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

CERTIFICATION TEST REPORT

FOR

802.11 a/b/g/n radio, Bluetooth Radio Function

MODEL NUMBER: A1403

FCC ID: BCGA1403
IC: 579C-A1403

(This report is also used to support FCC ID: BCGA1416 and BCGA1430 based upon permission given by FCC in KDB 154009)

REPORT NUMBER: 11U13938-1, Revision D1

ISSUE DATE: FEBRUARY 03, 2012

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	12/12/11	Initial Issue	F. Ibrahim
A	12/13/11	Revised Antenna Gains	A. Zaffar
B	02/02/12	Updated antenna port testing per KDB 558074	F. Ibrahim
C	02/02/12	Revised 1. Model number 2. FCC and IC ID	A. Zaffar
D	02/03/12	Revised EUT Description	A. Zaffar
D1	02/15/12	Revised cover page in referencing KDB 154009	A. Zaffar

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: The Apple iPad, Model A1403 is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, Bluetooth radio functions, and cellular using the CDMA/GSM 2G/3G/LTE data radio functions.

MODEL: A1403

SERIAL NUMBER: PT667496, PT654922

DATE TESTED: SEPTEMBER 20, 2011 - JANUARY 30, 2012

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	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:

CHIN PANG
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, 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 Apple iPad, Model A1403 is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, Bluetooth radio functions, and cellular using the CDMA/GSM 2G/3G/LTE data radio functions.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	19.29	84.92
2412 - 2462	802.11g	25.57	360.58
2412 - 2462	802.11n HT20	25.51	355.63
5745 - 5825	802.11a	26.24	420.73
5745 - 5825	802.11n HT20	26.44	440.55

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PiFA integrated antenna, with the following gain:

2.4 GHz band: -0.26 dBi
5.2 GHz band: 4.63 dBi
5.6 GHz band: 4.51 dBi
5.8 GHz band: 4.9 dBi

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 9B87
The EUT driver software installed during testing was Broadcom_Rel_5_90_156_24
The test utility software used during testing was WL_tool.

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 as worst-case scenario.

Worst-case data rates as provided by the manufacturer are:

For 11b mode: 1Mbps
For 11g mode: 6Mbps
For 11a mode: 6Mbps
For 11n HT20: MCS0

EUT is a portable device that has three orientations; therefore, X Y and Z orientations have been investigated, and the worst case was found to be at Z position.

Antenna port testing (except output power) and radiated emissions for CH1 and CH11 were performed at the target power of CH2 and CH10 respectively as worst-case scenario.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
Earphone	Apple	NA	NA
AC Adaptor	Apple	A1344	N/A

I/O CABLES (Conducted Setup)

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	Antenna	1	SMA	Shielded	0.1m	To Spectrum Analyzer

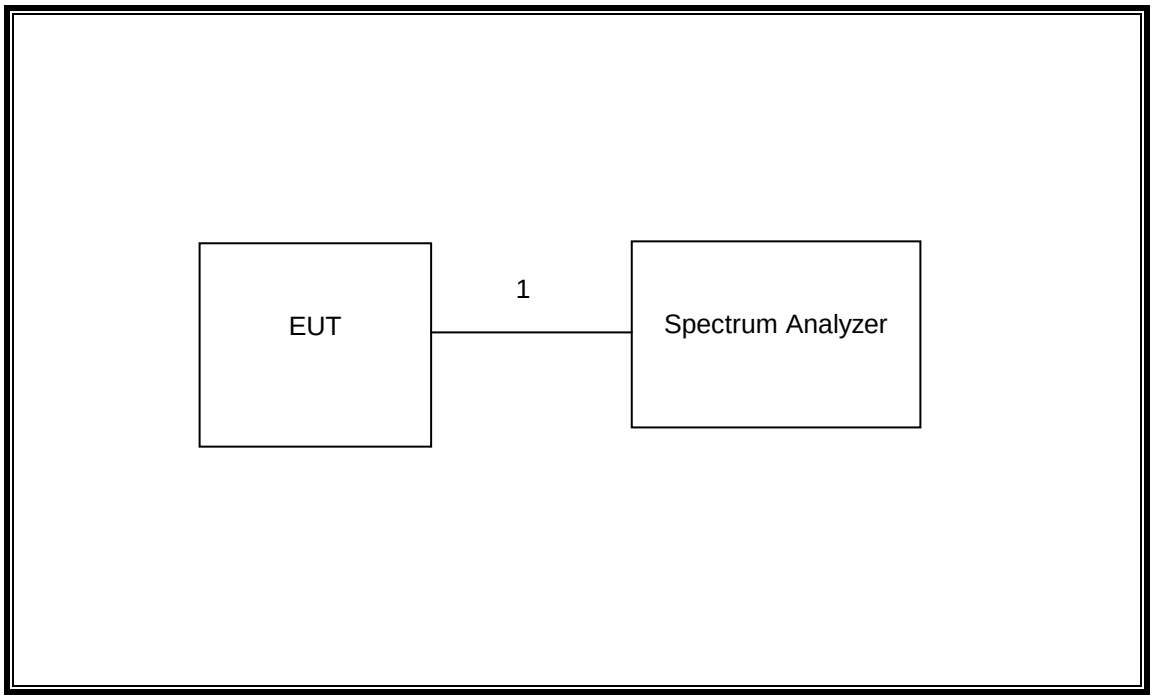
I/O CABLES (Radiated Setup)

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	1m	N/A
3	Jack	1	Earphone	Unshielded	0.5m	N/A

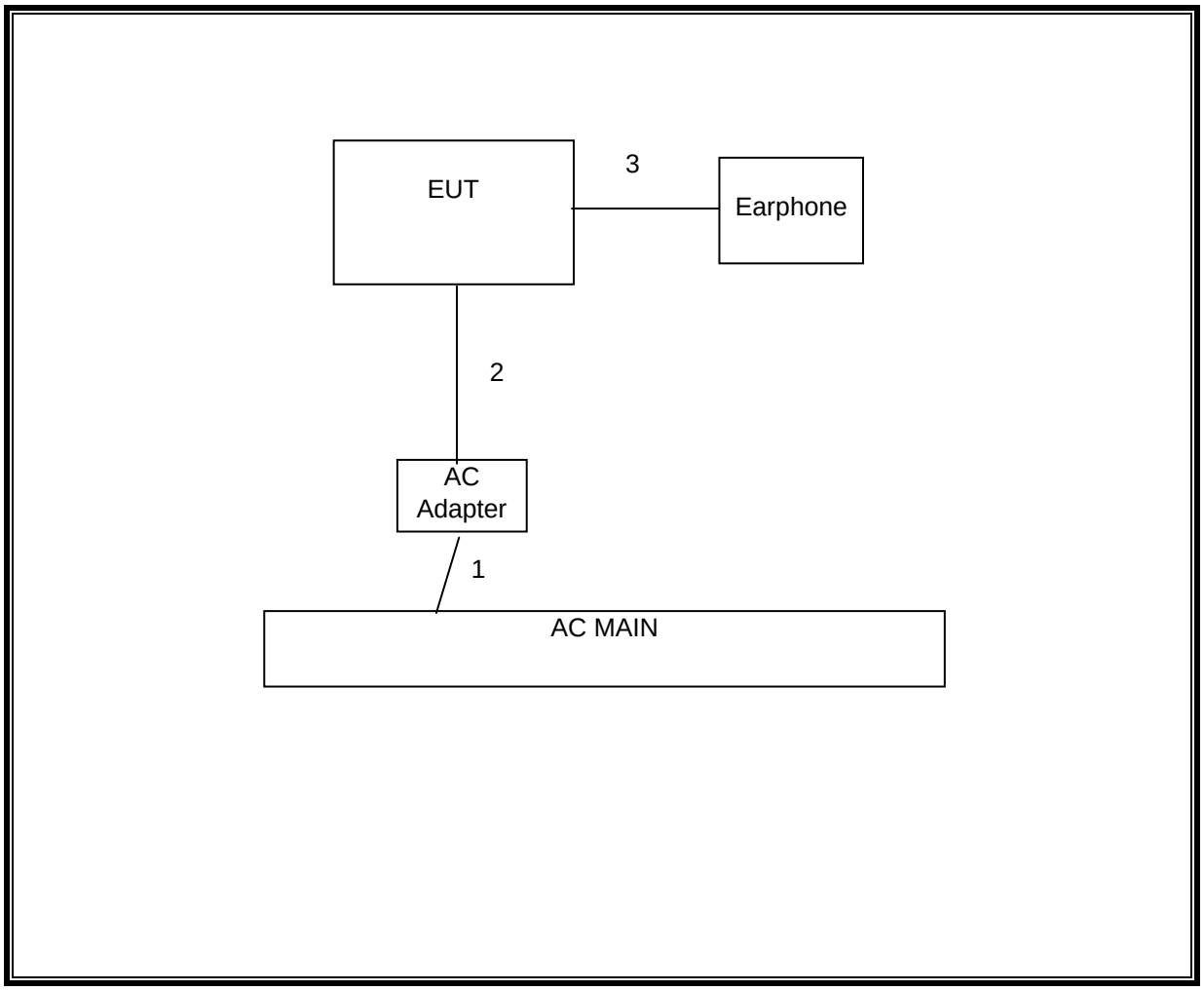
TEST SETUP

The EUT is a stand-alone device.

SETUP DIAGRAM FOR TESTS (CONDUCTED)



SETUP DIAGRAM FOR TESTS (RADIATED)



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 Date**	**Cal Due**
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	09/02/11	09/02/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	07/12/11	07/12/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/27/11	01/27/12
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	07/06/11	07/06/12
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/10/11	11/10/12
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRC13192	N02683	CNR	CNR
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR	CNR
Antenna, Horn, 18 GHz	EMCO	3115	C00783	06/29/11	06/29/12
Peak Power Meter	Agilent / HP	E4416A	C00963	03/22/11	03/22/13
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	04/13/11	04/13/12
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/11	07/28/12
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	06/14/11	06/14/12
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/02/11	08/02/12

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

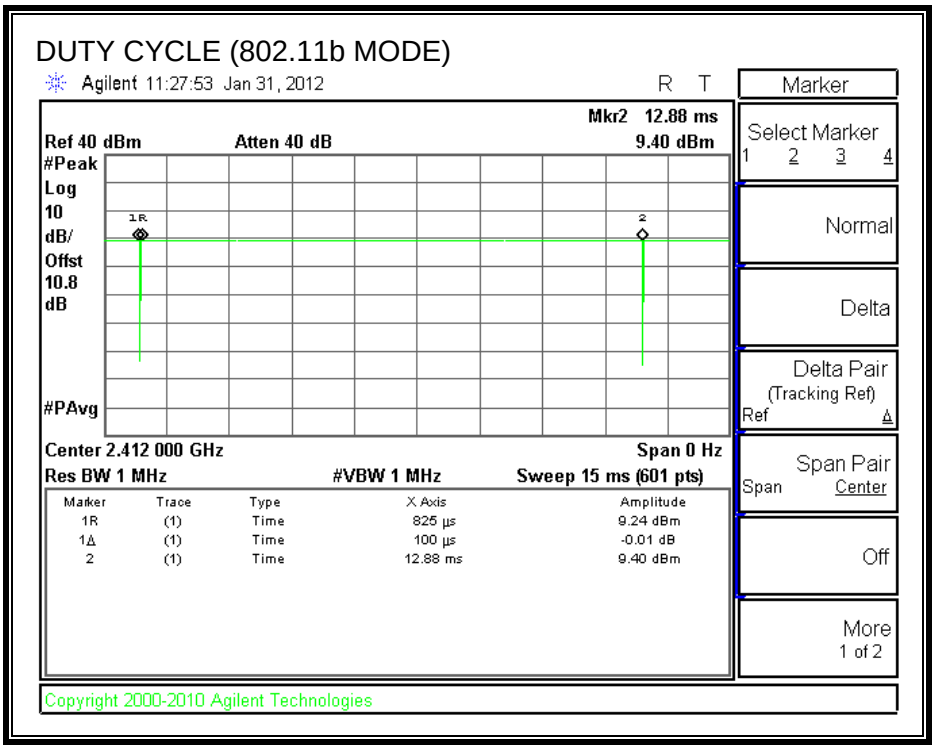
PROCEDURE

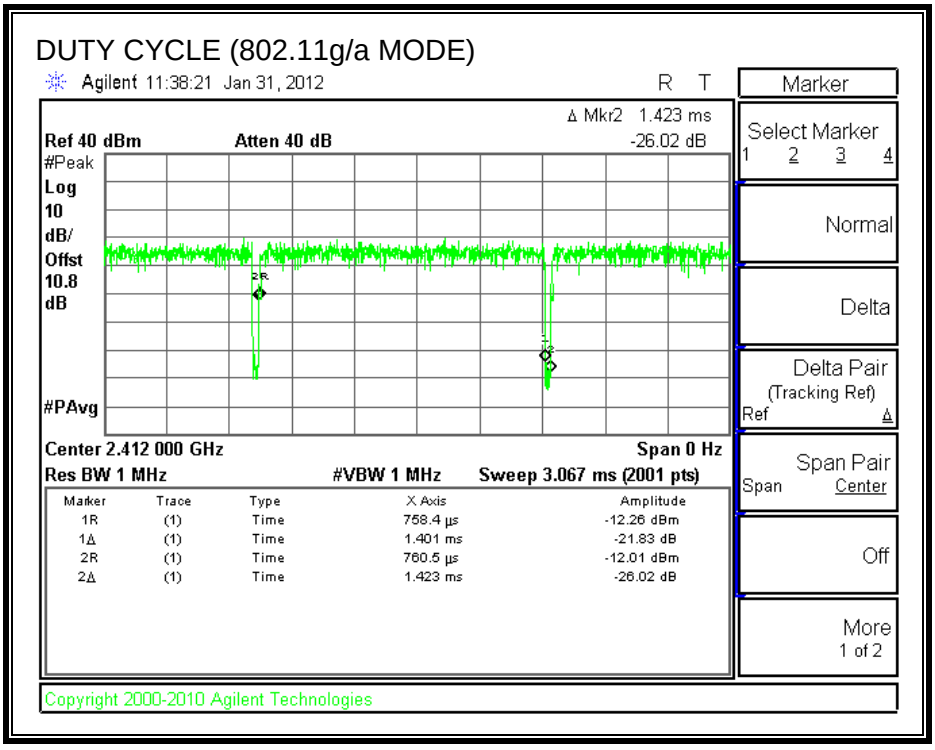
Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

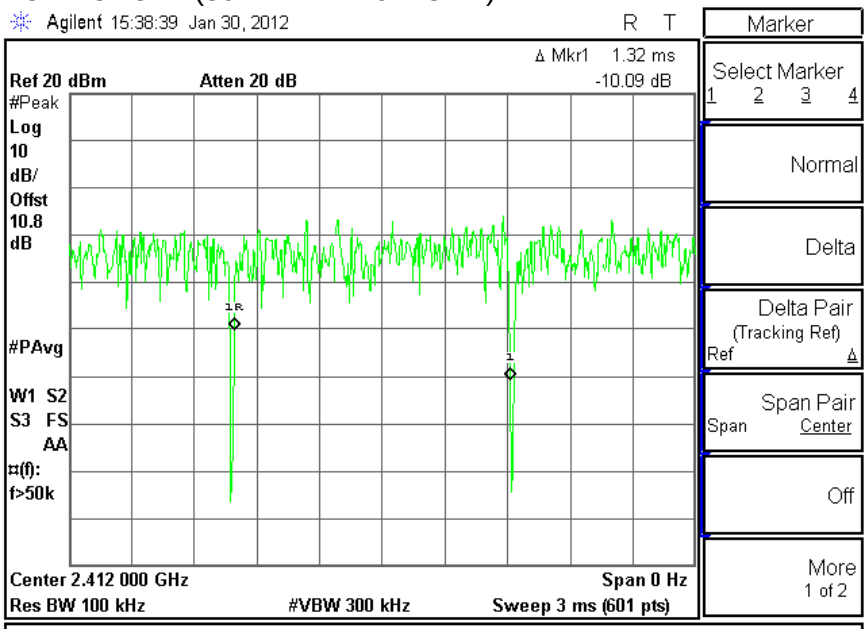
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
b	12.780	12.88	0.992	99.2%	0.03	0.078
g/a	1.4010	1.4230	0.985	98.5%	0.07	0.714
HT20	1.3200	1.340	0.985	98.5%	0.07	0.758

DUTY CYCLE PLOTS

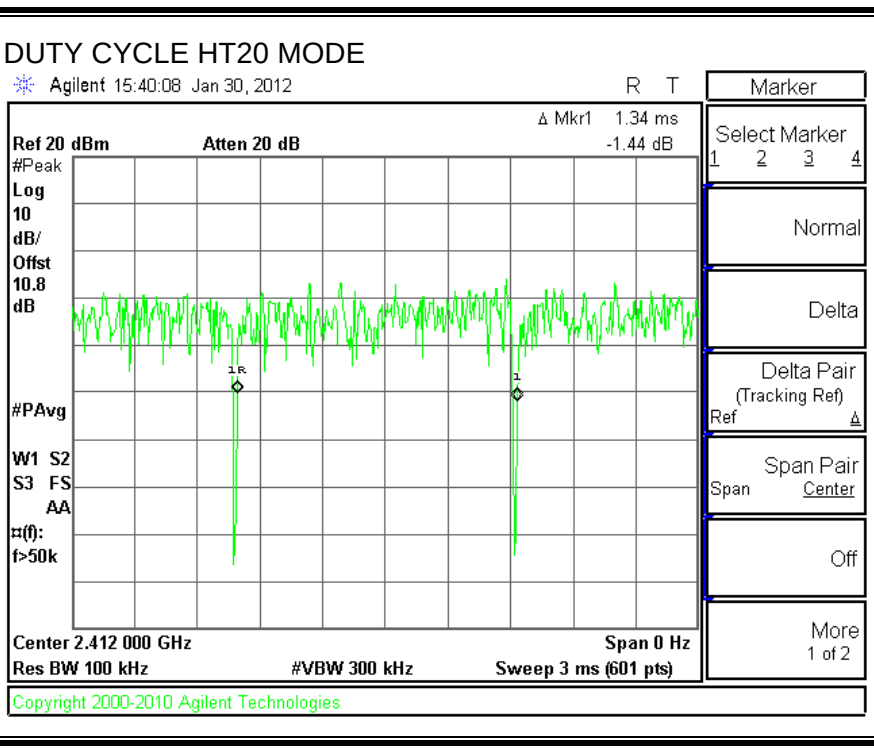




DUTY CYCLE (802.11n HT20 MODE)



DUTY CYCLE HT20 MODE



7.2. 802.11b MODE IN THE 2.4 GHz BAND

7.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

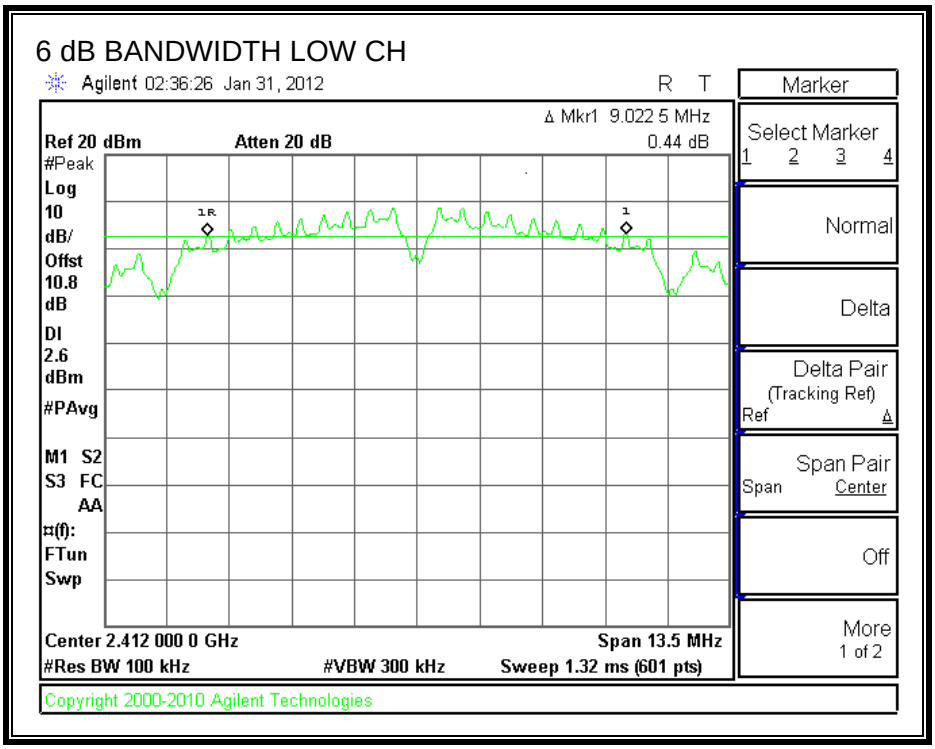
TEST PROCEDURE

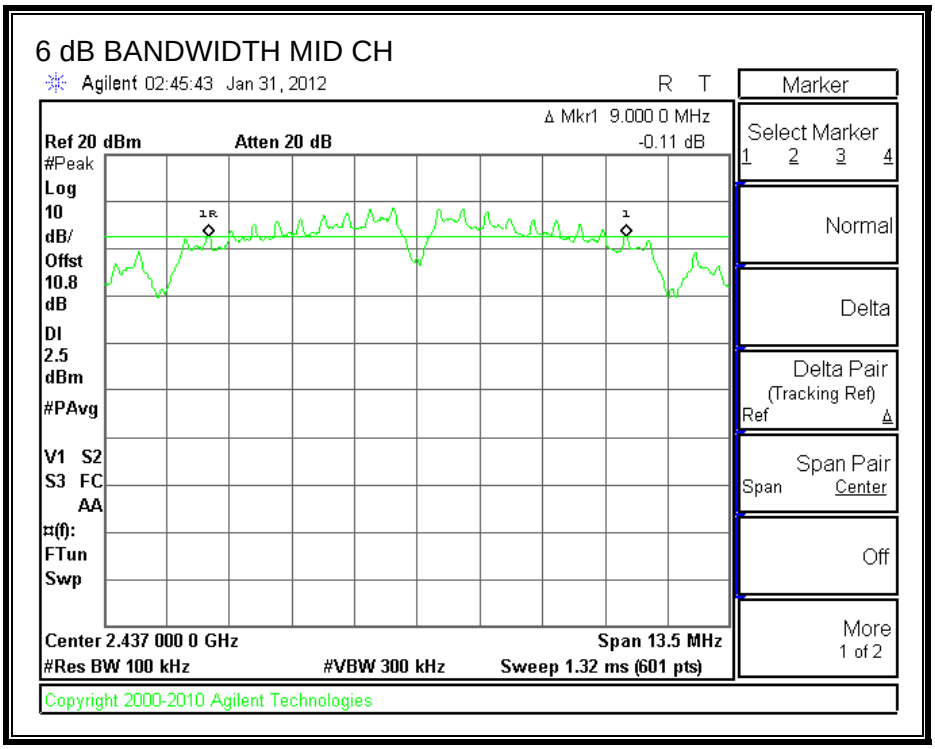
KDB 558074 dated 01/18/2012.

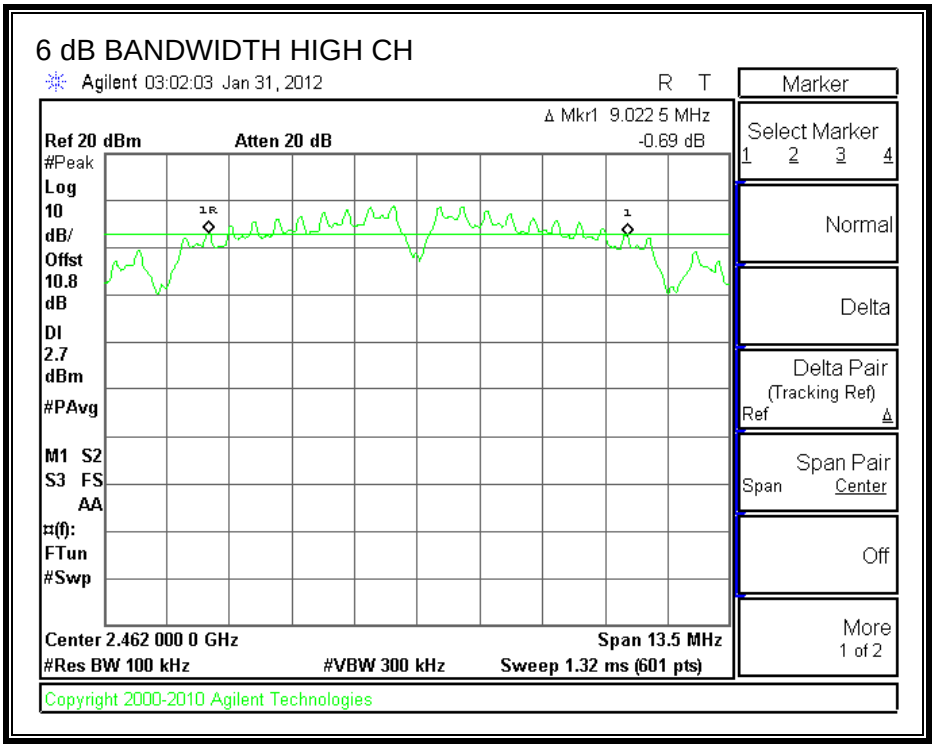
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	9.0225	0.5
Middle	2437	9.0000	0.5
High	2462	9.0225	0.5

6 dB BANDWIDTH







7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

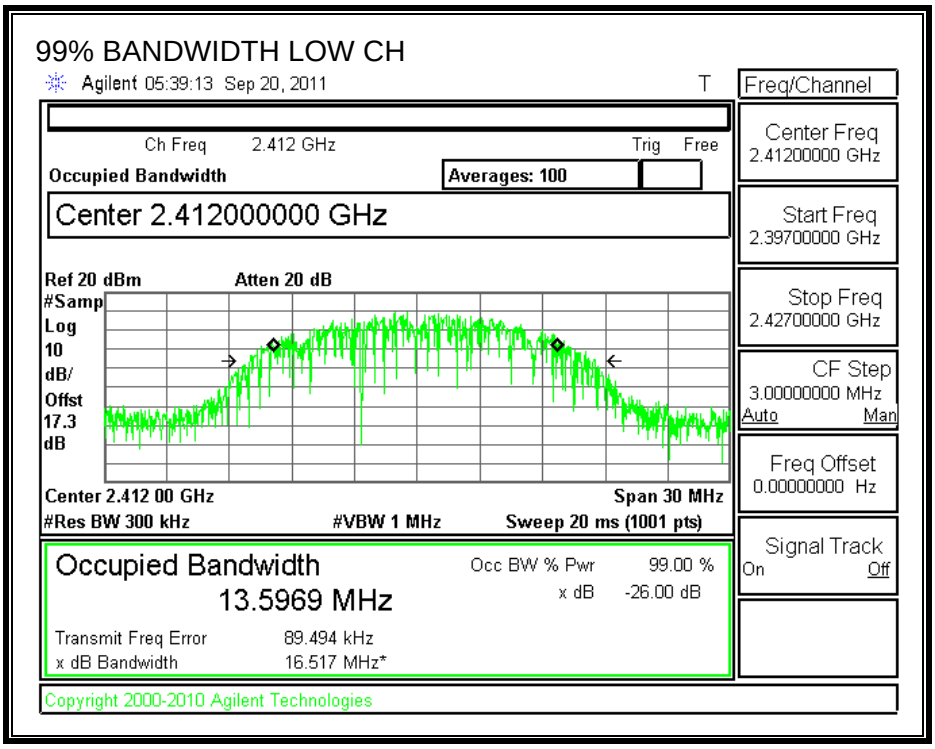
TEST PROCEDURE

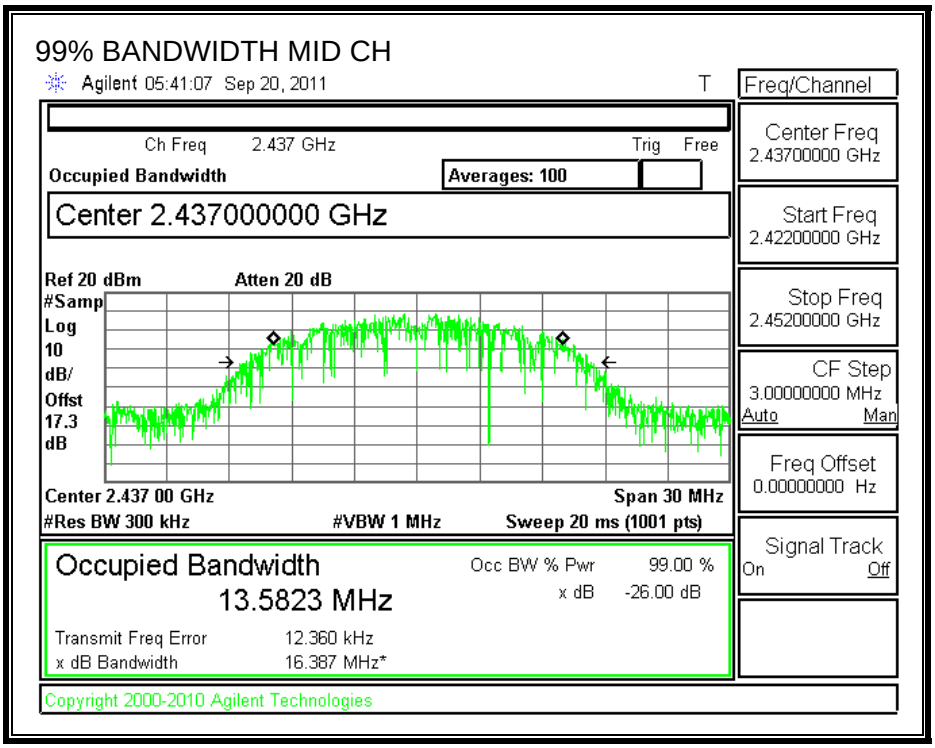
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

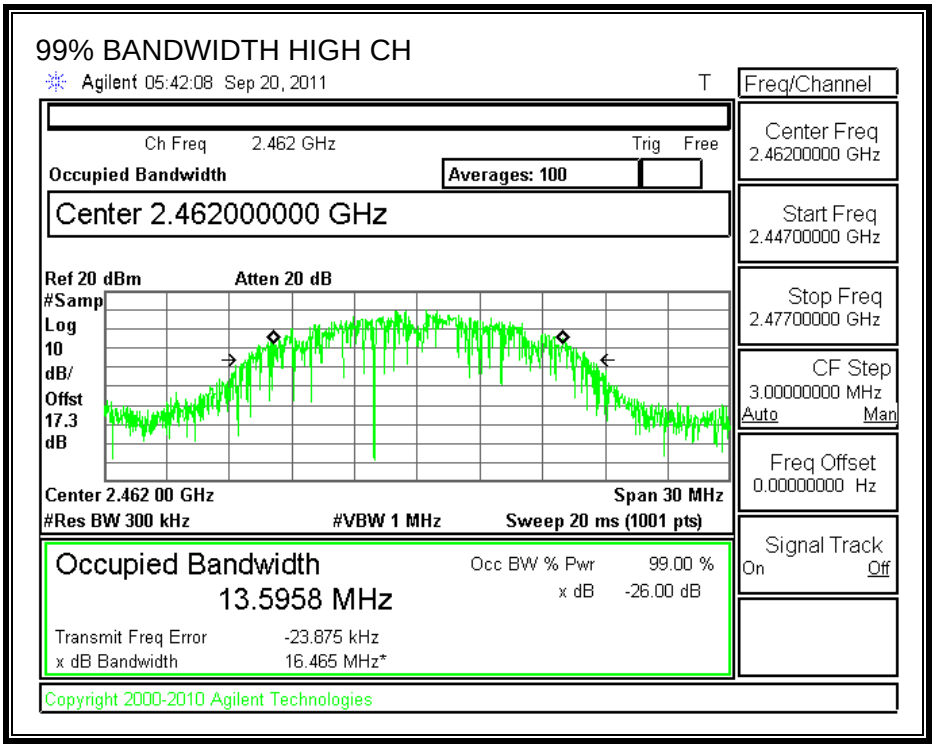
RESULTS

Frequency (MHz)	99% Bandwidth (MHz)
2412	13.5969
2437	13.5823
2462	13.5958

99% BANDWIDTH







7.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum effective legacy gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

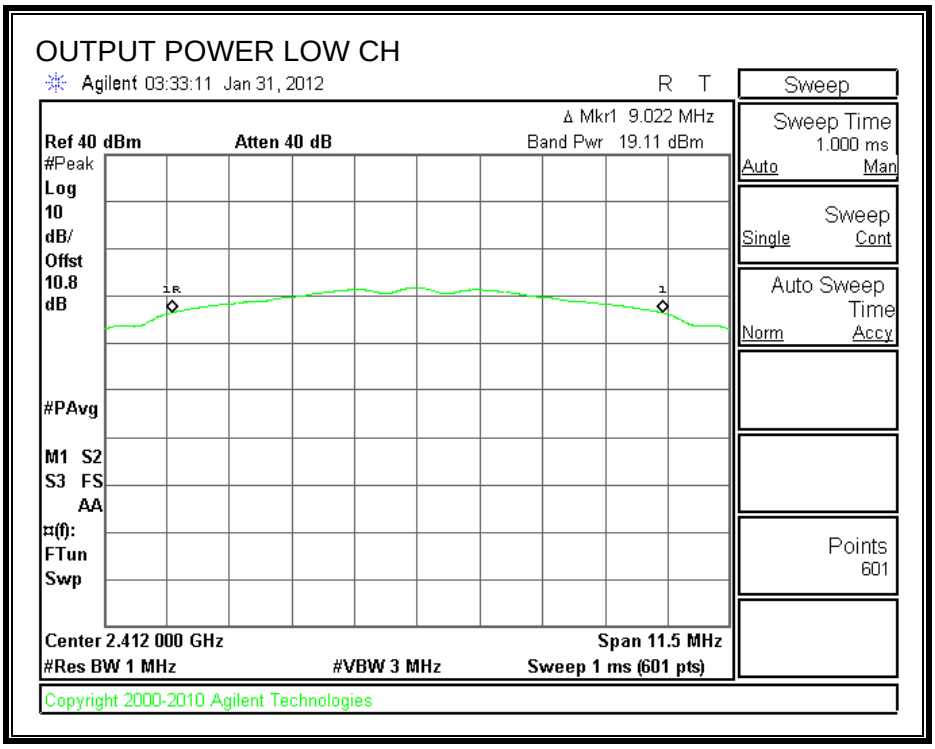
TEST PROCEDURE

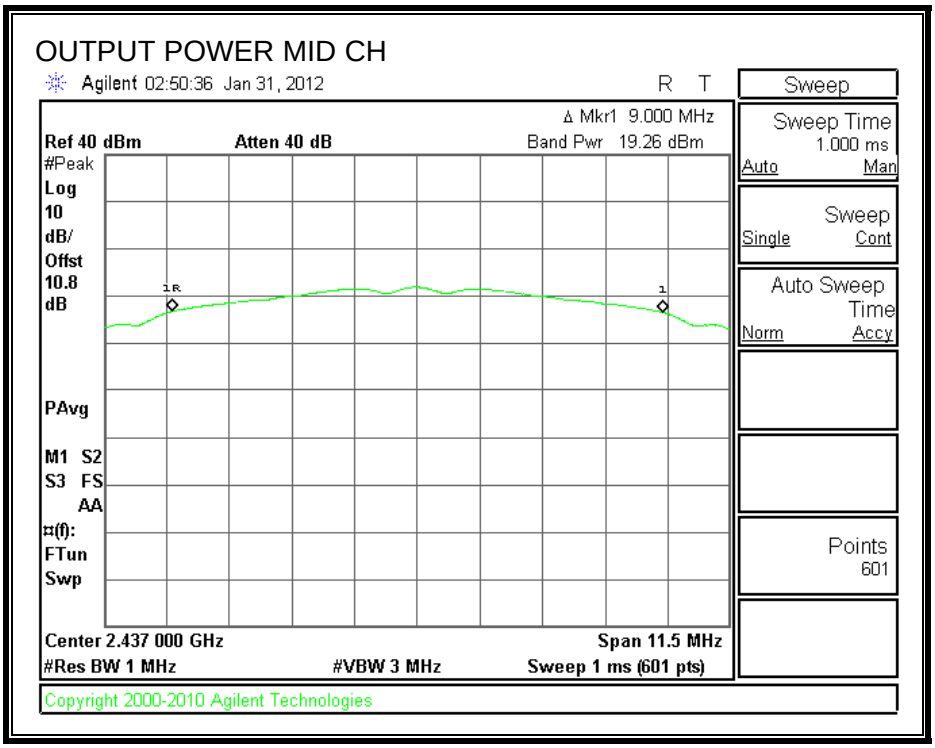
KDB 558074 dated 01/18/2012.

RESULTS

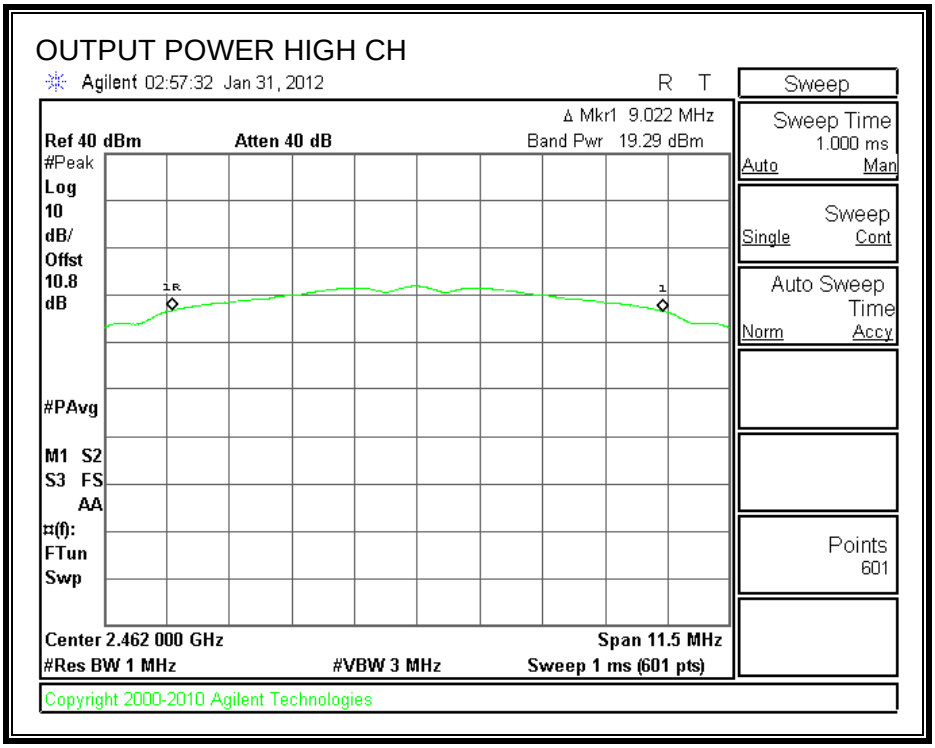
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.11	30	-10.89
Middle	2437	19.26	30	-10.74
High	2462	19.29	30	-10.71

OUTPUT POWER





OUTPUT POWER HIGH CH



7.2.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	2412	16.50
Middle	2437	16.50
High	2462	16.50

7.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

TEST PROCEDURE

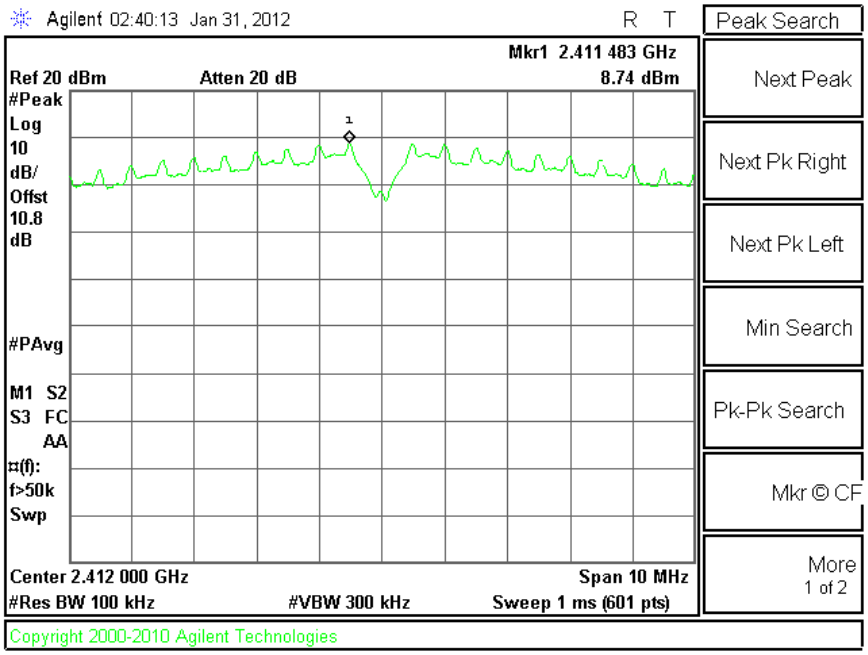
KDB 558074 dated 01/18/12.

RESULTS

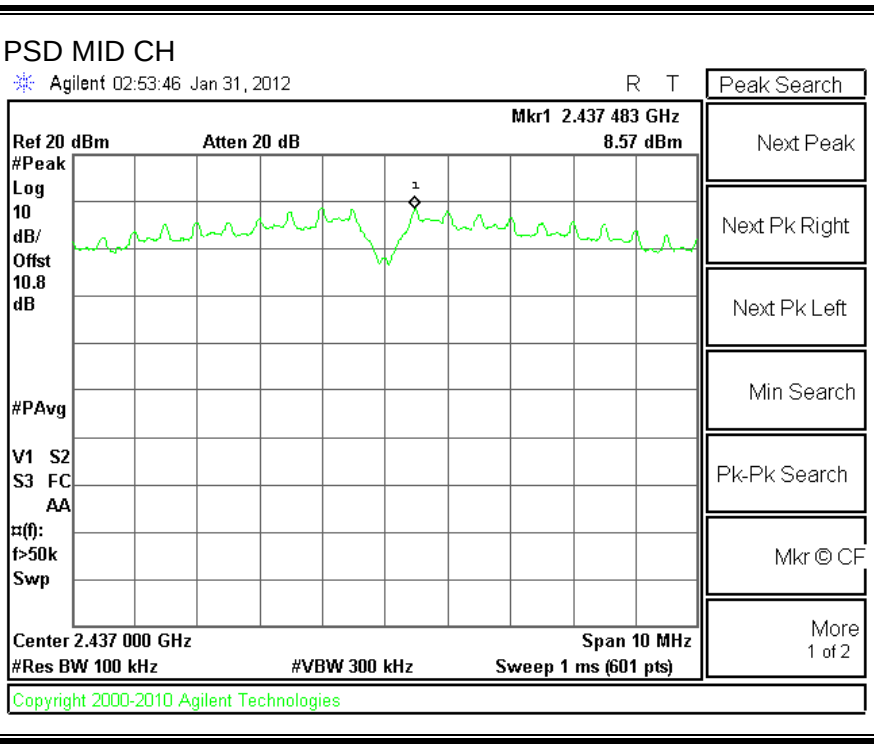
Channel	Frequency (MHz)	Marker Reading	10 log(3kHz/100kHz)	PPSD (dBm)	Limit (dBm)
Low	2412	8.74	15.2	-6.46	8
Middle	2437	8.57	15.2	-6.63	8
High	2462	8.41	15.2	-6.79	8

POWER SPECTRAL DENSITY

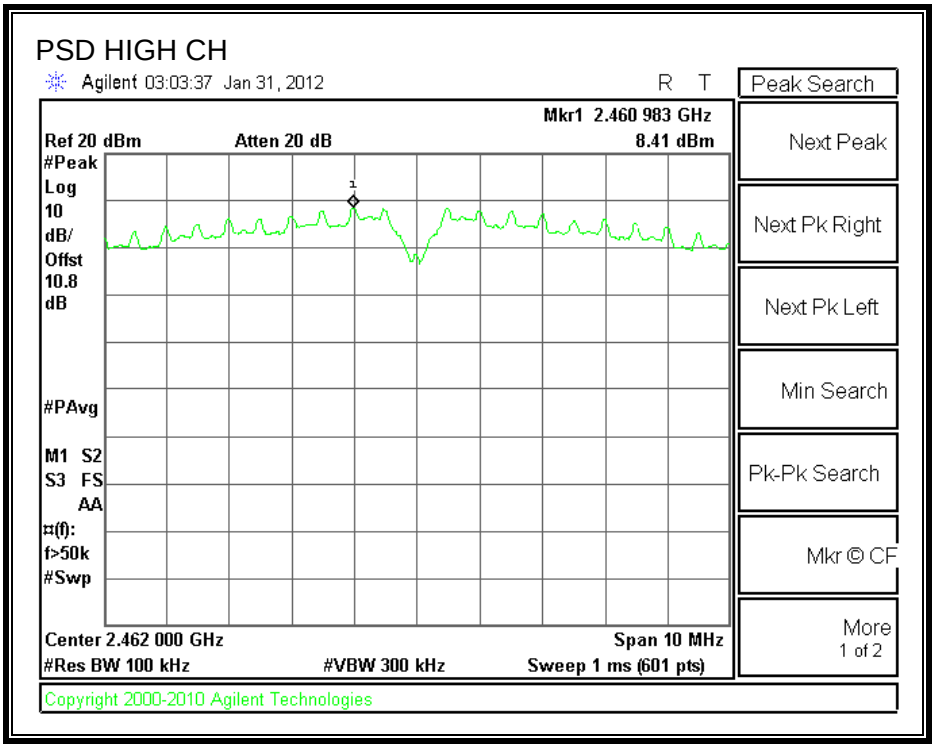
PSD LOW CH



PSD MID CH



PSD HIGH CH



7.2.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

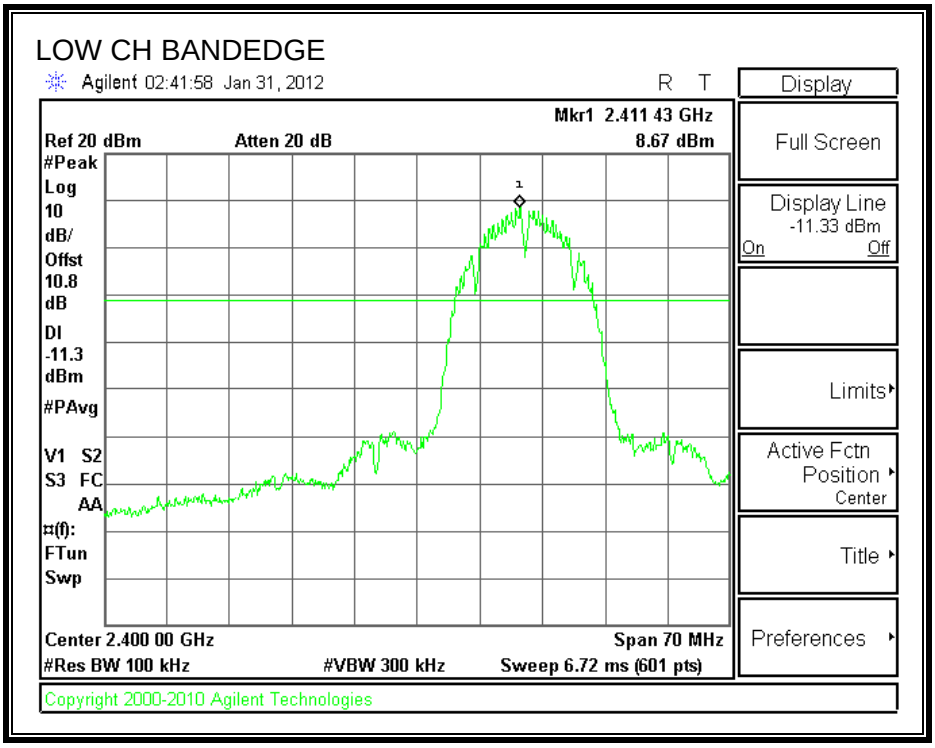
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

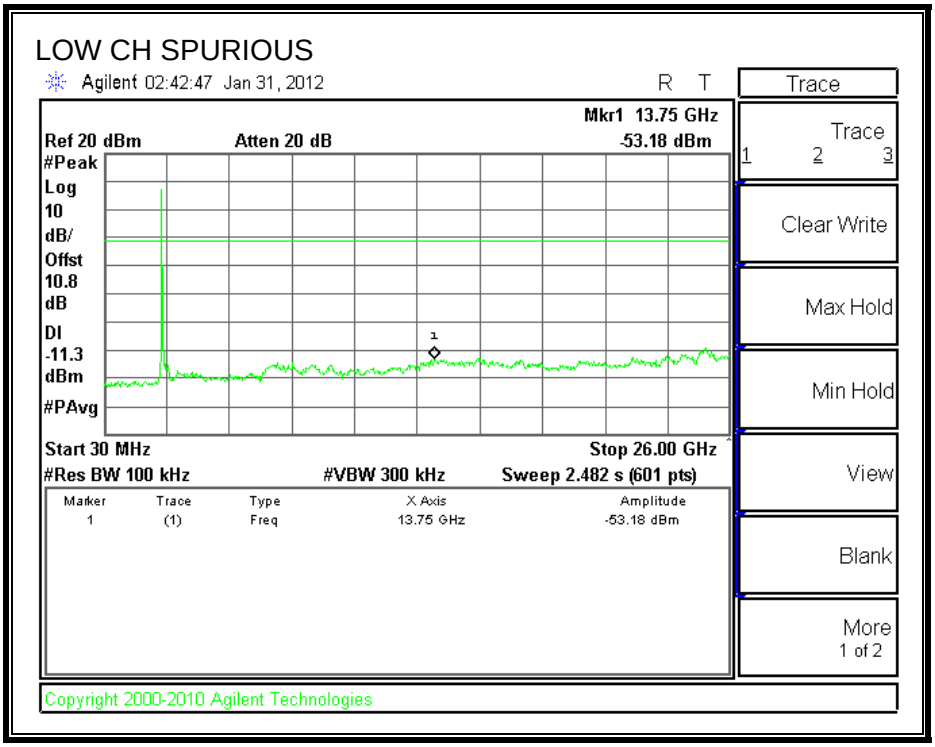
TEST PROCEDURE

KDB 558074 dated 01/18/12.

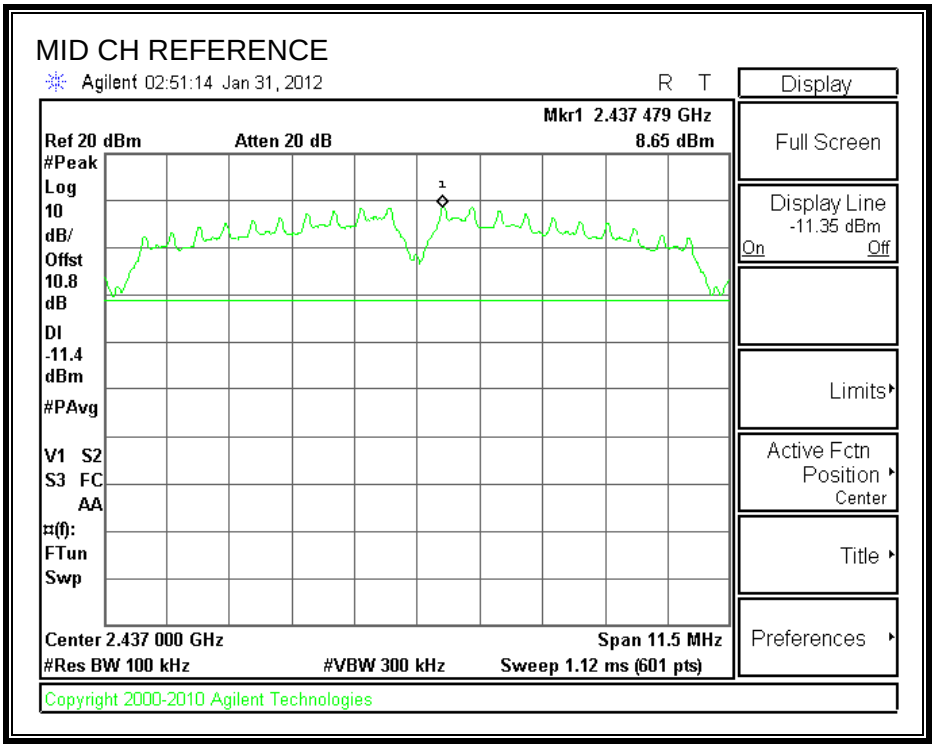
RESULTS

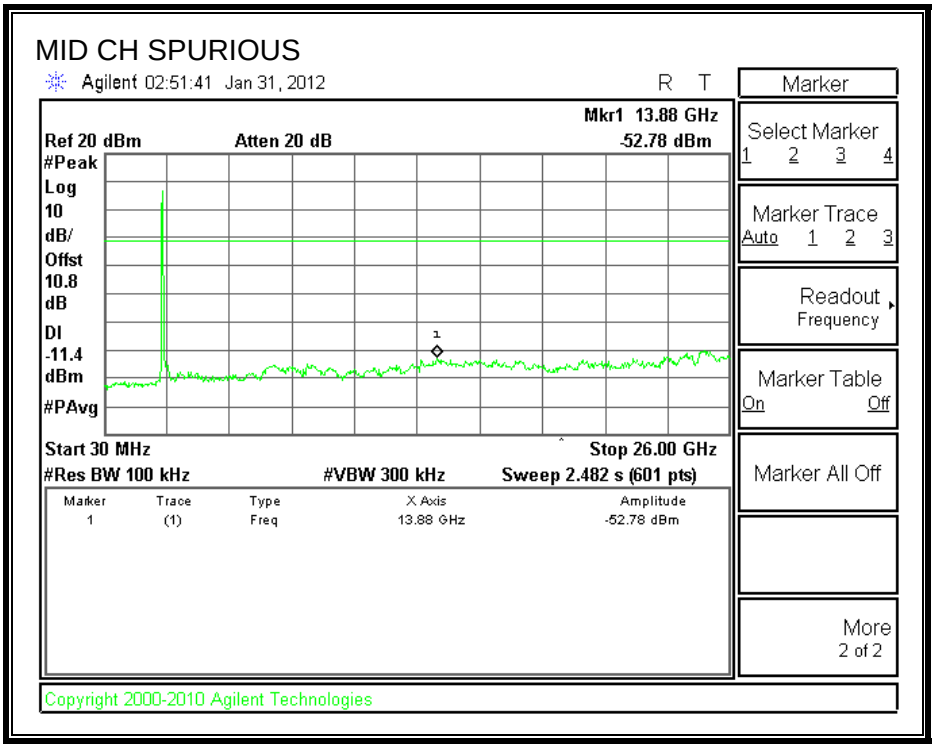
SPURIOUS EMISSIONS, LOW CHANNEL



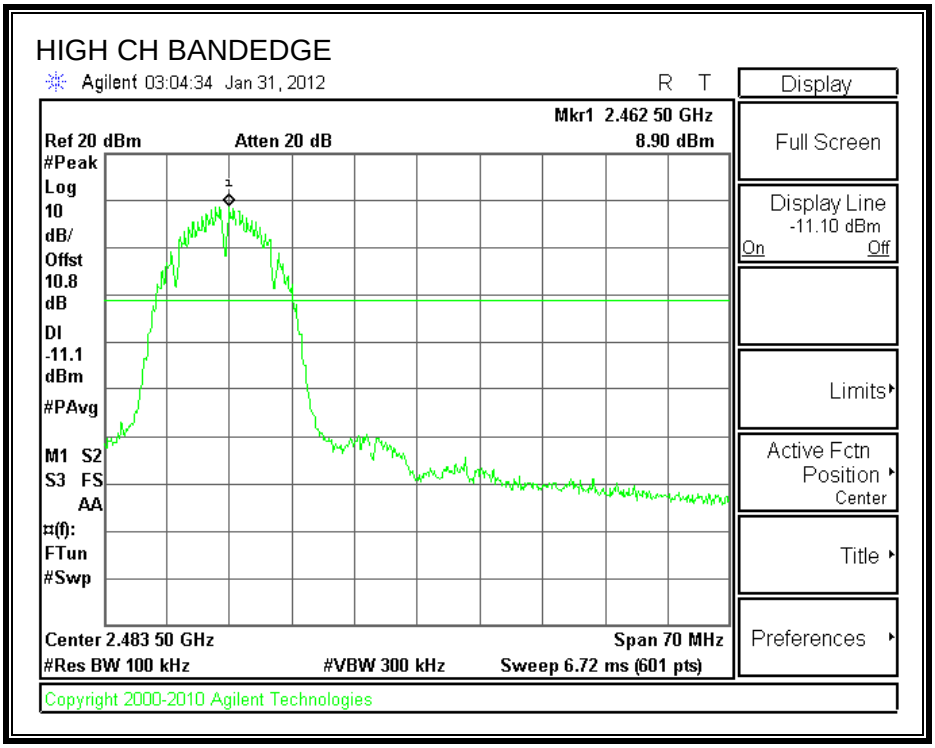


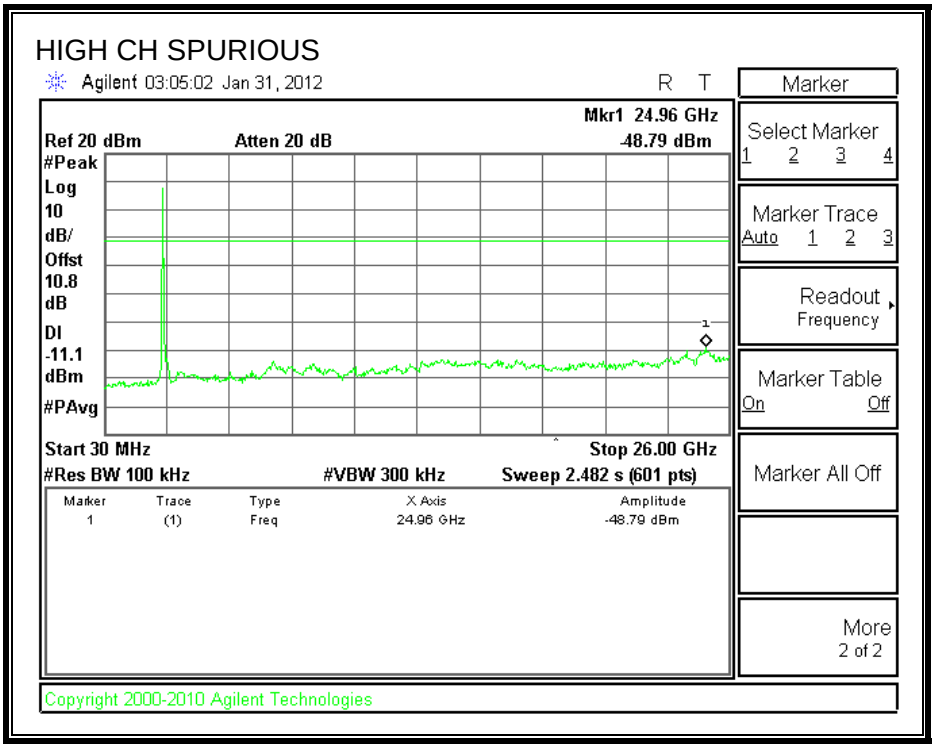
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





7.3. 802.11g MODE IN THE 2.4 GHz BAND

7.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

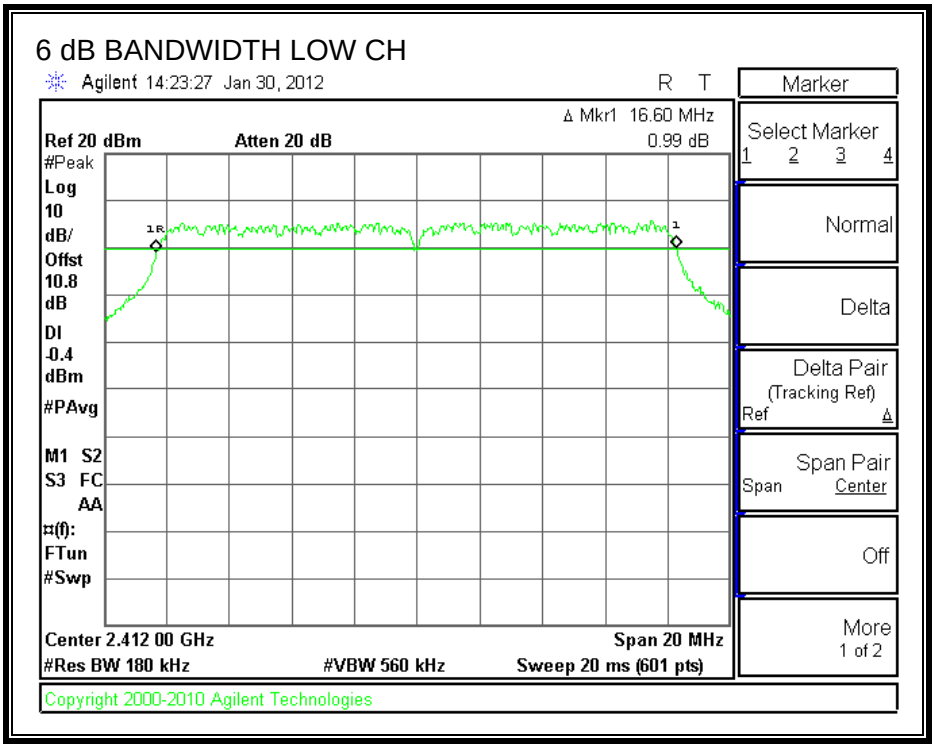
TEST PROCEDURE

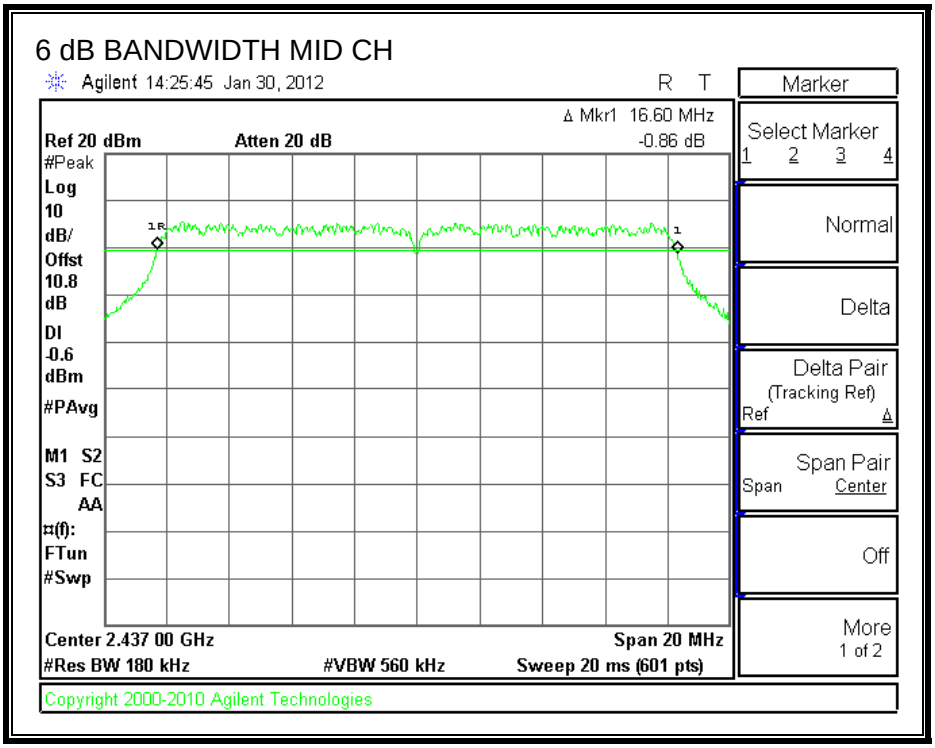
KDB 558074 dated 01/18/12.

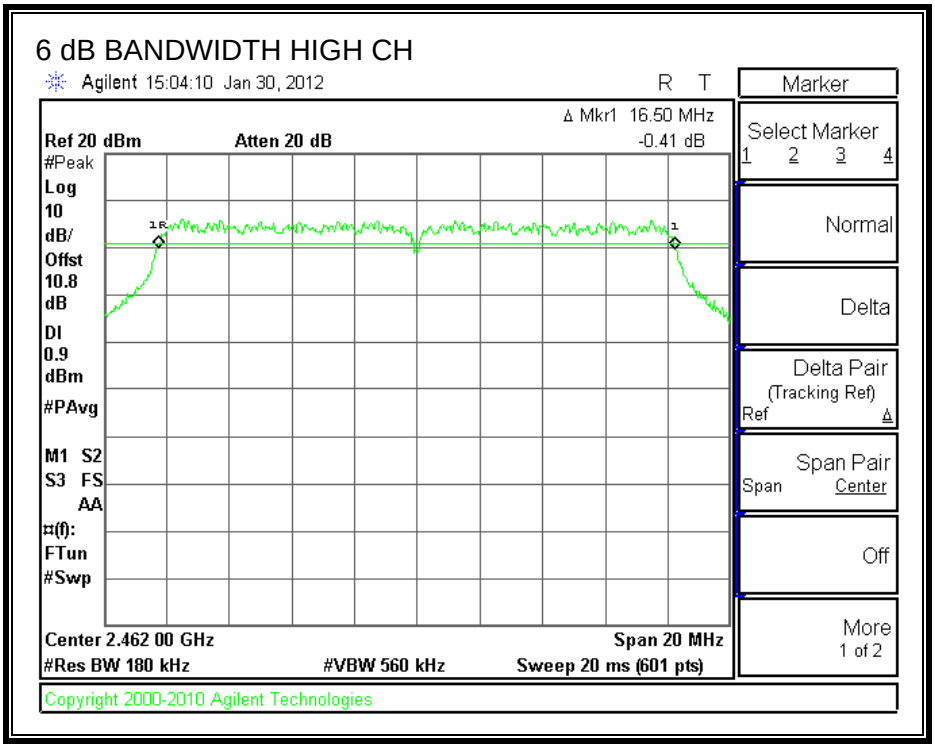
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	16.60	0.5
Middle	2437	16.60	0.5
High	2462	16.50	0.5

6 dB BANDWIDTH







7.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

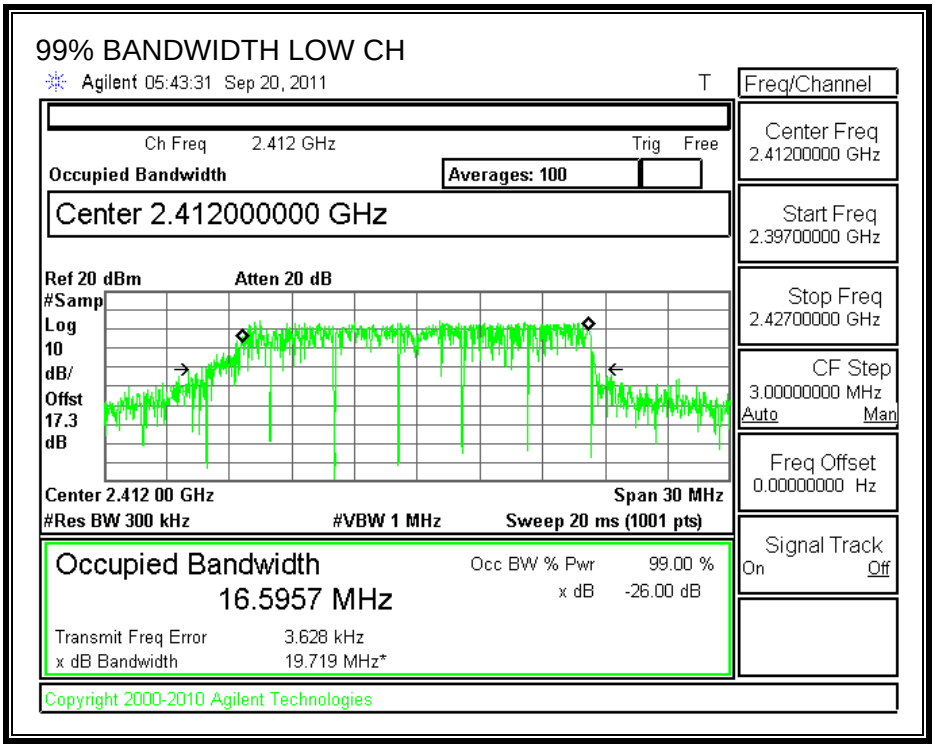
TEST PROCEDURE

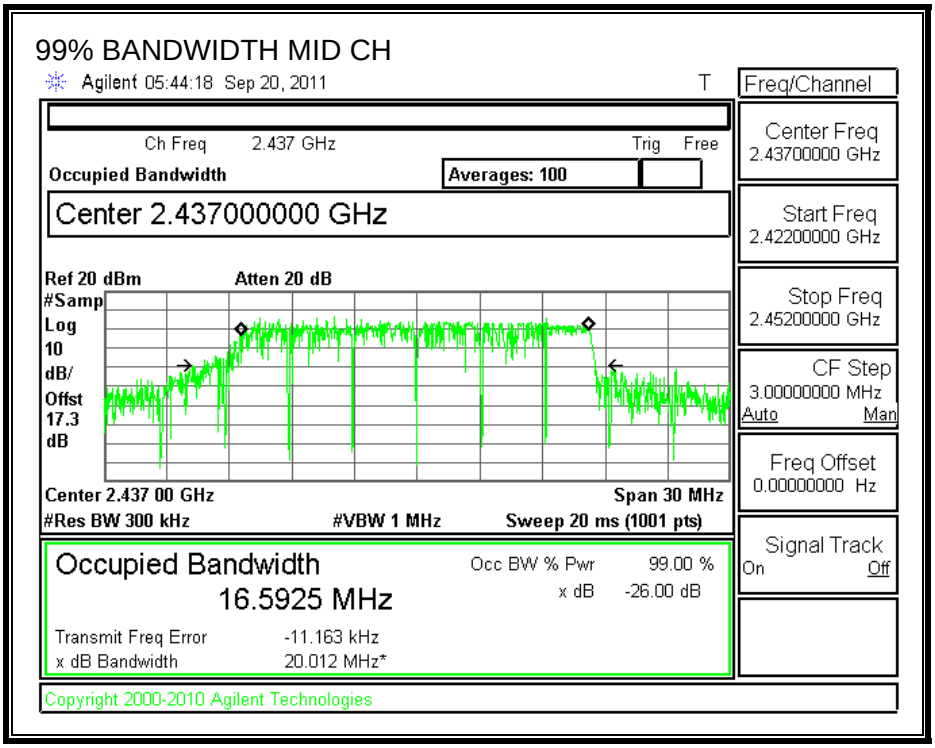
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

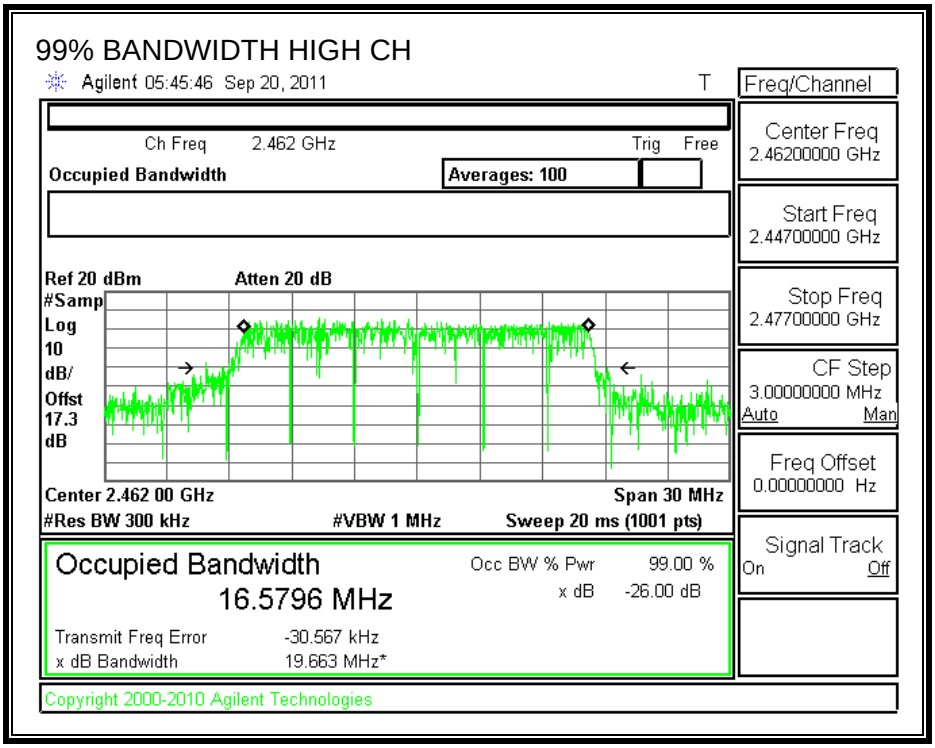
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.5957
Middle	2437	16.5925
High	2462	16.5796

99% BANDWIDTH







7.3.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum effective legacy gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

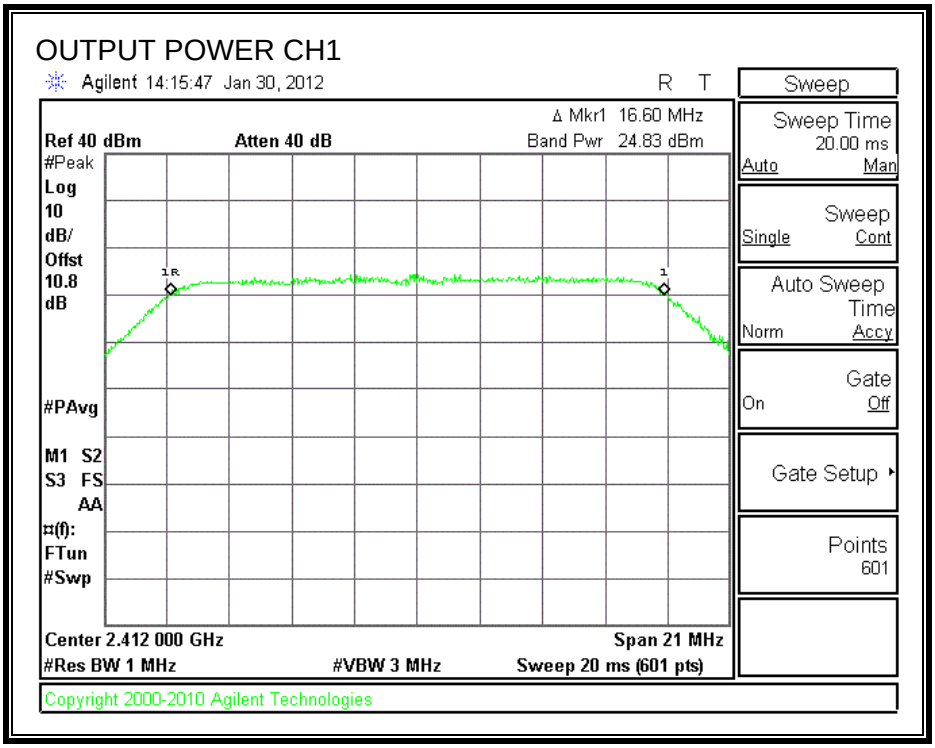
TEST PROCEDURE

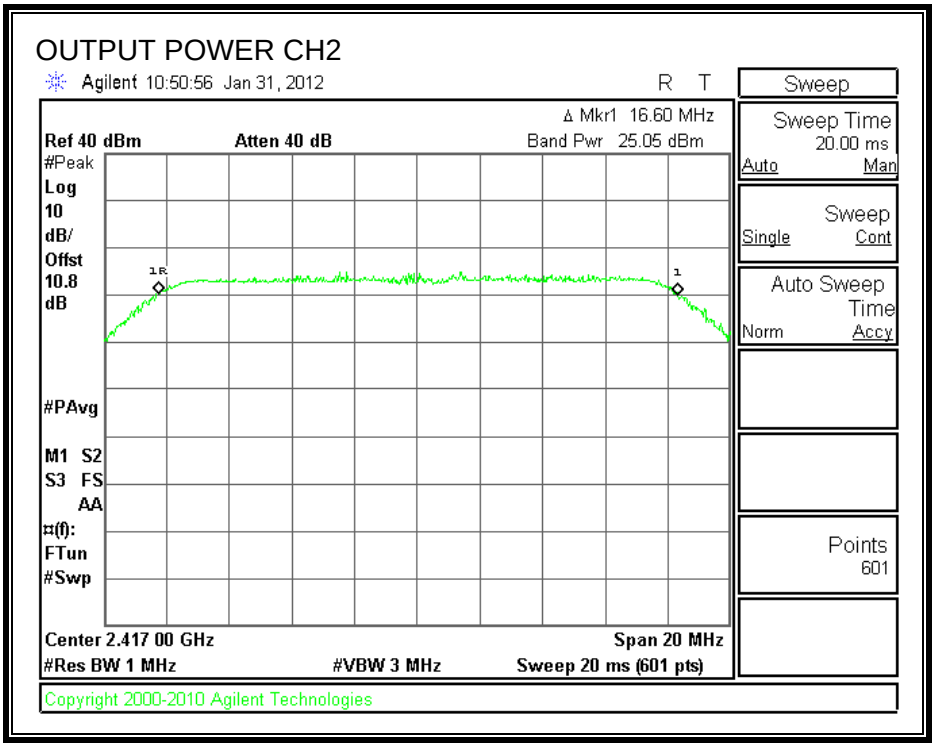
KDB 558074 dated 01/18/12.

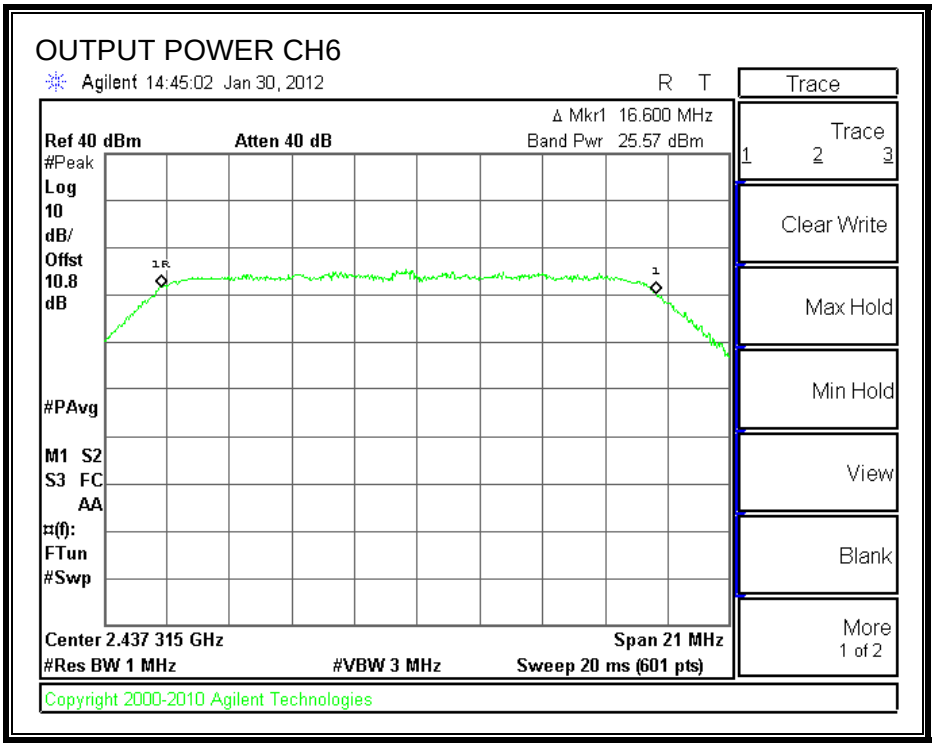
RESULTS

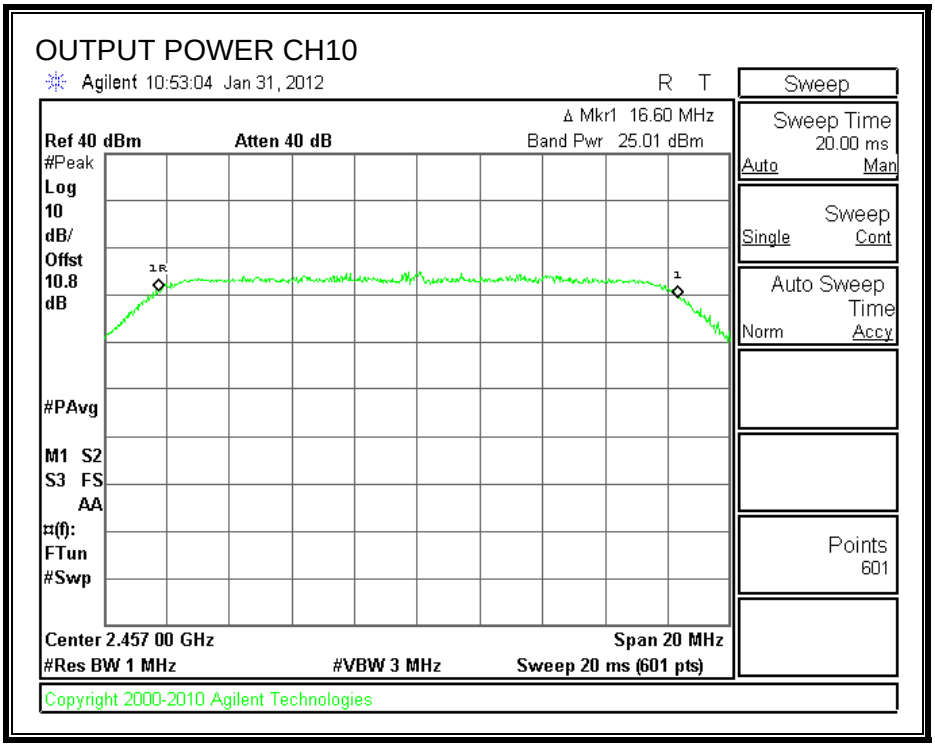
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH1	2412	24.83	30	-5.17
CH2	2417	25.05	30	-4.95
CH6	2437	25.57	30	-4.43
CH10	2457	25.01	30	-4.99
CH11	2462	24.93	30	-5.07

OUTPUT POWER

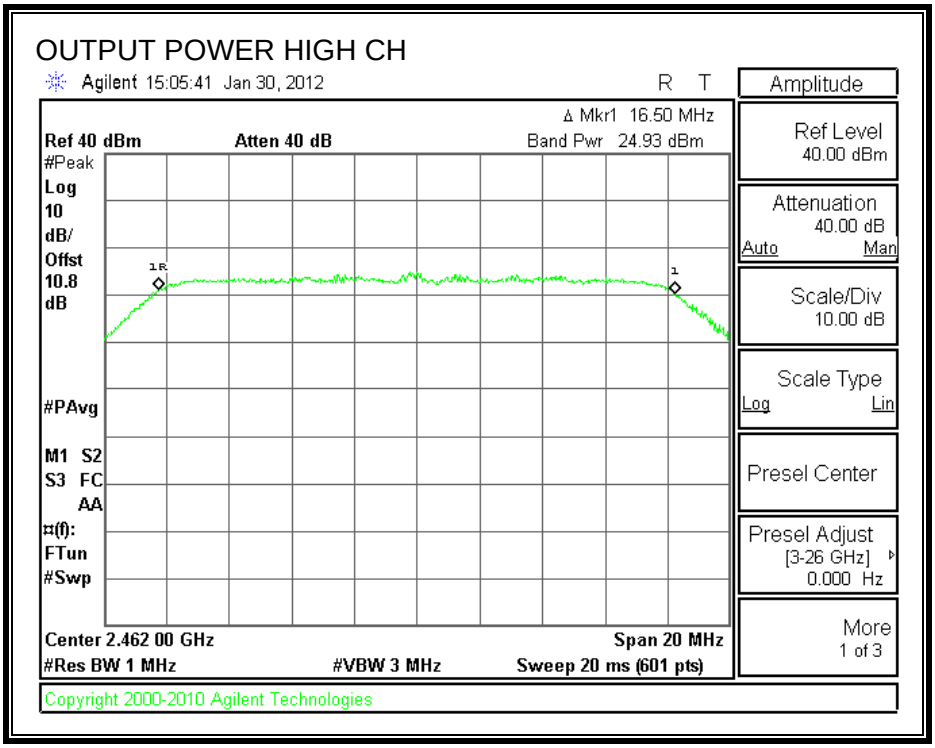








OUTPUT POWER HIGH CH



7.3.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
CH1	2412	16.00
CH2	2417	16.50
CH6	2437	16.50
CH10	2457	16.50
CH11	2462	16.00

POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

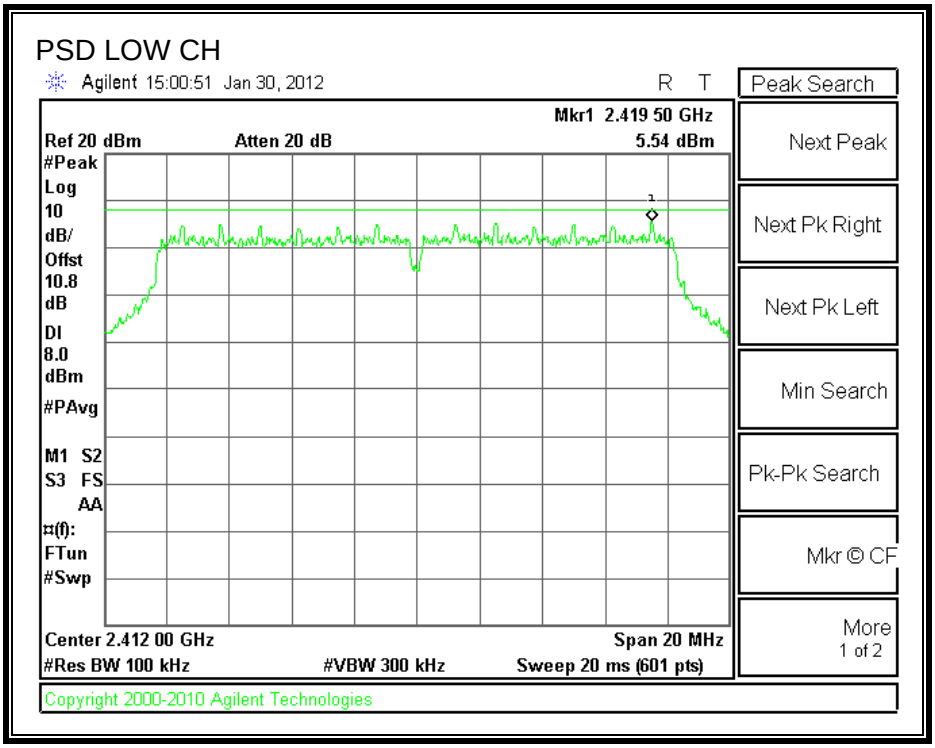
TEST PROCEDURE

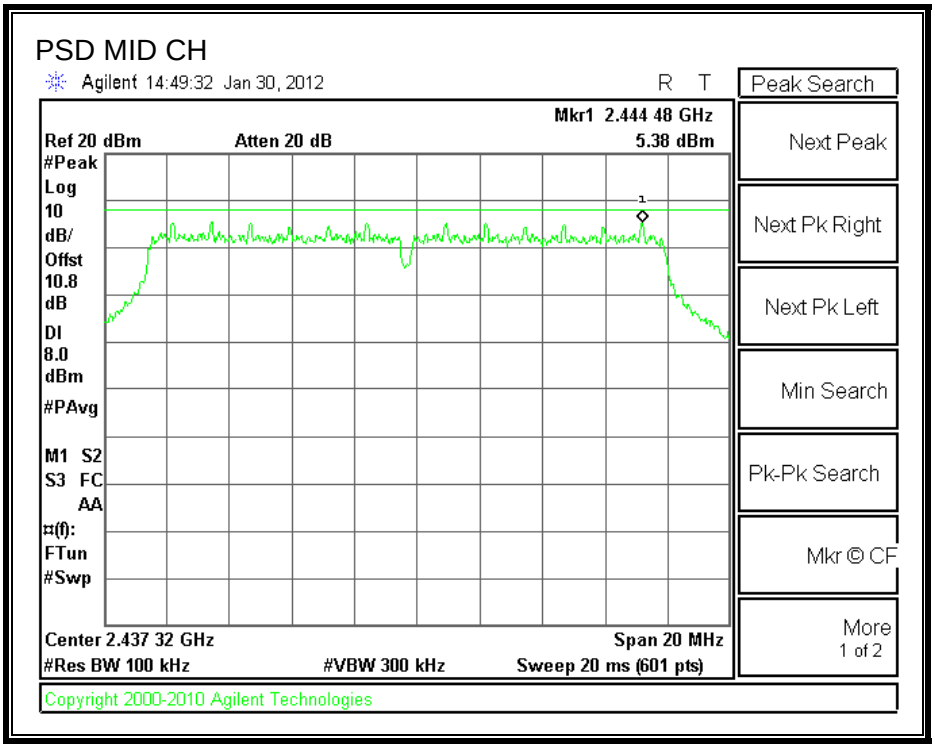
KDB 558074 dated 01/18/12.

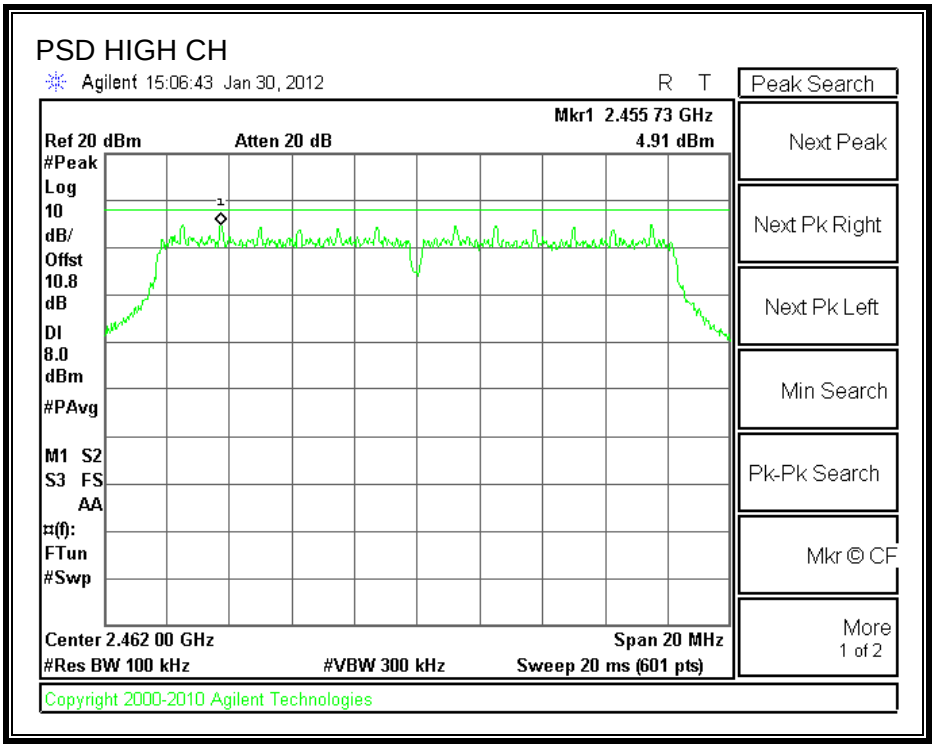
RESULTS

Channel	Frequency (MHz)	Marker Reading	10 log(3kHz/100kHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	5.54	15.2	-9.66	8	-17.66
Middle	2437	5.38	15.2	-9.82	8	-17.82
High	2462	4.91	15.2	-10.29	8	-18.29

POWER SPECTRAL DENSITY







7.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

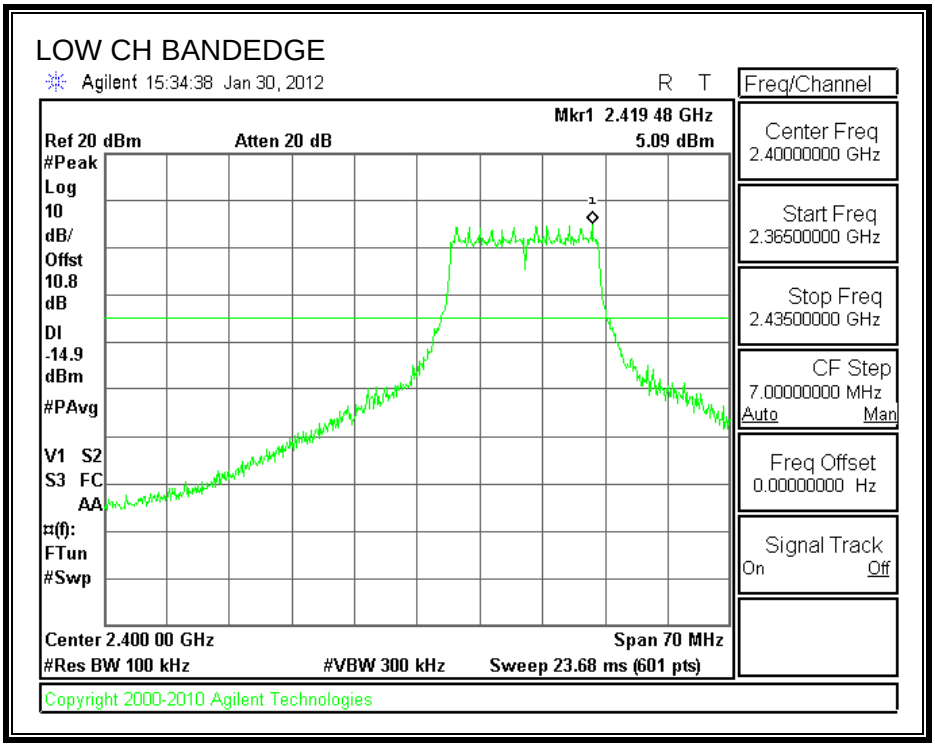
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

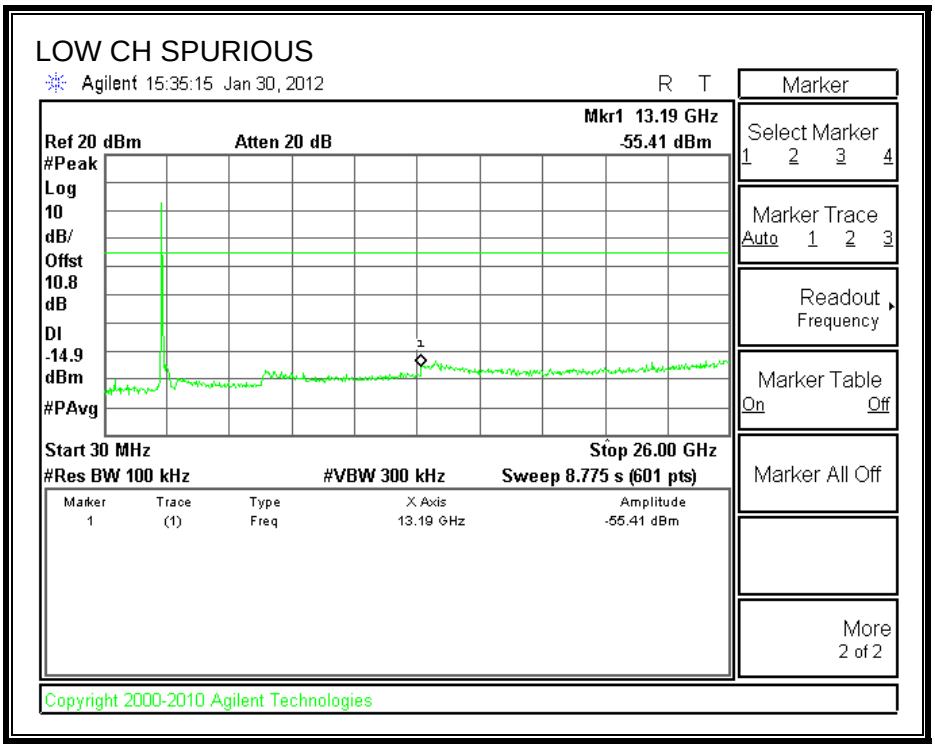
TEST PROCEDURE

KDB 558074 dated 01/18/12.

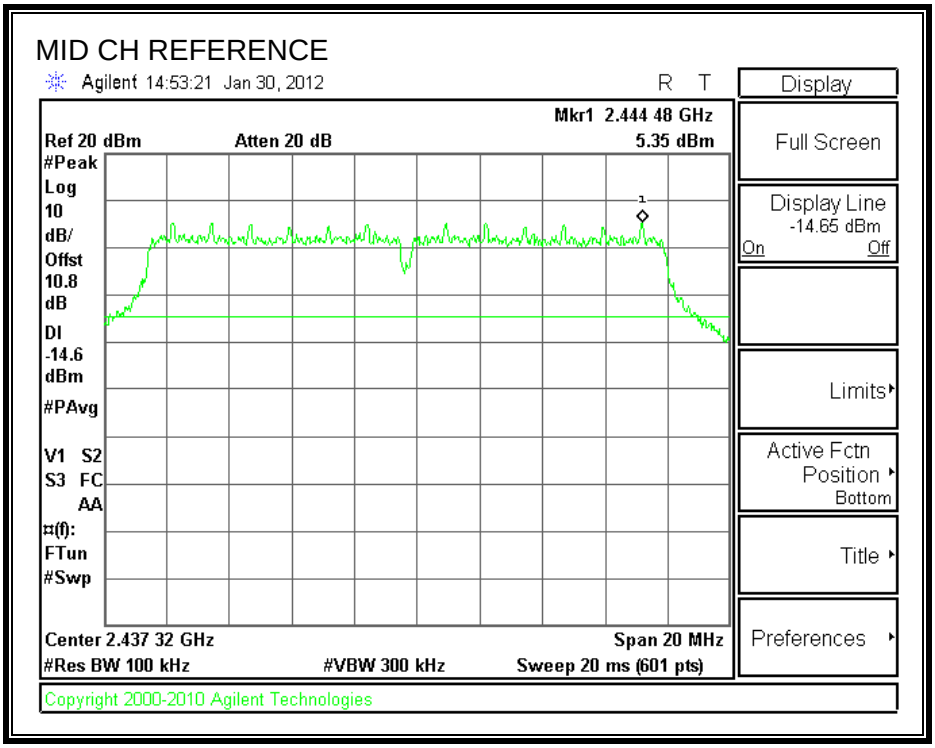
RESULTS

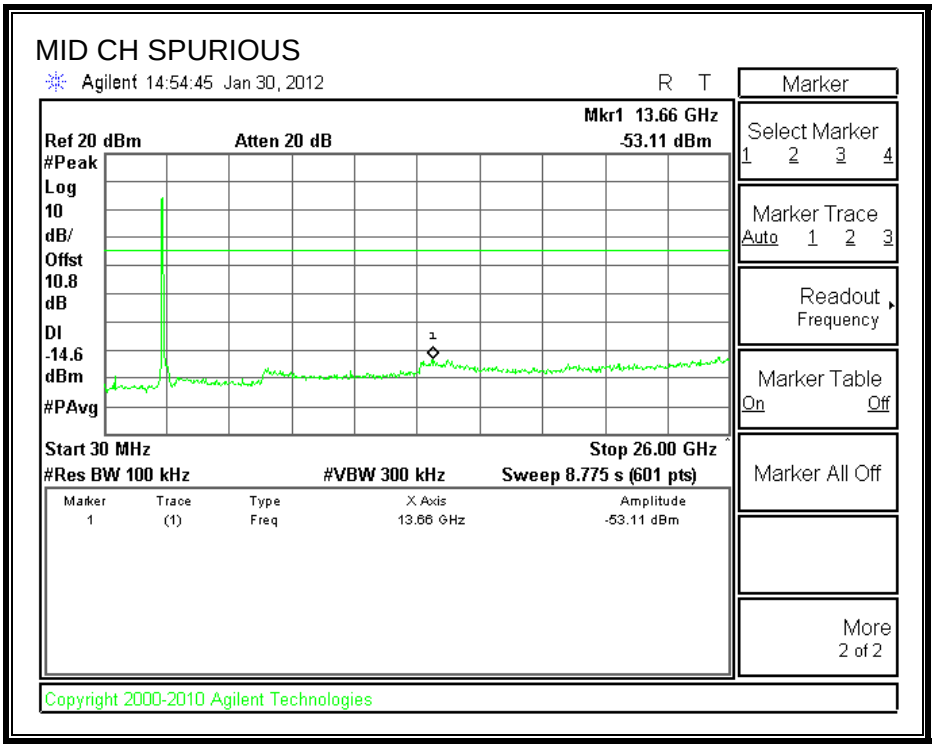
SPURIOUS EMISSIONS, LOW CHANNEL



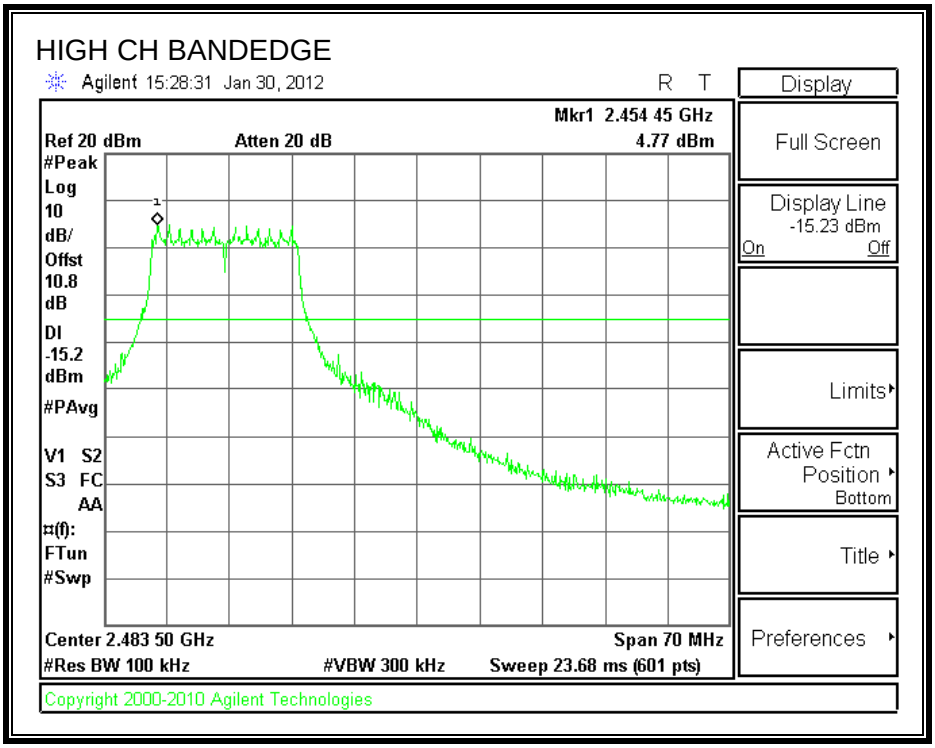


SPURIOUS EMISSIONS, MID CHANNEL

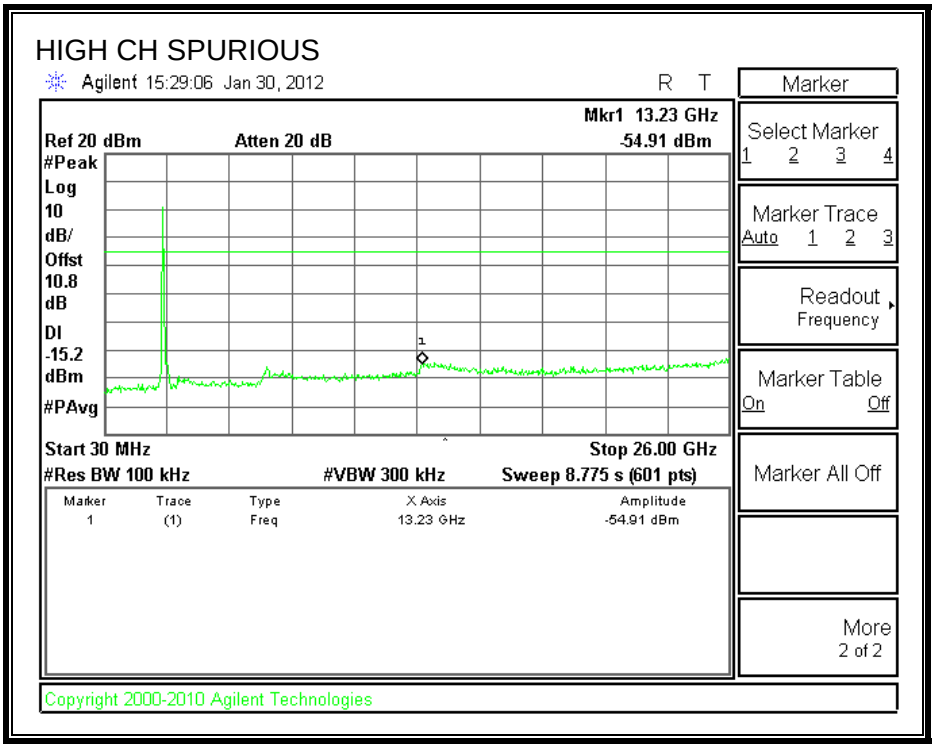




HIGH CH BANDEDGE



HIGH CH SPURIOUS



7.4. 802.11n HT20 MODE IN THE 2.4 GHz BAND

7.4.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

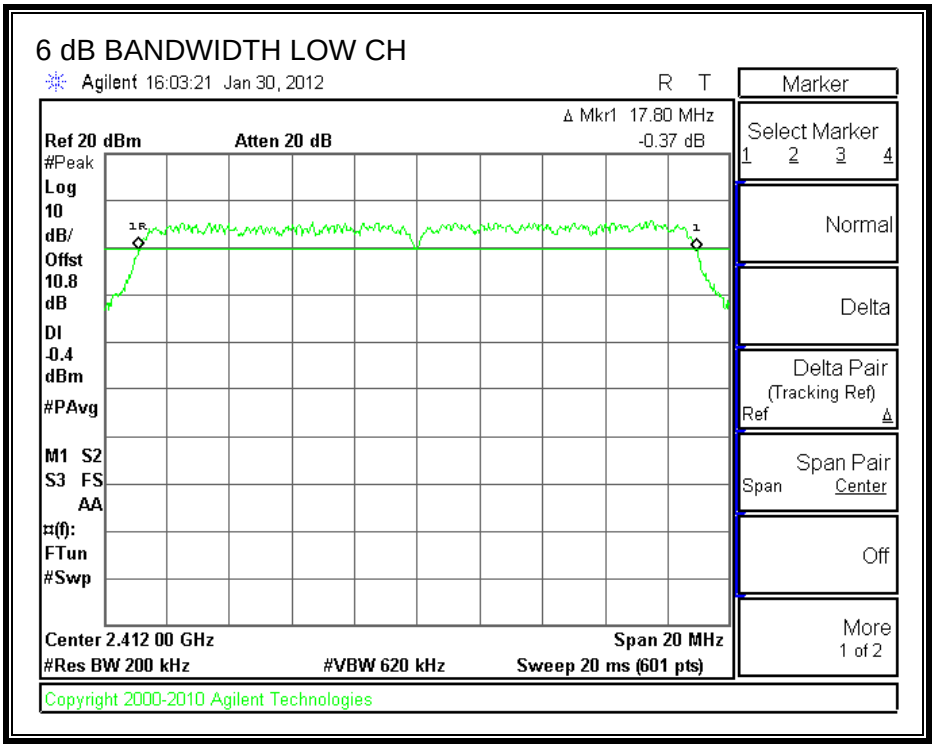
TEST PROCEDURE

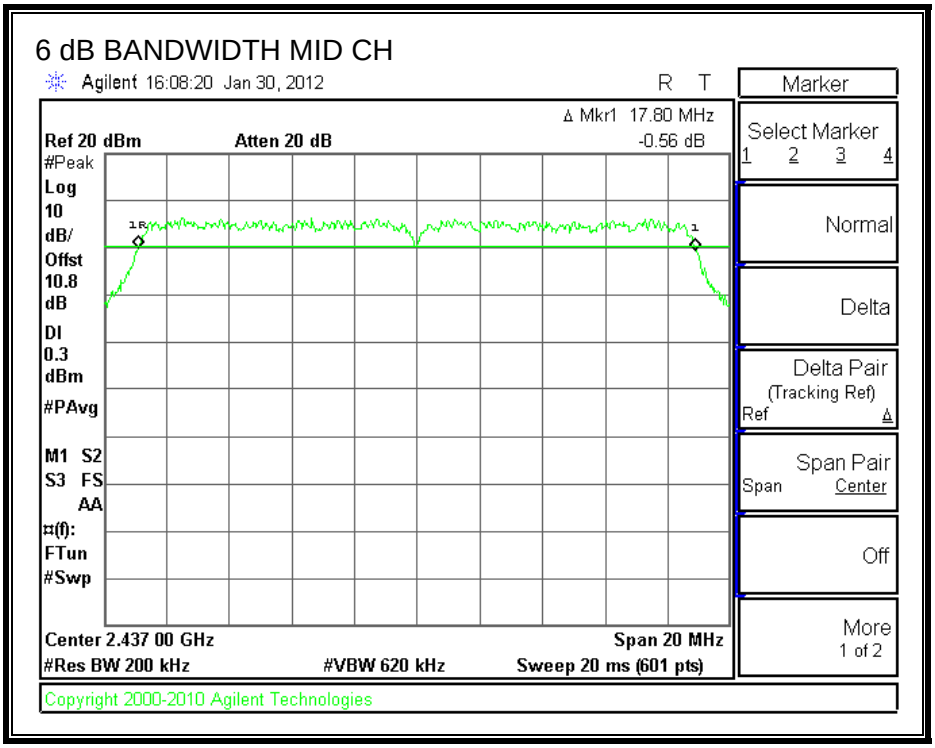
KDB 558074 dated 01/18/12.

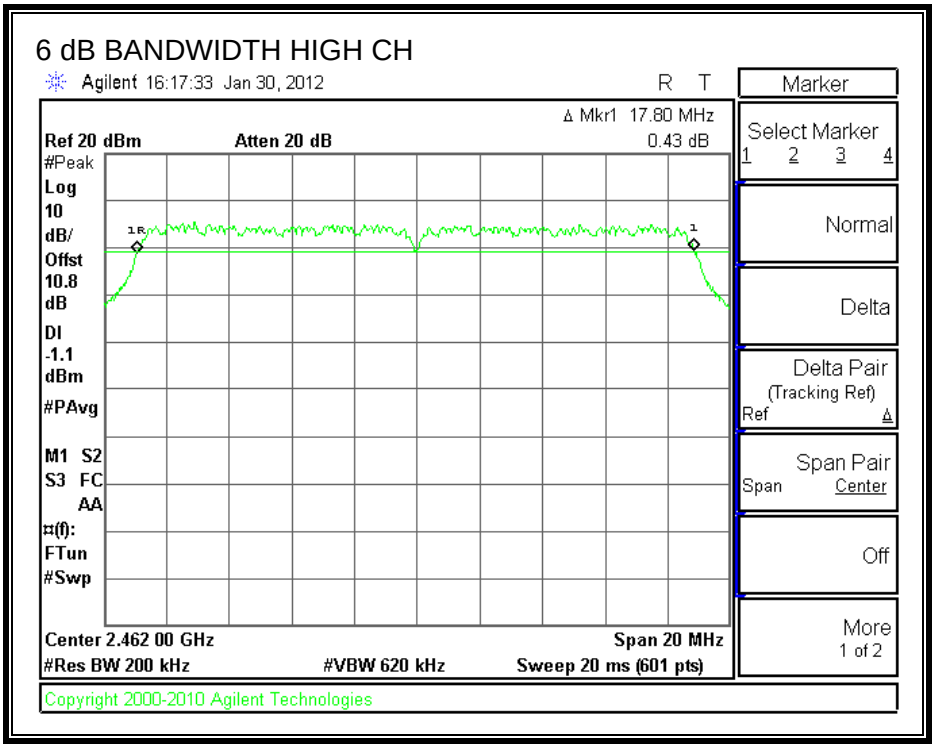
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	17.80	0.5
Middle	2437	17.80	0.5
High	2462	17.80	0.5

6 dB BANDWIDTH







7.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

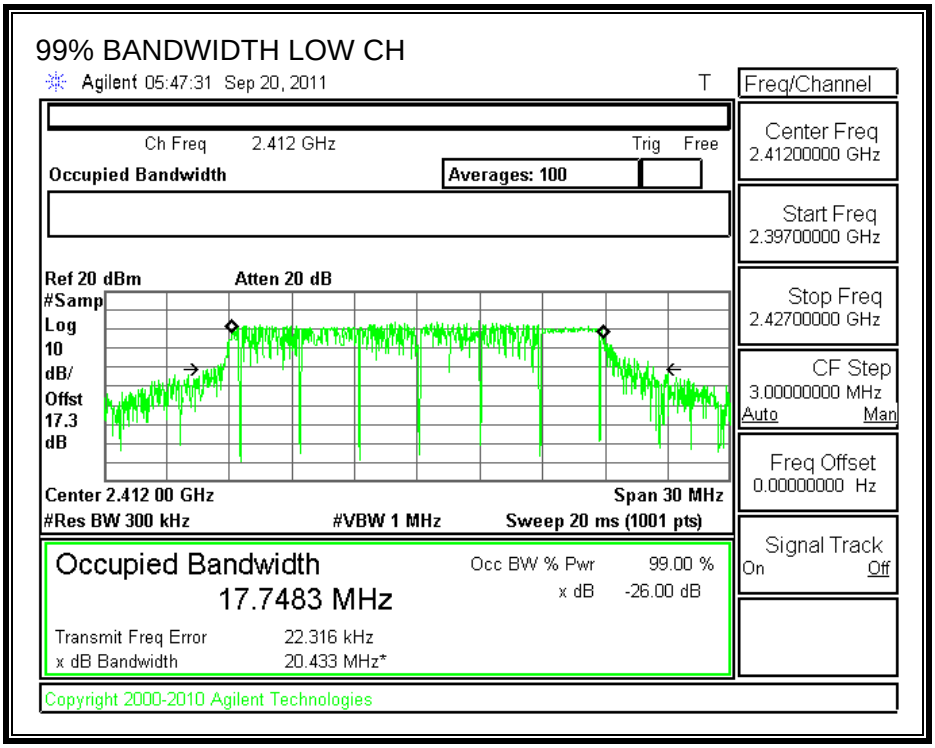
TEST PROCEDURE

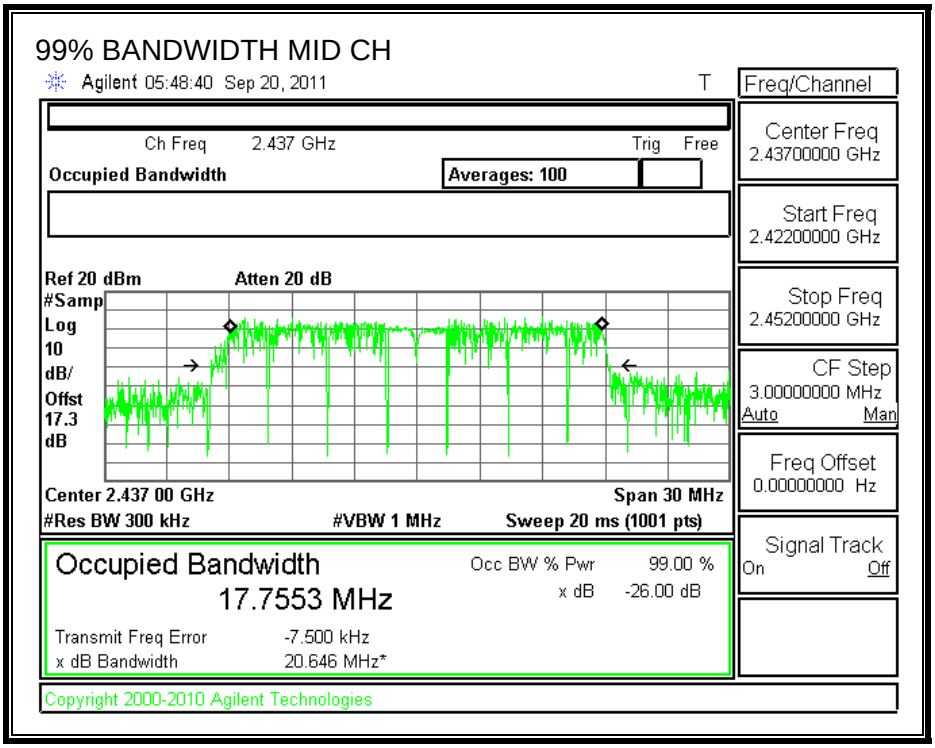
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

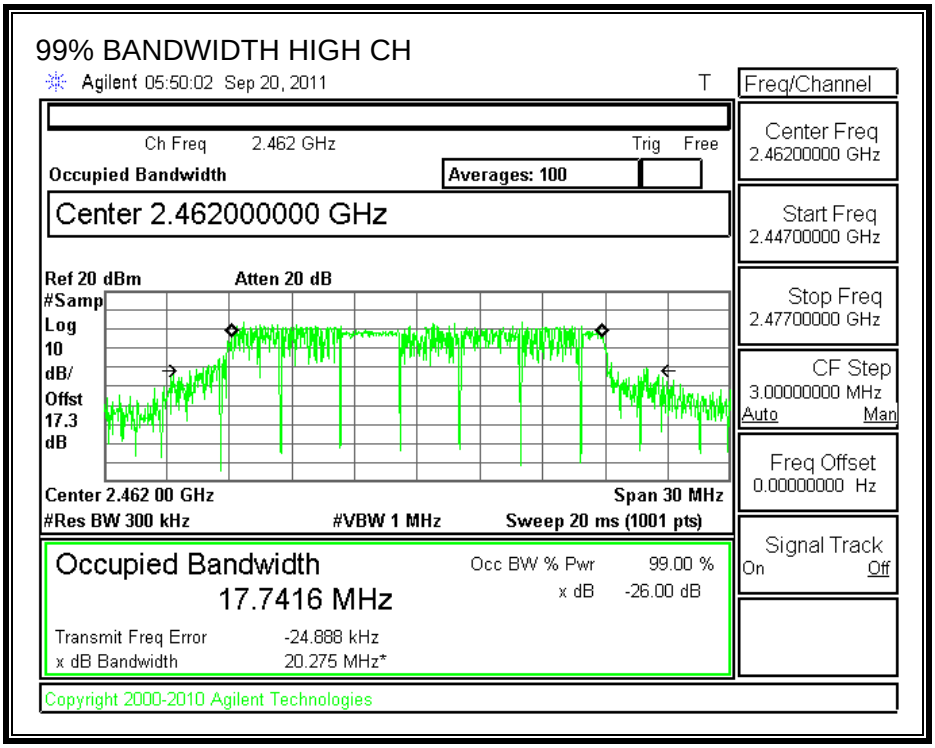
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	17.7483
Middle	2437	17.7553
High	2462	17.7416

99% BANDWIDTH







7.4.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum effective legacy gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

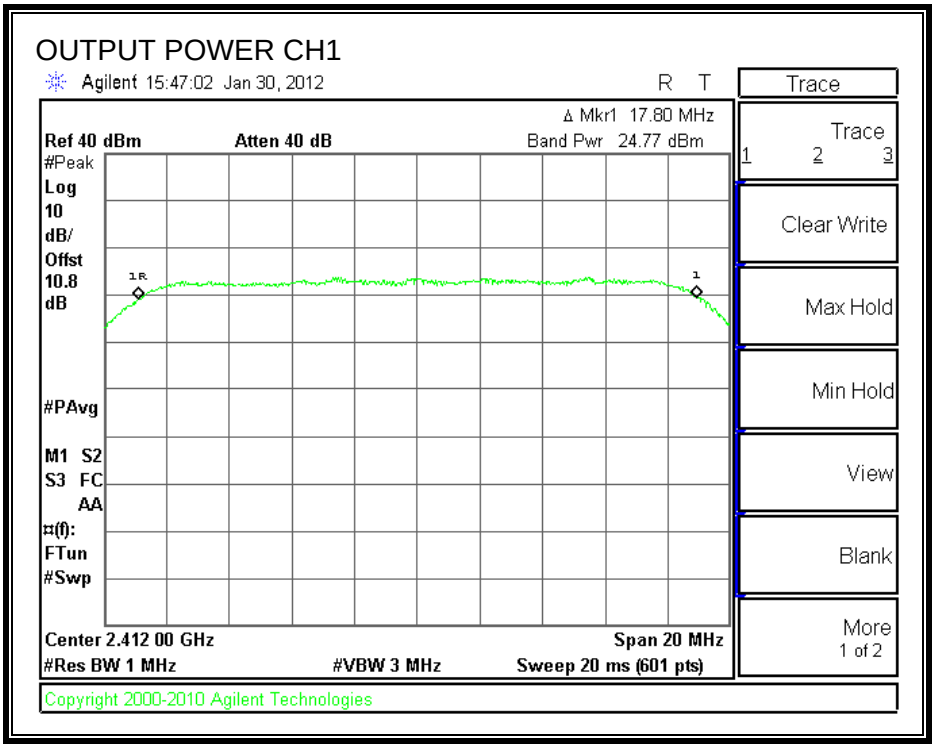
TEST PROCEDURE

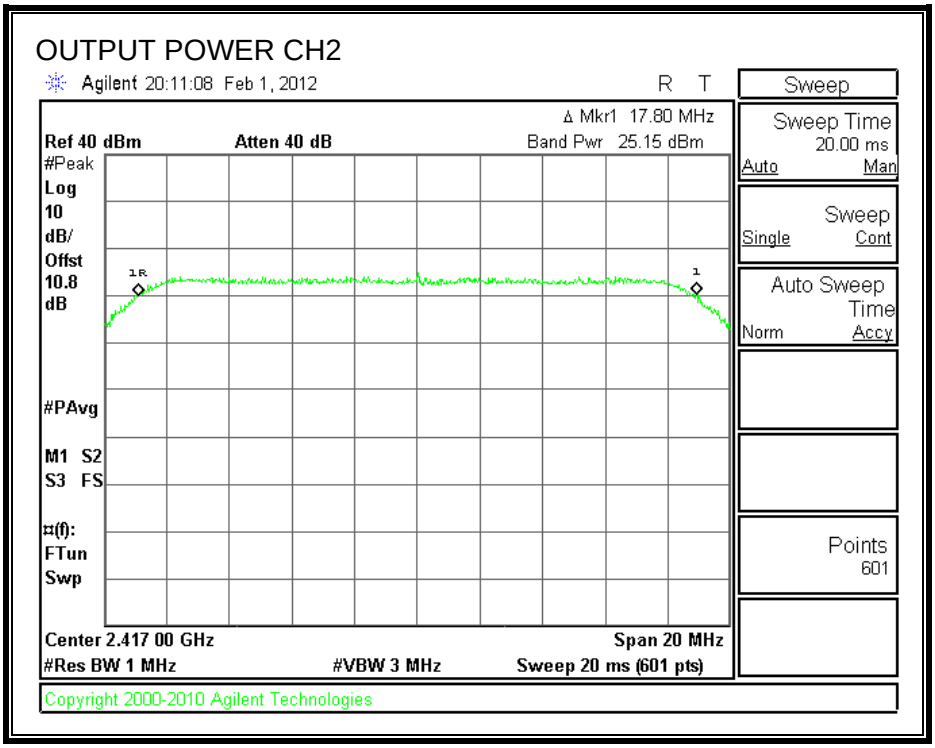
KDB 558074 dated 01/18/12.

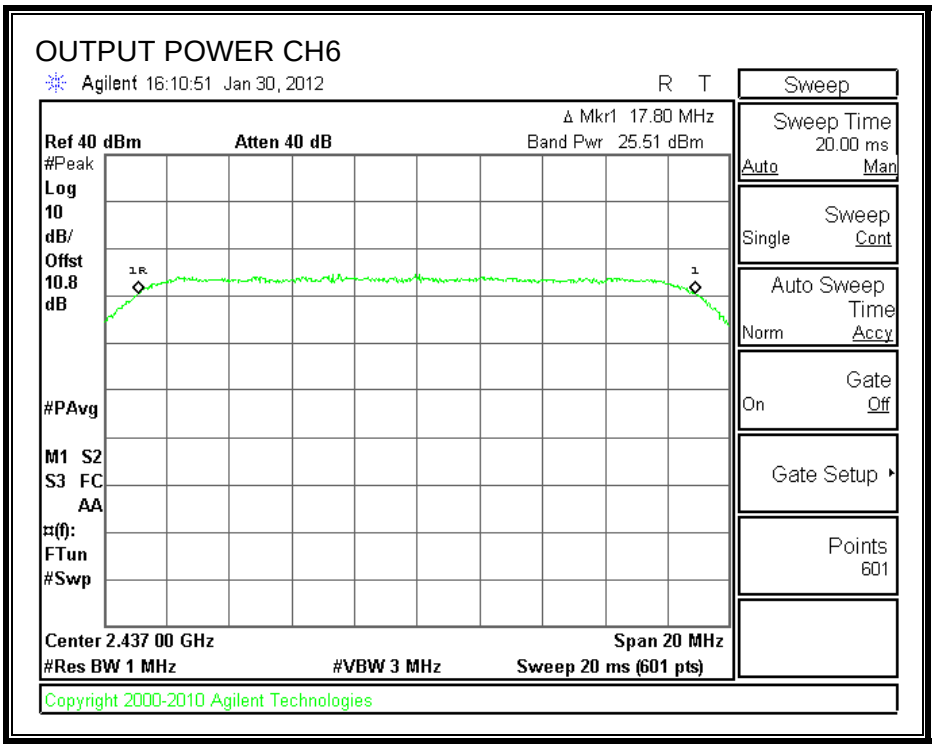
RESULTS

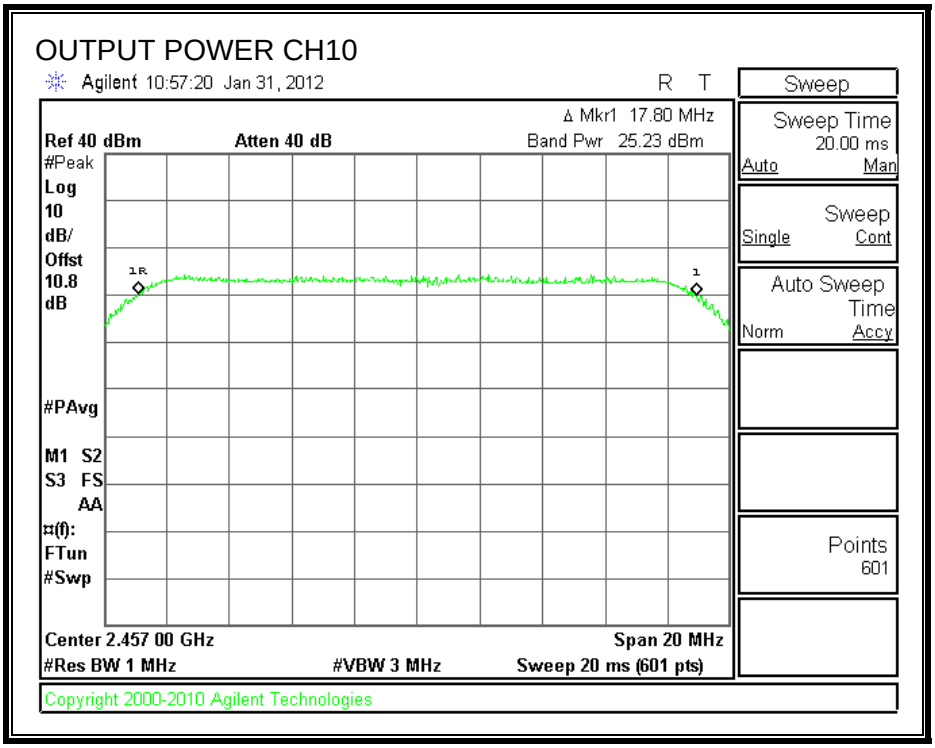
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
CH1	2412	24.77	30	-5.23
CH2	2417	25.15	30	-4.82
CH6	2437	25.51	30	-4.49
CH10	2457	25.23	30	-4.99
CH11	2462	24.25	30	-5.75

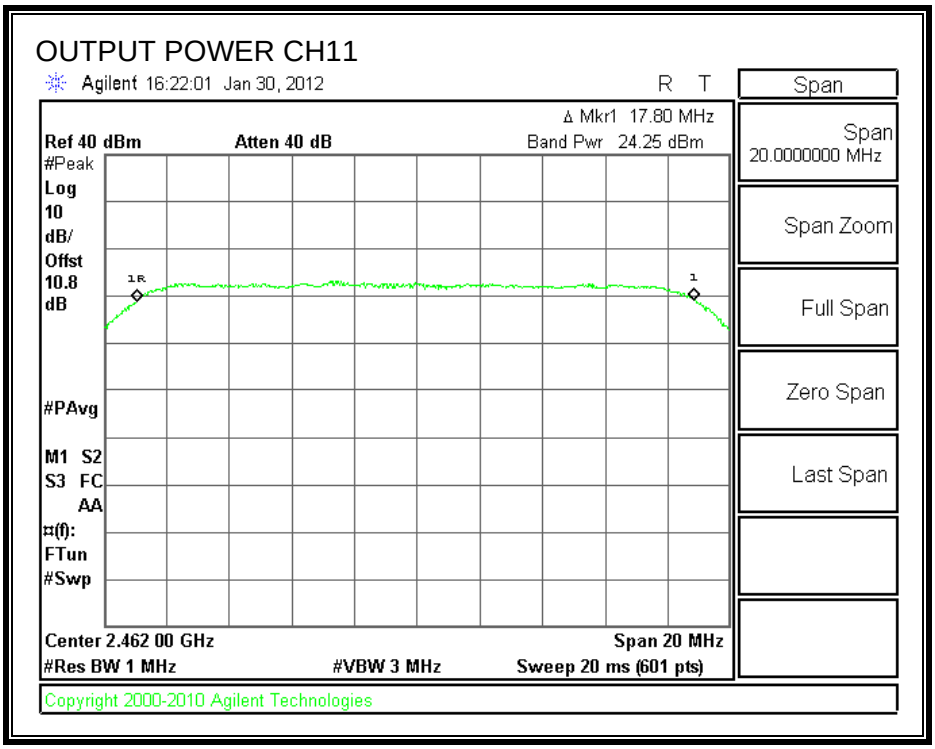
OUTPUT POWER











7.4.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
CH1	2412	15.50
CH2	2417	16.50
CH6	2437	16.50
CH10	2457	16.50
CH11	2462	15.00

7.4.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

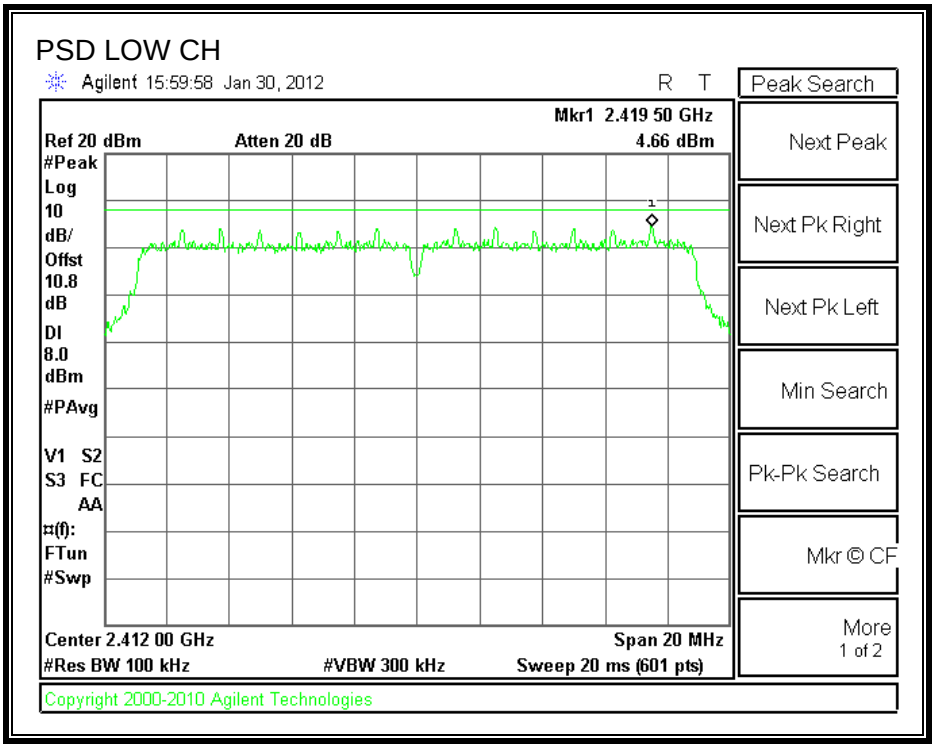
TEST PROCEDURE

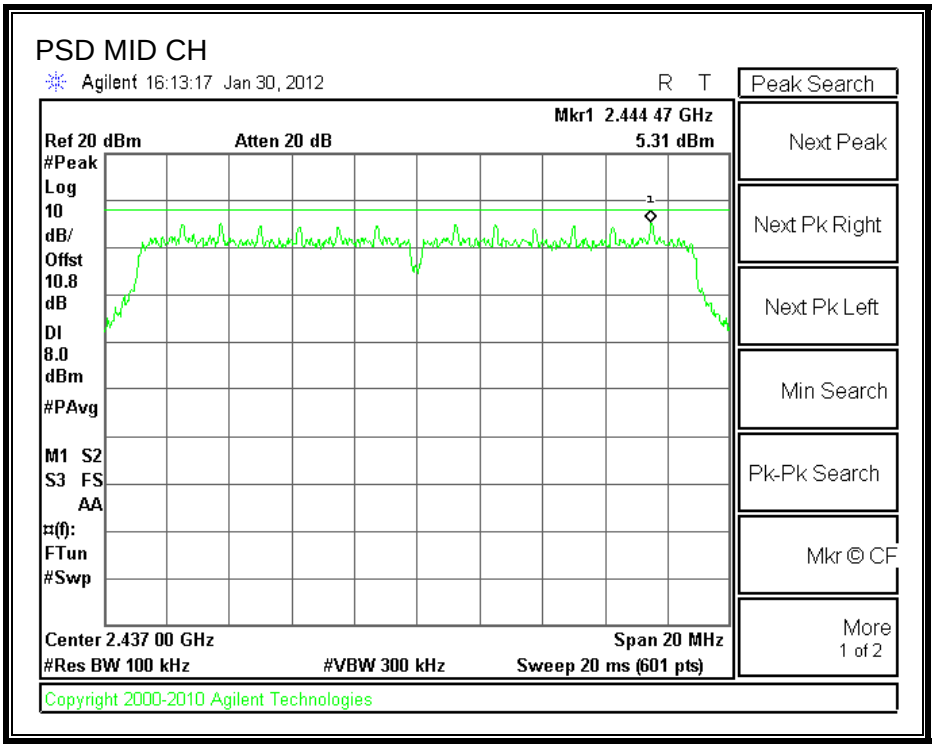
KDB 558074 dated 01/18/12.

RESULTS

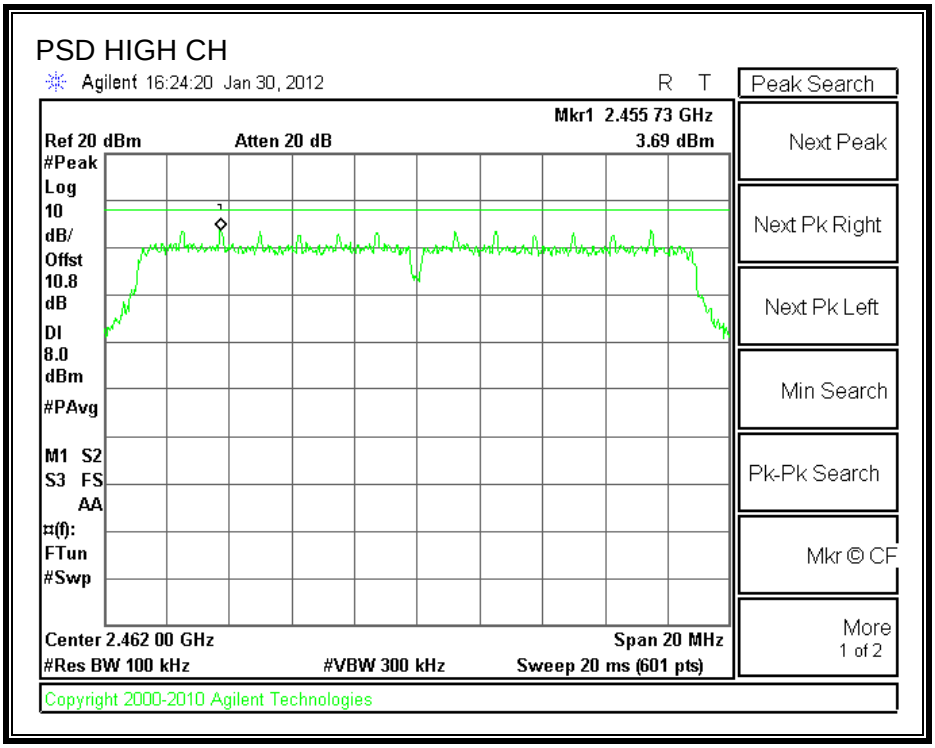
Channel	Frequency (MHz)	Marker Reading	10 log(3kHz/100kHz)	PPSD (dBm)	Limit (dBm)
Low	2412	4.66	15.2	-10.54	8
Middle	2437	5.31	15.2	-9.89	8
High	2462	3.69	15.2	-11.51	8

POWER SPECTRAL DENSITY





PSD HIGH CH



7.4.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

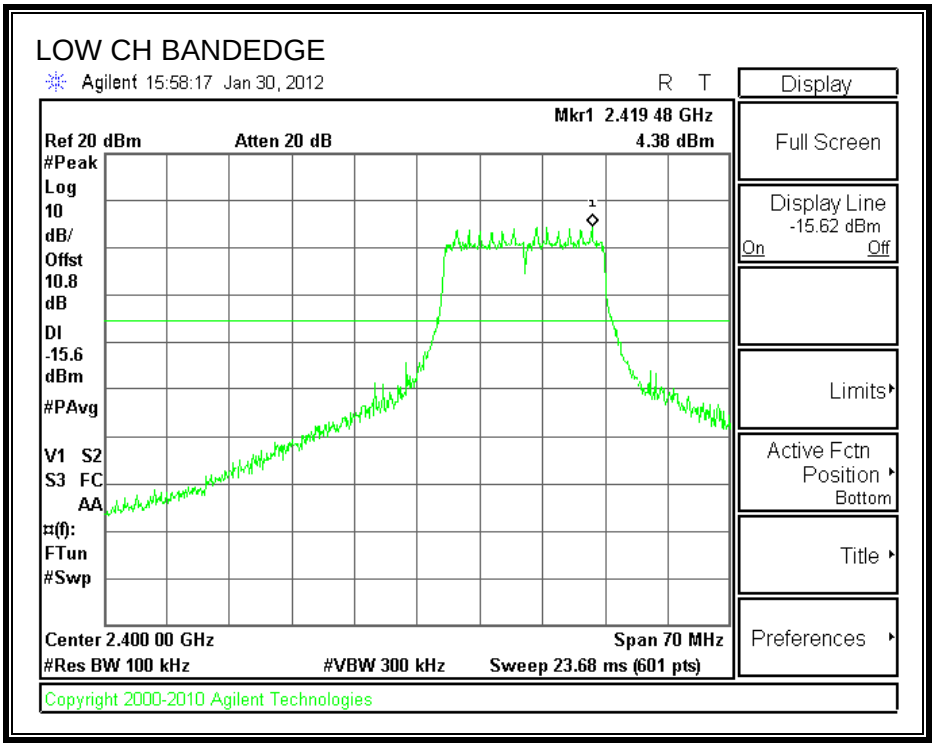
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

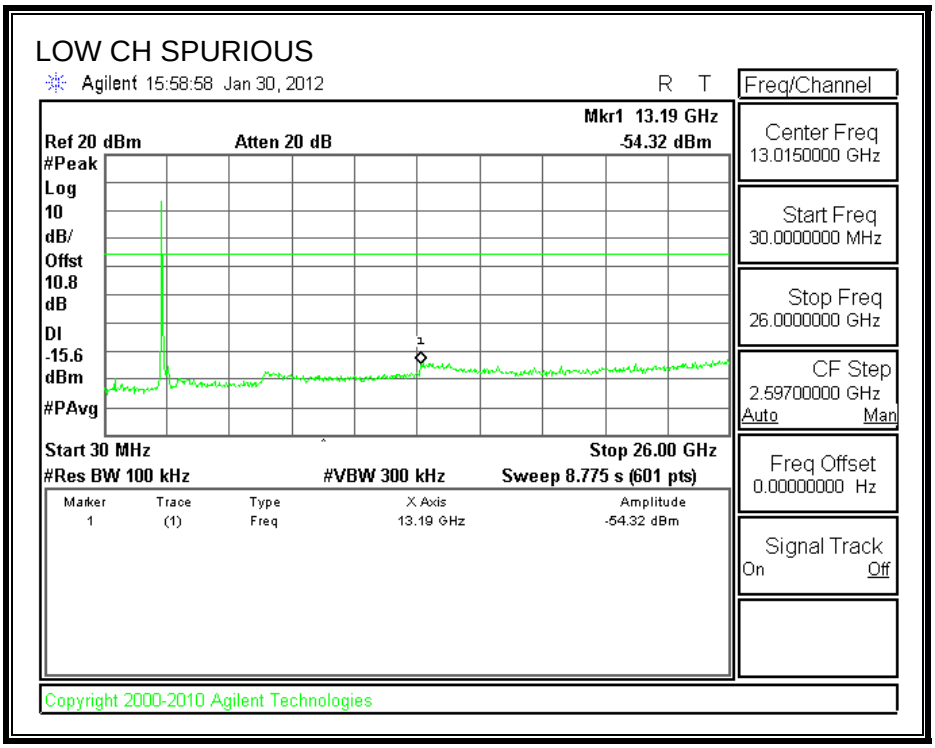
TEST PROCEDURE

KDB 558074 dated 01/18/12.

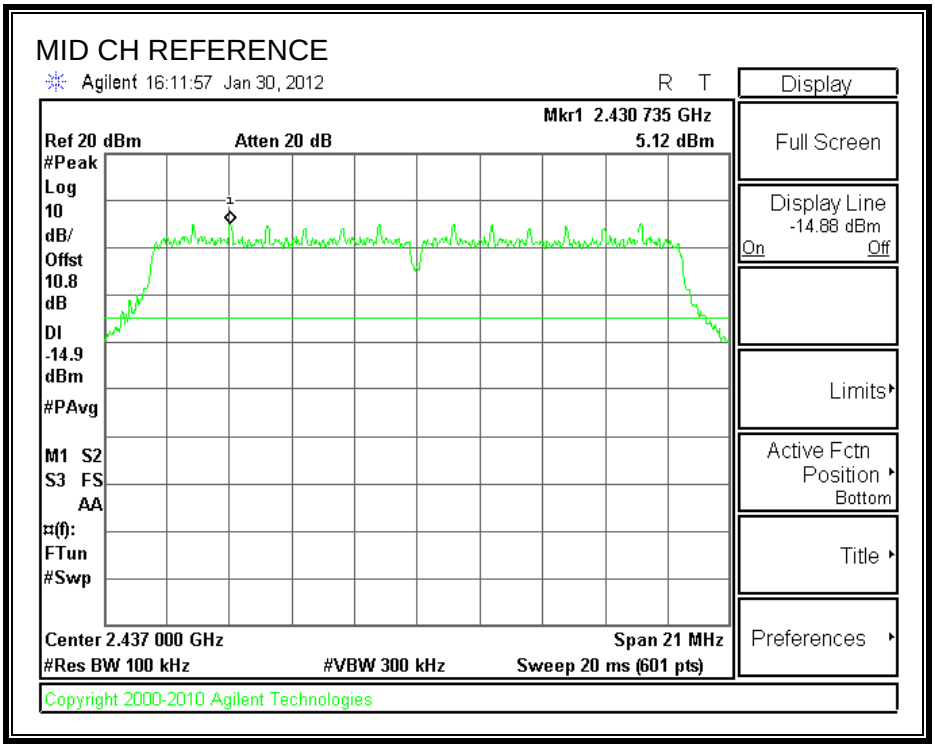
RESULTS

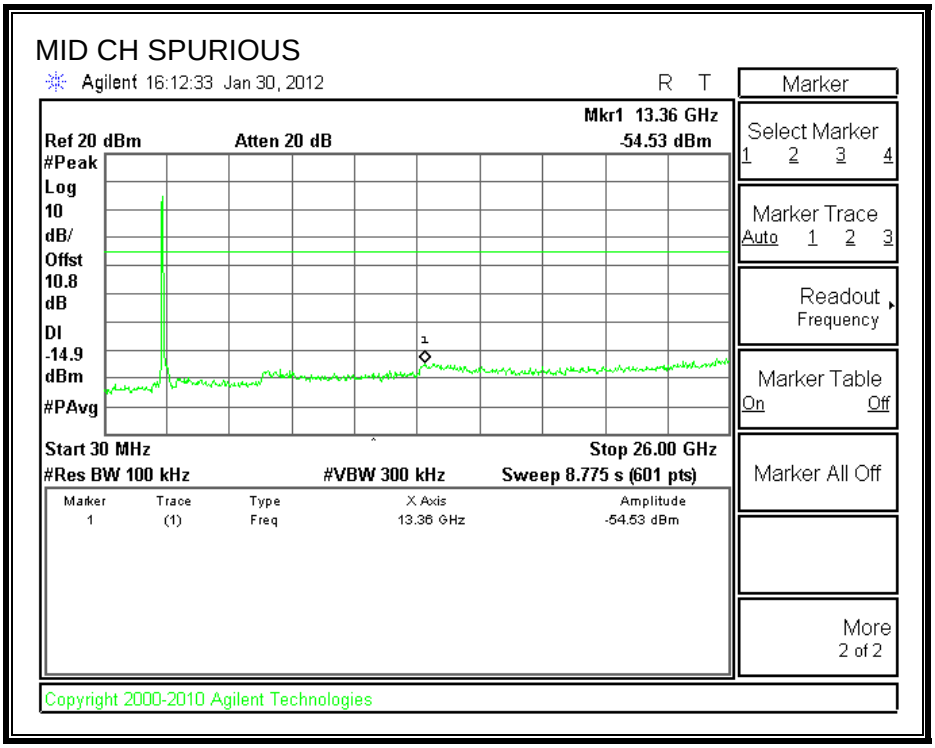
SPURIOUS EMISSIONS, LOW CHANNEL



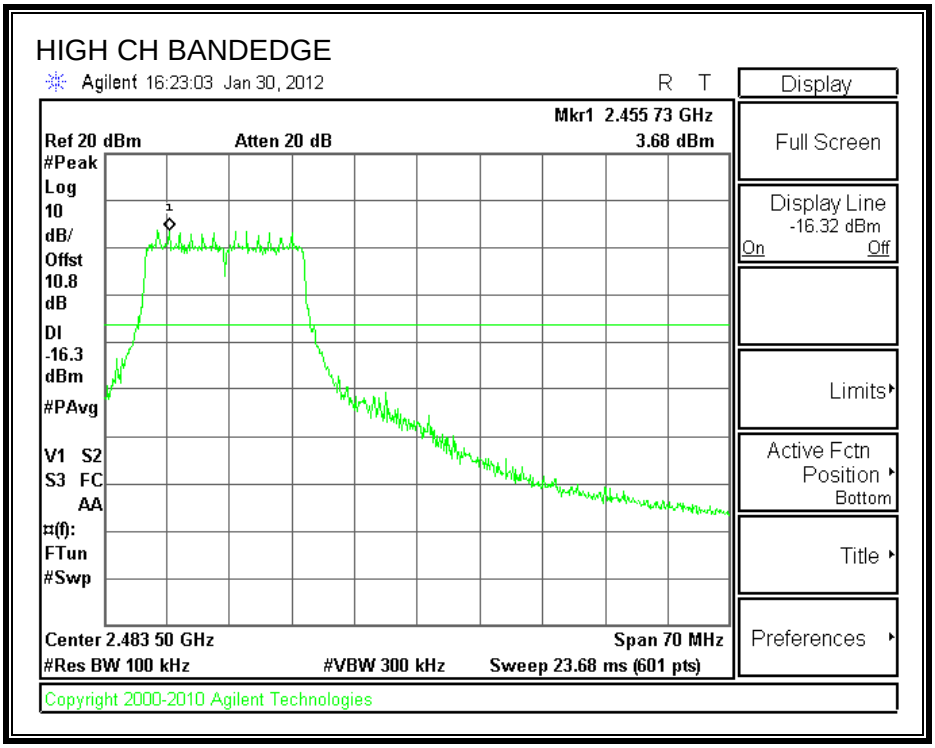


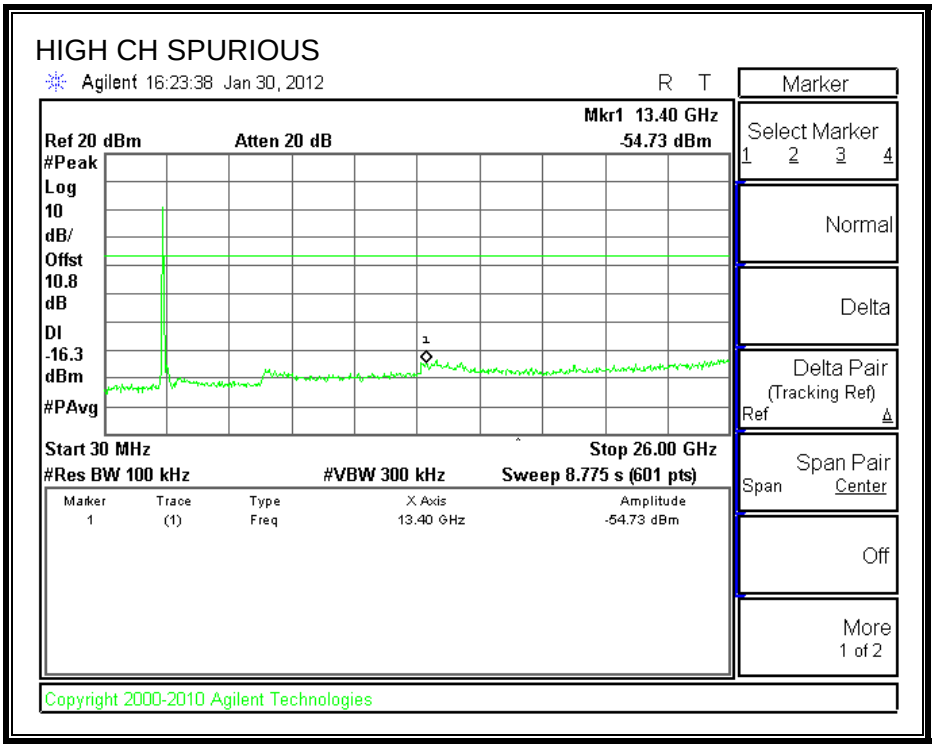
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





7.5. 802.11a MODE IN THE 5.8 GHz BAND

7.5.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

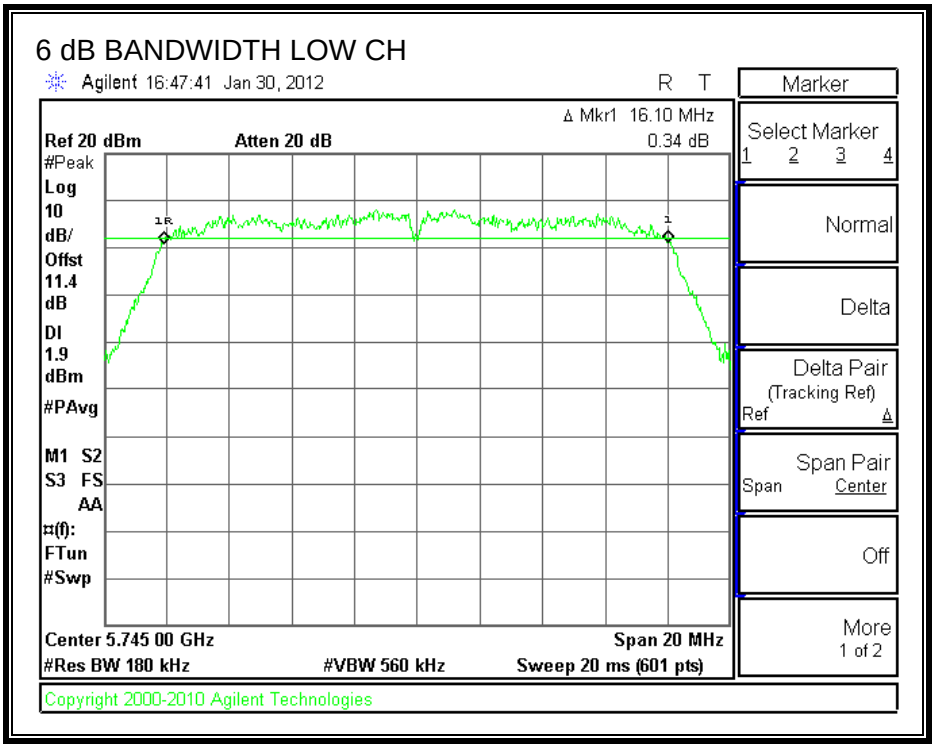
TEST PROCEDURE

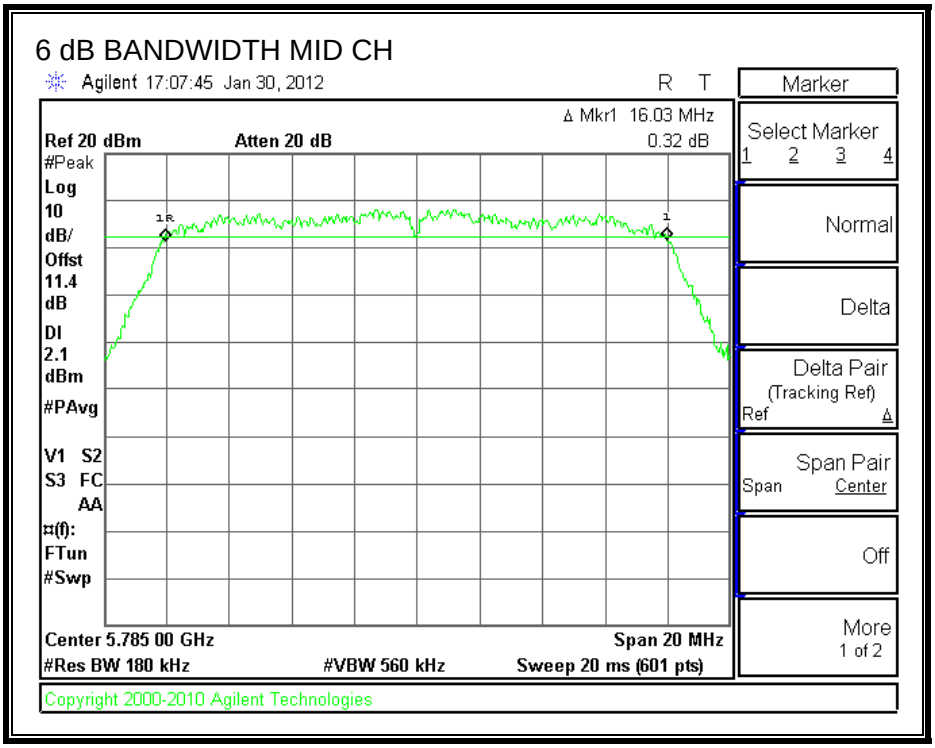
KDB 558074 dated 01/18/12.

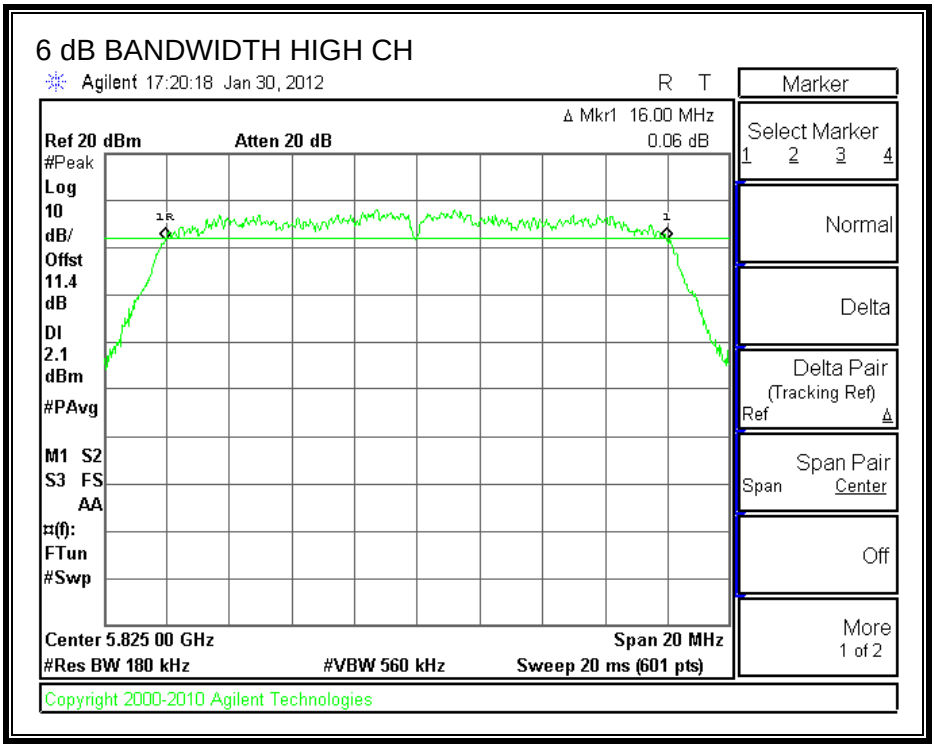
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5745	16.10	0.5
Middle	5785	16.03	0.5
High	5825	16.00	0.5

6 dB BANDWIDTH







7.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

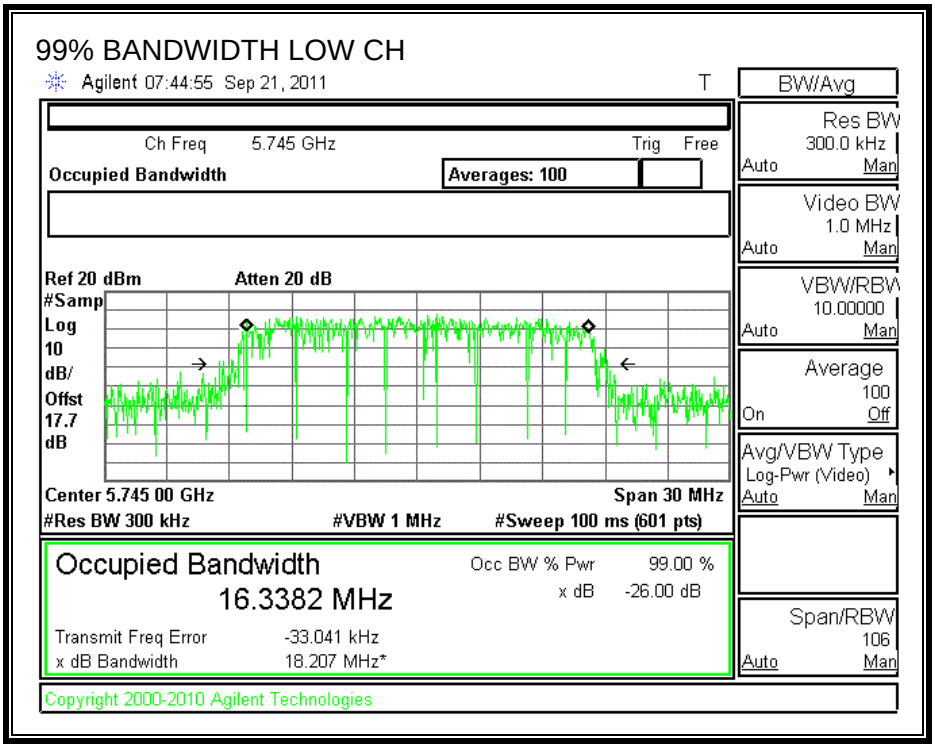
TEST PROCEDURE

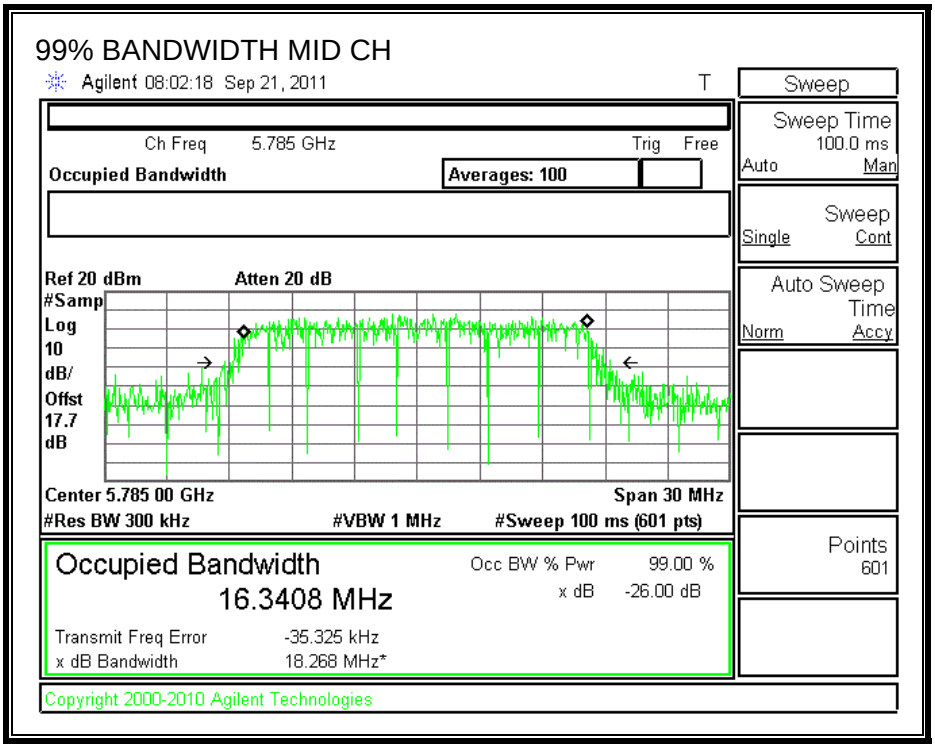
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

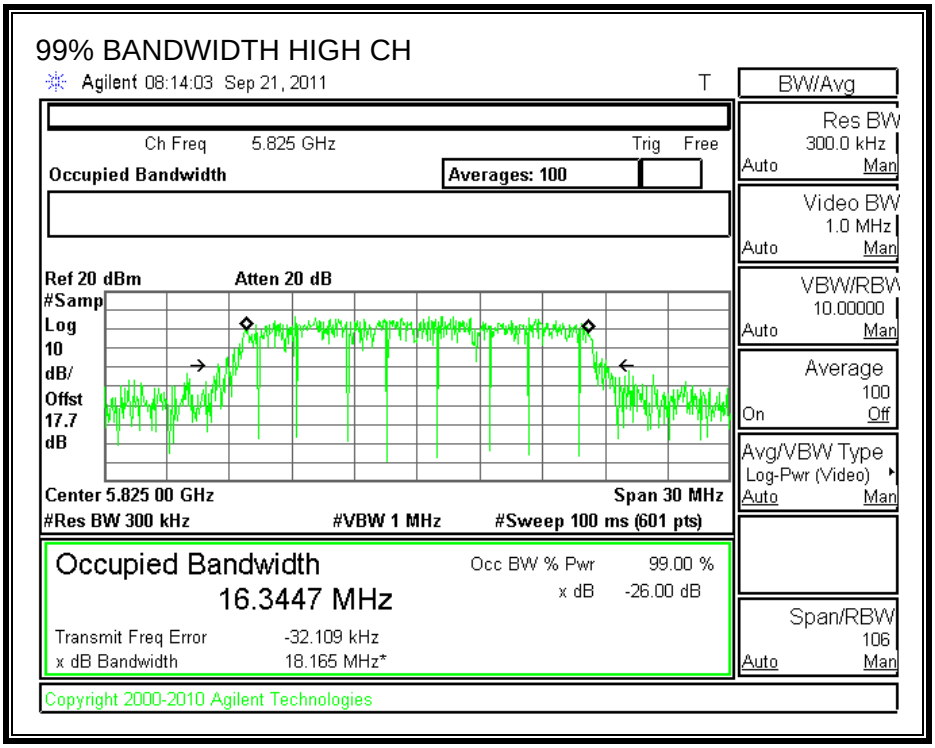
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	16.3382
Middle	5785	16.3408
High	5825	16.3447

99% BANDWIDTH







7.5.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

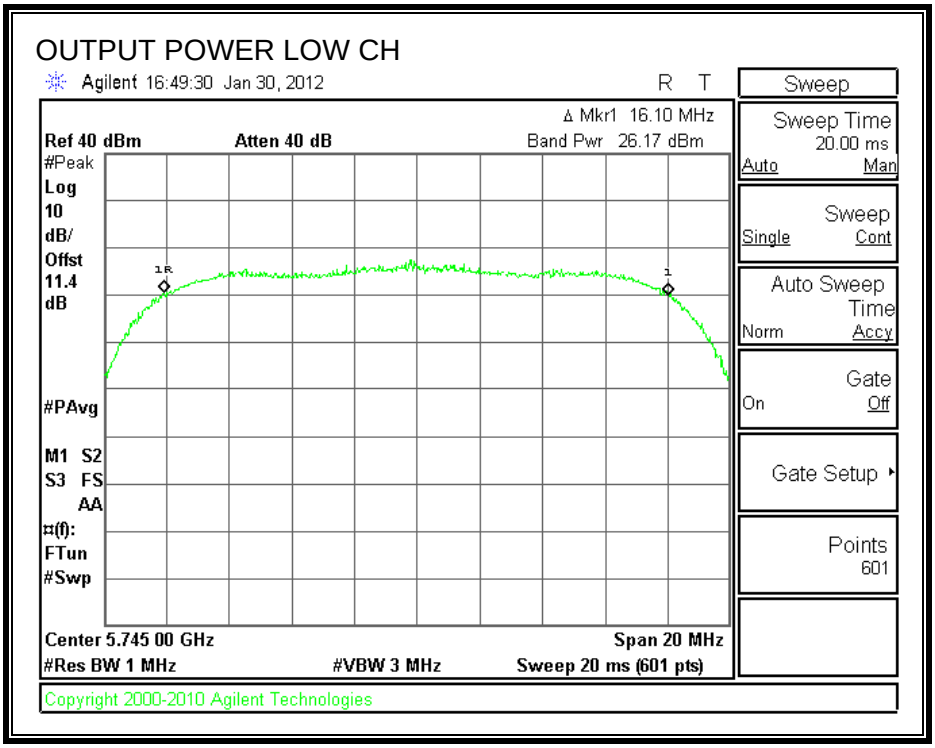
TEST PROCEDURE

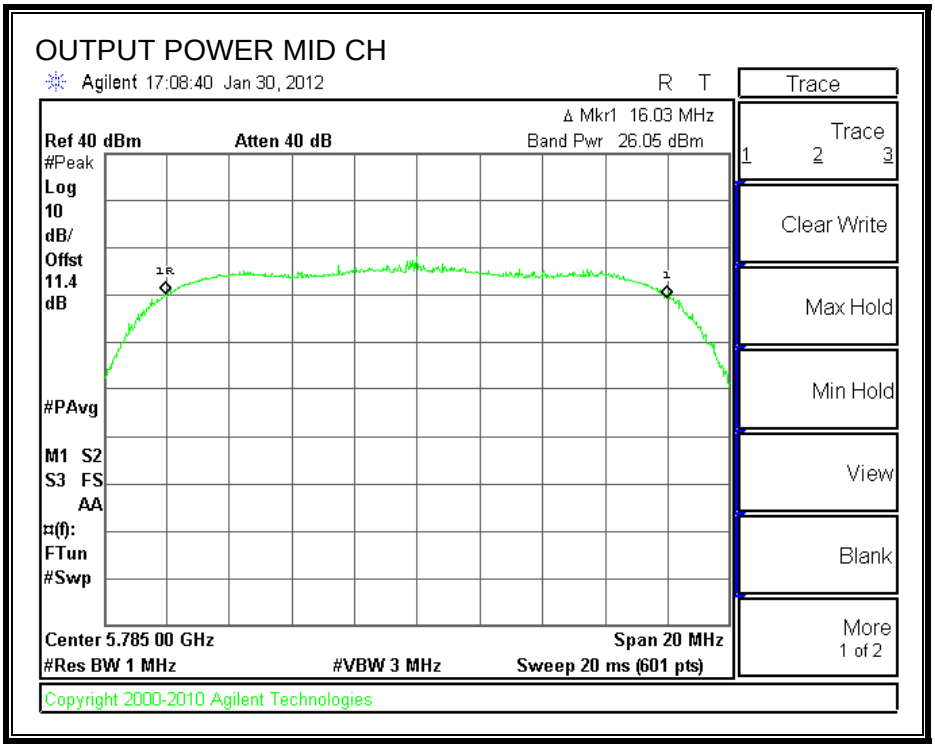
KDB 558074 dated 01/18/12.

RESULTS

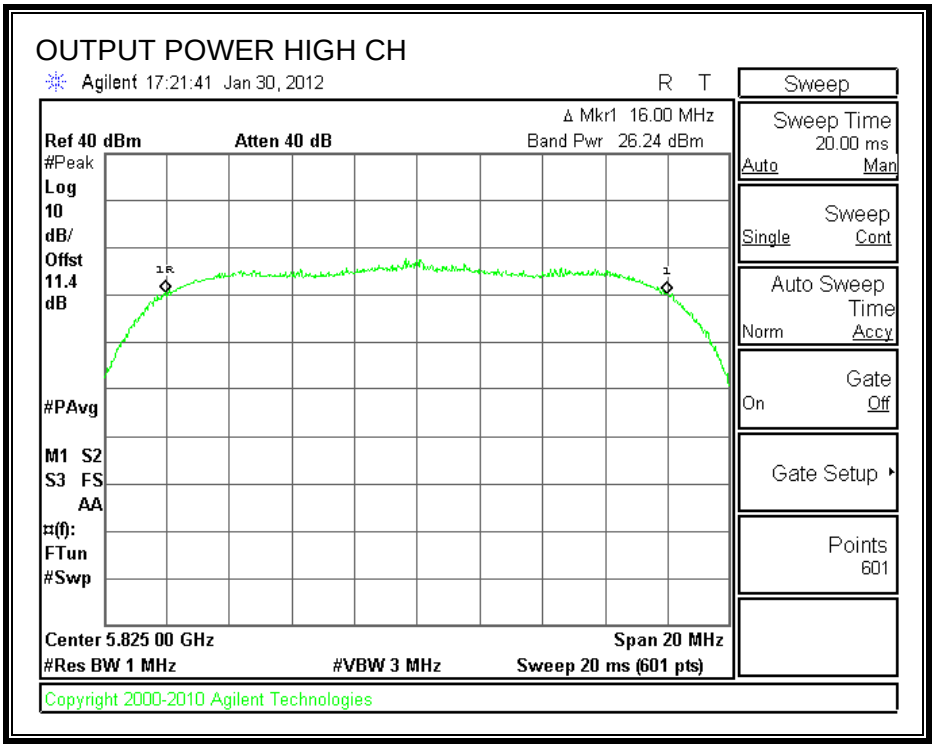
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	26.17	30	-3.83
Middle	5785	26.05	30	-3.95
High	5825	26.24	30	-3.76

OUTPUT POWER





OUTPUT POWER HIGH CH



7.5.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.4 dB (including 10 dB pad1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	5745	17.50
Middle	5785	17.50
High	5825	17.50

7.5.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

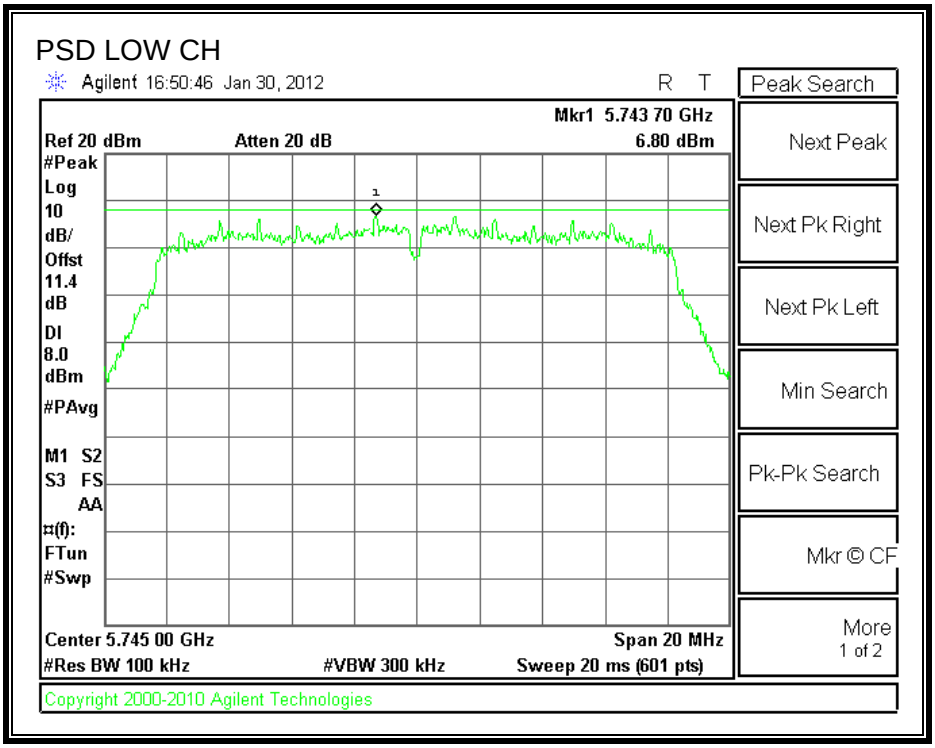
TEST PROCEDURE

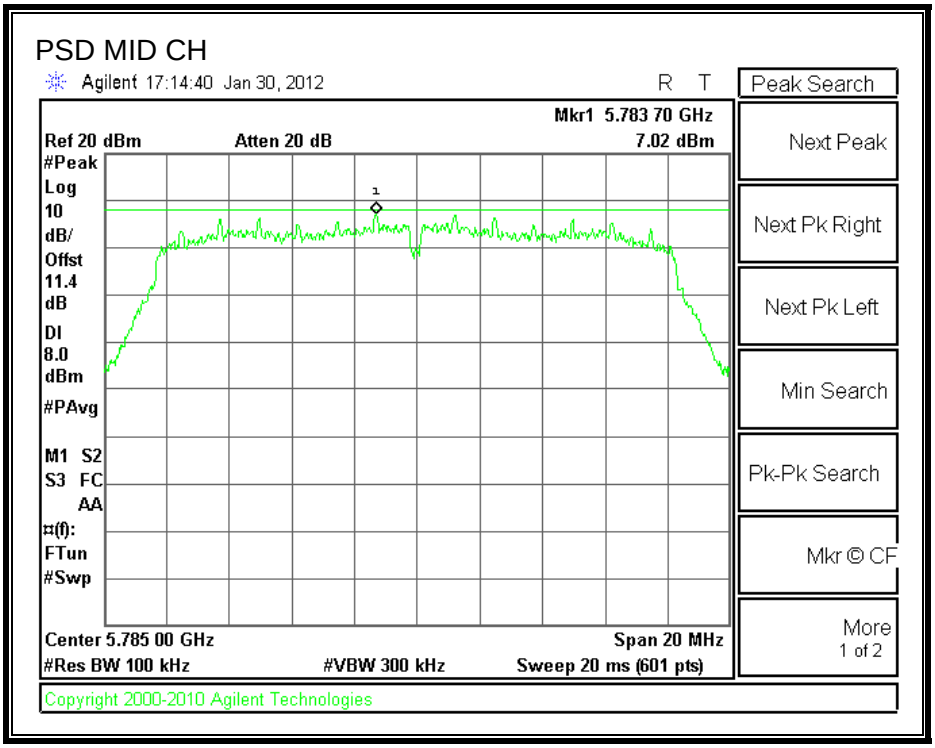
KDB 558074 dated 01/18/12.

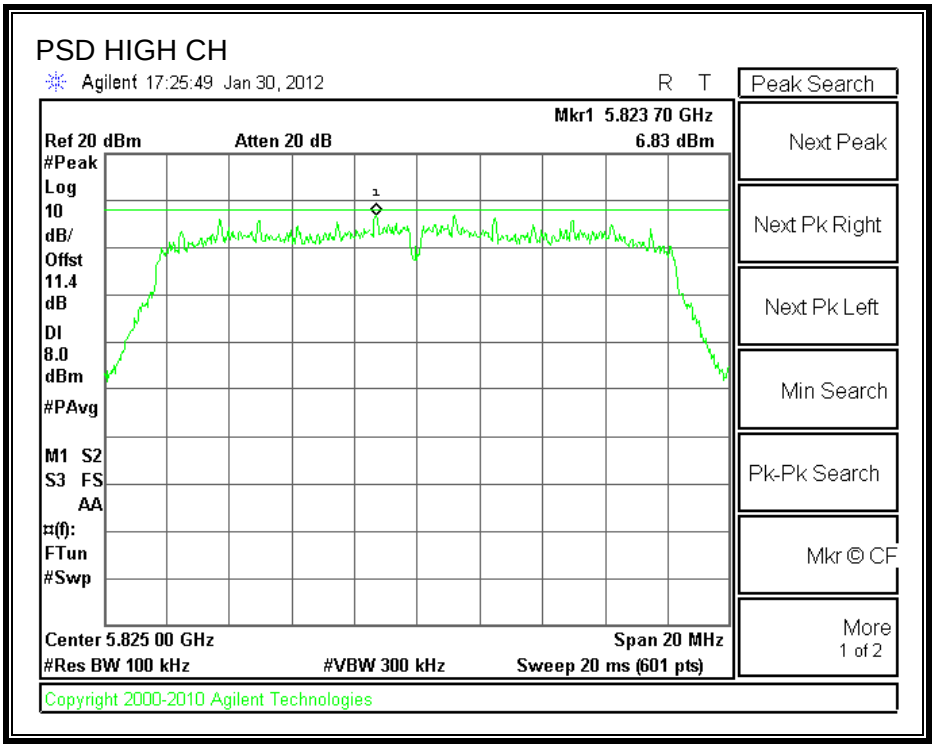
RESULTS

Channel	Frequency (MHz)	Marker Reading	10 log(3kHz/100kHz)	PPSD (dBm)	Limit (dBm)
Low	5745	6.8	15.2	-8.40	8
Middle	5785	7.02	15.2	-8.18	8
High	5825	6.83	15.2	-8.37	8

POWER SPECTRAL DENSITY







7.5.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

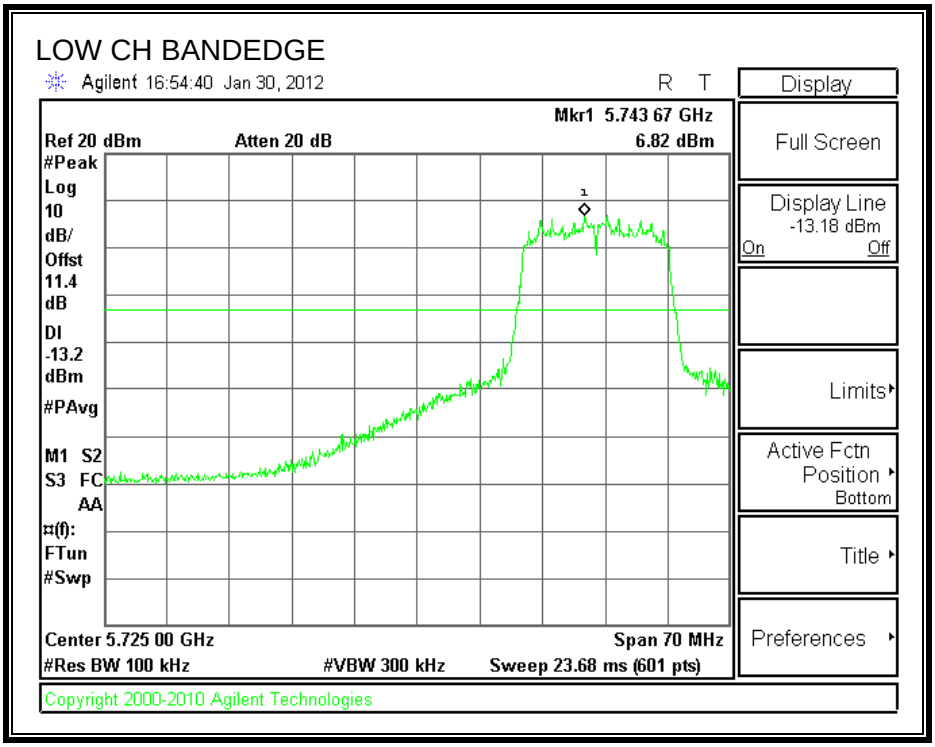
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

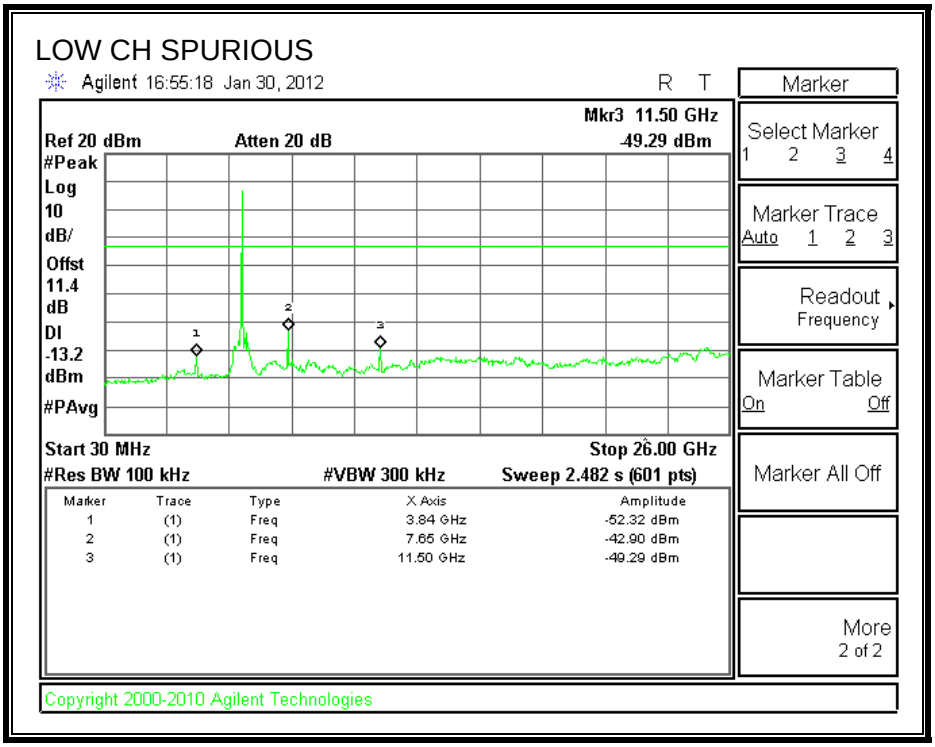
TEST PROCEDURE

KDB 558074 dated 01/18/12.

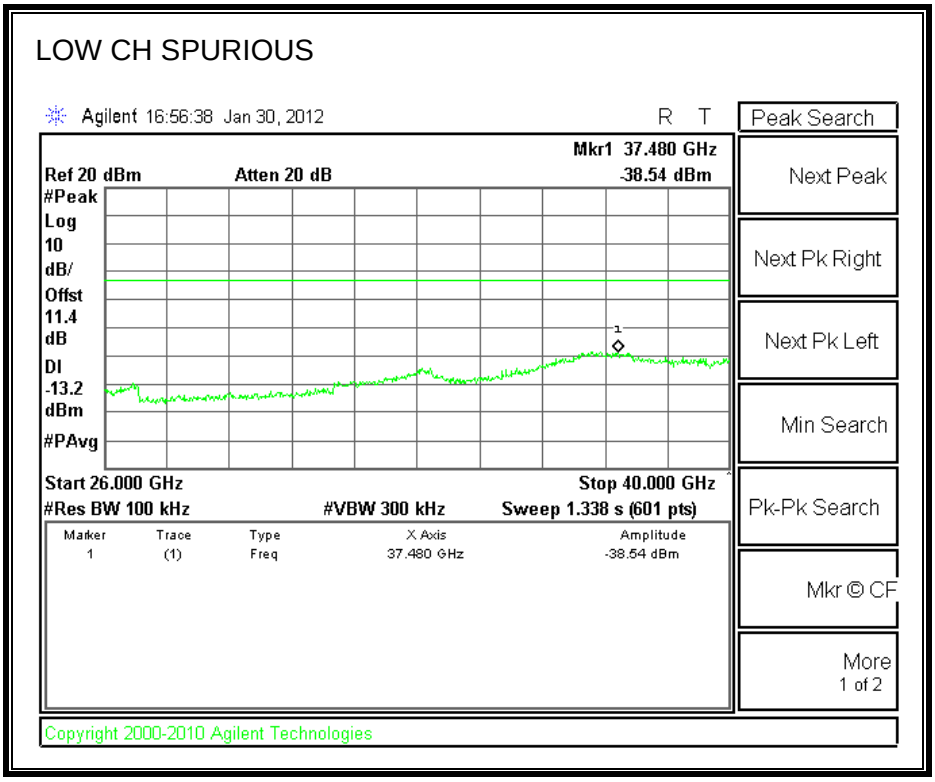
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

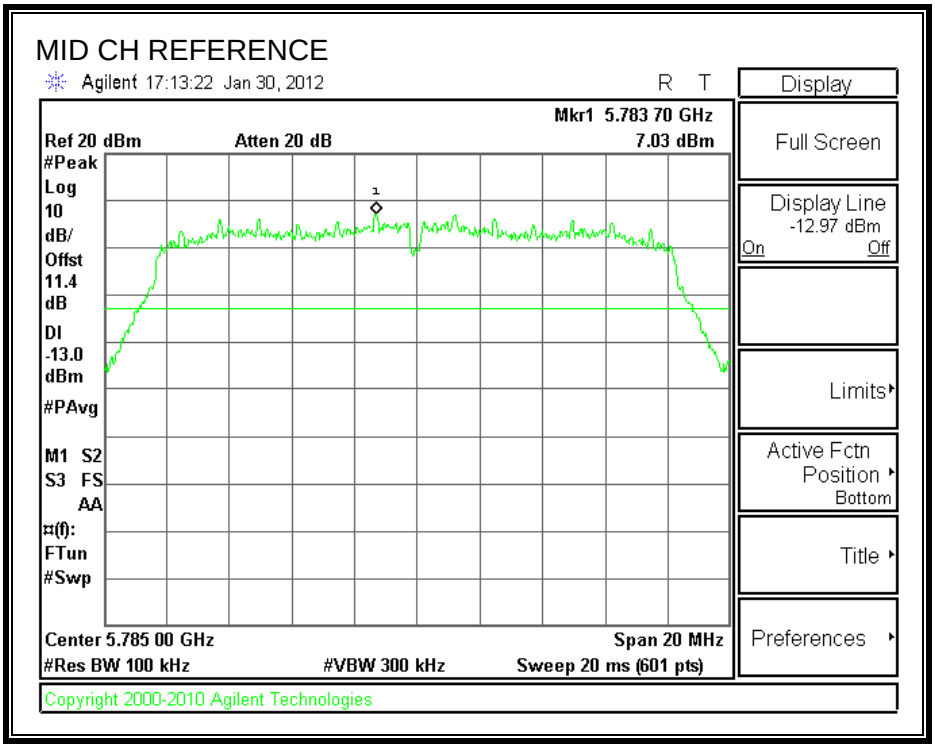


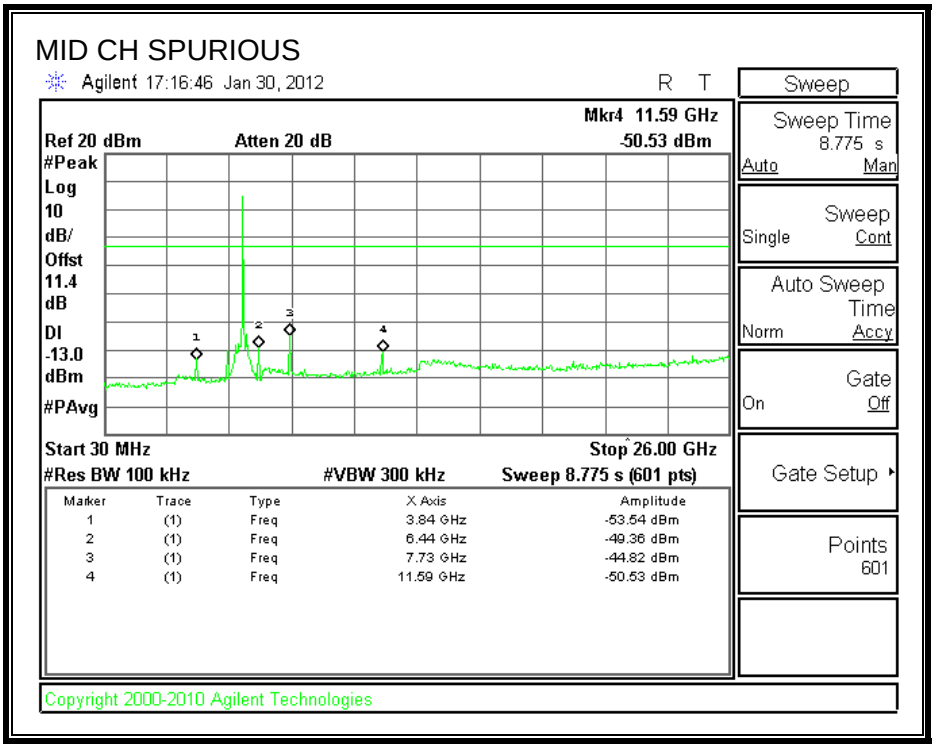


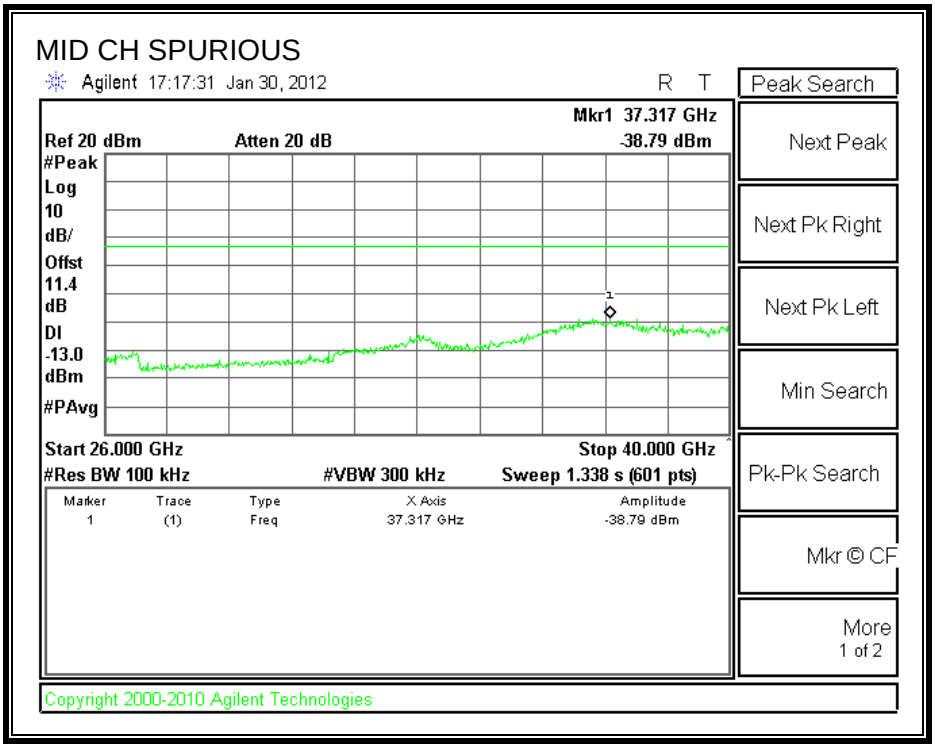
LOW CH SPURIOUS



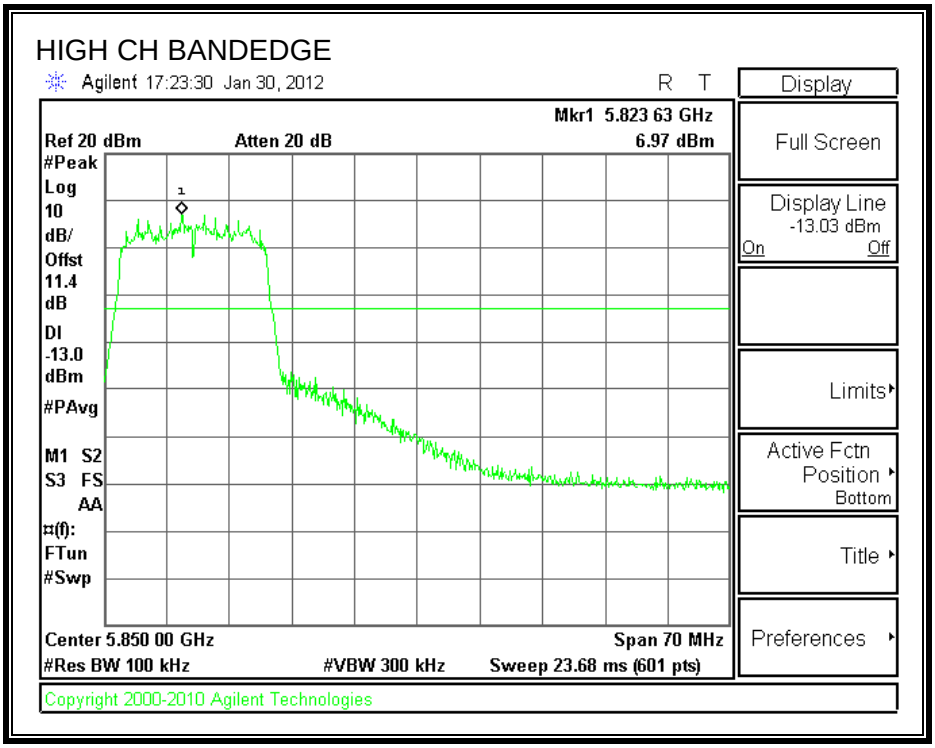
SPURIOUS EMISSIONS, MID CHANNEL

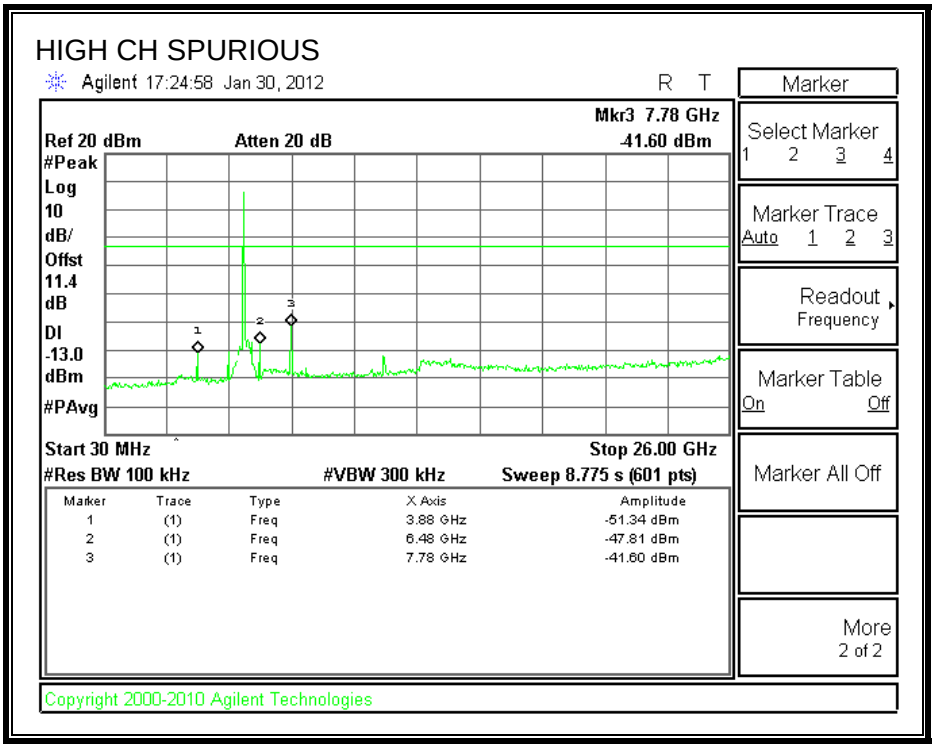


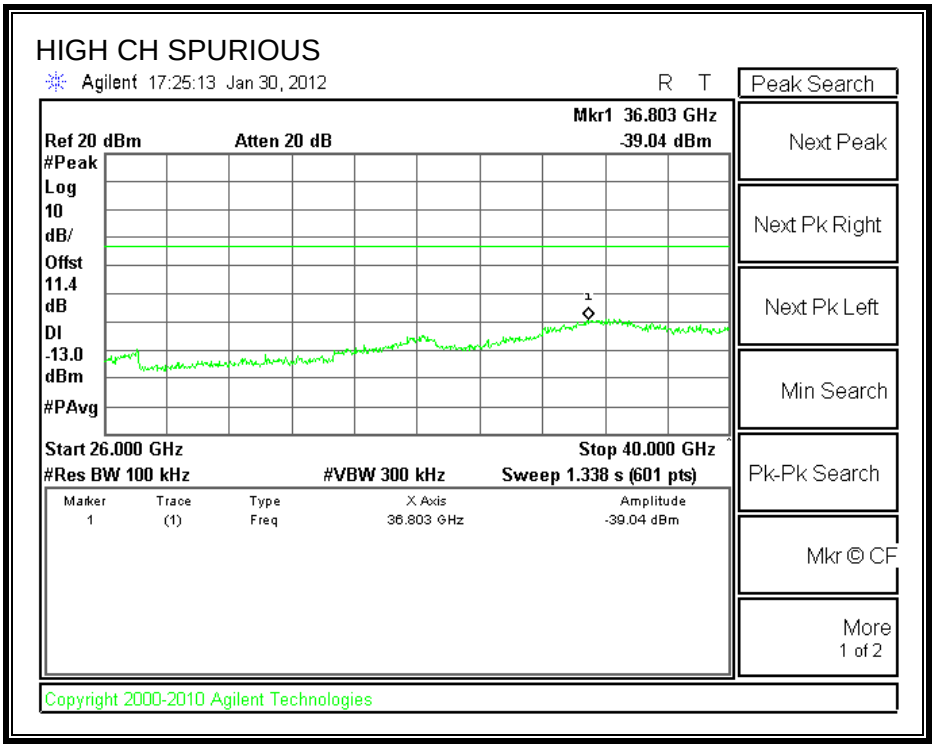




SPURIOUS EMISSIONS, HIGH CHANNEL







7.6. 802.11 HT20 MODE IN THE 5.8 GHz BAND

7.6.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

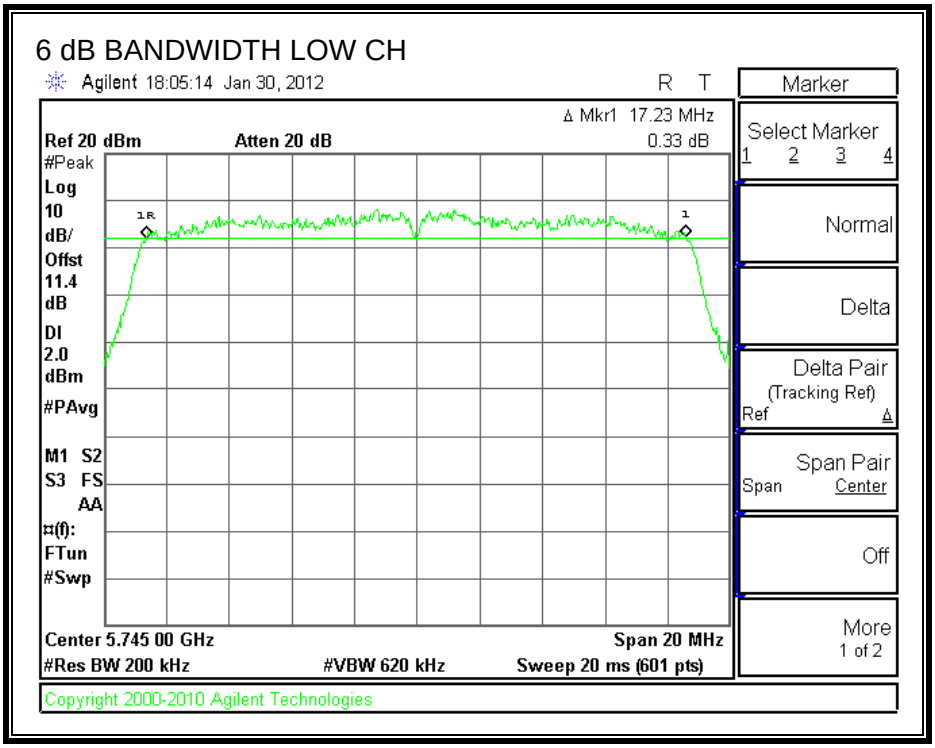
TEST PROCEDURE

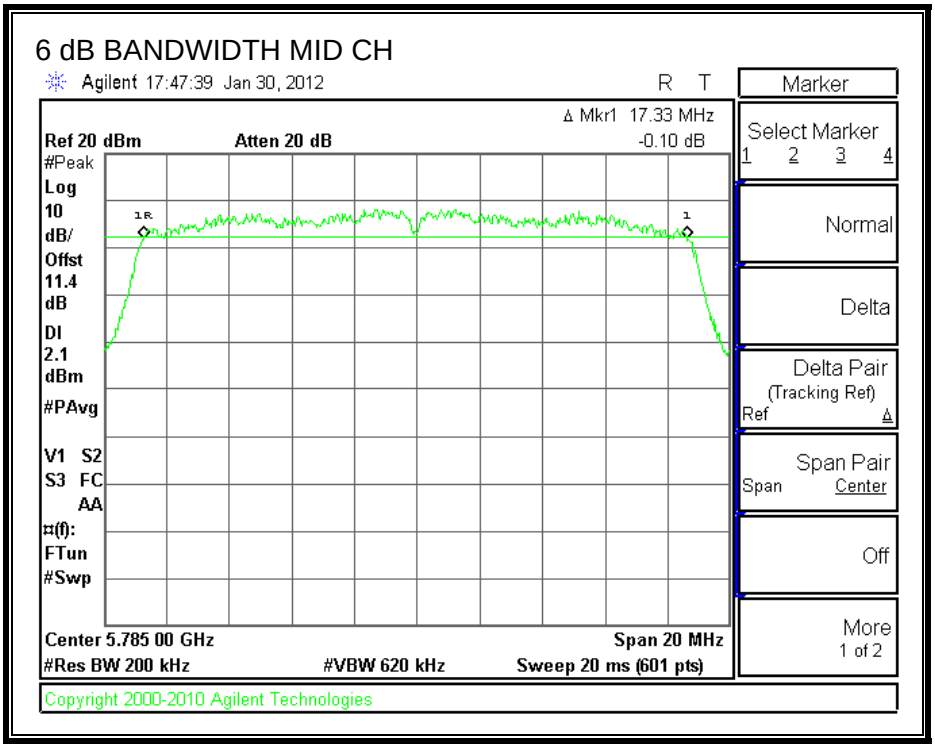
KDB 558074 dated 01/18/12.

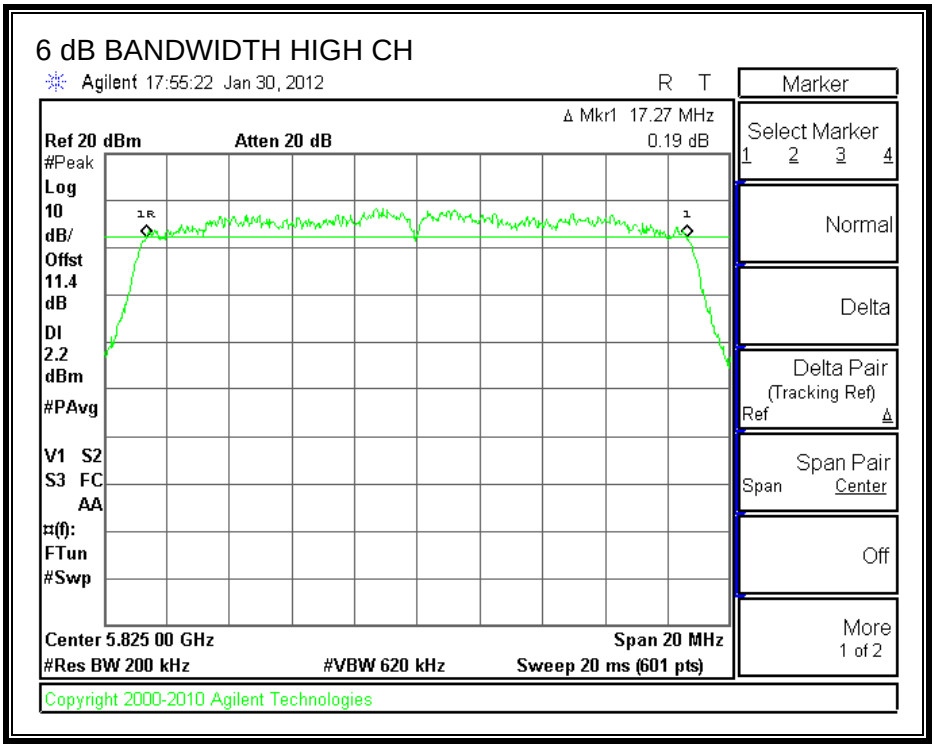
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5745	17.23	0.5
Middle	5785	17.33	0.5
High	5825	17.27	0.5

6 dB BANDWIDTH







7.6.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

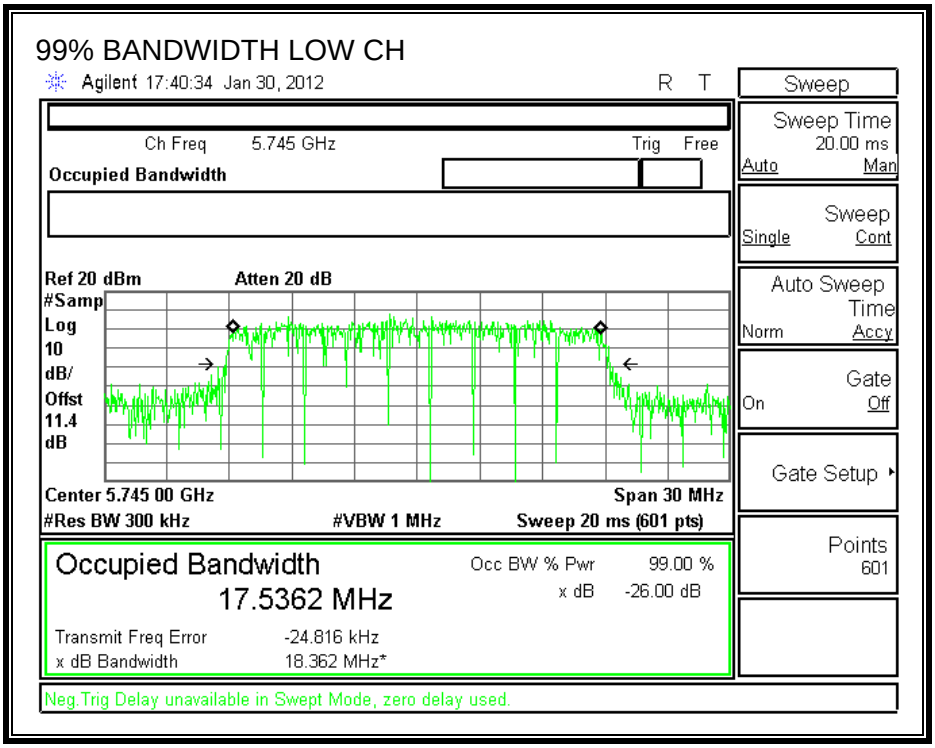
TEST PROCEDURE

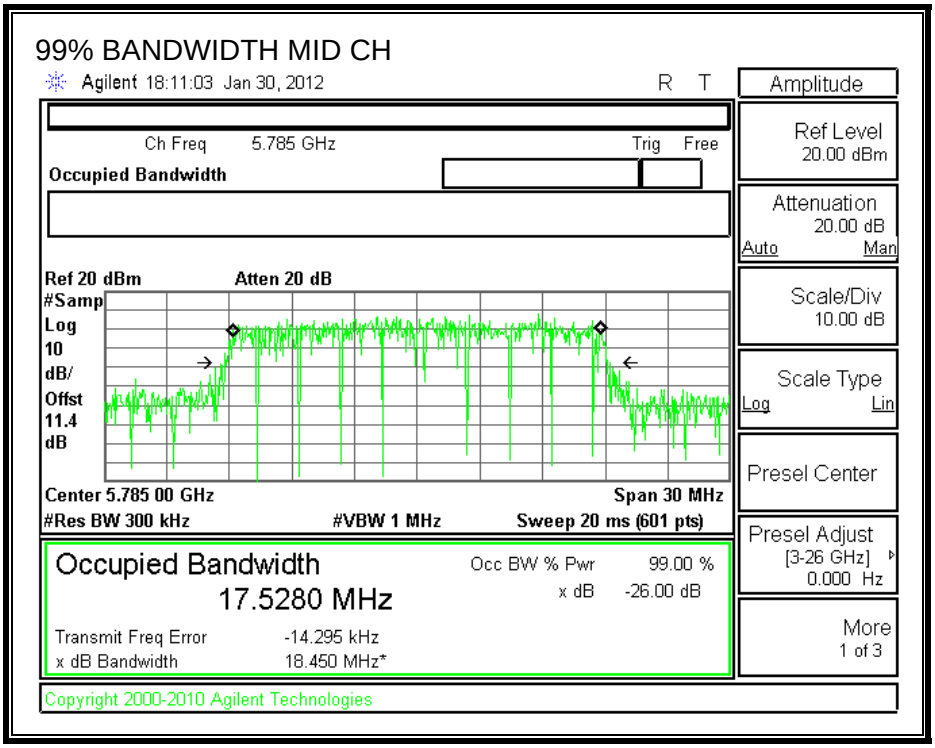
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

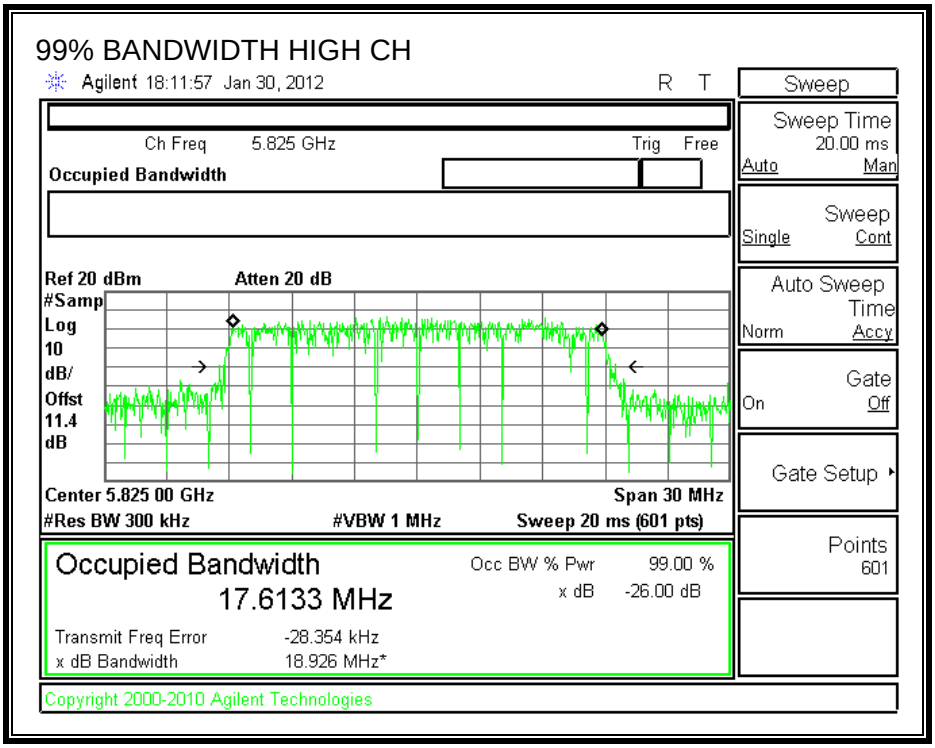
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.5362
Middle	5785	17.5280
High	5825	17.6133

99% BANDWIDTH







7.6.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

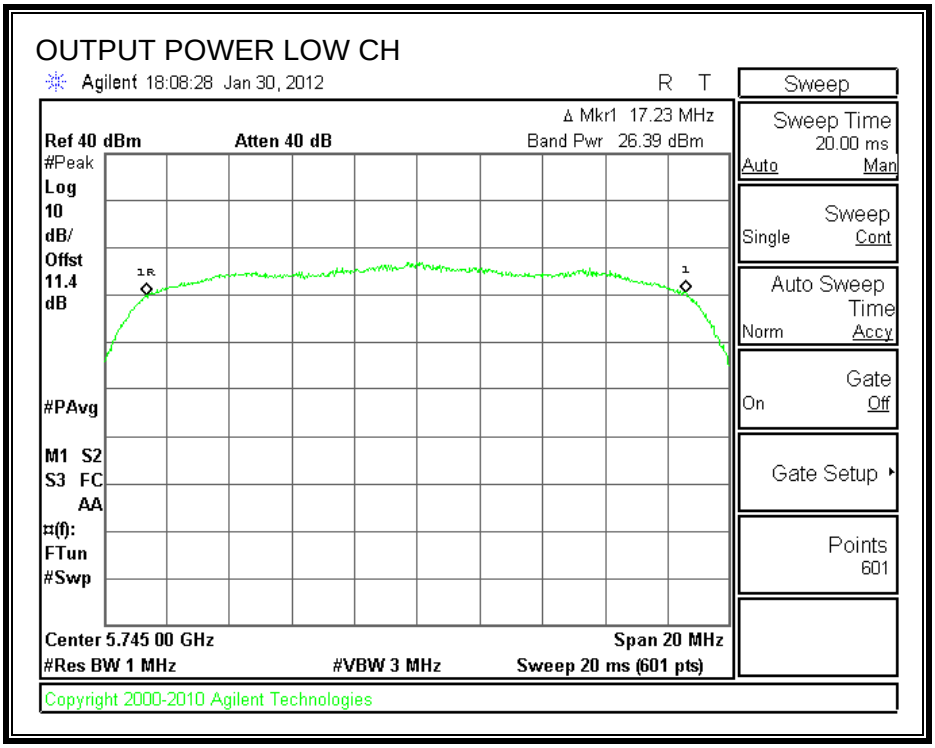
TEST PROCEDURE

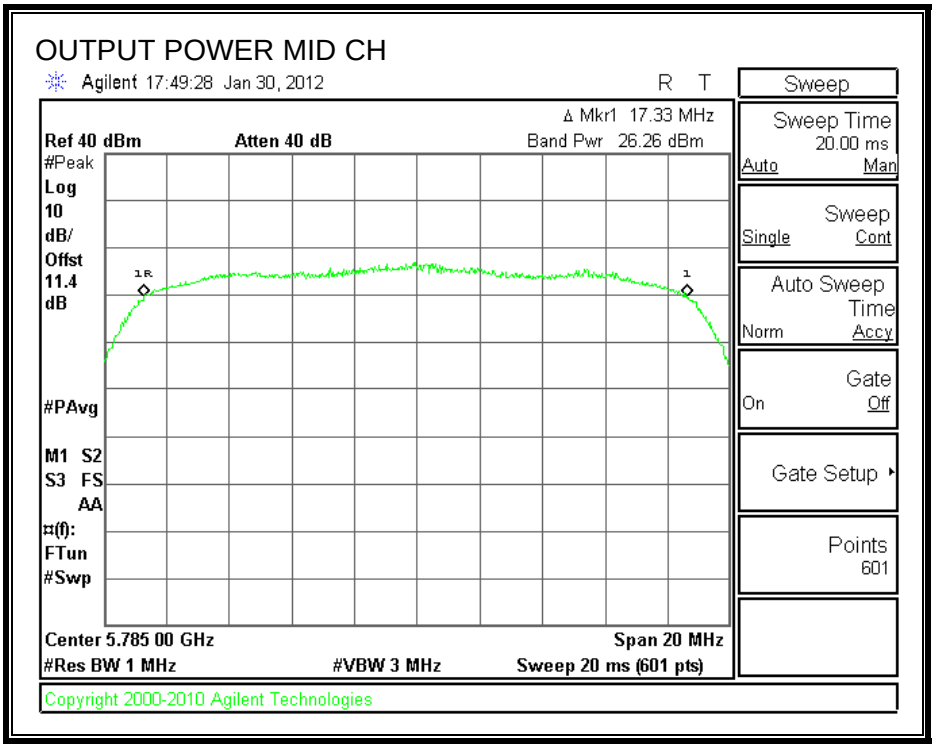
KDB 558074 dated 01/18/12.

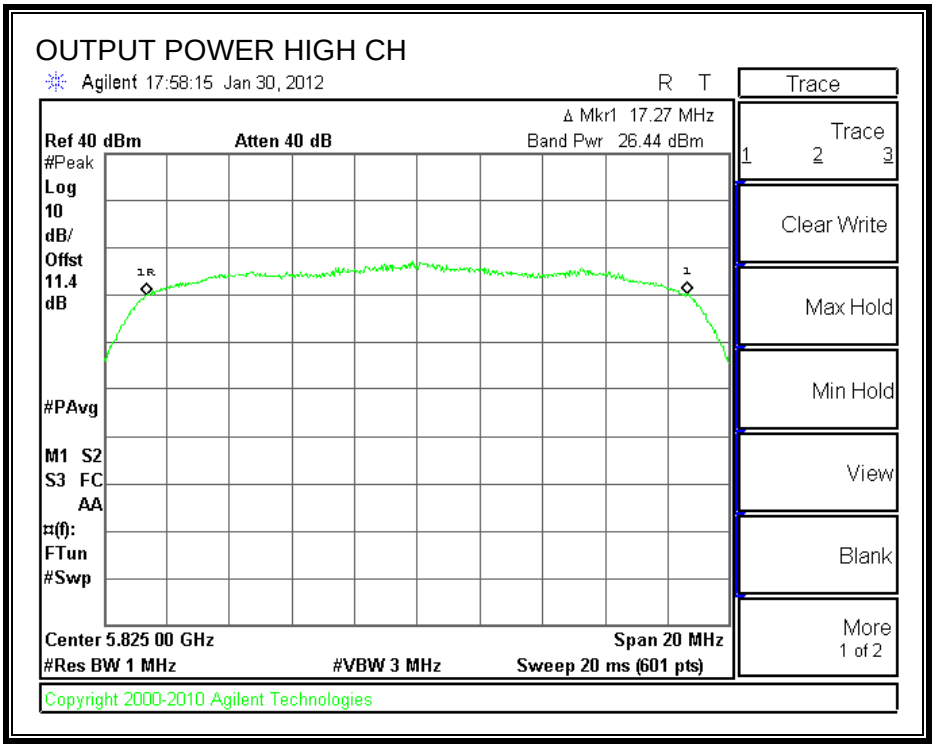
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	26.39	30	-3.61
Middle	5785	26.26	30	-3.74
High	5825	26.44	30	-3.56

OUTPUT POWER







7.6.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Power (dBm)
Low	5745	17.50
Middle	5785	17.50
High	5825	17.50

7.6.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

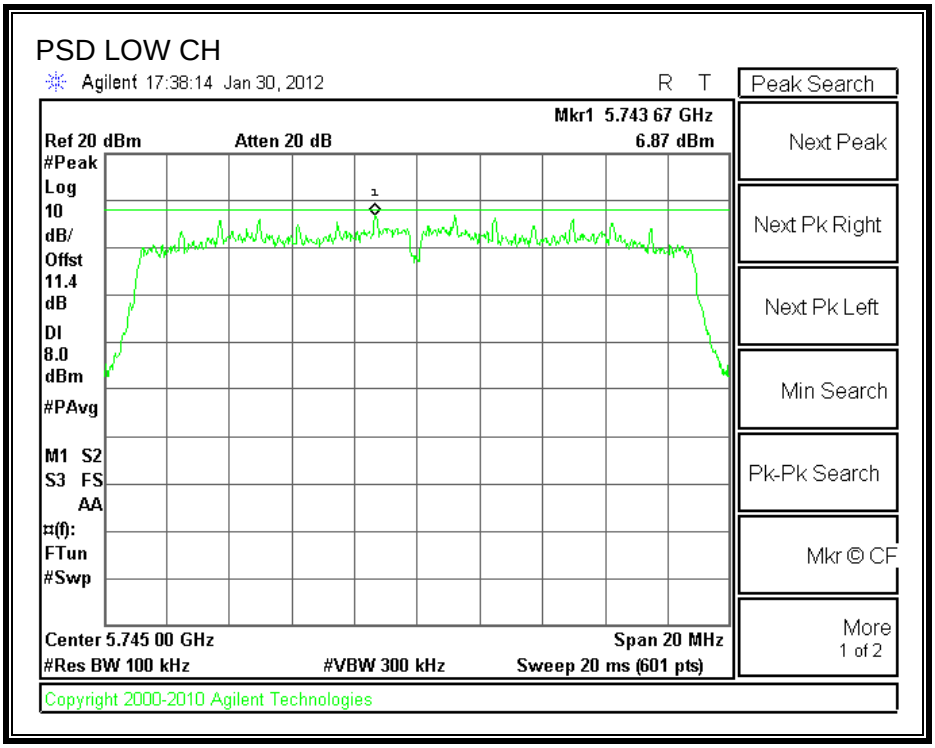
TEST PROCEDURE

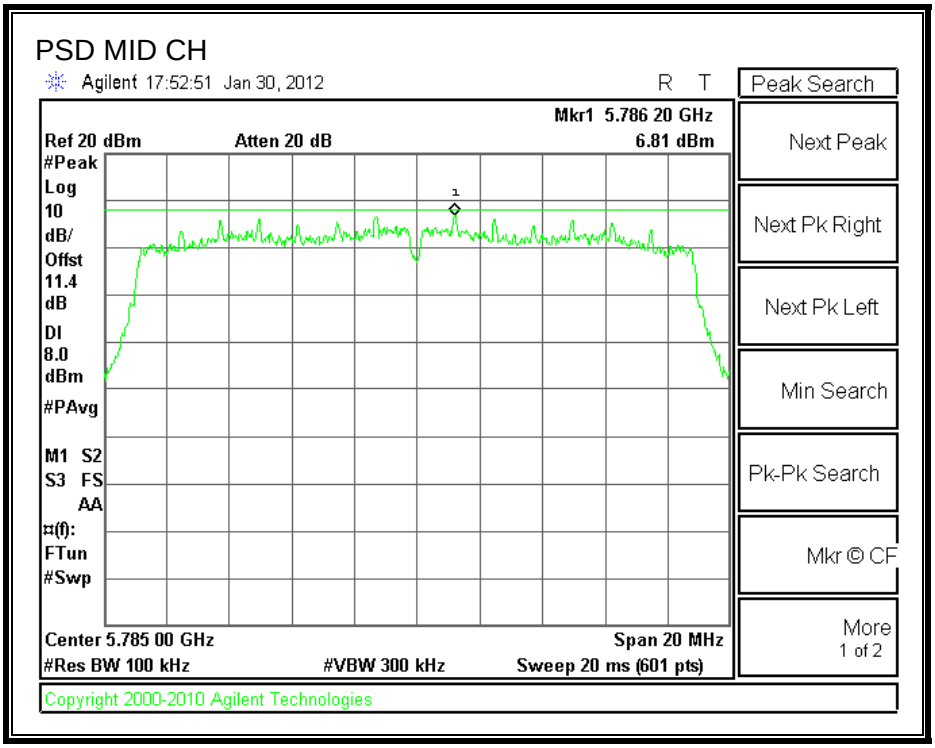
KDB 558074 dated 01/18/12.

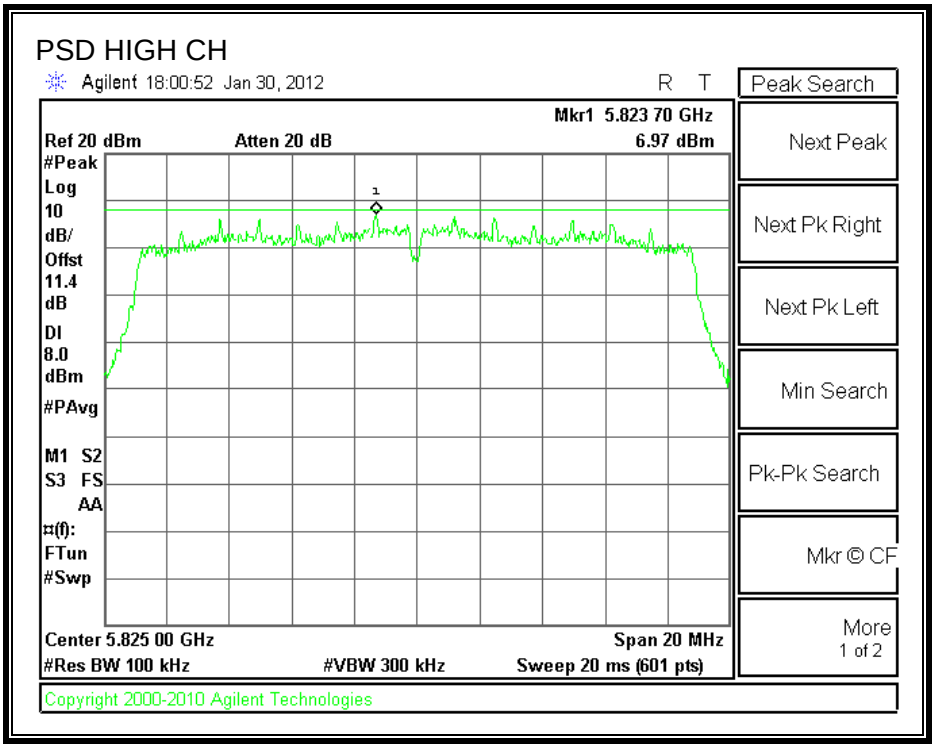
RESULTS

Channel	Frequency (MHz)	Marker Reading	10 log(3kHz/100kHz)	PPSD (dBm)	Limit (dBm)
Low	5745	6.87	15.2	-8.33	8
Middle	5785	6.81	15.2	-8.39	8
High	5825	6.97	15.2	-8.23	8

POWER SPECTRAL DENSITY







7.6.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

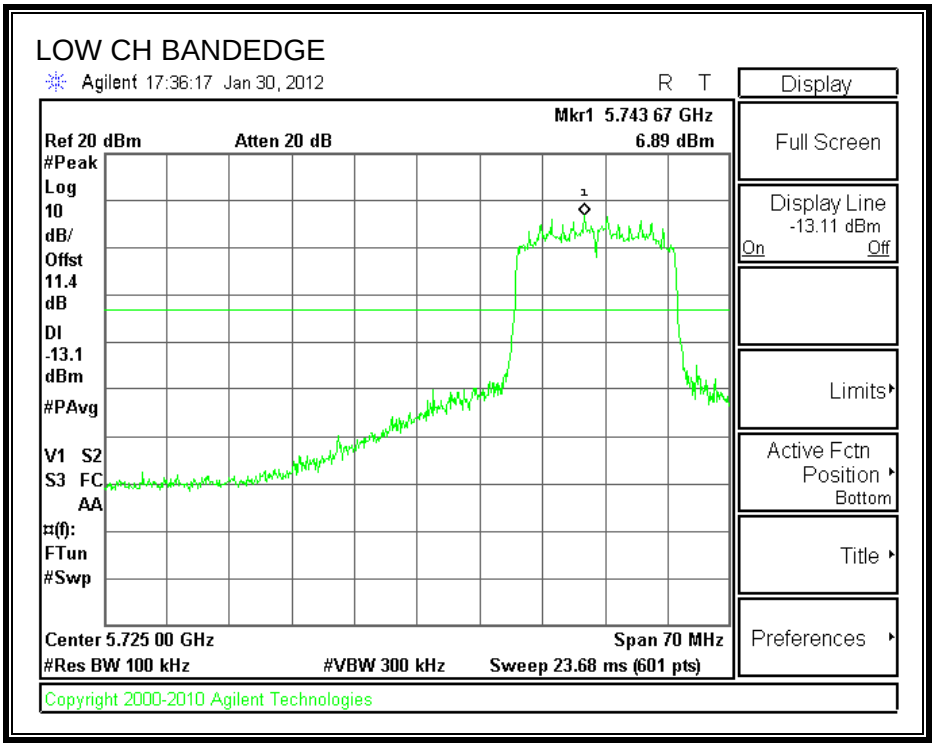
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

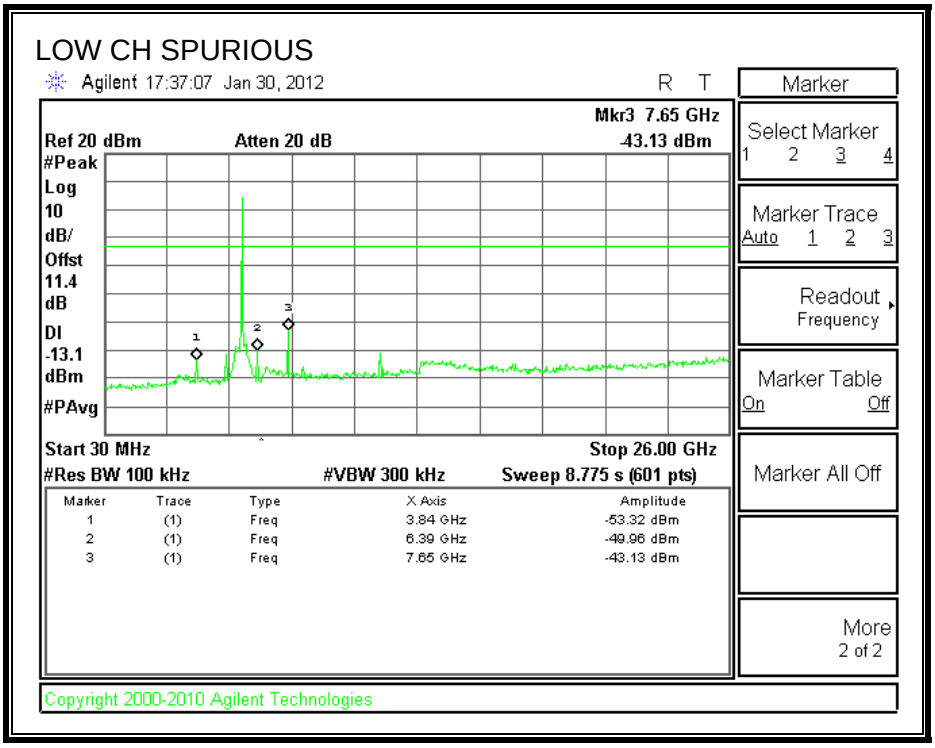
TEST PROCEDURE

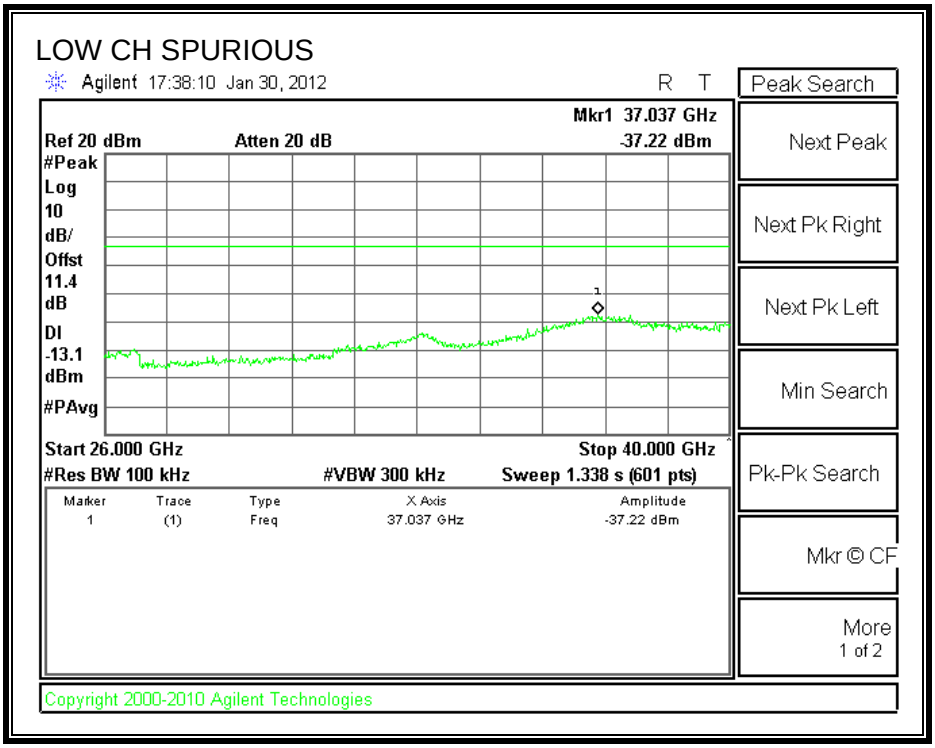
KDB 558074 dated 01/18/12.

RESULTS

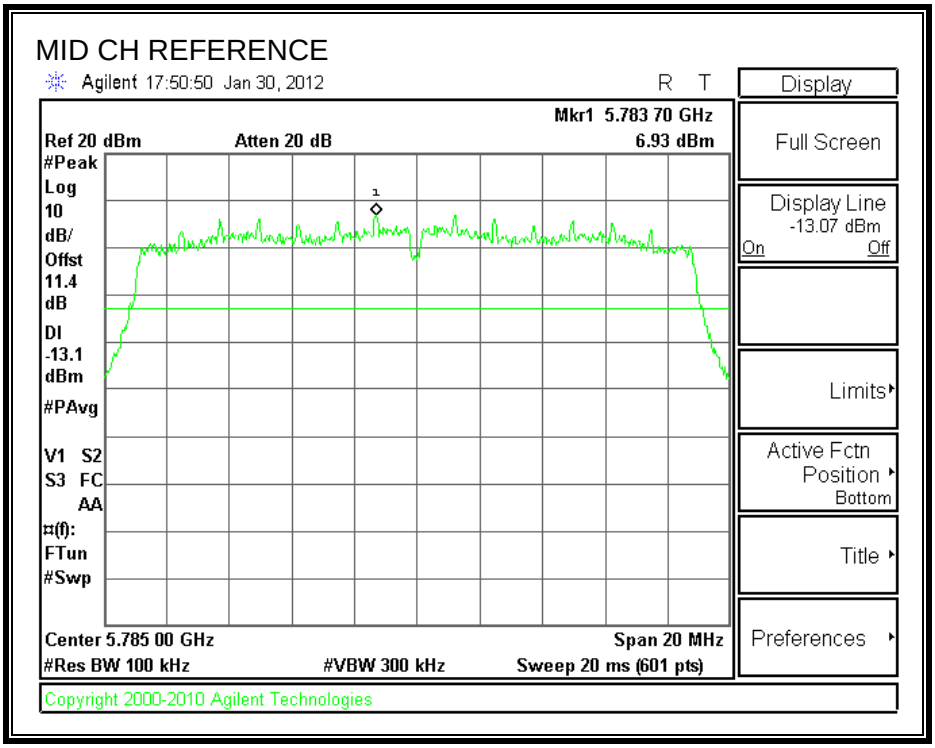
SPURIOUS EMISSIONS, LOW CHANNEL

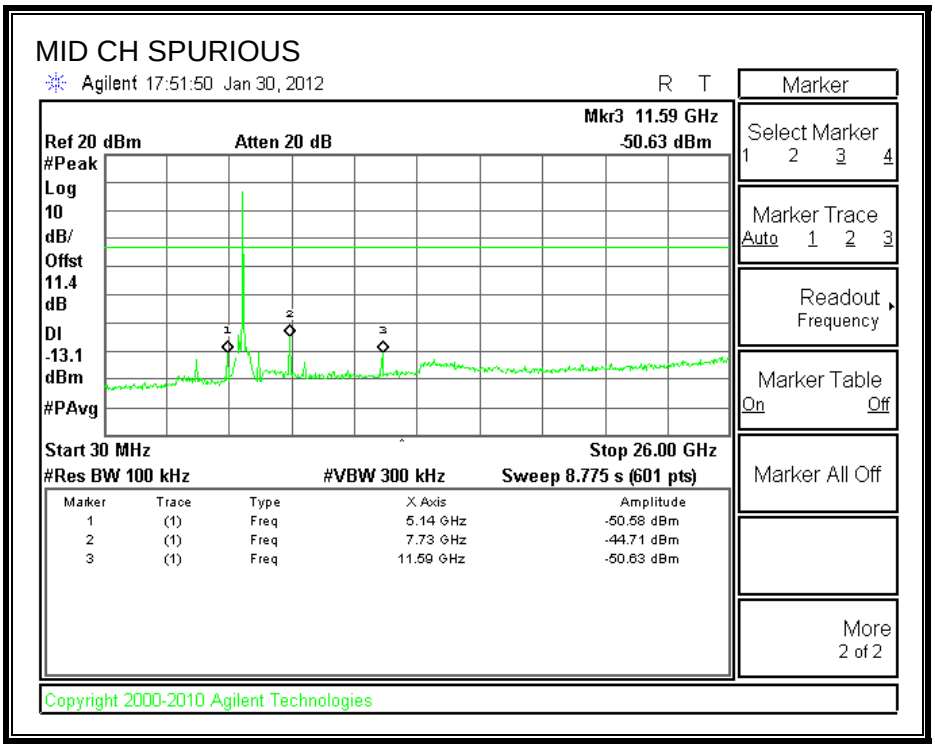


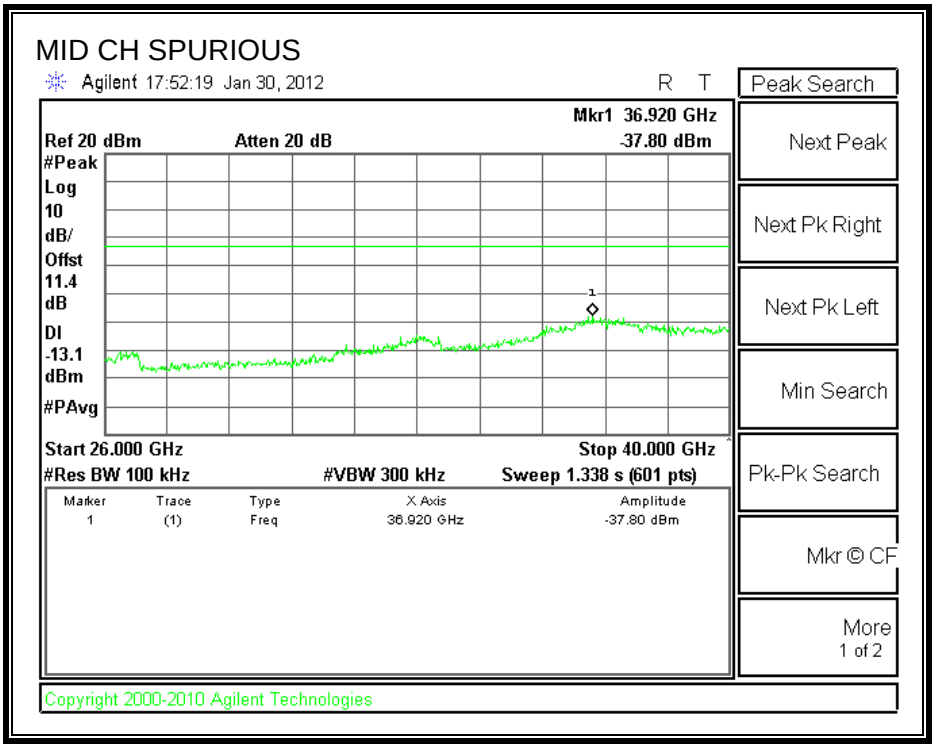




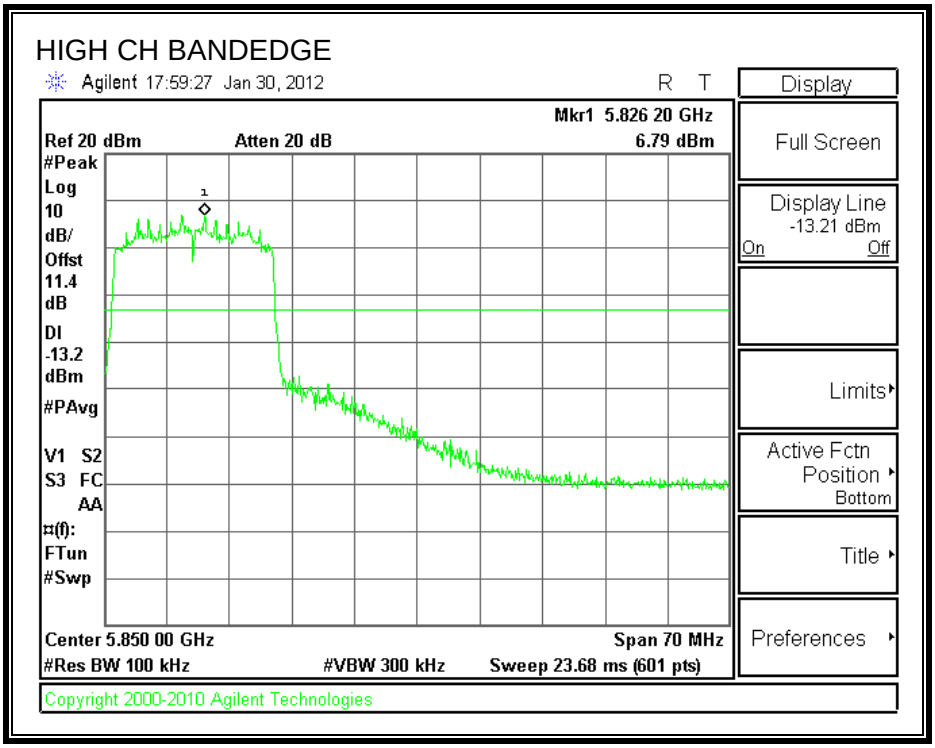
SPURIOUS EMISSIONS, MID CHANNEL

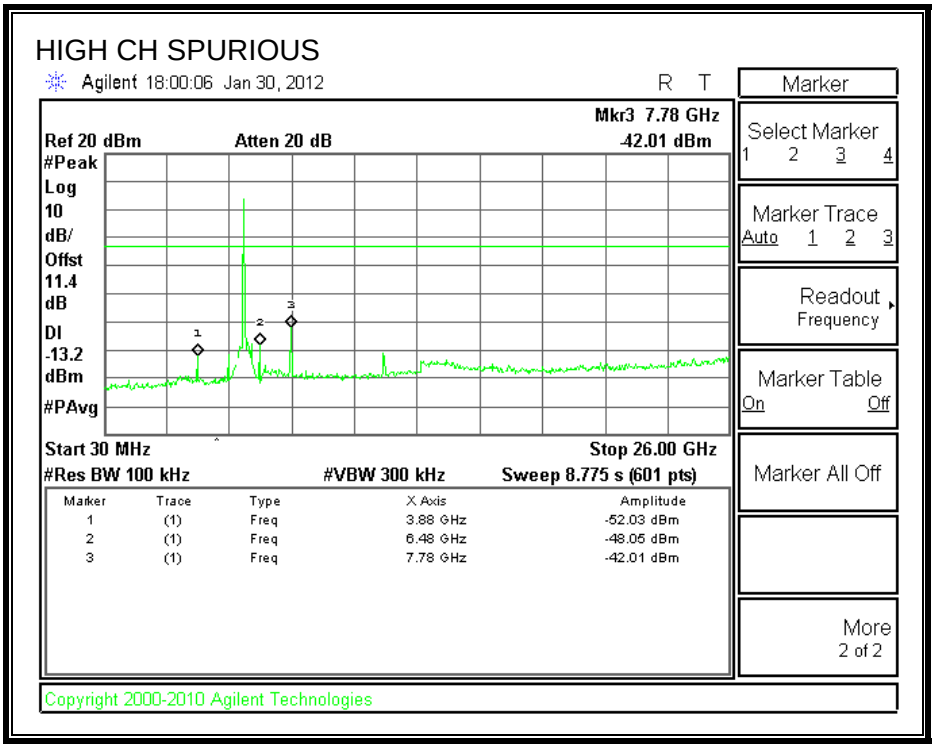


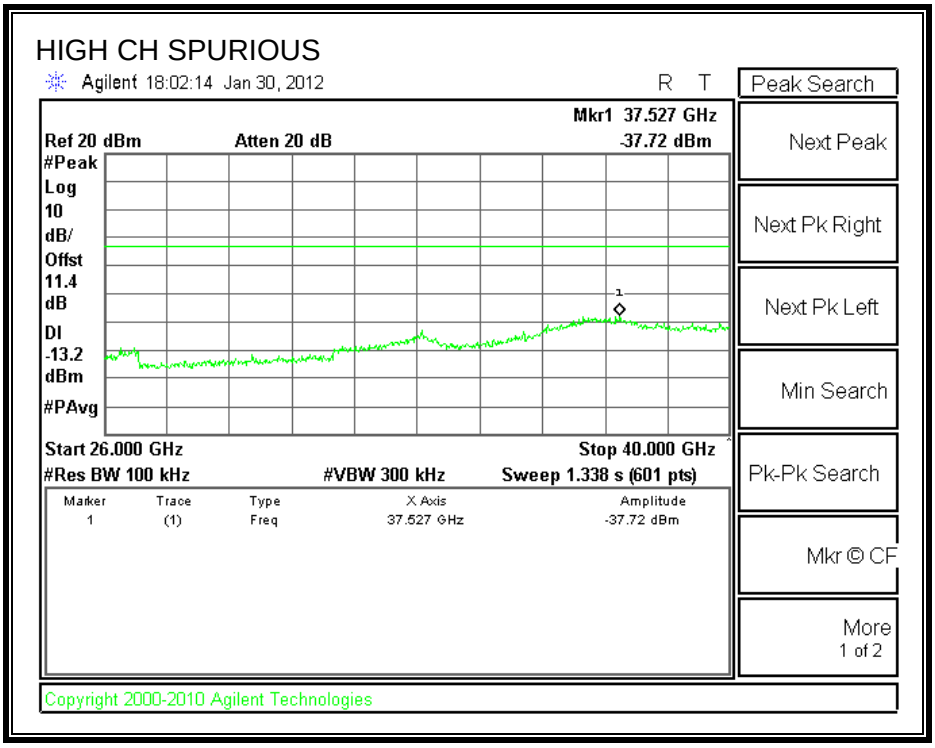




SPURIOUS EMISSIONS, HIGH CHANNEL







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.

For 2.4 GHz band, the spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

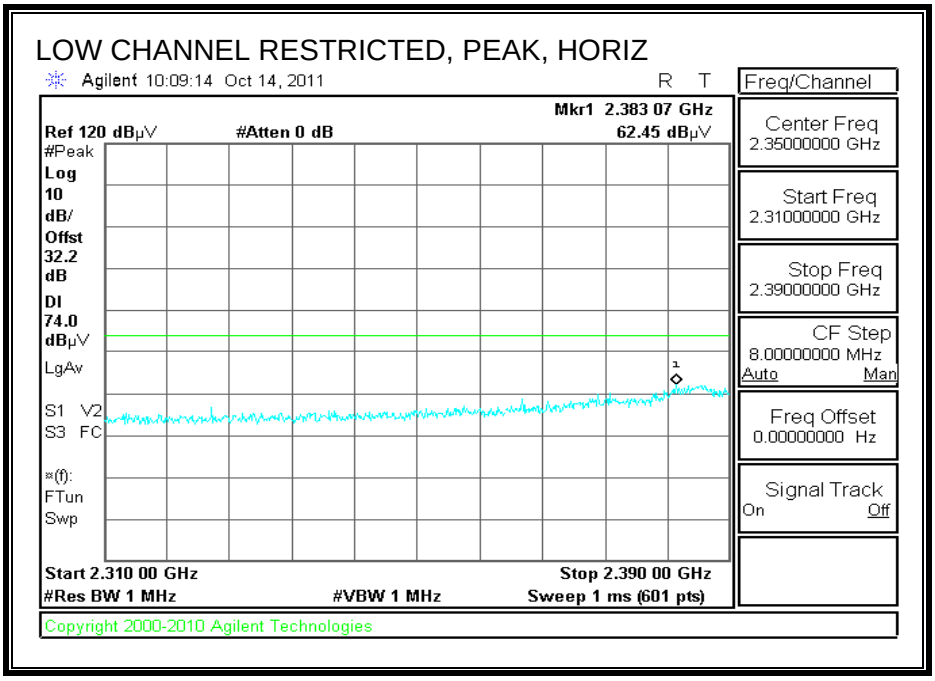
For 5.8 GHz band, the spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

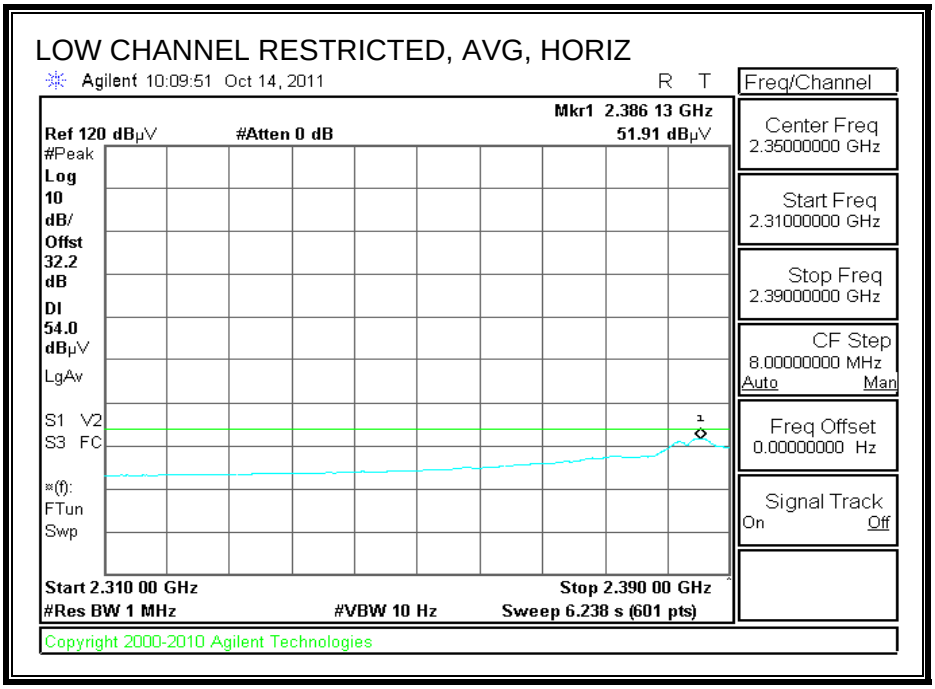
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

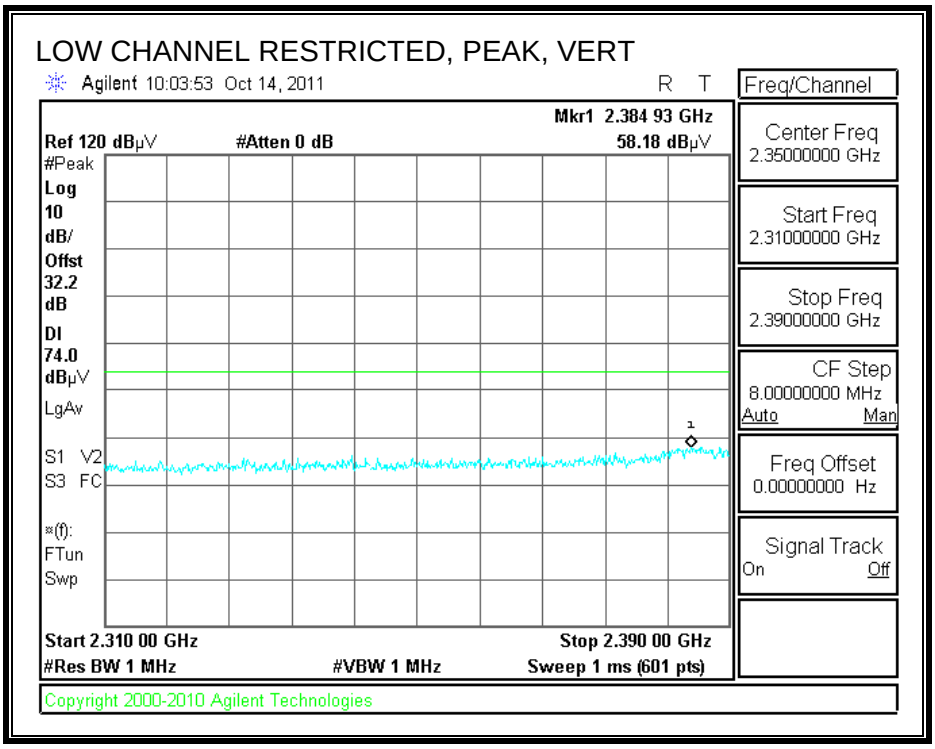
8.2.1. 802.11b MODE IN THE 2.4 GHz BAND

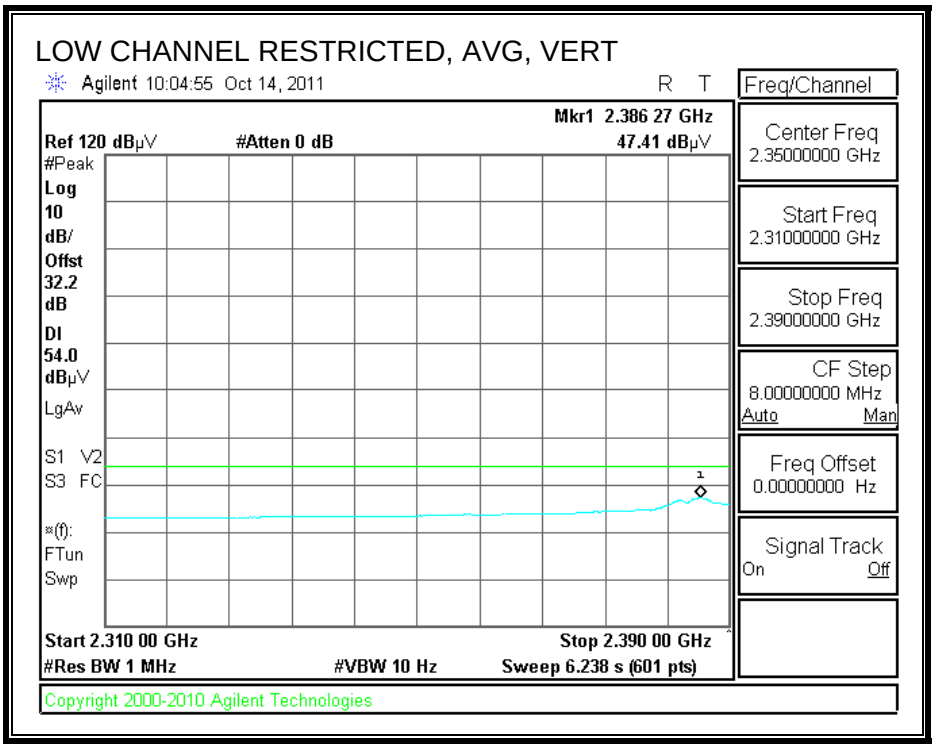
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



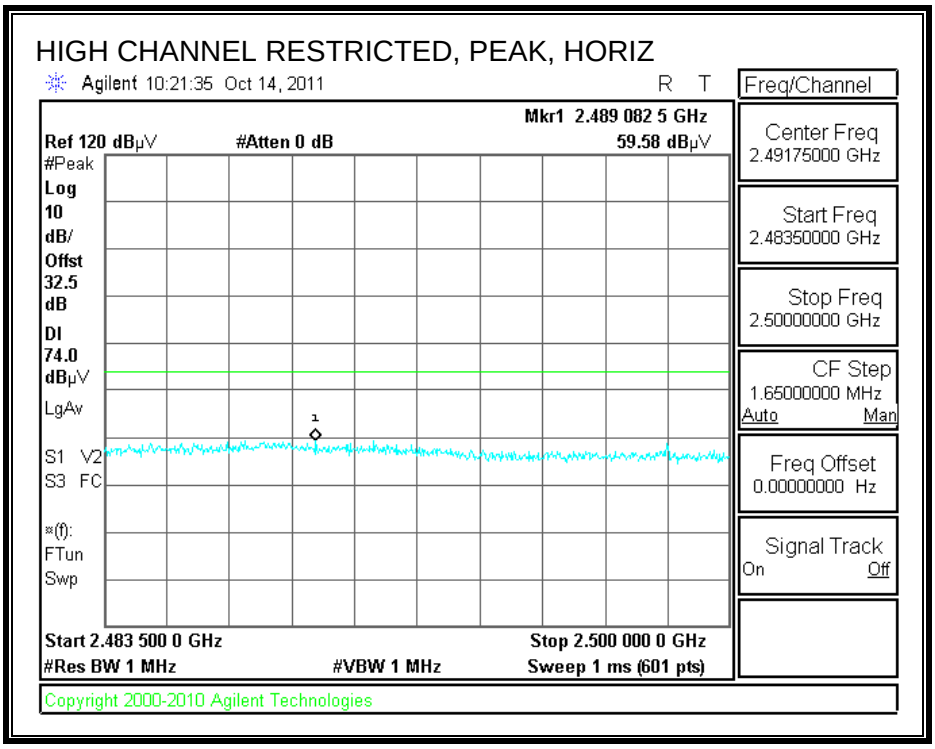


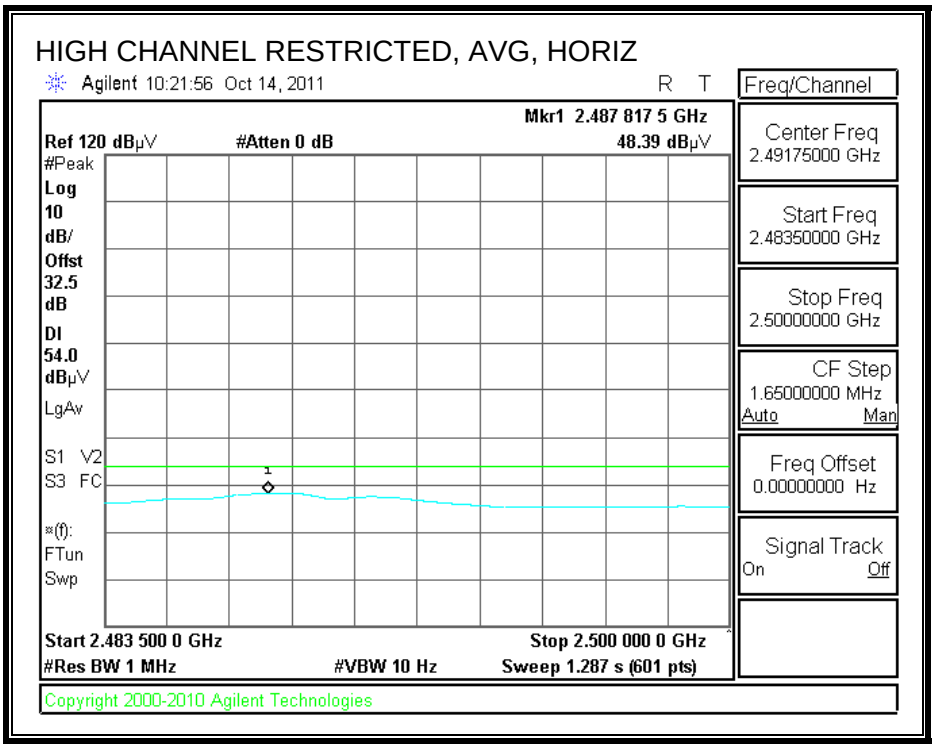
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



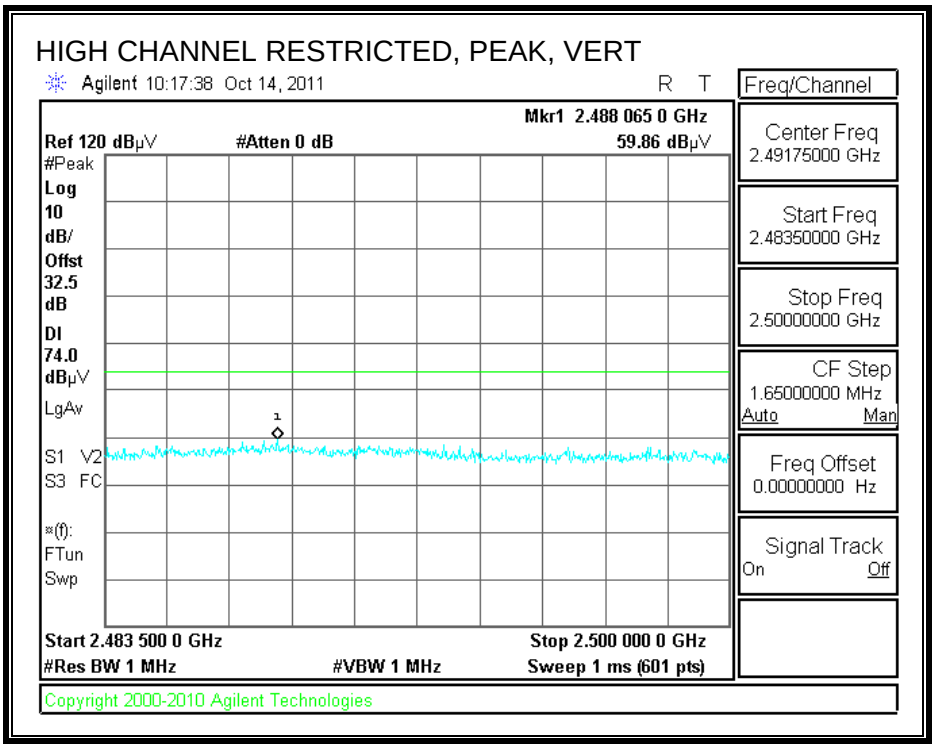


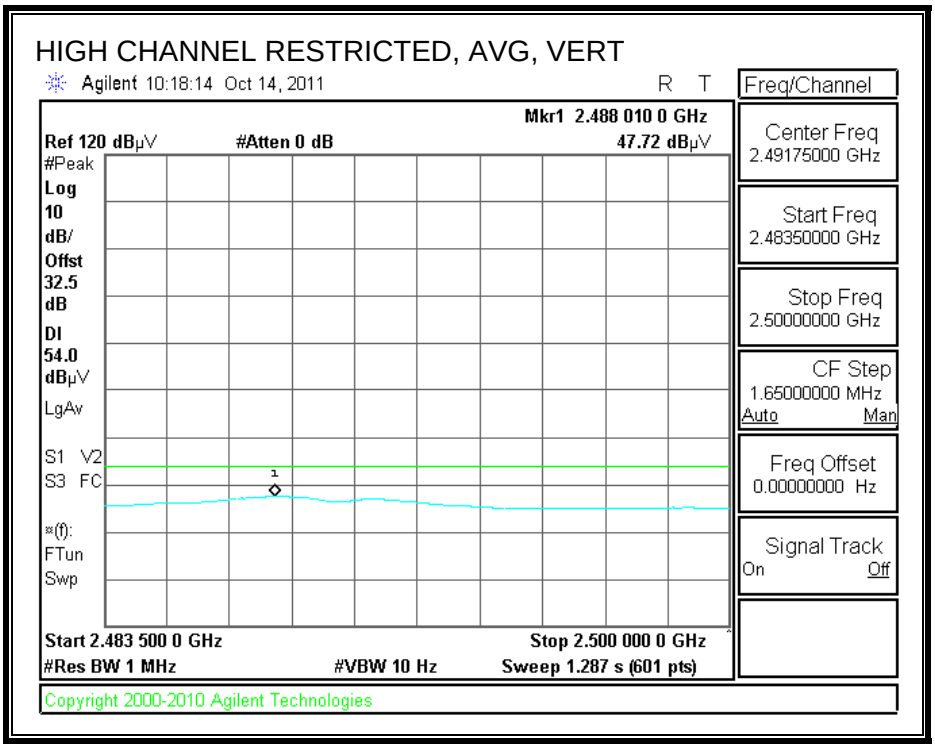
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 101/27/11
Project #: 11U13938
Company: Apple
Test Target: FCC 15.247
Mode Oper: TX, b mode

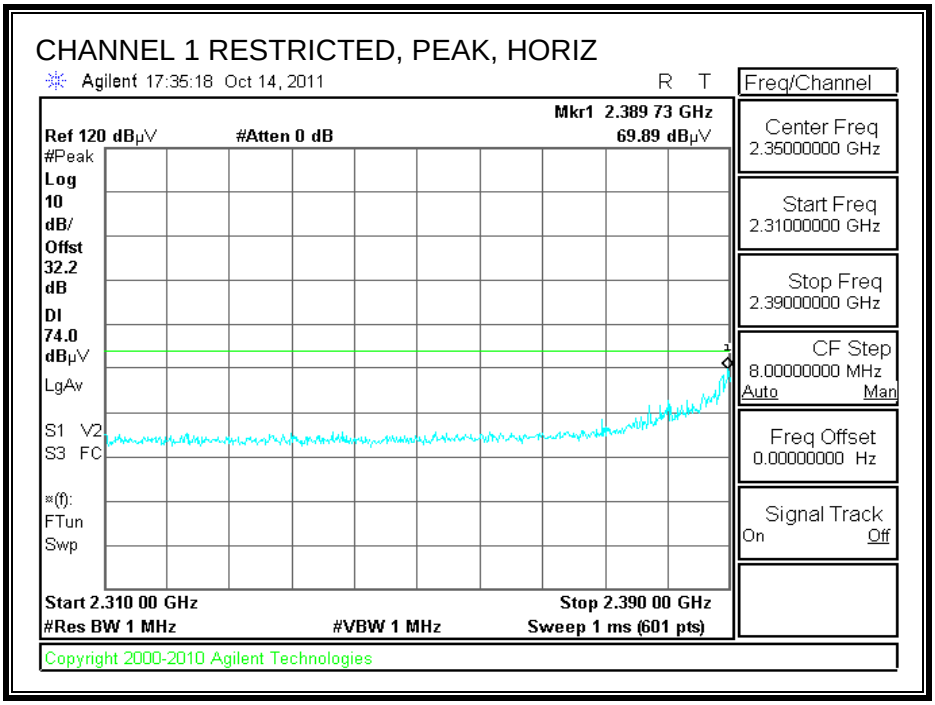
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

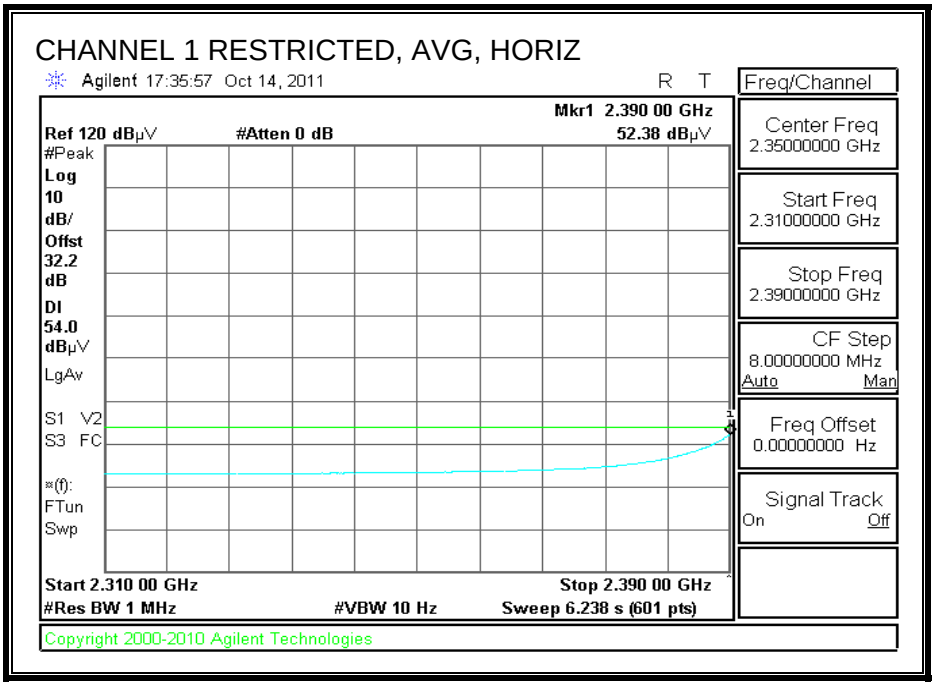
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 2412MHz													
4.824	3.0	38.2	33.2	5.8	-34.8	0.0	0.0	42.3	74.0	-31.7	H	P	
4.824	3.0	26.1	33.2	5.8	-34.8	0.0	0.0	30.2	54.0	-23.8	H	A	
4.824	3.0	38.8	33.2	5.8	-34.8	0.0	0.0	42.9	74.0	-31.1	V	P	
4.824	3.0	25.8	33.2	5.8	-34.8	0.0	0.0	30.0	54.0	-24.0	V	A	
Mid Ch, 2437MHz													
4.874	3.0	37.7	33.2	5.8	-34.9	0.0	0.0	41.9	74.0	-32.1	V	P	
4.874	3.0	25.6	33.2	5.8	-34.9	0.0	0.0	29.8	54.0	-24.2	V	A	
7.311	3.0	36.7	36.2	7.3	-34.7	0.0	0.0	45.5	74.0	-28.5	V	P	
7.311	3.0	24.8	36.2	7.3	-34.7	0.0	0.0	33.6	54.0	-20.4	V	A	
4.874	3.0	38.7	33.2	5.8	-34.9	0.0	0.0	43.0	74.0	-31.0	H	P	
4.874	3.0	28.0	33.2	5.8	-34.9	0.0	0.0	32.2	54.0	-21.8	H	A	
7.311	3.0	37.2	36.2	7.3	-34.7	0.0	0.0	46.0	74.0	-28.0	H	P	
7.311	3.0	24.7	36.2	7.3	-34.7	0.0	0.0	33.5	54.0	-20.5	H	A	
High Ch, 2462MHz													
4.924	3.0	37.9	33.3	5.9	-34.9	0.0	0.0	42.2	74.0	-31.8	H	P	
4.924	3.0	27.3	33.3	5.9	-34.9	0.0	0.0	31.6	54.0	-22.4	H	A	
7.386	3.0	37.2	36.3	7.3	-34.6	0.0	0.0	46.2	74.0	-27.9	H	P	
7.386	3.0	24.4	36.3	7.3	-34.6	0.0	0.0	33.4	54.0	-20.6	H	A	
4.924	3.0	38.1	33.3	5.9	-34.9	0.0	0.0	42.4	74.0	-31.6	V	P	
4.924	3.0	25.8	33.3	5.9	-34.9	0.0	0.0	30.1	54.0	-23.9	V	A	
7.386	3.0	36.8	36.3	7.3	-34.6	0.0	0.0	45.7	74.0	-28.3	V	P	
7.386	3.0	24.4	36.3	7.3	-34.6	0.0	0.0	33.4	54.0	-20.6	V	A	

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

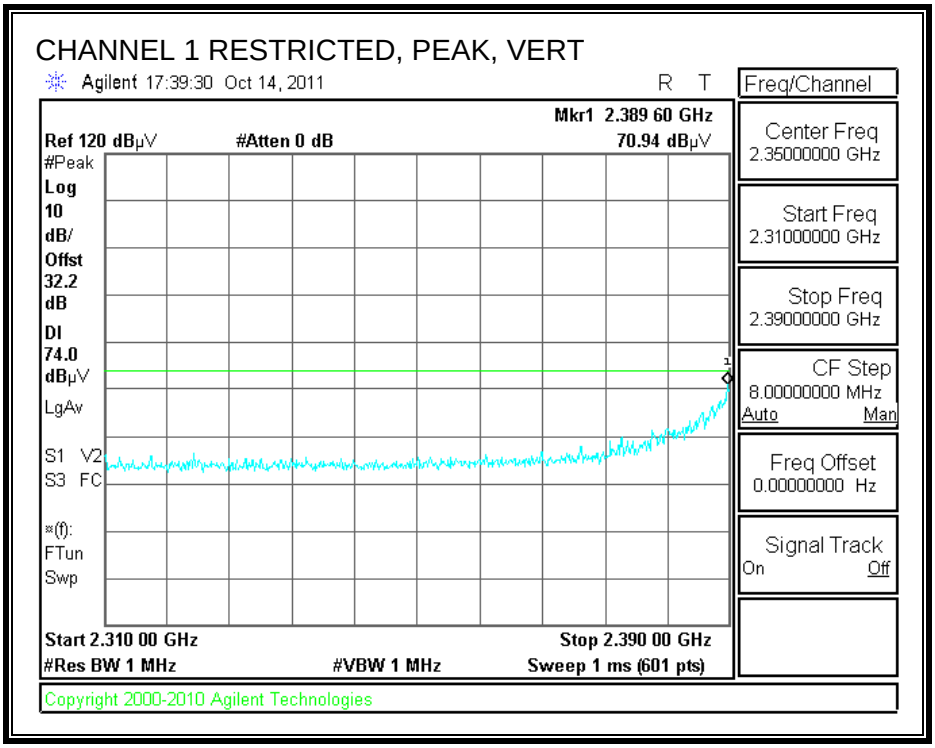
8.2.2. 802.11g MODE IN THE 2.4 GHz BAND

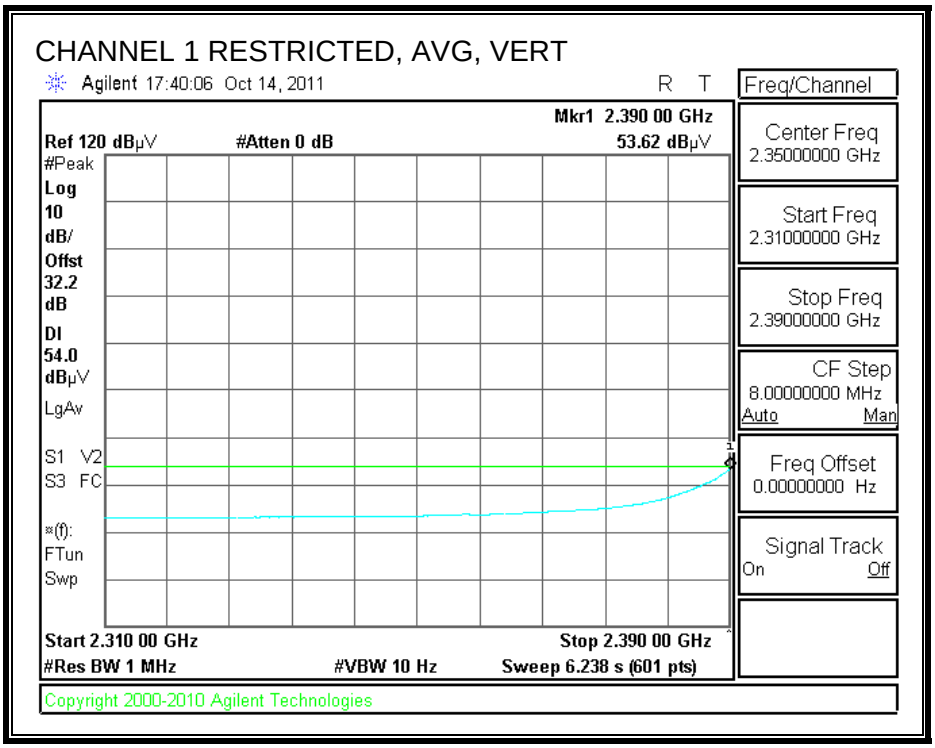
RESTRICTED BANDEDGE (CH1, HORIZONTAL)



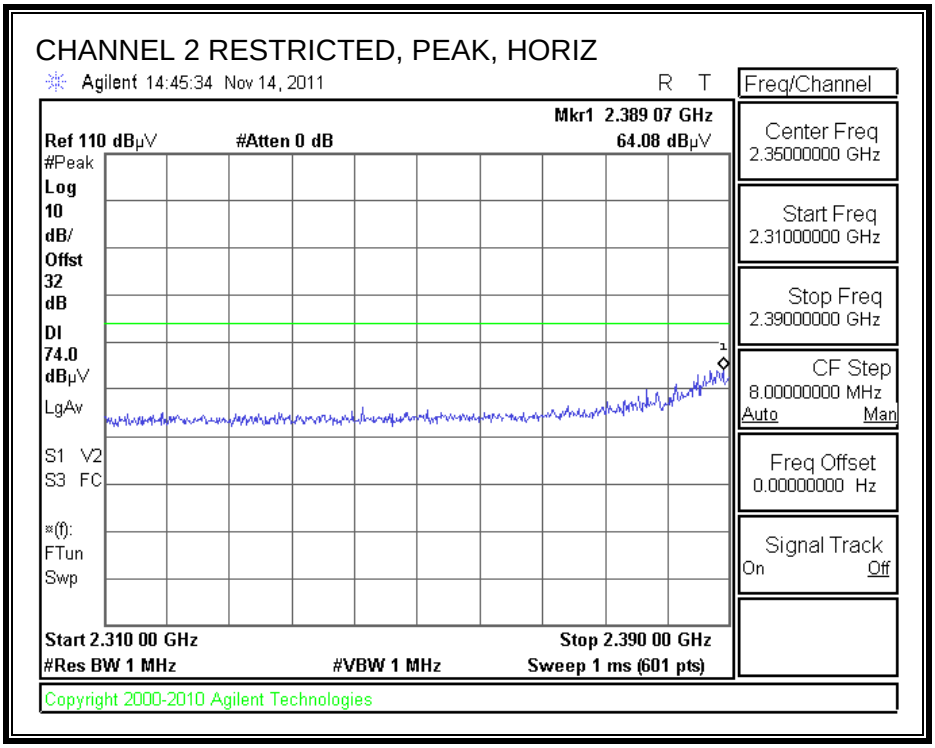


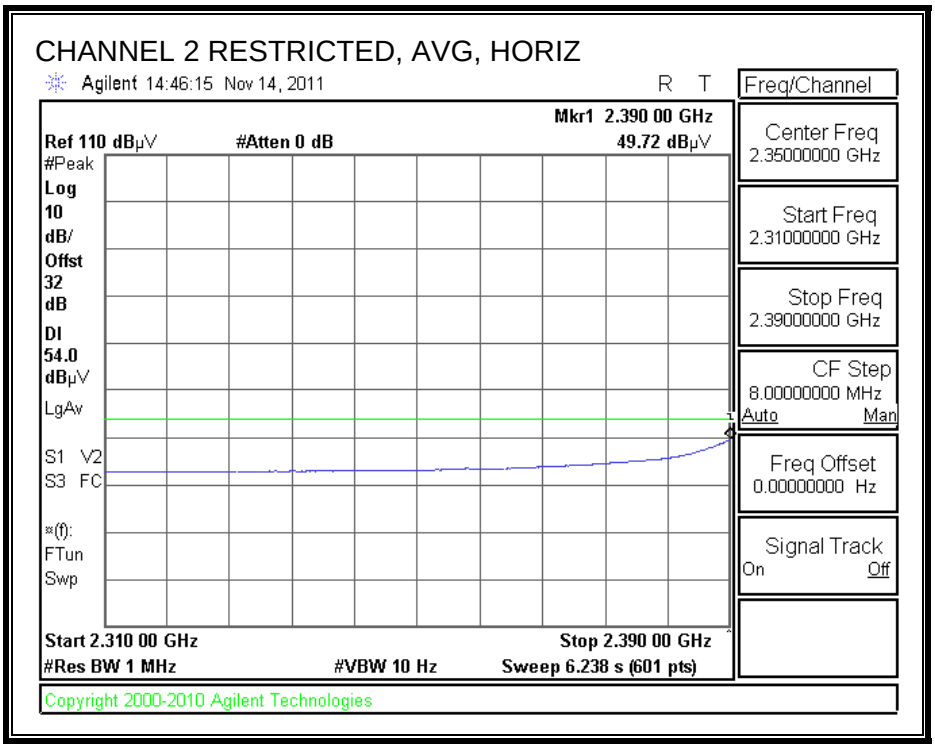
RESTRICTED BANDEDGE (CH1, VERTICAL)



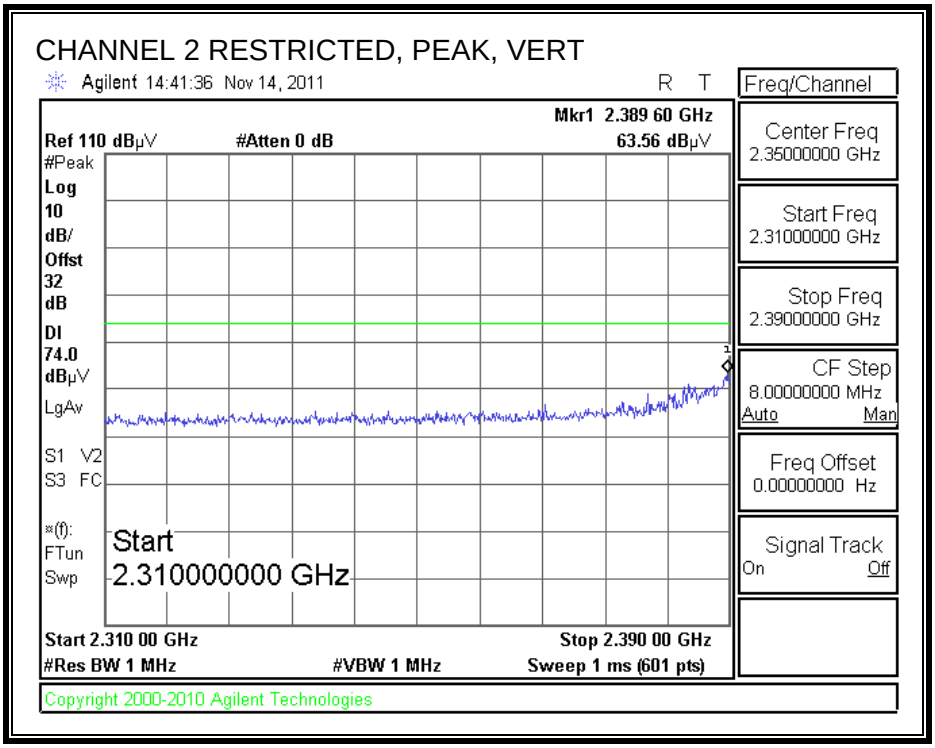


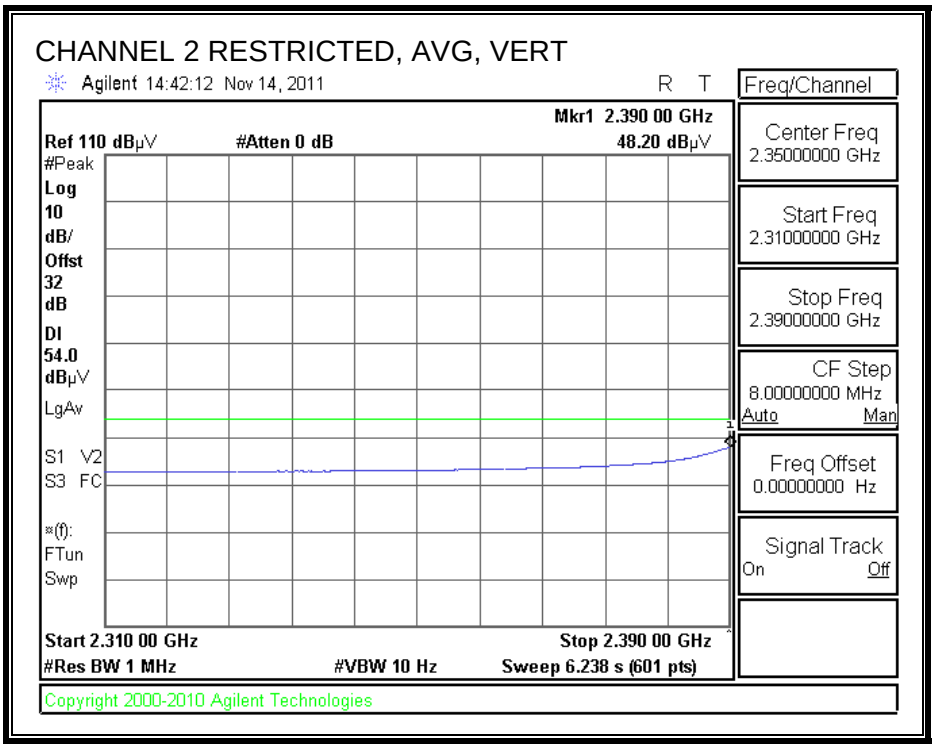
RESTRICTED BANDEDGE (CH2, HORIZONTAL)



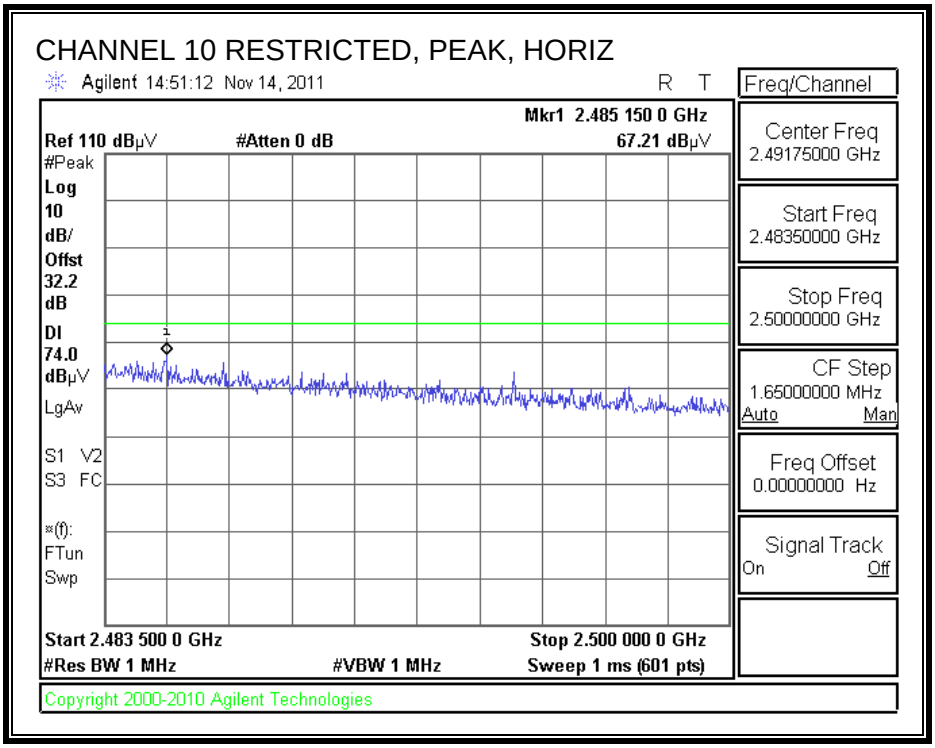


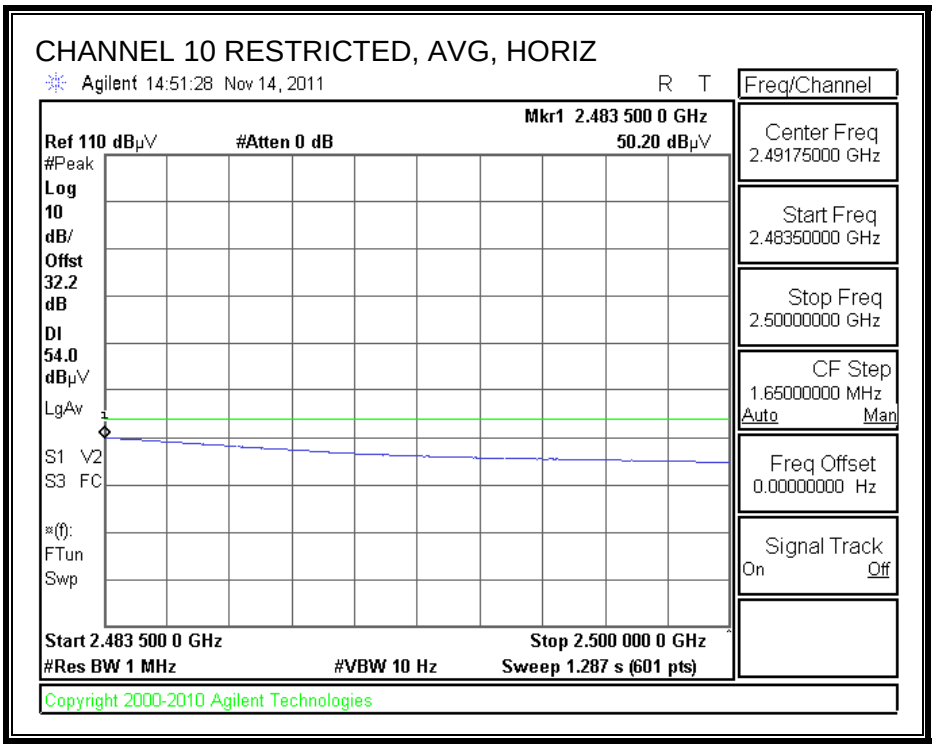
RESTRICTED BANDEDGE (CH2, VERTICAL)



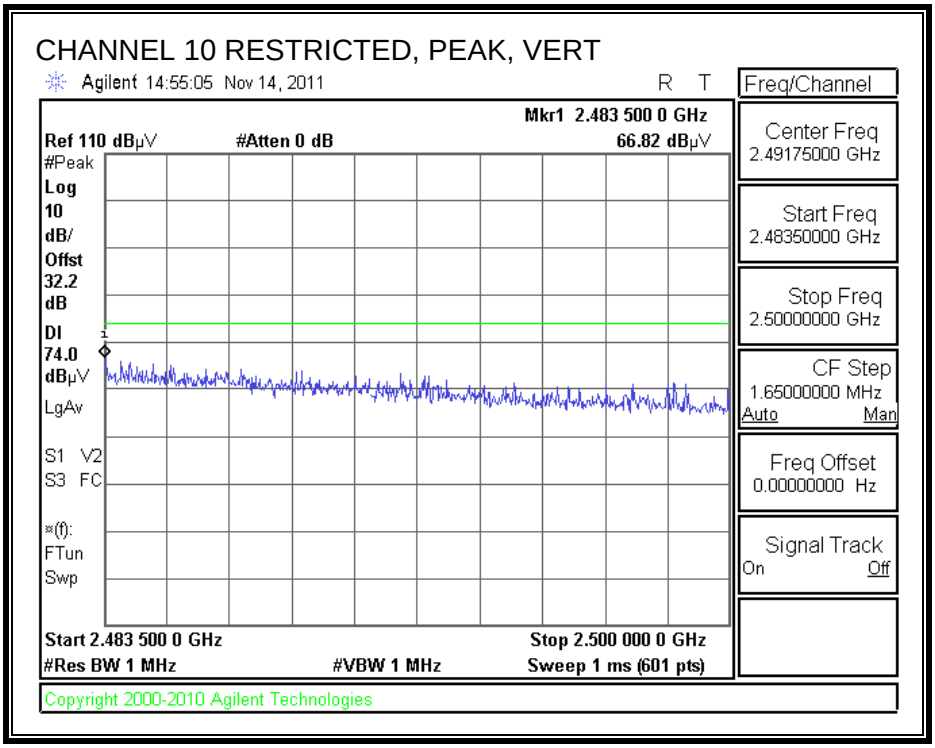


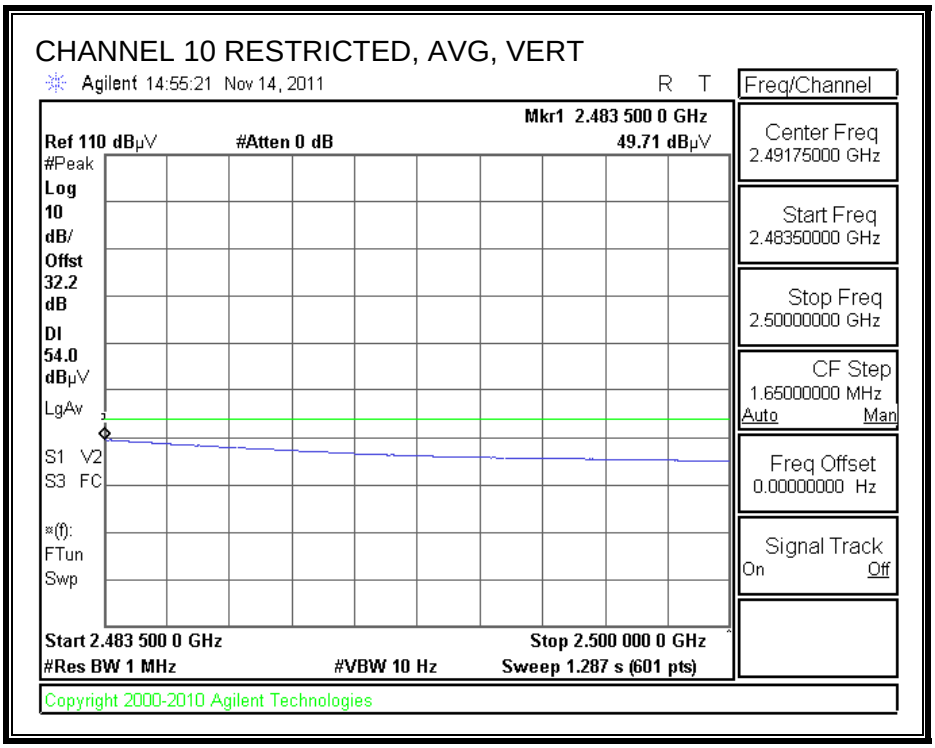
RESTRICTED BANDEDGE (CH10, HORIZONTAL)





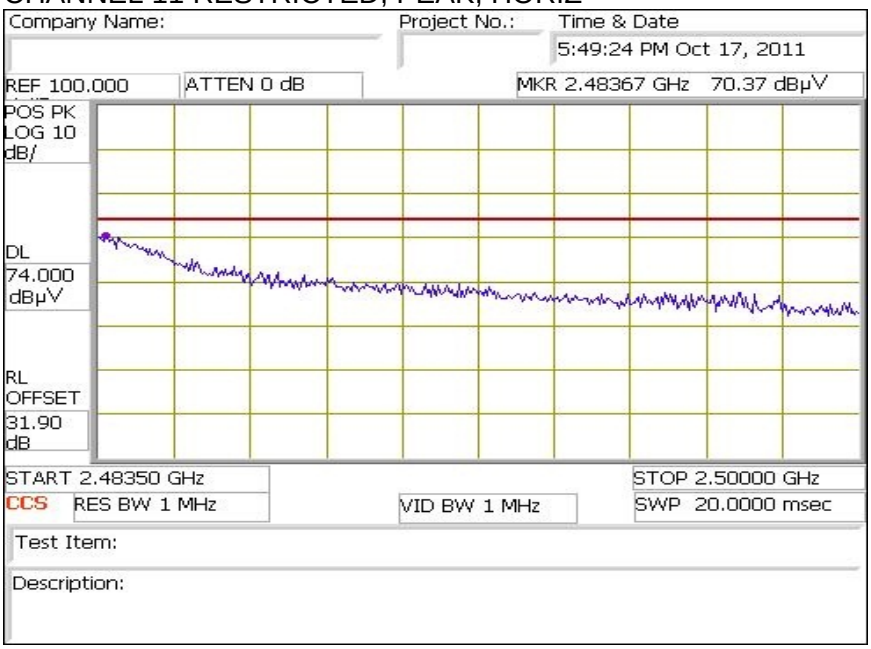
RESTRICTED BANDEDGE (CH10, VERTICAL)



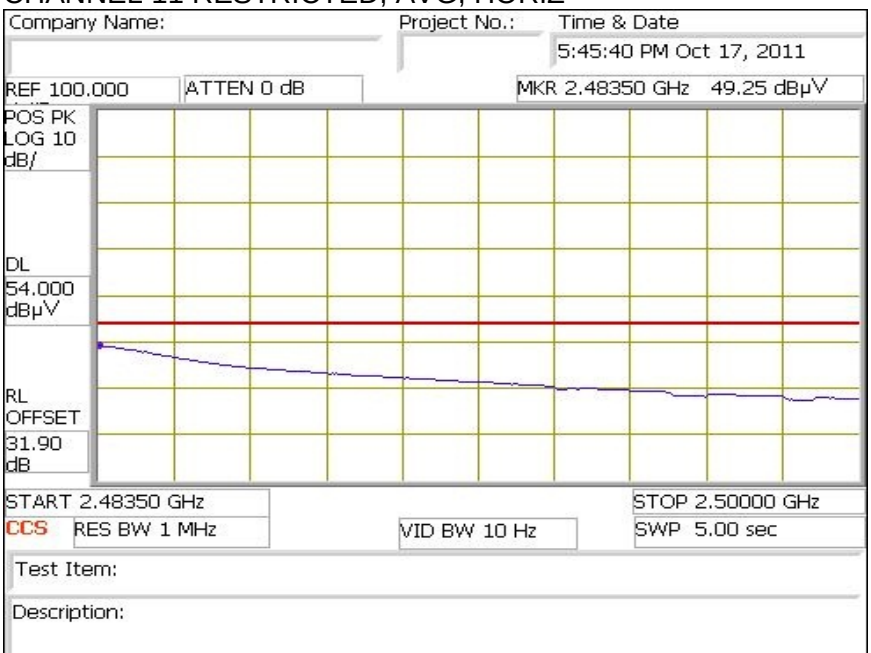


RESTRICTED BANDEDGE (CH11, HORIZONTAL)

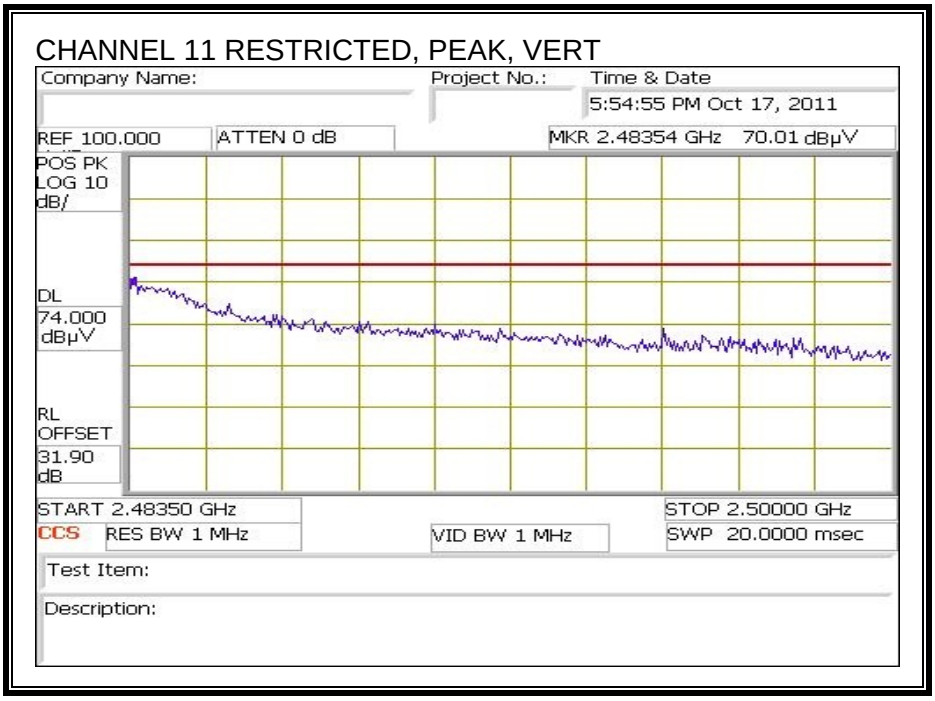
CHANNEL 11 RESTRICTED, PEAK, HORIZ

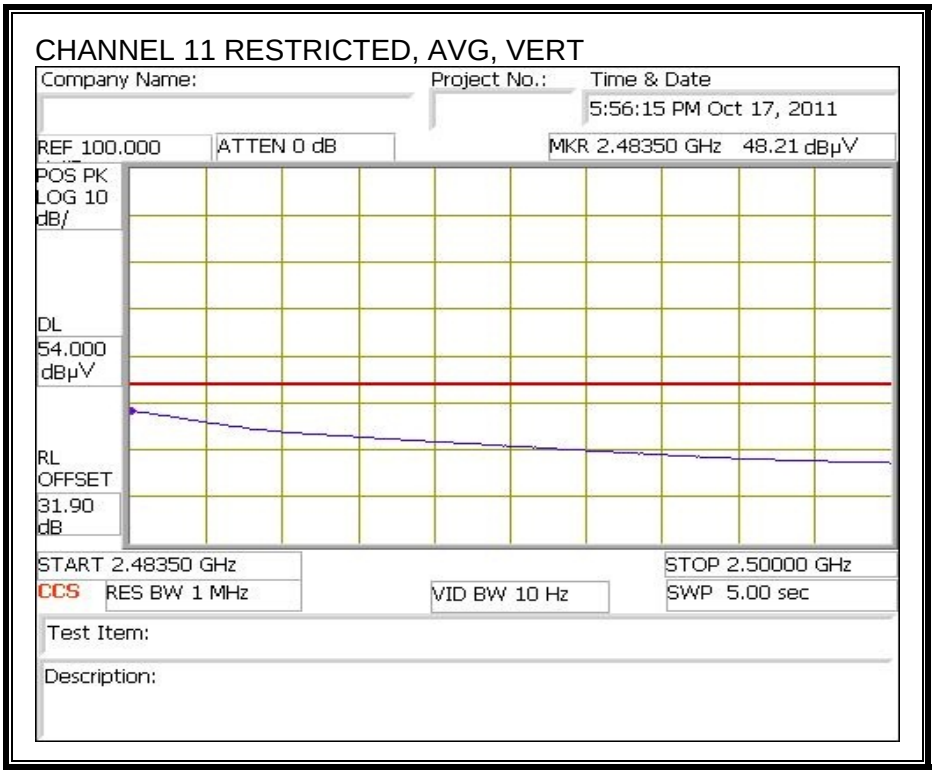


CHANNEL 11 RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (CH11, VERTICAL)





RMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 10/27/11
Project #: 11U13938
Company: Apple
Test Target: FCC 15.247
Mode Oper: TX, g 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

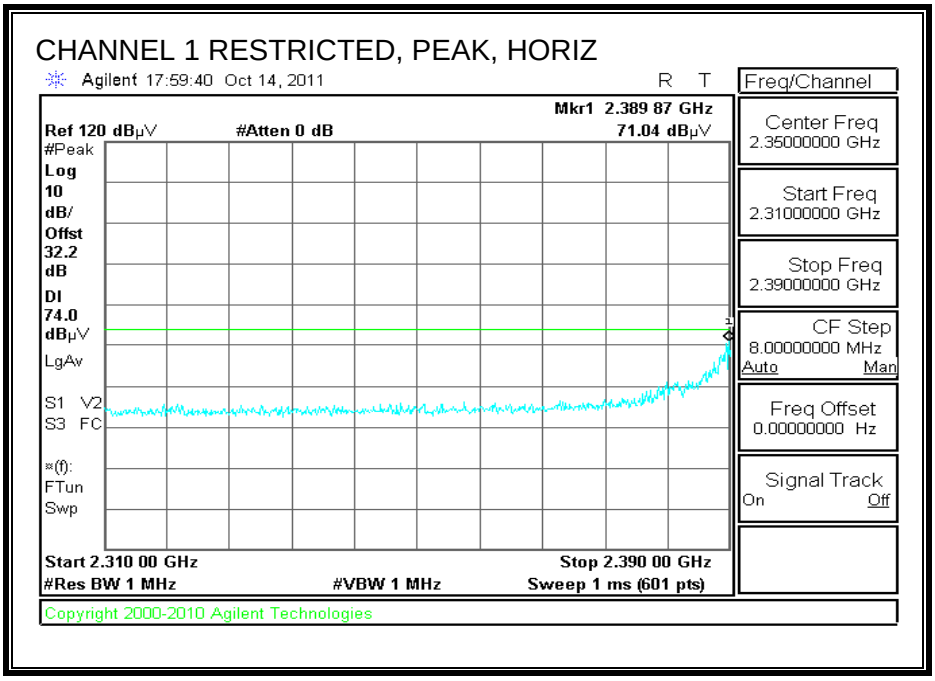
Average Field Strength Limit
Peak Field Strength Limit
Margin vs. Average Limit
Margin vs. Peak Limit

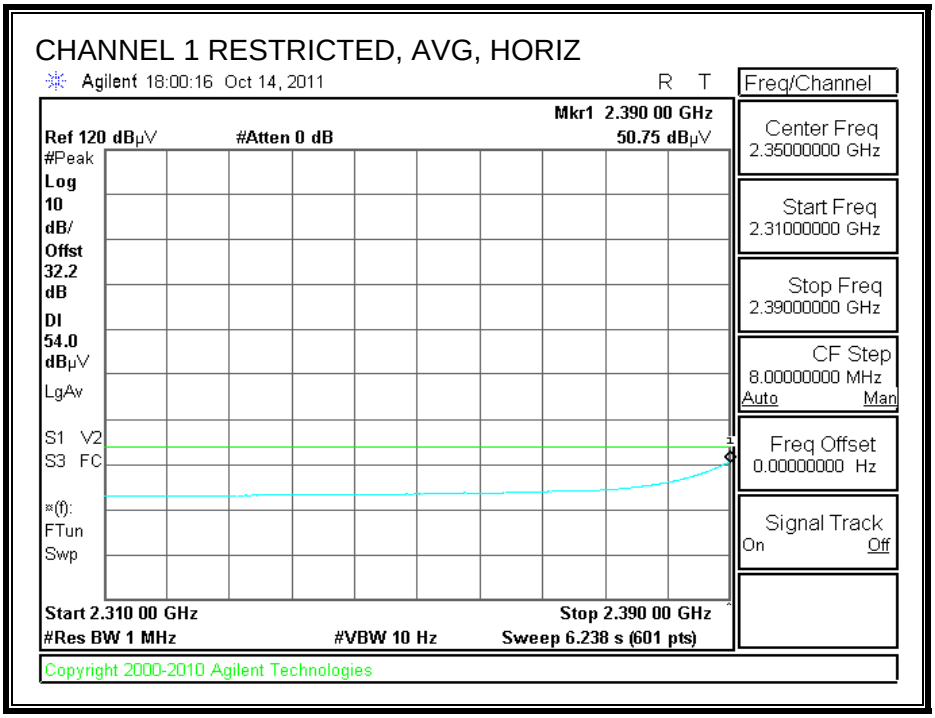
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 2412MHz													
4.824	3.0	38.0	33.2	5.8	-34.8	0.0	0.0	42.1	74.0	-31.9	V	P	
4.824	3.0	25.6	33.2	5.8	-34.8	0.0	0.0	29.7	54.0	-24.3	V	A	
4.824	3.0	37.9	33.2	5.8	-34.8	0.0	0.0	42.0	74.0	-32.0	H	P	
4.824	3.0	25.6	33.2	5.8	-34.8	0.0	0.0	29.7	54.0	-24.3	H	A	
Mid Ch, 2437MHz													
4.874	3.0	37.5	33.2	5.8	-34.9	0.0	0.0	41.8	74.0	-32.2	H	P	
4.874	3.0	25.4	33.2	5.8	-34.9	0.0	0.0	29.6	54.0	-24.4	H	A	
7.311	3.0	36.7	36.2	7.3	-34.7	0.0	0.0	45.5	74.0	-28.5	H	P	
7.311	3.0	24.6	36.2	7.3	-34.7	0.0	0.0	33.4	54.0	-20.6	H	A	
4.874	3.0	38.4	33.2	5.8	-34.9	0.0	0.0	42.6	74.0	-31.4	V	P	
4.874	3.0	25.4	33.2	5.8	-34.9	0.0	0.0	29.6	54.0	-24.4	V	A	
7.311	3.0	37.6	36.2	7.3	-34.7	0.0	0.0	46.4	74.0	-27.6	V	P	
7.311	3.0	24.6	36.2	7.3	-34.7	0.0	0.0	33.4	54.0	-20.6	V	A	
High Ch, 2462MHz													
4.924	3.0	38.9	33.3	5.9	-34.9	0.0	0.0	43.2	74.0	-30.8	V	P	
4.924	3.0	25.8	33.3	5.9	-34.9	0.0	0.0	30.1	54.0	-23.9	V	A	
7.386	3.0	37.4	36.3	7.3	-34.6	0.0	0.0	46.4	74.0	-27.6	V	P	
7.386	3.0	24.4	36.3	7.3	-34.6	0.0	0.0	33.3	54.0	-20.7	V	A	
4.924	3.0	38.4	33.3	5.9	-34.9	0.0	0.0	42.7	74.0	-31.3	H	P	
4.924	3.0	25.8	33.3	5.9	-34.9	0.0	0.0	30.1	54.0	-23.9	H	A	
7.386	3.0	36.5	36.3	7.3	-34.6	0.0	0.0	45.4	74.0	-28.6	H	P	
7.386	3.0	24.4	36.3	7.3	-34.6	0.0	0.0	33.3	54.0	-20.7	H	A	

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

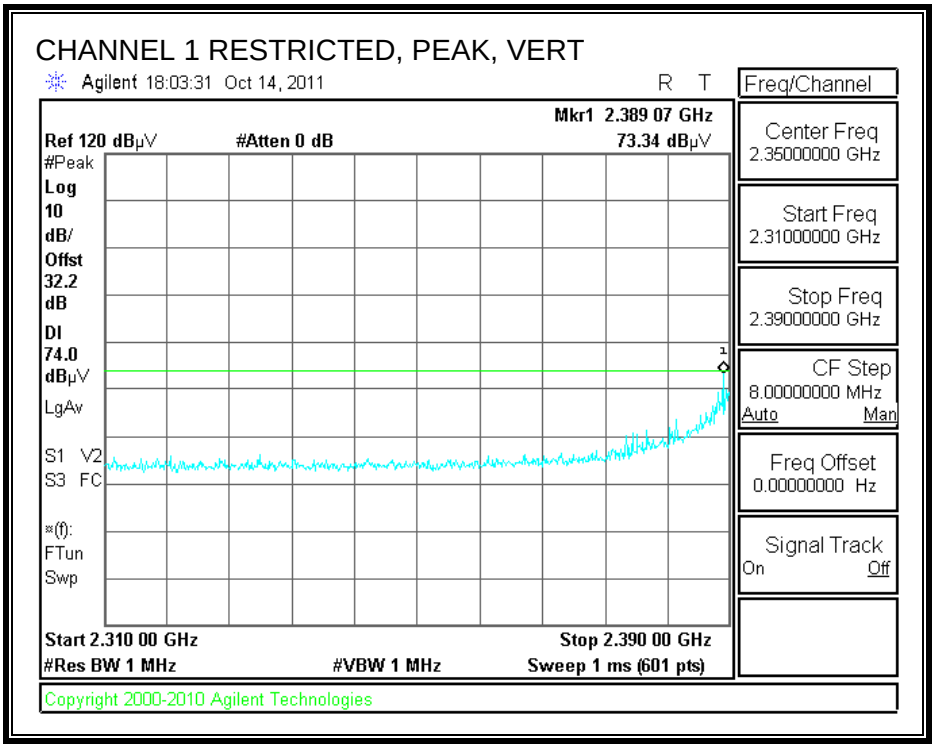
8.2.3. 802.11HT20 MODE IN THE 2.4 GHz BAND

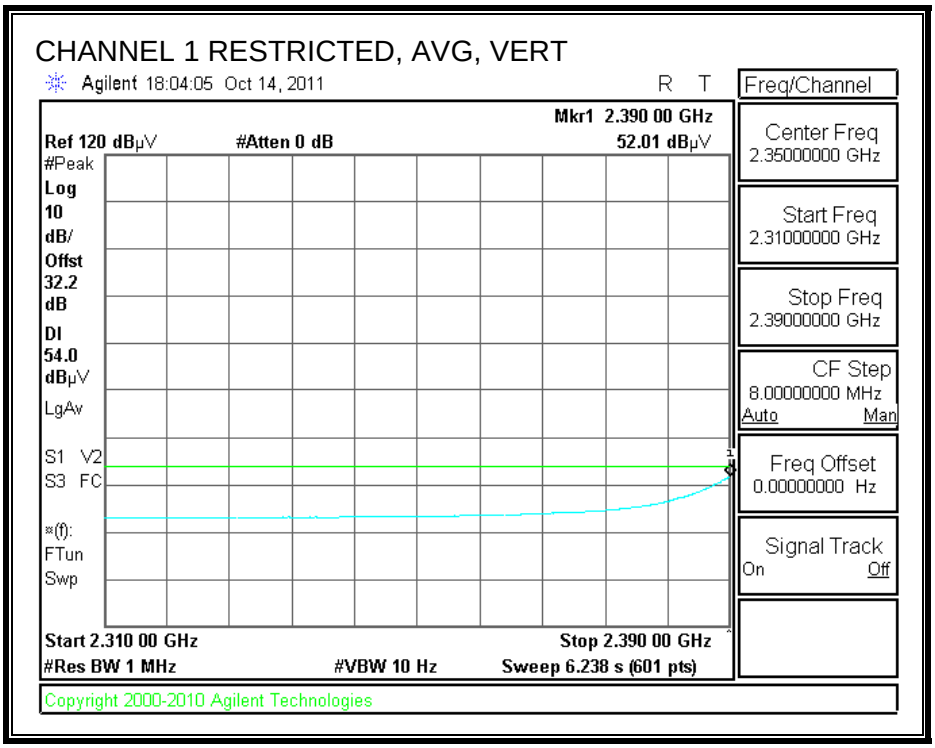
RESTRICTED BANDEDGE (CH1, HORIZONTAL)



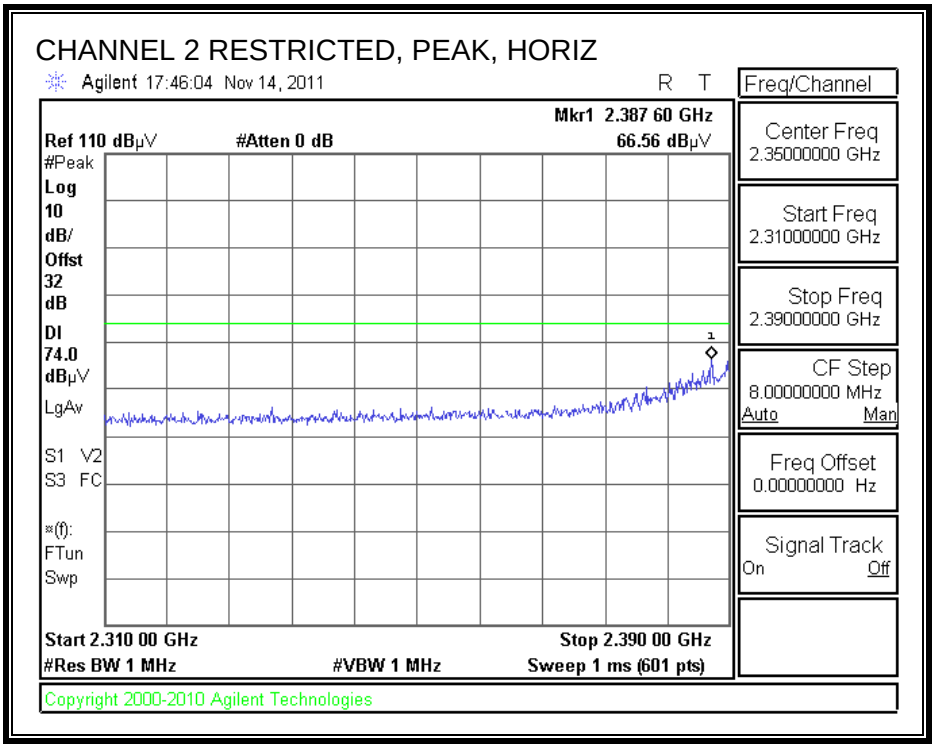


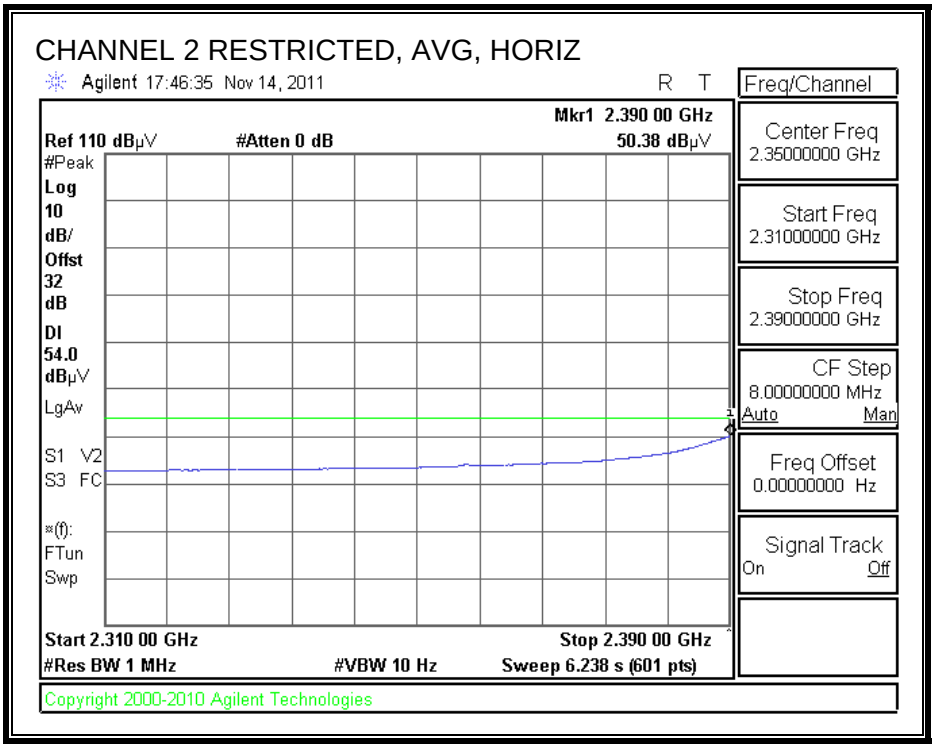
RESTRICTED BANDEDGE (CH1, VERTICAL)



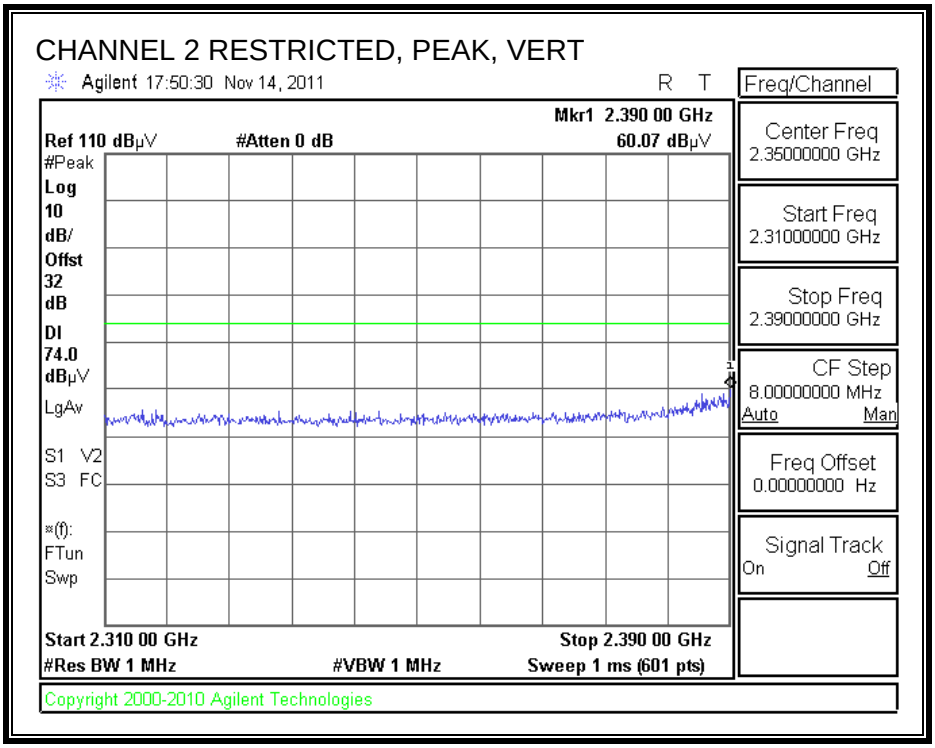


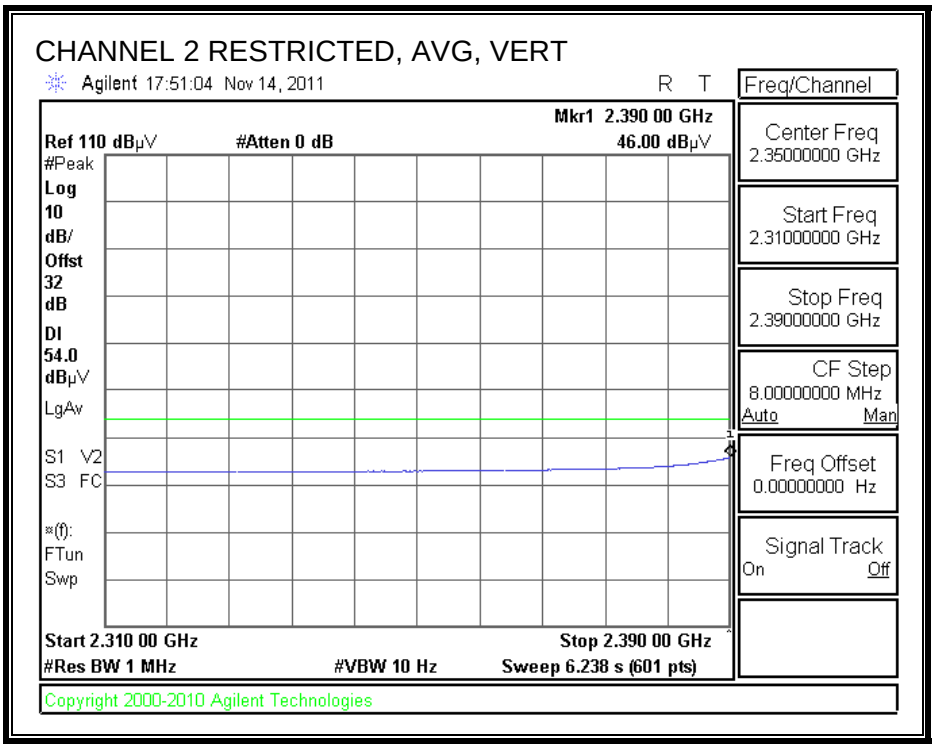
RESTRICTED BANDEDGE (CH2, HORIZONTAL)



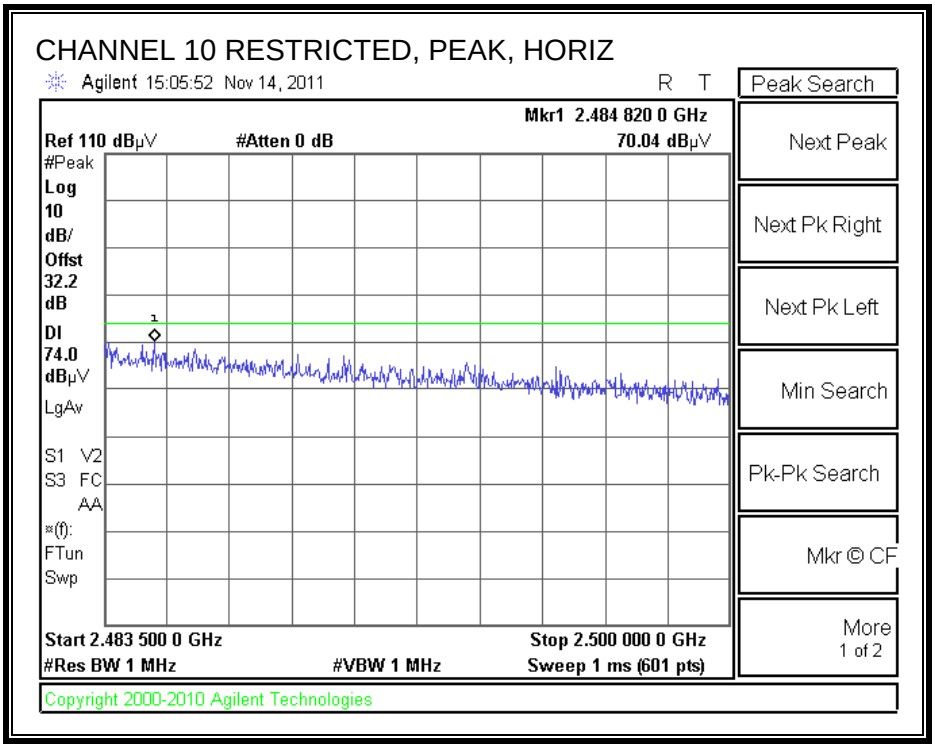


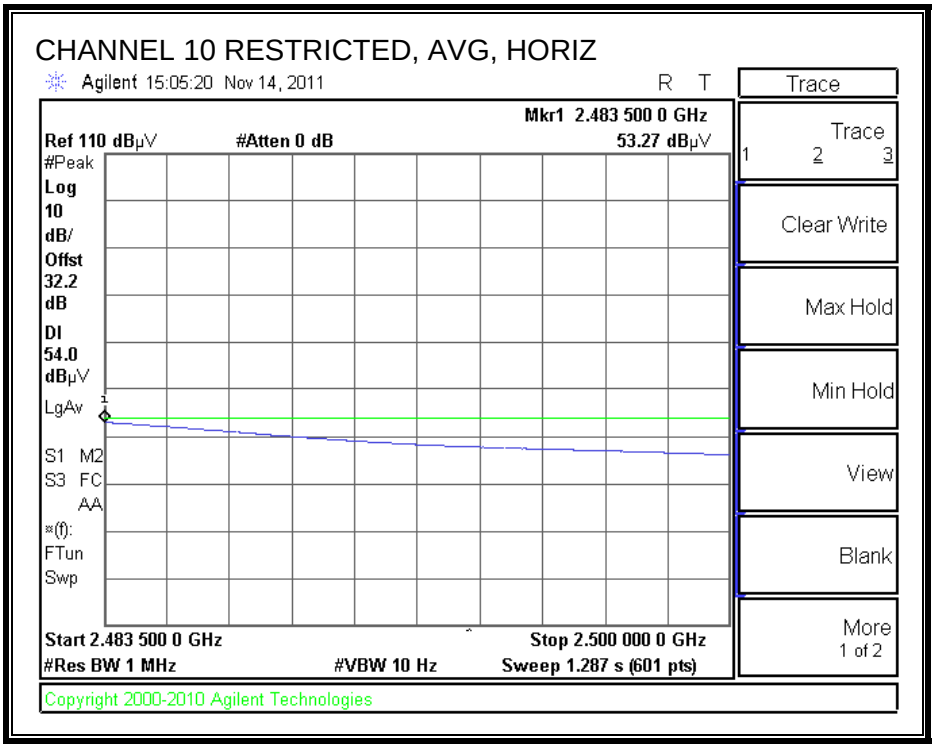
RESTRICTED BANDEDGE (CH2, VERTICAL)



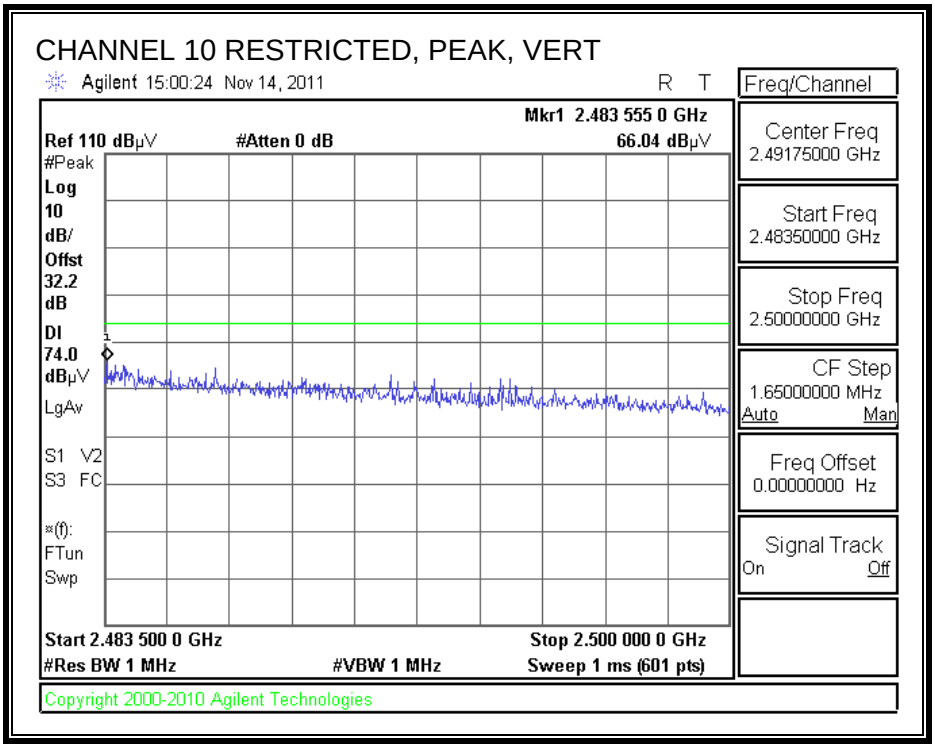


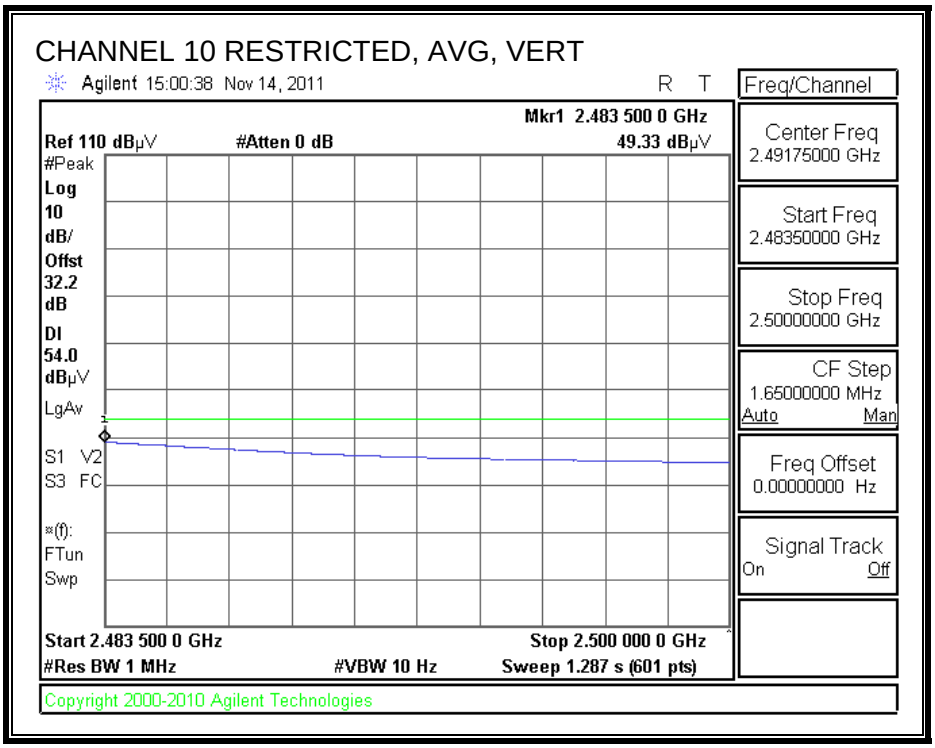
RESTRICTED BANDEDGE (CH10, HORIZONTAL)





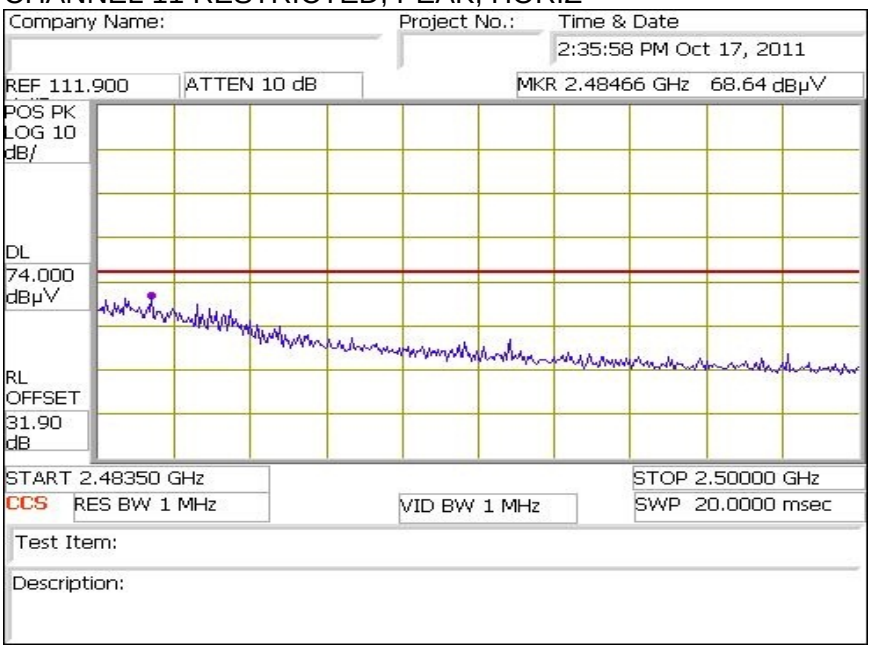
RESTRICTED BANDEDGE (CH10, VERTICAL)



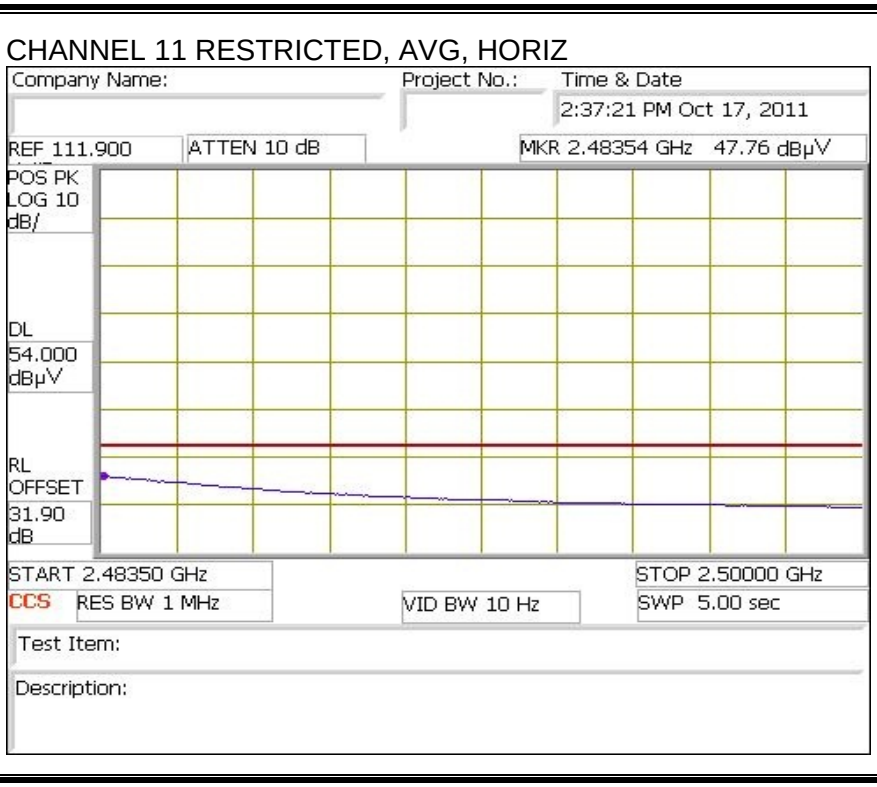


RESTRICTED BANDEDGE (CH11, HORIZONTAL)

CHANNEL 11 RESTRICTED, PEAK, HORIZ

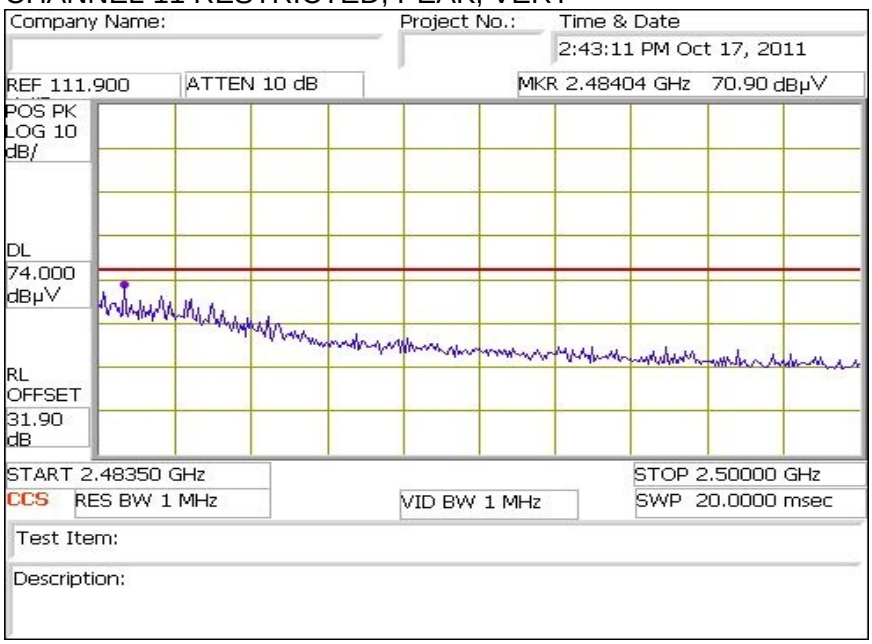


CHANNEL 11 RESTRICTED, AVG, HORIZ

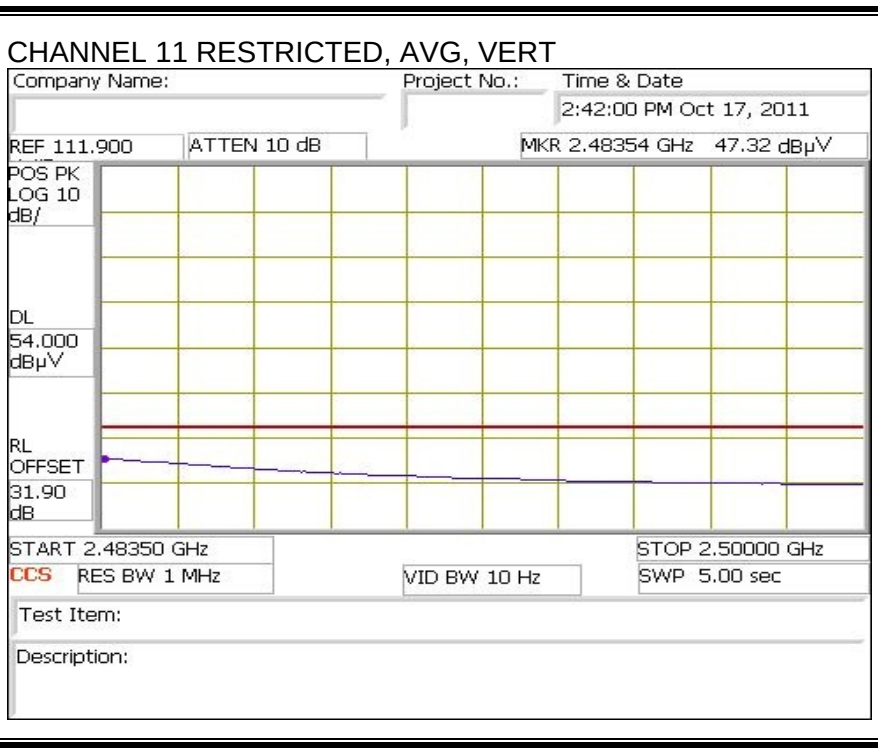


RESTRICTED BANDEDGE (CH11, VERTICAL)

CHANNEL 11 RESTRICTED, PEAK, VERT



CHANNEL 11 RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 10/27/11
Project #: 11U13938
Company: Apple
Test Target: FCC 15.247
Mode Oper: TX, HT20

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
Low Ch, 2412MHz													
4.824	3.0	38.0	33.2	5.8	-34.8	0.0	0.0	42.1	74.0	-31.9	H	P	
4.824	3.0	25.6	33.2	5.8	-34.8	0.0	0.0	29.7	54.0	-24.3	H	A	
4.824	3.0	38.2	33.2	5.8	-34.8	0.0	0.0	42.3	74.0	-31.7	V	P	
4.824	3.0	25.6	33.2	5.8	-34.8	0.0	0.0	29.8	54.0	-24.2	V	A	
Mid Ch, 2437MHz													
4.874	3.0	38.5	33.2	5.8	-34.9	0.0	0.0	42.8	74.0	-31.2	V	P	
4.874	3.0	25.4	33.2	5.8	-34.9	0.0	0.0	29.6	54.0	-24.4	V	A	
7.311	3.0	37.2	36.2	7.3	-34.7	0.0	0.0	46.0	74.0	-28.0	V	P	
7.311	3.0	24.6	36.2	7.3	-34.7	0.0	0.0	33.4	54.0	-20.6	V	A	
4.874	3.0	37.7	33.2	5.8	-34.9	0.0	0.0	42.0	74.0	-32.0	H	P	
4.874	3.0	25.4	33.2	5.8	-34.9	0.0	0.0	29.6	54.0	-24.4	H	A	
7.311	3.0	36.5	36.2	7.3	-34.7	0.0	0.0	45.3	74.0	-28.7	H	P	
7.311	3.0	24.6	36.2	7.3	-34.7	0.0	0.0	33.4	54.0	-20.6	H	A	
High Ch, 2462MHz													
4.924	3.0	38.1	33.3	5.9	-34.9	0.0	0.0	42.4	74.0	-31.6	H	P	
4.924	3.0	25.7	33.3	5.9	-34.9	0.0	0.0	30.0	54.0	-24.0	H	A	
7.386	3.0	36.4	36.3	7.3	-34.6	0.0	0.0	45.4	74.0	-28.6	H	P	
7.386	3.0	24.3	36.3	7.3	-34.6	0.0	0.0	33.2	54.0	-20.8	H	A	
4.924	3.0	38.4	33.3	5.9	-34.9	0.0	0.0	42.7	74.0	-31.3	V	P	
4.924	3.0	25.7	33.3	5.9	-34.9	0.0	0.0	30.0	54.0	-24.0	V	A	
7.386	3.0	36.7	36.3	7.3	-34.6	0.0	0.0	45.6	74.0	-28.4	V	P	
7.386	3.0	24.3	36.3	7.3	-34.6	0.0	0.0	33.2	54.0	-20.8	V	A	

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

8.2.4. 802.11a MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 10/28/11
Project #: 11U13938
Company: Apple
Test Target: FCC15.247
Mode Oper: TX, a mode, 5.8GHz band

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
Low Ch, 5745MHz													
11.490	3.0	38.6	39.2	9.5	-33.1	0.0	0.7	54.8	74.0	-19.2	H	P	
11.490	3.0	26.4	39.2	9.5	-33.1	0.0	0.7	42.7	54.0	-11.3	H	A	
11.490	3.0	39.0	39.2	9.5	-33.1	0.0	0.7	55.2	74.0	-18.8	V	P	
11.490	3.0	26.7	39.2	9.5	-33.1	0.0	0.7	42.9	54.0	-11.1	V	A	
Mid Ch, 5785MHz													
11.570	3.0	40.6	39.2	9.5	-33.0	0.0	0.7	57.1	74.0	-16.9	H	P	
11.570	3.0	26.8	39.2	9.5	-33.0	0.0	0.7	43.2	54.0	-10.8	H	A	
11.570	3.0	37.5	39.2	9.5	-33.0	0.0	0.7	53.9	74.0	-20.1	V	P	
11.570	3.0	25.1	39.2	9.5	-33.0	0.0	0.7	41.5	54.0	-12.5	V	A	
High CH, 5828MHz													
11.650	3.0	40.2	39.3	9.6	-32.9	0.0	0.7	54.8	74.0	-19.2	H	P	
11.650	3.0	26.5	39.3	9.6	-32.9	0.0	0.7	43.2	54.0	-10.8	H	A	
11.650	3.0	38.0	39.3	9.6	-32.9	0.0	0.7	54.7	74.0	-19.3	V	P	
11.650	3.0	25.4	39.3	9.6	-32.9	0.0	0.7	42.1	54.0	-11.9	V	A	

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

8.2.5. 802.11n HT20 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 10/28/11
Project #: 11U13938
Company: Apple
Test Target: FCC15.247
Mode Oper: TX, HT20, 5.8GHz Band

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
Low Ch, 5745MHz													
11.490	3.0	34.6	39.2	9.5	-33.1	0.0	0.7	50.8	74.0	-23.2	H	P	
11.490	3.0	22.2	39.2	9.5	-33.1	0.0	0.7	38.4	54.0	-15.6	H	A	
11.490	3.0	34.5	39.2	9.5	-33.1	0.0	0.7	50.7	74.0	-23.3	V	P	
11.490	3.0	22.2	39.2	9.5	-33.1	0.0	0.7	38.4	54.0	-15.6	V	A	
Mid Ch, 5785MHz													
11.570	3.0	34.9	39.2	9.5	-33.0	0.0	0.7	51.4	74.0	-22.6	H	P	
11.570	3.0	22.7	39.2	9.5	-33.0	0.0	0.7	39.1	54.0	-14.9	H	A	
11.570	3.0	34.4	39.2	9.5	-33.0	0.0	0.7	50.9	74.0	-23.2	V	P	
11.570	3.0	22.2	39.2	9.5	-33.0	0.0	0.7	38.7	54.0	-15.3	V	A	
High CH, 5828MHz													
11.650	3.0	34.9	39.3	9.6	-32.9	0.0	0.7	51.6	74.0	-22.4	H	P	
11.650	3.0	22.6	39.3	9.6	-32.9	0.0	0.7	39.3	54.0	-14.7	H	A	
11.650	3.0	34.5	39.3	9.6	-32.9	0.0	0.7	51.1	74.0	-22.9	V	P	
11.650	3.0	22.2	39.3	9.6	-32.9	0.0	0.7	38.9	54.0	-15.1	V	A	

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

8.3. RECEIVER ABOVE 1 GHz

8.3.1. RX ABOVE 1 GHz FOR 20 MHz BANDWIDTH IN THE 2.4 GHz BAND

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber-B

Company: Apple
Project #: 11U13938
Date: 10/31/2011
Test Engineer: Chin Pang
Configuration: EUT only
Mode: RX, 2.4GHz Band (Worst Case)

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A005(			FCC 15.209

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.200	3.0	52.0	31.7	24.7	2.9	-35.8	0.0	0.0	43.7	23.4	74	54	-30.3	-30.6	H
1.527	3.0	48.0	31.0	26.2	3.2	-35.7	0.0	0.0	41.8	24.8	74	54	-32.2	-29.2	H
1.073	3.0	47.5	32.0	24.1	2.7	-35.9	0.0	0.0	38.4	22.9	74	54	-35.6	-31.1	V
1.787	3.0	50.0	33.4	27.4	3.5	-35.5	0.0	0.0	45.4	28.8	74	54	-28.6	-25.2	V

Rev. 07.08.11
Note: No other emisions were detected above the system noise floor.

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

8.3.2. RX ABOVE 1 GHz FOR 20 MHz BANDWIDTH IN THE 5.8 GHz BAND

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber-B

Company: Apple
Project #: 11U13938
Date: 10/31/2011
Test Engineer: Chin Pang
Configuration: EUT only
Mode: RX, 5GHz Band (Worst Case)

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A005(			FCC 15.209

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.142	3.0	47.5	31.5	24.5	2.8	-35.9	0.0	0.0	38.9	22.9	74	54	-35.1	-31.1	H
3.158	3.0	46.8	30.4	30.8	5.0	-35.2	0.0	0.0	47.4	31.0	74	54	-26.6	-23.0	H
1.058	3.0	48.0	32.0	24.1	2.7	-35.9	0.0	0.0	38.9	22.9	74	54	-35.1	-31.1	V
2.542	3.0	46.5	30.0	29.0	4.4	-35.2	0.0	0.0	44.7	28.2	74	54	-29.3	-25.8	V

Rev. 07.08.11
Note: No other emisions were detected above the system noise floor.

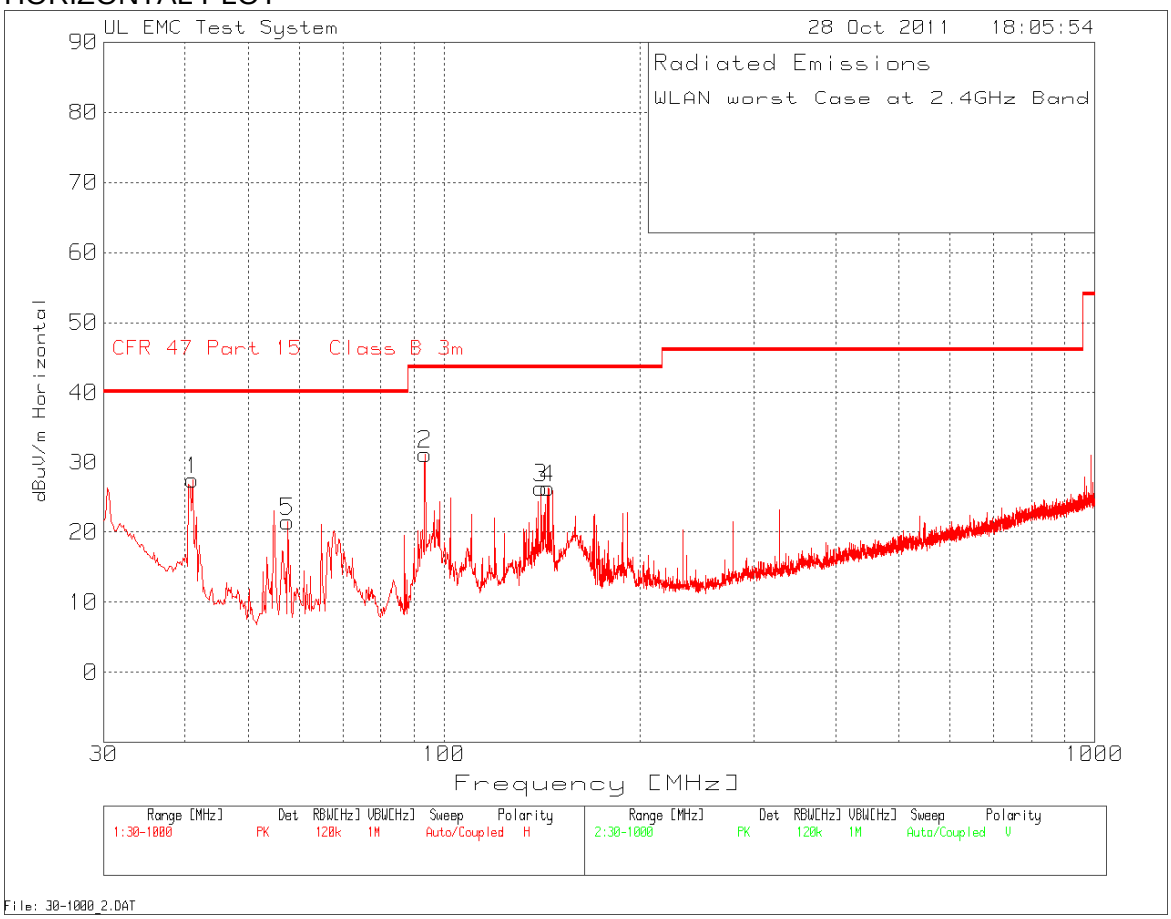
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

8.4. WORST-CASE BELOW 1 GHz

2.4GHz BAND

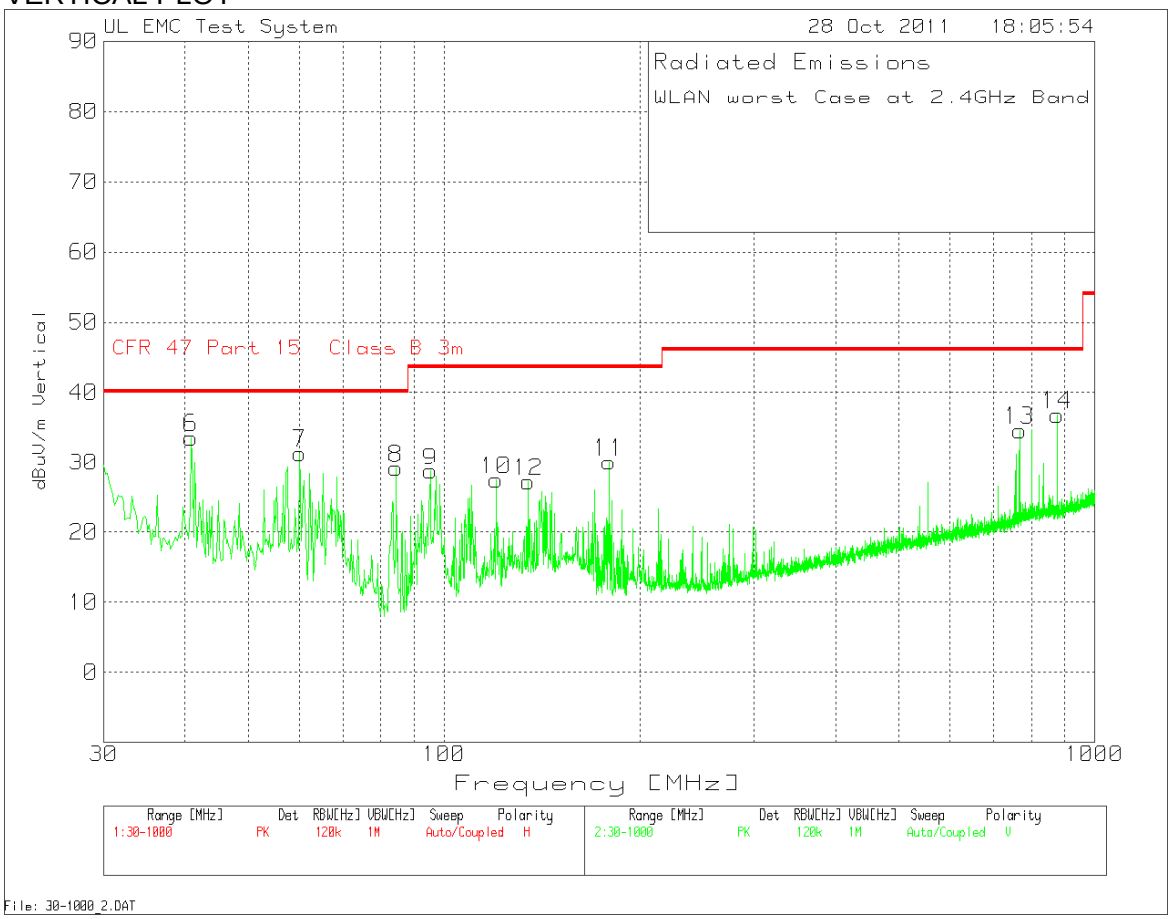
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

WLAN worst Case at 2.4GHz Band

Range 1 30 - 1000MHz

Frequency	Reading	Detector	Cable Loss	Amp Gain [dB	Ant Factors	Corrected Reading	15B Limit	Margin	Polarity
41.0492	42.59	PK	0.9	-29.4	13.4	27.49	40	-12.51	Horz
93.5811	50.77	PK	1.4	-29.3	8.4	31.27	43.5	-12.23	Horz
141.0731	40.6	PK	1.7	-29.2	13.2	26.3	43.5	-17.2	Horz
144.7562	40.73	PK	1.7	-29.1	12.9	26.23	43.5	-17.27	Horz
57.526	41.93	PK	1.1	-29.4	7.9	21.53	40	-18.47	Horz

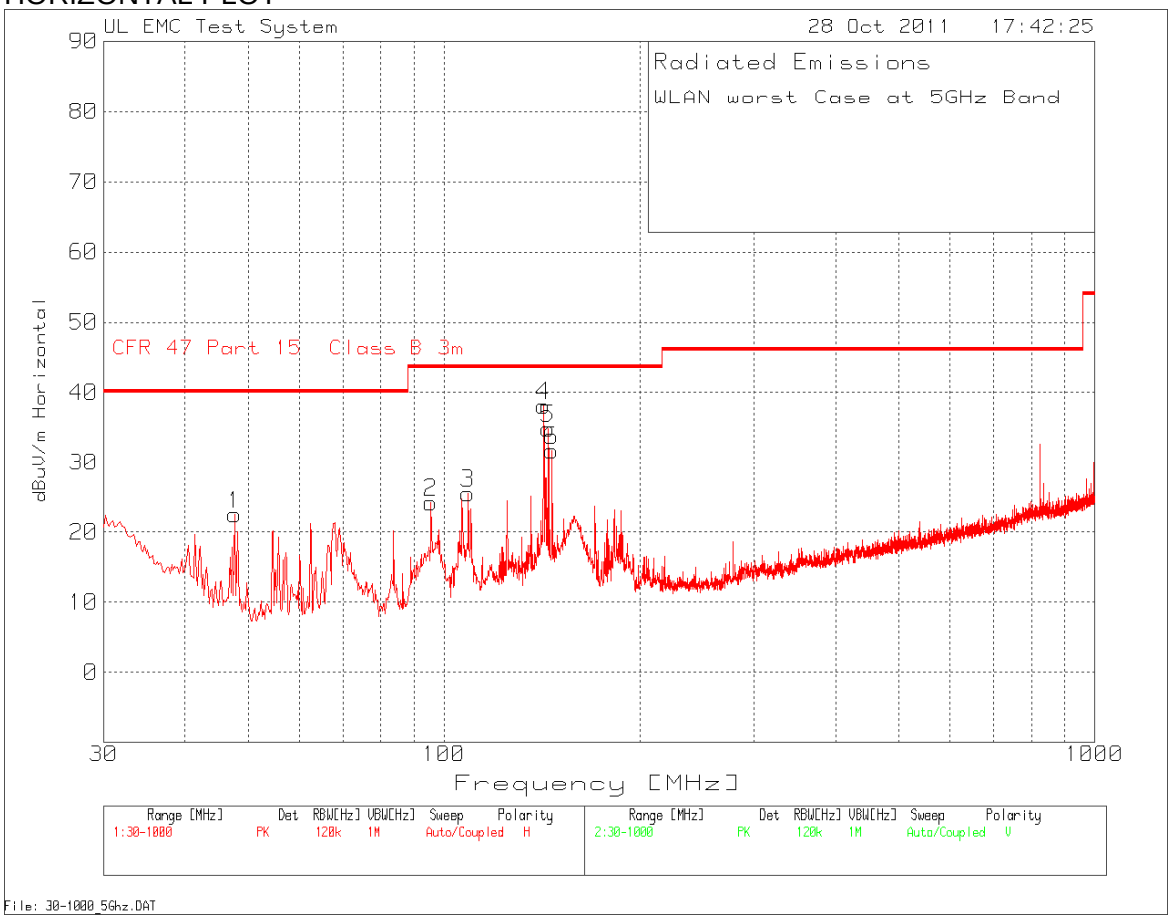
Range 2 30 - 1000MHz

Frequency	Reading	Detector	Cable Loss	Amp Gain [dB	Ant Factors	Corrected Reading	15B Limit	Margin	Polarity
40.8553	48.44	PK	0.9	-29.4	13.6	33.54	40	-6.46	Vert
60.046	51.71	PK	1.2	-29.4	7.9	31.41	40	-8.59	Vert
84.4704	49.8	PK	1.3	-29.4	7.5	29.2	40	-10.8	Vert
95.3257	47.7	PK	1.4	-29.3	8.9	28.7	43.5	-14.8	Vert
120.3317	41.43	PK	1.5	-29.2	13.7	27.43	43.5	-16.07	Vert
179.4544	46.44	PK	1.8	-29	10.8	30.04	43.5	-13.46	Vert
134.8701	41.43	PK	1.6	-29.2	13.4	27.23	43.5	-16.27	Vert
766.9984	39.35	PK	3.9	-29	20.4	34.65	46	-11.35	Vert
877.2962	39.9	PK	4.1	-28.6	21.4	36.8	46	-9.2	Vert

5GHz BAND

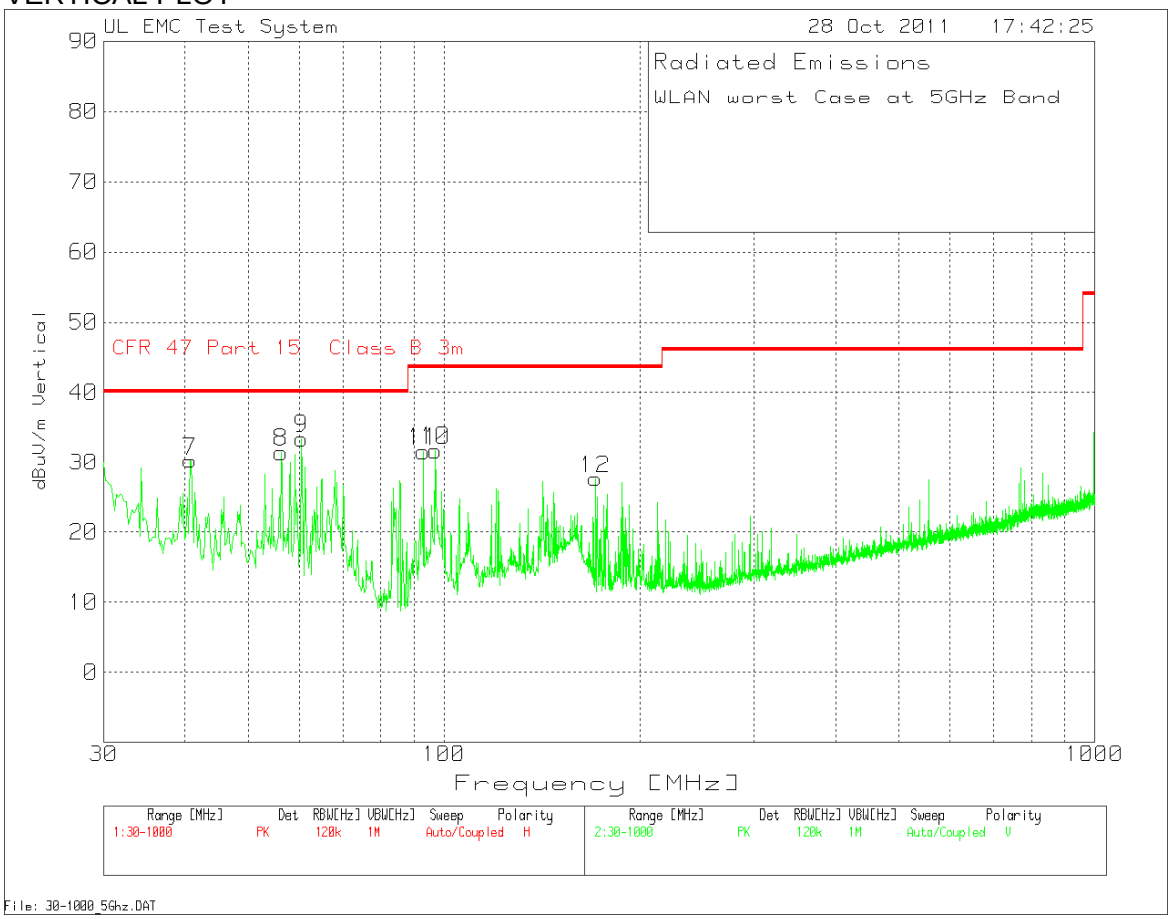
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

WLAN worst Case at 5GHz Band

Range 1 30 - 1000MHz

Frequency	Reading	Detector	Cable Loss	Amp Gain	Ant Gain	Correctec	15B Limit	Margin	Height [c	Polarity
47.6399	41.46	PK	1	-29.4	9.4	22.46	40	-17.54	100	Horz
95.5196	43.19	PK	1.4	-29.3	8.9	24.19	43.5	-19.31	200	Horz
108.8949	41.59	PK	1.5	-29.3	11.7	25.49	43.5	-18.01	100	Horz
142.4301	52.57	PK	1.7	-29.2	13.1	38.17	43.5	-5.33	100	Horz
144.5624	49.42	PK	1.7	-29.1	12.9	34.92	43.5	-8.58	100	Horz
146.5008	46.39	PK	1.7	-29.1	12.8	31.79	43.5	-11.71	200	Horz

Range 2 30 - 1000MHz

Frequency	Reading	Detector	Cable Loss	Amp Gain	Ant Gain	Correctec	15B Limit	Margin	Height [c	Polarity
40.6615	45.05	PK	0.9	-29.4	13.7	30.25	40	-9.75	109	Vert
56.1691	51.9	PK	1.1	-29.4	7.9	31.5	40	-8.5	109	Vert
60.4337	53.76	PK	1.2	-29.4	7.9	33.46	40	-6.54	109	Vert
97.0703	50.34	PK	1.4	-29.3	9.3	31.74	43.5	-11.76	109	Vert
92.9996	51.23	PK	1.4	-29.3	8.3	31.63	43.5	-11.87	109	Vert
170.9253	44.75	PK	1.8	-29	10.1	27.65	43.5	-15.85	200	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

ANSI C63.4

RESULTS

6 WORST EMISSIONS

WLAN (2.4GHz Band)

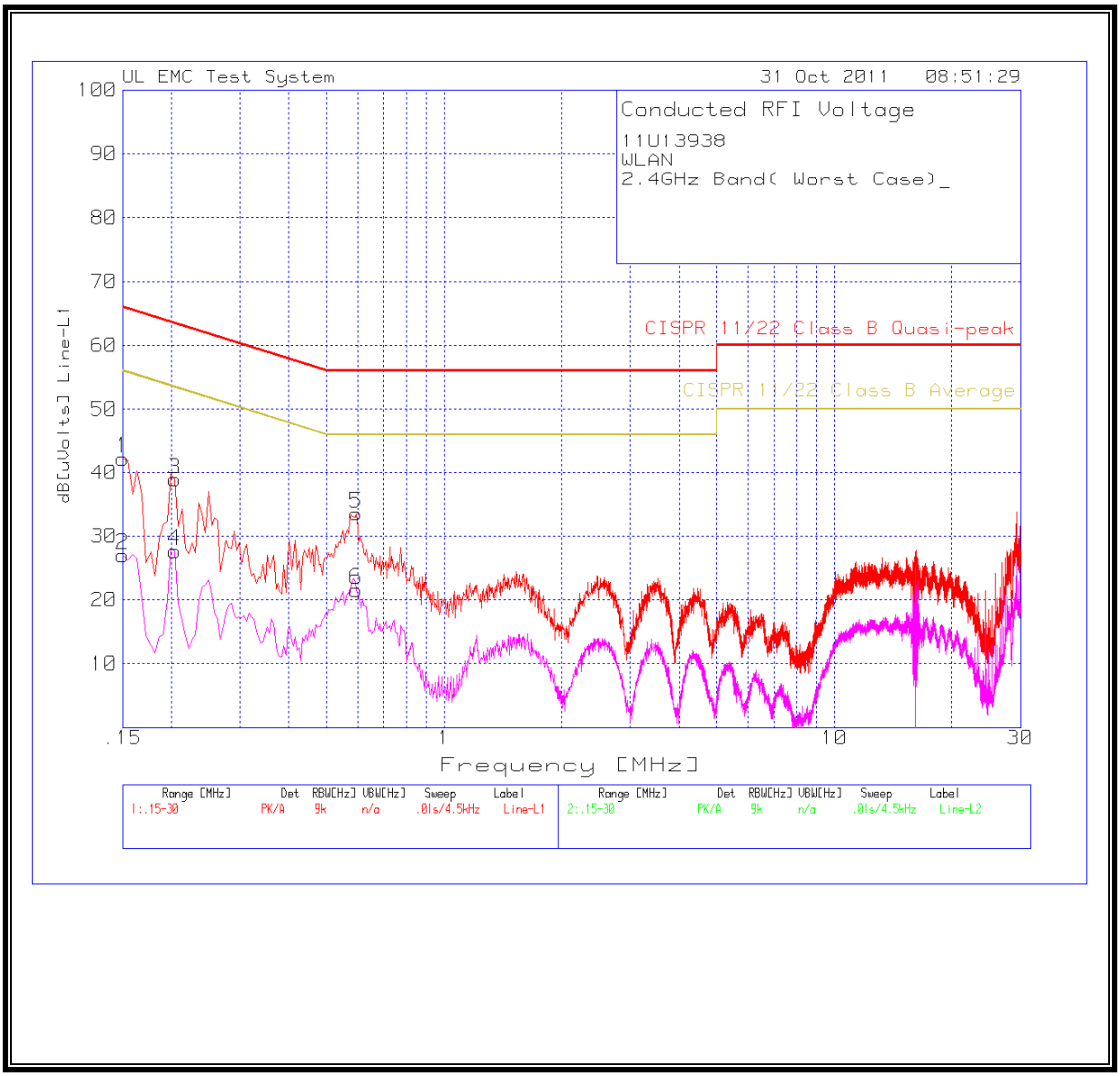
11U13938							
WLAN							
2.4GHz Band(Worst Case)							
Line-L1 .15 - 30MHz							
Frequency	Reading	Detector	Coreecte	Class B Q	Margin	Class B A	Margin
0.15	42.26	PK	42.26	66	-23.74	56	-13.74
0.15	27.04	Av	27.04	-	-	56	-28.96
0.204	38.87	PK	38.87	63.4	-24.53	53.4	-14.53
0.204	27.64	Av	27.64	-	-	53.4	-25.76
0.5955	33.53	PK	33.53	56	-22.47	46	-12.47
0.5955	21.53	Av	21.53	-	-	46	-24.47
Line-L2 .15 - 30MHz							
Frequency	Reading	Detector	Coreecte	Class B Q	Margin	Class B A	Margin
0.1545	41.93	PK	41.93	65.8	-23.87	55.8	-13.87
0.1545	27.09	Av	27.09	-	-	55.8	-28.71
0.1995	39.72	PK	39.72	63.6	-23.88	53.6	-13.88
0.1995	29.16	Av	29.16	-	-	53.6	-24.44
0.591	39.37	PK	39.37	56	-16.63	46	-6.63
0.591	29.25	Av	29.25	-	-	46	-16.75

WLAN (5GHz Band)

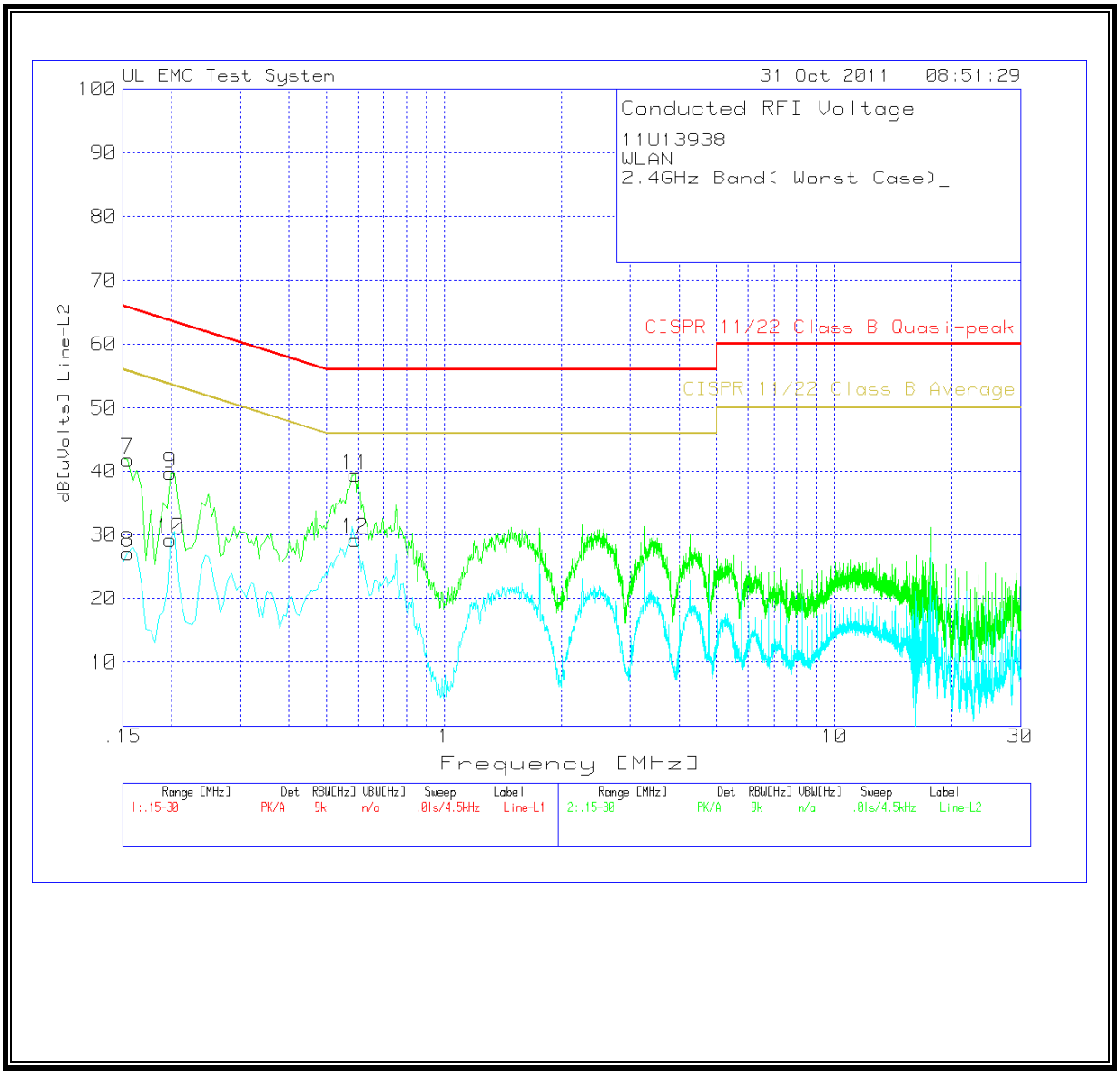
11U13938							
WLAN							
5GHz Band (Worst Case)							
Line-L1 .15 - 30MHz							
Frequency	Reading	Detector	Corrected Reading	Class B Qp	Margin	Class B Avg	Margin
0.1815	42.2	PK	42.2	64.4	-22.2	54.4	-12.2
0.1815	29.17	Av	29.17	-	-	54.4	-25.23
0.231	38.03	PK	38.03	62.4	-24.37	52.4	-14.37
0.231	21.1	Av	21.1	-	-	52.4	-31.3
0.5775	32	PK	32	56	-24	46	-14
0.5775	21.33	Av	21.33	-	-	46	-24.67
Line-L2 .15 - 30MHz							
Frequency	Reading	Detector	Corrected Reading	Class B Qp	Margin	Class B Avg	Margin
0.1815	41.55	PK	41.55	64.4	-22.85	54.4	-12.85
0.1815	30.87	Av	30.87	-	-	54.4	-23.53
0.222	37.53	PK	37.53	62.7	-25.17	52.7	-15.17
0.222	26.69	Av	26.69	-	-	52.7	-26.01
0.582	38.68	PK	38.68	56	-17.32	46	-7.32
0.582	28.19	Av	28.19	-	-	46	-17.81

2.4GHz BAND

LINE 1 RESULTS

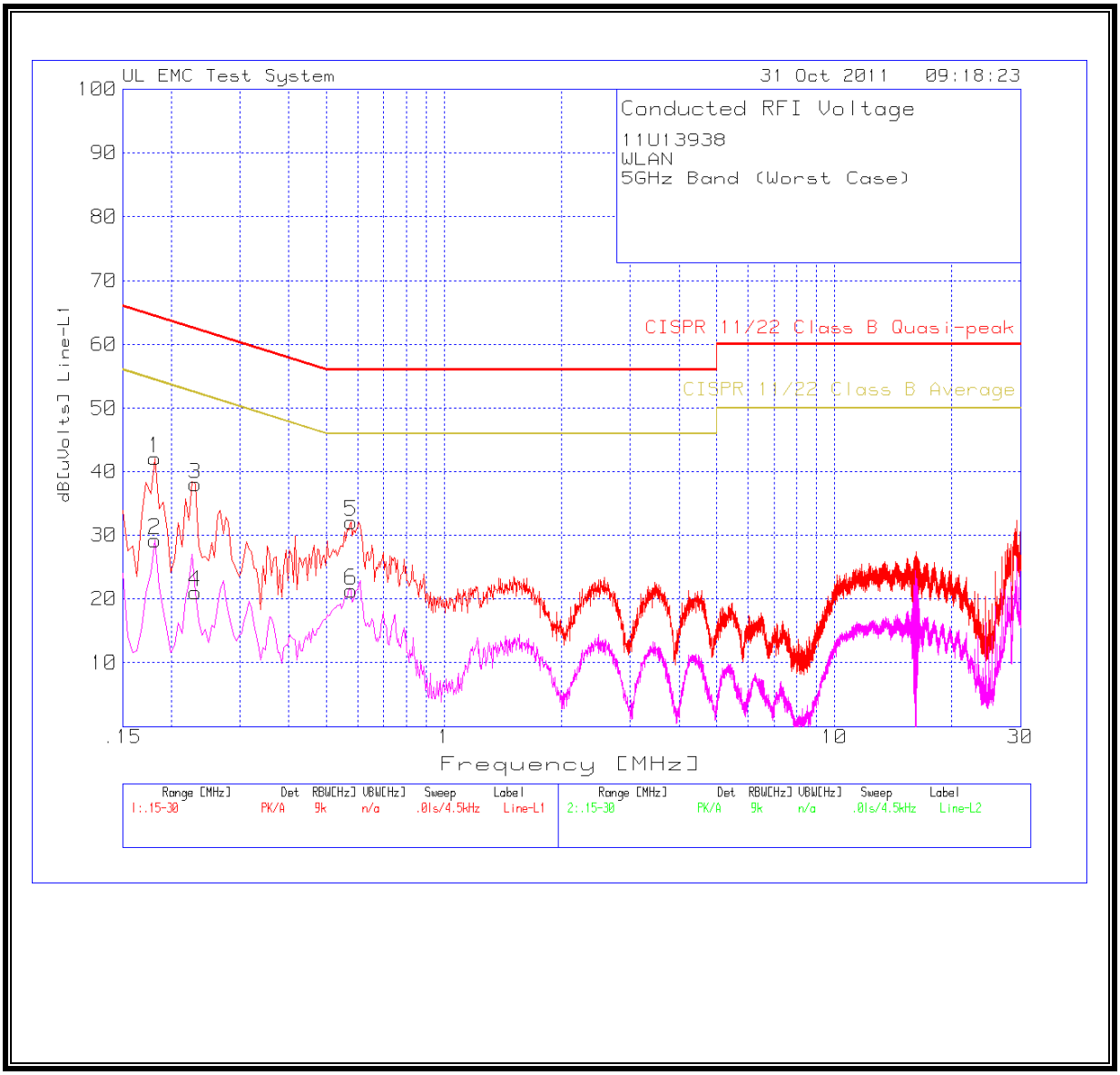


LINE 2 RESULTS



5GHz BAND

LINE 1 RESULTS



LINE 2 RESULTS