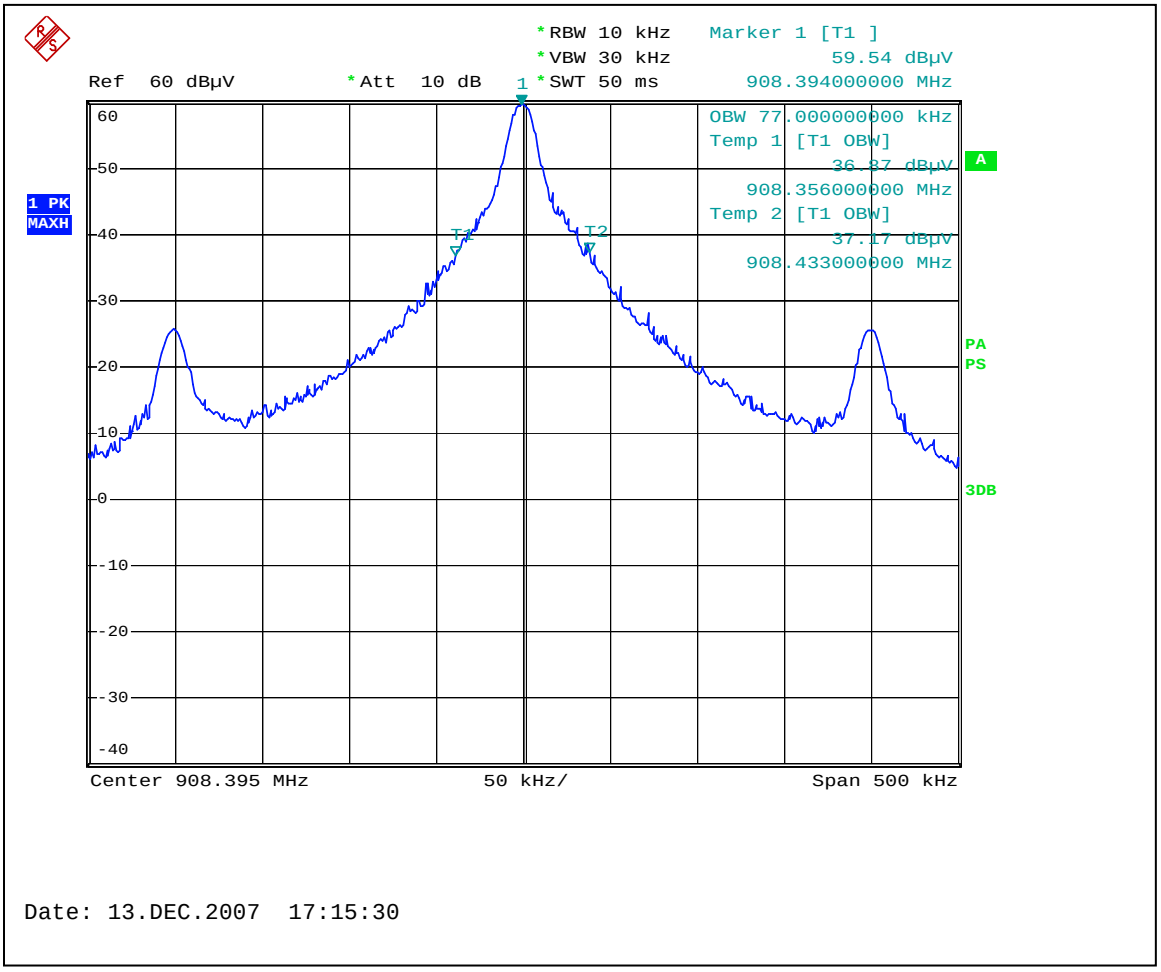
Graphs 3, 4 are show bandwidth of emissions

Notes: None

Graph 3


*RBW 10 kHz
*VBW 30 kHz
*SWT 50 ms
Delta 1 [T1]
1.53 dB
62.000000000 kHz
Ref 60 dBµV
*Att 10 dB
Marker 1 [T1]
39.43 dBµV
908.363000000 MHz
1 PK
MAXH
A
PA
PS
3DB
60
50
40
30
20
10
0
-10
-20
-30
-40
Center 908.395 MHz
50 kHz/
Span 500 kHz
Date: 13.DEC.2007 17:13:36

Graph 4


*RBW 10 kHz
*VBW 30 kHz
Ref 60 dBµV
*Att 10 dB
1 *SWT 50 ms
Marker 1 [T1]
59.54 dBµV
908.394000000 MHz
OBW 77.000000000 kHz
Temp 1 [T1 OBW]
36.87 dBµV
908.356000000 MHz
Temp 2 [T1 OBW]
37.17 dBµV
908.433000000 MHz
1 PK
MAXH
A
PA
PS
3DB
60
50
40
30
20
10
0
-10
-20
-30
-40
T1
T2
Center 908.395 MHz
50 kHz/
Span 500 kHz
Date: 13.DEC.2007 17:15:30

3.4 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 10 dB below the limits

Notes: None

Date:	December 10, 2007	**Result:** **Pass**
Standard:	FCC Part 15.207	
Tested by:	Uri Spector	
Test Point:	Line 1, Line 2	
Operation mode:	Transmitting mode	
Note:		

Table # 4

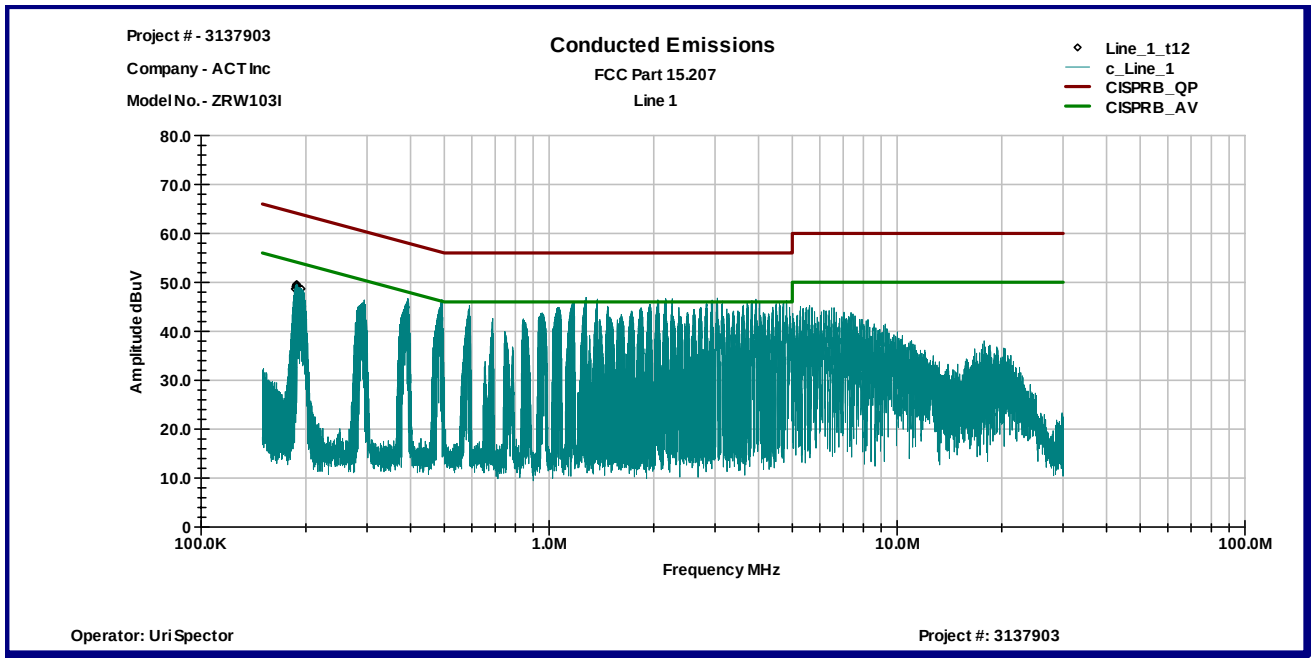
Line 1

Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
187.91 KHz	46.8	33.1	64.1	54.1	-17.3	-21.0
494.0 KHz	44.0	31.6	56.1	46.1	-12.1	-14.5
1.2802 MHz	45.5	30.6	56.0	46.0	-10.5	-15.4
2.1695 MHz	40.8	27.5	56.0	46.0	-15.2	-18.5
3.0565 MHz	39.1	24.9	56.0	46.0	-16.9	-21.1
3.942 MHz	41.1	26.7	56.0	46.0	-14.9	-19.3

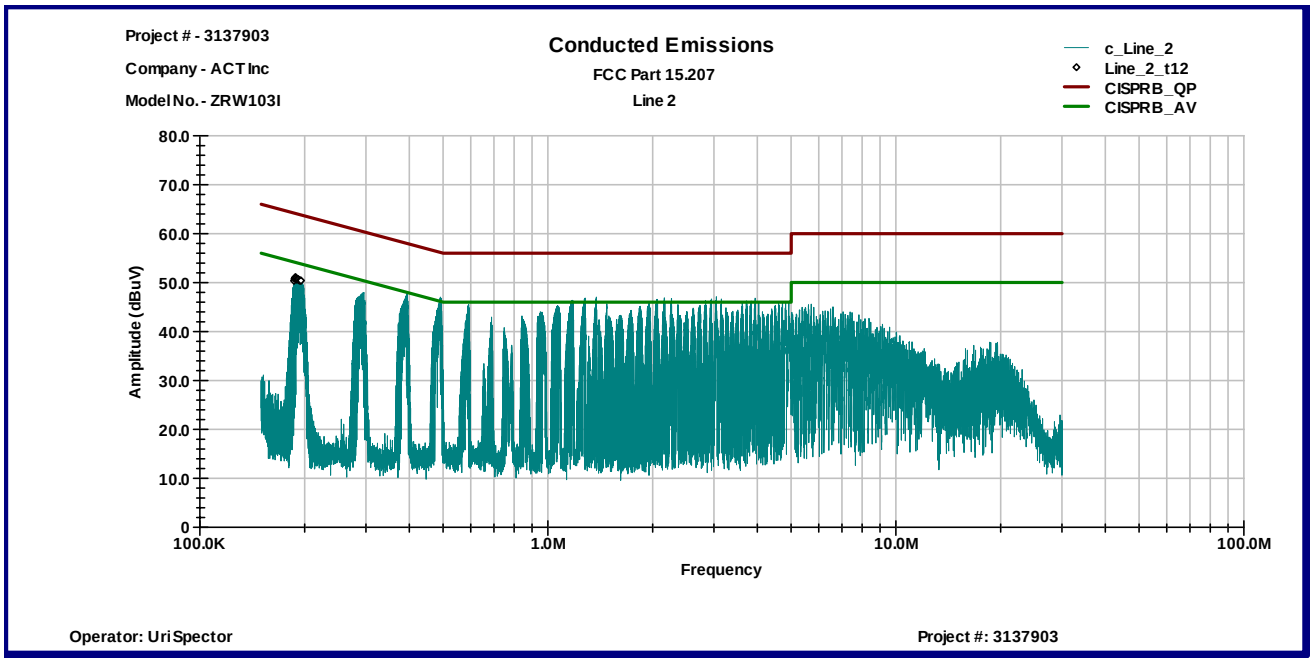
Line 2

Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
187.51 KHz	47.7	34.2	64.2	54.2	-16.5	-20.0
492.05 KHz	46.0	35.1	56.1	46.1	-10.1	-11.1
1.3779 MHz	46.0	31.2	56.0	46.0	-10.1	-14.8
2.1664 MHz	45.8	31.0	56.0	46.0	-10.2	-15.0
3.0513 MHz	46.0	30.4	56.0	46.0	-10.0	-15.6
3.9381 MHz	45.6	29.9	56.0	46.0	-10.4	-16.1

Graph 5



Graph 6



3.5 Digital device radiated emissions

Test location: ☐ OATS ☒ Anechoric Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-10GHz

Max. Emissions margin: 7.3 dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Tables 5, 6)

Date:	November 27, 2007	**Result: Pass**
Standard:	FCC Part 15.109, Class B	
Tested by:	Meak Nget	
Test Point:	Enclosure	
Operation mode:	Light ON	
Note:	Readings above 1GHz were taken using Peak detector	

Table # 5

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
30.00	V	100	19.9	0.6	0.0	6.6	27.1	40.0	-12.9	
54.00	V	100	8.1	0.8	0.0	6.3	15.2	40.0	-24.8	
95.00	V	100	9.9	1.0	0.0	5.8	16.8	43.5	-26.8	
198.00	V	100	9.4	1.6	0.0	5.5	16.5	43.5	-27.0	
240.00	V	100	11.7	1.7	0.0	5.6	19.0	46.0	-27.0	
300.00	V	100	13.6	2.0	0.0	6.4	22.0	46.0	-24.1	
430.00	V	100	16.6	2.4	0.0	6.3	25.3	46.0	-20.7	
35.00	H	150	17.2	0.7	0.0	6.3	24.2	40.0	-15.8	
55.00	H	240	7.8	0.8	0.0	6.1	14.7	40.0	-25.3	
95.00	H	180	9.9	1.0	0.0	5.7	16.7	43.5	-26.9	
350.00	H	160	14.8	2.2	0.0	6.3	23.2	46.0	-22.8	
520.00	H	210	17.8	2.7	0.0	6.9	27.4	46.0	-18.6	

Table # 6

Frequency MHz	Antenna Polarity	Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	Avg Limit dBµV/m	Margin dB
1.236 GHz	V	48.2	27.5	39.6	36.1	54.0	-17.9
1.82 GHz	V	55.9	29.7	38.9	46.7	54.0	-7.3
2.464 GHz	V	48.0	31.4	37.9	41.5	54.0	-12.5
2.488 GHz	V	48.1	31.4	37.8	41.7	54.0	-12.3
1.82 GHz	H	49.8	29.7	38.9	40.5	54.0	-13.5

3.6 Digital device conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **N/A**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 9.6 dB below the limits

Notes: None

Date:	November 27, 2007	**Result:** **Pass**
Standard:	FCC Part 15.107, Class B	
Tested by:	Meak Nget	
Test Point:	Line 1, Line 2	
Operation mode:	Light ON	
Note:		

Table # 7

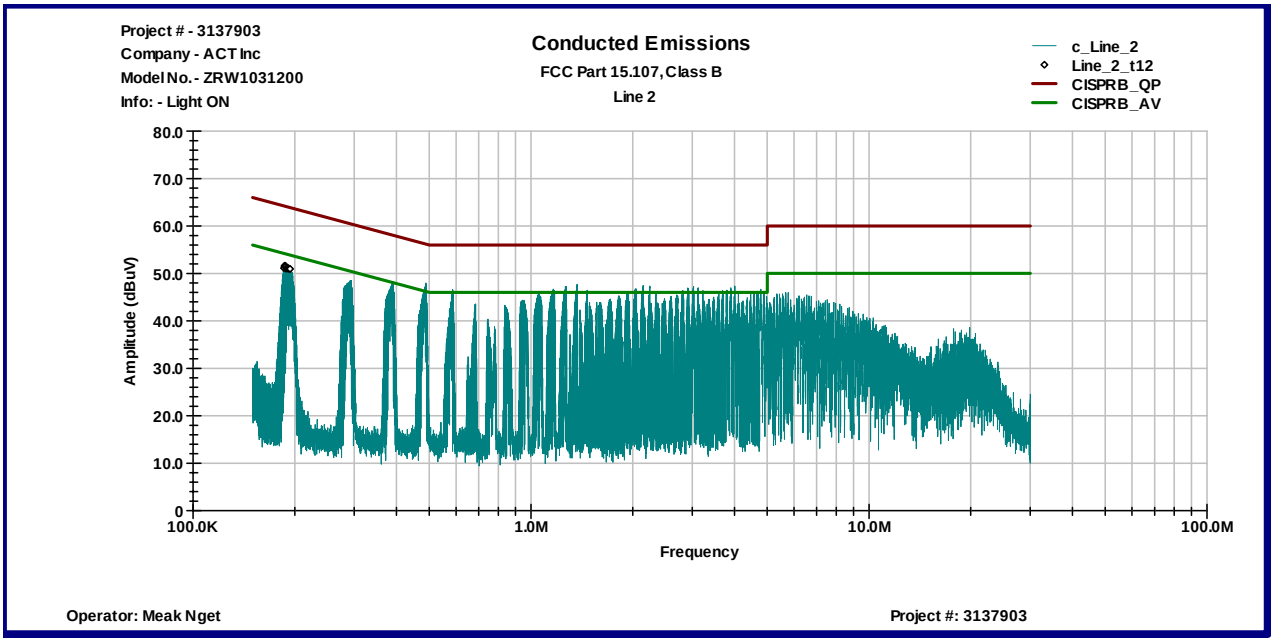
Line 1

Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
188.11 KHz	47.4	36.8	64.1	54.1	-16.7	-17.3
294.71 KHz	42.8	31.7	60.4	50.4	-17.6	-18.7
391.28 KHz	44.5	34.1	58.0	48.0	-13.6	-13.9
491.74 KHz	40.5	28.2	56.1	46.1	-15.6	-17.9
589.65 KHz	39.0	26.2	56.0	46.0	-17.0	-19.8
1.2783 MHz	21.2	17.3	56.0	46.0	-34.8	-28.8
2.0519 MHz	43.7	29.6	56.0	46.0	-12.3	-16.4
3.152 MHz	37.9	21.1	56.0	46.0	-18.2	-24.9
4.8207 MHz	31.4	19.4	56.0	46.0	-24.6	-26.6

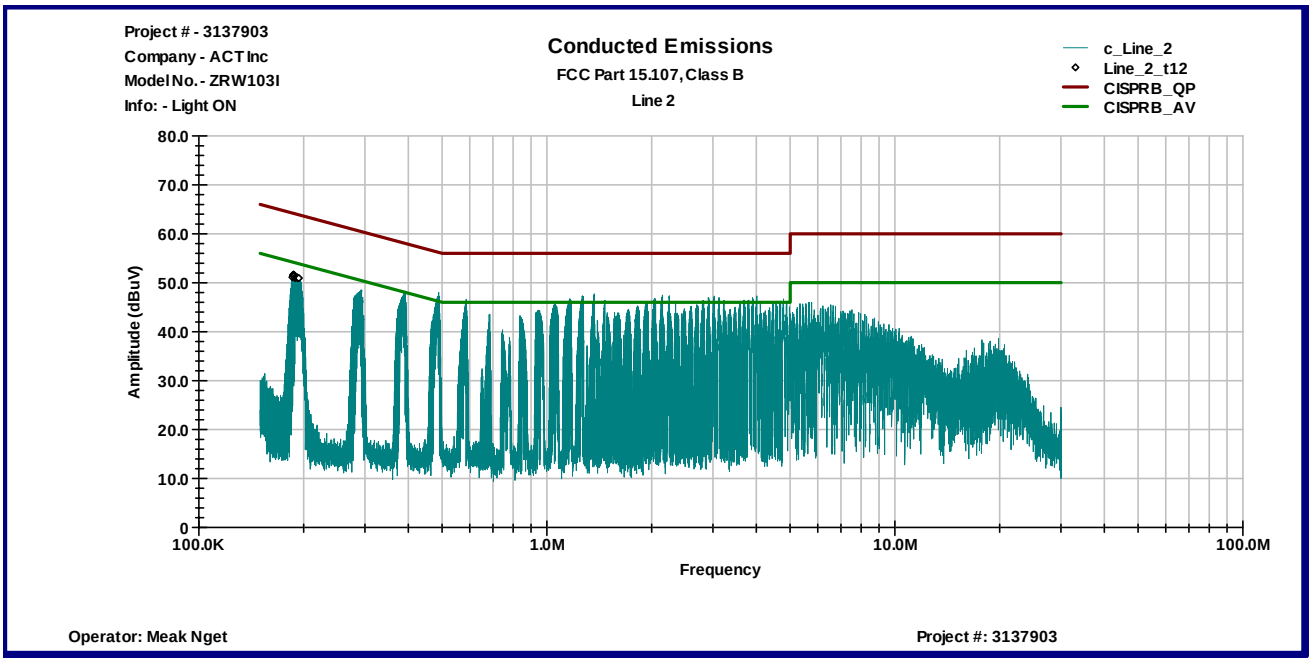
Line 2

Frequency	QP dBµV	AVG dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
185.3 KHz	46.8	32.7	64.2	54.2	-17.4	-21.6
294.93 KHz	46.5	35.5	60.4	50.4	-13.8	-14.8
391.22 KHz	47.1	37.0	58.0	48.0	-11.0	-11.0
489.23 KHz	46.6	35.9	56.2	46.2	-9.6	-10.3
587.9 KHz	45.2	33.2	56.0	46.0	-10.8	-12.8
1.3741 MHz	42.9	26.8	56.0	46.0	-13.1	-19.2
2.1456 MHz	44.8	31.3	56.0	46.0	-11.3	-14.7
3.0441 MHz	37.3	21.7	56.0	46.0	-18.7	-24.3
4.026 MHz	39.7	24.4	56.0	46.0	-16.3	-21.6

Graph 5



Graph 6



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	08/23/2008	☒
Spectrum Analyzer	R & S	ESCI	100358	04/27/2008	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	07/30/2008	☒
Horn Antenna	EMCO	3115	9507-4513	01/09/2008	☒
LISN	Fischer Custom Communications	FCC-LISN-2	316	09/24/2008	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	04/24/2008	☒
Filter	Reactel	7HS-1G-S12	0223	01/2008	☒
System	TILE! Instrument Control		Ver. 3.4.K.29	VBU	☒

Test Setup Photos