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Job Number: 1001541562
Project Number: 12CA51812B
File Number: E332959
Date: November 20, 2012
Model: ITCS-A200

Electromagnetic Compatibility Test Report

For

RF Controls LLC

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Job #: 1001541562 Project #: 12CA51812B File#: E322959
Model Number: ITCS-A200
Client Name: RF Controls LLC

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Test Report Details

Tests Performed By: **UL LLC**
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Northbrook, IL 60062

Tests Performed For: **RF Controls LLC**
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St. Louis, MO 63104

Applicant Contact: **Matt Narzinski**
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Test Report Date: **November 20, 2012**

Product Type: **Wireless Device**

Product standards: **FCC Part 15, Subpart C – Required tests for C2PC**

Model Number: **ITCS-A200**

EUT Category: **Frequency Hopping Spread Spectrum Transmitter**

Testing Start Date: **September 14, 2012**

Date Testing Complete: **September 21, 2012**

Overall Results: **Compliant**

UL LLC reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL LLC shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL LLC issued reports. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

This report may contain test results that are not covered by the NVLAP or A2LA accreditation. The scope of accreditation is limited to the specific tests that are listed on the NVLAP and/or A2LA websites referenced at the end of this report.

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Report Revision History

Revision Date	Description	Revised By	Revision Reviewed By
None			

1.0 G E N E R A L - Product Description

1.1 Equipment Description

The Equipment under test is a long range RF ID tag reader. It uses radio model IN610, certified under FCC ID: WFQIN610. This report is for class II permissive change – addition of antenna.

1.2 Device Configuration During Test

1.2.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	RF ID Reader	RF Controls LLC	ITCS-A200	None
AE	Laptop	Generic	-	Used to put the EUT in various test modes.
Note: EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test)				

1.2.2 Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	Mains	AC	Y	N	None
2	Ethernet	I/O	Y	Y	None
3	USB	I/O	N	Y	Only Used for factory and filed install programming.
Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports					

1.2.3 EUT Internal Operating Frequencies:

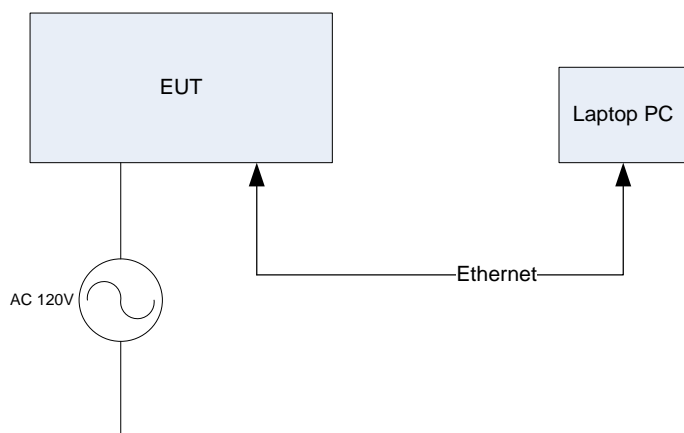
Frequency (MHz)	Description
24	U4, USB Microcontroller
12	U3, 32 bit Microcontroller
0.032768	U3, 32 bit Microcontroller

1.2.4 Power Interface:

Mode # /Rated	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
1	120Vac	-	-	60Hz	1	None

1.3 Block Diagram:

The diagram below illustrates the configuration of the equipment above.



1.4 EUT Configurations

Mode #	Description
1	EUT was setup on 80cm support and connected via Ethernet to laptop.

1.5 EUT Operation Modes

Mode #	Description
1	EUT transmitting with power level software setting of 2380 transmitting hopping on all channels.
2	EUT transmitting with power level software setting of 2380, transmitting on low, middle, and high channels individually.
3	EUT set to "digital mode only", transmitter active, but internal output attenuators set to maximum thus no tx is possible.

1.6 Rational for EUT Configuration

Mode #	Description
1	The selected EUT configuration was chosen to maximize emissions

2.0 **Summary**

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL LLC in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

2.1 **Deviations from standard test methods**

None

2.2 **Device Modifications Necessary for Compliance**

Multiple ferrites and internal I/O lines shield was attached to ground. Manufacturer will document all changes in detail in technical documentation.
--

2.3 Reference Standards

Standard Number	Standard Name	Standard Date
FCC Part 15, Subpart C	Digital Devices	2012

2.4 Results Summary

This product is considered Class B

Requirement – Test	Result (Compliant / Non-Compliant)*
Output Power	* N/A
Spurious Emissions (Radiated)	Compliant
Mains Terminal - Conducted Emissions	Compliant
Radiated Emissions - Digital	Compliant
* Power measurements were conducted to establish a reference table that will be used to adjust power on assembly line in final product.	

Test Engineer:



Bartlomiej Mucha (Ext.41216)
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Conformity Assessment Services

Reviewer:



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3.0 Calibration of Equipment Used for Measurement

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or the manufacturers' recommendation, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST); therefore, all test data recorded in this report is traceable to NIST.

4.0 EMISSIONS TEST RESULTS

The emissions tests were performed according to following regulations:

----- United States -----

Code of Federal Regulations Title 47	Part 15, Subpart B, Radio Frequency Devices
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Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be verified at the time the test is conducted.

Ambient Temperature, °C	22.5 ± 2.5	Relative Humidity, %	45 ± 15	Barometric Pressure, mBar	950 ± 150
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Measurement Uncertainty

Test	Uncertainty k=2
Conducted Emissions	0.9dB
Radiated Emissions	3.1dB

Sample Calculations

Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) - Gain (dB) + Cable Loss (dB)

Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)

Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

4.1 Test Conditions and Results – OUTPUT POWER

Test Description	For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.	
Basic Standard	47 CFR Part 15.247(b)(2) RSS-210, A8.4(2)	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	902MHz – 928MHz	Antenna Conducted
Limits		
Frequency (MHz)	Limit mW	
	Peak	
902 - 928	1000 (30dBm – gain of Antenna over 6dBi)	
Supplementary information: Per user manual specification power level on the device is adjustable. For power measurements a power table was created showing the software value and actual power measured. In the end product the power will be adjusted on assembly line based on power level setting used for radiated spurious emissions.		

Table 1 Maximum Peak Output Power EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	2
Supplementary information: None		

Table 2 Maximum Peak Output Power Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20111228	20121231
Attenuator with Cable	-	-	-	*	*
* Device characterized prior to use.					

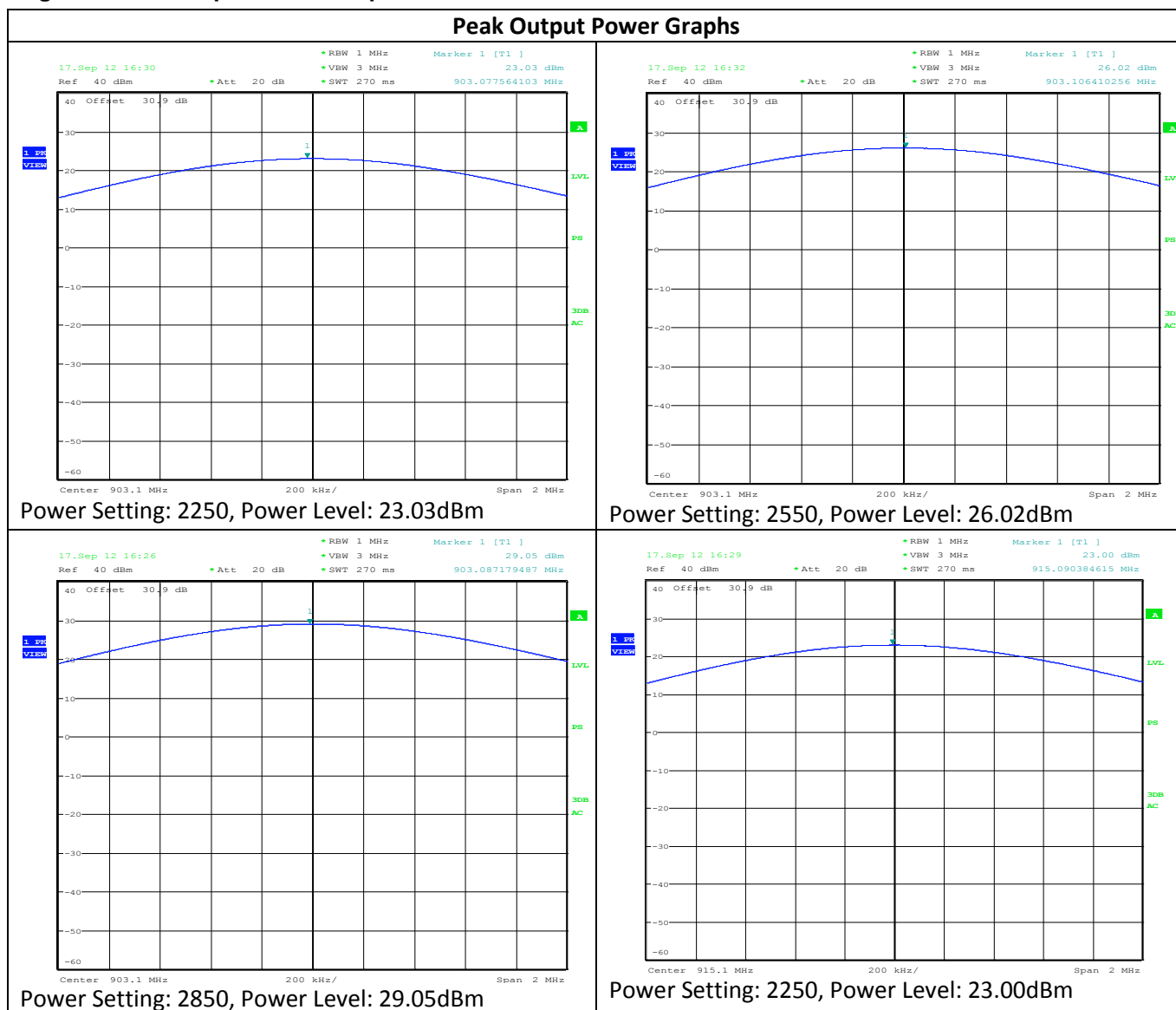
Model Number: ITCS-A200

Client Name: RF Controls LLC

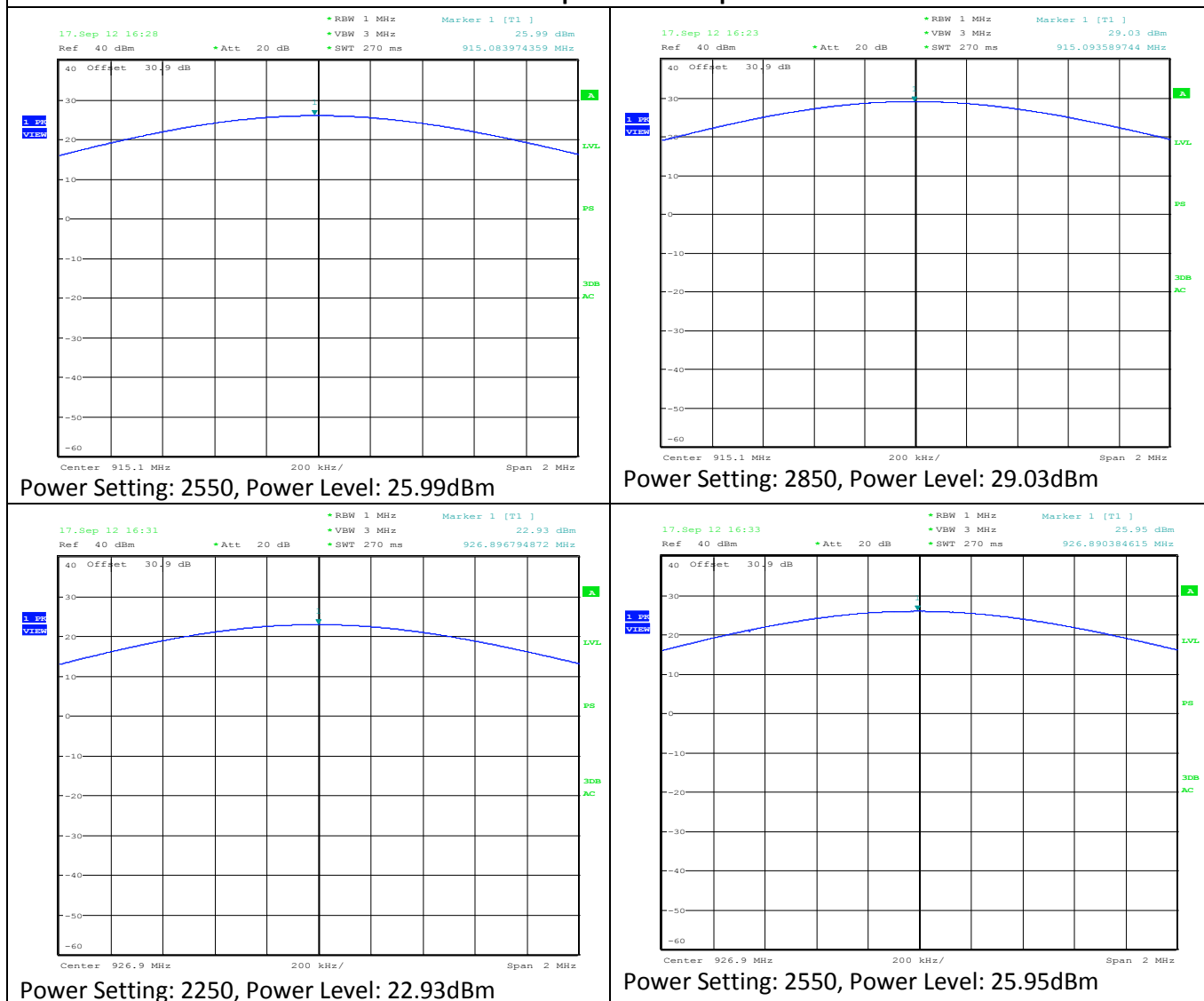
Table Peak Output Power Results vs software setting

	Software Value setting	Peak Power Reading dBm	Peak Power Reading mW
Low CH Power Setting 1	2250	23.03	200.91
Low CH Power Setting 2	2550	26.02	399.94
Low CH Power Setting 3	2850	29.05	803.53
Middle CH Power Setting 1	2250	23.00	199.53
Middle CH Power Setting 2	2550	25.99	397.19
Middle CH Power Setting 3	2850	29.03	799.83
High CH Power Setting 1	2250	22.93	196.34
High CH Power Setting 2	2550	25.95	393.55
High CH Power Setting 3	2850	28.99	792.50

Figure 1 Peak Output Power Graphs

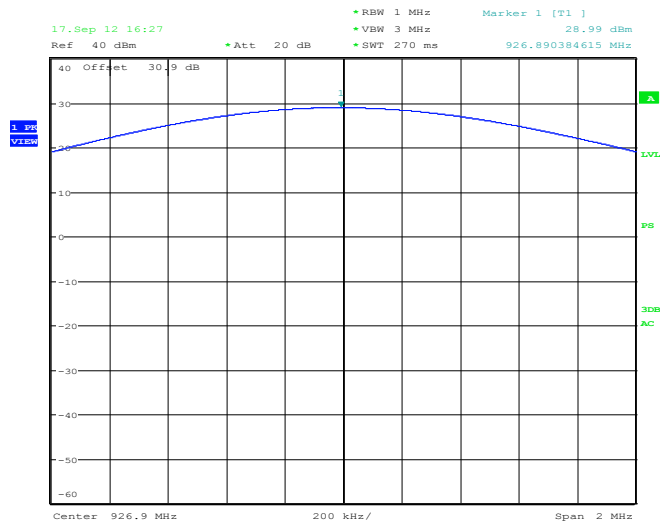


Peak Output Power Graphs



Model Number: ITCS-A200

Client Name: RF Controls LLC

Peak Output Power Graphs

Power Setting: 2850, Power Level: 28.99dBm

4.2 Test Conditions and Results – SPURIOUS EMISSIONS (Radiated)

Test Description	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section15.205(c)).		
Basic Standard	47 CFR Part 15.247(d) RSS-210, A8.5 RSS-Gen 7.2.1 and 7.2.3		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	10 meter distance	
Fully configured sample scanned over the following frequency range	1GHz – 10GHz	3 meter distance	
Limits (Radiated – Restricted Bands Only)			
Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Average	
	General Emissions	Fundamental	Spurious
30 – 88	29.54	-	-
88 – 216	33.06	-	-
216-960	35.56	-	-
960-1000	43.52	-	-
1,000-25,000	-	-	54
Supplementary information: Below 1GHz, spectrum was checked. All emissions related to the transmitter below 1GHz are not in the restricted band therefore only antenna conducted limits apply (20dB below the peak level of the fundamental).			

Table 3 SPURIOUS EMISSIONS EUT Configuration Settings

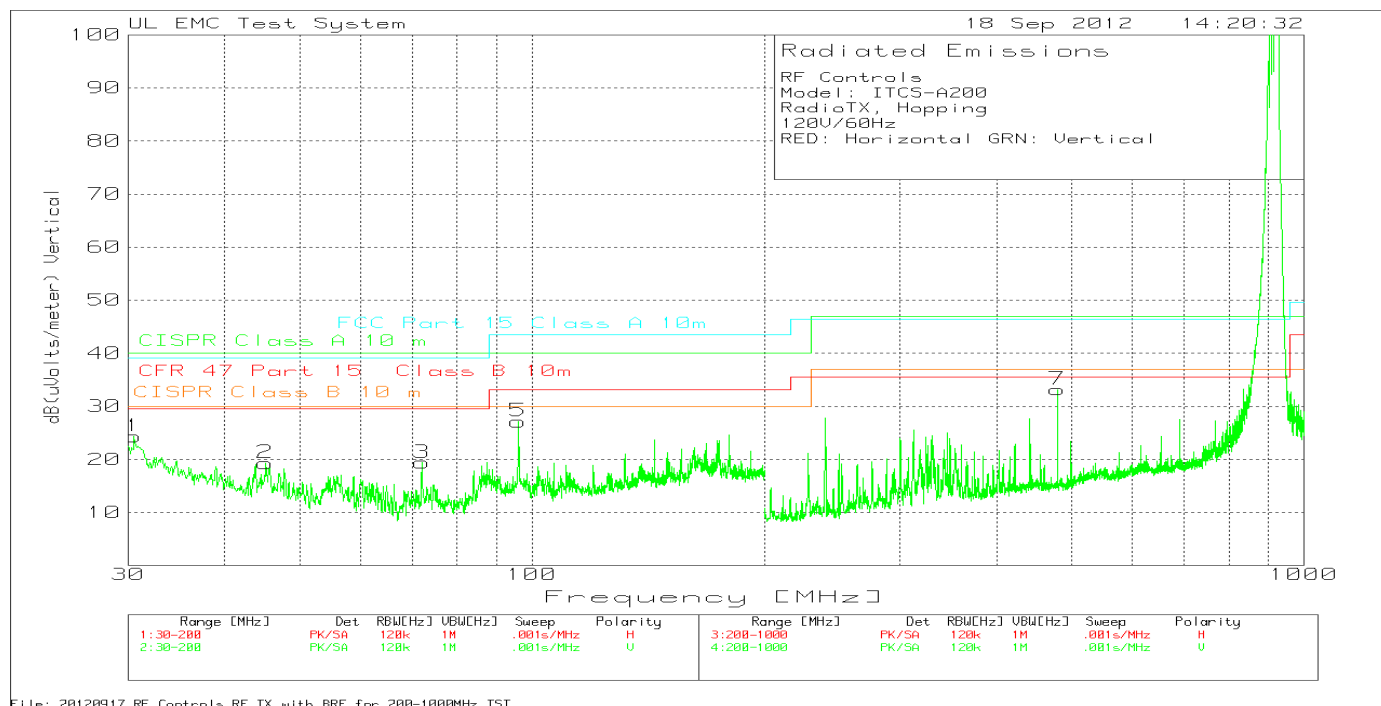
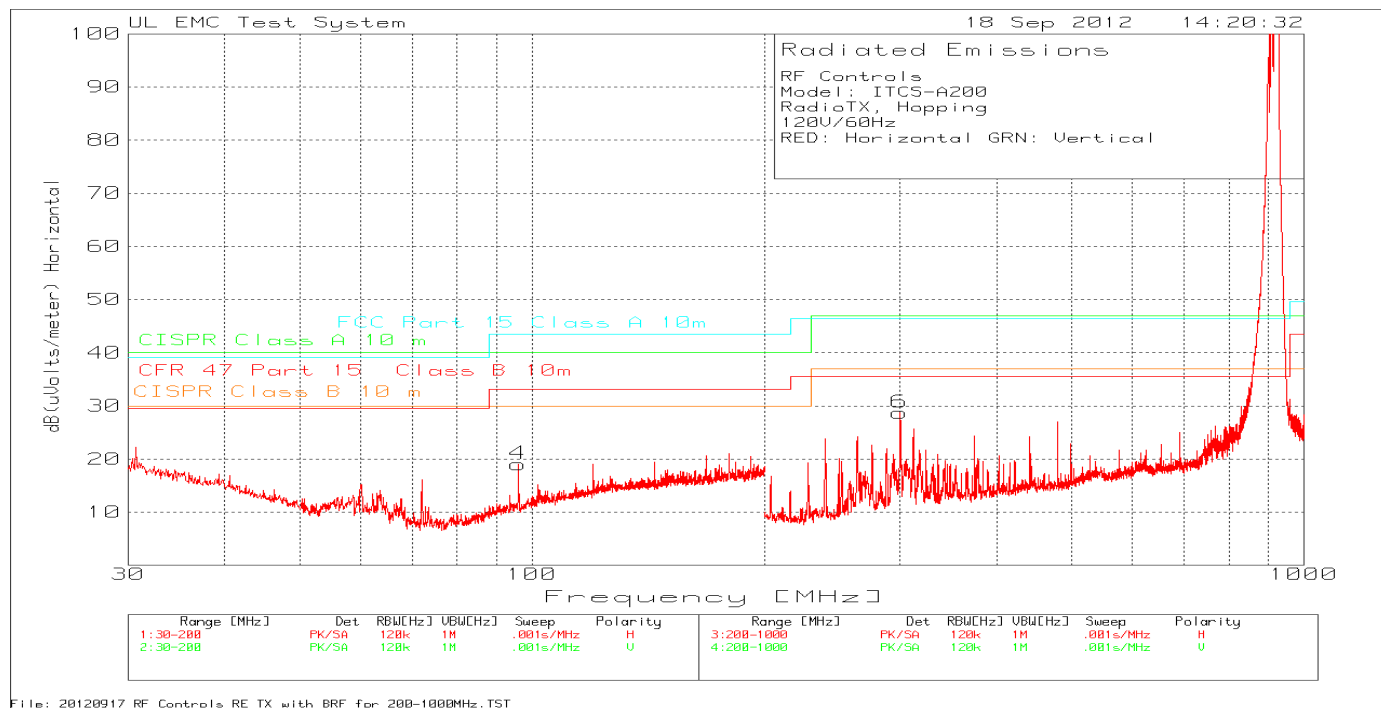
Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1 and 2
Supplementary information: None		

Table 4 SPURIOUS RADIATED EMISSIONS Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20111228	20121231
Bicon Antenna	Chase	VBA6106A	EMC4078	20120117	20130131
Log-P Antenna	Chase	UPA6109	EMC4258	20110927	20120928
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20111227	20121231
Antenna Array	UL	BOMS	EMC4276	20111227	20121231
Band Notch Filter	-	-	-	*	*

* Characterized prior to use

Figure 2 Radiated Spurious Emissions below 1GHz, Hopping with BRF



Area of the plot between 850MHz to 950MHz is a result of BRF factors inserted as losses in the path correction factors. All other emissions are product of the digital part of the device.

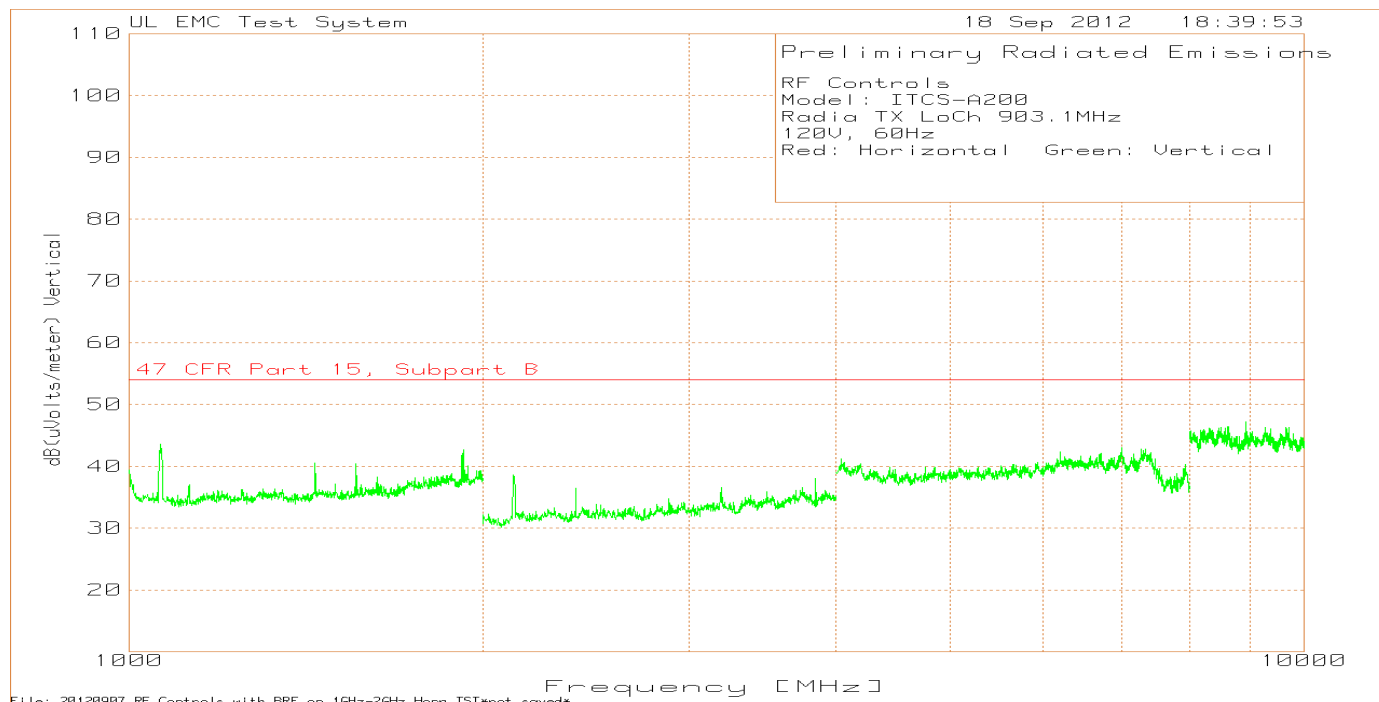
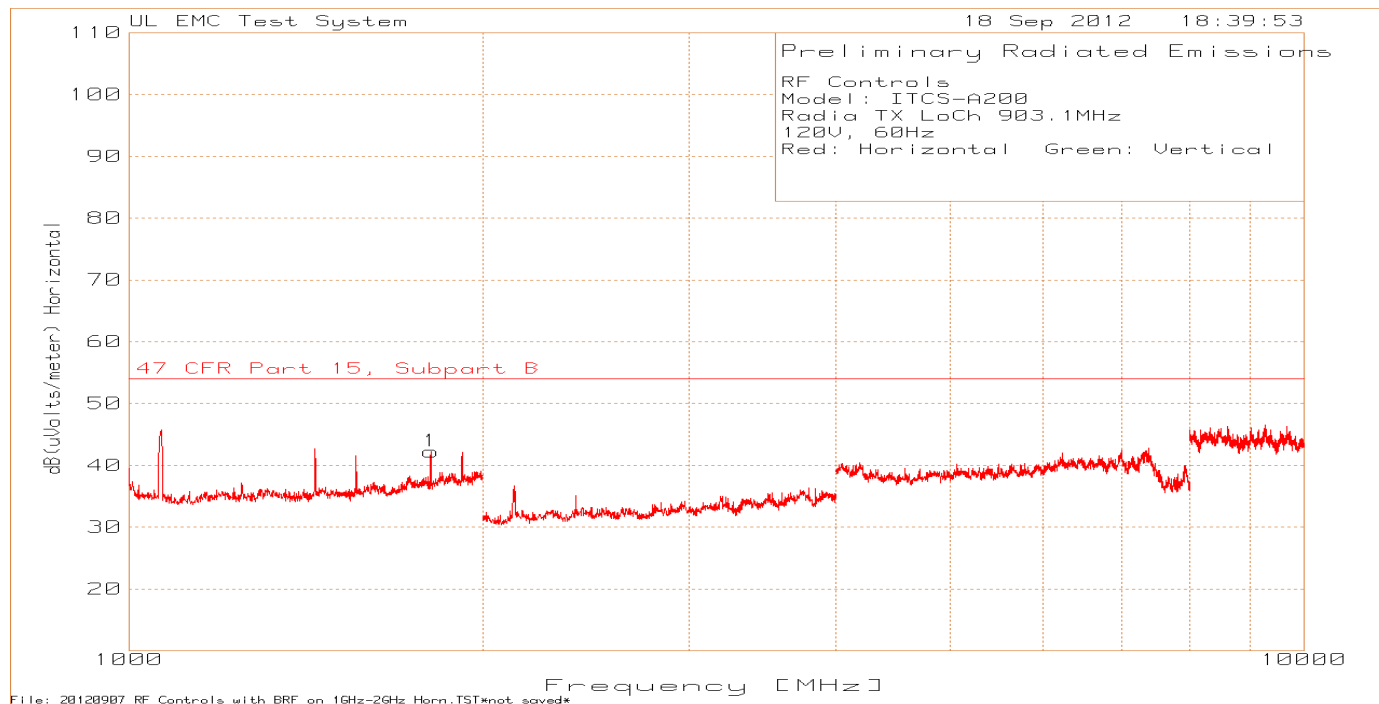
Model Number: ITCS-A200

Client Name: RF Controls LLC

Table 5 Radiated Spurious Emissions below 1GHz, Hopping with BRF

RF Controls Model: ITCS-A200 RadioTX, Hopping 120V/60Hz RED: Horizontal GRN: Vertical													
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB	Path Factor dB	900MHz BRF dB	Level dBuV/m	CISPR Class B 10 m	Margin dB	CFR 47 Part 15 Class B 10m	Margin	Height [cm]	Polarity
4	96.012	38.52	PK	9.9	-29.4	N/A	19.02	30	-10.98	33.1	-14.08	400	Horz
1	30.5097	35.91	PK	17.7	-29.3	N/A	24.31	30	-5.69	29.6	-5.29	99	Vert
2	45.2074	36.74	PK	12	-29.4	N/A	19.34	30	-10.66	29.6	-10.26	99	Vert
3	72.054	42.48	PK	6.3	-29.4	N/A	19.38	30	-10.62	29.6	-10.22	250	Vert
5	96.012	46.68	PK	9.9	-29.4	N/A	27.18	30	-2.82	33.1	-5.92	99	Vert
6	299.9334	48.3	PK	13	-32.8	0.2	28.7	37	-8.3	35.6	-6.9	199	Horz
7	480.0799	47.69	PK	17.2	-31.9	0.2	33.19	37	-3.81	35.6	-2.41	199	Vert
PK - Peak detector													

Figure 3 Radiated Spurious Emissions above 1GHz, Low Channel



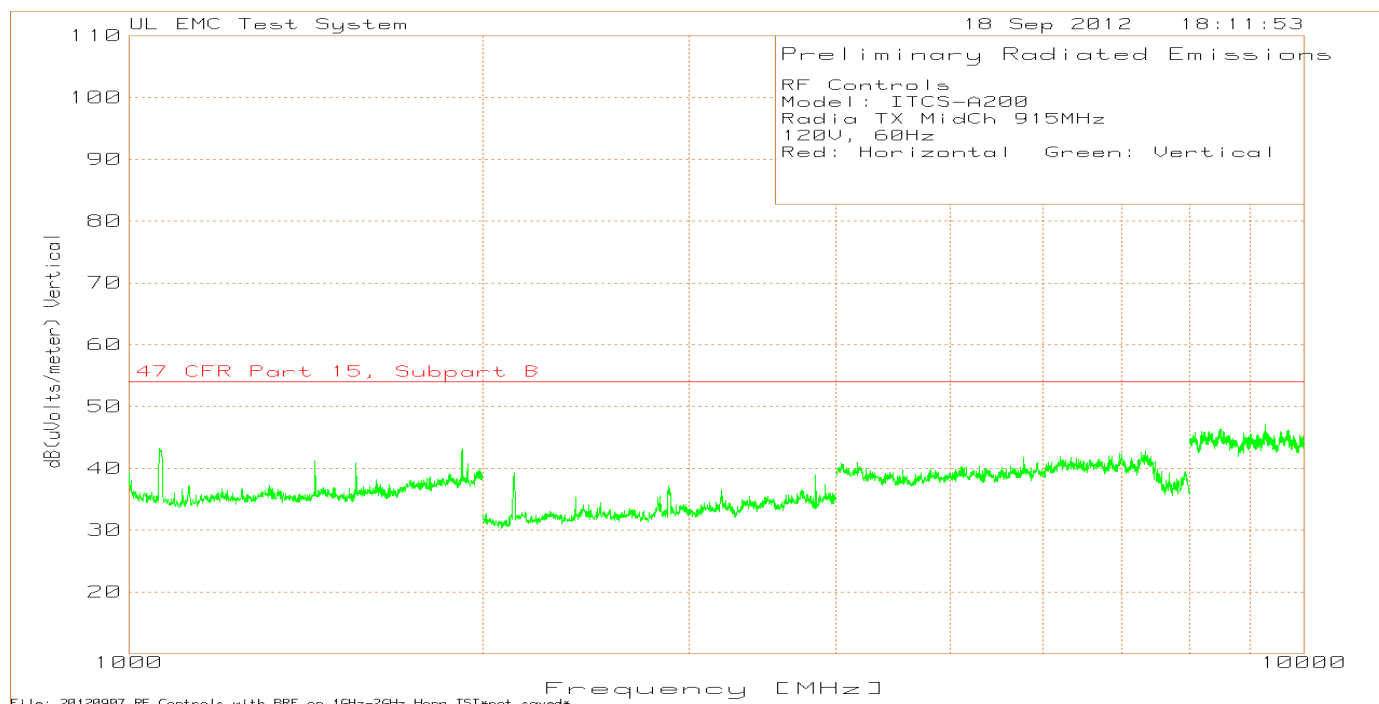
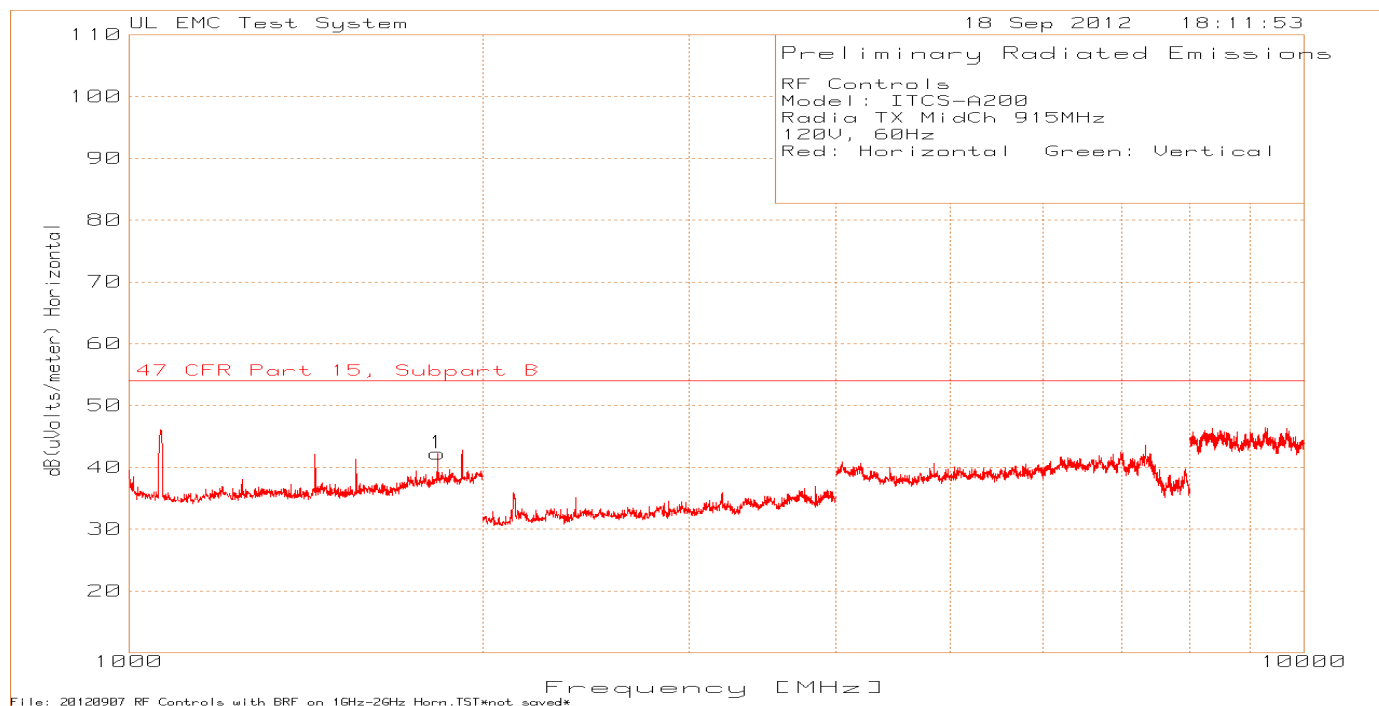
Model Number: ITCS-A200

Client Name: RF Controls LLC

Table 6 Radiated Spurious Emissions above 1GHz, Low Channel

RF Controls Model: ITCS-A200 Radia TX LoCh 903.1MHz 120V, 60Hz Red: Horizontal Green: Vertical											
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB	900MHz BRF 800MHz- 6GHz (dB)	Path Factor dB	Level dBuV/m	47 CFR Part 15, Subpart B	Margin	Height [cm]	Polarity
1	1806.807	69.99	PK	27	0.4	-55.2	42.19	54	-11.81	99	Horz
PK - Peak detector											

Figure 4 Radiated Spurious Emissions above 1GHz, Middle Channel



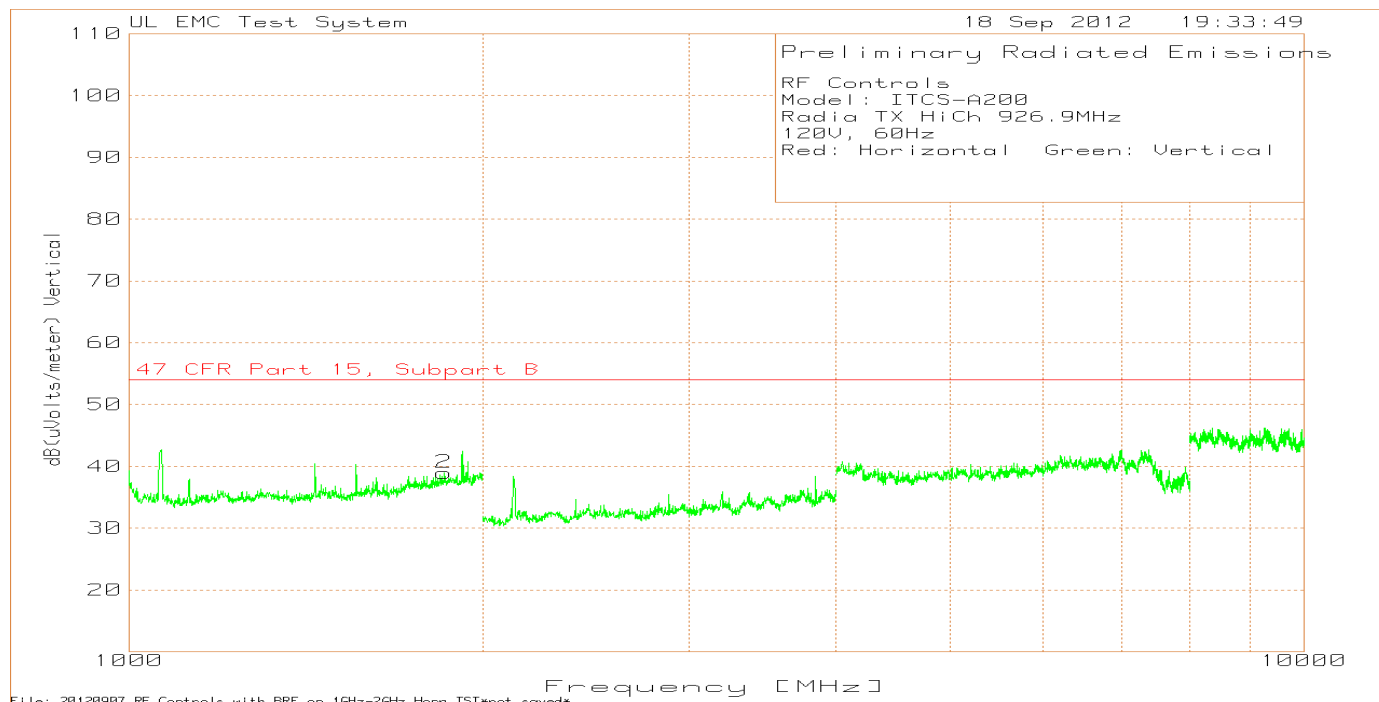
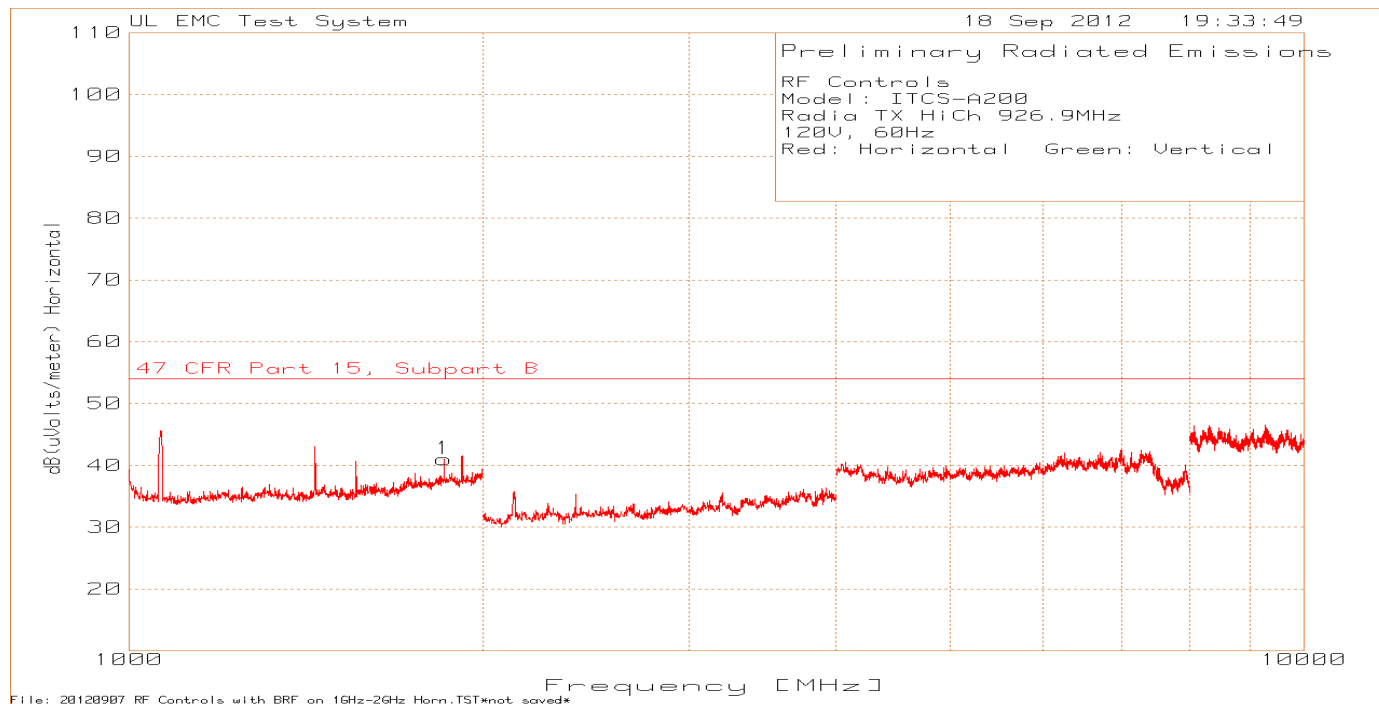
Model Number: ITCS-A200

Client Name: RF Controls LLC

Table 7 Radiated Spurious Emissions above 1GHz, Middle Channel

RF Controls Model: ITCS-A200 Radia TX MidCh 915MHz 120V, 60Hz Red: Horizontal Green: Vertical											
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB	900MHz BRF 800MHz-6GHz (dB)	Path Factor dB	Level dBuV/m	47 CFR Part 15, Subpart B	Margin	Height [cm]	Polarity
1	1830.831	69.78	PK	27.1	0.4	-54.98	42.3	54	-11.7	100	Horz
PK - Peak detector											

Figure 5 Radiated Spurious Emissions above 1GHz, High Channel



Model Number: ITCS-A200

Client Name: RF Controls LLC

Table 8 Radiated Spurious Emissions above 1GHz, High Channel

RF Controls Model: ITCS-A200 Radia TX HiCh 926.9MHz 120V, 60Hz Red: Horizontal Green: Vertical											
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB	900MHz BRF 800MHz-6GHz (dB)	Path Factor dB	Level dBuV	47 CFR Part 15, Subpart B	Margin	Height [cm]	Polarity
1	1853.854	67.75	PK	27.2	0.4	-54.32	41.03	54	-12.97	99	Horz
2	1853.854	65.7	PK	27.2	0.4	-54.32	38.98	54	-15.02	200	Vert
PK - Peak detector											

4.3 Test Conditions and Results – MAINS TERMINAL – CONDUCTED EMISSIONS

Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.	
Basic Standard	FCC Part 15, Subpart C, 15.209	
UL LPG	80-EM-S0026	
	Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range	150kHz to 30MHz	Mains
Limits - Class A		
Frequency (MHz)	Limit (dB μ V)	
	Quasi-Peak	Average
0.15-0.5	79	66
0.5-30	73	60
Limits - Class B		
Frequency (MHz)	Limit (dB μ V)	
	Quasi-Peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50
Supplementary information: None		

Table 9 Conducted Emissions EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Model Number: ITCS-A200

Client Name: RF Controls LLC

Table 10 Conducted Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	Dec 28 2011	Dec 31 2012
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224	N/A	N/A
HighPass Filter	Solar Electronics	2803-150	885551	N/A	N/A
Attenuator	HP	8494B	2831A00 838	N/A	N/A
LISN - L1	Solar	8602-50-TS-50-N	EMC4052	Jan 6 2012	Jan 6 2013
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	Jan 6 2012	Jan 6 2013
*LISN - L3	Solar	8602-50-TS-50-N	EMC4067	Jan 6 2012	Jan 6 2013
*LISN - L4	Solar	8602-50-TS-50-N	EMC4065	Jan 6 2012	Jan 6 2013
* used to power AE equipment					

Figure 6 Conducted Emissions Graph

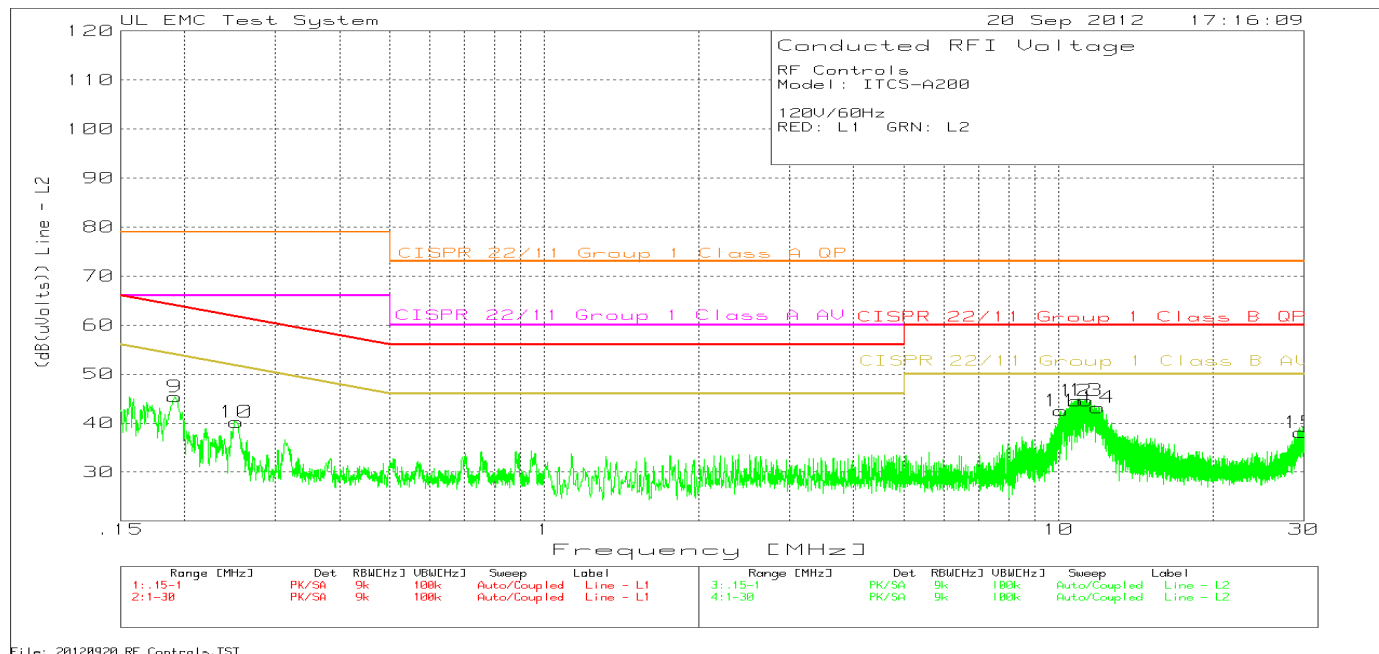
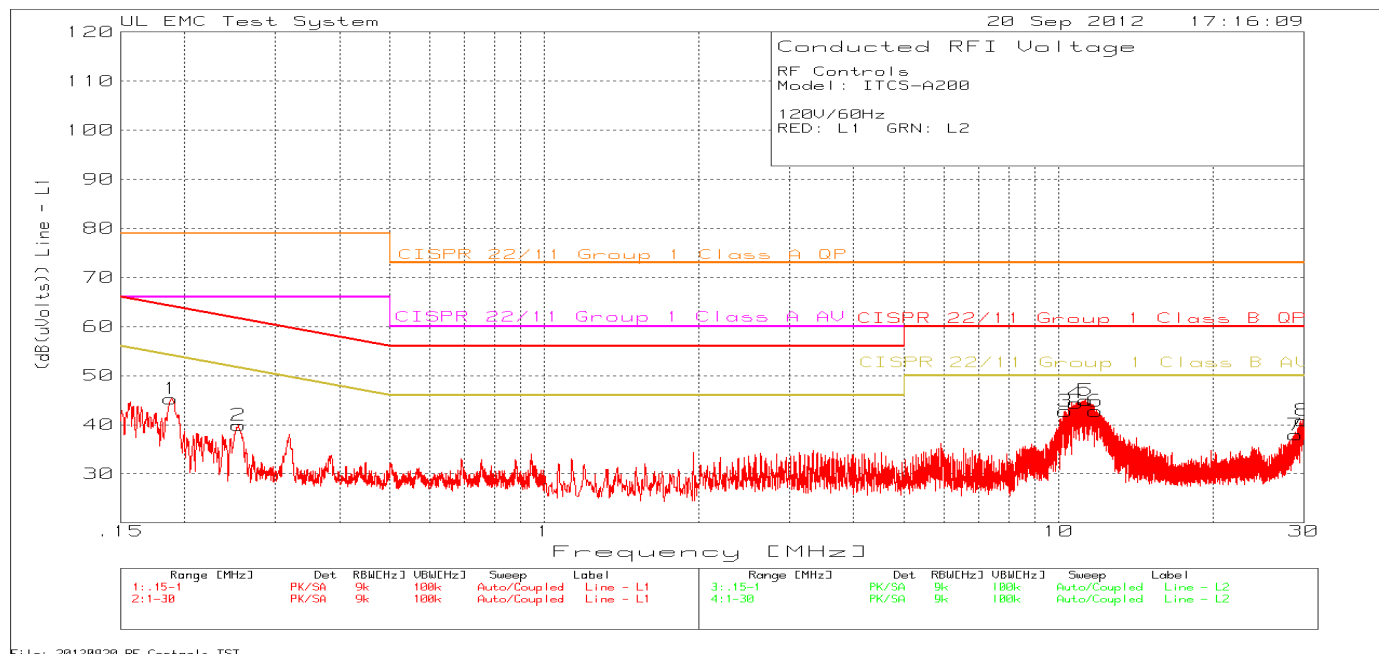


Table 11 Conducted Emissions Data Points

RF Controls
 Model: ITCS-A200
 120V/60Hz
 RED: L1 GRN: L2

Test No.	Frequency [MHz]	Meter Reading (dBUV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level (dB(uVolts))	Limit:1	2	3	4	5	6
=====											
Line - L1											
1	.18801	33.46 PK	.1	11.7	45.26	79	66	64.1	54.1	-	-
				Margin [dB]		-33.74	-20.74	-18.84	-8.84	-	-
2	.25447	28.67 PK	0	11.2	39.87	79	66	61.6	51.6	-	-
				Margin [dB]		-39.13	-26.13	-21.73	-11.73	-	-
3	10.31173	31.66 PK	.1	11	42.76	73	60	60	50	-	-
				Margin [dB]		-30.24	-17.24	-17.24	-7.24	-	-
4	10.81154	33.29 PK	.1	11	44.39	73	60	60	50	-	-
				Margin [dB]		-28.61	-15.61	-15.61	-5.61	-	-
5	11.3186	33.84 PK	.1	11	44.94	73	60	60	50	-	-
				Margin [dB]		-28.06	-15.06	-15.06	-5.06	-	-
6	11.82565	31.45 PK	.2	11.1	42.75	73	60	60	50	-	-
				Margin [dB]		-30.25	-17.25	-17.25	-7.25	-	-
7	28.98227	25.82 PK	.2	11.9	37.92	73	60	60	50	-	-
				Margin [dB]		-35.08	-22.08	-22.08	-12.08	-	-
8	29.85875	28.77 PK	.2	11.9	40.87	73	60	60	50	-	-
				Margin [dB]		-32.13	-19.13	-19.13	-9.13	-	-
Line - L2											
9	.19141	33.57 PK	.1	11.7	45.37	79	66	64	54	-	-
				Margin [dB]		-33.63	-20.63	-18.63	-8.63	-	-
10	.25235	28.89 PK	.1	11.2	40.19	79	66	61.7	51.7	-	-
				Margin [dB]		-38.81	-25.81	-21.51	-11.51	-	-
11	10.12339	31.4 PK	.1	11	42.5	73	60	60	50	-	-
				Margin [dB]		-30.5	-17.5	-17.5	-7.5	-	-
12	10.81878	33.47 PK	.1	11	44.57	73	60	60	50	-	-
				Margin [dB]		-28.43	-15.43	-15.43	-5.43	-	-
13	11.3186	33.39 PK	.1	11.1	44.59	73	60	60	50	-	-
				Margin [dB]		-28.41	-15.41	-15.41	-5.41	-	-
14	11.94517	31.87 PK	.2	11.1	43.17	73	60	60	50	-	-
				Margin [dB]		-29.83	-16.83	-16.83	-6.83	-	-
15	29.61246	26.07 PK	.1	11.9	38.07	73	60	60	50	-	-
				Margin [dB]		-34.93	-21.93	-21.93	-11.93	-	-
LIMIT 1: CISPR 22/11 Group 1 Class A QP											
LIMIT 2: CISPR 22/11 Group 1 Class A AV											
LIMIT 3: CISPR 22/11 Group 1 Class B QP											
LIMIT 4: CISPR 22/11 Group 1 Class B AV											

RF Controls
Model: ITCS-A200
120V/60Hz
RED: L1 GRN: L2

Test Frequency [MHz]	Meter Reading (dBuV)	Transducer Factor [dB]	Gain/Loss Factor [dB]	Level (dB(uVolts))	Limit:1	2	3	4	5	6
=====										
Line - L1										
.18862	31.68 QP	.1	11.7	43.48	79	66	64.1	54.1	-	-
			Margin [dB]:		-35.52	-22.52	-20.62	-10.62	-	-
.25475	25.92 QP	0	11.2	37.12	79	66	61.6	51.6	-	-
			Margin [dB]:		-41.88	-28.88	-24.48	-14.48	-	-
10.31105	28.74 QP	.1	11	39.84	73	60	60	50	-	-
			Margin [dB]:		-33.16	-20.16	-20.16	-10.16	-	-
10.81365	30.92 QP	.1	11	42.02	73	60	60	50	-	-
			Margin [dB]:		-30.98	-17.98	-17.98	-7.98	-	-
11.31705	31.03 QP	.1	11	42.13	73	60	60	50	-	-
			Margin [dB]:		-30.87	-17.87	-17.87	-7.87	-	-
11.82043	29.75 QP	.2	11.1	41.05	73	60	60	50	-	-
			Margin [dB]:		-31.95	-18.95	-18.95	-8.95	-	-
28.98643	21.62 QP	.2	11.9	33.72	73	60	60	50	-	-
			Margin [dB]:		-39.28	-26.28	-26.28	-16.28	-	-
29.86703	24.15 QP	.2	11.9	36.25	73	60	60	50	-	-
			Margin [dB]:		-36.75	-23.75	-23.75	-13.75	-	-
Line - L2										
.19132	31.67 QP	.1	11.7	43.47	79	66	63.98	53.98	-	-
			Margin [dB]:		-35.53	-22.53	-20.51	-10.51	-	-
.25148	27.1 QP	.1	11.3	38.5	79	66	61.71	51.71	-	-
			Margin [dB]:		-40.5	-27.5	-23.21	-13.21	-	-
10.12415	27.89 QP	.1	11	38.99	73	60	60	50	-	-
			Margin [dB]:		-34.01	-21.01	-21.01	-11.01	-	-
10.8161	30.96 QP	.1	11	42.06	73	60	60	50	-	-
			Margin [dB]:		-30.94	-17.94	-17.94	-7.94	-	-
11.31935	30.72 QP	.1	11.1	41.92	73	60	60	50	-	-
			Margin [dB]:		-31.08	-18.08	-18.08	-8.08	-	-
11.94785	29 QP	.2	11.1	40.3	73	60	60	50	-	-
			Margin [dB]:		-32.7	-19.7	-19.7	-9.7	-	-
29.61988	22.24 QP	.1	11.9	34.24	73	60	60	50	-	-
			Margin [dB]:		-38.76	-25.76	-25.76	-15.76	-	-

NOTE: "+" - Indicates an emission level in excess of the applicable limit (s).

PK - Peak detector
QP - Quasi-Peak detector

LIMIT 1: CISPR 22/11 Group 1 Class A QP
LIMIT 2: CISPR 22/11 Group 1 Class A AV
LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

RF Controls
Model: ITCS-A200
120V/60Hz
RED: L1 GRN: L2

Test	Meter	Transducer	Gain/Loss	Level	Limit:1	2	3	4	5	6
Frequency	Reading	Factor	Factor	(dB(uVolts))						
[MHz]	(dBuV)	[dB]	[dB]							
=====										
Line - L1										
.18862	21.19 Av	.1	11.7	32.99	79	66	64.1	54.1	-	-
			Margin [dB]:		-46.01	-33.01	-31.11	-21.11	-	-
.25475	17.41 Av	0	11.2	28.61	79	66	61.6	51.6	-	-
			Margin [dB]:		-50.39	-37.39	-32.99	-22.99	-	-
10.31105	21.63 Av	.1	11	32.73	73	60	60	50	-	-
			Margin [dB]:		-40.27	-27.27	-27.27	-17.27	-	-
10.81365	23.89 Av	.1	11	34.99	73	60	60	50	-	-
			Margin [dB]:		-38.01	-25.01	-25.01	-15.01	-	-
11.31705	25.14 Av	.1	11	36.24	73	60	60	50	-	-
			Margin [dB]:		-36.76	-23.76	-23.76	-13.76	-	-
11.82043	24.04 Av	.2	11.1	35.34	73	60	60	50	-	-
			Margin [dB]:		-37.66	-24.66	-24.66	-14.66	-	-
28.98643	15.07 Av	.2	11.9	27.17	73	60	60	50	-	-
			Margin [dB]:		-45.83	-32.83	-32.83	-22.83	-	-
29.86703	17.24 Av	.2	11.9	29.34	73	60	60	50	-	-
			Margin [dB]:		-43.66	-30.66	-30.66	-20.66	-	-
Line - L2										
.19132	19.33 Av	.1	11.7	31.13	79	66	63.98	53.98	-	-
			Margin [dB]:		-47.87	-34.87	-32.85	-22.85	-	-
.25148	17.84 Av	.1	11.3	29.24	79	66	61.71	51.71	-	-
			Margin [dB]:		-49.76	-36.76	-32.47	-22.47	-	-
10.12415	20.64 Av	.1	11	31.74	73	60	60	50	-	-
			Margin [dB]:		-41.26	-28.26	-28.26	-18.26	-	-
10.8161	24.29 Av	.1	11	35.39	73	60	60	50	-	-
			Margin [dB]:		-37.61	-24.61	-24.61	-14.61	-	-
11.31935	24.98 Av	.1	11.1	36.18	73	60	60	50	-	-
			Margin [dB]:		-36.82	-23.82	-23.82	-13.82	-	-
11.94785	23.07 Av	.2	11.1	34.37	73	60	60	50	-	-
			Margin [dB]:		-38.63	-25.63	-25.63	-15.63	-	-
29.61988	15.94 Av	.1	11.9	27.94	73	60	60	50	-	-
			Margin [dB]:		-45.06	-32.06	-32.06	-22.06	-	-

NOTE: "+" - Indicates an emission level in excess of the applicable limit (s).

PK - Peak detector
Av - average detection

LIMIT 1: CISPR 22/11 Group 1 Class A QP
LIMIT 2: CISPR 22/11 Group 1 Class A AV
LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

4.4 Test Conditions and Results – RADIATED EMISSIONS

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	
Basic Standard	47 CFR Part 15, Subpart B	
UL LPG	80-EM-S0029	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	(10 meter distance)
	1GHz – 5GHz	(3 meter distance)
Limits - Class B		
Frequency (MHz)	Limit (dBμV/m)	
	Quasi-Peak @ 10m	Average @ 3m
30 to 88	29.54	NA
88 to 216	33.06	NA
216 to 960	35.56	NA
960 to 1000	43.52	NA
1000 to 5000	N/A	54
Supplementary information: None		

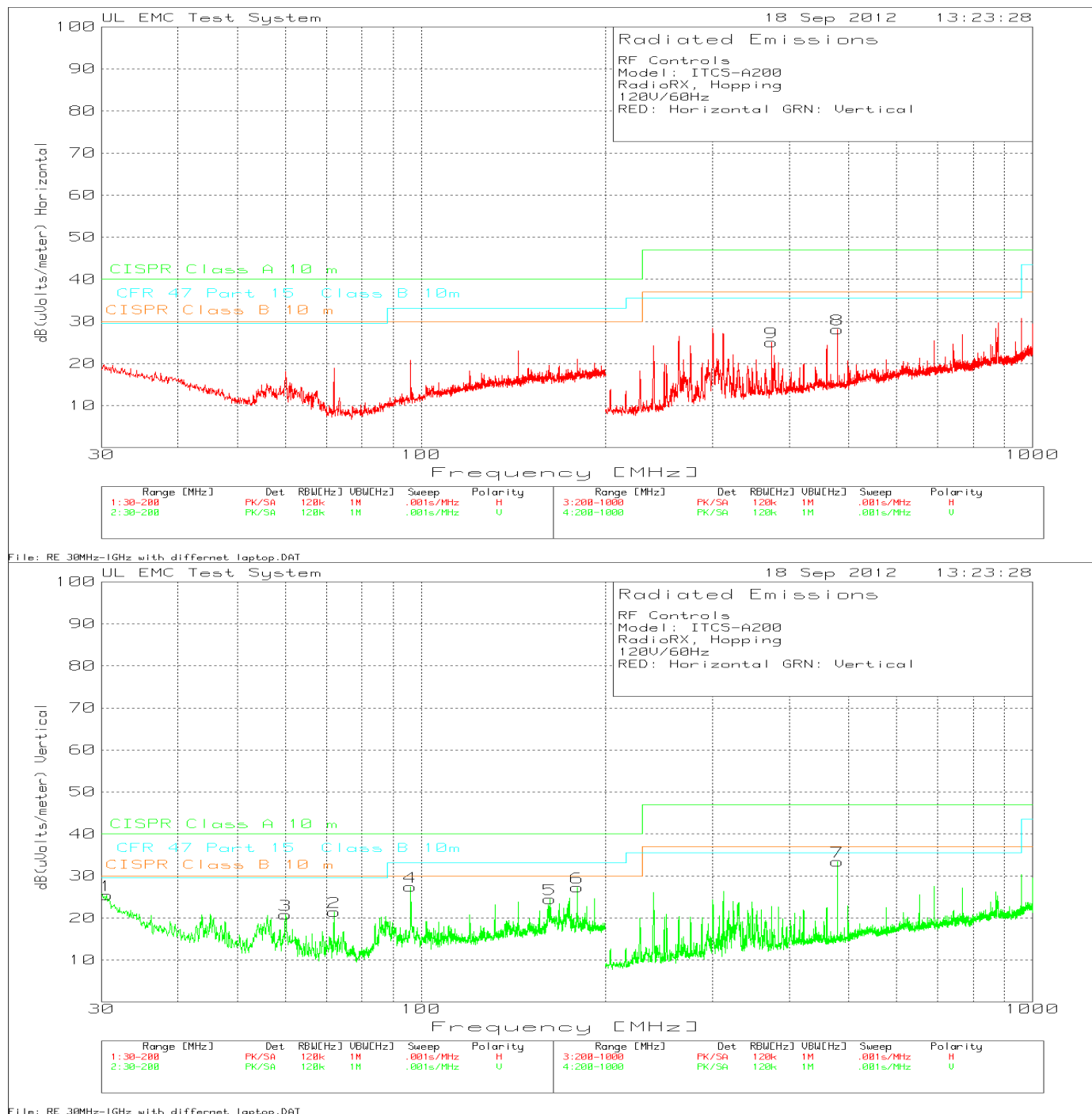
Table 12 Radiated Emissions EUT Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	3
Supplementary information: None		

Table 13 Radiated Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20111228	20121231
Bicon Antenna	Chase	VBA6106A	EMC4078	20120117	20130131
Log-P Antenna	Chase	UPA6109	EMC4258	20110927	20120928
Antenna Array	UL	BOMS	EMC4276	20111227	20121231

Figure 7 Radiated Emissions Graph below 1GHz



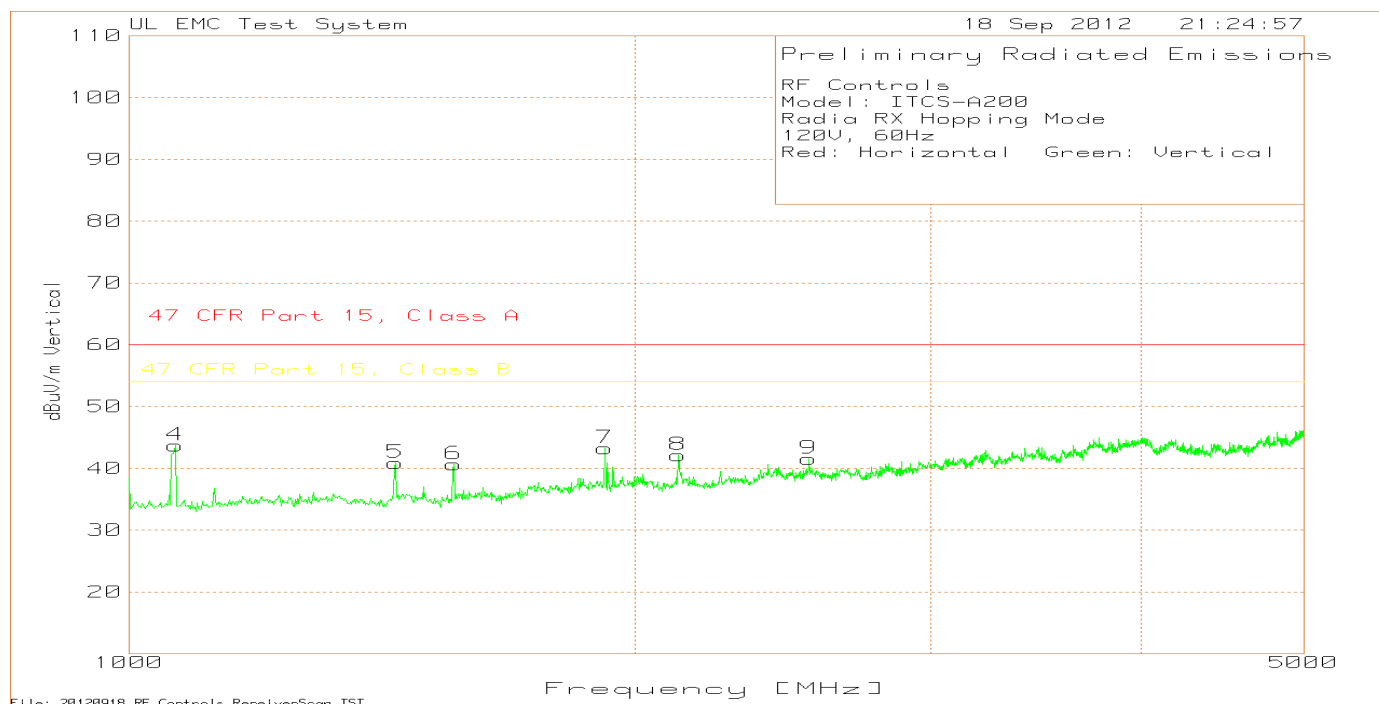
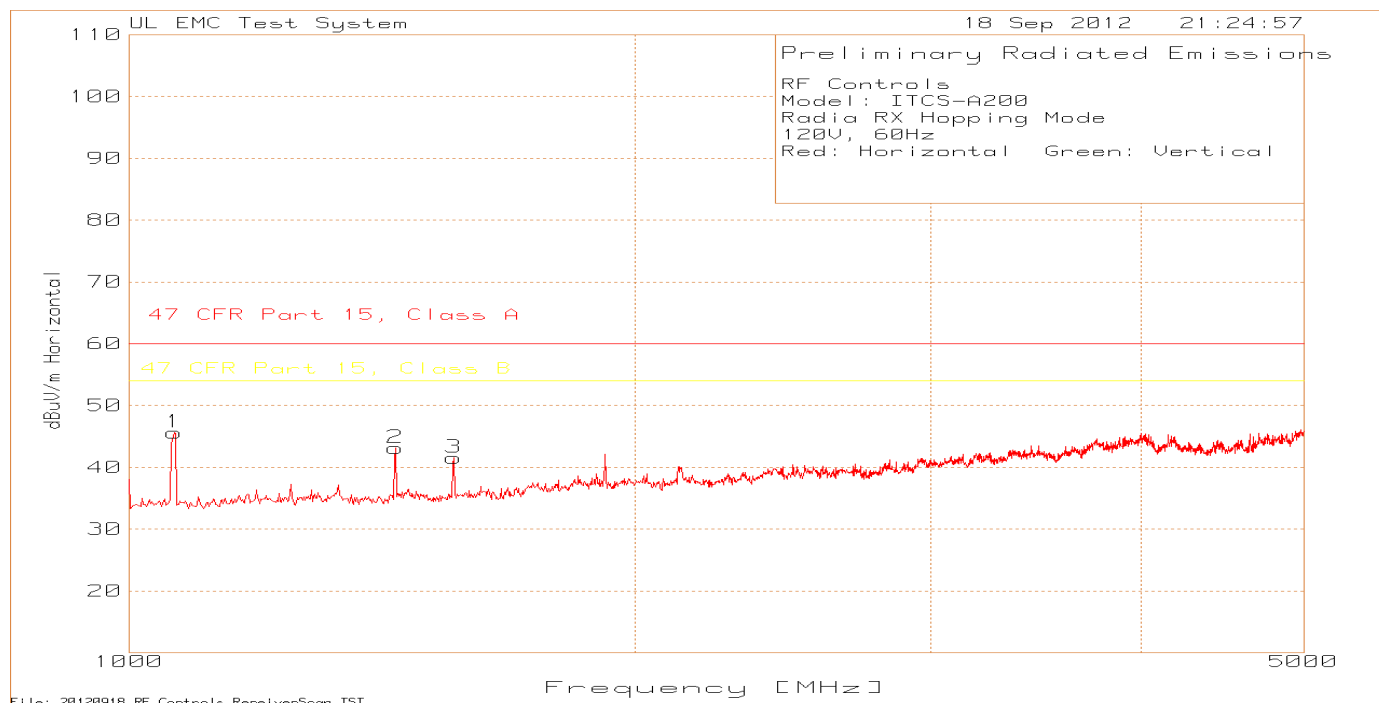
Model Number: ITCS-A200

Client Name: RF Controls LLC

Table 14 Radiated Emissions Data Points below 1GHz

RF Controls Model: ITCS-A200 RadioRX, Hopping 120V/60Hz RED: Horizontal GRN: Vertical												
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB	Antenna Factor dB	Level dBuV/m	CISPR Class B 10 m	Margin	CFR 47 Part 15 Class B 10m	Margin	Height [cm]	Polarity
1	30.5947	37.06	PK	17.7	-29.3	25.46	30	-4.54	29.6	-4.14	99	Vert
2	71.969	44.5	PK	6.3	-29.4	21.4	30	-8.6	29.6	-8.2	250	Vert
3	59.99	43.38	PK	6.8	-29.4	20.78	30	-9.22	29.6	-8.82	250	Vert
4	96.012	46.88	PK	9.9	-29.4	27.38	30	-2.62	33.1	-5.72	99	Vert
5	162.4488	38.63	PK	15.2	-29.3	24.53	30	-5.47	33.1	-8.57	99	Vert
6	180.1199	40.62	PK	15.8	-29.1	27.32	30	-2.68	33.1	-5.78	99	Vert
8	480.0799	42.83	PK	17.2	-31.9	28.13	37	-8.87	35.6	-7.47	99	Horz
9	374.2838	42.45	PK	15	-32.4	25.05	37	-11.95	35.6	-10.55	200	Horz
7	480.0799	48.07	PK	17.2	-31.9	33.37	37	-3.63	35.6	-2.23	200	Vert
Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB	Antenna Factor dB	Level dBuV/m	CISPR Class B 10 m	Margin	CFR 47 Part 15 Class B 10m	Margin	Azimuth [Degs]	Height [cm]	Polarity
30	35.54	QP	17.8	-29.3	24.04	30	-5.96	29.6	-5.56	72	100	Vert
96.011218	46.85	QP	9.9	-29.4	27.35	30	-2.65	33.1	-5.75	228	114	Vert
180.009765	35.17	QP	15.8	-29.1	21.87	30	-8.13	33.1	-11.23	158	101	Vert
480.045577	48.09	QP	17.2	-31.9	33.39	37	-3.61	35.6	-2.21	45	240	Vert
PK - Peak detector QP - Quasi-Peak detector												

Figure 8 Radiated Emissions Graph above 1GHz



Model Number: ITCS-A200

Client Name: RF Controls LLC

Table 15 Radiated Emissions Data Points above 1GHz

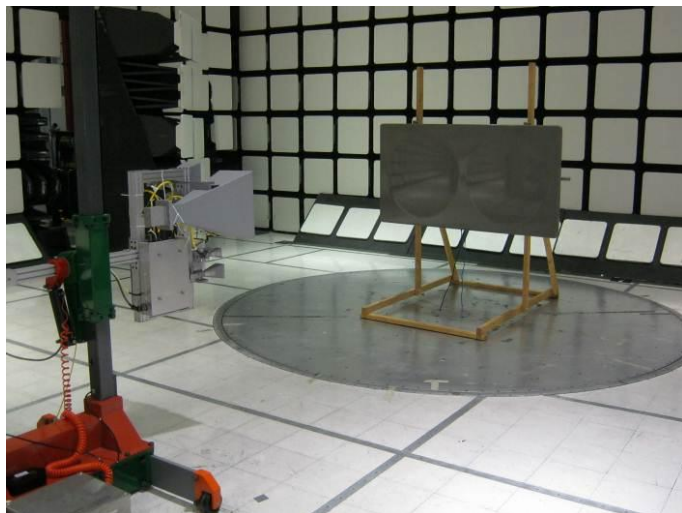
RF Controls Model: ITCS-A200 Radia RX Hopping Mode 120V, 60Hz Red: Horizontal Green: Vertical										
Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB	Path Factor dB	Level dBuV/m	47 CFR Part 15, Class B	Margin	Height [cm]	Polarity
1	1064.032	78.09	PK	24.2	-56.63	45.66	54	-8.34	200	Horz
2	1440.22	73.7	PK	25.1	-55.6	43.2	54	-10.8	100	Horz
3	1560.28	71.99	PK	25.2	-55.65	41.54	54	-12.46	100	Horz
4	1066.033	76.21	PK	24.2	-56.71	43.7	54	-10.3	100	Vert
5	1440.22	71.35	PK	25.1	-55.6	40.85	54	-13.15	100	Vert
6	1560.28	71.07	PK	25.2	-55.65	40.62	54	-13.38	100	Vert
7	1920.46	70.32	PK	27.4	-54.41	43.31	54	-10.69	200	Vert
8	2122.561	67.86	PK	27.5	-53.28	42.08	54	-11.92	150	Vert
9	2538.769	64.7	PK	28.9	-52.01	41.59	54	-12.41	100	Vert
PK - Peak detector										

Appendix A

Test Setup Photos



Radiated Emissions – Digital Below 1GHz



Radiated Emissions – Above 1GHz



Mains – Line Conducted Emissions

Appendix B

Antenna Gain Information

Antenna gain was measured using substitution power measurements with absorber on the floor between the EUT and receive antenna and between the substitution antenna and receive antenna.

Polarization	Freq MHz	SG Drive dBm	Level at Ant dBm	TX Ant Factor dBi	Substitution EIRP Level	Substitution FS dBuV/m	Software Radio Power Setting	EUT FS dBuV/m @ 3m	FS Delta EUT-Subs dB	EUT EIRP Level dBm	EUT EIRP Level mW	EUT Peak Power Measured dBm	Antenna Gain Level dBi
Horz	903.1	2.7	0.0	5.95	5.95	102.70	2380	130.05	27.35	33.30	2137.962	24.3	9.00
Vert	903.1	2.7	0.0	5.75	5.75	101.71	2380	131.18	29.47	35.22	3326.596	24.3	10.92
Horz	915.1	2.7	0.0	5.90	5.90	102.30	2380	129.28	26.98	32.88	1940.886	24.3	8.58
Vert	915.1	2.7	0.0	5.70	5.70	101.47	2380	131.72	30.25	35.95	3935.501	24.3	11.65
Horz	926.9	2.7	-0.1	5.90	5.80	102.15	2380	129.42	27.27	33.07	2027.683	24.3	8.77
Vert	926.9	2.7	-0.1	5.70	5.60	101.18	2380	130.81	29.63	35.23	3334.264	24.3	10.93

Based on above table maximum antenna gain is: 11.65dBi (5.65dB above 6dBi)

Power output used for antenna gain determination: 24.3dBm

Maximum allowed power output 1W (30dBm) – antenna gain over 6dBi (6.19dB) is 272.3mW (24.35dBm)

Maximum radio setting allowed per above (assuming linear power changer – see section 4.1): **2385**

Appendix C

Accreditations and Authorizations



NVLAP Lab code: 100414-0

NVLAP: The National Institute of Standards and Technology (NIST) administers the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP is comprised of laboratory accreditation programs (LAPs) which are established on the basis of requests and demonstrated need. Each LAP includes specific calibration and/or test standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration. NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests. Accreditation criteria are established in accordance with the U.S. Code of Federal Regulations (CFR, Title 15, Part 285), NVLAP Procedures and General Requirements, and encompass the requirements of ISO/IEC 17025. For a full scope listing see <http://ts.nist.gov/standards/scopes/1004140.htm>



FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland (Ref. No. 91044).



Industry Canada Industrie Canada

Industry of Canada: Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3. File #: IC 2180A



VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.: Radiated Emissions R-621 and G-344, Conducted Emissions C-642.



ICASA: ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).



NIST/CAB: Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 2004/108/EC, Annex III (2-3). Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.

NIST/CAB: Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).

NIST/CAB: Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22), IEC 61000-4-2, -4-3, -4-4, -4-5, and -4-6

