FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION CLASS 2 PERMISIVE CHANGE TEST REPORT

FOR

900MHz FHSS RF ID Reader

MODEL NUMBER: RFC-6100XR with Antenna Assembly ITCS-A-210

FCC ID: WFQRFC-6100XR
IC: 10717A-RFC6100XR

REPORT NUMBER: 10371452A

ISSUE DATE: June 18, 2014

Prepared for
RF Controls LLC
1400 South 3rd Street
Suite 220
Saint Louis, MO 63104

Prepared by
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NVLAP LAB CODE 100414-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	2014-06-18	Initial Issue	BM

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: **RF Controls LLC**
1400 South 3rd Street
Suite 220
Saint Louis, MO 63104

EUT DESCRIPTION: The EUT (Equipment Under Test) is a 900MHz FHSS RF ID Reader with 4x8 High Gain Steerable Beam Antenna.

MODEL: RFC-6100XR with Antenna Assembly ITCS-A-210

SERIAL NUMBER: Prototype

DATE TESTED: June 5, 2014

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

**In order to show compliance as a system this report must be used in combination with UL issued report under order number 10185788A and 10185788B.*

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. 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.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8, FCC publication DA 00-705.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 100414-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/100414.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test	Range	Equipment	Uncertainty k=2
Conducted Emissions	150k-30MHz	LISN	2.29dB
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.27dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.28dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.33dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.39dB
Radiated Emissions	1-6GHz	Horn	5.02dB
Radiated Emissions	6-18GHz	Horn	5.34dB
Radiated Emissions	18-26GHz	Horn	6.60dB
Radiated Emissions	26-40GHz	Horn	7.02dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT (Equipment Under Test) is a 900MHz FHSS RF ID Reader with 4x8 High Gain Steerable Beam Antenna. This antenna is identical to the one tested under UL Order # 10185788B, except for minor component changes to lower the power consumption to be able to operate the large array with PoE as the only source of power.

The antenna uses a radio module is manufactured by RF Controls LLC, certified under
FCC ID: WFQRFC-6100XR / IC:10717A-RFC6100XR

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power for ITCS-A-210 configuration as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
902-928	T6.25	24.00	251.36

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio is part of RF Controls Steerable Beam Antenna with declared gain of 11.65dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was RFRFCC000b031914, rev. 00b.
The EUT driver software installed in the host support equipment during testing was EthtoSerialConfig.application, rev. 1.0.0.42.
The test utility software used during testing was EthtoSerialConfig.application, rev. 1.0.0.42.

5.5. WORST-CASE CONFIGURATION AND MODE

EUT can operate in three different modulation modes described by manufacturer as T6.25 (largest bandwidth), T12.5 (medium bandwidth), and T25 (smallest bandwidth). Preliminary measurements showed that the output power does not change with the bandwidth change. The only measurements conducted with all three bandwidths were the bandwidth measurements and the band-edge measurements.

The EUT is powered by 48VDC PoE Adapter.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptopt Computer	Generic	-	-	-
PoE Adapter	Generic	-	-	-

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
0	Enclosure	1	n/a	n/a	n/a	-
1	Ethernet	1	RJ-45	Cat5 or Cat6	> 3m	Ethernet with Poe

TEST SETUP

The EUT is a fully functional, steerable beam antenna that incorporates a 900MHz FHSS RF Transceiver.

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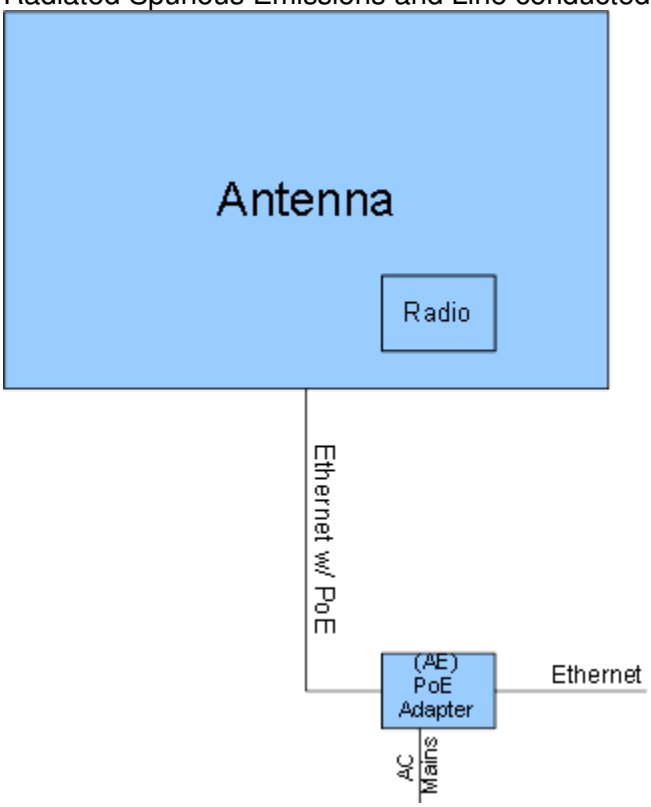
SETUP DIAGRAM FOR TESTS

Radiated Spurious Emissions and Line conducted Emissions



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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Radiated Emissions – 10-Meter Chamber

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20131227	20141231
Bicon Antenna	Chase	VBA6106A	EMC4078	20140401	20150401
Log-P Antenna	Chase	UPA6109	EMC4313	20131003	20141003
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20131226	20141231
Antenna Array	UL	BOMS	EMC4276	20130912	20140930

Conducted Emissions

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	Dec 30, 2013	Dec 30, 2014
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	2831A00838	N/A	N/A
LISN - L1	Solar	8602-50-TS-50-N	EMC4052	Jan 15, 2014	Jan 16, 2015
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	Jan 15, 2014	Jan 16, 2015

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7. ANTENNA PORT TEST RESULTS

7.1.1. OUTPUT POWER

LIMIT

§15.247 (b) (2)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is 11.65dBi. The maximum output power limit is 24.35dBm. While the radio is capable of maximum output power of 1 watt, the output is factory adjustable and may not be changed by installer. Output power was measured and specific setting for specific antenna assembly was established.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	902.75	23.92	24.35	-0.44
Middle	914.75	24.00	24.35	-0.35
High	927.25	23.87	24.35	-0.48

Please refer to UL Report issued under order # 10185788A and 10185788B for complete set of data with respect to the radio.

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8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters or 10 meters as noted. The EUT is configured in accordance with ANSI C63.4:2003. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 10 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 900 MHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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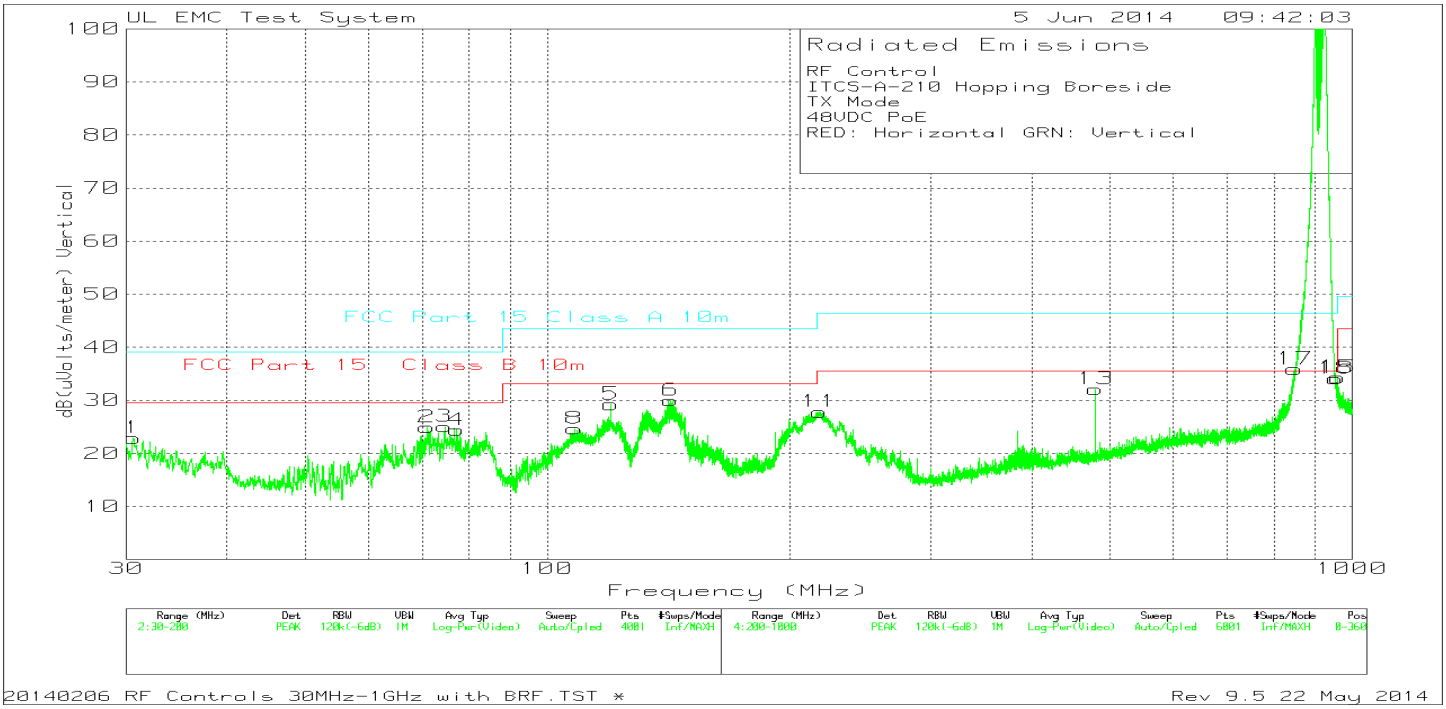
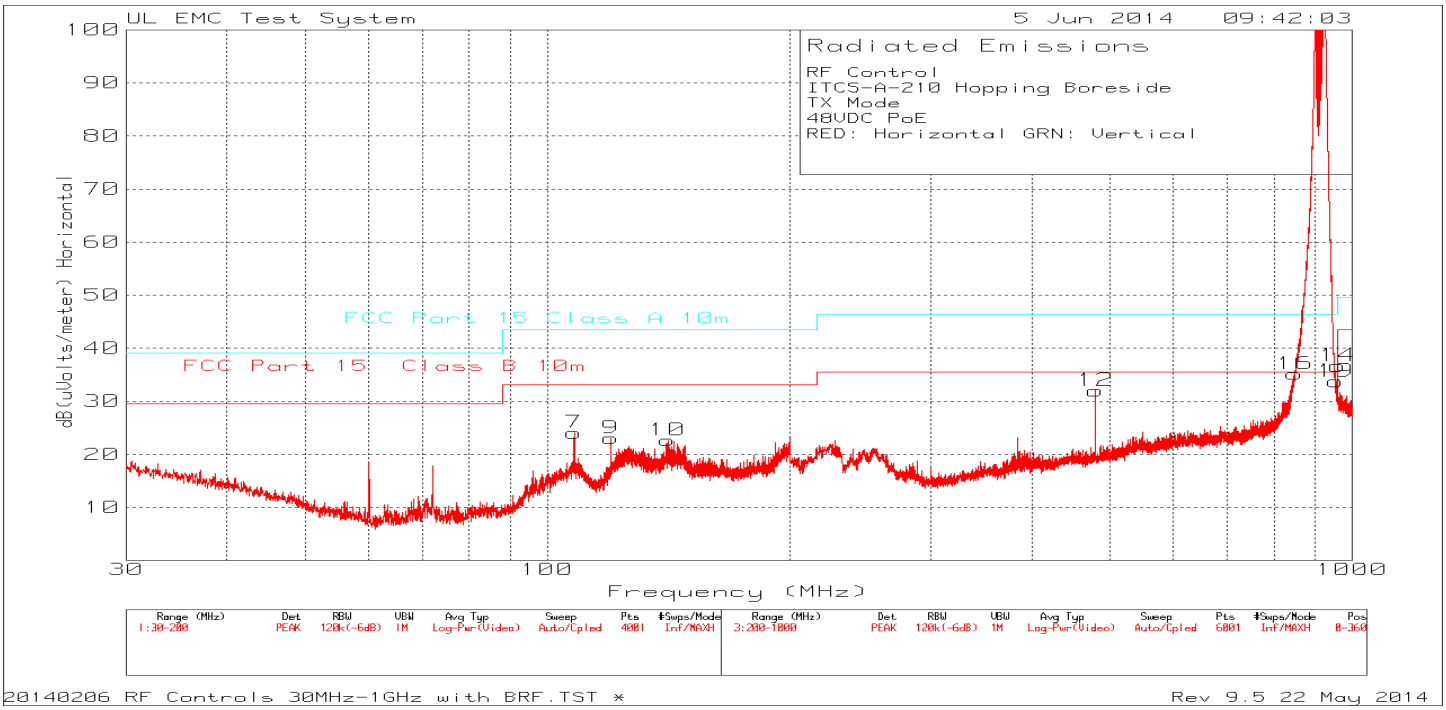
8.2. RADIATED SPUROUS BELOW 1 GHz

8.2.1. Radiated Spurious Emissions 30MHz-1GHz TX Hopping





* limits were extrapolated to distance of 10 meters

** The area between 800MHz to1GHz above the limit is product of the HPF. There are no restricted bandedges covered by the HPF and there were no spurious emissions recorded in any restricted bands below 1GHz. All emissions marked are product of digital part of the device. Measurement distance was set to 10 meters. Limits were extrapolated to 10 meter distance.

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RF Control
ITCS-A-210 Hopping Boreside
TX Mode
48VDC PoE
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	BRF Factor dB	Level dBuV/m	Limit FCC 15.109, class A dBuV/m	Margin dB	Limit FCC 15.209 dBuV/m	Margin dB	Azimuth Degs	Height [cm]	Polarity
7	107.9875	42.2	PK	11.8	-29.9	0	24.1	43.52	-19.42	33.07	-8.97	0-360	400	H
9	* 120.015	39.68	PK	13.2	-29.8	0	23.08	43.52	-20.44	33.07	-9.99	0-360	400	H
10	141.1375	38.08	PK	14.3	-29.7	0	22.68	43.52	-20.84	33.07	-10.39	0-360	400	H
1	30.595	35.5	PK	17.5	-30.1	0	22.9	39.08	-16.18	29.55	-6.65	0-360	99	V
2	70.8425	48.63	PK	6.2	-29.9	0	24.93	39.08	-14.15	29.55	-4.62	0-360	400	V
3	* 74.54	48.67	PK	6.4	-30	0	25.07	39.08	-14.01	29.55	-4.48	0-360	400	V
4	77.175	47.73	PK	6.6	-29.9	0	24.43	39.08	-14.65	29.55	-5.12	0-360	249	V
5	* 120.015	45.82	PK	13.2	-29.8	0	29.22	43.52	-14.3	33.07	-3.85	0-360	99	V
6	142.37	45.29	PK	14.4	-29.7	0	29.99	43.52	-13.53	33.07	-3.08	0-360	99	V
8	* 108.0725	42.76	PK	11.8	-29.9	0	24.66	43.52	-18.86	33.07	-8.41	0-360	99	V
12	479.9993	39.71	PK	17.2	-25.1	0.2	32.01	46.44	-14.43	35.57	-3.56	0-360	99	H
14	* 960.1314	34.07	PK	23.4	-24.3	3.5	36.67	49.54	-12.87	43.52	-6.85	0-360	99	H
16	849.1984	27.26	PK	22.6	-24.8	10.1	35.16	46.44	-11.28	35.57	-0.41	0-360	300	H
19	955.1981	29.25	PK	23.4	-24.4	5.5	33.75	46.44	-12.69	35.57	-1.82	0-360	99	H
11	218.1333	43.52	PK	10.8	-26.6	0.1	27.82	46.44	-18.62	35.57	-7.75	0-360	99	V
13	479.9993	39.83	PK	17.2	-25.1	0.2	32.13	46.44	-14.31	35.57	-3.44	0-360	199	V
15	* 960.1314	31.7	PK	23.4	-24.3	3.5	34.3	49.54	-15.24	43.52	-9.22	0-360	199	V
17	849.1984	27.97	PK	22.6	-24.8	10.1	35.87	46.44	-10.57	35.57	0.3	0-360	99	V
18	953.9981	28.81	PK	23.4	-24.5	6.4	34.11	46.44	-12.33	35.57	-1.46	0-360	99	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

Radiated Emission Data

	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	BRF Factor dB	Level dBuV/m	Limit FCC 15.109, class A dBuV/m	Margin dB	Limit FCC 15.209 dBuV/m	Margin dB	Azimuth Degs	Height [cm]	Polarity
	72.003	40.4	QP	6.2	-29.9	0	16.7	39.08	-22.38	29.55	-12.85	157	396	H
	70.852821	45.5	QP	6.2	-29.9	0	21.8	39.08	-17.28	29.55	-7.75	22	223	V
	* 74.451859	44.53	QP	6.3	-30	0	20.83	39.08	-18.25	29.55	-8.72	312	400	V
	77.202244	45.64	QP	6.6	-29.9	0	22.34	39.08	-16.74	29.55	-7.21	306	395	V
	* 120.00641	43.58	QP	13.2	-29.8	0	26.98	43.52	-16.54	33.07	-6.09	272	100	V
	142.38603	42.89	QP	14.4	-29.7	0	27.59	43.52	-15.93	33.07	-5.48	305	100	V
	480.03205	33.92	QP	17.2	-25.1	0.2	26.22	46.44	-20.22	35.57	-9.35	313	239	H
	* 960.06634	34.56	QP	23.4	-24.3	3.6	37.26	49.54	-12.28	43.52	-6.26	159	100	H
	* 960	28.23	QP	23.4	-24.3	3.6	30.93	46.44	-15.51	35.57	-4.64	159	100	H
	480.03365	36.81	QP	17.2	-25.1	0.2	29.11	46.44	-17.33	35.57	-6.46	4	285	V
	* 960.06891	30.85	QP	23.4	-24.3	3.6	33.55	49.54	-15.99	43.52	-9.97	142	290	V
	* 960	25.44	QP	23.4	-24.3	3.6	28.14	46.44	-18.3	35.57	-7.43	142	290	V

QP - Quasi-Peak detector

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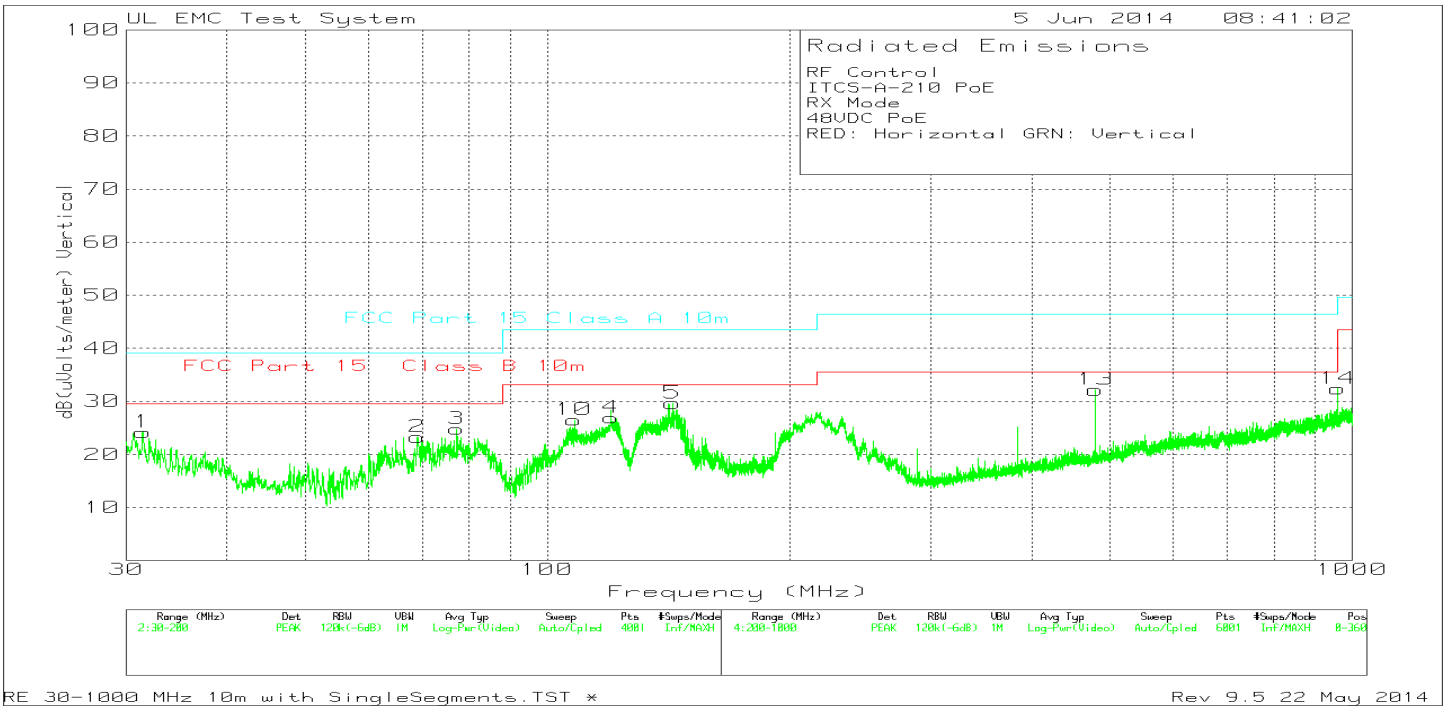
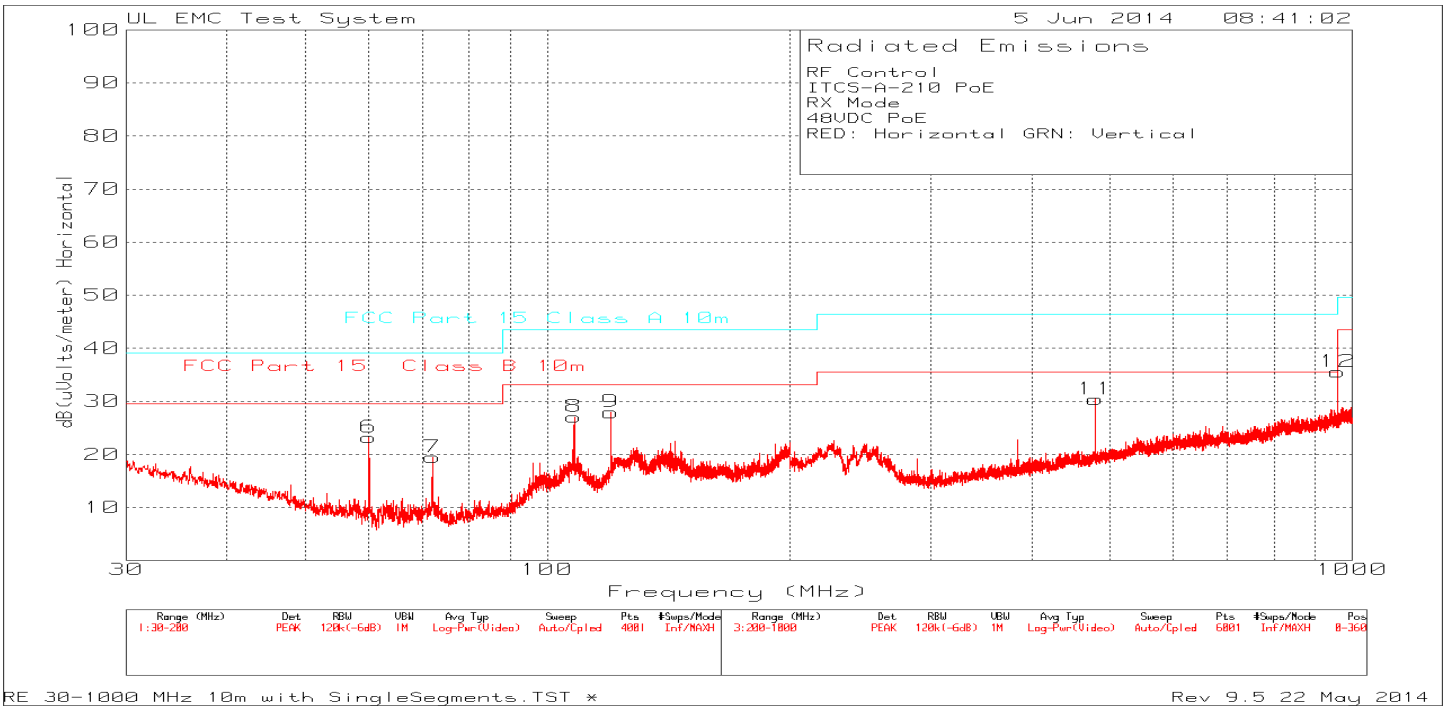
8.2.2. Radiated Spurious Emissions 30MHz-1GHz RX/ Digital Hopping





* limits were extrapolated to distance of 10 meters

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RF Control
ITCS-A-210 PoE
RX Mode
48VDC PoE
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	Limit FCC 15.109, Class A dBuV/m	Margin dB	Limit FCC 15.109, Class B dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
6	60.005	46.42	PK	6.8	-30	23.22	39.08	-15.86	29.55	-6.33	0-360	400	H
7	71.99	43.2	PK	6.2	-29.9	19.5	39.08	-19.58	29.55	-10.05	0-360	400	H
8	108.0088	45.18	PK	11.8	-29.9	27.08	43.52	-16.44	33.07	-5.99	0-360	400	H
9	120.015	44.53	PK	13.2	-29.8	27.93	43.52	-15.59	33.07	-5.14	0-360	400	H
1	31.445	37.07	PK	17.2	-30.1	24.17	39.08	-14.91	29.55	-5.38	0-360	99	V
2	68.9725	47.09	PK	6.2	-30	23.29	39.08	-15.79	29.55	-6.26	0-360	400	V
3	77.175	48.1	PK	6.6	-29.9	24.8	39.08	-14.28	29.55	-4.75	0-360	400	V
4	120.1	43.52	PK	13.2	-29.8	26.92	43.52	-16.6	33.07	-6.15	0-360	99	V
5	143.2625	45.04	PK	14.3	-29.7	29.64	43.52	-13.88	33.07	-3.43	0-360	99	V
10	107.9875	44.61	PK	11.8	-29.9	26.51	43.52	-17.01	33.07	-6.56	0-360	99	V
11	479.9993	38.31	PK	17.2	-25.1	30.41	46.44	-16.03	35.57	-5.16	0-360	99	H
12	960.1314	36.46	PK	23.4	-24.3	35.56	49.54	-13.98	43.52	-7.96	0-360	99	H
13	479.9993	40.08	PK	17.2	-25.1	32.18	46.44	-14.26	35.57	-3.39	0-360	199	V
14	960.1314	33.3	PK	23.4	-24.3	32.4	49.54	-17.14	43.52	-11.12	0-360	199	V

PK - Peak detector

Radiated Emission Data

	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	Limit FCC 15.109, Class A dBuV/m	Margin dB	Limit FCC 15.109, Class B dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
	108.0075	42.5	QP	11.8	-29.9	24.4	43.52	-19.12	33.07	-8.67	349	396	H
	120.0064	38.12	QP	13.2	-29.8	21.52	43.52	-22	33.07	-11.55	332	383	H
	31.43199	33.71	QP	17.2	-30.1	20.81	39.08	-18.27	29.55	-8.74	74	103	V
	77.20224	46.22	QP	6.6	-29.9	22.92	39.08	-16.16	29.55	-6.63	305	387	V
	143.2417	42.35	QP	14.3	-29.7	26.95	43.52	-16.57	33.07	-6.12	316	100	V
	480.0346	39.61	QP	17.2	-25.1	31.71	46.44	-14.73	35.57	-3.86	211	127	H
	960.0657	36.95	QP	23.4	-24.3	36.05	49.54	-13.49	43.52	-7.47	157	100	H
	960	30.28	QP	23.4	-24.3	29.38	46.44	-17.06	35.57	-6.19	157	100	H
	480.0321	36.99	QP	17.2	-25.1	29.09	46.44	-17.35	35.57	-6.48	4	299	V
	960.0679	33.24	QP	23.4	-24.3	32.34	49.54	-17.2	43.52	-11.18	144	295	V
	960.0679	33.24	QP	23.4	-24.3	32.34	49.54	-17.2	43.52	-11.18	144	295	V
	960	27.19	QP	23.4	-24.3	26.29	46.44	-20.15	35.57	-9.28	144	295	V

QP - Quasi-Peak detector

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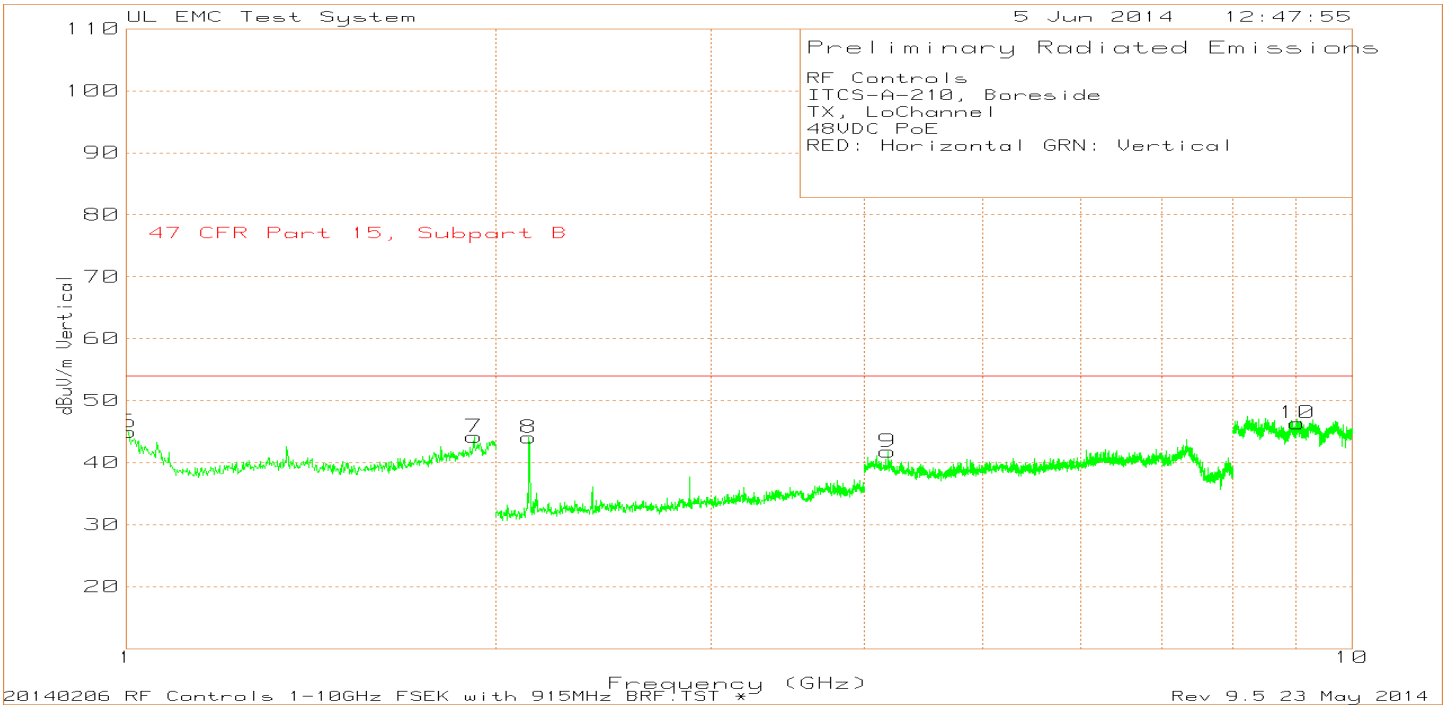
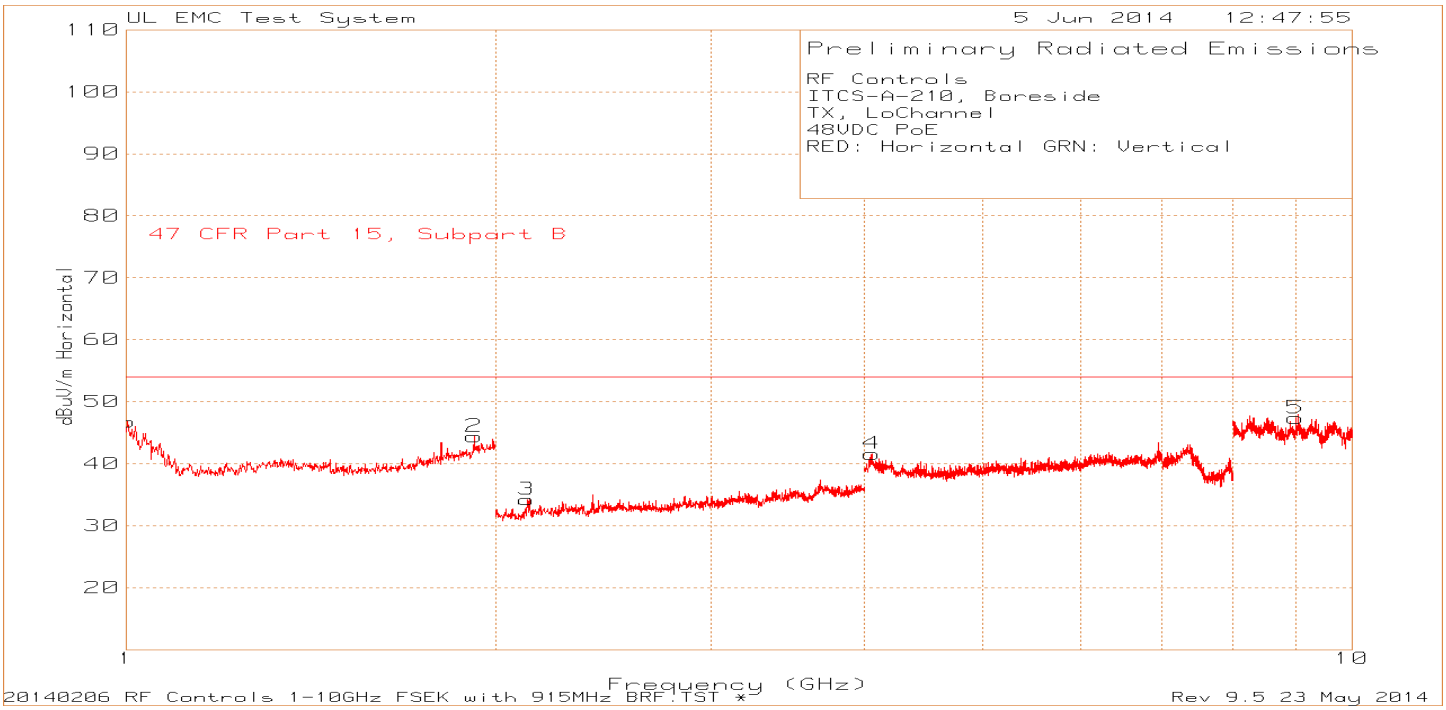
8.3. TRANSMITTER ABOVE 1 GHz

8.3.1. Radiated Emissions 1GHz – 10GHz Low Channel, Bore Side Beam Setting





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RF Controls
ITCS-A-210, Boreside
TX, LoChannel
48VDC PoE
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.002	74.12	PK	27.4	1.1	-55.85	46.77	54	-7.23	0-360	149	H
2	1.9218	65.52	PK	31.3	0.5	-52.94	44.38	-	-	0-360	149	H
3	2.1221	64.91	PK	21.5	0	-52.2	34.21	-	-	0-360	150	H
4	*4.06	63.73	PK	28.4	0	-50.53	41.6	54	-12.4	0-360	150	H
5	* 8.995	59.43	PK	36.1	0	-48.18	47.35	54	-6.65	0-360	150	H
6	*1.003	72.31	PK	27.4	1.1	-55.86	44.95	54	-9.05	0-360	150	V
7	1.9218	65.31	PK	31.3	0.5	-52.94	44.17	-	-	0-360	150	V
8	2.1301	74.69	PK	21.5	0	-52.13	44.06	-	-	0-360	150	V
9	* 4.1821	64.39	PK	28.3	0	-50.92	41.77	54	-12.23	0-360	150	V
10	* 9.029	58.28	PK	36.1	0	-48.02	46.36	54	-7.64	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

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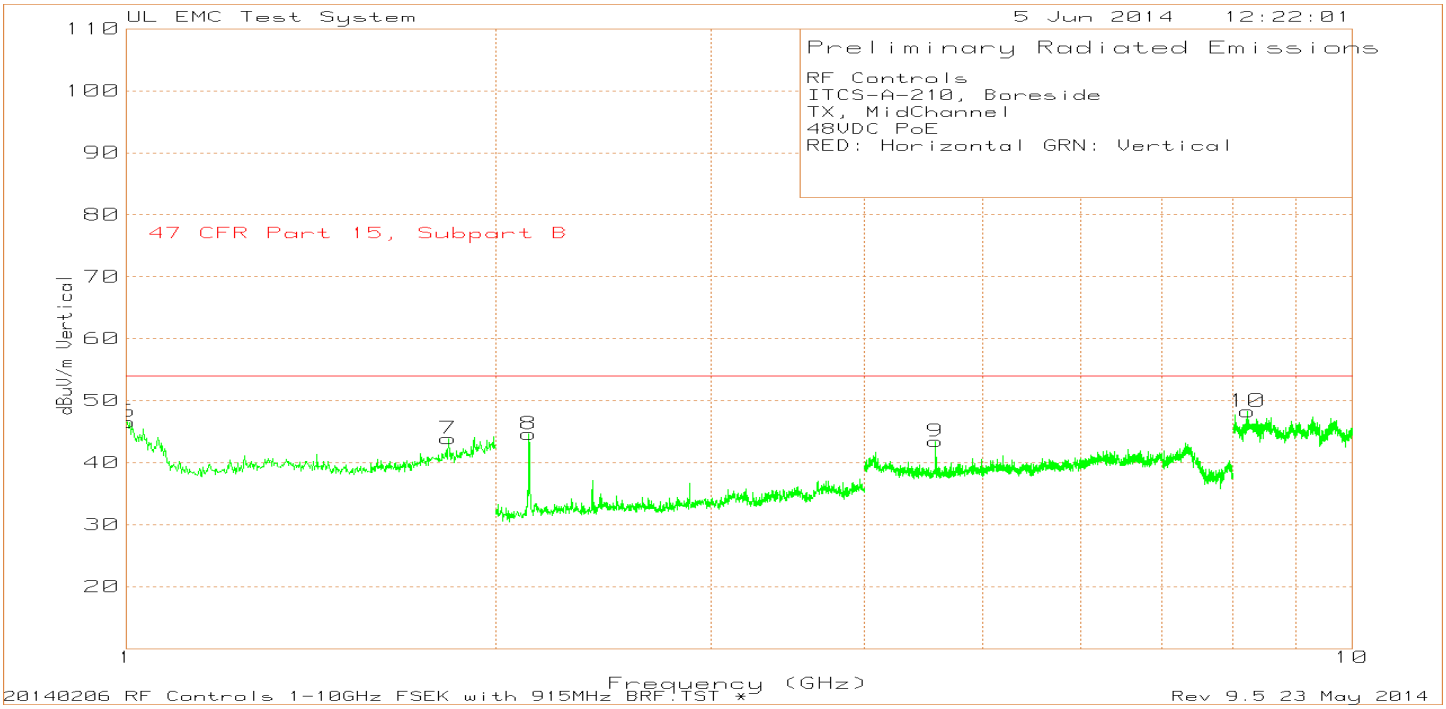
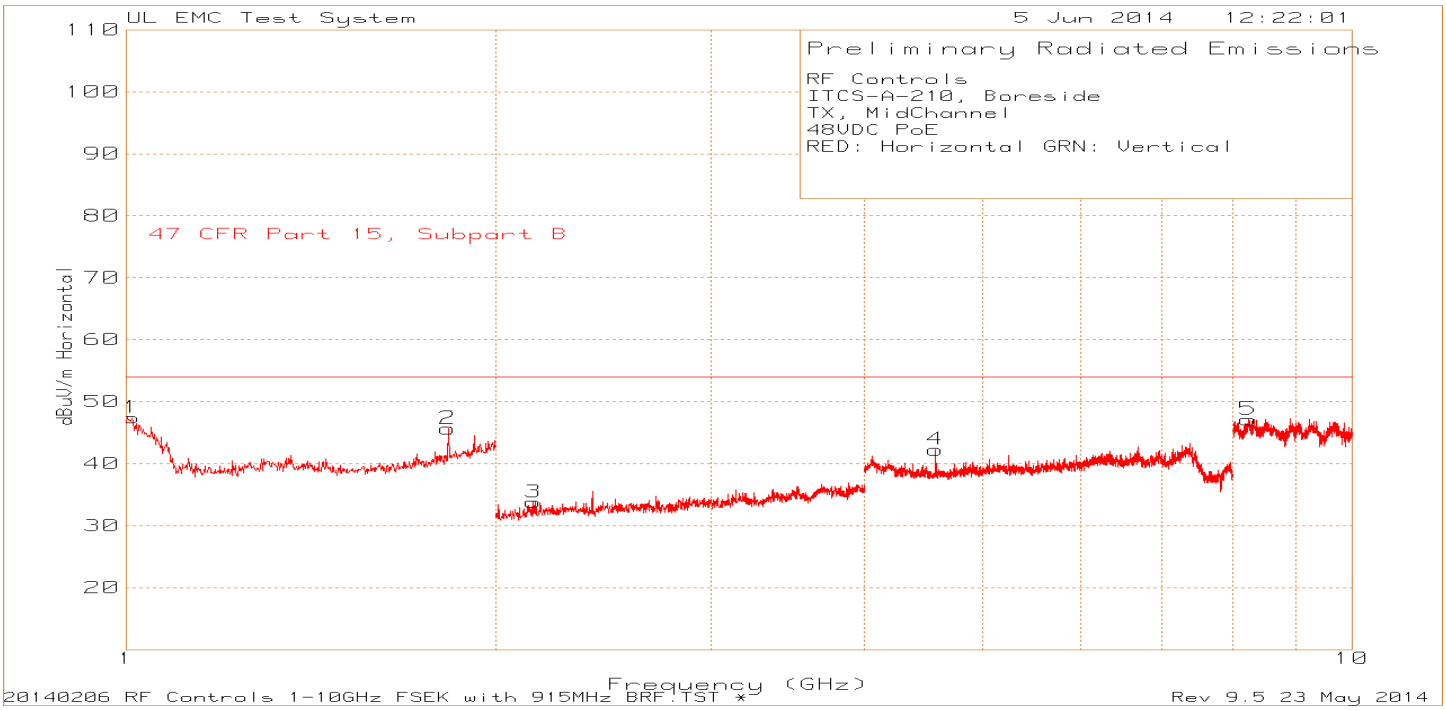
8.3.2. Radiated Emissions 1GHz – 10GHz Middle Channel, Bore Side Beam Setting





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RF Controls
ITCS-A-210, Boreside
TX, MidChannel
48VDC PoE
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.01	75.02	PK	27.4	0.9	-55.9	47.43	54	-6.57	0-360	149	H
2	1.8297	68.56	PK	30.2	0.4	-53.5	45.64	-	-	0-360	101	H
3	2.1481	64.09	PK	21.6	0	-51.9	33.79	-	-	0-360	150	H
4	* 4.5743	66.14	PK	27.7	0	-51.6	42.28	54	-11.72	0-360	150	H
5	* 8.2362	57.71	PK	36.4	0	-47	47.11	54	-6.89	0-360	150	H
6	* 1.002	73.96	PK	27.4	1.1	-55.9	46.61	54	-7.39	0-360	150	V
7	1.8317	66.72	PK	30.3	0.4	-53.5	43.9	-	-	0-360	150	V
8	2.1301	75.25	PK	21.5	0	-52.1	44.62	-	-	0-360	150	V
9	* 4.5743	67.31	PK	27.7	0	-51.6	43.45	54	-10.55	0-360	150	V
10	* 8.2222	58.91	PK	36.4	0	-47.1	48.26	54	-5.74	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

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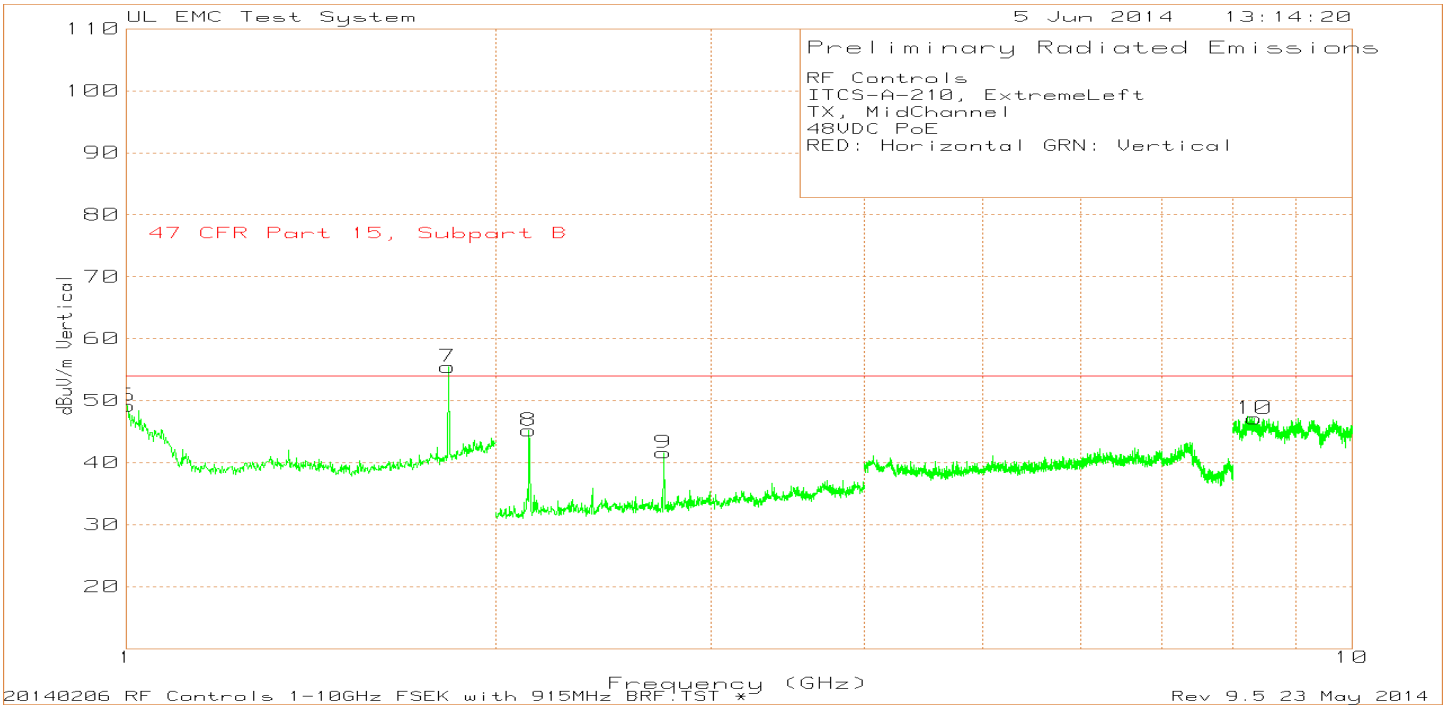
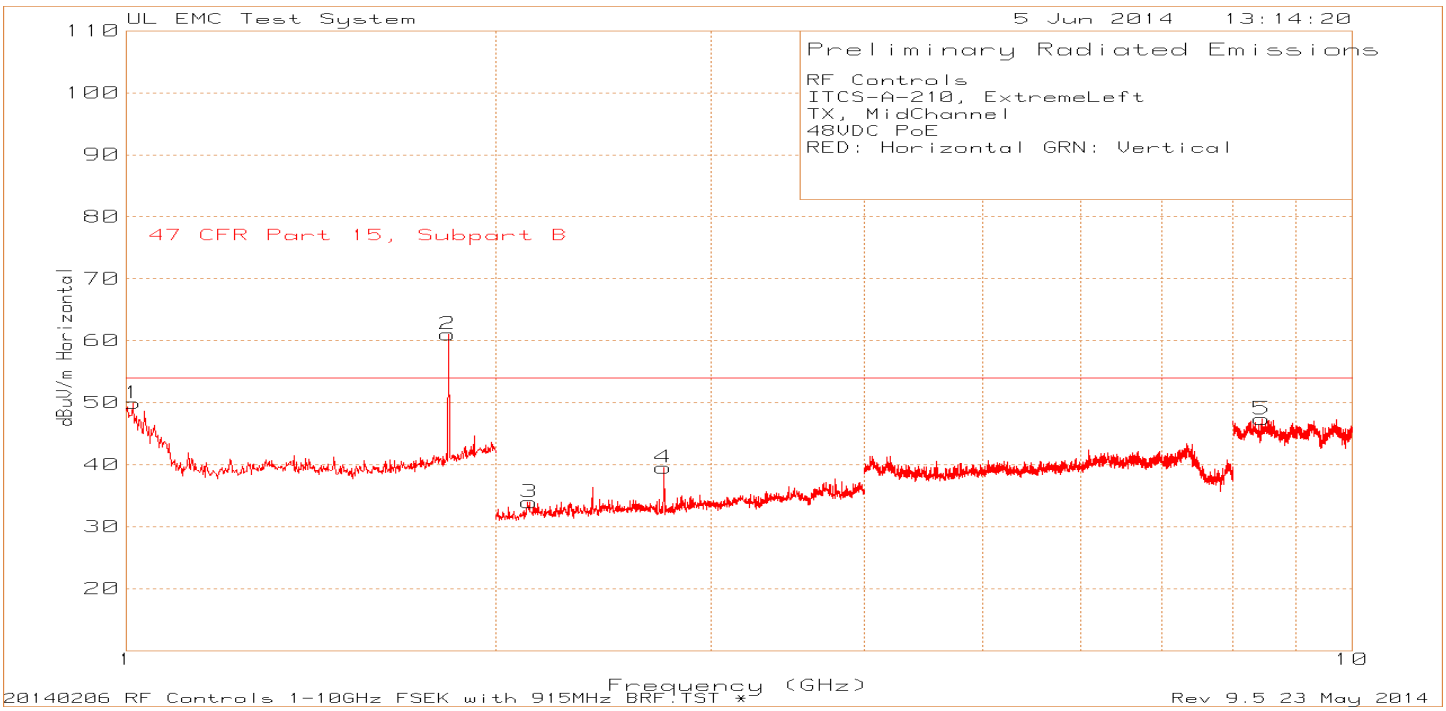
8.3.3. Radiated Emissions 1GHz – 10GHz Middle Channel, Extreme Left Beam Setting





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RF Controls
ITCS-A-210, ExtremeLeft
TX, MidChannel
48VDC PoE
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.012	77.55	PK	27.4	0.9	-55.92	49.93	54	-4.07	0-360	149	H
2	1.8297	83.97	PK	30.2	0.4	-53.52	61.05	-	-	0-360	149	H
3	2.1321	64.55	PK	21.5	0	-52.09	33.96	-	-	0-360	150	H
4	* 2.7447	68.09	PK	22.1	0	-50.67	39.52	54	-14.48	0-360	150	H
5	* 8.4444	59.37	PK	36.6	0	-48.62	47.35	54	-6.65	0-360	150	H
6	* 1.002	76.54	PK	27.4	1.1	-55.85	49.19	54	-4.81	0-360	150	V
7	1.8297	78.37	PK	30.2	0.4	-53.52	55.45	-	-	0-360	150	V
8	2.1301	75.83	PK	21.5	0	-52.13	45.2	-	-	0-360	150	V
9	* 2.7447	70.19	PK	22.1	0	-50.67	41.62	54	-12.38	0-360	150	V
10	* 8.3263	58.81	PK	36.5	0	-48.18	47.13	54	-6.87	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

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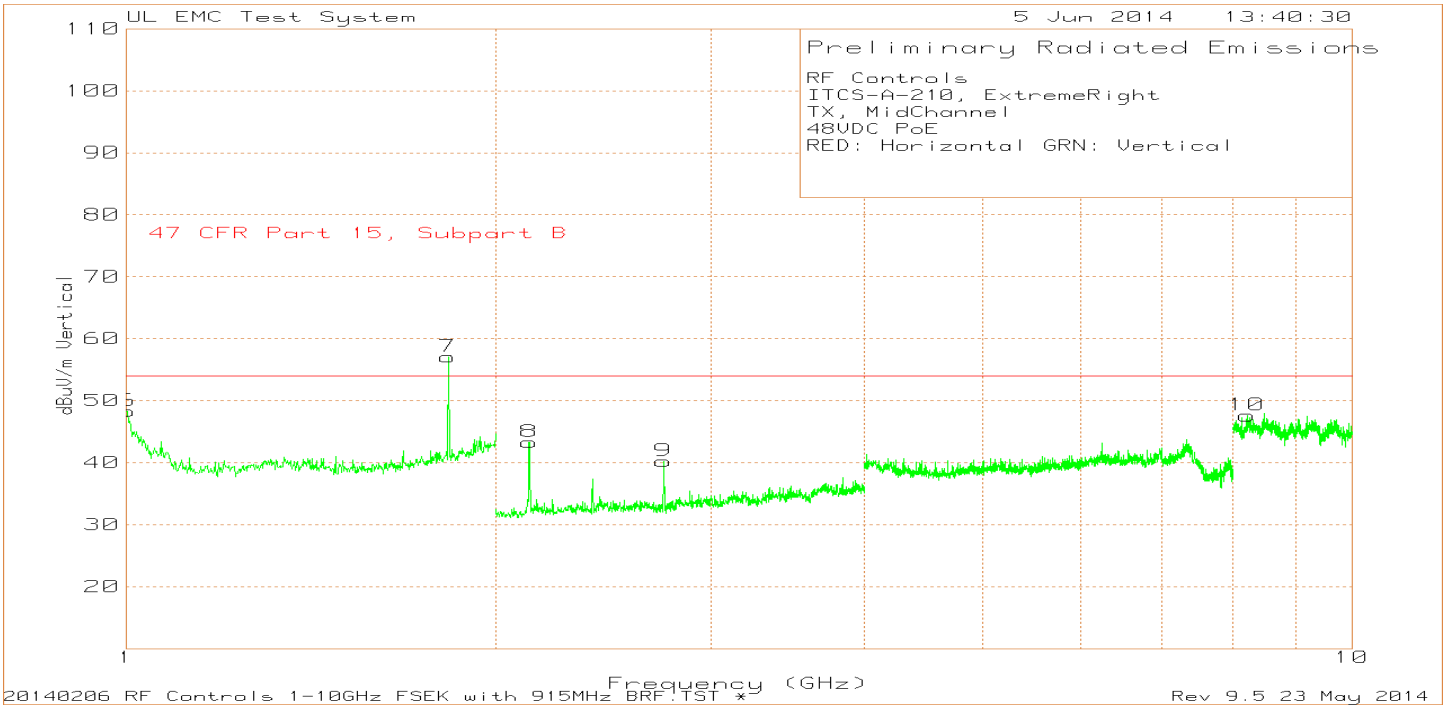
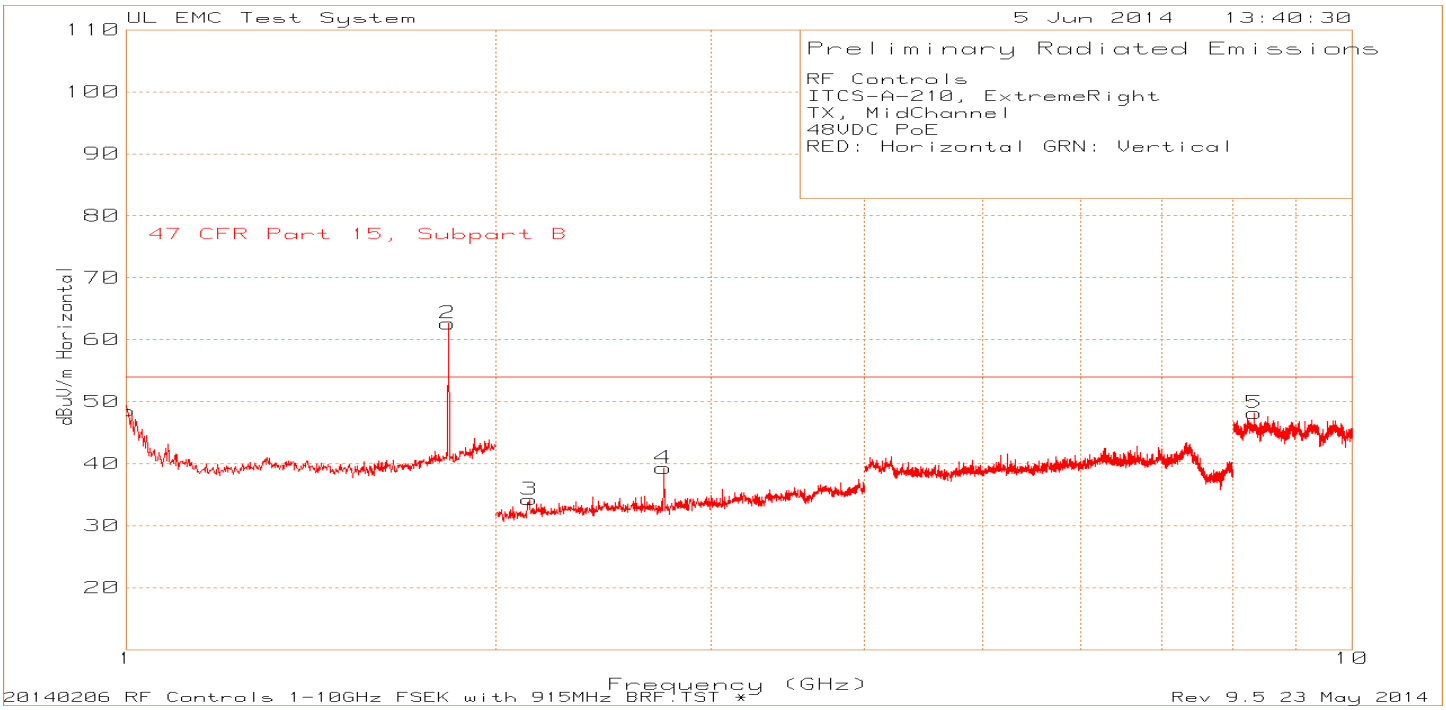
8.3.4. Radiated Emissions 1GHz – 10GHz Middle Channel, Extreme Right Beam Setting





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RF Controls
ITCS-A-210, ExtremeRight
TX, MidChannel
48VDC PoE
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.002	75.93	PK	27.4	1.1	-55.85	48.58	54	-5.42	0-360	149	H
2	1.8297	85.56	PK	30.2	0.4	-53.52	62.64	-	-	0-360	149	H
3	2.1321	64.82	PK	21.5	0	-52.09	34.23	-	-	0-360	150	H
4	* 2.7447	67.84	PK	22.1	0	-50.67	39.27	54	-14.73	0-360	150	H
5	* 8.3263	59.87	PK	36.5	0	-48.18	48.19	54	-5.81	0-360	150	H
6	* 1.002	75.67	PK	27.4	1.1	-55.85	48.32	54	-5.68	0-360	150	V
7	1.8297	80	PK	30.2	0.4	-53.52	57.08	-	-	0-360	150	V
8	2.1321	73.91	PK	21.5	0	-52.09	43.32	-	-	0-360	150	V
9	* 2.7447	68.81	PK	22.1	0	-50.67	40.24	54	-13.76	0-360	150	V
10	* 8.2102	58.54	PK	36.4	0	-47.31	47.63	54	-6.37	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

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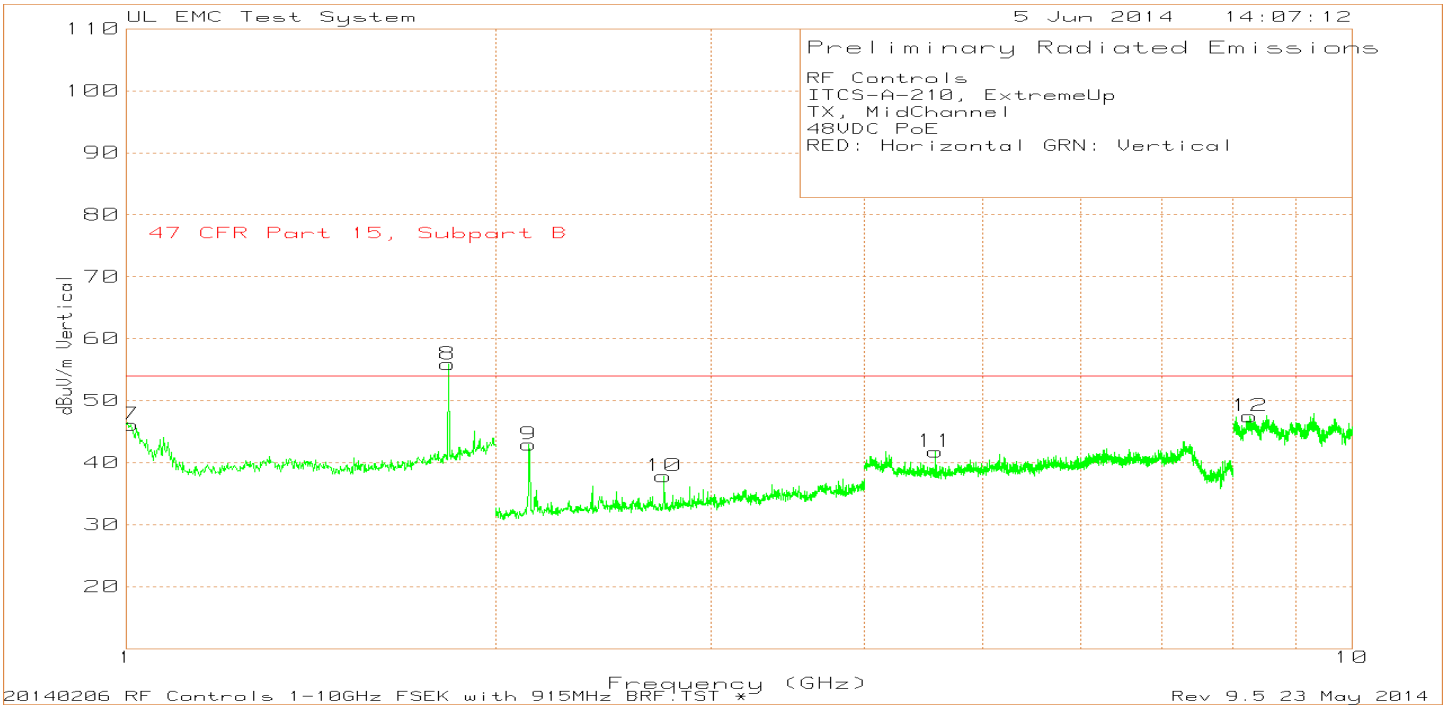
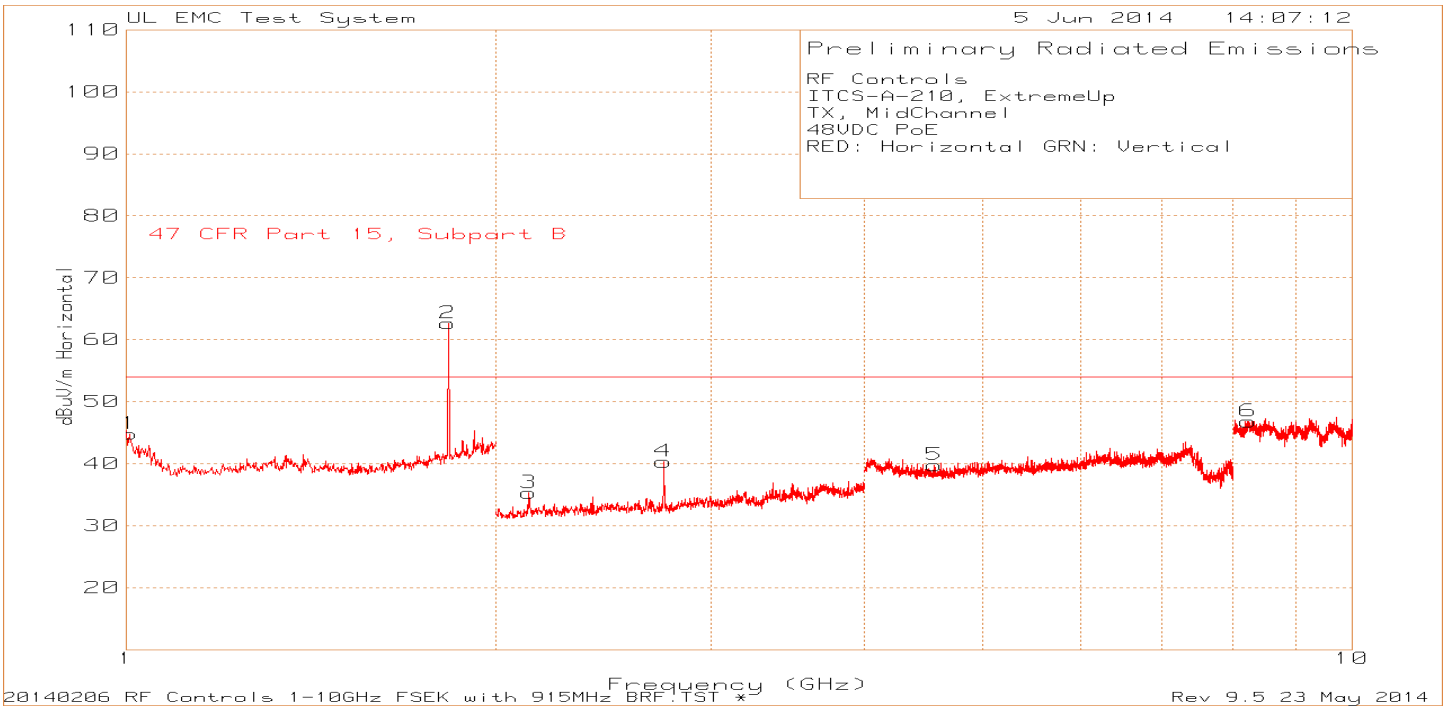
8.3.5. Radiated Emissions 1GHz – 10GHz Middle Channel, Extreme Up Beam Setting





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RF Controls
ITCS-A-210, ExtremeUp
TX, MidChannel
48VDC PoE
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.006	72.27	PK	27.4	1	-55.87	44.8	54	-9.2	0-360	149	H
2	1.8297	85.58	PK	30.2	0.4	-53.52	62.66	-	-	0-360	101	H
3	2.1301	65.92	PK	21.5	0	-52.13	35.29	-	-	0-360	150	H
4	* 2.7447	68.92	PK	22.1	0	-50.67	40.35	54	-13.65	0-360	150	H
5	* 4.5643	63.54	PK	27.8	0	-51.57	39.77	54	-14.23	0-360	150	H
6	* 8.2322	57.42	PK	36.4	0	-46.99	46.83	54	-7.17	0-360	150	H
7	* 1.008	73.6	PK	27.4	1	-55.88	46.12	54	-7.88	0-360	150	V
8	1.8297	78.82	PK	30.2	0.4	-53.52	55.9	-	-	0-360	150	V
9	2.1301	73.57	PK	21.5	0	-52.13	42.94	-	-	0-360	150	V
10	* 2.7447	66.39	PK	22.1	0	-50.67	37.82	54	-16.18	0-360	150	V
11	* 4.5743	65.62	PK	27.7	0	-51.56	41.76	54	-12.24	0-360	150	V
12	* 8.2543	58.32	PK	36.4	0	-47.21	47.51	54	-6.49	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

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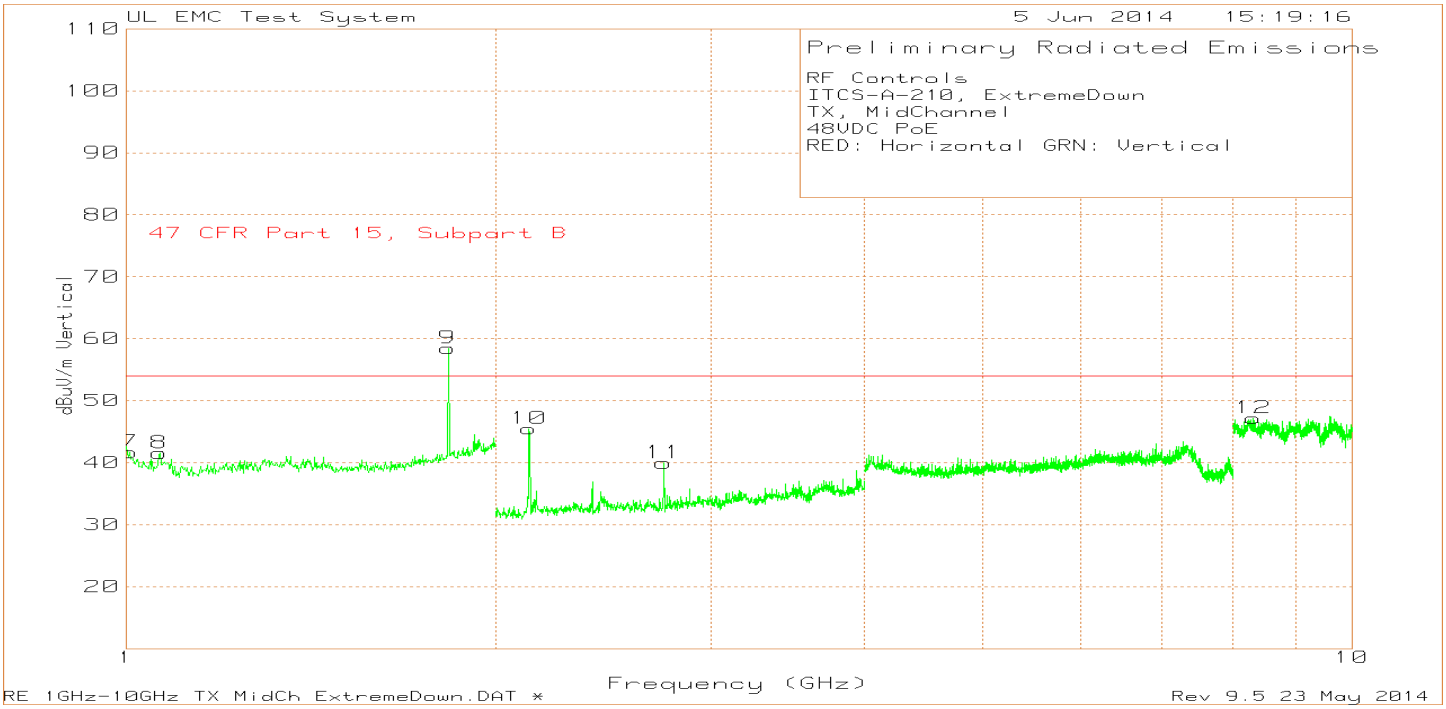
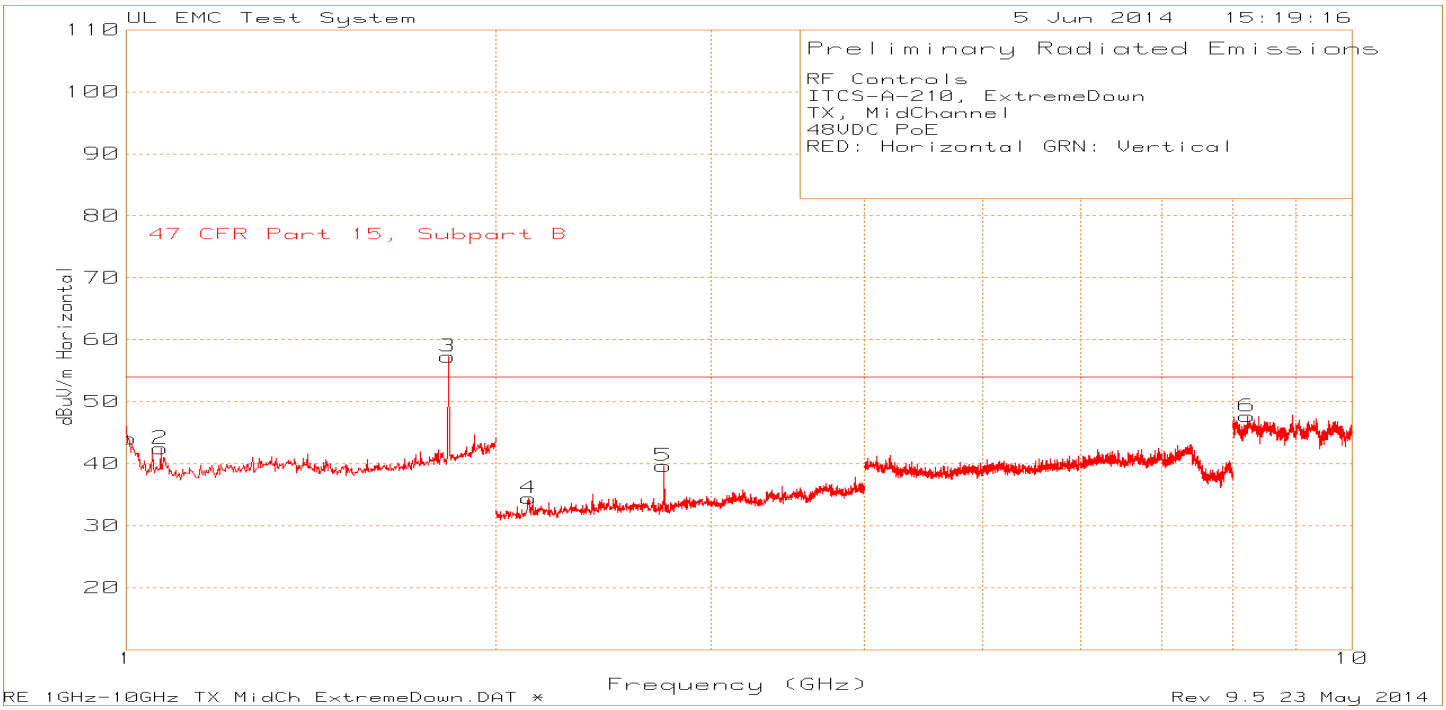
8.3.6. Radiated Emissions 1GHz – 10GHz Middle Channel, Extreme Down Beam Setting





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RF Controls
ITCS-A-210, ExtremeDow n
TX, MidChannel
48VDC PoE
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.004	71.4	PK	27.4	1.1	-55.86	44.04	54	-9.96	0-360	149	H
2	* 1.0661	70.74	PK	27.2	0.5	-55.98	42.46	54	-11.54	0-360	149	H
3	1.8297	80.2	PK	30.2	0.4	-53.52	57.28	-	-	0-360	149	H
4	2.1301	65.07	PK	21.5	0	-52.13	34.44	-	-	0-360	150	H
5	* 2.7447	68.2	PK	22.1	0	-50.67	39.63	54	-14.37	0-360	150	H
6	* 8.2182	58.38	PK	36.4	0	-47.13	47.65	54	-6.35	0-360	150	H
7	* 1.006	69.12	PK	27.4	1	-55.87	41.65	54	-12.35	0-360	150	V
8	* 1.0641	69.84	PK	27.2	0.5	-56	41.54	54	-12.46	0-360	150	V
9	1.8297	81.4	PK	30.2	0.4	-53.52	58.48	-	-	0-360	150	V
10	2.1301	76.13	PK	21.5	0	-52.13	45.5	-	-	0-360	150	V
11	* 2.7447	68.53	PK	22.1	0	-50.67	39.96	54	-14.04	0-360	150	V
12	* 8.3103	58.73	PK	36.5	0	-48.05	47.18	54	-6.82	0-360	150	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

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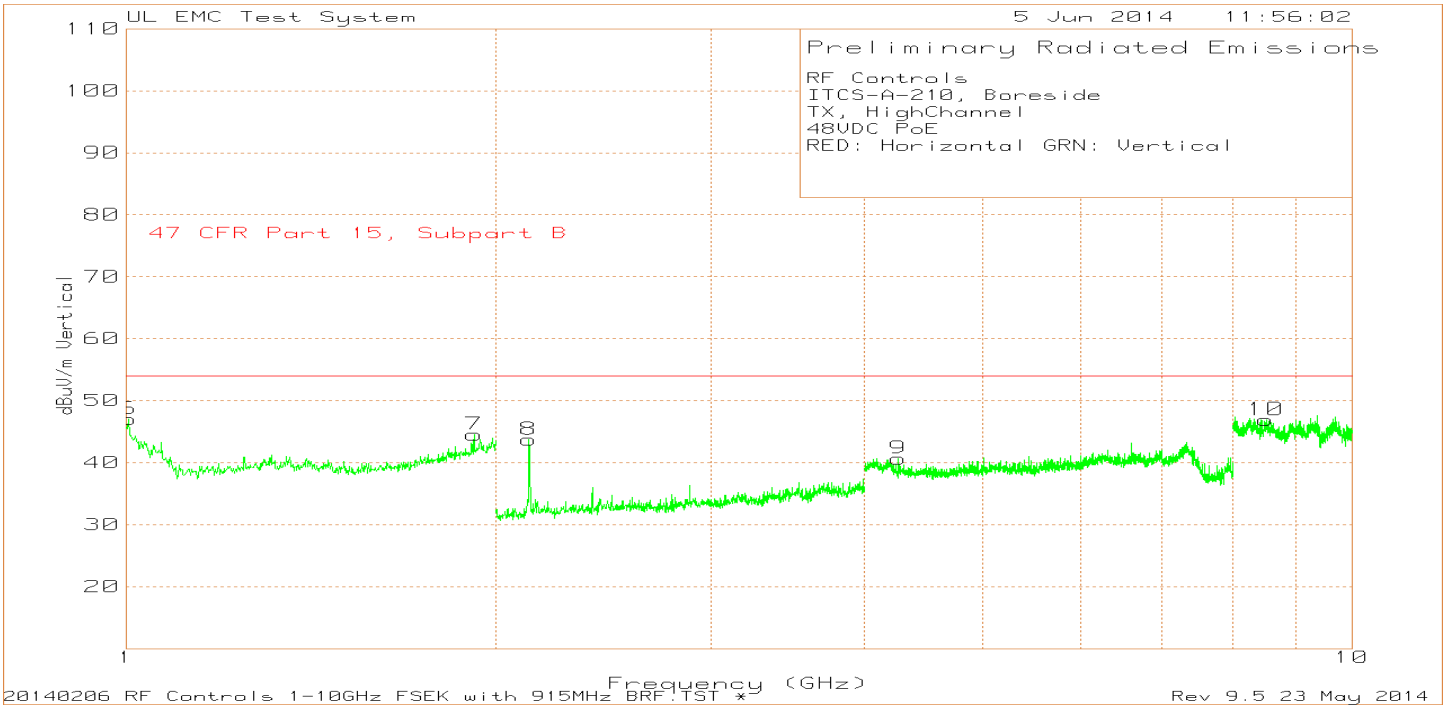
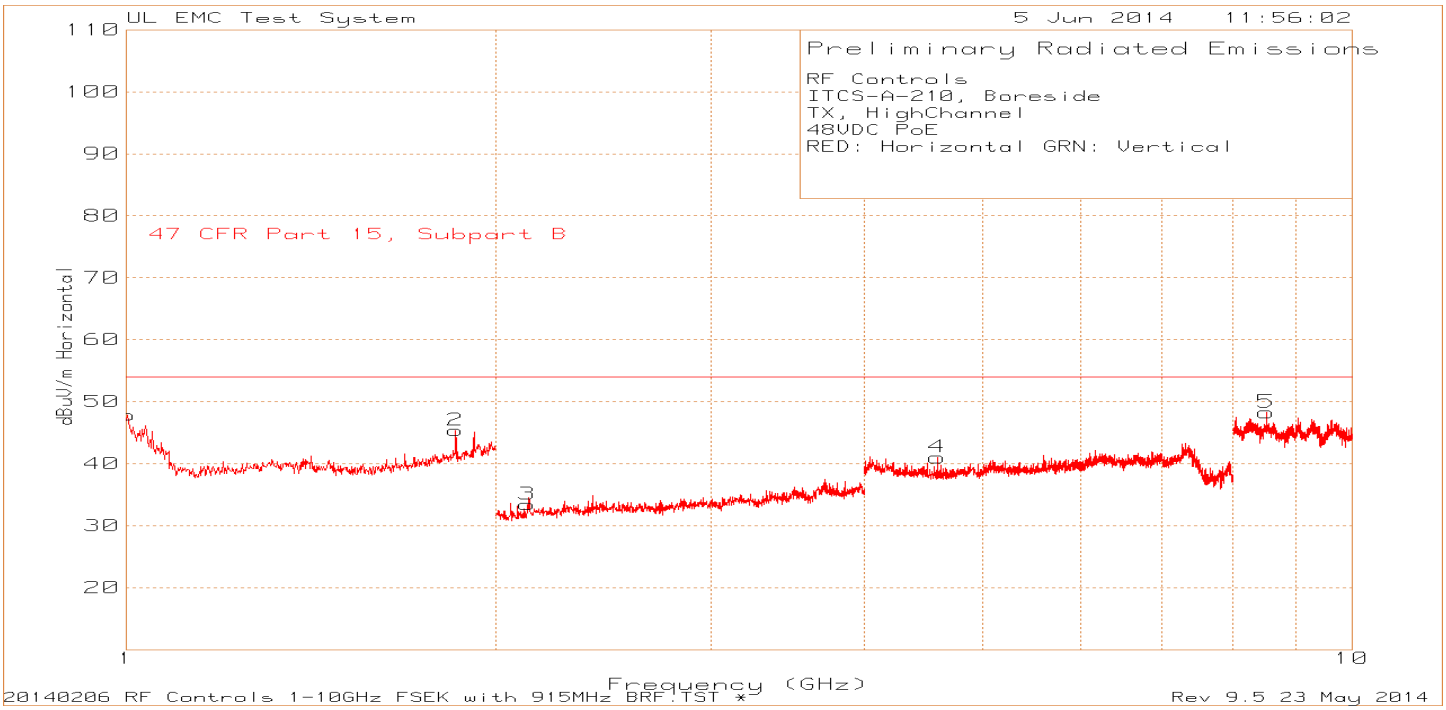
8.3.7. Radiated Emissions 1GHz – 10GHz High Channel, Bore Side Beam Setting





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RF Controls
ITCS-A-210, Boreside
TX, HighChannel
48VDC PoE
RED: Horizontal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	1.002	75.22	PK	27.4	1.1	-55.85	47.87	54	-6.13	0-360	149	H
2	1.8557	67.77	PK	30.6	0.4	-53.4	45.37	54	-8.63	0-360	101	H
3	2.1241	64.12	PK	21.5	0	-52.19	33.43	54	-20.57	0-360	150	H
4	4.5903	64.85	PK	27.7	0	-51.52	41.03	54	-12.97	0-360	150	H
5	8.5185	59.42	PK	36.7	0	-47.85	48.27	54	-5.73	0-360	150	H
6	1.004	74.42	PK	27.4	1.1	-55.86	47.06	54	-6.94	0-360	150	V
7	1.9218	65.7	PK	31.3	0.5	-52.94	44.56	54	-9.44	0-360	150	V
8	2.1301	74.35	PK	21.5	0	-52.13	43.72	54	-10.28	0-360	150	V
9	4.2661	64.3	PK	28.2	0	-51.83	40.67	54	-13.33	0-360	150	V
10	8.5085	58.09	PK	36.7	0	-47.88	46.91	54	-7.09	0-360	150	V

PK - Peak detector

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9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

UL VERIFICATION SERVICES INC.
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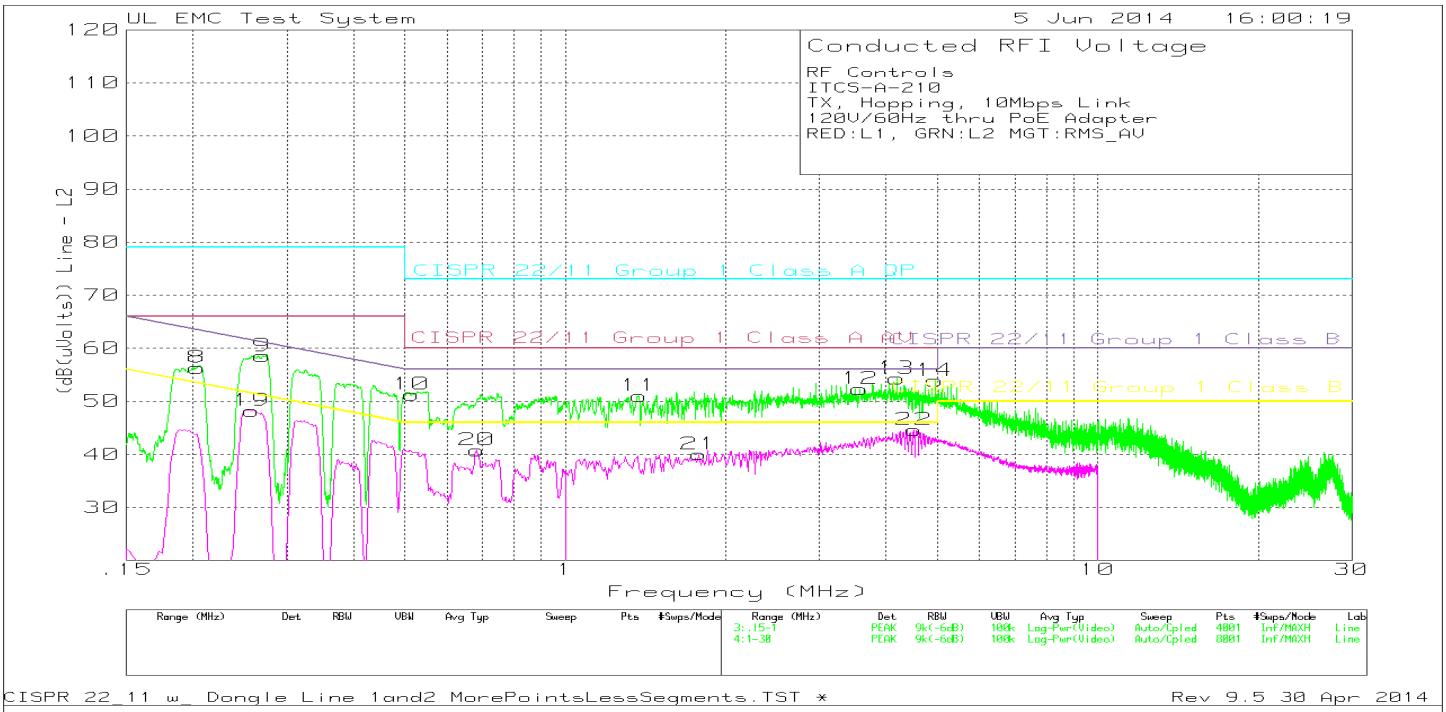
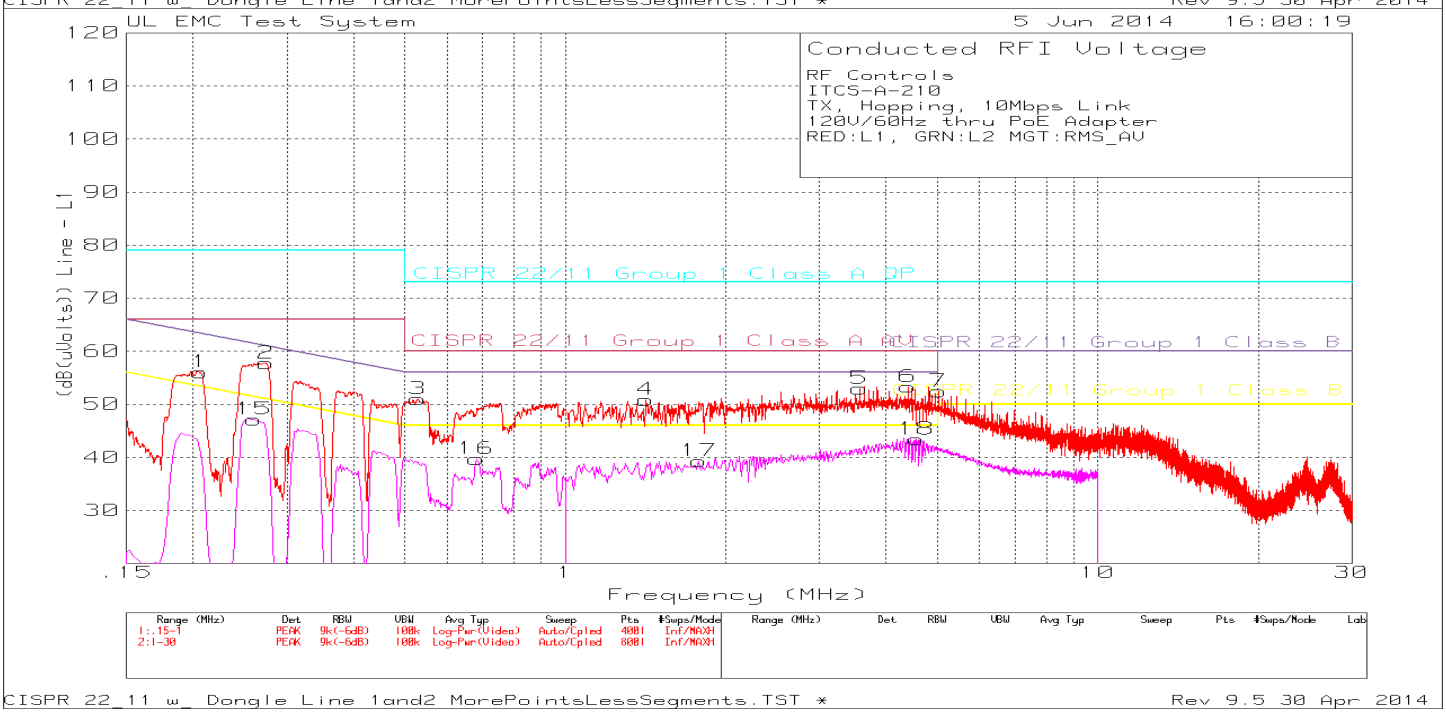
9.1. Line Conducted Emissions (PoE Supply), Ethernet @ 10Mbps





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RF Controls
ITCS-A-210
TX, Hopping, 10Mbps Link
120V/60Hz thru PoE Adapter
RED:L1, GRN:L2 MGT:RMS_AV

Trace Markers

No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1 .15 - 1MHz											
1	.20623	44.46dBuV PK	.1	11.5	56.06	79	66	63.36	53.36	-	-
					Margin (dB)	-22.94	-9.94	-7.3	2.7	-	-
2	.27439	46.64dBuV PK	.1	11	57.74	79	66	60.98	50.98	-	-
					Margin (dB)	-21.26	-8.26	-3.24	6.76	-	-
3	.5285	40.28dBuV PK	.1	10.6	50.98	73	60	56	46	-	-
					Margin (dB)	-22.02	-9.02	-5.02	4.98	-	-
15	.26025	35.94dBuV RMS	.1	11.1	47.14	79	66	61.42	51.42	-	-
					Margin (dB)	-31.86	-18.86	-14.28	-4.28	-	-
16	.681	29dBuV RMS	.1	10.6	39.7	73	60	56	46	-	-
					Margin (dB)	-33.3	-20.3	-16.3	-6.3	-	-
Line - L1 1 - 30MHz											
4	1.41688	40.16dBuV PK	.1	10.6	50.86	73	60	56	46	-	-
					Margin (dB)	-22.14	-9.14	-5.14	4.86	-	-
5	3.57375	42.16dBuV PK	.1	10.7	52.96	73	60	56	46	-	-
					Margin (dB)	-20.04	-7.04	-3.04	6.96	-	-
6	4.40388	42.5dBuV PK	.1	10.7	53.3	73	60	56	46	-	-
					Margin (dB)	-19.7	-6.7	-2.7	7.3	-	-
7	5.02375	41.62dBuV PK	.1	10.7	52.42	73	60	60	50	-	-
					Margin (dB)	-20.58	-7.58	-7.58	2.42	-	-
17	1.783	28.59dBuV RMS	.1	10.6	39.29	73	60	56	46	-	-
					Margin (dB)	-33.71	-20.71	-16.71	-6.71	-	-
18	4.564	32.59dBuV RMS	.1	10.7	43.39	73	60	56	46	-	-
					Margin (dB)	-29.61	-16.61	-12.61	-2.61	-	-
Line - L2 .15 - 1MHz											
8	.20346	44.74dBuV PK	.1	11.5	56.34	79	66	63.47	53.47	-	-
					Margin (dB)	-22.66	-9.66	-7.13	2.87	-	-
9	.26992	47.35dBuV PK	.1	11.1	58.55	79	66	61.12	51.12	-	-
					Margin (dB)	-20.45	-7.45	-2.57	7.43	-	-
10	.51498	40.46dBuV PK	.1	10.7	51.26	73	60	56	46	-	-
					Margin (dB)	-21.74	-8.74	-4.74	5.26	-	-
19	.258	36.91dBuV RMS	.1	11.2	48.21	79	66	61.5	51.5	-	-
					Margin (dB)	-30.79	-17.79	-13.29	-3.29	-	-
20	.68325	30.06dBuV RMS	.1	10.6	40.76	73	60	56	46	-	-
					Margin (dB)	-32.24	-19.24	-15.24	-5.24	-	-
Line - L2 1 - 30MHz											
11	1.377	40.32dBuV PK	.1	10.6	51.02	73	60	56	46	-	-
					Margin (dB)	-21.98	-8.98	-4.98	5.02	-	-
12	3.57375	41.55dBuV PK	.1	10.7	52.35	73	60	56	46	-	-
					Margin (dB)	-20.65	-7.65	-3.65	6.35	-	-
13	4.19	43.49dBuV PK	.1	10.7	54.29	73	60	56	46	-	-
					Margin (dB)	-18.71	-5.71	-1.71	8.29	-	-
14	4.94763	43dBuV PK	.1	10.8	53.9	73	60	56	46	-	-
					Margin (dB)	-19.1	-6.1	-2.1	7.9	-	-
21	1.783	29.31dBuV RMS	.1	10.6	40.01	73	60	56	46	-	-
					Margin (dB)	-32.99	-19.99	-15.99	-5.99	-	-
22	4.519	33.83dBuV RMS	.1	10.7	44.63	73	60	56	46	-	-
					Margin (dB)	-28.37	-15.37	-11.37	-1.37	-	-

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
PK - Peak detector
RMS - RMS detection

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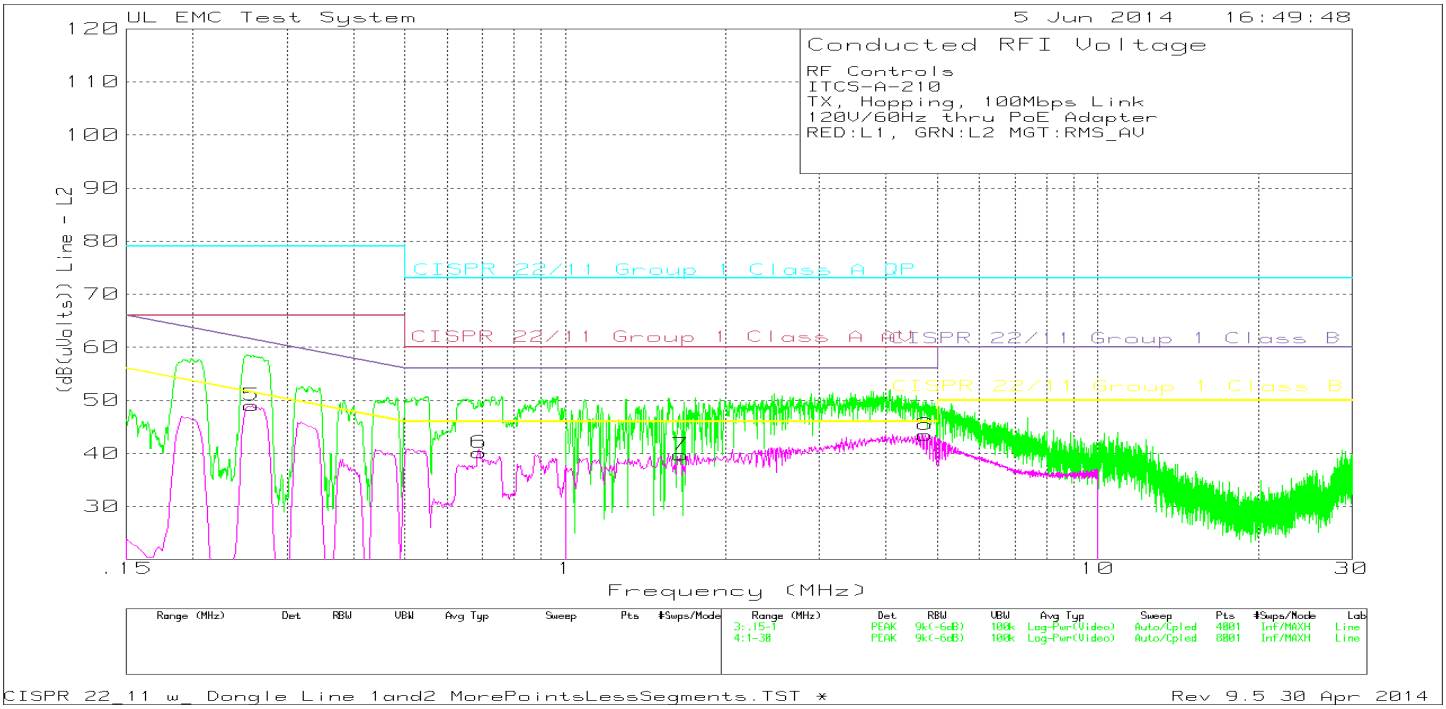
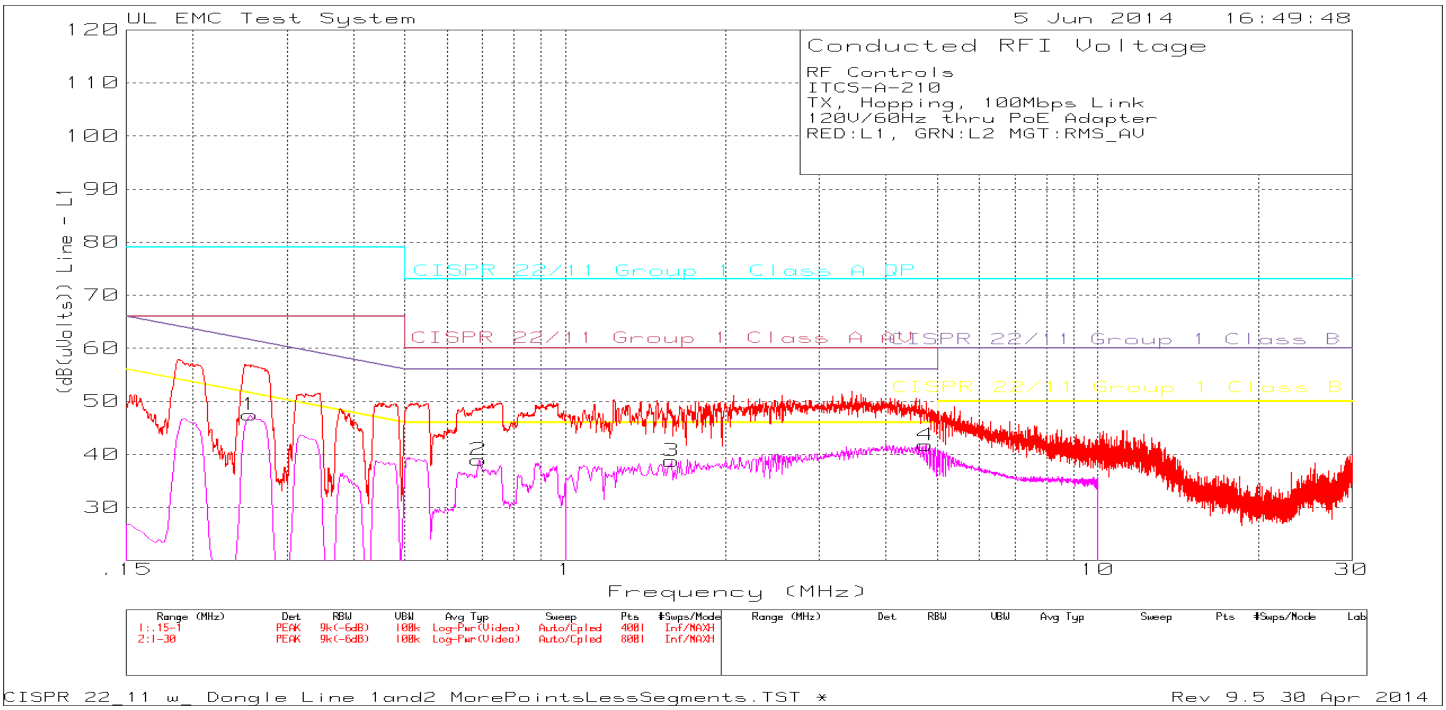
9.2. Line Conducted Emissions (PoE Supply), Ethernet @ 100Mbps





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RF Controls
ITCS-A-210
TX, Hopping, 100Mbps Link
120V/60Hz thru PoE Adapter
RED:L1, GRN:L2 MGT:RMS_AV

Trace Markers

No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1 .15 - 1MHz											
1	.25575	36.15dBuV RMS	.1	11.2	47.45	79	66	61.57	51.57	-	-
					Margin (dB)	-31.55	-18.55	-14.12	-4.12	-	-
2	.68775	28.26dBuV RMS	.1	10.6	38.96	73	60	56	46	-	-
					Margin (dB)	-34.04	-21.04	-17.04	-7.04	-	-
Line - L1 1 - 30MHz											
3	1.585	28.07dBuV RMS	.1	10.6	38.77	73	60	56	46	-	-
					Margin (dB)	-34.23	-21.23	-17.23	-7.23	-	-
4	4.753	30.97dBuV RMS	.1	10.7	41.77	73	60	56	46	-	-
					Margin (dB)	-31.23	-18.23	-14.23	-4.23	-	-
Line - L2 .15 - 1MHz											
5	.258	37.74dBuV RMS	.1	11.2	49.04	79	66	61.5	51.5	-	-
					Margin (dB)	-29.96	-16.96	-12.46	-2.46	-	-
6	.69	29.46dBuV RMS	.1	10.6	40.16	73	60	56	46	-	-
					Margin (dB)	-32.84	-19.84	-15.84	-5.84	-	-
Line - L2 1 - 30MHz											
7	1.648	29.04dBuV RMS	.1	10.6	39.74	73	60	56	46	-	-
					Margin (dB)	-33.26	-20.26	-16.26	-6.26	-	-
8	4.744	32.58dBuV RMS	.1	10.8	43.48	73	60	56	46	-	-
					Margin (dB)	-29.52	-16.52	-12.52	-2.52	-	-

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

RMS - RMS detection

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10. SETUP PHOTOS

RADIATED RF MEASUREMENT SETUP

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POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

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END OF REPORT

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