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

CERTIFICATION TEST REPORT

FOR

802.11 a/b/g/n 2X2 ACCESS POINT

MODEL NUMBER: A1392

FCC ID: BCGA1392
IC: 579C-A1392

REPORT NUMBER: 12U14633-1

ISSUE DATE: SEPTEMBER 25, 2012

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	09/25/12	Initial Issue	F. Ibrahim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: 802.11 a/b/g/n 2X2 ACCESS POINT

MODEL: A1392

SERIAL NUMBER: C86H809NF2R9 (RADIATED UNIT),
PT602637 (CONDUCTED UNIT)

DATE TESTED: MARCH 12 – MAY 18, 2012

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 9	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:

FRANK IBRAHIM
EMC SUPERVISOR
UL CCS

Tested By:

TOM CHEN
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, ANSI C63.10-2009, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11 a/b/g/n transceiver Access Point.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5240	802.11a	15.03	31.84
5180 - 5240	802.11n HT20	14.55	28.51
5190 - 5230	802.11n HT40	16.52	44.87
5260 - 5320	802.11a	21.08	128.23
5260 - 5320	802.11n HT20	20.95	124.45
5270 - 5310	802.11n HT40	22.21	166.34
5500 - 5700	802.11a	21.98	157.76
5500 - 5700	802.11n HT20	22.08	161.44
5510 - 5670	802.11n HT40	21.95	156.68

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes 2 IFA integrated antennas, with the following peak gains in dBi:

Frequency Range (MHz)	Ant0	Ant1
2400-2483.5	1.49	1.82
5150-5250	0.93	1.88
5250-5350	1.54	2.07
5470-5725	3.09	3.28
5745-5850	2.74	3.11

5.4. SOFTWARE AND FIRMWARE

The Utility software installed in the EUT during testing was ART v3.3.

The firmware installed in the EUT during testing was v7.6.2.d1auto20120216T6T0030-T0T

5.5. WORST-CASE CONFIGURATION AND MODE

For Radiated Emissions below 1 GHz and Power line Conducted Emissions, the channel with the highest conducted output power was selected.

Worst-case data rates as provided by the manufacturer are:
For 11b mode: 1Mbps
For 11g mode: 6Mbps
For 11n HT20 (2.4 GHz band): MCS0
For 11a mode: 6Mbps (5.2 GHz, 5.3 GHz, 5.6 GHz, 5.8 GHz bands)
For 11n HT20 (5.2 GHz, 5.3 GHz, 5.6 GHz, 5.8 GHz bands): MCS0
For 11n HT40 (5.2 GHz, 5.3 GHz, 5.6 GHz, 5.8 GHz bands): MCS0

EUT only has one orientation (laid down on the desktop) and it was tested in that orientation.

Since EUT passed radiated with antenna, no conducted spurious was performed.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
AC Adapter	Apple	A1184	N/A
Laptop PC	Apple	MacBook Pro	AOU269116

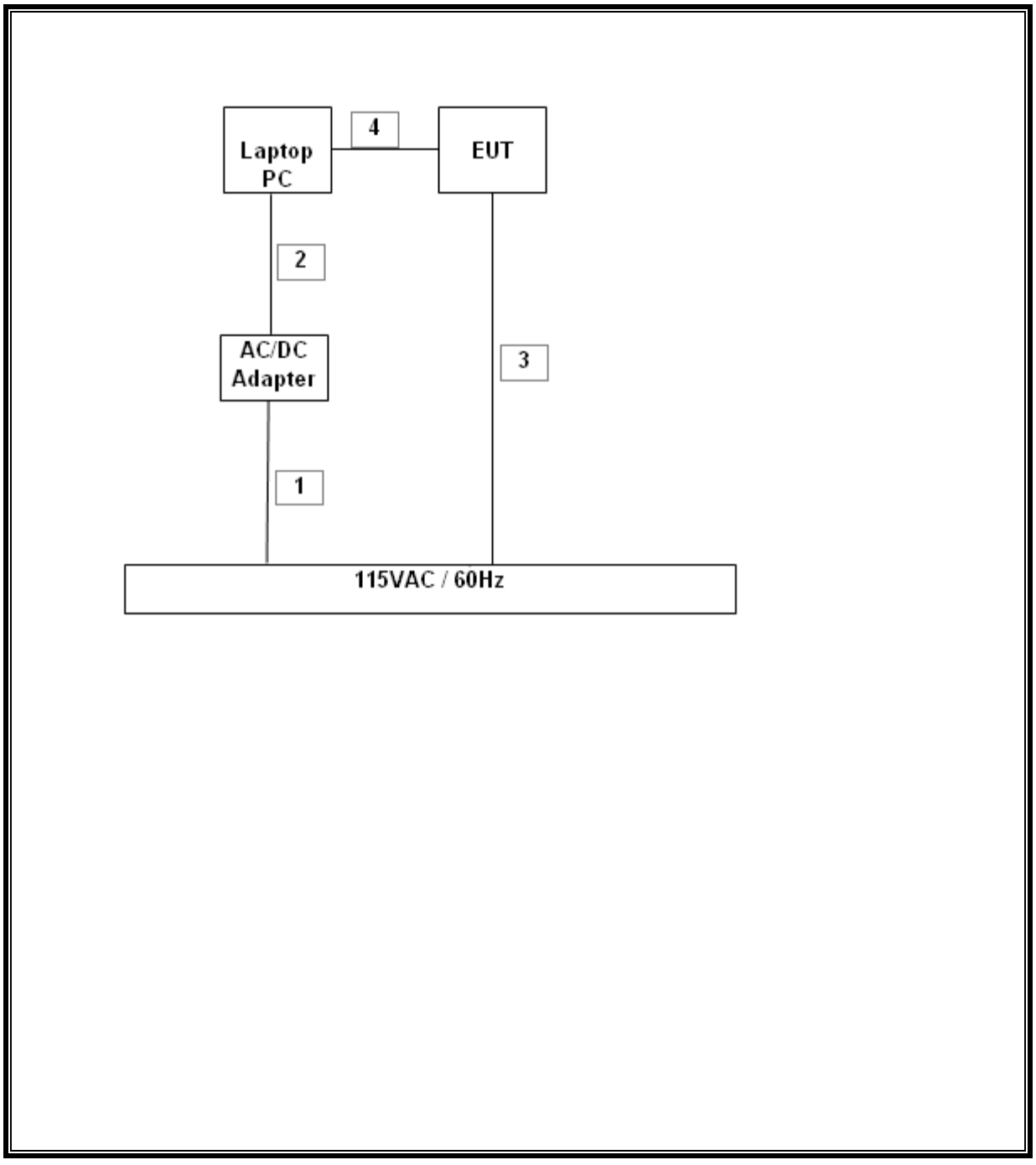
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	#of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Unshielded	2m	N/A
2	DC	1	DC	Unshielded	2.5m	N/A
3	AC	1	AC	Unshielded	2m	N/A
4	Ethernet	1	RJ45	Shielded	1.5m	N/A

TEST SETUP

The Access Point EUT is controlled externally with a laptop, via Ethernet.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/14/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	11/11/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/12
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/12
Horn Antenna, 40 GHz	ARA	MWH-2640/B	C00981	06/14/12
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	03/14/13
Reject Filter, 2.0-2.9 GHz	Micro-Tronics	BRM50702	N02684	CNR
High Pass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	05/11/12
Peak Power Meter	Agilent	N1911A	1260847C	08/04/12
Peak Power Sensor	Agilent	E9323A	1244073F	08/04/12
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02676	CNR
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
EMI Test Receiver, 30MHz	R & S	ESHS 20	N02396	08/19/13
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	12/13/12

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

7.1.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11a 20 MHz	1.353	1.400	0.966	96.6%	0.15	0.739
802.11n HT20	1.263	1.310	0.964	96.4%	0.16	0.792
802.11n HT40	0.6317	0.6533	0.967	96.7%	0.15	1.583

7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD

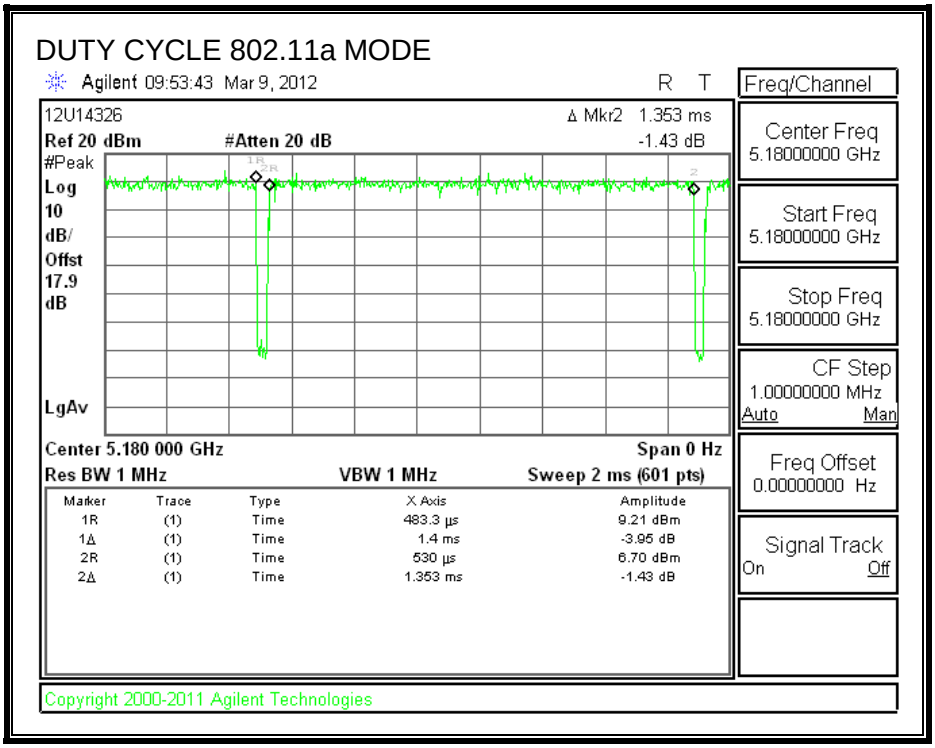
The Duty Cycle is less than 98% and not consistent therefore KDB 789033 Method SA-3 Alternative with Power RMS Averaging is used.

7.1.3. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS ABOVE 1 GHz

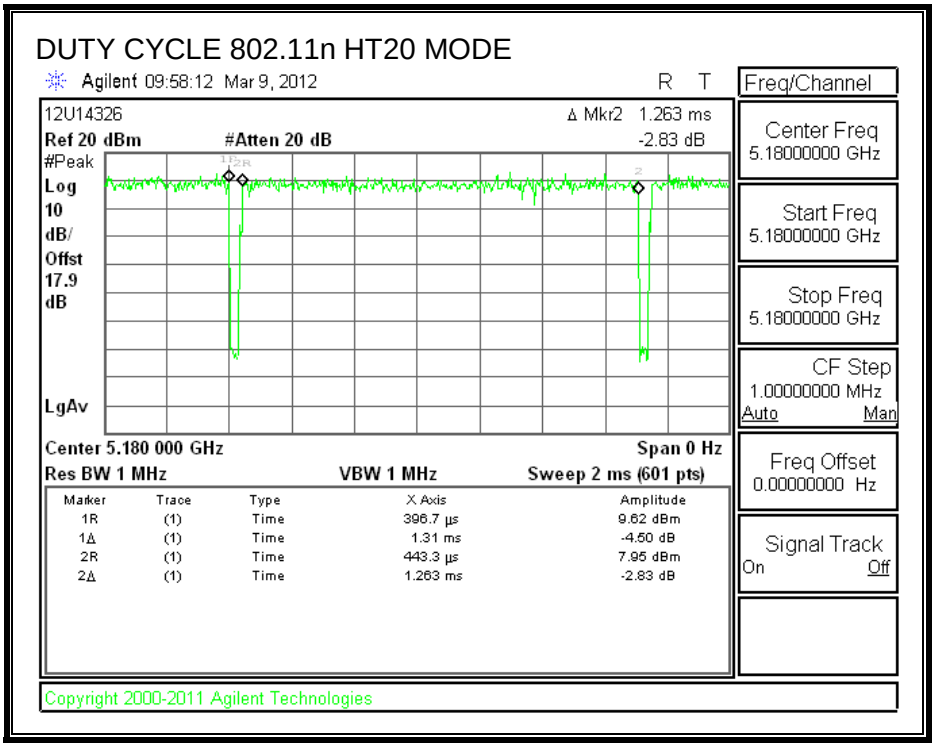
The Duty Cycle is less than 98% and consistent, KDB 789033 Method VB with Power RMS Averaging is used.

7.1.4. DUTY CYCLE PLOTS

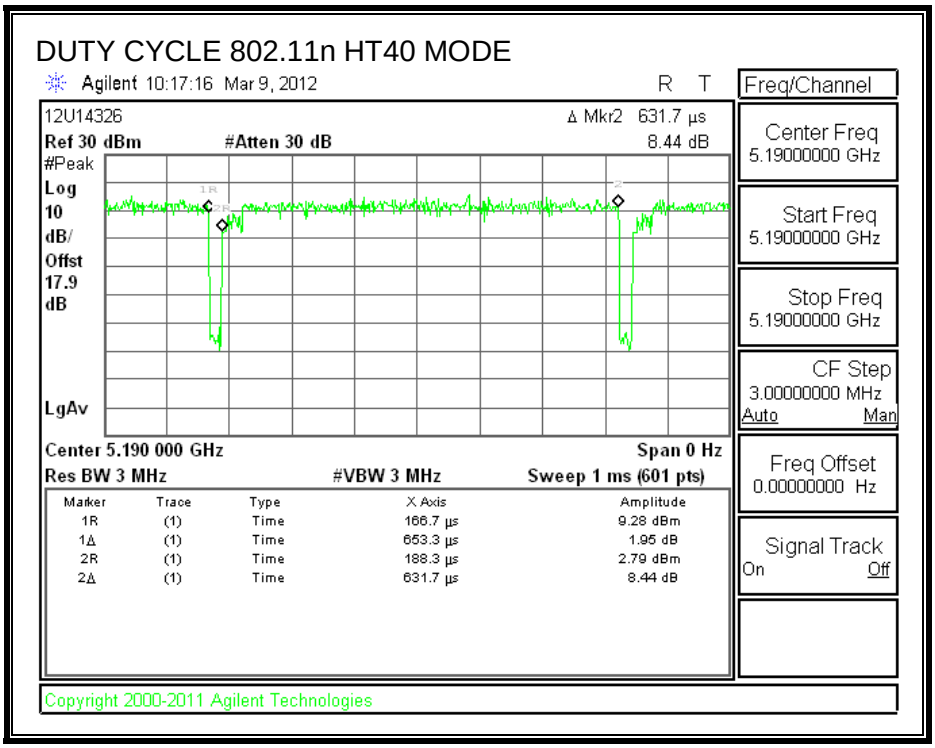
DUTY CYCLE 802.11a MODE



DUTY CYCLE 802.11n HT20 MODE



DUTY CYCLE 802.11n HT40 MODE



7.2. 802.11a MODE IN THE 5.2 GHz BAND

7.2.1. 26 dB BANDWIDTH

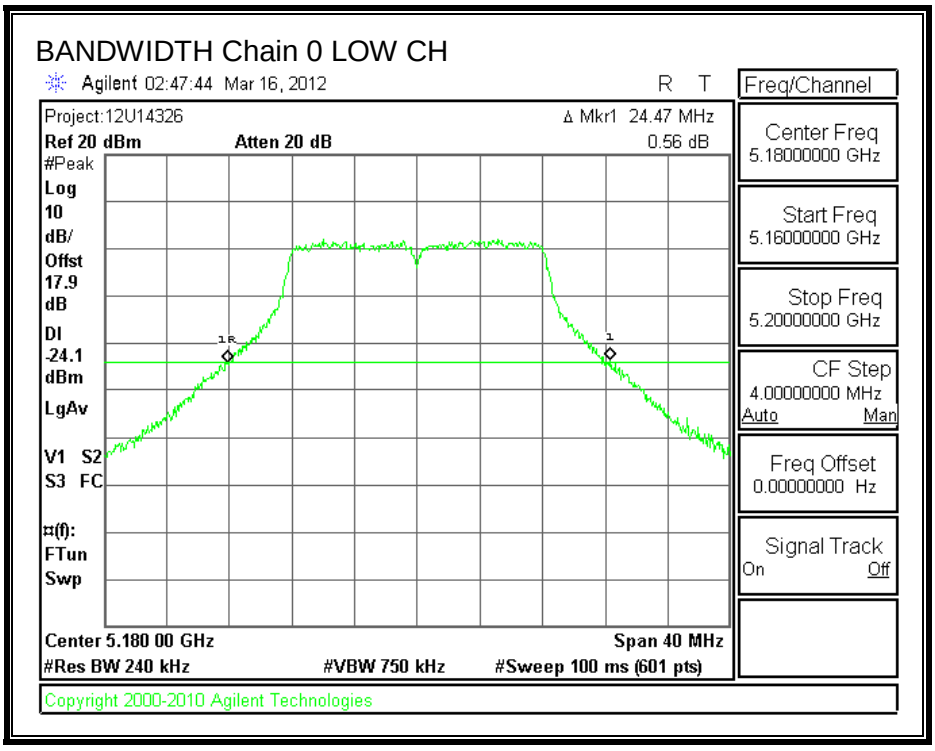
LIMITS

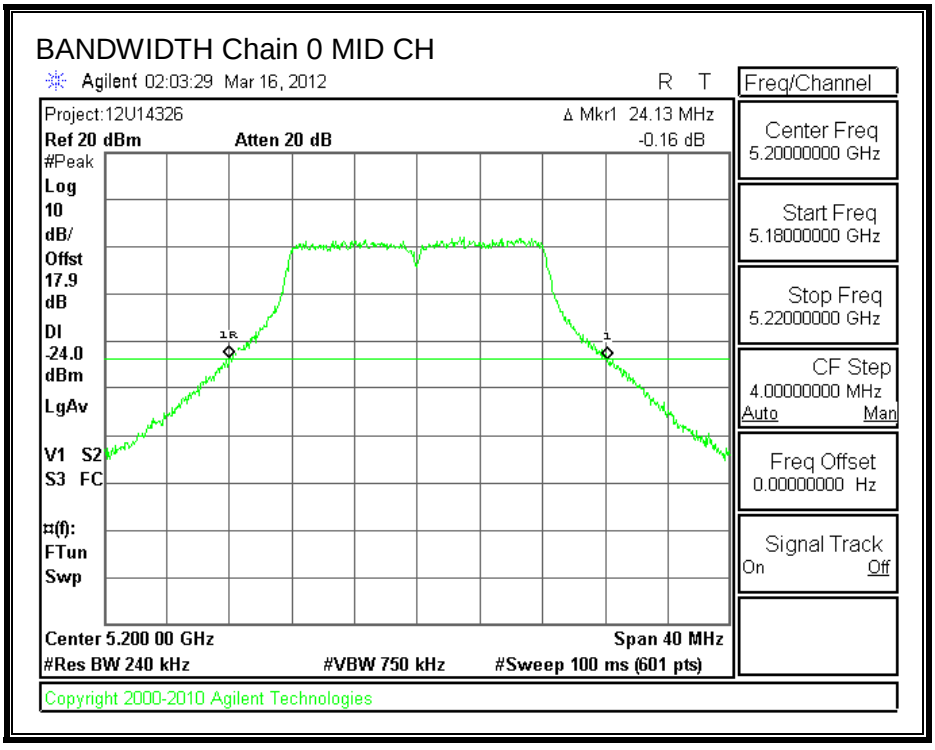
None; for reporting purposes only.

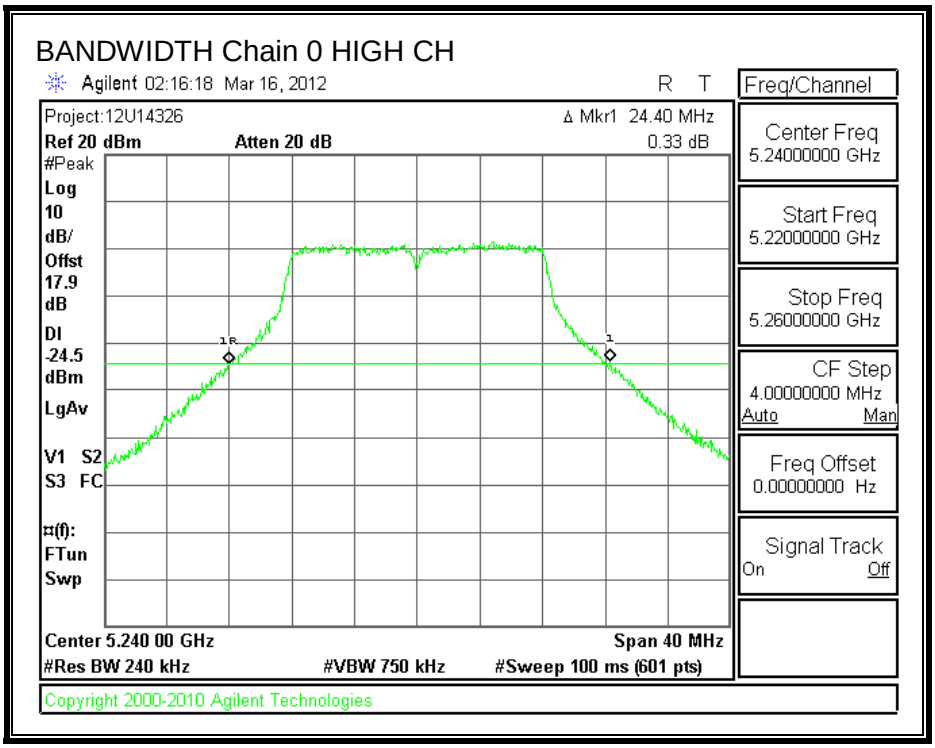
RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5180	24.47	23.80
Mid	5200	24.13	23.80
High	5240	24.40	24.07

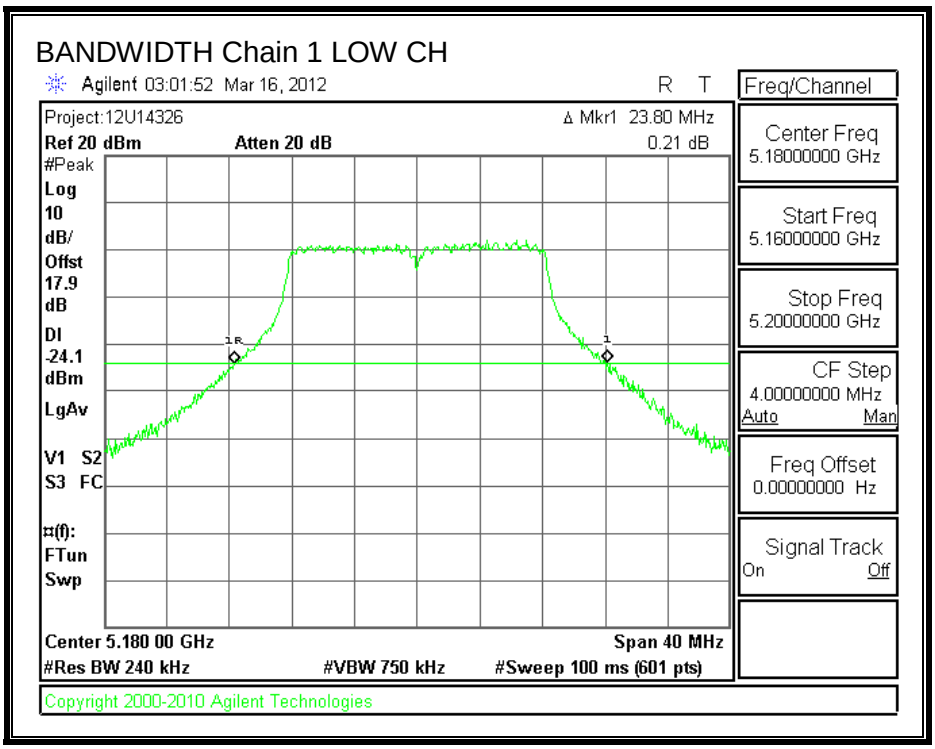
26 dB BANDWIDTH, Chain 0



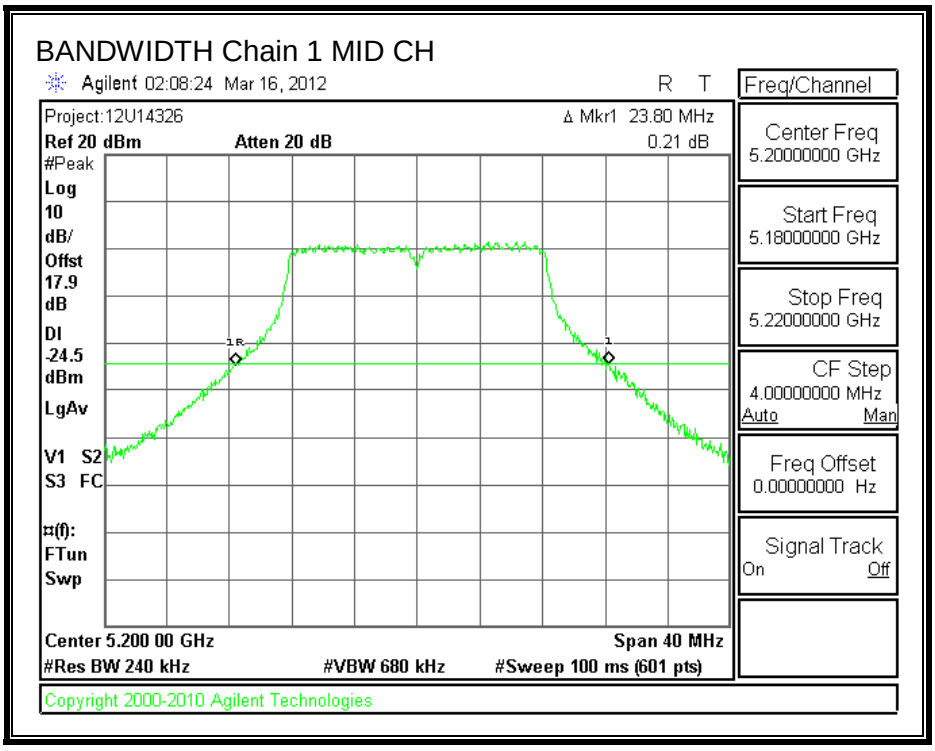




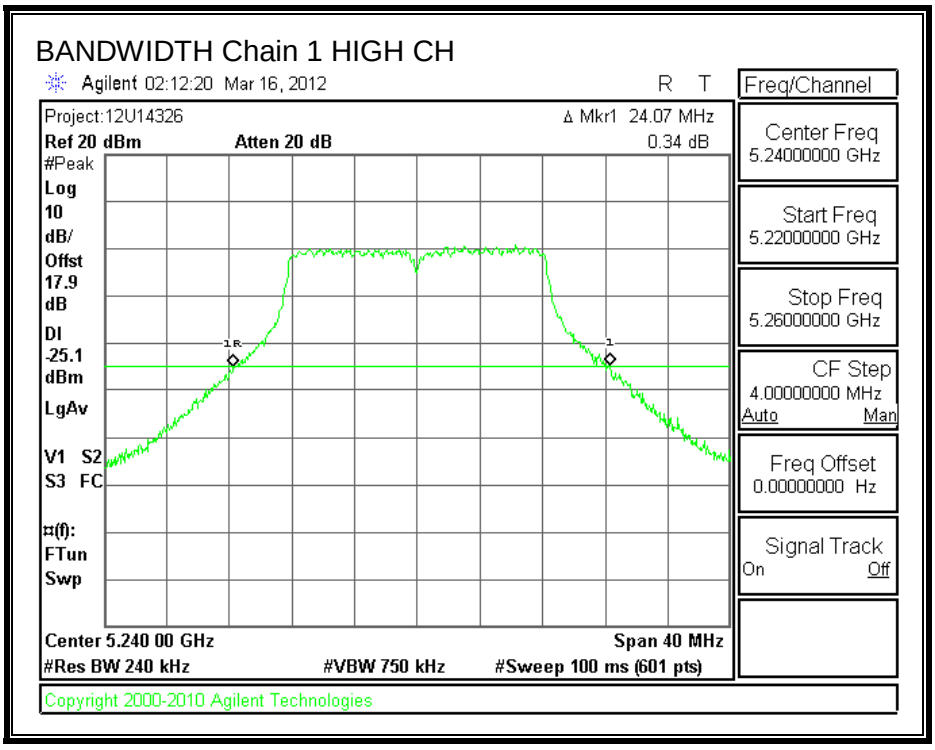
26 dB BANDWIDTH, Chain 1



BANDWIDTH Chain 1 MID CH



BANDWIDTH Chain 1 HIGH CH



7.2.2. 99% BANDWIDTH

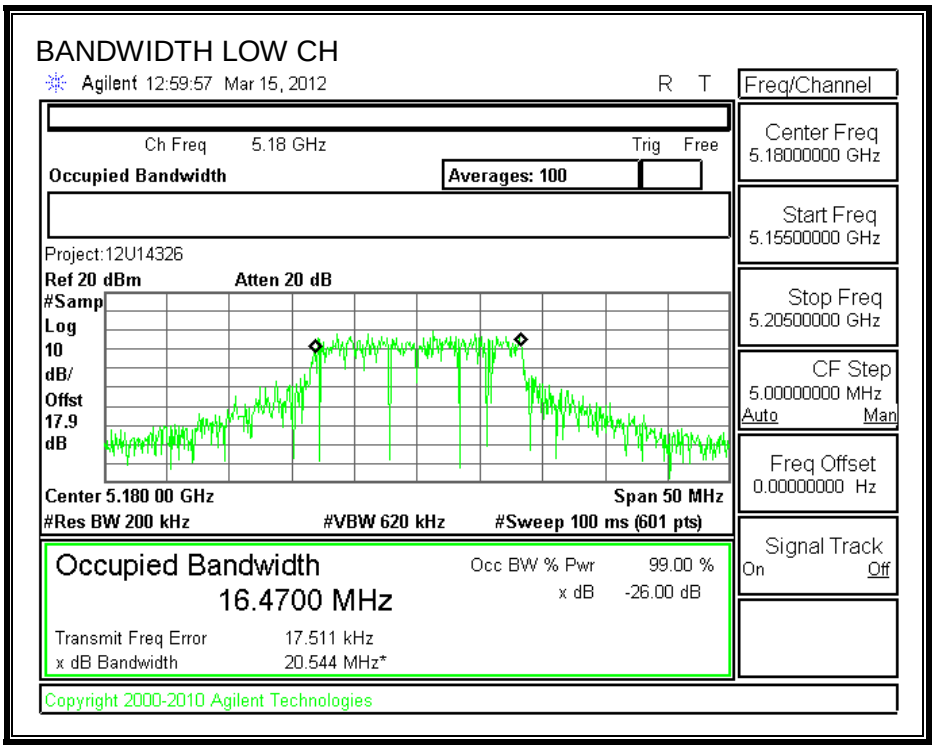
LIMITS

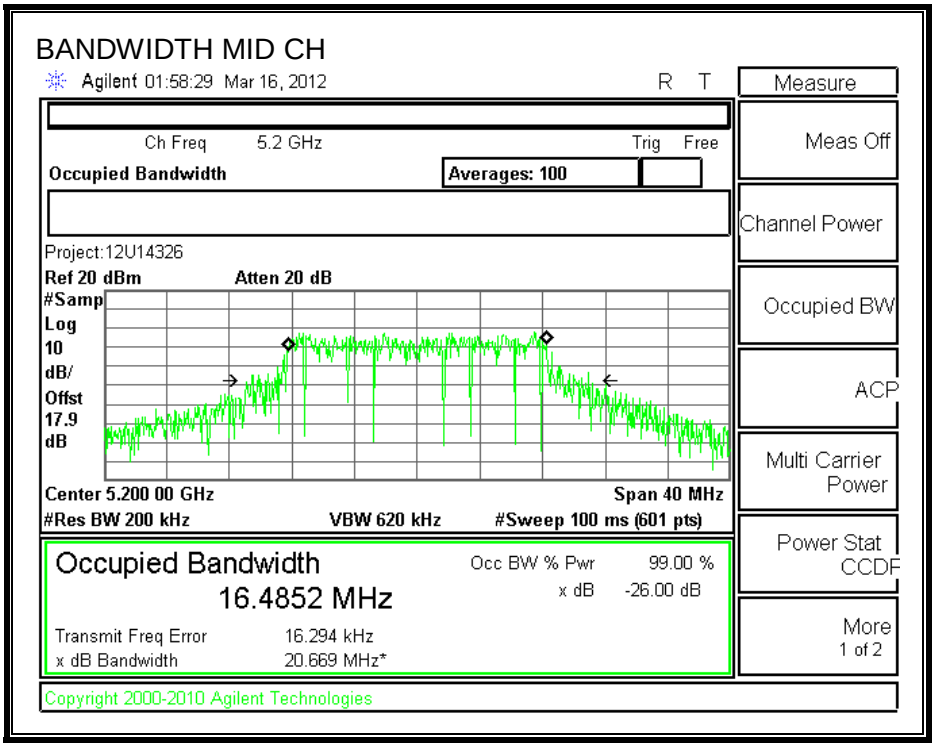
None; for reporting purposes only.

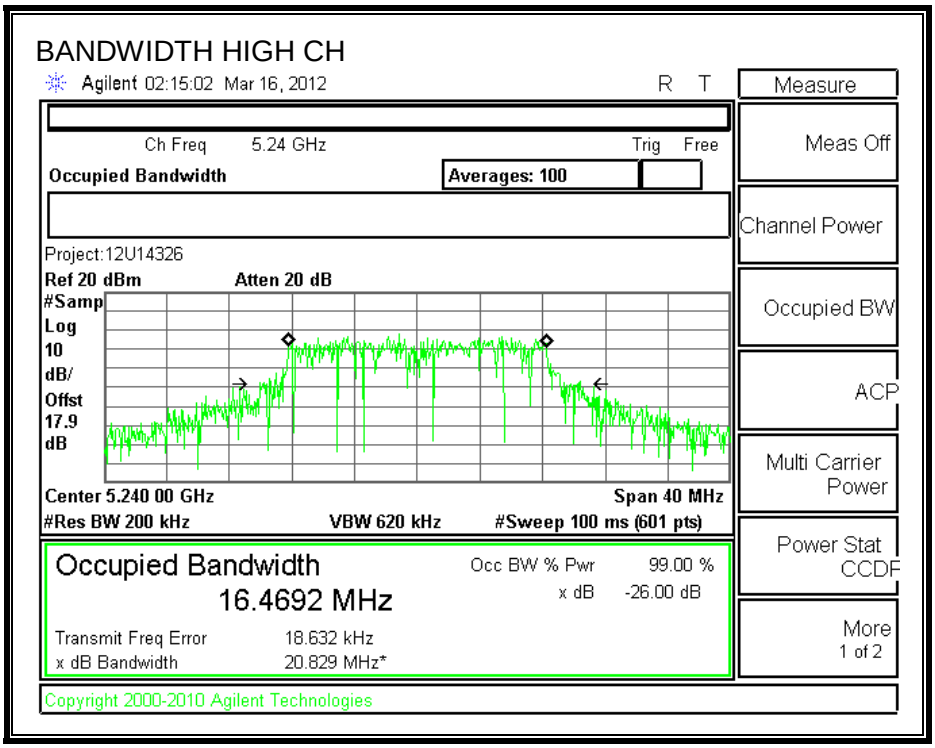
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5180	16.4700	16.4798
Mid	5200	16.4852	16.4717
High	5240	16.4692	16.4800

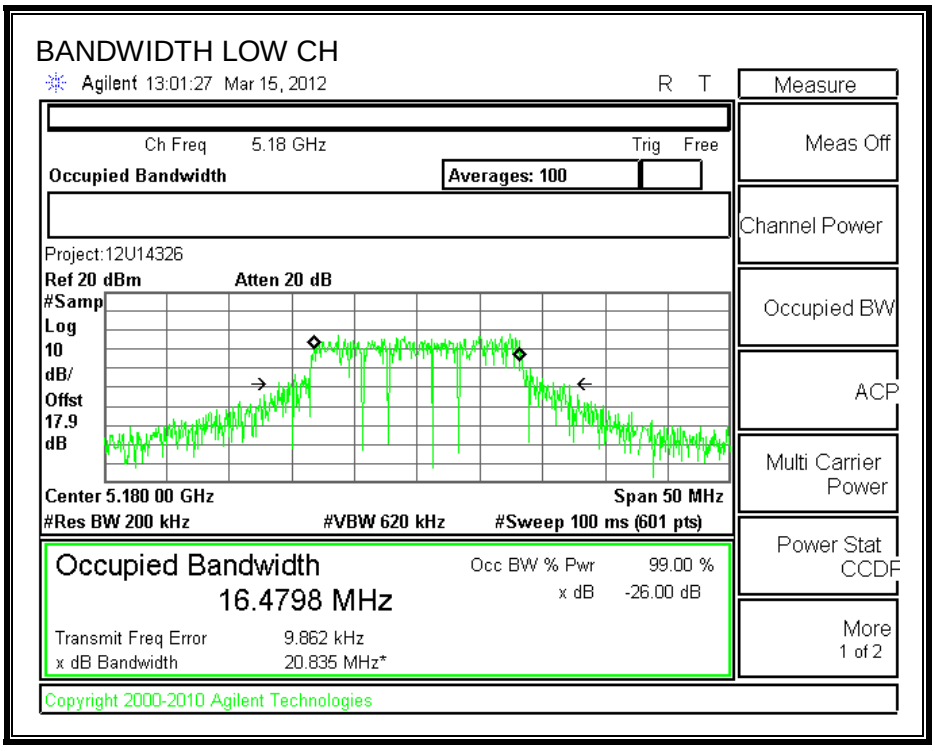
99% BANDWIDTH CHAIN 0

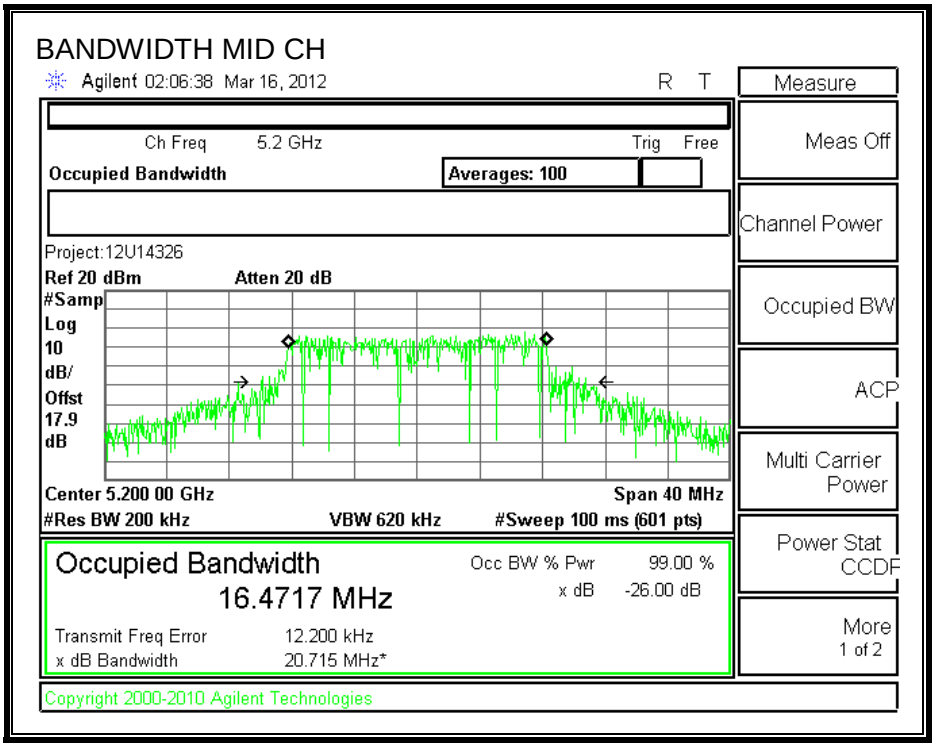


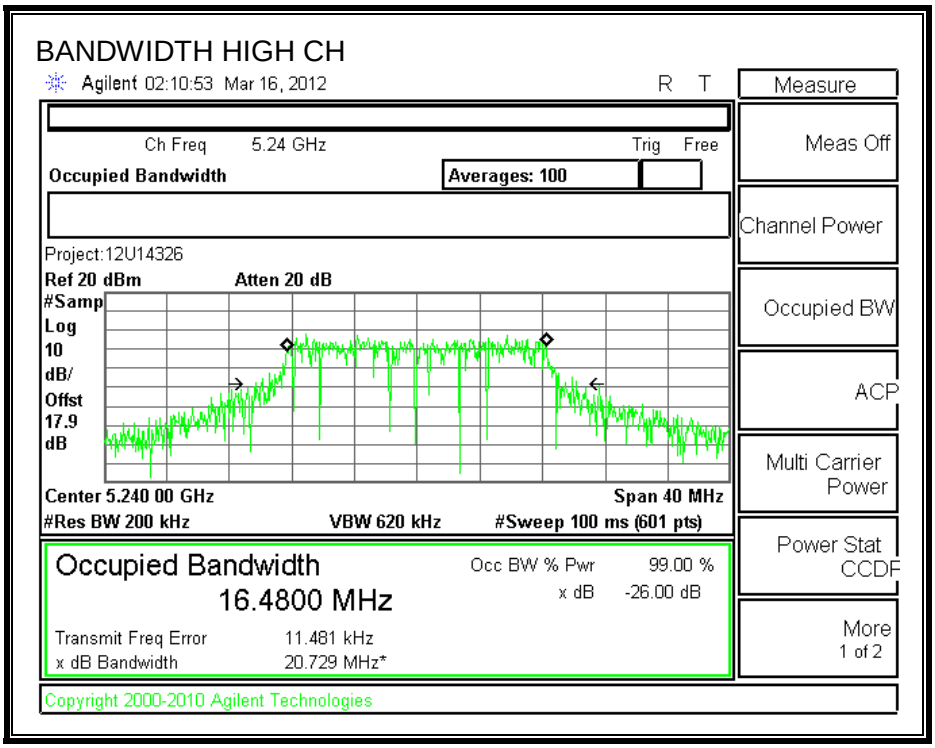




99% BANDWIDTH CHAIN 1







7.2.3. 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 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5180	11.60	12.10	14.87
Mid	5200	11.90	11.80	14.86
High	5240	11.00	11.30	14.16

7.2.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
0.93	1.88	4.43

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	17	23.8	17.77	4.43	17.00	4.00
Mid	5200	17	23.8	17.77	4.43	17.00	4.00
High	5240	17	24.1	17.81	4.43	17.00	4.00

Output Power Results

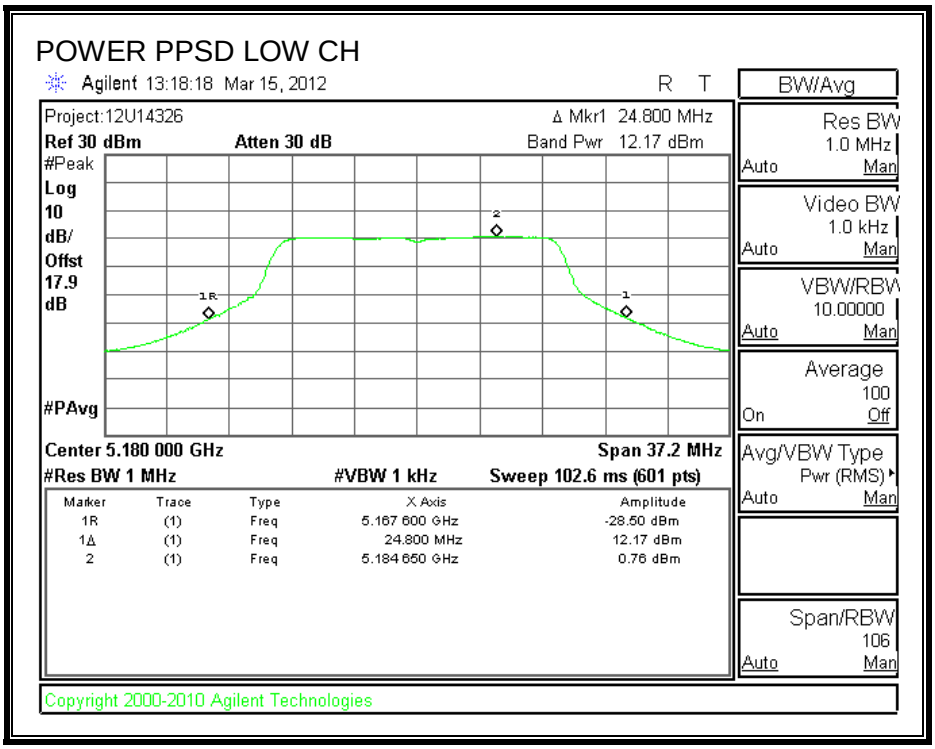
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	12.17	11.87	15.03	17.00	-1.97
Mid	5200	12.07	11.63	14.87	17.00	-2.13
High	5240	11.51	10.90	14.22	17.00	-2.78

PPSD Results

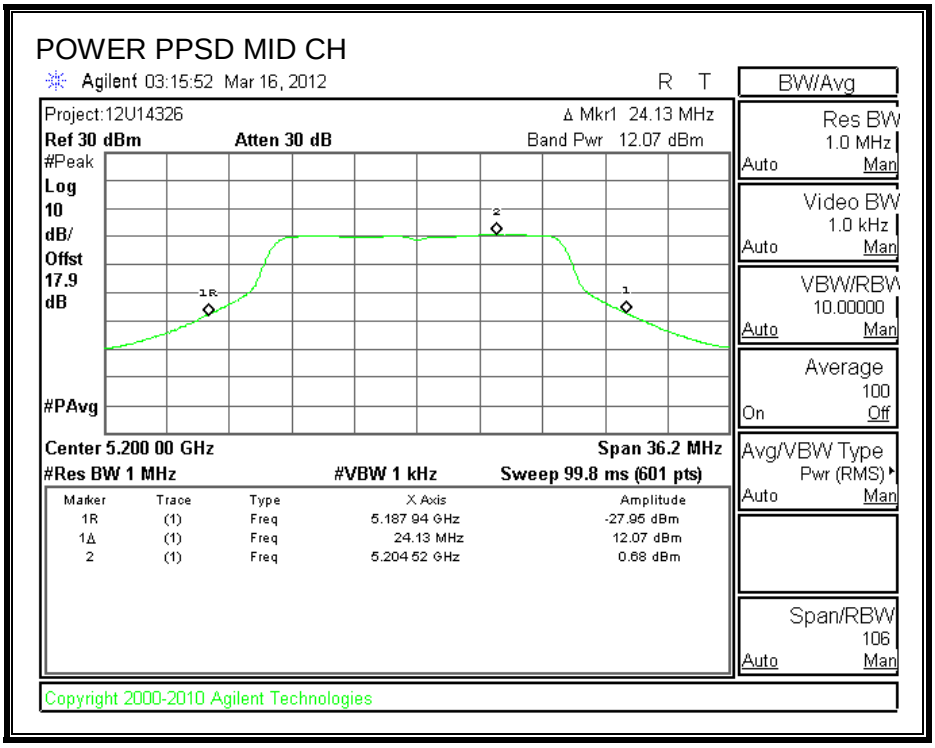
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5180	0.76	0.34	3.57	4.00	-0.43
Mid	5200	0.68	0.15	3.43	4.00	-0.57
High	5240	0.24	-0.62	2.84	4.00	-1.16

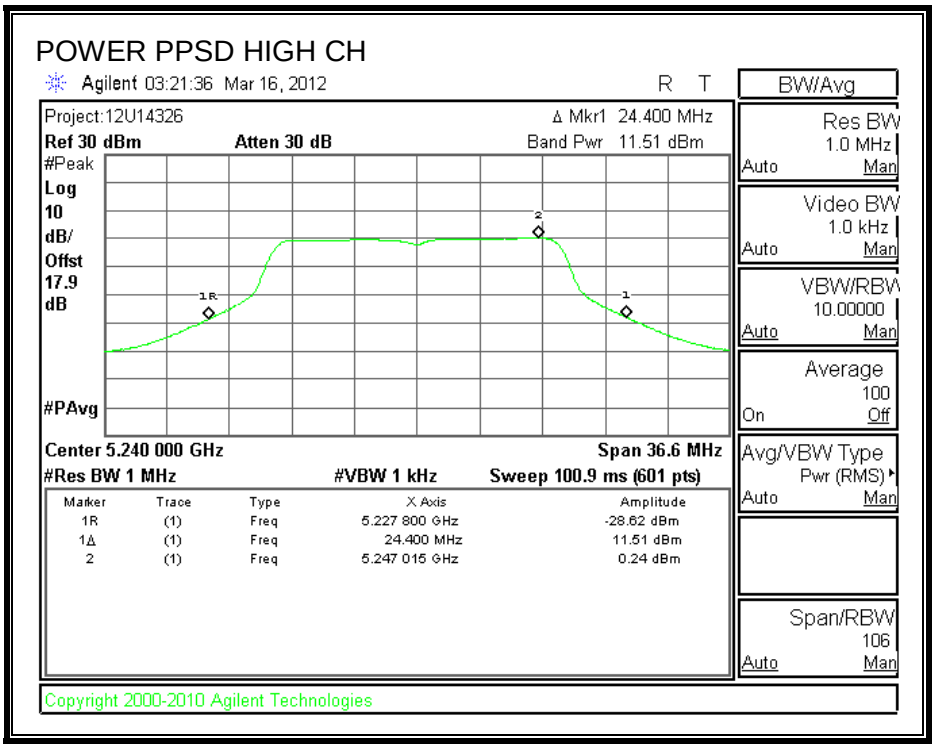
OUTPUT POWER AND PPSD CHAIN 0

POWER PPSD LOW CH

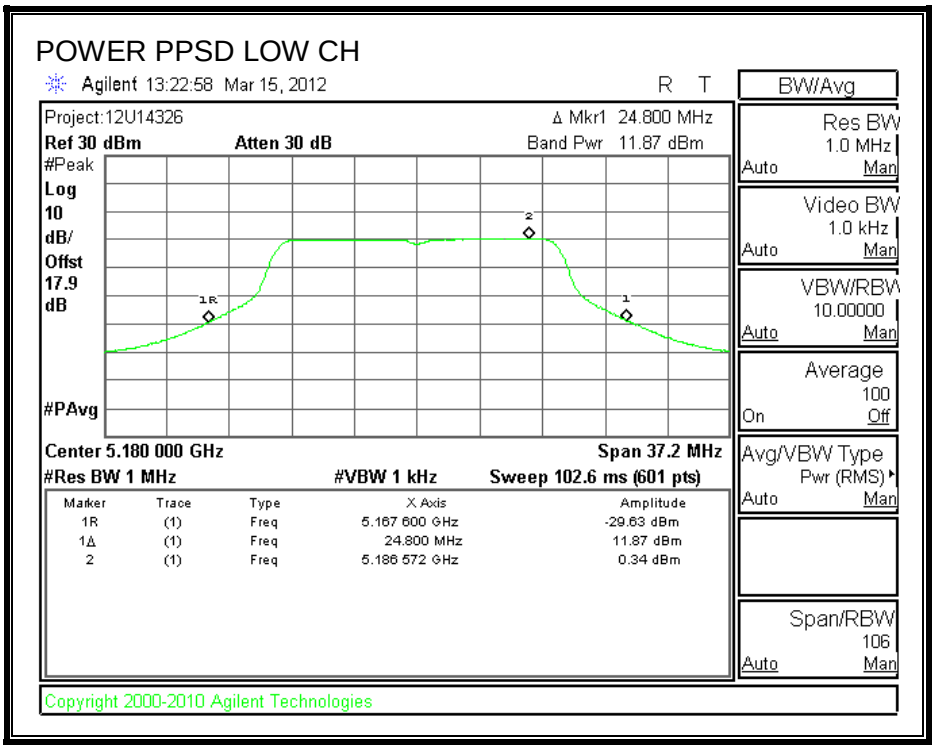


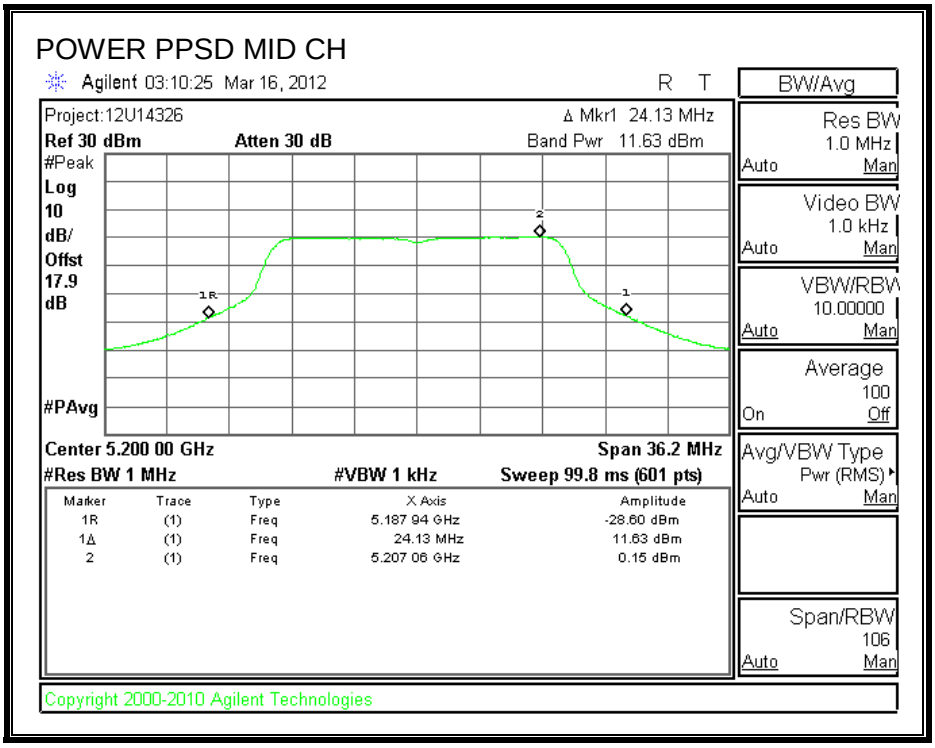
POWER PPSD MID CH

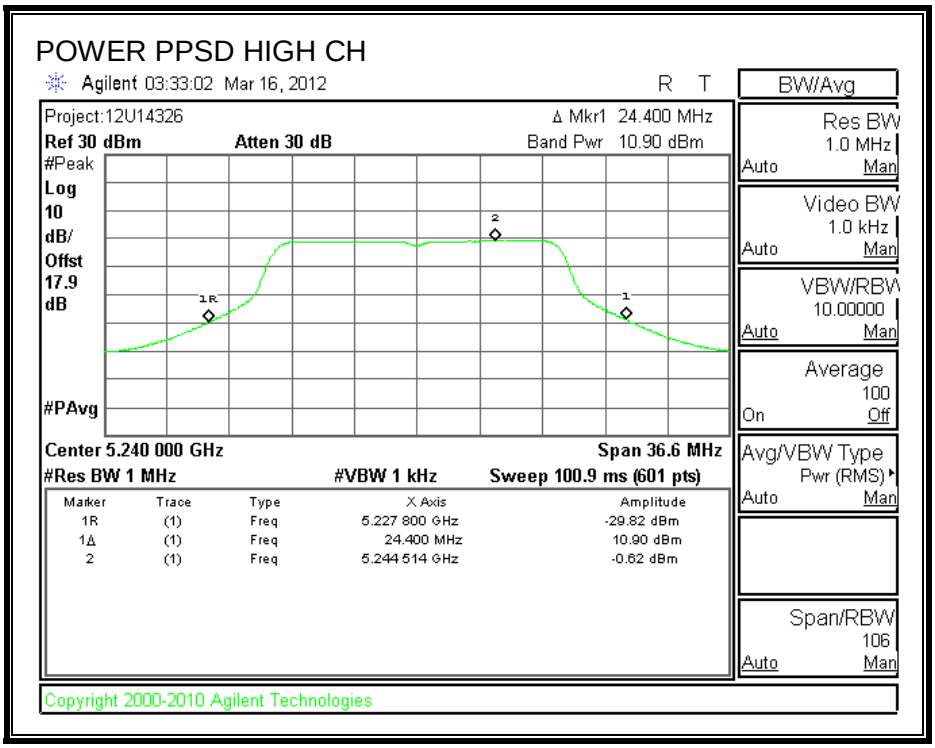




OUTPUT POWER AND PPSD CHAIN 1







7.2.5. PEAK EXCURSION

LIMITS

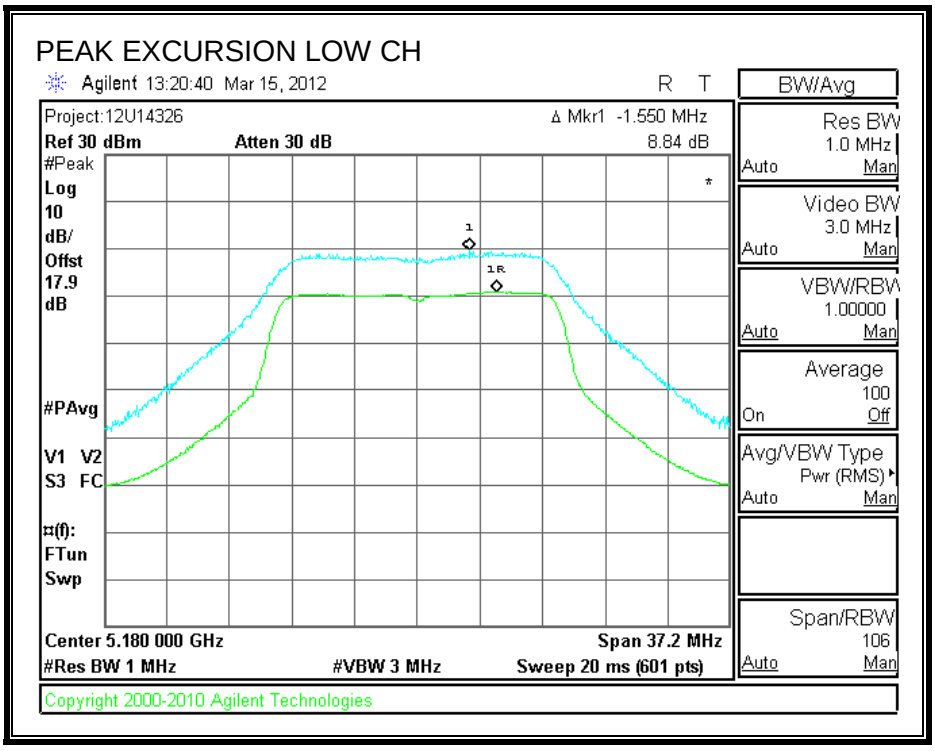
FCC §15.407 (a) (6)

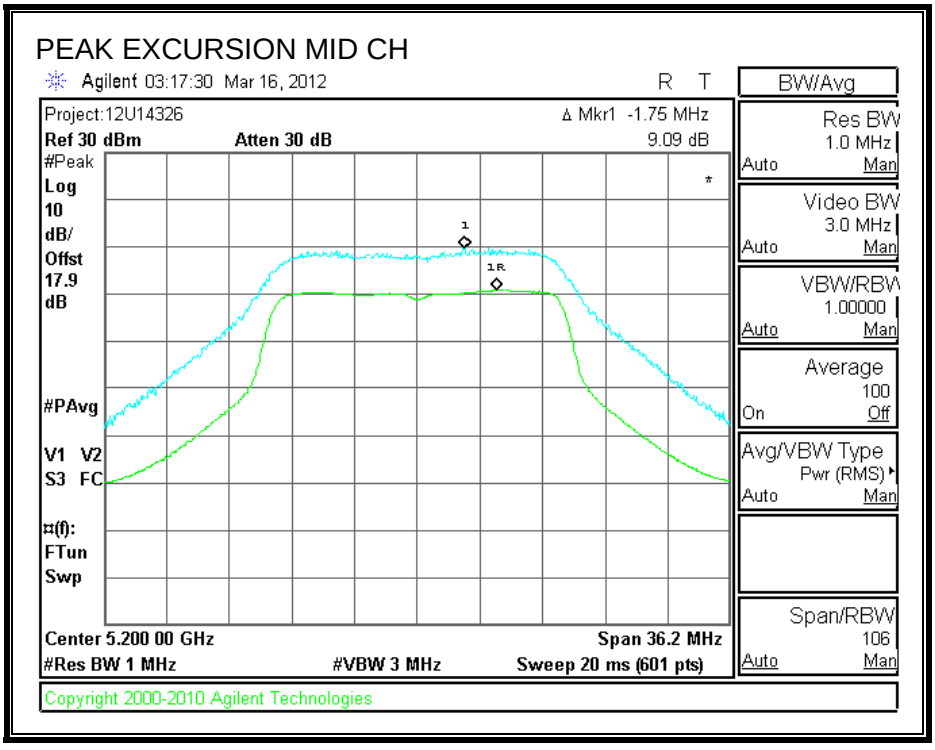
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

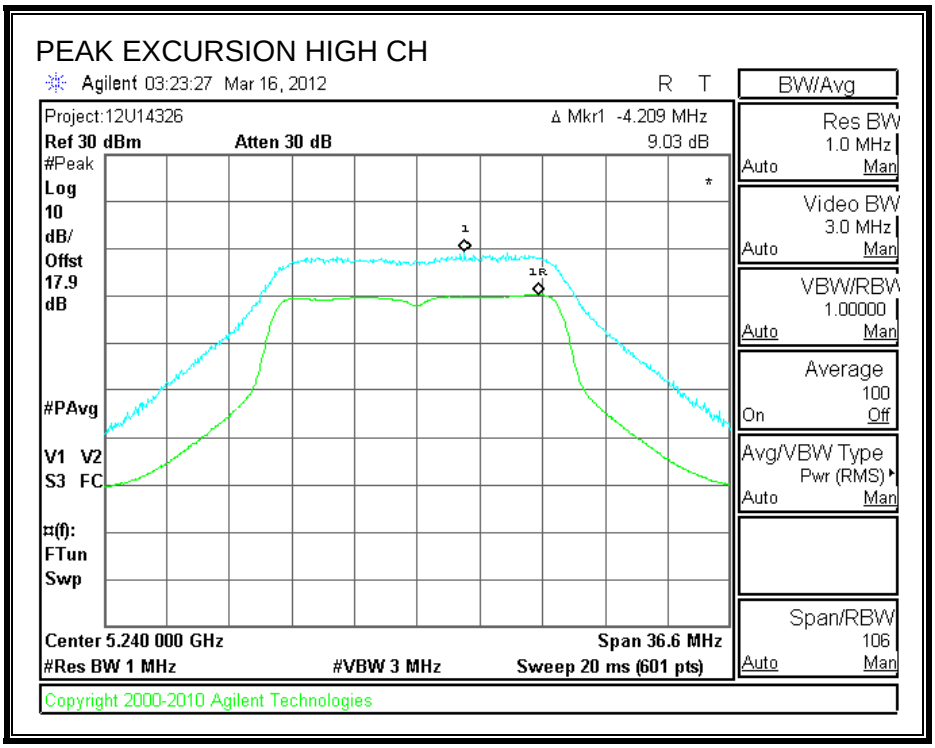
Channel	Frequency (MHz)	Pk Exc Chain 0 (dB)	Pk Exc Chain 1 (dB)	Limit (dB)	Worst-Case Margin (dB)
Low	5180	8.84	10.20	13	-2.8
Mid	5200	9.09	10.44	13	-2.6
High	5240	9.03	10.43	13	-2.6

PEAK EXCURSION CHAIN 0

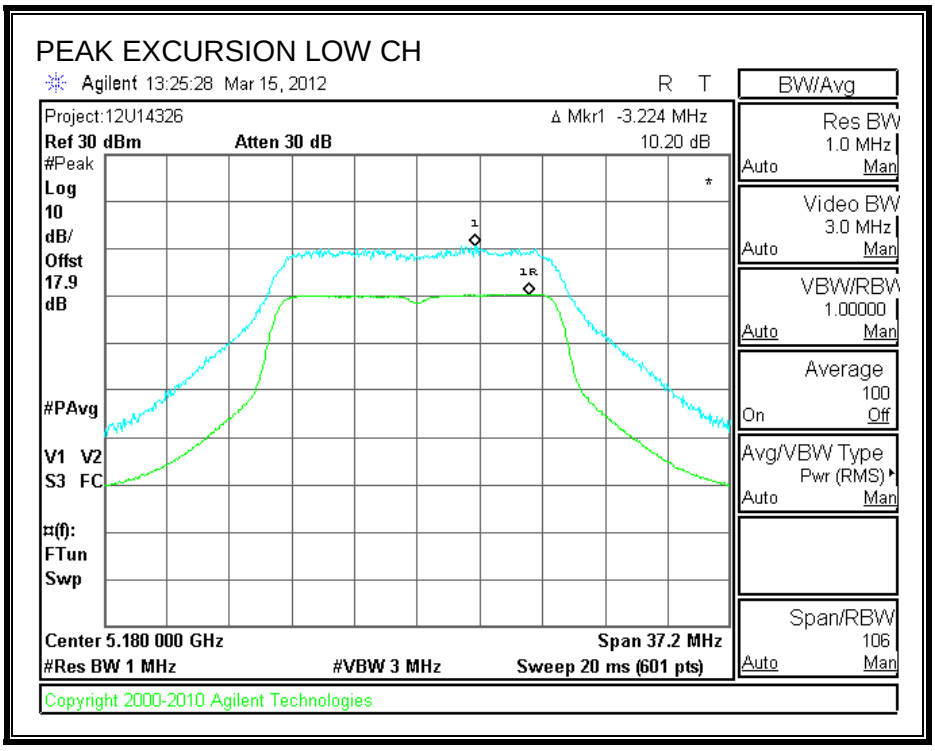


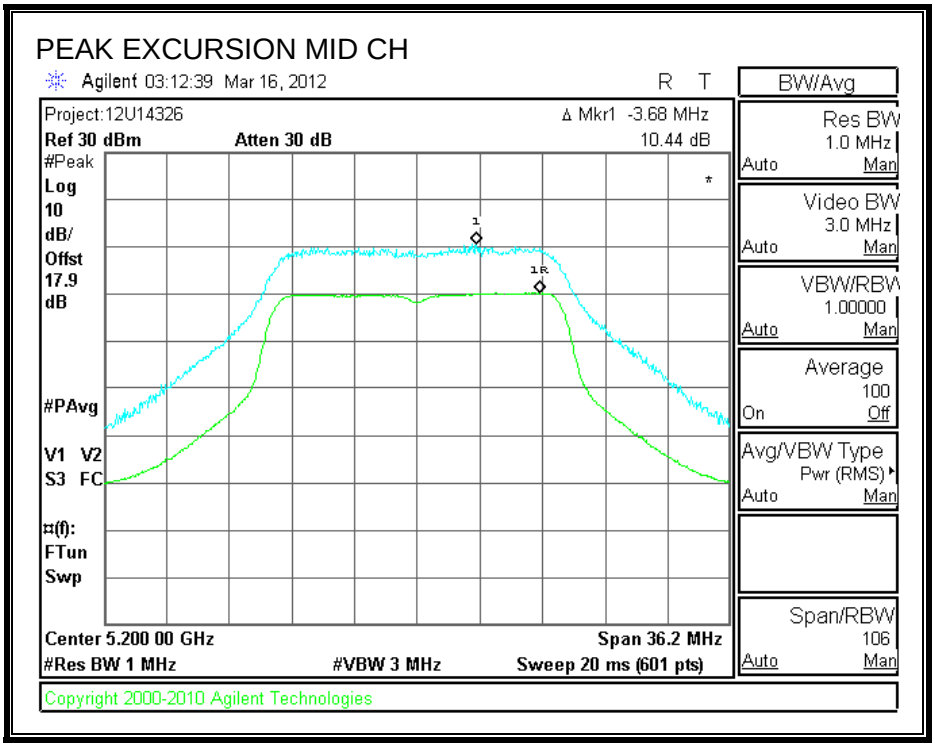


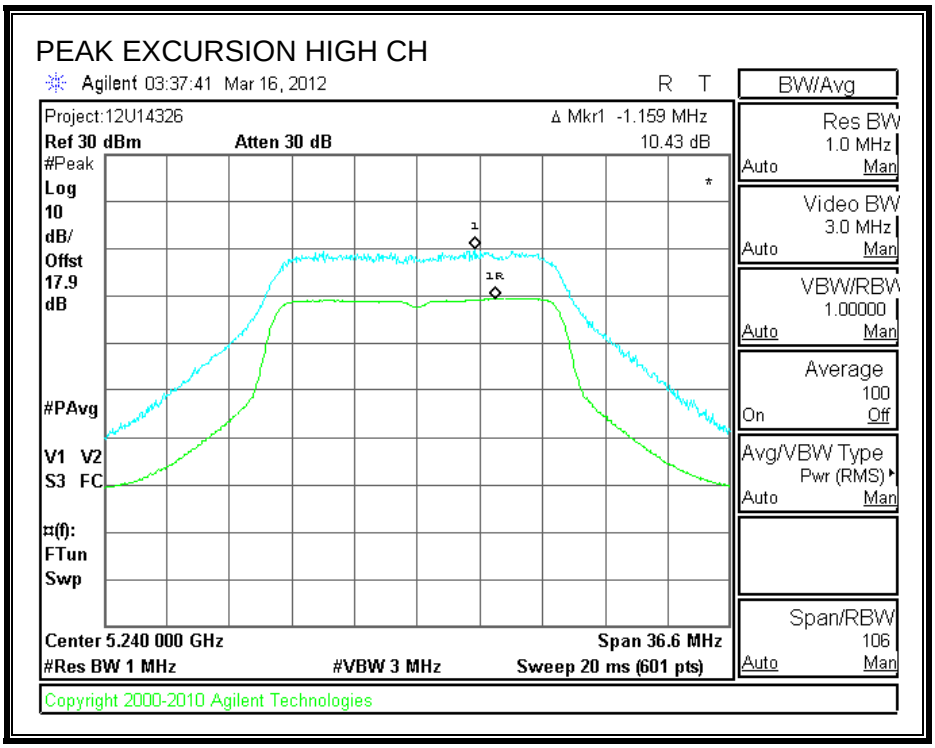
PEAK EXCURSION HIGH CH



PEAK EXCURSION CHAIN 1







7.3. 802.11n HT20 MODE IN THE 5.2 GHz BAND

7.3.1. 26 dB BANDWIDTH

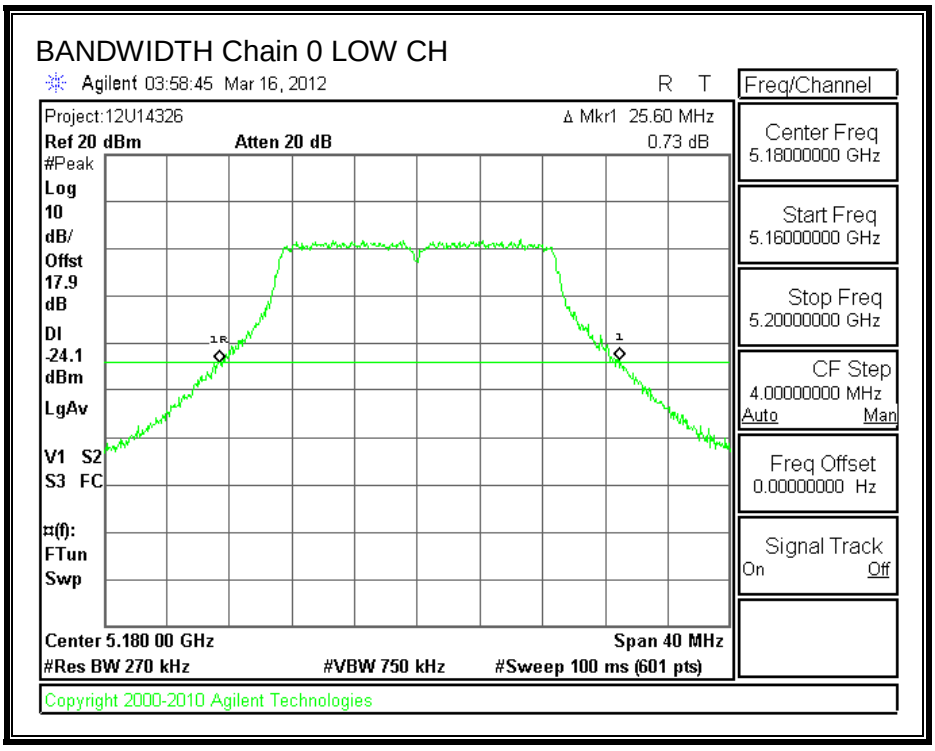
LIMITS

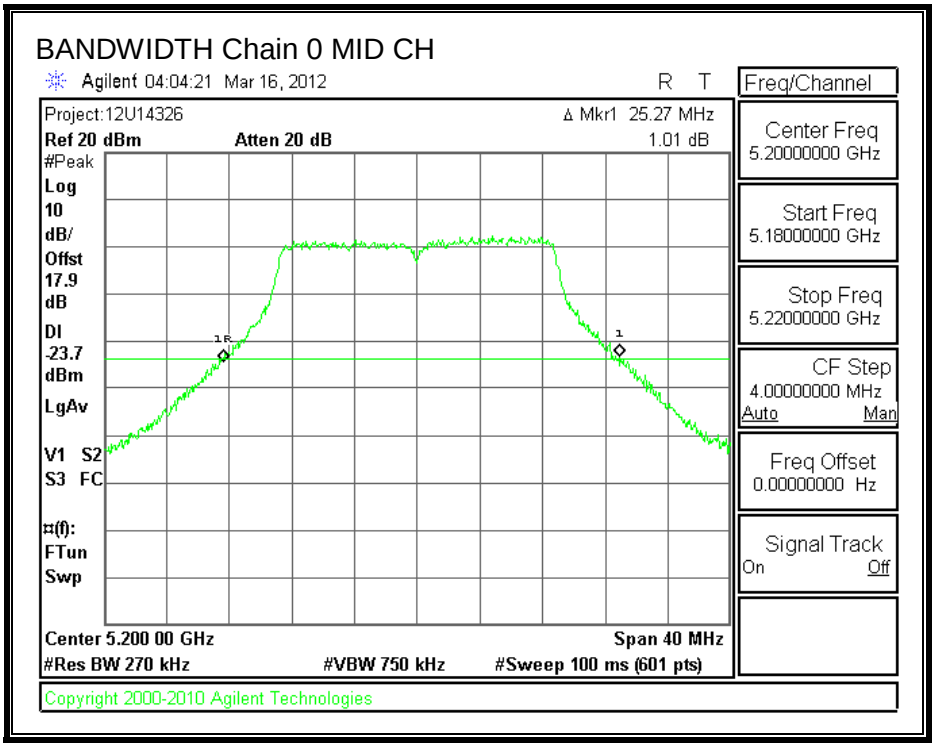
None; for reporting purposes only.

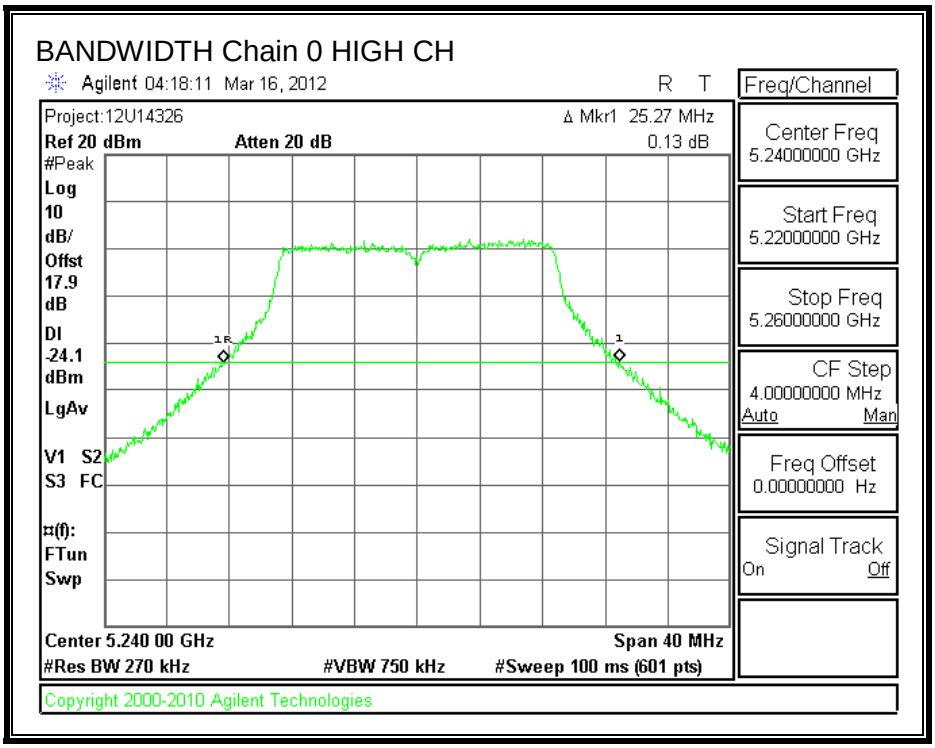
RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5180	25.60	25.20
Mid	5200	25.27	25.13
High	5240	25.27	25.00

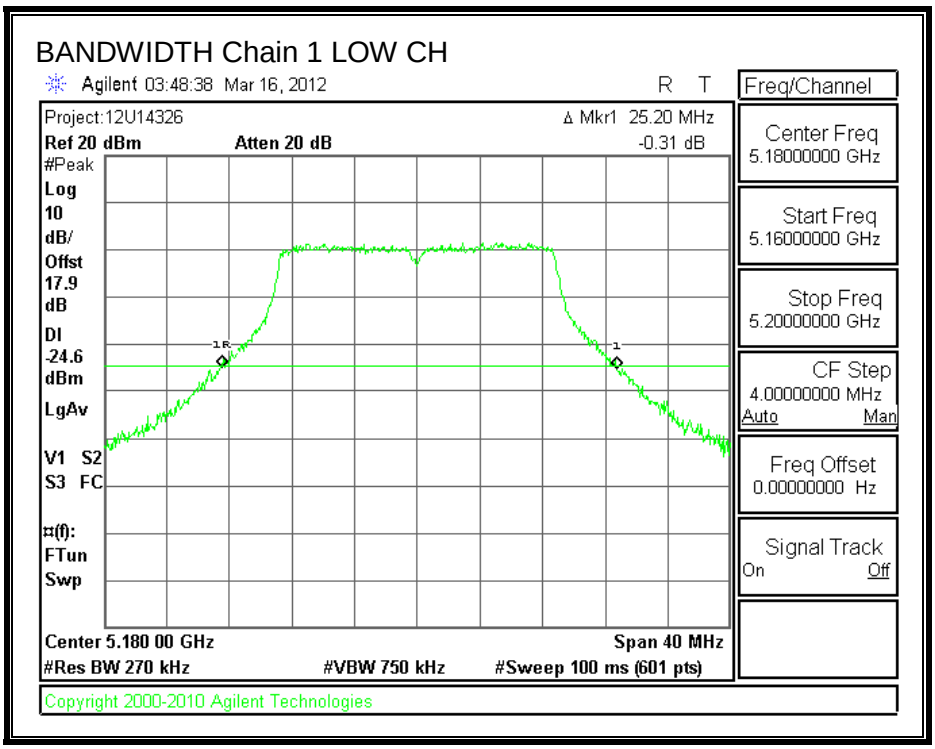
26 dB BANDWIDTH, Chain 0



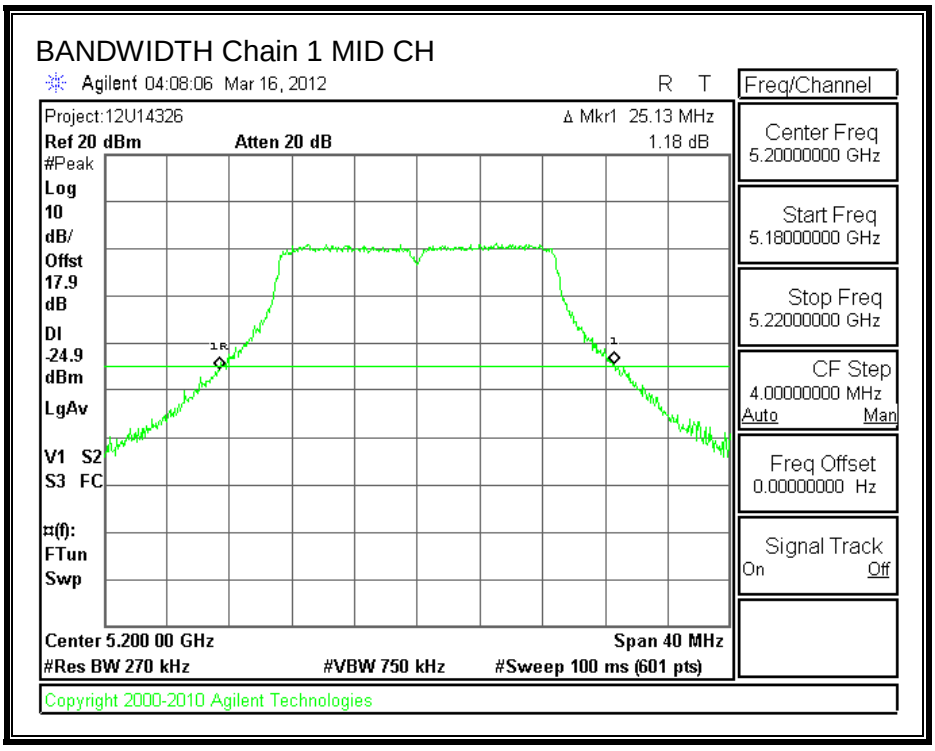




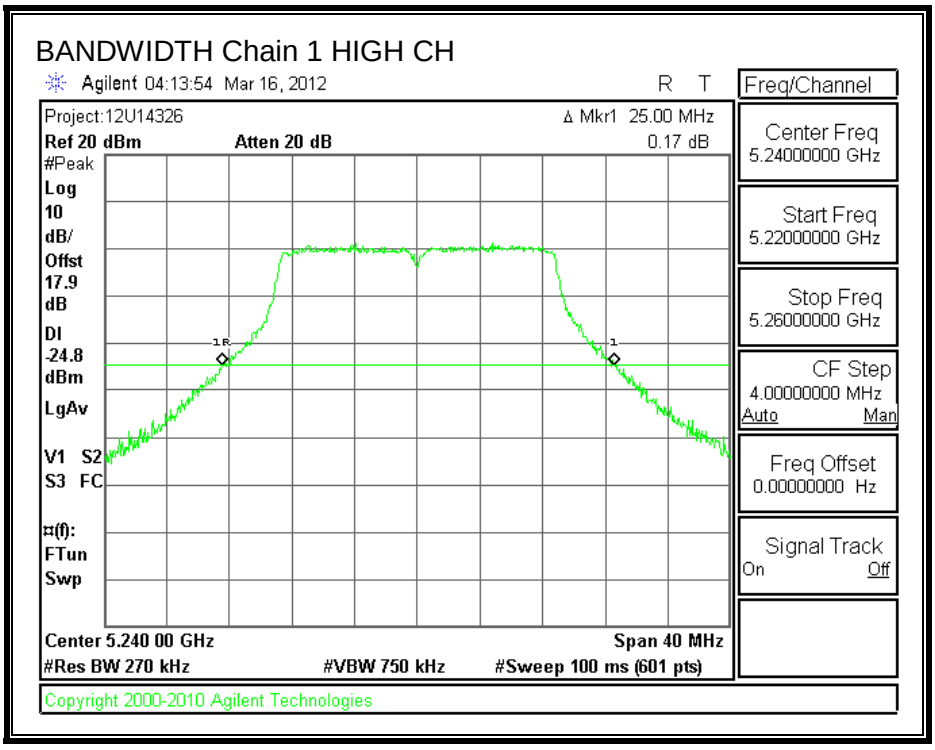
26 dB BANDWIDTH, Chain 1



BANDWIDTH Chain 1 MID CH



BANDWIDTH Chain 1 HIGH CH



7.3.2. 99% BANDWIDTH

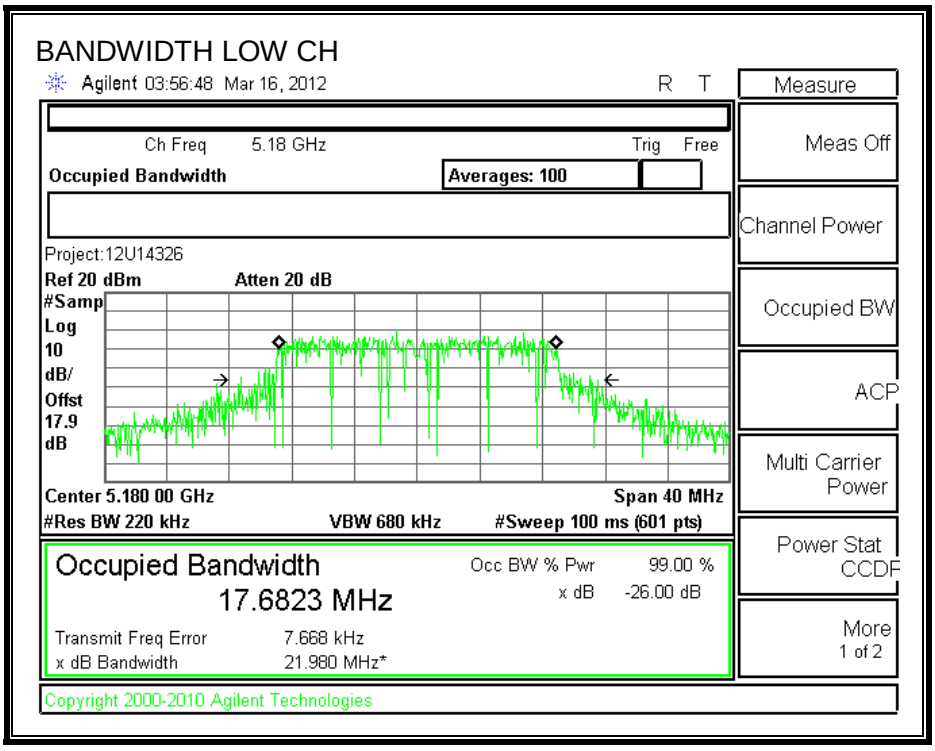
LIMITS

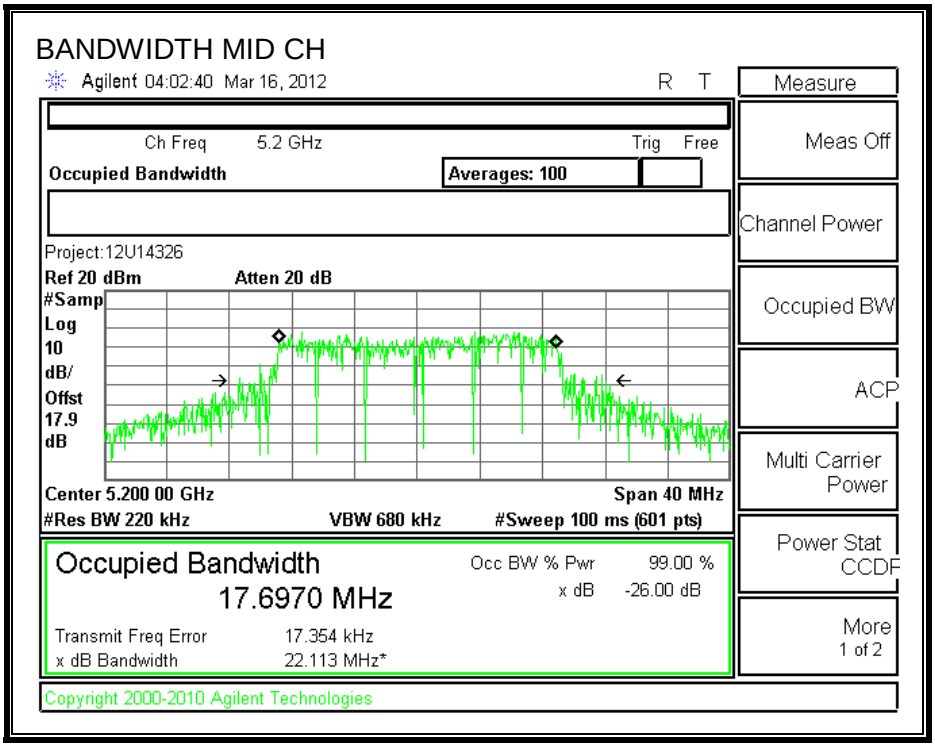
None; for reporting purposes only.

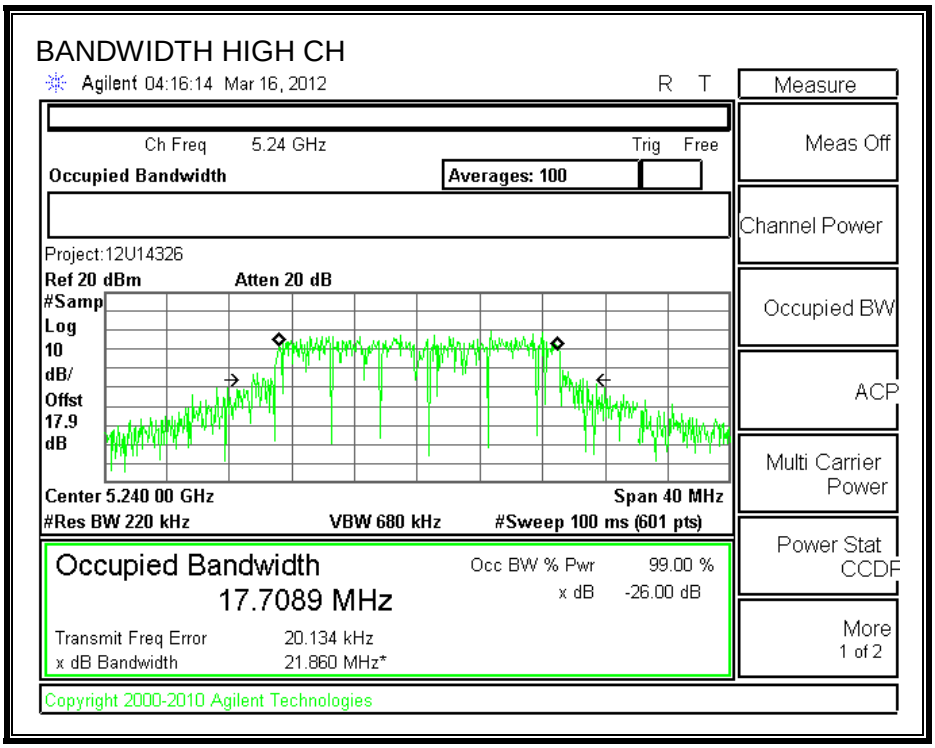
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5180	17.6823	17.6982
Mid	5200	17.6970	17.6879
High	5240	17.7089	17.6777

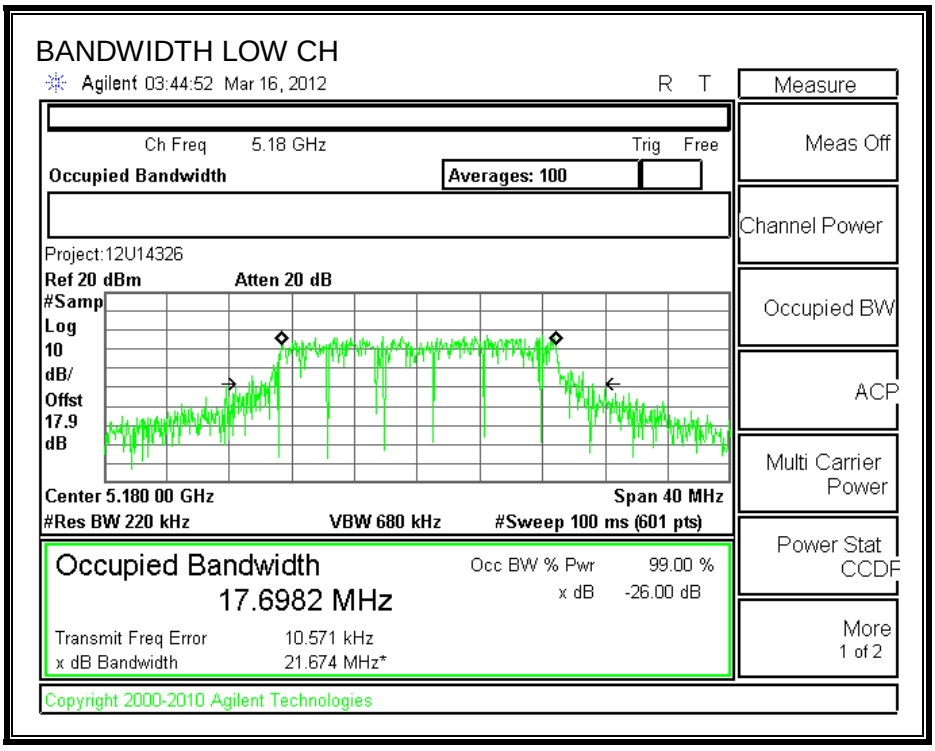
99% BANDWIDTH CHAIN 0

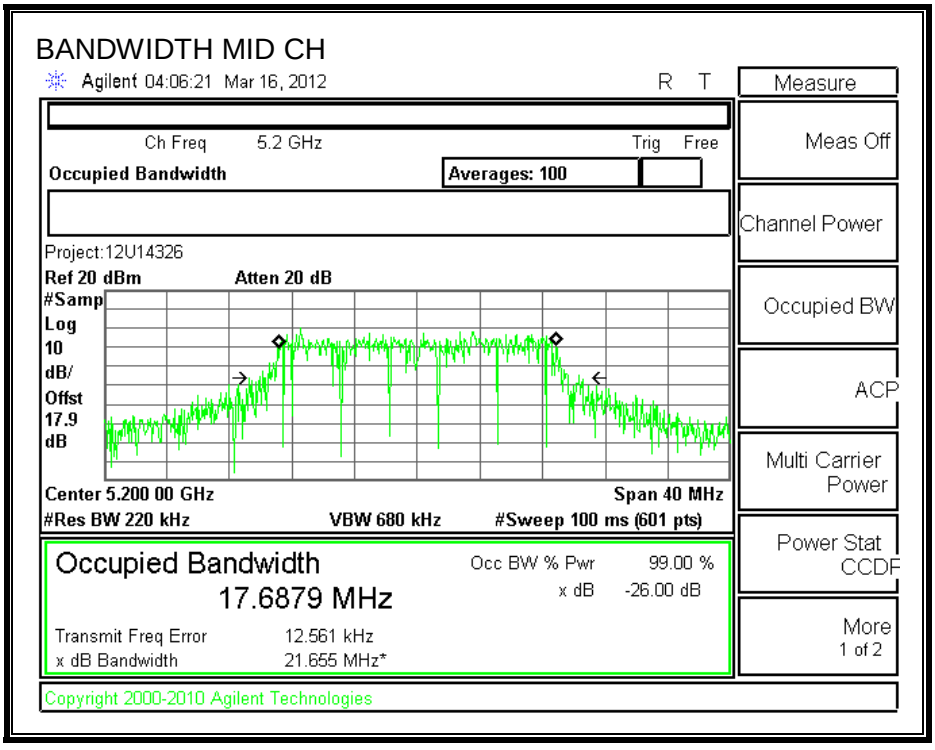


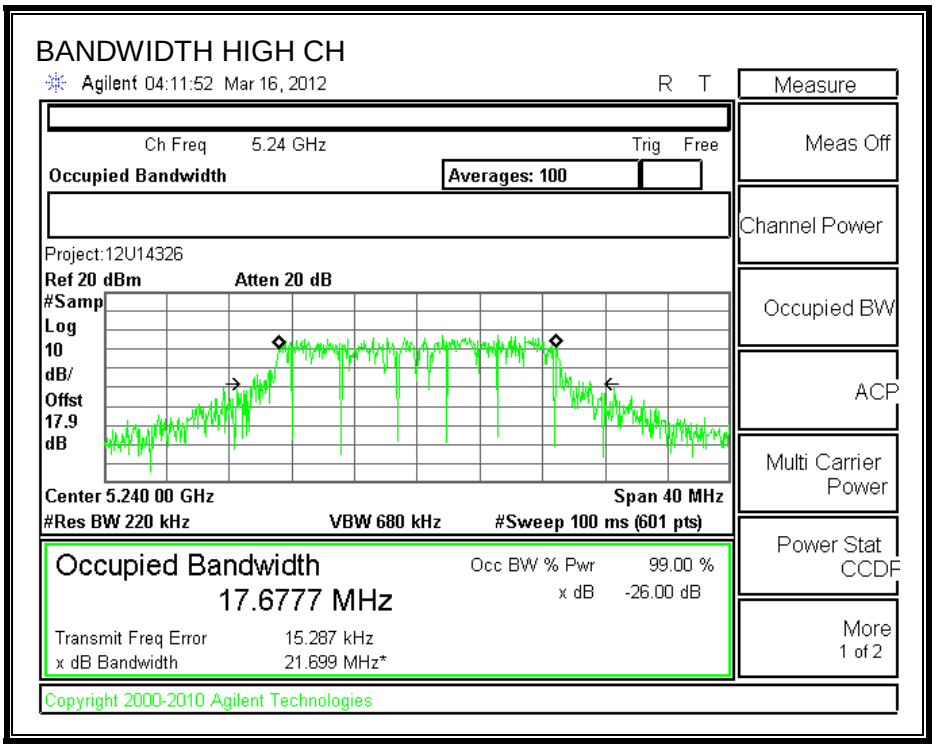




99% BANDWIDTH CHAIN 1







7.3.3. 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 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5180	11.40	11.50	14.46
Mid	5200	11.40	11.40	14.41
High	5240	11.10	11.50	14.31

7.3.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
0.93	1.88	1.43

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	17	25.20	18.01	1.43	17.00	4.00
Mid	5200	17	25.13	18.00	1.43	17.00	4.00
High	5240	17	25.00	17.98	1.43	17.00	4.00

Output Power Results

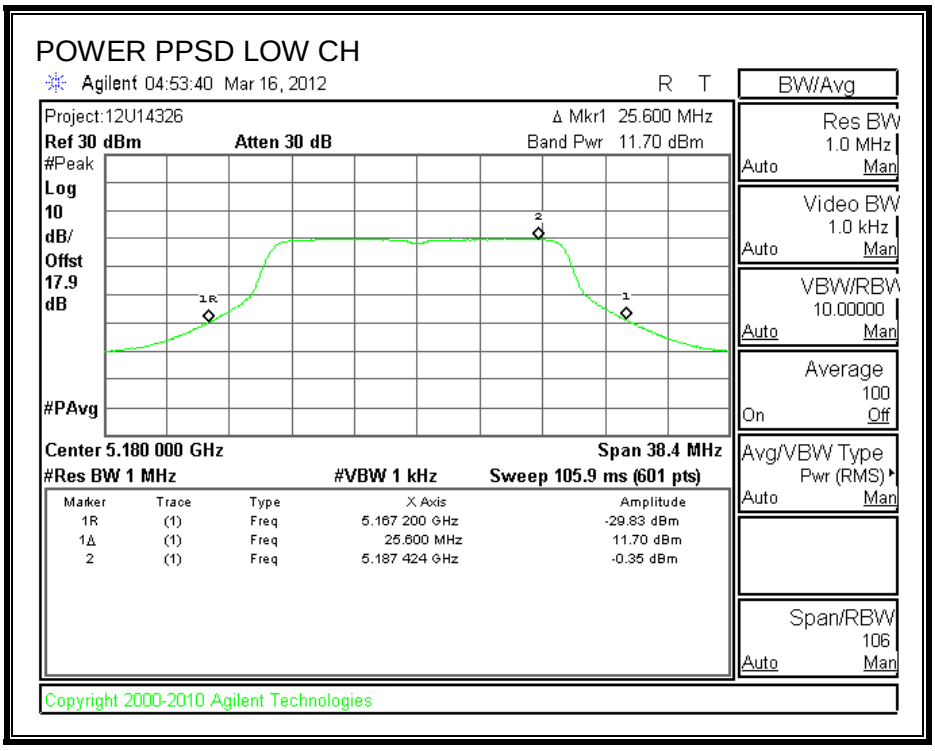
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	11.70	11.36	14.55	17.00	-2.45
Mid	5200	11.52	11.06	14.31	17.00	-2.69
High	5240	11.31	10.77	14.06	17.00	-2.94

PPSD Results

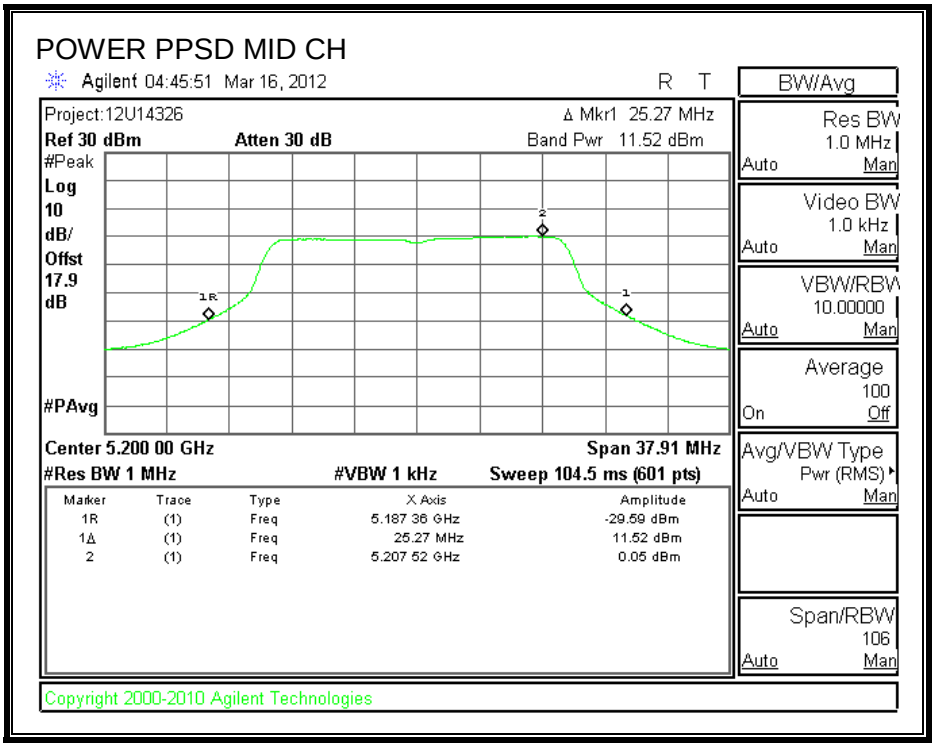
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5180	-0.35	-0.47	2.60	4.00	-1.40
Mid	5200	0.05	-0.76	2.67	4.00	-1.33
High	5240	-0.12	-1.08	2.44	4.00	-1.56

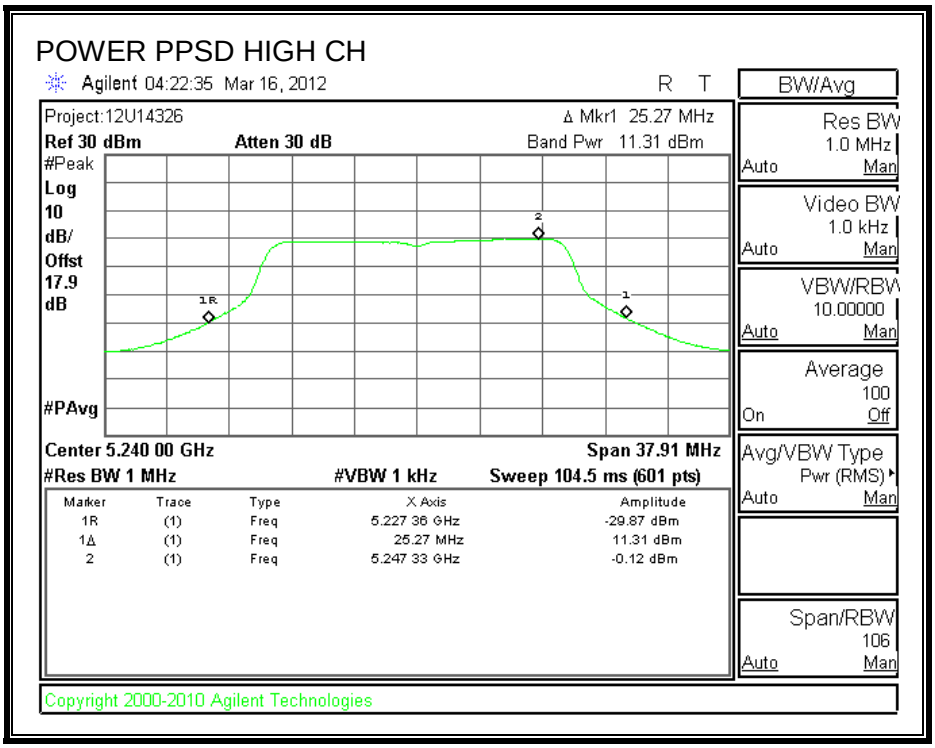
OUTPUT POWER AND PPSD CHAIN 0

POWER PPSD LOW CH

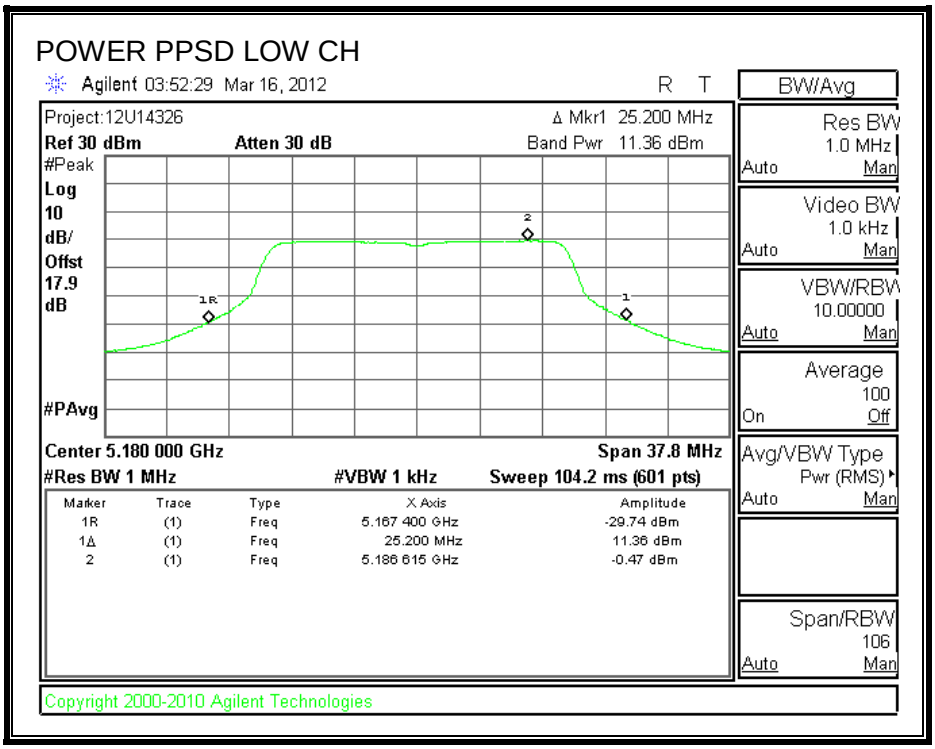


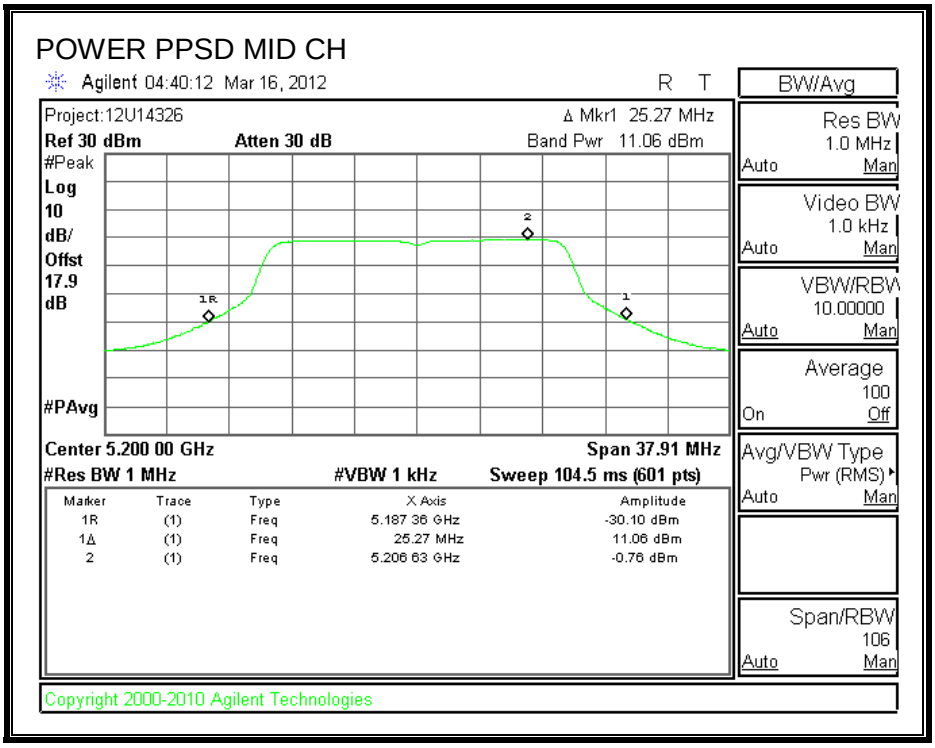
POWER PPSD MID CH

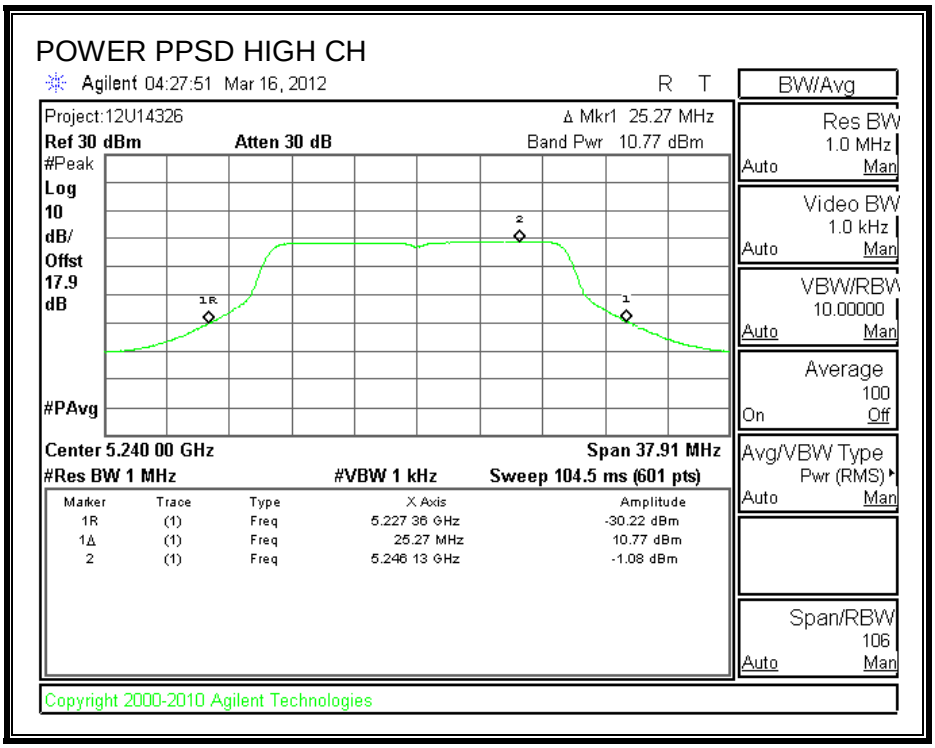




OUTPUT POWER AND PPSD CHAIN 1







7.3.5. PEAK EXCURSION

LIMITS

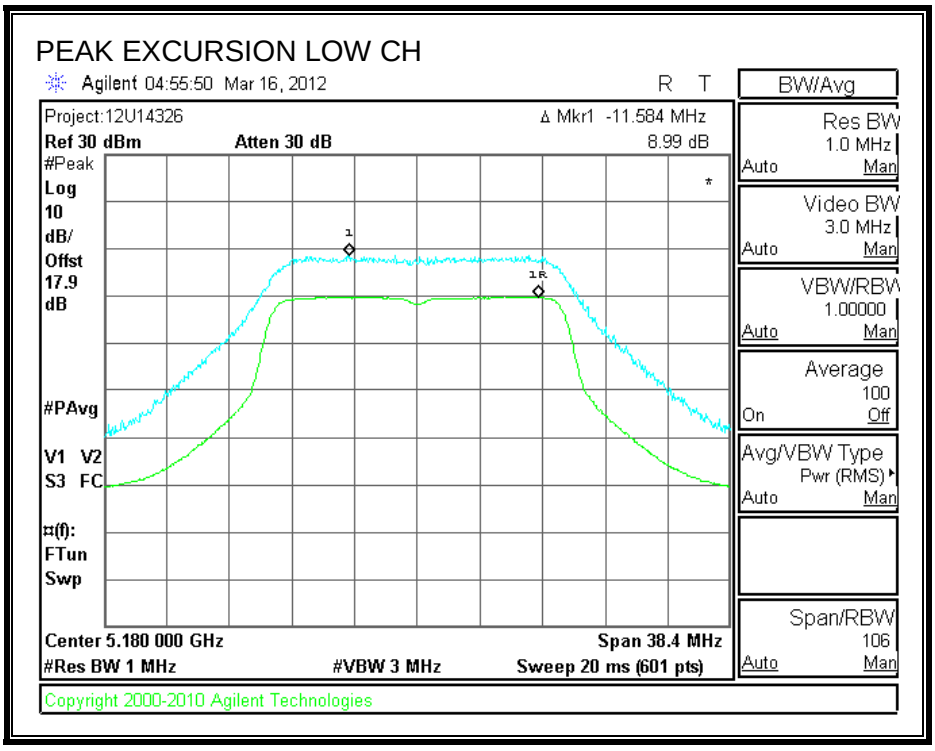
FCC §15.407 (a) (6)

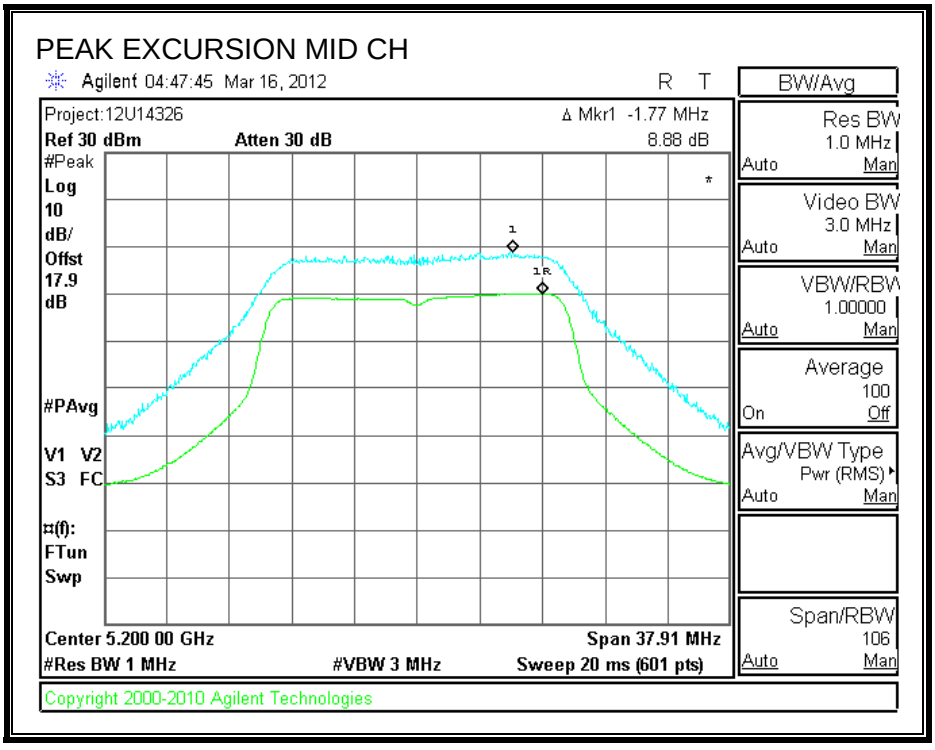
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

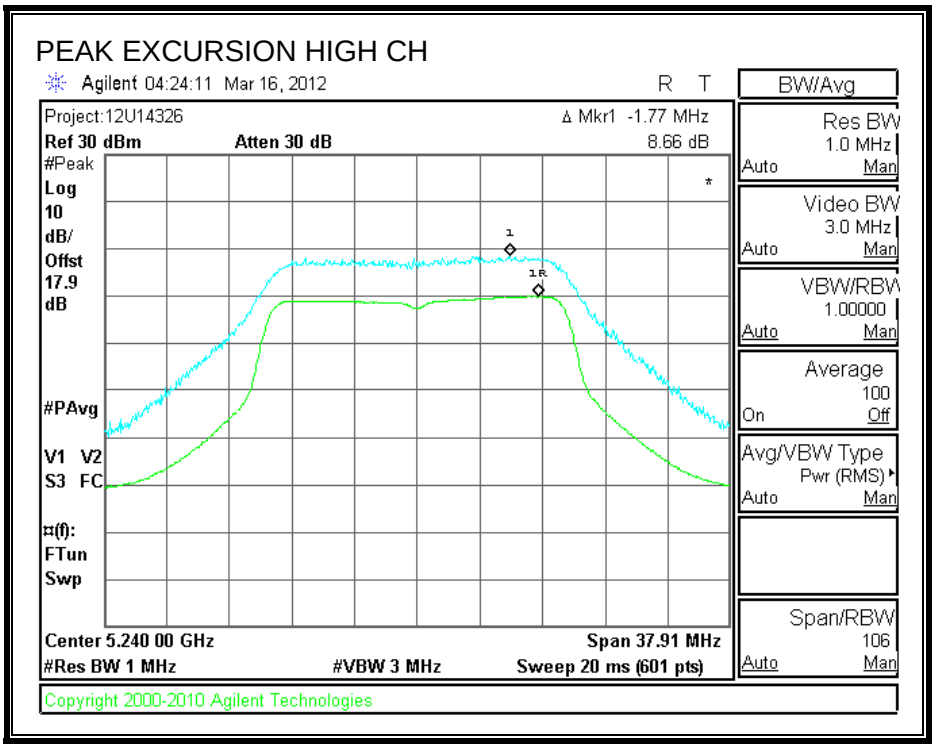
Channel	Frequency (MHz)	Pk Exc Chain 0 (dB)	Pk Exc Chain 1 (dB)	Limit (dB)	Worst-Case Margin (dB)
Low	5180	8.99	9.46	13	-3.5
Mid	5200	8.88	9.39	13	-3.6
High	5240	8.66	9.61	13	-3.4

PEAK EXCURSION CHAIN 0



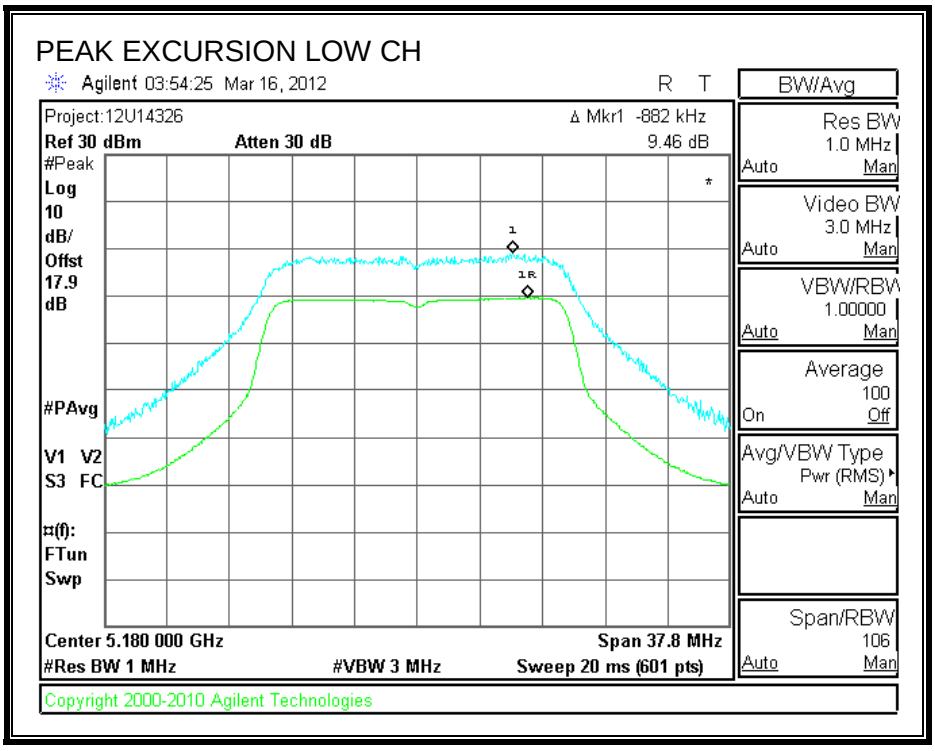


PEAK EXCURSION HIGH CH

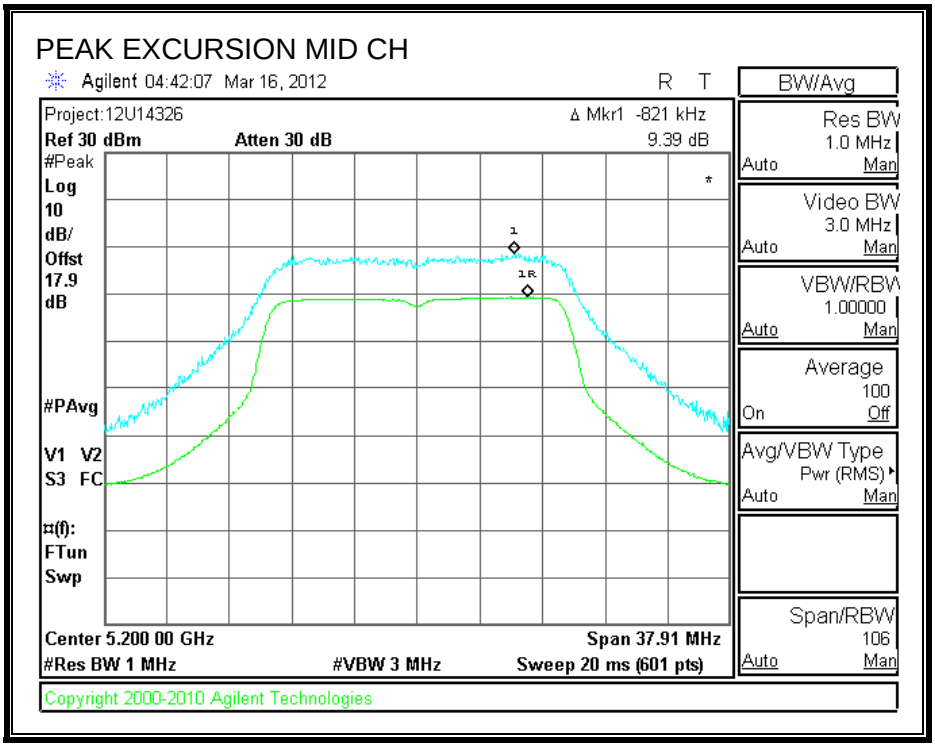


PEAK EXCURSION CHAIN 1

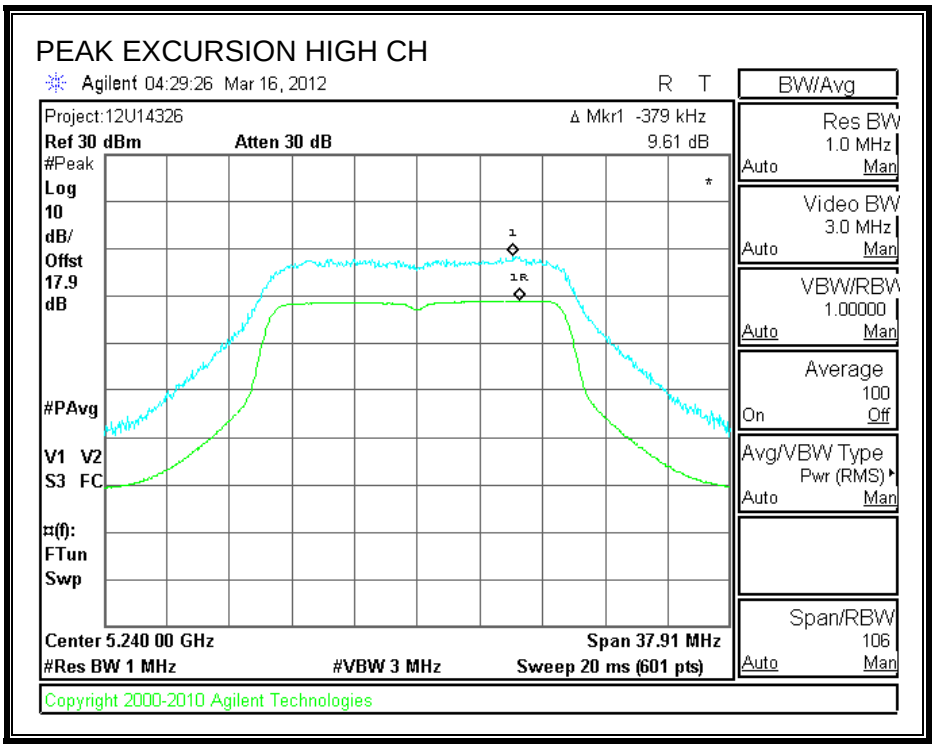
PEAK EXCURSION LOW CH



PEAK EXCURSION MID CH



PEAK EXCURSION HIGH CH



7.4. 802.11n HT40 MODE IN THE 5.2 GHz BAND

7.4.1. 26 dB BANDWIDTH

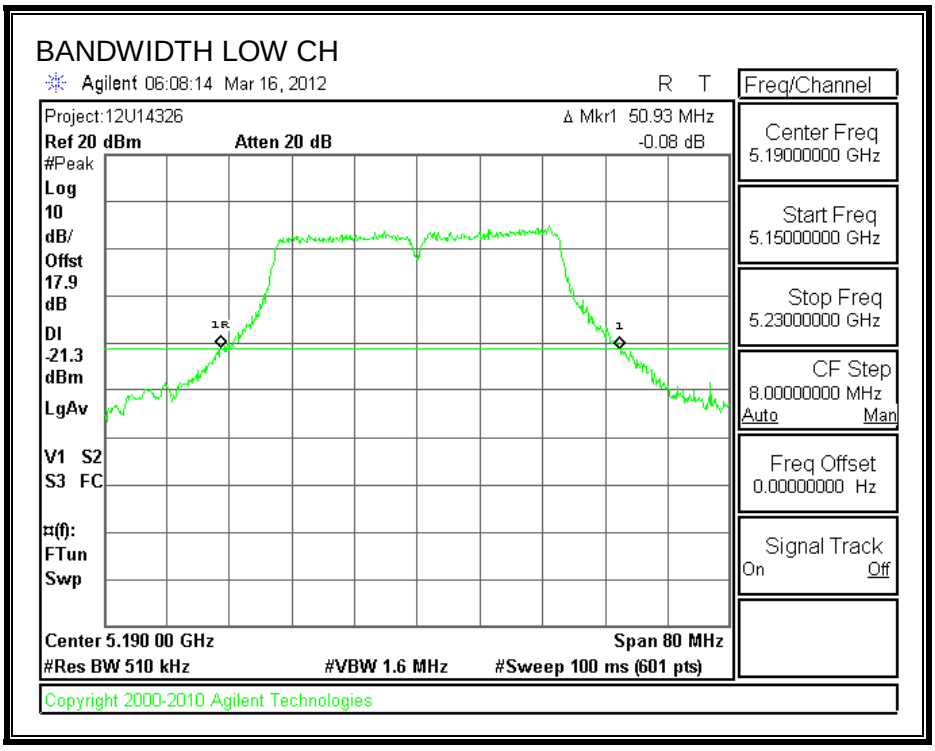
LIMITS

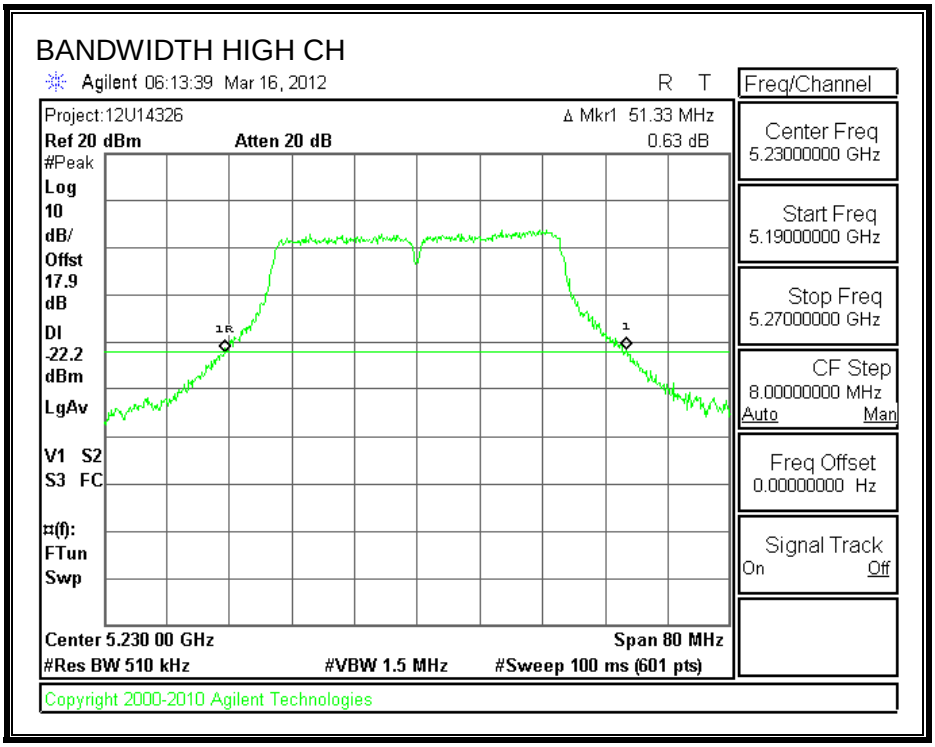
None; for reporting purposes only.

RESULTS

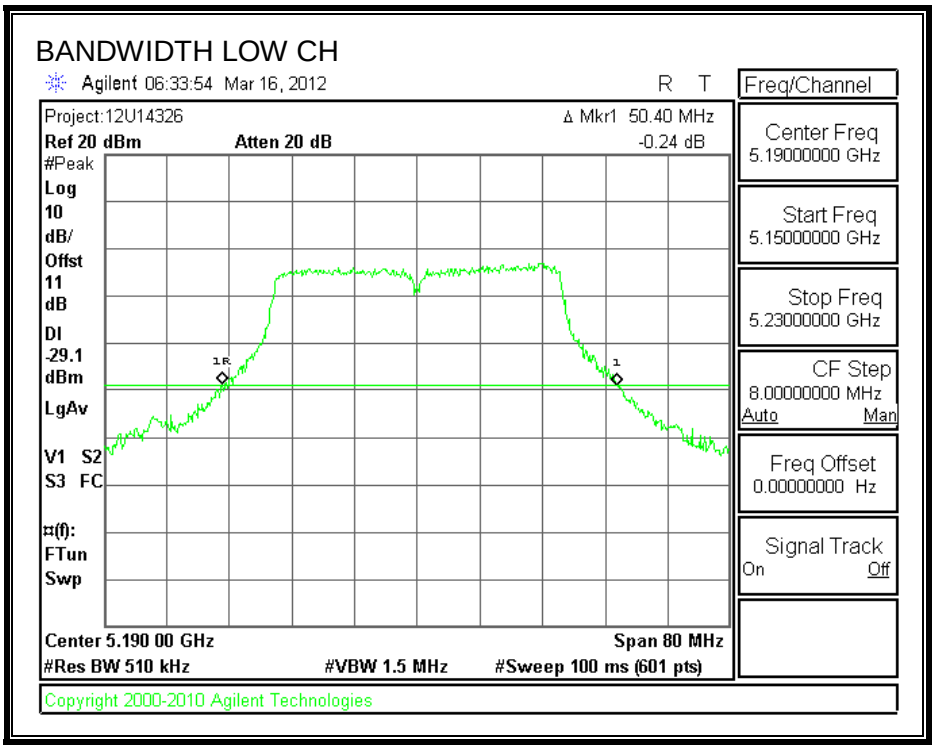
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5190	50.93	50.40
High	5230	51.33	50.53

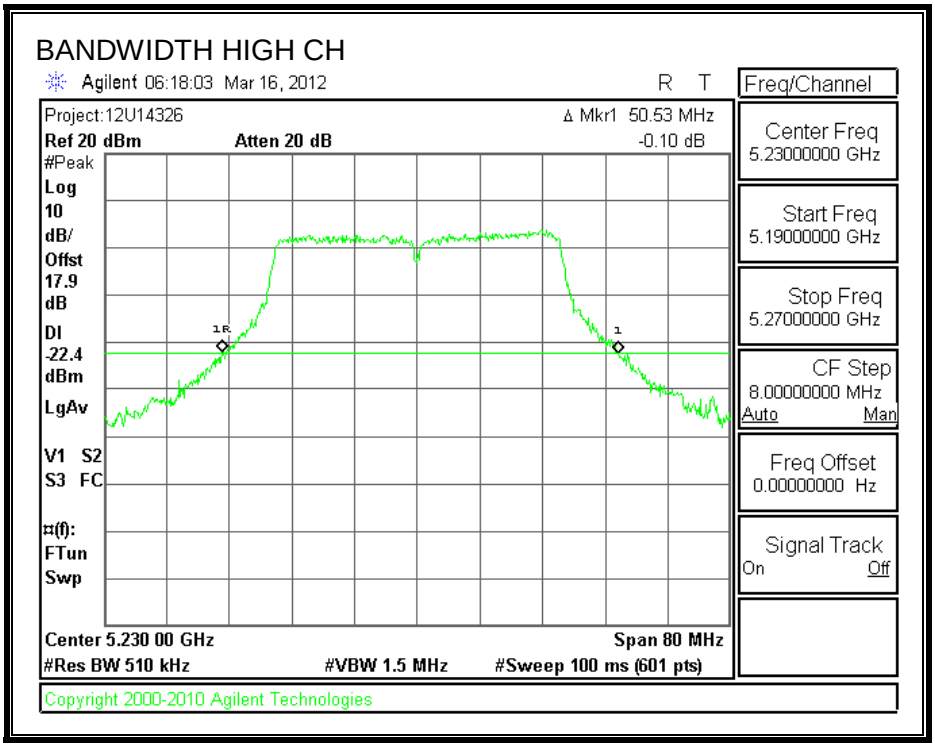
26 dB BANDWIDTH CHAIN 0





26 dB BANDWIDTH CHAIN 1





7.4.2. 99% BANDWIDTH

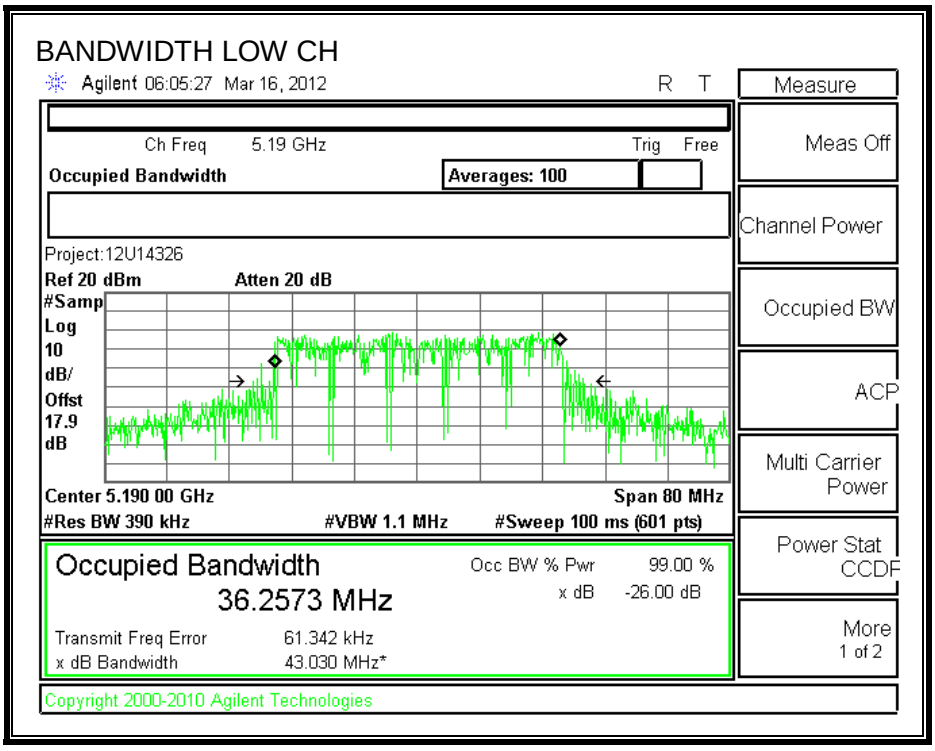
LIMITS

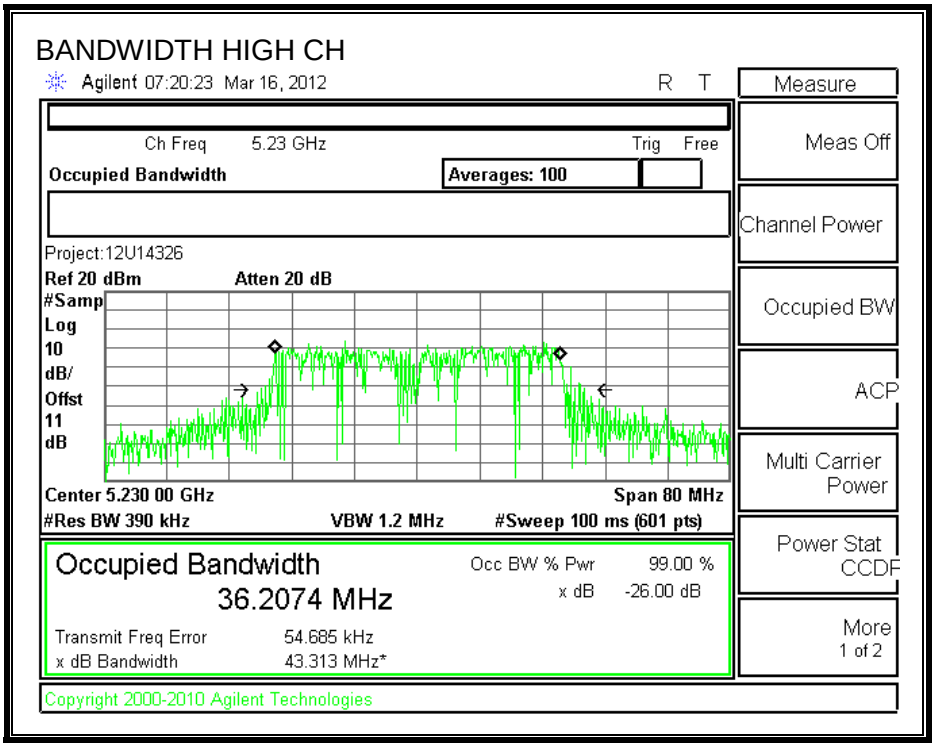
None; for reporting purposes only.

RESULTS

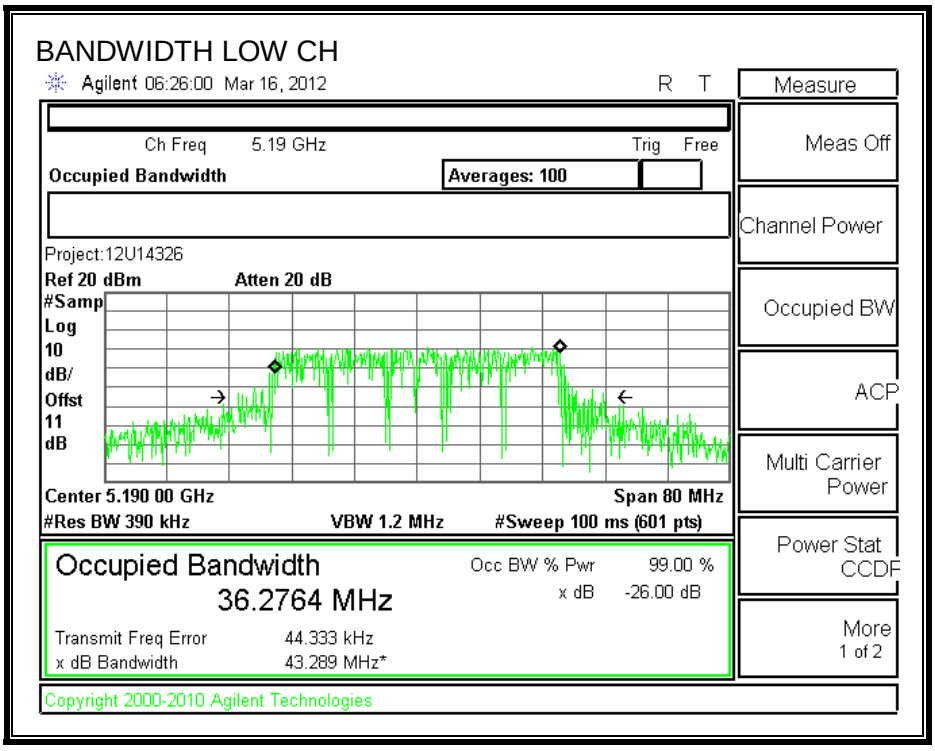
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5190	36.2573	36.2764
High	5230	36.2074	36.2519

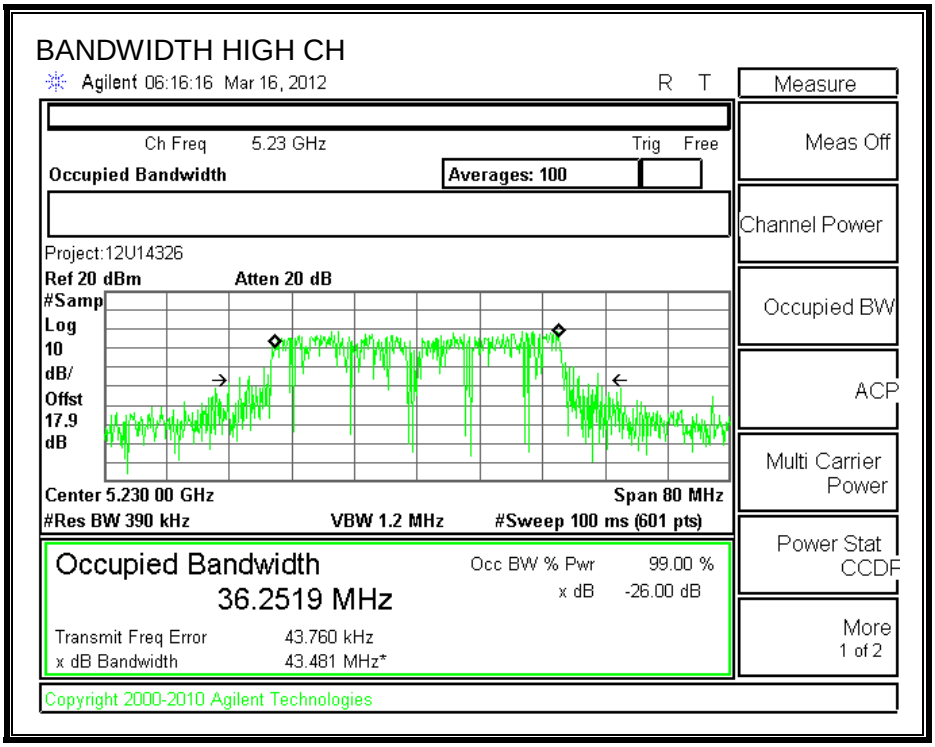
99% BANDWIDTH CHAIN 0





99% BANDWIDTH CHAIN 1





7.4.3. 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 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5190	13.60	13.50	16.56
High	5230	13.10	12.90	16.01

7.4.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
0.93	1.88	1.43

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5190	17	50.40	21.02	1.43	17.00	4.00
High	5230	17	50.53	21.04	1.43	17.00	4.00

Output Power Results

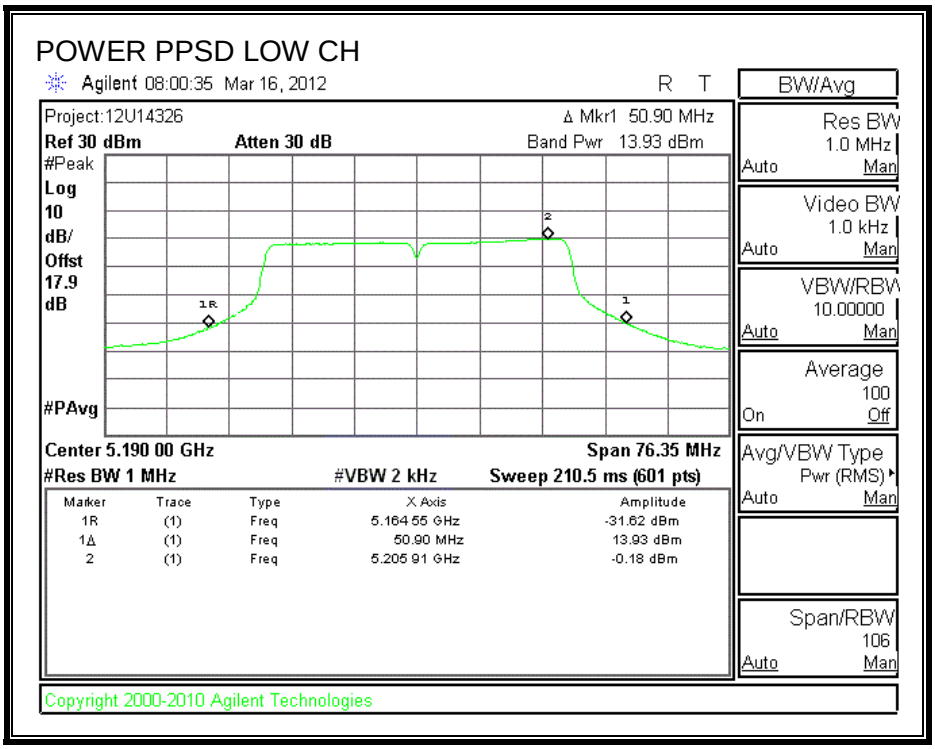
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	13.93	13.05	16.52	17.00	-0.48
High	5230	12.96	12.43	15.72	17.00	-1.28

PPSD Results

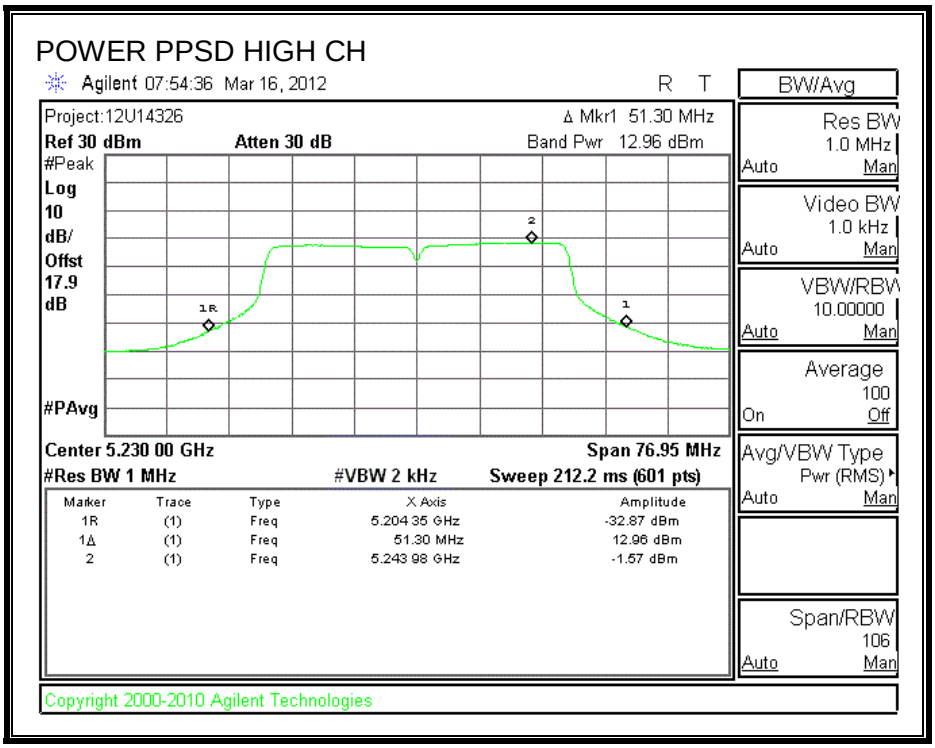
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5190	-0.18	-1.40	2.26	4.00	-1.74
High	5230	-1.57	-2.07	1.20	4.00	-2.80

OUTPUT POWER AND PPSD CHAIN 0

POWER PPSD LOW CH

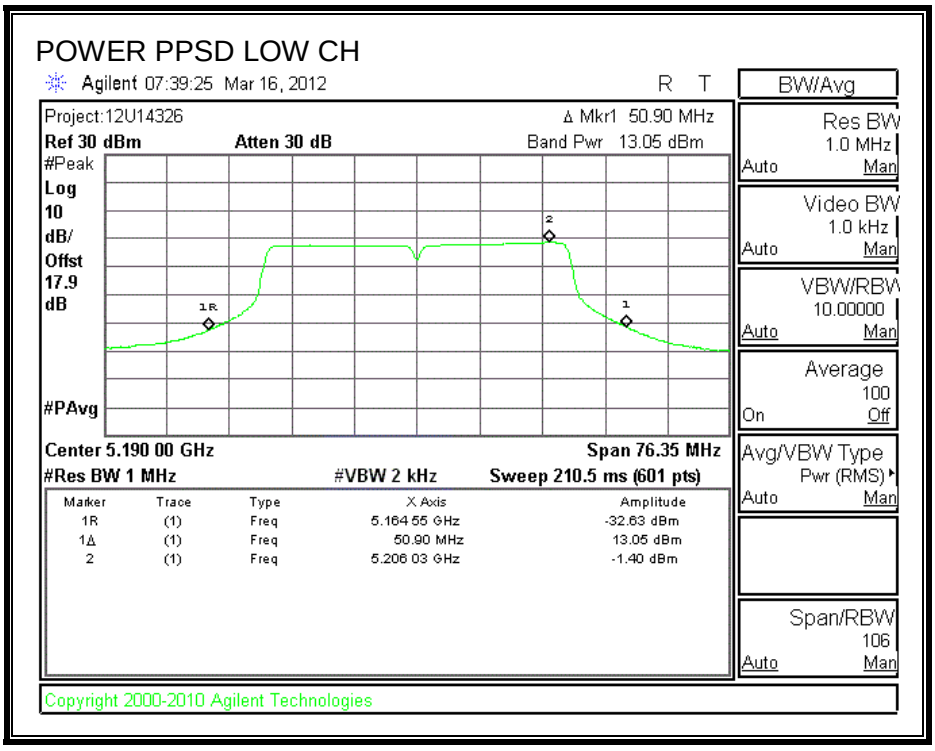


POWER PPSD HIGH CH

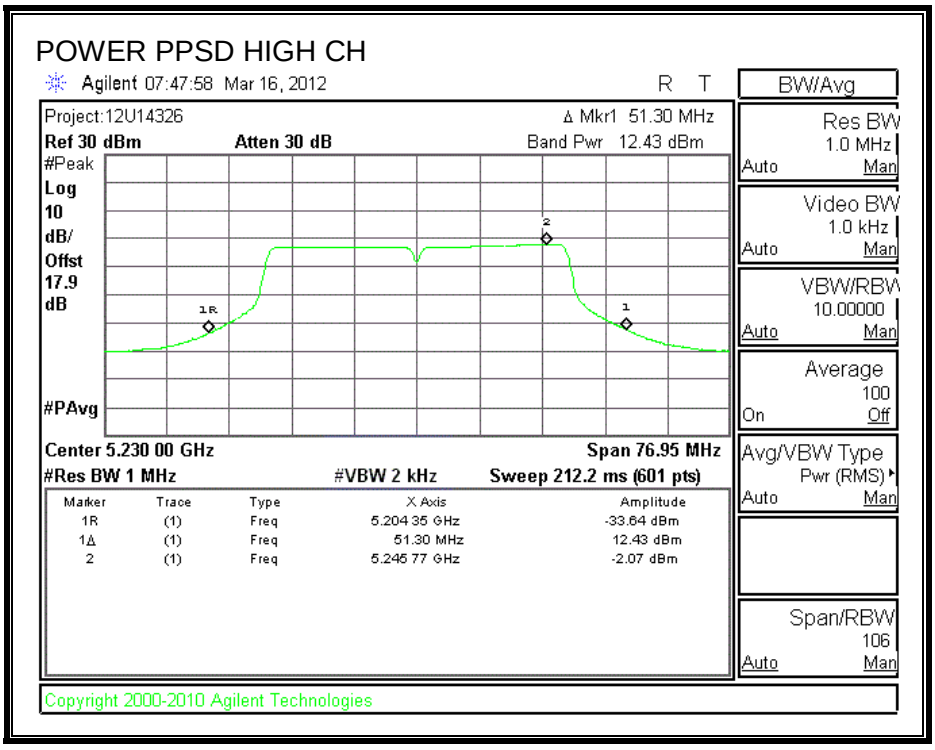


OUTPUT POWER AND PPSD CHAIN 1

POWER PPSD LOW CH



POWER PPSD HIGH CH



7.4.5. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

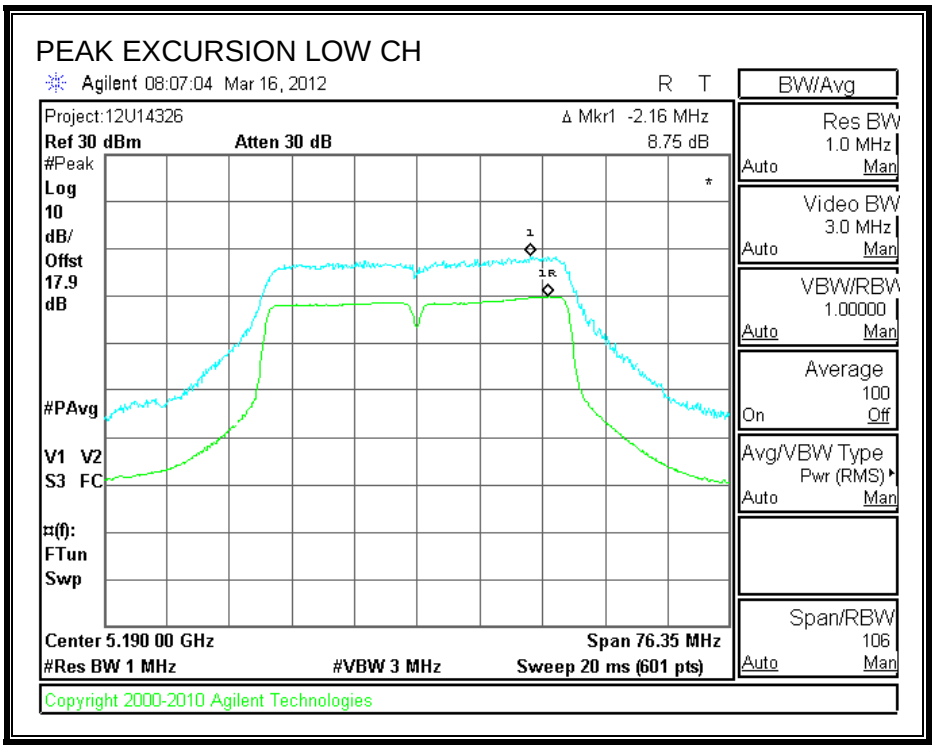
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

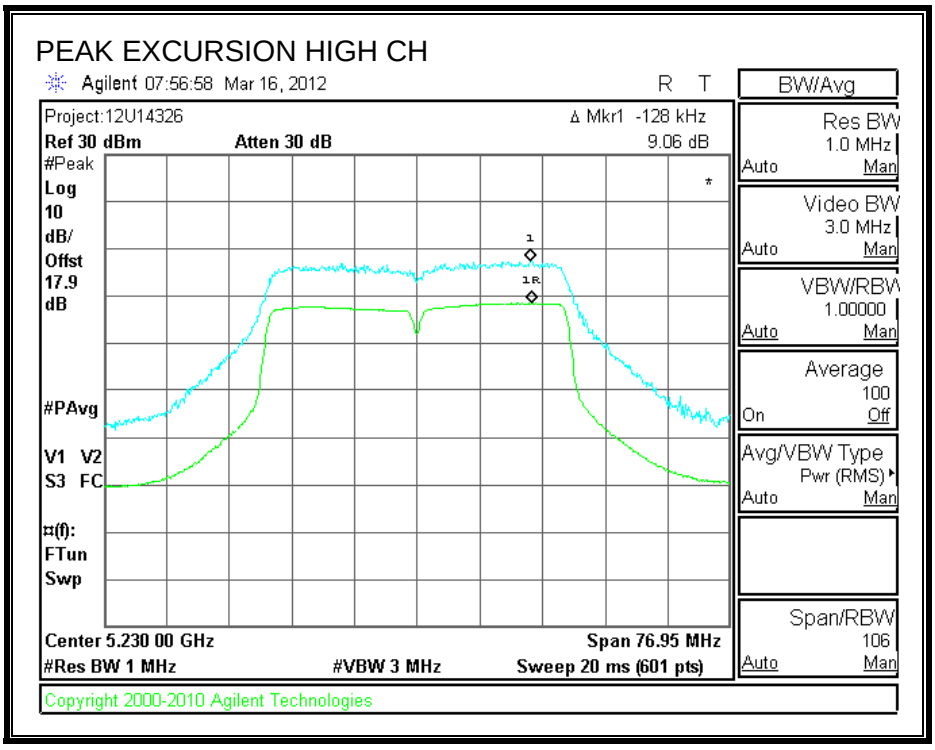
Channel	Frequency (MHz)	Pk Exc Chain 0 (dB)	Pk Exc Chain 1 (dB)	Limit (dB)	Worst-Case Margin (dB)
Low	5190	8.75	9.79	13	-3.2
High	5230	9.06	9.76	13	-3.2

PEAK EXCURSION CHAIN 0

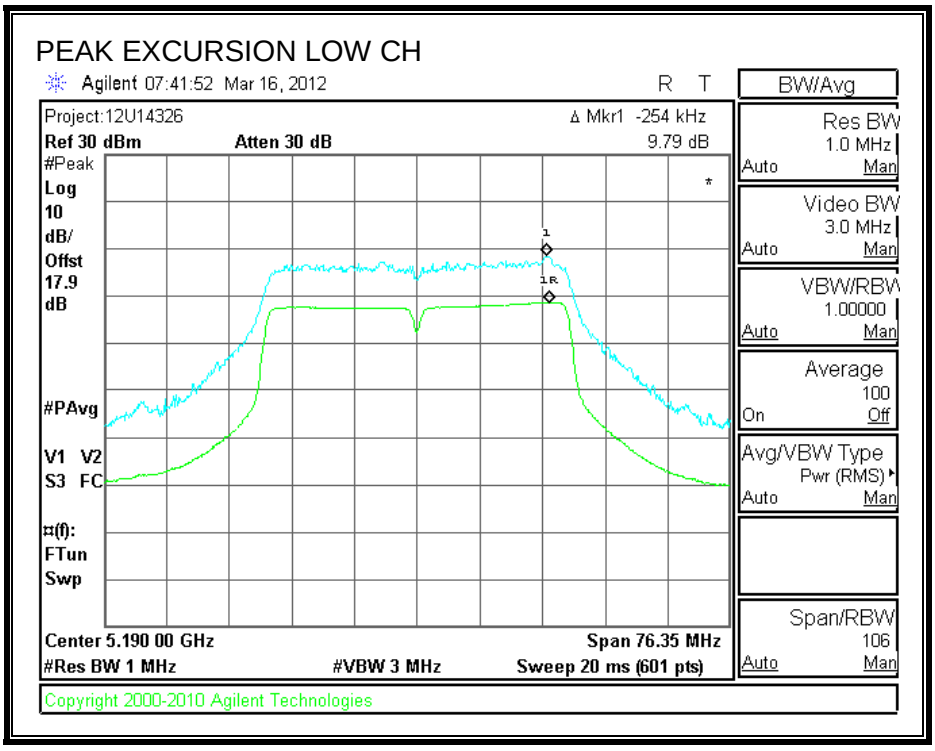
PEAK EXCURSION LOW CH

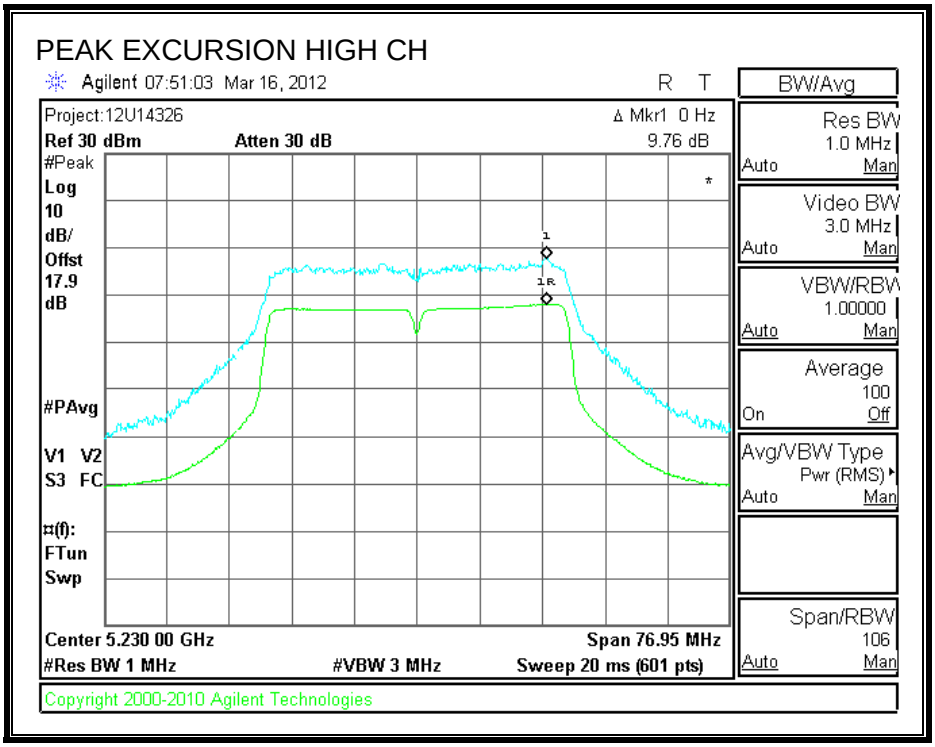


PEAK EXCURSION HIGH CH



PEAK EXCURSION CHAIN 1





7.5. 802.11a MODE IN THE 5.3 GHz BAND

7.5.1. 26 dB BANDWIDTH

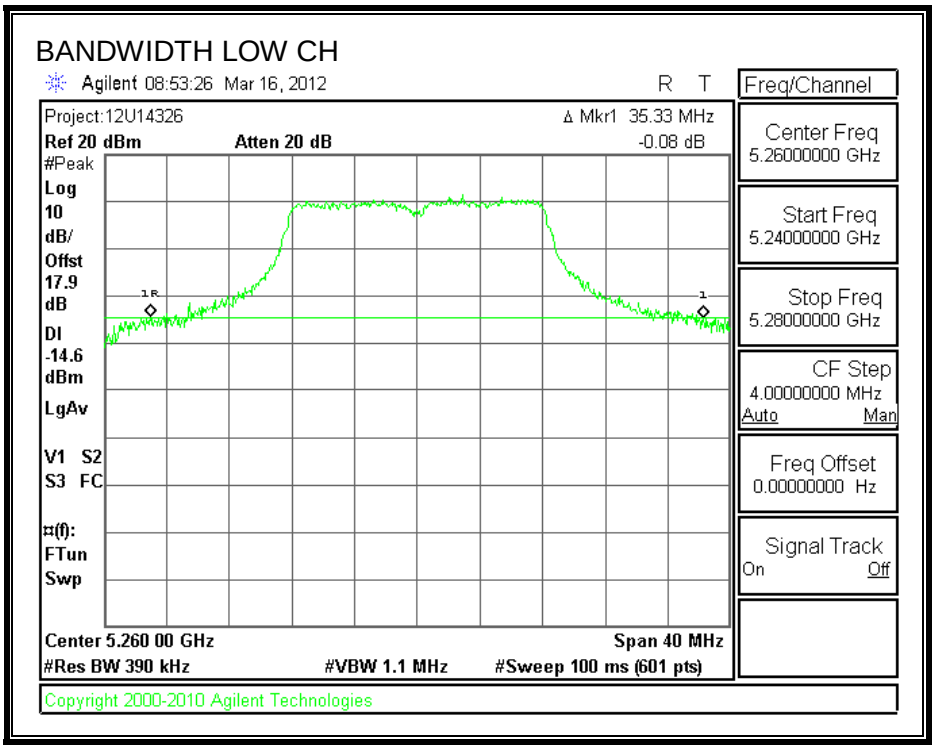
LIMITS

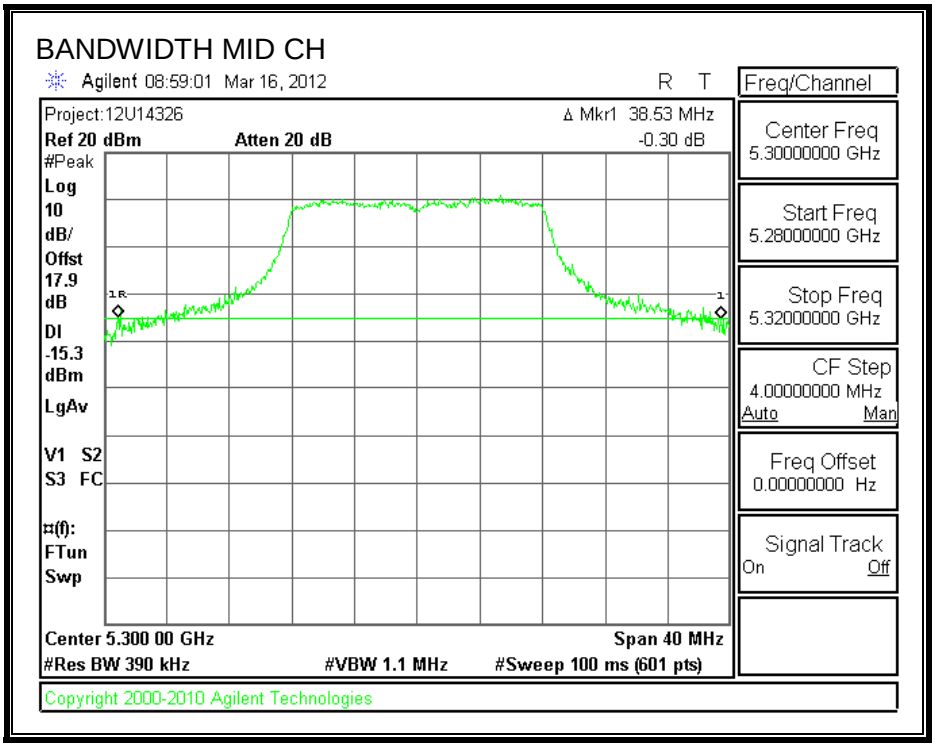
None; for reporting purposes only.

RESULTS

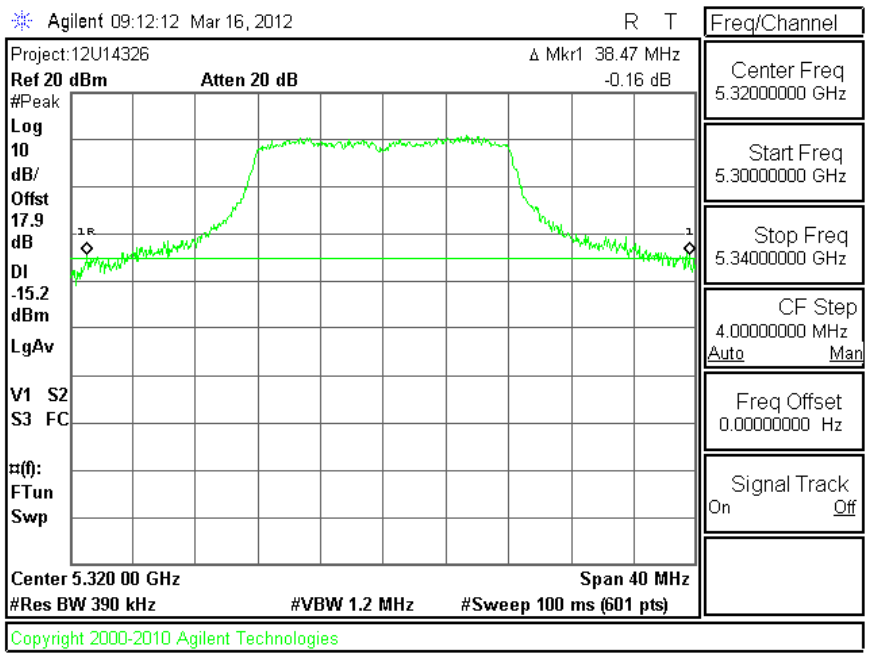
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5260	35.33	30.42
Mid	5300	38.53	32.08
High	5320	38.47	38.83

26 dB BANDWIDTH CHAIN 0

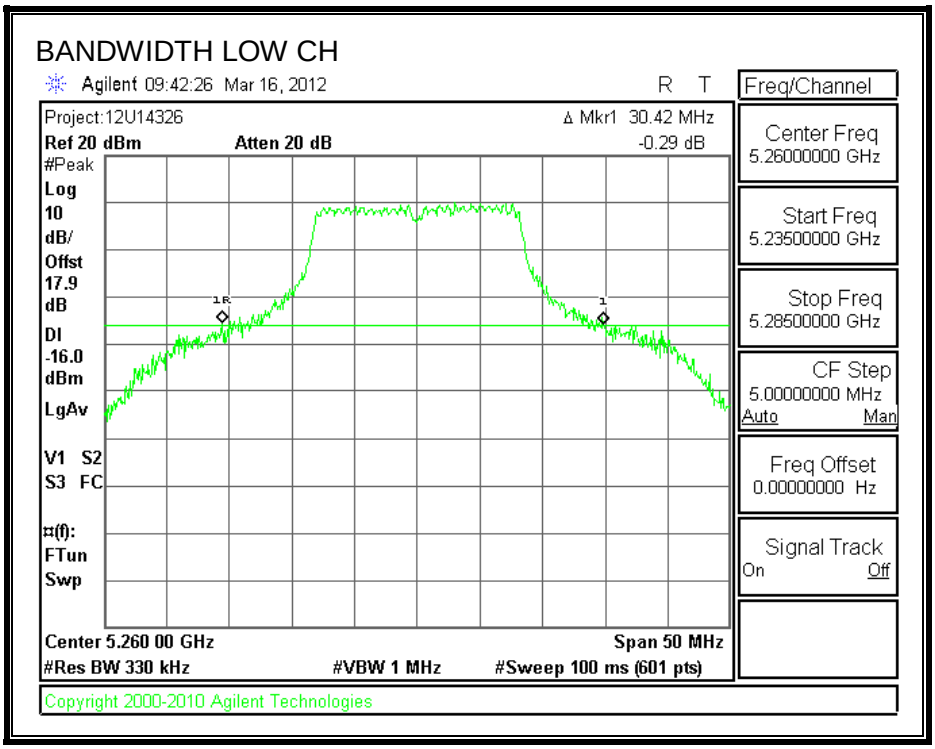


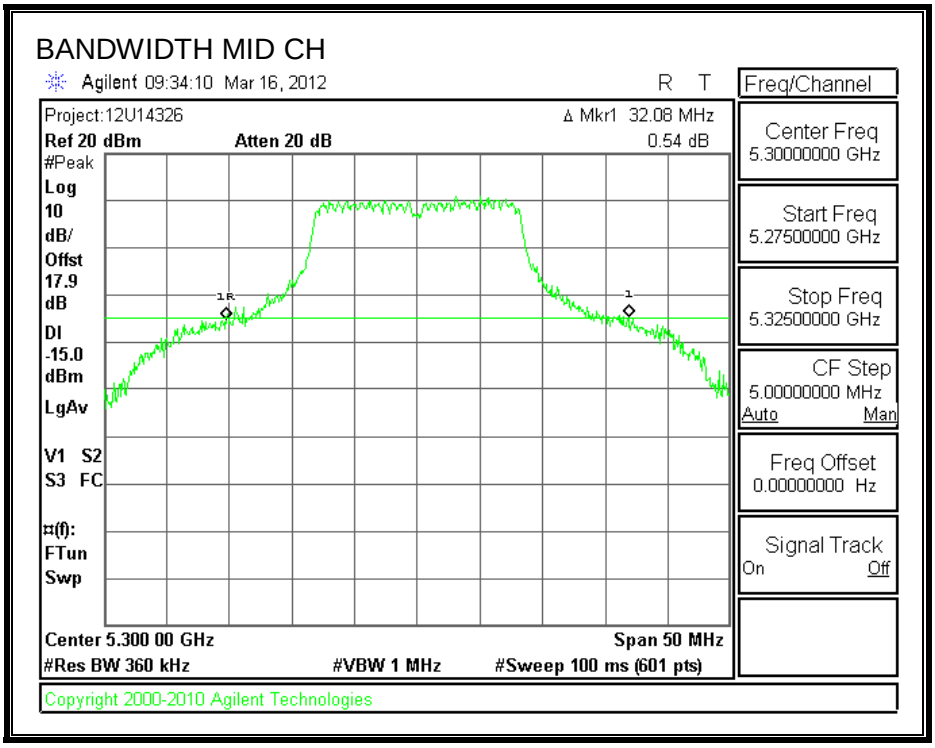


BANDWIDTH HIGH CH

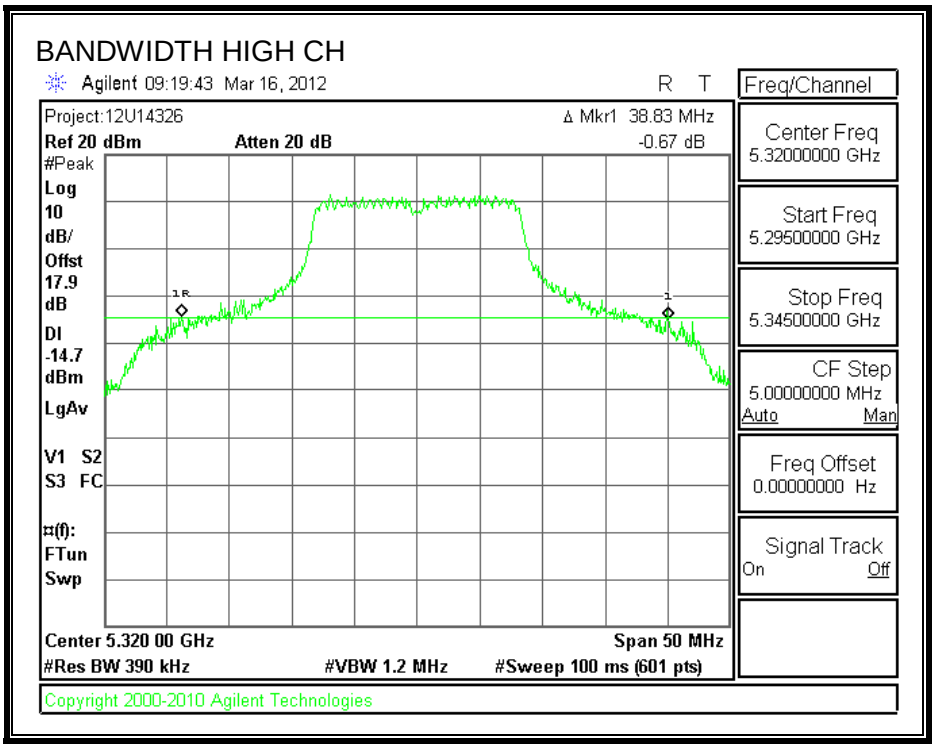


26 dB BANDWIDTH CHAIN 1





BANDWIDTH HIGH CH



7.5.2. 99% BANDWIDTH

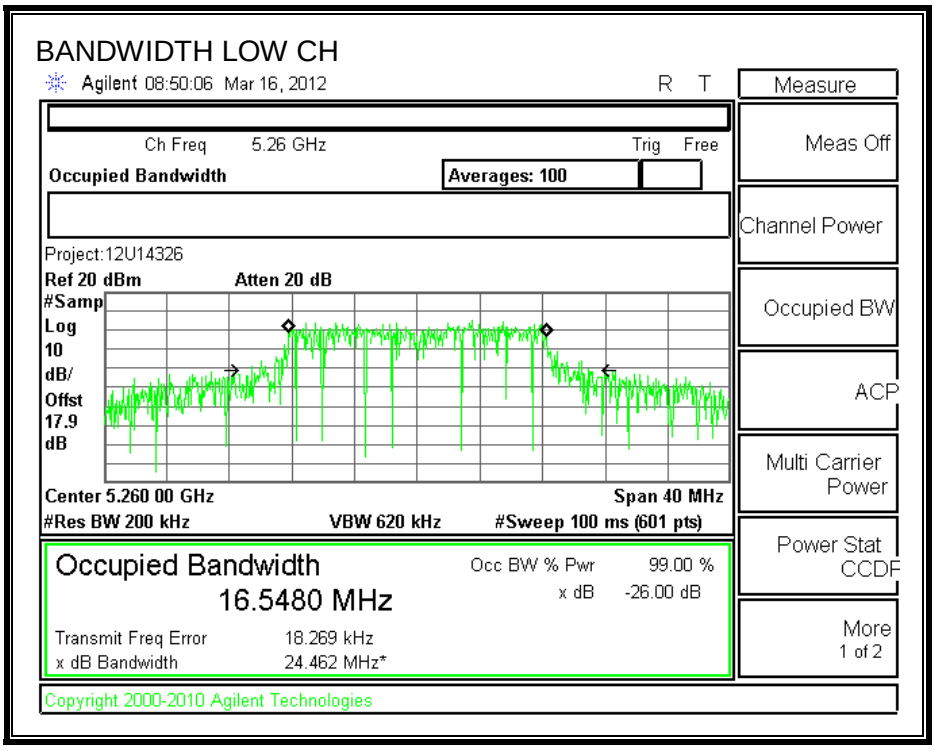
LIMITS

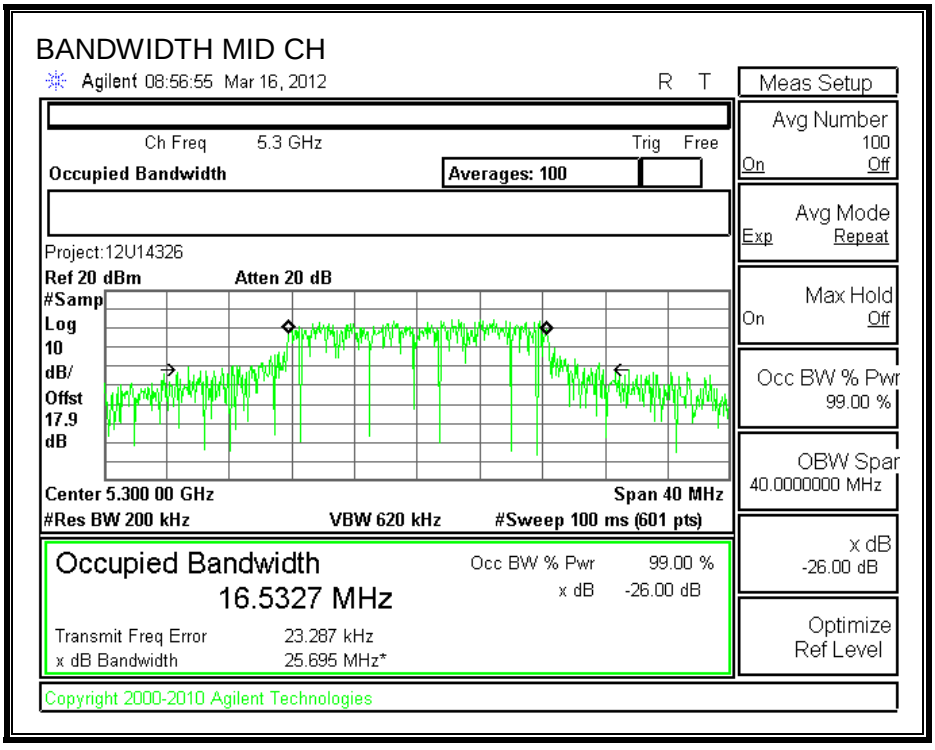
None; for reporting purposes only.

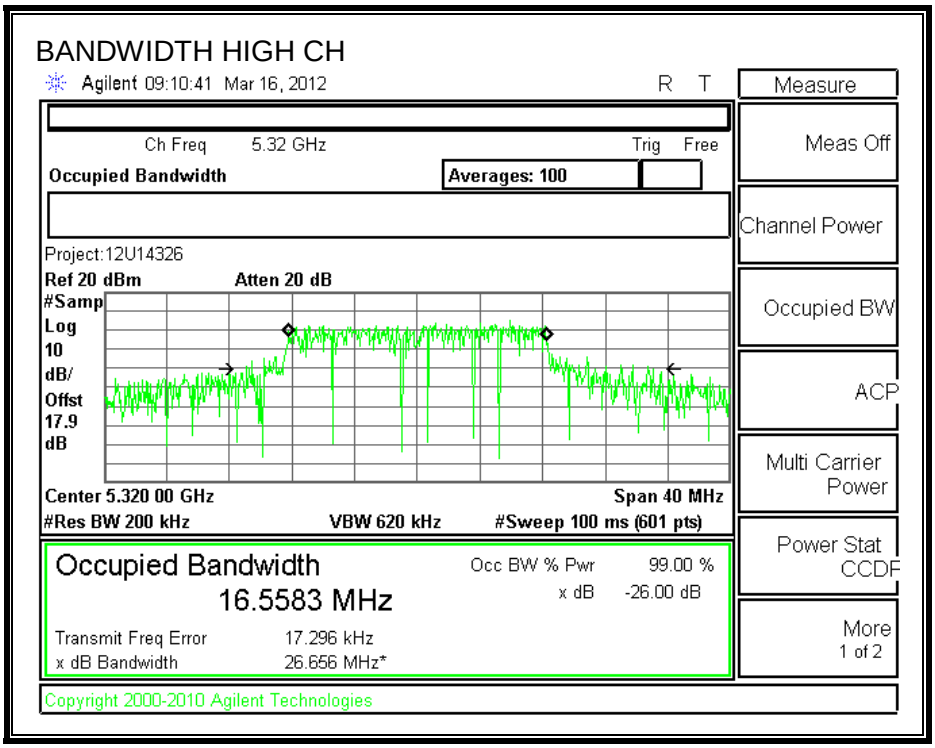
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5260	16.5480	16.4972
Mid	5300	16.5327	16.5361
High	5320	16.5583	16.5623

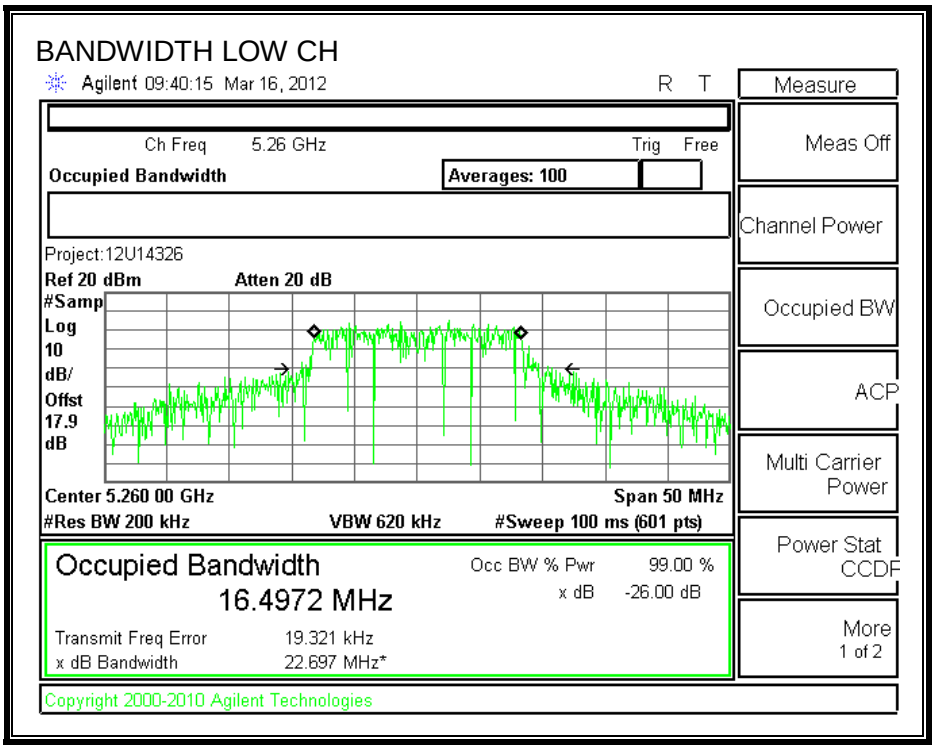
99% BANDWIDTH CHAIN 0

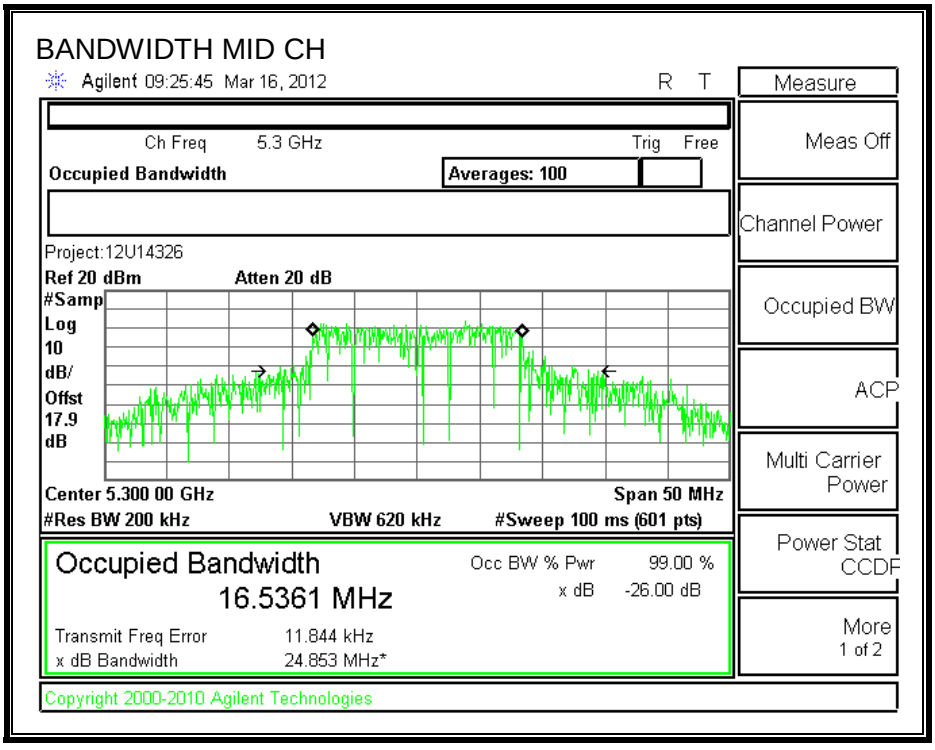


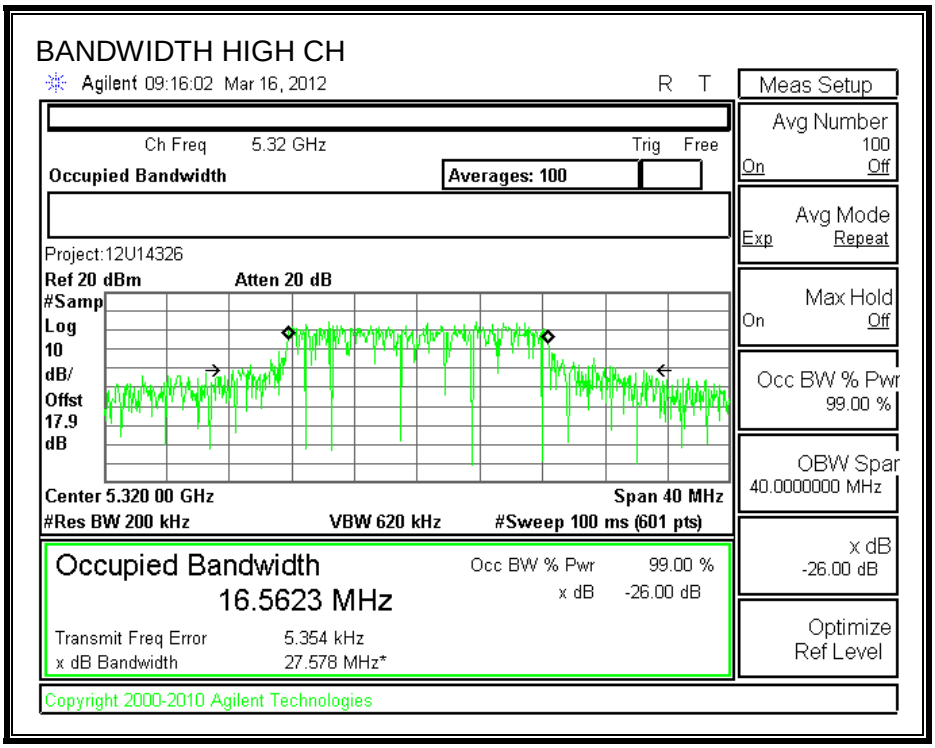




99% BANDWIDTH CHAIN 1







7.5.3. 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 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5260	17.60	18.05	20.84
Mid	5300	18.10	17.60	20.87
High	5320	17.60	18.00	20.81

7.5.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
1.54	2.07	4.82

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5260	24	30.42	25.83	4.82	24.00	11.00
Mid	5300	24	32.08	26.06	4.82	24.00	11.00
High	5320	24	38.47	26.85	4.82	24.00	11.00

Output Power Results

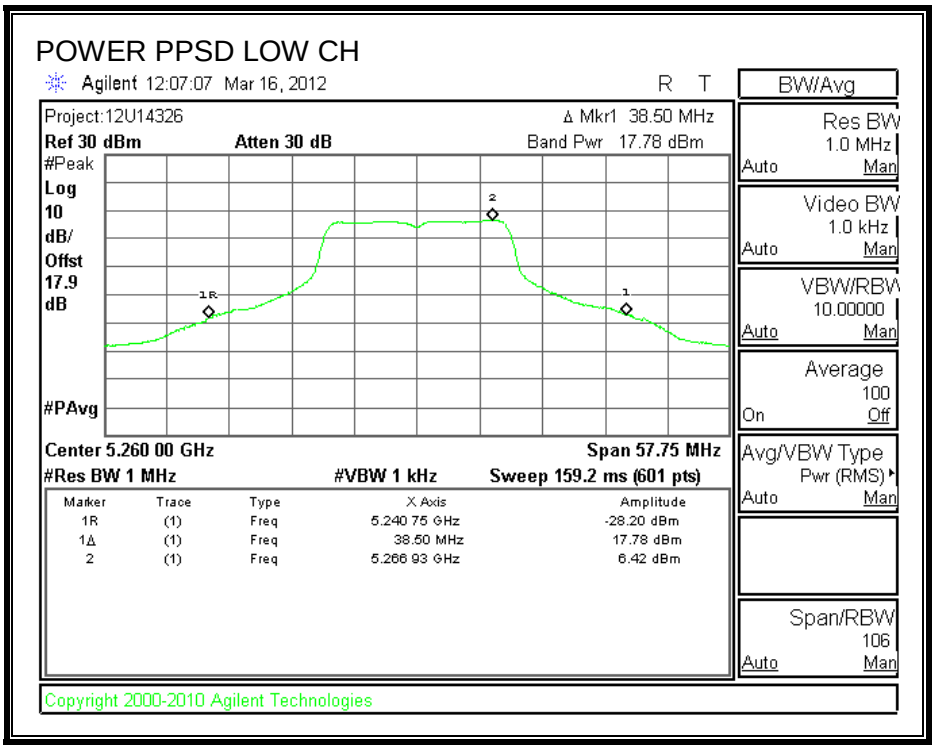
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	17.78	18.14	20.97	24.00	-3.03
Mid	5300	18.33	17.90	21.13	24.00	-2.87
High	5320	18.05	18.09	21.08	24.00	-2.92

PPSD Results

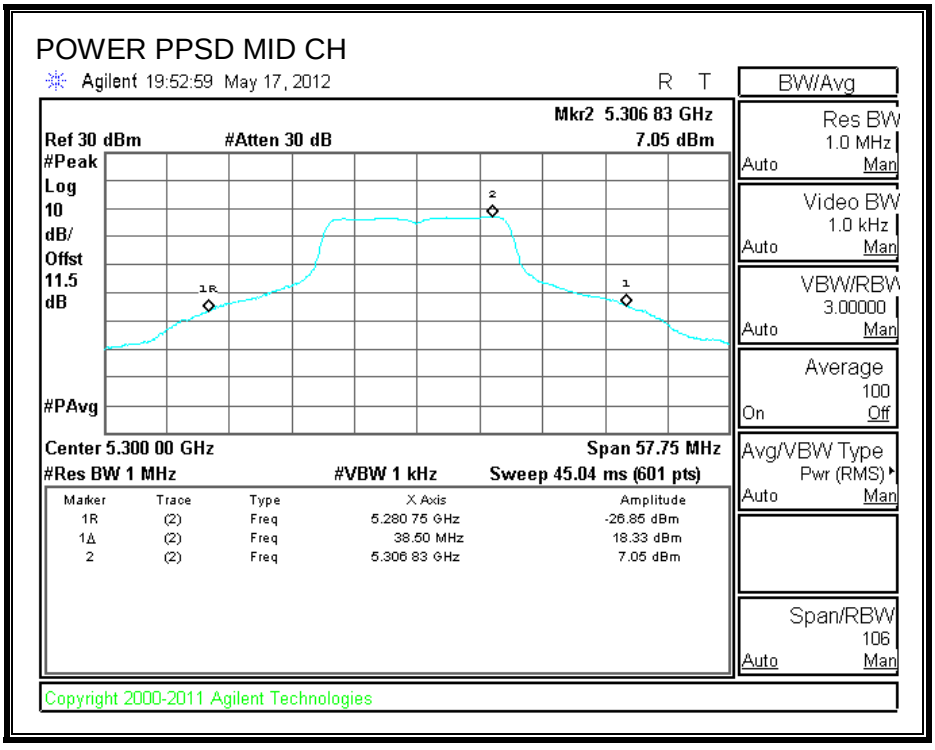
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5260	6.42	6.60	9.52	11.00	-1.48
Mid	5300	7.05	6.46	9.78	11.00	-1.22
High	5320	6.76	6.67	9.73	11.00	-1.27

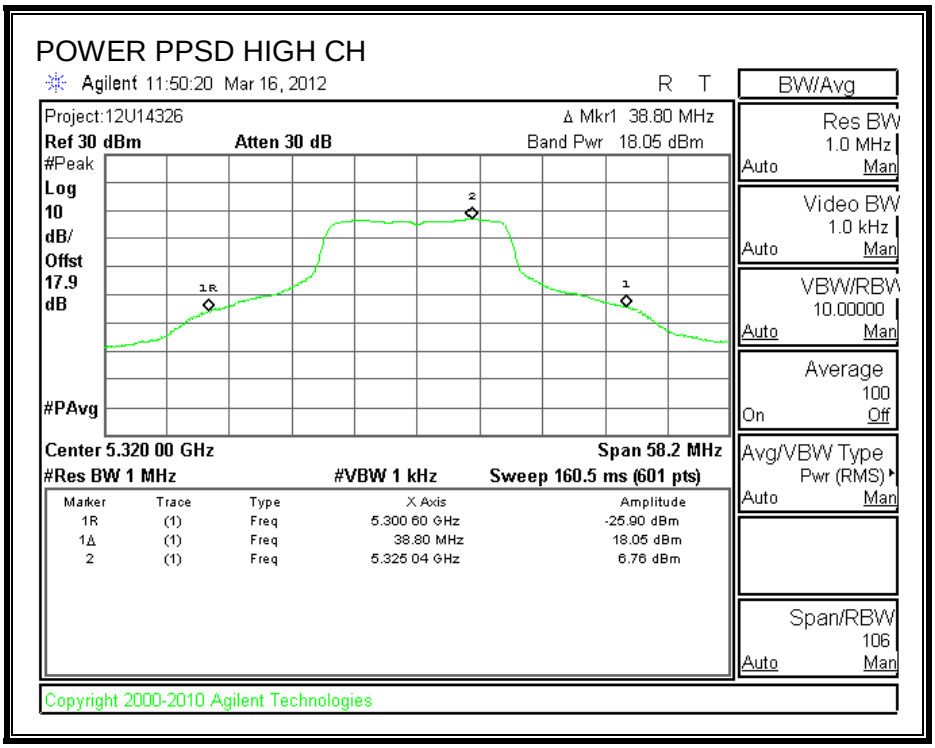
OUTPUT POWER AND PPSD CHAIN 0

POWER PPSD LOW CH

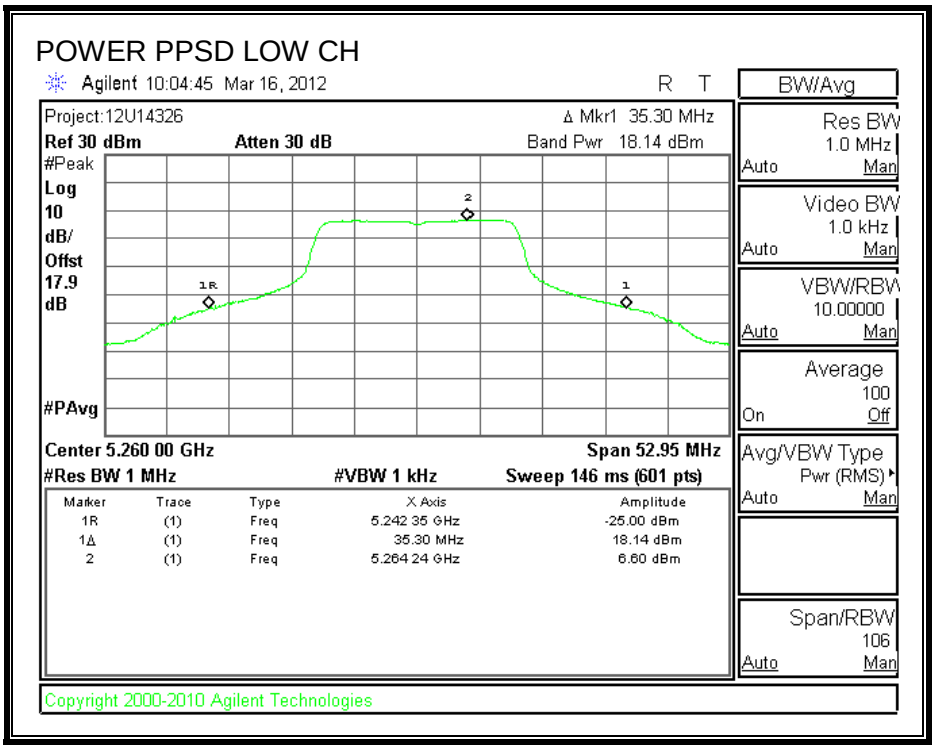


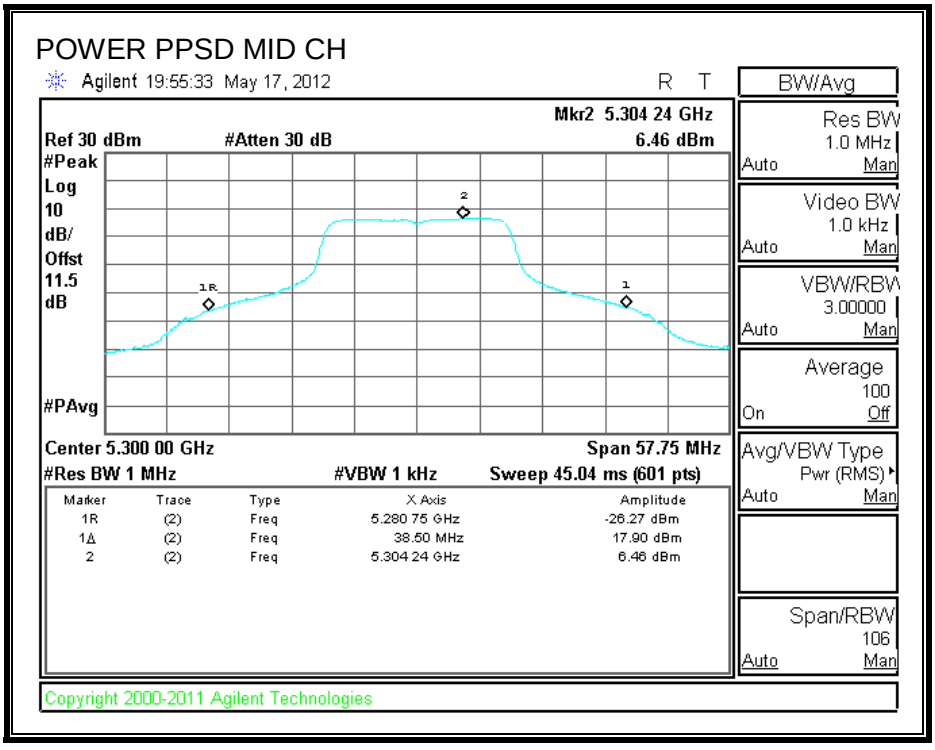
POWER PPSD MID CH

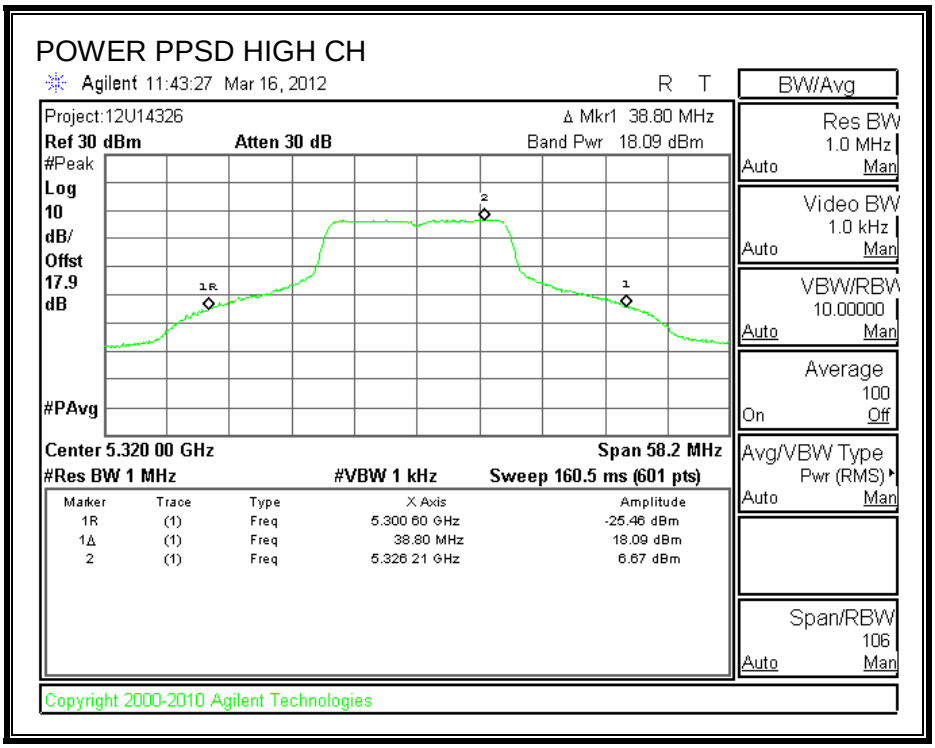




OUTPUT POWER AND PPSD CHAIN 1







7.5.5. PEAK EXCURSION

LIMITS

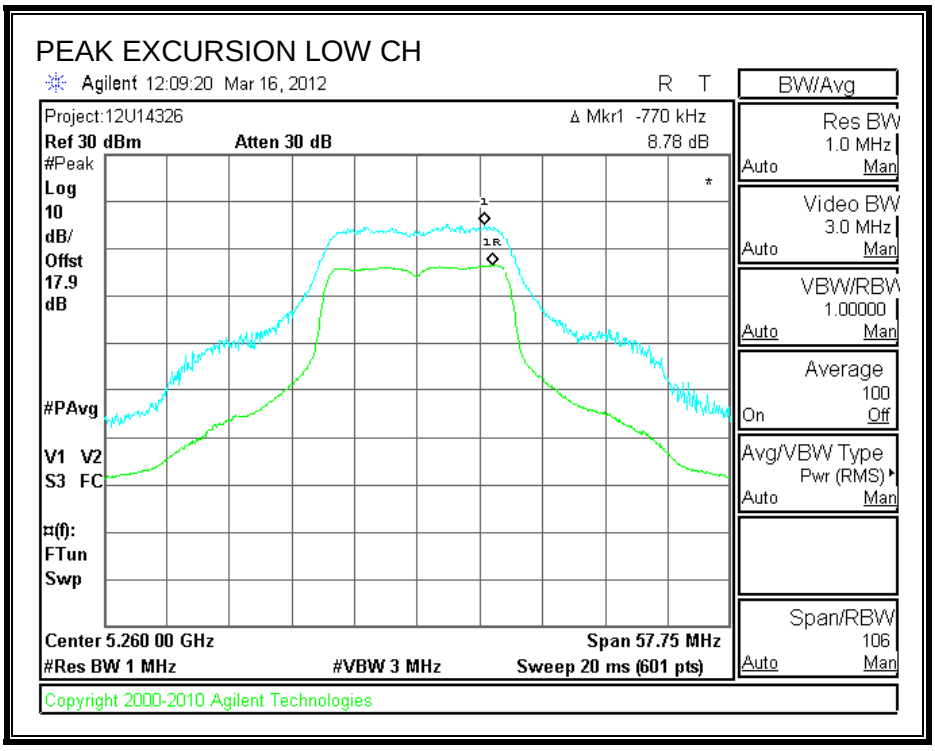
FCC §15.407 (a) (6)

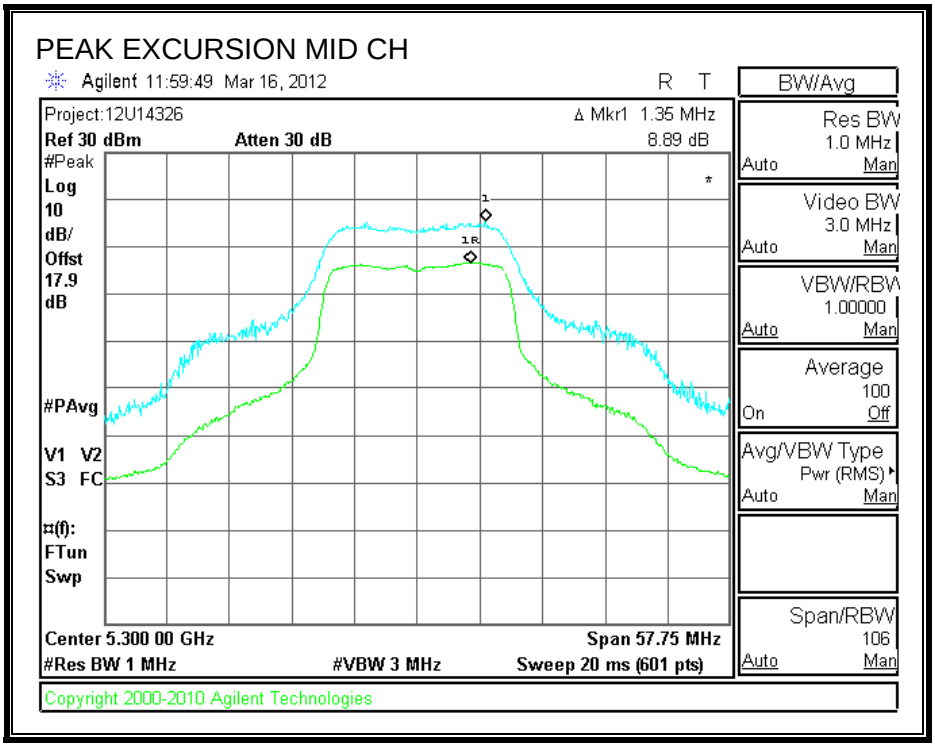
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

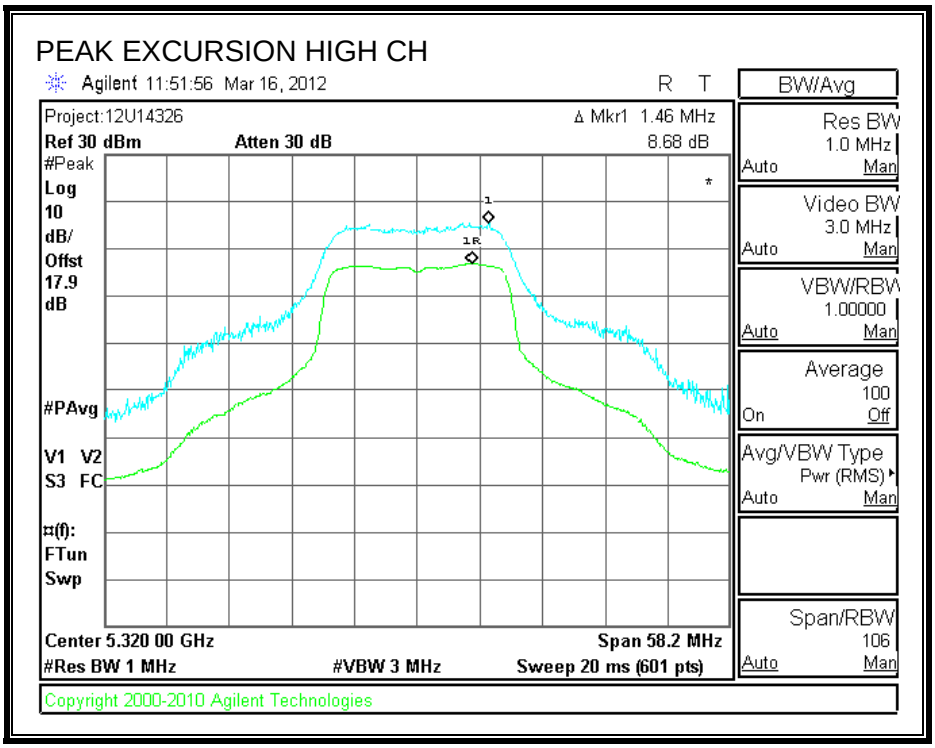
Channel	Frequency (MHz)	Pk Exc Chain 0 (dB)	Pk Exc Chain 1 (dB)	Limit (dB)	Worst-Case Margin (dB)
Low	5260	8.78	9.97	13	-3.0
Mid	5300	8.89	9.82	13	-3.2
High	5320	8.68	9.81	13	-3.2

PEAK EXCURSION CHAIN 0

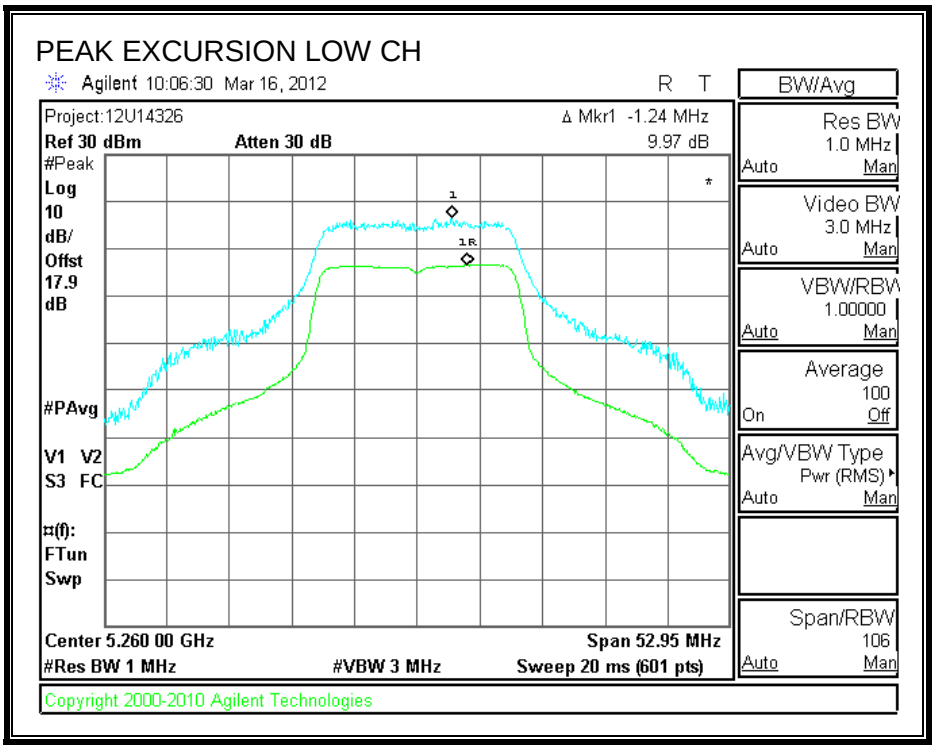


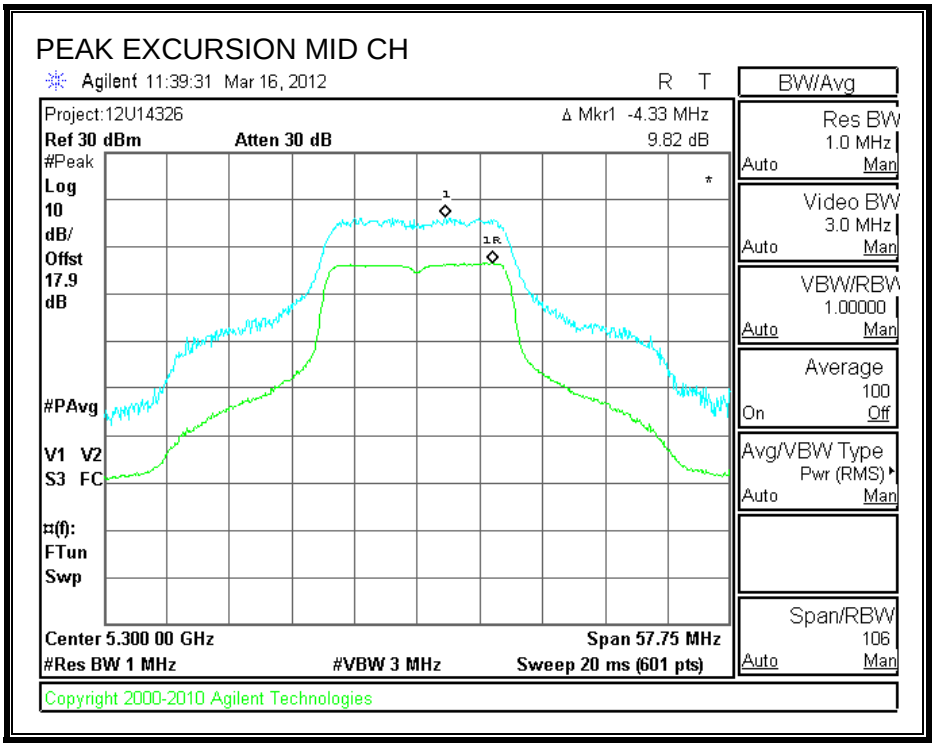


PEAK EXCURSION HIGH CH

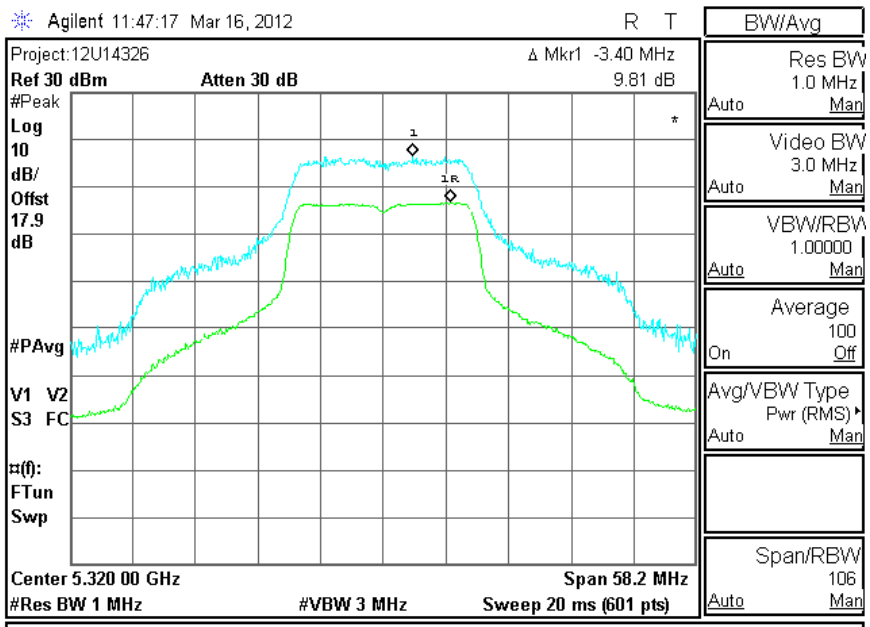


PEAK EXCURSION CHAIN 1





PEAK EXCURSION HIGH CH



7.6. 802.11n HT20 MODE IN THE 5.3 GHz BAND

7.6.1. 26 dB BANDWIDTH

LIMITS

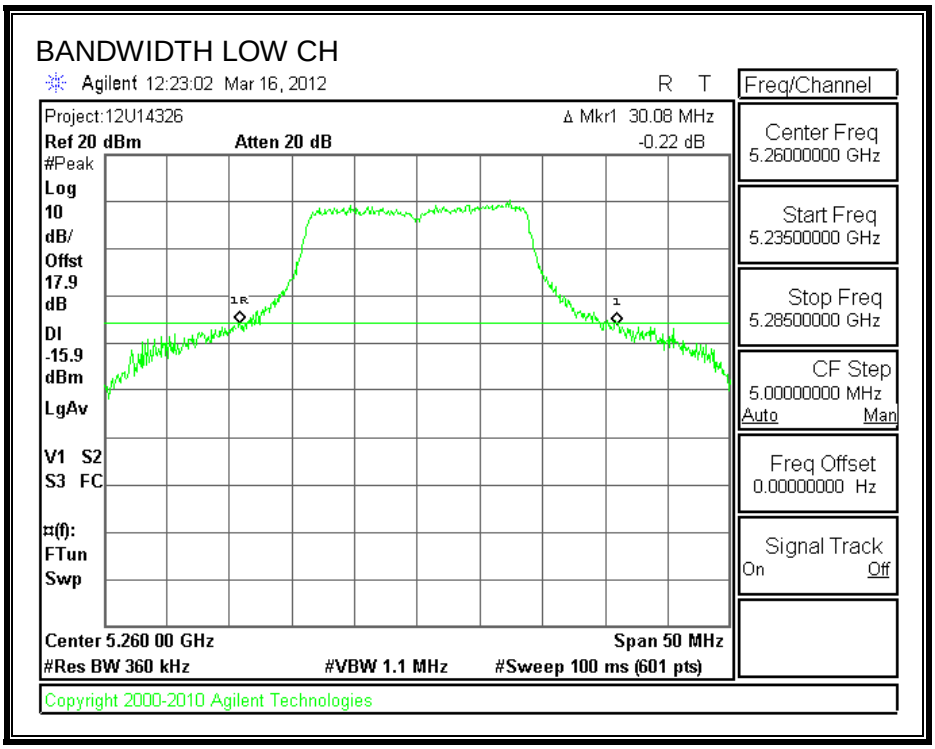
None; for reporting purposes only.

RESULTS

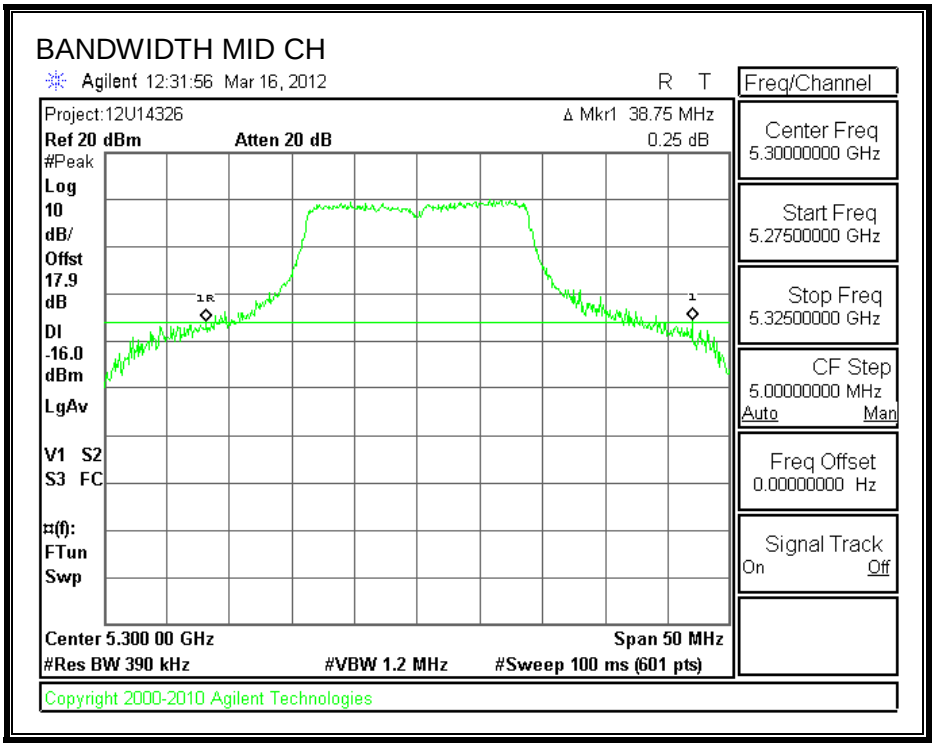
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5260	30.08	32.75
Mid	5300	38.75	39.17
High	5320	39.75	43.58

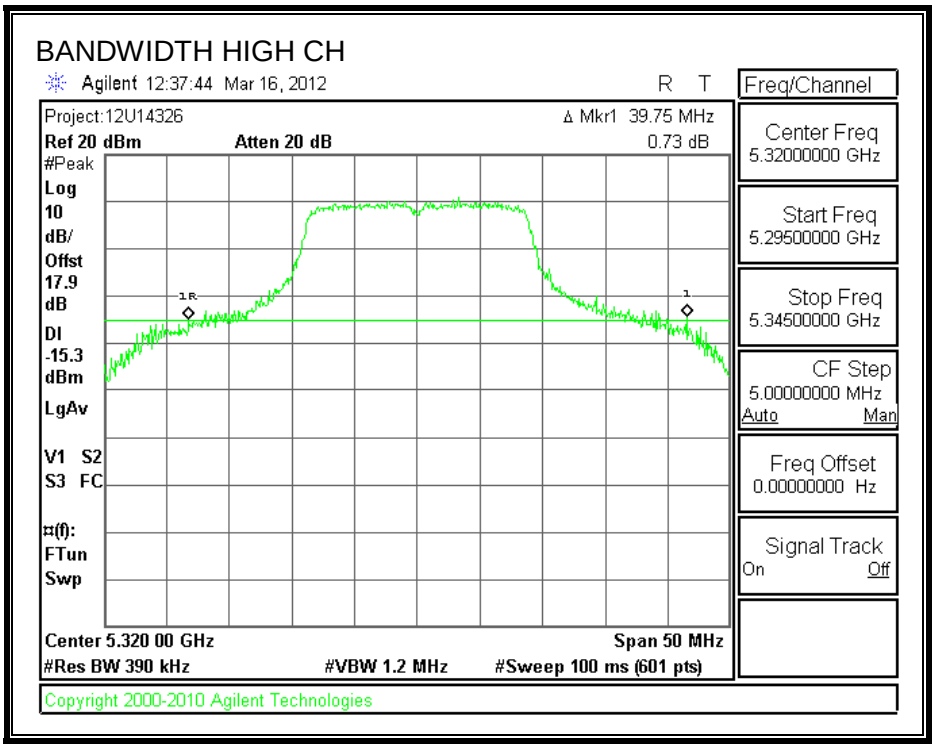
26 dB BANDWIDTH CHAIN 0

BANDWIDTH LOW CH

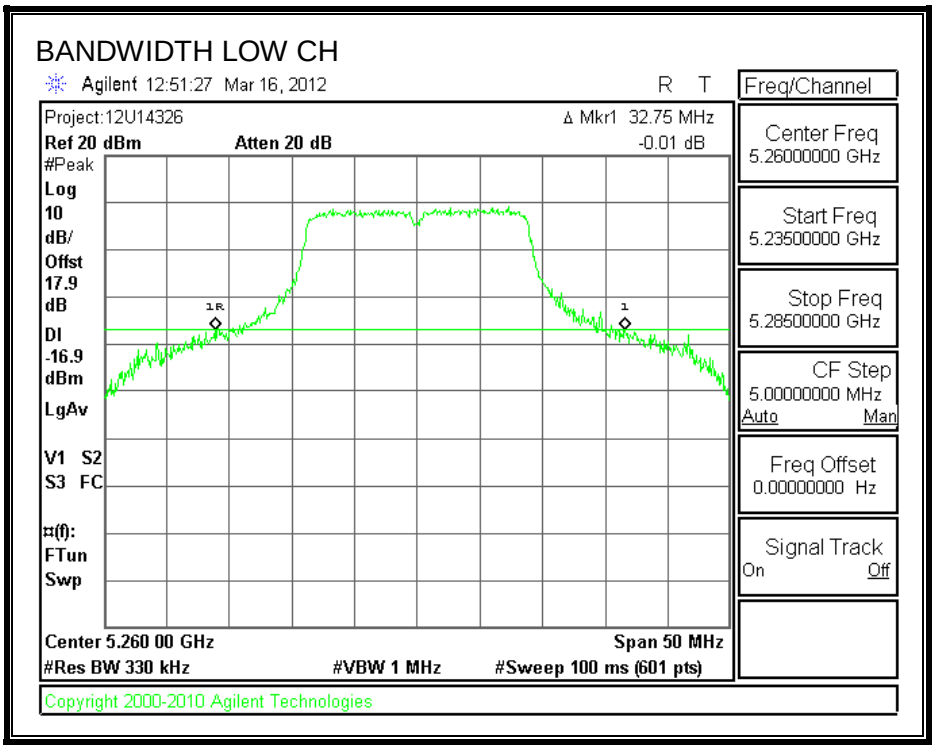


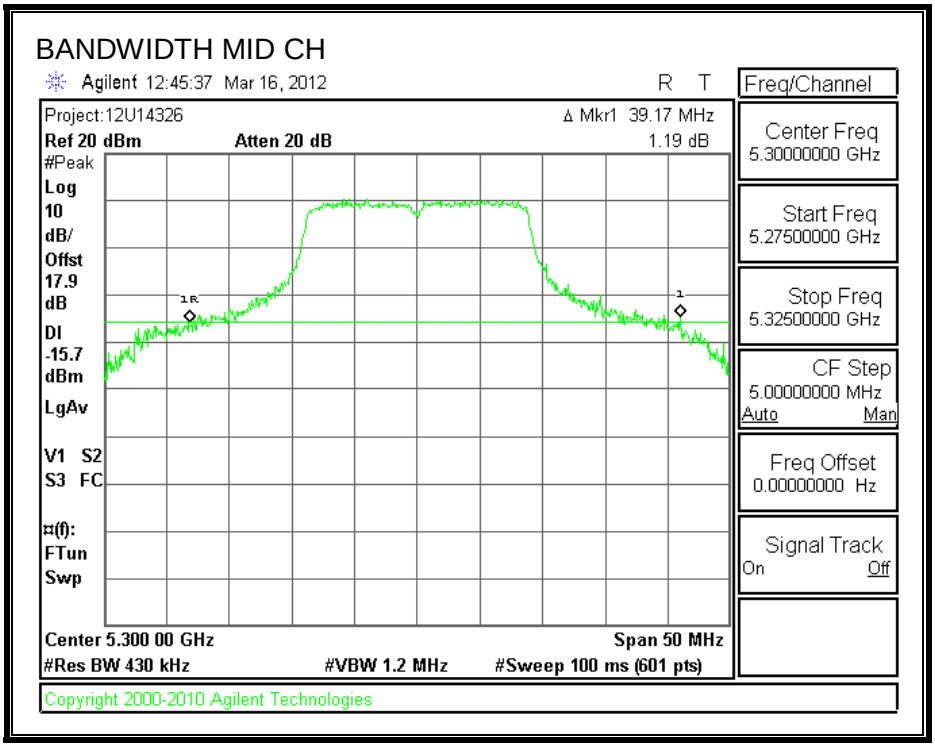
BANDWIDTH MID CH



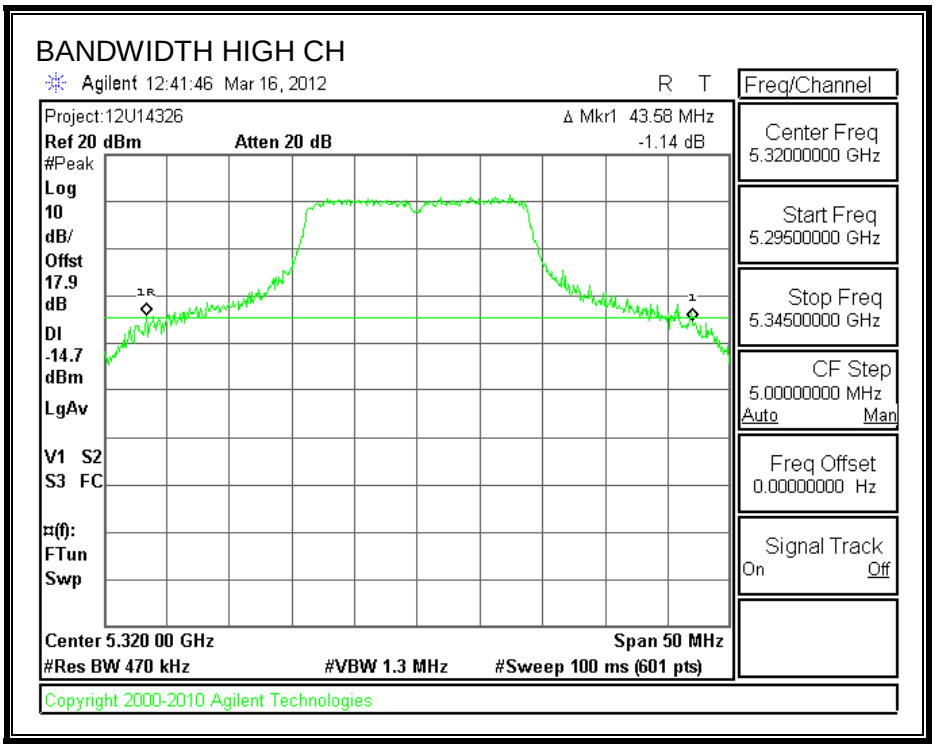


26 dB BANDWIDTH CHAIN 1





BANDWIDTH HIGH CH



7.6.2. 99% BANDWIDTH

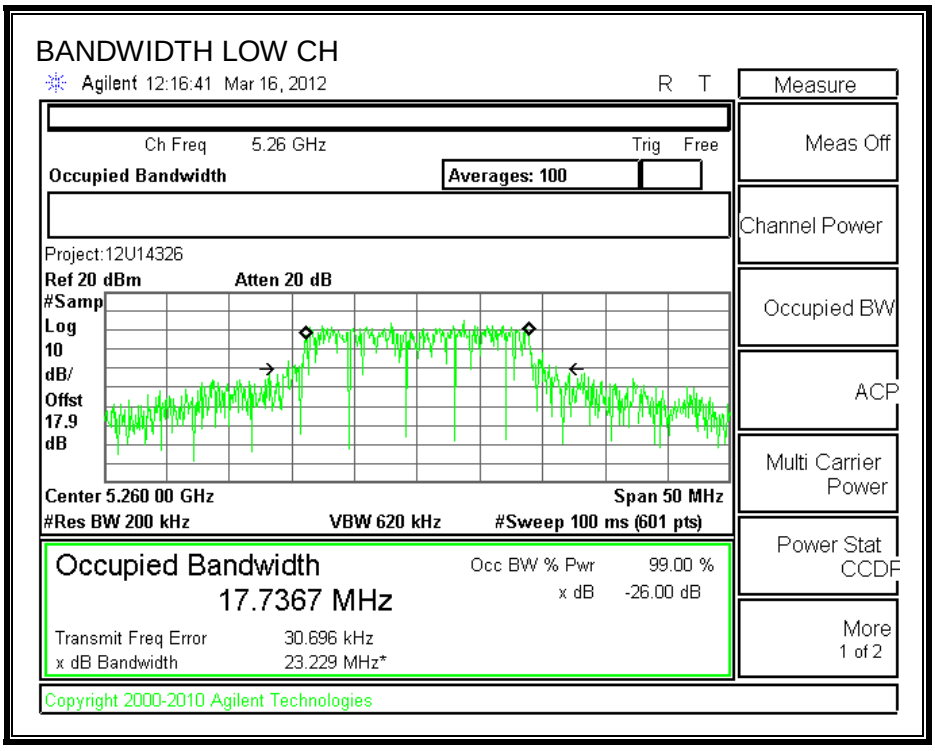
LIMITS

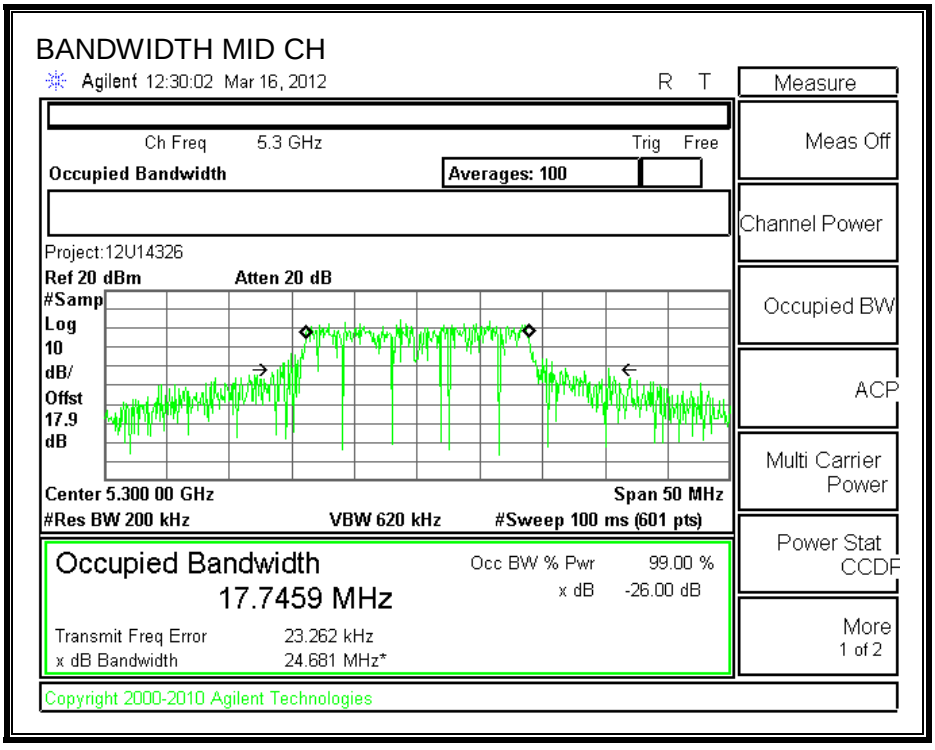
None; for reporting purposes only.

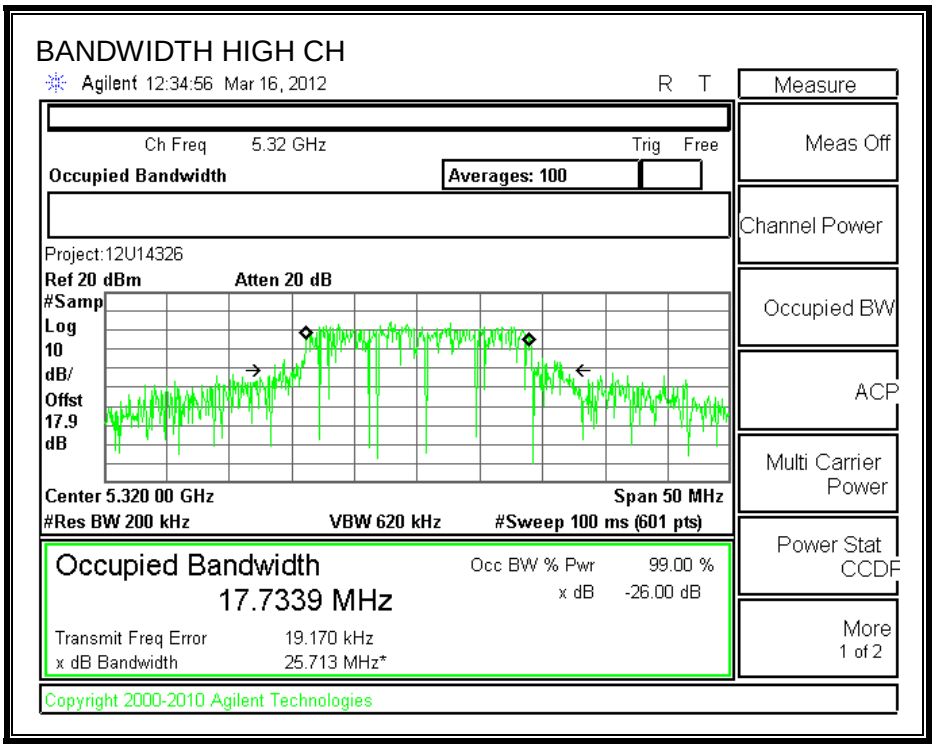
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5260	17.7367	17.6964
Mid	5300	17.7459	17.7317
High	5320	17.7339	17.7907

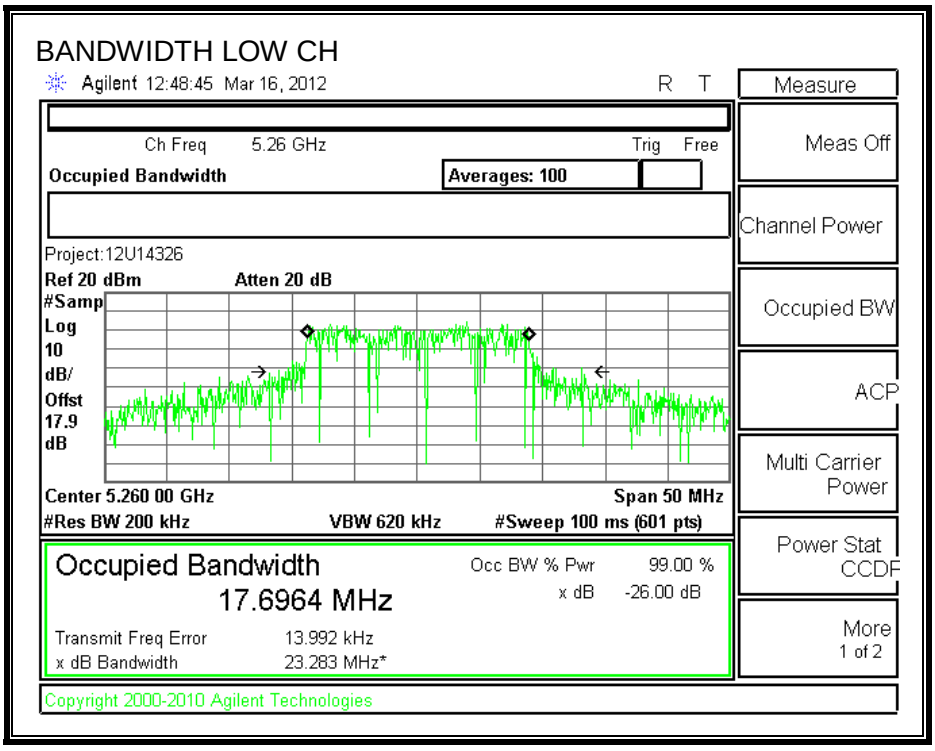
99% BANDWIDTH CHAIN 0

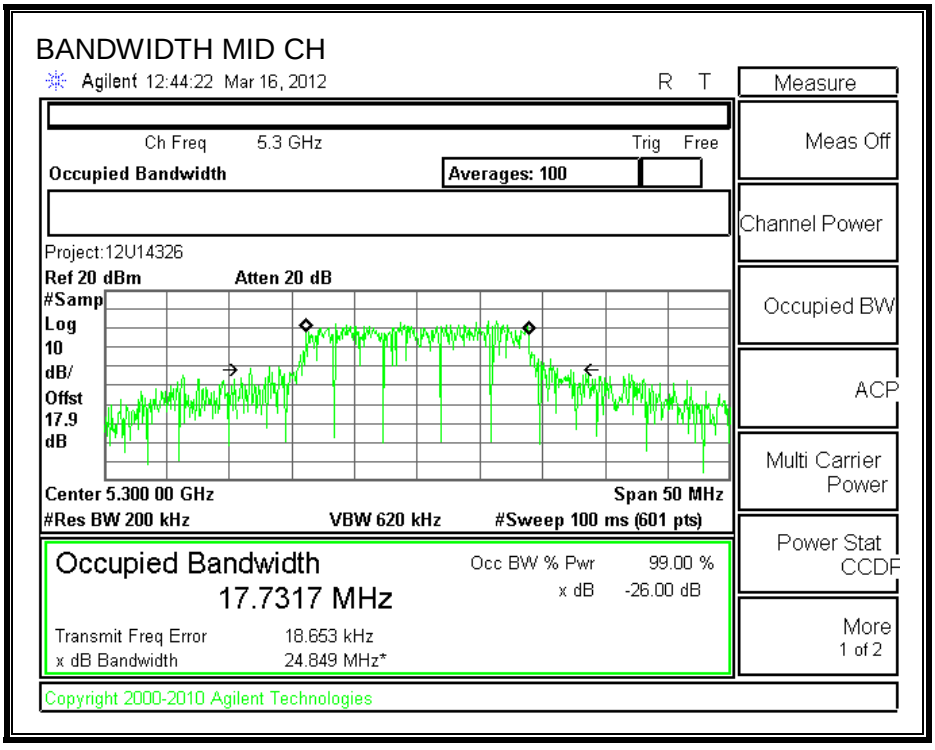


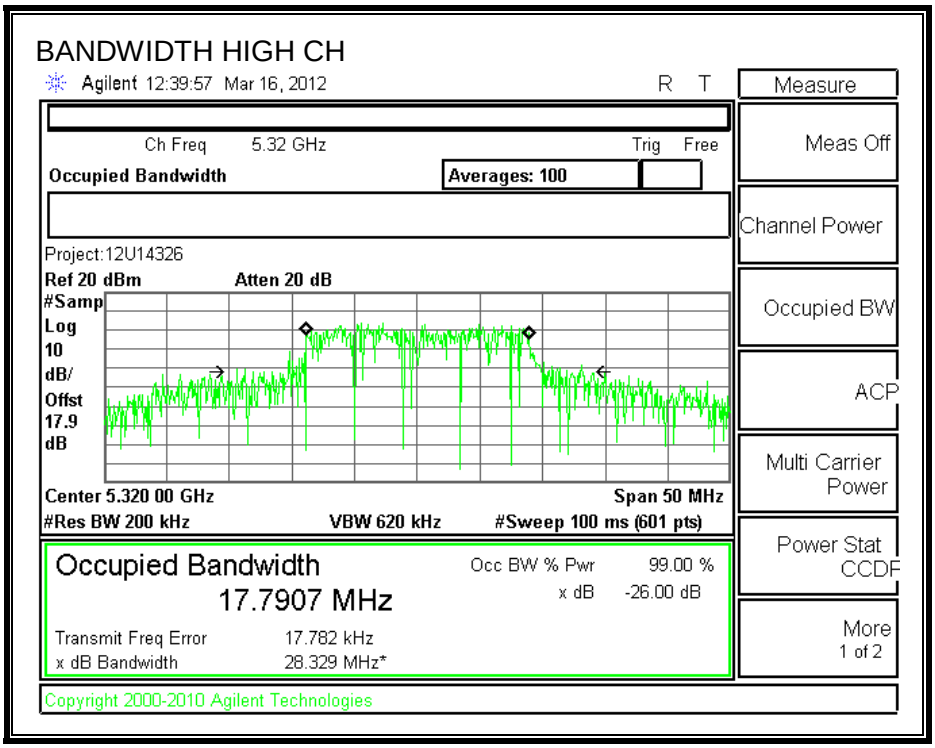




99% BANDWIDTH CHAIN 1







7.6.3. 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 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5260	17.70	17.60	20.66
Mid	5300	18.05	17.55	20.82
High	5320	18.10	17.65	20.89

7.6.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
1.54	2.07	1.81

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5260	24	30.08	25.78	1.81	24.00	11.00
Mid	5300	24	38.75	26.88	1.81	24.00	11.00
High	5320	24	39.75	26.99	1.81	24.00	11.00

Output Power Results

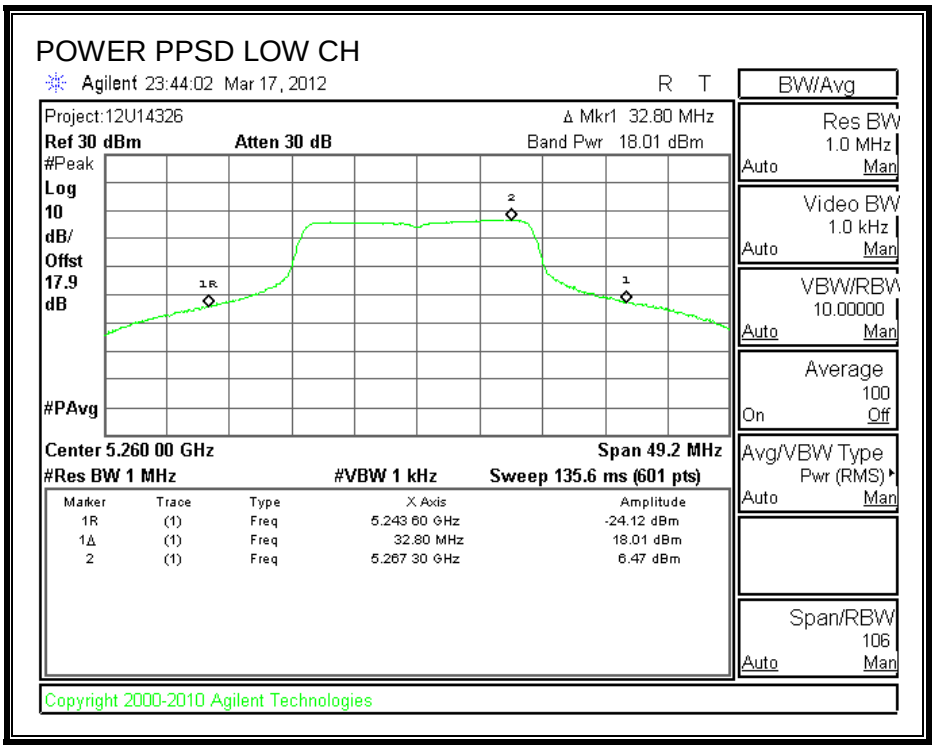
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	18.01	17.71	20.87	24.00	-3.13
Mid	5300	18.61	17.70	21.19	24.00	-2.81
High	5320	18.42	17.82	21.14	24.00	-2.86

PPSD Results

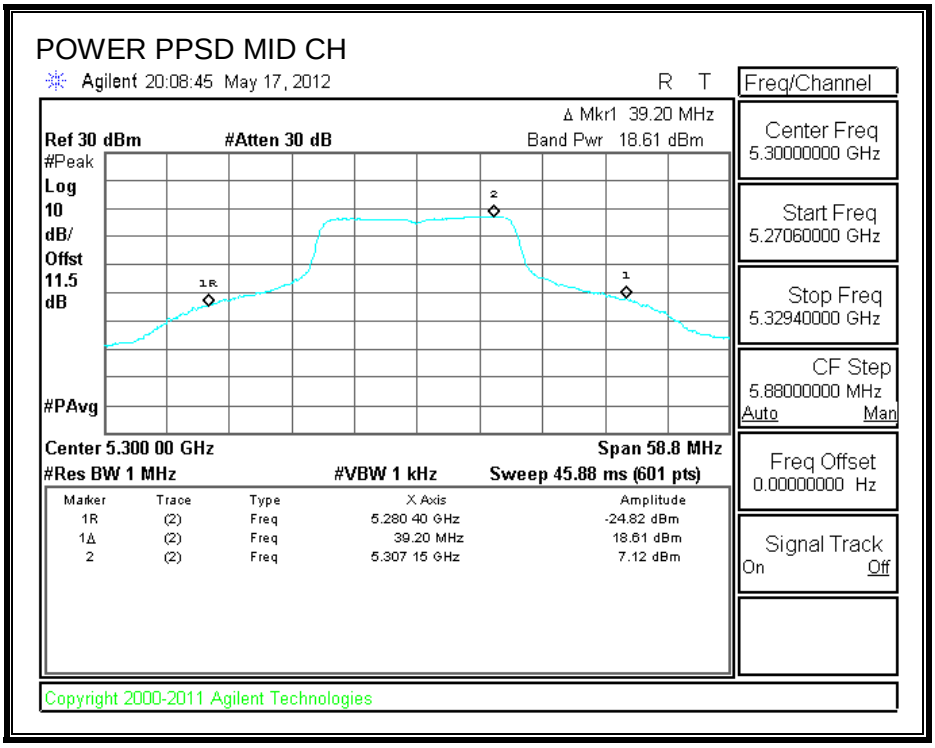
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5260	6.47	5.78	9.15	11.00	-1.85
Mid	5300	7.12	5.71	9.48	11.00	-1.52
High	5320	6.44	6.06	9.26	11.00	-1.74

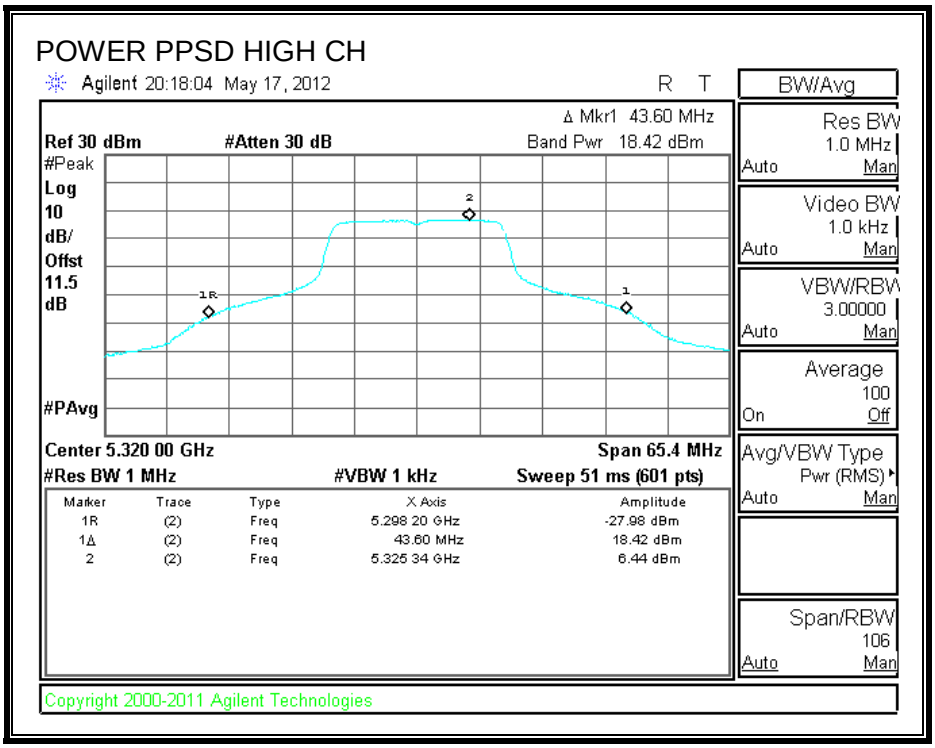
OUTPUT POWER AND PPSD CHAIN 0

POWER PPSD LOW CH

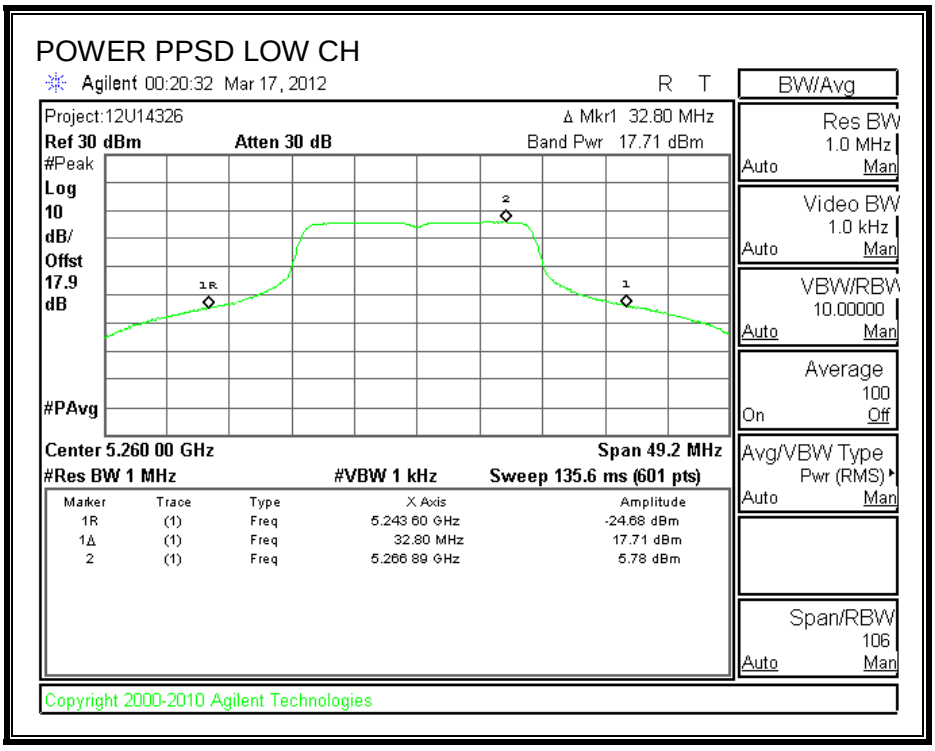


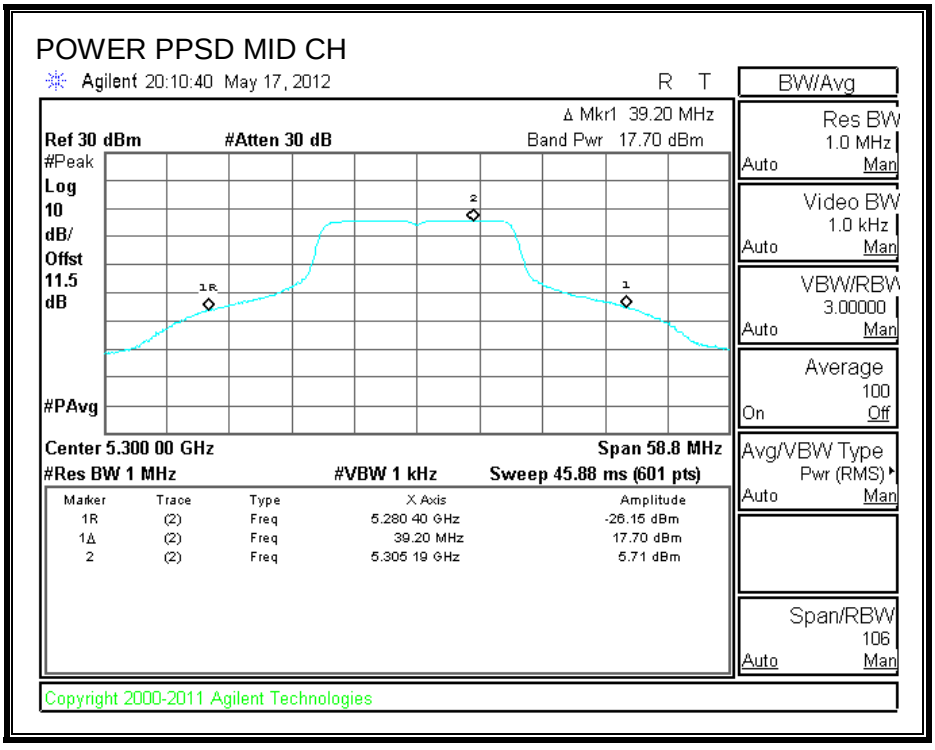
POWER PPSD MID CH

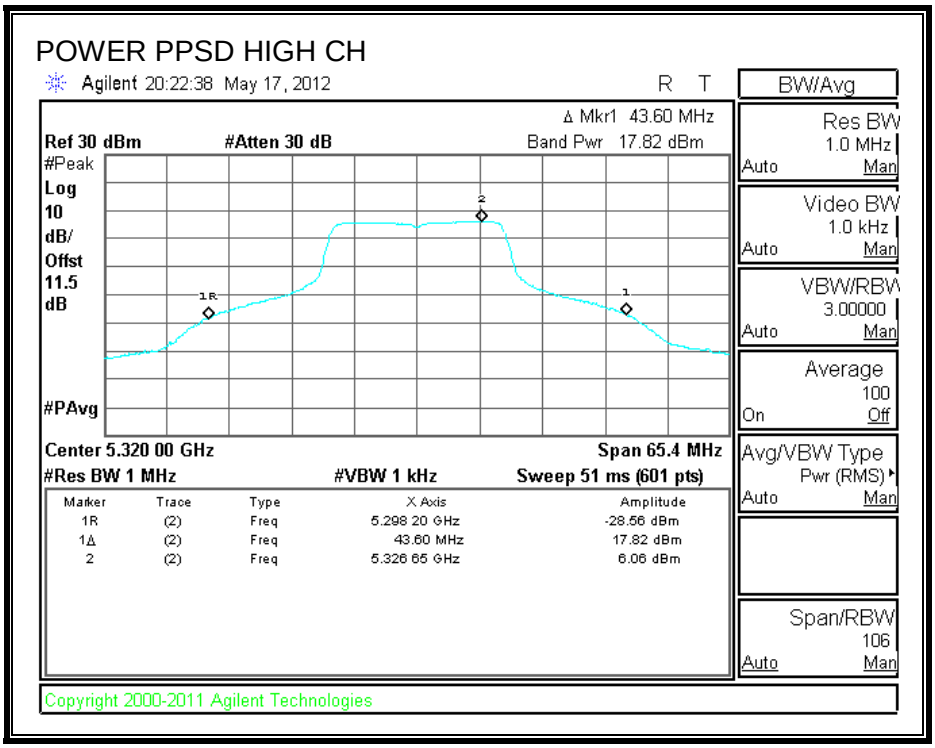




OUTPUT POWER AND PPSD CHAIN 1







7.6.5. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

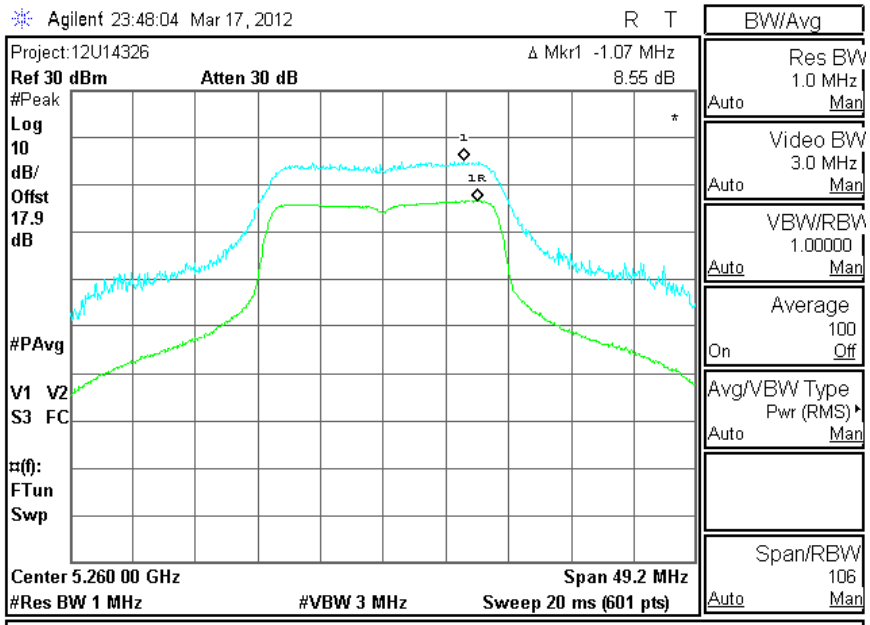
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

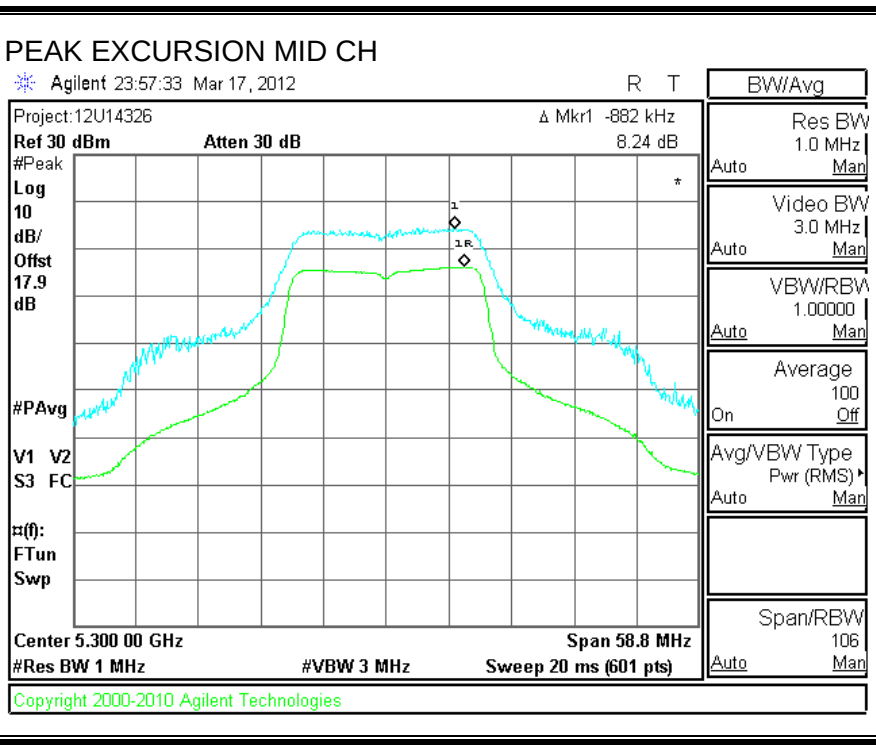
Channel	Frequency (MHz)	Pk Exc Chain 0 (dB)	Pk Exc Chain 1 (dB)	Limit (dB)	Worst-Case Margin (dB)
Low	5260	8.55	9.14	13	-3.9
Mid	5300	8.24	8.91	13	-4.1
High	5320	8.58	8.90	13	-4.1

PEAK EXCURSION CHAIN 0

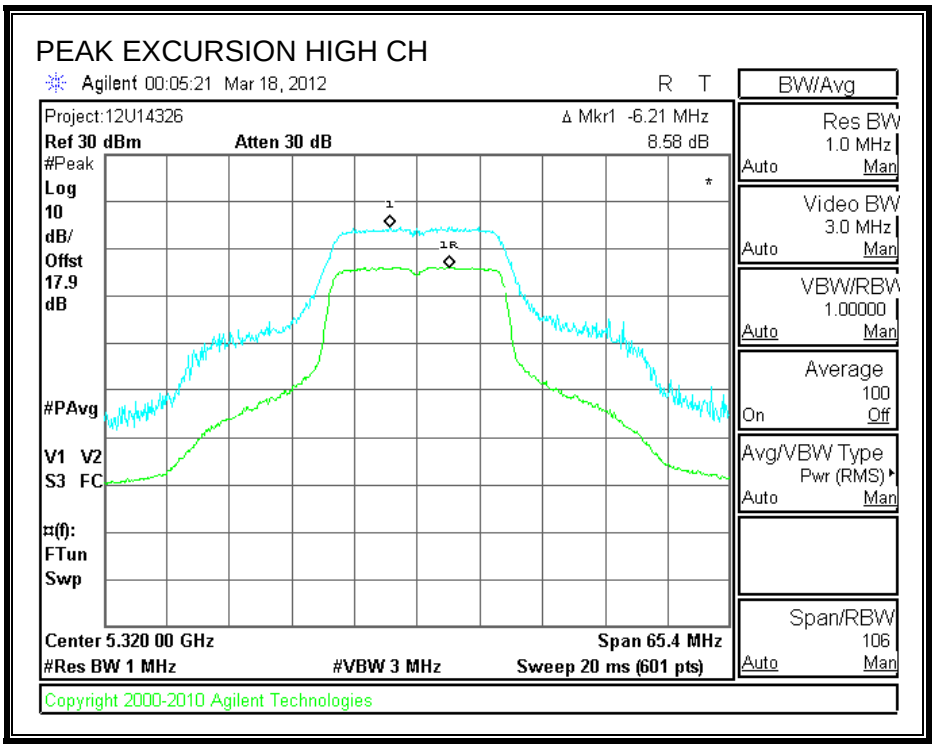
PEAK EXCURSION LOW CH



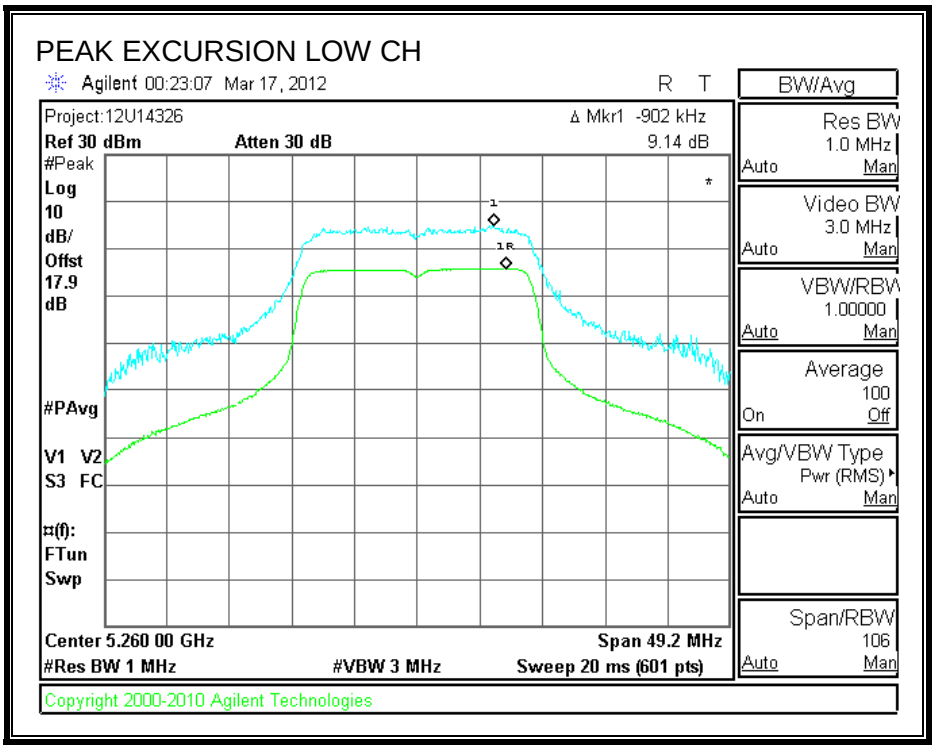
PEAK EXCURSION MID CH

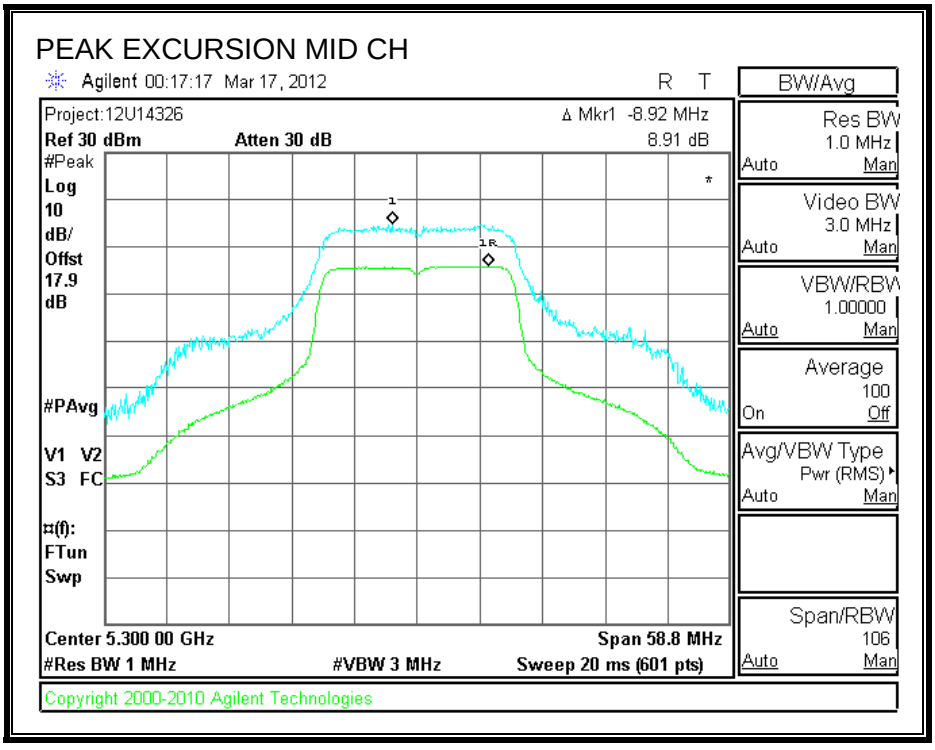


PEAK EXCURSION HIGH CH

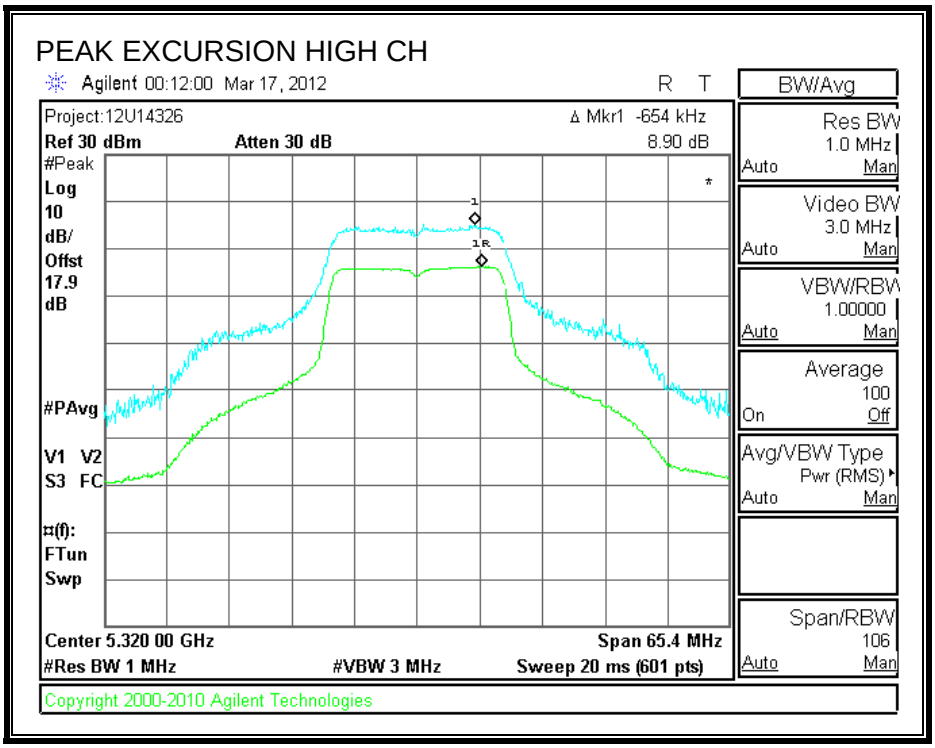


PEAK EXCURSION CHAIN 1





PEAK EXCURSION HIGH CH



7.7. 802.11n HT40 MODE IN THE 5.3 GHz BAND

7.7.1. 26 dB BANDWIDTH

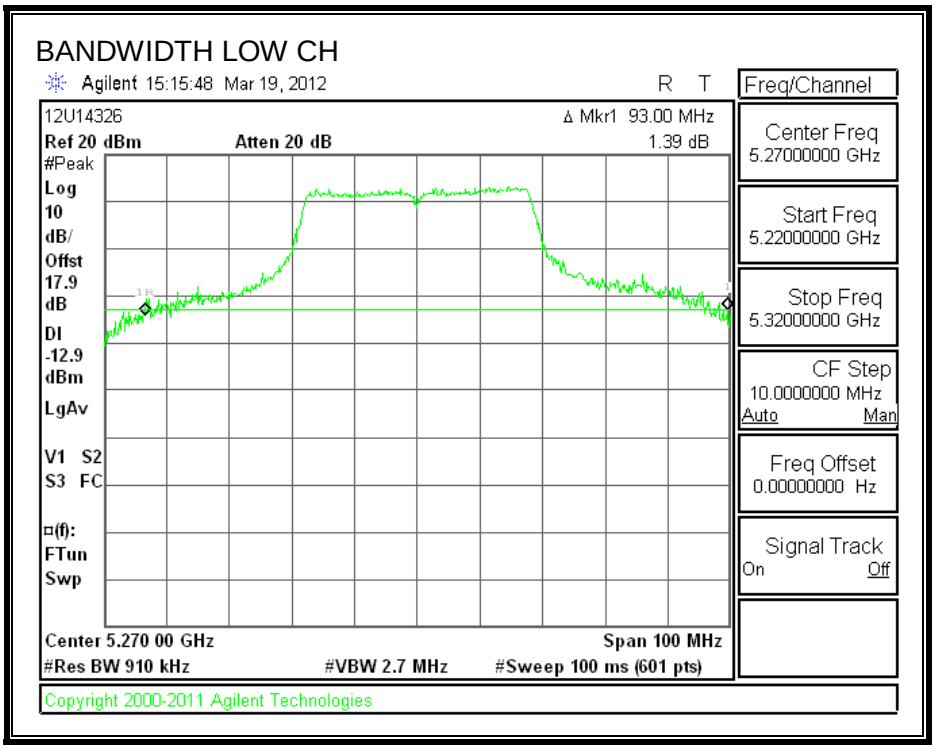
LIMITS

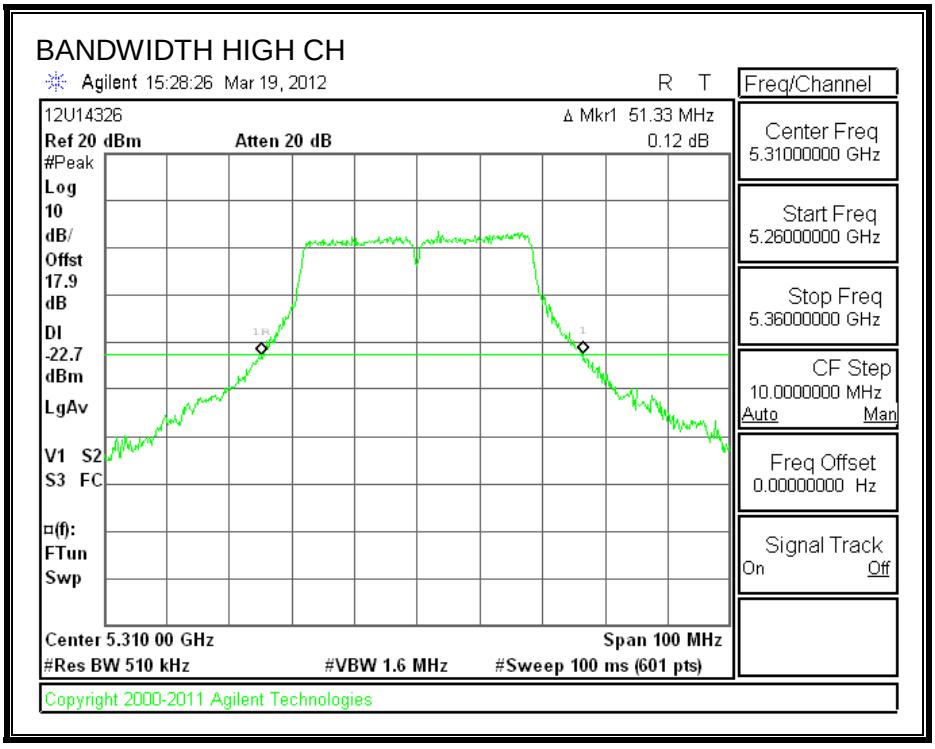
None; for reporting purposes only.

RESULTS

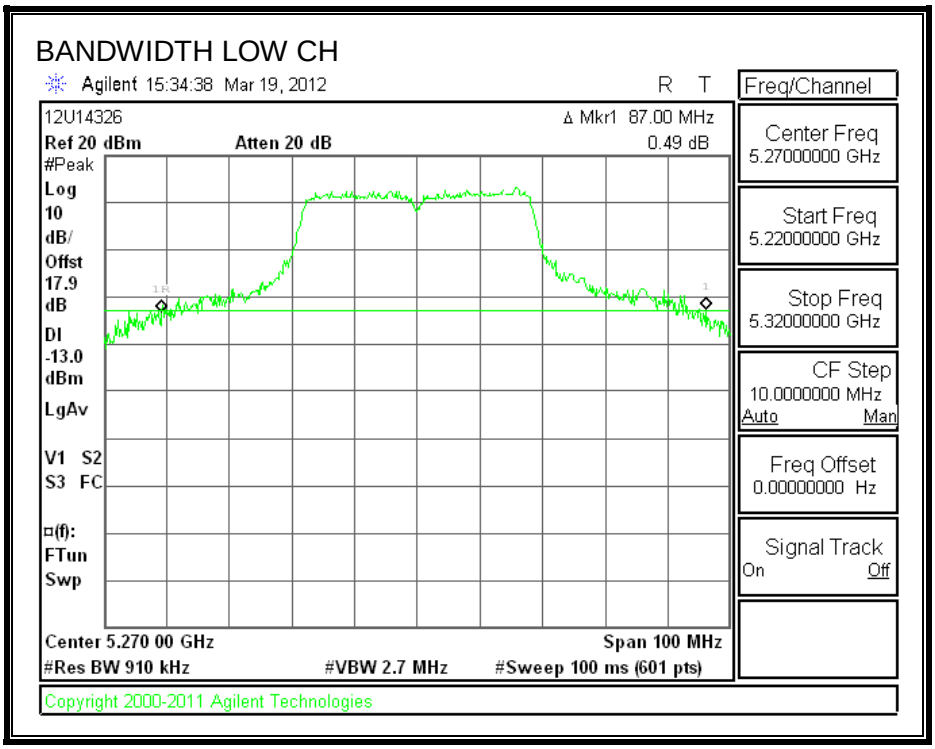
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5270	93.00	87.00
High	5310	51.33	51.17

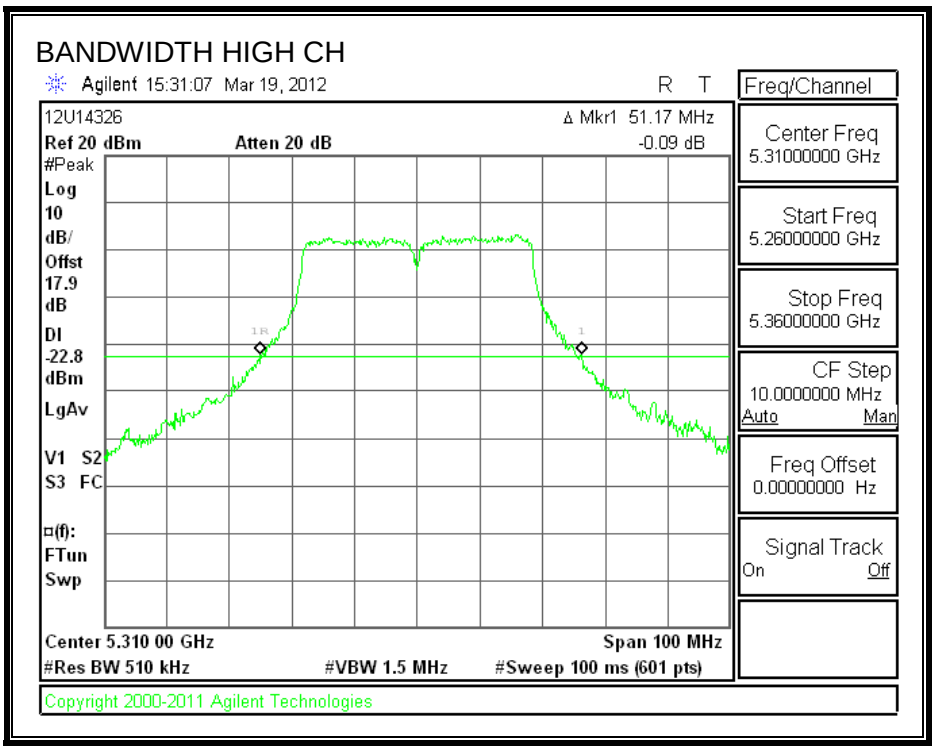
26 dB BANDWIDTH CHAIN 0





26 dB BANDWIDTH CHAIN 1





7.7.2. 99% BANDWIDTH

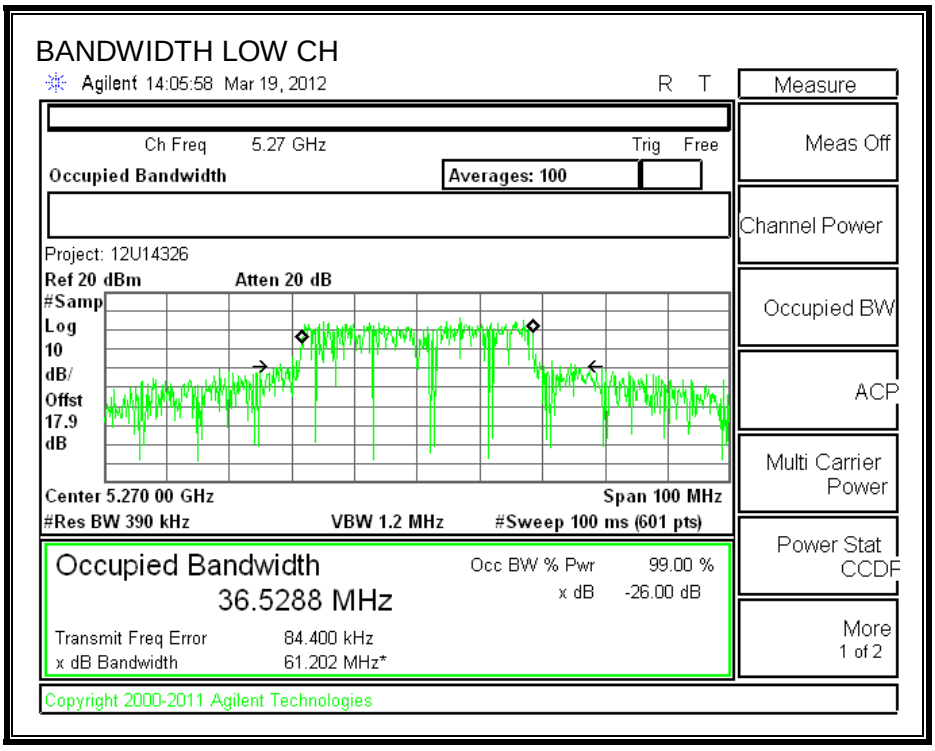
LIMITS

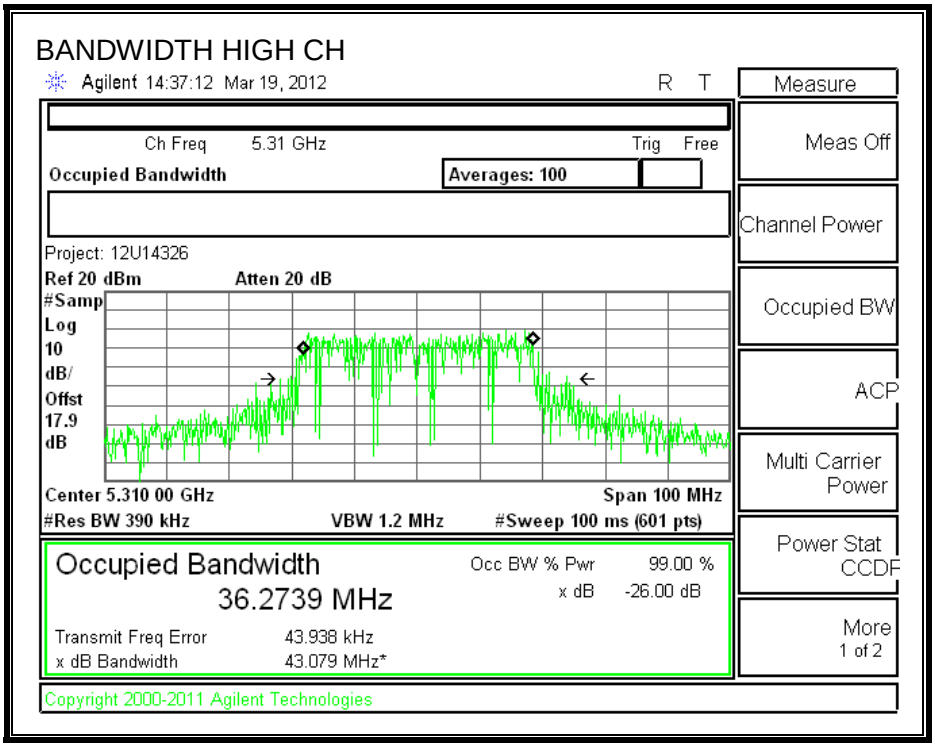
None; for reporting purposes only.

RESULTS

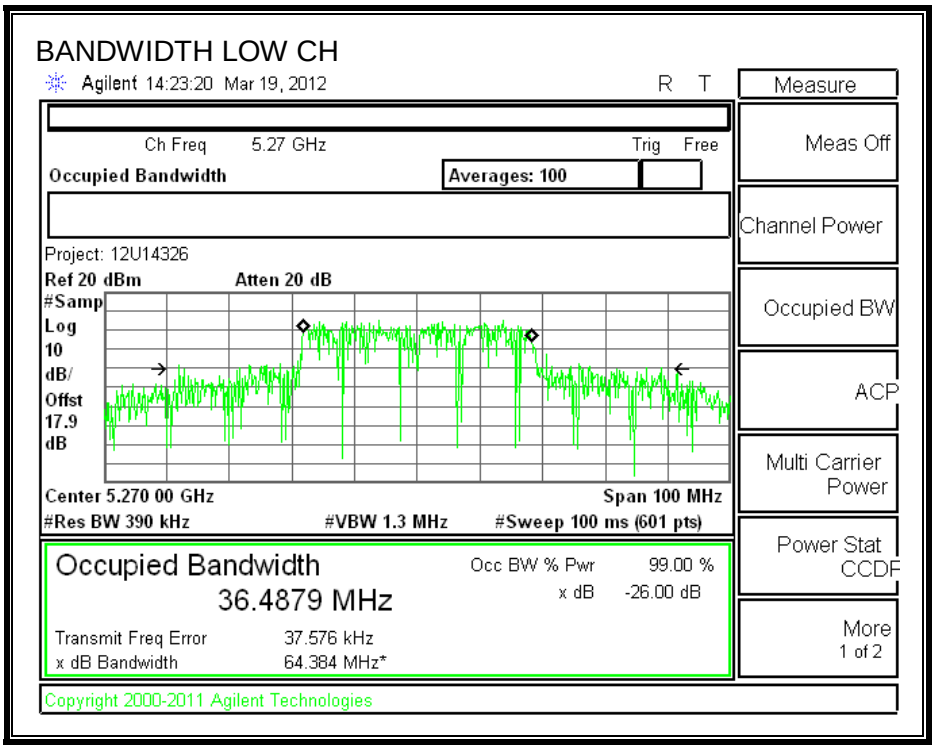
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5270	36.5288	36.4879
High	5310	36.2739	36.2095

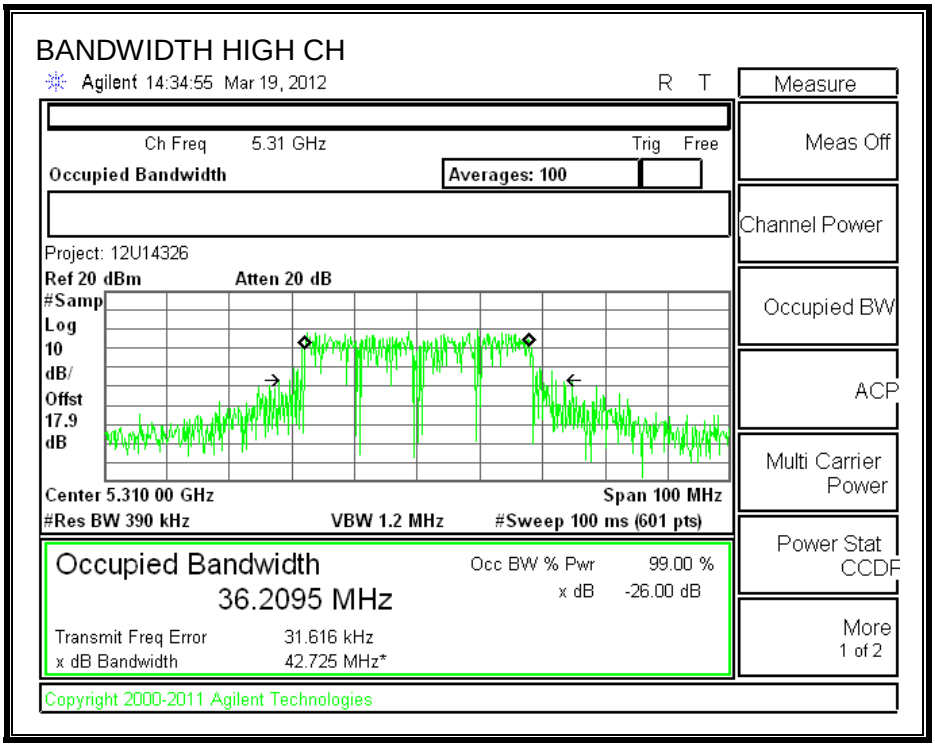
99% BANDWIDTH CHAIN 0





99% BANDWIDTH CHAIN 1





7.7.3. 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 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5270	19.00	18.90	21.96
High	5310	13.50	12.80	16.17

7.7.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
1.54	2.07	1.81

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5270	24	87.00	30.40	1.81	24.00	11.00
High	5310	24	51.17	28.09	1.81	24.00	11.00

Output Power Results

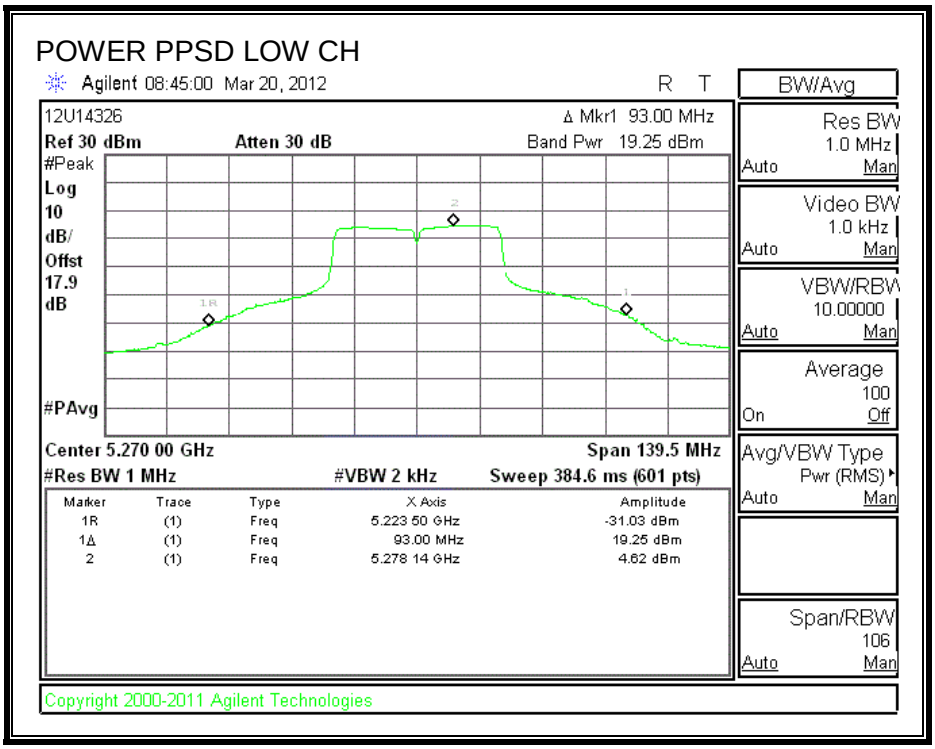
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5270	19.25	19.15	22.21	24.00	-1.79
High	5310	13.64	12.93	16.31	24.00	-7.69

PPSD Results

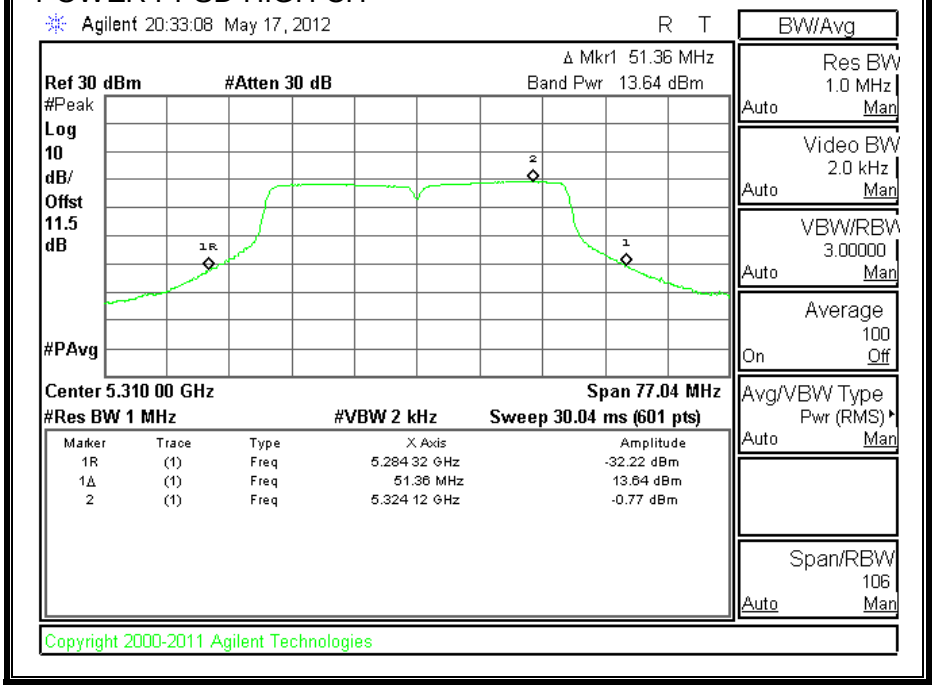
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5270	4.62	4.48	7.56	11.00	-3.44
High	5310	-0.77	-1.49	1.90	11.00	-9.10

OUTPUT POWER AND PPSD CHAIN 0

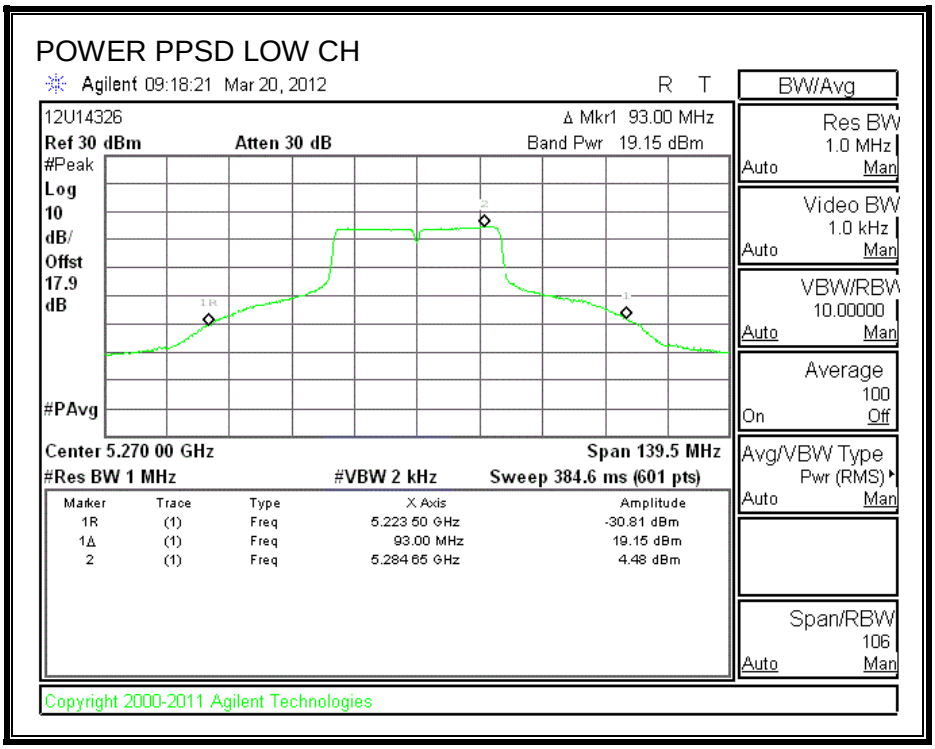
POWER PPSD LOW CH

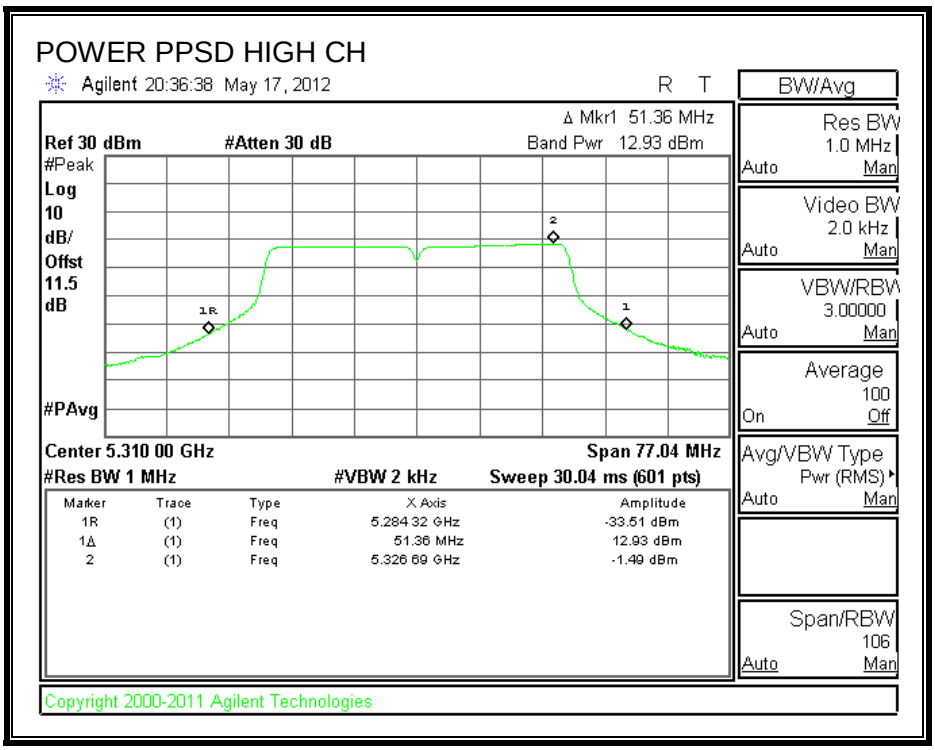


POWER PPSD HIGH CH



OUTPUT POWER AND PPSD CHAIN 1





7.7.5. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

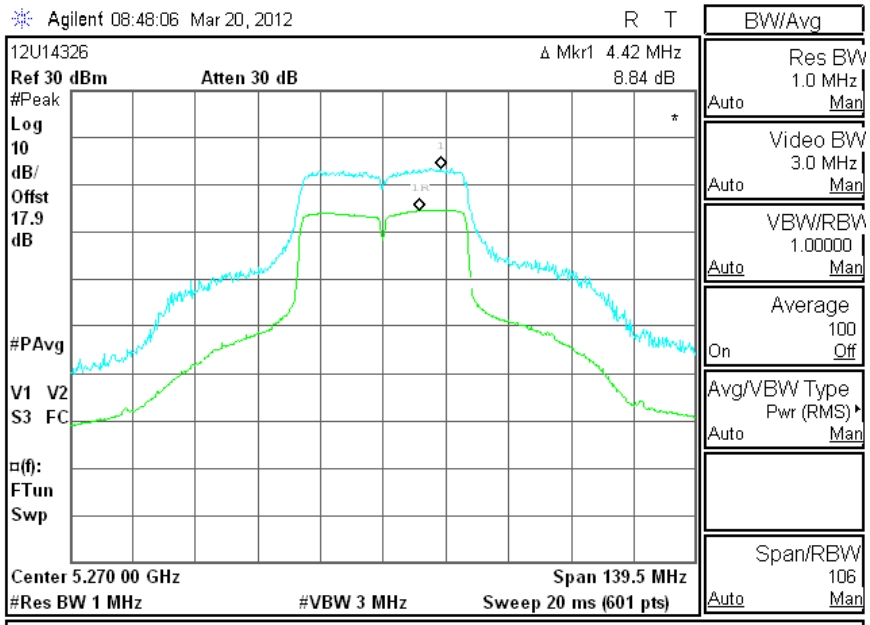
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

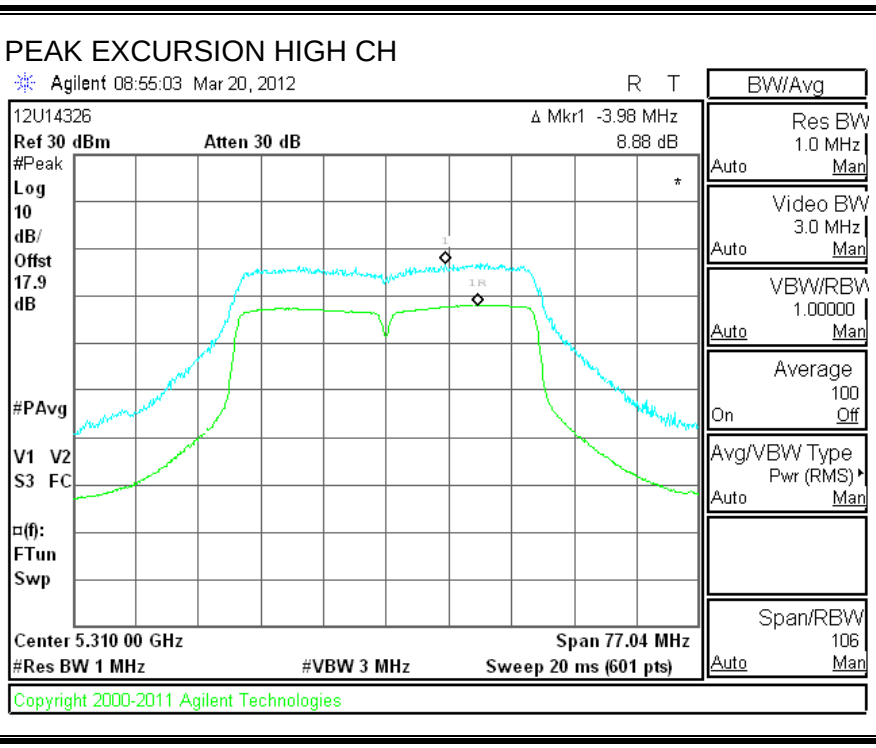
Channel	Frequency (MHz)	Pk Exc Chain 0 (dB)	Pk Exc Chain 1 (dB)	Limit (dB)	Worst-Case Margin (dB)
Low	5270	8.84	9.05	13	-4.0
High	5310	8.88	9.52	13	-3.5

PEAK EXCURSION CHAIN 0

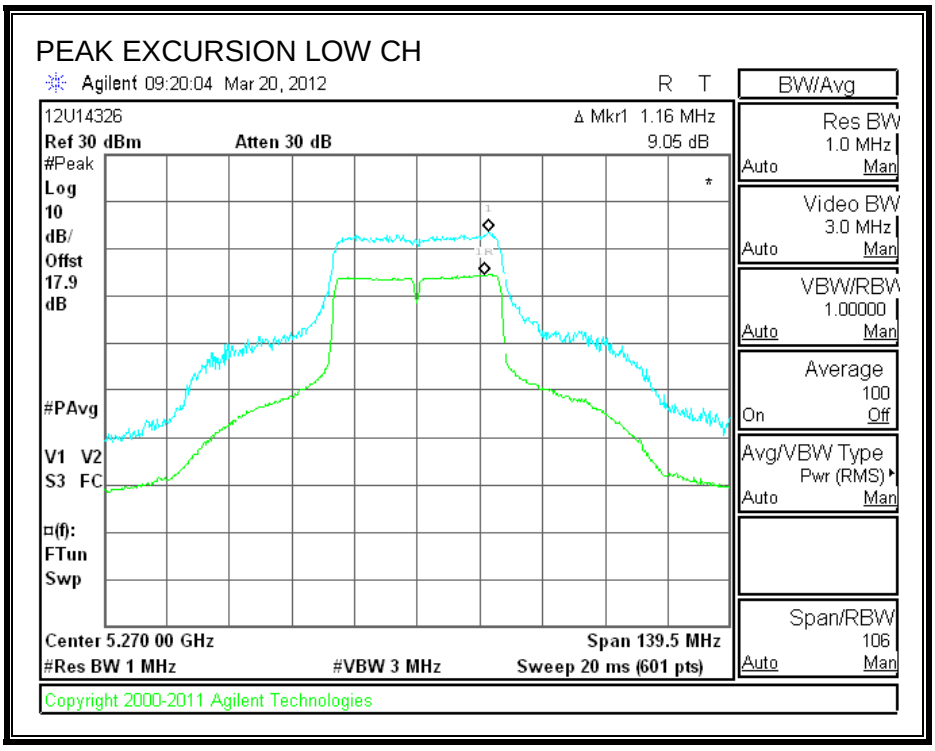
PEAK EXCURSION LOW CH

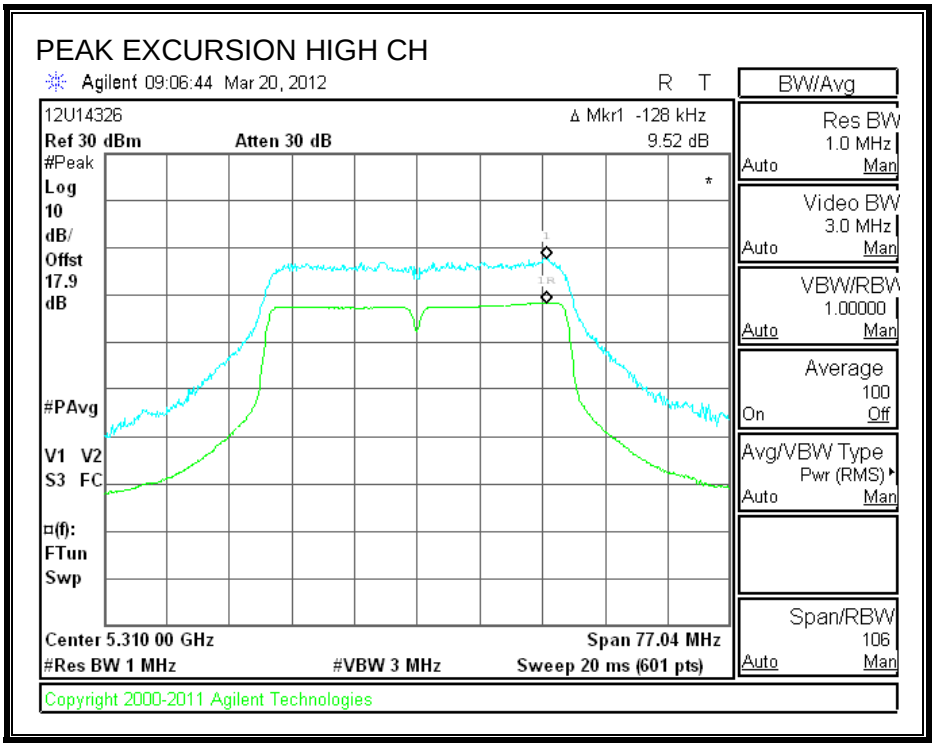


PEAK EXCURSION HIGH CH



PEAK EXCURSION CHAIN 1





7.8. 802.11a MODE IN THE 5.6 GHz BAND

7.8.1. 26 dB BANDWIDTH

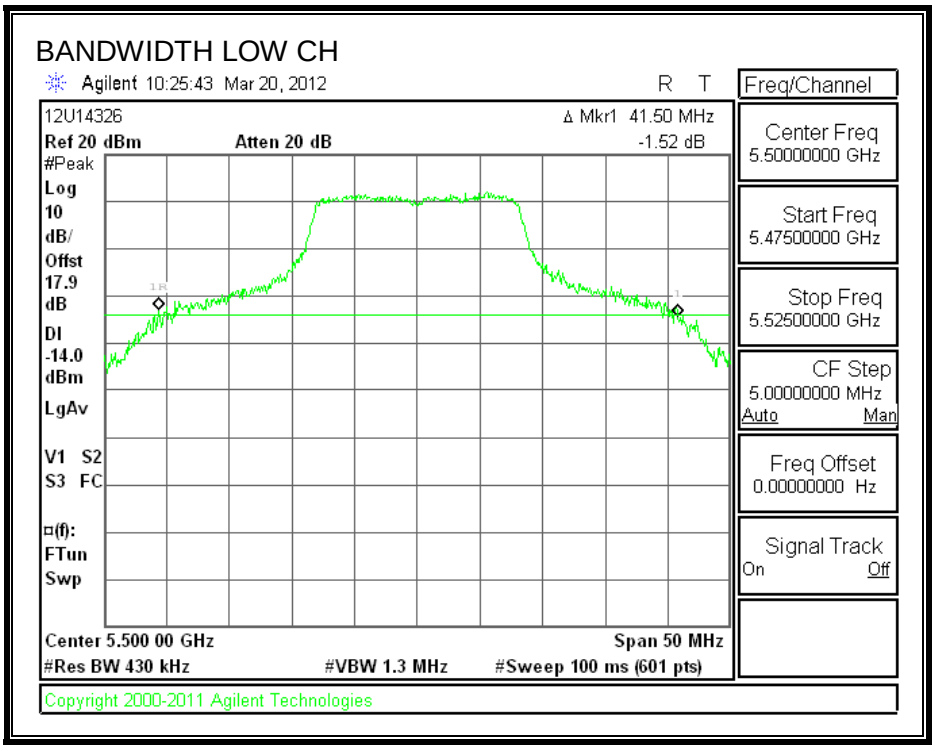
LIMITS

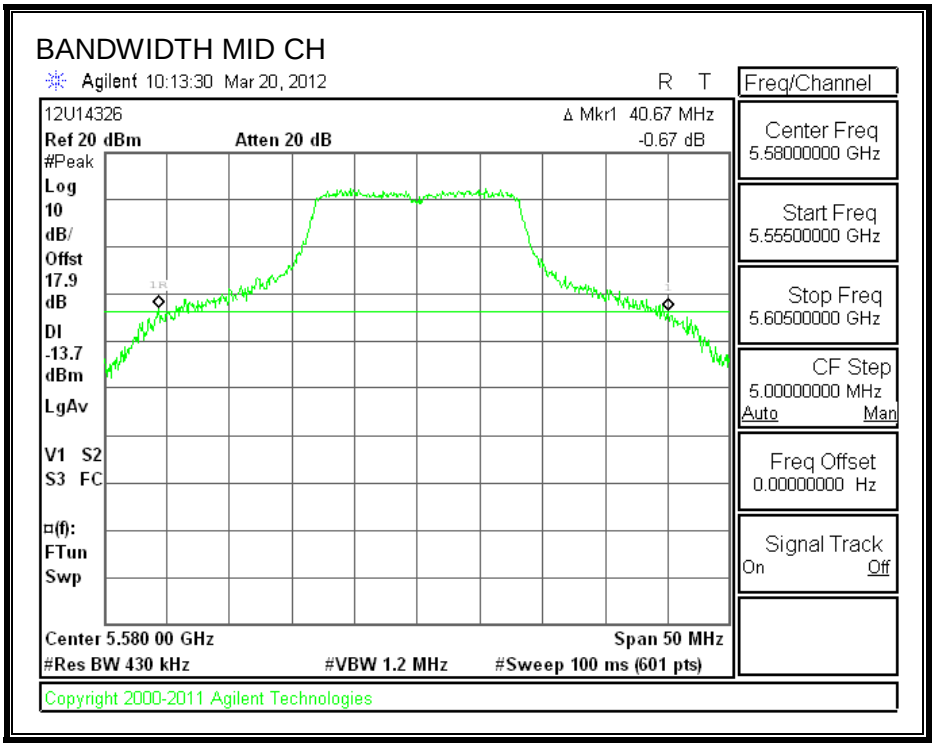
None; for reporting purposes only.

RESULTS

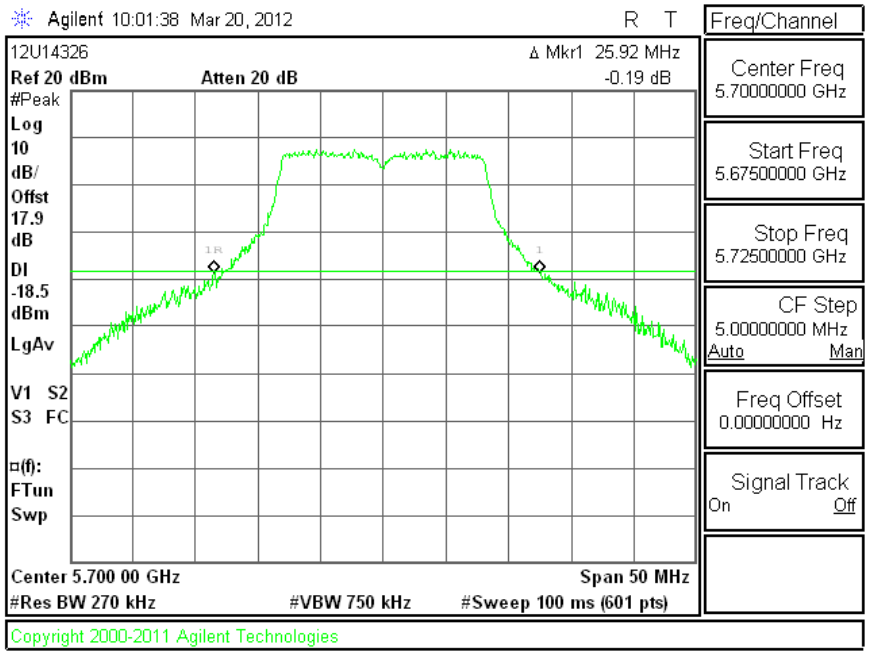
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5500	41.50	40.67
Mid	5580	40.67	39.08
High	5700	25.92	28.42

26 dB BANDWIDTH CHAIN 0

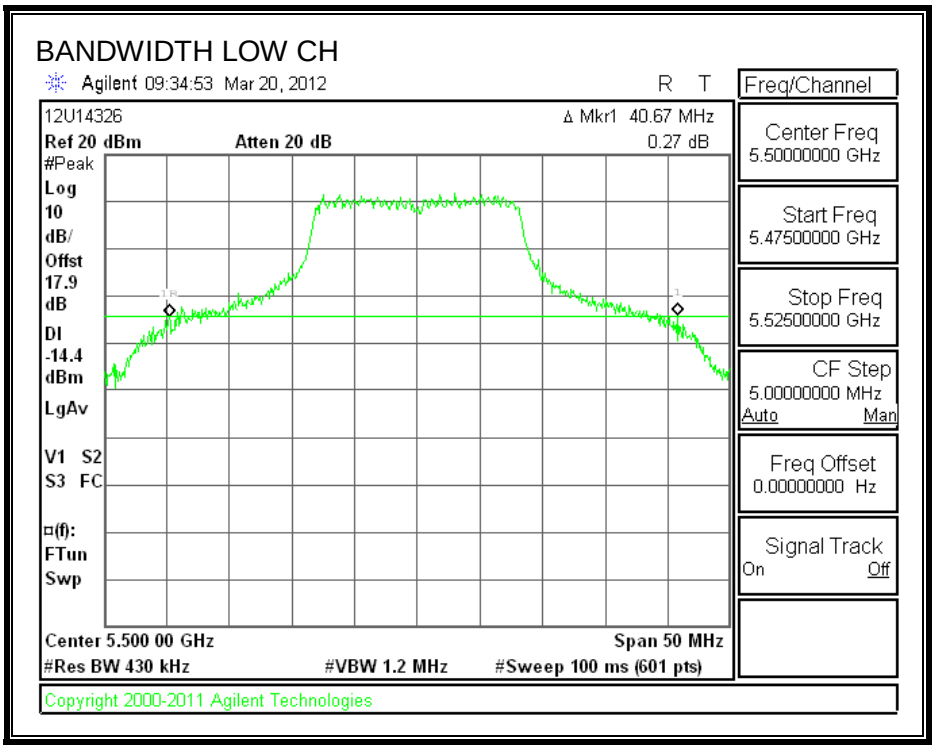


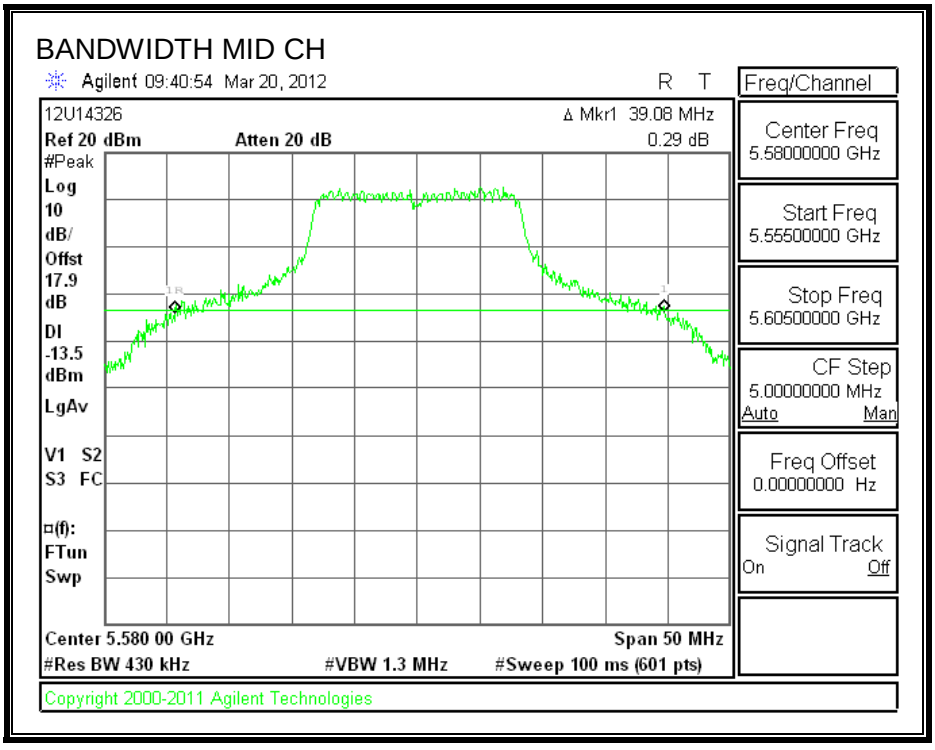


BANDWIDTH HIGH CH

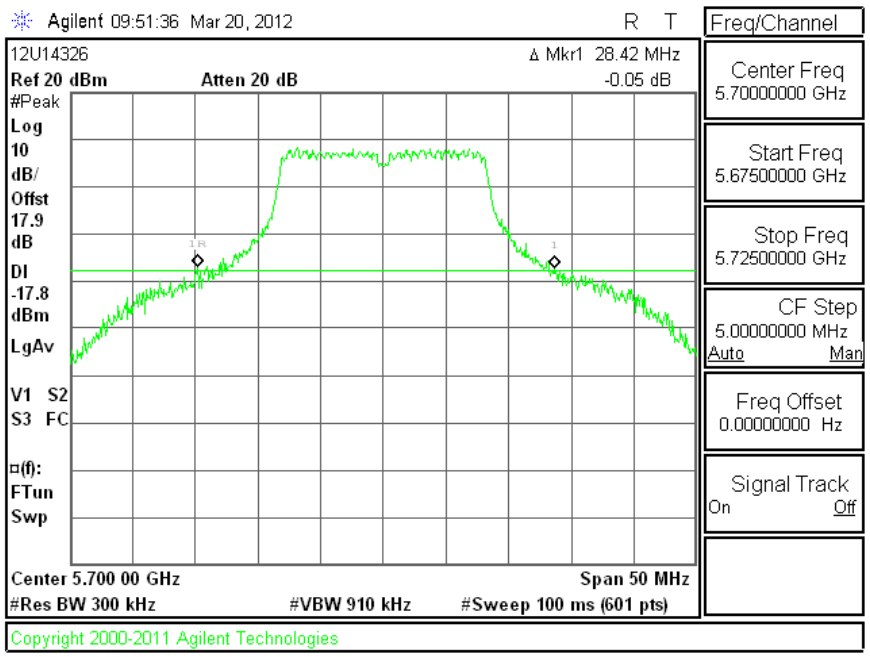


26 dB BANDWIDTH CHAIN 1





BANDWIDTH HIGH CH



7.8.2. 99% BANDWIDTH

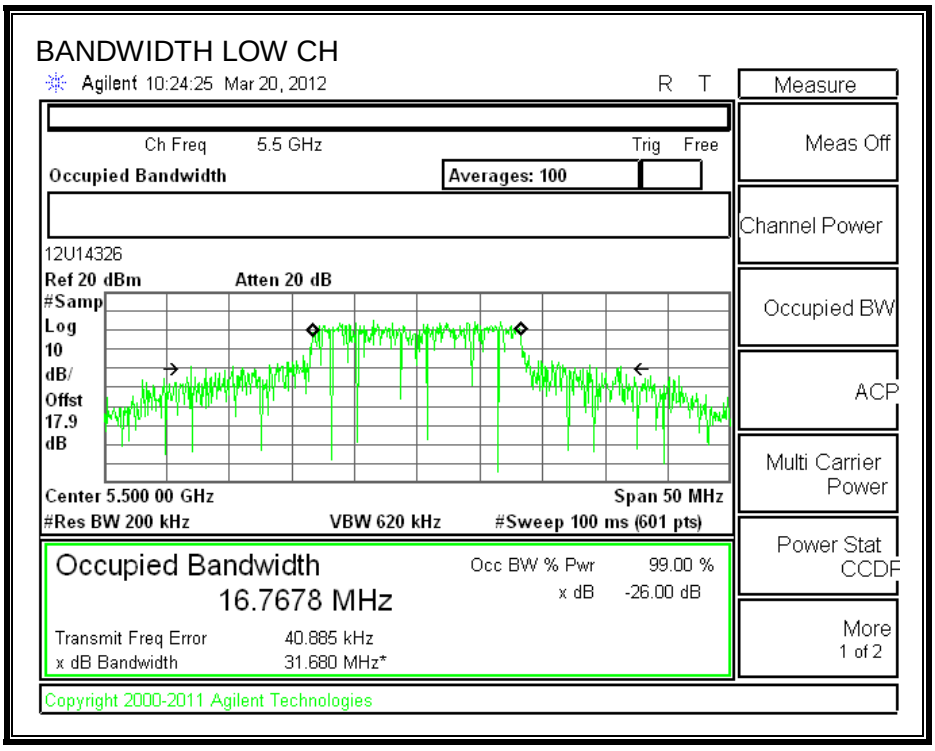
LIMITS

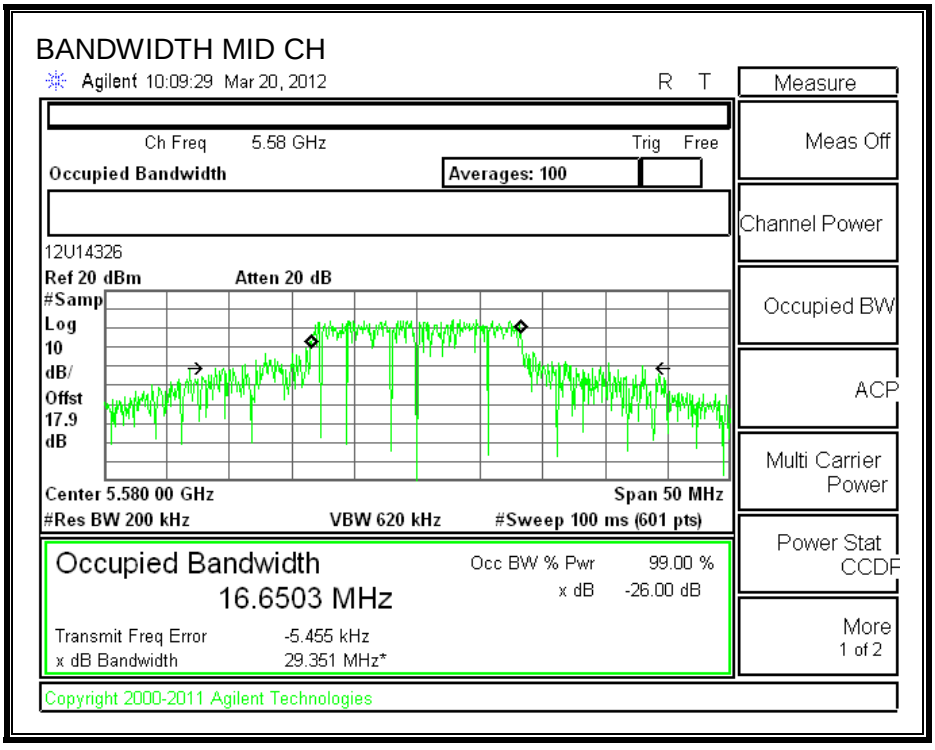
None; for reporting purposes only.

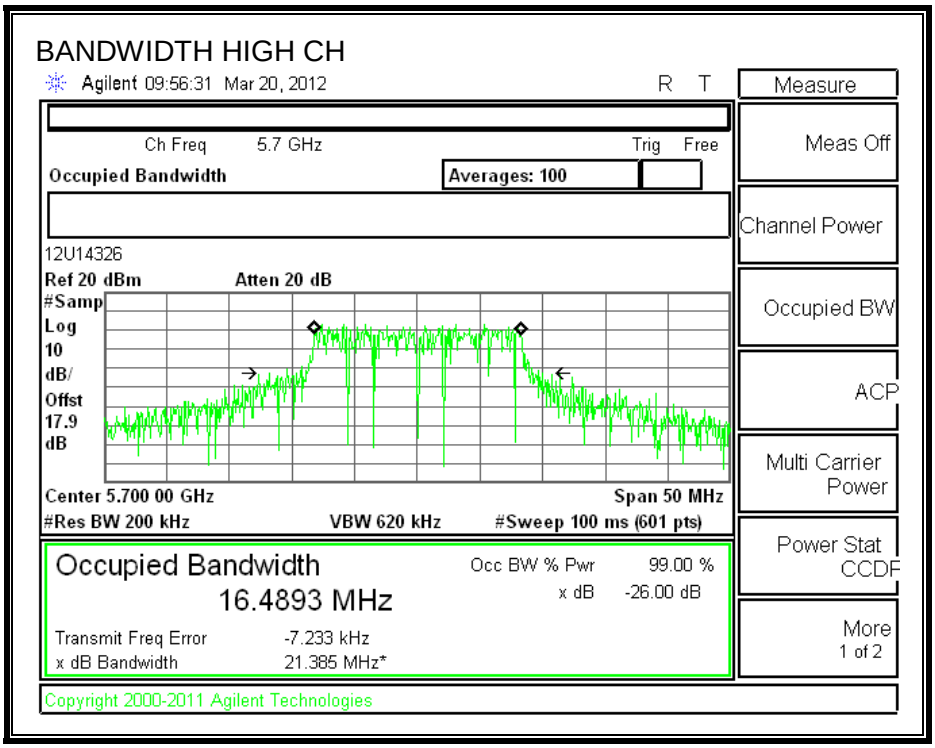
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5500	16.7678	16.6220
Mid	5580	16.6503	16.6646
High	5700	16.4893	16.4984

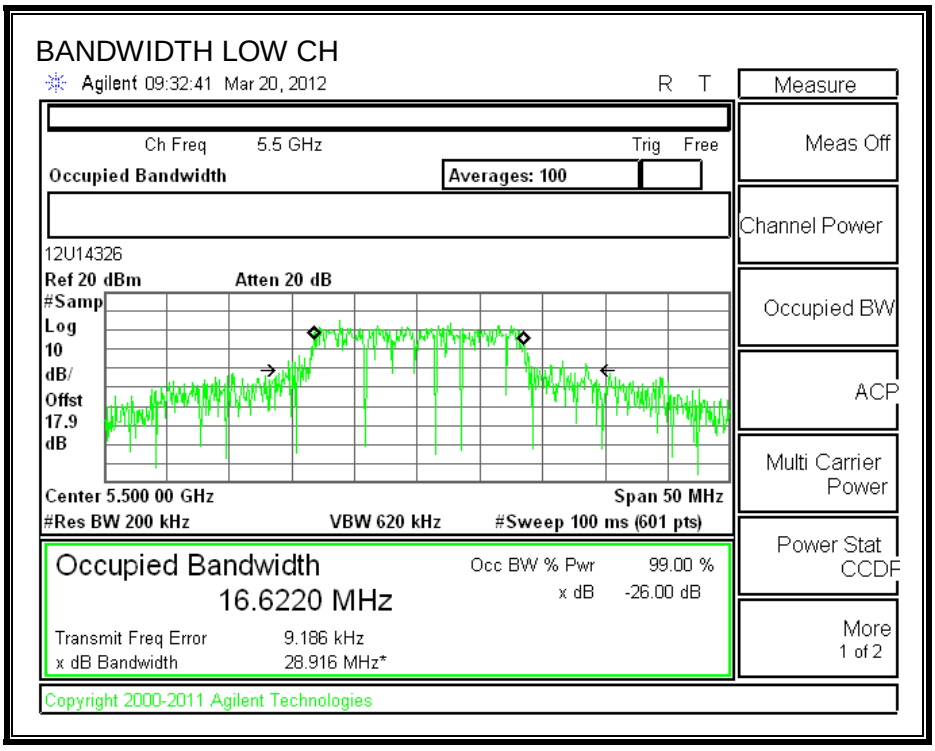
99% BANDWIDTH CHAIN 0

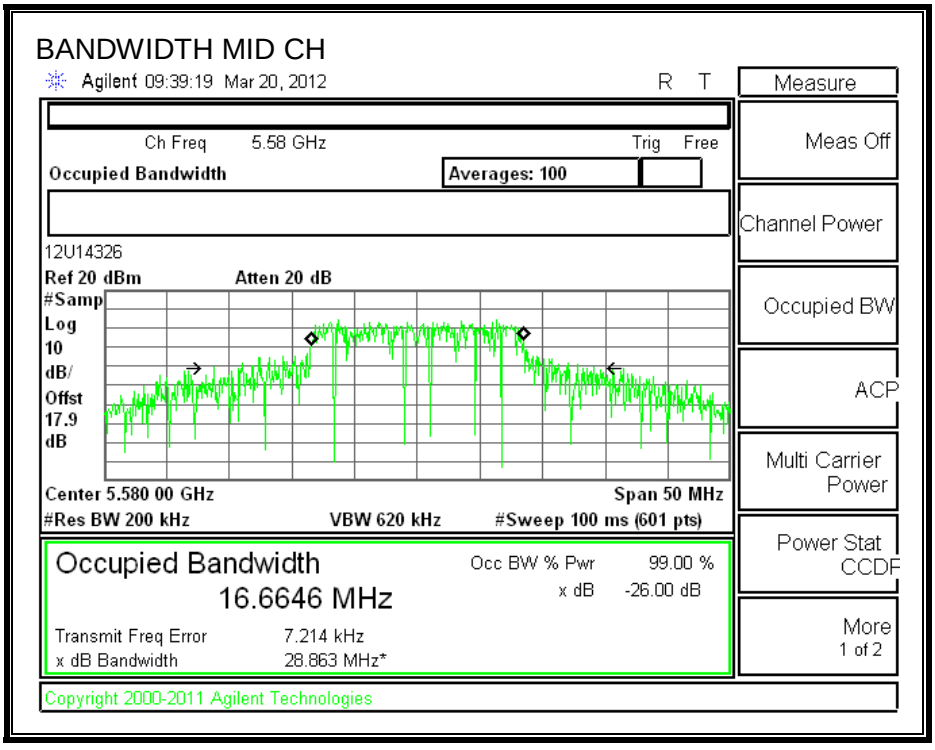


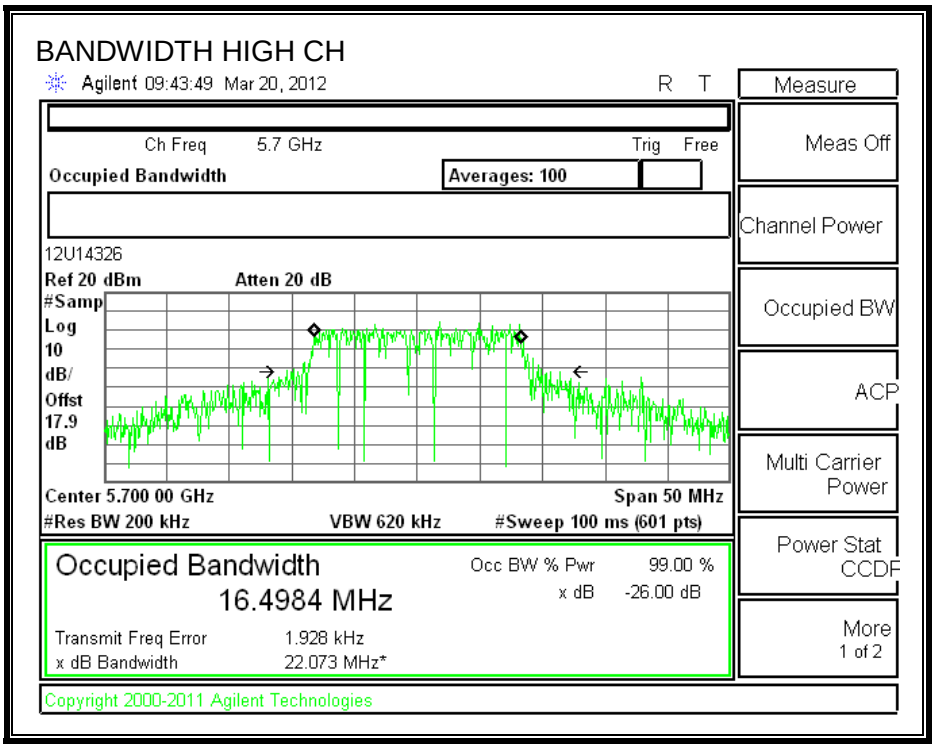




99% BANDWIDTH CHAIN 1







7.8.3. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (3)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
3.09	3.28	6.20

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5500	24	40.67	27.09	6.20	23.80	10.80
Mid	5580	24	39.08	26.92	6.20	23.80	10.80
High	5700	24	25.92	25.14	6.20	23.80	10.80

Output Power Results

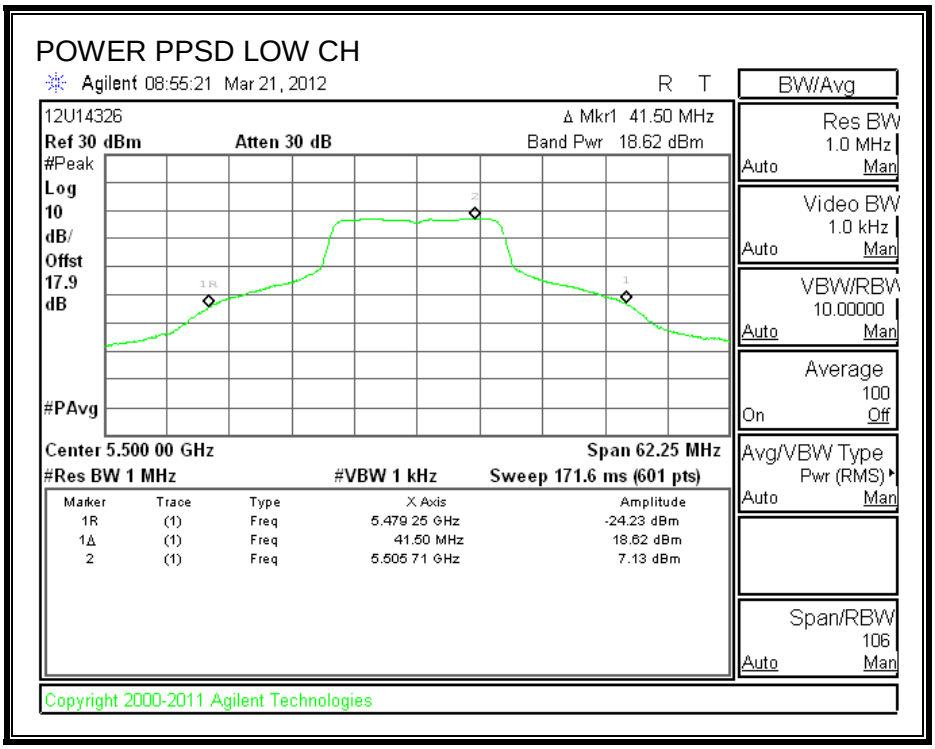
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	18.62	17.34	21.04	23.80	-2.76
Mid	5580	19.61	18.22	21.98	23.80	-1.82
High	5700	16.52	16.27	19.40	23.80	-4.40

PPSD Results

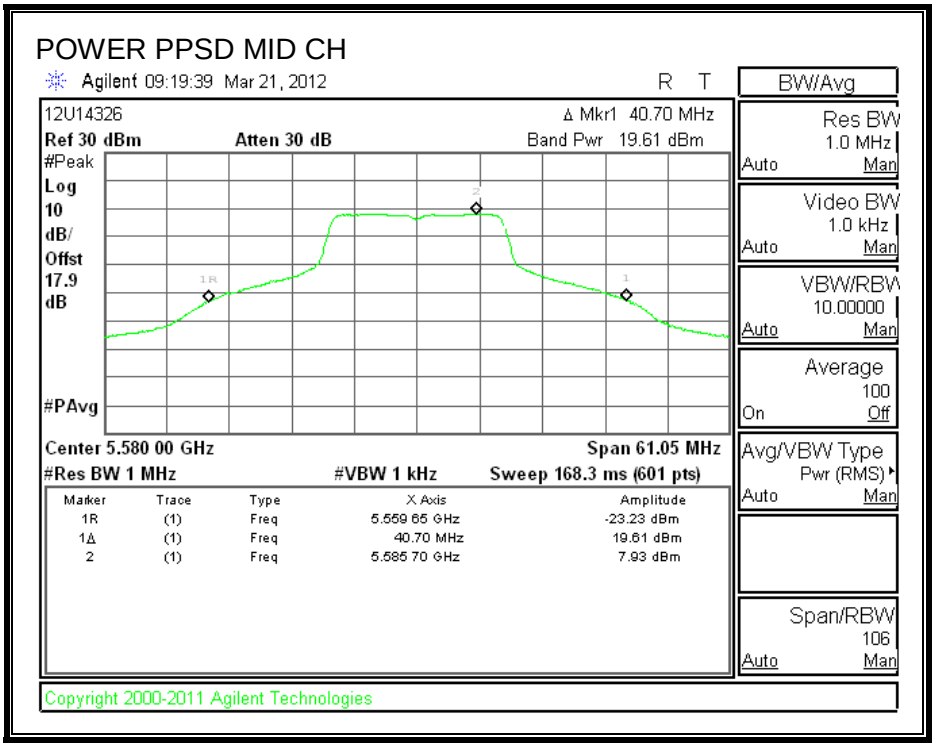
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5500	7.13	5.79	9.52	10.80	-1.28
Mid	5580	7.93	6.61	10.33	10.80	-0.47
High	5700	4.98	4.61	7.81	10.80	-2.99

OUTPUT POWER AND PPSD CHAIN 0

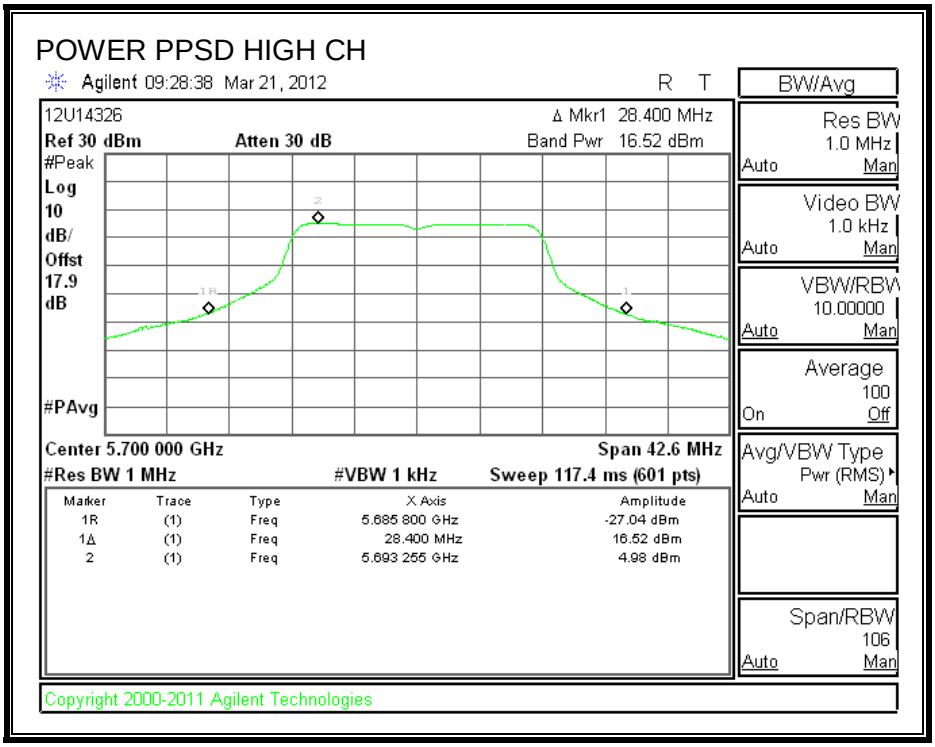
POWER PPSD LOW CH



POWER PPSD MID CH

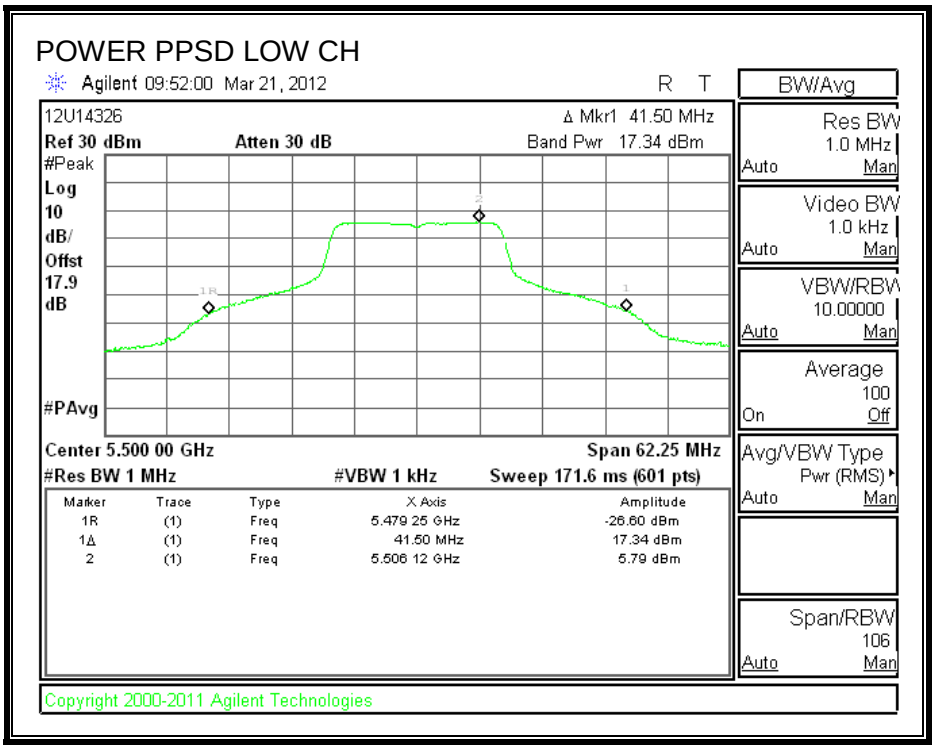


POWER PPSD HIGH CH

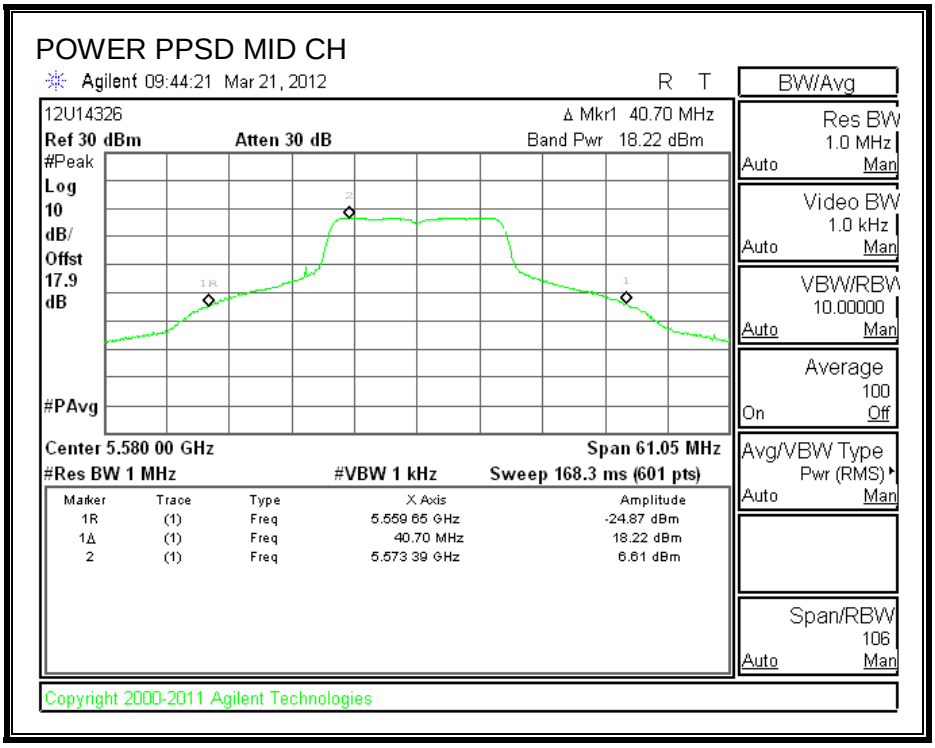


OUTPUT POWER AND PPSD CHAIN 1

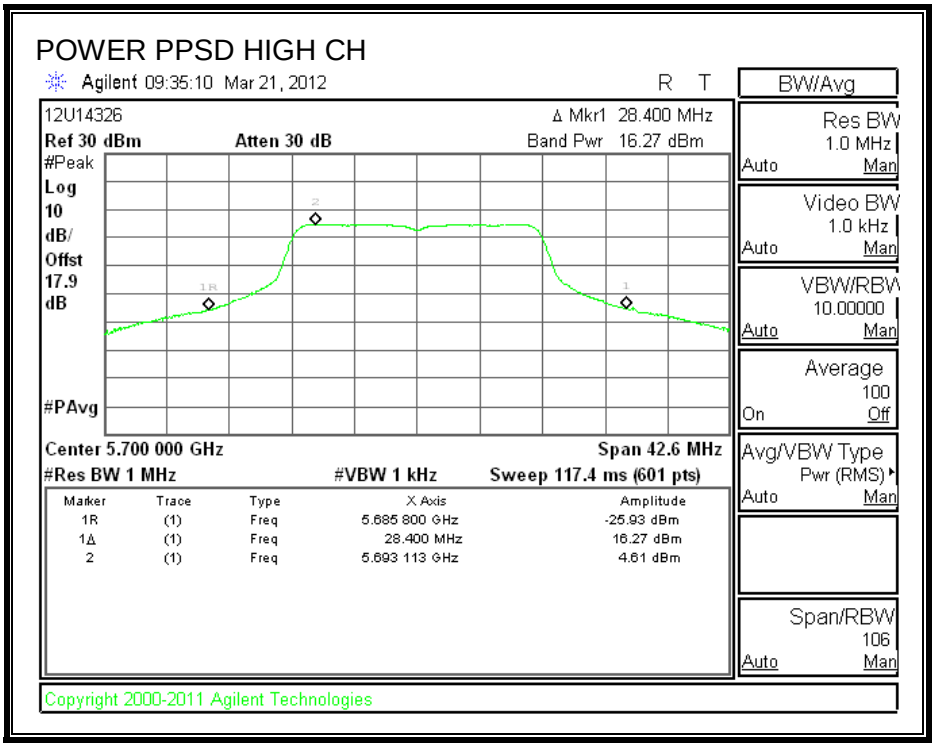
POWER PPSD LOW CH



POWER PPSD MID CH



POWER PPSD HIGH CH



7.8.4. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

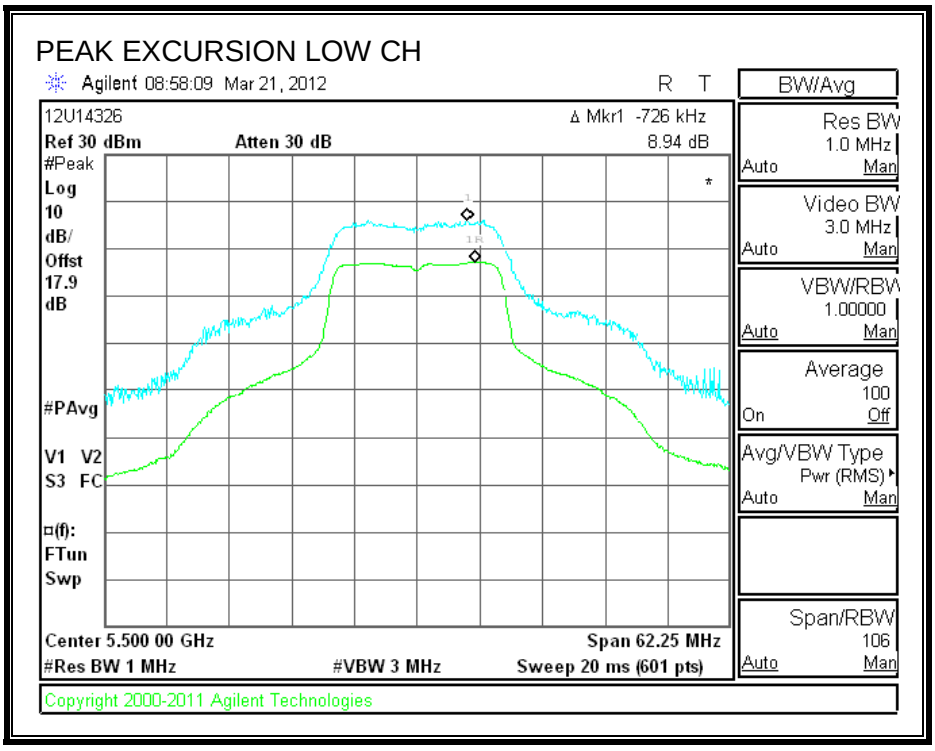
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

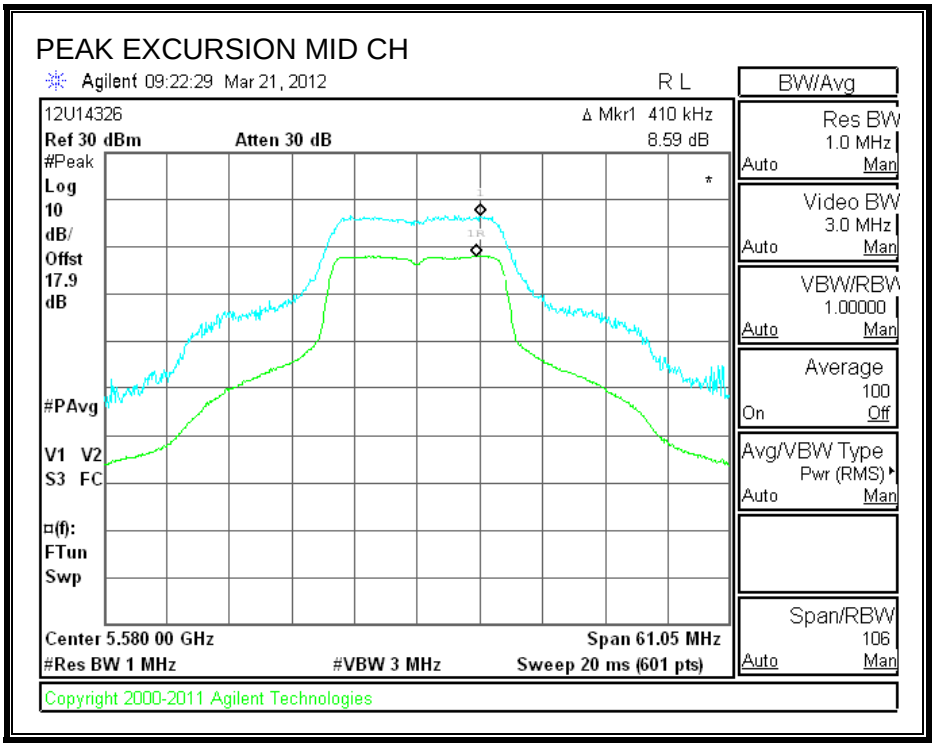
Channel	Frequency (MHz)	Pk Exc Chain 0 (dB)	Pk Exc Chain 1 (dB)	Limit (dB)	Worst-Case Margin (dB)
Low	5500	8.94	9.77	13	-3.2
Mid	5580	8.59	10.03	13	-3.0
High	5700	8.86	10.51	13	-2.5

PEAK EXCURSION CHAIN 0

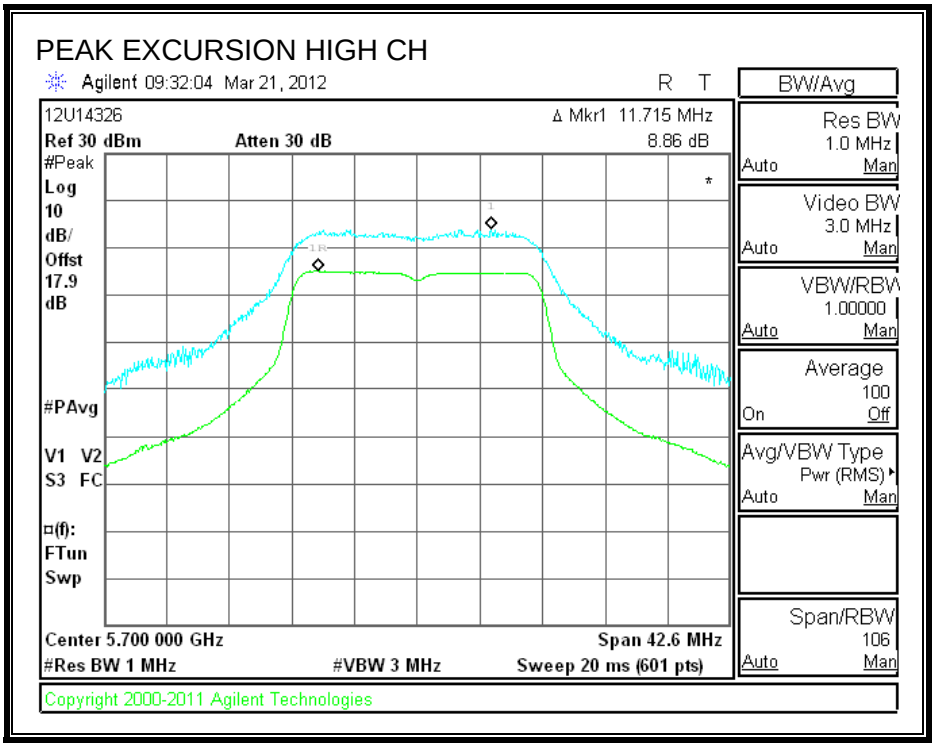
PEAK EXCURSION LOW CH



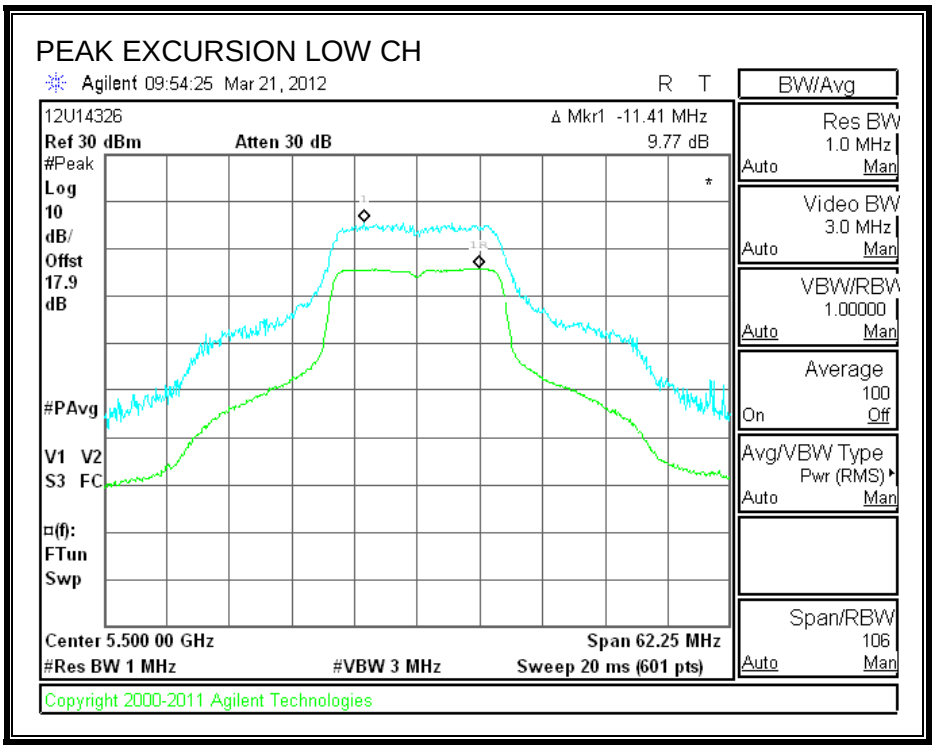
PEAK EXCURSION MID CH

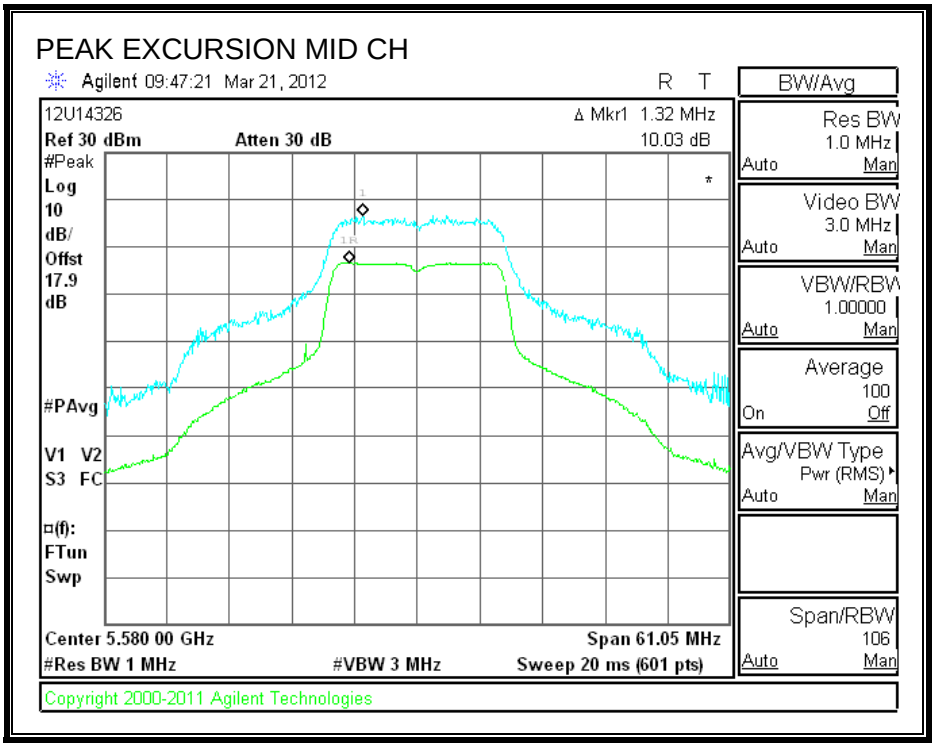


PEAK EXCURSION HIGH CH

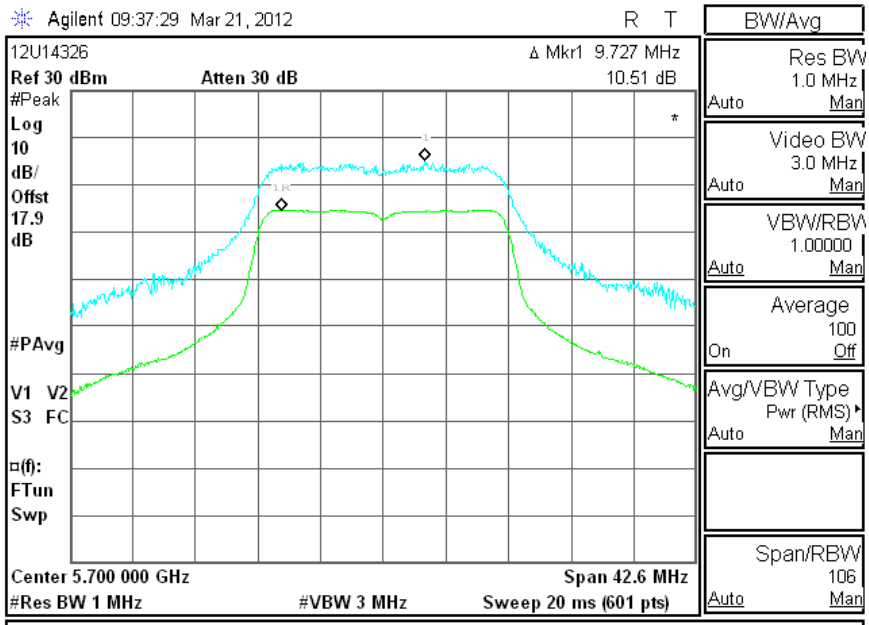


PEAK EXCURSION CHAIN 1





PEAK EXCURSION HIGH CH



7.9. 802.11n HT20 MODE IN THE 5.6 GHz BAND

7.9.1. 26 dB BANDWIDTH

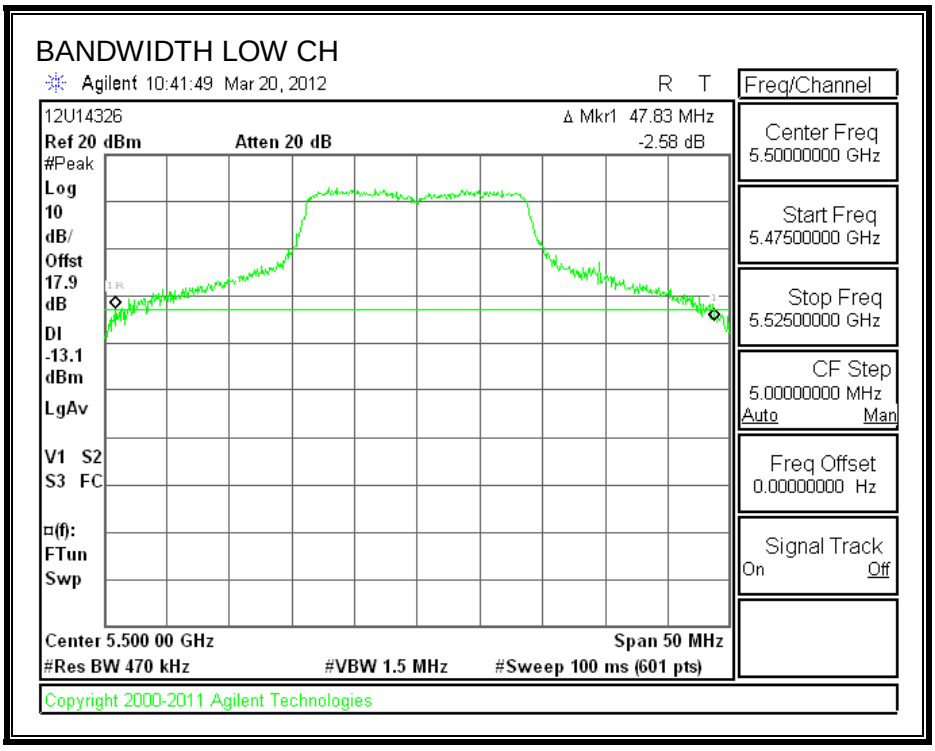
LIMITS

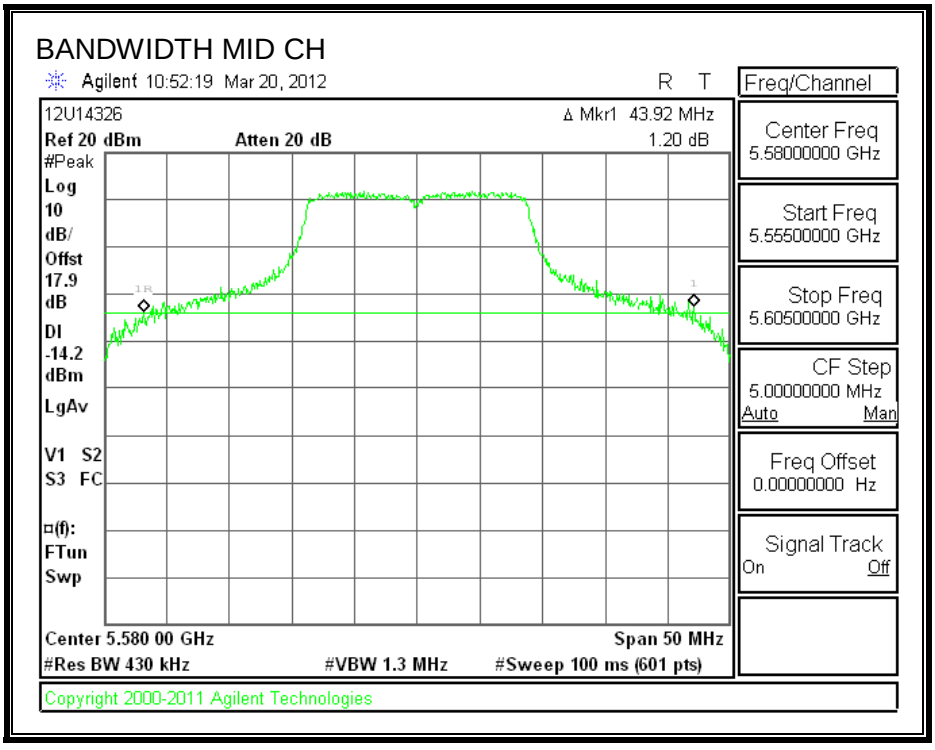
None; for reporting purposes only.

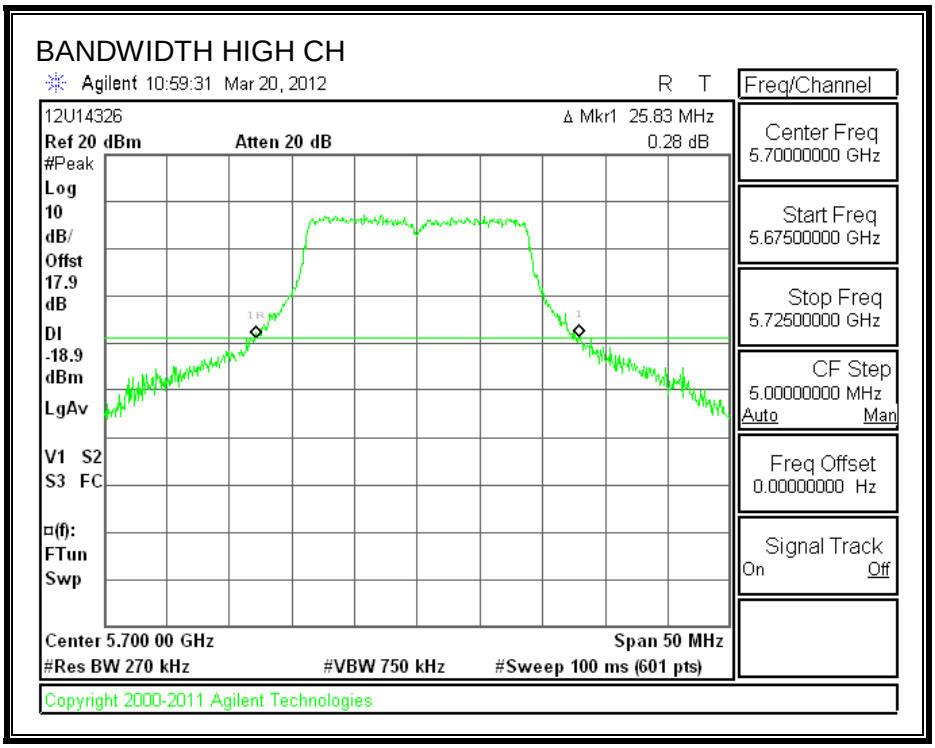
RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5500	47.83	45.83
Mid	5580	43.92	44.83
High	5700	25.83	36.67

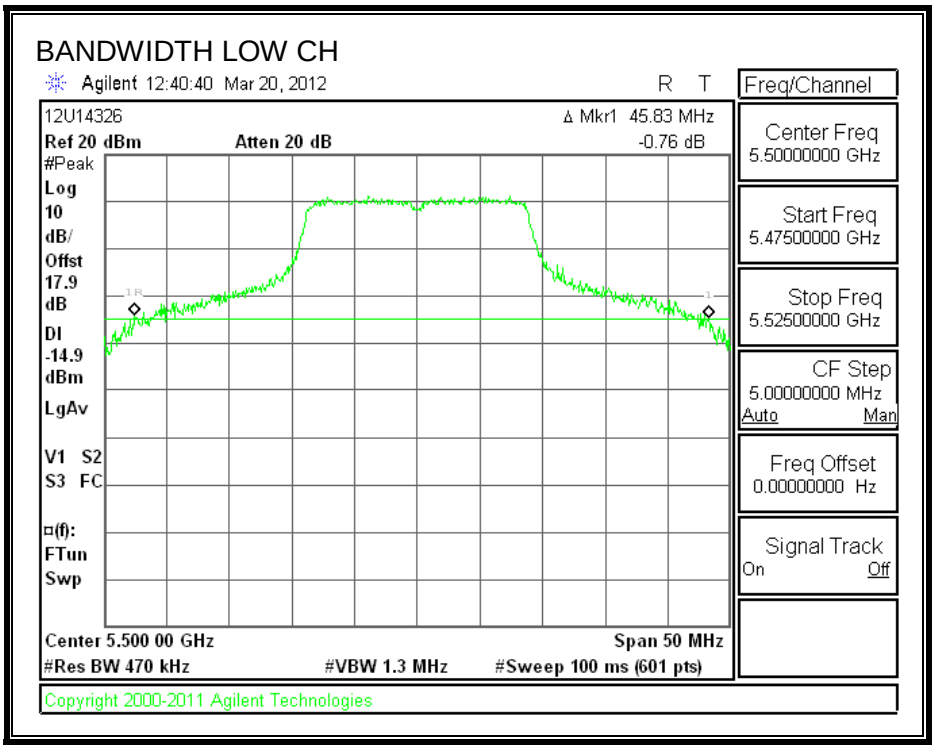
26 dB BANDWIDTH CHAIN 0

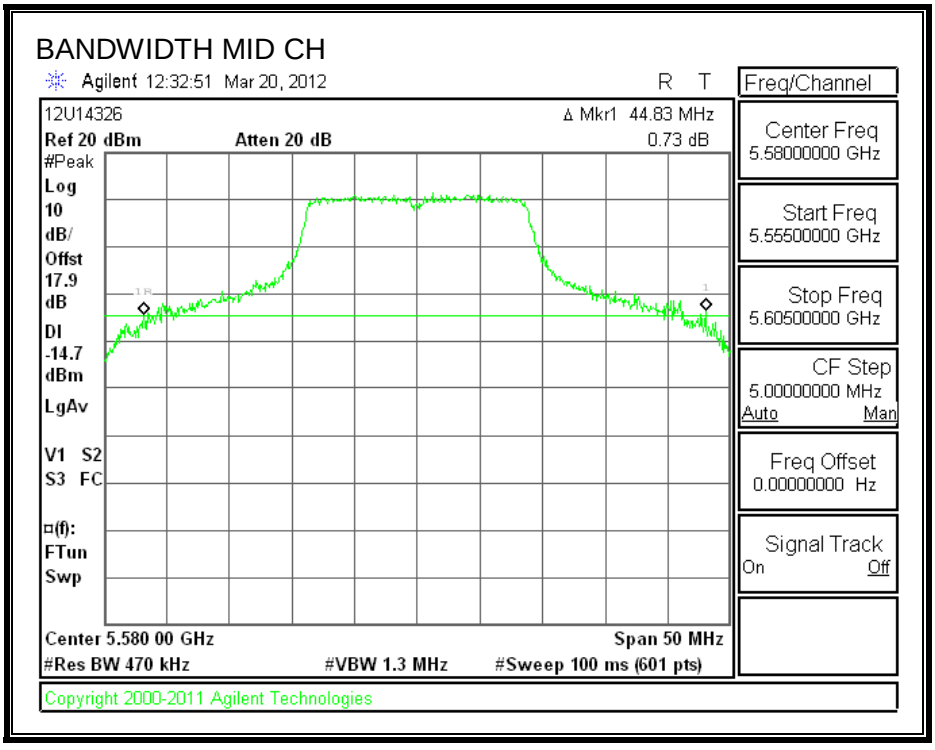




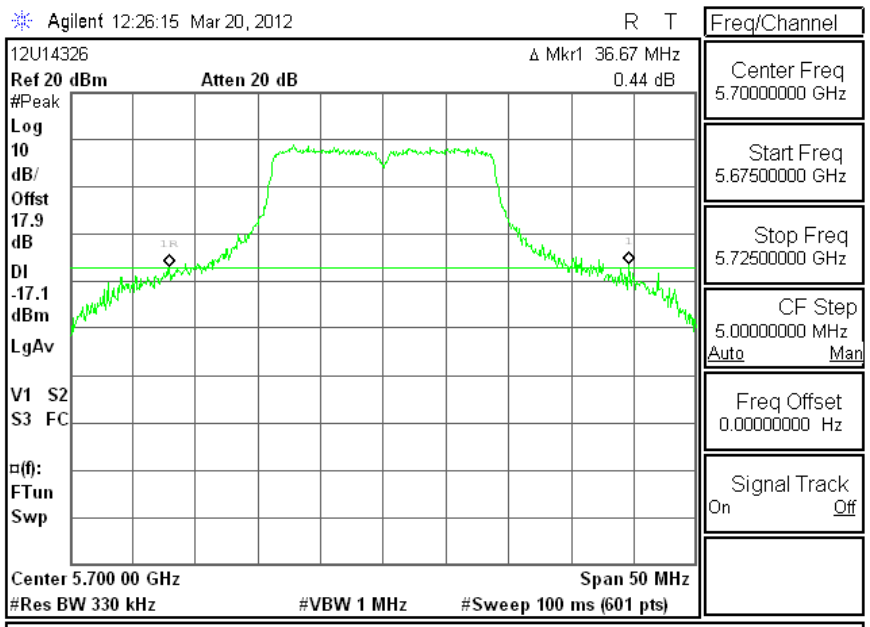


26 dB BANDWIDTH CHAIN 1





BANDWIDTH HIGH CH



7.9.2. 99% BANDWIDTH

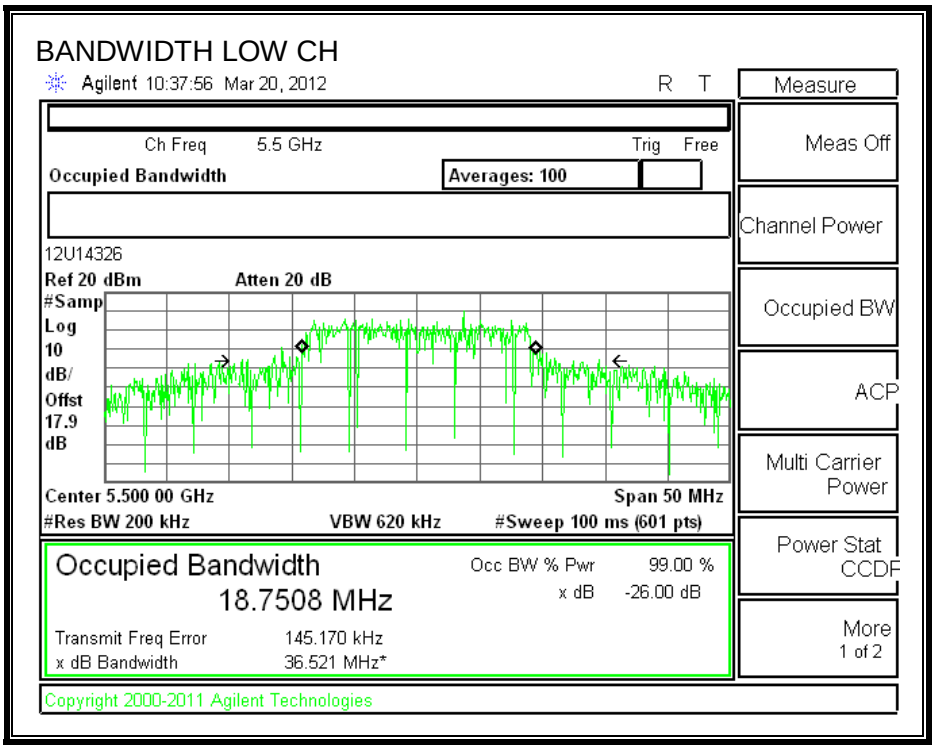
LIMITS

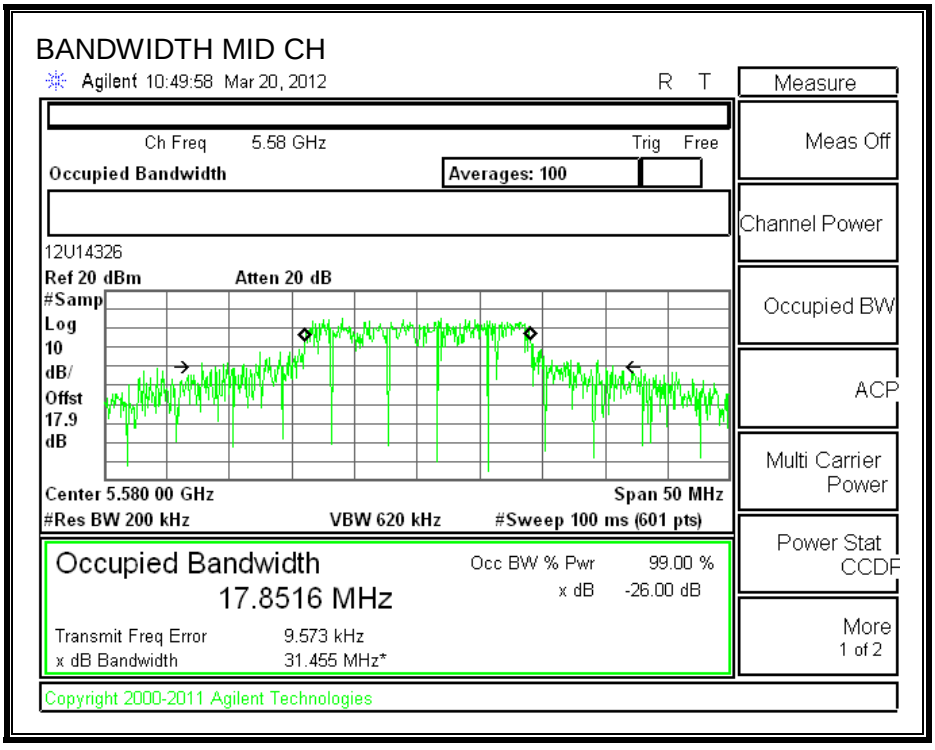
None; for reporting purposes only.

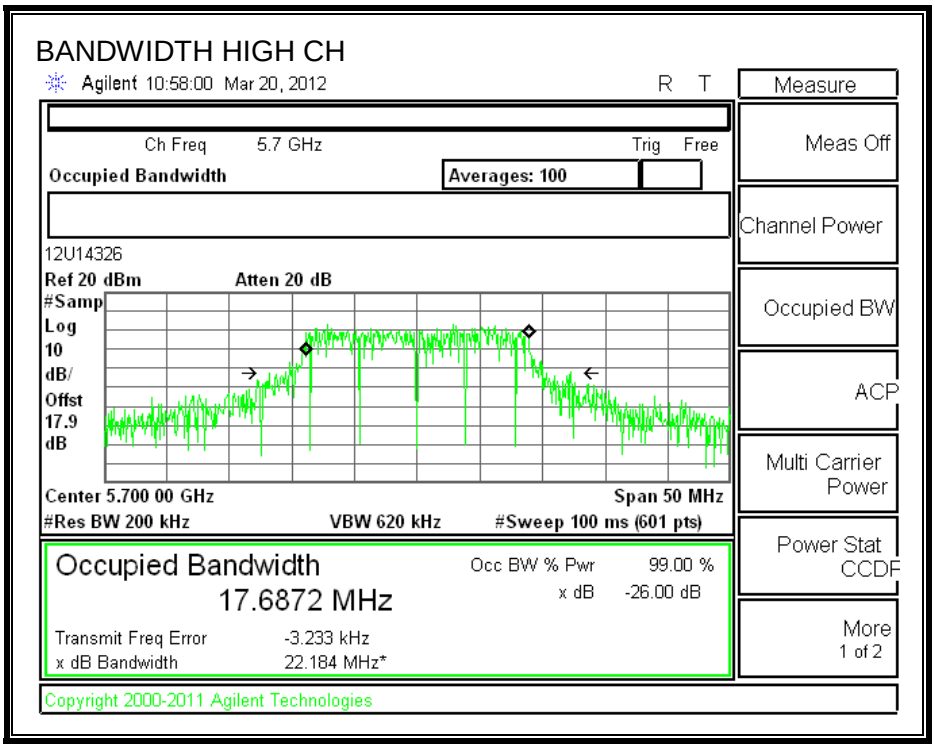
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5500	18.7508	17.9687
Mid	5580	17.8516	17.8484
High	5700	17.6872	17.7279

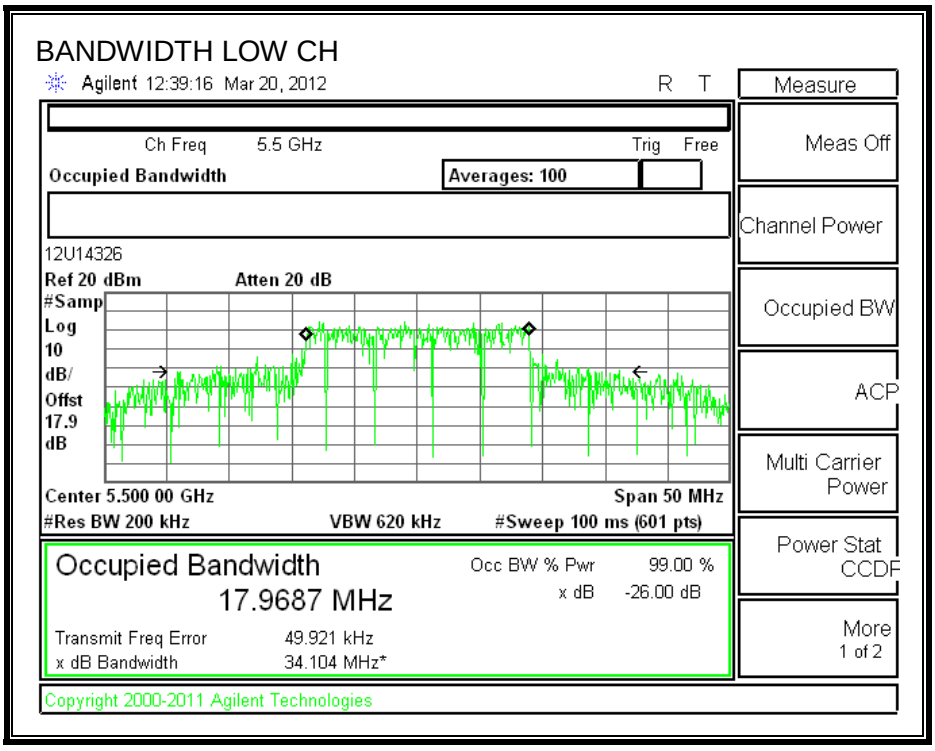
99% BANDWIDTH CHAIN 0

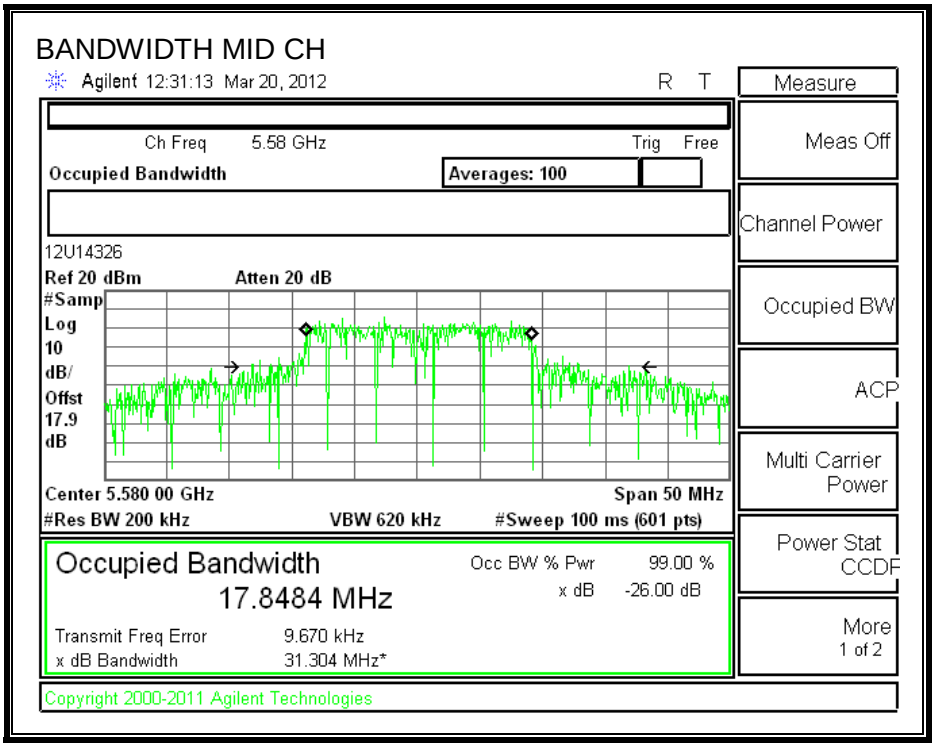


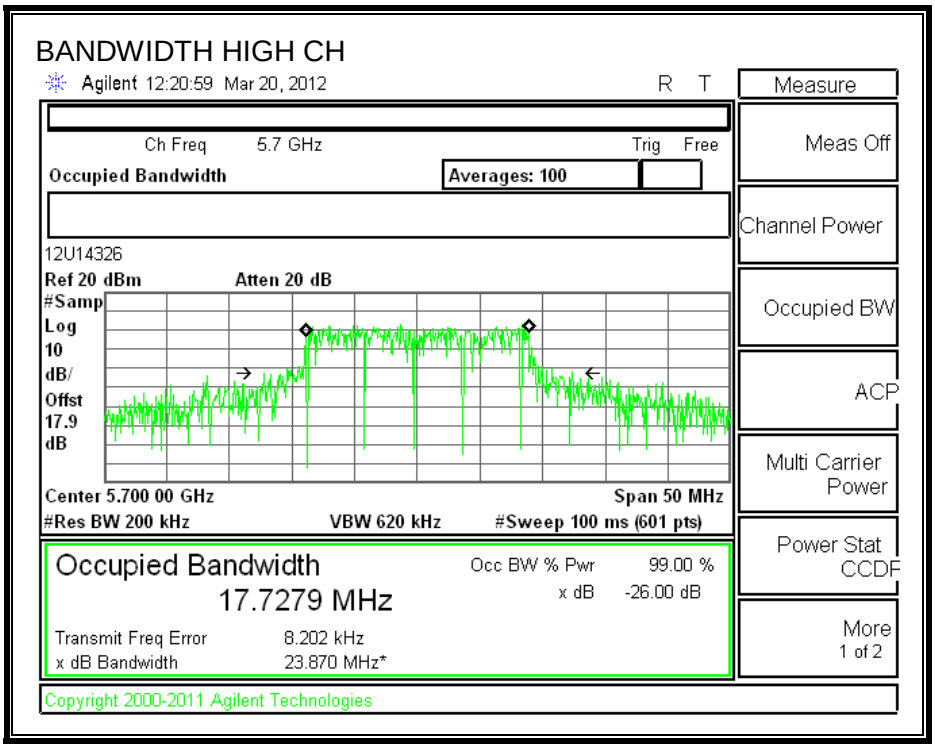




99% BANDWIDTH CHAIN 1







7.9.3. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (3)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.09	3.28	3.19

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5500	24	45.83	27.61	3.19	24.00	11.00
Mid	5580	24	43.92	27.43	3.19	24.00	11.00
High	5700	24	25.83	25.12	3.19	24.00	11.00

Output Power Results

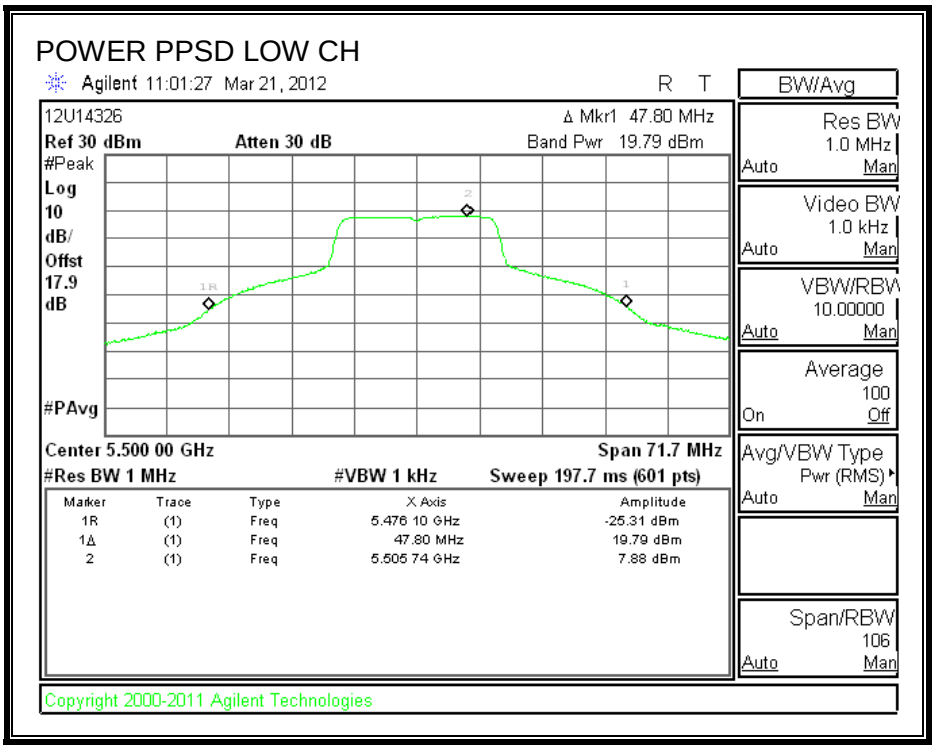
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	19.79	18.08	22.03	24.00	-1.97
Mid	5580	19.60	18.48	22.08	24.00	-1.92
High	5700	16.66	17.04	19.86	24.00	-4.14

PPSD Results

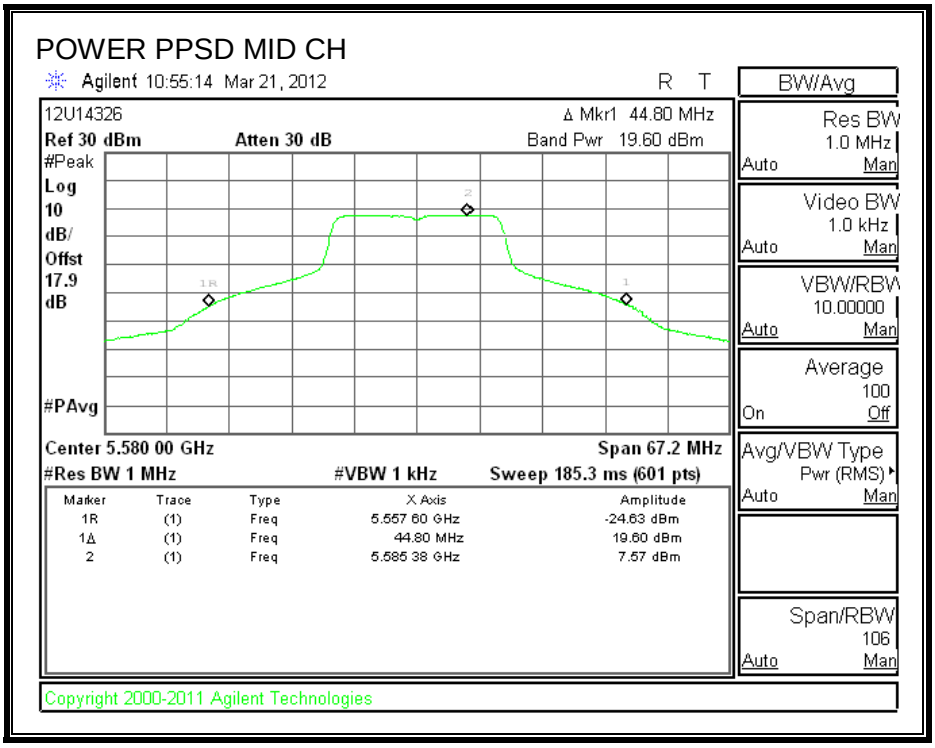
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5500	7.88	6.14	10.11	11.00	-0.89
Mid	5580	7.57	6.55	10.10	11.00	-0.90
High	5700	5.18	5.10	8.15	11.00	-2.85

OUTPUT POWER AND PPSD CHAIN 0

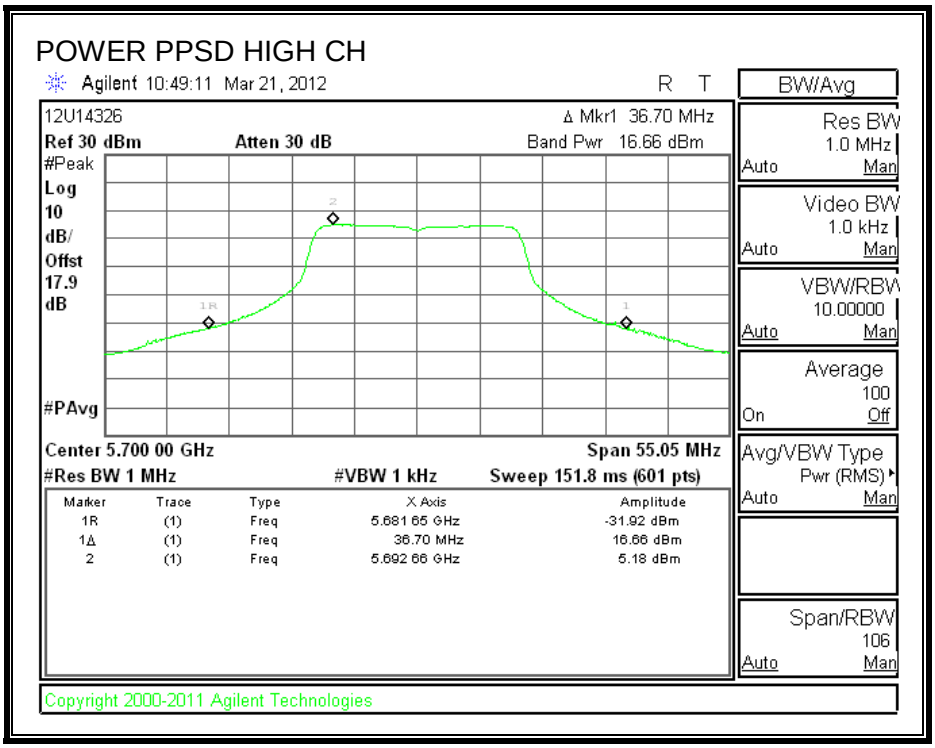
POWER PPSD LOW CH



POWER PPSD MID CH

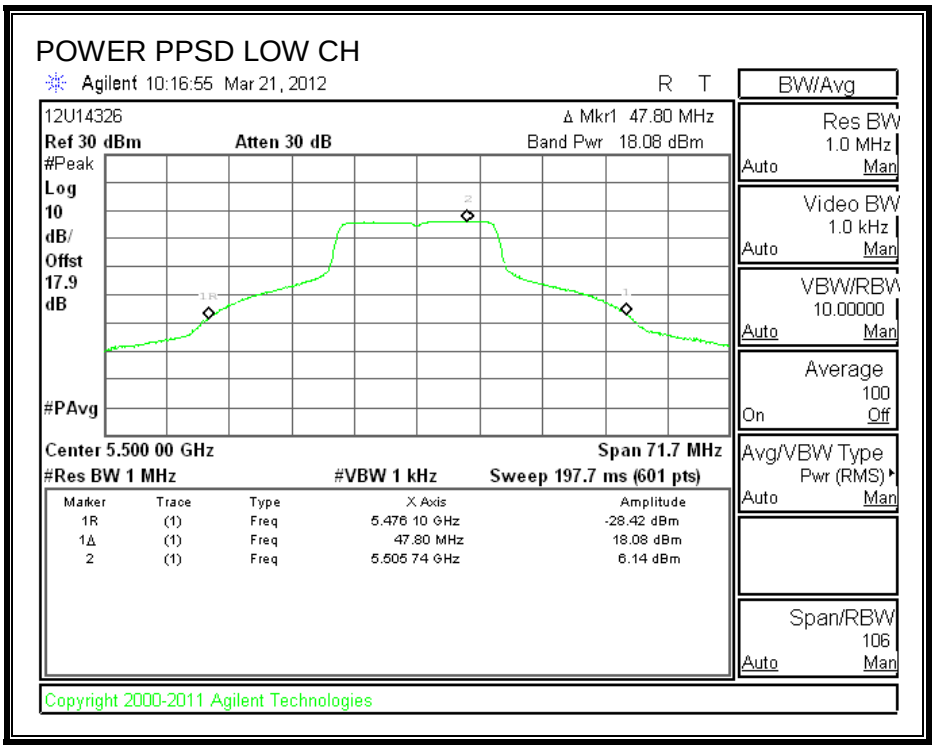


POWER PPSD HIGH CH

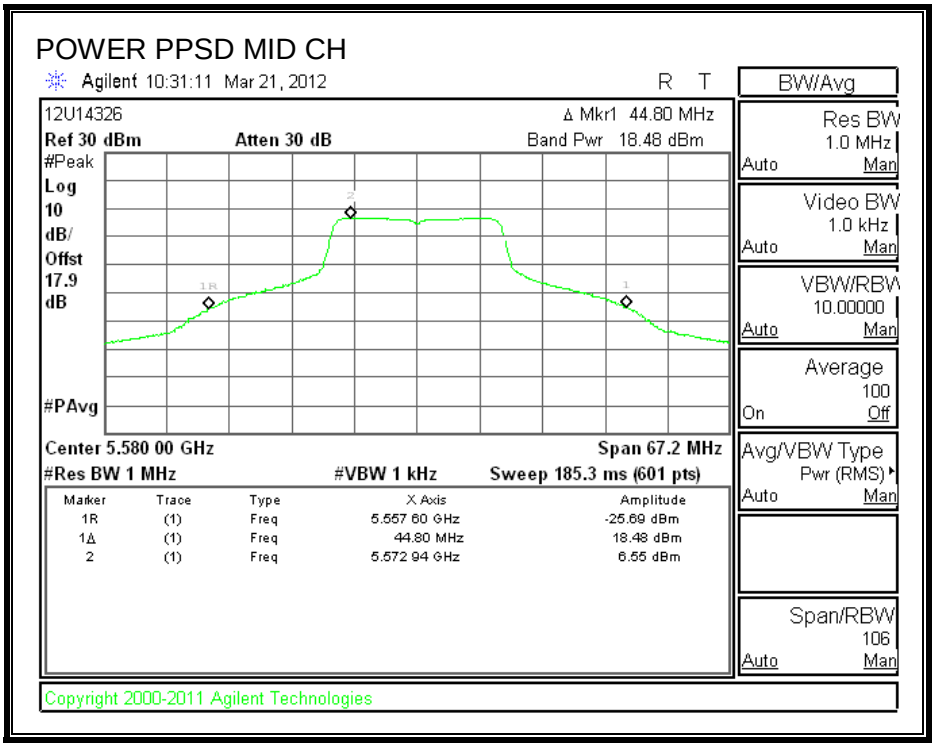


OUTPUT POWER AND PPSD CHAIN 1

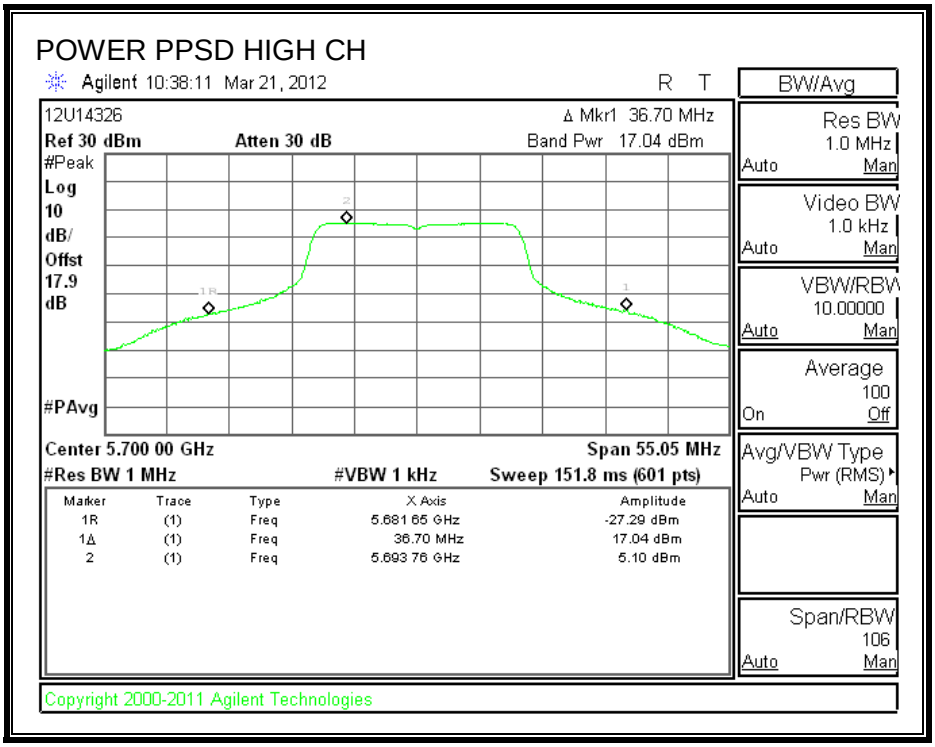
POWER PPSD LOW CH



POWER PPSD MID CH



POWER PPSD HIGH CH



7.9.4. PEAK EXCURSION

LIMITS

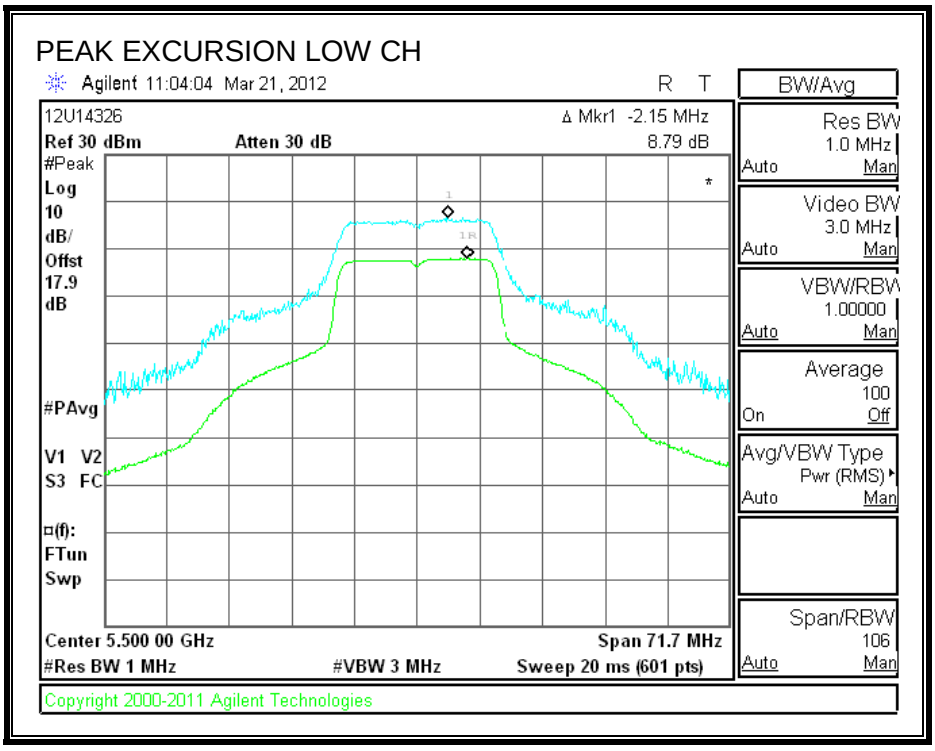
FCC §15.407 (a) (6)

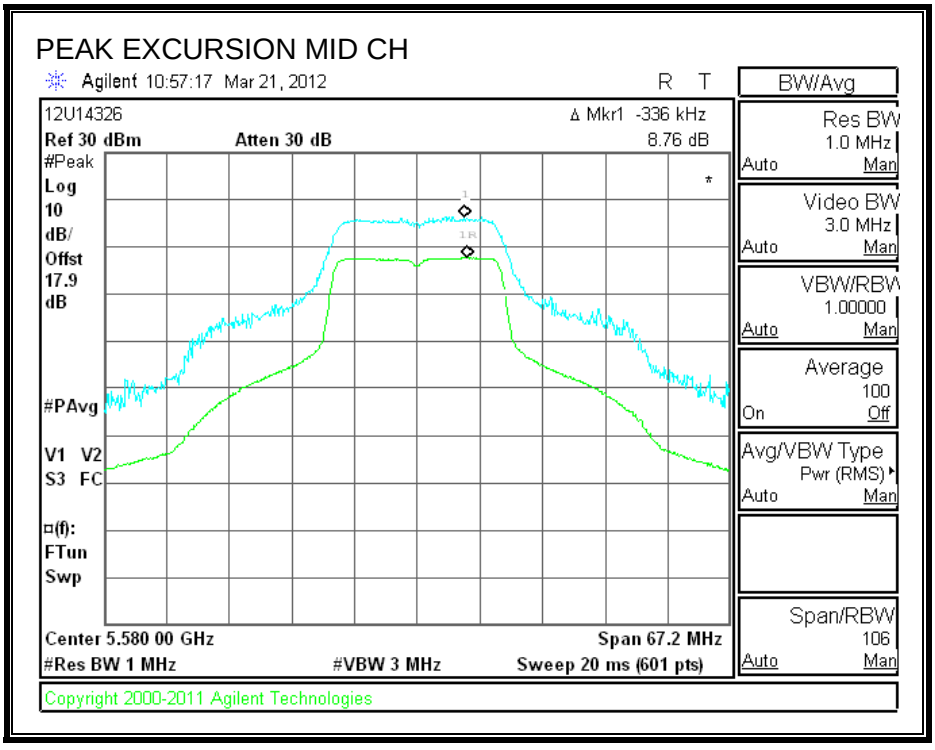
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

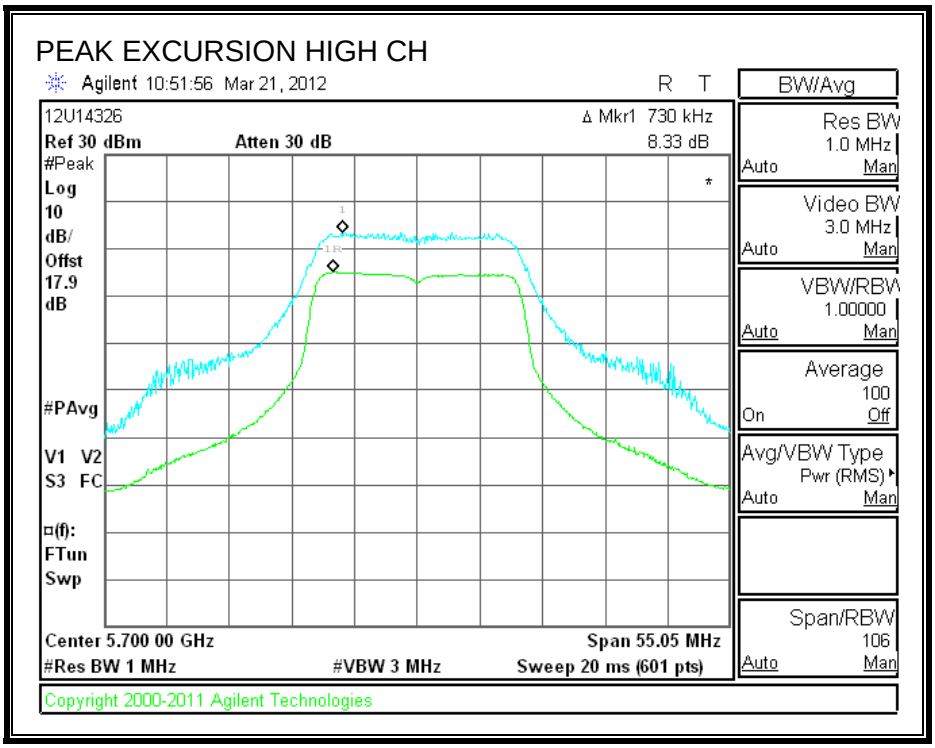
Channel	Frequency (MHz)	Pk Exc Chain 0 (dB)	Pk Exc Chain 1 (dB)	Limit (dB)	Worst-Case Margin (dB)
Low	5500	8.79	8.85	13	-4.2
Mid	5580	8.76	8.81	13	-4.2
High	5700	8.33	8.59	13	-4.4

PEAK EXCURSION CHAIN 0

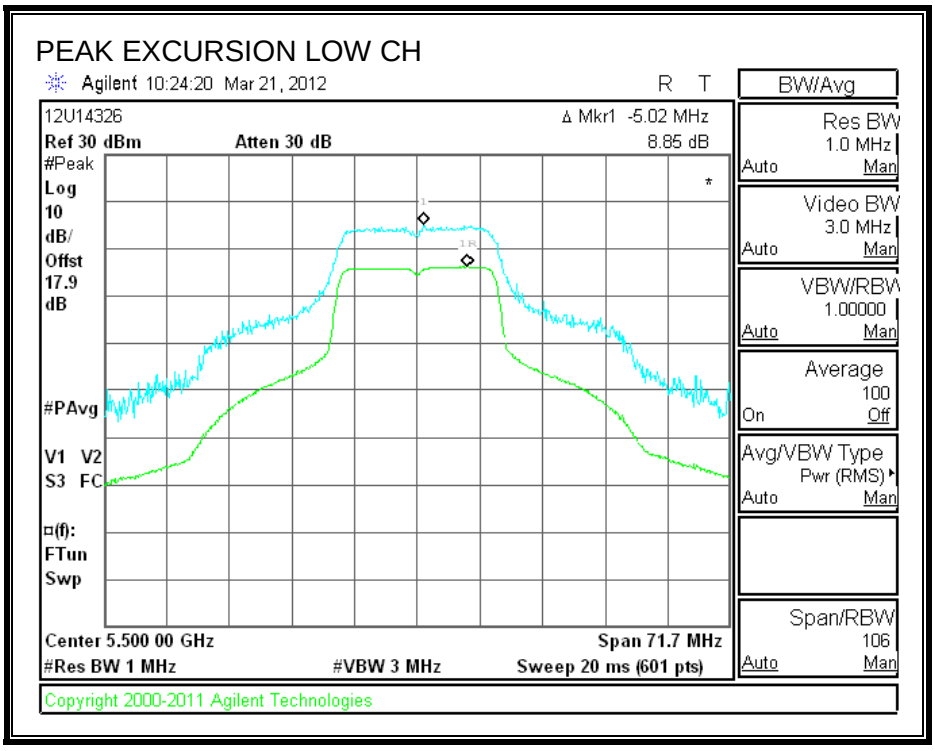


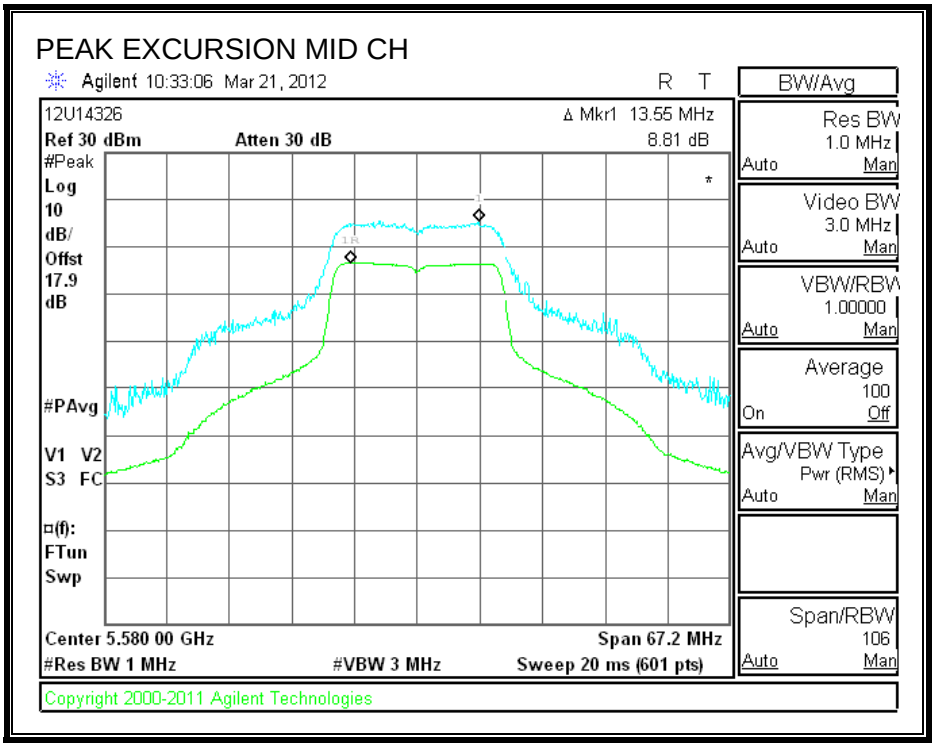


PEAK EXCURSION HIGH CH

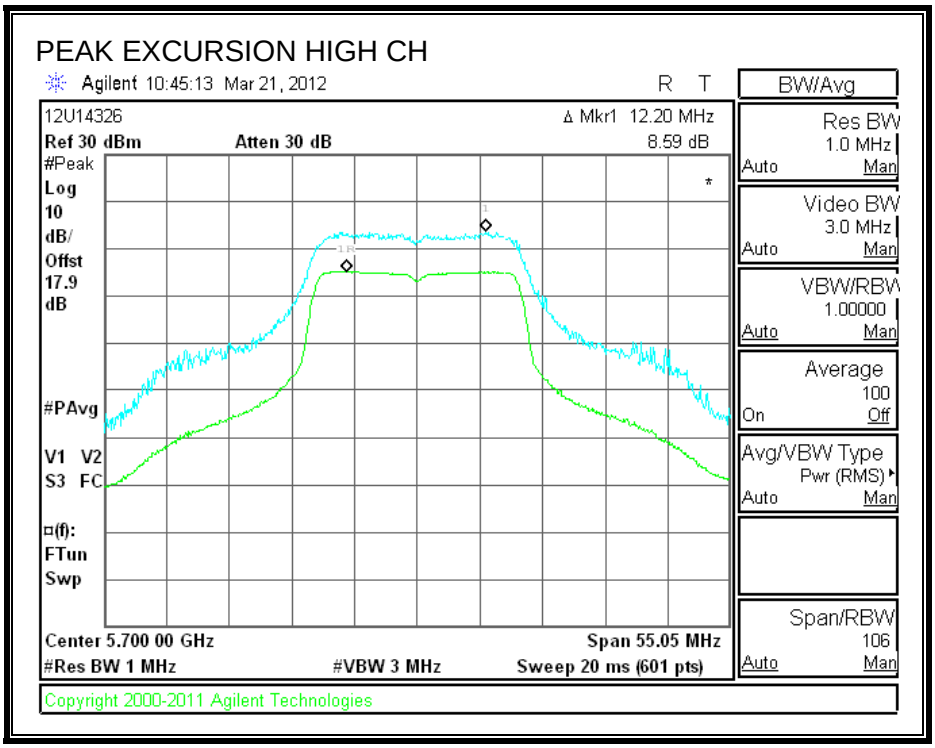


PEAK EXCURSION CHAIN 1





PEAK EXCURSION HIGH CH



7.10. 802.11n HT40 MODE IN THE 5.6 GHz BAND

7.10.1. 26 dB BANDWIDTH

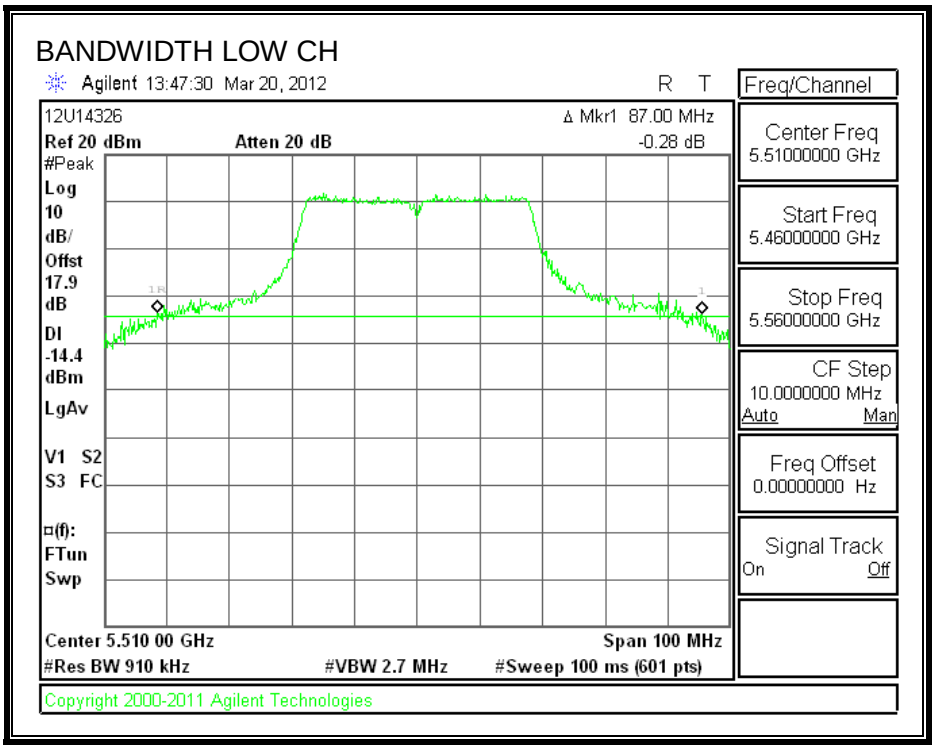
LIMITS

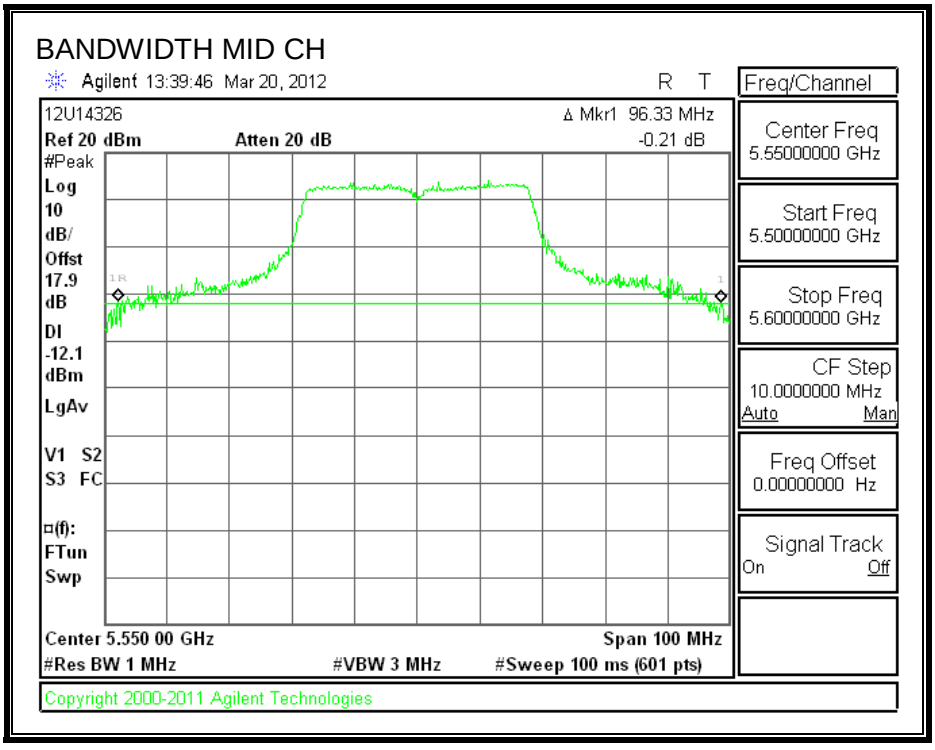
None; for reporting purposes only.

RESULTS

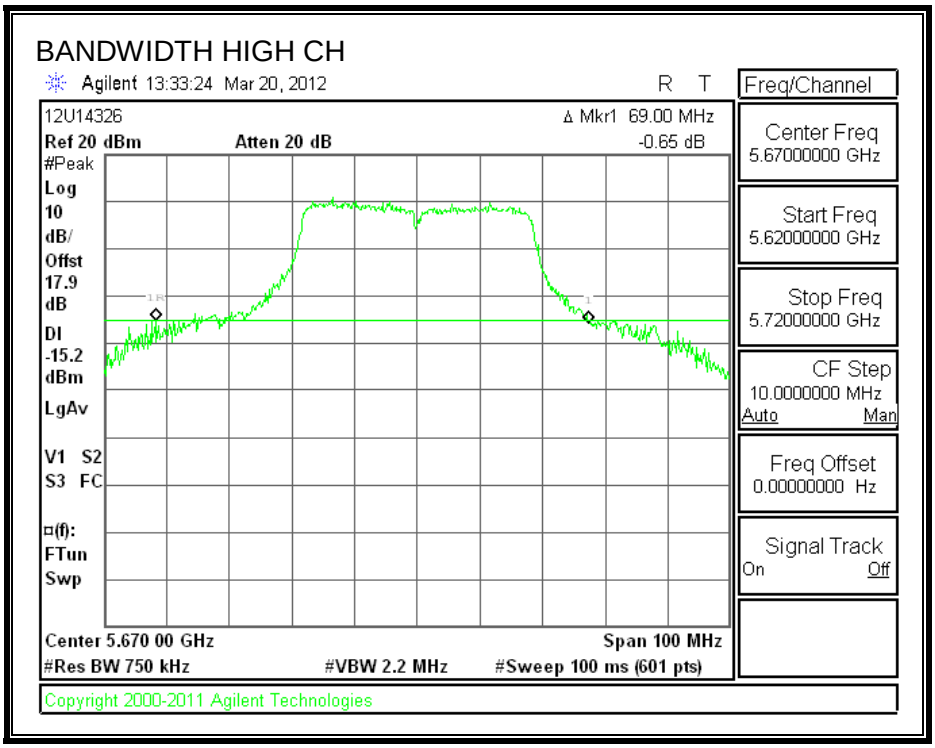
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5510	87.00	83.50
Mid	5550	96.33	88.67
High	5670	69.00	85.83

26 dB BANDWIDTH CHAIN 0

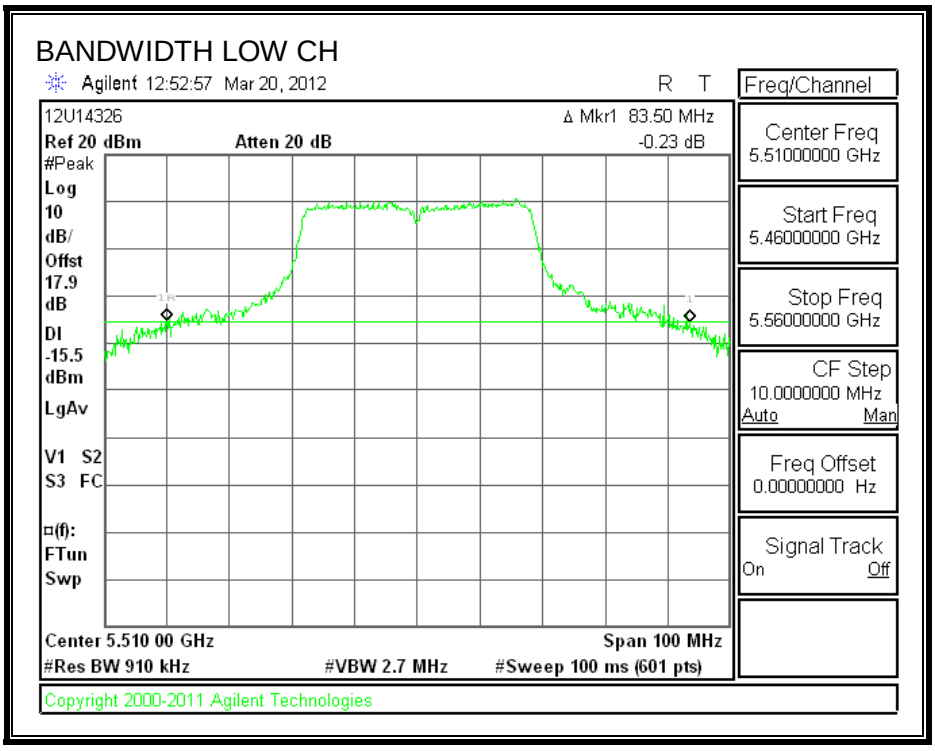


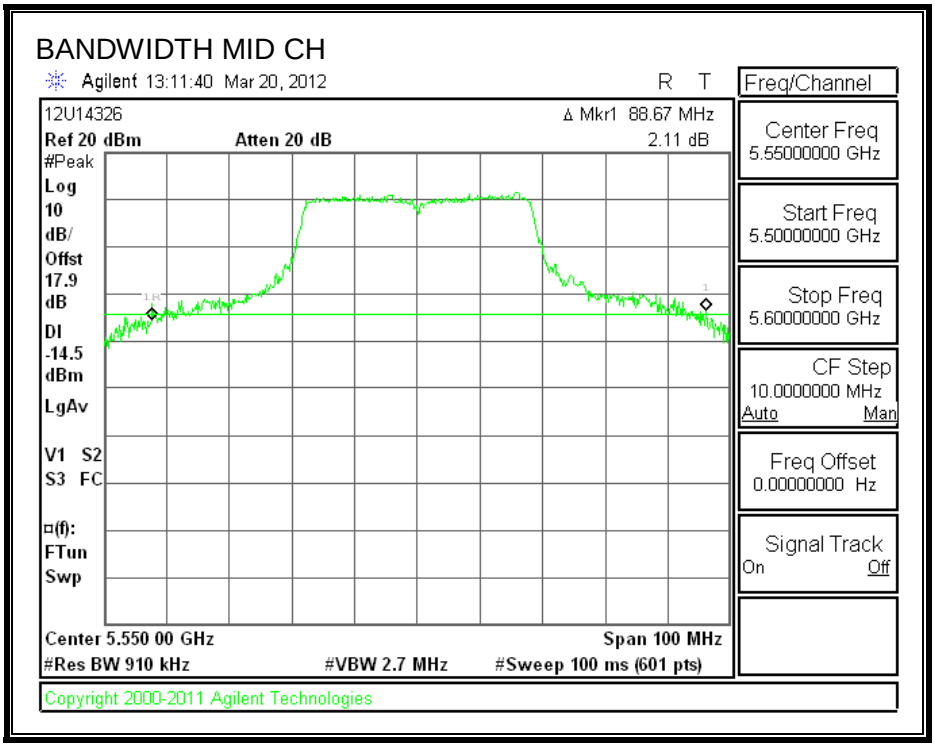


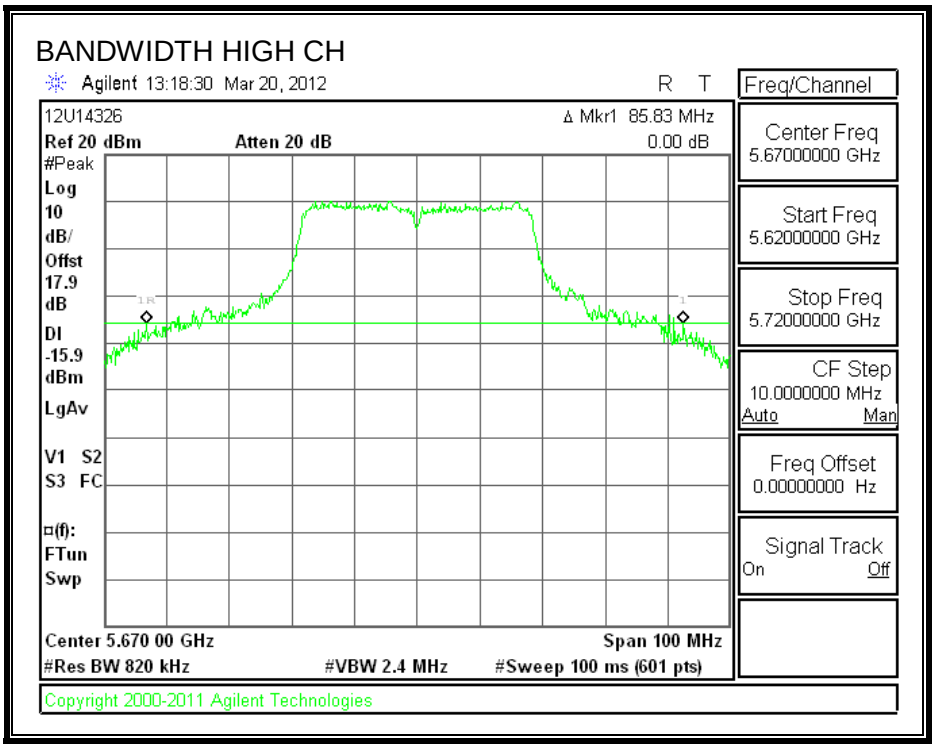
BANDWIDTH HIGH CH



26 dB BANDWIDTH CHAIN 1







7.10.2. 99% BANDWIDTH

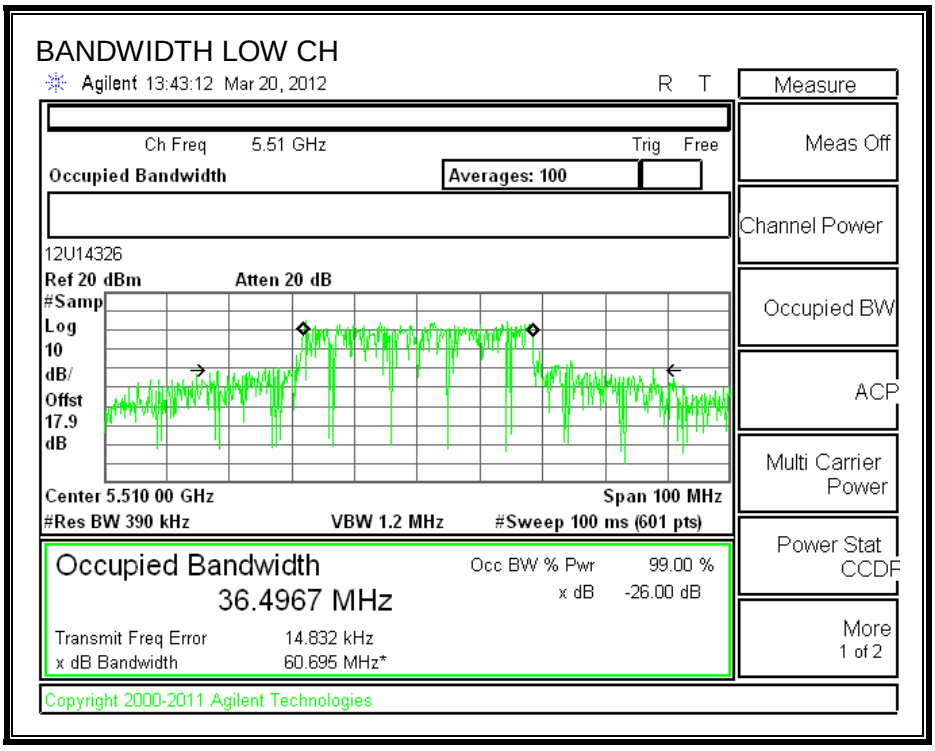
LIMITS

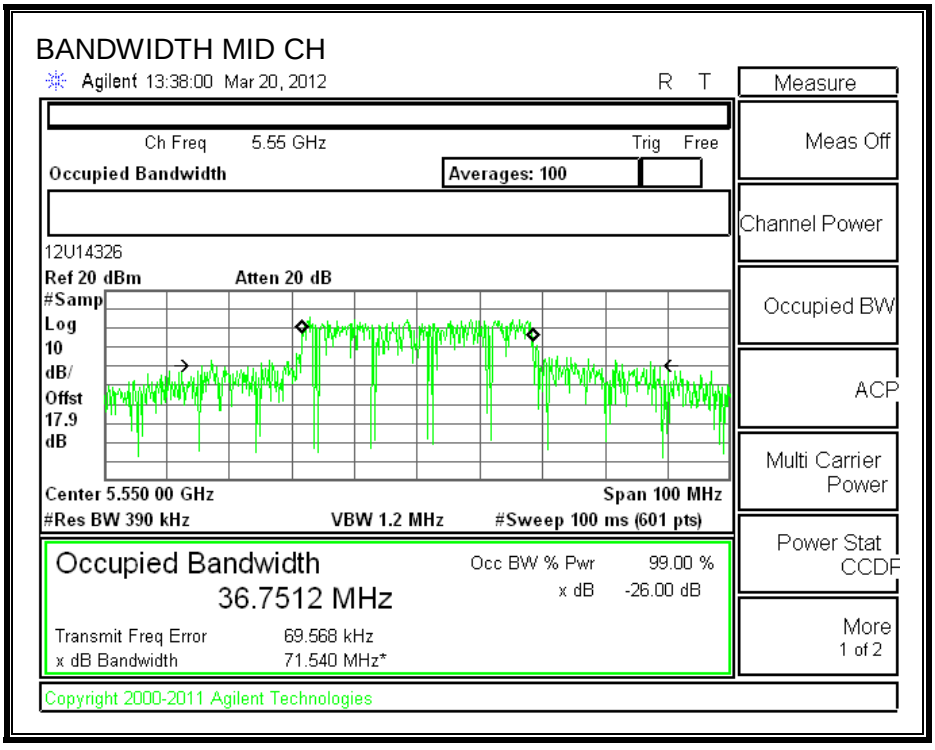
None; for reporting purposes only.

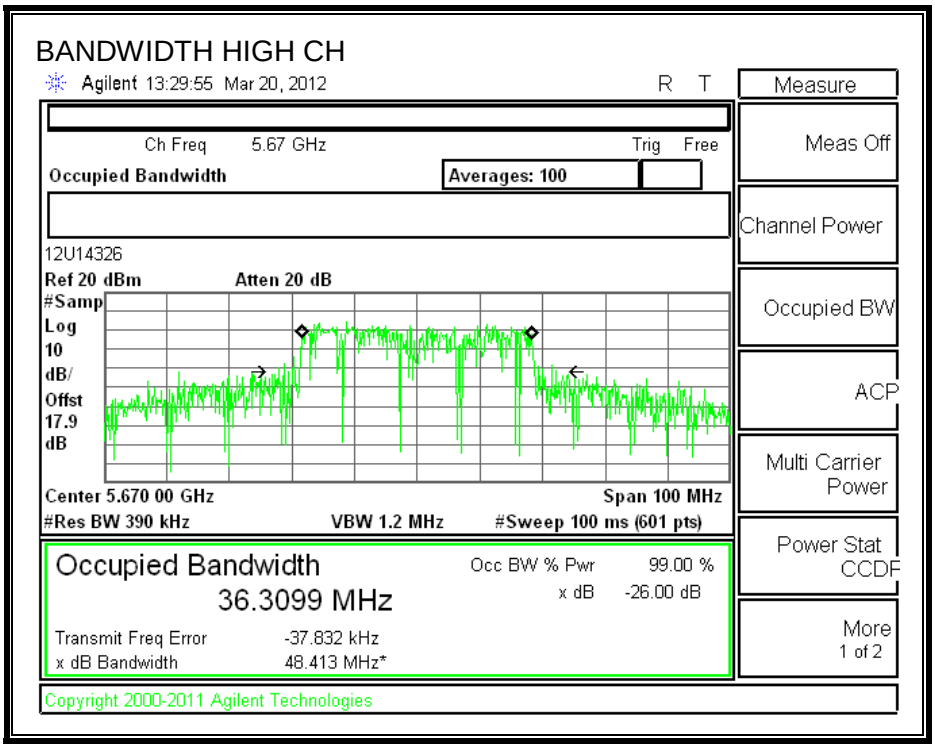
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5510	36.4967	36.4182
Mid	5550	36.7512	36.4850
High	5670	36.3099	36.3255

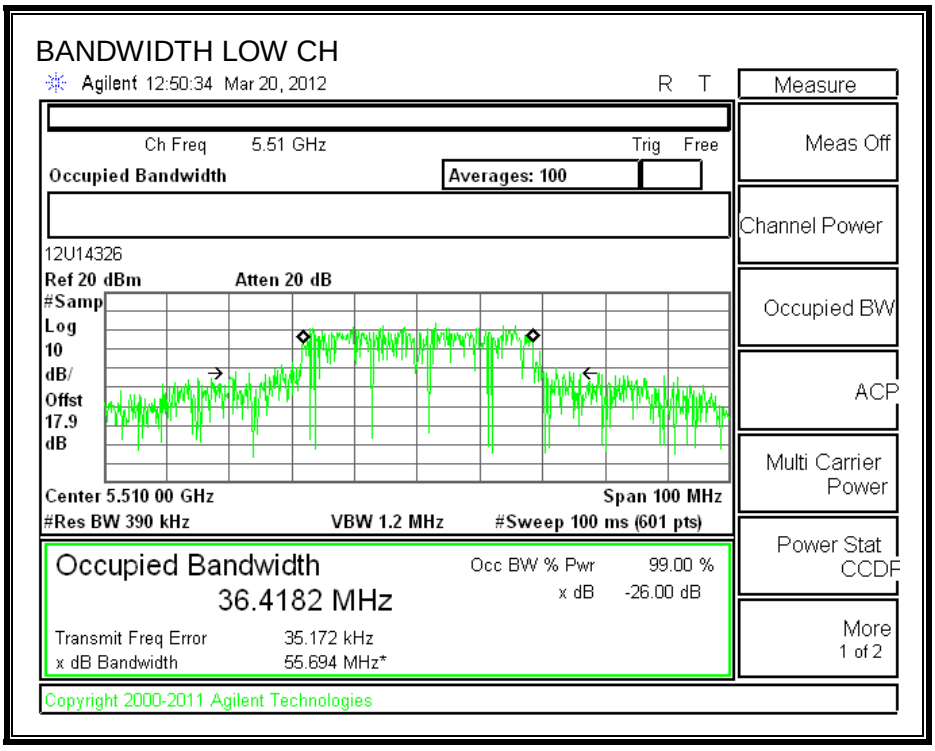
99% BANDWIDTH CHAIN 0

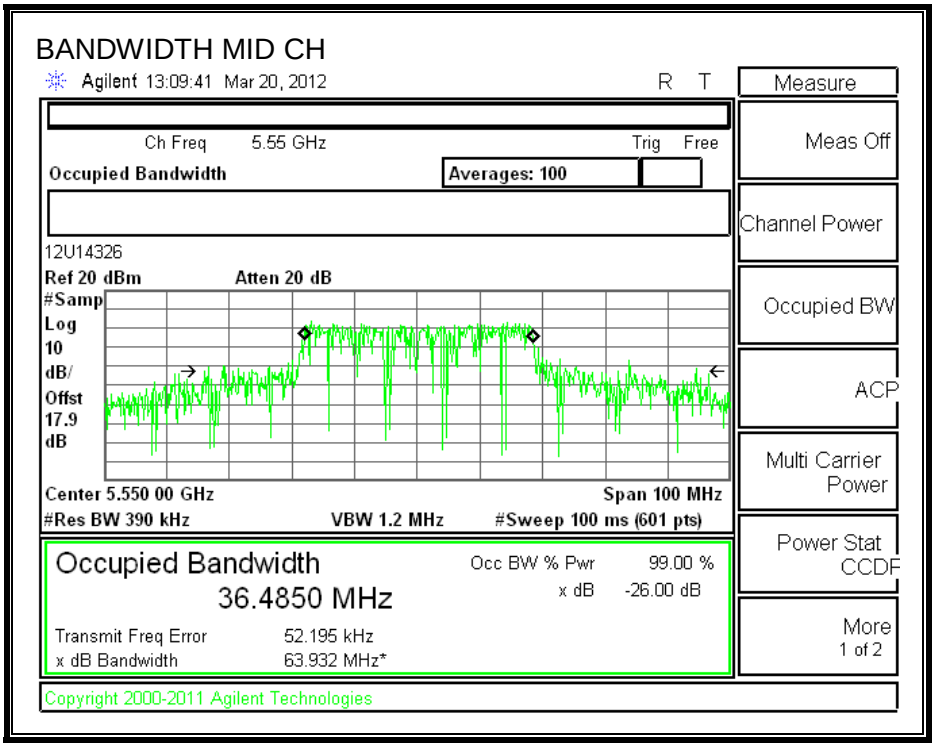


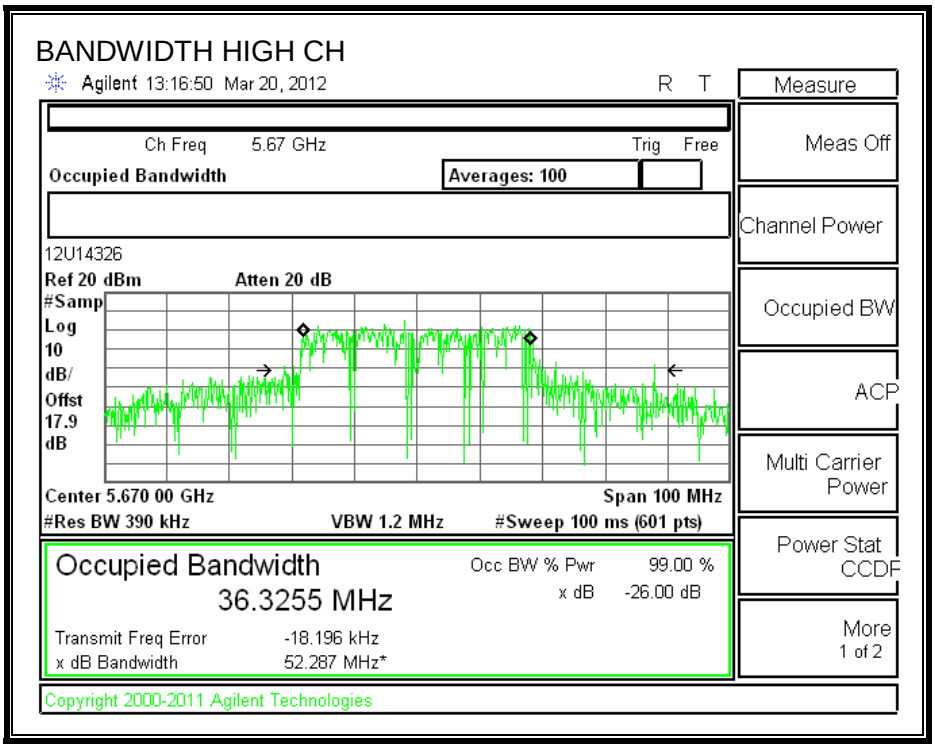




99% BANDWIDTH CHAIN 1







7.10.3. 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 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5510	17.70	16.70	20.24
Mid	5550	19.10	17.80	21.51
High	5670	17.50	17.10	20.31

7.10.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (3)

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.09	3.29	3.19

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5510	24	83.50	30.22	3.19	24.00	11.00
Mid	5550	24	88.67	30.48	3.19	24.00	11.00
High	5670	24	69.00	29.39	3.19	24.00	11.00

Output Power Results

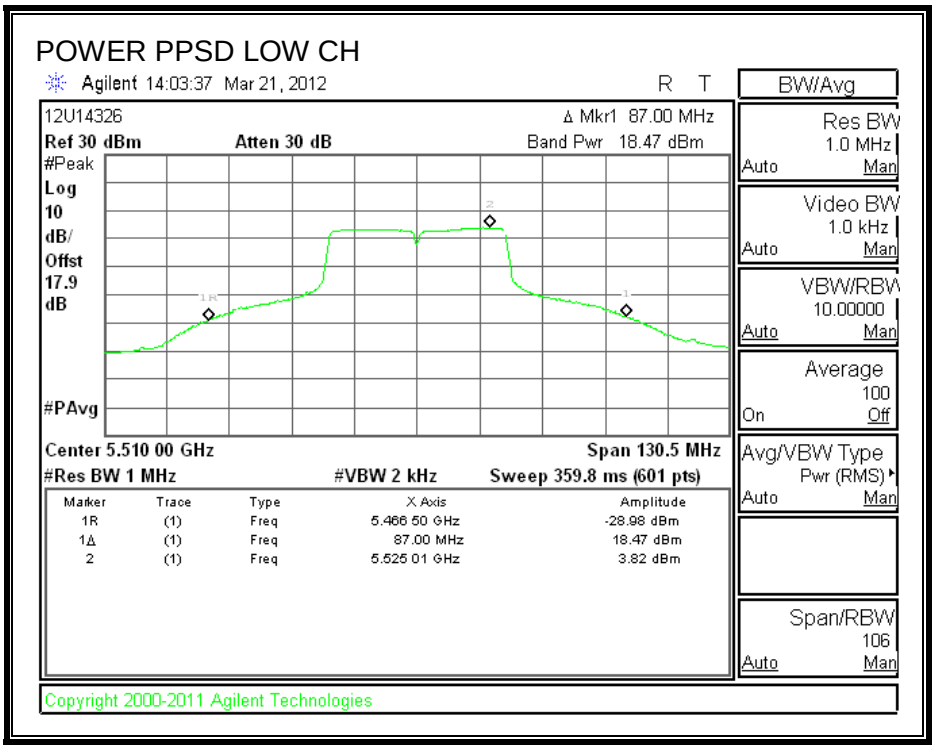
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5510	18.47	17.25	20.91	24.00	-3.09
Mid	5550	19.85	17.78	21.95	24.00	-2.05
High	5670	18.02	16.99	20.55	24.00	-3.45

PPSD Results

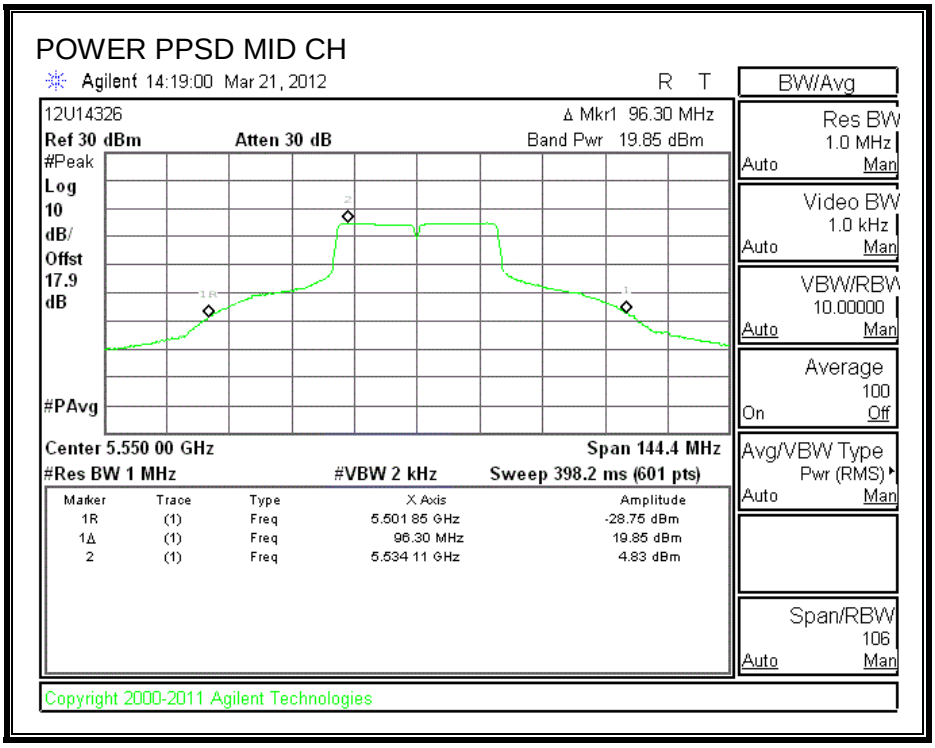
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5510	3.82	2.29	6.13	11.00	-4.87
Mid	5550	4.83	2.96	7.01	11.00	-3.99
High	5670	3.66	2.36	6.07	11.00	-4.93

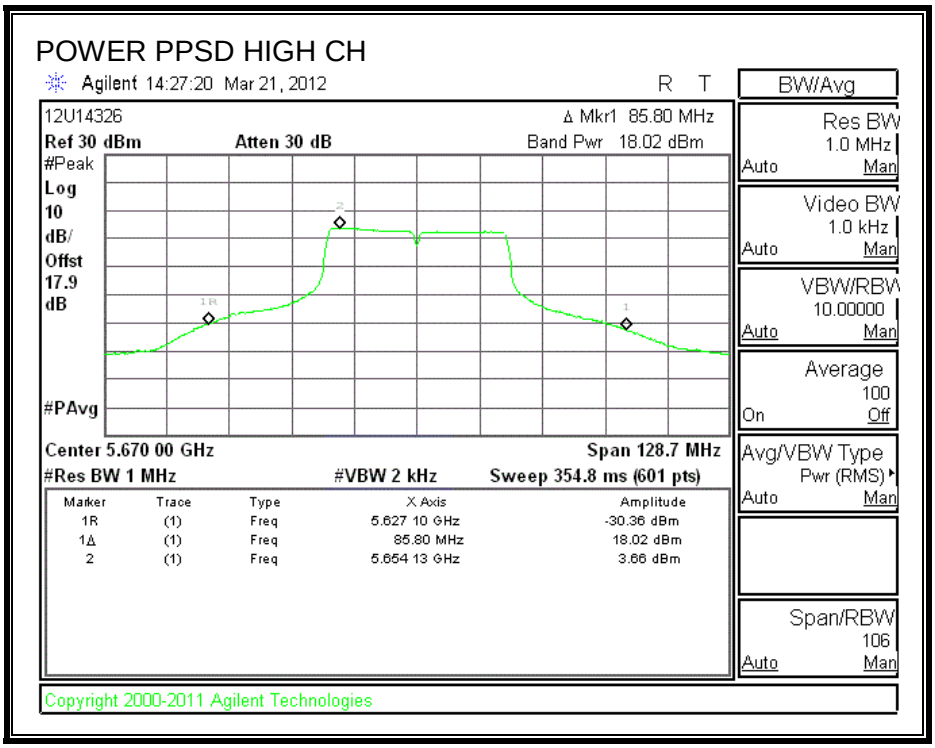
OUTPUT POWER AND PPSD CHAIN 0

POWER PPSD LOW CH



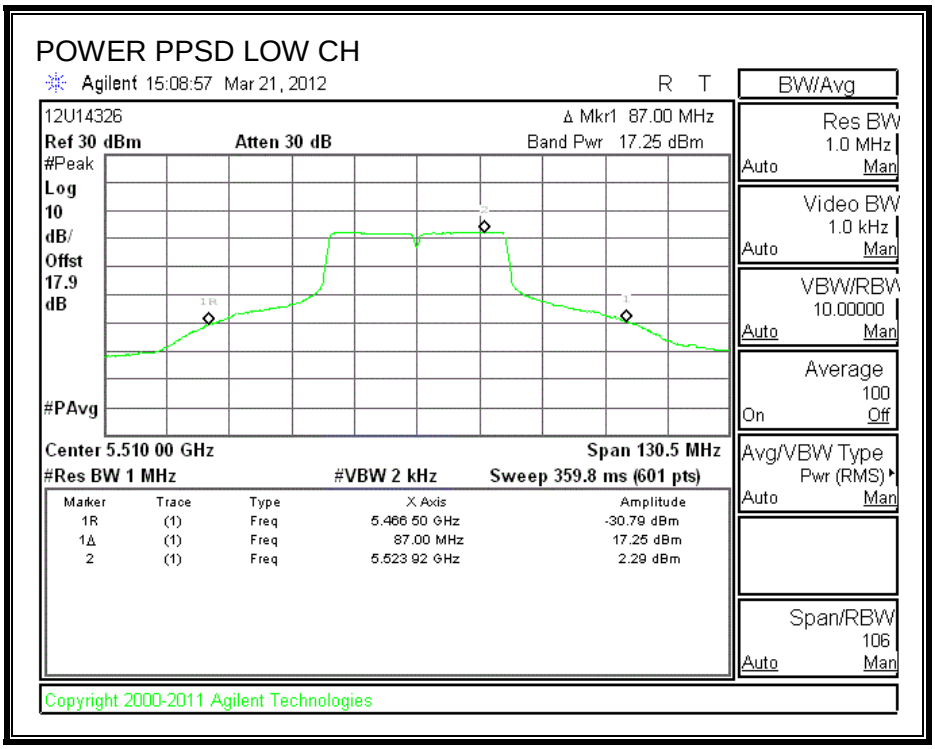
POWER PPSD MID CH



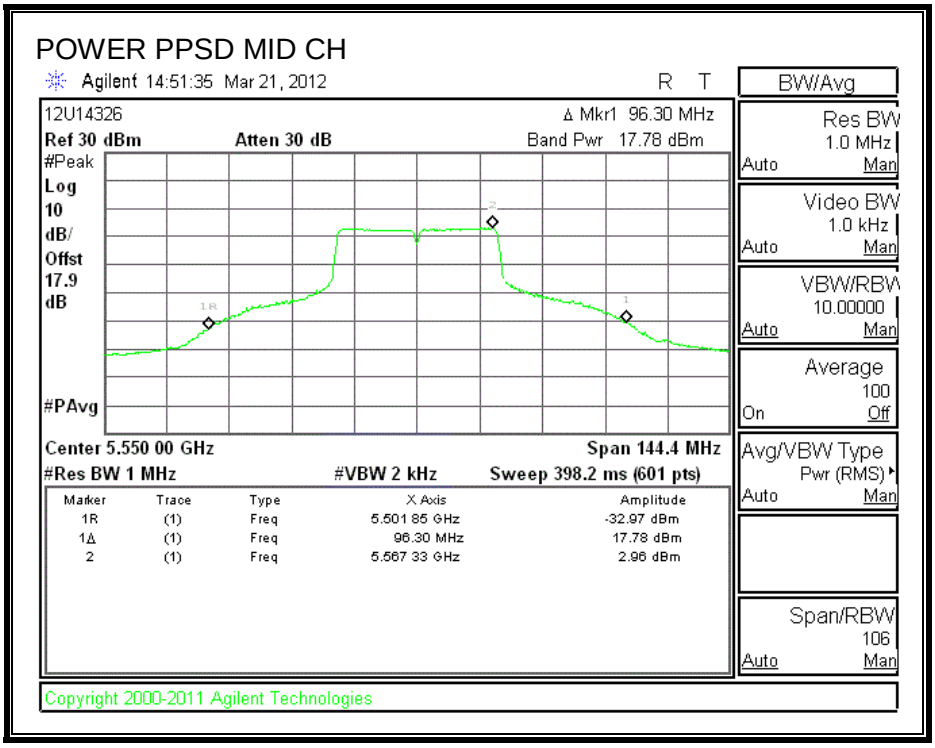


OUTPUT POWER AND PPSD CHAIN 1

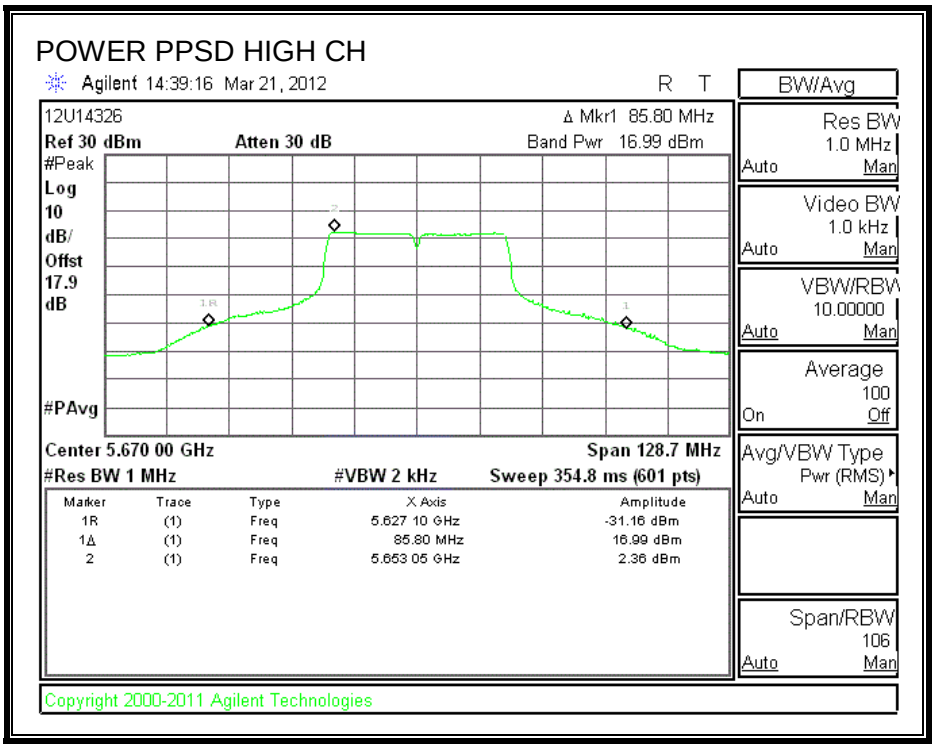
POWER PPSD LOW CH



POWER PPSD MID CH



POWER PPSD HIGH CH



7.10.5. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

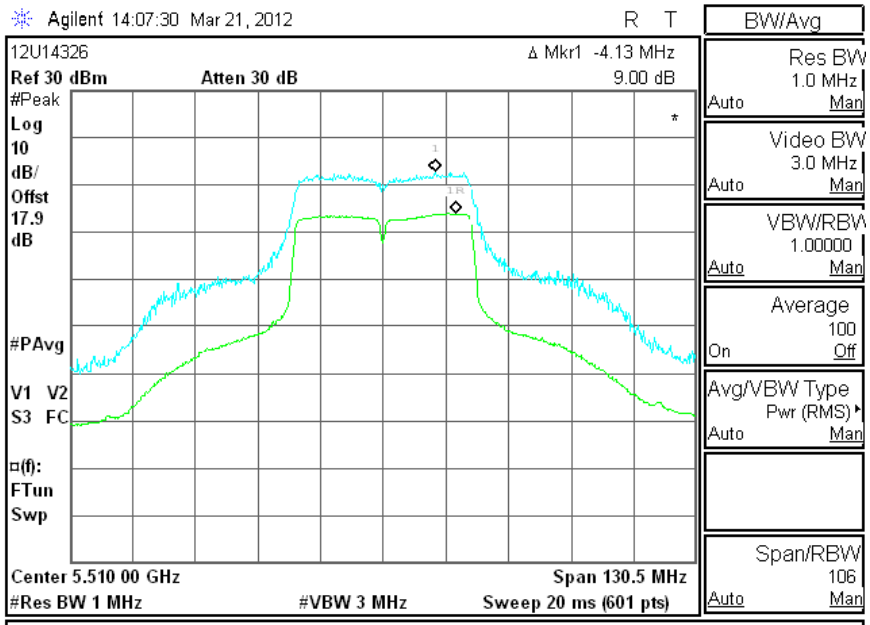
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

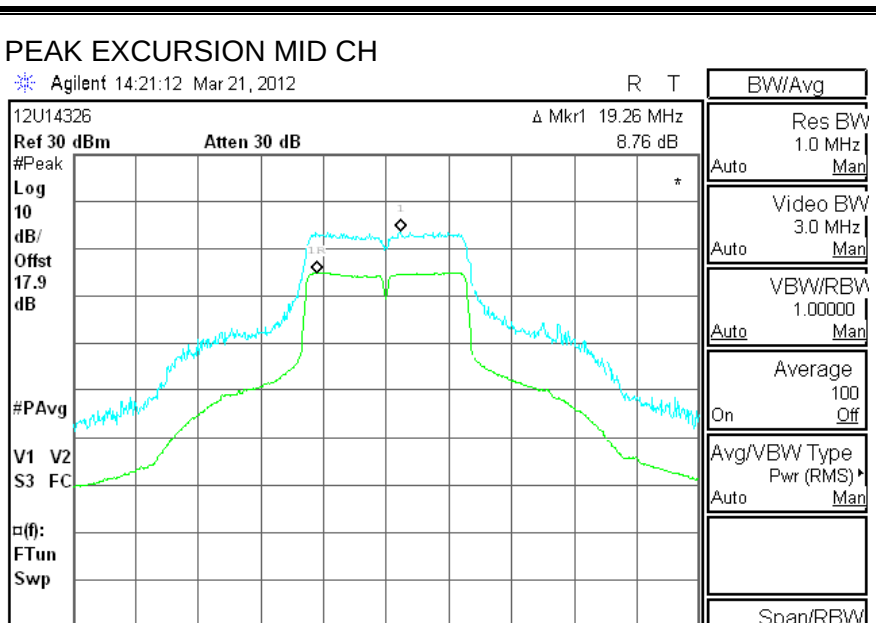
Channel	Frequency (MHz)	Pk Exc Chain 0 (dB)	Pk Exc Chain 1 (dB)	Limit (dB)	Worst-Case Margin (dB)
Low	5510	9.00	9.48	13	-3.5
Mid	5550	8.76	9.18	13	-3.8
High	5670	8.59	8.74	13	-4.3

PEAK EXCURSION CHAIN 0

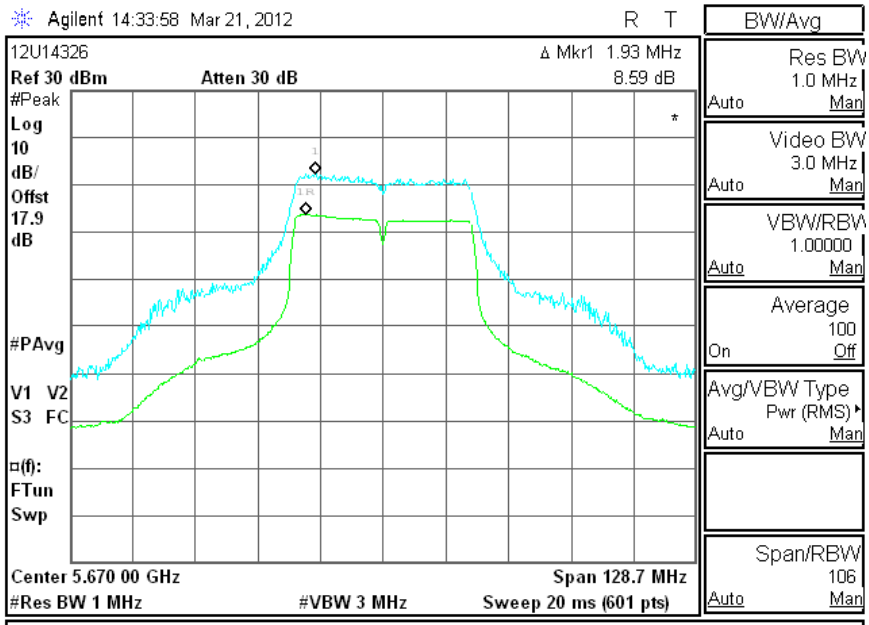
PEAK EXCURSION LOW CH



PEAK EXCURSION MID CH

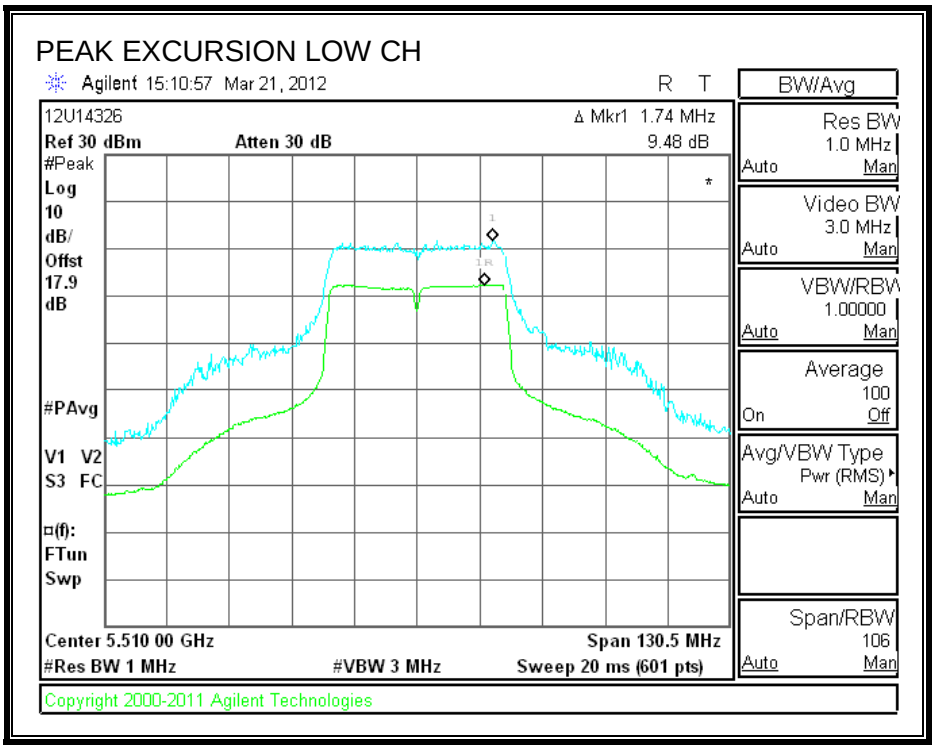


PEAK EXCURSION HIGH CH

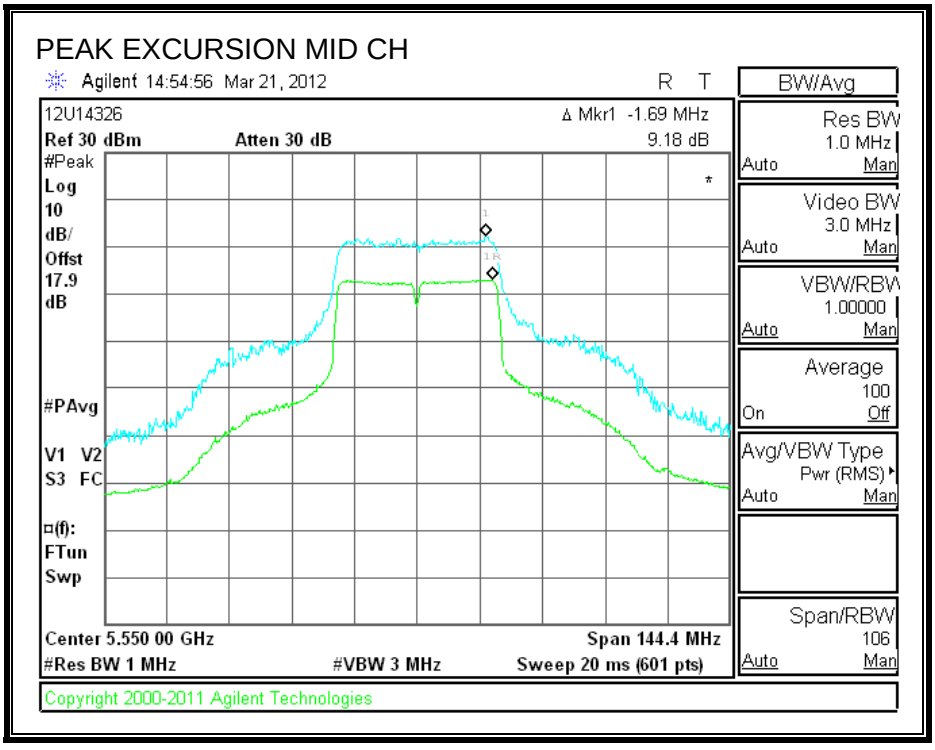


PEAK EXCURSION CHAIN 1

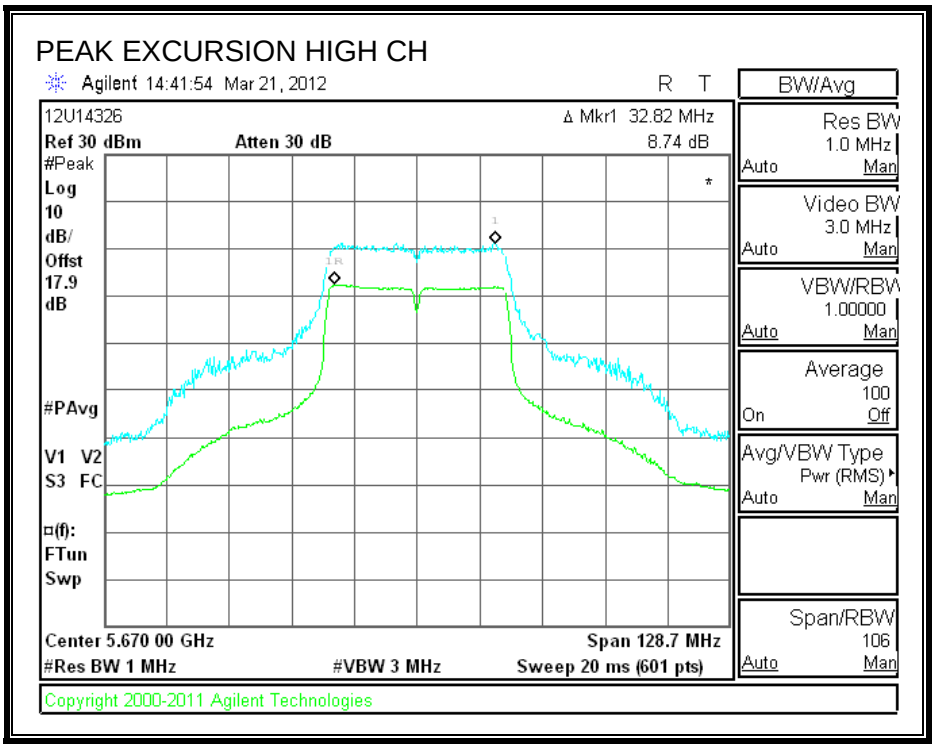
PEAK EXCURSION LOW CH



PEAK EXCURSION MID CH



PEAK EXCURSION HIGH CH



8. RADIATED TEST RESULTS

8.1. 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.

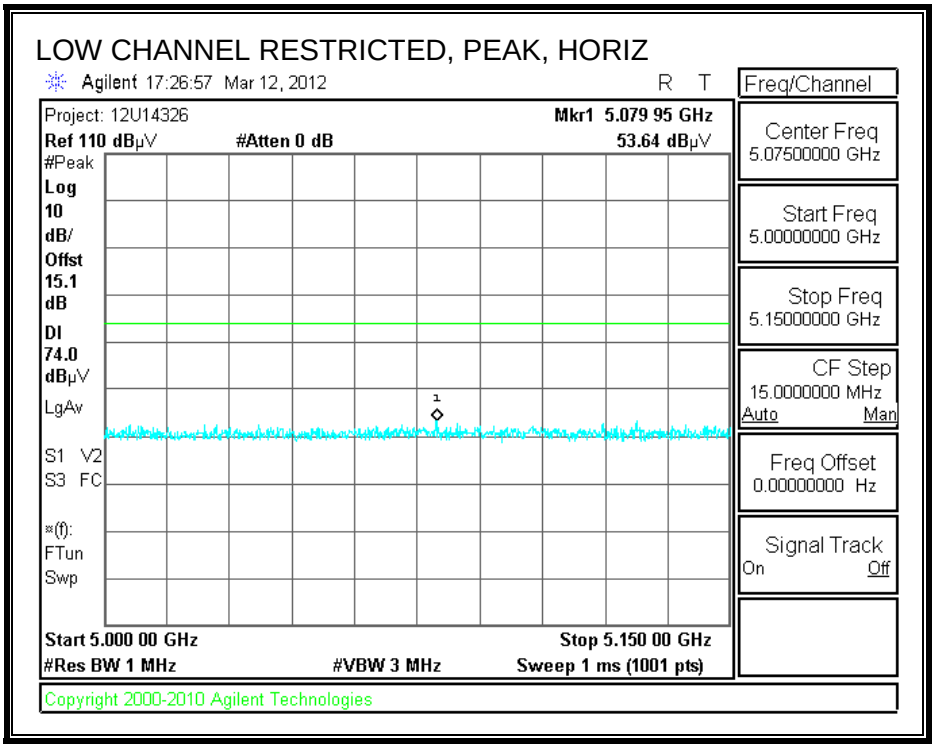
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

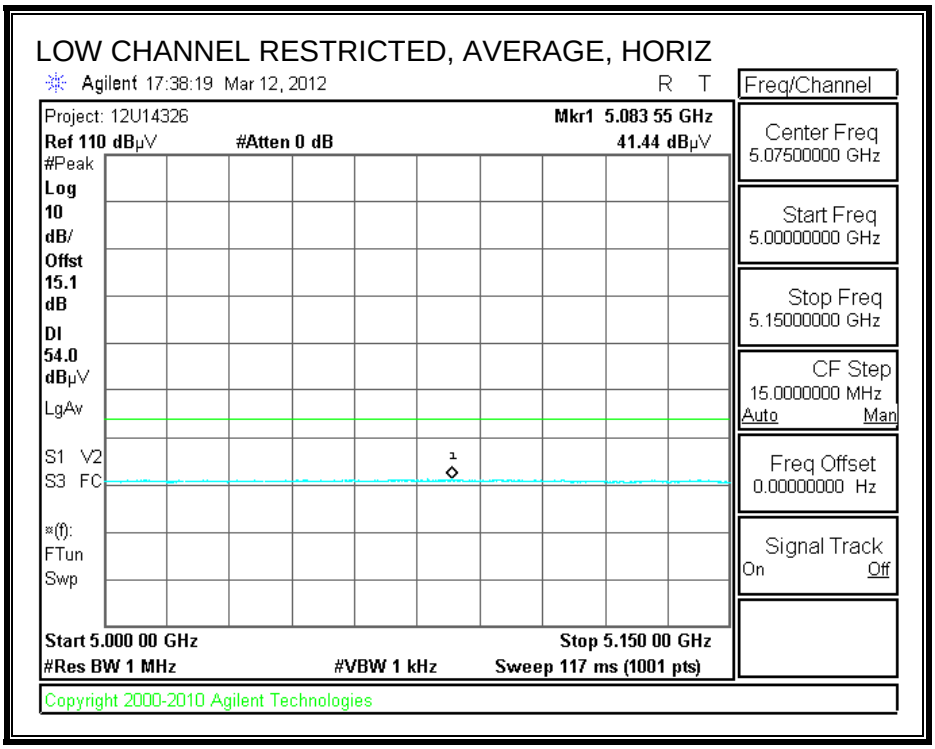
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

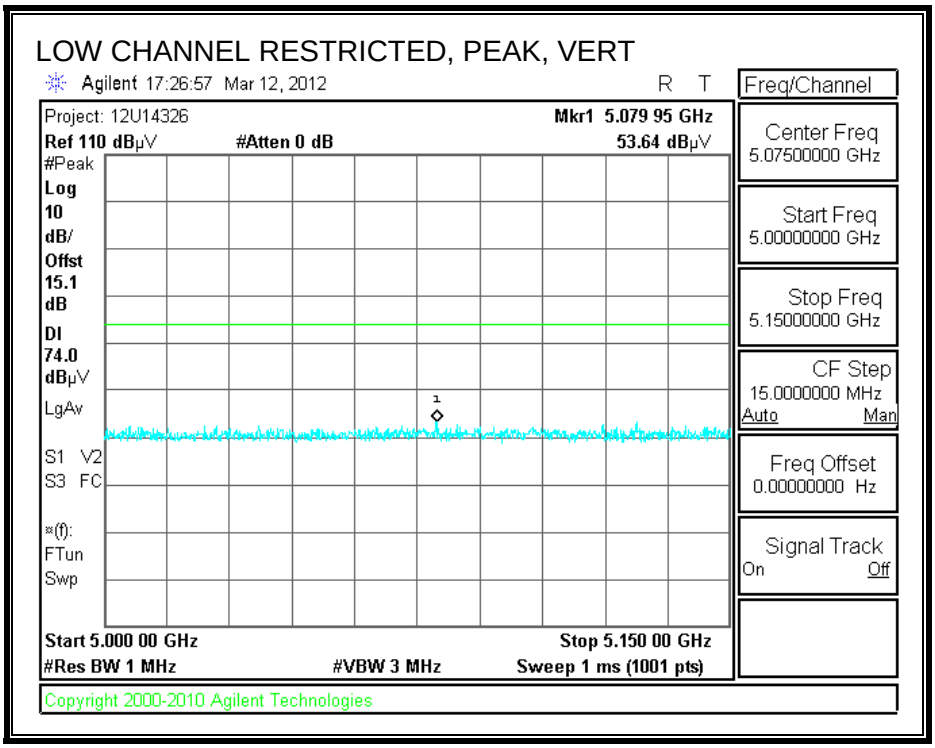
8.2.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

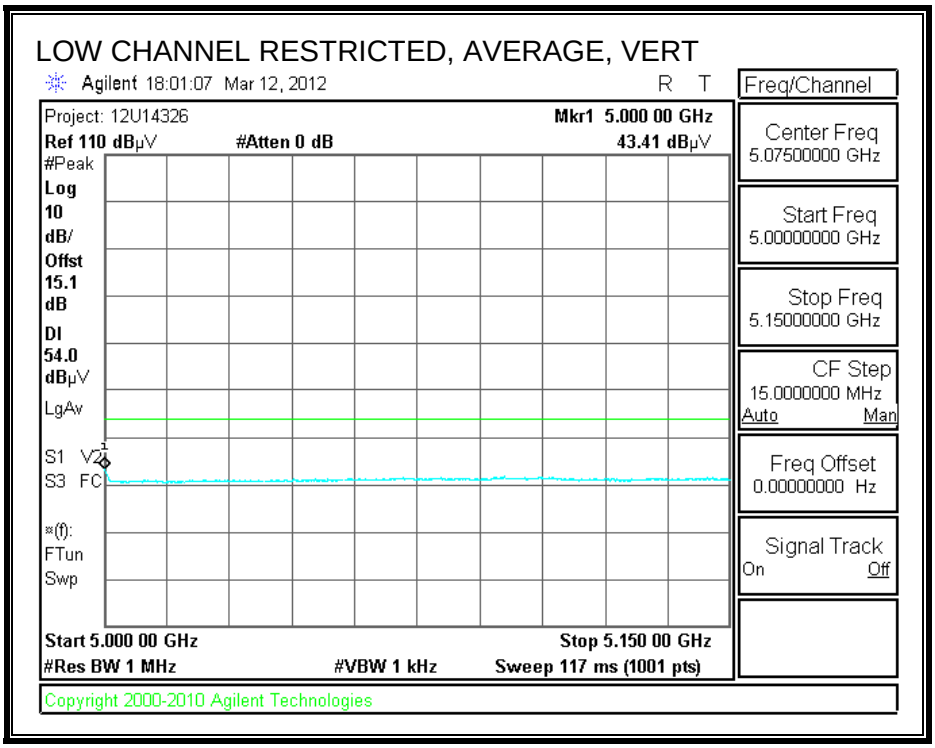




LOW CHANNEL RESTRICTED, PEAK, VERT



LOW CHANNEL RESTRICTED, AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/22/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11a, W52 TX mode

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

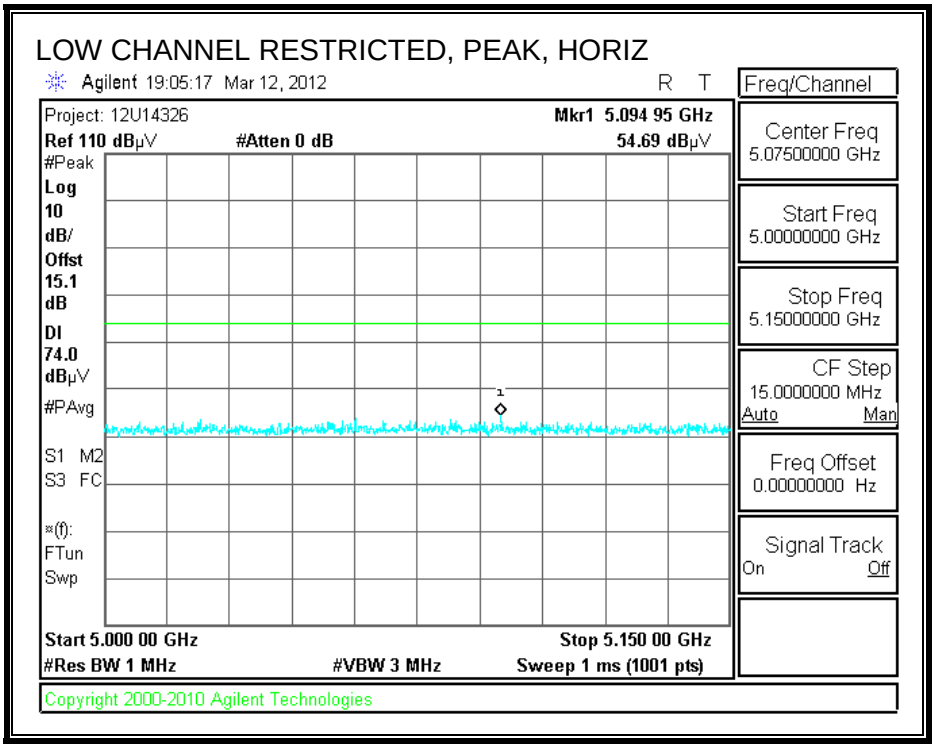
Average Field Strength Limit
Peak Field Strength Limit
Margin vs. Average Limit
Margin vs. Peak Limit

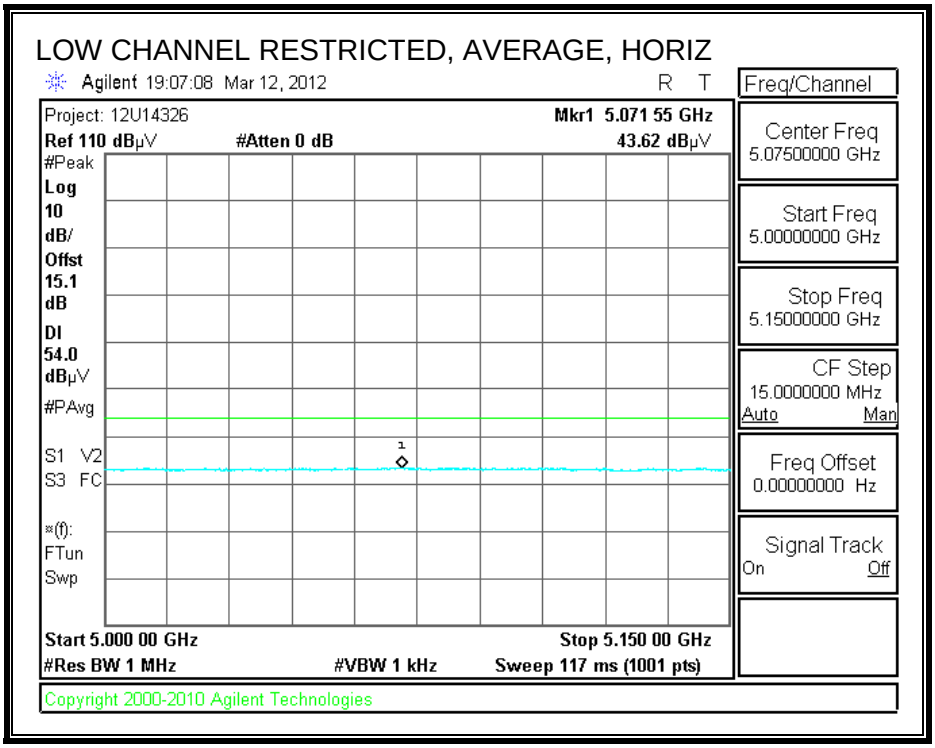
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5180MHz 11a													
15.540	3.0	35.1	39.1	12.5	-32.3	0.0	0.7	55.1	74.0	-18.9	V	P	
15.540	3.0	22.8	39.1	12.5	-32.3	0.0	0.7	42.8	54.0	-11.2	V	A	
15.540	3.0	35.7	39.1	12.5	-32.3	0.0	0.7	55.7	74.0	-18.3	H	P	
15.540	3.0	22.8	39.1	12.5	-32.3	0.0	0.7	42.8	54.0	-11.2	H	A	
5200MHz 11a													
15.540	3.0	34.9	39.1	12.5	-32.3	0.0	0.7	54.9	74.0	-19.1	H	P	
15.540	3.0	22.8	39.1	12.5	-32.3	0.0	0.7	42.8	54.0	-11.2	H	A	
15.600	3.0	35.3	38.9	12.5	-32.3	0.0	0.7	55.2	74.0	-18.8	V	P	
15.600	3.0	22.9	38.9	12.5	-32.3	0.0	0.7	42.7	54.0	-11.3	V	A	
5240MHz 11a													
15.720	3.0	34.5	38.5	12.6	-32.2	0.0	0.7	54.0	74.0	-20.0	V	P	
15.720	3.0	22.7	38.5	12.6	-32.2	0.0	0.7	42.2	54.0	-11.8	V	A	
15.720	3.0	35.4	38.5	12.6	-32.2	0.0	0.7	54.9	74.0	-19.1	H	P	
15.720	3.0	22.7	38.5	12.6	-32.2	0.0	0.7	42.2	54.0	-11.8	H	A	

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

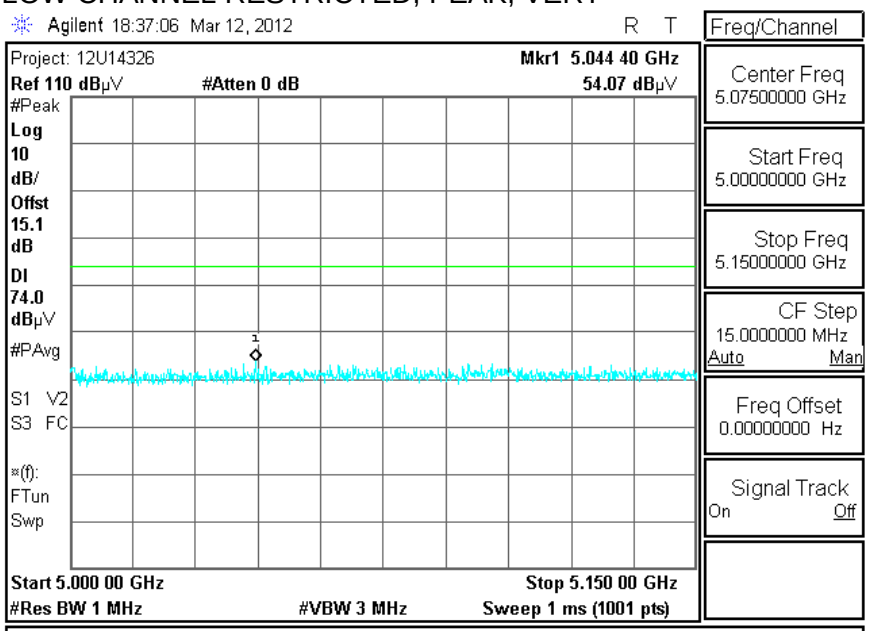
8.2.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

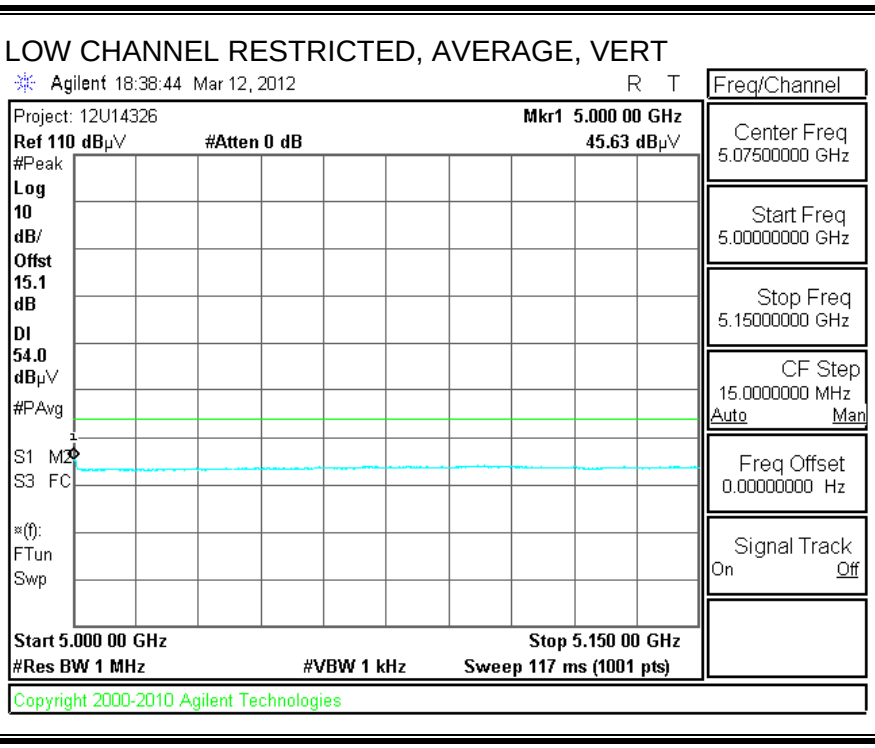




LOW CHANNEL RESTRICTED, PEAK, VERT



LOW CHANNEL RESTRICTED, AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/22/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.HT20, W52 TX mode

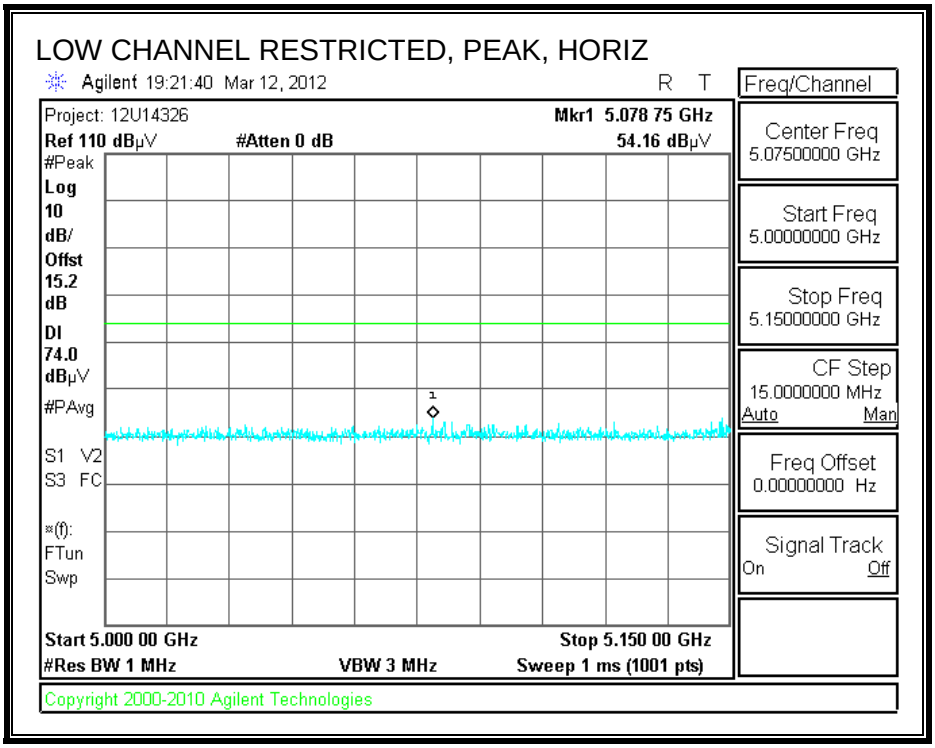
f	Measurement Frequency	Amp	Preamp Gain
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m
AF	Antenna Factor	Peak	Calculated Peak Field Strength
CL	Cable Loss	HPF	High Pass Filter

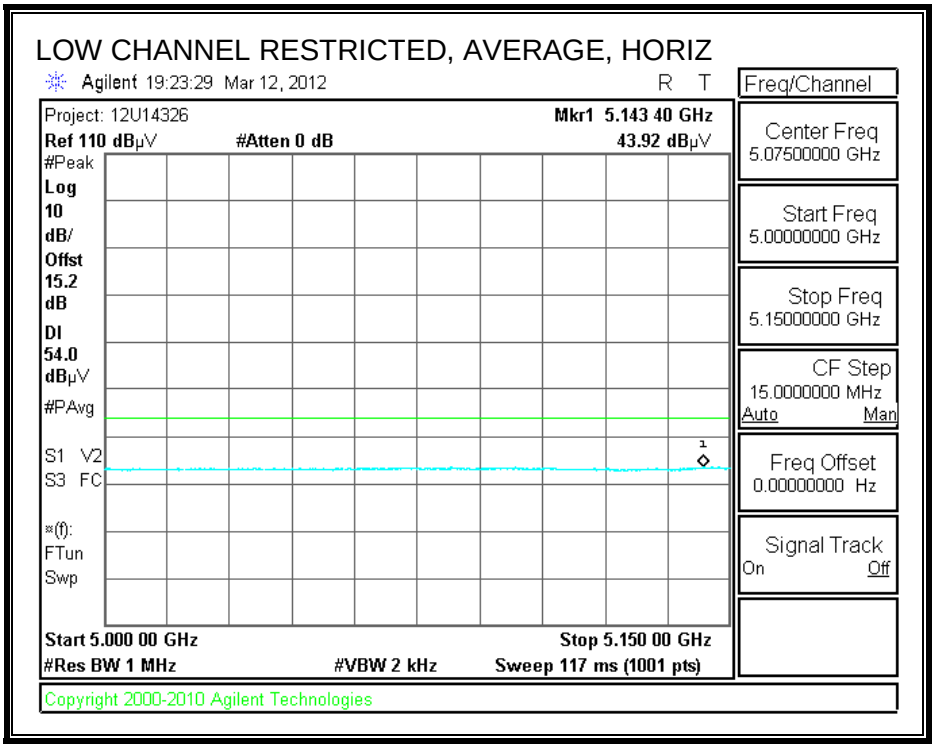
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5180MHz HT20													
15.540	3.0	35.2	39.1	12.5	-32.3	0.0	0.7	55.2	74.0	-18.8	H	P	
15.540	3.0	22.7	39.1	12.5	-32.3	0.0	0.7	42.8	54.0	-11.2	H	A	
15.540	3.0	35.9	39.1	12.5	-32.3	0.0	0.7	55.9	74.0	-18.1	V	P	
15.540	3.0	22.7	39.1	12.5	-32.3	0.0	0.7	42.7	54.0	-11.3	V	A	
5200MHz HT20													
15.600	3.0	35.6	38.9	12.5	-32.3	0.0	0.7	55.4	74.0	-18.6	V	P	
15.600	3.0	22.9	38.9	12.5	-32.3	0.0	0.7	42.7	54.0	-11.3	V	A	
15.600	3.0	35.1	38.9	12.5	-32.3	0.0	0.7	55.0	74.0	-19.0	H	P	
15.600	3.0	22.9	38.9	12.5	-32.3	0.0	0.7	42.7	54.0	-11.3	H	A	
5240MHz HT20													
15.720	3.0	35.0	38.5	12.6	-32.2	0.0	0.7	54.5	74.0	-19.5	H	P	
15.720	3.0	22.7	38.5	12.6	-32.2	0.0	0.7	42.3	54.0	-11.7	H	A	
15.720	3.0	35.2	38.5	12.6	-32.2	0.0	0.7	54.7	74.0	-19.3	V	P	
15.720	3.0	22.7	38.5	12.6	-32.2	0.0	0.7	42.3	54.0	-11.7	V	A	

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

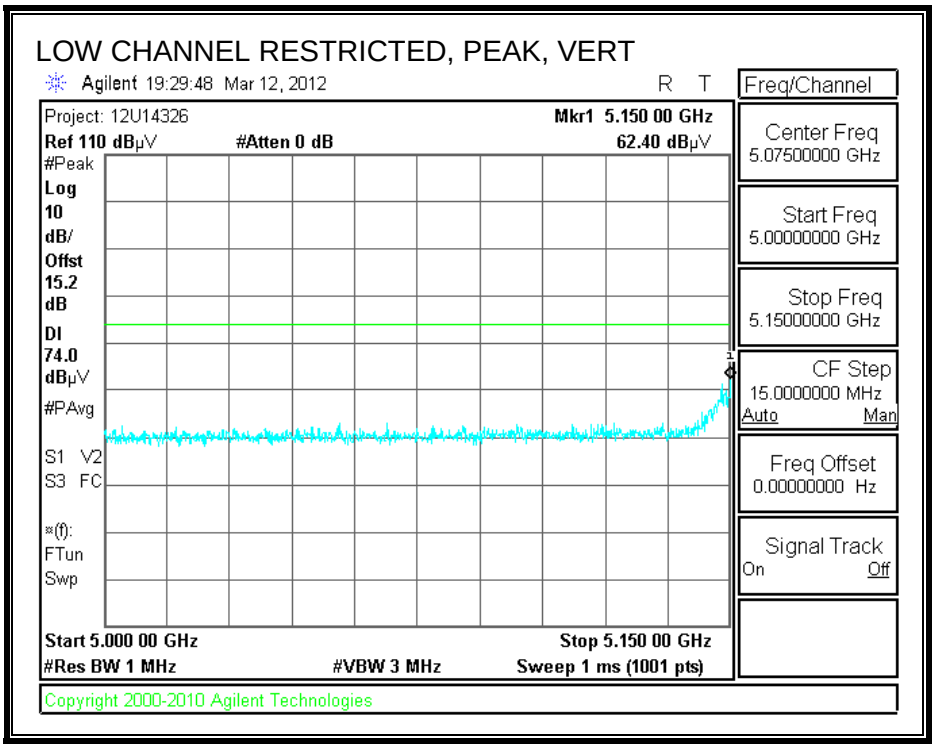
8.2.3. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

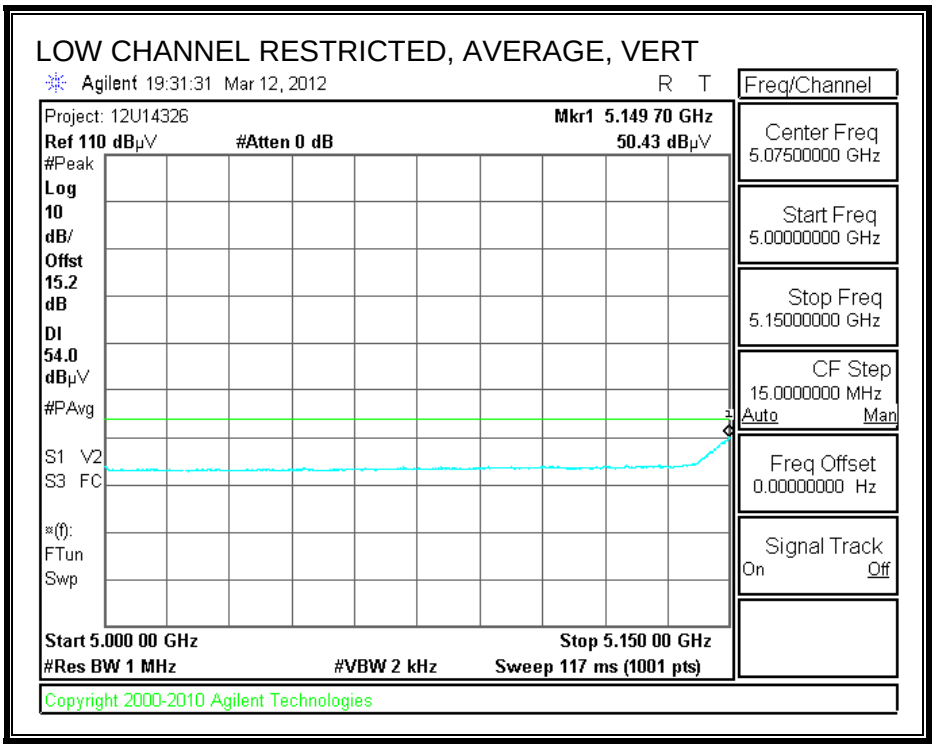




LOW CHANNEL RESTRICTED, PEAK, VERT



LOW CHANNEL RESTRICTED, AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

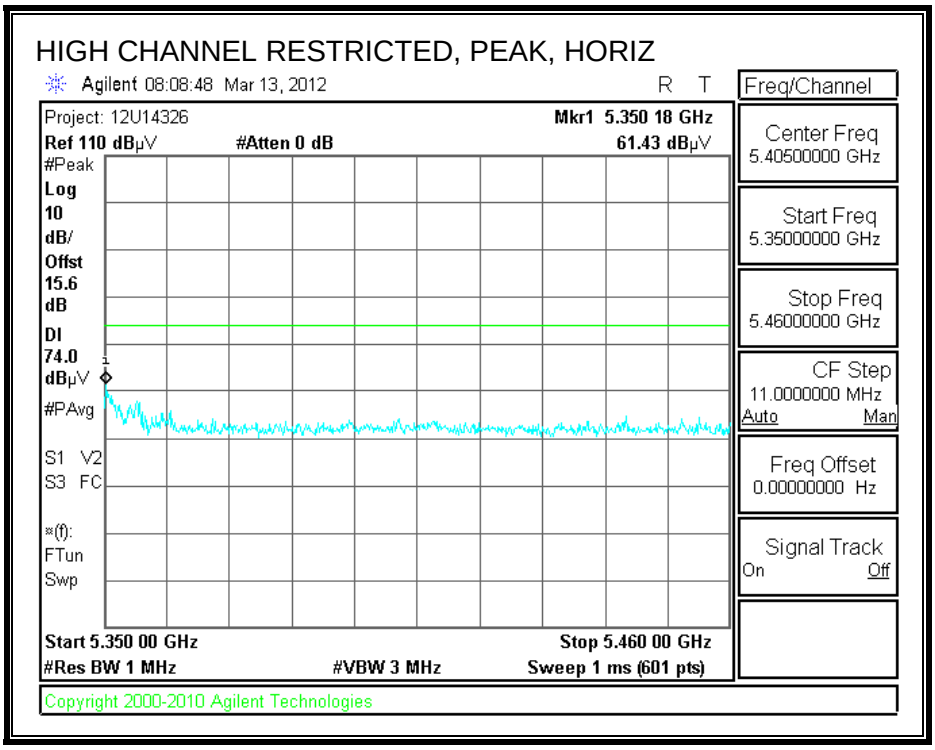
Test Engr: Tom Chen
Date: 03/22/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.HT40, W52 TX mode

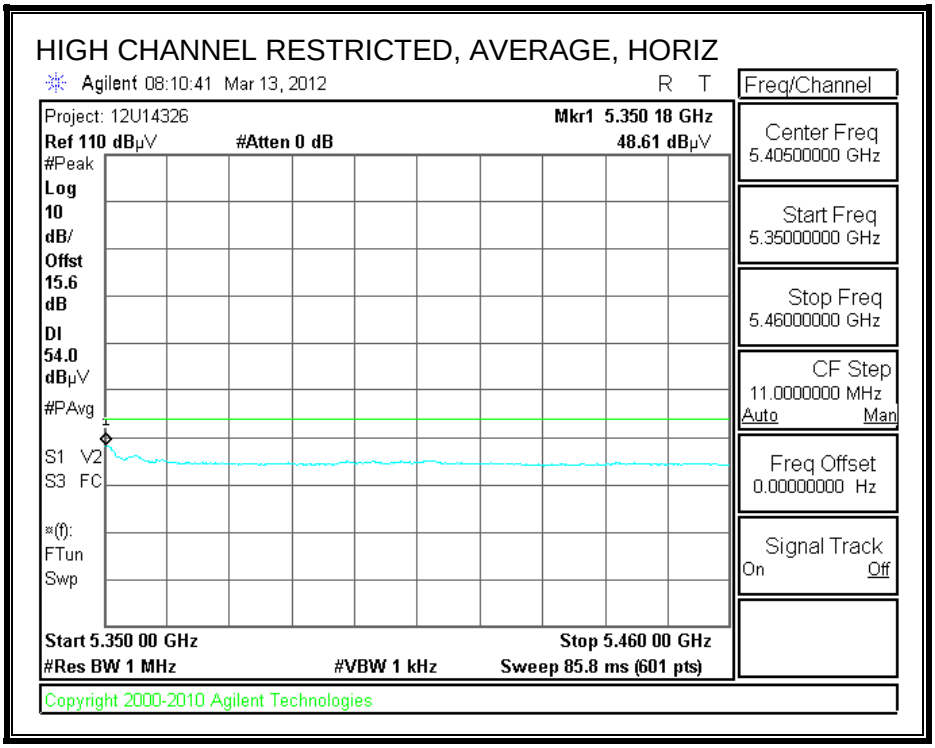
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin 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
5190MHz HT40													
15.570	3.0	35.6	39.0	12.5	-32.3	0.0	0.7	55.6	74.0	-18.4	H	P	
15.570	3.0	22.8	39.0	12.5	-32.3	0.0	0.7	42.8	54.0	-11.2	H	A	
5190MHz HT40													
15.570	3.0	34.6	39.0	12.5	-32.3	0.0	0.7	54.5	74.0	-19.5	V	P	
15.570	3.0	22.8	39.0	12.5	-32.3	0.0	0.7	42.8	54.0	-11.2	V	A	
5230MHz HT40													
15.690	3.0	35.8	38.6	12.6	-32.3	0.0	0.7	55.5	74.0	-18.5	V	P	
15.690	3.0	22.7	38.6	12.6	-32.3	0.0	0.7	42.4	54.0	-11.6	V	A	
5230MHz HT40													
15.690	3.0	35.2	38.6	12.6	-32.3	0.0	0.7	54.9	74.0	-19.1	H	P	
15.690	3.0	22.8	38.6	12.6	-32.3	0.0	0.7	42.4	54.0	-11.6	H	A	

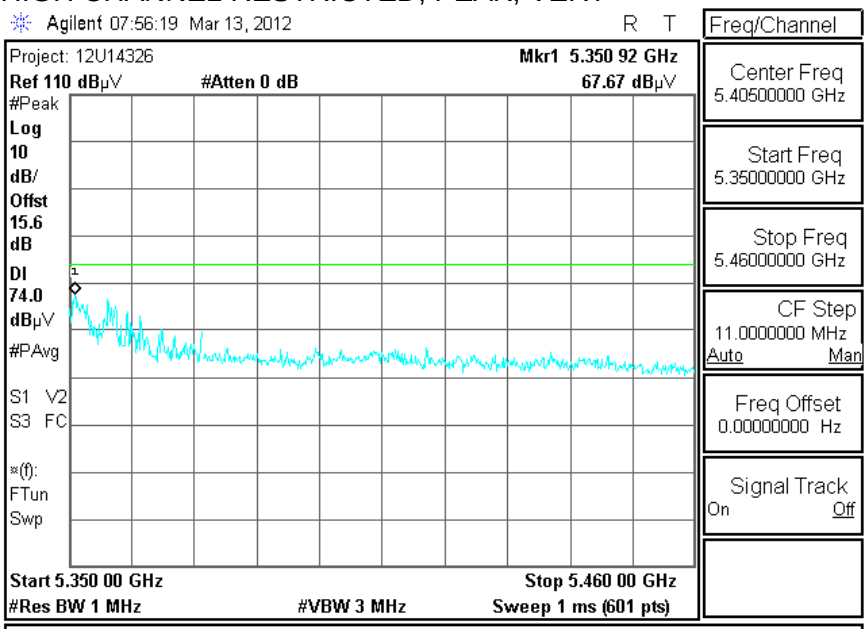
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.2.4. TX ABOVE 1 GHz 802.11a MODE IN THE 5.3 GHz BAND
RESTRICTED BANDEDGE (HIGH CHANNEL)

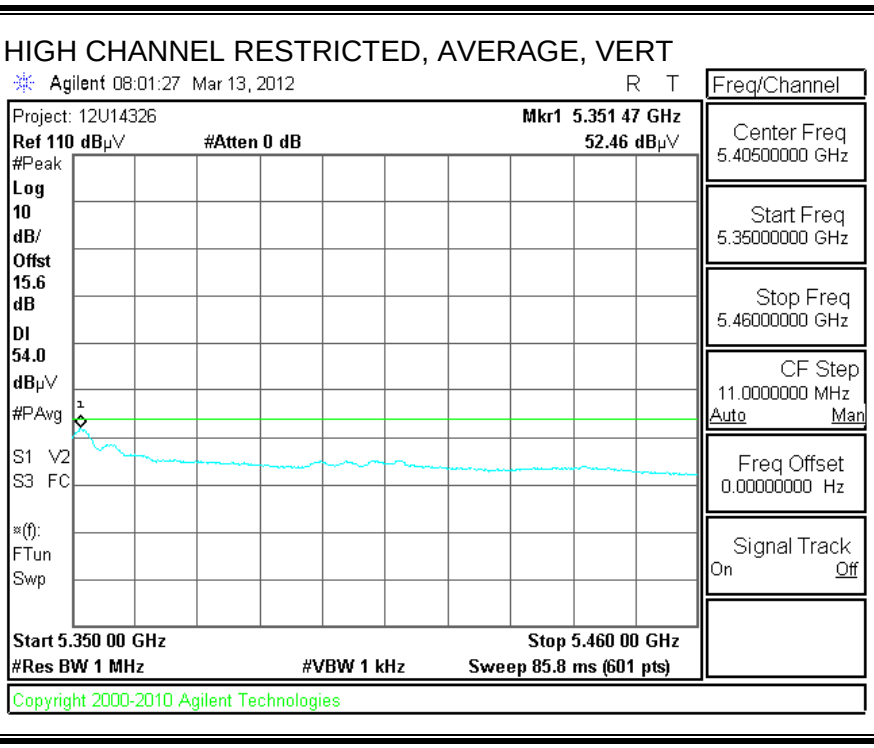




HIGH CHANNEL RESTRICTED, PEAK, VERT



HIGH CHANNEL RESTRICTED, AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/20/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11a, W53 TX mode

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

Average Field Strength Limit
Peak Field Strength Limit
Margin vs. Average Limit
Margin vs. Peak Limit

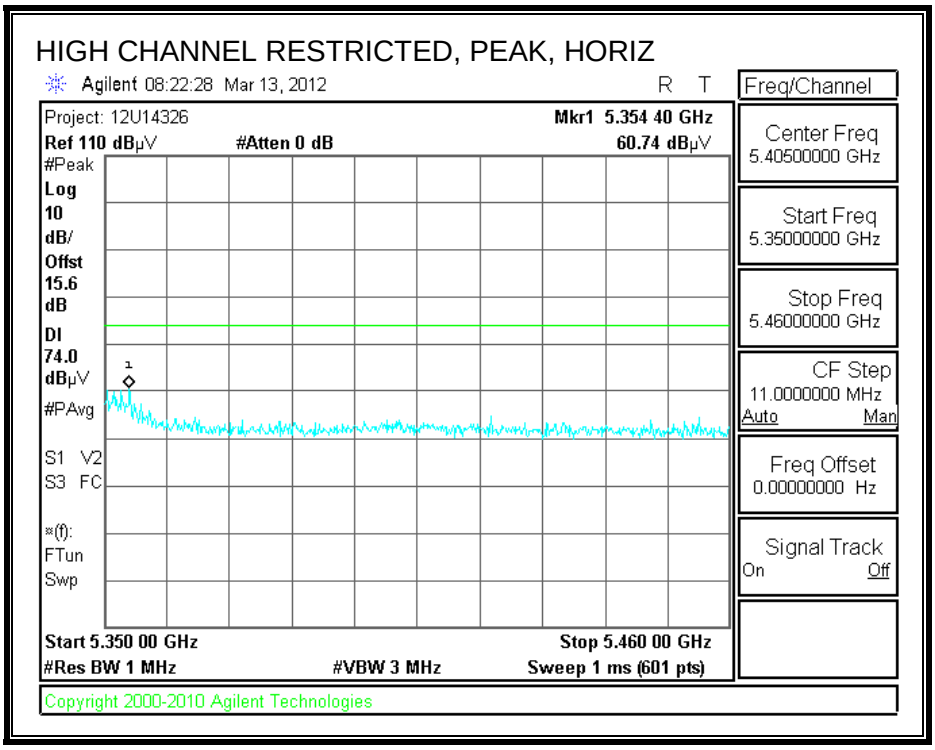
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5260 MHz 11a													
15.780	3.0	35.1	38.3	12.6	-32.2	0.0	0.7	54.5	74.0	-19.5	V	P	
15.780	3.0	22.5	38.3	12.6	-32.2	0.0	0.7	41.9	54.0	-12.1	V	A	
5260 MHz 11a													
15.780	3.0	36.7	38.3	12.6	-32.2	0.0	0.7	56.1	74.0	-17.9	H	P	
15.780	3.0	22.6	38.3	12.6	-32.2	0.0	0.7	42.0	54.0	-12.0	H	A	
5300 MHz 11a													
10.600	3.0	38.6	38.1	9.7	-33.9	0.0	0.8	53.2	74.0	-20.8	H	P	
10.600	3.0	25.9	38.1	9.7	-33.9	0.0	0.8	40.5	54.0	-13.5	H	A	
15.900	3.0	35.5	37.9	12.7	-32.2	0.0	0.7	54.6	74.0	-19.4	H	P	
15.900	3.0	22.9	37.9	12.7	-32.2	0.0	0.7	42.1	54.0	-11.9	H	A	
5300 MHz 11a													
10.600	3.0	46.0	38.1	9.7	-33.9	0.0	0.8	60.6	74.0	-13.4	V	P	
10.600	3.0	31.5	38.1	9.7	-33.9	0.0	0.8	46.2	54.0	-7.8	V	A	
15.900	3.0	36.2	37.9	12.7	-32.2	0.0	0.7	55.3	74.0	-18.7	V	P	
15.900	3.0	23.7	37.9	12.7	-32.2	0.0	0.7	42.8	54.0	-11.2	V	A	
5320 MHz 11a													
10.640	3.0	44.9	38.2	9.7	-33.9	0.0	0.8	59.6	74.0	-14.4	V	P	
10.640	3.0	30.7	38.2	9.7	-33.9	0.0	0.8	45.4	54.0	-8.6	V	A	
10.640	3.0	39.4	38.2	9.7	-33.9	0.0	0.8	54.2	74.0	-19.8	H	P	
10.640	3.0	26.4	38.2	9.7	-33.9	0.0	0.8	41.1	54.0	-12.9	H	A	

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

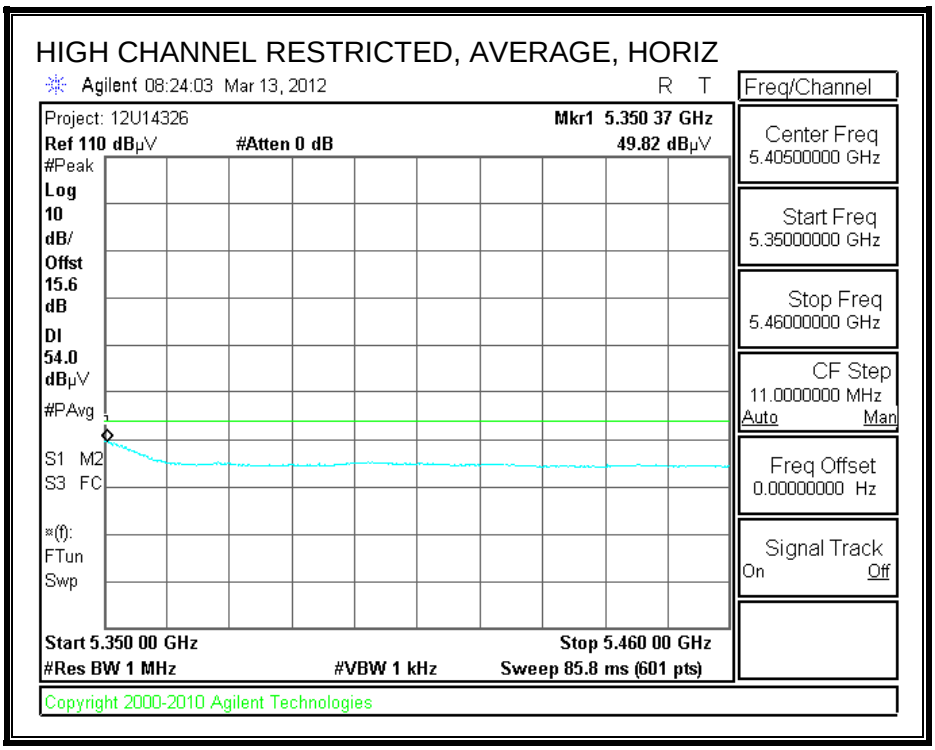
8.2.5. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.3 GHz BAND

RESTRICTED BANDEDGE (HIGH CHANNEL)

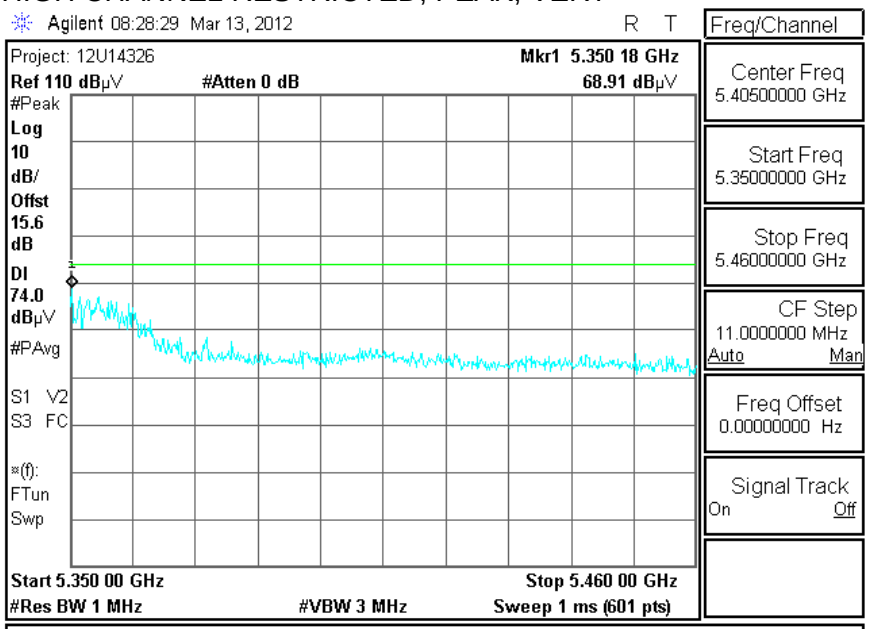
HIGH CHANNEL RESTRICTED, PEAK, HORIZ



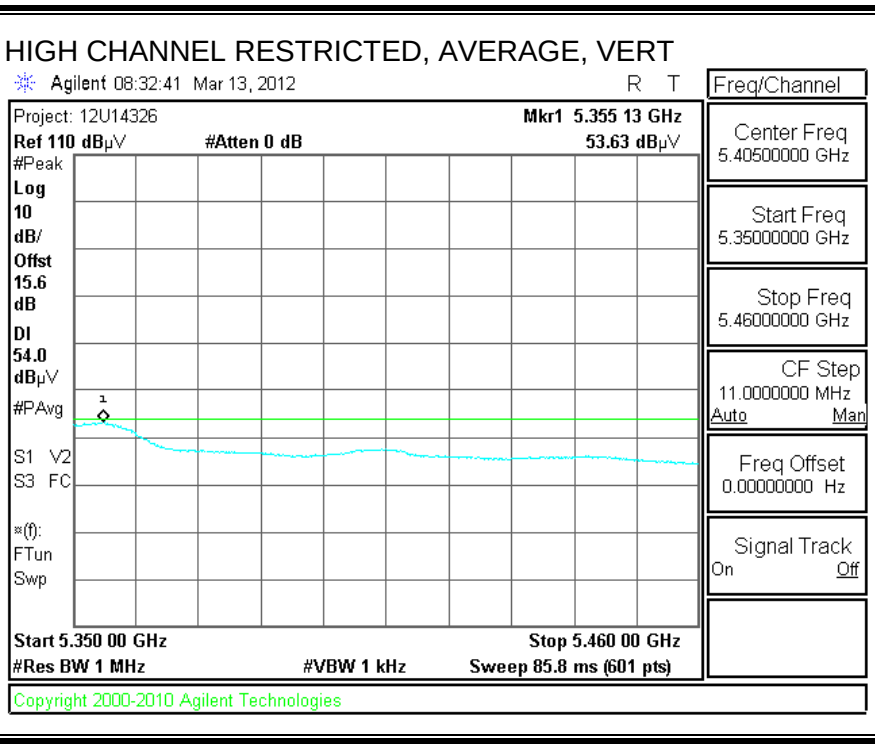
HIGH CHANNEL RESTRICTED, AVERAGE, HORIZ



HIGH CHANNEL RESTRICTED, PEAK, VERT



HIGH CHANNEL RESTRICTED, AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/20/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT20, W53 TX mode

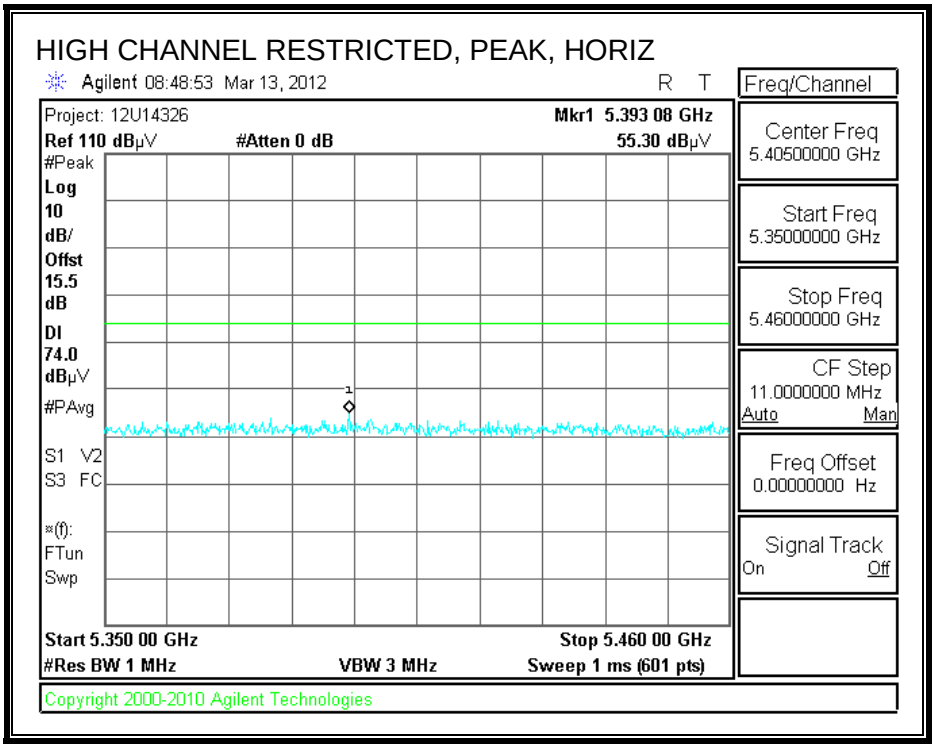
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

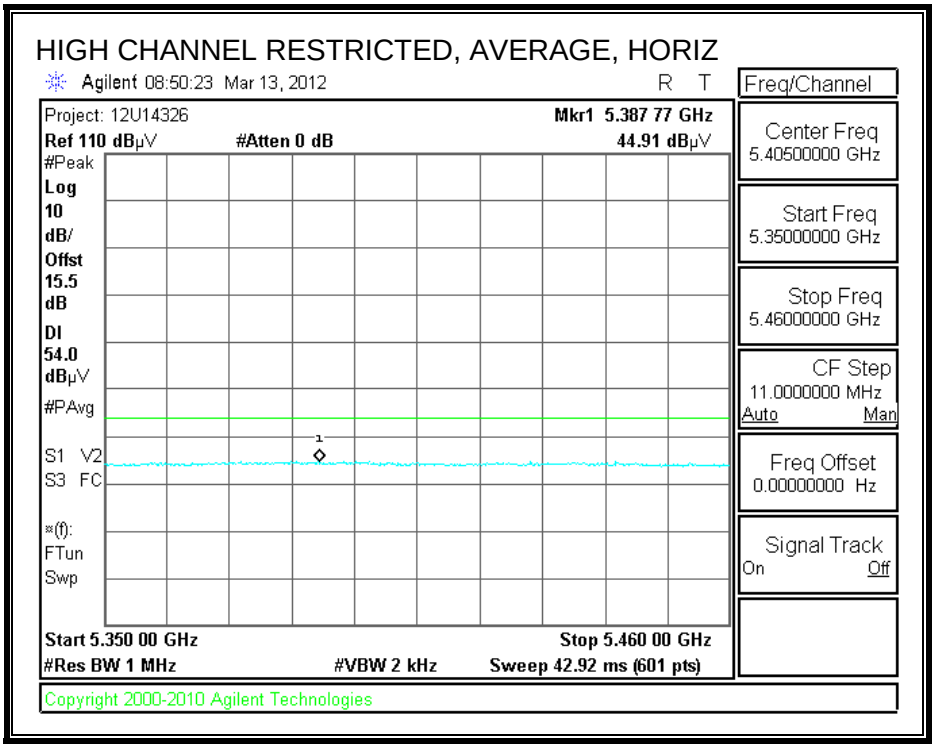
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5260 MHz HT20													
15.780	3.0	35.9	38.3	12.6	-32.2	0.0	0.7	55.3	74.0	-18.7	V	P	
15.780	3.0	23.3	38.3	12.6	-32.2	0.0	0.7	42.8	54.0	-11.2	V	A	
5260 MHz HT20													
15.780	3.0	35.8	38.3	12.6	-32.2	0.0	0.7	55.2	74.0	-18.8	H	P	
15.780	3.0	23.2	38.3	12.6	-32.2	0.0	0.7	42.6	54.0	-11.4	H	A	
5300 MHz HT20													
10.600	3.0	49.3	38.1	9.7	-33.9	0.0	0.8	63.9	74.0	-10.1	V	P	
10.600	3.0	35.7	38.1	9.7	-33.9	0.0	0.8	50.3	54.0	-3.7	V	A	
15.900	3.0	35.3	37.9	12.7	-32.2	0.0	0.7	54.4	74.0	-19.6	V	P	
15.900	3.0	23.2	37.9	12.7	-32.2	0.0	0.7	42.3	54.0	-11.7	V	A	
5300 MHz HT20													
10.600	3.0	45.7	38.1	9.7	-33.9	0.0	0.8	60.3	74.0	-13.7	H	P	
10.600	3.0	30.8	38.1	9.7	-33.9	0.0	0.8	45.5	54.0	-8.5	H	A	
15.900	3.0	34.8	37.9	12.7	-32.2	0.0	0.7	53.9	74.0	-20.1	H	P	
15.900	3.0	22.9	37.9	12.7	-32.2	0.0	0.7	42.0	54.0	-12.0	H	A	
5320 MHz HT20													
10.640	3.0	43.5	38.2	9.7	-33.9	0.0	0.8	58.2	74.0	-15.8	H	P	
10.640	3.0	29.8	38.2	9.7	-33.9	0.0	0.8	44.5	54.0	-9.5	H	A	
15.960	3.0	34.5	37.7	12.7	-32.2	0.0	0.7	53.4	74.0	-20.6	H	P	
15.960	3.0	22.9	37.7	12.7	-32.2	0.0	0.7	41.9	54.0	-12.1	H	A	
5320 MHz HT20													
10.640	3.0	49.7	38.2	9.7	-33.9	0.0	0.8	64.5	74.0	-9.6	V	P	
10.640	3.0	34.7	38.2	9.7	-33.9	0.0	0.8	49.4	54.0	-4.6	V	A	
15.960	3.0	34.7	37.7	12.7	-32.2	0.0	0.7	53.6	74.0	-20.4	V	P	
15.960	3.0	23.0	37.7	12.7	-32.2	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.

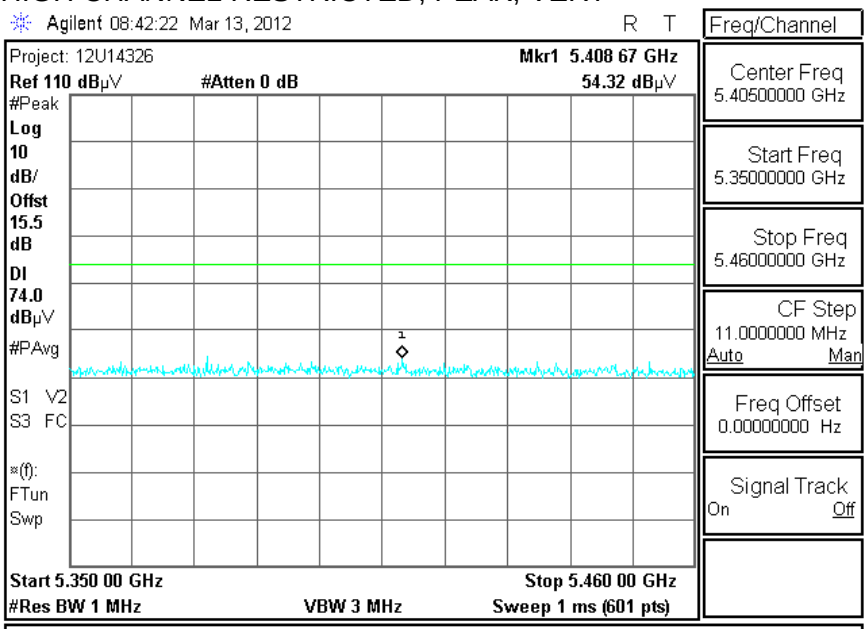
8.2.6. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.3 GHz BAND

RESTRICTED BANDEDGE (HIGH CHANNEL)

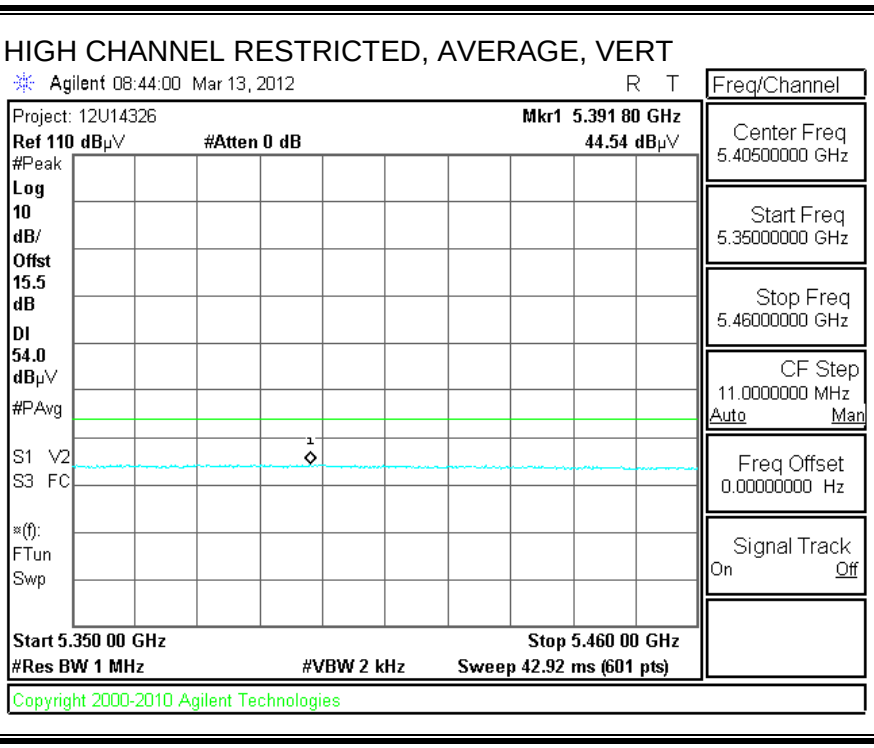




HIGH CHANNEL RESTRICTED, PEAK, VERT



HIGH CHANNEL RESTRICTED, AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/20/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT40, W53 TX mode

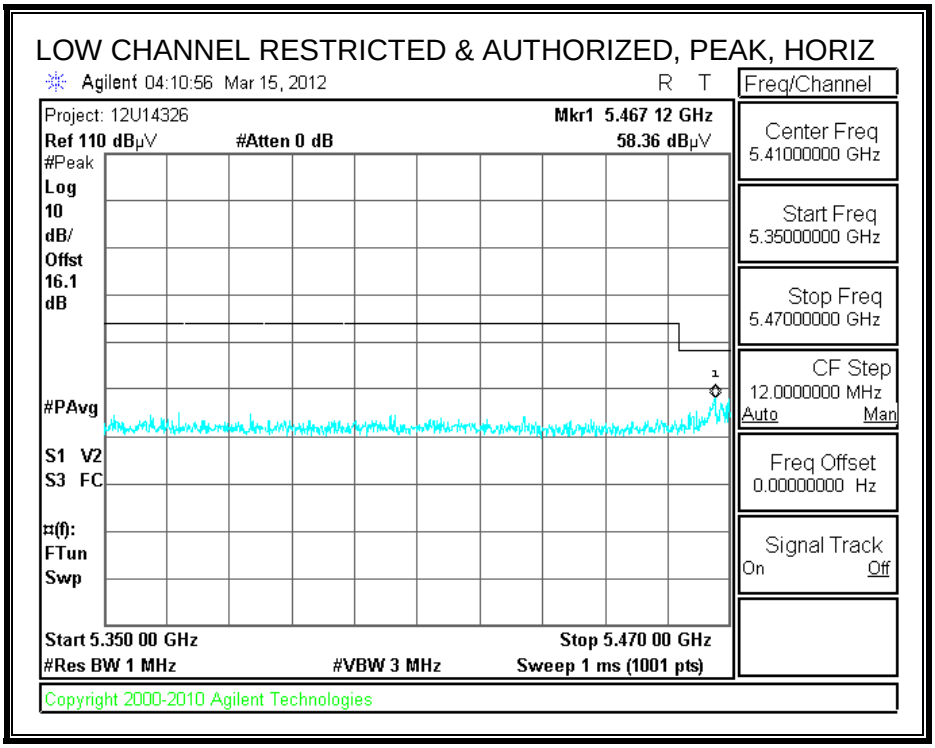
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

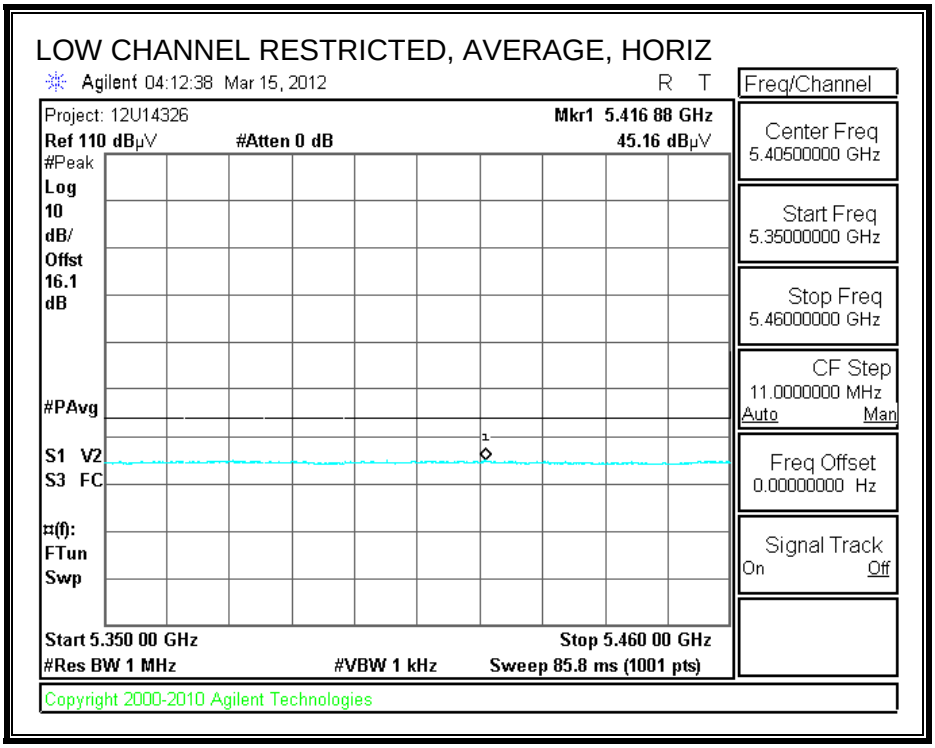
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5270 MHz HT40													
15.810	3.0	35.7	38.2	12.6	-32.2	0.0	0.7	55.0	74.0	-19.0	V	P	
15.810	3.0	23.7	38.2	12.6	-32.2	0.0	0.7	43.0	54.0	-11.0	V	A	
5270 MHz HT40													
15.810	3.0	35.8	38.2	12.6	-32.2	0.0	0.7	55.1	74.0	-18.9	H	P	
15.810	3.0	23.0	38.2	12.6	-32.2	0.0	0.7	42.3	54.0	-11.7	H	A	
5310 MHz HT40													
10.620	3.0	36.3	38.1	9.7	-33.9	0.0	0.8	51.0	74.0	-23.0	H	P	
10.620	3.0	23.9	38.1	9.7	-33.9	0.0	0.8	38.6	54.0	-15.4	H	A	
5310 MHz HT40													
10.620	3.0	37.3	38.1	9.7	-33.9	0.0	0.8	52.0	74.0	-22.0	V	P	
10.620	3.0	24.9	38.1	9.7	-33.9	0.0	0.8	39.6	54.0	-14.4	V	A	

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

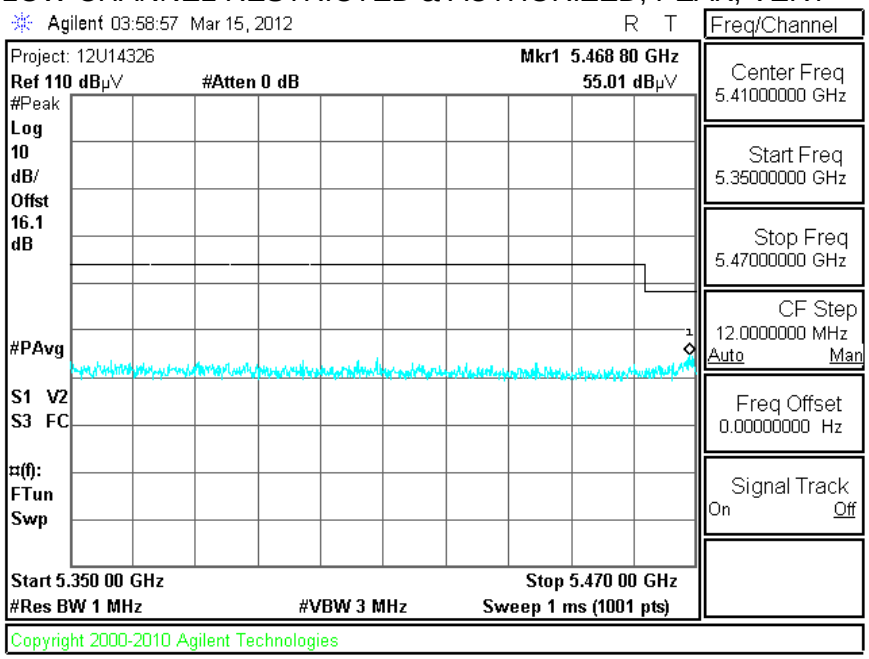
8.2.7. TX ABOVE 1 GHz 802.11a MODE IN THE 5.6 GHz BAND

RESTRICTED & AUTHORIZED BANDEDGE (LOW CHANNEL)

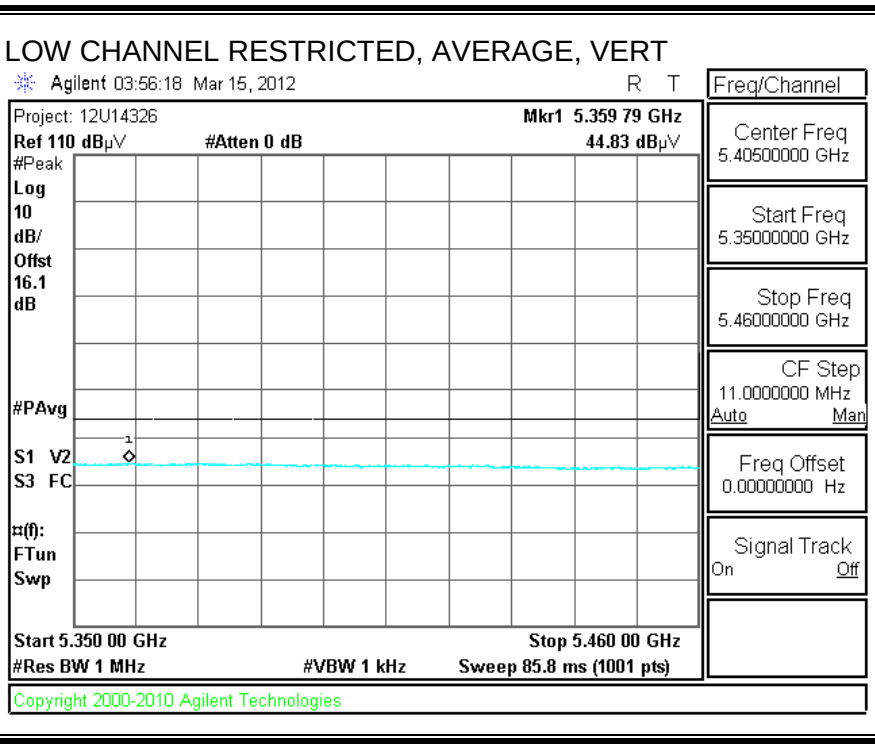




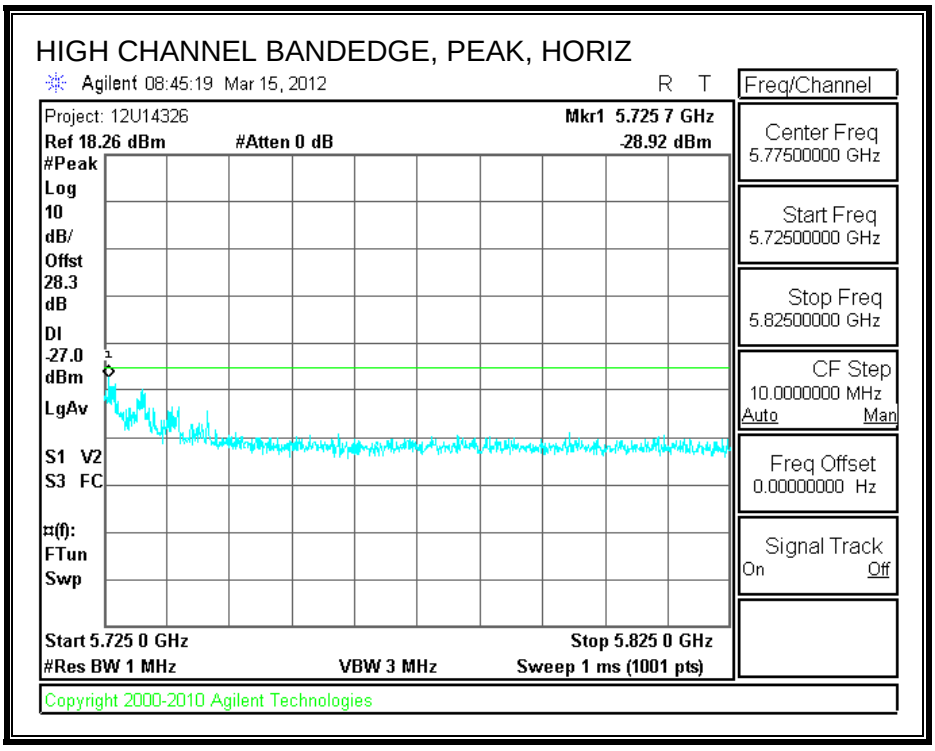
LOW CHANNEL RESTRICTED & AUTHORIZED, PEAK, VERT

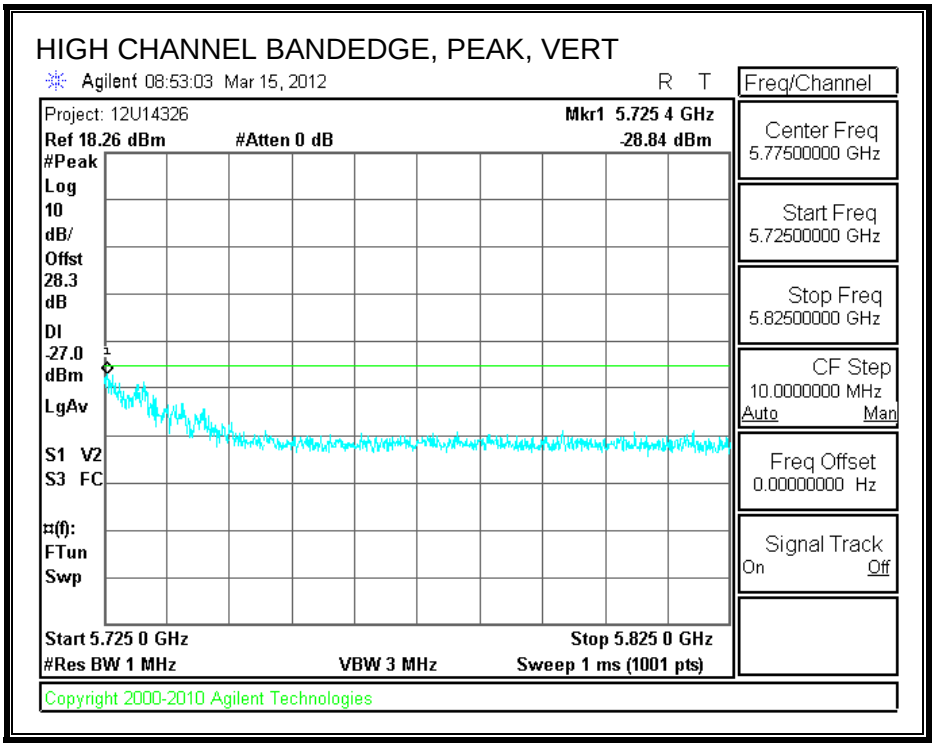


LOW CHANNEL RESTRICTED, AVERAGE, VERT



AUTHORIZED BANDEDGE (HIGH CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/21/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11a, W56 TX mode

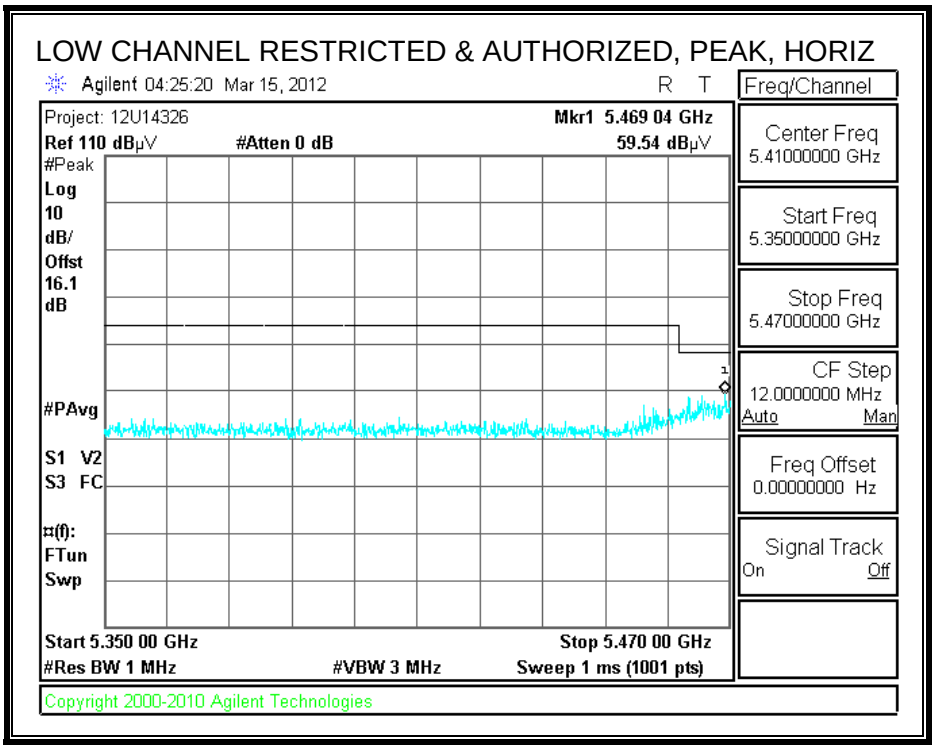
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

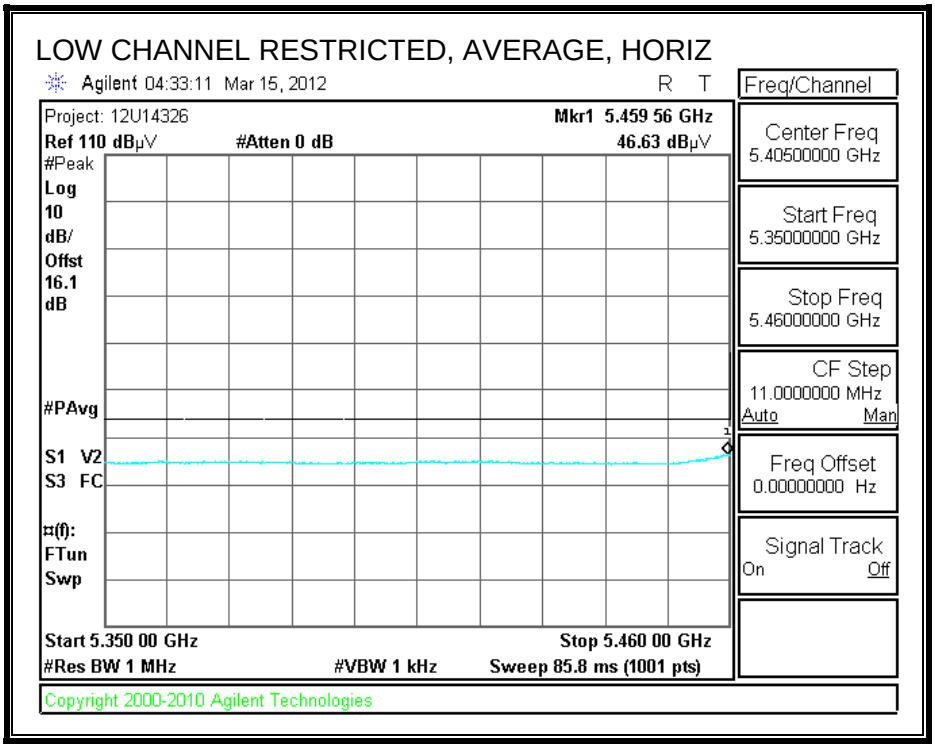
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5500MHz 11a													
11.000	3.0	44.8	38.3	10.1	-35.6	0.0	0.7	58.2	74.0	-15.8	V	P	
11.000	3.0	29.4	38.3	10.1	-35.6	0.0	0.7	42.9	54.0	-11.1	V	A	
5500MHz 11a													
11.000	3.0	38.5	38.3	10.1	-35.6	0.0	0.7	52.0	74.0	-22.0	H	P	
11.000	3.0	24.9	38.3	10.1	-35.6	0.0	0.7	38.4	54.0	-15.6	H	A	
5580MHz 11a													
11.160	3.0	38.7	38.5	10.2	-35.6	0.0	0.7	52.5	74.0	-21.5	H	P	
11.160	3.0	26.8	38.5	10.2	-35.6	0.0	0.7	40.6	54.0	-13.4	H	A	
5580MHz 11a													
11.160	3.0	44.8	38.5	10.2	-35.6	0.0	0.7	58.6	74.0	-15.4	V	P	
11.160	3.0	30.6	38.5	10.2	-35.6	0.0	0.7	44.4	54.0	-9.6	V	A	
5700MHz 11a													
11.400	3.0	42.7	38.7	10.4	-35.6	0.0	0.7	57.0	74.0	-17.0	V	P	
11.400	3.0	26.0	38.7	10.4	-35.6	0.0	0.7	40.4	54.0	-13.6	V	A	
5700MHz 11a													
11.400	3.0	35.6	38.7	10.4	-35.6	0.0	0.7	49.9	74.0	-24.1	H	P	
11.400	3.0	23.6	38.7	10.4	-35.6	0.0	0.7	37.9	54.0	-16.1	H	A	

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

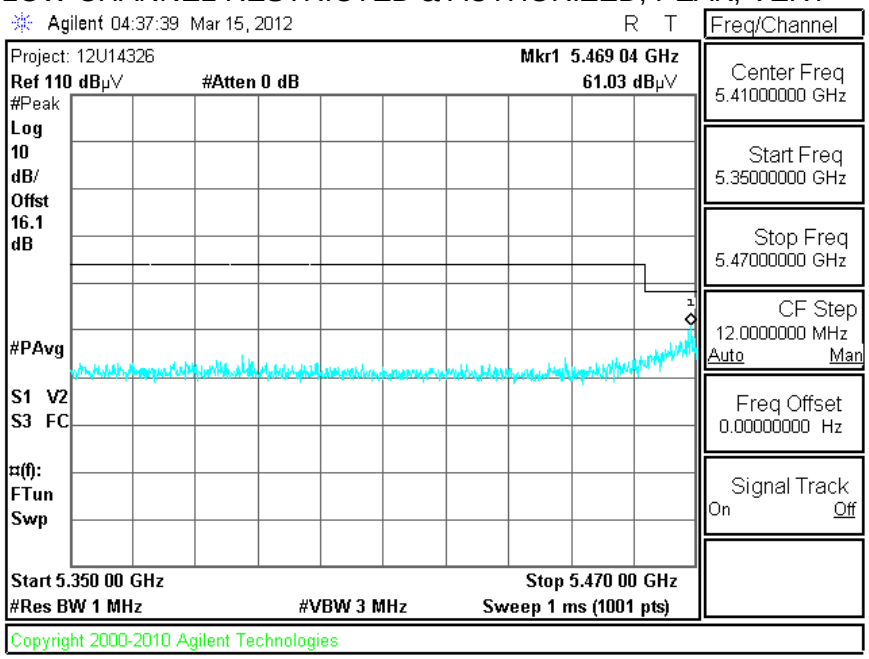
8.2.8. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.6 GHz BAND

RESTRICTED & AUTHORIZED BANDEDGE (LOW CHANNEL)

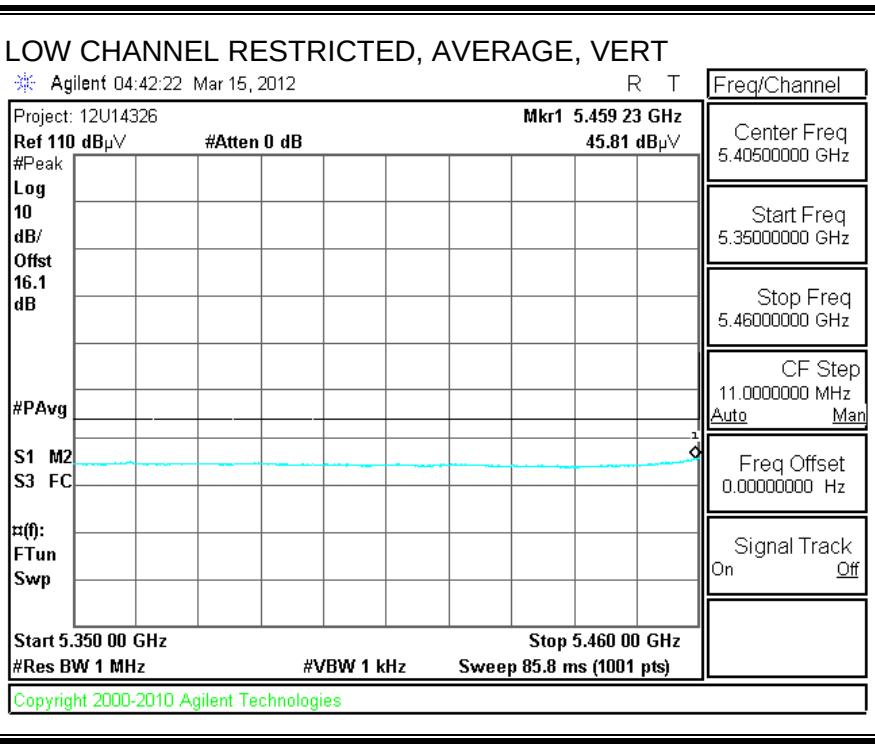




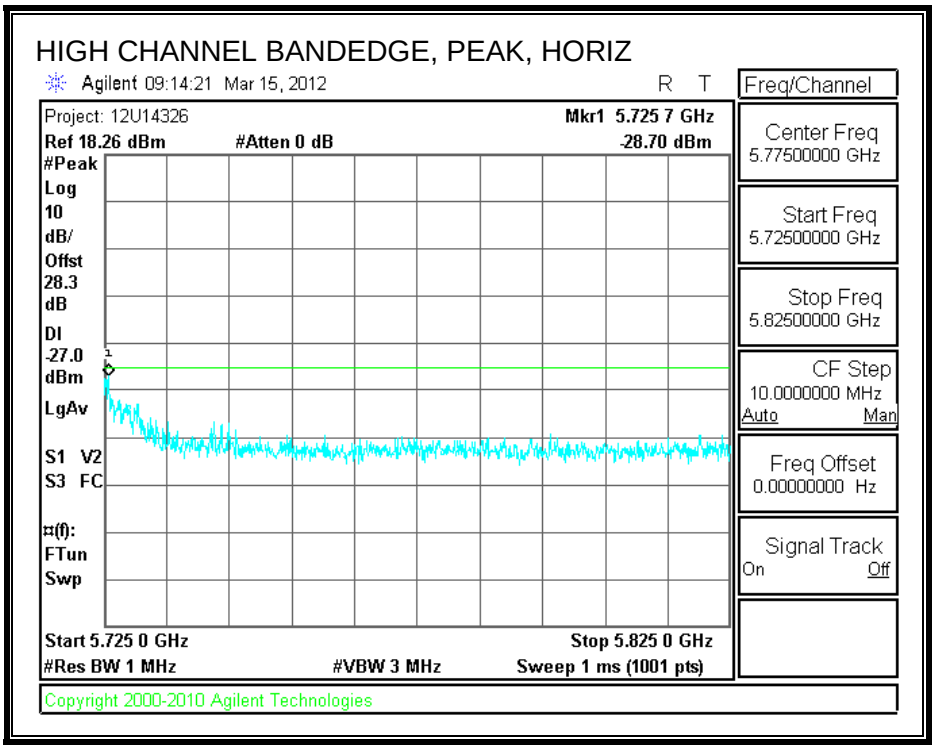
LOW CHANNEL RESTRICTED & AUTHORIZED, PEAK, VERT

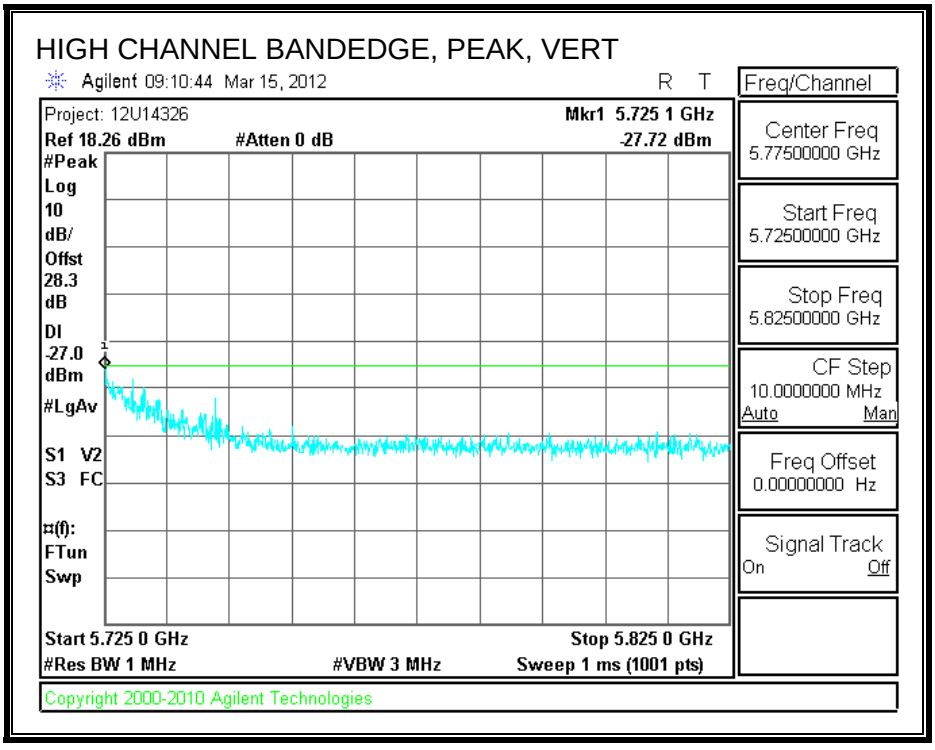


LOW CHANNEL RESTRICTED, AVERAGE, VERT



AUTHORIZED BANDEDGE (HIGH CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/21/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT20, W56 TX mode

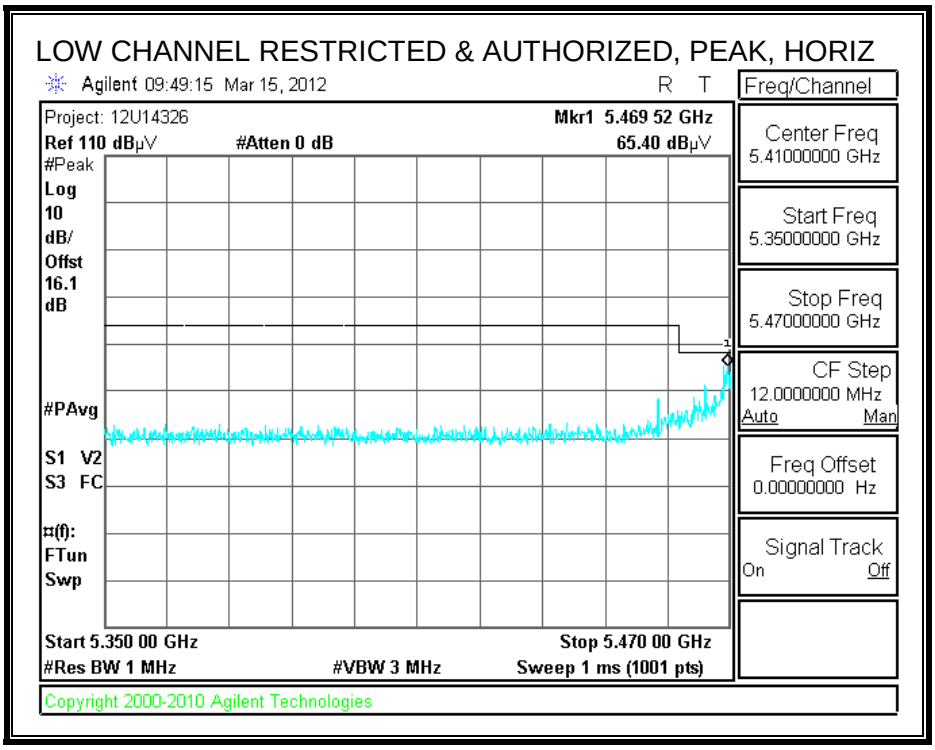
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

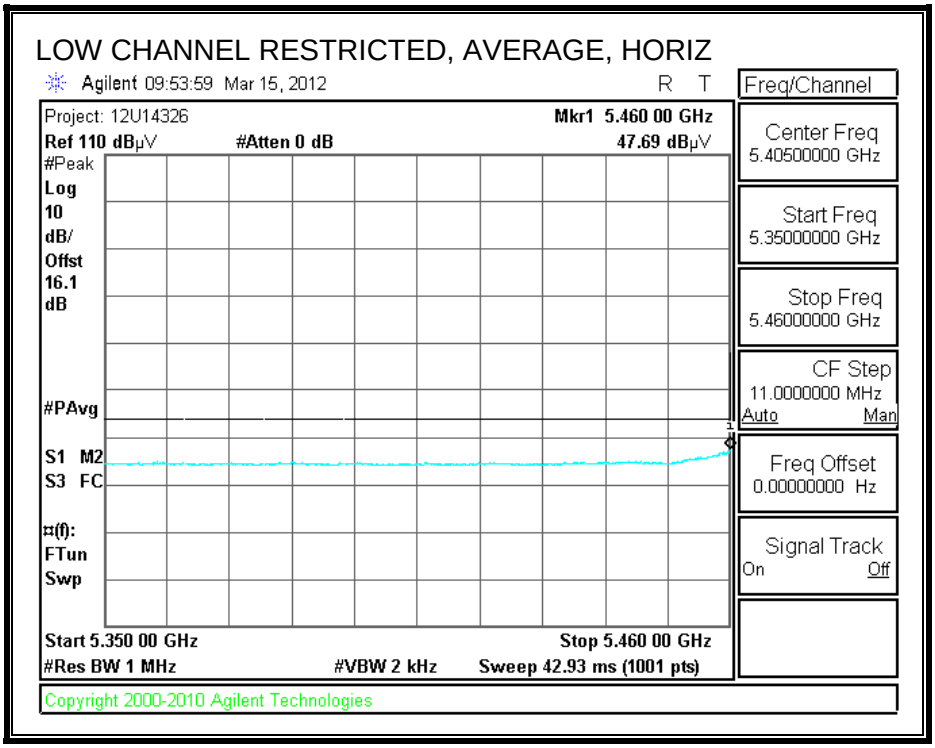
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5500MHz HT20													
11.000	3.0	46.1	38.3	10.1	-35.6	0.0	0.7	59.5	74.0	-14.5	V	P	
11.000	3.0	32.2	38.3	10.1	-35.6	0.0	0.7	45.6	54.0	-8.4	V	A	
5500MHz HT20													
11.000	3.0	36.9	38.3	10.1	-35.6	0.0	0.7	50.3	74.0	-23.7	H	P	
11.000	3.0	24.0	38.3	10.1	-35.6	0.0	0.7	37.4	54.0	-16.6	H	A	
5580MHz HT20													
11.160	3.0	40.9	38.5	10.2	-35.6	0.0	0.7	54.7	74.0	-19.3	H	P	
11.160	3.0	27.8	38.5	10.2	-35.6	0.0	0.7	41.6	54.0	-12.4	H	A	
5580MHz HT20													
11.160	3.0	44.2	38.5	10.2	-35.6	0.0	0.7	58.0	74.0	-16.0	V	P	
11.160	3.0	29.9	38.5	10.2	-35.6	0.0	0.7	43.7	54.0	-10.3	V	A	
5700MHz HT20													
11.400	3.0	35.5	38.7	10.4	-35.6	0.0	0.7	49.8	74.0	-24.2	H	P	
11.400	3.0	23.5	38.7	10.4	-35.6	0.0	0.7	37.8	54.0	-16.2	H	A	
5700MHz HT20													
11.400	3.0	41.1	38.7	10.4	-35.6	0.0	0.7	55.4	74.0	-18.6	V	P	
11.400	3.0	26.2	38.7	10.4	-35.6	0.0	0.7	40.5	54.0	-13.5	V	A	

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

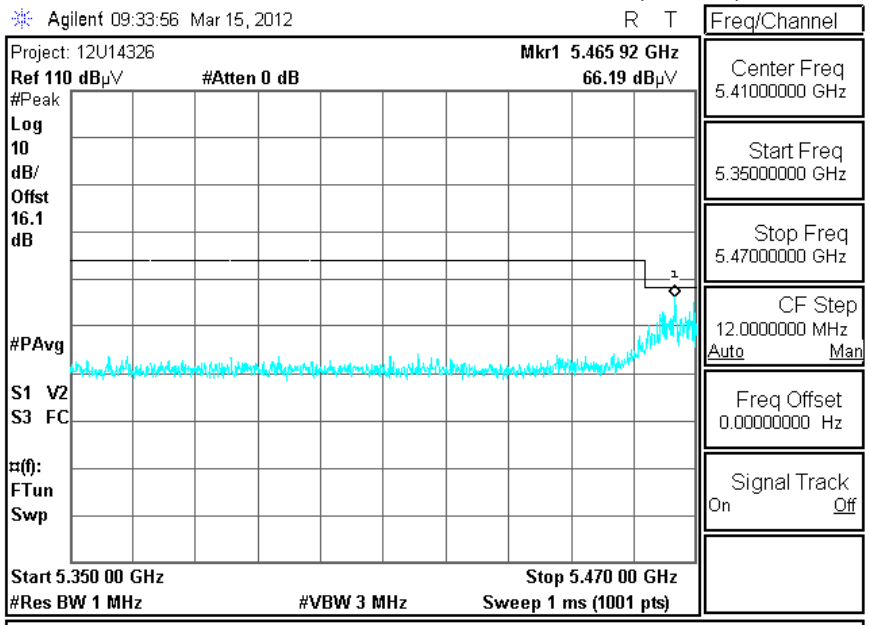
8.2.9. TX ABOVE 1 GHz 802.11n HT40 MODE IN THE 5.6 GHz BAND

RESTRICTED & AUTHORIZED BANDEDGE (LOW CHANNEL)

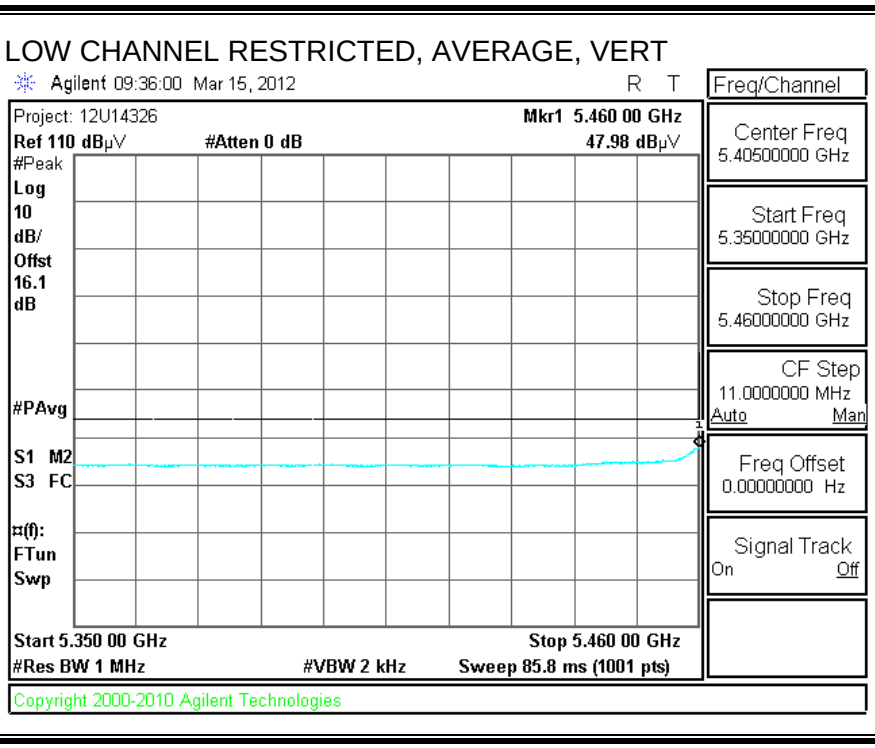




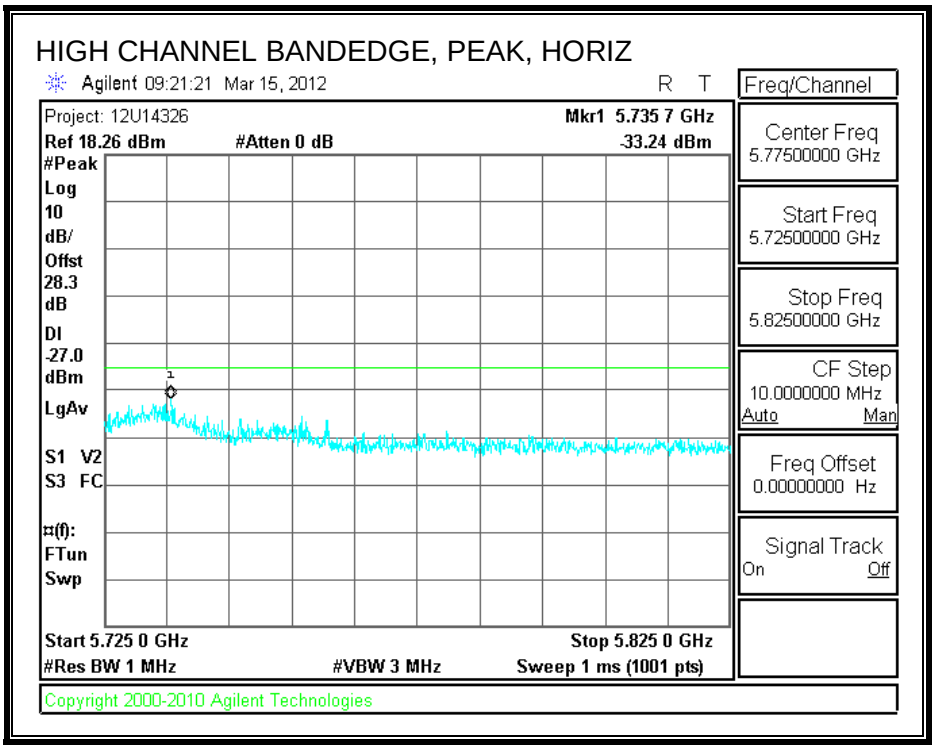
LOW CHANNEL RESTRICTED & AUTHORIZED, PEAK, VERT

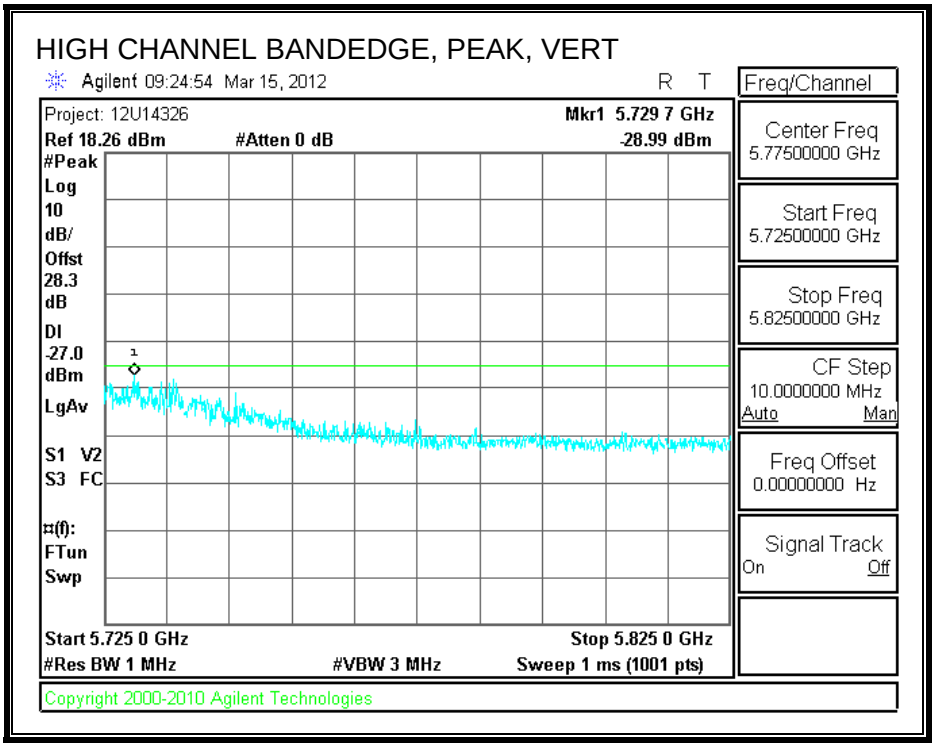


LOW CHANNEL RESTRICTED, AVERAGE, VERT



AUTHORIZED BANDEDGE (HIGH CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/21/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT40, W56 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		

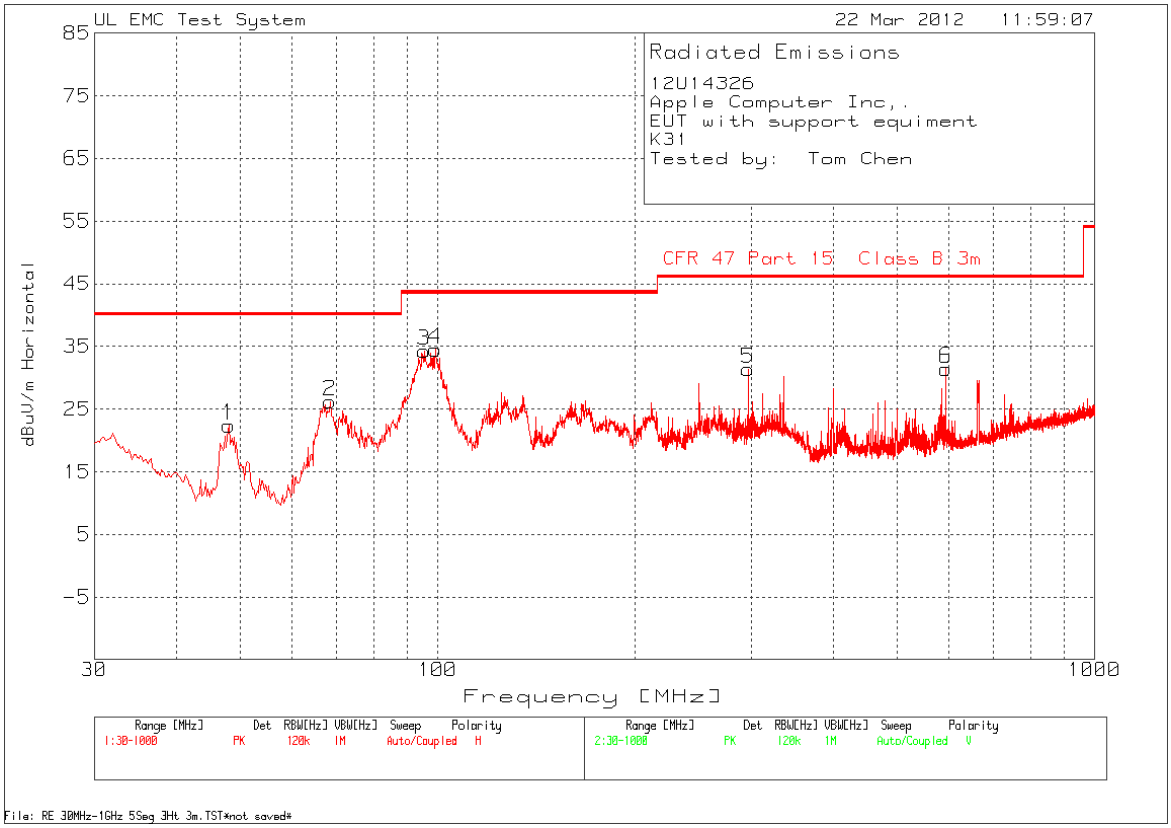
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5510MHz HT40													
11.020	3.0	40.0	38.3	10.1	-35.6	0.0	0.7	53.5	74.0	-20.5	V	P	
11.020	3.0	25.2	38.3	10.1	-35.6	0.0	0.7	38.7	54.0	-15.3	V	A	
5510MHz HT40													
11.020	3.0	35.5	38.3	10.1	-35.6	0.0	0.7	49.0	74.0	-25.0	H	P	
11.020	3.0	23.1	38.3	10.1	-35.6	0.0	0.7	36.6	54.0	-17.4	H	A	
5550MHz HT40													
11.100	3.0	35.8	38.4	10.1	-35.6	0.0	0.7	49.5	74.0	-24.5	H	P	
11.100	3.0	23.0	38.4	10.1	-35.6	0.0	0.7	36.7	54.0	-17.3	H	A	
5550MHz HT40													
11.100	3.0	34.8	38.4	10.1	-35.6	0.0	0.7	48.5	74.0	-25.5	V	P	
11.100	3.0	23.1	38.4	10.1	-35.6	0.0	0.7	36.8	54.0	-17.2	V	A	
5670MHz HT40													
11.340	3.0	41.9	38.7	10.4	-35.6	0.0	0.7	56.0	74.0	-18.0	V	P	
11.340	3.0	26.9	38.7	10.4	-35.6	0.0	0.7	41.1	54.0	-12.9	V	A	
5670MHz HT40													
11.340	3.0	36.0	38.7	10.4	-35.6	0.0	0.7	50.2	74.0	-23.8	H	P	
11.340	3.0	24.1	38.7	10.4	-35.6	0.0	0.7	38.3	54.0	-15.7	H	A	

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

8.3. WORST-CASE BELOW 1 GHz

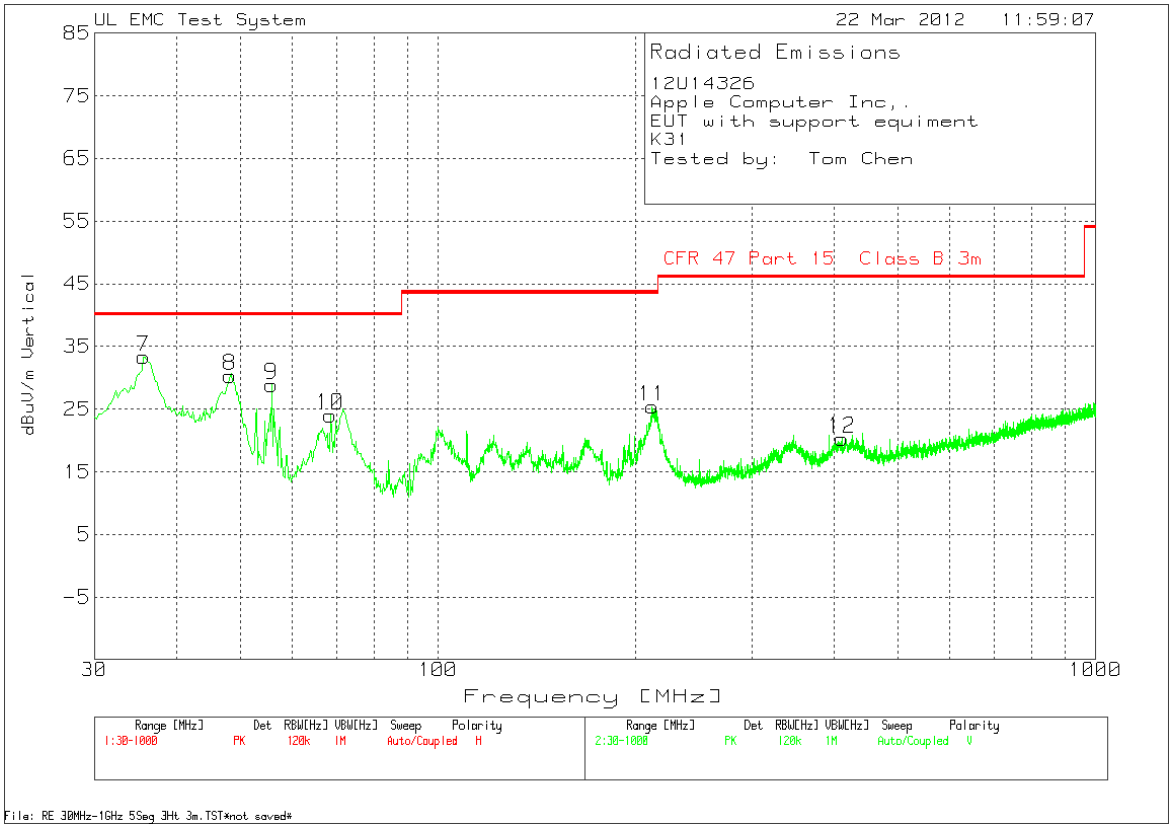
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

12U14326
Apple Computer Inc,.
EUT with support equiment
K31
Tested by: Tom Chen

Range 1 30 - 1000MHz

Test Frequency	Meter Reading	Detector	25MHz-1Ghz ChmbrB Amp [dB]	T130 Bilog Factors.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Polarity
48.0276	42.3	PK	-29.1	9.2	22.4	40	Horz
68.5751	46.92	PK	-28.9	8.2	26.22	40	Horz
95.3257	53.96	PK	-28.6	8.9	34.26	43.5	Horz
99.2026	53.23	PK	-28.6	9.9	34.53	43.5	Horz
296.9245	45.05	PK	-26.9	13.2	31.35	46	Horz
593.8949	39.97	PK	-26.7	18.2	31.47	46	Horz

Range 2 30 - 1000MHz

Test Frequency	Meter Reading	Detector	25MHz-1Ghz ChmbrB Amp [dB]	T130 Bilog Factors.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Polarity
35.6215	44.95	PK	-29.2	17.6	33.35	40	Vert
48.2214	50.3	PK	-29.1	9.1	30.3	40	Vert
55.7814	49.95	PK	-29	7.9	28.85	40	Vert
68.5751	44.71	PK	-28.9	8.2	24.01	40	Vert
211.6327	40.88	PK	-27.5	12	25.38	43.5	Vert
411.4868	32	PK	-26.9	15.2	20.3	46	Vert

9. 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:12U14326
Client Name:Apple computer Inc,.
Model/Device:K31
Test Volt/Freq:FCC Class B 120VAC 60 Hz
Test By:Tom Chen

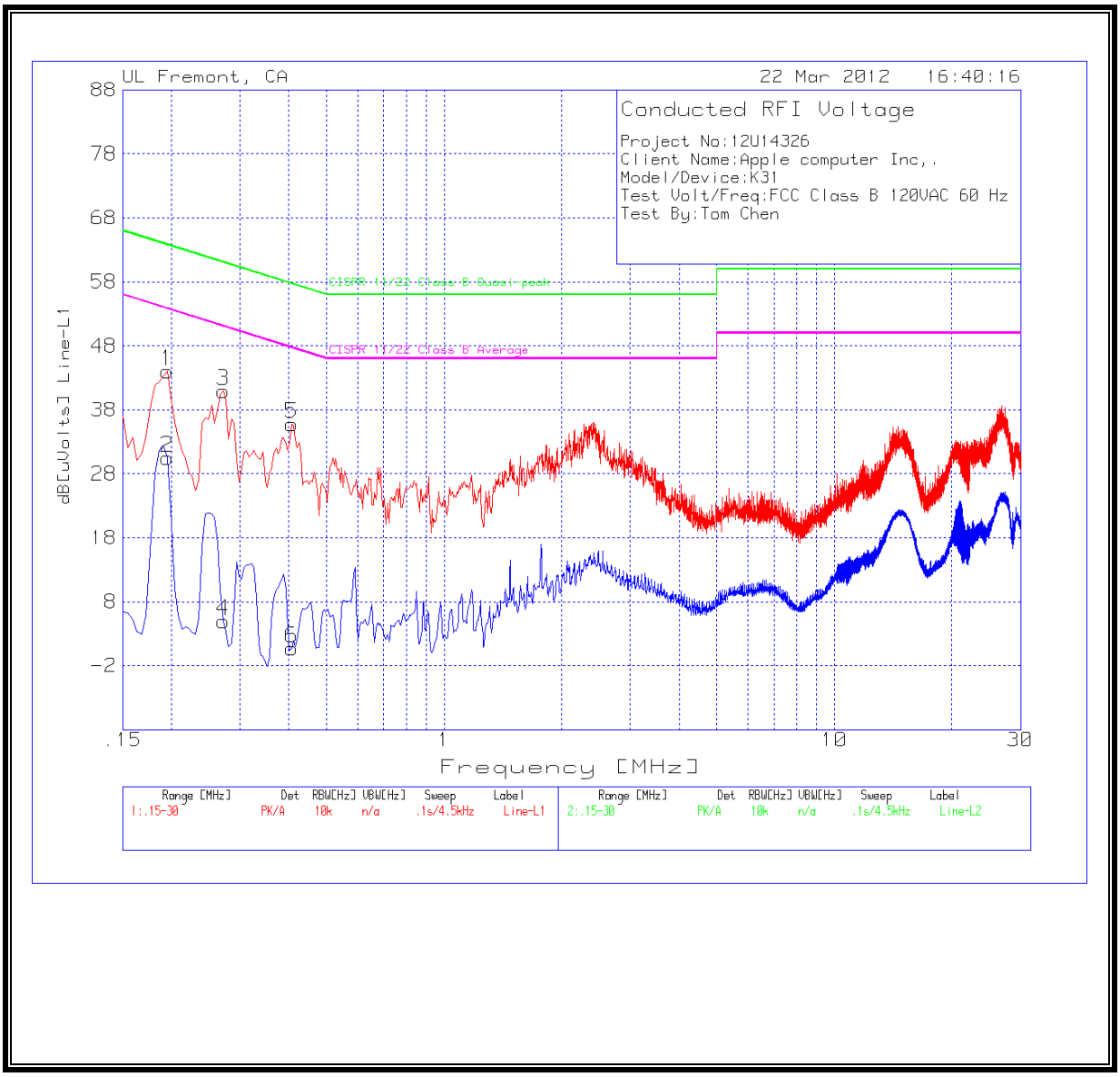
Line-L1 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dB[uVolts]	CISPR 11/22 Class B Quasi-peak	Margin	CISPR 11/22 Class B Average	Margin
0.195	43.93	PK	0.1	0	44.03	63.8	-19.77	-	-
0.195	30.38	Av	0.1	0	30.48	-	-	53.8	-23.32
0.2715	40.8	PK	0.1	0	40.9	61.1	-20.2	-	-
0.2715	4.93	Av	0.1	0	5.03	-	-	51.1	-46.07
0.4065	35.72	PK	0.1	0	35.82	57.7	-21.88	-	-
0.4065	0.6	Av	0.1	0	0.7	-	-	47.7	-47

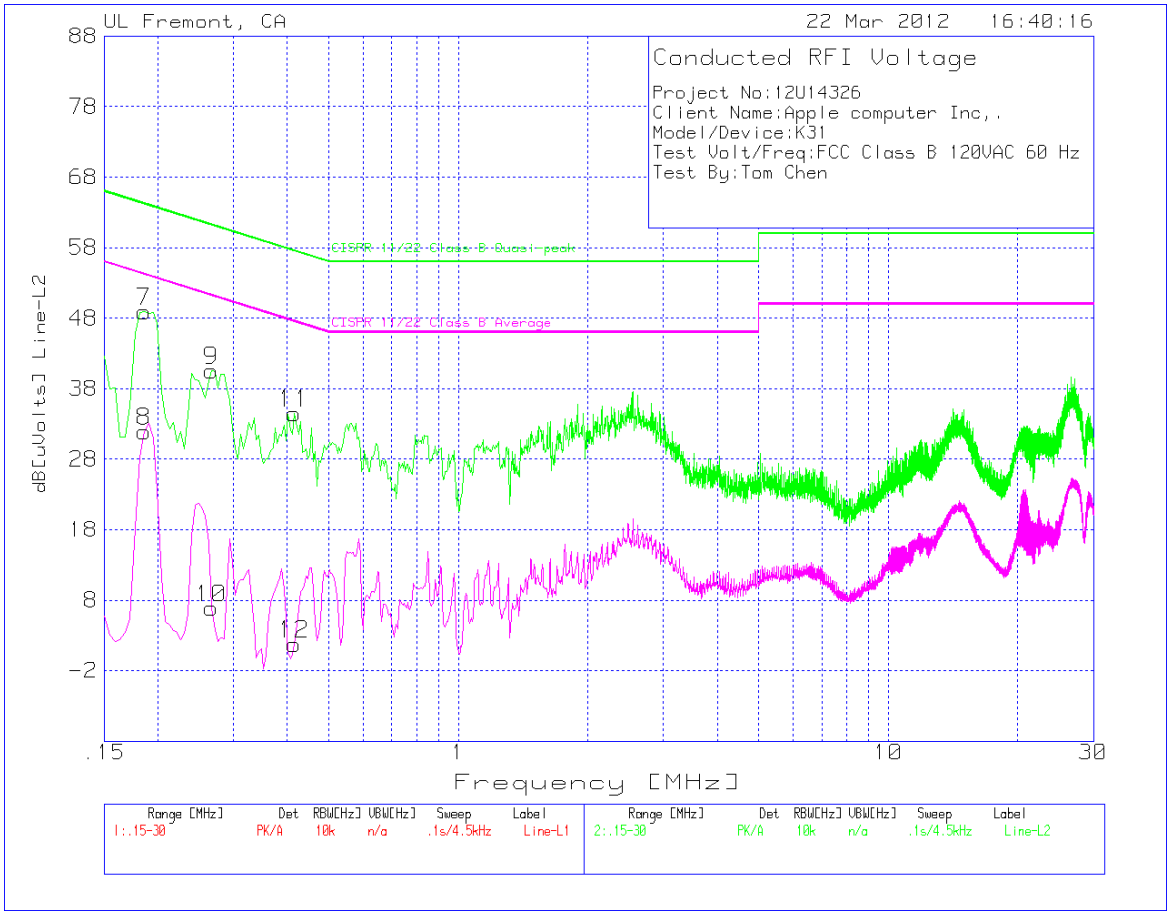
Line-L2 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L2.TXT [dB]	LC Cables 2&3.TXT [dB]	dB[uVolts]	CISPR 11/22 Class B Quasi-peak	Margin	CISPR 11/22 Class B Average	Margin
0.186	48.81	PK	0.1	0	48.91	64.2	-15.29	-	-
0.186	31.81	Av	0.1	0	31.91	-	-	54.2	-22.29
0.267	40.45	PK	0.1	0	40.55	61.2	-20.65	-	-
0.267	6.75	Av	0.1	0	6.85	-	-	51.2	-44.35
0.4155	34.38	PK	0.1	0	34.48	57.5	-23.02	-	-
0.4155	1.64	Av	0.1	0	1.74	-	-	47.5	-45.76

LINE 1 RESULTS



LINE 2 RESULTS



10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)
where
S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))
where
D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RSS-102 Clause 2.5.2 RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 2.5 W;
- at or above 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 5 W.

RESULTS

Multiple chain or colocated transmitters								
Band	**Mode**	**Chain for MIMO**	**Separation Distance (m)**	**Output AV Power (dBm)**	**Antenna Gain (dBi)**	**Duty Cycle (%)**	**IC Power Density (W/m^2)**	**FCC Power Density (mW/cm^2)**
5.2 GHz	WLAN	1		13.60	0.93	96.7		
5.2 GHz	WLAN	2		13.50	1.88	96.7		
Combined			0.20				0.12	0.012

Multiple chain or colocated transmitters									
Band	**Mode**	**Chain for MIMO**	**Separation Distance (m)**	**Output Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**EIRP (W)**	**IC Power Density (W/m^2)**	**FCC Power Density (mW/cm^2)**
2.4 GHz	WLAN	1		20.50	1.49	21.99	0.16		
2.4 GHz	WLAN	2		20.65	1.82	22.47	0.18		
5.2 GHz	WLAN	1		13.60	0.93	14.53	0.03		
5.2 GHz	WLAN	2		13.50	1.88	15.38	0.03		
Combined			0.20				0.40	0.79	0.079

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
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
Channel Closing Transmission Time	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

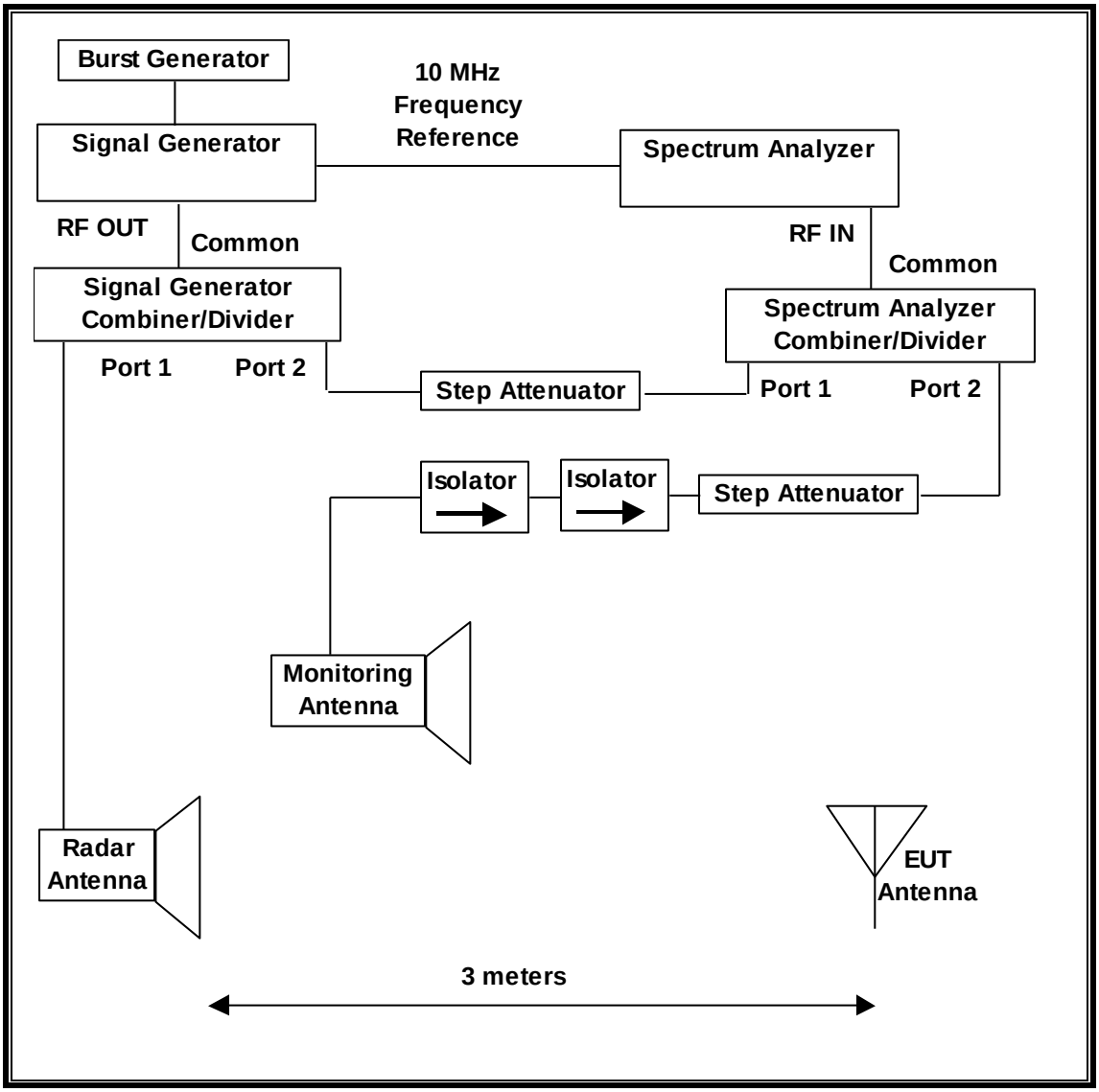
Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000-2000	80%	30

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 Freqeuncy 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.

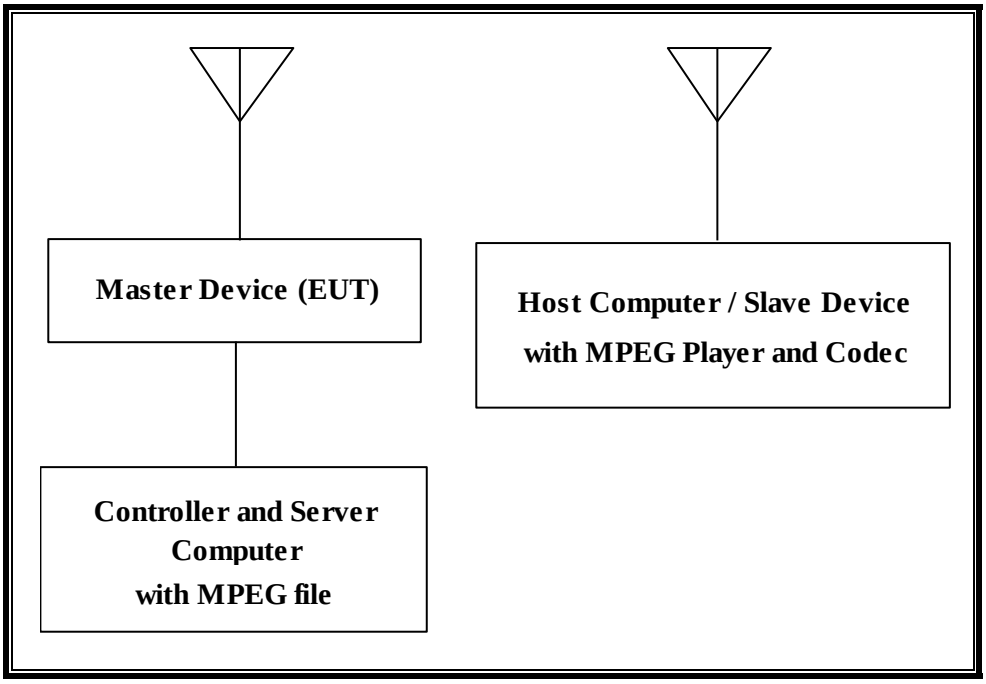
TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial 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
Arbitrary Waveform Generator	Agilent / HP	33220A	C01146	09/16/12

11.1.3. SETUP OF EUT

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**
Notebook PC (Controller/Server)	Apple	MacBook Pro A1297	W89350HD8YA	DoC
AC Adapter (Controller/Server PC)	Delta Electronics	A1343	C0415060MCADJ92AR	DoC
Notebook PC (Host/Slave Radio)	Apple	MacBook A1278	C02GM2BLDV13	QDS-BRCM1055
AC Adapter (Host PC)	Delta Electronics	A1222	MV8100WD2Z8VA	DoC

11.1.4. DESCRIPTION OF EUT

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges, excluding operation in the 5600 to 5650 MHz band.

The EUT is a Master Device.

The highest power level within these bands is 24.28 dBm EIRP in the 5250-5350 MHz band and 25.36 dBm EIRP in the 5470-5725 MHz band.

The highest gain antenna assembly utilized with the EUT has a gain of 2.07 dBi in the 5250-5350 MHz band and 3.28 dBi in the 5470-5725 MHz band. The lowest gain antenna assembly utilized with the EUT has a gain of 1.54 dBi in the 5250-5350 MHz band and 3.09 dBi in the 5470-5725 MHz band.

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

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 two transmitter/receiver chains, each connected to an antenna to perform radiated tests.

The Slave device associated with the EUT during these tests does not have radar detection capability.

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 VLC version 2.0.1 media player.

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 are implemented: 20 MHz and 40 MHz.

The software installed in the access point is version 7.6.3d1 dev (09/11/12 Build).

UNIFORM CHANNEL SPREADING

See Manufacturer’s Attestation.

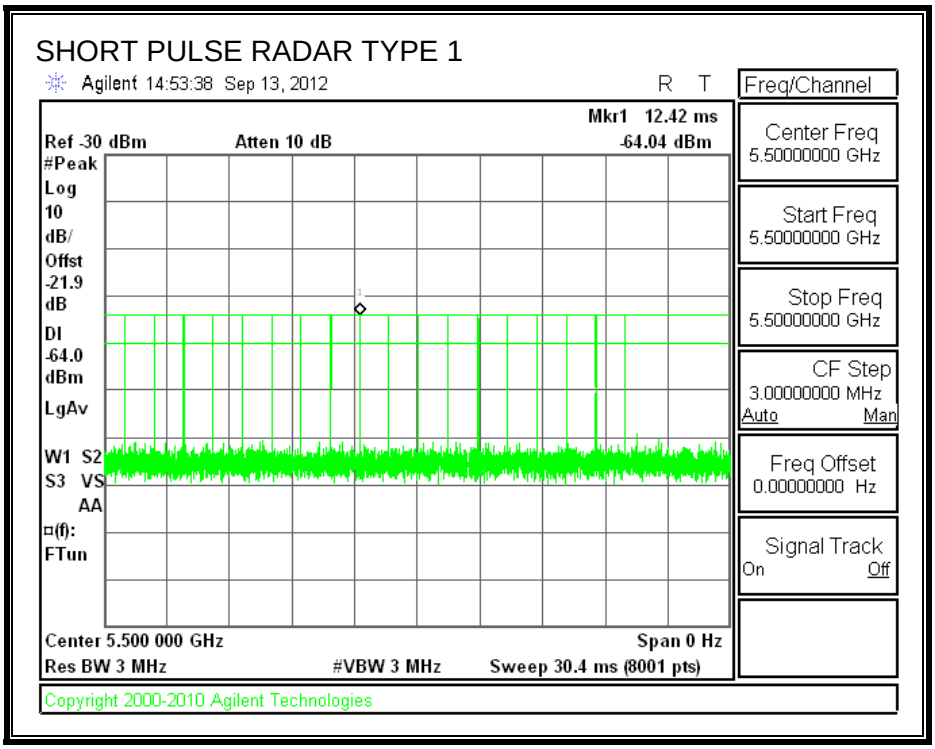
11.2. RESULTS FOR 20 MHz BANDWIDTH

11.2.1. TEST CHANNEL

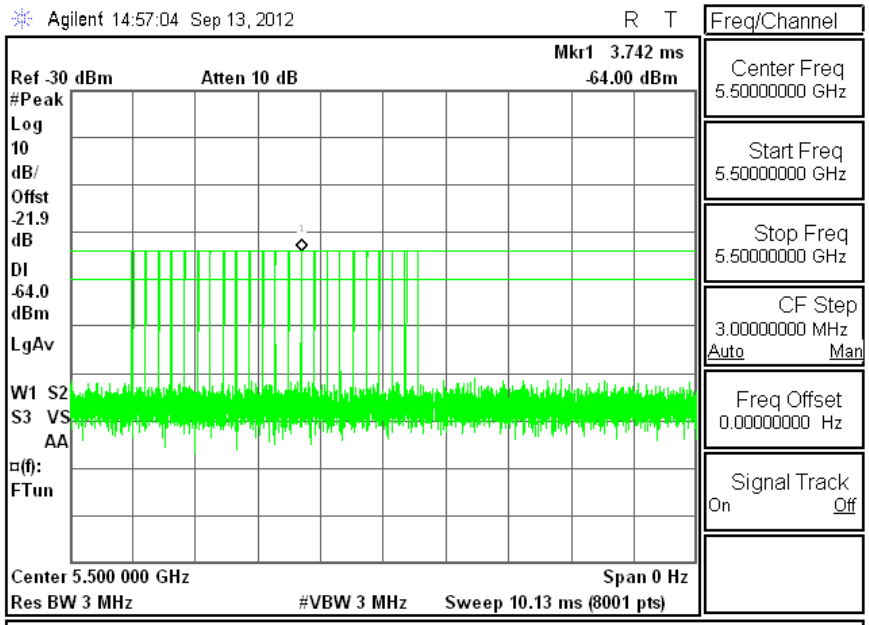
All tests were performed at a channel center frequency of 5500 MHz.

11.2.2. RADAR WAVEFORMS AND TRAFFIC

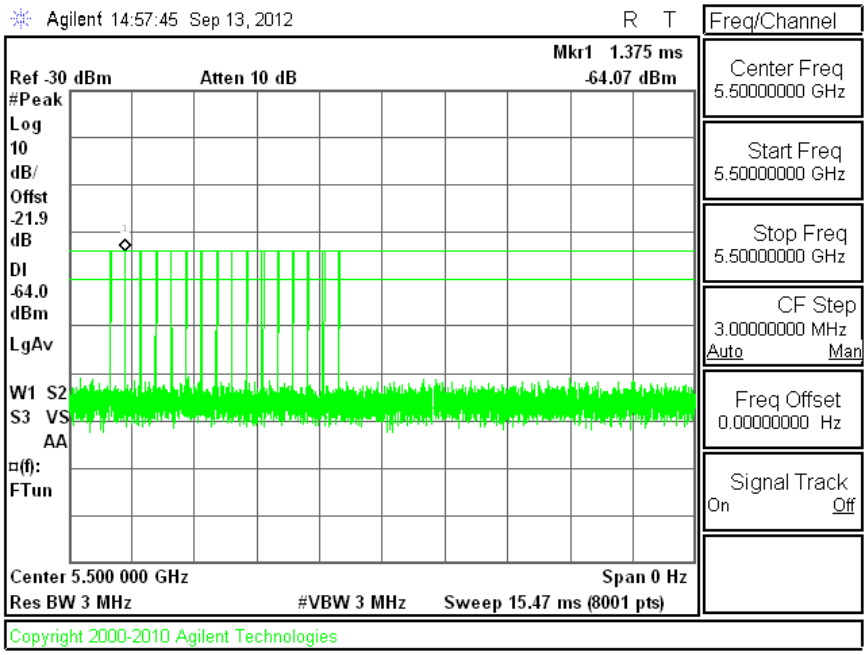
RADAR WAVEFORMS



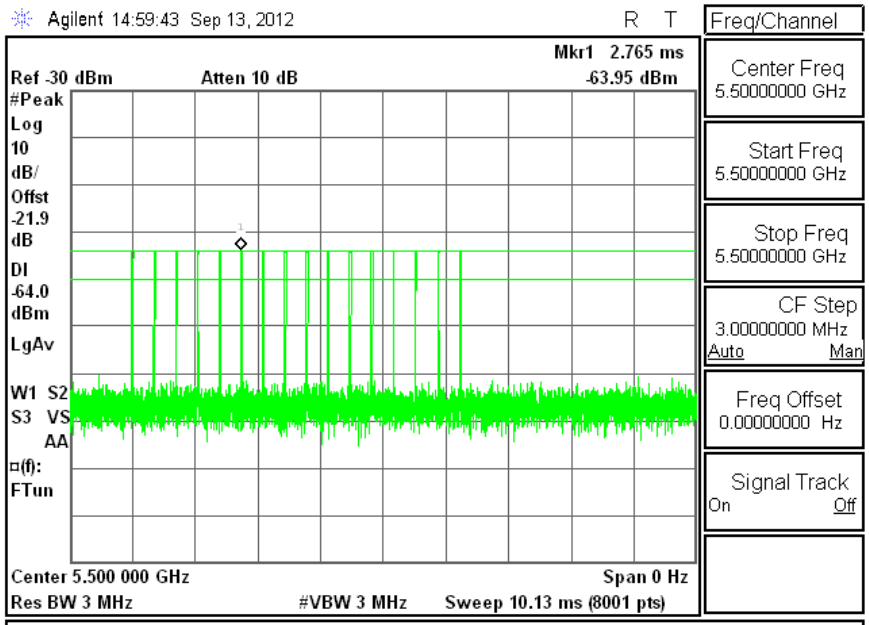
SAMPLE OF RADAR TYPE 2



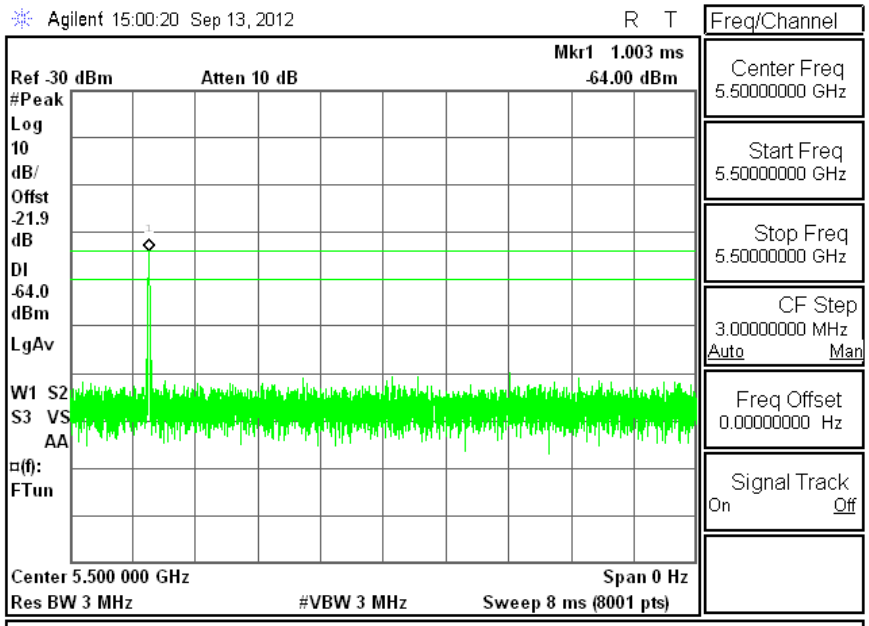
SAMPLE OF RADAR TYPE 3

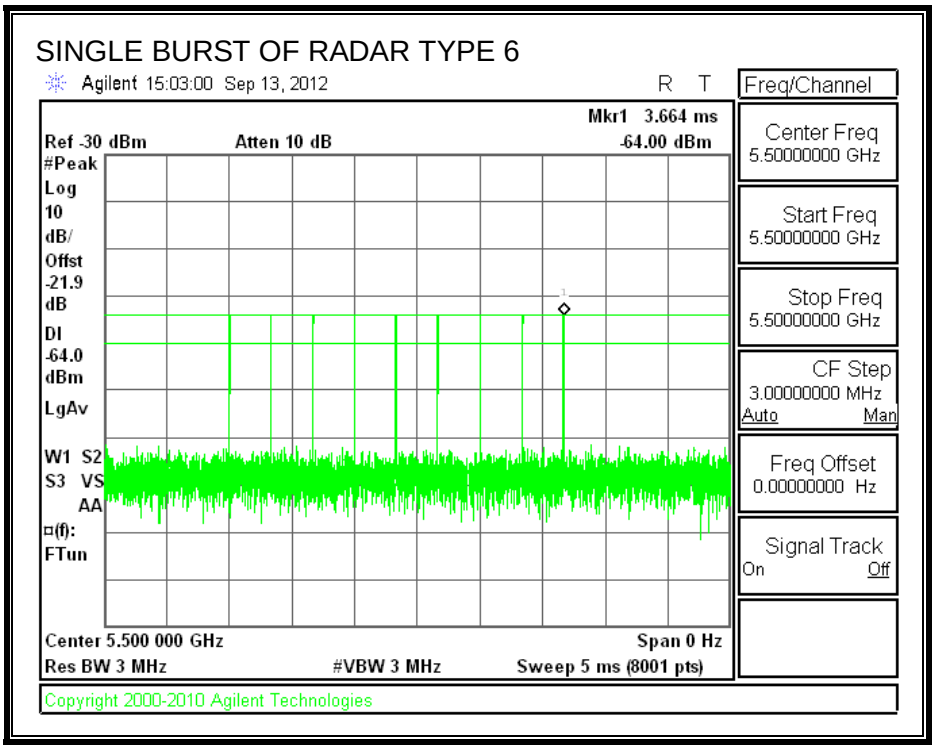


SAMPLE OF RADAR TYPE 4

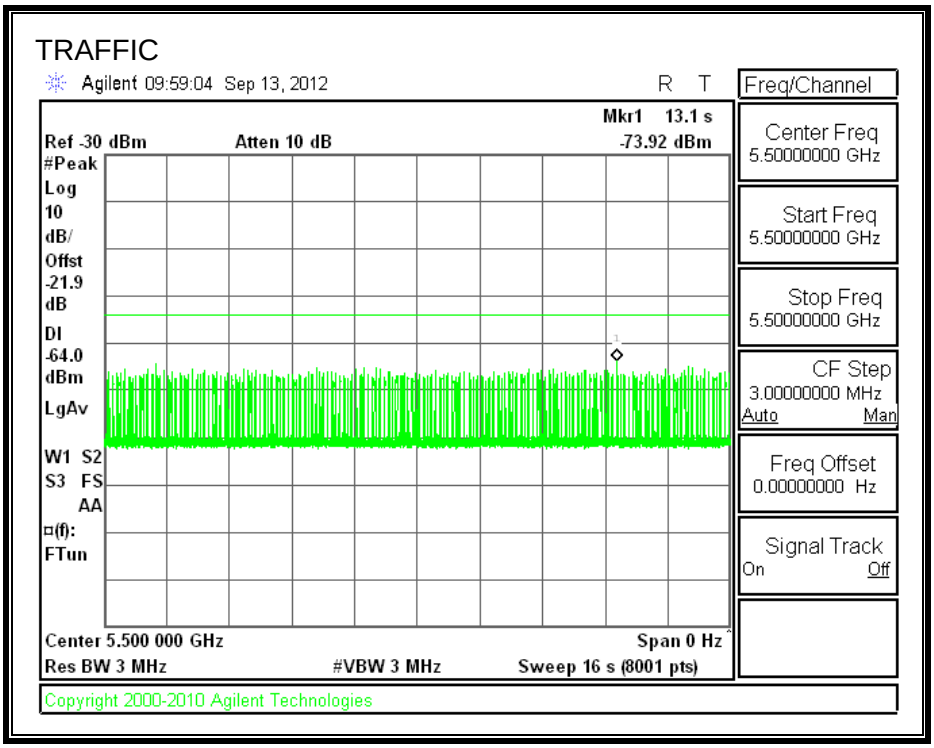


SAMPLE OF SINGLE BURST OF RADAR TYPE 5





TRAFFIC



11.2.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A link was established on channel then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

PROCEDURE FOR TIMING OF RADAR BURST

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
30.34	132.1	101.8	41.8

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
29.93	72.6	42.7	1.0

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
30.04	130.0	100.0	58.2

QUALITATIVE RESULTS

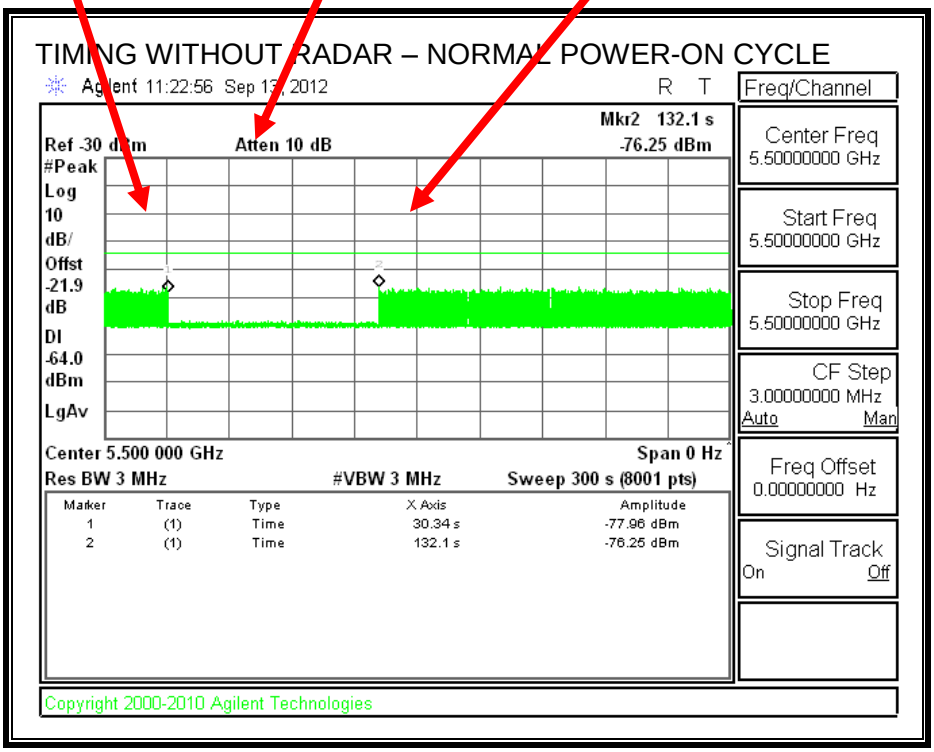
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT does not display any radar parameter values	No transmissions on channel
Within 54 to 60 second window	EUT does not display any radar parameter values	No transmissions on channel

TIMING WITHOUT RADAR DURING CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



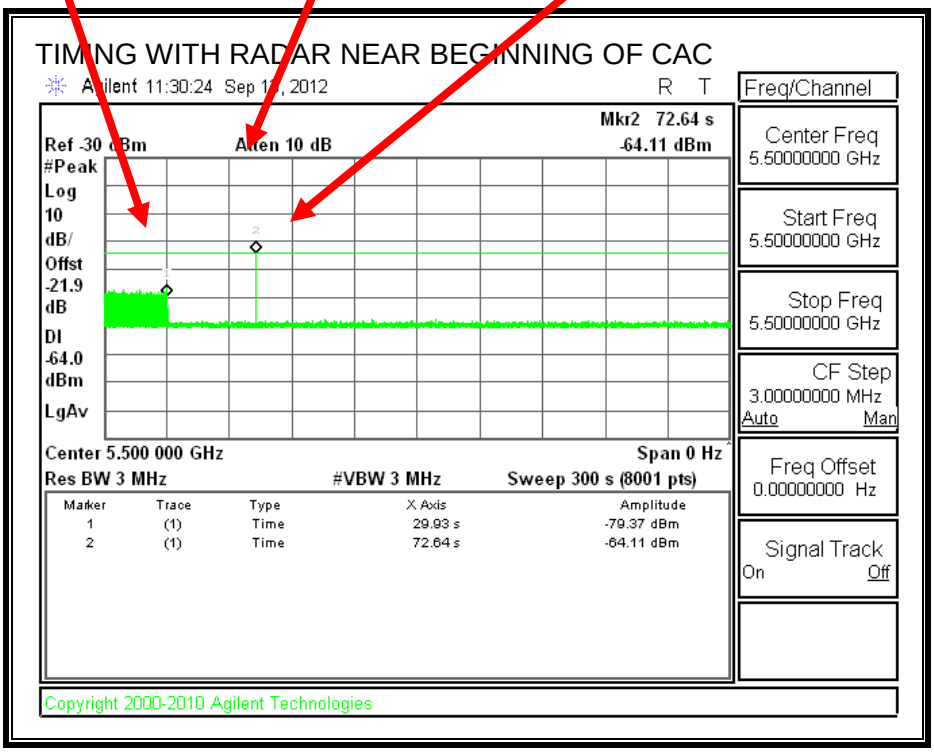
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



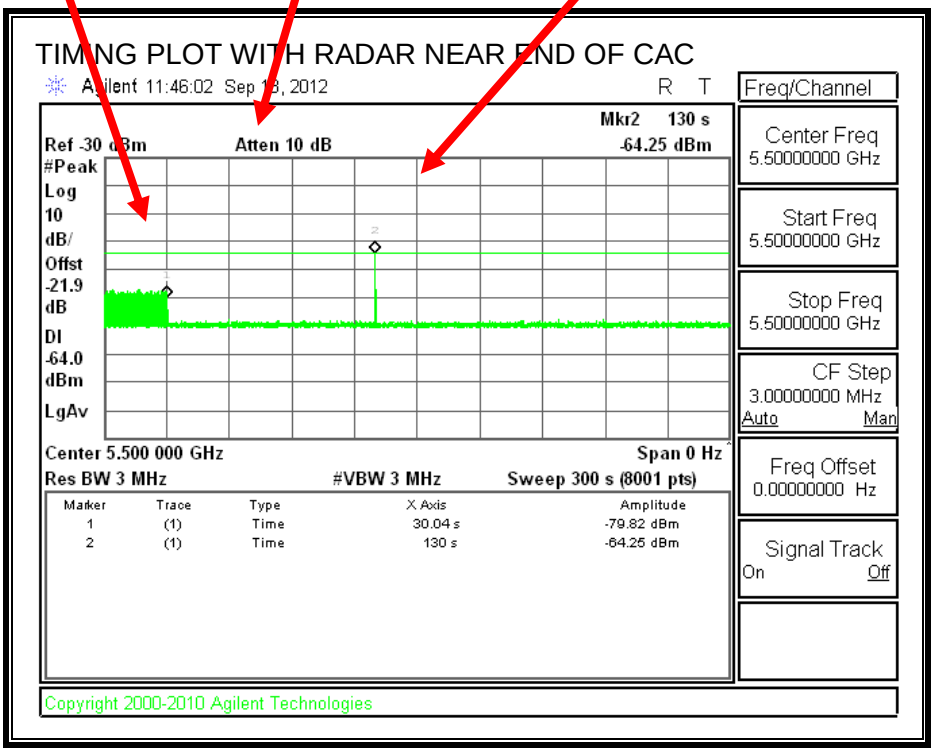
No EUT transmissions were observed after the radar signal.

TIMING PLOT WITH RADAR NEAR END OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

11.2.4. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.2.5. 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).

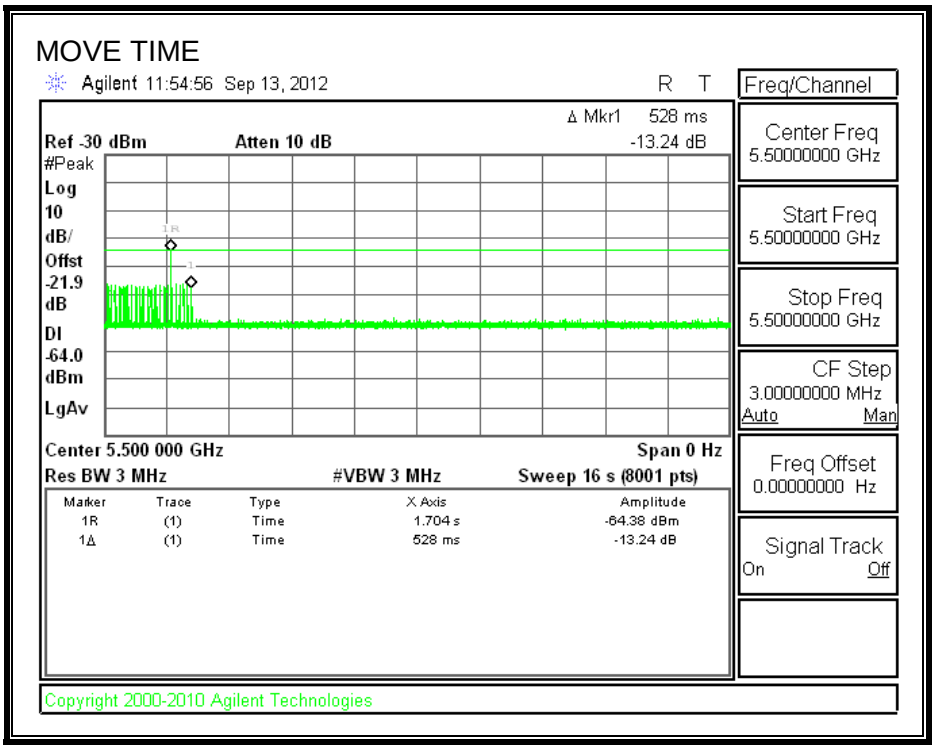
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

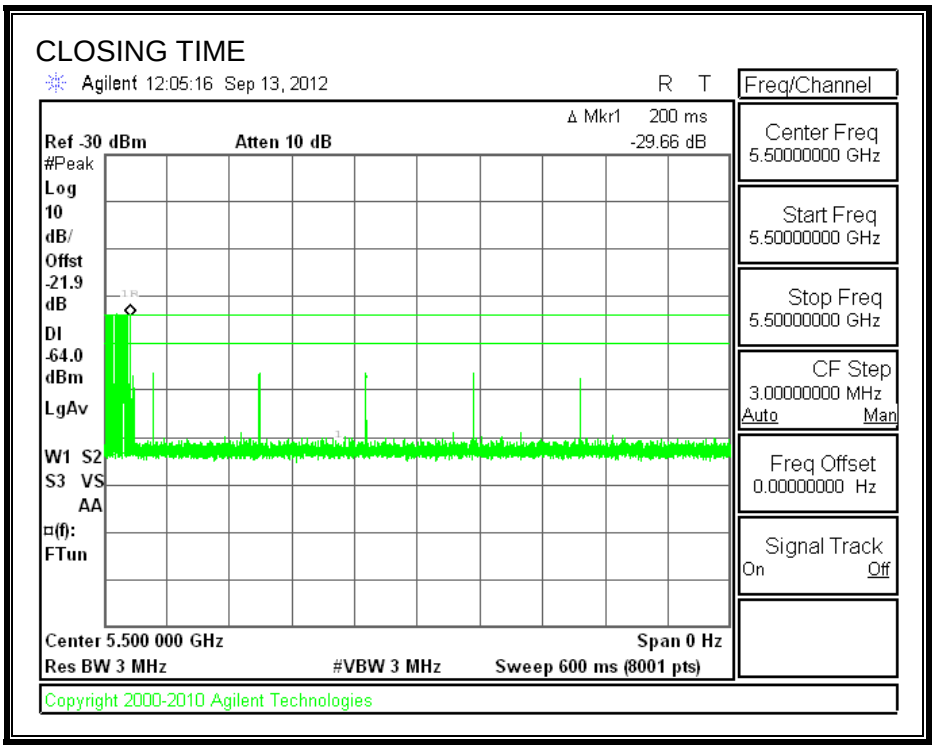
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.528	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	10.0	60
IC	34.0	260

MOVE TIME



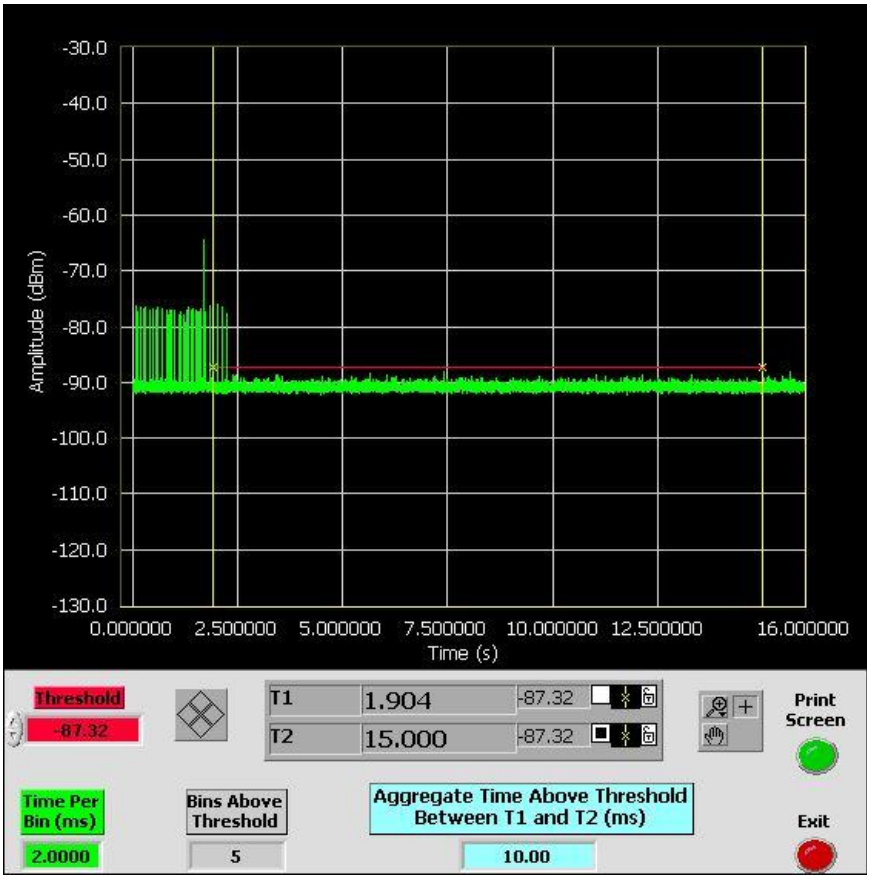
CHANNEL CLOSING TIME



AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

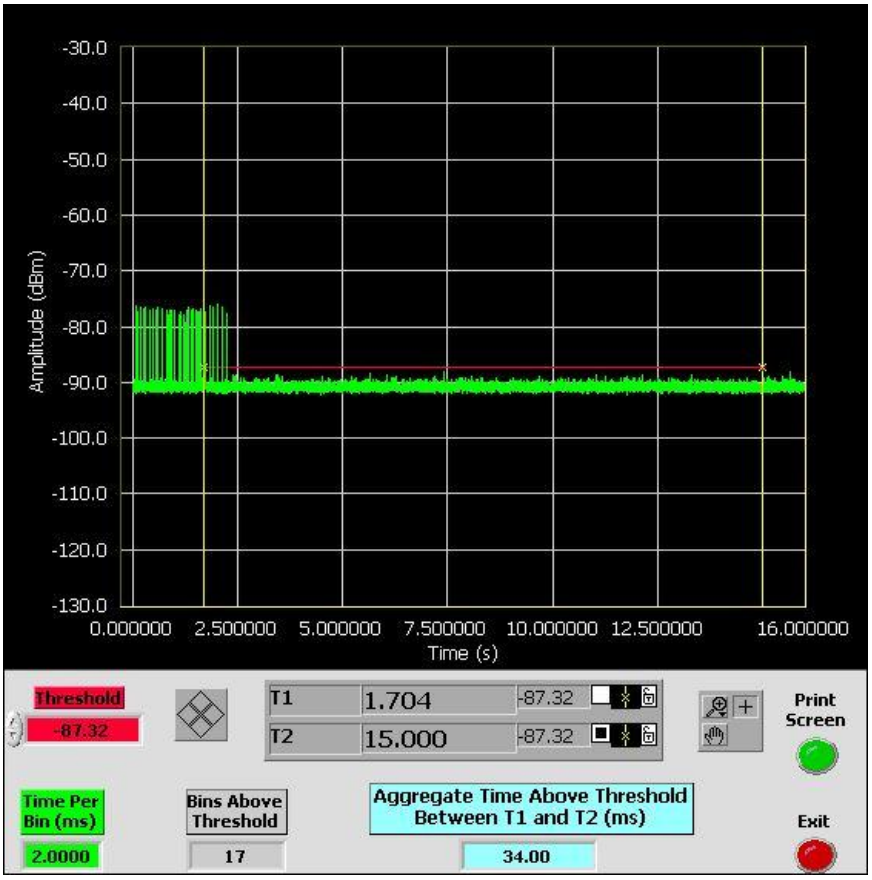
Only intermittent transmissions are observed during the FCC aggregate monitoring period.

FCC AGGREGATE CLOSING TIME



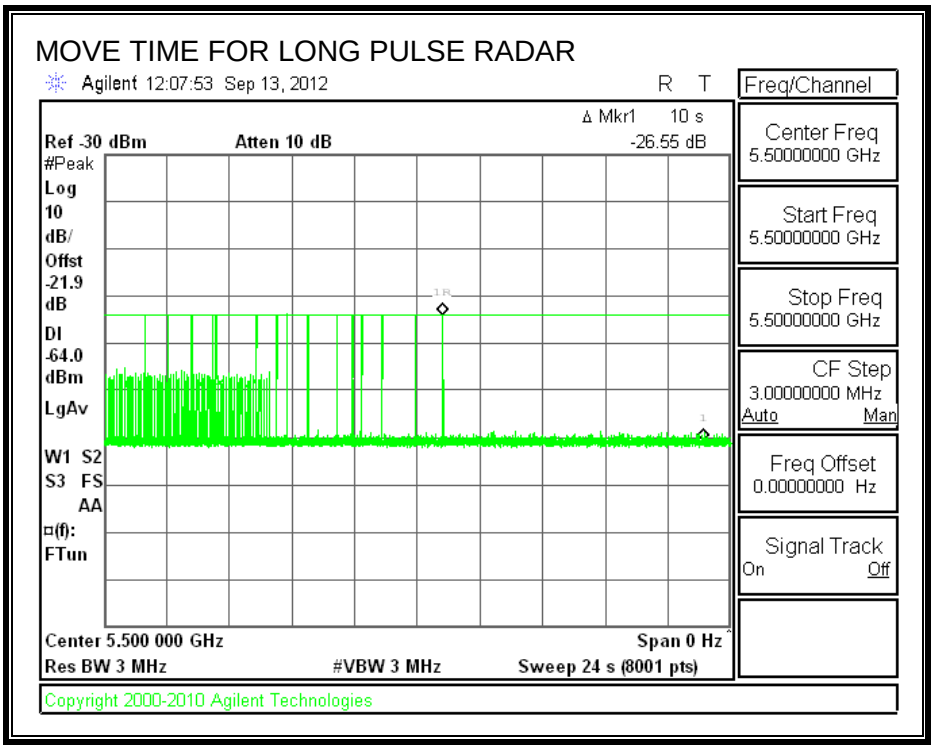
Only intermittent transmissions are observed during the IC aggregate monitoring period.

IC AGGREGATE CLOSING TIME



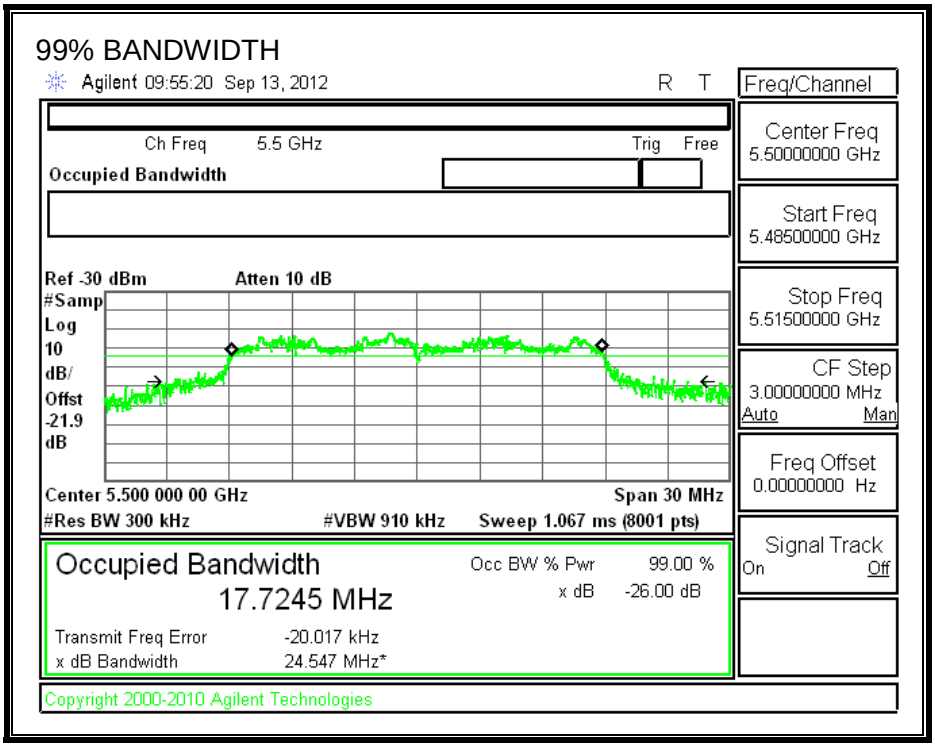
LONG PULSE CHANNEL MOVE TIME

The traffic ceases prior to 10 seconds after the end of the radar waveform.



11.2.6. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5492	5508	16	17.725	90.3	80

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results				
FCC Type 1 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5492	10	10	100	FL
5493	10	10	100	
5494	10	10	100	
5495	10	9	90	
5496	10	10	100	
5497	10	10	100	
5498	10	10	100	
5499	10	10	100	
5500	10	10	100	
5501	10	10	100	
5502	10	10	100	
5503	10	10	100	
5504	10	10	100	
5505	10	10	100	
5506	10	10	100	
5507	10	10	100	
5508	10	10	100	FH

11.2.7. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary				
Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail
FCC Short Pulse Type 1	30	100.00	60	Pass
FCC Short Pulse Type 2	30	90.00	60	Pass
FCC Short Pulse Type 3	30	96.67	60	Pass
FCC Short Pulse Type 4	30	96.67	60	Pass
Aggregate		95.83	80	Pass
FCC Long Pulse Type 5	30	100.00	80	Pass
FCC Hopping Type 6	34	100.00	70	Pass

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
2001	2.8	211.00	23	Yes
2002	1.9	222.00	26	Yes
2003	3.6	201.00	29	Yes
2004	4	157.00	27	Yes
2005	2.3	222.00	25	Yes
2006	1.4	208.00	29	Yes
2007	2.5	157.00	26	Yes
2008	1.2	183.00	27	Yes
2009	3.3	168.00	26	Yes
2010	3.1	152.00	29	Yes
2011	1.5	187.00	23	Yes
2012	1.8	177.00	29	Yes
2013	4	155.00	23	Yes
2014	1.9	179.00	25	No
2015	1.7	172.00	26	Yes
2016	3	176.00	24	Yes
2017	4	201.00	26	Yes
2018	3.3	178.00	26	Yes
2019	2.8	177.00	26	Yes
2020	3.5	206.00	29	Yes
2021	2.7	176.00	29	Yes
2022	1	161.00	25	Yes
2023	1.6	224.00	24	Yes
2024	2.7	208.00	28	Yes
2025	3.5	156.00	28	Yes
2026	2.9	182.00	28	Yes
2027	4.8	194.00	27	Yes
2028	1	155.00	23	No
2029	4.5	157.00	28	Yes
2030	1.2	154.00	24	No

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
3001	9.1	377.00	16	Yes
3002	9.3	310.00	17	Yes
3003	7	378.00	18	Yes
3004	7.7	482.00	17	Yes
3005	5.5	268.00	17	Yes
3006	5.6	494.00	16	Yes
3007	6.6	377.00	17	Yes
3008	9.5	441.00	18	Yes
3009	5.2	274.00	16	Yes
3010	8.4	253.00	17	Yes
3011	9	335.00	16	Yes
3012	5.5	287.00	18	Yes
3013	8.2	271.00	18	Yes
3014	9	496.00	18	Yes
3015	6.4	457.00	18	Yes
3016	9.7	487.00	17	Yes
3017	8.7	321.00	18	Yes
3018	7.1	462.00	18	Yes
3019	9.1	451.00	18	Yes
3020	8.9	358.00	17	Yes
3021	7.9	258.00	16	Yes
3022	9.3	381.00	18	No
3023	7.2	428.00	17	Yes
3024	7.3	396.00	18	Yes
3025	7	353.00	17	Yes
3026	9.7	338.00	17	Yes
3027	9.1	257.00	18	Yes
3028	9.5	437.00	18	Yes
3029	6.5	448	17	Yes
3030	5.3	329	17	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
4001	15.2	353.00	16	Yes
4002	14.6	423.00	16	Yes
4003	17.5	322.00	16	Yes
4004	16.2	265.00	15	Yes
4005	16.1	407.00	15	Yes
4006	18.8	499.00	15	Yes
4007	13.4	316.00	16	Yes
4008	13	298.00	12	Yes
4009	18.4	350.00	16	Yes
4010	15.8	446.00	12	Yes
4011	15.8	349.00	14	Yes
4012	17.3	385.00	14	Yes
4013	10.1	337.00	13	Yes
4014	16.2	376.00	13	Yes
4015	12.9	475.00	16	Yes
4016	12.8	490.00	12	Yes
4017	20	304.00	13	Yes
4018	10.2	319.00	12	Yes
4019	16.3	428.00	16	Yes
4020	14.4	261.00	12	Yes
4021	19.2	306.00	16	Yes
4022	10	392.00	14	Yes
4023	19.9	281.00	16	Yes
4024	10.9	326.00	12	Yes
4025	15.3	451.00	15	No
4026	13.2	450.00	16	Yes
4027	19.4	426.00	14	Yes
4028	14.6	445.00	12	Yes
4029	13.3	445.00	15	Yes
4030	13.7	398.00	15	Yes

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	Yes

Note: The Type 5 randomized parameters are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	174	5492	4	Yes
2	649	5493	4	Yes
3	1124	5494	2	Yes
4	1599	5495	1	Yes
5	2549	5496	5	Yes
6	3024	5497	2	Yes
7	3499	5498	2	Yes
8	3974	5499	4	Yes
9	4449	5500	1	Yes
10	4924	5501	5	Yes
11	5399	5502	5	Yes
12	5874	5503	5	Yes
13	6349	5504	3	Yes
14	6824	5505	4	Yes
15	7299	5506	4	Yes
16	7774	5507	5	Yes
17	8249	5508	6	Yes
18	8724	5492	4	Yes
19	9199	5493	4	Yes
20	9674	5494	5	Yes
21	10149	5495	2	Yes
22	10624	5496	3	Yes
23	11099	5497	3	Yes
24	11574	5498	4	Yes
25	12049	5499	2	Yes
26	12524	5500	5	Yes
27	12999	5501	4	Yes
28	13474	5502	4	Yes
29	13949	5503	1	Yes
30	14424	5504	2	Yes
31	14899	5505	3	Yes
32	15374	5506	4	Yes
33	15849	5507	3	Yes
34	16324	5508	3	Yes

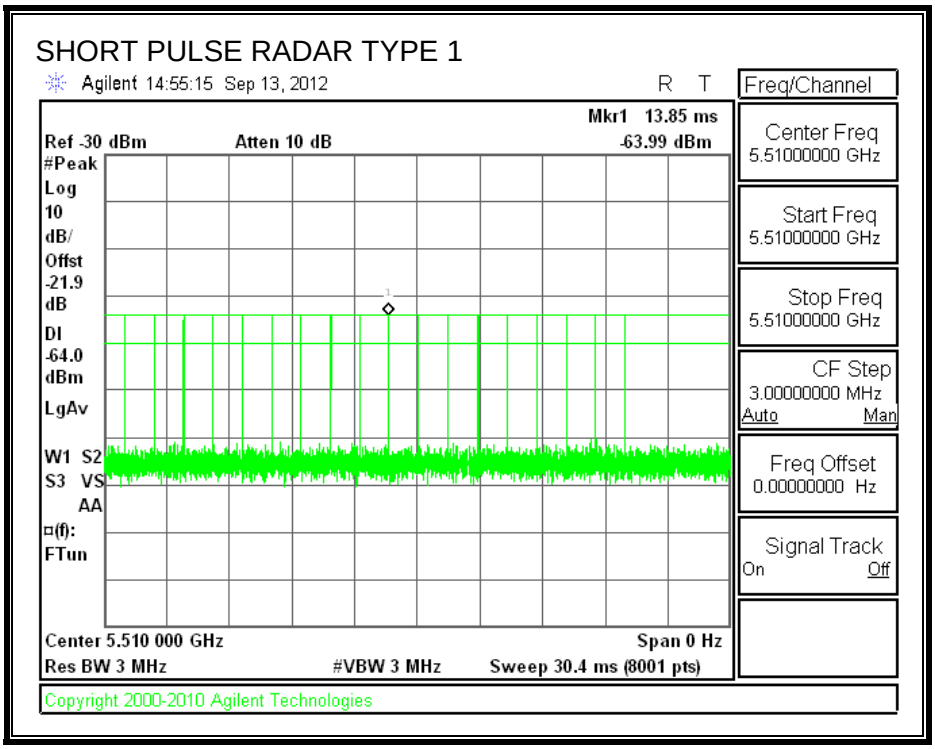
11.3. RESULTS FOR 40 MHz BANDWIDTH

11.3.1. TEST CHANNEL

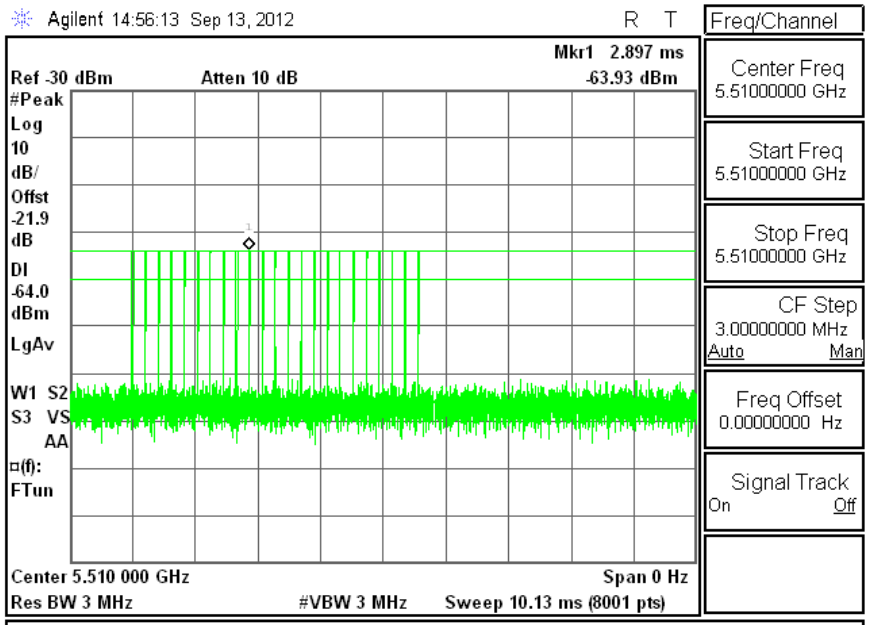
All tests were performed at a channel center frequency of 5510 MHz.

11.3.2. RADAR WAVEFORMS AND TRAFFIC

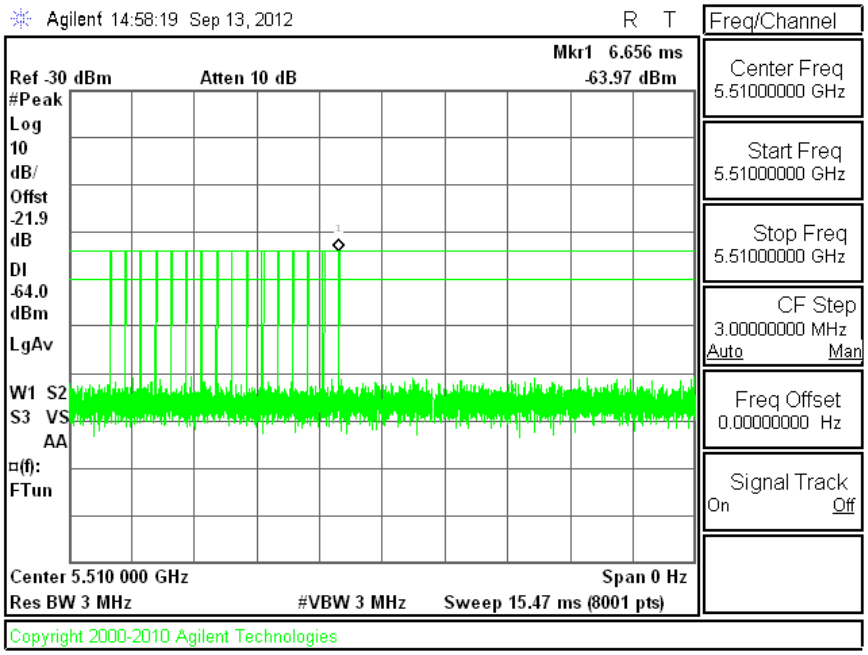
RADAR WAVEFORMS



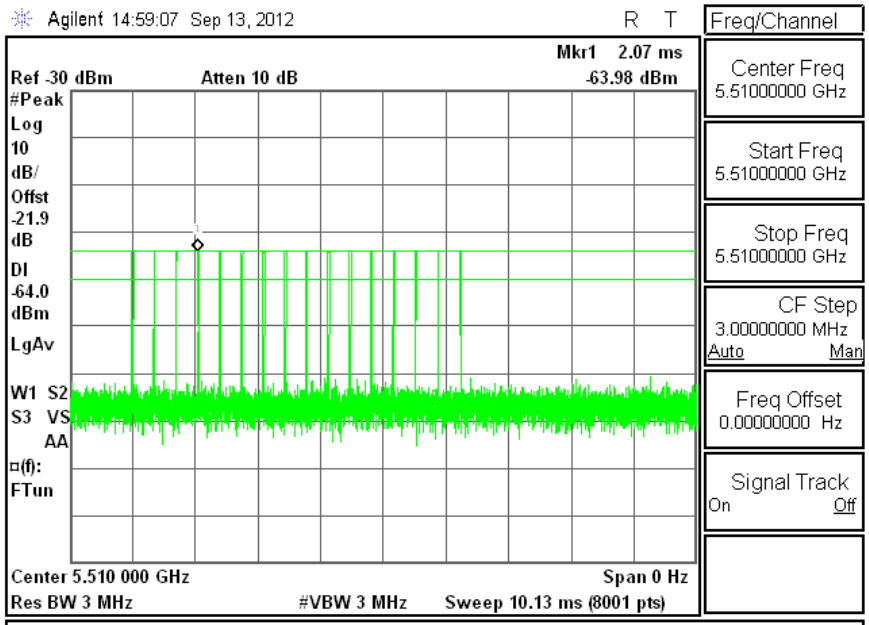
SAMPLE OF RADAR TYPE 2



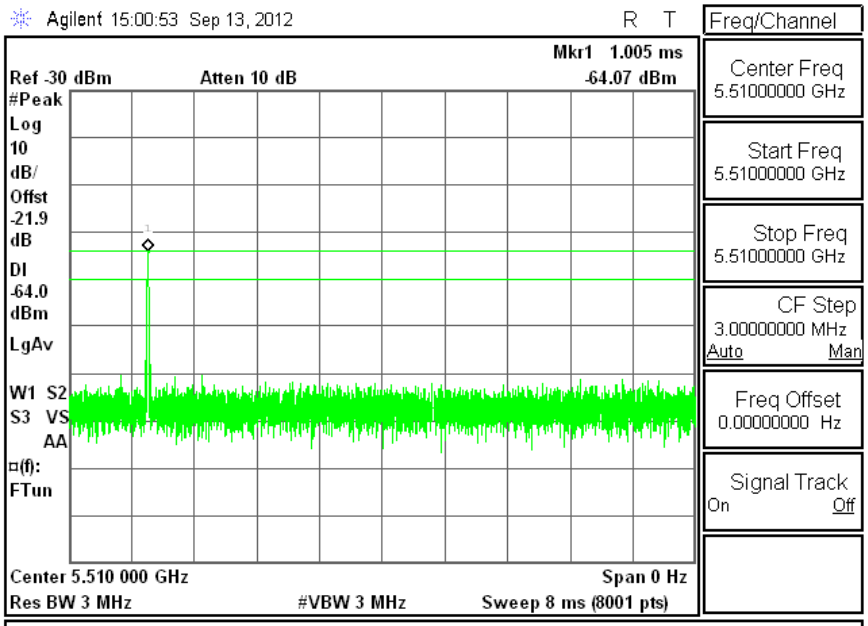
SAMPLE OF RADAR TYPE 3

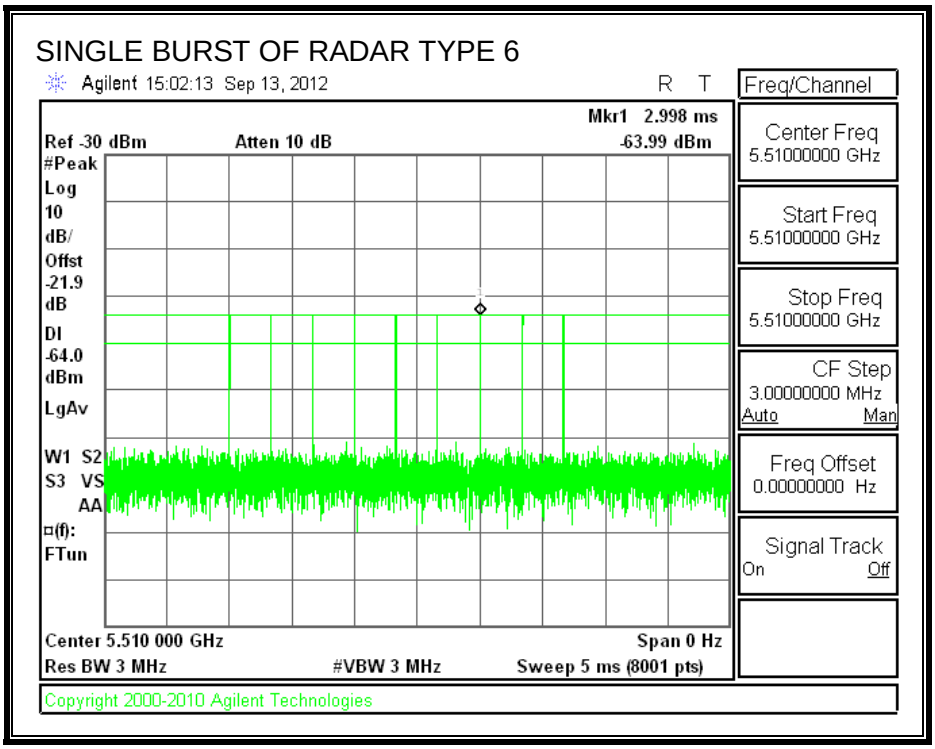


SAMPLE OF RADAR TYPE 4

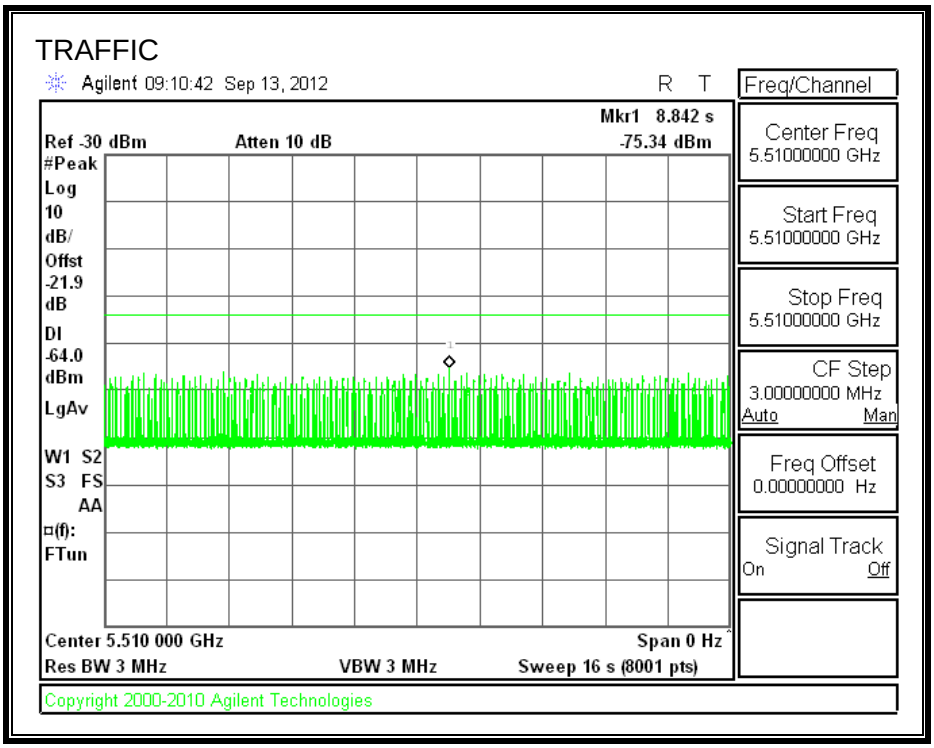


SAMPLE OF SINGLE BURST OF RADAR TYPE 5





TRAFFIC



11.3.3. CHANNEL AVAILABILITY CHECK TIME

PROCEDURE TO DETERMINE INITIAL POWER-UP CYCLE TIME

A link was established on channel then the EUT was rebooted. The time from the cessation of traffic to the re-initialization of traffic was measured as the time required for the EUT to complete the total power-up cycle. The time to complete the initial power-up period is 60 seconds less than this total power-up time.

PROCEDURE FOR TIMING OF RADAR BURST

With a link established on channel, the EUT was rebooted. A radar signal was triggered within 0 to 6 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

The Non-Occupancy list was cleared. With a link established on channel, the EUT was rebooted. A radar signal was triggered within 54 to 60 seconds after the initial power-up period, and transmissions on the channel were monitored on the spectrum analyzer.

QUANTITATIVE RESULTS

No Radar Triggered

Timing of Reboot (sec)	Timing of Start of Traffic (sec)	Total Power-up Cycle Time (sec)	Initial Power-up Cycle Time (sec)
29.81	130.6	100.8	40.8

Radar Near Beginning of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
29.7	71.1	41.4	0.6

Radar Near End of CAC

Timing of Reboot (sec)	Timing of Radar Burst (sec)	Radar Relative to Reboot (sec)	Radar Relative to Start of CAC (sec)
29.62	129.3	99.7	58.9

QUALITATIVE RESULTS

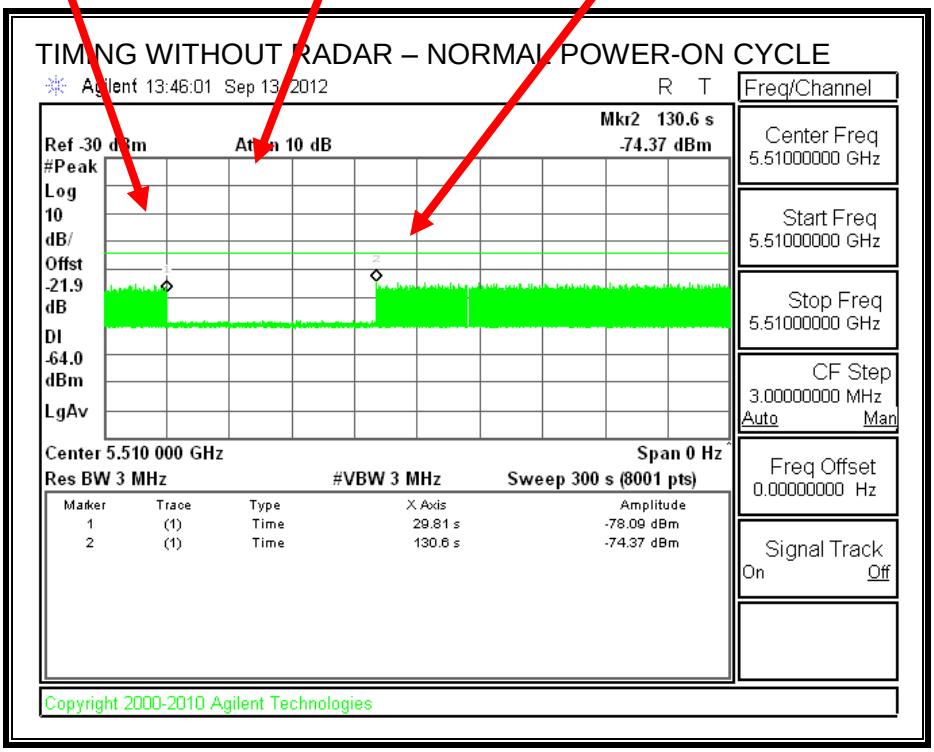
Timing of Radar Burst	Display on Control Computer	Spectrum Analyzer Display
No Radar Triggered	EUT marks Channel as active	Transmissions begin on channel after completion of the initial power-up cycle and the CAC
Within 0 to 6 second window	EUT does not display any radar parameter values	No transmissions on channel
Within 54 to 60 second window	EUT does not display any radar parameter values	No transmissions on channel

TIMING WITHOUT RADAR DURING CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

End of CAC
Traffic is Initiated



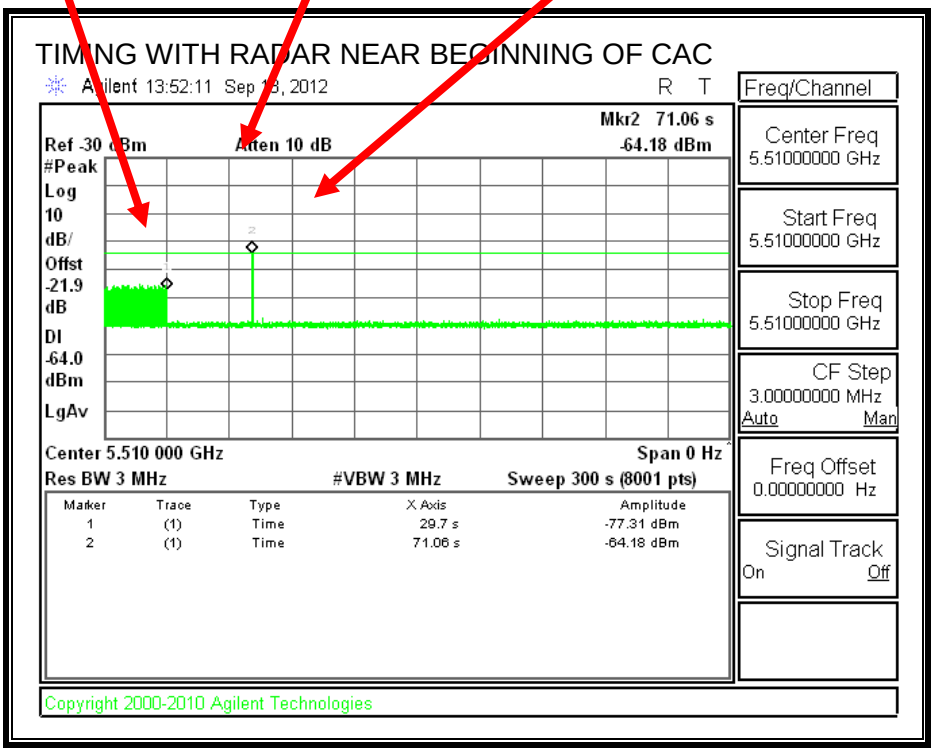
Transmissions begin on channel after completion of the initial power-up cycle and the CAC.

TIMING WITH RADAR NEAR BEGINNING OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



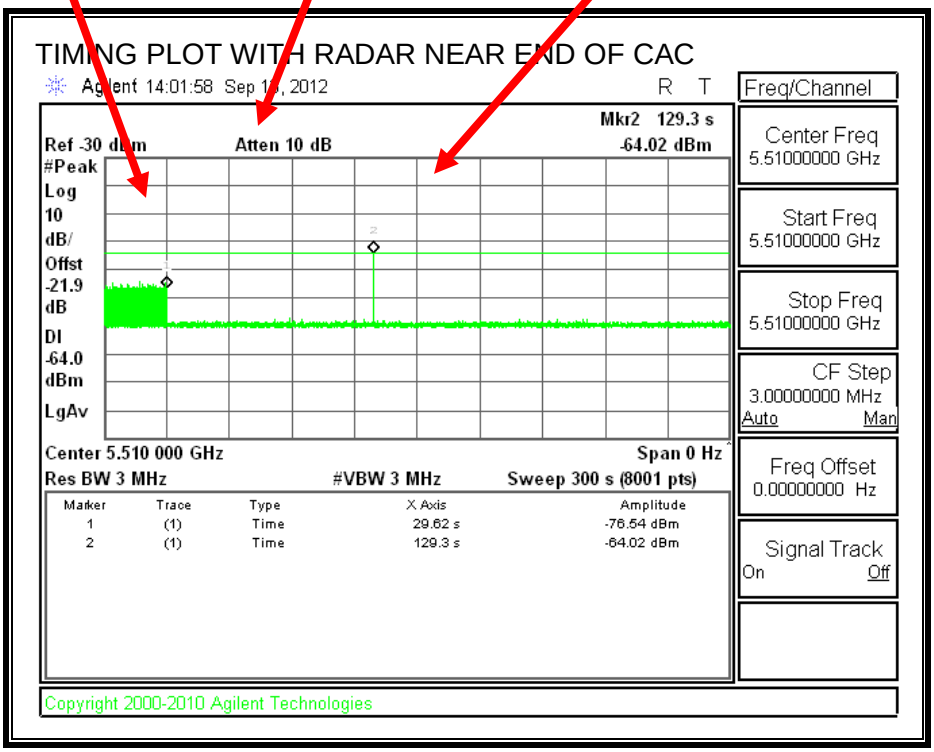
No EUT transmissions were observed after the radar signal.

TIMING PLOT WITH RADAR NEAR END OF CAC

AP is rebooted
Traffic ceases
Start of Initial Power-up cycle

End of Initial Power-up cycle
Start of CAC

Radar Signal Applied



No EUT transmissions were observed after the radar signal.

11.3.4. OVERLAPPING CHANNEL TESTS

RESULTS

These tests are not applicable.

11.3.5. 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).

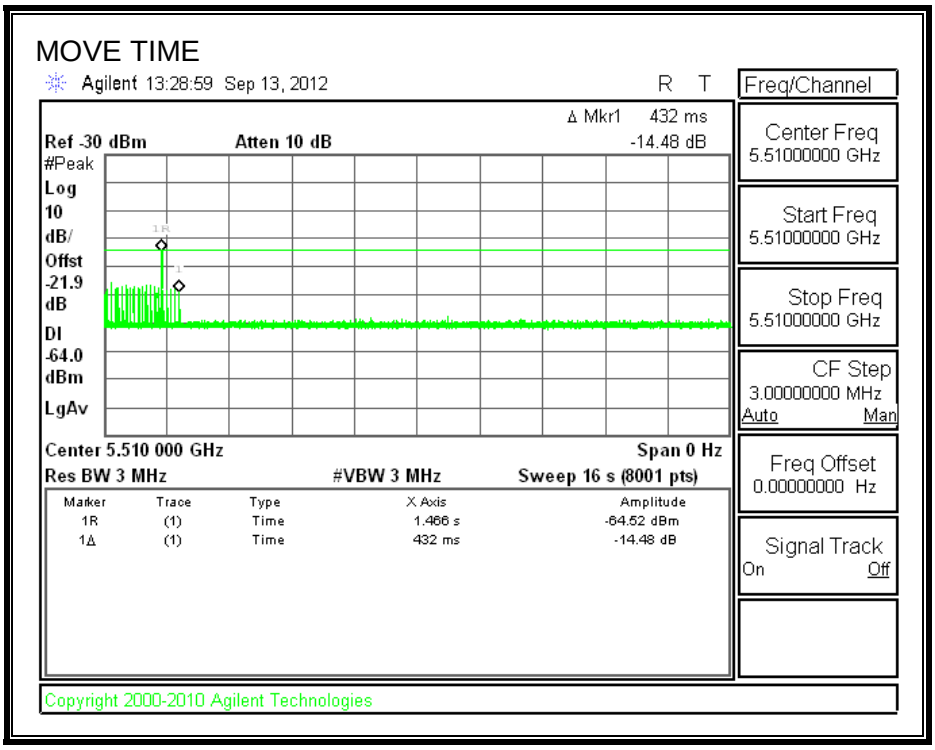
The observation period over which the IC aggregate time is calculated begins at (Reference Marker) and ends no earlier than (Reference Marker + 10 sec).

RESULTS

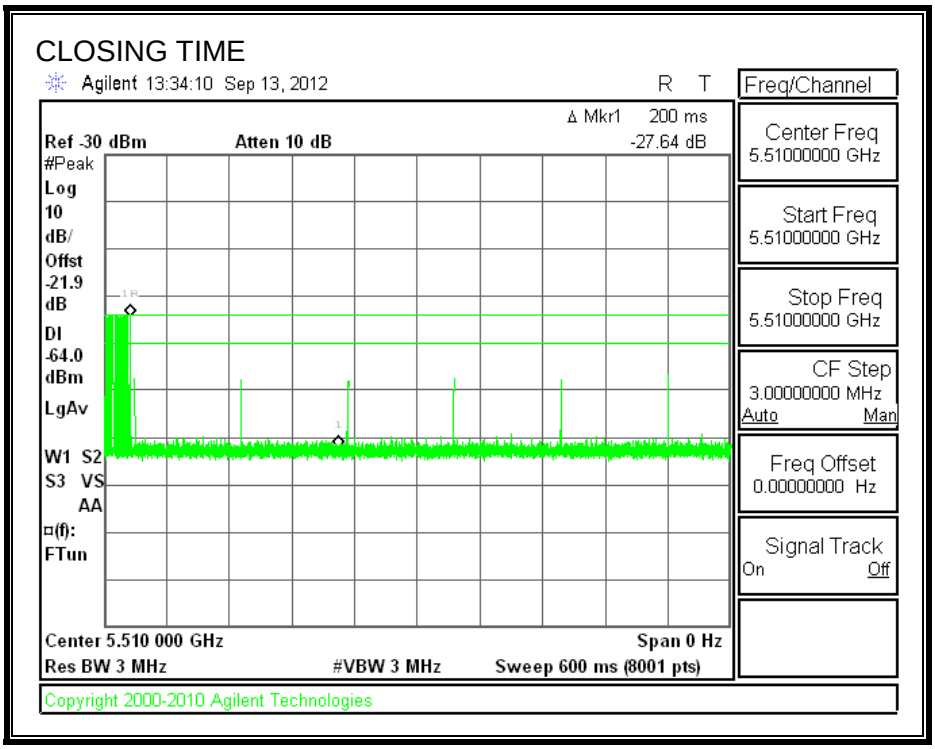
Agency	Channel Move Time (sec)	Limit (sec)
FCC / IC	0.432	10

Agency	Aggregate Channel Closing Transmission Time (msec)	Limit (msec)
FCC	6.0	60
IC	12.0	260

MOVE TIME

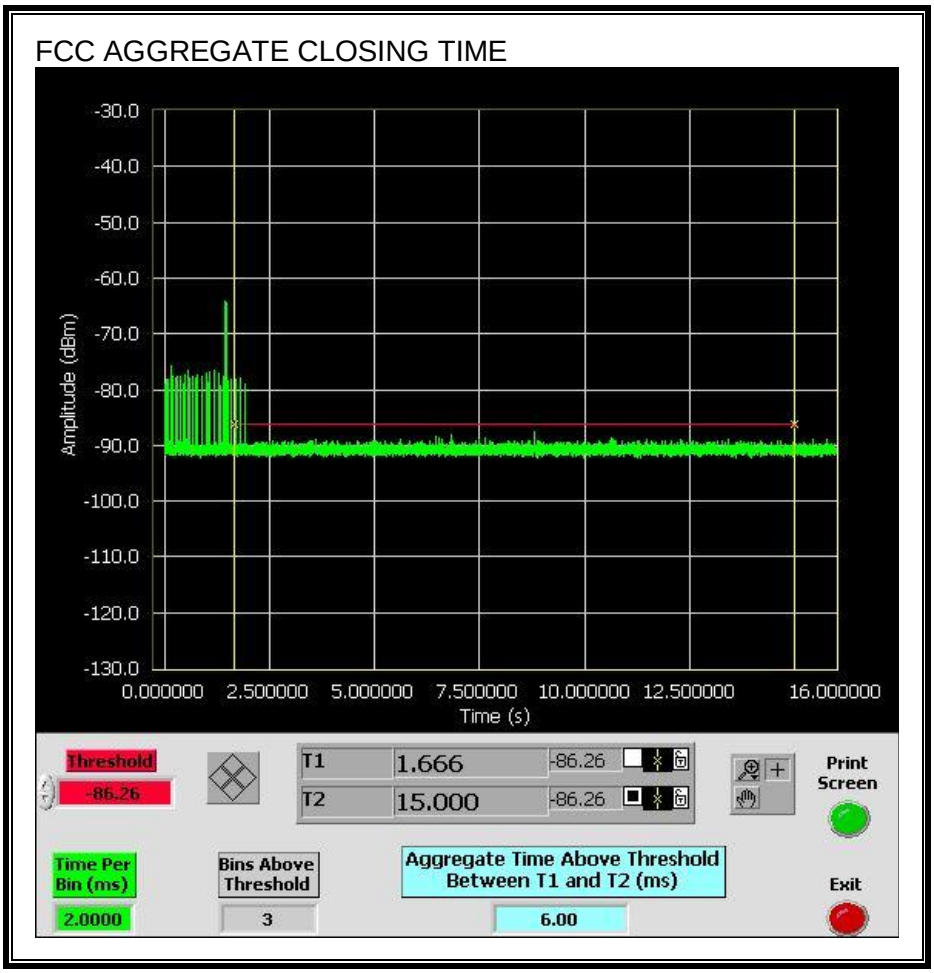


CHANNEL CLOSING TIME



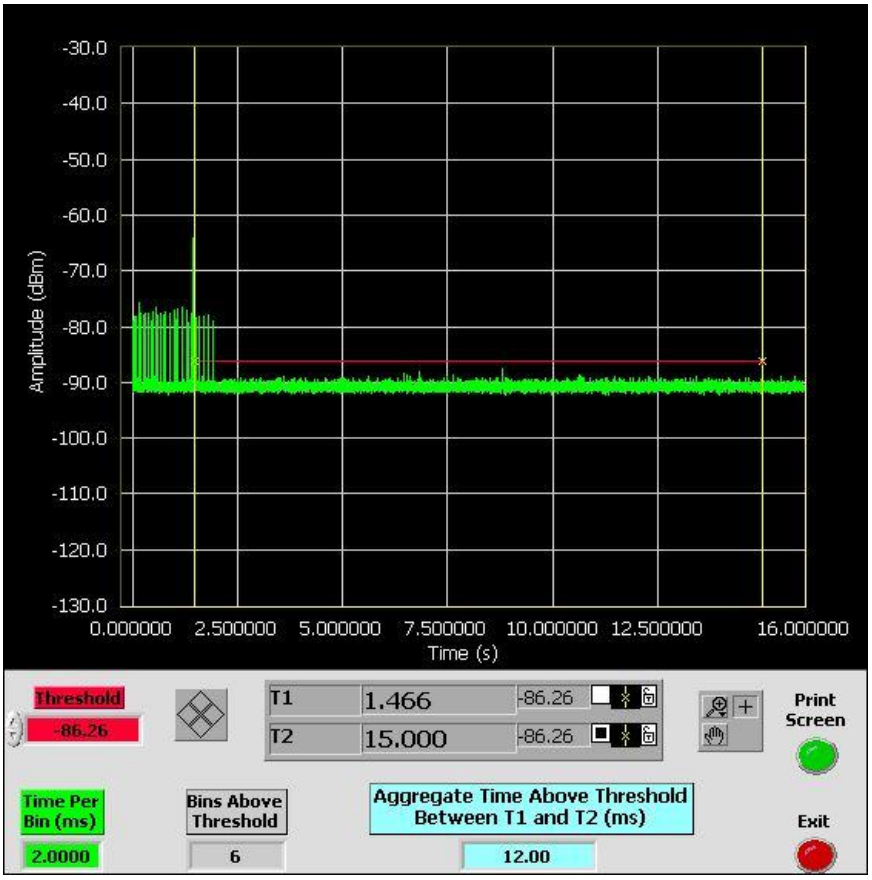
AGGREGATE CHANNEL CLOSING TRANSMISSION TIME

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



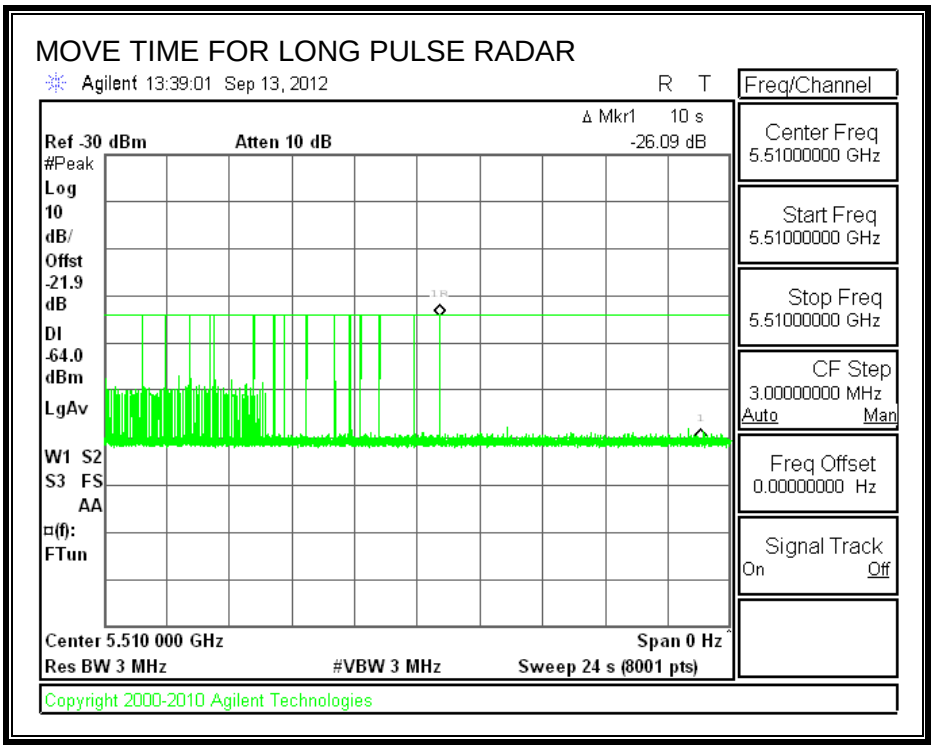
Only intermittent transmissions are observed during the IC aggregate monitoring period.

IC AGGREGATE CLOSING TIME



LONG PULSE CHANNEL MOVE TIME

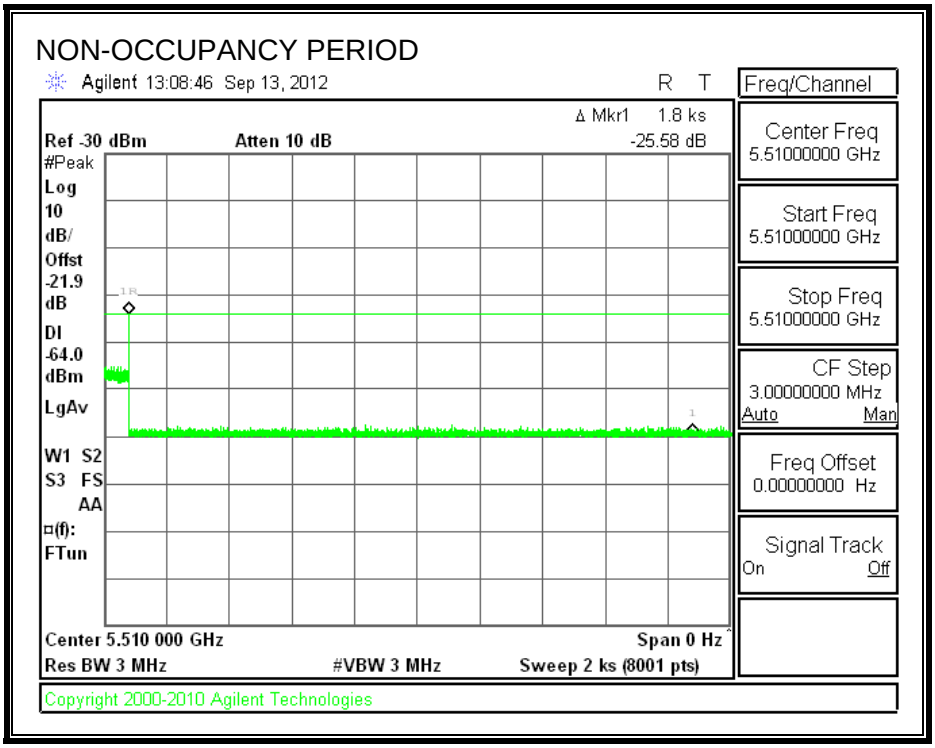
The traffic ceases prior to 10 seconds after the end of the radar waveform.



11.3.6. NON-OCCUPANCY PERIOD

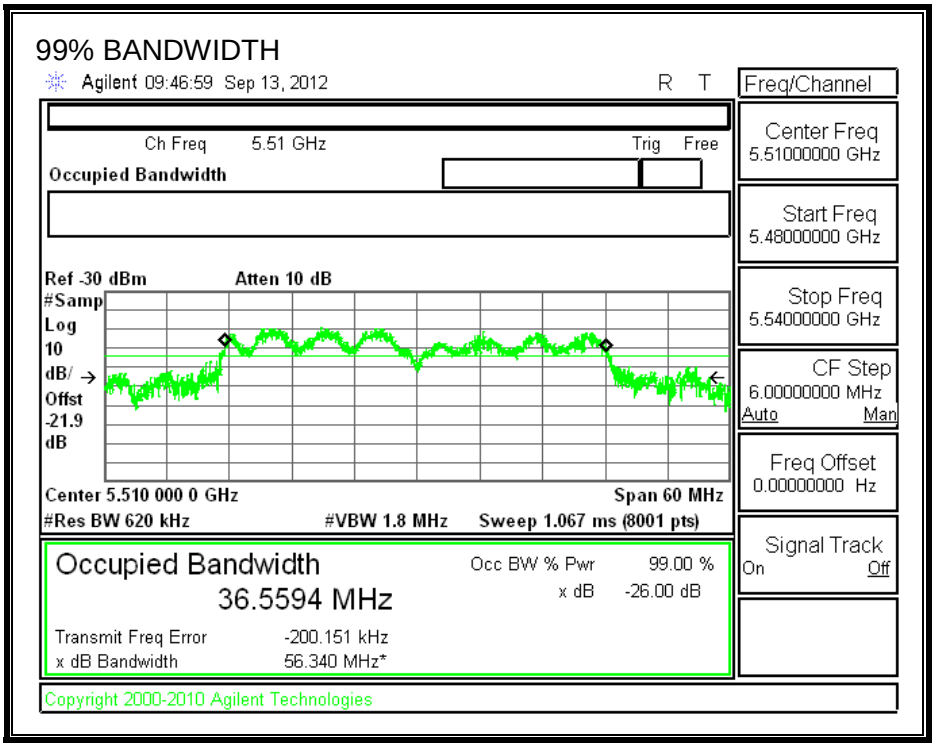
RESULTS

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



11.3.7. DETECTION BANDWIDTH

REFERENCE PLOT OF 99% POWER BANDWIDTH



RESULTS

FL (MHz)	FH (MHz)	Detection Bandwidth (MHz)	99% Power Bandwidth (MHz)	Ratio of Detection BW to 99% Power BW (%)	Minimum Limit (%)
5492	5528	36	36.559	98.5	80

DETECTION BANDWIDTH PROBABILITY

DETECTION BANDWIDTH PROBABILITY RESULTS

Detection Bandwidth Test Results				
FCC Type 1 Waveform: 1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst				
Frequency (MHz)	Number of Trials	Number Detected	Detection (%)	Mark
5492	10	10	100	FL
5493	10	10	100	
5494	10	10	100	
5495	10	10	100	
5496	10	10	100	
5497	10	10	100	
5498	10	10	100	
5499	10	10	100	
5500	10	10	100	
5501	10	10	100	
5502	10	10	100	
5503	10	10	100	
5504	10	10	100	
5505	10	10	100	
5506	10	10	100	
5507	10	10	100	
5508	10	10	100	
5509	10	10	100	
5510	10	10	100	
5511	10	10	100	
5512	10	10	100	
5513	10	10	100	
5514	10	10	100	
5515	10	10	100	
5516	10	10	100	
5517	10	10	100	
5518	10	10	100	
5519	10	10	100	
5520	10	10	100	
5521	10	10	100	
5522	10	10	100	
5523	10	10	100	
5524	10	9	90	
5525	10	10	100	
5526	10	10	100	
5527	10	10	100	
5528	10	10	100	FH

11.3.8. IN-SERVICE MONITORING

RESULTS

FCC Radar Test Summary				
Signal Type	Number of Trials	Detection (%)	Limit (%)	Pass/Fail
FCC Short Pulse Type 1	30	100.00	60	Pass
FCC Short Pulse Type 2	30	93.33	60	Pass
FCC Short Pulse Type 3	30	96.67	60	Pass
FCC Short Pulse Type 4	30	93.33	60	Pass
Aggregate		95.83	80	Pass
FCC Long Pulse Type 5	30	100.00	80	Pass
FCC Hopping Type 6	37	100.00	70	Pass

TYPE 1 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 1	
1 us Pulse Width, 1428 us PRI, 18 Pulses per Burst	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	Yes

TYPE 2 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 2				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
2001	2.8	211.00	23	Yes
2002	1.9	222.00	26	Yes
2003	3.6	201.00	29	Yes
2004	4	157.00	27	Yes
2005	2.3	222.00	25	Yes
2006	1.4	208.00	29	Yes
2007	2.5	157.00	26	Yes
2008	1.2	183.00	27	Yes
2009	3.3	168.00	26	Yes
2010	3.1	152.00	29	Yes
2011	1.5	187.00	23	No
2012	1.8	177.00	29	Yes
2013	4	155.00	23	Yes
2014	1.9	179.00	25	Yes
2015	1.7	172.00	26	Yes
2016	3	176.00	24	Yes
2017	4	201.00	26	Yes
2018	3.3	178.00	26	No
2019	2.8	177.00	26	Yes
2020	3.5	206.00	29	Yes
2021	2.7	176.00	29	Yes
2022	1	161.00	25	Yes
2023	1.6	224.00	24	Yes
2024	2.7	208.00	28	Yes
2025	3.5	156.00	28	Yes
2026	2.9	182.00	28	Yes
2027	4.8	194.00	27	Yes
2028	1	155.00	23	Yes
2029	4.5	157.00	28	Yes
2030	1.2	154.00	24	Yes

TYPE 3 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 3				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
3001	9.1	377.00	16	Yes
3002	9.3	310.00	17	No
3003	7	378.00	18	Yes
3004	7.7	482.00	17	Yes
3005	5.5	268.00	17	Yes
3006	5.6	494.00	16	Yes
3007	6.6	377.00	17	Yes
3008	9.5	441.00	18	Yes
3009	5.2	274.00	16	Yes
3010	8.4	253.00	17	Yes
3011	9	335.00	16	Yes
3012	5.5	287.00	18	Yes
3013	8.2	271.00	18	Yes
3014	9	496.00	18	Yes
3015	6.4	457.00	18	Yes
3016	9.7	487.00	17	Yes
3017	8.7	321.00	18	Yes
3018	7.1	462.00	18	Yes
3019	9.1	451.00	18	Yes
3020	8.9	358.00	17	Yes
3021	7.9	258.00	16	Yes
3022	9.3	381.00	18	Yes
3023	7.2	428.00	17	Yes
3024	7.3	396.00	18	Yes
3025	7	353.00	17	Yes
3026	9.7	338.00	17	Yes
3027	9.1	257.00	18	Yes
3028	9.5	437.00	18	Yes
3029	6.5	448	17	Yes
3030	5.3	329	17	Yes

TYPE 4 DETECTION PROBABILITY

Data Sheet for FCC Short Pulse Radar Type 4				
Waveform	Pulse Width (us)	PRI (us)	Pulses Per Burst	Successful Detection (Yes/No)
4001	15.2	353.00	16	Yes
4002	14.6	423.00	16	Yes
4003	17.5	322.00	16	Yes
4004	16.2	265.00	15	Yes
4005	16.1	407.00	15	Yes
4006	18.8	499.00	15	Yes
4007	13.4	316.00	16	Yes
4008	13	298.00	12	Yes
4009	18.4	350.00	16	Yes
4010	15.8	446.00	12	Yes
4011	15.8	349.00	14	Yes
4012	17.3	385.00	14	No
4013	10.1	337.00	13	Yes
4014	16.2	376.00	13	Yes
4015	12.9	475.00	16	Yes
4016	12.8	490.00	12	Yes
4017	20	304.00	13	Yes
4018	10.2	319.00	12	Yes
4019	16.3	428.00	16	Yes
4020	14.4	261.00	12	Yes
4021	19.2	306.00	16	Yes
4022	10	392.00	14	Yes
4023	19.9	281.00	16	Yes
4024	10.9	326.00	12	Yes
4025	15.3	451.00	15	Yes
4026	13.2	450.00	16	Yes
4027	19.4	426.00	14	Yes
4028	14.6	445.00	12	Yes
4029	13.3	445.00	15	Yes
4030	13.7	398.00	15	No

TYPE 5 DETECTION PROBABILITY

Data Sheet for FCC Long Pulse Radar Type 5	
Trial	Successful Detection (Yes/No)
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes
9	Yes
10	Yes
11	Yes
12	Yes
13	Yes
14	Yes
15	Yes
16	Yes
17	Yes
18	Yes
19	Yes
20	Yes
21	Yes
22	Yes
23	Yes
24	Yes
25	Yes
26	Yes
27	Yes
28	Yes
29	Yes
30	Yes

Note: The Type 5 randomized parameters are shown in a separate document.

TYPE 6 DETECTION PROBABILITY

Data Sheet for FCC Hopping Radar Type 6				
1 us Pulse Width, 333 us PRI, 9 Pulses per Burst, 1 Burst per Hop				
NTIA August 2005 Hopping Sequence				
Trial	Starting Index Within Sequence	Signal Generator Frequency (MHz)	Hops within Detection BW	Successful Detection (Yes/No)
1	112	5492	5	Yes
2	587	5493	8	Yes
3	1062	5494	7	Yes
4	1537	5495	8	Yes
5	2012	5496	8	Yes
6	2487	5497	8	Yes
7	2962	5498	9	Yes
8	3437	5499	7	Yes
9	3912	5500	5	Yes
10	4387	5501	8	Yes
11	4862	5502	8	Yes
12	5337	5503	6	Yes
13	5812	5504	8	Yes
14	6287	5505	7	Yes
15	6762	5506	7	Yes
16	7237	5507	7	Yes
17	7712	5508	7	Yes
18	8187	5509	11	Yes
19	8662	5510	6	Yes
20	9137	5511	12	Yes
21	9612	5512	9	Yes
22	10087	5513	7	Yes
23	10562	5514	7	Yes
24	11037	5515	8	Yes
25	11512	5516	8	Yes
26	11987	5517	13	Yes
27	12462	5518	8	Yes
28	12937	5519	14	Yes
29	13412	5520	14	Yes
30	13887	5521	3	Yes
31	14362	5522	9	Yes
32	14837	5523	7	Yes
33	15312	5524	9	Yes
34	15787	5525	7	Yes
35	16262	5526	2	Yes
36	16737	5527	7	Yes
37	17212	5528	6	Yes