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

CERTIFICATION TEST REPORT

Portable Transceiver

MODEL NUMBER: Transmitter

FCC ID: 2AE4KBUD002
IC: 20769BUD002

REPORT NUMBER: 10667825A

ISSUE DATE: October 29, 2015

Prepared for
Five Element Robotics
1333 Compus Parkway
Wall, NJ 07753
US

Prepared by
UL LLC
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Northbrook, IL 60062
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NVLAP Lab code: 100414-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	2015-10-29	Initial Issue	BM

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Five Element Robotics
1333 Compus Parkway
Wall, NJ 07753
US

EUT DESCRIPTION: Portable Transceiver

MODEL: Transmitter

SERIAL NUMBER: Non-Serialized

DATE TESTED: August 2015 – September 2015

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 4	Pass

UL LLC 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 LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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.

Approved & Released For
UL LLC By:

Michael Ferrer
EMC Engineer
UL LLC

Tested By:

Bart Mucha
EMC Enginner
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, RSS-210 Issue 8, ICES-003 Issue 5.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60062 USA.

UL NBK is accredited by NVLAP, Laboratory Code 100414-0. The full scope of accreditation can be viewed at http://ts.nist.gov/

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

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)

4.3. MEASUREMENT UNCERTAINTY

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

Test	Range	Equipment	Uncertainty k=2
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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a portable device that implements a 2.4GHz 802.15.4 transceiver via the Atmel ATMEGA256RFR2 microcontroller. The EUT pairs with the platform robot to achieve a follow behavior.

5.2. MAXIMUM OUTPUT E-FIELD STRENGTH

The transmitter has a maximum output peak E-field as follows:

Frequency Range (MHz)	Mode	Output PK E-field Strength (dBuV/m)
2405 - 2480	GFSK	78.54

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Part Number: Ceramic Chip Antenna by Johanson Technology 2450AT18D0100E

Antenna Peak Gain: 1.5dBi

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT (transmitter) during testing was version 1.0.

The firmware installed in the EUT (platform) during testing was version 0.9.17.

The test utility software used during testing was FCCTest revision 1.0.

5.5. WORST-CASE CONFIGURATION AND MODE

The transmitter will be positioned in single orientation during normal use.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
*Power Supply	Generic	M050100U111	-	-
*used for charging only				

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	1	miniUSB	2-wire	1m	cable between supply and the EUT

TEST SETUP

The device was setup with intenal battery.

SETUP DIAGRAM FOR TESTS

6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List					
Description	**Manufacturer**	**Model**	**EMC No.**	**Cal Date**	**Cal Due**
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014		
Conducted Software	UL	UL EMC	Ver 9.5, May 17 2012		
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20141216	20151231
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	20141830	20151231
Bicon Antenna	Electro-Metrics	EM6912A	EMC4070	20141014	20151031
Log-P Antenna	Chase	UPA6109	EMC4313	20141119	20151130
Loop Antenna	EMCO	6502/1	EMC4026	20150420	20160430
Antenna Array	UL	BOMS	EMC4276	20141201	20151231
Spectrum Analyzer	Agilent	N9030A (PXA)	EMC4360	20141219	20151219
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESR	EMC4377	20150423	20160423
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	20150109	20160110
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	20150109	20160110

7. TEST RESULTS

7.1.1. 99% and 20dB BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

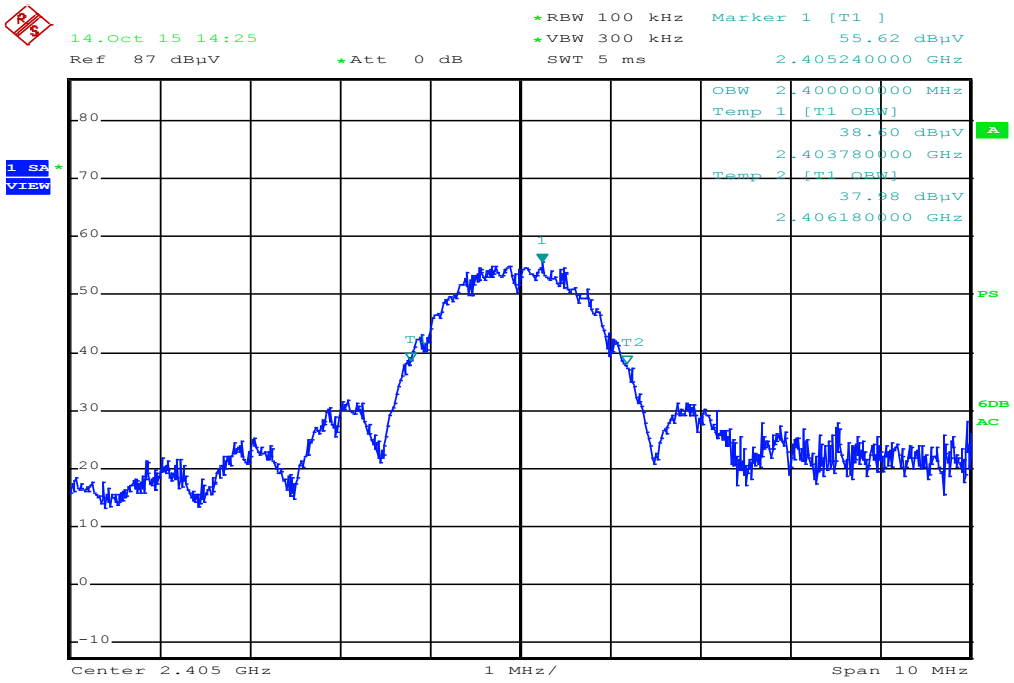
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

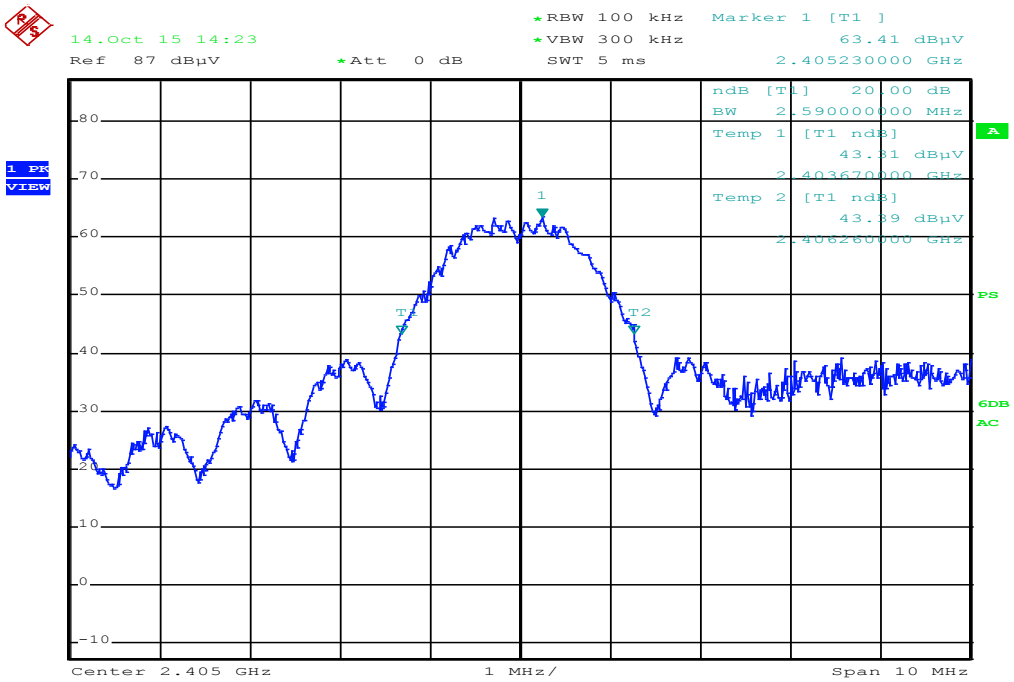
Channel	Frequency (MHz)	99% Bandwidth (MHz)	20dB Bandwidth (MHz)
Low	2405	2.4	2.59
Middle	2445	2.5	2.65
High	2480	2.49	2.65

Low Channel

99% Bandwidth

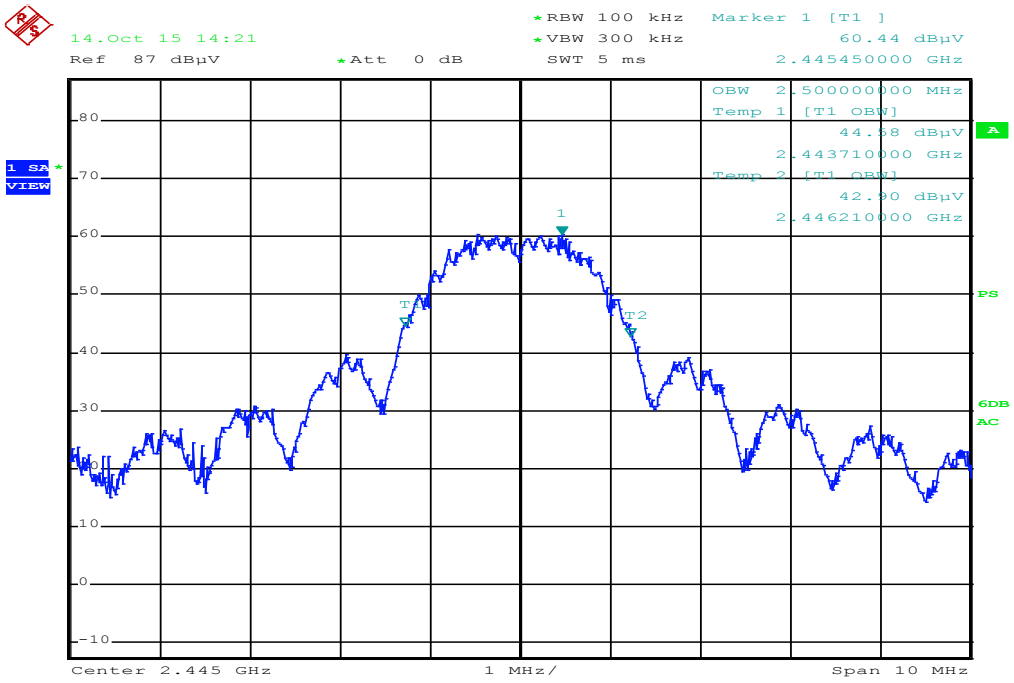


20dB Bandwidth

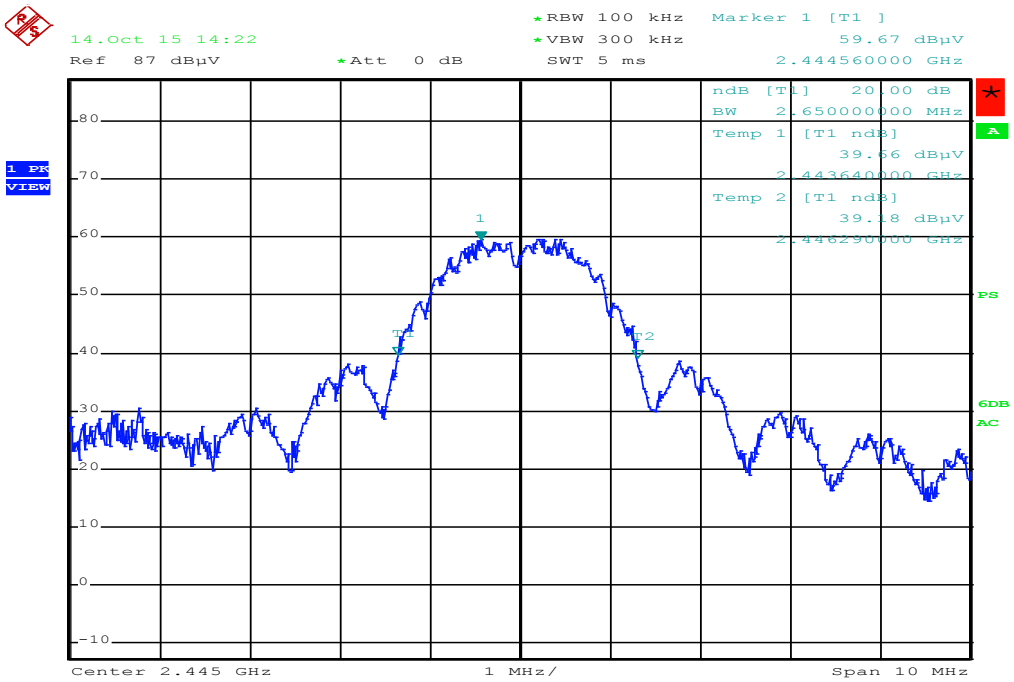


Middle Channel

99% Bandwidth

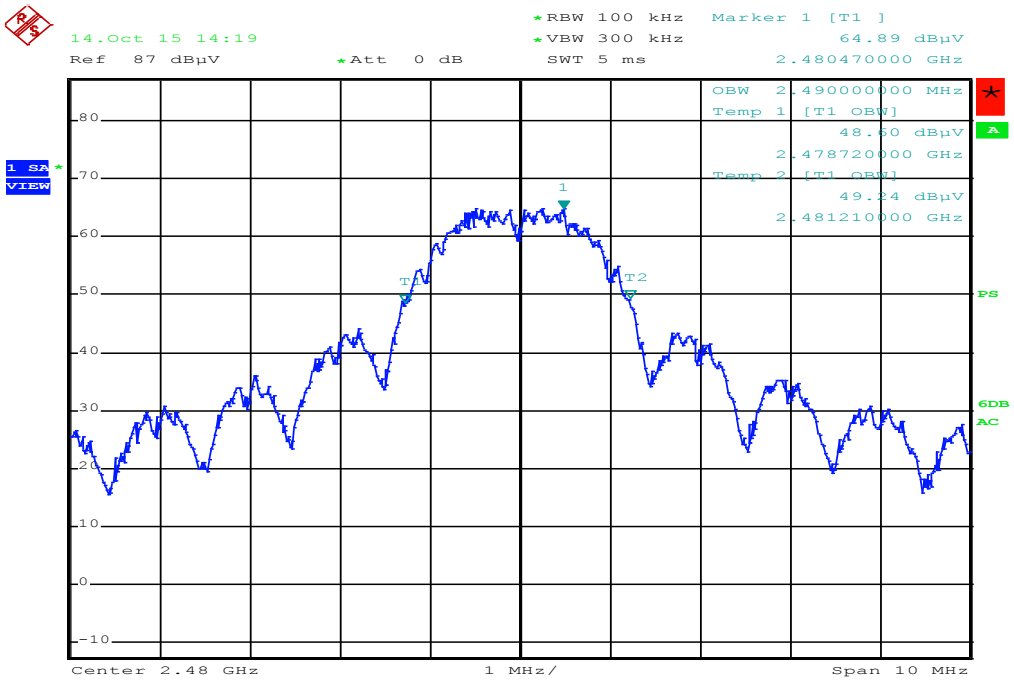


20dB Bandwidth

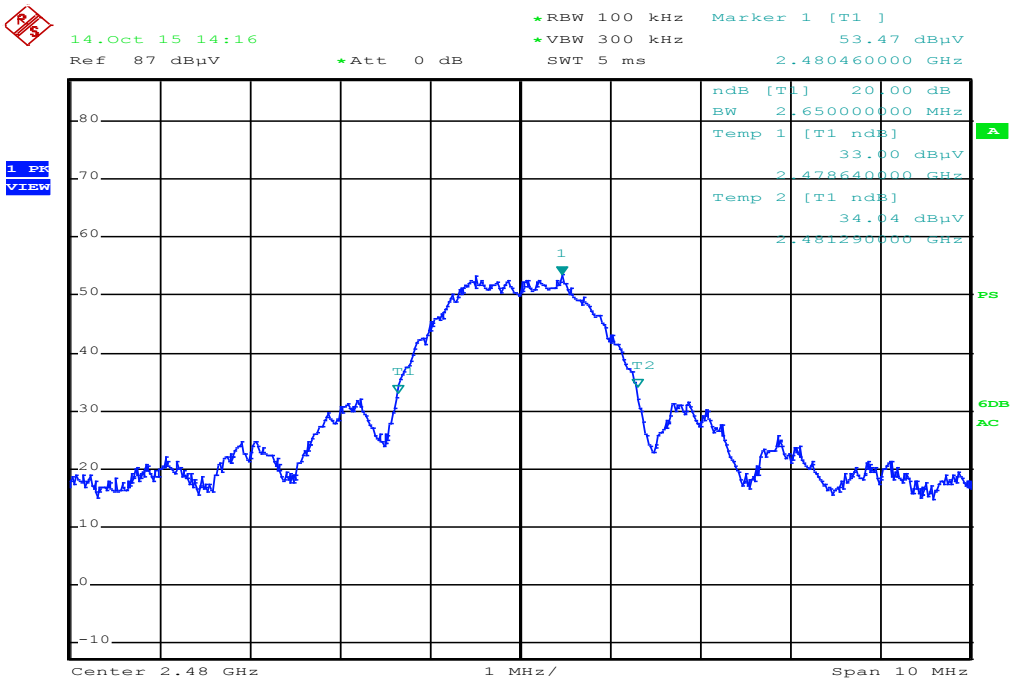


High Channel

99% Bandwidth



20dB Bandwidth



7.2. RADIATED EMISSIONS

LIMIT

IC RSS-210, A2.9
FCC 15.249

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHZ, and 24.0–24.25 GHz.
(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

RESULTS

7.2.1. FUNDAMENTAL FREQUENCY RADIATED EMISSION

Low Channel Data

5 Element Robotics											
TX, LoCh, X-Axis											
Model: Transmitter											
Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	Limit FCC 15.249 dBuV/m @ 3m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity	Notes
2.4052	108.54	Pk	21.8	-51.8	78.54	114	-35.46	164	100	H	X-Axis
2.4044	108.2	RMS AV	21.8	-51.83	78.17	94	-15.83	164	100	H	X-Axis
2.4053	103.68	Pk	21.8	-51.8	73.68	114	-40.32	239	100	V	X-Axis
2.4044	103.32	RMS AV	21.8	-51.83	73.29	94	-20.71	239	100	V	X-Axis
2.4052	103.03	Pk	21.8	-51.8	73.03	114	-40.97	194	229	H	Z-Axis
2.4045	102.65	RMS AV	21.8	-51.83	72.62	94	-21.38	194	229	H	Z-Axis
2.4052	108.48	Pk	21.8	-51.8	78.48	114	-35.52	196	100	V	Z-Axis
2.4045	108.16	RMS AV	21.8	-51.83	78.13	94	-15.87	196	100	V	Z-Axis
2.4053	102.77	Pk	21.8	-51.8	72.77	114	-41.23	97	100	H	Y-Axis
2.4044	102.46	RMS AV	21.8	-51.83	72.43	94	-21.57	97	100	H	Y-Axis
2.4052	102.19	Pk	21.8	-51.8	72.19	114	-41.81	241	100	V	Y-Axis
2.4045	101.9	RMS AV	21.8	-51.83	71.87	94	-22.13	241	100	V	Y-Axis

Middle Channel Data

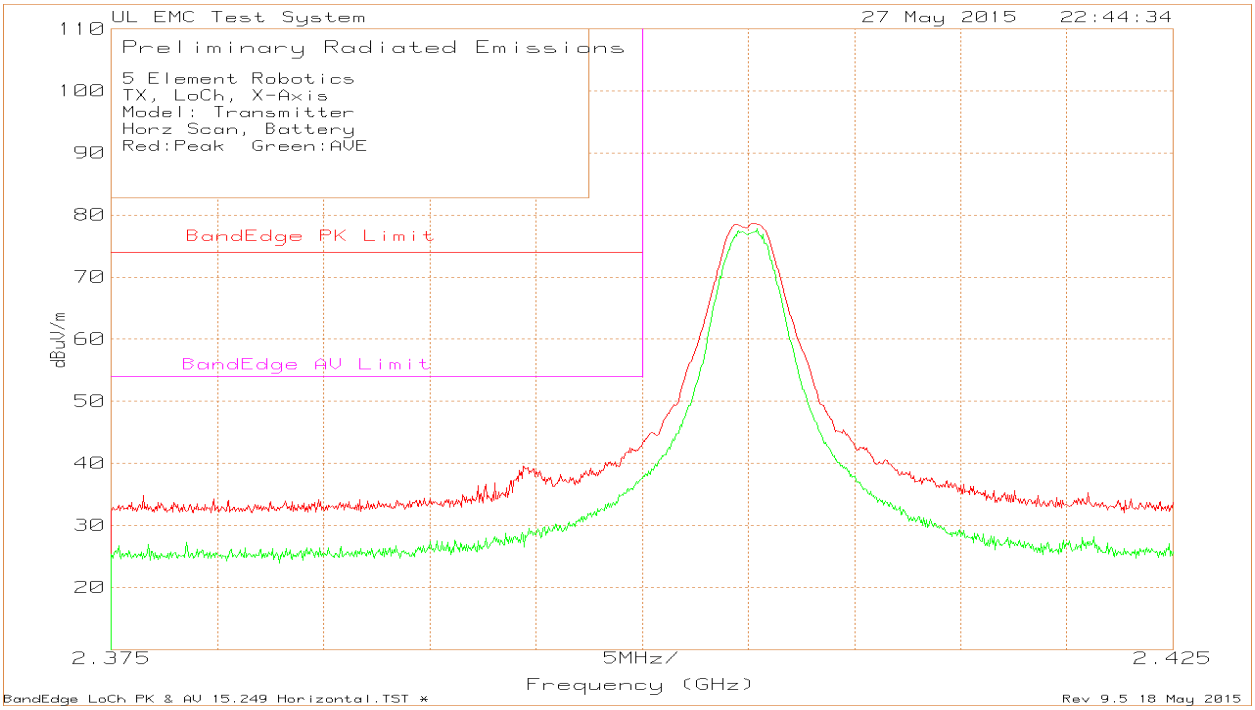
5 Element Robotics											
TX, MidCh, X-Axis											
Model: Transmitter											
Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	Limit FCC 15.249 dBuV/m @ 3m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity	Notes
2.445	105.99	Pk	21.9	-51.28	76.61	114	-37.39	171	100	H	X-Axis
2.4444	105.64	RMS AV	21.9	-51.28	76.26	94	-17.74	171	100	H	X-Axis
2.4452	99.79	Pk	21.9	-51.28	70.41	114	-43.59	226	100	V	X-Axis
2.4454	99.36	RMS AV	21.9	-51.27	69.99	94	-24.01	226	100	V	X-Axis
2.445	99.07	Pk	21.9	-51.28	69.69	114	-44.31	189	216	H	Z-Axis
2.4445	98.66	RMS AV	21.9	-51.28	69.28	94	-24.72	189	216	H	Z-Axis
2.4451	106.19	Pk	21.9	-51.28	76.81	114	-37.19	180	100	V	Z-Axis
2.4445	105.85	RMS AV	21.9	-51.28	76.47	94	-17.53	180	100	V	Z-Axis
2.4451	98.63	Pk	21.9	-51.28	69.25	114	-44.75	284	100	H	Y-Axis
2.4444	98.18	RMS AV	21.9	-51.28	68.8	94	-25.2	284	100	H	Y-Axis
2.4451	98.35	Pk	21.9	-51.28	68.97	114	-45.03	81	100	V	Y-Axis
2.4445	97.9	RMS AV	21.9	-51.28	68.52	94	-25.48	81	100	V	Y-Axis

High Channel Data

5 Element Robotics											
TX, HiCh, X-Axis											
Model: Transmitter											
Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	Limit FCC 15.249 dBuV/m @ 3m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity	Notes
2.4802	107.98	Pk	22	-51.7	78.3	114	-35.7	168	100	H	X-Axis
2.4794	107.6	RMS AV	22	-51.7	77.94	94	-16.06	168	100	H	X-Axis
2.4802	102.13	Pk	22	-51.7	72.45	114	-41.55	225	100	V	X-Axis
2.4794	101.77	RMS AV	22	-51.7	72.11	94	-21.89	225	100	V	X-Axis
2.4801	101.6	Pk	22	-51.7	71.92	114	-42.08	185	246	H	Z-Axis
2.4794	101.16	RMS AV	22	-51.7	71.5	94	-22.5	185	246	H	Z-Axis
2.4802	107.91	Pk	22	-51.7	78.23	114	-35.77	181	100	V	Z-Axis
2.4795	107.6	RMS AV	22	-51.7	77.93	94	-16.07	181	100	V	Z-Axis
2.4803	101.43	Pk	22	-51.7	71.75	114	-42.25	297	100	H	Y-Axis
2.4795	101.11	RMS AV	22	-51.7	71.44	94	-22.56	297	100	H	Y-Axis
2.4801	99.69	Pk	22	-51.7	70.01	114	-43.99	81	114	V	Y-Axis
2.4794	99.32	RMS AV	22	-51.7	69.66	94	-24.34	81	114	V	Y-Axis

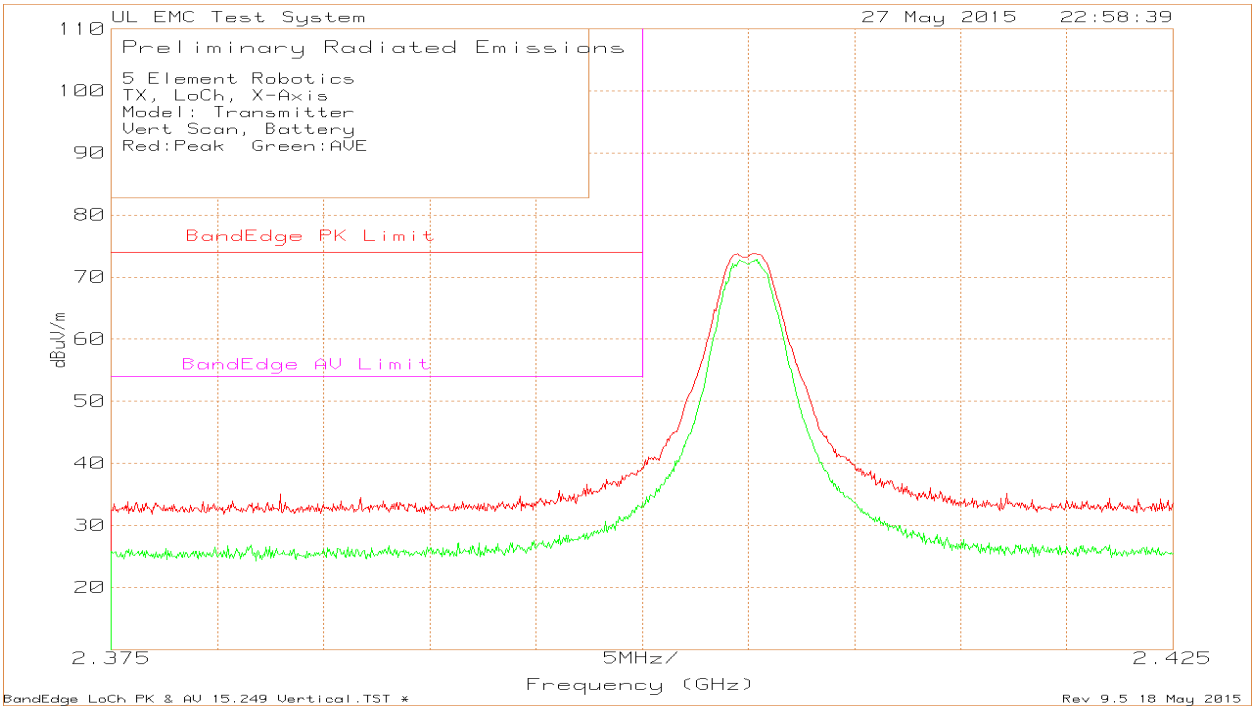
7.2.2. TRANSMITTER RESTRICTED BAND EDGES

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



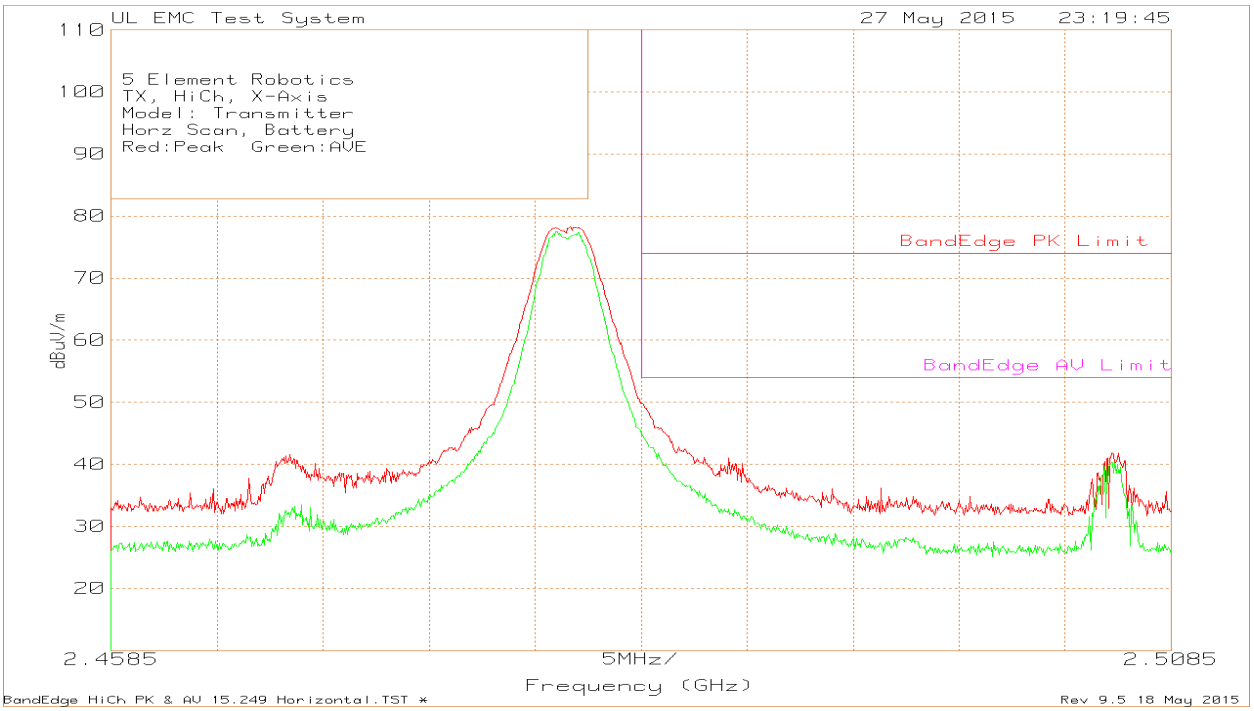
5 Element Robotics													
TX, LoCh, X-Axis													
Model: Transmitter													
Horz Scan, Battery													
Red:Peak Green:AVE													
Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Facotr dB/m	Path Factor dB	Level dBuV/m	Peak Limit dBuVm	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
Peak													
1	2.4053	108.61	Pk	21.8	-51.8	78.61	-	-	-	-	164	100	H
2	2.4002	74.09	Pk	21.8	-51.93	43.96	-	-	-	-	164	100	H
3	2.4	73.35	Pk	21.8	-51.93	43.22	74	-30.78	54	-10.78	164	100	H
4	2.3998	72.33	Pk	21.8	-51.93	42.2	74	-31.8	54	-11.8	164	100	H
5	2.3945	69.57	Pk	21.8	-51.97	39.4	74	-34.6	54	-14.6	164	100	H
Average													
6	2.4054	107.81	AV	21.8	-51.8	77.81	-	-	-	-	164	100	H
7	2.4002	68.36	AV	21.8	-51.93	38.23	-	-	-	-	164	100	H
8	2.4	67.62	AV	21.8	-51.93	37.49	74	-36.51	54	-16.51	164	100	H
9	2.3998	67.24	AV	21.8	-51.93	37.11	74	-36.89	54	-16.89	164	100	H
10	2.3948	59.32	AV	21.8	-51.97	29.15	74	-44.85	54	-24.85	164	100	H
PK - Peak Datector													
AV - AVerage detector													

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



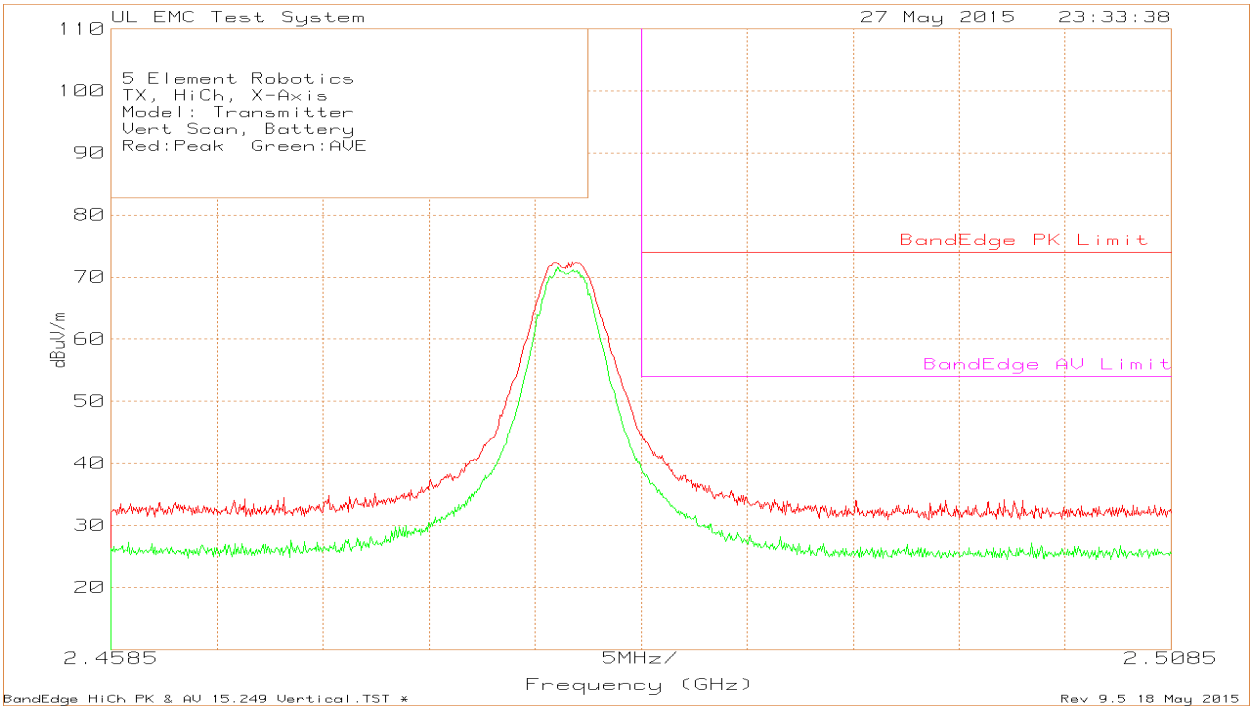
5 Element Robotics													
TX, LoCh, X-Axis													
Model: Transmitter													
Vert Scan, Battery													
Red:Peak Green:AVE													
Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Facotr dB/m	Path Factor dB	Level dBuV/m	Peak Limit dBuVm	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
Peak													
1	2.4053	103.82	Pk	21.8	-51.8	73.82	-	-	-	-	238	100	V
2	2.4003	71.1	Pk	21.8	-51.93	40.97	-	-	-	-	238	100	V
3	2.4	69.42	Pk	21.8	-51.93	39.29	74	-34.71	54	-14.71	238	100	V
4	2.3997	68.23	Pk	21.8	-51.93	38.1	74	-35.9	54	-15.9	238	100	V
Average													
5	2.4054	102.89	AV	21.8	-51.8	72.89	-	-	-	-	238	100	V
6	2.4003	63.79	AV	21.8	-51.93	33.66	-	-	-	-	238	100	V
7	2.4	63.74	AV	21.8	-51.93	33.61	74	-40.39	54	-20.39	238	100	V
8	2.3997	63.09	AV	21.8	-51.93	32.96	74	-41.04	54	-21.04	238	100	V
Pk - Peak detector													
AV - AVerage Detector													

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



5 Element Robotics													
TX, HiCh, X-Axis													
Model: Transmitter													
Horz Scan, Battery													
Red:Peak Green:AVE													
Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Facotr dB/m	Path Factor dB	Level dBuV/m	Peak Limit dBuVm	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
Peak													
1	2.4802	107.91	Pk	22	-51.68	78.23	-	-	-	-	170	100	H
2	2.4834	80.27	Pk	22.1	-51.73	50.64	-	-	-	-	170	100	H
3	2.4835	79.48	Pk	22.1	-51.74	49.84	74	-24.16	54	-4.16	170	100	H
4	2.4836	79.34	Pk	22.1	-51.74	49.7	74	-24.3	54	-4.3	170	100	H
5	2.5058	71.63	Pk	22.1	-51.92	41.81	74	-32.19	54	-12.19	170	100	H
Average													
6	2.4795	107.16	av	22	-51.66	77.5	-	-	-	-	170	100	H
7	2.4834	75.47	av	22.1	-51.73	45.84	-	-	-	-	170	100	H
8	2.4835	74.38	av	22.1	-51.74	44.74	74	-29.26	54	-9.26	170	100	H
9	2.4836	74.04	av	22.1	-51.74	44.4	74	-29.6	54	-9.6	170	100	H
10	2.5057	70.2	av	22.1	-51.92	40.38	74	-33.62	54	-13.62	170	100	H
PK - Peak Detector													
Av - Average Detector													

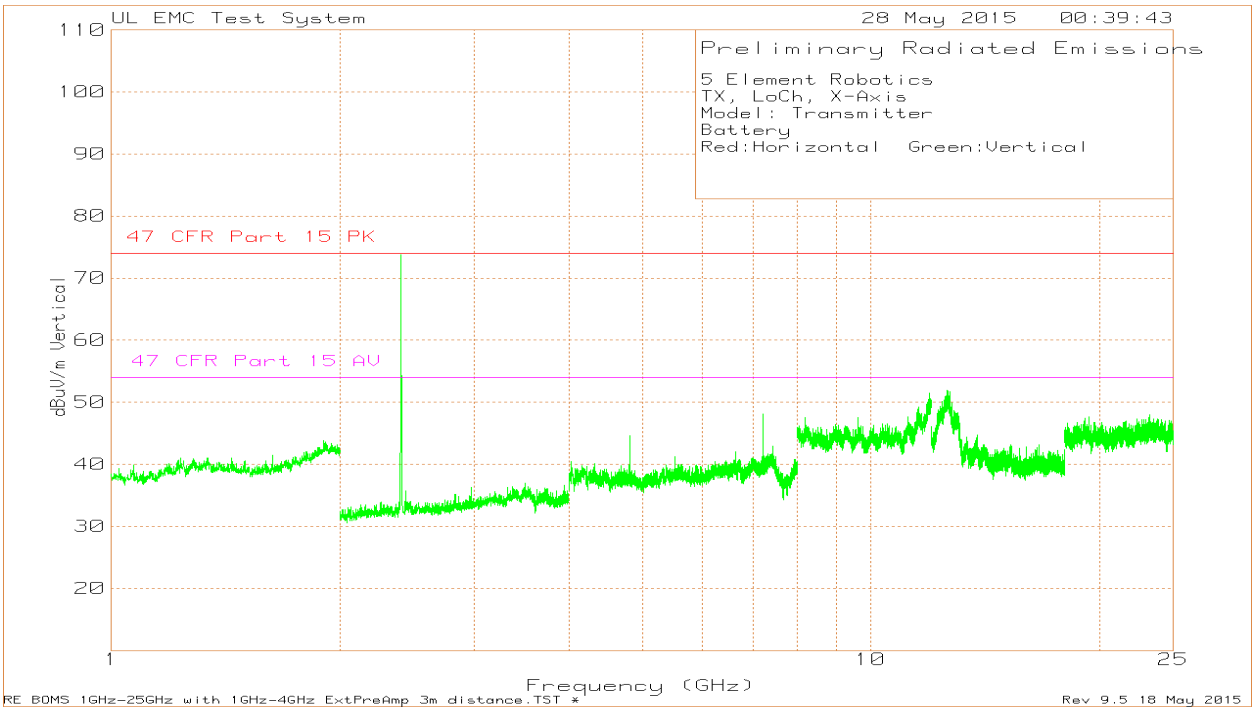
RESTRICTED BANDEDGE (HIGH CHANNEL, Vertical)

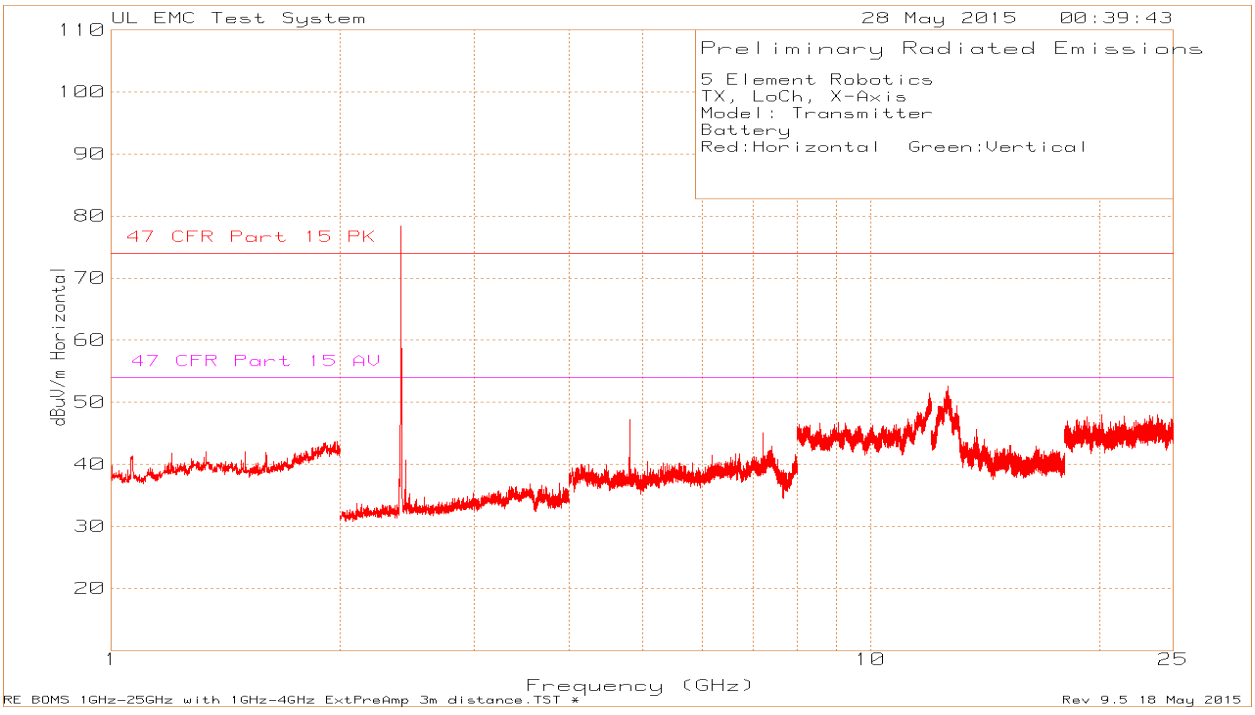


5 Element Robotics													
TX, HiCh, X-Axis													
Model: Transmitter													
Vert Scan, Battery													
Red:Peak Green:AVE													
Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Facotr dB/m	Path Factor dB	Level dBuV/m	Peak Limit dBuVm	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
Peak													
1	2.4803	102.08	Pk	22	-51.68	72.4	-	-	-	-	225	100	V
2	2.4834	74.56	Pk	22.1	-51.73	44.93	-	-	-	-	225	100	V
3	2.4835	74.33	Pk	22.1	-51.74	44.69	74	-29.31	54	-9.31	225	100	V
4	2.4836	73.48	Pk	22.1	-51.74	43.84	74	-30.16	54	-10.16	225	100	V
Average													
5	2.4796	101.3	AV	22	-51.67	71.63	-	-	-	-	225	100	V
6	2.4834	69.92	AV	22.1	-51.73	40.29	-	-	-	-	225	100	V
7	2.4835	68.71	AV	22.1	-51.74	39.07	74	-34.93	54	-14.93	225	100	V
8	2.4836	67.97	AV	22.1	-51.74	38.33	74	-35.67	54	-15.67	225	100	V
Pk - Peak detector													
AV - Average Detector													

7.2.3. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz

Low Channel Scan

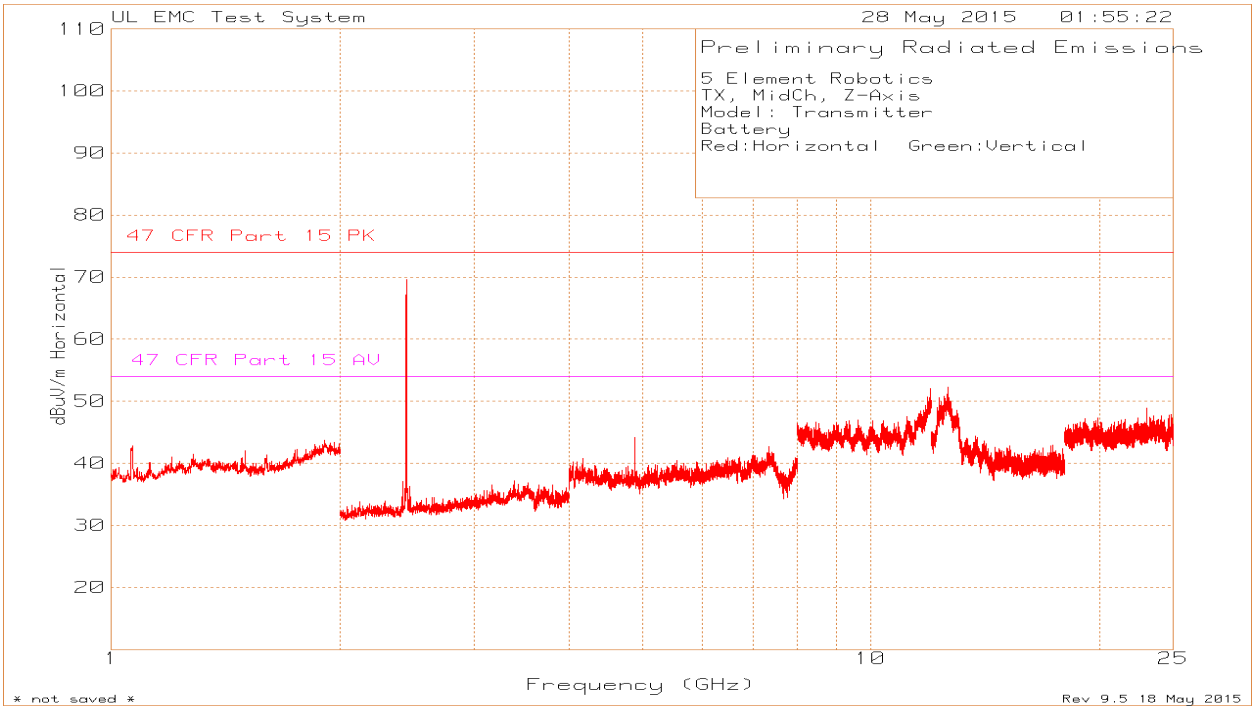


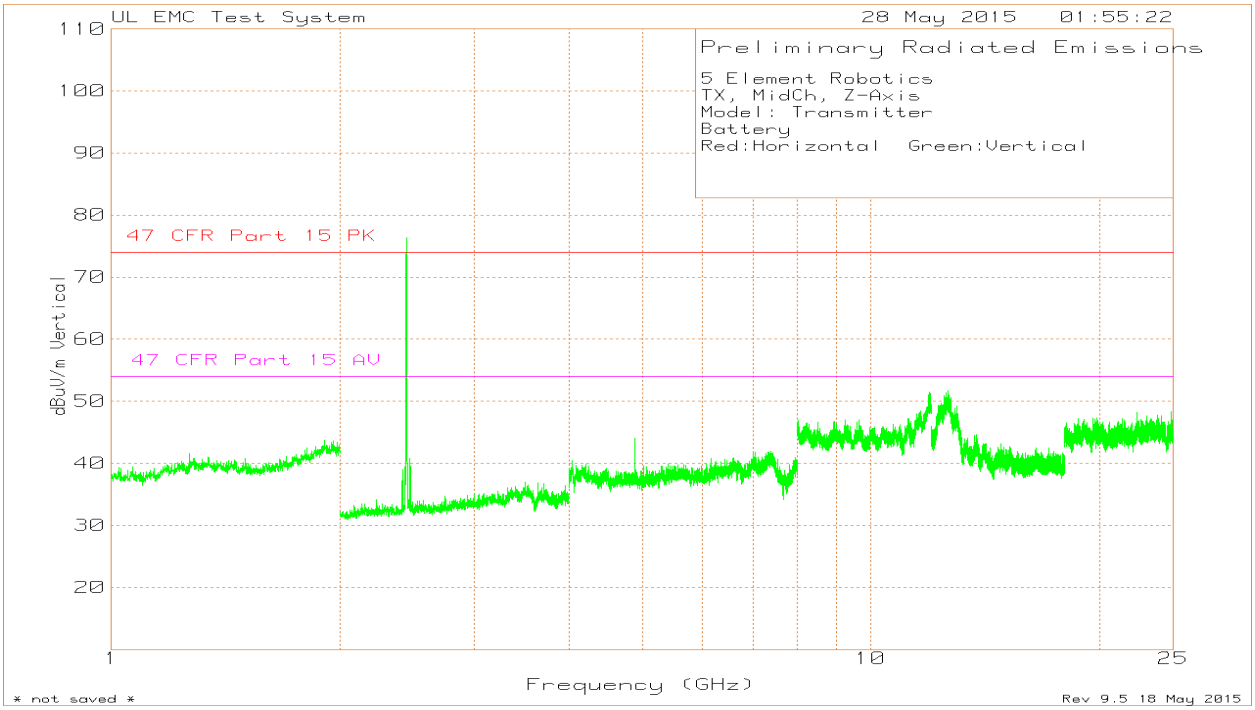


Low Channel Data

5 Element Robotics													
TX, LoCh, X-Axis													
Model: Transmitter													
Battery													
Red:Horizontal Green:Vertical													
Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Gain/Loss (dB)	Level dBuV/m	Peak Limit dBuV/m	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.405	108.39	Pk	21.8	-51.81	-	-	-	-	24.38	0-360	99	H
2	4.811	70.01	Pk	27.7	-50.55	47.16	74	-26.84	54	-6.84	0-360	100	H
3	7.217	62.02	Pk	29.8	-46.77	45.05	74	-28.95	54	-8.95	0-360	149	H
7	9.618	58.08	Pk	36.4	-48.38	46.1	74	-27.9	54	-7.9	0-360	99	H
4	2.404	103.85	Pk	21.8	-51.84	-	-	-	-	19.81	0-360	99	V
5	4.809	67.53	Pk	27.7	-50.57	44.66	74	-29.34	54	-9.34	0-360	150	V
6	7.214	65.09	Pk	29.8	-46.73	48.16	74	-25.84	54	-5.84	0-360	99	V
8	9.622	59.41	Pk	36.4	-48.3	47.51	74	-26.49	54	-6.49	0-360	99	V
PK - Peak Detector													
Radiated Emission Data													
	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Gain/Loss (dB)	Level dBuV/m	Peak Limit dBuV/m	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	4.8109	72.43	Pk	27.7	-50.55	49.58	74	-24.42	-	-	151	100	H
	4.809	70.37	AV RMS	27.7	-50.57	47.5	-	-	54	-6.5	151	100	H
	4.8091	68.41	Pk	27.7	-50.57	45.54	74	-28.46	-	-	44	100	V
	4.809	64.95	AV RMS	27.7	-50.57	42.08	-	-	54	-11.92	44	100	V
	7.2134	65.77	Pk	29.8	-46.72	48.85	74	-25.15	-	-	152	181	H
	7.2133	63.26	AV RMS	29.8	-46.72	46.34	-	-	54	-7.66	152	181	H
	7.2134	66.66	Pk	29.8	-46.72	49.74	74	-24.26	-	-	301	100	V
	7.2133	63.64	AV RMS	29.8	-46.72	46.72	-	-	54	-7.28	301	100	V
	9.6178	65.24	Pk	36.4	-48.38	53.26	74	-20.74	-	-	314	100	V
	9.6219	60.57	AV RMS	36.4	-48.3	48.67	-	-	54	-5.33	314	100	V
	9.6179	64.31	Pk	36.4	-48.38	52.33	74	-21.67	-	-	239	100	H
	9.618	58.6	AV RMS	36.4	-48.38	46.62	-	-	54	-7.38	239	100	H
PK - Peak Detector													
AV - Average Detector													

Middle Channel Scan

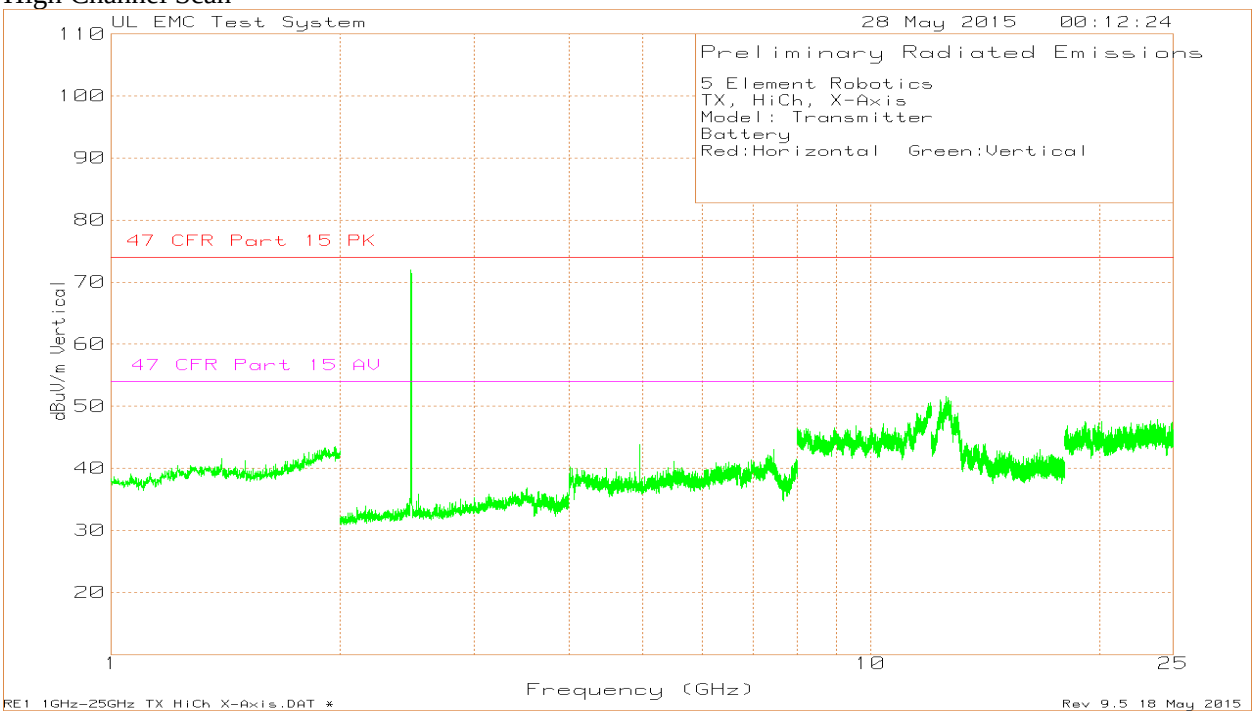


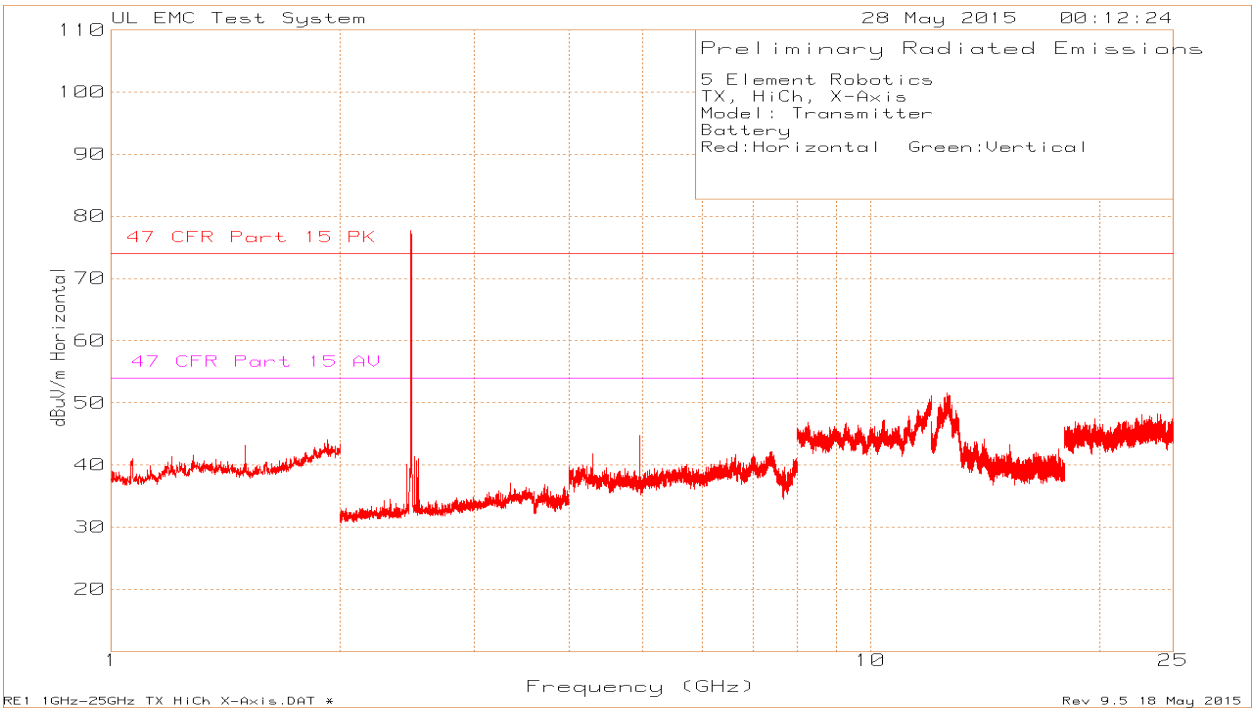


Middle Channel Data

5 Element Robotics													
TX, MidCh, Z-Axis													
Model: Transmitter													
Battery													
Red:Horizontal Green:Vertical													
Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Gain/Loss (dB)	Level dBuV/m	Peak Limit dBuV/m	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.445	98.99	Pk	21.9	-51.28	69.61	-	-	-	-	0-360	150	H
2	4.891	66.86	Pk	27.7	-50.42	44.14	74	-29.86	54	-9.86	0-360	101	H
3	7.337	57.91	Pk	30.7	-45.9	42.71	74	-31.29	54	-11.29	0-360	149	H
4	2.444	105.8	Pk	21.9	-51.28	76.42	-	-	-	-	0-360	99	V
5	4.889	66.74	Pk	27.7	-50.42	44.02	74	-29.98	54	-9.98	0-360	150	V
6	7.337	55.91	Pk	30.7	-45.9	40.71	74	-33.29	54	-13.29	0-360	99	V
Pk - Peak detector													
Radiated Emission Data													
	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Gain/Loss (dB)	Level dBuV/m	Peak Limit dBuV/m	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	4.8909	68.68	Pk	27.7	-50.42	45.96	74	-28.04	-	-	162	101	H
	4.8909	65.86	AV RMS	27.7	-50.42	43.14	-	-	54	-10.86	162	101	H
	4.8892	68.68	Pk	27.7	-50.42	45.96	74	-28.04	-	-	283	220	V
	4.889	65.69	AV RMS	27.7	-50.42	42.97	-	-	54	-11.03	283	220	V
	7.333	59.28	Pk	30.7	-45.92	44.06	74	-29.94	-	-	243	100	H
	7.3333	53.6	AV RMS	30.7	-45.92	38.38	-	-	54	-15.62	243	100	H
	7.3366	59.1	Pk	30.7	-45.9	43.9	74	-30.1	-	-	101	100	V
	7.3361	53.75	AV RMS	30.7	-45.9	38.55	-	-	54	-15.45	101	100	V
PK - Peak Detector													
AV - Average Detector													

High Channel Scan



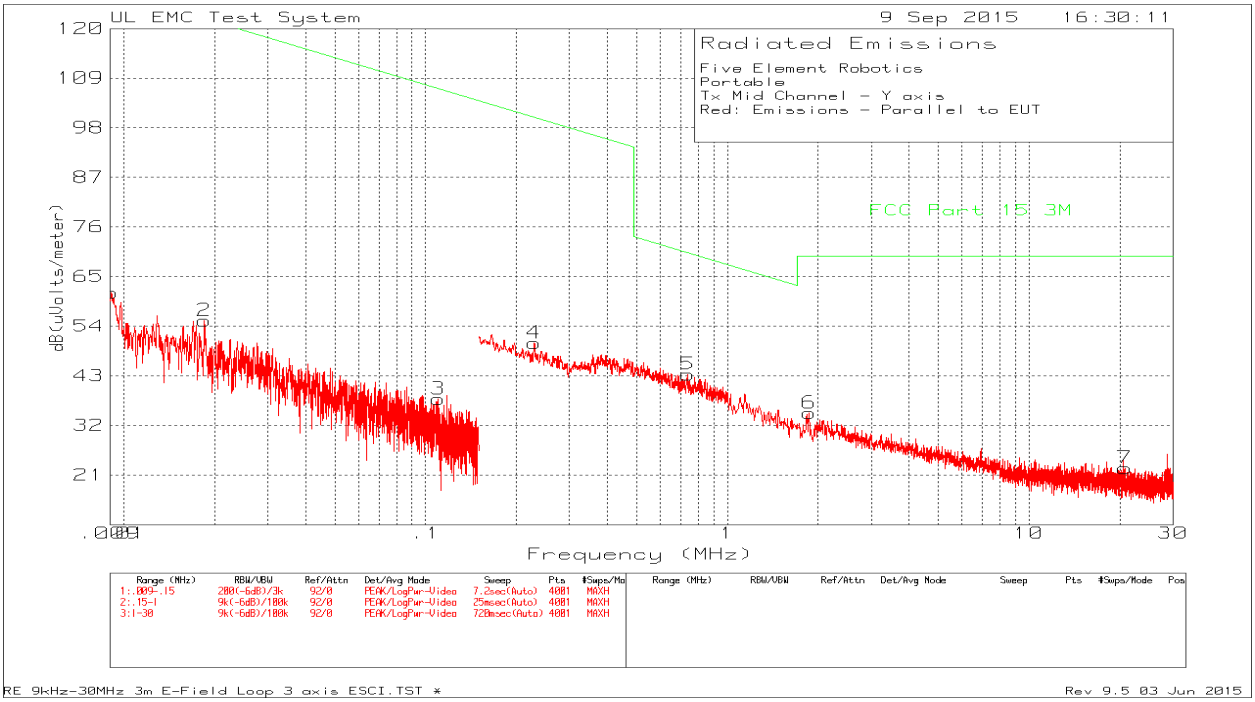


High Channel Data

5 Element Robotics													
TX, HiCh, X-Axis													
Model: Transmitter													
Battery													
Red:Horizontal Green:Vertical													
Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Gain/Loss (dB)	Level dBuV/m	Peak Limit dBuV/m	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.479	107.37	Pk	22	-51.66	-	-	-	-	23.71	0-360	99	H
2	4.959	67.68	Pk	27.8	-50.74	44.74	74	-29.26	54	-9.26	0-360	101	H
5	7.44	57.83	Pk	30.6	-46.81	41.62	74	-32.38	54	-12.38	0-360	149	H
3	2.479	101.64	Pk	22	-51.66	-	-	-	-	17.98	0-360	99	V
4	4.959	66.73	Pk	27.8	-50.74	43.79	74	-30.21	54	-10.21	0-360	150	V
6	7.442	59.41	Pk	30.5	-46.87	43.04	74	-30.96	54	-10.96	0-360	150	V
Pk - Peak detector													
Radiated Emission Data													
	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Gain/Loss (dB)	Level dBuV/m	Peak Limit dBuV/m	Margin (dB)	Average Limit dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	4.961	69.47	Pk	27.8	-50.74	46.53	74	-27.47	-	-	294	100	H
	4.9591	66.59	AV RMS	27.8	-50.74	43.65	-	-	54	-10.35	294	100	H
	4.9589	69	Pk	27.8	-50.74	46.06	74	-27.94	-	-	184	100	V
	4.959	66	AV RMS	27.8	-50.74	43.06	-	-	54	-10.94	184	100	V
	7.4381	60.98	Pk	30.6	-46.76	44.82	74	-29.18	-	-	307	100	V
	7.4413	55.51	AV RMS	30.5	-46.85	39.16	-	-	54	-14.84	307	100	V
	7.4387	59.83	Pk	30.6	-46.78	43.65	74	-30.35	-	-	97	100	H
	7.4413	53.83	AV RMS	30.5	-46.85	37.48	-	-	54	-16.52	97	100	H
PK - Peak Detector													
AV - Average Detector													

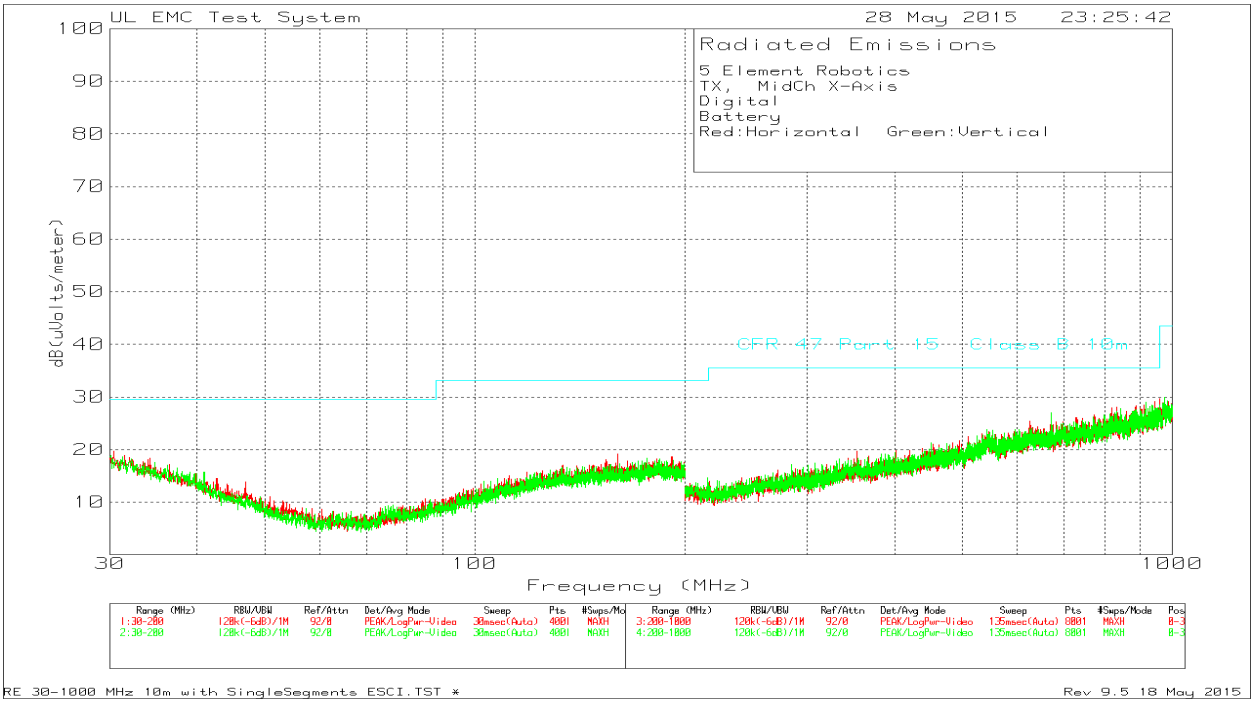
7.2.4. WORST-CASE BELOW 1 GHz

9kHz – 30MHz



Five Element Robotics									
Portable									
Tx Mid Channel - Y axis									
Red: Emissions - Parallel to EUT									
Trace Markers									
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	Limit FCC Part 15 Class B 10m dBuV/m	Margin (dB)	Azimuth [Degs]
1	0.00907	39.11	Pk	22.3	0	61.41	128.43	-67.02	0-360
2	0.018485	37.81	Pk	17.4	0	55.21	122.25	-67.04	0-360
3	0.110255	25.41	Pk	12.4	0	37.81	106.75	-68.94	0-360
4	0.22924	38.22	Pk	12	0	50.22	100.39	-50.17	0-360
5	0.73937	31.28	Pk	12	0	43.28	70.23	-26.95	0-360
6	1.87	22.31	Pk	12.3	0.1	34.71	69.54	-34.83	0-360
7	20.7635	11.72	Pk	10.5	0.3	22.52	69.54	-47.02	0-360
Pk - Peak detector									

30MHz – 1GHz



5 Element Robotics											
TX, MidCh X-Axis											
Digital											
Battery											
Red:Horizontal Green:Vertical											
Trace Markers											
Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Facotr dB/m	Path Factor dB	Level dBuV/m	Limit dBuVm	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	34.2075	31.97	Pk	16.5	-30.1	18.37	29.55	-11.18	0-360	100	H
2	160.475	33.26	Pk	15.5	-29.6	19.16	33.07	-13.91	0-360	250	H
5	31.2325	31.09	Pk	17.7	-30.2	18.59	29.55	-10.96	0-360	100	V
6	176.625	32.18	Pk	15.6	-29.4	18.38	33.07	-14.69	0-360	100	V
3	271.6	32.12	Pk	12.7	-28.7	16.12	35.57	-19.45	0-360	100	H
4	831.6	31.94	Pk	22.5	-26.4	28.04	35.57	-7.53	0-360	100	H
7	284.5	32.54	Pk	13.2	-28.5	17.24	35.57	-18.33	0-360	100	V
8	671	32.58	Pk	20.2	-25.7	27.08	35.57	-8.49	0-360	100	V
Pk - Peak detector											