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

CLASS II PERMISSIVE CHANGE CERTIFICATION TEST REPORT

FOR

802.11a/g/n WLAN + Bluetooth PCI-E Custom Combination Card
(Tested inside of MacBook Pro. model A1398)

MODEL NUMBER: BCM94331CSAX

FCC ID: QDS-BRCM1062
IC: 4324A-BRCM1062

REPORT NUMBER: 12U14283-2, Revision B

ISSUE DATE: MAY 23, 2012

Prepared for
BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	05/17/12	Initial Issue	F. Ibrahim
A	05/21/12	Updated client address	A. Zaffar
B	05/23/12	Updated section 5.3 and section 5.4	F. Ibrahim

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A

EUT DESCRIPTION: 802.11a/g/n WLAN + Bluetooth PCI-E Custom Combination Card (Tested inside of MacBook Pro. model A1398)

MODEL: BCM94331CSAX

SERIAL NUMBER: C86201300XKDNP6'/

DATE TESTED: FEBRUARY 27 – MARCH 02, 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 ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, 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

802.11a/g/n WLAN + Bluetooth PCI-E Custom Combination Card (Tested inside of MacBook Pro. model A1398).

The radio module is manufactured by Broadcom.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

Different antennas with different gains were used and the radio module was installed inside a specific host laptop PC

5.3. MAXIMUM *OUTPUT POWER*

Average Power was measured and verified to be within +/- 0.5 dB from the original values covered under report number “11U14154-7A FCC IC UNII WLAN Report”.

Power was reduced more than 0.5 dB only for the following modes, and Peak Power plots are provided for these two cases in this report:

1) 5.2 GHz band: 802.11n HT40 1TX (in order to pass both BE radiated and conducted PK/PPSD)
2) 5.6 GHz band: 802.11n HT40 1TX CDD MCS0 (in order to pass BE radiated)

Note: For all other modes where the PK power or PPSD with new antenna gain showed non-compliance the power was reduced and new PK power plots and/or PPSD plots were inserted into this report, however, for these modes the output power remains within +/- 0.5 dB. For the modes that did not show any non-compliance with the new antenna gain. Please refer to the original report “11U14154-7 FCC IC UNII WLAN Report”.

DESCRIPTION OF AVAILABLE ANTENNAS

No.	Antenna Manufacturer	Antenna Type	Model	Peak gain 2402 to 2484Mhz dBi	Peak gain 5150 to 5250MHz dBi	Peak gain 5250 to 5350MHz dBi	Peak gain 5470 to 5725MHz dBi	Peak gain 5725 to 5850MHz dBi
1	Amphenol	802.11abgn WLAN Antenna		0.12	7.04	7.09	5.03	2.66
2	Amphenol	802.11abgn WLAN/BT Antenna		5.30	6.70	7.06	6.66	5.93
3	Amphenol	802.11abgn WLAN Antenna		4.69	3.79	3.58	3.94	6.04
			total (mW)	7.36	12.13	12.48	10.30	9.78
Composite 3x3 CDD mode testing for FCC/NCC ONLY dBi				8.6687781	10.838219	10.961713	10.126723	9.903389

No.	Antenna Manufacturer	Antenna Type	Model	Peak gain 2402 to 2484Mhz dBi	Peak gain 5150 to 5250MHz dBi	Peak gain 5250 to 5350MHz dBi	Peak gain 5470 to 5725MHz dBi	Peak gain 5725 to 5850MHz dBi
1	Molex	802.11abgn WLAN Antenna		-0.79	5.87	5.12	4.16	3.21
2	Molex	802.11abgn WLAN/BT Antenna		4.67	6.60	6.46	6.25	5.41
3	Molex	802.11abgn WLAN Antenna		2.92	4.15	4.32	4.31	4.06
			total (mW)	5.72	11.03	10.38	9.52	8.12
Composite 3x3 CDD mode testing for FCC/NCC ONLY dBi				7.5765555	10.42761	10.162273	9.7867609	9.093583

Note: Since the Amphenol combined antennas gain is higher than the Molex combined antennas gain, Amphenol antenna was selected for testing as worst-case scenario to cover the Molex antenna.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 5.106.192.12
The test utility software used during testing was BCM Internal, rev. 5.106.RC192.12.

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was tested as radio module installed inside a host laptop PC.

Worst-Case data rates, from the original reports, were as follows:

For 5GHz Band:
All final tests in the 802.11a Legacy mode were made at 6 Mb/s.
All final tests in the 802.11n 20 MHz CDD/SDM mode were made at MCS0.
All final tests in the 802.11n 40 MHz CDD/SDM mode were made at MCS0.

Worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was the mode and channel with the highest output power.

All legacy modes were measured with the highest gain for each type of antenna.

5.6. DESCRIPTION OF TEST SETUP

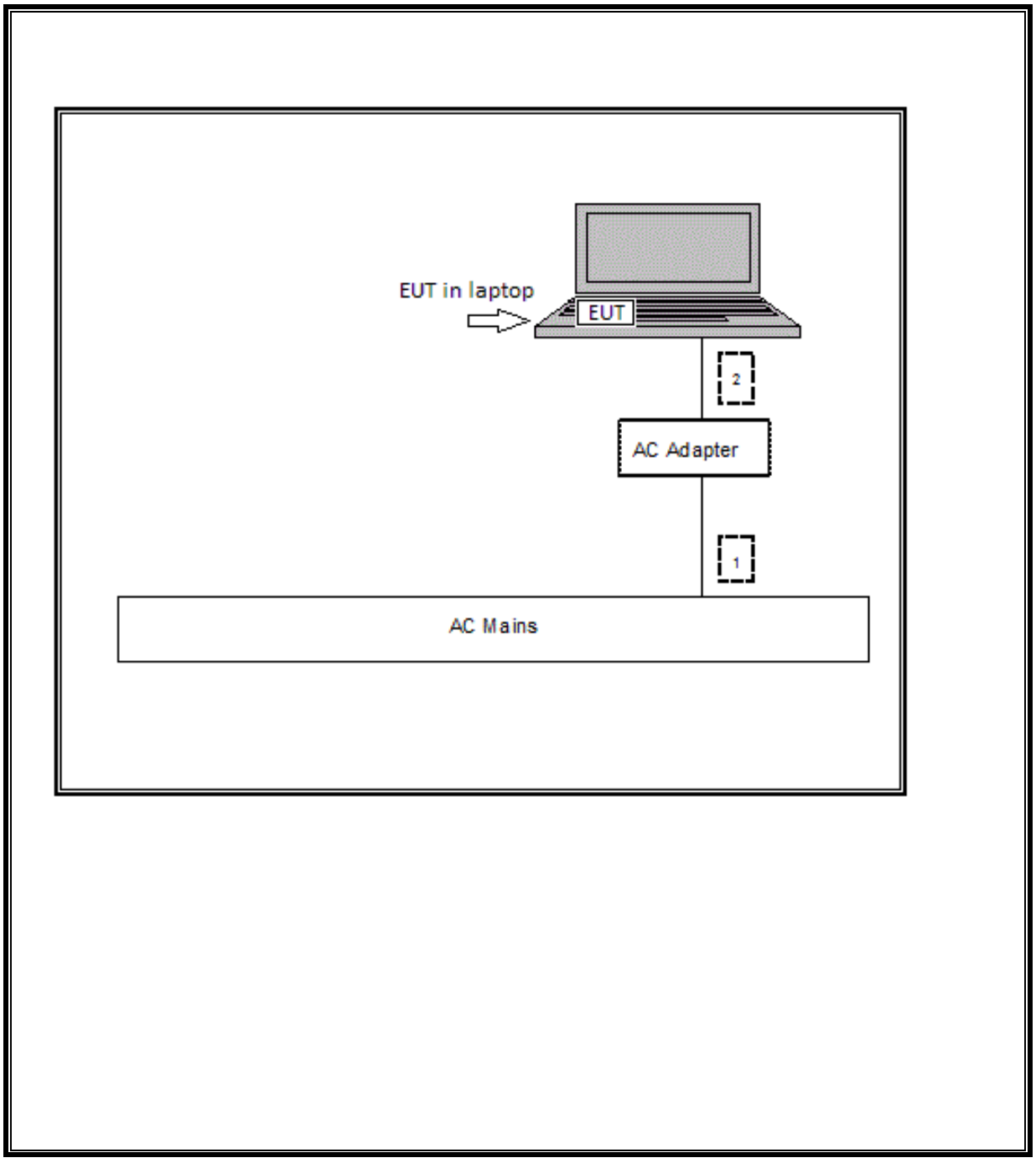
SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter	Apple	ADP-85FB TA	C04203404B6DT9PhH	DoC

I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	US 115V	Un-shielded	1.5m	N/A
2	DC	1	DC	Un-shielded	1.5m	N/A

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	MY461804919	04/09/13
Peak Power Meter	Agilent	N1911A	1282124A	08/04/12
Peak Power Sensor	Agilent	E9323A	1240537J	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

For all antenna port test results refer to the original report “11U14154-7 FCC IC UNII WLAN Report”, except for the following items:

7.1. DUTY CYCLE AND ON TIME RESULTS

For 802.11n HT40 SDM MCS21 mode, duty cycle correction factor is 1.3 dB.

7.2. 802.11a 20MHz 1TX MODE IN THE 5.2 GHz BAND

7.2.1. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

TEST PROCEDURE

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

RESULTS

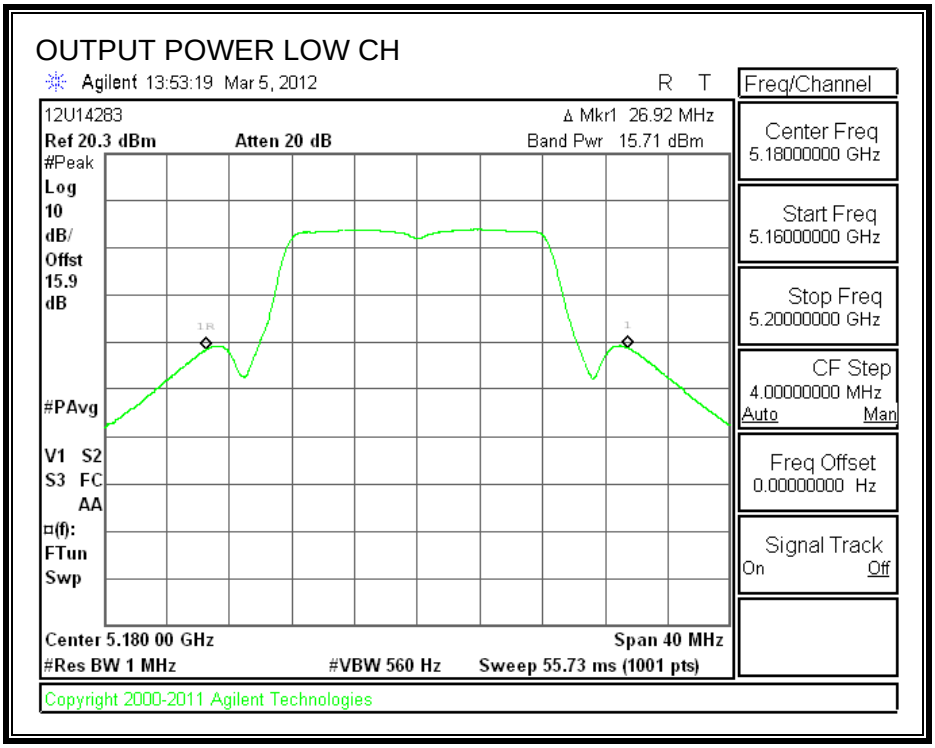
Limit

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	17	26.92	18.30	7.04	15.96
Mid	5220	17	26.75	18.27	7.04	15.96
High	5240	17	26.00	18.15	7.04	15.96

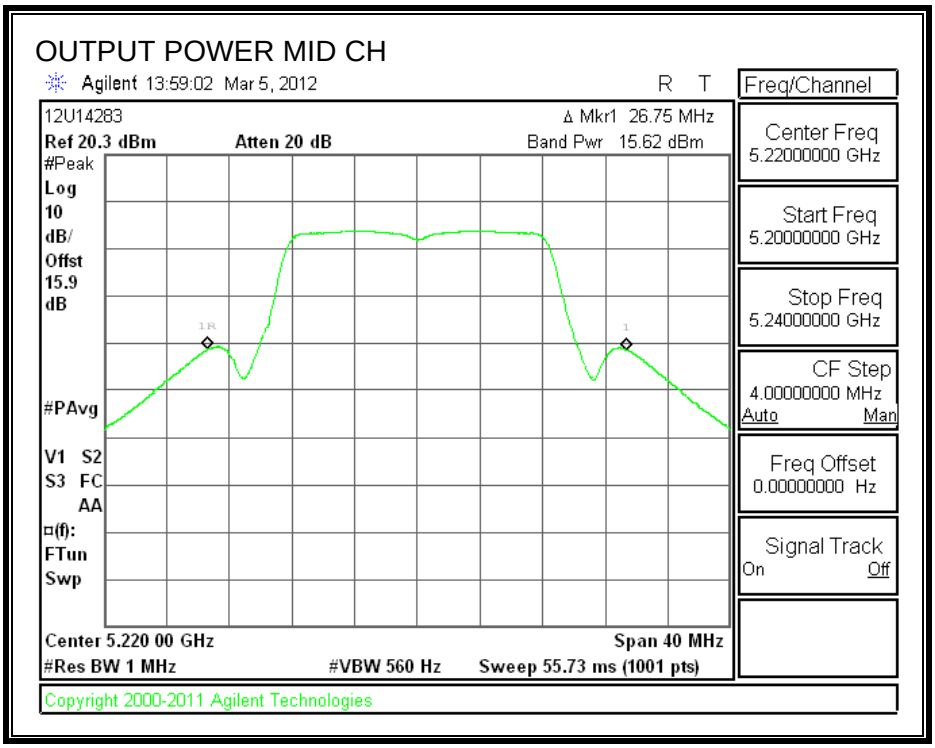
Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	15.71	15.96	-0.25
Mid	5220	15.62	15.96	-0.34
High	5240	15.51	15.96	-0.45

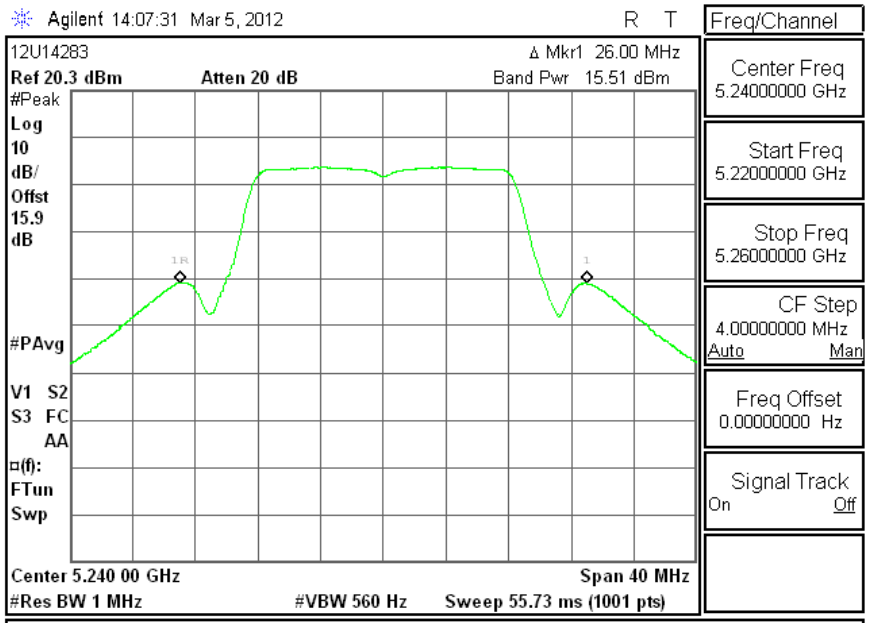
OUTPUT POWER



OUTPUT POWER MID CH



OUTPUT POWER HIGH CH



7.2.2. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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 peak transmit 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.

The maximum antenna gain is 7.04 dBi, therefore the limit is 2.96 dBm.

TEST PROCEDURE

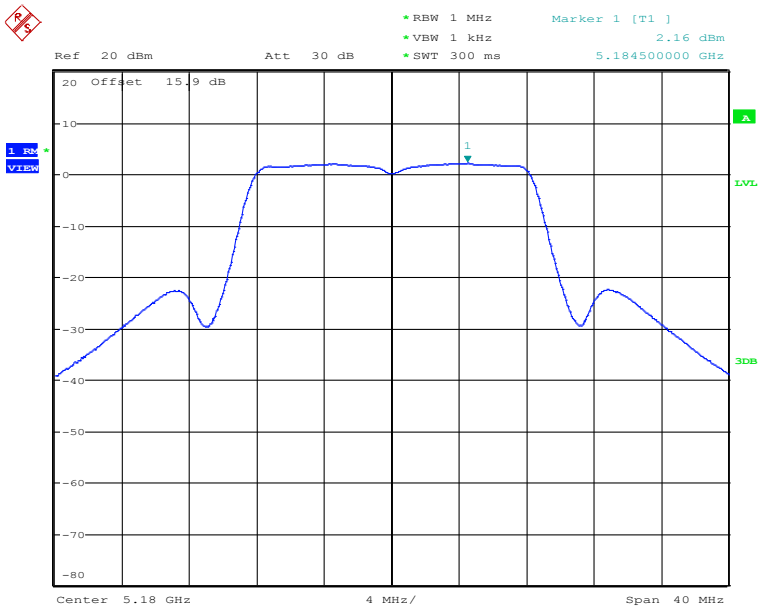
Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

RESULTS

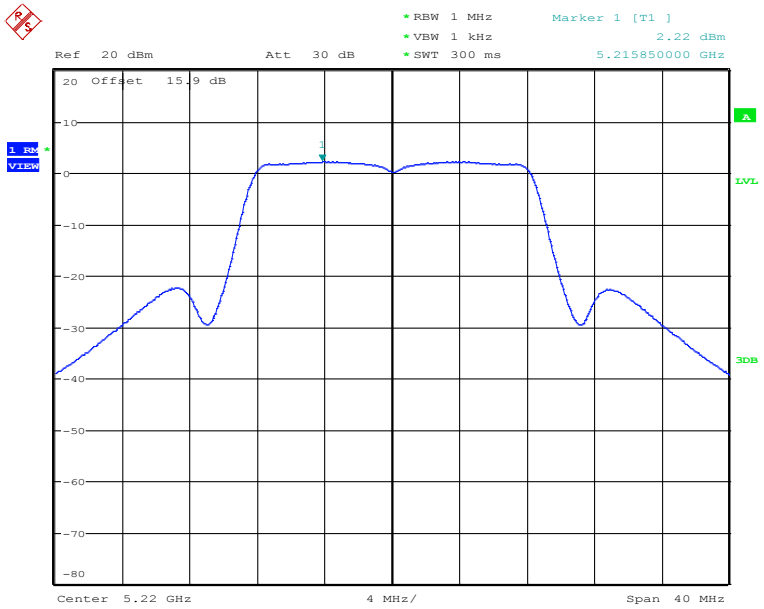
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	2.16	2.96	-0.80
Middle	5220	2.22	2.96	-0.74
High	5240	2.67	2.96	-0.29

POWER SPECTRAL DENSITY

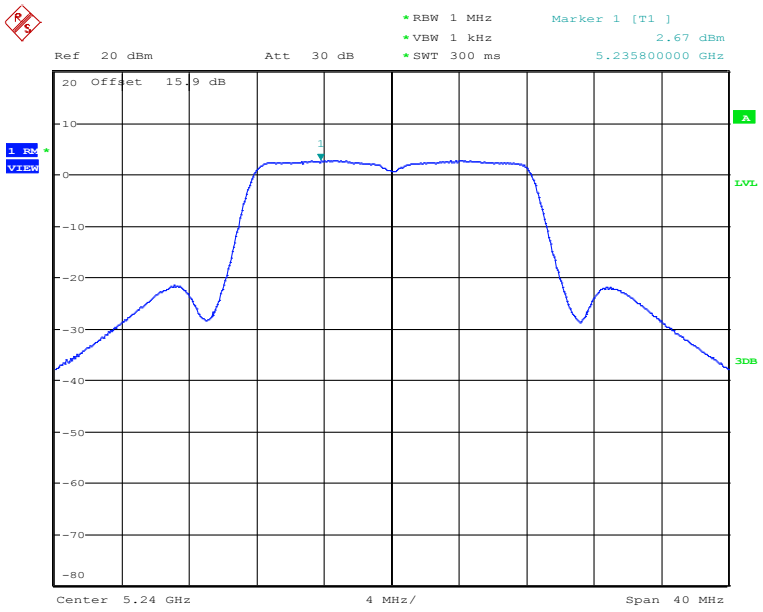
PSD LOW CH



PSD MID CH



PSD HIGH CH



7.3. 802.11n HT40 1TX MODE IN THE 5.2 GHz BAND

7.3.1. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

TEST PROCEDURE

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

RESULTS

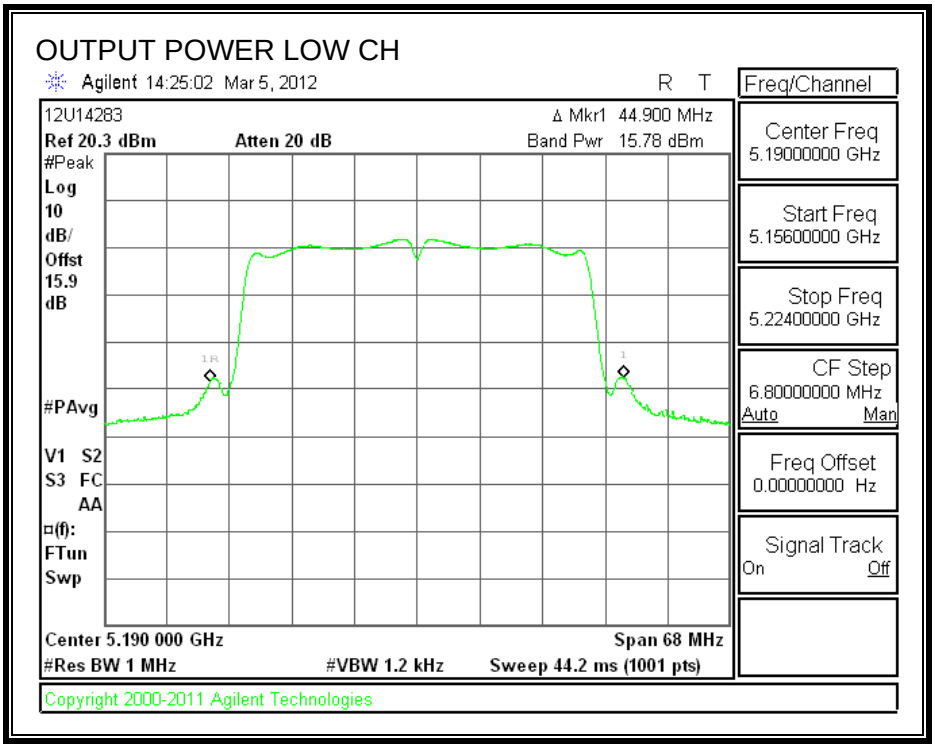
Limit

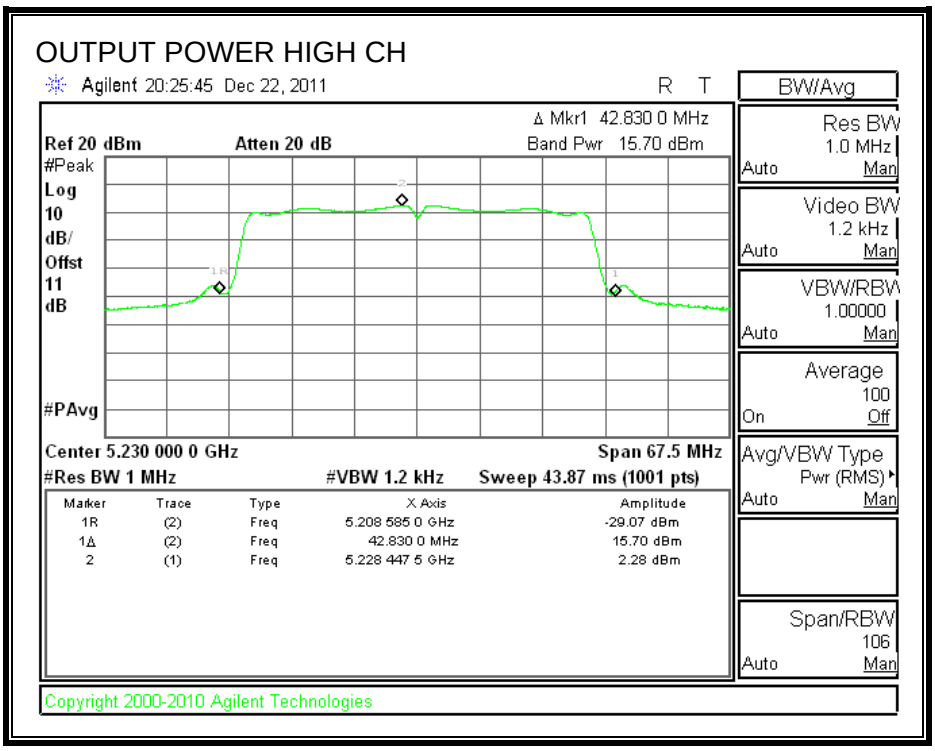
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5190	17	44.83	20.52	7.04	15.96
High	5230	17	42.83	20.32	7.04	15.96

Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	15.78	15.96	-0.18
High	5230	15.70	15.96	-0.26

OUTPUT POWER





7.3.2. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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 peak transmit 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.

The maximum antenna gain is 7.04 dBi, therefore the limit is 2.96 dBm.

TEST PROCEDURE

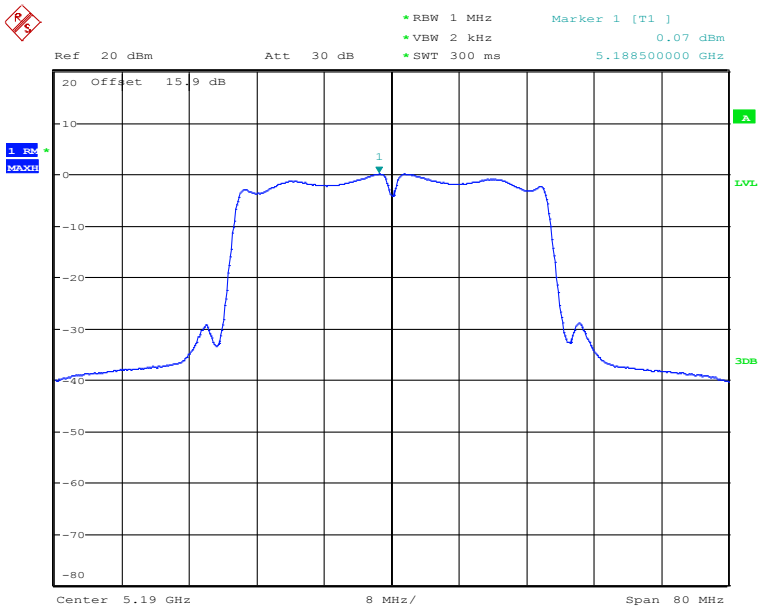
Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5190	0.07	2.96	-2.89

POWER SPECTRAL DENSITY

PSD LOW CH



7.4. 802.11n HT40 2TX MODE IN THE 5.2 GHz BAND, CDD MCS0

7.4.1. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

Antenna Gain (Chain 1) (dBi)	Antenna Gain (Chain 2) (dBi)	Effective Legacy Gain (dBi)
7.04	6.7	9.88

For the 5.15-5.25 GHz band, 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. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

TEST PROCEDURE

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

RESULTS

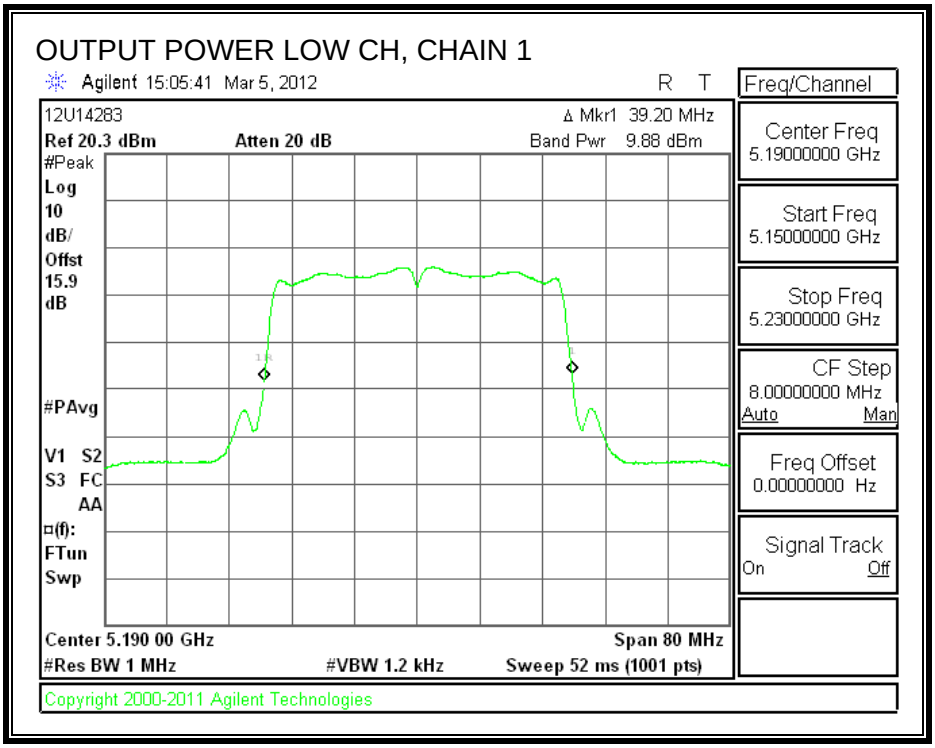
Limit

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Effective Antenna Gain (dBi)	Limit (dBm)
Low	5190	17	39.2	19.93	9.88	13.12
High	5230	17	39.5	19.97	9.88	13.12

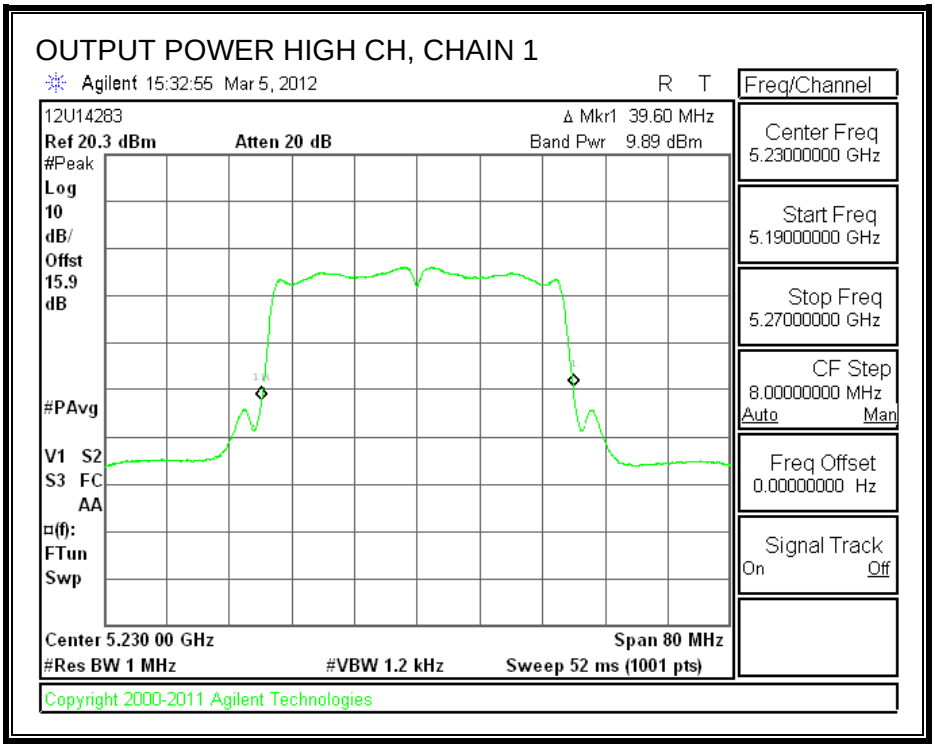
Individual Chain Results

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	9.88	9.66	12.78	13.12	-0.34
High	5230	9.89	9.35	12.64	13.12	-0.48

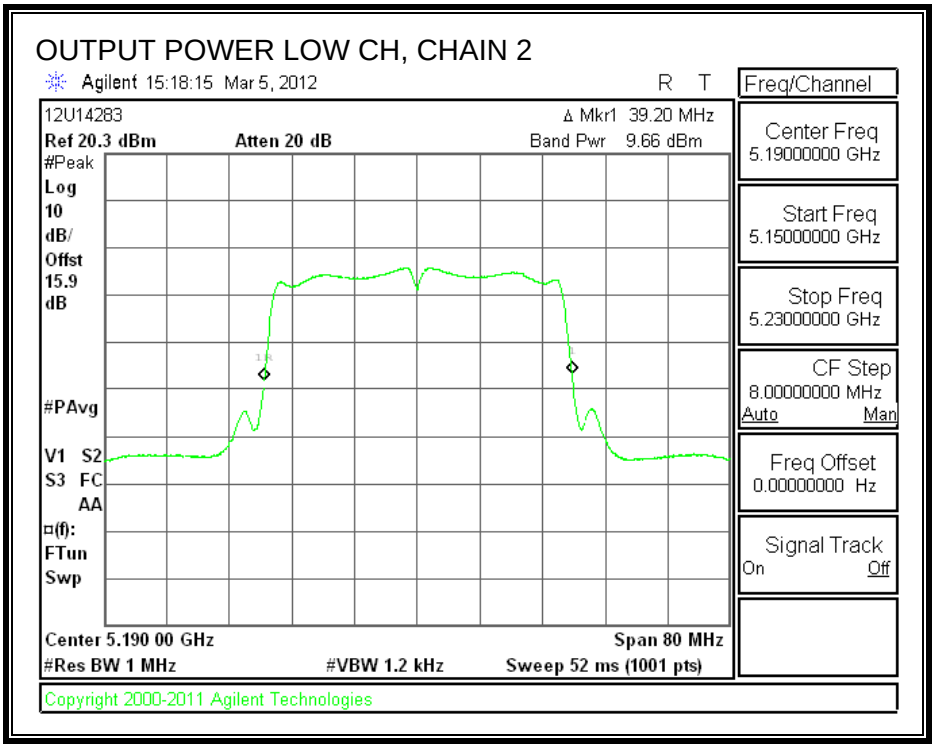
CHAIN 1 OUTPUT POWER



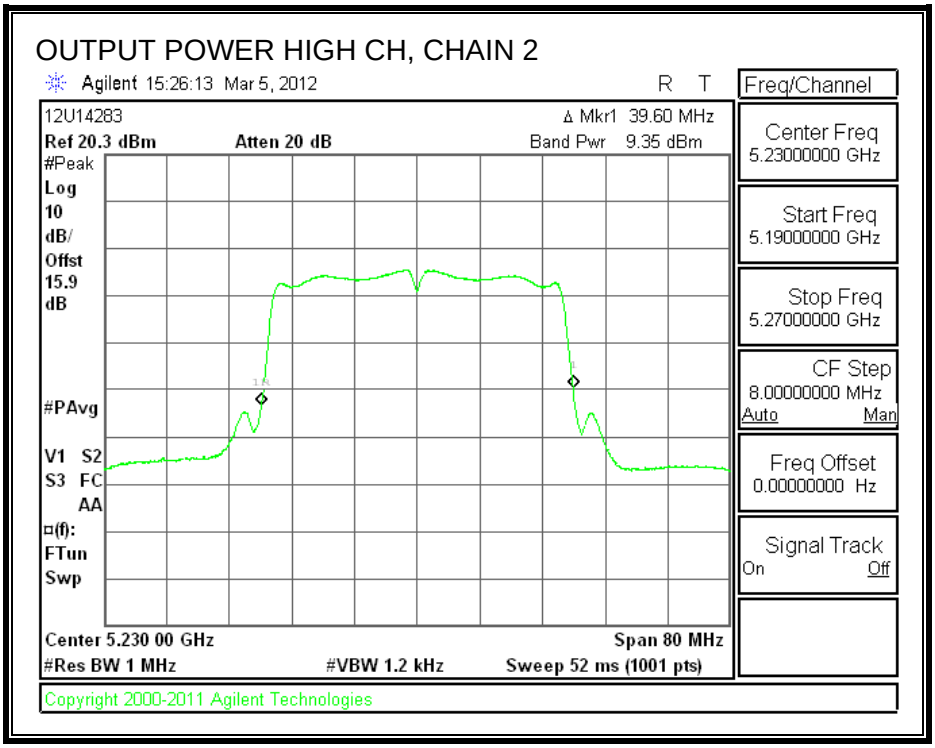
OUTPUT POWER HIGH CH, CHAIN 1



CHAIN 2 OUTPUT POWER



OUTPUT POWER HIGH CH, CHAIN 2



7.4.2. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

Antenna Gain (Chain 1) (dBi)	Antenna Gain (Chain 2) (dBi)	Effective Legacy Gain (dBi)
7.04	6.7	9.88

For the 5.15-5.25 GHz band, 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 peak transmit 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.

The maximum effective antenna gain is 9.88 dBi, therefore the limit is 0.12 dBm.

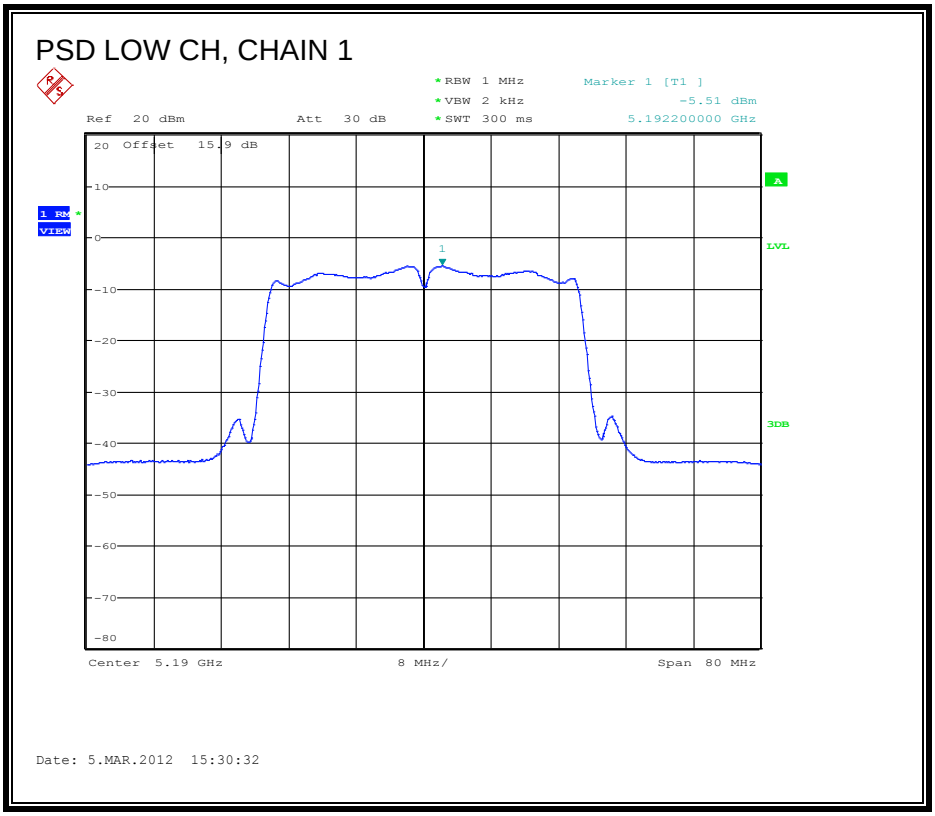
TEST PROCEDURE

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

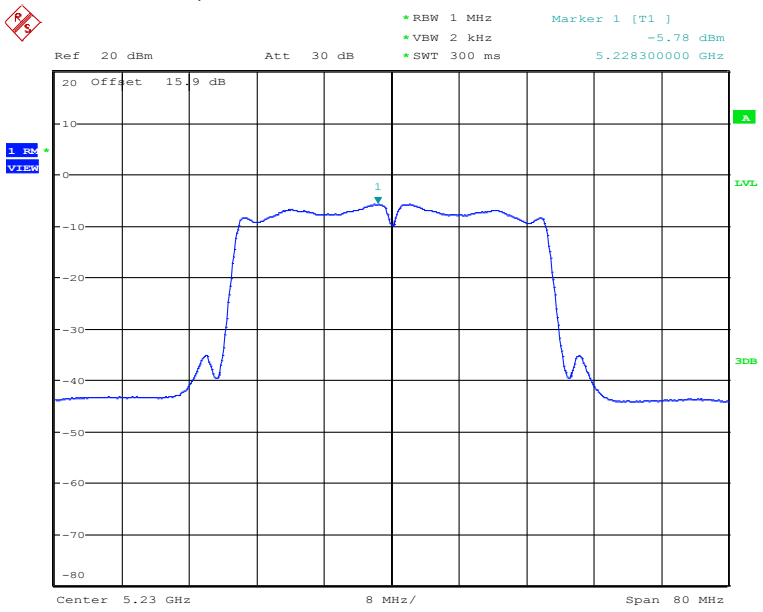
RESULTS

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5190	-5.51	-6.15	-2.81	0.12	-2.93
High	5230	-5.78	-6.23	-2.99	0.12	-3.11

CHAIN 1 POWER SPECTRAL DENSITY



PSD HIGH CH, CHAIN 1



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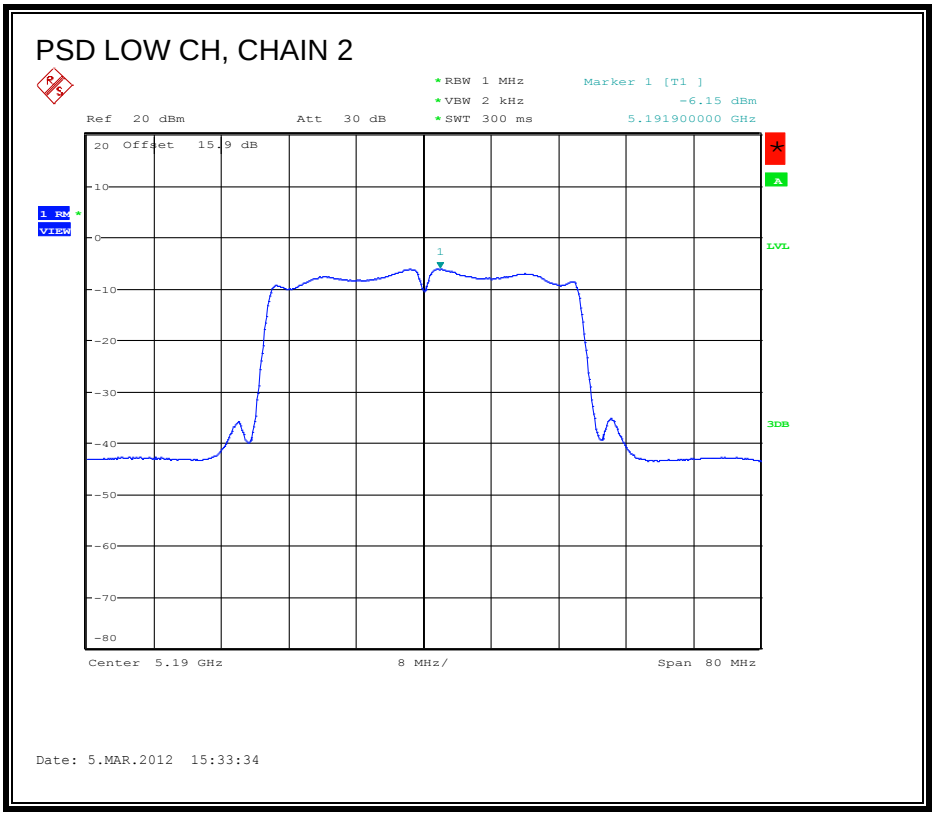
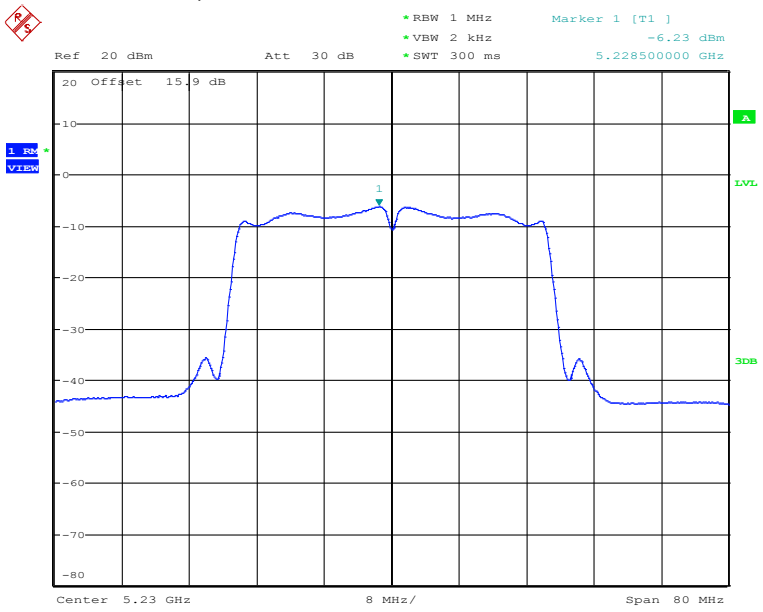
CHAIN 2 POWER SPECTRAL DENSITY



PSD HIGH CH, CHAIN 2



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7.5. 802.11n HT20 3 TX MODE IN THE 5.3 GHz BAND, CDD MCS0

7.5.1. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (Chain 1) (dBi)	Antenna Gain (Chain 2) (dBi)	Antenna Gain (Chain 3) (dBi)	Effective Legacy Gain (dBi)
7.09	7.06	3.58	10.96

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

The maximum antenna gain is 10.96 dBi, therefore the limit is 6.04 dBm.

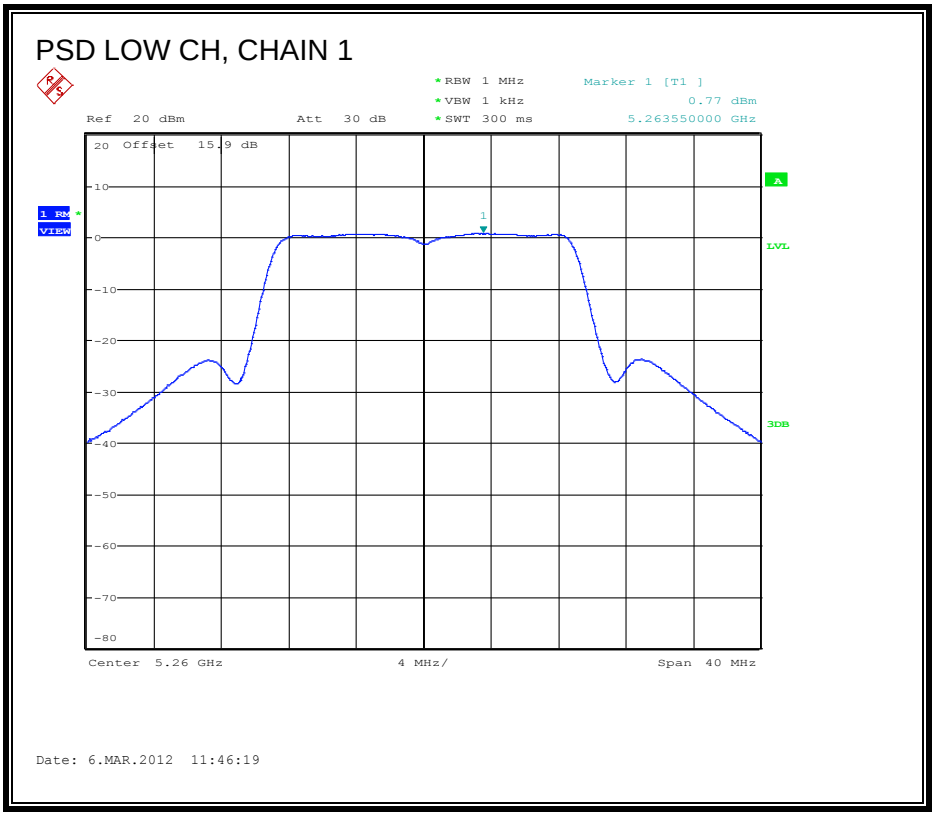
TEST PROCEDURE

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

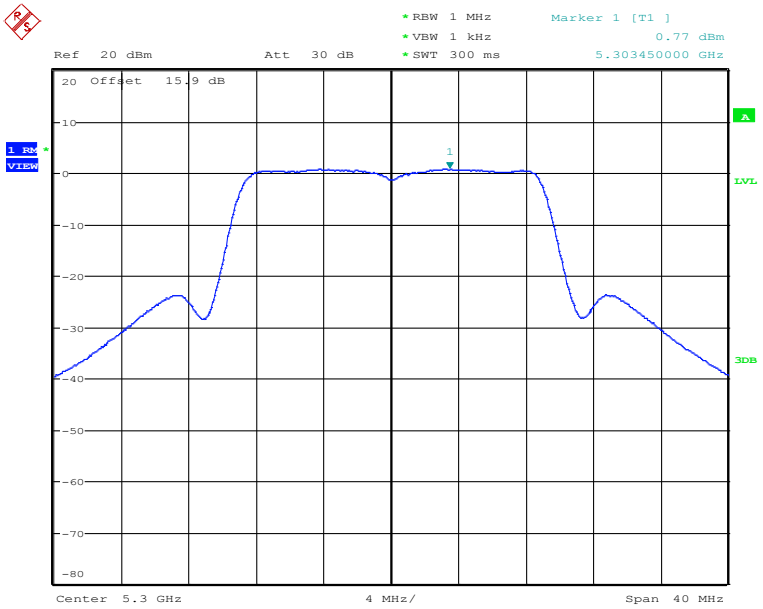
RESULTS

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Chain 3 PPSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5260	0.77	1.03	1.45	5.86	6.04	-0.18
Middle	5300	0.77	0.47	0.78	5.45	6.04	-0.59
High	5320	0.81	0.83	1.1	5.69	6.04	-0.35

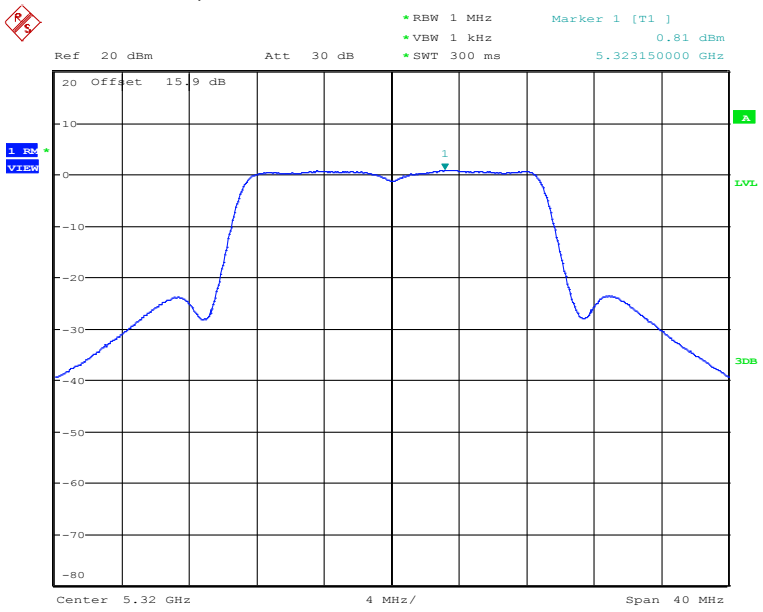
CHAIN 1 POWER SPECTRAL DENSITY



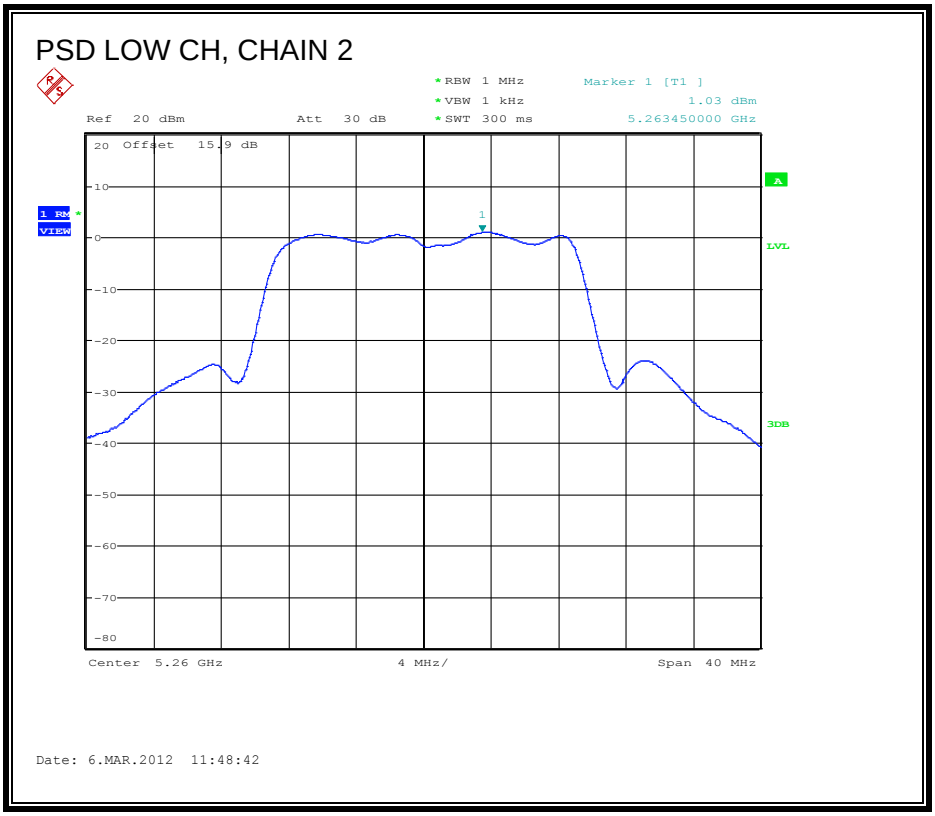
PSD MID CH, CHAIN 1



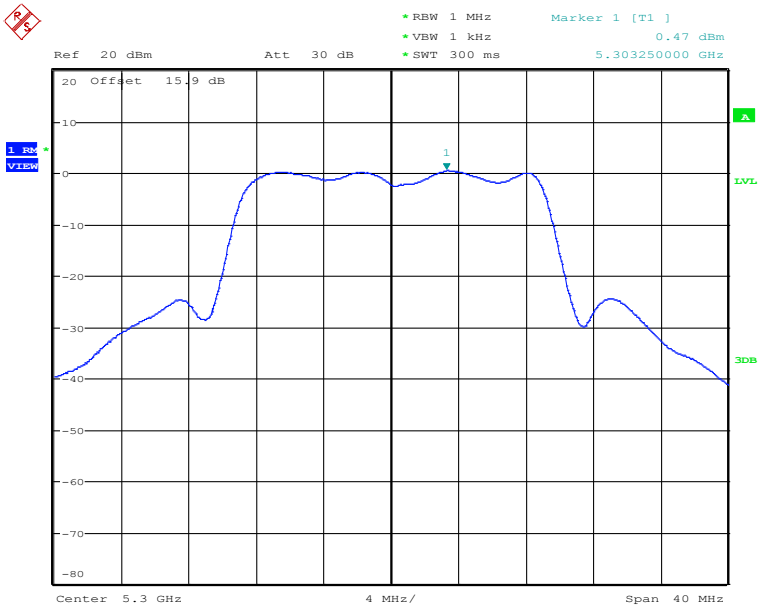
PSD HIGH CH, CHAIN 1



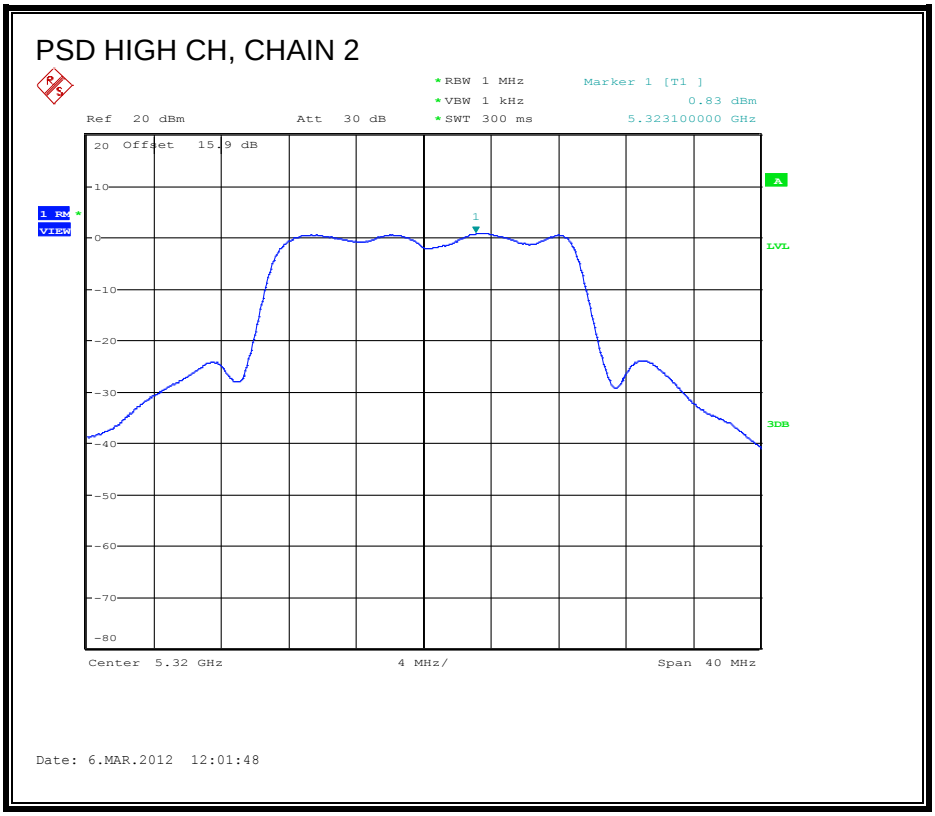
CHAIN 2 POWER SPECTRAL DENSITY



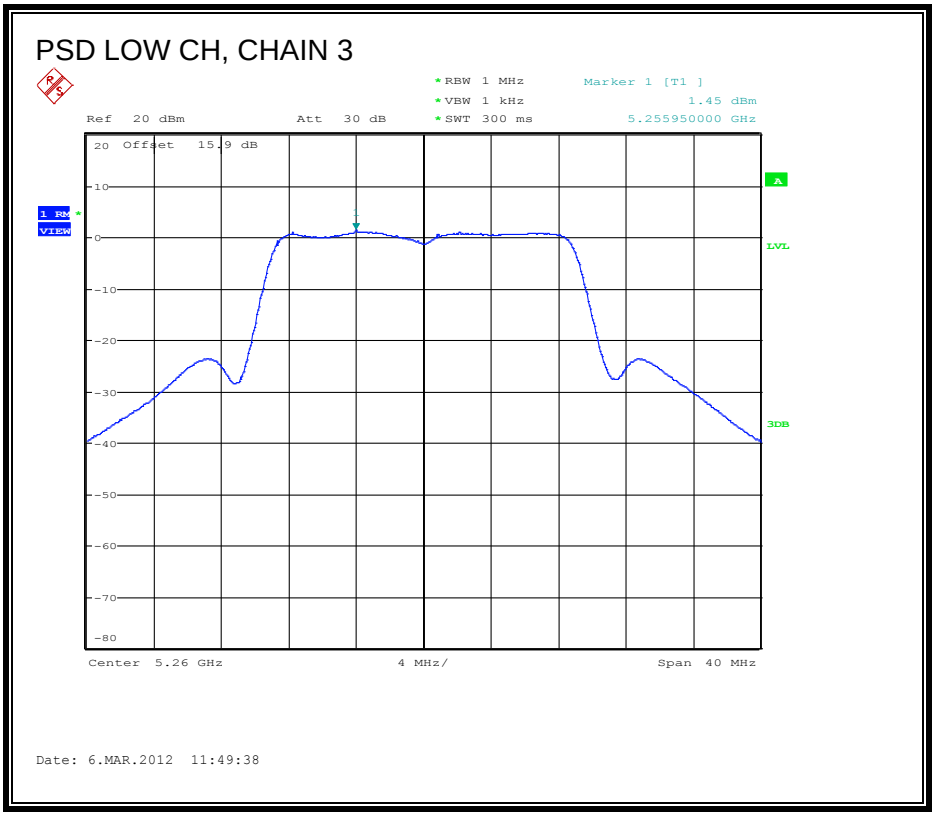
PSD MID CH, CHAIN 2



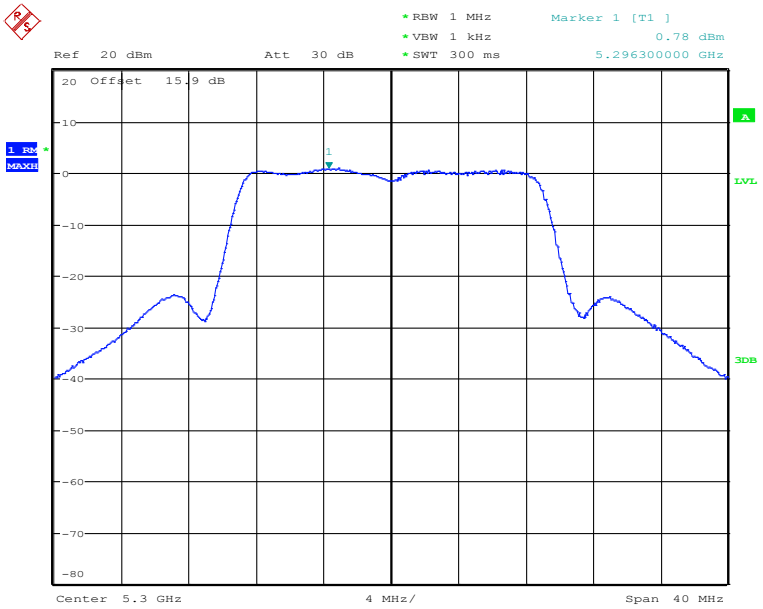
PSD HIGH CH, CHAIN 2



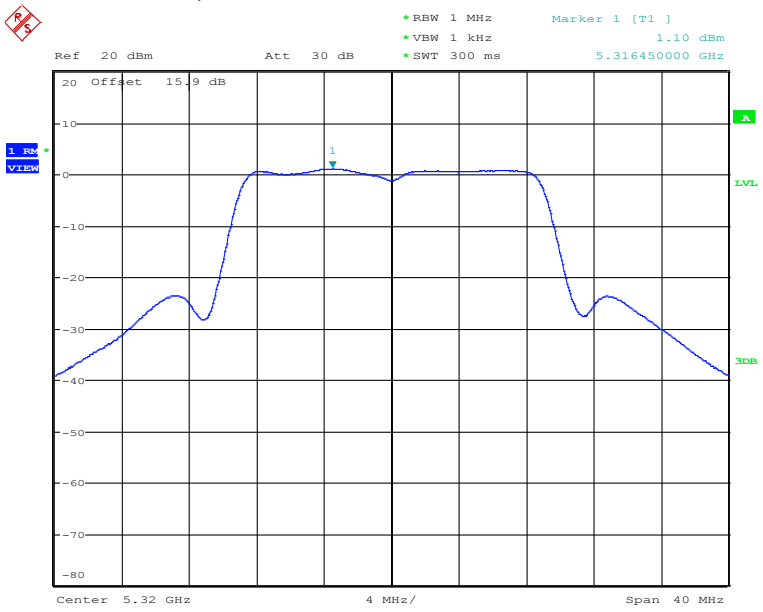
CHAIN 3 POWER SPECTRAL DENSITY



PSD MID CH, CHAIN 3



PSD HIGH CH, CHAIN 3



7.6. 802.11n HT40 3TX MODE IN THE 5.3 GHz BAND, CDD MCS0

7.6.1. OUTPUT POWER

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (Chain 1) (dBi)	Antenna Gain (Chain 2) (dBi)	Antenna Gain (Chain 3) (dBi)	Effective Legacy Gain (dBi)
7.09	7.06	3.58	10.96

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band 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 MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

TEST PROCEDURE

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

RESULTS

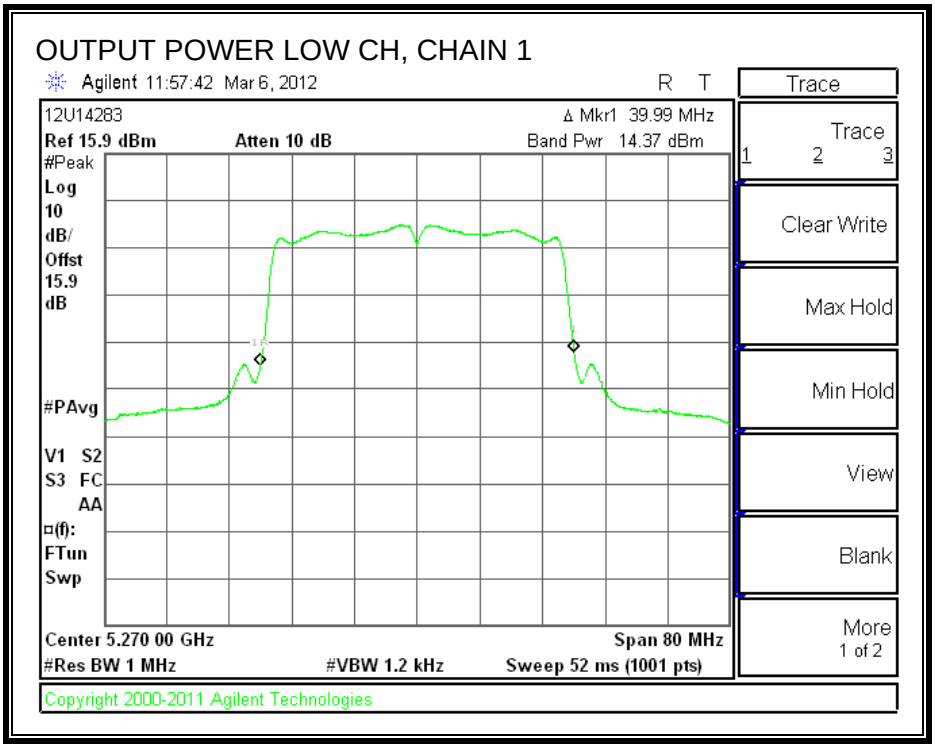
Limit

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5270	23.98	39.67	26.98	10.96	19.02
High	5310	23.98	39.5	26.97	10.96	19.02

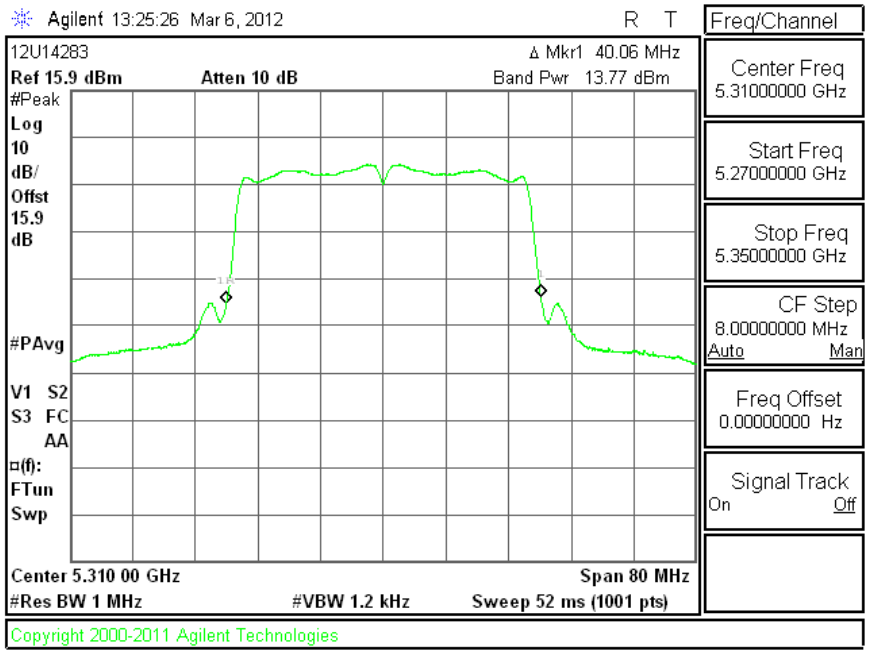
Individual Chain Results

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5270	14.37	13.69	14.24	18.88	19.02	-0.14
High	5310	13.77	13.84	14.05	18.66	19.02	-0.36

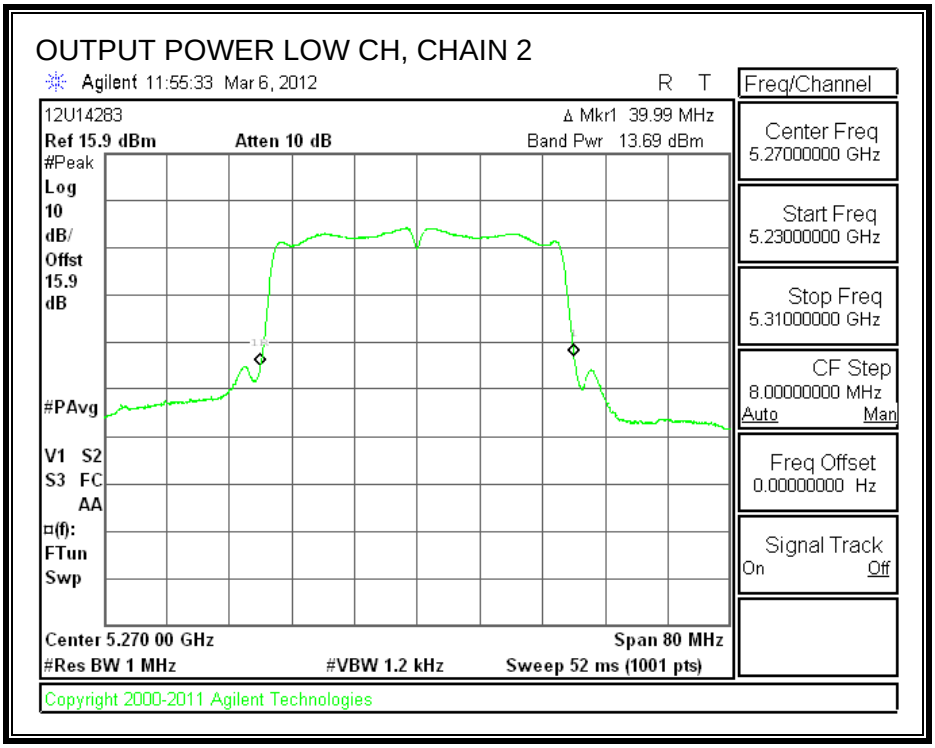
CHAIN 1 OUTPUT POWER



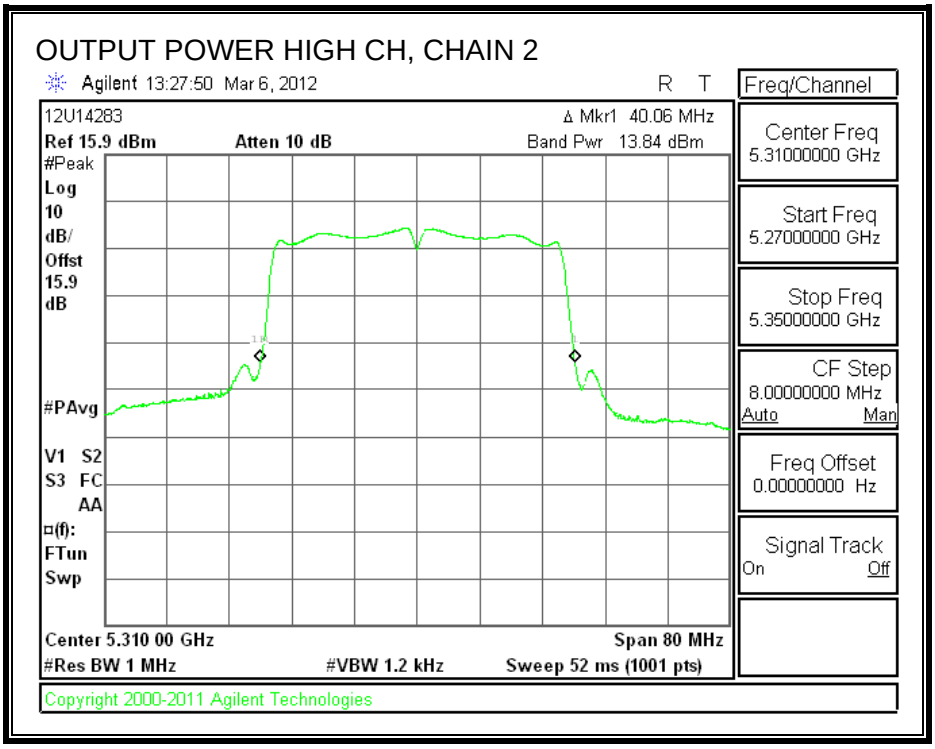
OUTPUT POWER HIGH CH, CHAIN 1



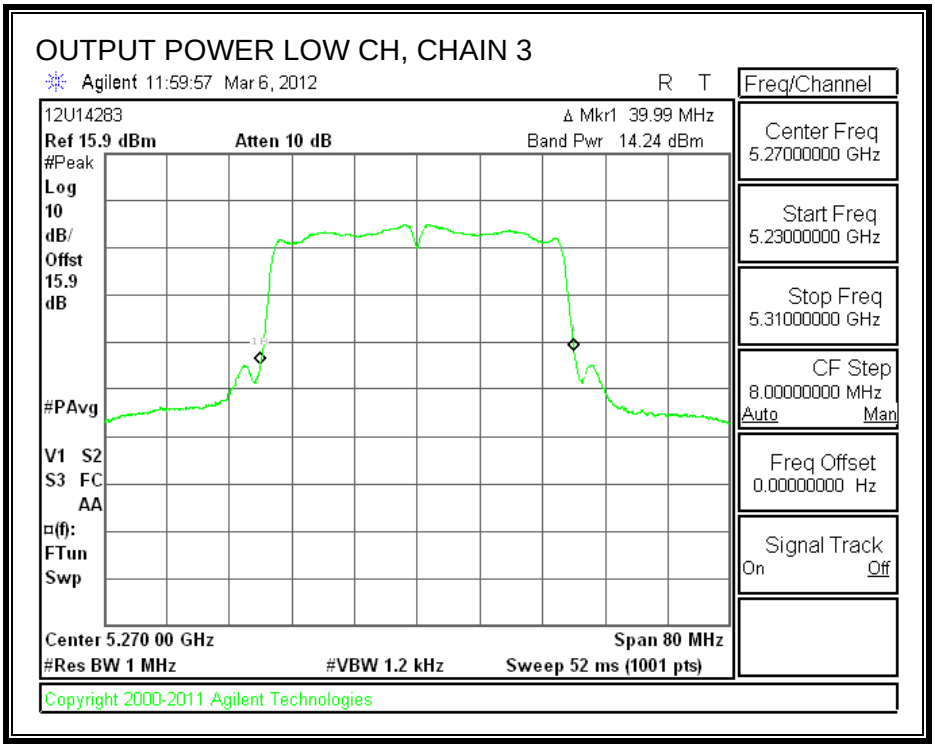
CHAIN 2 OUTPUT POWER



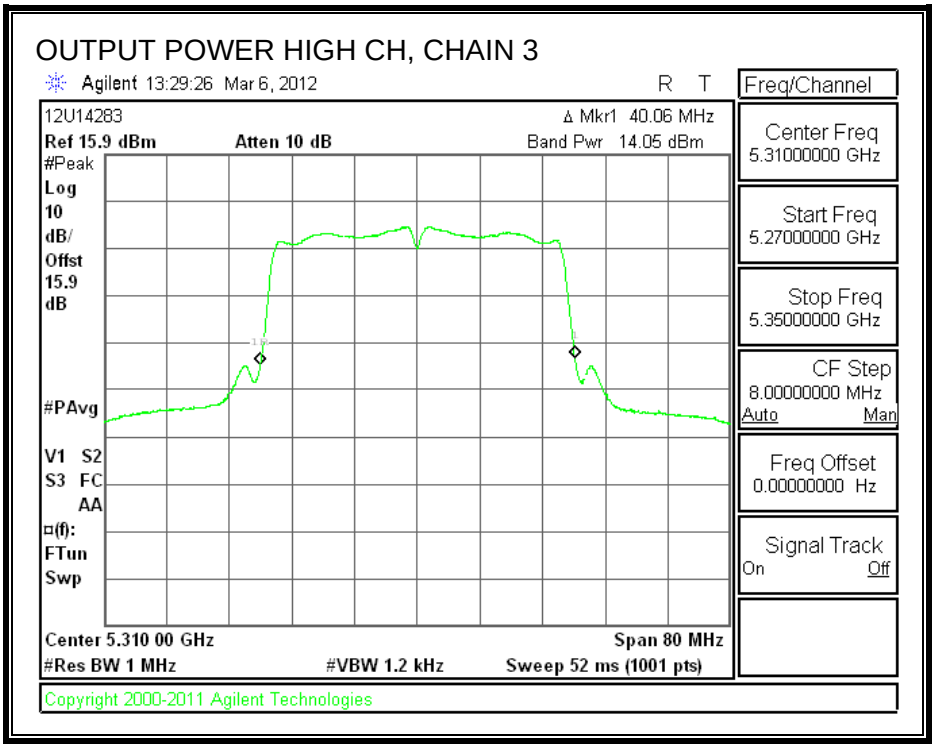
OUTPUT POWER HIGH CH, CHAIN 2



CHAIN 3 OUTPUT POWER



OUTPUT POWER HIGH CH, CHAIN 3



7.6.2. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (Chain 1) (dBi)	Antenna Gain (Chain 2) (dBi)	Antenna Gain (Chain 3) (dBi)	Effective Legacy Gain (dBi)
7.09	7.06	3.58	10.96

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

The maximum antenna gain is 10.96 dBi, therefore the limit is 6.04 dBm.

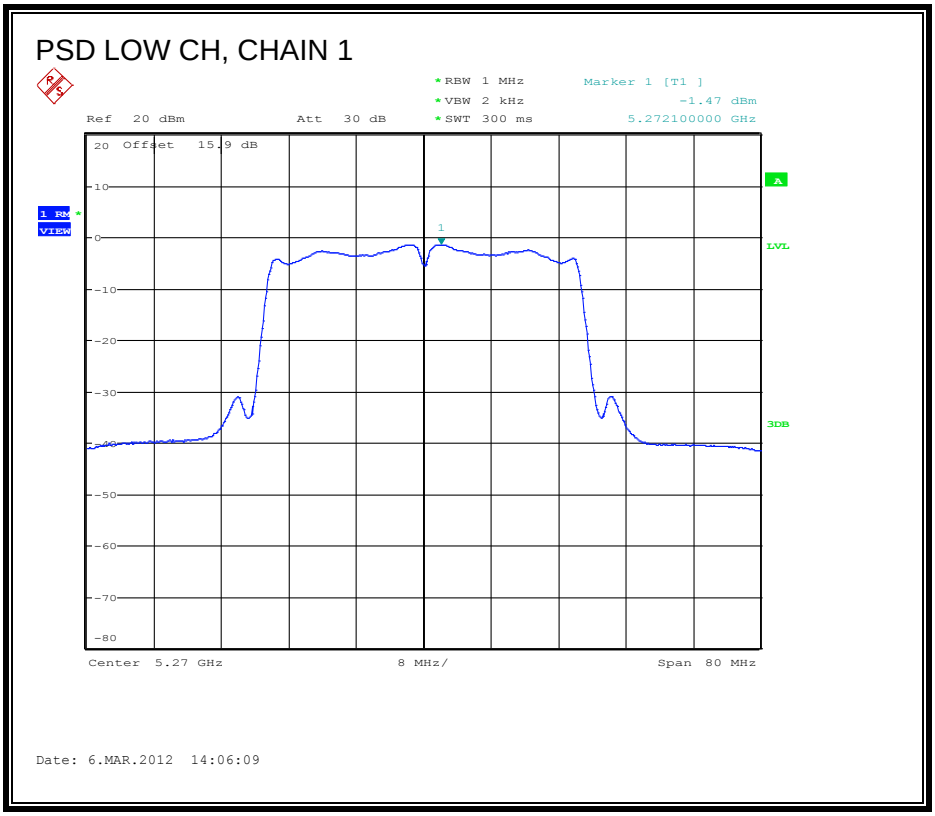
TEST PROCEDURE

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

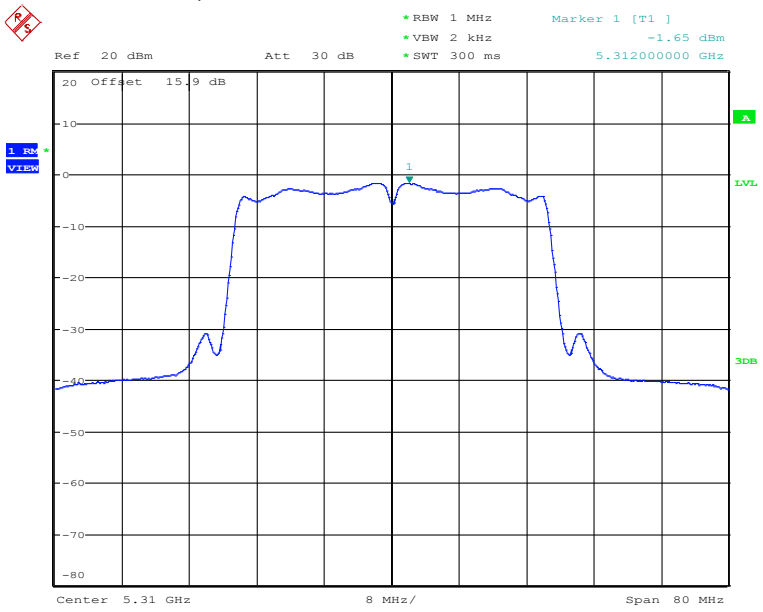
RESULTS

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Chain 3 PPSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5270	-1.47	-1.76	-1.19	3.30	6.04	-2.74
High	5310	-1.65	-1.72	-1.39	3.19	6.04	-2.85

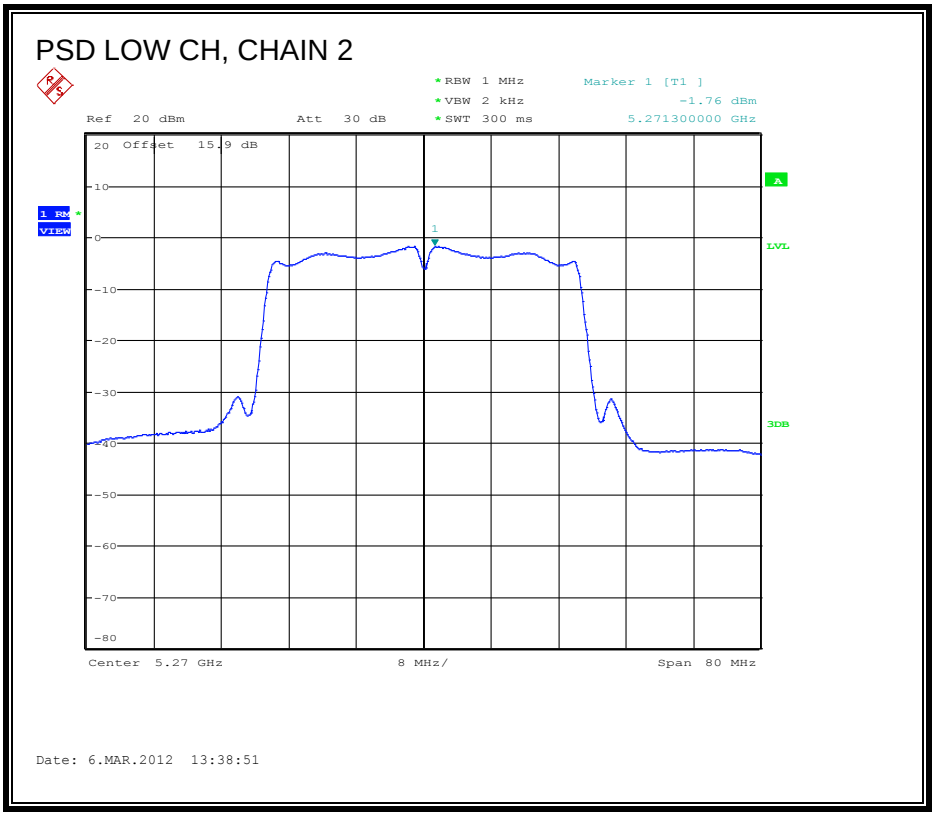
CHAIN 1 POWER SPECTRAL DENSITY



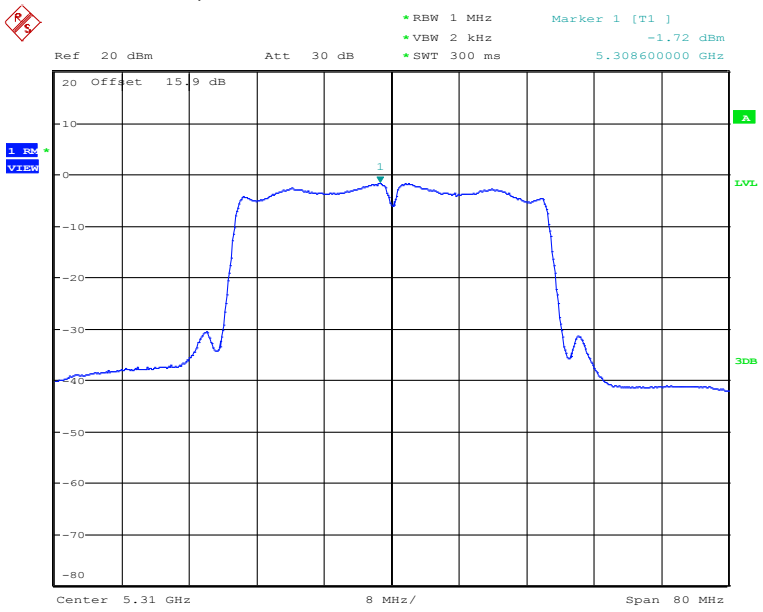
PSD HIGH CH, CHAIN 1



CHAIN 2 POWER SPECTRAL DENSITY

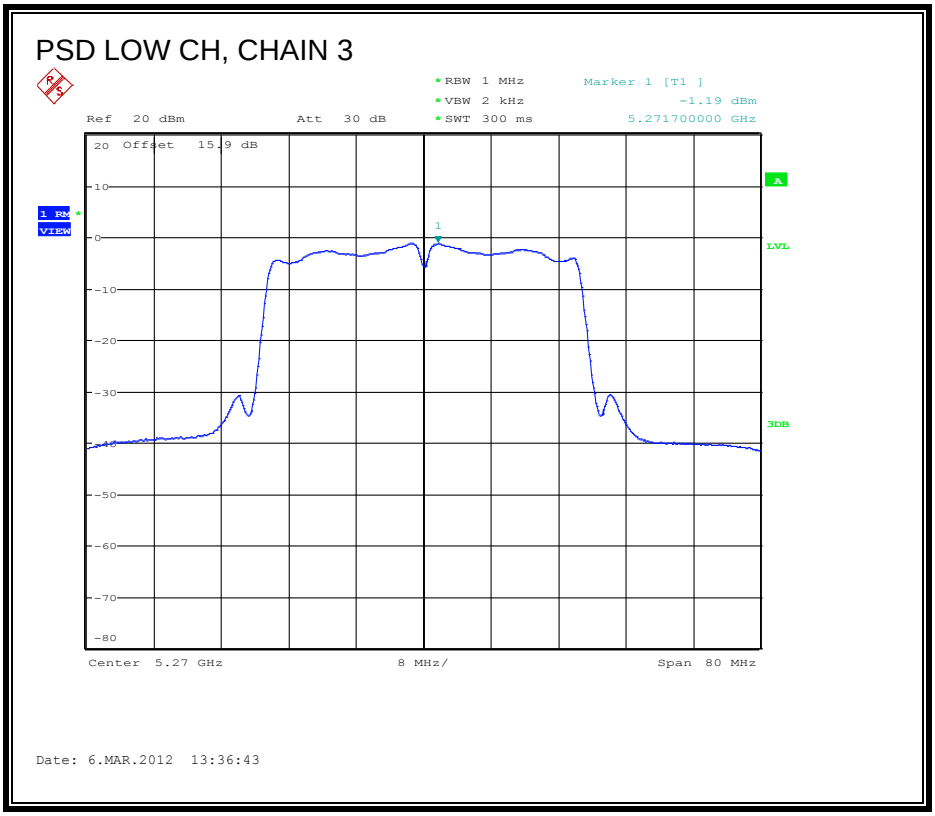


PSD HIGH CH, CHAIN 2

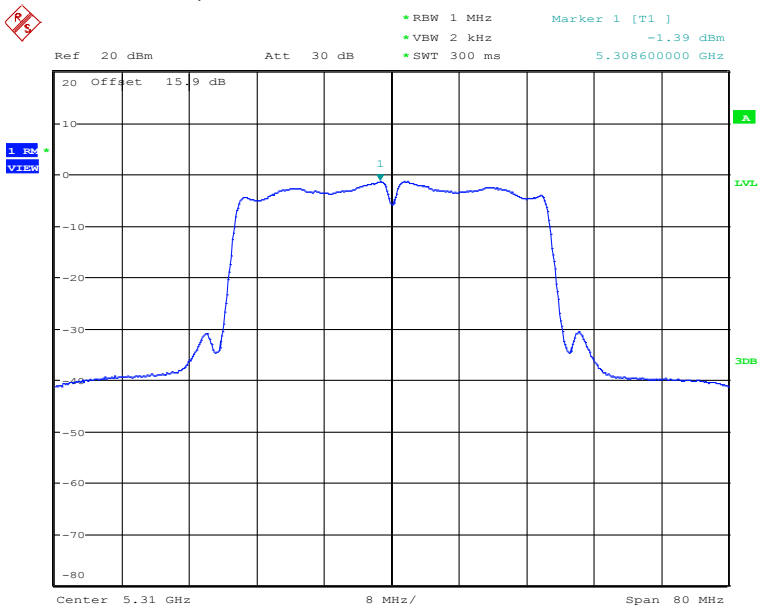


Date: 6.MAR.2012 13:59:37

CHAIN 3 POWER SPECTRAL DENSITY



PSD HIGH CH, CHAIN 3



Date: 6.MAR.2012 14:01:36

7.7. 802.11n HT40 1TX MODE IN THE 5.6 GHz BAND, CDD MCS0

7.7.1. OUTPUT POWER

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band 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 MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

TEST PROCEDURE

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

RESULTS

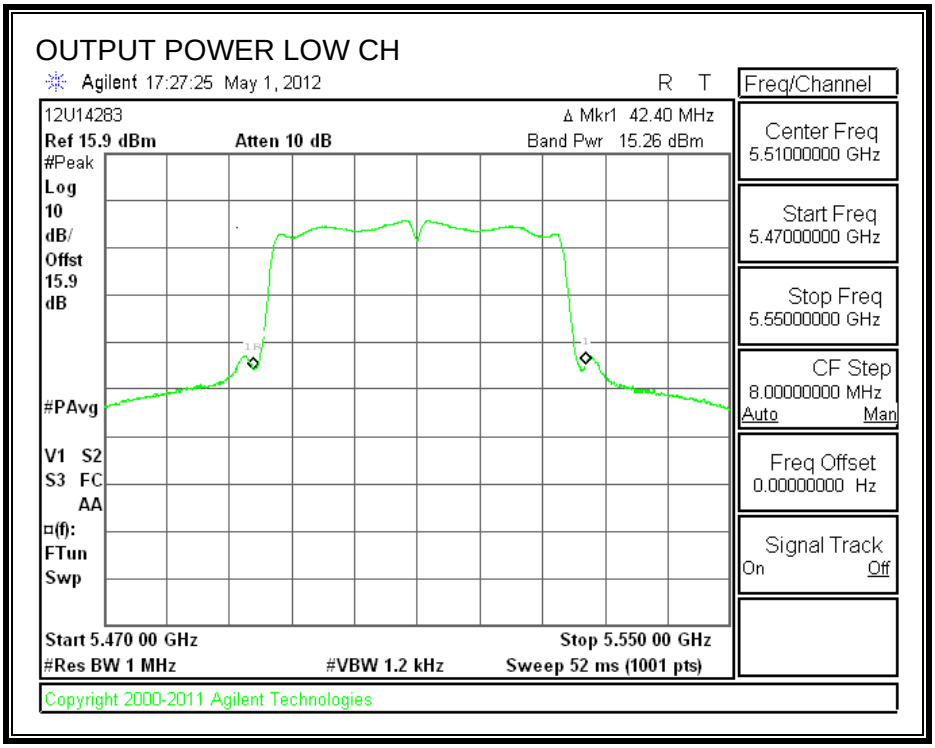
Limit

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5510	24	42.4	27.27	6.66	23.34

Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5510	15.26	23.34	-8.08

OUTPUT POWER



7.8. 802.11n HT20 3TX MODE IN THE 5.6 GHz BAND, CDD MCS0

7.8.1. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (Chain 1) (dBi)	Antenna Gain (Chain 2) (dBi)	Antenna Gain (Chain 3) (dBi)	Effective Legacy Gain (dBi)
5.03	6.66	3.94	10.13

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

The maximum effective antenna gain is 10.13 dBi, therefore the limit is 6.87 dBm.

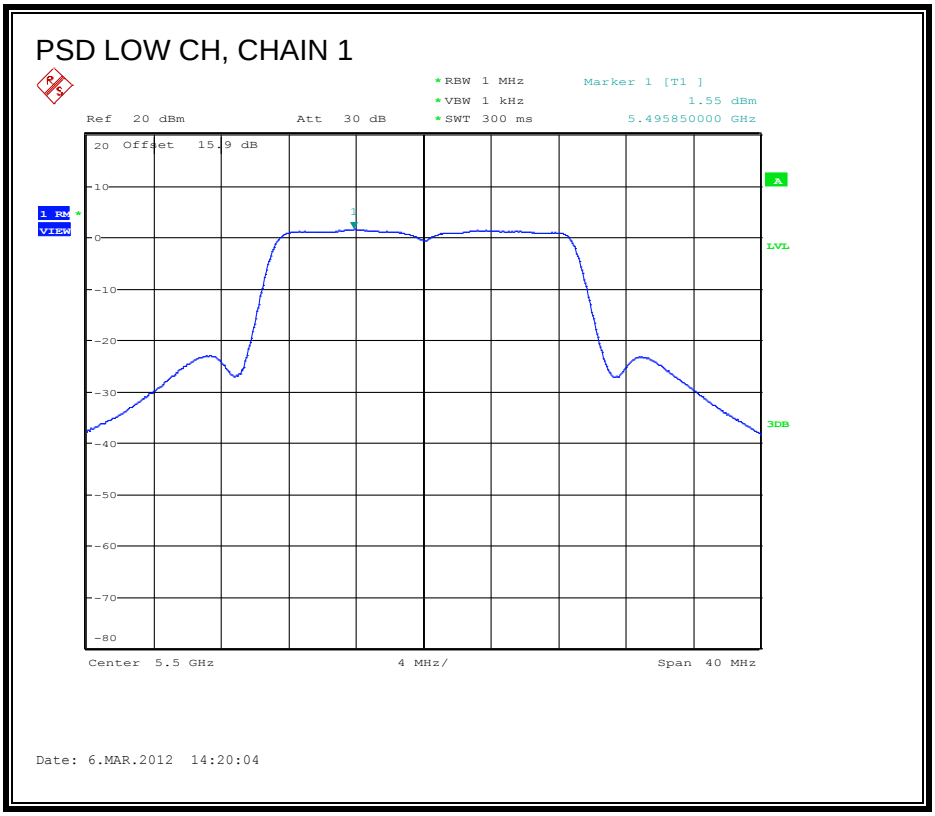
TEST PROCEDURE

Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, dated 10/25/2011.

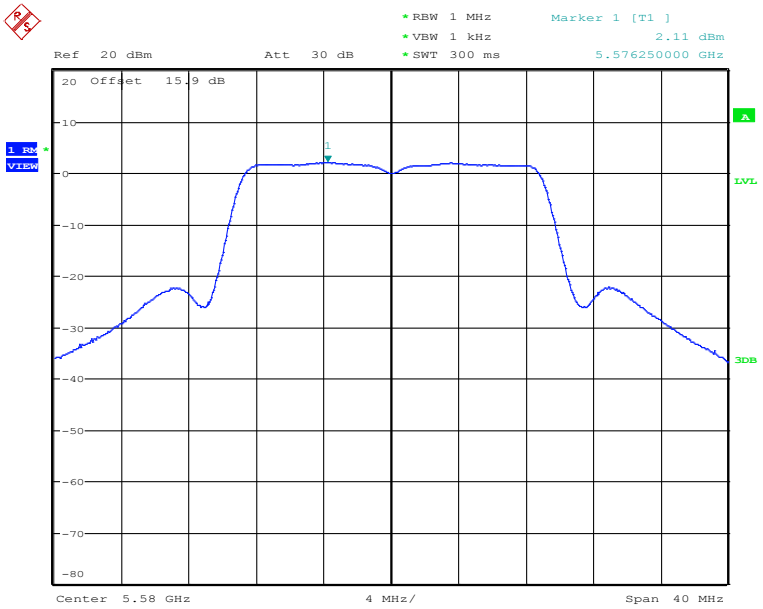
RESULTS

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Chain 3 PPSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5500	1.55	0.79	1.61	6.10	6.87	-0.77
Middle	5580	2.11	1.13	2.35	6.67	6.87	-0.20
High	5700	1.73	1.03	1.82	6.31	6.87	-0.56

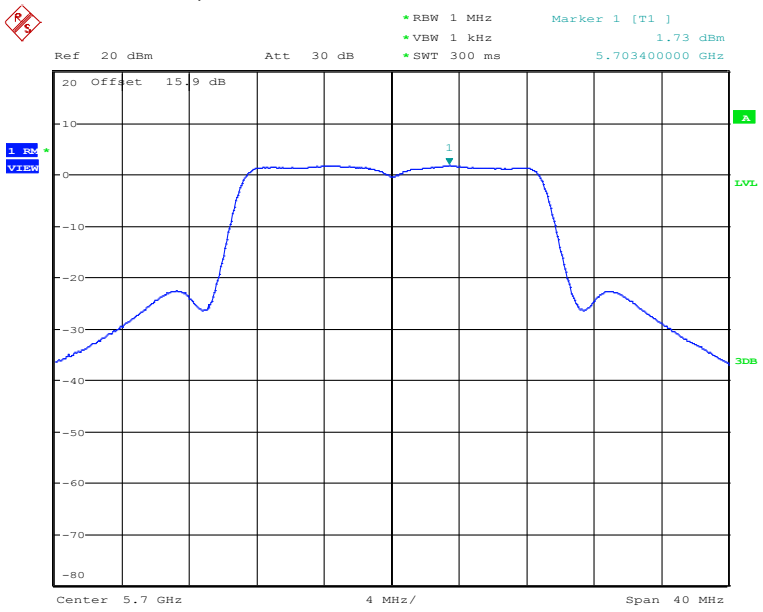
CHAIN 1 POWER SPECTRAL DENSITY



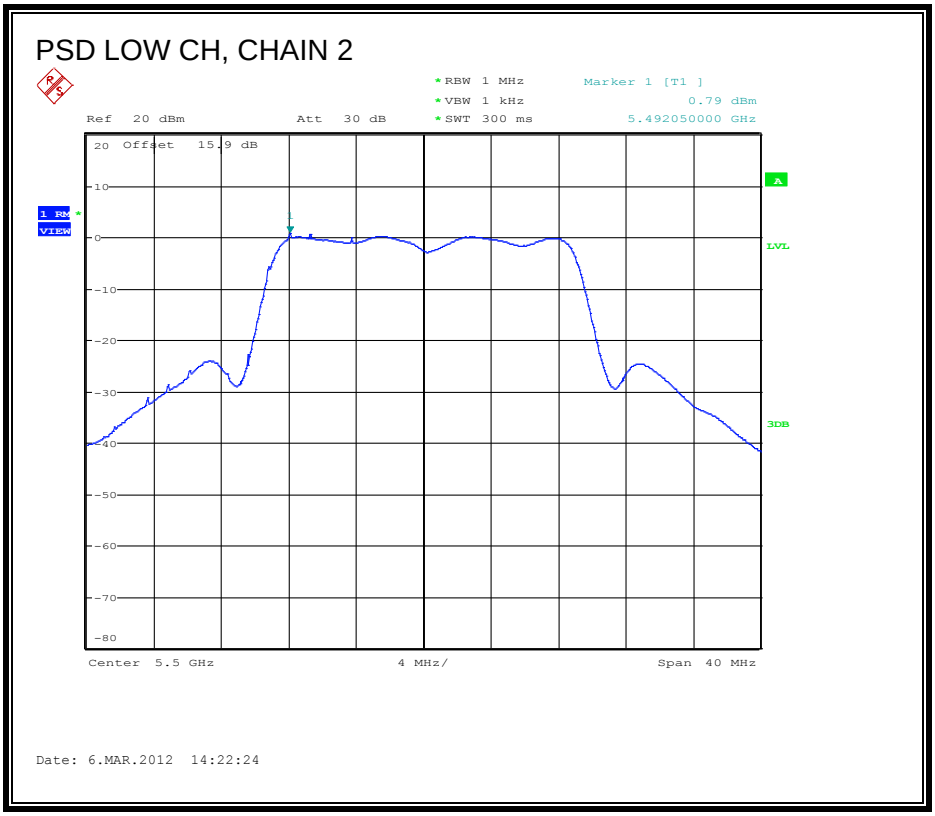
PSD MID CH, CHAIN 1



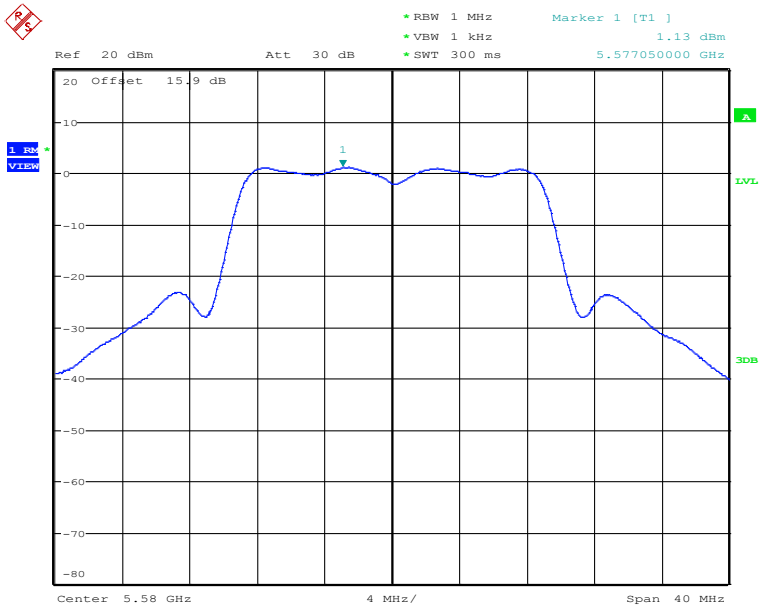
PSD HIGH CH, CHAIN 1



CHAIN 2 POWER SPECTRAL DENSITY

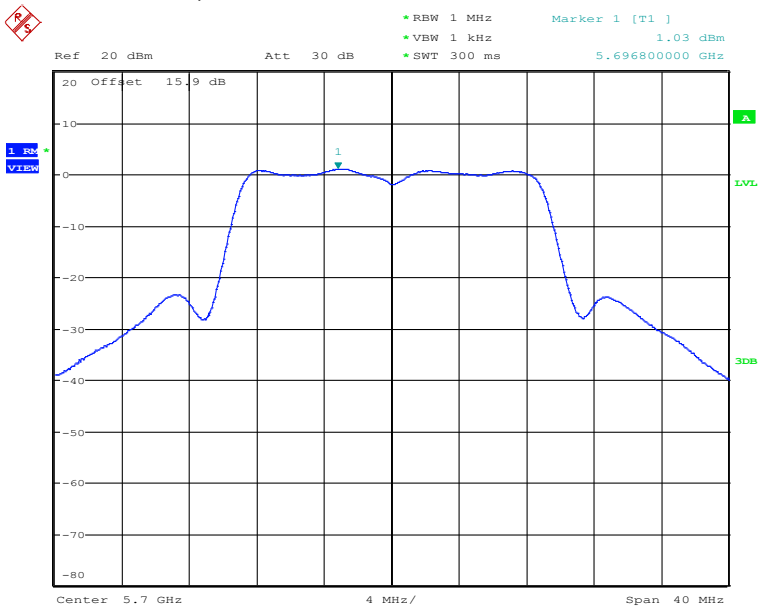


PSD MID CH, CHAIN 2

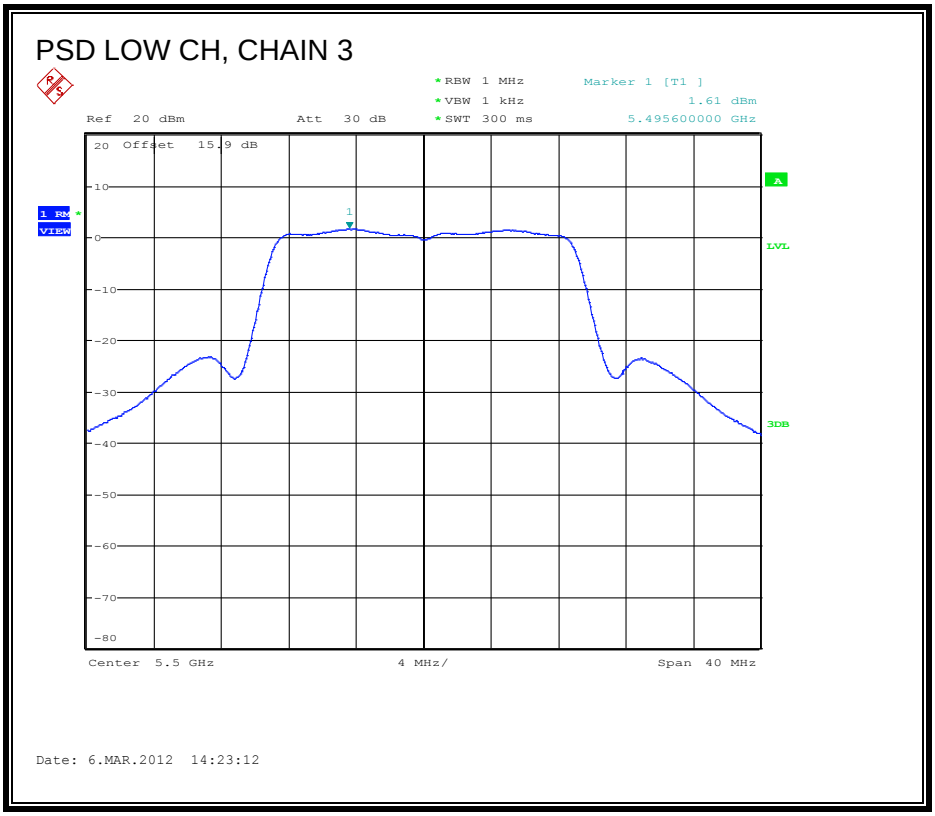


Date: 6.MAR.2012 14:43:33

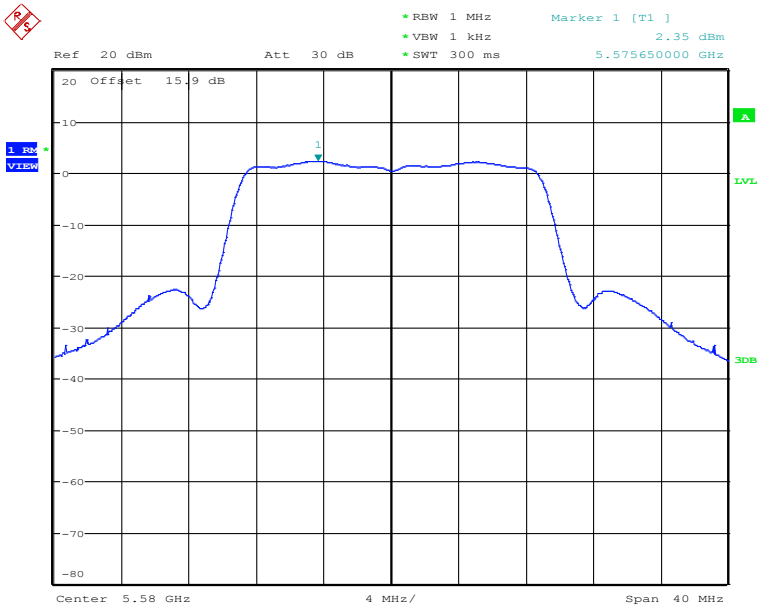
PSD HIGH CH, CHAIN 2



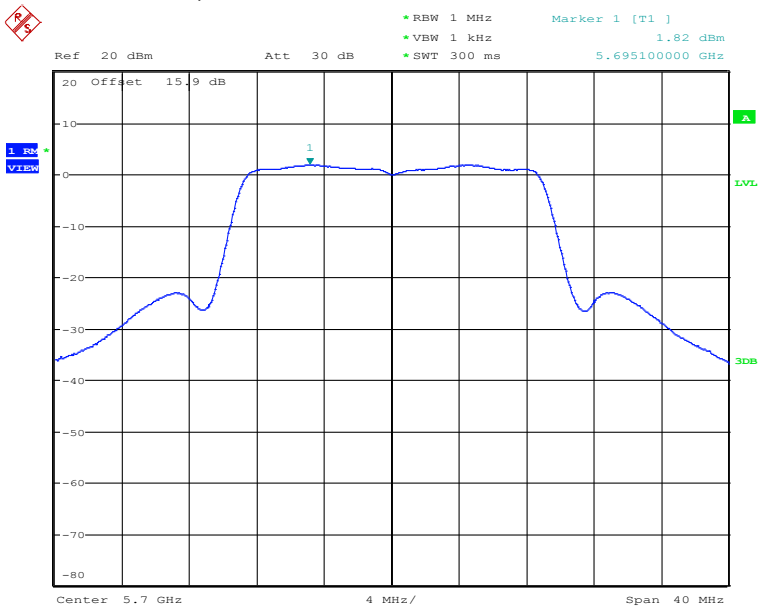
CHAIN 3 POWER SPECTRAL DENSITY



PSD MID CH, CHAIN 3



PSD HIGH CH, CHAIN 3



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. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

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, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz 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 1TX, 5.2 GHz BAND, LEGACY

Covered by testing to 11n HT20 3x3 CDD MCS0

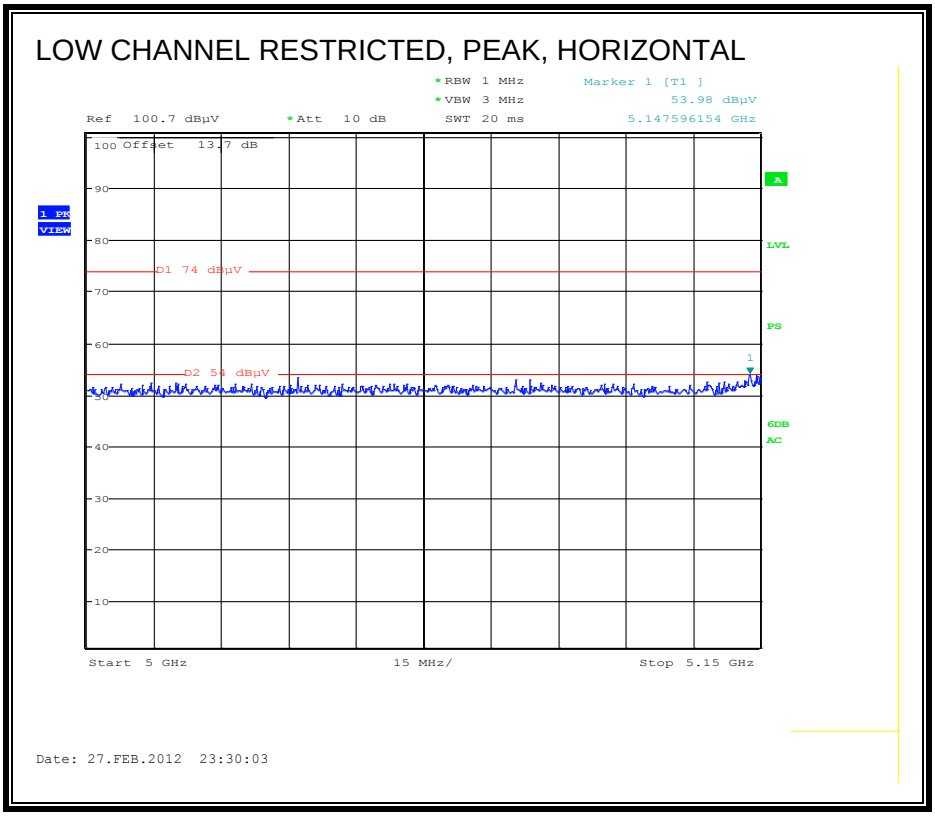
8.2.2. TX ABOVE 1 GHz, 802.11a 2TX, 5.2 GHz BAND, STBC MCS0

Covered by testing to 11n HT20 3x3 CCD MCS0

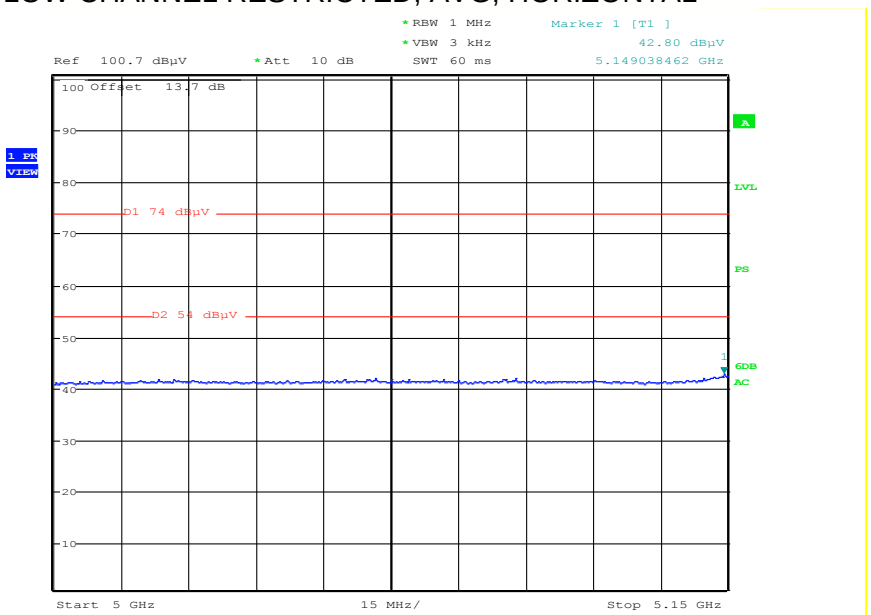
8.2.3. TX ABOVE 1 GHz, 802.11n HT20, 3TX, 5.2 GHz BAND, CDD MCS0

This mode is not implemented in the 5.2 GHz band and will be disabled in production devices. This mode is tested for harmonic / band edge / spurious emissions @ 14 dBm average power per chain at worst case mode / power to cover all 1x1 & 2x2 modes.

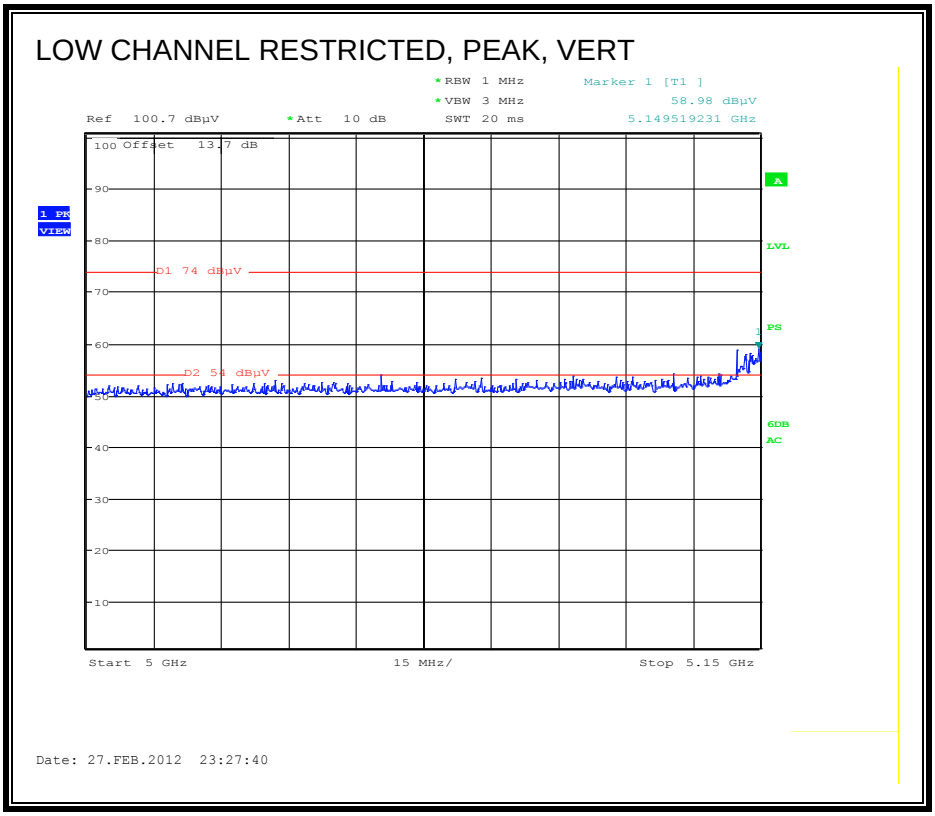
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



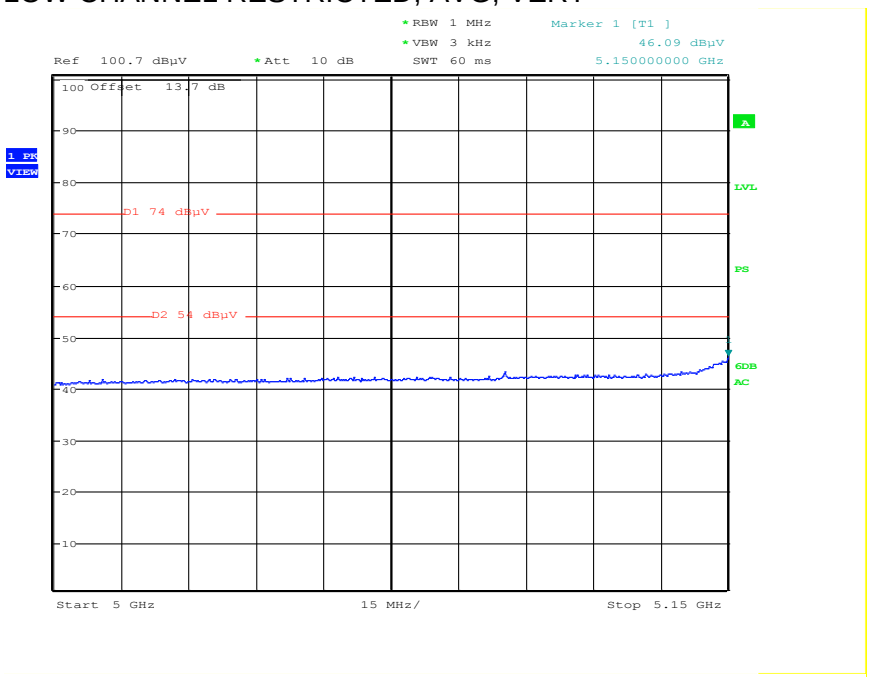
LOW CHANNEL RESTRICTED, AVG, HORIZONTAL



RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



LOW CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 02/29/12
Project #: 12U14283
Company: Apple Inc.,
Test Target: FCC Class B
Mode Oper: 802.11n 3TX HT20 MCS0 CDD, TX mode

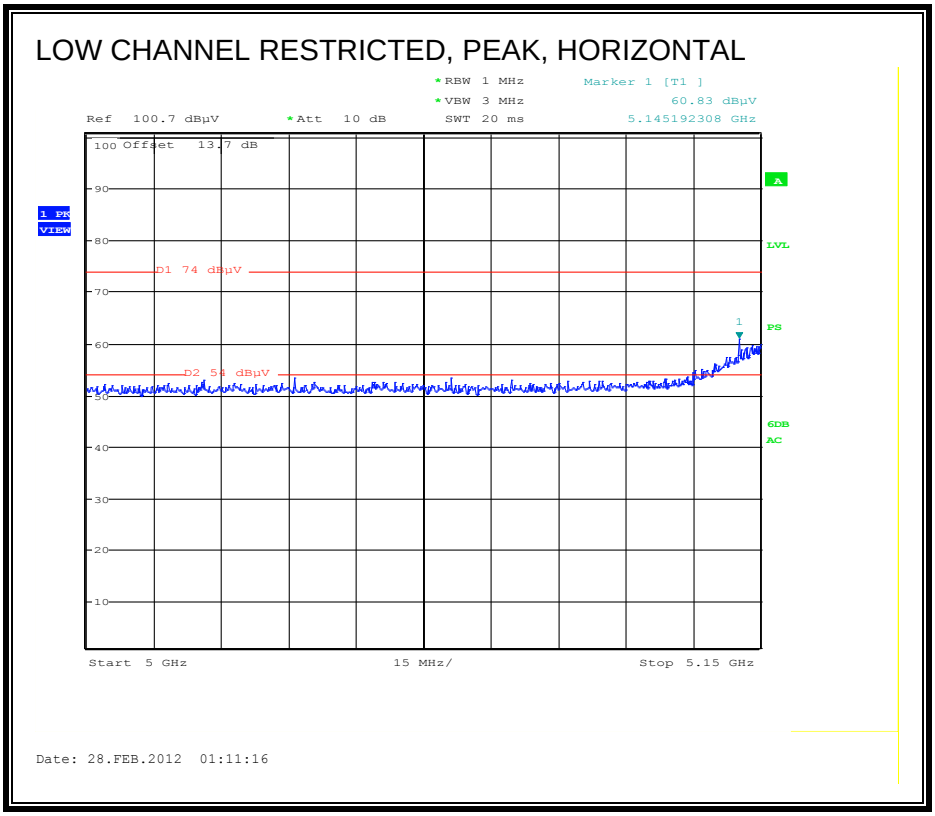
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. 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
5180MHz 3TX HT20 MCS0 cdd													
15.540	3.0	38.4	39.1	13.0	-31.9	0.0	0.7	59.2	74.0	-14.8	V	P	
15.540	3.0	24.1	39.1	13.0	-31.9	0.0	0.7	44.9	54.0	-9.1	V	A	
5180MHz 3TX HT20 MCS0 cdd													
15.540	3.0	34.8	39.1	13.0	-31.9	0.0	0.7	54.9	74.0	-19.1	H	P	
15.540	3.0	23.5	39.1	13.0	-31.9	0.0	0.7	43.6	54.0	-10.4	H	A	
5220MHz 3TX HT20 MCS0 cdd													
15.660	3.0	34.8	38.6	13.0	-31.9	0.0	0.7	54.6	74.0	-19.4	H	P	
15.660	3.0	23.6	38.6	13.0	-31.9	0.0	0.7	43.4	54.0	-10.6	H	A	
5220MHz 3TX HT20 MCS0 cdd													
15.660	3.0	36.0	38.6	13.0	-31.9	0.0	0.7	56.5	74.0	-17.5	V	P	
15.660	3.0	22.3	38.6	13.0	-31.9	0.0	0.7	42.7	54.0	-11.3	V	A	
5240MHz 3TX HT20 MCS0 cdd													
15.720	3.0	35.6	38.4	13.1	-31.9	0.0	0.7	55.9	74.0	-18.1	V	P	
15.720	3.0	21.2	38.4	13.1	-31.9	0.0	0.7	41.5	54.0	-12.5	V	A	
5240MHz 3TX HT20 MCS0 cdd													
15.720	3.0	35.4	38.4	13.1	-31.9	0.0	0.7	55.0	74.0	-19.0	H	P	
15.720	3.0	23.4	38.4	13.1	-31.9	0.0	0.7	43.0	54.0	-11.0	H	A	

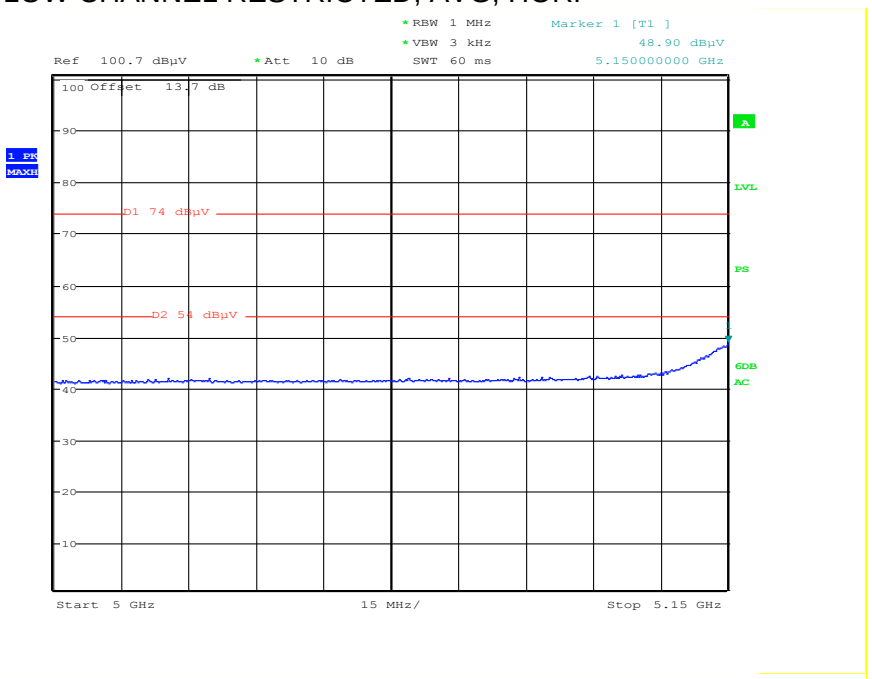
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.2.4. TX ABOVE 1 GHz, 802.11n HT40, 1TX, 5.2 GHz BAND, CDD MCS0

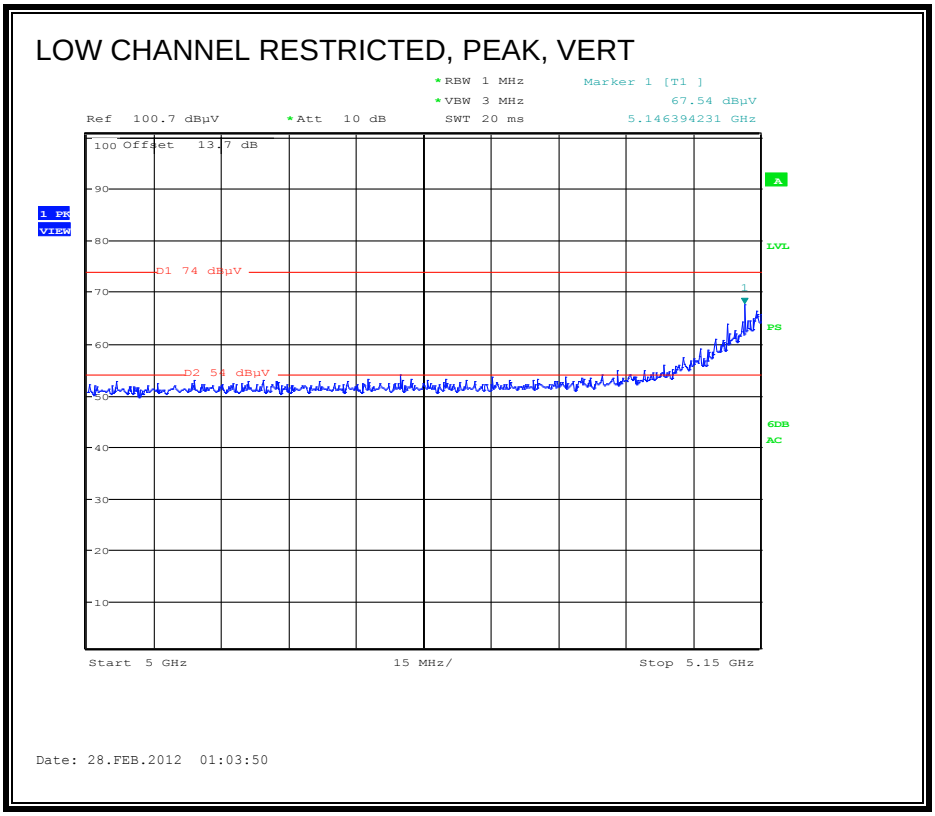
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



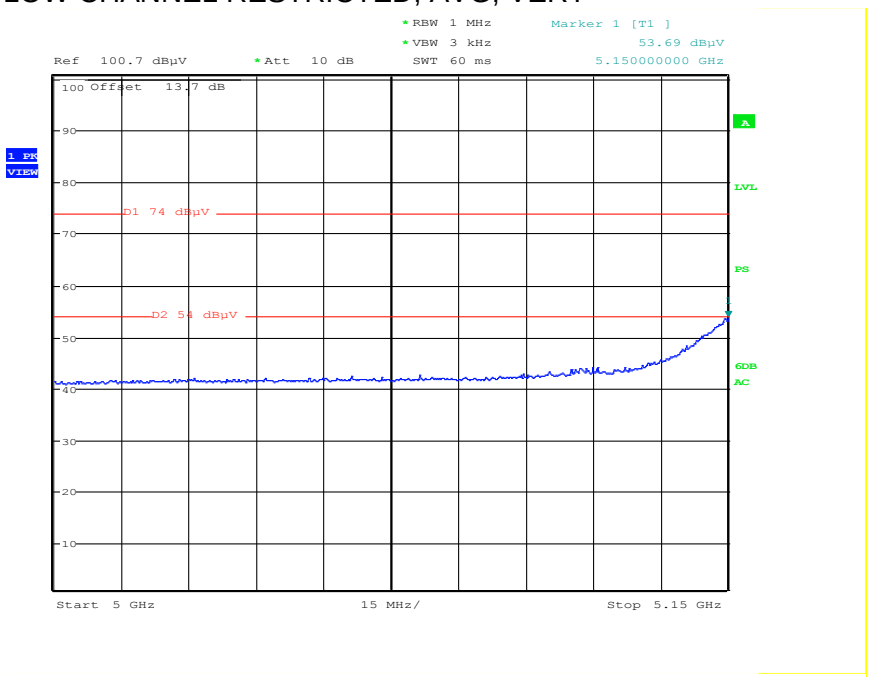
LOW CHANNEL RESTRICTED, AVG, HORI



RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



LOW CHANNEL RESTRICTED, AVG, VERT

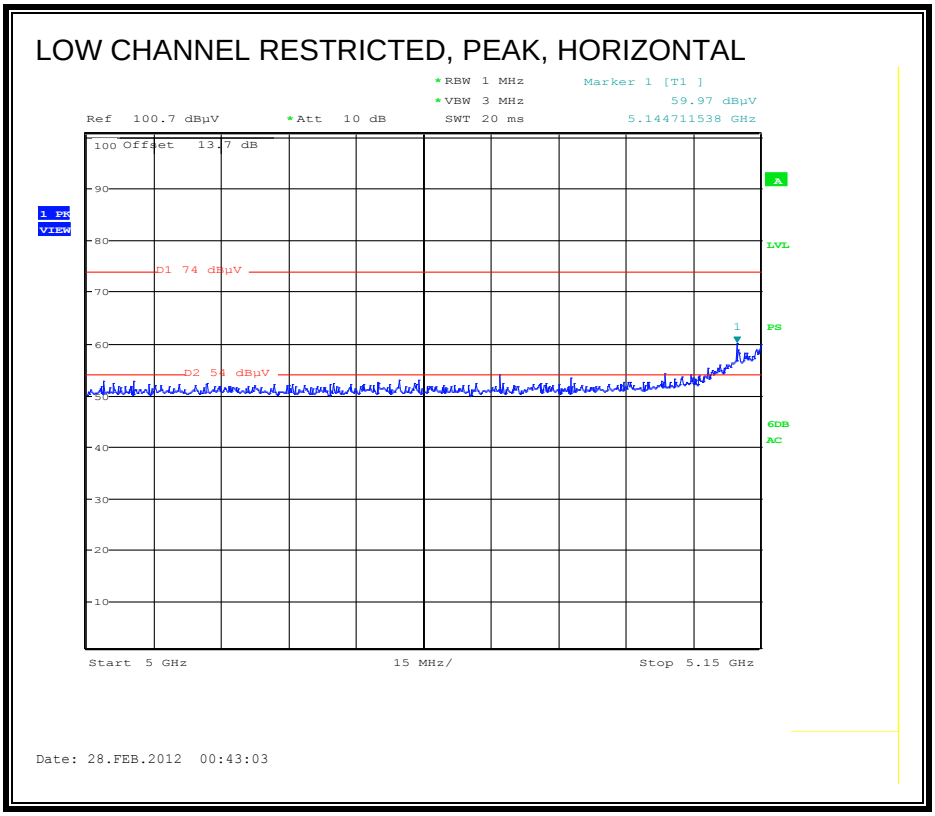


HARMONICS AND SPURIOUS EMISSIONS

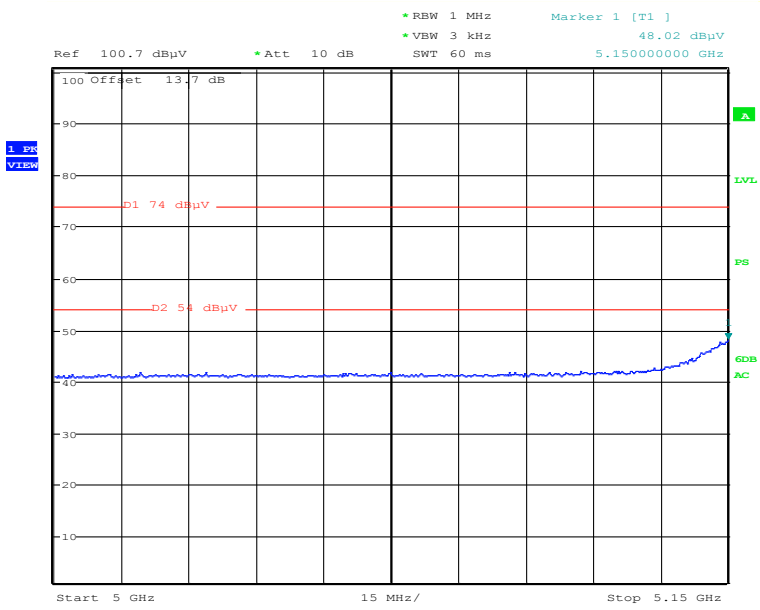
Covered by testing to 11n HT40 CDD MCS0

8.2.5. TX ABOVE 1 GHz, 802.11n HT40, 3TX, 5.2 GHz BAND, CDD MCS0

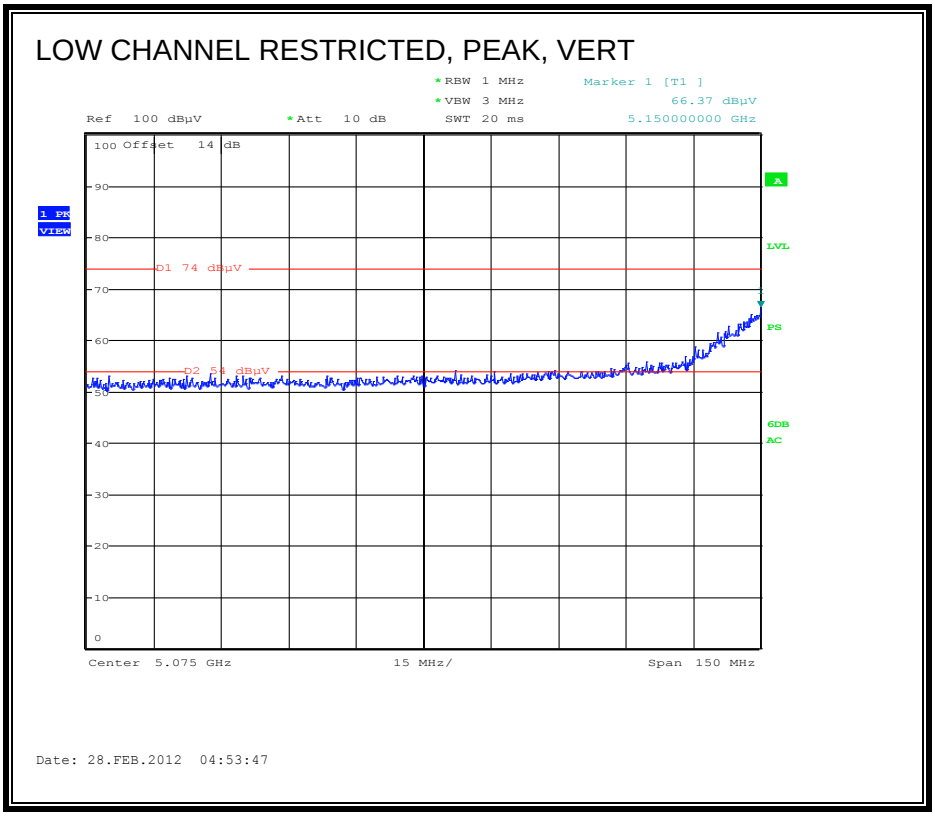
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



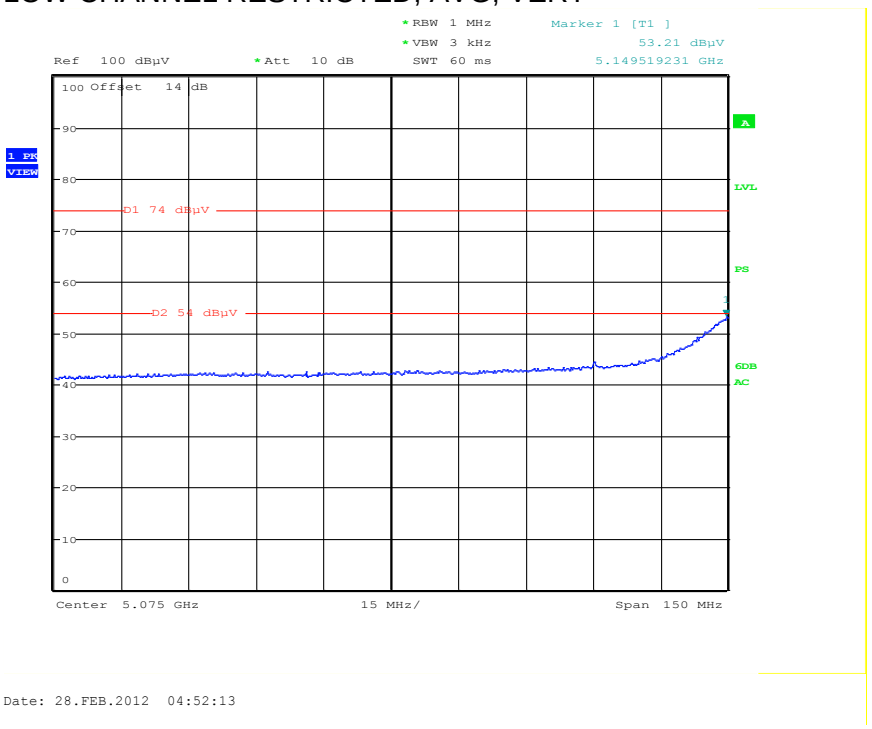
LOW CHANNEL RESTRICTED, AVG, HORIZONTAL



RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



LOW CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 02/29/12
Project #: 12U14283
Company: Apple Inc.,
Test Target: FCC Class B
Mode Oper: 802.11n 3TX HT40 MCS0 CDD, TX mode

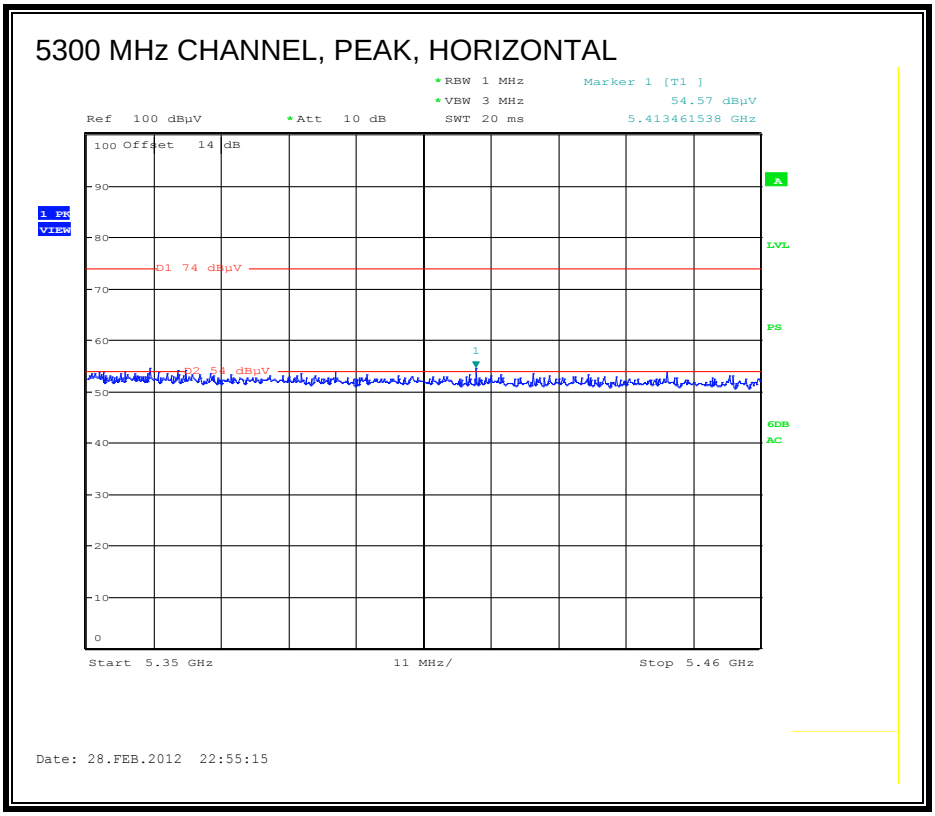
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. 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 3TX HT40 MCS0 CDD													
15.570	3.0	38.3	38.9	13.0	-31.9	0.0	0.7	59.1	74.0	-15.0	V	P	
15.570	3.0	25.0	38.9	13.0	-31.9	0.0	0.7	45.7	54.0	-8.3	V	A	
5190MHz 3TX HT40 MCS0 CDD													
15.570	3.0	29.2	38.9	13.0	-31.9	0.0	0.7	49.9	74.0	-24.1	H	P	
15.570	3.0	18.0	38.9	13.0	-31.9	0.0	0.7	38.7	54.0	-15.3	H	A	
5230MHz 3TX HT40 MCS0 CDD													
15.690	3.0	29.5	38.5	13.0	-31.9	0.0	0.7	49.9	74.0	-24.1	H	P	
15.690	3.0	17.7	38.5	13.0	-31.9	0.0	0.7	38.1	54.0	-15.9	H	A	
5230MHz 3TX HT40 MCS0 CDD													
15.690	3.0	27.5	38.5	13.0	-31.9	0.0	0.7	47.9	74.0	-26.1	V	P	
15.690	3.0	15.9	38.5	13.0	-31.9	0.0	0.7	36.3	54.0	-17.7	V	A	

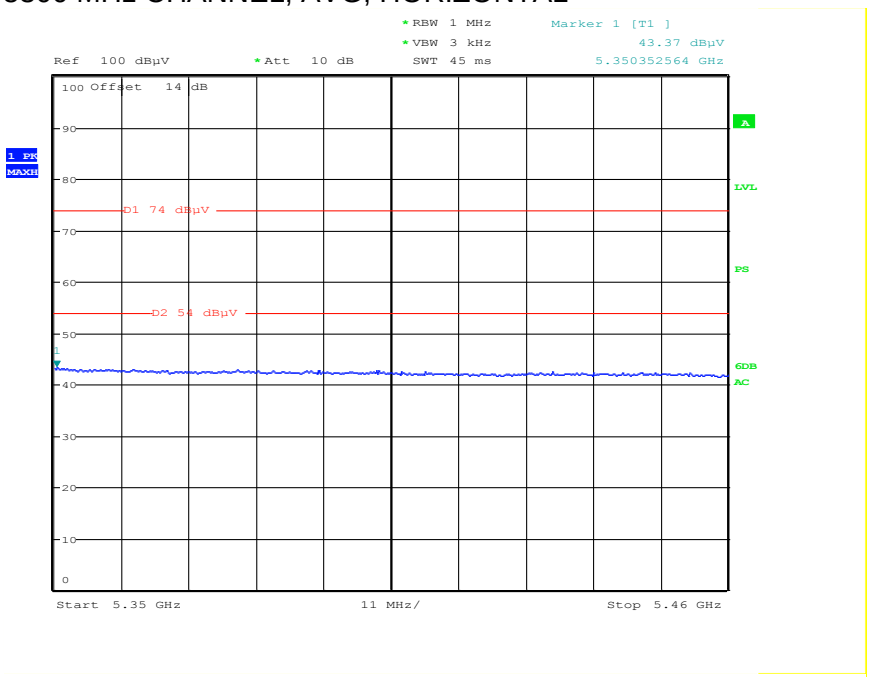
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.2.6. TX ABOVE 1 GHz, 802.11a 1TX, 5.3 GHz BAND, LEGACY

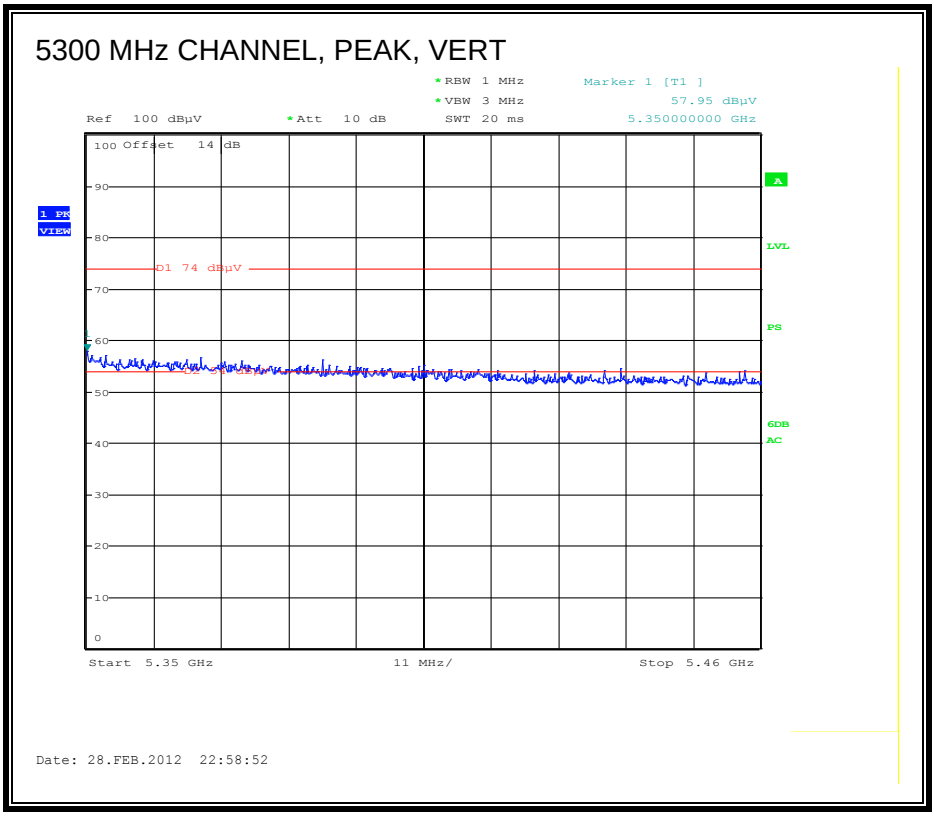
AUTHORIZED BANDEDGE (5300 MHz CHANNEL, HORIZONTAL)



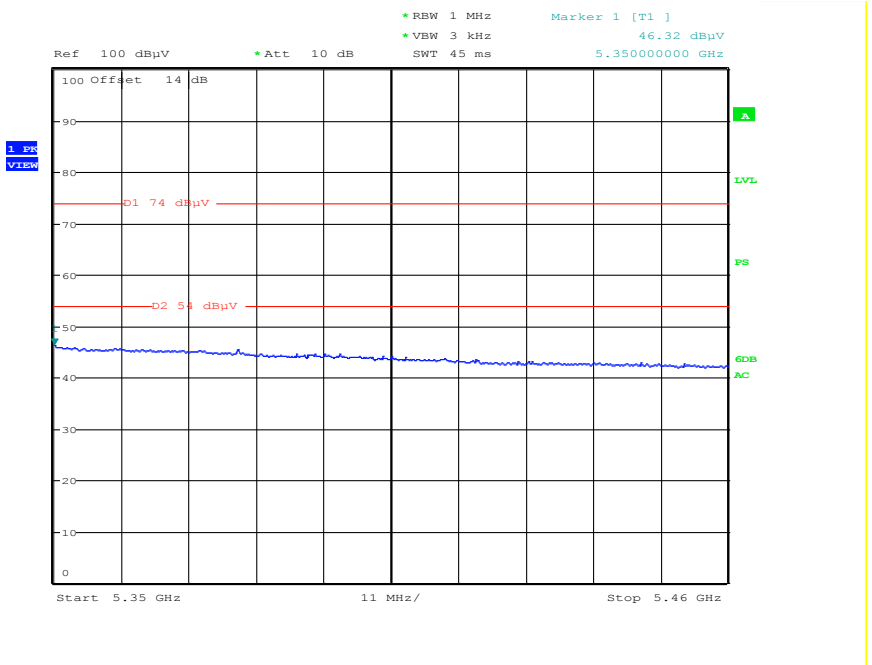
5300 MHz CHANNEL, AVG, HORIZONTAL



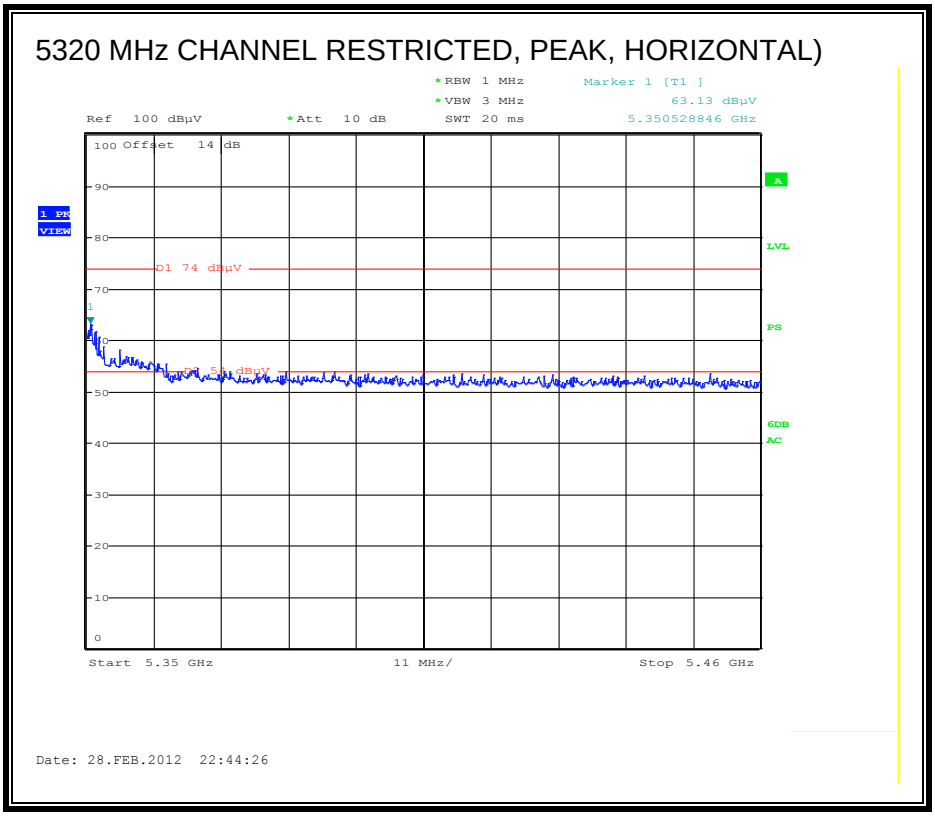
AUTHORIZED BANDEDGE (5300 MHz CHANNEL, VERTICAL)



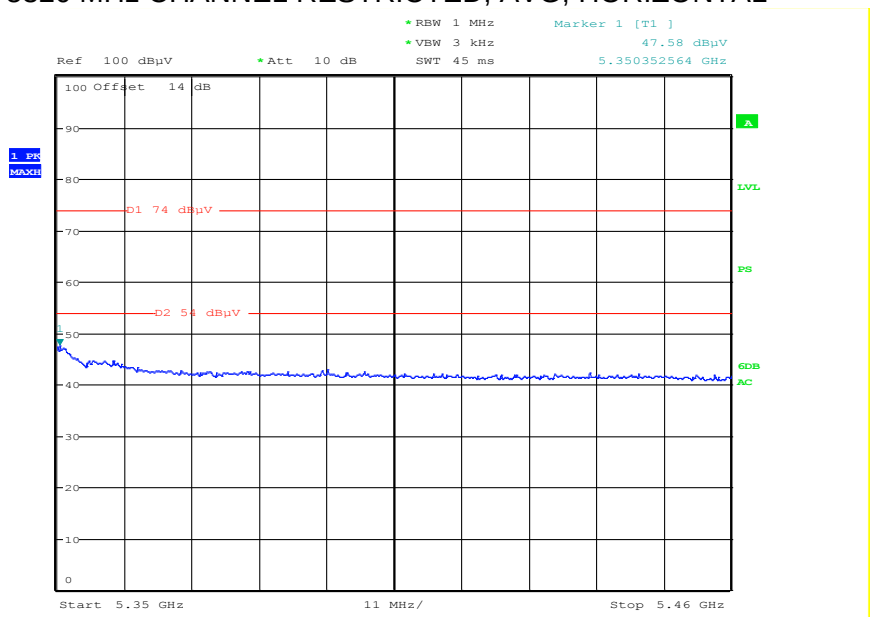
5300 MHz CHANNEL, AVG, VERT



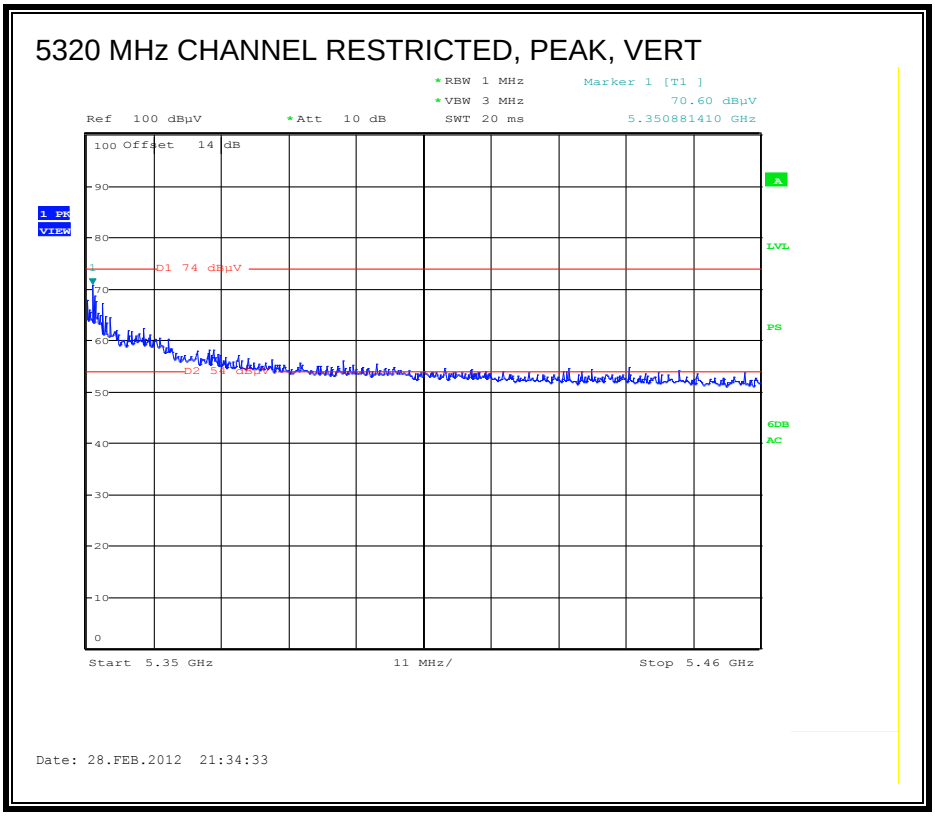
RESTRICTED BANDEDGE (5320 MHz CHANNEL, HORIZONTAL)



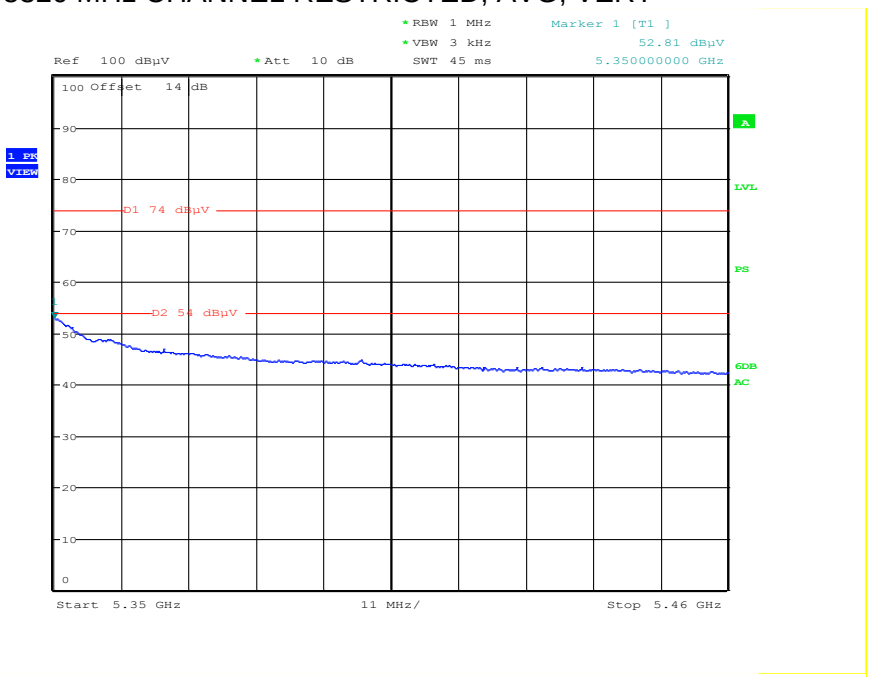
5320 MHz CHANNEL RESTRICTED, AVG, HORIZONTAL



RESTRICTED BANDEDGE (5320 MHz CHANNEL, VERTICAL)



5320 MHz CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

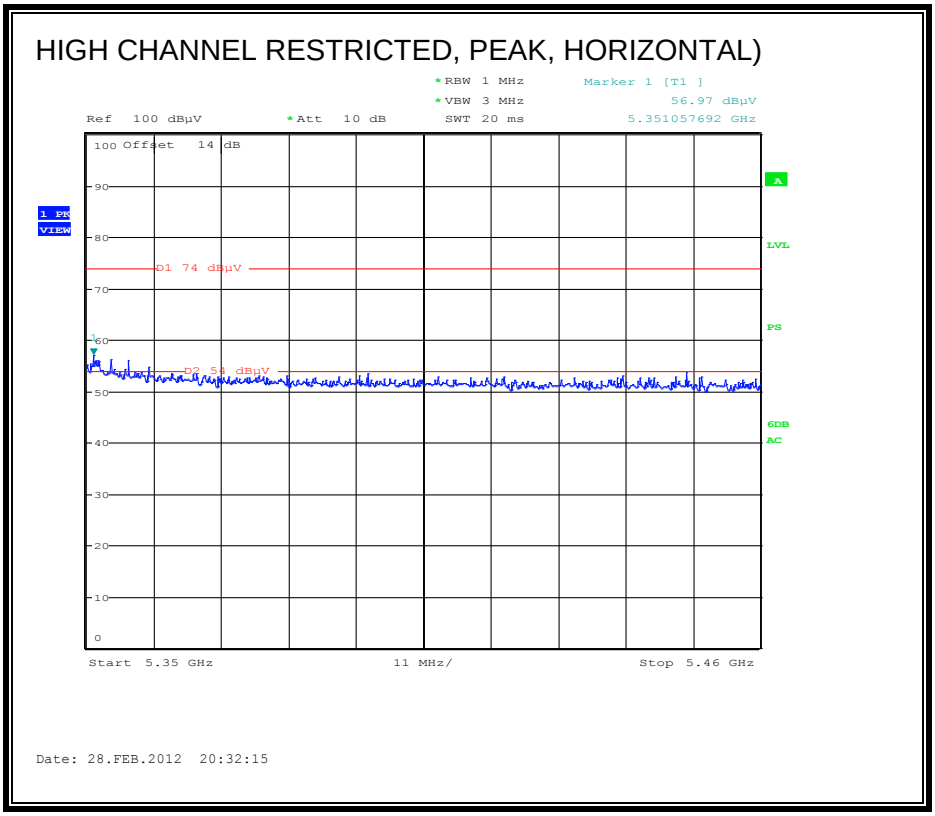
Covered by testing to 11n 3x3 HT20 CDD MCS0

8.2.7. TX ABOVE 1 GHz, 802.11a 2TX, 5.3 GHz BAND, STBC MCS0

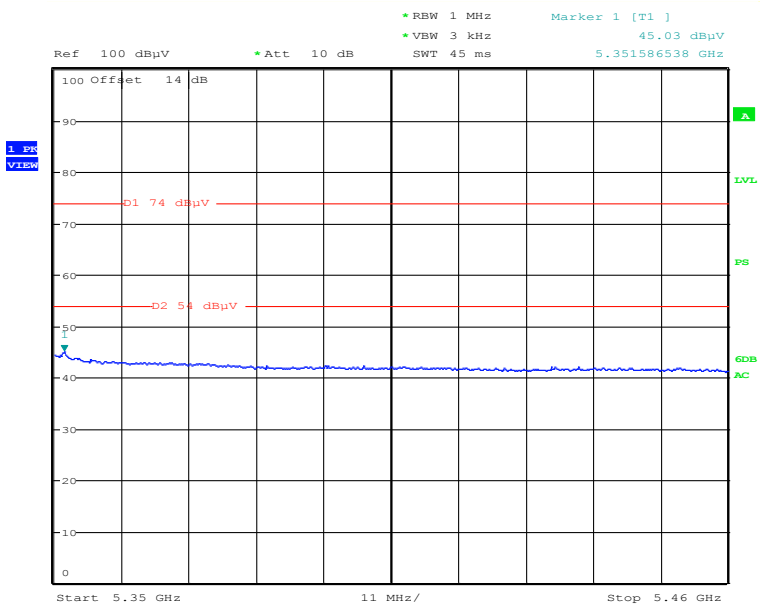
Covered by testing to 11n HT20 3x3 CCD MCS0

8.2.8. TX ABOVE 1 GHz, 802.11n HT20, 3TX 5.3 GHz BAND, CDD MCS0

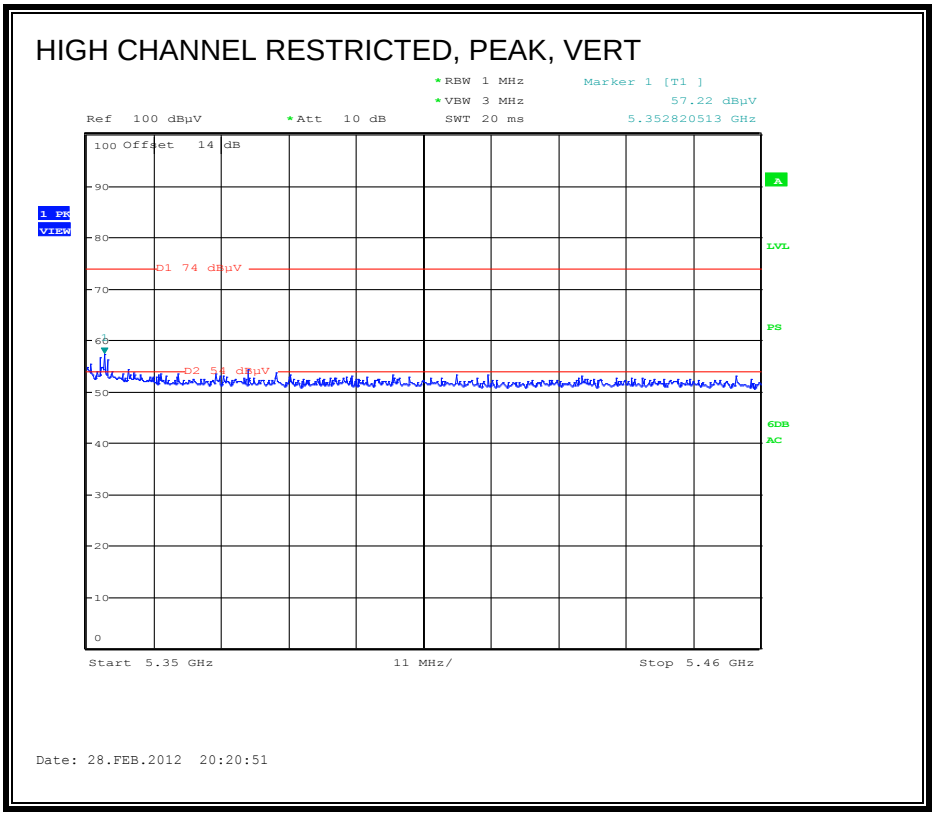
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



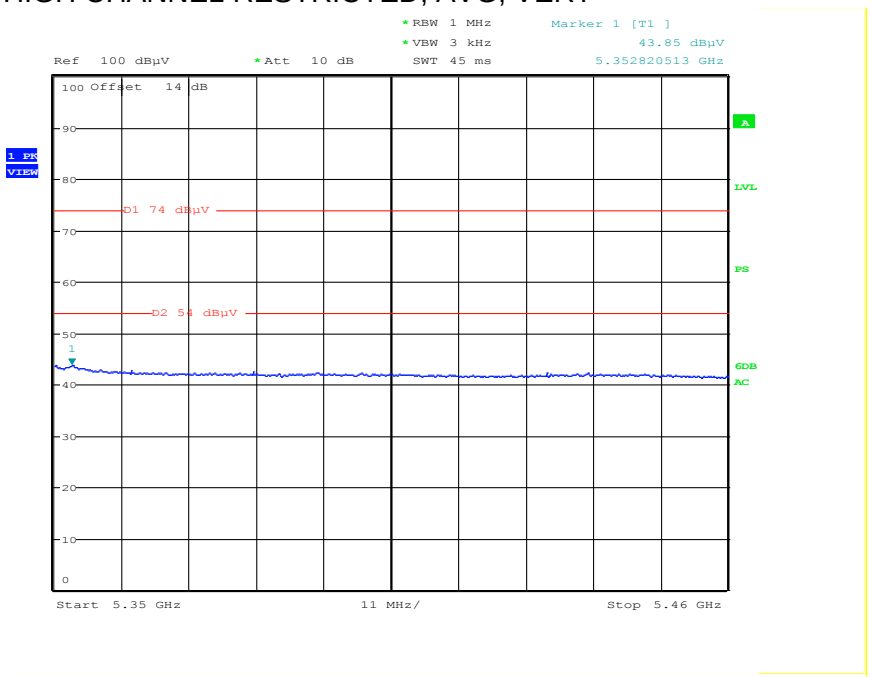
HIGH CHANNEL RESTRICTED, AVG, HORIZONTAL



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 02/29/12
Project #: 12U14283
Company: Apple Inc.,
Test Target: FCC Class B
Mode Oper: 802.11n 3TX HT20 MCS0 CDD, TX mode

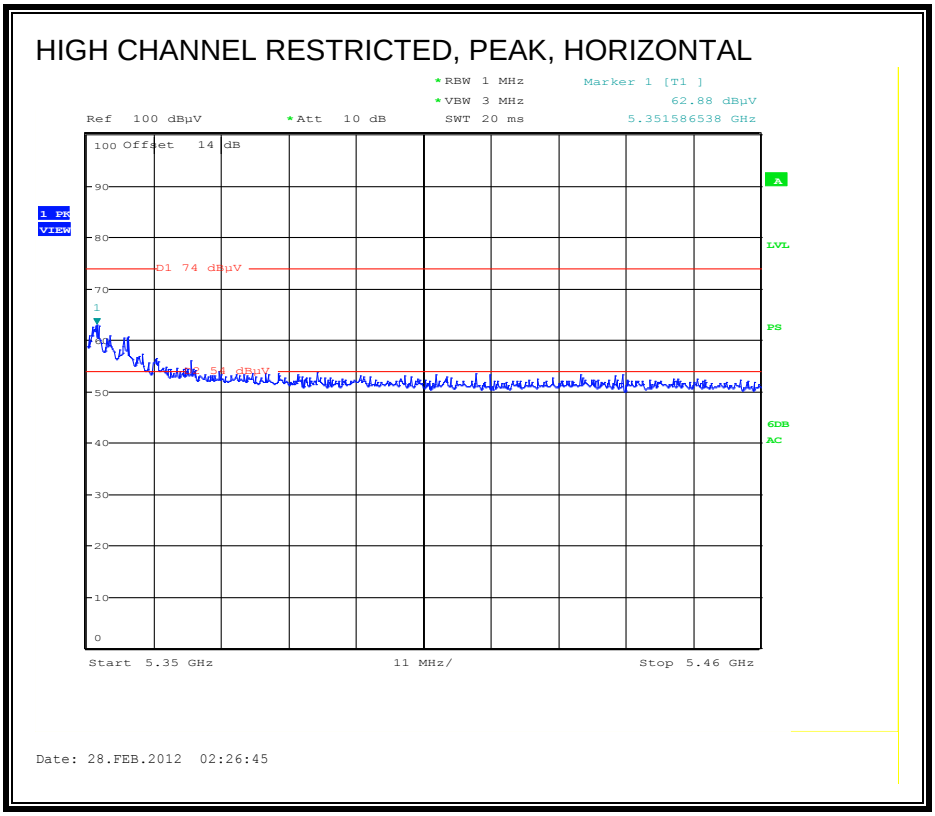
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin 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
5260MHz 3TX HT40 MCS0 CDD													
15.780	3.0	35.7	38.2	13.1	-31.9	0.0	0.7	55.8	74.0	-18.2	V	P	
15.780	3.0	23.7	38.2	13.1	-31.9	0.0	0.7	43.8	54.0	-10.2	V	A	
15.780	3.0	35.0	38.2	13.1	-31.9	0.0	0.7	55.2	74.0	-18.8	H	P	
15.780	3.0	23.1	38.2	13.1	-31.9	0.0	0.7	43.2	54.0	-10.8	H	A	
5300MHz 3TX HT40 MCS0 CDD													
10.600	3.0	34.9	38.4	9.9	-34.0	0.0	0.8	49.9	74.0	-24.1	V	P	
10.600	3.0	24.5	38.4	9.9	-34.0	0.0	0.8	39.5	54.0	-14.5	V	A	
15.900	3.0	35.6	37.8	13.2	-31.8	0.0	0.7	55.4	74.0	-18.6	V	P	
15.900	3.0	23.5	37.8	13.2	-31.8	0.0	0.7	43.3	54.0	-10.7	V	A	
5300MHz 3TX HT40 MCS0 CDD													
10.600	3.0	35.7	38.4	9.9	-34.0	0.0	0.8	50.7	74.0	-23.3	H	P	
10.600	3.0	24.5	38.4	9.9	-34.0	0.0	0.8	39.6	54.0	-14.4	H	A	
15.900	3.0	35.5	37.8	13.2	-31.8	0.0	0.7	55.3	74.0	-18.7	H	P	
15.900	3.0	23.5	37.8	13.2	-31.8	0.0	0.7	43.3	54.0	-10.7	H	A	
5320MHz 3TX HT40 MCS0 CDD													
10.640	3.0	35.1	38.4	10.0	-34.0	0.0	0.8	50.3	74.0	-23.7	H	P	
10.640	3.0	24.1	38.4	10.0	-34.0	0.0	0.8	39.3	54.0	-14.7	H	A	
15.960	3.0	36.3	37.6	13.2	-31.8	0.0	0.7	55.9	74.0	-18.1	H	P	
15.960	3.0	23.5	37.6	13.2	-31.8	0.0	0.7	43.1	54.0	-10.9	H	A	
5320MHz 3TX HT40 MCS0 CDD													
10.640	3.0	35.2	38.4	10.0	-34.0	0.0	0.8	50.3	74.0	-23.7	V	P	
10.640	3.0	23.6	38.4	10.0	-34.0	0.0	0.8	38.8	54.0	-15.2	V	A	
15.960	3.0	35.3	37.6	13.2	-31.8	0.0	0.7	55.0	74.0	-19.0	V	P	
15.960	3.0	23.4	37.6	13.2	-31.8	0.0	0.7	43.1	54.0	-10.9	V	A	

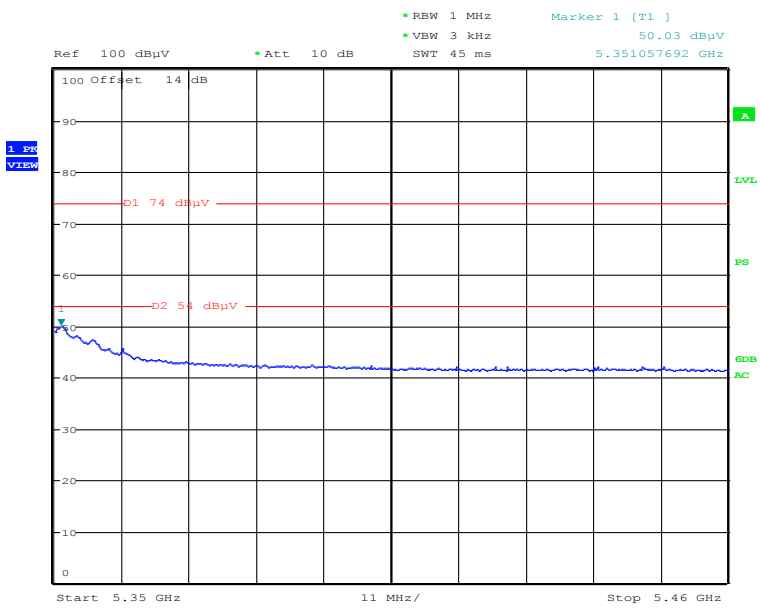
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.2.9. TX ABOVE 1 GHz, 802.11n HT40, 1TX, 5.3 GHz BAND, CDD MCS0

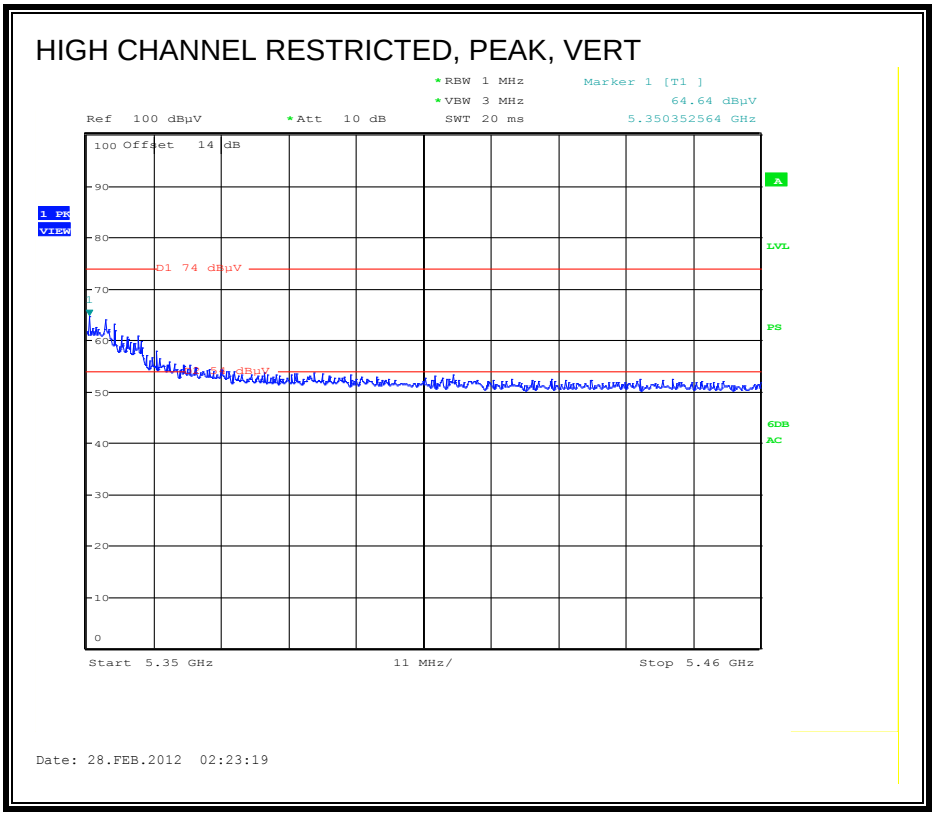
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



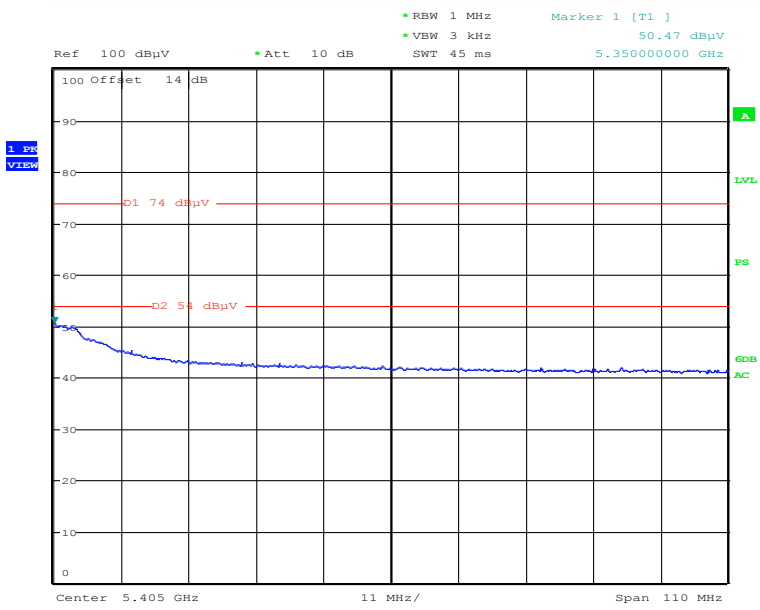
HIGH CHANNEL RESTRICTED, AVG, HORIZONTAL



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT

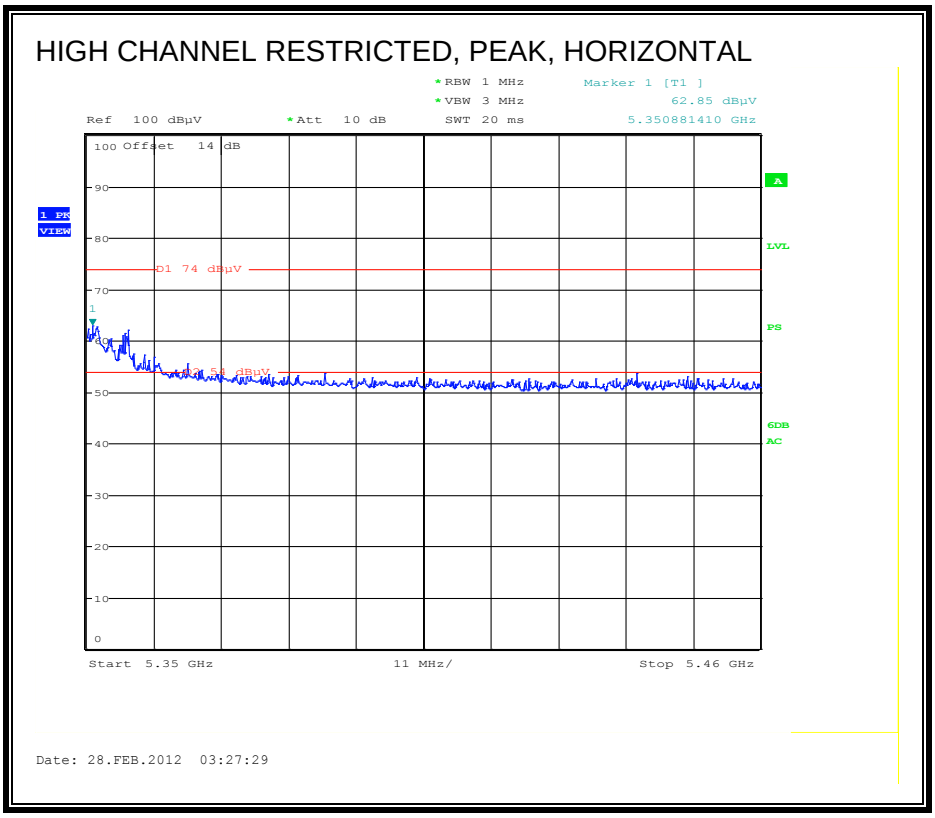


HARMONICS AND SPURIOUS EMISSIONS

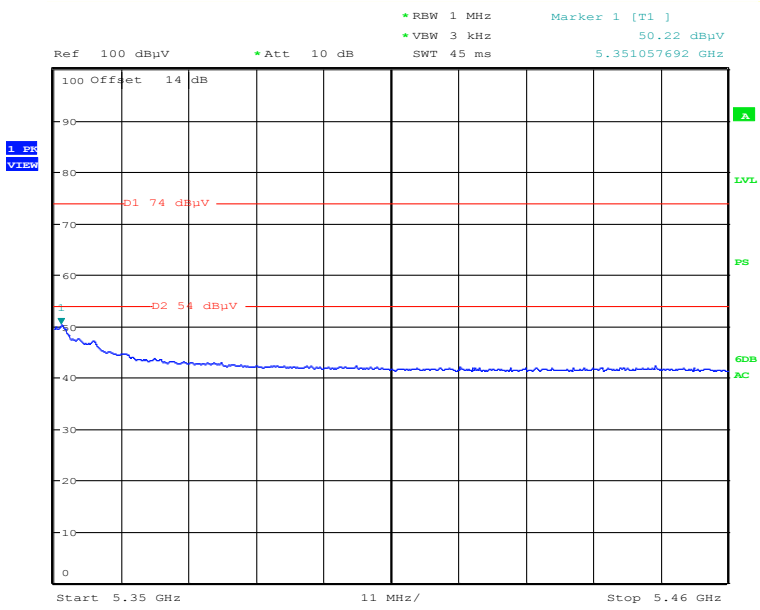
Covered by testing to 11n HT40 3x3 CDD MCS0

8.2.10. TX ABOVE 1 GHz, 802.11n HT40, 3TX, 5.3 GHz BAND, CDD MCS0

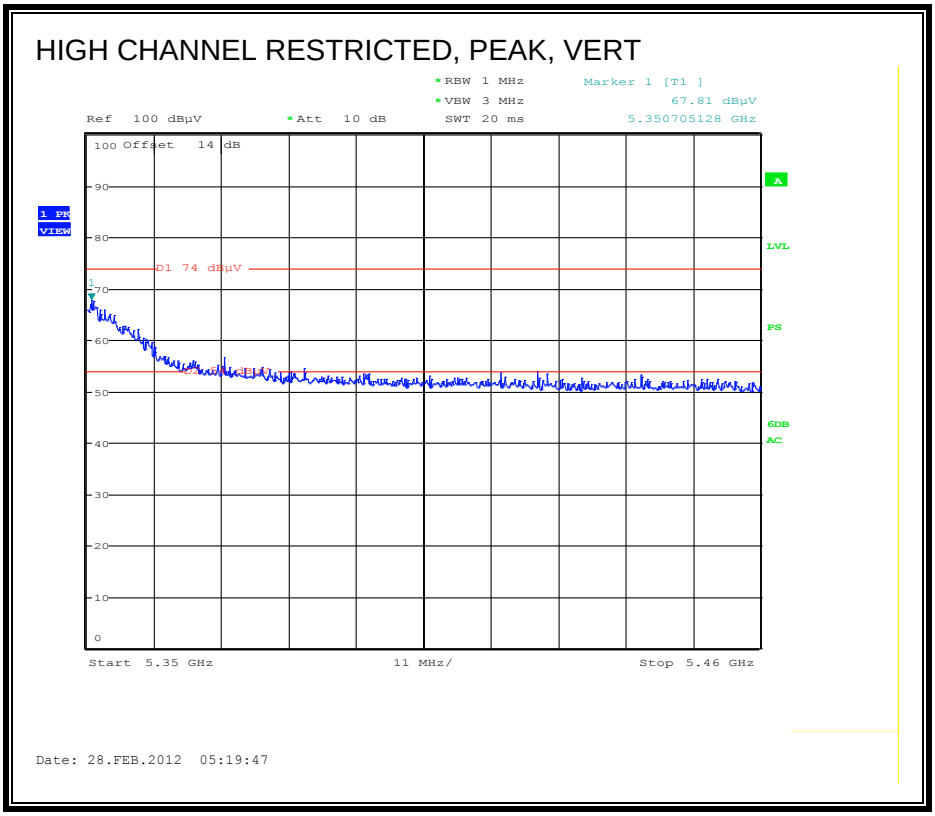
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTVERTICAL)



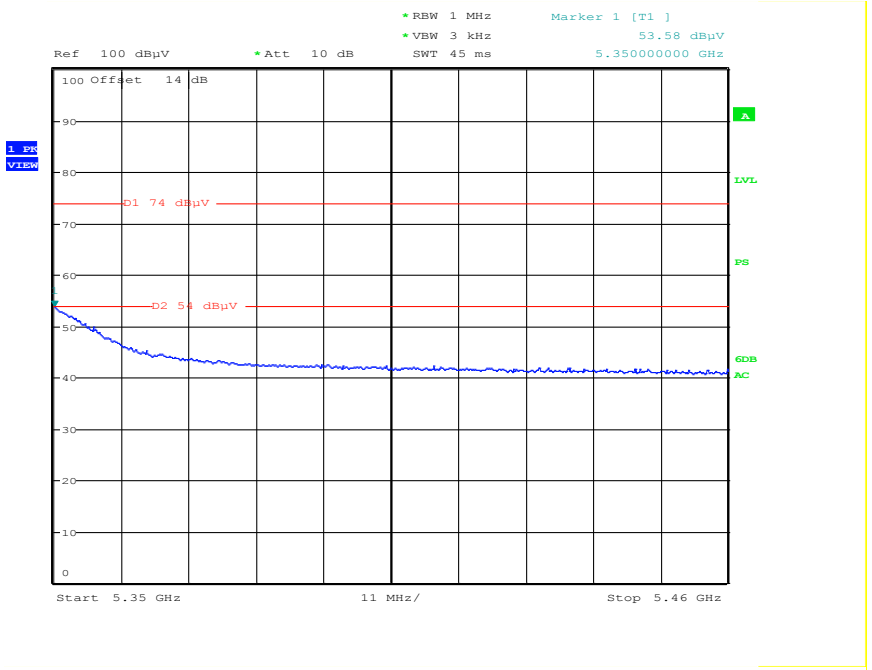
HIGH CHANNEL RESTRICTED, AVG, HORIZONTAL



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/01/12
Project #: 12U14283
Company: Apple Inc.,
Test Target: FCC Class B
Mode Oper: 802.11n 3TX HT40 MCS0 CDD, 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		

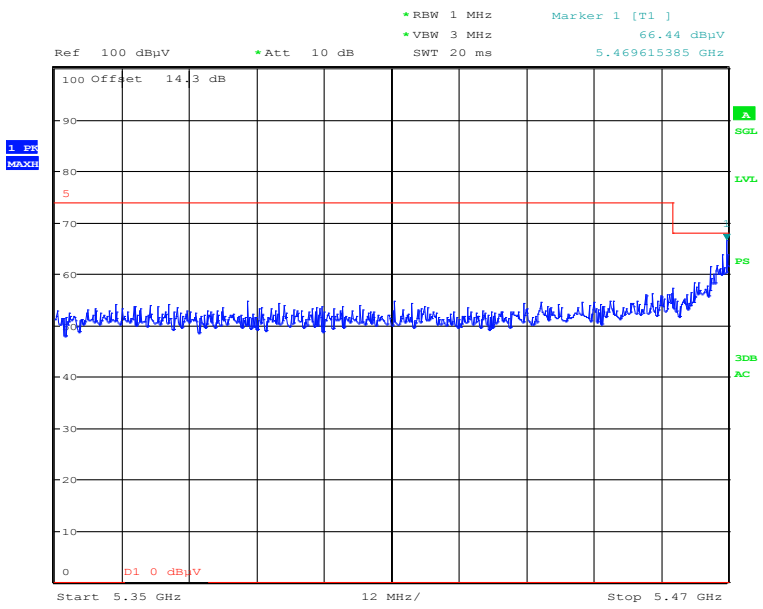
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5270MHz 3TX MCS0 CDD													
15.810	3.0	35.1	38.1	13.1	-31.9	0.0	0.7	55.2	74.0	-18.8	V	P	
15.810	3.0	23.5	38.1	13.1	-31.9	0.0	0.7	43.5	54.0	-10.5	V	A	
5270MHz 3TX MCS0 CDD													
15.810	3.0	35.0	38.1	13.1	-31.9	0.0	0.7	55.1	74.0	-18.9	H	P	
15.810	3.0	23.4	38.1	13.1	-31.9	0.0	0.7	43.5	54.0	-10.5	H	A	
5310MHz 3TX MCS0 CDD													
10.620	3.0	35.3	38.4	10.0	-34.0	0.0	0.8	50.4	74.0	-23.6	V	P	
10.620	3.0	23.5	38.4	10.0	-34.0	0.0	0.8	38.6	54.0	-15.4	V	A	
15.930	3.0	36.5	37.7	13.2	-31.8	0.0	0.7	56.2	74.0	-17.8	V	P	
15.930	3.0	23.1	37.7	13.2	-31.8	0.0	0.7	42.8	54.0	-11.2	V	A	
5310MHz 3TX MCS0 CDD													
10.620	3.0	35.9	38.4	10.0	-34.0	0.0	0.8	51.0	74.0	-23.0	H	P	
10.620	3.0	24.0	38.4	10.0	-34.0	0.0	0.8	39.1	54.0	-14.9	H	A	
15.930	3.0	36.1	37.7	13.2	-31.8	0.0	0.7	55.8	74.0	-18.2	H	P	
15.930	3.0	23.8	37.7	13.2	-31.8	0.0	0.7	43.5	54.0	-10.5	H	A	

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

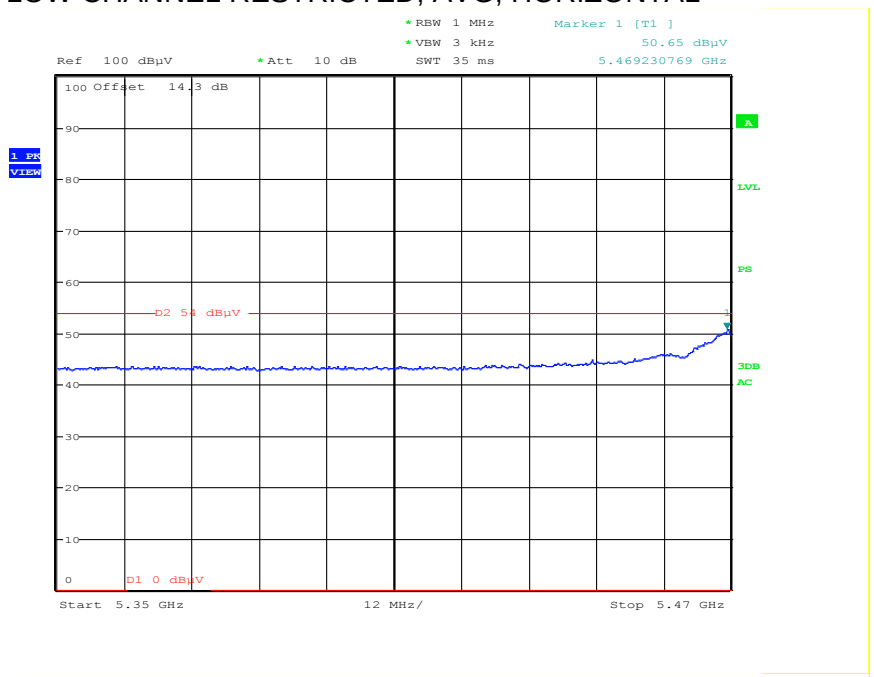
8.2.11. TX ABOVE 1 GHz, 802.11a 1TX, 5.6 GHz BAND, LEGACY

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL

LOW CHANNEL RESTRICTED, PEAK, HORIZONTAL

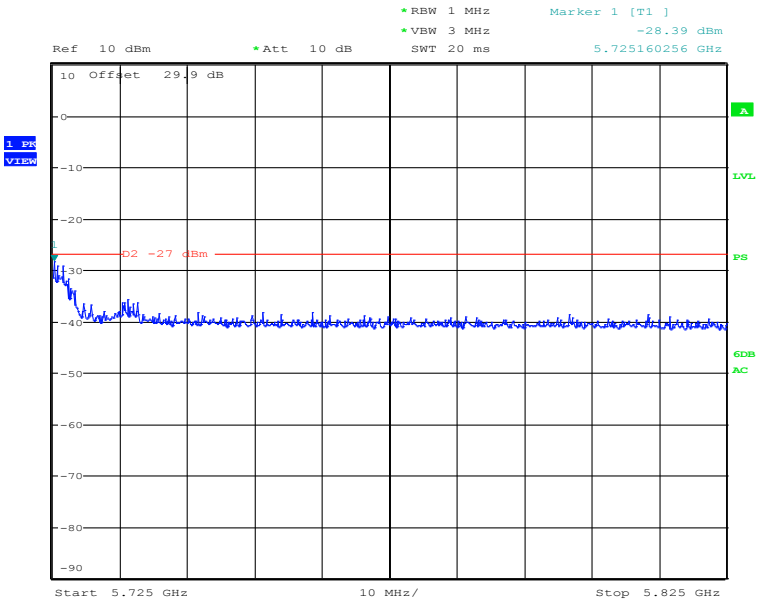


LOW CHANNEL RESTRICTED, AVG, HORIZONTAL



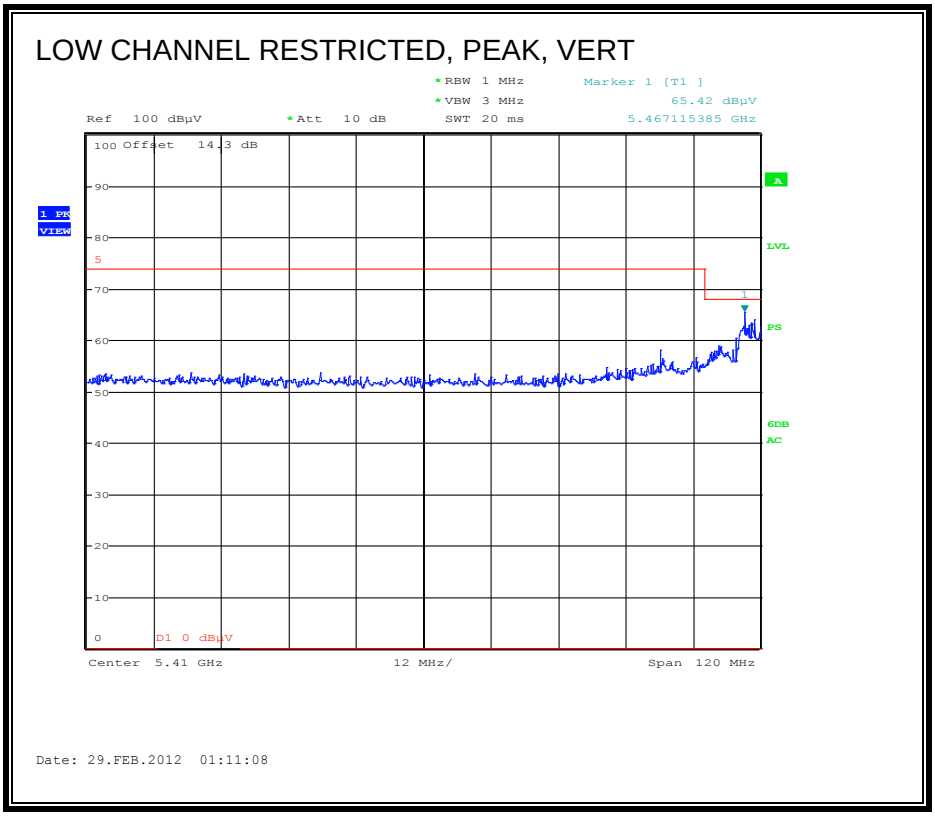
AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL, PEAK, HORIZONTAL

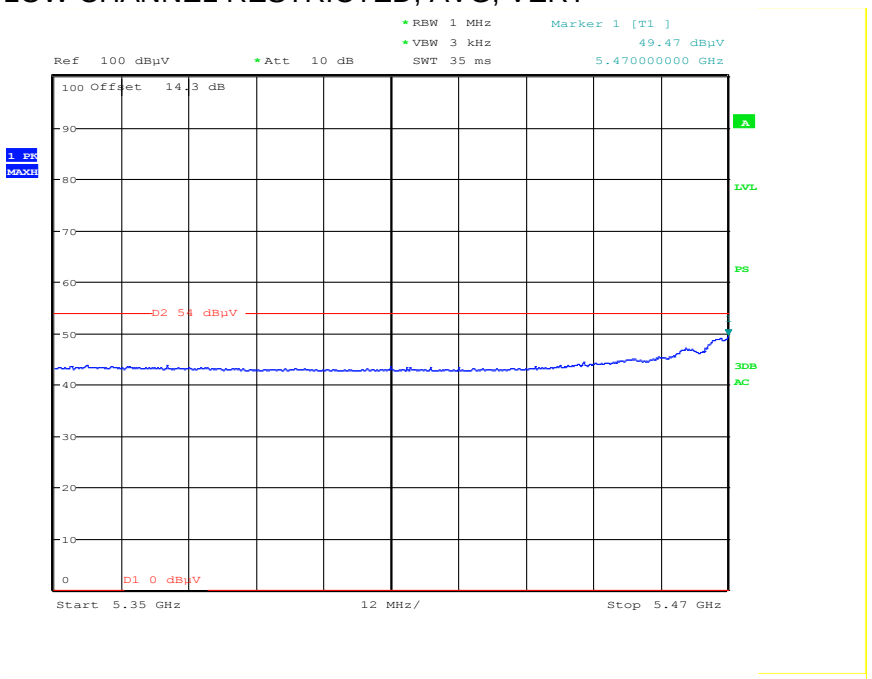


Date: 29.FEB.2012 18:59:02

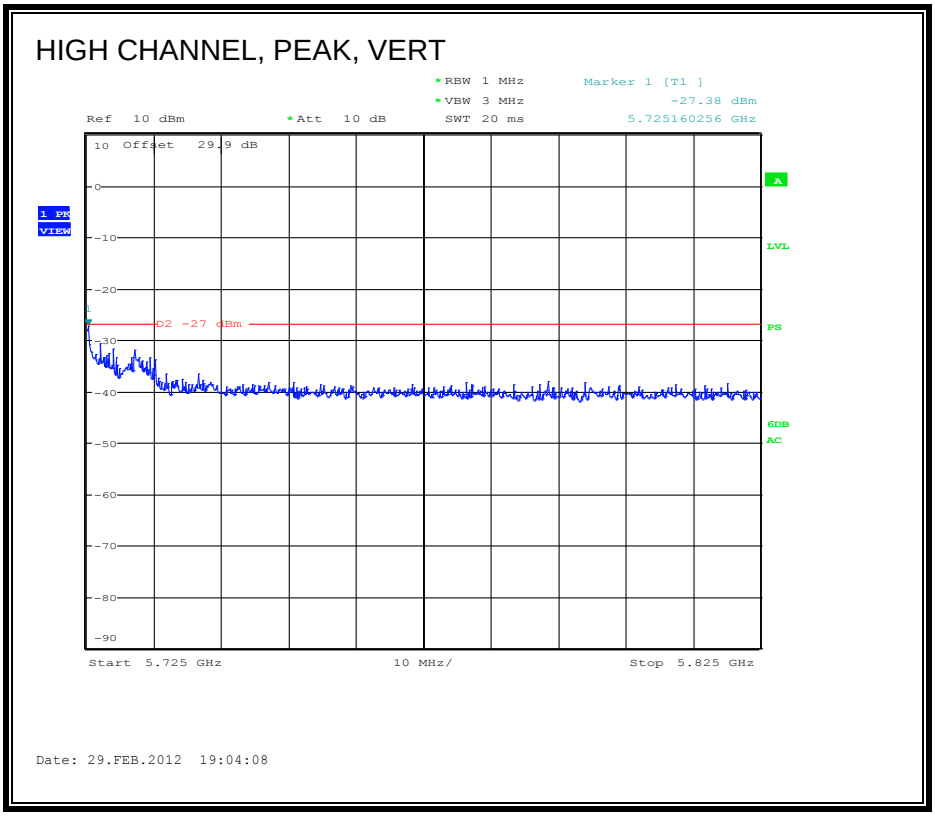
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



LOW CHANNEL RESTRICTED, AVG, VERT



AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

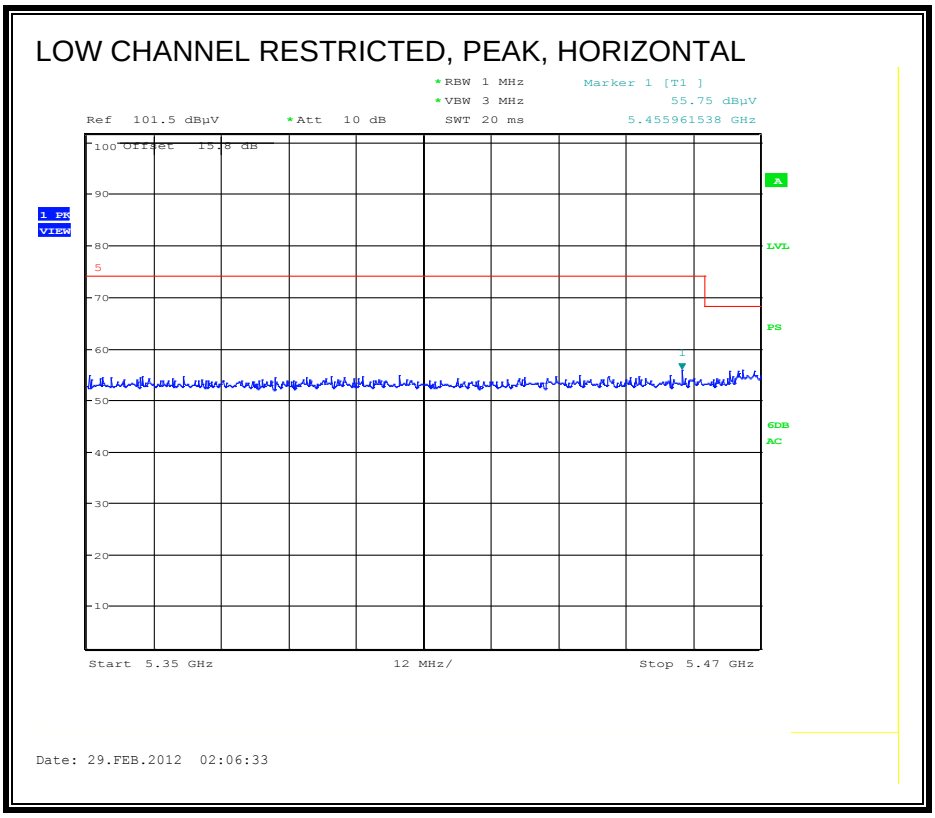
Covered by testing to 11n HT20 3x3 CDD MCS0

8.2.12. TX ABOVE 1 GHz, 802.11a 2TX, 5.6 GHz BAND, CDD MCS0, STBC MCS0

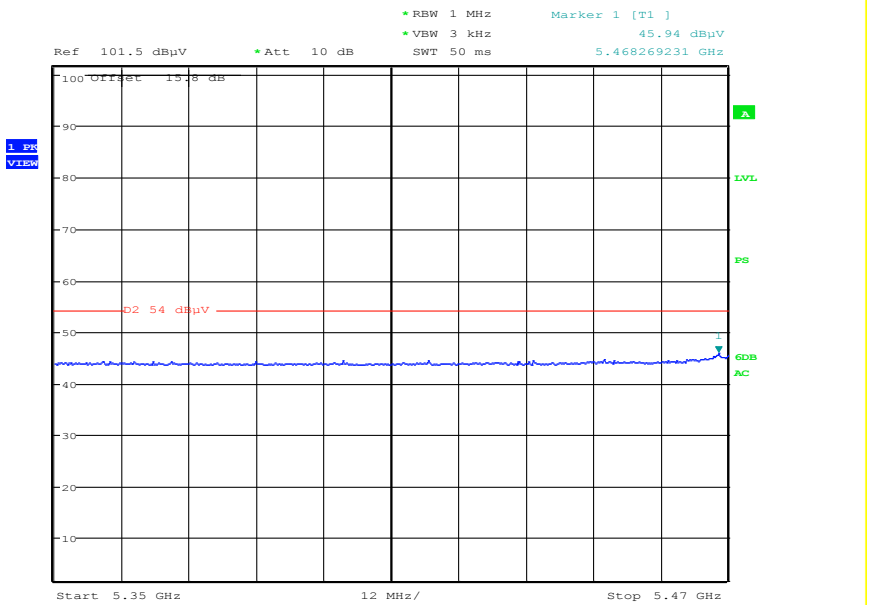
Covered by testing to 11n HT20 3x3 CDD MCS0

8.2.13. TX ABOVE 1 GHz, 802.11n HT20, 3TX, 5.6 GHz BAND, CDD MCS0

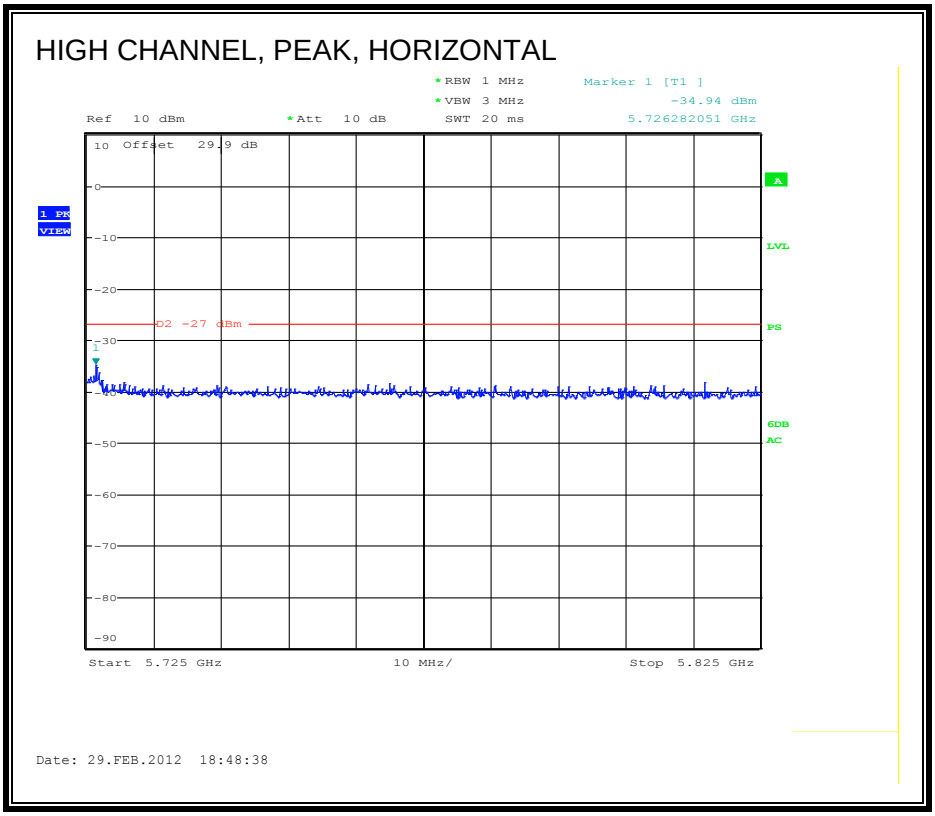
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



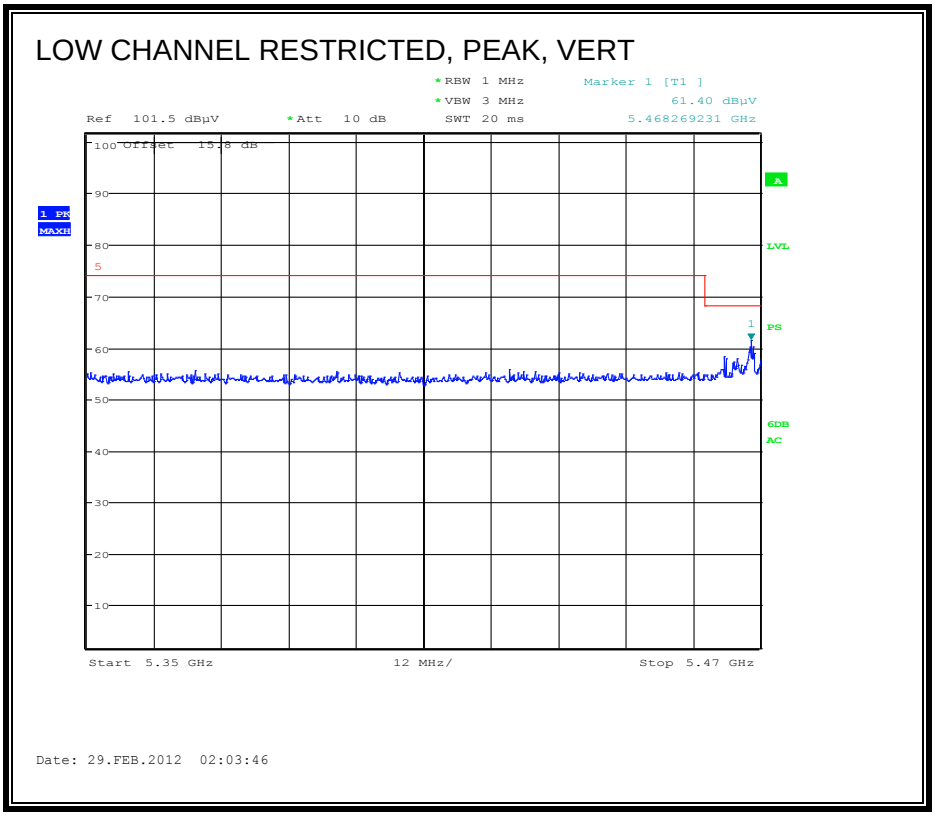
LOW CHANNEL RESTRICTED, AVG, HORIZONTAL



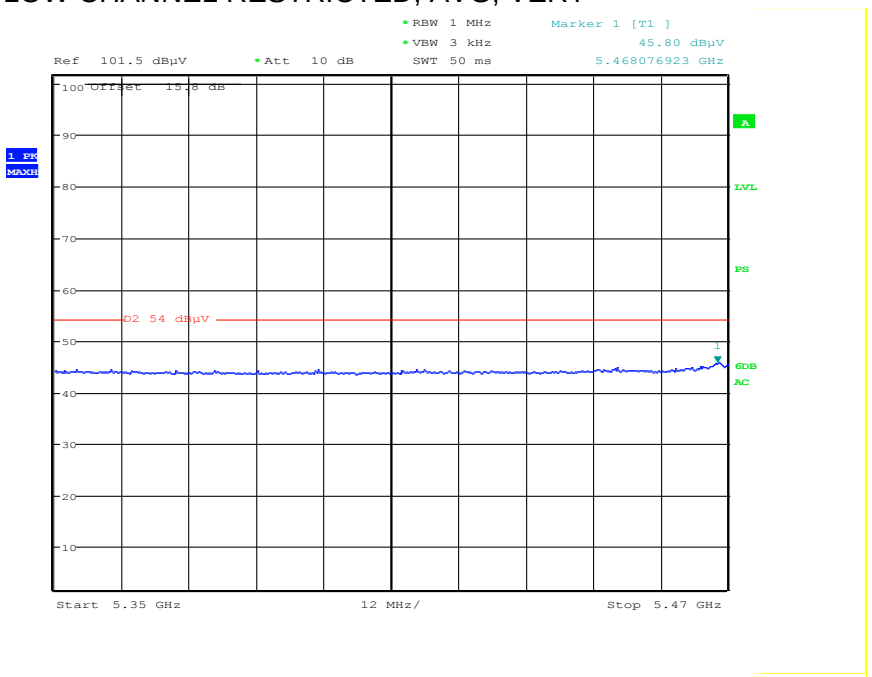
AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



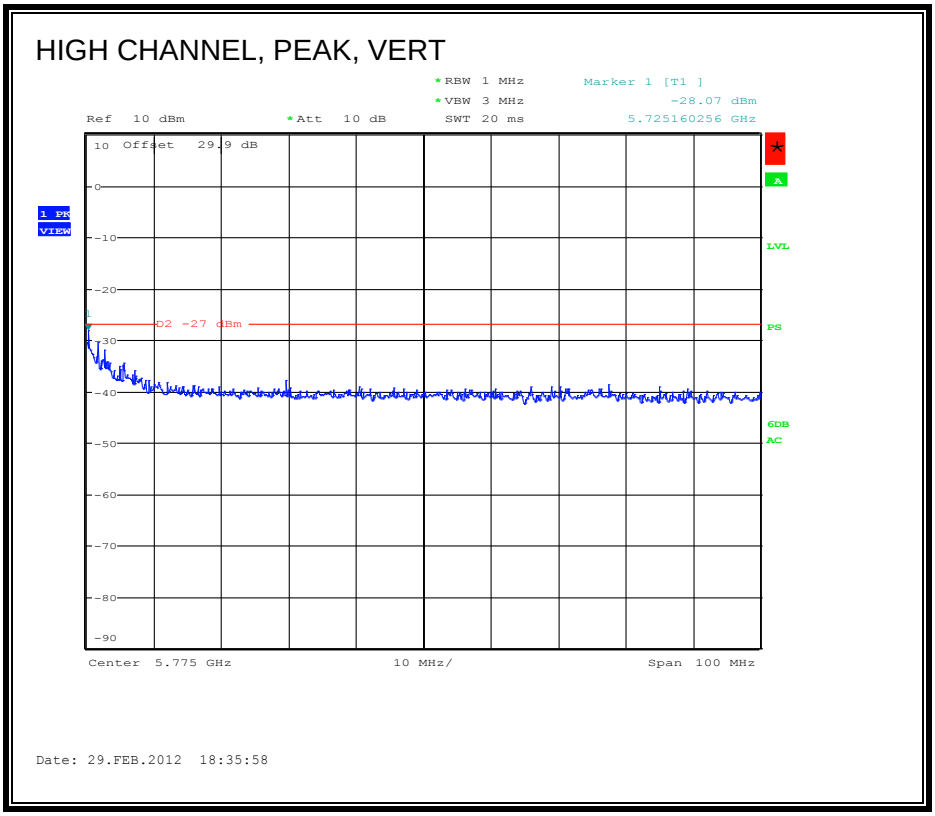
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



LOW CHANNEL RESTRICTED, AVG, VERT



AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/01/12
Project #: 12U14283
Company: Apple Inc.,
Test Target: FCC Class B
Mode Oper: 802.11n 3TX HT20 MCS0 CDD, TX mode

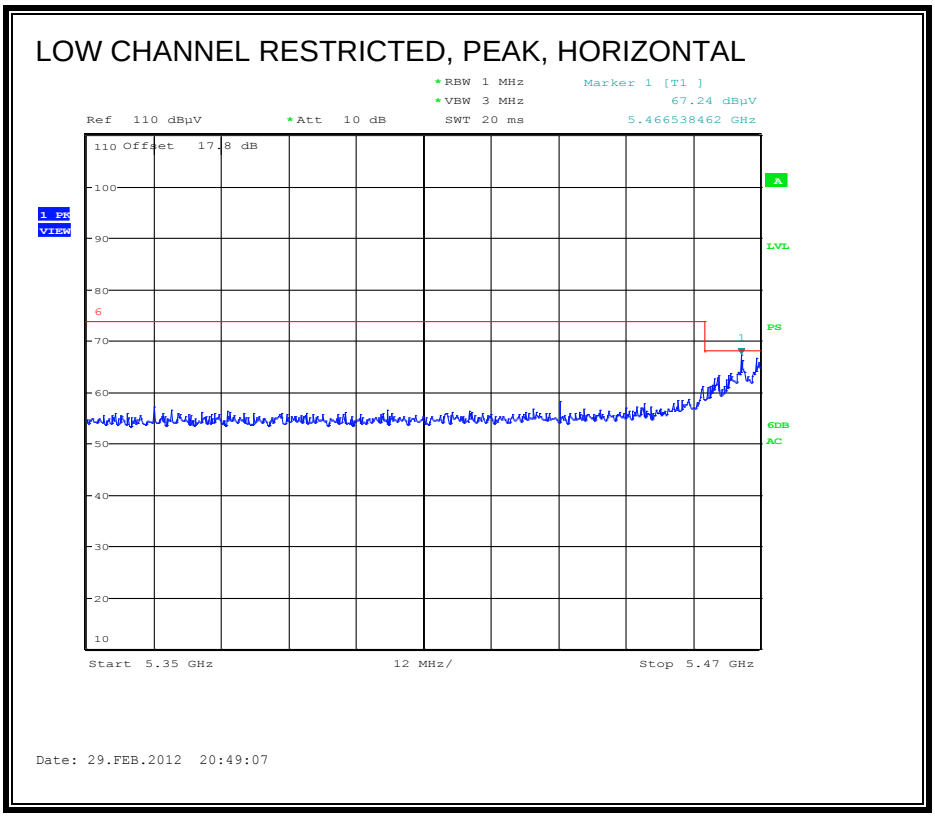
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin 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 3TX MCS0 CDD													
11.000	3.0	35.9	38.4	10.5	-33.6	0.0	0.7	51.9	74.0	-22.1	H	P	
11.000	3.0	23.5	38.4	10.5	-33.6	0.0	0.7	39.5	54.0	-14.5	H	A	
5500MHz 3TX MCS0 CDD													
11.000	3.0	35.5	38.4	10.5	-33.6	0.0	0.7	51.5	74.0	-22.5	V	P	
11.000	3.0	23.7	38.4	10.5	-33.6	0.0	0.7	39.8	54.0	-14.3	V	A	
5600MHz 3TX HT20 MCS0 CDD													
11.200	3.0	34.6	38.6	10.8	-33.4	0.0	0.7	51.3	74.0	-22.7	V	P	
11.200	3.0	22.9	38.6	10.8	-33.4	0.0	0.7	39.6	54.0	-14.4	V	A	
5600MHz 3TX HT20 MCS0 CDD													
11.200	3.0	34.4	38.6	10.8	-33.4	0.0	0.7	51.1	74.0	-22.9	H	P	
11.200	3.0	22.7	38.6	10.8	-33.4	0.0	0.7	39.4	54.0	-14.6	H	A	
5700MHz 3TX HT20 MCS0 CDD													
11.400	3.0	34.6	38.8	11.1	-33.2	0.0	0.7	52.0	74.0	-22.0	H	P	
11.400	3.0	22.7	38.8	11.1	-33.2	0.0	0.7	40.1	54.0	-13.9	H	A	
5700MHz 3TX HT20 MCS0 CDD													
11.400	3.0	35.4	38.8	11.1	-33.2	0.0	0.7	52.8	74.0	-21.2	V	P	
11.400	3.0	23.1	38.8	11.1	-33.2	0.0	0.7	40.5	54.0	-13.5	V	A	

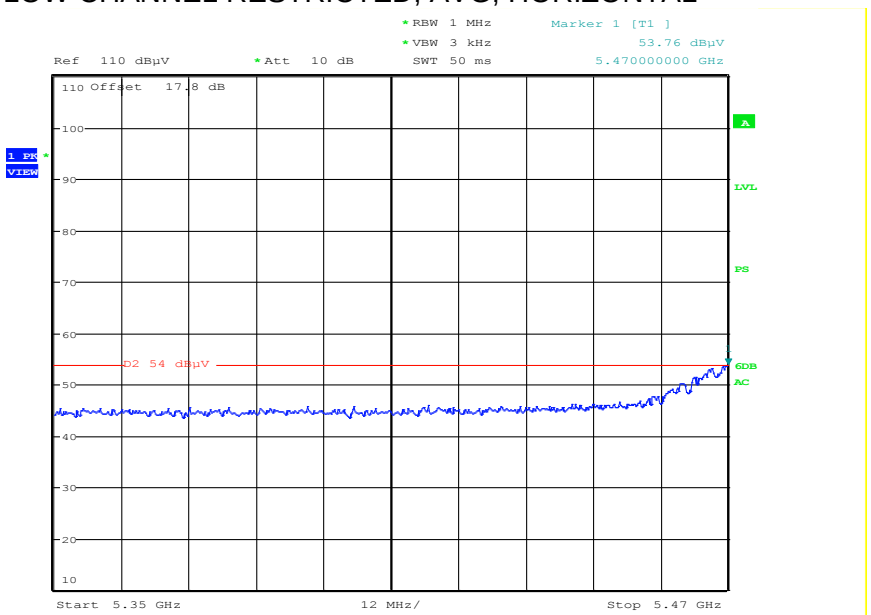
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.2.14. TX ABOVE 1 GHz, 802.11n HT40, 1TX, 5.6 GHz BAND, CDD MCS0

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

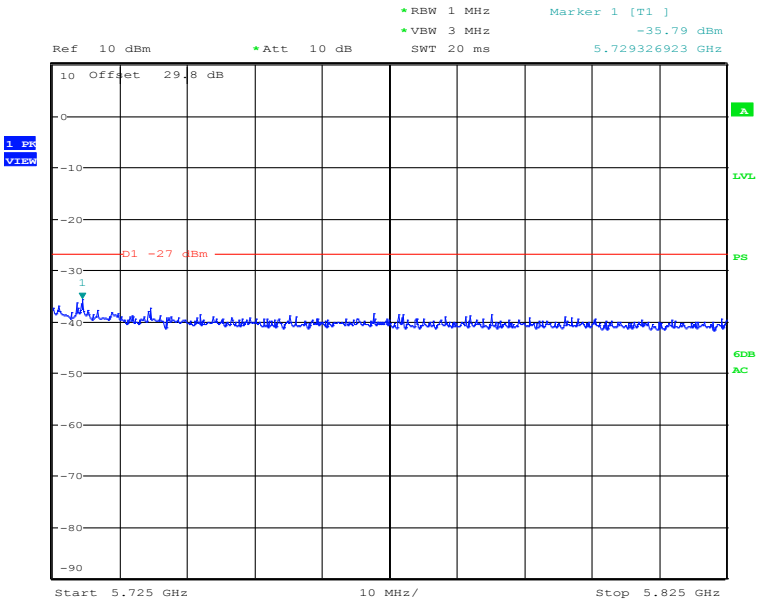


LOW CHANNEL RESTRICTED, AVG, HORIZONTAL



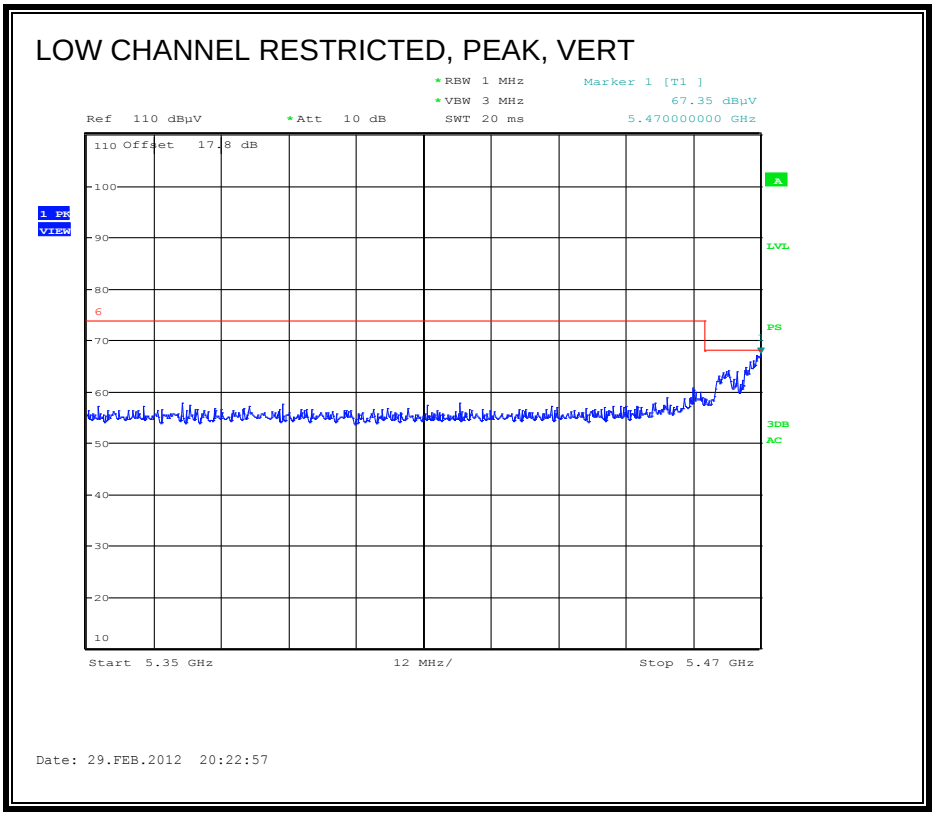
AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL, PEAK, HORIZONTAL

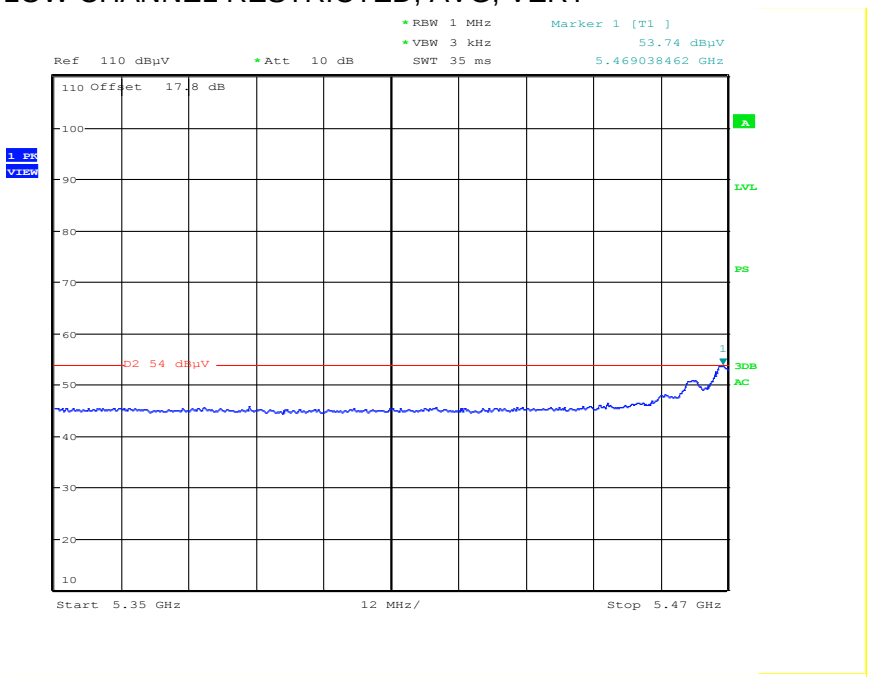


Date: 29.FEB.2012 23:37:56

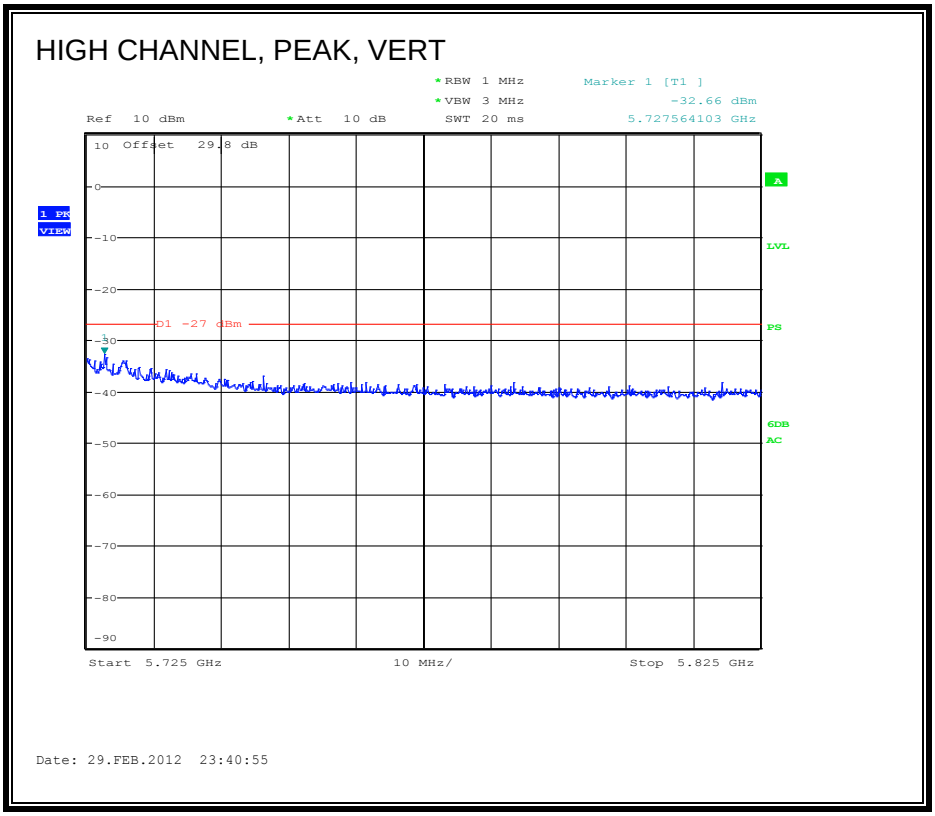
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



LOW CHANNEL RESTRICTED, AVG, VERT



AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)

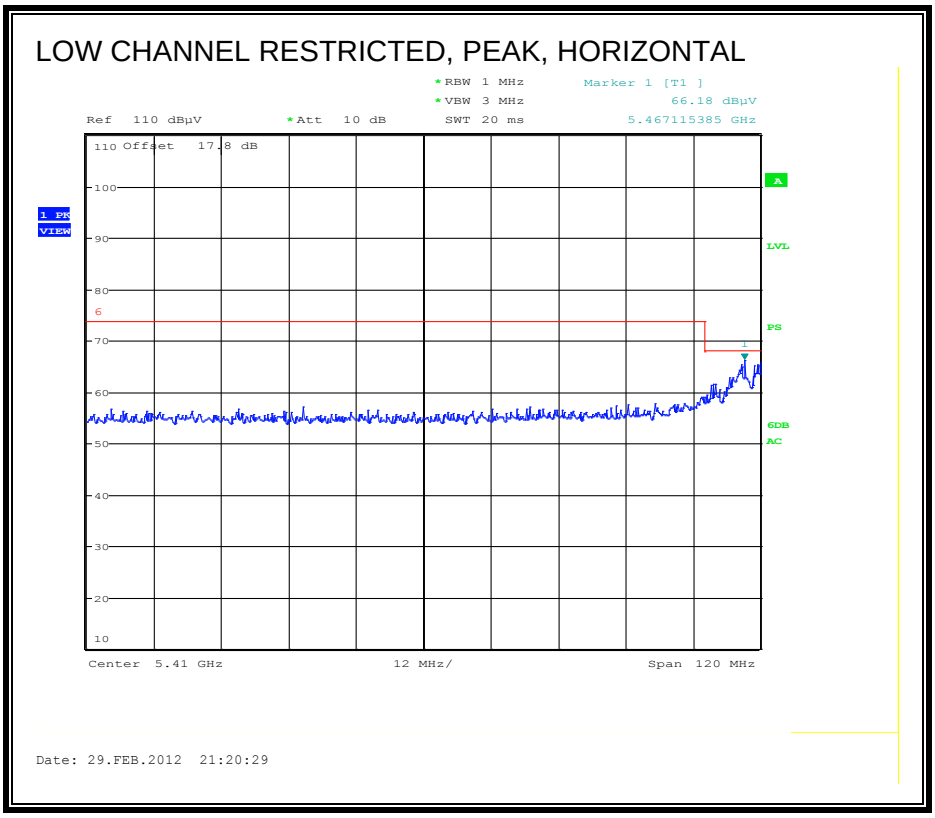


HARMONICS AND SPURIOUS EMISSIONS

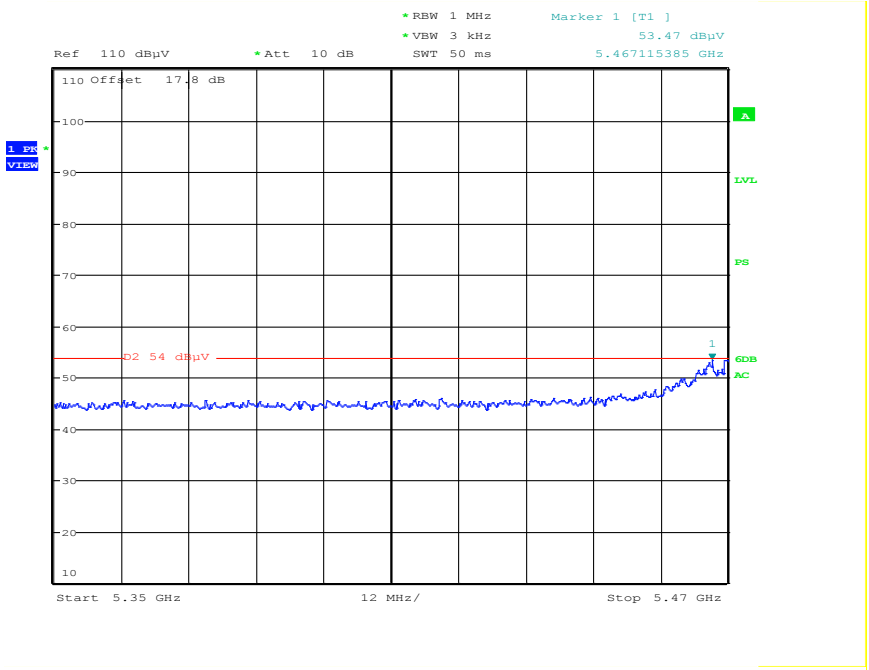
Covered by testing to 11n HT40 3x3 CDD MCS0

8.2.15. TX ABOVE 1 GHz, 802.11n HT40, 3TX, 5.6 GHz BAND, CDD MCS0

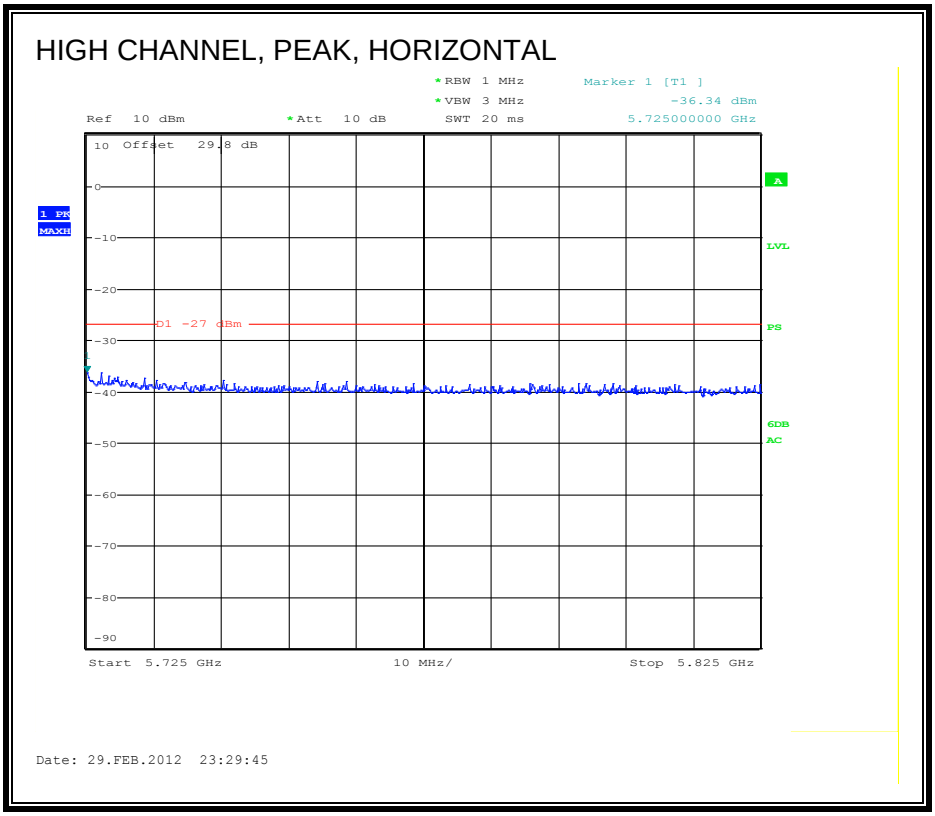
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



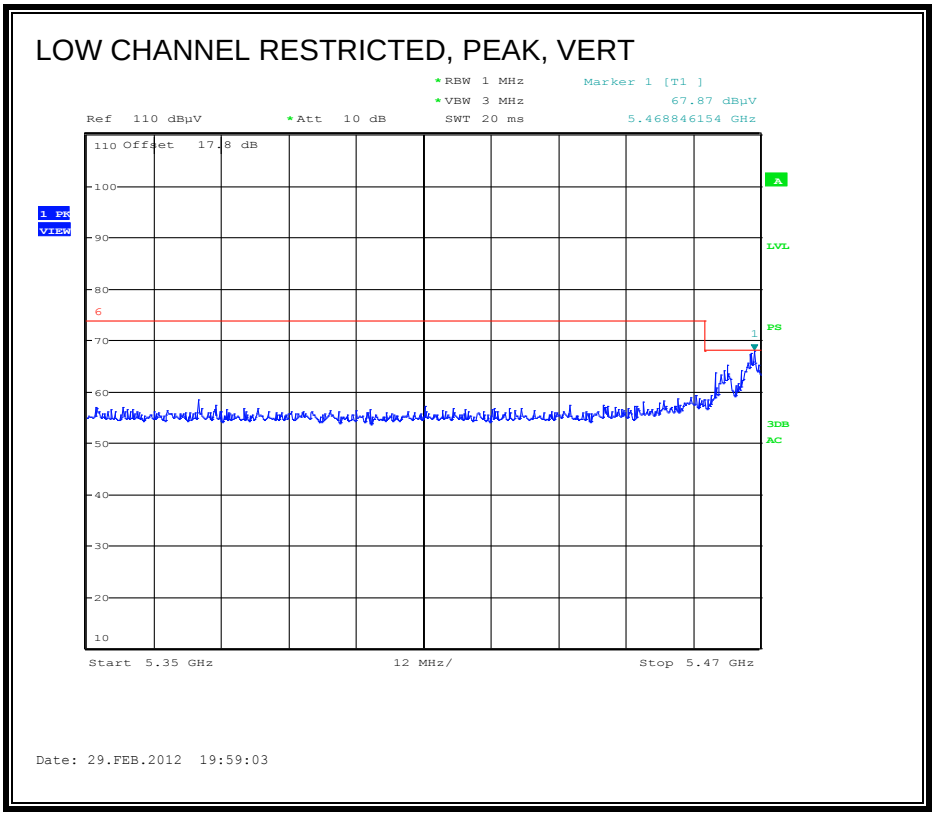
LOW CHANNEL RESTRICTED, AVG, HORIZONTAL



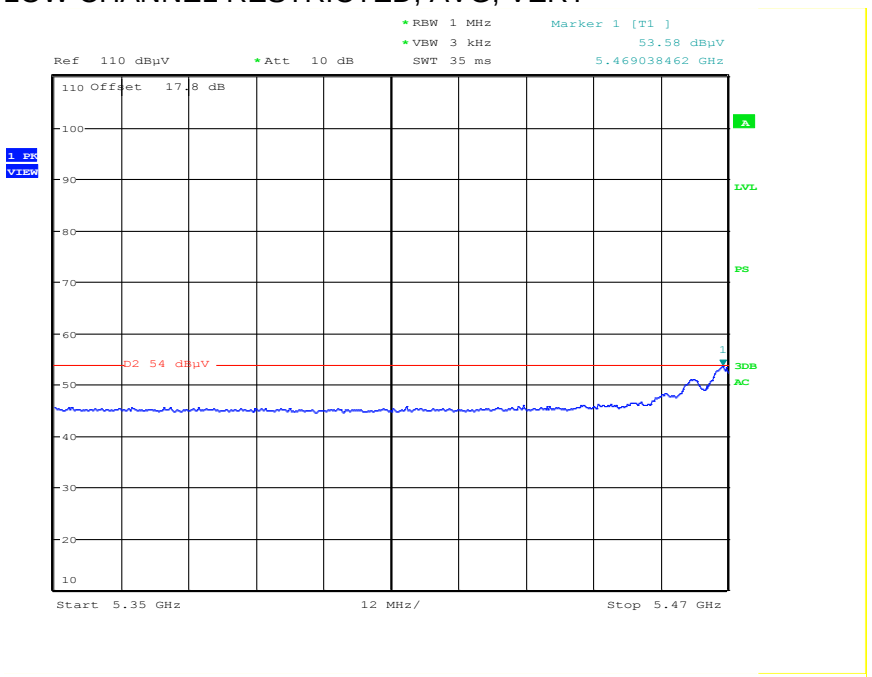
AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



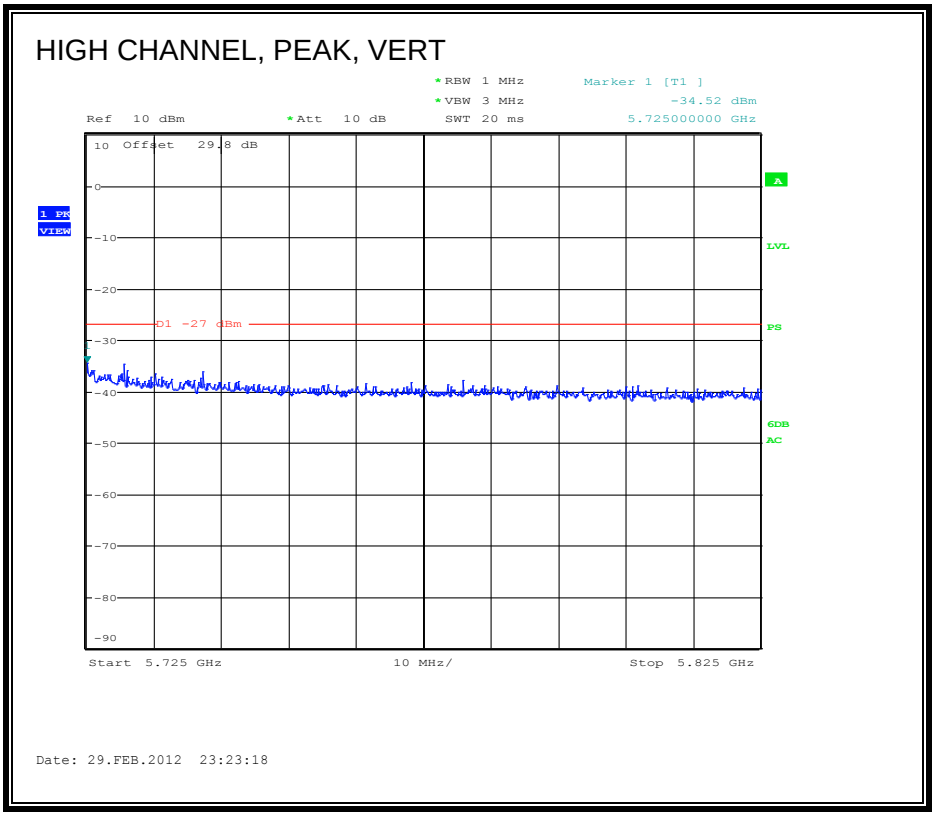
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



LOW CHANNEL RESTRICTED, AVG, VERT



AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/01/12
Project #: 12U14283
Company: Apple Inc.,
Test Target: FCC Class B
Mode Oper: 802.11n 3TX HT40 MCS0 CDD, 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		

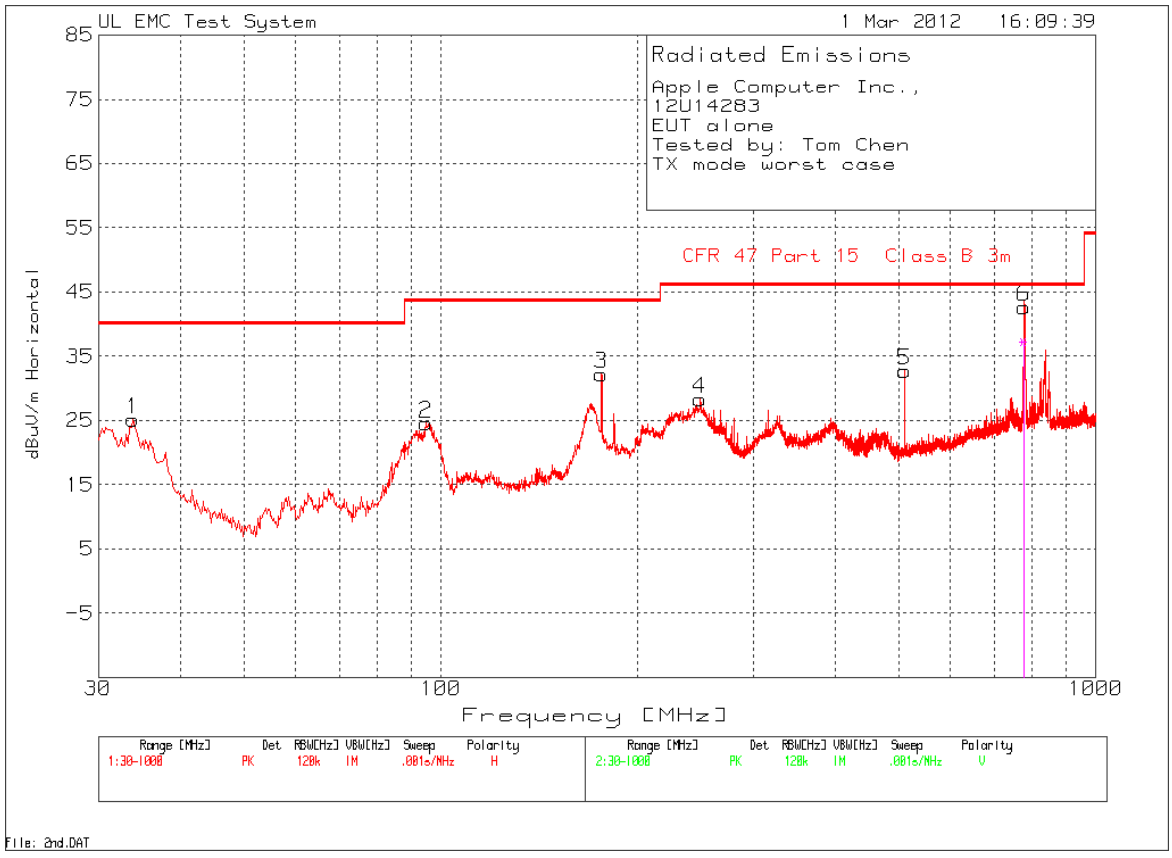
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5510MHz 3TX HT40 MCS0 CDD													
11.020	3.0	34.8	38.4	10.5	-33.6	0.0	0.7	50.9	74.0	-23.1	V	P	
11.020	3.0	23.5	38.4	10.5	-33.6	0.0	0.7	39.5	54.0	-14.5	V	A	
5510MHz 3TX HT40 MCS0 CDD													
11.020	3.0	34.8	38.4	10.5	-33.6	0.0	0.7	50.9	74.0	-23.1	H	P	
11.020	3.0	23.5	38.4	10.5	-33.6	0.0	0.7	39.6	54.0	-14.4	H	A	
5550MHz 3TX HT40 MCS0 CDD													
11.100	3.0	34.7	38.5	10.6	-33.5	0.0	0.7	51.1	74.0	-22.9	H	P	
11.100	3.0	23.4	38.5	10.6	-33.5	0.0	0.7	39.8	54.0	-14.2	H	A	
5550MHz 3TX HT40 MCS0 CDD													
11.100	3.0	34.7	38.5	10.6	-33.5	0.0	0.7	51.0	74.0	-23.0	V	P	
11.100	3.0	23.4	38.5	10.6	-33.5	0.0	0.7	39.8	54.0	-14.2	V	A	
5670MHz 3TX HT40 MCS0 CDD													
11.340	3.0	33.9	38.7	11.0	-33.2	0.0	0.7	51.1	74.0	-22.9	V	P	
11.340	3.0	21.2	38.7	11.0	-33.2	0.0	0.7	38.4	54.0	-15.6	V	A	
5670MHz 3TX HT40 MCS0 CDD													
11.340	3.0	34.1	38.7	11.0	-33.2	0.0	0.7	51.3	74.0	-22.7	H	P	
11.340	3.0	22.8	38.7	11.0	-33.2	0.0	0.7	40.0	54.0	-14.0	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

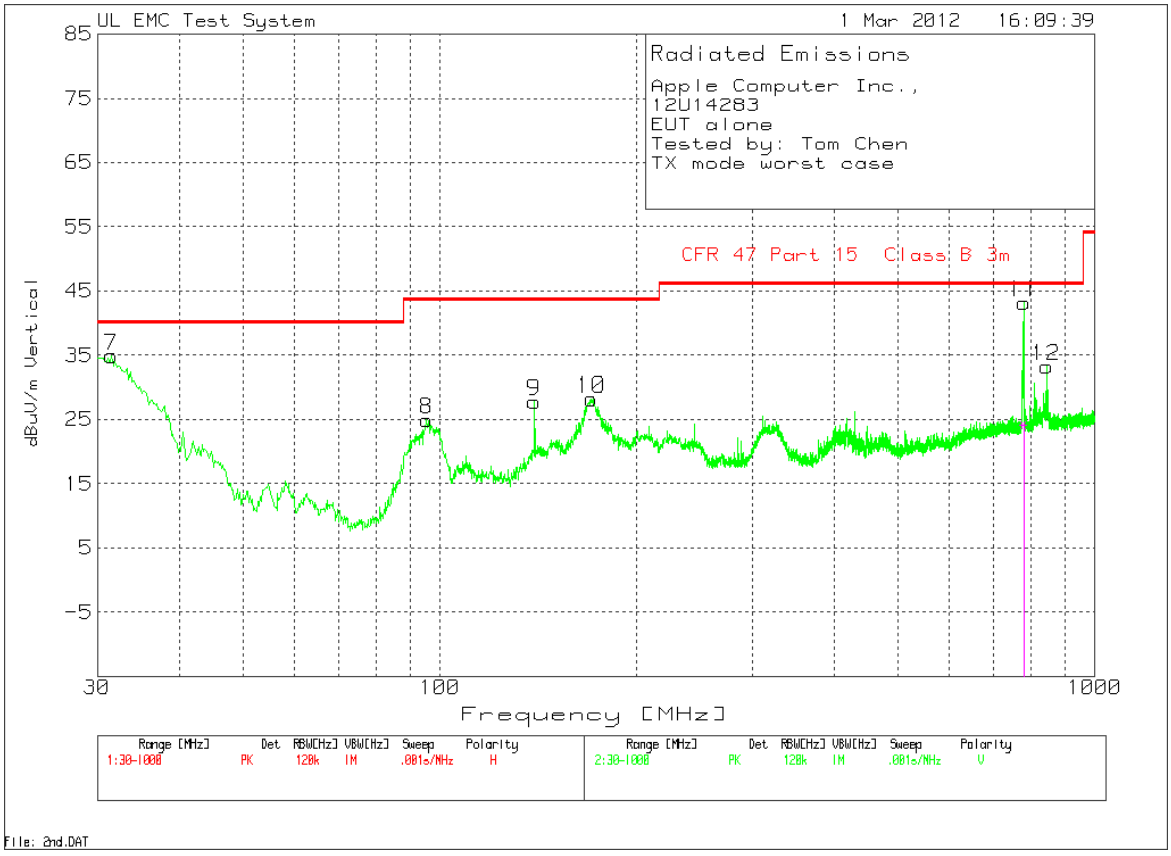
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Apple Computer Inc.,
12U14283
EUT alone
Tested by: Tom Chen
TX mode worst case

Horizontal 30 - 1000MHz

Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX [dB]	T185 Sunol JB1.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
33.8769	34.37	PK	-27.6	18.4	25.17	40	-14.83	99	Horz
94.9381	43.06	PK	-27	8.5	24.56	43.5	-18.94	301	Horz
175.9652	47.52	PK	-26.4	11.1	32.22	43.5	-11.28	99	Horz
248.8509	42.72	PK	-25.9	11.5	28.32	46	-17.68	99	Horz
510.5416	39.61	PK	-24.7	17.8	32.71	46	-13.29	301	Horz
776.6906	45.08	PK	-23.4	21	42.68	46	-3.32	399	Horz
776.69	39.56	QP	-23.4	21	37.16	46	-8.84	100	Horz

Vertical 30 - 1000MHz

Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX [dB]	T185 Sunol JB1.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
31.5508	42.33	PK	-27.5	20.1	34.93	40	-5.07	99	Vert
95.5196	43.14	PK	-26.9	8.7	24.94	43.5	-18.56	99	Vert
139.5224	41.32	PK	-26.7	13.2	27.82	43.5	-15.68	99	Vert
170.5376	43.22	PK	-26.4	11.4	28.22	43.5	-15.28	99	Vert
779.4045	45.42	PK	-23.3	21.1	43.22	46	-2.78	201	Vert
779.4	26.3	QP	-23.3	21.1	24.1	46	-21.9	102	Vert
844.3425	34.75	PK	-23.2	21.7	33.25	46	-12.75	99	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

Apple
12U14283
EUT install in Notebook PC
Tested by: Tom Chen
TX mode Worst Case

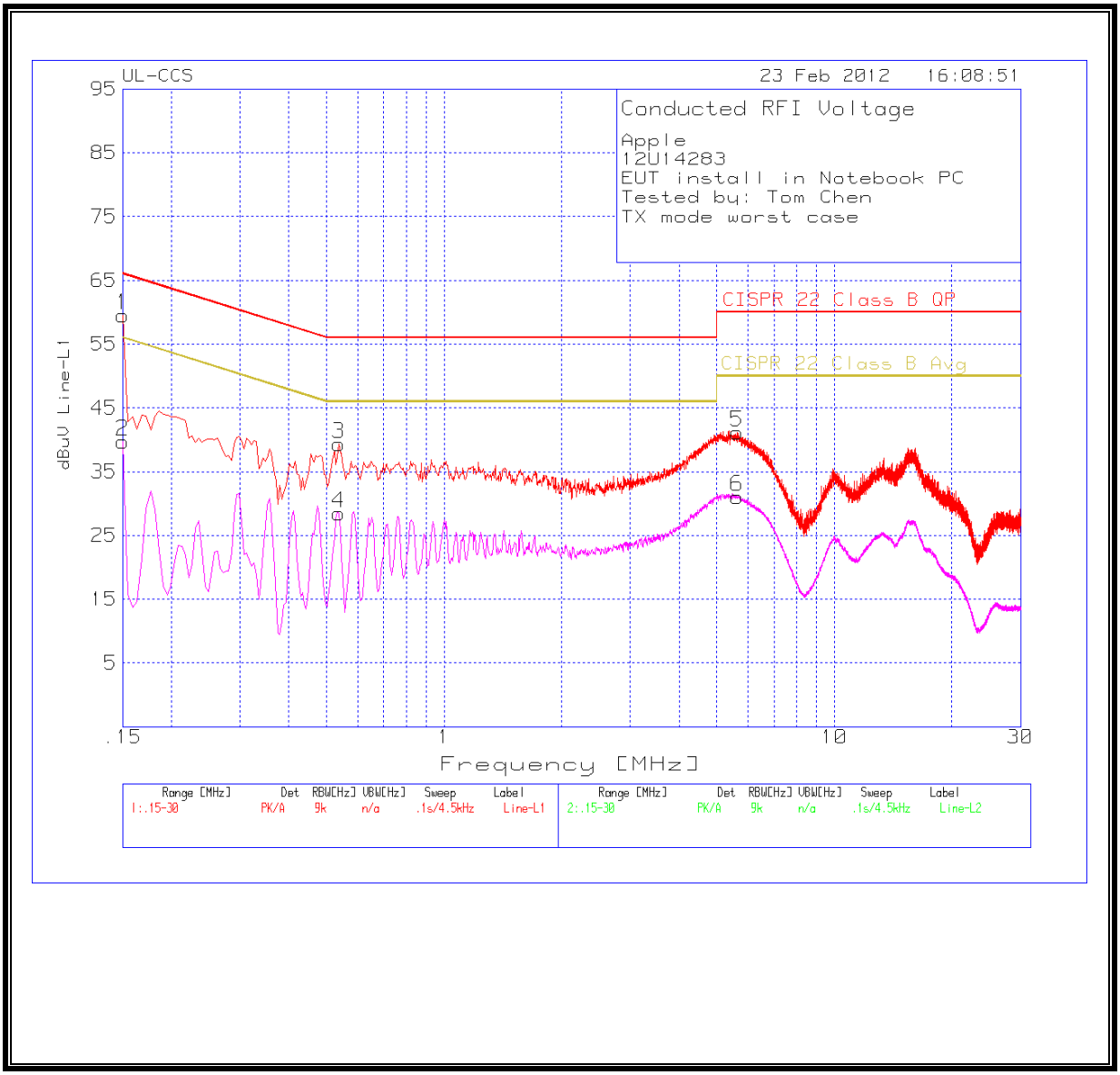
Line-L1 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dBuV	CISPR 22 Class B QP	Margin	CISPR 22 Class B Avg	Margin
0.15	59.41	PK	0.1	0	59.51	66	-6.49	-	-
0.15	39.66	Av	0.1	0	39.76	-	-	56	-16.24
0.537	39.28	PK	0.1	0	39.38	56	-16.62	-	-
0.537	28.4	Av	0.1	0	28.5	-	-	46	-17.5
5.6265	40.94	PK	0.1	0.1	41.14	60	-18.86	-	-
5.6265	30.82	Av	0.1	0.1	31.02	-	-	50	-18.98

Line-L2 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L2.TXT [dB]	LC Cables 2&3.TXT [dB]	dBuV	CISPR 22 Class B QP	Margin	CISPR 22 Class B Avg	Margin
0.15	59.32	PK	0.1	0	59.42	66	-6.58	-	-
0.15	30.38	Av	0.1	0	30.48	-	-	56	-25.52
0.249	39.73	PK	0.1	0	39.83	61.8	-21.97	-	-
0.249	31.09	Av	0.1	0	31.19	-	-	51.8	-20.61
5.6625	41.42	PK	0.1	0.1	41.62	60	-18.38	-	-
5.6625	31.01	Av	0.1	0.1	31.21	-	-	50	-18.79

LINE 1 RESULTS



LINE 2 RESULTS