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

CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n WLAN + Bluetooth PCI-E Custom Combination Card

MODEL NUMBER: BCM94331CD

FCC ID: QDS-BRCM1064
IC: 4324A-BRCM1064

REPORT NUMBER: 12U14227-3, Revision C

ISSUE DATE: JUNE 07, 2012

Prepared for

BROADCOM CORPORATION
190 MATHILDA PLACE
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Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	05/29/12	Initial Issue	F. Ibrahim
A	05/30/12	Added board revision on page 5 and updated WF2 antenna model number	A. Zaffar
B	06/04/12	Revised section 5.2	F. Ibrahim
C	06/07/12	Revised section 5.5	F. Ibrahim

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086, USA
EUT DESCRIPTION:	802.11a/b/g/n WLAN + Bluetooth PCI-E Custom Combination Card
MODEL:	BCM94331CD
SERIAL NUMBER:	C8Y2104004NDRJVE4, C8Y210600VWDRJVEM (P508)
DATE TESTED:	APRIL 9, 2012 - MAY 25, 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:

DAVID GARCIA
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, 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 EUT is an 802.11a/g/n WLAN + Bluetooth PCI-E Custom Combination Card

The radio module is manufactured by Broadcom.

5.2. MAXIMUM RMS OUTPUT POWER

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

2400 - 2483.5 MHz Authorized Frequency Band						
Frequency Range (MHz)	Mode	PK Power, Chain 1 (dBm)	PK Power, Chain 2 (dBm)	PK Power, Chain 3 (dBm)	Total PK power (dBm)	Total PK power (mW)
2412 - 2462	802.11b Legacy 1TX	Covered by the worst case 802.11b CDD 3TX Mode testing				
2412 - 2462	802.11b CDD 2TX	Covered by the worst case 802.11b CDD 3TX Mode testing				
2412 - 2462	802.11b CDD 3TX	18.973	19.077	19.063	23.809	240.381
2412 - 2462	802.11g Legacy 1TX	19.007	N/A	N/A	19.007	79.561
2412 - 2462	802.11n HT20 1TX	Covered by the worst case 802.11g Legacy Mode testing				
2412 - 2462	802.11g CDD 2TX	Covered by the worst case 802.11n HT20 CDD 2TX Mode testing				
2412 - 2462	802.11g CDD 3TX	Covered by the worst case 802.11n HT20 CDD 3TX Mode testing				
2412 - 2462	802.11n HT20 CDD 3TX	18.280	18.119	18.334	23.017	200.309
5725 - 5850 MHz Authorized Frequency Band						
Frequency Range (MHz)	Mode	PK Power, Chain 1 (dBm)	PK Power, Chain 2 (dBm)	PK Power, Chain 3 (dBm)	Total PK power (dBm)	Total PK power (mW)
5745 - 5825	802.11a Legacy 1TX	Covered by the worst case 802.11n HT20 CDD 3TX				
5745 - 5825	802.11n HT20 1TX	Covered by the worst case 802.11n HT20 CDD 3TX				
5745 - 5825	802.11a CDD 2TX	Covered by the worst case 802.11n HT20 CDD 2TX				
5745 - 5825	802.11a CDD 3TX	Covered by the worst case 802.11n HT20 CDD 3TX				
5745 - 5825	802.11n CDD 3TX	18.628	18.483	18.500	23.309	214.240
5755 - 5795	802.11n HT40 1TX	Covered by the worst case 802.11n HT40 CDD 3TX				
5755 - 5795	802.11n HT40 CDD 3TX	18.737	18.883	18.822	23.586	228.349

Note: Option 5.2.2.1 Measurement Procedure AVG1 from KDB D01 558074 was used to measure the Average Output Power.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

FCC/IC/NCC FMA - BCM94331CD, X33
FCC ID: QDS-BRCM1064
IC ID: 4324A-BRCM1064

No.	Antenna Manufacturer	Antenna Type	Model	Peak gain @ 2412, 2422, 2432MHz, (BT)	Peak gain @ 2412, 2422, 2432MHz, (WLAN)	Peak gain (5150-5250MHz) @5200MHz	Peak gain (5250-5350MHz) @5320MHz	Peak gain (5470-5725MHz) @5500, 5700MHz	Peak gain (5725-5850MHz) @5785, 5805MHz
1	Amphenol/Molex	802.11abgn WLAN Antenna (Circular Panel)	WF2 (604-3218)	NA	4.32	4.83	5.53	5.53	4.86
1	Amphenol/Molex	802.11abgn WLAN Antenna	WF3 (604-3075)	NA	4.77	2.84	1.34	2.68	1.95
1	Amphenol/Molex	802.11abgn WLAN Antenna	WF4 (604-3074)	NA	3.72	1.18	1.96	1.26	3.09

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 5.106.98.65.
The test utility software used during testing was BCM Internal, rev. 5.106.RC98.65.

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was tested as an external module installed in a test jig board connected to a host Laptop PC.

Worst-Case data rates, as provided by the client, were as follows:

For 2.4 GHz Band:
802.11b: 1 Mb/s.
802.11g: 6 Mb/s.
802.11n 20MHz: MCS0.

For 5.8 GHz Band:
802.11a: 6 Mb/s.
802.11n 20MHz: MCS0.
802.11n 40MHz: 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.

For the modes where CH2 and CH10 were tested for output power, all other test items at CH1 and CH11 were performed with the higher power level between CH1 and CH2, and between CH10 and CH11 as worst-case scenario.

For all modes with single chain, chain 1 was selected per the software provided by the client.

802.11a mode bandedges for Ch. 36, 64, 100, and 140 were all performed. Harmonics were covered at same 802.11a legacy powers, but using the HT20 3Tx CDD mode.

HT40 SISO 1Tx Ch. 38, 62, 102, and 134 bandedges were all performed. Harmonics were covered at the same HT40 SISO 1Tx power, but using the HT40 3Tx CDD mode.

HT20 3Tx power for bandedges are much lower for CDD and SDM, but harmonics were performed legacy or SISO 1Tx power levels using the HT20 3Tx CDD mode.

HT40 3Tx power for bandedges are much lower for CDD and SDM, but harmonics were performed legacy or SISO 1Tx power levels using the HT40 3Tx CDD mode.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	G560	CBU4495773	DoC
Laptop	H-P	dv6000	CNF6463KP7	DoC
AC Adapter	Lenovo	ADP-65KH B	11S36001646ZZ10011FKEZ	DoC
AC Adapter	H-P	PA-1650-02H	592C40CRGUBR9B	DoC
Adapter Board	Catalyst	MINI2EXP	JUAN 02	N/A
Adapter Board	Catalyst	MINI2EXP	BRCM 2011-05	N/A
Adapter Board	Broadcom	BCM94331CSMFG	1458923	N/A
Adapter Board	Broadcom	BCM94331CSMFG	1458963	N/A

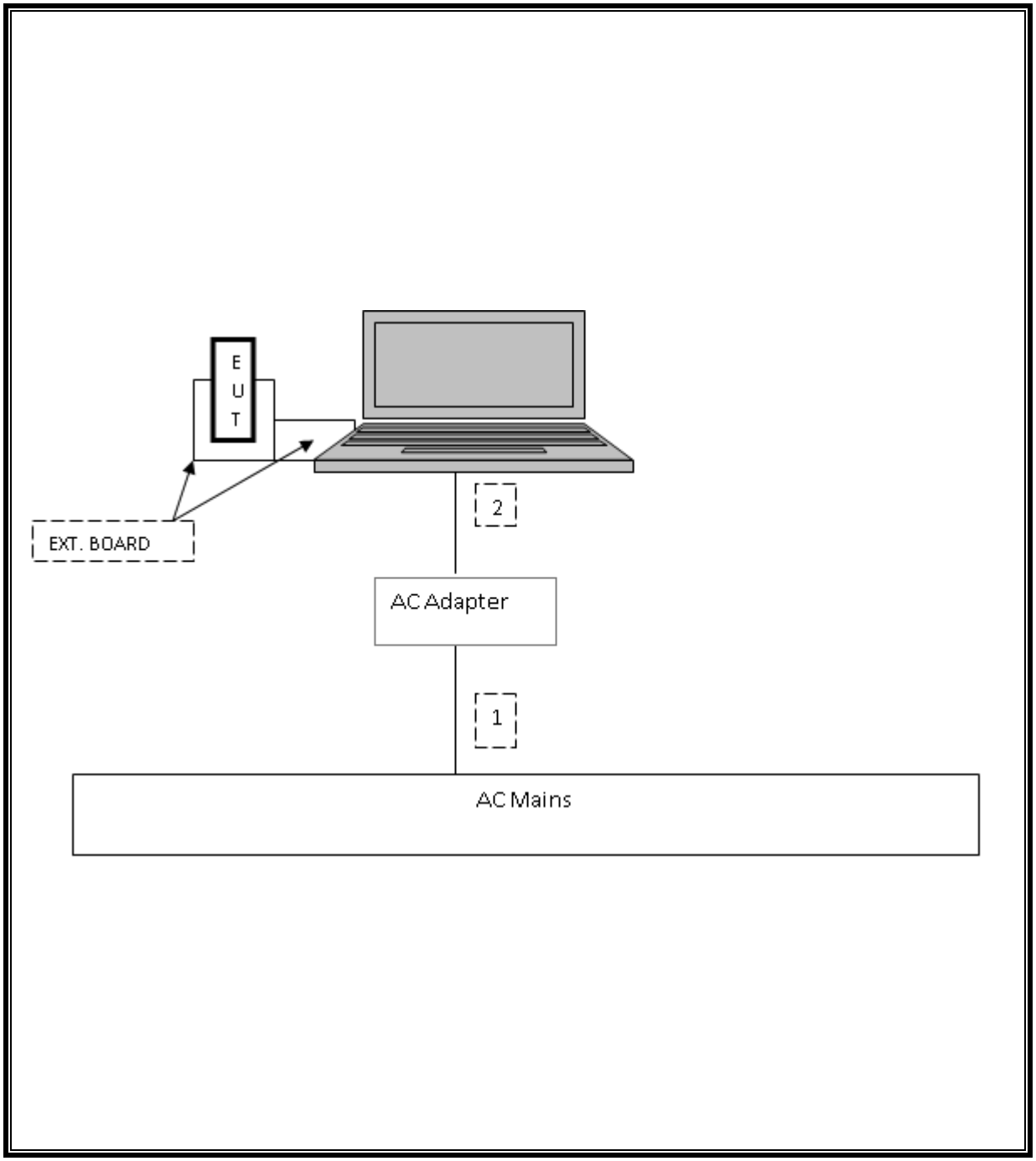
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	US 115V	Un-Shielded	1m	NA
2	DC	1	DC	Un-Shielded	1.8m	Ferrite at laptop's end
1	AC	1	US 115V	Un-Shielded	1.8m	NA
2	DC	1	DC	Un-Shielded	1.75m	Ferrite at laptop's end

TEST SETUP

The EUT is attached to a jig board which is installed in the PCMCI slot of a host laptop computer during the tests. Test software exercised the radio card.

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 Date**	**Cal Due**
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/15/11	12/15/12
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	09/02/11	09/02/12
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	05/04/11	05/04/12
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	03/22/12	03/22/13
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	02/16/12	02/16/13
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	08/04/11	08/04/12
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	07/06/11	07/06/12
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/19/11	08/19/13
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/11	12/13/12
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/11	12/13/12
Antenna, Horn, 18 GHz	EMCO	3115	C00783	06/29/11	06/29/12
Antenna, Horn, 18 GHz	EMCO	3115	C00872	09/20/11	09/20/12
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
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1		02/07/12	02/07/13
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	07/12/11	07/12/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	07/18/11	07/18/12
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/02/11	08/02/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	11/11/11	11/11/12
LISN, 30 MHz	FCC	50/250-25-2	C00626	12/13/11	12/13/12

7. ANTENNA PORT TEST RESULTS

7.1. 802.11g 1TX LEGACY MODE IN THE 2.4 GHz BAND

7.1.1. 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.

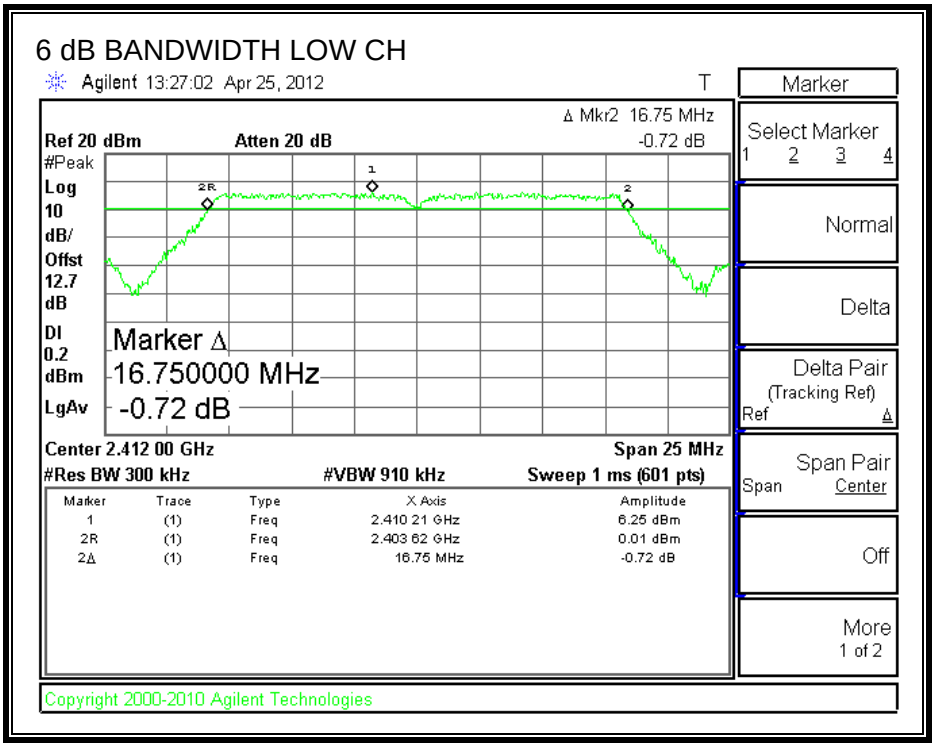
TEST PROCEDURE

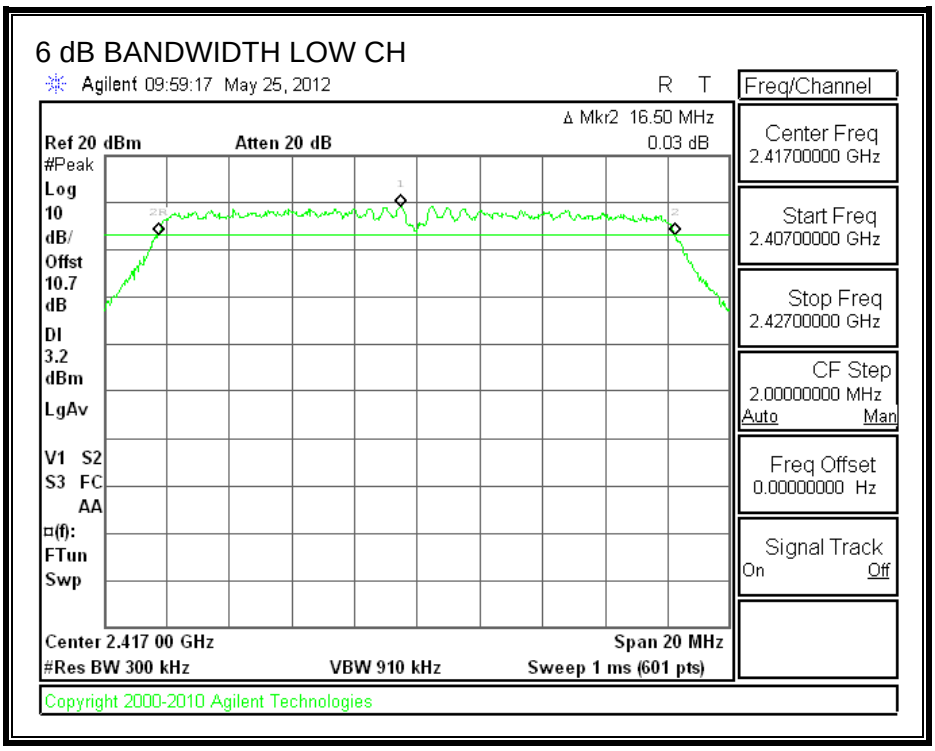
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

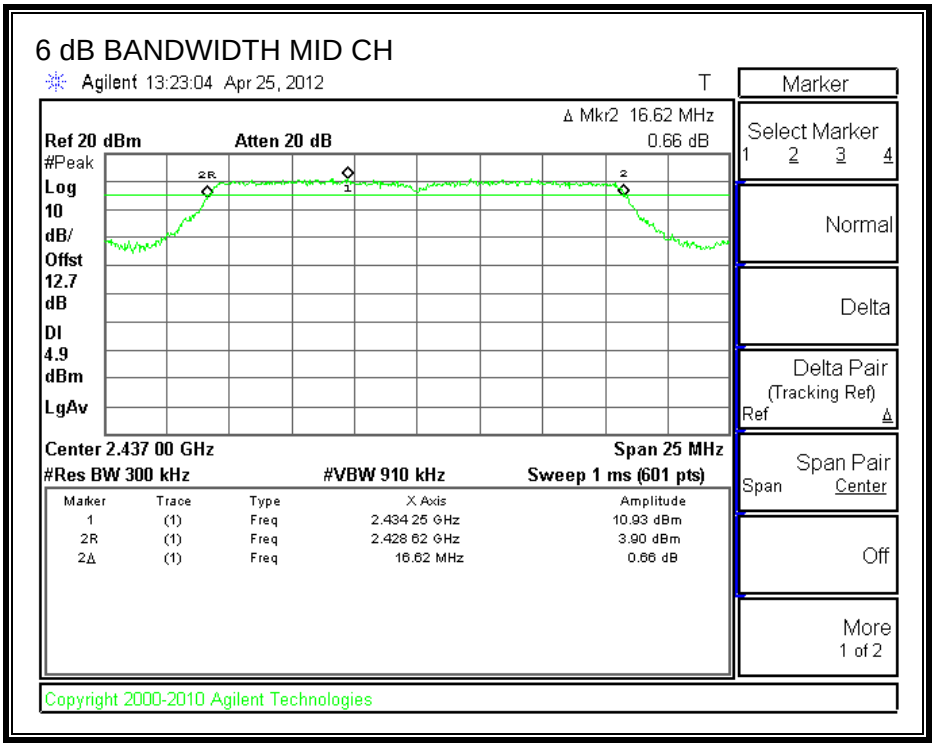
RESULTS

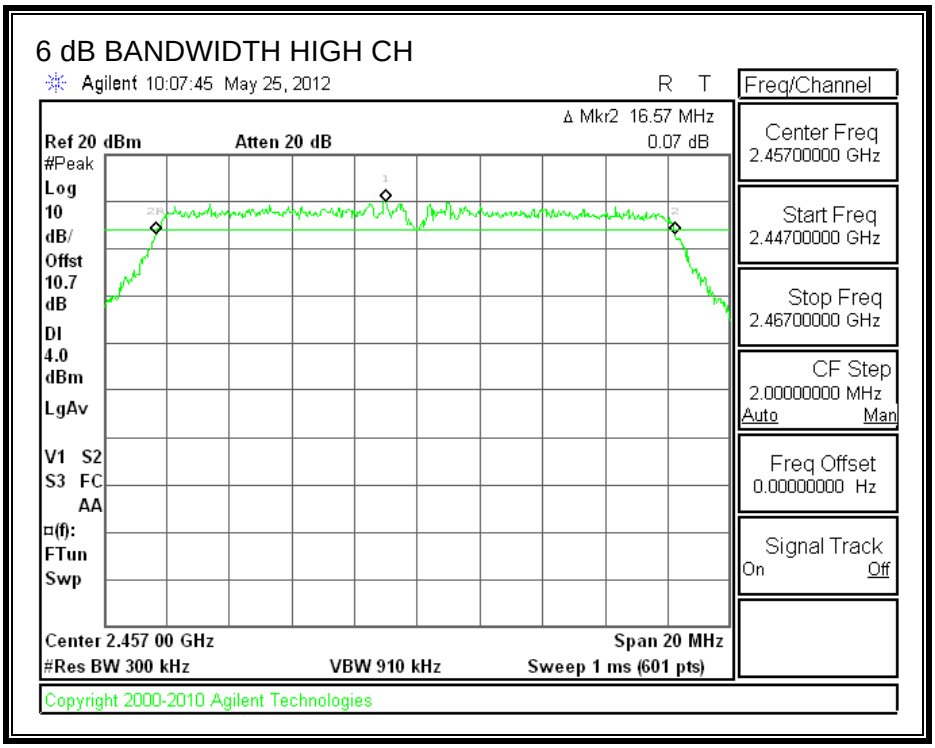
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	16.75	0.5
Low	2417	16.50	0.5
Middle	2437	16.62	0.5
High	2457	16.57	0.5
High	2462	16.50	0.5

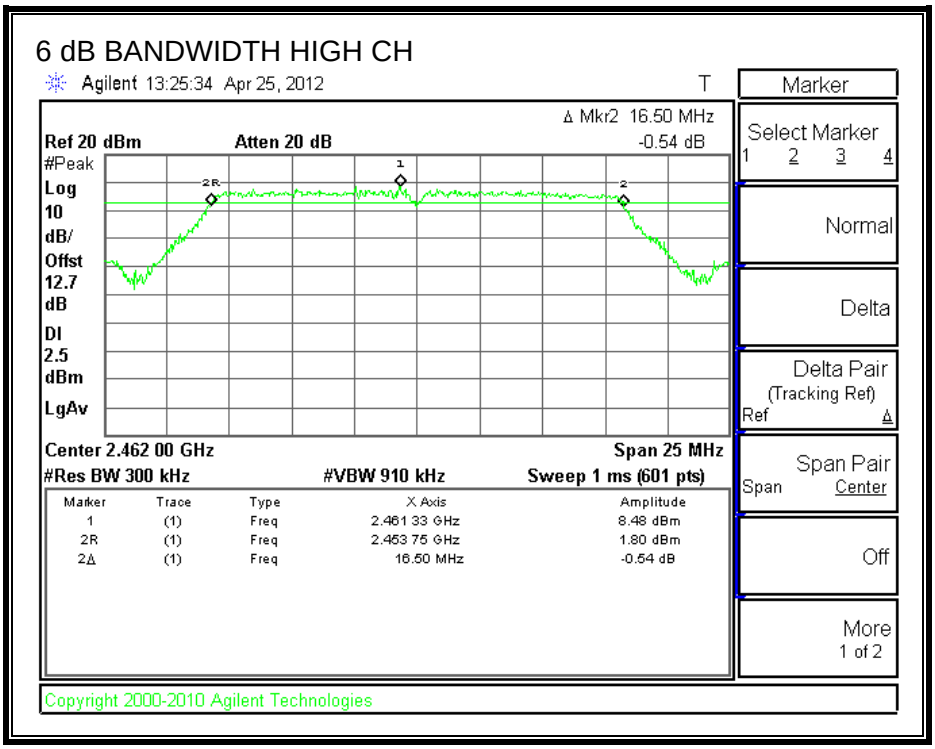
6 dB BANDWIDTH











7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

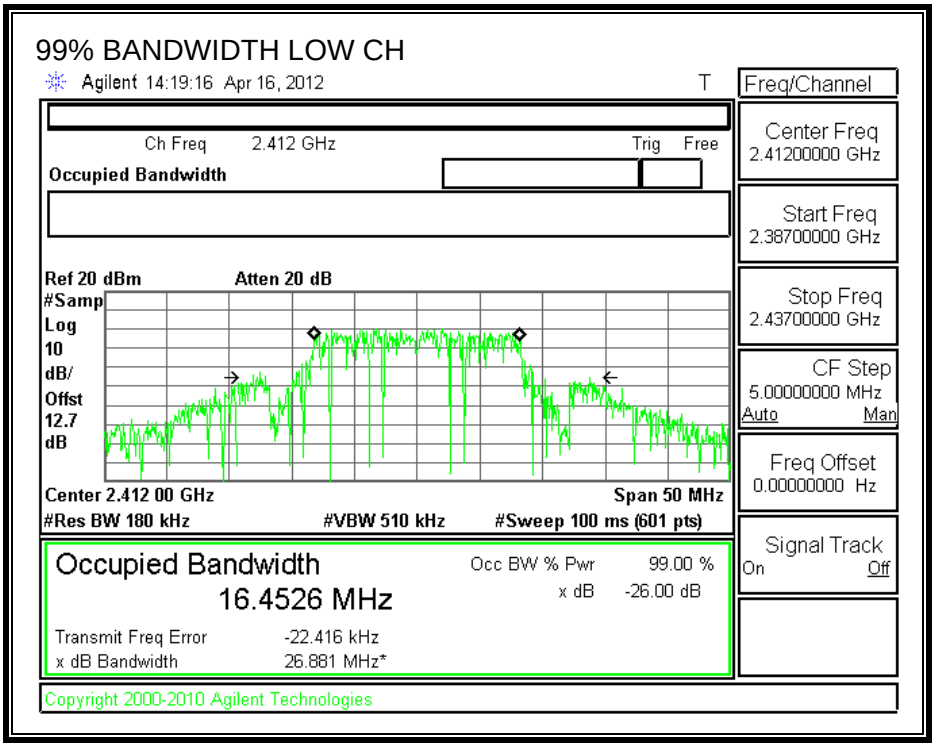
TEST PROCEDURE

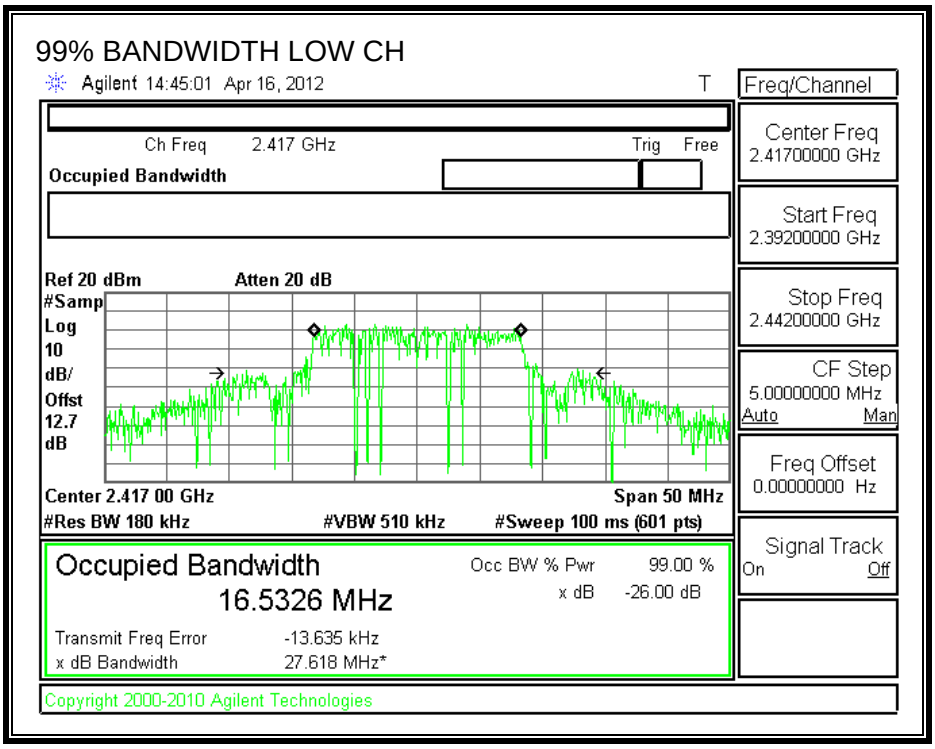
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

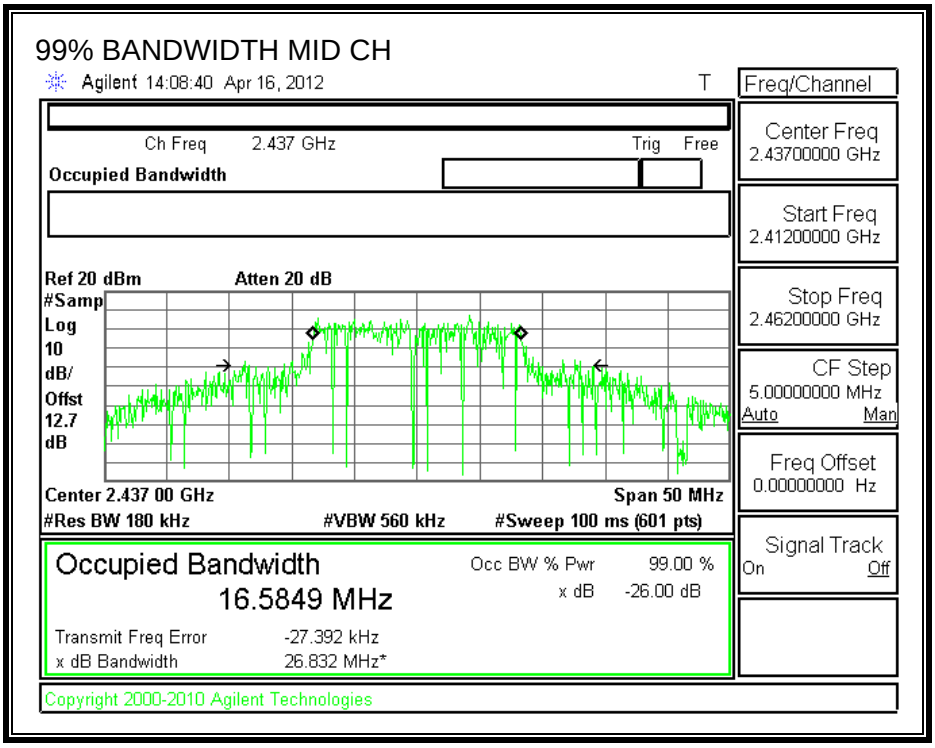
RESULTS

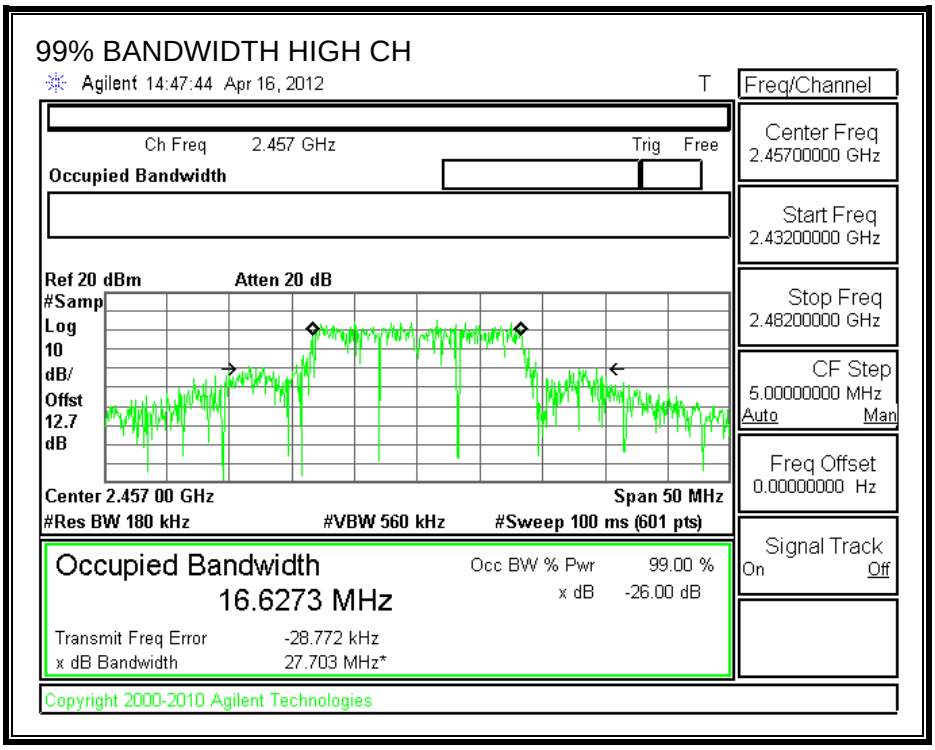
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.4526
Low	2417	16.5326
Middle	2437	16.5849
High	2457	16.6273
High	2462	16.4348

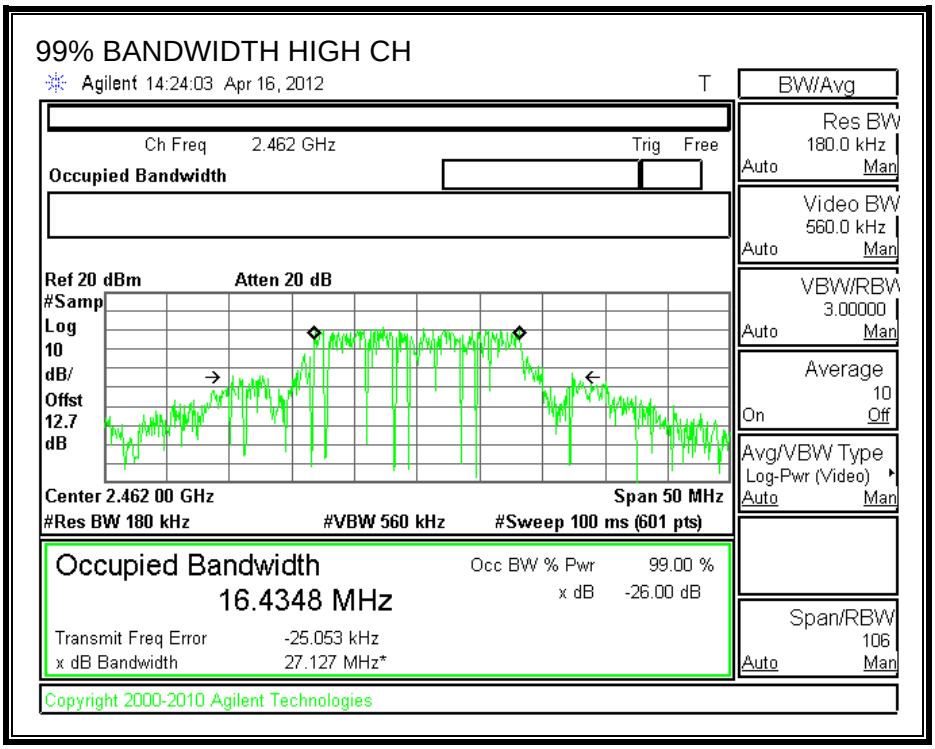
99% BANDWIDTH











7.1.3. 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.

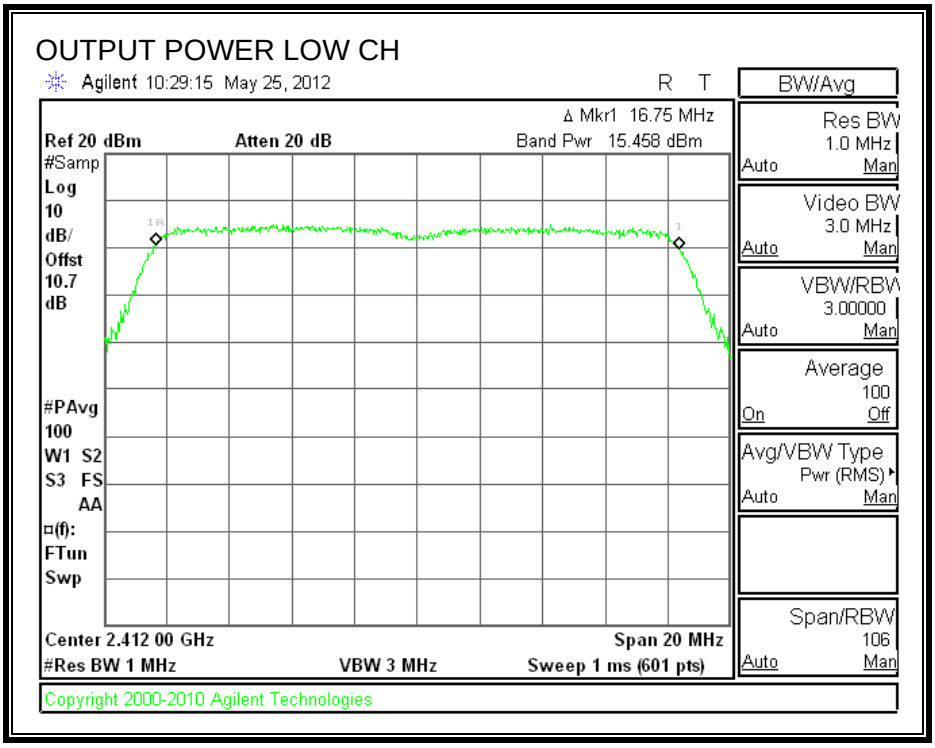
TEST PROCEDURE

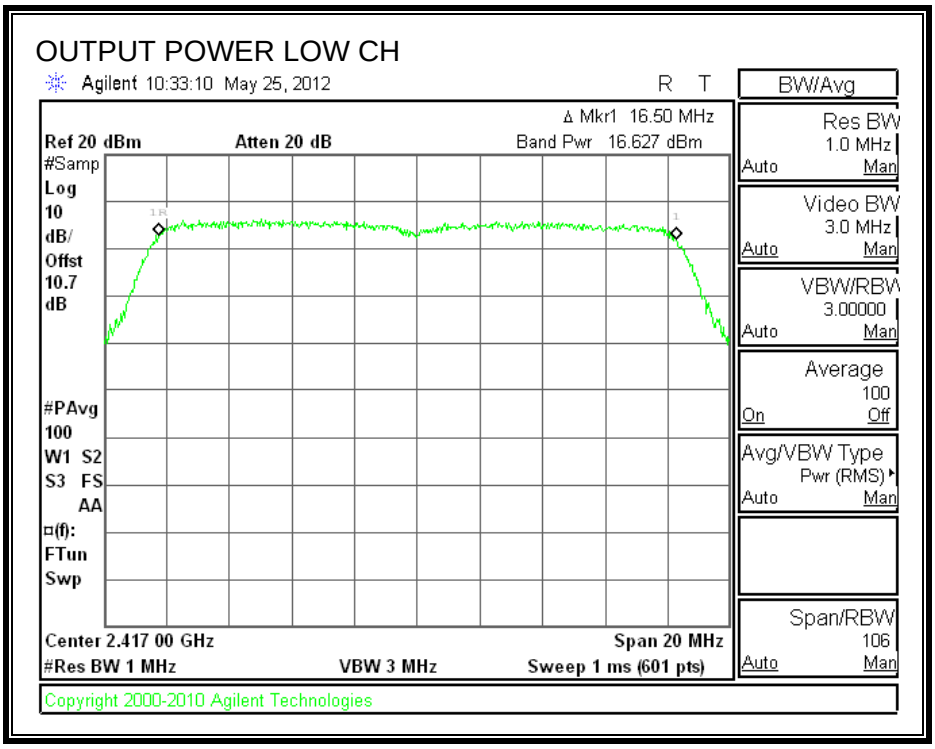
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

RESULTS

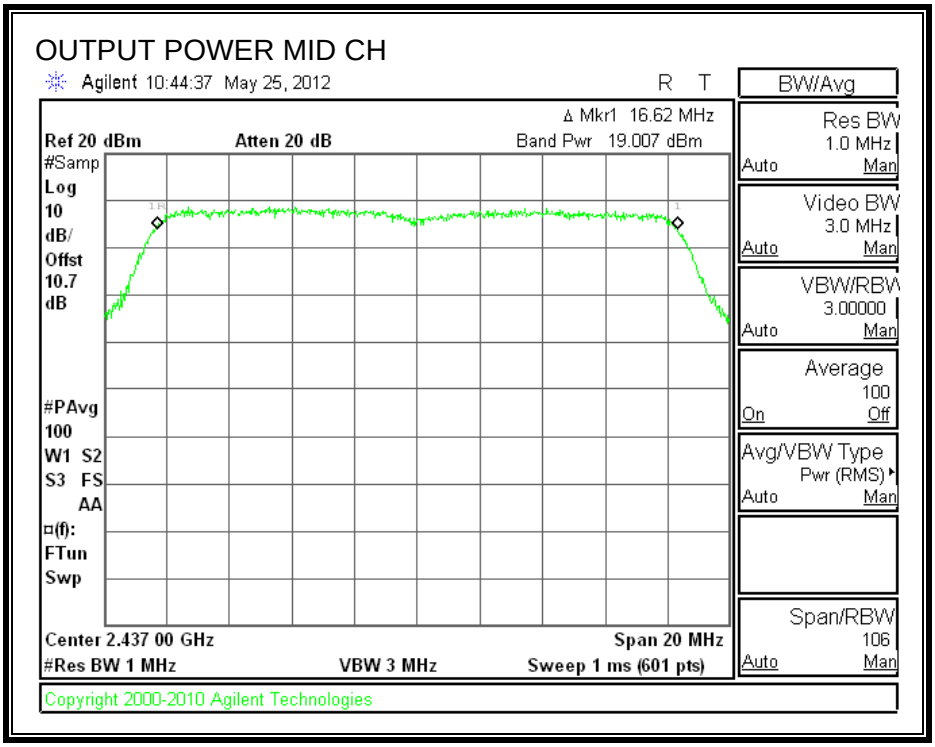
Channel Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
2412	15.458	30	-14.54
2417	16.627	30	-13.37
2437	19.007	30	-10.99
2457	17.492	30	-12.51
2462	16.034	30	-13.97

OUTPUT POWER

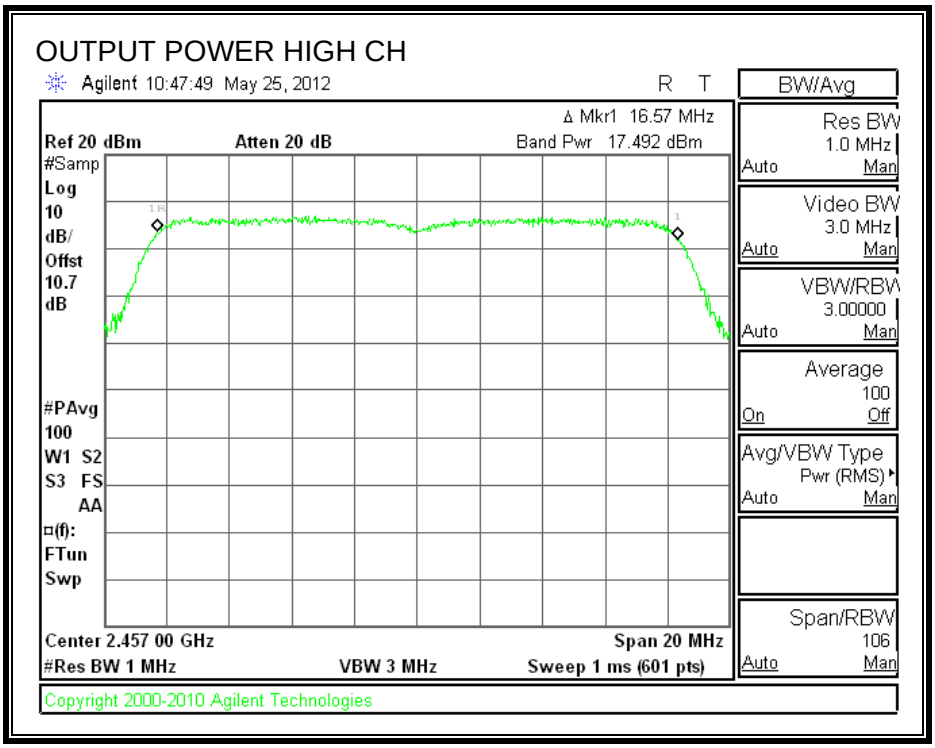


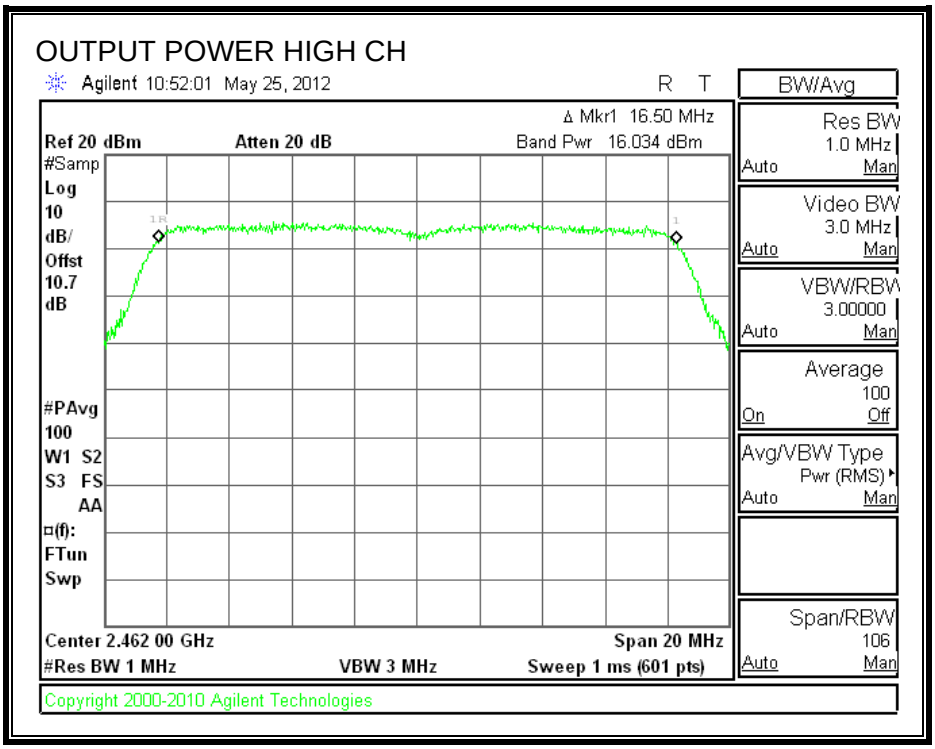


OUTPUT POWER MID CH



OUTPUT POWER HIGH CH





7.1.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

TEST PROCEDURE

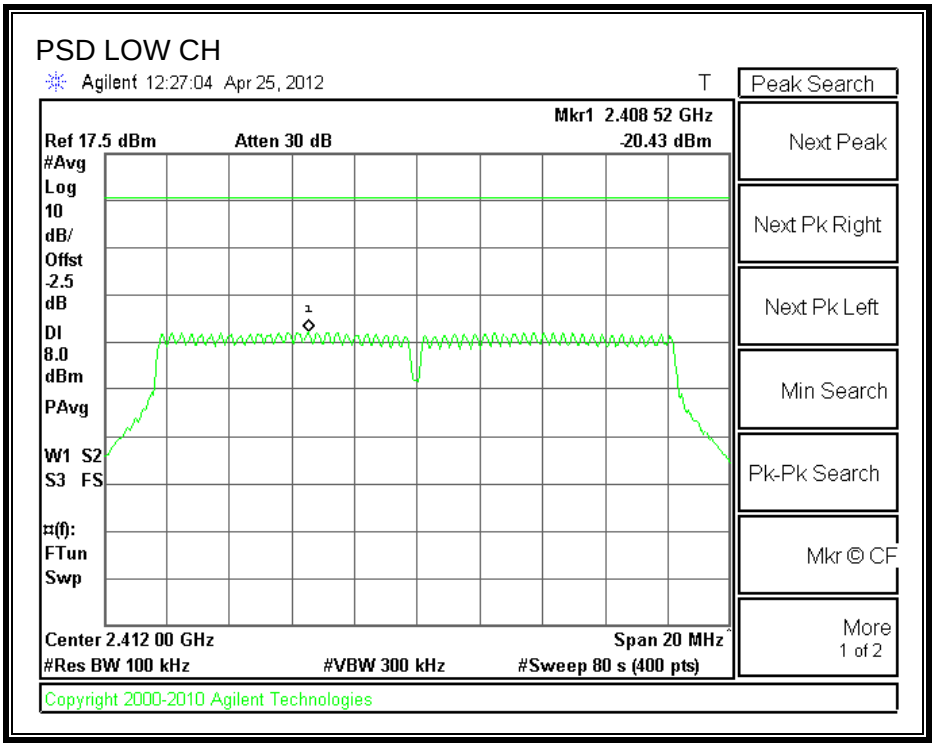
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

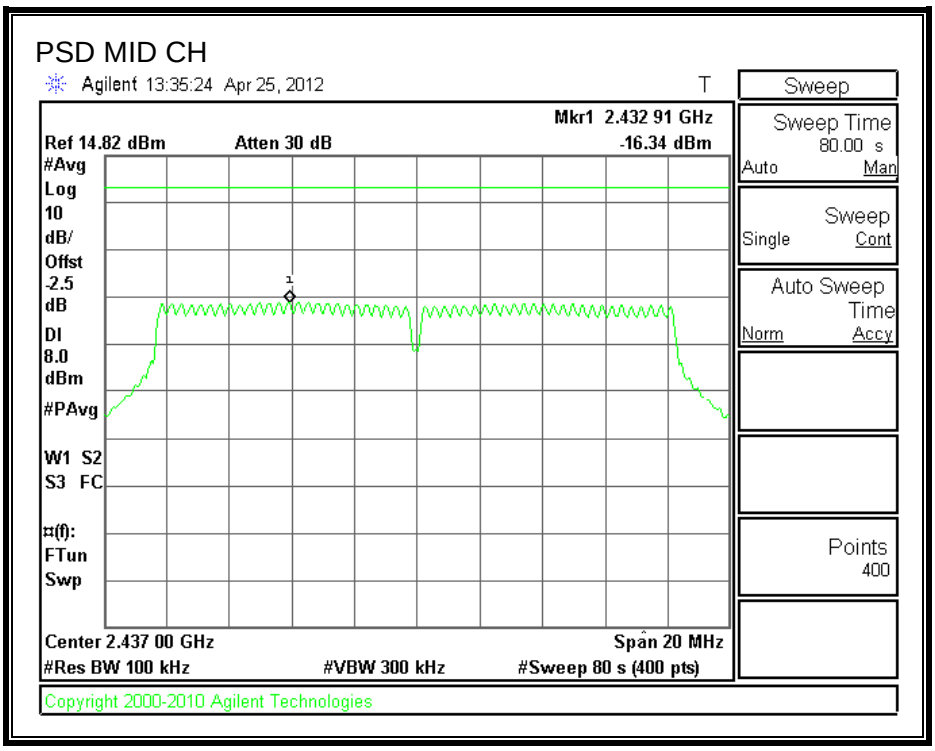
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-20.43	8	-28.43
Middle	2437	-16.34	8	-24.34
High	2462	-19.93	8	-27.93

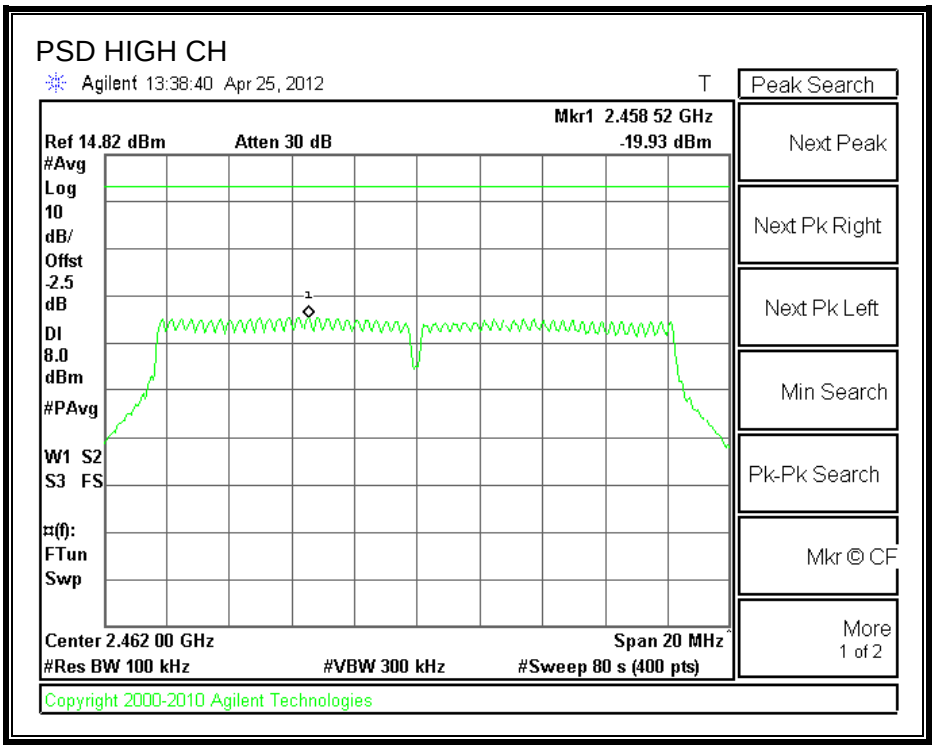
Note: The spectrum analyzer offset = attenuator loss + cable loss + 10 log(3/100 kHz) = -2.5 dB

POWER SPECTRAL DENSITY





PSD HIGH CH



7.1.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

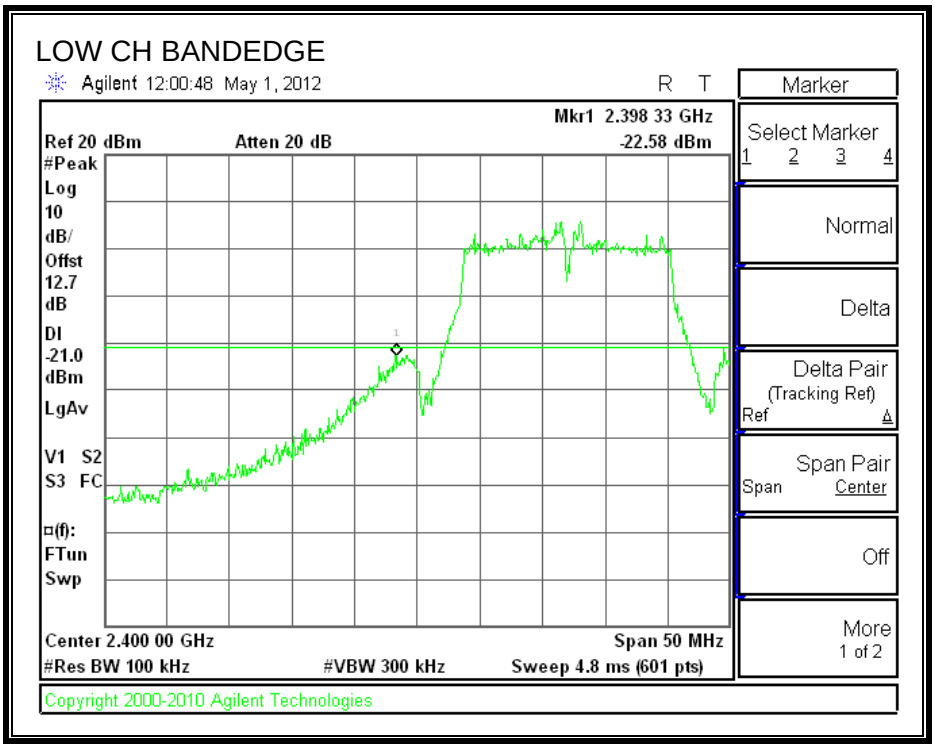
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

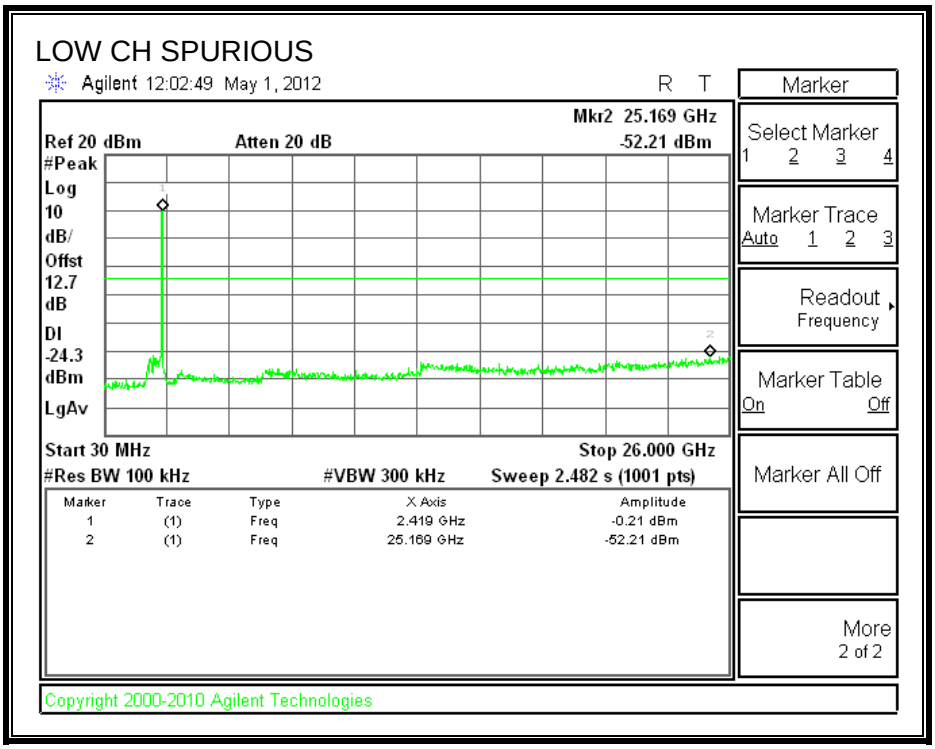
TEST PROCEDURE

KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

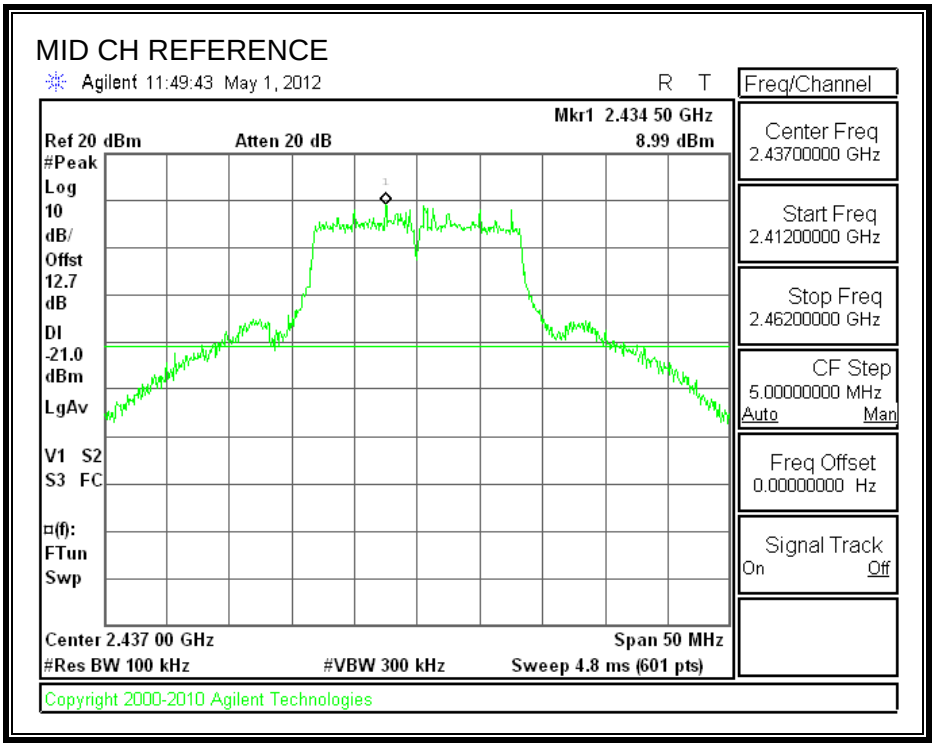
RESULTS

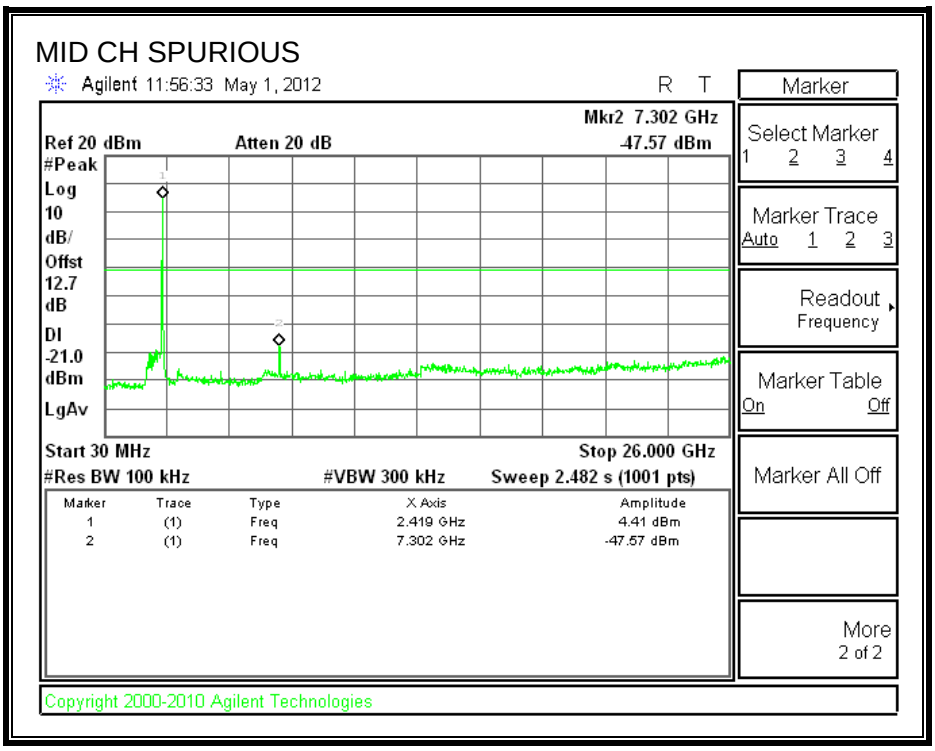
SPURIOUS EMISSIONS, LOW CHANNEL



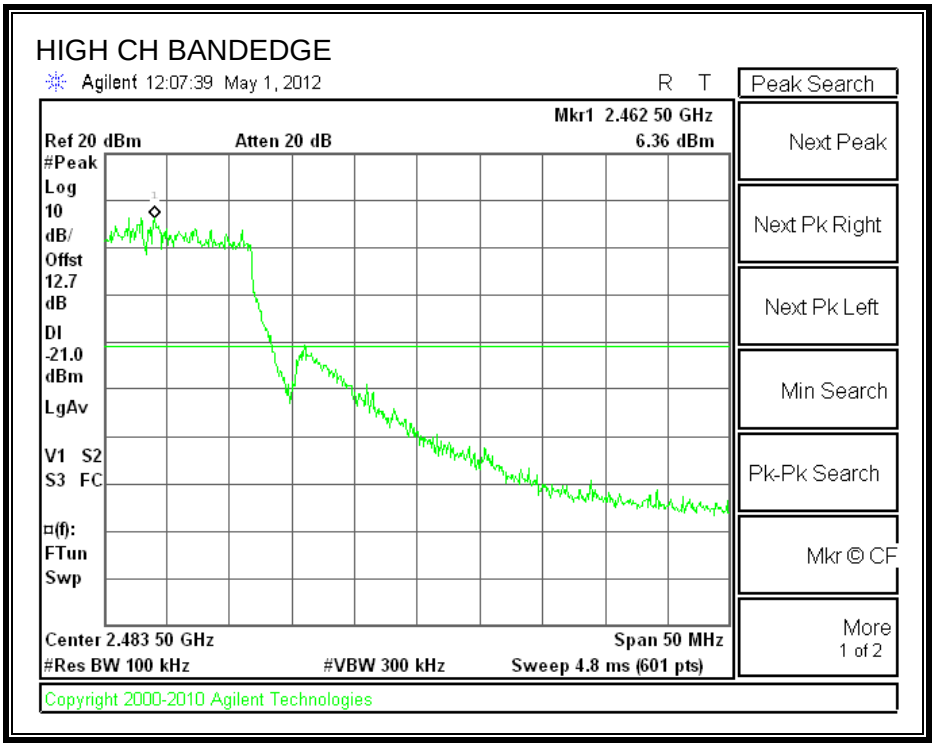


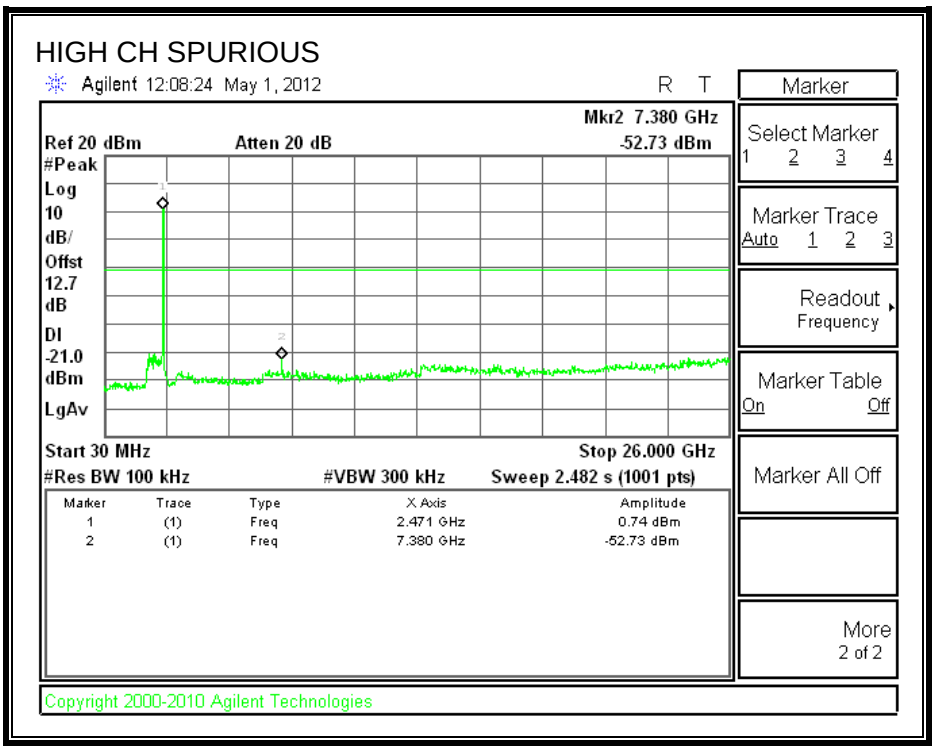
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





7.2. 802.11b CDD 3TX 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.

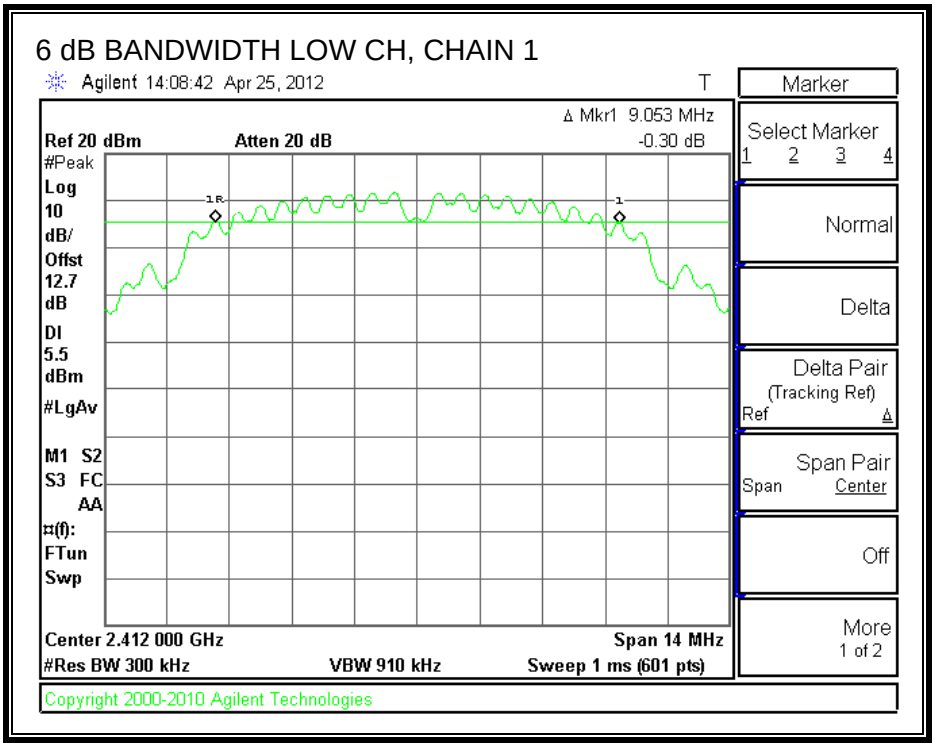
TEST PROCEDURE

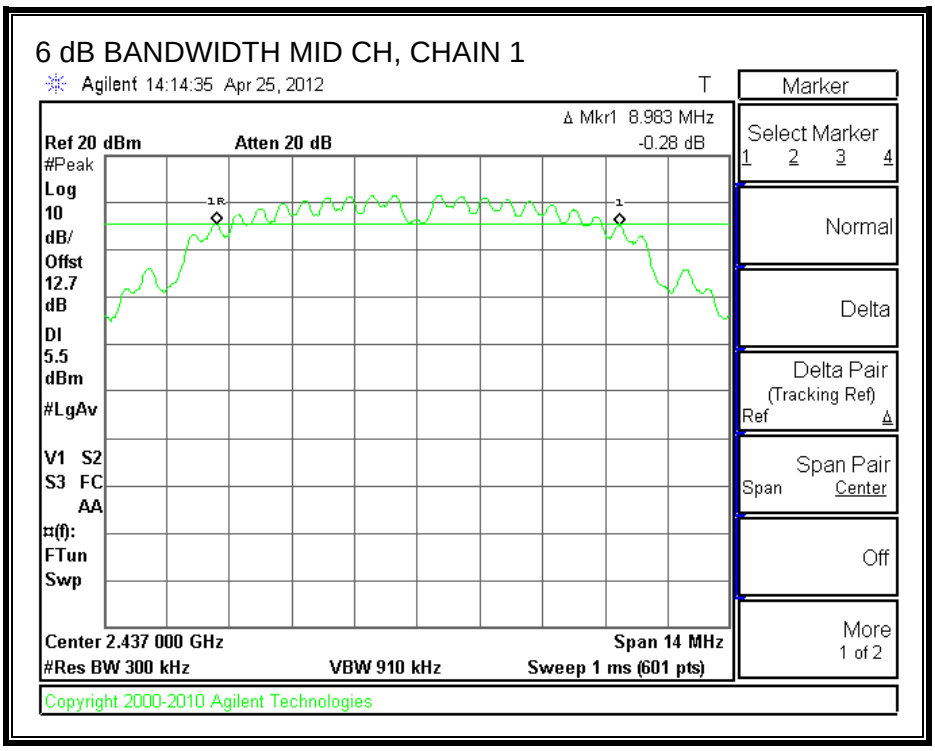
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

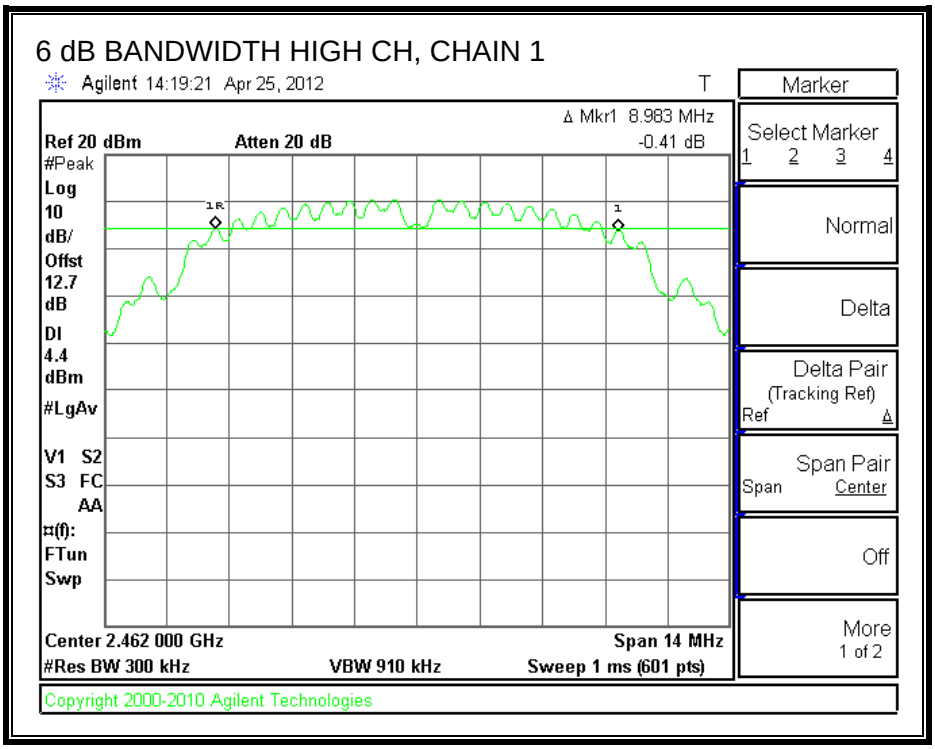
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Chain 3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	9.053	9.030	8.983	0.5
Middle	2437	8.983	9.053	8.983	0.5
High	2462	8.983	9.007	9.007	0.5

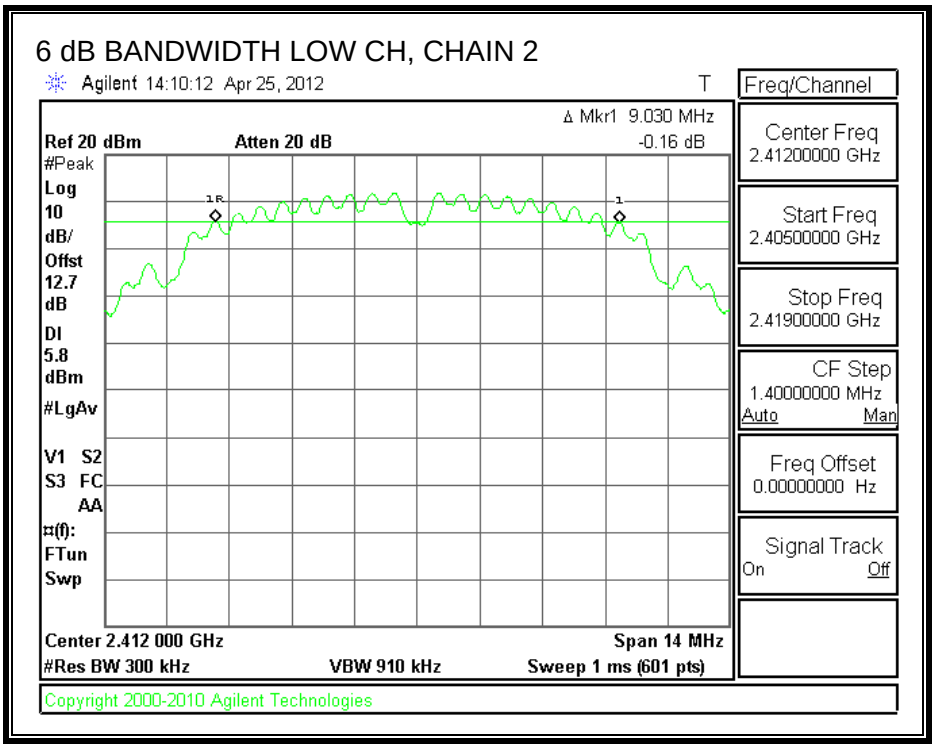
6 dB BANDWIDTH, CHAIN 1

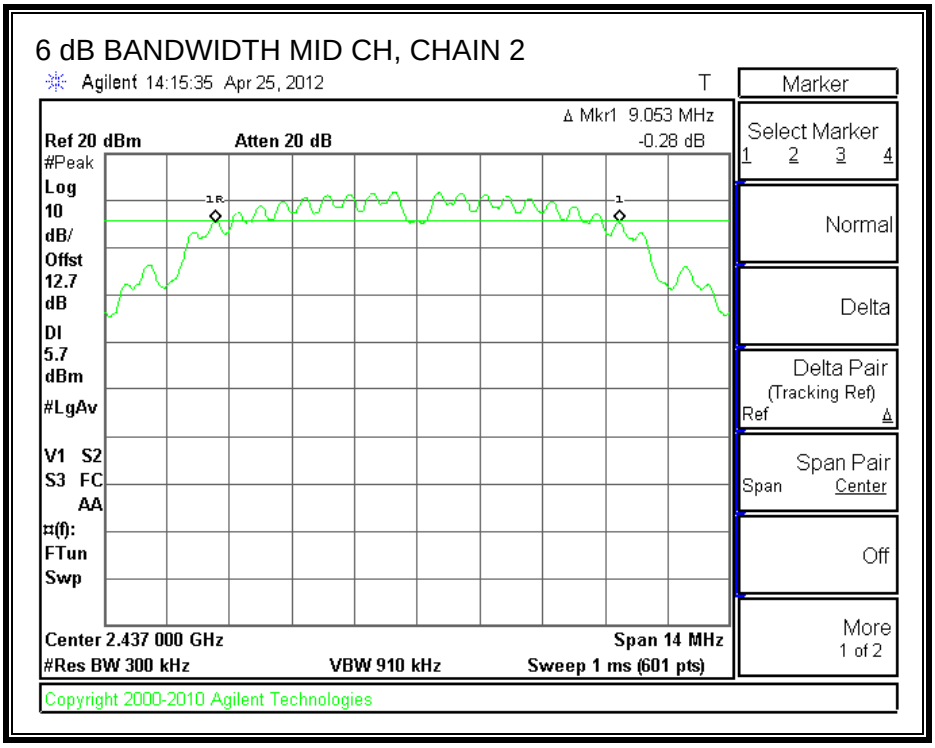


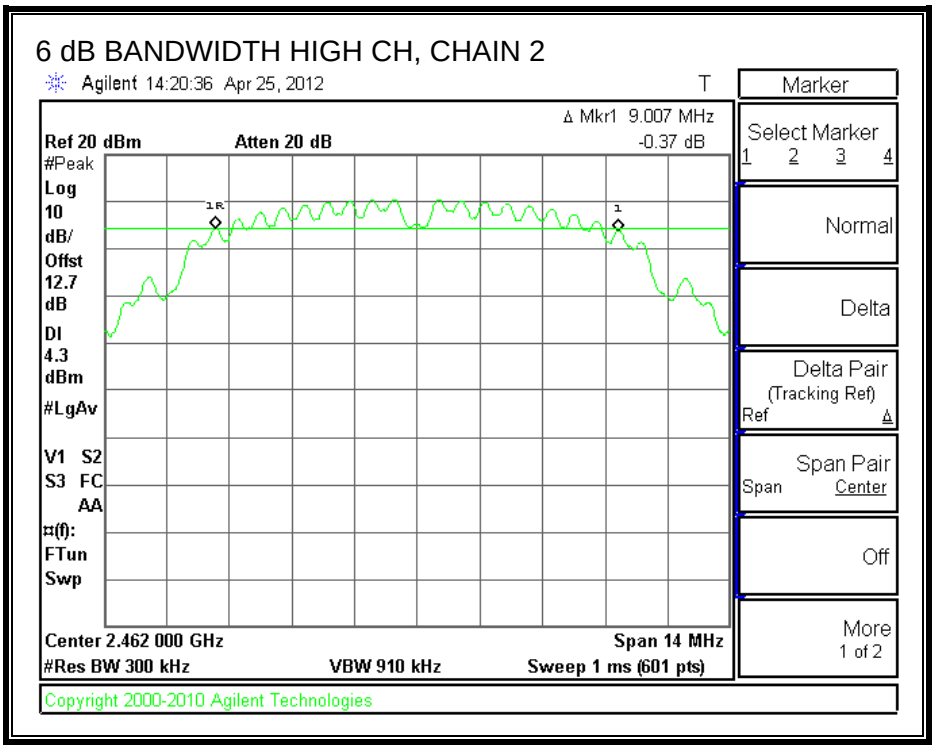




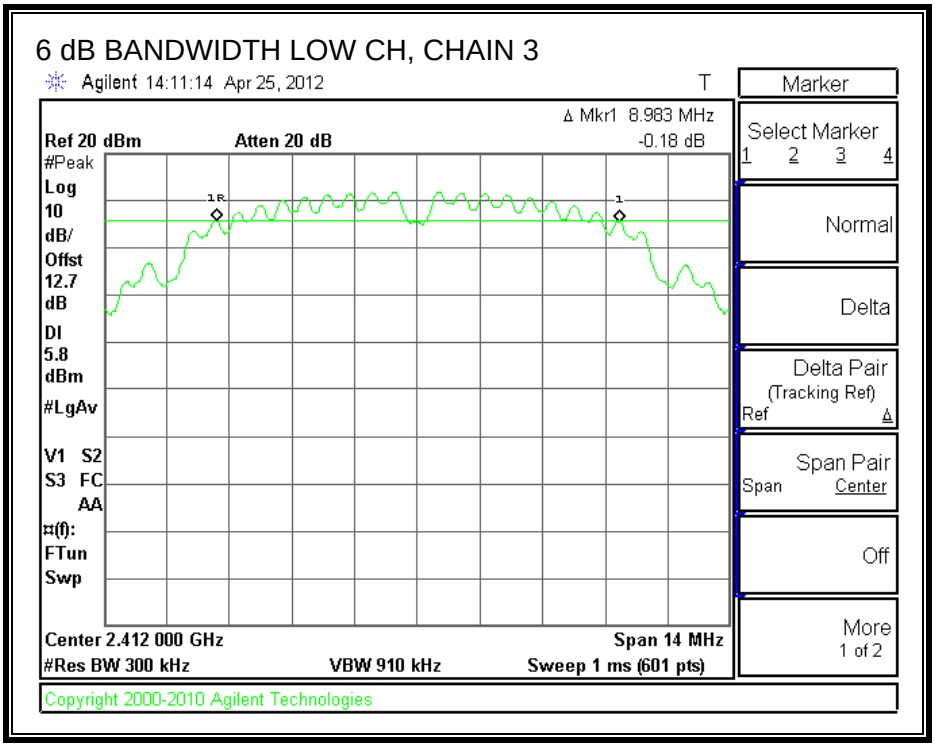
6 dB BANDWIDTH, CHAIN 2

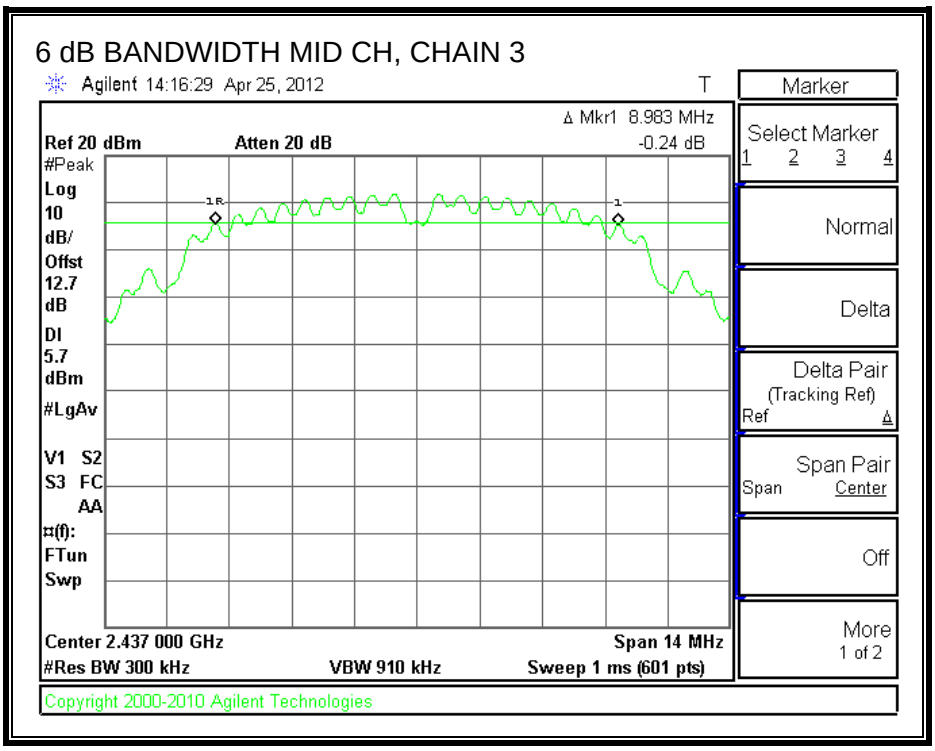


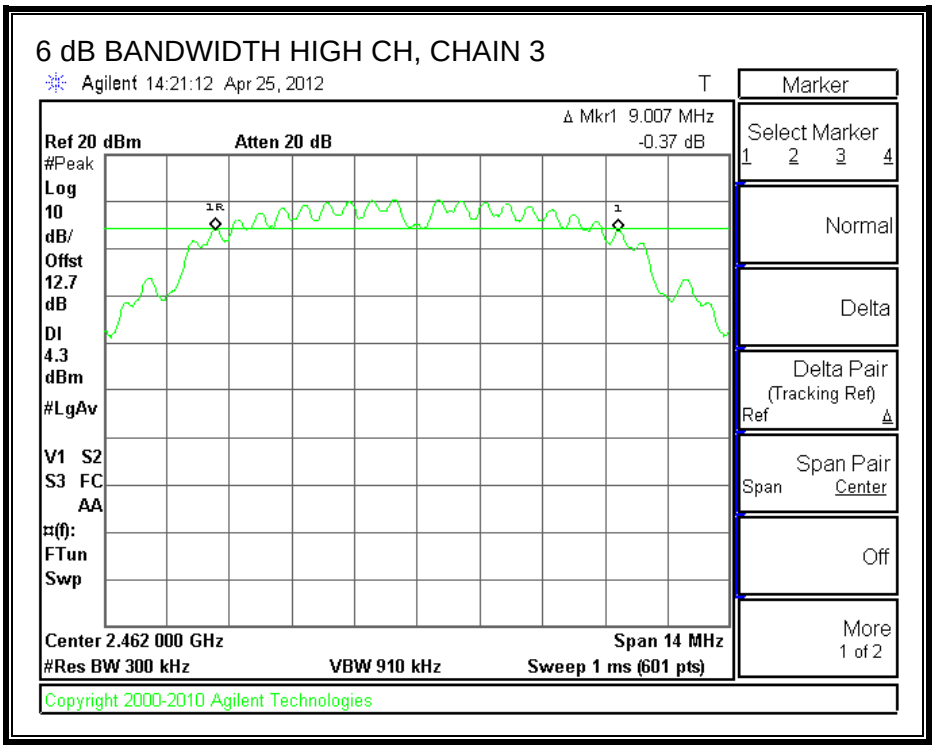




6 dB BANDWIDTH, CHAIN 3







7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

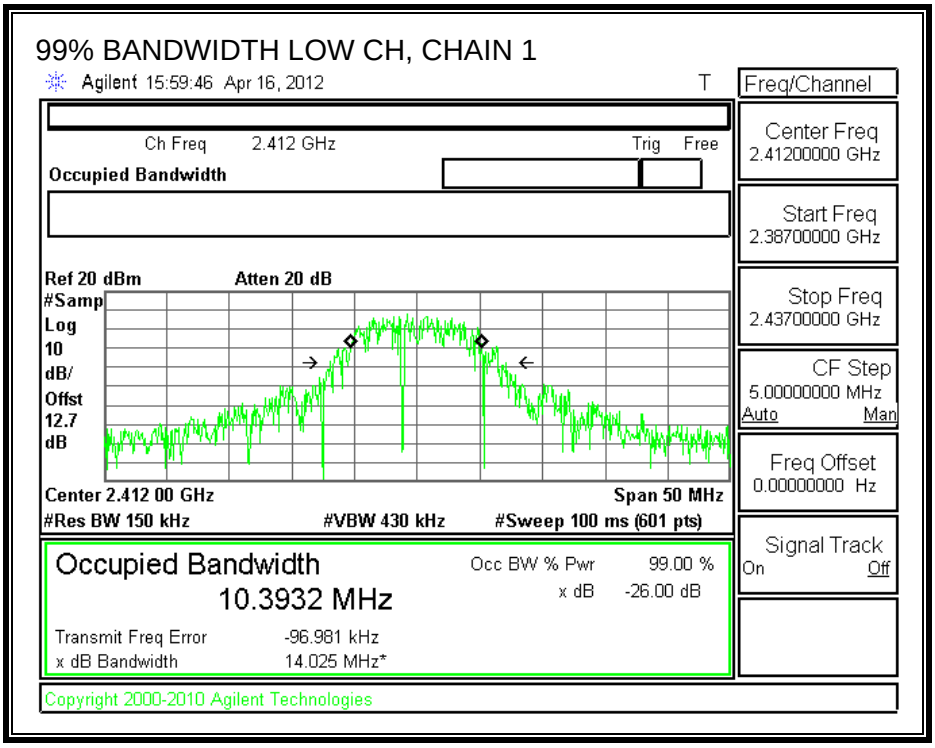
TEST PROCEDURE

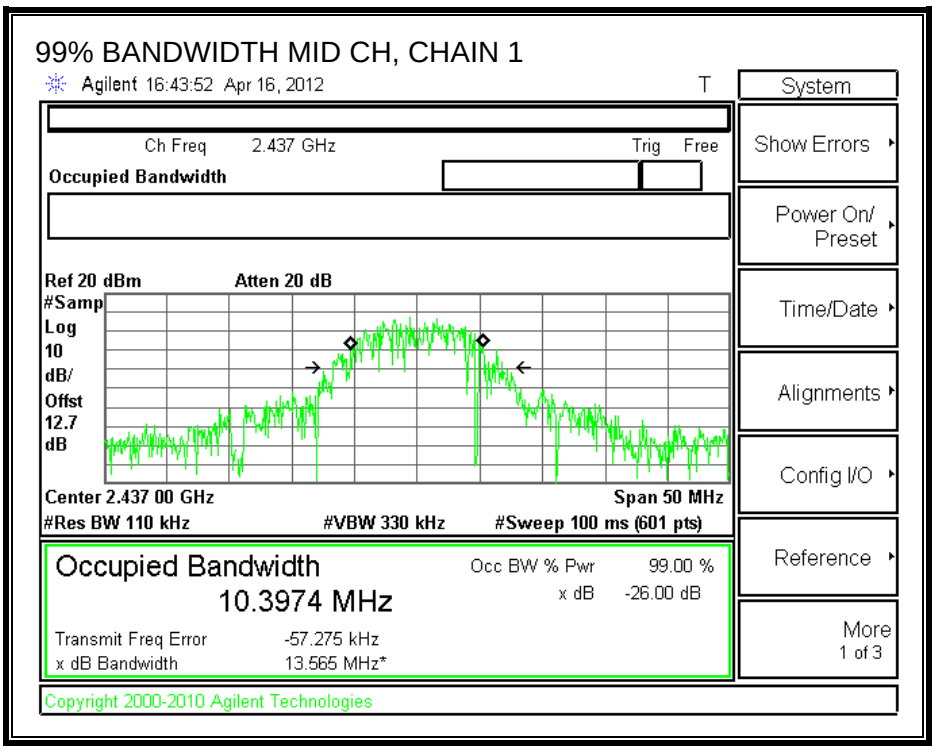
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

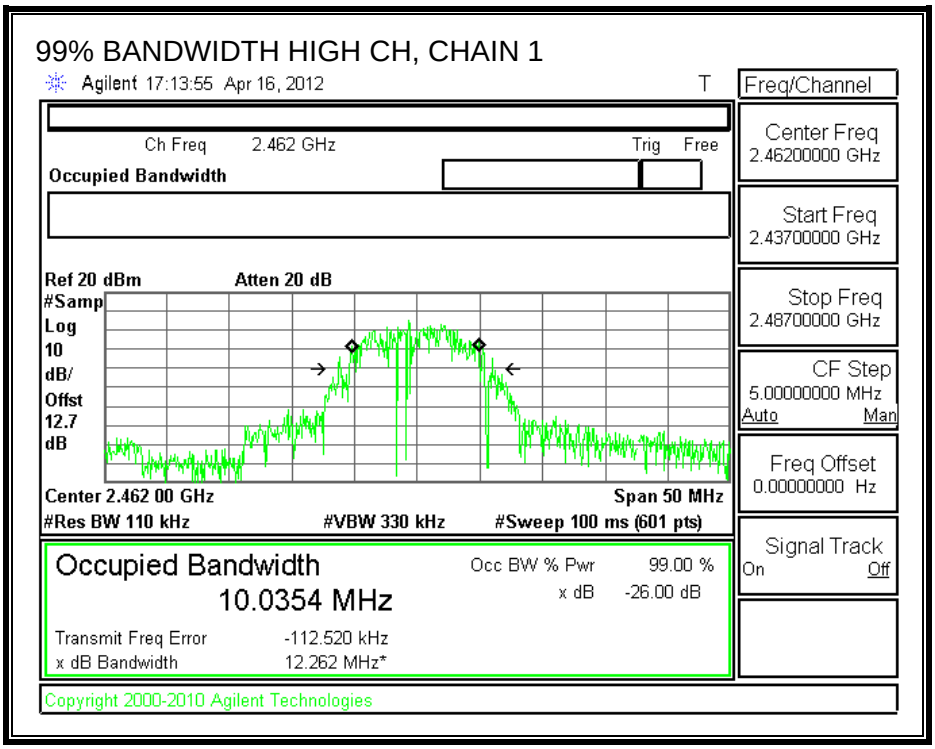
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	2412	10.3932	10.2321	10.1473
Middle	2437	10.3974	10.4124	10.3719
High	2462	10.0354	10.1509	10.1778

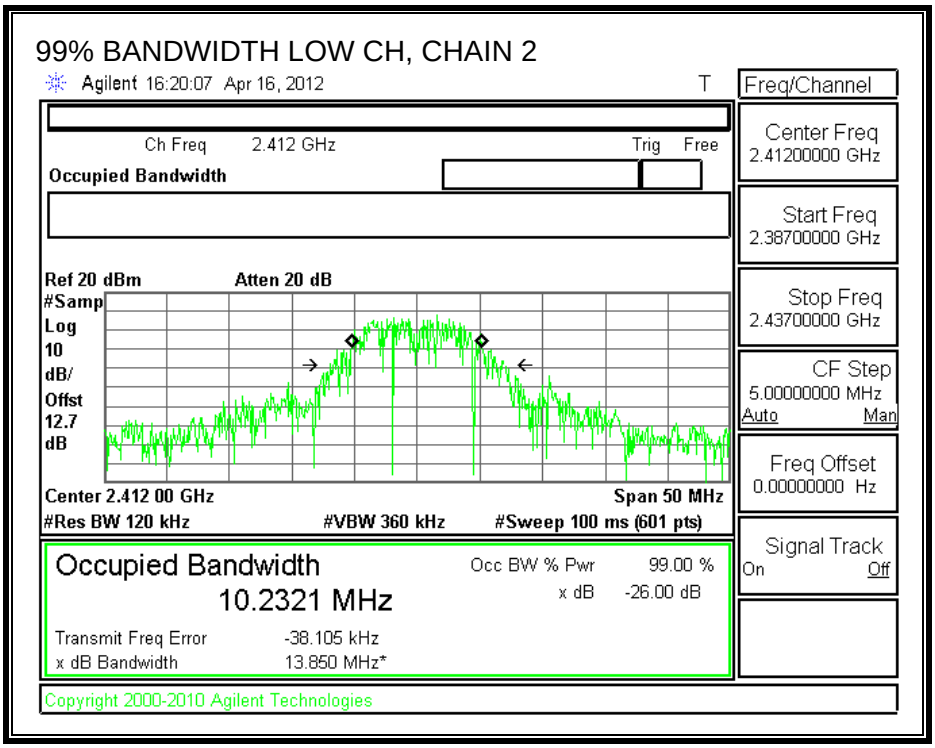
99% BANDWIDTH, CHAIN 1

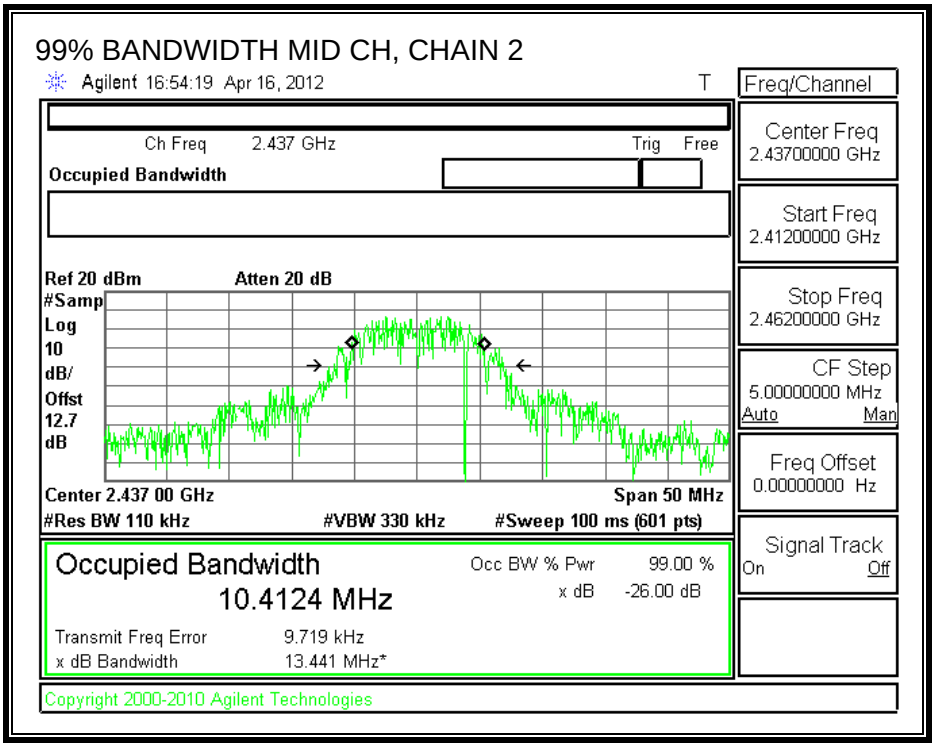


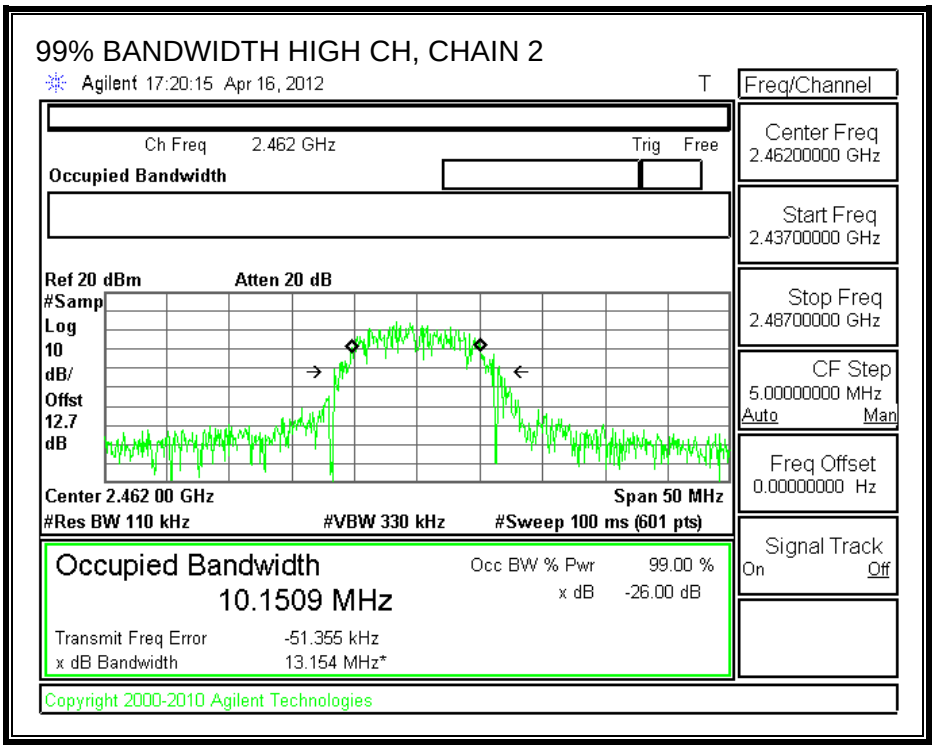




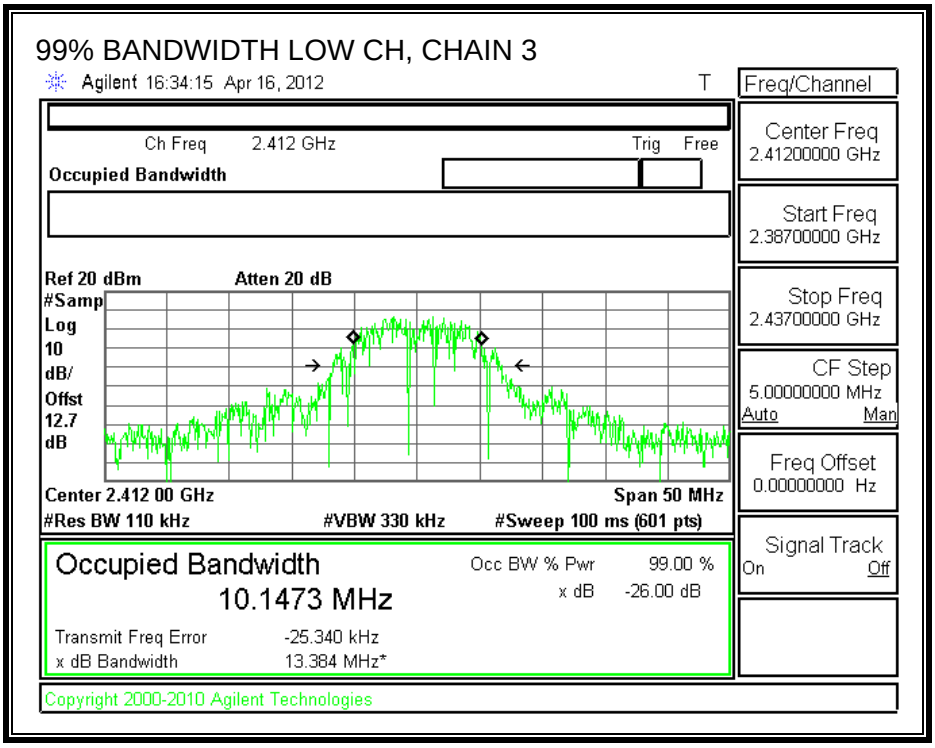
99% BANDWIDTH, CHAIN 2

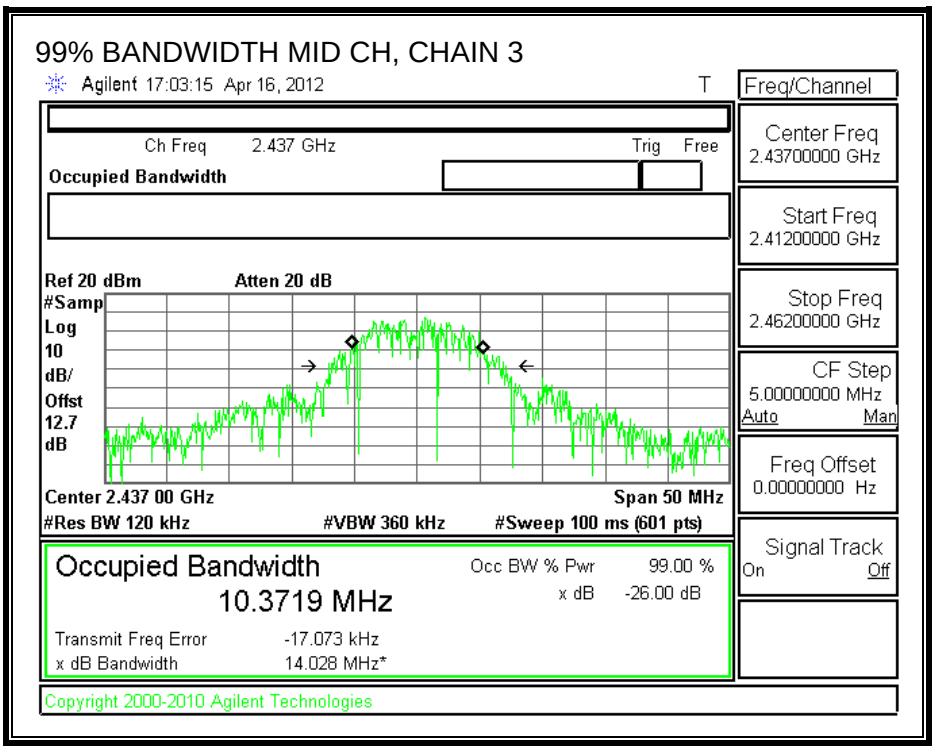




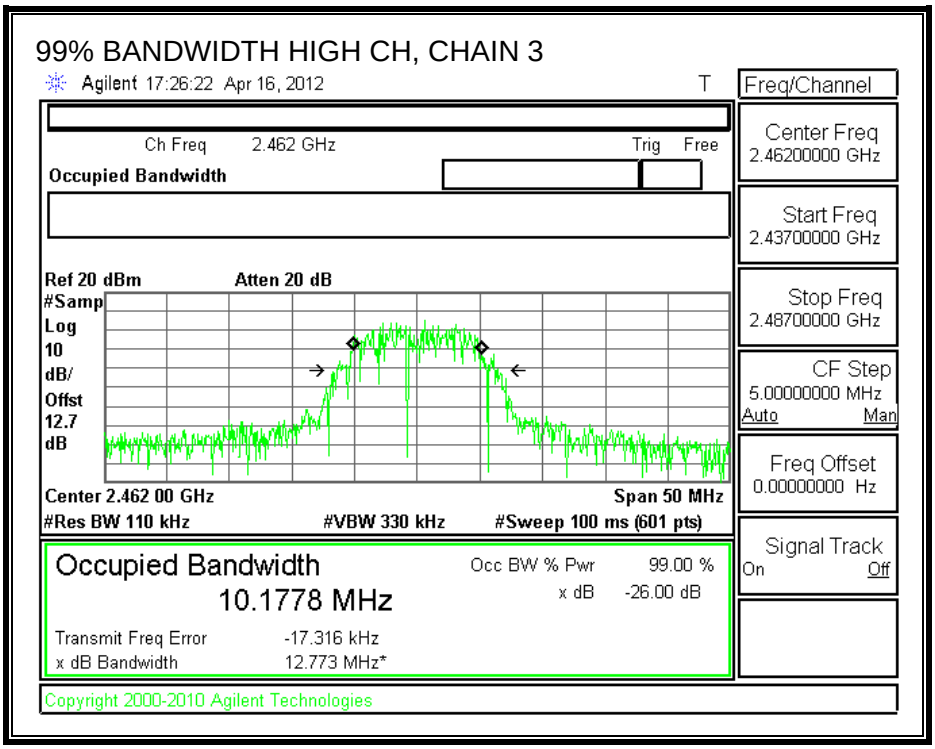


99% BANDWIDTH, CHAIN 3





99% BANDWIDTH HIGH CH, CHAIN 3



7.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Chain 3 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
4.32	4.77	3.72	9.05

The maximum effective legacy gain is 9.05 dBi for other than fixed, point-to-point operations, therefore the limit is 26.95 dBm.

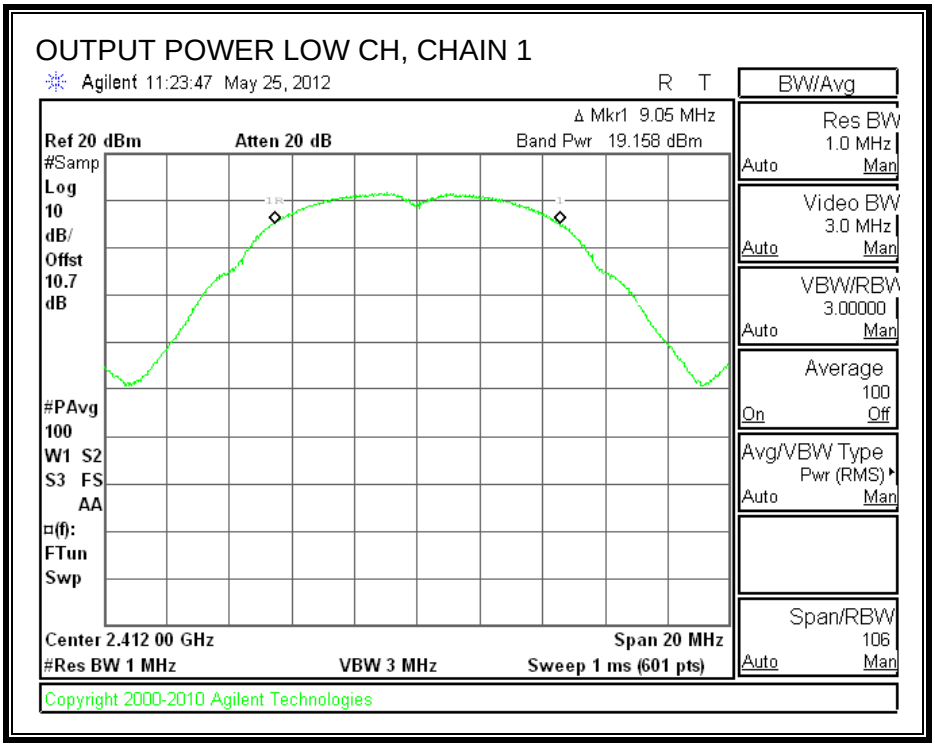
TEST PROCEDURE

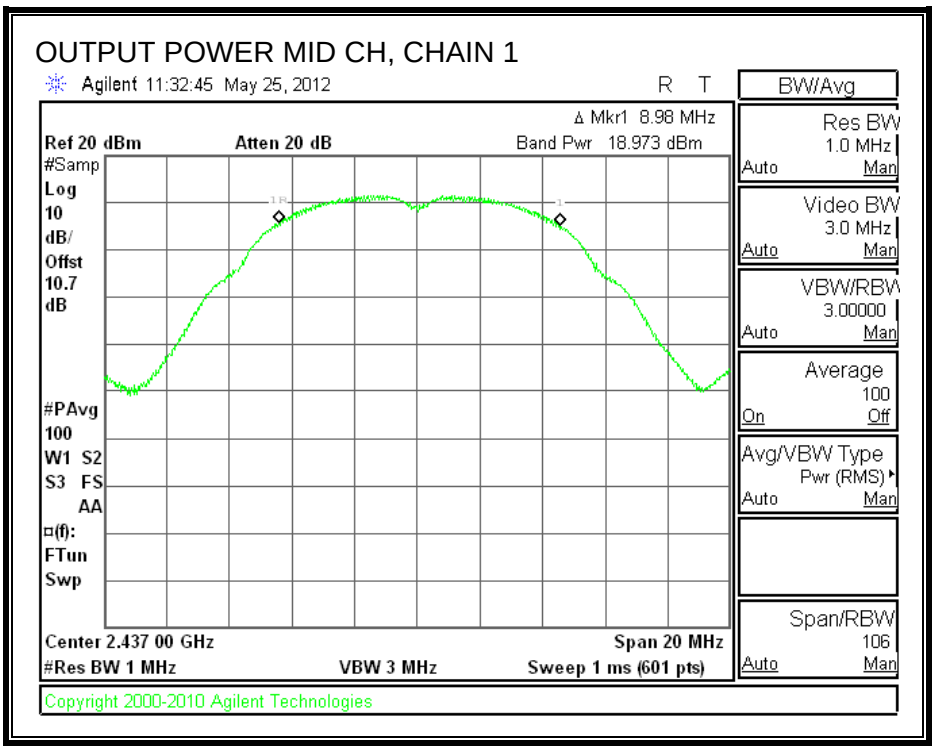
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

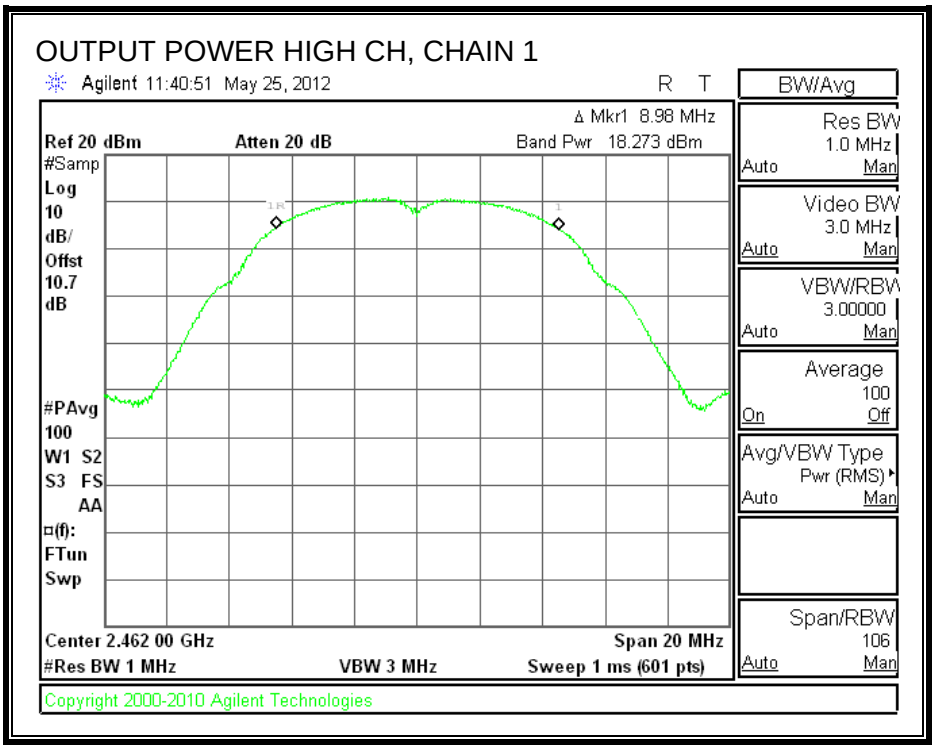
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Chain 3 PK Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.158	18.678	19.087	23.751	26.95	-3.199
Mid	2437	18.973	19.077	19.063	23.809	26.95	-3.141
High	2462	18.273	17.829	18.453	22.964	26.95	-3.986

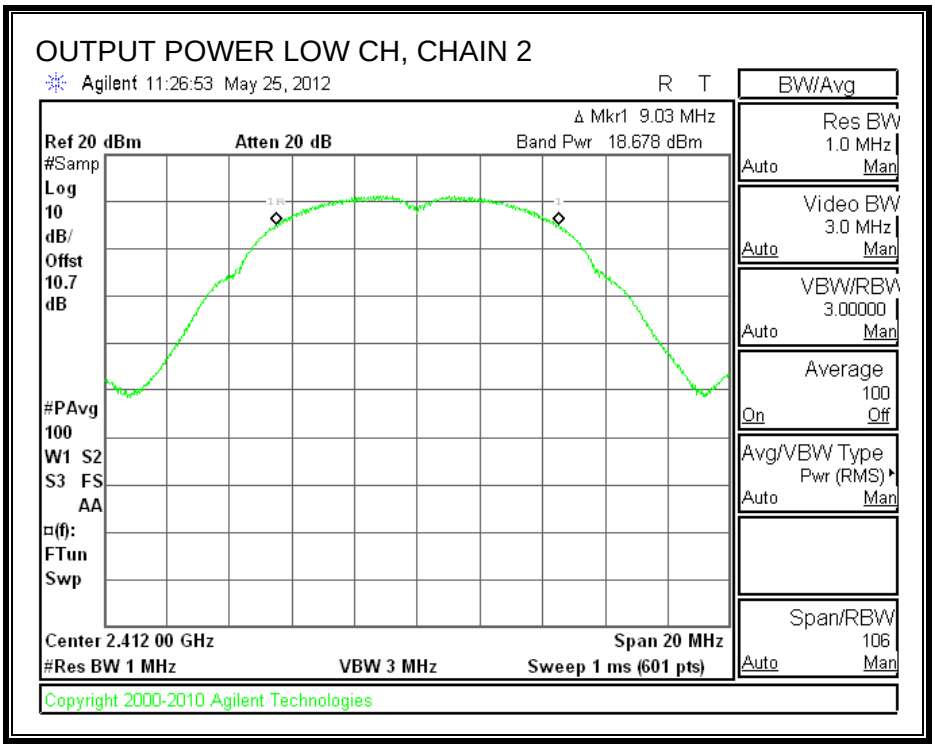
CHAIN 1 OUTPUT POWER

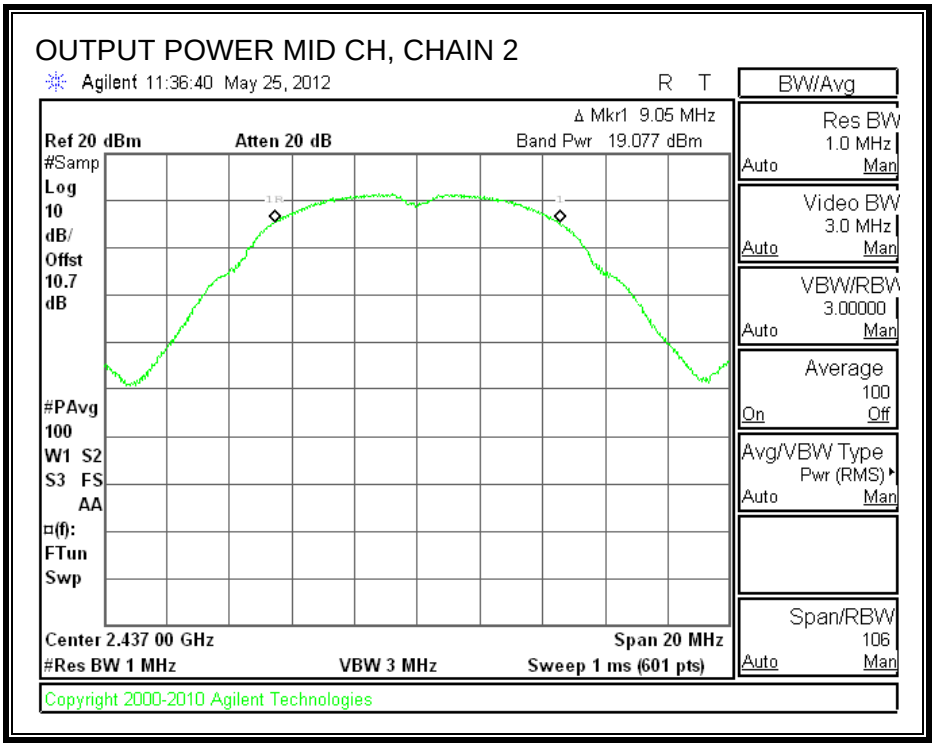


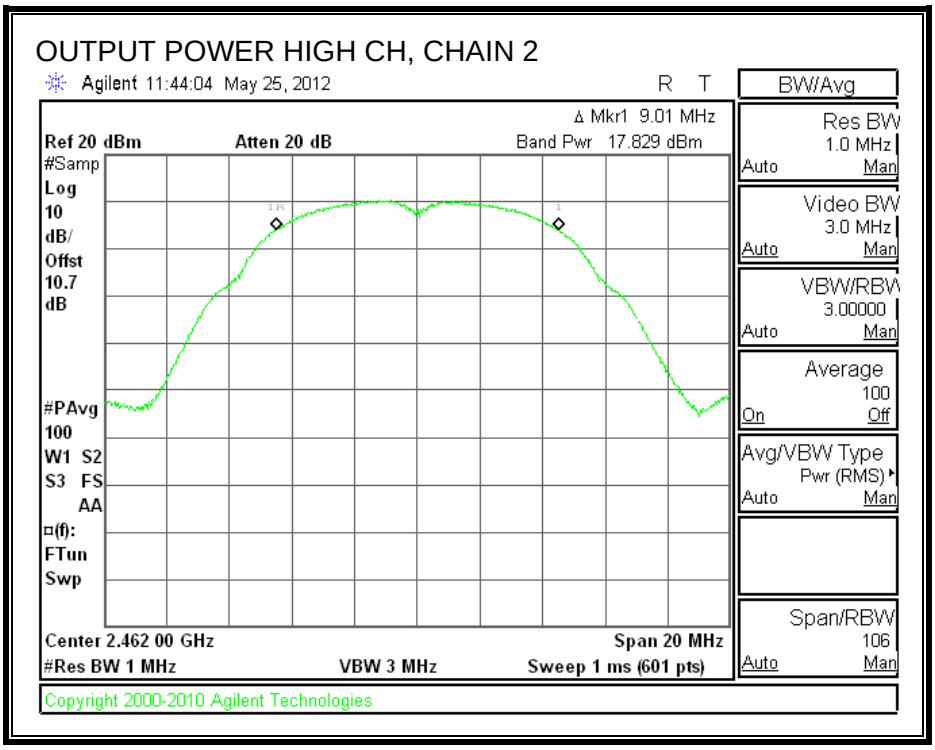




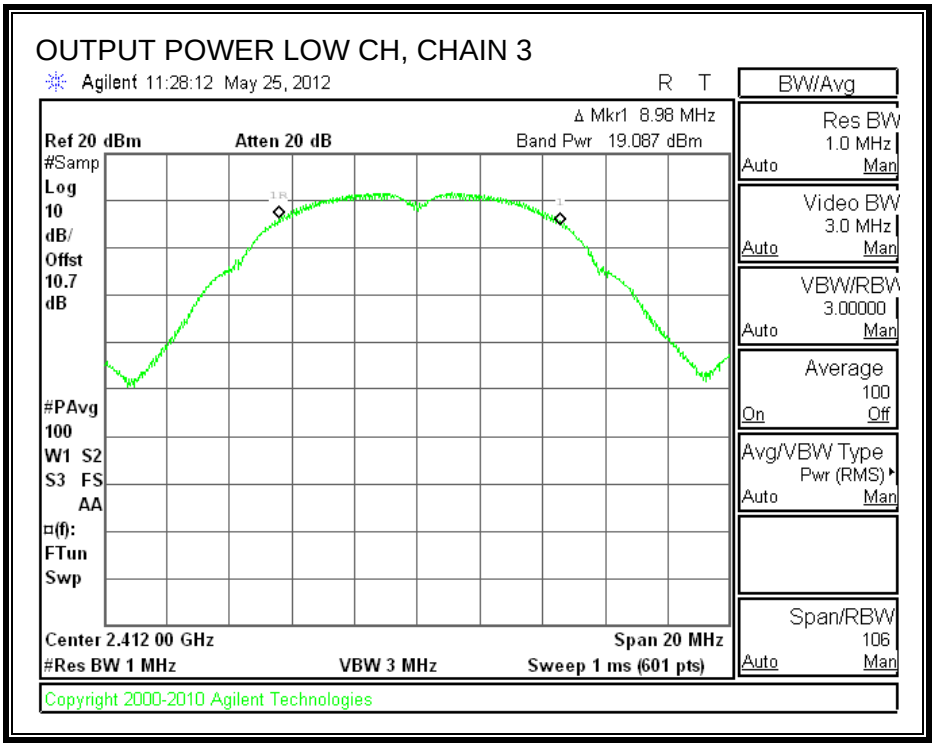
CHAIN 2 OUTPUT POWER

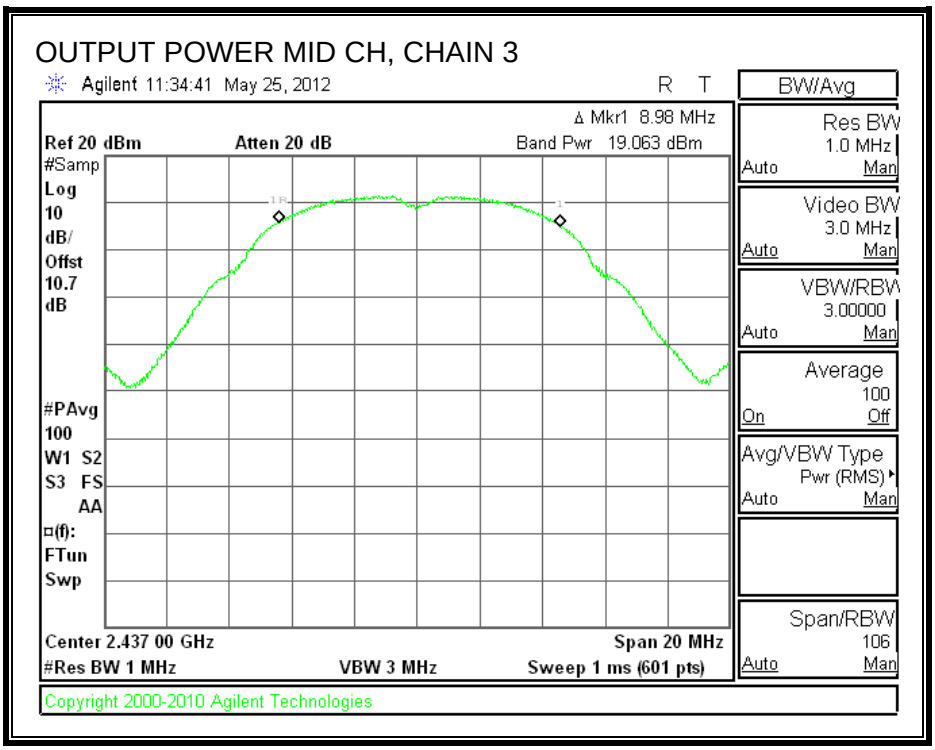


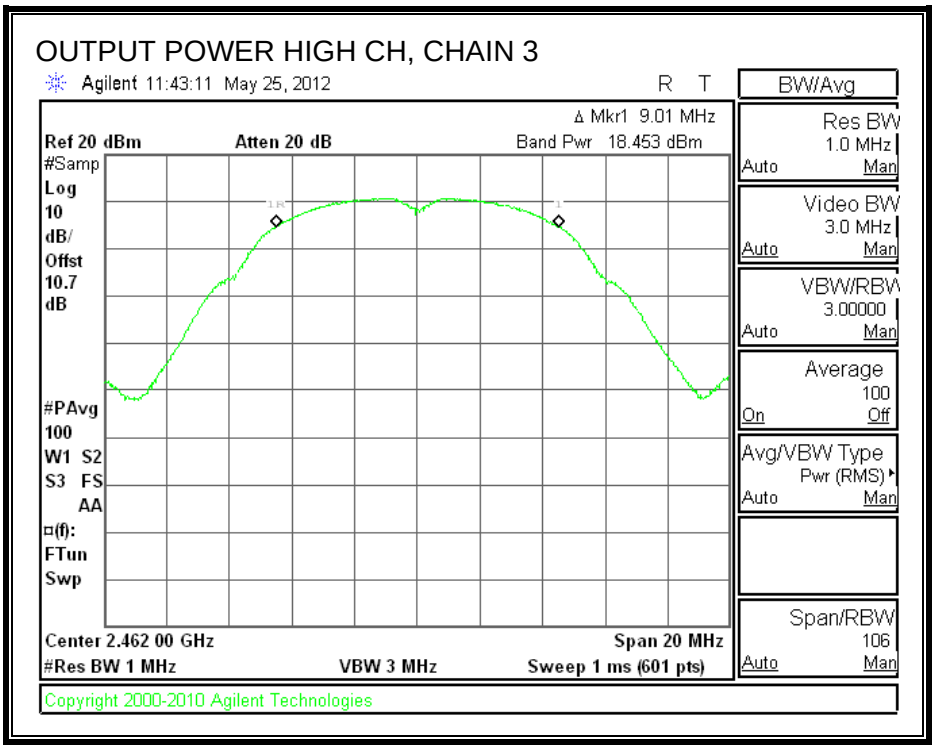




CHAIN 3 OUTPUT POWER







7.2.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

TEST PROCEDURE

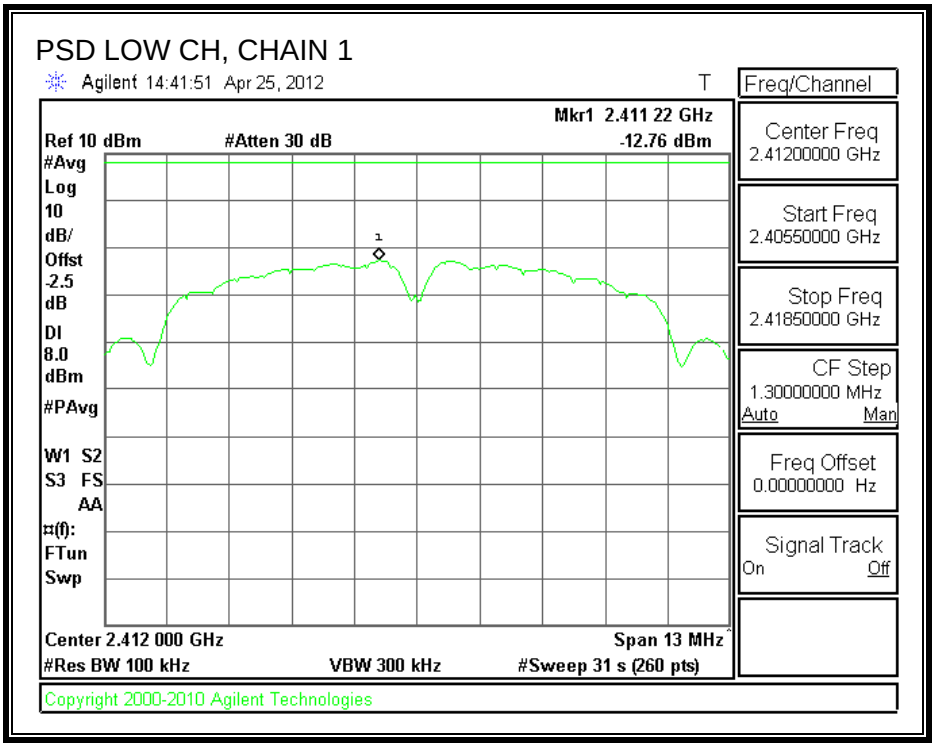
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

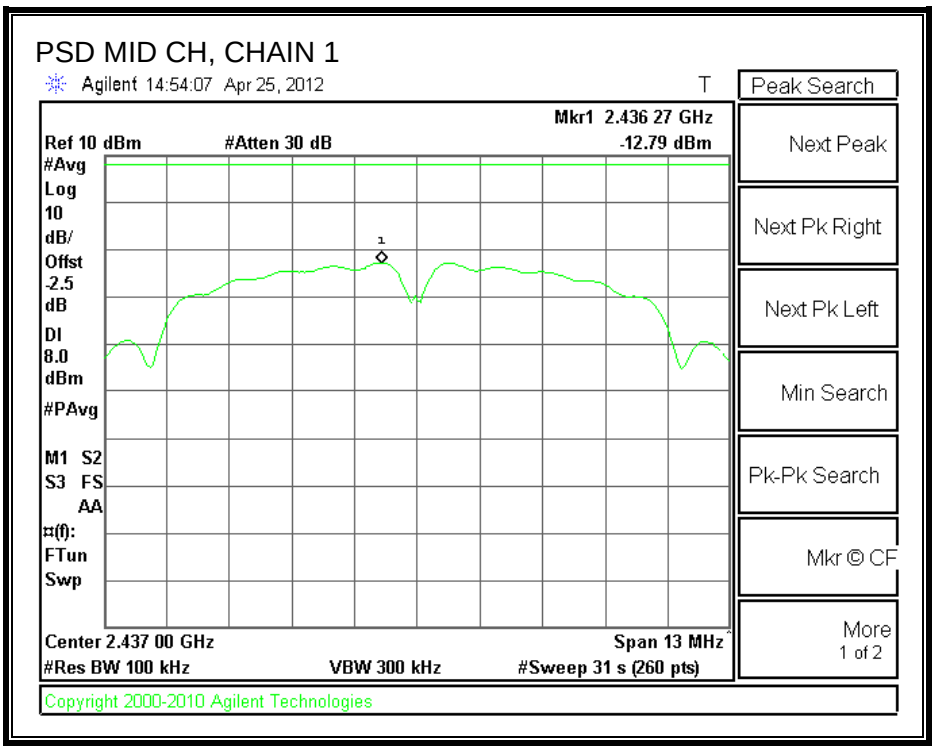
RESULTS

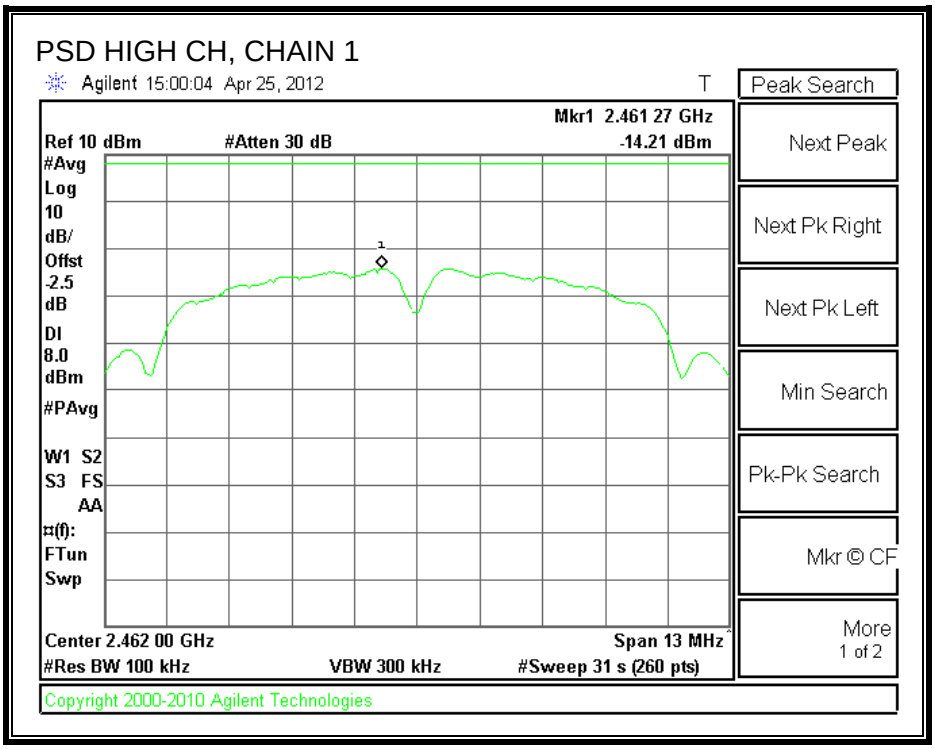
Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Chain 3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-12.76	-12.85	-12.61	-7.97	8	-15.97
Middle	2437	-12.79	-12.80	-12.69	-7.99	8	-15.99
High	2462	-14.21	-14.03	-13.85	-9.26	8	-17.26

Note: The spectrum analyzer offset = attenuator loss + cable loss + 10 log(3/100 kHz) = -2.5 dB

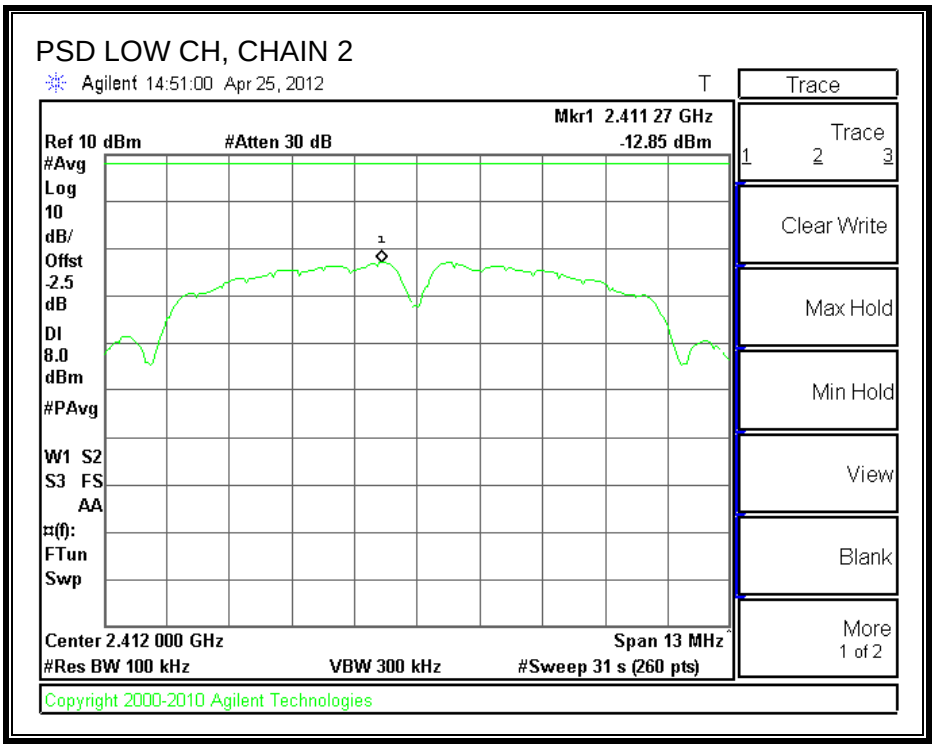
POWER SPECTRAL DENSITY, CHAIN 1

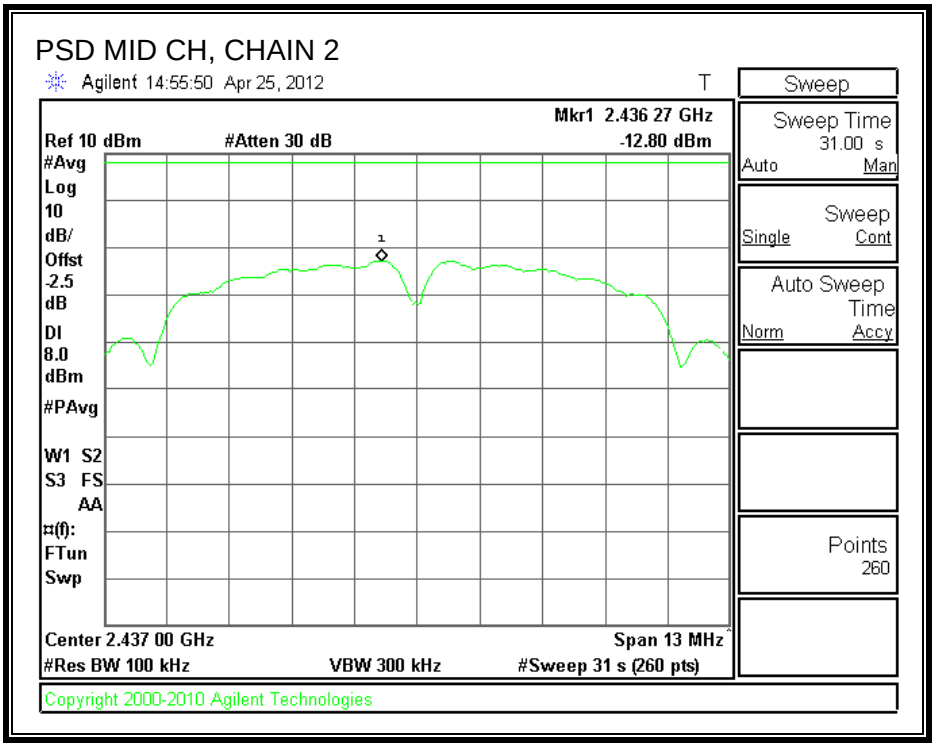


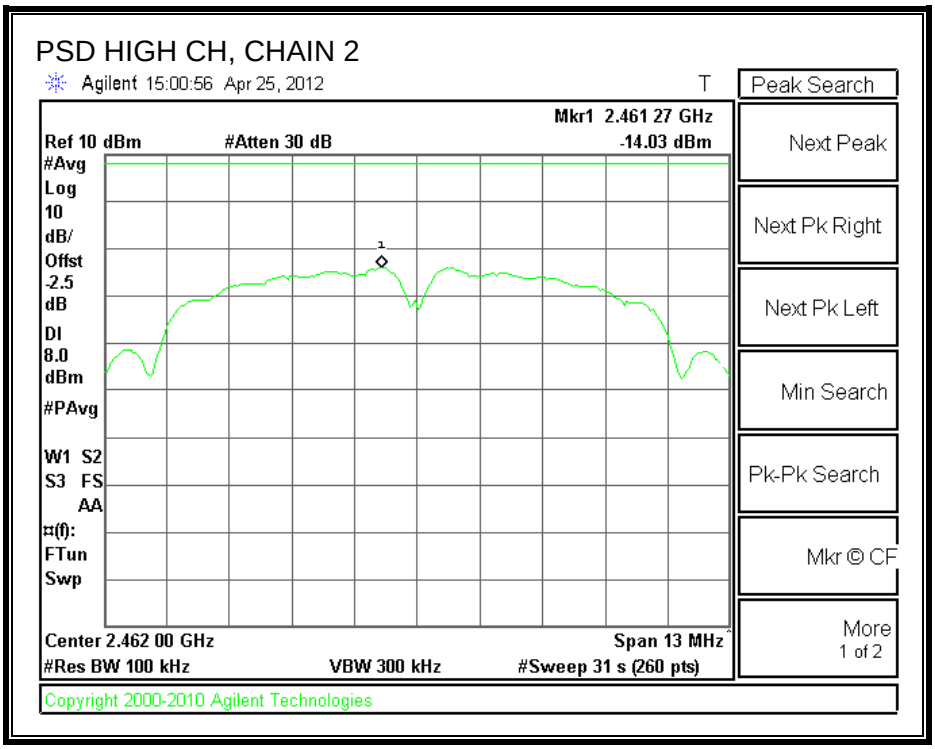




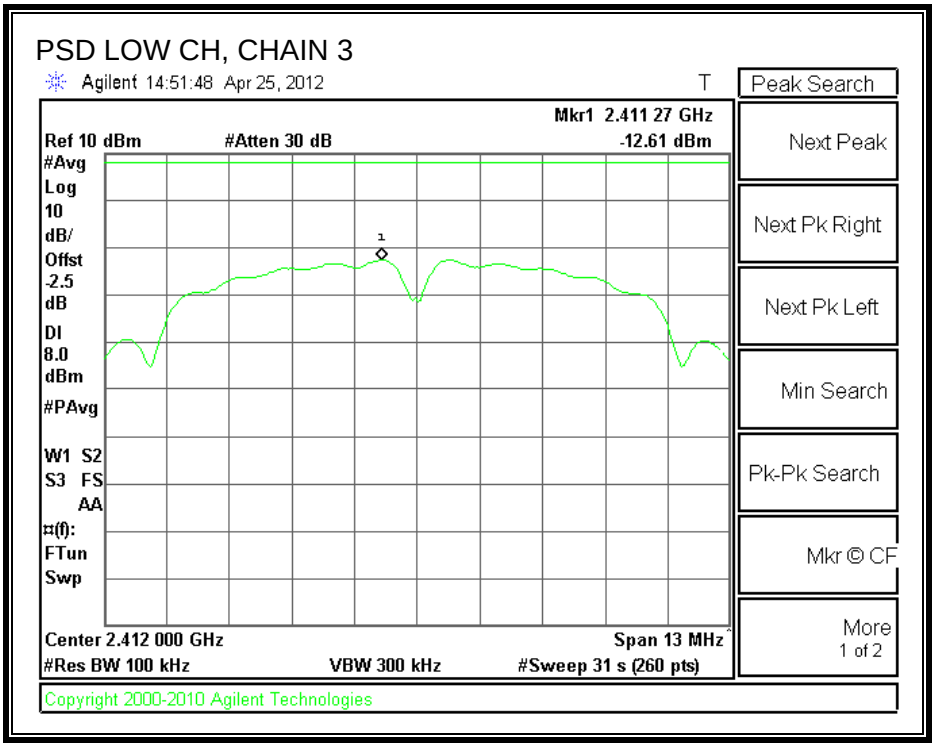
POWER SPECTRAL DENSITY, CHAIN 2

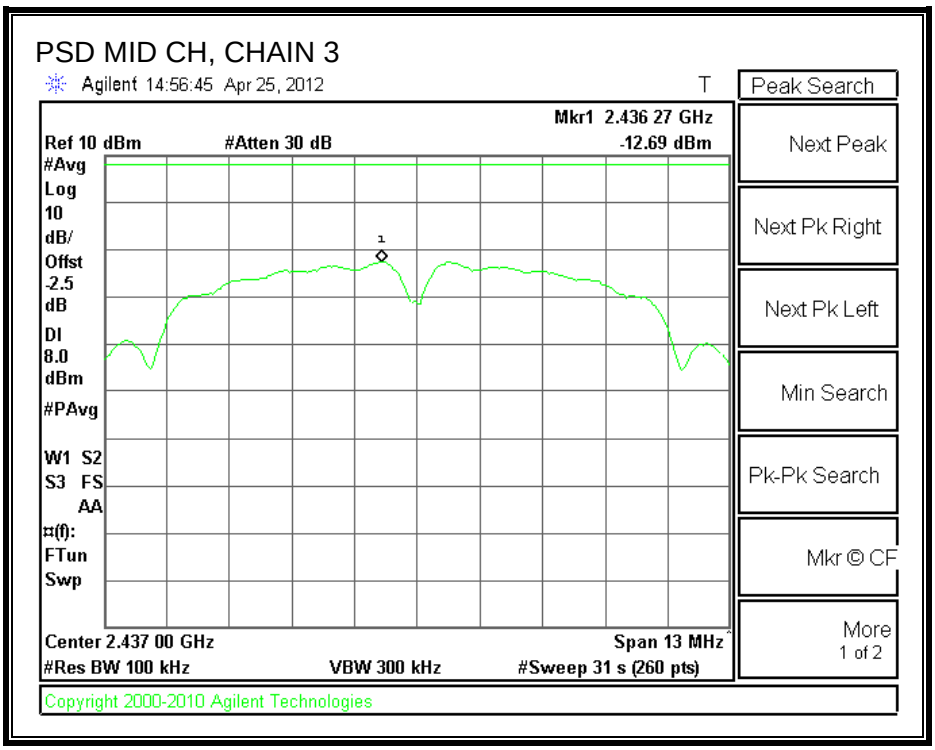


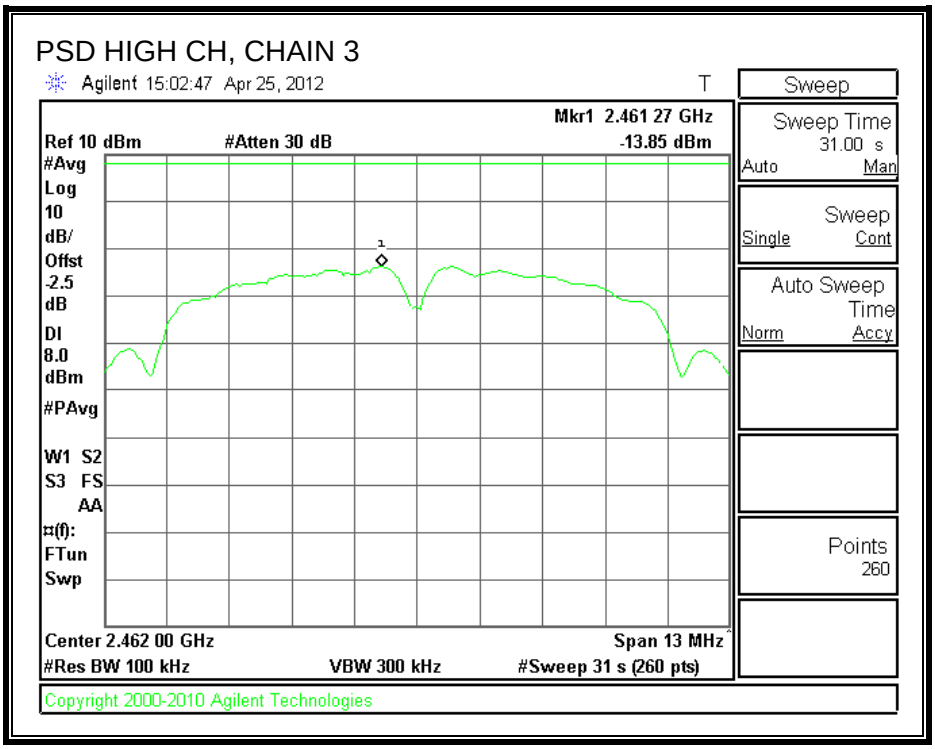




POWER SPECTRAL DENSITY, CHAIN 3







7.2.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

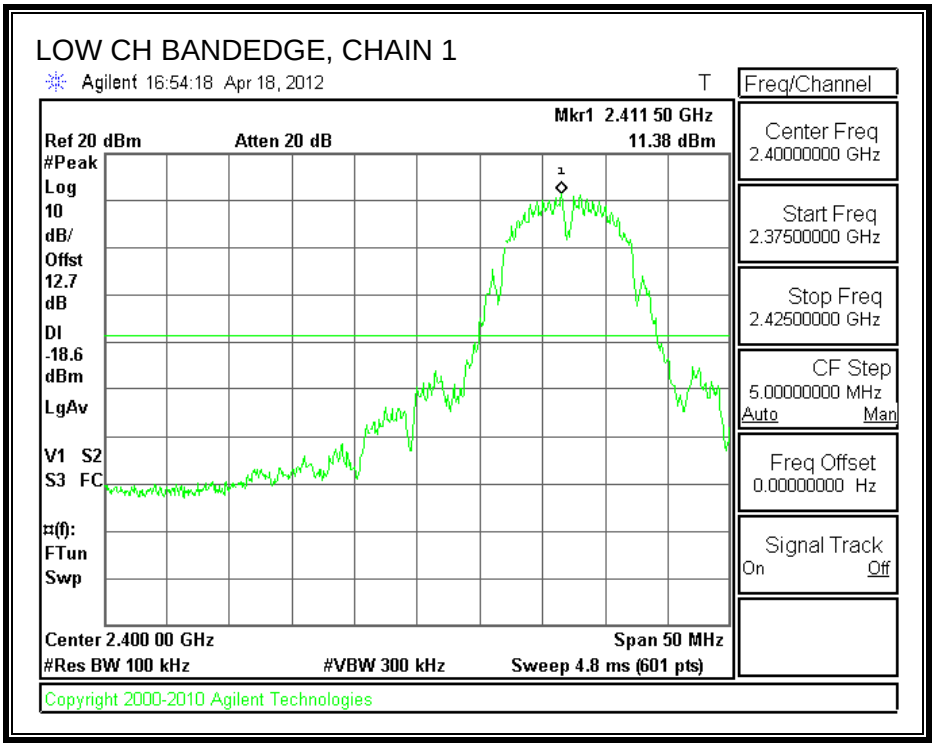
IC RSS-210 A8.5

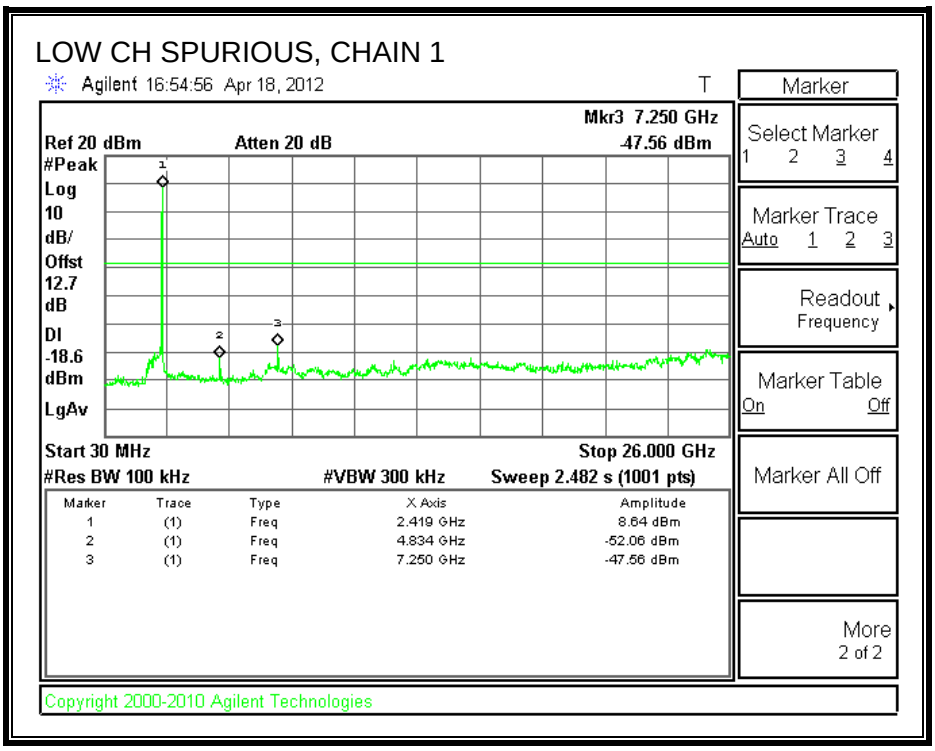
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

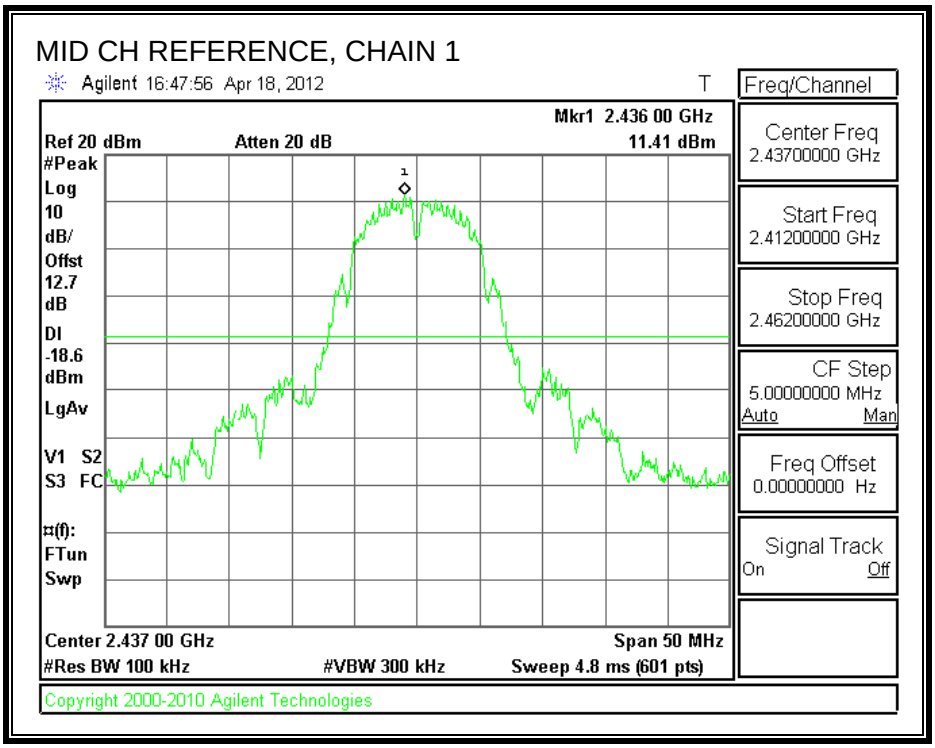
TEST PROCEDURE

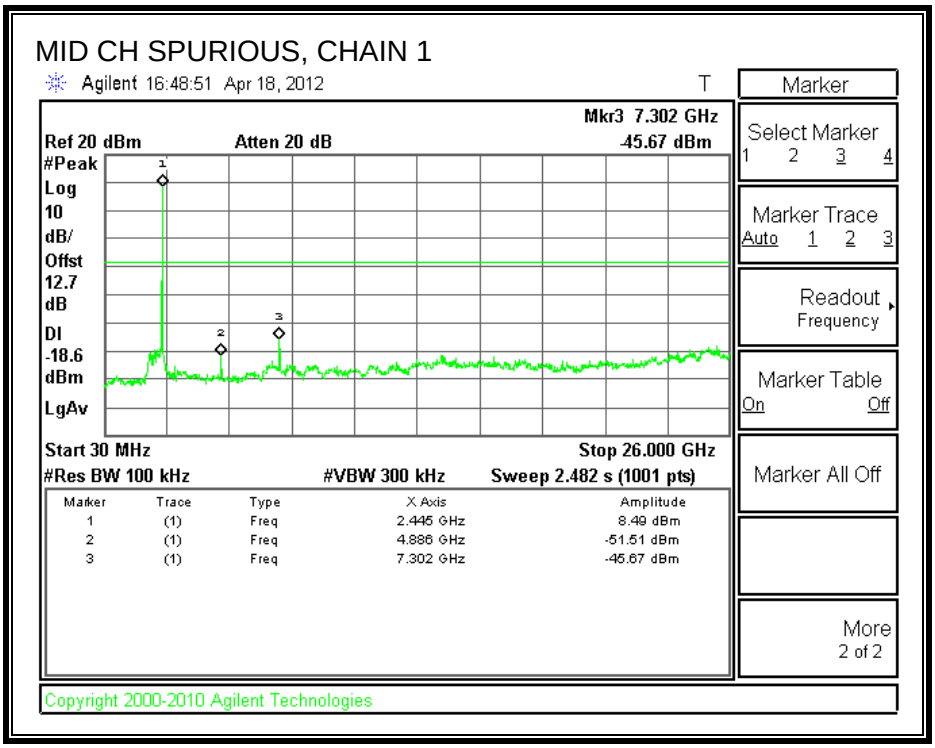
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

CHAIN 1 SPURIOUS EMISSIONS

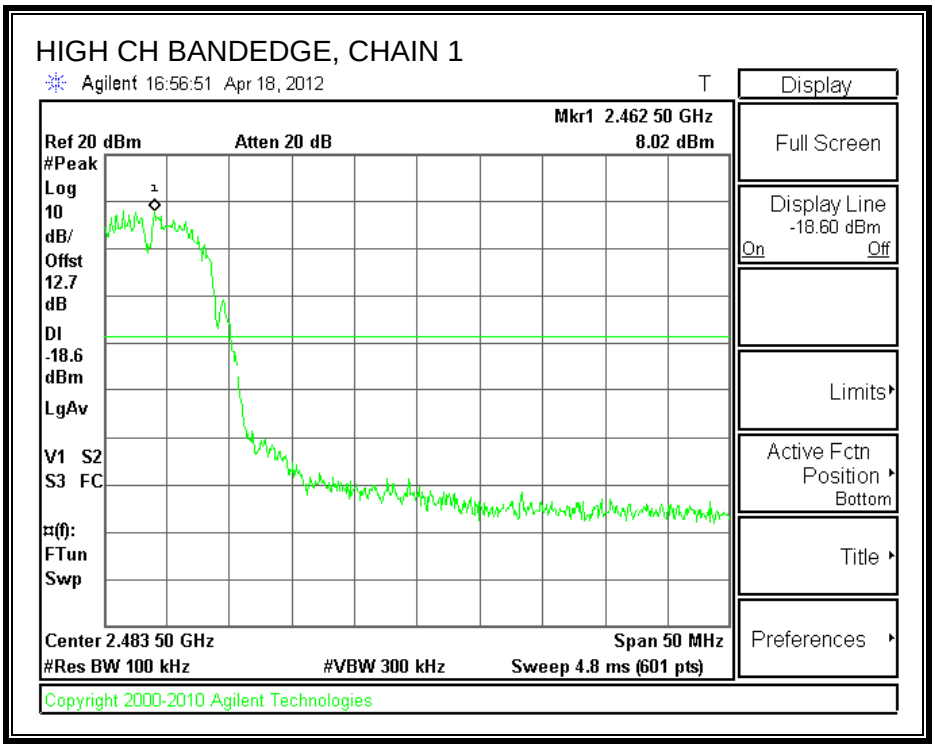




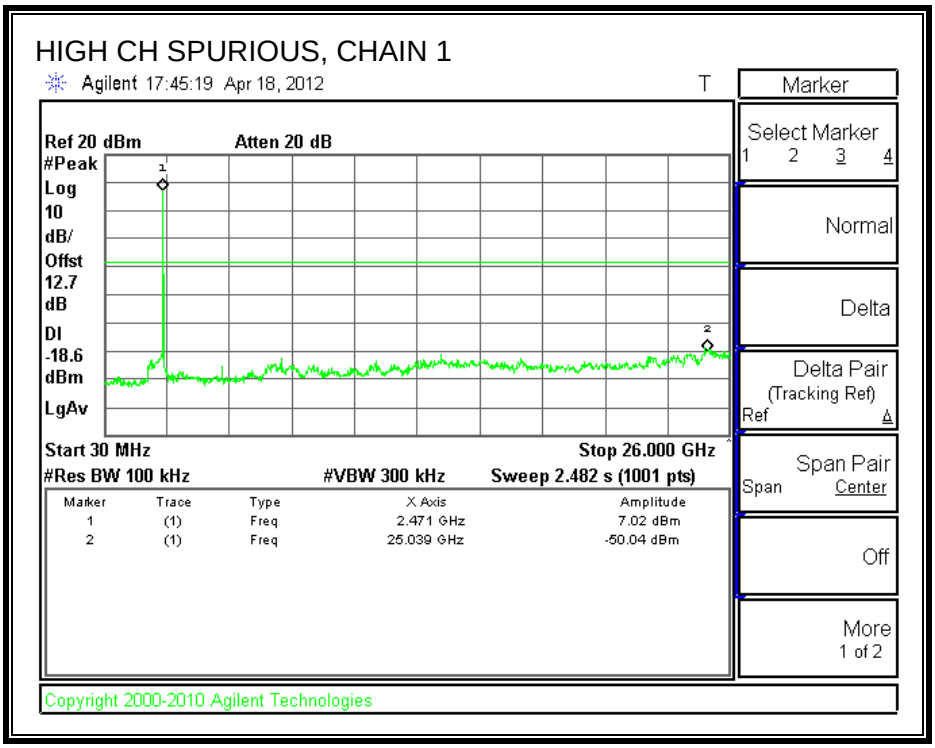




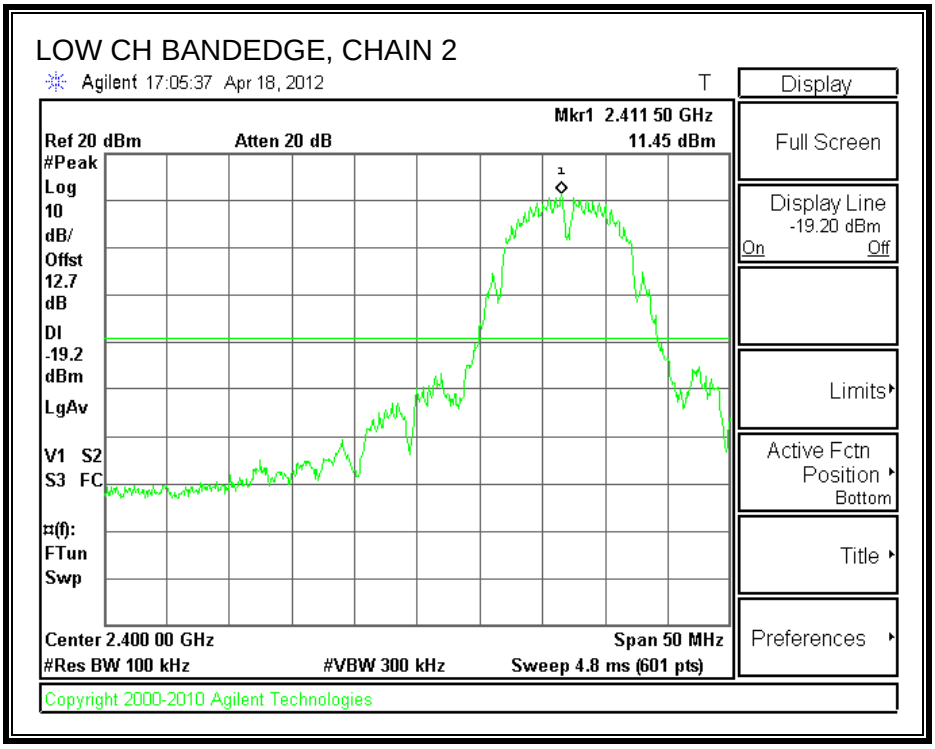
HIGH CH BANDEDGE, CHAIN 1

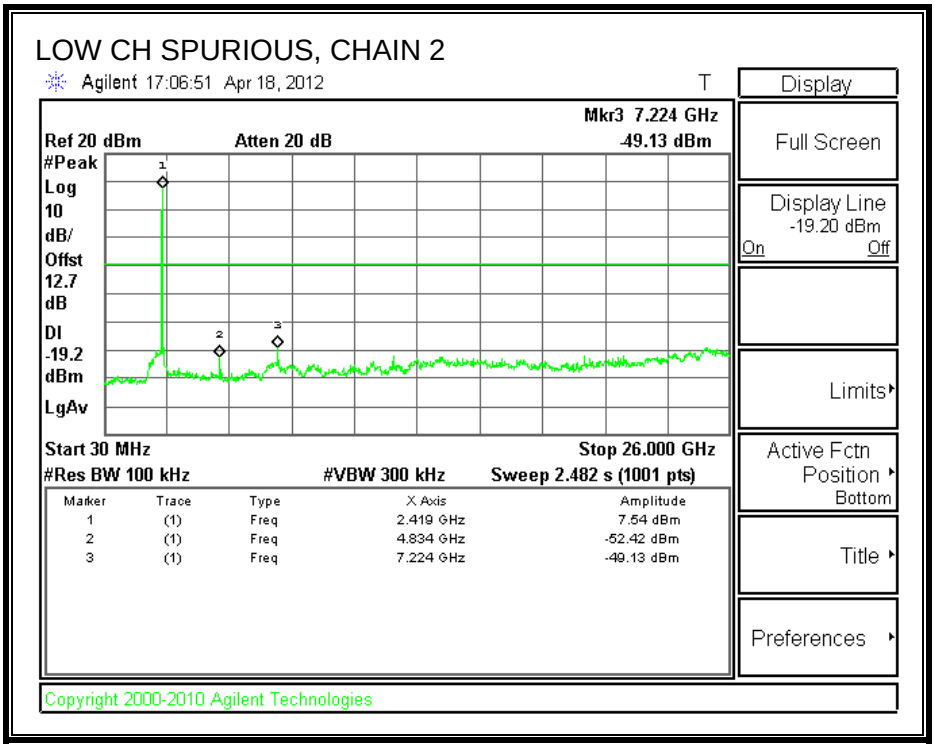


HIGH CH SPURIOUS, CHAIN 1

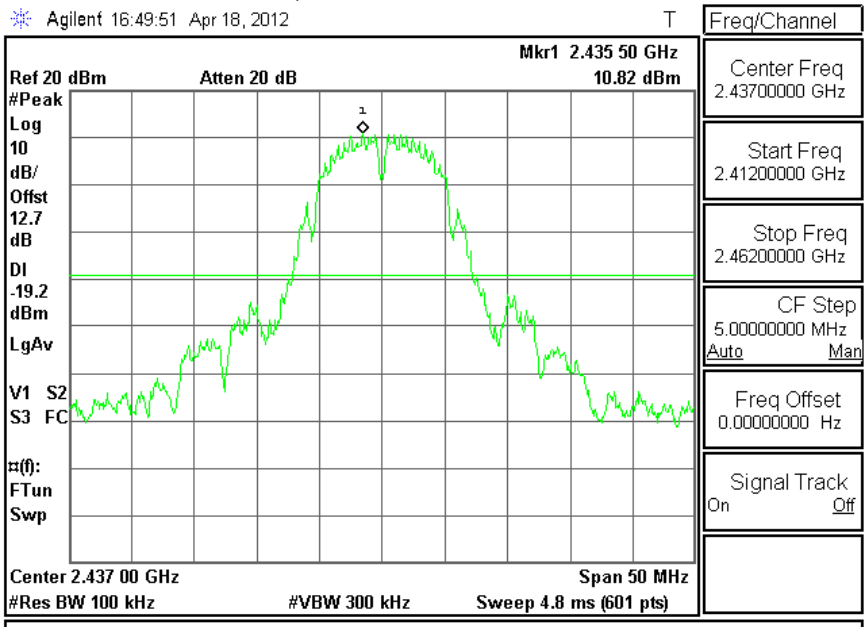


CHAIN 2 SPURIOUS EMISSIONS

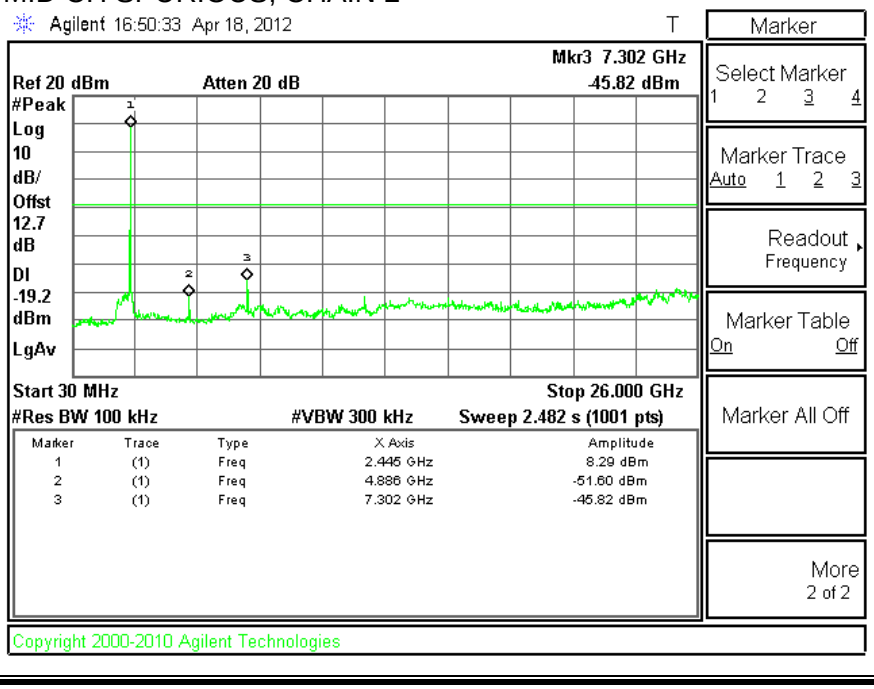




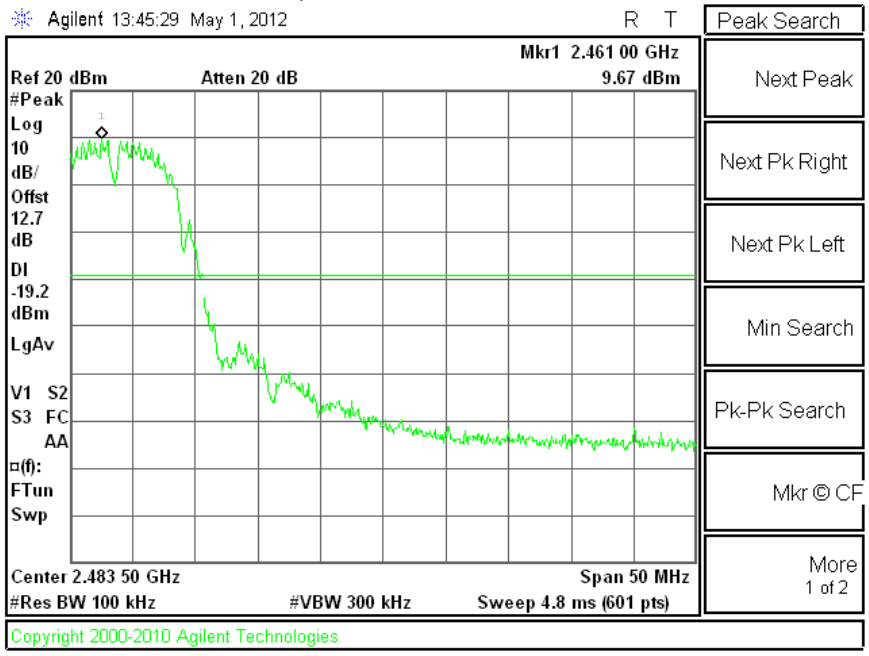
MID CH REFERENCE, CHAIN 2



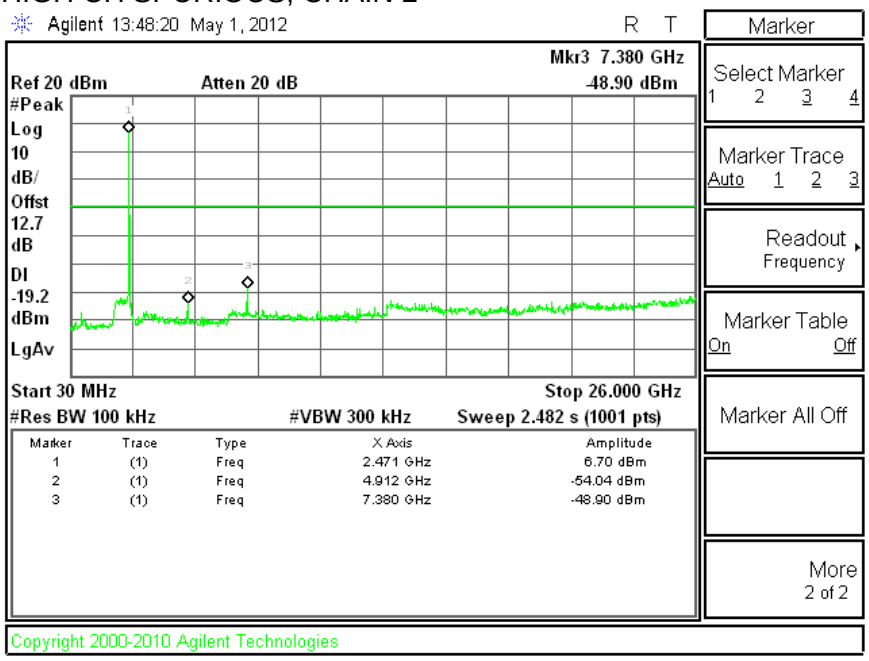
MID CH SPURIOUS, CHAIN 2



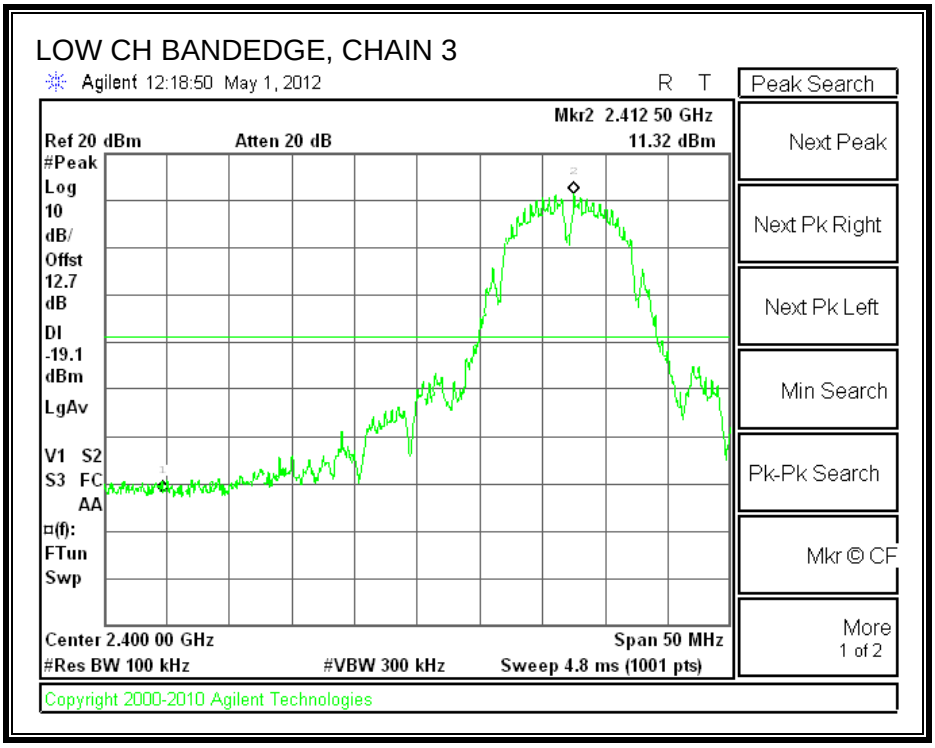
HIGH CH BANDEDGE, CHAIN 2

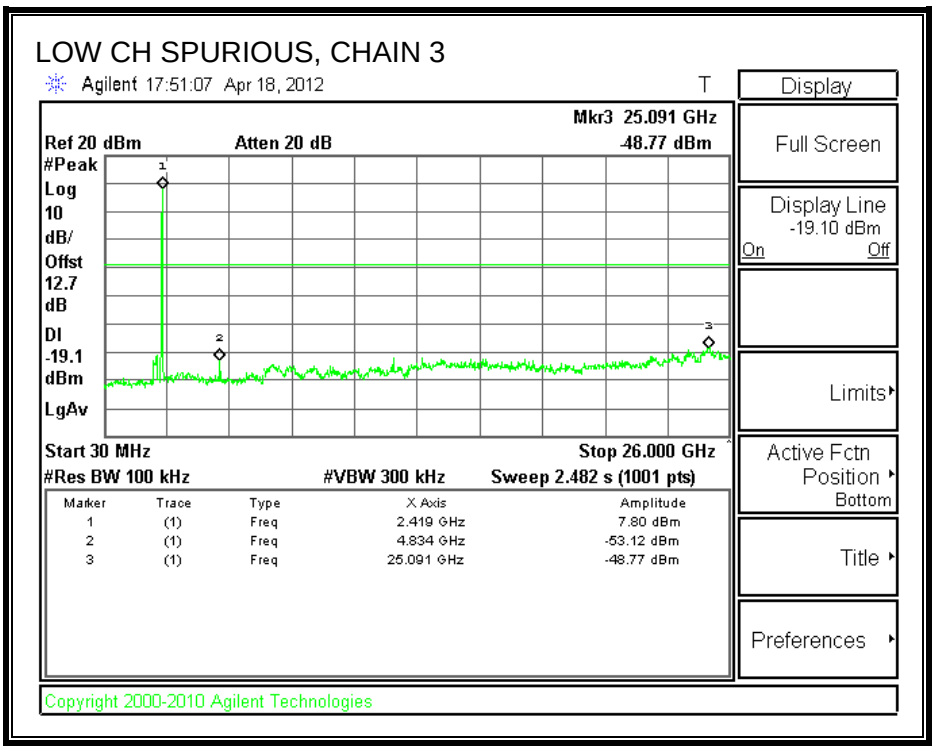


HIGH CH SPURIOUS, CHAIN 2

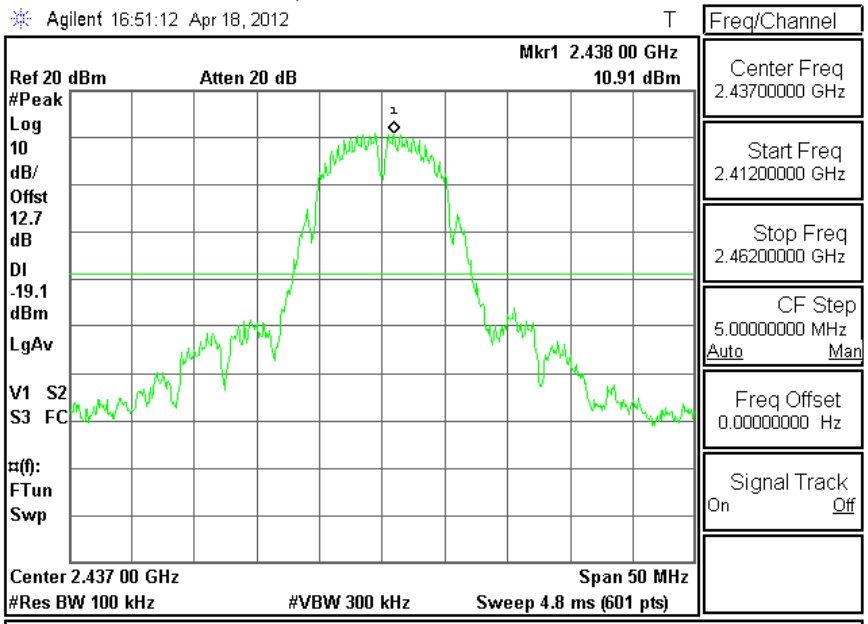


CHAIN 3 SPURIOUS EMISSIONS

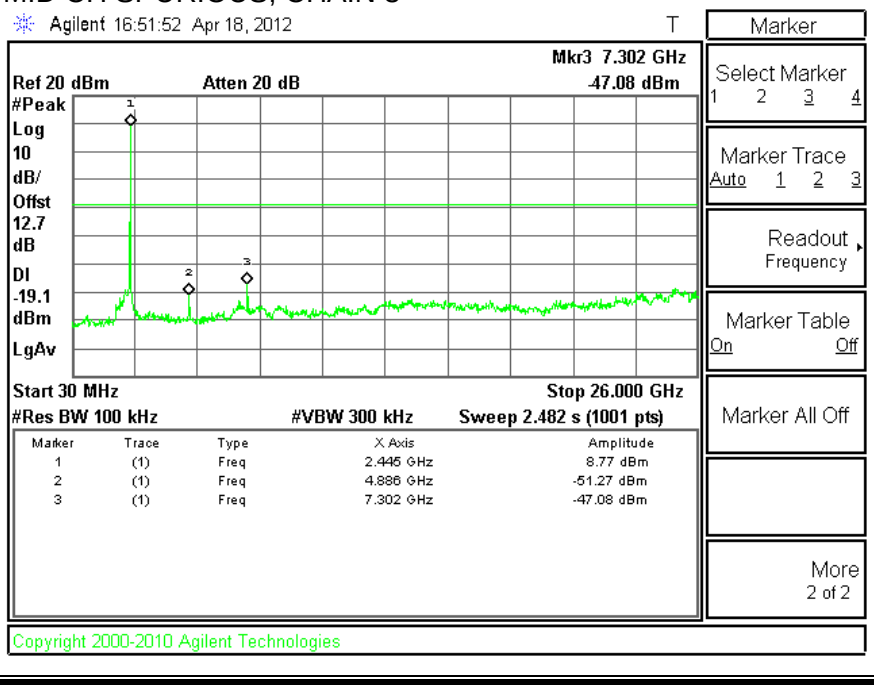




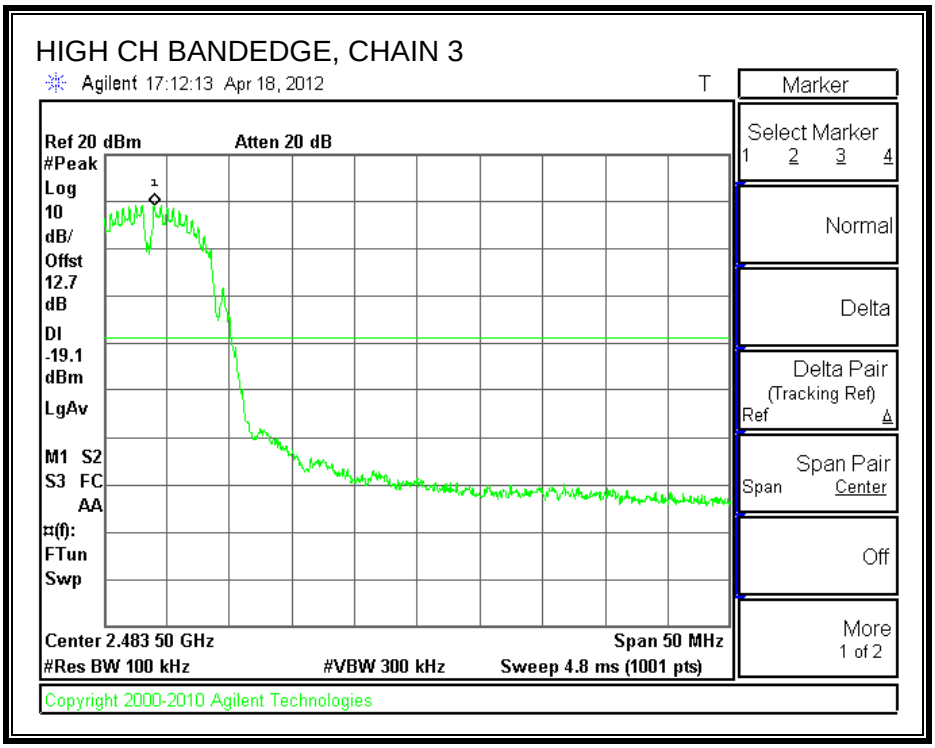
MID CH REFERENCE, CHAIN 3



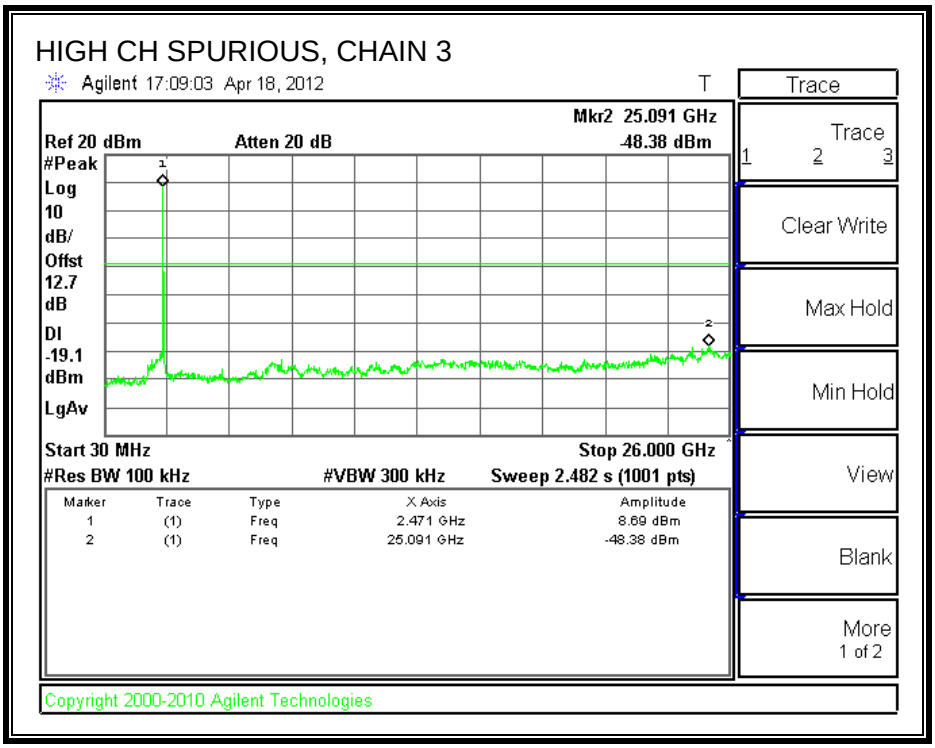
MID CH SPURIOUS, CHAIN 3



HIGH CH BANDEDGE, CHAIN 3



HIGH CH SPURIOUS, CHAIN 3



7.3. 802.11n HT20 CDD 3TX 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.

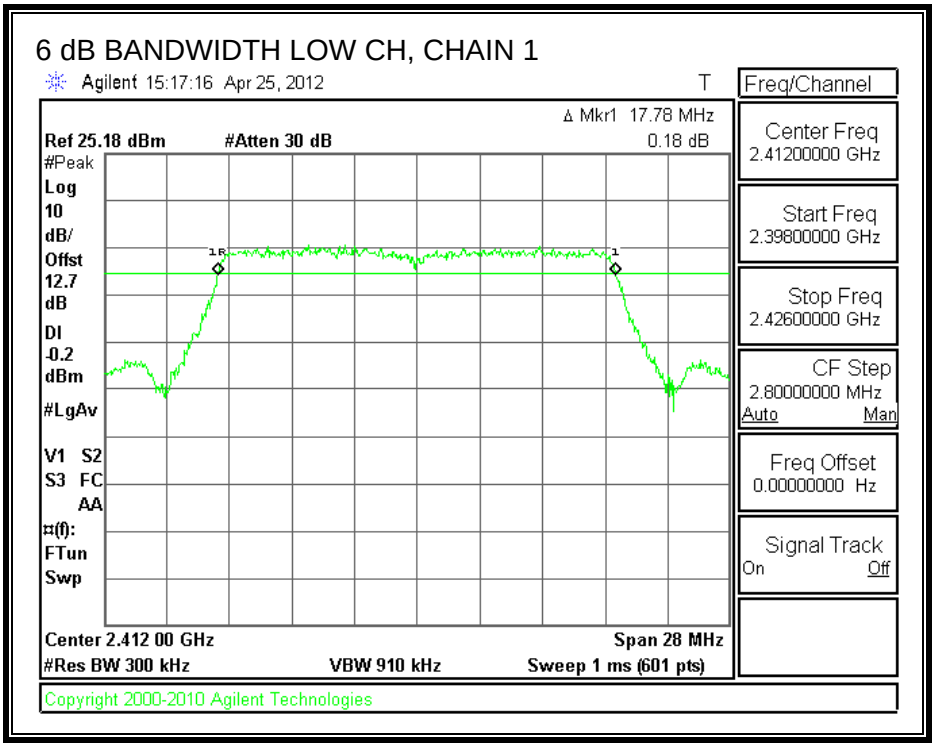
TEST PROCEDURE

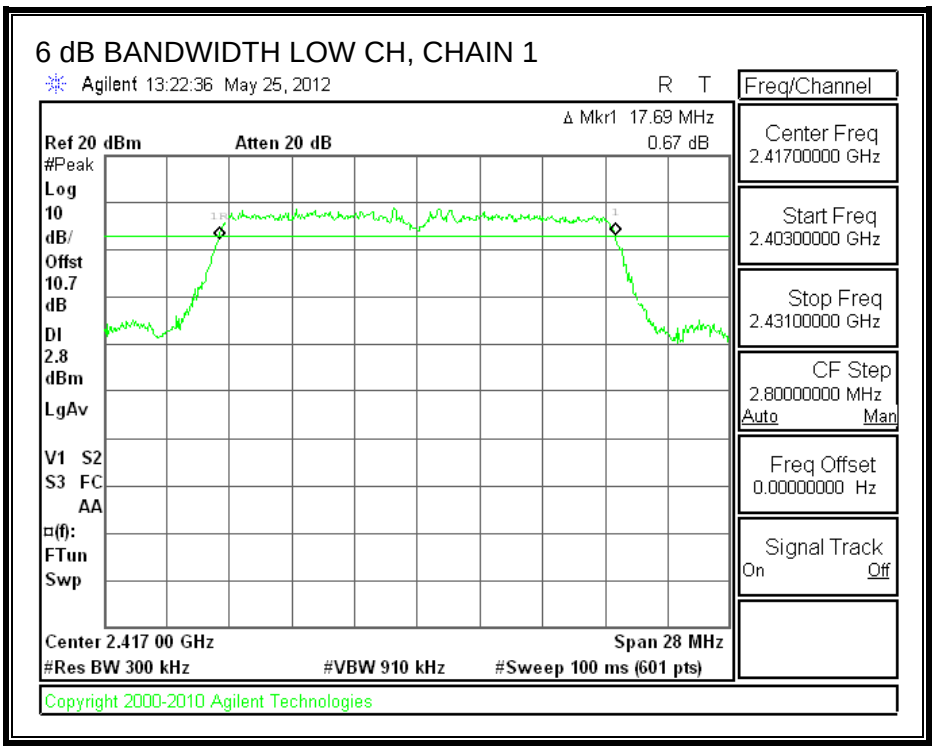
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

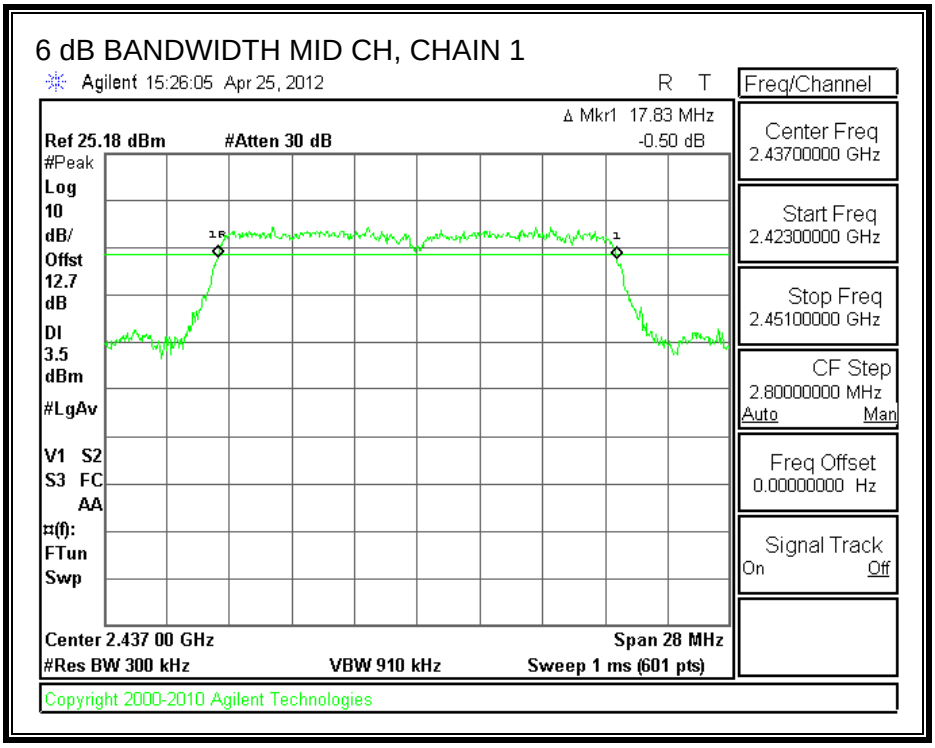
RESULTS

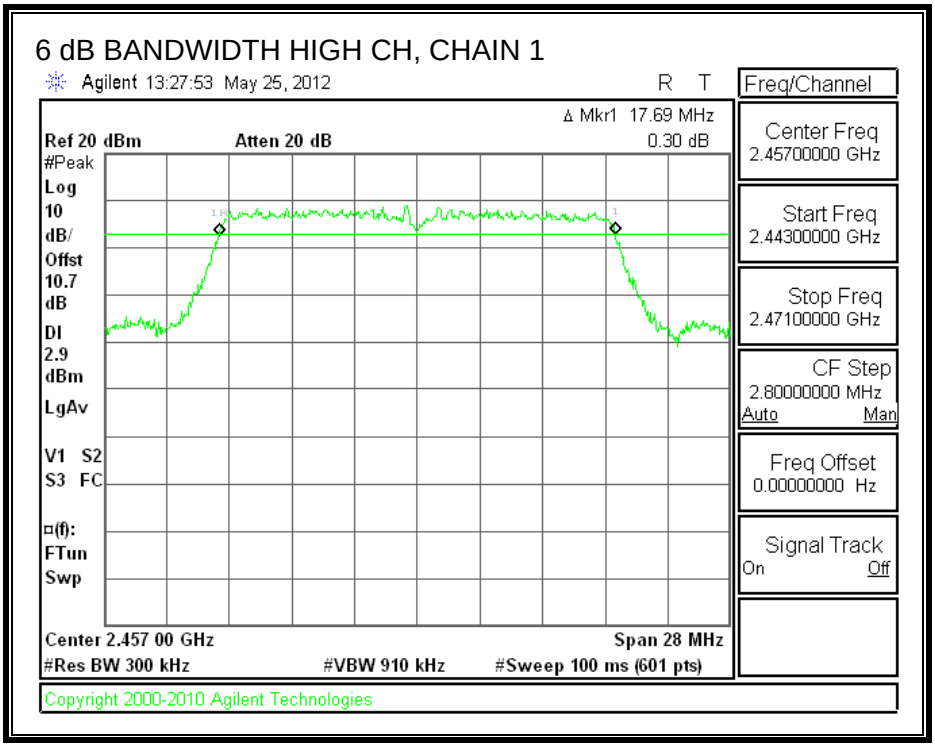
Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Chain 3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	17.78	17.78	17.83	0.5
Low	2417	17.69	17.73	17.78	0.5
Middle	2437	17.83	17.78	17.83	0.5
High	2457	17.69	17.73	17.73	0.5
High	2462	17.69	17.78	17.83	0.5

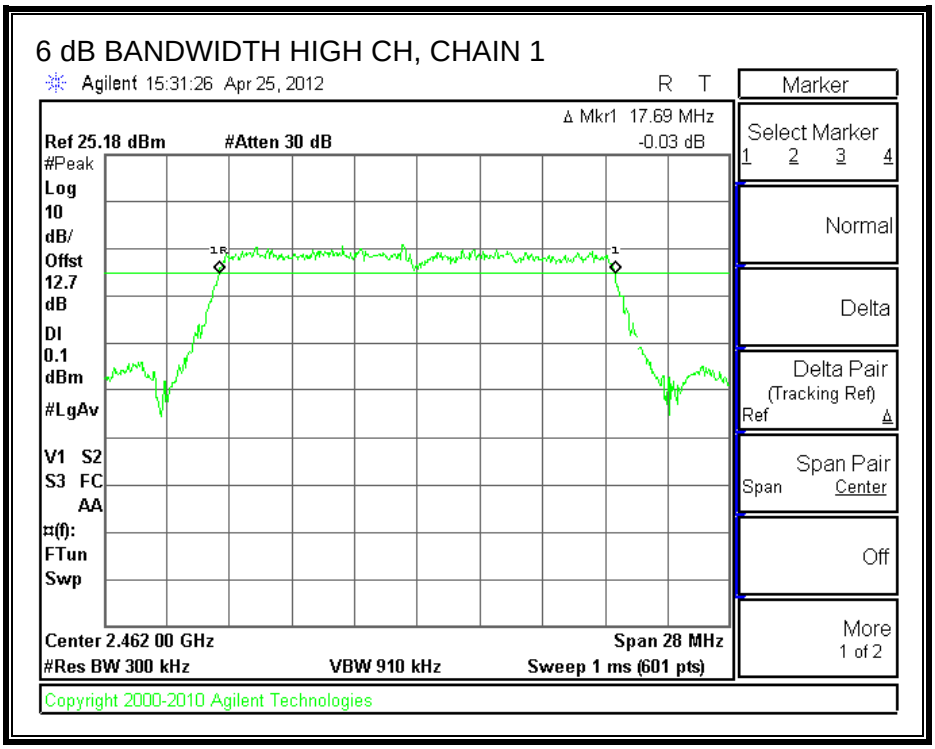
6 dB BANDWIDTH, CHAIN 1



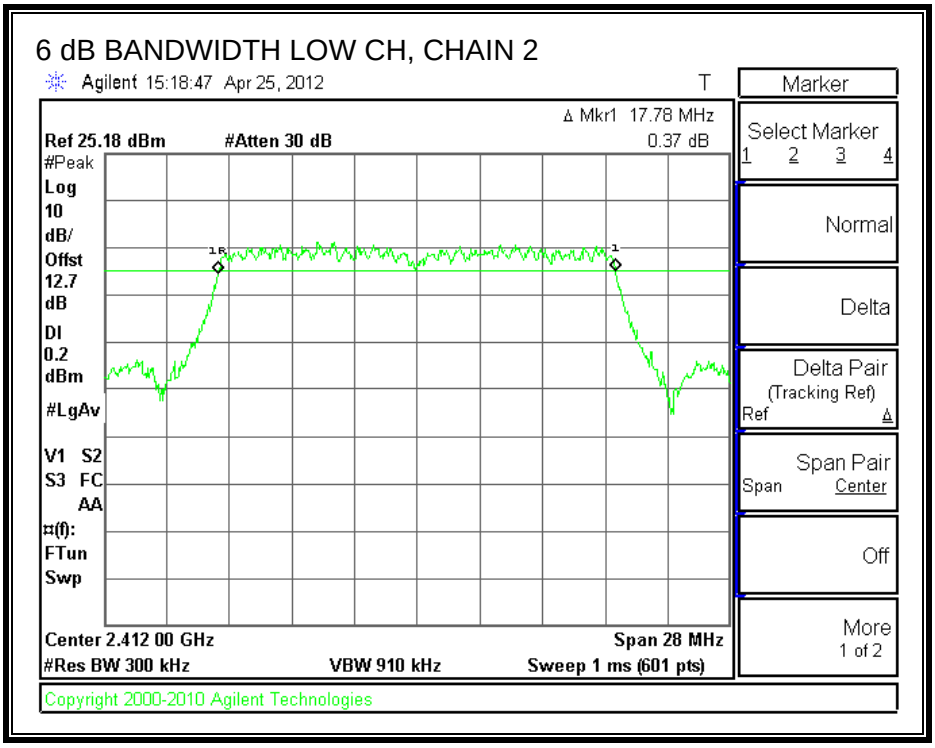


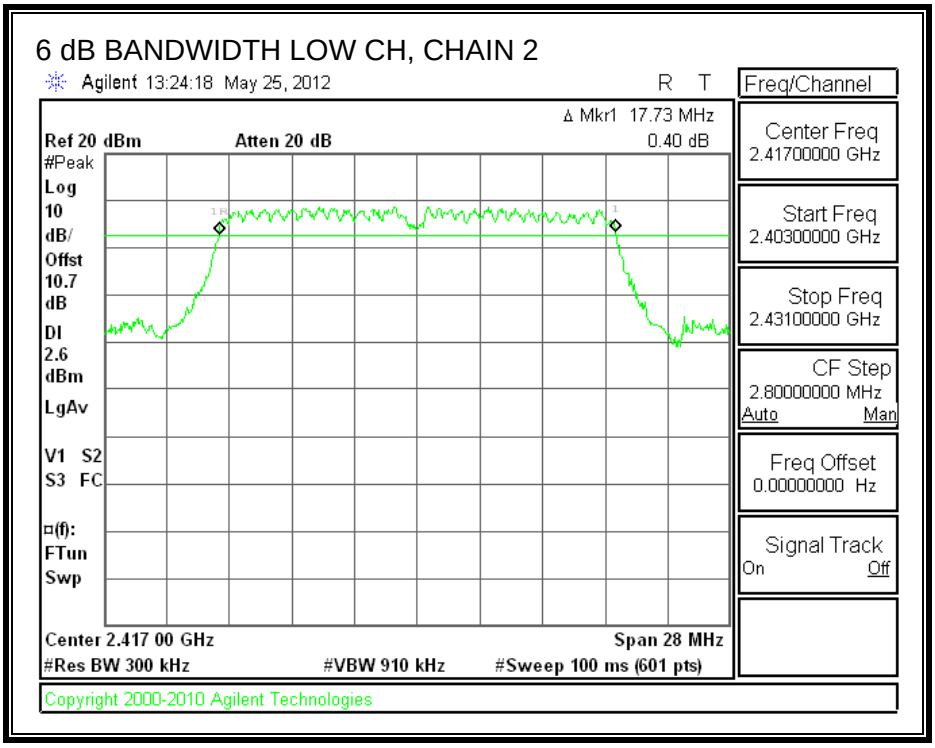




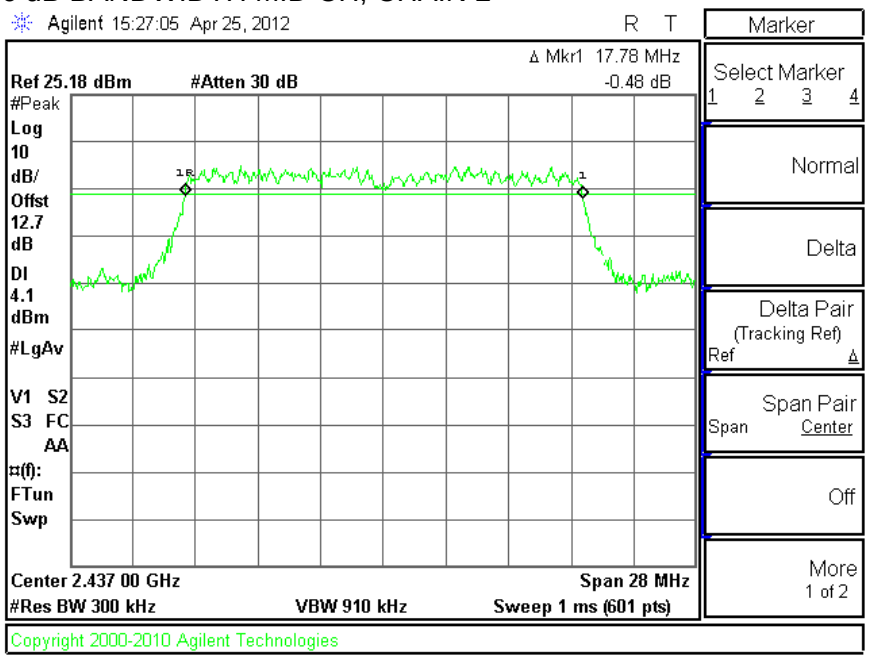


6 dB BANDWIDTH, CHAIN 2

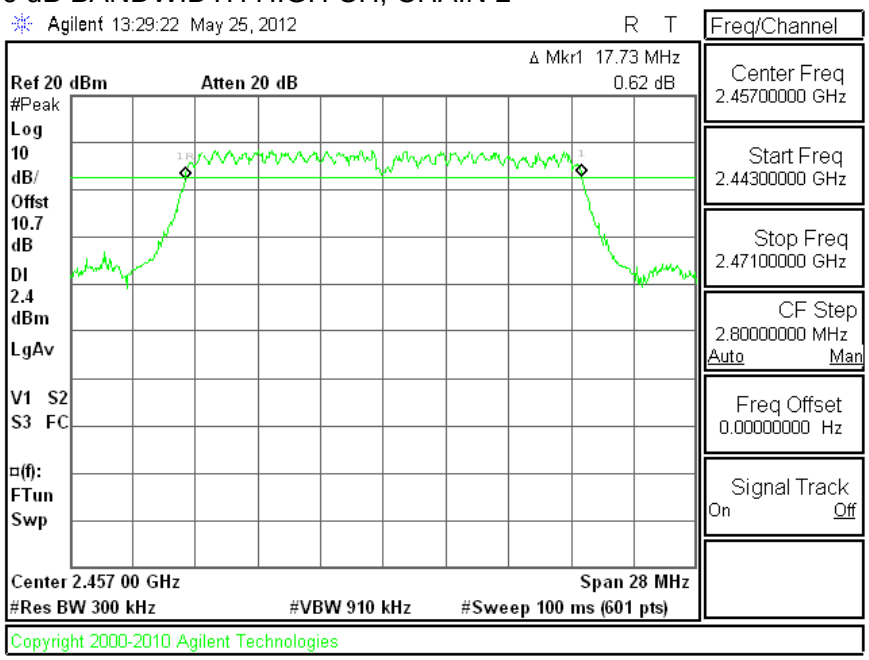


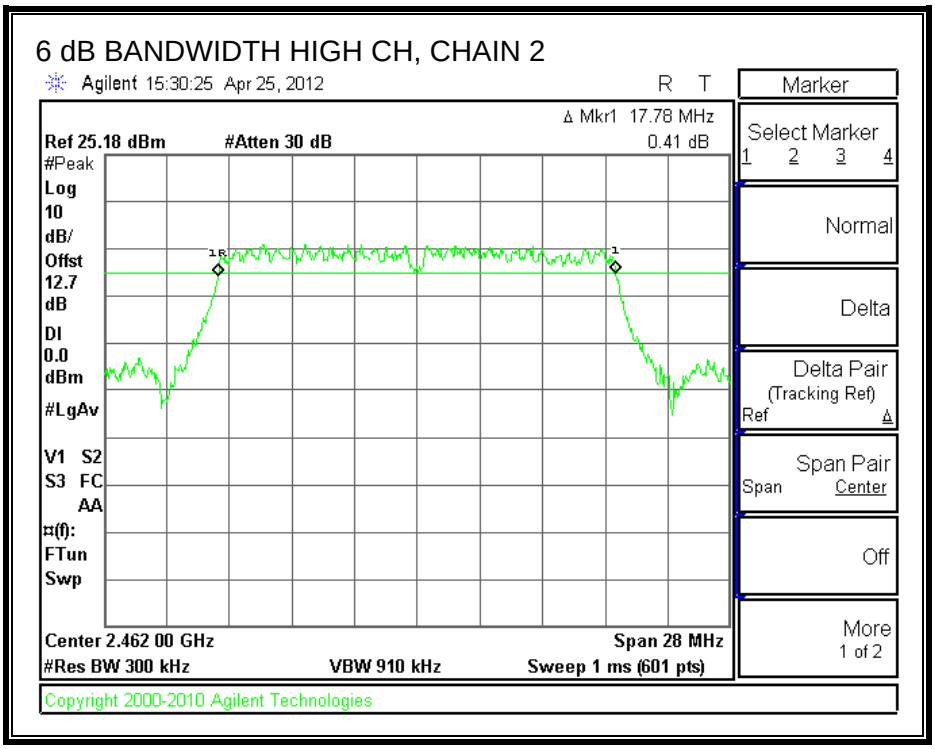


6 dB BANDWIDTH MID CH, CHAIN 2

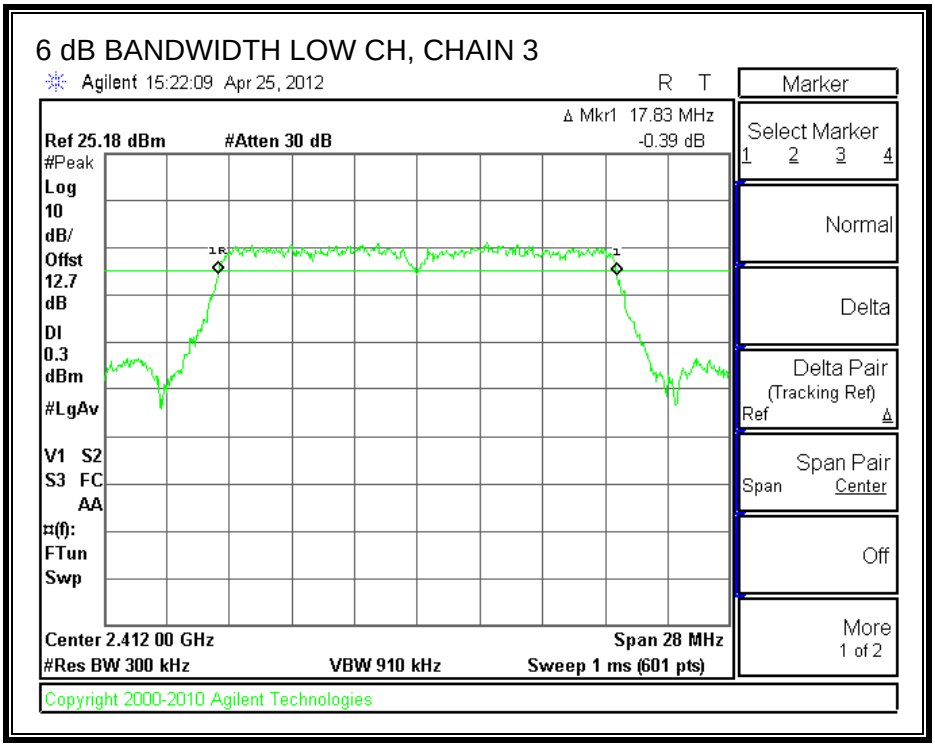


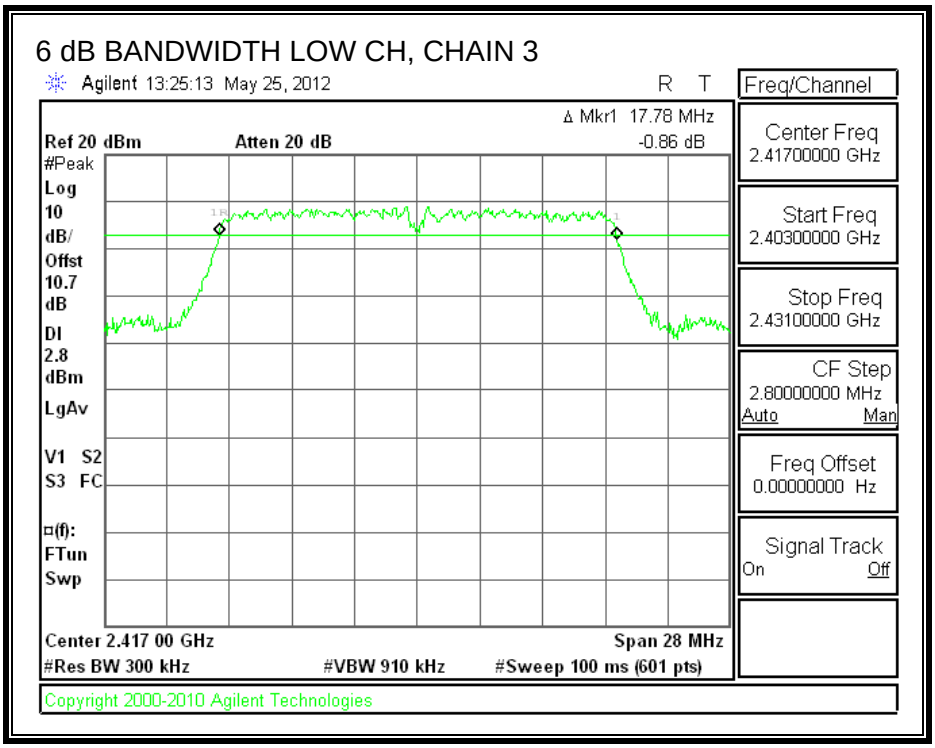
6 dB BANDWIDTH HIGH CH, CHAIN 2



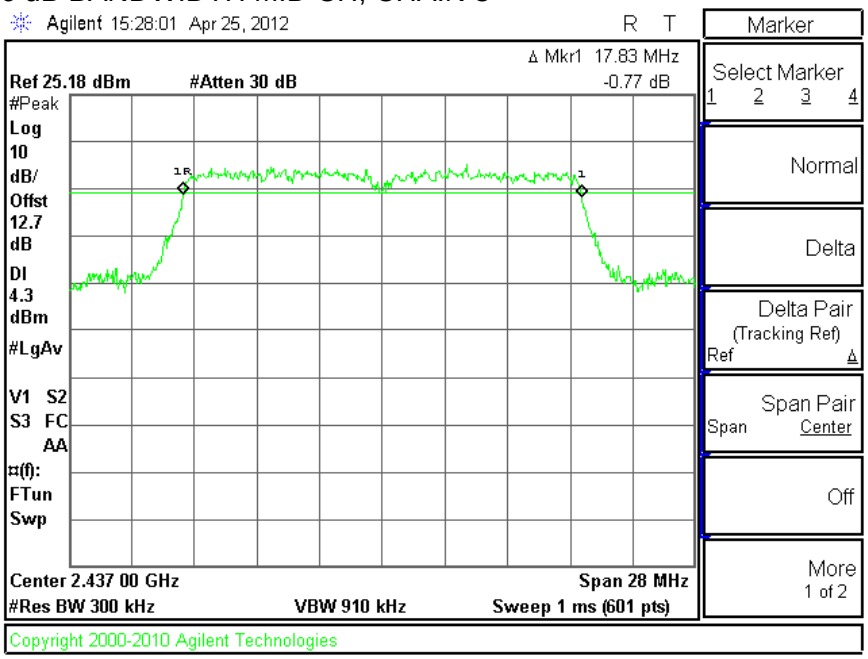


6 dB BANDWIDTH, CHAIN 3

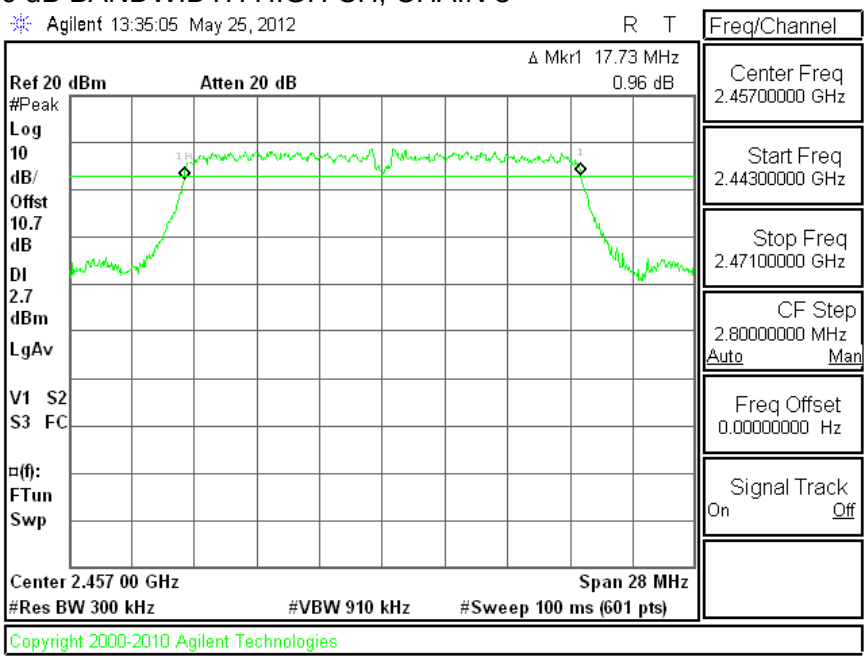


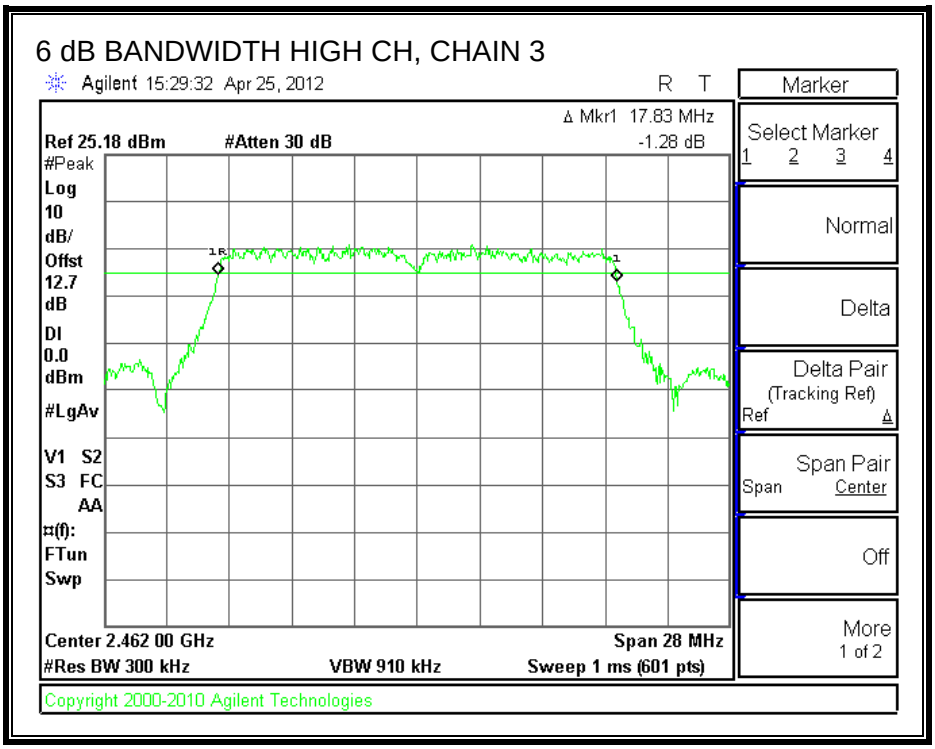


6 dB BANDWIDTH MID CH, CHAIN 3



6 dB BANDWIDTH HIGH CH, CHAIN 3





7.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

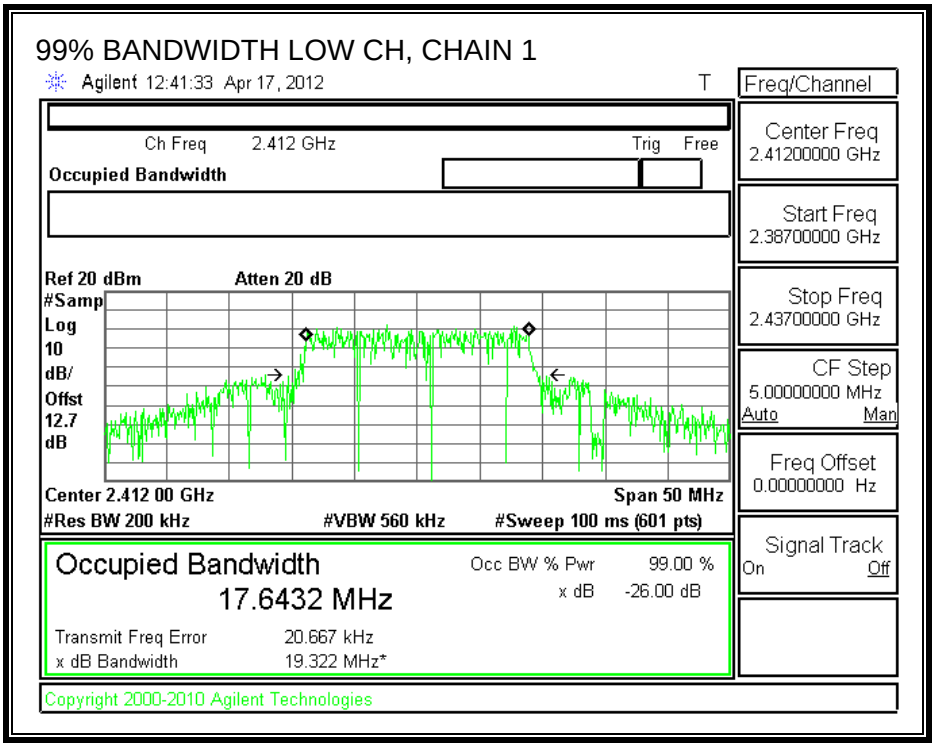
TEST PROCEDURE

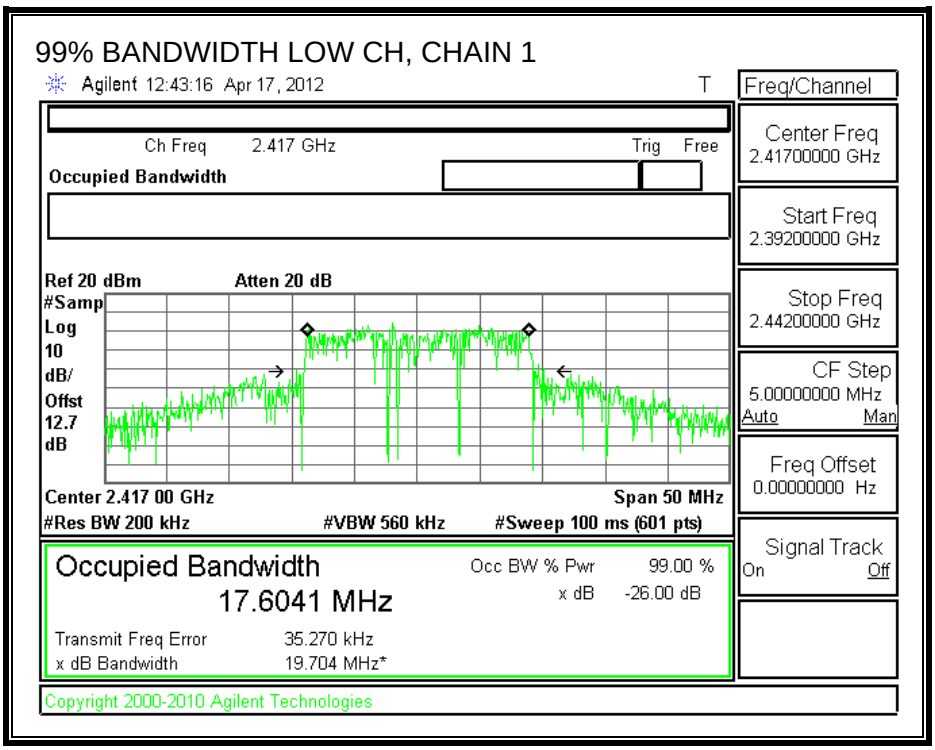
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

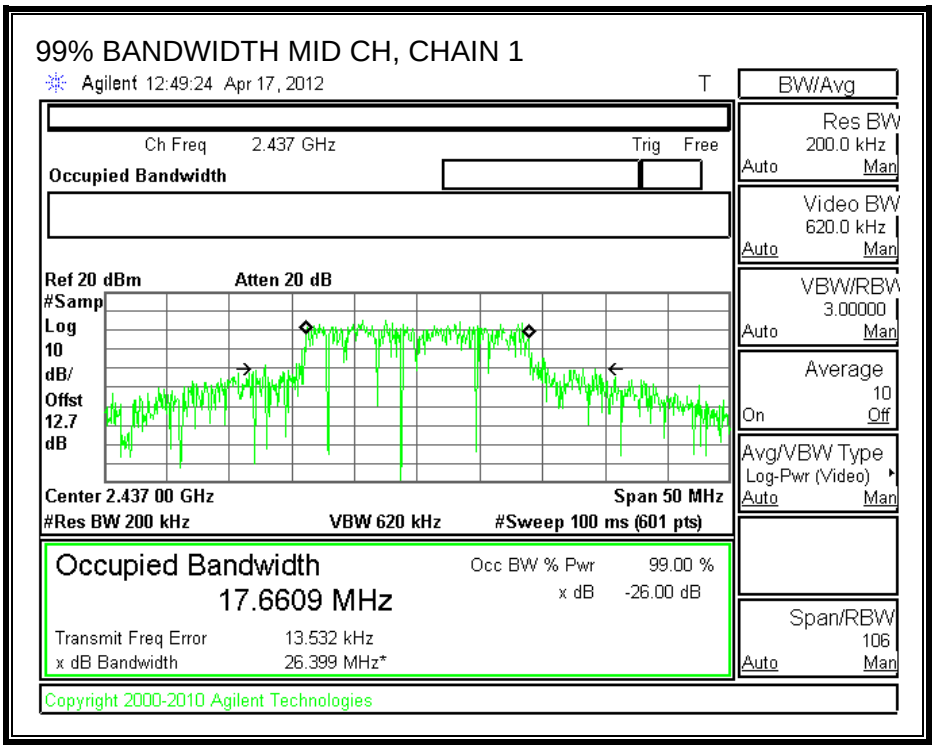
RESULTS

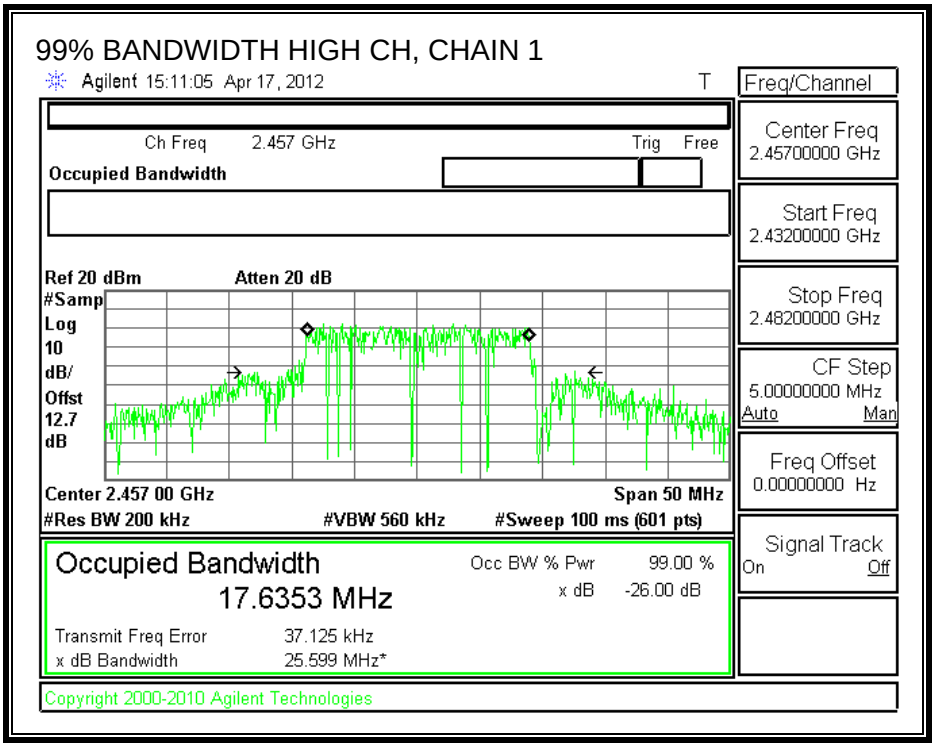
Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	2412	17.6432	17.606	17.5773
Low	2417	17.6041	17.7121	17.6579
Middle	2437	17.6609	17.7047	17.7168
High	2457	17.6353	17.6108	17.8782
High	2462	17.6091	17.6997	17.5800

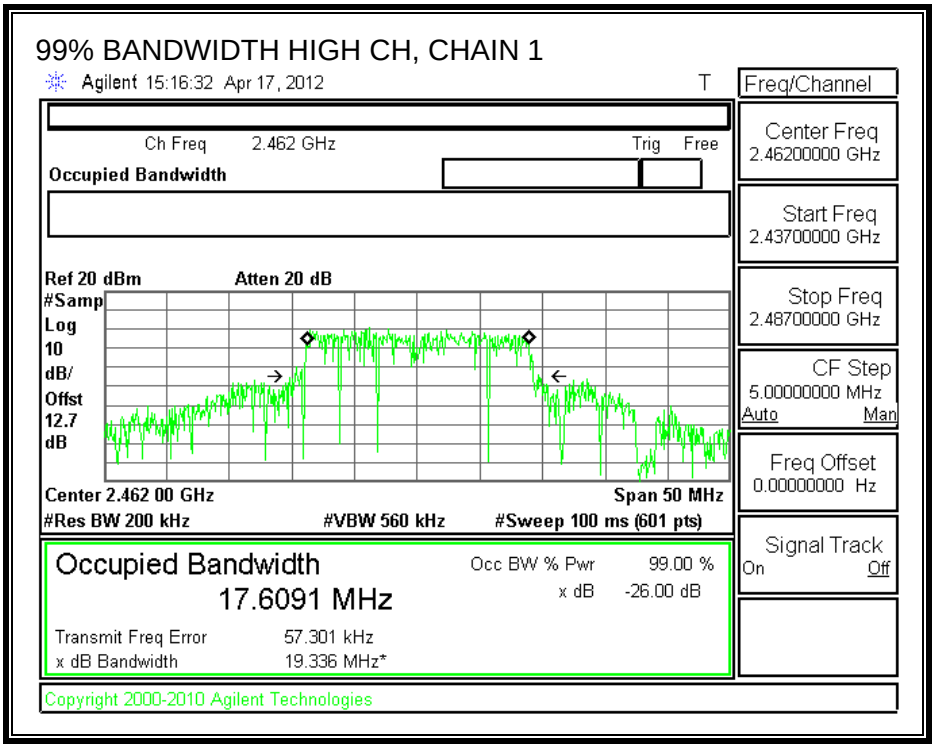
99% BANDWIDTH, CHAIN 1



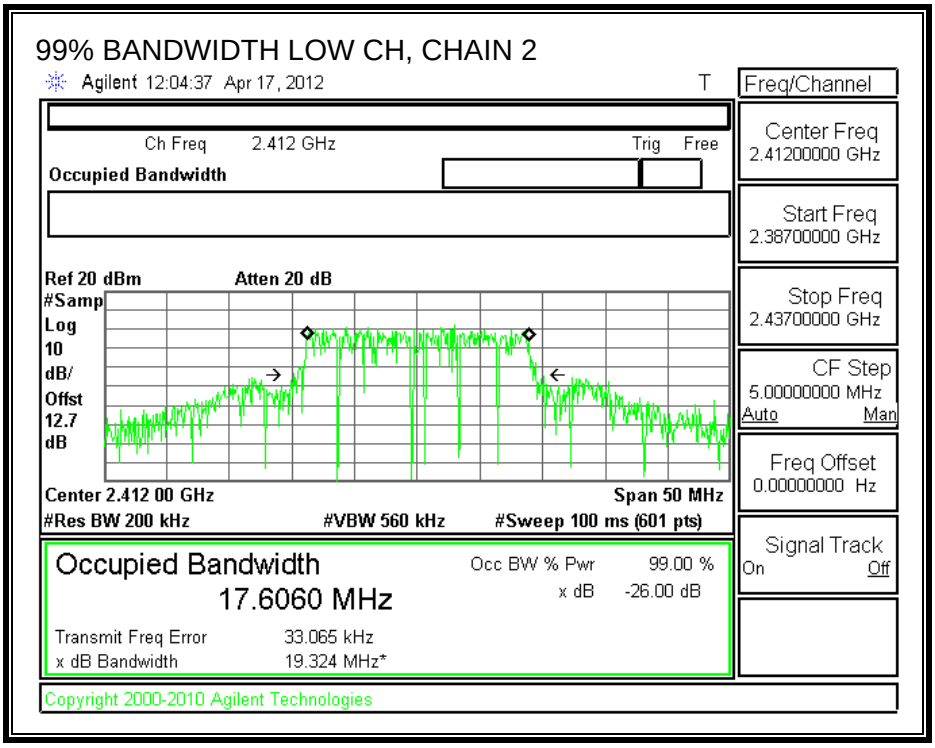


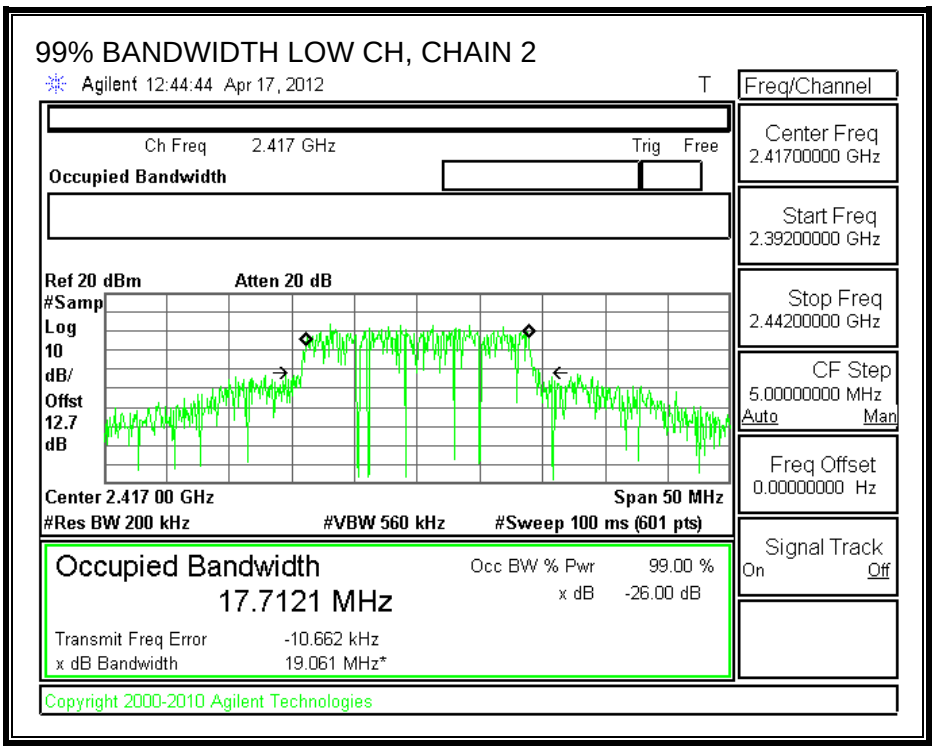


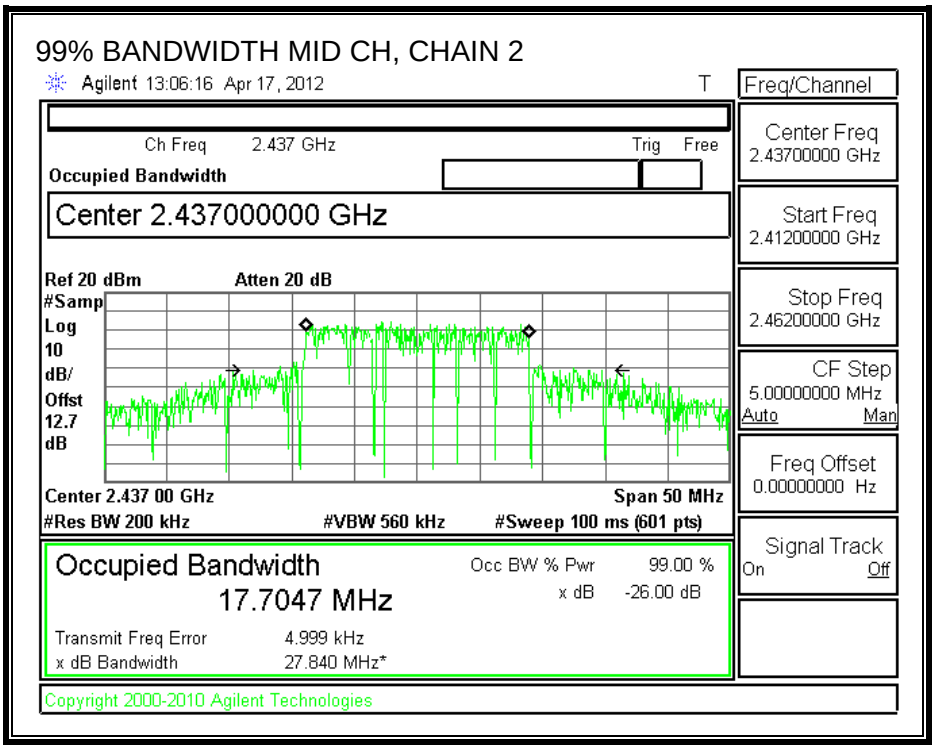


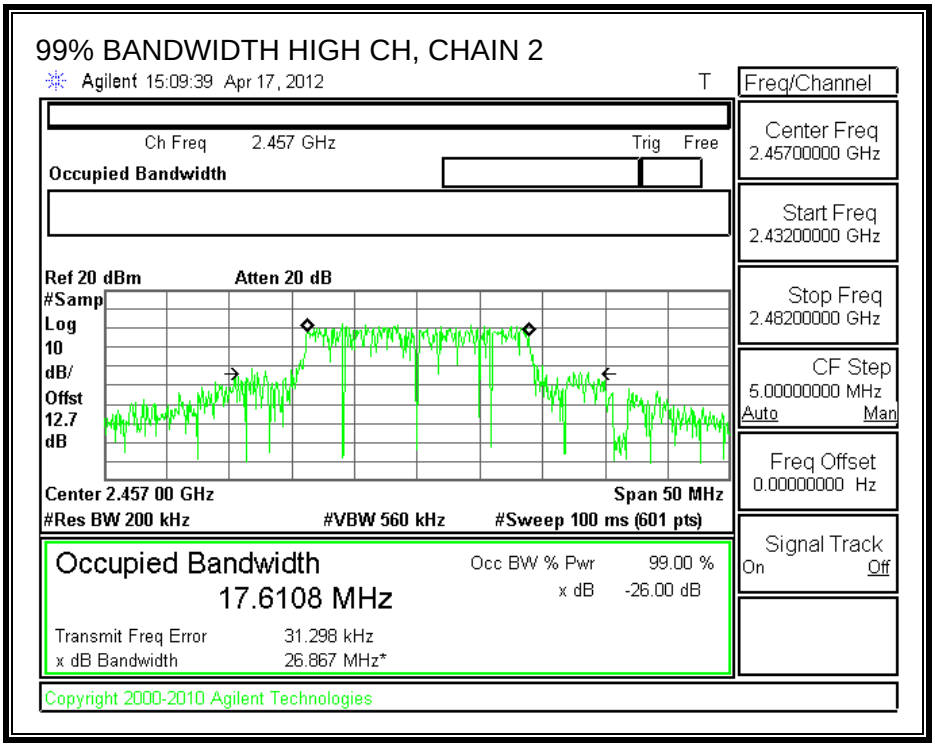


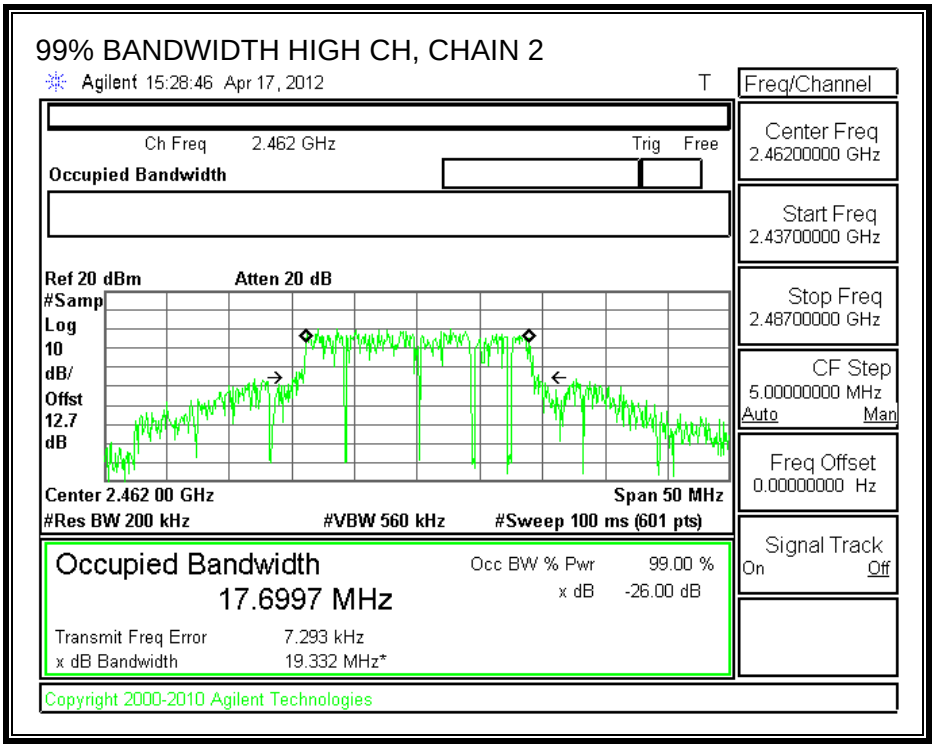
99% BANDWIDTH, CHAIN 2



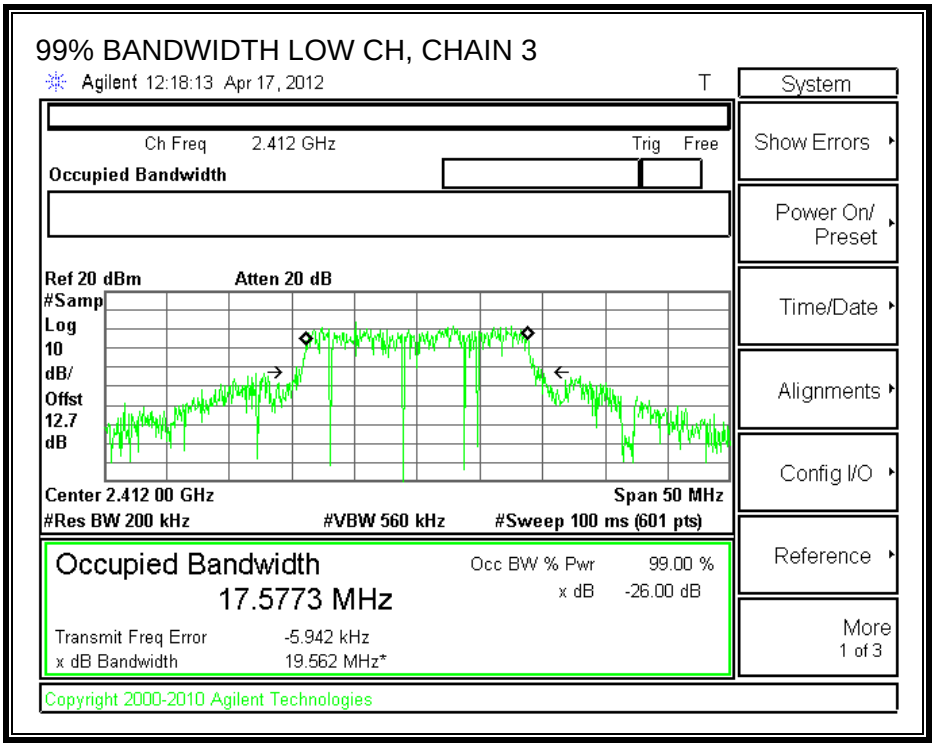


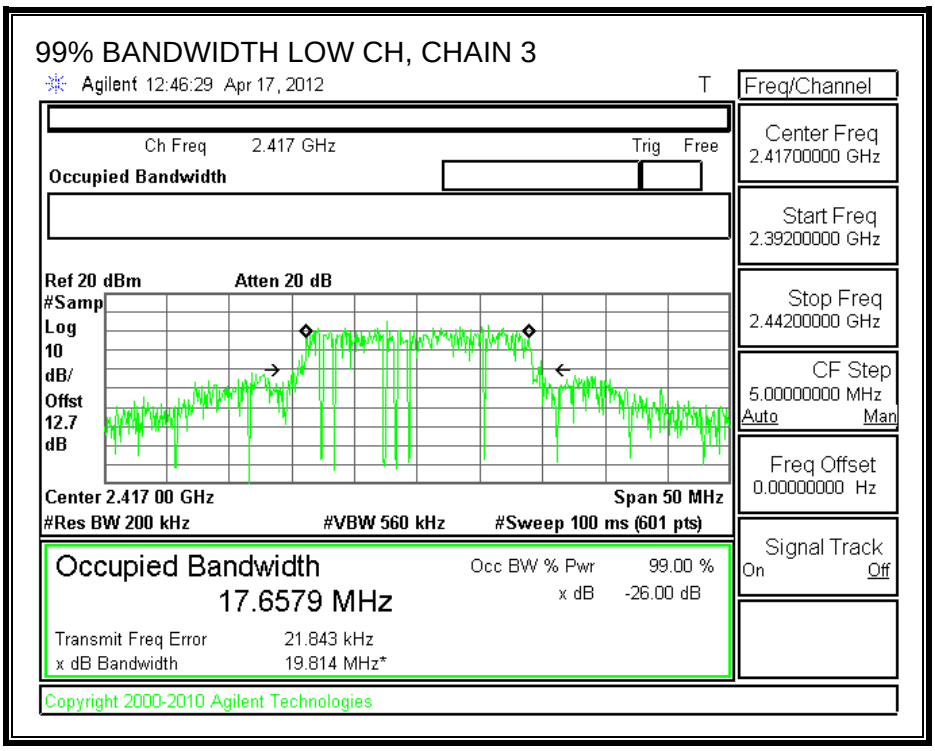


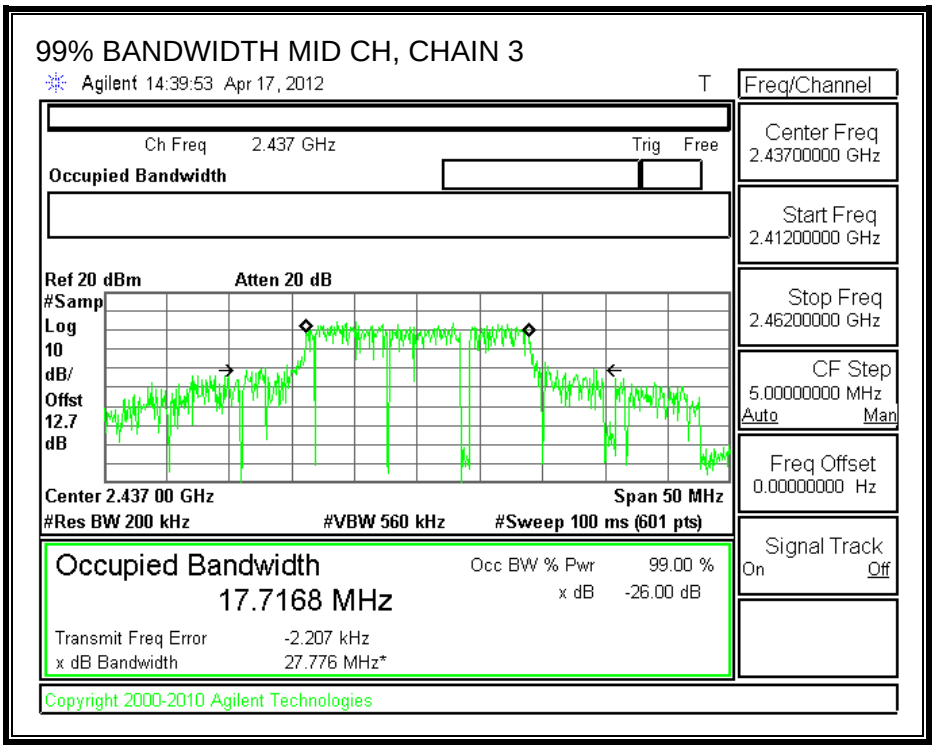


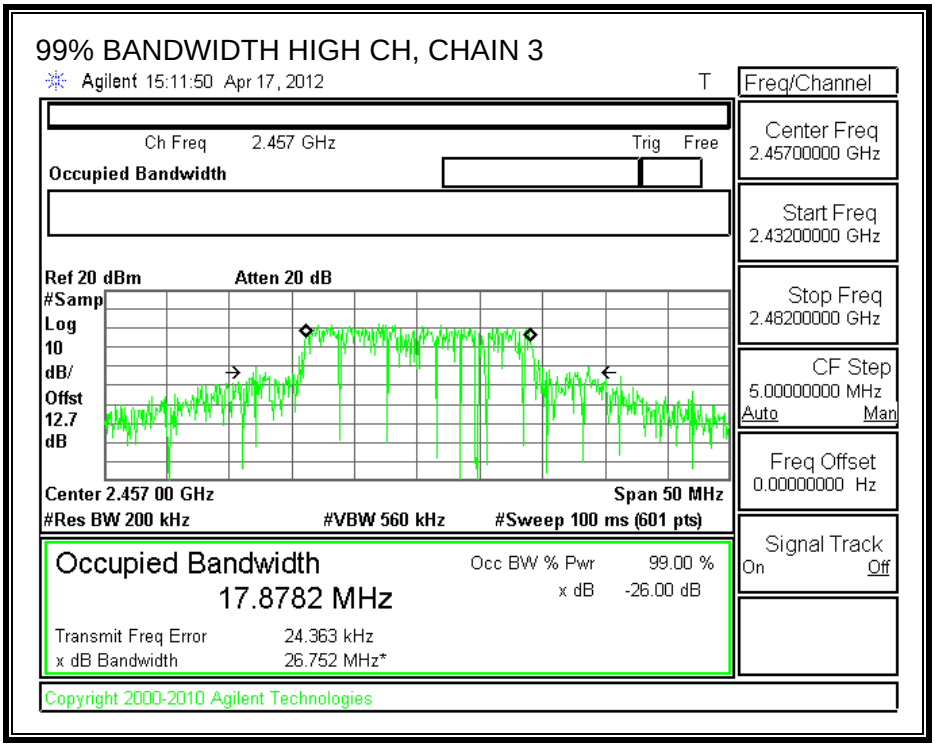


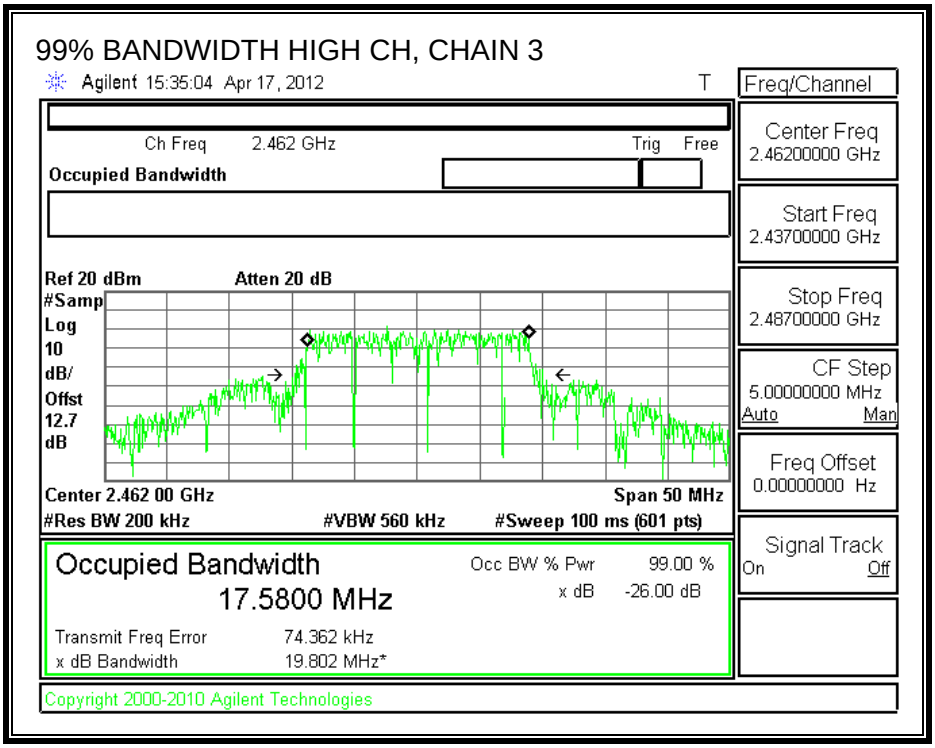
99% BANDWIDTH, CHAIN 3











7.3.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Chain 3 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
4.32	4.77	3.72	9.05

The maximum effective legacy gain is 9.05 dBi for other than fixed, point-to-point operations, therefore the limit is 26.95 dBm.

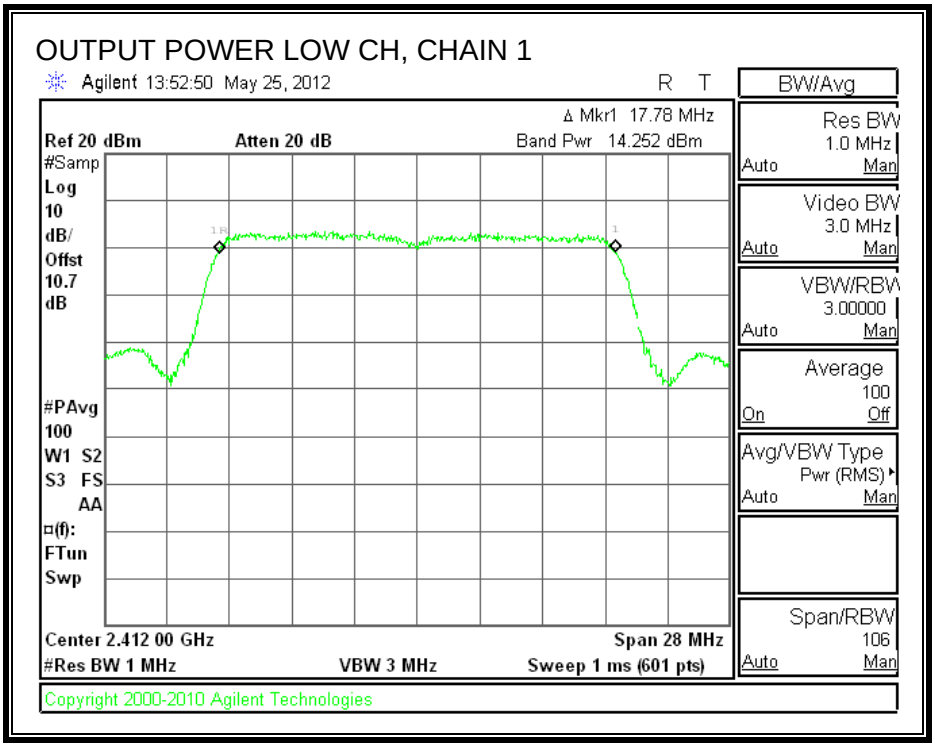
TEST PROCEDURE

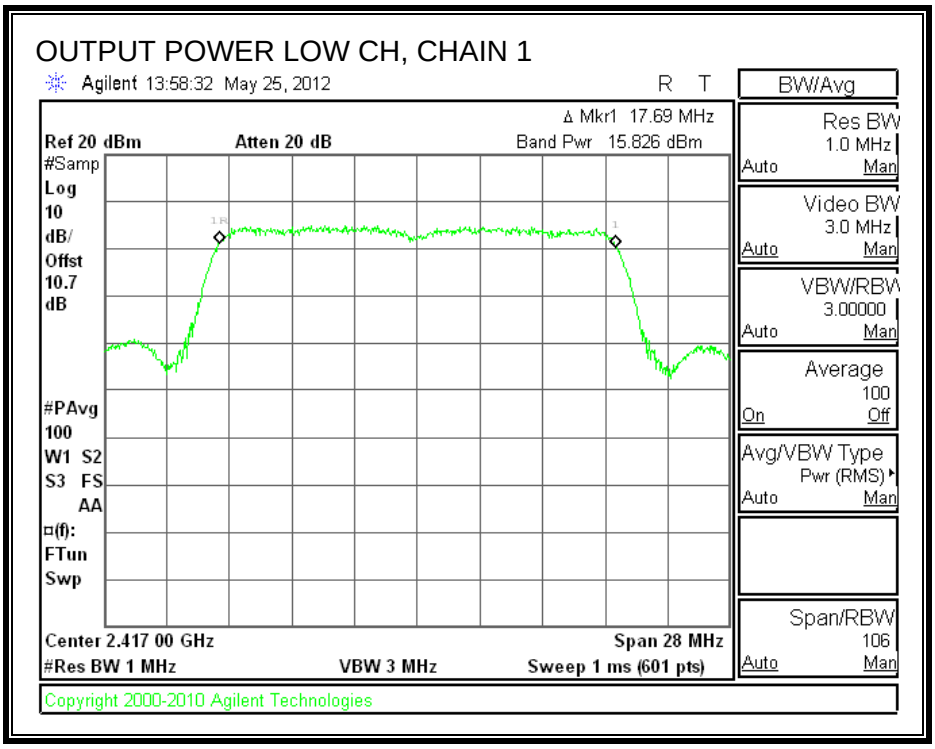
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

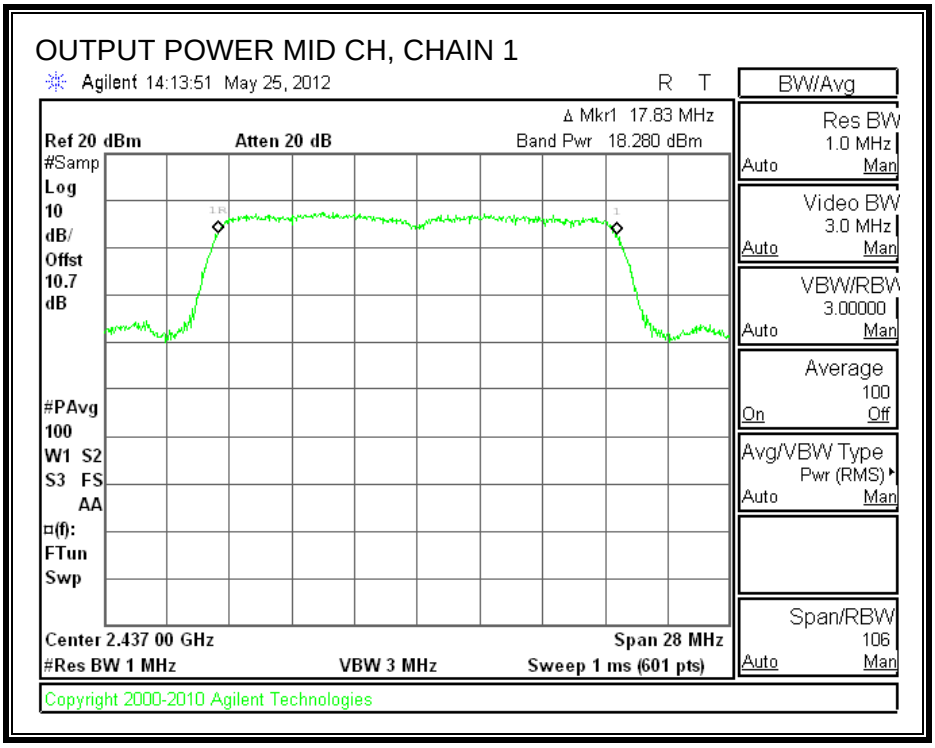
RESULTS

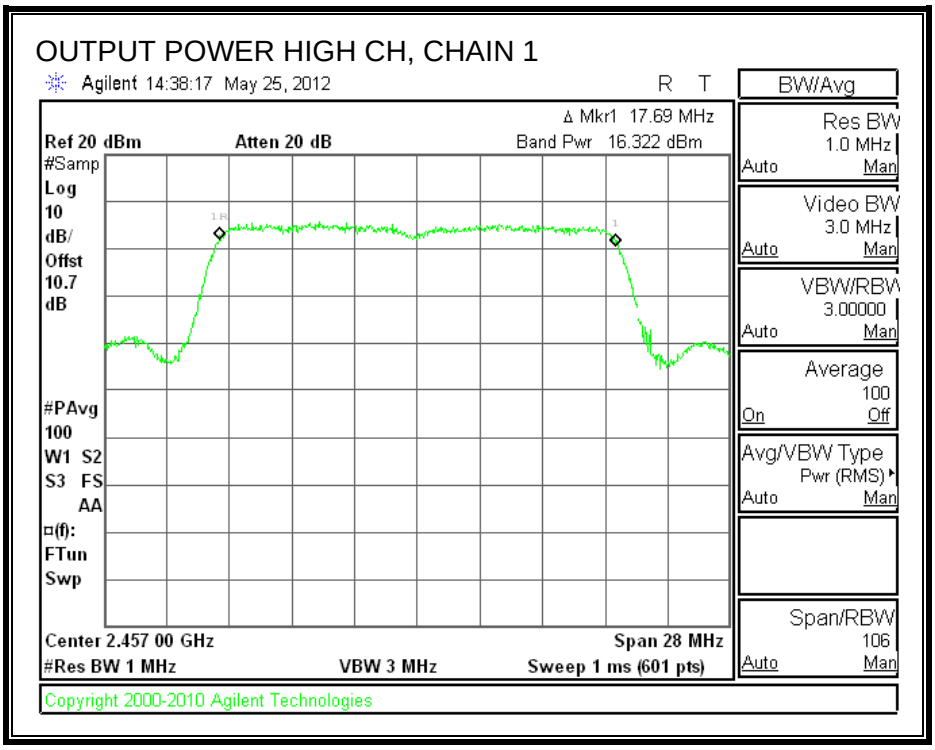
Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Chain 3 PK Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
2412	14.252	13.989	14.231	18.930	26.95	-8.020
2417	15.826	15.670	15.831	20.548	26.95	-6.402
2437	18.280	18.119	18.334	23.017	26.95	-3.933
2457	16.322	16.057	16.273	20.990	26.95	-5.960
2462	14.196	14.150	14.436	19.034	26.95	-7.916

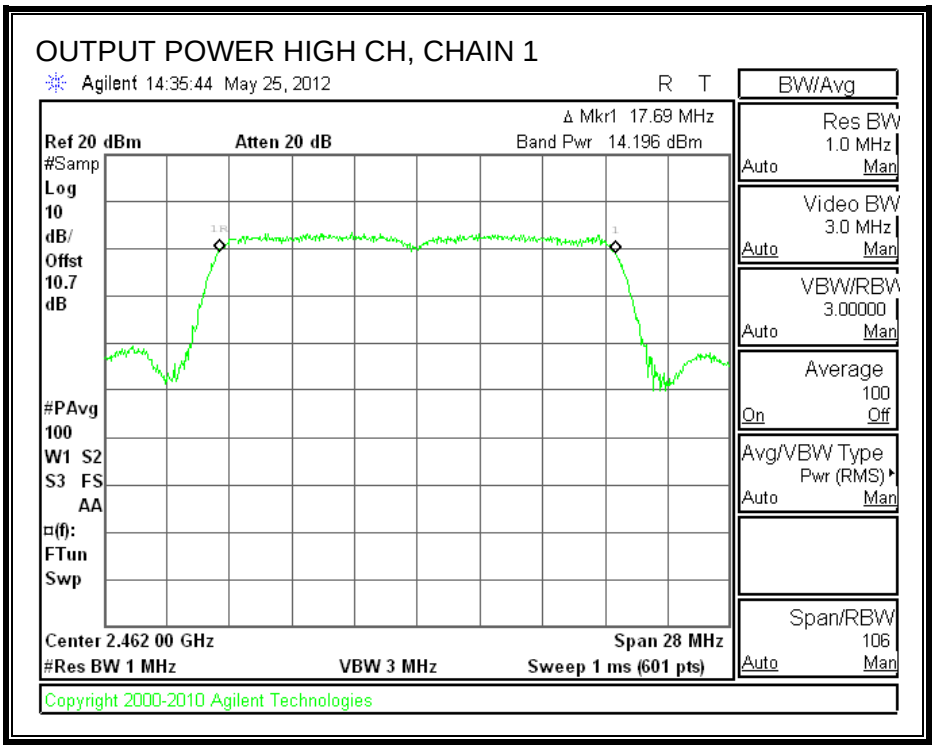
CHAIN 1 OUTPUT POWER



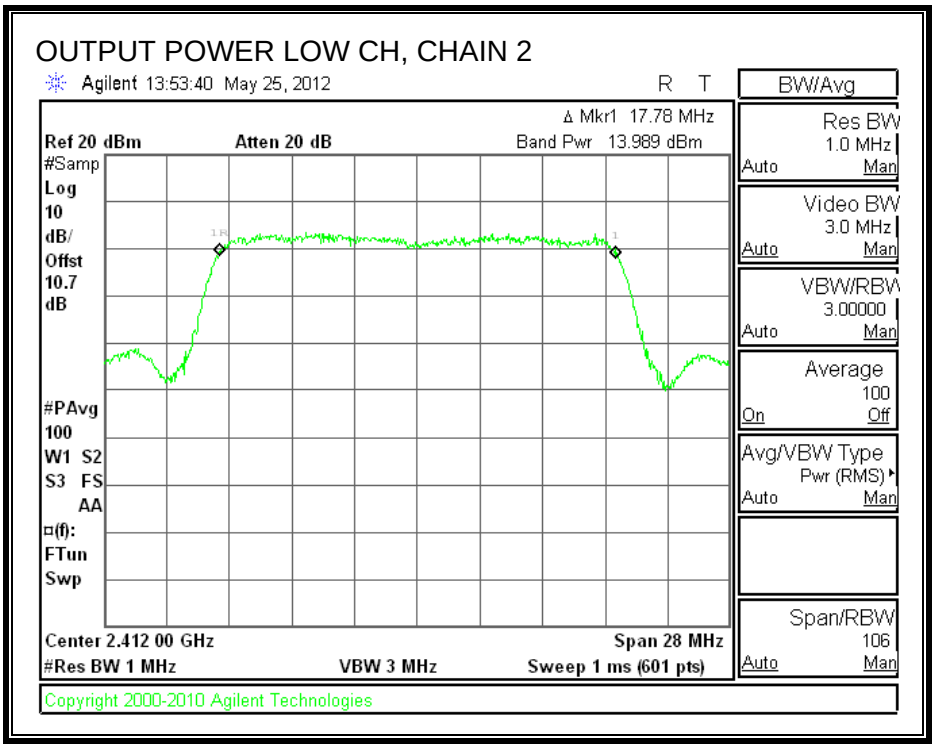


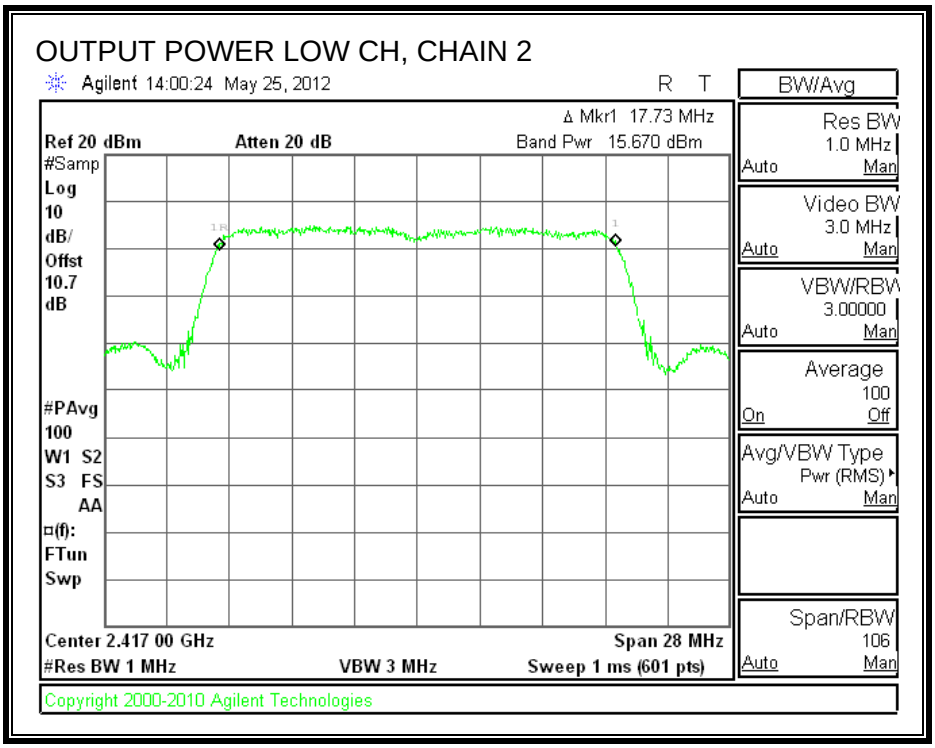


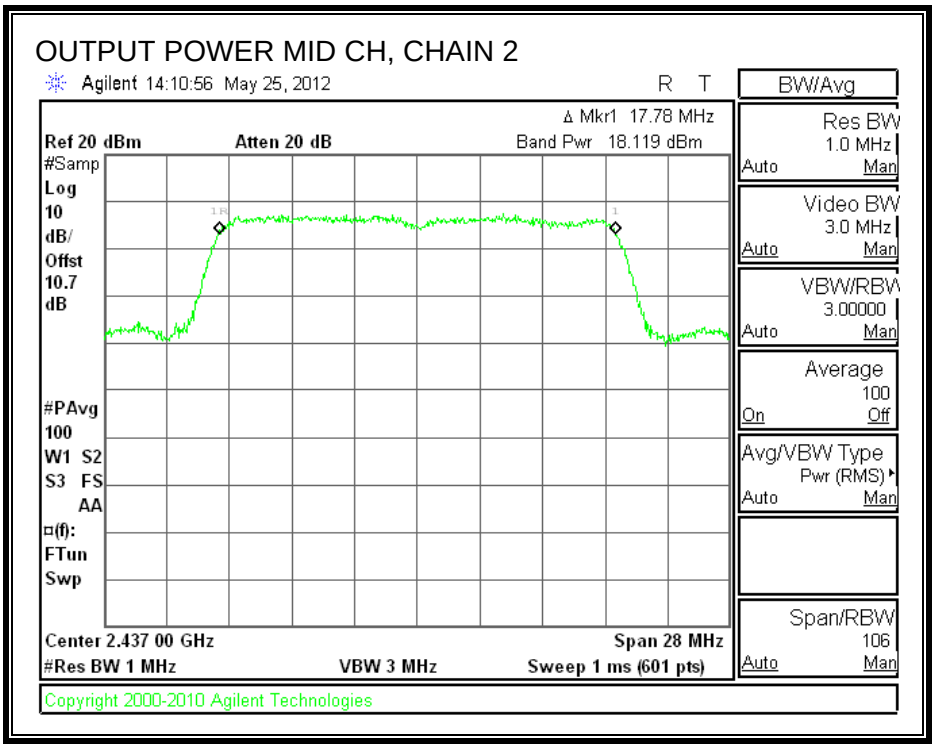


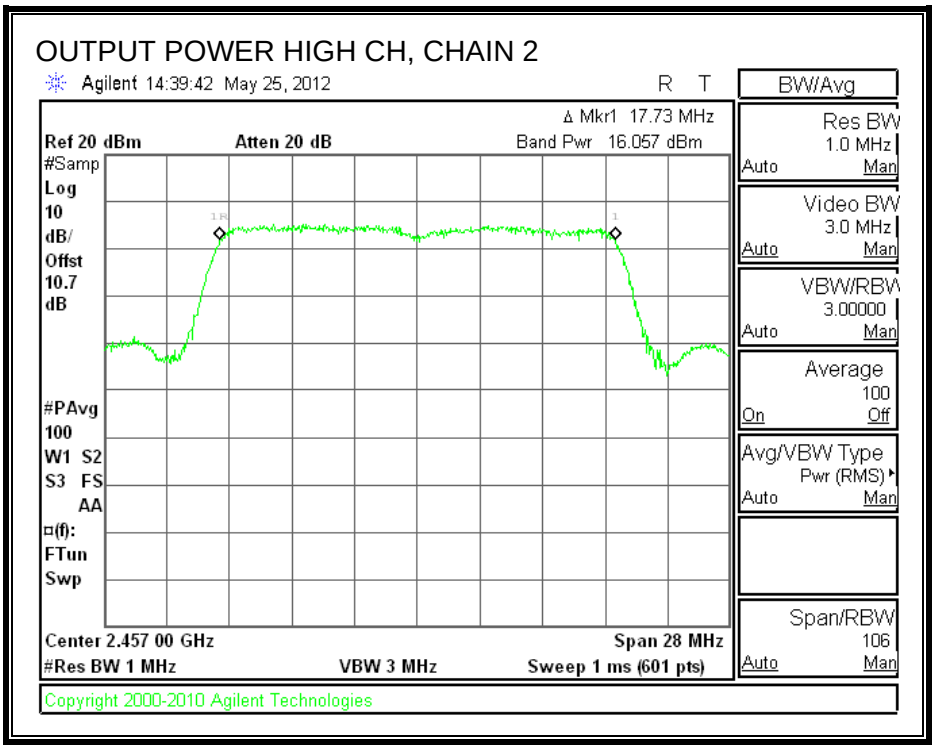


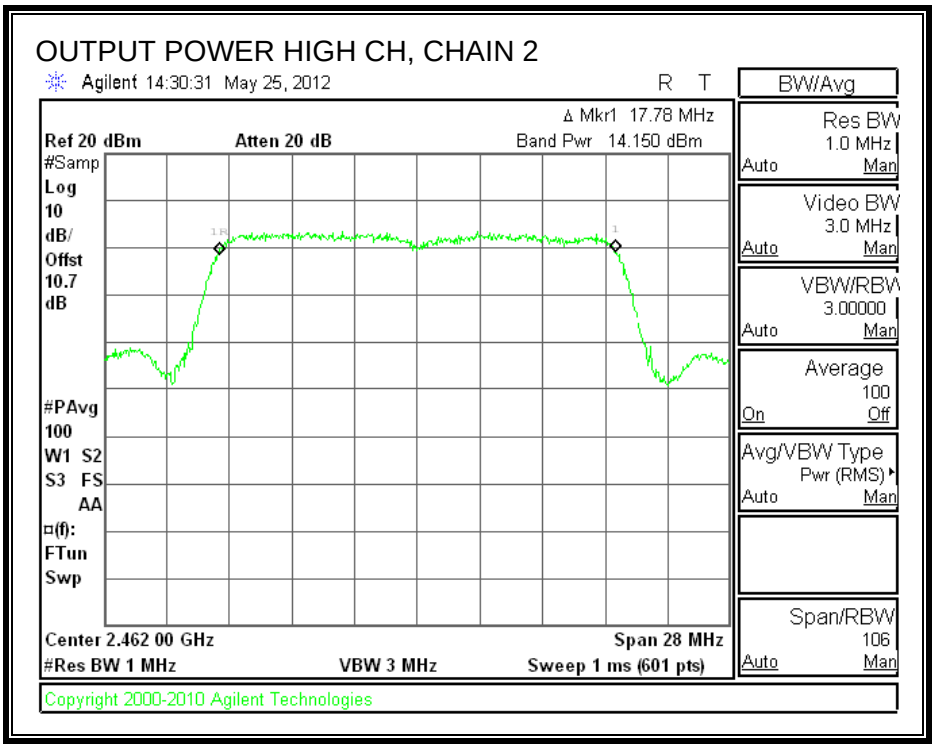
CHAIN 2 OUTPUT POWER



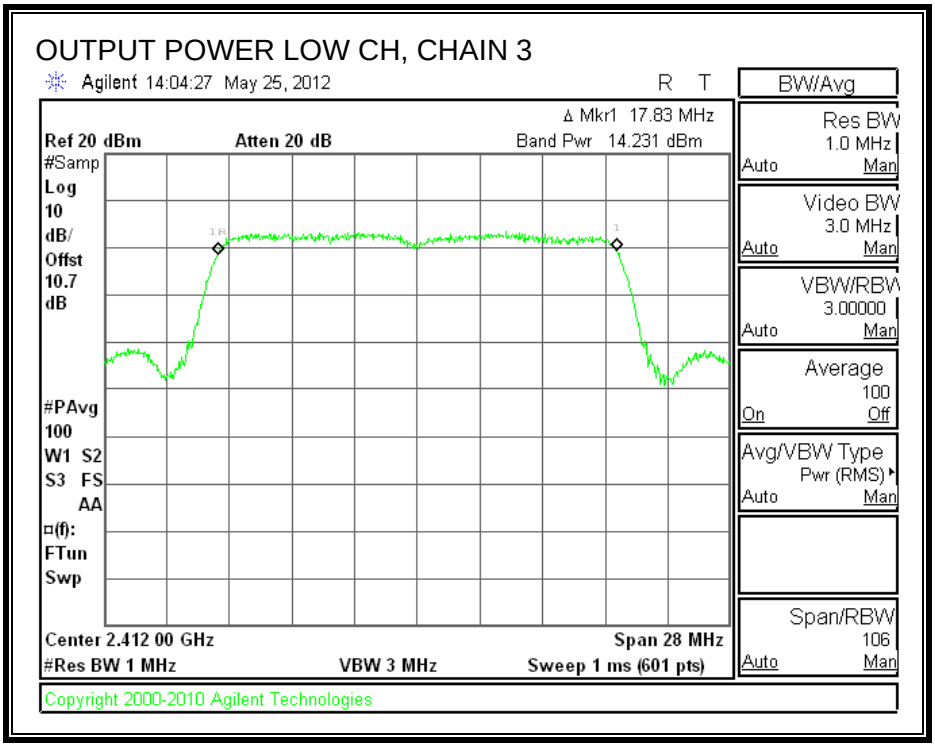


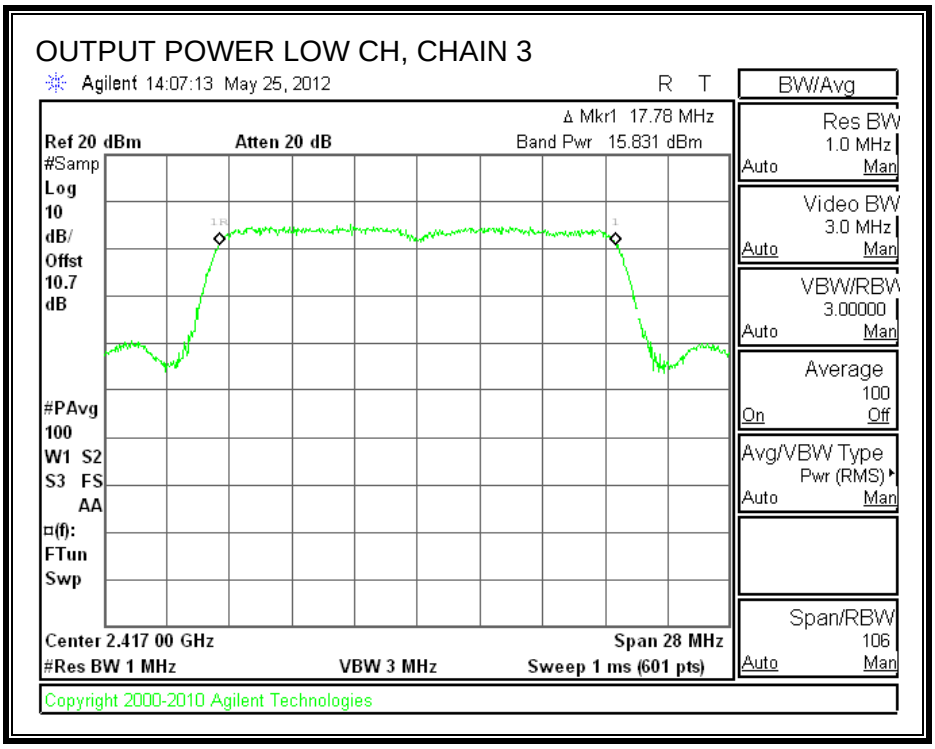


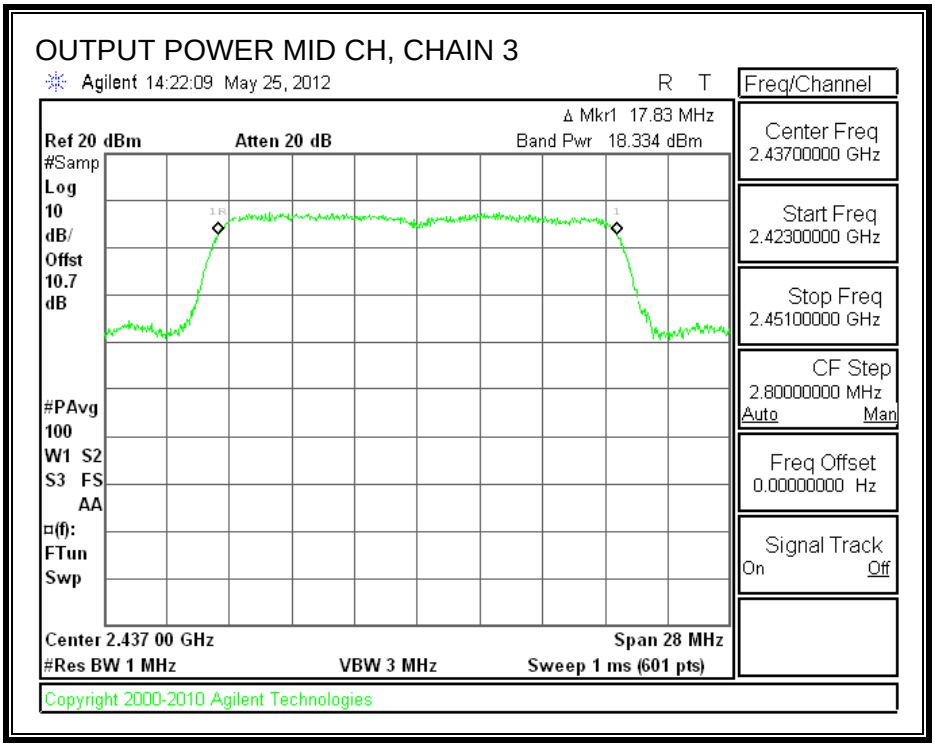


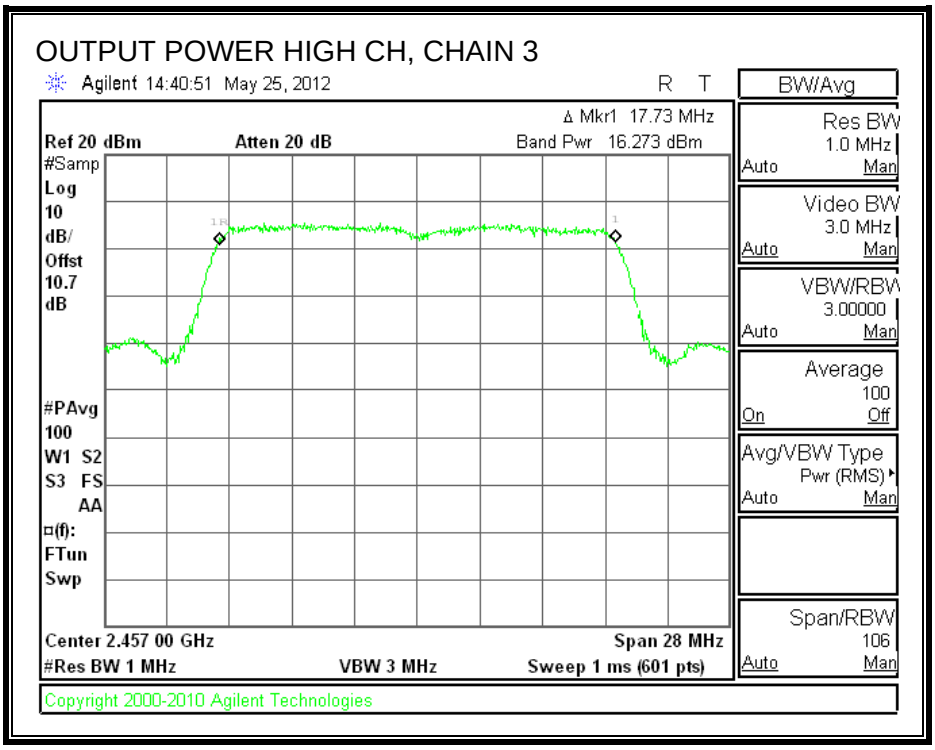


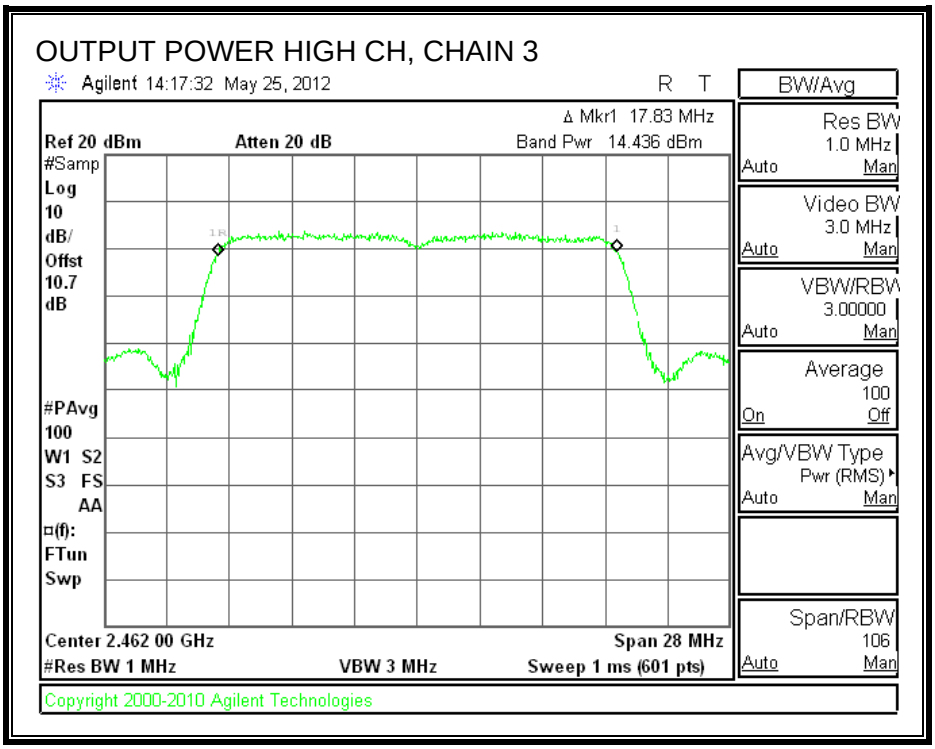
CHAIN 3 OUTPUT POWER











7.3.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

TEST PROCEDURE

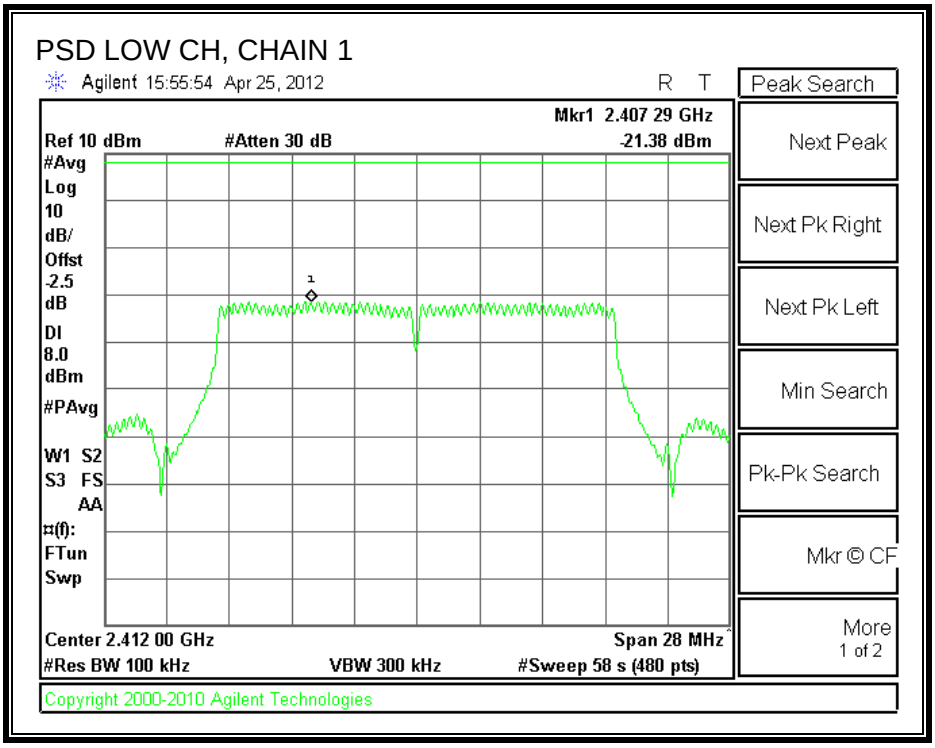
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

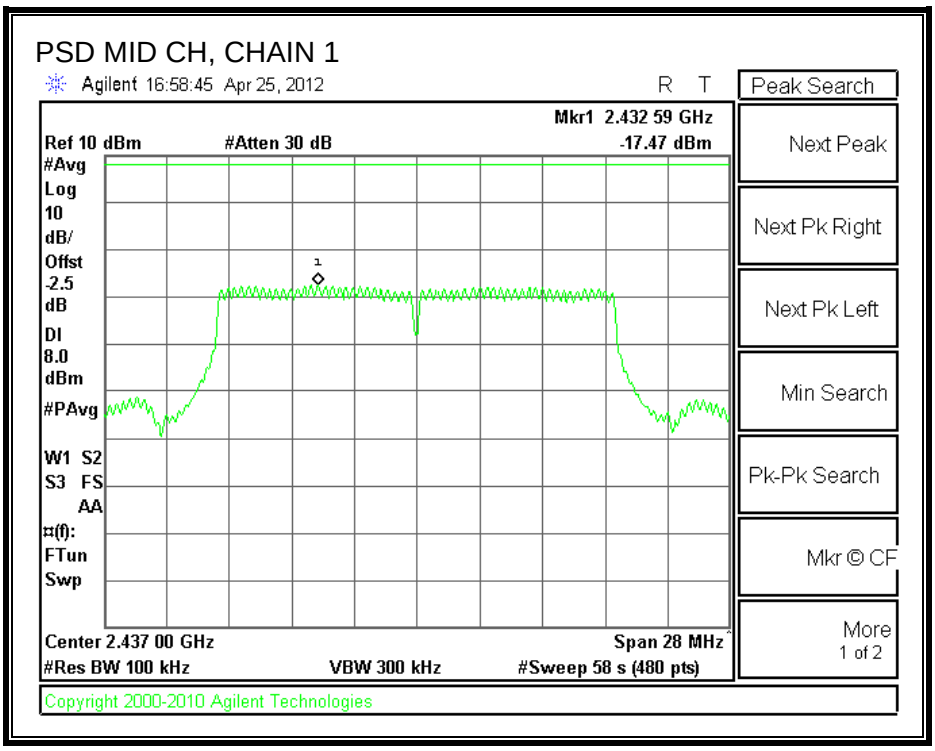
RESULTS

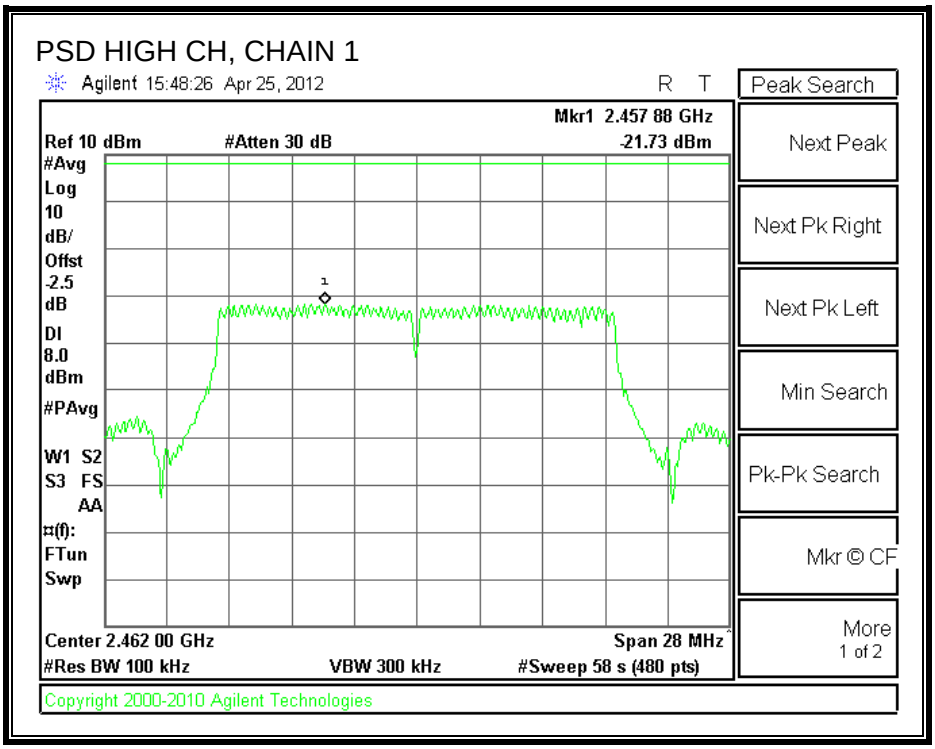
Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Chain 3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-21.38	-21.07	-21.11	-16.41	8	-24.41
Middle	2437	-17.47	-17.63	-17.33	-12.70	8	-20.70
High	2462	-21.73	-21.71	-21.43	-16.85	8	-24.85

Note: The spectrum analyzer offset = attenuator loss + cable loss + 10 log(3/100 kHz) = -2.5 dB

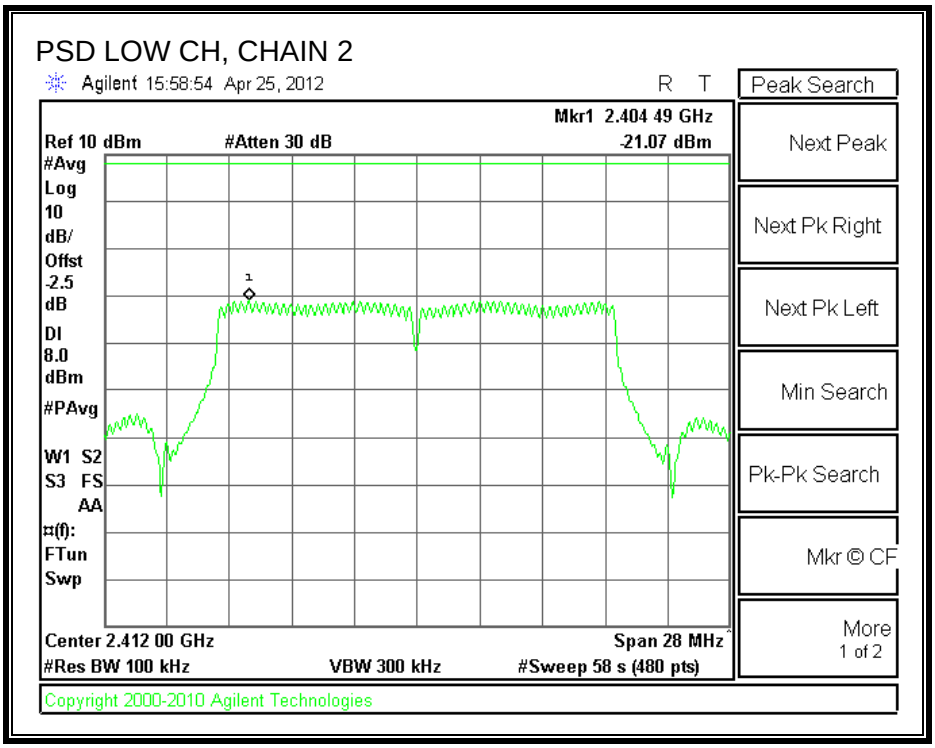
POWER SPECTRAL DENSITY, CHAIN 1

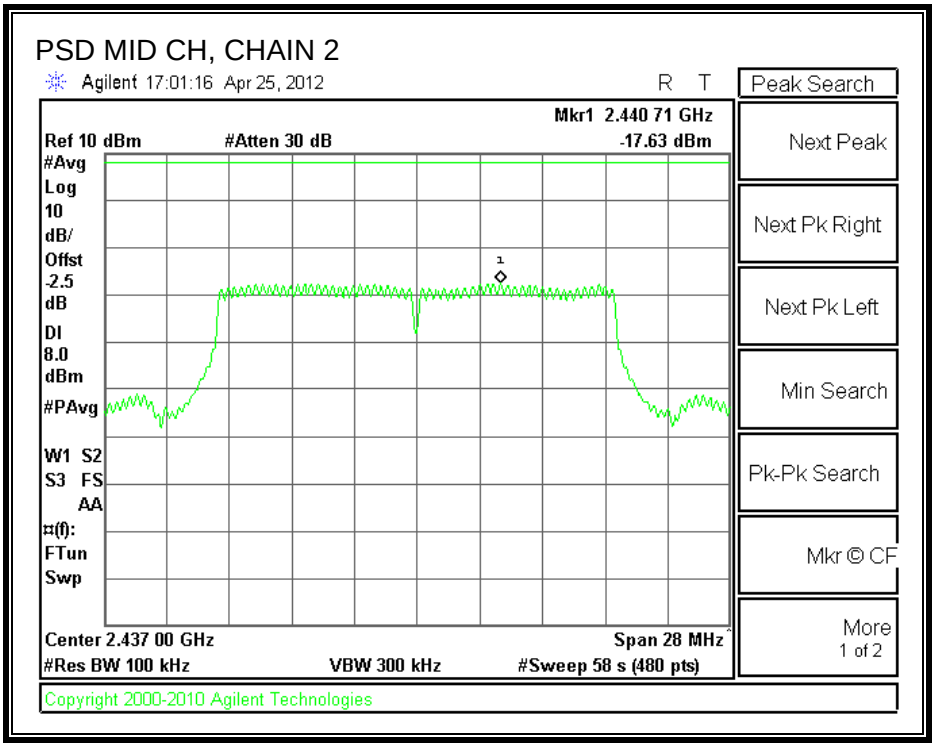


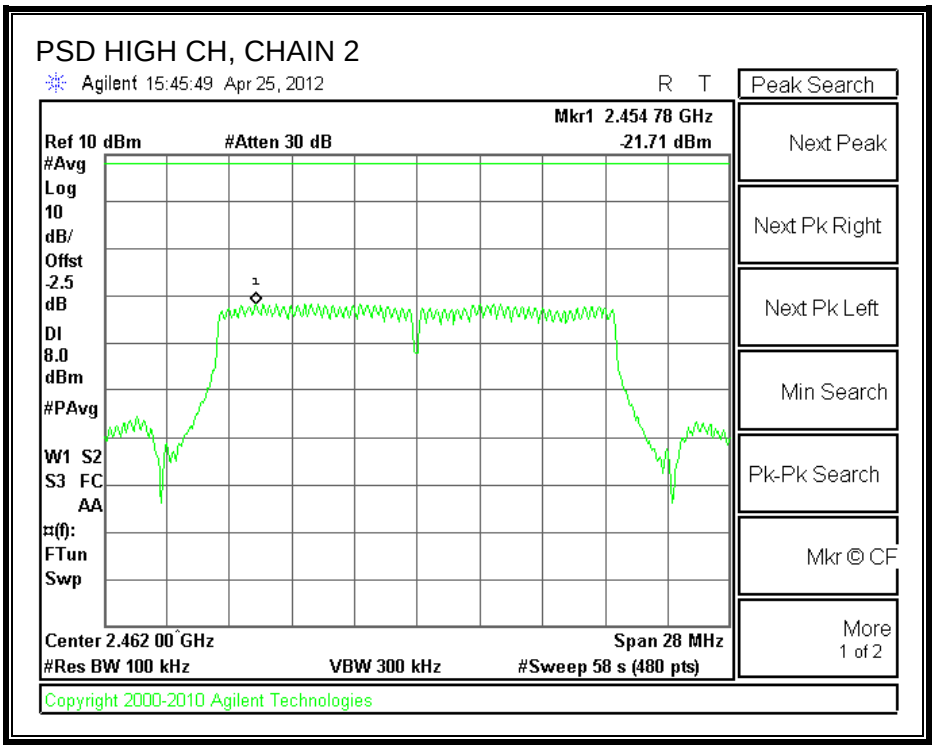




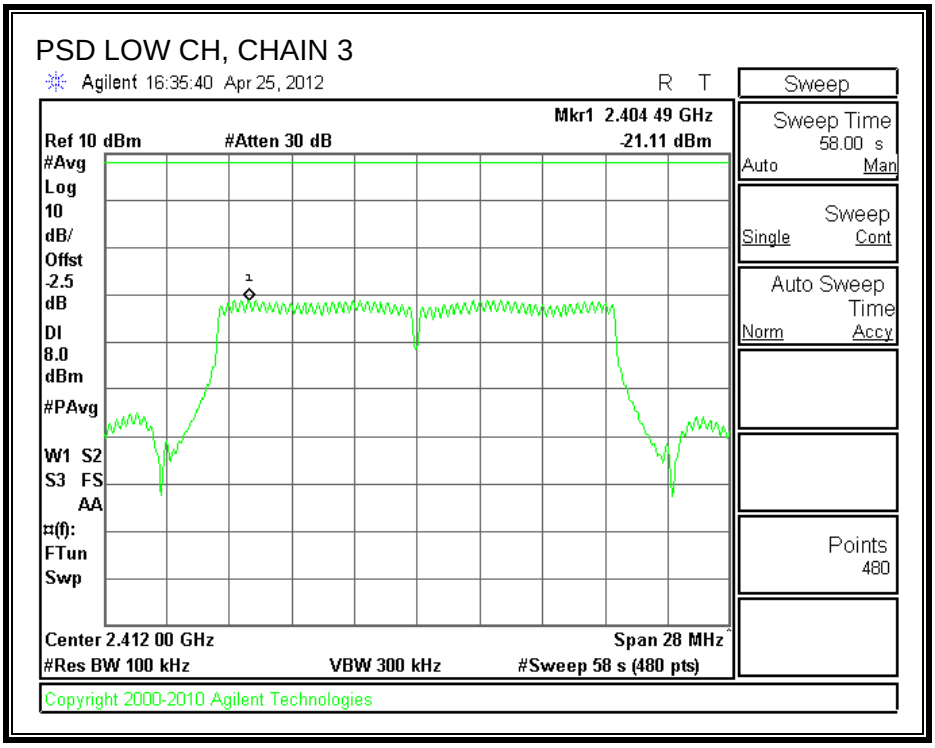
POWER SPECTRAL DENSITY, CHAIN 2

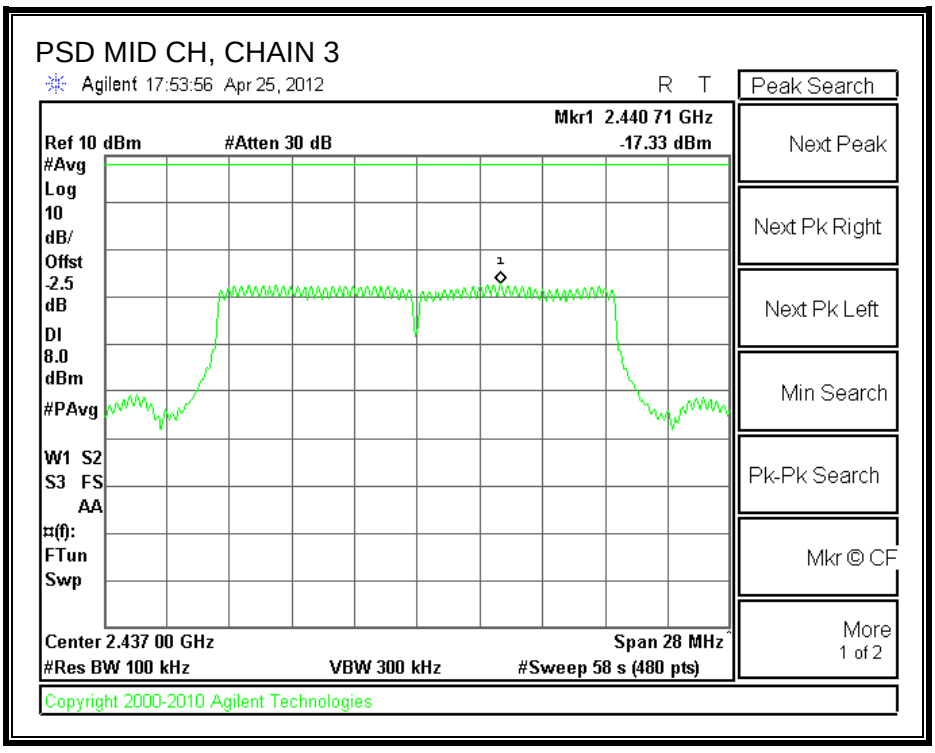


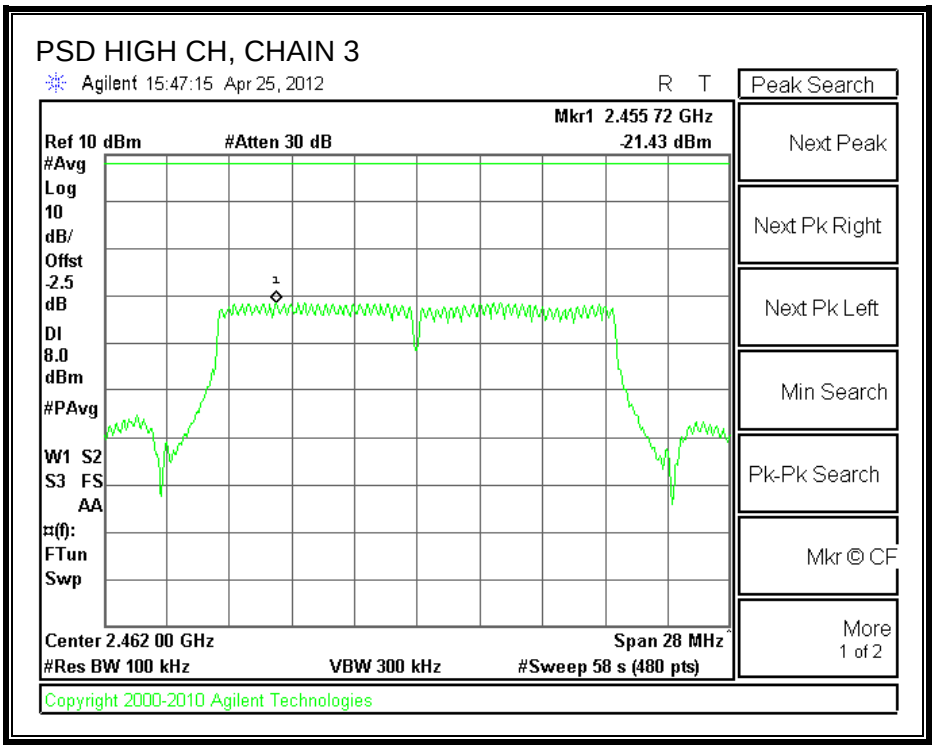




POWER SPECTRAL DENSITY, CHAIN 3







7.3.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

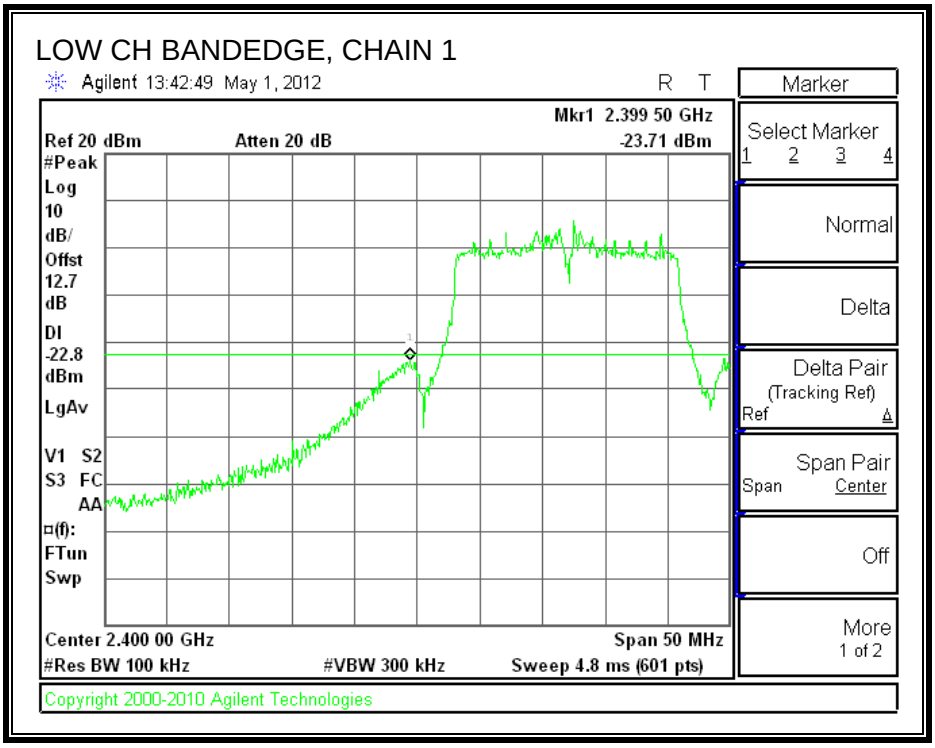
IC RSS-210 A8.5

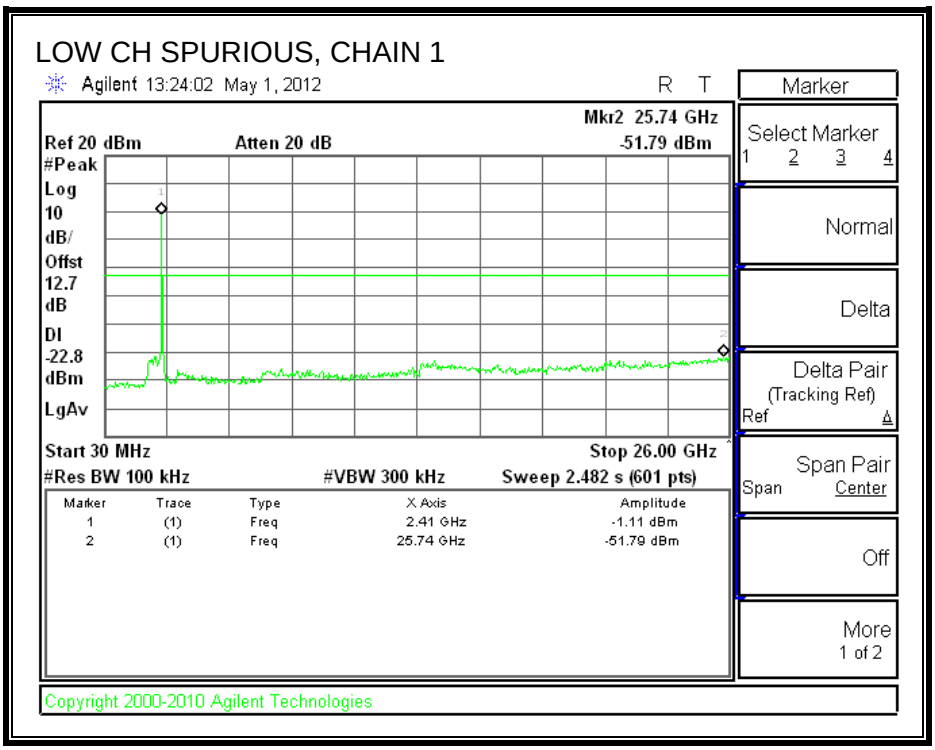
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

TEST PROCEDURE

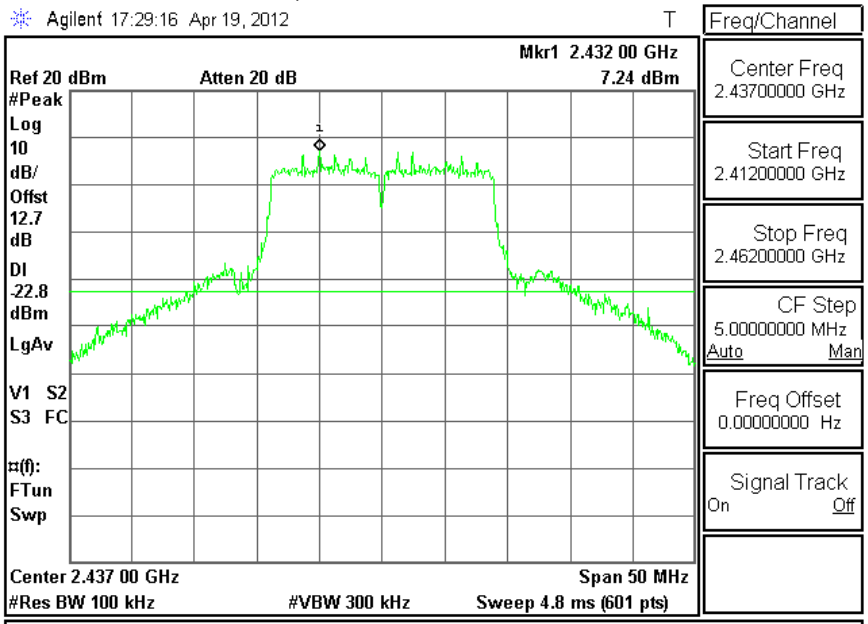
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

CHAIN 1 SPURIOUS EMISSIONS

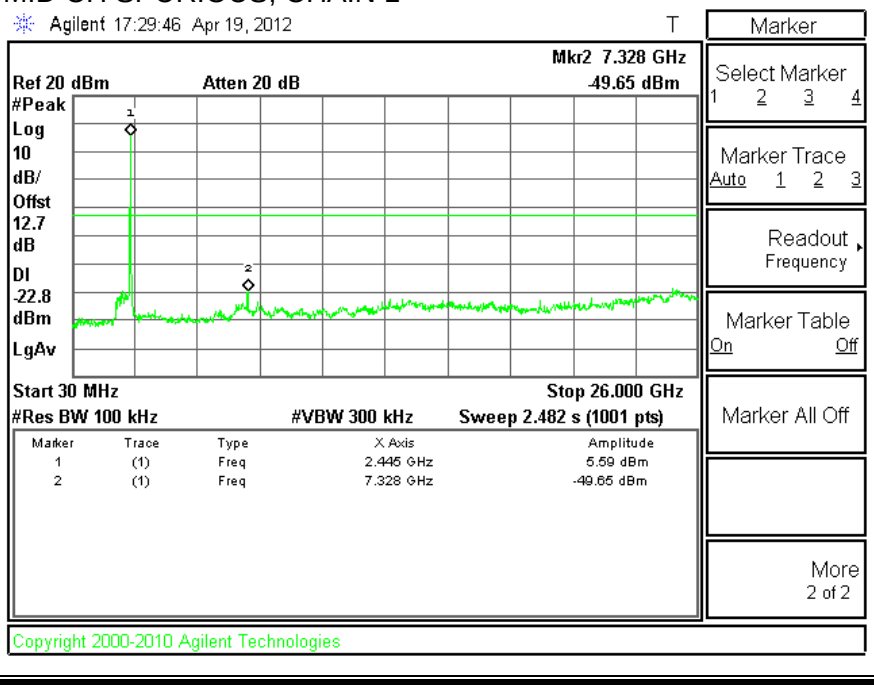




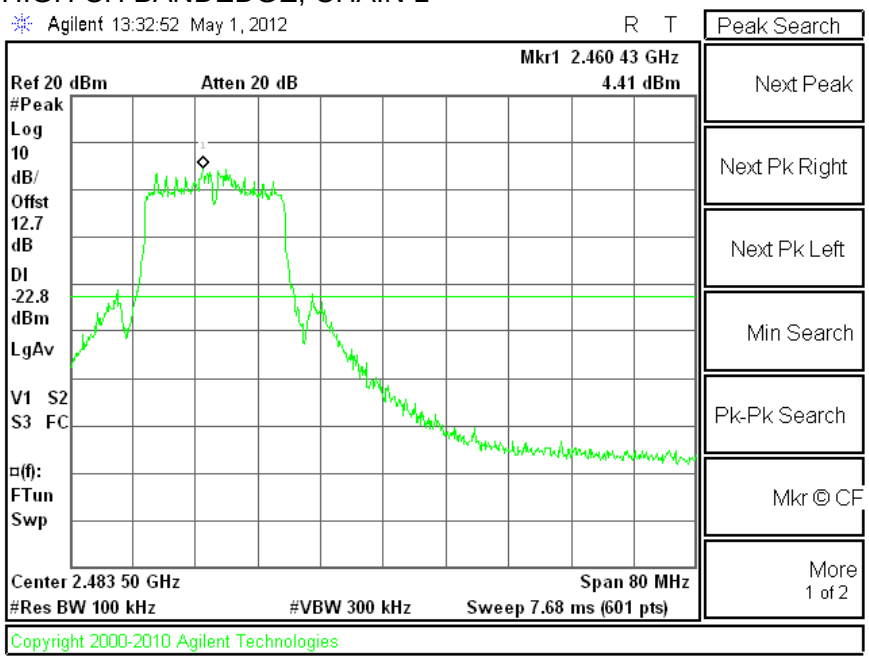
MID CH REFERENCE, CHAIN 1



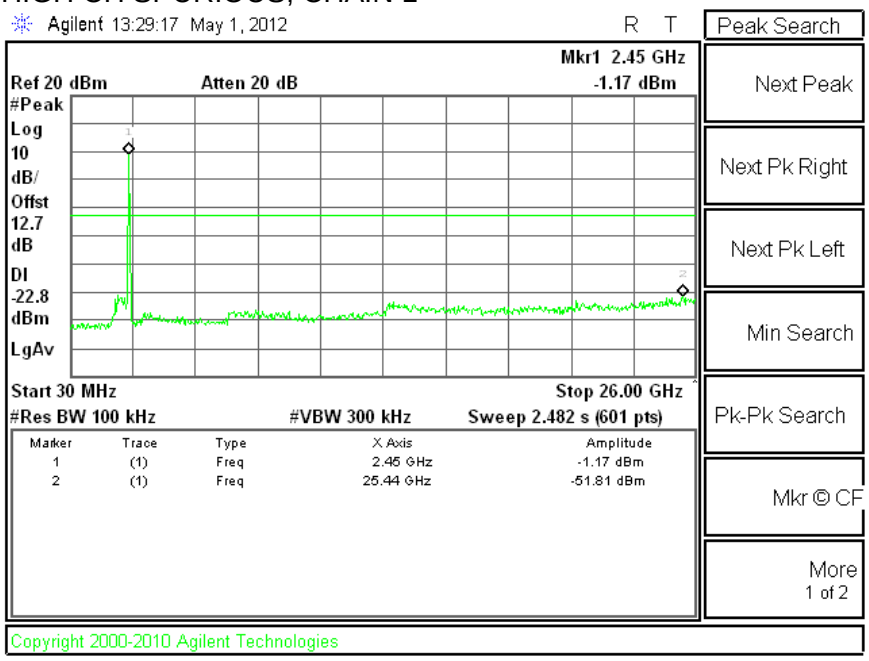
MID CH SPURIOUS, CHAIN 1



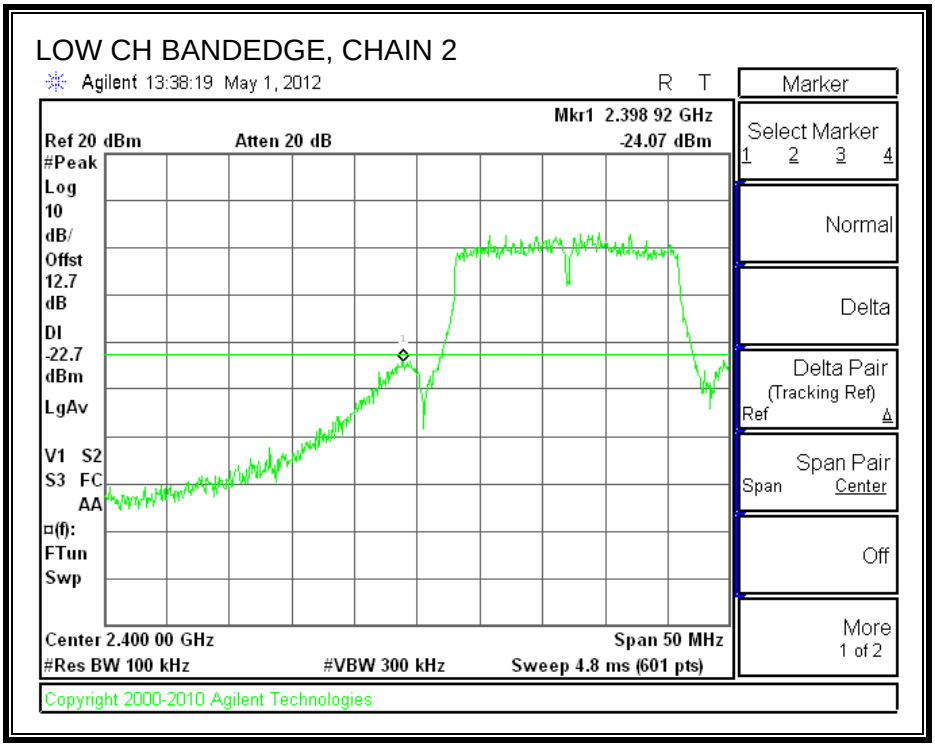
HIGH CH BANDEDGE, CHAIN 1

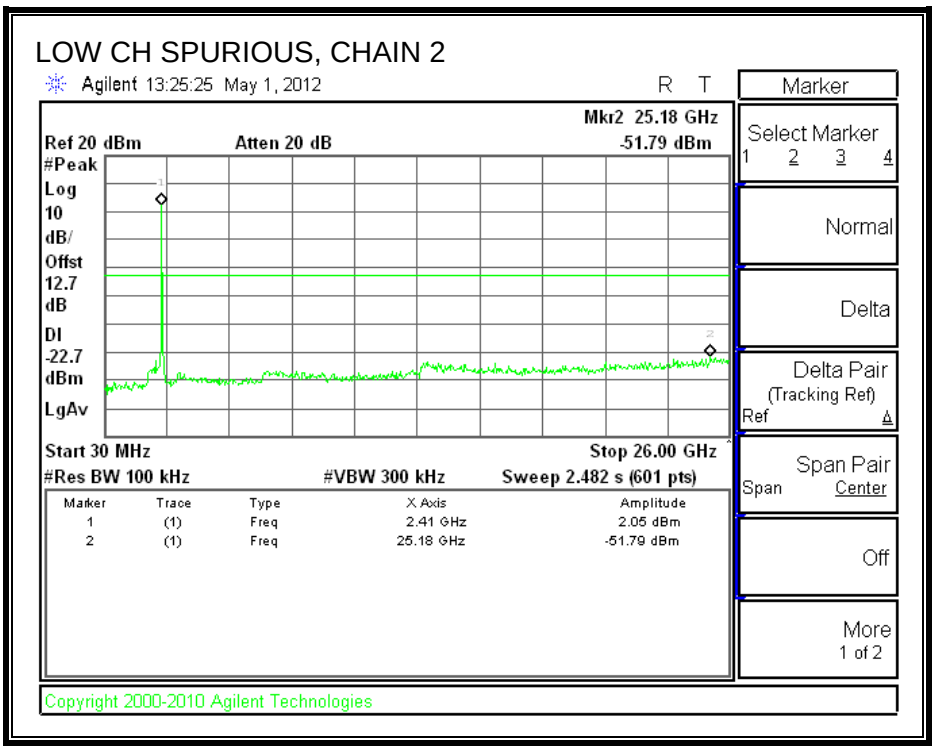


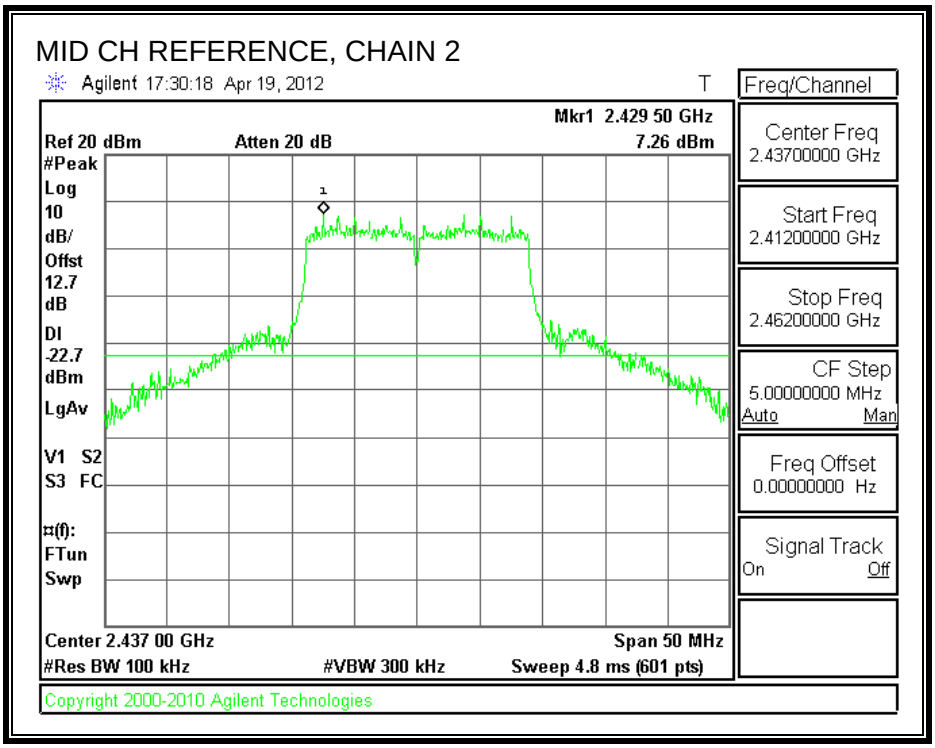
HIGH CH SPURIOUS, CHAIN 1

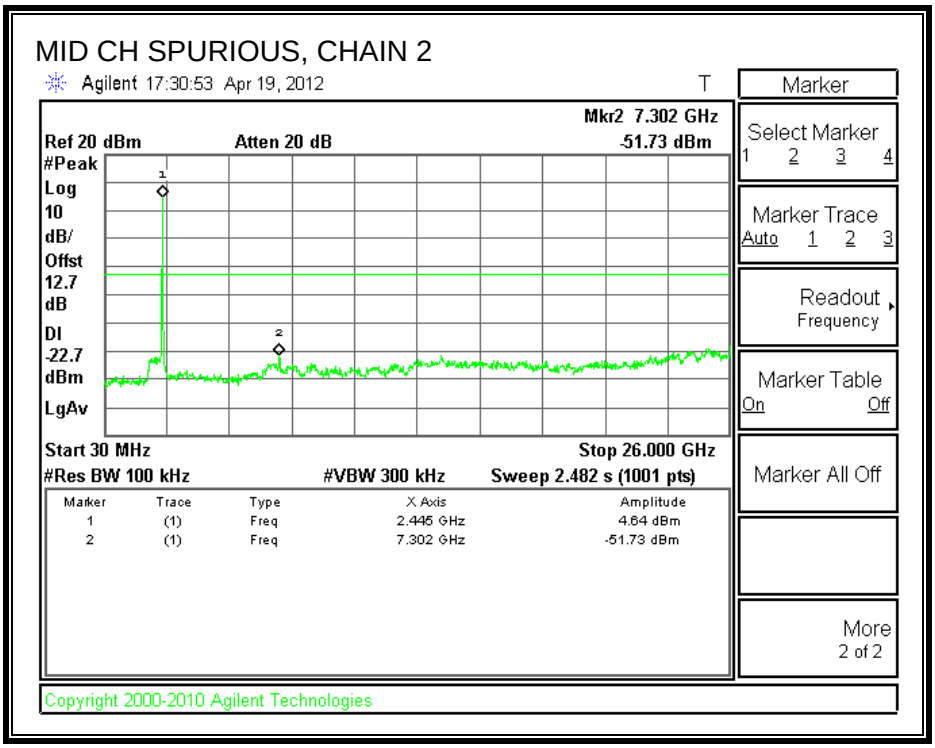


CHAIN 2 SPURIOUS EMISSIONS

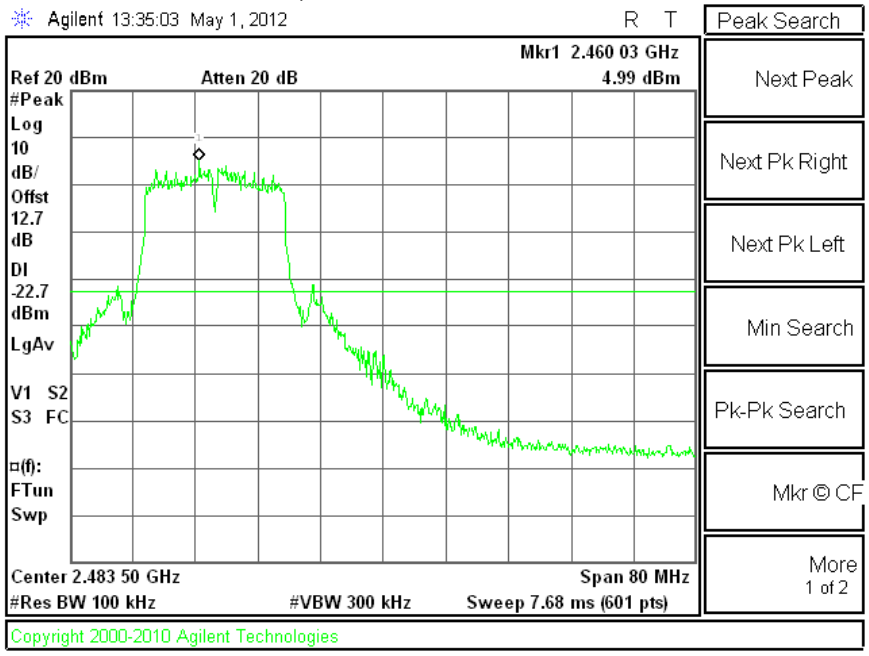




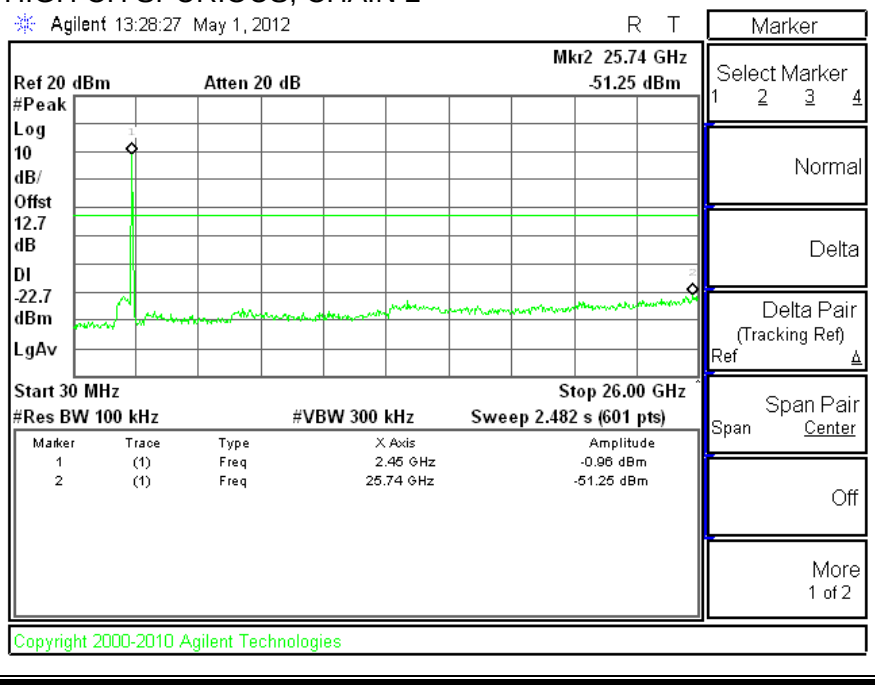




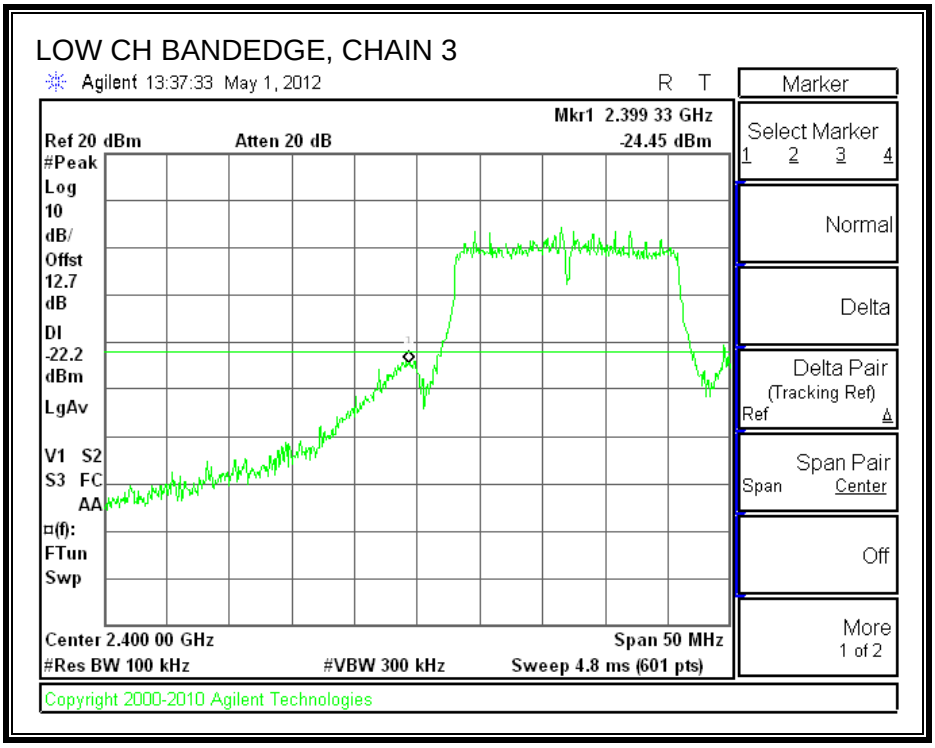
HIGH CH BANDEDGE, CHAIN 2

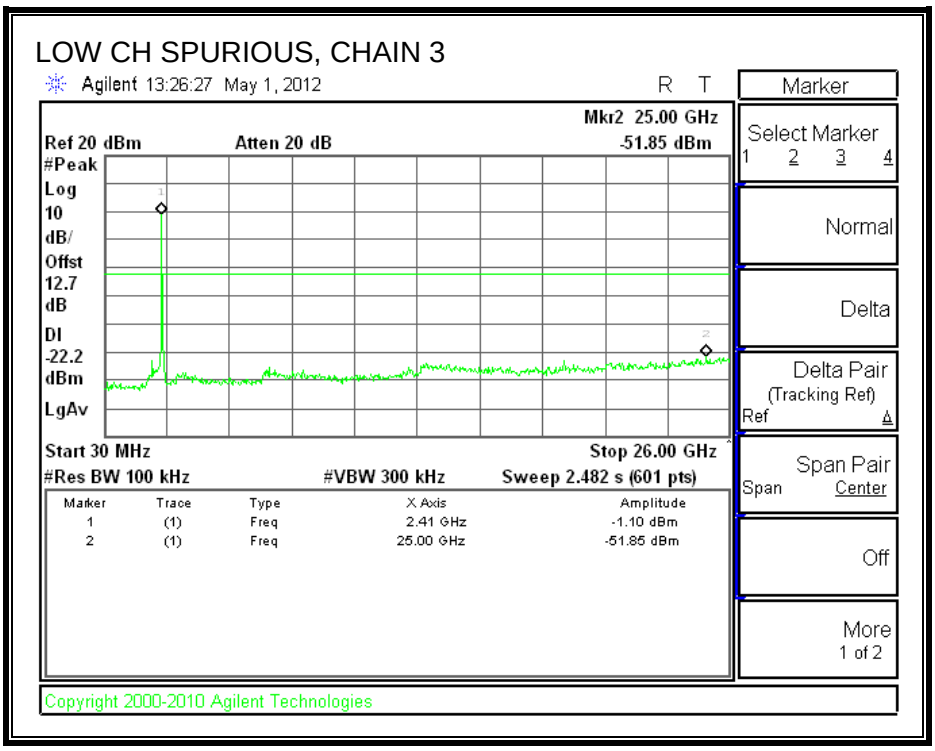


HIGH CH SPURIOUS, CHAIN 2

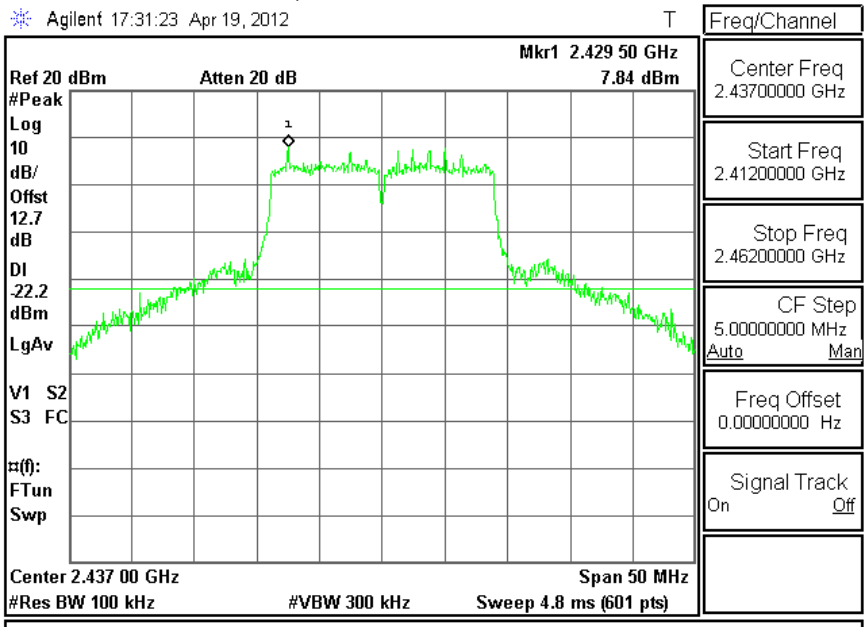


CHAIN 3 SPURIOUS EMISSIONS

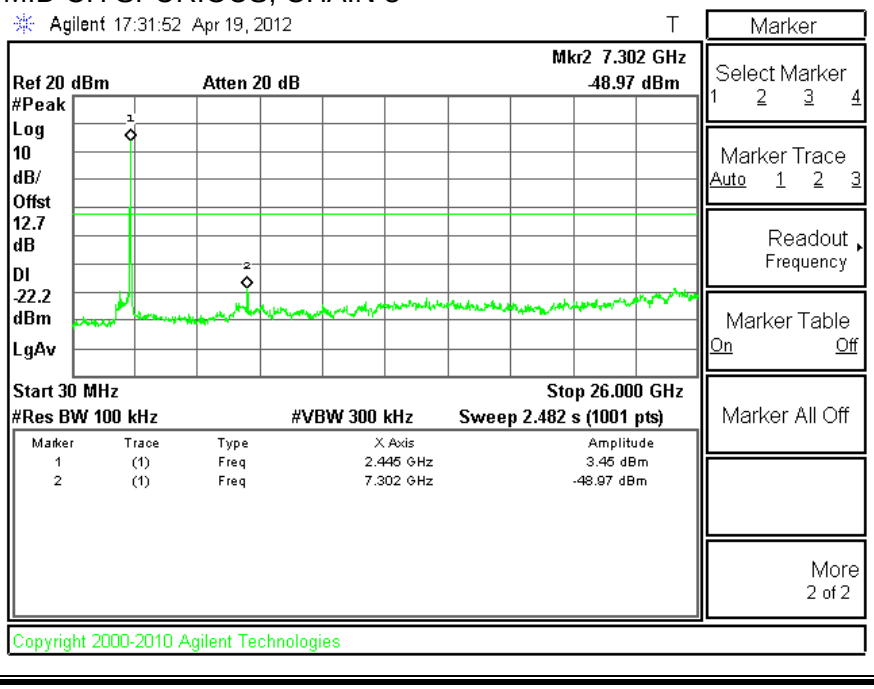




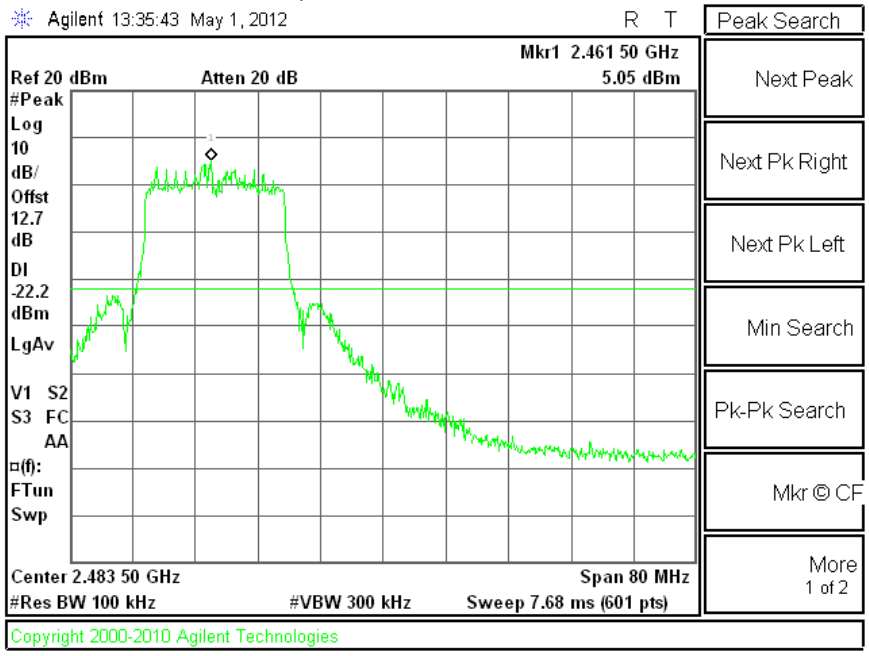
MID CH REFERENCE, CHAIN 3



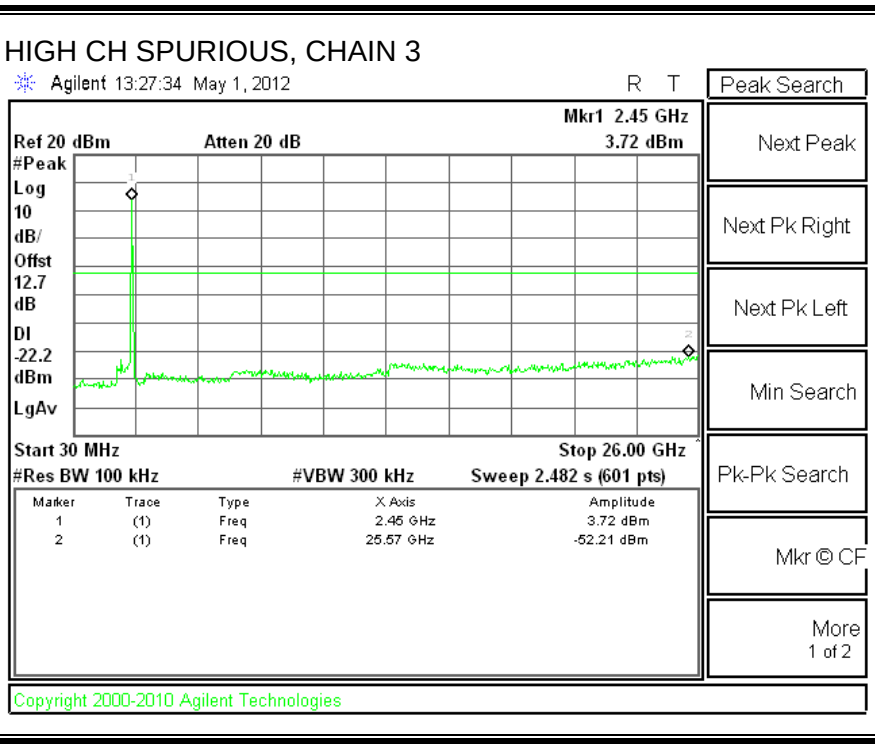
MID CH SPURIOUS, CHAIN 3



HIGH CH BANDEDGE, CHAIN 3



HIGH CH SPURIOUS, CHAIN 3



7.4. 802.11n HT20 CDD 3TX MODE IN THE 5.8 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.

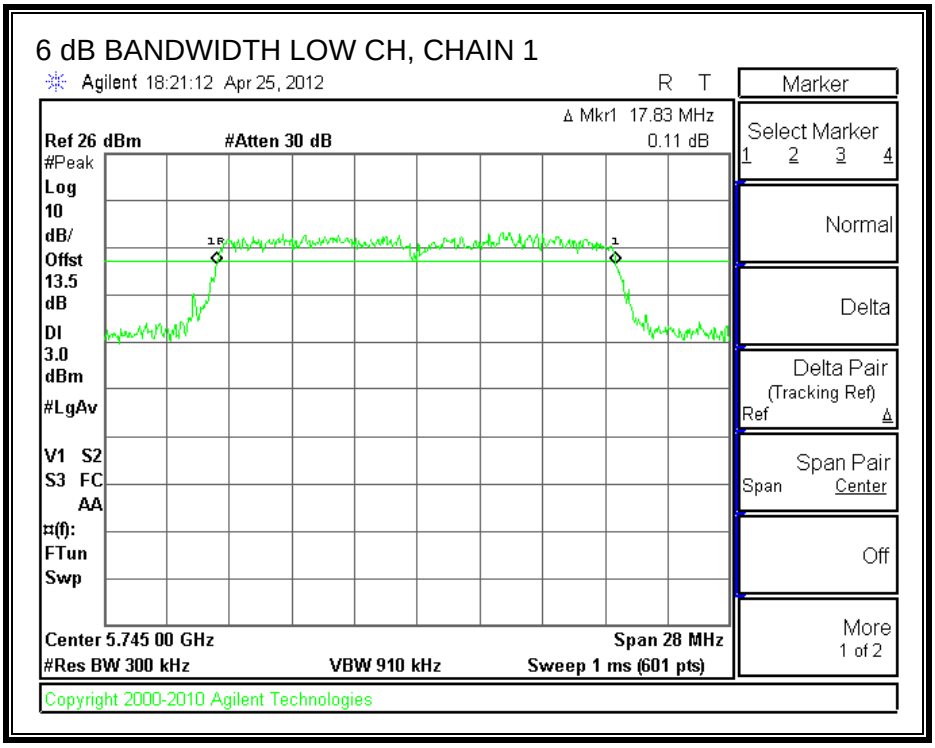
TEST PROCEDURE

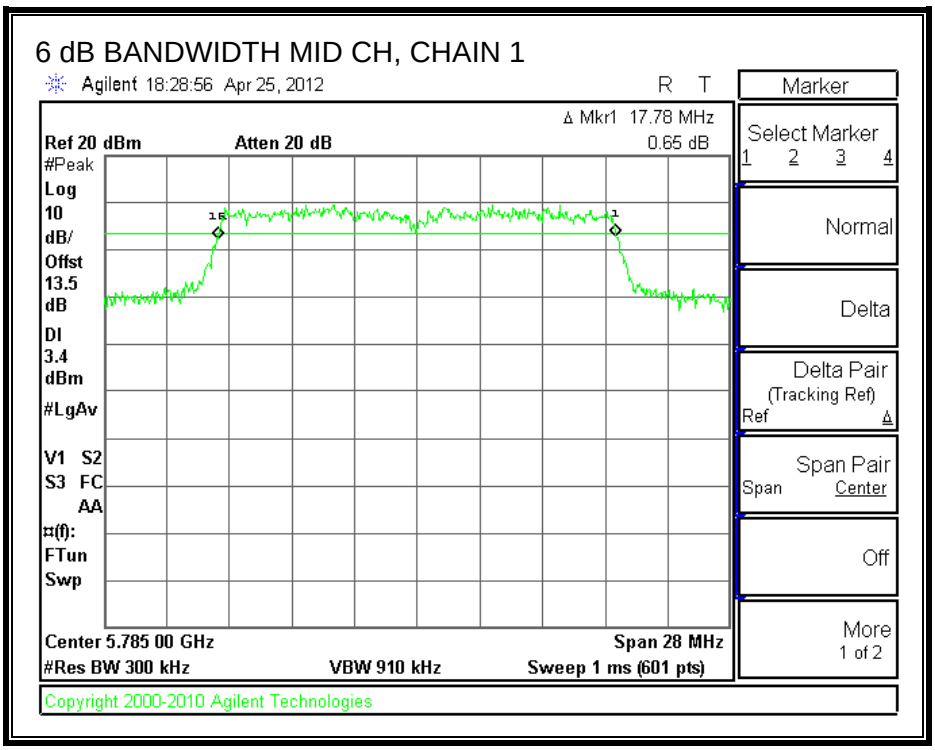
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

RESULTS

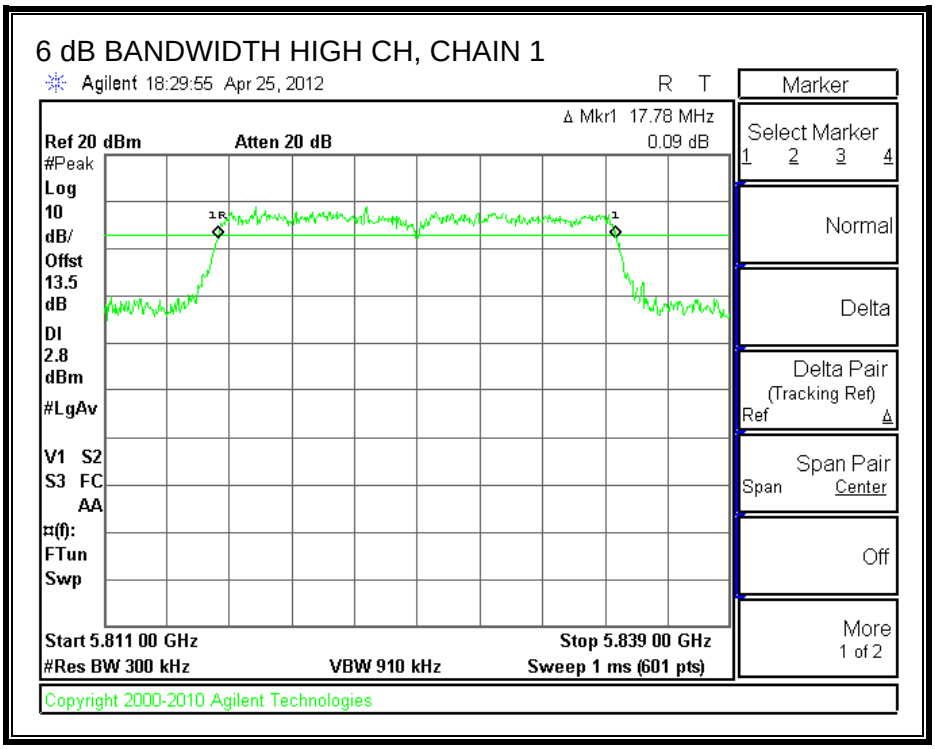
Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Chain 3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5745	17.83	17.73	17.78	0.5
Middle	5785	17.78	17.69	17.78	0.5
High	5825	17.78	17.64	17.78	0.5

6 dB BANDWIDTH, CHAIN 1

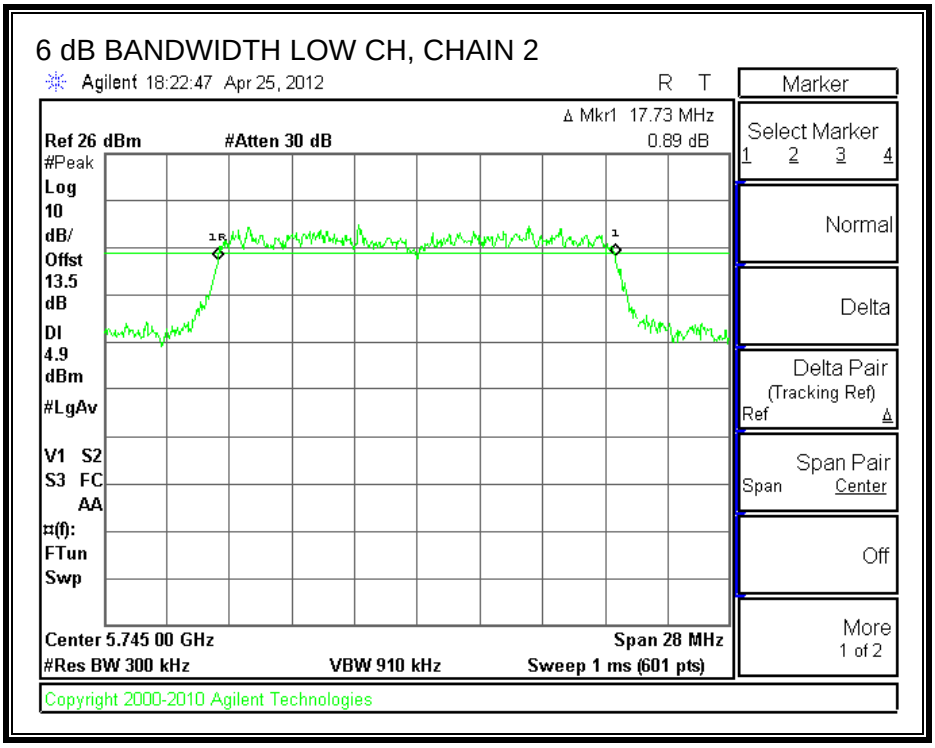


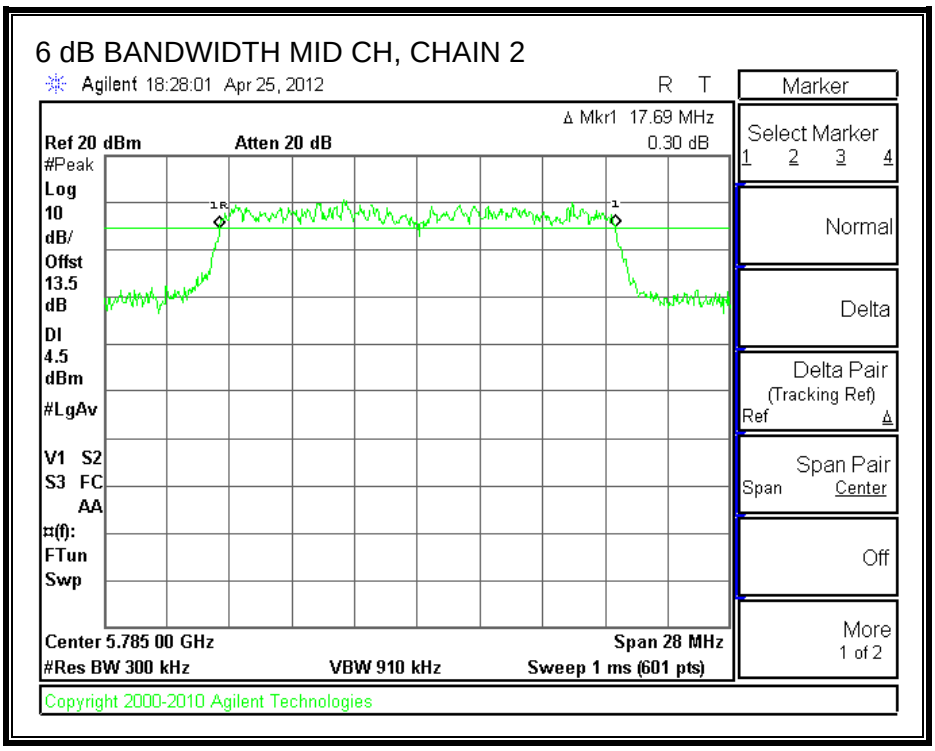


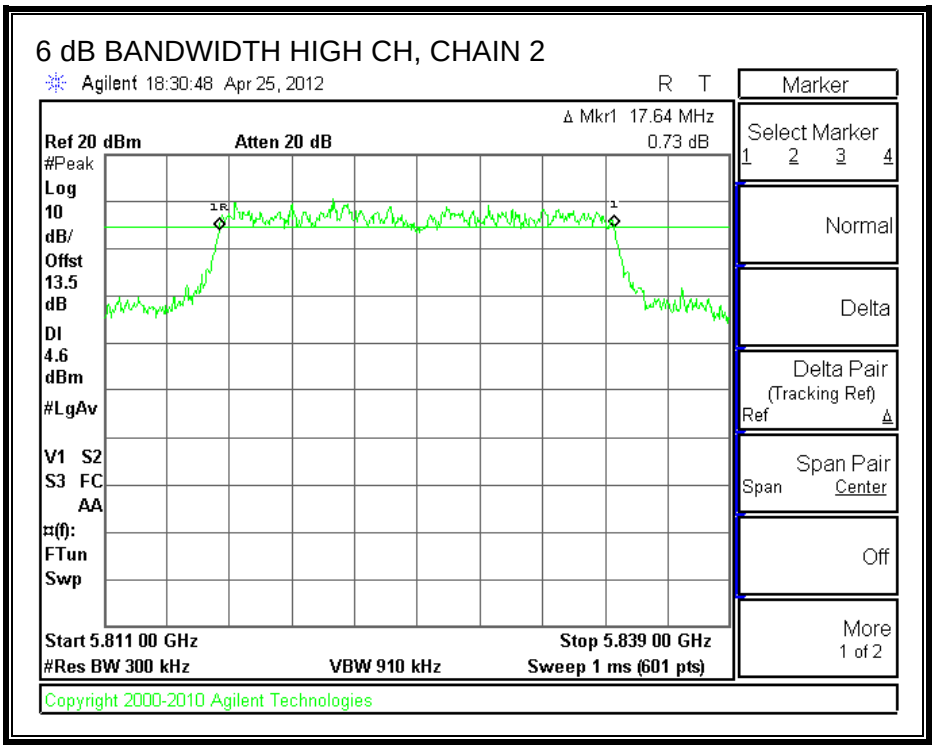
6 dB BANDWIDTH HIGH CH, CHAIN 1



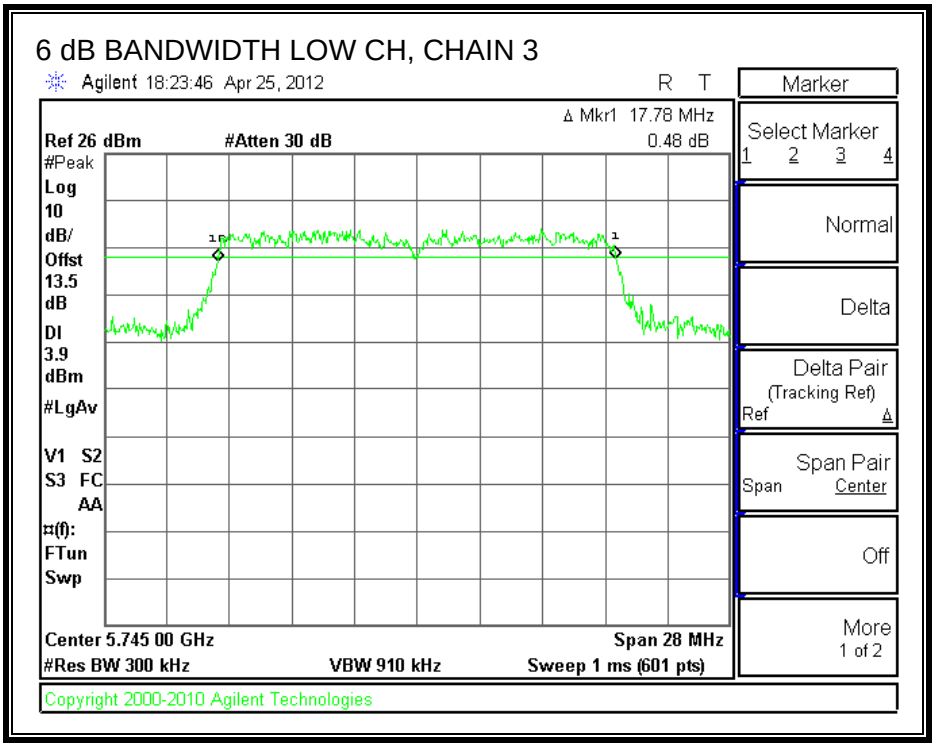
6 dB BANDWIDTH, CHAIN 2

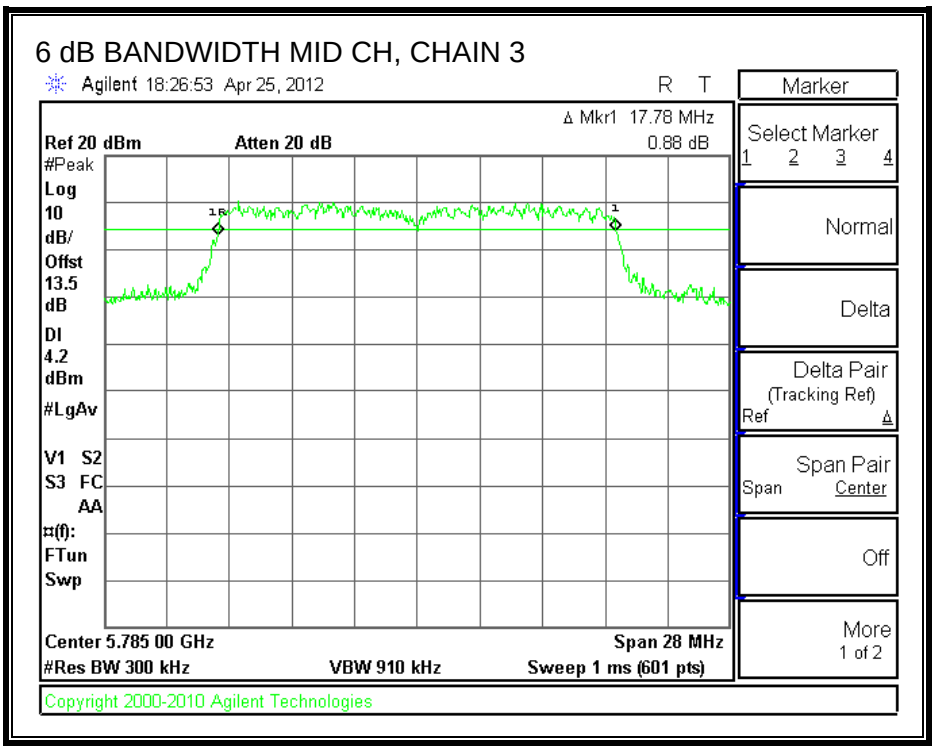




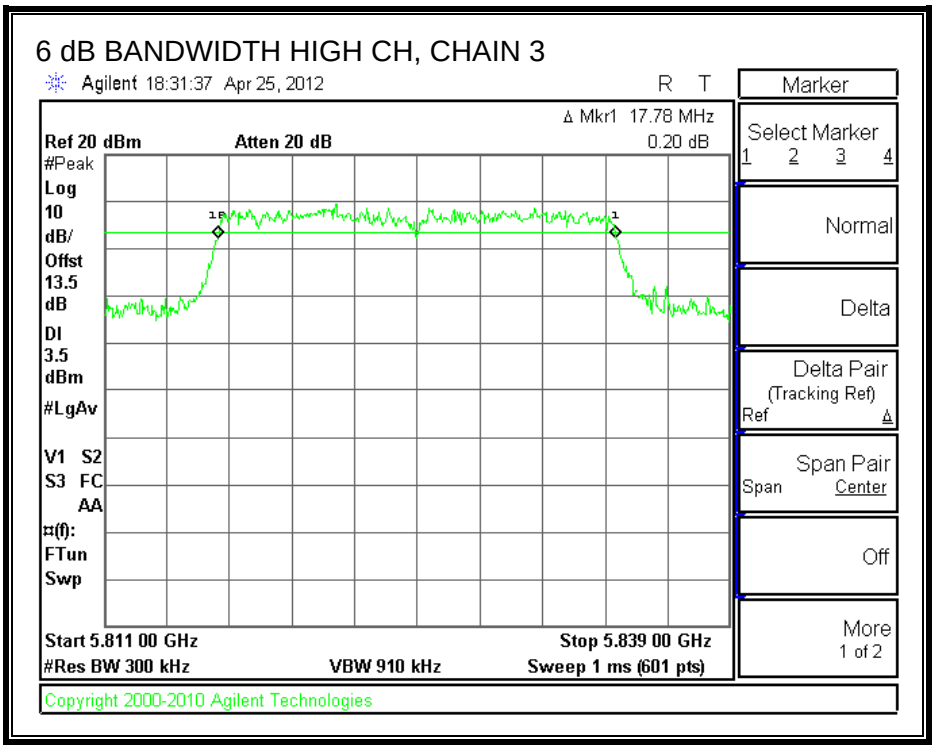


6 dB BANDWIDTH, CHAIN 3





6 dB BANDWIDTH HIGH CH, CHAIN 3



7.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

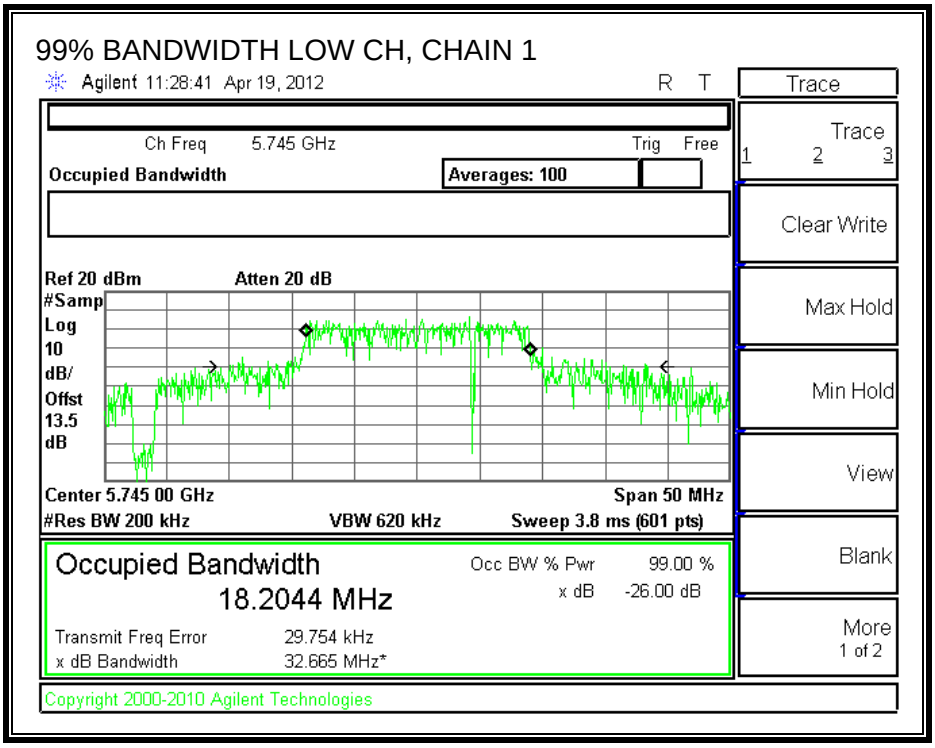
TEST PROCEDURE

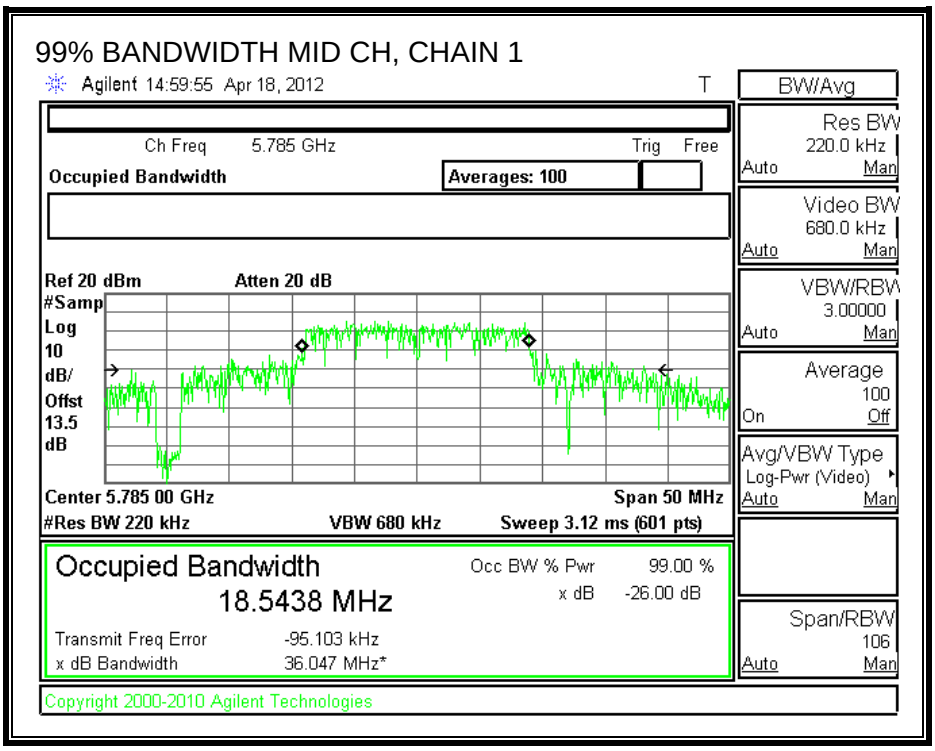
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

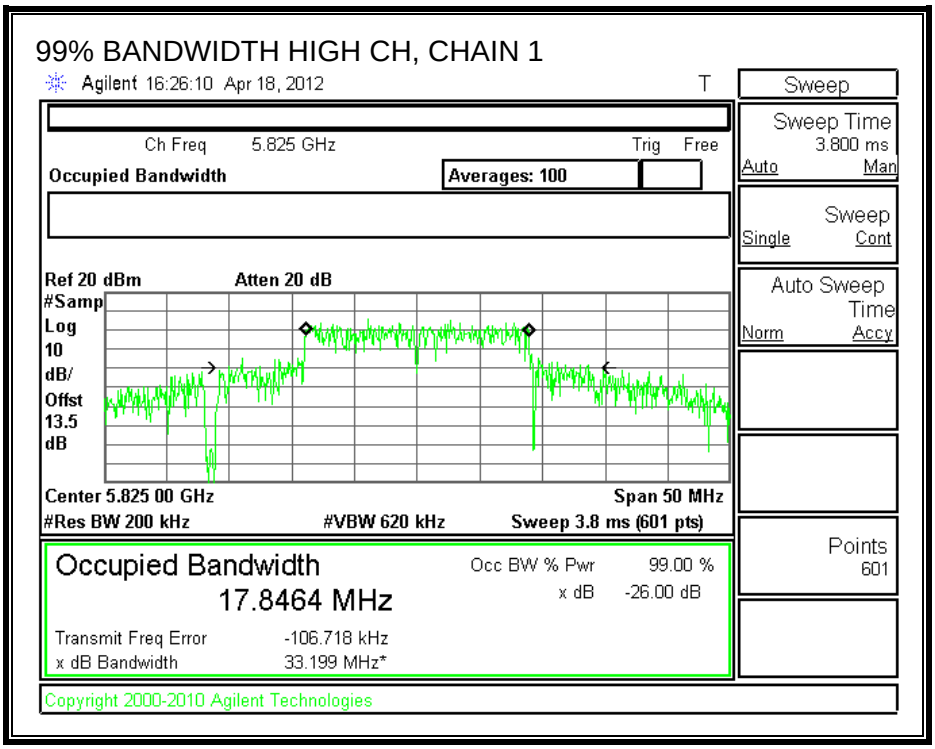
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	5745	18.2044	17.7882	18.0165
Middle	5785	18.5438	18.3597	18.4893
High	5825	17.8464	17.8873	17.7886

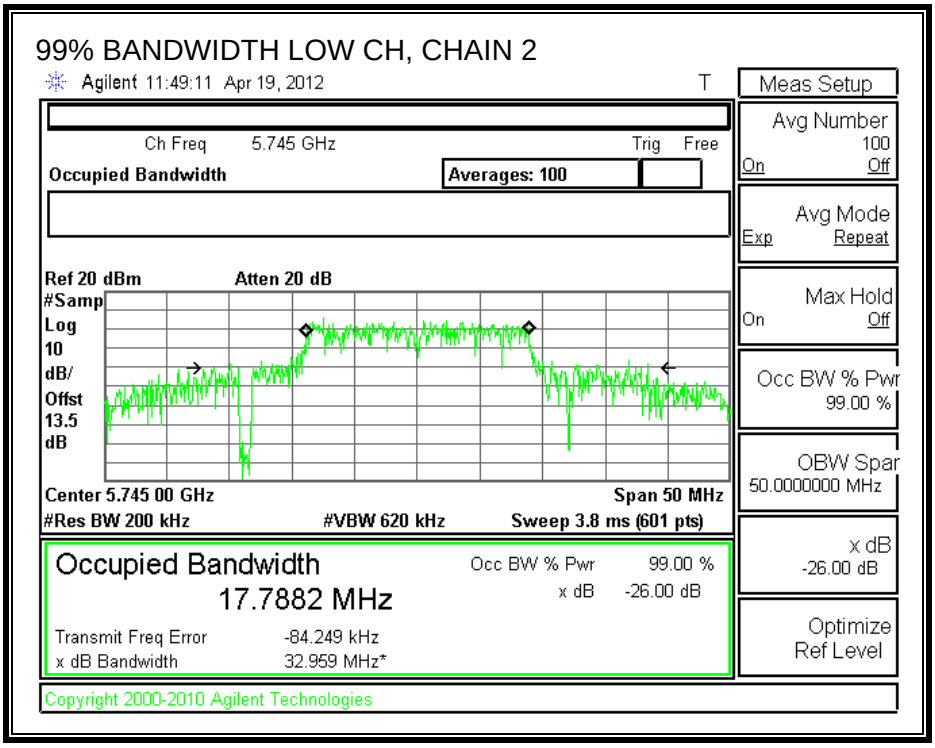
99% BANDWIDTH, CHAIN 1

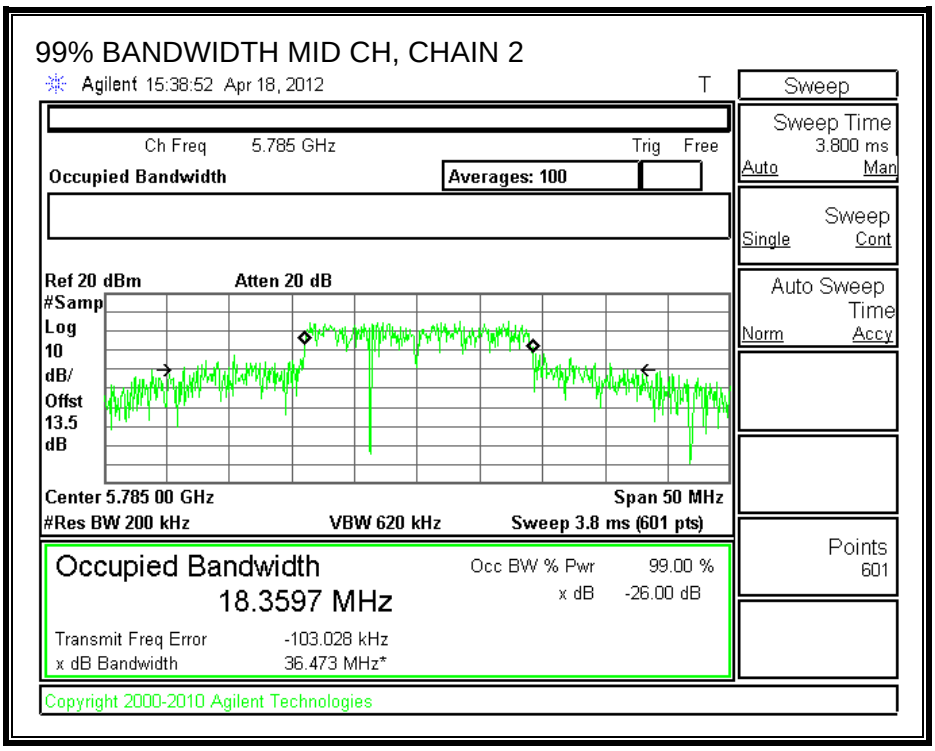


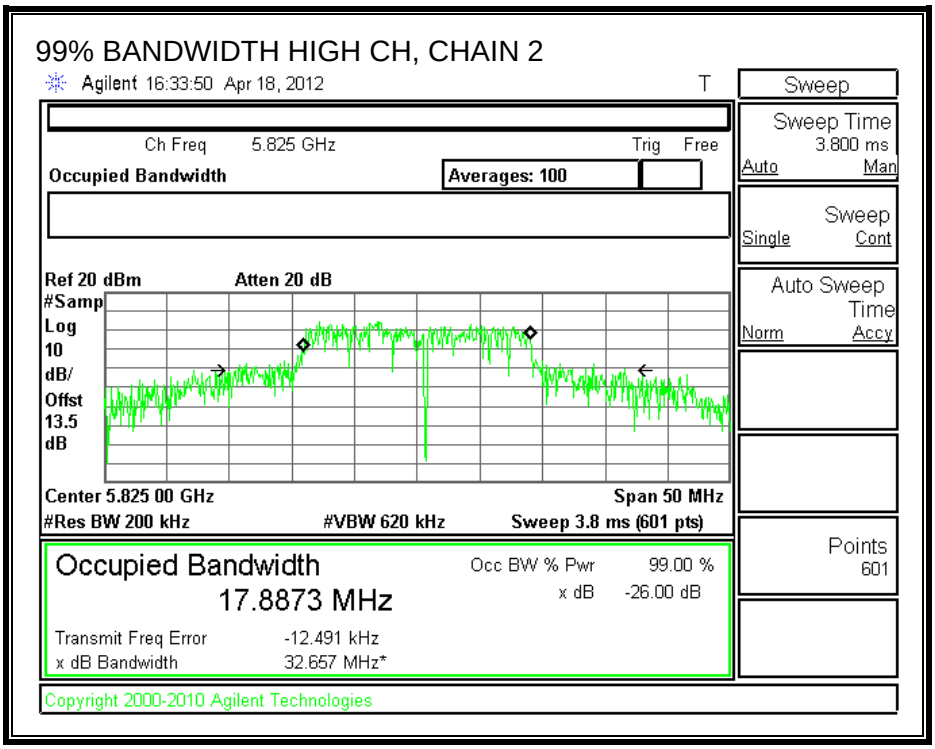




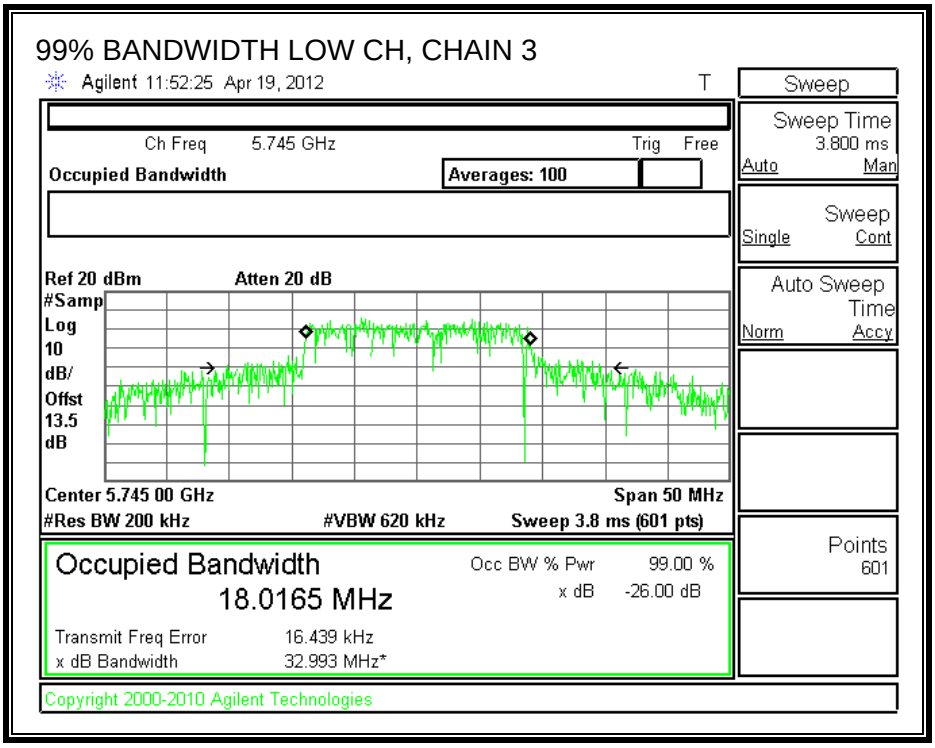
99% BANDWIDTH, CHAIN 2

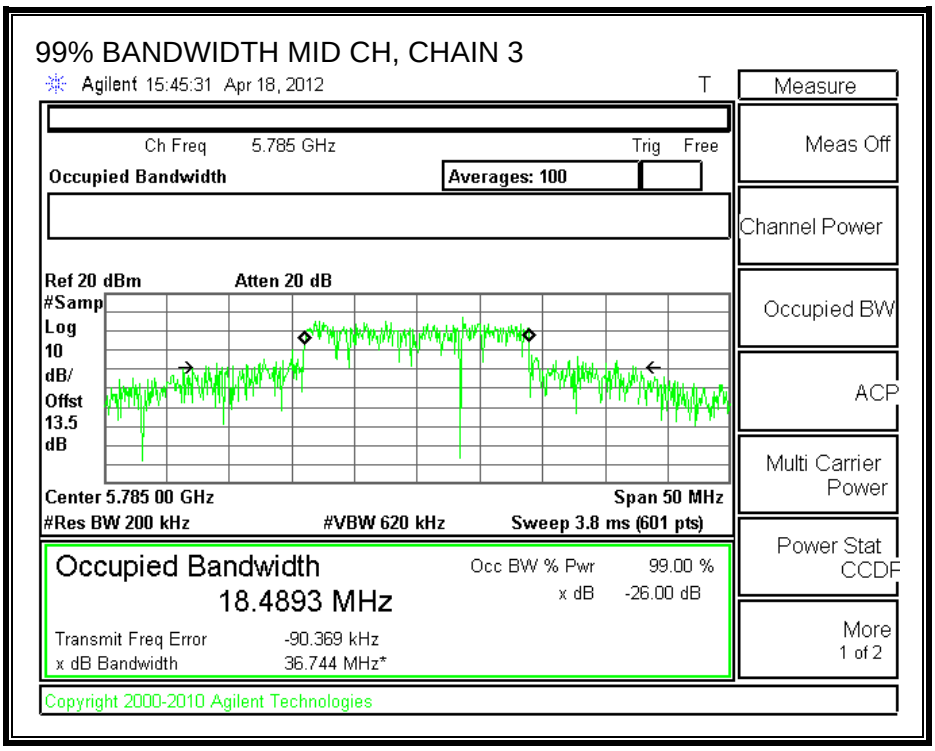


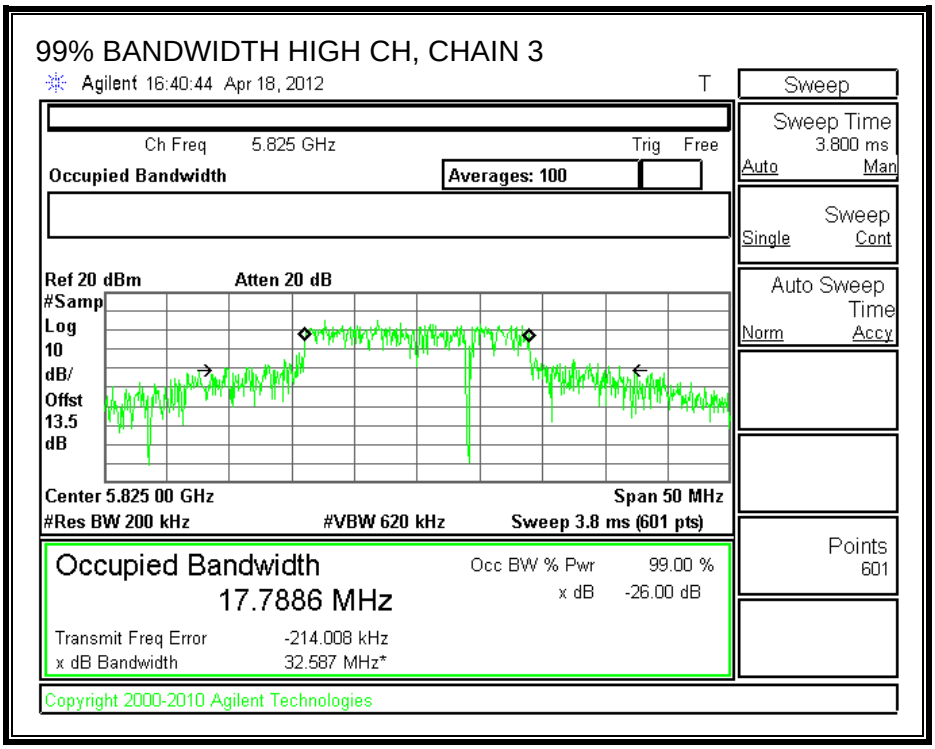




99% BANDWIDTH, CHAIN 3







7.4.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Chain 3 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
4.86	1.95	3.09	8.15

The maximum effective legacy gain is 9.05 dBi for other than fixed, point-to-point operations, therefore the limit is 27.85 dBm.

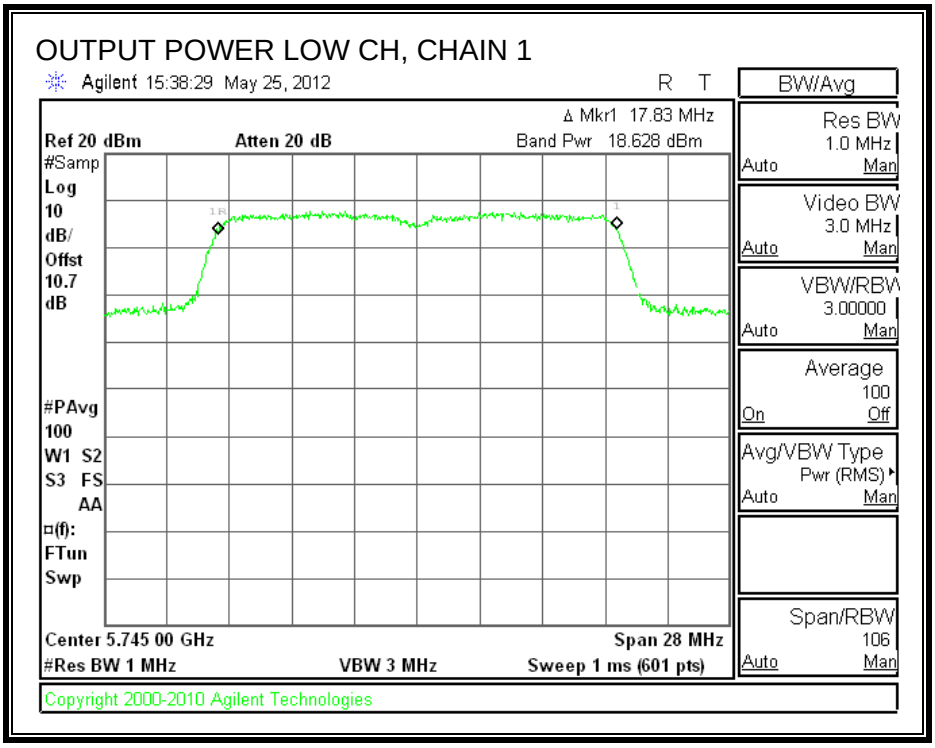
TEST PROCEDURE

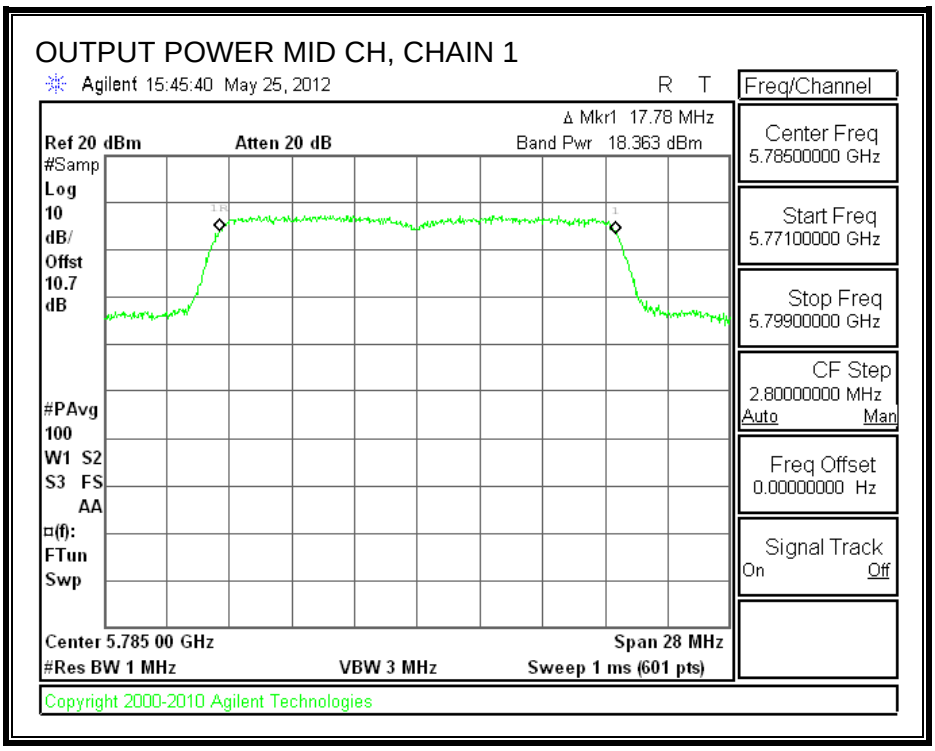
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

RESULTS

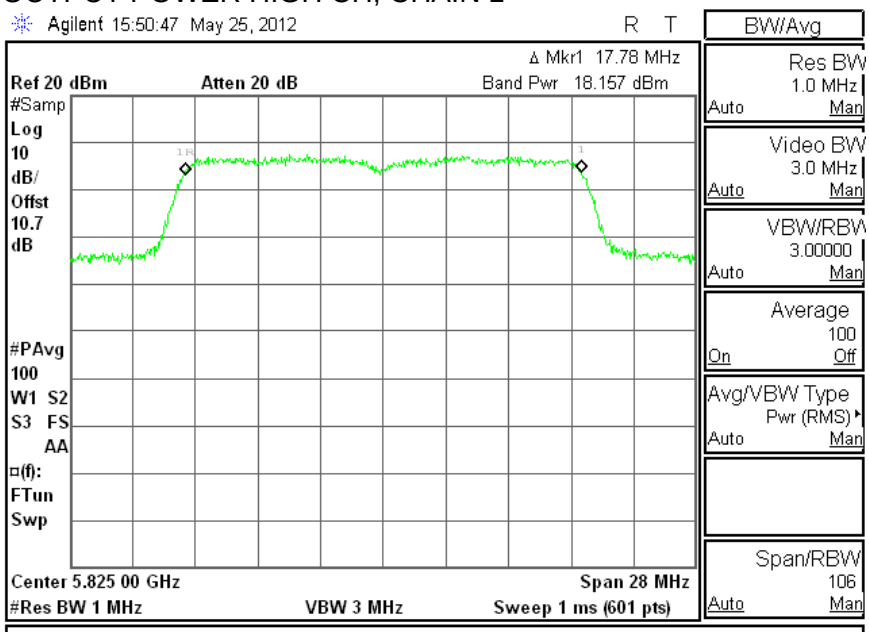
Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Chain 3 PK Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	18.628	18.483	18.500	23.309	27.85	-4.541
Mid	5785	18.363	18.293	18.195	23.055	27.85	-4.795
High	5825	18.157	17.959	17.842	22.759	27.85	-5.091

CHAIN 1 OUTPUT POWER

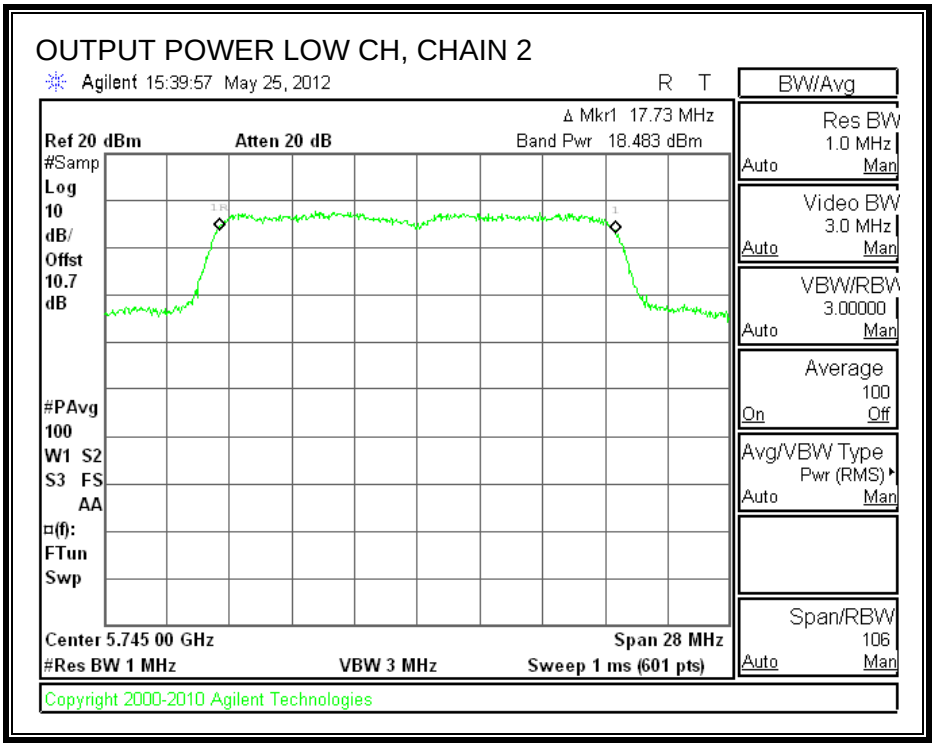


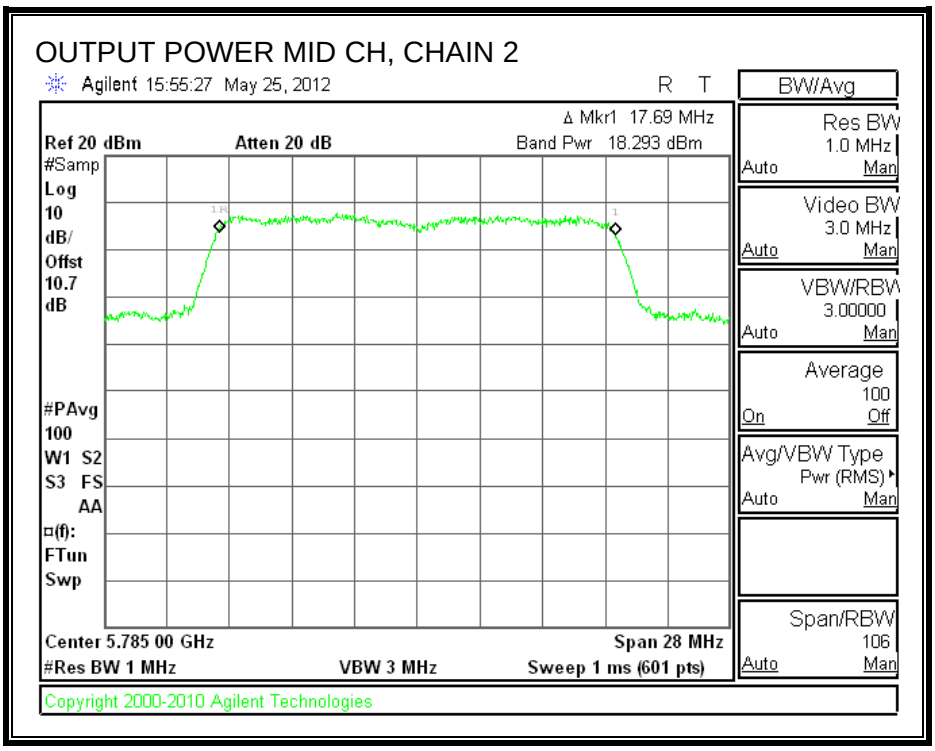


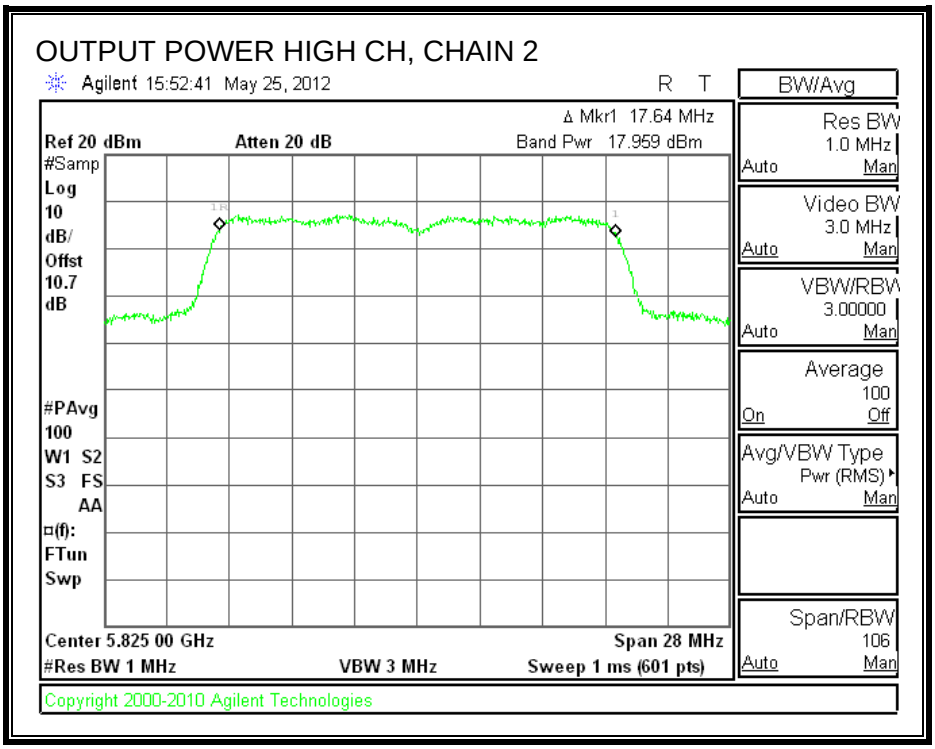
OUTPUT POWER HIGH CH, CHAIN 1



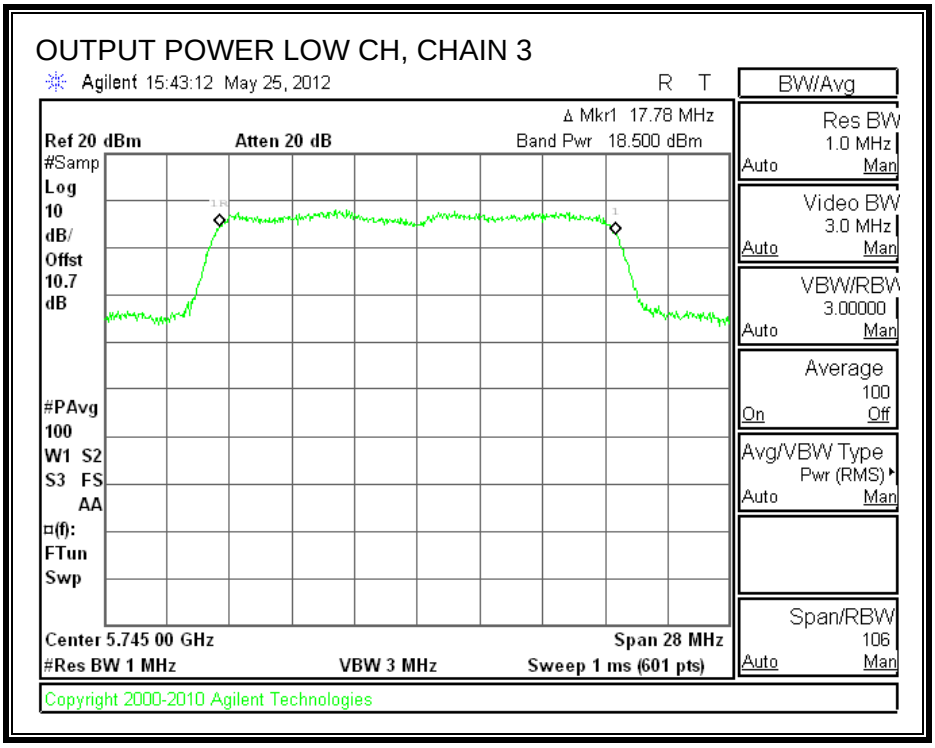
CHAIN 2 OUTPUT POWER

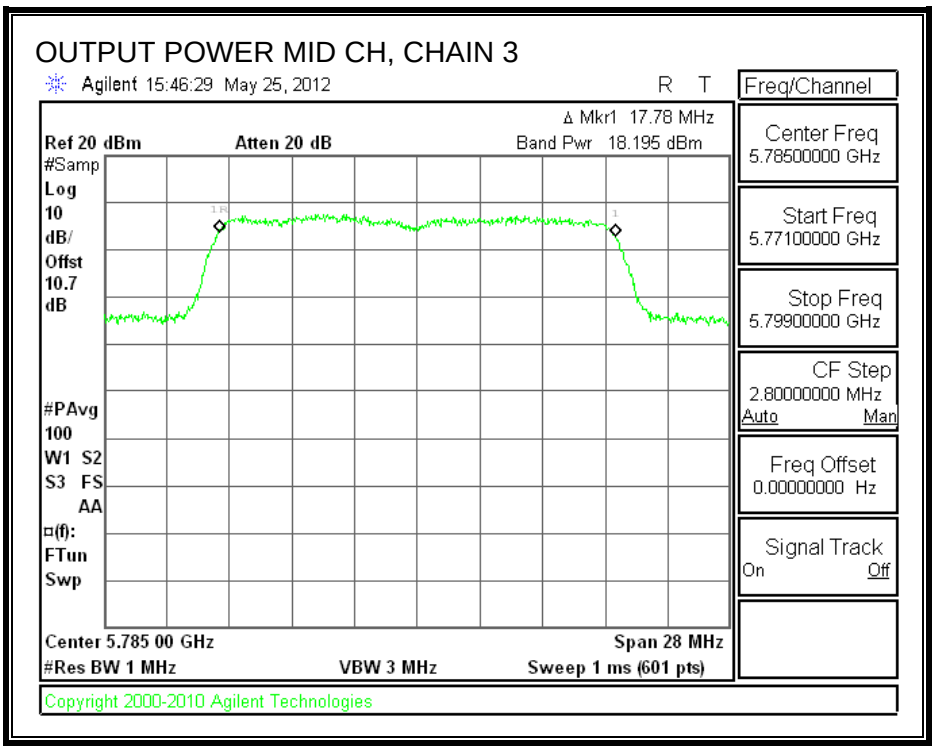


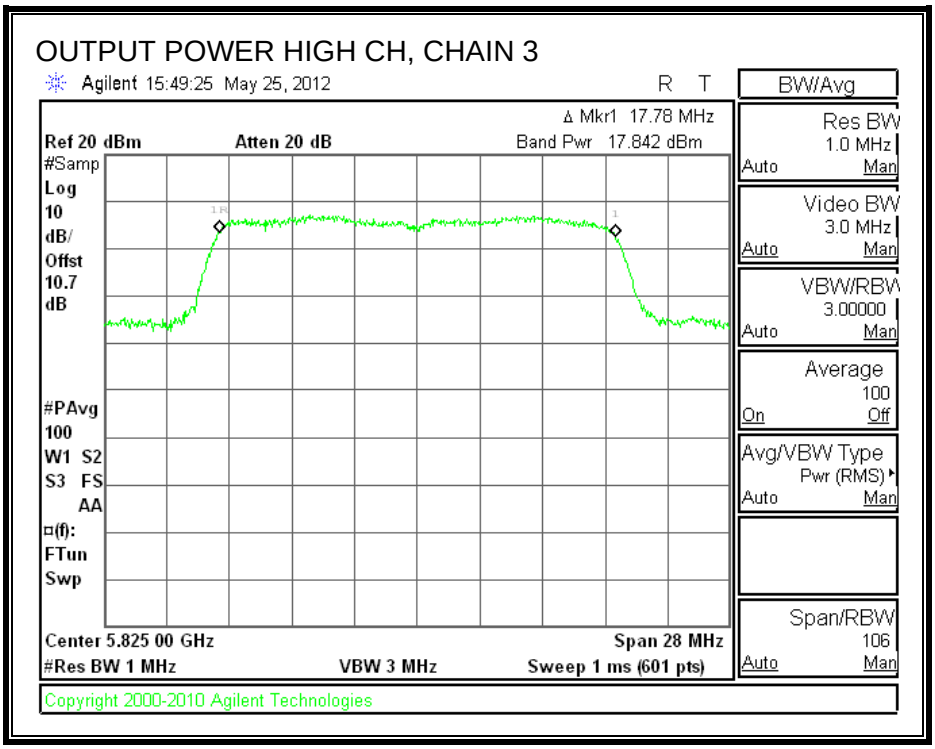




CHAIN 3 OUTPUT POWER







7.4.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

TEST PROCEDURE

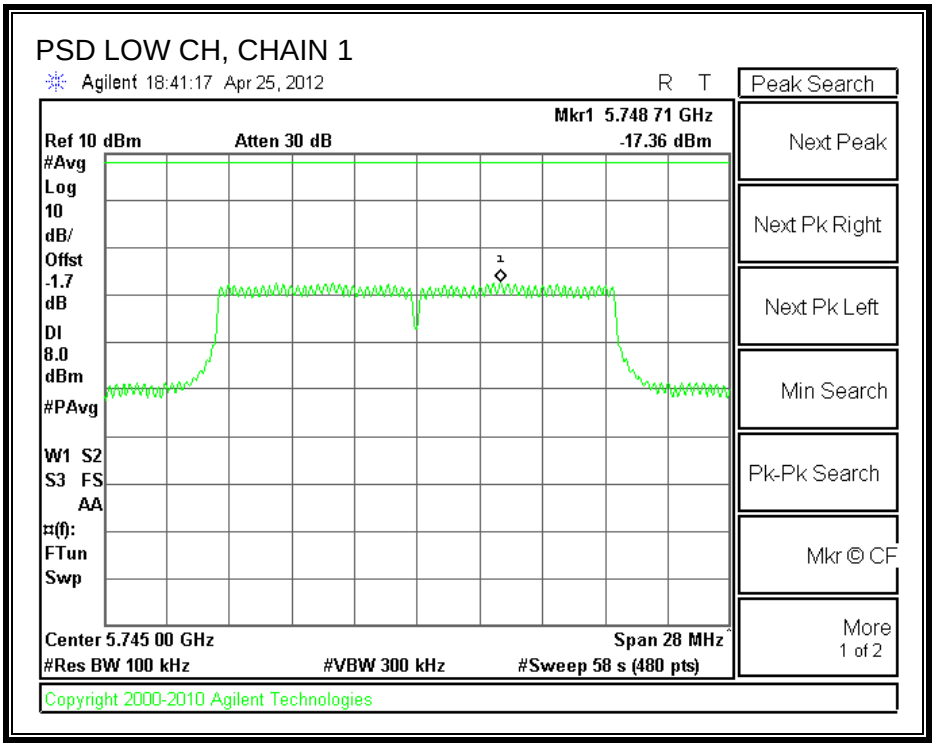
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

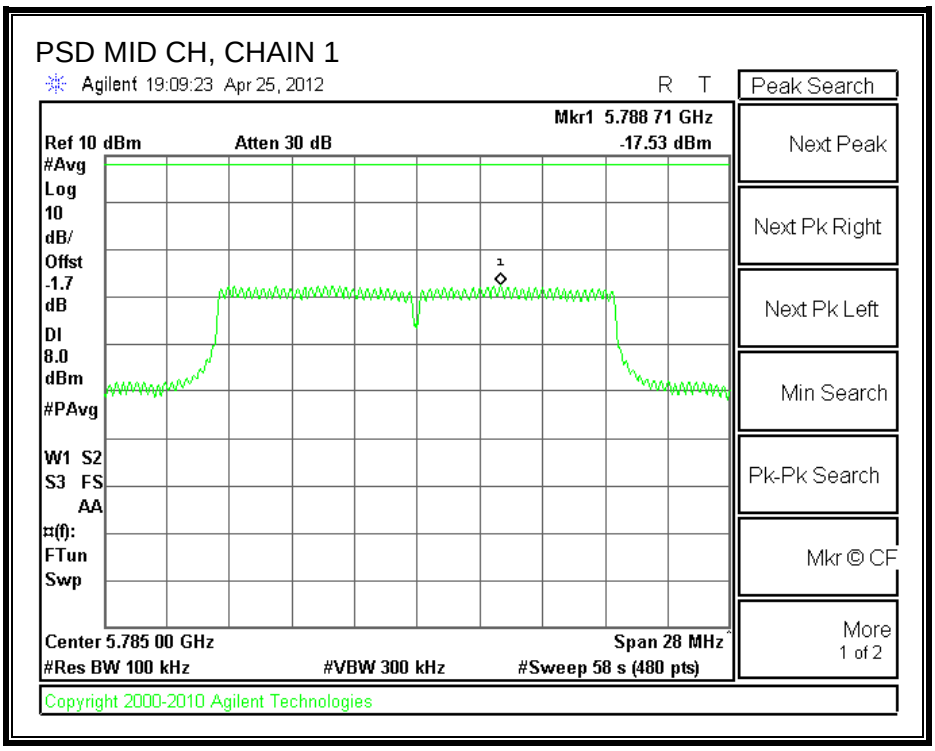
RESULTS:

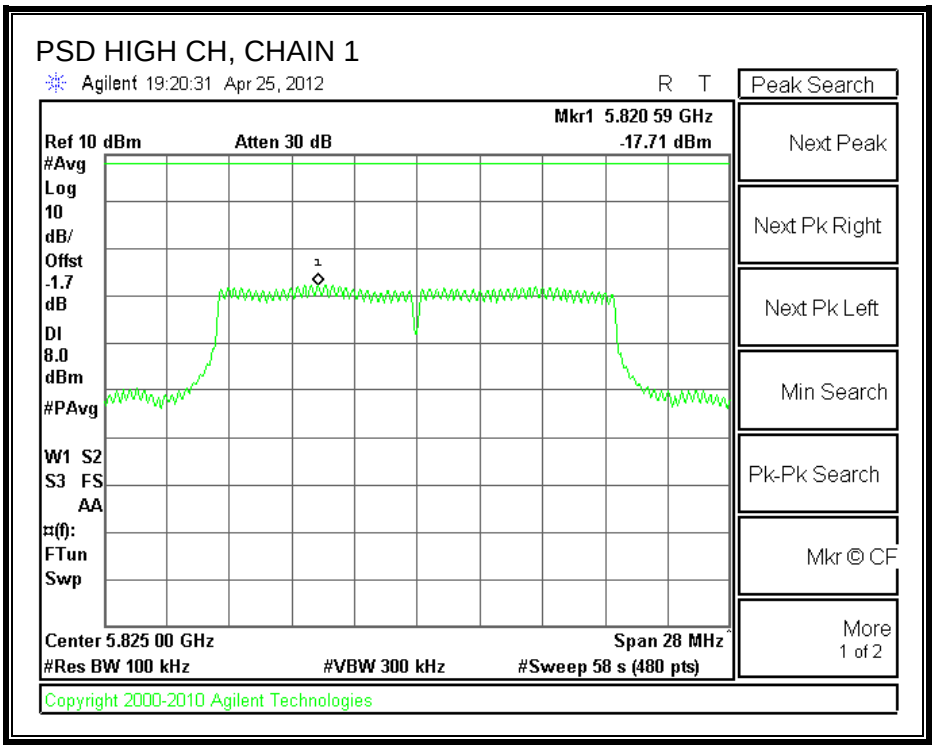
Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Chain 3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-17.36	-18.00	-16.65	-12.53	8	-20.53
Middle	5785	-17.53	-17.31	-17.02	-12.51	8	-20.51
High	5825	-17.71	-17.69	-17.54	-12.87	8	-20.87

Note: The spectrum analyzer offset = attenuator loss + cable loss + 10 log(3/100 kHz) = -1.7 dB

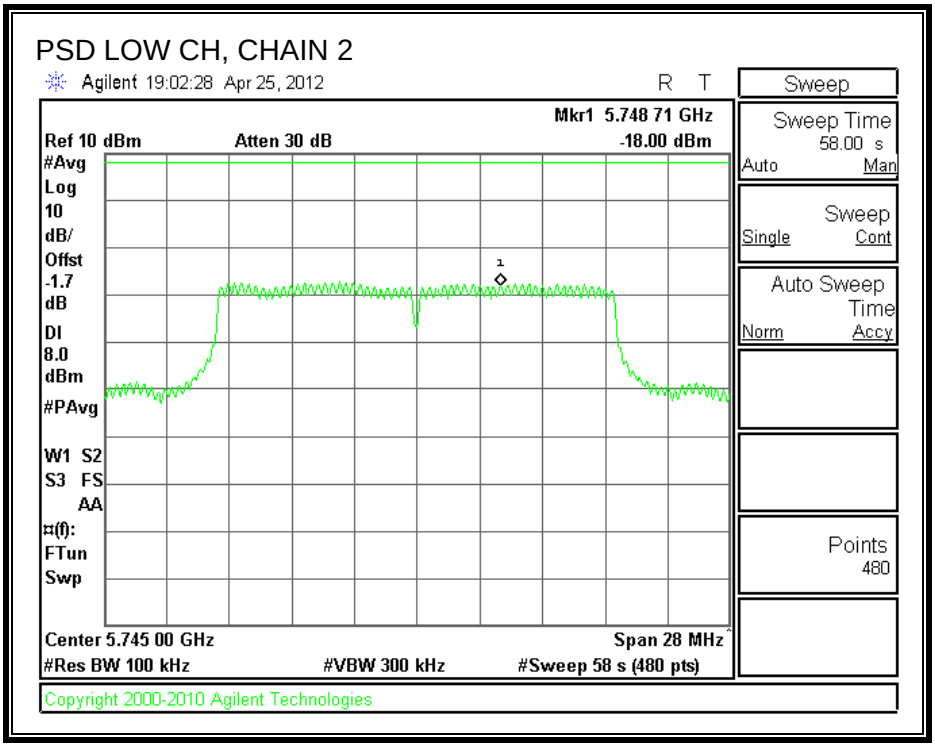
POWER SPECTRAL DENSITY, CHAIN 1

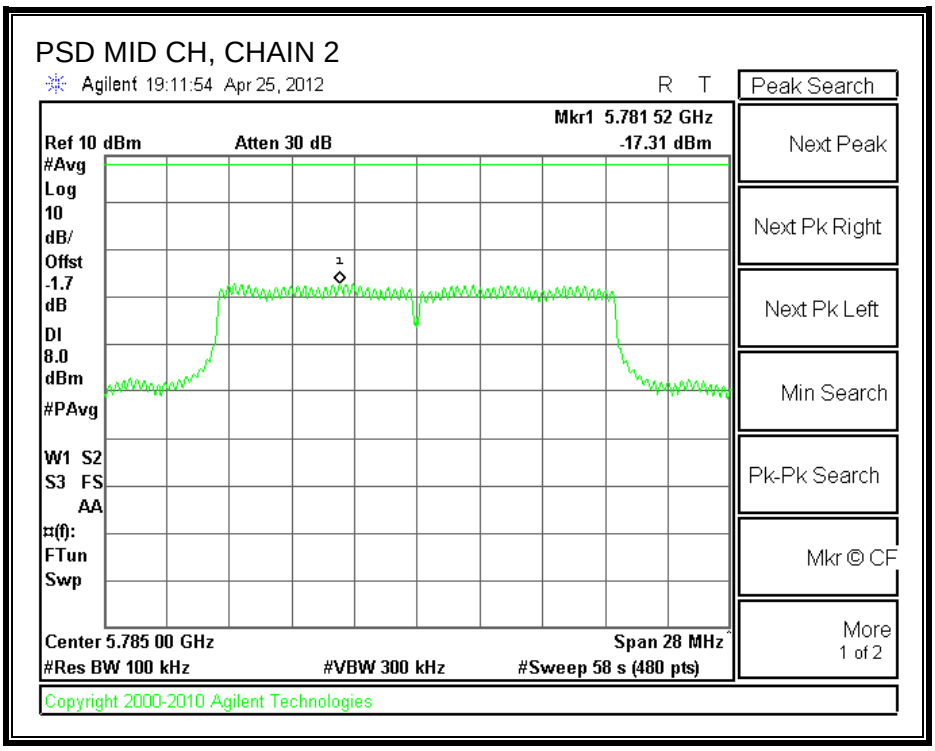




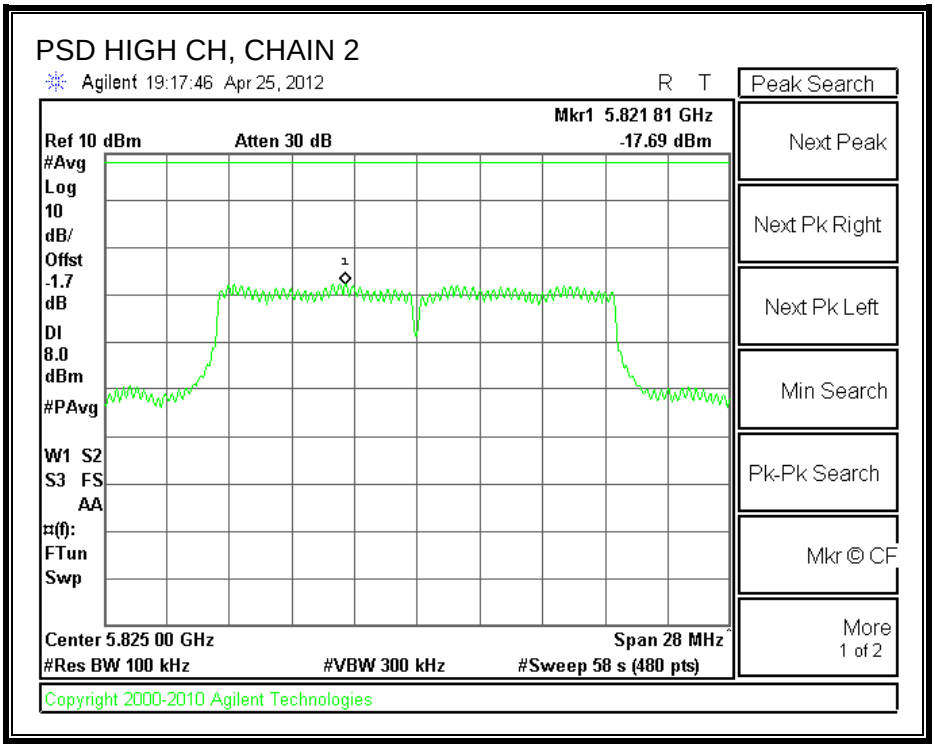


POWER SPECTRAL DENSITY, CHAIN 2

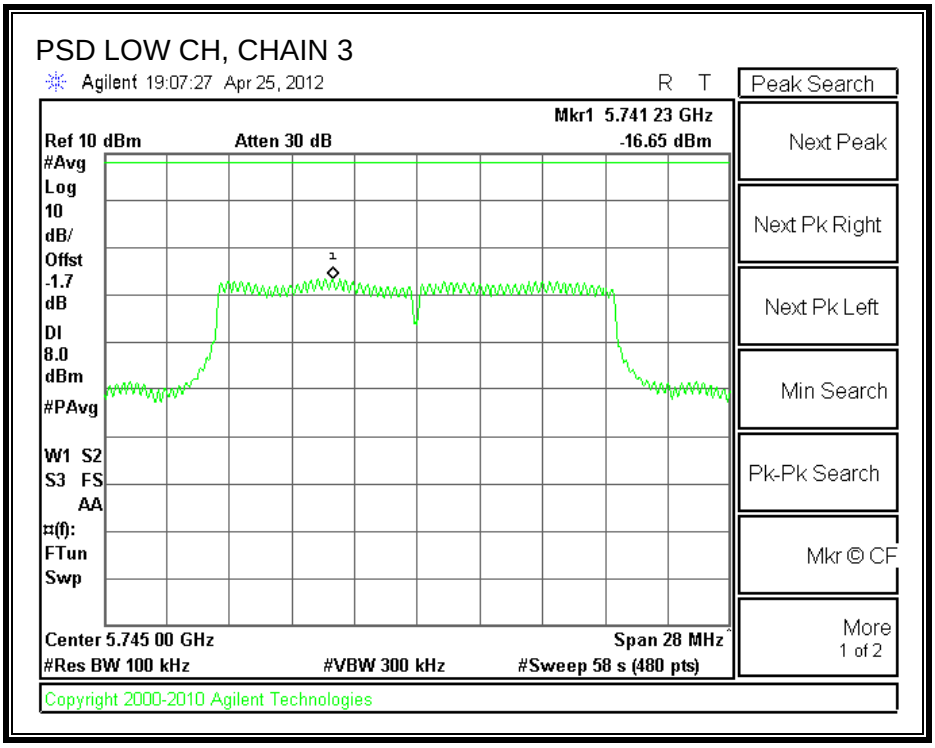


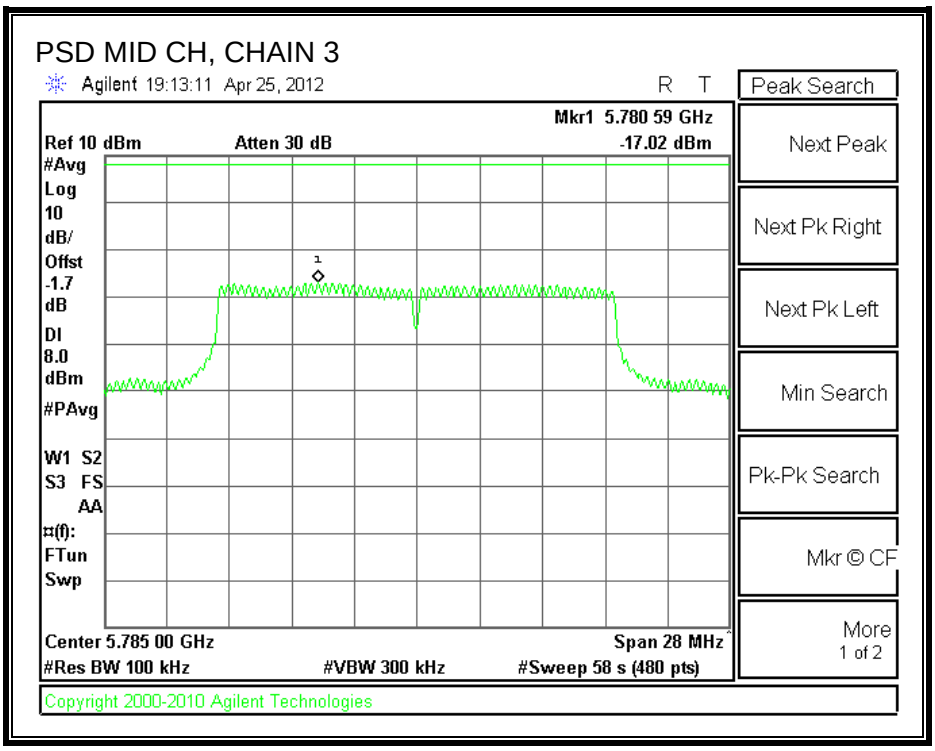


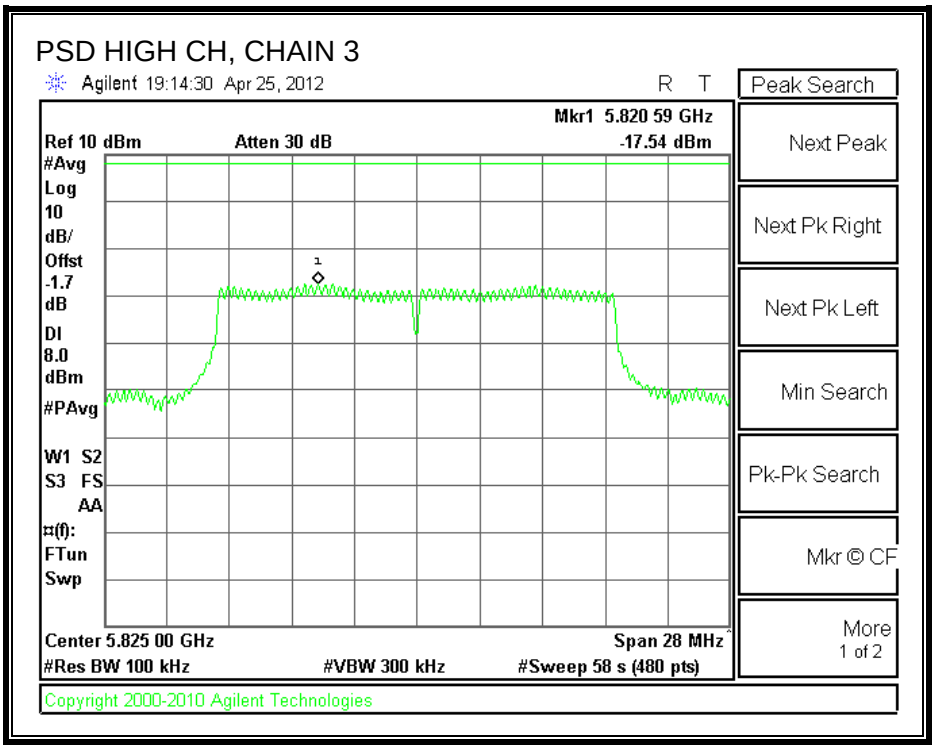
PSD HIGH CH, CHAIN 2



POWER SPECTRAL DENSITY, CHAIN 3







7.4.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

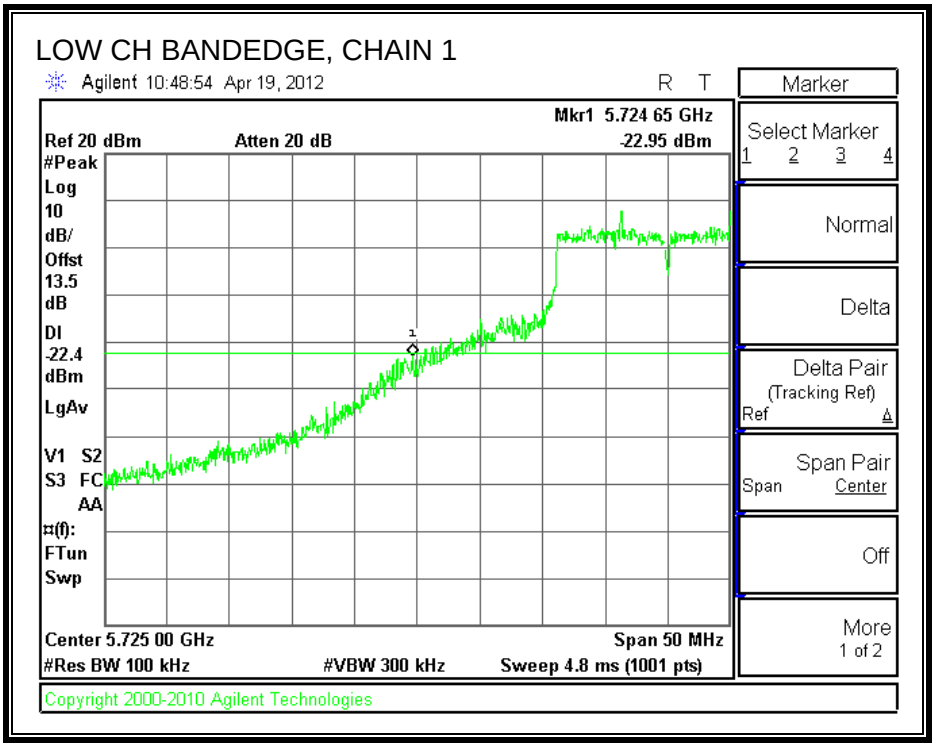
IC RSS-210 A8.5

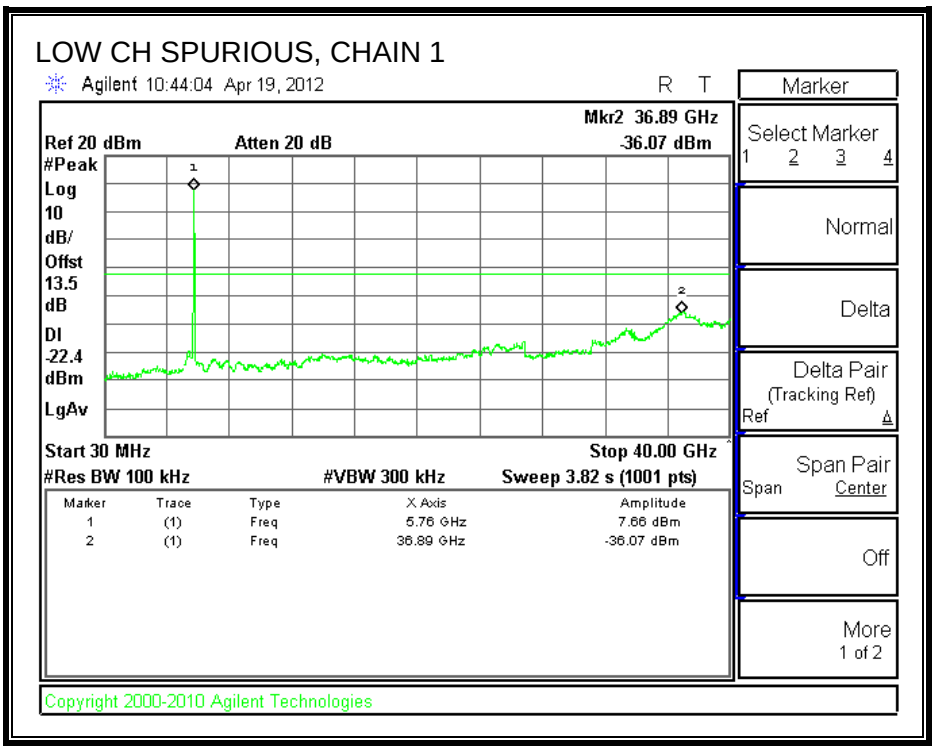
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

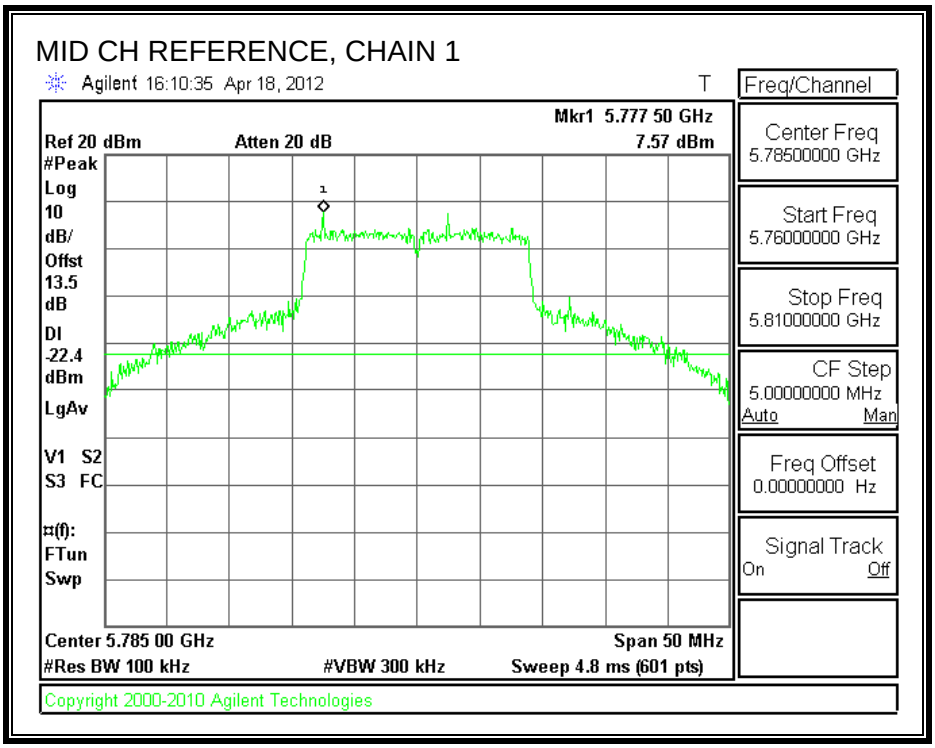
TEST PROCEDURE

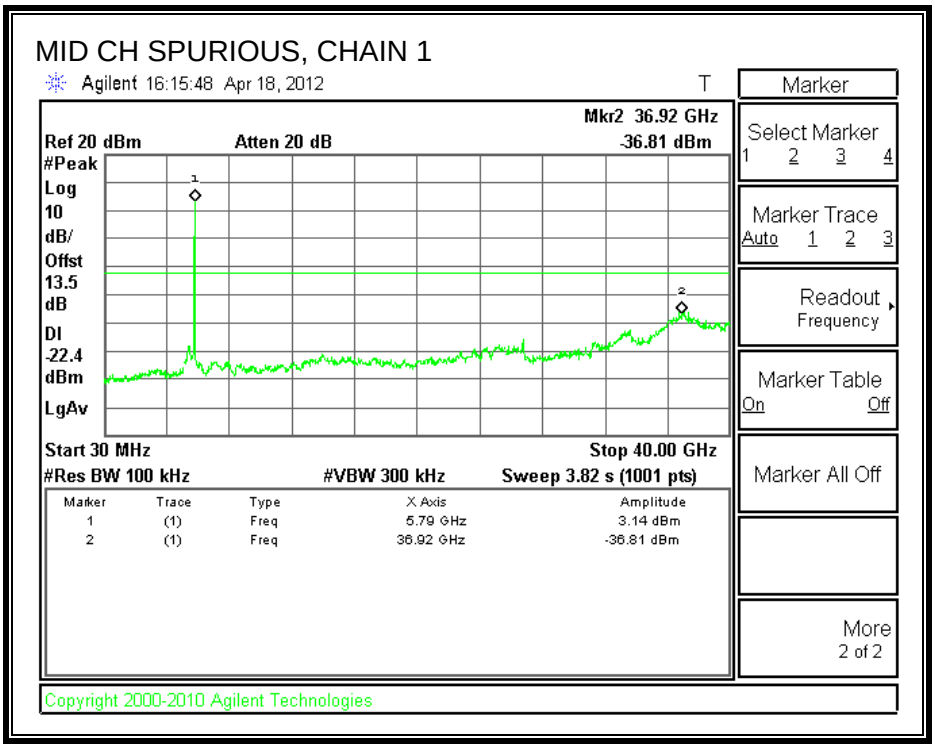
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

CHAIN 1 SPURIOUS EMISSIONS

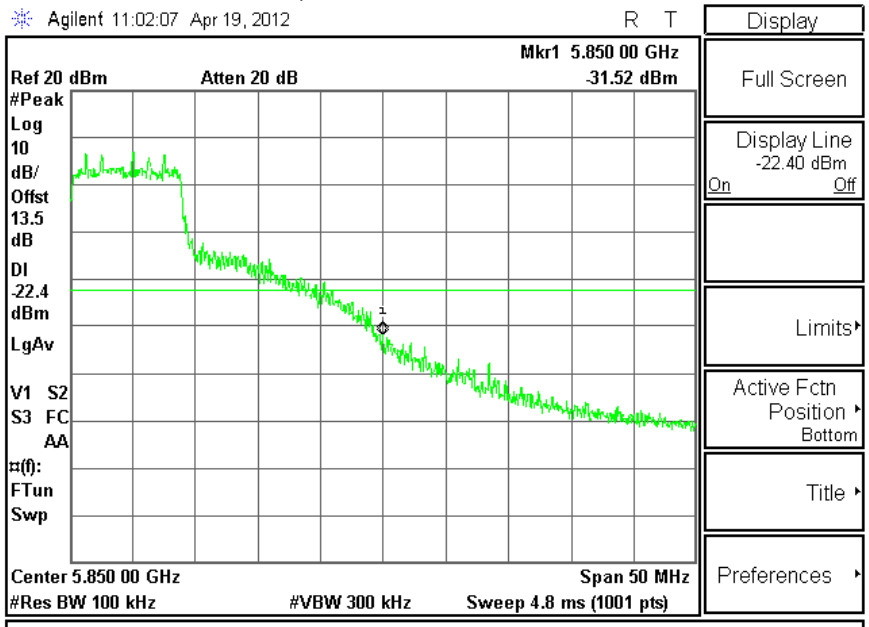




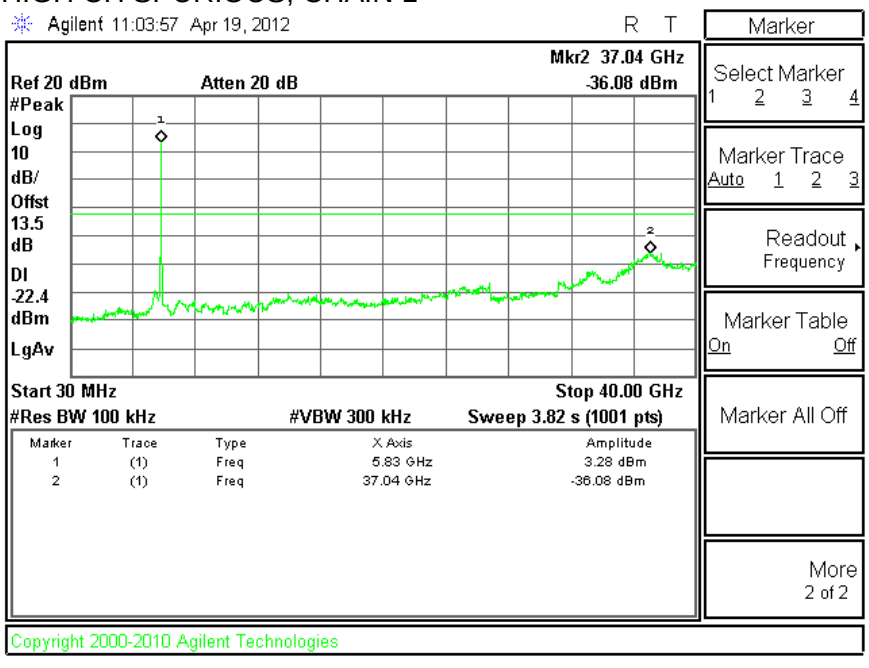




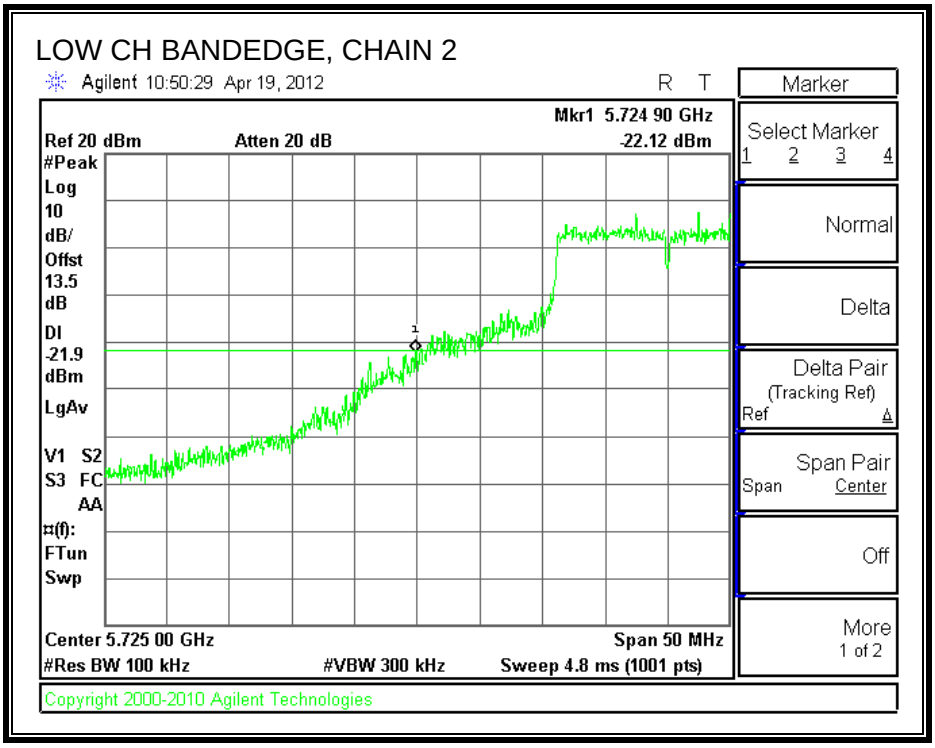
HIGH CH BANDEDGE, CHAIN 1

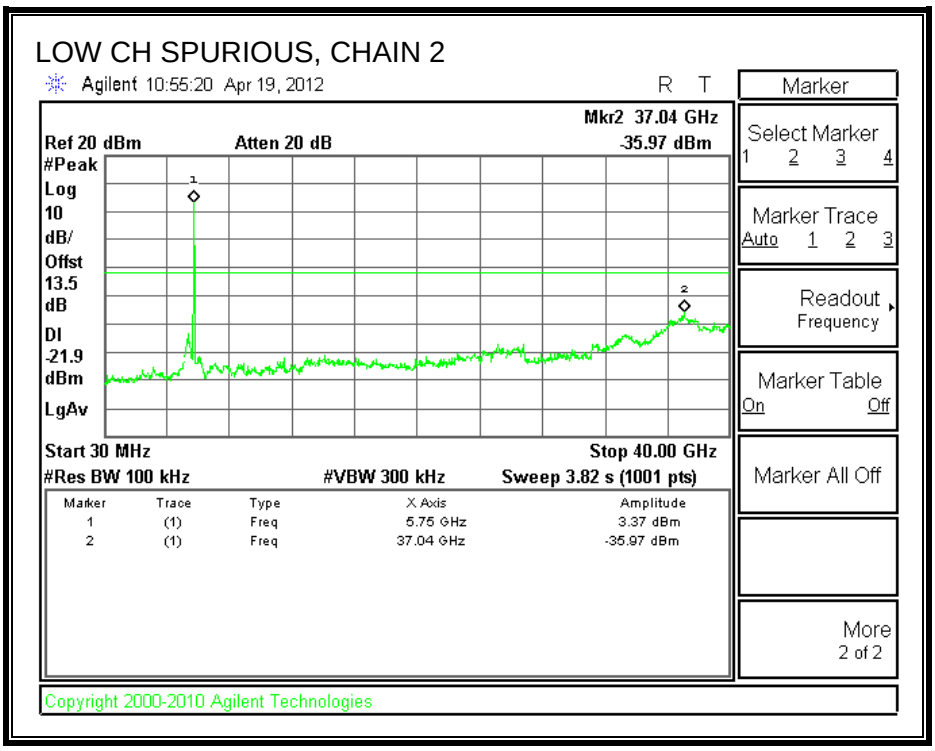


HIGH CH SPURIOUS, CHAIN 1

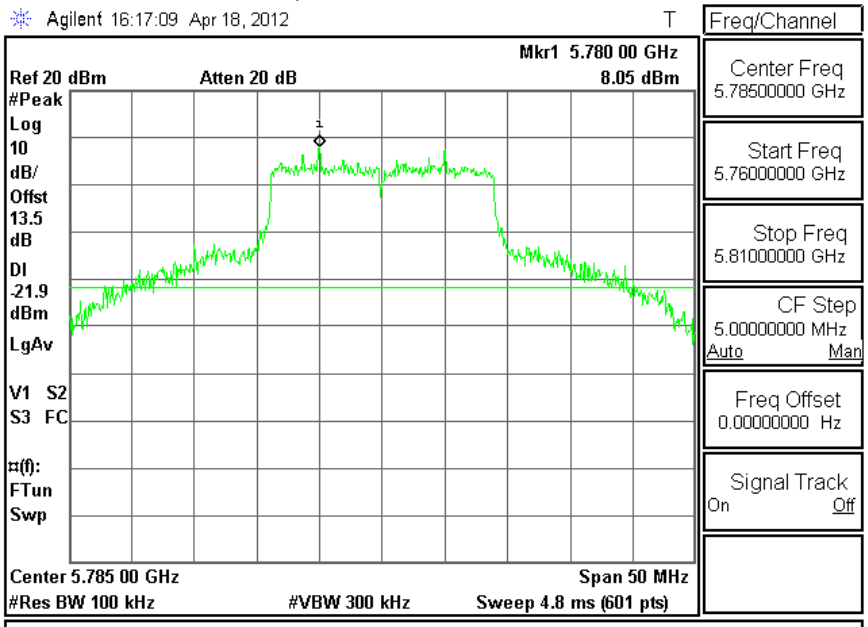


CHAIN 2 SPURIOUS EMISSIONS

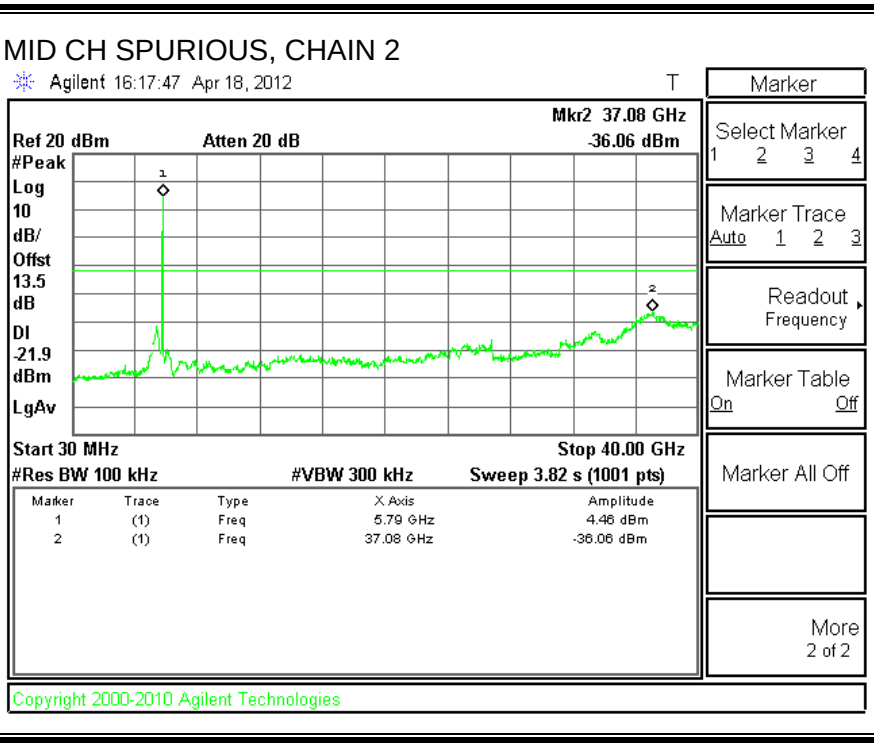




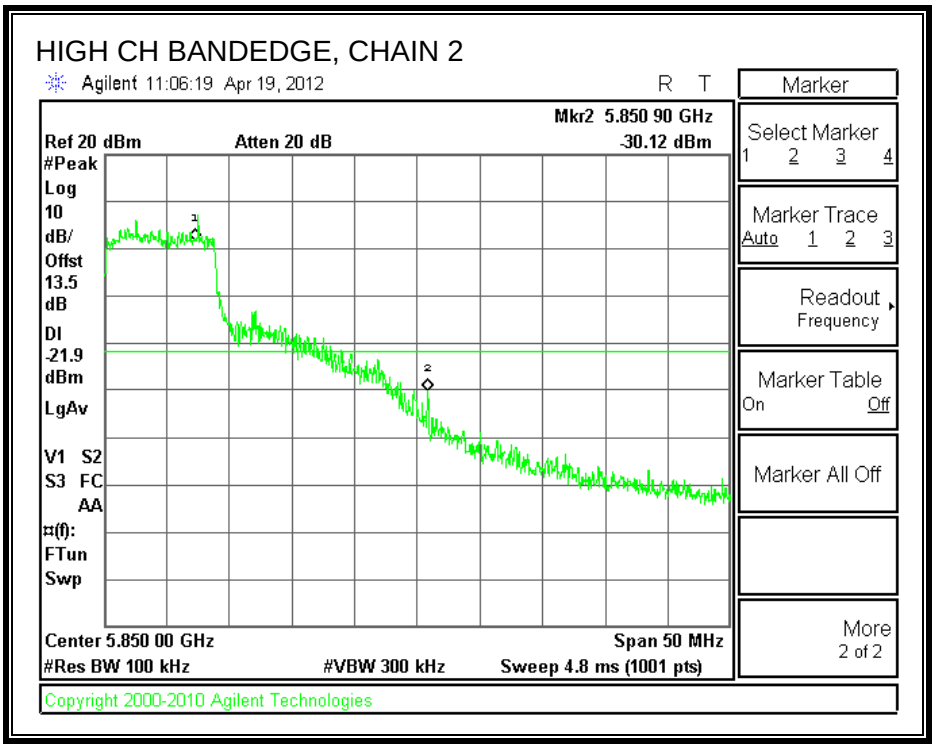
MID CH REFERENCE, CHAIN 2



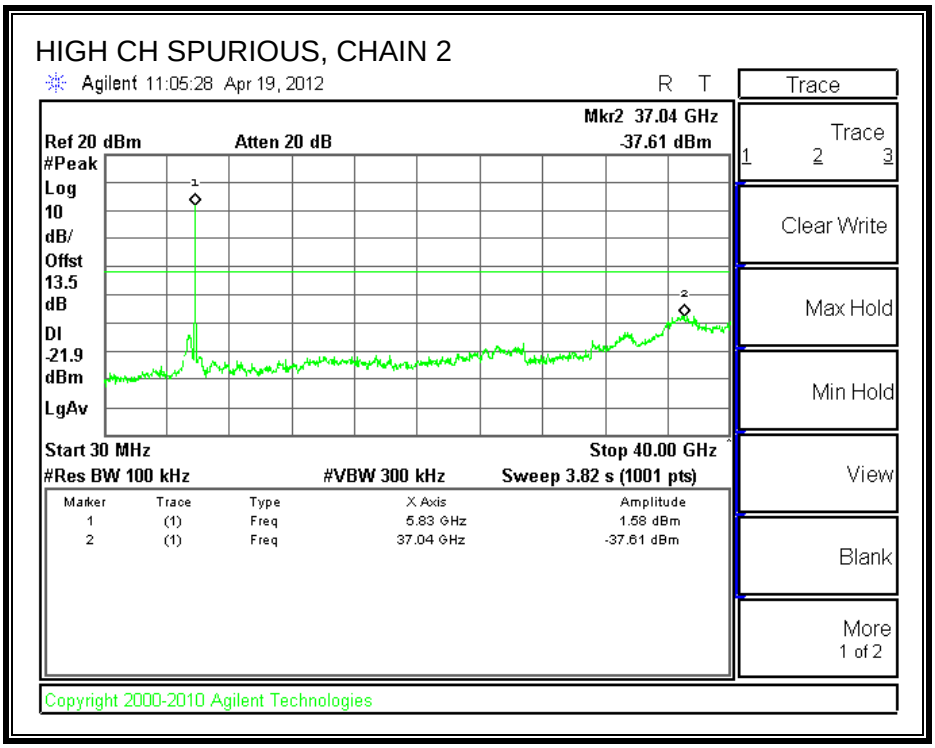
MID CH SPURIOUS, CHAIN 2



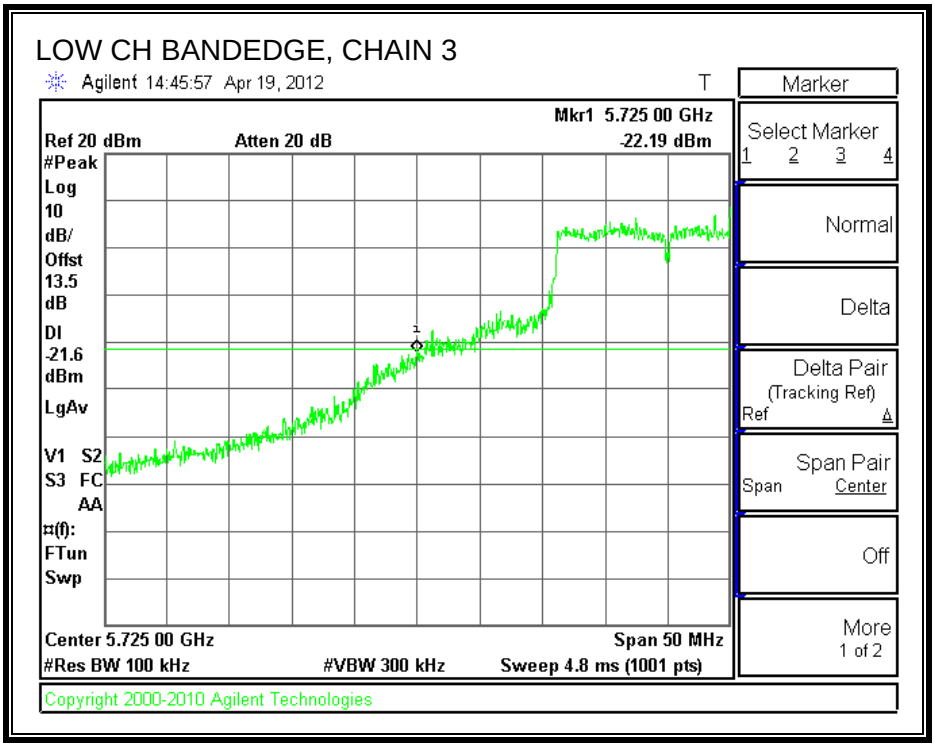
HIGH CH BANDEDGE, CHAIN 2

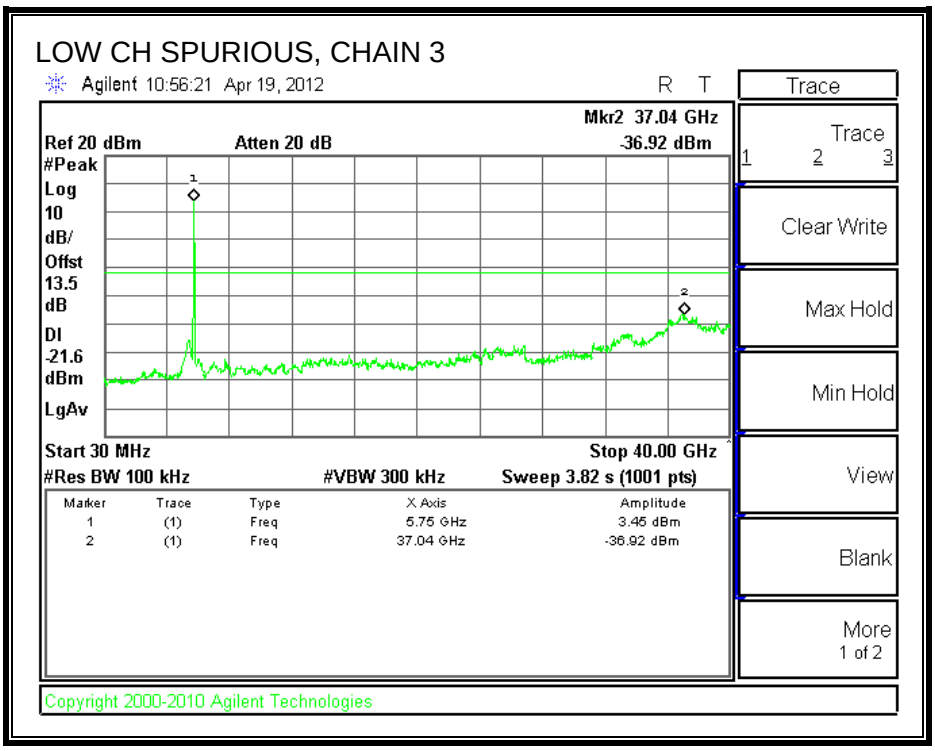


HIGH CH SPURIOUS, CHAIN 2

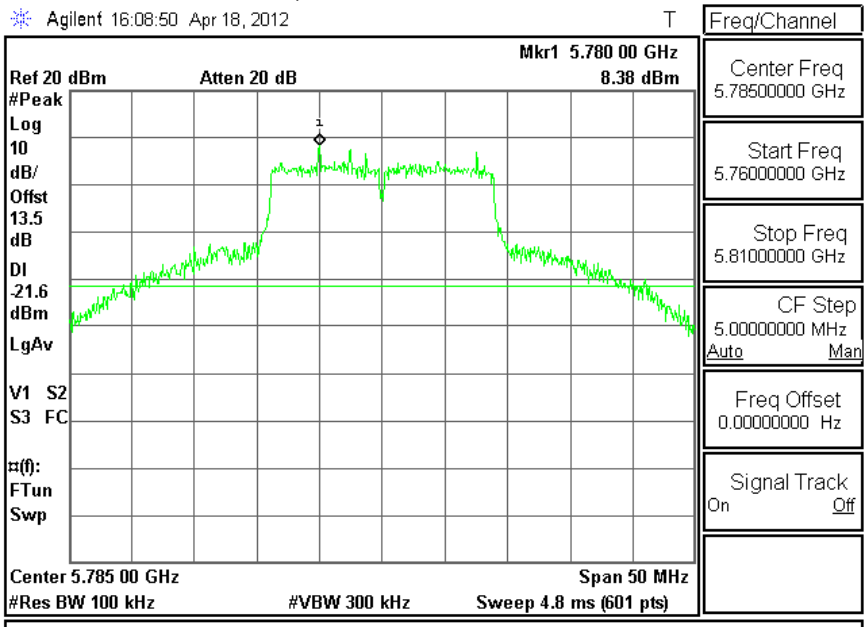


CHAIN 3 SPURIOUS EMISSIONS

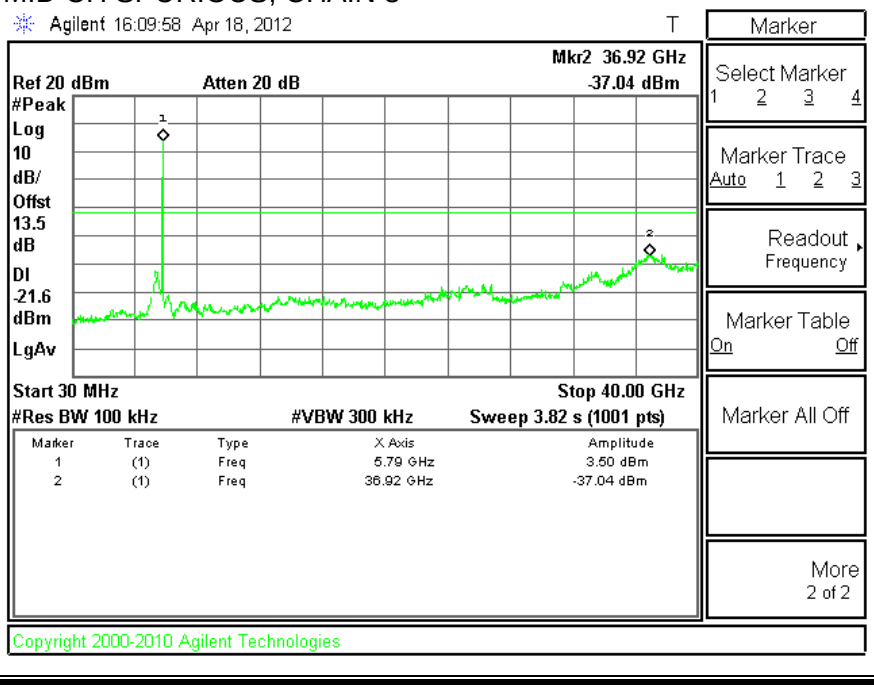




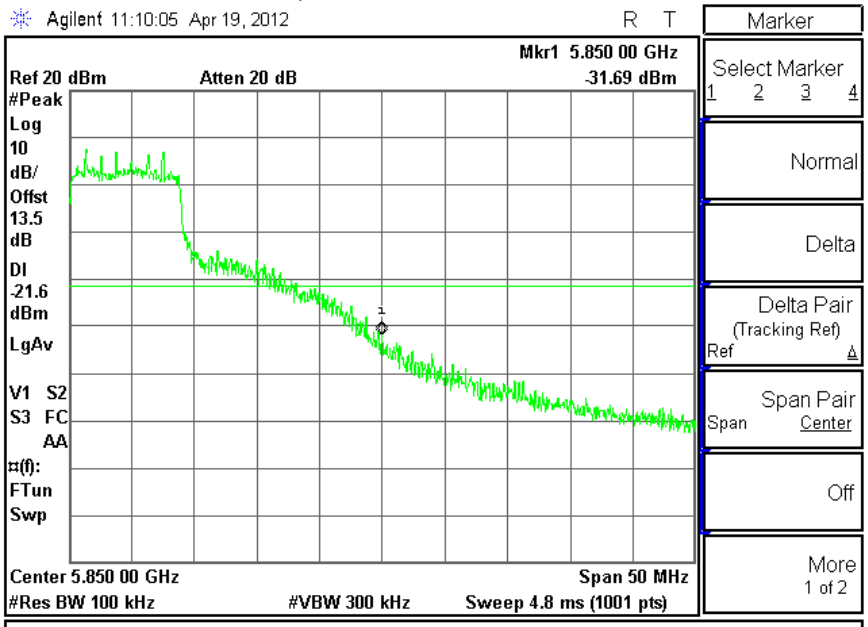
MID CH REFERENCE, CHAIN 3



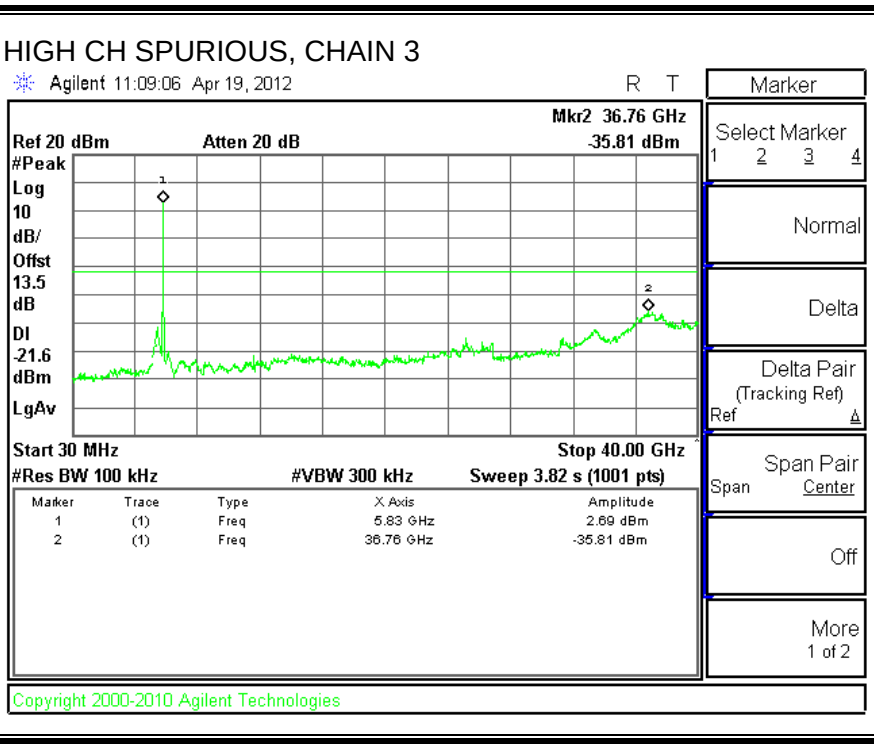
MID CH SPURIOUS, CHAIN 3



HIGH CH BANDEDGE, CHAIN 3



HIGH CH SPURIOUS, CHAIN 3



7.5. 802.11n HT40 CDD 3TX 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 6 dB bandwidth shall be at least 500 kHz.

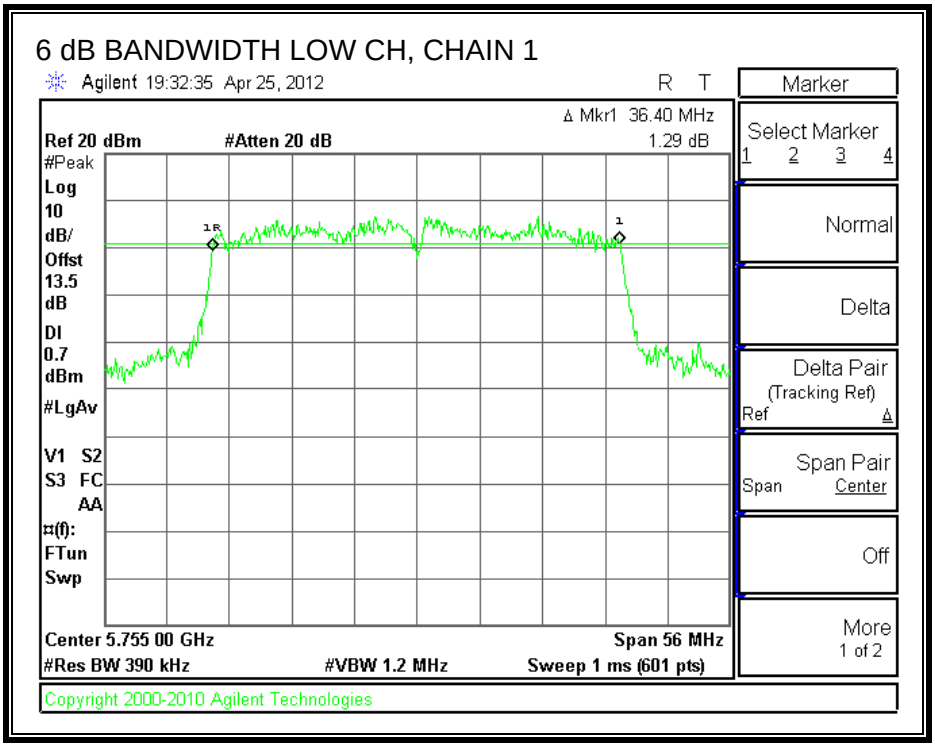
TEST PROCEDURE

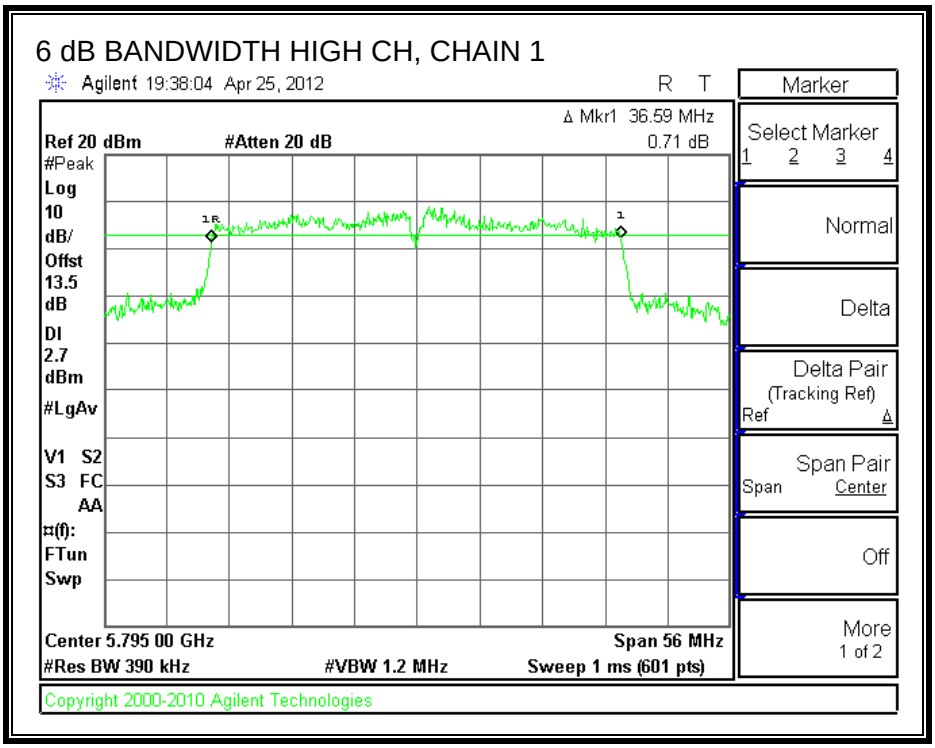
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

RESULTS

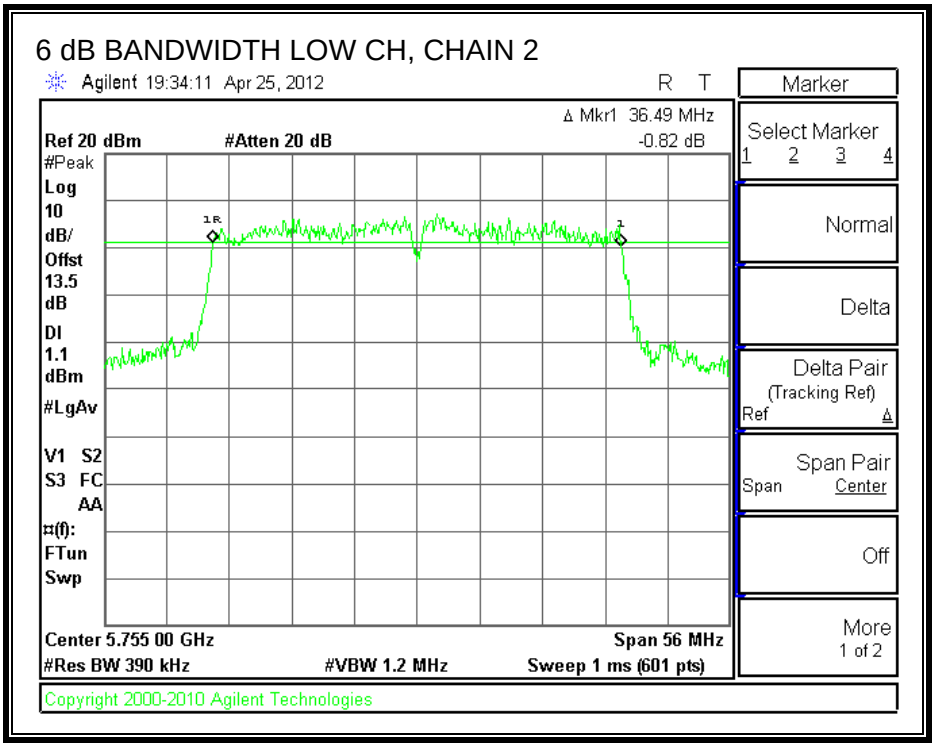
Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Chain 3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5755	36.40	36.49	36.68	0.5
High	5795	36.59	36.40	36.68	0.5

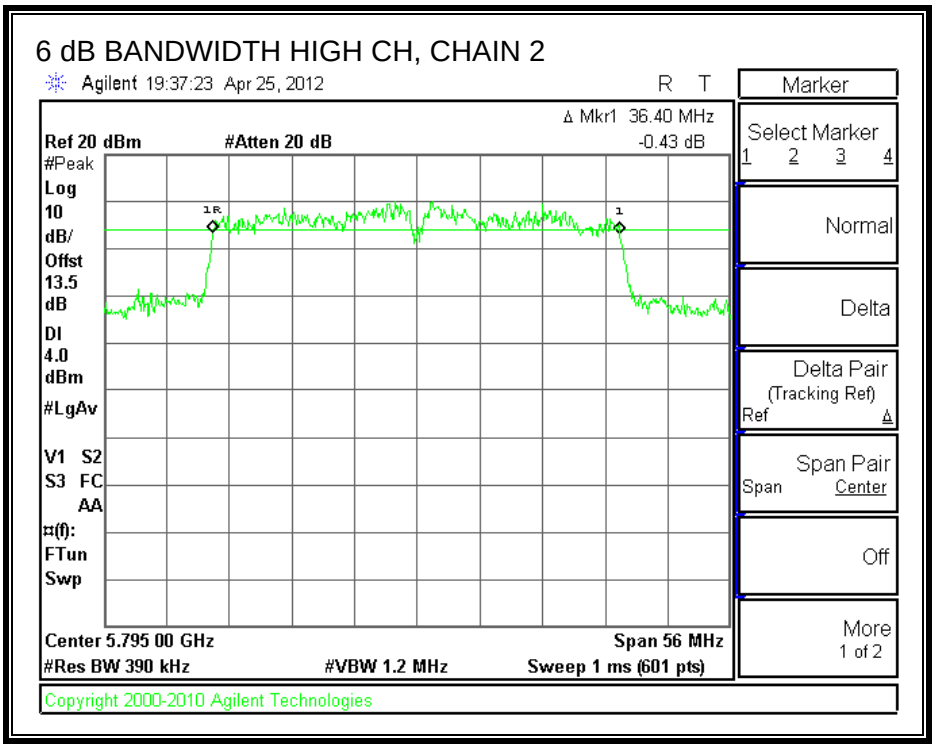
6 dB BANDWIDTH, CHAIN 1



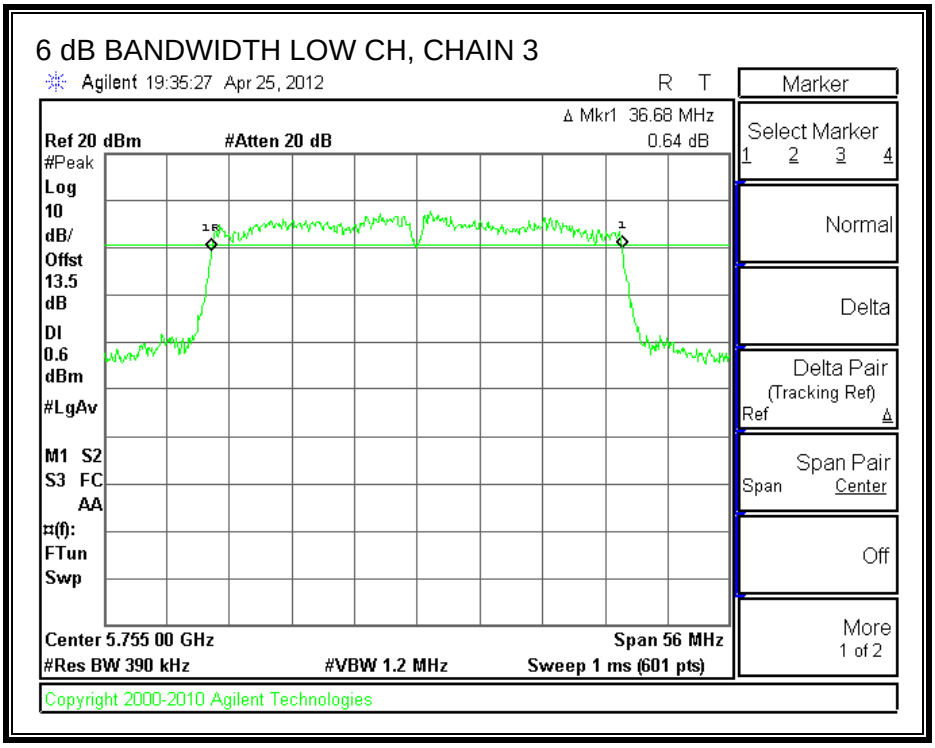


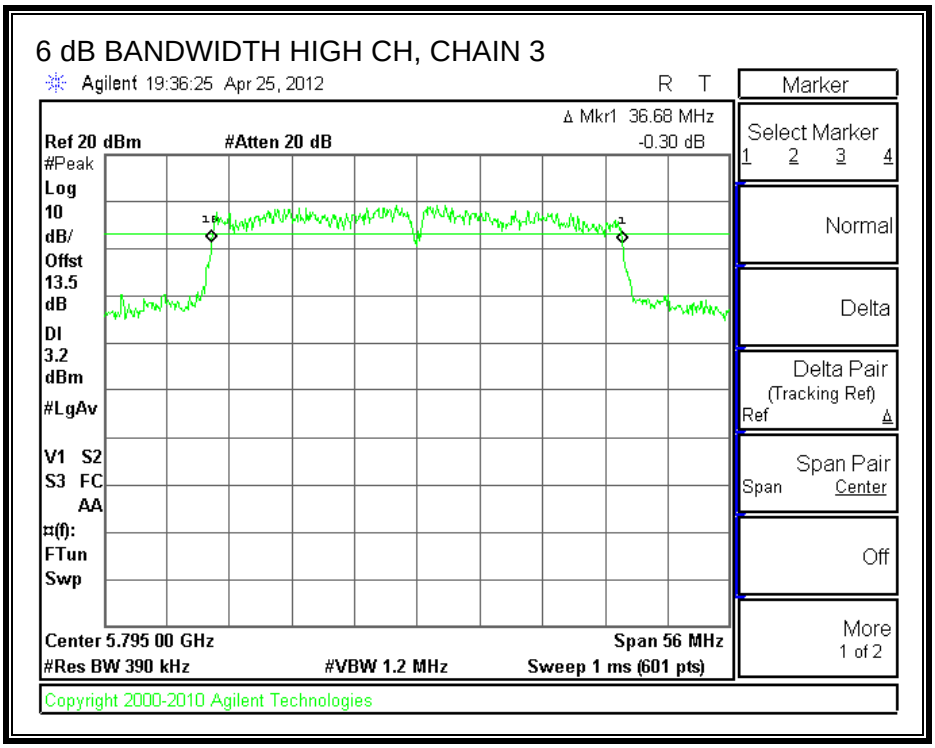
6 dB BANDWIDTH, CHAIN 2





6 dB BANDWIDTH, CHAIN 3





7.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

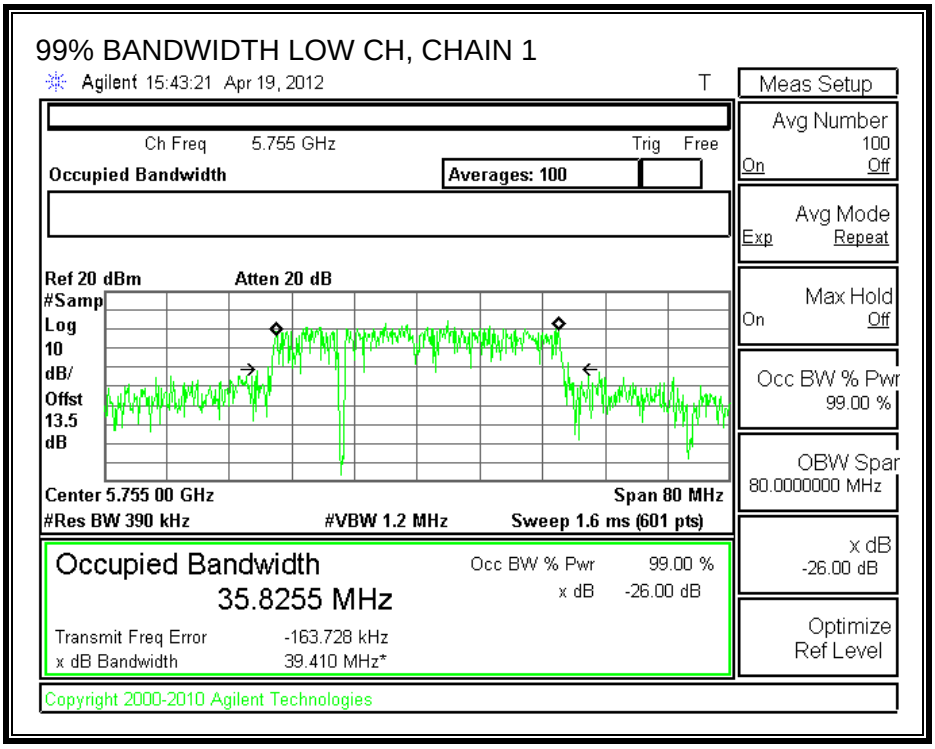
TEST PROCEDURE

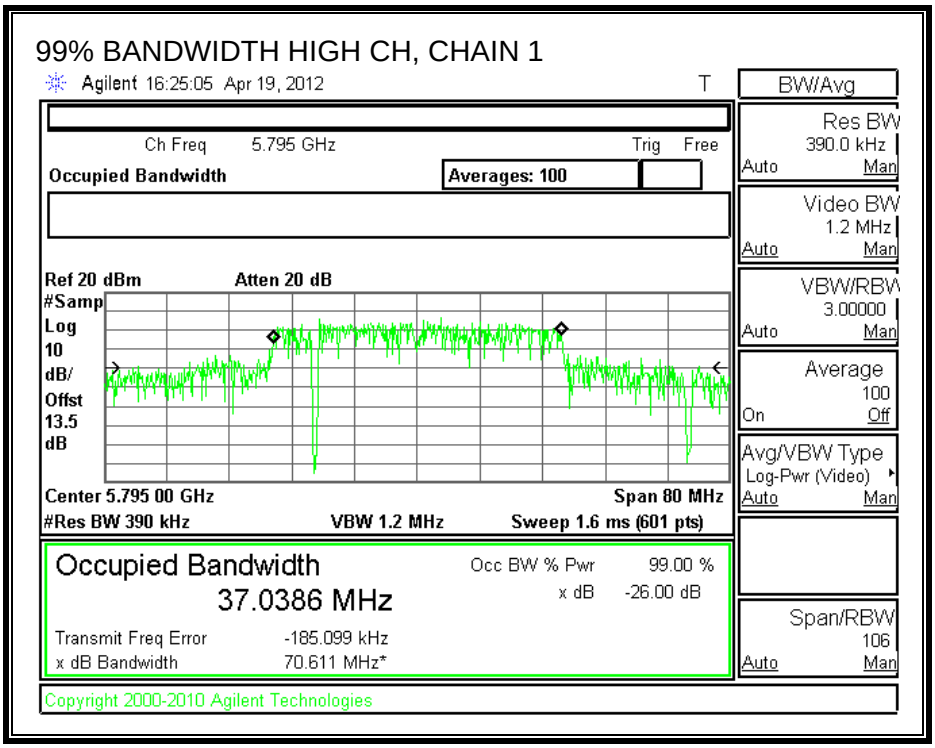
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

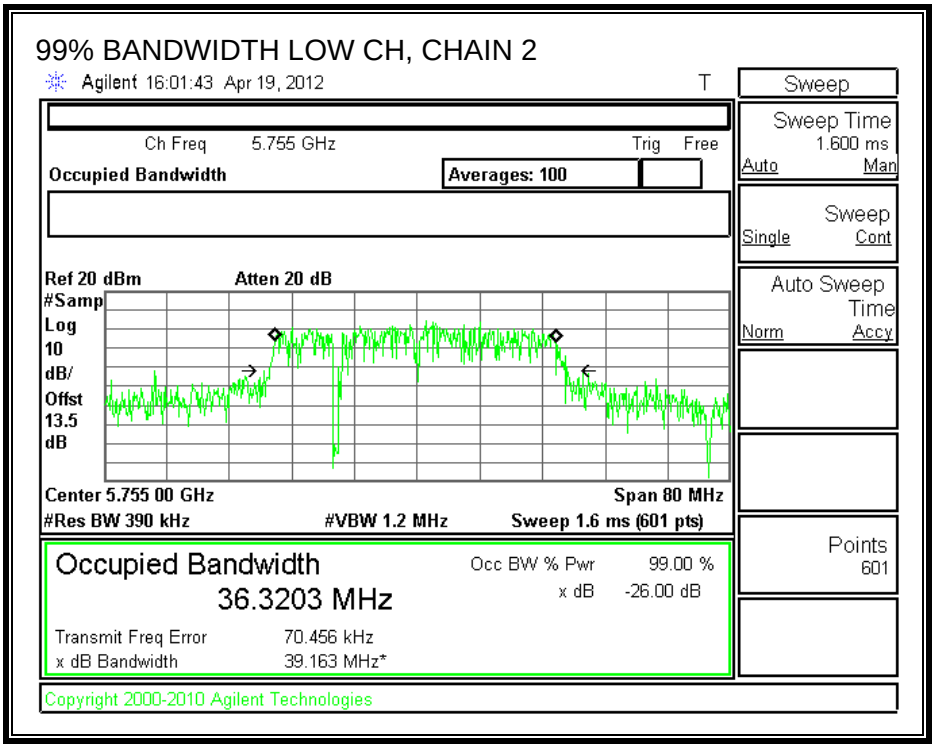
Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	5755	35.8255	36.3203	37.4694
High	5795	37.0386	37.4512	37.6377

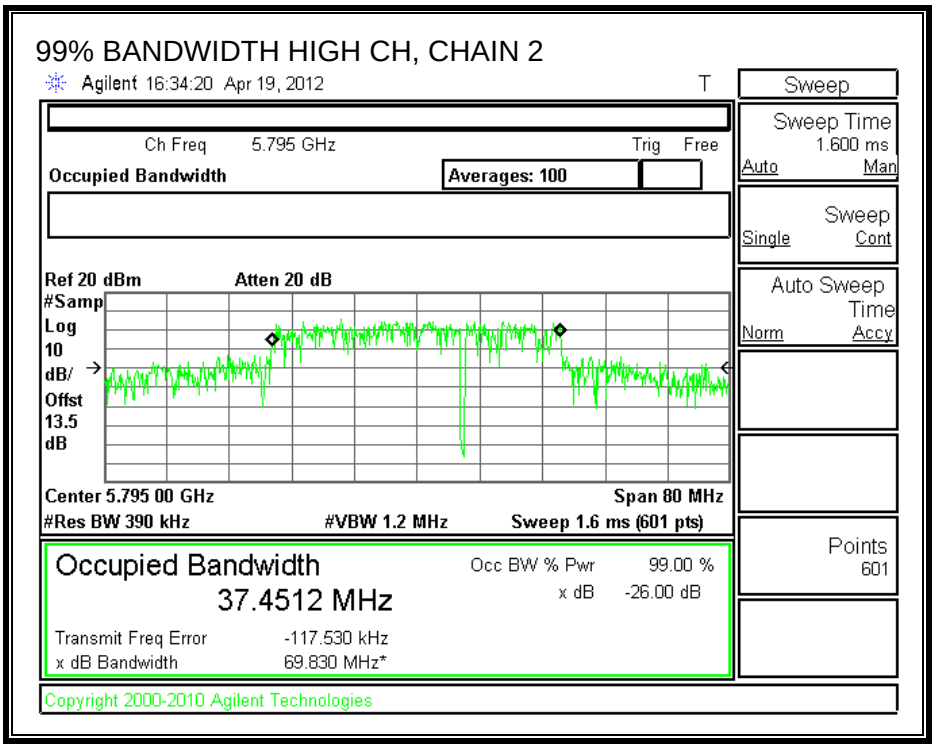
99% BANDWIDTH, CHAIN 1



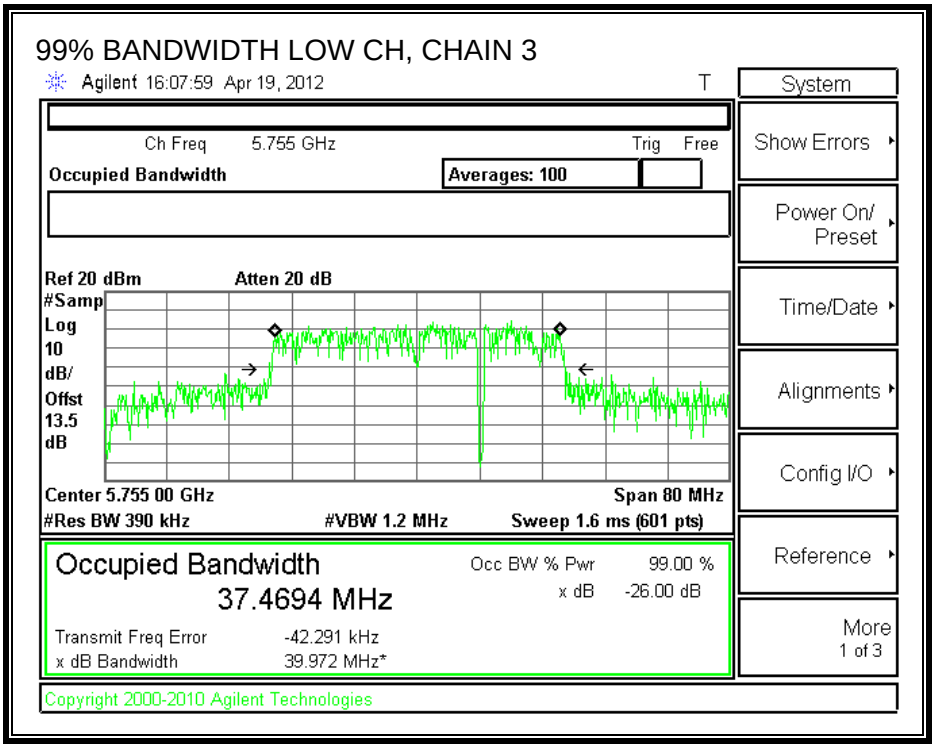


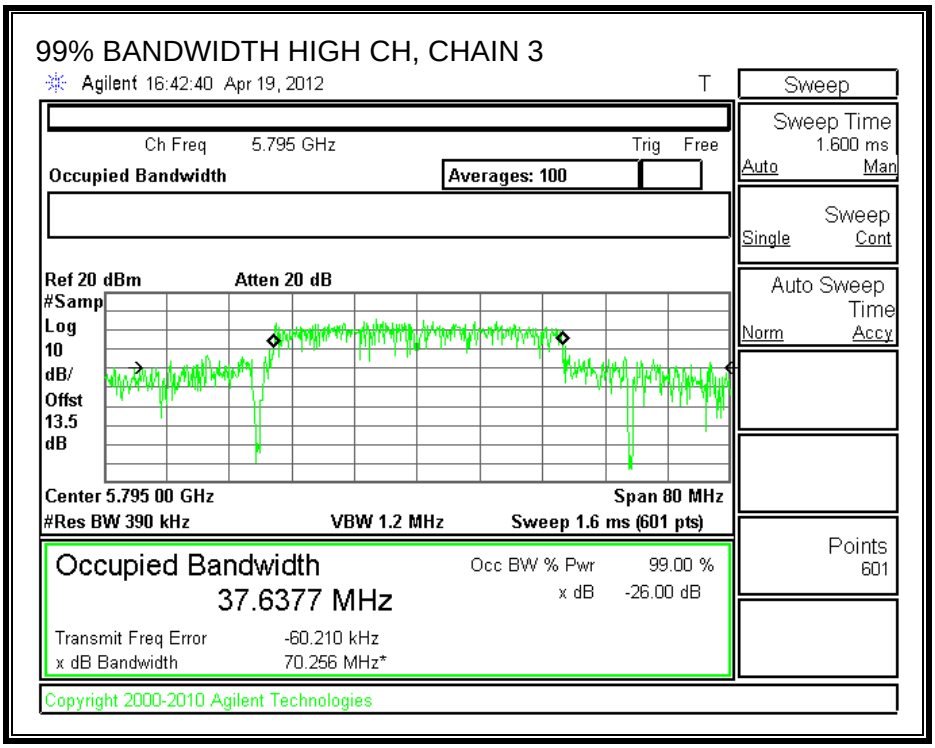
99% BANDWIDTH, CHAIN 2





99% BANDWIDTH, CHAIN 3





7.5.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Chain 3 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
4.86	1.95	3.09	8.15

The maximum effective legacy gain is 9.05 dBi for other than fixed, point-to-point operations, therefore the limit is 27.85 dBm.

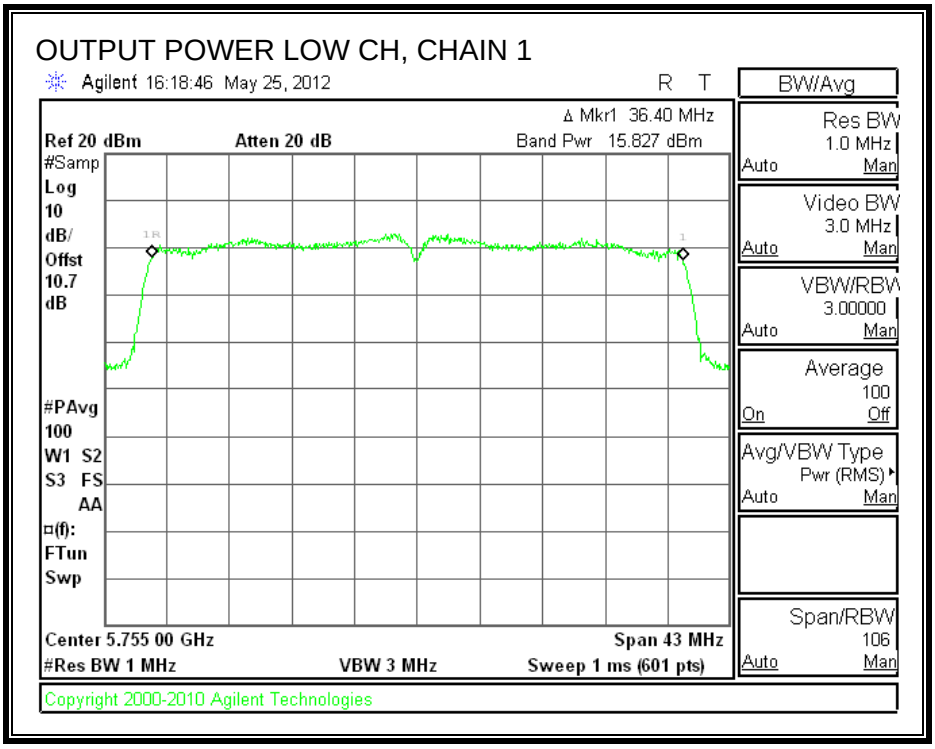
TEST PROCEDURE

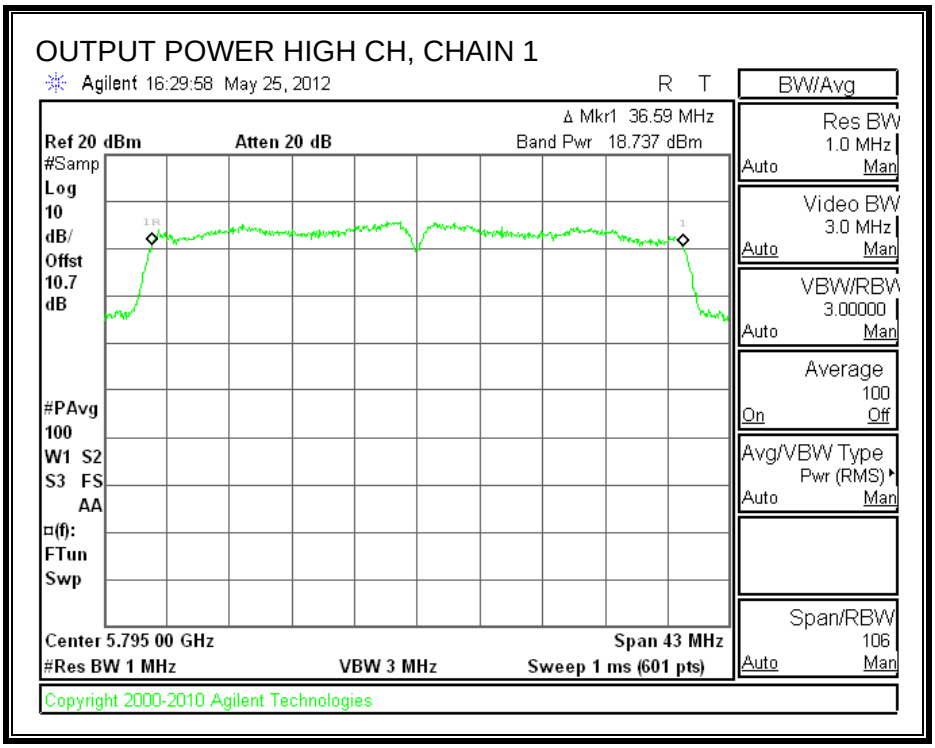
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

RESULTS

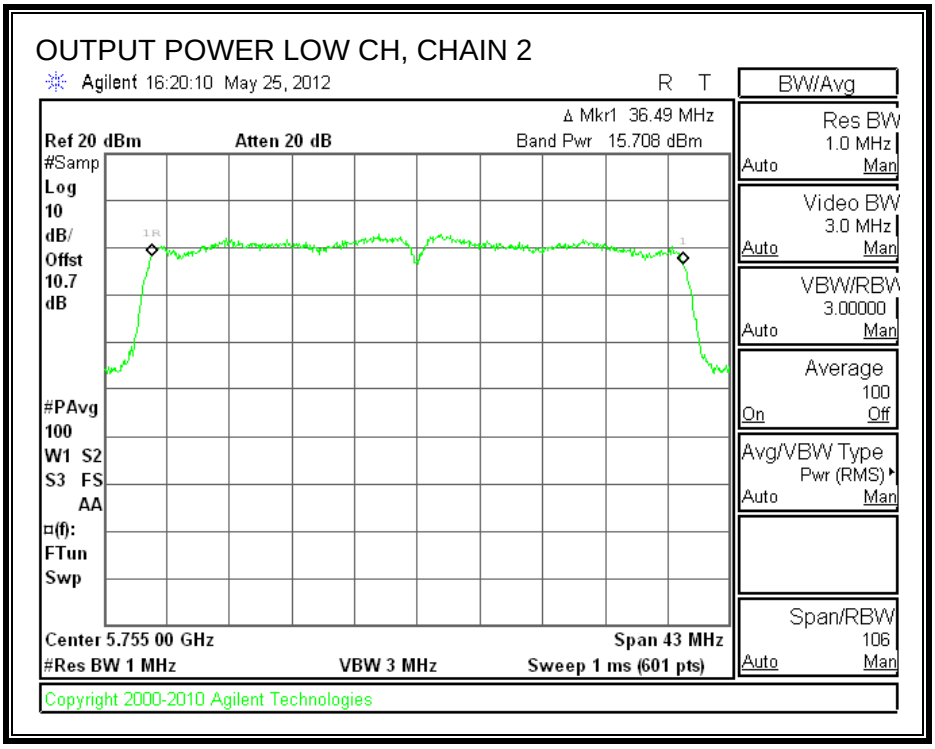
Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Chain 3 PK Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5755	15.827	15.708	15.412	20.424	27.85	-7.426
High	5795	18.737	18.883	18.822	23.586	27.85	-4.264

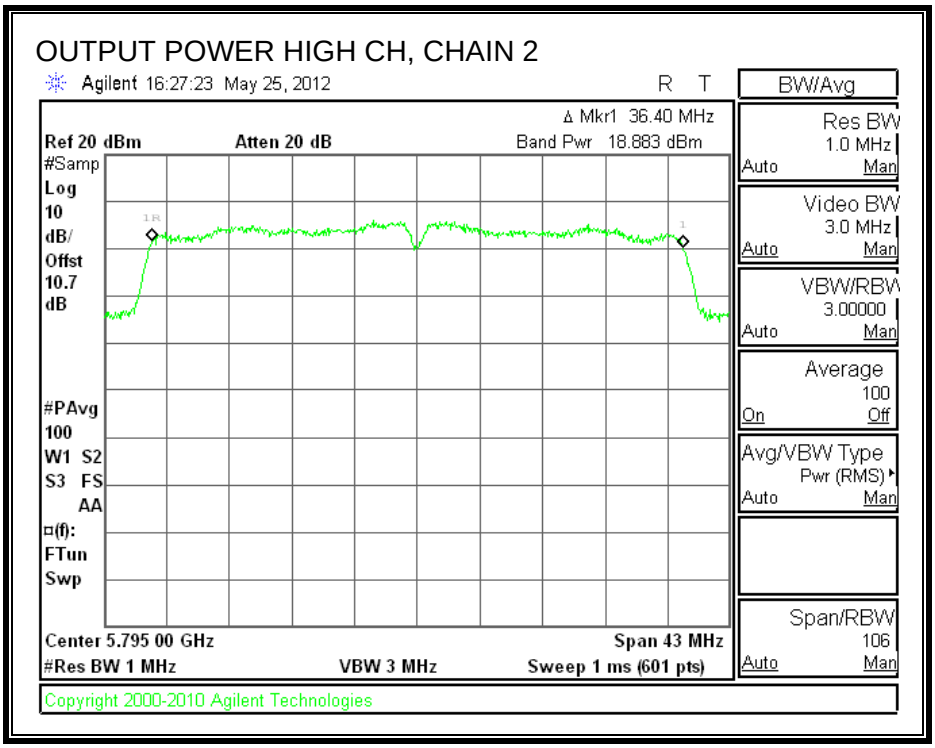
CHAIN 1 OUTPUT POWER



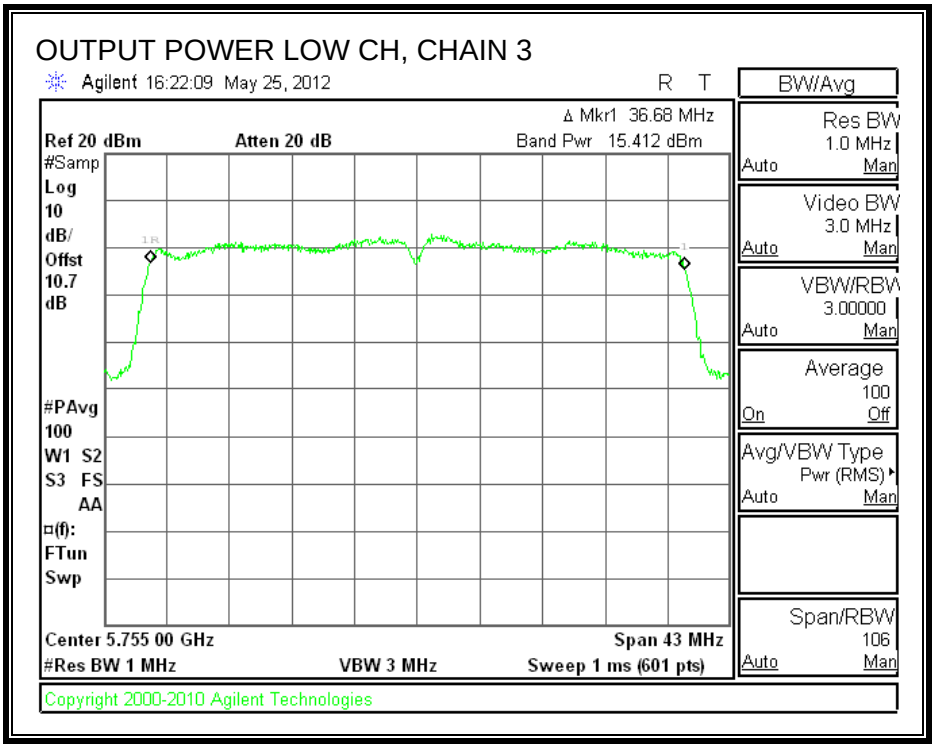


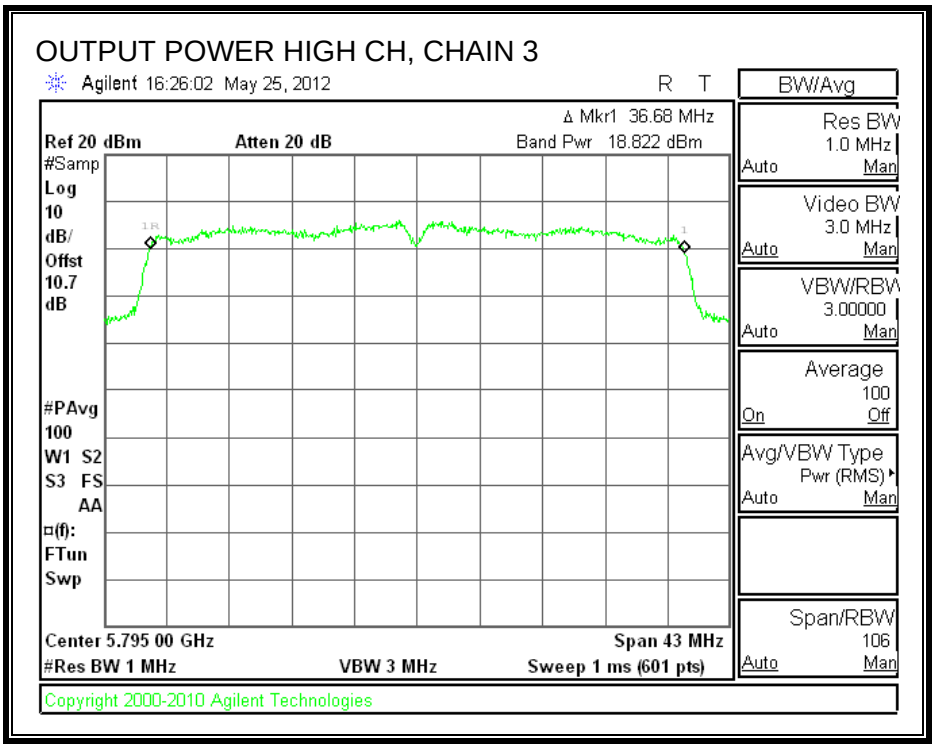
CHAIN 2 OUTPUT POWER





CHAIN 3 OUTPUT POWER





7.5.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

TEST PROCEDURE

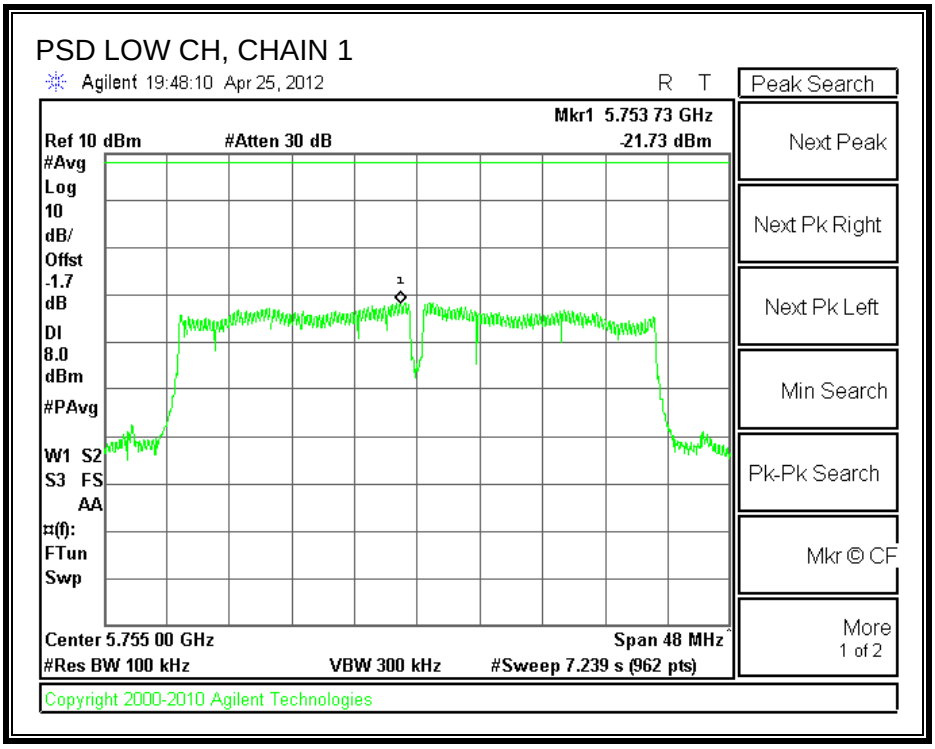
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

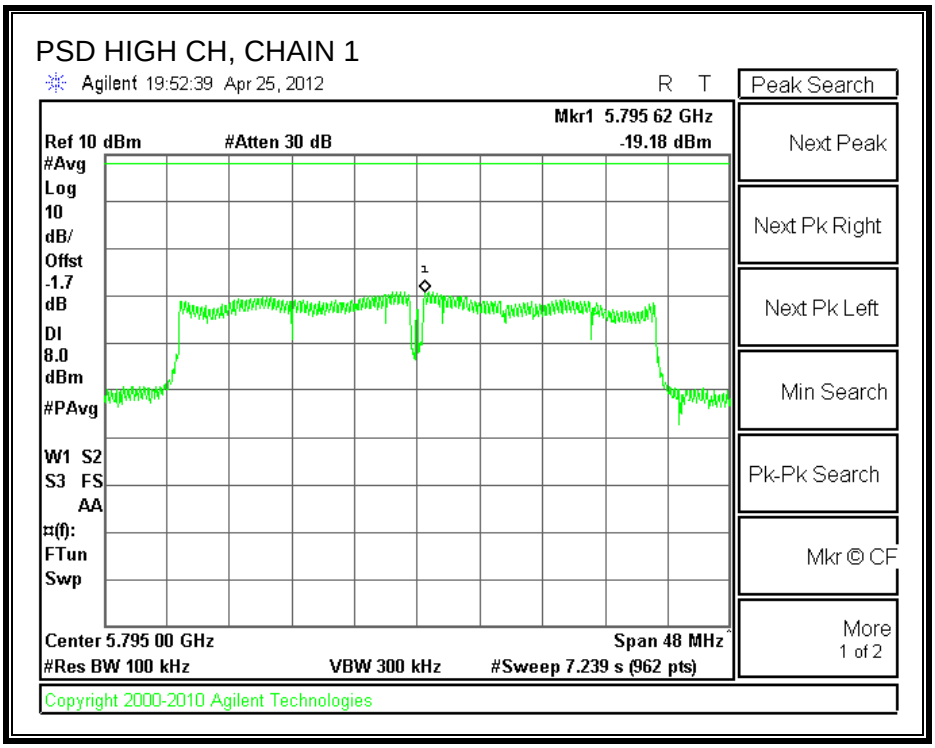
RESULTS:

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Chain 3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5755	-21.73	-21.67	-21.34	-16.81	8	-24.81
High	5795	-19.18	-18.86	-18.82	-14.18	8	-22.18

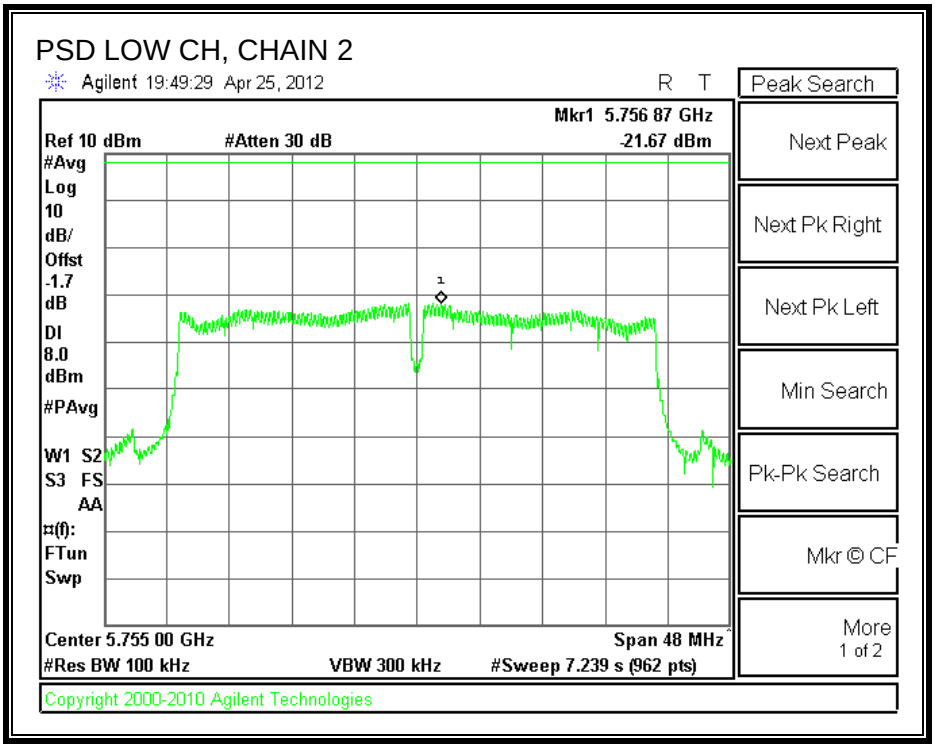
Note: The spectrum analyzer offset = attenuator loss + cable loss + 10 log(3/100 kHz) = -1.7 dB

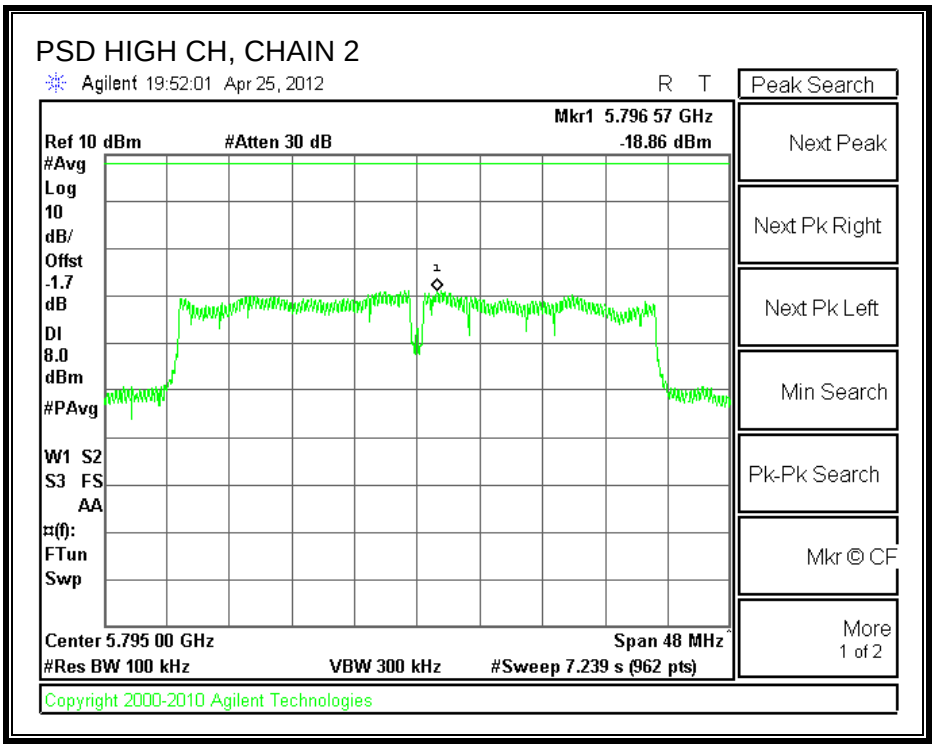
POWER SPECTRAL DENSITY, CHAIN 1



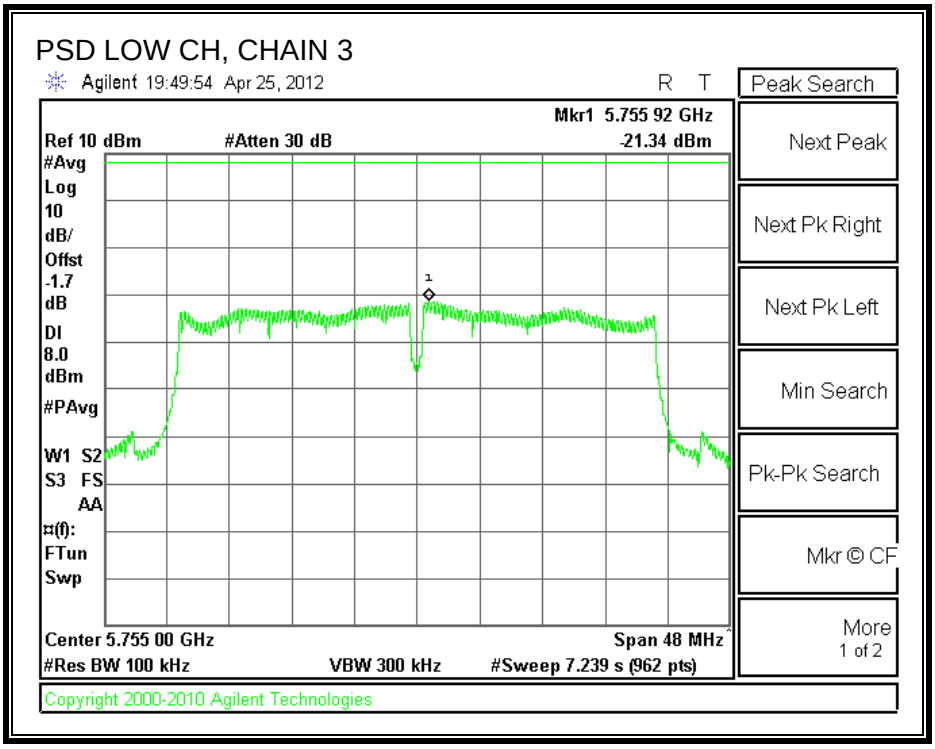


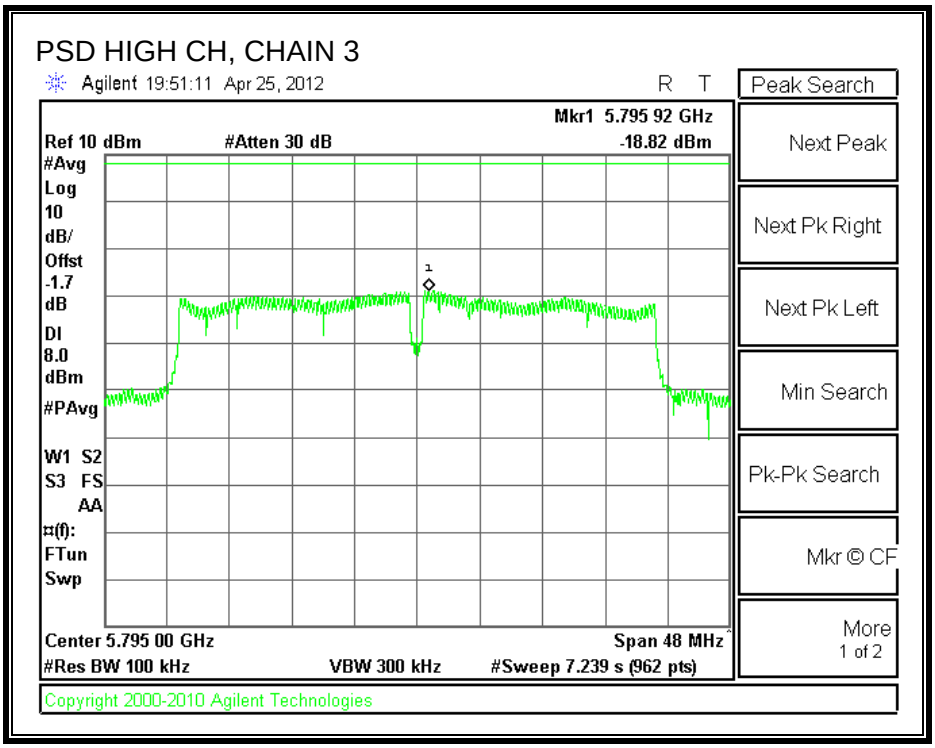
POWER SPECTRAL DENSITY, CHAIN 2





POWER SPECTRAL DENSITY, CHAIN 3





7.5.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

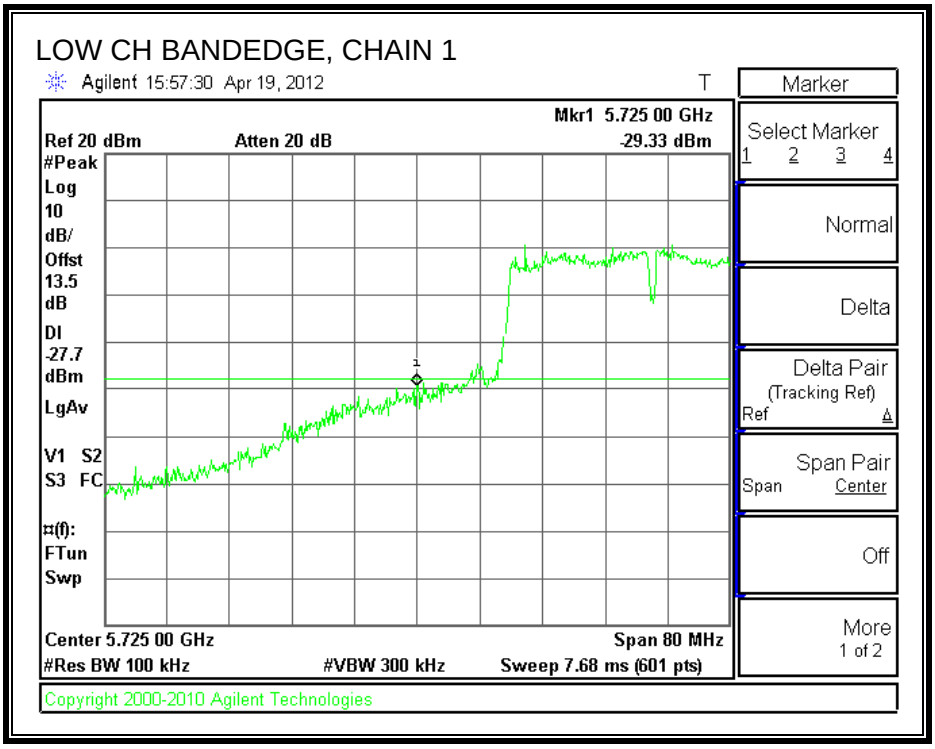
IC RSS-210 A8.5

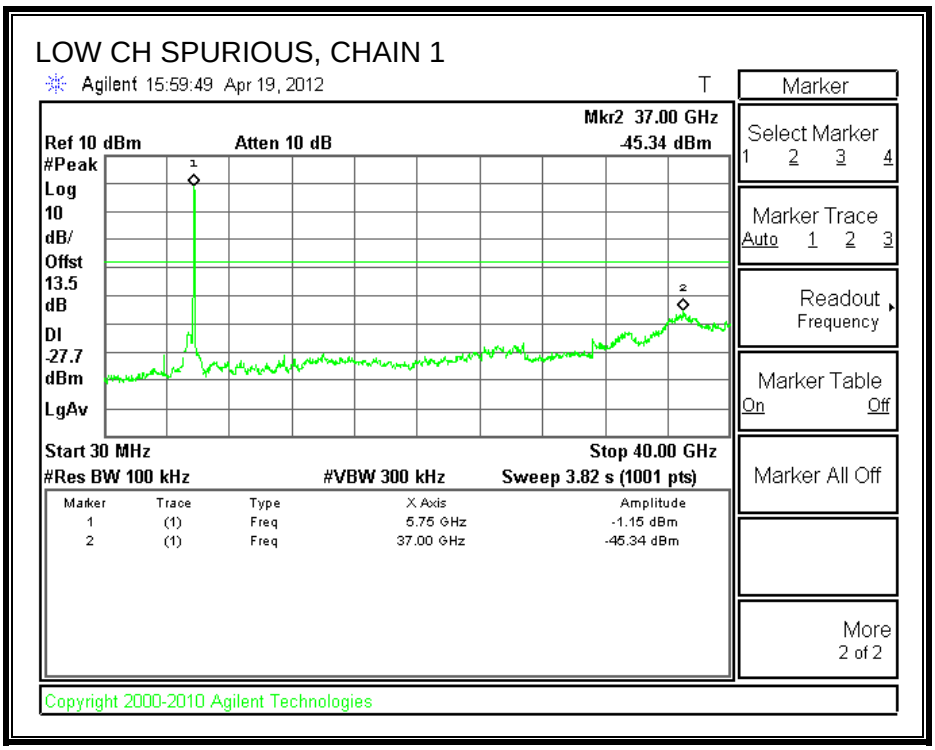
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

TEST PROCEDURE

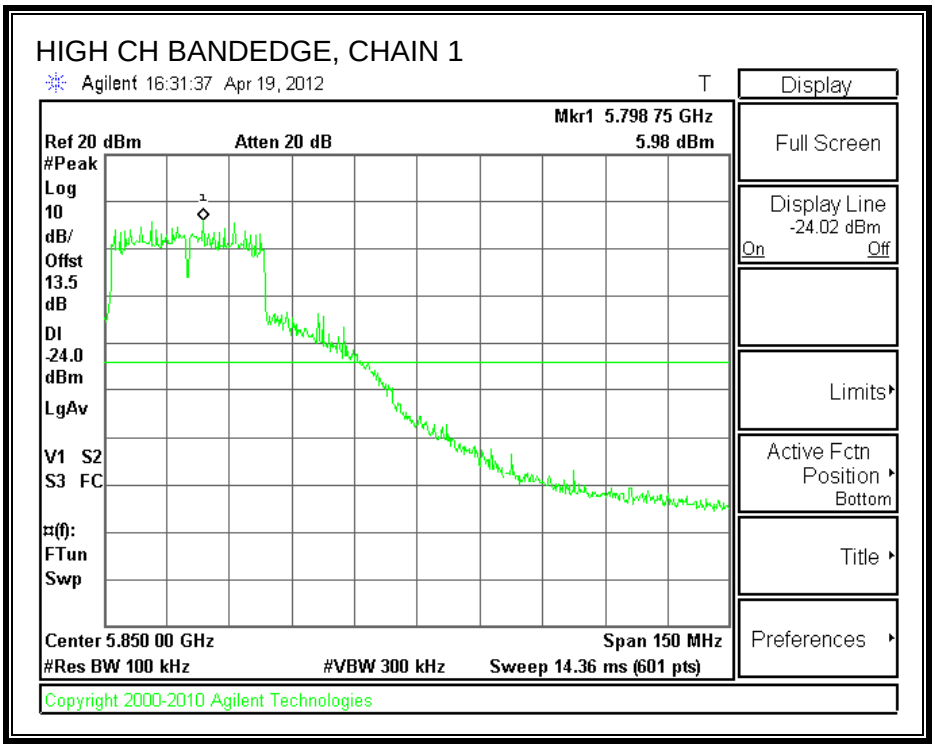
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

CHAIN 1 SPURIOUS EMISSIONS

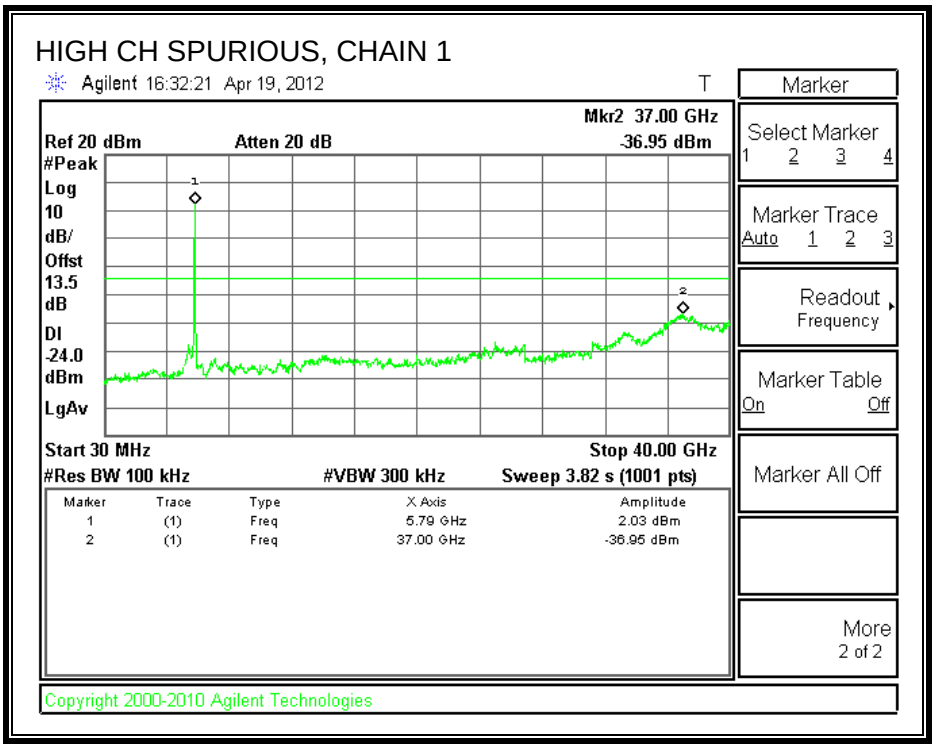




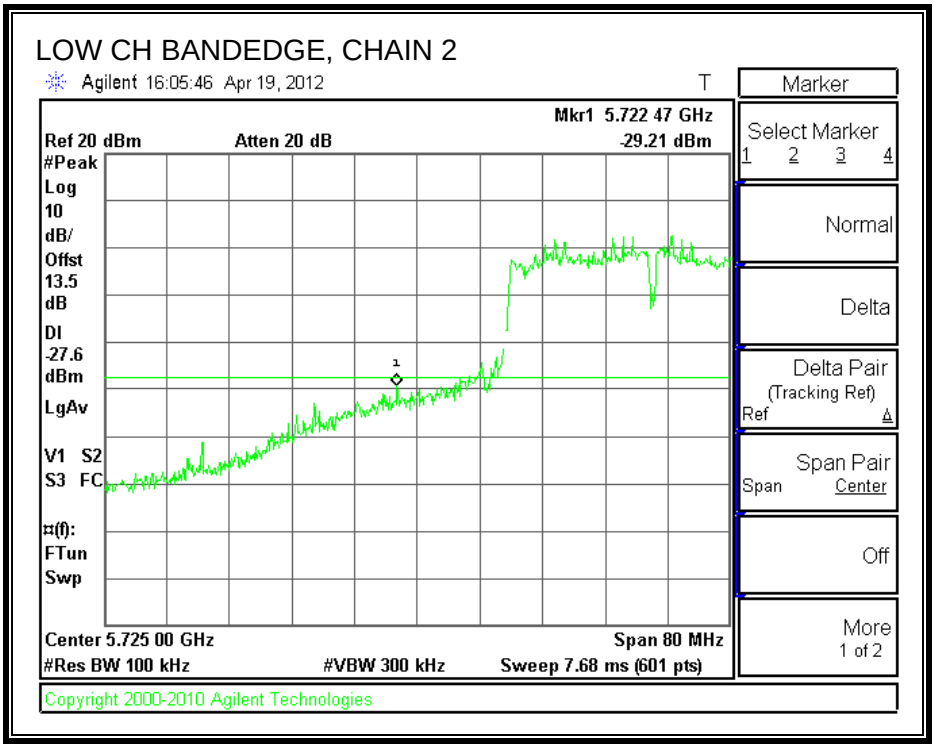
HIGH CH BANDEDGE, CHAIN 1

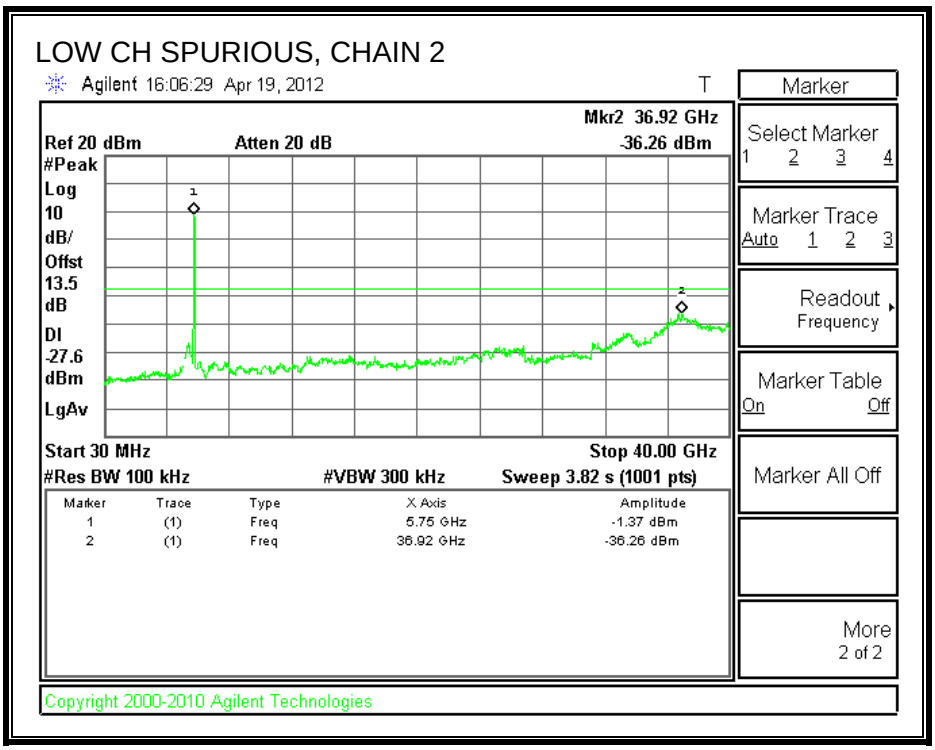


HIGH CH SPURIOUS, CHAIN 1

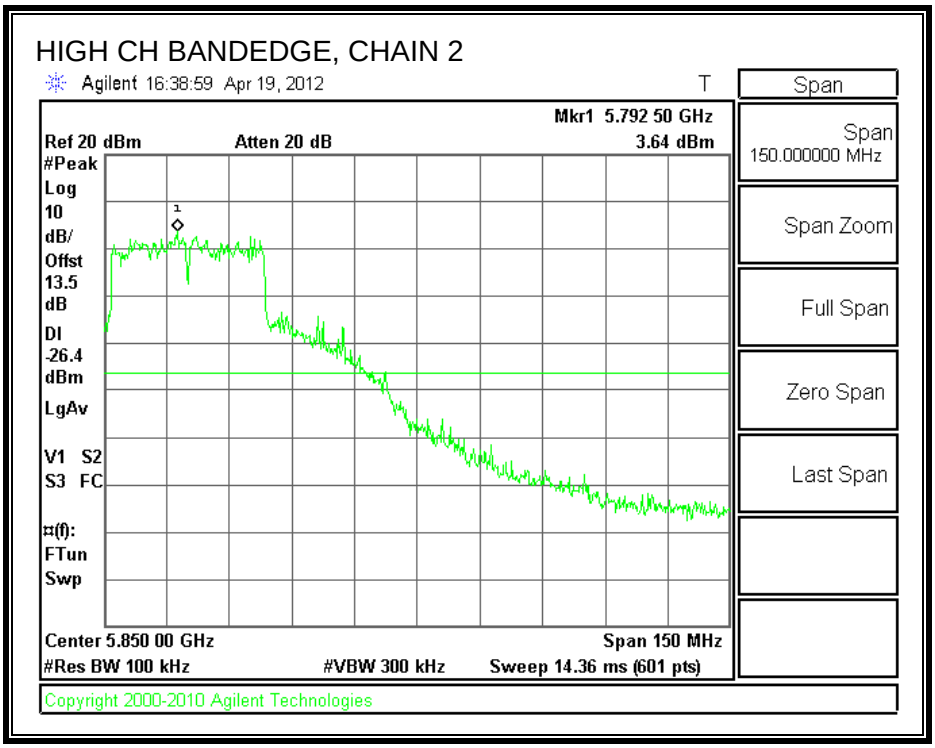


CHAIN 2 SPURIOUS EMISSIONS

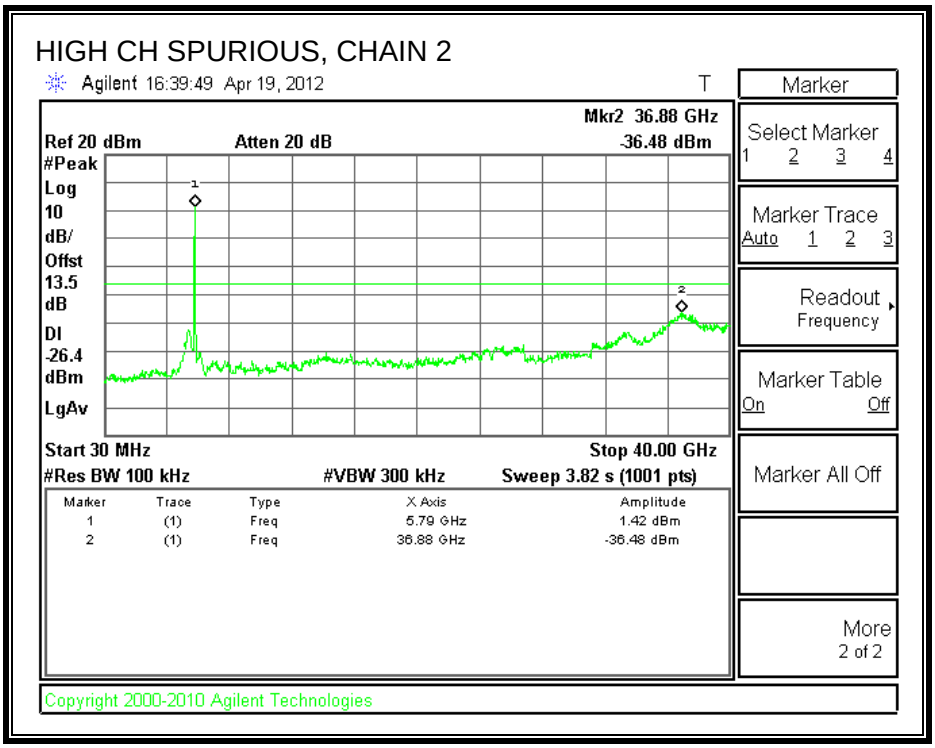




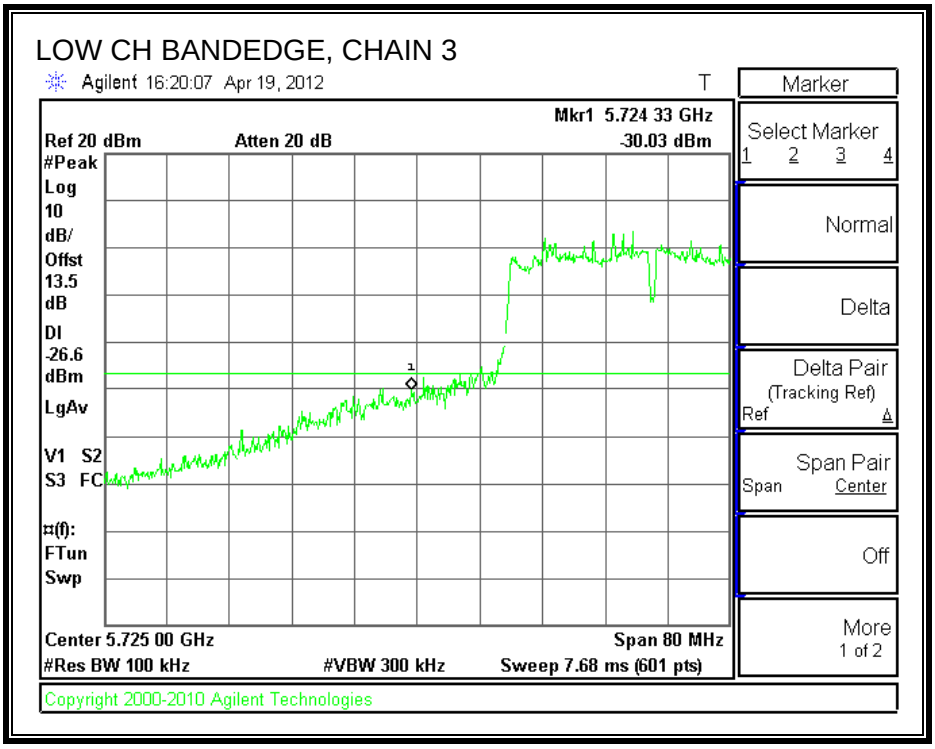
HIGH CH BANDEDGE, CHAIN 2

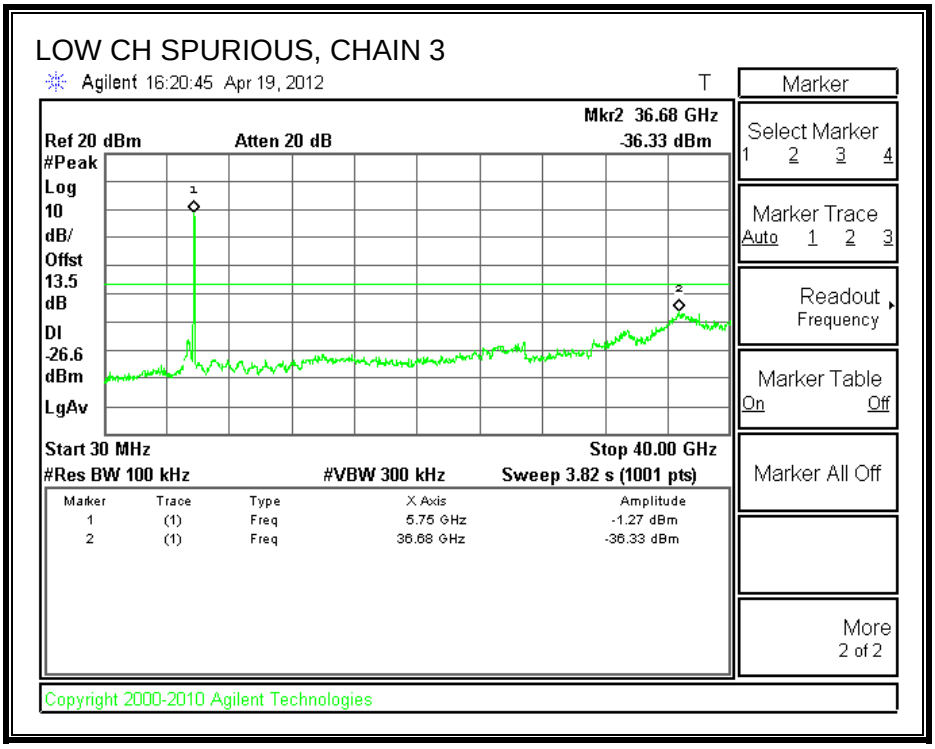


HIGH CH SPURIOUS, CHAIN 2

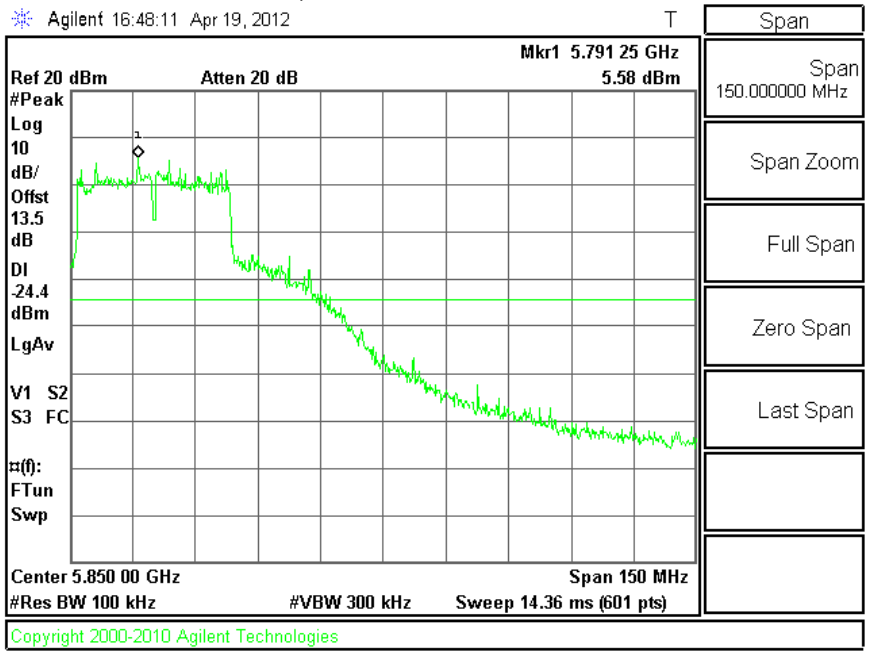


CHAIN 3 SPURIOUS EMISSIONS

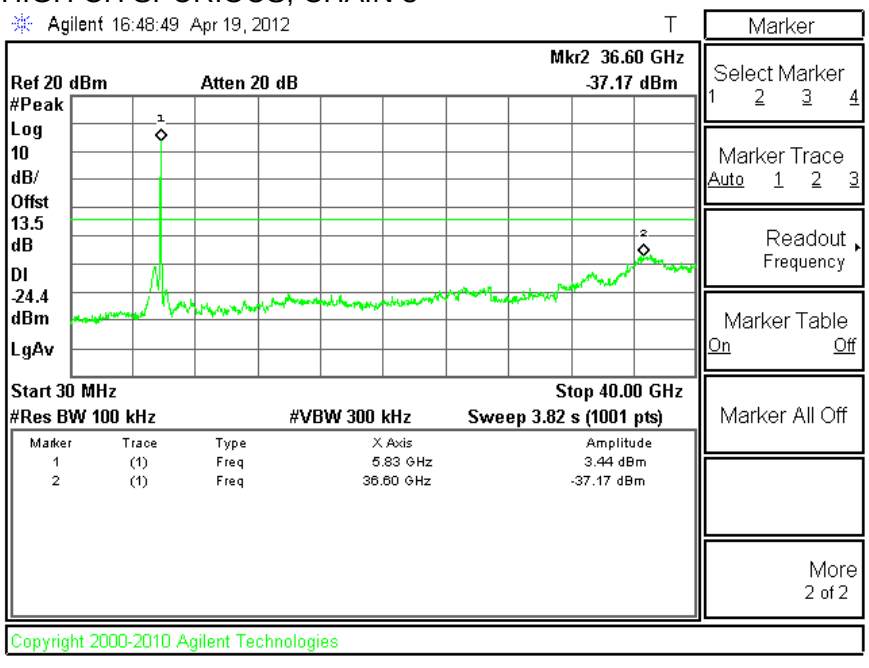




HIGH CH BANDEDGE, CHAIN 3



HIGH CH SPURIOUS, 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 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

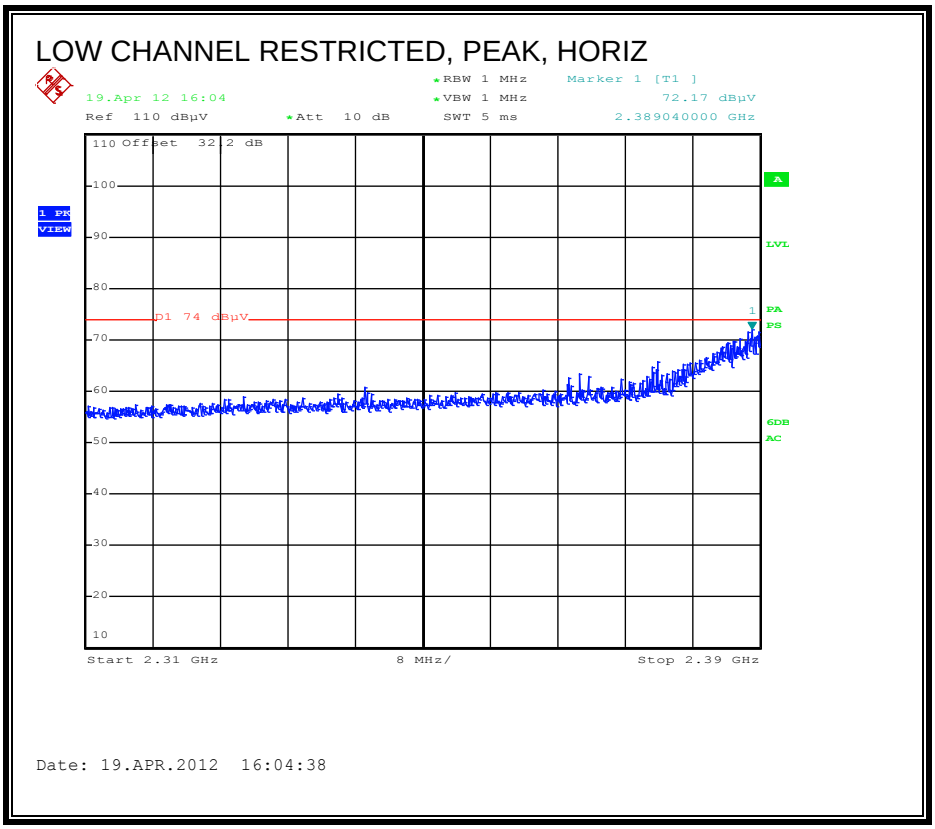
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

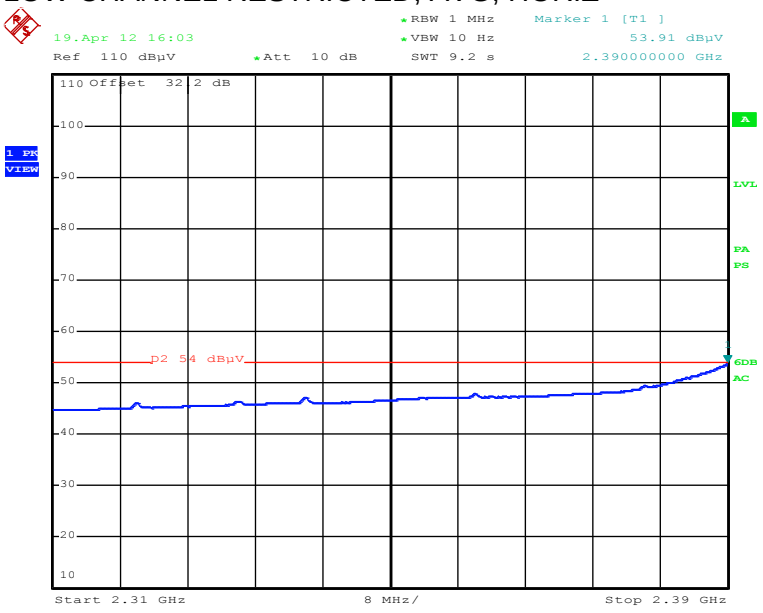
8.2. TRANSMITTER ABOVE 1 GHz

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

RESTRICTED BANDEDGE (LOW CHANNEL, 2412 MHz, HORIZONTAL)

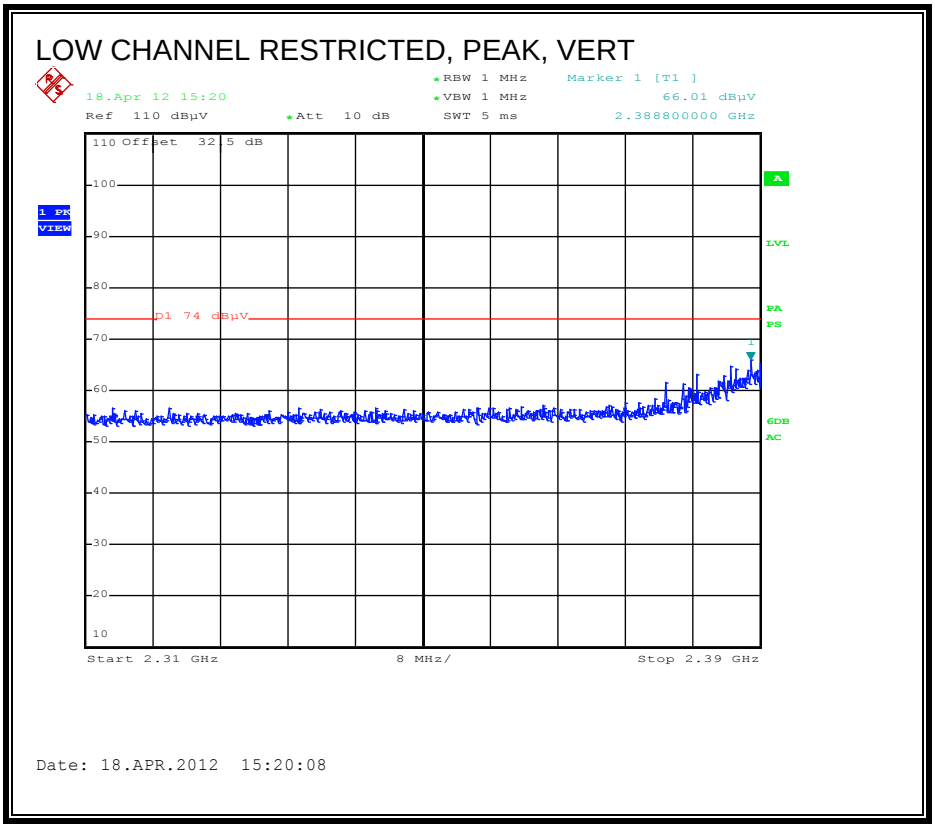


LOW CHANNEL RESTRICTED, AVG, HORIZ

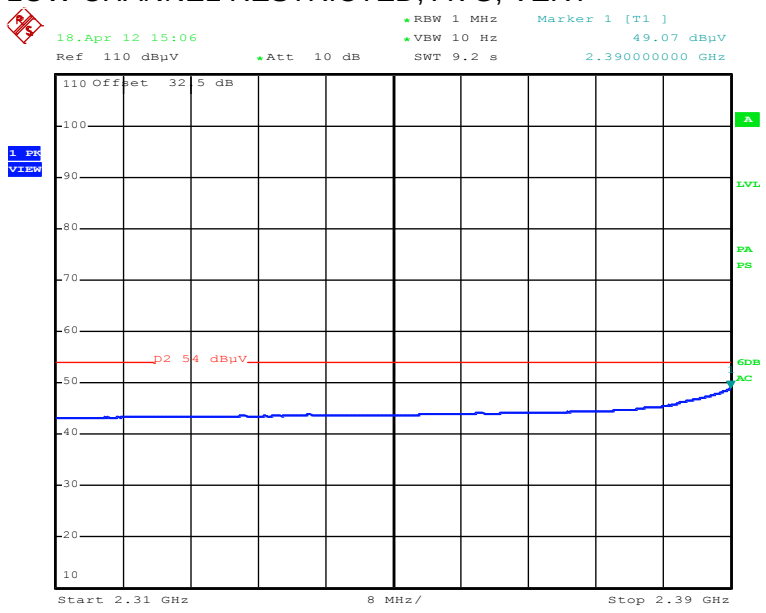


Date: 19.APR.2012 16:03:38

RESTRICTED BANDEDGE (LOW CHANNEL, 2412 MHz, VERTICAL)

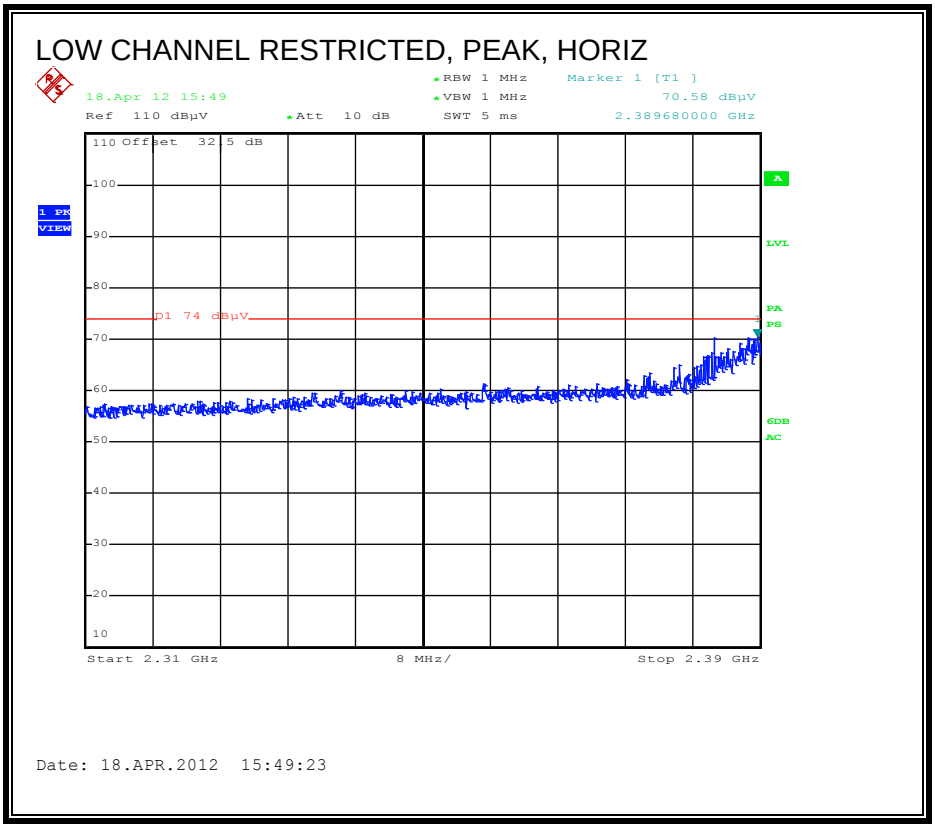


LOW CHANNEL RESTRICTED, AVG, VERT

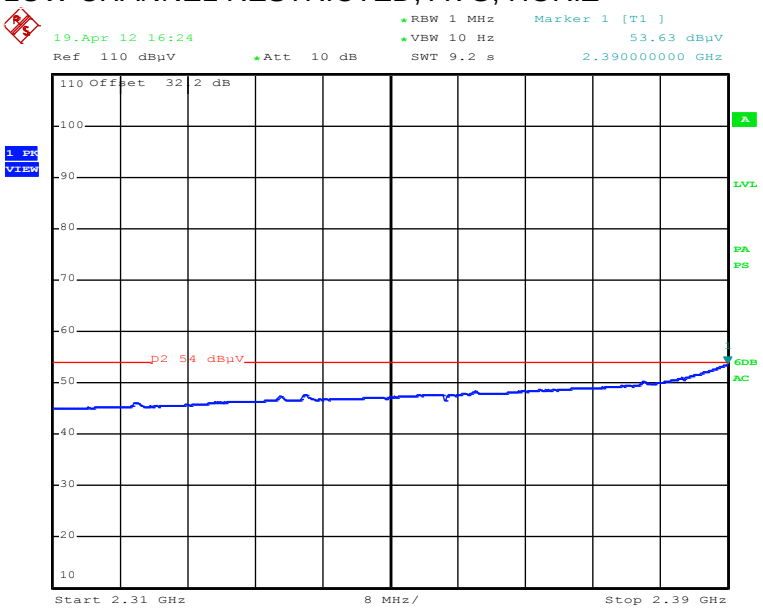


Date: 18.APR.2012 15:06:51

RESTRICTED BANDEDGE (LOW CHANNEL, 2417 MHz, HORIZONTAL)

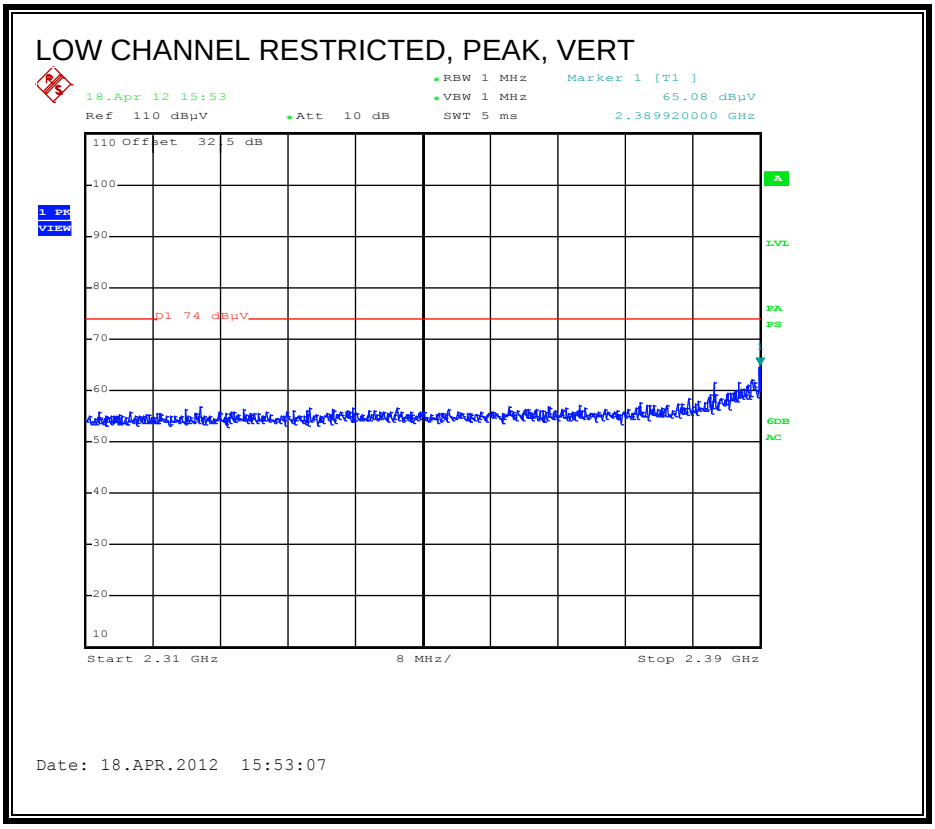


LOW CHANNEL RESTRICTED, AVG, HORIZ

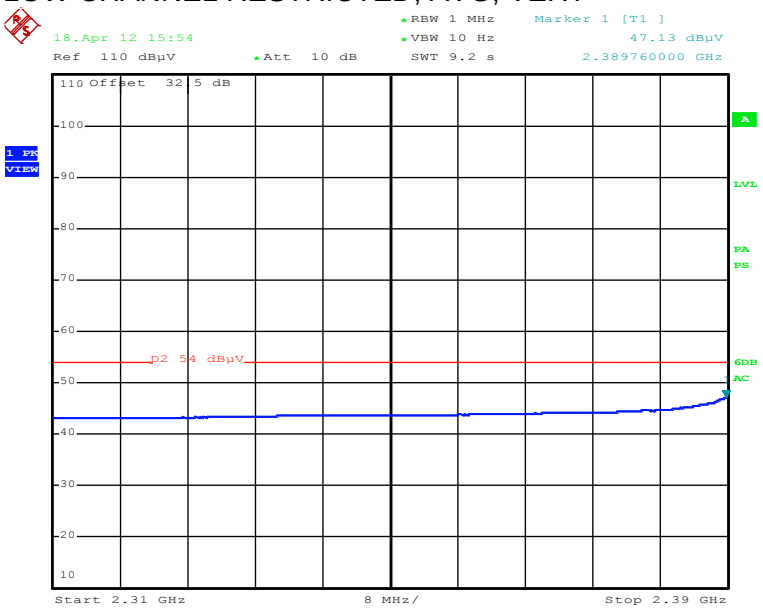


Date: 19.APR.2012 16:24:17

RESTRICTED BANDEDGE (LOW CHANNEL, 2417 MHz, VERTICAL)

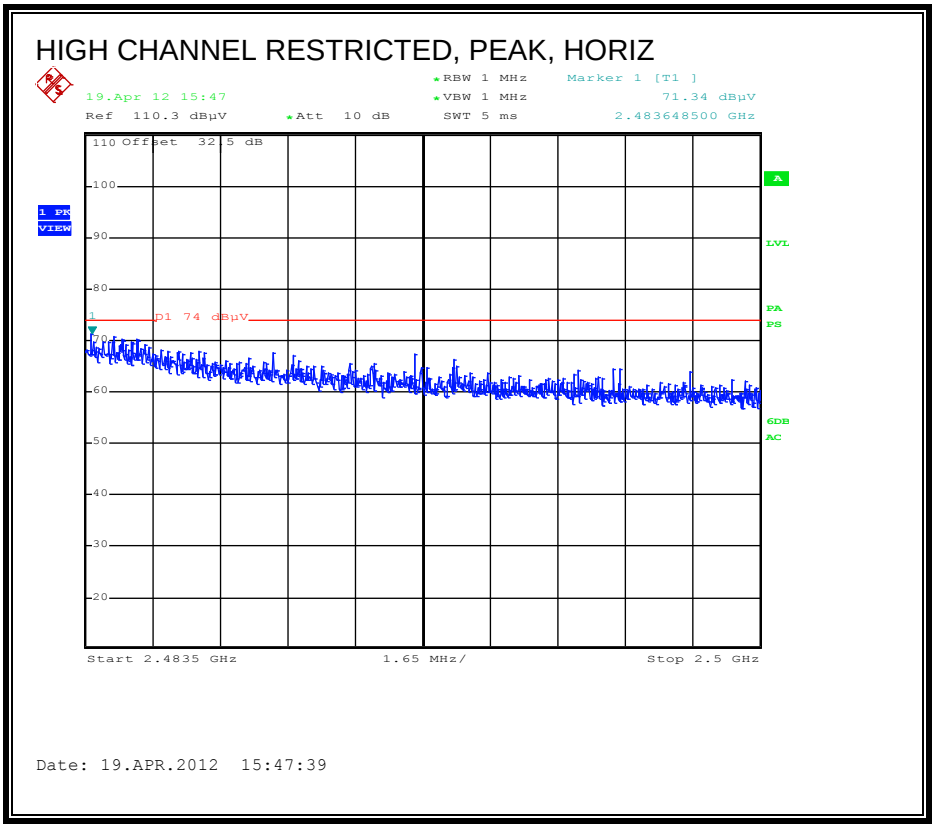


LOW CHANNEL RESTRICTED, AVG, VERT

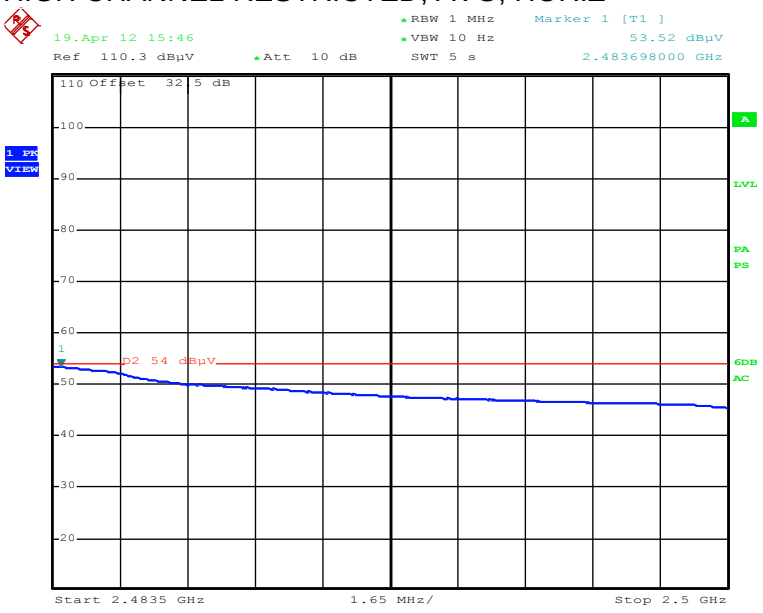


Date: 18.APR.2012 15:54:15

RESTRICTED BANDEDGE (HIGH CHANNEL, 2457 MHz HORIZONTAL)

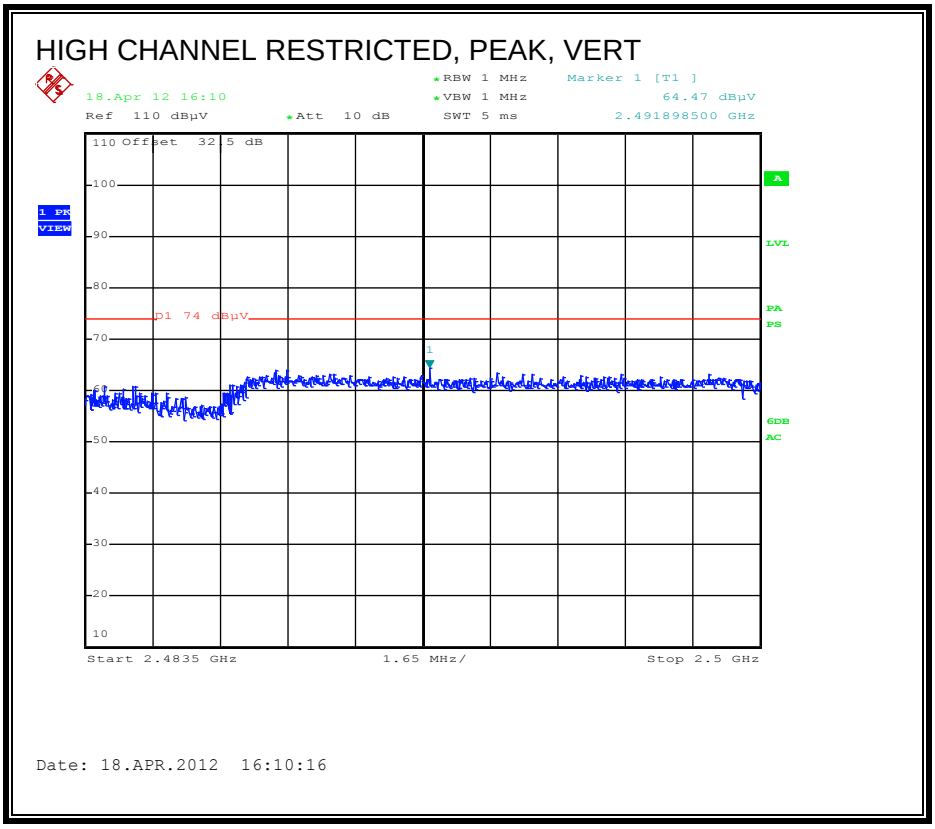


HIGH CHANNEL RESTRICTED, AVG, HORIZ

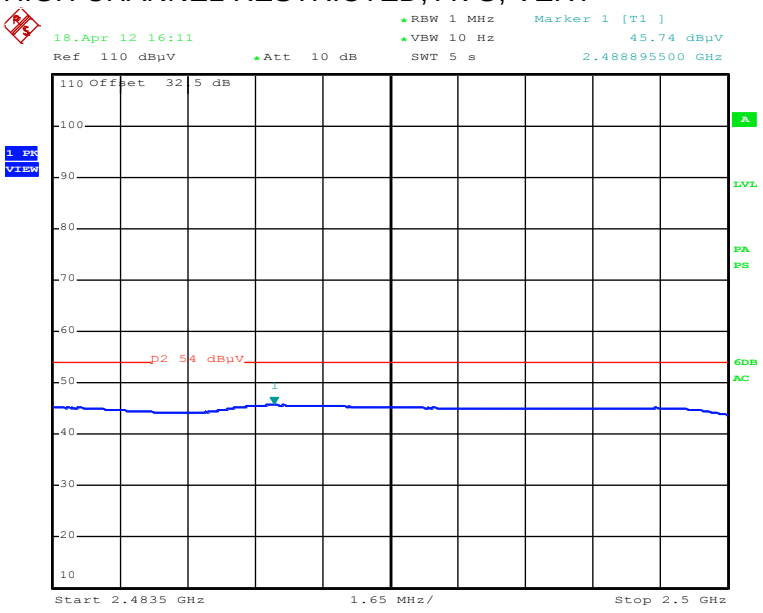


Date: 19.APR.2012 15:46:05

RESTRICTED BANDEDGE (HIGH CHANNEL, 2457 MHz, VERTICAL)

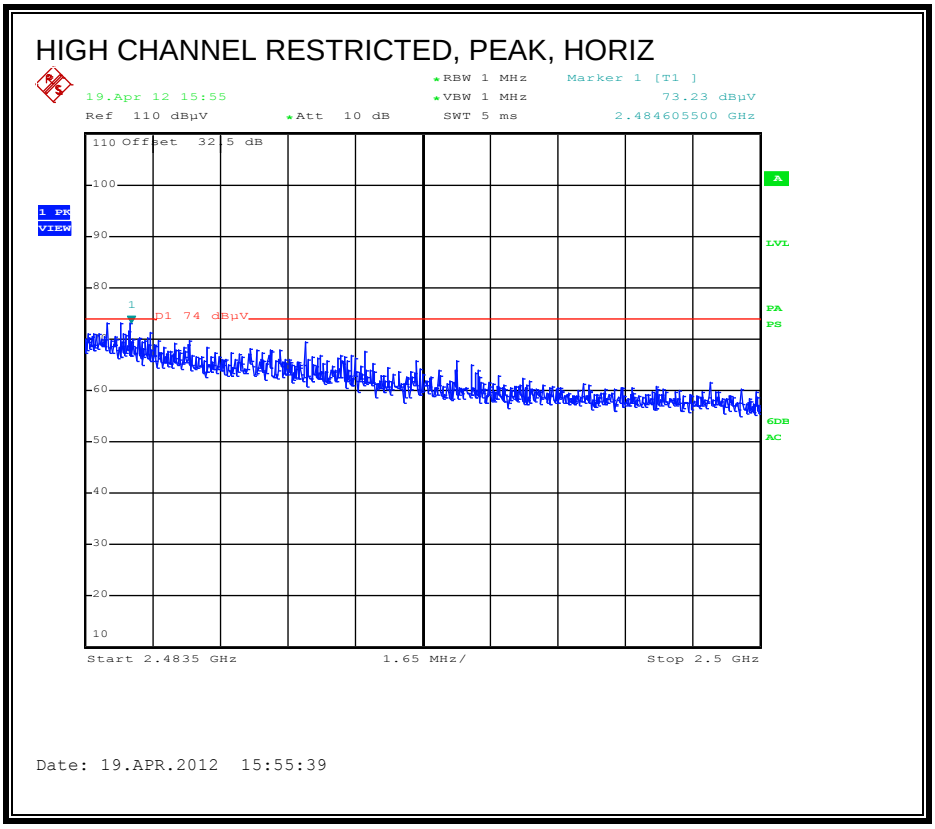


HIGH CHANNEL RESTRICTED, AVG, VERT

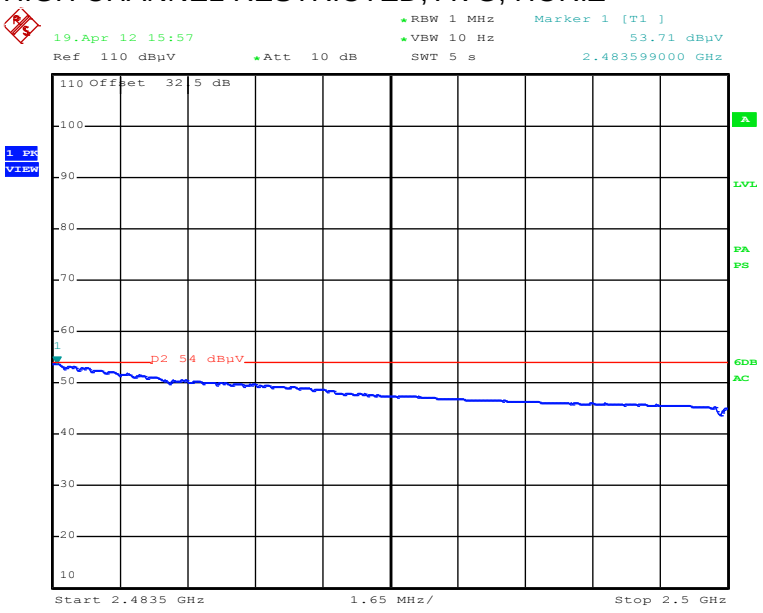


Date: 18.APR.2012 16:11:01

RESTRICTED BANDEDGE (HIGH CHANNEL, 2462 MHz, HORIZONTAL)

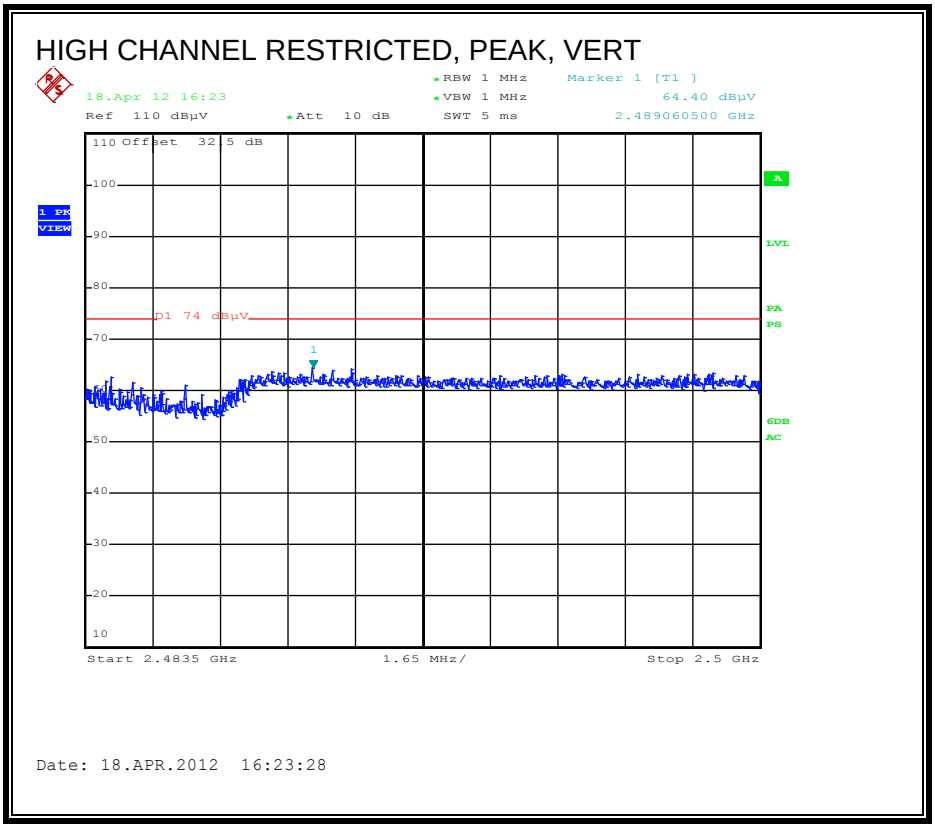


HIGH CHANNEL RESTRICTED, AVG, HORIZ

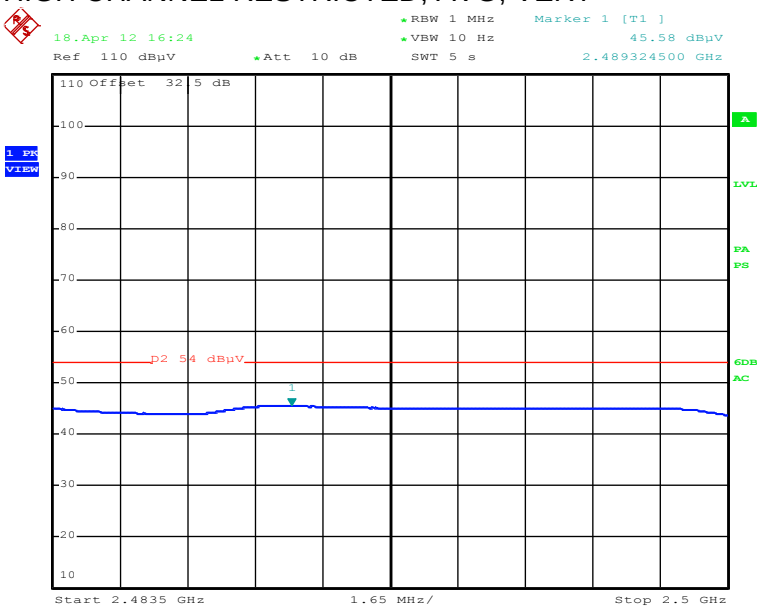


Date: 19.APR.2012 15:57:32

RESTRICTED BANDEDGE (HIGH CHANNEL, 2462MHz, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



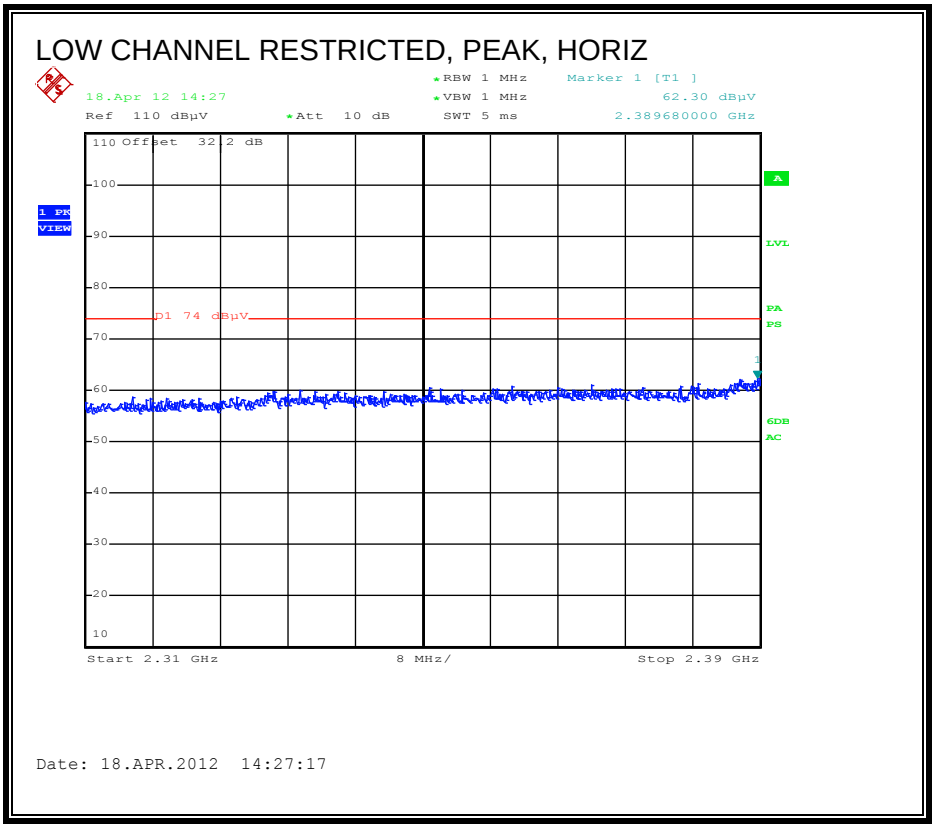
Date: 18.APR.2012 16:24:14

HARMONICS AND SPURIOUS EMISSIONS

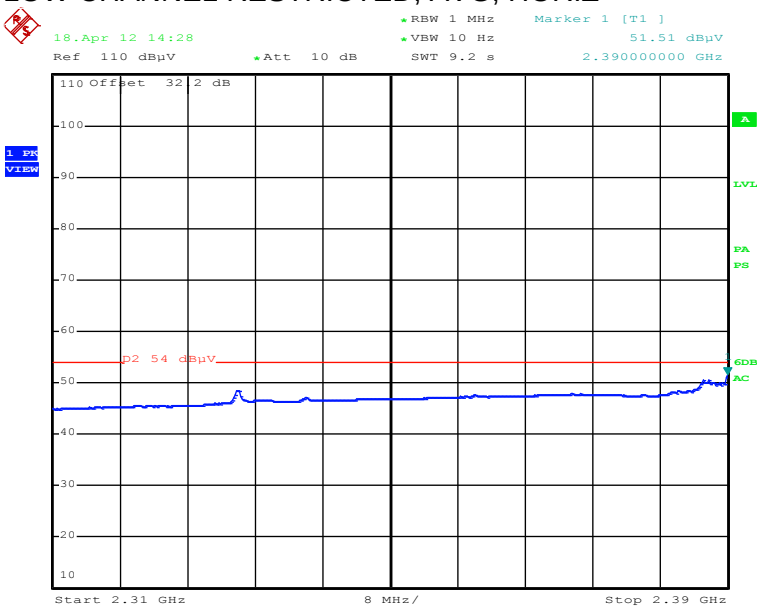
Covered by testing to 11n HT20 3x3 CCD MCS0

8.2.2. TX ABOVE 1 GHz, 802.11b CDD 3TX MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

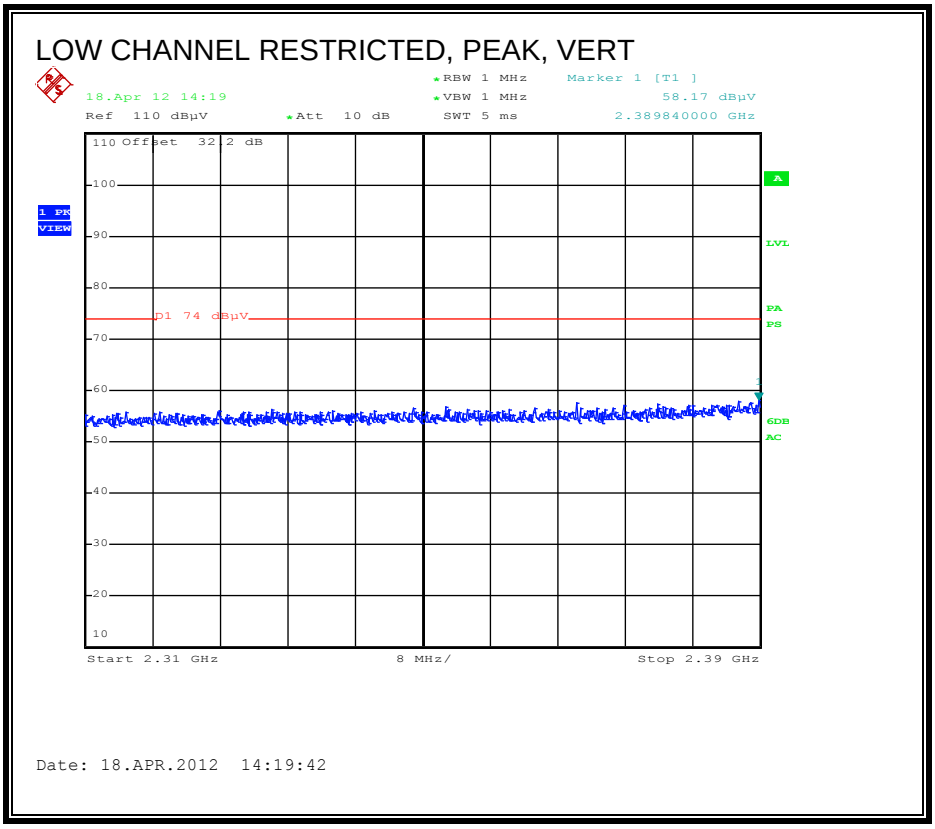


LOW CHANNEL RESTRICTED, AVG, HORIZ

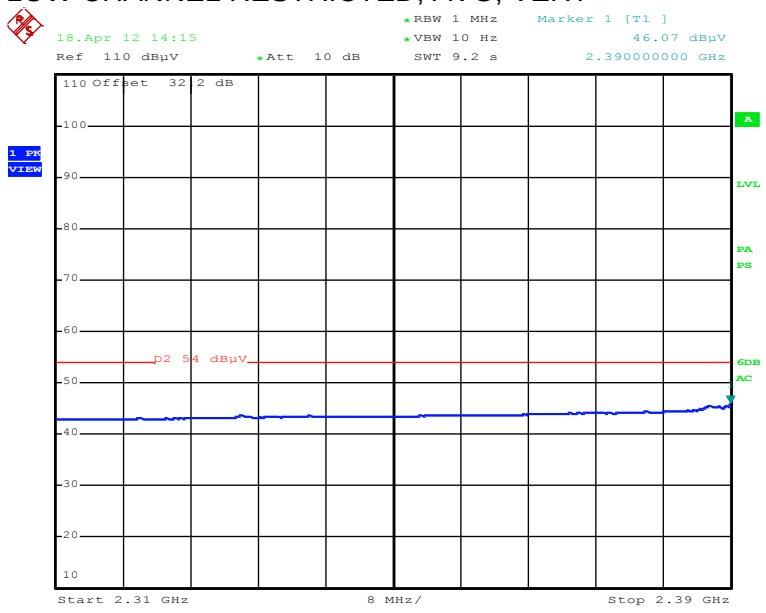


Date: 18.APR.2012 14:28:28

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

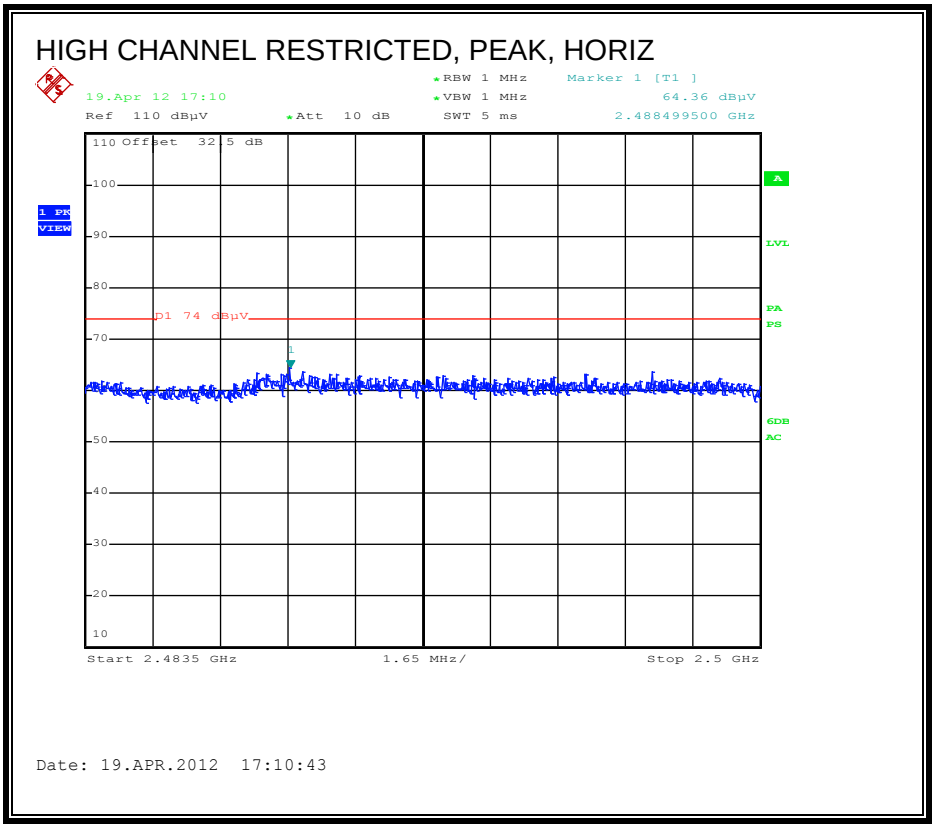


LOW CHANNEL RESTRICTED, AVG, VERT

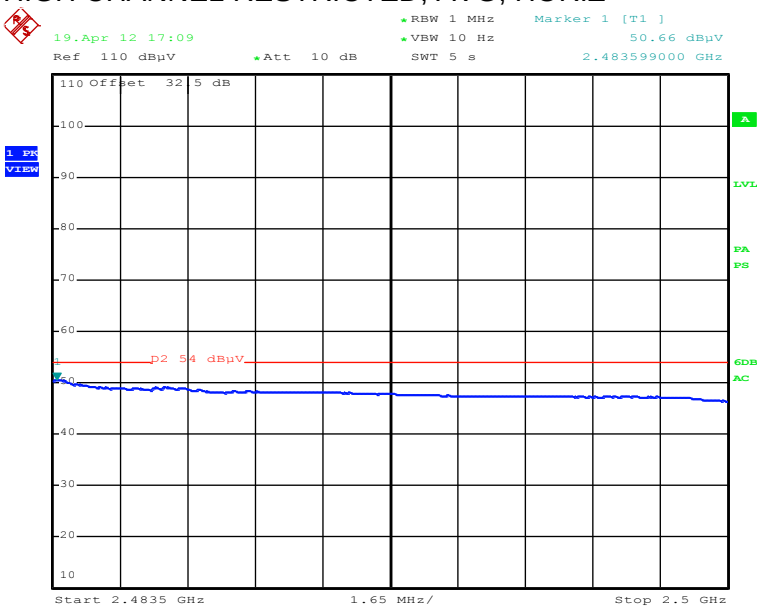


Date: 18.APR.2012 14:15:54

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

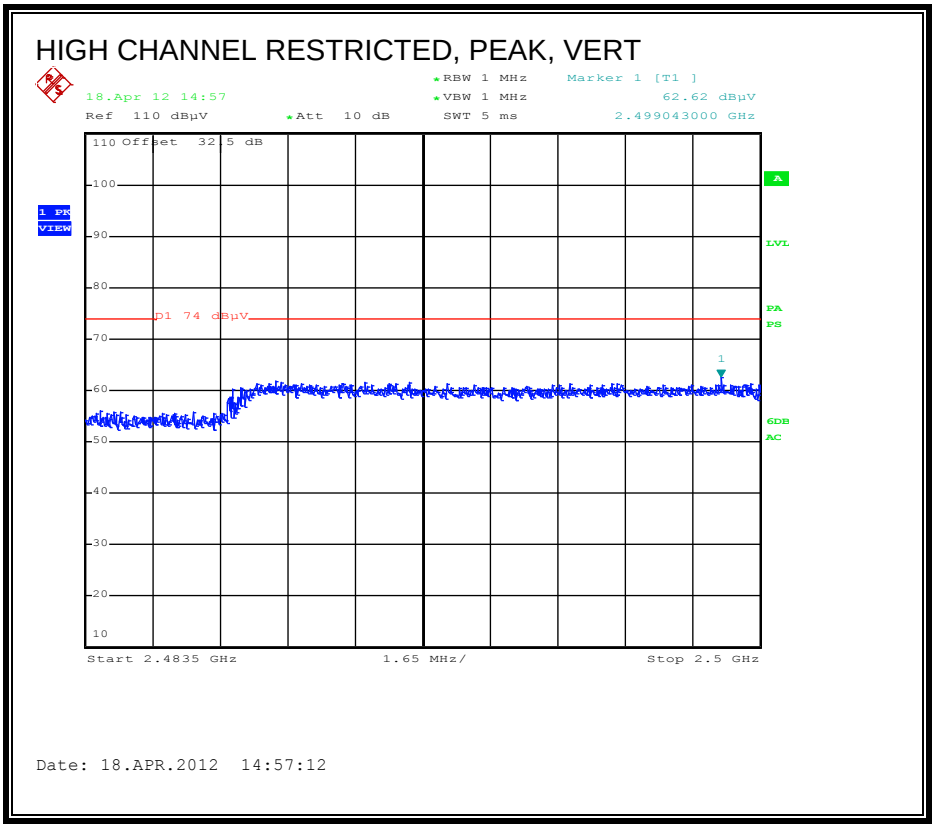


HIGH CHANNEL RESTRICTED, AVG, HORIZ

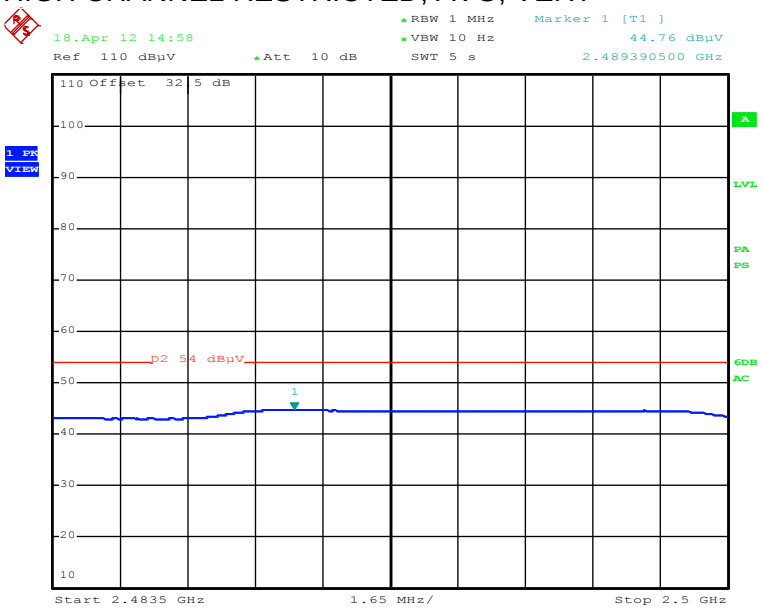


Date: 19.APR.2012 17:09:32

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



Date: 18.APR.2012 14:58:35

HARMONICS AND SPURIOUS EMISSIONS

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

Company: Broadcom
Project #: 12U14227
Date: 4/17/2012
Test Engineer: D. Garcia
Configuration: EUT, test board, laptop, antenna
Mode: 11b 3x3
Rotated antenna and have laptop 14" above table on styrofoam per Broadcom specification

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 15.205

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_001

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

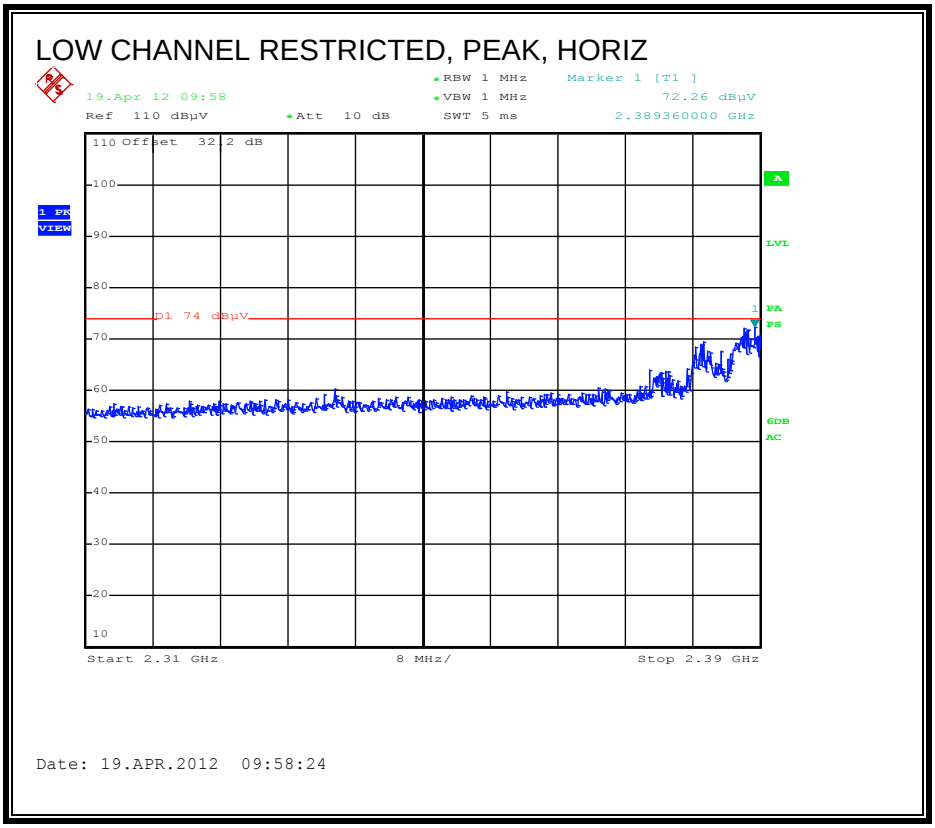
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Channel: 2412 MHz															
4.824	3.0	47.8	44.7	33.1	6.3	-34.8	0.0	0.0	52.4	49.2	74	54	-21.6	-4.8	H
12.060	3.0	35.9	26.1	39.4	11.1	-32.3	0.0	0.0	54.0	44.2	74	54	-20.0	-9.8	H
4.824	3.0	45.0	40.9	33.1	6.3	-34.8	0.0	0.0	49.5	45.5	74	54	-24.5	-8.5	V
12.060	3.0	37.5	28.4	39.4	11.1	-32.3	0.0	0.0	55.7	46.5	74	54	-18.3	-7.5	V
Mid Channel: 2437 MHz															
4.874	3.0	48.4	45.4	33.1	6.3	-34.8	0.0	0.0	53.0	50.1	74	54	-21.0	-3.9	H
7.310	3.0	48.5	42.9	35.8	8.5	-34.9	0.0	0.0	57.9	52.3	74	54	-16.1	-1.7	H
12.185	3.0	34.9	24.9	39.5	11.1	-32.3	0.0	0.0	53.2	43.2	74	54	-20.8	-10.8	H
4.874	3.0	44.4	40.0	33.1	6.3	-34.8	0.0	0.0	49.0	44.6	74	54	-25.0	-9.4	V
7.310	3.0	45.0	39.0	35.8	8.5	-34.9	0.0	0.0	54.4	48.4	74	54	-19.6	-5.6	V
12.185	3.0	36.2	25.9	39.5	11.1	-32.3	0.0	0.0	54.4	44.2	74	54	-19.6	-9.8	V
High Channel: 2462 MHz															
4.924	3.0	48.0	44.8	33.2	6.3	-34.8	0.0	0.0	52.7	49.5	74	54	-21.3	-4.5	H
7.386	3.0	49.1	44.0	35.9	8.5	-34.9	0.0	0.0	58.6	53.6	74	54	-15.4	-0.4	H
12.310	3.0	34.7	24.0	39.5	11.2	-32.3	0.0	0.0	53.1	42.5	74	54	-20.9	-11.5	H
4.924	3.0	47.4	43.0	33.2	6.3	-34.8	0.0	0.0	52.1	47.7	74	54	-21.9	-6.3	V
7.386	3.0	51.8	43.7	35.9	8.5	-34.9	0.0	0.0	61.4	53.2	74	54	-12.6	-0.8	V
12.310	3.0	35.6	24.7	39.5	11.2	-32.3	0.0	0.0	54.0	43.2	74	54	-20.0	-10.8	V

Rev. 11.10.11

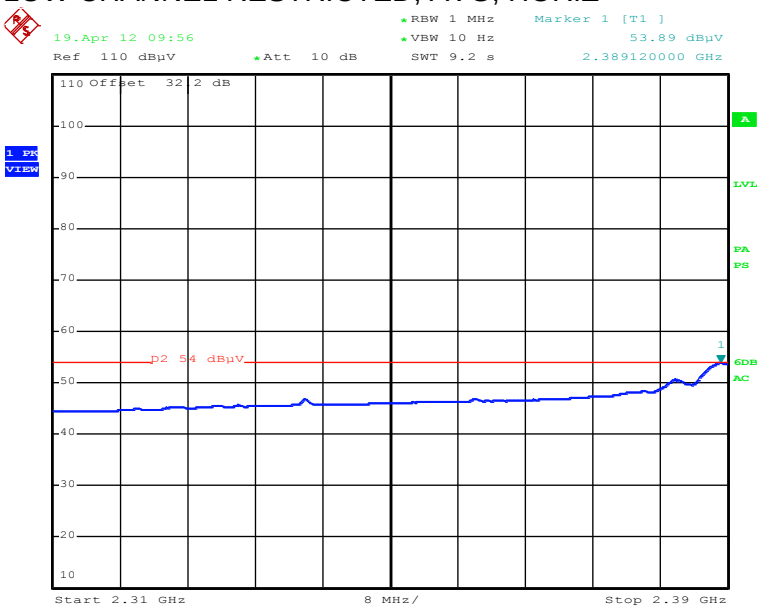
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

8.2.3. TX ABOVE 1 GHz, 802.11n HT20 3TX MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, 2412 MHz, HORIZONTAL)

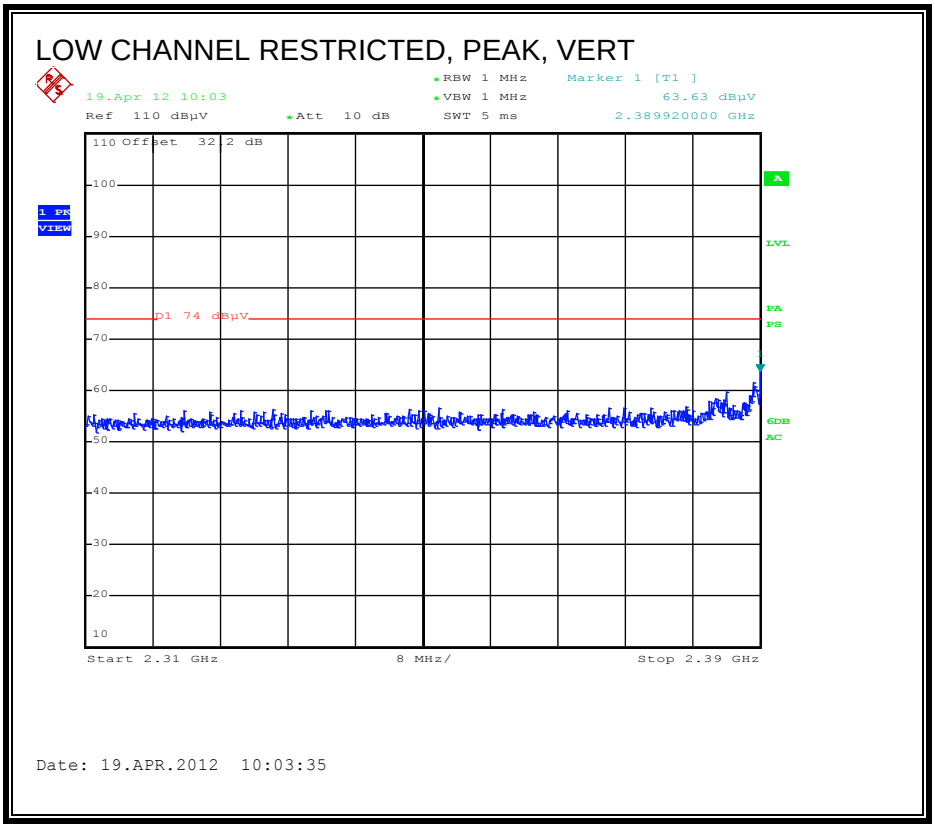


LOW CHANNEL RESTRICTED, AVG, HORIZ

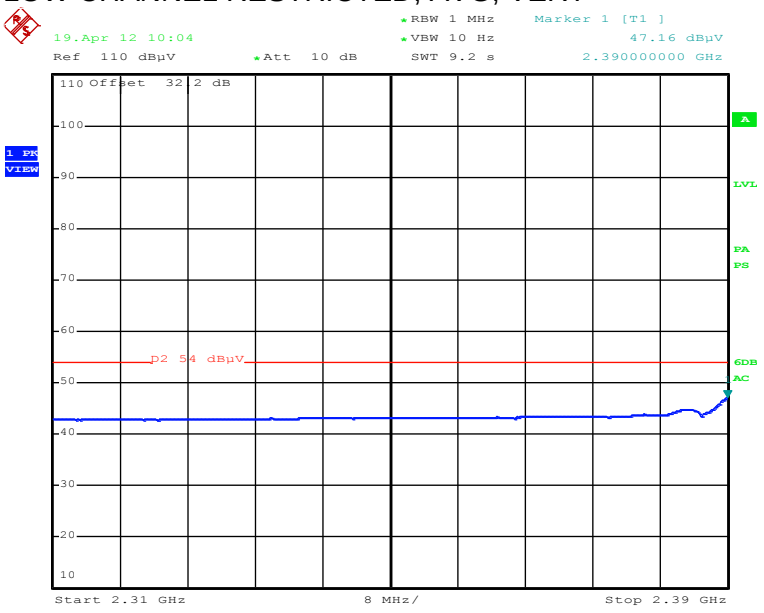


Date: 19.APR.2012 09:56:07

RESTRICTED BANDEDGE (LOW CHANNEL, 2412 MHz, VERTICAL)

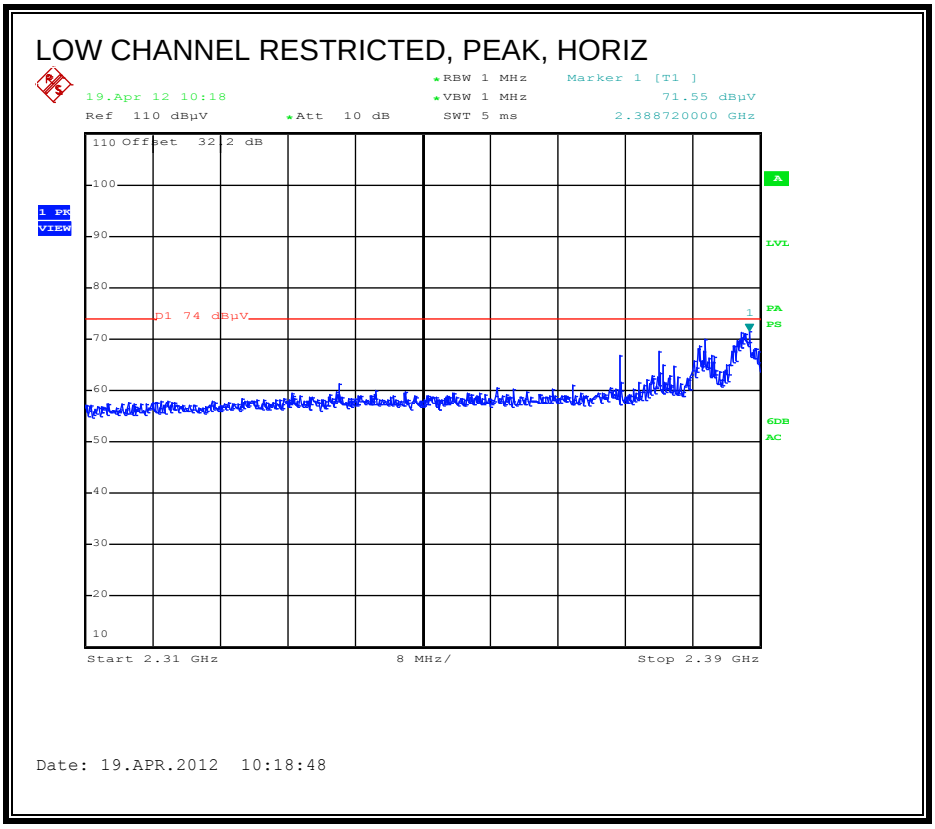


LOW CHANNEL RESTRICTED, AVG, VERT

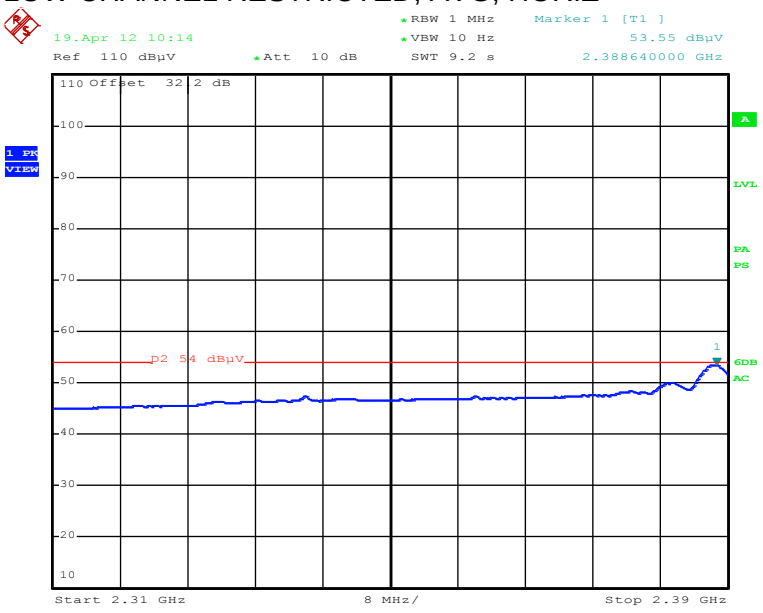


Date: 19.APR.2012 10:04:27

RESTRICTED BANDEDGE (LOW CHANNEL, 2417 MHz, HORIZONTAL)

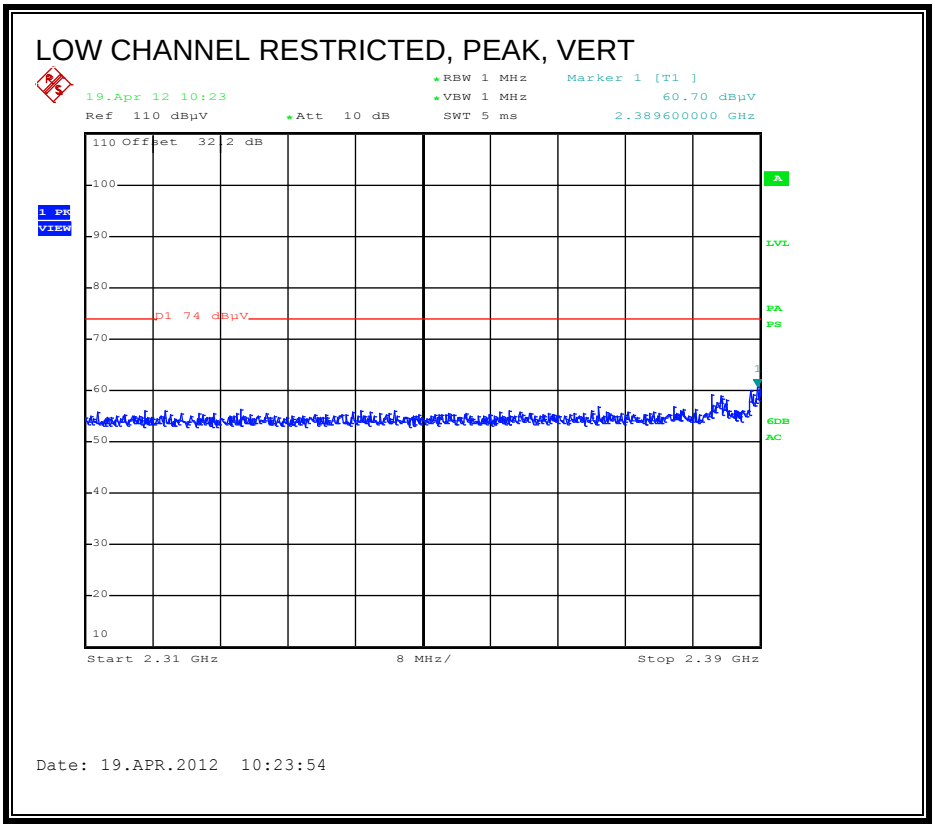


LOW CHANNEL RESTRICTED, AVG, HORIZ

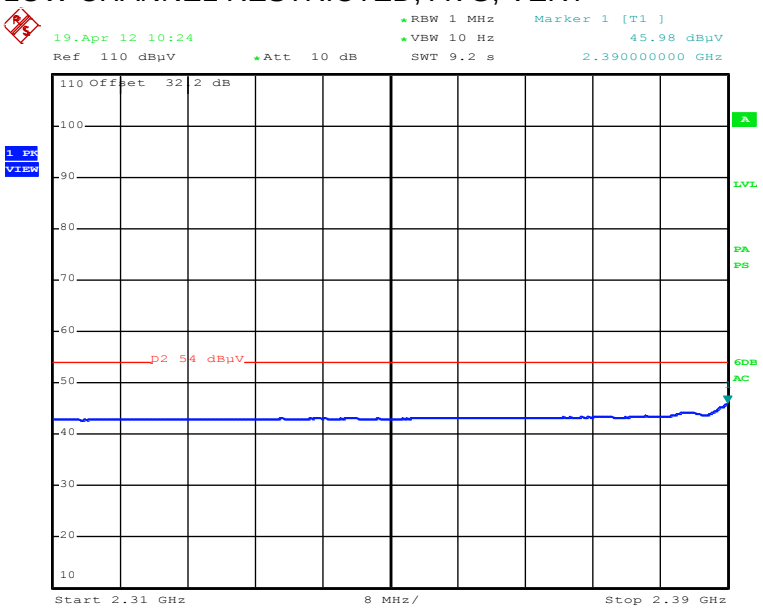


Date: 19.APR.2012 10:14:03

RESTRICTED BANDEDGE (LOW CHANNEL, 2417 MHz, VERTICAL)

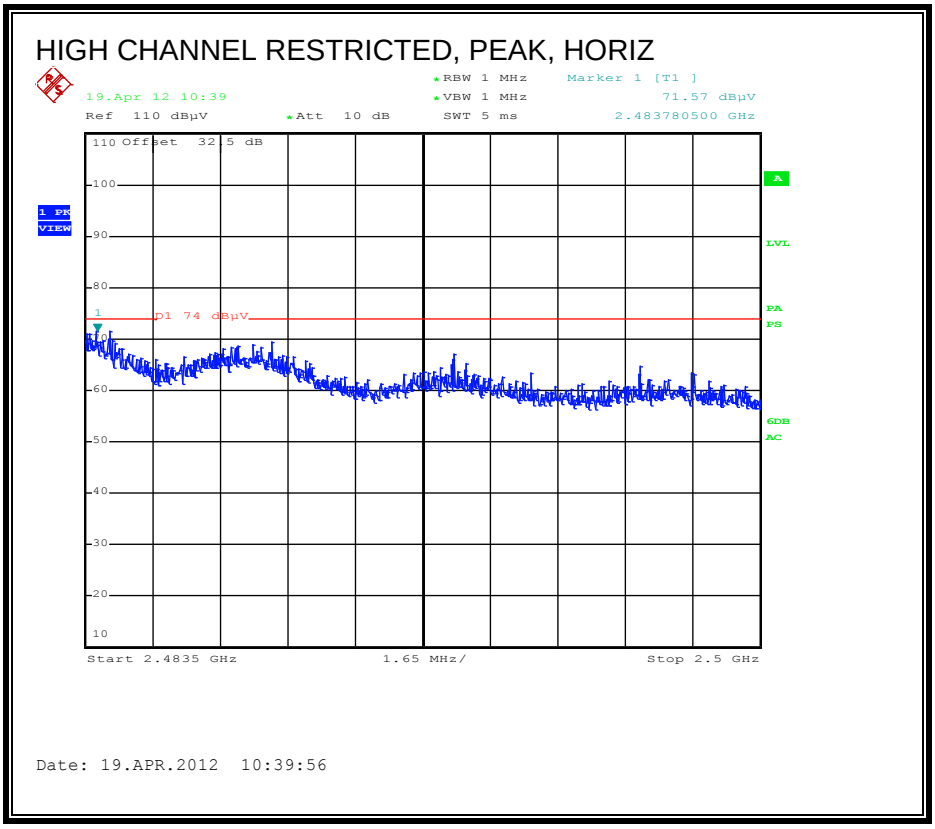


LOW CHANNEL RESTRICTED, AVG, VERT

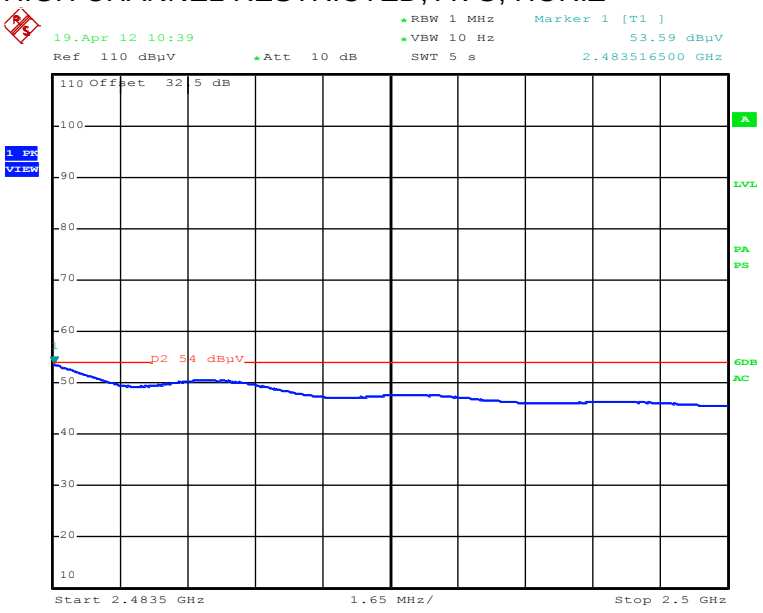


Date: 19.APR.2012 10:24:55

RESTRICTED BANDEDGE (HIGH CHANNEL, 2457 MHz, HORIZONTAL)

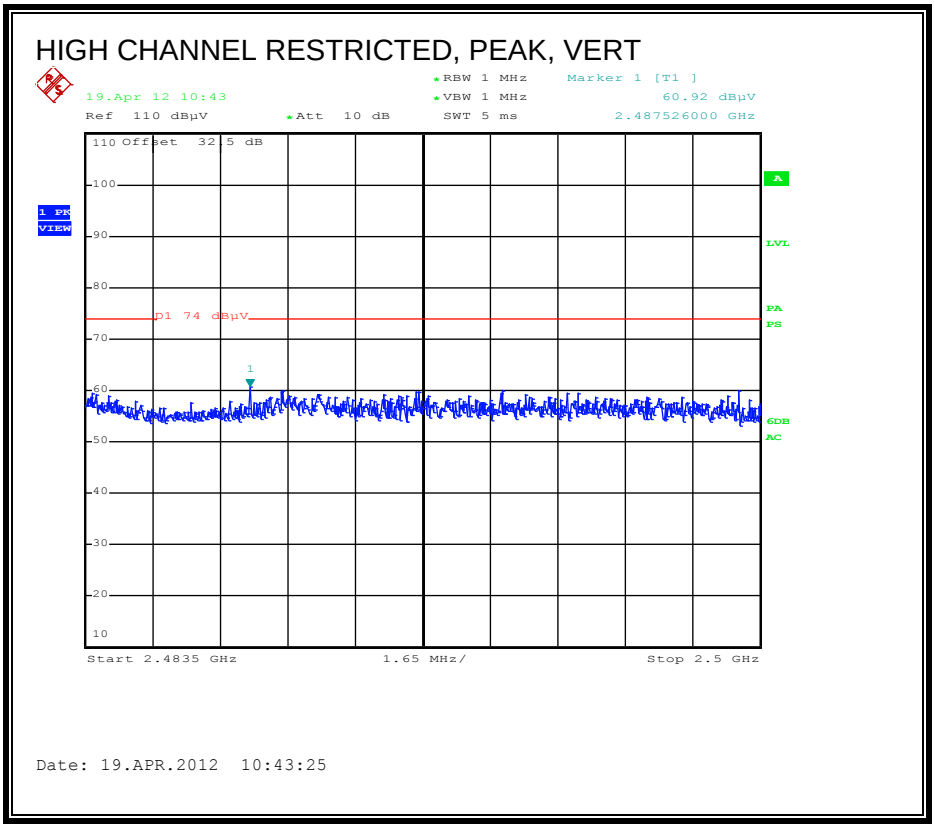


HIGH CHANNEL RESTRICTED, AVG, HORIZ

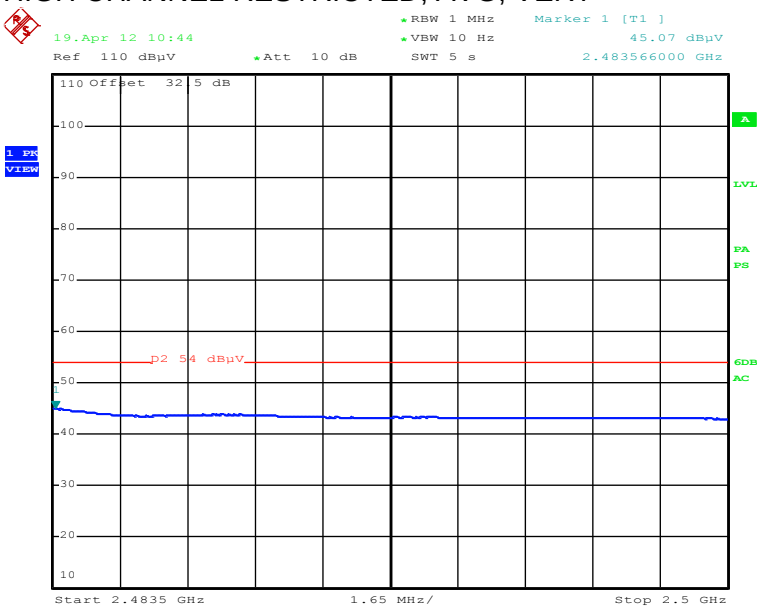


Date: 19.APR.2012 10:39:06

RESTRICTED BANDEDGE (HIGH CHANNEL, 2457 MHz, VERTICAL)

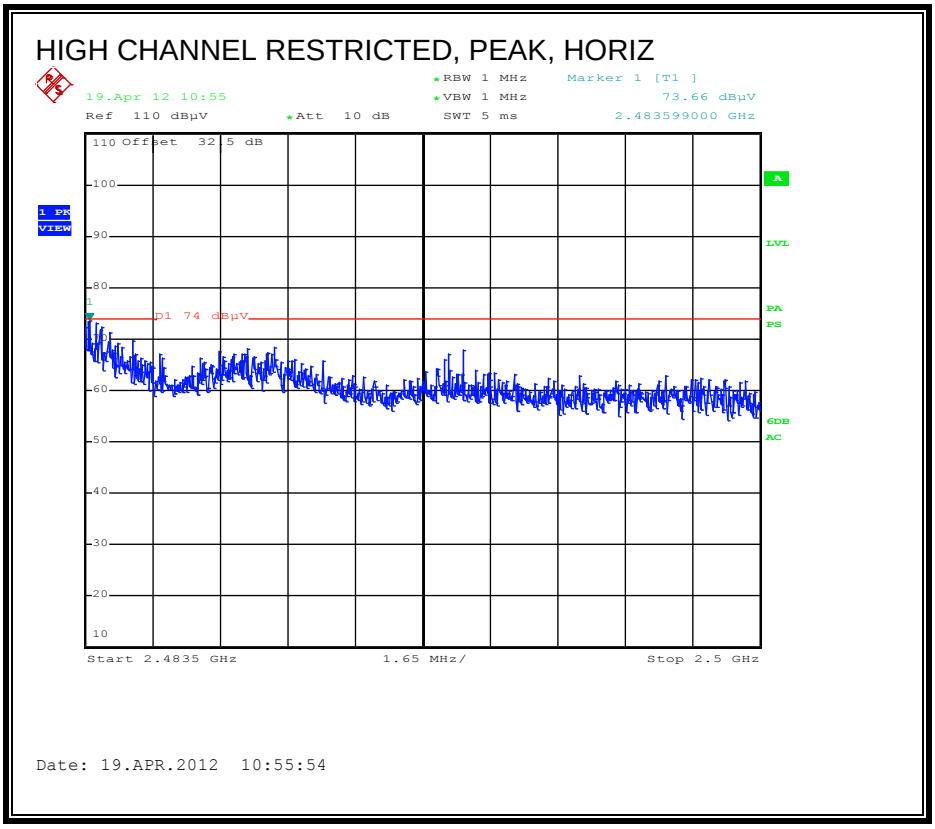


HIGH CHANNEL RESTRICTED, AVG, VERT

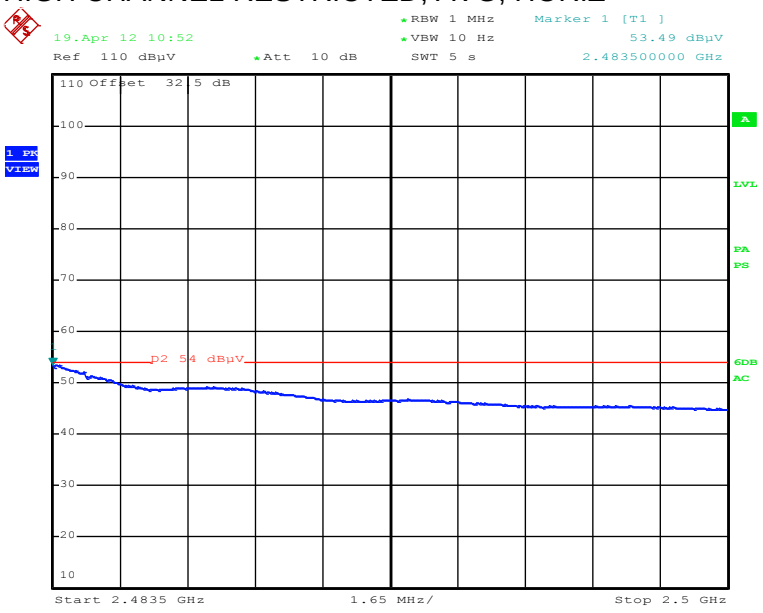


Date: 19.APR.2012 10:44:17

RESTRICTED BANDEDGE (HIGH CHANNEL, 2462 MHz, HORIZONTAL)

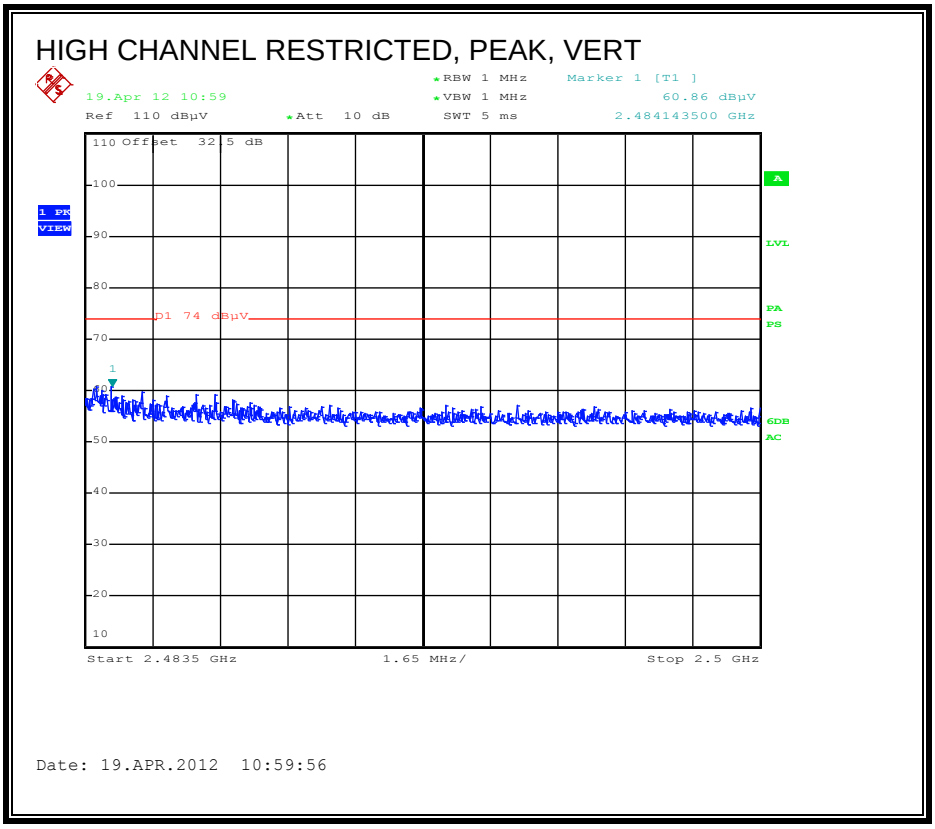


HIGH CHANNEL RESTRICTED, AVG, HORIZ

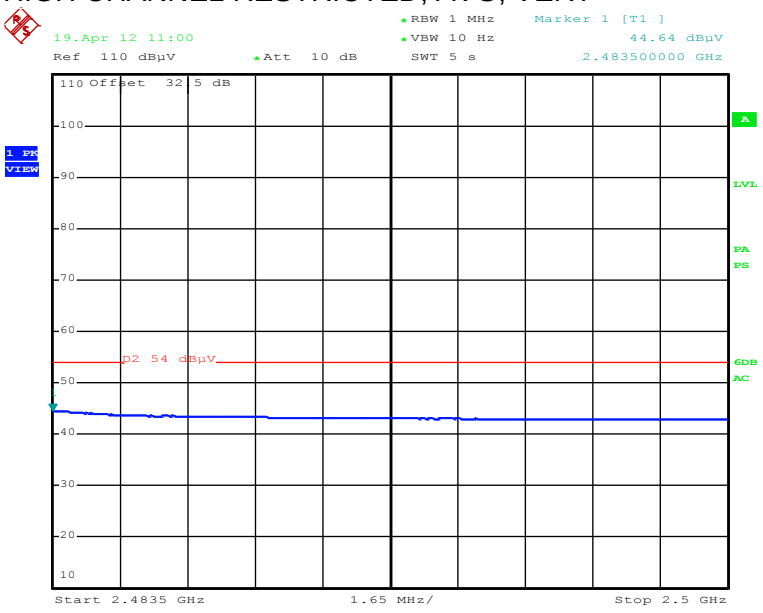


Date: 19.APR.2012 10:52:18

RESTRICTED BANDEDGE (HIGH CHANNEL, 2462 MHz, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

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

Company: Broadcom
Project #: 12U14227
Date: 4/17/2012
Test Engineer: D. Garcia
Configuration: EUT, test board, laptop, antenna
Mode: 11n 3x3 CDD
Rotated antenna and have laptop 14" above table on styrofoam per Broadcom specification

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 15.205

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_001

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)
Low Channel: 2412 MHz															
4.824	3.0	46.9	33.6	33.1	6.3	-34.8	0.0	0.0	51.4	38.2	74	54	-22.6	-15.8	H
12.060	3.0	33.7	23.2	39.4	11.1	-32.3	0.0	0.0	51.8	41.4	74	54	-22.2	-12.6	H
4.824	3.0	43.5	30.8	33.1	6.3	-34.8	0.0	0.0	48.0	35.3	74	54	-26.0	-18.7	V
12.060	3.0	36.2	23.2	39.4	11.1	-32.3	0.0	0.0	54.4	41.3	74	54	-19.6	-12.7	V
Mid Channel: 2437 MHz															
4.874	3.0	50.9	35.1	33.1	6.3	-34.8	0.0	0.0	55.5	39.8	74	54	-18.5	-14.2	H
7.310	3.0	49.2	35.9	35.8	8.5	-34.9	0.0	0.0	58.6	45.3	74	54	-15.4	-8.7	H
12.185	3.0	35.3	23.1	39.5	11.1	-32.3	0.0	0.0	53.5	41.4	74	54	-20.5	-12.6	H
4.874	3.0	48.4	32.3	33.1	6.3	-34.8	0.0	0.0	53.0	36.9	74	54	-21.0	-17.1	V
7.311	3.0	48.1	34.2	35.8	8.5	-34.9	0.0	0.0	57.5	43.6	74	54	-16.5	-10.4	V
12.185	3.0	36.1	23.2	39.5	11.1	-32.3	0.0	0.0	54.4	41.5	74	54	-19.6	-12.5	V
High Channel: 2462 MHz															
4.924	3.0	44.9	29.0	33.2	6.3	-34.8	0.0	0.0	49.6	33.7	74	54	-24.4	-20.3	H
7.386	3.0	46.8	30.8	35.9	8.5	-34.9	0.0	0.0	56.3	40.4	74	54	-17.7	-13.6	H
12.310	3.0	34.6	22.3	39.5	11.2	-32.3	0.0	0.0	53.0	40.8	74	54	-21.0	-13.2	H
4.924	3.0	41.2	28.6	33.2	6.3	-34.8	0.0	0.0	45.9	33.4	74	54	-28.1	-20.6	V
7.386	3.0	43.2	28.7	35.9	8.5	-34.9	0.0	0.0	52.7	38.2	74	54	-21.3	-15.8	V
12.310	3.0	36.2	23.1	39.5	11.2	-32.3	0.0	0.0	54.6	41.5	74	54	-19.4	-12.5	V

Rev. 11.10.11

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		

8.2.4. TX ABOVE 1 GHz, 802.11n HT20 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: D. Garcia
Date: 04/10/12
Project #: 12U14227
Company: Broadcom
Test Target: FCC 15.247
Mode Oper: HT20 5.8GHz 3x3 CDD

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 Channel: 5745 MHz													
11.490	3.0	35.0	38.8	10.5	-32.9	0.0	0.0	51.5	74.0	-22.5	H	P	
11.490	3.0	22.6	38.8	10.5	-32.9	0.0	0.0	39.1	54.0	-14.9	H	A	
11.490	3.0	35.1	38.8	10.5	-32.9	0.0	0.0	51.6	74.0	-22.4	V	P	
11.490	3.0	22.6	38.8	10.5	-32.9	0.0	0.0	39.1	54.0	-14.9	V	A	
Mid Channel: 5785 MHz													
11.570	3.0	43.0	38.9	10.6	-32.8	0.0	0.0	59.7	74.0	-14.3	H	P	
11.570	3.0	29.4	38.9	10.6	-32.8	0.0	0.0	46.1	54.0	-7.9	H	A	
11.570	3.0	47.3	38.9	10.6	-32.8	0.0	0.0	64.0	74.0	-10.0	V	P	
11.570	3.0	35.1	38.9	10.6	-32.8	0.0	0.0	51.9	54.0	-2.1	V	A	
High Channel: 5825 MHz													
11.650	3.0	46.6	39.0	10.7	-32.7	0.0	0.0	63.6	74.0	-10.4	H	P	
11.650	3.0	33.9	39.0	10.7	-32.7	0.0	0.0	50.9	54.0	-3.1	H	A	
11.650	3.0	50.4	39.0	10.7	-32.7	0.0	0.0	67.4	74.0	-6.6	V	P	-q77
11.650	3.0	36.8	39.0	10.7	-32.7	0.0	0.0	53.8	54.0	-0.2	V	A	-q77

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

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

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: D. Garcia
Date: 04/20/12
Project #: 12U14227
Company: Broadcom
Test Target: FCC 15.247
Mode Oper: HT40 5.8GHz 3x3 CDD

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

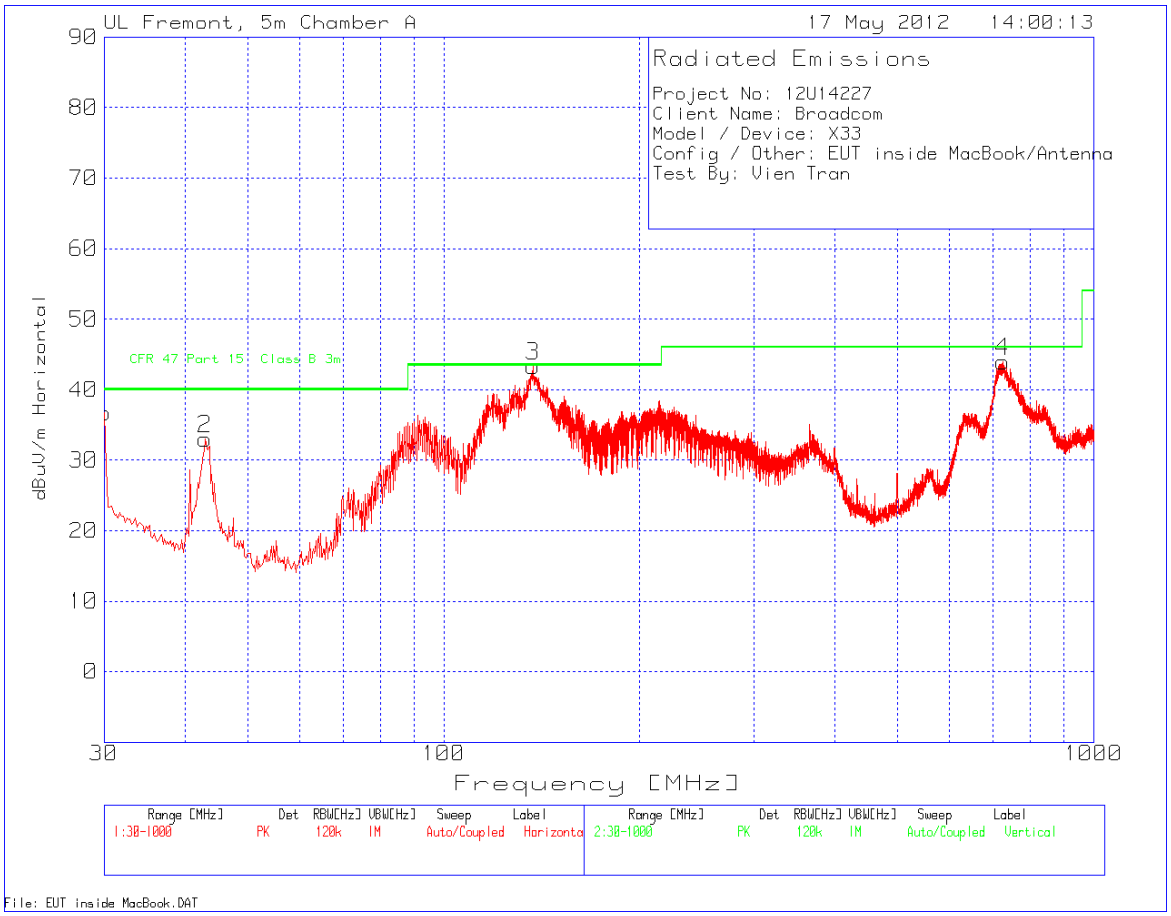
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Channel: 5755 MHz													
11.510	3.0	38.4	38.8	10.6	-32.8	0.0	0.7	55.6	74.0	-18.4	H	P	set to -q80
11.510	3.0	26.2	38.8	10.6	-32.8	0.0	0.7	43.5	54.0	-10.5	H	A	set to -q80
11.510	3.0	44.0	38.8	10.6	-32.8	0.0	0.7	61.3	74.0	-12.7	V	P	set to -q80
11.510	3.0	30.2	38.8	10.6	-32.8	0.0	0.7	47.4	54.0	-6.6	V	A	set to -q80
High Channel: 5795 MHz													
11.590	3.0	43.5	38.9	10.6	-32.7	0.0	0.7	61.0	74.0	-13.0	H	P	
11.590	3.0	29.0	38.9	10.6	-32.7	0.0	0.7	46.5	54.0	-7.5	H	A	
11.590	3.0	49.6	38.9	10.6	-32.7	0.0	0.7	67.1	74.0	-6.9	V	P	
11.590	3.0	33.7	38.9	10.6	-32.7	0.0	0.7	51.2	54.0	-2.8	V	A	

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

8.3. WORST-CASE BELOW 1 GHz

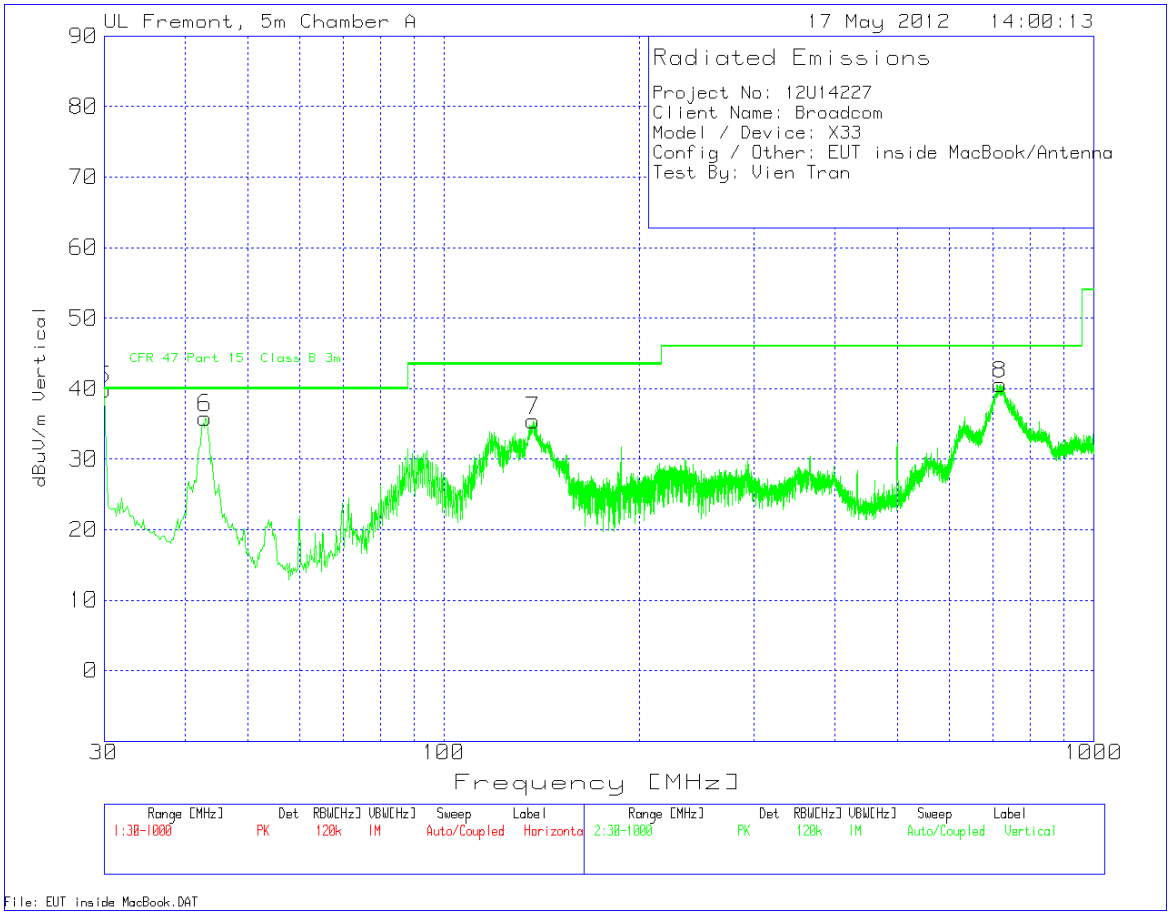
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Project No: 12U14227
Client Name: Broadcom
Model / Device: X33
Config / Other: EUT inside MacBook/Antenna
Test By: Vien Tran

Horizontal 30 - 1000MHz

Test Frequency	Meter Reading	Detector	1GHz ChmbrA Amplified. TX [dB]	T243 Sunol Bilog.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
30	42.99	PK	-27.5	21.3	36.79	40.0	-3.21	200	Horz
42.9876	48.53	PK	-27.4	11.9	33.03	40.0	-6.97	400	Horz
137.3901	57.02	PK	-26.7	13.0	43.32	43.5	-0.18	200	Horz
137.3901	53.81	QK	-26.7	13.0	40.11	43.5	-3.39	200	Horz
725.9033	47.02	PK	-23.3	20.2	43.92	46.0	-2.08	100	Horz
725.9033	45.14	PK	-23.3	20.2	42.04	46.0	-3.96	100	Horz

Vertical 30 - 1000MHz

Test Frequency	Meter Reading	Detector	1GHz ChmbrA Amplified. TX [dB]	T243 Sunol Bilog.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
30	46.01	PK	-27.5	21.3	39.81	40.0	-0.19	400	Vert
30	40.72	PK	-27.5	21.3	34.52	40.0	-5.48	400	Vert
42.9876	51.35	PK	-27.4	11.9	35.85	40.0	-4.15	100	Vert
137.3901	49.18	PK	-26.7	13.0	35.48	43.5	-8.02	200	Vert
717.3741	43.66	PK	-23.2	20.1	40.56	46.0	-5.44	100	Vert

PK - Peak detector
QP - Quasi-Peak detector
Av - Average detector

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

6 WORST EMISSIONS

Project No:12U14227
Client Name:Broadcom
Model/Device:802.11a/g/n 3x3 MIMO WLAN + BT
Test Volt/Freq:120 Vac / 60Hz
Test By:Vien Tran

Line-L1 .15 - 30MHz

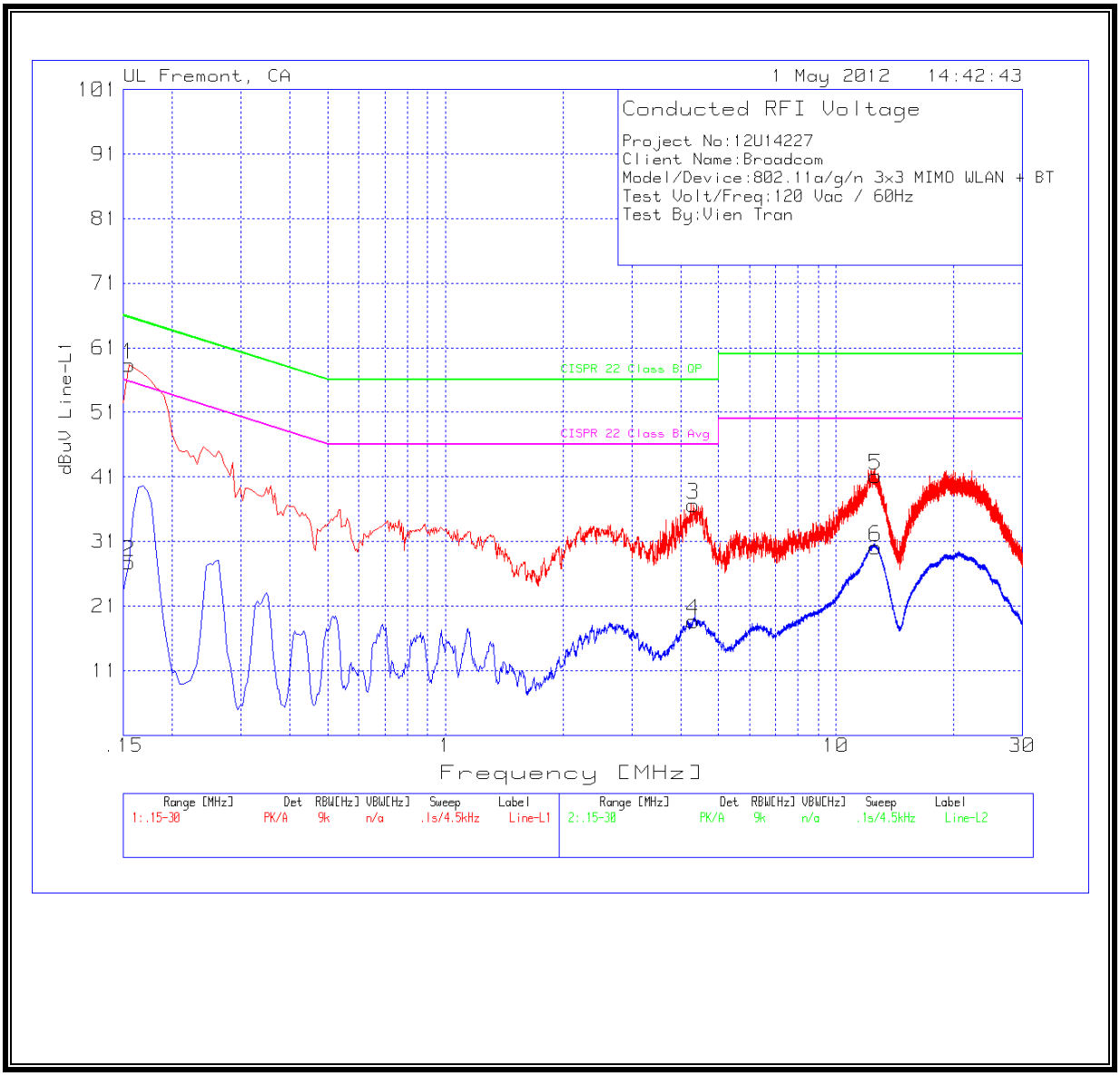
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dBuV	CISPR 22 Class B QP	Margin	CISPR 22 Class B Avg	Margin
0.155	58.27	PK	0.1	0.00	58.37	65.8	-7.43	-	-
0.155	27.73	Av	0.1	0.00	27.83	-	-	55.80	-27.97
4.308	36.5	PK	0.1	0.10	36.70	56	-19.30	-	-
4.308	18.47	Av	0.1	0.10	18.67	-	-	46.00	-27.33
12.615	40.75	PK	0.2	0.20	41.15	60	-18.85	-	-
12.615	29.67	Av	0.2	0.20	30.07	-	-	50.00	-19.93

Line-L2 .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
0.164	54.87	PK	0.1	0	54.97	65.3	-10.33	-	-
0.164	35.78	Av	0.1	0	35.88	-	-	55.3	-19.42
4.232	36.83	PK	0.1	0.1	37.03	56	-18.97	-	-
4.232	19.17	Av	0.1	0.1	19.37	-	-	46	-26.63
12.539	41.39	PK	0.2	0.2	41.79	60	-18.21	-	-
12.539	29.68	Av	0.2	0.2	30.08	-	-	50	-19.92

PK - Peak detector
QP - Quasi-Peak detector
Av - Average detector

LINE 1 RESULTS



LINE 2 RESULTS