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

CERTIFICATION TEST REPORT

FOR

WIRELESS TRANSMITTER

MODEL NUMBER: 100461-000

FCC ID: 2AE82100461-000

REPORT NUMBER: 10680918

ISSUE DATE: August 21, 2015

Prepared for
BREG INC.
2885 LOKER AVE E.
CARLSBAD
CA, 92010, USA

Prepared by
UL LLC
333 PFINGSTEN RD.
NORTHBROOK, IL 60062
TEL: (847) 272-8800

NVLAP Lab code: 100414-0

Revision History

Rev.	Issue Date	Revisions	Revised By
1.0	August 21, 2015	Initial Issue	Joseph McWilliams

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS 4

2. TEST METHODOLOGY 5

3. FACILITIES AND ACCREDITATION 5

4. CALIBRATION AND UNCERTAINTY 5

4.1. MEASURING INSTRUMENT CALIBRATION 5

4.2. SAMPLE CALCULATION 5

4.3. MEASUREMENT UNCERTAINTY 6

4.4. DESCRIPTION OF TEST SETUP 8

5. TEST AND MEASUREMENT EQUIPMENT 10

6. TEST RESULTS 11

6.1. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS 11

6.2. 99% BANDWIDTH 12

6.3. 20dB BANDWIDTH 16

6.4. RADIATED EMISSIONS 20

6.4.1. FUNDAMENTAL FREQUENCY RADIATED EMISSION 21
6.4.2. FUNDAMENTAL FREQUENCY RADIATED EMISSION WORST CASE DATA 23
6.4.3. TRANSMITTER RESTRICTED BAND EDGES 24
6.4.4. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz 32
6.4.5. SPURIOUS EMISSIONS 30 TO 1000 MHz 38

7. SETUP PHOTOS 40

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BREG INC
2885 Loker Ave E.
CARLSBAD, CA 92010, USA

EUT DESCRIPTION: WIRELESS TRANSMITTER

MODEL: 100461-000

SERIAL NUMBER: None

DATE TESTED: 04-27-15 to 6-17-15

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	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
WiSE Program Manager
UL LLC

Tested By:

Joseph McWilliams
WiSE Senior Engineer
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15

The EUT was tested at 1.5M height for emissions above 1GHz

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/Standards/scopes/1004140.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

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	30-200MHz	Bicon 3m Horz	3.30dB
Radiated Emissions	30-130MHz	Bicon 3m Vert	4.84dB
Radiated Emissions	130-200MHz	Bicon 3m Vert	4.94dB
Radiated Emissions	200-1000MHz	LogP 3m Horz	3.46dB
Radiated Emissions	200-1000MHz	LogP 3m Vert	4.98dB
Radiated Emissions	1-6GHz	Horn	5.02dB
Radiated Emissions	6-18GHz	Horn	5.34dB
Radiated Emissions	18-26GHz	Horn	6.60dB
Conducted Ant Port	30MHz-26GHz	Spectrum Analyzer	2.94

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

1. EQUIPMENT UNDER TEST

1.1. DESCRIPTION OF EUT

The EUT is a BLE wireless transmitter.

The radio module is manufactured by Texas Instruments. The EUT does not transmit in charging mode.

1.2. 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)
2402	Low Channel	91.54

1.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an Inverted F antenna, with a maximum gain of 5.3 dBi.

1.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 6.00116, rev. v0.92.

The EUT driver software installed during testing was utilizing the Texas Instruments CC2541 production drivers

The test utility software used during testing was 6.00112, rev. v1.08.

1.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The worst case channel was the low channel in the Z orientation.

4.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
iPod Touch	Apple	iPod Touch 8.1	CCQNWK70G22Y	BCG-A1421

I/O CABLES

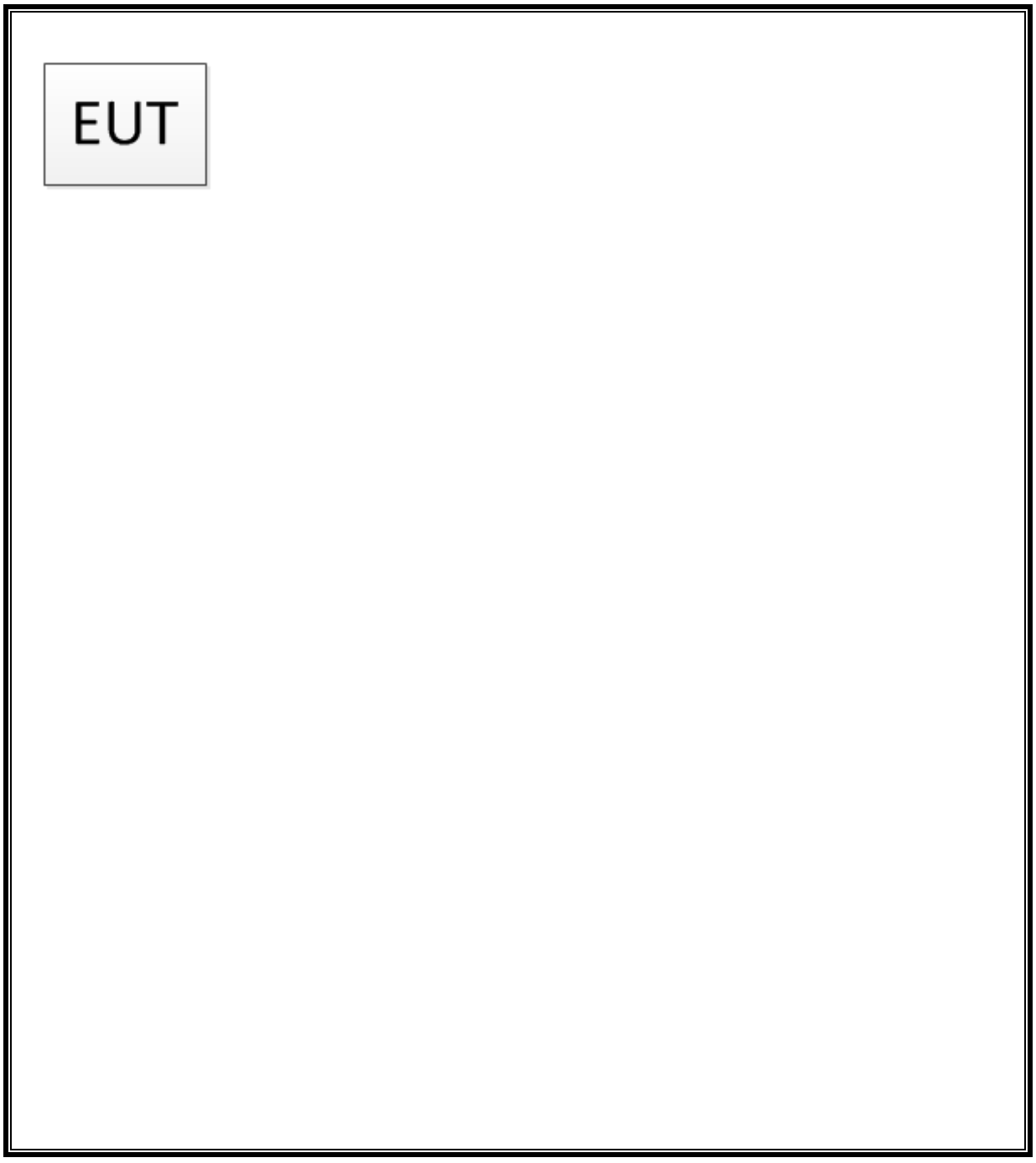
I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	0	USB	USB	1	None

TEST SETUP

The EUT is battery operated and was tested in normal operating mode, the test units were programed for lowest, middle and highest channel operation only. A separate sample was used with an iPod Touch to imitate normal hopping operation.

For the radiated tests, sampels were provided witout the final plastic inclosure, as plastic does not affect wireless signals the test data is considered worst case without the plastic enclosure. The final assembly will have a plastic enclosure.

SETUP DIAGRAM FOR TESTS



5. 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**	**T 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	ESR	EMC4377	04/20/15	04/20/16
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224	N/A	N/A
HighPass Filter	Solar Electronics	2803-150	EMC4327	N/A	N/A
Attenuator	HP	8494B	2831A00838	N/A	N/A
LISN - L1	Solar	8602-50-TS-50-N	EMC4052	01/15/15	01/15/16
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	01/09/15	01/09/16
Signal Analyzer	Agilent	PXA	EMC4360	12/19/14	12/19/15
Near Field Probe	EMCO	7405	1270	N/A	N/A
Test Receiver	Rhode & Schwarz	ESCI	EMC4328	12/18/14	12/30/15
Log-P Antenna	Chase	UPA6112A	EMC4313	11/19/14	11/19/15
Bicon Antenna	Electro-Metrics	UPA6109	EMC4323	12/18/14	12/31/15
Antenna Array	UL	BOMS	EMC4276	NA	NA
Test Receiver	Rhode & Schwarz	ESU	EMC4323	12/16/14	12/30/15

6. TEST RESULTS

6.1. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

The manufacturer has stated that the duty cycle is (.68*554μs +.32*1332μs)/30ms=2.7%

6.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

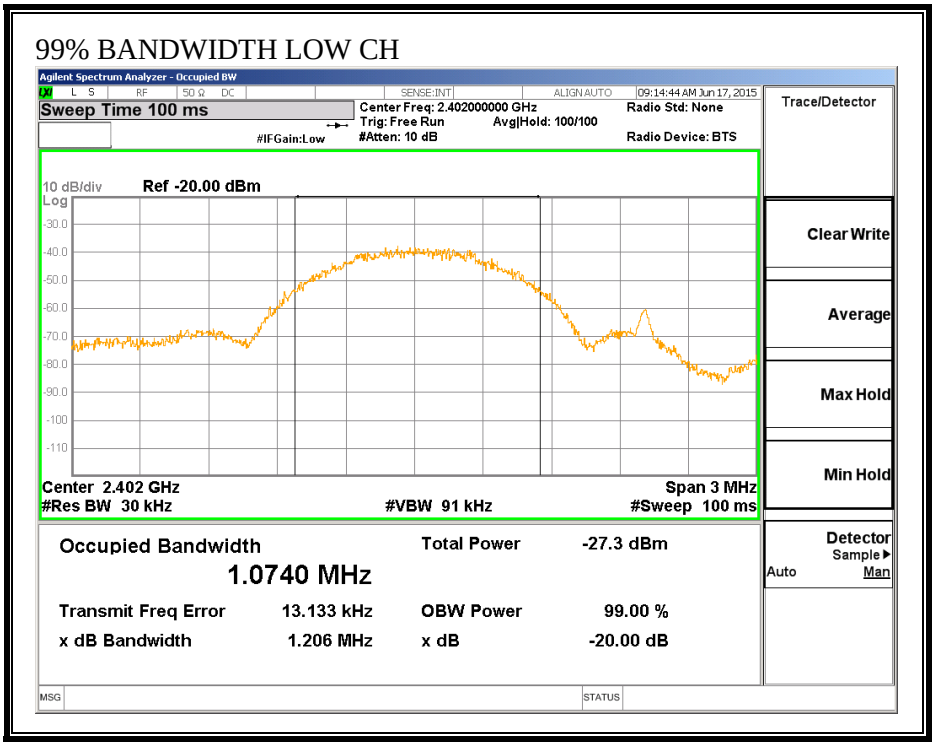
TEST PROCEDURE

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.

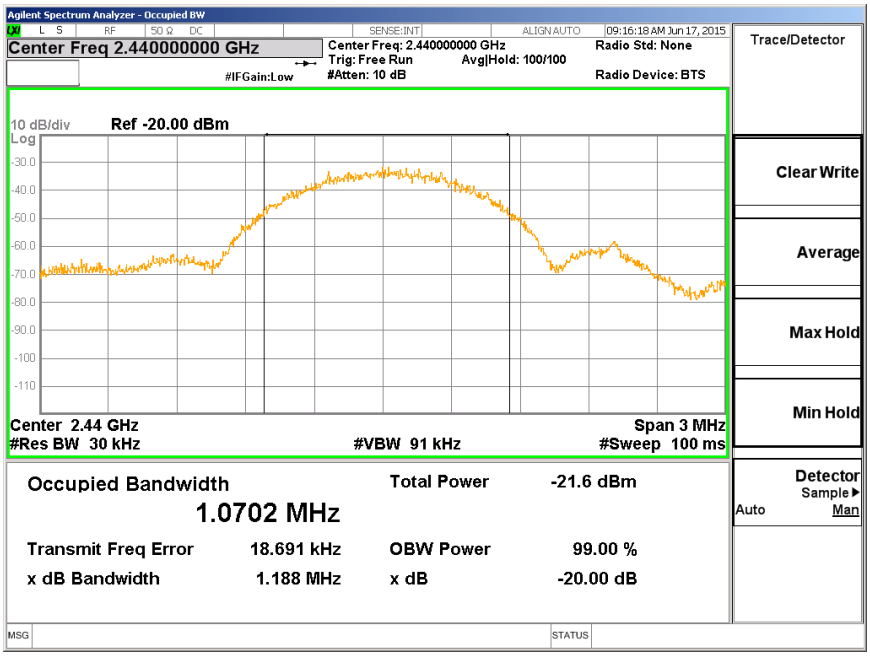
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.074
Middle	2440	1.0702
High	2480	1.0778

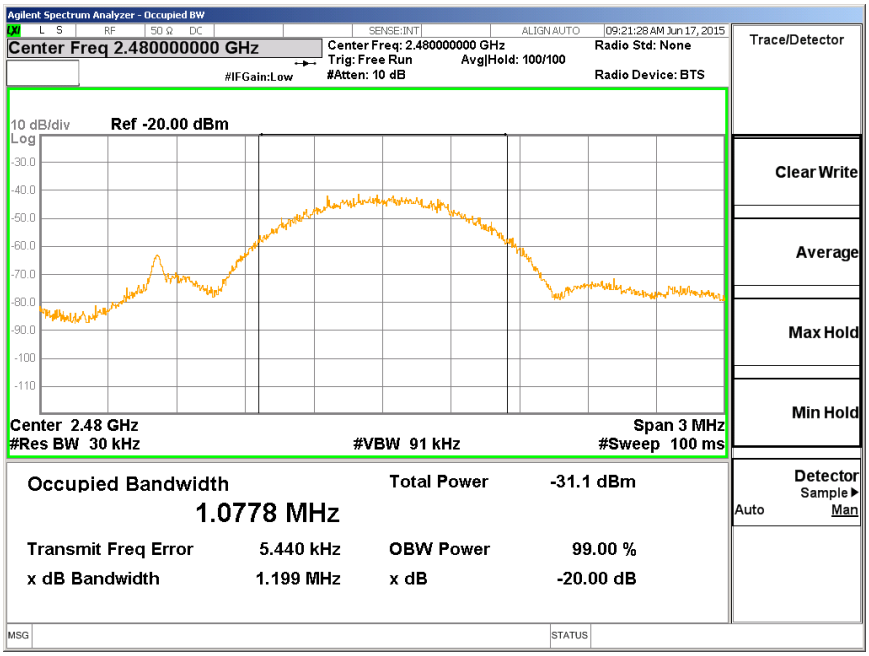
99% BANDWIDTH



99% BANDWIDTH MID CH



99% BANDWIDTH HIGH CH



6.3. 20dB BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

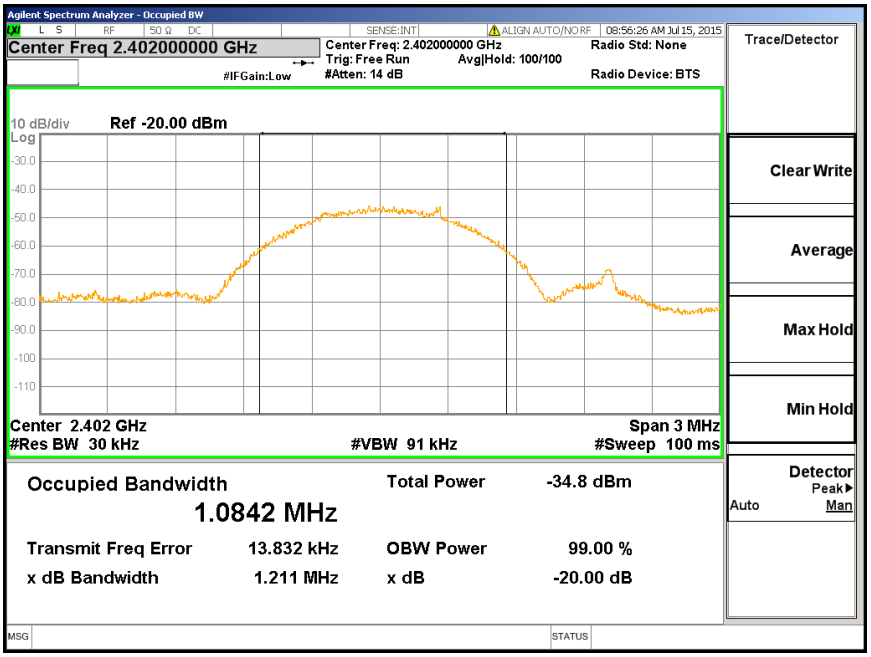
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

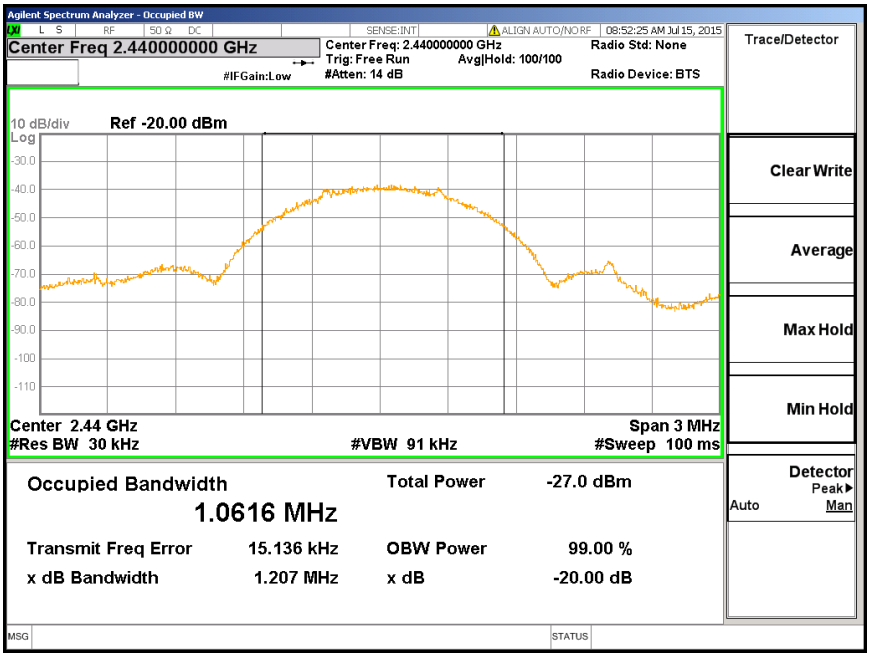
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.211
Middle	2440	1.207
High	2480	1.226

20dB BANDWIDTH

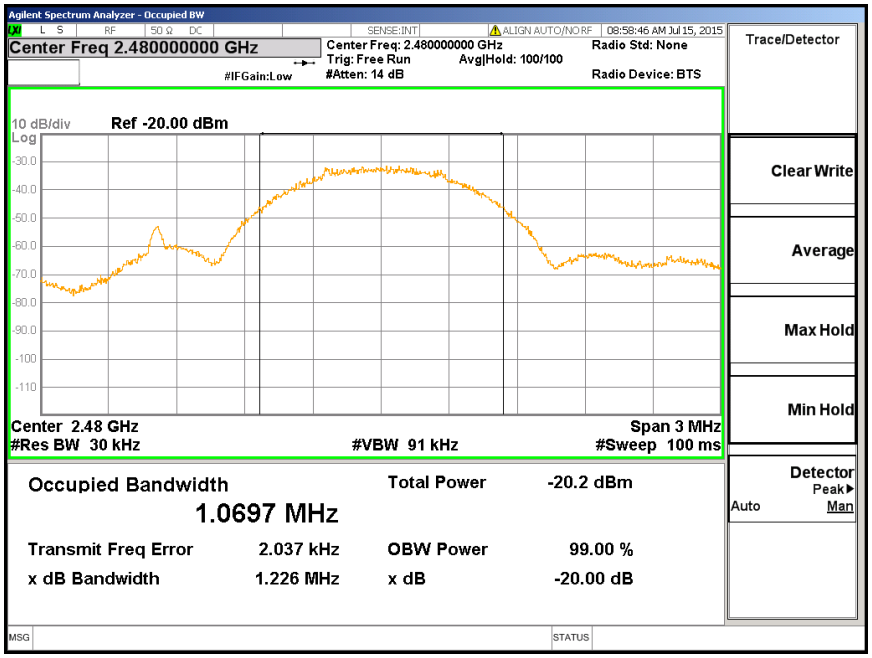
20dB BANDWIDTH LOW CH



20dB BANDWIDTH MID CH



20dB BANDWIDTH HIGH CH



6.4. 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

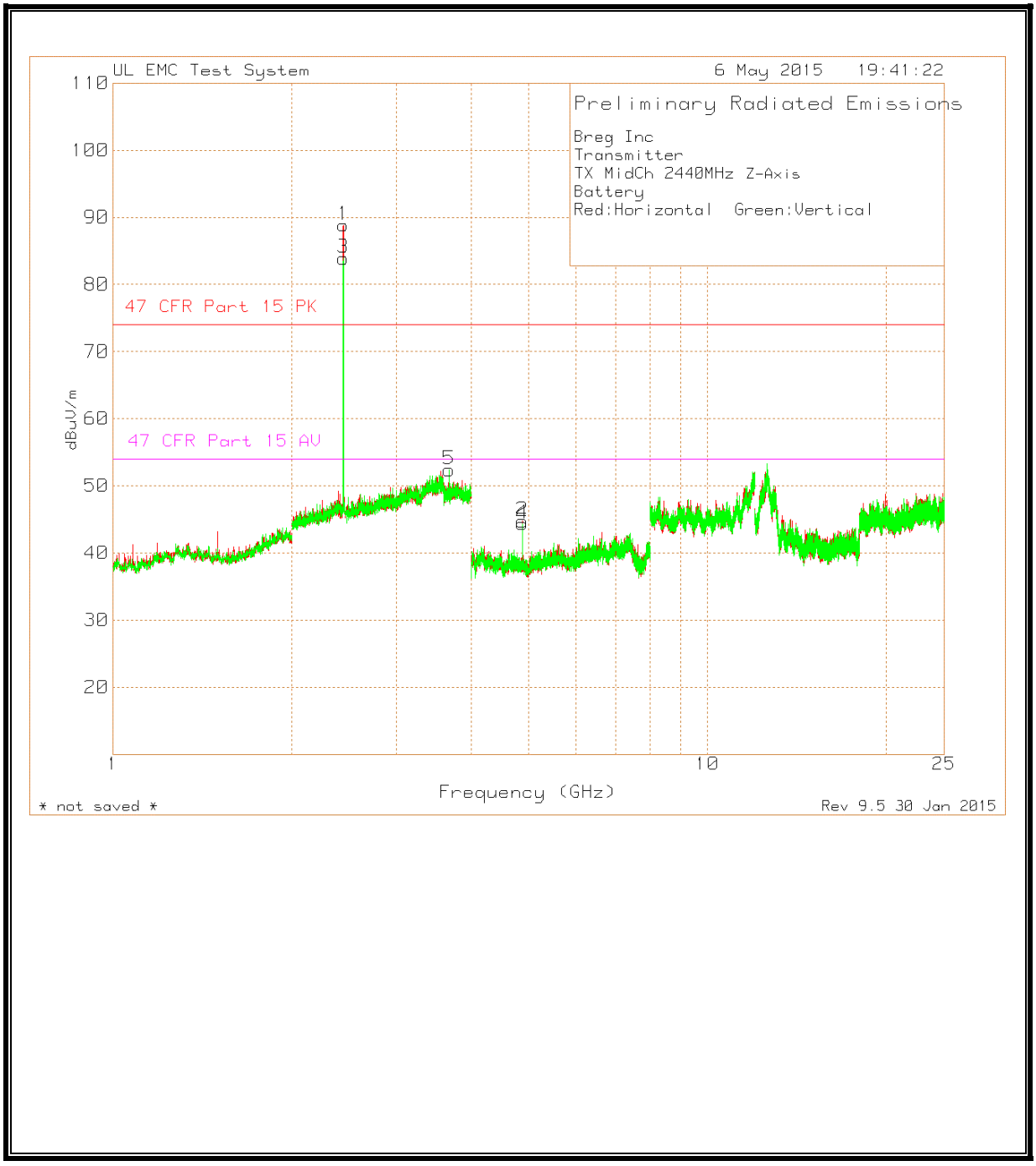
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

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

6.4.1. FUNDAMENTAL FREQUENCY RADIATED EMISSION



Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	47 CFR Part 15 PK	Margin (dB)	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.44	62.38	Pk	21.9	4.58	88.86	-	-	-	-	0-360	200	H
2	4.882	67.41	Pk	27.7	-50.37	44.74	74	-29.26	54	-9.26	0-360	200	H
3	2.44	57.45	Pk	21.9	4.58	83.93	-	-	-	-	0-360	99	V
5	3.675	22.94	Pk	23.4	6.04	52.38	74	-21.62	54	-1.62	0-360	150	V
4	4.881	67.03	Pk	27.7	-50.36	44.37	74	-29.63	54	-9.63	0-360	99	V

Pk - Peak detector

Radiated Emission Data												
Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	47 CFR Part 15 PK	Margin (dB)	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
3.675	28.48	Pk	23.4	6.04	57.92	74	-16.08	-	-	0	150	V
3.6755	15.86	Av	23.4	6.04	45.3	-	-	54	-8.7	0	150	V
4.8805	69.08	Pk	27.7	-50.36	46.42	74	-27.58	-	-	270	100	H
4.88	61.87	Av	27.7	-50.35	39.22	-	-	54	-14.78	270	100	H
4.8805	68.81	Pk	27.7	-50.36	46.15	74	-27.85	-	-	72	100	V
4.88	62.57	Av	27.7	-50.35	39.92	-	-	54	-14.08	72	100	V

Pk - Peak detector
Av - Average detection

Rev 9.5 30 Jan 2015

6.4.2. FUNDAMENTAL FREQUENCY RADIATED EMISSION WORST CASE DATA

Radiated Emission Data													
Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB)	Gain/Loss (dB)	Corrected Reading dBuV/m	47 CFR Part 15 PK	PK Margin (dB)	47 CFR Part 15 AV	AV Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity	Notes
2.4402	64.12	Pk	21.9	4.58	90.6	114	-23.4	94	-3.4	358	100	H	1
2.44	63.25	Av	21.9	4.58	89.73	114	-24.27	94	-4.27	358	100	H	1
2.4403	55.52	Pk	21.9	4.58	82	114	-32	94	-12	161	350	V	1
2.44	54.52	Av	21.9	4.58	81	114	-33	94	-13	161	350	V	1
2.4402	58.14	Pk	21.9	4.58	84.62	114	-29.38	94	-9.38	357	100	H	2
2.44	57.17	Av	21.9	4.58	83.65	114	-30.35	94	-10.35	357	100	H	2
2.4402	63.49	Pk	21.9	4.58	89.97	114	-24.03	94	-4.03	222	100	V	2
2.44	62.62	Av	21.9	4.58	89.1	114	-24.9	94	-4.9	222	100	V	2
2.4403	65.01	Pk	21.9	4.58	91.49	114	-22.51	94	**-2.51**	173	173	H	3
2.44	64.14	Av	21.9	4.58	90.62	114	-23.38	94	-3.38	173	173	H	3
2.4403	60	Pk	21.9	4.58	86.48	114	-27.52	94	-7.52	98	100	V	3
2.44	59.07	Av	21.9	4.58	85.55	114	-28.45	94	-8.45	98	100	V	3

Notes:
1 - X-Axis LED Up MidCh
2 - Y-Axis
3 - Z-Axis

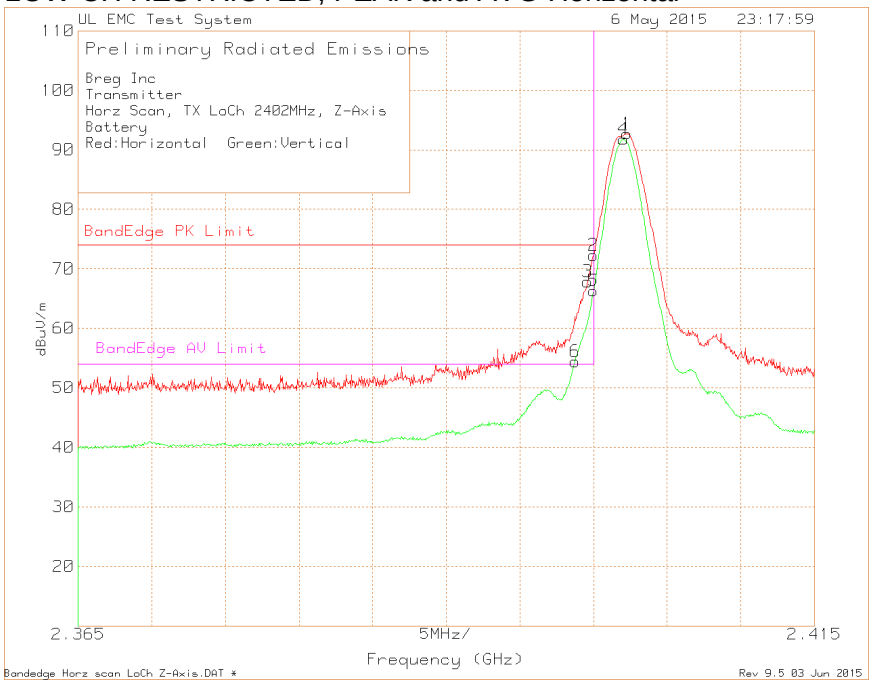
Pk - Peak detector
Av - Average detection

Rev 9.5 30 Jan 2015

6.4.3. TRANSMITTER RESTRICTED BAND EDGES

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CH RESTRICTED, PEAK and AVG Horizontal



LOW CH RESTRICTED, Peak and AVG, Horizontal Data

Trace Markers

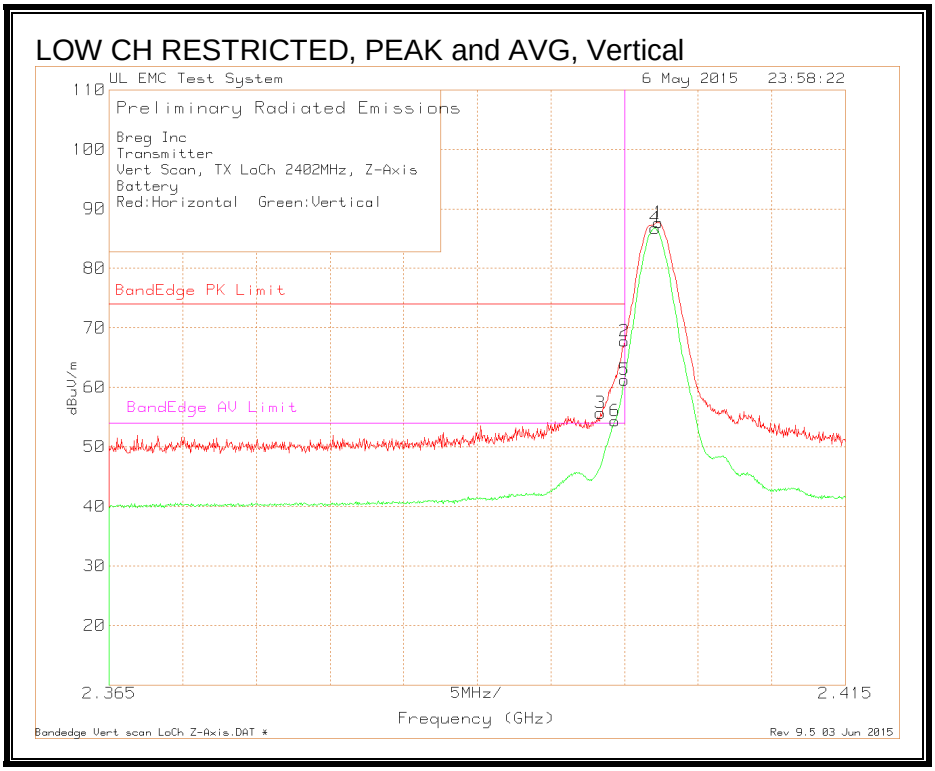
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	Duty Cycle Average Relaxation (dB)	Band Edge PK Limit	Margin (dB)	Band Edge AV Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.4023	66.34	Pk	21.8	4.58	92.72	-31.37	-	-	-	-	177	145	H
2	2.4	45.85	Pk	21.8	4.61	72.26	-31.37	74	-1.74	54	-13.11	177	145	H
3	2.3996	41.43	Pk	21.8	4.61	67.84	-31.37	74	-6.16	54	-17.53	177	145	H
4	2.4021	65.41	Pk	21.8	4.58	91.79	-31.37	-	-	-	-	177	145	H
5	2.4	39.9	Pk	21.8	4.61	66.31	-31.37	74	-7.69	54	-19.06	177	145	H
6	2.3988	27.98	Pk	21.8	4.62	54.4	-31.37	74	-19.6	54	-30.97	177	145	H

Pk - Peak detector

Rev 9.5 03 Jun 2015

The manufacturer has stated that the duty cycle is (.68*554µs +.32*1332µs)/30ms=2.7%, this was used to calculate the duty cycle relaxation (20*log(0.027))=-31.37dB.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



LOW CH RESTRICTED, PEAK and AVG, Vertical Data

Trace Markers

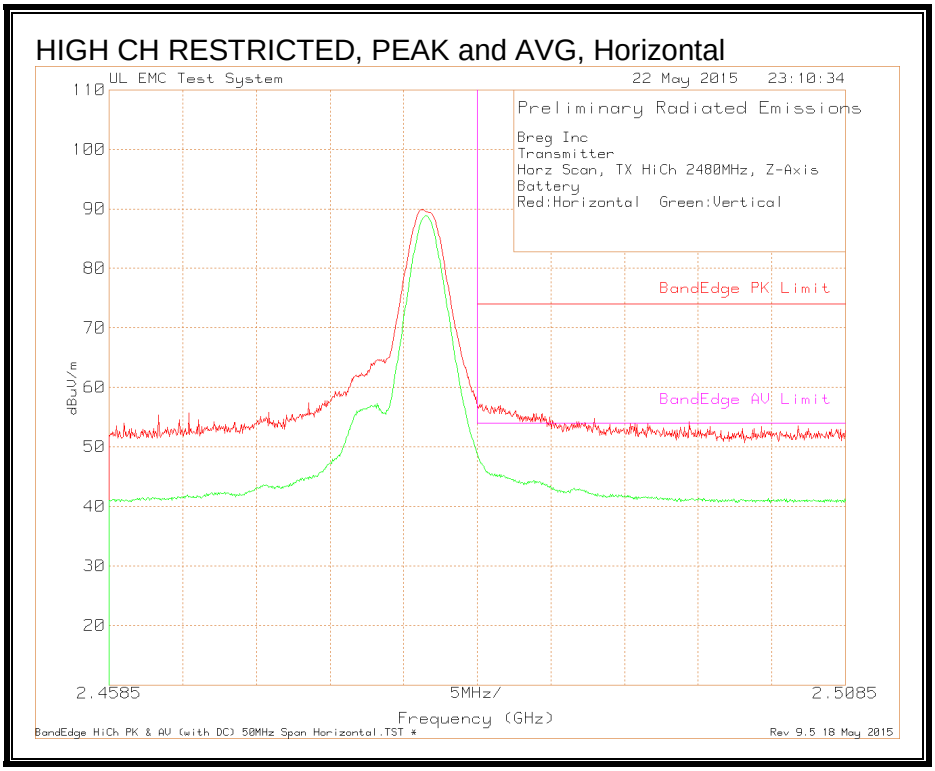
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	Duty Cycle Average Relaxation (dB)	Band Edge PK Limit	Margin (dB)	Band Edge AV Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.4023	61.32	Pk	21.8	4.58	87.7	-31.37	-	-	-	-	94	99	V
2	2.4	41.37	Pk	21.8	4.61	67.78	-31.37	74	-6.22	54	-17.59	94	99	V
3	2.3984	29.26	Pk	21.8	4.63	55.69	-31.37	74	-18.31	54	-29.68	94	99	V
4	2.4021	60.39	Pk	21.8	4.58	86.77	-31.37	-	-	-	-	94	99	V
5	2.4	34.85	Pk	21.8	4.61	61.26	-31.37	74	-12.74	54	-24.11	94	99	V
6	2.3994	27.93	Pk	21.8	4.62	54.35	-31.37	74	-19.65	54	-31.02	94	99	V

Pk - Peak detector

Rev 9.5 03 Jun 2015

The manufacturer has stated that the duty cycle is (.68*554µs +.32*1332µs)/30ms=2.7%, this was used to calculate the duty cycle relaxation (20*log(0.027))=-31.37dB.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



HIGH CH RESTRICTED, PEAK and AVG, Horizontal Data

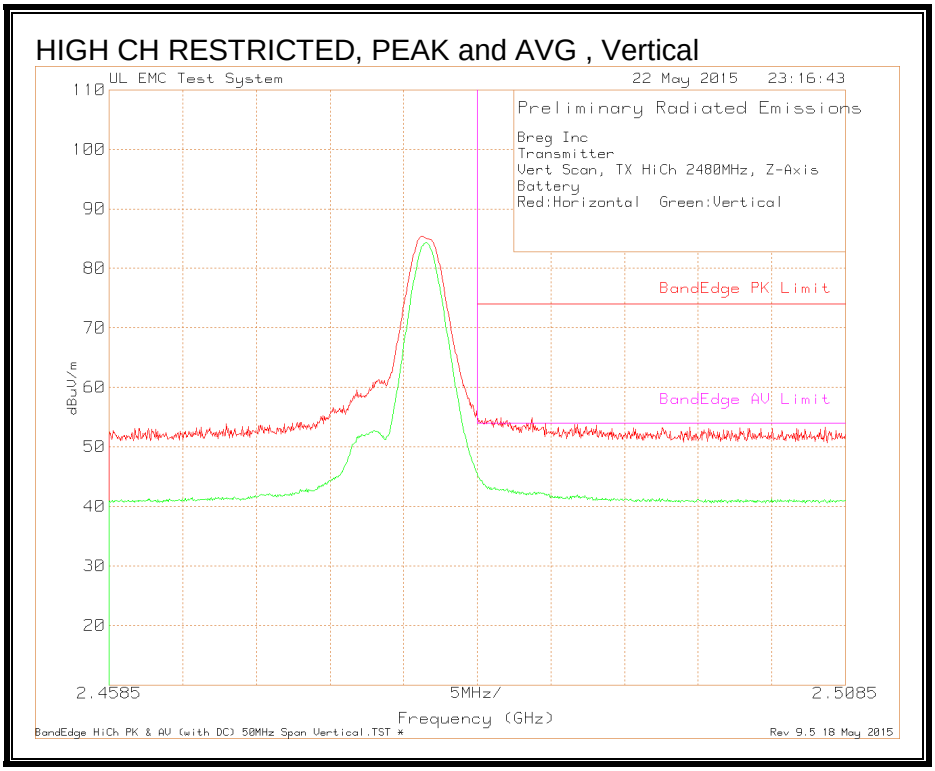
Trace Markers														
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Gain/Loss (dB)	Corrected Reading dBuV/m	Duty Cycle Average Relaxation	BandEdge PK Limit	Margin (dB)	Band Edge AV Limit	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.4798	63.52	Pk	22	4.36	89.88	-31.37	-	-	-	-	195	146	H
2	2.4835	30.89	Pk	22.1	4.37	57.36	-31.37	-	-	-	-	195	146	H
3	2.4835	30.62	Pk	22.1	4.37	57.09	-31.37	74	-16.91	54	-28.28	195	146	H
4	2.4836	30.3	Pk	22.1	4.37	56.77	-31.37	74	-17.23	54	-28.6	195	146	H
5	2.4851	30.46	Pk	22.1	4.37	56.93	-31.37	74	-17.07	54		195	146	H
6	2.48	62.55	Pk	22	4.36	88.91	-31.37	-	-	-	-	195	146	H
7	2.4835	22.69	Pk	22.1	4.37	49.16	-31.37	-	-	-	-	195	146	H
8	2.4835	22.31	Pk	22.1	4.37	48.78	-31.37	74	-25.22	54	-36.59	195	146	H
9	2.4836	22.09	Pk	22.1	4.37	48.56	-31.37	74	-25.44	54	-36.81	195	146	H
10	2.4851	18.44	Pk	22.1	4.37	44.91	-31.37	74	-29.09	54	-40.46	195	146	H

Pk - Peak detector

Rev 9.5 18 May 2015

The manufacturer has stated that the duty cycle is (.68*554µs +.32*1332µs)/30ms=2.7%, this was used to calculate the duty cycle relaxation (20*log(0.027))=-31.37dB.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CH RESTRICTED, Peak and AVG, Vertical Data

Trace Markers

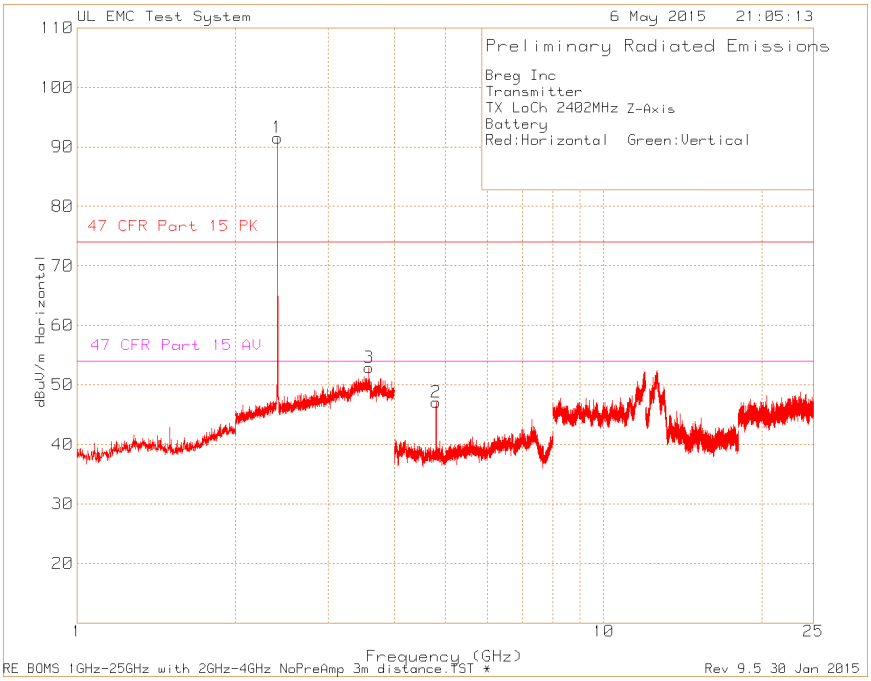
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	Duty Cycle Average Relaxation	BandEdge PK Limit	Margin (dB)	Band Edge AV Limit	Margin (dB)	Azimuth [Degs]	Height [cm]
1	2.4798	59.05	Pk	22	4.36	85.41	-31.37	-	-	-	-	72	100
2	2.4835	29.57	Pk	22.1	4.37	56.04	-31.37	-	-	-	-	72	100
3	2.4835	28.14	Pk	22.1	4.37	54.61	-31.37	74	-19.39	54	-30.76	72	100
4	2.4836	28.29	Pk	22.1	4.37	54.76	-31.37	74	-19.24	54	-30.61	72	100
5	2.4872	28.42	Pk	22.1	4.38	54.9	-31.37	74	-19.1	54	-30.47	72	100
6	2.48	58.02	Pk	22	4.36	84.38	-31.37	-	-	-	-	72	100
7	2.4835	19.27	Pk	22.1	4.37	45.74	-31.37	-	-	-	-	72	100
8	2.4835	19	Pk	22.1	4.37	45.47	-31.37	74	-28.53	54	-39.9	72	100
9	2.4836	18.58	Pk	22.1	4.37	45.05	-31.37	74	-28.95	54	-40.32	72	100
10	2.4872	15.55	Pk	22.1	4.38	42.03	-31.37	74	-31.97	54	-43.34	72	100

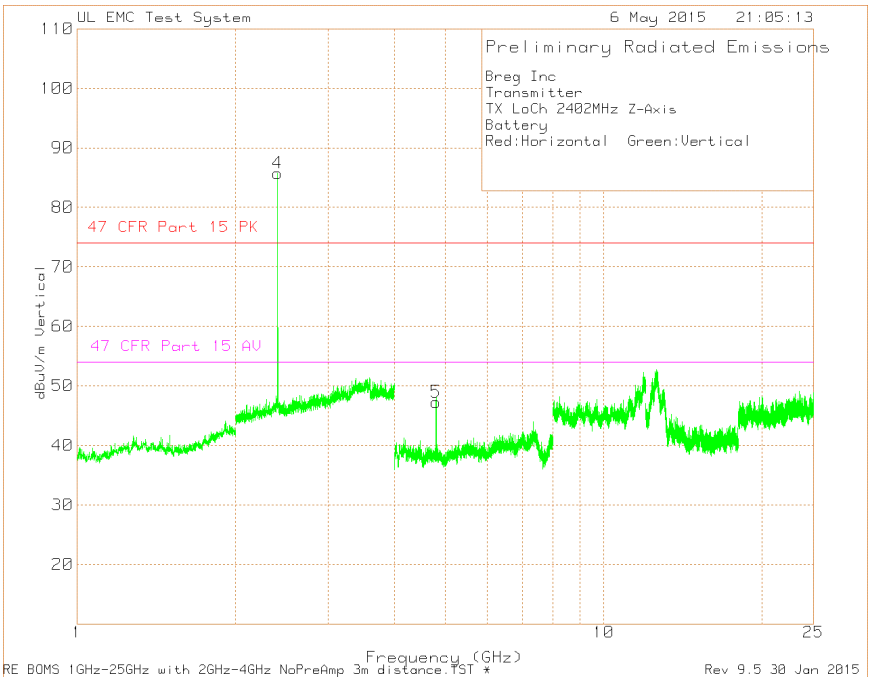
Pk - Peak detector

Rev 9.5 18 May 2015

The manufacturer has stated that the duty cycle is (.68*554µs +.32*1332µs)/30ms=2.7%, this was used to calculate the duty cycle relaxation (20*log(0.027))=-31.37dB.

6.4.4. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz





HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz

Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	47 CFR Part 15 PK	Margin (dB)	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.402	65.16	Pk	21.8	4.58	91.54	-	-	-	-	0-360	150	H
3	3.583	23.88	Pk	23.3	5.71	52.89	74	-21.11	54	-1.11	0-360	200	H
2	4.805	70.01	Pk	27.7	-50.63	47.08	74	-26.92	54	-6.92	0-360	200	H
4	2.402	59.34	Pk	21.8	4.58	85.72	-	-	-	-	0-360	99	V
5	4.803	70.2	Pk	27.7	-50.67	47.23	74	-26.77	54	-6.77	0-360	99	V

Pk - Peak detector

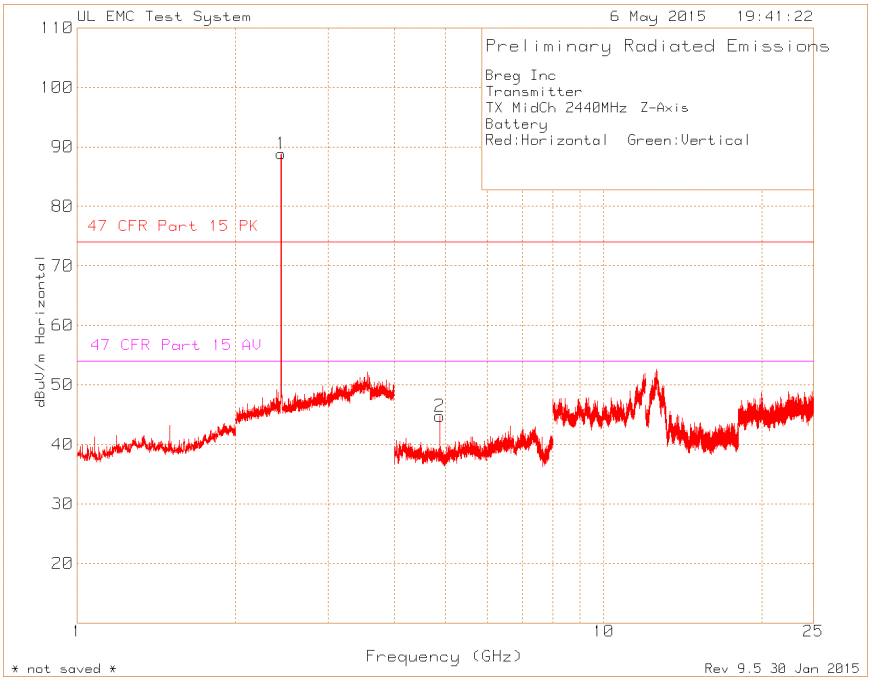
Radiated Emission Data													
Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	47 CFR Part 15 PK	Margin (dB)	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity	Notes
3.5837	31.11	Pk	23.2	5.71	60.02	74	-13.98	-	-	360	200	H	3
3.5473	30.89	Pk	23.4	5.67	59.96	74	-14.04	-	-	360	200	H	3
3.584	17.09	Avg	23.2	5.71	46	-	-	54	-8	360	200	H	3
4.8046	71.72	Pk	27.7	-50.64	48.78	74	-25.22	-	-	282	100	H	3
4.804	66.49	Av	27.7	-50.65	43.54	-	-	54	-10.46	282	100	H	3
4.8045	72.23	Pk	27.7	-50.64	49.29	74	-24.71	-	-	75	100	V	3
4.804	67.09	Av	27.7	-50.65	44.14	-	-	54	-9.86	75	100	V	3

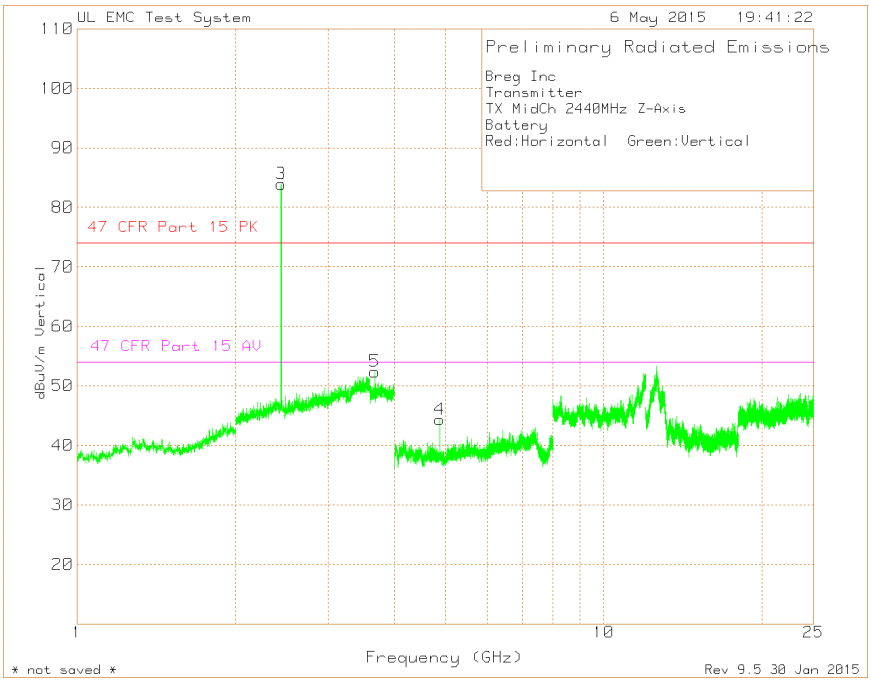
Notes:
3 - Z-Axis

Pk - Peak detector
Avg - Video < Resolution bandwidth Log IF
Av - Average detection

Rev 9.5 30 Jan 2015

HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz





HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz

Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	47 CFR Part 15 PK	Margin (dB)	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.44	62.38	Pk	21.9	4.58	88.86	-	-	-	-	0-360	200	H
2	4.882	67.41	Pk	27.7	-50.37	44.74	74	-29.26	54	-9.26	0-360	200	H
3	2.44	57.45	Pk	21.9	4.58	83.93	-	-	-	-	0-360	99	V
5	3.675	22.94	Pk	23.4	6.04	52.38	74	-21.62	54	-1.62	0-360	150	V
4	4.881	67.03	Pk	27.7	-50.36	44.37	74	-29.63	54	-9.63	0-360	99	V

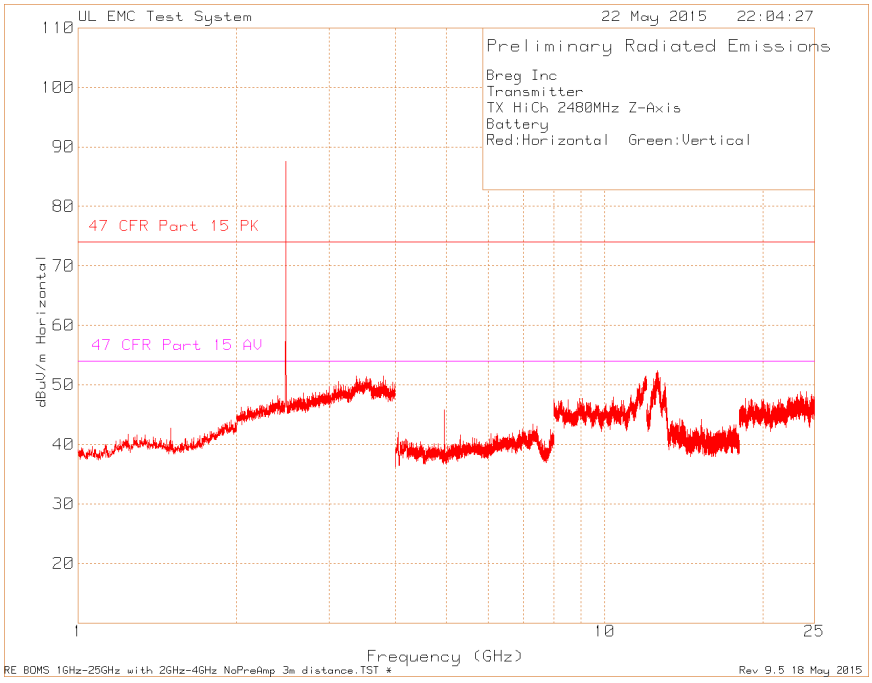
Pk - Peak detector

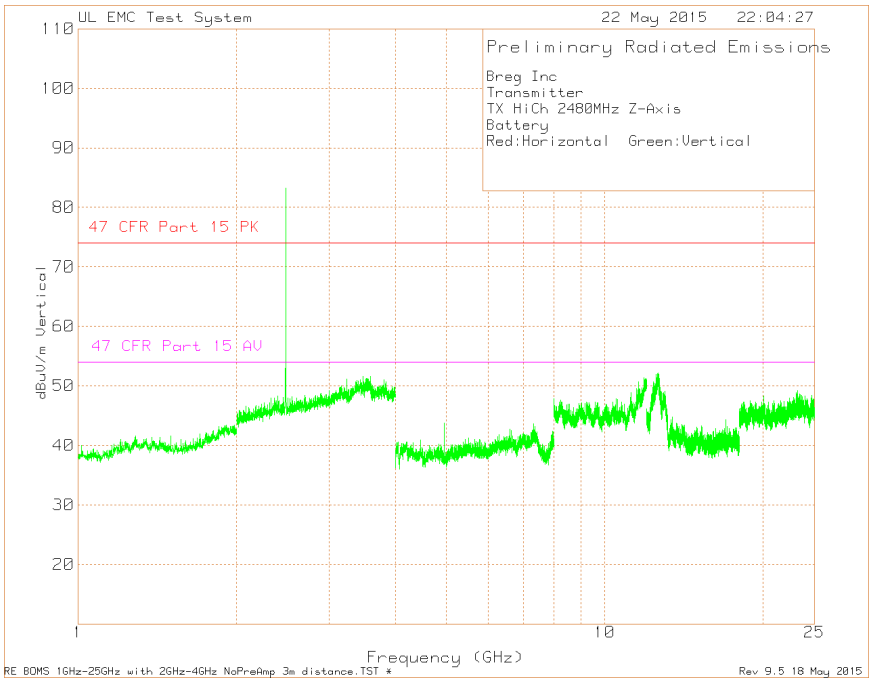
Radiated Emission Data												
Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	47 CFR Part 15 PK	Margin (dB)	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
3.675	28.48	Pk	23.4	6.04	57.92	74	-16.08	-	-	0	150	V
3.6755	15.86	Av	23.4	6.04	45.3	-	-	54	-8.7	0	150	V
4.8805	69.08	Pk	27.7	-50.36	46.42	74	-27.58	-	-	270	100	H
4.88	61.87	Av	27.7	-50.35	39.22	-	-	54	-14.78	270	100	H
4.8805	68.81	Pk	27.7	-50.36	46.15	74	-27.85	-	-	72	100	V
4.88	62.57	Av	27.7	-50.35	39.92	-	-	54	-14.08	72	100	V

Pk - Peak detector
Av - Average detection

Rev 9.5 30 Jan 2015

HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz





HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz

Trace Markers													
Marker No.	Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	47 CFR Part 15 PK	Margin (dB)	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	2.48	61.15	Pk	22	4.36	87.51	-	-	-	-	0-360	150	H
2	4.96	68.7	Pk	27.8	-50.74	45.76	74	-28.24	54	-8.24	0-360	100	H
3	2.48	56.92	Pk	22	4.36	83.28	-	-	-	-	0-360	100	V
4	4.96	66.68	Pk	27.8	-50.74	43.74	74	-30.26	54	-10.26	0-360	100	V

Pk - Peak detector

Radiated Emission Data													
Test Frequency (GHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	Corrected Reading dBuV/m	47 CFR Part 15 PK	Margin (dB)	47 CFR Part 15 AV	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity	Notes
4.9598	69.4	Pk	27.8	-50.74	46.46	74	-27.54	-	-	360	100	H	1
4.96	63.32	Av	27.8	-50.74	40.38	-	-	54	-13.62	360	100	H	1
4.9597	69.28	Pk	27.8	-50.74	46.34	74	-27.66	-	-	257	100	V	1
4.96	62.08	Av	27.8	-50.74	39.14	-	-	54	-14.86	257	100	V	1

Notes:
1 - HiCh Z-Axis

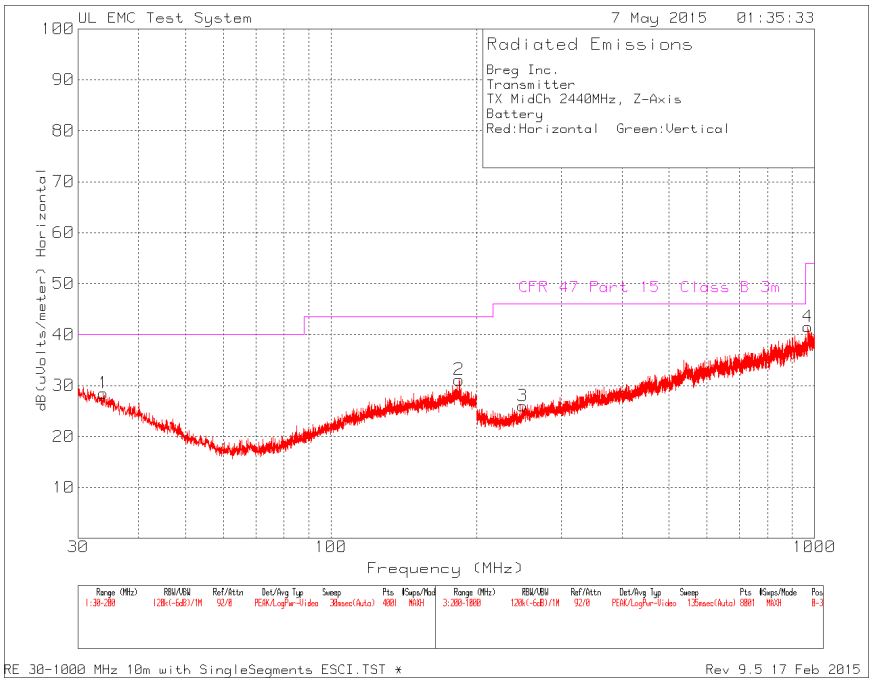
Pk - Peak detector
Av - Average detection

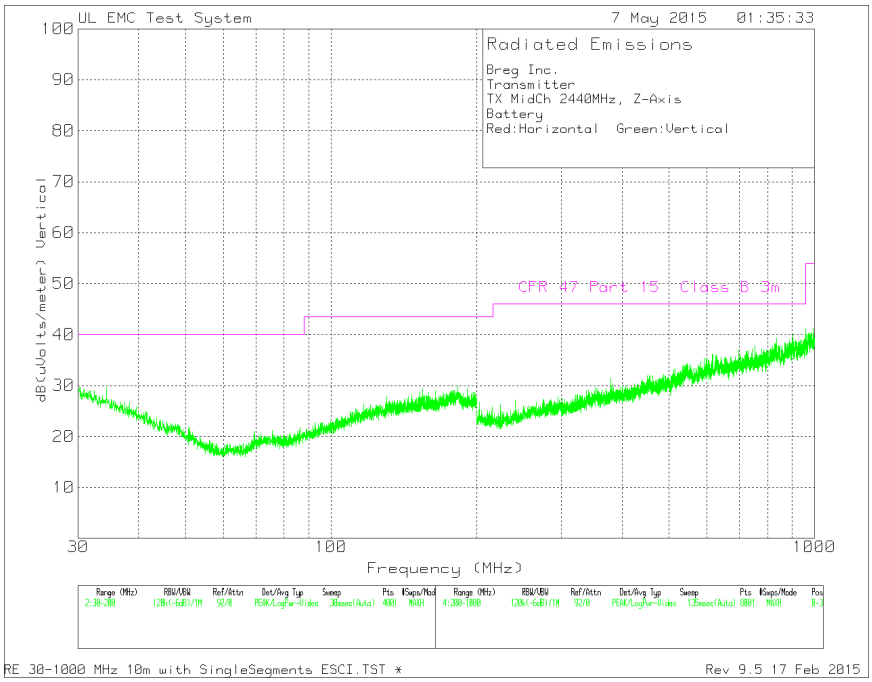
Rev 9.5 18 May 2015

WORST-CASE BELOW 1 GHz

6.4.5. SPURIOUS EMISSIONS 30 TO 1000 MHz

(TX MidCh Battery Plot)





SPURIOUS EMISSIONS 30 TO 1000 MHz (TX MidCh Battery Data)

Trace Markers

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor	Cable Factor	10m to 3m Limit	Corrected Reading dB(uVolts/ meter)	CFR 47 Part 15 Class B 3m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	33.825	31.46	Pk	16.6	-30.1	10.5	28.46	40	-11.54	0-360	400	H
2	183.9775	33.73	Pk	16.1	-29.2	10.5	31.13	43.52	-12.39	0-360	250	H
3	249.1	32.41	Pk	11.9	-28.8	10.5	26.01	46.02	-20.01	0-360	300	H
4	970.2	32.33	Pk	23.9	-25.2	10.5	41.53	53.97	-12.44	0-360	300	H

Pk - Peak detector

Rev 9.5 17 Feb 2015