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

CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n 3X3 W/NO BEAM FORMING MODULE

MODEL NUMBER: AR5BHB112

FCC ID: WA7-AR5BHB112
IC: 6627C-AR5BHB112

REPORT NUMBER: 13U14943

ISSUE DATE: 2013-04-24

Prepared for
FLUKE NETWORKS
6920 SEAWAY BLVD
EVERRET, WA 98203 USA

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NVLAP LAB CODE 100255-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	4/24/13	Initial Issue	M. Antola

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: FLUKE NETWORKS
6920 SEAWAY BLVD
EVERRET, WA, 98203, USA

EUT DESCRIPTION: 802.11a/b/g/n 3X3 W/NO BEAM FORMING MODULE

MODEL: AR5BHB112

SERIAL NUMBER: NON-SERIALIZED PRODUCTION UNIT

DATE TESTED: 2013-04-03 to 2013-04-20

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

UL LLC 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 UL LLC 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 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 By:

Bob DeLisi
WiSE Principal Engineer
UL

Tested By:

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WiSE Project Lead
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%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11a/b/g/n 3x3 product with the option of no beam forming module.

The radio module is manufactured by Atheros.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding a new antenna types with lower gain.

5.3. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	21.91	155.24
2412 - 2462	802.11g	18.97	78.89
2412 - 2462	802.11n HT20	20	100.00
2422 - 2452	802.11n HT40	15.8	38.02
5745 - 5825	802.11a	19.81	95.72
5745 - 5825	802.11n HT20	19.82	95.94
5755 - 5795	802.11n HT40	19.73	93.97

In order to pass Band edge measurements, the 2.4 GHz band must be reduced from the original average output powers as table shown below:

802.11g, 6Mbps Mode

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Notes
High	2462	13.92	13.04	13.11	18.15	Original power setting
High	2462	11.65	11.49	11.08	16.18	Adjusted power setting

Peak power measurements were also re-measured under this mode/frequency and results are contained within this report.

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a total of 3 external connector mount antennas manufactured by Centurion. Each antenna has a maximum gain of 2.1 dBi in the 2.4GHz band and 2.5 dBi in the 5.8GHz band.

5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Atheros AR9300 Anwi Diagnostic Kernel Driver.

The test utility software used during testing was Atheros Radio Test 2 (ART2-GUI), Version 2.3.

5.6. WORST-CASE CONFIGURATION AND MODE

Radiated emission was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in the X orientation.

Based on the baseline scan, the worst-case data rates were:

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11a mode: 9 Mbps
802.11n HT20mode: MCS0
802.11n HT40mode: MCS0

Radiated emissions for EUT with antenna was performed and passed; therefore, antenna port spurious was not performed.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Dell	PP04X	CN-0HN338-48643-7BO-1010	DoC
Express Card Adapter	Fluke Networks	EC2C	--	DoC
AC Adapter	Dell	PA-1900-02D	CN-09T215-71615-51K-1D89	DoC

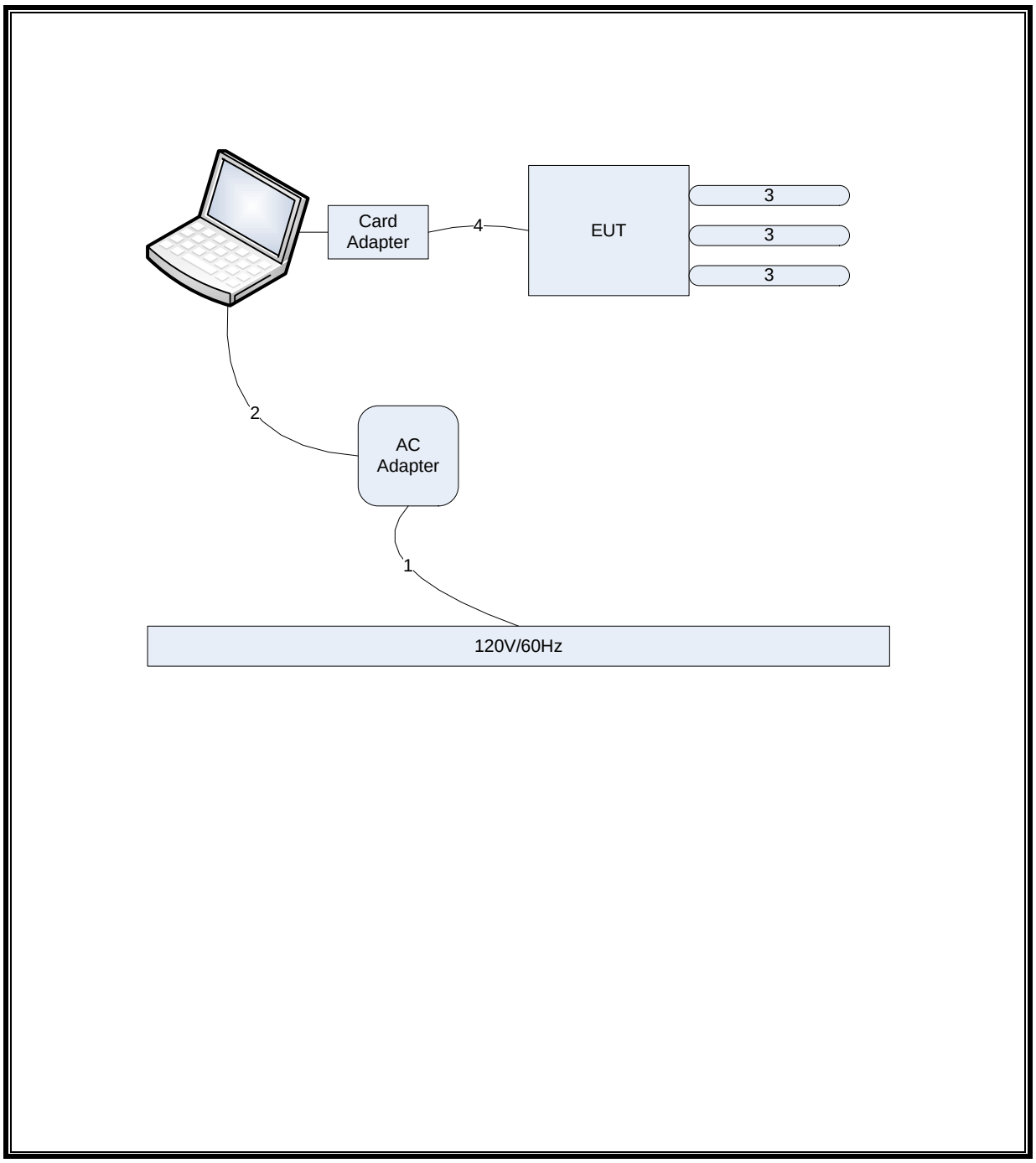
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	US 115V	Unshielded	1	None
2	DC	1	DC	Unshielded	2	None
3	Ant Port	3	RP-SMA	Unshielded	NA	None
4	mHDMI	1	mHDMI	Shielded	0.1	None

TEST SETUP

The EUT is connected to a host laptop computer via a PCI-E adapter board during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Radiated Emissions					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
30-1000MHz					
EMI Receiver	Rohde & Schwarz	ESIB26	ME5B-081	2013-01-29	2014-01-31
Log-P Antenna	Schaffner	UPA6109	44067	2012-05-16	2013-05-16
Bicon Antenna	Schaffner	VBA6106A	43441	2012-11-12	2013-11-12
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 9.5	44740	N/A	N/A
Above 1GHz (Band Optimized System)					
EMI Receiver	Rohde & Schwarz	ESIB40	34968	2013-01-30	2014-01-31
Horn Antenna (1-2 GHz)	ETS	3161-01 (26°)**	51442	2008-03-28	See * below
Horn Antenna (2-4 GHz)	ETS	3161-02 (22°)**	48107	2007-09-27	See * below
Horn Antenna (4-8 GHz)	ETS	3161-03 (22°)**	48106	2007-09-27	See * below
Horn Antenna (8-12 GHz)	ETS	3160-07 (26°)**	8933	2008-11-24	See * below
Horn Antenna (12-18 GHz)	ETS	3160-08 (26°)**	8932	2007-09-27	See * below
Horn Antenna (18-26.5 GHz)	ETS	3160-09 (27°)**	8947	2007-09-26	See * below
Horn Antenna (26.5-40 GHz)	ETS	3160-10 (27°)**	73004	2007-09-26	See * below
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
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22

* - 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.

** - Number in parentheses denotes antenna beam width.

Bench Tests					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
RF Room 1					
Spectrum Analyzer	Agilent	E4446A	72823	2013-01-29	2014-01-31
Horn Antenna	EMCO	3115	ME5A-766	2012-11-28	2013-11-28
Power Sensor	Rohde & Schwarz	NRP-Z81	73137	2013-01-30	2014-01-31
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22

7. MEASUREMENT METHODS

KDB 558074 Measurement Procedure PK2 is used for power and PKPSD is used for power spectral density.

Unwanted emissions within Restricted Bands are measured using traditional radiated procedures.

8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

8.1.1. ON TIME AND DUTY CYCLE RESULTS

2.4GHz Band

Mode	ON Time B (usec)	OFF Time (usec)	Period (usec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (Hz)
802.11g	1359	51	1400	0.971	97.1%	0.13	736
802.11n HT20	1272	50	1322	0.962	96.2%	0.17	786
802.11n HT40	632	38	670	0.943	94.3%	0.26	1,583

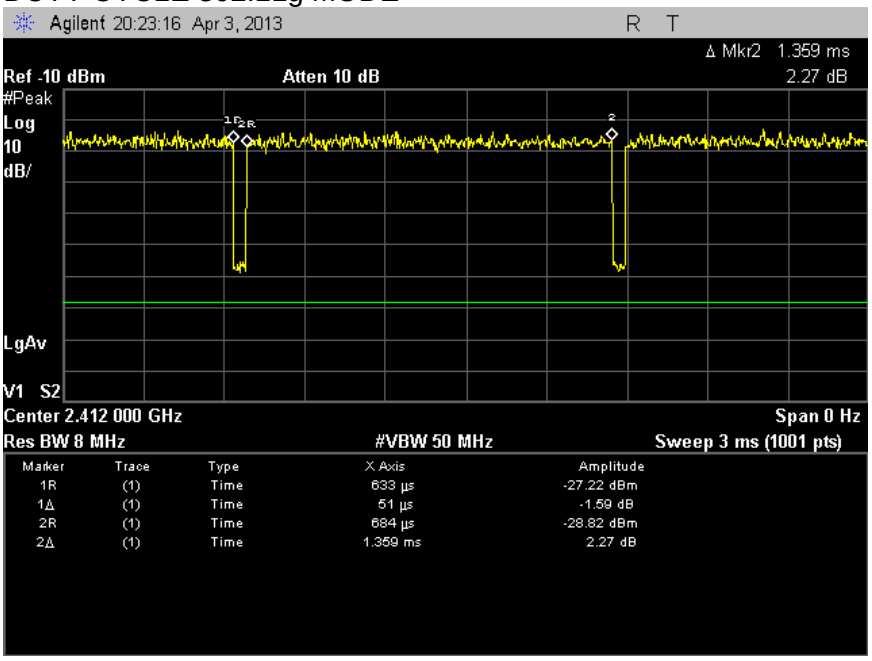
5.8GHz Band

Mode	ON Time B (usec)	OFF Time (usec)	Period (usec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (Hz)
802.11a	1359	45	1404	0.968	96.8%	0.14	736
802.11n HT20	1272	44	1312	0.970	97.0%	0.13	786

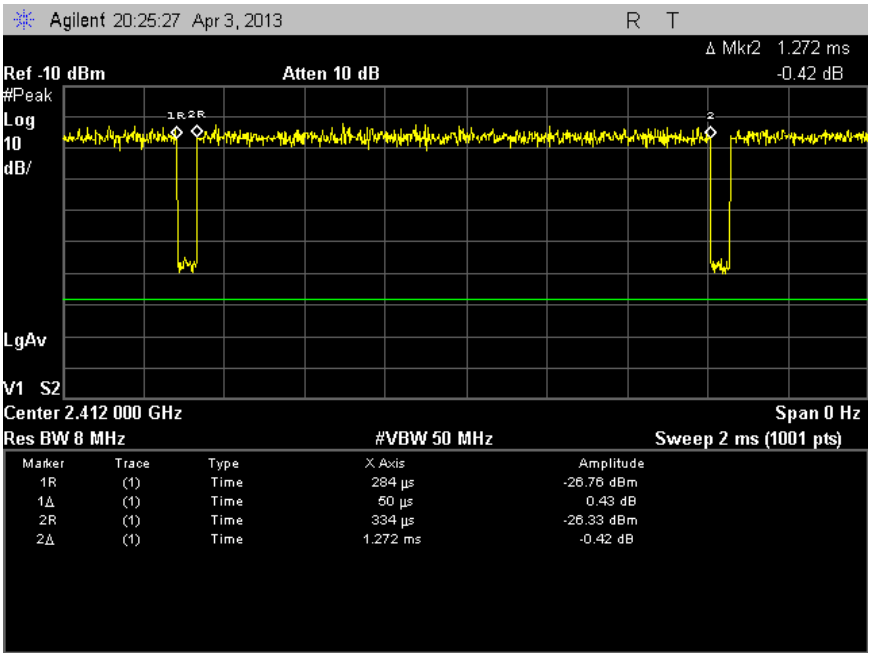
Note: The 802.11b mode operates at 100% duty cycle.

8.1.2. DUTY CYCLE PLOTS – 2.4GHz BAND

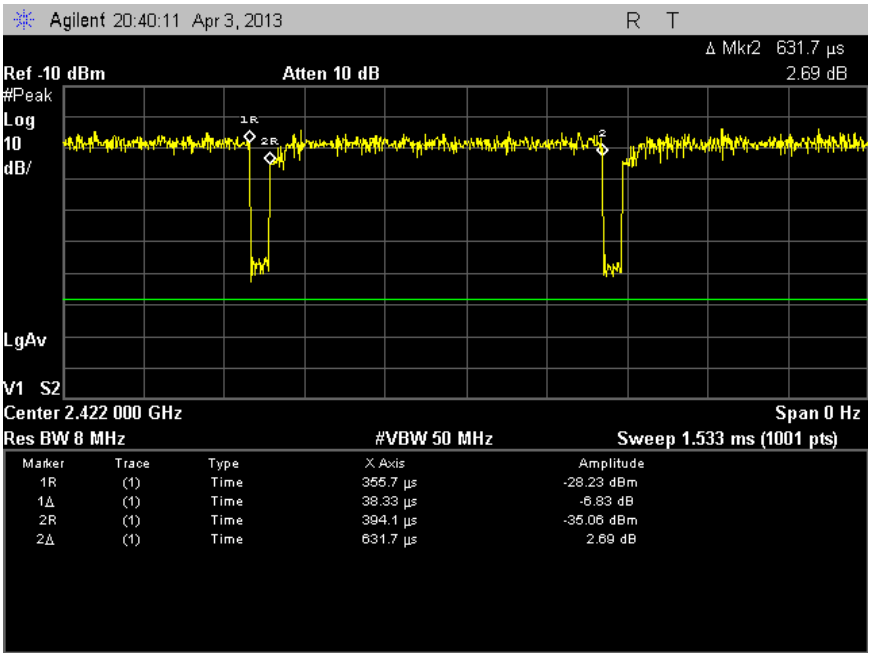
DUTY CYCLE 802.11g MODE



DUTY CYCLE 802.11n HT20 MODE

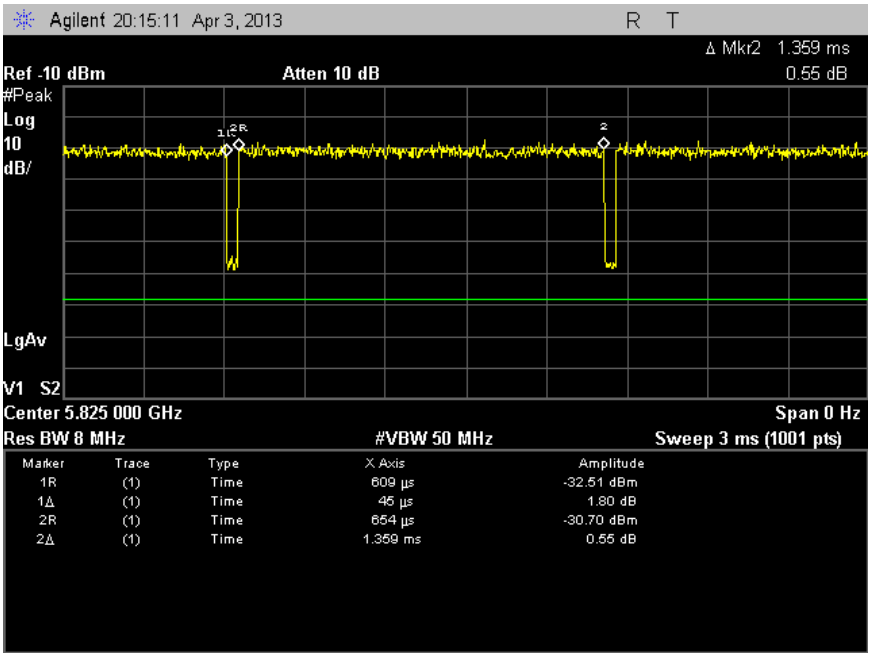


DUTY CYCLE 802.11n HT40 MODE

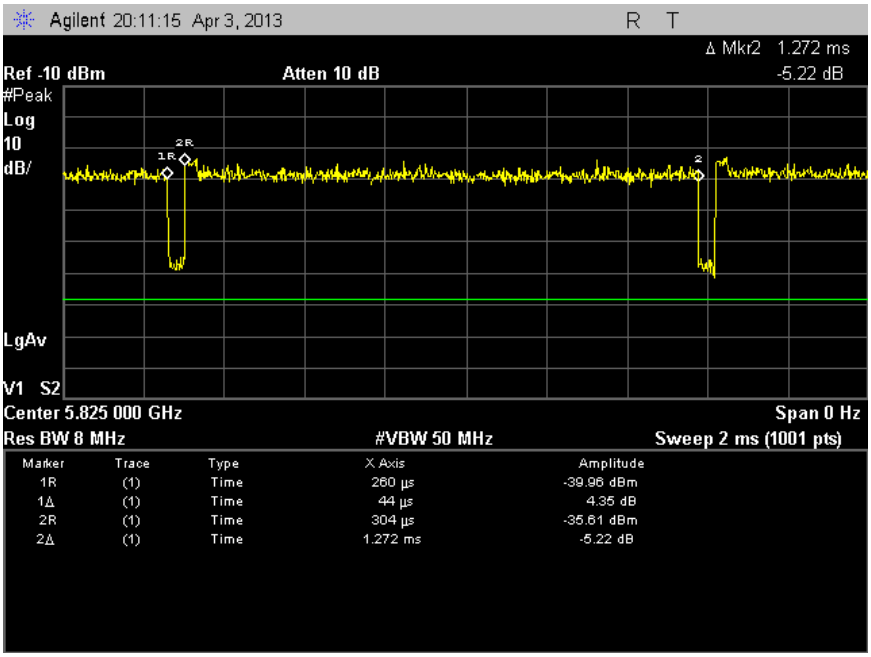


8.1.3. DUTY CYCLE PLOTS – 5GHz BAND

DUTY CYCLE 802.11a MODE



DUTY CYCLE 802.11n HT20 MODE



9. 802.11g MODE IN THE 2.4 GHz BAND

9.1.1. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10 dB was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

802.11g, 6Mbps Mode

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	2412	8.28	7.23	6.80	12.25
Mid	2437	14.76	14.21	13.53	18.97
High	2462	11.65	11.49	11.08	16.18

9.1.2. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is the same for each chain. The directional gain is:

Antenna Gain (dBi)	10 * Log (3 chains) (dB)	Correlated Chains Directional Gain (dBi)
2.10	4.77	6.87

RESULTS

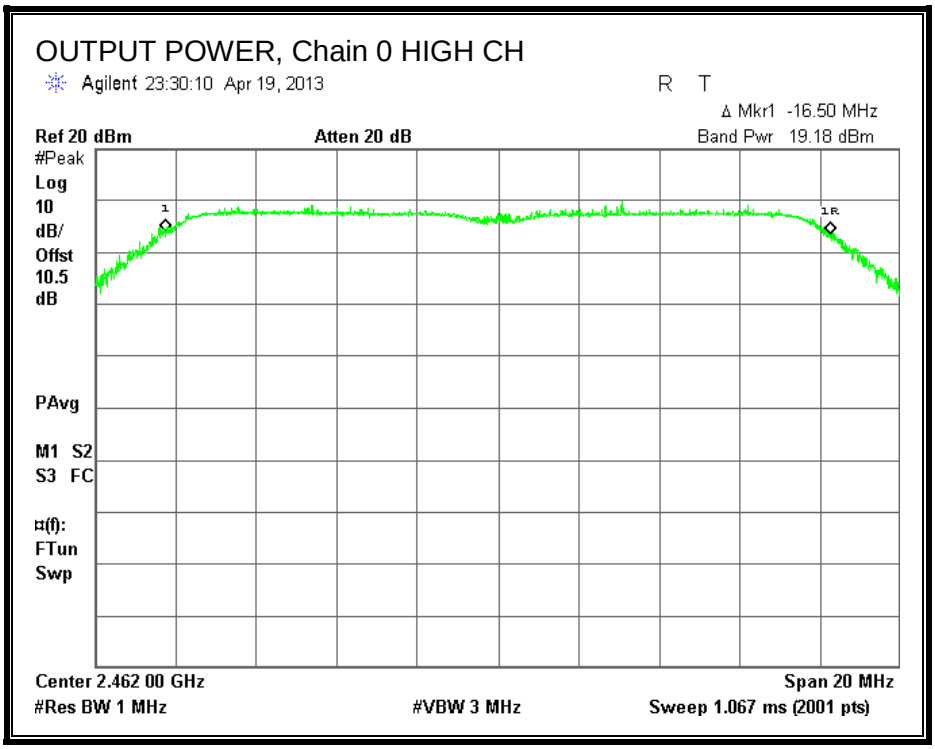
Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
High	2462	2.10	30.00	30	36	30.00

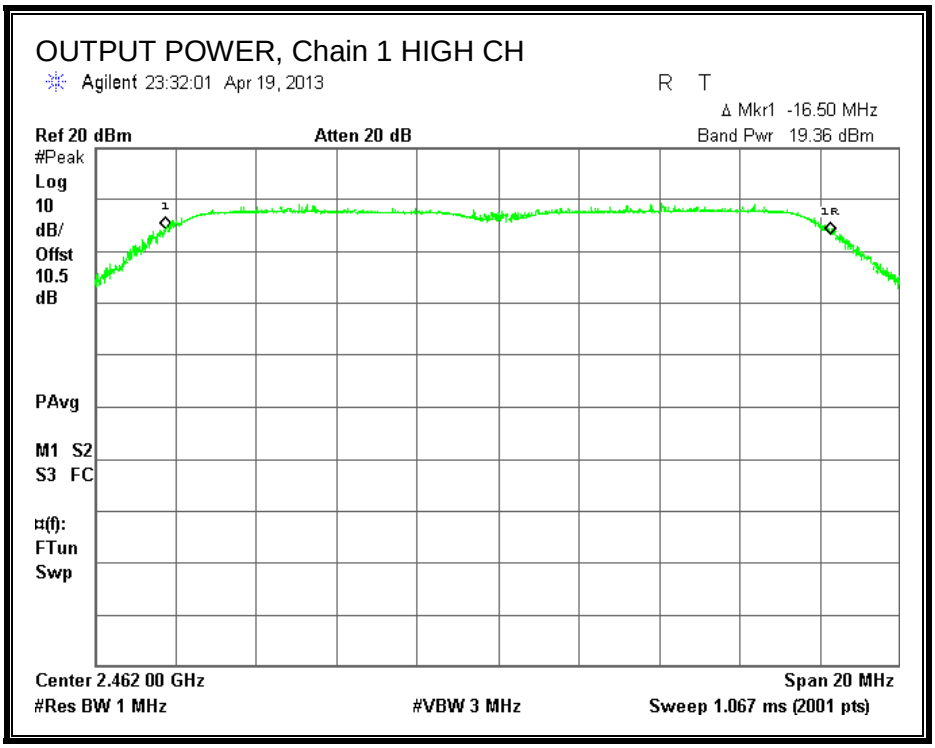
Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
High	2462	19.18	19.36	18.87	23.91	30.00	-6.09

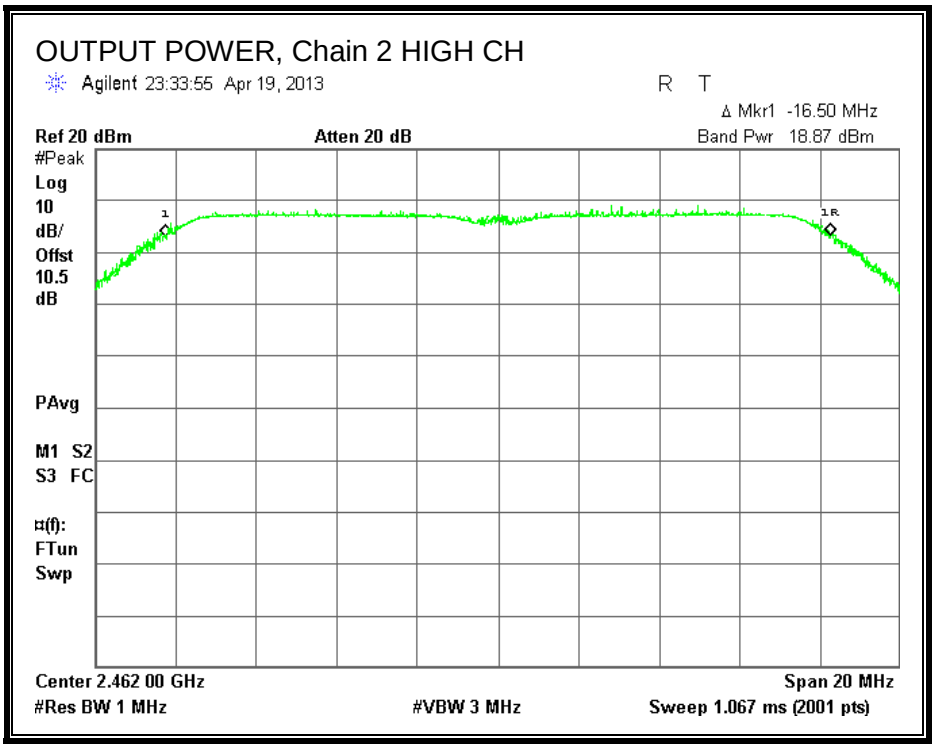
OUTPUT POWER, Chain 0



OUTPUT POWER, Chain 1



OUTPUT POWER, Chain 2



10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (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.

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; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

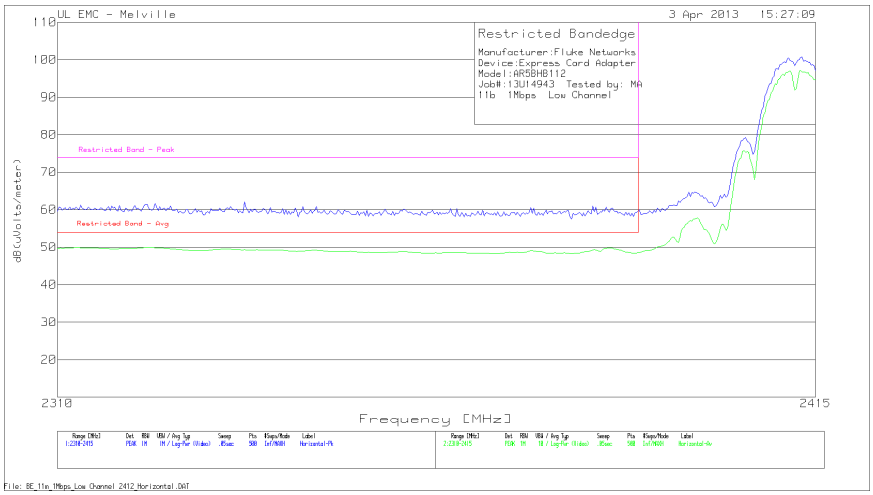
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

10.2. TRANSMITTER ABOVE 1 GHz

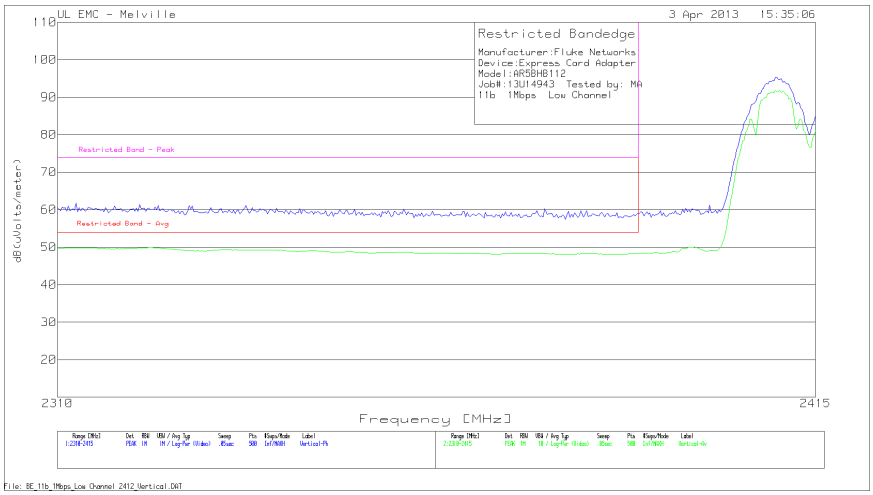
10.2.1. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, PEAK & AVERAGE, HORIZ

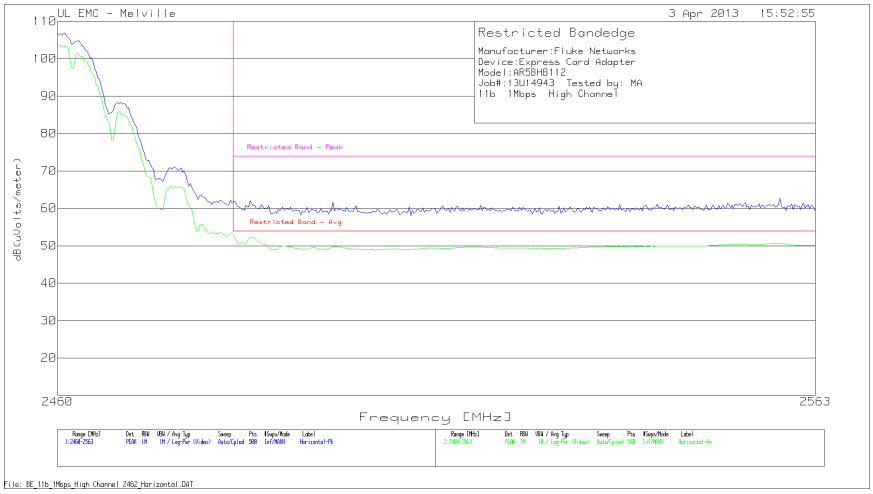


LOW CHANNEL RESTRICTED, PEAK & AVERAGE, VERT

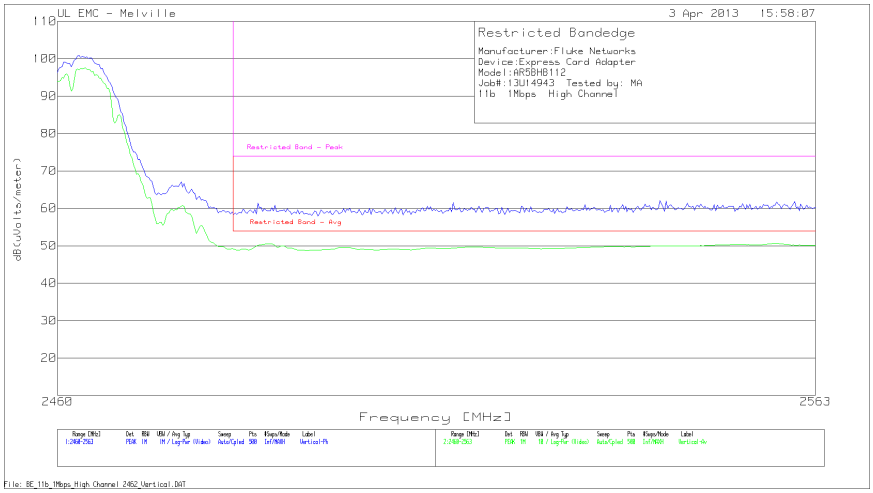


AUTHORIZED BANDEDGE (HIGH CHANNEL)

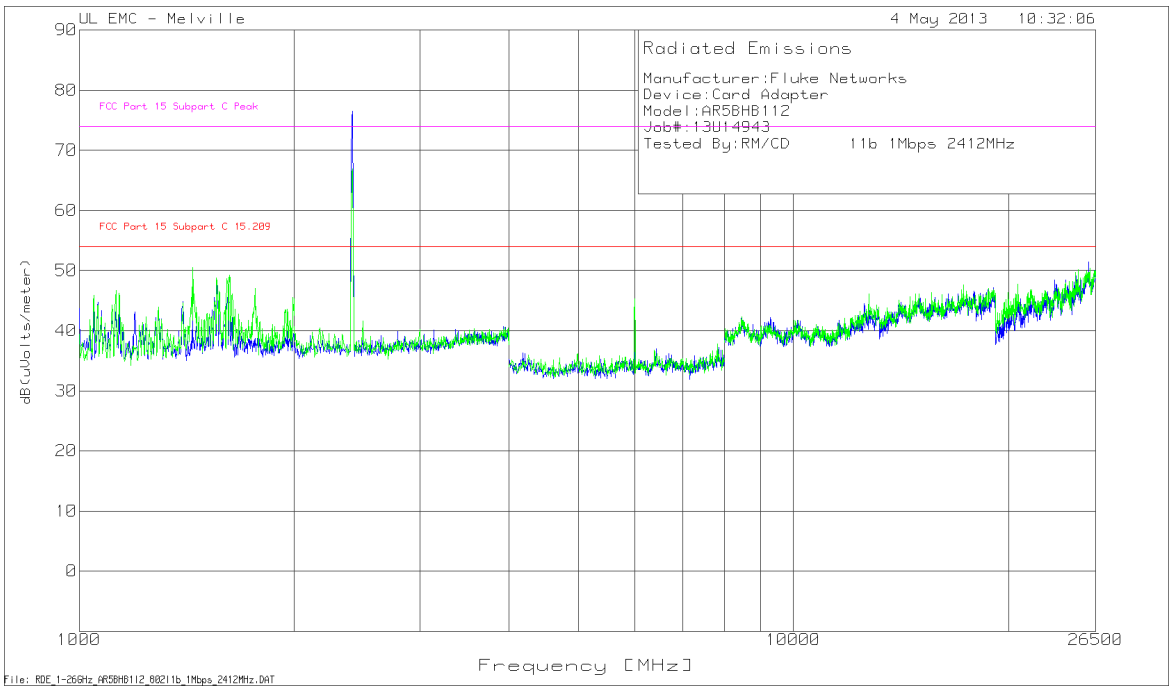
HIGH CHANNEL BANDEDGE, PEAK & AVERAGE, HORIZ



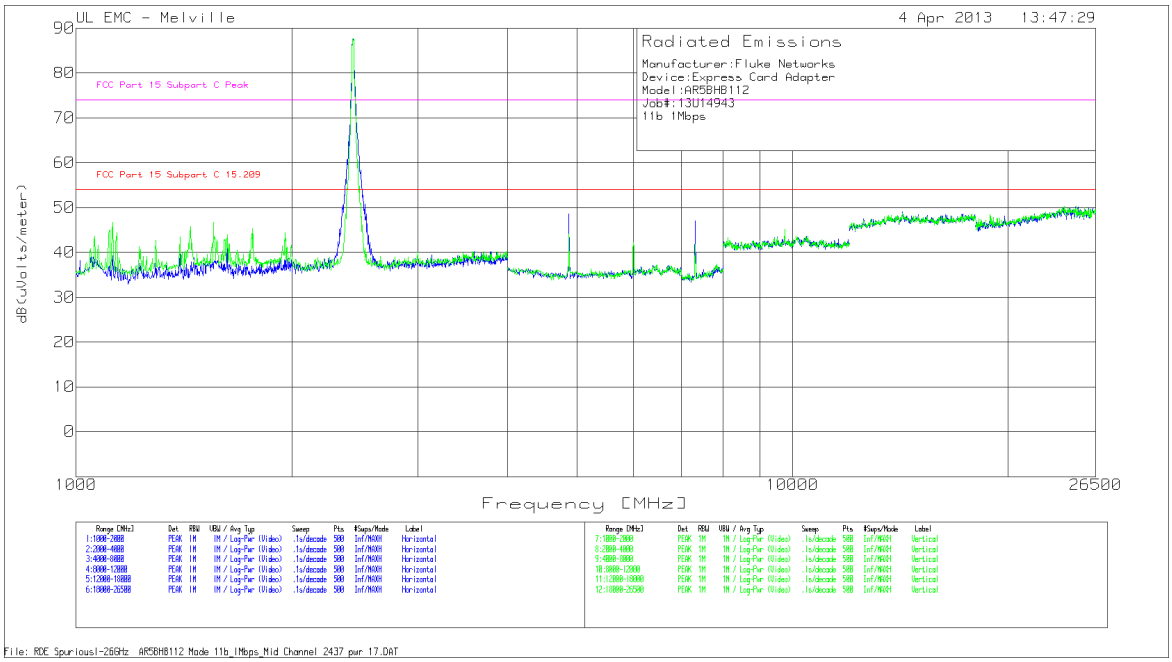
HIGH CHANNEL BANDEDGE, PEAK & AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

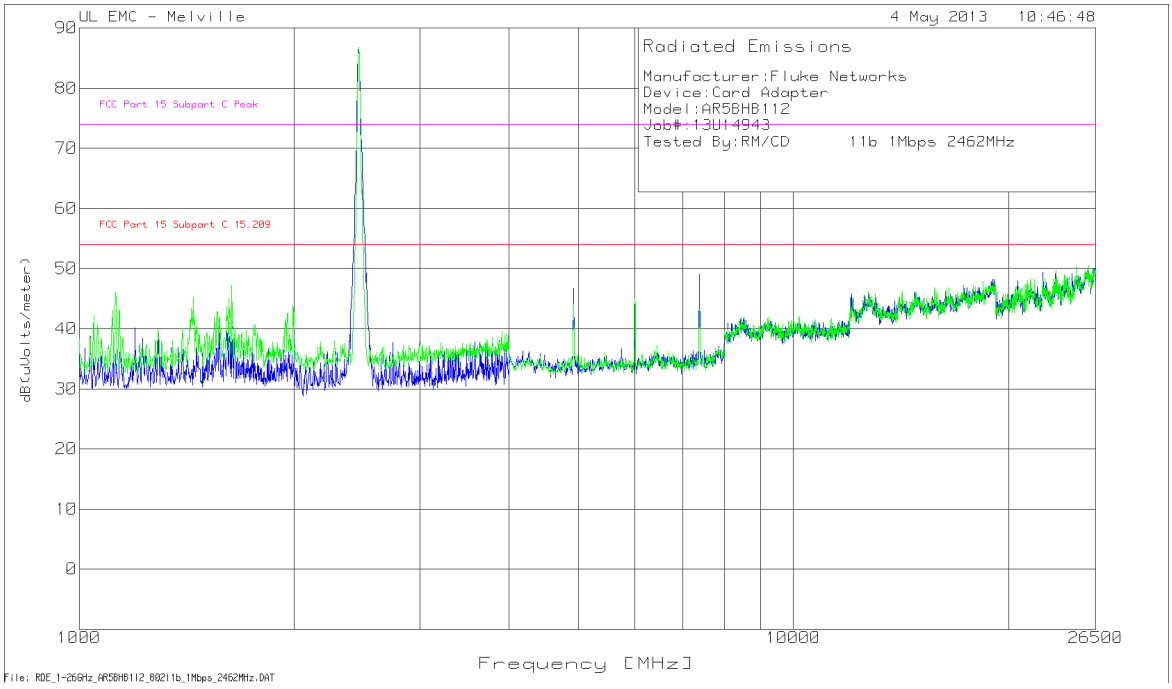


Low Channel



Mid Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)



High Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)

Manufacturer:Fluke Networks
Device:Express Card Adapter
Model:AR5BHB112
Job#:13U14943
11b 1Mbps

Low Channel - 2412MHz

Test Frequency	Meter Reading	Detector	AF-48106 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
4824.0301	66.73	PK	27.1	-53.51	40.32	-	-	74	-33.68	139	164	Horz
4824.02	67.59	PK	27.1	-53.51	41.18	-	-	74	-32.82	160	354	Vert
4824.02	61.01	LnAv	27.1	-53.51	34.6	54	-19.4	-	-	160	354	Vert
4824.0301	59.86	LnAv	27.1	-53.51	33.45	54	-20.55	-	-	139	164	Horz

Mid Channel - 2437MHz

Test Frequency	Meter Reading	Detector	AF-48106 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
4873.9198	78.6	PK	27.2	-53.25	52.55	-	-	74	-21.45	158	354	Vert
4873.9198	80.51	PK	27.2	-53.25	54.46	-	-	74	-19.54	95	343	Horz
7309.9679	75.58	PK	28	-52.38	51.2	-	-	74	-22.8	29	260	Horz
7309.9679	75.19	PK	28	-52.38	50.81	-	-	74	-23.19	0	367	Vert
4873.9374	75.69	LnAv	27.2	-53.25	49.64	54	-4.36	-	-	232	218	Horz
4873.9374	65.53	LnAv	27.2	-53.25	39.48	54	-14.52	-	-	232	218	Vert
7311.992	71.91	LnAv	28	-52.38	47.53	54	-6.47	-	-	6	344	Vert
7311.992	68.46	LnAv	28	-52.38	44.08	54	-9.92	-	-	31	288	Horz

High Channel - 2462MHz

Test Frequency	Meter Reading	Detector	AF-48106 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
4923.9098	76.55	PK	27.2	-53.3	50.45	-	-	74	-23.55	84	332	Horz
4923.9098	76.87	PK	27.2	-53.3	50.77	-	-	74	-23.23	146	233	Vert
7381.8918	69.92	PK	28.1	-52.09	45.93	-	-	74	-28.07	340	393	Vert
7381.8918	67.65	PK	28.1	-52.09	43.66	-	-	74	-30.34	270	260	Horz
4923.98	75.26	LnAv	27.2	-53.3	49.16	54	-4.84	-	-	272	313	Horz
4923.9098	74.9	LnAv	27.2	-53.3	48.8	54	-5.2	-	-	146	233	Vert
7381.8918	65	LnAv	28.1	-52.09	41.01	54	-12.99	-	-	340	393	Vert
7381.8918	60.25	LnAv	28.1	-52.09	36.26	54	-17.74	-	-	270	260	Horz

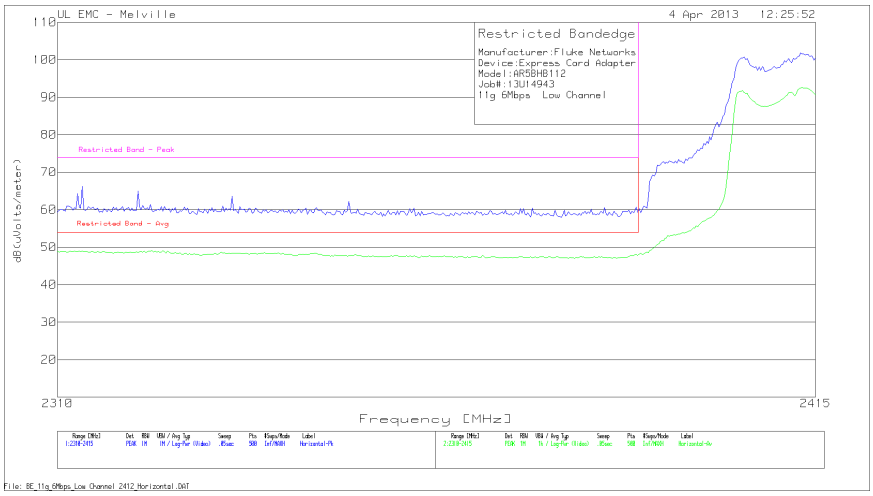
PK - Peak detector
LnAv - Linear Average detector

NOTE: No other emissions were noted above the system noise floor

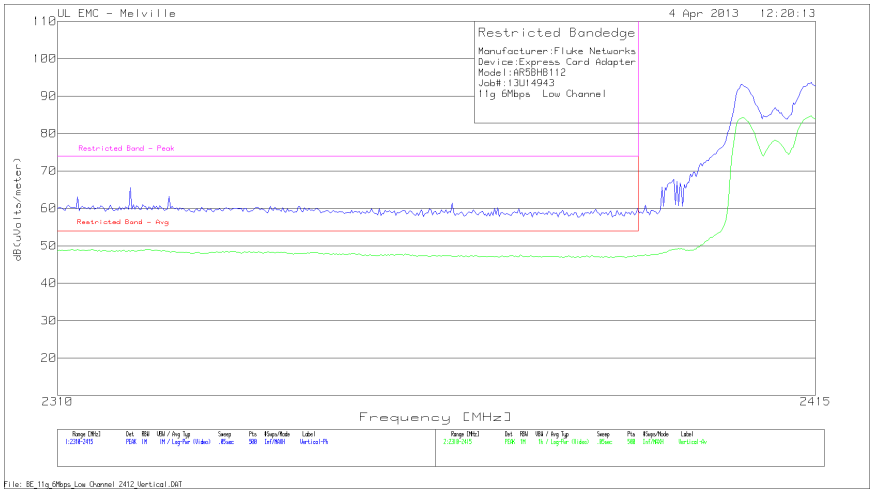
10.2.2. TX ABOVE 1 GHz 802.11g MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, PEAK & AVERAGE, HORIZ



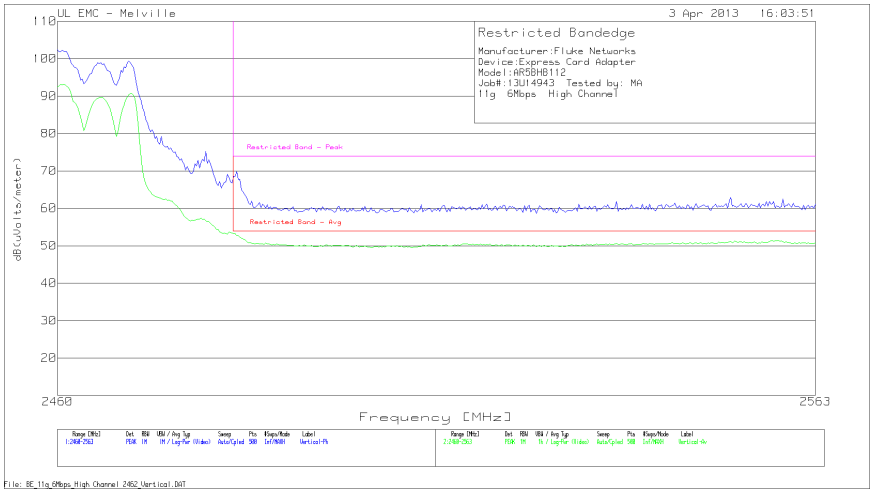
LOW CHANNEL RESTRICTED, PEAK & AVERAGE, VERT



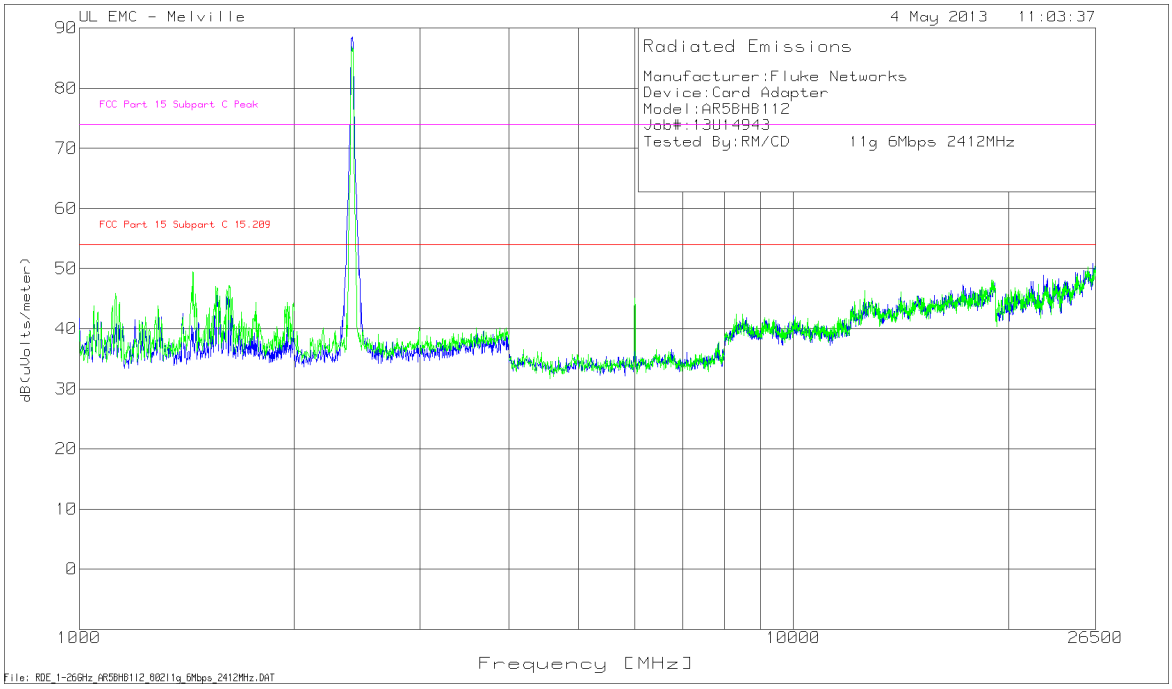
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HIGH CHANNEL BANDEDGE, PEAK & AVERAGE, HORIZ

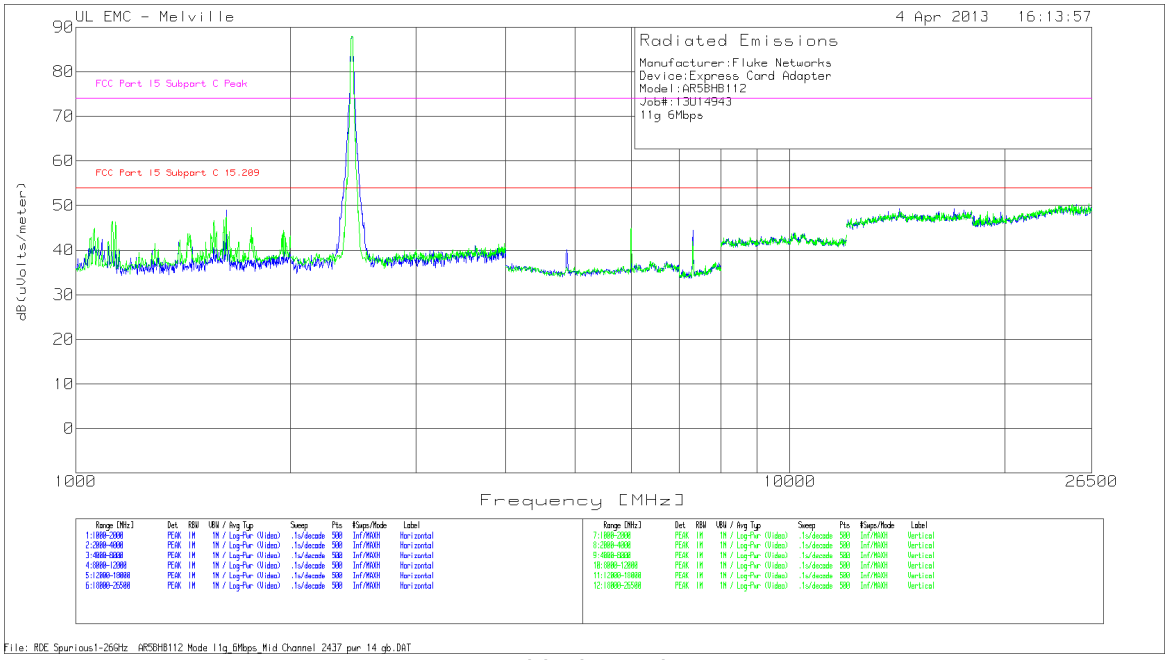
HIGH CHANNEL BANDEDGE, PEAK & AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

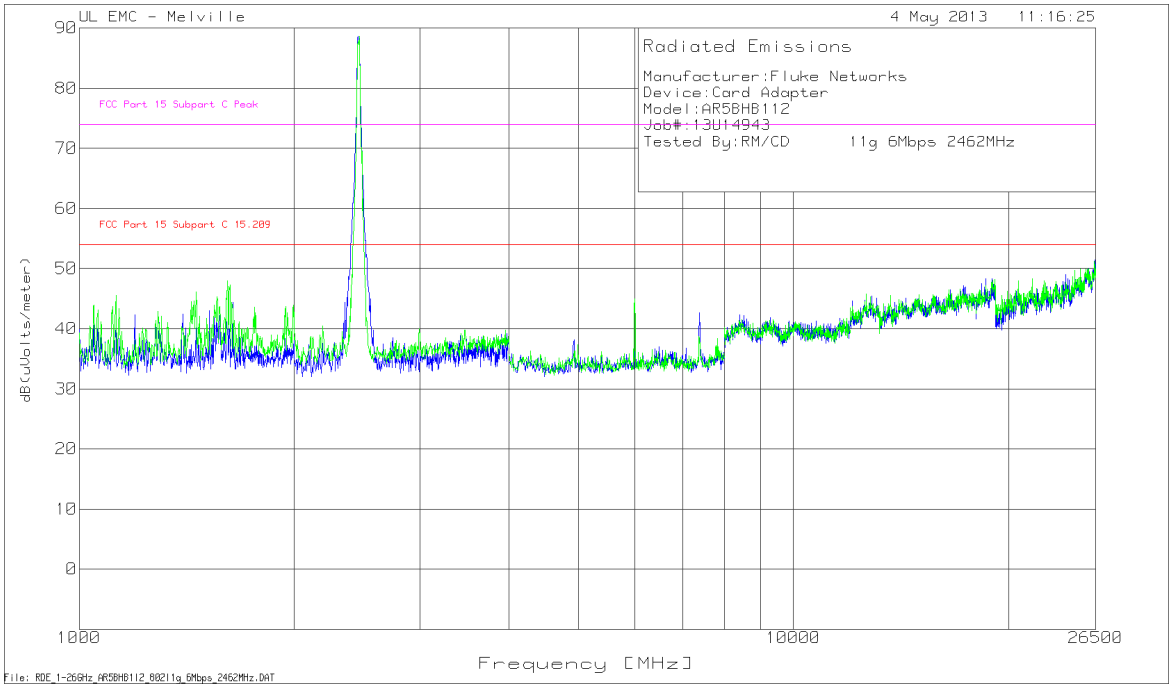


Low Channel



Mid Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)



High Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)

Manufacturer:Fluke Networks
Device:Express Card Adapter
Model:AR5BHB112
Job#:13U14943
11g 6Mbps

Low Channel - 2412MHz

Test Frequency	Meter Reading	Detector	AF-48106 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
4824.0933	64.01	PK	27.1	-53.51	37.6	-	-	74	-36.4	167	198	Vert
4824.0933	64.69	PK	27.1	-53.51	38.28	-	-	74	-35.72	275	285	Horz
4824.0933	52.51	LnAv	27.1	-53.51	26.1	54	-27.9	-	-	167	198	Vert
4824.0933	52.61	LnAv	27.1	-53.51	26.2	54	-27.8	-	-	275	285	Horz

Mid Channel - 2437MHz

Test Frequency	Meter Reading	Detector	AF-48106 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
4874.8216	75.75	PK	27.2	-53.26	49.69	-	-	74	-24.31	154	392	Vert
4874.8216	80.61	PK	27.2	-53.26	54.55	-	-	74	-19.45	94	340	Horz
7311	77.6	PK	28	-52.38	53.22	-	-	74	-20.78	25	157	Horz
7311	78.21	PK	28	-52.38	53.83	-	-	74	-20.17	337	312	Vert
4874.8216	60.35	LnAv	27.2	-53.26	34.29	54	-19.71	-	-	154	392	Vert
4874.8216	65.4	LnAv	27.2	-53.26	39.34	54	-14.66	-	-	94	340	Horz
7311	56.15	LnAv	28	-52.38	31.77	54	-22.23	-	-	25	157	Horz
7311	55.24	LnAv	28	-52.38	30.86	54	-23.14	-	-	337	312	Vert

High Channel - 2462MHz

Test Frequency	Meter Reading	Detector	AF-48106 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
4924.9018	79.98	PK	27.2	-53.36	53.82	-	-	74	-20.18	103	336	Horz
4924.9018	72.97	PK	27.2	-53.36	46.81	-	-	74	-27.19	148	300	Vert
7386.1533	71.92	PK	28.1	-52.05	47.97	-	-	74	-26.03	175	377	Vert
7386.1533	72.87	PK	28.1	-52.05	48.92	-	-	74	-25.08	269	304	Horz
4924.9018	66.74	LnAv	27.2	-53.36	40.58	54	-13.42	-	-	103	336	Horz
4924.9018	59.43	LnAv	27.2	-53.36	33.27	54	-20.73	-	-	148	300	Vert
7386.1533	56.72	LnAv	28.1	-52.05	32.77	54	-21.23	-	-	175	377	Vert
7386.1533	56.37	LnAv	28.1	-52.05	32.42	54	-21.58	-	-	269	304	Horz

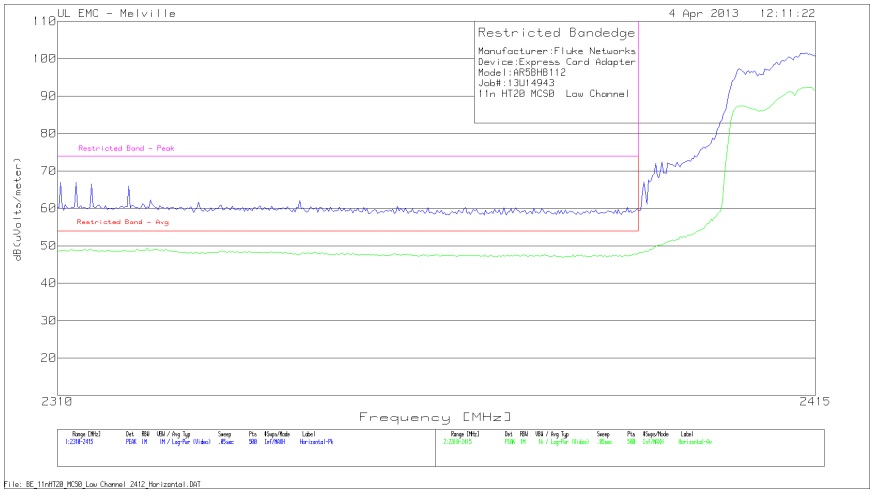
PK - Peak detector
LnAv - Linear Average detector

NOTE: No other emissions noted above the system noise floor

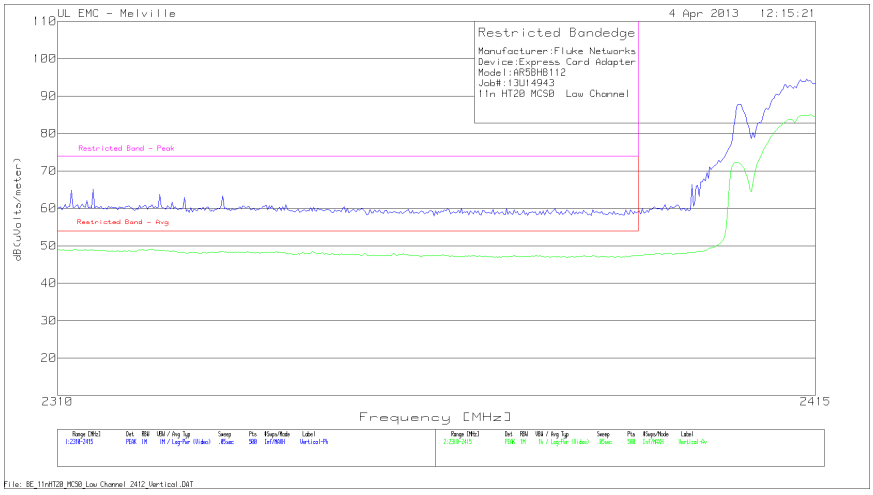
10.2.3. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, PEAK & AVERAGE, HORIZ



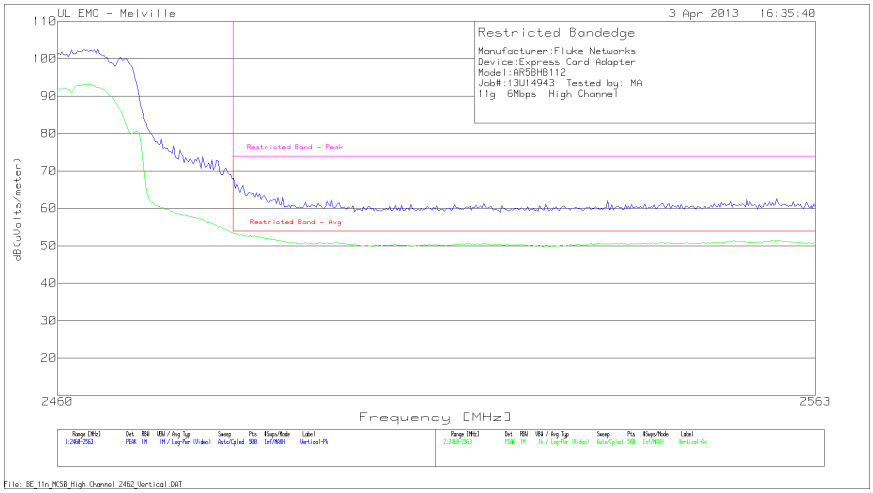
LOW CHANNEL RESTRICTED, PEAK & AVERAGE, VERT



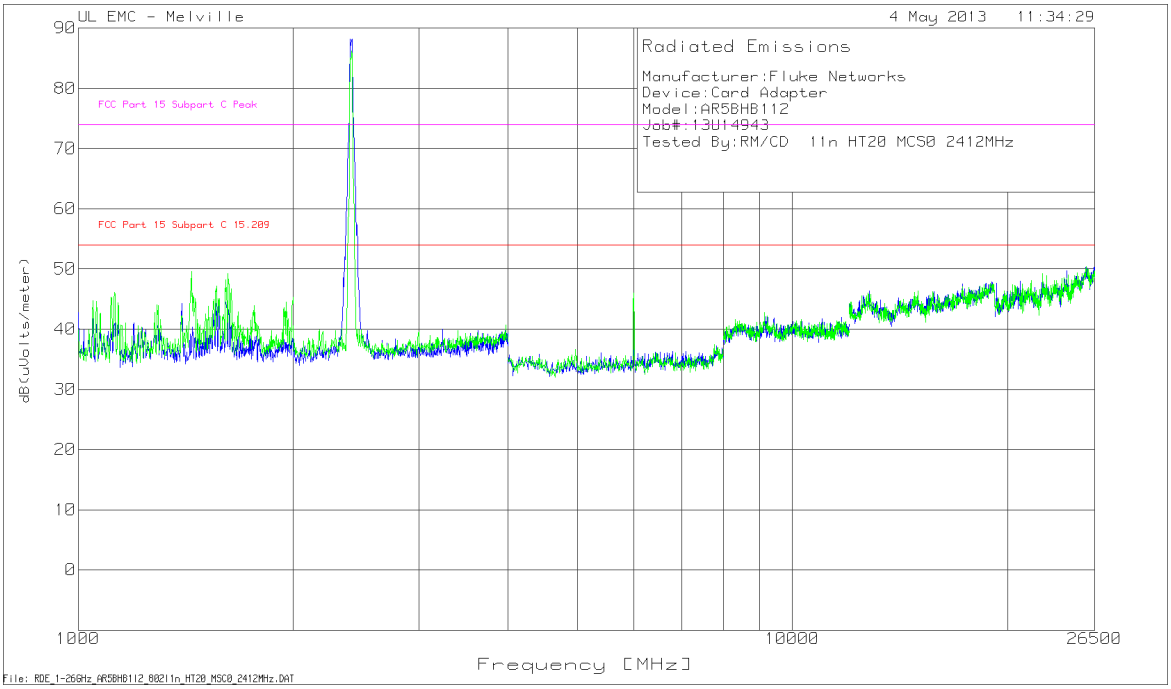
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HIGH CHANNEL BANDEDGE, PEAK & AVERAGE, HORIZ

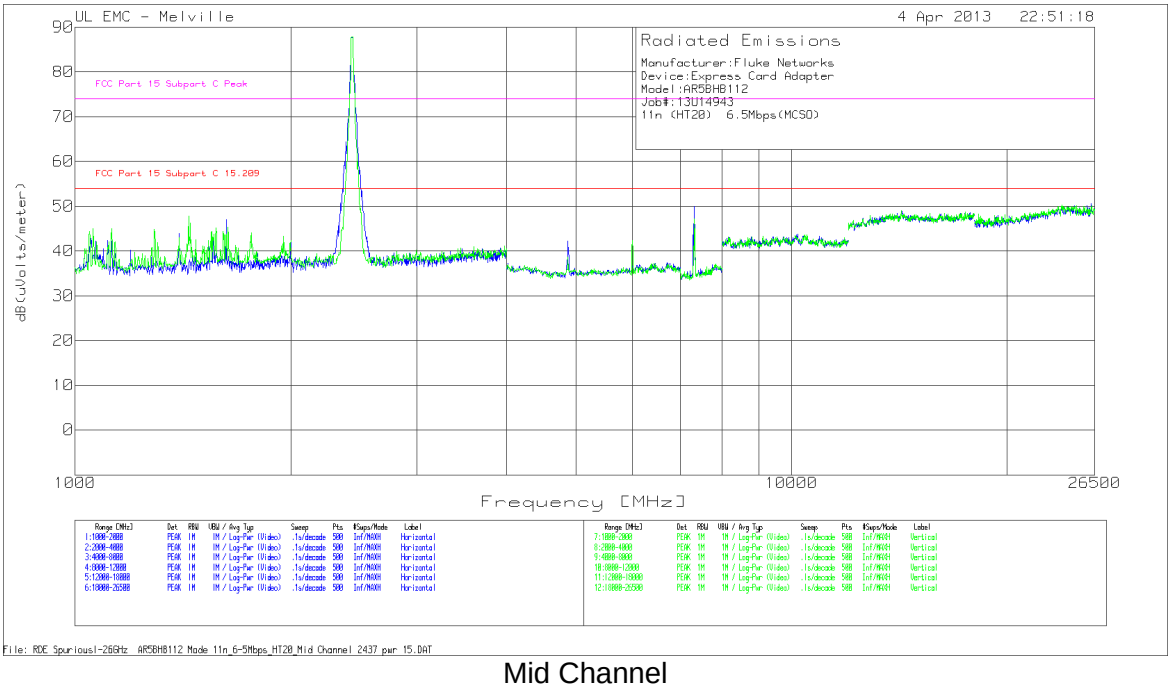
HIGH CHANNEL BANDEDGE, PEAK & AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

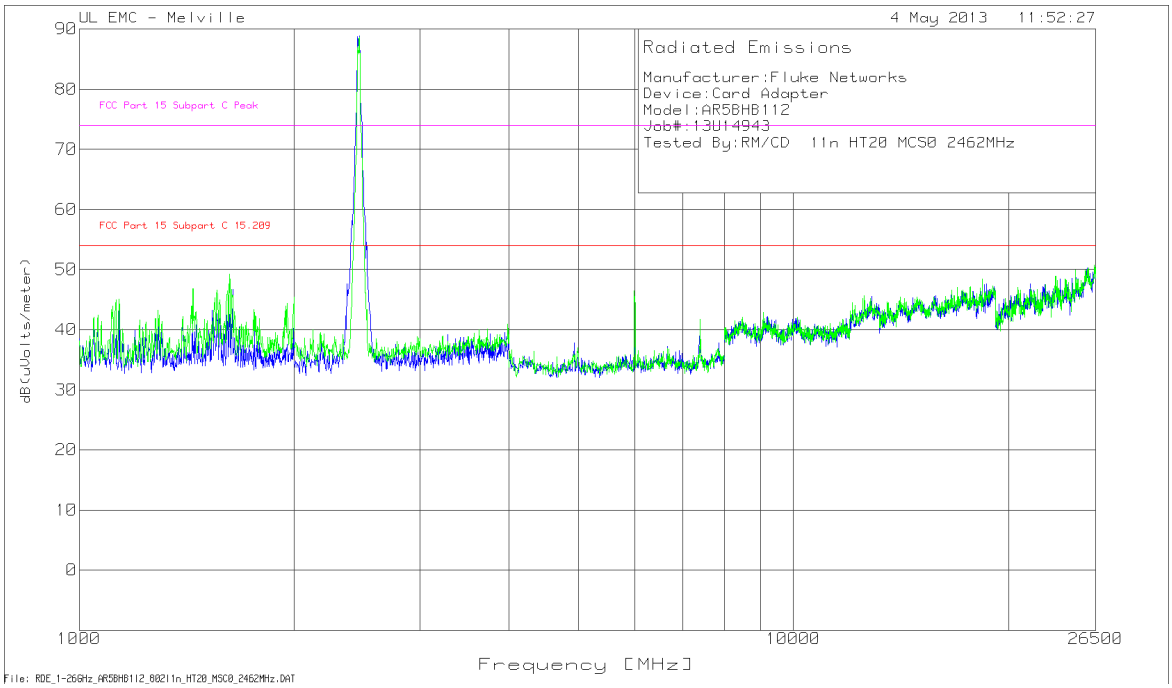


Low Channel



Mid Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)



High Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)

Manufacturer:Fluke Networks
Device:Express Card Adapter
Model:AR5BHB112
Job#:13U14943
11n (HT20) 6.5Mbps(MCS0)

Low Channel - 2412MHz

Test Frequency	Meter Reading	Detector	AF-48106 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
4824.0571	64	PK	27.1	-53.51	37.59	-	-	74	-36.41	92	222	Horz
4824.0571	63.52	PK	27.1	-53.51	37.11	-	-	74	-36.89	1	115	Vert
4824.0571	52.56	LnAv	27.1	-53.51	26.15	54	-27.85	-	-	92	222	Horz
4824.0571	51.18	LnAv	27.1	-53.51	24.77	54	-29.23	-	-	1	115	Vert

Mid Channel - 2437MHz

Test Frequency	Meter Reading	Detector	AF-48106 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
4874.011	77.75	PK	27.2	-53.25	51.7	-	-	74	-22.3	128	347	Horz
4874.011	78.02	PK	27.2	-53.25	51.97	-	-	74	-22.03	152	350	Vert
7311.2535	81.69	PK	28	-52.38	57.31	-	-	74	-16.69	169	360	Vert
7311.2535	81.39	PK	28	-52.38	57.01	-	-	74	-16.99	67	300	Horz
4874.011	61.05	LnAv	27.2	-53.25	35	54	-19	-	-	128	347	Horz
4874.011	61.25	LnAv	27.2	-53.25	35.2	54	-18.8	-	-	152	350	Vert
7311.2535	57.77	LnAv	28	-52.38	33.39	54	-20.61	-	-	169	360	Vert
7311.2535	59.43	LnAv	28	-52.38	35.05	54	-18.95	-	-	67	300	Horz

High Channel - 2462MHz

Test Frequency	Meter Reading	Detector	AF-48106 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
4924.35	62.25	PK	27.2	-53.33	36.12	-	-	74	-37.88	80	265	Vert
4924.35	71.88	PK	27.2	-53.33	45.75	-	-	74	-28.25	68	279	Horz
7386.149	69.32	PK	28.1	-52.05	45.37	-	-	74	-28.63	32	136	Horz
7386.149	72.84	PK	28.1	-52.05	48.89	-	-	74	-25.11	0	359	Vert
4924.35	52.7	LnAv	27.2	-53.33	26.57	54	-27.43	-	-	80	265	Vert
4924.35	58.79	LnAv	27.2	-53.33	32.66	54	-21.34	-	-	68	279	Horz
7386.149	54.2	LnAv	28.1	-52.05	30.25	54	-23.75	-	-	32	136	Horz
7386.149	55.79	LnAv	28.1	-52.05	31.84	54	-22.16	-	-	0	359	Vert

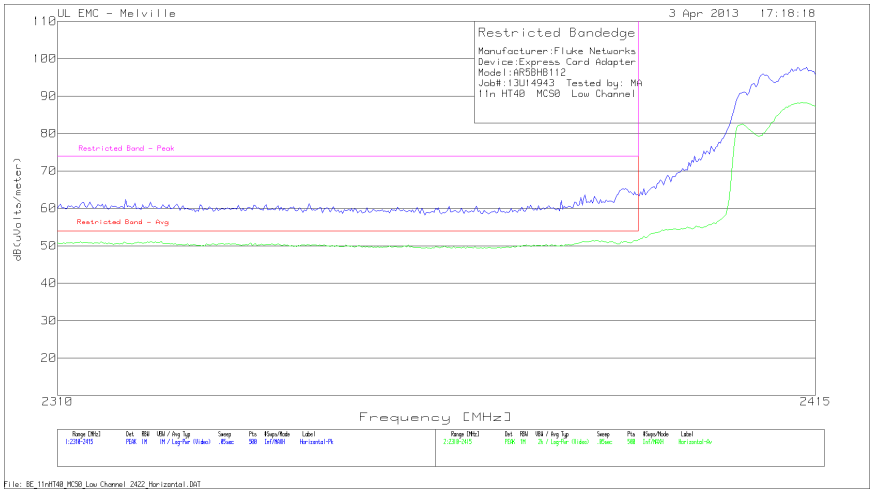
PK - Peak detector
LnAv - Linear Average detector

NOTE: No other emissions detected above the system noise floor

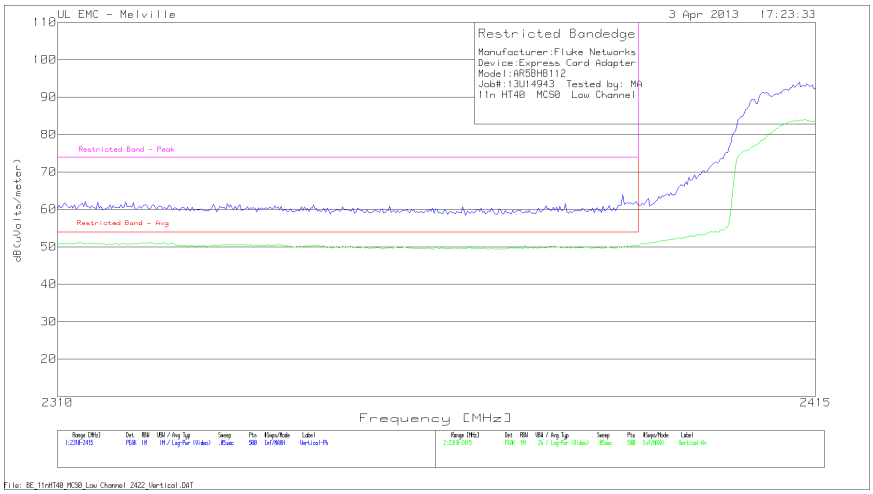
10.2.4. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, PEAK & AVERAGE, HORIZ

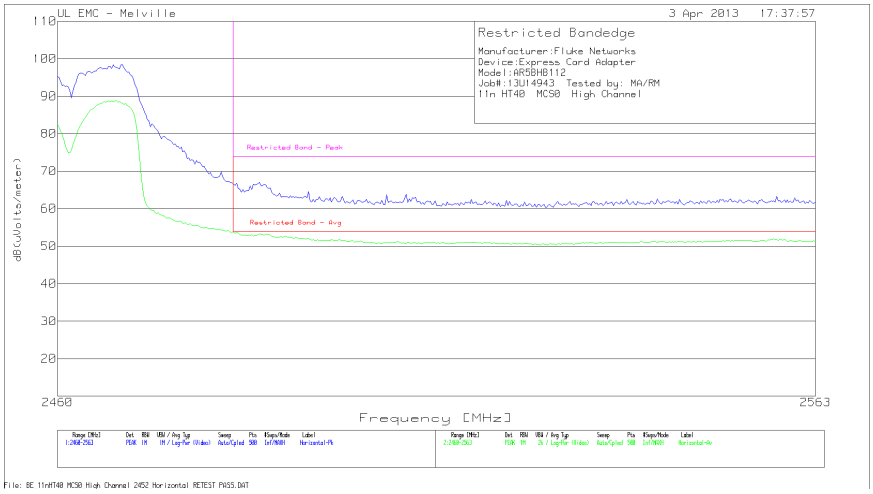


LOW CHANNEL RESTRICTED, PEAK & AVERAGE, VERT



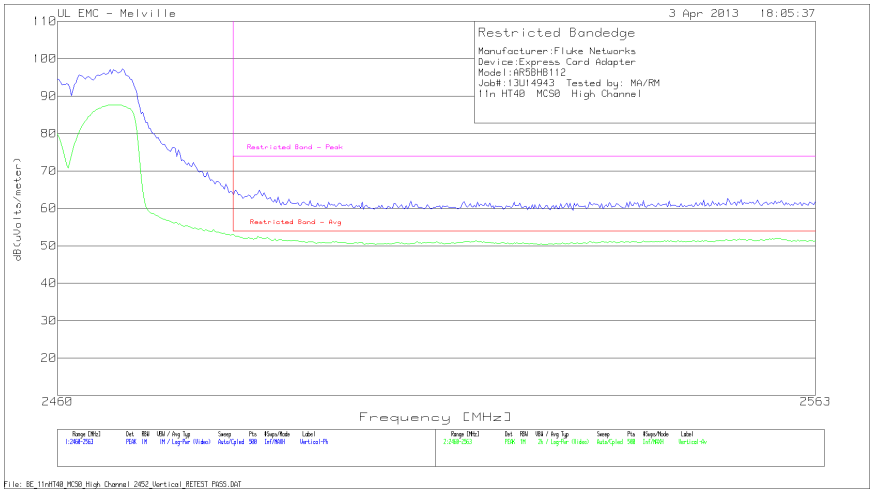
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HIGH CHANNEL BANDEDGE, PEAK & AVERAGE, HORIZ

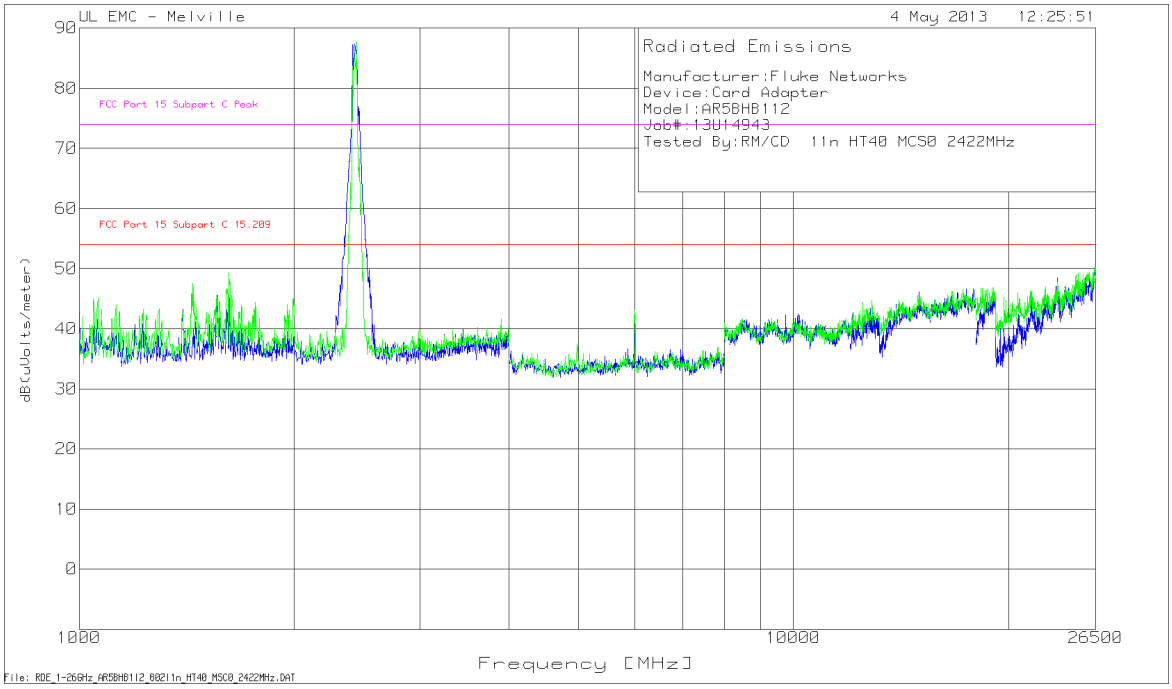


Marker No.	Test Frequency	Meter Reading	Detector	AF-48107 [dB/m]	BOMS Factor (dB)	dB(uVolts/meter)	Restricted Band - Avg	Margin (dB)
2	2484.15	28.21	PK	21.6	3.68	53.49	54	-0.51

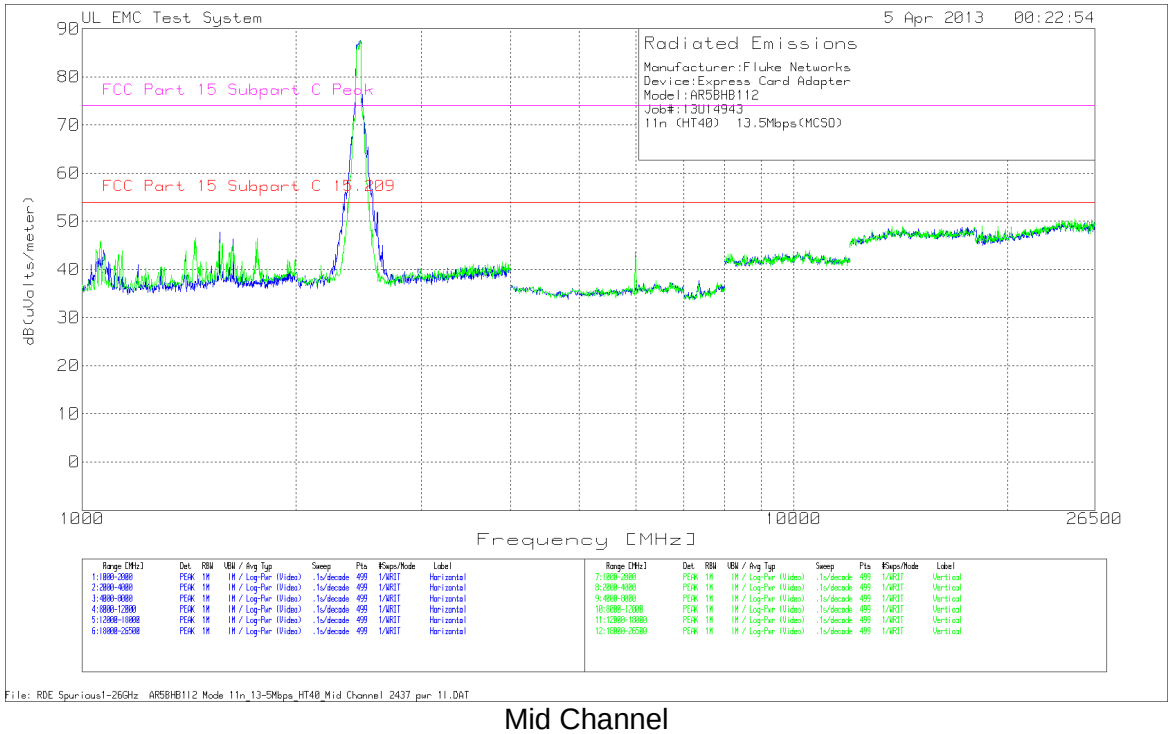
HIGH CHANNEL BANDEDGE, PEAK & AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

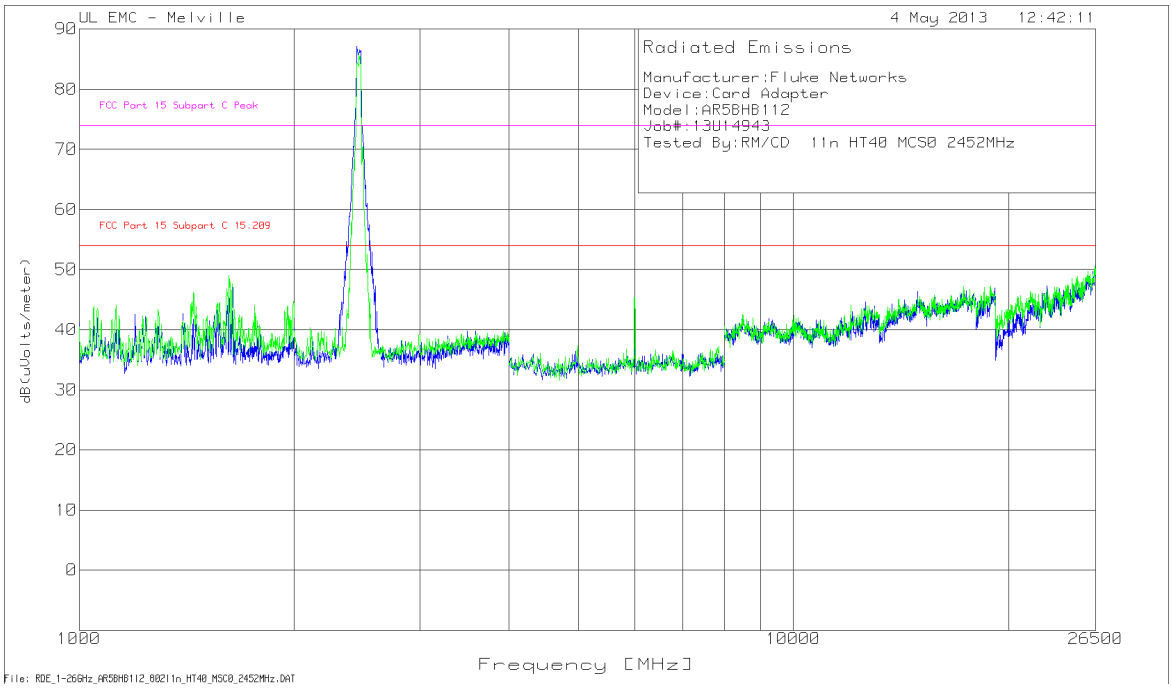


Low Channel



Mid Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)

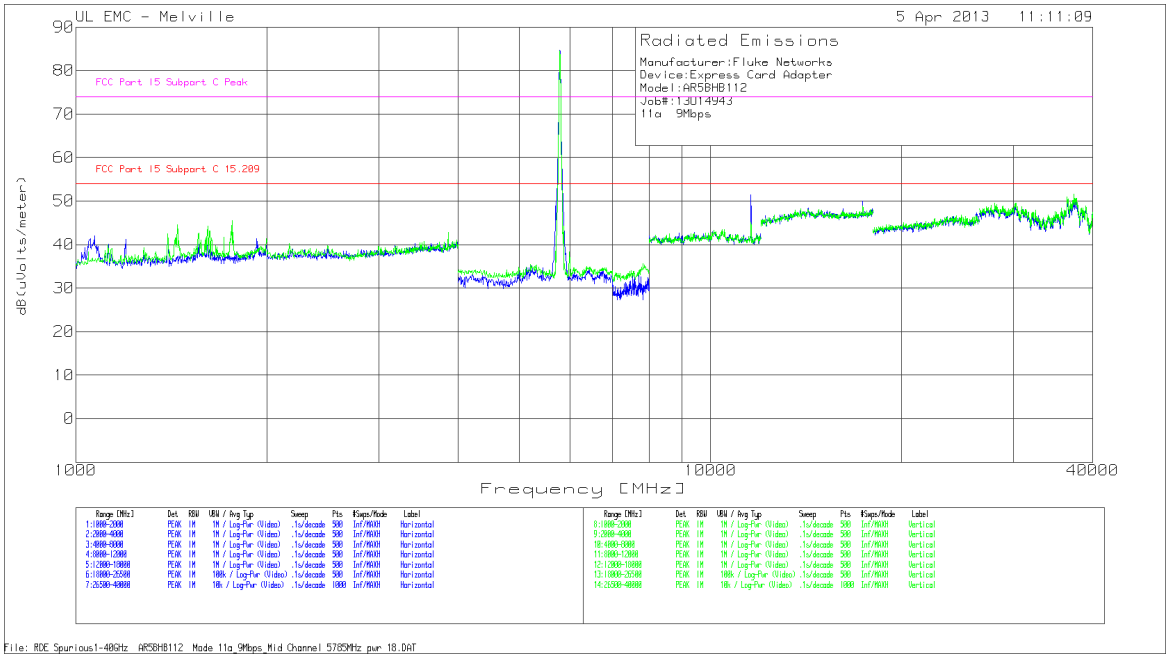


High Channel

NOTE: No emissions detected above the system noise floor for low, mid or high channels.

10.2.5. TX ABOVE 1 GHz 802.11a MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

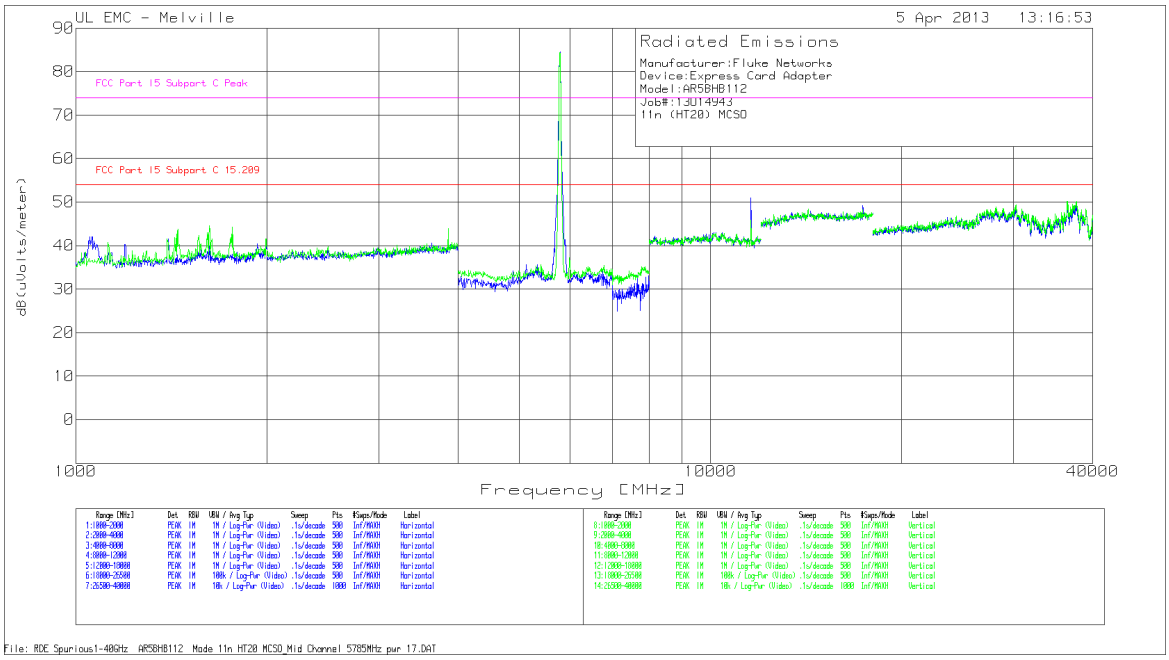


HARMONICS AND SPURIOUS EMISSIONS (CONT)

Manufacturer:Fluke Networks												
Device:Express Card Adapter												
Model:AR5BHB112												
Job#:13U14943												
11a 9Mbps												
Low Channel - 5745MHz												
Test Frequency	Meter Reading	Detector	AF-8933 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
11490.601	76.39	PK	33.4	-49.08	60.71	-	-	74	-13.29	343	311	Vert
11490.601	76.92	PK	33.4	-49.08	61.24	-	-	74	-12.76	293	310	Horz
11490.601	62.89	LnAv	33.4	-49.08	47.21	54	-6.79	-	-	343	311	Vert
11490.601	60.42	LnAv	33.4	-49.08	44.74	54	-9.26	-	-	293	310	Horz
Mid Channel - 5785MHz												
Test Frequency	Meter Reading	Detector	AF-8933 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
11569.95	74.55	PK	33.5	-49.65	58.4	-	-	74	-15.6	340	366	Vert
11569.95	77.79	PK	33.5	-49.65	61.64	-	-	74	-12.36	294	260	Horz
11569.95	58.93	LnAv	33.5	-49.65	42.78	54	-11.22	-	-	340	366	Vert
11569.95	60.55	LnAv	33.5	-49.65	44.4	54	-9.6	-	-	294	260	Horz
High Channel - 5825MHz												
Test Frequency	Meter Reading	Detector	AF-8933 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
11650.02	76.13	PK	33.6	-49.77	59.96	-	-	74	-14.04	16	378	Vert
11650.301	72.7	PK	33.6	-49.78	56.52	-	-	74	-17.48	56	278	Horz
11650.02	62.15	LnAv	33.6	-49.77	45.98	54	-8.02	-	-	16	378	Vert
11650.301	57.66	LnAv	33.6	-49.78	41.48	54	-12.52	-	-	56	278	Horz
PK - Peak detector												
LnAv - Linear Average detector												

10.2.6. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS



HARMONICS AND SPURIOUS EMISSIONS (CONT)

Manufacturer:Fluke Networks
Device:Express Card Adapter
Model:AR5BHB112
Job#:13U14943
11n HT20 MCS0

Low Channel - 5745MHz

Test Frequency	Meter Reading	Detector	AF-8933 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
11489.9	73.75	PK	33.4	-49.04	58.11	-	-	74	-15.89	298	223	Horz
11489.9	77.06	PK	33.4	-49.04	61.42	-	-	74	-12.58	336	352	Vert
11489.9	60.01	LnAv	33.4	-49.04	44.37	54	-9.63	-	-	298	223	Horz
11489.9	62.28	LnAv	33.4	-49.04	46.64	54	-7.36	-	-	336	352	Vert

Test Frequency	Meter Reading	Detector	AF-8947 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
22980	61.89	PK	40.6	-53.29	49.2	-	-	74	-24.8	119	397	Vert
22980	61.99	PK	40.6	-53.29	49.3	-	-	74	-24.7	240	308	Horz
22980	50.82	LnAv	40.6	-53.29	38.13	54	-15.87	-	-	119	397	Vert
22980	49.93	LnAv	40.6	-53.29	37.24	54	-16.76	-	-	240	308	Horz

Mid Channel - 5785MHz

Test Frequency	Meter Reading	Detector	AF-8933 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
11570.501	69.74	PK	33.5	-49.66	53.58	-	-	74	-20.42	179	116	Vert
11570.501	76.9	PK	33.5	-49.66	60.74	-	-	74	-13.26	258	370	Horz
11570.501	55.87	LnAv	33.5	-49.66	39.71	54	-14.29	-	-	179	116	Vert
11570.501	61.56	LnAv	33.5	-49.66	45.4	54	-8.6	-	-	258	370	Horz

High Channel - 5825MHz

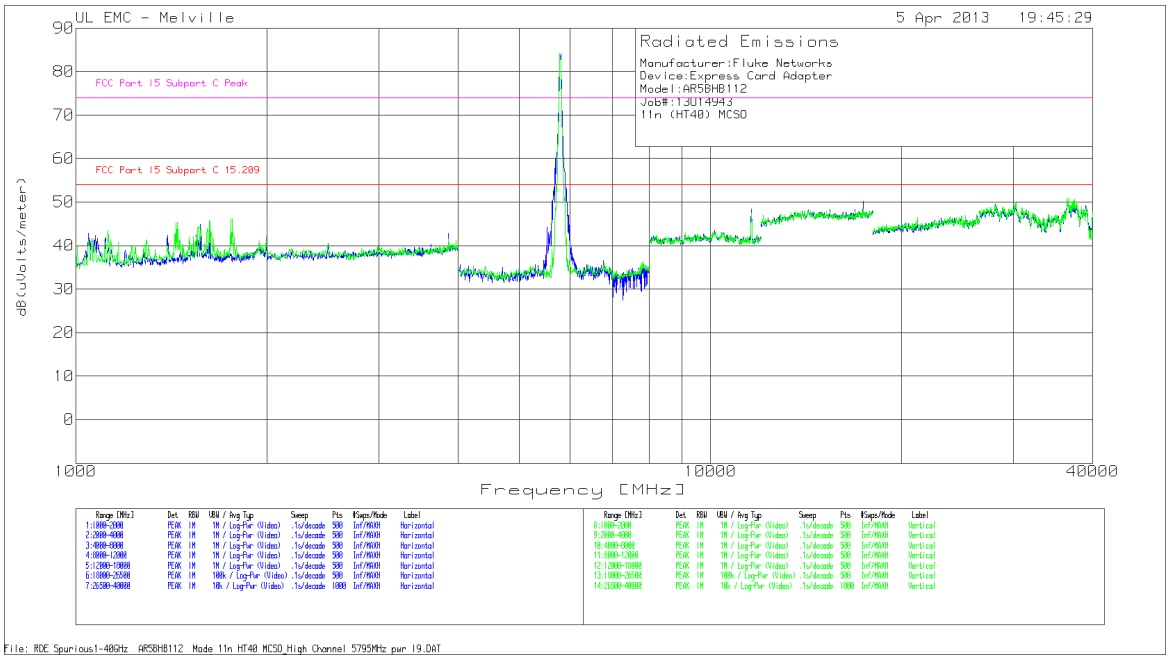
Test Frequency	Meter Reading	Detector	AF-8933 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
11650.701	74.51	PK	33.6	-49.8	58.31	-	-	74	-15.69	291	305	Horz
11650.701	75.88	PK	33.6	-49.8	59.68	-	-	74	-14.32	18	358	Vert
11650.701	60.07	LnAv	33.6	-49.8	43.87	54	-10.13	-	-	291	305	Horz
11650.701	60.21	LnAv	33.6	-49.8	44.01	54	-9.99	-	-	18	358	Vert

PK - Peak detector
LnAv - Linear Average detector

NOTE: No other emissions deteceted above the system noise floor.

10.2.7. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS



HARMONICS AND SPURIOUS EMISSIONS (CONT)

Manufacturer:Fluke Networks
Device:Express Card Adapter
Model:AR5BHB112
Job#:13U14943
11n HT40 MCS0

Low Channel - 5755MHz

Test Frequency	Meter Reading	Detector	AF-8933 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
11510.1	73.66	PK	33.4	-49.64	57.42	-	-	74	-16.58	58	253	Horz
11510.1	72.54	PK	33.4	-49.64	56.3	-	-	74	-17.7	188	112	Vert
11510.1	59.55	LnAv	33.4	-49.64	43.31	54	-10.69	-	-	58	253	Horz
11510.1	58.28	LnAv	33.4	-49.64	42.04	54	-11.96	-	-	188	112	Vert

High Channel - 5795MHz

Test Frequency	Meter Reading	Detector	AF-8933 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
11590.531	68.84	PK	33.5	-49.51	52.83	-	-	74	-21.17	192	263	Vert
11590.531	76.66	PK	33.5	-49.51	60.65	-	-	74	-13.35	73	392	Horz
11590.531	54.91	LnAv	33.5	-49.51	38.9	54	-15.1	-	-	192	263	Vert
11590.531	60.85	LnAv	33.5	-49.51	44.84	54	-9.16	-	-	73	392	Horz

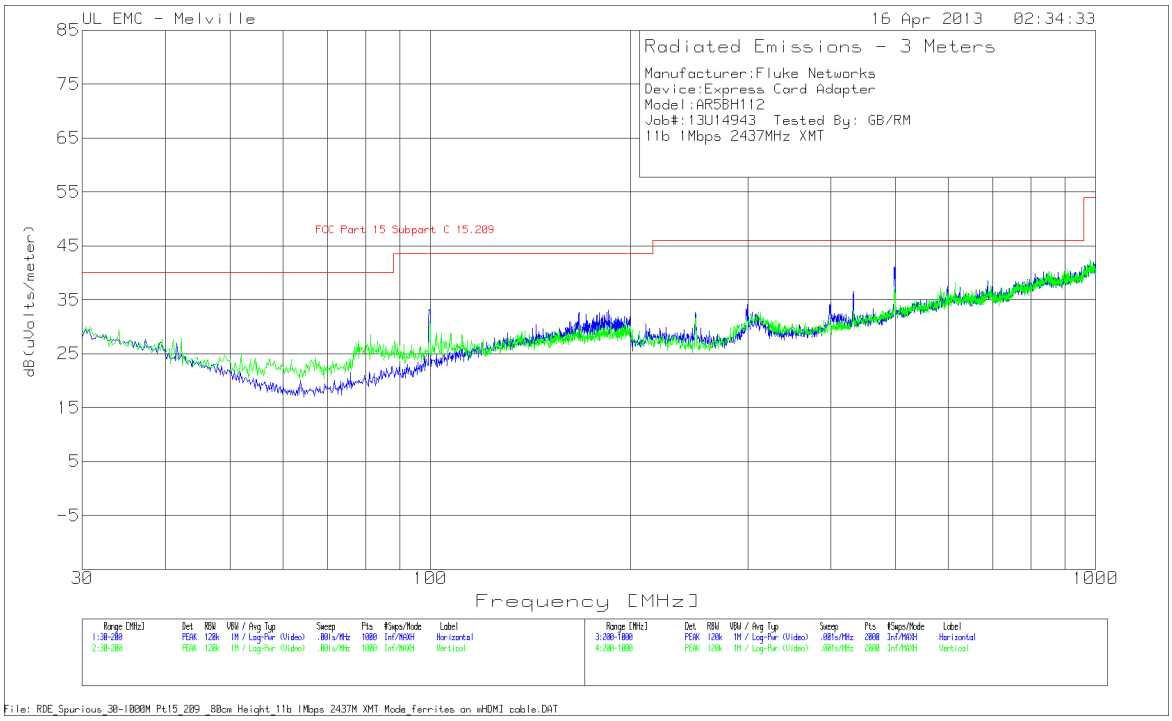
PK - Peak detector
LnAv - Linear Average detector

NOTE: No other emissions deteceted above the system noise floor.

10.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (2.4GHz BAND WORST-CASE CONFIGURATION)

HORIZONTAL & VERICAL PLOT



HORIZONTAL & VERICAL DATA

Manufacturer:Fluke Networks
Device:Express Card Adapter
Model:AR5BH112
Job#:13U14943 Tested By: GB/RM
11b 1Mbps 2437MHz XMT

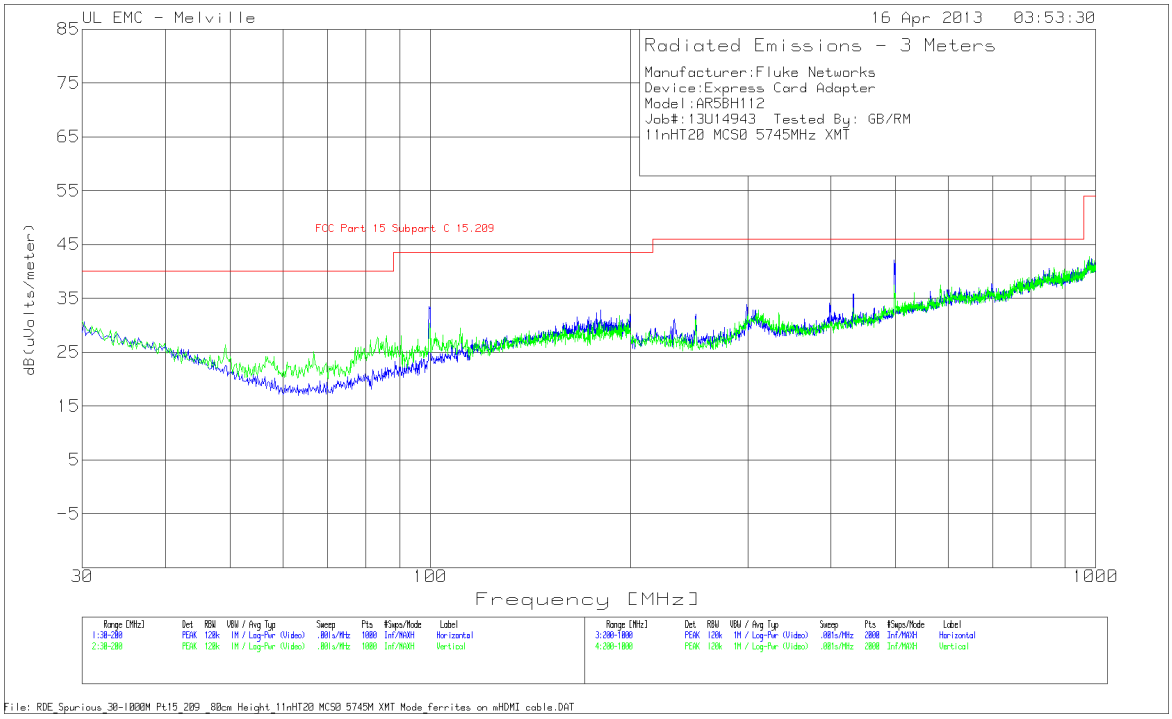
Horizontal 200 - 1000MHz

Test Frequency	Meter Reading	Detector	AF-44067 [dB/m]	GL-3M [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (	Azimuth [Degs]	Height [cm]	Polarity
250.3847	18.41	QP	11.9	0.9	31.21	46	-14.79	94	109	Horz
299.7702	17.82	QP	13	1.1	31.92	46	-14.08	148	100	Horz
399.712	15.98	QP	15.7	1.3	32.98	46	-13.02	149	100	Horz
432.003	16.69	QP	16.4	1.5	34.59	46	-11.41	147	226	Horz
497.8382	20.68	QP	17.7	1.5	39.88	46	-6.12	278	205	Horz
497.8454	16.26	QP	17.7	1.5	35.46	46	-10.54	219	202	Vert

QP - Quasi-Peak detector

SPURIOUS EMISSIONS 30 TO 1000 MHz (5GHz BAND WORST-CASE CONFIGURATION)

HORIZONTAL & VERICAL PLOT



HORIZONTAL & VERICAL DATA

Manufacturer:Fluke Networks										
Device:Express Card Adapter										
Model:AR5BH112										
Job#:13U14943 Tested By: GB/RM										
11nHT20 MCS0 5745MHz XMT										
Test Frequency	Meter Reading	Detector	AF-43441 [dB/m]	GL-3M [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
99.607	21.7	QP	10.7	0.4	32.8	43.5	-10.7	159	321	Horz
99.6027	18.45	QP	10.7	0.4	29.55	43.5	-13.95	271	259	Vert
Test Frequency	Meter Reading	Detector	AF-44067 [dB/m]	GL-3M [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
398.2764	16.14	QP	15.6	1.4	33.14	46	-12.86	149	102	Horz
432.0002	16.61	QP	16.4	1.5	34.51	46	-11.49	146	234	Horz
497.8302	20.8	QP	17.7	1.5	40	46	-6	278	206	Horz
497.8482	16.12	QP	17.7	1.5	35.32	46	-10.68	220	207	Vert
QP - Quasi-Peak detector										