8.4.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

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

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Limits

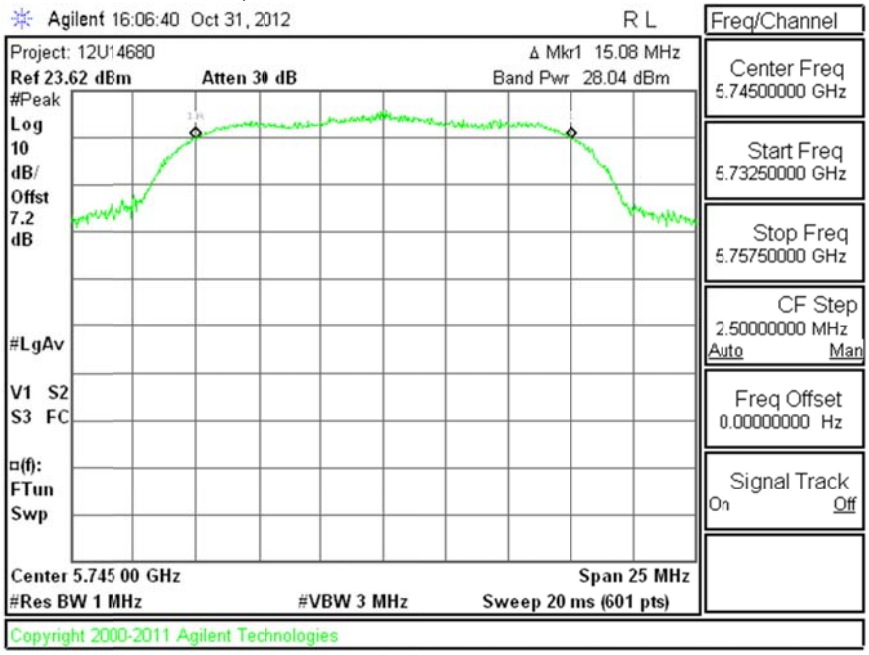
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	5745	2.62	30.00	30	36	30.00
Mid	5785	2.62	30.00	30	36	30.00
High	5825	2.62	30.00	30	36	30.00

Results

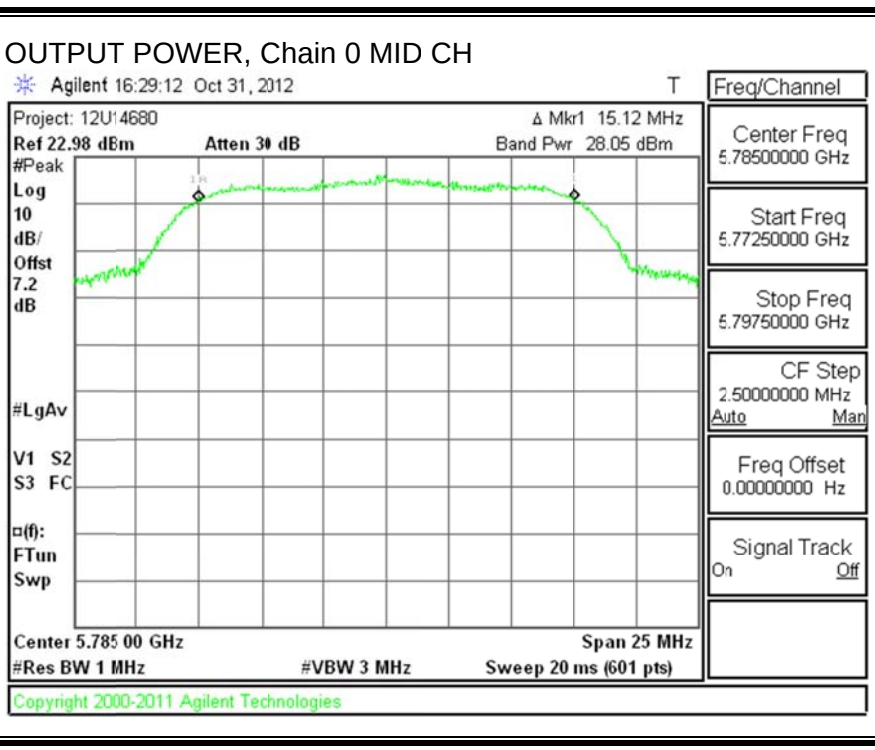
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	5745	28.04	28.04	30.00	-1.96
Mid	5785	28.05	28.05	30.00	-1.95
High	5825	27.93	27.93	30.00	-2.07

OUTPUT POWER, Chain 0

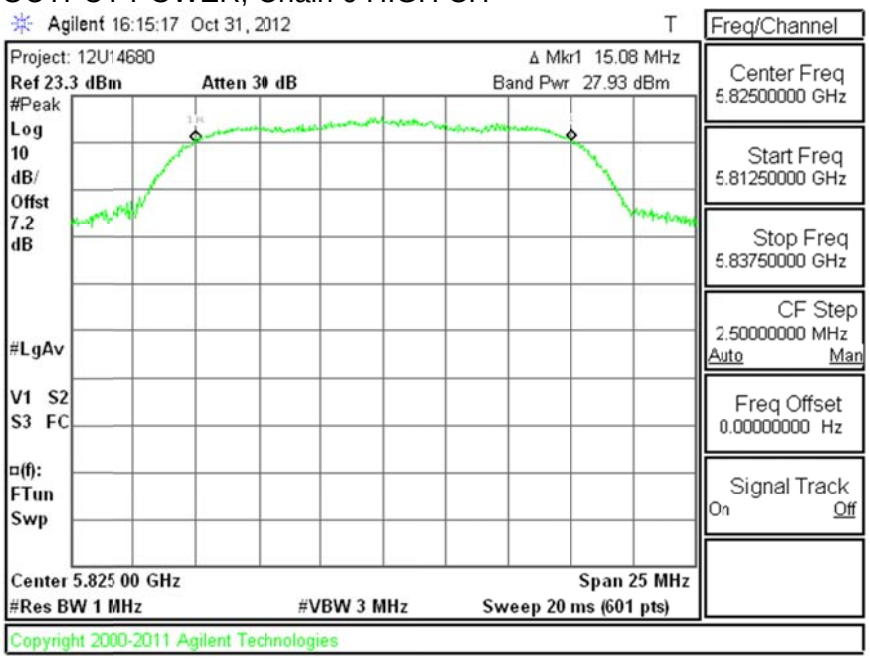
OUTPUT POWER, Chain 0 LOW CH



OUTPUT POWER, Chain 0 MID CH



OUTPUT POWER, Chain 0 HIGH CH



8.4.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

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

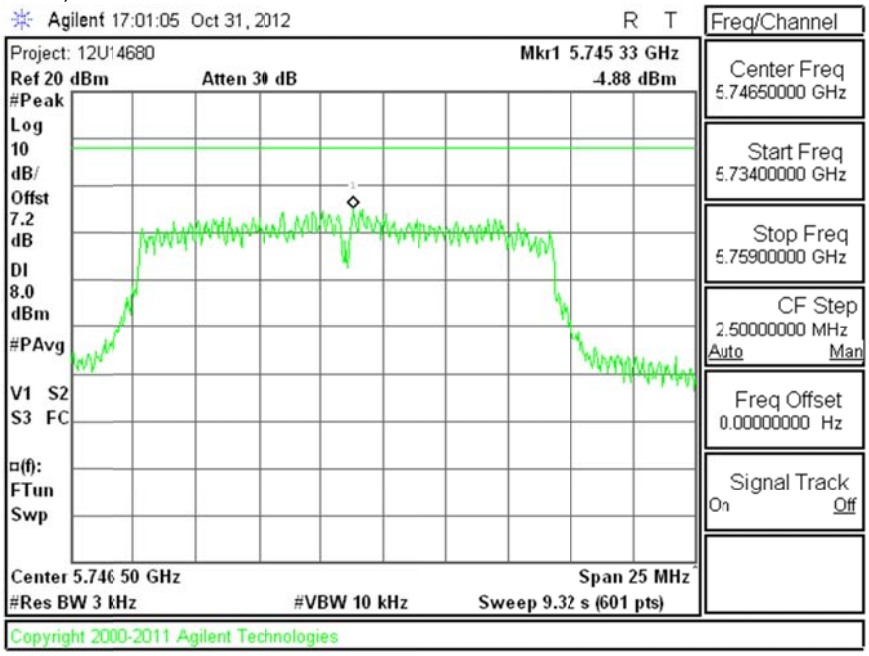
RESULTS

PSD Results

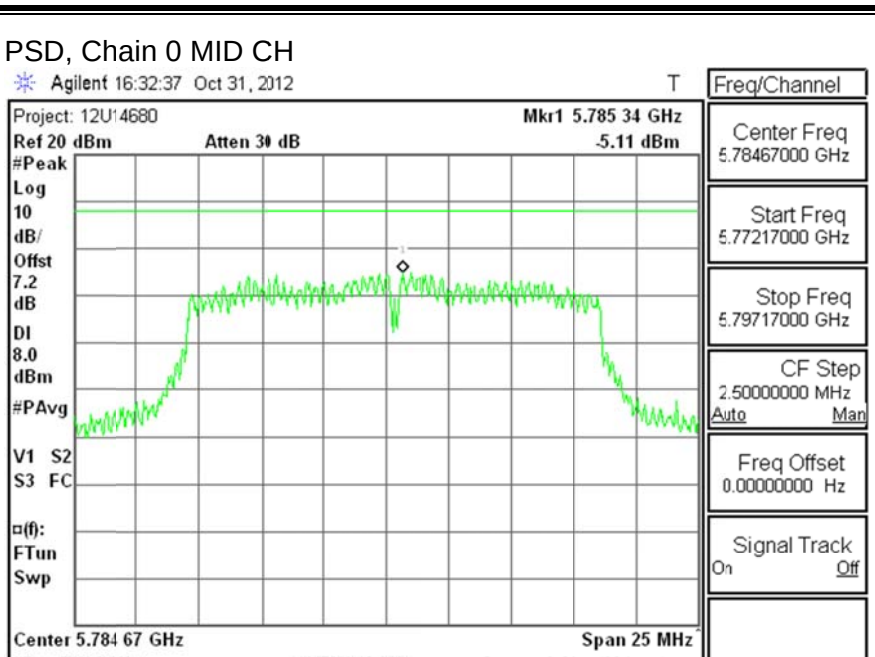
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-4.88	8.0	-12.9
Mid	5785	-5.11	8.0	-13.1
High	5825	-5.10	8.0	-13.1

PSD, Chain 0

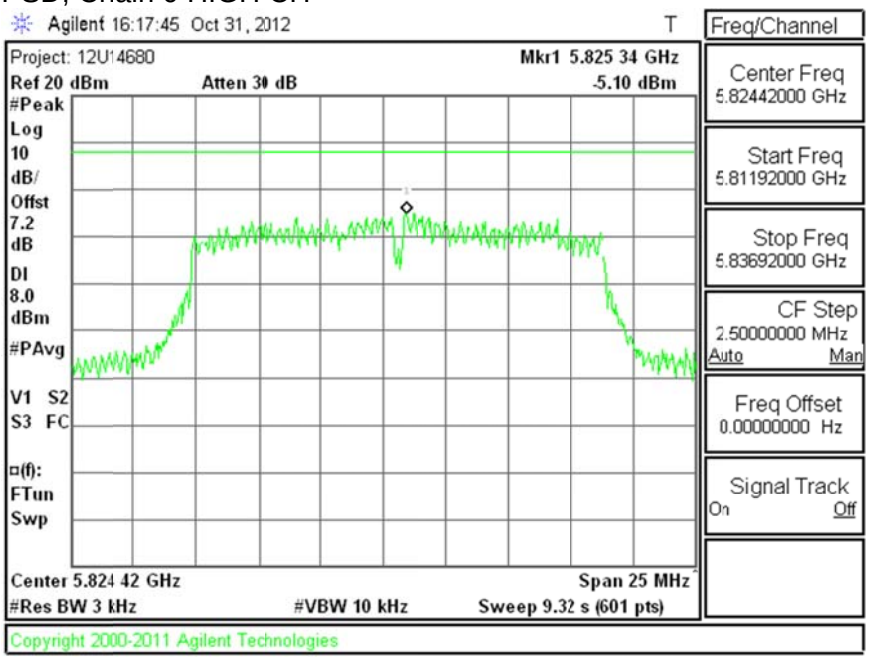
PSD, Chain 0 LOW CH



PSD, Chain 0 MID CH



PSD, Chain 0 HIGH CH



8.4.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

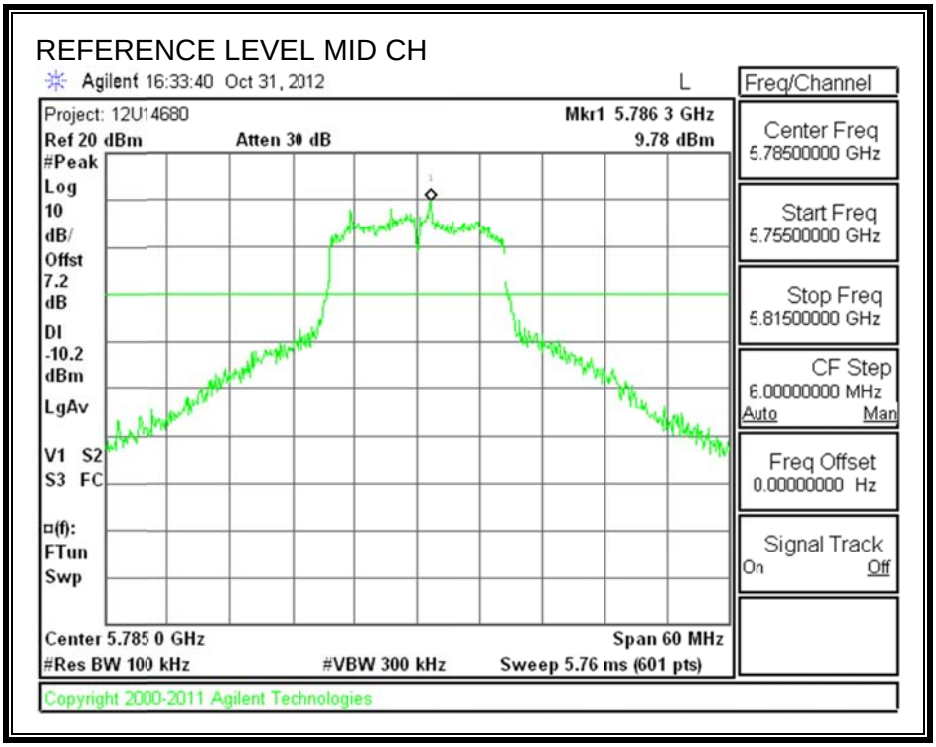
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

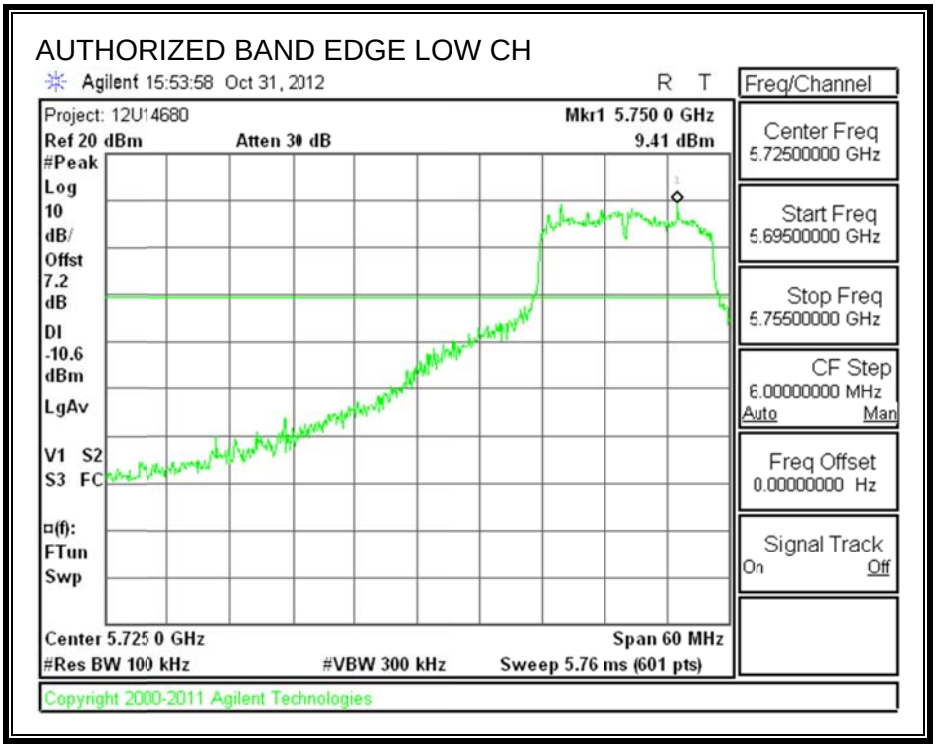
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

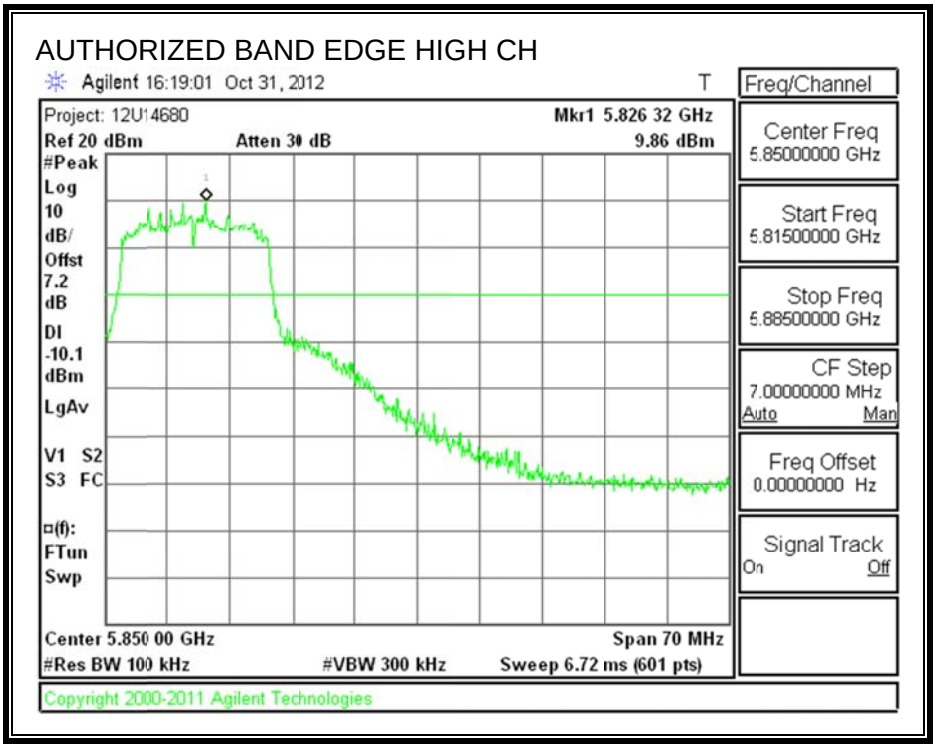
IN-BAND REFERENCE LEVEL



LOW CHANNEL BANDEDGE

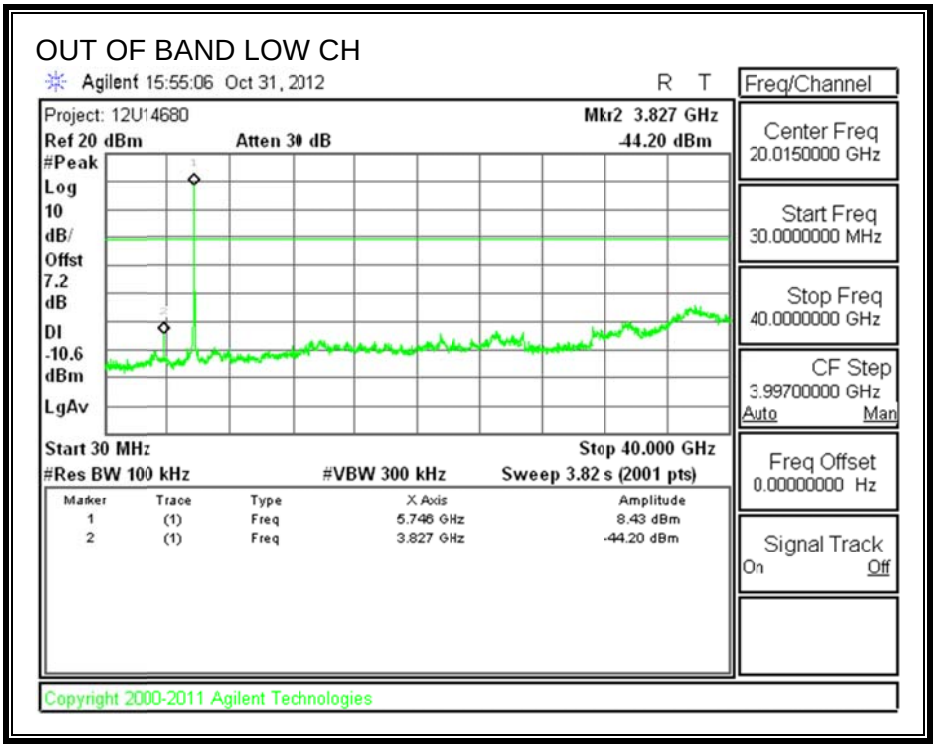


HIGH CHANNEL BANDEDGE

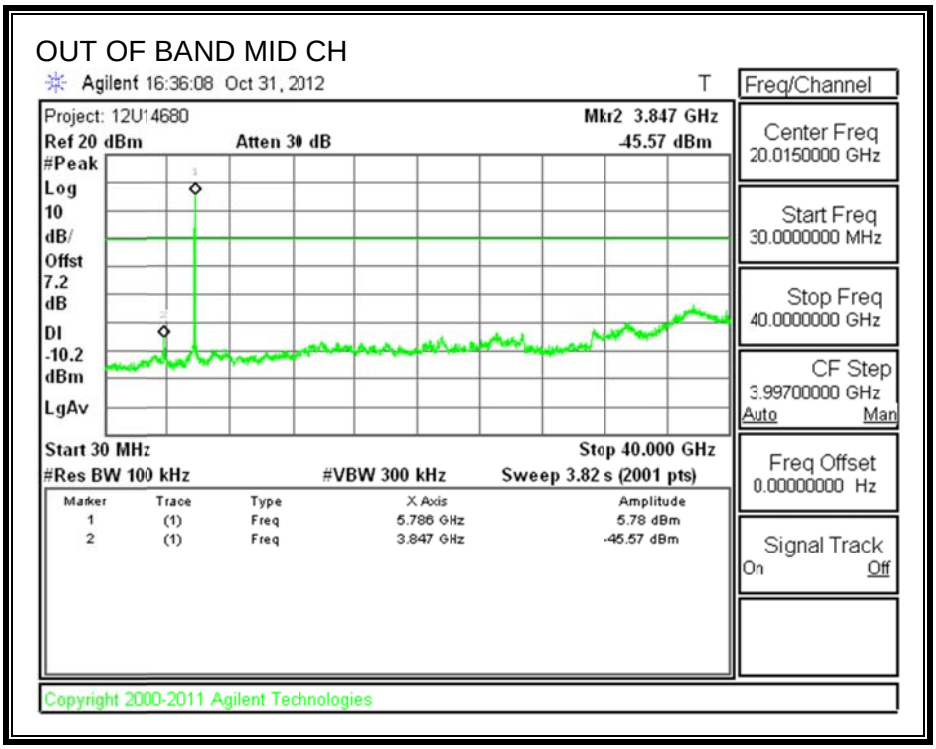


OUT-OF-BAND EMISSIONS

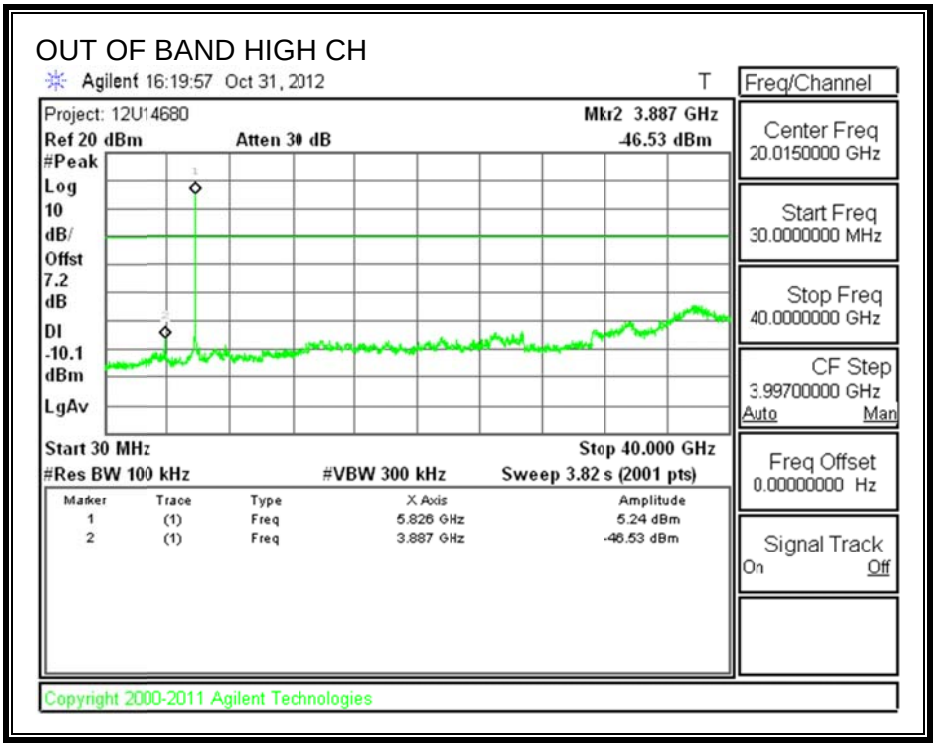
OUT OF BAND LOW CH



OUT OF BAND MID CH



OUT OF BAND HIGH CH



8.5. 802.11n HT20 MODE IN THE 5.8 GHz BAND

8.5.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

TEST PROCEDURE

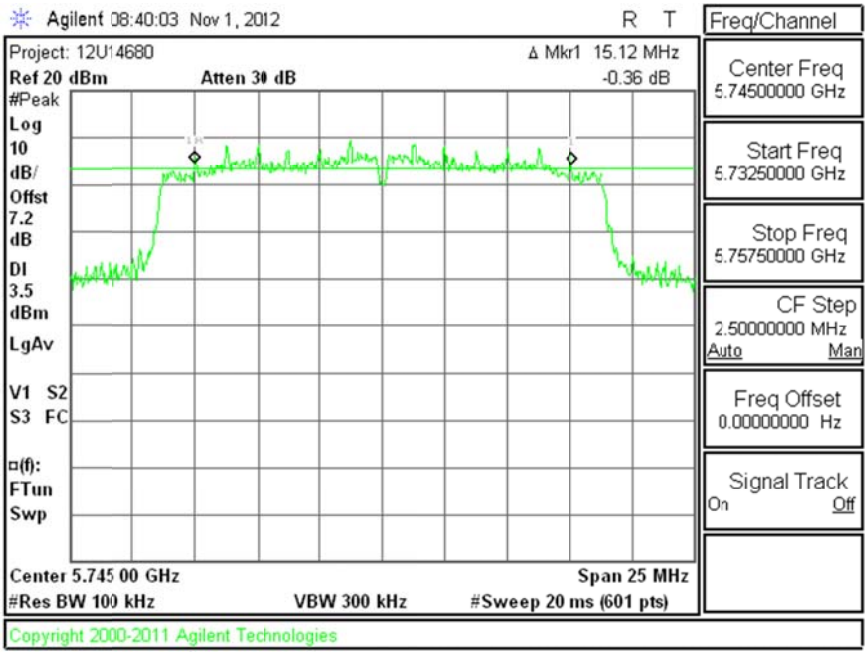
The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW >= 3 x RBW, peak detector and max hold.

RESULTS

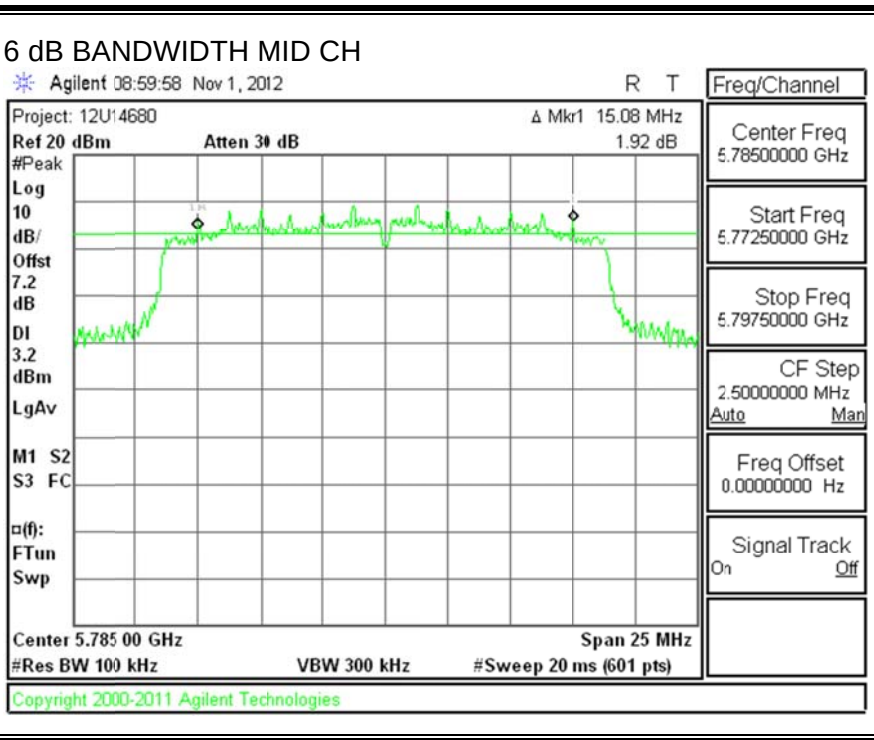
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5745	15.120	0.5
Mid	5785	15.080	0.5
High	5825	15.120	0.5

6 dB BANDWIDTH

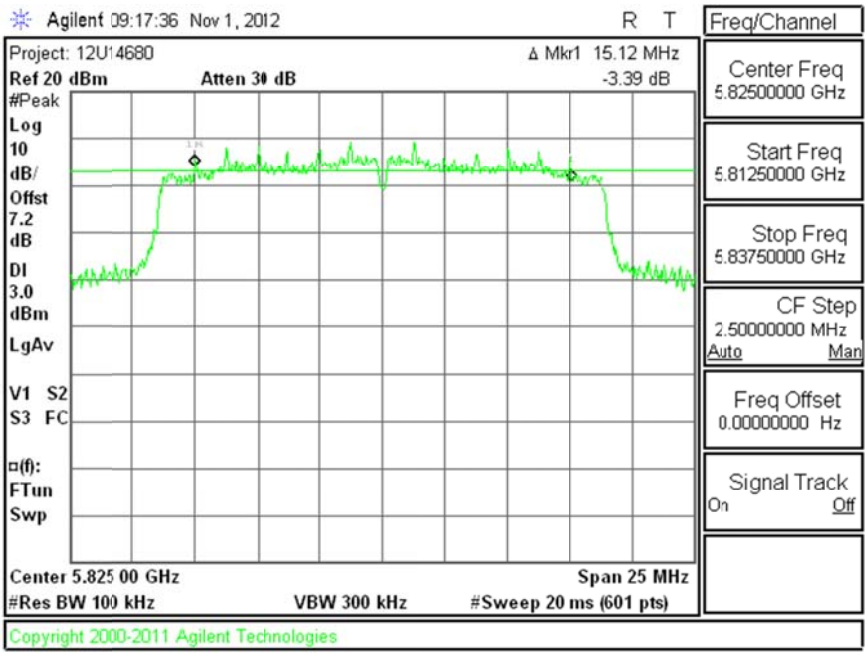
6 dB BANDWIDTH LOW CH



6 dB BANDWIDTH MID CH



6 dB BANDWIDTH HIGH CH



8.5.2. 99% BANDWIDTH

LIMITS

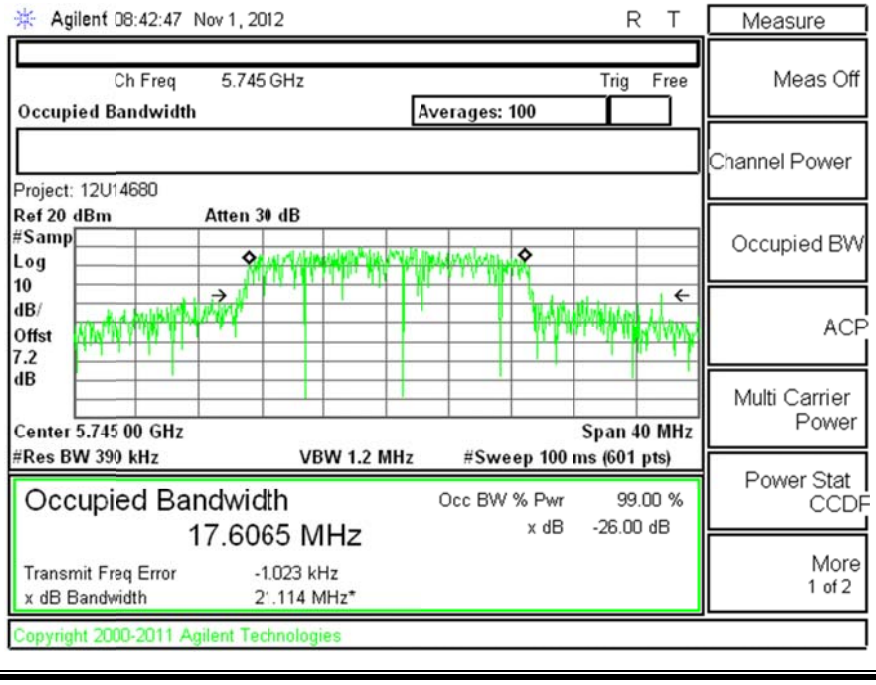
None; for reporting purposes only.

RESULTS

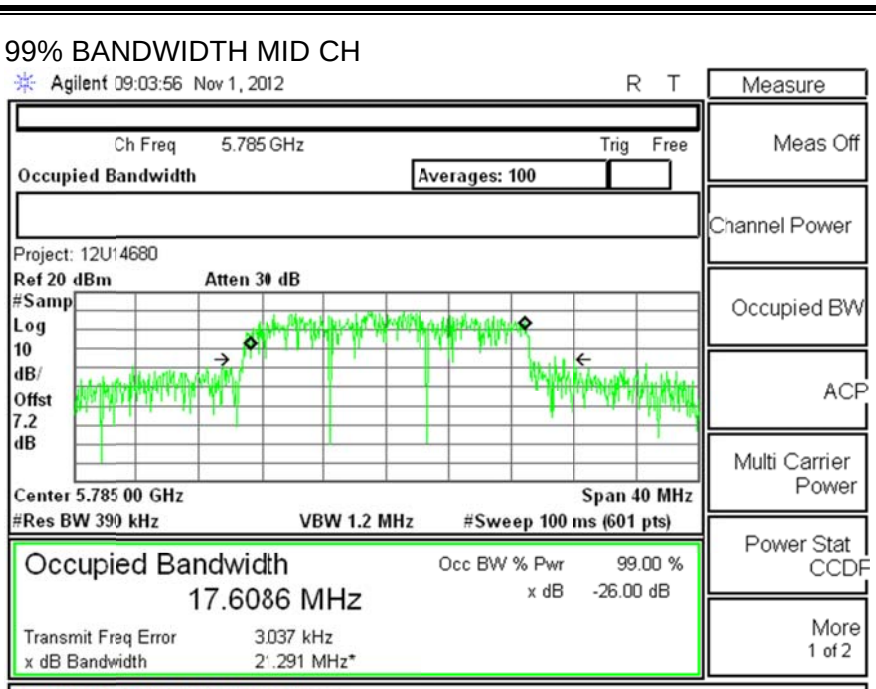
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.6065
Mid	5785	17.6068
High	5825	17.5904

99% BANDWIDTH

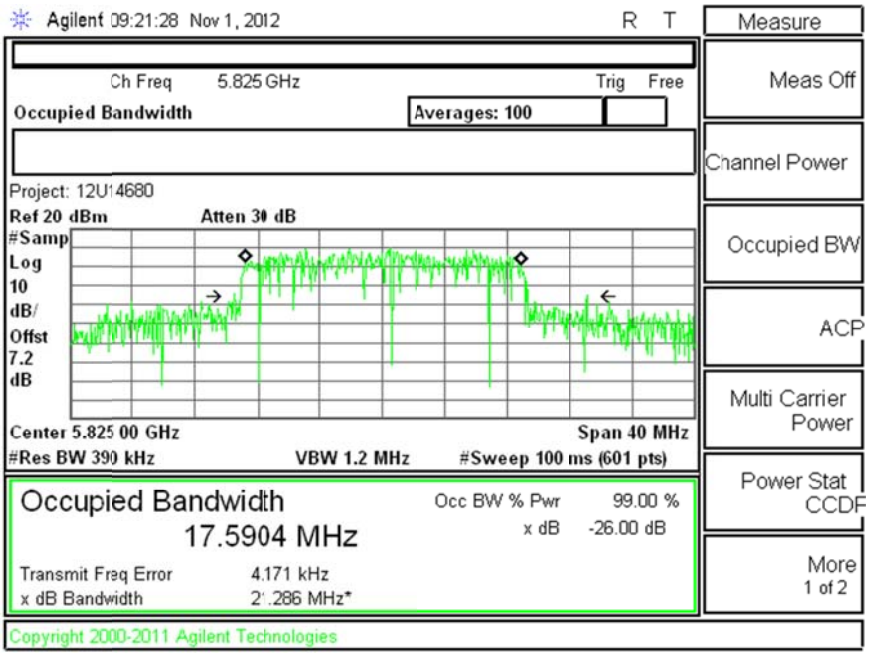
99% BANDWIDTH LOW CH



99% BANDWIDTH MID CH



99% BANDWIDTH HIGH CH



8.5.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5745	19.50
Mid	5785	19.50
High	5825	19.50

8.5.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

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

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Limits

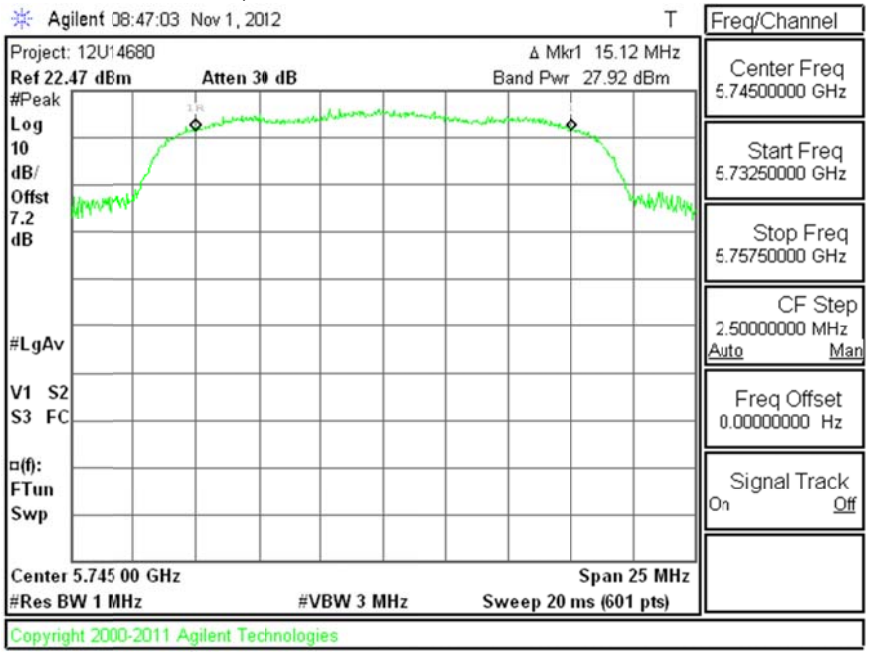
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	5745	2.62	30.00	30	36	30.00
Mid	5785	2.62	30.00	30	36	30.00
High	5825	2.62	30.00	30	36	30.00

Results

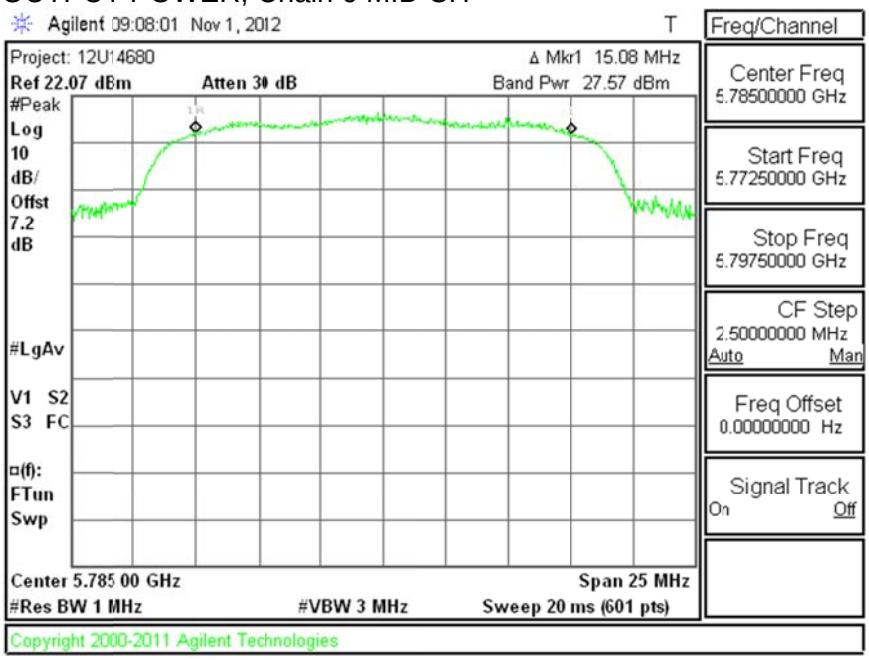
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	5745	27.92	27.92	30.00	-2.08
Mid	5785	27.57	27.57	30.00	-2.43
High	5825	27.61	27.61	30.00	-2.39

OUTPUT POWER, Chain 0

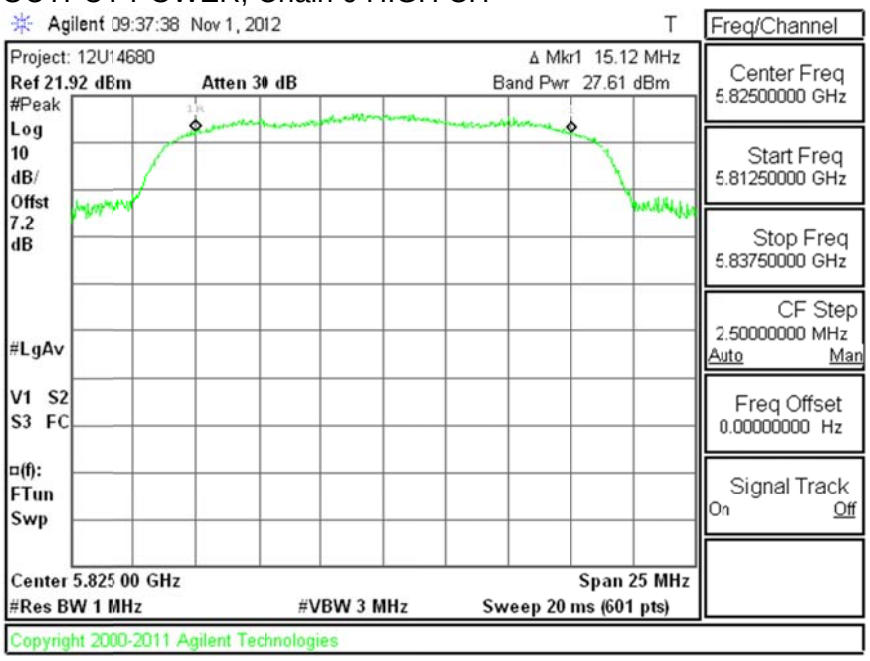
OUTPUT POWER, Chain 0 LOW CH



OUTPUT POWER, Chain 0 MID CH



OUTPUT POWER, Chain 0 HIGH CH



8.5.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

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

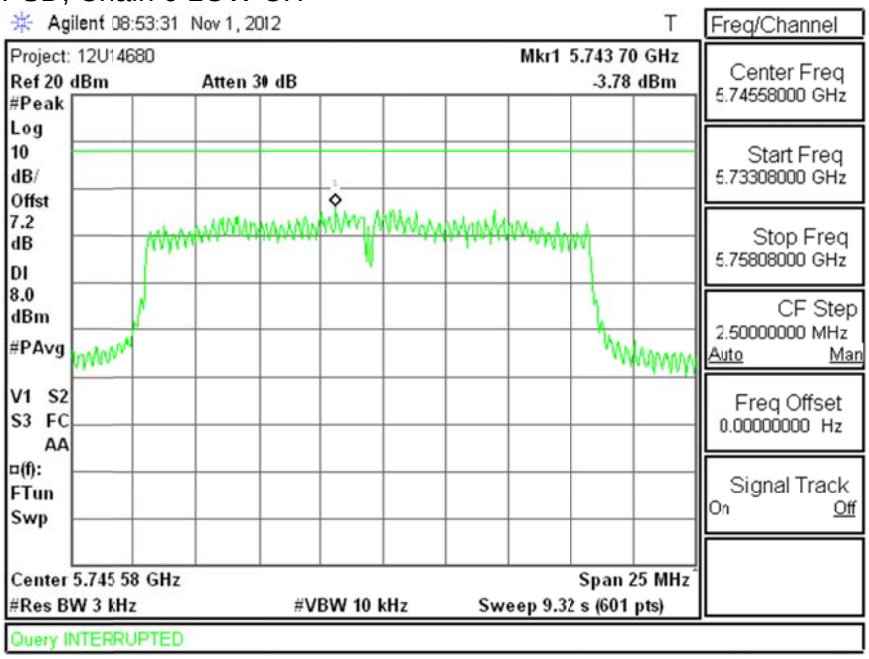
RESULTS

PSD Results

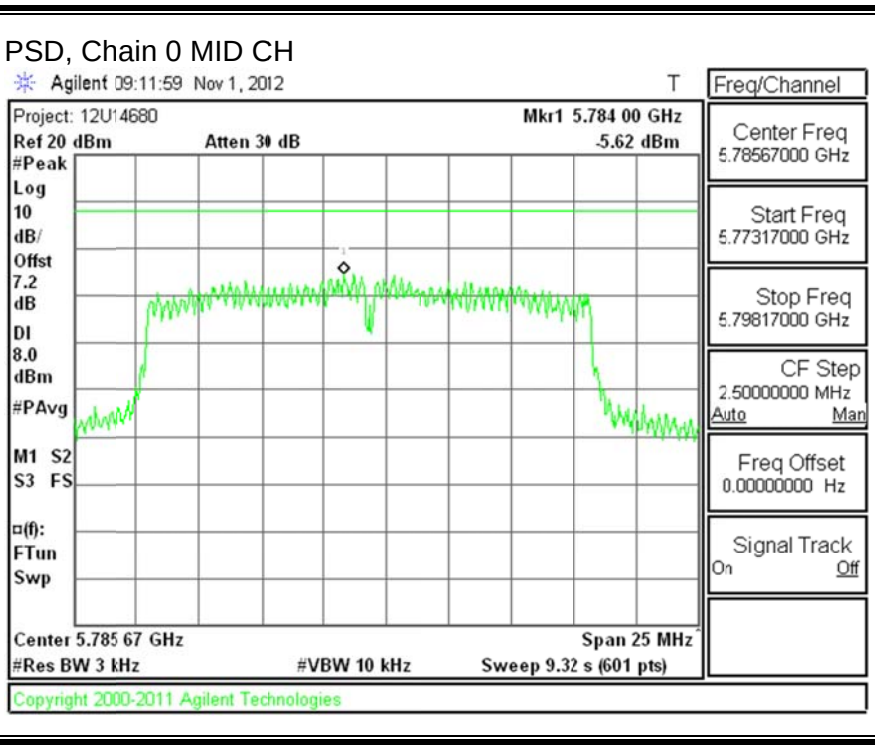
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-3.78	8.0	-11.8
Mid	5785	-5.62	8.0	-13.6
High	5825	-3.92	8.0	-11.9

PSD, Chain 0

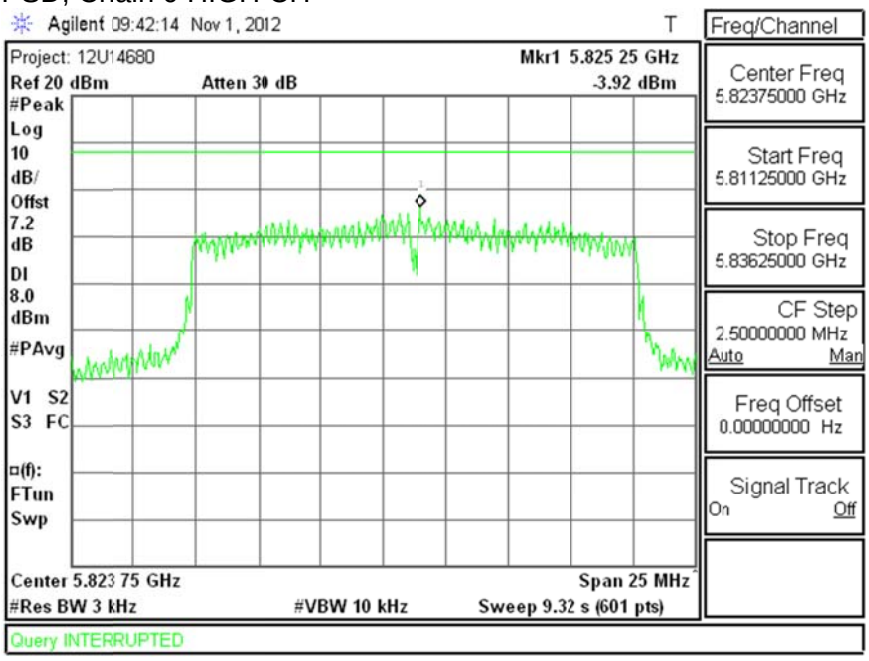
PSD, Chain 0 LOW CH



PSD, Chain 0 MID CH



PSD, Chain 0 HIGH CH



8.5.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

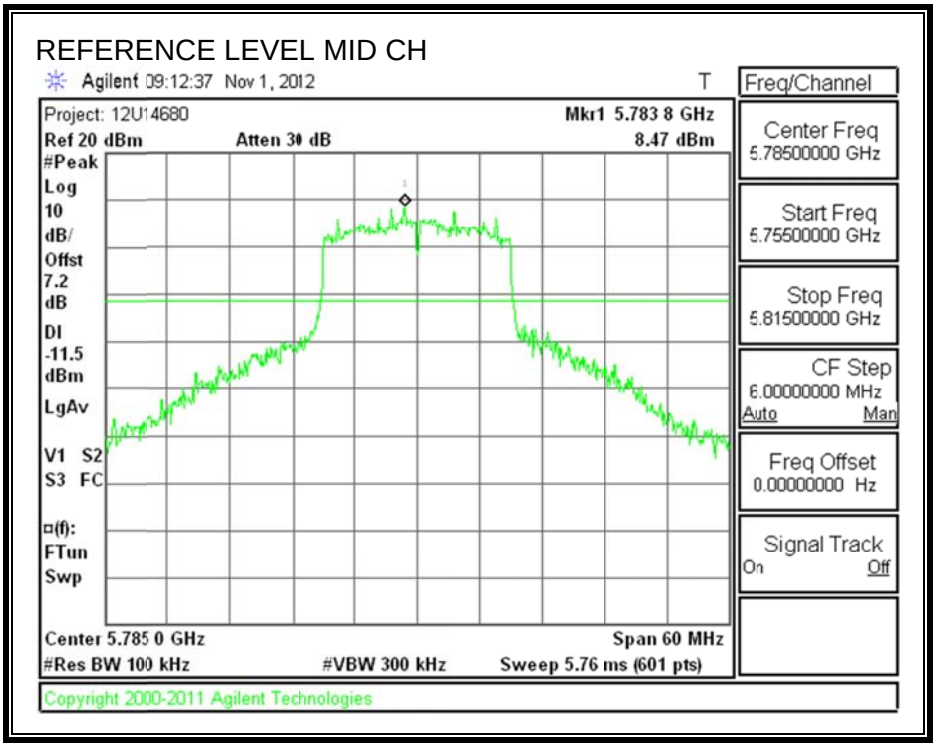
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

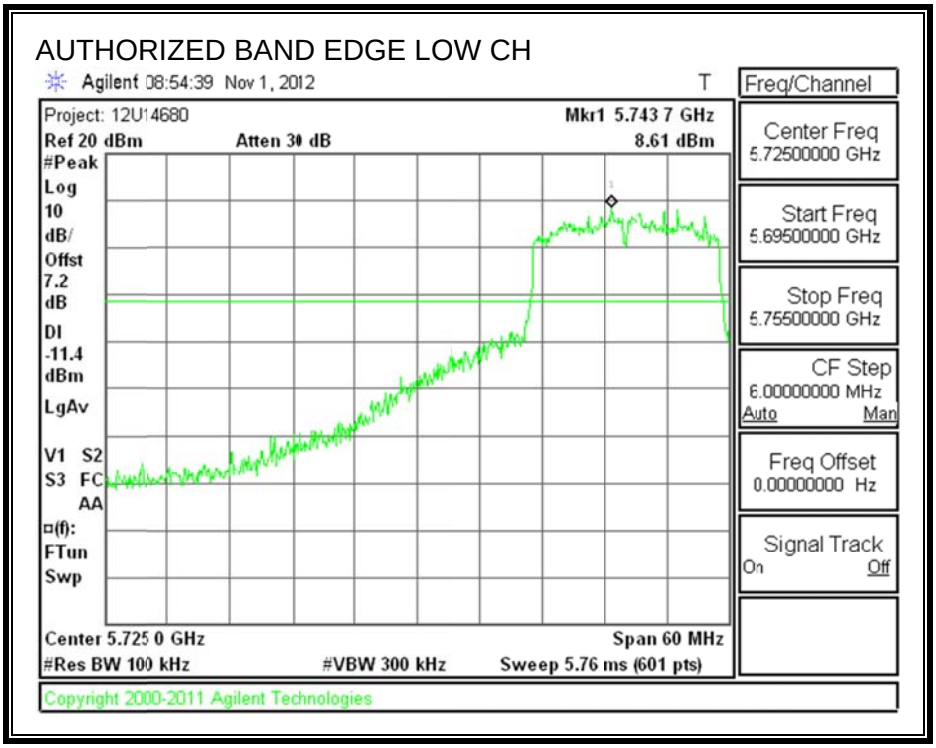
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

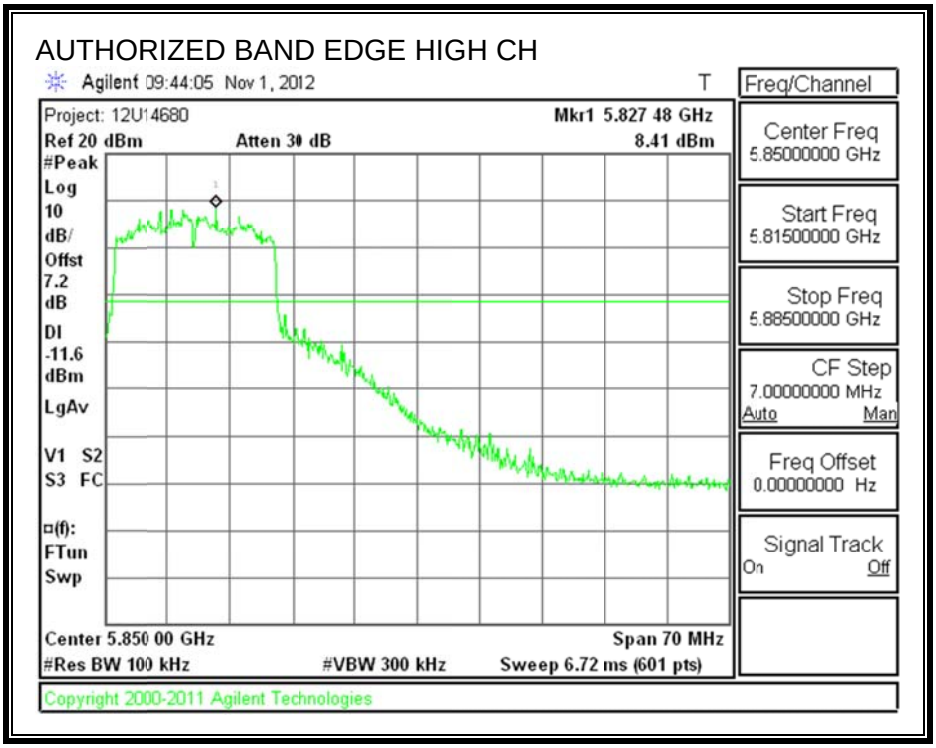
IN-BAND REFERENCE LEVEL



LOW CHANNEL BANDEDGE

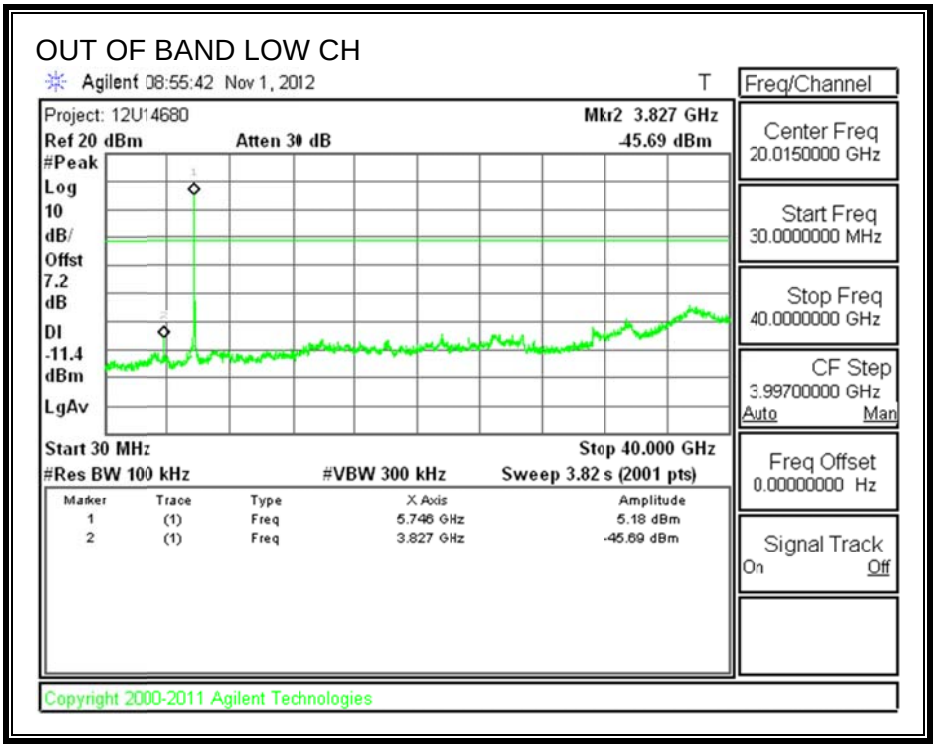


HIGH CHANNEL BANDEDGE

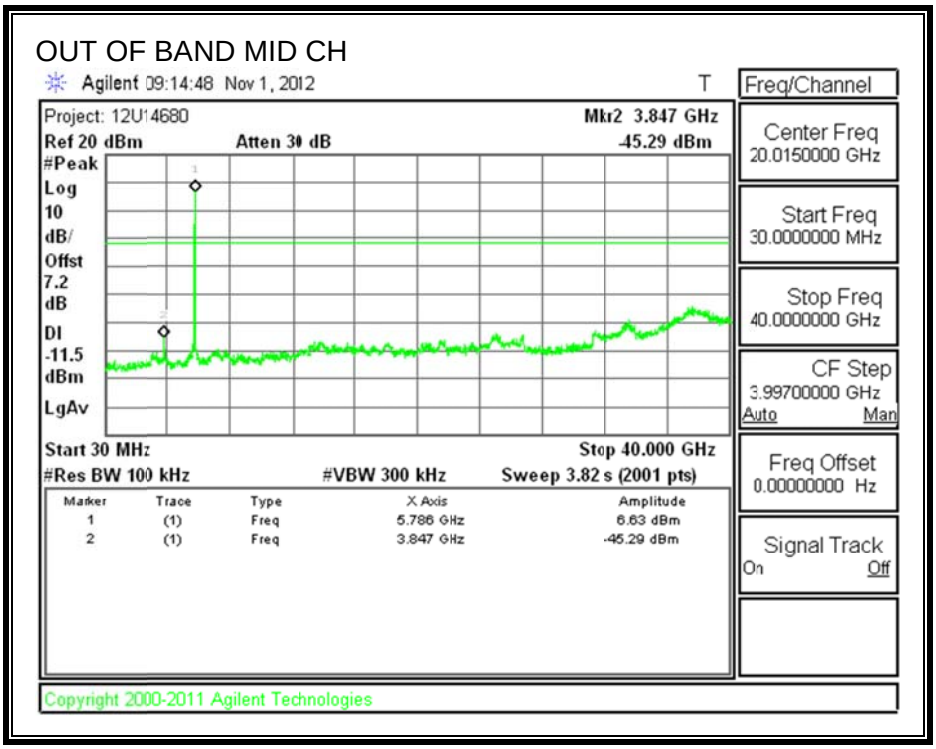


OUT-OF-BAND EMISSIONS

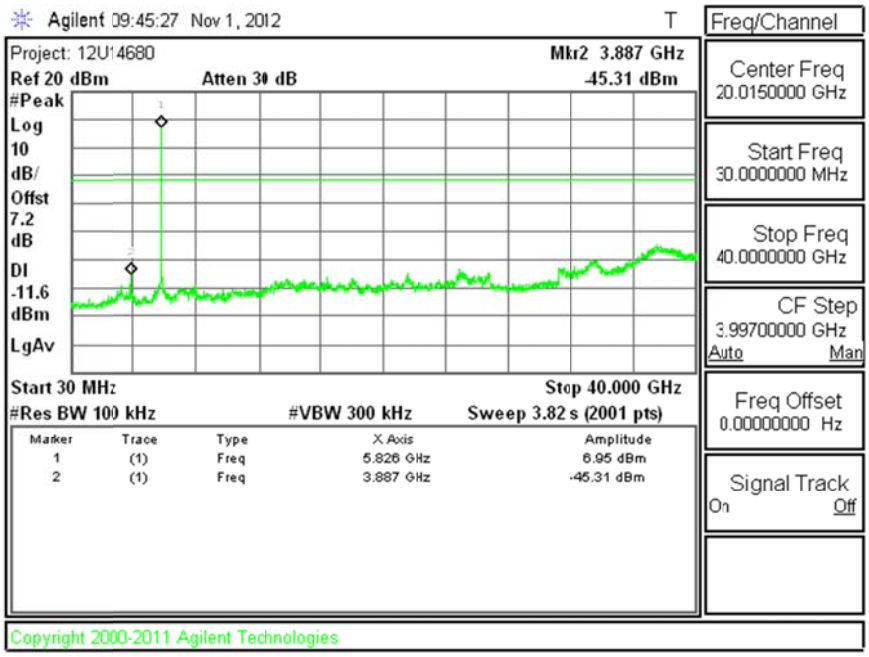
OUT OF BAND LOW CH



OUT OF BAND MID CH



OUT OF BAND HIGH CH



8.6. 802.11n HT40 MODE IN THE 5.8 GHz BAND

8.6.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

TEST PROCEDURE

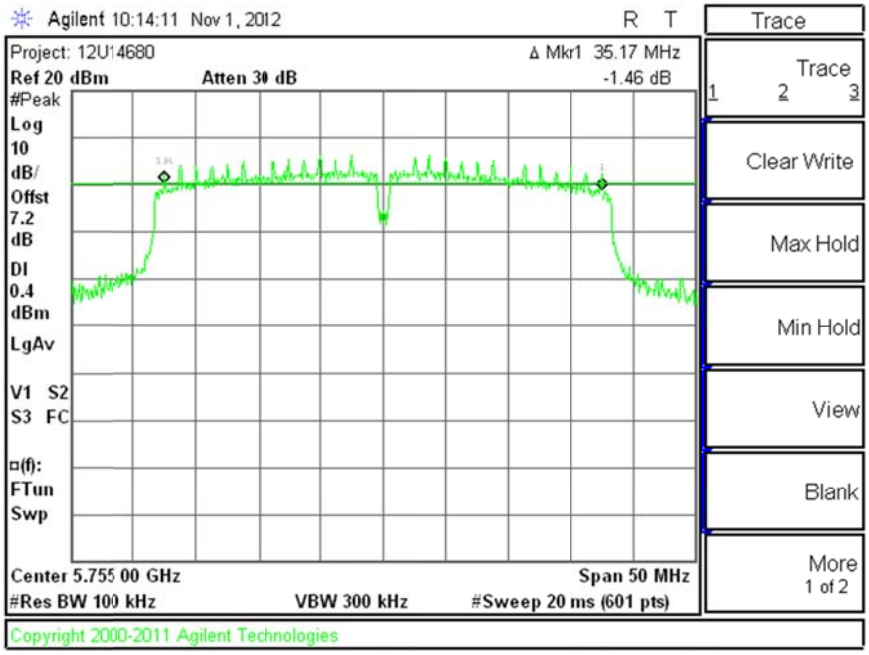
The transmitter output is connected to a spectrum analyzer with the RBW set between 1% and 5% of the EBW, the VBW >= 3 x RBW, peak detector and max hold.

RESULTS

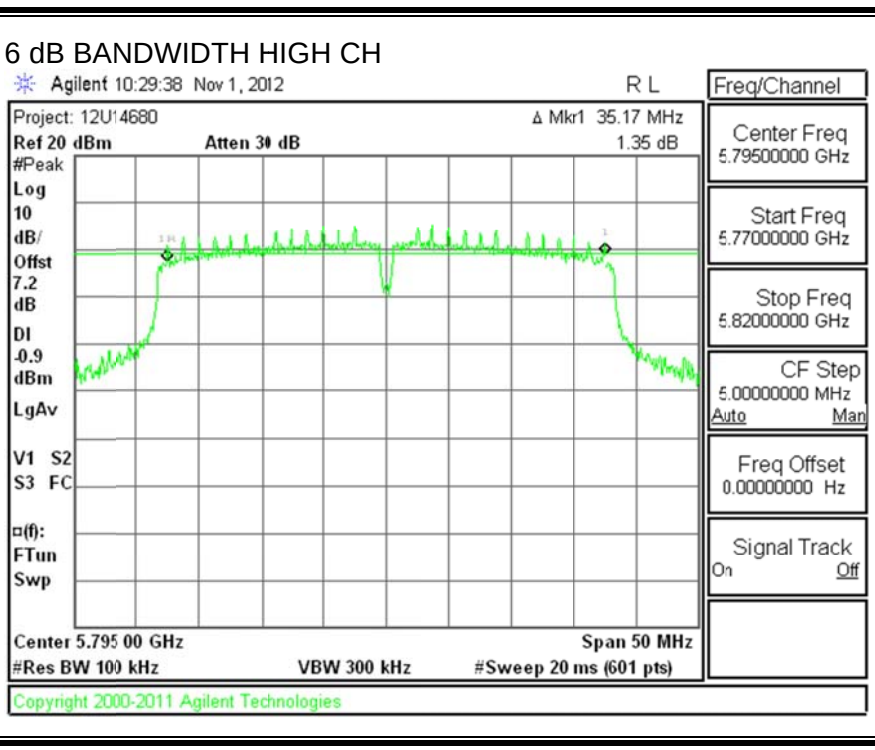
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5755	35.170	0.5
High	5795	35.170	0.5

6 dB BANDWIDTH

6 dB BANDWIDTH LOW CH



6 dB BANDWIDTH HIGH CH



8.6.2. 99% BANDWIDTH

LIMITS

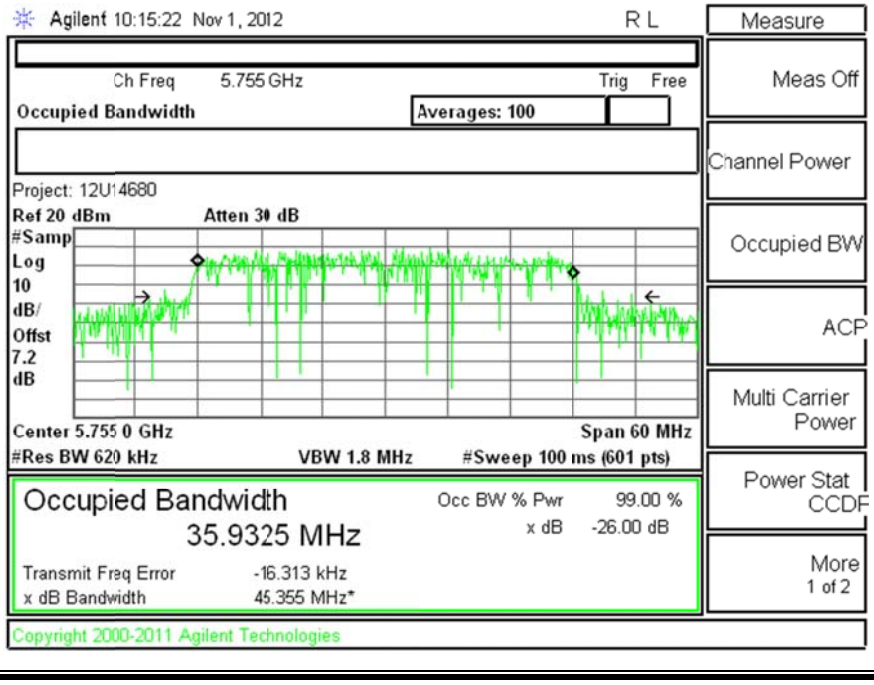
None; for reporting purposes only.

RESULTS

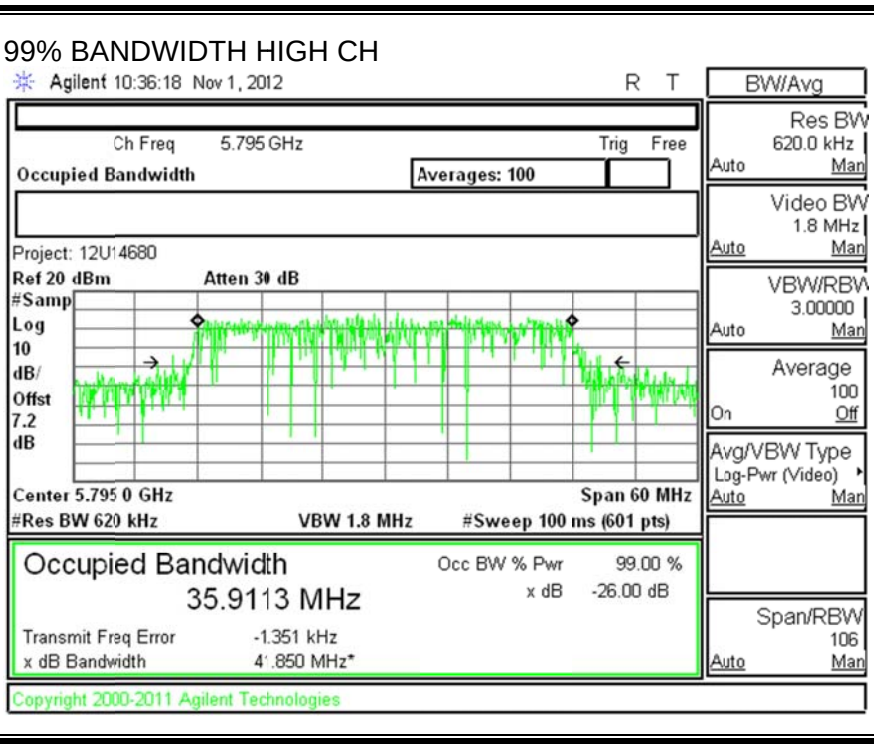
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	35.9325
High	5795	35.9113

99% BANDWIDTH

99% BANDWIDTH LOW CH



99% BANDWIDTH HIGH CH



8.6.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5755	19.50
High	5795	19.50

8.6.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

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

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Limits

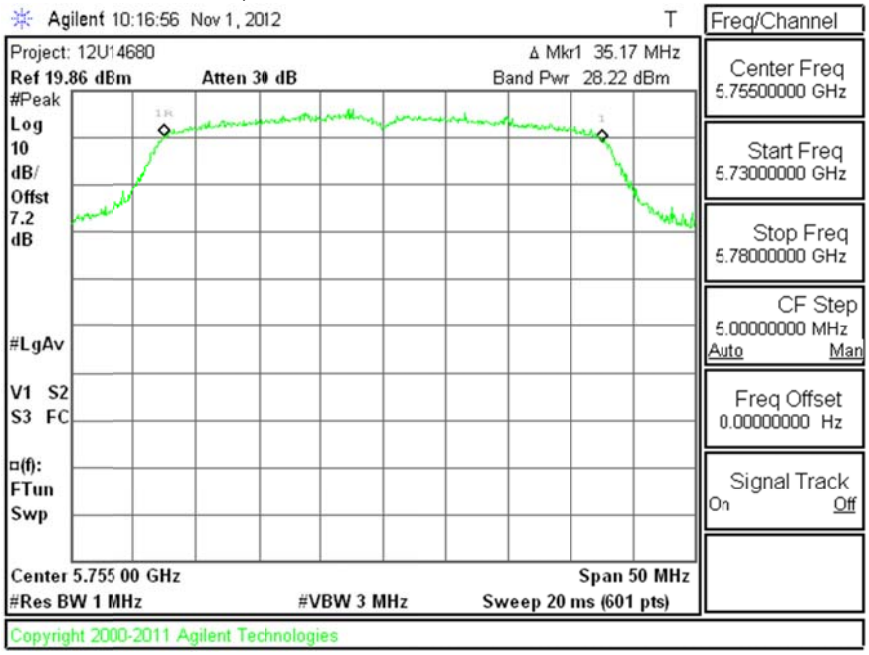
Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	5755	2.62	30.00	30	36	30.00
High	5795	2.62	30.00	30	36	30.00

Results

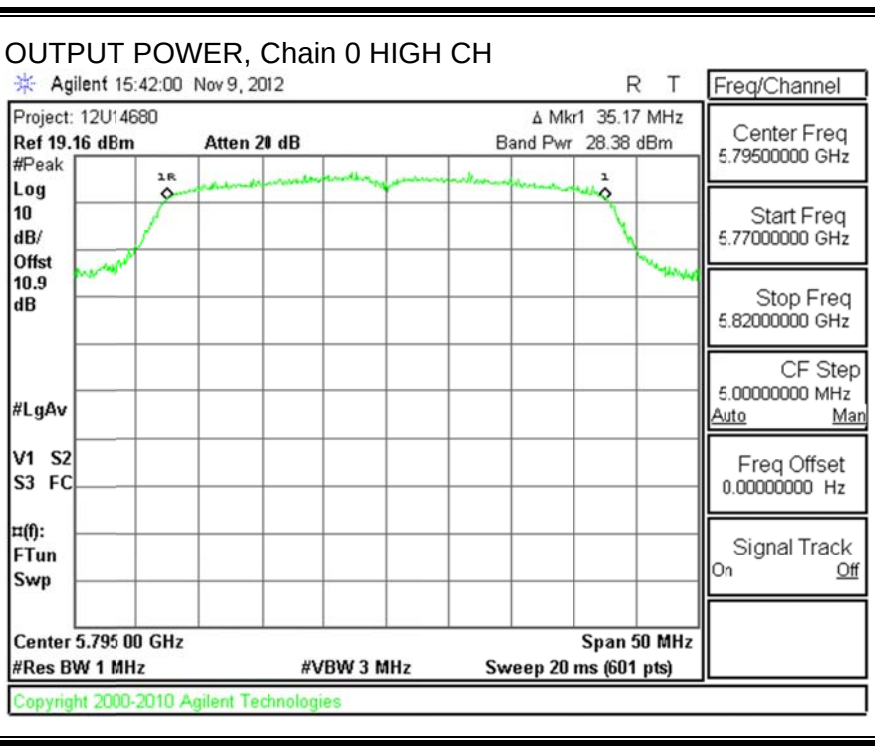
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	5755	28.22	28.22	30.00	-1.78
High	5795	28.38	28.38	30.00	-1.62

OUTPUT POWER, Chain 0

OUTPUT POWER, Chain 0 LOW CH



OUTPUT POWER, Chain 0 HIGH CH



8.6.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

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

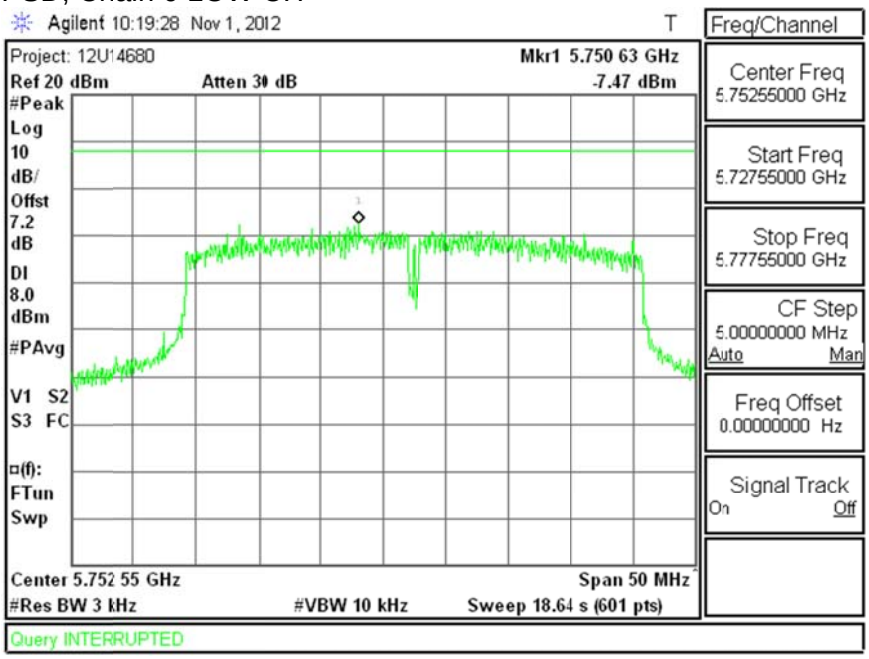
RESULTS

PSD Results

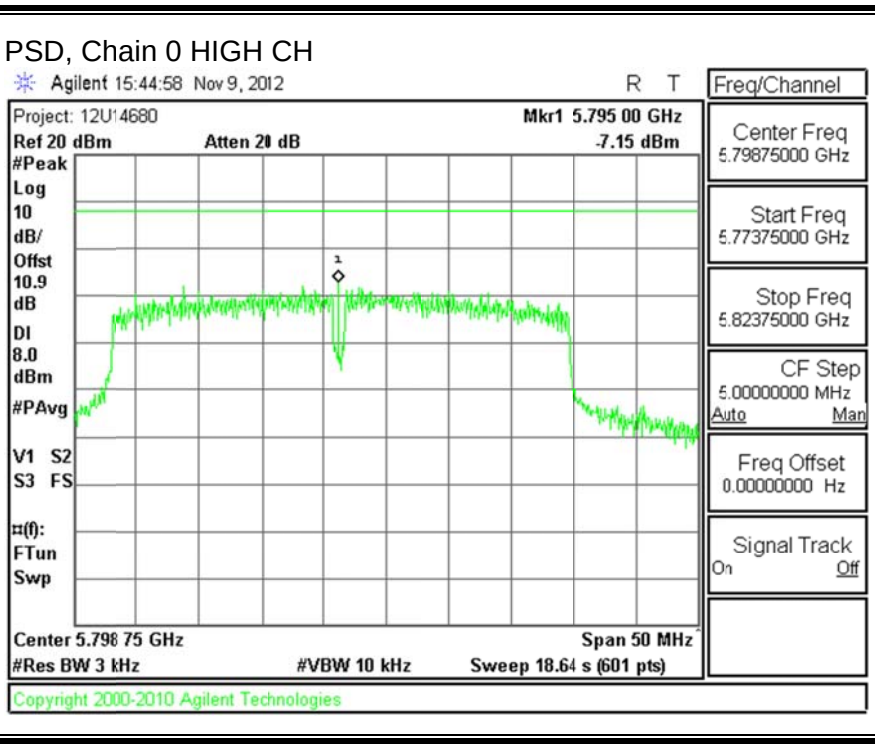
Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Limit (dBm)	Margin (dB)
Low	5755	-7.47	8.0	-15.5
High	5795	-7.15	8.0	-15.2

PSD, Chain 0

PSD, Chain 0 LOW CH



PSD, Chain 0 HIGH CH



8.6.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

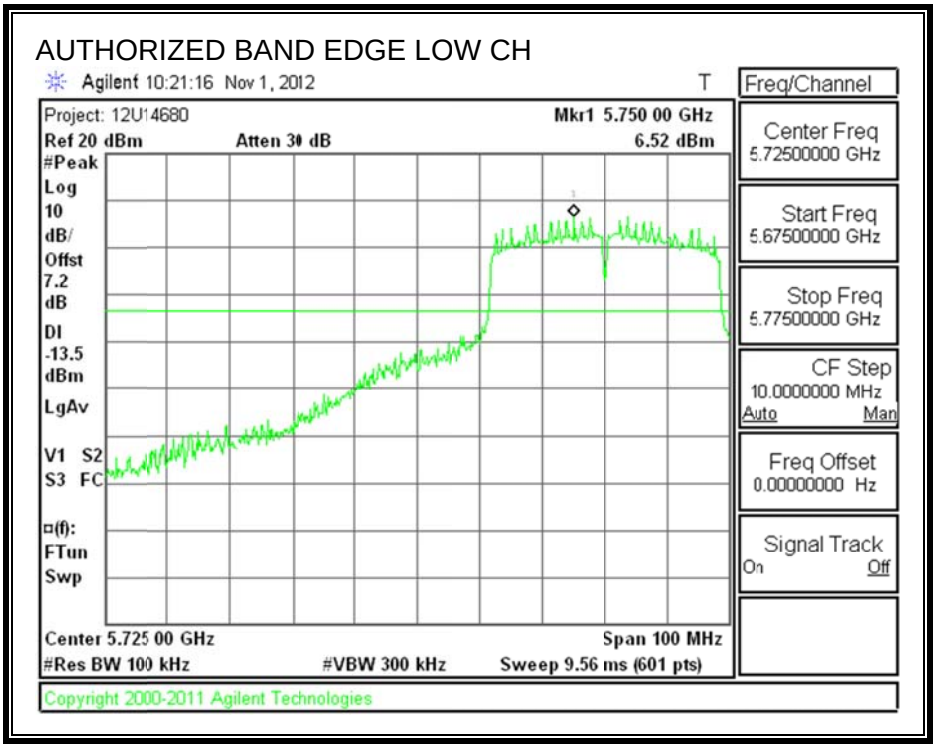
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

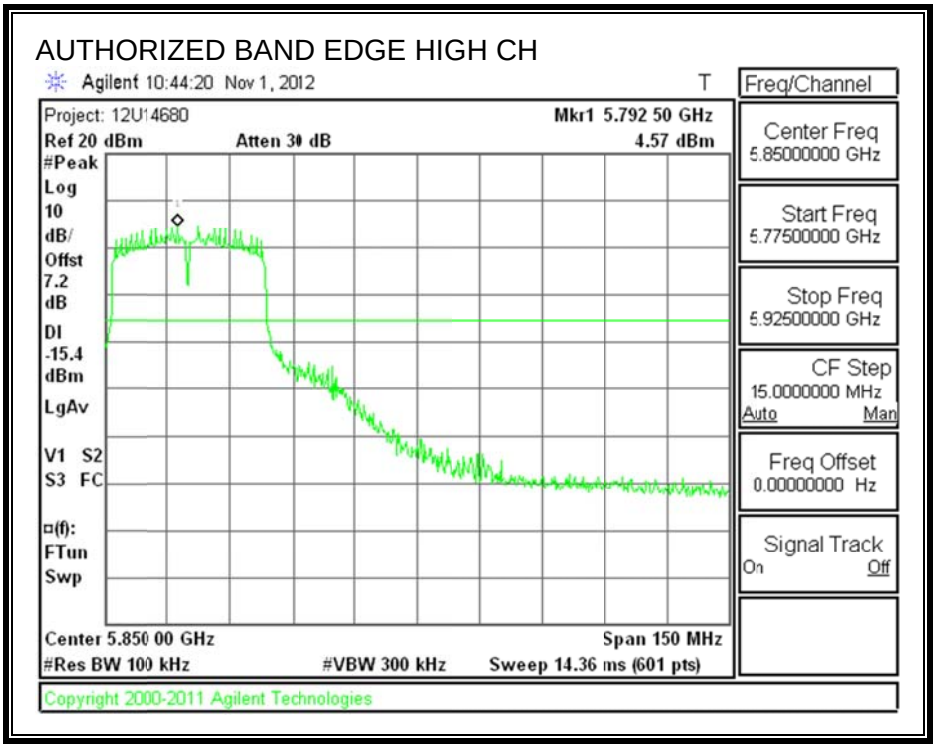
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

LOW CHANNEL BANDEDGE

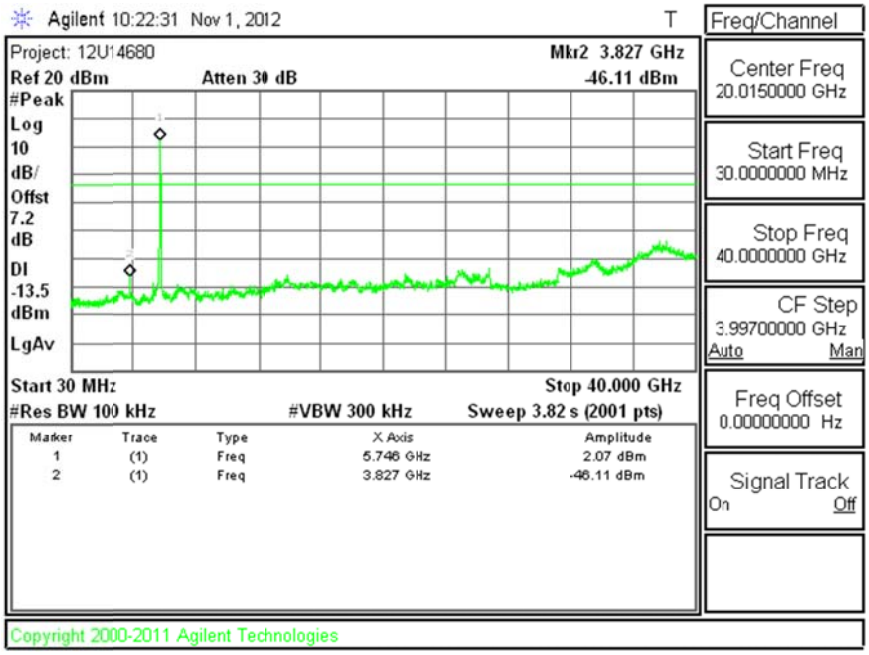


HIGH CHANNEL BANDEDGE

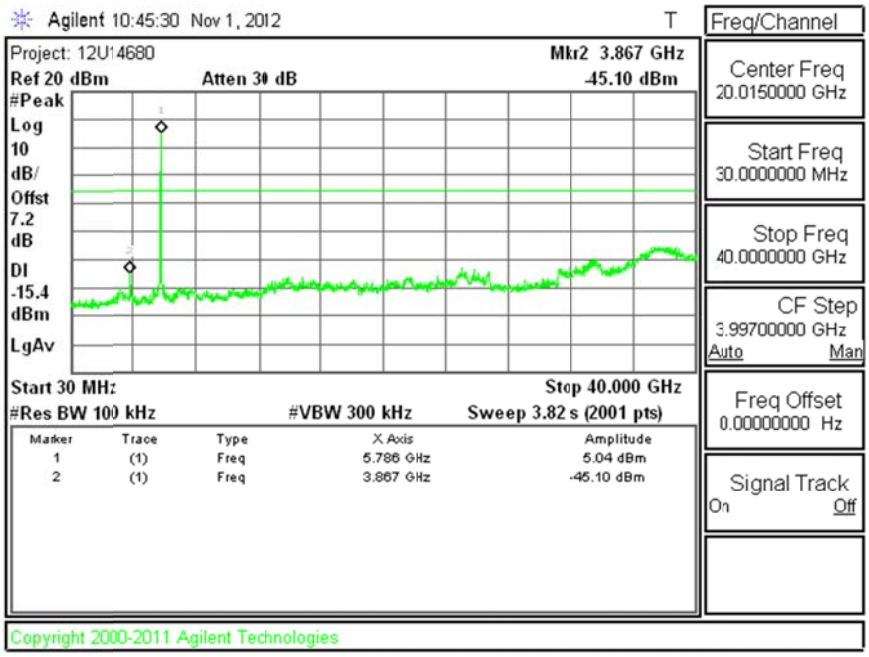


OUT-OF-BAND EMISSIONS

OUT OF BAND LOW CH



OUT OF BAND HIGH CH



9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

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

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

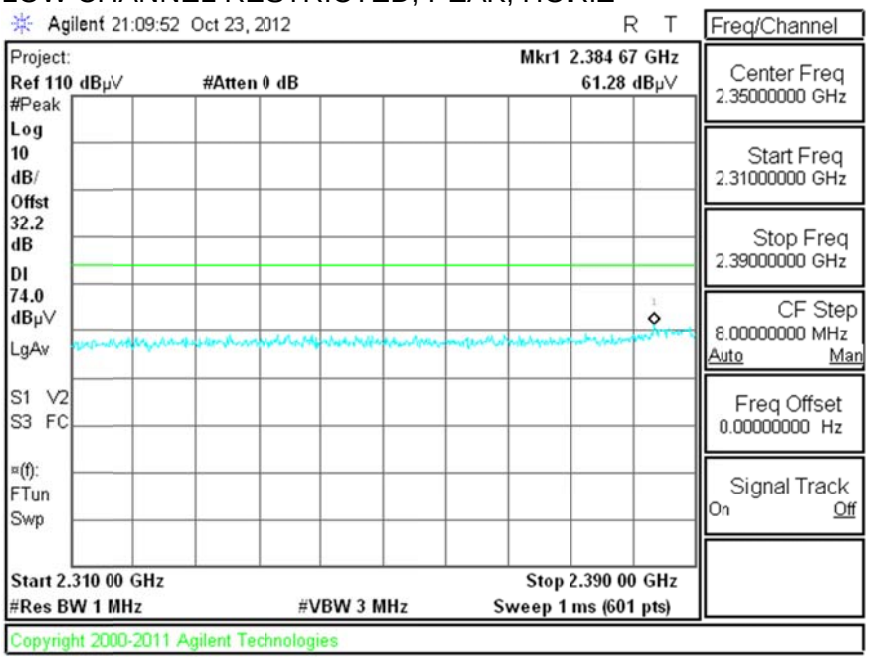
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

9.2. TRANSMITTER ABOVE 1 GHz

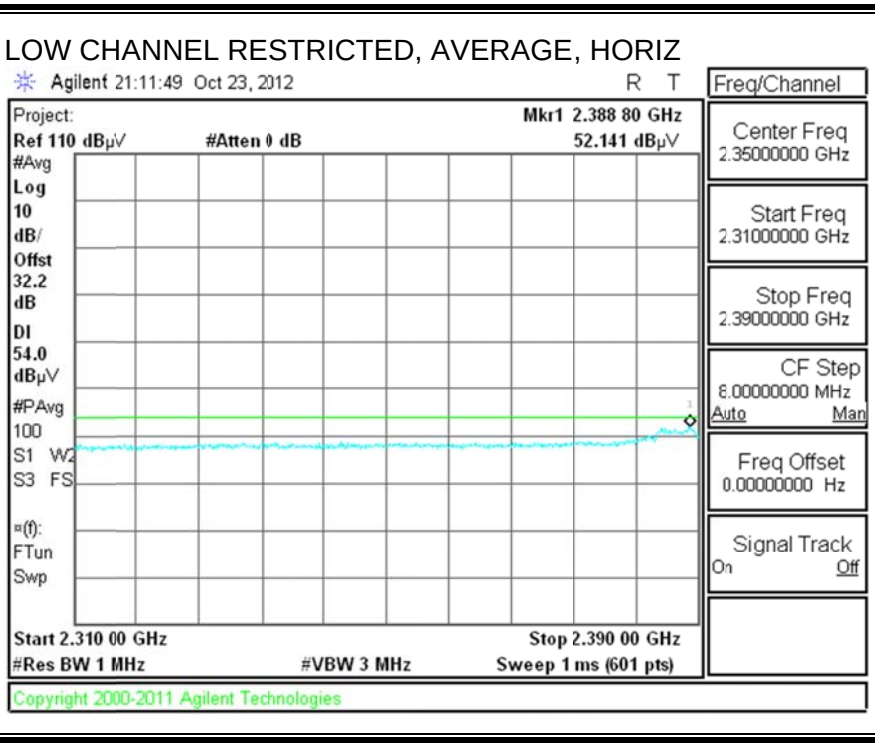
9.3. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

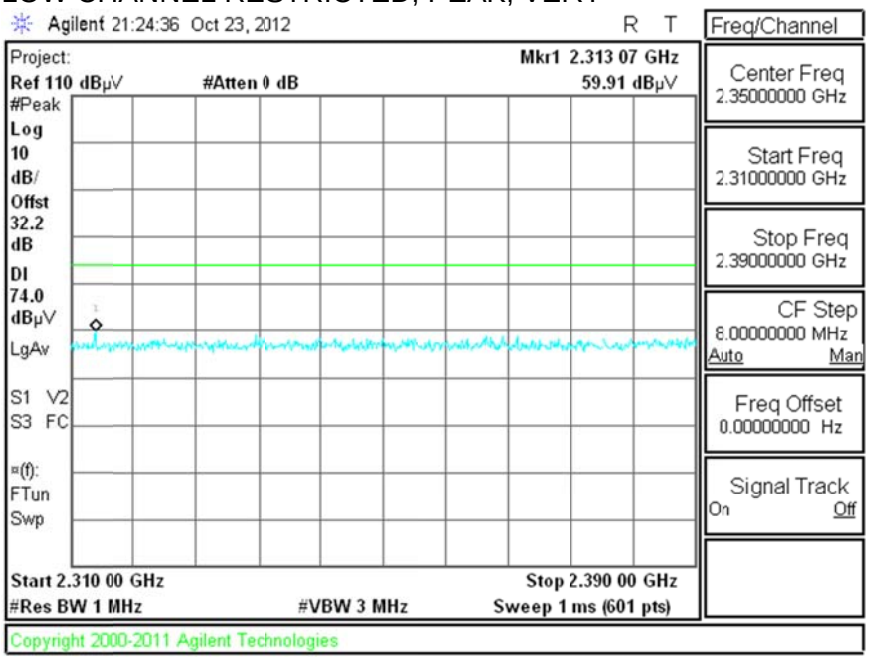
LOW CHANNEL RESTRICTED, PEAK, HORIZ



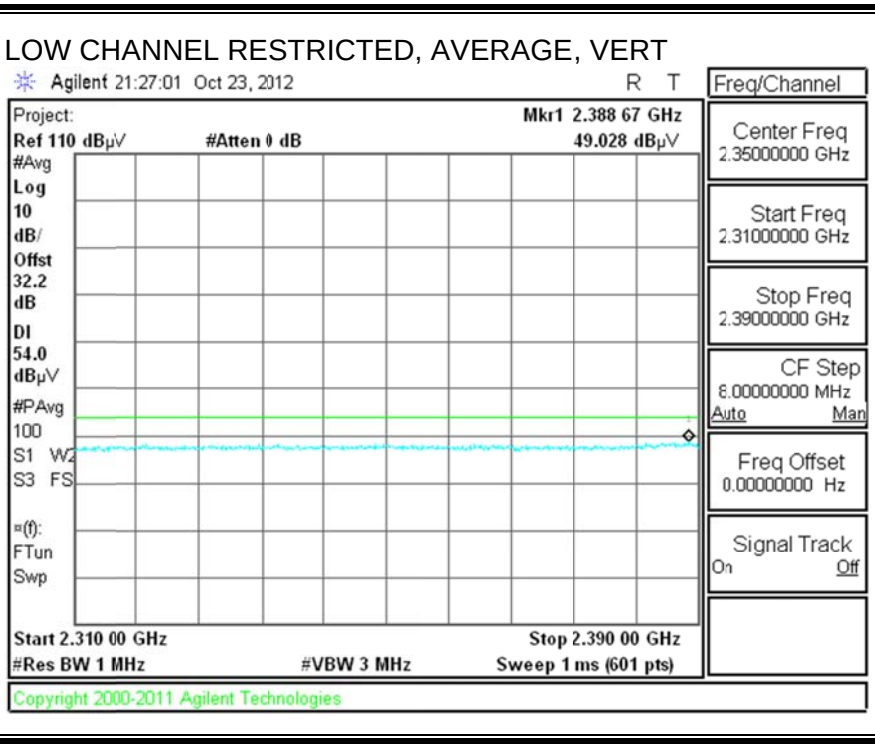
LOW CHANNEL RESTRICTED, AVERAGE, HORIZ



LOW CHANNEL RESTRICTED, PEAK, VERT

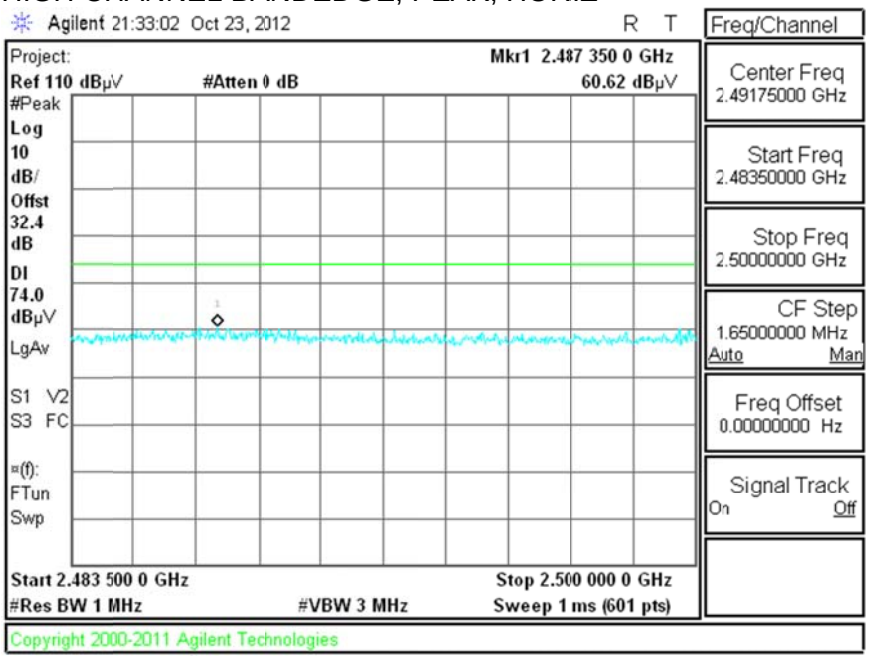


LOW CHANNEL RESTRICTED, AVERAGE, VERT

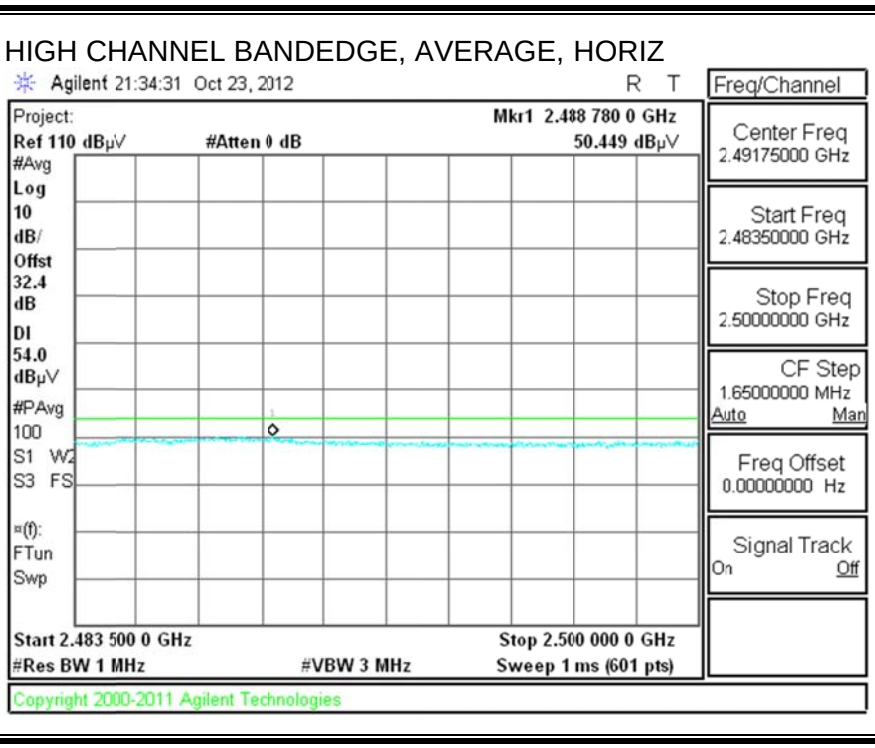


AUTHORIZED BANDEDGE (HIGH CHANNEL)

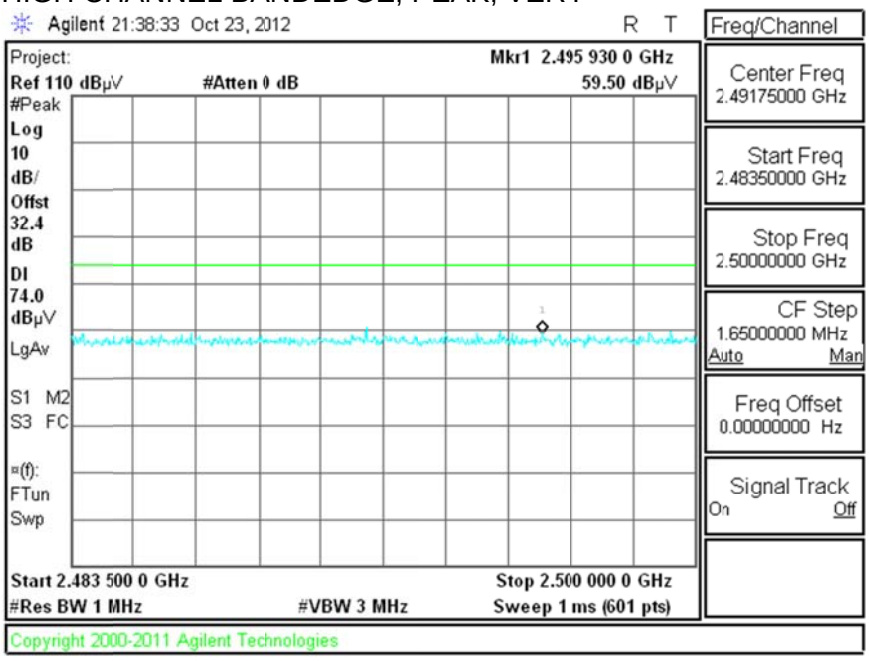
HIGH CHANNEL BANDEDGE, PEAK, HORIZ



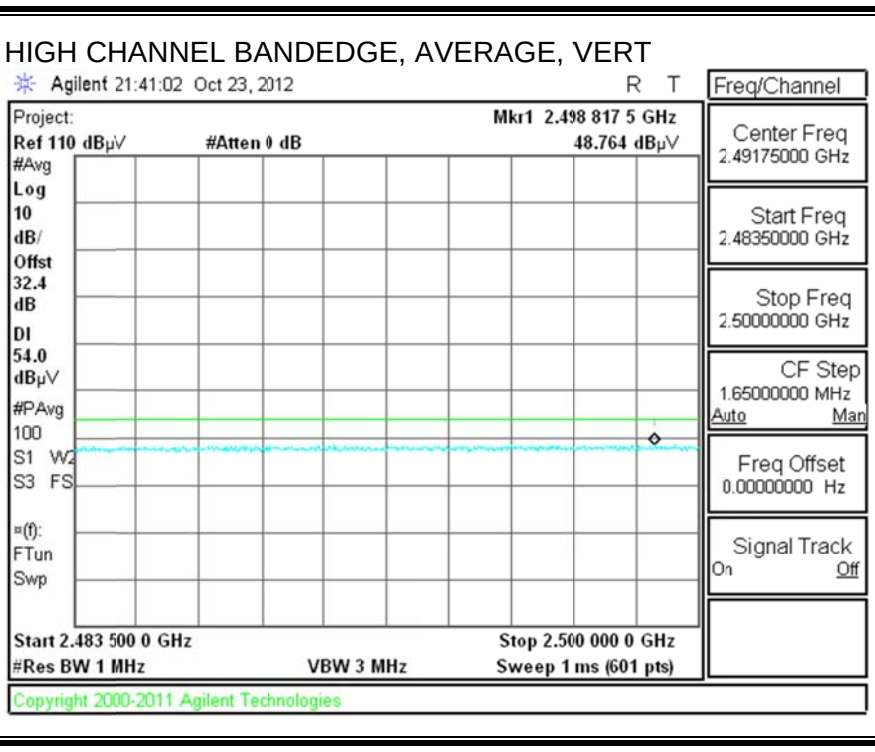
HIGH CHANNEL BANDEDGE, AVERAGE, HORIZ



HIGH CHANNEL BANDEDGE, PEAK, VERT



HIGH CHANNEL BANDEDGE, AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/03/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11b 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	

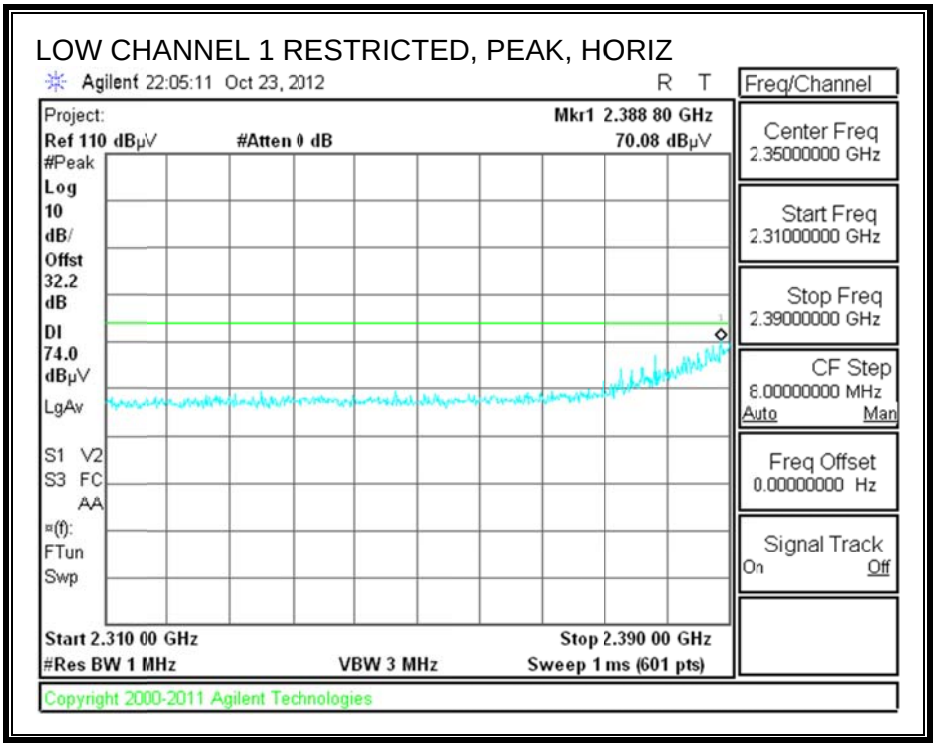
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2412 MHz 11b													
4.824	3.0	45.8	33.1	6.3	-35.5	0.0	0.0	49.7	74.0	-24.3	H	P	
4.824	3.0	41.4	33.1	6.3	-35.5	0.0	0.0	45.2	54.0	-8.8	H	A	
4.824	3.0	43.2	33.1	6.3	-35.5	0.0	0.0	47.0	74.0	-27.0	V	P	
4.824	3.0	43.3	33.1	6.3	-35.5	0.0	0.0	47.1	54.0	-6.9	V	A	
2437 MHz 11b													
4.874	3.0	43.5	33.1	6.3	-35.5	0.0	0.0	47.5	74.0	-26.5	H	P	
4.874	3.0	42.4	33.1	6.3	-35.5	0.0	0.0	46.4	54.0	-7.6	H	A	
4.874	3.0	41.8	33.1	6.3	-35.5	0.0	0.0	45.7	74.0	-28.3	V	P	
4.874	3.0	36.6	33.1	6.3	-35.5	0.0	0.0	40.6	54.0	-13.4	V	A	
2462 MHz 11b													
4.924	3.0	41.8	33.2	6.3	-35.5	0.0	0.0	45.9	74.0	-28.1	H	P	
4.924	3.0	35.7	33.2	6.3	-35.5	0.0	0.0	39.8	54.0	-14.2	H	A	
4.924	3.0	40.7	33.2	6.3	-35.5	0.0	0.0	44.7	74.0	-29.3	V	P	
4.924	3.0	36.6	33.2	6.3	-35.5	0.0	0.0	40.6	54.0	-13.4	V	A	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

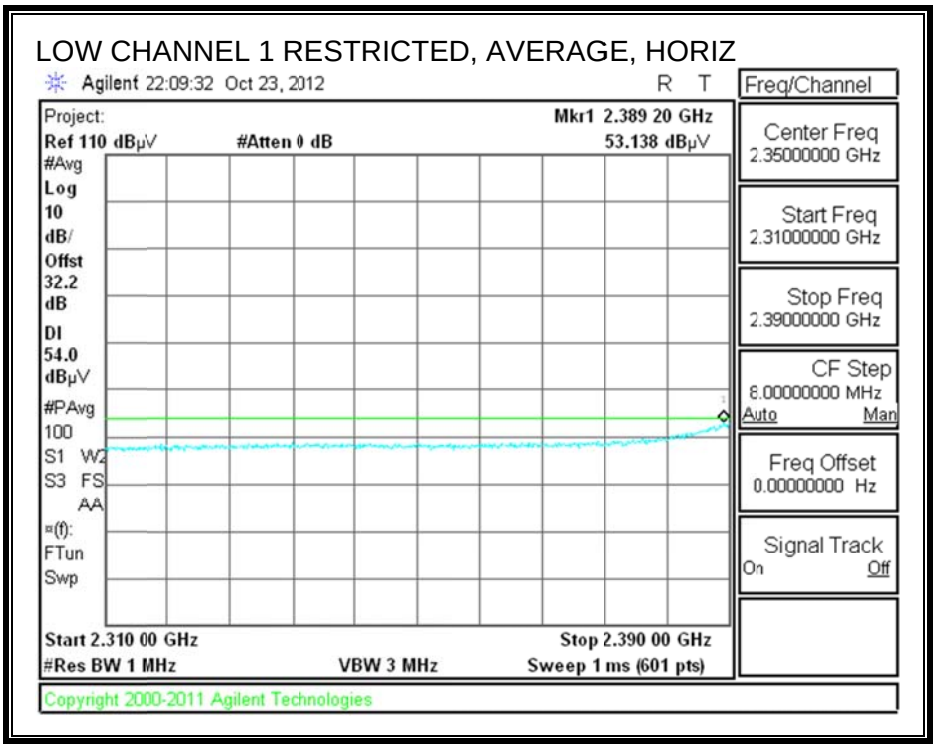
9.4. TX ABOVE 1 GHz 802.11g MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL 1)

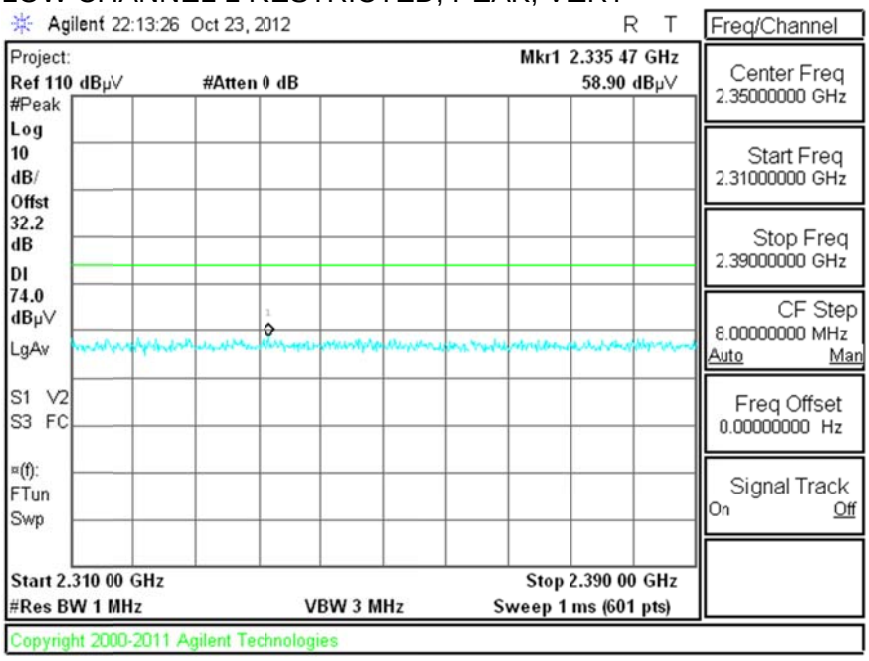
LOW CHANNEL 1 RESTRICTED, PEAK, HORIZ



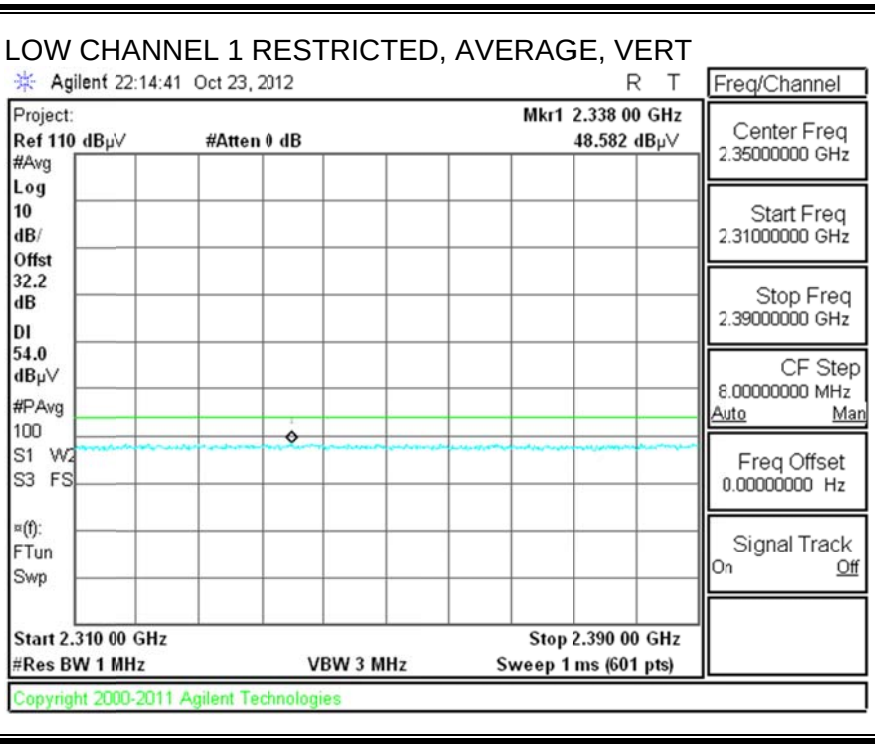
LOW CHANNEL 1 RESTRICTED, AVERAGE, HORIZ



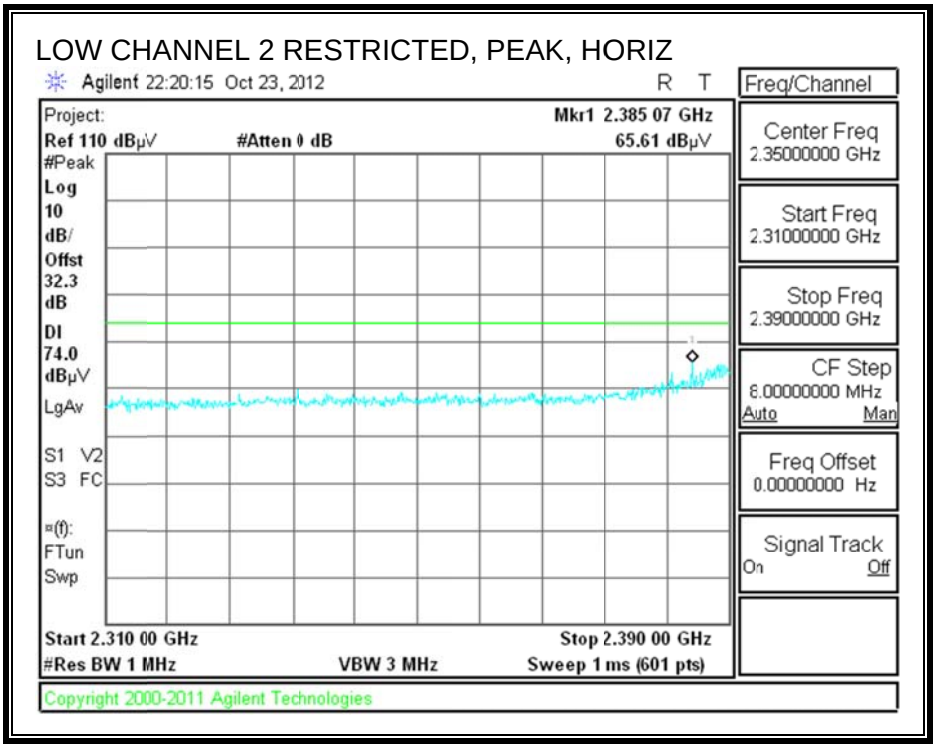
LOW CHANNEL 1 RESTRICTED, PEAK, VERT

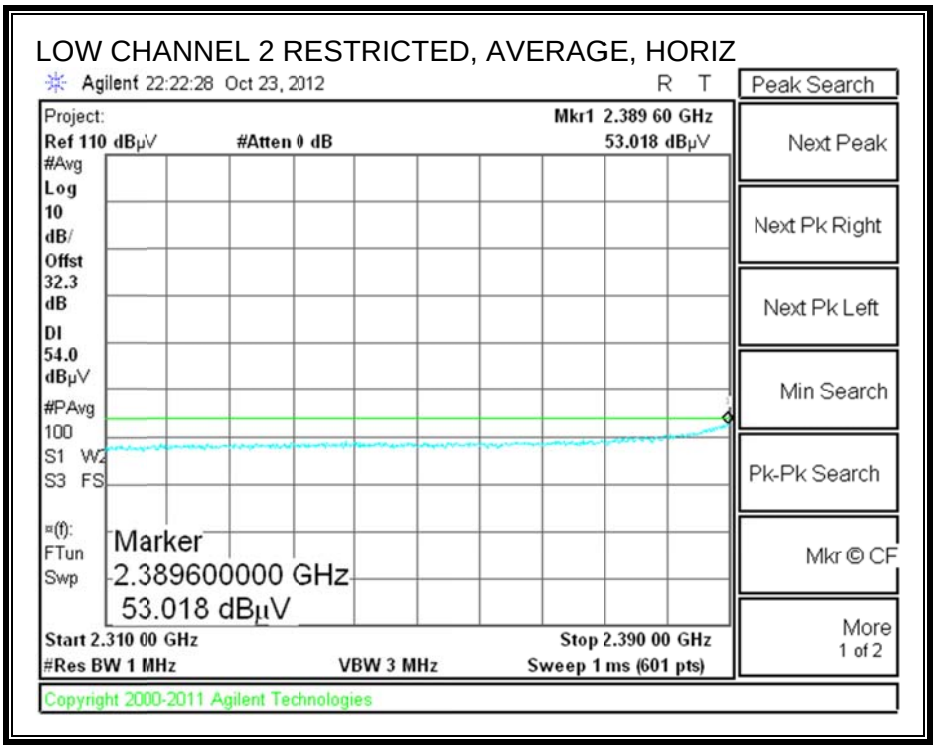


LOW CHANNEL 1 RESTRICTED, AVERAGE, VERT

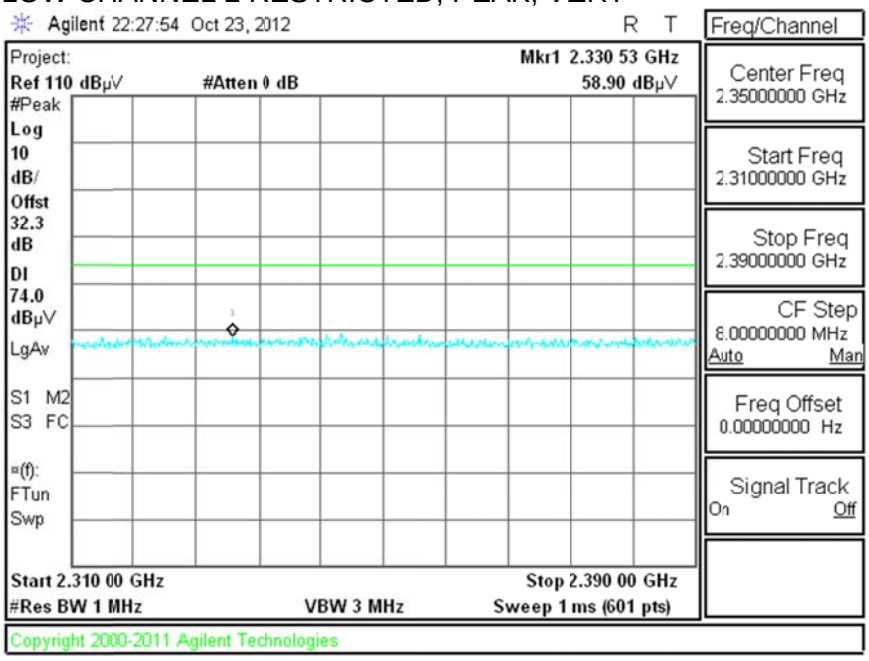


RESTRICTED BANDEDGE (LOW CHANNEL 2)

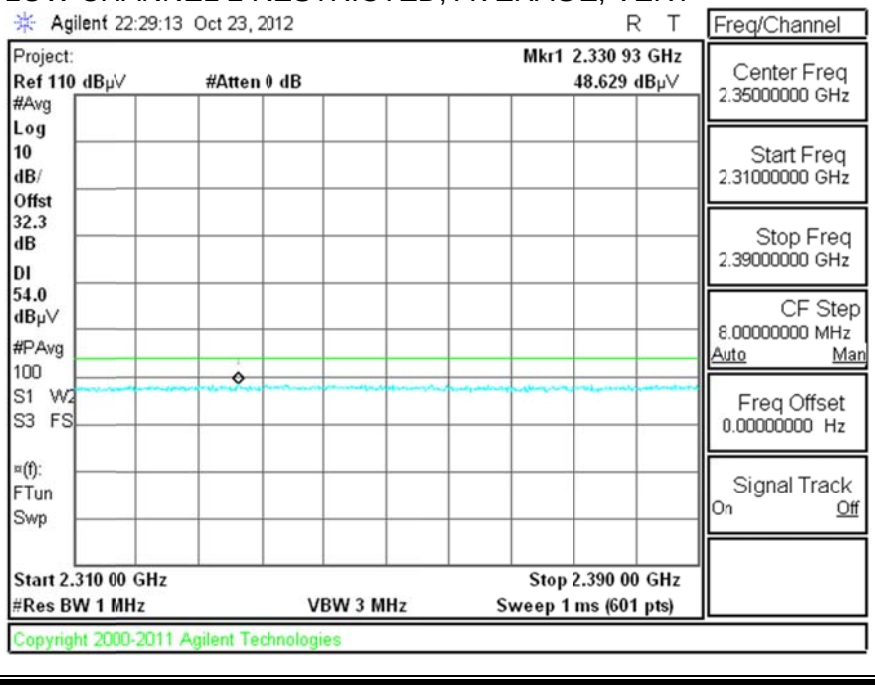




LOW CHANNEL 2 RESTRICTED, PEAK, VERT

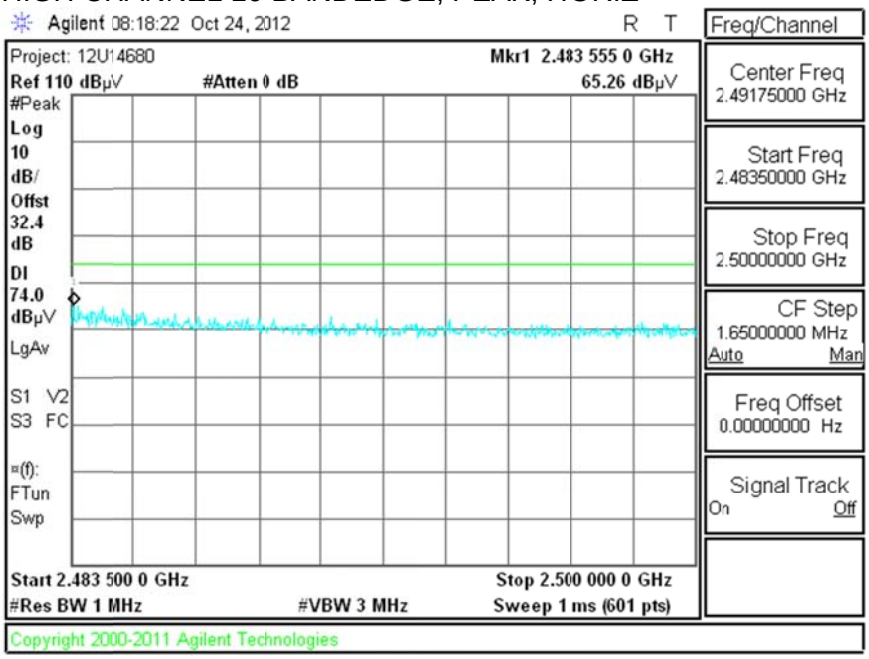


LOW CHANNEL 2 RESTRICTED, AVERAGE, VERT

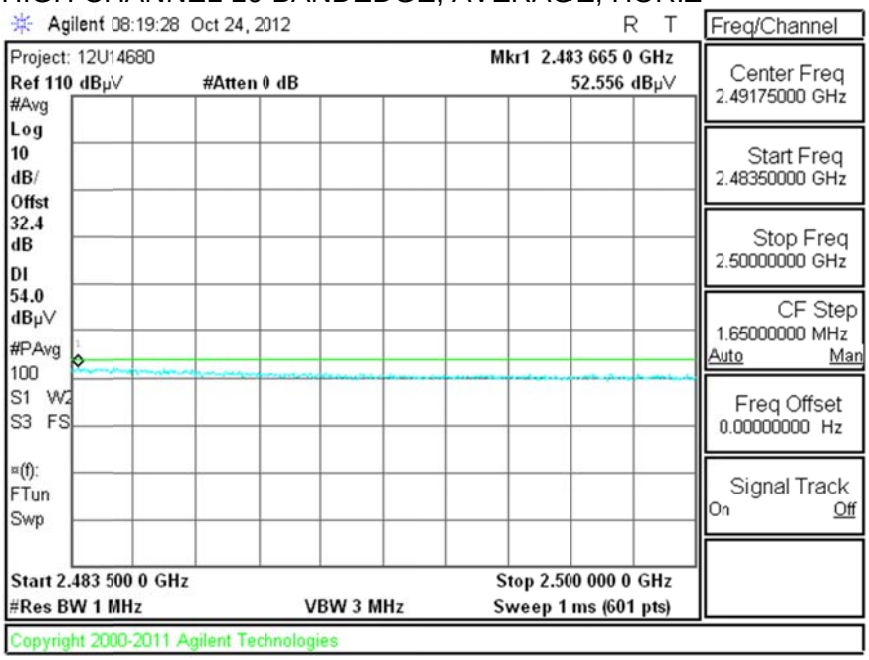


AUTHORIZED BANDEDGE (HIGH CHANNEL 10)

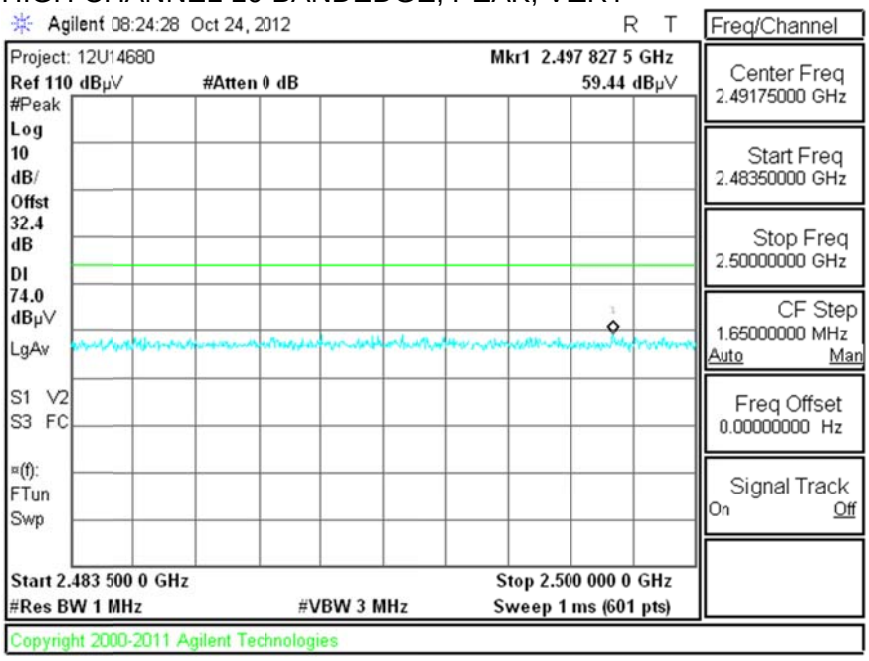
HIGH CHANNEL 10 BANDEDGE, PEAK, HORIZ



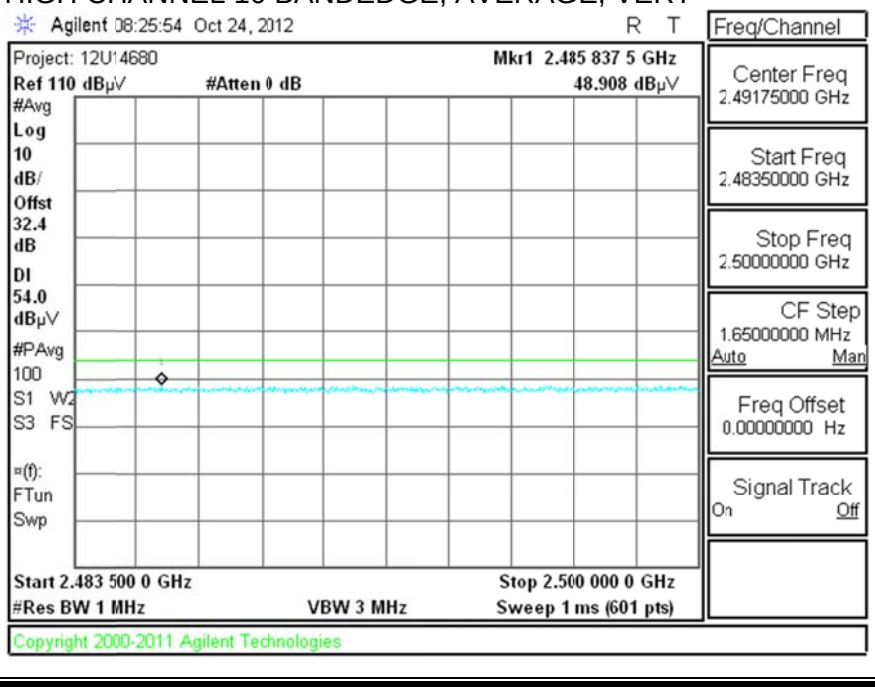
HIGH CHANNEL 10 BANDEDGE, AVERAGE, HORIZ



HIGH CHANNEL 10 BANDEDGE, PEAK, VERT

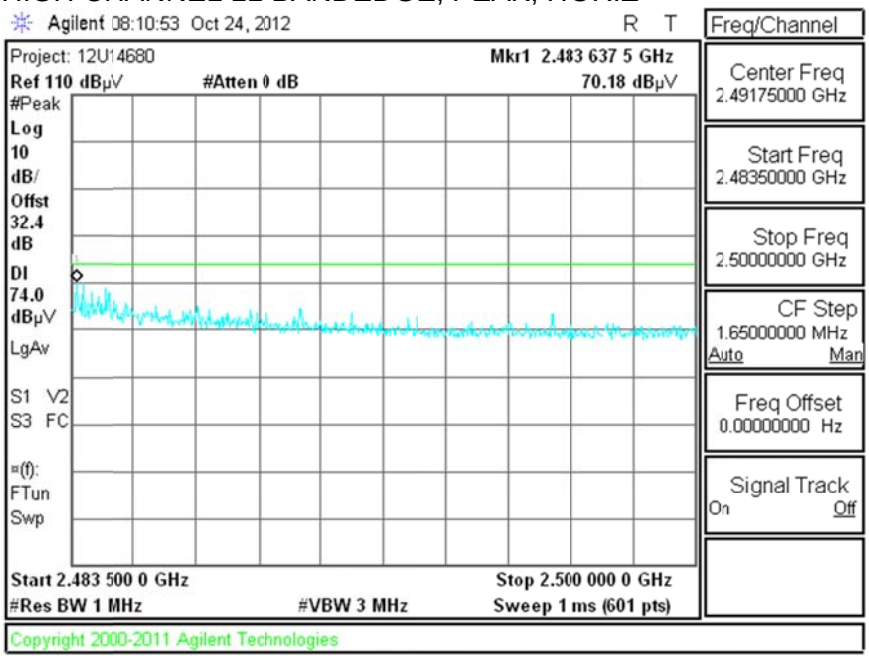


HIGH CHANNEL 10 BANDEDGE, AVERAGE, VERT

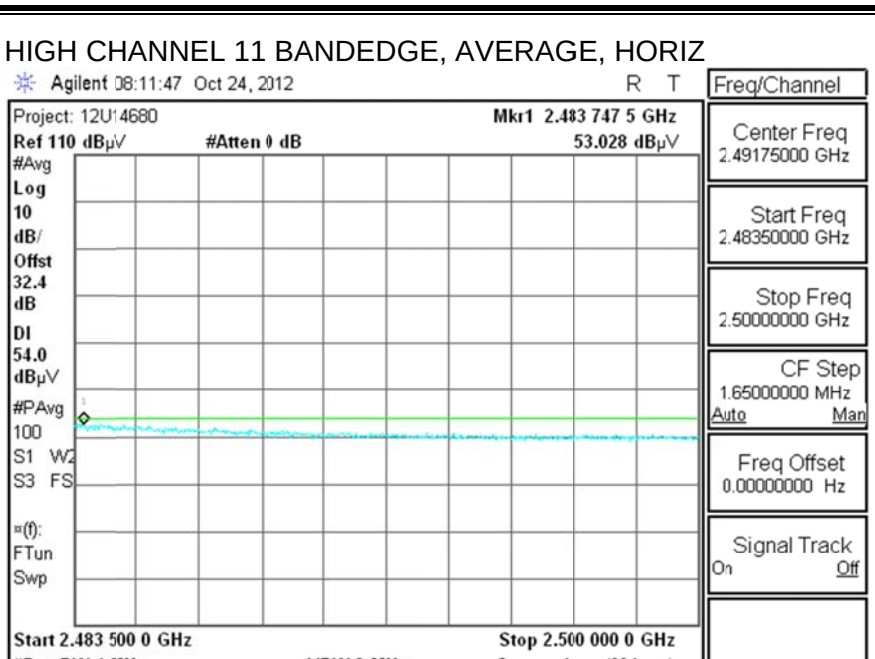


AUTHORIZED BANDEDGE (HIGH CHANNEL 11)

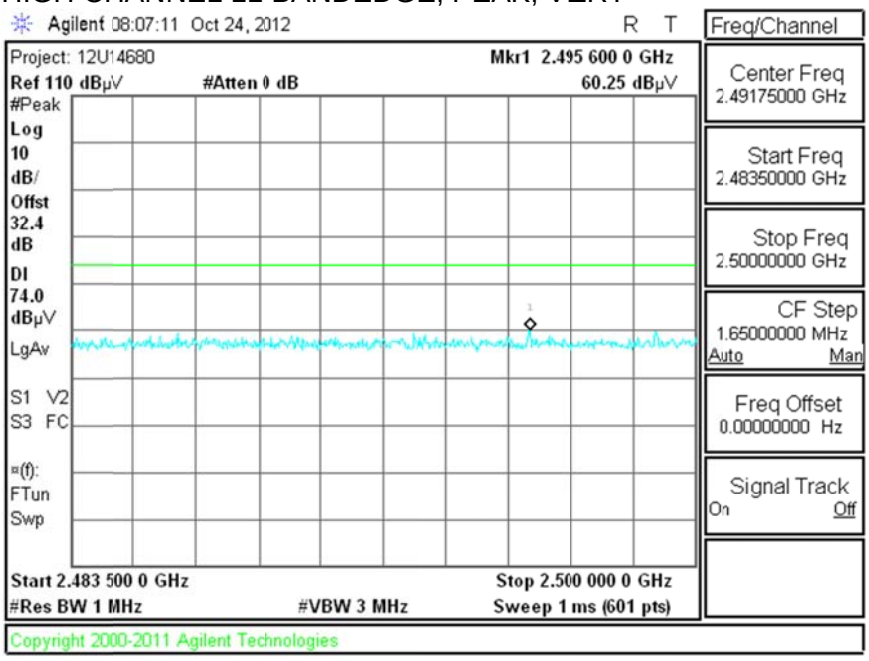
HIGH CHANNEL 11 BANDEDGE, PEAK, HORIZ



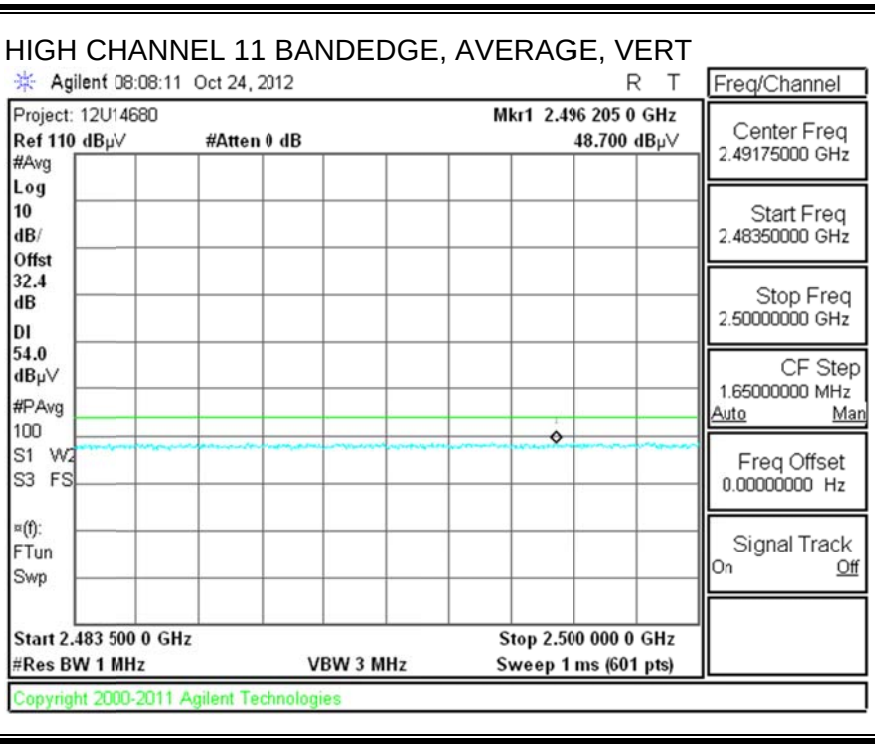
HIGH CHANNEL 11 BANDEDGE, AVERAGE, HORIZ



HIGH CHANNEL 11 BANDEDGE, PEAK, VERT



HIGH CHANNEL 11 BANDEDGE, AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/03/12
Project #: 12U14680
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11g TX mode

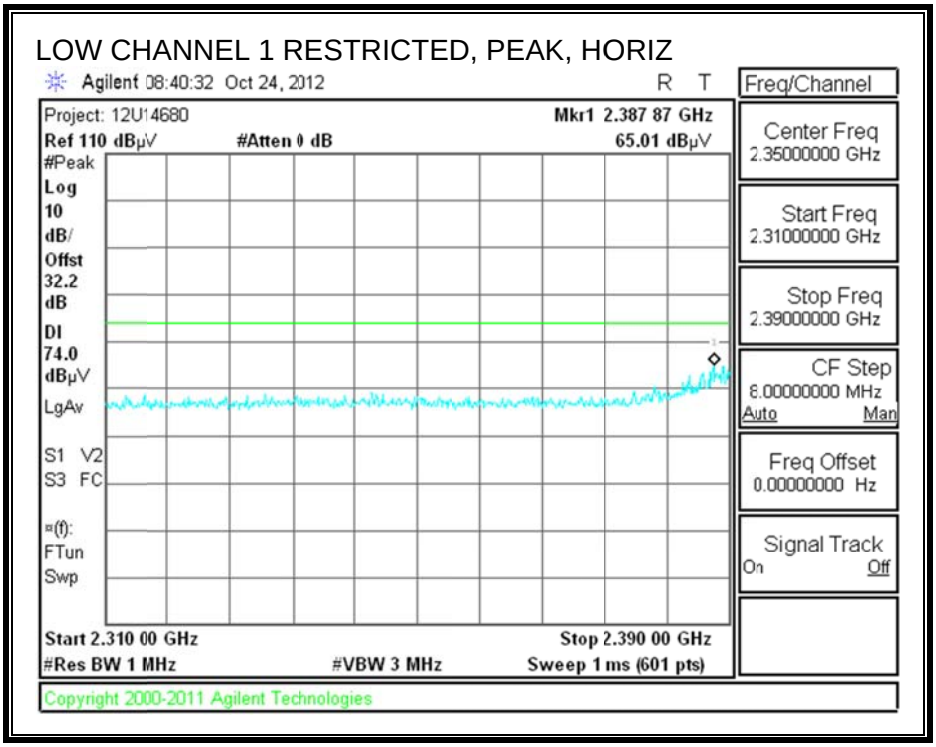
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs.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

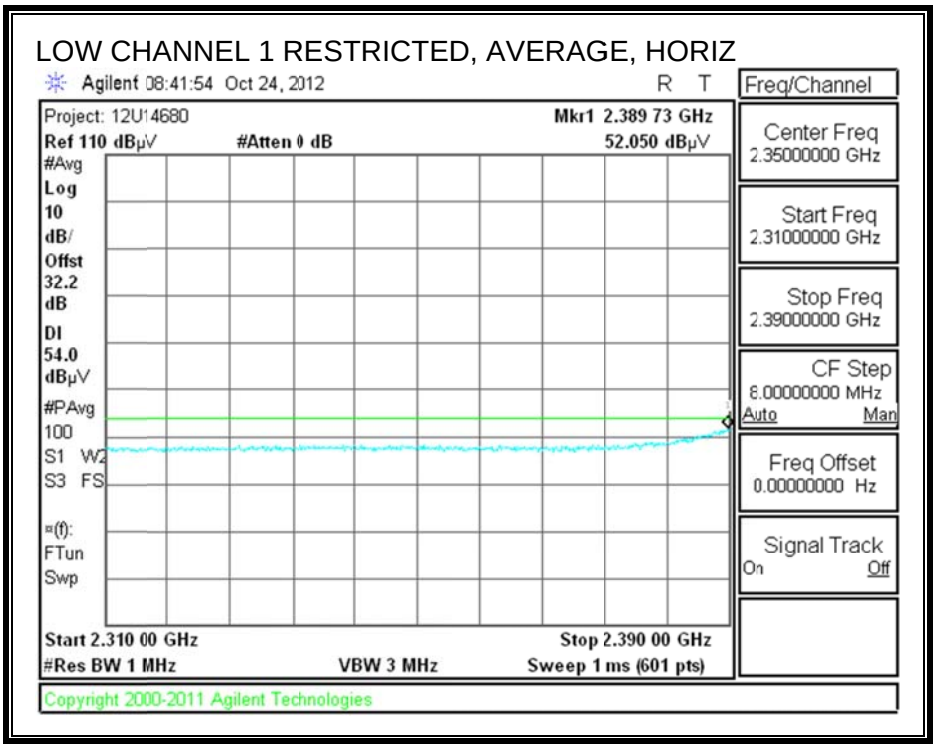
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2412 MHz 11g													
4.824	3.0	41.5	33.1	6.3	-35.5	0.0	0.0	45.4	74.0	-28.6	H	P	
4.824	3.0	33.6	33.1	6.3	-35.5	0.0	0.0	37.4	54.0	-16.6	H	A	
4.824	3.0	41.4	33.1	6.3	-35.5	0.0	0.0	45.2	74.0	-28.8	V	P	
4.824	3.0	35.2	33.1	6.3	-35.5	0.0	0.0	39.1	54.0	-14.9	V	A	
2437 MHz 11g													
4.874	3.0	40.8	33.1	6.3	-35.5	0.0	0.0	44.7	74.0	-29.3	H	P	
4.874	3.0	30.5	33.1	6.3	-35.5	0.0	0.0	34.4	54.0	-19.6	H	A	
4.874	3.0	42.6	33.1	6.3	-35.5	0.0	0.0	46.5	74.0	-27.5	V	P	
4.874	3.0	42.4	33.1	6.3	-35.5	0.0	0.0	46.3	54.0	-7.7	V	A	
2462 MHz 11g													
4.924	3.0	39.1	33.2	6.3	-35.5	0.0	0.0	43.1	74.0	-30.9	H	P	
4.924	3.0	28.5	33.2	6.3	-35.5	0.0	0.0	32.6	54.0	-21.4	H	A	
4.924	3.0	39.1	33.2	6.3	-35.5	0.0	0.0	43.2	74.0	-30.8	V	P	
4.924	3.0	29.1	33.2	6.3	-35.5	0.0	0.0	33.2	54.0	-20.8	V	A	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

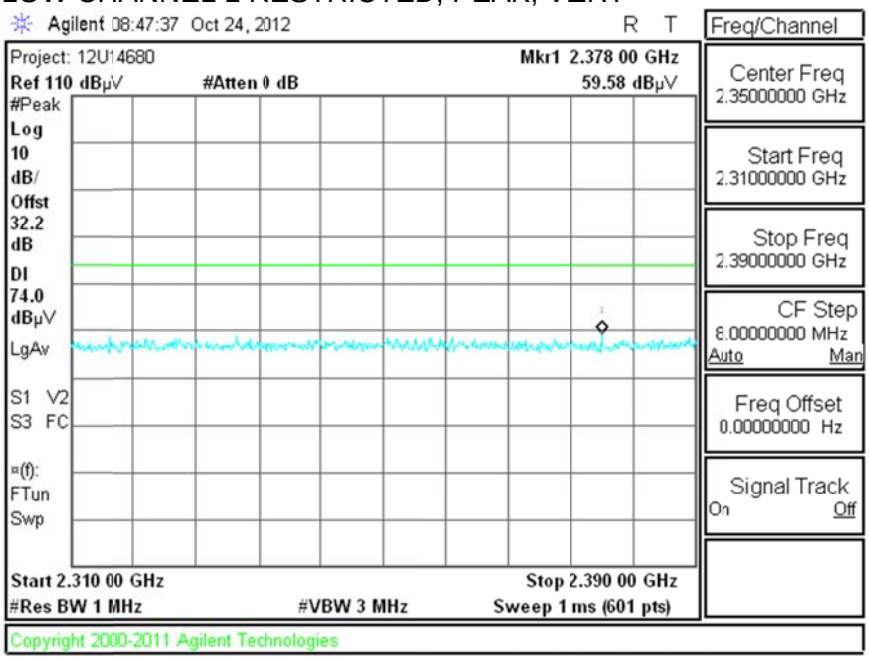
9.5. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL 1)

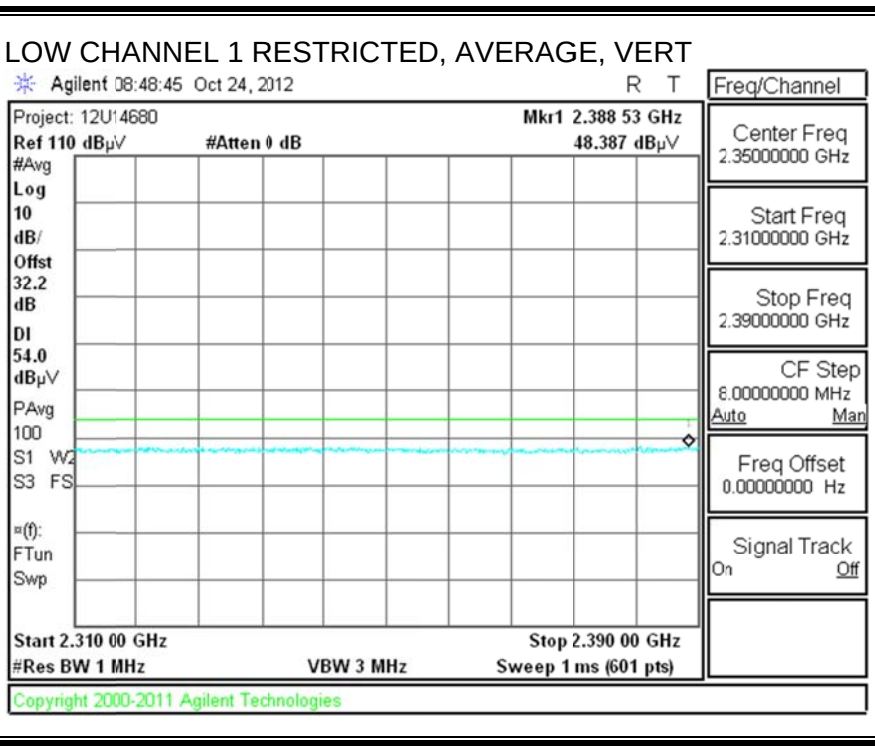




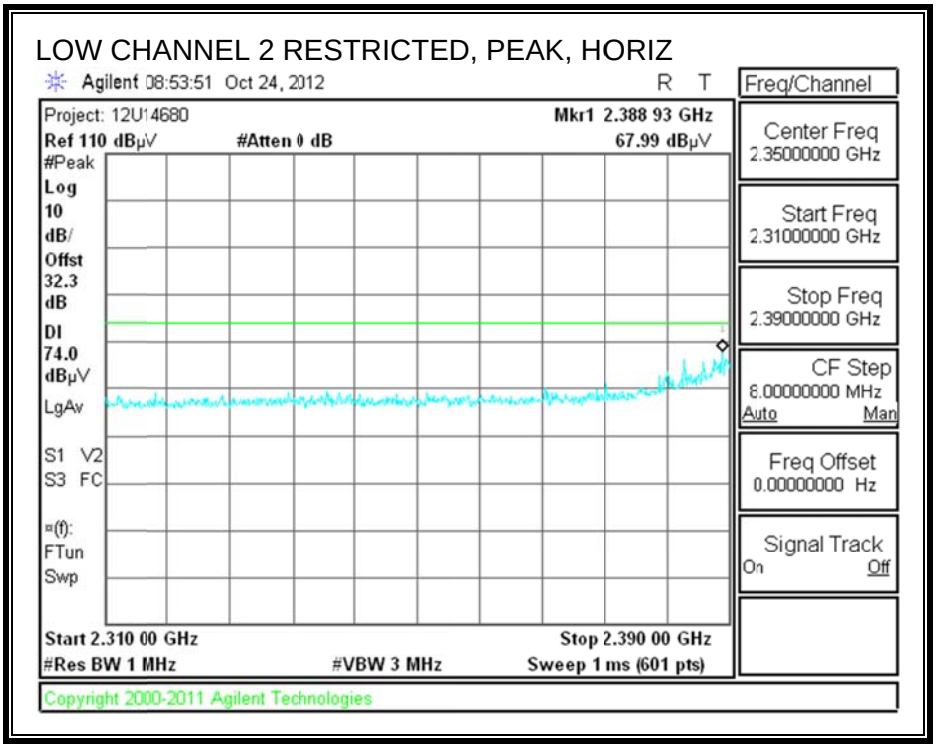
LOW CHANNEL 1 RESTRICTED, PEAK, VERT

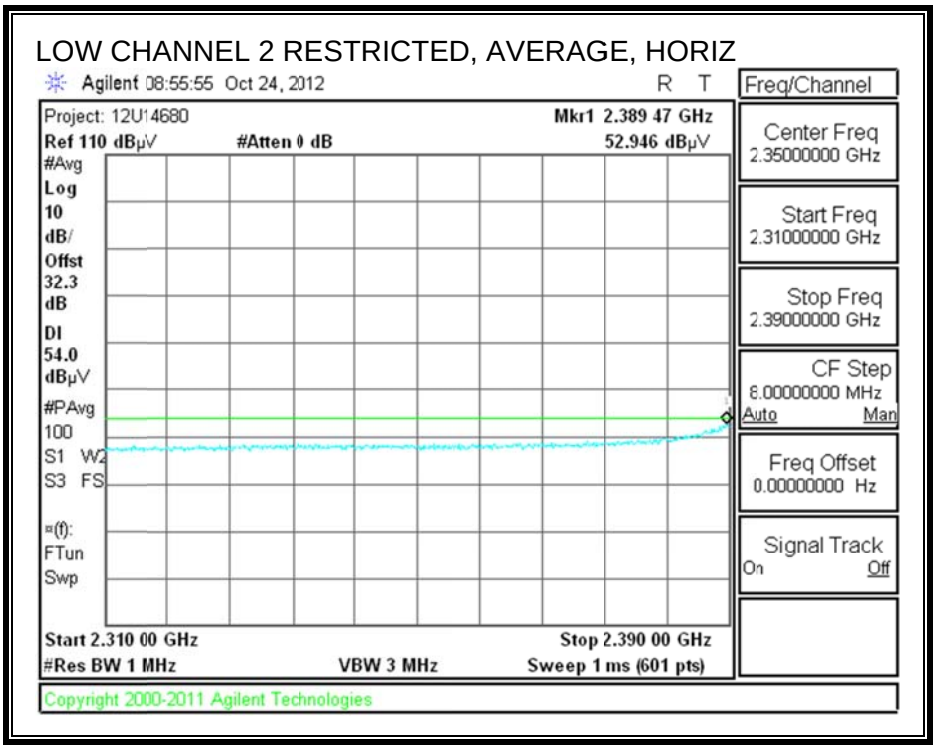


LOW CHANNEL 1 RESTRICTED, AVERAGE, VERT

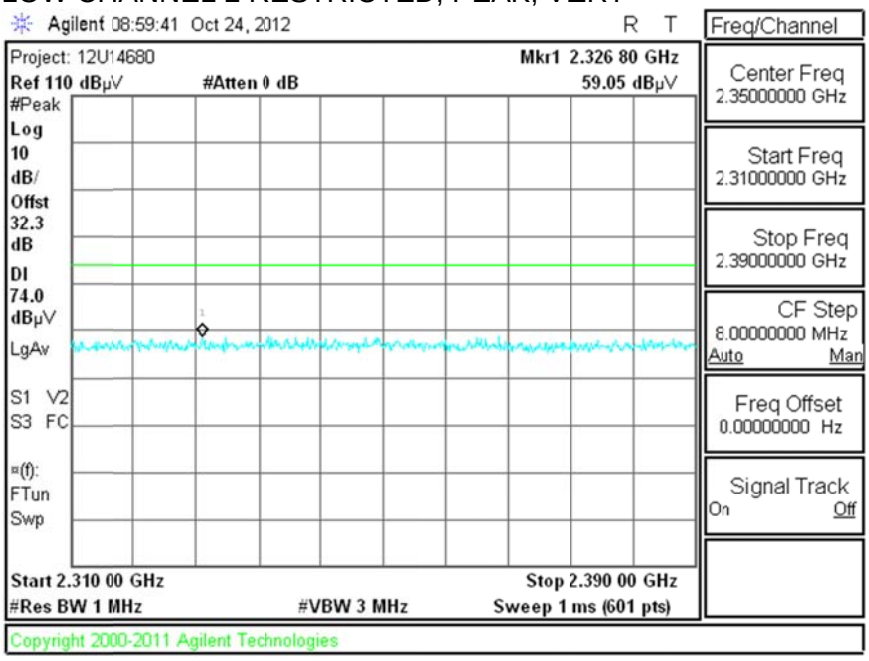


RESTRICTED BANDEDGE (LOW CHANNEL 2)

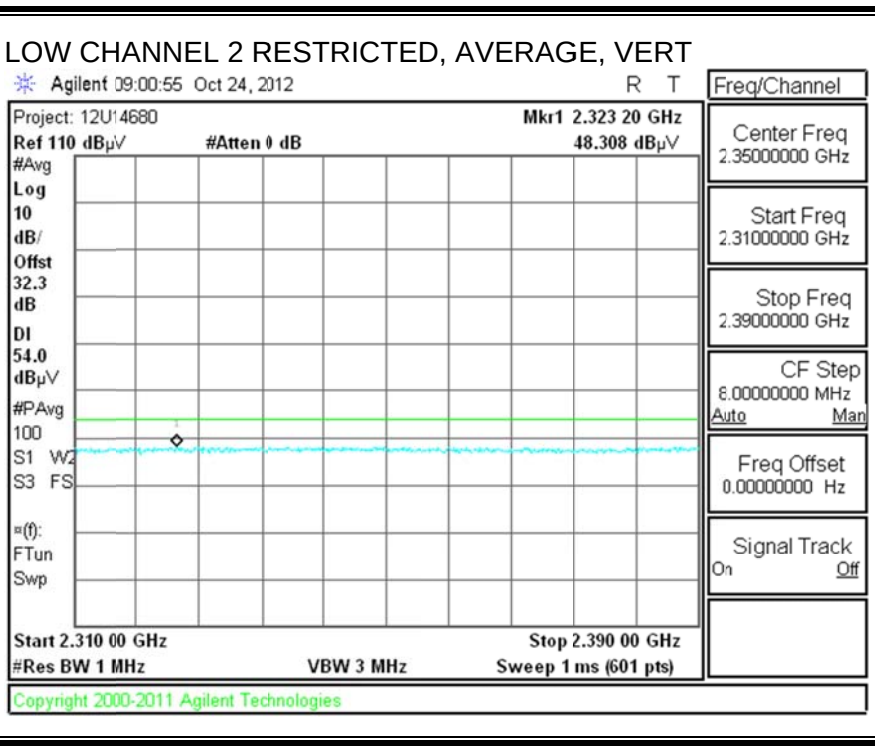




LOW CHANNEL 2 RESTRICTED, PEAK, VERT

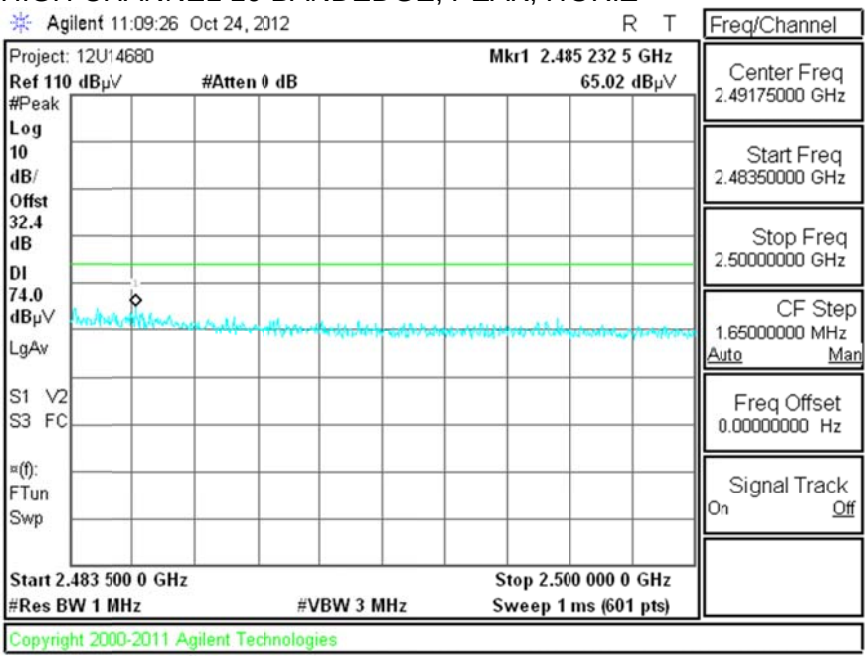


LOW CHANNEL 2 RESTRICTED, AVERAGE, VERT

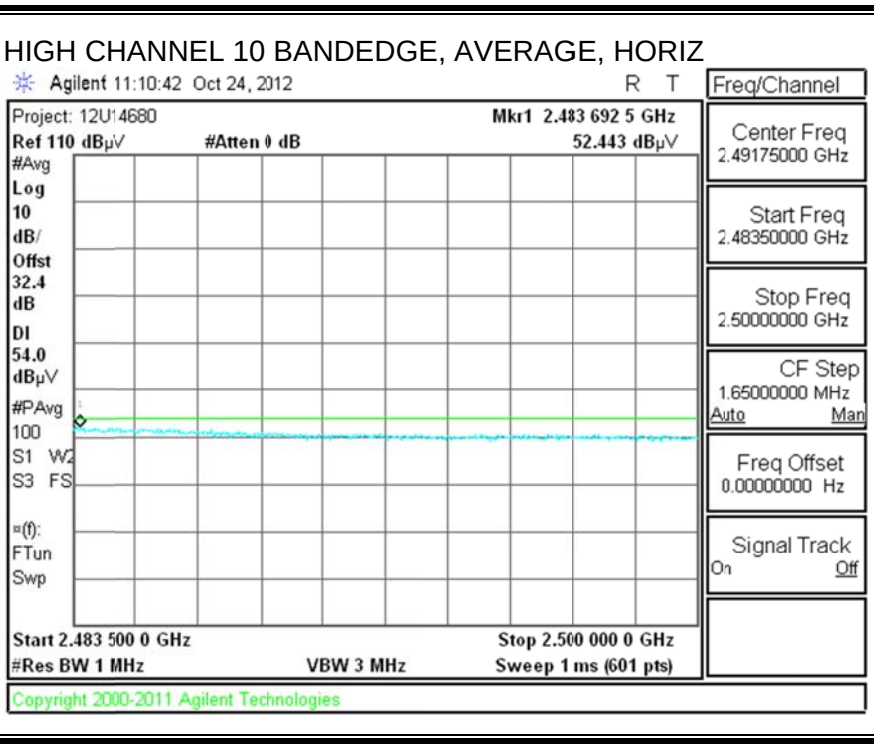


AUTHORIZED BANDEDGE (HIGH CHANNEL 10)

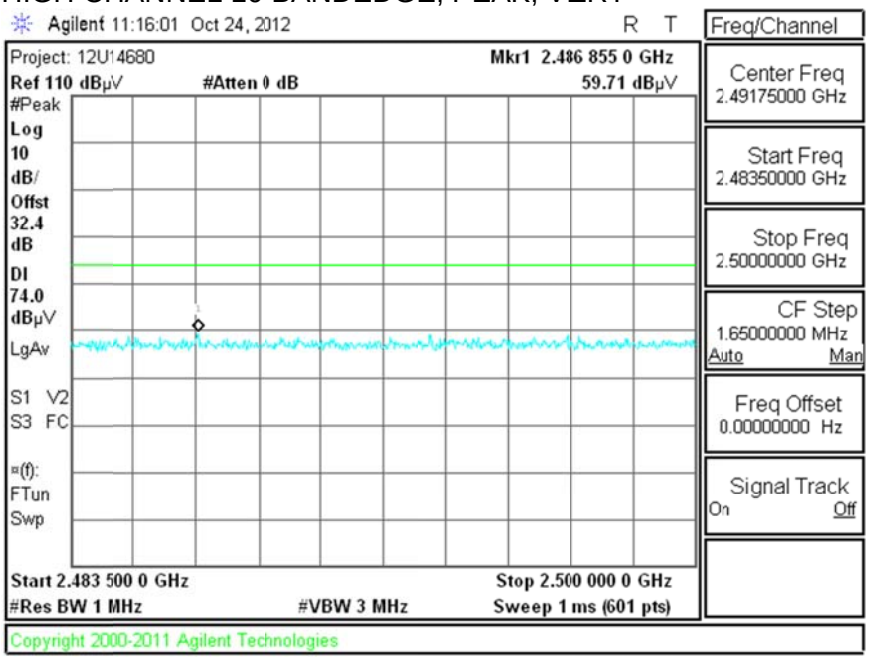
HIGH CHANNEL 10 BANDEDGE, PEAK, HORIZ



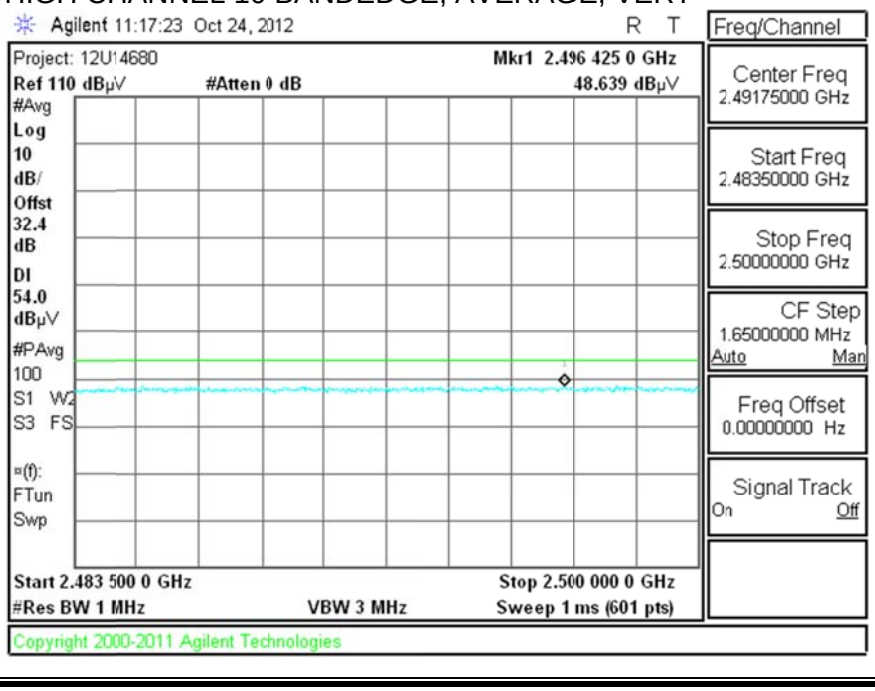
HIGH CHANNEL 10 BANDEDGE, AVERAGE, HORIZ



HIGH CHANNEL 10 BANDEDGE, PEAK, VERT

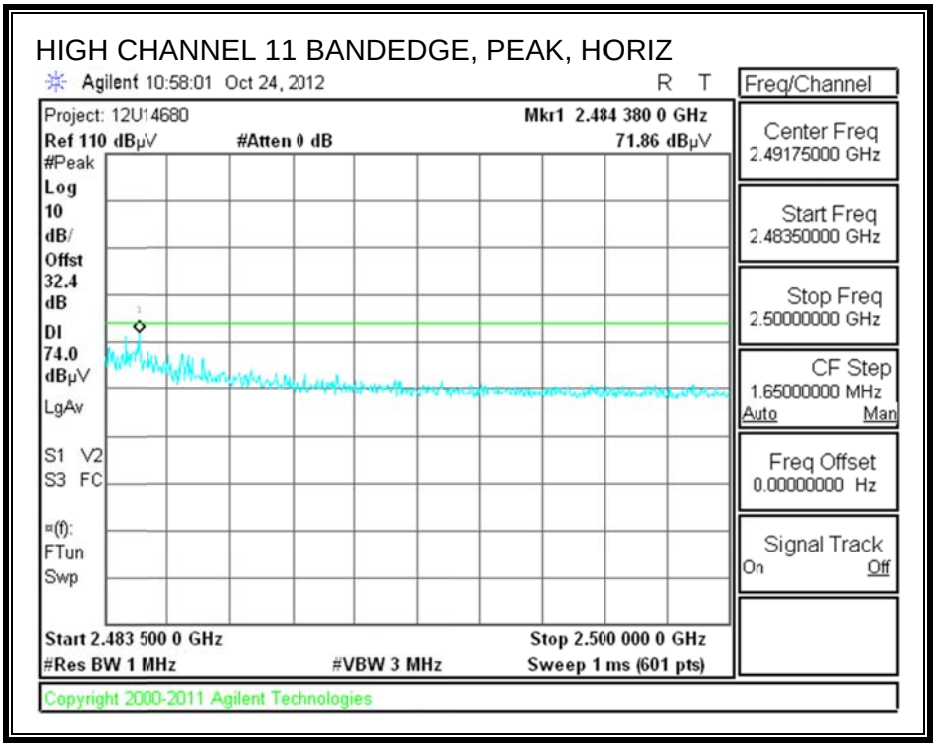


HIGH CHANNEL 10 BANDEDGE, AVERAGE, VERT

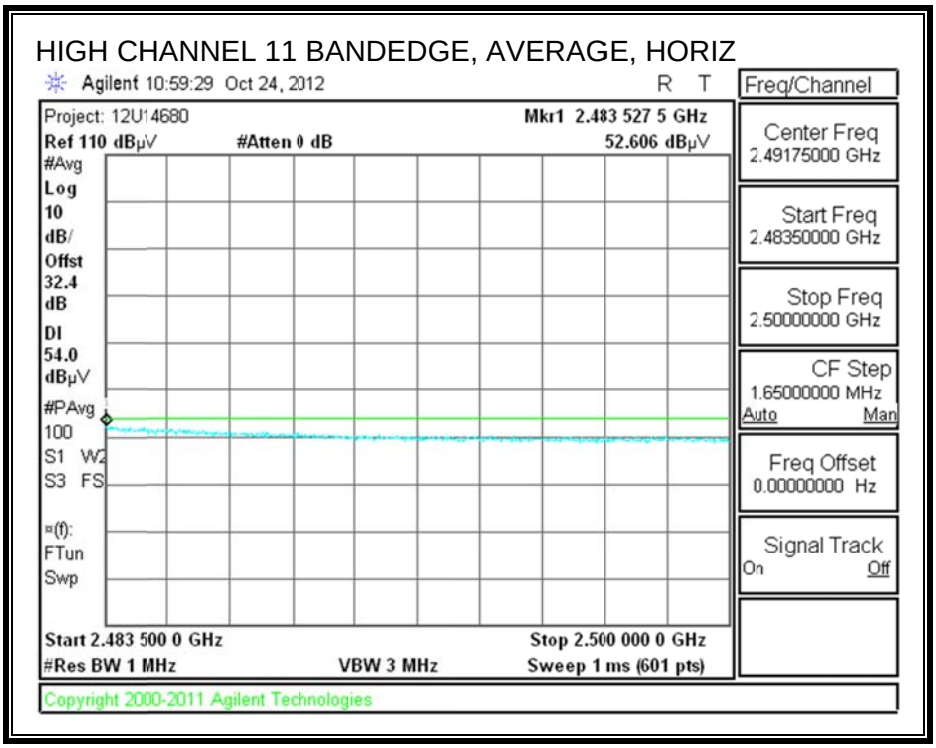


AUTHORIZED BANDEDGE (HIGH CHANNEL 11)

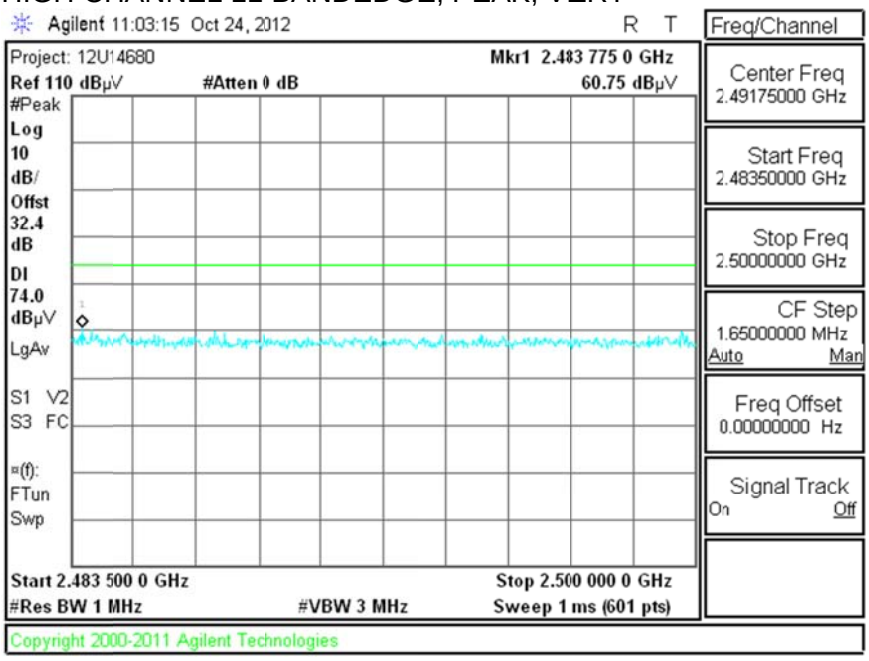
HIGH CHANNEL 11 BANDEDGE, PEAK, HORIZ



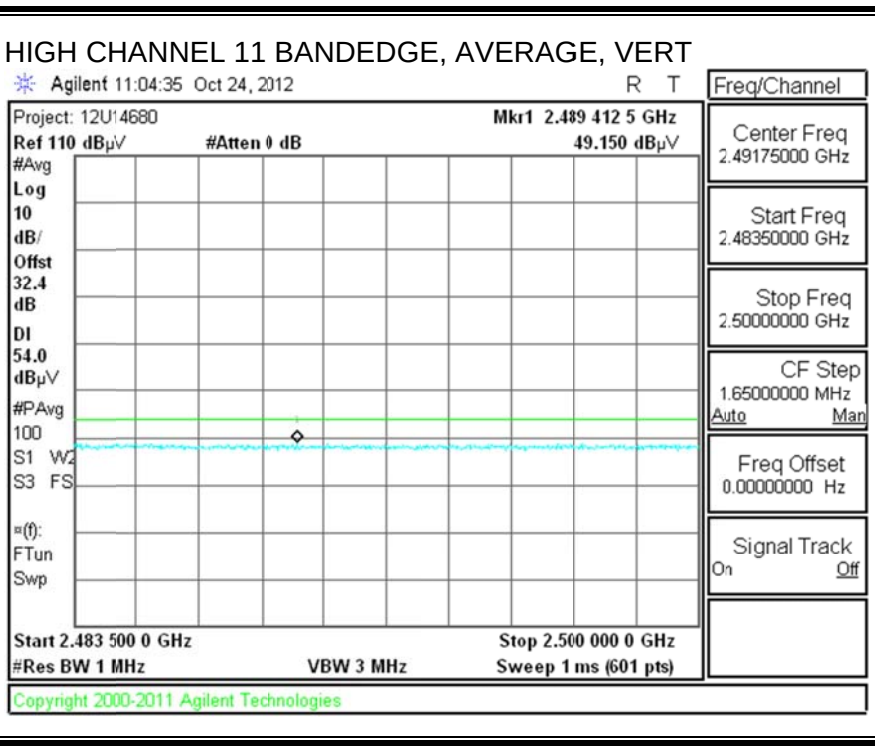
HIGH CHANNEL 11 BANDEDGE, AVERAGE, HORIZ



HIGH CHANNEL 11 BANDEDGE, PEAK, VERT



HIGH CHANNEL 11 BANDEDGE, AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/03/12
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
2412 MHz 11n HT20													
4.824	3.0	40.7	33.1	6.3	-35.5	0.0	0.0	44.5	74.0	-29.5	H	P	
4.824	3.0	30.6	33.1	6.3	-35.5	0.0	0.0	34.4	54.0	-19.6	H	A	
4.824	3.0	41.0	33.1	6.3	-35.5	0.0	0.0	44.9	74.0	-29.1	V	P	
4.824	3.0	35.1	33.1	6.3	-35.5	0.0	0.0	39.0	54.0	-15.1	V	A	
2437 MHz 11n HT20													
4.874	3.0	41.6	33.1	6.3	-35.5	0.0	0.0	45.5	74.0	-28.5	H	P	
4.874	3.0	34.2	33.1	6.3	-35.5	0.0	0.0	38.2	54.0	-15.8	H	A	
4.874	3.0	42.3	33.1	6.3	-35.5	0.0	0.0	46.3	74.0	-27.7	V	P	
4.874	3.0	31.6	33.1	6.3	-35.5	0.0	0.0	35.5	54.0	-18.5	V	A	
2462 MHz 11n HT20													
4.924	3.0	38.5	33.2	6.3	-35.5	0.0	0.0	42.5	74.0	-31.5	H	P	
4.924	3.0	34.5	33.2	6.3	-35.5	0.0	0.0	38.5	54.0	-15.5	H	A	
4.924	3.0	38.3	33.2	6.3	-35.5	0.0	0.0	42.4	74.0	-31.6	V	P	
4.924	3.0	32.1	33.2	6.3	-35.5	0.0	0.0	36.1	54.0	-17.9	V	A	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

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

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/03/12
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/QP	Notes
5745 MHz 11a													
11.490	3.0	34.8	38.8	10.5	-35.5	0.0	0.7	49.3	74.0	-24.7	H	P	
11.490	3.0	27.8	38.8	10.5	-35.5	0.0	0.7	42.3	54.0	-11.7	H	A	
11.490	3.0	34.6	38.8	10.5	-35.5	0.0	0.7	49.1	74.0	-24.9	V	P	
11.490	3.0	28.2	38.8	10.5	-35.5	0.0	0.7	42.7	54.0	-11.3	V	A	
5785 MHz 11a													
11.570	3.0	34.7	38.9	10.6	-35.5	0.0	0.7	49.4	74.0	-24.6	H	P	
11.570	3.0	27.0	38.9	10.6	-35.5	0.0	0.7	41.7	54.0	-12.3	H	A	
11.570	3.0	34.4	38.9	10.6	-35.5	0.0	0.7	49.1	74.0	-24.9	V	P	
11.570	3.0	31.4	38.9	10.6	-35.5	0.0	0.7	46.1	54.0	-7.9	V	A	
5825 MHz 11a													
11.650	3.0	34.7	39.0	10.7	-35.5	0.0	0.7	49.5	74.0	-24.5	H	P	
11.650	3.0	24.6	39.0	10.7	-35.5	0.0	0.7	39.5	54.0	-14.5	H	A	
11.650	3.0	34.9	39.0	10.7	-35.5	0.0	0.7	49.8	74.0	-24.2	V	P	
11.650	3.0	28.5	39.0	10.7	-35.5	0.0	0.7	43.3	54.0	-10.7	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 HT20 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/03/12
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
5745 MHz 11n HT20													
11.490	3.0	34.4	38.8	10.5	-35.5	0.0	0.7	48.9	74.0	-25.1	H	P	
11.490	3.0	27.4	38.8	10.5	-35.5	0.0	0.7	41.9	54.0	-12.1	H	A	
11.490	3.0	34.2	38.8	10.5	-35.5	0.0	0.7	48.7	74.0	-25.3	V	P	
11.490	3.0	27.8	38.8	10.5	-35.5	0.0	0.7	42.3	54.0	-11.7	V	A	
5785 MHz 11n HT20													
11.570	3.0	34.3	38.9	10.6	-35.5	0.0	0.7	49.0	74.0	-25.0	H	P	
11.570	3.0	26.6	38.9	10.6	-35.5	0.0	0.7	41.3	54.0	-12.7	H	A	
11.570	3.0	34.0	38.9	10.6	-35.5	0.0	0.7	48.7	74.0	-25.3	V	P	
11.570	3.0	31.0	38.9	10.6	-35.5	0.0	0.7	45.7	54.0	-8.3	V	A	
5825 MHz 11n HT20													
11.650	3.0	34.3	39.0	10.7	-35.5	0.0	0.7	49.1	74.0	-24.9	H	P	
11.650	3.0	24.2	39.0	10.7	-35.5	0.0	0.7	39.1	54.0	-14.9	H	A	
11.650	3.0	34.6	39.0	10.7	-35.5	0.0	0.7	49.4	74.0	-24.6	V	P	
11.650	3.0	28.1	39.0	10.7	-35.5	0.0	0.7	42.9	54.0	-11.1	V	A	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

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

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 11/03/12
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		

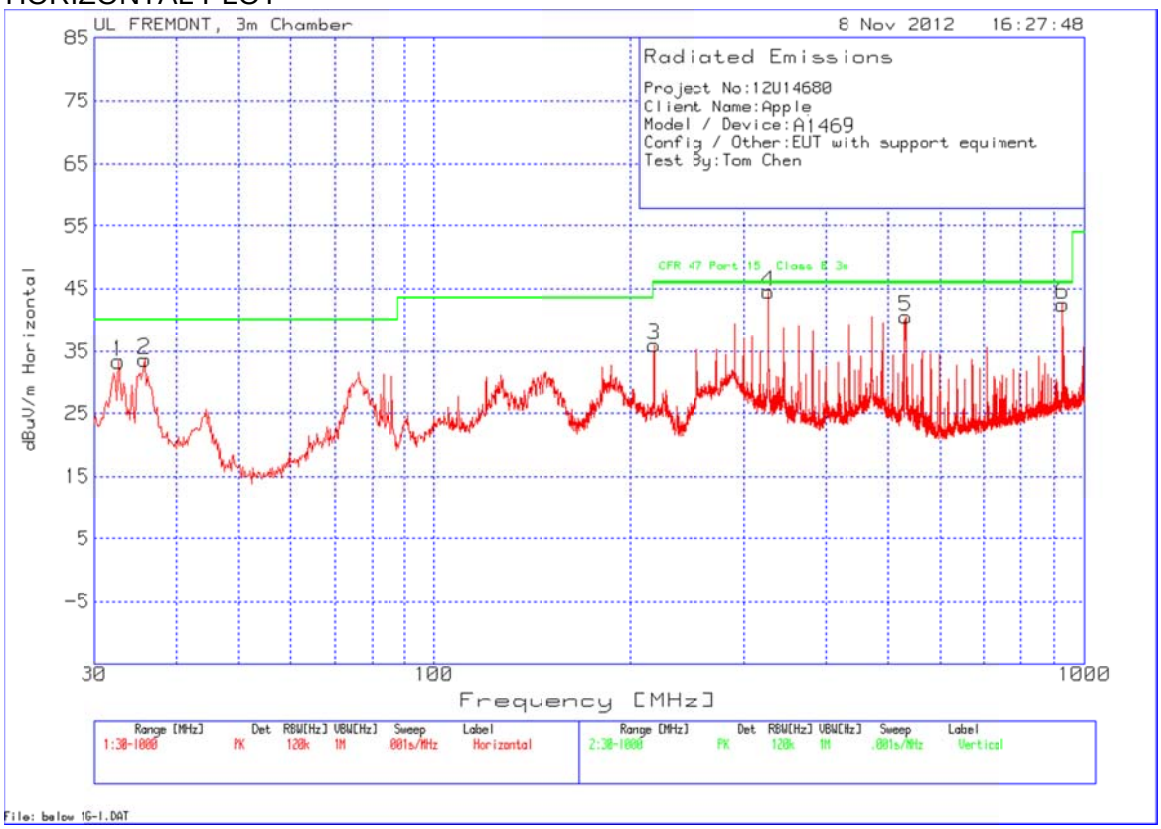
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5755 MHz HT40													
11.510	3.0	34.6	38.8	10.6	-35.5	0.0	0.7	49.2	74.0	-24.8	H	P	
11.510	3.0	28.1	38.8	10.6	-35.5	0.0	0.7	42.6	54.0	-11.4	H	A	
5755 MHz HT40													
11.510	3.0	34.7	38.8	10.6	-35.5	0.0	0.7	49.2	74.0	-24.8	V	P	
11.510	3.0	28.1	38.8	10.6	-35.5	0.0	0.7	42.6	54.0	-11.4	V	A	
5795 MHz HT40													
11.590	3.0	34.5	38.9	10.6	-35.5	0.0	0.7	49.3	74.0	-24.7	H	P	
11.590	3.0	27.3	38.9	10.6	-35.5	0.0	0.7	42.0	54.0	-12.0	H	A	
5795 MHz HT40													
11.590	3.0	35.1	38.9	10.6	-35.5	0.0	0.7	49.8	74.0	-24.2	V	P	
11.590	3.0	27.3	38.9	10.6	-35.5	0.0	0.7	42.0	54.0	-12.0	V	A	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

WORST-CASE BELOW 1 GHz

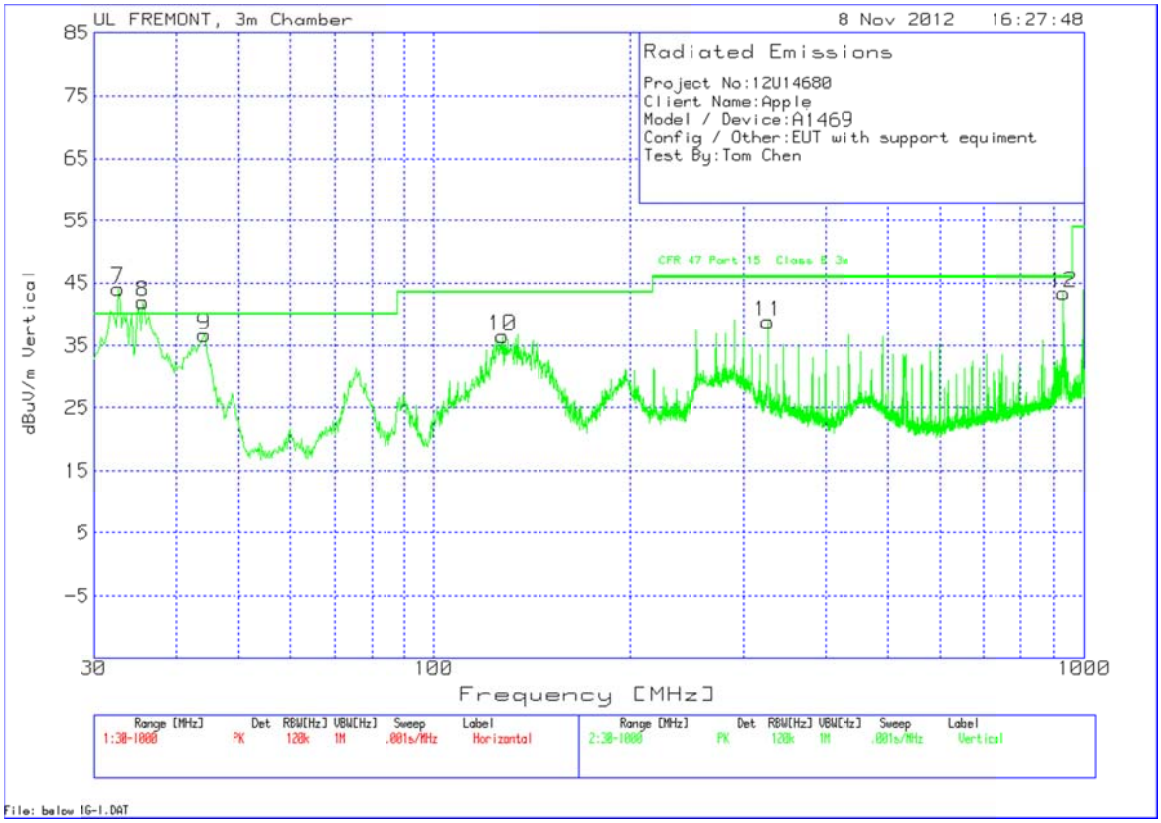
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Project No:12U14680
Client Name:Apple
Model / Device:A1469
Config / Other:EUT with support equiment
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

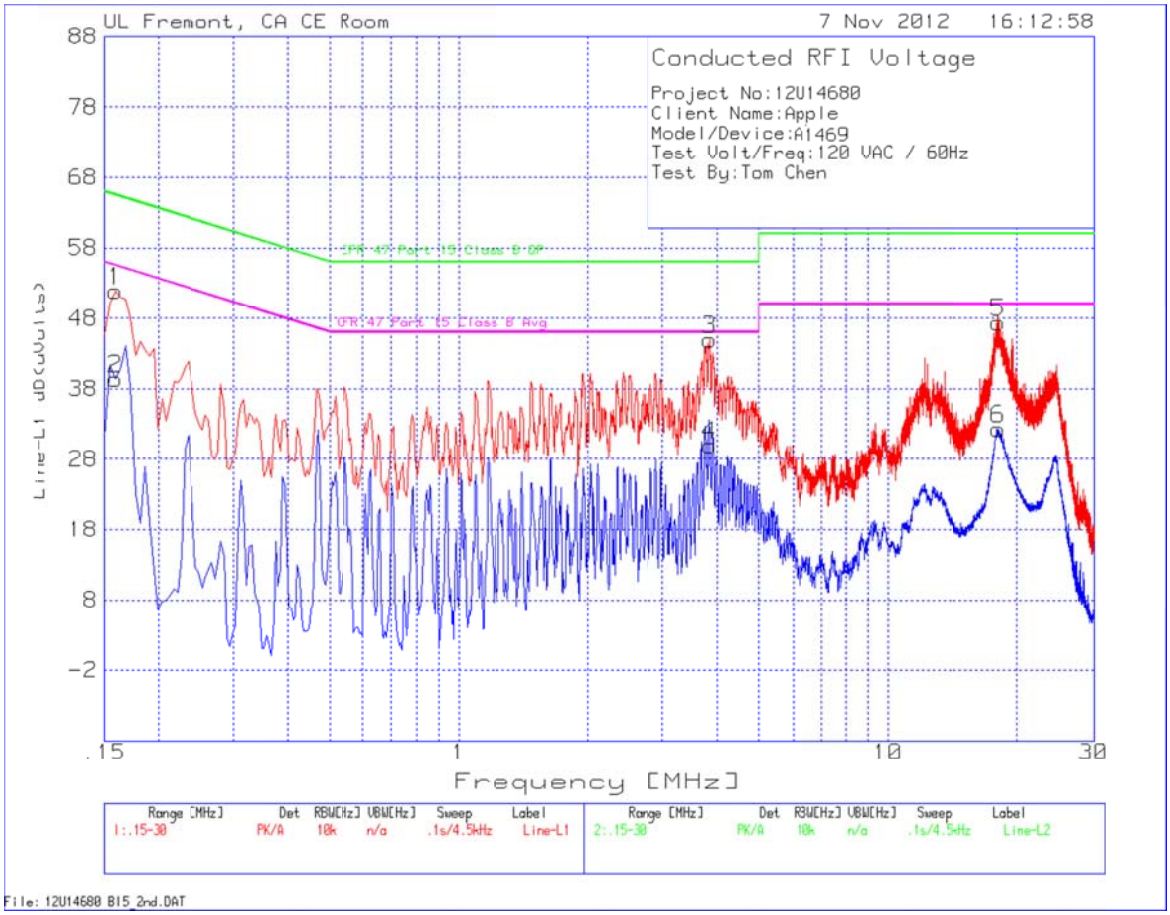
Line-L1 .15 - 30MHz

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