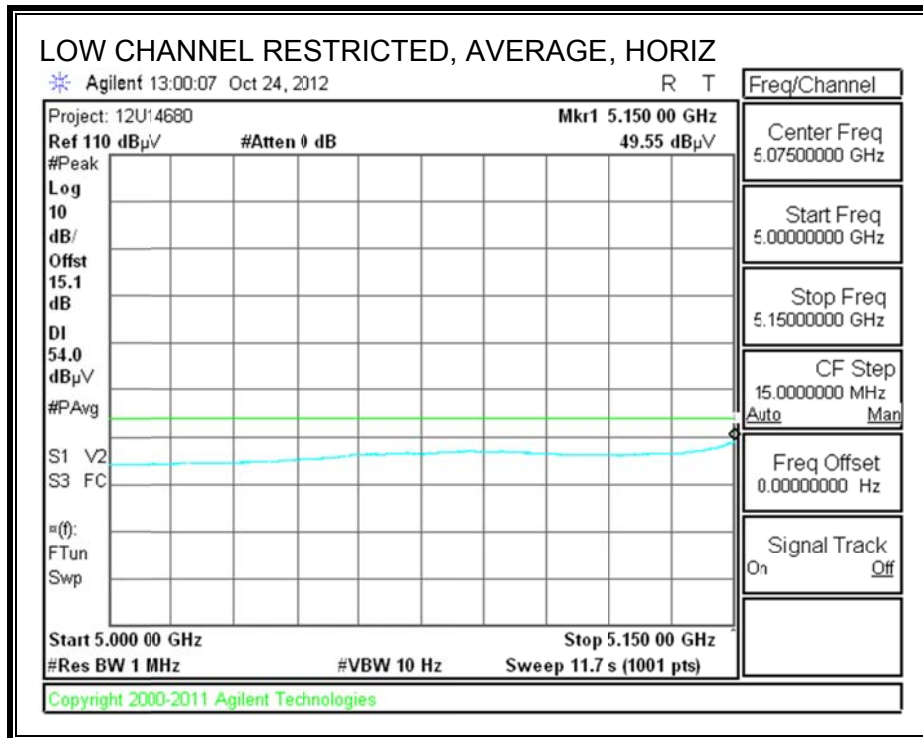
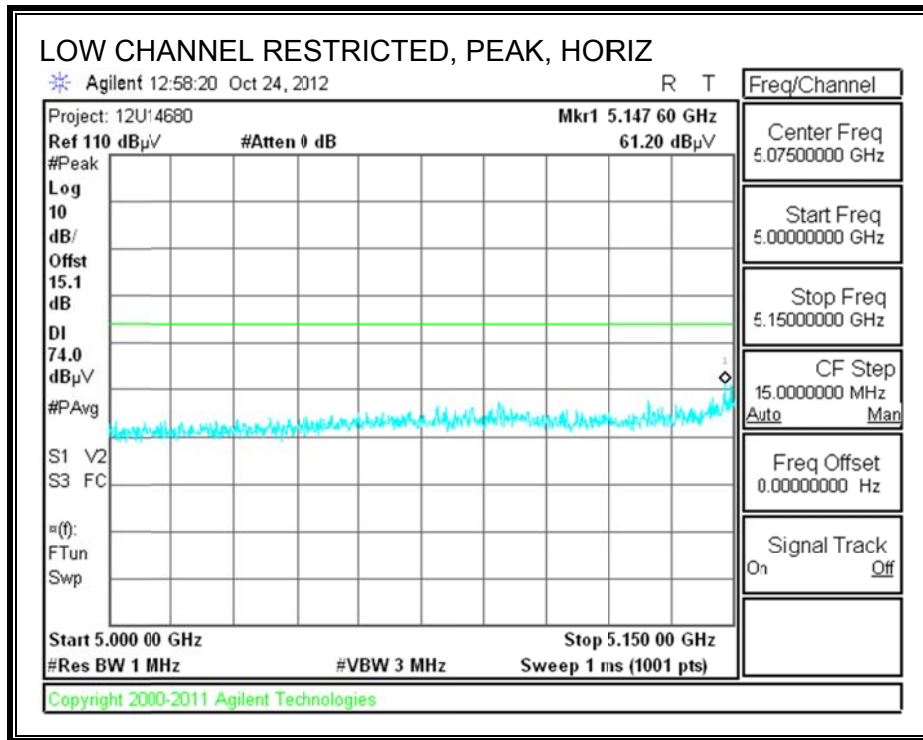
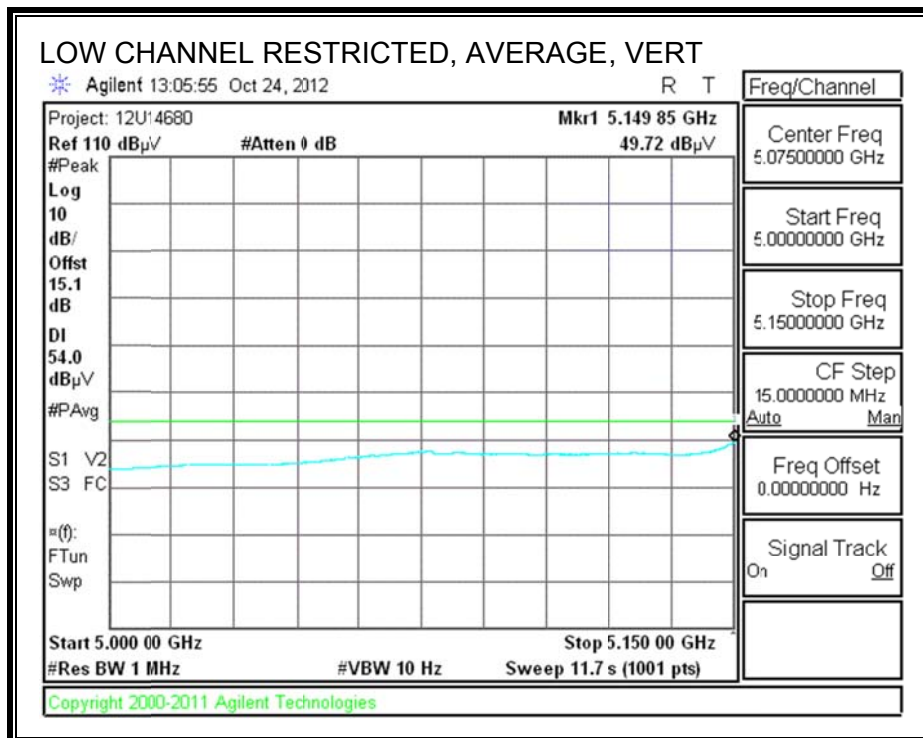
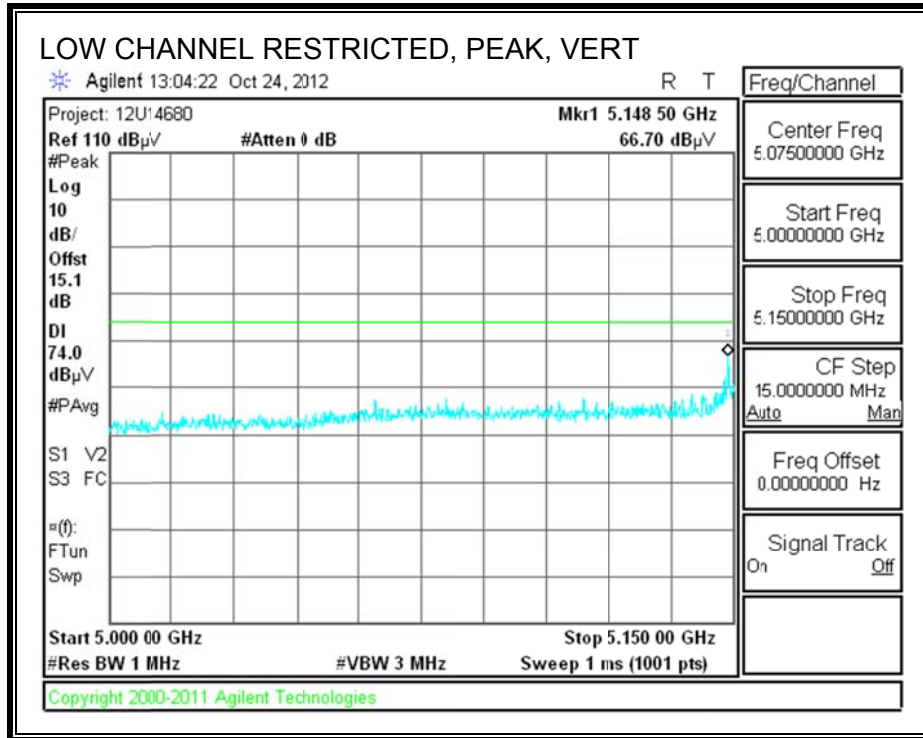


9.3. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
 Date: 11/05/12
 Project #: 12U14680
 Company: Apple
 Test Target: FCC Class B
 Mode Oper: 802.11n HT20 TX mode

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit
 CL Cable Loss HPF High Pass Filter

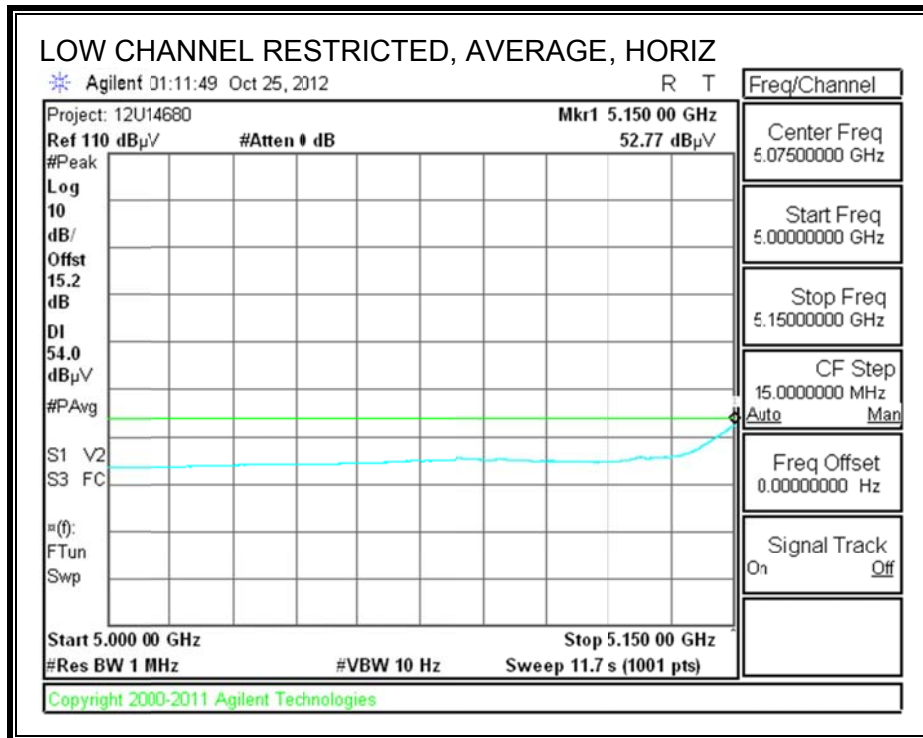
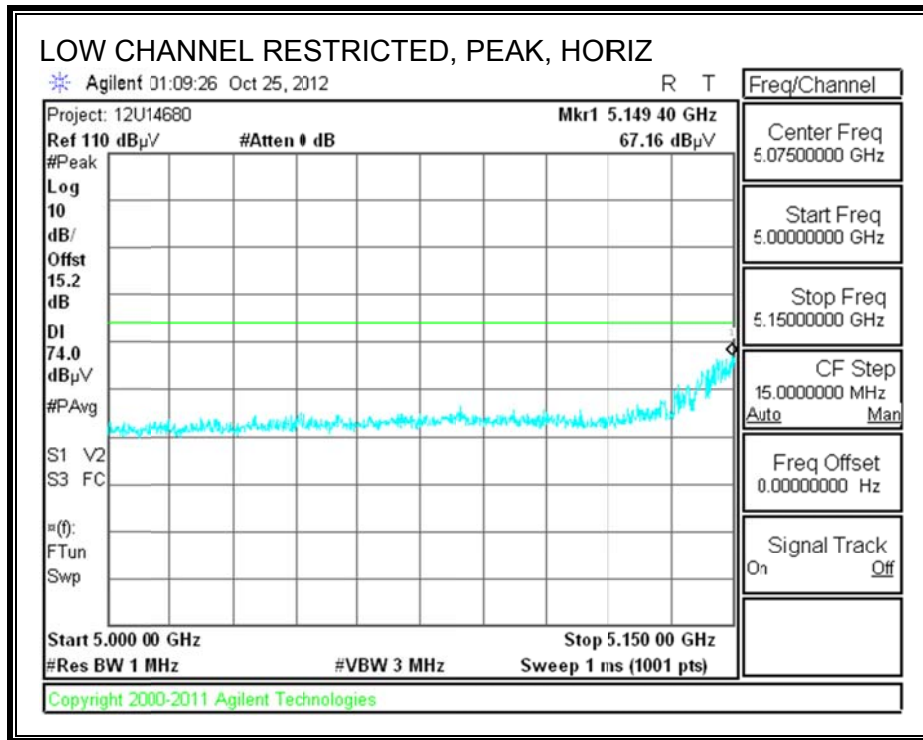
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5180 MHz 11n HT20													
15.540	3.0	34.7	39.1	13.0	-31.9	0.0	0.7	55.6	74.0	-18.4	V	P	
15.540	3.0	24.4	39.1	13.0	-31.9	0.0	0.7	45.2	54.0	-8.8	V	A	
15.540	3.0	35.3	39.1	13.0	-31.9	0.0	0.7	56.1	74.0	-17.9	H	P	
15.540	3.0	24.3	39.1	13.0	-31.9	0.0	0.7	45.2	54.0	-8.8	H	A	
5200 MHz 11n HT20													
15.600	3.0	34.5	38.8	13.0	-31.9	0.0	0.7	55.1	74.0	-18.9	H	P	
15.600	3.0	24.3	38.8	13.0	-31.9	0.0	0.7	45.0	54.0	-9.0	H	A	
15.600	3.0	34.8	38.8	13.0	-31.9	0.0	0.7	55.5	74.0	-18.5	V	P	
15.600	3.0	24.3	38.8	13.0	-31.9	0.0	0.7	45.0	54.0	-9.0	V	A	
5240 MHz 11n HT20													
15.720	3.0	35.2	38.4	13.1	-31.9	0.0	0.7	55.6	74.0	-18.4	H	P	
15.720	3.0	24.2	38.4	13.1	-31.9	0.0	0.7	44.5	54.0	-9.5	H	A	
15.720	3.0	34.4	38.4	13.1	-31.9	0.0	0.7	54.7	74.0	-19.3	V	P	
15.720	3.0	24.2	38.4	13.1	-31.9	0.0	0.7	44.5	54.0	-9.5	V	A	

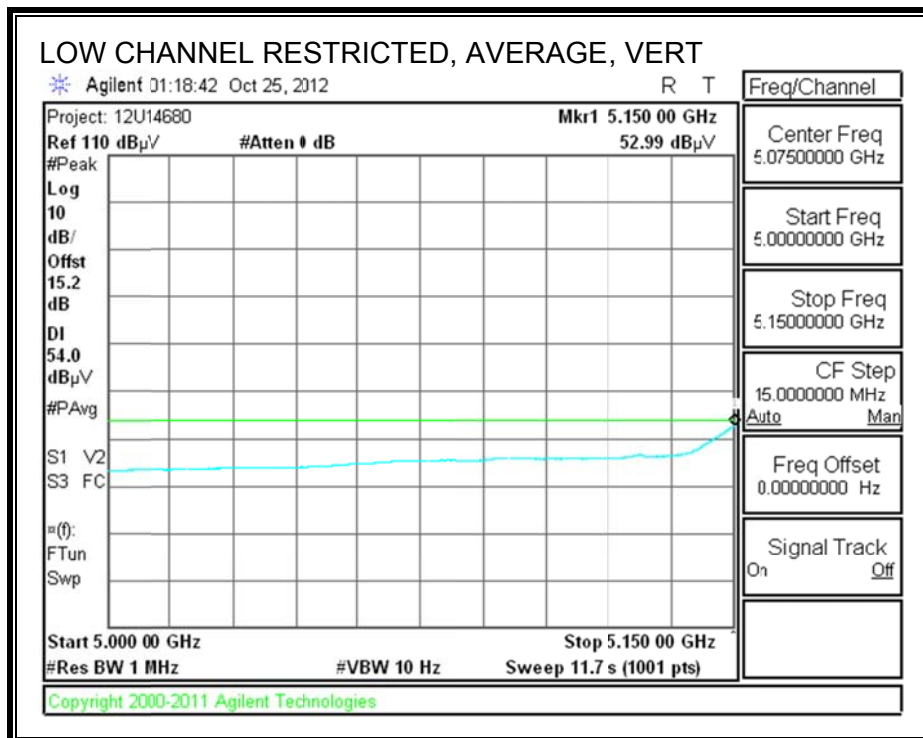
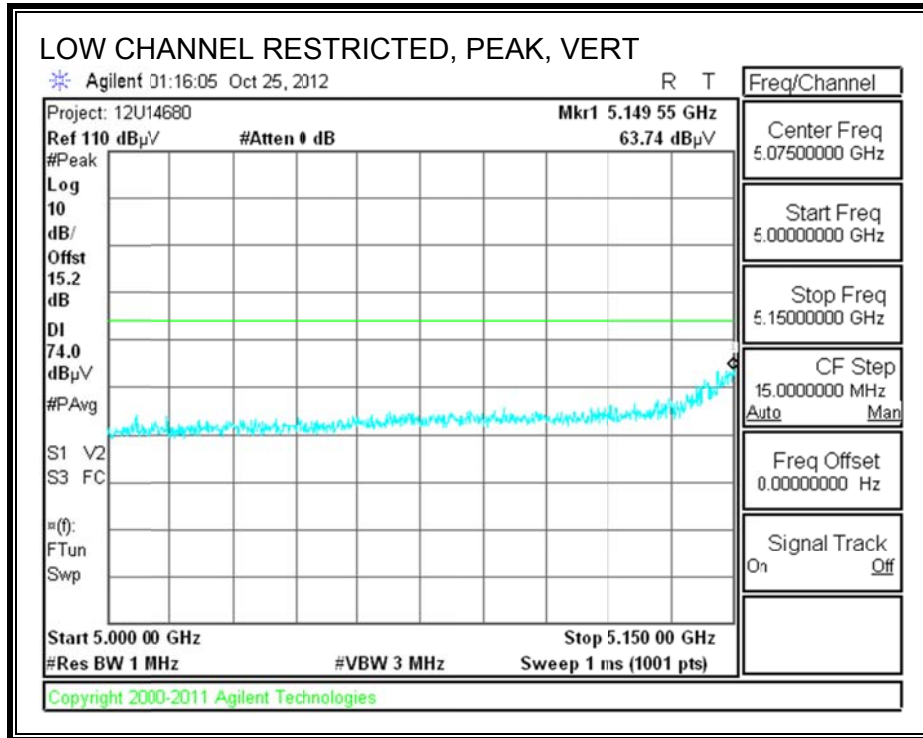
Rev. 4.1.2.7

Note: No other emissions were detected above the system noise floor.

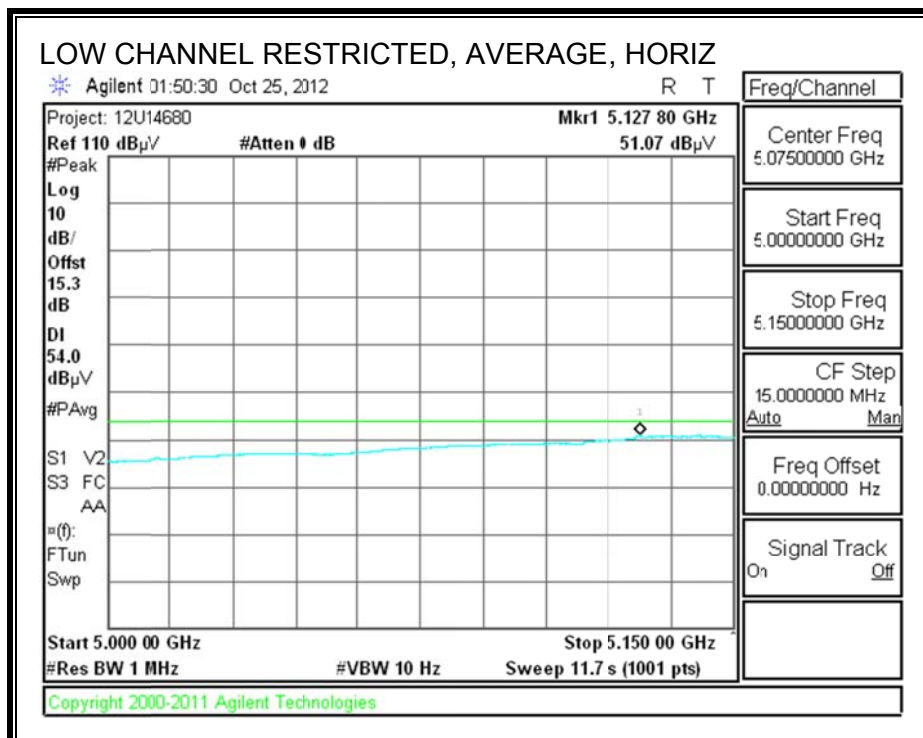
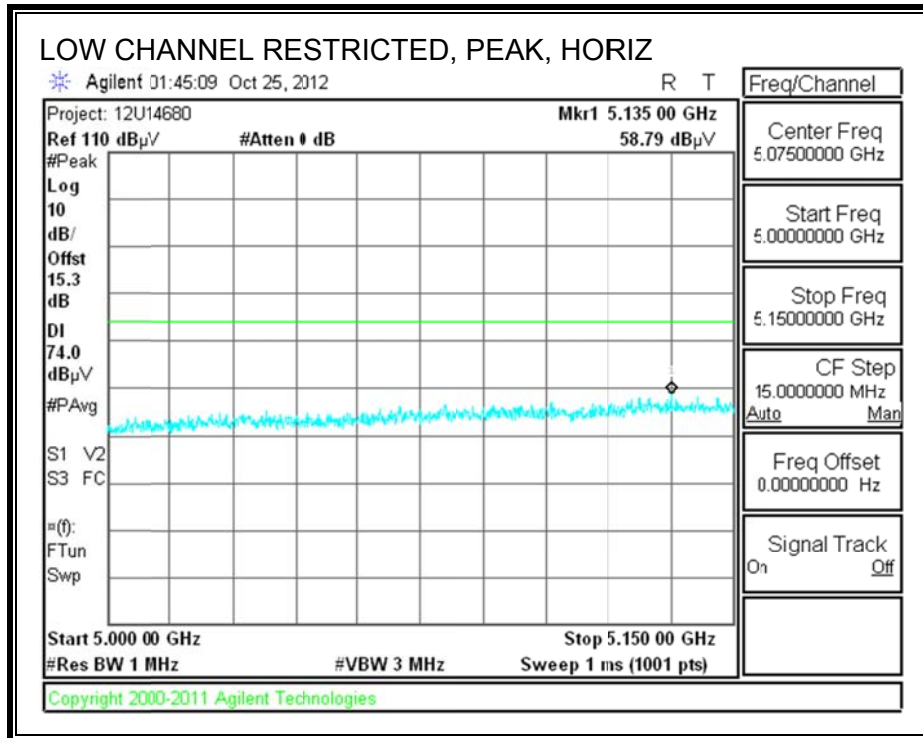
9.4. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND

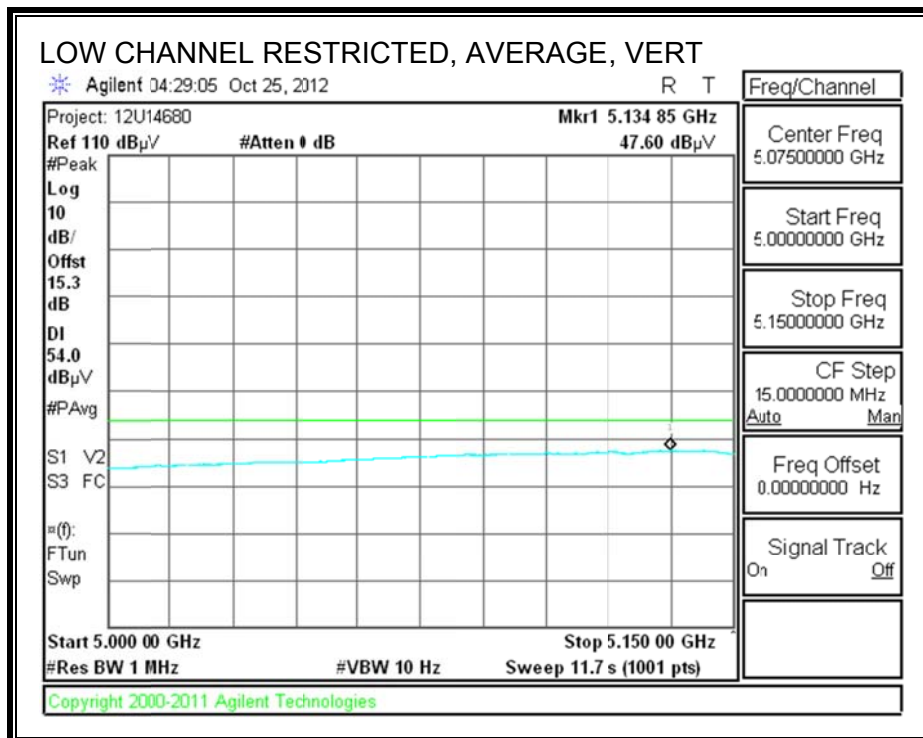
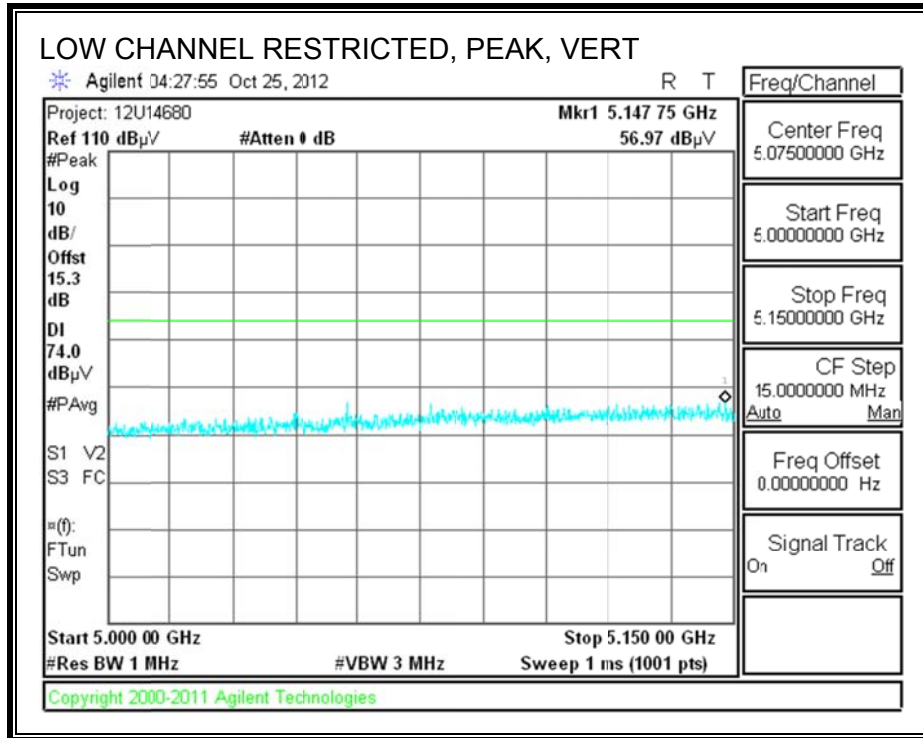
RESTRICTED BANDEDGE (LOW 1 CHANNEL)





RESTRICTED BANDEDGE (LOW 2 CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Tom Chen											
Date:		11/06/12											
Project #:		12U14680											
Company:		Apple											
Test Target:		FCC Class B											
Mode Oper:		802.11n HT40 TX mode											
f	Measurement Frequency	Amp	Preamp Gain					Average Field Strength Limit					
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters					Peak Field Strength Limit					
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m					Margin vs. Average Limit					
AF	Antenna Factor	Peak	Calculated Peak Field Strength					Margin vs. Peak Limit					
CL	Cable Loss	HPF	High Pass Filter										

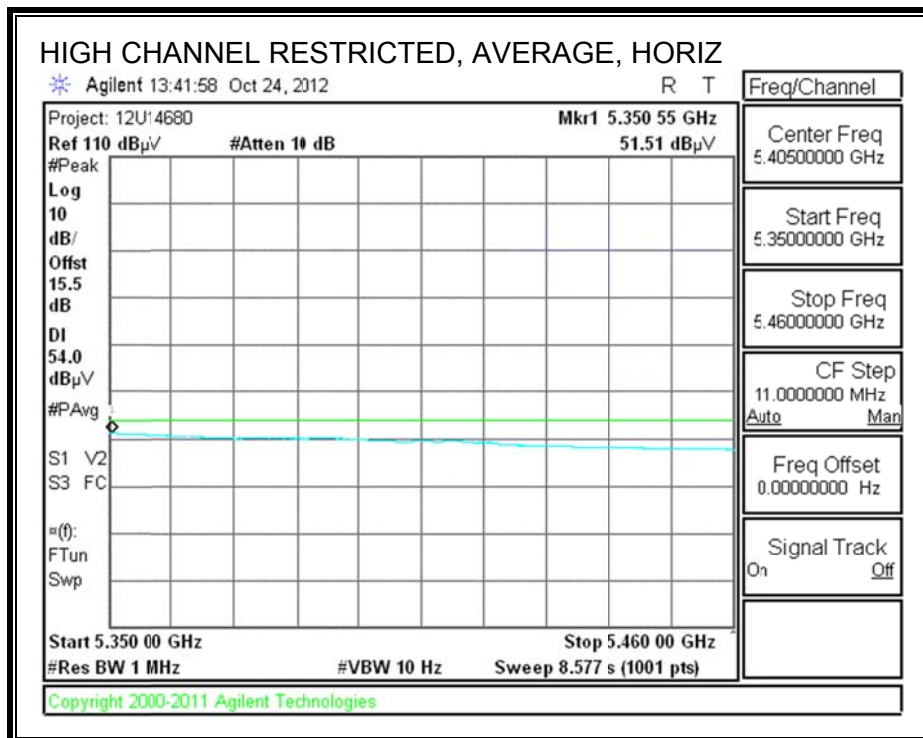
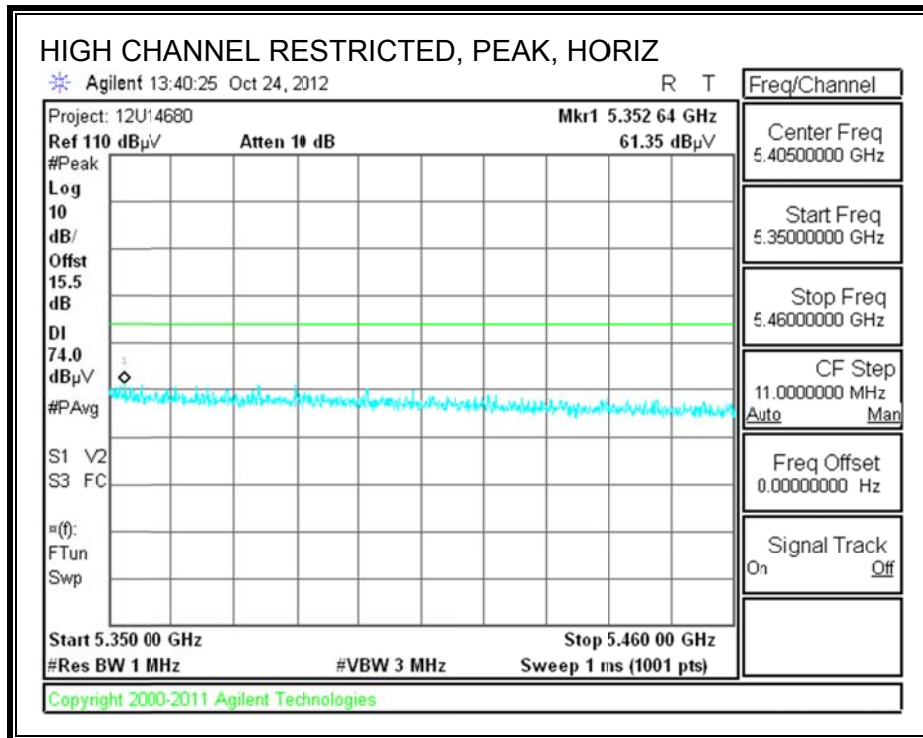
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/Q/P	Notes
5190MHz HT40													
15.570	3.0	35.1	38.9	13.0	-31.9	0.0	0.7	55.8	74.0	-18.2	H	P	
15.570	3.0	24.4	38.9	13.0	-31.9	0.0	0.7	45.2	54.0	-8.8	H	A	
5190MHz HT40													
15.570	3.0	35.0	38.9	13.0	-31.9	0.0	0.7	55.8	74.0	-18.2	V	P	
15.570	3.0	24.4	38.9	13.0	-31.9	0.0	0.7	45.1	54.0	-8.9	V	A	
5230MHz HT40													
15.690	3.0	35.1	38.5	13.0	-31.9	0.0	0.7	55.5	74.0	-18.5	H	P	
15.690	3.0	24.4	38.5	13.0	-31.9	0.0	0.7	44.8	54.0	-9.2	H	A	
5230MHz HT40													
15.690	3.0	34.7	38.5	13.0	-31.9	0.0	0.7	55.1	74.0	-18.9	V	P	
15.690	3.0	24.4	38.5	13.0	-31.9	0.0	0.7	44.8	54.0	-9.2	V	A	

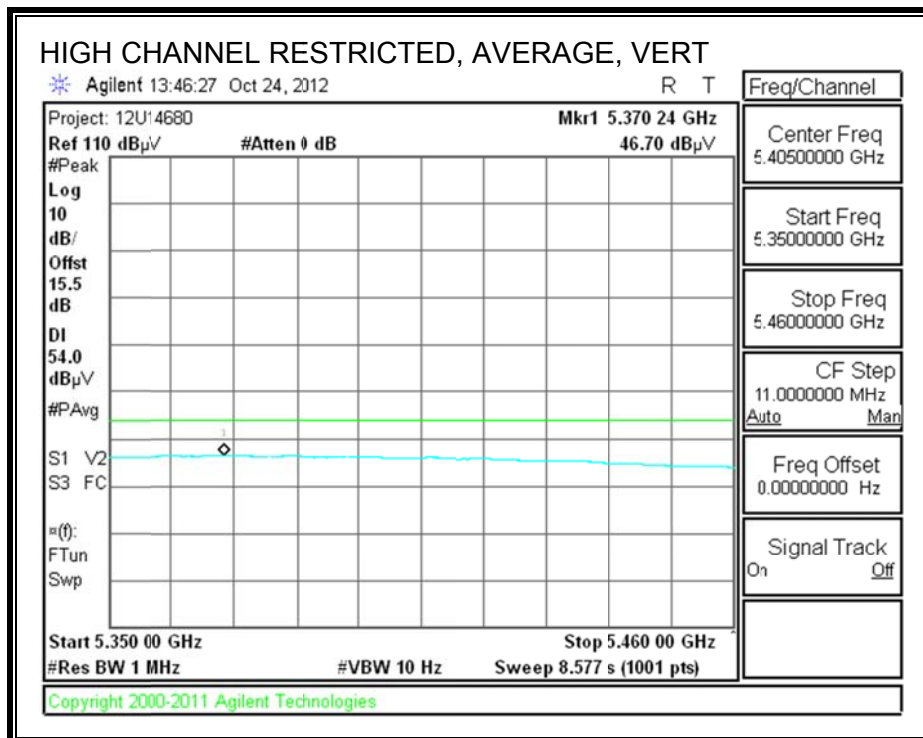
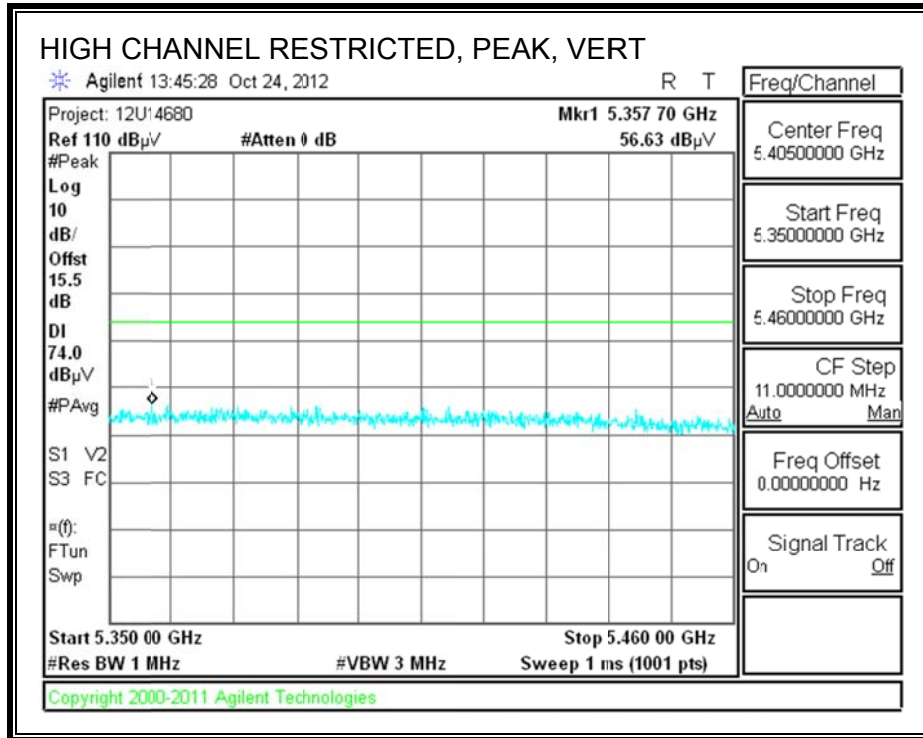
Rev. 4.1.2.7

Note: No other emissions were detected above the system noise floor.

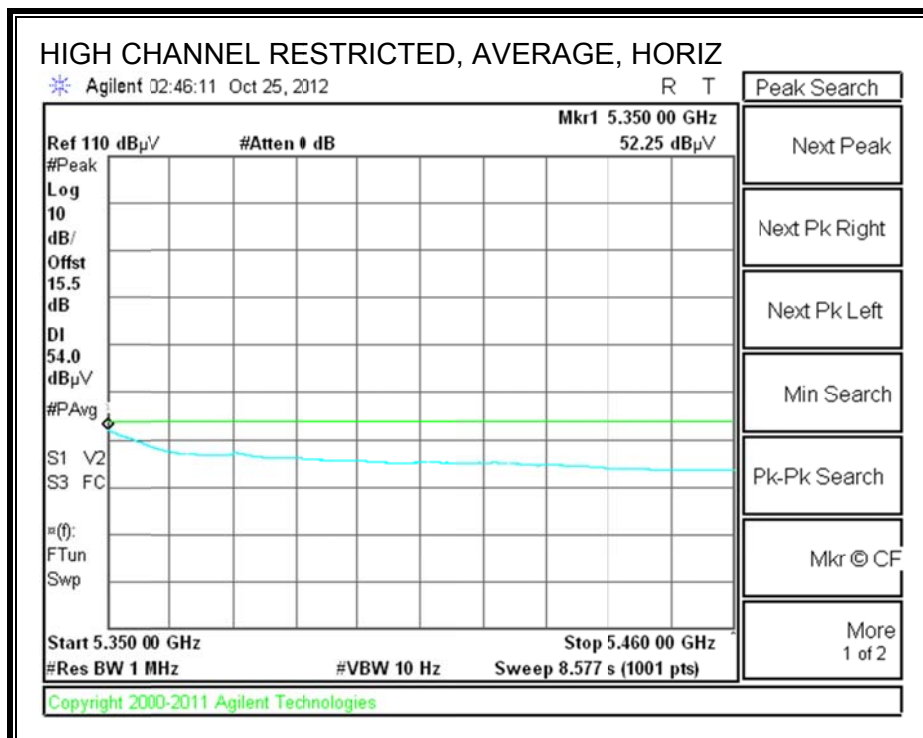
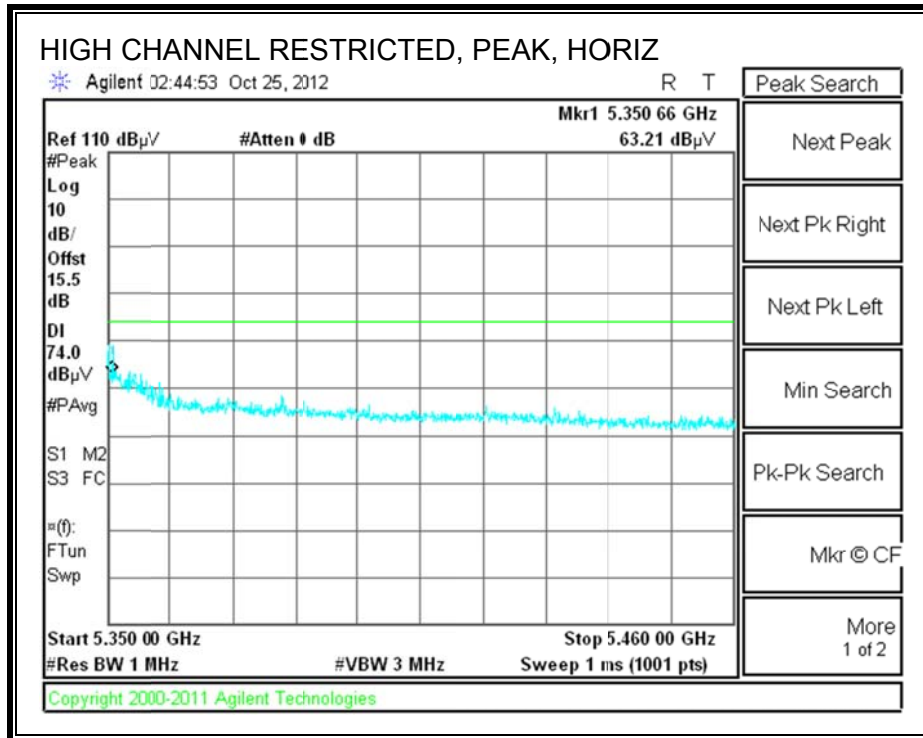
9.5. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND

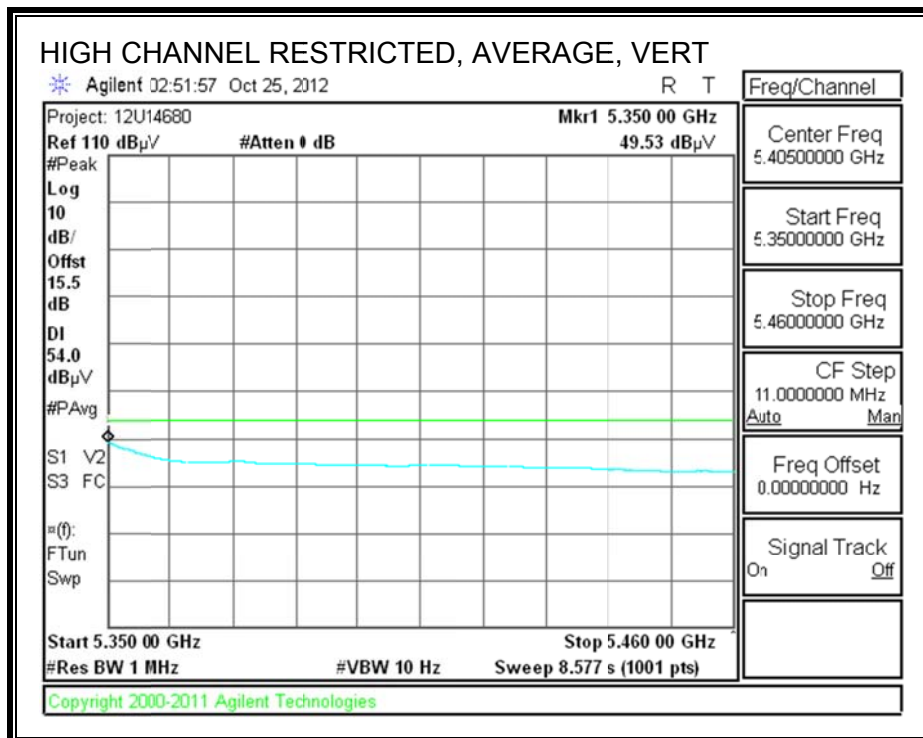
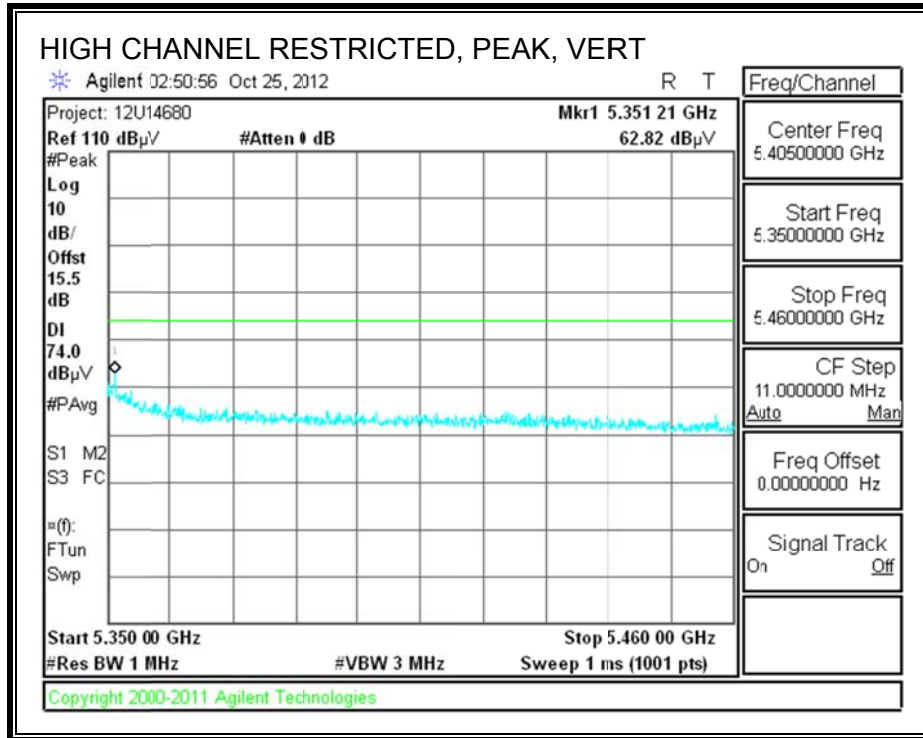
RESTRICTED BANDEDGE (HIGH 1 CHANNEL)





RESTRICTED BANDEDGE (HIGH 2 CHANNEL)



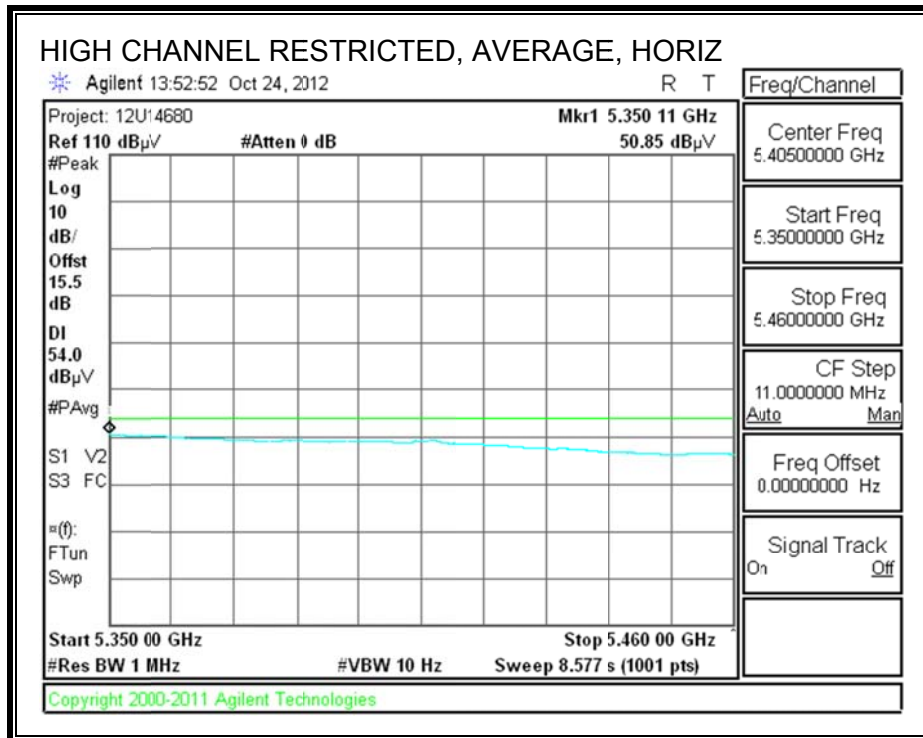
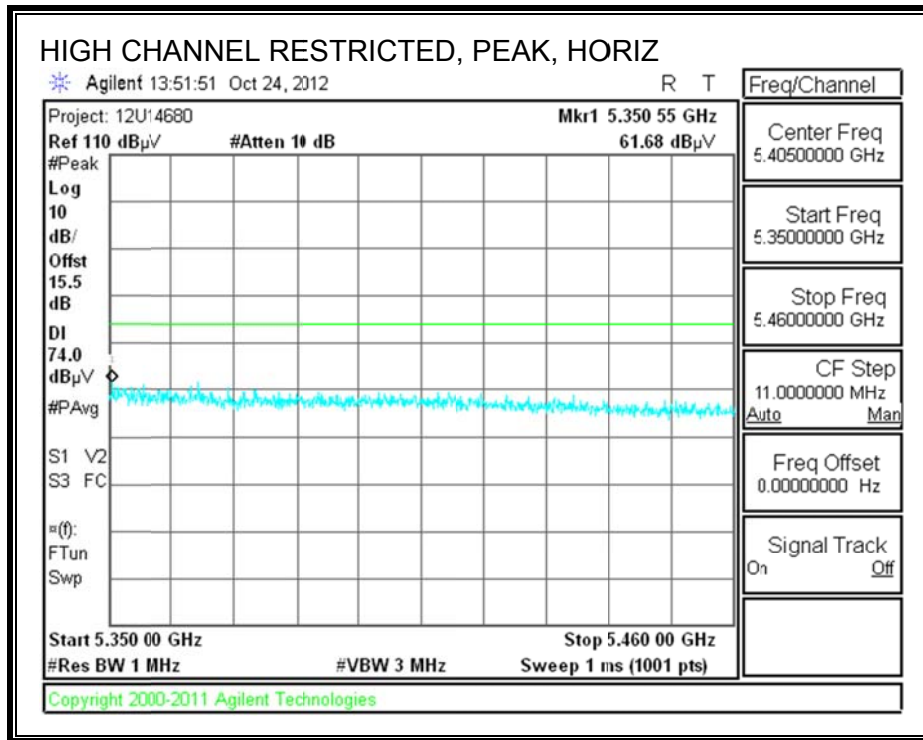


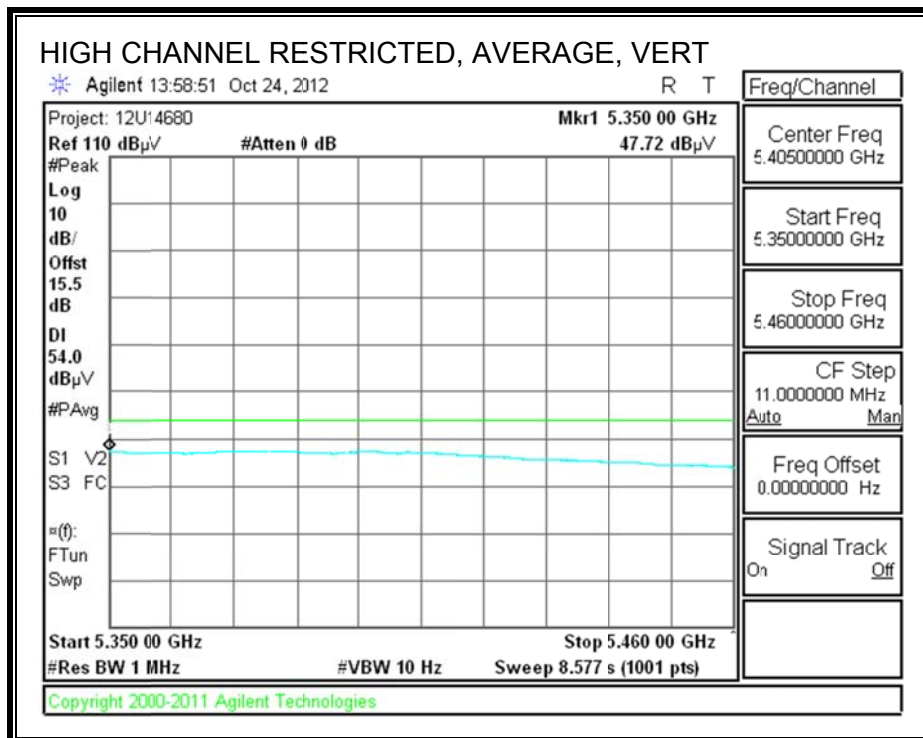
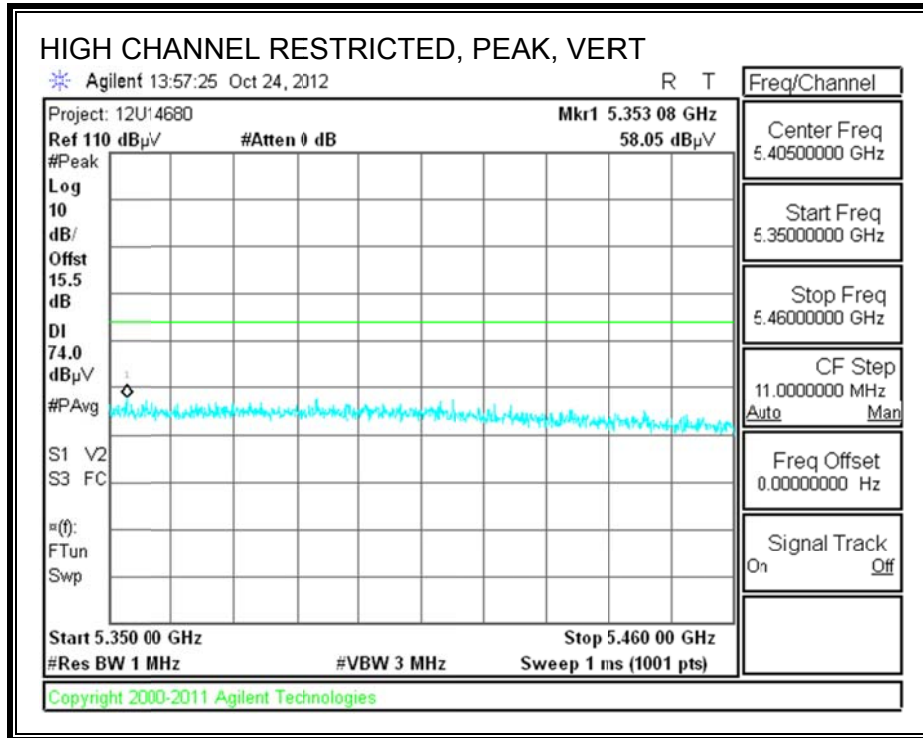
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Tom Chen											
Date:		11/05/12											
Project #:		12U14680											
Company:		Apple											
Test Target:		FCC Class B											
Mode Oper:		802.11a TX mode											
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit									
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit									
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit									
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit									
CL	Cable Loss	HPF	High Pass Filter										
f	Dist	Read	AF	CL	Amp	D Corr	Fltr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/Q/P	
5260 MHz 11a													
15.780	3.0	34.5	38.2	13.1	-31.9	0.0	0.7	54.7	74.0	-19.3	V	P	
15.780	3.0	24.0	38.2	13.1	-31.9	0.0	0.7	44.2	54.0	-9.8	V	A	
15.780	3.0	34.3	38.2	13.1	-31.9	0.0	0.7	54.4	74.0	-19.6	H	P	
15.780	3.0	24.0	38.2	13.1	-31.9	0.0	0.7	44.1	54.0	-9.9	H	A	
5300 MHz 11a													
15.900	3.0	34.4	37.8	13.2	-31.8	0.0	0.7	54.2	74.0	-19.8	H	P	
15.900	3.0	24.1	37.8	13.2	-31.8	0.0	0.7	43.9	54.0	-10.1	H	A	
15.900	3.0	34.7	37.8	13.2	-31.8	0.0	0.7	54.5	74.0	-19.5	V	P	
15.900	3.0	24.1	37.8	13.2	-31.8	0.0	0.7	43.9	54.0	-10.1	V	A	
5320 MHz 11a													
15.960	3.0	34.6	37.8	13.2	-31.8	0.0	0.7	54.4	74.0	-19.6	V	P	
15.960	3.0	24.1	37.8	13.2	-31.8	0.0	0.7	43.9	54.0	-10.1	V	A	
15.960	3.0	34.6	37.8	13.2	-31.8	0.0	0.7	54.4	74.0	-19.6	H	P	
15.960	3.0	24.1	37.8	13.2	-31.8	0.0	0.7	43.9	54.0	-10.1	H	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

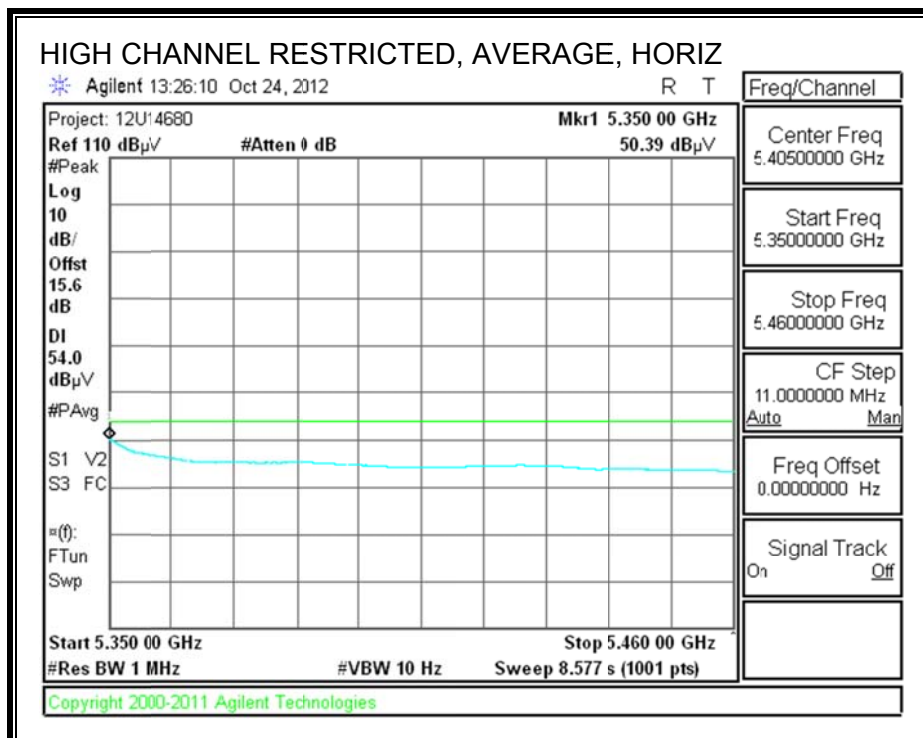
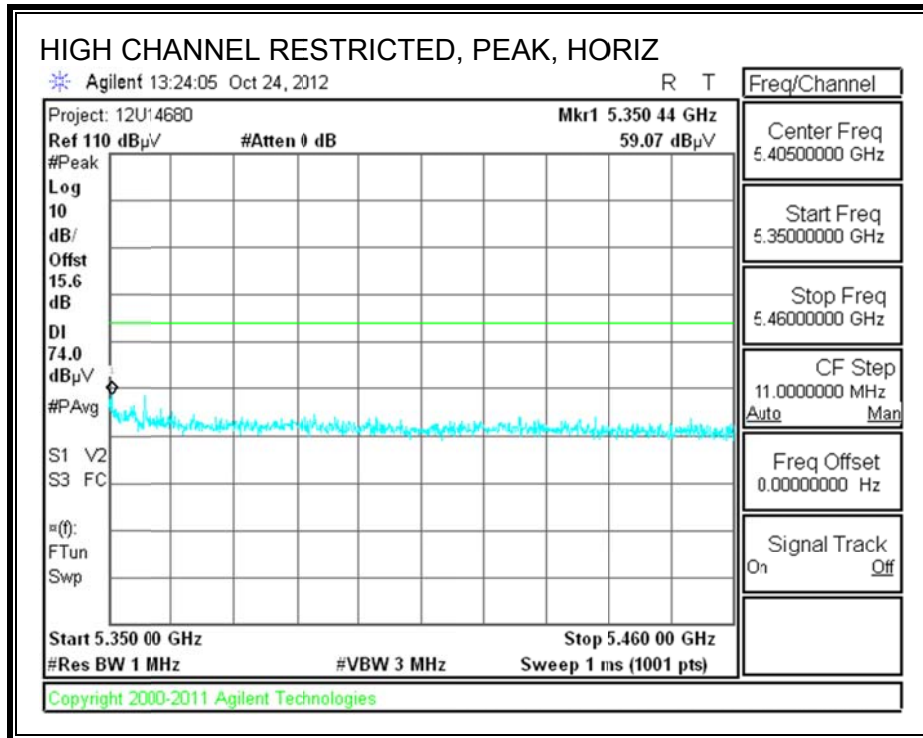
9.6. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND

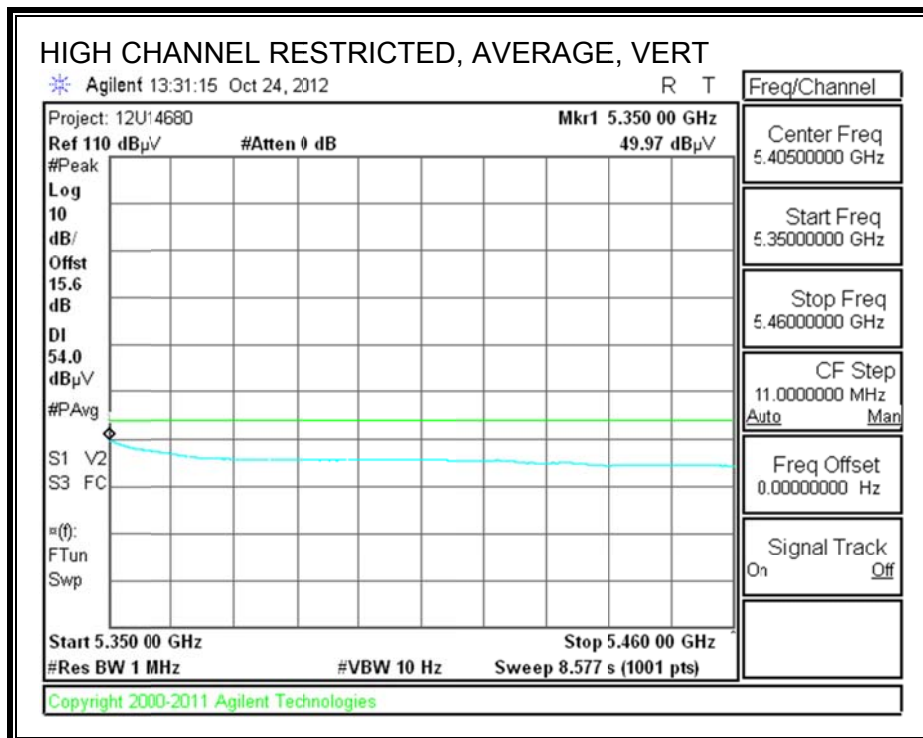
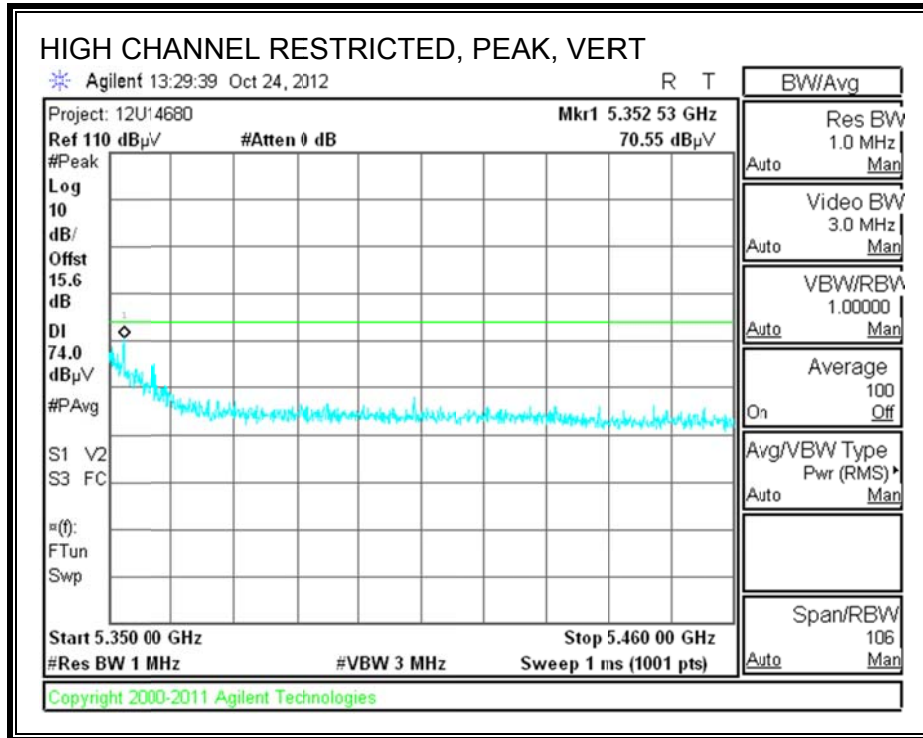
RESTRICTED BANDEDGE (HIGH 1 CHANNEL)





RESTRICTED BANDEDGE (HIGH 2 CHANNEL)



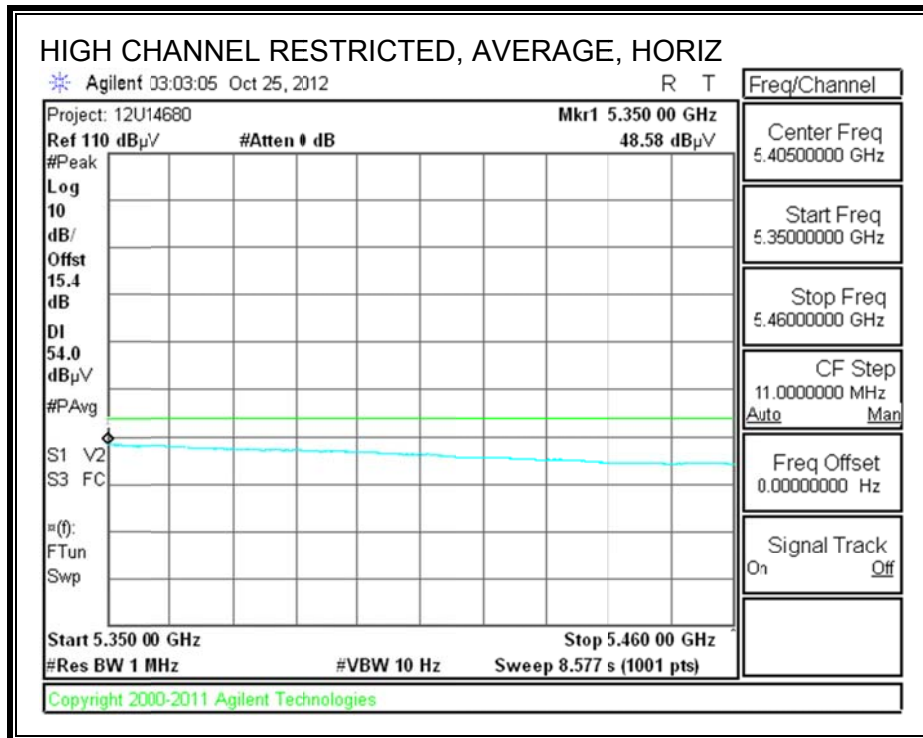
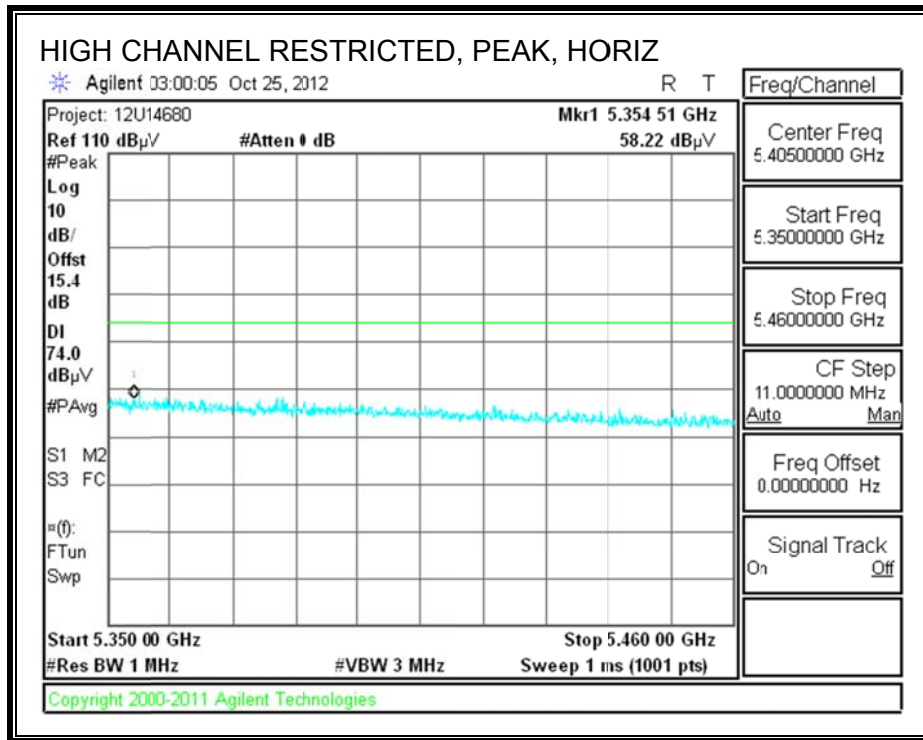


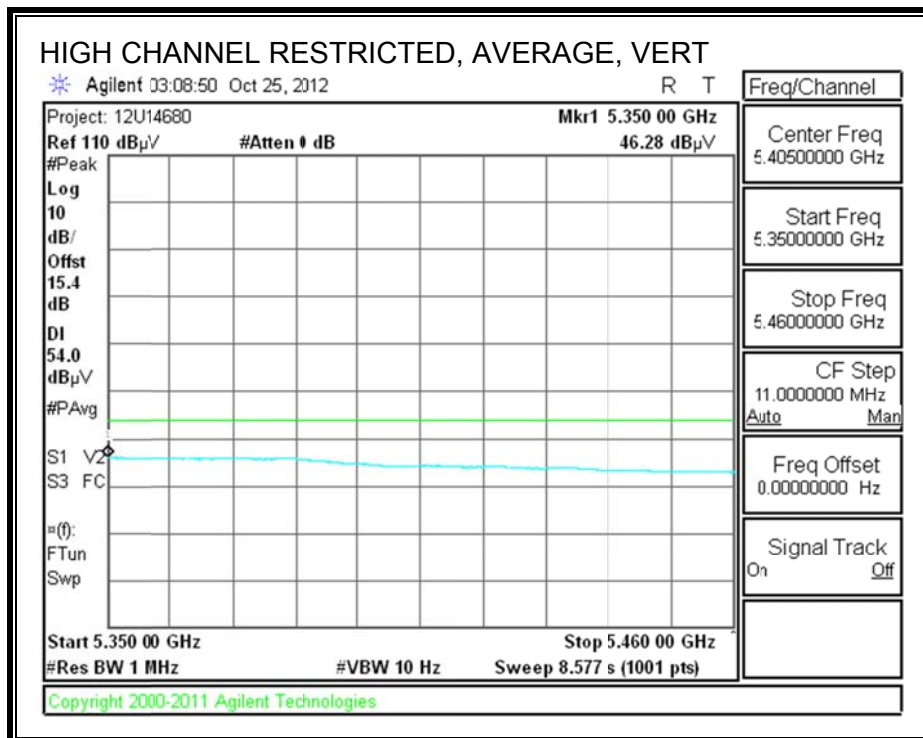
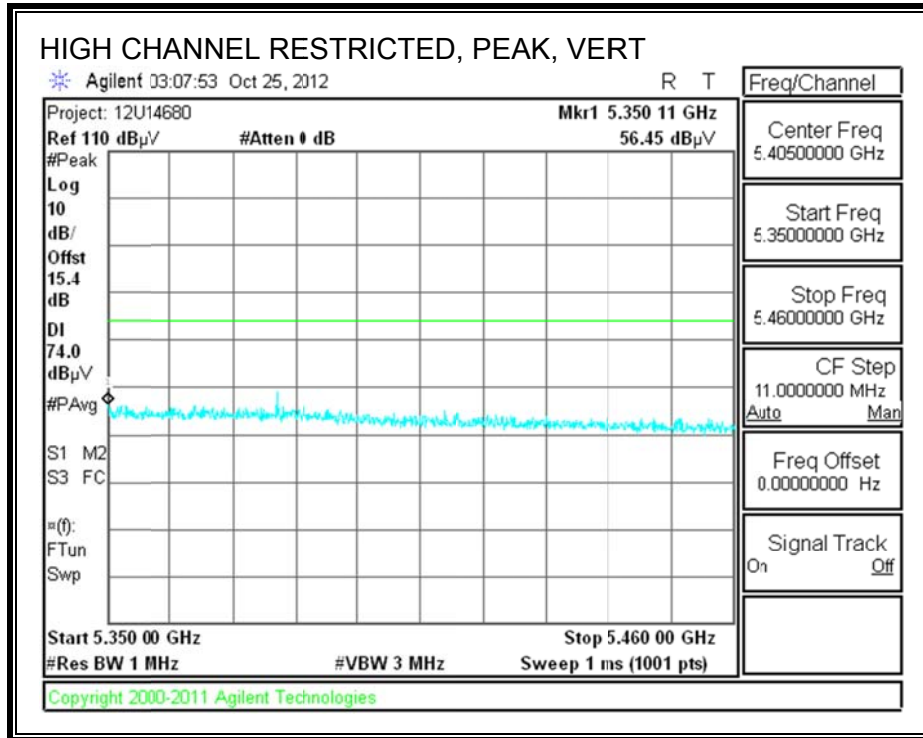
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Tom Chen											
Date:		11/06/12											
Project #:		12U14680											
Company:		Apple											
Test Target:		FCC Class B											
Mode Oper:		802.11n HT20 TX mode											
f	Measurement Frequency	Amp	Preamp Gain					Average Field Strength Limit					
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters					Peak Field Strength Limit					
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m					Margin vs. Average Limit					
AF	Antenna Factor	Peak	Calculated Peak Field Strength					Margin vs. Peak Limit					
CL	Cable Loss	HPF	High Pass Filter										
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/Q/P	Notes
5260 MHz HT20													
15.780	3.0	34.9	38.2	13.1	-31.9	0.0	0.7	55.1	74.0	-18.9	H	P	
15.780	3.0	24.0	38.2	13.1	-31.9	0.0	0.7	44.2	54.0	-9.8	H	A	
15.780	3.0	34.1	38.2	13.1	-31.9	0.0	0.7	54.3	74.0	-19.7	V	P	
15.780	3.0	24.0	38.2	13.1	-31.9	0.0	0.7	44.2	54.0	-9.8	V	A	
5300 MHz HT20													
15.900	3.0	34.4	37.8	13.2	-31.8	0.0	0.7	54.2	74.0	-19.8	H	P	
15.900	3.0	24.2	37.8	13.2	-31.8	0.0	0.7	44.0	54.0	-10.0	H	A	
15.900	3.0	34.6	37.8	13.2	-31.8	0.0	0.7	54.4	74.0	-19.6	V	P	
15.900	3.0	24.2	37.8	13.2	-31.8	0.0	0.7	44.0	54.0	-10.0	V	A	
5320 MHz HT20													
15.960	3.0	35.1	37.6	13.2	-31.8	0.0	0.7	54.7	74.0	-19.3	H	P	
15.960	3.0	24.3	37.6	13.2	-31.8	0.0	0.7	43.9	54.0	-10.1	H	A	
15.960	3.0	34.8	37.6	13.2	-31.8	0.0	0.7	54.4	74.0	-19.6	V	P	
15.960	3.0	24.3	37.6	13.2	-31.8	0.0	0.7	44.0	54.0	-10.0	V	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

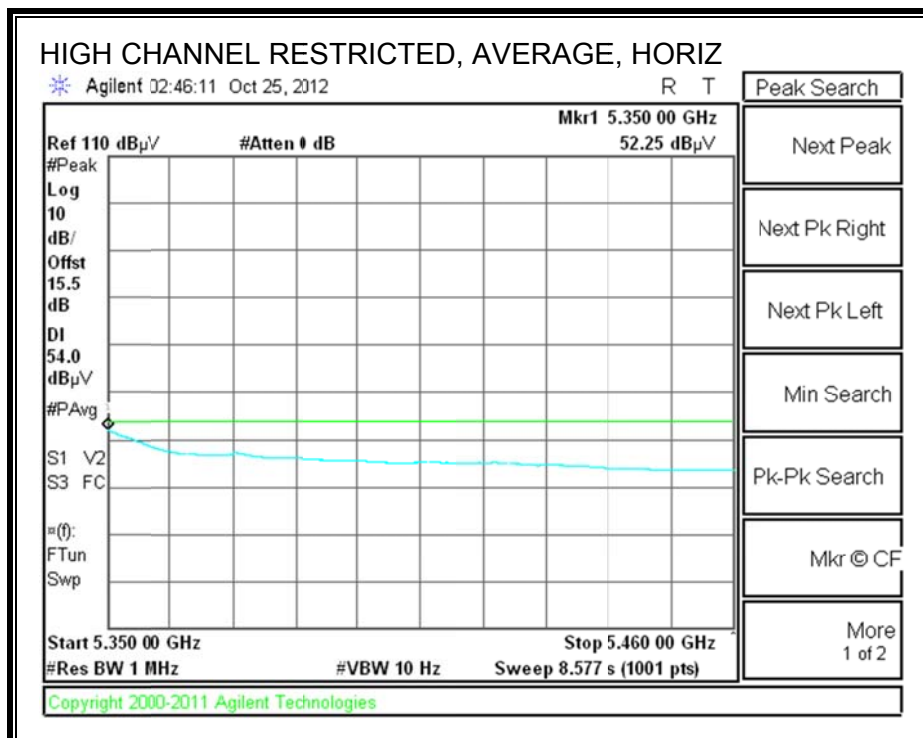
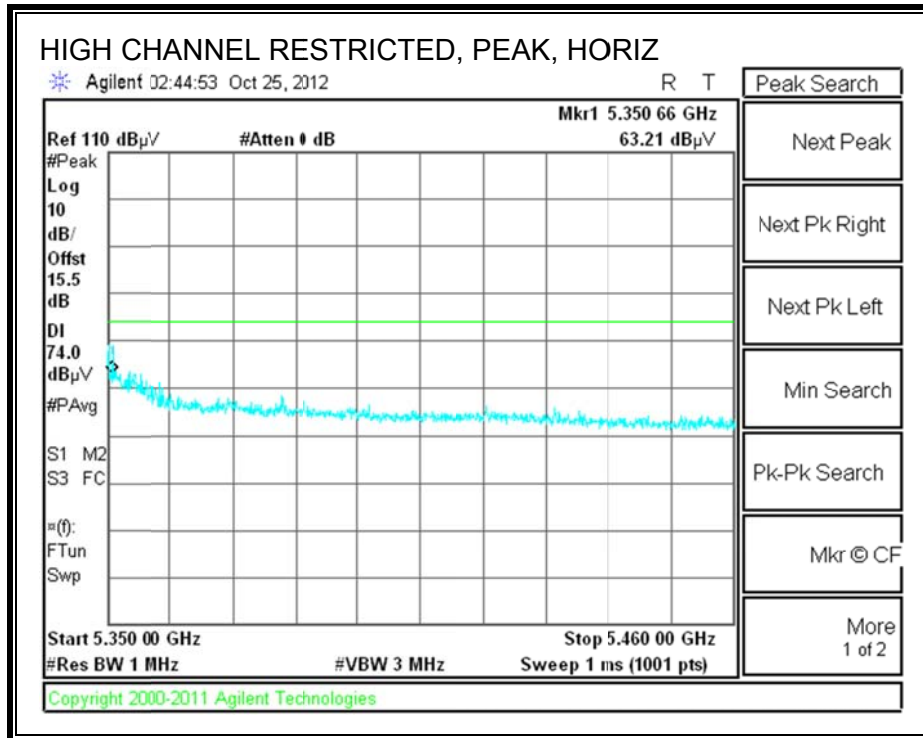
9.7. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND

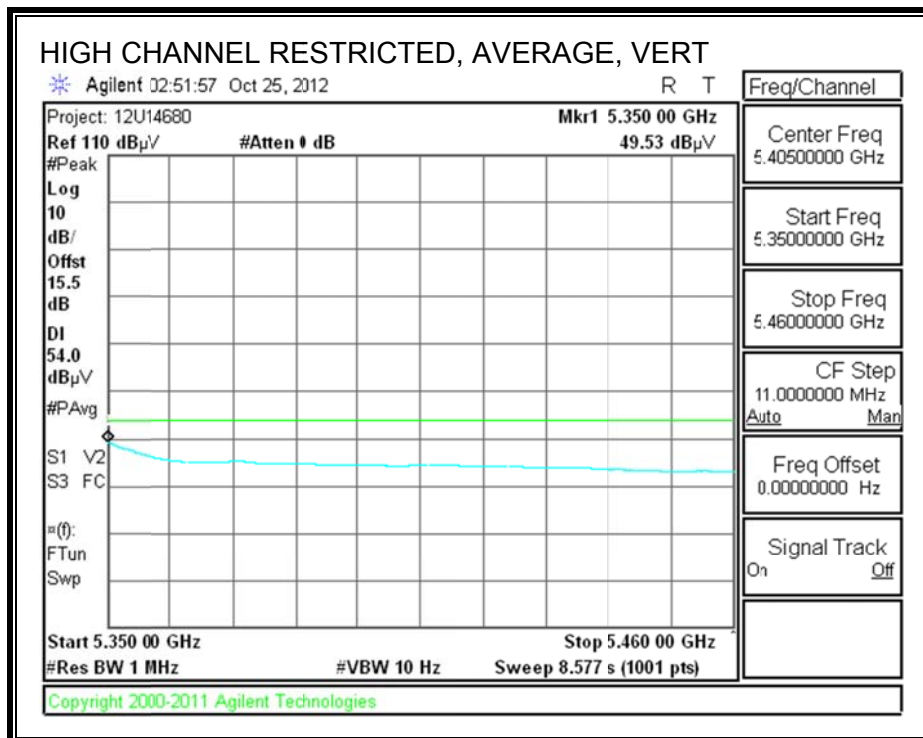
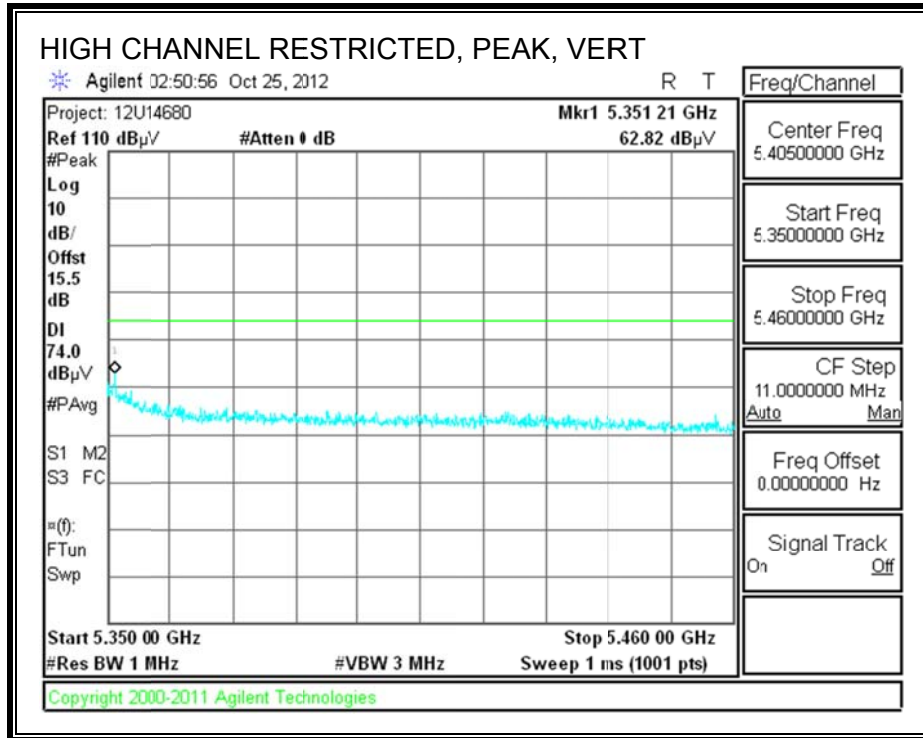
RESTRICTED BANDEDGE (HIGH 1 CHANNEL)





RESTRICTED BANDEDGE (HIGH 2 CHANNEL)



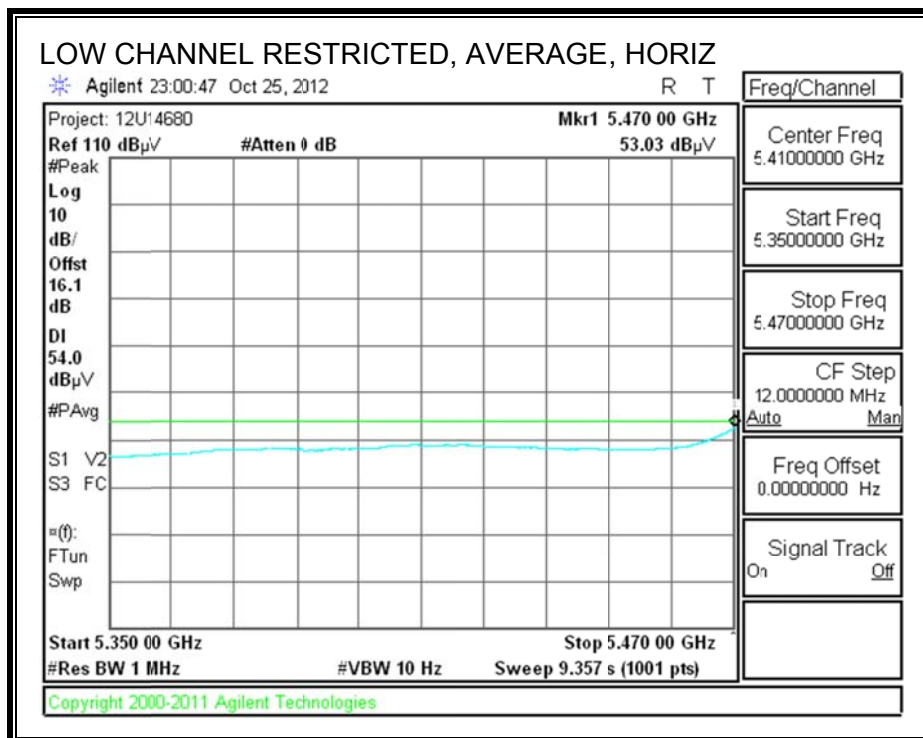
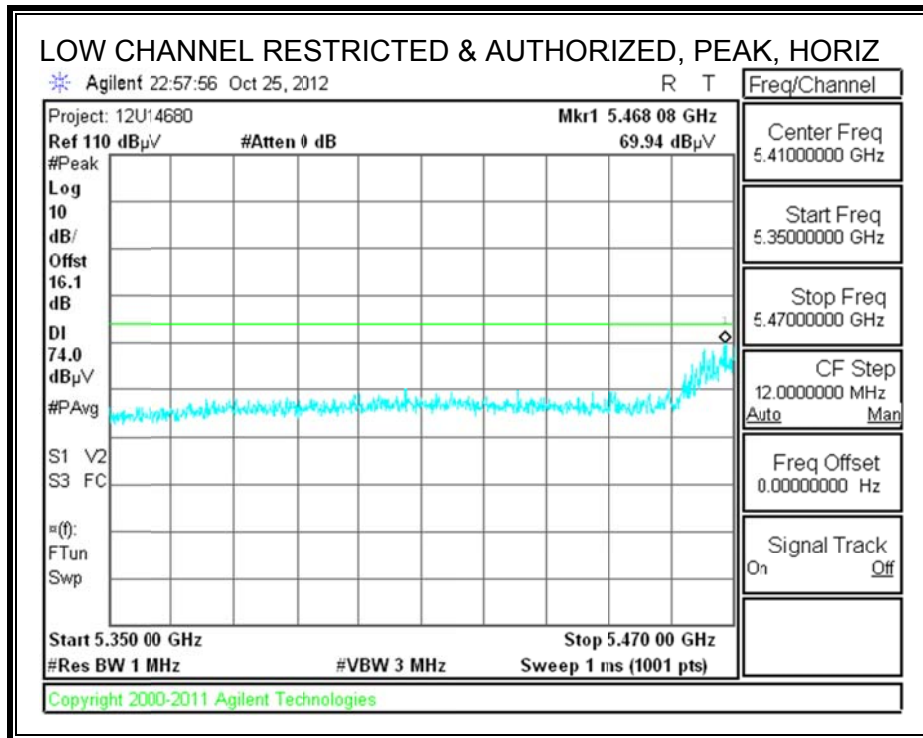


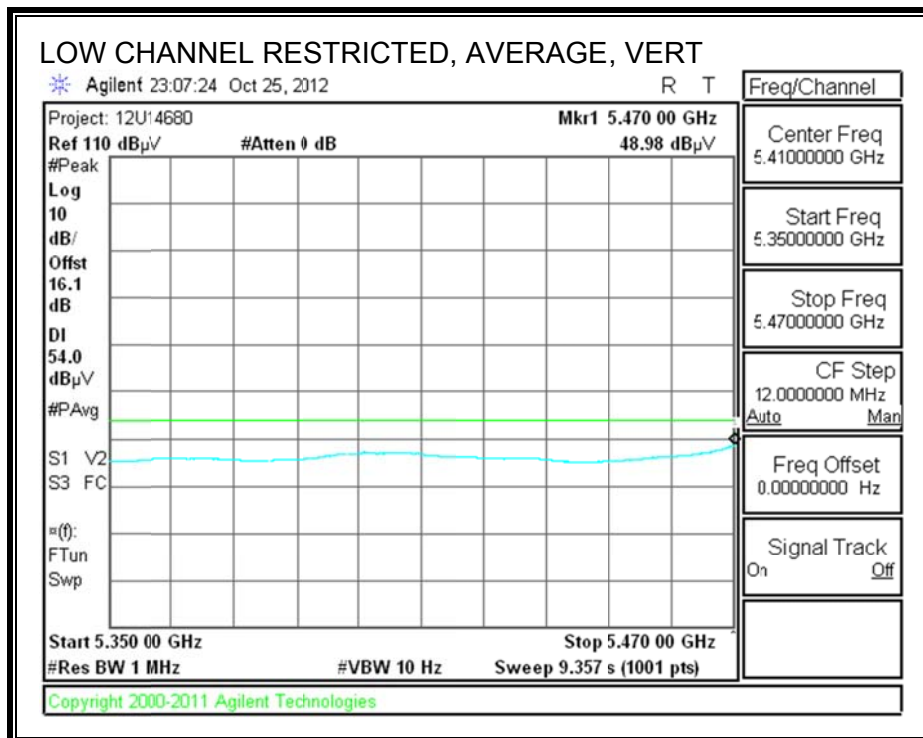
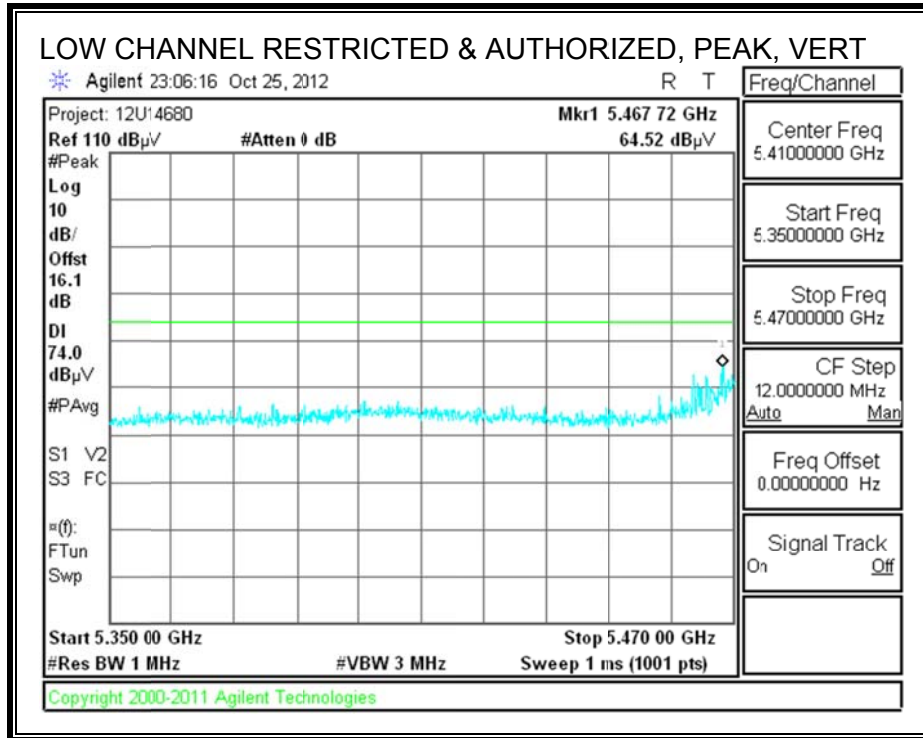
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Tom Chen											
Date:		11/06/12											
Project #:		12U14680											
Company:		Apple											
Test Target:		FCC Class B											
Mode Oper:		802.11n HT40 TX mode											
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit									
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit									
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit									
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit									
CL	Cable Loss	HPF	High Pass Filter										
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/Q/P	Notes
5270MHz HT40													
15.810	3.0	34.0	38.1	13.1	-31.9	0.0	0.7	54.1	74.0	-19.9	H	P	
15.810	3.0	24.1	38.1	13.1	-31.9	0.0	0.7	44.1	54.0	-9.9	H	A	
5270MHz HT40													
15.810	3.0	34.4	38.1	13.1	-31.9	0.0	0.7	54.4	74.0	-19.6	V	P	
15.810	3.0	24.0	38.1	13.1	-31.9	0.0	0.7	44.1	54.0	-9.9	V	A	
5310MHz HT40													
15.930	3.0	34.8	37.7	13.2	-31.8	0.0	0.7	54.6	74.0	-19.4	H	P	
15.930	3.0	24.3	37.7	13.2	-31.8	0.0	0.7	44.0	54.0	-10.0	H	A	
5310MHz HT40													
15.930	3.0	35.0	37.7	13.2	-31.8	0.0	0.7	54.8	74.0	-19.2	V	P	
15.930	3.0	24.3	37.7	13.2	-31.8	0.0	0.7	44.0	54.0	-10.0	V	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

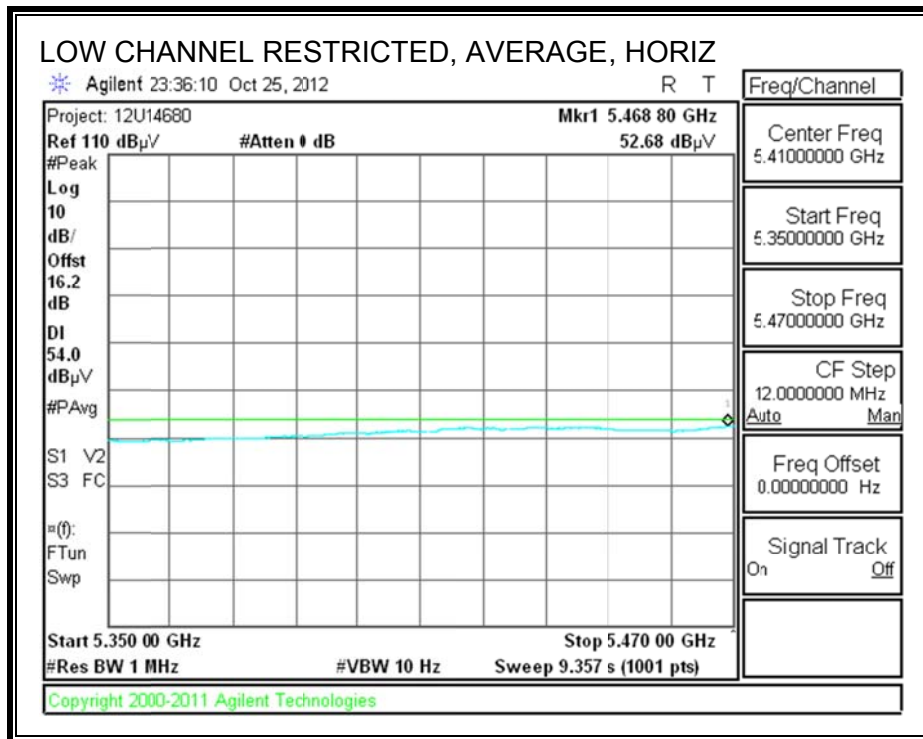
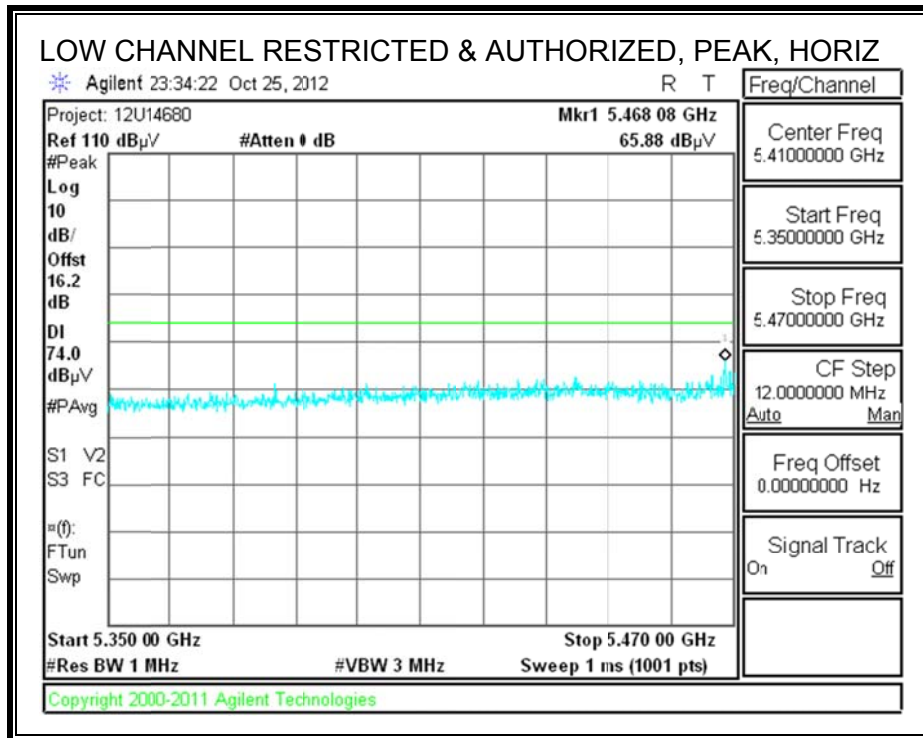
9.8. TX ABOVE 1 GHz 802.11a MODE IN THE 5.6 GHz BAND

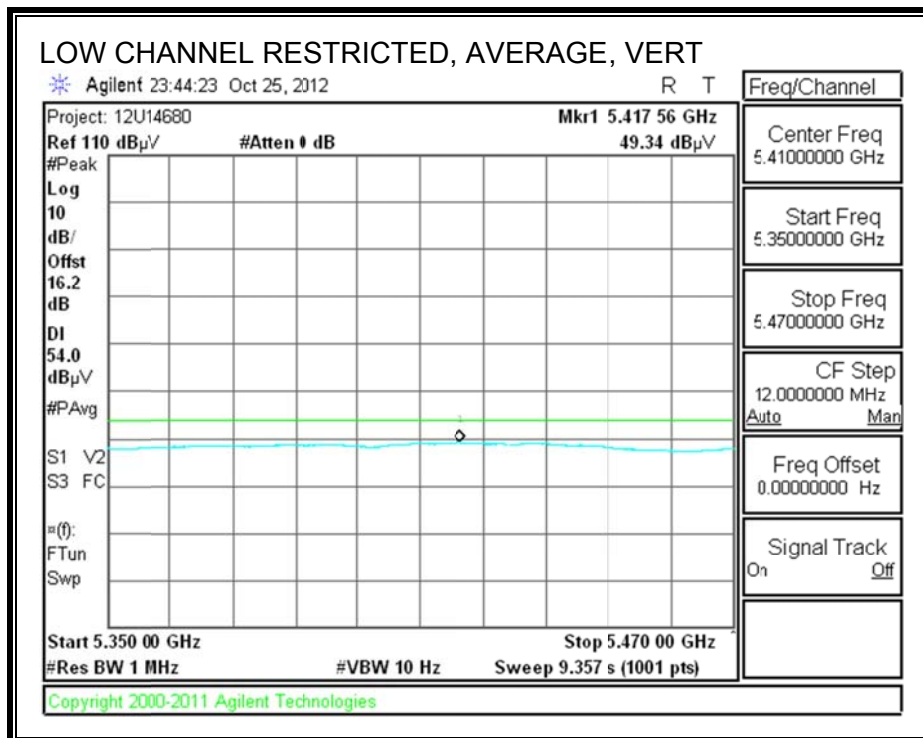
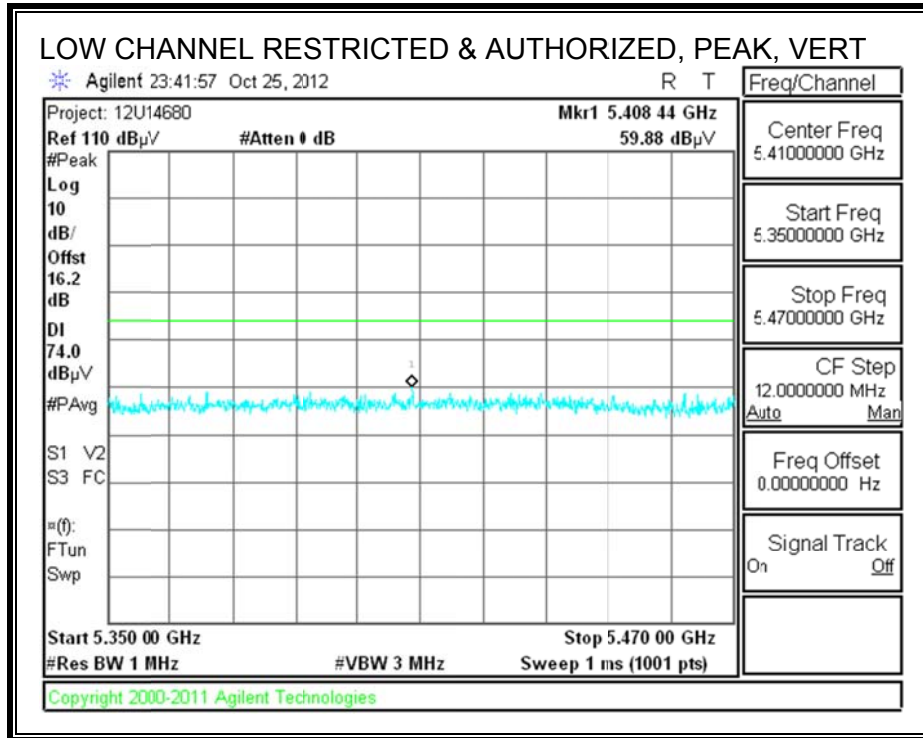
RESTRICTED & AUTHORIZED BANDEDGE (LOW 1 CHANNEL)



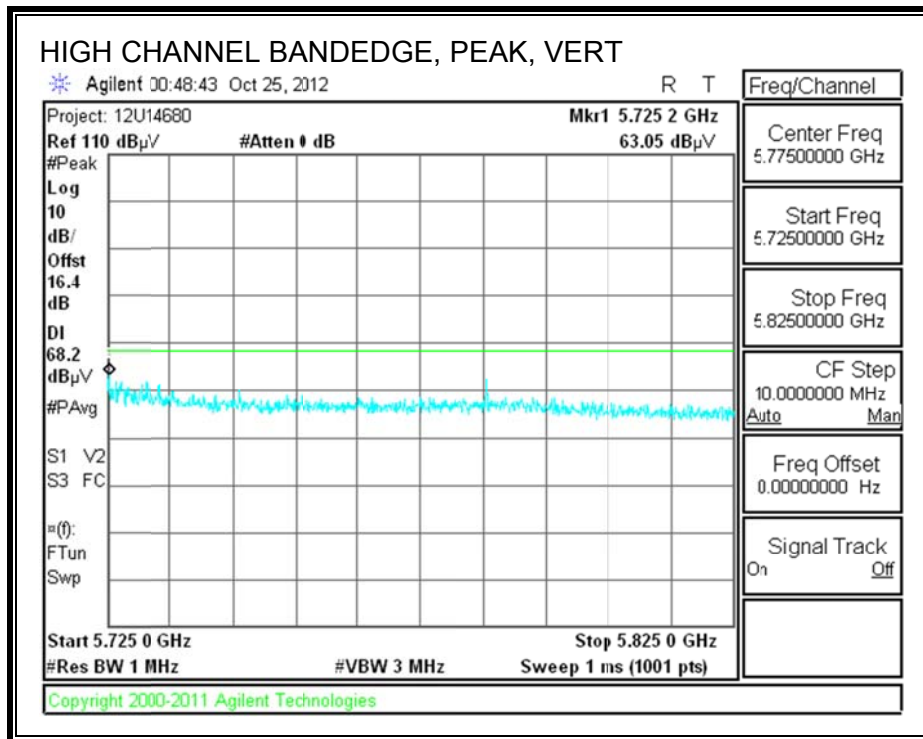
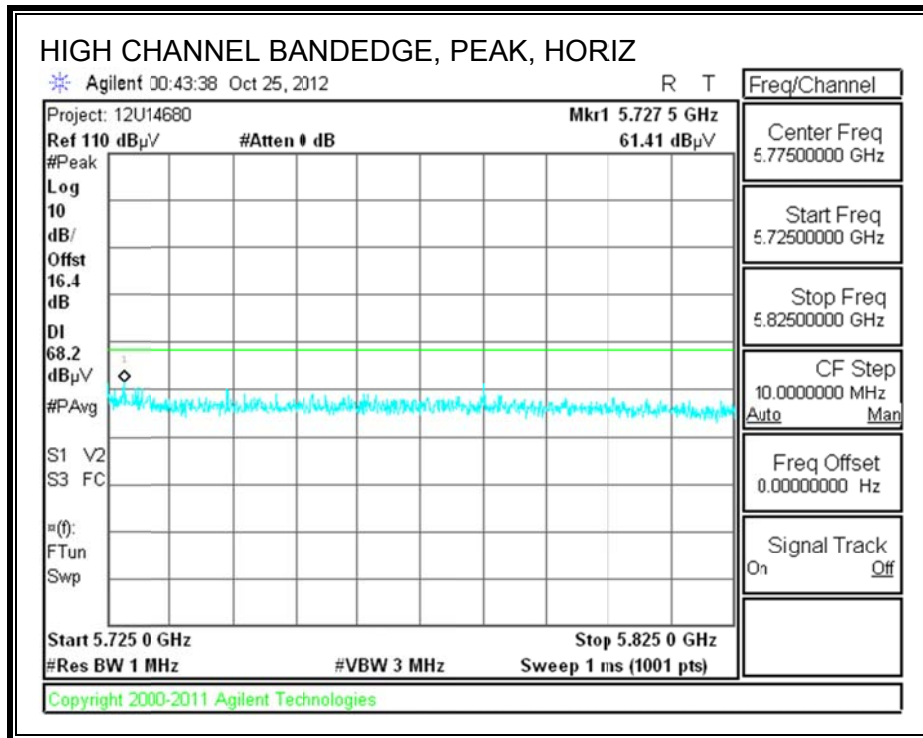


RESTRICTED & AUTHORIZED BANDEGE (LOW 2 CHANNEL)

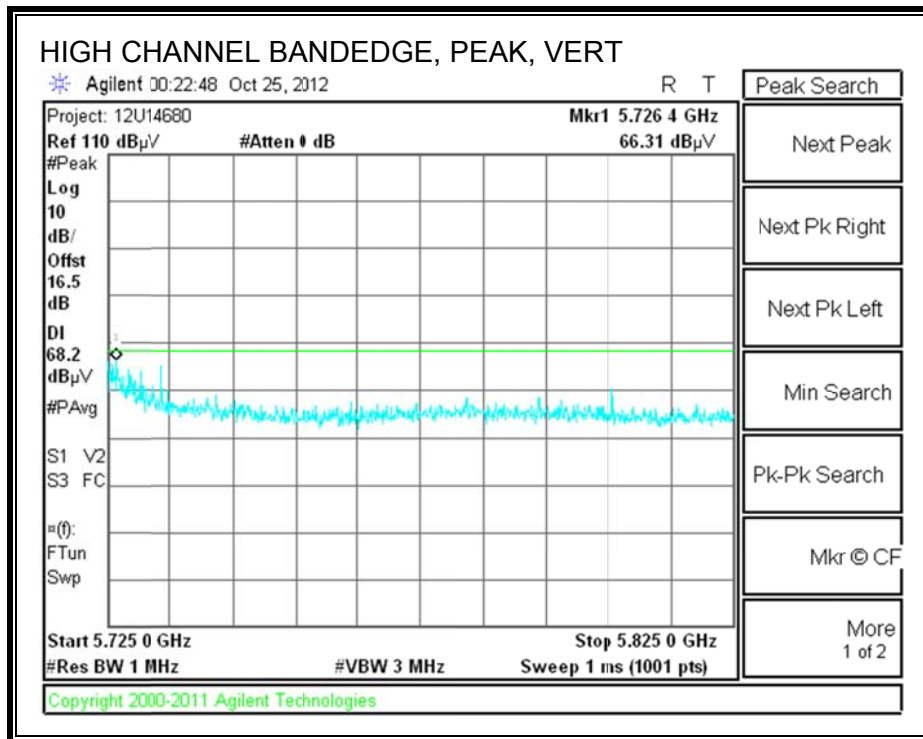
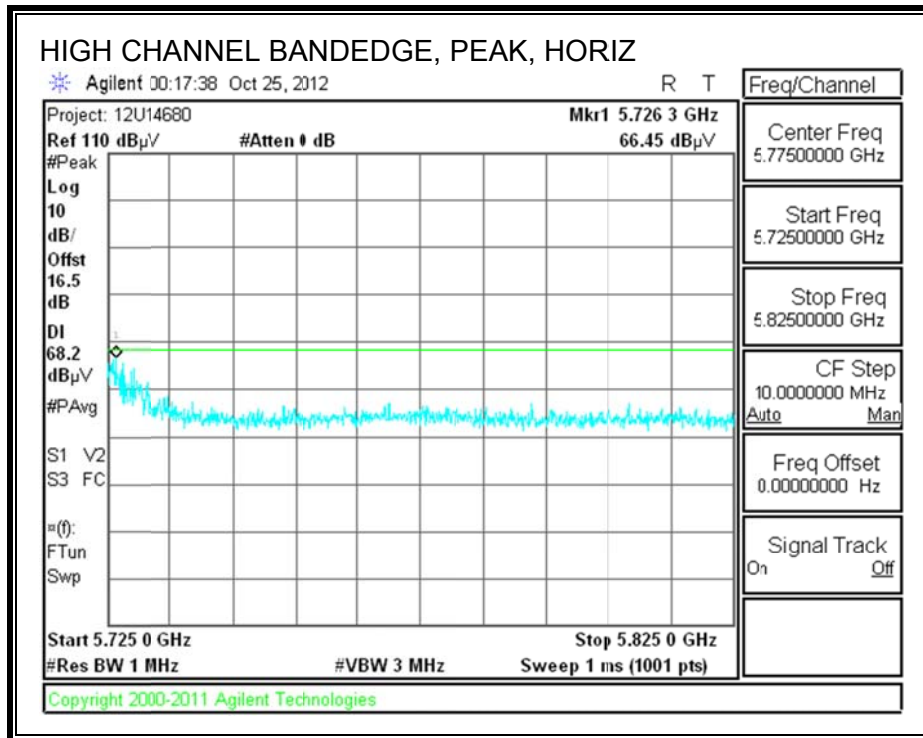




AUTHORIZED BANDEDGE (HIGH 1 CHANNEL)



AUTHORIZED BANDEDGE (HIGH 2 CHANNEL)

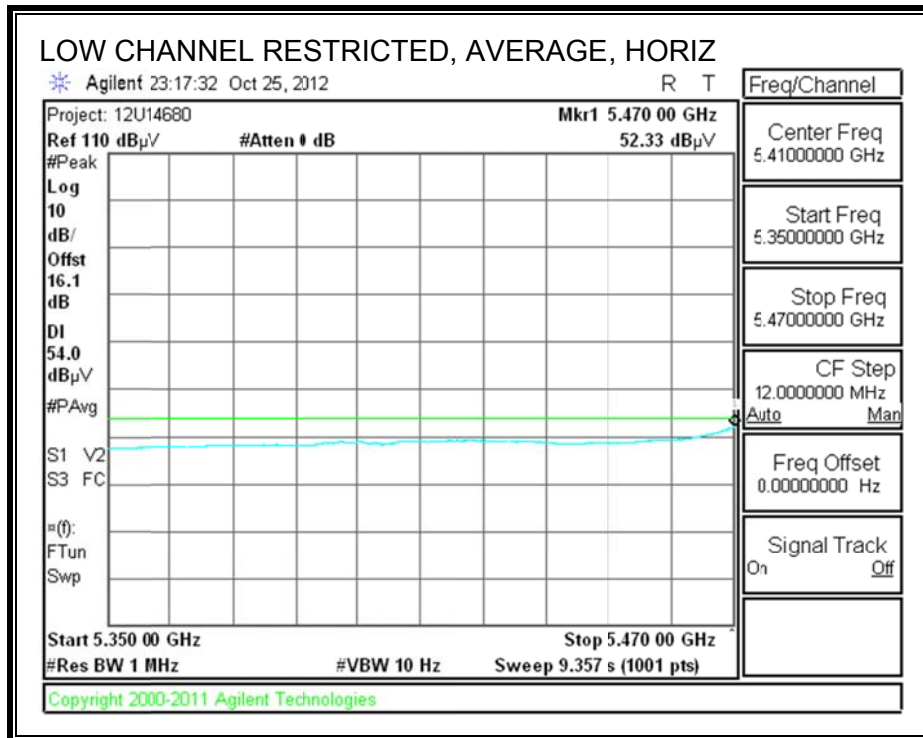
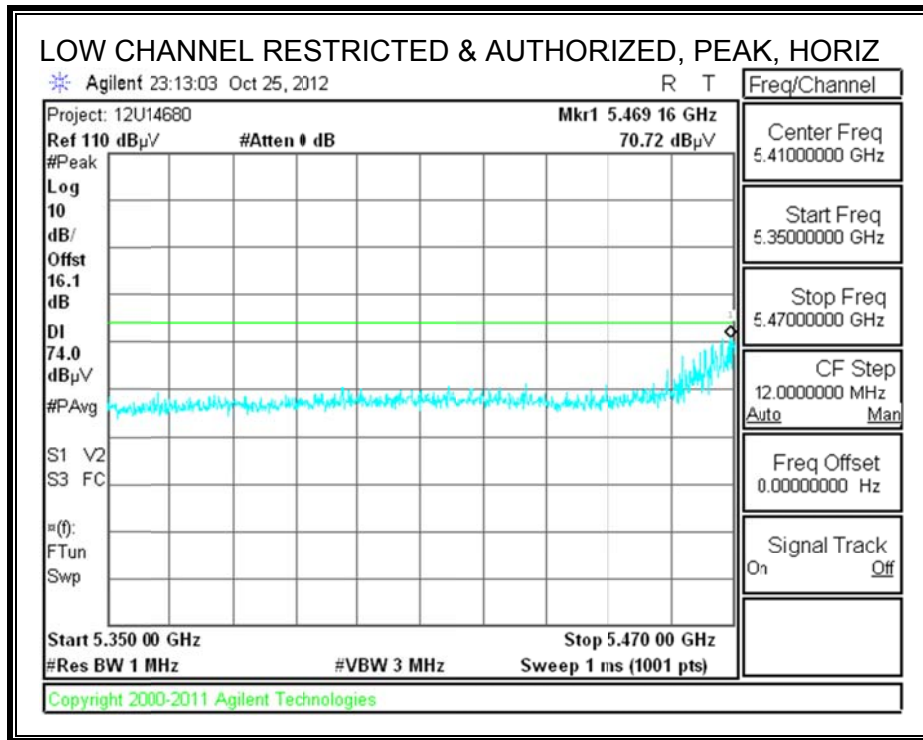


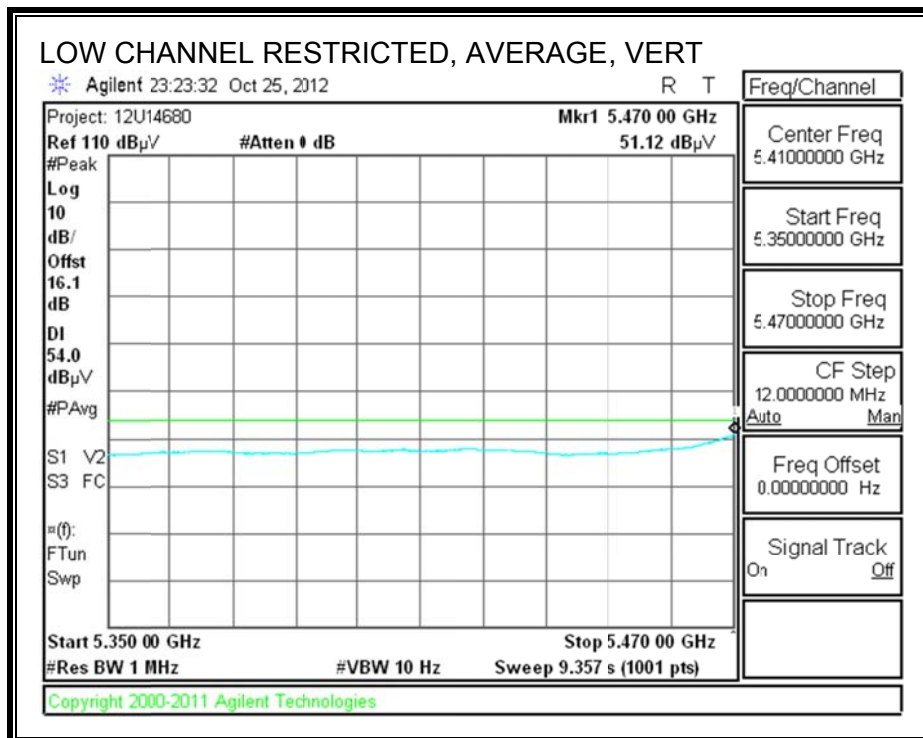
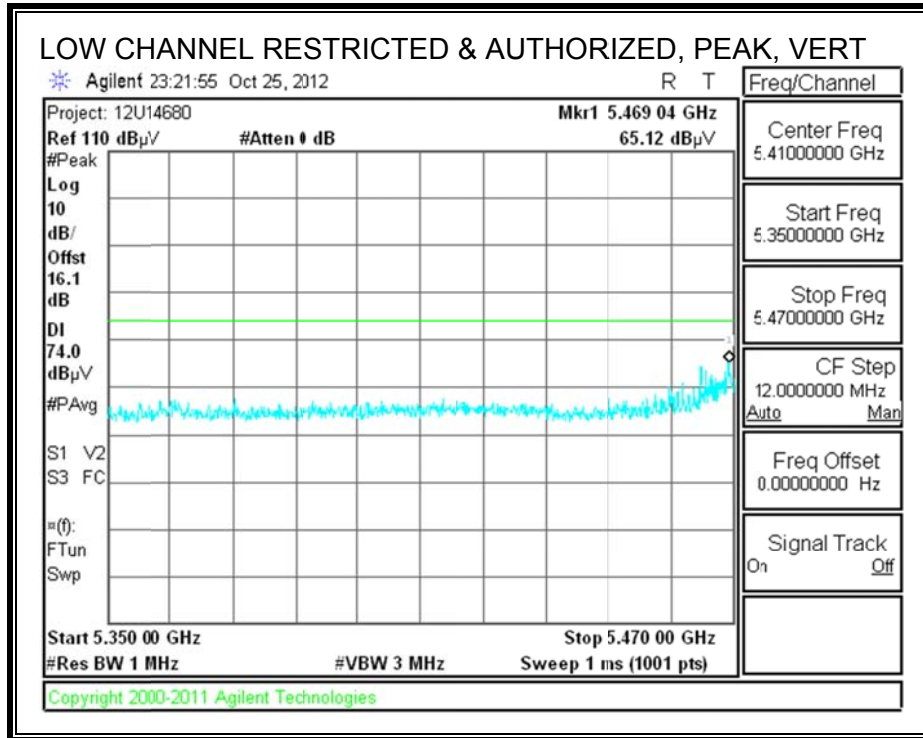
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Tom Chen											
Date:		11/06/12											
Project #:		12U14680											
Company:		Apple											
Test Target:		FCC Class B											
Mode Oper:		802.11a TX mode											
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit									
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit									
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit									
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit									
CL	Cable Loss	HPF	High Pass Filter										
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/Q/P	Notes
5500 MHz 11a													
11.000	3.0	34.8	38.4	10.5	-33.6	0.0	0.7	50.8	74.0	-23.2	H	P	
11.000	3.0	24.5	38.4	10.5	-33.6	0.0	0.7	40.5	54.0	-13.5	H	A	
11.000	3.0	35.3	38.4	10.5	-33.6	0.0	0.7	51.3	74.0	-22.7	V	P	
11.000	3.0	24.8	38.4	10.5	-33.6	0.0	0.7	40.8	54.0	-13.2	V	A	
5580 MHz 11a													
11.160	3.0	34.5	38.5	10.7	-33.4	0.0	0.7	51.0	74.0	-23.0	H	P	
11.160	3.0	24.1	38.5	10.7	-33.4	0.0	0.7	40.7	54.0	-13.3	H	A	
11.160	3.0	37.0	38.5	10.7	-33.4	0.0	0.7	53.6	74.0	-20.4	V	P	
11.160	3.0	25.8	38.5	10.7	-33.4	0.0	0.7	42.3	54.0	-11.7	V	A	
5700 MHz 11a													
11.400	3.0	35.7	38.8	11.1	-33.2	0.0	0.7	53.1	74.0	-20.9	V	P	
11.400	3.0	24.2	38.8	11.1	-33.2	0.0	0.7	41.6	54.0	-12.4	V	A	
11.400	3.0	33.9	38.8	11.1	-33.2	0.0	0.7	51.3	74.0	-22.7	H	P	
11.400	3.0	23.7	38.8	11.1	-33.2	0.0	0.7	41.1	54.0	-12.9	H	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

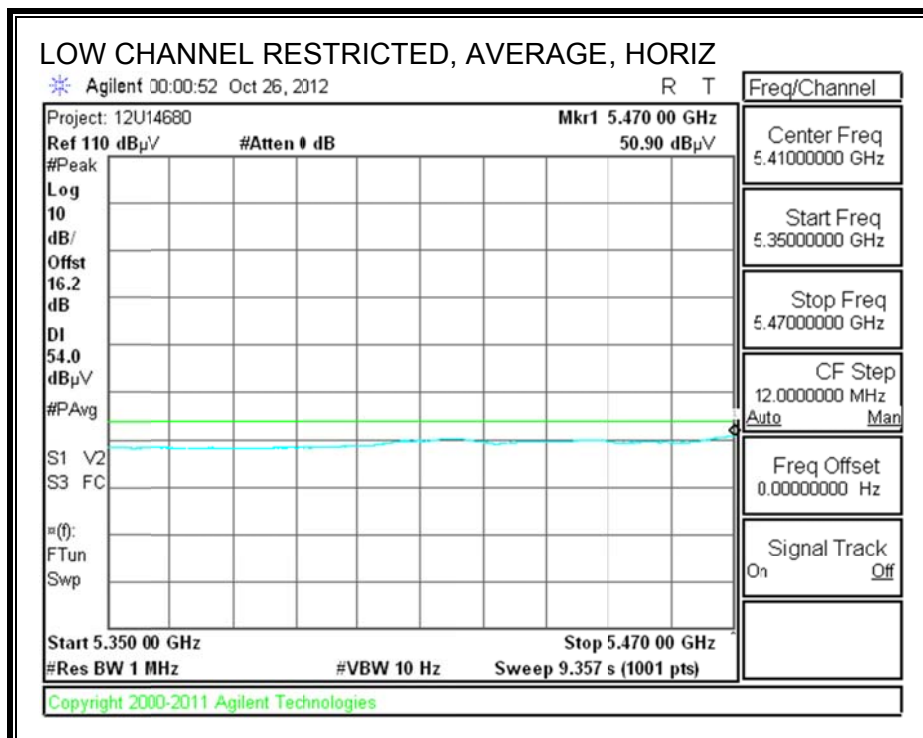
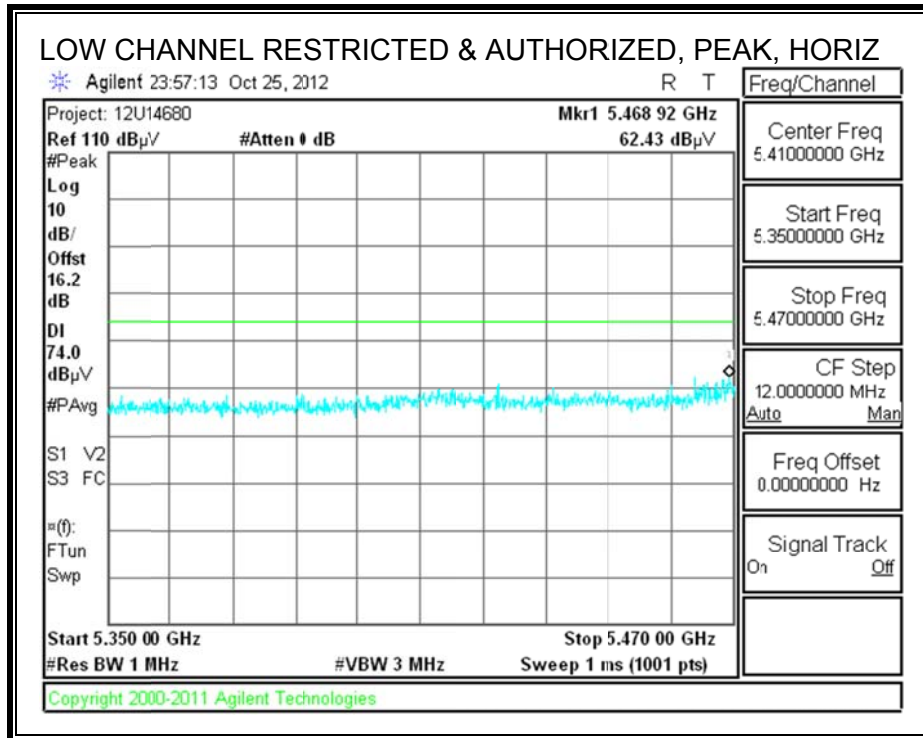
9.9. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.6 GHz BAND

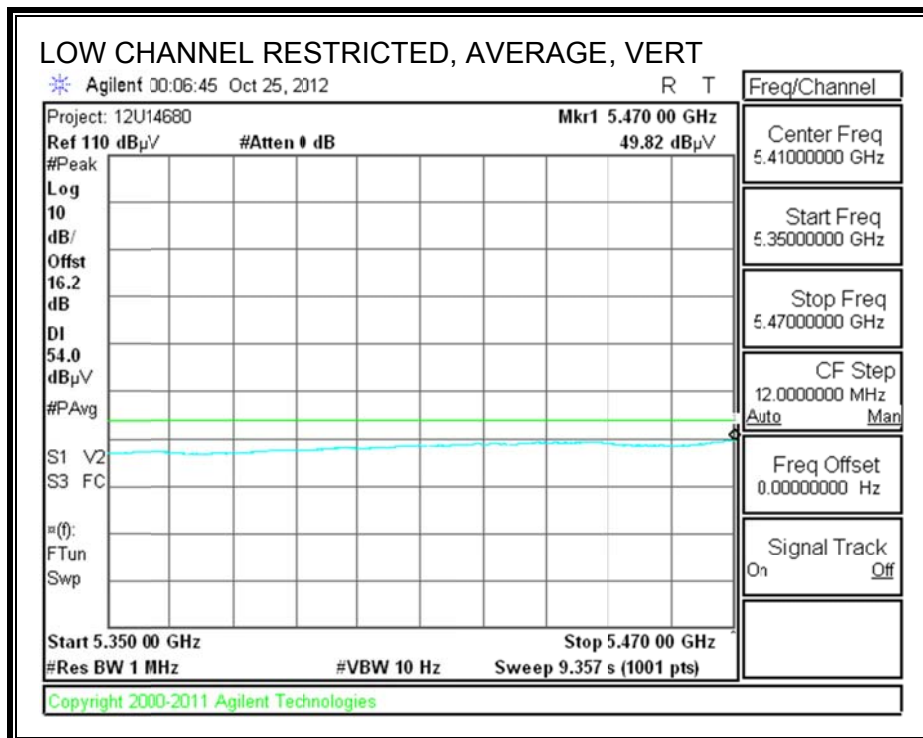
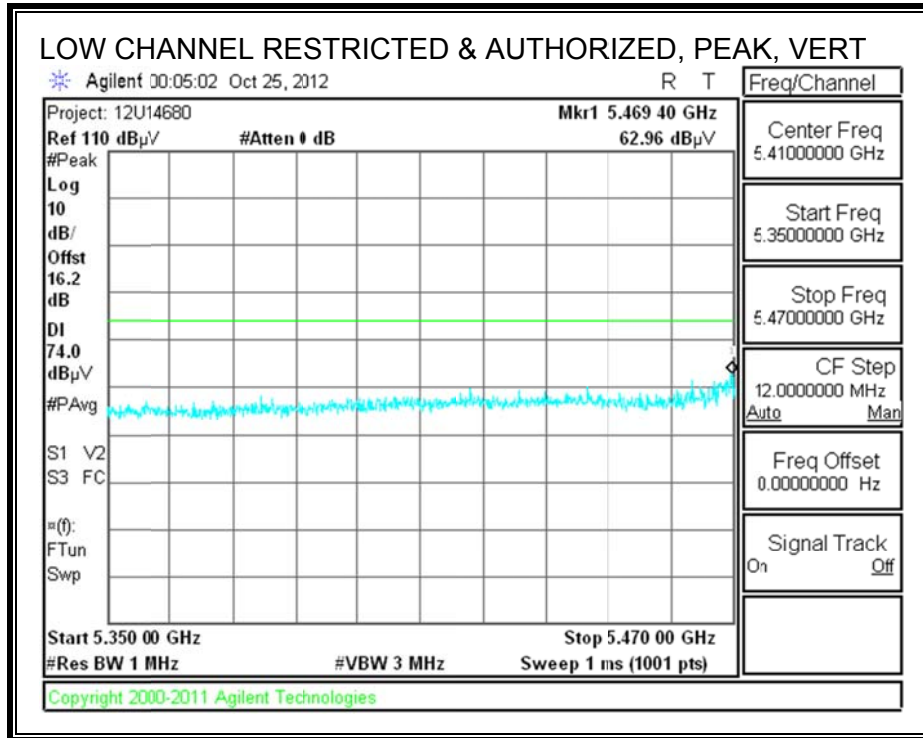
RESTRICTED & AUTHORIZED BANDEDGE (LOW 1 CHANNEL)



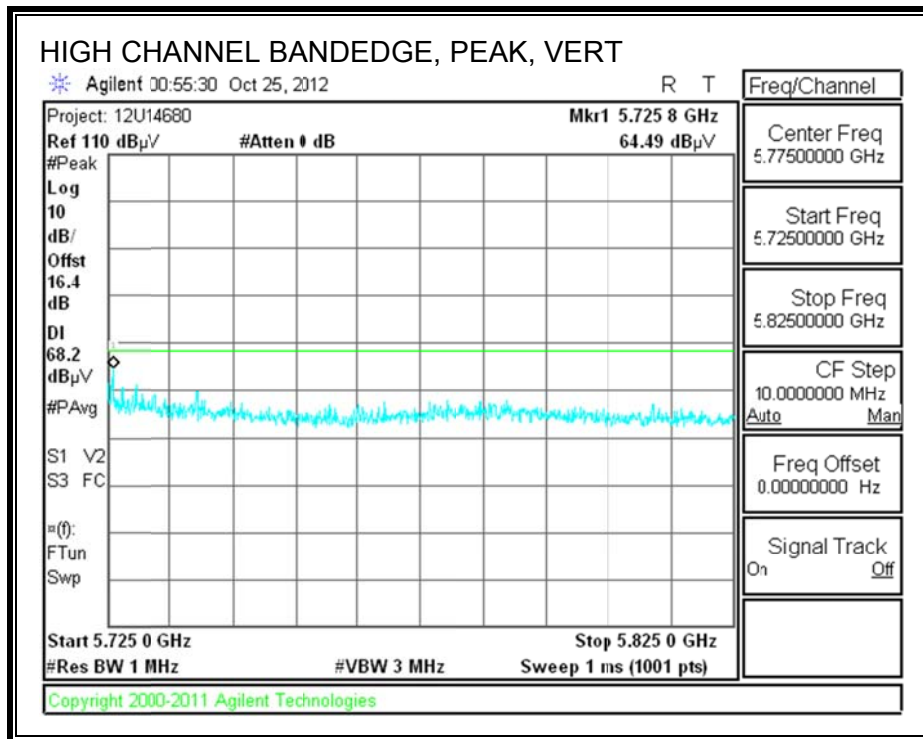
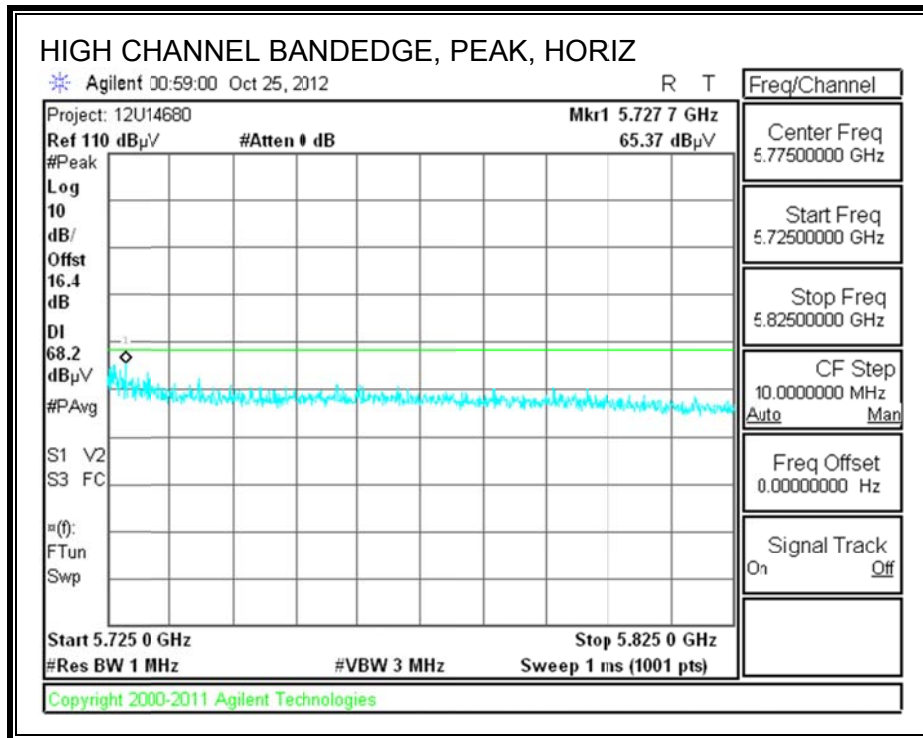


RESTRICTED & AUTHORIZED BANDEGE (LOW 2 CHANNEL)

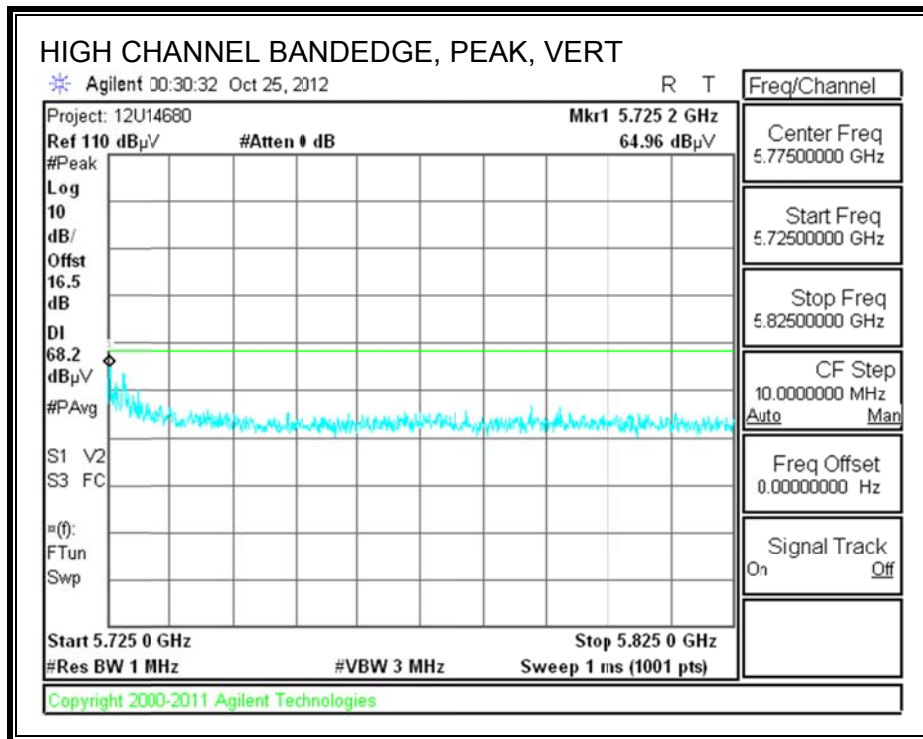
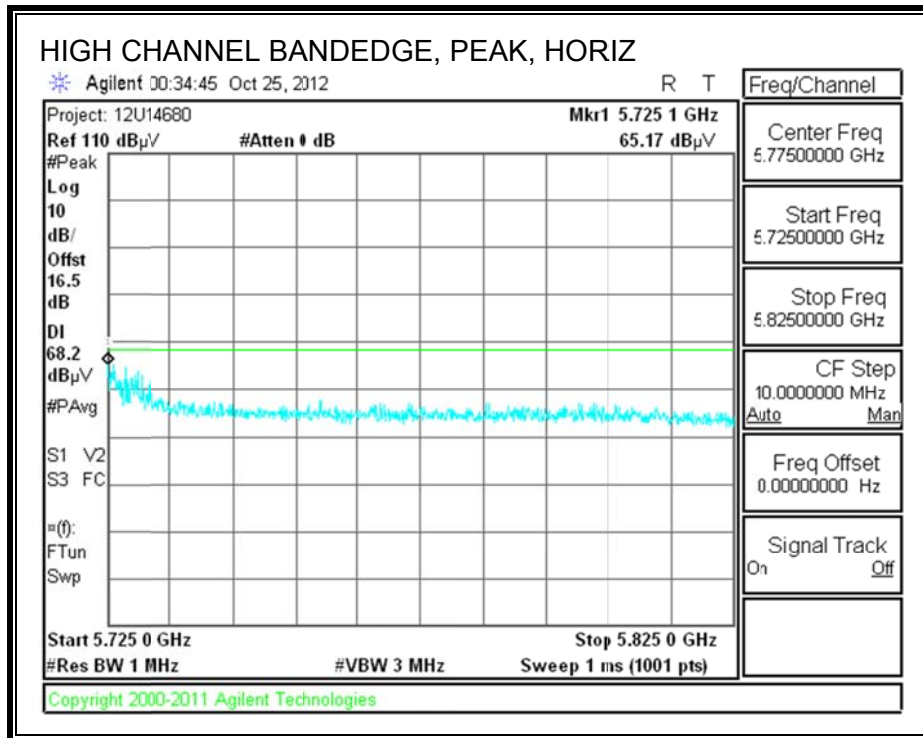




AUTHORIZED BANDEDGE (HIGH 1 CHANNEL)



AUTHORIZED BANDEDGE (HIGH 2 CHANNEL)

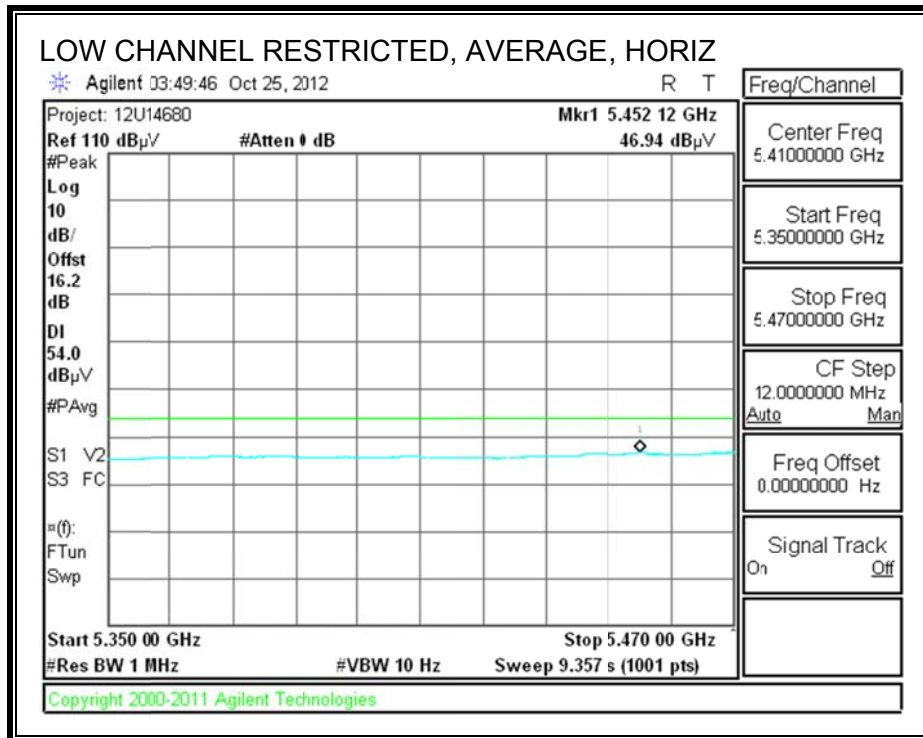
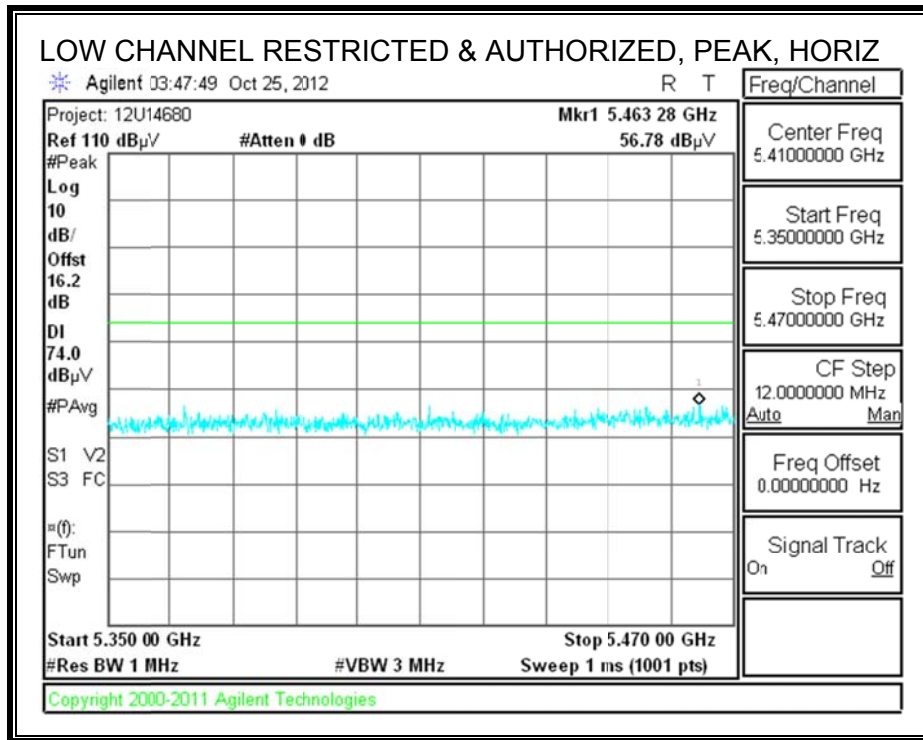


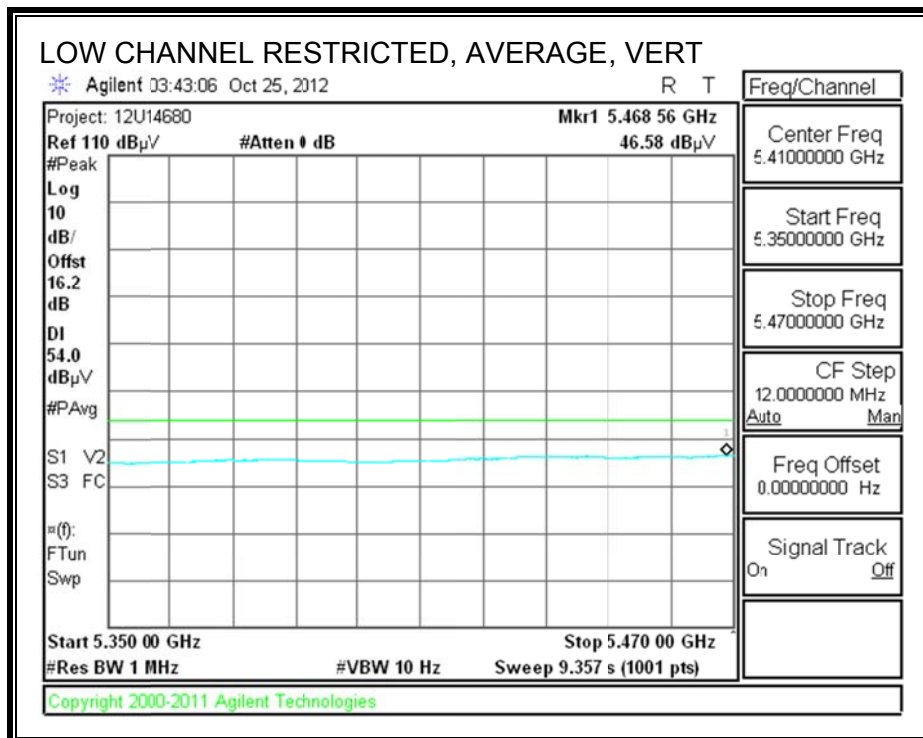
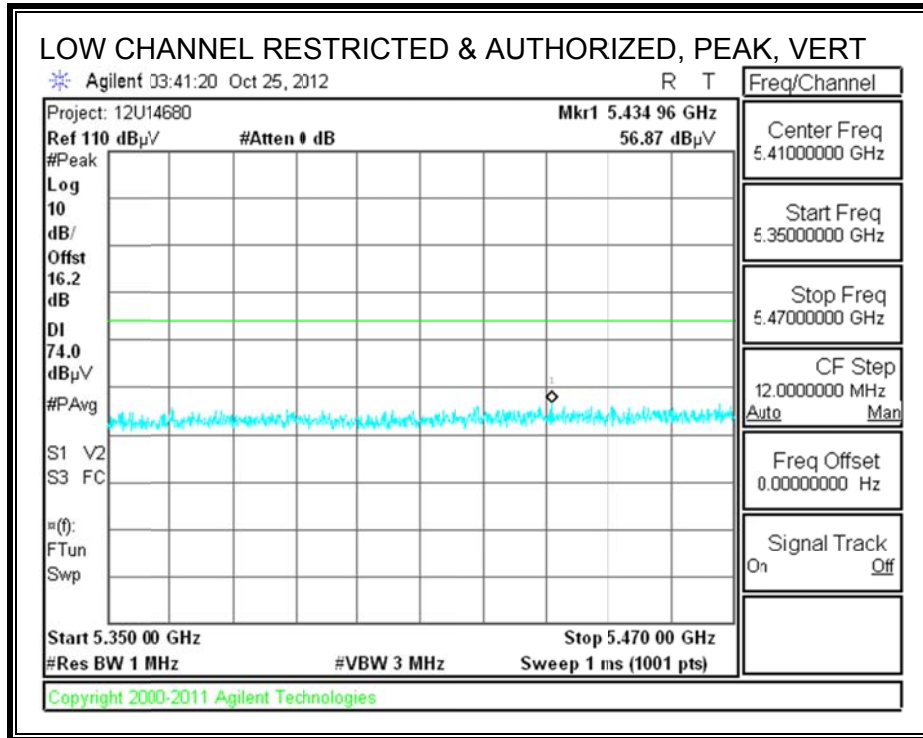
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Tom Chen											
Date:		11/06/12											
Project #:		12U14680											
Company:		Apple											
Test Target:		FCC Class B											
Mode Oper:		802.11n HT20 TX mode											
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit									
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit									
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit									
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit									
CL	Cable Loss	HPF	High Pass Filter										
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/Q/P	Notes
5500 MHz HT20													
11.000	3.0	34.1	38.4	10.5	-33.6	0.0	0.7	50.2	74.0	-23.8	H	P	
11.000	3.0	24.3	38.4	10.5	-33.6	0.0	0.7	40.4	54.0	-13.6	H	A	
11.000	3.0	35.3	38.4	10.5	-33.6	0.0	0.7	51.4	74.0	-22.6	V	P	
11.000	3.0	25.5	38.4	10.5	-33.6	0.0	0.7	41.6	54.0	-12.4	V	A	
5580 MHz HT20													
11.160	3.0	34.4	38.5	10.7	-33.4	0.0	0.7	50.9	74.0	-23.1	H	P	
11.160	3.0	24.0	38.5	10.7	-33.4	0.0	0.7	40.6	54.0	-13.4	H	A	
11.160	3.0	35.2	38.5	10.7	-33.4	0.0	0.7	51.8	74.0	-22.2	V	P	
11.160	3.0	25.4	38.5	10.7	-33.4	0.0	0.7	42.0	54.0	-12.1	V	A	
5700 MHz HT20													
11.400	3.0	34.0	38.8	11.1	-33.2	0.0	0.7	51.4	74.0	-22.6	H	P	
11.400	3.0	23.7	38.8	11.1	-33.2	0.0	0.7	41.1	54.0	-12.9	H	A	
11.400	3.0	34.7	38.8	11.1	-33.2	0.0	0.7	52.1	74.0	-21.9	V	P	
11.400	3.0	23.9	38.8	11.1	-33.2	0.0	0.7	41.3	54.0	-12.7	V	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

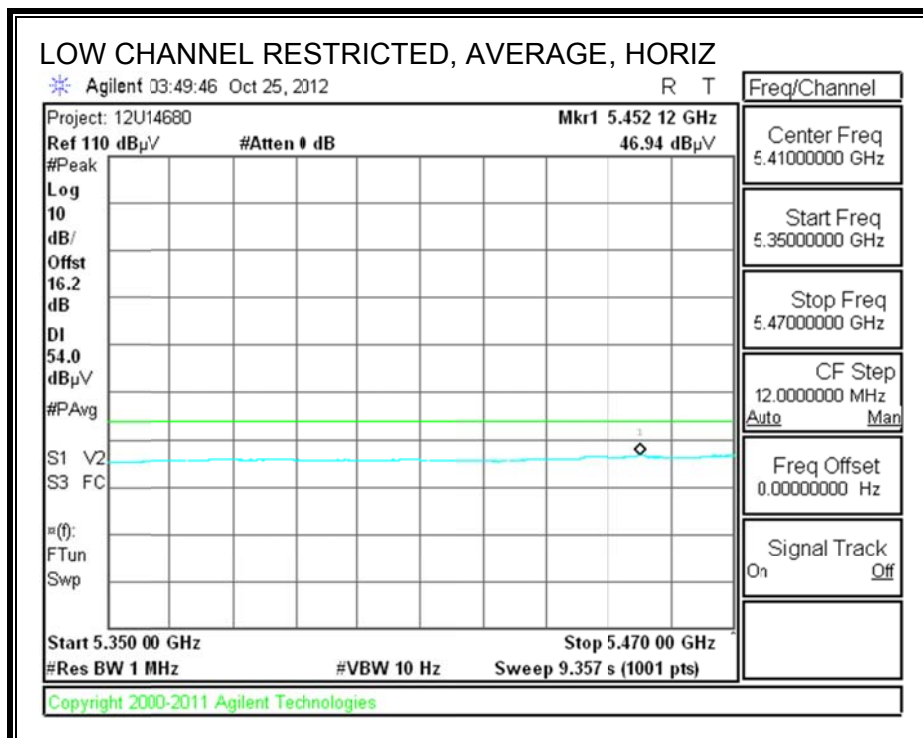
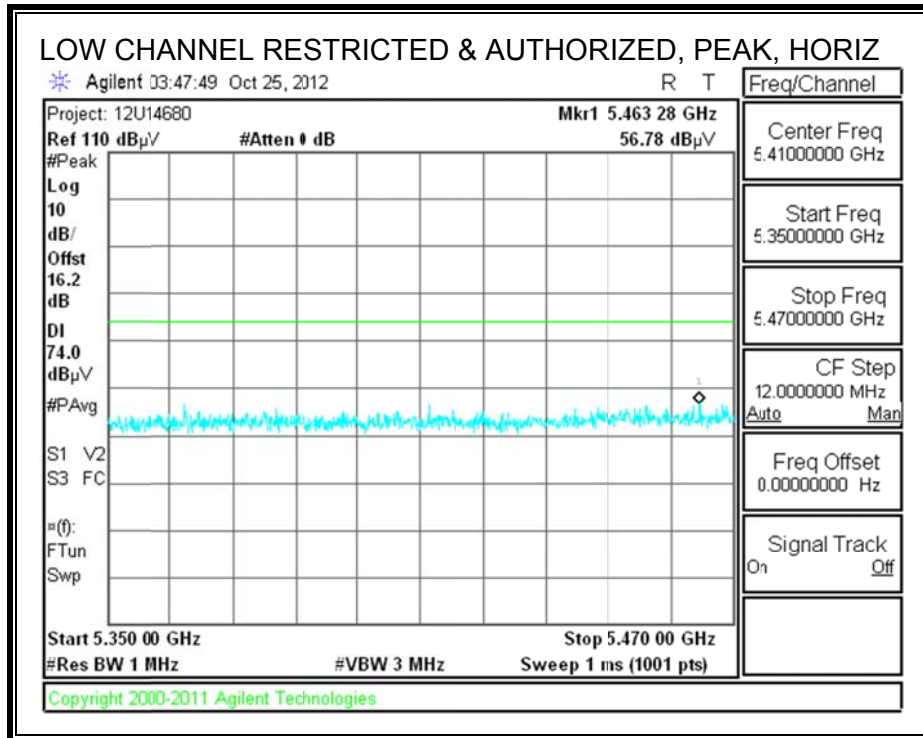
9.10. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.6 GHz BAND

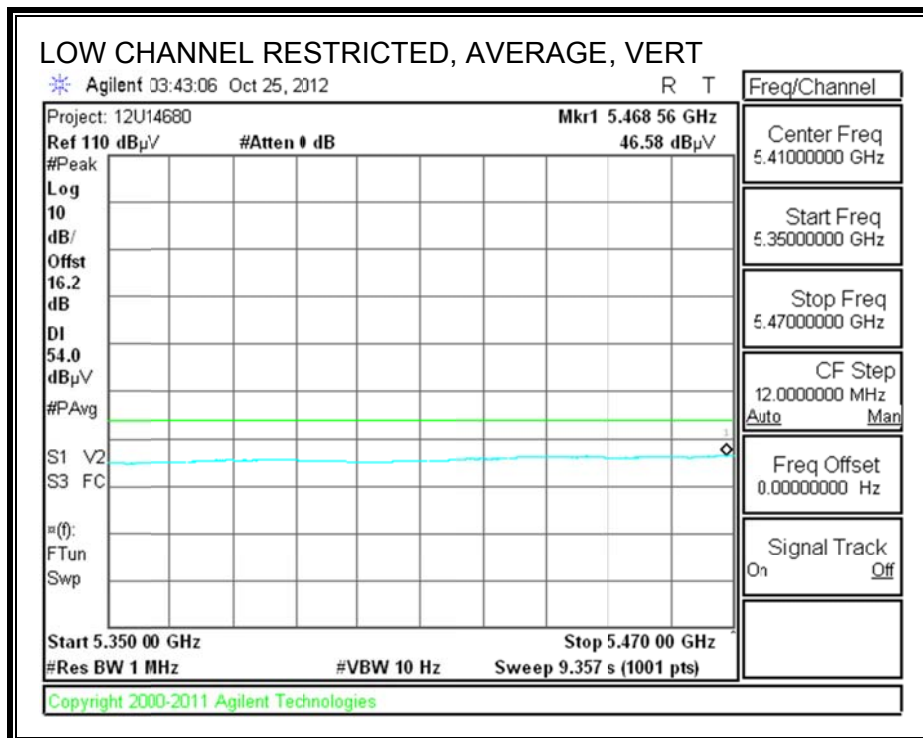
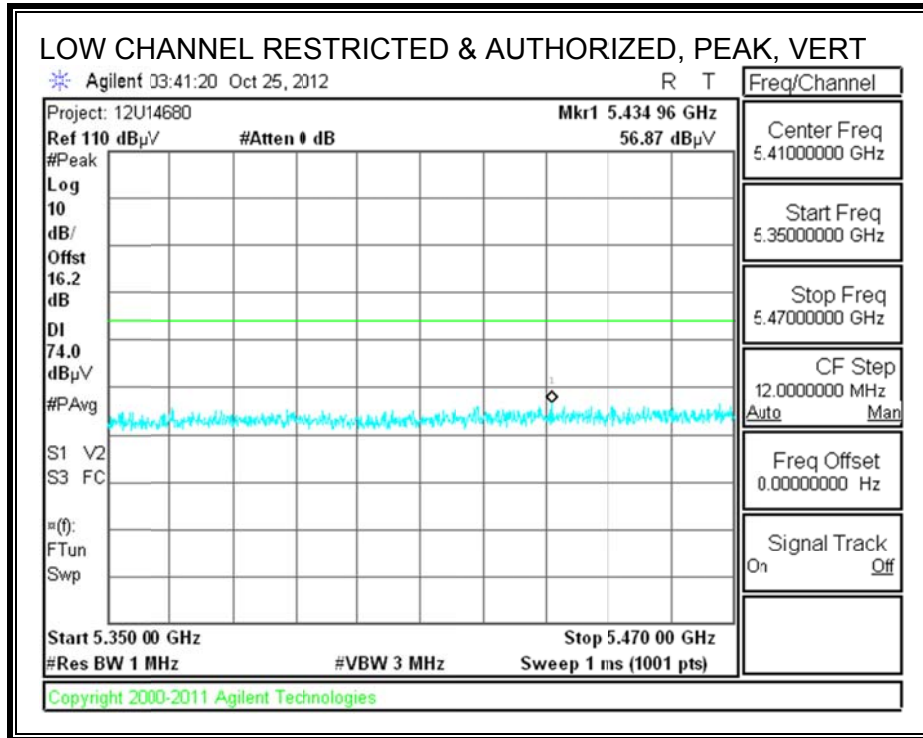
RESTRICTED & AUTHORIZED BANDEDGE (LOW 1 CHANNEL)



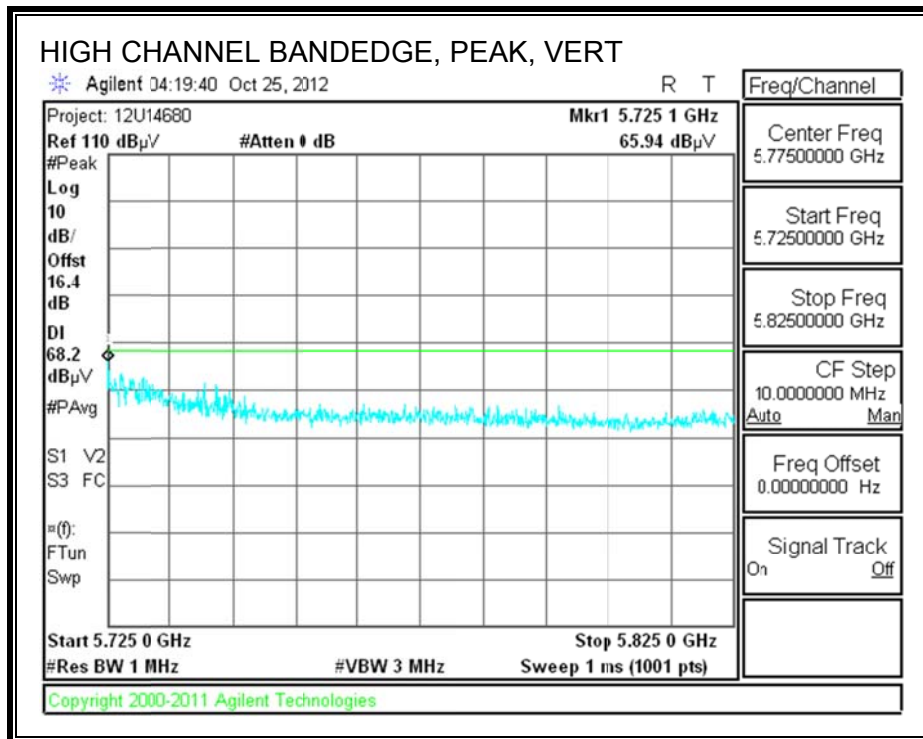
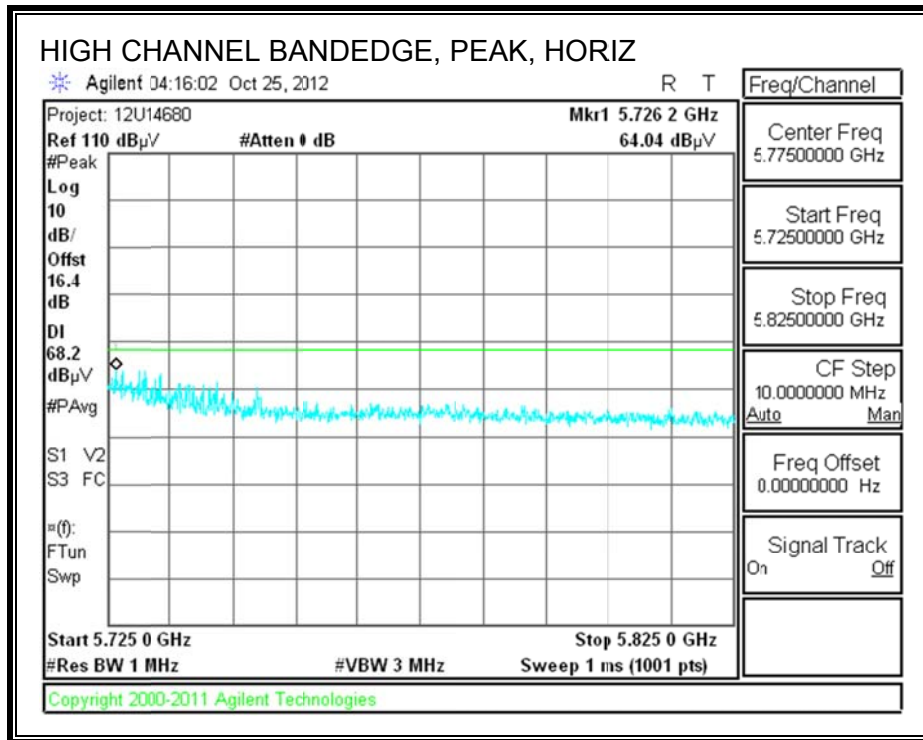


RESTRICTED & AUTHORIZED BANDEGE (LOW 2 CHANNEL)





AUTHORIZED BANDEDGE (HIGH CHANNEL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
 Date: 11/06/12
 Project #: 12U14680
 Company: Apple
 Test Target: FCC Class B
 Mode Oper: 802.11n HT40 TX mode

f Measurement Frequency Amp Preamp Gain Average Field Strength Limit
 Dist Distance to Antenna D Corr Distance Correct to 3 meters Peak Field Strength Limit
 Read Analyzer Reading Avg Average Field Strength @ 3 m Margin vs. Average Limit
 AF Antenna Factor Peak Calculated Peak Field Strength Margin vs. Peak Limit
 CL Cable Loss HPF High Pass Filter

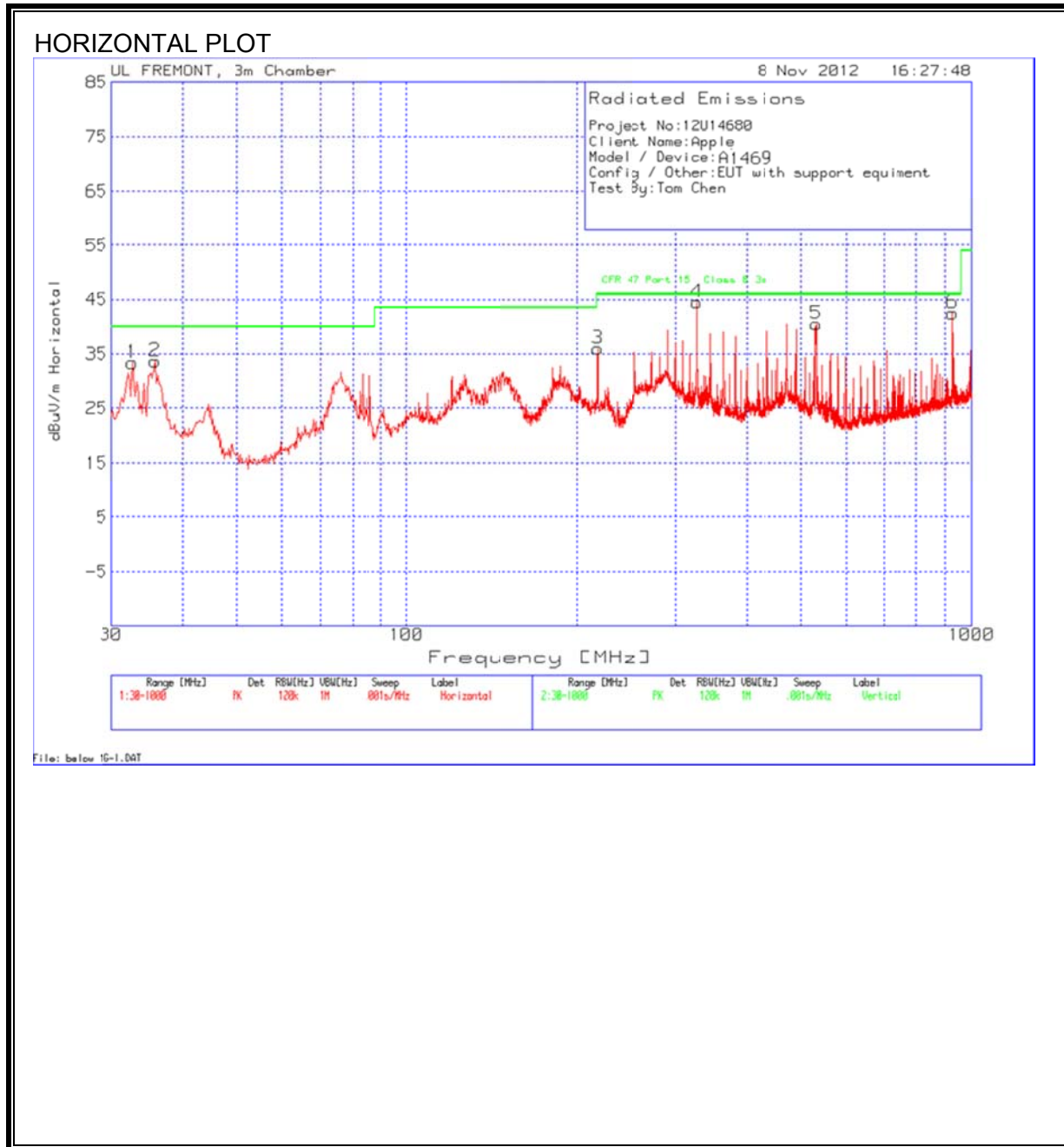
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/Q/P	Notes
5510MHz HT40													
11.020	3.0	35.0	38.4	10.5	-33.6	0.0	0.7	51.0	74.0	-23.0	H	P	
11.020	3.0	24.3	38.4	10.5	-33.6	0.0	0.7	40.4	54.0	-13.6	H	A	
11.020	3.0	34.5	38.4	10.5	-33.6	0.0	0.7	50.6	74.0	-23.4	V	P	
11.020	3.0	24.3	38.4	10.5	-33.6	0.0	0.7	40.4	54.0	-13.6	V	A	
5550MHz HT40													
11.100	3.0	35.2	38.5	10.6	-33.5	0.0	0.7	51.5	74.0	-22.5	H	P	
11.100	3.0	24.2	38.5	10.6	-33.5	0.0	0.7	40.6	54.0	-13.4	H	A	
11.100	3.0	35.3	38.5	10.6	-33.5	0.0	0.7	51.6	74.0	-22.4	V	P	
11.100	3.0	24.3	38.5	10.6	-33.5	0.0	0.7	40.6	54.0	-13.4	V	A	
5670MHz HT40													
11.340	3.0	33.8	38.7	11.0	-33.2	0.0	0.7	51.0	74.0	-23.0	H	P	
11.340	3.0	23.8	38.7	11.0	-33.2	0.0	0.7	41.0	54.0	-13.0	H	A	
11.340	3.0	34.0	38.7	11.0	-33.2	0.0	0.7	51.1	74.0	-22.9	V	P	
11.340	3.0	23.7	38.7	11.0	-33.2	0.0	0.7	40.9	54.0	-13.1	V	A	

Rev. 4.1.2.7

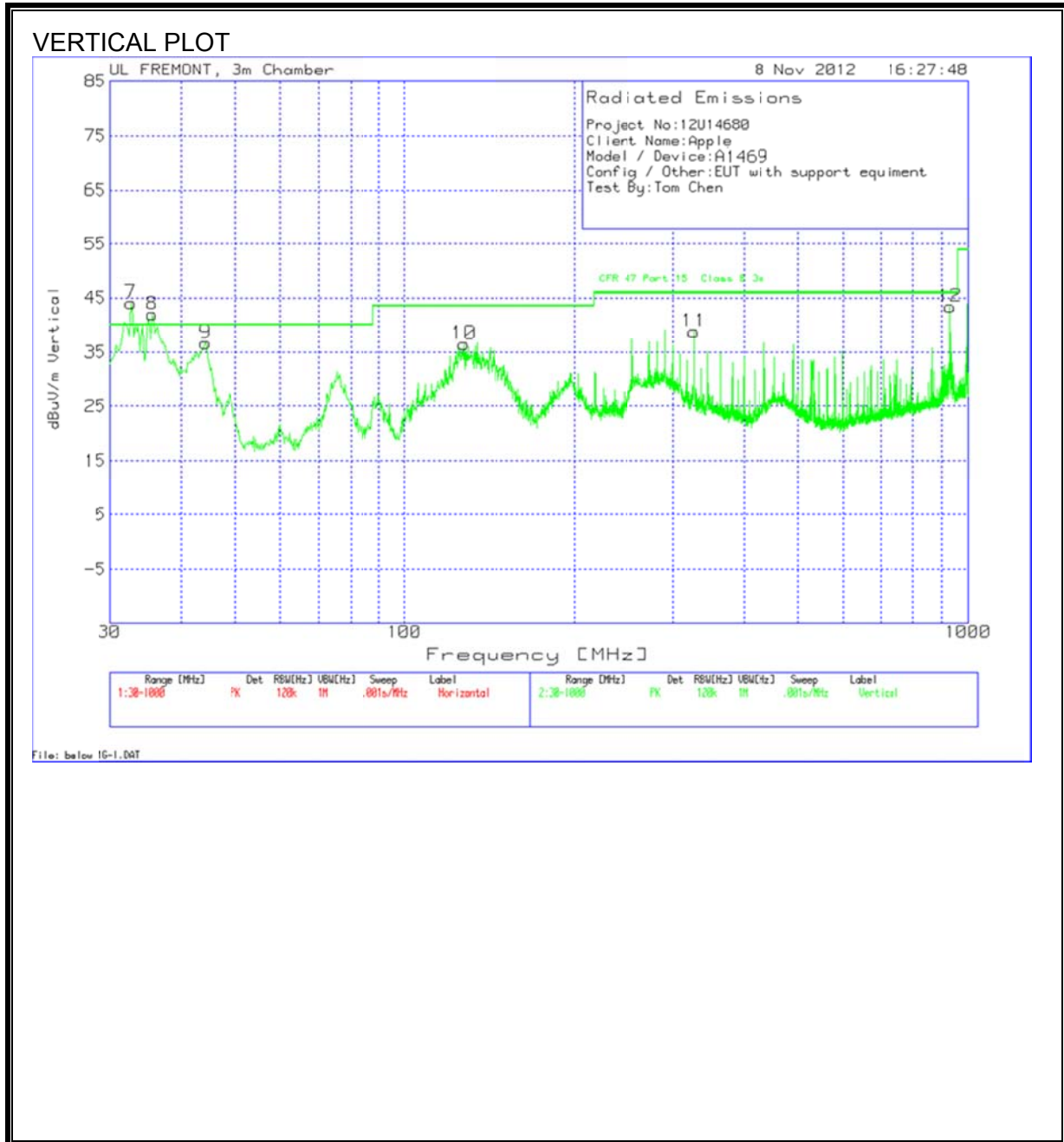
Note: No other emissions were detected above the system noise floor.

9.11. WORST-CASE BELOW 1 GHz

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



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



HORIZONTAL AND VERTICAL DATA

Project No:12U14680
 Client Name:Apple
 Model / Device:A1469
 Config / Other:EUT with support equipment
 Test By:Tom Chen

Horizontal 30 - 1000MHz

Marker No.	Test Frequency	Meter Reading	Detector	25MHz-1GHz Chambr 3m Amplified (dB)	Antenna T185 (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Polarity
1	32.7138	41.61	PK	-27.5	19.2	33.31	40	-6.69	Horz
2	35.8153	44.09	PK	-27.4	16.9	33.59	40	-6.41	Horz
3	217.6419	51.04	PK	-25.7	10.6	35.94	46	-10.06	Horz
4	326.5614	48.28	QP	-25.3	13.8	36.78	46	-9.22	Horz
5	531.8645	48.34	PK	-25.8	18	40.54	46	-5.46	Horz
6	926.5328	44.17	PK	-23.9	22.3	42.57	46	-3.43	Horz

Vertical 30 - 1000MHz

Marker No.	Test Frequency	Meter Reading	Detector	25MHz-1GHz Chambr 3m Amplified (dB)	Antenna T185 (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Polarity
7	32.605	41.11	QP	-27.5	19.3	32.91	40	-7.09	Vert
8	35.6874	42.96	QP	-27.4	17	32.56	40	-7.44	Vert
9	44.1507	53.22	PK	-27.4	10.8	36.62	40	-3.38	Vert
10	127.1163	49.04	PK	-26.5	13.9	36.44	43.5	-7.06	Vert
11	326.3889	50.29	PK	-25.3	13.8	38.79	46	-7.21	Vert
12	930.2158	23.25	QP	-23.8	22.4	21.85	46	-24.15	Vert

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

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 C63.4.

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

6 WORST EMISSIONS

Project No:12U14680
 Client Name:Apple
 Model/Device:A1469
 Test Volt/Freq:120 VAC / 60Hz
 Test By:Tom Chen

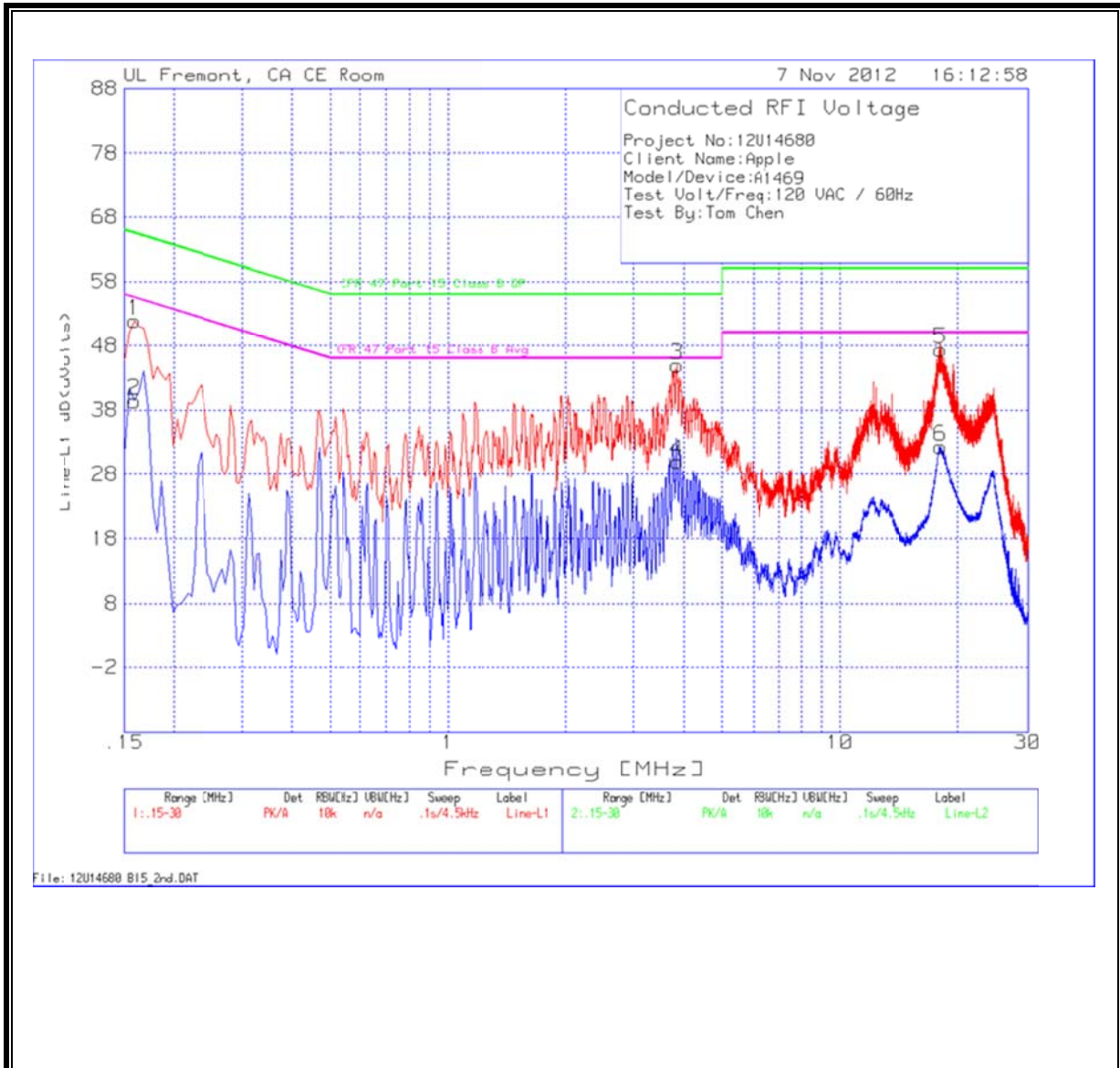
Line-L1 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.159	51.79	PK	0.1	0	51.89	65.5	-13.61	-	-
0.159	39.33	Av	0.1	0	39.43	-	-	55.5	-16.07
3.8535	44.69	PK	0.1	0.1	44.89	56	-11.11	-	-
3.8535	29.82	Av	0.1	0.1	30.02	-	-	46	-15.98
18.1185	46.96	PK	0.2	0.2	47.36	60	-12.64	-	-
18.1185	31.87	Av	0.2	0.2	32.27	-	-	50	-17.73

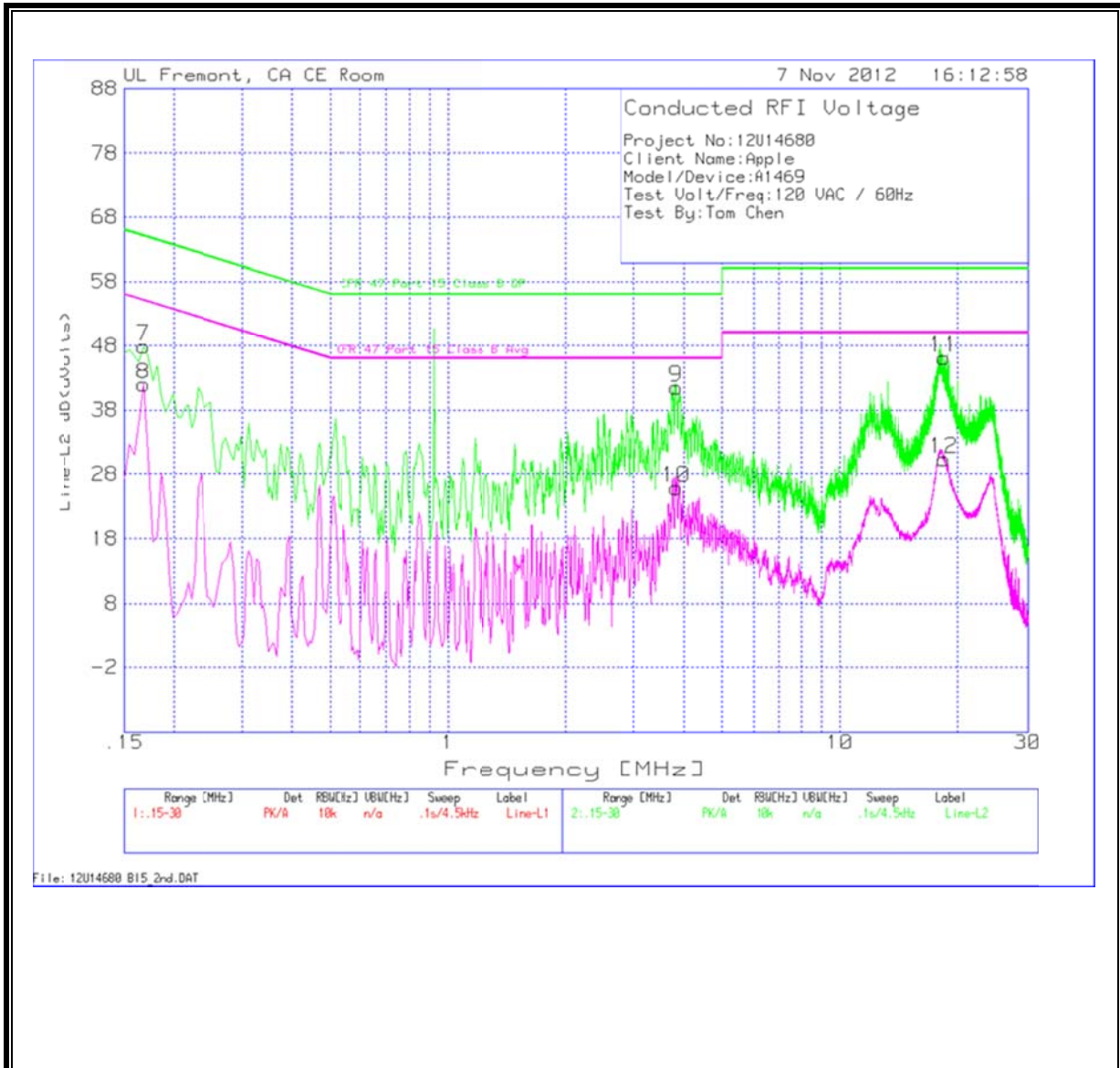
Line-L2 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L2.TXT (dB)	LC Cables 2&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.168	47.8	PK	0.1	0	47.9	65.1	-17.2	-	-
0.168	41.81	Av	0.1	0	41.91	-	-	55.1	-13.19
3.8355	41.28	PK	0.1	0.1	41.48	56	-14.52	-	-
3.8355	25.71	Av	0.1	0.1	25.91	-	-	46	-20.09
18.4605	45.65	PK	0.2	0.2	46.05	60	-13.95	-	-
18.4605	30.02	Av	0.2	0.2	30.42	-	-	50	-19.58

LINE 1 RESULTS



LINE 2 RESULTS



11. DYNAMIC FREQUENCY SELECTION

11.1. OVERVIEW

11.1.1. LIMITS

INDUSTRY CANADA

IC RSS-210 is closely harmonized with FCC Part 15 DFS rules. The deviations are as follows:

RSS-210 Issue 7 A9.4 (b) (ii) **Channel Availability Check Time:** ...

Additional requirements for the band 5600-5650 MHz: Until further notice, devices subject to this Section shall not be capable of transmitting in the band 5600-5650 MHz, so that Environment Canada weather radars operating in this band are protected.

RSS-210 Issue 7 A9.4 (b) (iv) **Channel closing time:** the maximum channel closing time is 260 ms.

FCC

§15.407 (h) and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION".

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
Uniform Spreading	Yes	Not required	Not required

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

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

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 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.	

Table 4: DFS Response requirement values

Parameter	Value
<i>Non-occupancy period</i>	30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds
<i>Channel Closing Transmission Time</i>	200 milliseconds + approx. 60 milliseconds over remaining 10 second period

The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:
 For the Short pulse radar Test Signals this instant is the end of the *Burst*.
 For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated.
 For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.
 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 channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
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

Table 6 – Long Pulse Radar Test Signal

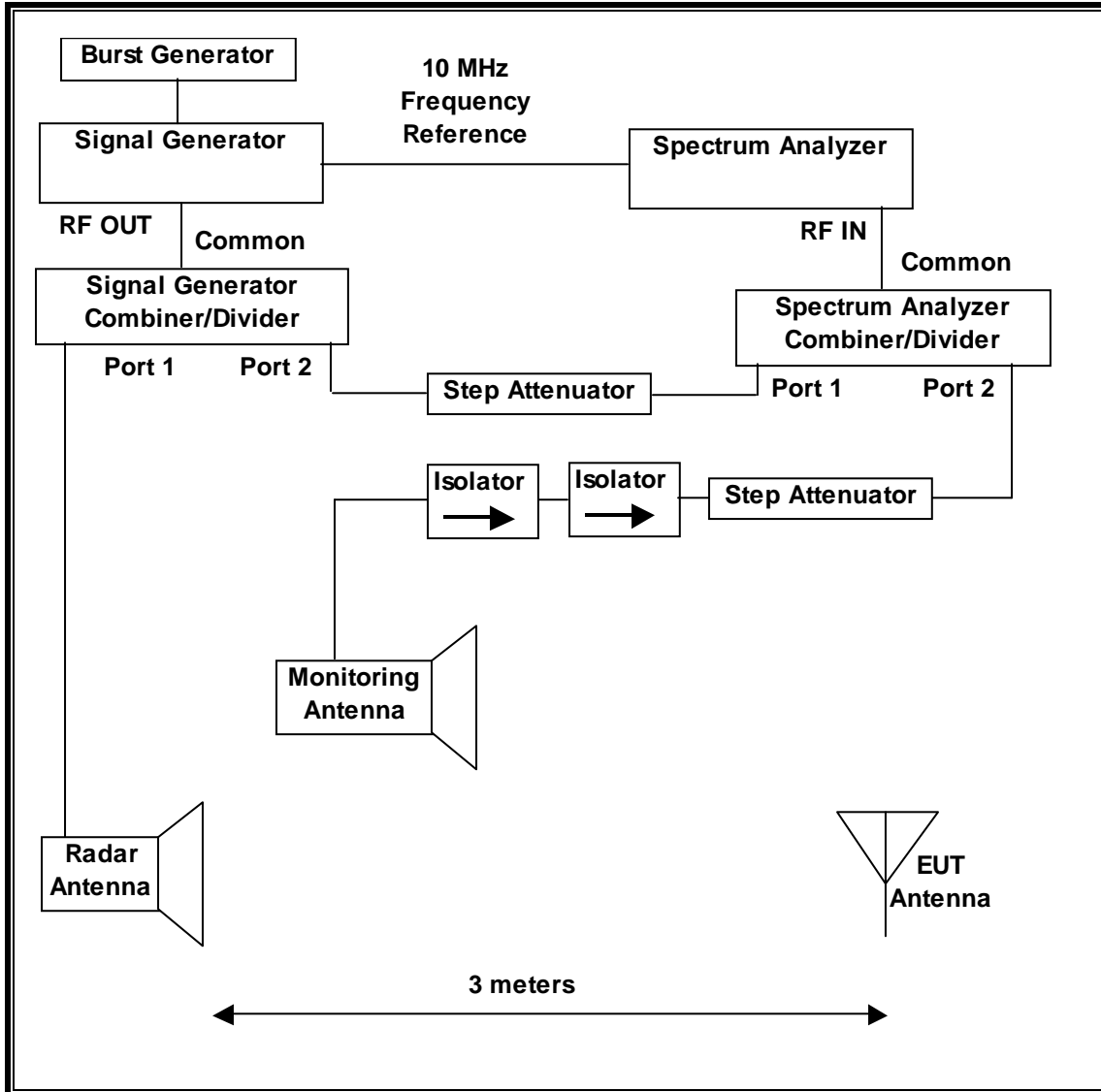
Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000-2000	80%	30

Table 7 – Frequency Hopping Radar Test Signal

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

11.1.2. 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 FCC 06-96 APPENDIX. 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.

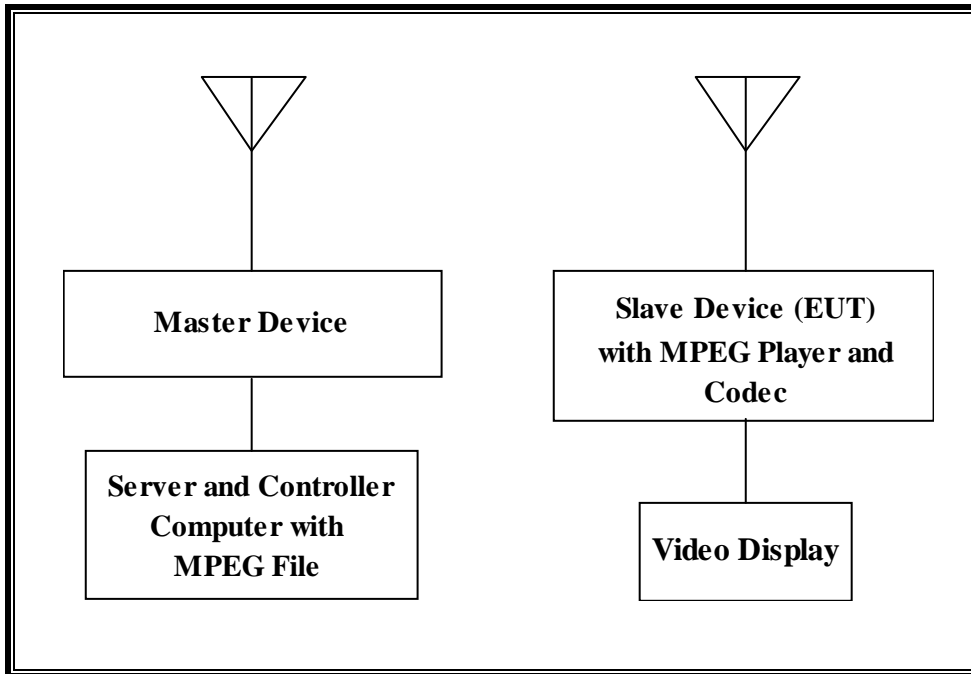
TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset Number	Cal Due
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/18/13
Vector Signal Generator, 20GHz	Agilent / HP	E8267C	C01066	11/17/12

11.1.3. SETUP OF EUT (CLIENT MODE)

RADIATED METHOD EUT TEST SETUP



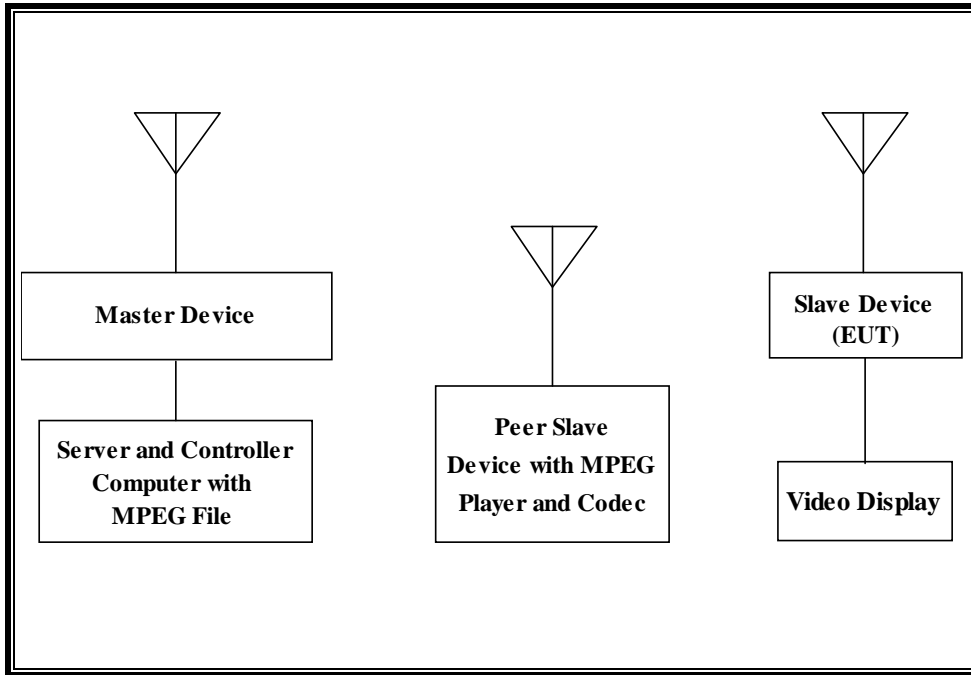
SUPPORT EQUIPMENT

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

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Wireless Access Point (Master Device)	Cisco	AIR-AP1252AG-A-K9	FTX130390D9	LDK102061
AC Adapter (AP)	Delta Electronics	EADP-45BB B	DTH1049902N	DoC
Notebook PC (Controller/Server)	Apple	MacBook Pro A1150	AOU257941	DoC
AC Adapter (Controller/Server)	Delta Electronics	A1344	MV05104CNAL1A	DoC

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

RADIATED METHOD EUT TEST SETUP



SUPPORT EQUIPMENT

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

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Wireless Access Point (Master Device)	Cisco	AIR-AP1252AG-A-K9	FTX130390D9	LDK102061
AC Adapter (AP)	Delta Electronics	EADP-45BB B	DTH1049902N	DoC
Notebook PC (Controller/Server)	Apple	MacBook Pro A1150	AOU257941	DoC
AC Adapter (Controller PC)	Delta Electronics	A1344	MV05104CNAL1A	DoC
Tablet PC (Peer Slave)	Apple	A1460	DLXJ908HF8LD	BCGA1460
Video Display Monitor	Dell	U2410F	CN-0F525M-72872-1B5-AGAL	DoC

11.1.5. DESCRIPTION OF EUT

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

The EUT is a Slave Device without Radar Detection.

The highest power level within these bands is 22.87 dBm EIRP in the 5250-5350 MHz band and 22.78 dBm EIRP in the 5470-5725 MHz band.

The only antenna assembly utilized with the EUT has a gain of 3.16 dBi in the 5250-5350 MHz band and 2.34 dBi in the 5470-5725 MHz band.

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 margin to the limit.

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

In the client mode, 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 Safari web browser. In the Client-to-Client Communications mode, WLAN traffic is generated by streaming the video file TestFile.mp2 "6 ½ Magic Hours" from the Master, to the Slave, and mirror to the peer slave device in full motion video mode using Safari web browser.

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

The EUT utilizes the 802.11a/n architecture. Two nominal channel bandwidths of 20 MHz and 40 MHz are implemented in standard client mode. Two nominal channel bandwidths of 20 MHz and 40 MHz are implemented in Client-to-Client Communications Mode.

The software installed in the EUT is IOS 5.2.

UNIFORM CHANNEL SPREADING

This requirement is not applicable to Slave radio devices.

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

The Master Device is a Cisco Access Point, FCC ID: LDK102061. The minimum antenna gain for the Master Device is 3.5 dBi.

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

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

The software installed in the access point is 12.4(25d)JA1.

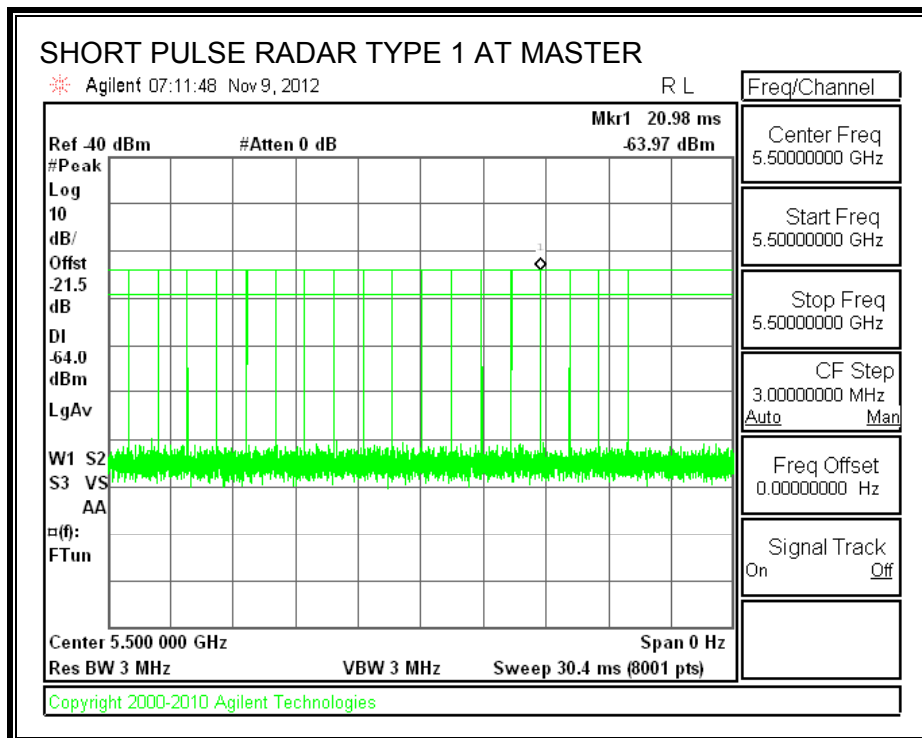
11.2. CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH

11.2.1. TEST CHANNEL

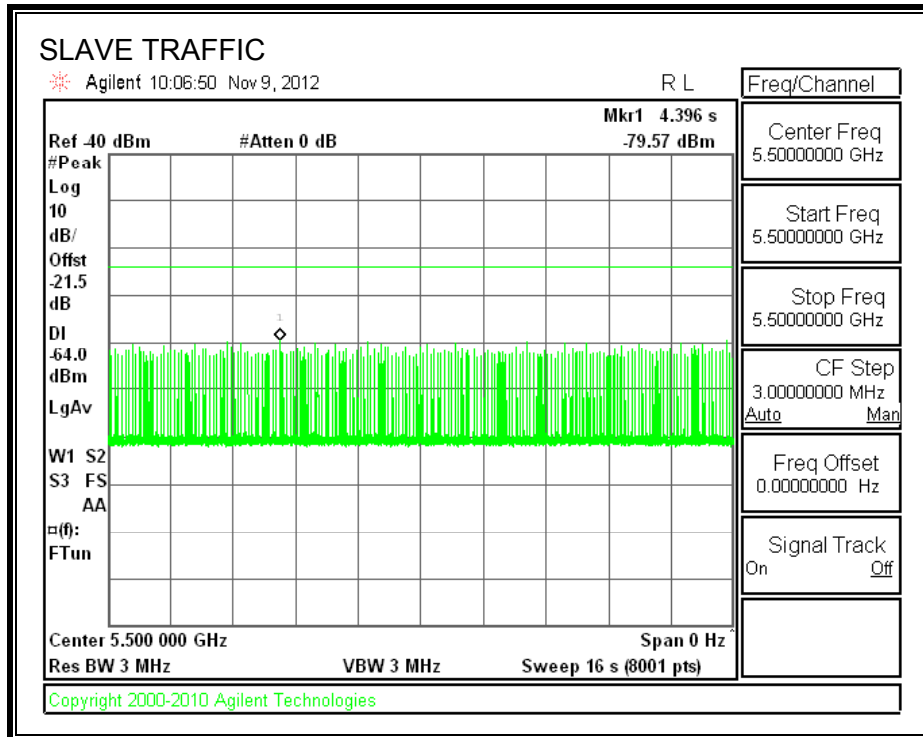
All tests were performed at a channel center frequency of 5500 MHz.

11.2.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



TRAFFIC



11.2.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.2.4. 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 FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

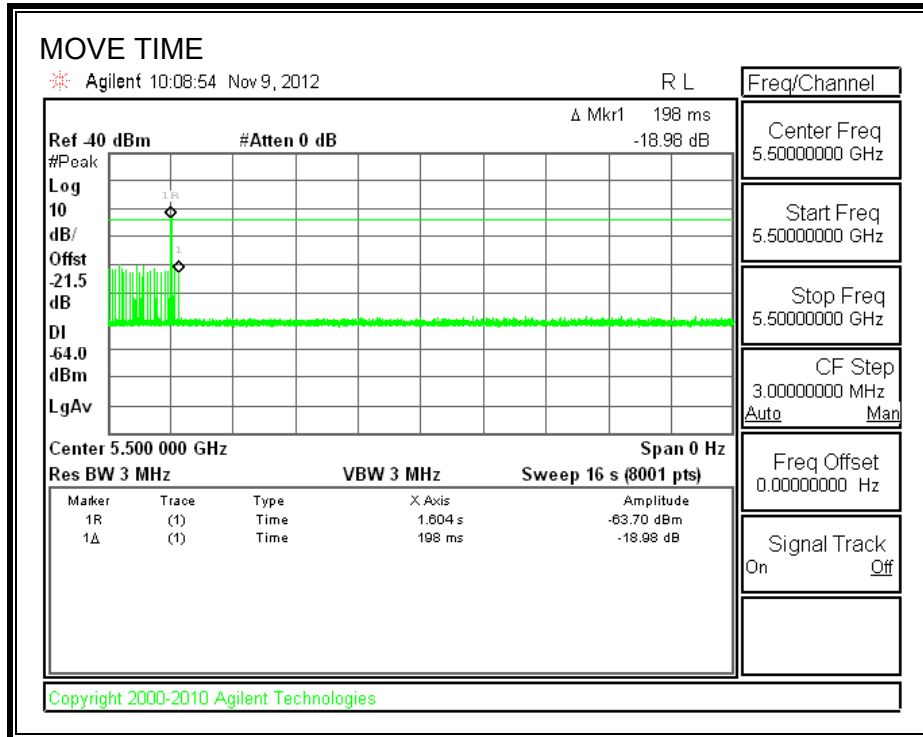
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

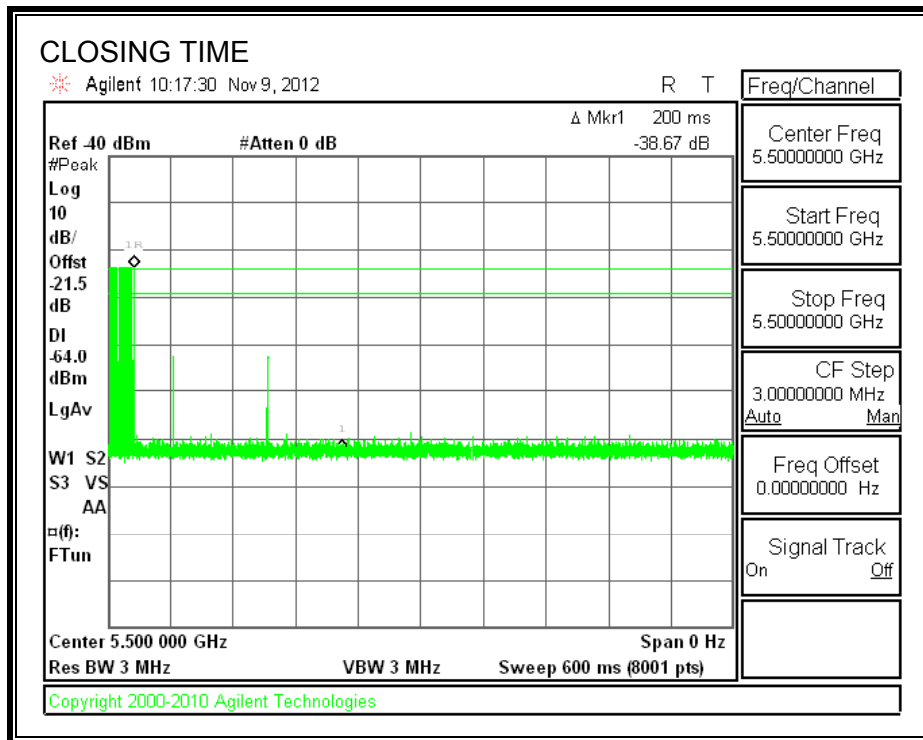
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.198	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	8.0	260

MOVE TIME

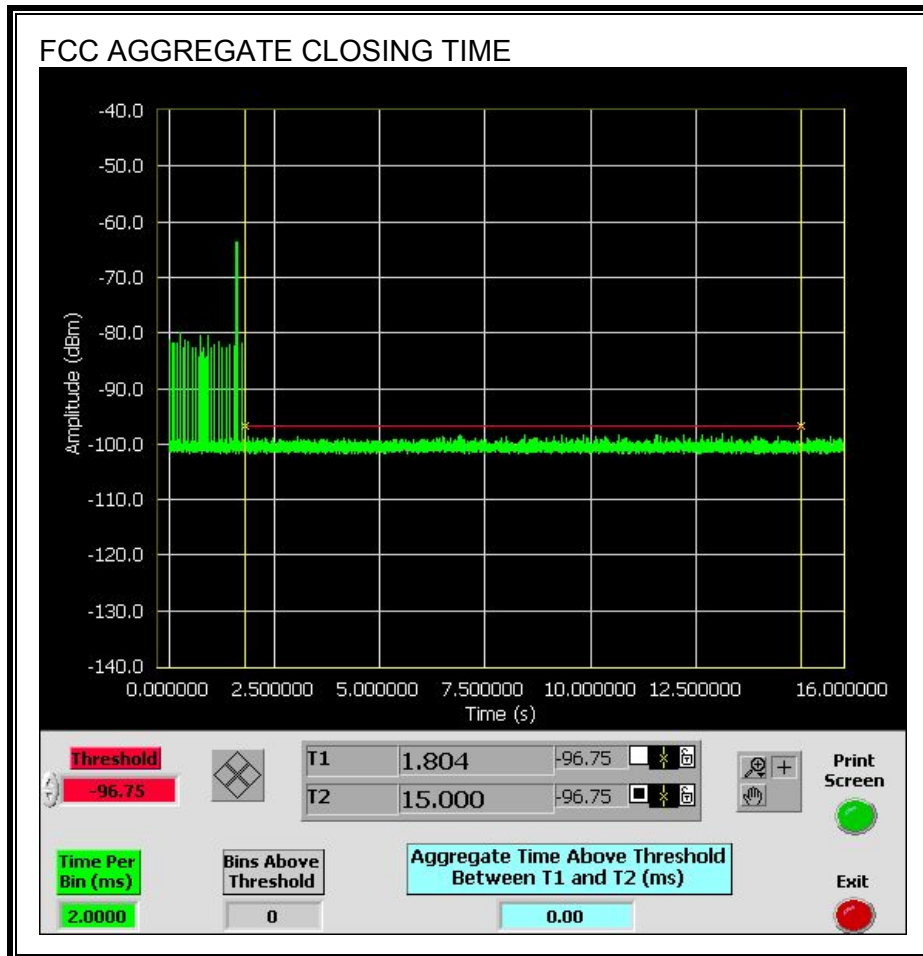


CHANNEL CLOSING TIME

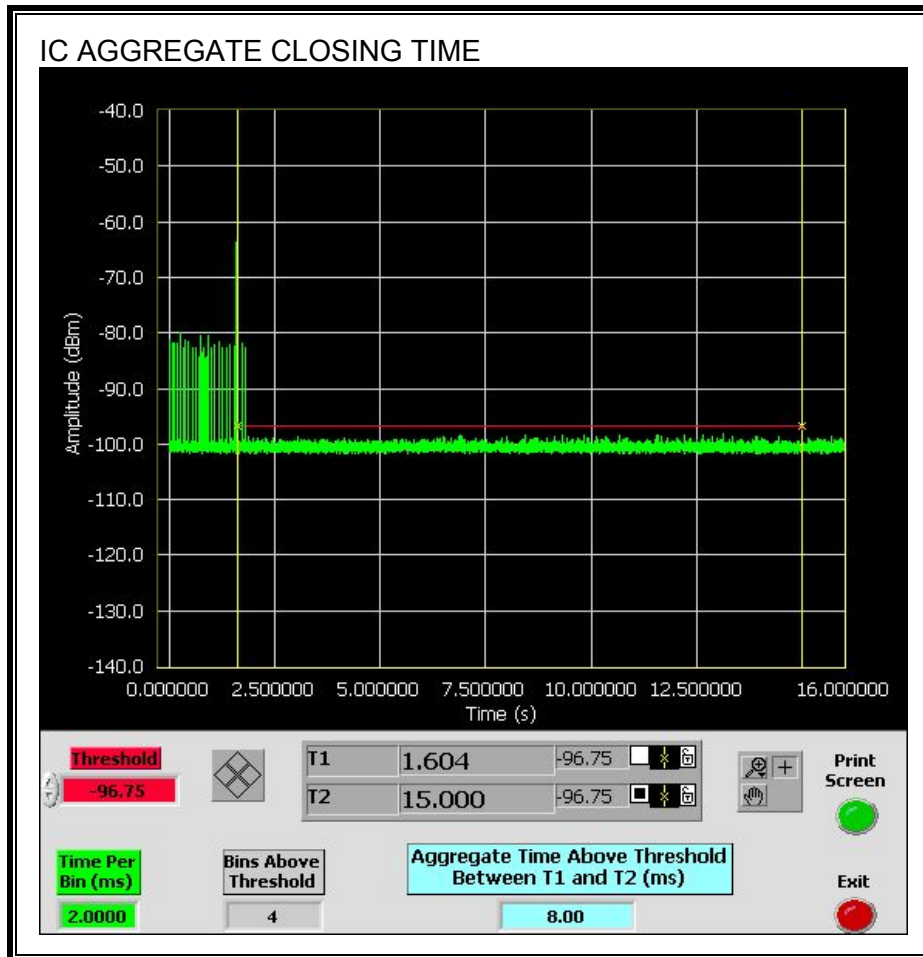


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



Only intermittent transmissions are observed during the IC aggregate monitoring period.



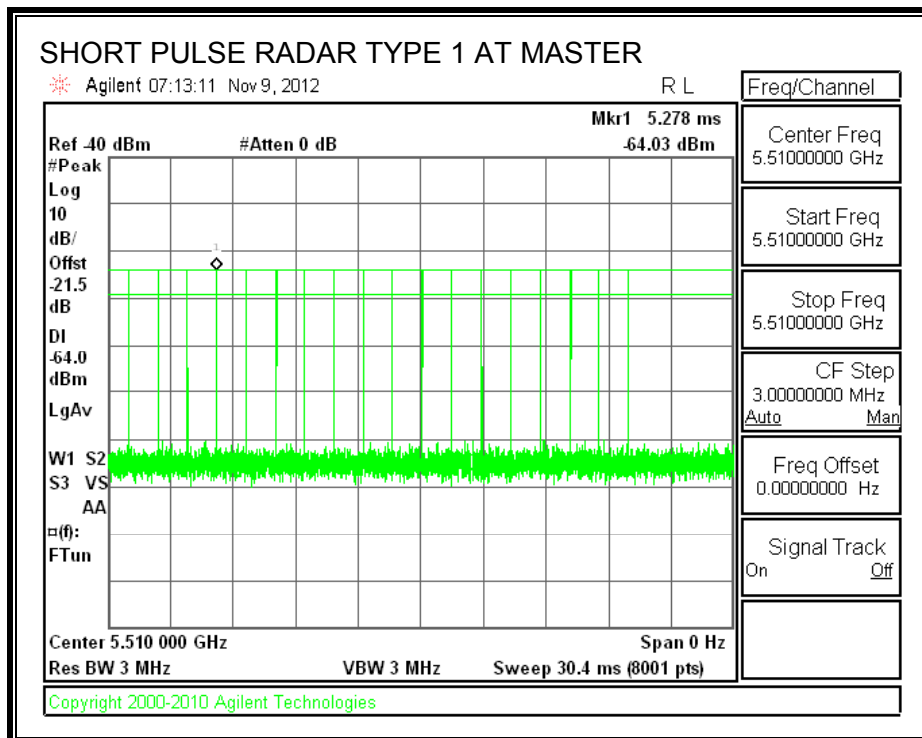
11.3. CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH

11.3.1. TEST CHANNEL

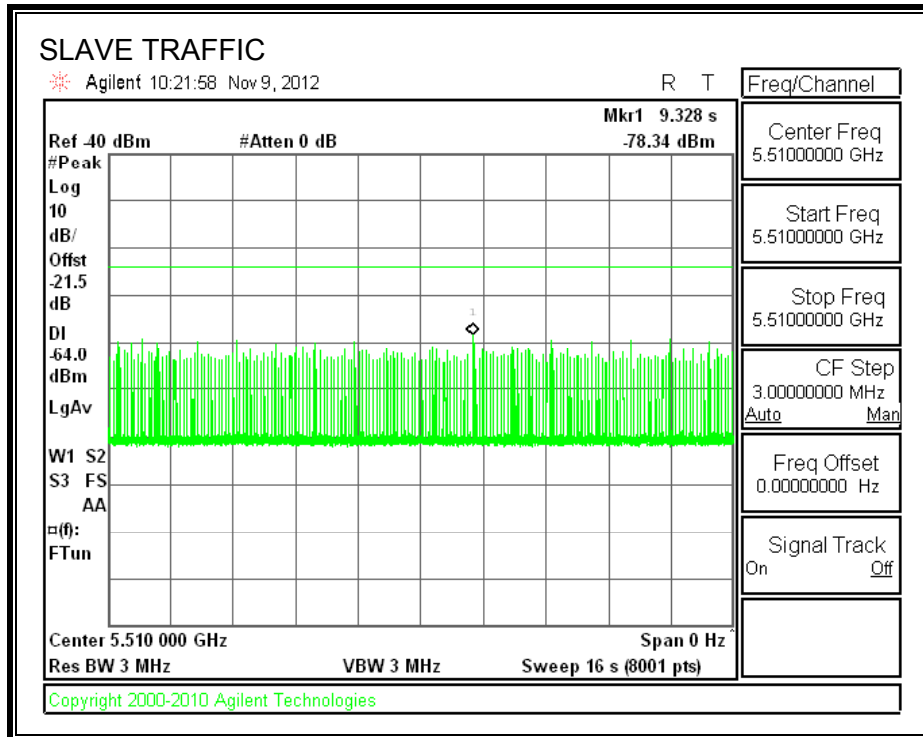
All tests were performed at a channel center frequency of 5510 MHz.

11.3.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



TRAFFIC



11.3.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.3.4. 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 FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

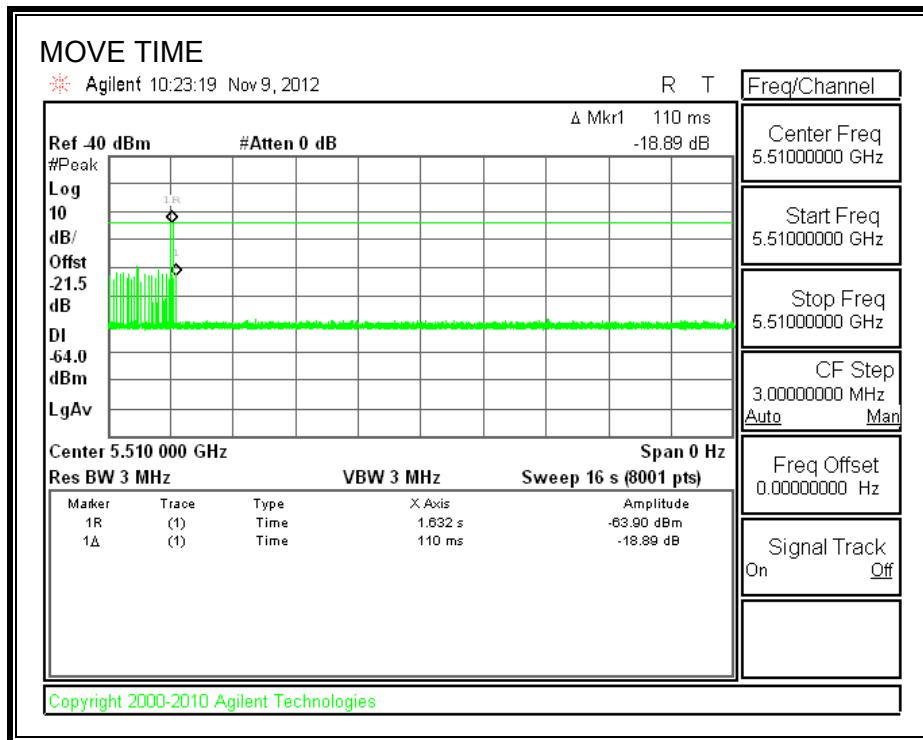
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

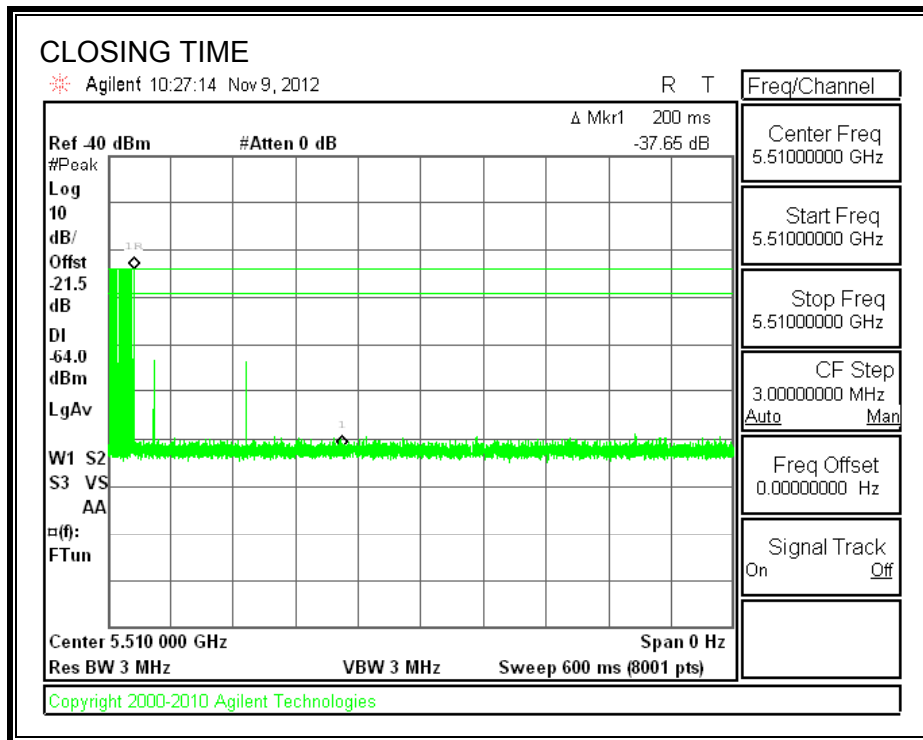
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.110	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	8.0	260

MOVE TIME

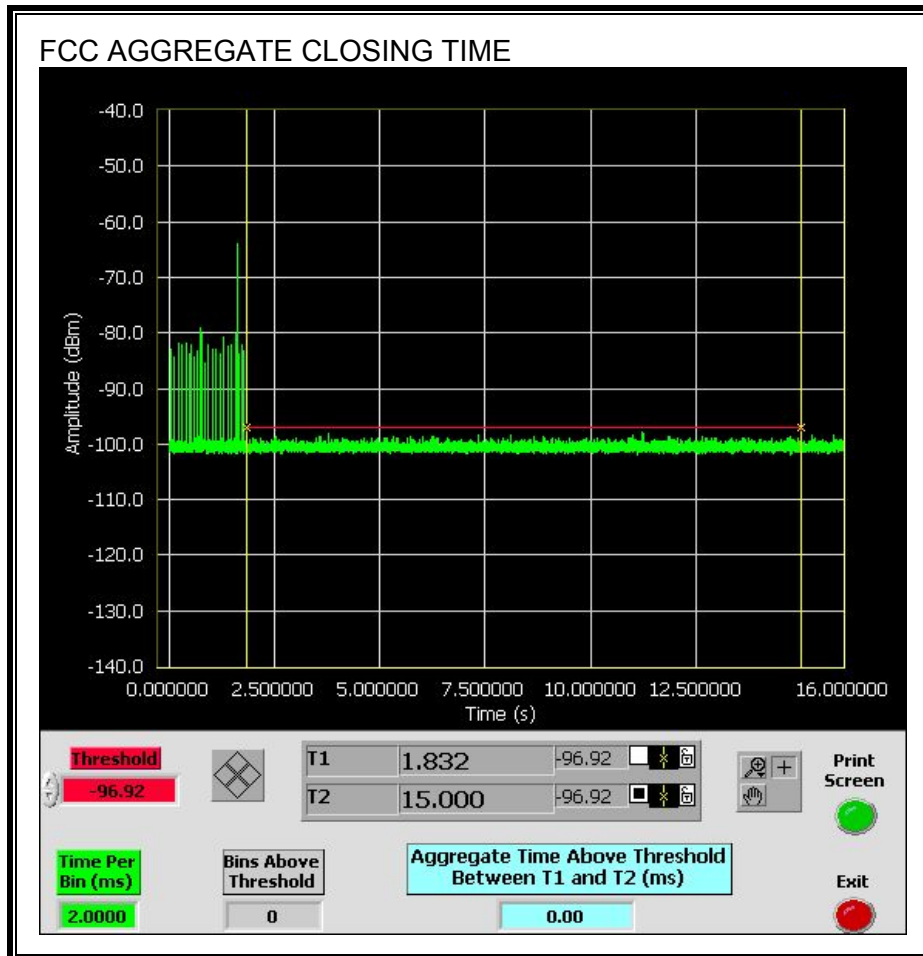


CHANNEL CLOSING TIME

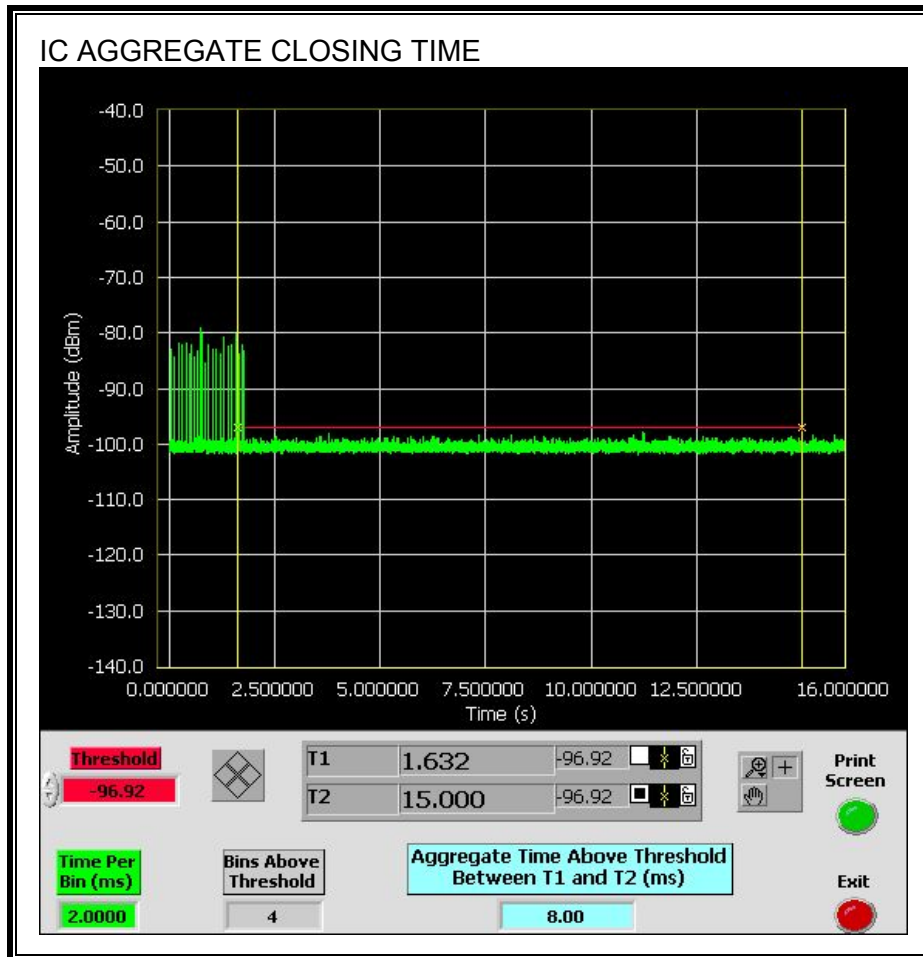


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



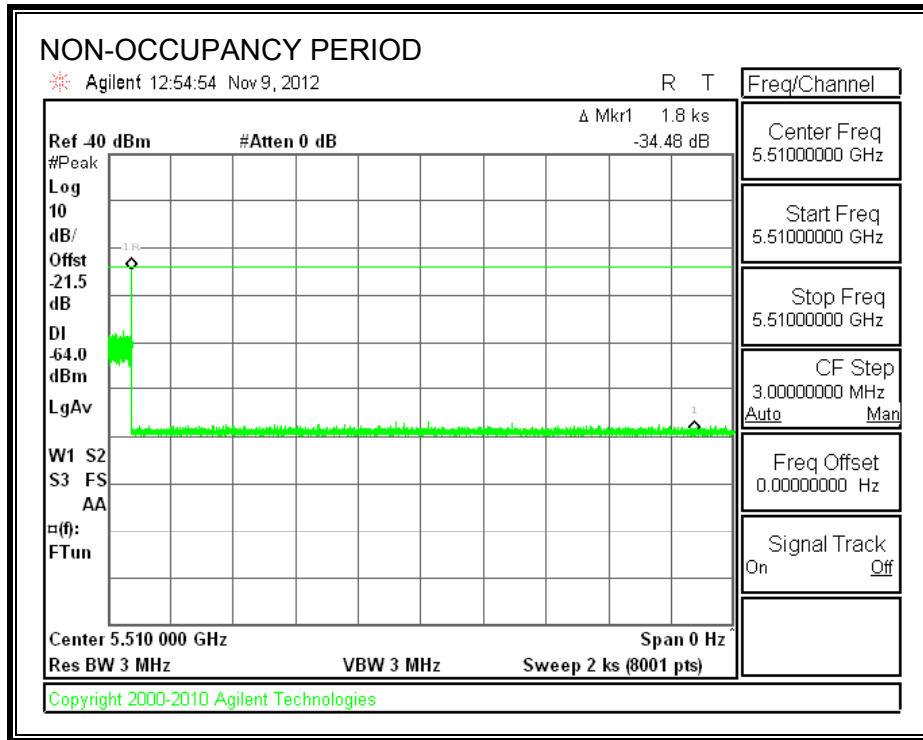
Only intermittent transmissions are observed during the IC aggregate monitoring period.



11.3.5. NON-OCCUPANCY PERIOD

RESULTS

No EUT transmissions were observed on the test channel during the 30-minute observation time.



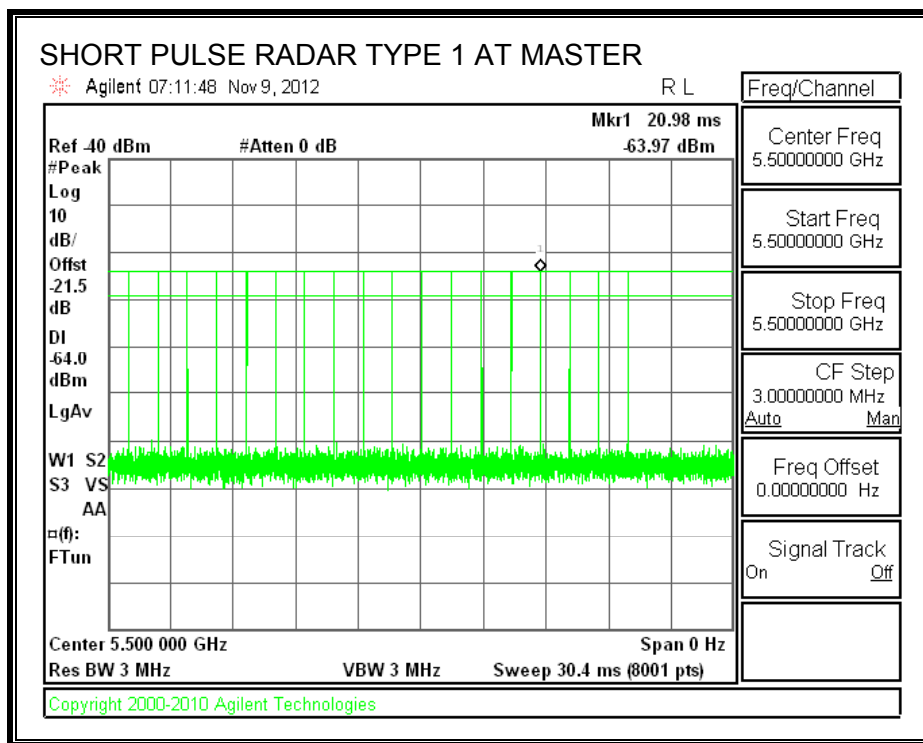
11.4. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH

11.4.1. TEST CHANNEL

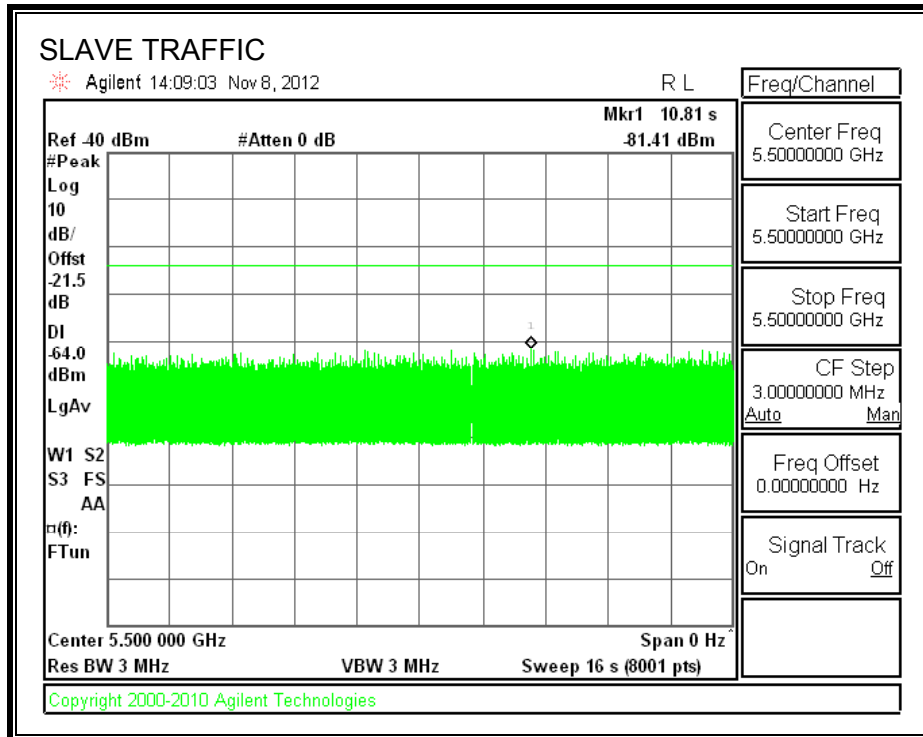
All tests were performed at a channel center frequency of 5500 MHz.

11.4.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



TRAFFIC



11.4.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.4.4. 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 FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

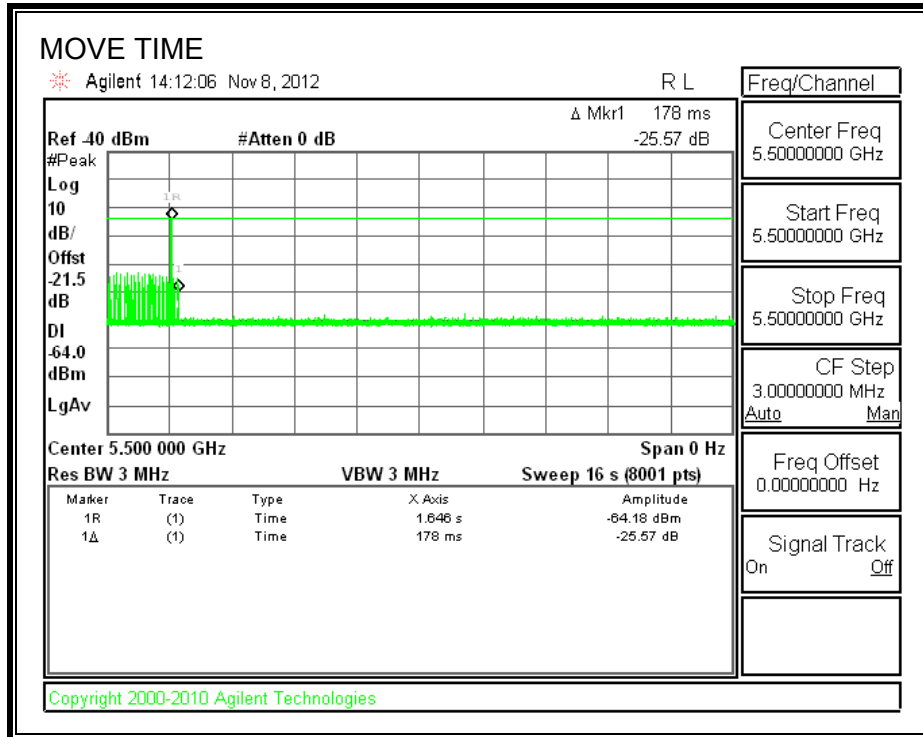
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

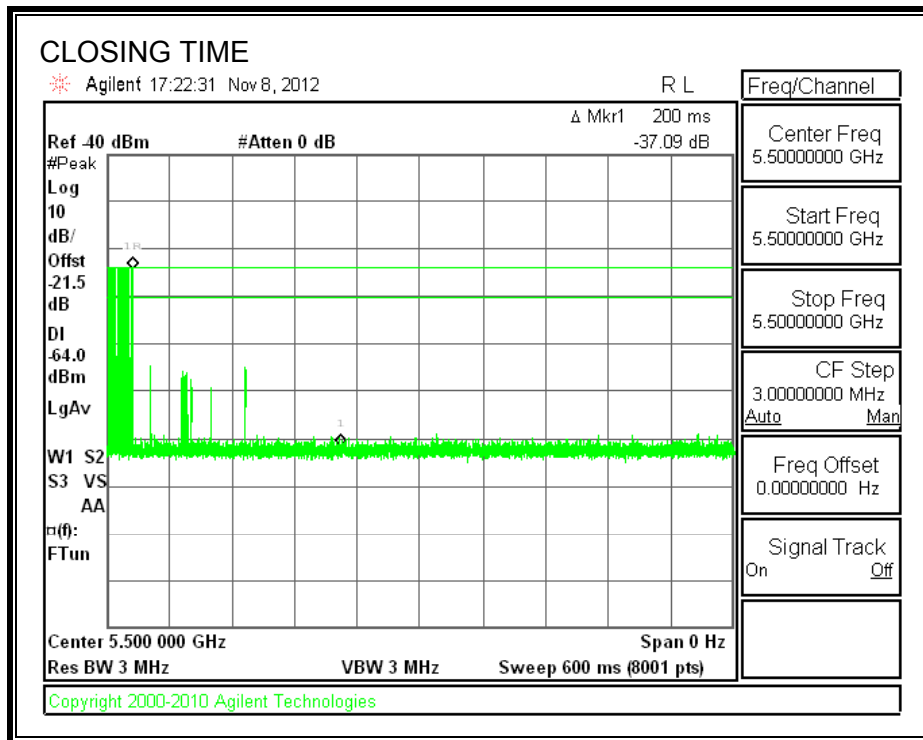
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.178	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	24.0	260

MOVE TIME

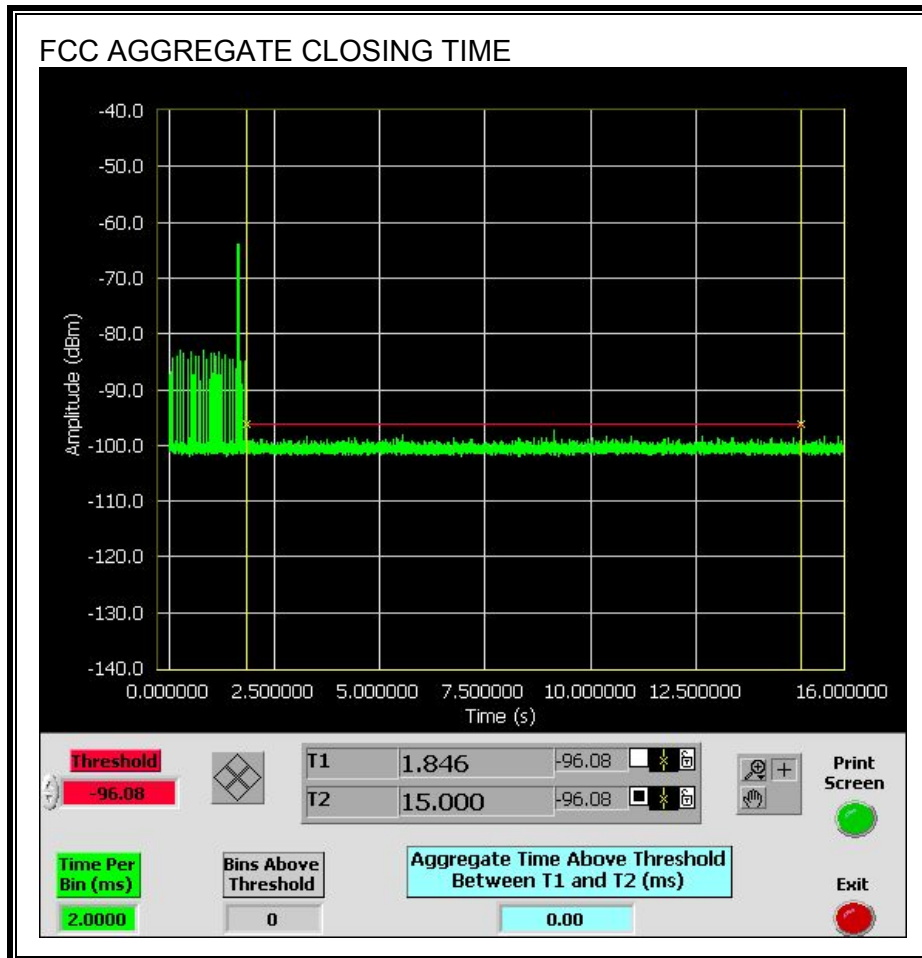


CHANNEL CLOSING TIME

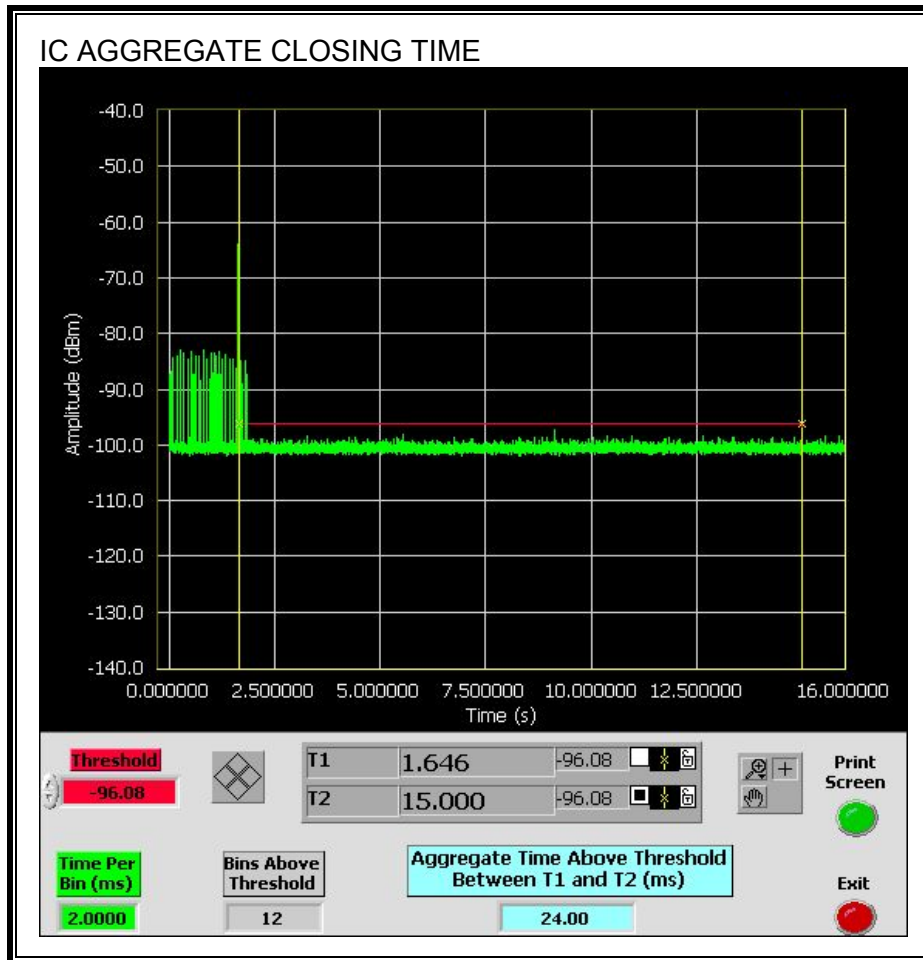


AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



Only intermittent transmissions are observed during the IC aggregate monitoring period.



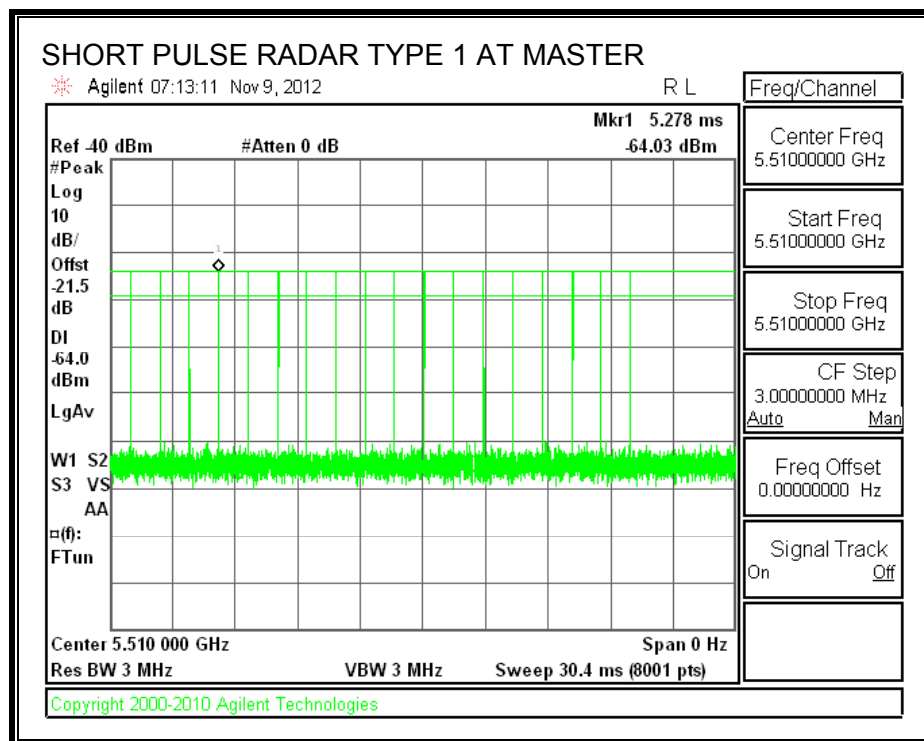
11.5. CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 40 MHz BANDWIDTH

11.5.1. TEST CHANNEL

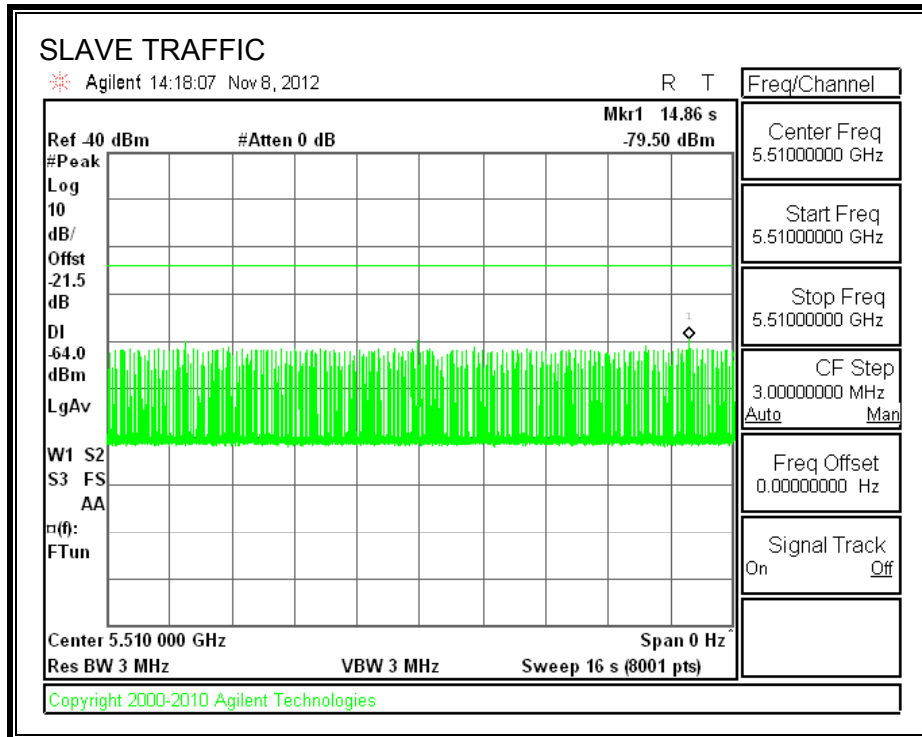
All tests were performed at a channel center frequency of 5510 MHz.

11.5.2. RADAR WAVEFORM AND TRAFFIC

RADAR WAVEFORM



TRAFFIC



11.5.3. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.5.4. 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 FCC aggregate time is calculated begins at (Reference Marker + 200 msec) and ends no earlier than (Reference Marker + 10 sec).

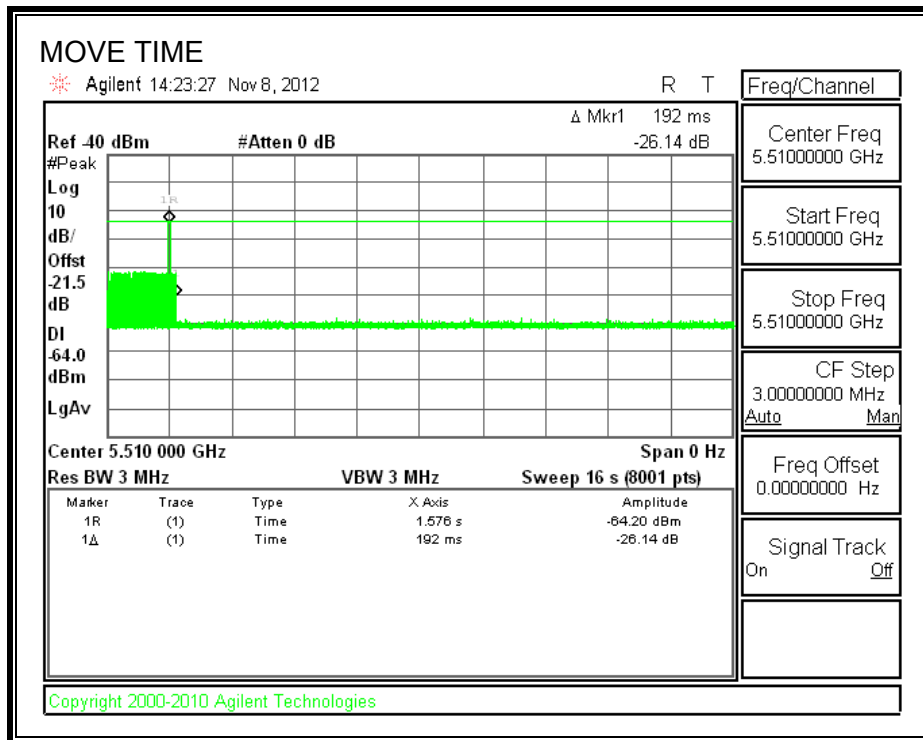
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

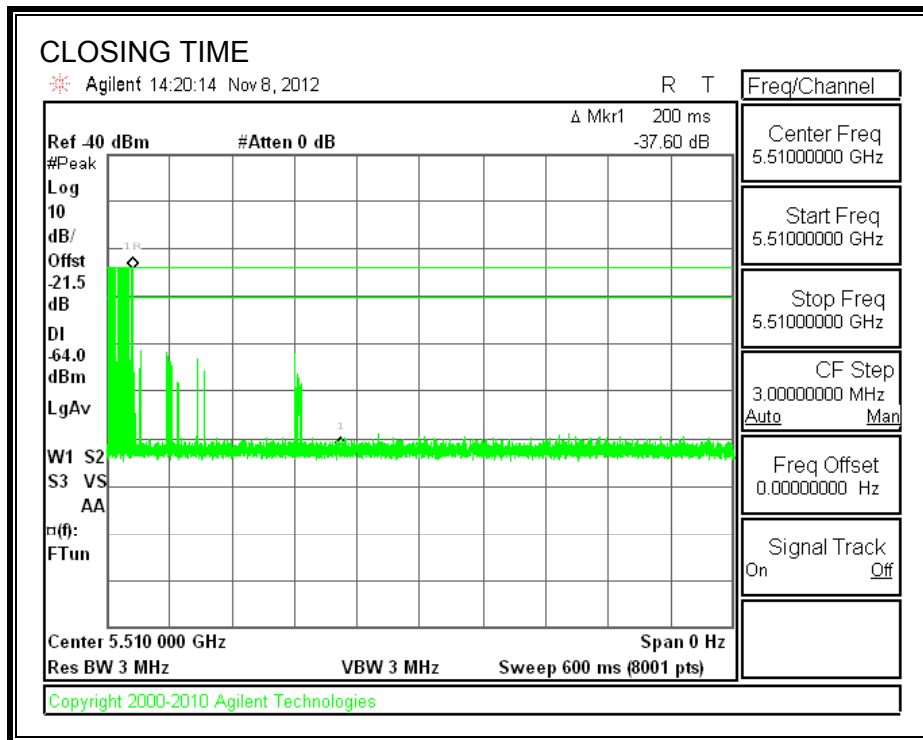
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.192	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	0.0	60
IC	28.0	260

MOVE TIME

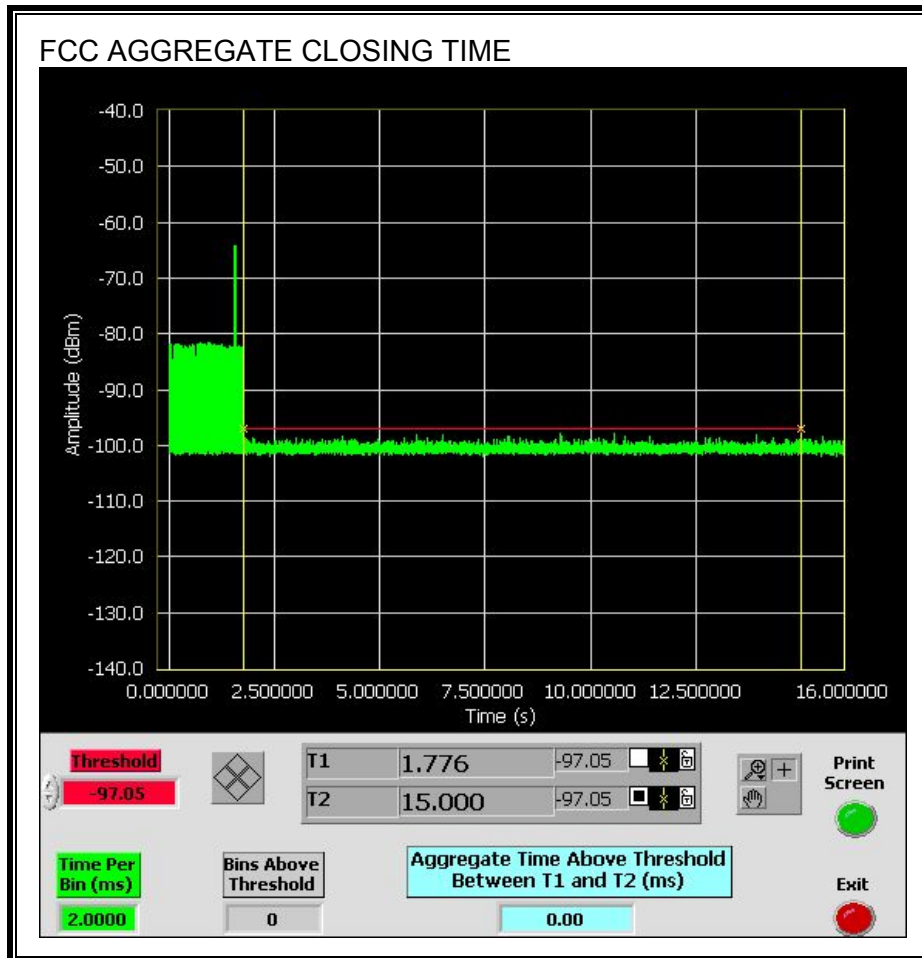


CHANNEL CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

No transmissions are observed during the FCC aggregate monitoring period.



Only intermittent transmissions are observed during the IC aggregate monitoring period.

