



**FCC CFR47 PART 15 SUBPART E
INDUSTRY CANADA RSS-247 ISSUE 1**

CERTIFICATION TEST REPORT

FOR

UNII 5.8GHz a mode Wireless Access Point

MODEL NUMBER: TPWLR58B1

FCC ID: ZJ3-TPWLR58B1

IC ID: 9698A-TPWLR58B1

REPORT NUMBER: 15U21031-E1

ISSUE DATE: JUNE 23, 2015

Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Issue			
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-	06/23/15	Initial Issue	P. Zhang

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: TruePath Wireless
EUT DESCRIPTION: UNII 5.8GHz 11a mode Wireless access point.
MODEL: TPWLR58B1
SERIAL NUMBER: 7-116 (Radiated)
DATE TESTED: JUNE 23, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Pass
INDUSTRY CANADA RSS-247 Issue 1	Pass
INDUSTRY CANADA RSS-GEN Issue 4	Pass

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

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2009 for FCC and ANSI C63.10-2013 for IC, RSS-GEN Issue 4, RSS-247 Issue 1.

Testing for radiated emissions above 1GHz was performed with the EUT elevated at 1.5m instead of 0.8m. 1.5m is the required height in ANSI C63.10:2013 as referenced by RSS GEN issue 4. This test height has been permitted by FCC as discussed in FCC/TCB conference call in December 2014.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☒ Chamber A(IC: 2324B-1)	☐ Chamber D(IC: 2324B-4)
☐ Chamber B(IC: 2324B-2)	☐ Chamber E(IC: 2324B-5)
☐ Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 2324B-6)
	☐ Chamber G(IC: 2324B-7)
	☐ Chamber H(IC: 2324B-8)

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.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	3.52 dB
Radiated Disturbance, 30 to 40000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a UNII 5.8GHz 11a mode Wireless Access Point.

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB antenna, with a maximum gain of 15.4 dBi.

5.3. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were 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 the Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in the Z orientation.

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

802.11a mode: 6 Mbps

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	N/A	N/A	N/A
Router	Mikrotik	N/A	N/A	N/A
AC-DC Power Supply	Artesyn	N/A	ZFHN2339	N/A

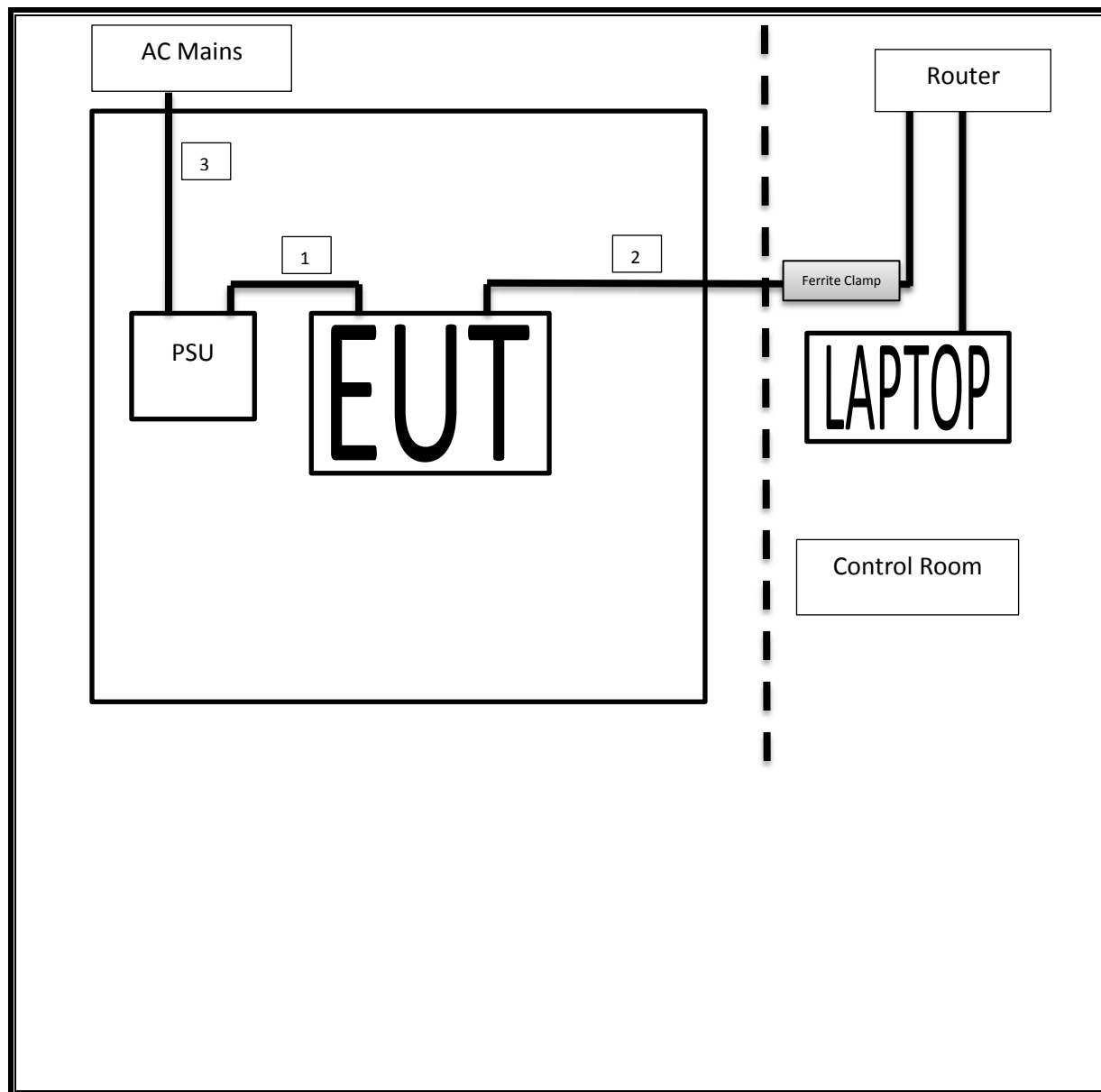
I/O CABLES

I/O Cable List					
Cable No	Port	# of identical ports	Cable Type	Cable Length (m)	Remarks
1	DC Power Cable	1	Shielded	1.5m	N/A
2	Ethernet Cable	1	Shielded	1.5m	Double Shielded
3	AC Power Cable	1	Shielded	1.5m	

TEST SETUP

The EUT is setup as a stand-alone device.

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	Asset	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/20/15
Spectrum Analyzer, 9KHz-40GHz	HP	8564E	C00986	04/01/16
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	08/13/15
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/18/15
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/15
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/15
Antenna, Horn, 1-18 GHz	ETS	3117	C01022	02/21/16
Antenna, Horn, 18- 26 GHz	ARA	MWH-1826/B	C00946	11/12/15
Antenna, Horn, 26-40 GHz	ARA	MWH-2640	C00891	06/28/15
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	T243	03/06/16
RF Preamplifier, 100KHz -> 1300MHz	HP	TBD	C00825	06/01/16
RF Preamplifier, 1GHz - 18GHz	Miteq	NSP4000-SP2	924343	03/23/16
RF Preamplifier, 1GHz - 26.5GHz	HP	8449B	F00351	06/27/15
AC Power Supply, 2,500VA 45-500Hz	Elgar-Ametek	CW2501M	F00013	CNR
RF Preamplifier, 1GHz - 40GHz	Miteq	NSP4000-SP2	C00990	08/20/15
Attenuator / Switch driver	HP	11713A	F00204	CNR
Low Pass Filter 3GHz	Micro-Tronics	LPS17541	F00219	05/23/16
High Pass Filter 5GHz	Micro-Tronics	HPS17542	F00222	05/22/16
High Pass Filter 6GHz	Micro-Tronics	HPM17543	F00224	05/22/16
Ferrite Clamp	FCC Inc.	N/A	61	CNR
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014	
Conducted Software	UL	UL EMC	Ver 9.5, May 17 2012	
CLT Software	UL	UL RF	Ver 1.0, Feb 2 2015	
Antenna Port Software	UL	UL RF	Ver 2.1.1.1, Jan 20 2015	

7. SUMMARY TABLE

FCC Part Section	RSS Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
15.407 (b) & 15.209	RSS-GEN 8.9/7	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	38.15dBuV/m

8. MEASUREMENT METHOD

789033 D02 General UNII Test Procedures New Rules v01

The Duty Cycle is less than 98% and consistent therefore KDB 789033 Method SA-2 is used for .power and PPSD

The Duty Cycle is less than 98% and consistent, KDB 789033 Method AD with Power RMS Averaging and duty cycle correction is used.

9. TRANSMITTER ABOVE 1 GHz

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit ($\mu\text{V/m}$) at 3 m	Field Strength Limit (dB $\mu\text{V/m}$) 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 for below 1GHz and 150cm for above 1GHz. 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.

Reference to KDB 789033 UNII part G) 6) d) Method AD:

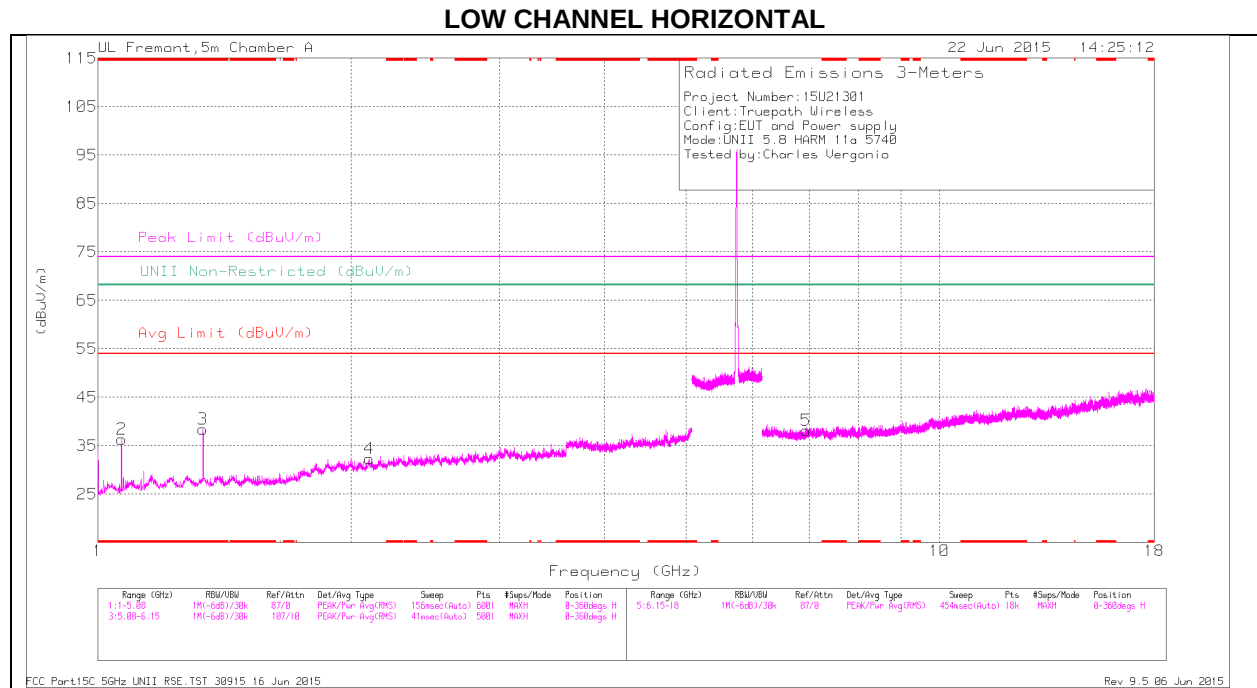
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor to the reading offset for average measurements.

The spectrum from 1GHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

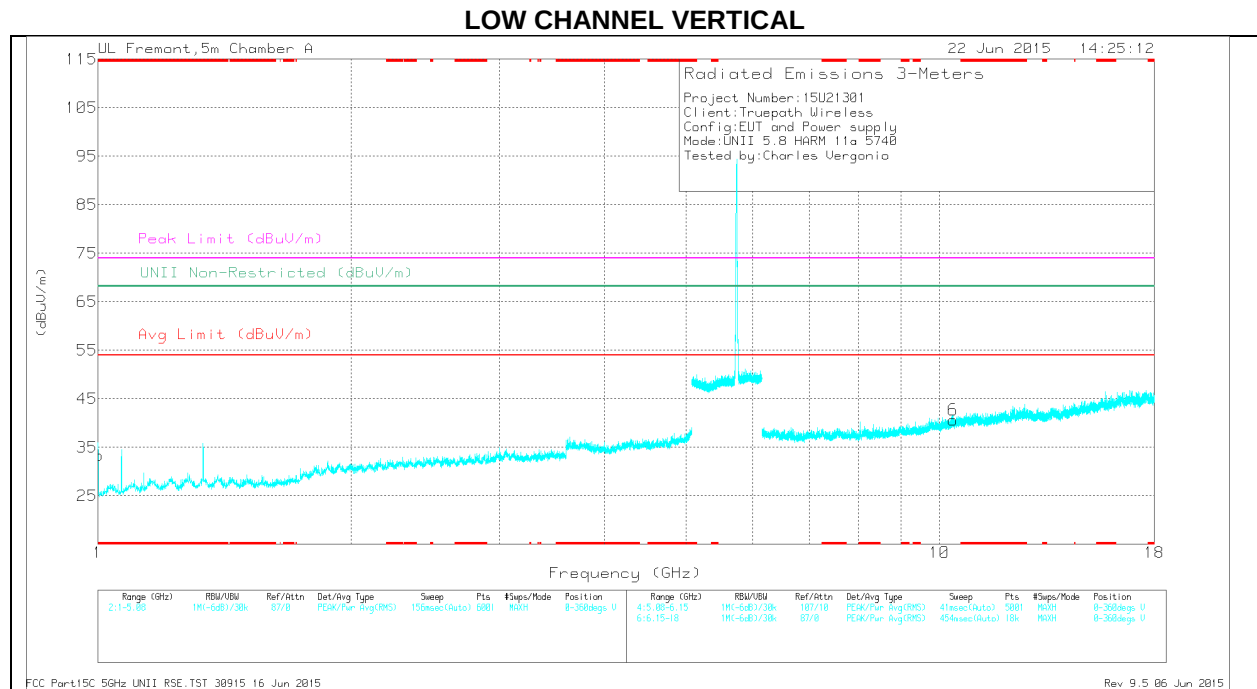
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

9.1. 5.8 GHz

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



Note: Emission was scanned up to 40GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.



Note: Emission was scanned up to 40GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

LOW CHANNEL DATA

TRACE MARKERS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Chl/ Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 1.067	45.06	Pk	27.2	-35.9	0	36.36	-	-	74	-37.64	-	-	0-360	201	H
3	* 1.333	45.78	Pk	28.7	-36	0	38.48	-	-	74	-35.52	-	-	0-360	100	H
1	* 1.001	42.6	Pk	27	-36.2	0	33.4	-	-	74	-40.6	-	-	0-360	200	V
4	2.101	35.98	Pk	31.4	-35.1	0	32.28	-	-	-	-	68.2	-35.92	0-360	100	H
5	6.944	29.91	Pk	35.6	-27.3	0	38.21	-	-	-	-	68.2	-29.99	0-360	201	H
6	10.378	26.69	Pk	37.4	-23.5	0	40.59	-	-	-	-	68.2	-27.61	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

Radiated Emissions

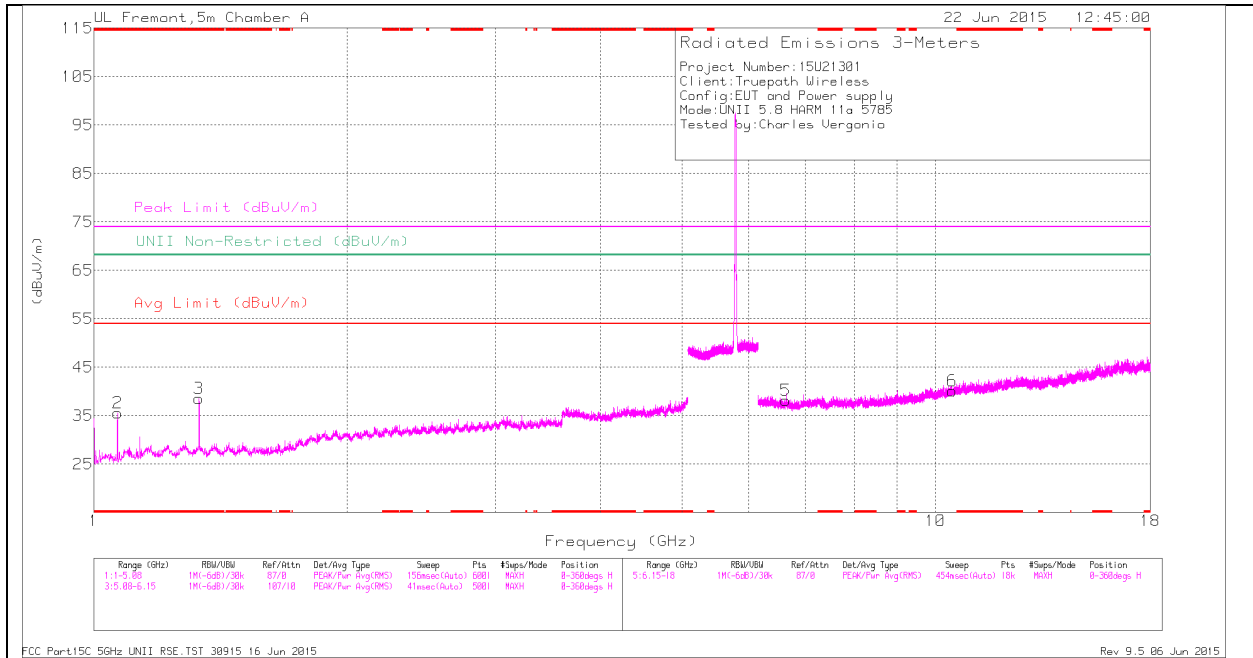
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Chl/ Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.066	48.04	PK3	27.2	-35.9	0	39.34	-	-	74	-34.66	-	-	279	184	H
* 1.067	42.62	ADR	27.2	-35.9	.09	34.01	54	-19.99	-	-	-	-	279	184	H
* 1.333	50.21	PK3	28.7	-36	0	42.91	-	-	74	-31.09	-	-	209	139	H
* 1.333	45.36	ADR	28.7	-36	.09	38.15	54	-15.85	-	-	-	-	209	139	H
* 1	50.01	PK3	27	-36.2	0	40.81	-	-	74	-33.19	-	-	203	199	V
* 1	43.66	ADR	27	-36.2	.09	34.55	54	-19.45	-	-	-	-	203	199	V
2.101	43.84	PK3	31.4	-35.1	0	40.14	-	-	-	-	68.2	-28.06	203	100	H
6.942	38.33	PK3	35.6	-27.3	0	46.63	-	-	-	-	68.2	-21.57	203	202	H
10.378	34.62	PK3	37.4	-23.5	0	48.52	-	-	-	-	68.2	-19.68	203	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

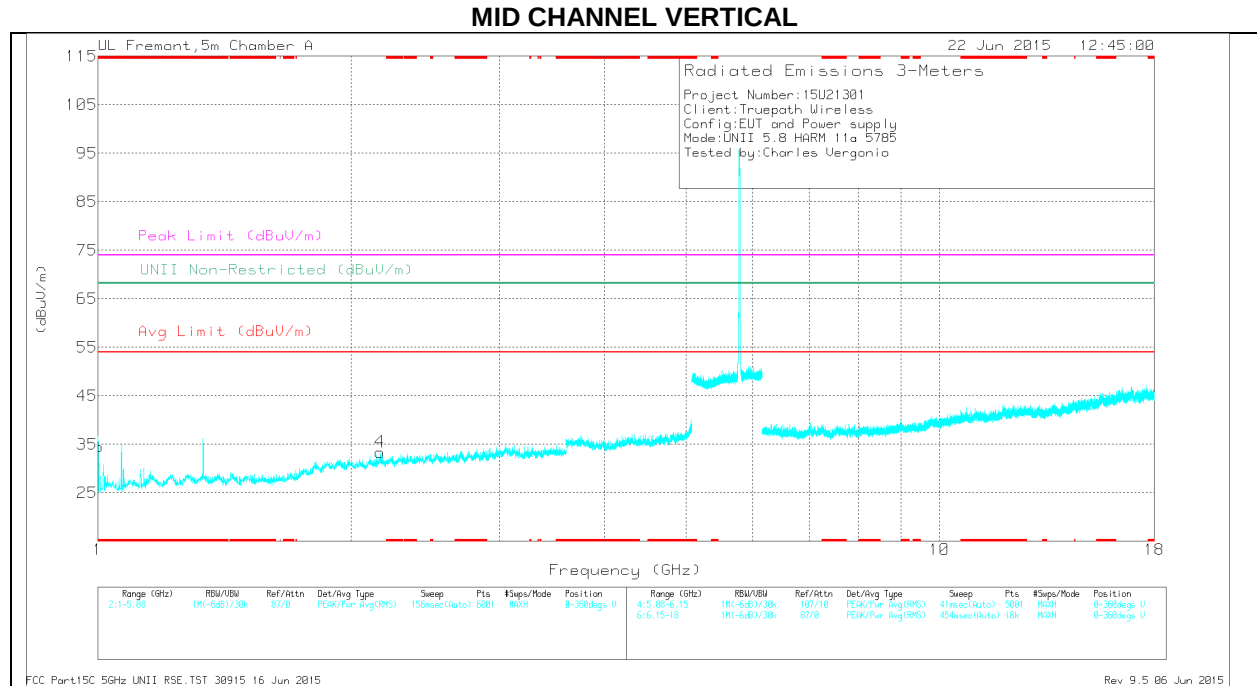
PK3 - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

MID CHANNEL HORIZONTAL



Note: Emission was scanned up to 40GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.



Note: Emission was scanned up to 40GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

MID CHANNEL DATA

TRACE MARKERS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 1.067	44.26	Pk	27.2	-35.9	0	35.56	-	-	74	-38.44	-	-	0-360	201	H
3	* 1.333	45.9	Pk	28.7	-36	0	38.6	-	-	74	-35.4	-	-	0-360	100	H
1	* 1.001	43.72	Pk	27	-36.2	0	34.52	-	-	74	-39.48	-	-	0-360	200	V
4	2.165	36.53	Pk	31.3	-34.4	0	33.43	-	-	-	-	68.2	-34.77	0-360	200	V
5	6.636	29.97	Pk	35.6	-27.4	0	38.17	-	-	-	-	68.2	-30.03	0-360	201	H
6	10.466	26.1	Pk	37.5	-23.5	0	40.1	-	-	-	-	68.2	-28.1	0-360	100	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

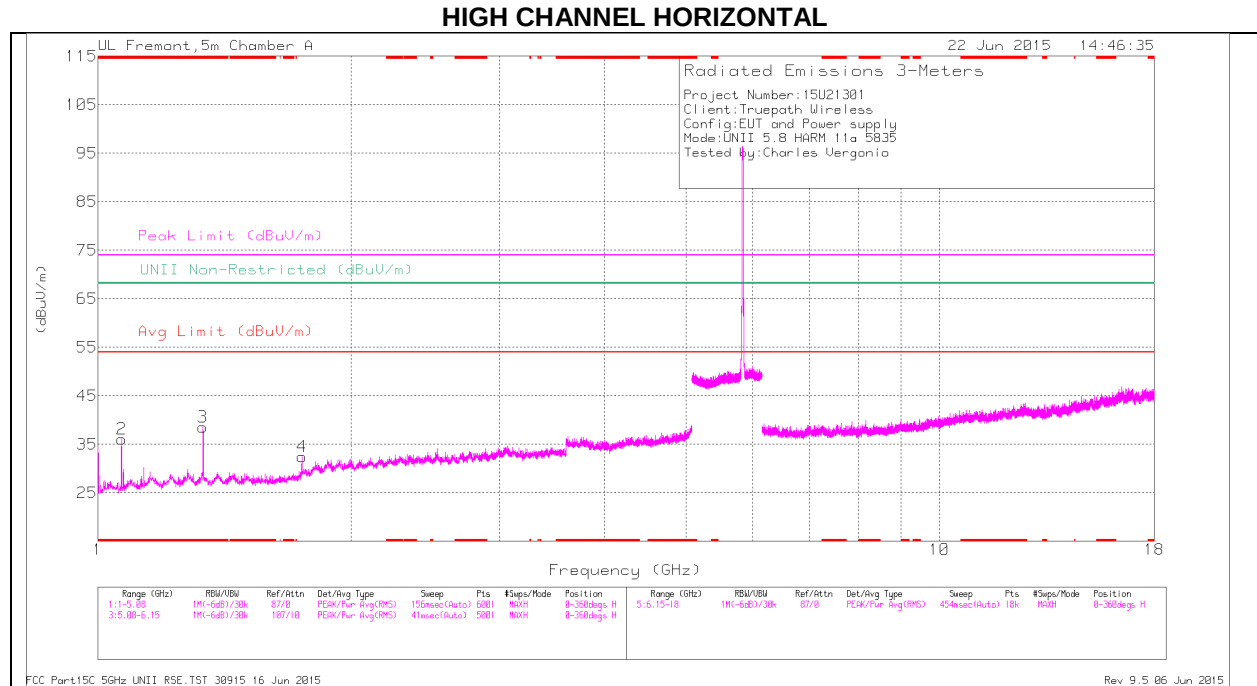
Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Ftr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.067	49.71	PK3	27.2	-35.9	0	41.01	-	-	74	-32.99	-	-	218	119	H
* 1.067	43.48	ADR	27.2	-35.9	.09	34.87	54	-19.13	-	-	-	-	218	119	H
* 1.333	50.38	PK3	28.7	-36	0	43.08	-	-	74	-30.92	-	-	208	101	H
* 1.333	45.35	ADR	28.7	-36	.09	38.14	54	-15.86	-	-	-	-	208	101	H
* 1	49.98	PK3	27	-36.2	0	40.78	-	-	74	-33.22	-	-	186	194	V
* 1	43.52	ADR	27	-36.2	.09	34.41	54	-19.59	-	-	-	-	186	194	V
2.166	44.28	PK3	31.3	-34.4	0	41.18	-	-	-	-	68.2	-27.02	186	201	V
6.636	38.69	PK3	35.6	-27.4	0	46.89	-	-	-	-	68.2	-21.31	186	201	H
10.465	35.45	PK3	37.5	-23.5	0	49.45	-	-	-	-	68.2	-18.75	186	100	H

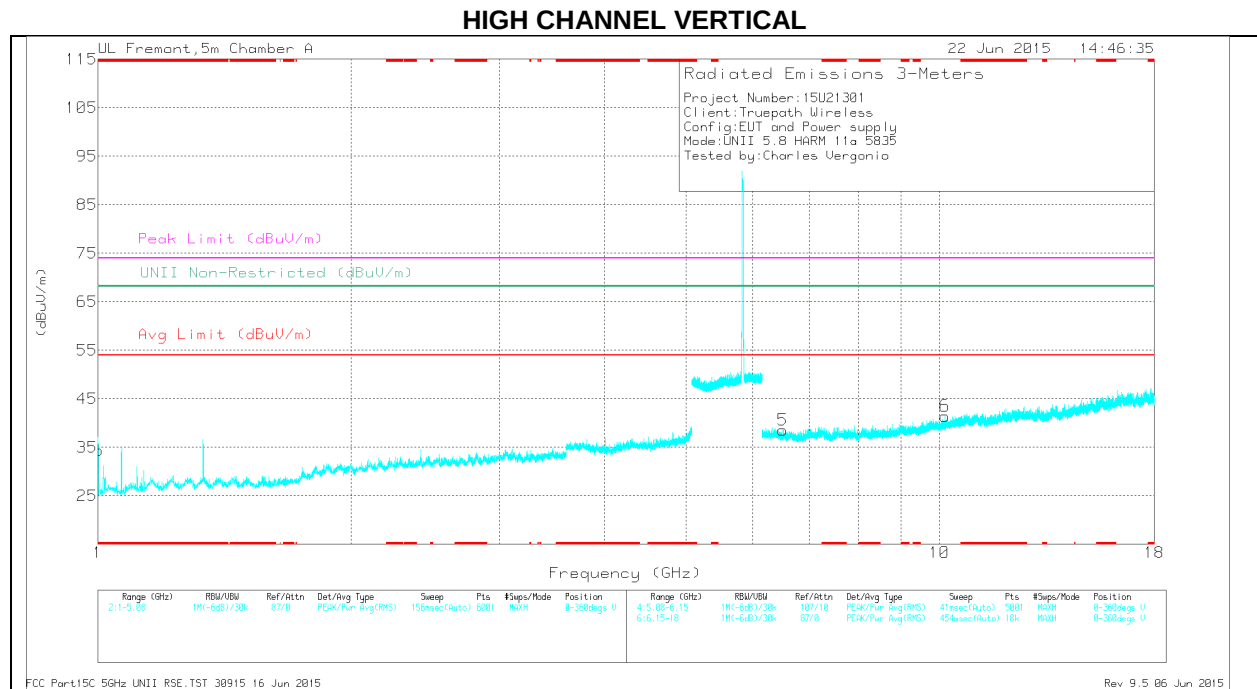
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average



Note: Emission was scanned up to 40GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.



Note: Emission was scanned up to 40GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HIGH CHANNEL DATA

TRACE MARKERS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Chl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 1.067	44.82	Pk	27.2	-35.9	0	36.12	-	-	74	-37.88	-	-	0-360	201	H
3	* 1.333	45.91	Pk	28.7	-36	0	38.61	-	-	74	-35.39	-	-	0-360	201	H
1	* 1.001	43.62	Pk	27	-36.2	0	34.42	-	-	74	-39.58	-	-	0-360	200	V
4	1.747	38.31	Pk	29.3	-35.2	0	32.41	-	-	-	-	68.2	-35.79	0-360	100	H
5	6.512	31.51	Pk	35.5	-28.4	0	38.61	-	-	-	-	68.2	-29.59	0-360	100	V
6	10.155	28.18	Pk	37.2	-23.9	0	41.48	-	-	-	-	68.2	-26.72	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Chl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.067	50.64	PK3	27.2	-35.9	0	41.94	-	-	74	-32.06	-	-	277	184	H
* 1.067	45.32	ADR	27.2	-35.9	.09	36.71	54	-17.29	-	-	-	-	277	184	H
* 1.333	49.69	PK3	28.7	-36	0	42.39	-	-	74	-31.61	-	-	144	203	H
* 1.333	44.5	ADR	28.7	-36	.09	37.29	54	-16.71	-	-	-	-	144	203	H
* 1	49.92	PK3	27	-36.2	0	40.72	-	-	74	-33.28	-	-	142	103	V
* 1	43.8	ADR	27	-36.2	.09	34.69	54	-19.31	-	-	-	-	142	103	V
1.746	44.07	PK3	29.2	-35.2	0	38.07	-	-	-	-	68.2	-30.13	142	101	H
1.749	32.44	ADR	29.3	-35.2	.09	26.63	-	-	-	-	-	-	142	101	H
6.512	39.28	PK3	35.5	-28.4	0	46.38	-	-	-	-	68.2	-21.82	142	101	V
6.512	27.99	ADR	35.5	-28.4	.09	35.18	-	-	-	-	-	-	142	101	V
10.153	34.89	PK3	37.2	-23.9	0	48.19	-	-	-	-	68.2	-20.01	142	101	V
10.154	23.87	ADR	37.2	-23.9	.09	37.26	-	-	-	-	-	-	142	101	V

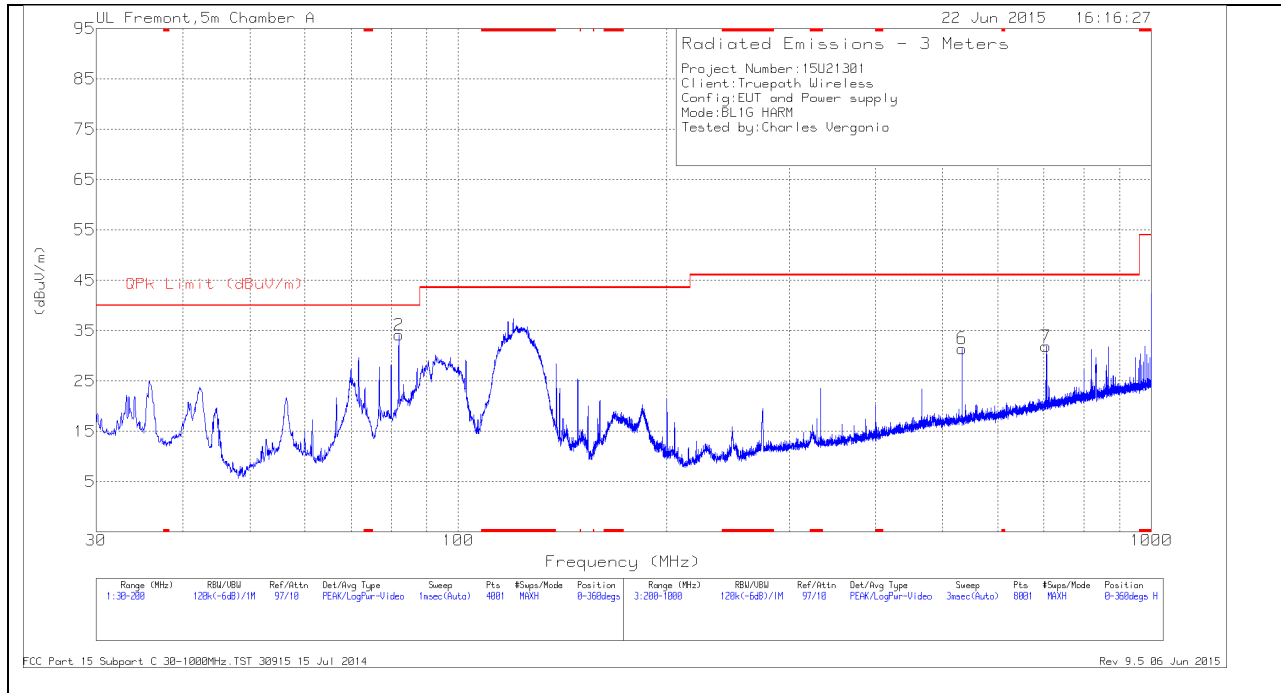
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - U-NII: Maximum Peak

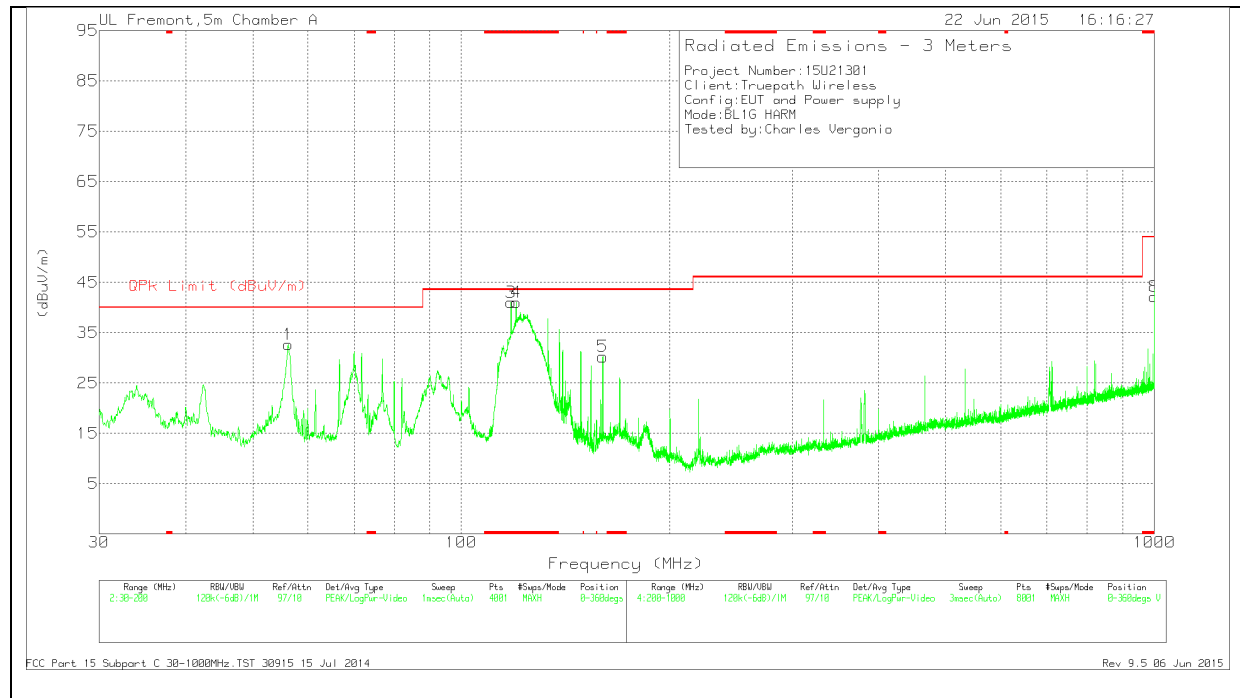
ADR - U-NII AD primary method, RMS average

10. WORST-CASE BELOW 1 GHz (in the 5.8 GHz Band)

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



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



Below 1G Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 117.9325	57.89	Pk	13.6	-30.5	40.99	43.52	-2.53	0-360	101	V
4	* 120.015	57.51	Pk	13.9	-30.4	41.01	43.52	-2.51	0-360	101	V
8	* 999.9	45.31	Pk	23.3	-26.5	42.11	53.97	-11.86	0-360	101	V
1	56.2225	56.34	Pk	7.2	-30.9	32.64	40	-7.36	0-360	101	V
2	82.0625	57.61	Pk	7.2	-30.7	34.11	40	-5.89	0-360	199	H
5	160.0075	48.43	Pk	12	-30.2	30.23	43.52	-13.29	0-360	101	V
6	533.3	42.14	Pk	17.9	-28.6	31.44	46.02	-14.58	0-360	101	H
7	704.8	39.88	Pk	20.1	-28.1	31.88	46.02	-14.14	0-360	299	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 117.9545	53.64	Qp	13.6	-30.5	36.74	43.52	-6.78	306	238	V
* 120.004	54.53	Qp	13.9	-30.4	38.03	43.52	-5.49	346	191	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Qp - Quasi-Peak detector