FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

Bluetooth® 4.0 Low Energy Single Mode Module

MODEL NUMBER: BR-LE4.0-S2A

FCC ID: XDULE40-S2
IC: 8456A-LE4S2

REPORT NUMBER: 11U13712-1

ISSUE DATE: 2011-07-15
REVISION DATE: 2011-12-28

Prepared for
BlueRadios, Inc.
7173 S. Havana Street, Suite 600
Englewood
CO, 80112, USA

Prepared by
UNDERWRITERS LABORATORIES INC.
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NVLAP LAB CODE 100255-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	2011-06-17	Initial Issue	B. DeLisi
1.0	2011-12-21	Manufacturer changed model number, FCC and IC ID numbers. Report updated to reflect new information.	B. DeLisi
1.1	2011-28-21	Updated antenna gain information, included omitted conducted mains data and test setup photos	B. DeLisi

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1285 WALT WHITMAN RD, MELVILLE, NY 11747, USA TEL: (631) 271-6200 FAX: (877) 854-3577

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BlueRadios, Inc.
7173 S. Havana Street, Suite 600
Englewood
CO, 80112, USA

EUT DESCRIPTION: Bluetooth® 4.0 Low Energy Single Mode Module

MODEL: BR-LE4.0-S2A

SERIAL NUMBER: None

DATE TESTED: 2011-04-25 to 2011-06-08

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

Underwriters Laboratories Inc. tested the above equipment in accordance with the requirements set forth in the above standards, using test results reported in the test report documents referenced below and/or documentation furnished by the applicant. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Inc. based on interpretations of these calculations. The results show that the equipment 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 by the referenced documents. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories 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.

Approved & Released For UL By:

Joseph Danisi
Lead Engineering Associate
UL

Tested By:

Bob DeLisi
Sr. Staff Engineer
UL

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4:2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 1285 Walt Whitman Rd. Melville, NY 11747, USA.

UL Melville is accredited by NVLAP, Laboratory Code 100255-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/1002550.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:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.3 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.00 dB

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 is an Bluetooth transceiver BR-LE4.0-S2A.

The radio module is manufactured by BlueRadio Inc

After testing was completed the manufacturer changed to the model number from BR-LE4.0-S2 to BR-LE4.0-S2A. Throughout this report the Model BR-LE4.0-S2 is representative of BR-LE4.0-S2A.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	LE	3.92	2.47

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a chip antenna with a maximum gain of 2 dBi.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Texas Instruments, Smart RF Studio rev. 1.4.9.

5.5. WORST-CASE CONFIGURATION AND MODE

All final tests in the LE mode were made at 1 Mb/s.

For radiated emissions below 1 GHz the worst-case configuration is determined to be the mode and channel with the highest output power.

Conducted mains tests the worst-case configuration is determined to be the mode and channel with the highest output power.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Test Board	BlueRadios Inc	BR-BOB Rev 2	-	N/A
Debugger	Texas Instruments	CC Debugger	10550	N/A
Laptop	Lenovo	T410	R801EHLE-10/10	DoC
Laptop AC Adapter	Lenovo	92P1156	11S92P1156Z1ZD XN0612XM	DoC

I/O CABLES

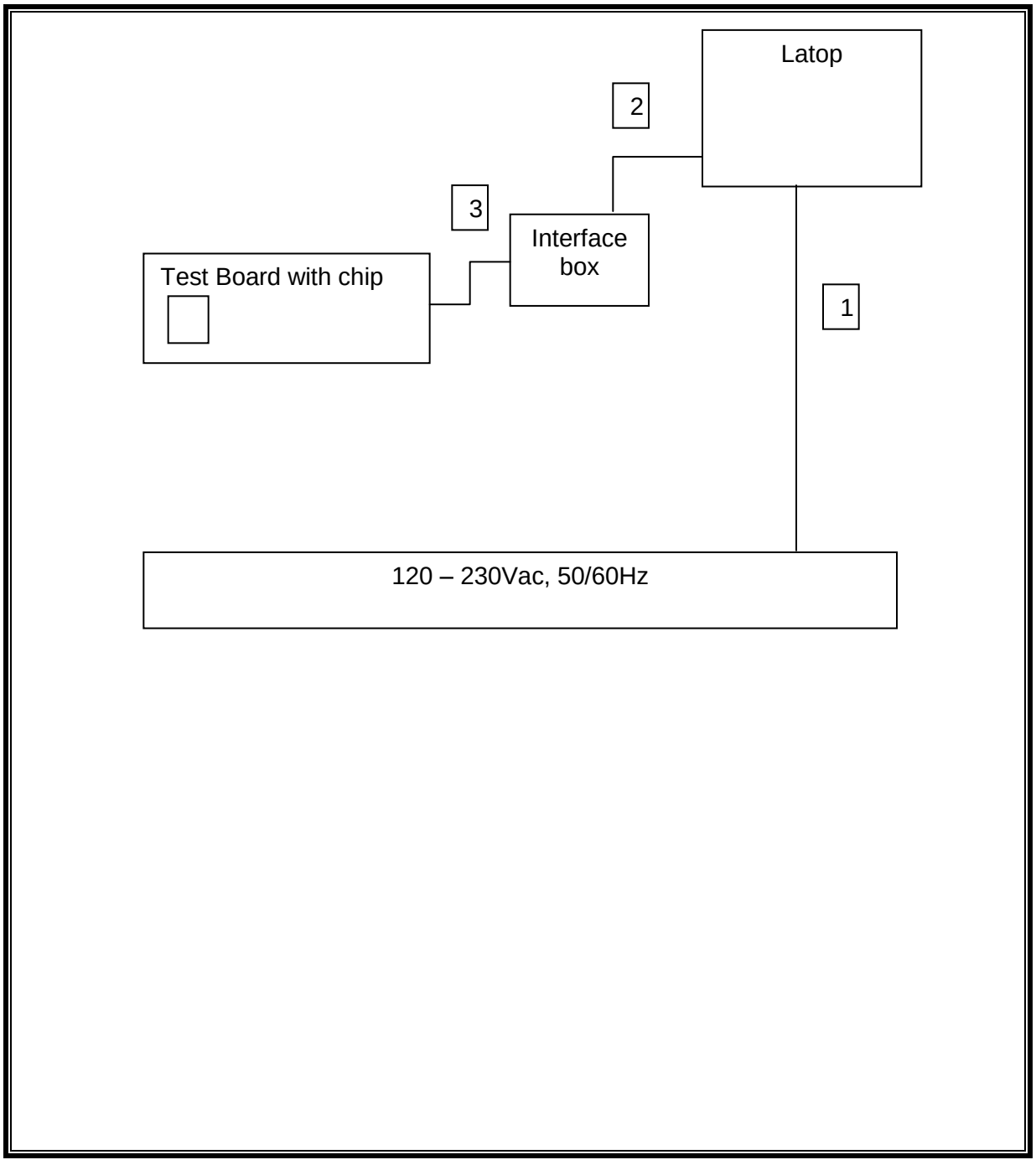
I/O CABLE LIST						
Cable No.	**Port**	**# of Identica Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	AC	Unshielded	1.8m	AC Power for Laptop only
2	USB	1	USB	Shielded	1.8m	None
3	Ribbon	1	10pin	Unshielded	0.13m	None

TEST SETUP

The EUT is installed on an adapter board during the tests. Test software exercised the radio.

The EUT was preliminary tested in the X, Y and Z axis for radiated testing. The Y axis was determined to represent the worst case configuration. All radiated testing was done in the orientation.

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	Identifier	Cal Date	Cal Due Date
30-1000MHz					
EMI Receiver	Rohde & Schwarz	ESIB40	34968	2011-03-01	2012-03-01
Log-P Antenna	Schaffner	UPA6109	AT0030	2010-06-28	2011-06-28
Bicon Antenna	Schaffner	VBA6106A	43441	2010-09-09	2011-09-09
Bias Tee	Miteq	AM-1523-7687	44392	N/A	N/A
Bias Tee	Miteq	AM-1523-7687	44393	N/A	N/A
Preamp	Miteq	AM-3A-000110-7687	44391	N/A	N/A
Preamp	Miteq	AM-3A-000110-7687	44394	N/A	N/A
Switch Driver	HP	11713A	ME7A-627	N/A	N/A
System Controller	Sunol Sciences	SC99V	44396	N/A	N/A
Camera Controller	Panasonic	WV-CU254	44395	N/A	N/A
RF Switch Box	UL	1	44398	N/A	N/A
Measurement Software	UL	Version 9.3	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2010-12-07	2012-12-07
Multimeter	Fluke	87V	44547	2011-02-01	2012-02-28
Above 1GHz (Band Optimized System)					
EMI Receiver	Rohde & Schwarz	ESIB40	34968	2011-03-01	2012-03-01
Horn Antenna (1-2 GHz)	ETS	3161-01	51442	2008-03-28	See * below
Horn Antenna (2-4 GHz)	ETS	3161-02	48107	2007-09-27	See * below
Horn Antenna (4-8 GHz)	ETS	3161-03	48106	2007-09-27	See * below
Horn Antenna (8-12 GHz)	ETS	3160-07	8933	2008-11-24	See * below
Horn Antenna (12-18 GHz)	ETS	3160-08	8932	2007-09-27	See * below
Horn Antenna (18-26.5 GHz)	ETS	3160-09	8947	2007-09-26	See * below
Signal Generator	Anritsu	68369B	63761	2011-02-02	2012-02-09
Signal Path Controller	HP	11713A	50250	N/A	N/A
Gain Controller	HP	11713A	50251	N/A	N/A
RF Switch / Preamp Fixture	UL	BOMS1	50249	N/A	N/A
System Controller	UL	BOMS2	50252	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2010-12-07	2012-12-07
Multimeter	Fluke	87V	44547	2011-02-01	2012-02-28

* - Note: As allowed by the calibration standard ANSI C63.4 Section 4.4.2, standard gain horns need only a one-time calibration. Only if physical damage occurs will the horn antenna require re-calibration.
* Gain standard horn antennas (sometimes called standard gain horn antennas) need not be calibrated beyond that which is provided by the manufacturer unless they are damaged or deterioration is suspected, or they are used at a distance closer than $2D^2/\lambda$. Gain standard horn antennas have gains that are fixed by their dimensions and dimensional tolerances.

Test Equipment Used – Antenna Port					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Conducted Antenna Port Tests					
EMI Receiver	Agilent	E4446A	70728	2011-02-04	2013-02-04
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2010-12-07	2012-12-07
Multimeter	Fluke	87V	44547	2011-02-01	2012-02-28

Test Equipment Used – Conducted Emissions					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Conducted Emissions – GP 1					
EMI Receiver	Rohde & Schwarz	ESIB26	ME5B-081	2011-01-27	2012-01-31
LISN	EMCO	3825/2R	ME5-790	2011-02-04	2012-02-29
LISN	Solar	9252-50-R-24-BNC	ME5A-636	2011-02-04	2012-02-29
Switch Driver	HP	11713A	44397	N/A	N/A
RF Switch Box	UL	4	44404	N/A	N/A

Test Equipment Used – Conducted Emissions					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Measurement Software	UL	Version 9.3	44736	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	43734	2010-03-08	2012-03-08
Multimeter	Fluke	83III	ME5B-305	2011-02-01	2012-02-29

7. ANTENNA PORT TEST RESULTS

7.1.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

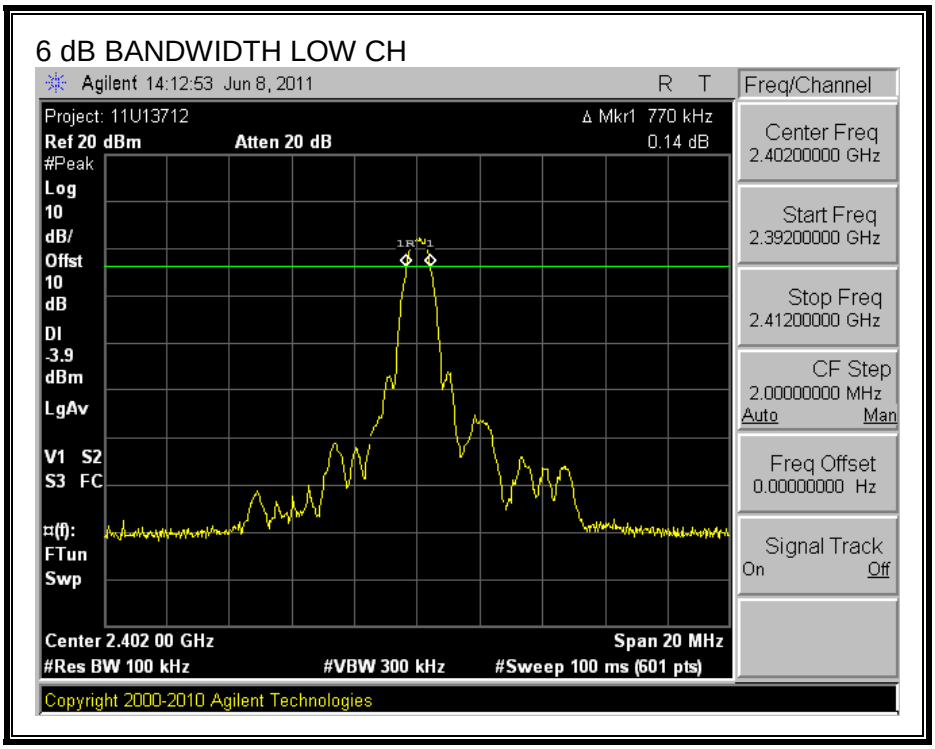
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

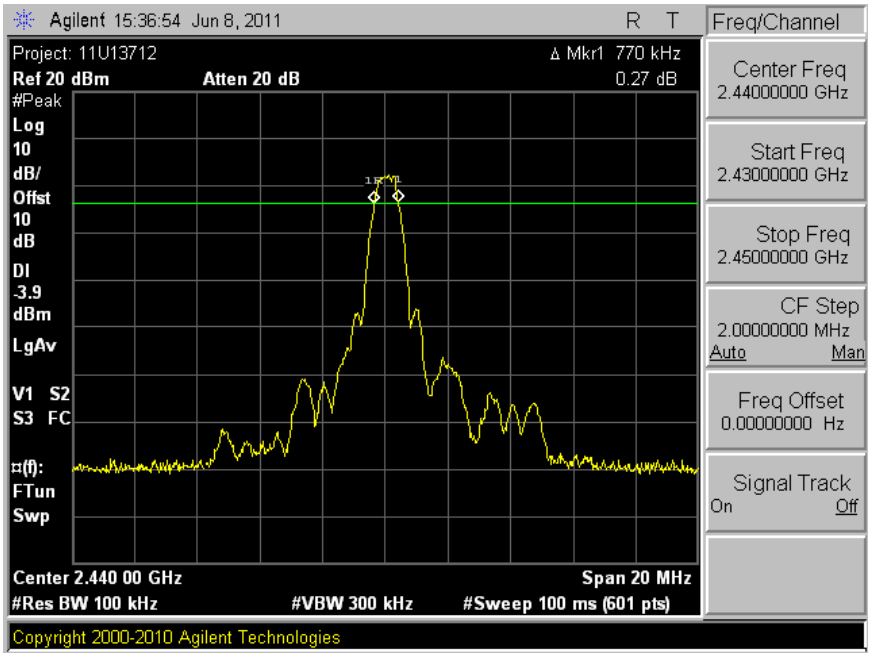
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.77	0.5
Middle	2440	0.77	0.5
High	2480	0.77	0.5

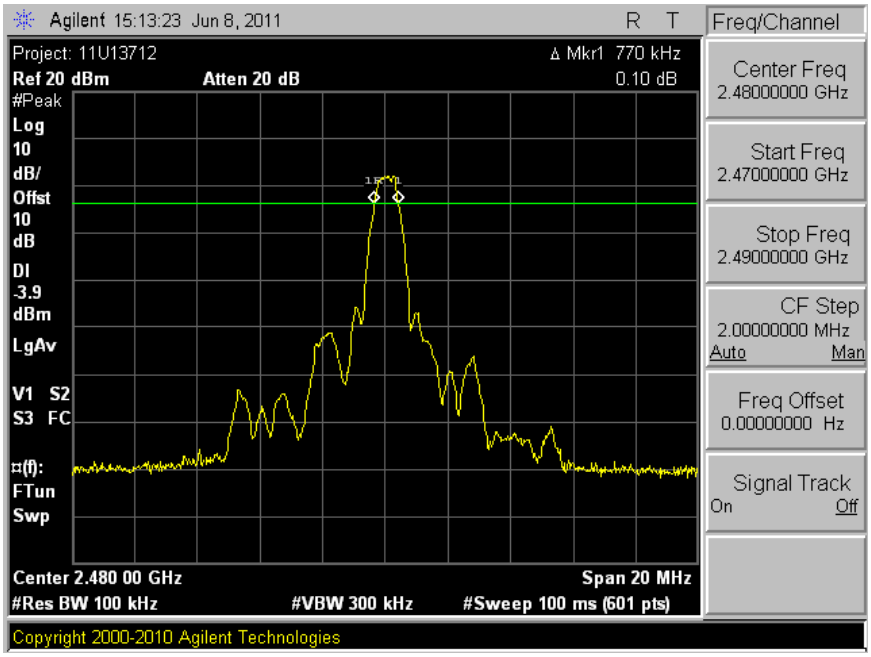
6 dB BANDWIDTH



6 dB BANDWIDTH MID CH



6 dB BANDWIDTH HIGH CH



7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

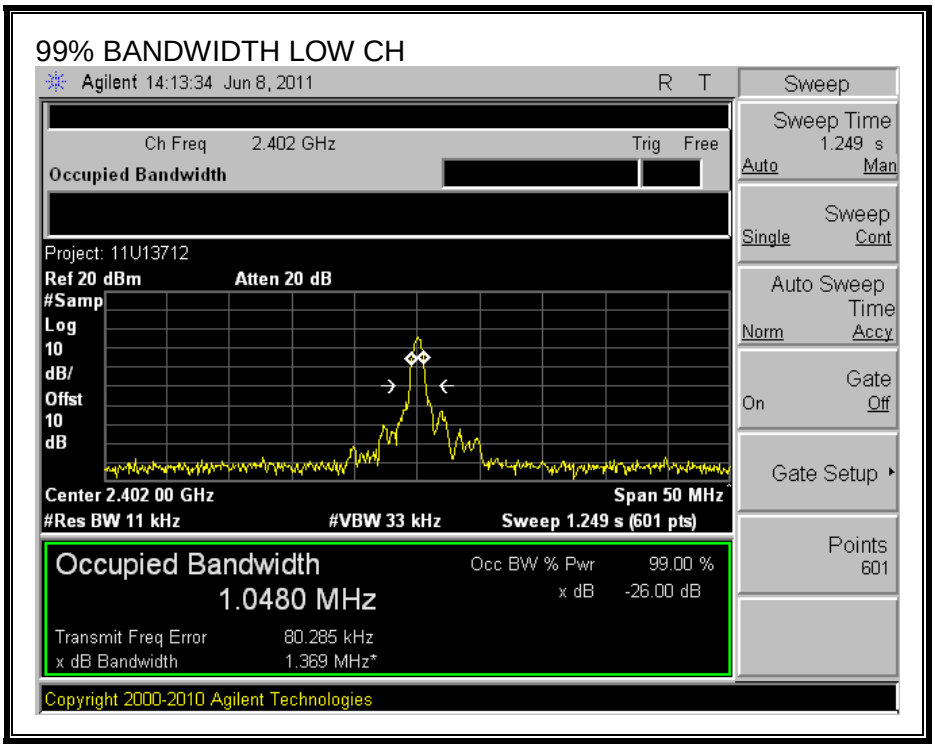
TEST PROCEDURE

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.

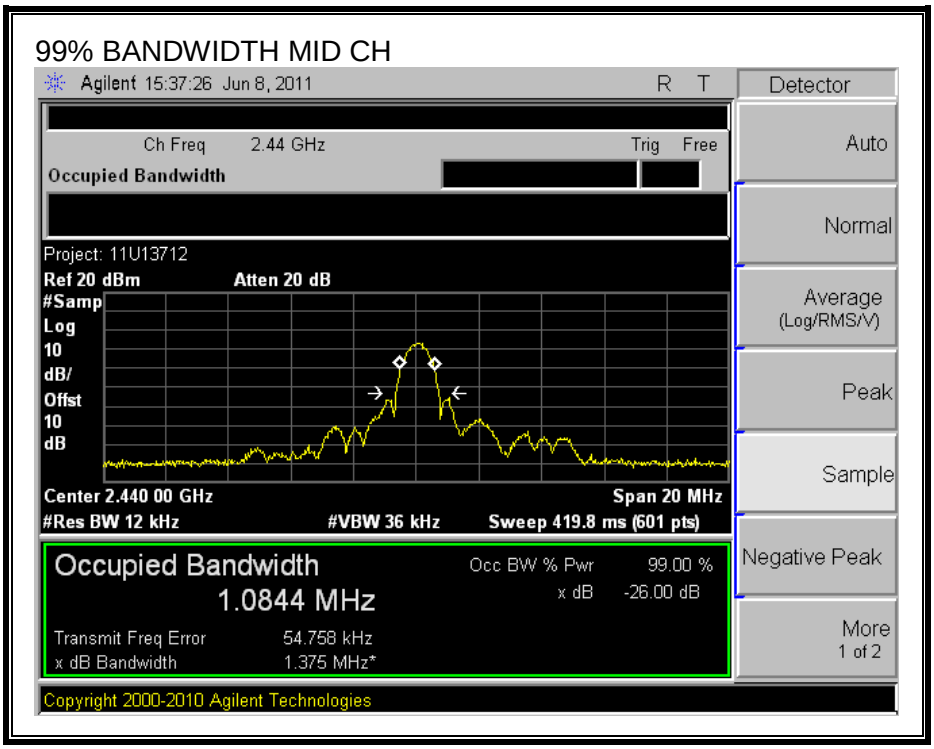
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.048
Middle	2440	1.084
High	2480	1.09

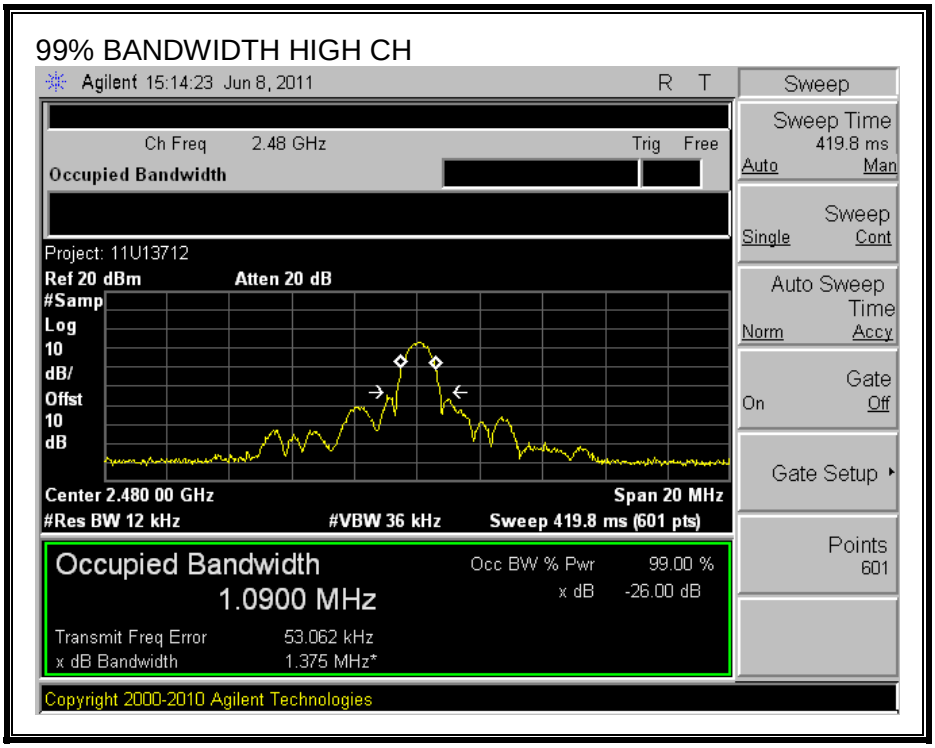
99% BANDWIDTH



99% BANDWIDTH MID CH



99% BANDWIDTH HIGH CH



7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

Peak power is measured using a spectrum analyzer.

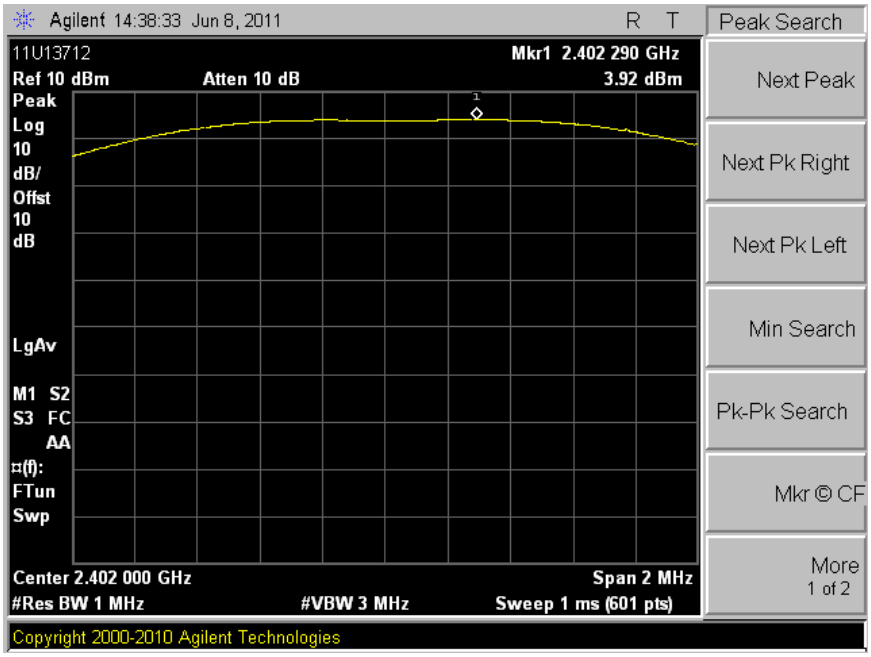
RESULTS

Channel	Frequency (MHz)	Spectrum Analyzer Reading (dBm)	Attenuator and Cable Offset (dB)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	3.92	0	3.92	30	-26.08
Middle	2437	3.86	0	3.86	30	-26.14
High	2462	3.81	0	3.81	30	-26.19

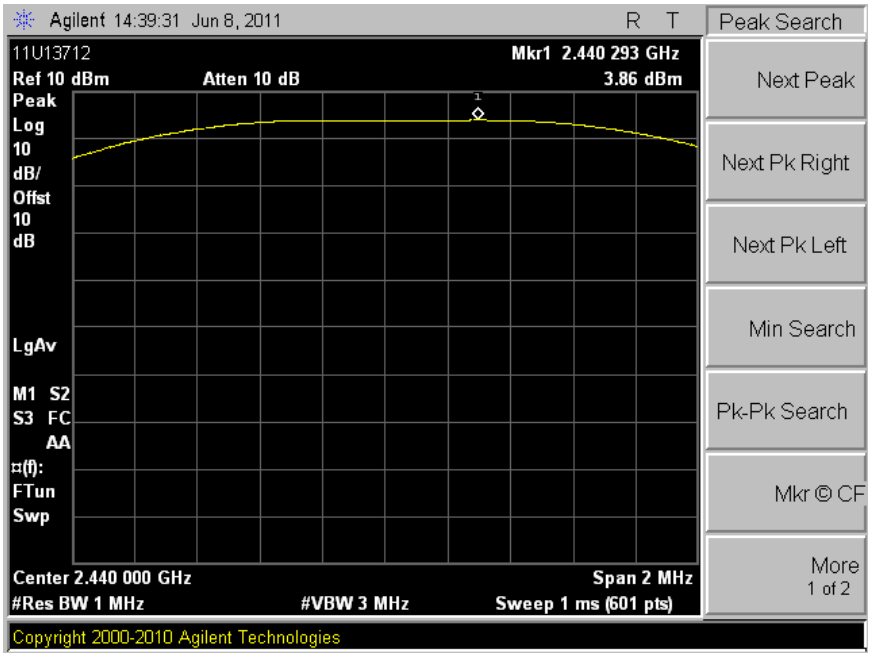
Note: Attenuator/cable offset already part of measurement offset in spectrum analyzer.

OUTPUT POWER

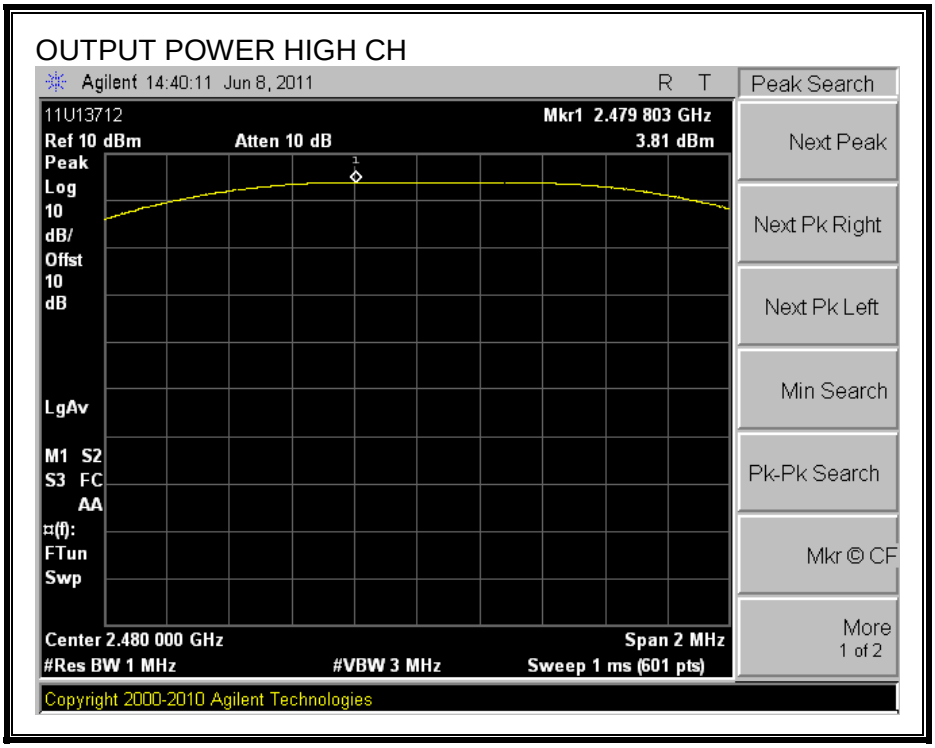
OUTPUT POWER LOW CH



OUTPUT POWER MID CH



OUTPUT POWER HIGH CH



7.1.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST PROCEDURE

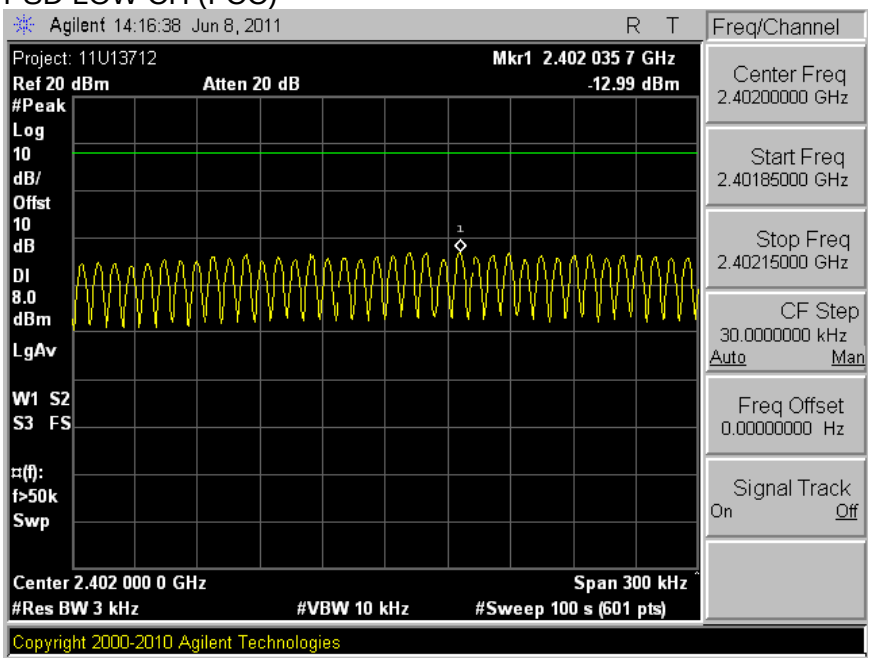
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

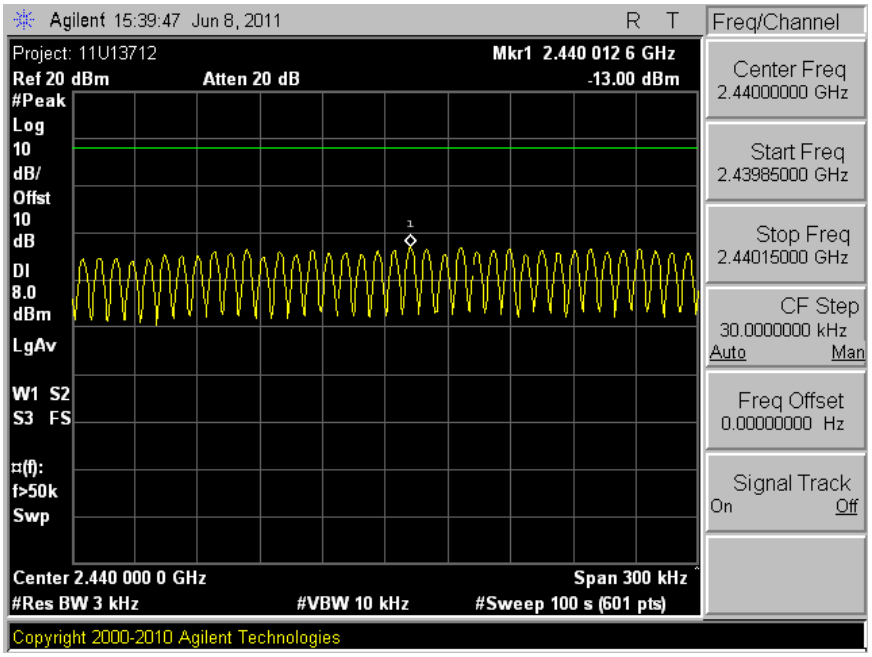
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-12.99	8	-20.99
Middle	2440	-13.00	8	-21.00
High	2480	-12.99	8	-20.99

POWER SPECTRAL DENSITY

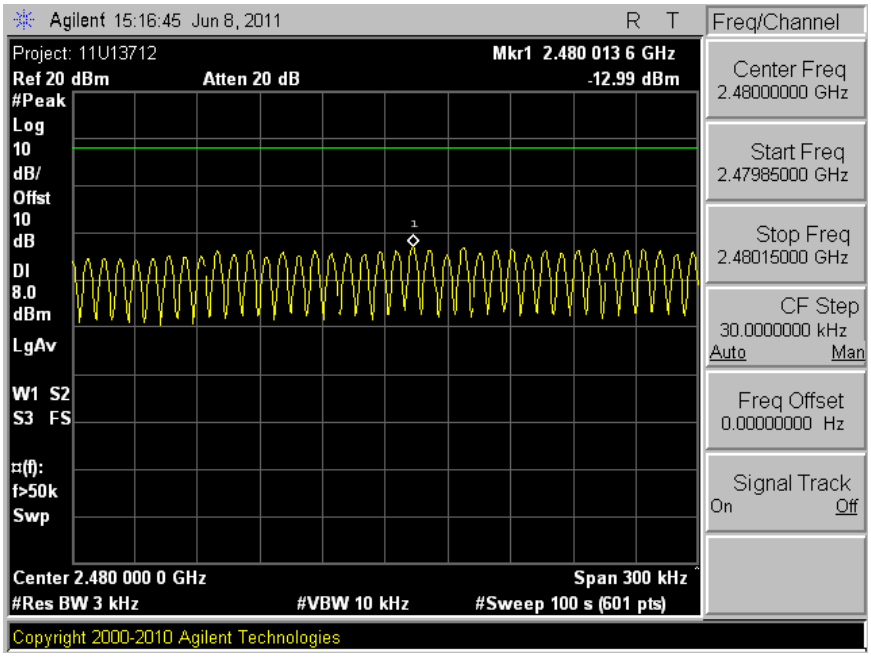
PSD LOW CH (FCC)



PSD MID CH



PSD HIGH CH



7.1.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

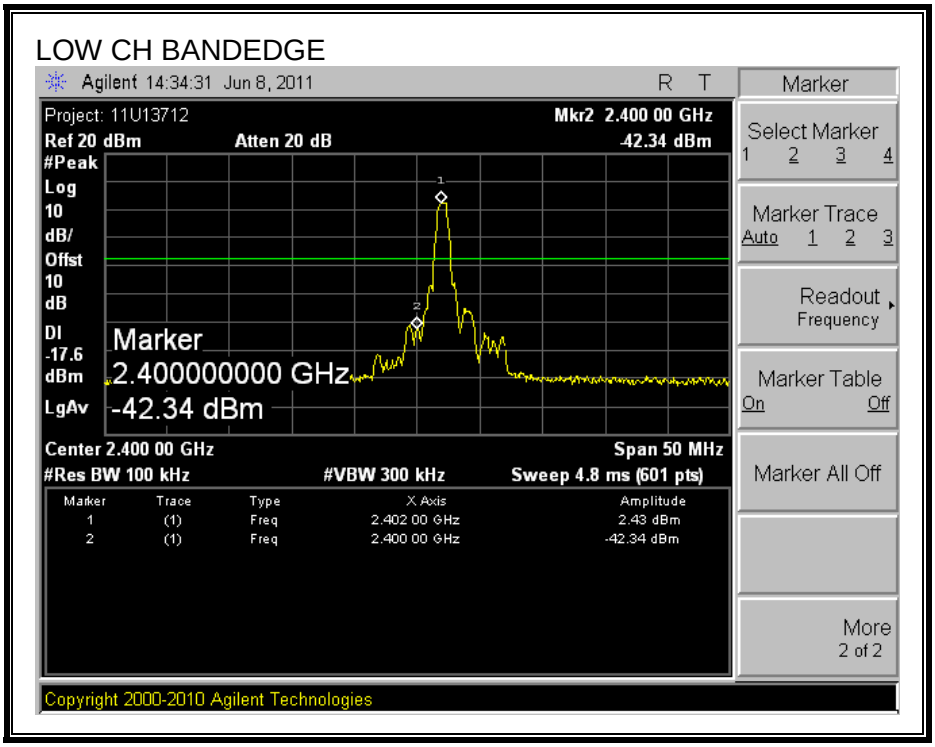
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

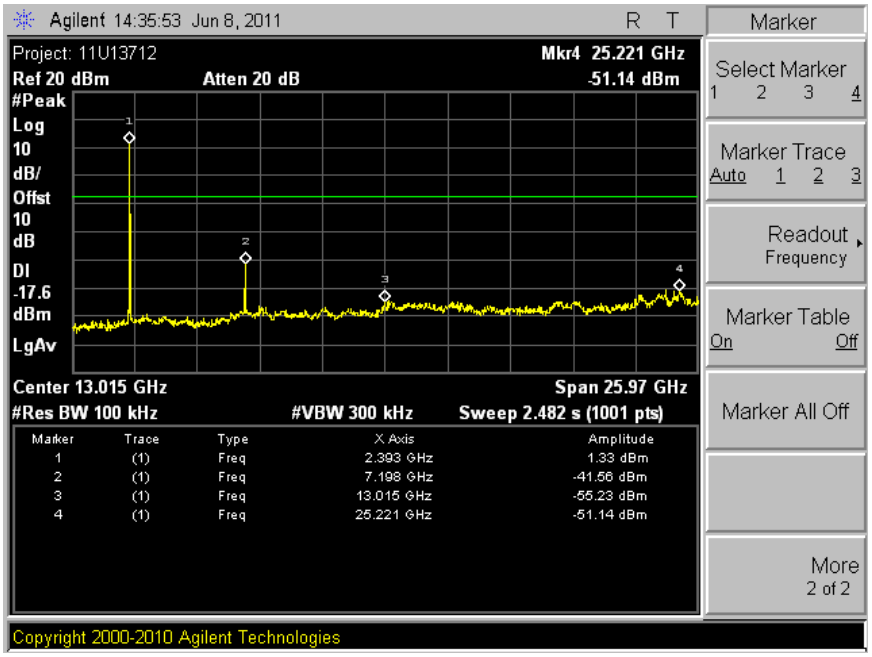
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

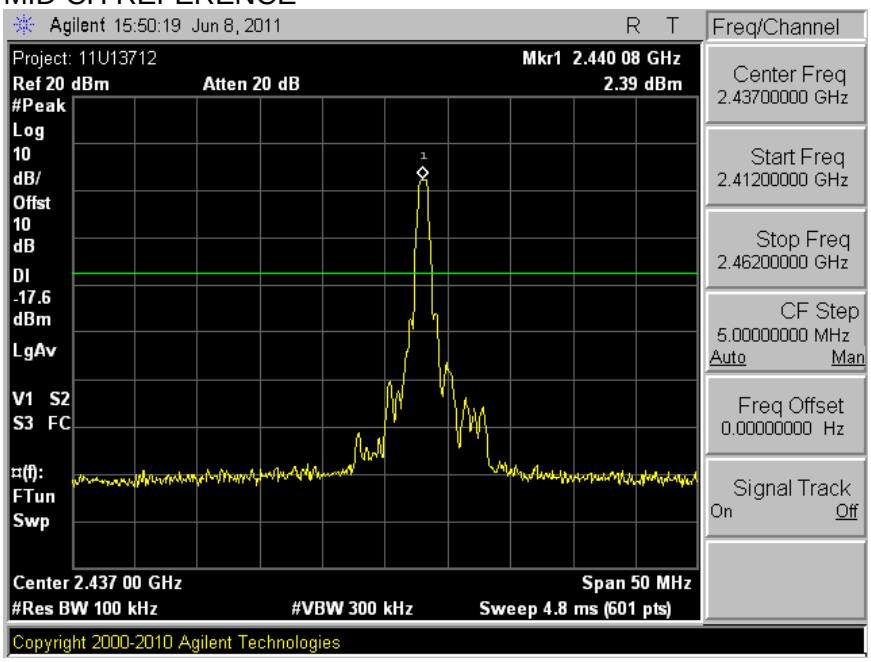


LOW CH SPURIOUS

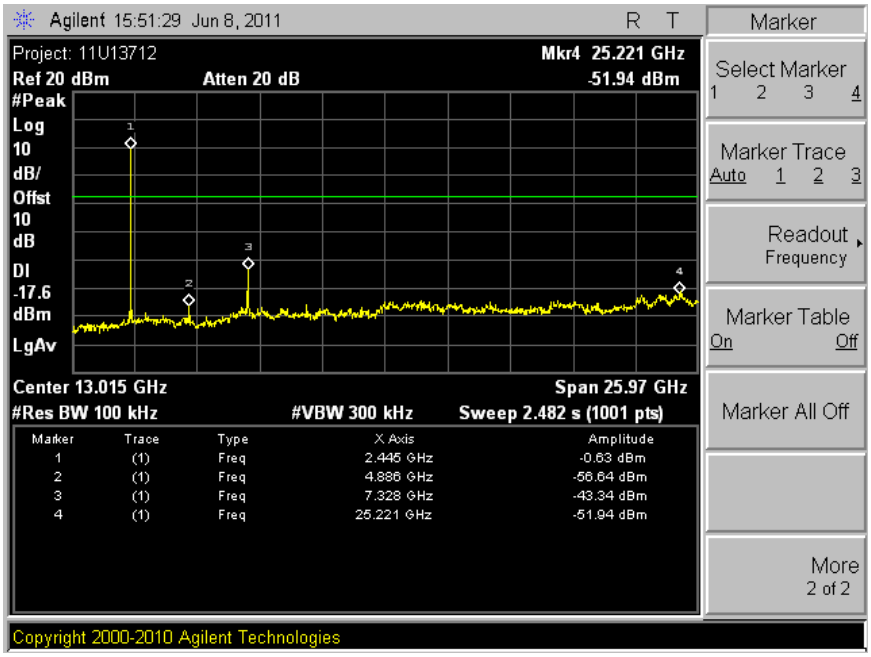


SPURIOUS EMISSIONS, MID CHANNEL

MID CH REFERENCE

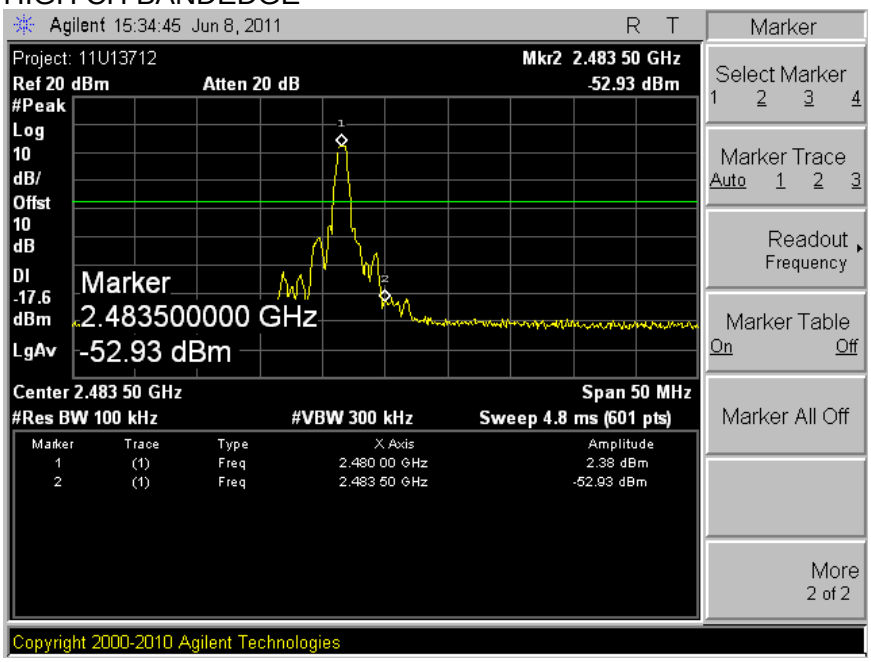


MID CH SPURIOUS

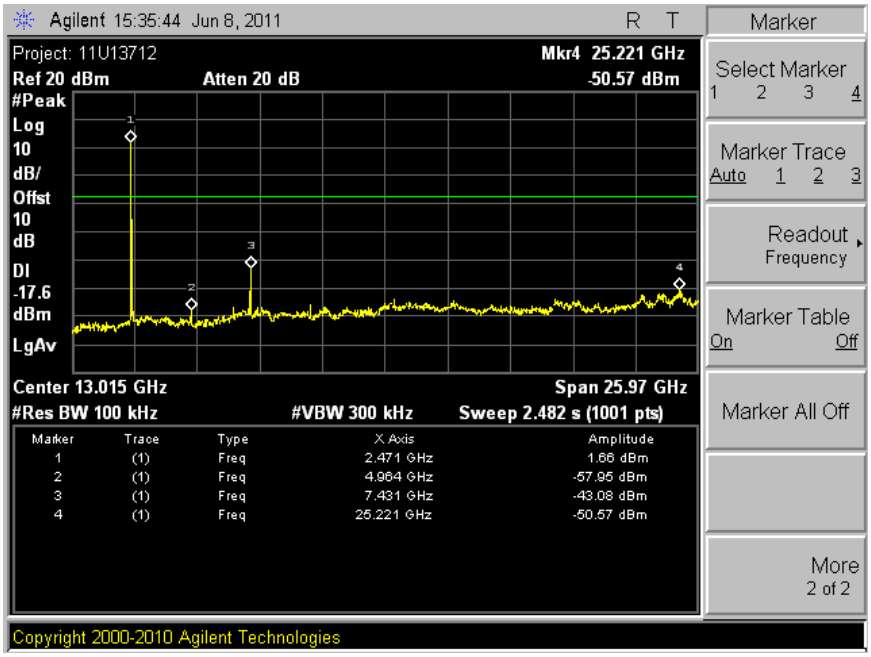


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CH BANDEDGE



HIGH CH SPURIOUS



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.5 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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. 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.

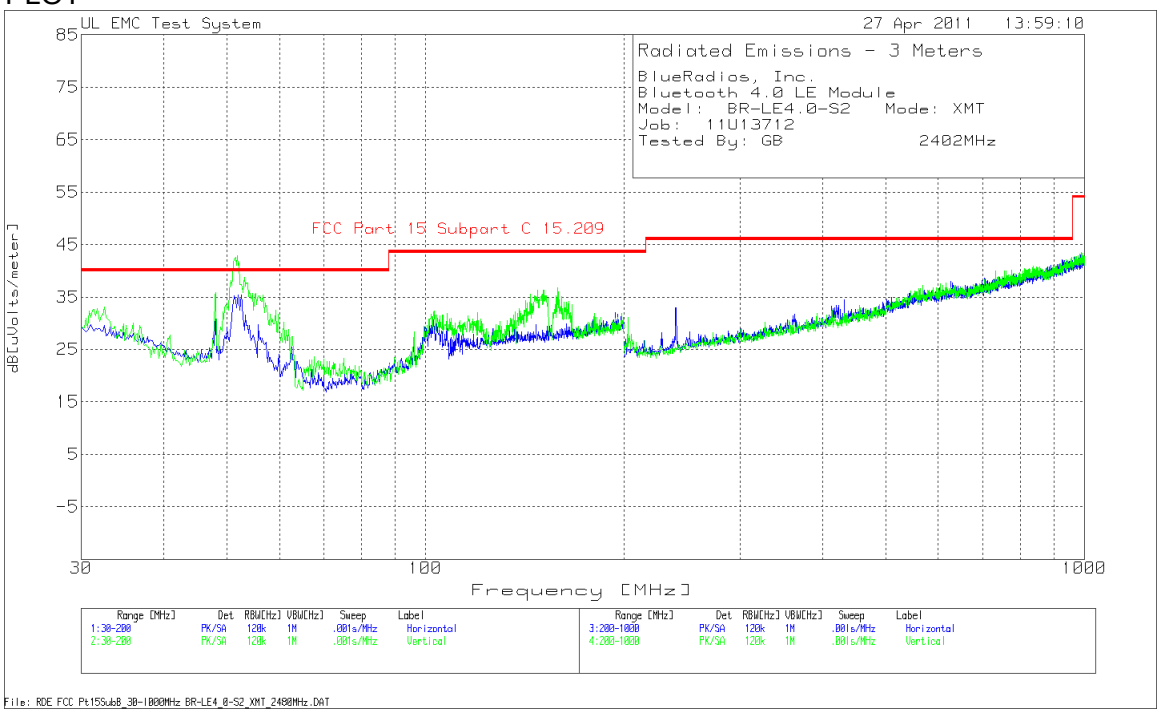
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

8.2. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)

PLOT



DATA

BlueRadios, Inc.
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: XMT
Job: 11U13712
Tested By: GB 2402MHz

Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/ meter]	Limit 1	Margin 1[dB]	Azimuth [degs]	Height [cm]	Polarity
Horizontal 30 - 200MHz										
52.5754	21.08	QP	0.7	9.3	31.08	40	-8.92	182	289	Horz
51.27	18.82	QP	0.7	9.7	29.22	40	-10.78	224	320	Horz
Vertical 30 - 200MHz										
51.78	8.84	QP	0.7	9.1	18.64	40	-21.36	112	354	Vert
50.9	10.54	QP	0.7	9.3	20.54	40	-19.46	60	147	Vert
53.1	18.77	QP	0.7	8.5	27.97	40	-12.03	238	114	Vert
48.0125	9.78	QP	0.7	10.3	20.78	40	-19.22	250	112	Vert

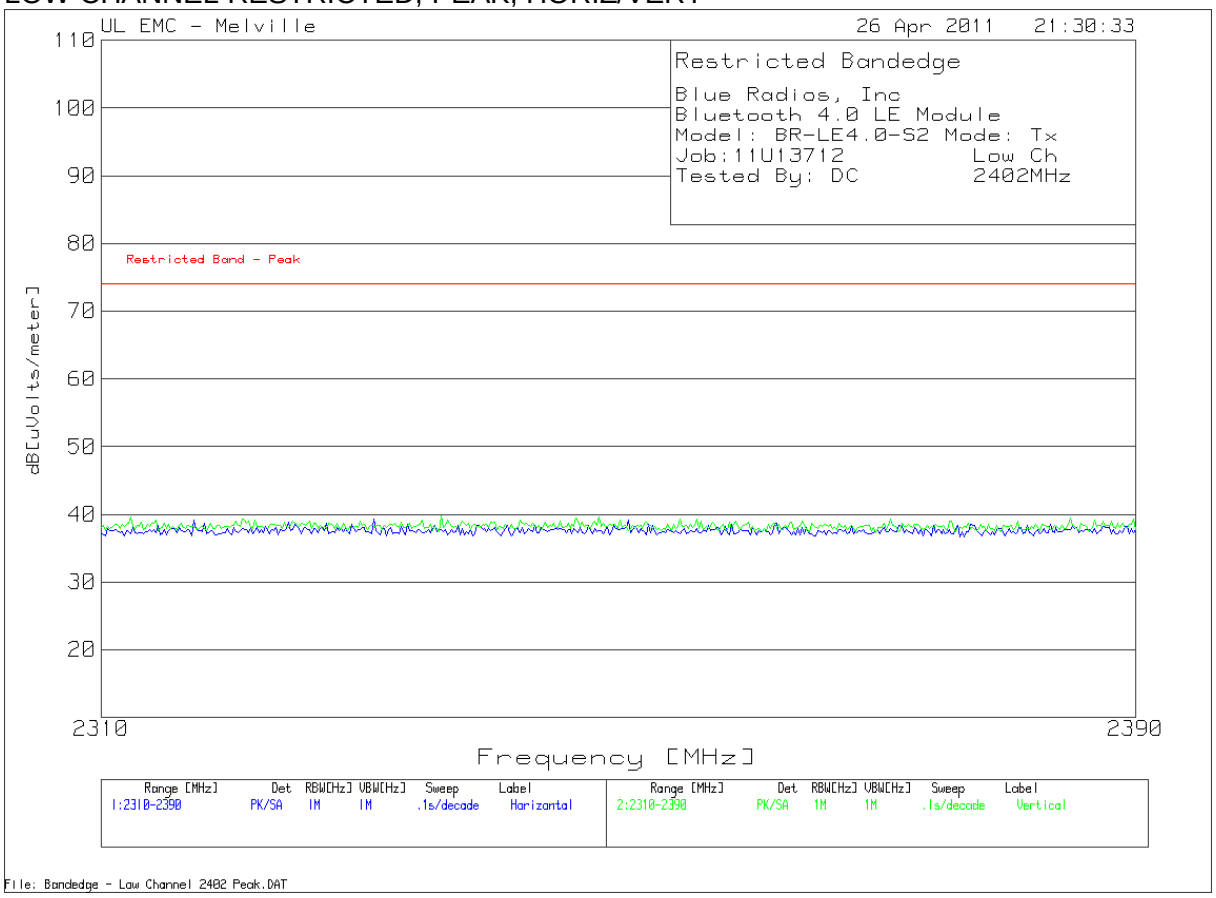
LIMIT 1: FCC Part 15 Subpart C 15.209

PK - Peak detector
QP - Quasi-Peak detector

8.2.1. TRANSMITTER ABOVE 1 GHz LE MODE

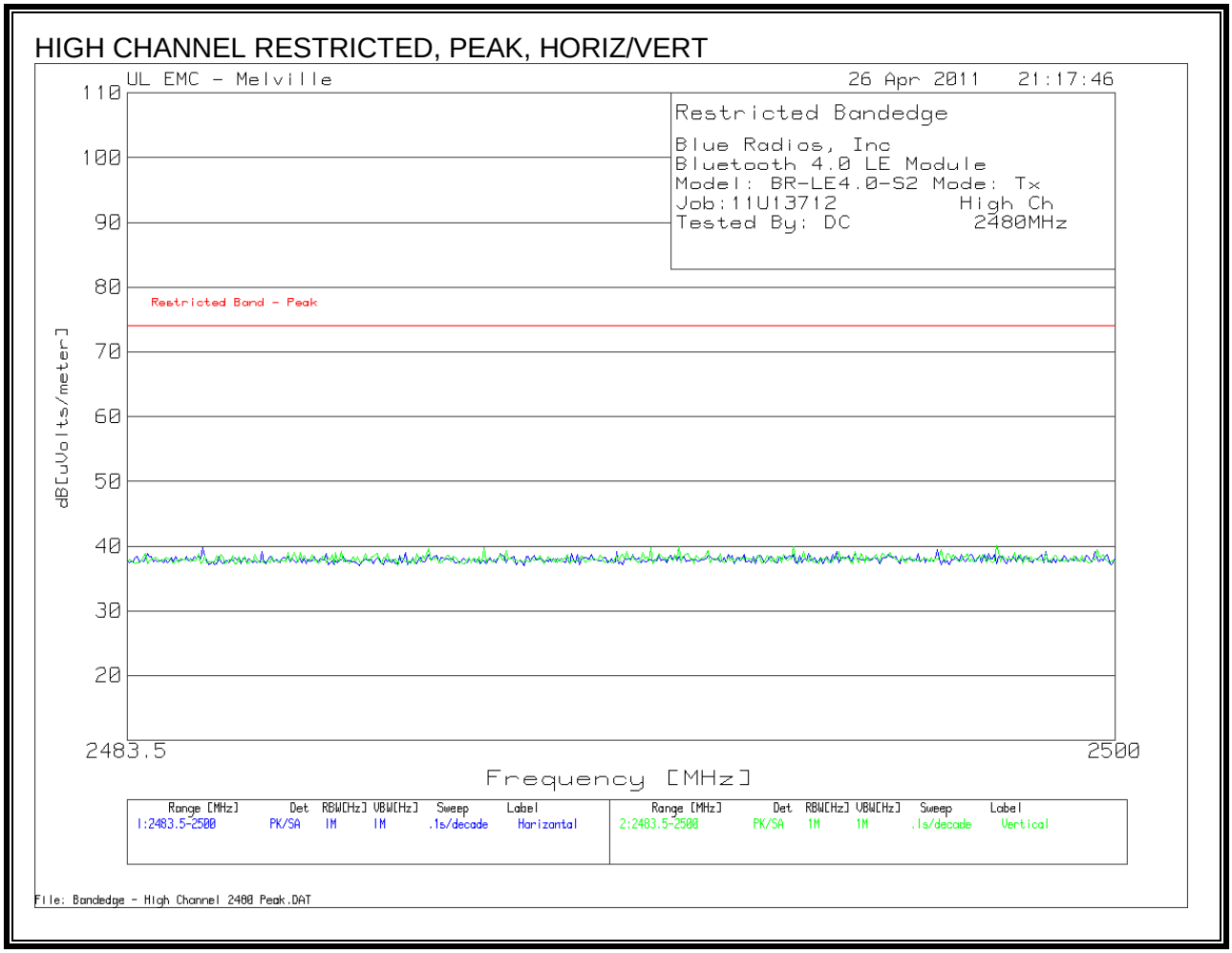
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL/VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ/VERT

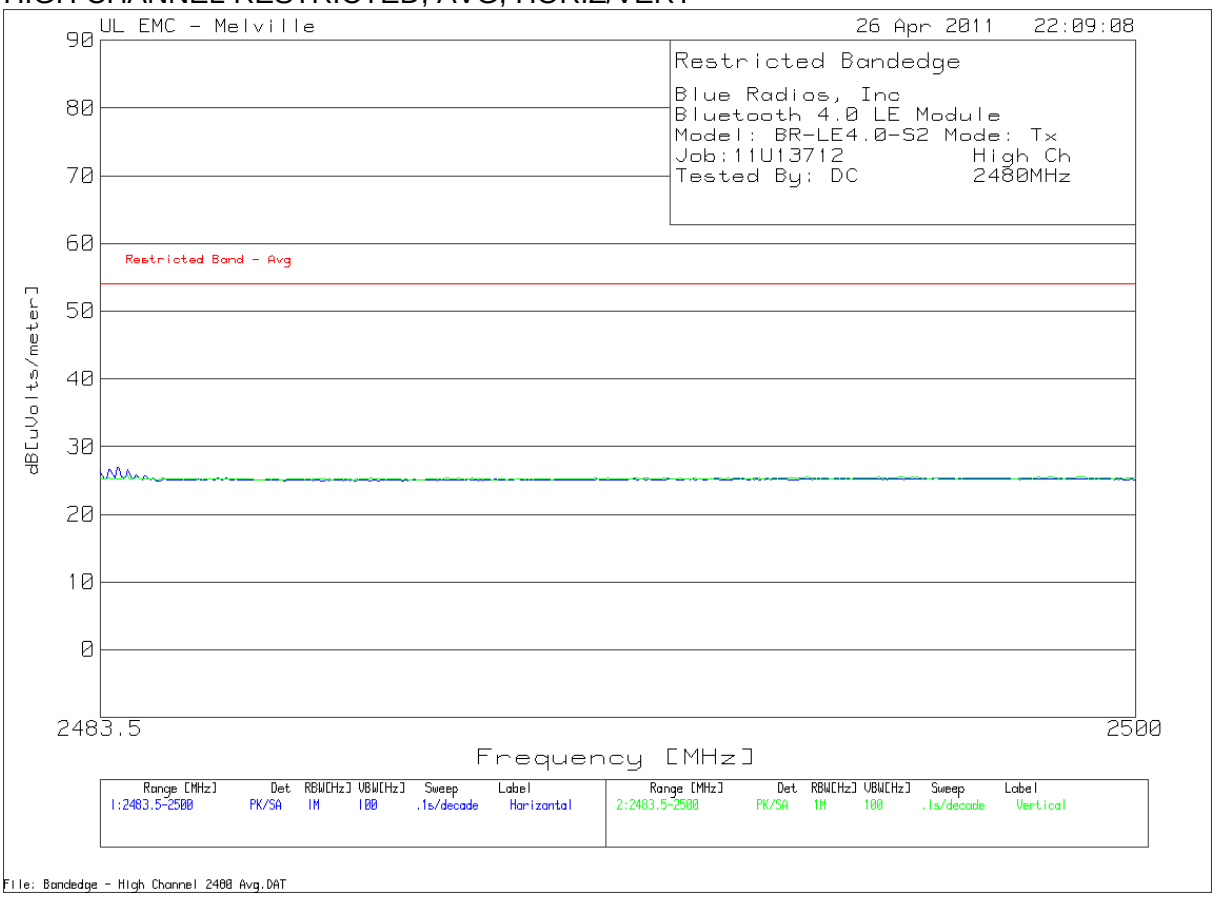


LOW CHANNEL RESTRICTED, AVG, HORIZ/VERT

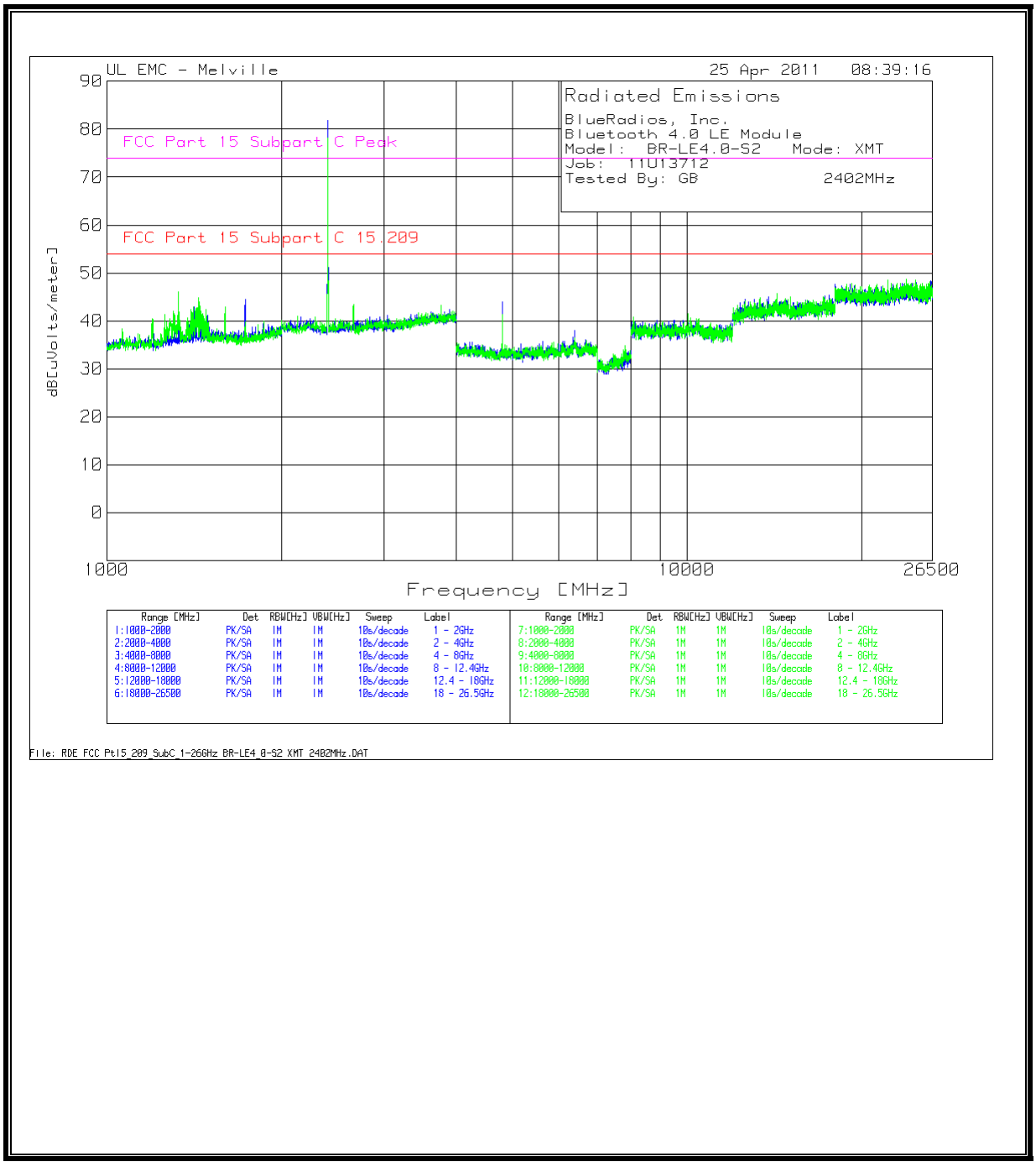
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL/VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, HORIZ/VERT



HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL)



BlueRadios, Inc.
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: XMT
Job: 11U13712
Tested By: GB 2402MHz

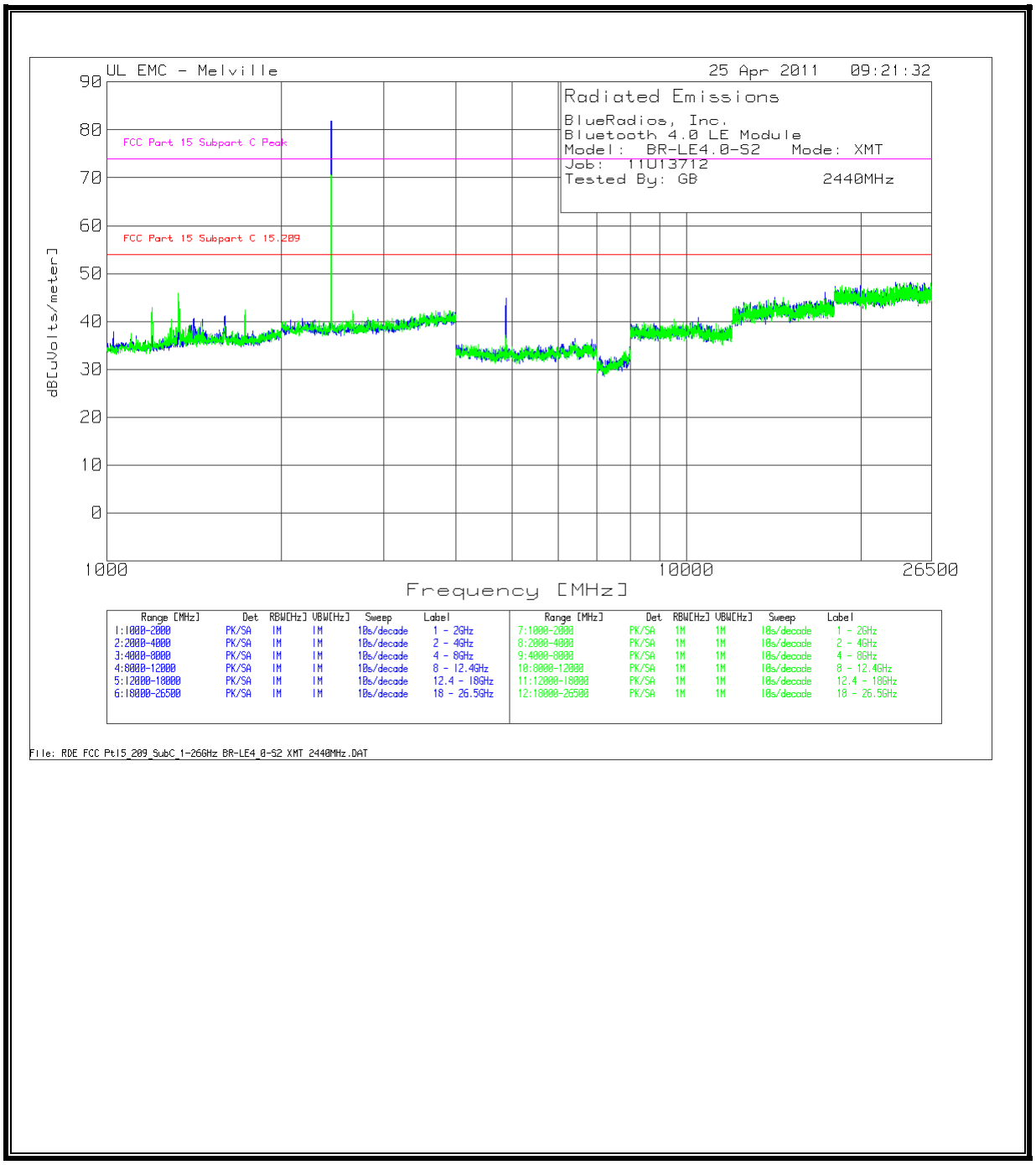
Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit 1	Margin 1[dB]	Limit 2	Margin 2[dB]	Azimuth [degs]	Height [cm]	Polarity
1 - 2GHz 1000 - 2000MHz												
1412.9719	66.7	PK	-44.42	20.7	42.98	54	-11.02	74	-31.02	8	106	Horz
1412.9719	49.58	Av	-44.42	20.7	25.86	54	-28.14	74	-48.14	8	106	Horz
1730.3758	70.28	PK	-44.13	20.8	46.95	54	-7.05	74	-27.05	349	279	Horz
1730.3758	65.96	Av	-44.13	20.8	42.63	54	-11.37	74	-31.37	349	279	Horz
2 - 4GHz 2000 - 4000MHz												
2402.402*	103.53	PK	-42.85	21.1	81.78	NA	NA	NA	NA		100	Horz
4 - 8GHz 4000 - 8000MHz												
4803.6162	76	PK	-52.53	27.1	50.57	54	-3.43	74	-23.43	170	389	Horz
4803.6162	69.76	Av	-52.53	27.1	44.33	54	-9.67	74	-29.67	170	389	Horz
1 - 2GHz 1000 - 2000MHz												
1328	77.84	PK	-44.42	20.6	54.02	54	0.02	74	-19.98	63	237	Vert
1438.2856	71.26	PK	-44.31	20.7	47.65	54	-6.35	74	-26.35	47	360	Vert
1438.2856	49.66	Av	-44.31	20.7	26.05	54	-27.95	74	-47.95	47	360	Vert
2 - 4GHz 2000 - 4000MHz												
2400.4*	99.78	PK	-42.86	21.3	78.22	NA	NA	NA	NA		100	Vert
4 - 8GHz 4000 - 8000MHz												
4803.6263	79.19	PK	-52.53	27.3	53.96	54	-0.04	74	-20.04	85	359	Vert
4803.6263	73.18	Av	-52.53	27.3	47.95	54	-6.05	74	-26.05	85	359	Vert

*Fundemental - not subject to limits

LIMIT 1: FCC Part 15 Subpart C 15.209
LIMIT 2: FCC Part 15 Subpart C Peak

PK - Peak detector
Av - Average detector

HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL)



BlueRadios, Inc.
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: XMT
Job: 11U13712
Tested By: GB 2440MHz

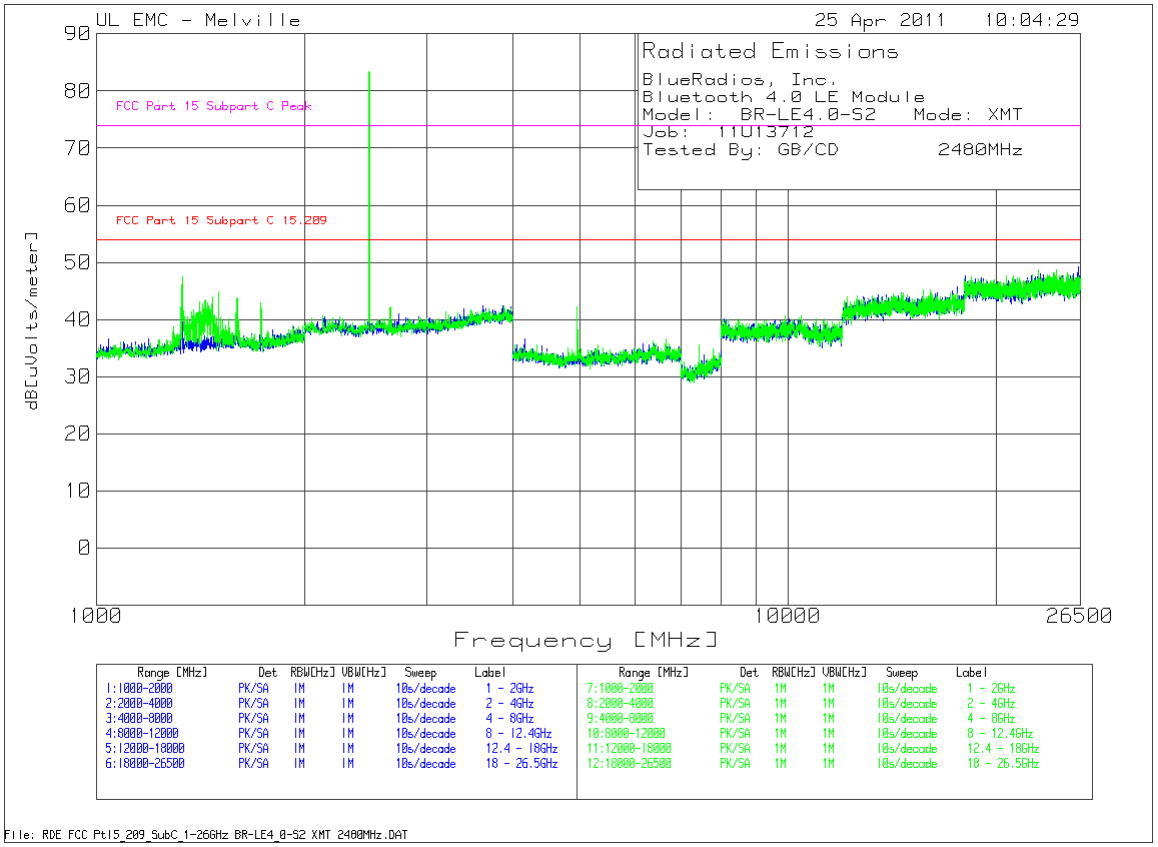
Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/ meter]	Limit 1	Margin 1[dB]	Limit 2	Margin 2[dB]	Azimuth [degs]	Height [cm]	Polarity
1 - 2GHz 1000 - 2000MHz												
1331.2949	67.74	PK	-44.43	20.6	43.91	54	-10.09	74	-30.09	66	226	Horz
1331.2949	49.22	Av	-44.43	20.6	25.39	54	-28.61	74	-48.61	66	226	Horz
1592.593	64.69	PK	-44.17	21.2	41.72	54	-12.28	74	-32.28	54	188	Horz
1592.593	48.99	Av	-44.17	21.2	26.02	54	-27.98	74	-47.98	54	188	Horz
2 - 4GHz 2000 - 4000MHz												
2438.438*	103.41	PK	-42.79	21.2	81.82	NA	NA	NA	NA		100	Horz
4 - 8GHz 4000 - 8000MHz												
4882.075	70.63	PK	-52.53	27.2	45.3	54	-8.7	74	-28.7	0	317	Horz
4882.075	67.62	Av	-52.53	27.2	42.29	54	-11.71	74	-31.71	0	317	Horz
1 - 2GHz 1000 - 2000MHz												
1197.197	64.69	PK	-44.51	19.8	39.98	54	-14.02	74	-34.02	134	306	Vert
1197.197	49.32	Av	-44.51	19.8	24.61	54	-29.39	74	-49.39	134	306	Vert
1329.5464	72.74	PK	-44.42	20.6	48.92	54	-5.08	74	-25.08	240	369	Vert
1329.5464	49.65	Av	-44.42	20.6	25.83	54	-28.17	74	-48.17	240	369	Vert
1730.3753	73.96	PK	-44.13	20.8	50.63	54	-3.37	74	-23.37	275	344	Vert
1730.3753	68.88	Av	-44.13	20.8	45.55	54	-8.45	74	-28.45	275	344	Vert
2 - 4GHz 2000 - 4000MHz												
2438.438*	91.81	PK	-42.79	21.5	70.52	NA	NA	NA	NA		100	Vert
4 - 8GHz 4000 - 8000MHz												
4879.6324	77.57	PK	-52.52	27.5	52.55	54	-1.45	74	-21.45	65	390	Vert
4879.6324	71.17	Av	-52.52	27.5	46.15	54	-7.85	74	-27.85	65	390	Vert

* Fundemetnal - not subject to limits

LIMIT 1: FCC Part 15 Subpart C 15.209
LIMIT 2: FCC Part 15 Subpart C Peak

PK - Peak detector
Av - Average detector

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL)



BlueRadios, Inc.
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: XMT
Job: 11U13712
Tested By: GB/CD 2480MHz

Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/ meter]	Limit 1	Margin 1[dB]	Limit 2	Margin 2[dB]	Azimuth [degs]	Height [cm]	Polarity
1 - 2GHz 1000 - 2000MHz												
1329.329	67.45	PK	-44.42	20.6	43.63	54	-10.37	74	-30.37	77	244	Horz
1329.329	49.21	Av	-44.42	20.6	25.39	54	-28.61	74	-48.61	77	244	Horz
1598.599	64.28	PK	-44.17	21.2	41.31	54	-12.69	74	-32.69	136	391	Horz
1598.599	49.67	Av	-44.17	21.2	26.7	54	-27.3	74	-47.3	136	391	Horz
2 - 4GHz 2000 - 4000MHz												
2478.478*	103.35	PK	-42.86	21.3	81.79	NA	NA	NA	NA		100	Horz
4 - 8GHz 4000 - 8000MHz												
4960.477	74.24	PK	-52.5	27.3	49.04	54	-4.96	74	-24.96	339	378	Horz
4960.477	68.07	Av	-52.5	27.3	42.87	54	-11.13	74	-31.13	339	378	Horz
1 - 2GHz 1000 - 2000MHz												
1326.326	71.04	PK	-44.44	20.6	47.2	54	-6.8	74	-26.8	53	374	Vert
1326.326	49.02	Av	-44.44	20.6	25.18	54	-28.82	74	-48.82	53	374	Vert
1330.33	77.21	PK	-44.43	20.6	53.38	54	-0.62	74	-20.62	65	274	Vert
1330.33	49.85	Av	-44.43	20.6	26.02	54	-27.98	74	-47.98	65	274	Vert
1468.0311	64.24	PK	-44.2	20.8	40.84	54	-13.16	74	-33.16	244	383	Vert
1468.0311	48.56	Av	-44.2	20.8	25.16	54	-28.84	74	-48.84	244	383	Vert
1500.2956	68.67	PK	-44.32	20.8	45.15	54	-8.85	74	-28.85	60	353	Vert
1500.2956	49.53	Av	-44.32	20.8	26.01	54	-27.99	74	-47.99	60	353	Vert
1727.4545	61.36	PK	-44.15	20.8	38.01	54	-15.99	74	-35.99	43	328	Vert
1727.4545	48.81	Av	-44.15	20.8	25.46	54	-28.54	74	-48.54	43	328	Vert
2 - 4GHz 2000 - 4000MHz												
2478.478*	104.64	PK	-42.86	21.6	83.38	NA	NA	NA	NA		100	Vert
4 - 8GHz 4000 - 8000MHz												
4959.6129	77.01	PK	-52.51	27.4	51.9	54	-2.1	74	-22.1	278	360	Vert
4959.6129	70.28	Av	-52.51	27.4	45.17	54	-8.83	74	-28.83	278	360	Vert

* Fundemetnal - not subject to limits

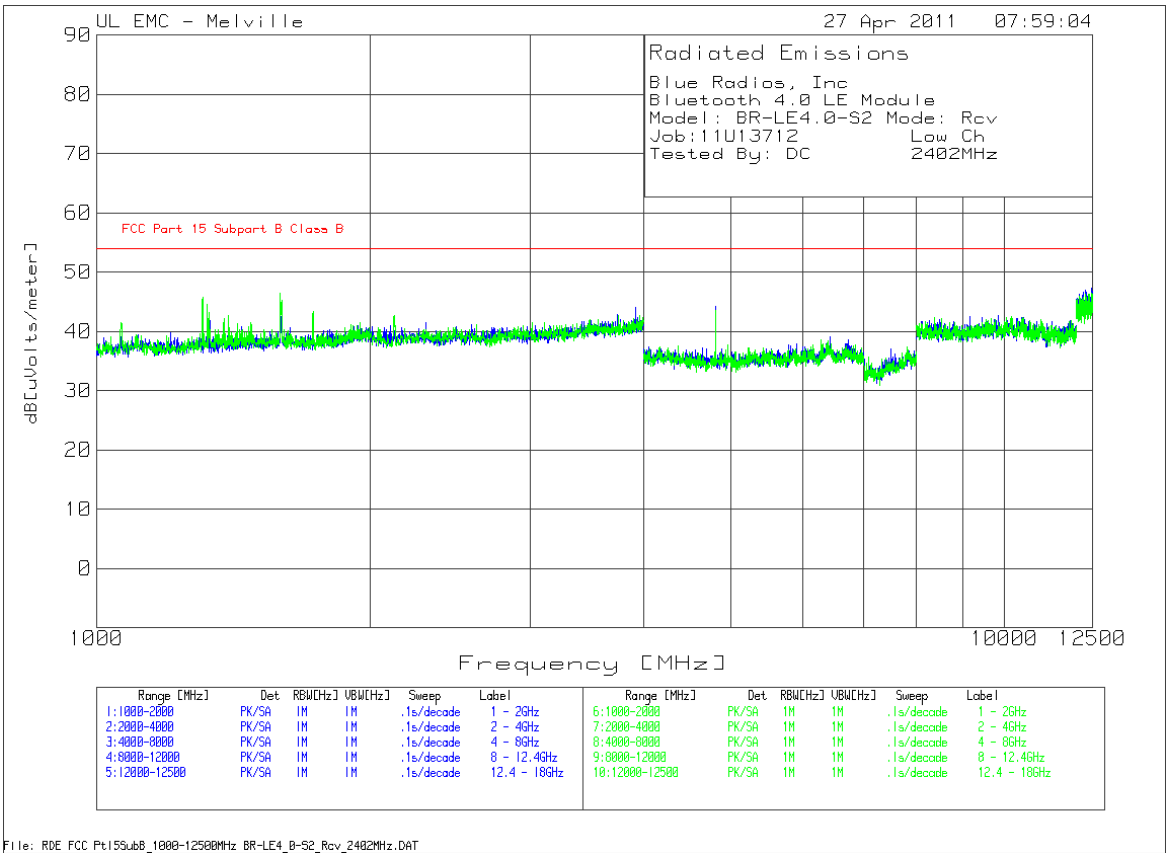
LIMIT 1: FCC Part 15 Subpart C 15.209
LIMIT 2: FCC Part 15 Subpart C Peak

PK - Peak detector
Av - Average detector

8.3. RECEIVER ABOVE 1 GHz

8.3.1. RECEIVER ABOVE 1 GHz FOR LE MODE

LOW CHANNEL



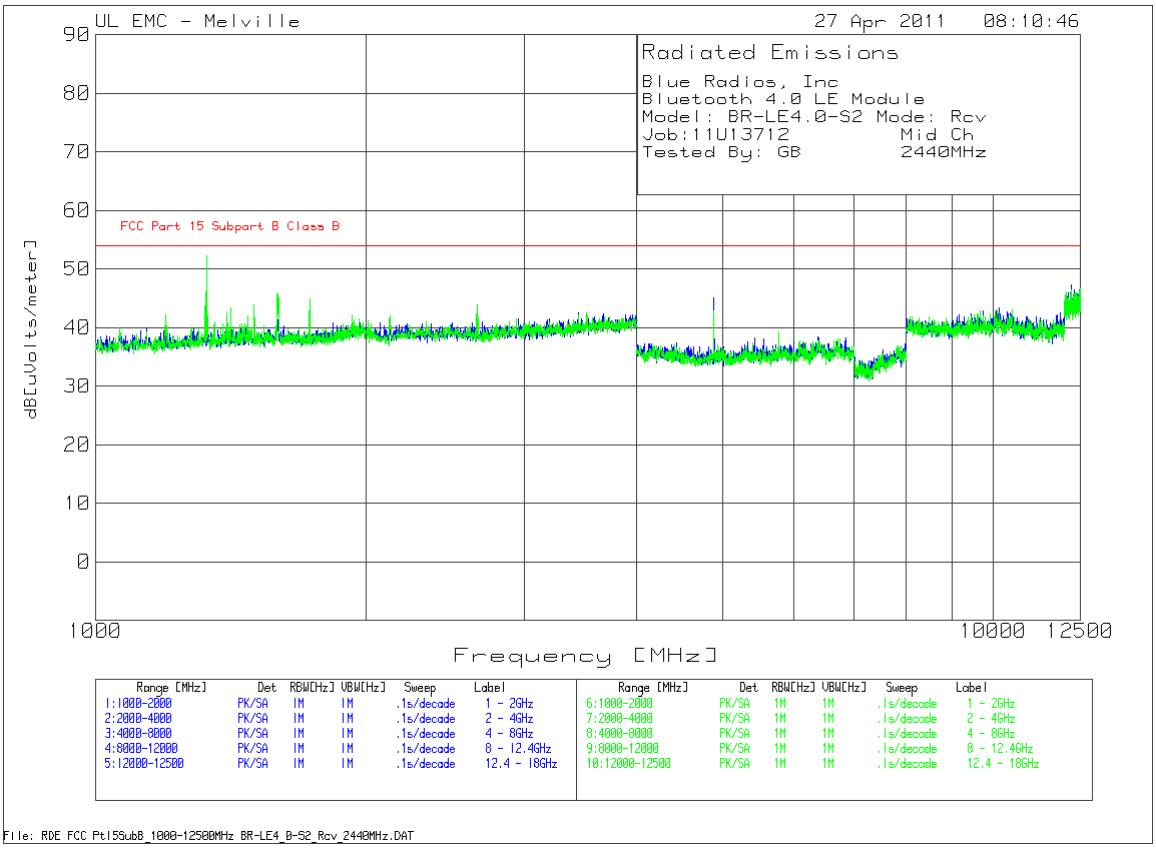
Blue Radios, Inc
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: Rcv
Job:11U13712 Low Ch
Tested By: DC 2402MHz

Marker Number	Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/ meter]	Limit 1	Margin 1[dB]	Azimuth [degs]	Height [cm]	Polarity
1 - 2GHz 1000 - 2000MHz											
1	1594.595	62.91	PK	-41.67	21.2	42.44	54	-11.56	337	214	Horz
2 - 4GHz 2000 - 4000MHz											
2	3917.918	60.58	PK	-39.26	22.7	44.02	54	-9.98	102	215	Horz
4 - 8GHz 4000 - 8000MHz											
3	4805.871	67.19	PK	-50.05	27.1	44.24	54	-9.76	273	100	Horz
1 - 2GHz 1000 - 2000MHz											
4	1308.308	67.1	PK	-41.87	20.5	45.73	54	-8.27	7	215	Vert
5	1592.593	66.9	PK	-41.67	21.2	46.43	54	-7.57	273	215	Vert
4 - 8GHz 4000 - 8000MHz											
6	4805.871	66.23	PK	-50.05	27.3	43.48	54	-10.52	109	100	Vert

LIMIT 1: FCC Part 15 Subpart B Class B

PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector
CAV - CISPR Average detector
RMS - RMS detection
CRMS - CISPR RMS detection

MID CHANNEL



Blue Radios, Inc
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: Rcv
Job:11U13712 Mid Ch
Tested By: GB 2440MHz

Marker Number	Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/ meter]	Limit 1	Margin 1[dB]	Azimuth [degs]	Height [cm]	Polarity
4 - 8GHz 4000 - 8000MHz											
6	4880.587	67.92	PK	-50.02	27.2	45.1	54	-8.9	161	100	Horz
1 - 2GHz 1000 - 2000MHz											
1	1329.329	73.61	PK	-41.92	20.6	52.29	54	-1.71	144	215	Vert
2	1593.594	66.43	PK	-41.65	21.2	45.98	54	-8.02	60	100	Vert
3	1730.731	65.85	PK	-41.65	20.8	45	54	-9	274	100	Vert
2 - 4GHz 2000 - 4000MHz											
4	2662.663	62.57	PK	-39.95	21.2	43.82	54	-10.18	229	214	Vert
4 - 8GHz 4000 - 8000MHz											
5	4880.587	65.38	PK	-50.02	27.5	42.86	54	-11.14	247	215	Vert

LIMIT 1: FCC Part 15 Subpart B Class B

PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector
CAV - CISPR Average detector
RMS - RMS detection
CRMS - CISPR RMS detection

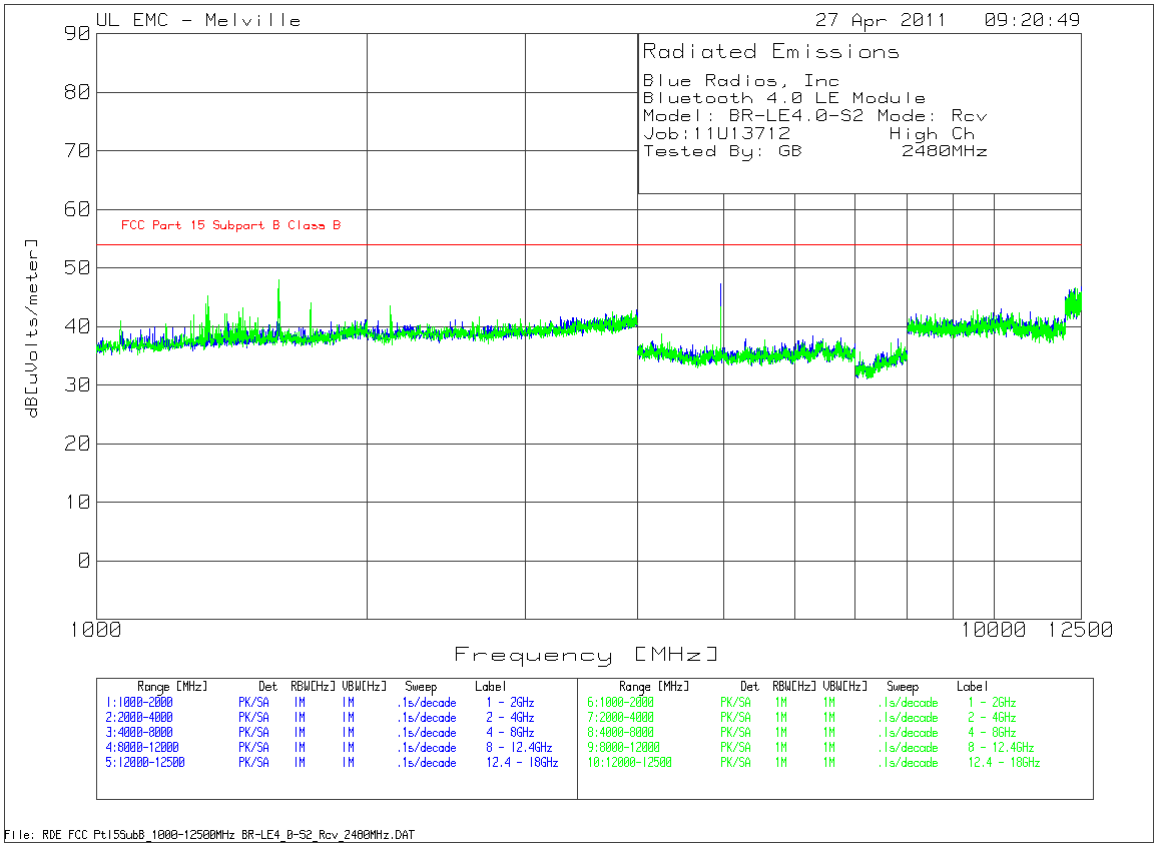
Blue Radios, Inc
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: Rcv
Job:11U13712 Mid Ch
Tested By: GB 2440MHz

Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/ meter]	Limit 1	Margin 1[dB]	Azimuth [degs]	Height [cm]	Polarity
1 - 2GHz 1000 - 2000MHz										
1328.271	49.27	Av	-41.92	20.6	27.95	54	-26.05	81	238	Vert

LIMIT 1: FCC Part 15 Subpart B Class B

PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector
CAV - CISPR Average detector
RMS - RMS detection
CRMS - CISPR RMS detection

HIGH CHANNEL



Blue Radios, Inc
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: Rcv
Job:11U13712 High Ch
Tested By: GB 2480MHz

Marker Number	Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit 1	Margin 1[dB]	Azimuth [degs]	Height [cm]	Polarity
4 - 8GHz 4000 - 8000MHz											
6	4957.972	70.04	PK	-50.05	27.3	47.29	54	-6.71	94	215	Horz
1 - 2GHz 1000 - 2000MHz											
1	1330.33	66.64	PK	-41.93	20.6	45.31	54	-8.69	67	215	Vert
2	1595.596	68.48	PK	-41.66	21.2	48.02	54	-5.98	293	215	Vert
3	1730.731	64.86	PK	-41.65	20.8	44.01	54	-9.99	293	215	Vert
2 - 4GHz 2000 - 4000MHz											
4	2124.124	63.6	PK	-40.91	20.8	43.49	54	-10.51	228	214	Vert
4 - 8GHz 4000 - 8000MHz											
5	4957.972	66.06	PK	-50.05	27.4	43.41	54	-10.59	7	100	Vert

LIMIT 1: FCC Part 15 Subpart B Class B

PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector
CAV - CISPR Average detector
RMS - RMS detection
CRMS - CISPR RMS detection

Blue Radios, Inc
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: Rcv
Job:11U13712 High Ch
Tested By: GB 2480MHz

Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit 1	Margin 1[dB]	Azimuth [degs]	Height [cm]	Polarity
4 - 8GHz 4000 - 8000MHz										
4958.1648	69.56	Av	-50.05	27.3	46.81	54	-7.19	3	316	Horz
1 - 2GHz 1000 - 2000MHz										
1595	49.93	Av	-41.68	21.2	29.45	54	-24.55	341	362	Vert
4 - 8GHz 4000 - 8000MHz										
4958.0884	68.07	Av	-50.05	27.4	45.42	54	-8.58	16	397	Vert

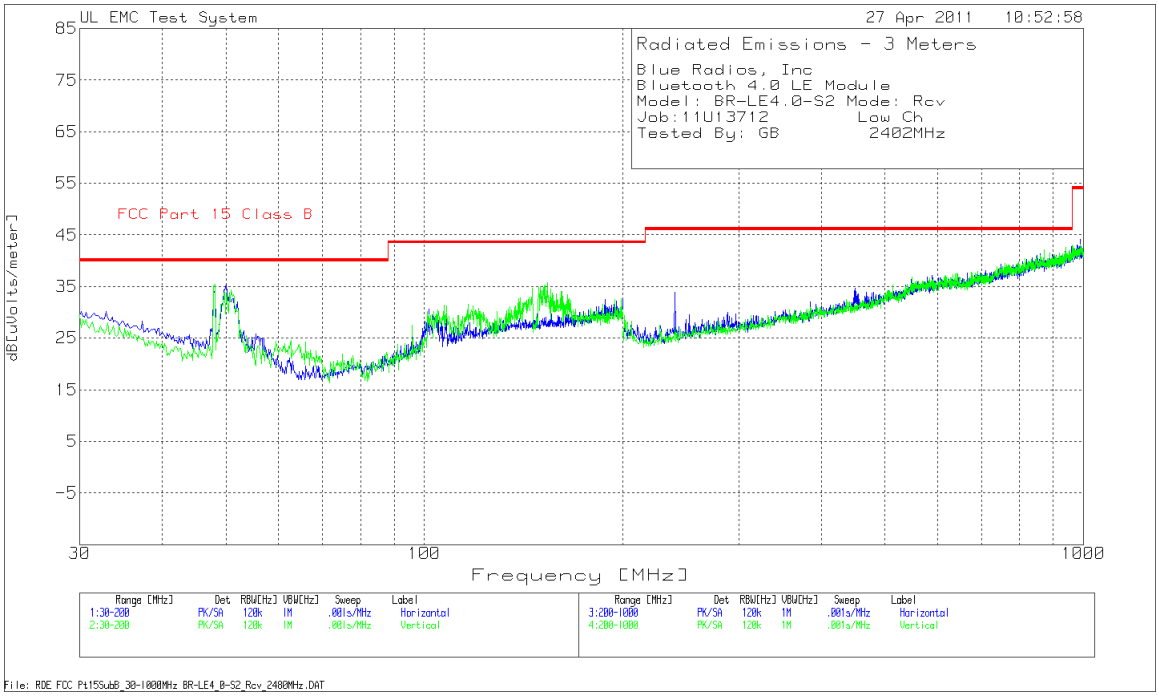
LIMIT 1: FCC Part 15 Subpart B Class B

PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector
CAV - CISPR Average detector
RMS - RMS detection
CRMS - CISPR RMS detection

8.4. DIGITAL DEVICE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE)

PLOT



DATA

Blue Radios, Inc
Bluetooth 4.0 LE Module
Model: BR-LE4.0-S2 Mode: Rcv
Job:11U13712 Low Ch
Tested By: GB 2402MHz

Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit 1	Margin 1[dB]	Azimuth [degs]	Height [cm]	Polarity
Horizontal 30 - 200MHz										
50.0338	18.85	QP	0.7	10.5	30.05	40	-9.95	180	374	Horz
51.1862	21.8	PK	0.7	10.2	32.7	40	-7.3	297	300	Horz
Vertical 30 - 200MHz										
47.98	19.05	QP	0.7	10.3	30.05	40	-9.95	77	306	Vert
49.7	14.35	QP	0.7	10.1	25.15	40	-14.85	169	181	Vert
50.1	8.41	QP	0.7	10	19.11	40	-20.89	137	192	Vert
Horizontal 200 - 1000MHz										
239.6198	20.29	PK	1.6	12	33.89	46	-12.11	166	100	Horz

LIMIT 1: FCC Part 15 Class B

PK - Peak detector
QP - Quasi-Peak detector

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

ANSI C63.4

RESULTS

6 WORST EMISSIONS (TX Mode)

BlueRadio Inc.
Bluetooth 4.0 Single Mode Module
Model: BR-LE4.0-S2
Job: 11U13712 120V 60Hz
Tested By: MM 2402MHz/Xmt

Marker Number	Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit 1	Margin 1[dB]	Limit 2	Margin 2[dB]
Line - L1 .15 - 1MHz										
1	0.19404	46.7	PK	11.2	0	57.9	63.9	-6	53.9	4
2	0.3401	33.96	PK	10.7	0	44.66	59.2	-14.54	49.2	-4.54
3	0.39196	29.98	PK	10.6	0	40.58	58	-17.42	48	-7.42
4	0.52169	27.22	PK	10.5	0	37.72	56	-18.28	46	-8.28
Line - L1 1 - 30MHz										
5	2.4793	26.23	PK	10.4	0	36.63	56	-19.37	46	-9.37
6	2.9898	25.5	PK	10.4	0	35.9	56	-20.1	46	-10.1
Neutral .15 - 1MHz										
7	0.19863	42.28	PK	11.1	0	53.38	63.7	-10.32	53.7	-0.32
8	0.2561	32.74	PK	10.9	0	43.64	61.6	-17.96	51.6	-7.96
9	0.38873	29.63	PK	10.6	0	40.23	58.1	-17.87	48.1	-7.87
10	0.6465	27.43	PK	10.5	0	37.93	56	-18.07	46	-8.07
11	0.81279	28.35	PK	10.4	0	38.75	56	-17.25	46	-7.25
12	0.85581	29.32	PK	10.4	0	39.72	56	-16.28	46	-6.28
13	0.97143	27.06	PK	10.4	0	37.46	56	-18.54	46	-8.54
Neutral 1 - 30MHz										
14	1.19144	27.64	PK	10.4	0	38.04	56	-17.96	46	-7.96
15	1.38288	27.94	PK	10.4	0	38.34	56	-17.66	46	-7.66

LIMIT 1: FCC Part 15 Subpart C QPk
LIMIT 2: FCC Part 15 Subpart C Avg

PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector
CAV - CISPR Average detector
RMS - RMS detection
CRMS - CISPR RMS detection

BlueRadio Inc.
Bluetooth 4.0 Single Mode Module
Model: BR-LE4.0-S2
Job: 11U13712 120V 60Hz
Tested By: MM 2402MHz/Xmt

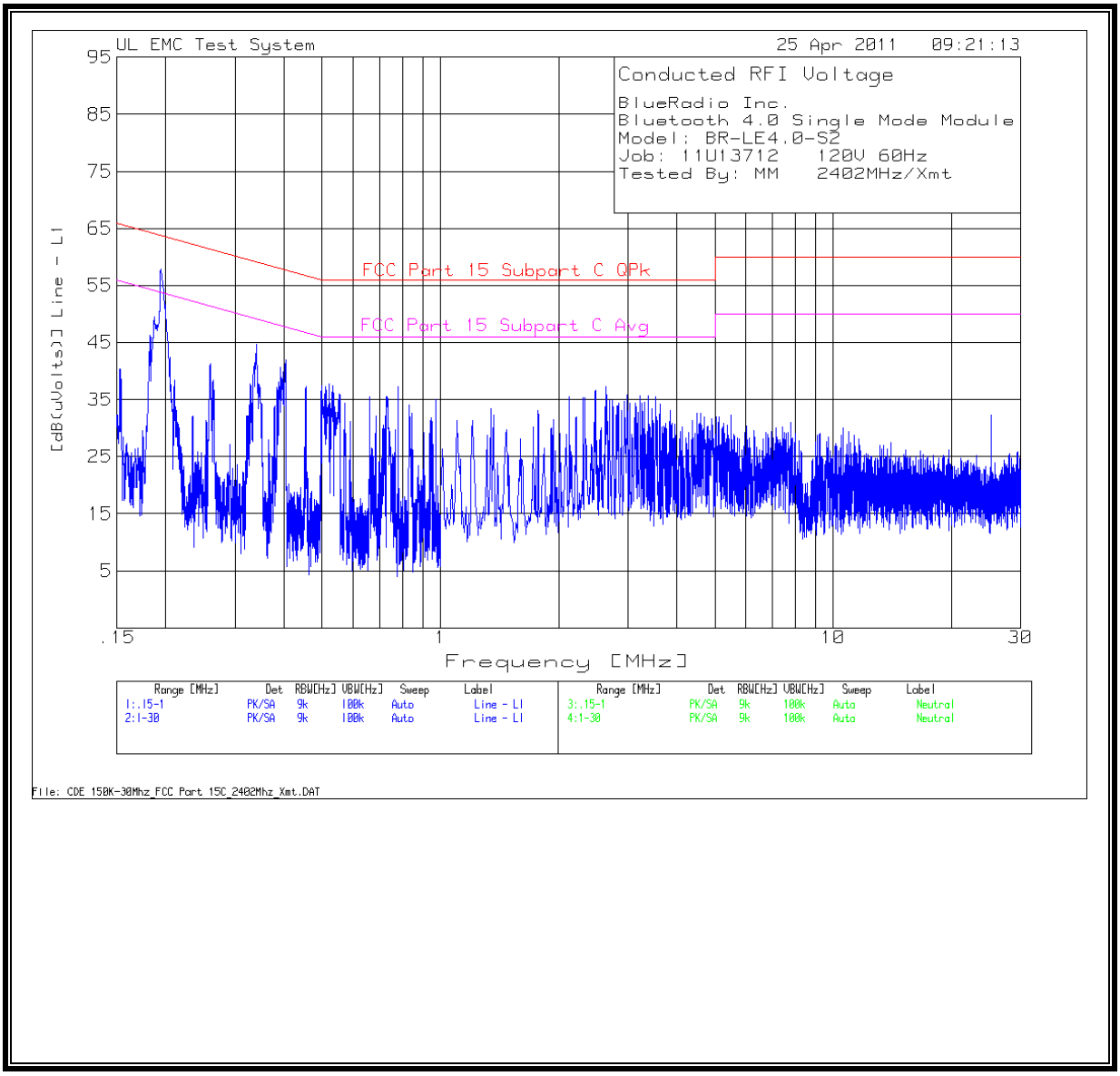
Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transduce Factor [dB]	Level [dB(uVolts)]	Limit 1	Margin 1[dB]	Limit 2	Margin 2[dB]
Line - L1 .15 - 1MHz									
0.19353	25.02	Av	11.2	0	36.22	63.9	-27.68	53.9	-17.68
0.33921	16.95	Av	10.7	0	27.65	59.2	-31.55	49.2	-21.55
0.39171	24.26	Av	10.6	0	34.86	58	-23.14	48	-13.14
0.52124	21.38	Av	10.5	0	31.88	56	-24.12	46	-14.12
Line - L1 1 - 30MHz									
2.47944	10.97	Av	10.4	0	21.37	56	-34.63	46	-24.63
2.99031	8.34	Av	10.4	0	18.74	56	-37.26	46	-27.26
Neutral .15 - 1MHz									
0.19864	34.34	Av	11.1	0	45.44	63.7	-18.26	53.7	-8.26
0.25634	26.83	Av	10.9	0	37.73	61.5	-23.77	51.5	-13.77
0.38841	17.2	Av	10.6	0	27.8	58.1	-30.3	48.1	-20.3
0.64619	11.77	Av	10.5	0	22.27	56	-33.73	46	-23.73
0.81274	12.91	Av	10.4	0	23.31	56	-32.69	46	-22.69
0.85573	8.81	Av	10.4	0	19.21	56	-36.79	46	-26.79
0.97169	10.74	Av	10.4	0	21.14	56	-34.86	46	-24.86
Neutral 1 - 30MHz									
1.19123	8.88	Av	10.4	0	19.28	56	-36.72	46	-26.72
1.38314	8.45	Av	10.4	0	18.85	56	-37.15	46	-27.15

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

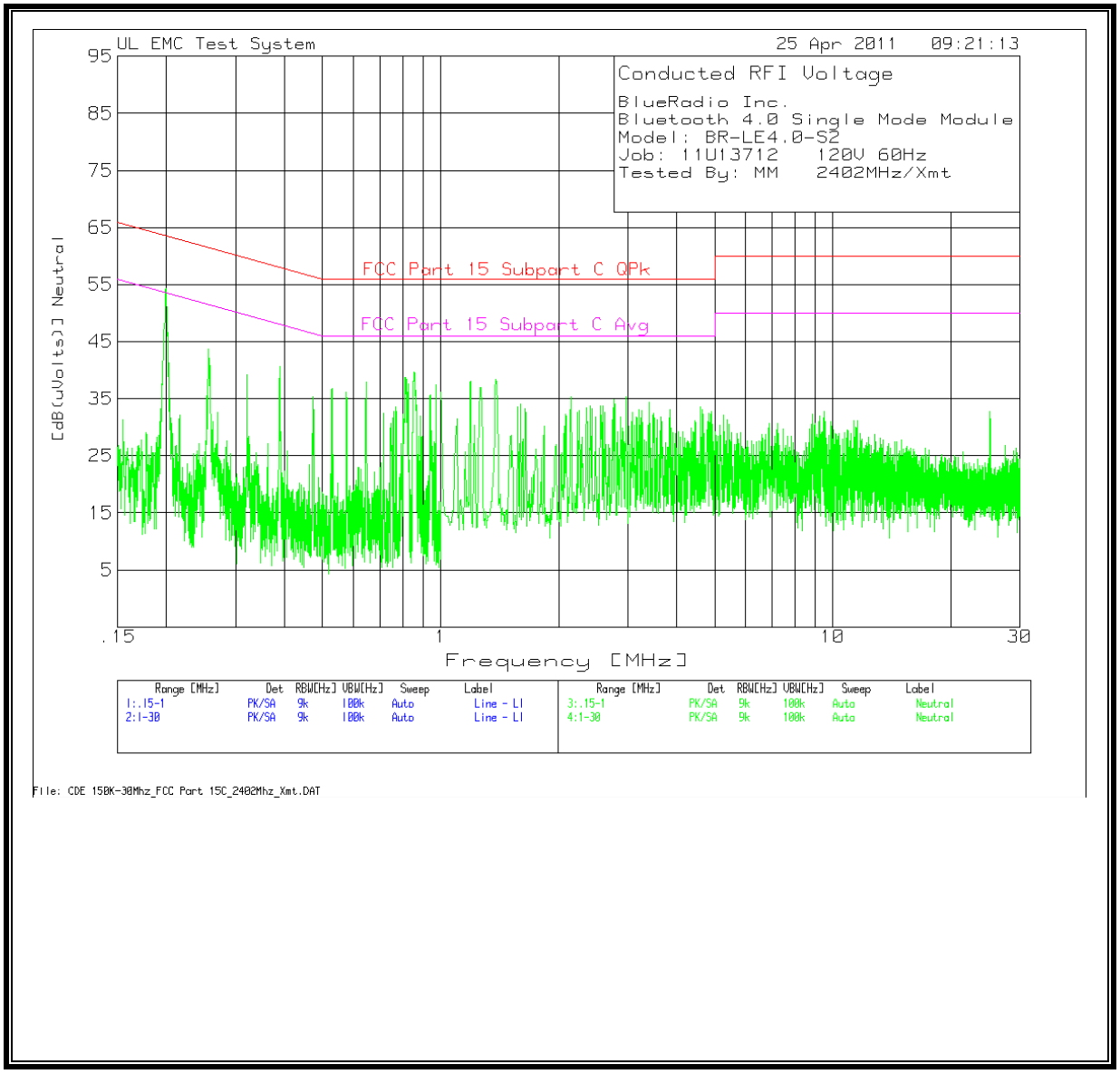
PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detection
Av - average detection
CAV - CISPR average detection
RMS - RMS detection
CRMS - CISPR RMS detection

LIMIT 1: FCC Part 15 Subpart C QPk
LIMIT 2: FCC Part 15 Subpart C Avg

LINE 1 RESULTS



LINE 2 RESULTS



6 WORST EMISSIONS (RX Mode)

BlueRadio Inc.
Bluetooth 4.0 Single Mode Module
Model: BR-LE4.0-S2
Job: 11U13712 120V 60Hz
Tested By: MM 2402MHz/Rec.

Marker Number	Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit 1	Margin 1[dB]	Limit 2	Margin 2[dB]
Line - L1 .15 - 1MHz										
1	0.15748	45.71	PK	11.5	0	57.21	65.6	-8.39	55.6	1.61
2	0.16054	40.19	PK	11.5	0	51.69	65.4	-13.71	55.4	-3.71
3	0.17806	33.54	PK	11.3	0	44.84	64.6	-19.76	54.6	-9.76
4	0.19897	33.89	PK	11.1	0	44.99	63.7	-18.71	53.7	-8.71
5	0.27753	31.31	PK	10.8	0	42.11	60.9	-18.79	50.9	-8.79
6	0.46133	29.73	PK	10.5	0	40.23	56.7	-16.47	46.7	-6.47
7	0.50112	28.07	PK	10.5	0	38.57	56	-17.43	46	-7.43
Neutral .15 - 1MHz										
8	0.16513	39.61	PK	11.4	0	51.01	65.2	-14.19	55.2	-4.19
9	0.16938	39.26	PK	11.4	0	50.66	65	-14.34	55	-4.34
10	0.17415	36.54	PK	11.3	0	47.84	64.8	-16.96	54.8	-6.96
11	0.19897	32.29	PK	11.1	0	43.39	63.7	-20.31	53.7	-10.31
12	0.21784	36.27	PK	11	0	47.27	62.9	-15.63	52.9	-5.63
13	0.22005	32.72	PK	11	0	43.72	62.8	-19.08	52.8	-9.08
14	0.25644	33.67	PK	10.9	0	44.57	61.5	-16.93	51.5	-6.93
15	0.39825	29.09	PK	10.6	0	39.69	57.9	-18.21	47.9	-8.21
16	0.47868	30.34	PK	10.5	0	40.84	56.4	-15.56	46.4	-5.56
17	0.49262	30.15	PK	10.5	0	40.65	56.1	-15.45	46.1	-5.45

LIMIT 1: FCC Part 15 Class B QPk
LIMIT 2: FCC Part 15 Class B Avg

PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector
CAV - CISPR Average detector
RMS - RMS detection
CRMS - CISPR RMS detection

BlueRadio Inc.
Bluetooth 4.0 Single Mode Module
Model: BR-LE4.0-S2
Job: 11U13712 120V 60Hz
Tested By: MM 2402MHz/Rec.

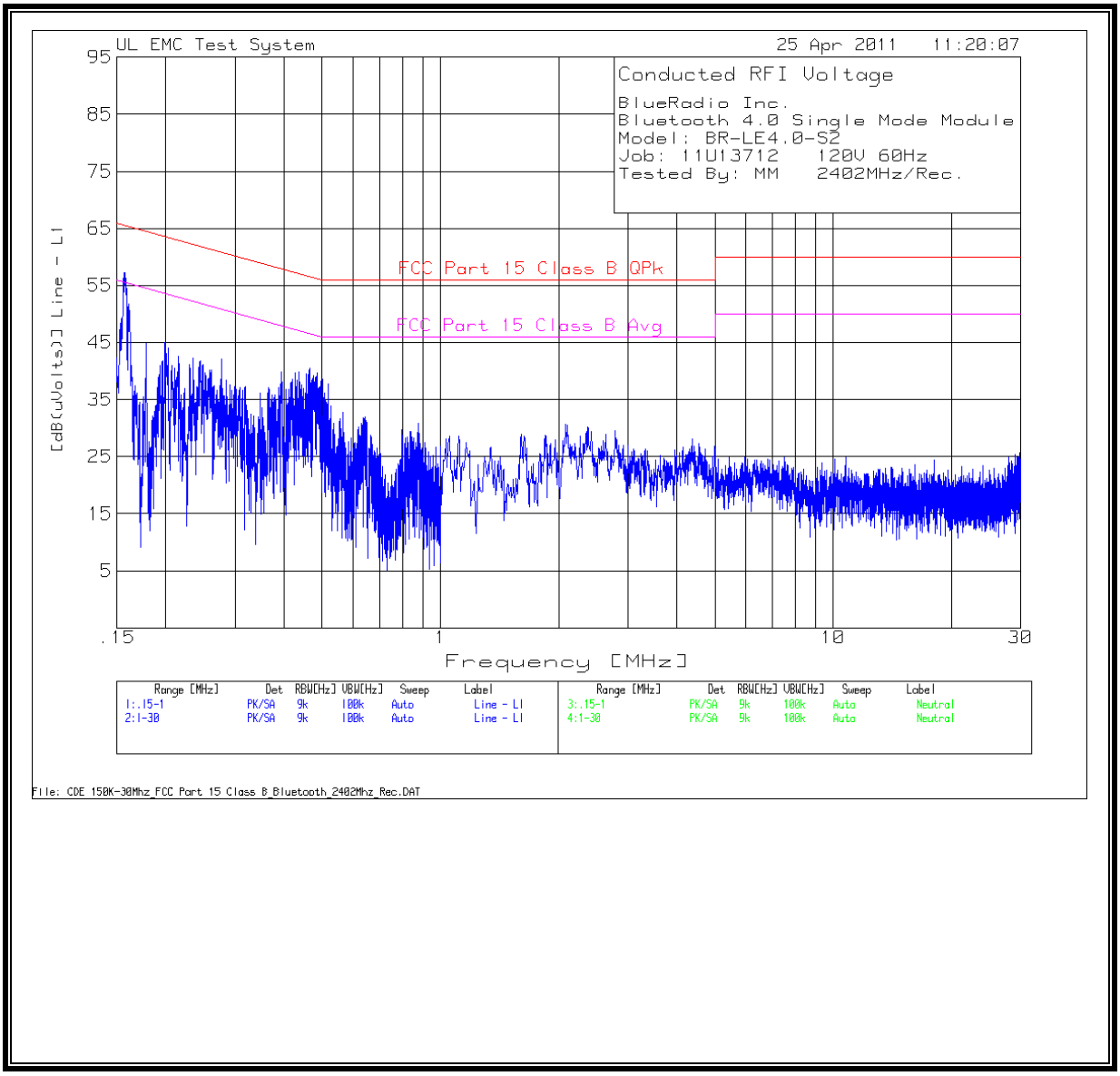
Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit 1	Margin 1[dB]	Limit 2	Margin 2[dB]
Line - L1 .15 - 1MHz									
0.15692	30.31	Av	11.5	0	41.81	65.6	-23.79	55.6	-13.79
0.16074	31.23	Av	11.5	0	42.73	65.4	-22.67	55.4	-12.67
0.17802	29.11	Av	11.3	0	40.41	64.6	-24.19	54.6	-14.19
0.19867	27.9	Av	11.1	0	39	63.7	-24.7	53.7	-14.7
0.27754	18.59	Av	10.8	0	29.39	60.9	-31.51	50.9	-21.51
0.46126	23.23	Av	10.5	0	33.73	56.7	-22.97	46.7	-12.97
0.5011	20.86	Av	10.5	0	31.36	56	-24.64	46	-14.64
Neutral .15 - 1MHz									
0.1651	32.93	Av	11.4	0	44.33	65.2	-20.87	55.2	-10.87
0.16887	30.84	Av	11.4	0	42.24	65	-22.76	55	-12.76
0.17384	29.28	Av	11.3	0	40.58	64.8	-24.22	54.8	-14.22
0.19866	27.93	Av	11.1	0	39.03	63.7	-24.67	53.7	-14.67
0.21747	21.97	Av	11	0	32.97	62.9	-29.93	52.9	-19.93
0.22033	21.1	Av	11	0	32.1	62.8	-30.7	52.8	-20.7
0.25617	22.31	Av	10.9	0	33.21	61.6	-28.39	51.6	-18.39
0.39815	19.94	Av	10.6	0	30.54	57.9	-27.36	47.9	-17.36
0.47828	23.68	Av	10.5	0	34.18	56.4	-22.22	46.4	-12.22
0.49222	22.39	Av	10.5	0	32.89	56.1	-23.21	46.1	-13.21

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

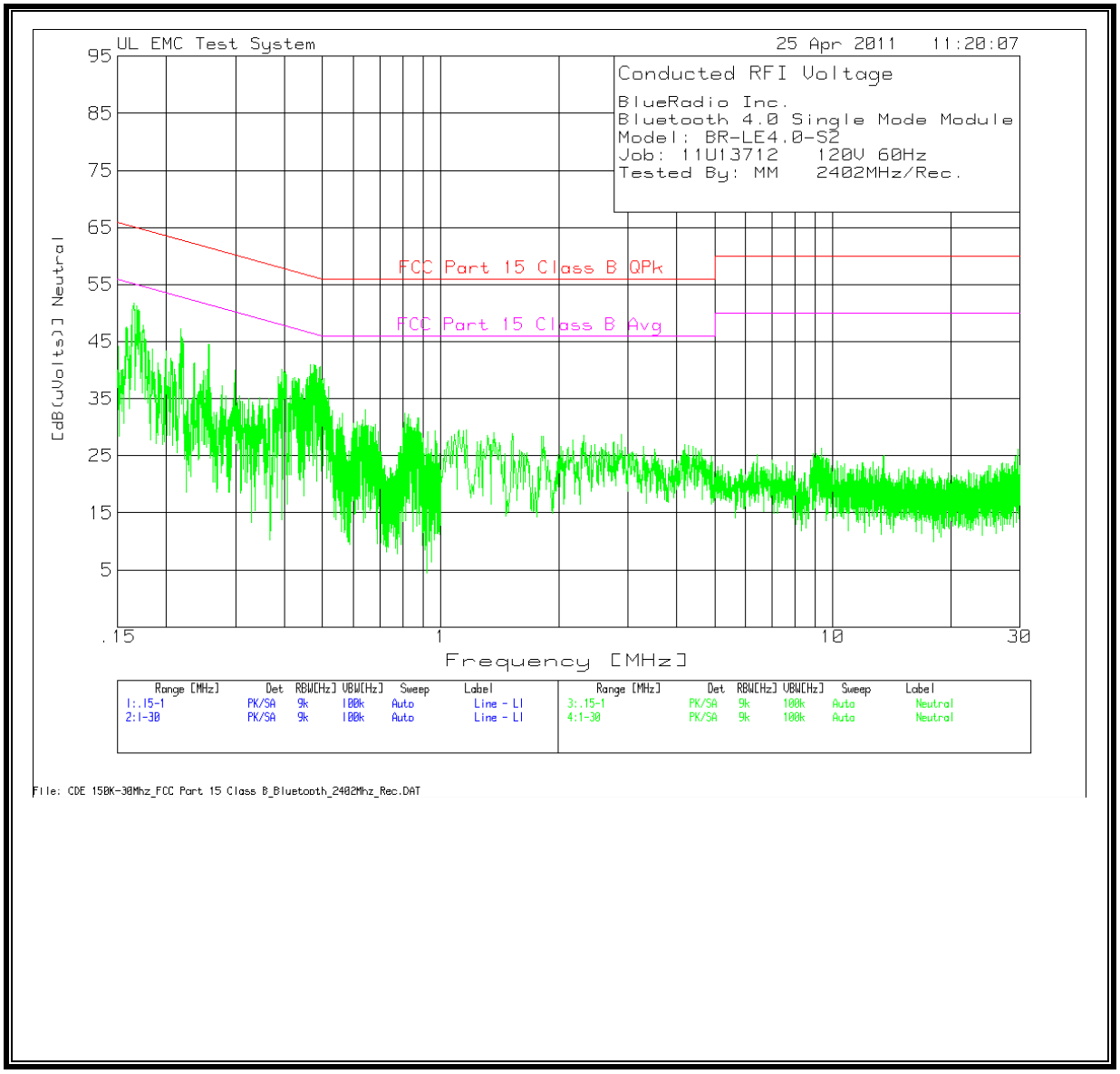
PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detection
Av - average detection
CAV - CISPR average detection
RMS - RMS detection
CRMS - CISPR RMS detection

LIMIT 1: FCC Part 15 Class B QPk
LIMIT 2: FCC Part 15 Class B Avg

LINE 1 RESULTS



LINE 2 RESULTS



10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

Band	Mode	IC Limit (W/m^2)	FCC Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	Separation Distance (m)
2.4 GHz	Bluetooth	10.00	1.000	3.92	3.00	0.01