## 11.21. 802.11n HT20 2Tx CDD MODE IN THE 5.8 GHz BAND
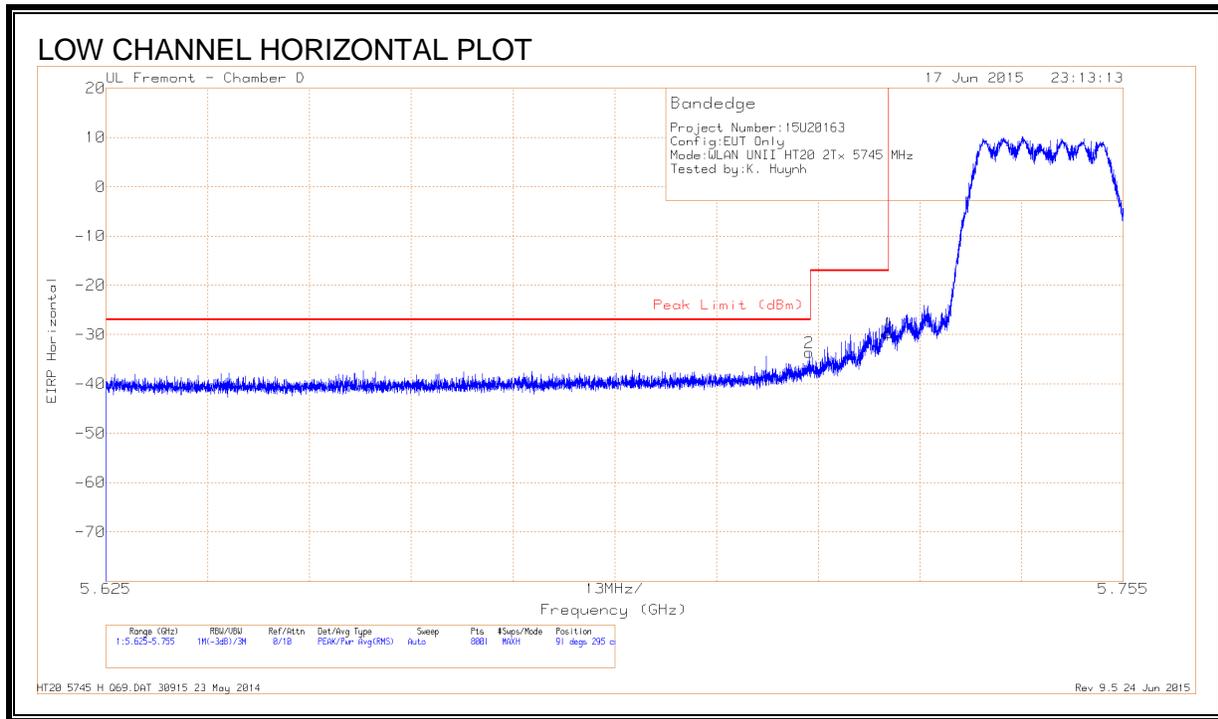
**RESTRICTED BANDEDGE (LOW CHANNEL)**

DATA

| Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fl tr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-55.21	Pk	34.7	-21	11.8	-29.71	-17	-12.71	91	295	H
2	5.715	-59.16	Pk	34.7	-21	11.8	-33.66	-27	-6.66	91	295	H

Pk - Peak detector
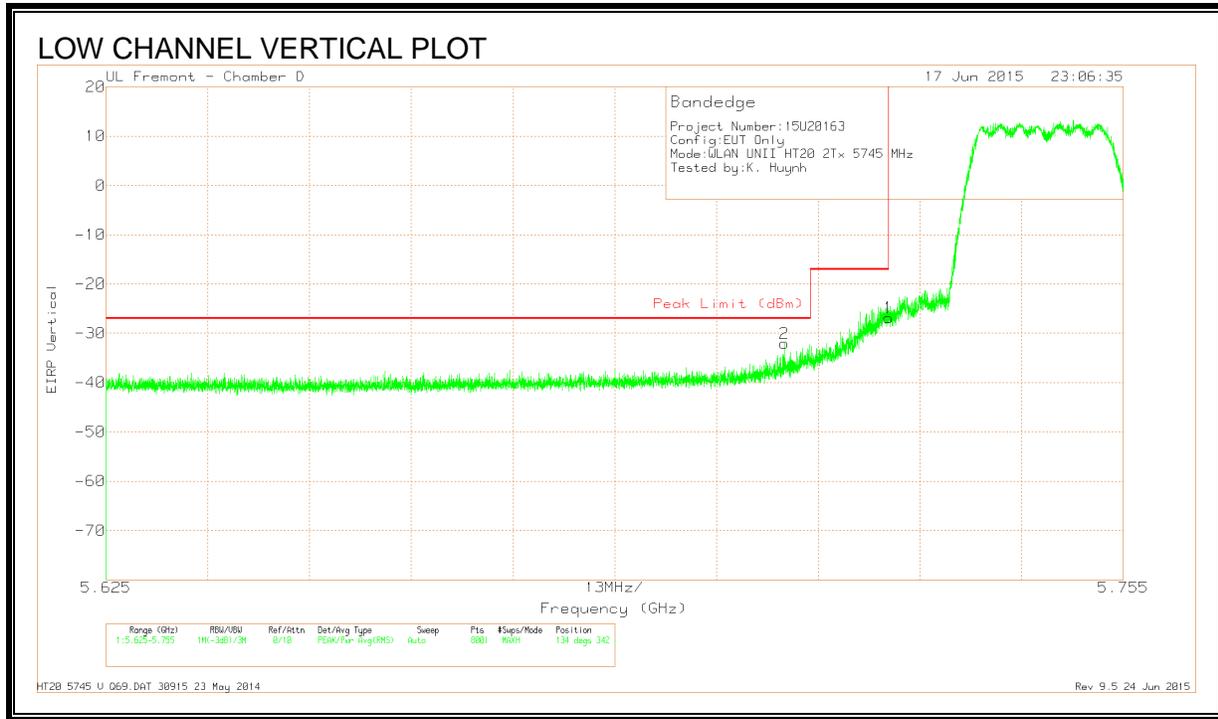
DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fl tr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-52.32	Pk	34.7	-21	11.8	-26.82	-17	-9.82	134	342	V
2	5.712	-57.81	Pk	34.7	-21	11.8	-32.31	-27	-5.31	134	342	V

Pk - Peak detector
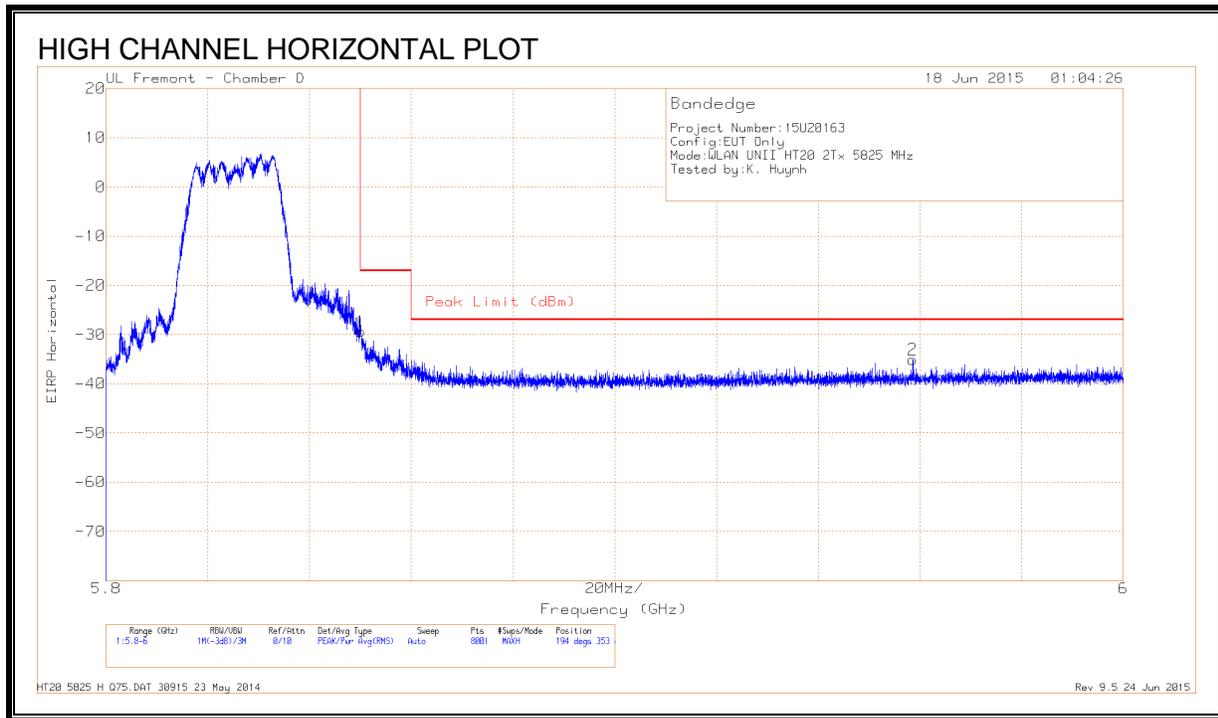
RESTRICTED BANDEDGE (HIGH CHANNEL)

HIGH CHANNEL HORIZONTAL PLOT

DATA

| Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fl tr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-54.84	Pk	34.9	-21.2	11.8	-29.34	-17	-12.34	194	353	H
2	5.959	-60.75	Pk	35	-21.1	11.8	-35.05	-27	-8.05	194	353	H

Pk - Peak detector
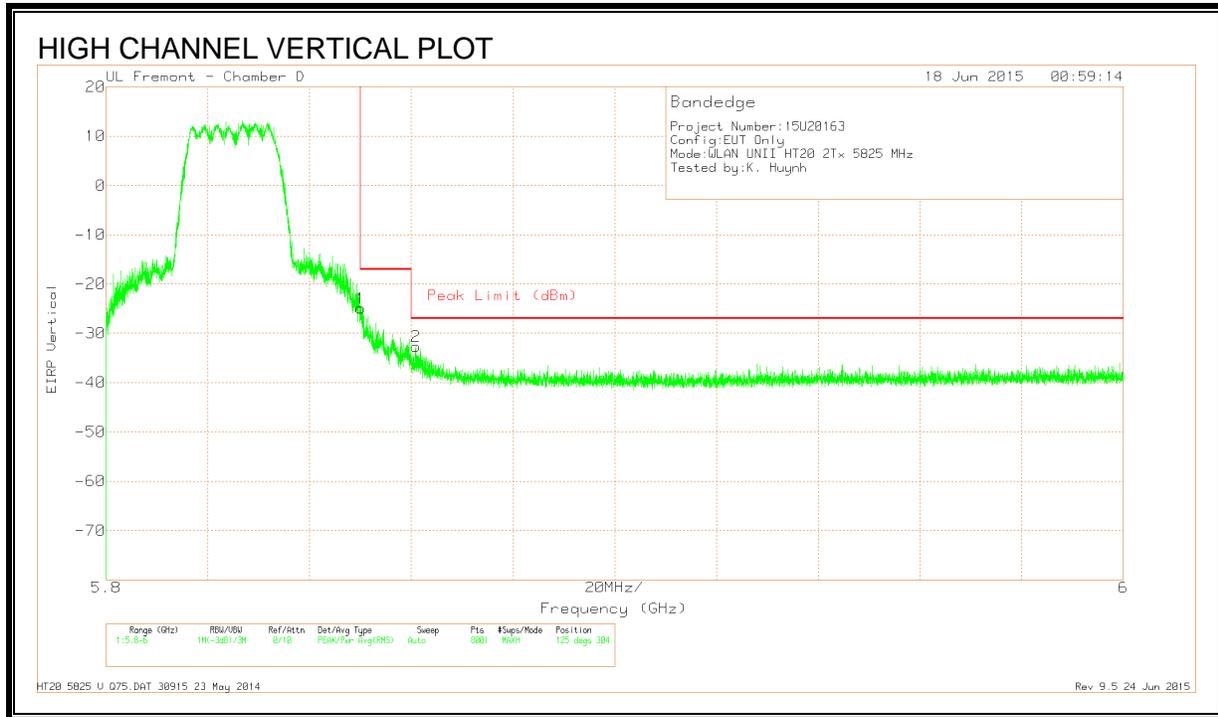
HIGH CHANNEL VERTICAL PLOT

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-50.46	Pk	34.9	-21.2	11.8	-24.96	-17	-7.96	125	304	V
2	5.861	-58.03	Pk	34.9	-21.3	11.8	-32.63	-27	-5.63	125	304	V

Pk - Peak detector
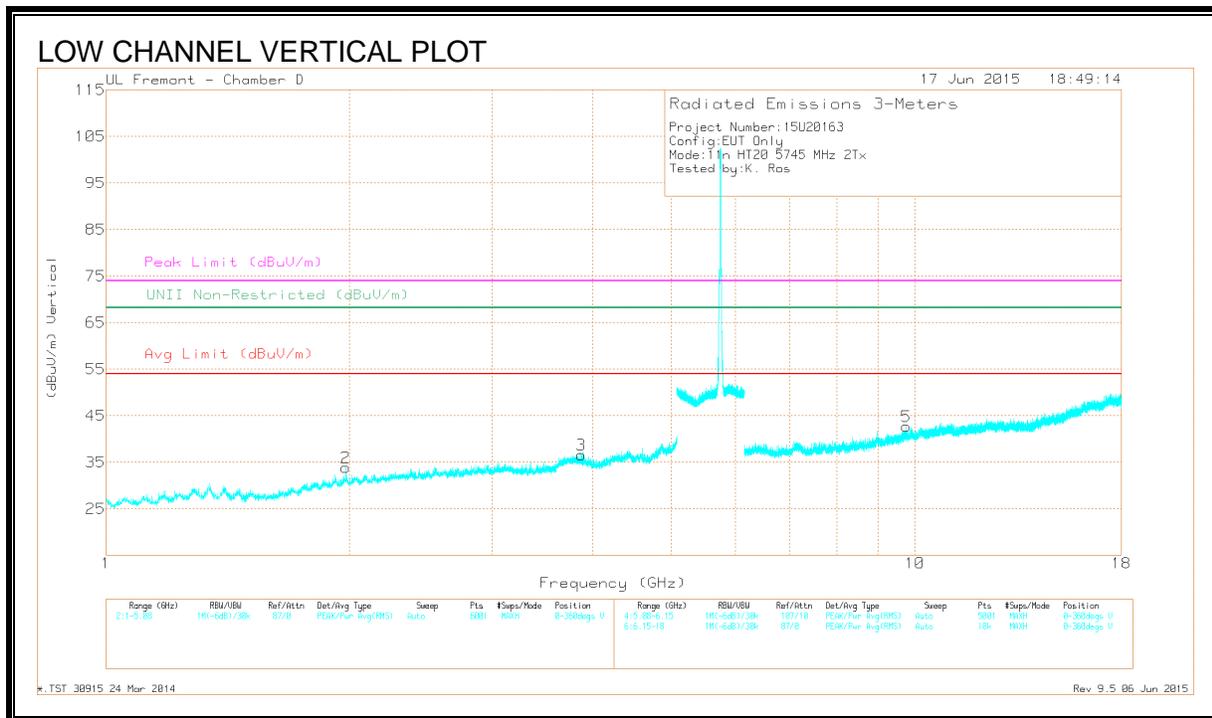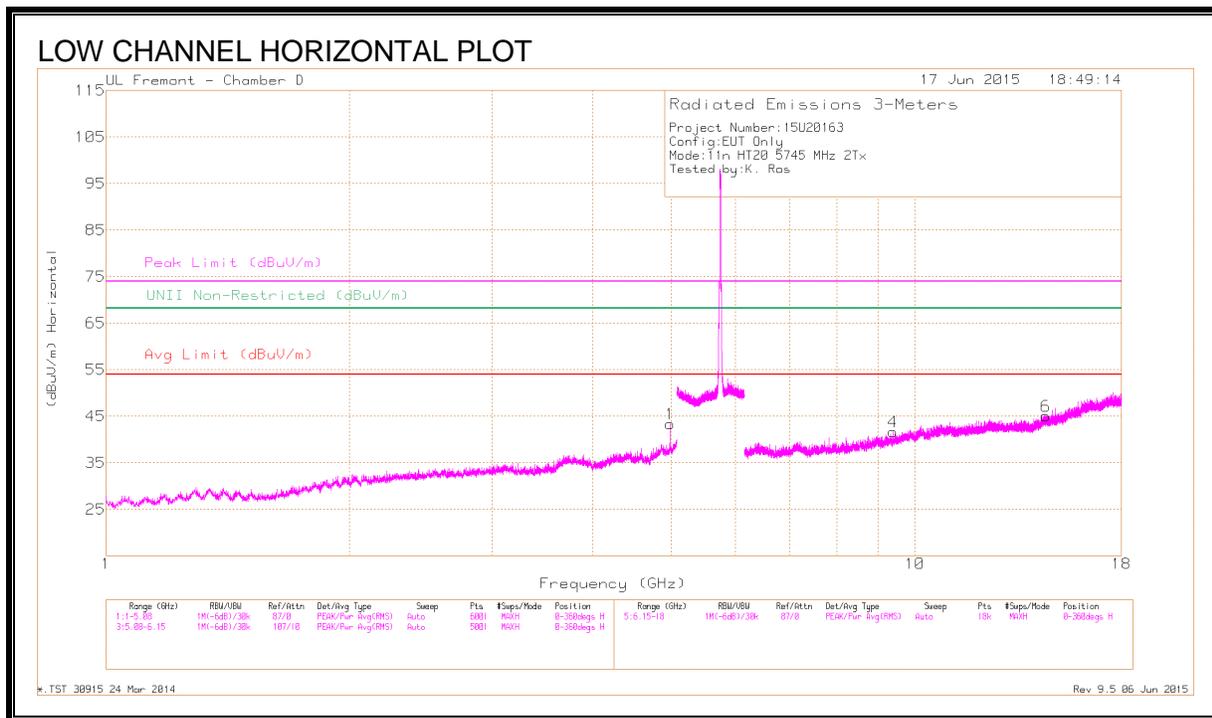
LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS


LOW CHANNEL HORIZONTAL PLOT

LOW CHANNEL VERTICAL PLOT

DATA

| Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (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	* 4.977	38.14	PK3	34.2	-26.9	45.44	-	-	74	-28.56	-	-	238	150	H
	* 4.979	26.8	ADR	34.2	-26.9	34.1	54	-19.9	-	-	-	-	238	150	H
2	1.979	40.83	PK3	31	-30.8	41.03	-	-	-	-	68.2	-27.17	299	125	V
3	* 3.868	38.95	PK3	33.4	-29	43.35	-	-	74	-30.65	-	-	299	125	V
	* 3.867	27.7	ADR	33.4	-29	32.1	54	-21.9	-	-	-	-	299	125	V
4	* 9.397	34.59	PK3	36.5	-22.2	48.89	-	-	74	-25.11	-	-	242	177	H
	* 9.398	23.2	ADR	36.5	-22.2	37.5	54	-16.5	-	-	-	-	242	177	H
5	9.753	35.28	PK3	36.9	-22.1	50.08	-	-	-	-	68.2	-18.12	195	222	V
6	14.516	36.88	PK3	39.6	-22.8	53.68	-	-	-	-	68.2	-14.52	293	400	H

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK3 - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

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MID CHANNEL HARMONICS AND SPURIOUS EMISSIONS
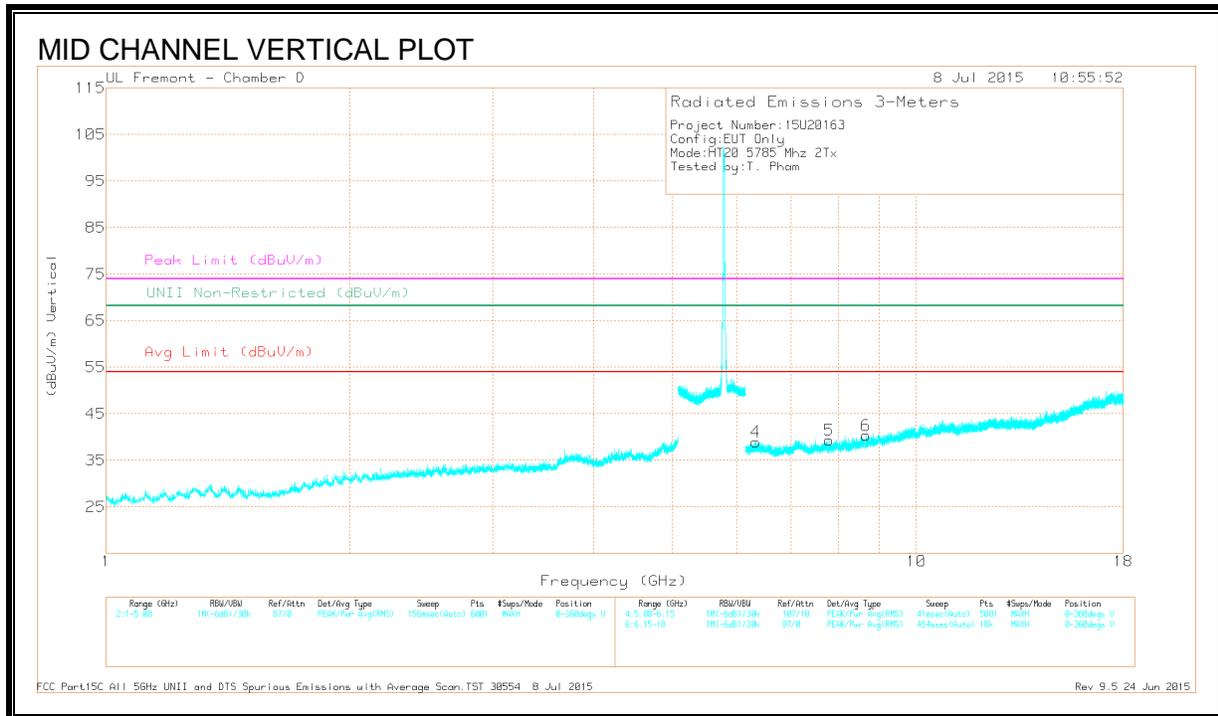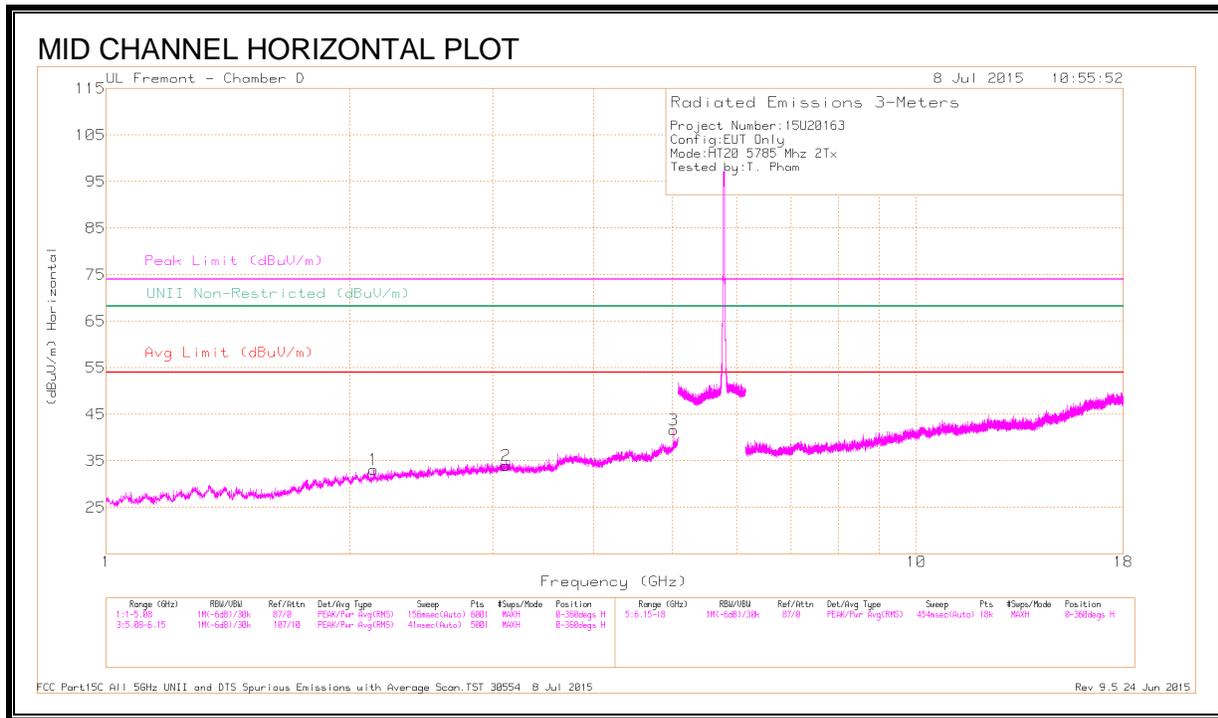
DATA

| Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (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	2.141	40.11	PK-U	31.4	-30.9	40.61	-	-	-	-	68.2	-27.59	360	101	H
2	3.112	39.22	PK-U	32.8	-28.9	43.12	-	-	-	-	68.2	-25.08	8	200	H
3	* 5.013	40.96	PK-U	34.3	-26.4	48.86	-	-	74	-25.14	-	-	8	200	H
	* 5.014	31.33	ADR	34.3	-26.4	39.23	54	-14.77	-	-	-	-	8	200	H
4	6.336	36.49	PK-U	35.4	-25.9	45.99	-	-	-	-	68.2	-22.21	8	200	V
5	7.799	35.79	PK-U	35.6	-24.6	46.79	-	-	-	-	68.2	-21.41	8	200	V
6	8.671	35.78	PK-U	35.9	-23.1	48.58	-	-	-	-	68.2	-19.62	8	200	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS
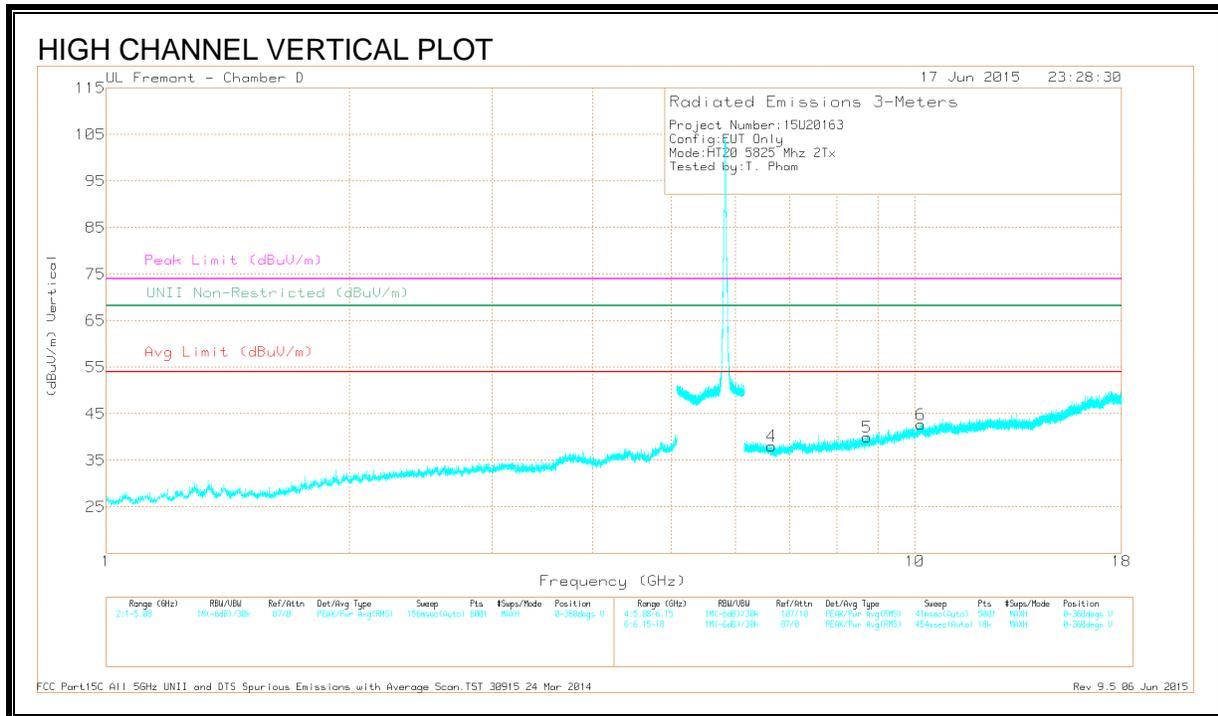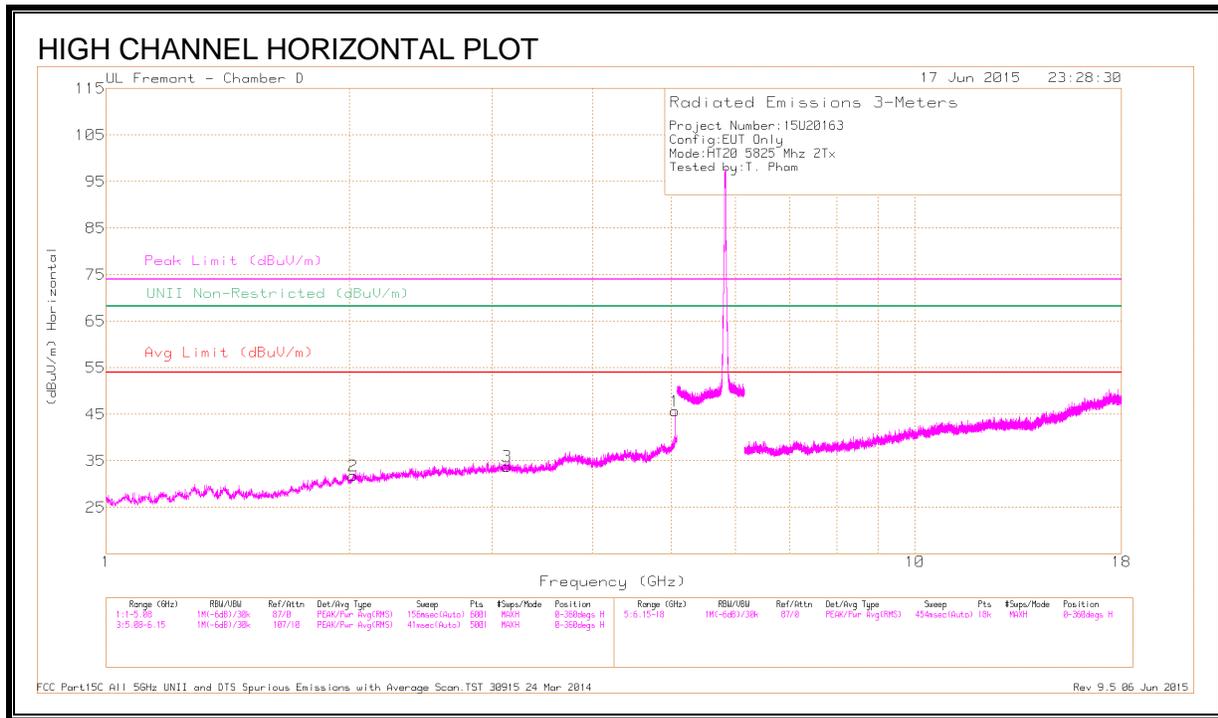
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (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	* 5.048	42.28	PK3	34.3	-25.7	50.88	-	-	74	-23.12	-	-	360	262	H
	* 5.048	33.28	ADR	34.3	-25.7	41.88	54	-12.12	-	-	-	-	360	262	H
2	2.017	39.66	PK3	31.1	-30.7	40.06	-	-	-	-	68.2	-28.14	360	262	H
3	3.132	38.92	PK3	32.8	-28.7	43.02	-	-	-	-	68.2	-25.18	360	262	H
4	6.649	36.66	PK3	35.5	-26.2	45.96	-	-	-	-	68.2	-22.24	360	262	V
5	8.726	35.08	PK3	35.9	-23.1	47.88	-	-	-	-	68.2	-20.32	360	262	V
6	10.167	33.57	PK3	37.2	-20.5	50.27	-	-	-	-	68.2	-17.93	360	262	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK3 - U-NII: Maximum Peak

11.22.   802.11n HT40 1Tx MODE IN THE 5.8 GHz BAND

RESTRICTED BANDEDGE,CHAIN 0 (LOW CHANNEL)
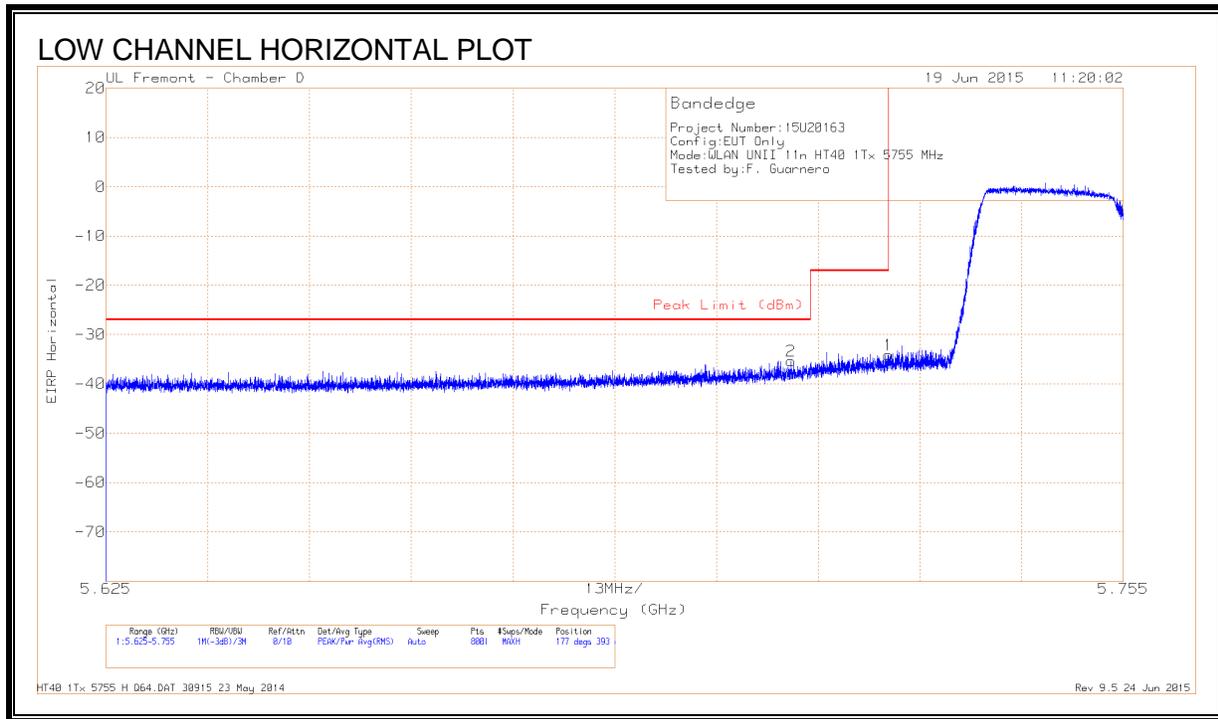
DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-59.58	Pk	34.7	-21	11.8	-34.08	-17	-17.08	177	393	H
2	5.713	-60.87	Pk	34.7	-21	11.8	-35.37	-27	-8.37	177	393	H

Pk - Peak detector
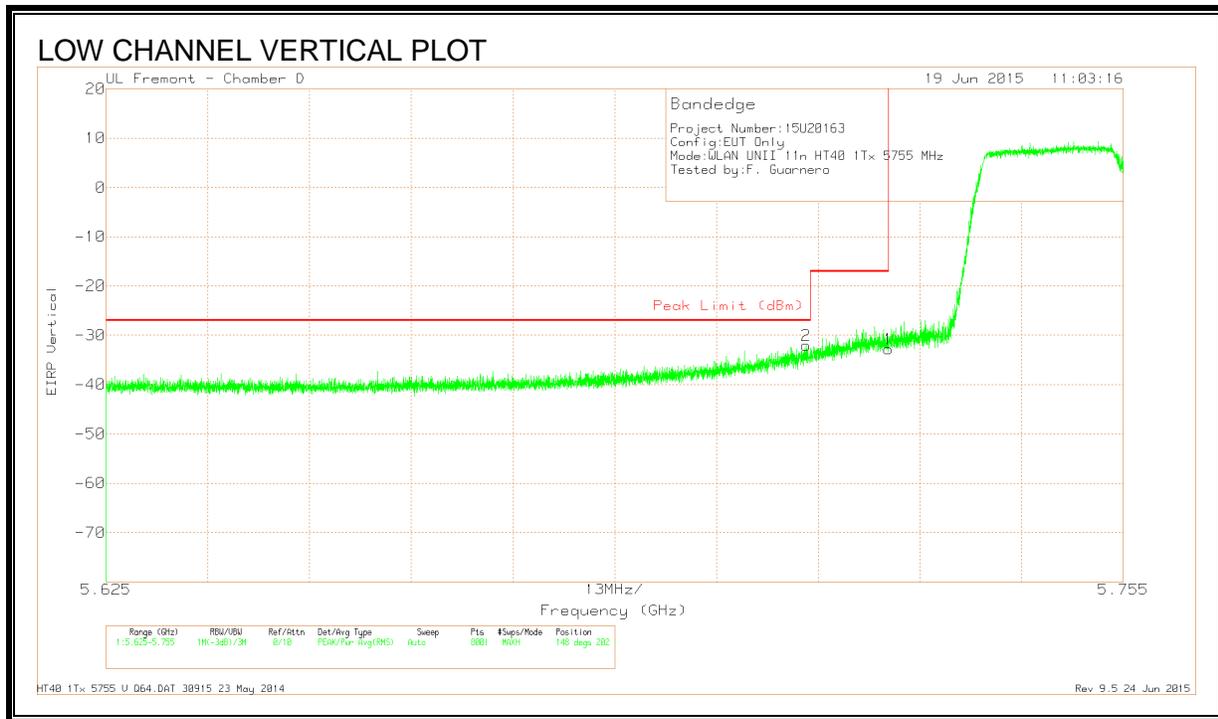
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LOW CHANNEL VERTICAL PLOT

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-58.26	Pk	34.7	-21	11.8	-32.76	-17	-15.76	148	202	V
2	5.714	-57.5	Pk	34.7	-21	11.8	-32	-27	-5	148	202	V

Pk - Peak detector

RESTRICTED BANDEDGE,CHAIN 0 (HIGH CHANNEL)
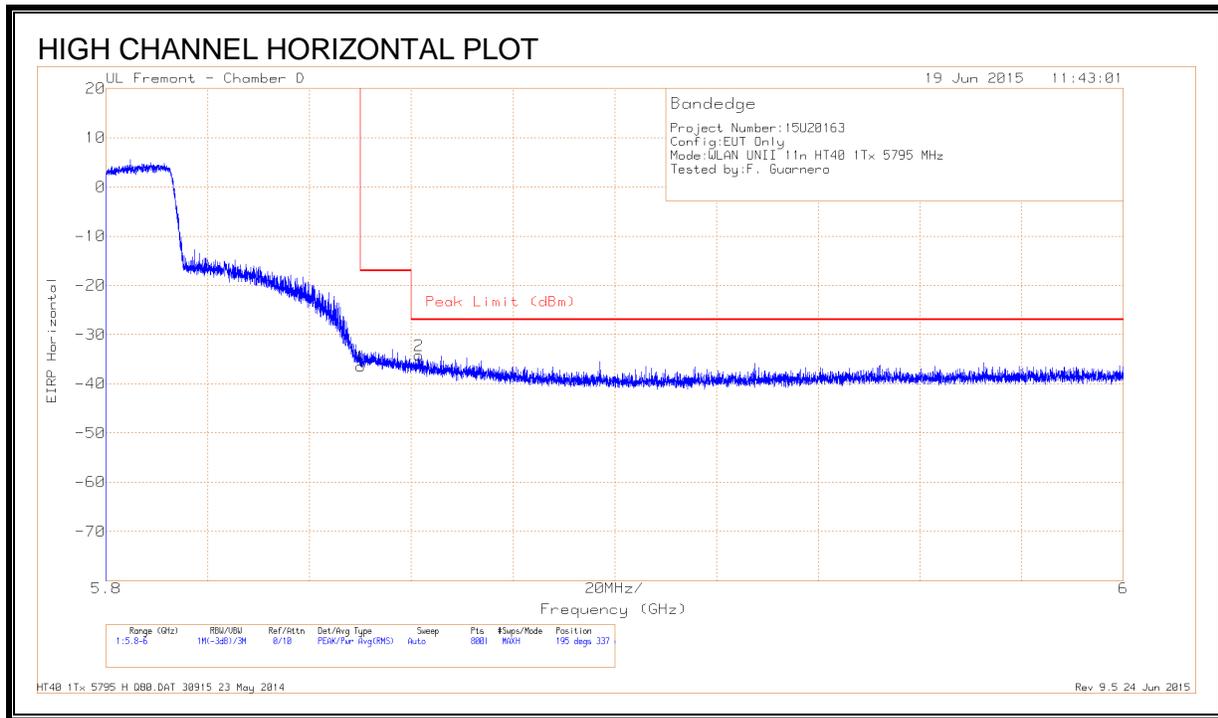
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| Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-61.99	Pk	34.9	-21.2	11.8	-36.49	-17	-19.49	195	337	H
2	5.862	-59.62	Pk	34.9	-21.3	11.8	-34.22	-27	-7.22	195	337	H

Pk - Peak detector
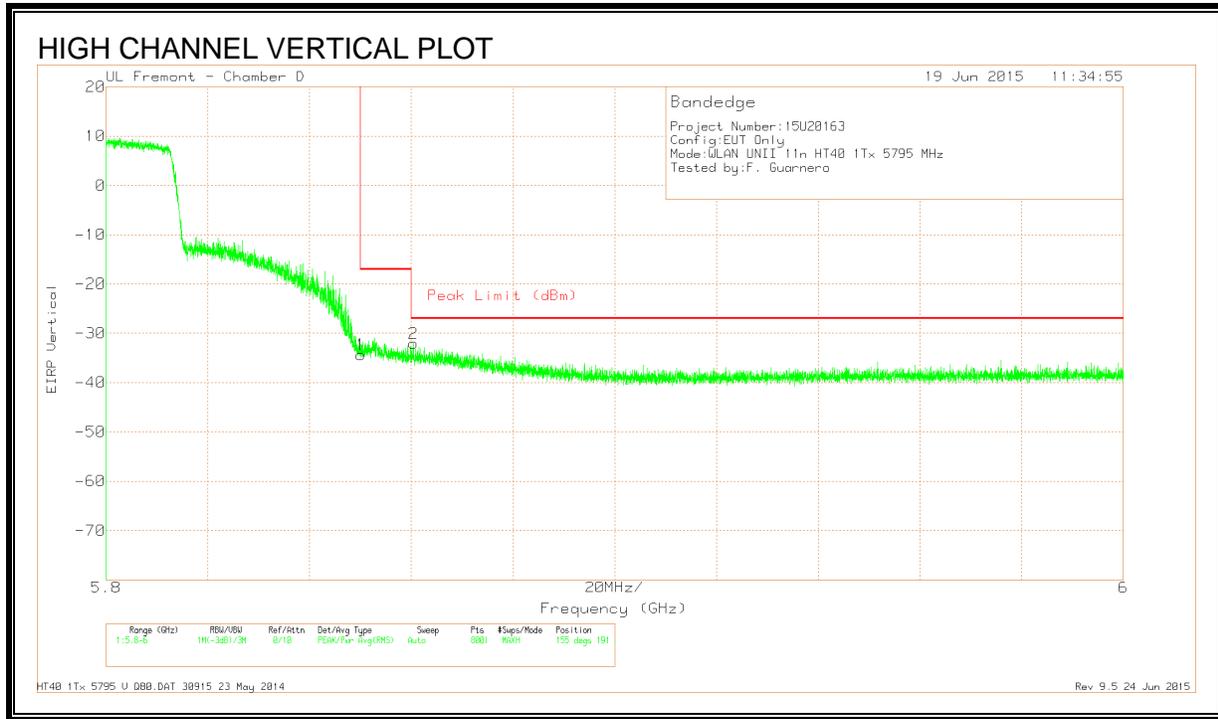
HIGH CHANNEL VERTICAL PLOT

DATA

| Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-59.81	Pk	34.9	-21.2	11.8	-34.31	-17	-17.31	155	191	V
2	5.86	-57.48	Pk	34.9	-21.3	11.8	-32.08	-27	-5.08	155	191	V

Pk - Peak detector
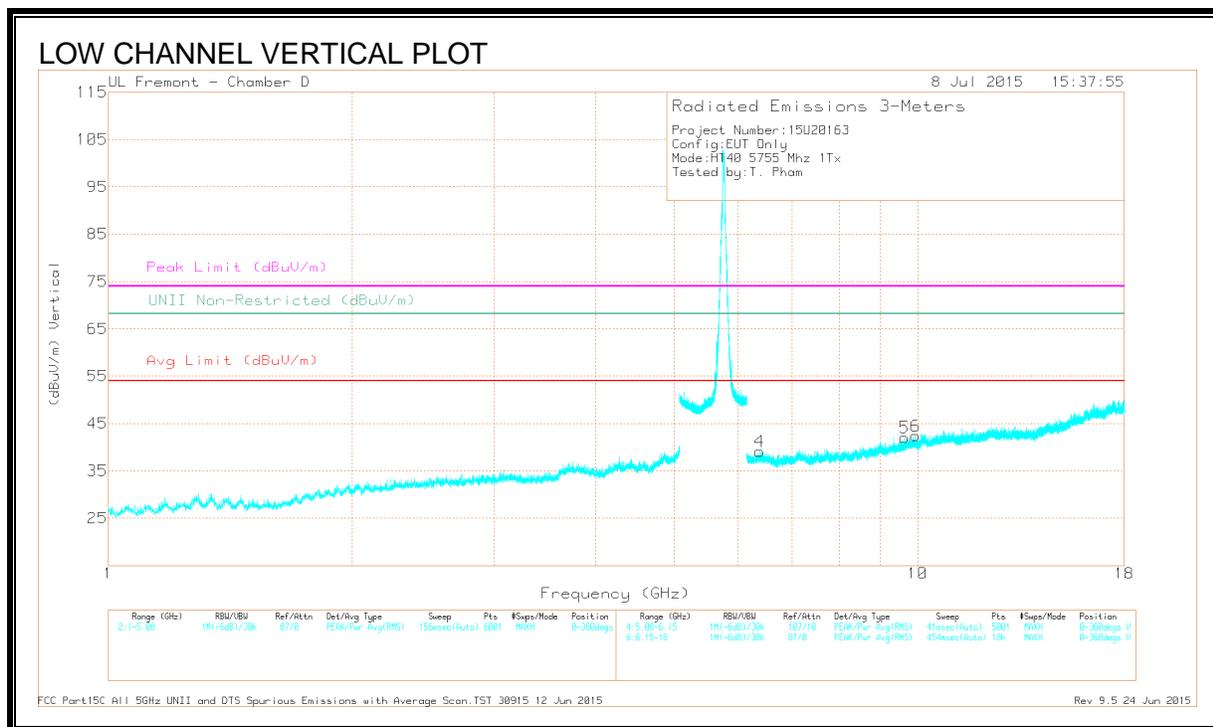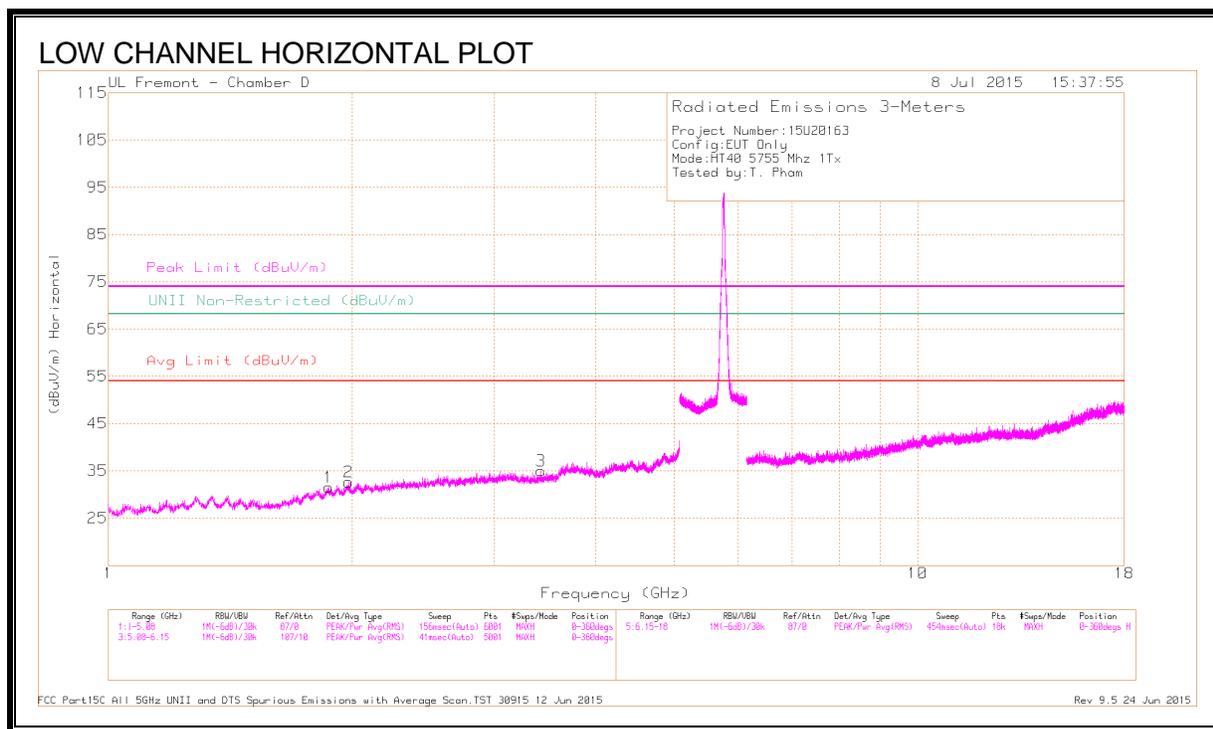
LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (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	1.874	40.86	PK-U	30.6	-31.4	40.06	-	-	-	-	68.2	-28.14	1	101	H
2	1.98	40.48	PK-U	31	-30.8	40.68	-	-	-	-	68.2	-27.52	1	101	H
3	3.424	39	PK-U	32.7	-29.3	42.4	-	-	-	-	68.2	-25.8	1	101	H
4	6.38	36.84	PK-U	35.4	-26	46.24	-	-	-	-	68.2	-21.96	1	101	V
5	9.637	34.24	PK-U	36.7	-21.9	49.04	-	-	-	-	68.2	-19.16	1	101	V
6	9.934	33.61	PK-U	37.1	-21.3	49.41	-	-	-	-	68.2	-18.79	1	101	V

PK-U - U-NII: Maximum Peak
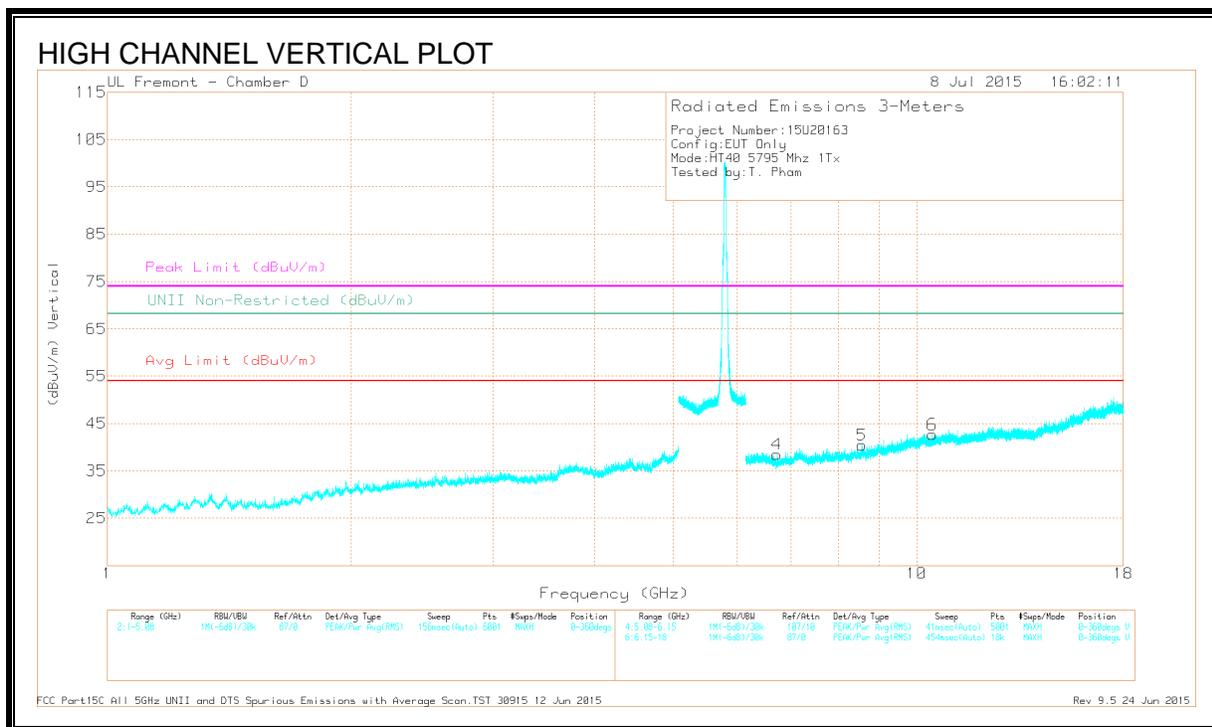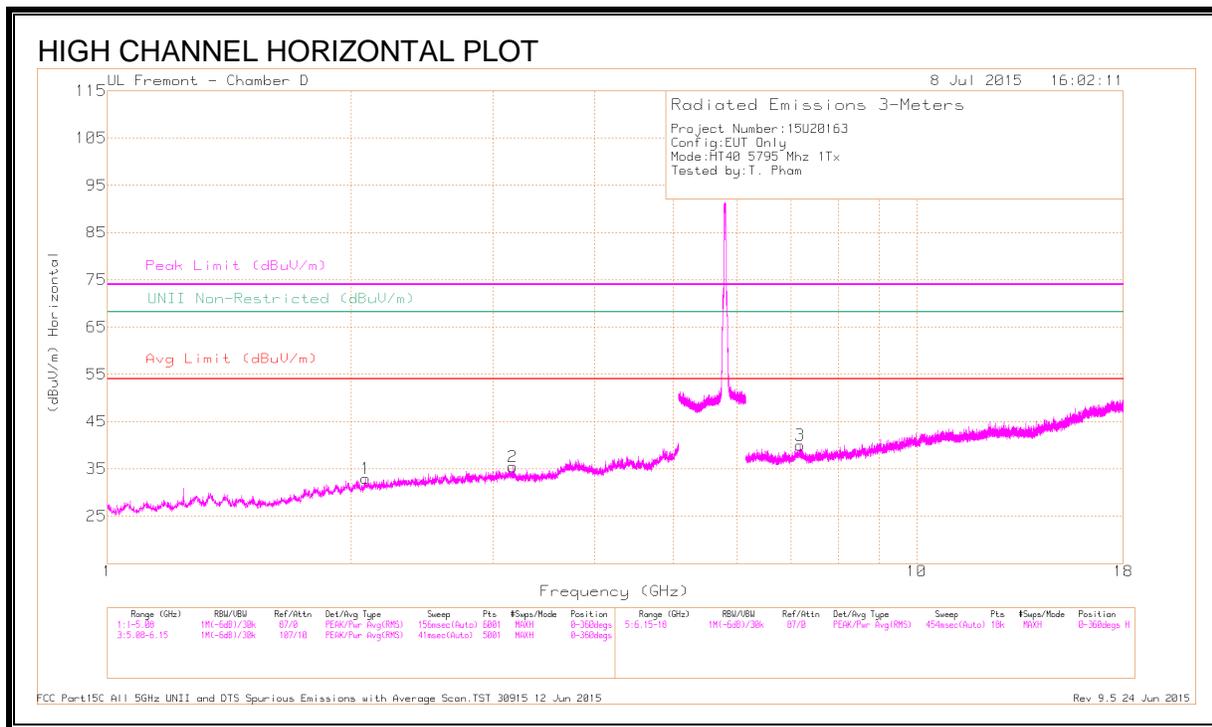
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HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (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	2.083	40.46	PK-U	31.3	-30.6	41.16	-	-	-	-	68.2	-27.04	0	101	H
2	3.172	39.52	PK-U	32.7	-29	43.22	-	-	-	-	68.2	-24.98	0	101	H
3	6.72	37.21	PK-U	35.5	-26.6	46.11	-	-	-	-	68.2	-22.09	0	101	V
4	7.176	35.54	PK-U	35.5	-24.3	46.74	-	-	-	-	68.2	-21.46	0	101	H
5	8.554	35.38	PK-U	35.8	-23.1	48.08	-	-	-	-	68.2	-20.12	0	101	V
6	10.456	34.62	PK-U	37.5	-21.7	50.42	-	-	-	-	68.2	-17.78	0	101	V

PK-U - U-NII: Maximum Peak
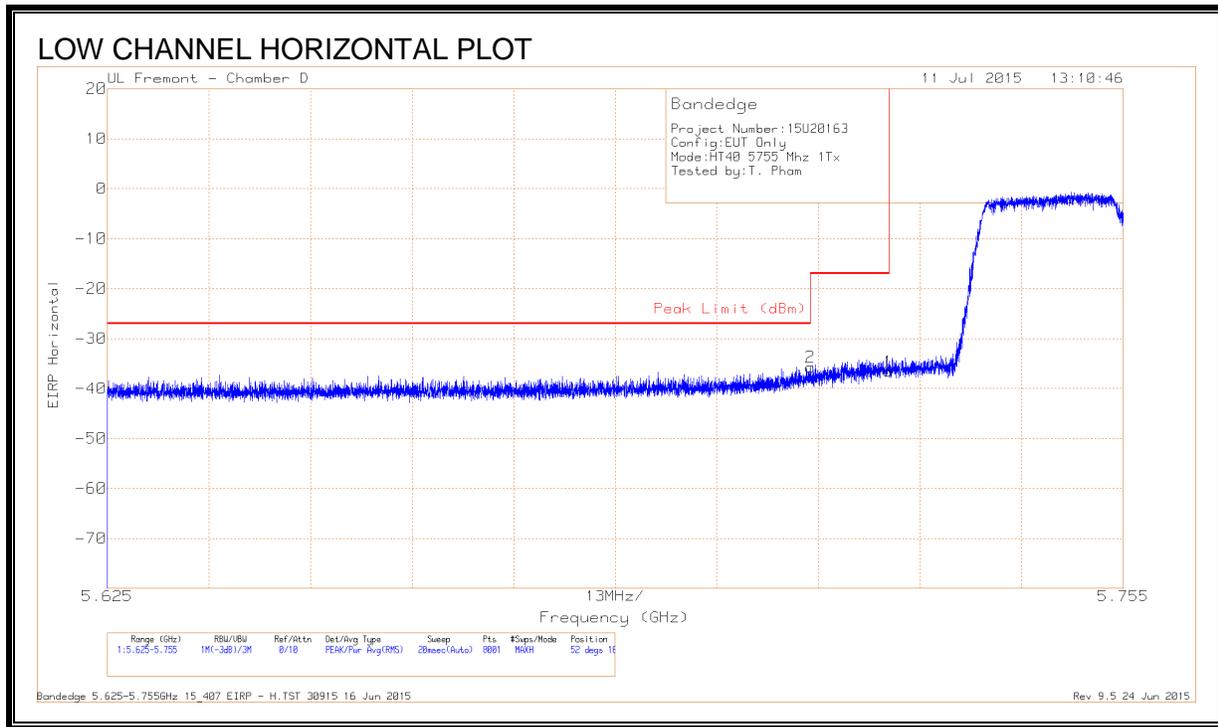
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RESTRICTED BANDEDGE, CHAIN 1 (LOW CHANNEL)

LOW CHANNEL HORIZONTAL PLOT

UL Fremont - Chamber D   11 Jul 2015   13:10:46

Bandedge
Project Number:15U20163
Config:EUT Only
Mode:HT40 5755 Mhz 1Tx
Tested by:T. Pham

Peak Limit (dBm)

EIRP Horizontal

5.625   13MHz/   5.755
                             Frequency (GHz)

| Range (GHz) | RBW/VBW | Ref/Attn | Det/Avg Type | Sweep | Pts | #Swps/Mode | Position |
| 1:5.625-5.755 | 1M(-3dB)/3M | 0/10 | PEAK/Pwr Avg(RMS) | 20msec(Auto) | 8001 | MAXH | 52 degs 1F |

Bandedge 5.625-5.755GHz 15_407 EIRP - H.TST 30915 16 Jun 2015   Rev 9.5 24 Jun 2015

DATA

| Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-65.41	Pk	34.6	-17.6	11.8	-36.61	-17	-19.61	52	162	H
2	5.715	-64.59	Pk	34.6	-17.5	11.8	-35.69	-27	-8.69	52	162	H

Pk - Peak detector
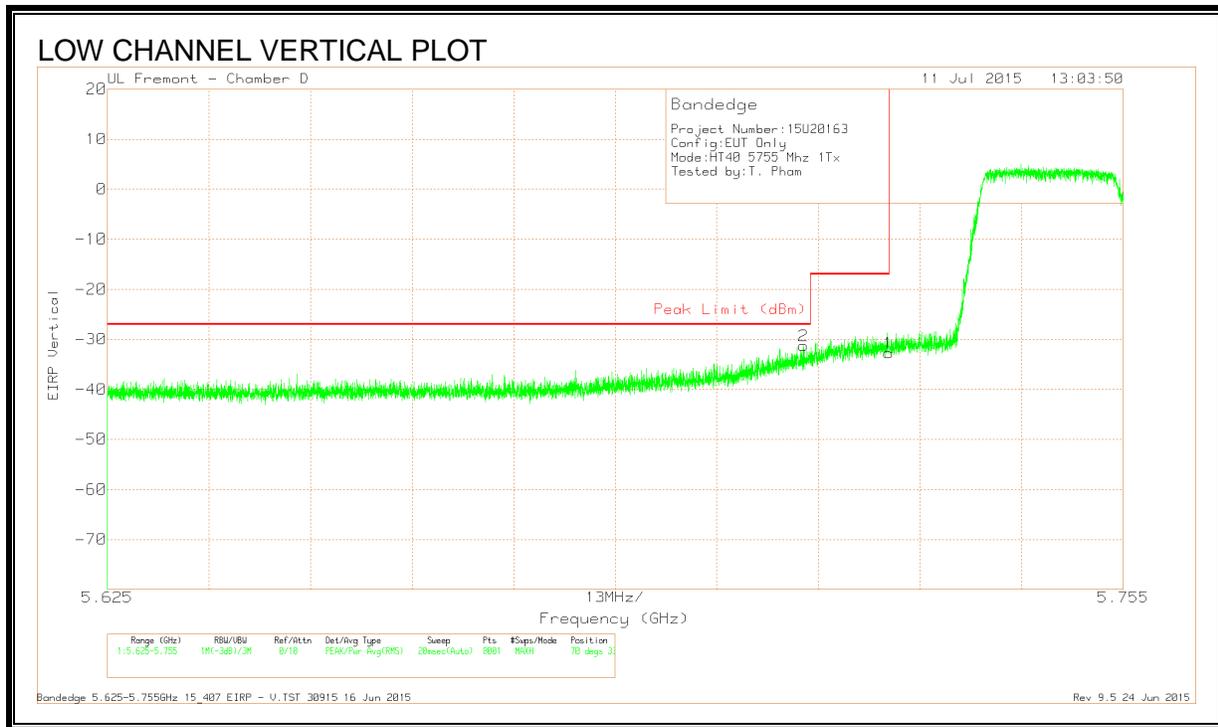
LOW CHANNEL VERTICAL PLOT

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-61.53	Pk	34.6	-17.6	11.8	-32.73	-17	-15.73	70	334	V
2	5.714	-60.17	Pk	34.6	-17.5	11.8	-31.27	-27	-4.27	70	334	V

Pk - Peak detector

RESTRICTED BANDEDGE, CHAIN 1 (HIGH CHANNEL)
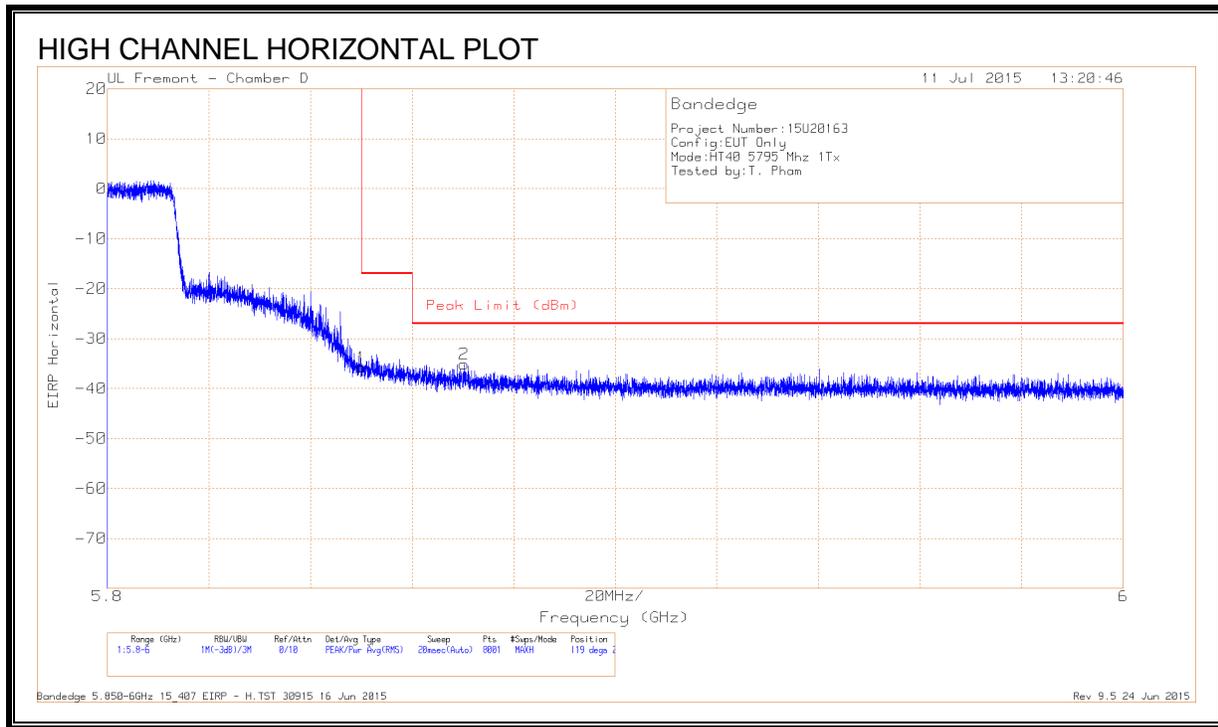
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| Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-64.76	Pk	34.9	-17.7	11.8	-35.76	-17	-18.76	119	224	H
2	5.87	-64.27	Pk	35	-17.6	11.8	-35.07	-27	-8.07	119	224	H

Pk - Peak detector
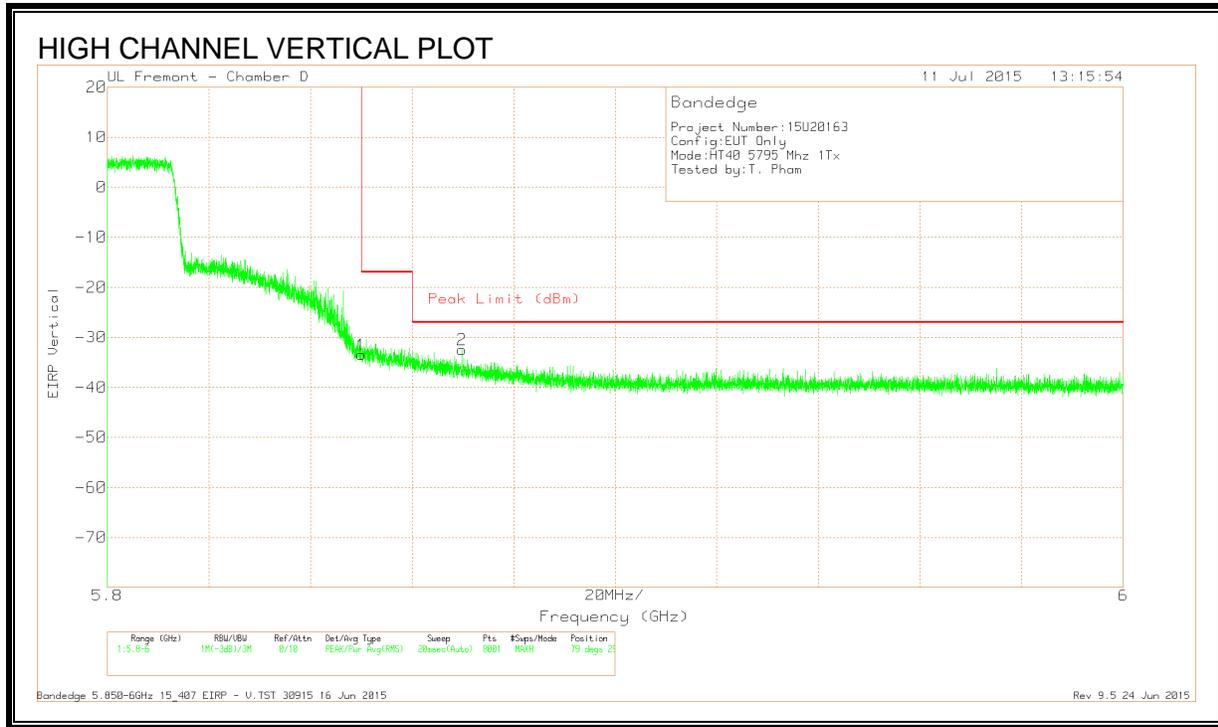
HIGH CHANNEL VERTICAL PLOT

DATA

| Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-62.46	Pk	34.9	-17.7	11.8	-33.46	-17	-16.46	79	293	V
2	5.87	-61.66	Pk	35	-17.6	11.8	-32.46	-27	-5.46	79	293	V

Pk - Peak detector
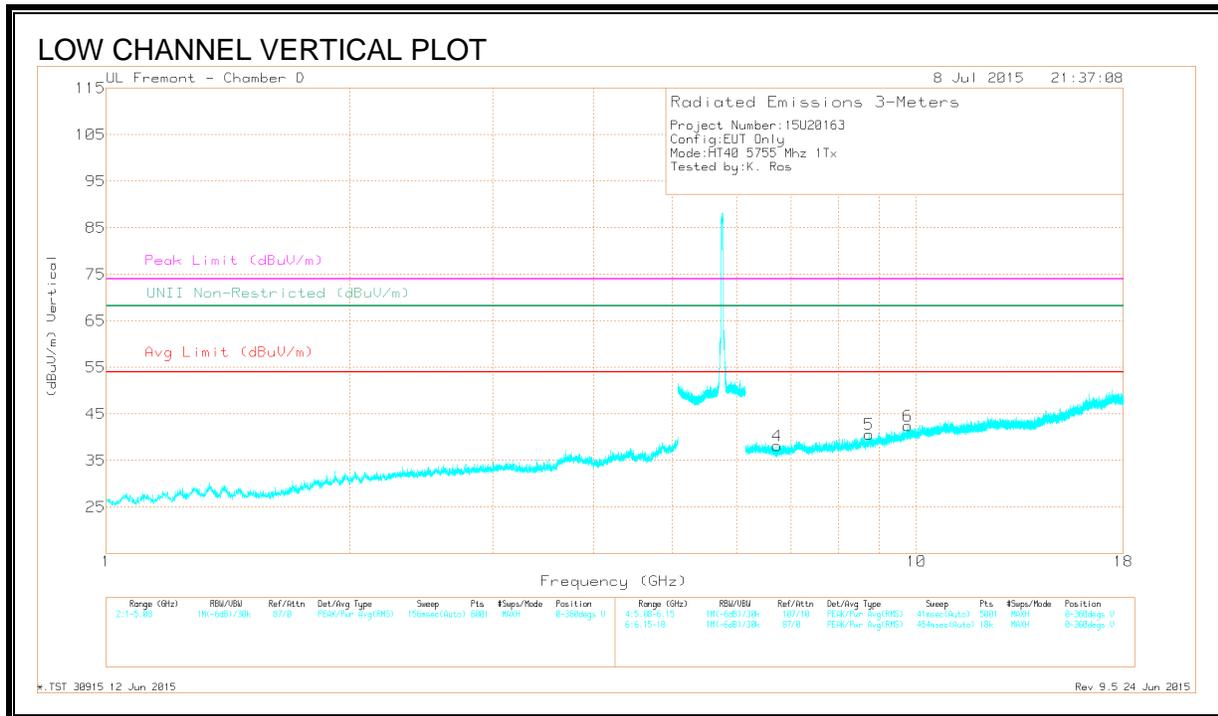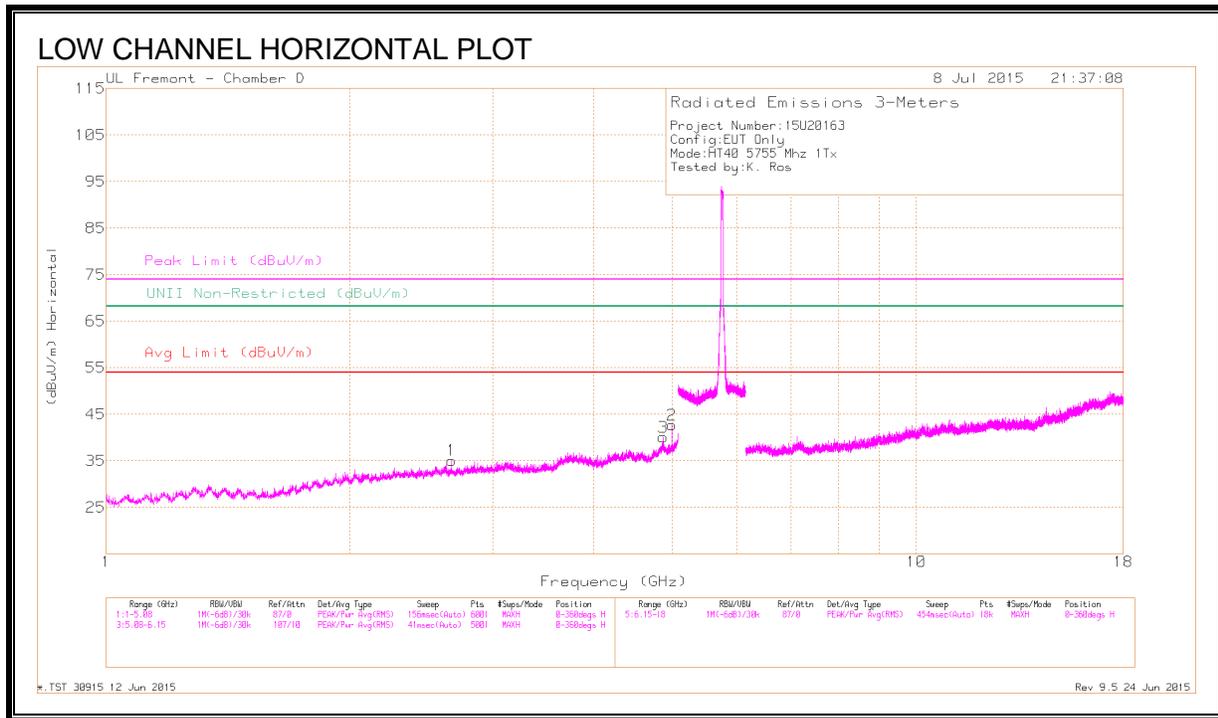
LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS

DATA

| Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (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	* 2.666	40.53	PK-U	32.4	-30.6	42.33	-	-	74	-31.67	-	-	256	139	H
	* 2.669	28.52	ADR	32.4	-30.6	30.32	54	-23.68	-	-	-	-	256	139	H
2	* 4.988	40.61	PK-U	34.2	-26.9	47.91	-	-	74	-26.09	-	-	186	184	H
	* 4.988	32.43	ADR	34.2	-26.9	39.73	54	-14.27	-	-	-	-	186	184	H
3	* 4.868	37.24	PK-U	34.1	-25.2	46.14	-	-	74	-27.86	-	-	209	167	H
	* 4.866	25.53	ADR	34.1	-25.3	34.33	54	-19.67	-	-	-	-	209	167	H
4	6.734	37.43	PK-U	35.5	-26.5	46.43	-	-	-	-	68.2	-21.77	151	205	V
5	8.747	34.68	PK-U	35.9	-22.9	47.68	-	-	-	-	68.2	-20.52	192	178	V
6	9.76	35.03	PK-U	36.9	-22.2	49.73	-	-	-	-	68.2	-18.47	84	221	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS
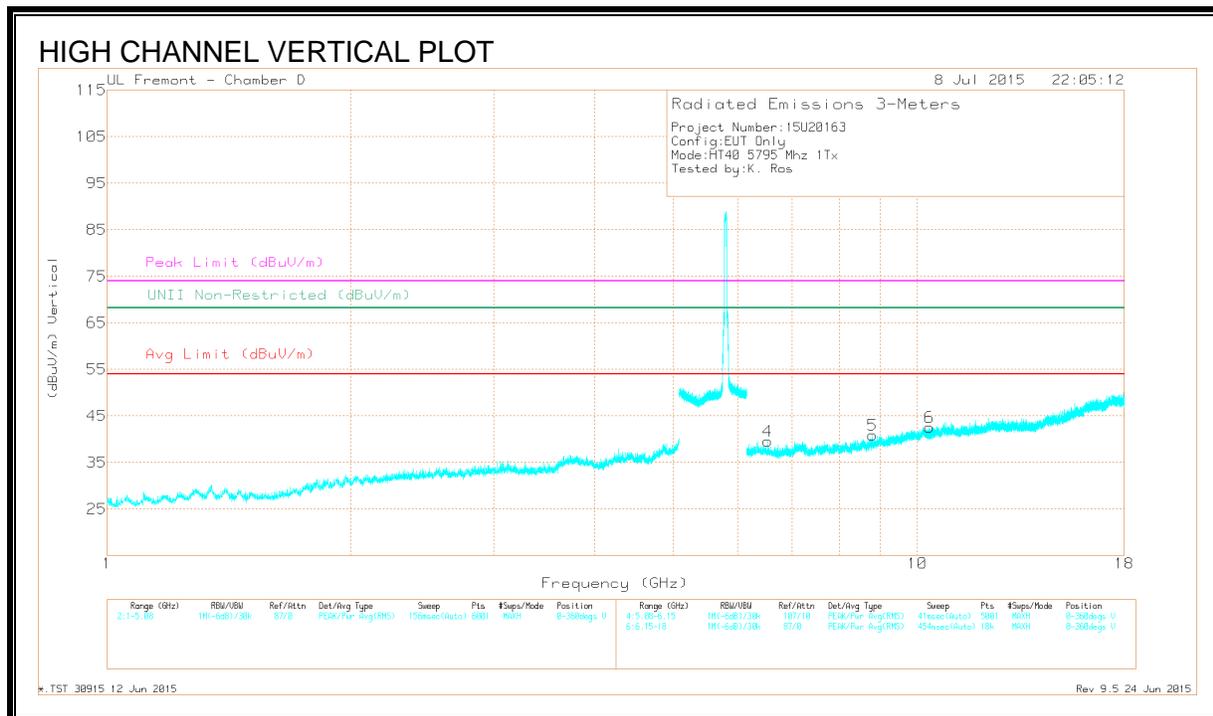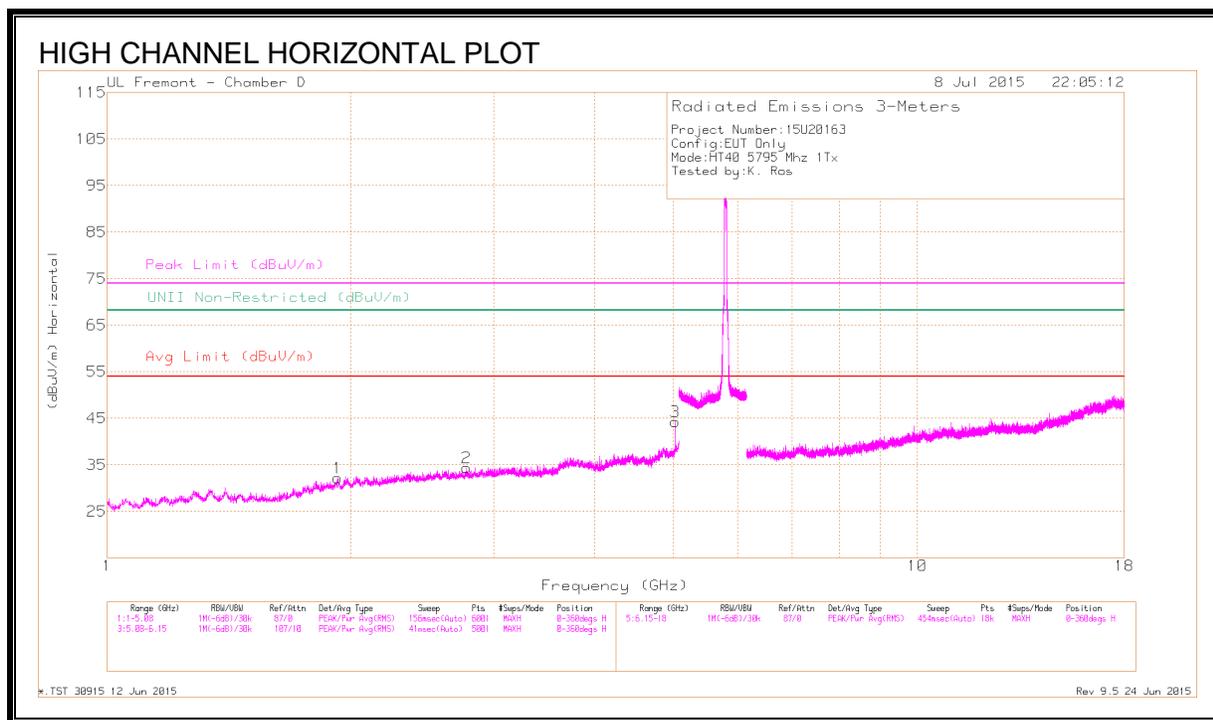
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (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	1.924	40.4	PK-U	30.8	-31.1	40.1	-	-	-	-	68.2	-28.1	130	136	H
2	* 2.777	39.26	PK-U	32.5	-29.9	41.86	-	-	74	-32.14	-	-	77	194	H
	* 2.776	28.05	ADR	32.5	-29.9	30.65	54	-23.35	-	-	-	-	77	194	H
3	* 5.022	40.31	PK-U	34.3	-26	48.61	-	-	74	-25.39	-	-	201	172	H
	* 5.022	32.45	ADR	34.3	-26	40.75	54	-13.25	-	-	-	-	201	172	H
4	6.537	36.59	PK-U	35.5	-25.5	46.59	-	-	-	-	68.2	-21.61	149	210	V
5	8.795	34.83	PK-U	35.9	-23	47.73	-	-	-	-	68.2	-20.47	195	229	V
6	10.339	34.73	PK-U	37.3	-21.7	50.33	-	-	-	-	68.2	-17.87	288	264	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

11.23. 802.11n HT40 2Tx CDD MODE IN THE 5.8 GHz BAND
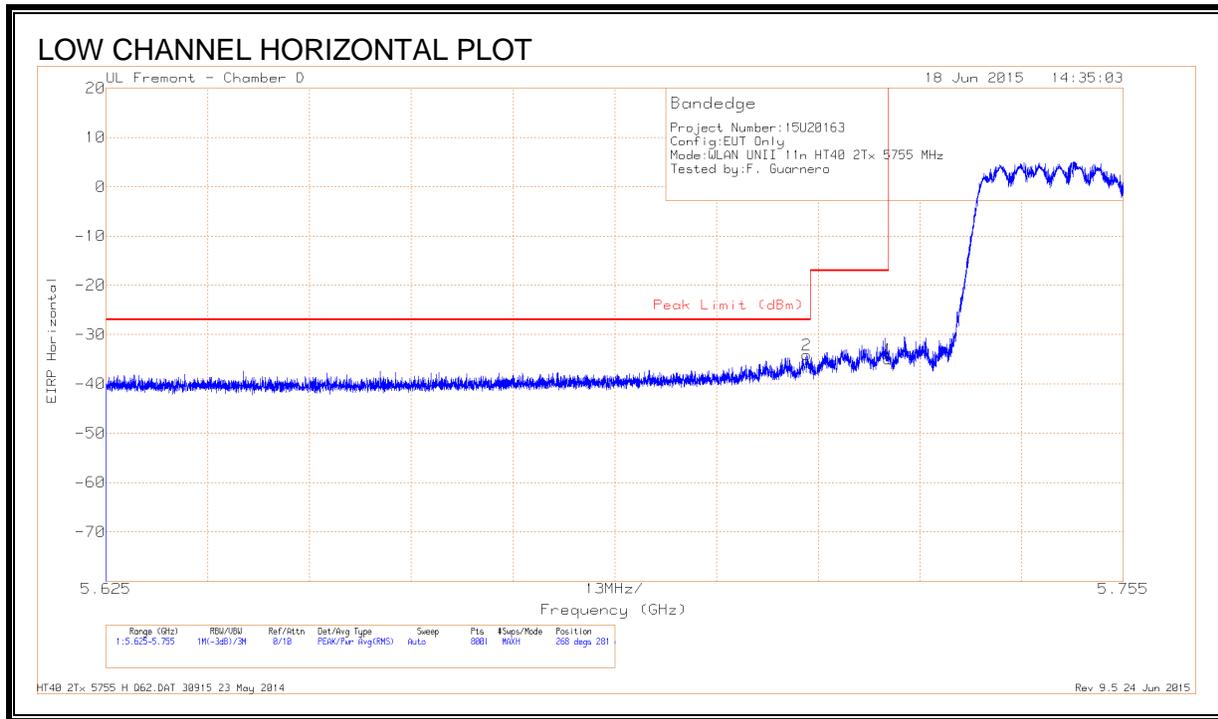
RESTRICTED BANDEDGE (LOW CHANNEL)

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-60.5	Pk	34.7	-21	11.8	-35	-17	-18	268	281	H
2	5.715	-59.63	Pk	34.7	-21	11.8	-34.13	-27	-7.13	268	281	H

Pk - Peak detector
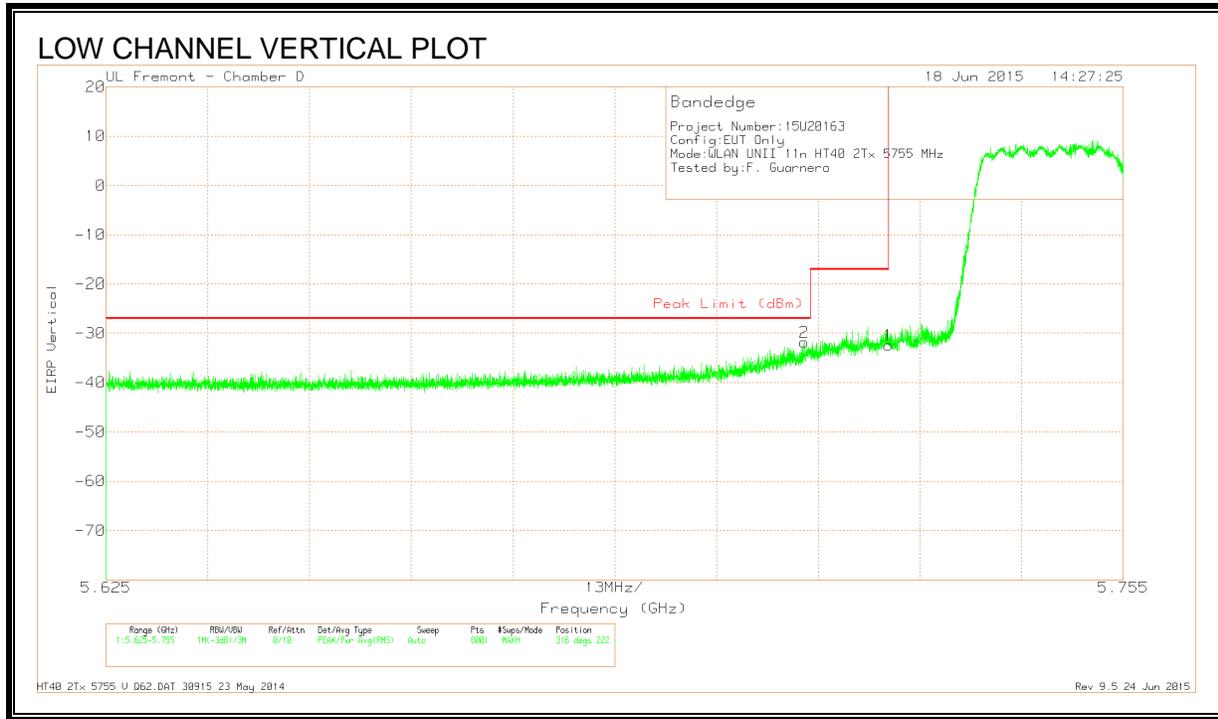
LOW CHANNEL VERTICAL PLOT

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-57.88	Pk	34.7	-21	11.8	-32.38	-17	-15.38	316	222	V
2	5.714	-57.24	Pk	34.7	-21	11.8	-31.74	-27	-4.74	316	222	V

Pk - Peak detector
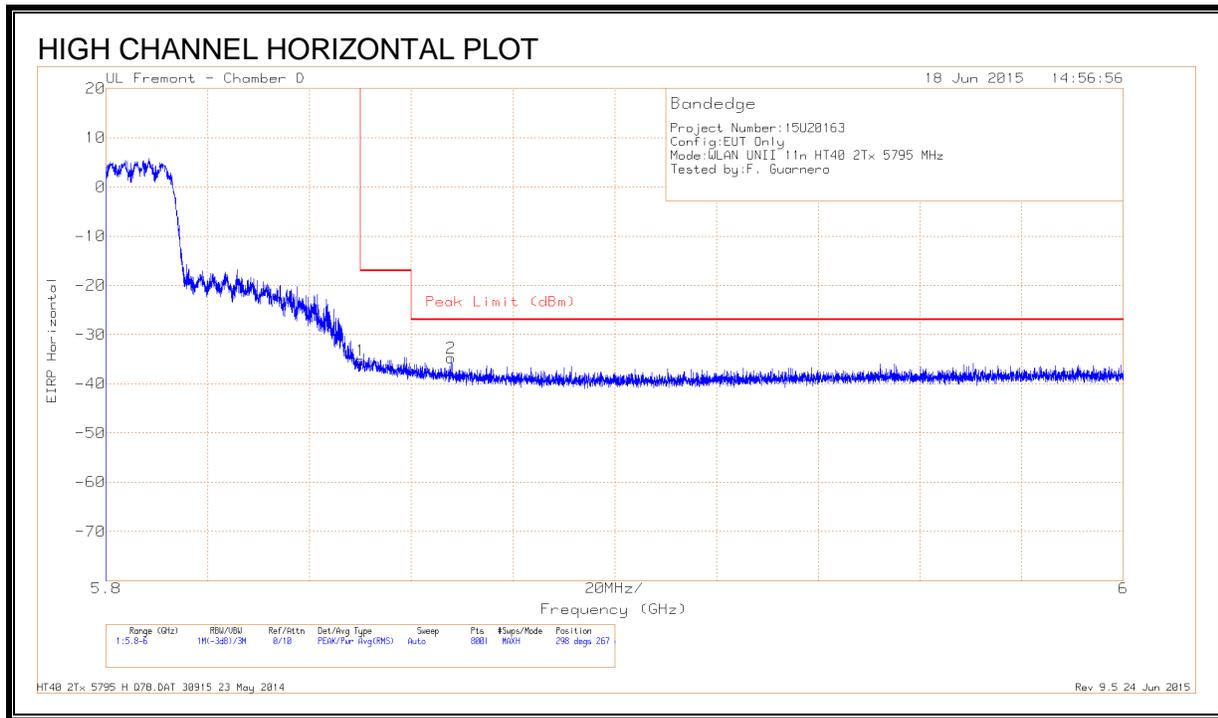
RESTRICTED BANDEDGE (HIGH CHANNEL)

HIGH CHANNEL HORIZONTAL PLOT

UL Fremont - Chamber D   18 Jun 2015   14:56:56

Bandedge
Project Number:15U20163
Config:EUT Only
Mode:WLAN UNII 11n HT40 2Tx 5795 MHz
Tested by:F. Guarnero

Peak Limit (dBm)

Range (GHz)	RBW/VBW	Ref/Attn	Det/Avg Type	Sweep	Pts	#Sups/Mode	Position
1:5.8-6	1M(-3dB)/3M	0/10	PEAK/Pwr Avg(RMS)	Auto	8001	MAXH	298 degs 267

HT40 2Tx 5795 H Q78.DAT 30915 23 May 2014   Rev 9.5 24 Jun 2015

**DATA**

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-60.7	Pk	34.9	-21.2	11.8	-35.2	-17	-18.2	298	267	H
2	5.868	-60.28	Pk	34.9	-21.2	11.8	-34.78	-27	-7.78	298	267	H

Pk - Peak detector
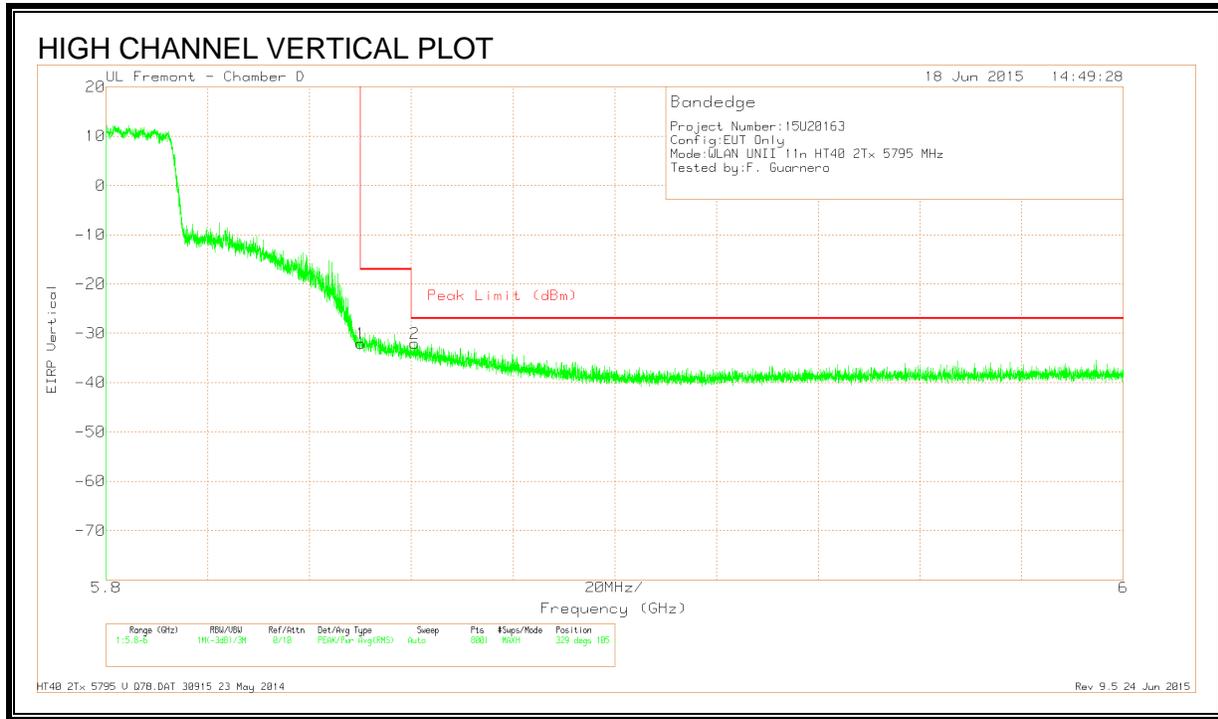
HIGH CHANNEL VERTICAL PLOT

UL Fremont - Chamber D   18 Jun 2015   14:49:28

Bandedge
Project Number:15U20163
Config:EUT Only
Mode:WLAN UNII 11n HT40 2Tx 5795 MHz
Tested by:F. Guarnero

Peak Limit (dBm)

Range (GHz)	RBW/VBW	Ref/Attn	Det/Avg Type	Sweep	Pts	#Swps/Mode	Position
1:5.8-6	1M/-3dB1/3N	0/10	PEAK/Pwr Avg(RMS)	Auto	8001	MAXH	329.degs.105

HT40 2Tx 5795 V Q70.DAT 30915 23 May 2014   Rev 9.5 24 Jun 2015

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-57.49	Pk	34.9	-21.2	11.8	-31.99	-17	-14.99	329	105	V
2	5.861	-57.79	Pk	34.9	-21.3	11.8	-32.39	-27	-5.39	329	105	V

Pk - Peak detector
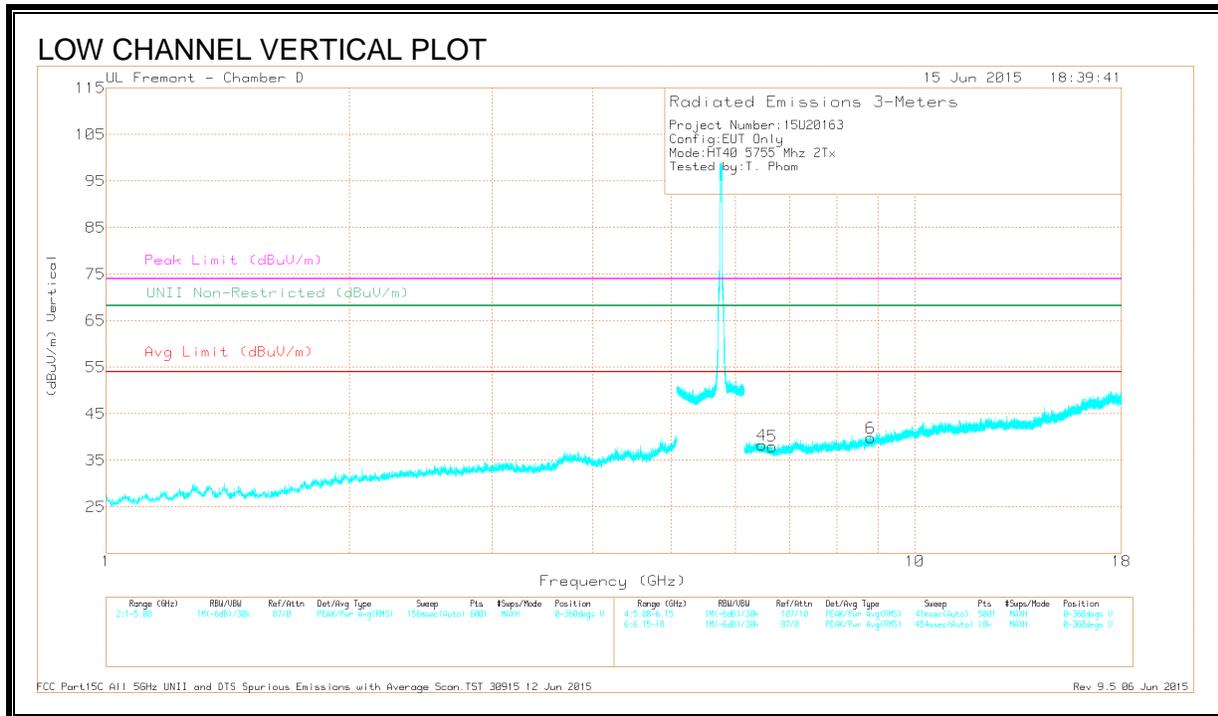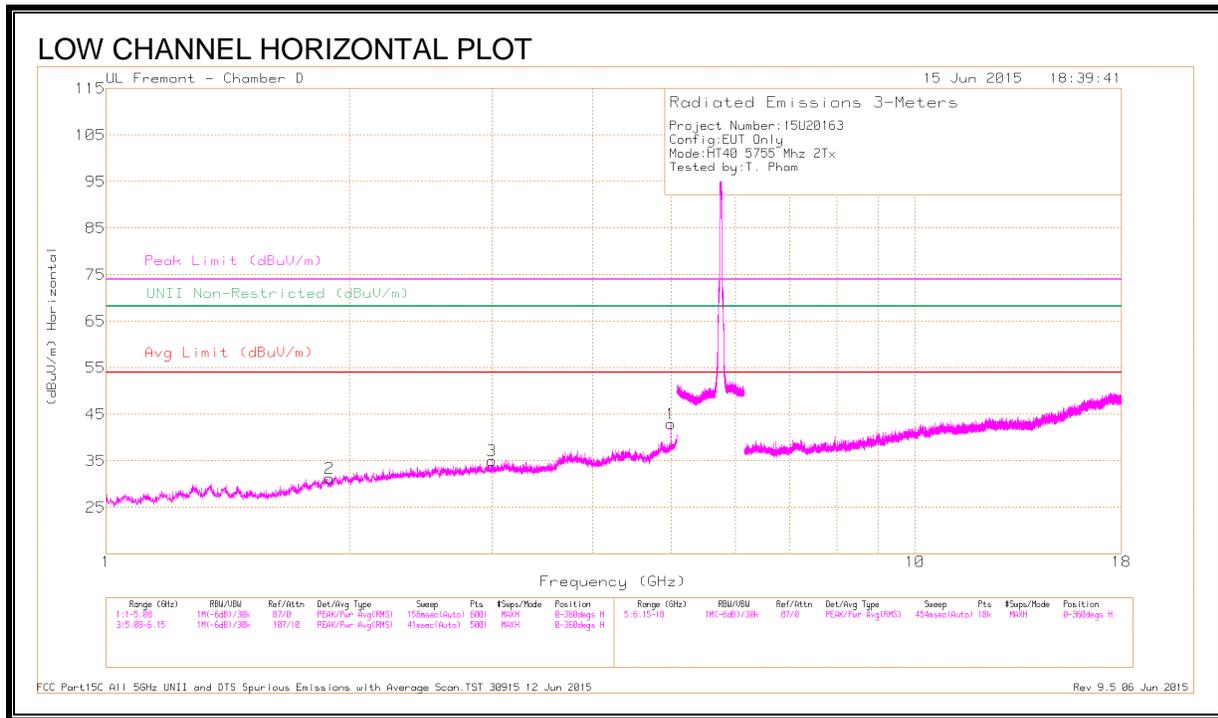
LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS

UL VERIFICATION SERVICES INC.
47173 BENICIA STREET, FREMONT, CA 94538, USA   TEL: (510) 771-1000

FORM NO: CCSUP4701J
FAX: (510) 661-0888
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DATA

| Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (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	* 4.988	40.09	PK3	34.2	-26.9	47.39	-	-	74	-26.61	-	-	249	290	H
	* 4.988	29.49	ADR	34.2	-26.9	36.79	54	-17.21	-	-	-	-	249	290	H
2	1.891	39.99	PK3	30.7	-31.4	39.29	-	-	-	-	68.2	-28.91	249	290	H
3	3.001	40.13	PK3	32.9	-30.2	42.83	-	-	-	-	68.2	-25.37	249	290	H
4	6.465	37.53	PK3	35.5	-25.9	47.13	-	-	-	-	68.2	-21.07	249	290	V
5	6.658	36.47	PK3	35.5	-26.3	45.67	-	-	-	-	68.2	-22.53	249	290	V
6	8.815	35.15	PK3	35.9	-23.2	47.85	-	-	-	-	68.2	-20.35	249	290	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK3 - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS
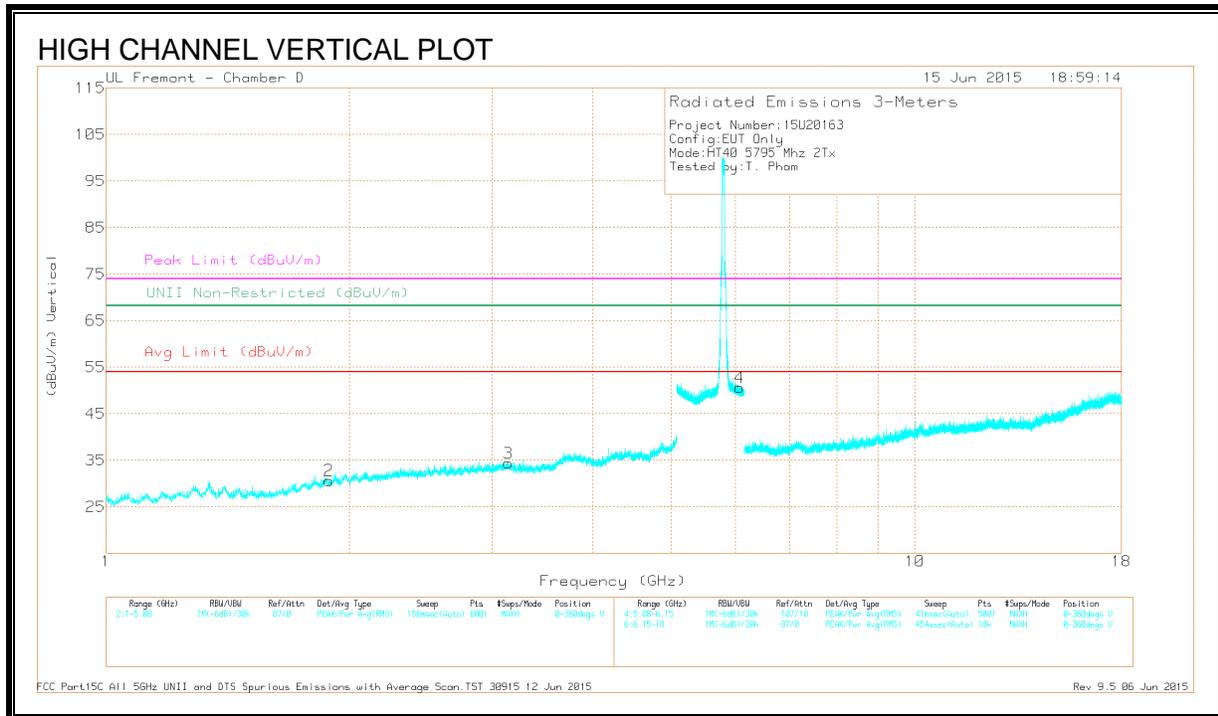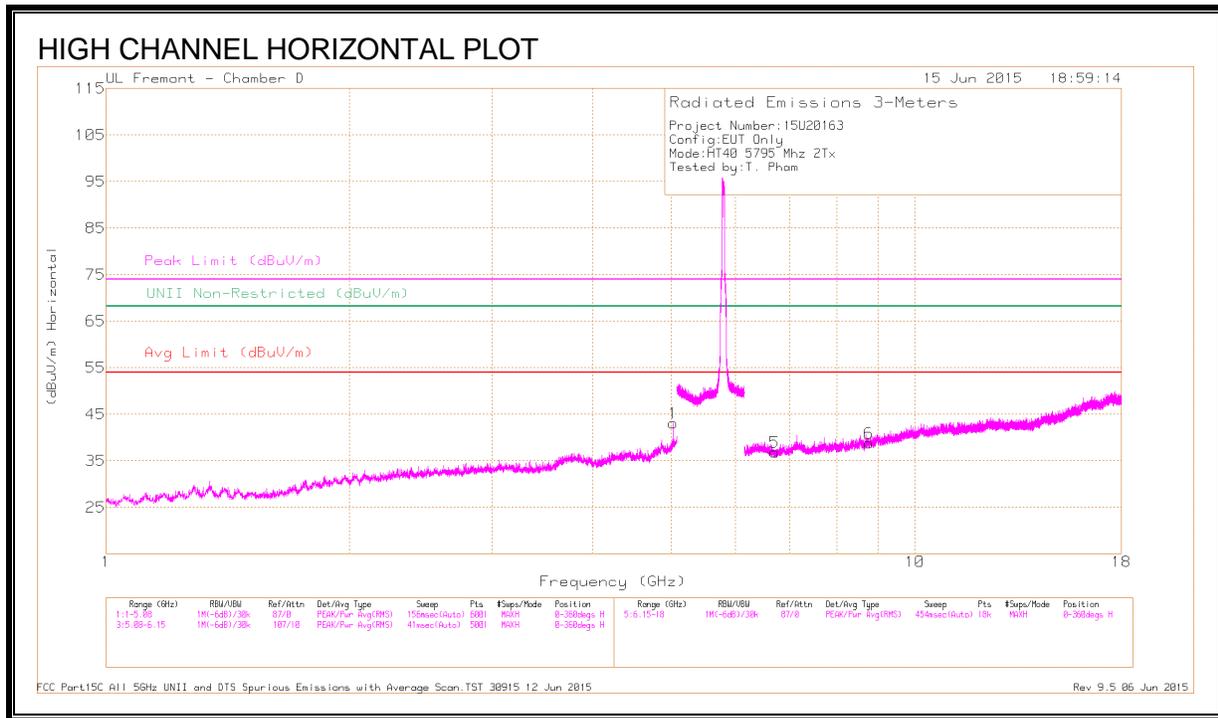
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (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	* 5.023	41.42	PK3	34.3	-26	49.72	-	-	74	-24.28	-	-	178	197	H
	* 5.022	33.11	ADR	34.3	-26	41.41	54	-12.59	-	-	-	-	178	197	H
2	1.886	40.47	PK3	30.7	-31.4	39.77	-	-	-	-	68.2	-28.43	178	197	V
3	3.144	39.01	PK3	32.7	-28.7	43.01	-	-	-	-	68.2	-25.19	178	197	V
4	6.073	40.98	PK3	35.6	-17.8	58.78	-	-	-	-	68.2	-9.42	178	197	V
5	6.712	36.47	PK3	35.5	-26.5	45.47	-	-	-	-	68.2	-22.73	178	197	H
6	8.771	35.1	PK3	35.9	-23.4	47.6	-	-	-	-	68.2	-20.6	178	197	H

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK3 - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

11.24. 802.11ac 80MHz 1Tx MODE IN THE 5.8 GHz BAND
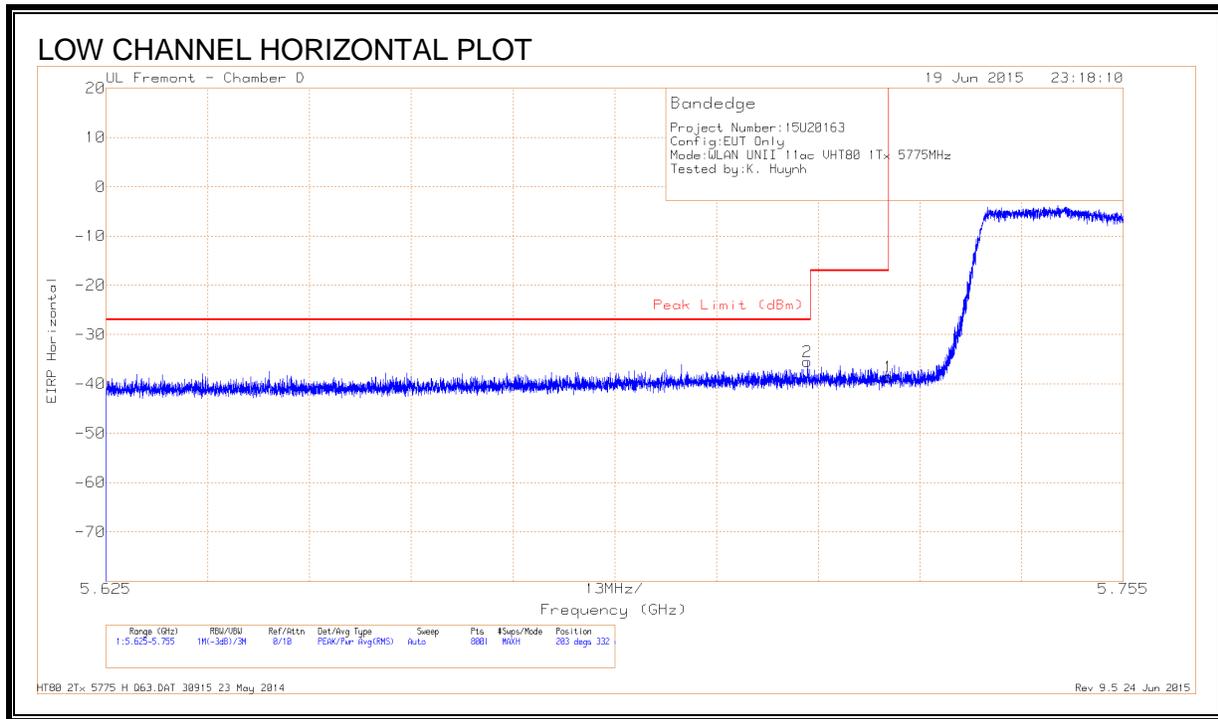
RESTRICTED BANDEDGE, CHAIN 0 (LOW)

DATA

| Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-64.07	Pk	34.7	-21	11.8	0	-38.57	-17	-21.57	203	332	H
2	5.715	-60.97	Pk	34.7	-21	11.8	0	-35.47	-27	-8.47	203	332	H

Pk - Peak detector
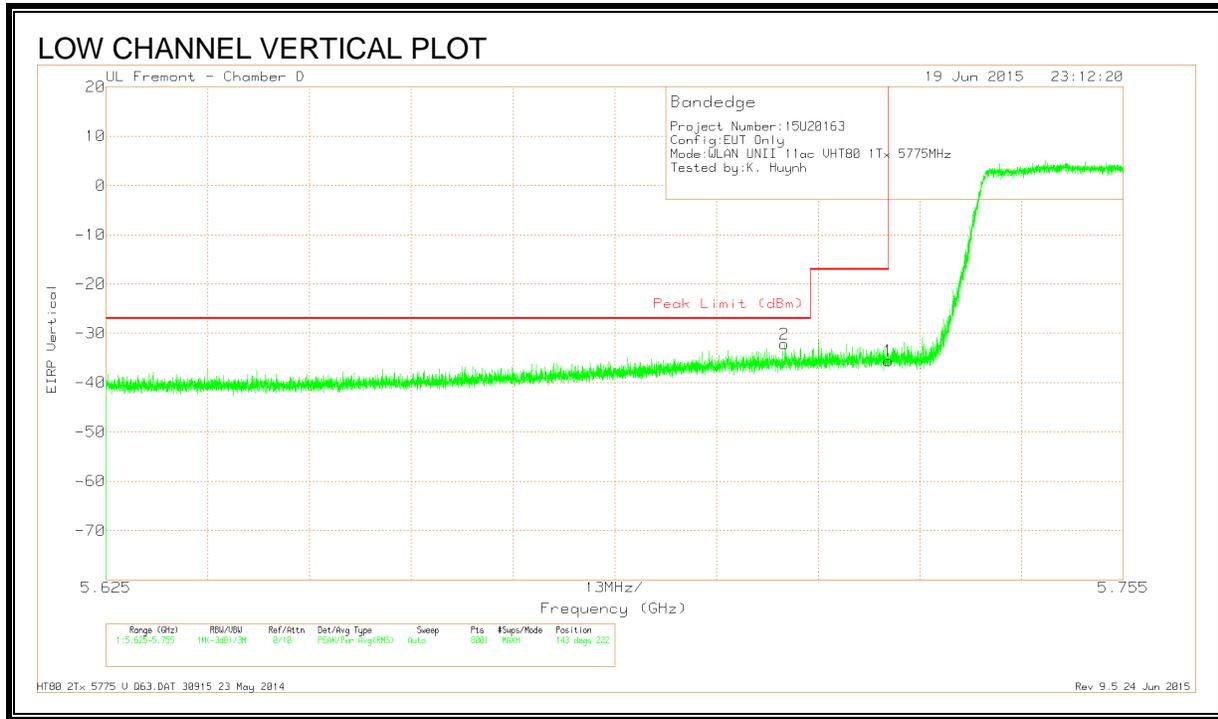
LOW CHANNEL VERTICAL PLOT

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-61.04	Pk	34.7	-21	11.8	0	-35.54	-17	-18.54	143	222	V
2	5.712	-57.68	Pk	34.7	-21	11.8	0	-32.18	-27	-5.18	143	222	V

Pk - Peak detector
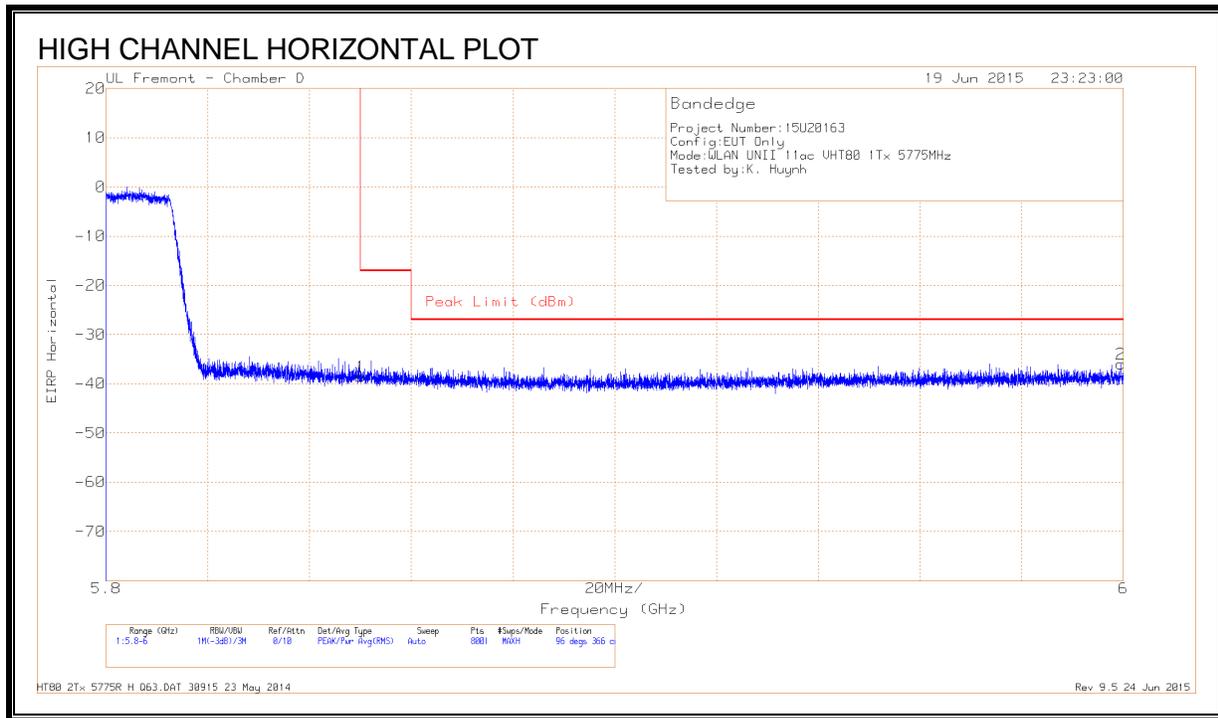
RESTRICTED BANDEDGE,CHAIN 0 (HIGH)

HIGH CHANNEL HORIZONTAL PLOT

UL Fremont - Chamber D   19 Jun 2015   23:23:00

Bandedge
Project Number:15U20163
Config:EUT Only
Mode:WLAN UNII 11ac VHT80 1Tx 5775MHz
Tested by:K. Huynh

Peak Limit (dBm)

Range (GHz)	RBW/VBW	Ref/Attn	Det/Avg Type	Sweep	Pts	#Sups/Mode	Position
1:5.8-6	1M(-3dB)/3M	0/10	PEAK/Pwr Avg(RMS)	Auto	8001	MAXH	96 degs 366 c

HT80 2Tx 5775R H 063.DAT 30915 23 May 2014   Rev 9.5 24 Jun 2015

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-64.06	Pk	34.9	-21.2	11.8	0	-38.56	-17	-21.56	96	366	H
2	6	-62.05	Pk	35.1	-20.8	11.8	0	-35.95	-27	-8.95	96	366	H

Pk - Peak detector
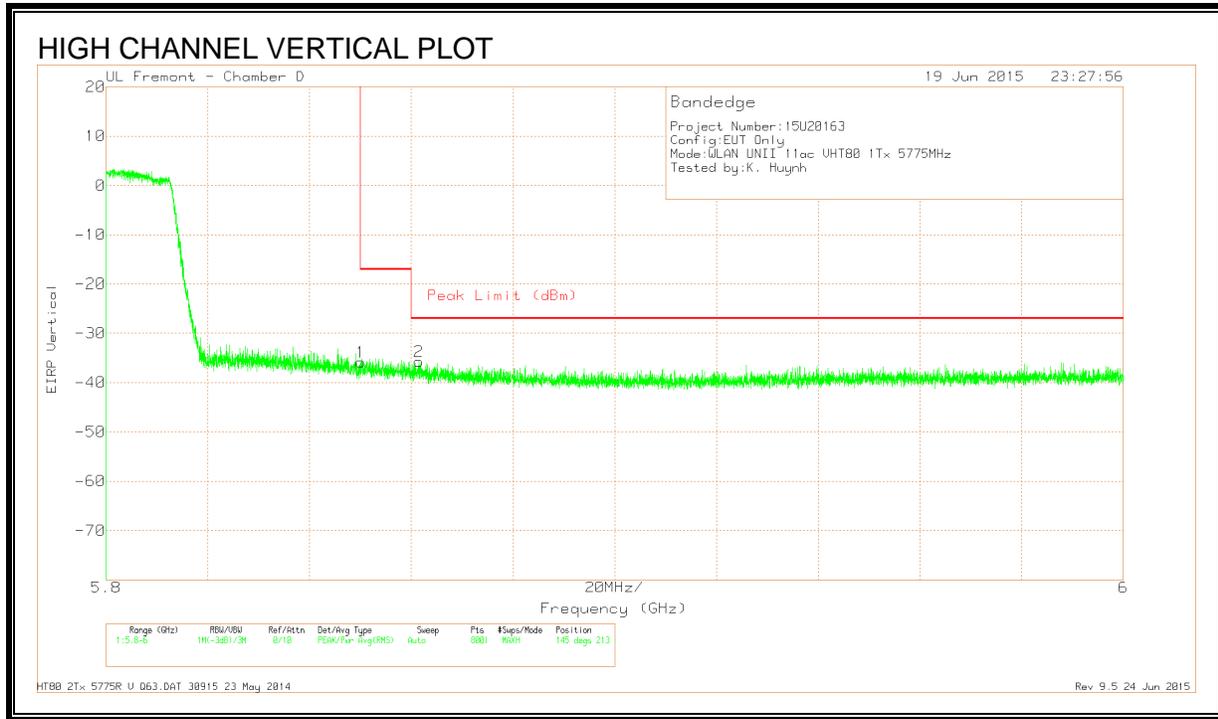
HIGH CHANNEL VERTICAL PLOT

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fl tr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-61.36	Pk	34.9	-21.2	11.8	0	-35.86	-17	-18.86	145	213	V
2	5.861	-61.12	Pk	34.9	-21.3	11.8	0	-35.72	-27	-8.72	145	213	V

Pk - Peak detector
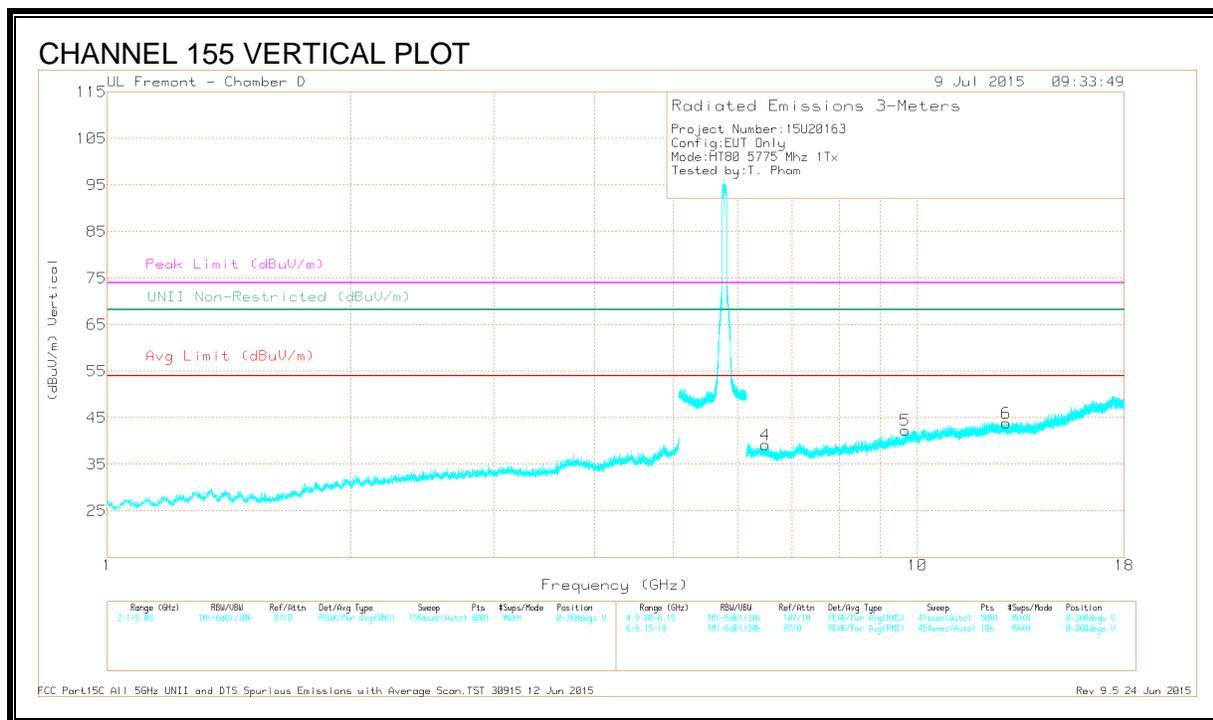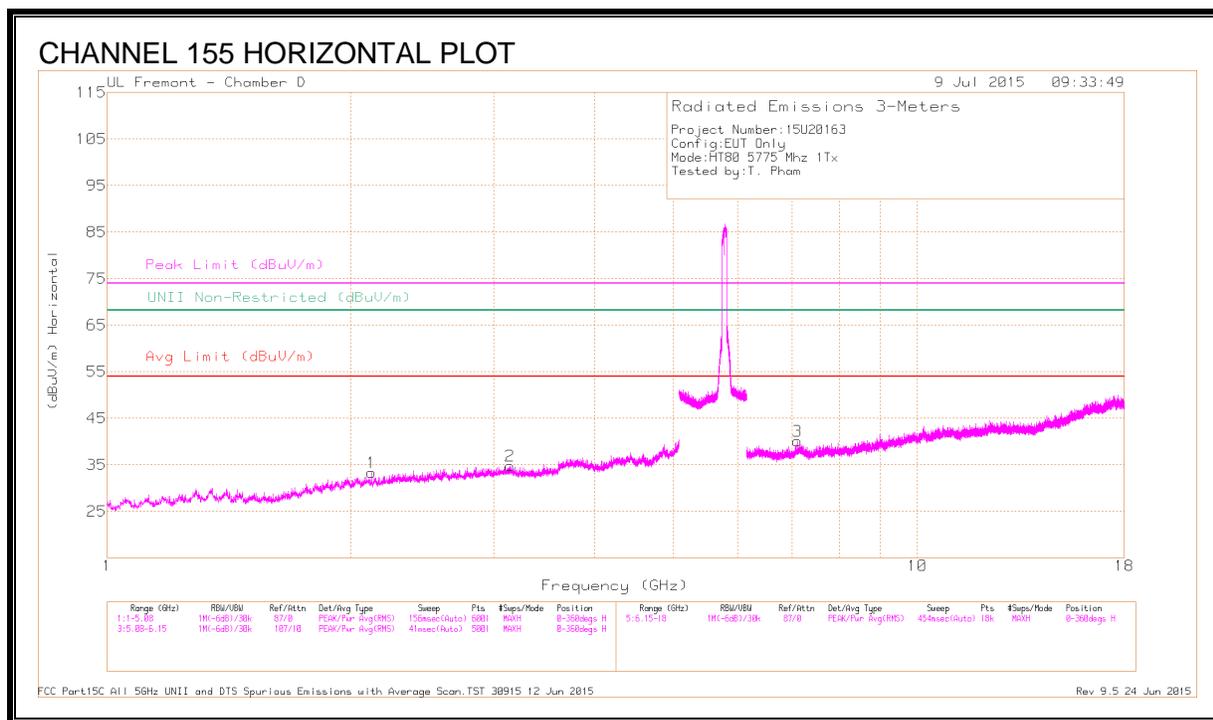
CHANNEL 155 HARMONICS AND SPURIOUS EMISSIONS

CHANNEL 155 HORIZONTAL PLOT


CHANNEL 155 VERTICAL PLOT

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/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	2.119	40.16	PK-U	31.4	-30.8	0	40.76	-	-	-	-	68.2	-27.44	0	101	H
2	3.142	39.52	PK-U	32.8	-28.7	0	43.62	-	-	-	-	68.2	-24.58	0	101	H
3	6.49	37.14	PK-U	35.5	-25.7	0	46.94	-	-	-	-	68.2	-21.26	0	101	V
4	7.111	35.97	PK-U	35.5	-24.9	0	46.57	-	-	-	-	68.2	-21.63	0	101	H
5	9.657	33.94	PK-U	36.8	-22.3	0	48.44	-	-	-	-	68.2	-19.76	0	101	V
6	12.865	34.98	PK-U	39.2	-22.5	0	51.68	-	-	-	-	68.2	-16.52	0	101	V

PK-U - U-NII: Maximum Peak

RESTRICTED BANDEDGE, CHAIN 1 (LOW)
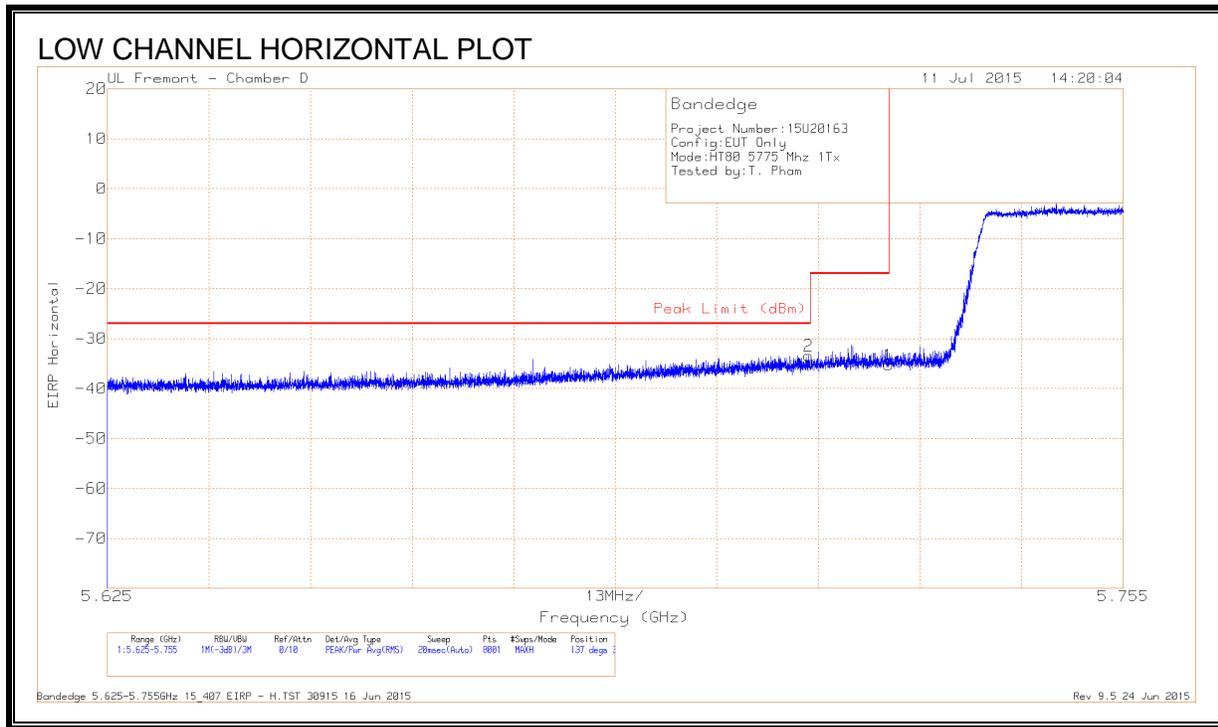
DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-64.07	Pk	34.6	-17.6	11.8	0	-35.27	-17	-18.27	137	329	H
2	5.715	-62.32	Pk	34.6	-17.5	11.8	0	-33.42	-27	-6.42	137	329	H

Pk - Peak detector
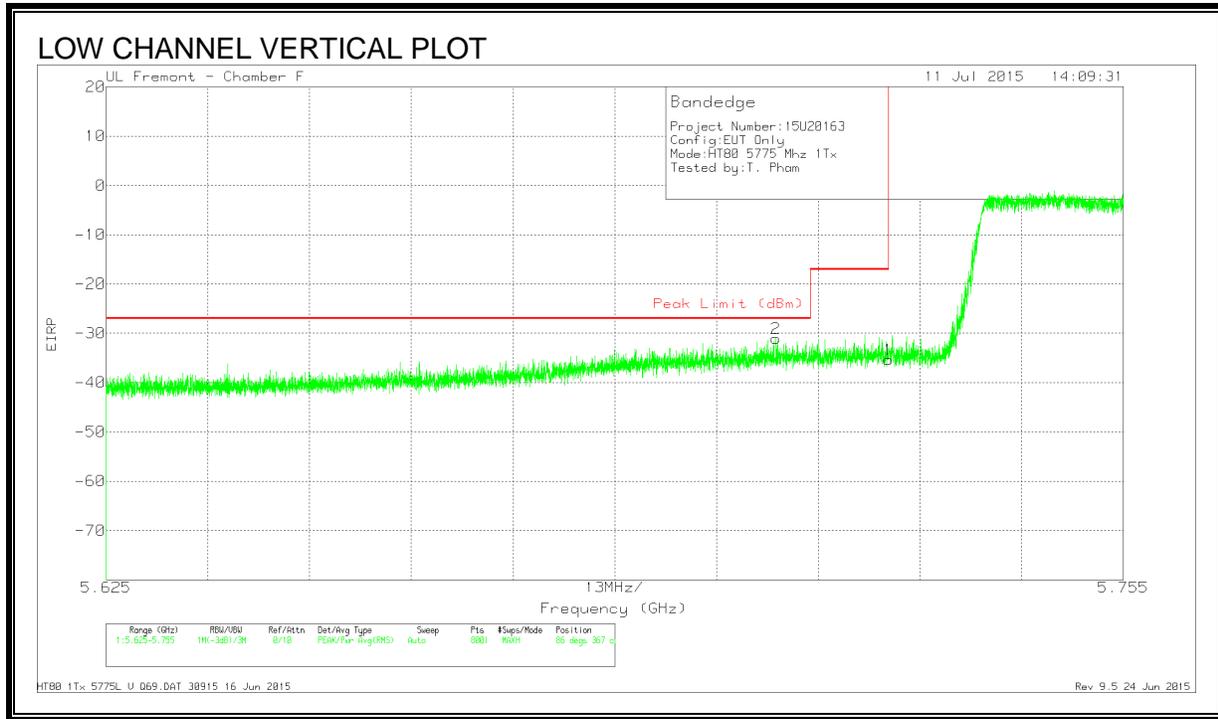
DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl/Fl tr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-64.19	Pk	34.6	-17.6	11.8	0	-35.39	-17	-18.39	86	367	V
2	5.711	-59.91	Pk	34.5	-17.5	11.8	0	-31.11	-27	-4.11	86	367	V

Pk - Peak detector
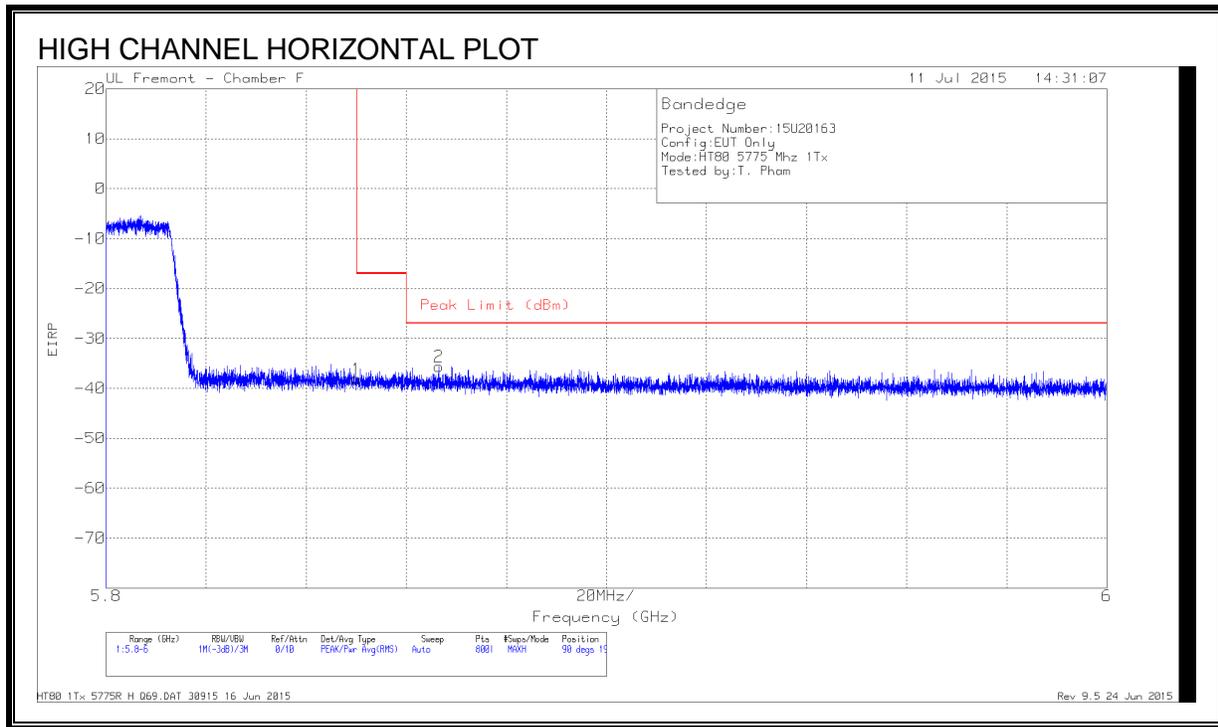
RESTRICTED BANDEDGE, CHAIN 1 (HIGH)

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-67.09	Pk	34.9	-17.7	11.8	0	-38.09	-17	-21.09	90	193	H
2	5.866	-64.82	Pk	35	-17.6	11.8	0	-35.62	-27	-8.62	90	193	H

Pk - Peak detector
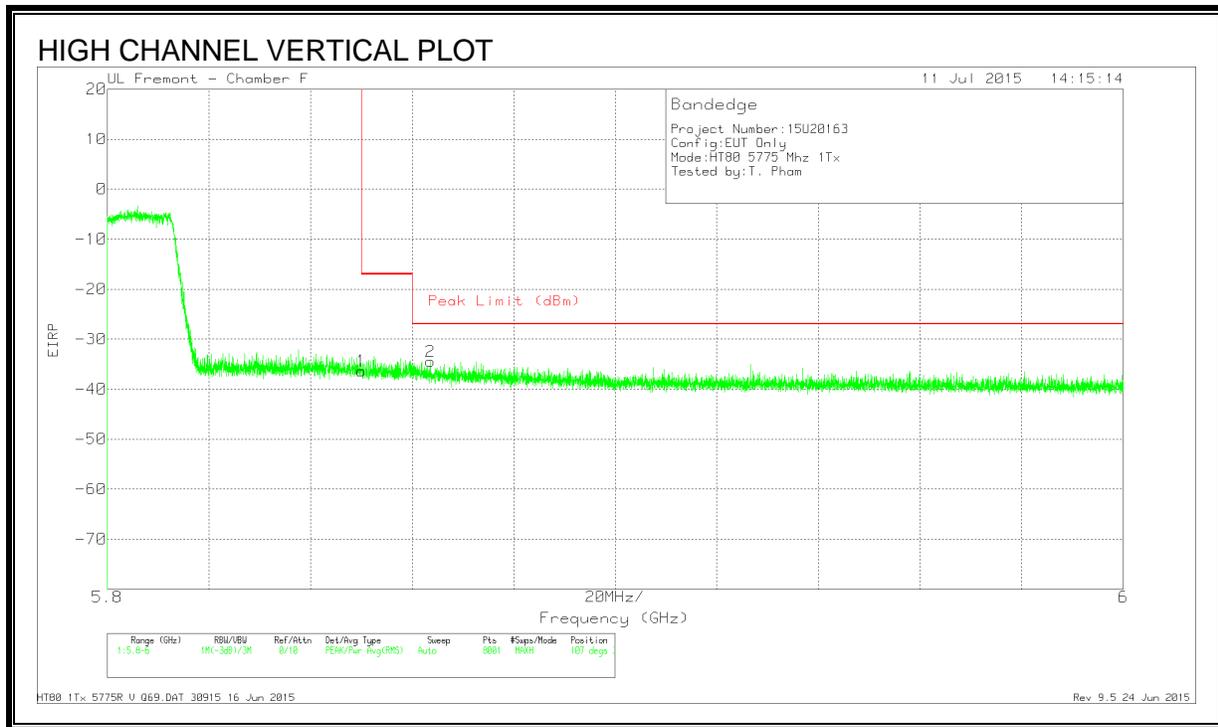
HIGH CHANNEL VERTICAL PLOT

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-65.35	Pk	34.9	-17.7	11.8	0	-36.35	-17	-19.35	107	340	V
2	5.864	-63.68	Pk	35	-17.6	11.8	0	-34.48	-27	-7.48	107	340	V

Pk - Peak detector
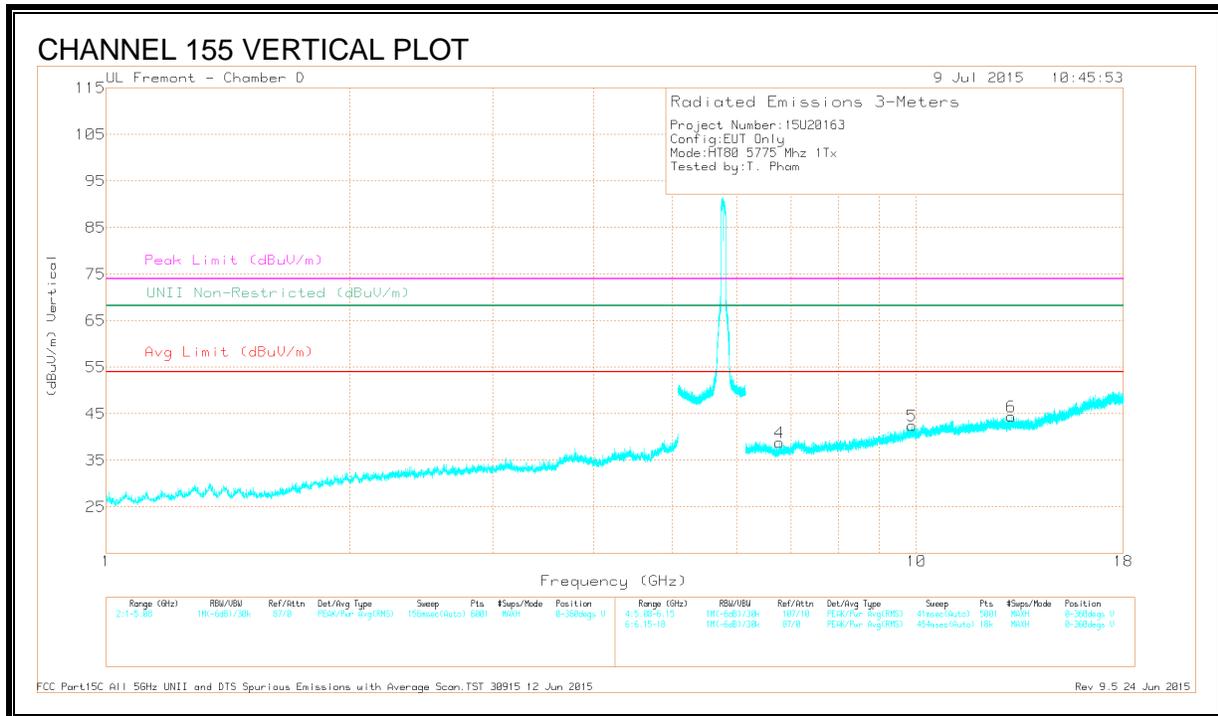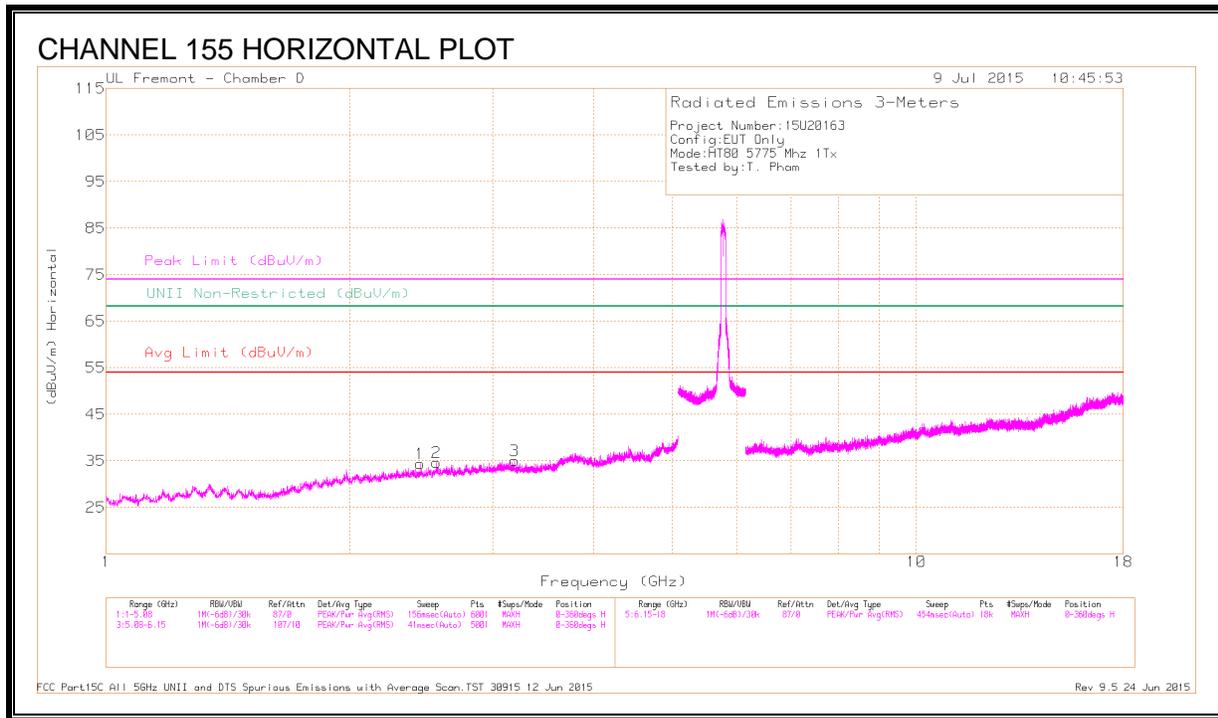
CHANNEL 155 HARMONICS AND SPURIOUS EMISSIONS

## DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/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	2.441	40.14	PK-U	32.1	-30.8	0	41.44	-	-	-	-	68.2	-26.76	0	101	H
2	2.557	39.79	PK-U	32.3	-29.7	0	42.39	-	-	-	-	68.2	-25.81	0	101	H
3	3.189	39.33	PK-U	32.7	-29.1	0	42.93	-	-	-	-	68.2	-25.27	0	101	H
4	6.774	36.61	PK-U	35.5	-26.3	0	45.81	-	-	-	-	68.2	-22.39	0	101	V
5	9.871	34.35	PK-U	37	-21.2	0	50.15	-	-	-	-	68.2	-18.05	0	101	V
6	13.096	36.18	PK-U	39.1	-22.7	0	52.58	-	-	-	-	68.2	-15.62	0	101	V

PK-U - U-NII: Maximum Peak

11.25. 802.11ac 80MHz 2Tx CDD MODE IN THE 5.8 GHz BAND
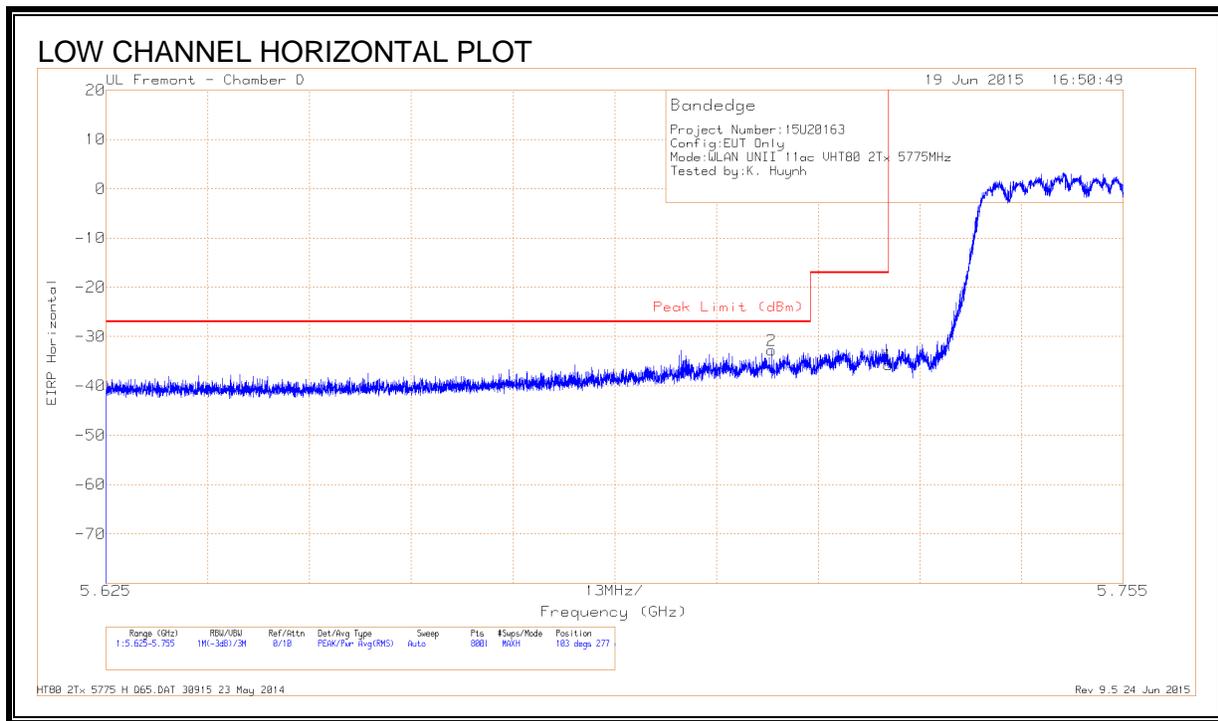
RESTRICTED BANDEDGE (LOW)

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-61.19	Pk	34.7	-21	11.8	0	-35.69	-17	-18.69	103	277	H
2	5.71	-58.22	Pk	34.7	-21	11.8	0	-32.72	-27	-5.72	103	277	H

Pk - Peak detector
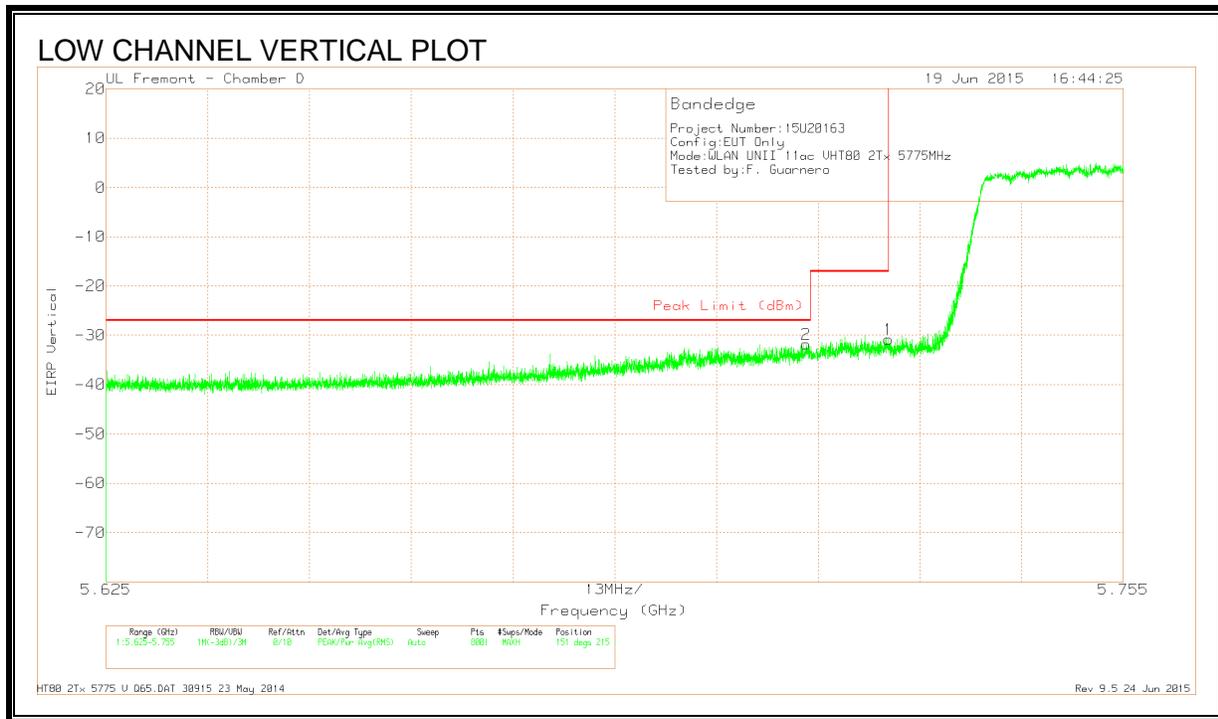
LOW CHANNEL VERTICAL PLOT

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.725	-56.31	Pk	34.7	-21	11.8	0	-30.81	-17	-13.81	151	215	V
2	5.714	-57.39	Pk	34.7	-21	11.8	0	-31.89	-27	-4.89	151	215	V

Pk - Peak detector
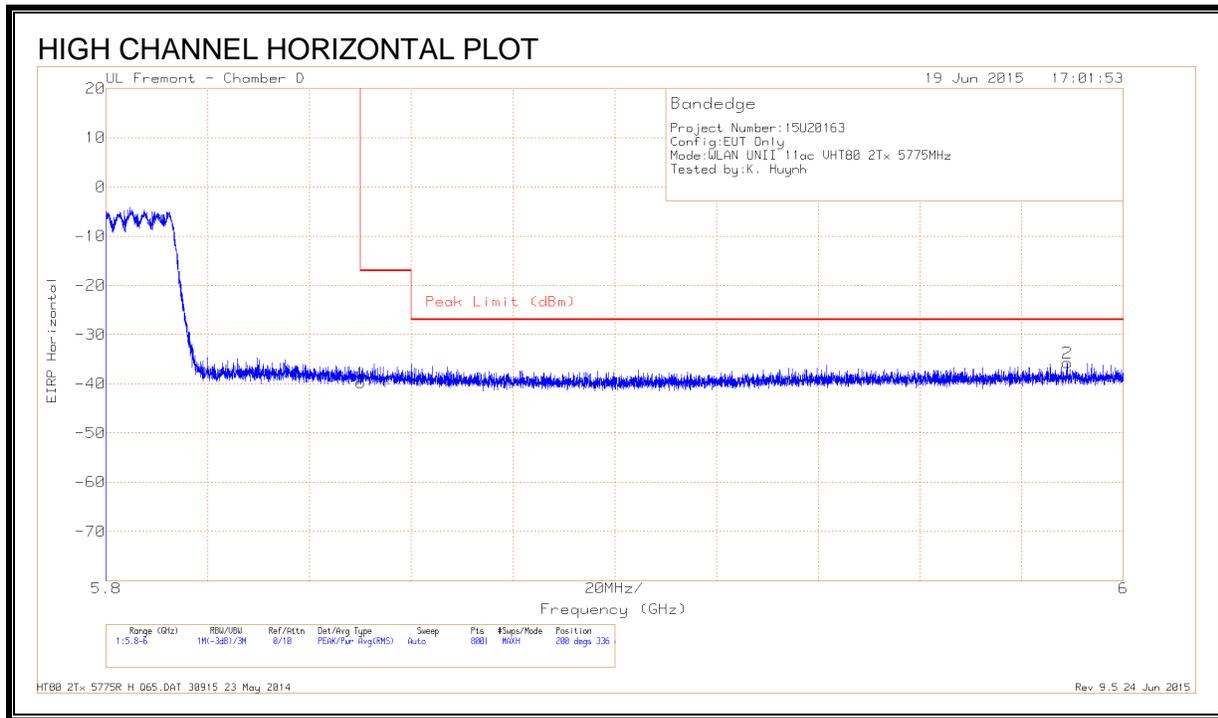
RESTRICTED BANDEDGE (HIGH)

HIGH CHANNEL HORIZONTAL PLOT

UL Fremont - Chamber D   19 Jun 2015   17:01:53

Bandedge
Project Number:15U20163
Config:EUT Only
Mode:WLAN UNII 11ac VHT80 2Tx 5775MHz
Tested by:K. Huynh

Peak Limit (dBm)

Range (GHz)	RBW/VBW	Ref/Attn	Det/Avg Type	Sweep	Pts	#Swps/Mode	Position
1:5.8-6	1M(-3dB)/3M	0/10	PEAK/Pwr Avg(RMS)	Auto	8001	MAXH	200 degs 336

HT80 2Tx 5775R H Q65.DAT 30915 23 May 2014   Rev 9.5 24 Jun 2015

DATA

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-65.26	Pk	34.9	-21.2	11.8	0	-39.76	-17	-22.76	200	336	H
2	5.989	-61.77	Pk	35.1	-20.9	11.8	0	-35.77	-27	-8.77	200	336	H

Pk - Peak detector
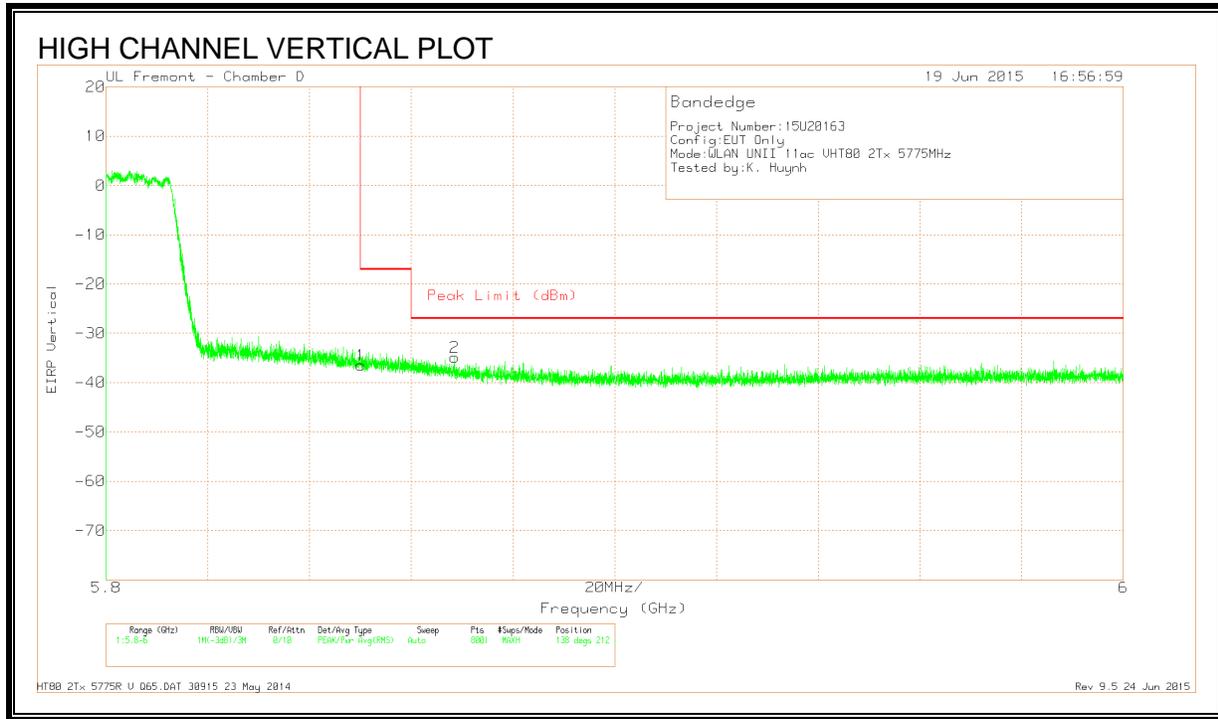
HIGH CHANNEL VERTICAL PLOT

DATA

| Marker	Frequency (GHz)	Meter Reading (dBm)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Conversion Factor (dB)	DC Corr (dB)	Corrected Reading EIRP	Peak Limit (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.85	-61.96	Pk	34.9	-21.2	11.8	0	-36.46	-17	-19.46	138	212	V
2	5.868	-60.35	Pk	34.9	-21.2	11.8	0	-34.85	-27	-7.85	138	212	V

Pk - Peak detector
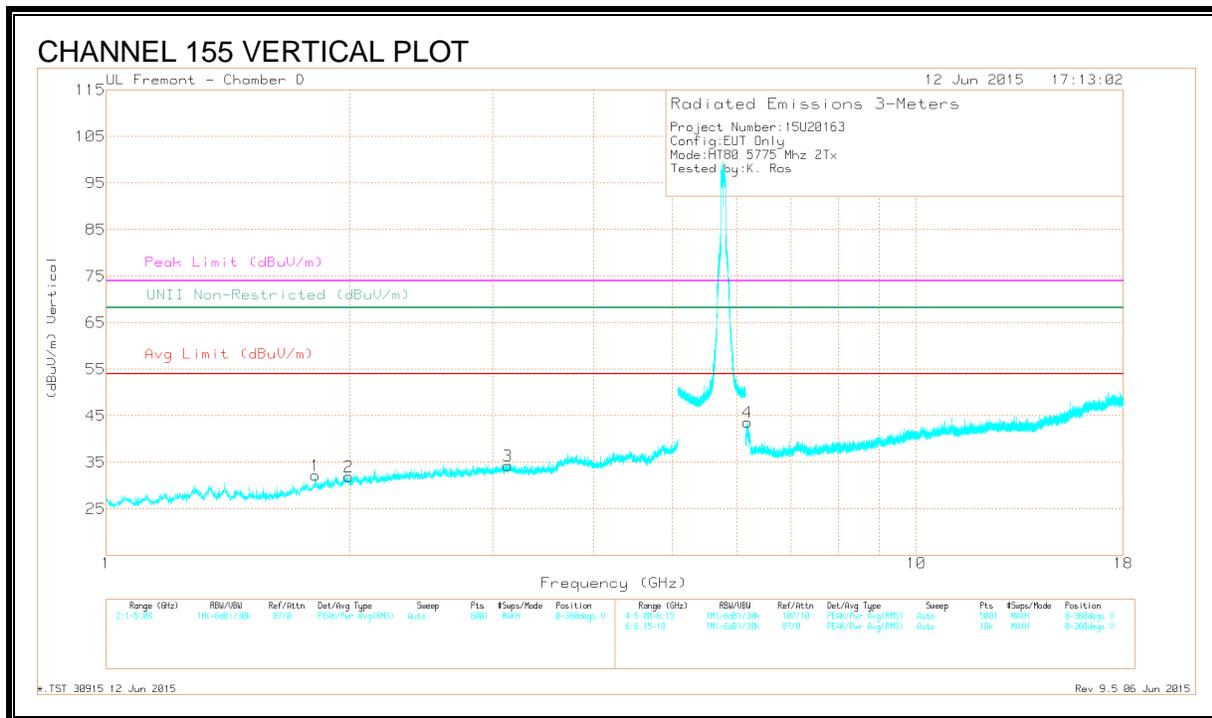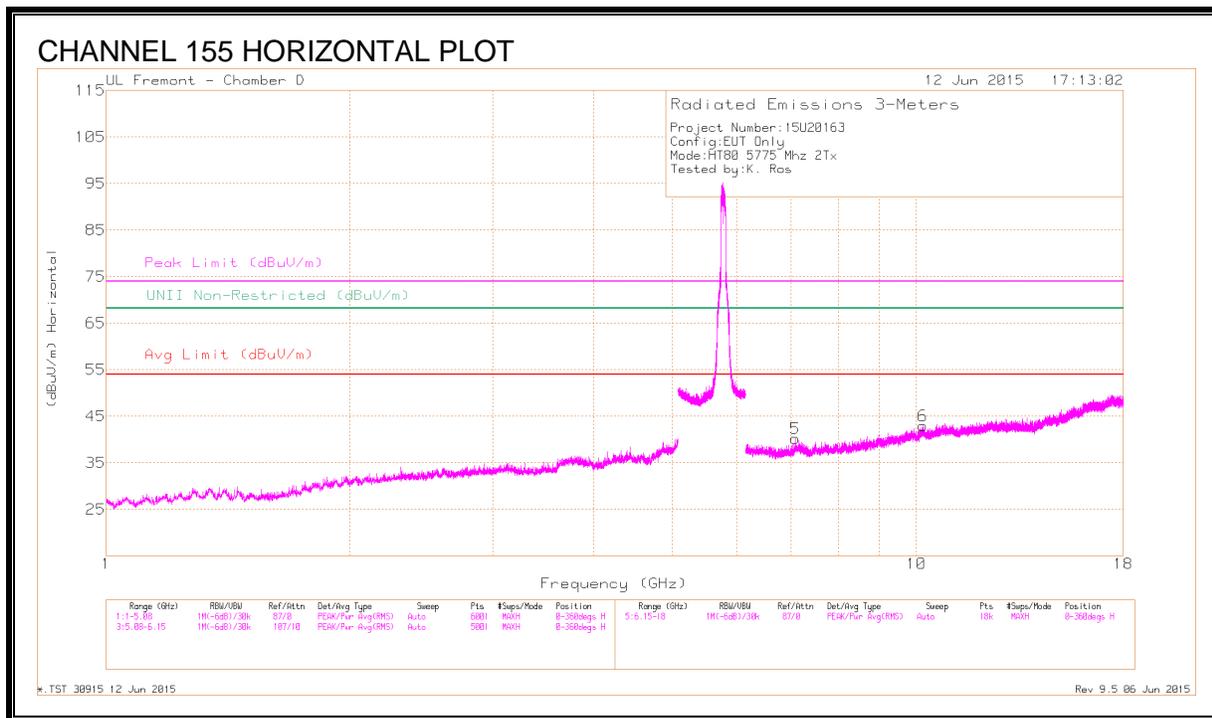
CHANNEL 155 HARMONICS AND SPURIOUS EMISSIONS

DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/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	1.813	41.23	PK-U	30.2	-31.3	0	40.13	-	-	-	-	68.2	-28.07	0	102	V
2	1.99	39.62	PK-U	31.1	-30.7	0	40.02	-	-	-	-	68.2	-28.18	0	102	V
3	3.13	39.14	PK-U	32.8	-28.7	0	43.24	-	-	-	-	68.2	-24.96	0	102	V
4	6.189	43.02	PK-U	35.5	-26.6	0	51.92	-	-	-	-	68.2	-16.28	63	199	V
5	7.09	36.69	PK-U	35.5	-25.1	0	47.09	-	-	-	-	68.2	-21.11	0	102	H
6	10.179	34.18	PK-U	37.2	-20.6	0	50.78	-	-	-	-	68.2	-17.42	0	102	H

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

11.26. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)
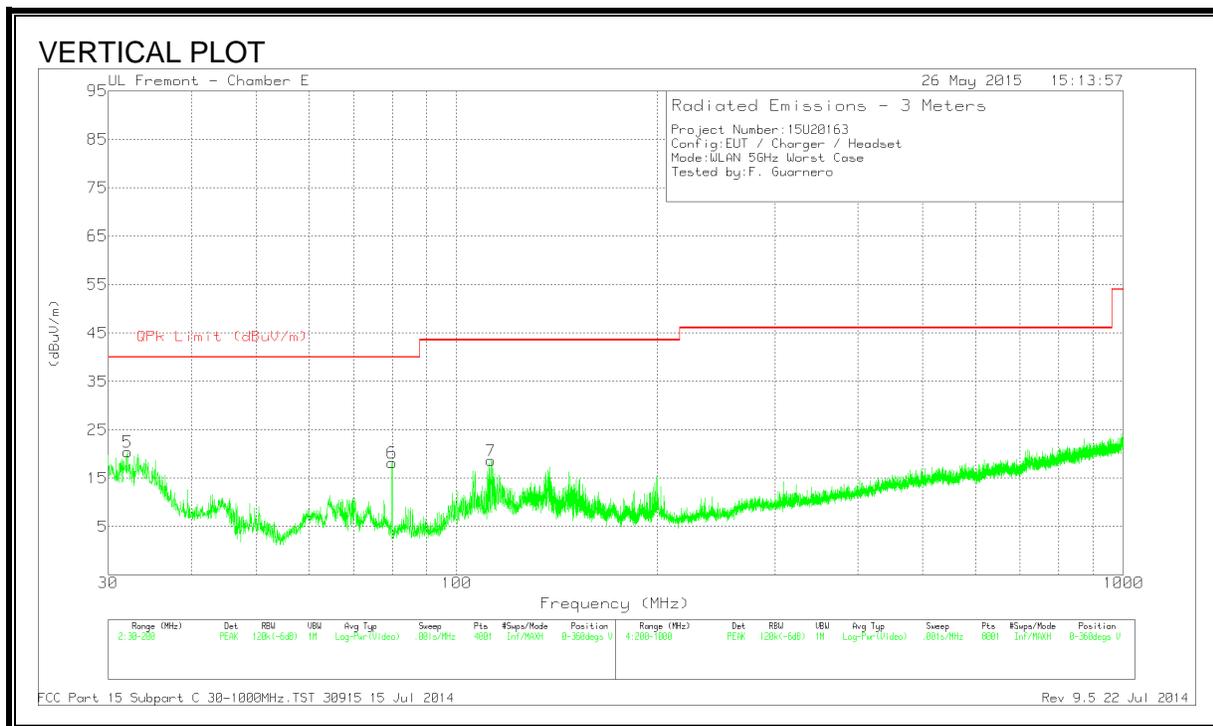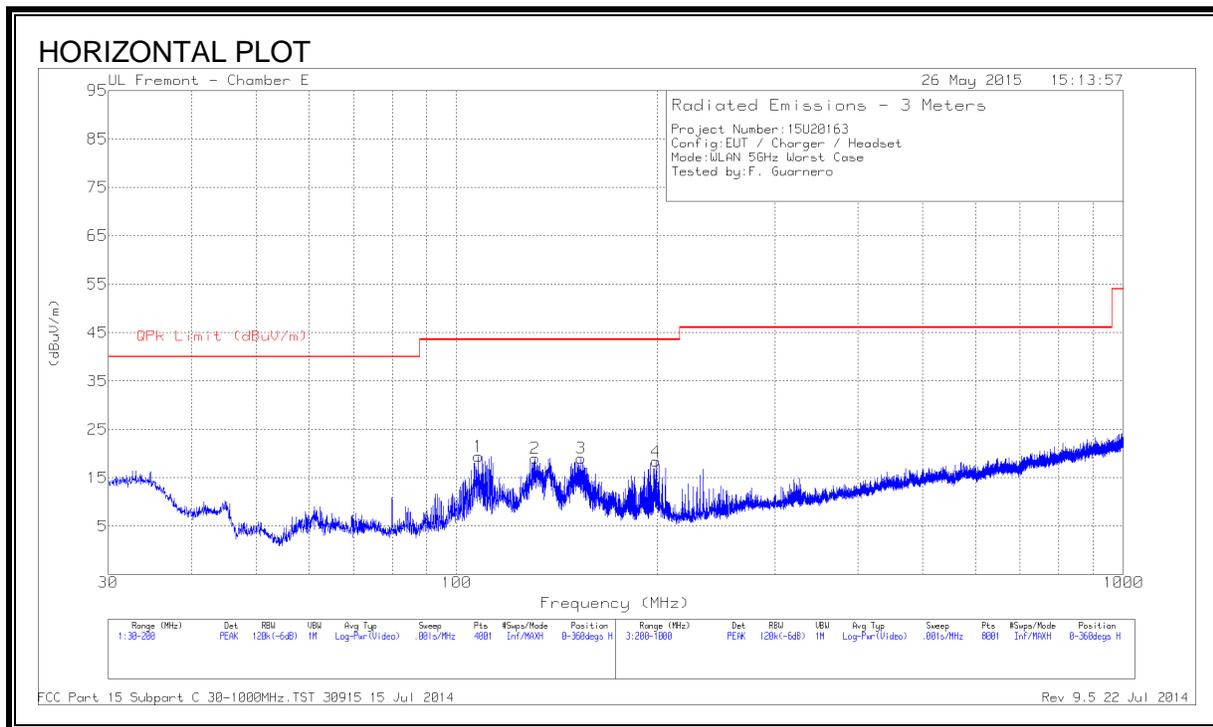
HORIZONTAL AND VERTICAL DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T408 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	107.8175	38.73	PK	11.9	-31.2	19.43	43.52	-24.09	0-360	301	H
2	* 130.98	36.55	PK	13.7	-31.2	19.05	43.52	-24.47	0-360	201	H
3	153.59	37.89	PK	12.3	-31.1	19.09	43.52	-24.43	0-360	201	H
4	198.98	36.81	PK	12.4	-30.8	18.41	43.52	-25.11	0-360	201	H
5	32.0825	32.22	PK	20	-31.8	20.42	40	-19.58	0-360	100	V
6	79.98	41.71	PK	8	-31.5	18.21	40	-21.79	0-360	100	V
7	* 112.4925	37.03	PK	12.9	-31.3	18.63	43.52	-24.89	0-360	100	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

11.27.   WORST-CASE ABOVE 18 GHz

SPURIOUS EMISSIONS 18000 TO 26000 MHz (WORST-CASE CONFIGURATION)
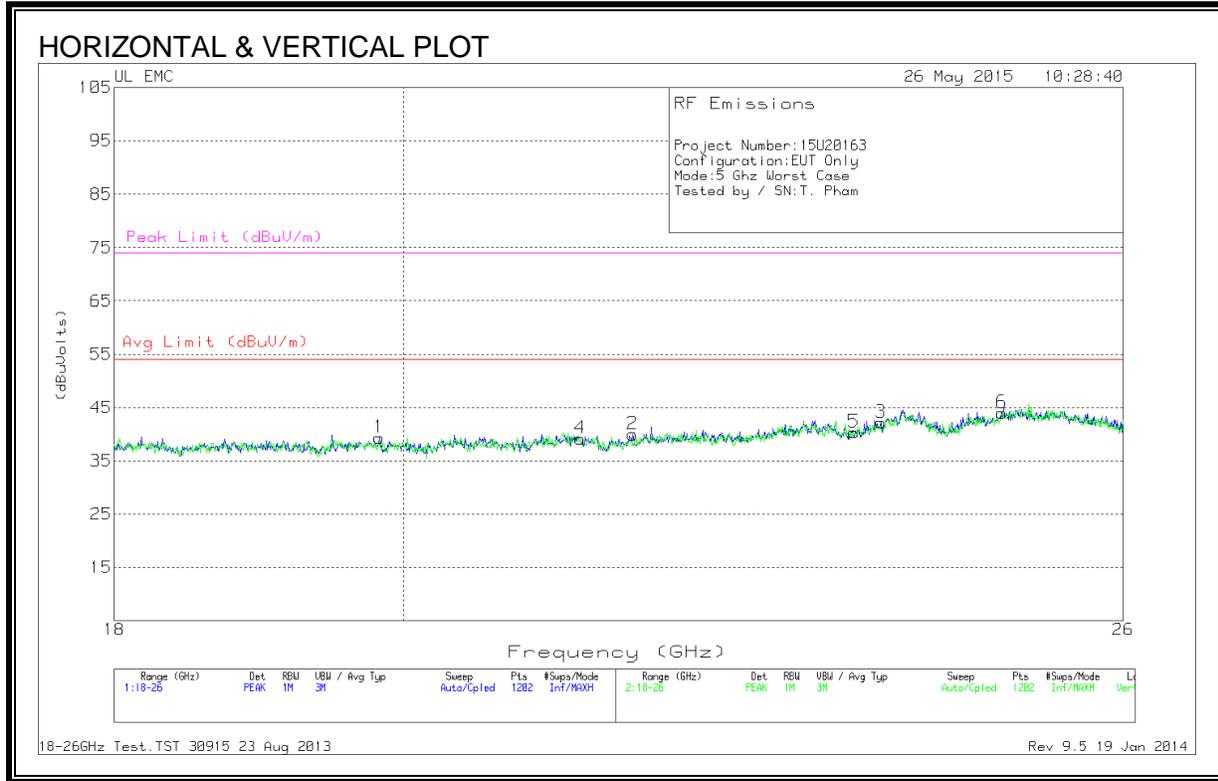
HORIZONTAL AND VERTICAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.825	40.53	PK	33	-24.7	-9.5	39.333	54	-14.667	74	-34.667
2	21.744	40.9	PK	33.6	-25	-9.5	40	54	-14	74	-34
3	23.802	41.37	PK	34.2	-23.9	-9.5	42.167	54	-11.833	74	-31.833
4	21.331	40.37	PK	33.3	-25	-9.5	39.167	54	-14.833	74	-34.833
5	23.569	39.83	PK	34.1	-24.1	-9.5	40.33	54	-13.667	74	-33.667
6	24.874	42.3	PK	34.5	-23.3	-9.5	44	54	-10	74	-30

PK - Peak detector

SPURIOUS EMISSIONS 26000 TO 40000 MHz (WORST-CASE CONFIGURATION,)
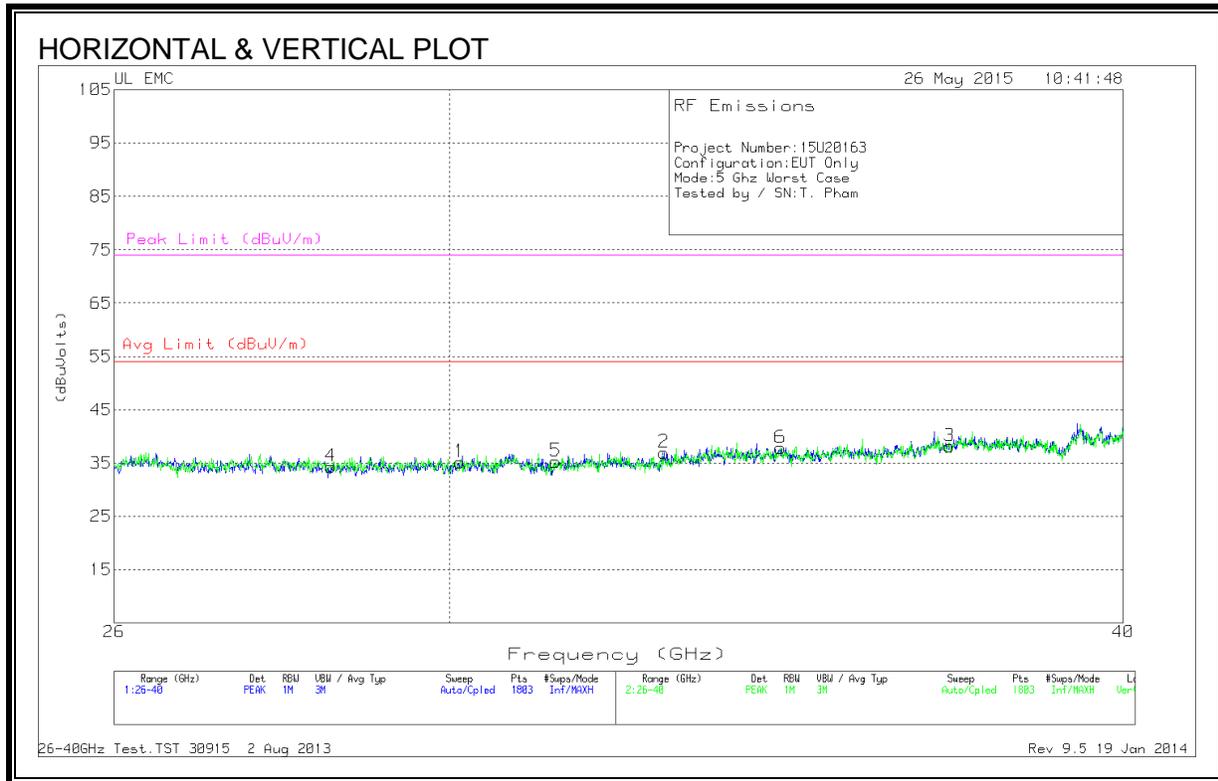
HORIZONTAL AND VERTICAL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T90 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	30.133	45.07	PK	35.9	-36.3	-9.5	35.167	54	-18.83	74	-38.833
2	32.876	46.9	PK	36.6	-37	-9.5	37	54	-17	74	-37
3	37.141	48.57	PK	37.2	-38.1	-9.5	38.167	54	-15.833	74	-35.833
4	28.517	43.43	PK	35.7	-35.3	-9.5	34.333	54	-19.667	74	-39.667
5	31.392	45.13	PK	36.1	-36.4	-9.5	35.33	54	-18.667	74	-38.667
6	34.554	46.93	PK	37.4	-37	-9.5	37.833	54	-16.167	74	-36.167

PK - Peak detector

12.   AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	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

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10: 2013.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

12.1. EUT POWERED BY AC/DC ADAPTER VIA USB CABLE

LINE 1 RESULTS
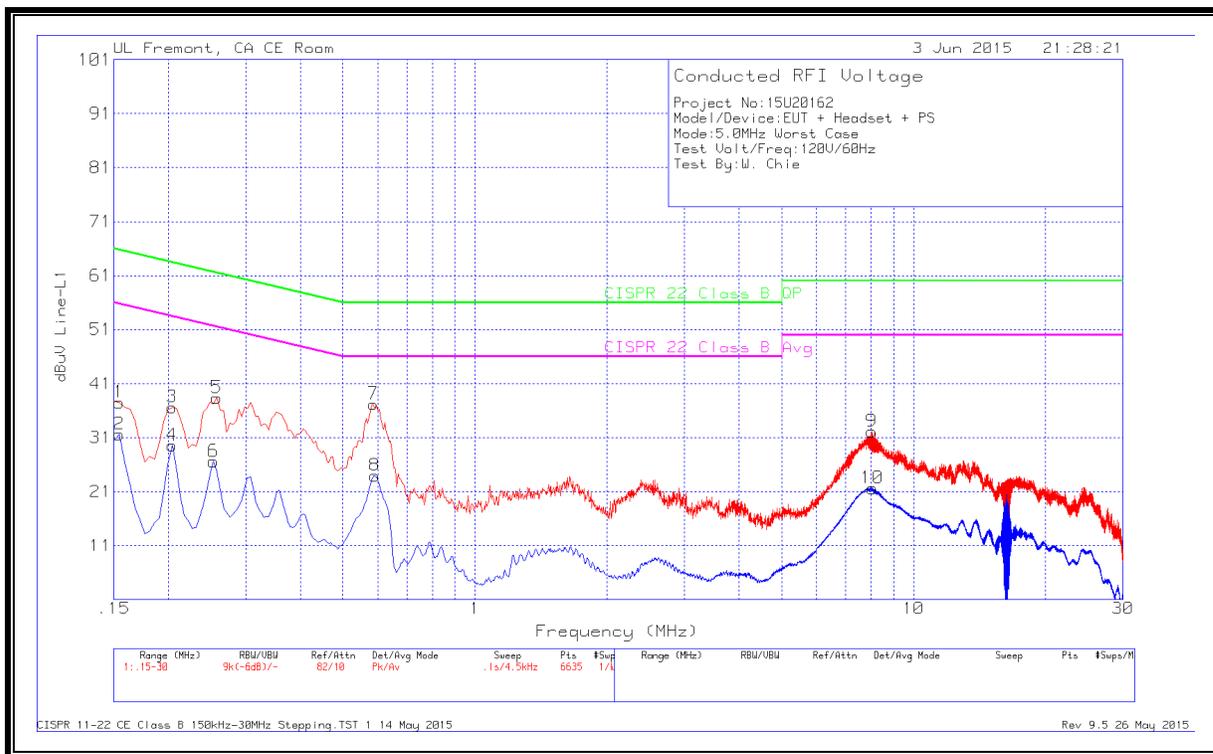
WORST EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.1545	36.23	Pk	1.3	0	37.53	65.75	-28.22	-	-
2	.1545	30.31	Av	1.3	0	31.61	-	-	55.75	-24.14
3	.204	35.74	Pk	.9	0	36.64	63.45	-26.81	-	-
4	.204	28.62	Av	.9	0	29.52	-	-	53.45	-23.93
5	.258	37.65	Pk	.7	0	38.35	61.5	-23.15	-	-
6	.2535	25.89	Av	.7	0	26.59	-	-	51.64	-25.05
7	.5865	36.88	Pk	.3	0	37.18	56	-18.82	-	-
8	.591	23.64	Av	.3	0	23.94	-	-	46	-22.06
9	8.034	31.83	Pk	.2	.1	32.13	60	-27.87	-	-
10	8.0475	21.32	Av	.2	.1	21.62	-	-	50	-28.38

Pk - Peak detector
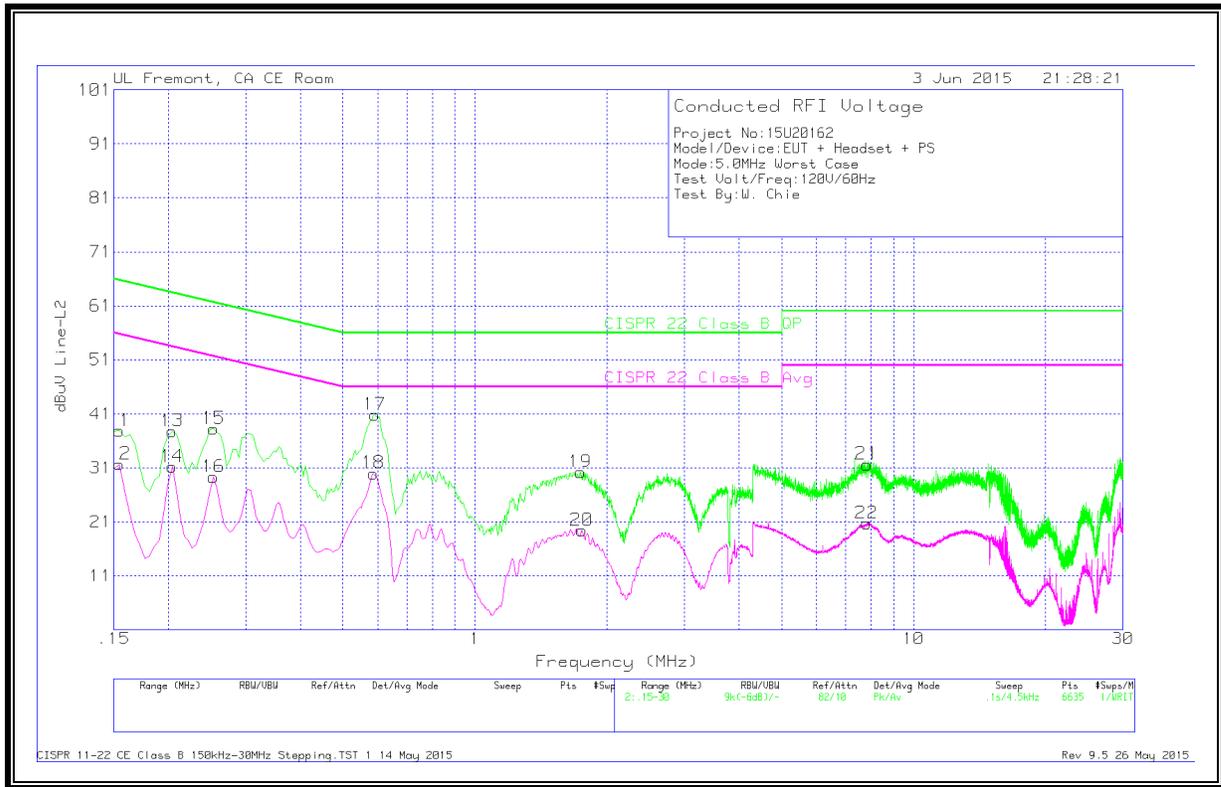
Av - Average detection

LINE 2 RESULTS

WORST EMISSIONS

| Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
11	.1545	36.45	Pk	1.4	0	37.85	65.75	-27.9	-	-
12	.1545	30.28	Av	1.4	0	31.68	-	-	55.75	-24.07
13	.204	36.77	Pk	1	0	37.77	63.45	-25.68	-	-
14	.204	30.2	Av	1	0	31.2	-	-	53.45	-22.25
15	.2535	37.52	Pk	.7	0	38.22	61.64	-23.42	-	-
16	.2535	28.6	Av	.7	0	29.3	-	-	51.64	-22.34
17	.591	40.56	Pk	.3	0	40.86	56	-15.14	-	-
18	.5865	29.69	Av	.3	0	29.99	-	-	46	-16.01
19	1.7385	29.9	Pk	.2	.1	30.2	56	-25.8	-	-
20	1.752	19.11	Av	.2	.1	19.41	-	-	46	-26.59
21	7.8225	31.35	Pk	.2	.1	31.65	60	-28.35	-	-
22	7.8135	20.42	Av	.2	.1	20.72	-	-	50	-29.28

Pk - Peak detector

Av - Average detection

12.2.   EUT POWERED BY HOST PC VIA USB CABLE

LINE 1 RESULTS
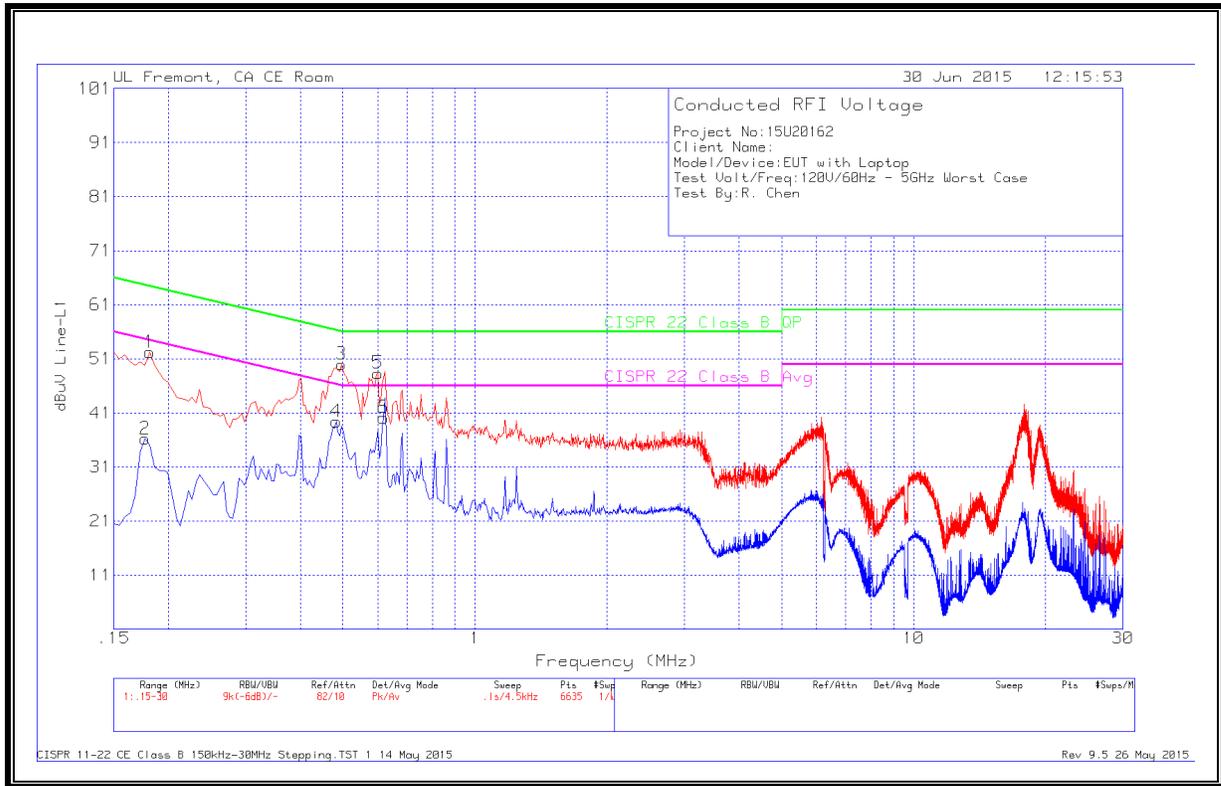
WORST EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.1815	51.1	Pk	1.1	0	52.2	64.42	-12.22	-	-
2	.177	35.09	Av	1.1	0	36.19	-	-	54.63	-18.44
3	.4965	49.69	Pk	.3	0	49.99	56.06	-6.07	-	-
4	.483	38.98	Av	.4	0	39.38	-	-	46.29	-6.91
5	.6	48.01	Pk	.3	0	48.31	56	-7.69	-	-
6	.618	39.81	Av	.3	0	40.11	-	-	46	-5.89

Pk - Peak detector
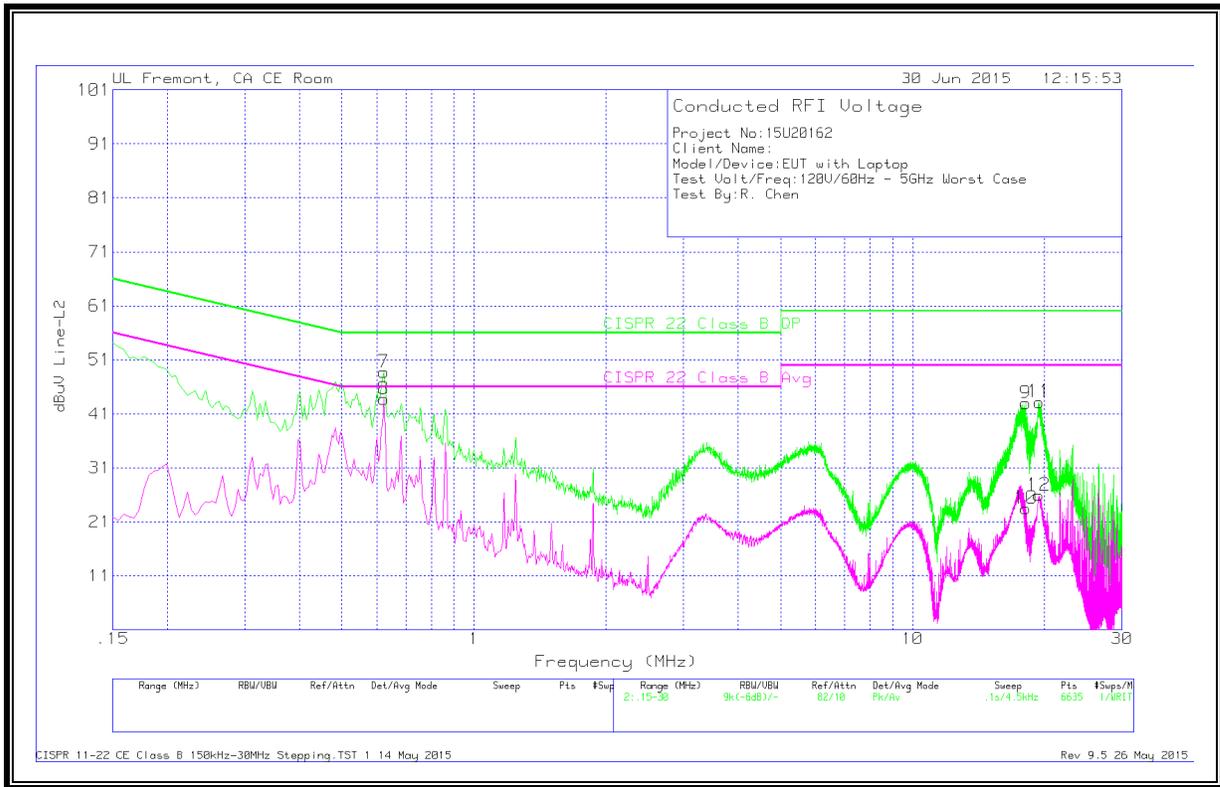
Av - Average detection

LINE 2 RESULTS

WORST EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
7	.6225	48.42	Pk	.3	0	48.72	56	-7.28	-	-
8	.6225	43.45	Av	.3	0	43.75	-	-	46	-2.25
9	18.114	42.51	Pk	.3	.2	43.01	60	-16.99	-	-
10	18.096	22.98	Av	.3	.2	23.48	-	-	50	-26.52
11	19.4325	42.68	Pk	.3	.2	43.18	60	-16.82	-	-
12	19.3965	25.41	Av	.3	.2	25.91	-	-	50	-24.09

Pk - Peak detector

Av - Average detection

13. DYNAMIC FREQUENCY SELECTION

13.1. OVERVIEW

13.1.1. LIMITS

INDUSTRY CANADA

IC RSS-247 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-247 Issue 1

Note: For the band 5600–5650 MHz, no operation is permitted.

Until further notice, devices subject to this annex shall not be capable of transmitting in the band 5600–5650 MHz. This restriction is for the protection of Environment Canada weather radars operating in this band.

FCC

§15.407 (h), FCC KDB 905462 D02 "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION" and KDB 905462 D03 "U-NII CLIENT DEVICES WITHOUT RADAR DETECTION CAPABILITY".

Table 1: Applicability of DFS requirements prior to use of a channel

Requirement	Operational Mode		
	Master	Client (without radar detection)	Client (with radar detection)
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client **(without DFS)**	Client **(with DFS)**
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar DFS	Client (without DFS)
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in all 20 MHz channel blocks and a null frequency between the bonded 20 MHz channel blocks.		

Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see notes)
E.I.R.P. ≥ 200 milliwatt	-64 dBm
E.I.R.P. < 200 milliwatt and power spectral density < 10 dBm/MHz	-62 dBm
E.I.R.P. < 200 milliwatt that do not meet power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna **Note 2:** Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. **Note 3:** E.I.R.P. is based on the highest antenna gain. For MIMO devices refer to KDB publication 662911 D01.	

Table 4: DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds (See Note 1)
Channel Closing Transmission Time	200 milliseconds + approx. 60 milliseconds over remaining 10 second period. (See Notes 1 and 2)
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. (See Note 3)
Note 1: *Channel Move Time* and the *Channel Closing Transmission Time* should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. **Note 2:** The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* move (an aggregate of 60 milliseconds) during the remainder of the 10-second period. The aggregate duration of control signals will not count quiet periods in between transmissions. **Note 3:** During the *U-NII Detection Bandwidth* detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (usec)	PRI (usec)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in table 5a	Roundup: $\{(1/360) \times (19 \times 10^6\ PRI_{usec})\}$	60%	30
		Test B: 15 unique PRI values randomly selected within the range of 518-3066 usec. With a minimum increment of 1 usec, excluding PRI values selected in Test A			
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

Note 1: Short Pulse Radar Type 0 should be used for the *Detection Bandwidth* test, *Channel Move Time*, and *Channel Closing Time* tests.

Table 6 – Long Pulse Radar Test Signal

Radar Waveform Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

Table 7 – Frequency Hopping Radar Test Signal

Radar Waveform Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	9	0.333	300	70%	30

13.1.1. TEST AND MEASUREMENT SYSTEM

RADIATED METHOD SYSTEM BLOCK DIAGRAM
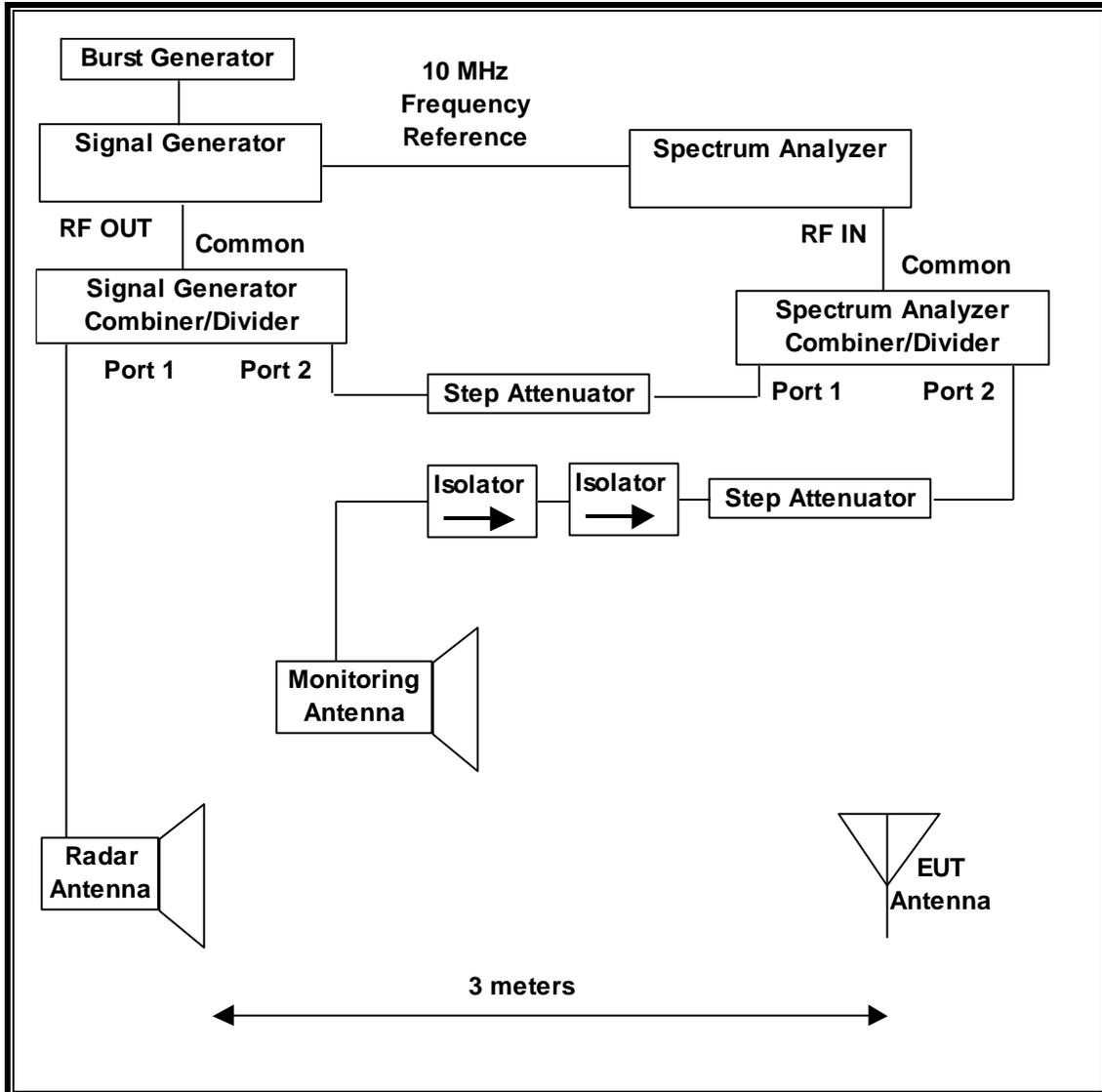
SYSTEM OVERVIEW

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem of KDB 905462 D02. The frequency of the signal generator is incremented in 1 MHz steps from F_L to F_H for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

SYSTEM CALIBRATION

A 50-ohm load is connected in place of the spectrum analyzer, and the spectrum analyzer is connected to a horn antenna via a coaxial cable, with the reference level offset set to (horn antenna gain – coaxial cable loss). The signal generator is set to CW mode. The amplitude of the signal generator is adjusted to yield a level of –64 dBm as measured on the spectrum analyzer.

Without changing any of the instrument settings, the spectrum analyzer is reconnected to the Common port of the Spectrum Analyzer Combiner/Divider. The Reference Level Offset of the spectrum analyzer is adjusted so that the displayed amplitude of the signal is –64 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

A link is established between the Master and Slave and the distance between the units is adjusted as needed to provide a suitable received level at the Master and Slave devices. The video test file is streamed to generate WLAN traffic. The monitoring antenna is adjusted so that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	Cal Due
Spectrum Analyzer, PXA, 3Hz to 50GHz	Agilent	N9030A	MY52350671	06/25/15
Signal Generator, MXG X-Series RF Vector	Agilent	N5172B	MY51350337	02/17/16

13.1.2.   SETUP OF EUT (CLIENT MODE)

**RADIATED METHOD EUT TEST SETUP**

SUPPORT EQUIPMENT

The following support equipment was utilized on the following dates for the DFS tests documented in this report:

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
802.11a/b/g/n/ac Wireless Access (Master Device 2)	Apple	A1392	C86LCE5GFJ1R	BCGA1470
Notebook PC (Controller/Server)	Apple	A1181	W865101LWGK	DoC
AC Adapter (Controller/Server PC)	Delta Electronics	A1143	C0420640G9KDJ92 BD	DoC

13.1.3.   SETUP OF EUT (CLIENT-TO-CLIENT COMMUNICATIONS MODE)

RADIATED METHOD EUT TEST SETUP

SUPPORT EQUIPMENT

The following support equipment was utilized on the following dates for the DFS tests documented in this report:

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
802.11a/b/g/n/ac Wireless Access (Master Device 2)	Apple	A1392	C86LCE5GFJ1R	BCGA1470
Notebook PC (Controller/Server)	Apple	A1181	W865101LWGK	DoC
AC Adapter (Controller/Server PC)	Delta Electronics	A1143	C0420640G9KDJ92 BD	DoC
Apple TV (Peer Slave Device)	Apple	A1469	5215	BCGA1469
Video Display	Dell	U2410f	CN-0FJ525N-72872-1B5-AGAL	DoC

13.1.4. DESCRIPTION OF EUT

For FCC the EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

For IC the EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges, excluding the 5600-5650 MHz range.

The EUT is a Slave Device without Radar Detection.

The highest power level within these bands is 21.00 dBm EIRP in the 5250-5350 MHz band and 21.00 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 1.89 dBi in the 5250-5350 MHz band and 0.27 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of -2.15 dBi in the 5250-5350 MHz band and -0.12 dBi in the 5470-5725 MHz band.

Two identical antennas are utilized to meet the diversity and MIMO operational requirements.

The rated output power of the Master Devices are > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

The EUT uses two transmitter/receiver chain connected to an antenna to perform radiated tests.

WLAN traffic is generated by streaming the video file TestFile.mp2 "6 ½ Magic Hours" from the Master to the Slave in full motion video mode using OPlayer Lite media player.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes the 802.11ac architecture. Three nominal channel bandwidths are implemented: 20 MHz, 40 MHz and 80 MHz.

In Client-to-Client Communications Mode the EUT utilizes the 802.11ac architecture between the EUT and the Master Device 2 where three nominal channel bandwidths are implemented: 20 MHz, 40 MHz and 80 MHz.   However, 802.11a/n architecture is utilized between the EUT and the Peer Slave Device in Client-to Client Communications Mode where only two nominal channel bandwidths are implemented: 20 MHz and 40 MHz.

The software installed in the EUT is 9.0 (13A272).

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UNIFORM CHANNEL SPREADING

This function is not applicable to Slave Devices.

OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS

The Master Device is an Apple, Inc. Access Point, FCC ID: BCGA1470. The minimum antenna gain for the Master Device is 1.4 dBi.

The rated output power of the Master unit is > 23dBm (EIRP). Therefore the required interference threshold level is –64 dBm. After correction for procedural adjustments, the required radiated threshold at the antenna port is –64 + 1 = -63 dBm.

The calibrated radiated DFS Detection Threshold level is set to –64 dBm. The tested level is lower than the required level hence it provides a margin to the limit.

The software installed in the access point is 7.7D3.

13.2. CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH

### 13.2.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz.

13.2.2. RADAR WAVEFORM AND TRAFFIC
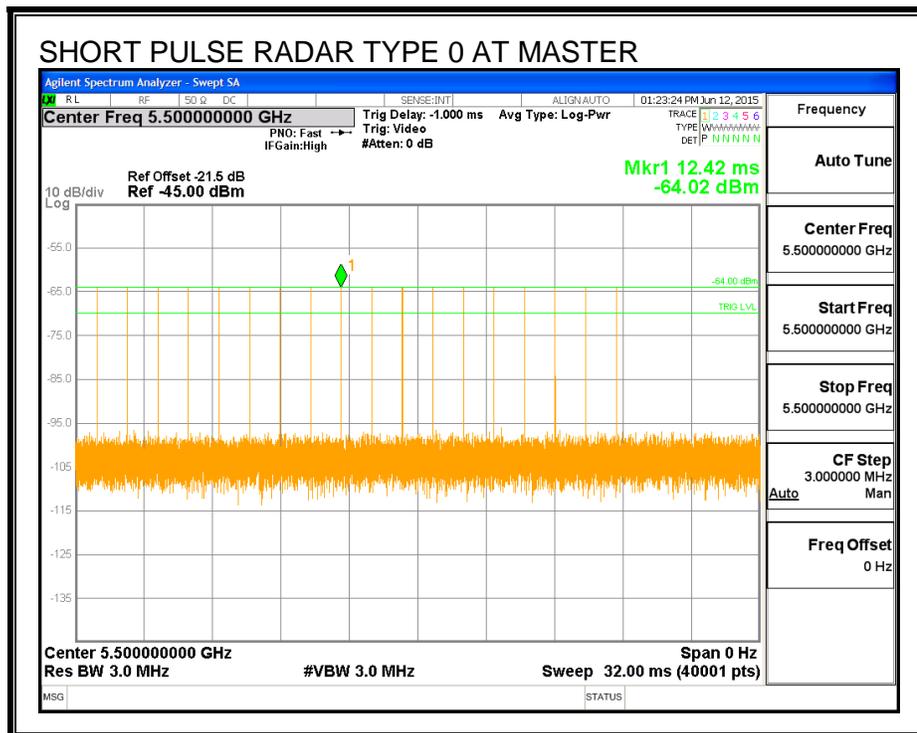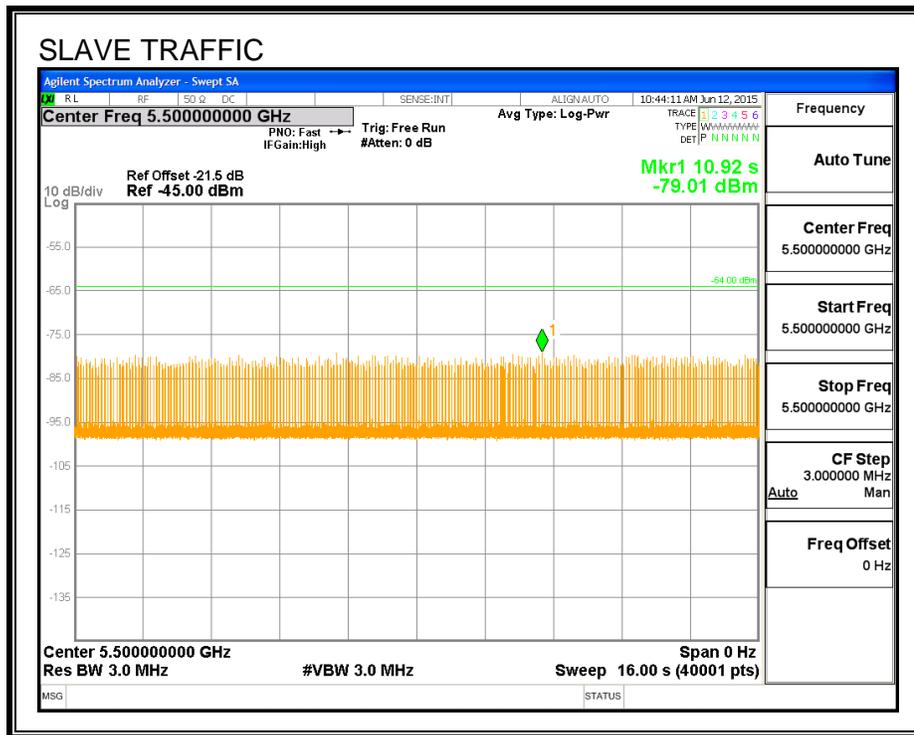
RADAR WAVEFORM

TRAFFIC

CHANNEL LOADING

The level of traffic loading on the channel by the EUT is 15.43%

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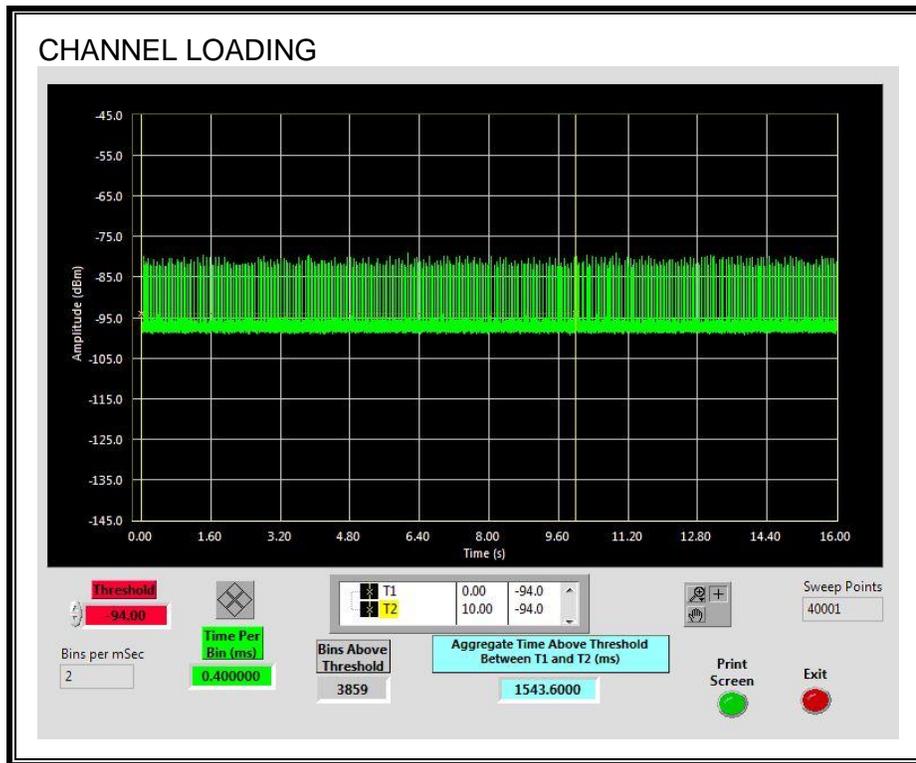
13.2.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

13.2.4. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.1008	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.0	60
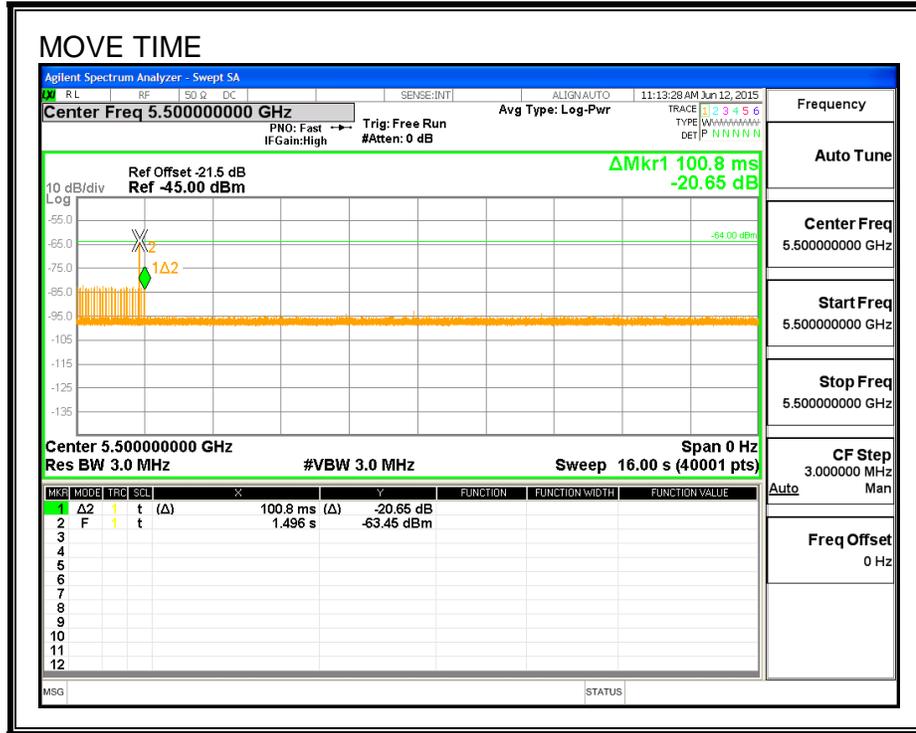
MOVE TIME

CHANNEL CLOSING TIME
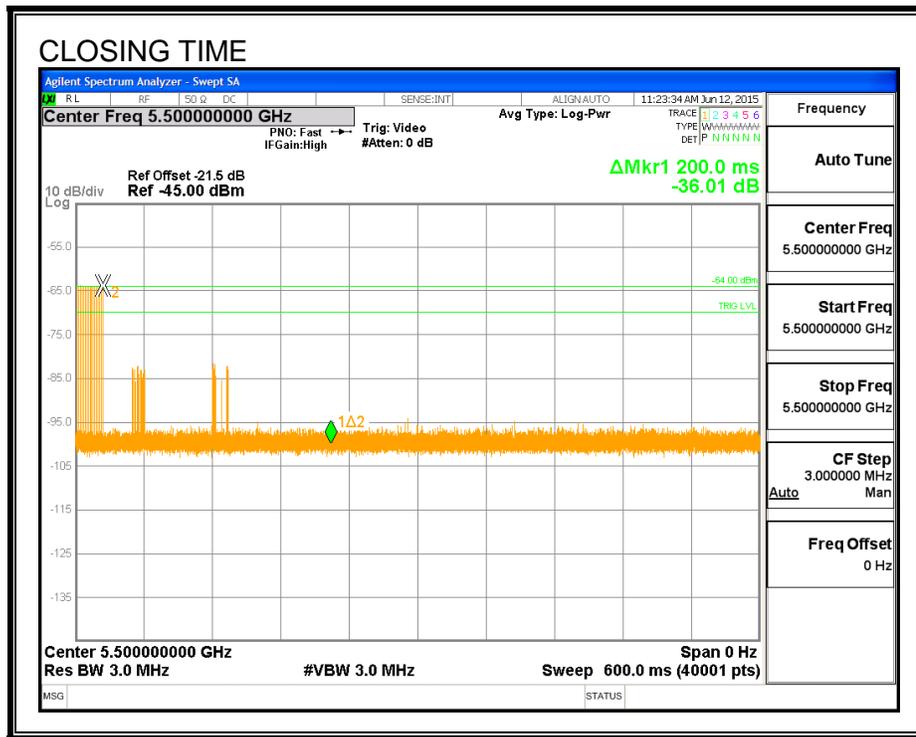
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.
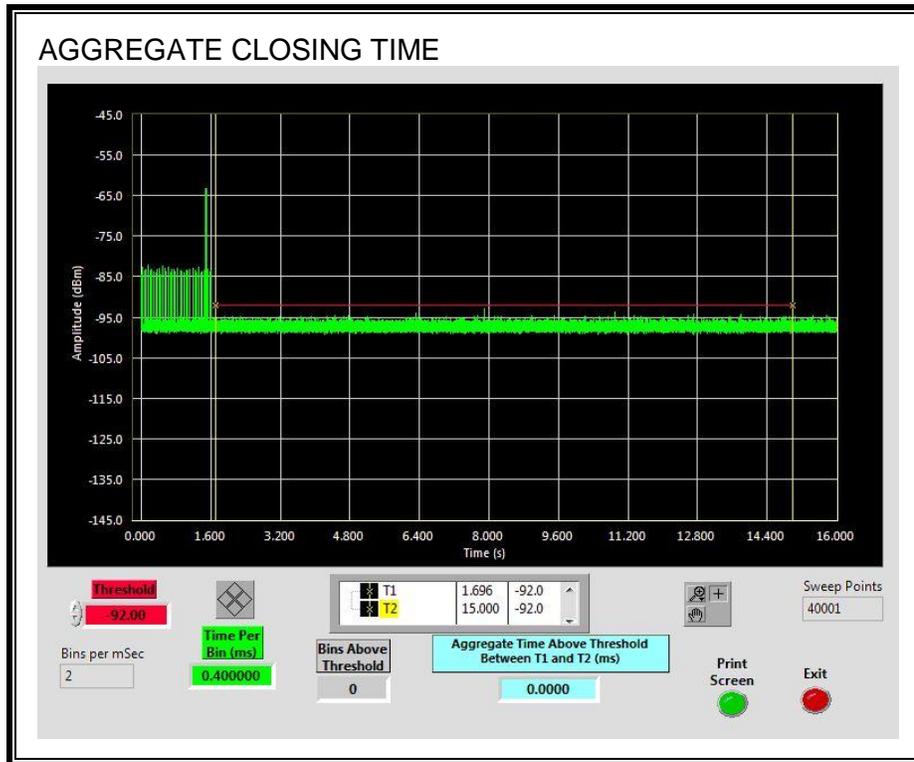
13.3. CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH

13.3.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5510 MHz.

13.3.2. RADAR WAVEFORM AND TRAFFIC

<u>RADAR WAVEFORM</u>
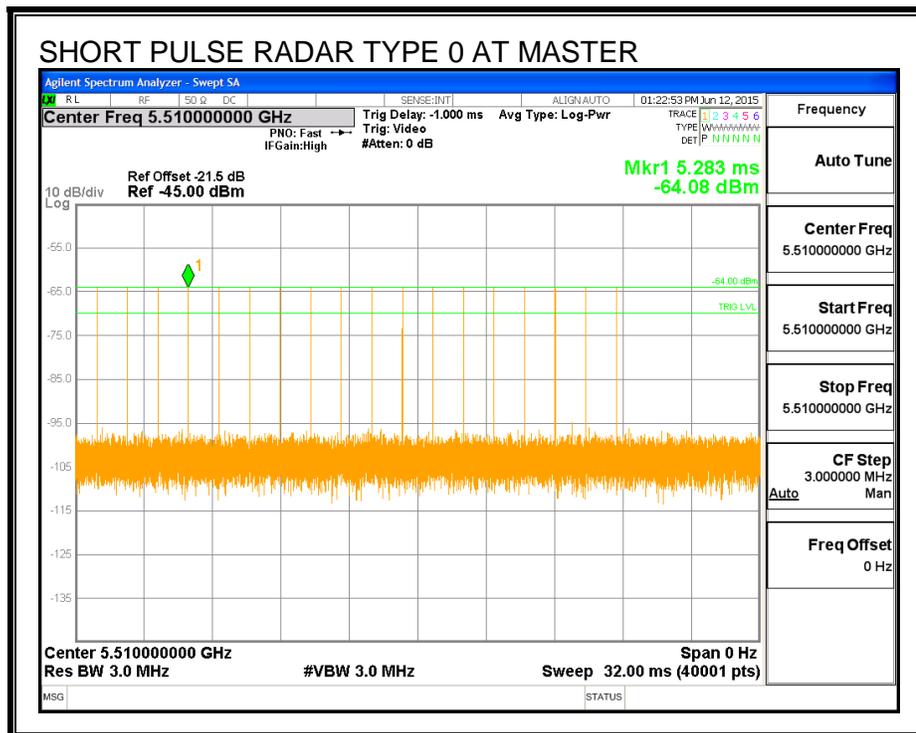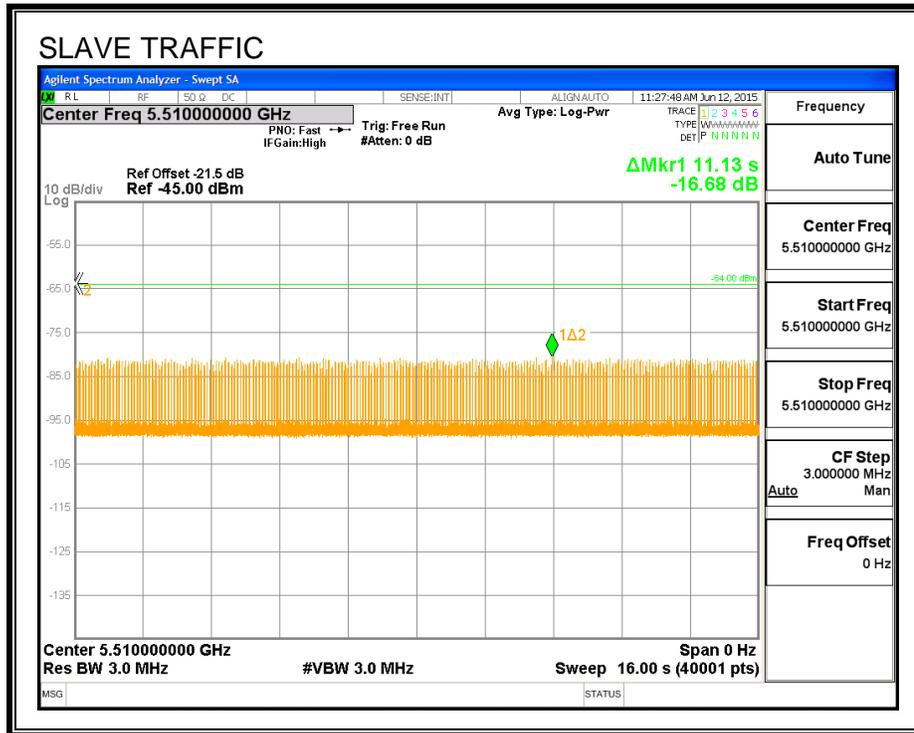
TRAFFIC
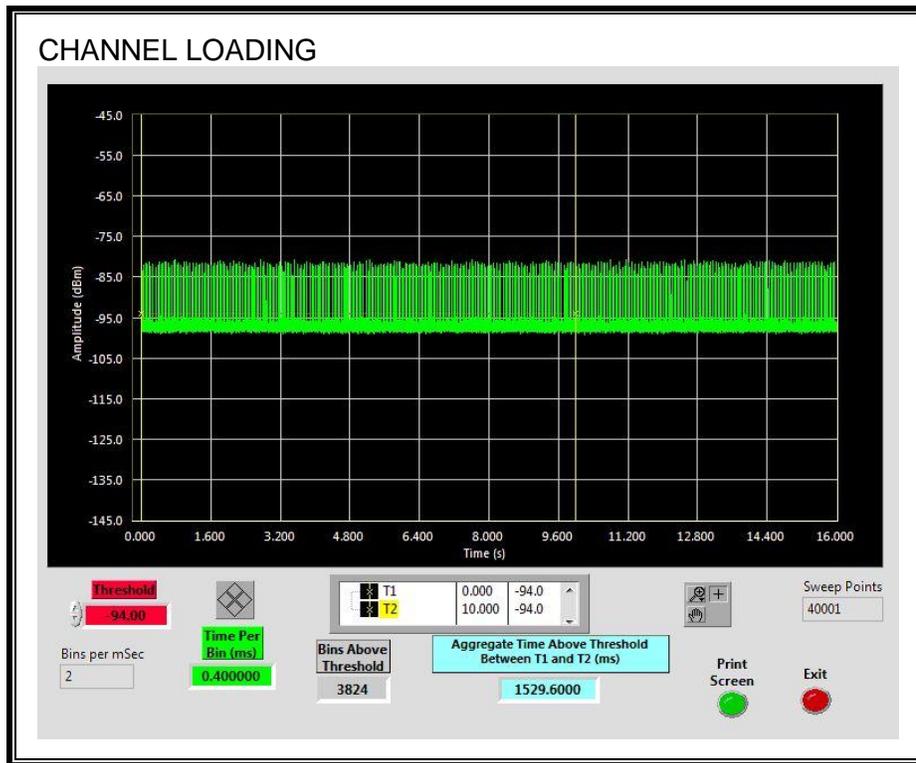
CHANNEL LOADING

The level of traffic loading on the channel by the EUT is 15.29%

13.3.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

13.3.4. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.0608	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.0	60
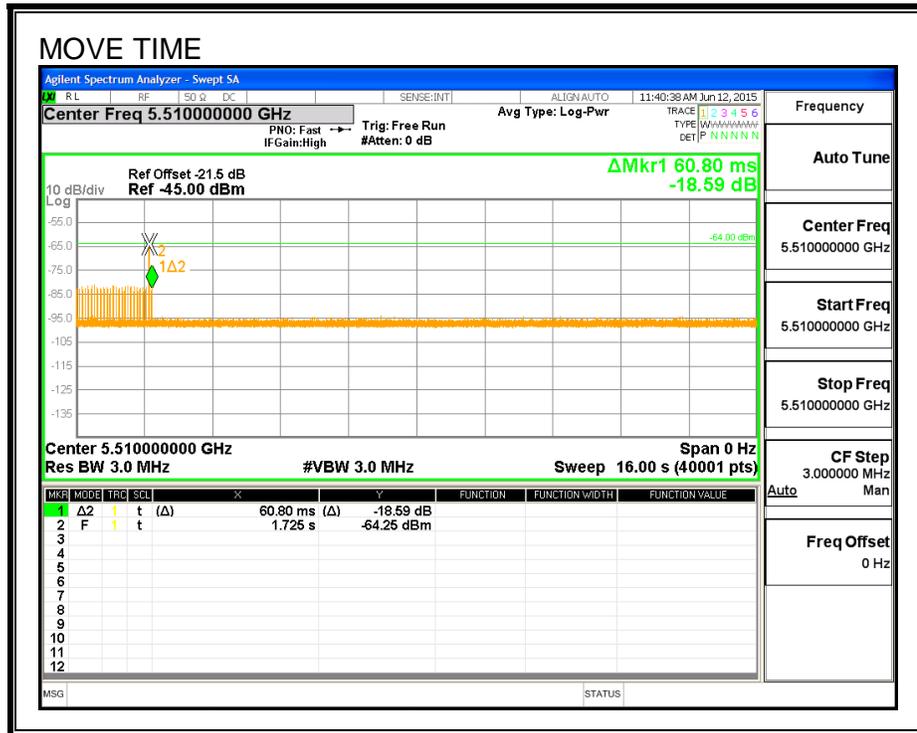
MOVE TIME

CHANNEL CLOSING TIME
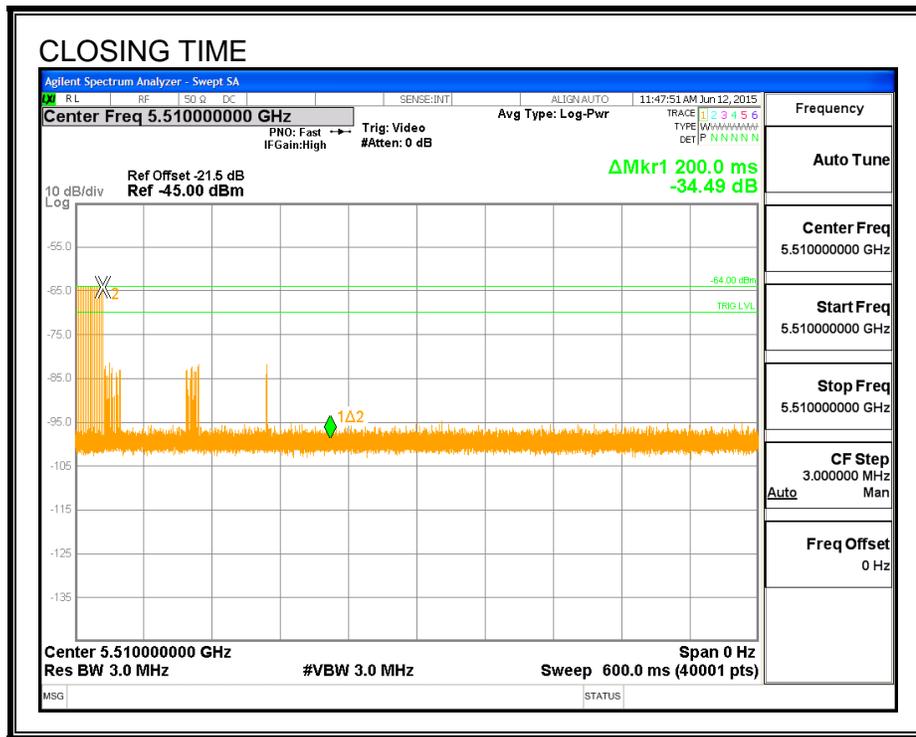
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.
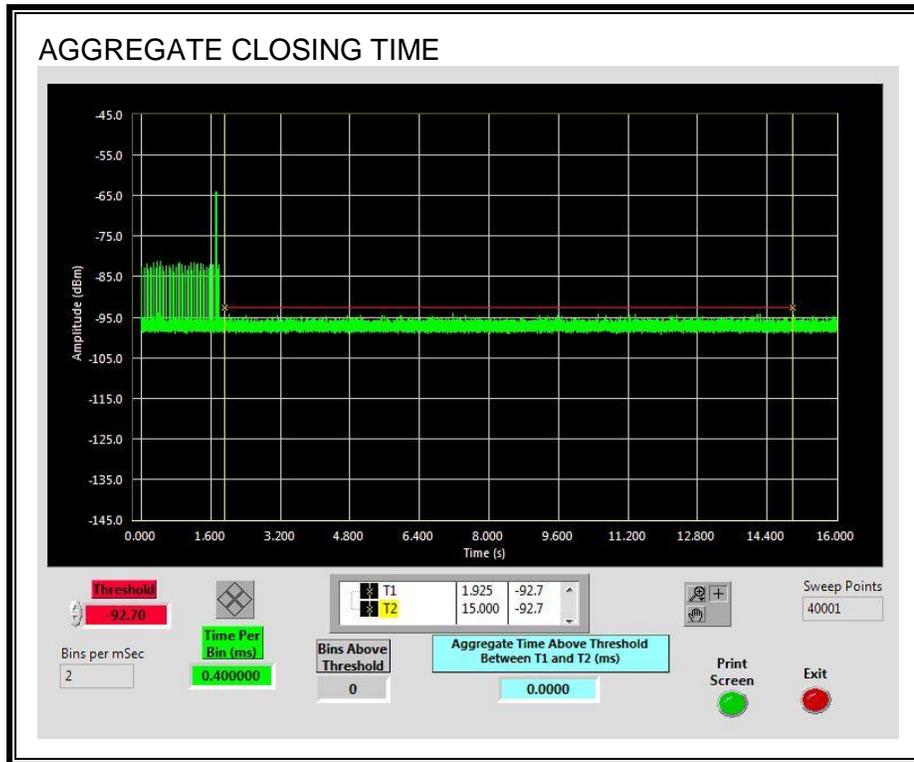
13.4. CLIENT MODE RESULTS FOR 80 MHz BANDWIDTH

13.4.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5530 MHz.

13.4.2. RADAR WAVEFORM AND TRAFFIC

<u>RADAR WAVEFORM</u>
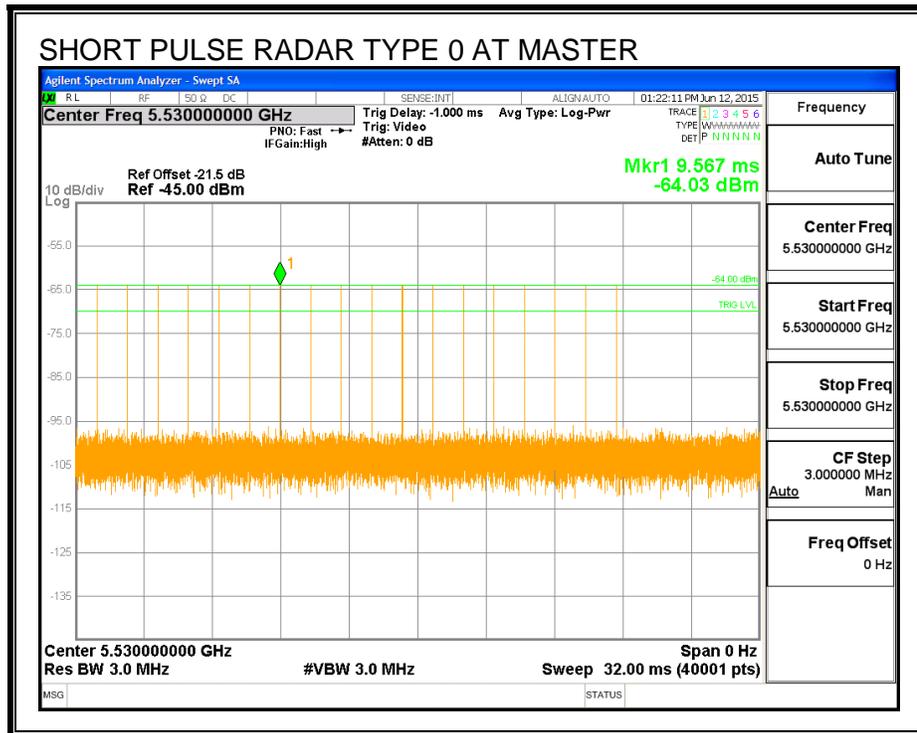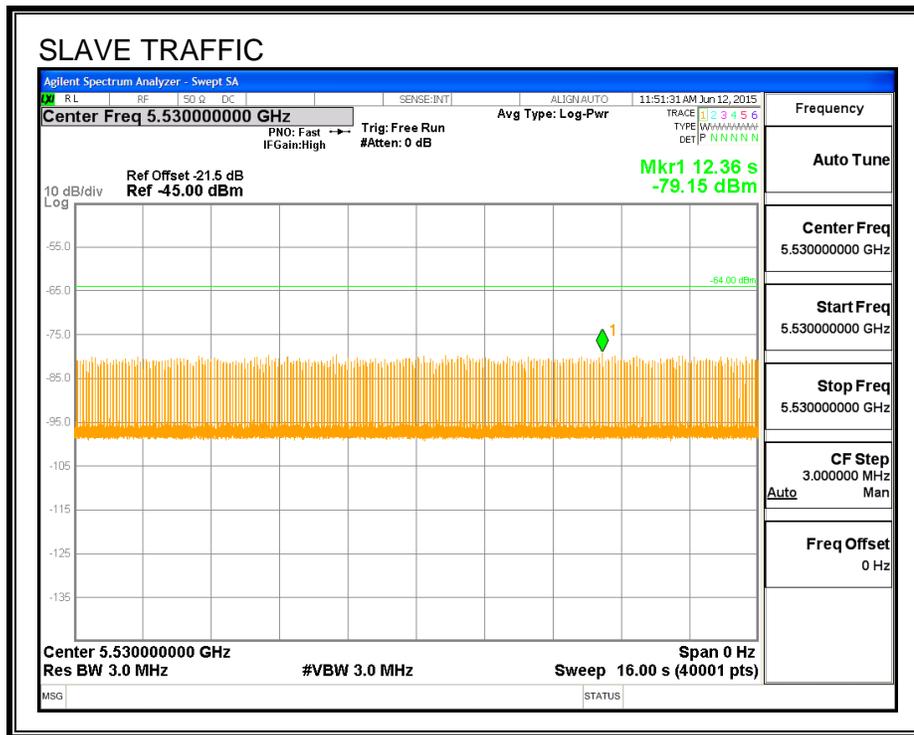
TRAFFIC
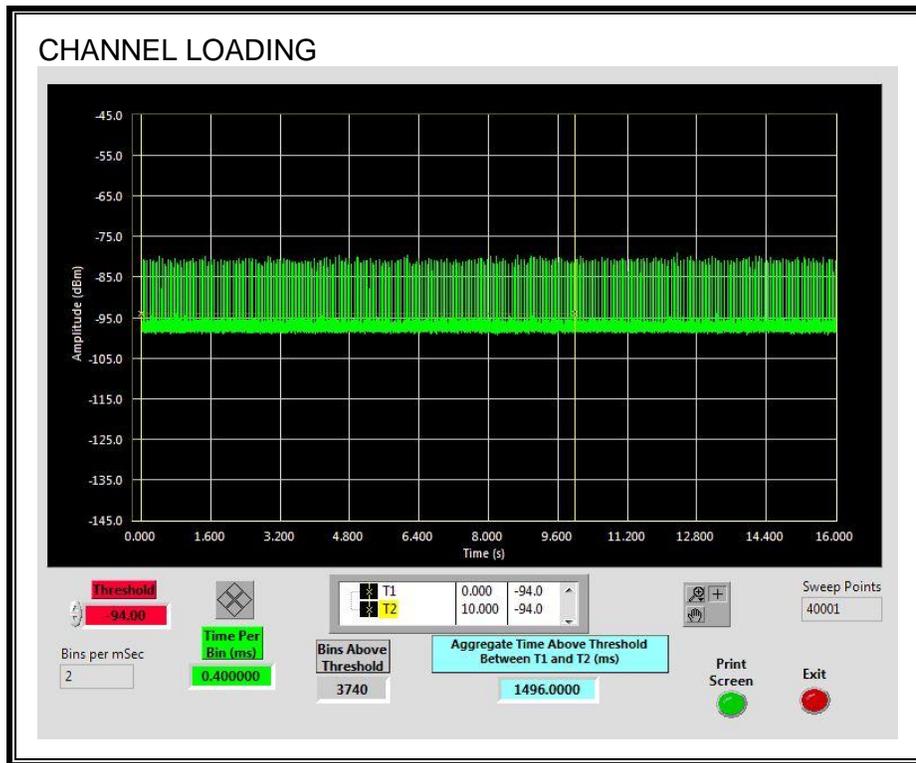
CHANNEL LOADING

The level of traffic loading on the channel by the EUT is 14.96%

13.4.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

13.4.4. MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.1116	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.0	60
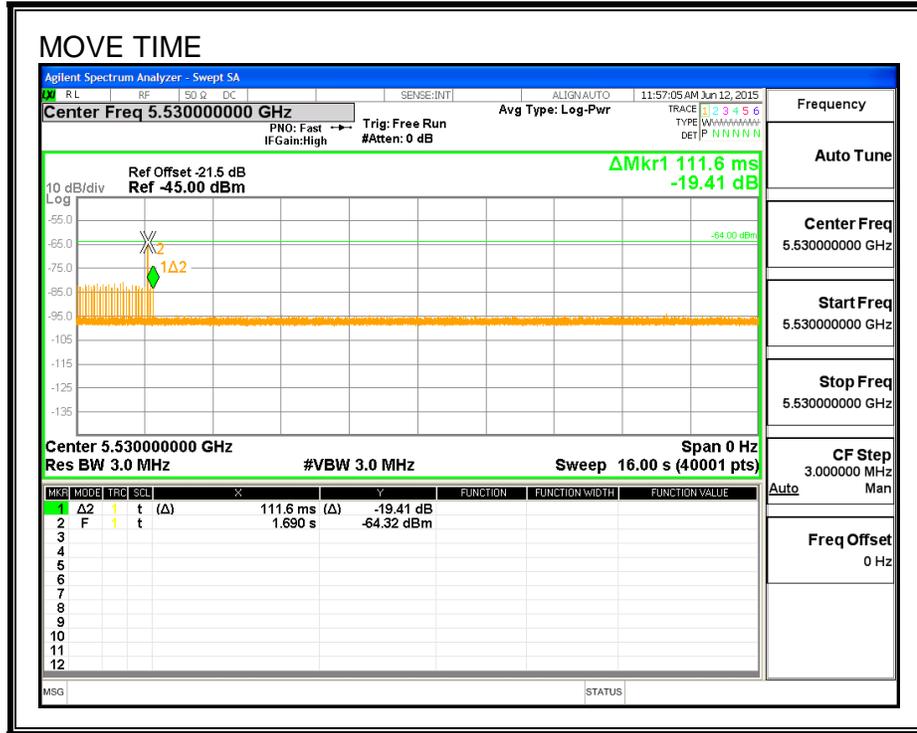
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MOVE TIME

CHANNEL CLOSING TIME

AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the aggregate monitoring period.

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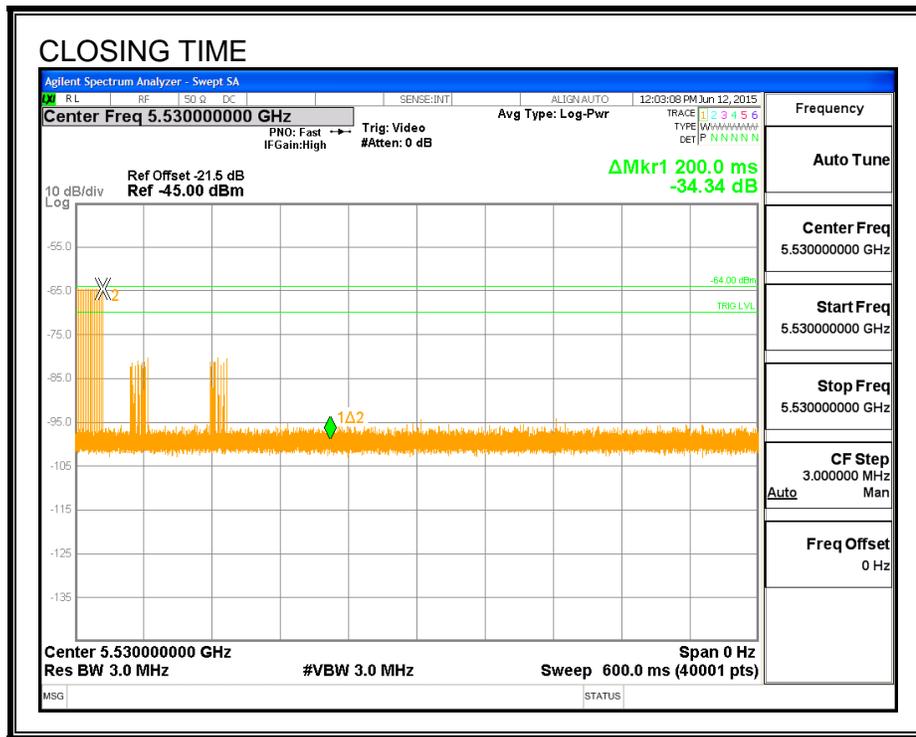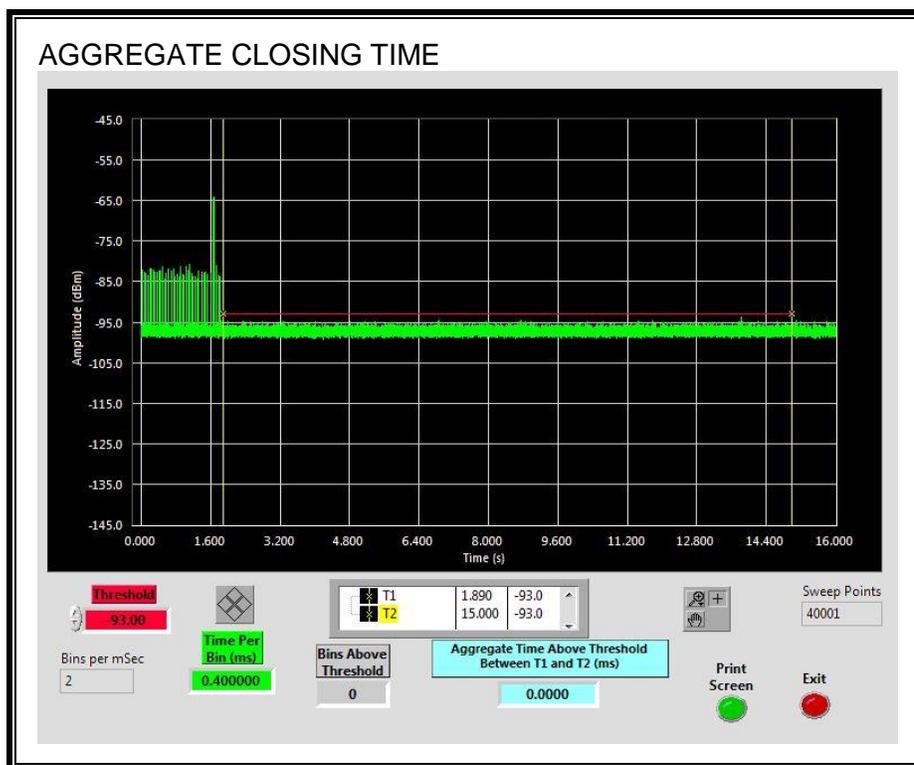
13.4.5.   10-MINUTE BEACON MONITORING PERIOD

RESULTS

No EUT transmissions were observed on the test channel during the 30-minute observation time.
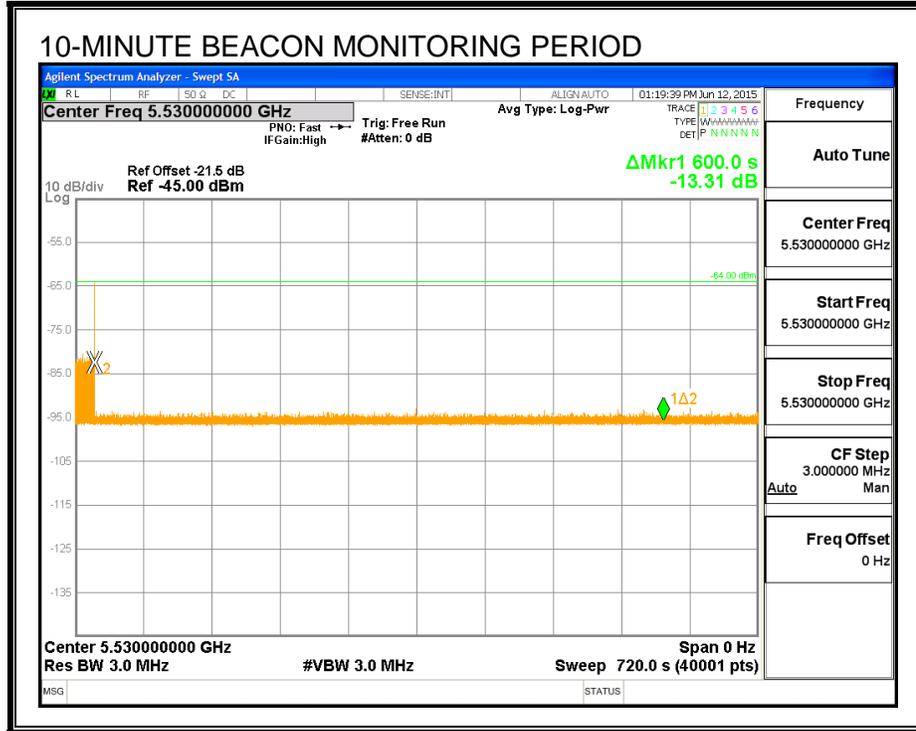
13.5. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH

13.5.1. TEST CHANNEL

All tests were performed at a channel center frequency of 5500 MHz.

13.5.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM
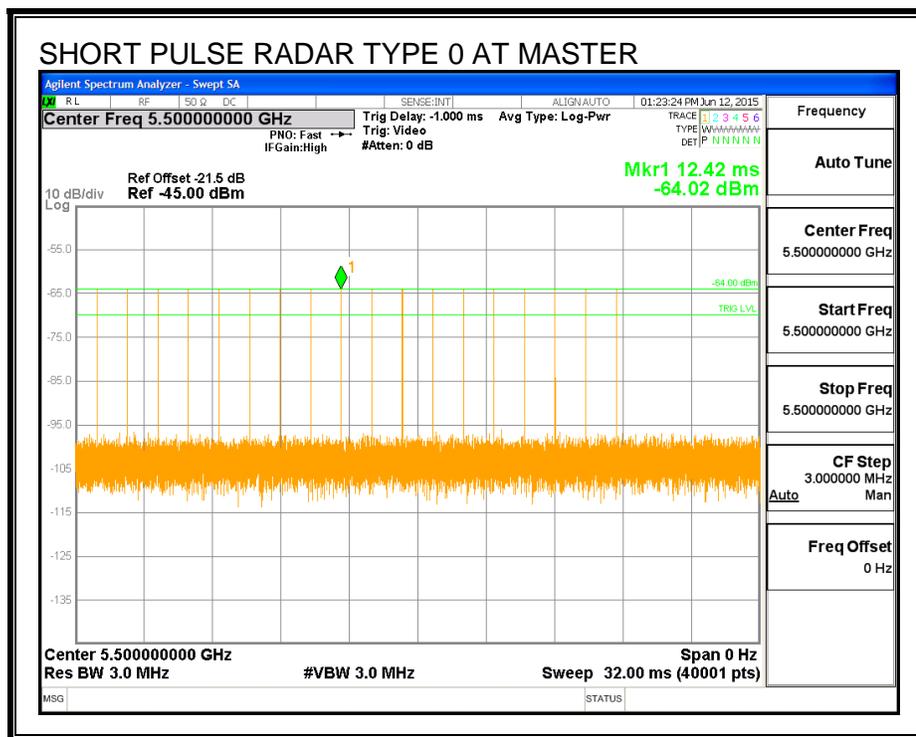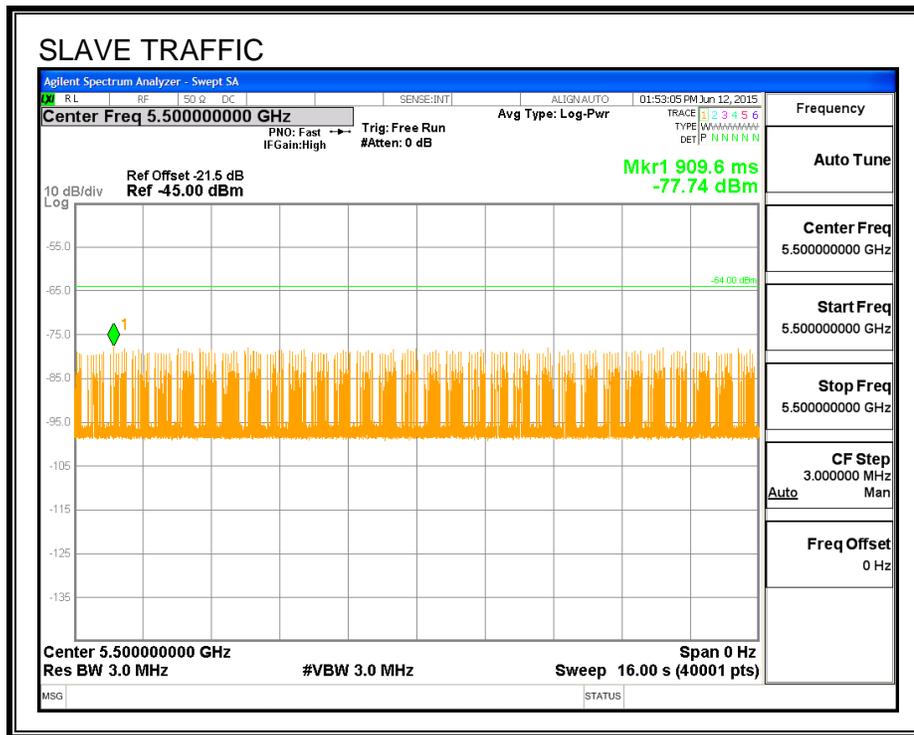
TRAFFIC
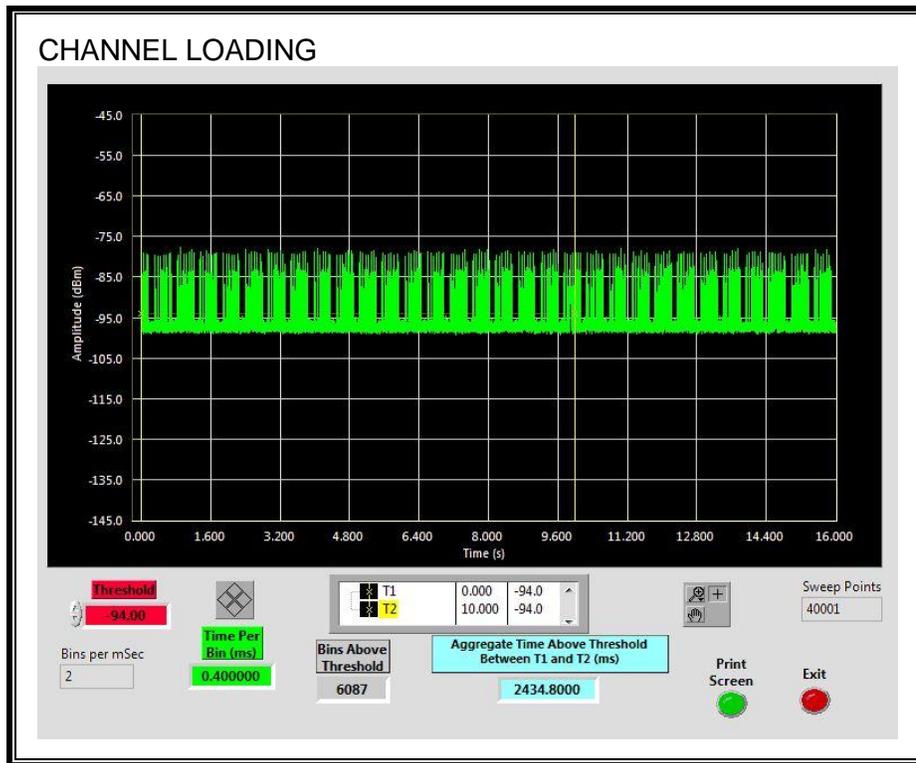
CHANNEL LOADING

The level of traffic loading on the channel by the EUT is 24.34%

13.5.3.   OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

13.5.4.   MOVE AND CLOSING TIME

REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

Channel Move Time (sec)	Limit (sec)
0.3372	10

Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
0.4	60

MOVE TIME

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CHANNEL CLOSING TIME