CRITERION TECHNOLOGY

NVLAP LAB CODE 100396-0

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EMC QUALIFICATION TEST REPORT

TWIN PEAKS ROBOTICS WIRELESS ROBOTICS CONTROLLER, RRC1.3

FCC ID ZC6RRC1-3

TESTED TO CONFORM WITH:

☒ **Emissions Standards**

for

INDUSTRIAL, SCIENTIFIC AND MEDICAL (ISM)

TEST REPORT NUMBER: 101004-1625

DATE OF TEST COMPLETION: FEBRUARY 17, 2011

MANUFACTURER'S ADDRESS: 2217 LAKE PARK DRIVE
LONGMONT, CO 80503

PHONE: 303-775-2409

Approved by:

Laboratory Director

DOCUMENT REVISION HISTORY

REVISION #	REPORT NUMBER	DESCRIPTION OF REVISION	DATE OF REVISION
0	101004-1625	ORIGINAL REPORT	2010-10-27
REV 1	101004-1625	ADDITIONAL TEST DATA ADDED	2011-01-05
REV 2	101004-1625	ADDED FCC ID NUMBER TO COVER PAGE	2011-01-06
REV 3	101004-1625	ADDITIONAL TEST DATA ADDED	2011-02-03
REV 4	101004-1625	ADDITIONAL TEST DATA ADDED	2011-02-22
REV 5	101004-1625	ADDITIONAL TEST DATA ADDED	2011-02-28
REV 6	101004-1625	ADDITIONAL TEST DATA ADDED	2011-03-10
REV 7	101004-1625	CHANGED THE FCC ID NUMBER ON COVER PAGE	2011-03-15

DISCLAIMERS

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The client is aware that Criterion Technology has performed testing in accordance with the applicable standard(s). Test data is accurate within ANSI parameters for Emissions testing, unless a specific level of accuracy has been defined in writing prior to testing, by Criterion Technology and the client.

Criterion Technology reports apply only to the specific Equipment Under Test (EUT) sample(s) tested under the test conditions described in this report. If the manufacturer intends to use this report as a document demonstrating compliance of this model, additional models of this product must have electrical and mechanical characteristics identical to the device tested for this report. Criterion Technology shall have no liability for any deductions, inferences, or generalizations drawn by the client or others from Criterion Technology issued reports.

Total liability is limited to the amount invoiced for the testing of this EUT and the contents of this report are not warranted.

Compliance with the appropriate governmental standards is the responsibility of the manufacturer.

Any questions regarding this report should be directed to:

Laboratory Director
Criterion Technology Corp.
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Rollinsville, Colorado 80474
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mailto:laboratory_director@criteriontech.com

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This report may contain data which is not covered by the NVLAP accreditation.

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NVLAP(#100396-0)
FCC(#90688)
BSMI(#SL2-IN-007R)
Industry Canada(#IC 3301A-1).
VCCI(#1255) 3&10 meter site (#R-2826), Immunity Shield room(#C-3118), Open Area Site(#C-3119)
Nemko(#ELA-214)
NMi (EU Competent Body Accreditation)
The National Institute for Standards and Technology (NIST) has designated Criterion Technology a Conformity Assessment Body (CAB) for Taiwan (BSMI # SL2-IN-E-007R) Korea (US0026).

All Criterion Technology instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regula in accordance with ISO 9002, ISO 17025, ANSI/NCSL Z540-I-1994 and are traceable to national standards.

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EMC QUALIFICATION TEST REPORT
WIRELESS ROBOTICS CONTROLLER, RRC1.3

1.0 EXECUTIVE SUMMARY

1.1 PURPOSE

The purpose of this report is to present EMC test data and demonstrate conformity to the requirements of the prescribed standards for Emissions and/or Immunity.

1.2 CONFORMITY

The test article was tested to the standards listed in Table I with the indicated conformity status. All test methods were performed in accordance to with the standards listed.

TABLE I. EMISSIONS CONFORMITY SUMMARY

TEST TYPE	COMPLIANCE STANDARD	TESTING TECHNIQUE	TEST DESCRIPTION	PRODUCT CLASSIFICATION	CONFORMITY STATUS
EMISSIONS	FCC Part 15	FCC PART 15	Unintentional Radiated Emissions	Class B	**PASSED**
			Intentional Radiated Emissions		**PASSED**

1.3 EQUIPMENT UNDER TEST (EUT)

EUT NAME: **WIRELESS ROBOTICS CONTROLLER**

EUT MODEL/PART NUMBER(S): **RRC1.3**

2.0 EMISSIONS TEST STANDARDS

FCC Part 15, Subpart B **Class B**

2.1 ☒ UNINTENTIONAL RADIATED EMISSIONS – 30 MHZ TO 1000 MHZ

Measurements for *Radiated Emissions* were performed over the frequency range of 30 MHz to 1000 MHz in the horizontal and vertical antenna polarities to the requirements of:

FCC Part 15 **Class B**

Testing Conditions

Date of Test:	October 13, 2010
Temperature:	19° C
Relative Humidity:	40 %
Test Voltage:	Battery powered
Test Operator:	SP

Test Location

Criterion Technology Open Area Test Site

Test Distance

Antenna Distance: **3 meter(s)** **Final Measurement(s)**

Test Equipment

☒ Rohde and Schwarz Receiver, ESVS-30
☒ Mini Circuits Pre-Amp #2
☒ Chase BiLog Antenna, Model CB6111

Test Results of Radiated Emissions

Test Status: **PASSED** Frequency Range: **30 MHz to 1000 MHz**

Minimum Margin to Limit: **-13.83** dB at **49.8434** MHz

Uncerainty Horizontal under 200 MHz:	**4.64**	dB
Uncerainty Horizontal over 200 MHz:	**4.04**	dB
Uncerainty Verticle under 200 MHz:	**4.85**	dB
Uncerainty Verticle over 200 MHz:	**4.64**	dB

Remarks

See: **APPENDIX A** for EUT Photographs
APPENDIX B for Data Sheets
APPENDIX D for Test Equipment Calibration Status

2.2 ☒ UNINTENTIONAL RADIATED EMISSIONS ABOVE 1GHZ

Measurements for *Radiated Emissions* were performed over the frequency range of 1 GHz to 5 GHz in the horizontal and vertical antenna polarities to the requirements of:

FCC Part 15 **Class B**

Testing Conditions

Date of Test:	October 13, 2010
Temperature:	19° C
Relative Humidity:	40 %
Test Voltage:	Battery powered
Test Operator:	SP

Test Location

Criterion Technology Open Area Test Site

Test Distance

Antenna Distance: **3 meter(s)** **Final Measurement(s)**

Test Equipment

☒ Hewlett-Packard Spectrum Analyzer, HP 8566B ☒ Hewlett-Packard Quasi-Peak Adapter, HP 85650A
☐ Hewlett-Packard Tracking Generator, HP 85645A
☐ Rohde and Schwarz Receiver, ESHS-30 ☐ Rohde and Schwarz Receiver, ESVS-30
☐ Mini Circuits Pre-Amp #2 ☒ Veratech Pre-Amp #3
☐ Chase BiLog Antenna, Model CB6111 ? Antenna Research, Horn Antenna, Model DRG118/A
☐ EMCO BiConnical Antenna, Model 3108 ☐ EMCO Log Periodic Antenna, Model 3146

Test Results of Radiated Emissions

Test Status: **PASSED** Frequency Range: **1 GHz to 5 GHz**

Minimum Margin to Limit: **-22.07** dB at **2197.0818** MHz

Remarks

See: **APPENDIX A** for EUT Photographs
APPENDIX B for Data Sheets
APPENDIX D for Test Equipment Calibration Status

2.3 ☒ INTENTIONAL RADIATED EMISSIONS

Measurements for *Intentional Radiated Emissions* were performed over the frequency range of 1 GHz to 9.5 GHz the horizontal and vertical antenna polarities to the requirements of:

FCC Part 15.249

Testing Conditions

Date of Test:	February 17, 2011
Temperature:	14° C
Relative Humidity:	27 %
Test Voltage:	Battery powered
Test Operator:	SP

Test Location

Criterion Technology Open Area Test Site

Test Distance

Antenna Distance: **3 meter(s)** **Final Measurement(s)**

Test Equipment

☒ Hewlett-Packard Spectrum Analyzer, HP 8566B ☒ Hewlett-Packard Quasi-Peak Adapter, HP 85650A
☐ Hewlett-Packard Tracking Generator, HP 85645A
☐ Rohde and Schwarz Receiver, ESHS-30 ☐ Rohde and Schwarz Receiver, ESVS-30
☐ Mini Circuits Pre-Amp #2 ☒ Veratech Pre-Amp #3
☐ Chase BiLog Antenna, Model 1121 ☒ Antenna Research, Horn Antenna, Model DRG118/A
☐ EMCO BiConnical Antenna, Model 3108 ☐ EMCO Log Periodic Antenna, Model 3146
☒ EMCO Active Loop, 6502

Test Accessories: Laptop

Test Results of Radiated Emissions

Test Status: **PASSED** Frequency Range: **1 GHz to 9.5 GHz**

Fundamental:	**-0.1**	dB at	**902.48**	MHz
Harmonics:	**-2.70**	dB at	**1804.96**	MHz

Remarks

See: **APPENDIX A** for EUT Photographs
APPENDIX B for Data Sheets
APPENDIX D for Test Equipment Calibration Status

2.4 CHANNEL BANDWIDTH

Measurements for bandwidth, band edges, number of channels were performed in accordance with the Operations to the Requirements of:

FCC Part 15.249

Testing Conditions

Date of Test:	January 5, 2011
Temperature:	13° C
Relative Humidity:	28 %
Test Voltage:	Battery powered
Test Operator:	SP

Test Location

Criterion Technology Open Area Test Site

Test Equipment

Hewlett-Packard Spectrum Analyzer, HP 8566B

Test Results of Occupied Bandwidth and 20 db Bandedges

Test Status: **PASSED** Frequency: **902.5 MHz**

20 dB lower Bandedge:	**902.2185 MHz**
20 dB upper Bandedge:	**902.7635 MHz**
20 dB Occupied Channel Bandwidth:	**0.544909 MHz**

Remarks

See: **APPENDIX A** for EUT Photographs
APPENDIX B for Data Sheets
APPENDIX D for Test Equipment Calibration Status

2.5 CHANNEL BANDWIDTH

Measurements for bandwidth, band edges, number of channels were performed in accordance with the Operations to the Requirements of:

FCC Part 15.249

Testing Conditions

Date of Test:	January 5, 2011
Temperature:	13° C
Relative Humidity:	28 %
Test Voltage:	Battery powered
Test Operator:	SP

Test Location

Criterion Technology Open Area Test Site

Test Equipment

Hewlett-Packard Spectrum Analyzer, HP 8566B

Test Results of Occupied Bandwidth and 20 db Bandedges

Test Status: **PASSED** Frequency: **915 MHz**

20 dB lower Bandedge:	**914.7366 MHz**
20 dB upper Bandedge:	**915.2824 MHz**
20 dB Occupied Channel Bandwidth:	**0.545872 MHz**

Remarks

See: **APPENDIX A** for EUT Photographs
APPENDIX B for Data Sheets
APPENDIX D for Test Equipment Calibration Status

2.6 CHANNEL BANDWIDTH

Measurements for bandwidth, band edges, number of channels were performed in accordance with the Operations to the Requirements of:

FCC Part 15.249

Testing Conditions

Date of Test:	January 5, 2011
Temperature:	13° C
Relative Humidity:	28 %
Test Voltage:	Battery powered
Test Operator:	SP

Test Location

Criterion Technology Open Area Test Site

Test Equipment

Hewlett-Packard Spectrum Analyzer, HP 8566B

Test Results of Occupied Bandwidth and 20 db Bandedges

Test Status: **PASSED** Frequency: **927.5 MHz**

20 dB lower Bandedge:	**927.2306 MHz**
20 dB upper Bandedge:	**927.7734 MHz**
20 dB Occupied Channel Bandwidth:	**0.542878 MHz**

Remarks

See: **APPENDIX A** for EUT Photographs
APPENDIX B for Data Sheets
APPENDIX D for Test Equipment Calibration Status

2.7 FREQUENCY SATBILITY

Measurements for bandwidth, band edges, number of channels were performed in accordance with the Operations to the Requirements of:

FCC Part 15.249

Testing Conditions

Date of Test:	December 8, 2010
Relative Humidity:	26 %
Test Voltage:	Battery powered
Test Operator:	SP

Test Location

Criterion Technology Immunity Area

Test Equipment

Hewlett-Packard Spectrum Analyzer, HP 8566B

Test Results of Frestability in Extreme Conditions

Test Status: **PASSED** Frequency: **915 MHz**

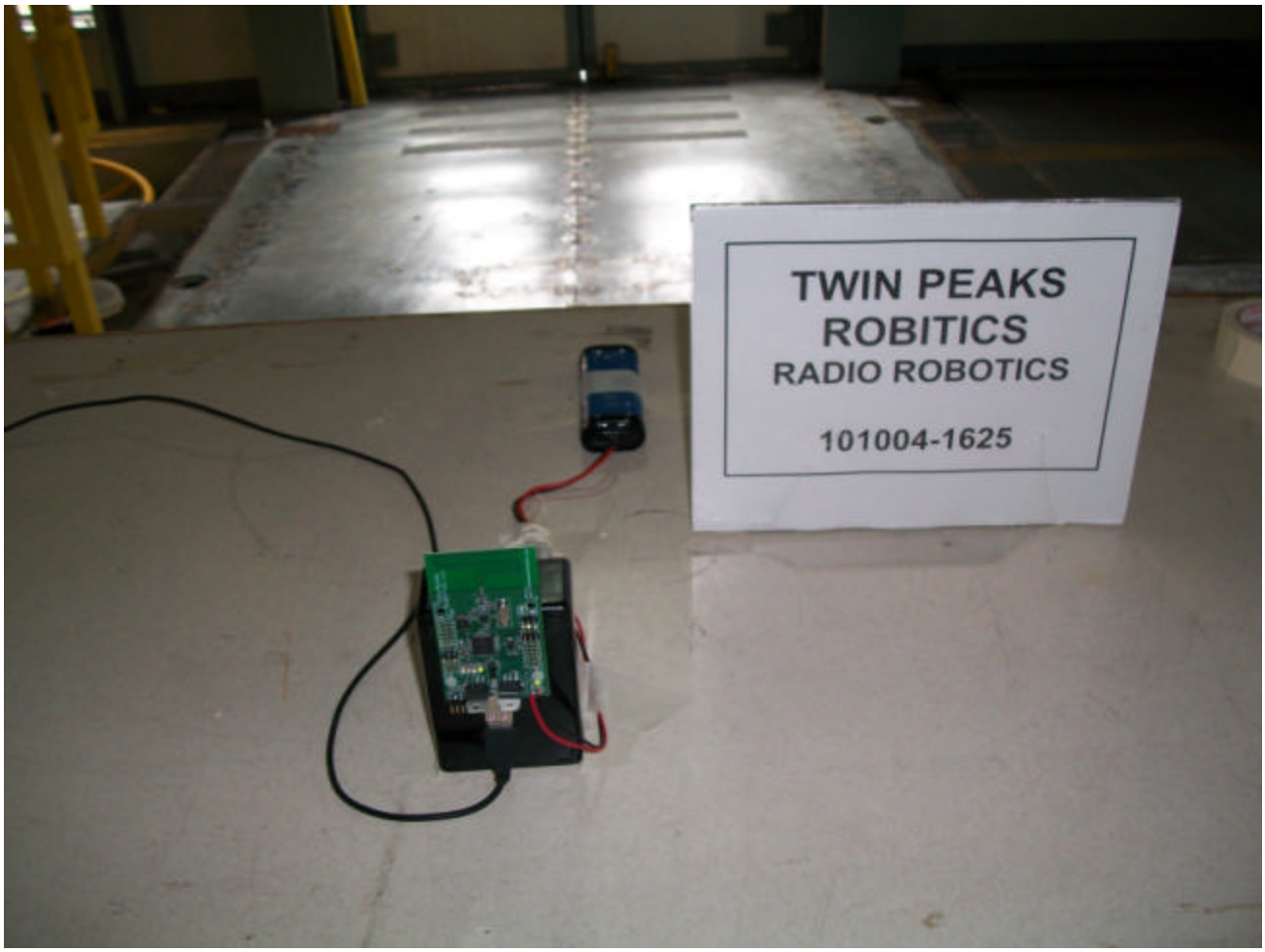
Margin to Limit: **6.96 kHz @ -5º C, 6.8 VDC**

Remarks

See: **APPENDIX A** for EUT Photographs
APPENDIX B for Data Sheets
APPENDIX D for Test Equipment Calibration Status

3.0 APPENDIX A: EUT PHOTOGRAPHS

3.1 RADIATED EMISSIONS

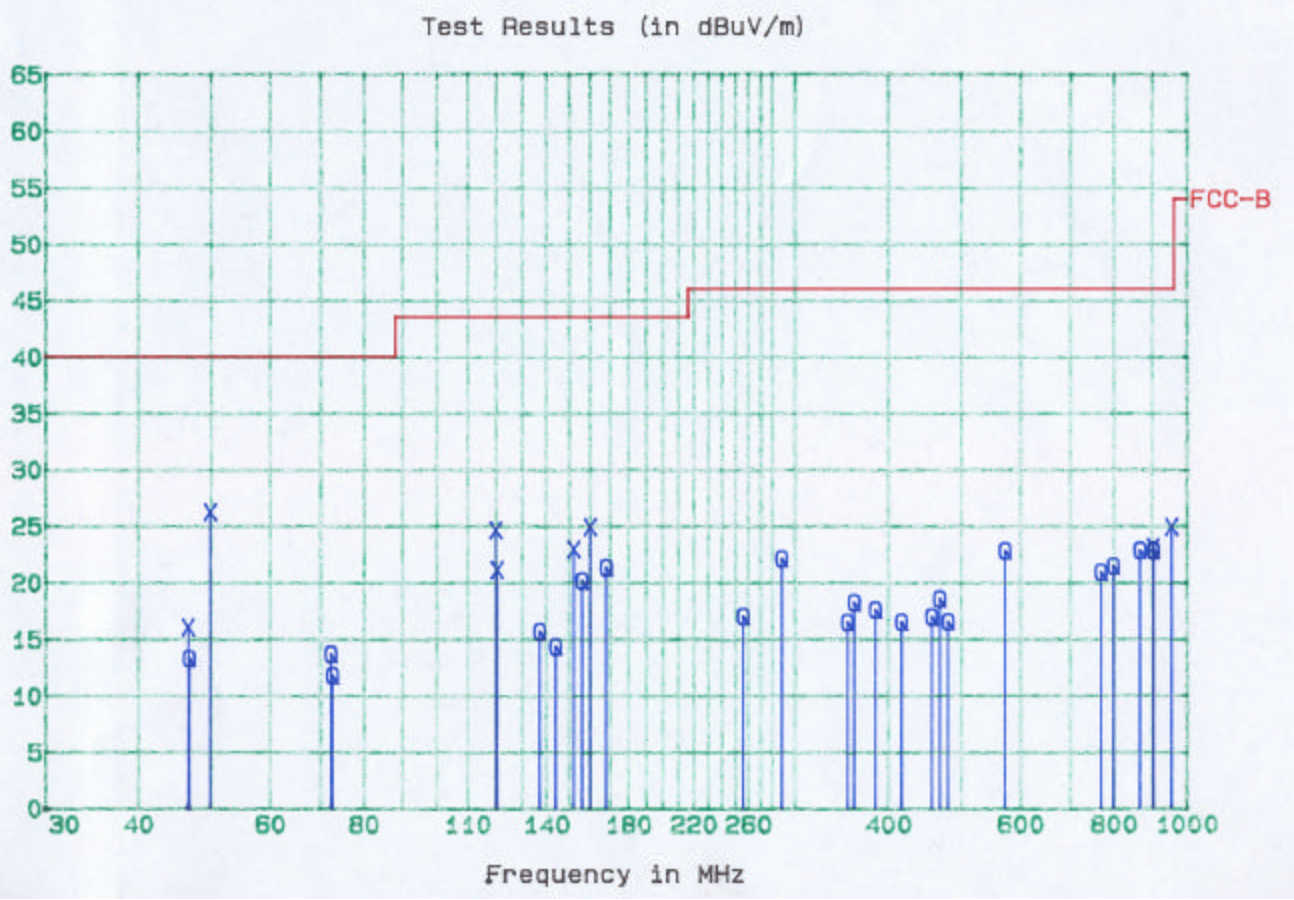


3.2 RADIATED EMISSIONS

4.0 APPENDIX B: DATA SHEETS

4.1 UNINTENTIONAL RADIATED EMISSIONS PLOT – 30 MHZ TO 1 GHZ

Criterion Technology **Date: October 13, 2010**
EUT: Wireless Robotics Controller, RRC1.3
Manufacturer: Twin Peaks Robotics
Tester: SP **SpiD: 101004-1625**
EUT Level: production unit
EUT Information: 8 VDC battery ops w/usb joy stick
Test Information: FCC Part 15, Class B, 3 meters
Test Cond: Temp: 19° C **Humidity: 40 %**



4.2 UNINTENTIONAL RADIATED EMISSIONS TABLE – 30 MHZ TO 1 GHZ

Notes:

Fval = Ival + AF + Cable + Pads – Amp

Where:
Fval is the final electric field in dbuv/m
Ival is the initial reading from the EMC receiver or spec an in dbuv.
AF is the antenna factor, a + value is loss
Cable is the cable attenuation in db, a + value is loss
Pads is the total attenuator loss in db, a + value is loss
Amp is the preamplifier gain in db, a + value is amplifier gain

A Sample calculation with Ival, AF, Cable, Pads, & Amp values of
50 dbuv, 18, 4, 3, 32 respectively is:

Fval = 50 + 18 + 4 + 3 –32 = 43 dbuv/m

Minimum Margin to Limit: **-13.83** dB at **49.8434** MHz

Criterion Technology Wed Oct 13 12:49:43 2010
EUT: Wireless Robotics Controller, RRC1.3
Manufacturer: Twin Peaks Robotics
Tester: sp
Special ID: 101004-1625
EUT Level: Production Unit
EUT Information: 8 VDC Battery ops w/usb joy stick
Test information: FCC P15-B, 3m

Table 1: Scan List, sorted by margin to limit FCC-B, -30.0dB filter

Freq, MHz	Value dBuV/m	Sts	Margin to FCC-B limits (dB)	TT	Hght	Az	Comment
49.8434	26.17	m	-13.83	302	100	V	.
160.0880	24.86	m	-18.66	270	150	V	.....
119.9801	24.58	m	-18.94	127	258	H	.
152.3415	22.86	m	-20.66	0	100	V	.
954.5180	24.85	m	-21.17	0	100	V	.....
168.1710	21.29	q	-22.23	270	200	H	.....
120.4260	21.06	m	-22.46	90	200	V	.....
902.2340	23.06	m	-22.96	358	100	V	.
902.7348	22.79	q	-23.23	90	200	V	.
865.8170	22.78	q	-23.24	270	150	V	.....
902.4835	22.75	q	-23.27	270	150	H	.
572.0140	22.75	q	-23.27	0	100	V	.....
156.1000	20.11	q	-23.41	270	150	V	.....
288.2360	22.06	q	-23.96	270	200	H	.....
46.5580	15.99	m	-24.01	163	100	H	.
798.4560	21.41	q	-24.61	270	150	H	.....
768.3860	20.87	q	-25.15	270	150	H	.....
72.2489	13.65	q	-26.35	270	150	V	.....
46.6780	13.26	q	-26.74	90	250	H	.
468.0090	18.52	q	-27.50	0	113	V	.....
360.0160	18.17	q	-27.85	270	200	H	.....
137.1799	15.64	q	-27.88	270	150	V	.
72.6000	11.77	q	-28.23	270	150	V	.

384.1580	17.55	q	-28.47	270	200	H	.....
256.0100	16.97	q	-29.05	270	200	H	.....
456.8000	16.92	q	-29.10	270	200	H	.....
144.0290	14.30	q	-29.22	90	250	H	.....
480.0800	16.50	q	-29.52	270	150	V	.....
416.4910	16.48	q	-29.54	270	200	H	.....
352.6870	16.45	q	-29.57	270	200	H	.....

Table 2: Scan List for FCC-B, sorted by Frequency, -30.0dB filter

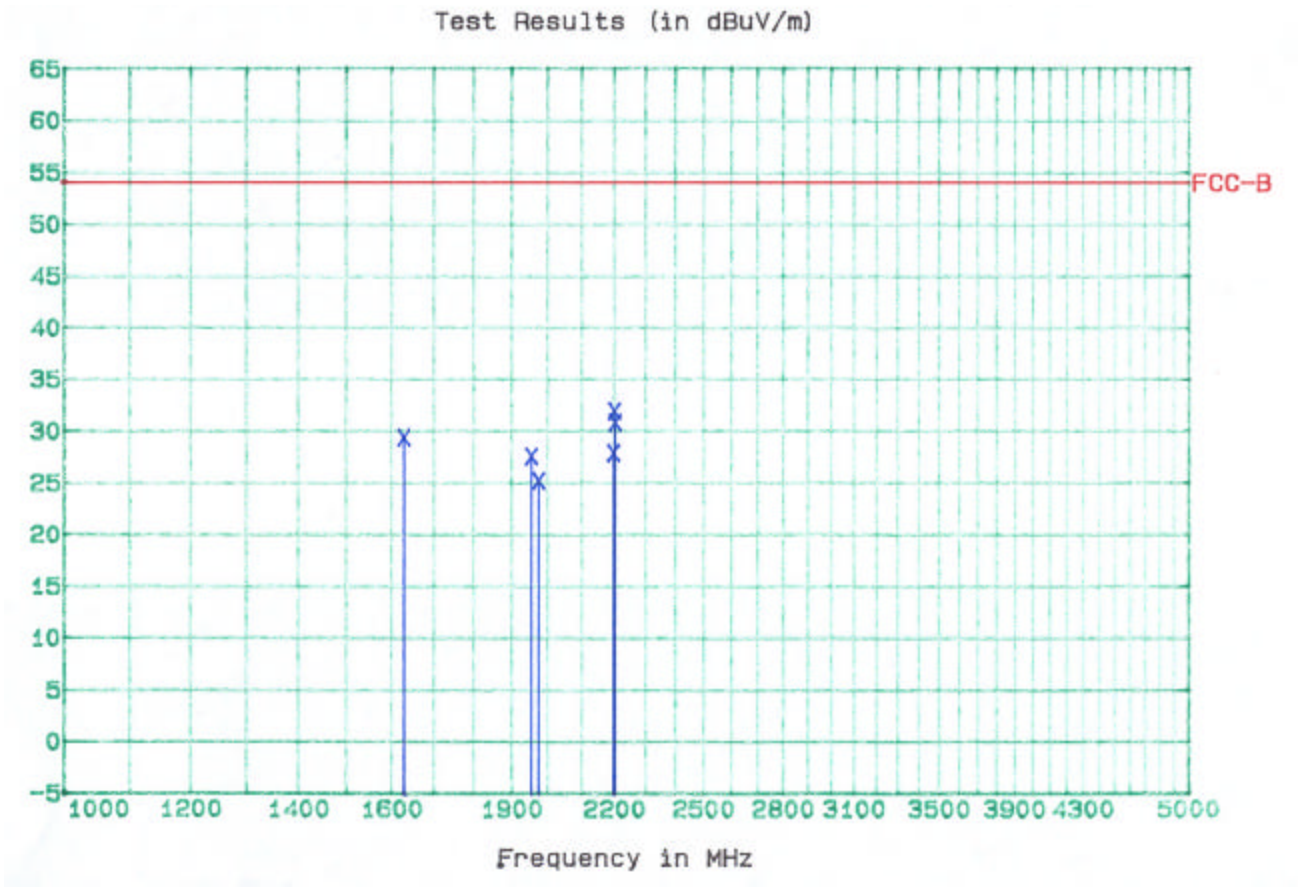
Freq, MHz	Final Value dBuV/m	Sts	Margin to FCC-B limits (dB)	TT	Hght	Az	Comment
46.5580	15.99	m	-24.01	163	100	H	.
46.6780	13.26	q	-26.74	90	250	H	.
49.8434	26.17	m	-13.83	302	100	V	.
72.2489	13.65	q	-26.35	270	150	V	.....
72.6000	11.77	q	-28.23	270	150	V	.
119.9801	24.58	m	-18.94	127	258	H	.
120.4260	21.06	m	-22.46	90	200	V	.....
137.1799	15.64	q	-27.88	270	150	V	.
144.0290	14.30	q	-29.22	90	250	H	.....
152.3415	22.86	m	-20.66	0	100	V	.
156.1000	20.11	q	-23.41	270	150	V	.....
160.0880	24.86	m	-18.66	270	150	V	.....
168.1710	21.29	q	-22.23	270	200	H	.....
256.0100	16.97	q	-29.05	270	200	H	.....
288.2360	22.06	q	-23.96	270	200	H	.....
352.6870	16.45	q	-29.57	270	200	H	.....
360.0160	18.17	q	-27.85	270	200	H	.....
384.1580	17.55	q	-28.47	270	200	H	.....
416.4910	16.48	q	-29.54	270	200	H	.....
456.8000	16.92	q	-29.10	270	200	H	.....
468.0090	18.52	q	-27.50	0	113	V	.....
480.0800	16.50	q	-29.52	270	150	V	.....
572.0140	22.75	q	-23.27	0	100	V	.....
768.3860	20.87	q	-25.15	270	150	H	.....
798.4560	21.41	q	-24.61	270	150	H	.....
865.8170	22.78	q	-23.24	270	150	V	.....
902.2340	23.06	m	-22.96	358	100	V	.
902.4835	22.75	q	-23.27	270	150	H	.
902.7348	22.79	q	-23.23	90	200	V	.
954.5180	24.85	m	-21.17	0	100	V	.....

Table 3: Complete Scan List Sorted by Frequency

Freq, MHz	I-val before xducr factors dBuV	Final Value dBuV/m	Sts	TT	Hght	Az	Time	Comment
46.5580	28.45	15.99	m	163	100	H	Wed Oct 13 12:24:51 2010	.
46.6780	25.77	13.26	q	90	250	H	Wed Oct 13 10:04:56 2010	.
48.1067	21.86	8.70	q	270	150	V	Wed Oct 13 11:25:04 2010	.....
49.8434	40.15	26.17	m	302	100	V	Wed Oct 13 12:27:11 2010	.
72.2489	29.25	13.65	q	270	150	V	Wed Oct 13 11:25:11 2010	.....
72.6000	27.33	11.77	q	270	150	V	Wed Oct 13 11:25:13 2010	.
119.9801	34.35	24.58	m	127	258	H	Wed Oct 13 12:02:22 2010	.
120.4260	30.82	21.06	m	90	200	V	Wed Oct 13 10:48:46 2010	.....
137.1799	25.35	15.64	q	270	150	V	Wed Oct 13 11:25:24 2010	.
144.0290	24.37	14.30	q	90	250	H	Wed Oct 13 10:05:23 2010	.....
152.3415	33.29	22.86	m	0	100	V	Wed Oct 13 09:38:23 2010	.
156.1000	30.99	20.11	q	270	150	V	Wed Oct 13 11:25:33 2010	.....
160.0880	36.09	24.86	m	270	150	V	Wed Oct 13 11:25:36 2010	.....
168.1710	33.00	21.29	q	270	200	H	Wed Oct 13 11:20:31 2010	.....
192.4210	19.40	7.46	q	270	100	V	Wed Oct 13 11:34:02 2010	.....
216.4560	26.52	15.13	q	270	200	H	Wed Oct 13 11:20:36 2010	.....
240.5980	21.42	11.98	q	270	200	H	Wed Oct 13 11:20:39 2010	.....
247.9270	19.29	10.54	q	270	150	H	Wed Oct 13 11:23:23 2010	.....
256.0100	25.01	16.97	q	270	200	H	Wed Oct 13 11:20:43 2010	.....
260.1060	21.92	13.65	q	270	200	H	Wed Oct 13 11:20:46 2010	.....
264.0930	18.73	10.33	q	270	200	H	Wed Oct 13 11:20:48 2010	.....
288.2360	29.98	22.06	q	270	200	H	Wed Oct 13 11:20:51 2010	.....
312.3780	18.67	11.32	q	270	200	H	Wed Oct 13 11:20:54 2010	.....
336.6280	22.59	16.00	q	270	200	H	Wed Oct 13 11:20:56 2010	.....
352.6870	22.45	16.45	q	270	200	H	Wed Oct 13 11:20:58 2010	.....
360.0160	23.43	18.17	q	270	200	H	Wed Oct 13 11:21:01 2010	.....
384.1580	22.83	17.55	q	270	200	H	Wed Oct 13 11:21:03 2010	.....
416.4910	20.64	16.48	q	270	200	H	Wed Oct 13 11:21:05 2010	.....
432.5500	18.93	15.02	q	270	200	H	Wed Oct 13 11:21:08 2010	.....
456.8000	20.10	16.92	q	270	200	H	Wed Oct 13 11:21:10 2010	.....
468.0090	21.49	18.52	q	0	113	V	Wed Oct 13 09:31:54 2010	.....
480.0800	19.22	16.50	q	270	150	V	Wed Oct 13 11:26:17 2010	.....
572.0140	23.40	22.75	q	0	100	V	Wed Oct 13 09:39:11 2010	.....
768.3860	19.09	20.87	q	270	150	H	Wed Oct 13 11:23:59 2010	.....
798.4560	19.35	21.41	q	270	150	H	Wed Oct 13 11:24:01 2010	.....
865.8170	20.15	22.78	q	270	150	V	Wed Oct 13 11:26:25 2010	.....
902.2340	20.41	23.06	m	358	100	V	Wed Oct 13 12:22:59 2010	.
902.4835	20.10	22.75	q	270	150	H	Wed Oct 13 11:24:07 2010	.
902.7348	20.14	22.79	q	90	200	V	Wed Oct 13 10:49:56 2010	.
954.5180	20.73	24.85	m	0	100	V	Wed Oct 13 12:10:39 2010	.....

4.3 UNINTENTIONAL RADIATED EMISSIONS PLOT – ABOVE 1 GHZ

Criterion Technology **Date: October 13, 2010**
EUT: Wireless Robotics Controller, RRC1.3
Manufacturer: Twin Peaks Robotics
Tester: SP **SpiD: 101004-1625**
EUT Level: production unit
EUT Information: 8 VDC battery ops w/usb joy stick
Test Information: FCC Part 15, Class B, 3 meters
Test Cond: Temp: 19° C **Humidity: 40 %**



4.4 UNINTENTIONAL RADIATED EMISSIONS TABLE – ABOVE 1 GHZ

Notes:

Fval = Ival + AF + Cable + Pads – Amp

Where:
Fval is the final electric field in dbuv/m
Ival is the initial reading from the EMC receiver or spec an in dbuv.
AF is the antenna factor, a + value is loss
Cable is the cable attenuation in db, a + value is loss
Pads is the total attenuator loss in db, a + value is loss
Amp is the preamplifier gain in db, a + value is amplifier gain

A Sample calculation with Ival, AF, Cable, Pads, & Amp values of
50 dbuv, 18, 4, 3, 32 respectively is:

Fval = 50 + 18 + 4 + 3 –32 = 43 dbuv/m

Minimum Margin to Limit: **-22.07** dB at **2197.0818** MHz

Criterion Technology Wed Oct 13 15:23:25 2010
EUT: Wireless Robotics Controller, RRC1.3
Manufacturer: Twin Peaks Robotics
Tester: SP
Special ID: 101004-1625
EUT Level: Production Unit
EUT Information: 8 VDC Battery ops w/usb joy stick
Test information: FCC P15-B, 3m

Table 1: Scan List, sorted by margin to limit FCC-B, -30.0dB filter

Freq, MHz	Value dBuV/m	Sts	Margin to FCC-B limits (dB)	TT	Hght	Az	Comment
2197.0818	31.91	m	-22.07	134	100	H	.
2198.7377	30.82	m	-23.16	1	100	H	.
1624.6967	29.38	m	-24.60	302	100	H	.
2193.5567	27.91	m	-26.07	360	100	V	.
1951.1783	27.57	m	-26.41	1	100	V	.
1971.3000	25.21	m	-28.77	1	100	V	.....

Table 2: Scan List for FCC-B, sorted by Frequency, -30.0dB filter

Freq, MHz	Final Value dBuV/m	Sts	Margin to FCC-B limits (dB)	TT	Hght	Az	Comment
1624.6967	29.38	m	-24.60	302	100	H	.
1951.1783	27.57	m	-26.41	1	100	V	.
1971.3000	25.21	m	-28.77	1	100	V	.....
2193.5567	27.91	m	-26.07	360	100	V	.
2197.0818	31.91	m	-22.07	134	100	H	.
2198.7377	30.82	m	-23.16	1	100	H	.

Table 3: Complete Scan List Sorted by Frequency

Freq, MHz	I-val before xducr factors dBuV	Final Value dBuV/m	Sts	TT	Hght	Az	Time	Comment
1006.4000	36.47	20.38	a	1	100	H	Wed Oct 13 14:57:04 2010	.
1058.2000	36.14	20.21	a	1	100	H	Wed Oct 13 14:57:10 2010	.
1110.5000	35.39	19.73	a	1	100	V	Wed Oct 13 14:55:28 2010	.....
1162.5000	34.16	18.81	a	1	100	H	Wed Oct 13 14:58:05 2010	.....
1547.5493	33.44	20.72	a	1	100	V	Wed Oct 13 14:54:41 2010	.
1624.6967	41.40	29.38	m	302	100	H	Wed Oct 13 13:27:17 2010	.
1642.2000	31.83	20.01	a	1	100	V	Wed Oct 13 14:55:42 2010	.....
1805.0000	32.40	22.29	a	1	100	H	Wed Oct 13 14:58:17 2010	.....
1921.4000	31.27	23.13	a	1	100	V	Wed Oct 13 14:55:56 2010	.....
1922.0000	31.32	23.19	a	1	100	V	Wed Oct 13 14:56:04 2010	.....
1923.0000	31.33	23.23	a	1	100	V	Wed Oct 13 14:56:14 2010	.....
1934.4000	31.32	23.51	a	1	100	V	Wed Oct 13 14:56:22 2010	.....
1951.1783	34.71	27.57	m	1	100	V	Wed Oct 13 14:54:47 2010	.
1971.3000	31.53	25.21	m	1	100	V	Wed Oct 13 14:56:30 2010	.....
2193.5567	34.43	27.91	m	360	100	V	Wed Oct 13 15:09:08 2010	.
2197.0818	38.48	31.91	m	134	100	H	Wed Oct 13 15:04:59 2010	.
2198.7377	37.41	30.82	m	1	100	H	Wed Oct 13 14:57:41 2010	.
5000.0000	2.72	1.94	m	123	100	H	Wed Oct 13 15:03:36 2010	.

4.5 INTENTIONAL RADIATED EMISSIONS

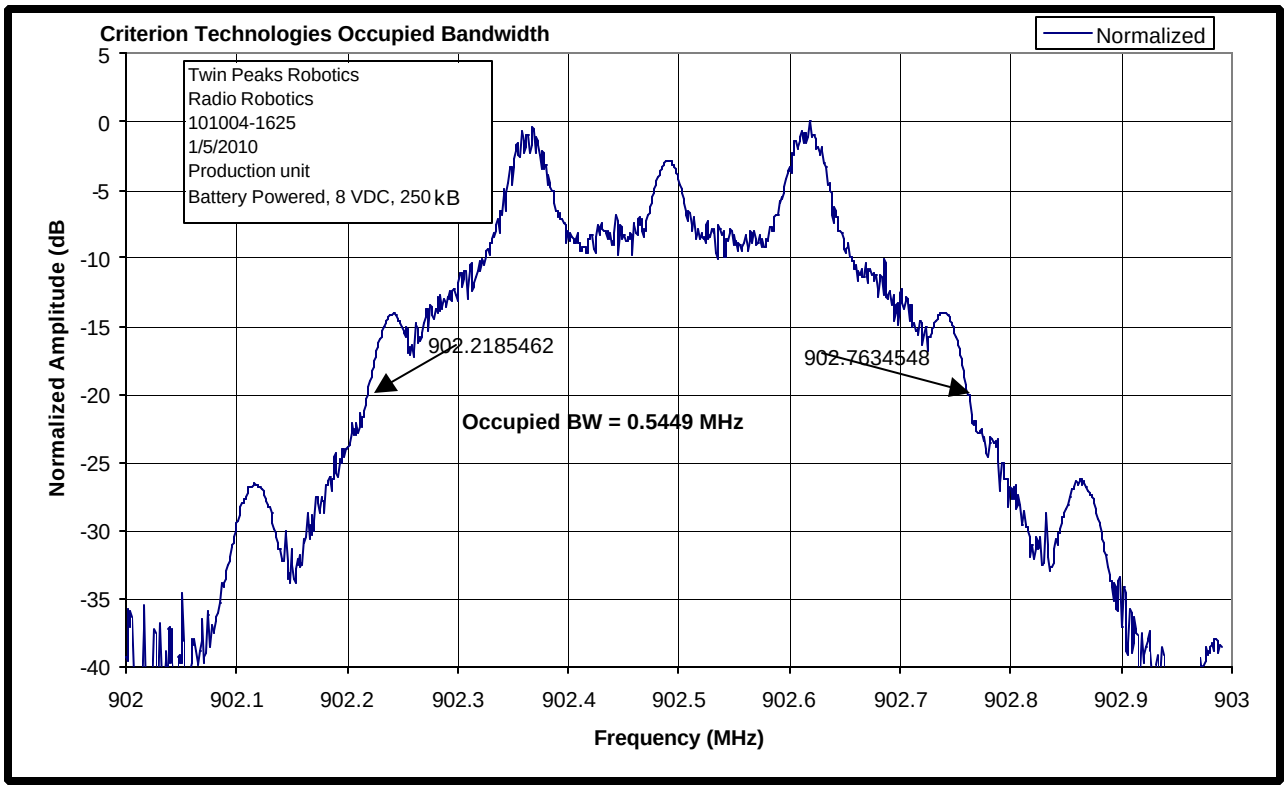
RADIO ROBOTICS, Battery-CW radiator										
CHANNEL	Fundamental Freq (GHz) (bold is max emission)	Fval before rcvr pads (dBuV/m)	Recv. Pads (dB) *	Field Strength (dBuV/m)	Elev	AZ	Pol	Orientation	FCC Limit part 15.249, 50 mV/m or 94 dBuV/m	Margin to Limit (dB)
Low	902.4800	59.05	31.7	90.75	114.1	289	V	X	94.0	-3.3
Mid	915.0009	59.71	31.7	91.41	111.1	332	V	X	94.0	-2.6
High	927.4947	59.07	31.7	90.77	115.1	332	V	X	94.0	-3.2
Low	**902.4800**	**62.22**	**31.7**	**93.92**	**100**	**267**	**H**	**Y**	**94.0**	**-0.1**
Mid	915.0009	60.19	31.7	91.89	100	267	H	Y	94.0	-2.1
High	927.4947	61.11	31.7	92.81	100	111	H	Y	94.0	-1.2
Low	902.4800	61.92	31.7	93.62	100	239	H	Z	94.0	-0.4
Mid	915.0009	58.68	31.7	90.38	148.4	237	H	Z	94.0	-3.6
High	927.4947	58.32	31.7	90.02	100	241	H	Z	94.0	-4.0

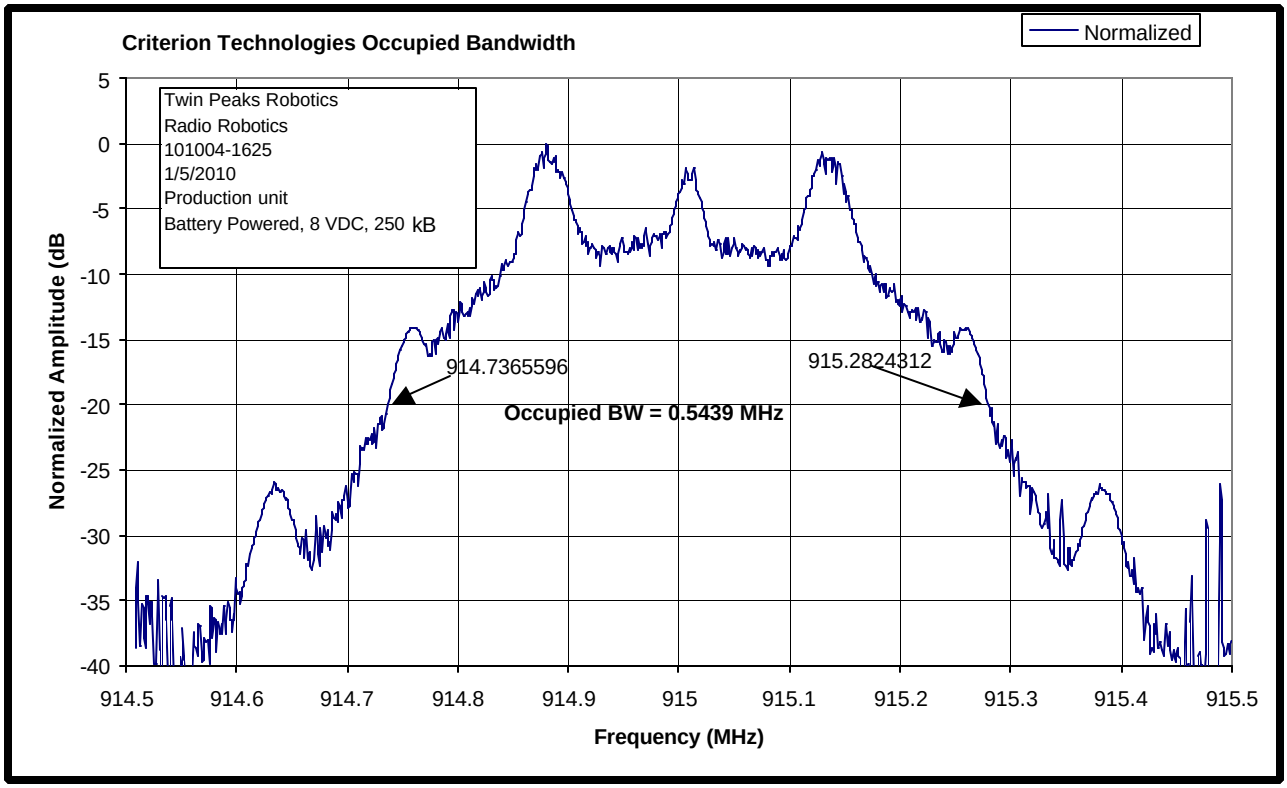
*-Pad insertion from Maintanance data C:\Data\Maintenance\8-30-10\OperatingCables.xls\'DeviceCompare' tab

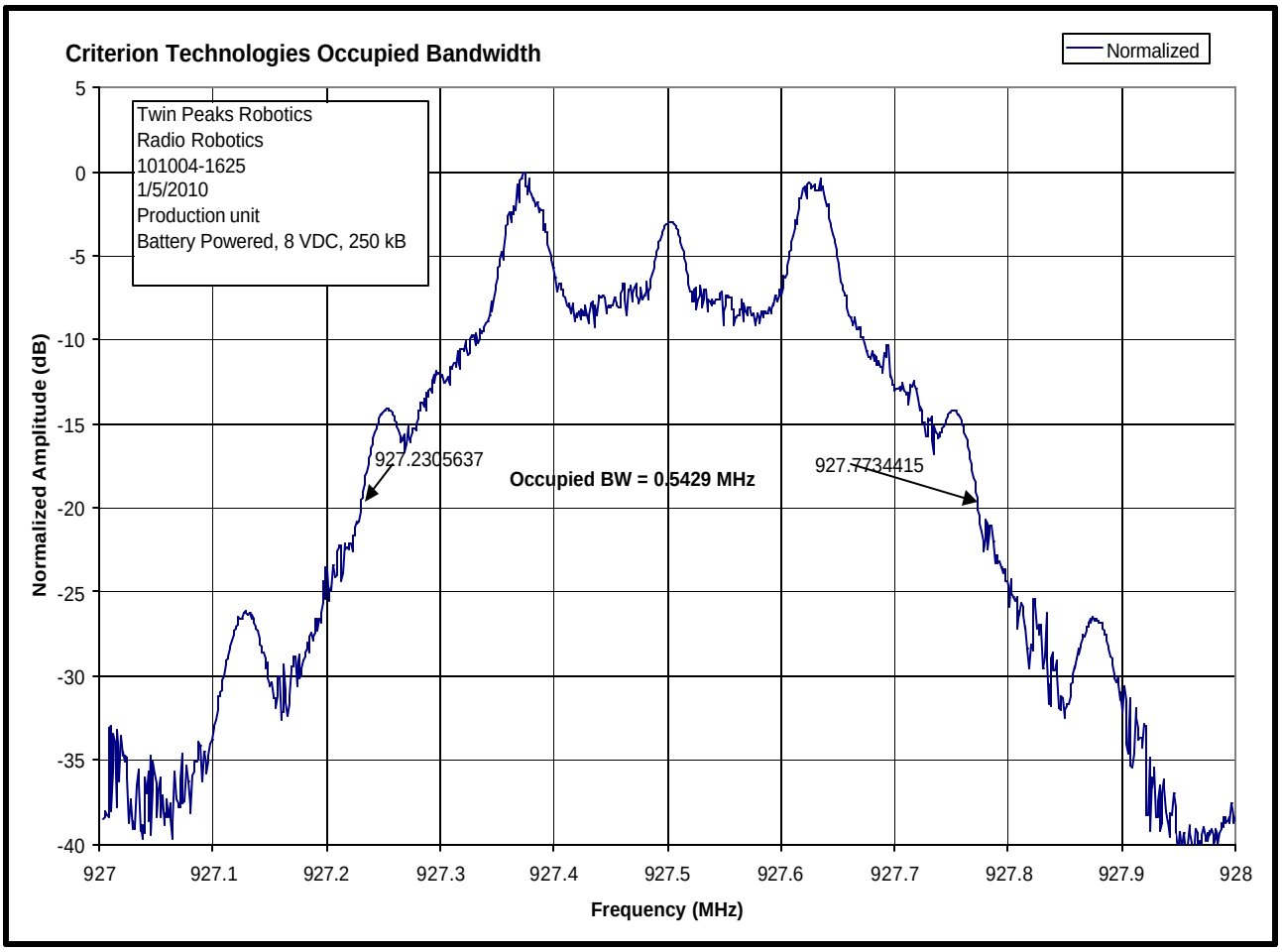
Harmonic	Frequency (Bold => restricted band)	F val	FCC part 15.249 limit, 500 uV/m or 54 dBuV/m	Margin to Limit (db)	Elev	AZ	Pol	Orientation	Antennas
2nd	1804.96	51.3	54	-2.70	134.3	238	H	Y	DRG 118A
3rd	**2782.473**	30.87	54	-23.13	100	161	V	Y	DRG 118A
4th	**3709.964**	32.91	54	-21.09	134.3	240	V	Y	DRG 118A
5th	**4637.455**	28.6	54	-25.40	100	132	V	Y	DRG 118A
6th	5564.946	39.9	54	-14.10	114.1	306	V	Y	DRG 118A
7th	6492.437	38.9	54	-15.10	100	149	H	Y	DRG 118A
8th	**7419.928**	41.82	54	-12.18	100	0	V	Y	DRG 118A
9th	**8347.419**	42.9	54	-11.10	100	0	H	Y	DRG 118A
10th	**9024.8**		54	-54.00				Y	DRG 118A

* => noise floor measurement. The spec an will retrun the same amplitude regardless of these settings.

4.6 CHANNEL BANDWIDTH




Criterion Technologies Occupied Bandwidth
Normalized
Twin Peaks Robotics
Radio Robotics
101004-1625
1/5/2010
Production unit
Battery Powered, 8 VDC, 250 kB
914.7365596
915.2824312
Occupied BW = 0.5439 MHz
Normalized Amplitude (dB
Frequency (MHz)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
914.5
914.6
914.7
914.8
914.9
915
915.1
915.2
915.3
915.4
915.5


Criterion Technologies Occupied Bandwidth
Normalized
Twin Peaks Robotics
Radio Robotics
101004-1625
1/5/2010
Production unit
Battery Powered, 8 VDC, 250 kB
927.2305637
Occupied BW = 0.5429 MHz
927.7734415
Normalized Amplitude (dB)
Frequency (MHz)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
927
927.1
927.2
927.3
927.4
927.5
927.6
927.7
927.8
927.9
928

4.7 FREQUENCY STABILITY

Low Channel

+20 °C @8VDC	902.489299		6.8vdc Limit ± 9.02 kHz	9.2vdc Limit ± 9.02 kHz
	6.8 VDC	9.2 VDC	Frequency change (kHz)	Frequency change (kHz)
+20 ° C	902.489232	902.489215	-0.066500	-0.083500
-5 ° C	902.487584	902.487592	-1.714500	-1.706500
+10 ° C	902.489803	902.489806	0.504500	0.507500
+20 ° C	902.489295	902.489289	-0.003500	-0.009500
+40 ° C	902.488636	902.488638	-0.662500	-0.660500
+50 ° C	902.488099	902.488095	-1.199500	-1.203500
Return to 20 ° C	902.489377	902.489379	0.078500	0.080500

Mid Channel

+20 °C @8VDC	915.00746		6.8vdc Limit ± 9.15 kHz	9.2vdc Limit ± 9.15 kHz
	6.8 VDC	9.2 VDC	Frequency change (kHz)	Frequency change (kHz)
+20 ° C	915.007465	915.007383	0.005000	-0.077000
-5 ° C	**915.005267**	915.005284	**-2.193000**	-2.176000
+10 ° C	915.007946	915.007944	0.486000	0.484000
+20 ° C	915.007523	915.007521	0.063000	0.061000
+40 ° C	915.007803	915.007812	0.343000	0.352000
+50 ° C	915.007151	915.007159	-0.309000	-0.301000
Return to 20 ° C	915.007653	915.007657	0.193000	0.197000

High Channel

+20 °C @8VDC	927.498452		6.8vdc Limit ± 9.27 kHz	9.2vdc Limit ± 9.27 kHz
	6.8 VDC	9.2 VDC	Frequency change (kHz)	Frequency change (kHz)
+20 ° C	927.498612	927.498594	0.160000	0.142000
-5 ° C	927.496479	927.49652	-1.973000	-1.932000
+10 ° C	927.498946	927.49895	0.494000	0.498000
+20 ° C	927.498877	927.49887	0.425000	0.418000
+40 ° C	927.498278	927.498277	-0.174000	-0.175000
+50 ° C	927.498204	927.49821	-0.248000	-0.242000
Return to 20 ° C	927.49894	927.498948	0.488000	0.496000

Margin to limit 9.15 - 2.19 kHz = 6.96 kHz at -5 C 6.8vdc

5.0 APPENDIX C: PRODUCT INFORMATION FORM

General Information **Date** 10/4/10

Company Name: TwinPeaksRobotics

Company Address: 2217 Lake Park Drive, Longmont, CO 80503

Contacts: Paul Shepherd Phone: 303-775-2409

email: paul@twinpeaksrobotics.com

Market Information (Check all that Apply)

USA X Canada Euro.Union Taiwan Japan New Zealand Australia

Other

Product Information

Name Wireless Robotics Controller Model Number RRC1.3 Serial Number: none

Product Dimensions: 3.75 X 2 X 1 inches Weight: 2oz

Product Power Source:

Battery: ☐ No ☒ Yes

Voltage 7 – 9 volts

AC Supply: No

# of cords:

Voltage for each:

I/O Cables:

# of cords under 3 meters: 1

# of cords over 3 meters: 0

List Support equipment if any: none

Emissions Testing:

Is this equipment to be used in a residence: ☐ No (Class A) ☒ Yes (Class B)

Does this have a transmitter or Transceiver: ☐ No ☒ Yes

Highest oscillator/Clock frequency (including internal clocks only to the microprocessor): 32MHz

To be compliant with C63.4-2003 test methodology, for the emissions testing, the equipment must be exercising all of the functionality within the capability of the Equipment under test. In addition, the equipment must be equipped in the configuration of maximum capability, which will be offered to customers. The test software installed in the Equipment Under Test (EUT) must exercise all of the modules in this maximum capability configuration.

Description of the maximum capability configuration: Cont transmission, power at –2 dBm, Joystick

Name and revision # of the test software used for the emissions test: TPR_TestCode 1.0

Please attach or include the product spec or pre production spec

32 MIPS Microchip PIC24FJ256GB106 processor
Power input between 7.2 and 10 volts
integral 915MHz Transceiver with built in antenna
USB Controller
28 IO connections for robotics control
IO programmable to support various perperials
1Mbit EEProm
Real Time Clock
Accessory Power of 1 Amp at 3 Volts and 1 Amp at 5 Volts
Low Power Capable

6.0 APPENDIX D: TEST EQUIPMENT AND CALIBRATION STATUS

Manufacturer	Name/Description	Model Number	Serial Number	Cal. Due Date
Solar Electronics	LISN	8012-50-R-24-BNC	892310	10/15/2010
Haefely Trench	Test Mag	Mag 100	80162	10/15/2010
Gigatronics	Power Sensor	80301A-410	1831996	10/15/2010
Gigatronics	Power Meter	8541C	1830945	10/15/2010
Hewlett Packard	Tracking Generator	HP85645A	3210A00124	10/22/2010
FCC	LISN	FCC-TLISN-T4-02	20252	11/24/2010
FCC	EM Clamp	F2031	309	12/2/2010
FCC	CDN	FCC-801-M3-25	9714	12/2/2010
Rohde/ Schwarz	LISN	ESH2-Z5	828739-001	12/8/2010
Rohde/ Schwarz	VHF/UHF Receiver	ESVS-30	863342014	12/8/2010
Rohde/ Schwarz	HF Receiver	ESHS-30	826003/011	12/8/2010
Califorina Instruments	AC Power Source Pacs-1	5001iX-CTS-411	55637/ 72242	3/24/2011
Haefely Trench	Surge Generator	PSURGE 6.1	083-906-07	5/26/2011
Haefely Trench	EFT Tester	PEFT Junior	583-333-51	5/26/2011
Haefely Trench	Surge Coupler	FP-Surge 32.1	083-925-05	5/26/2011
EMCO	Active Loop	6502	2626	5/28/2011
Veratech	Preamp (AMP2)	unknown	N/A	9/6/2011
Amplifier Research	E-Field Probe	FP2080	20236	10/16/2011
Amplifier Research	E-Field Probe	FP2000	19682	10/19/2011
EMCO	Horn	3160-08	1147	1/19/2012
Hewlett Packard	Signal Generator	HP 8648D	3642000145	3/9/2012
Hewlett Packard	Quasi Peak Adapter	85650A	3014A18942	5/3/2012
Hewlett Packard	Spectrum Analyzer	HP 8566B	2240A0195	5/21/2012
Hewlett Packard	Spectrum Analyzer Display	HP 85662A	3014A18942	5/21/2012
Haefely Trench	ESD Gun	PESD 1600	H605100	6/2/2012

7.0 APPENDIX E: TEST DIRECTIVES, STANDARDS AND METHODS

7.1.1 EUROPEAN DIRECTIVES, STANDARDS AND METHODS

89/336/EEC: Council Directive of 03 May 1989 on the Approximation of the Laws of the Member States Relating to Electromagnetic Compatibility, OJEC No. L 139/19-26, Aug 1993.

BS DD ENV 50204 (CENELEC): Testing and Measurement Techniques; Radiated Electromagnetic Field from Digital Radio Telephones - Immunity Test, 1996.

EN 55011 (CENELEC): ISM Radio-Frequency Equipment Radio Disturbance Characteristics - Limits and Methods of Measurement, 2007.

EN 55014-1 (CENELEC): Part 1. Electromagnetic Compatibility Requirements for Household Appliances, Electric Tools and Similar Apparatus - Part 1. Emission - Product Family Standard, 2007.

EN 55022 (CENELEC): ITE - Radio-Frequency Equipment Radio Disturbance Characteristics - Limits and Methods of Measurement, 2008.

CISPR 22: Information Technology Equipment – Radio Disturbance Characteristics - Limits and Methods of Measurement, 2009.

EN 55024 (CENELEC): ITE - Immunity Characteristics - Limits and Methods of Measurement, 2008.

EN 55103-1: Product Family standard for audio, video, audio - visual and entertainment lighting control apparatus for professional use. Part 1: Emissions, April 1997.

EN 55103-2: Product Family standard for audio, video, audio - visual and entertainment lighting control apparatus for professional use. Part 2: Immunity, April 1997.

EN 60601-1-2 (CENELEC): Medical Electrical Equipment. Part 1. General Requirements for Safety - Section 1.2. Collateral Standard: Electromagnetic Compatibility - Requirements and Tests, Third Edition 2007.

EN 61000-6-1: EMC- Part 6-1. Generic Standard-Immunity for residential, commercial and light-industrial Environments 2007.

EN 61000-6-2: EMC- Part 6-2. Generic Standard-Immunity for Industrial Environments, 2005.

EN 61000-6-3: EMC- Part 6-3. Generic Standard-Emissions for residential, commercial and light-industrial Environments 2007.

EN61000-6-4 (CENELEC): EMC - Generic Emission Standard, Part 6-4: Industrial Environment, 2007.

EN 61000-3-2 (CENELEC): EMC - Part 2. Limits for Harmonic Current Emissions (Equipment Input Current ≤16 A per phase), 2009.

EN 61000-3-3 (CENELEC): EMC - Part 3. Limitation of Voltage Fluctuation and Flicker in Low-Voltage Supply Systems for Equipment with Rated Current ≤16 A, 2008.

EN 61000-4-2 (CENELEC): EMC - Part 4. Testing and Measurement Techniques; Section 2. Electrostatic Discharge Immunity Test, 2009.

EN 61000-4-3 (CENELEC): EMC - Part 4. Testing and Measurement Techniques; Section 3. Radiated, Radio-Frequency, Electromagnetic Field Immunity, 2010.

EN 61000-4-4 (CENELEC): EMC - Part 4. Testing and Measurement Techniques; Section 4. Electrical Fast Transient/Burst Immunity Test, 2010.

EN 61000-4-5 (CENELEC): EMC - Part 4. Testing and Measurement Techniques; Section 5. Surge Immunity Test, 2006.

EN 61000-4-6 (CENELEC): EMC - Part 4. Testing and Measurement Techniques; Section 6. Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields, 2009.

EN 61000-4-8 (CENELEC): EMC - Part 4. Testing and Measurement Techniques; Section 8. Power Frequency Magnetic Field Immunity Test, 2010.

EN 61000-4-11 (CENELEC): EMC - Part 4. Testing and Measurement Techniques; Section 11. Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests, 2004

ETSI EN 300 220-1 V2.1.1 – Electromagnetic Compatibility and Radio spectrum Matters (ERM); Short range devices (SRD); radio equipment to be used in the 25MHz to 1000 MHz frequency range with power levels ranging up to 500 mW; Part 1: Technical characteristics and test methods; 2006.

ETSI EN 300 220-2 V2.1.1 – Electromagnetic Compatibility and Radio spectrum Matters (ERM); Short range devices (SRD); radio equipment to be used in the 25MHz to 1000 MHz frequency range with power levels ranging up to 500 mW; Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive, 2006

ETSI EN 300 220-3 V1.1.1 – Electromagnetic Compatibility and Radio spectrum Matters (ERM); Short range devices (SRD); radio equipment to be used in the 25MHz to 1000 MHz frequency range with power levels ranging up to 500 mW; Part 3: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive

ETSI EN 300 683 –Radio Equipment and Systems (RES); ElectroMagnetic Compatibility (EMC) Standard for Short Range Devices (SRD) Operating on Frequencies between 9 kHz and 25kHz, 1997

EN 300 328 v1.7.1: Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive, 2006.

EN 301 489-1 v1.8.1: Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements, 2008.

EN 301 489-3 v1.4.1: Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Rangr Devices (SRD) operating on frequencies between 9kHz and 40 GHz, 2002.

EN 301 489-17 v2.1.1: Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic compatibility (EMC) standard for radio equipment; Part 17: Specific conditions for Broadband Data Transmission Systems, 2008.

EN 61326 (CENELEC): Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements, 2005.

EN 61326-1 Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements,
- Part 1: General Requriments, 2008

7.1.2 47 CFR FCC PART 15 RADIO FREQUENCY DEVICES: OCT 2009

Subpart A General.

Subpart B Unintentional Radiators.

Subpart C Intentional Radiators.

Subpart D Unlicensed Personal Communications Service Devices.

7.1.3 47 CFR FCC PART 22 PUBLIC MOBILE SERVICES: OCT 2009

7.1.4 47 CFR FCC PART 24 PERSONAL COMMUNICATIONS SERVICES: OCT 2009

7.1.5 JAPAN

VCCI V-3

7.1.6 CANADA

ICES-001: Interference-Causing Equipment Standard - ISM RF Generators, 2006.

ICES-003: Interference-Causing Equipment Standard - Digital Apparatus, 2004.

7.1.7 AUSTRALIA/NEW ZEALAND

SAA AS/NZ 3548: Limits and Methods of Measurement of Radio Disturbance Characteristics of ITE, 1997.

AS/NZS 4268:2008: Radio Equipment and systems -Short range devices -Limits and methods of measurement.

AS/NZS CISPR22

7.1.8 TAIWAN

CNS13438, 2006.

7.1.9 KOREA

KN22, September 29, 2005

KN 24, 1998