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

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER: A1392

FCC ID: BCGA1392
IC: 579C-A1392

REPORT NUMBER: 12U14326-2, Revision B

ISSUE DATE: JUNE 11, 2012

Prepared for
APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	05/31/12	Initial Issue	F. Ibrahim
A	06/06/12	Corrected corrupted table in section 7.1.3	F. Ibrahim
B	06/11/12	Added MPE Co-located Calculation	F. Ibrahim

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1. ATTESTATION OF TEST RESULTS

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

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

MODEL: A1392

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

DATE TESTED: MARCH 21 – MAY 31, 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:

TOM CHEN
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

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

3. FACILITIES AND ACCREDITATION

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	23.313	214.437
2412 - 2462	802.11g	24.398	275.296
2412 - 2462	802.11n HT20	23.333	215.427

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745-5825	802.11a	22.669	184.884
5745-5825	802.11n HT20	22.349	171.751
5755-5795	802.11n HT40	21.777	150.557

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

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

5.4. SOFTWARE AND FIRMWARE

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

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

5.5. WORST-CASE CONFIGURATION AND MODE

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

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

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

Duty cycle of 100% was used for all testing.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

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

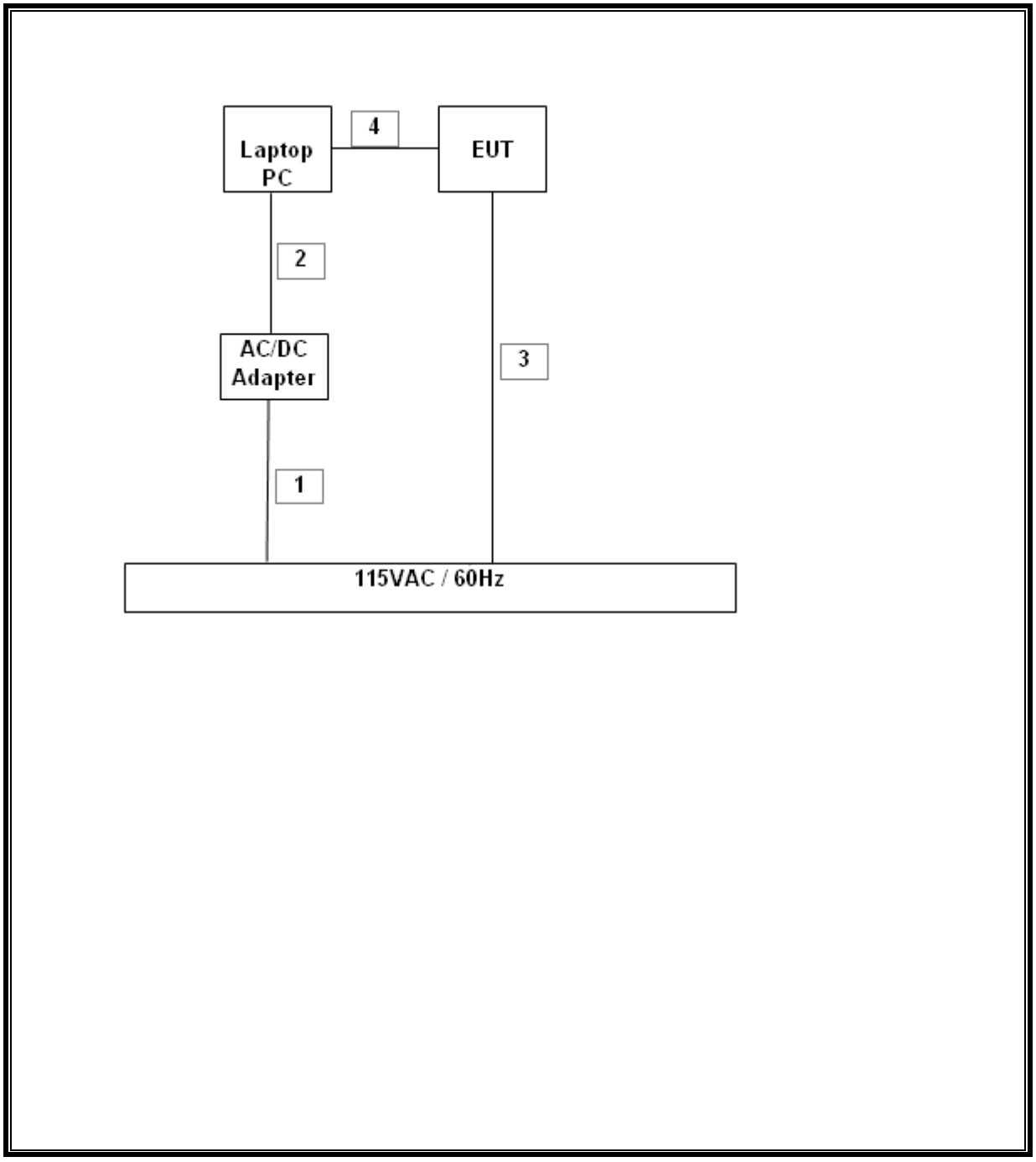
I/O CABLES

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

TEST SETUP

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

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

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

7. ANTENNA PORT TEST RESULTS

7.1. 802.11b 2TX 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.

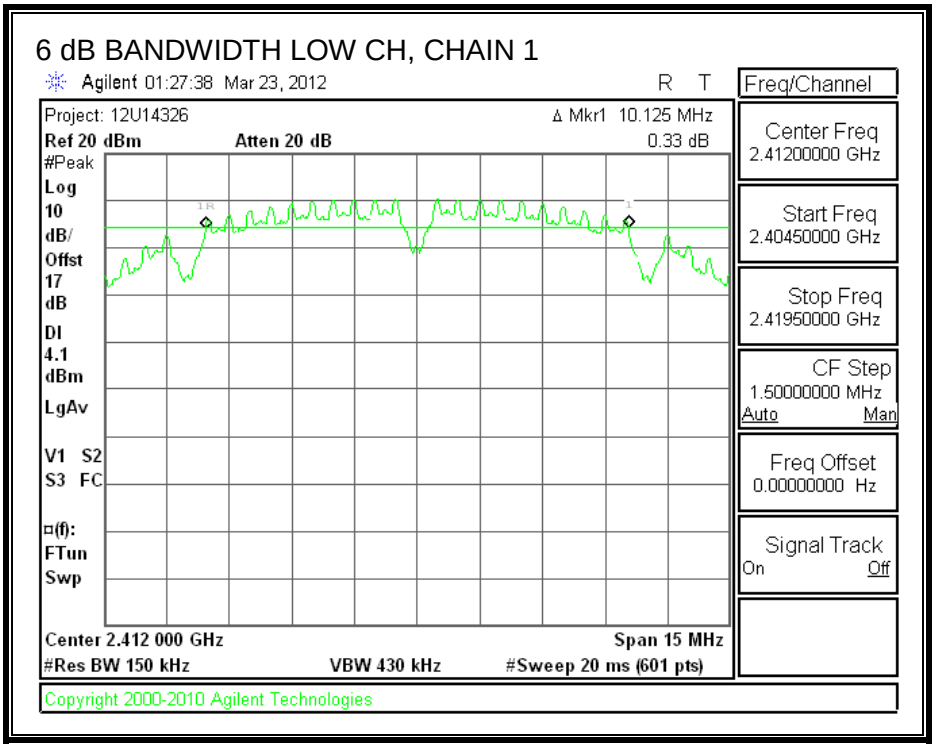
TEST PROCEDURE

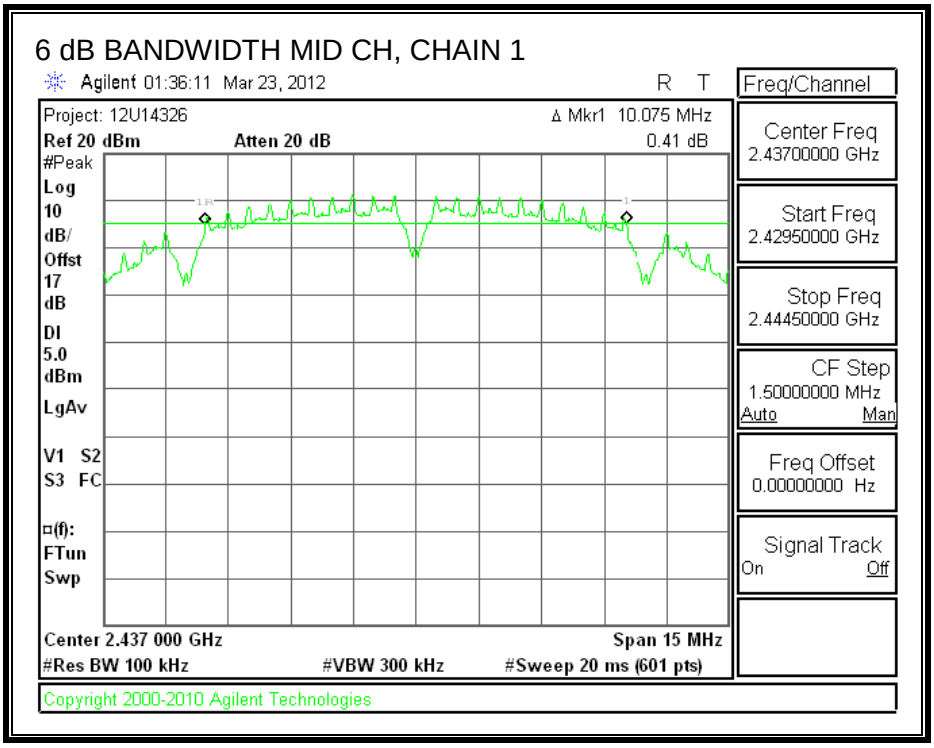
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

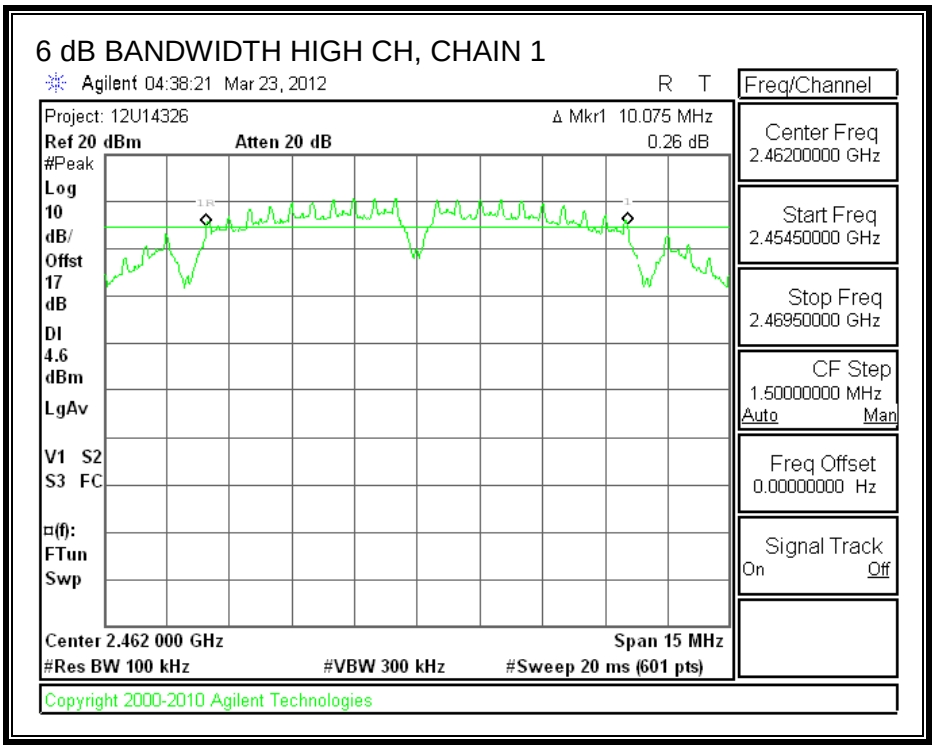
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW	Chain 2 6 dB BW	Minimum Limit (MHz)
Low	2412	10.125	10.075	0.5
Middle	2437	10.075	10.075	0.5
High	2462	10.075	10.075	0.5

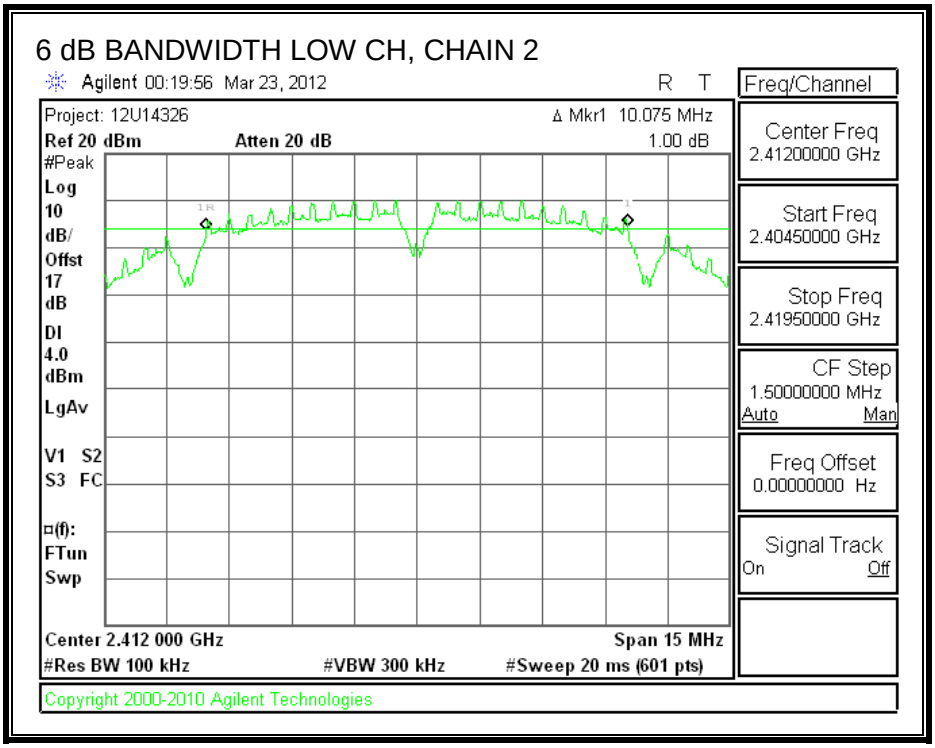
6 dB BANDWIDTH, CHAIN 1

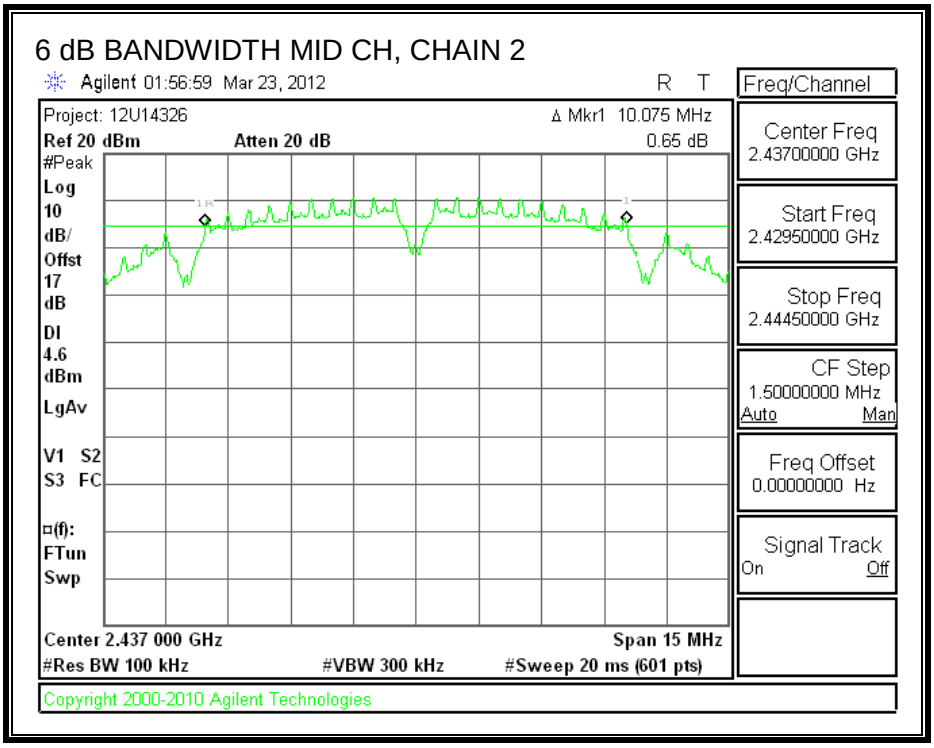




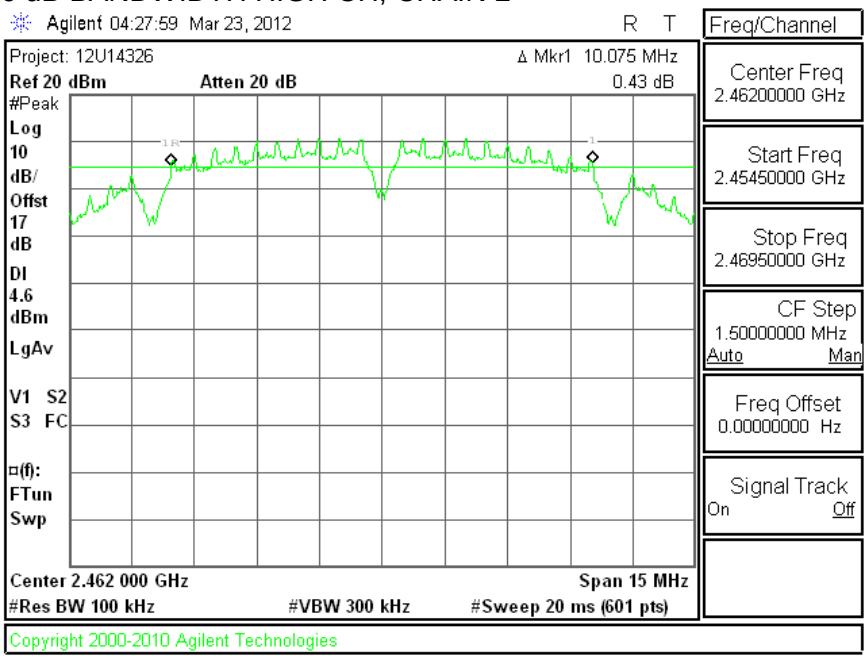


6 dB BANDWIDTH, CHAIN 2





6 dB BANDWIDTH HIGH CH, CHAIN 2



7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

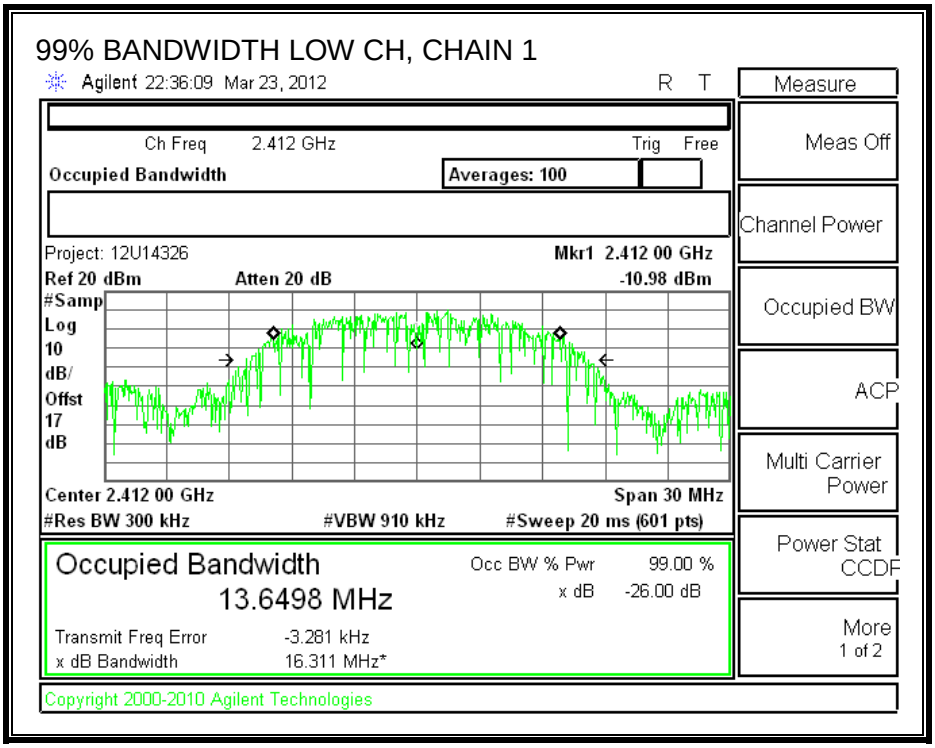
TEST PROCEDURE

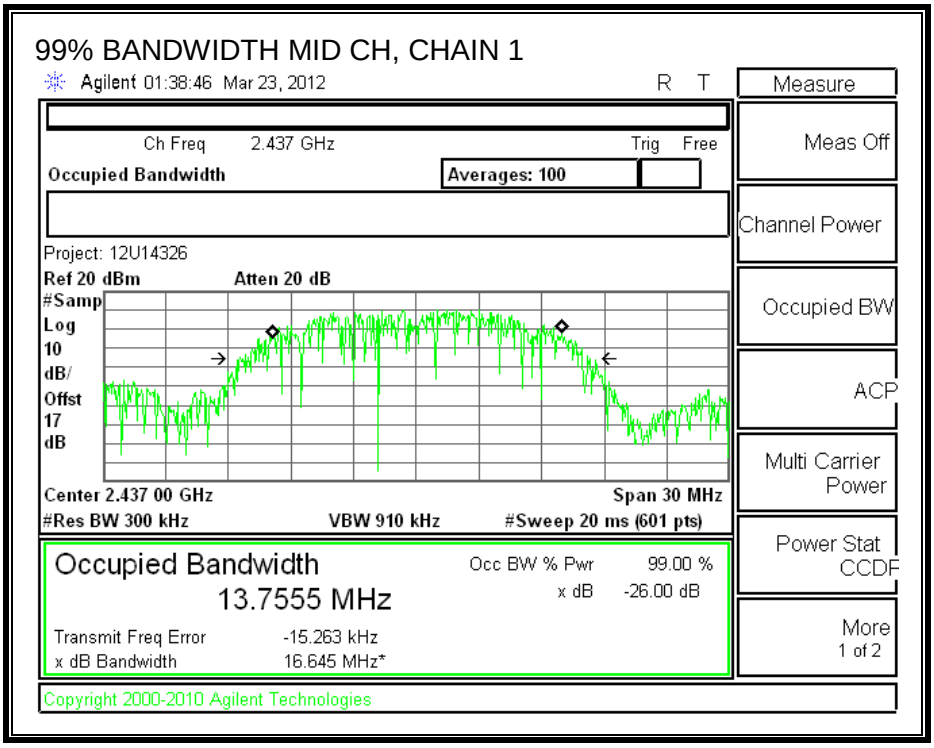
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

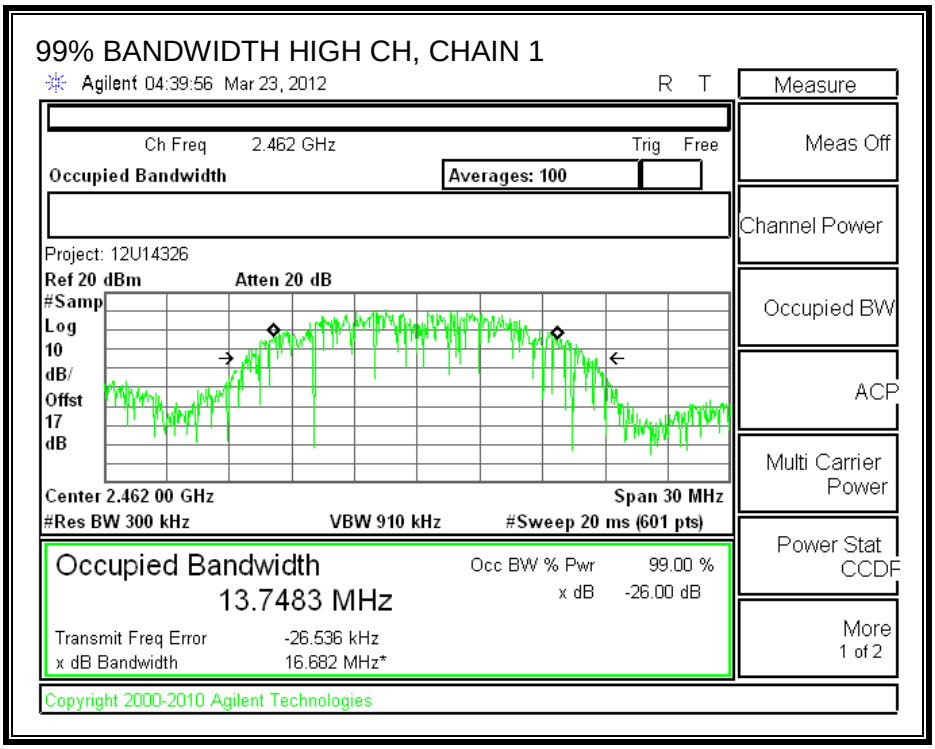
RESULTS

Channel	Frequency	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	2412	13.6498	13.7466
Middle	2437	13.7555	13.7763
High	2462	13.7483	13.8018

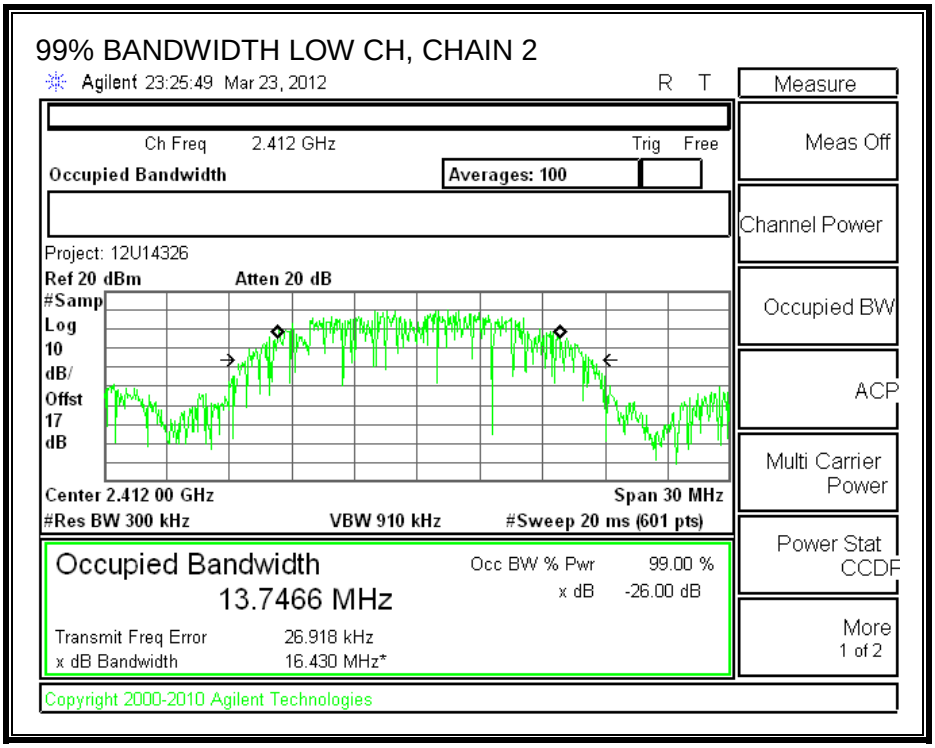
99% BANDWIDTH, CHAIN 1

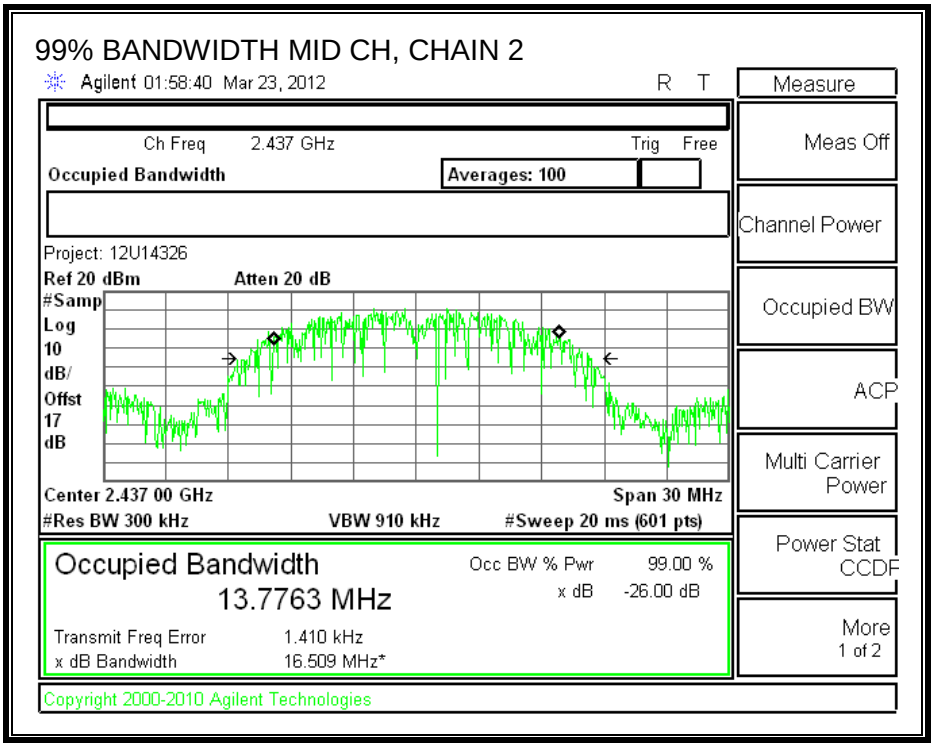


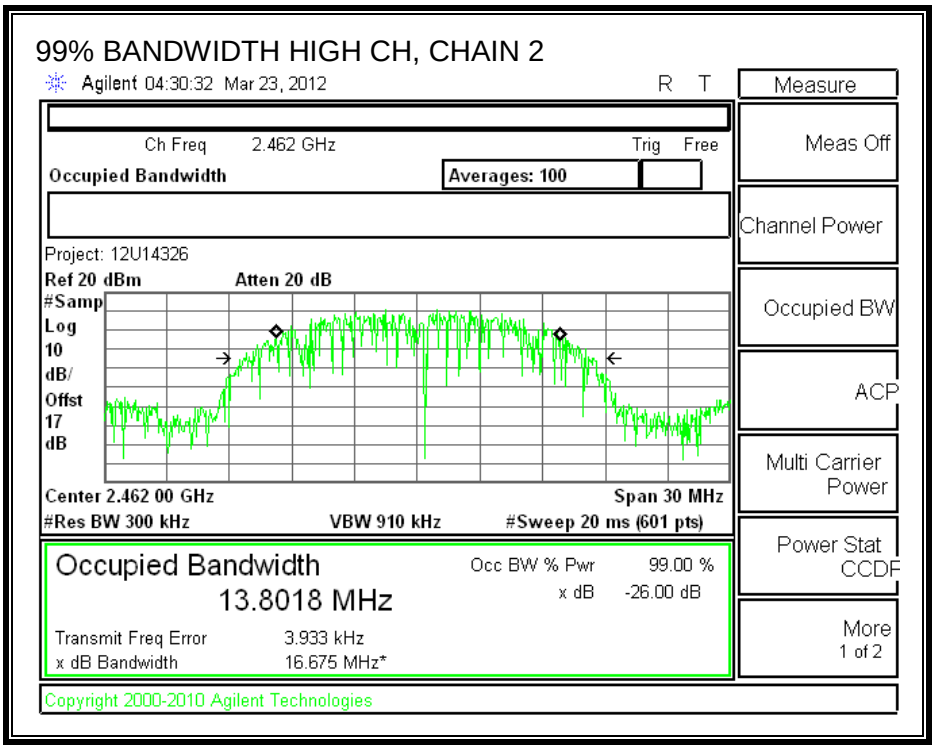




99% BANDWIDTH, CHAIN 2







7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
1.49	1.82	4.67

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

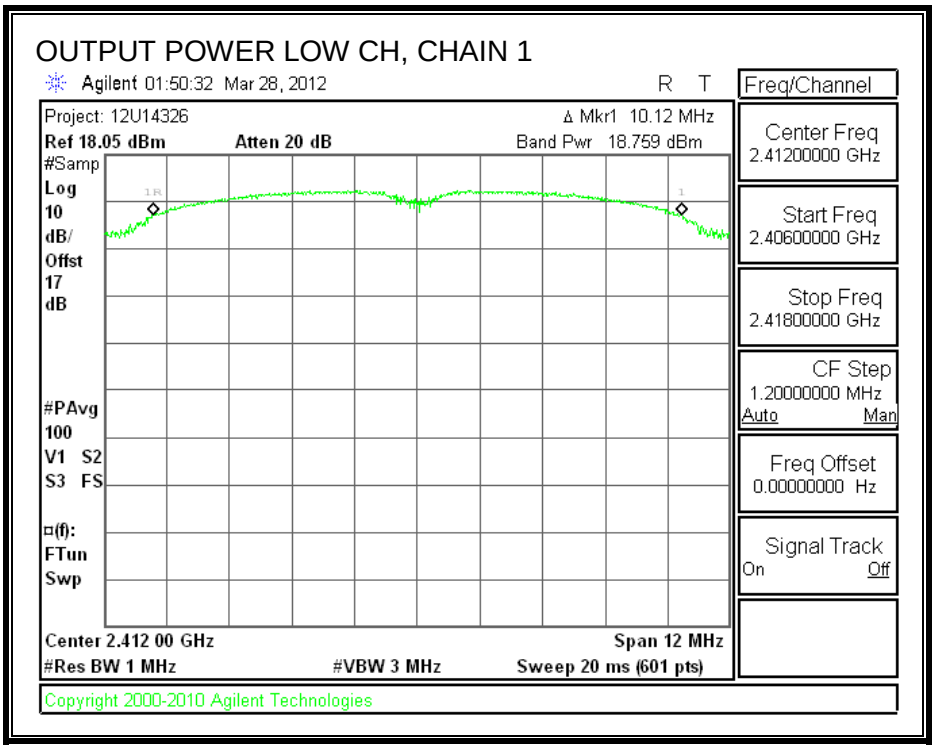
TEST PROCEDURE

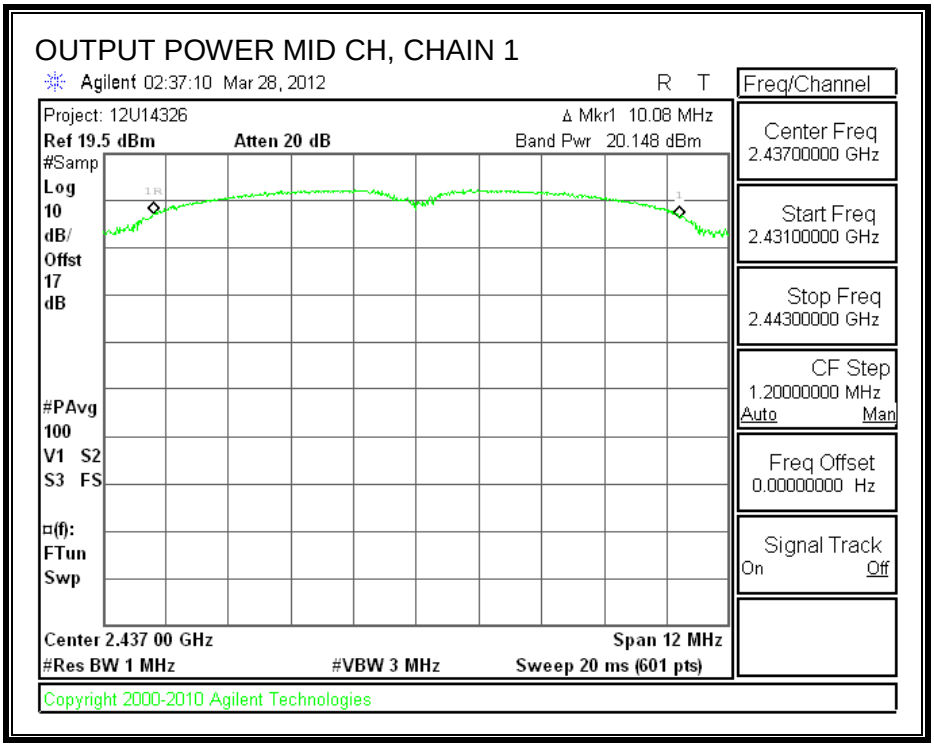
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

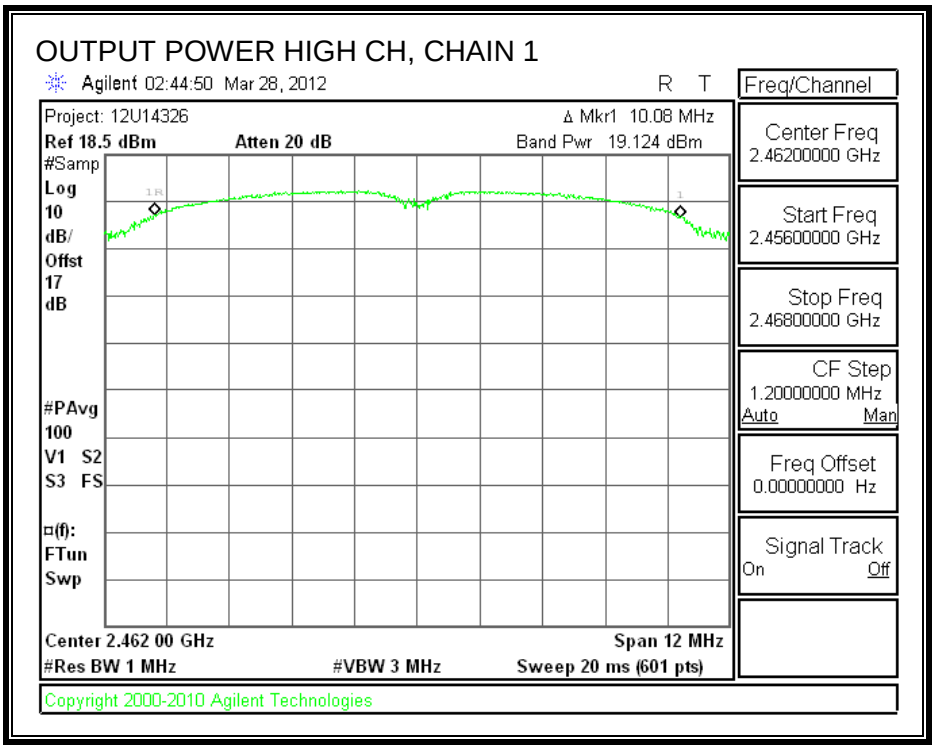
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	18.759	19.913	0.00	22.385	30.00	-7.615
Mid	2437	20.148	20.452	0.00	23.313	30.00	-6.687
High	2462	19.124	18.975	0.00	22.060	30.00	-7.940

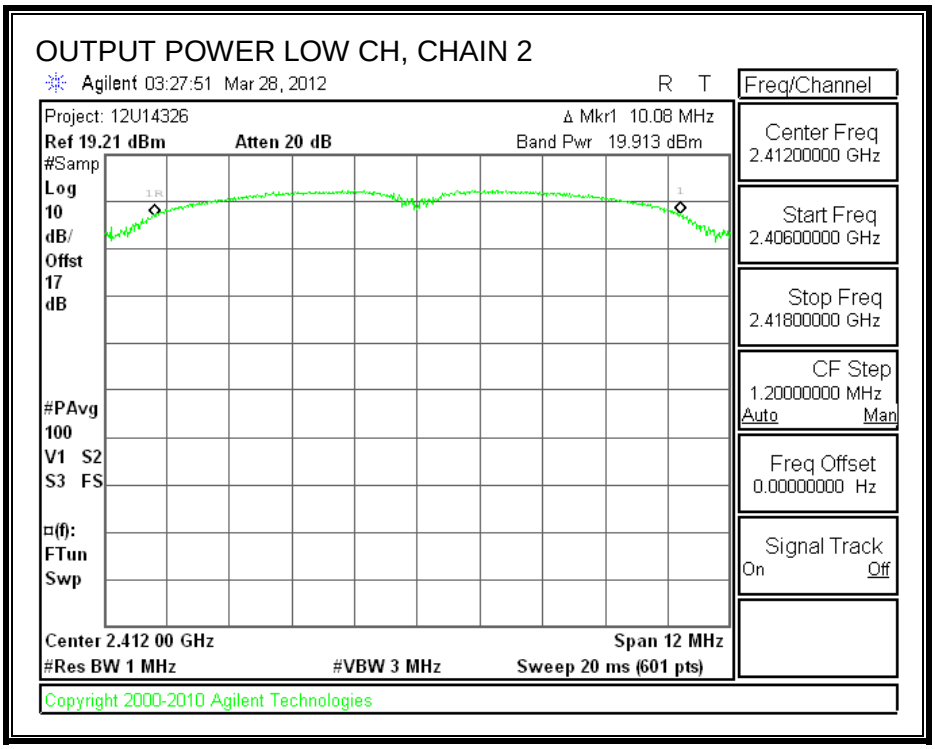
CHAIN 1 OUTPUT POWER



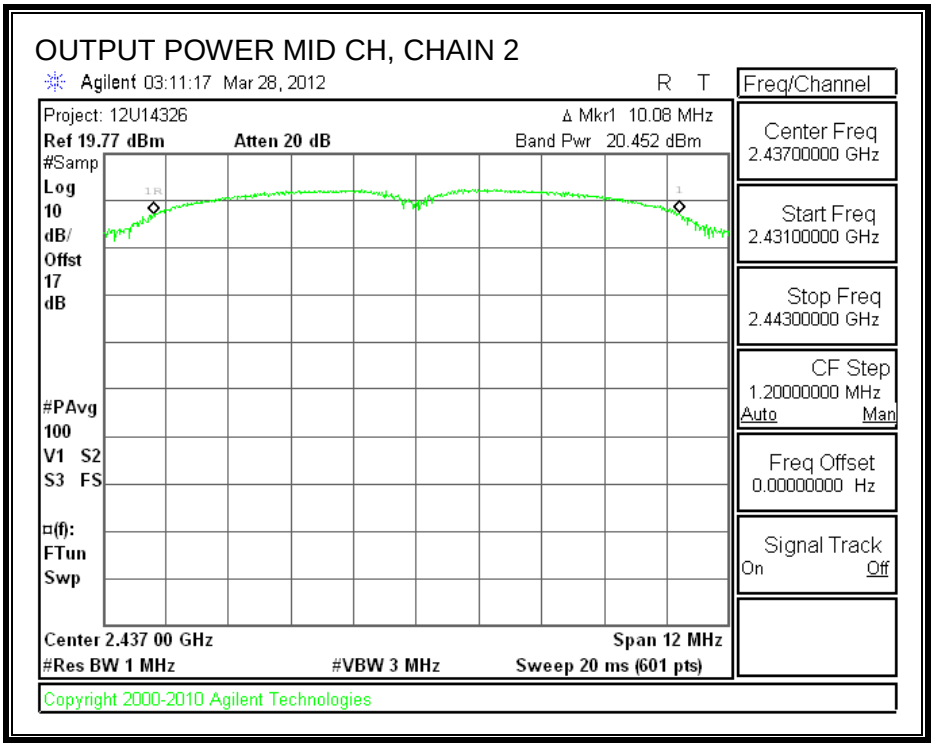




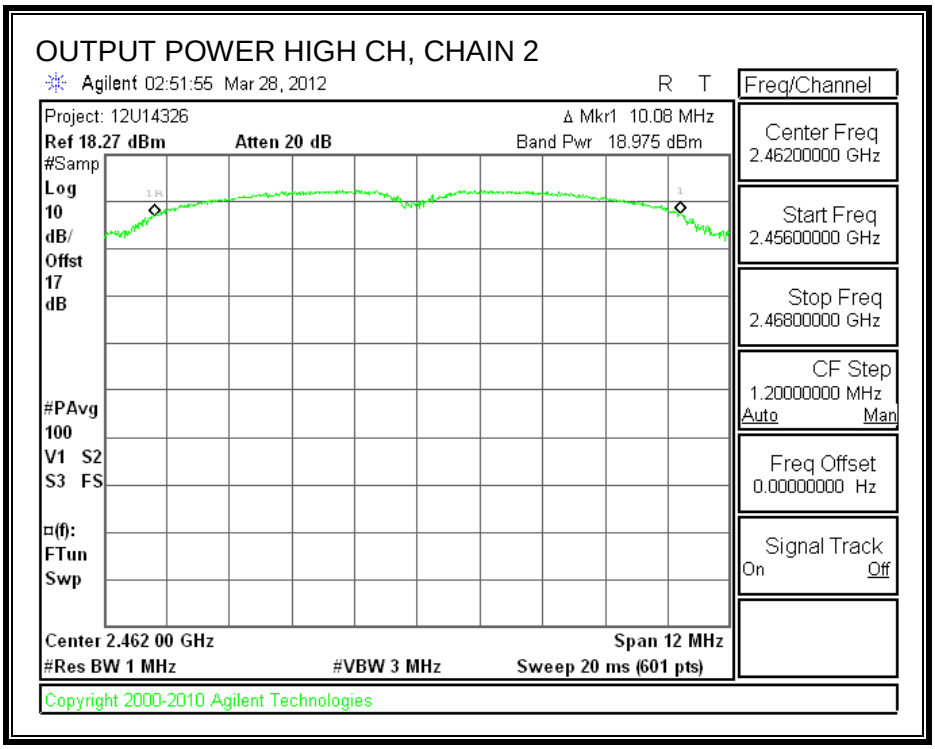
CHAIN 2 OUTPUT POWER



OUTPUT POWER MID CH, CHAIN 2



OUTPUT POWER HIGH CH, CHAIN 2



7.1.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	2412	18.70	19.10	21.91
Middle	2437	20.10	19.70	22.91
High	2462	18.60	18.90	21.76

7.1.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

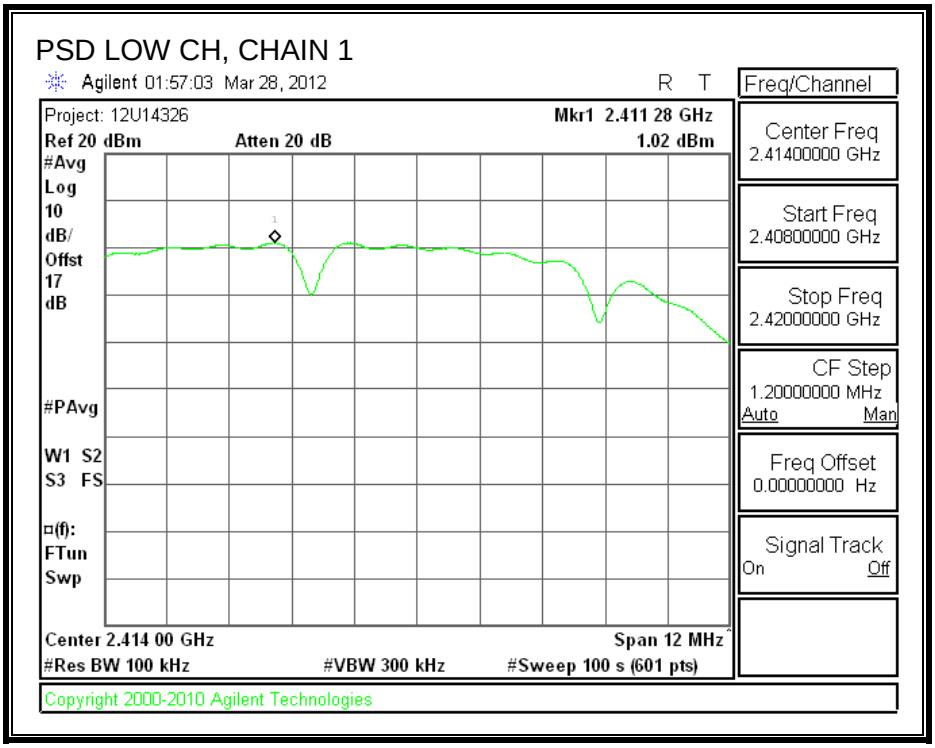
TEST PROCEDURE

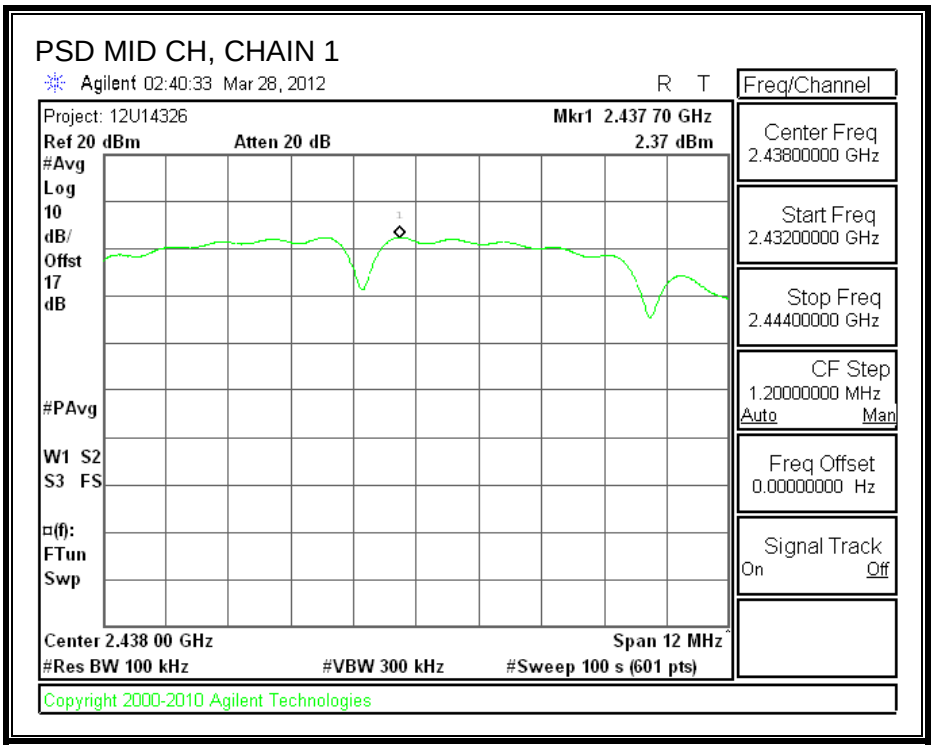
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.".

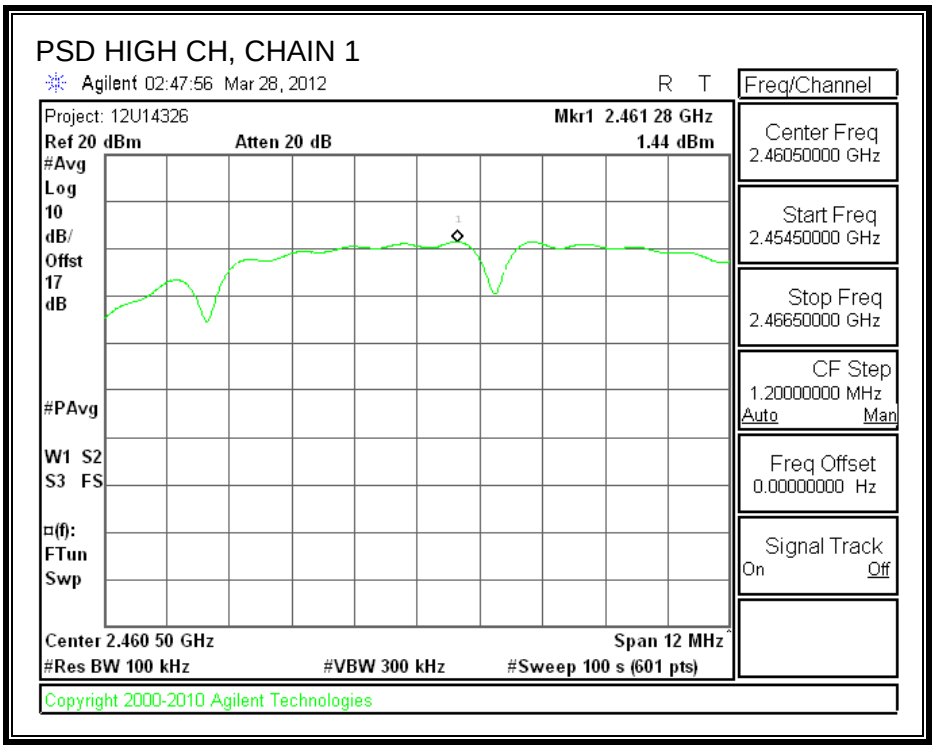
RESULTS

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	10log(3kHz/ 100kHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	1.02	2.17	-15.20	-10.56	8	-18.56
Middle	2437	2.37	2.69	-15.20	-9.66	8	-17.66
High	2462	1.44	1.24	-15.20	-10.85	8	-18.85

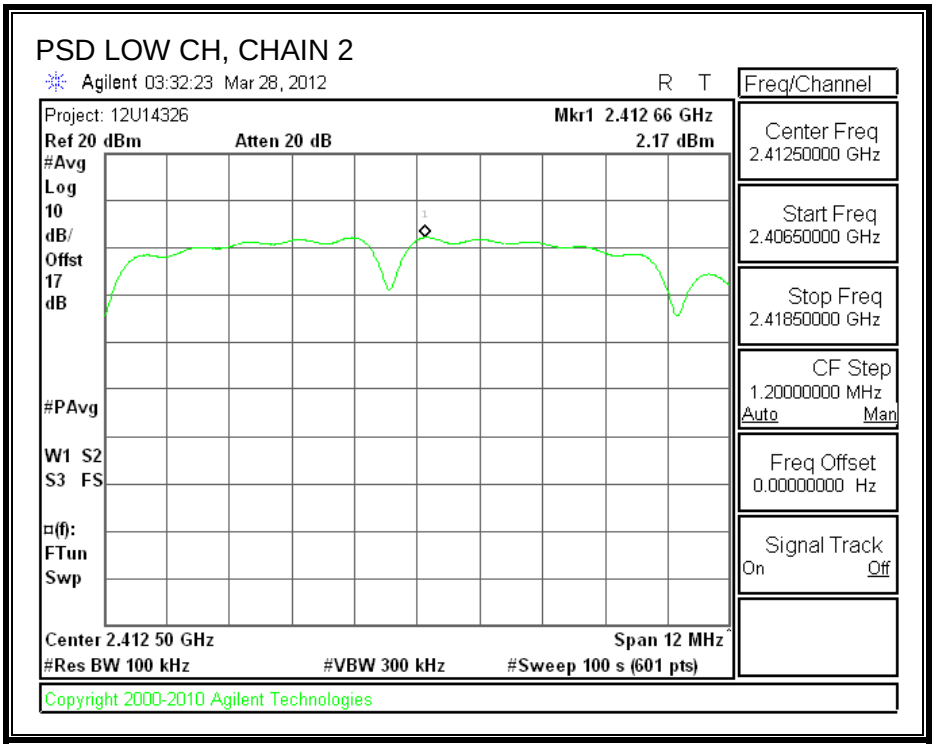
POWER SPECTRAL DENSITY, CHAIN 1

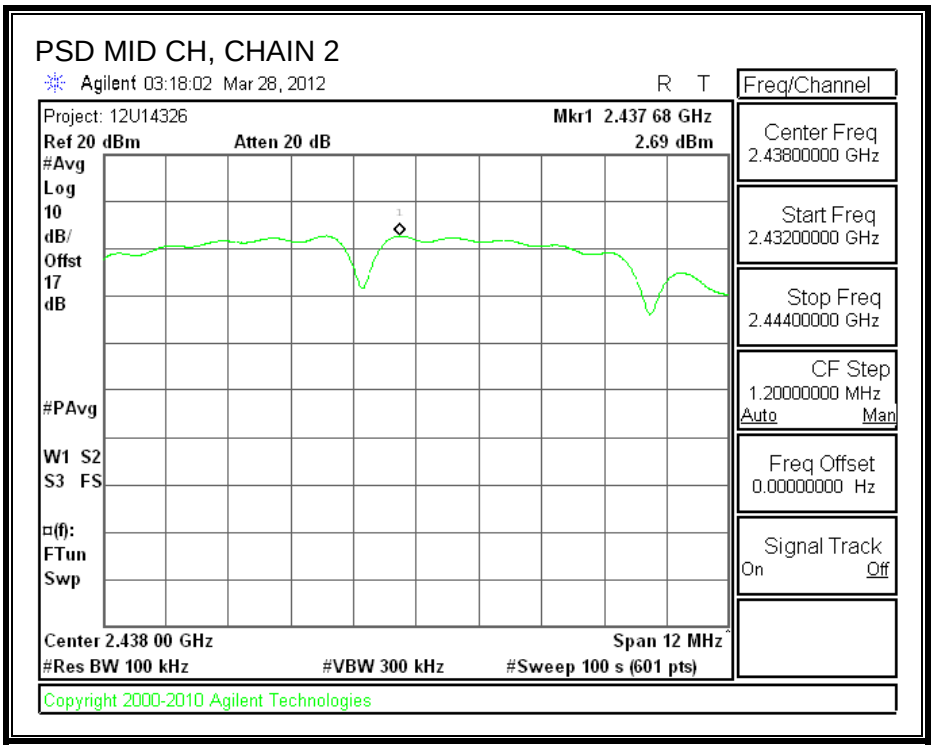


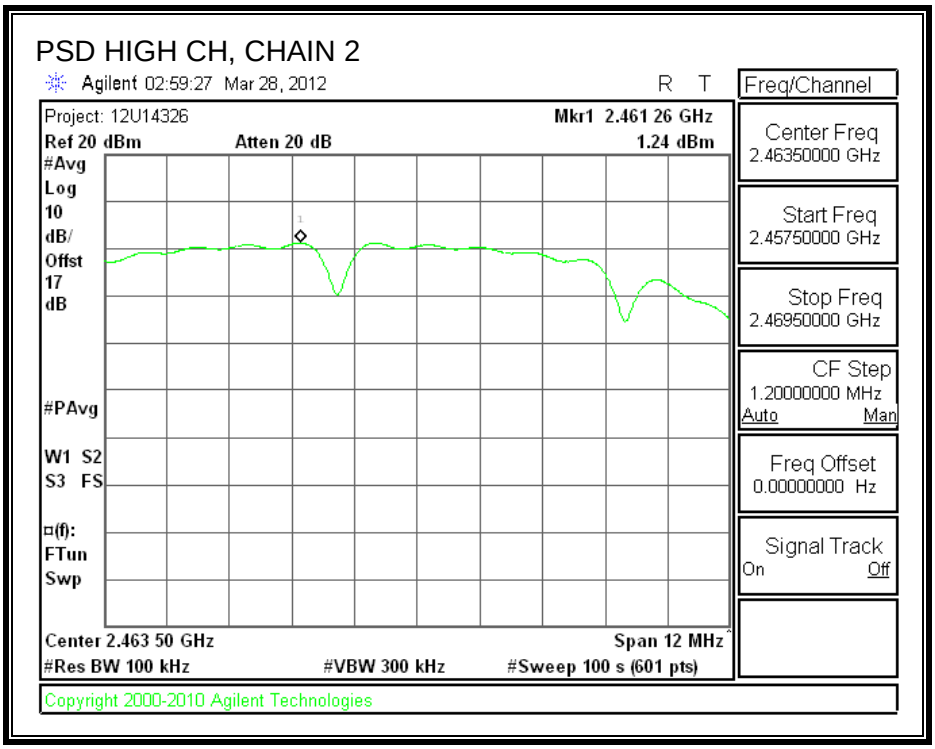




POWER SPECTRAL DENSITY, CHAIN 2







7.1.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

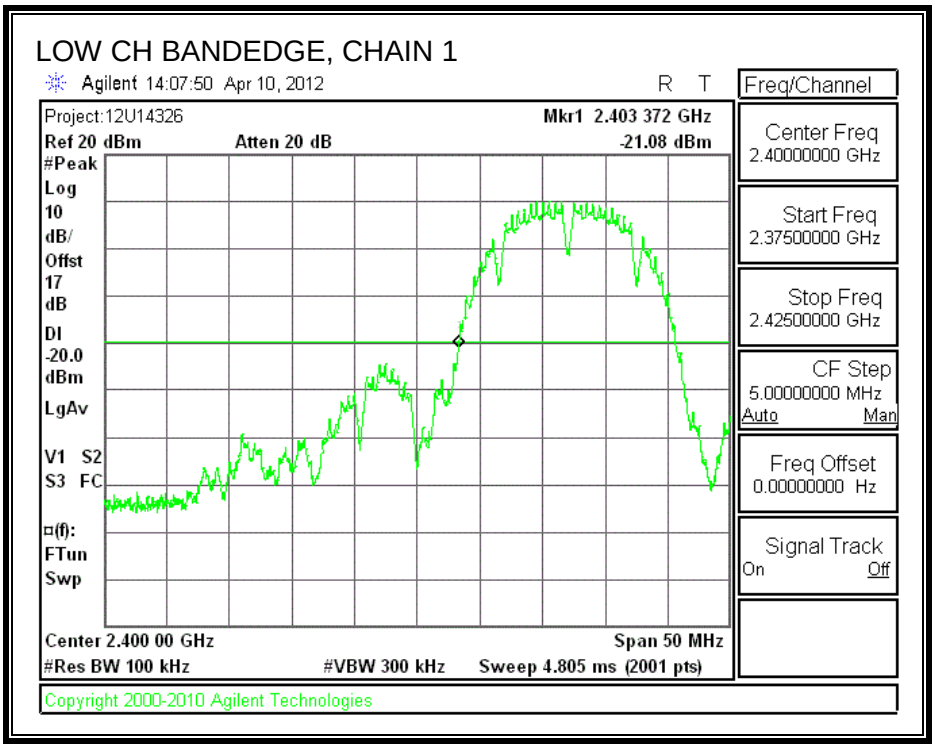
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

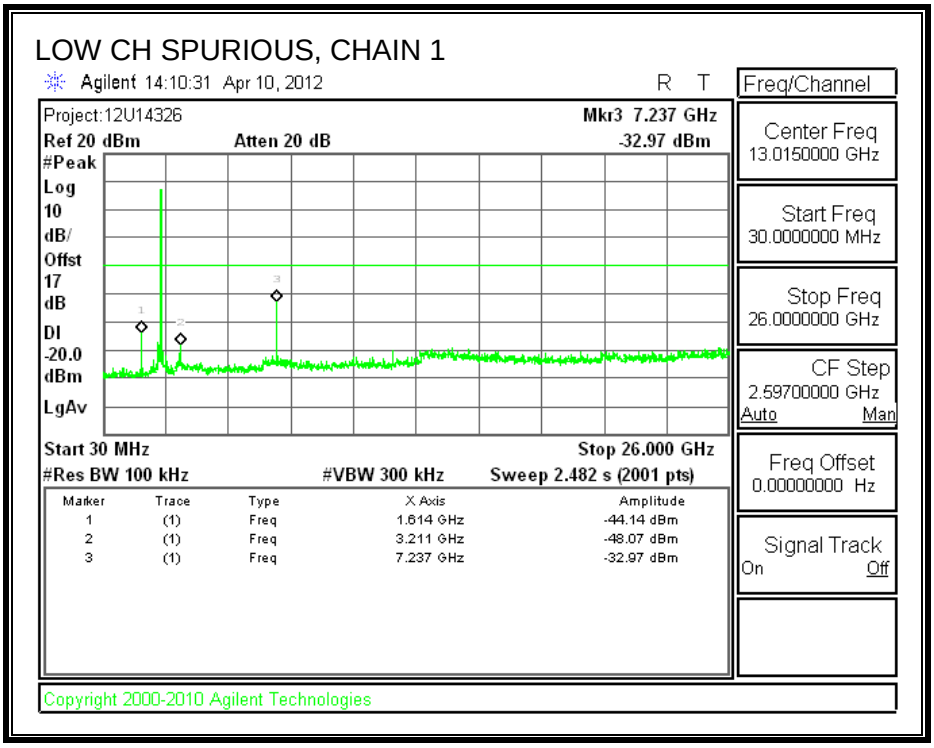
TEST PROCEDURE

KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

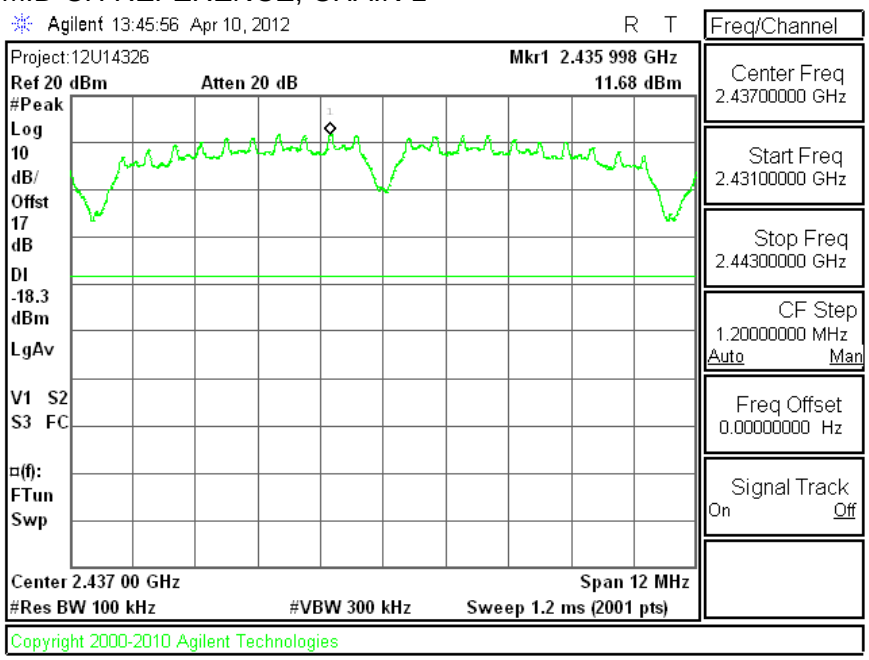
RESULTS

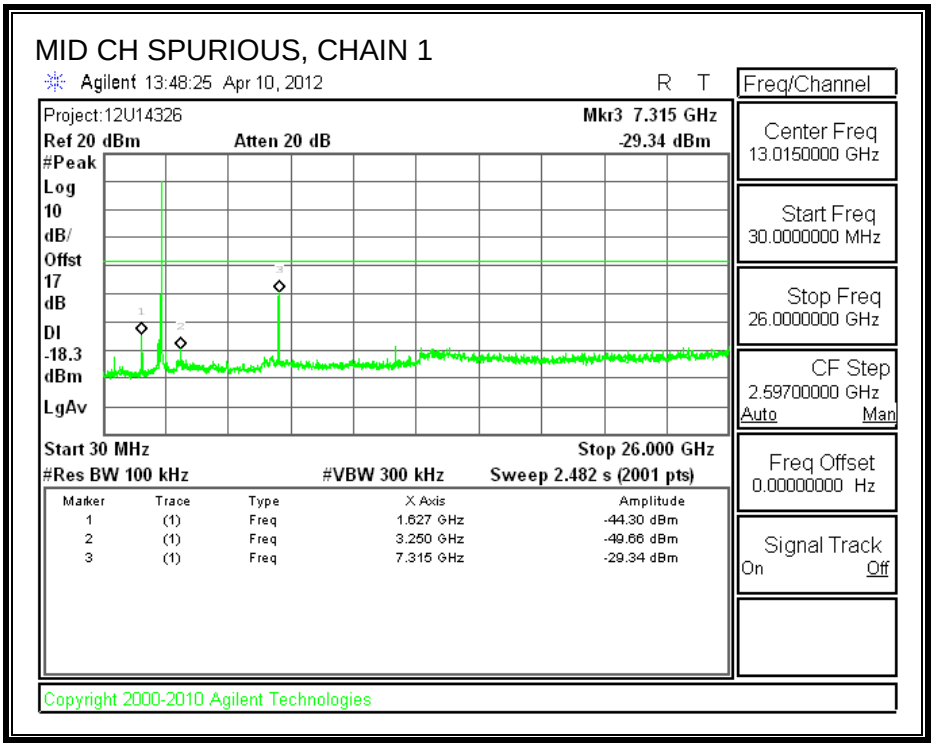
CHAIN 1 SPURIOUS EMISSIONS

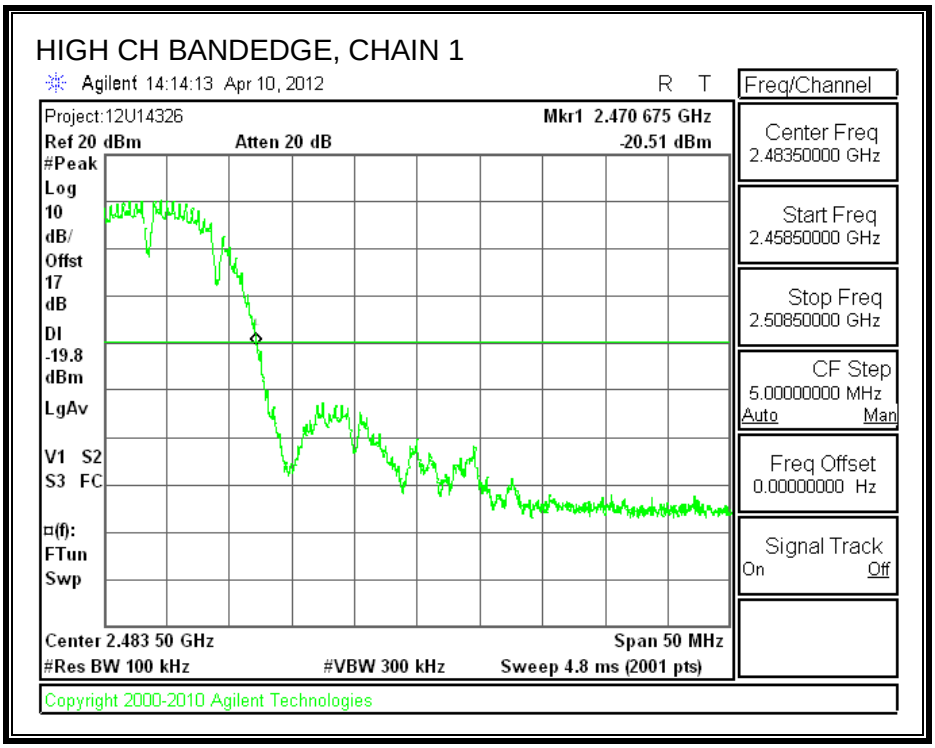


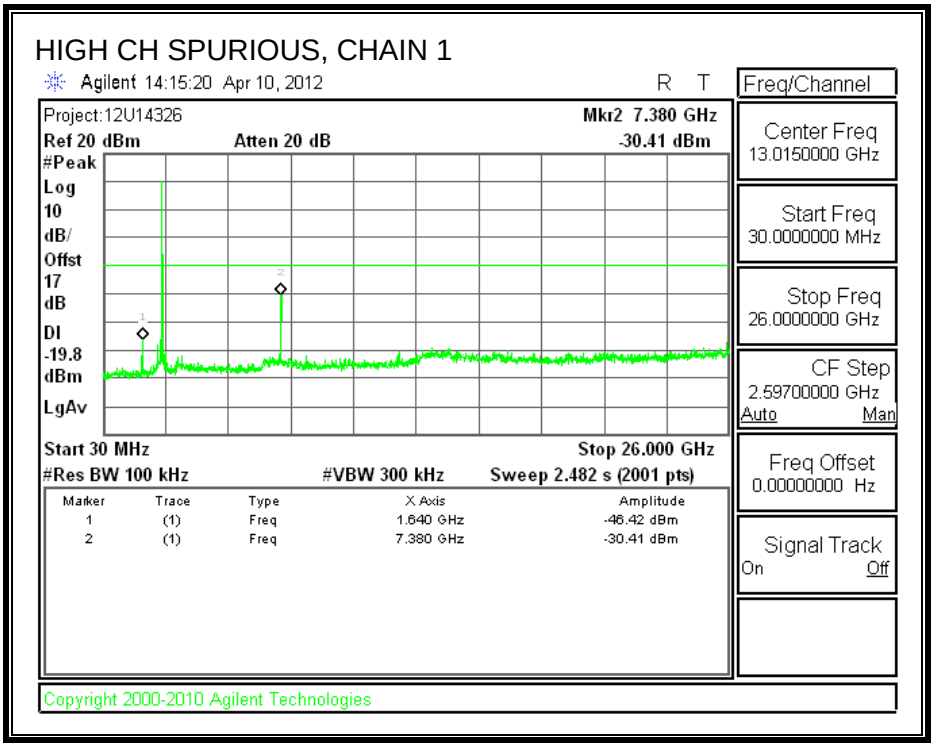


MID CH REFERENCE, CHAIN 1

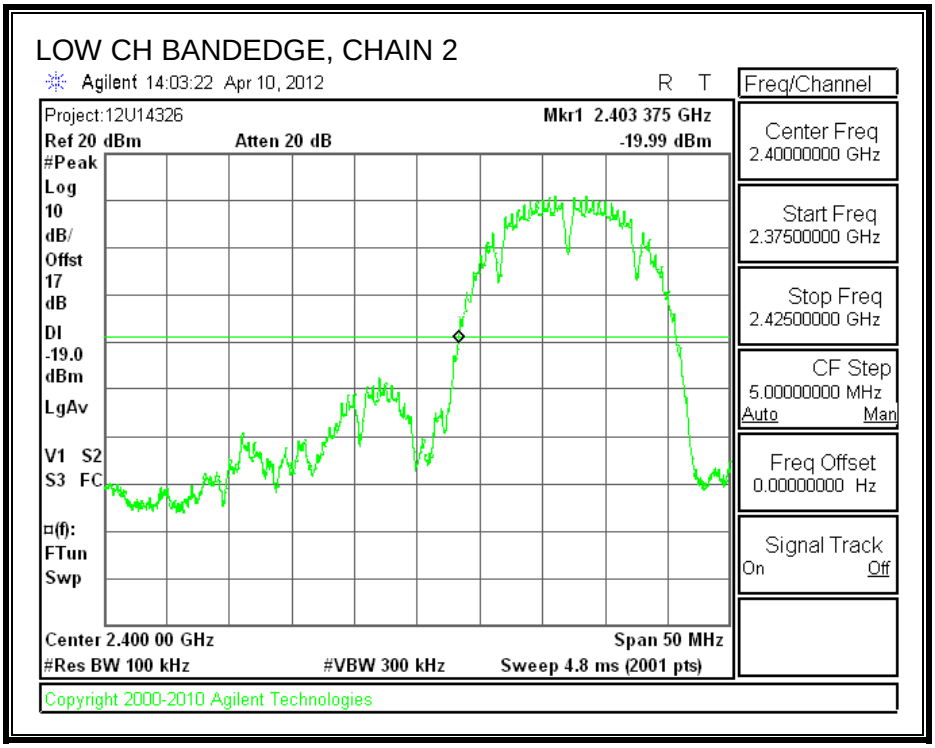


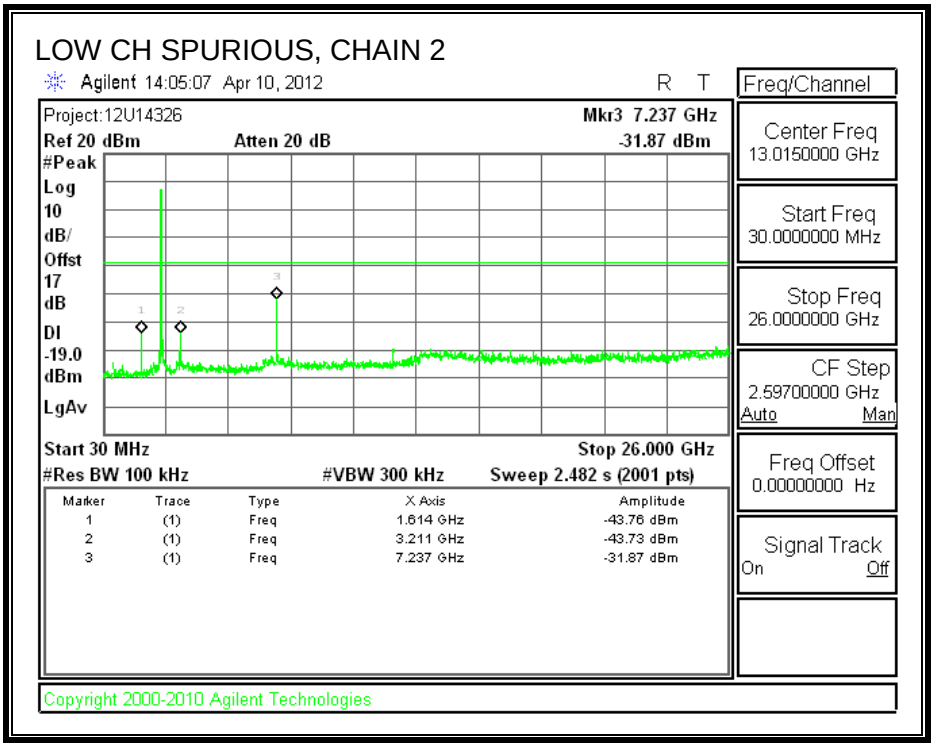


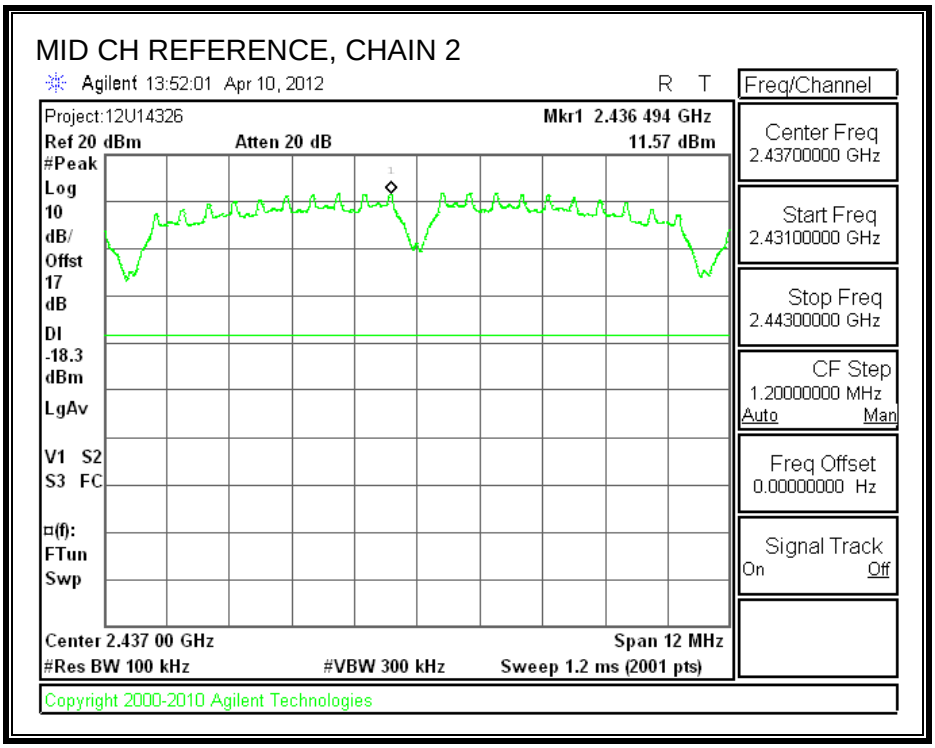


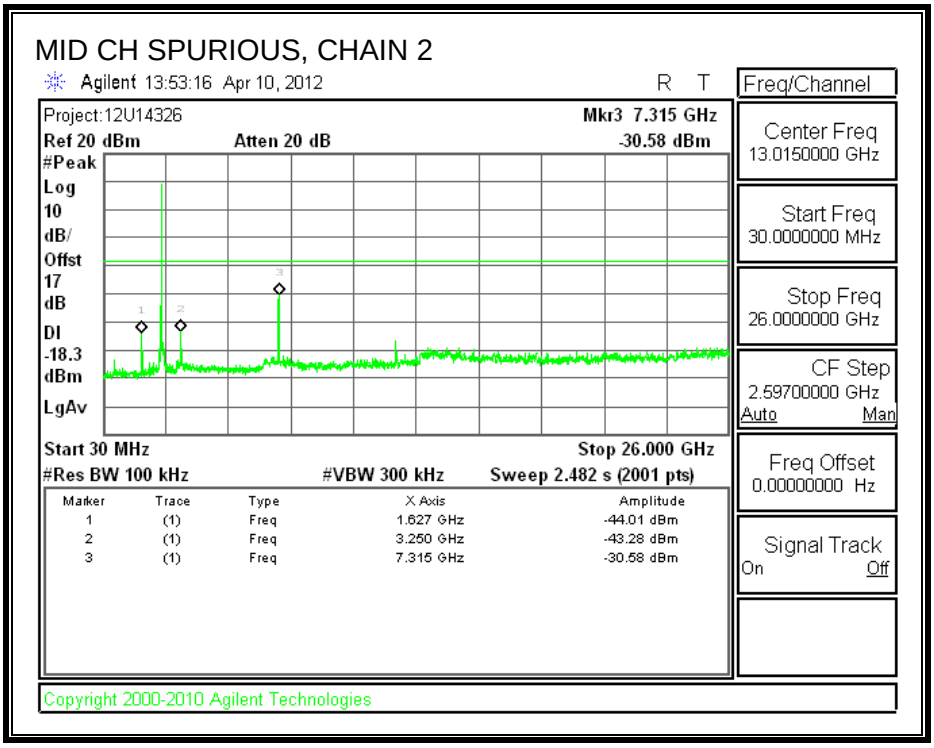


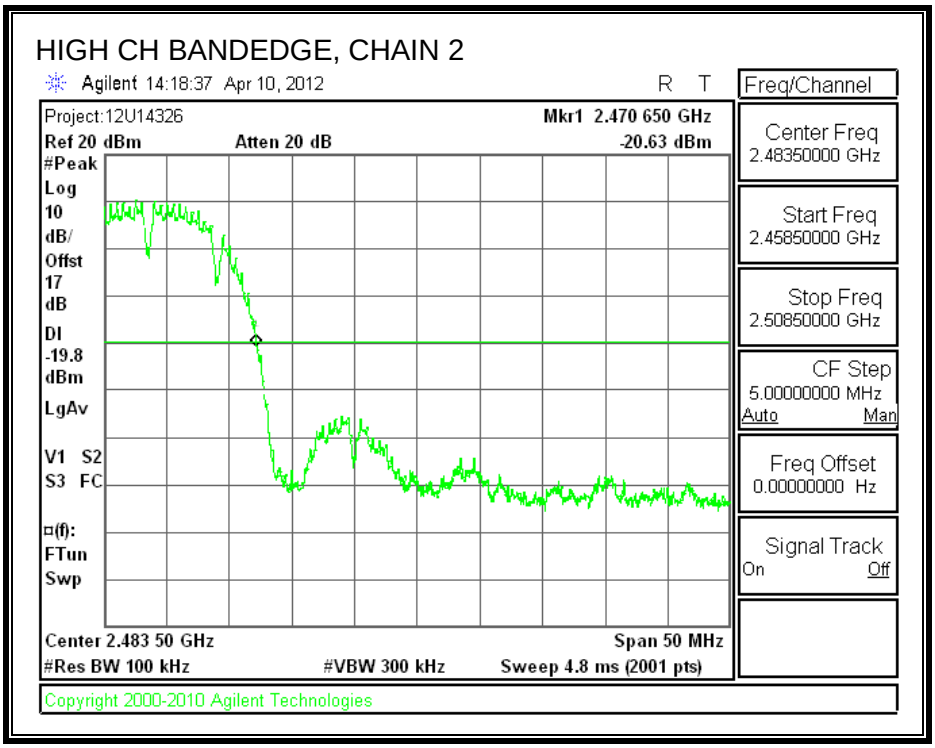
CHAIN 2 SPURIOUS EMISSIONS



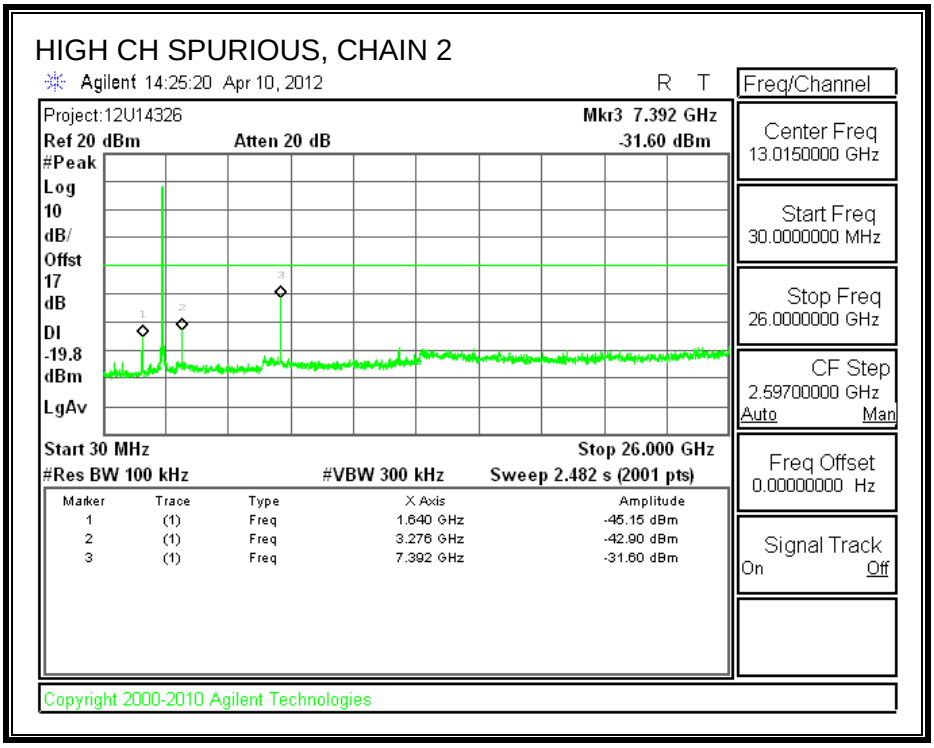








HIGH CH SPURIOUS, CHAIN 2



7.2. 802.11g 2TX LEGACY 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.

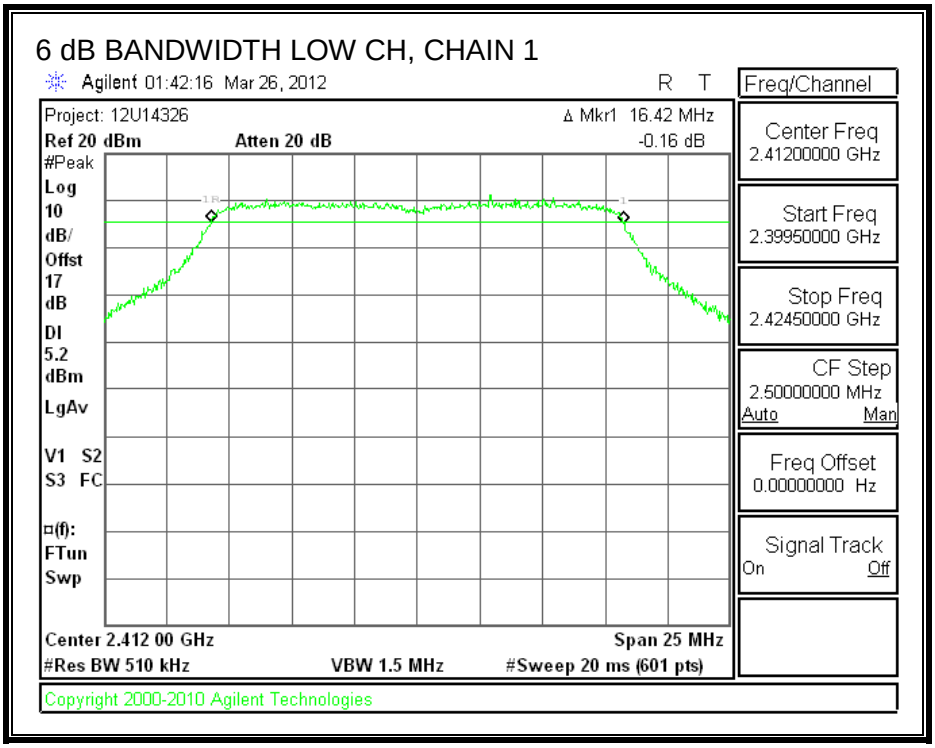
TEST PROCEDURE

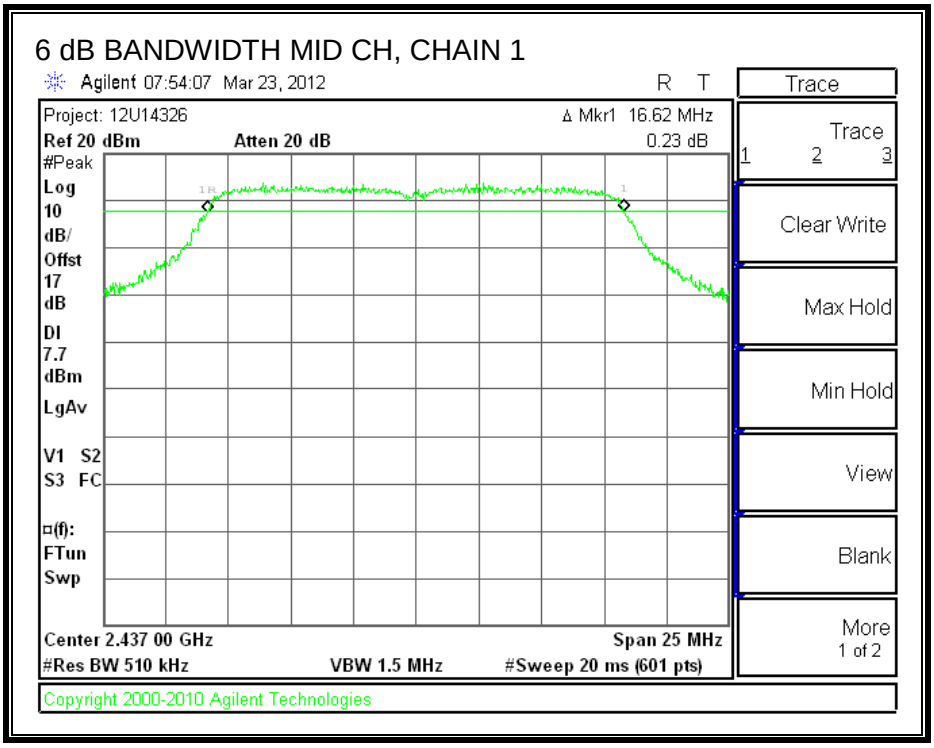
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

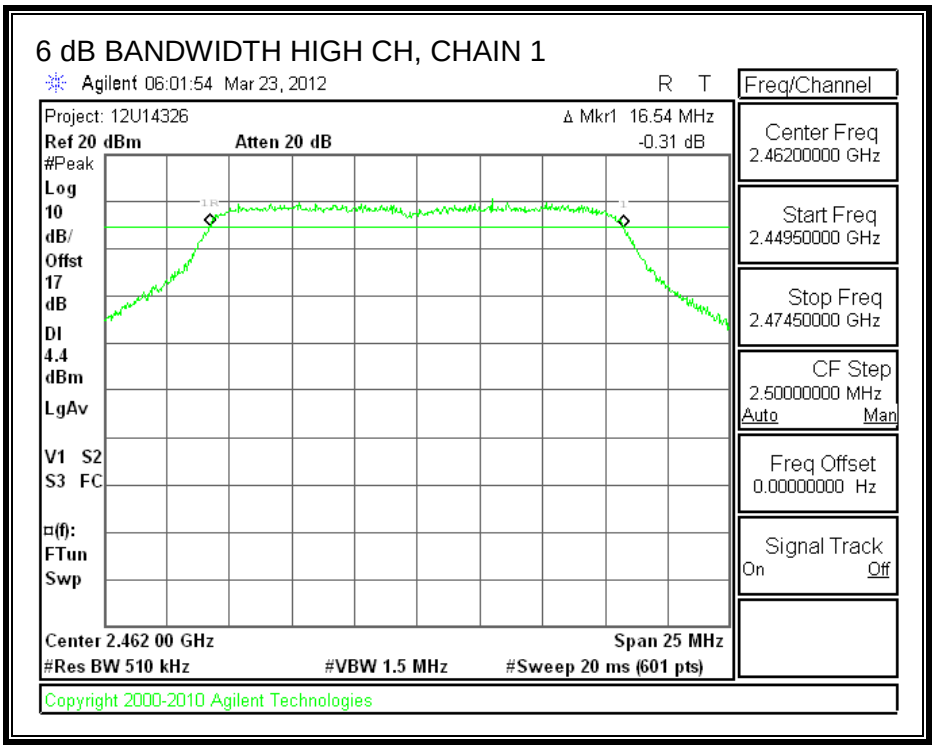
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	16.42	16.58	0.5
Middle	2437	16.62	16.58	0.5
High	2462	16.54	16.54	0.5

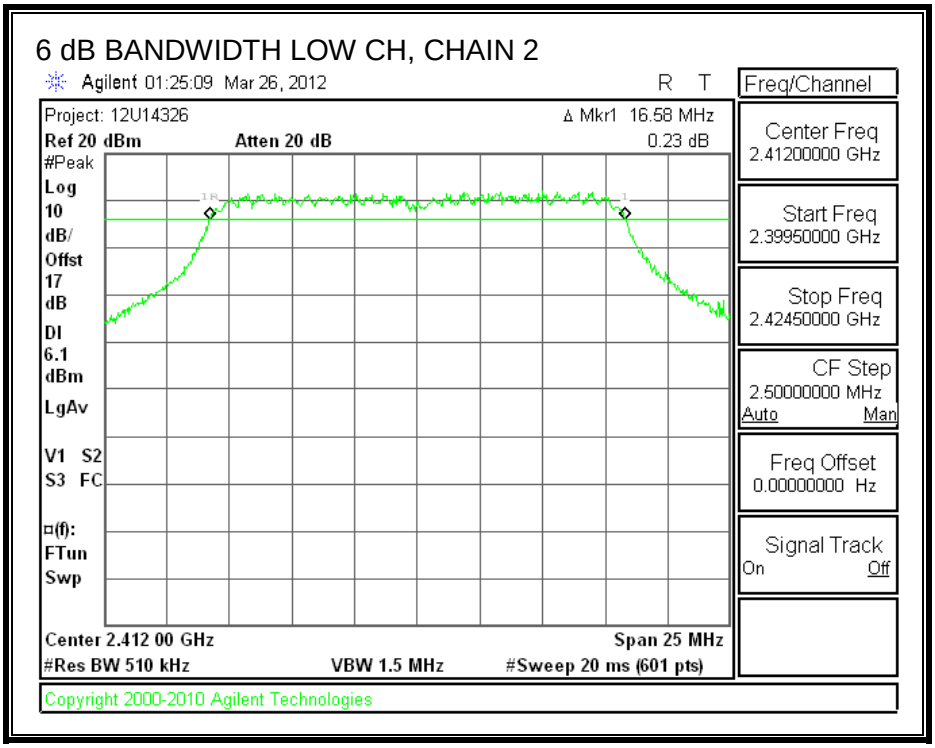
6 dB BANDWIDTH, CHAIN 1

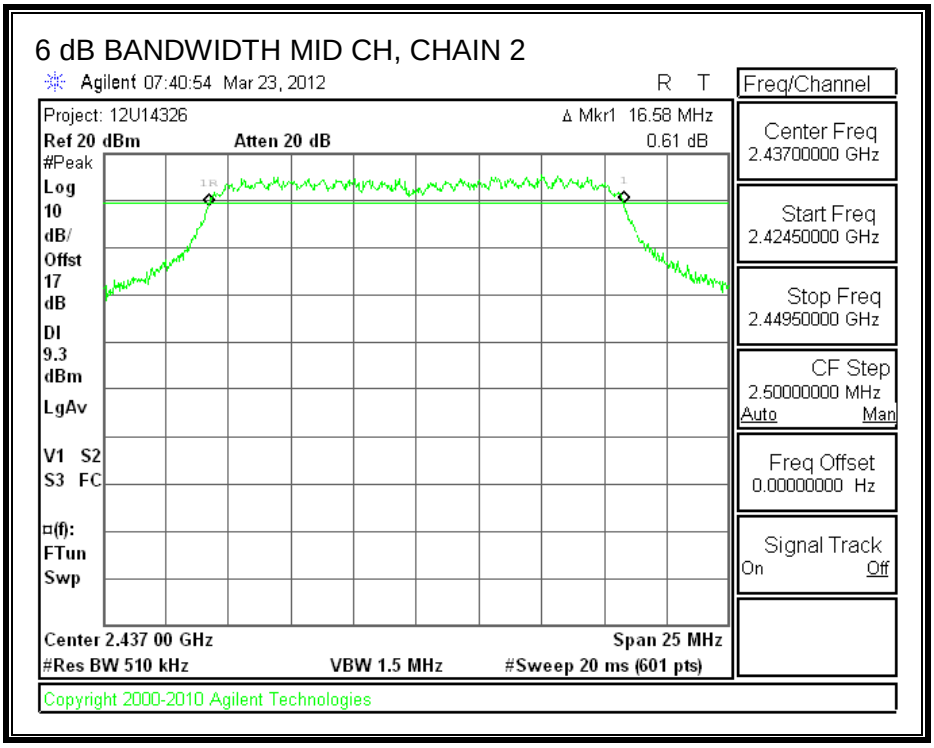


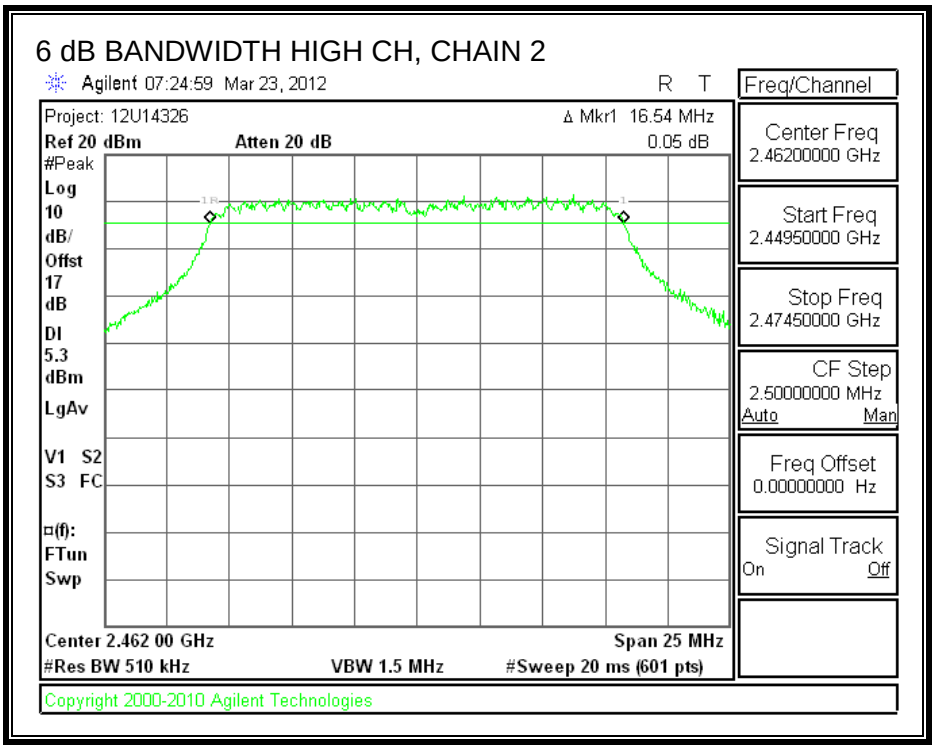




6 dB BANDWIDTH, CHAIN 2







7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

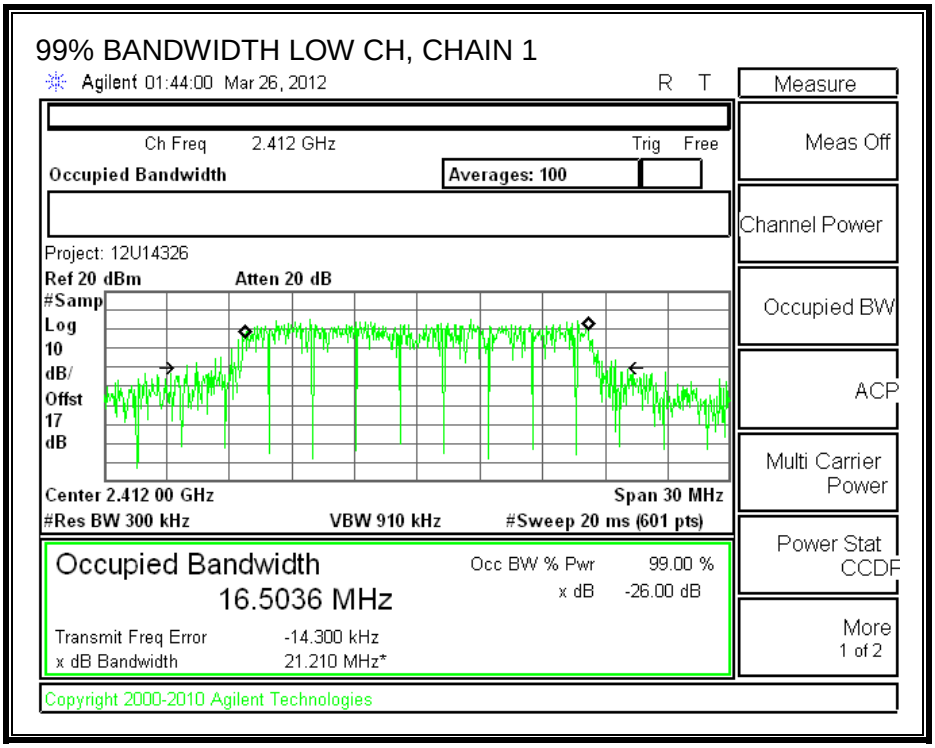
TEST PROCEDURE

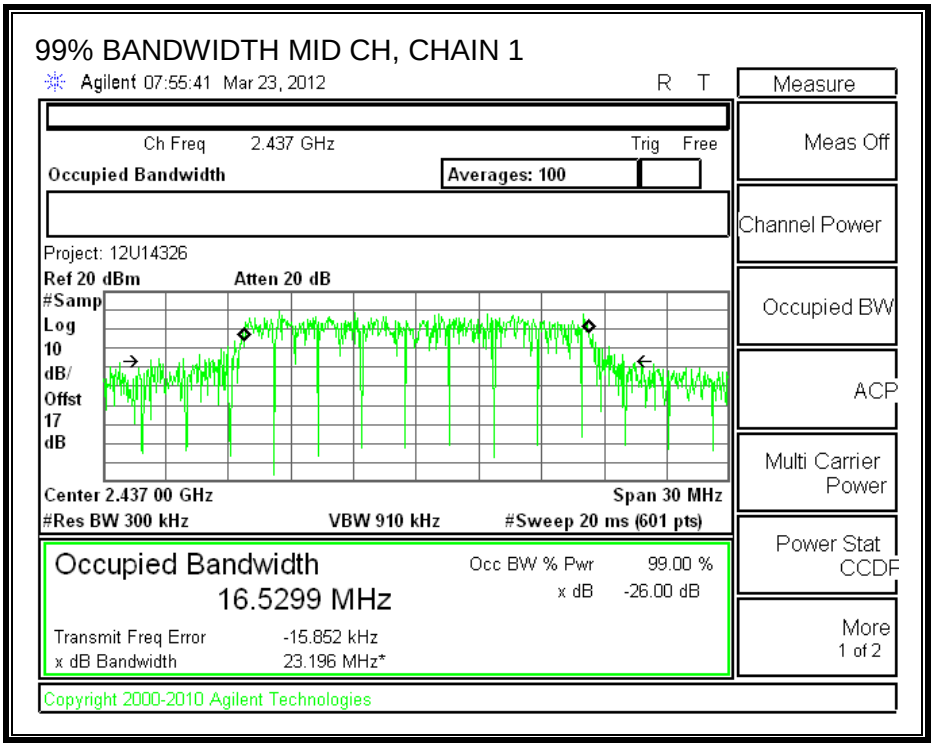
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

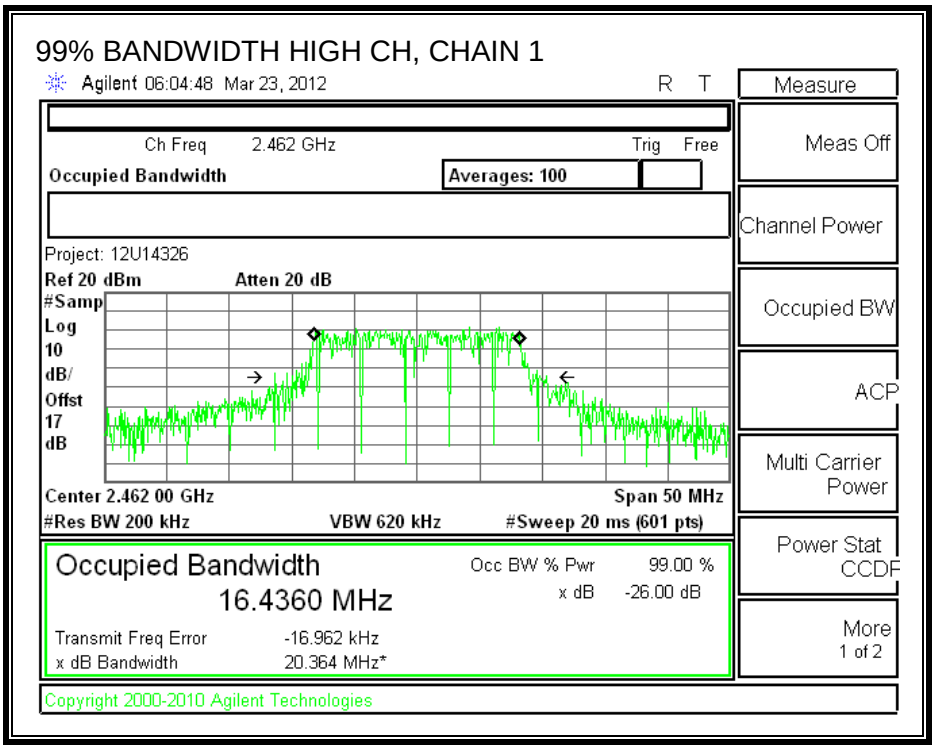
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	2412	16.5036	16.4967
Middle	2437	16.5299	16.5313
High	2462	16.4360	16.4288

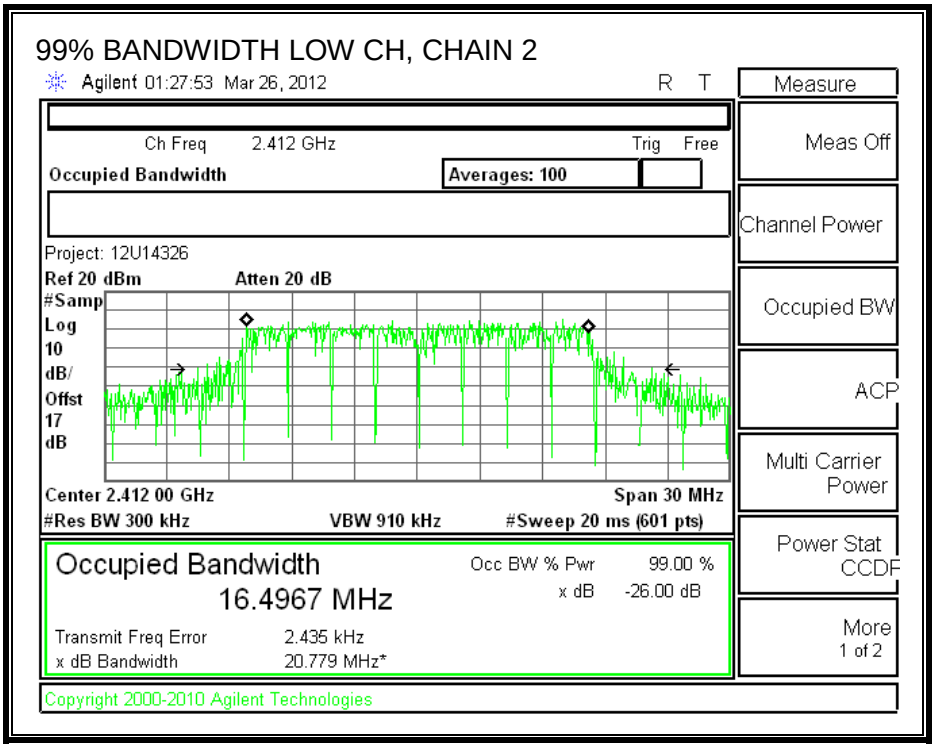
99% BANDWIDTH, CHAIN 1

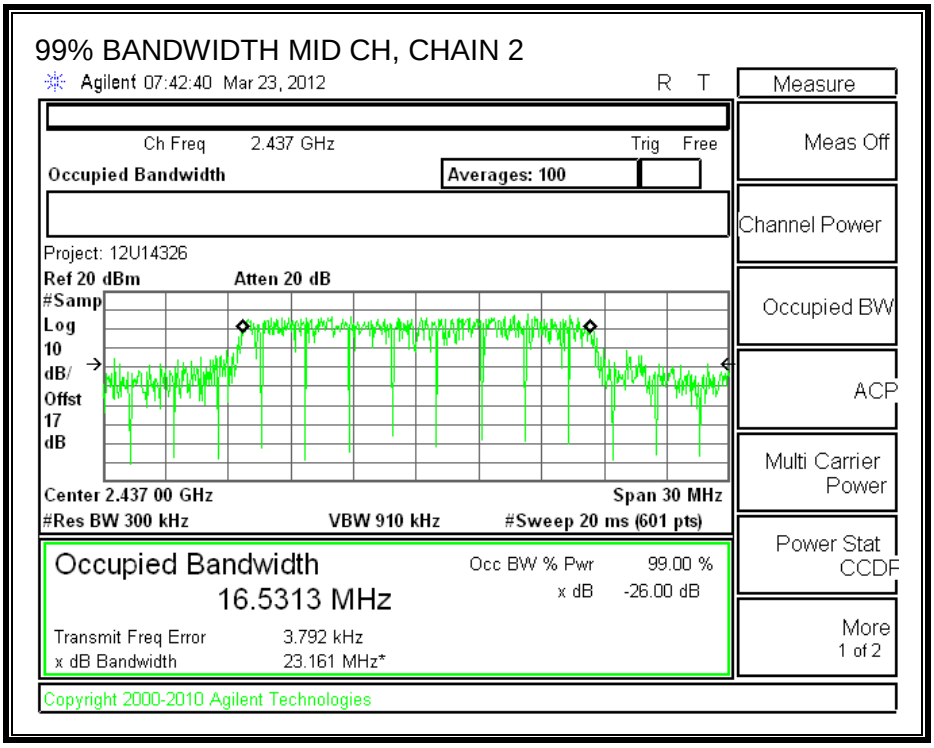


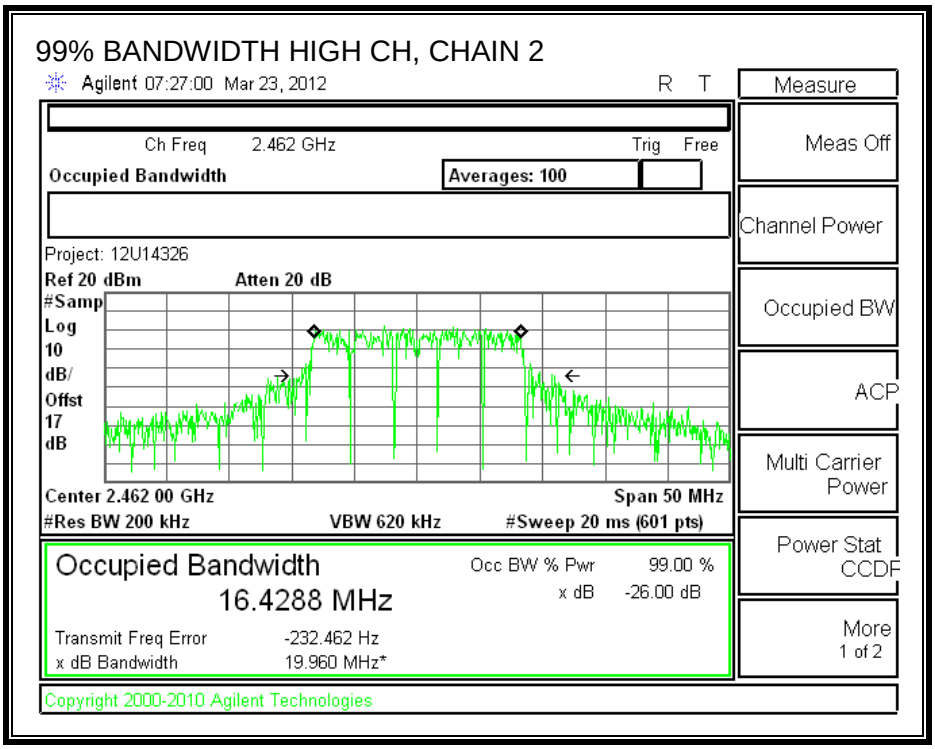




99% BANDWIDTH, CHAIN 2







7.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
1.49	1.82	4.67

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

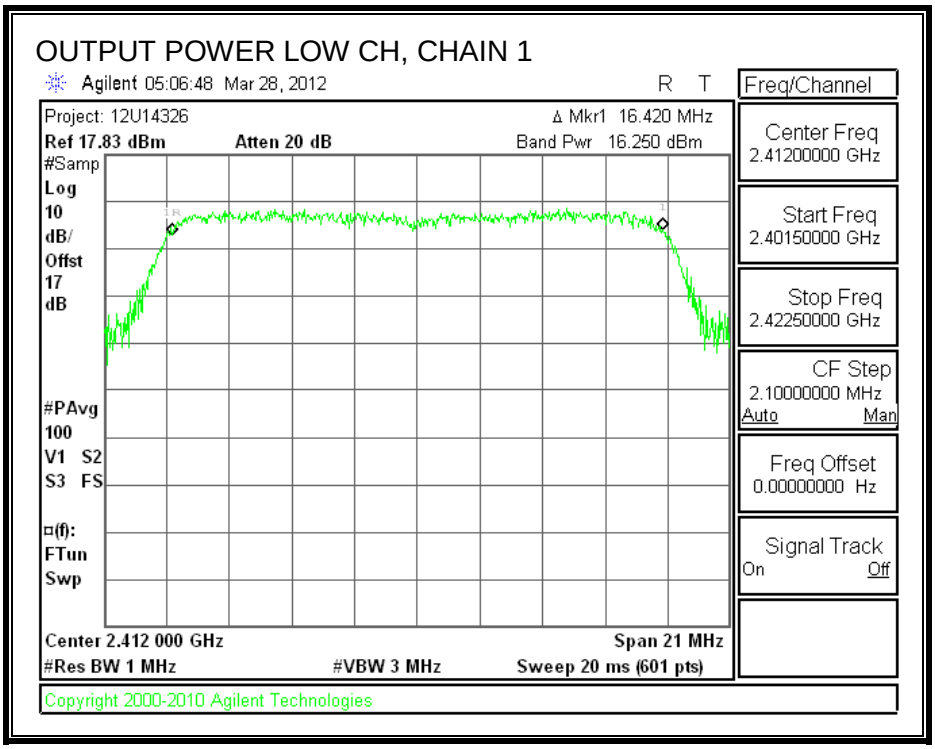
TEST PROCEDURE

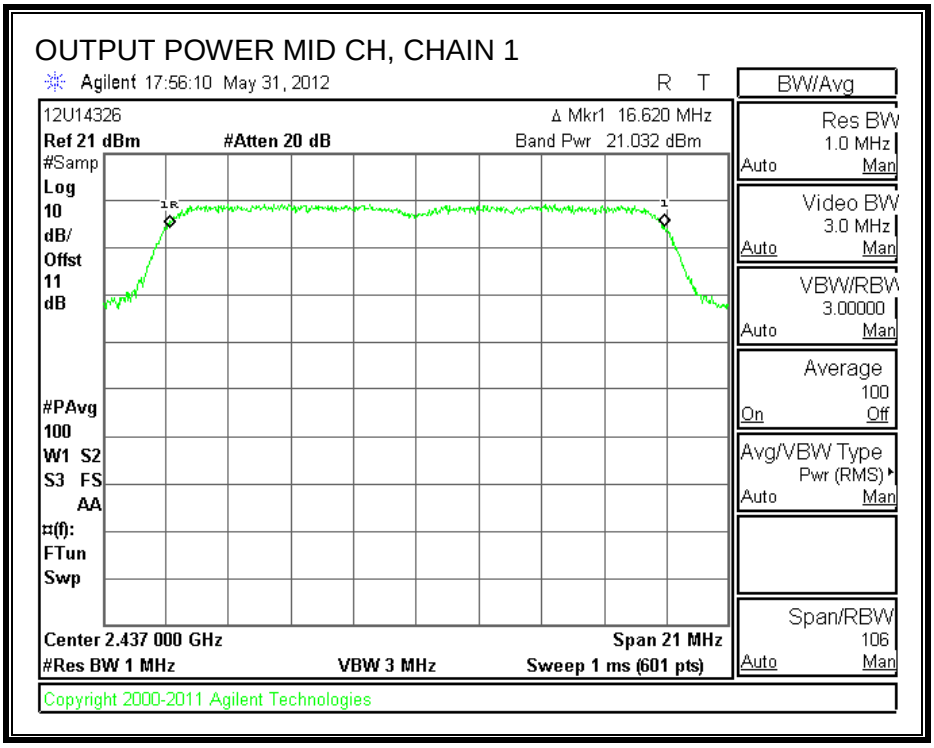
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

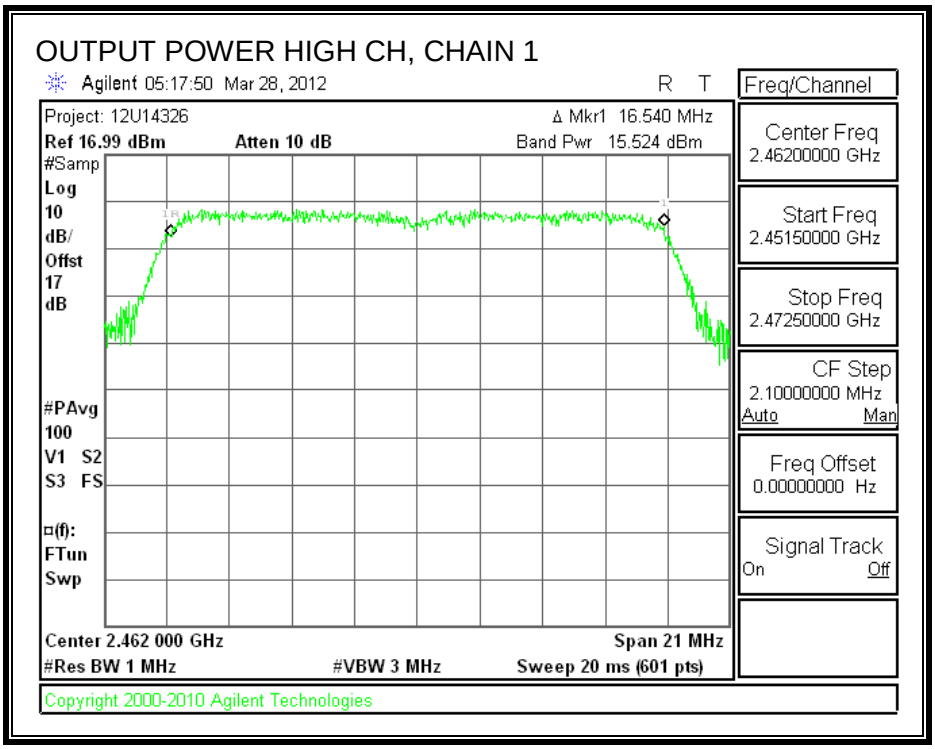
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	16.250	16.856	0.00	19.574	30.00	-10.426
Mid	2437	21.032	21.717	0.00	24.398	30.00	-5.602
High	2462	15.524	15.640	0.00	18.593	30.00	-11.407

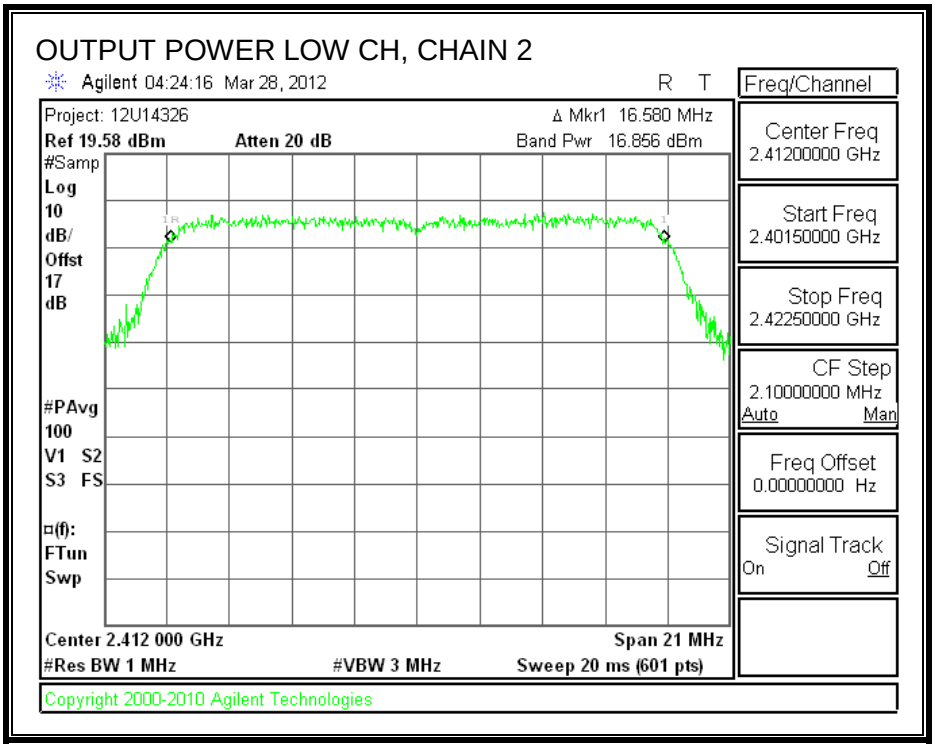
CHAIN 1 OUTPUT POWER

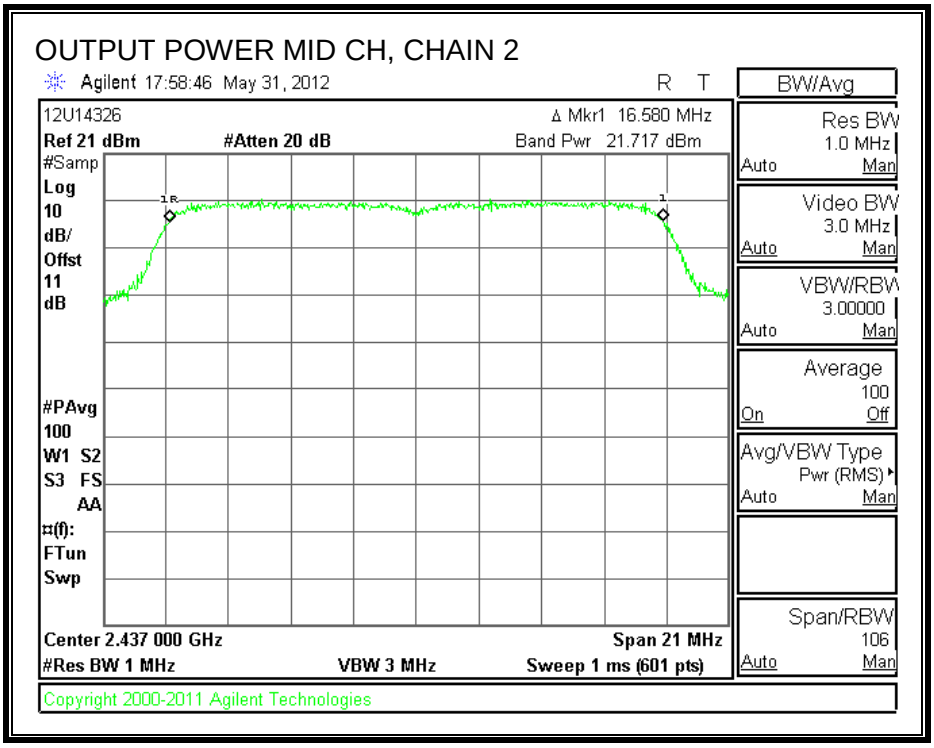


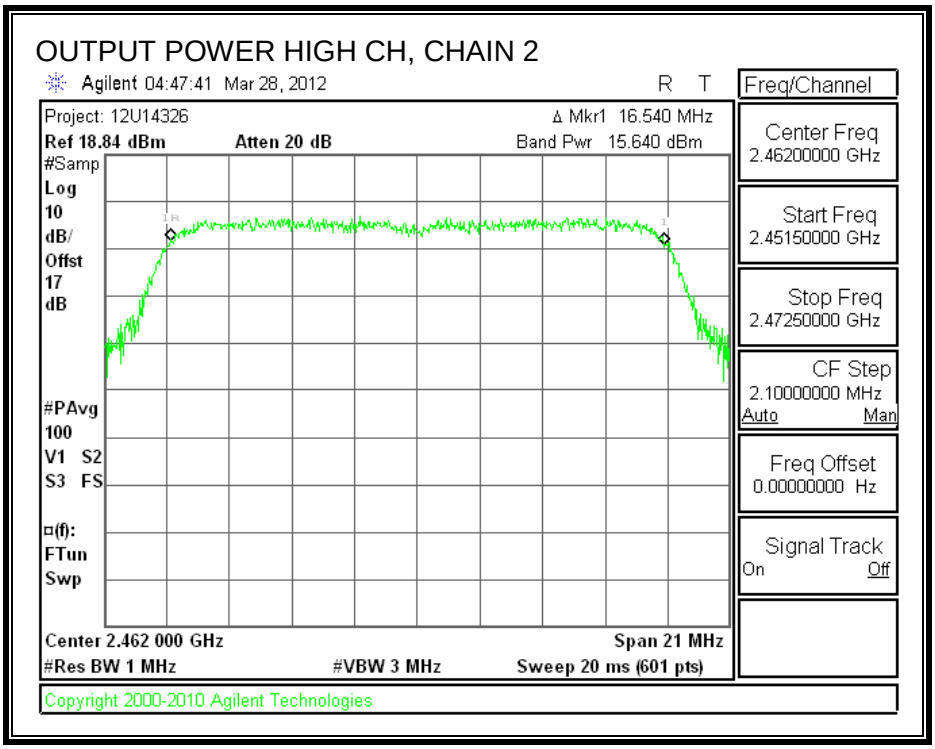




CHAIN 2 OUTPUT POWER







7.2.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	2412	15.50	15.70	18.61
Middle	2437	20.50	20.65	23.59
High	2462	15.50	15.60	18.56

7.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

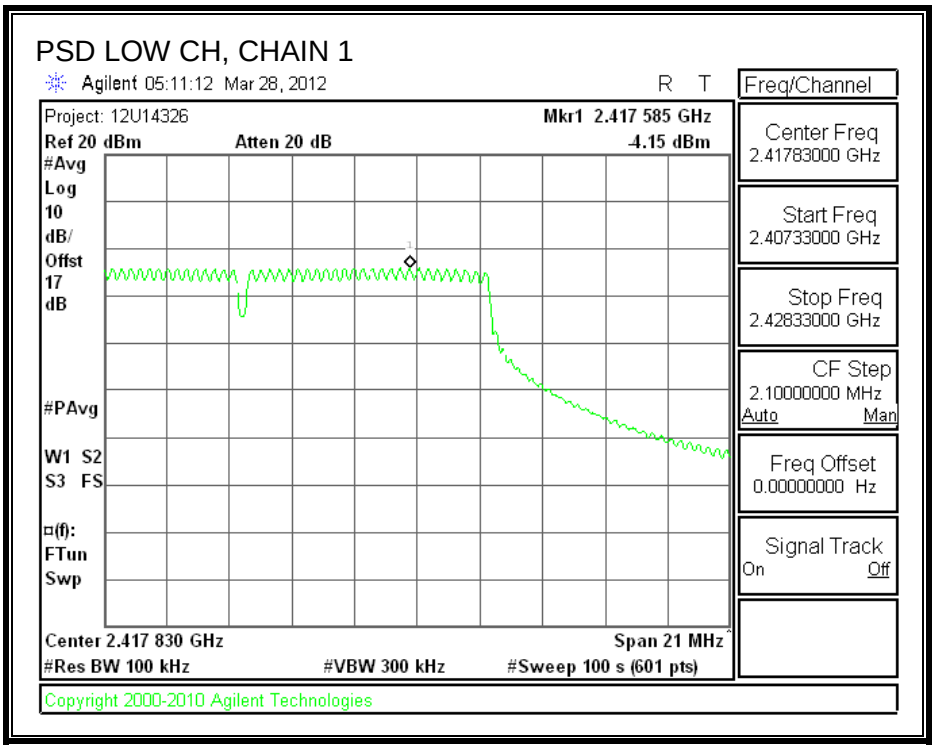
TEST PROCEDURE

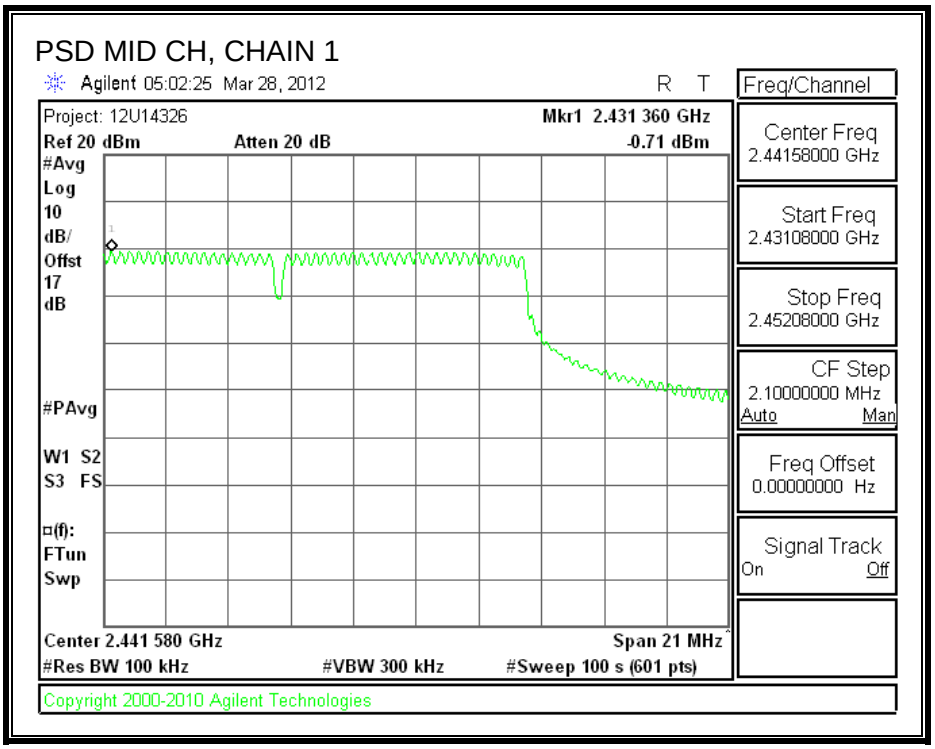
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

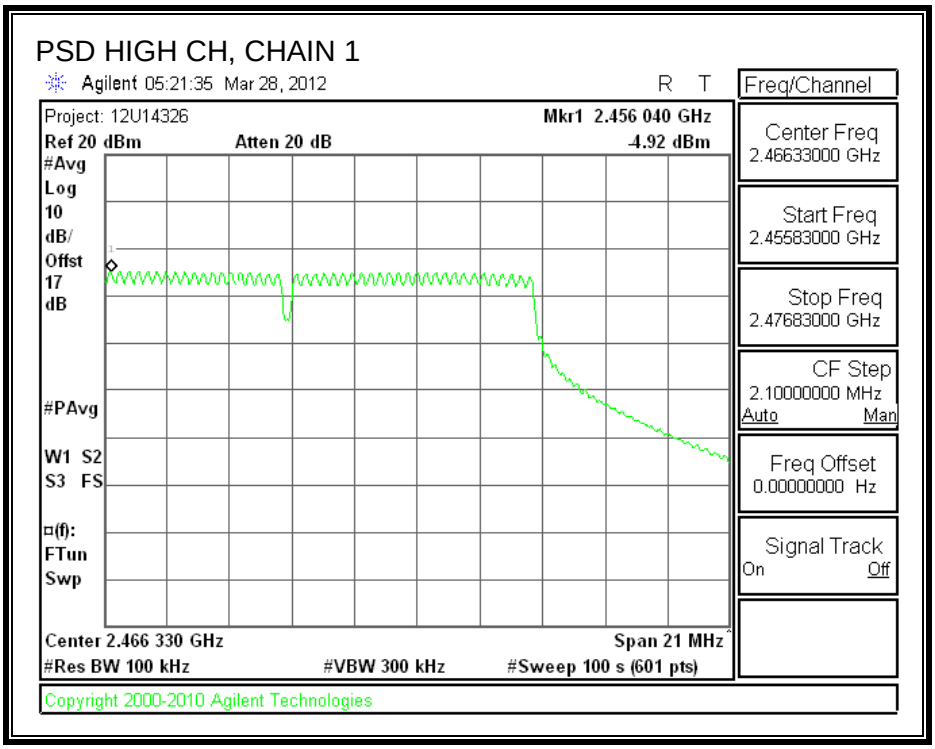
RESULTS

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	10log(3kHz/ 100kHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-4.15	-3.52	-15.20	-16.01	8	-24.01
Middle	2437	-0.71	-0.22	-15.20	-12.65	8	-20.65
High	2462	-4.92	-4.88	-15.20	-17.09	8	-25.09

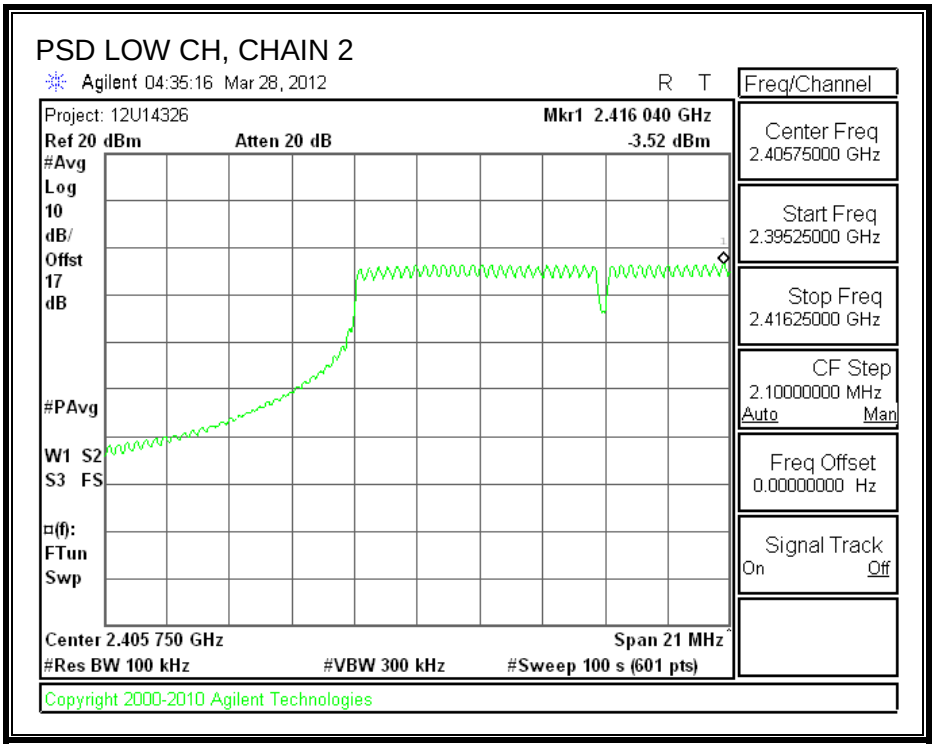
POWER SPECTRAL DENSITY, CHAIN 1

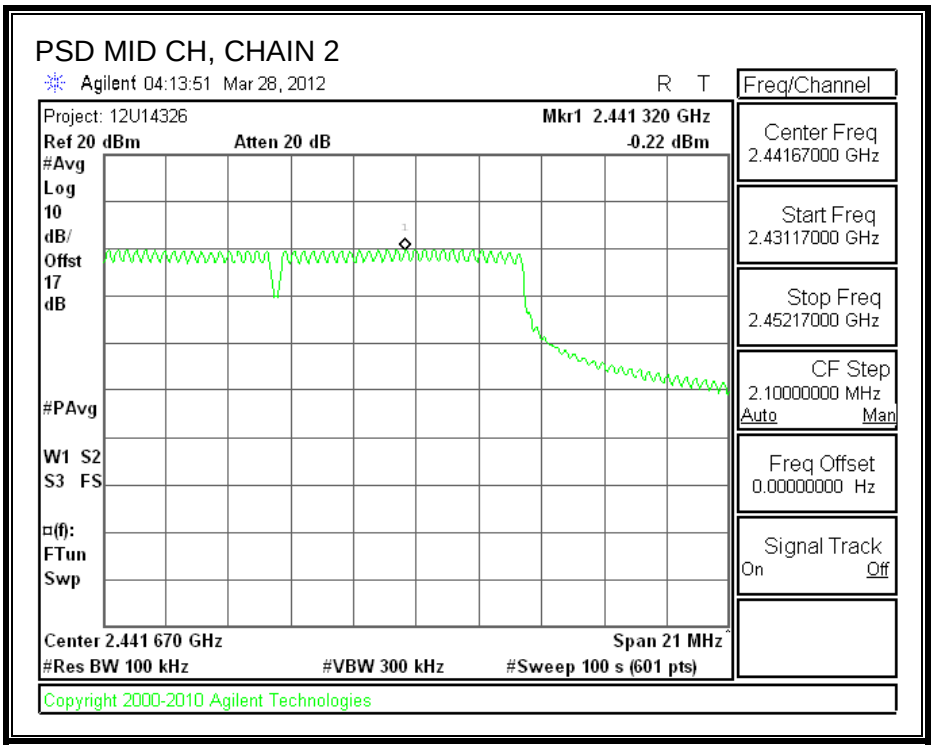


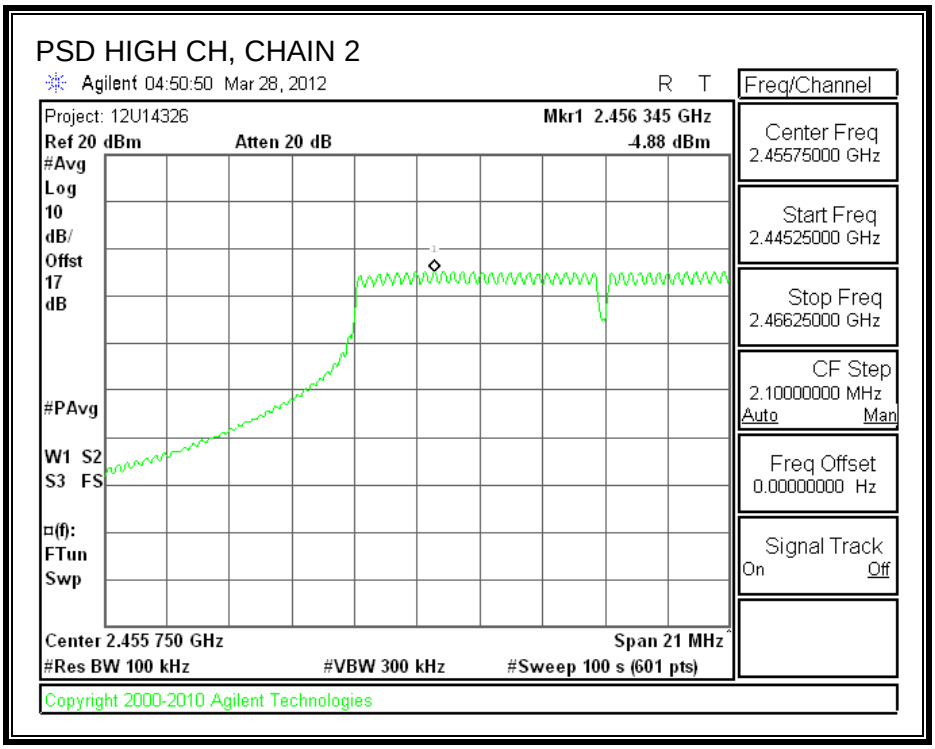




POWER SPECTRAL DENSITY, CHAIN 2







7.2.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

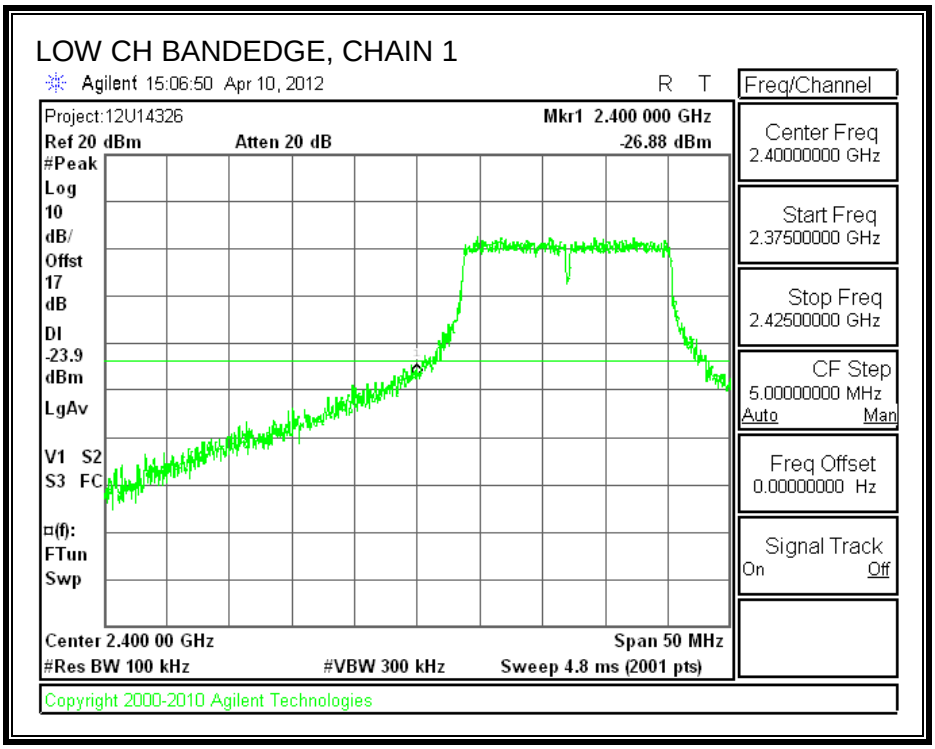
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

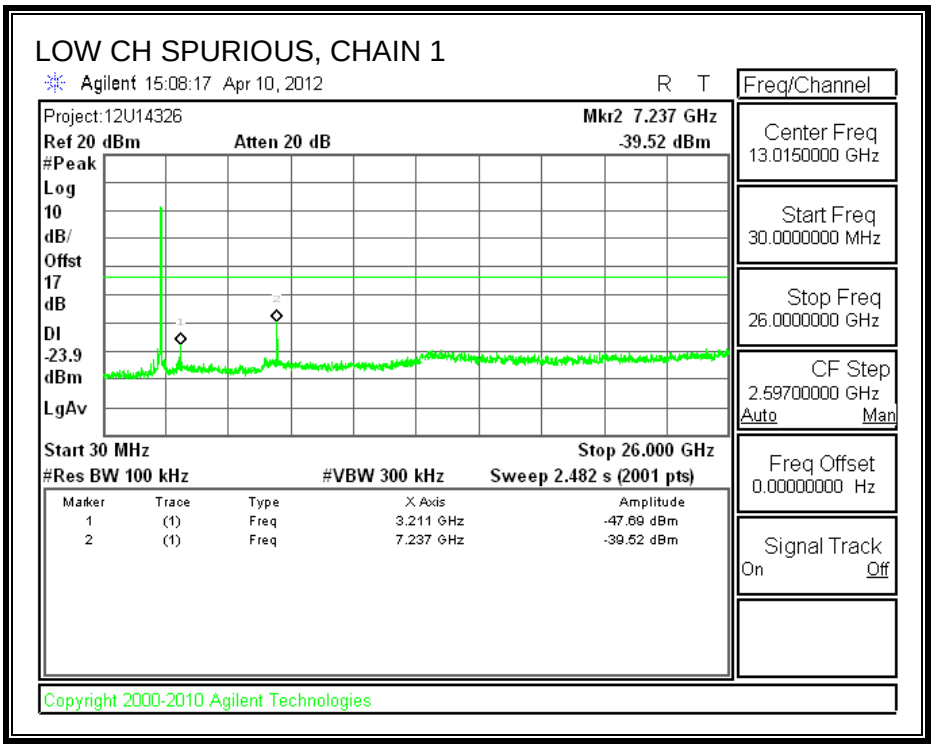
TEST PROCEDURE

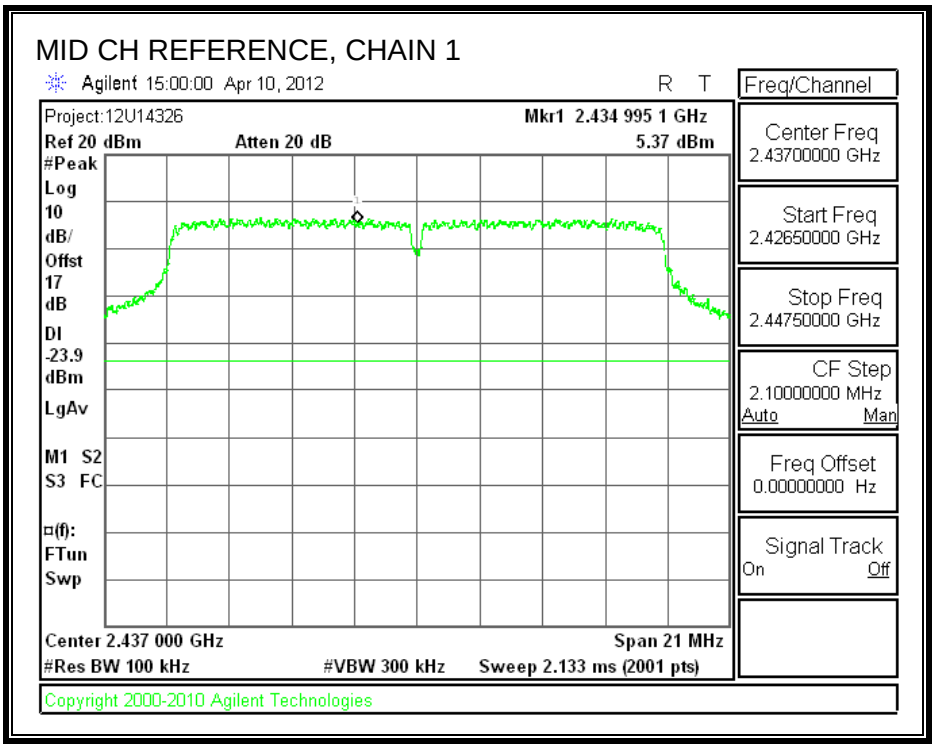
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

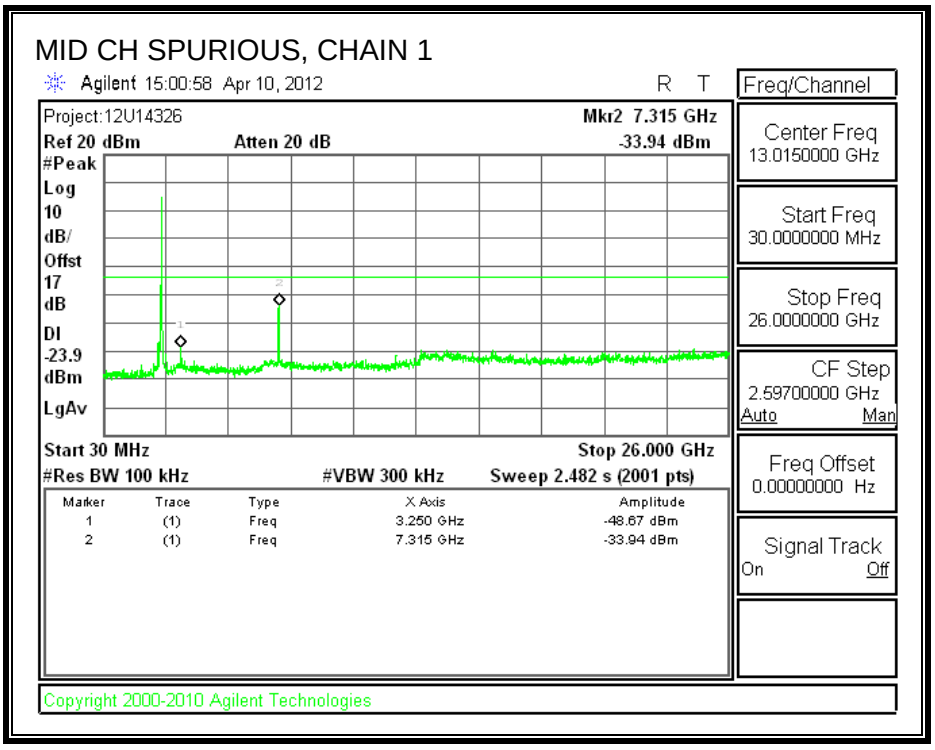
RESULTS

CHAIN 1 SPURIOUS EMISSIONS

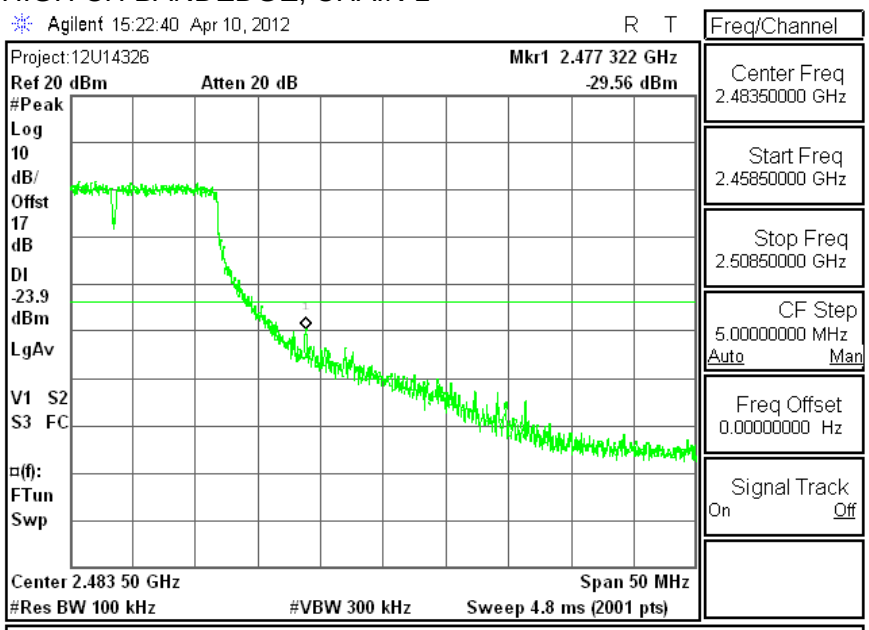




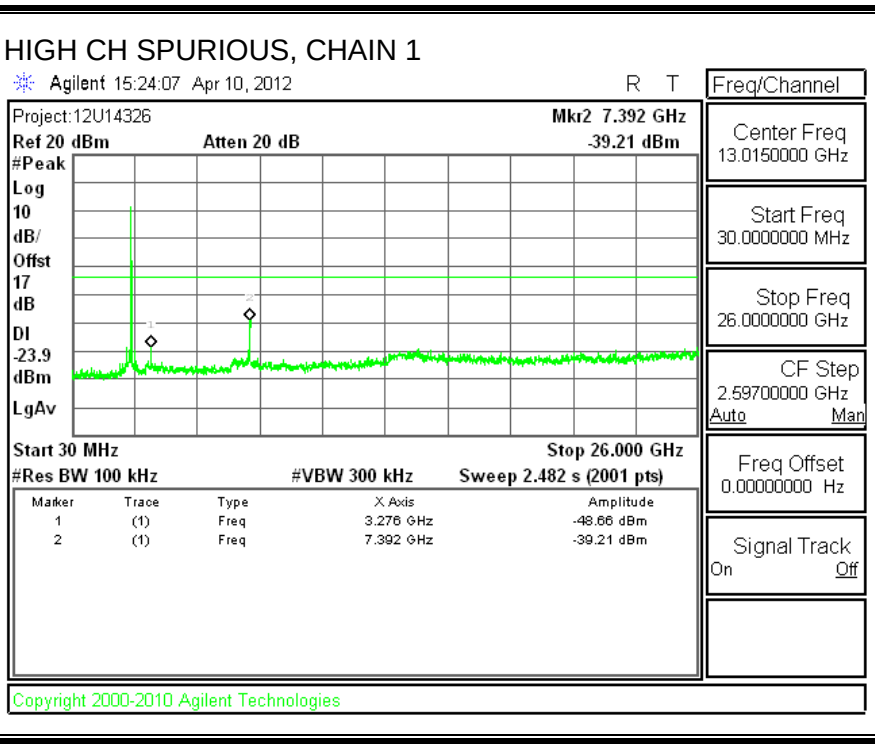




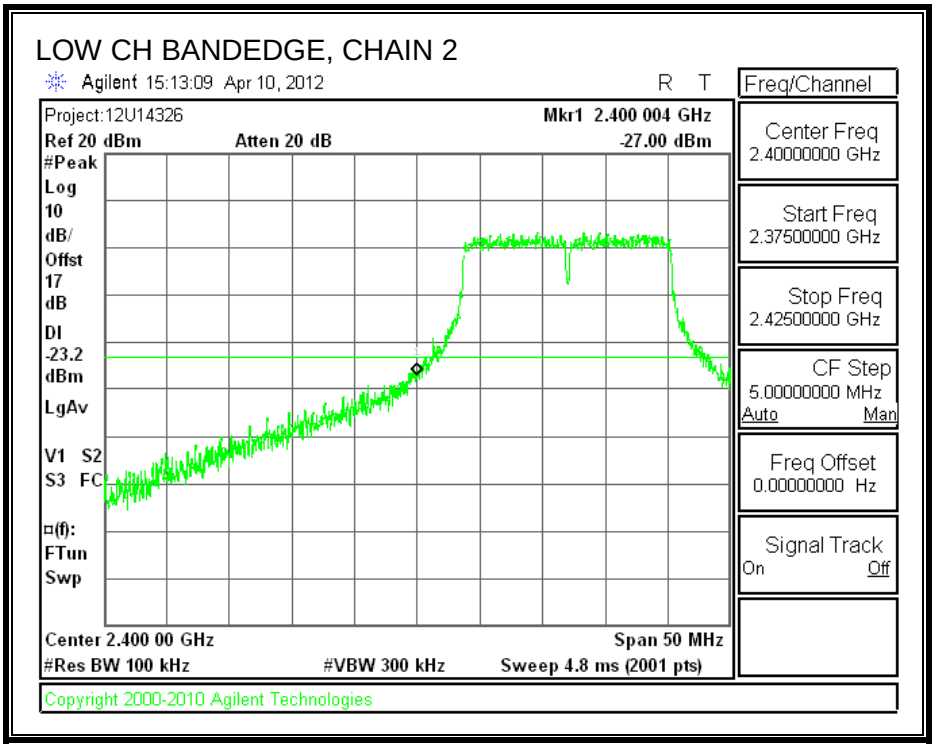
HIGH CH BANDEDGE, CHAIN 1

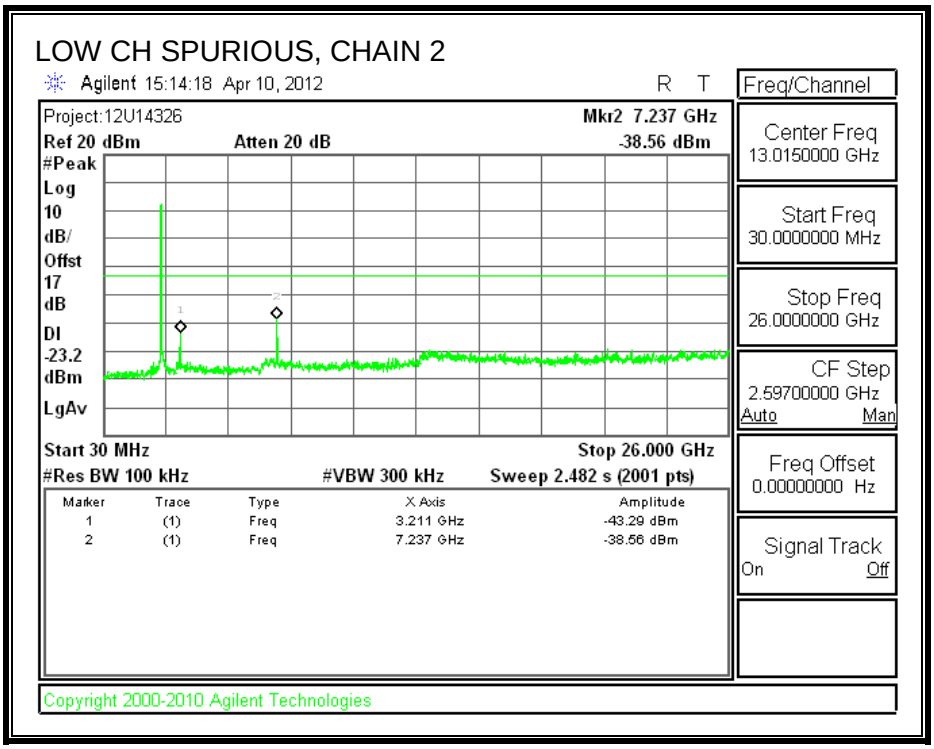


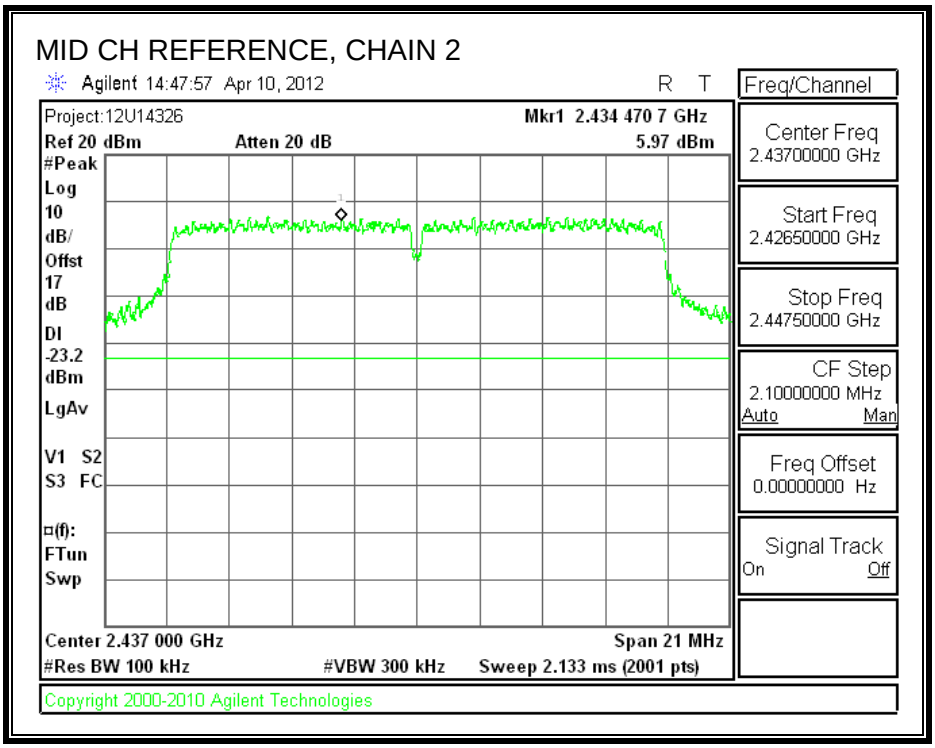
HIGH CH SPURIOUS, CHAIN 1

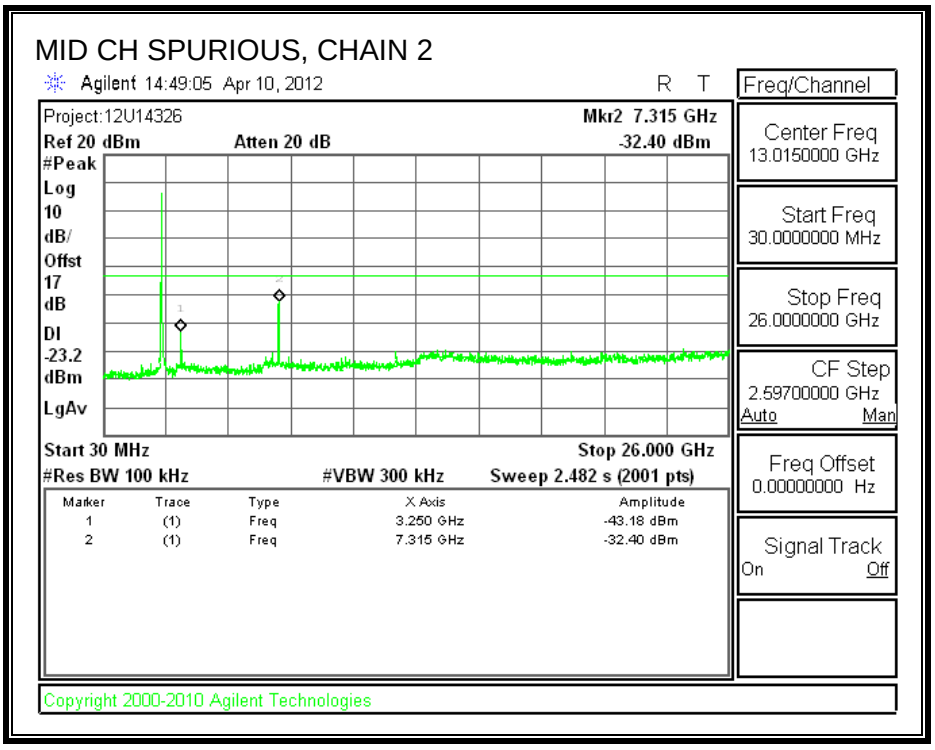


CHAIN 2 SPURIOUS EMISSIONS

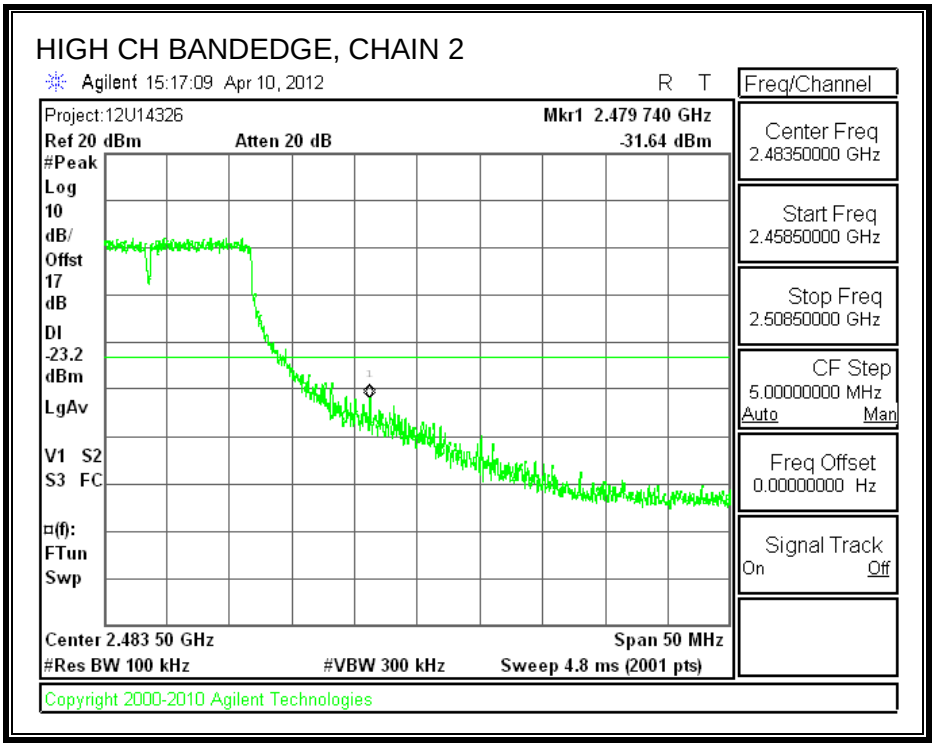




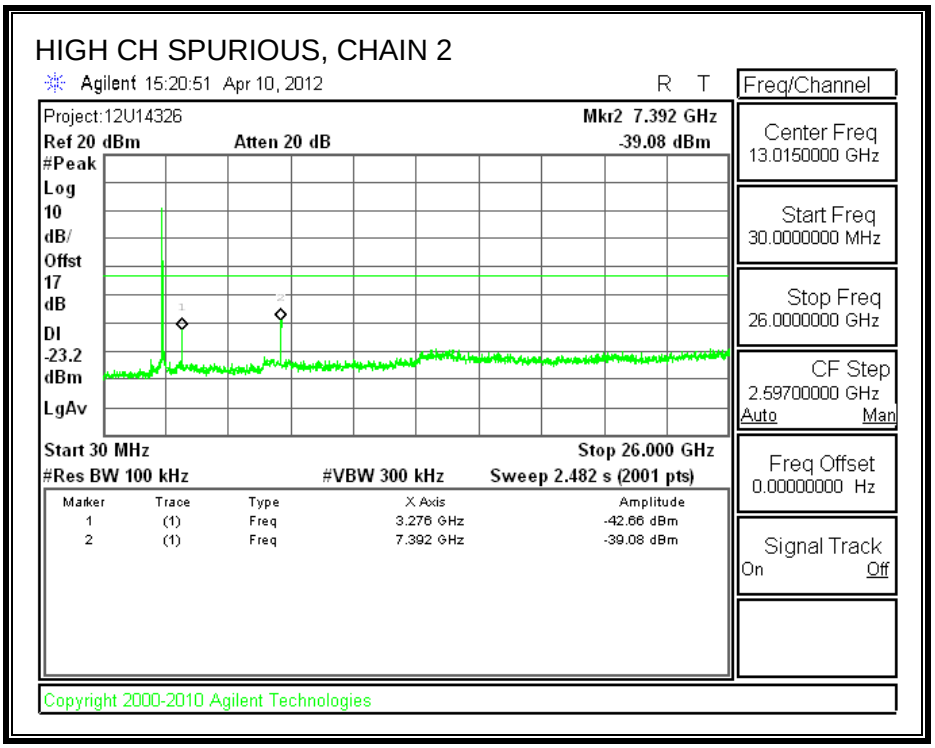




HIGH CH BANDEDGE, CHAIN 2



HIGH CH SPURIOUS, CHAIN 2



7.3. 802.11n HT20 2TX 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.

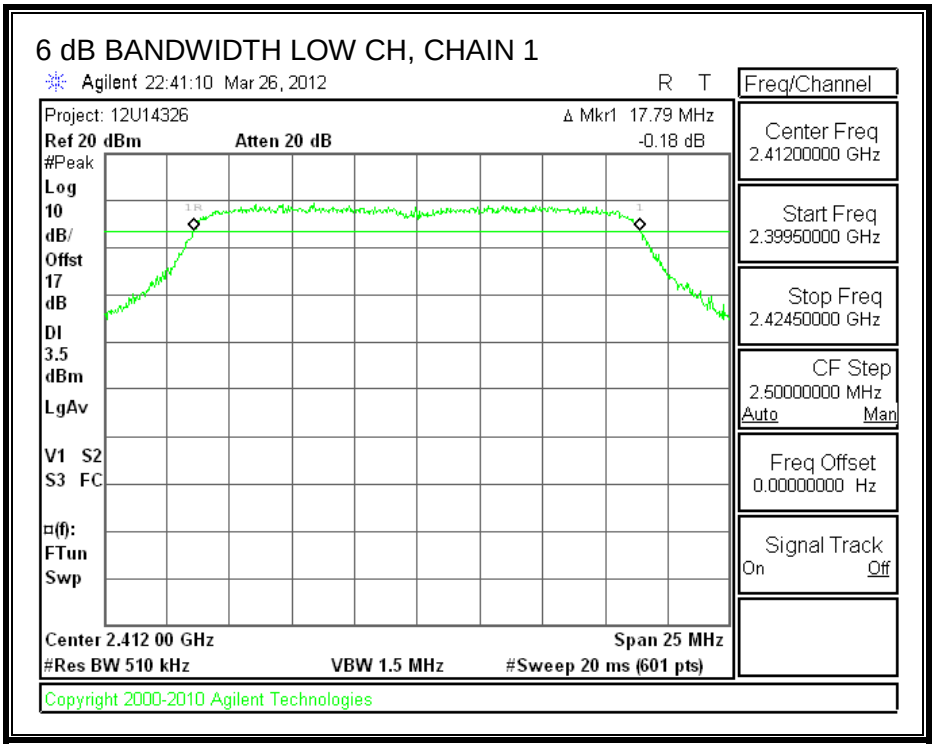
TEST PROCEDURE

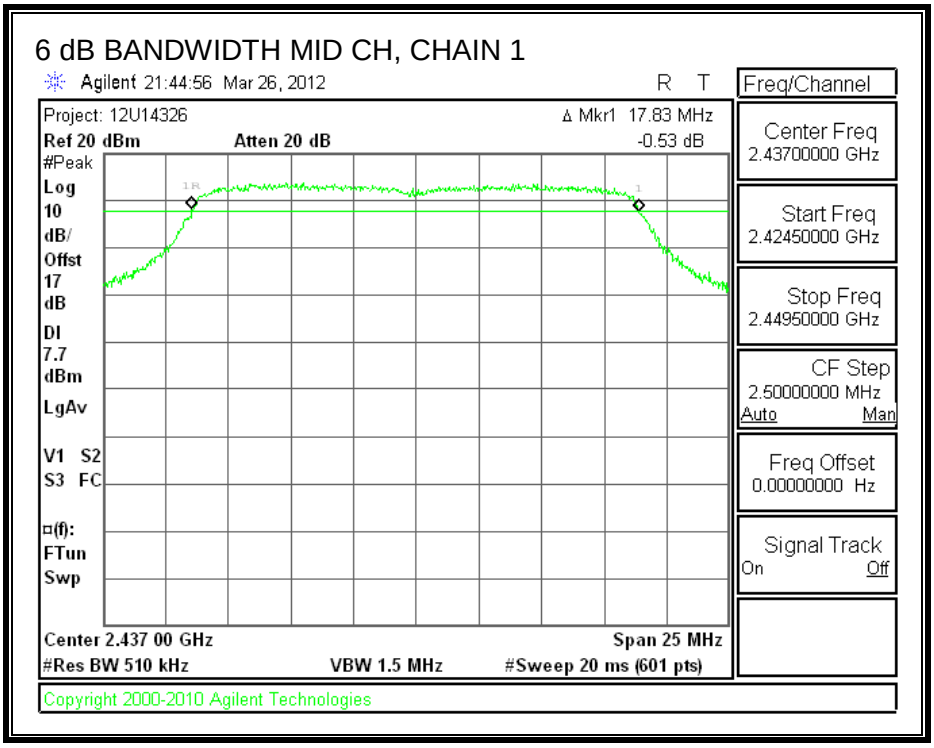
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

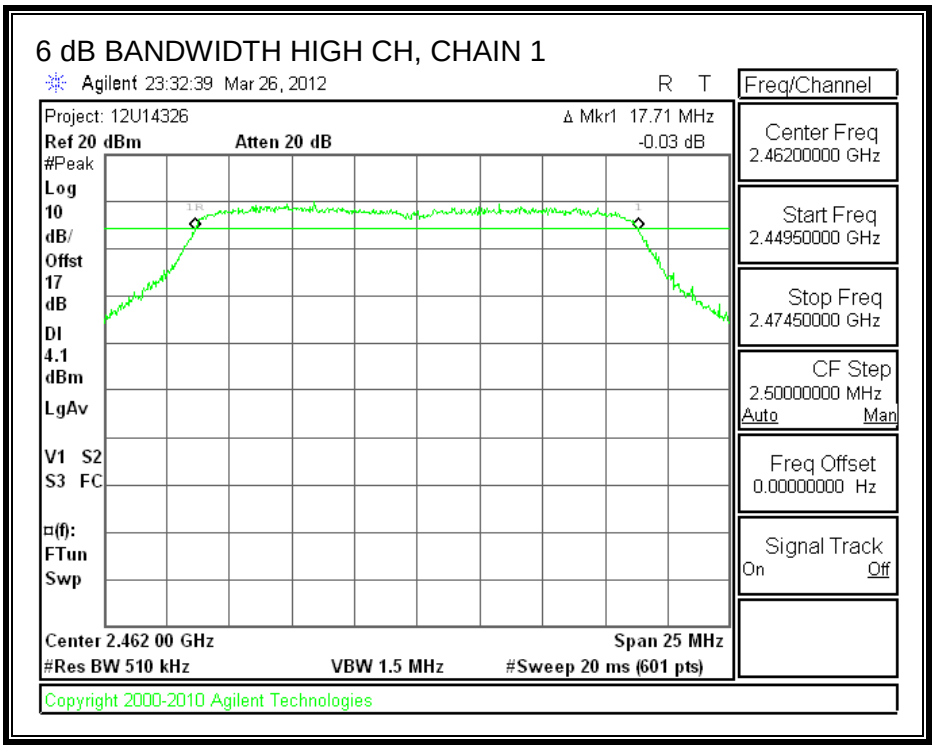
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	17.79	17.79	0.5
Middle	2437	17.83	17.96	0.5
High	2462	17.71	17.83	0.5

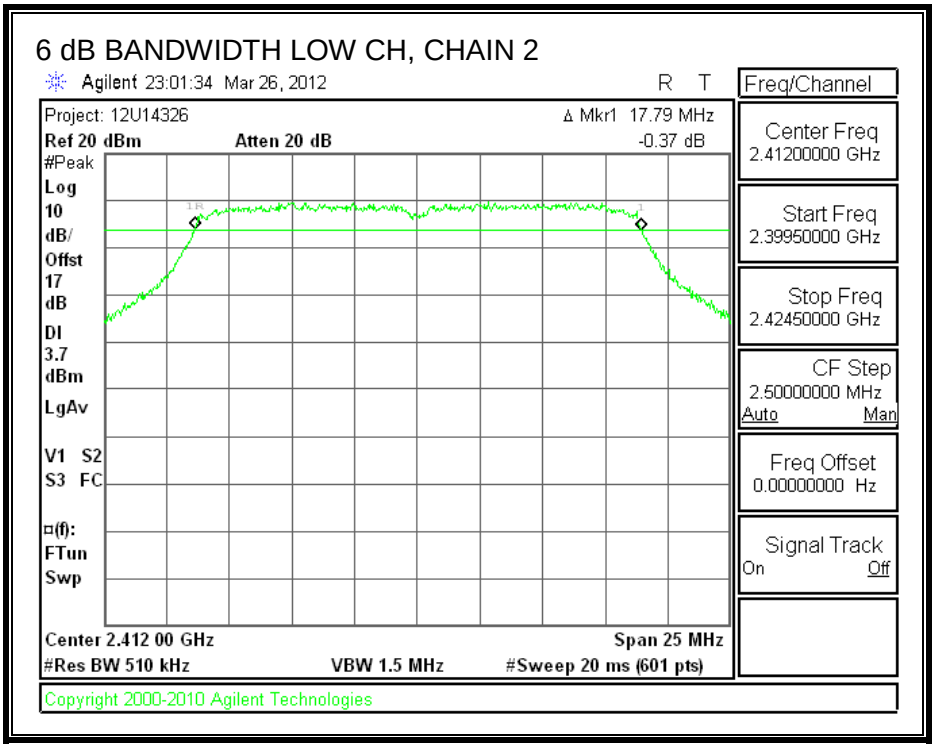
6 dB BANDWIDTH, CHAIN 1

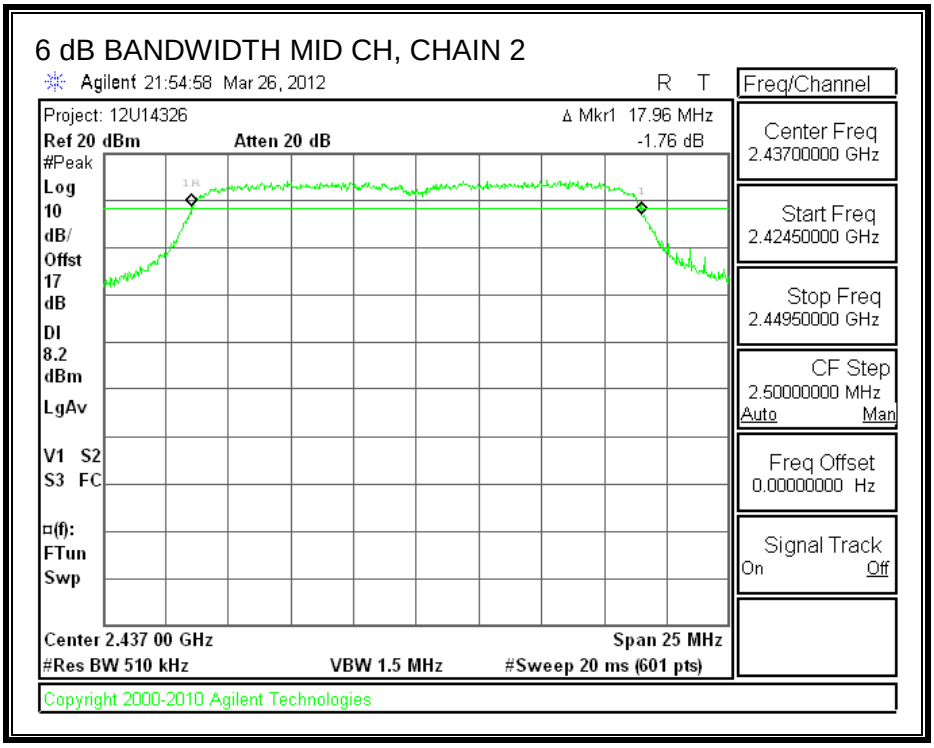


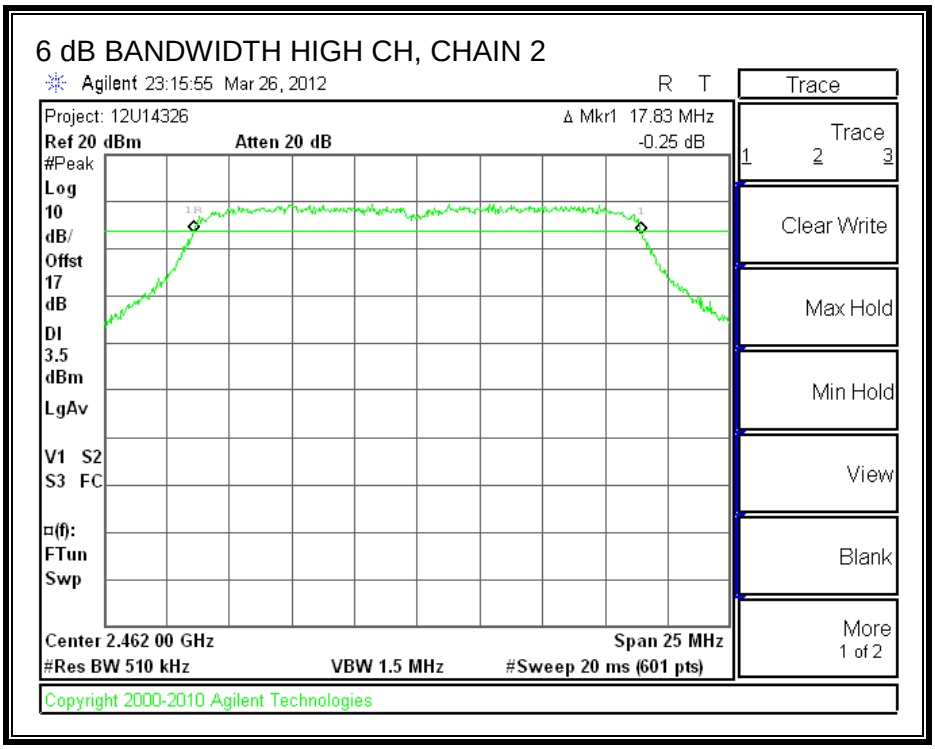




6 dB BANDWIDTH, CHAIN 2







7.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

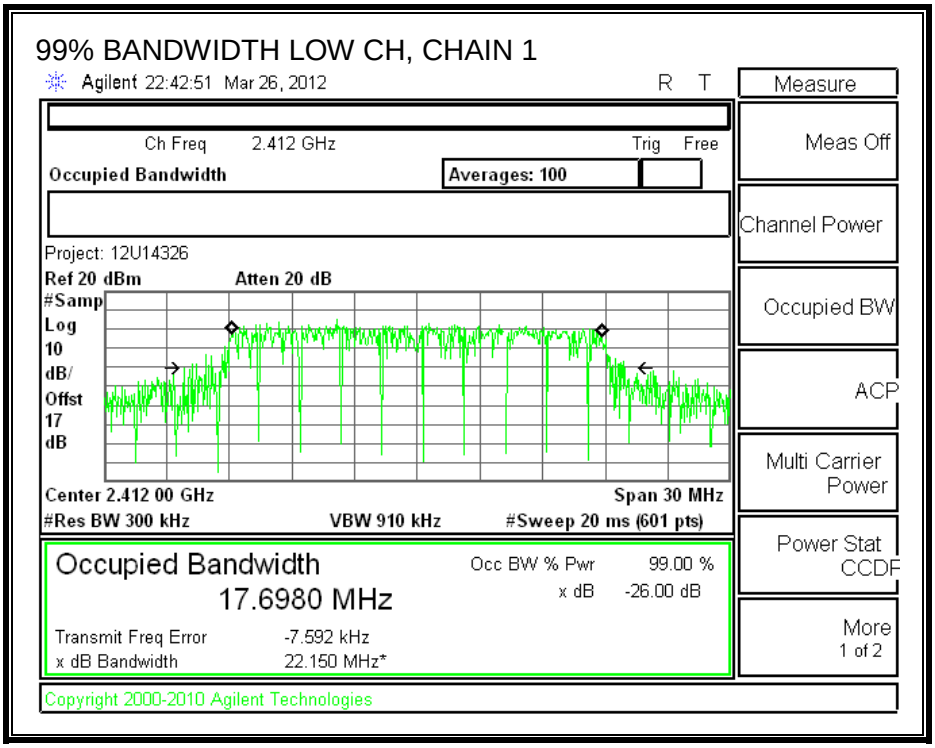
TEST PROCEDURE

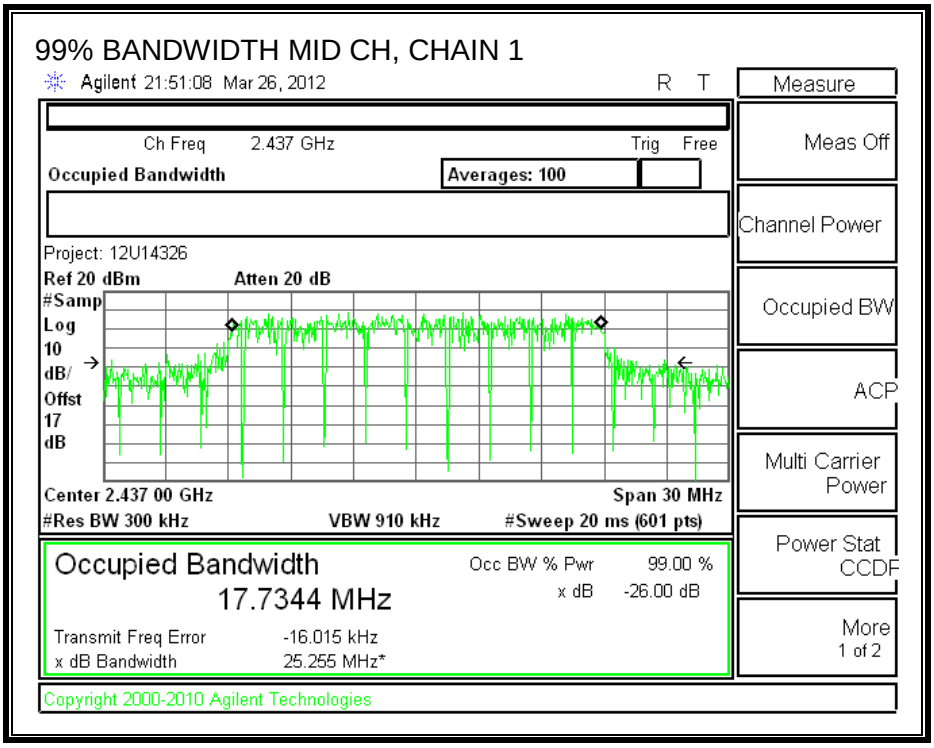
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

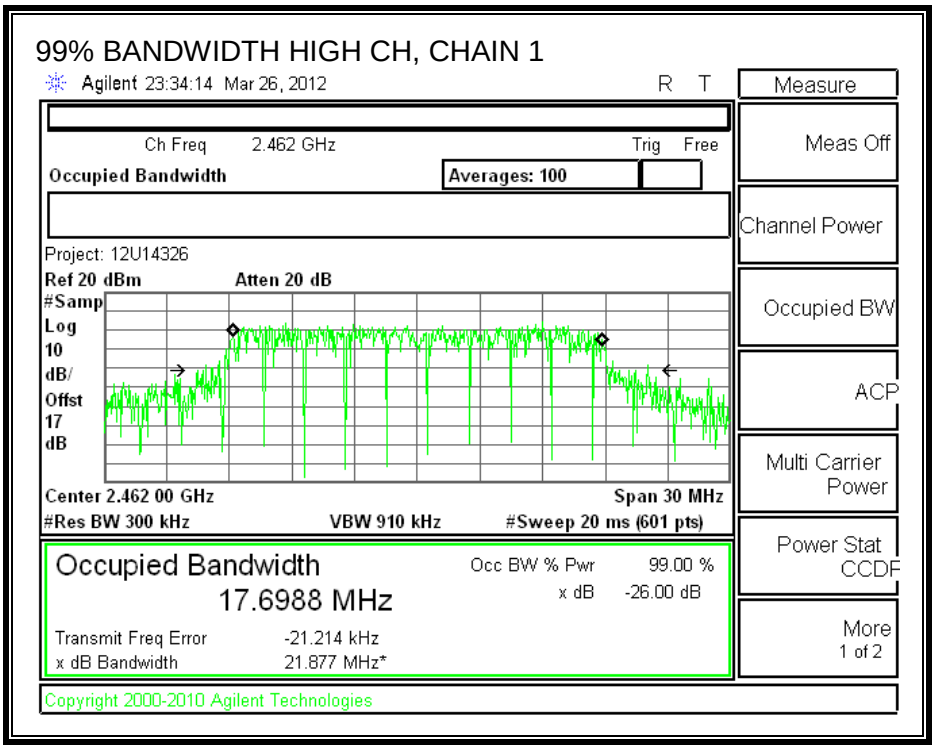
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	2412	17.6980	17.6842
Middle	2437	17.7344	17.7338
High	2462	17.6988	17.6641

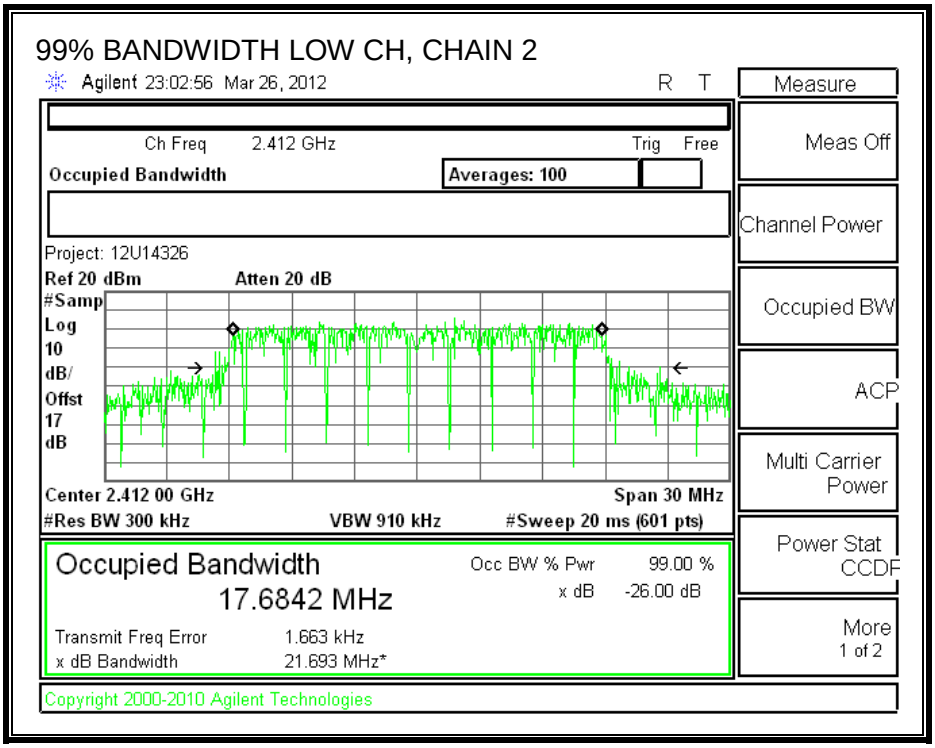
99% BANDWIDTH, CHAIN 1

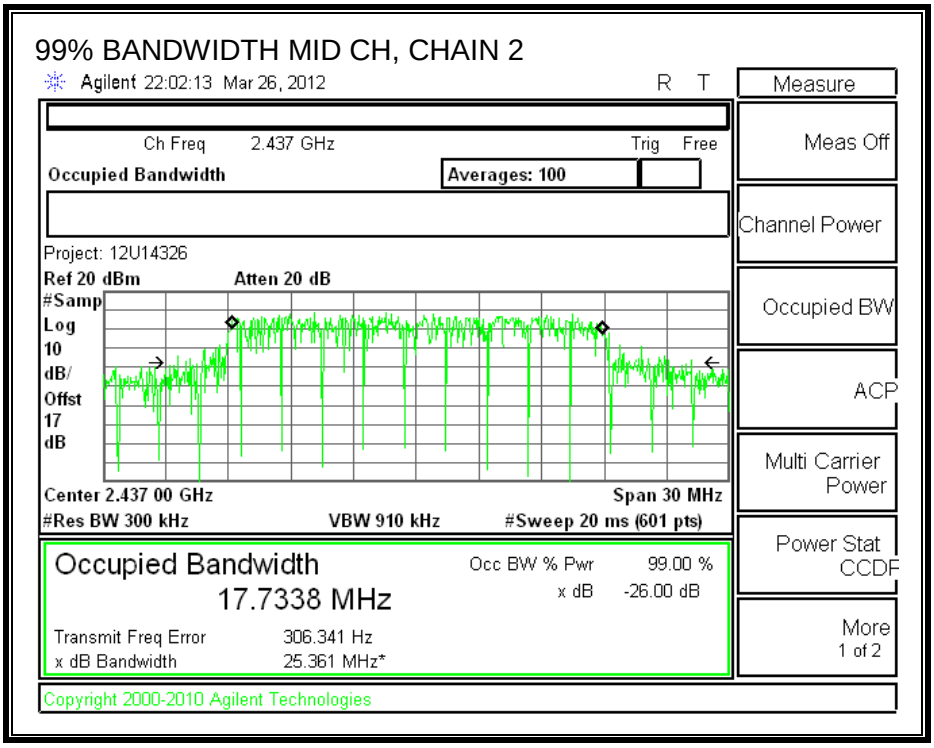


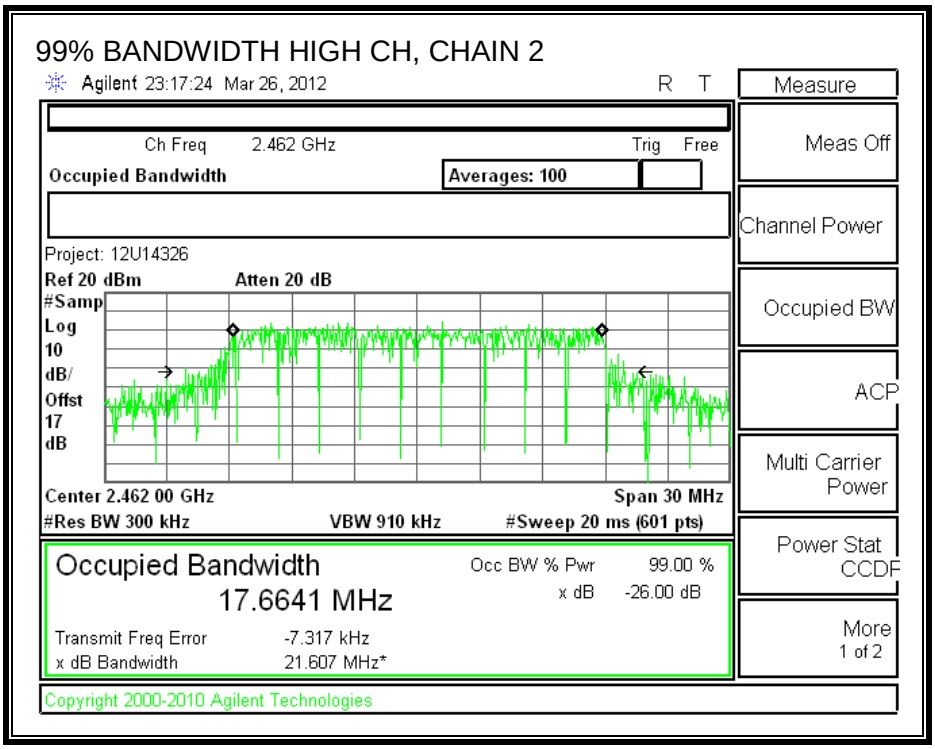




99% BANDWIDTH, CHAIN 2







7.3.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
1.49	1.82	1.66

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

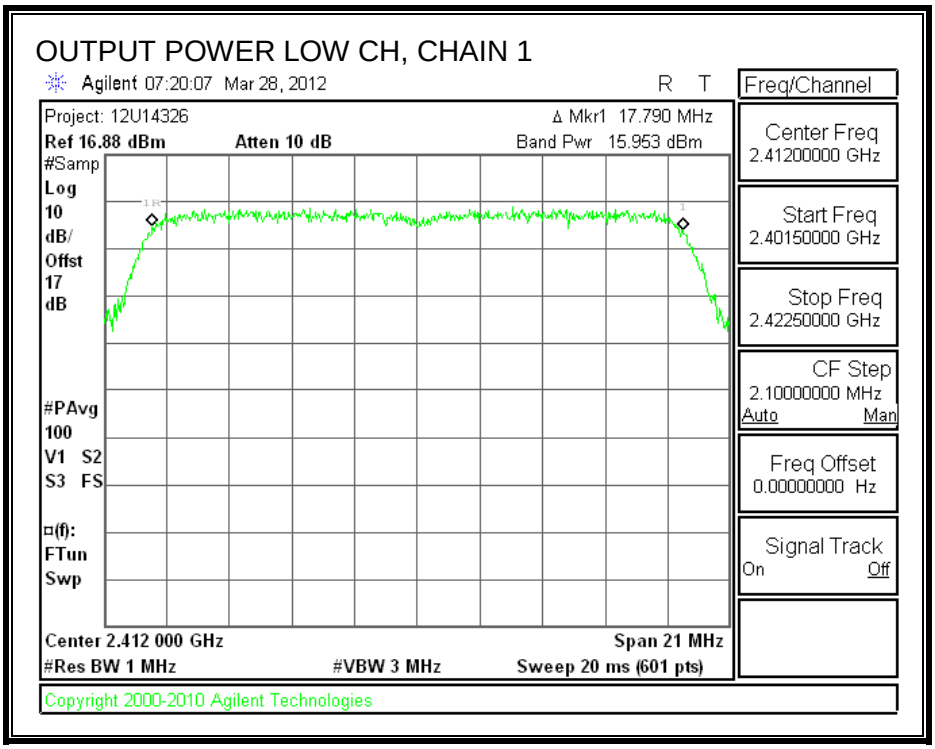
TEST PROCEDURE

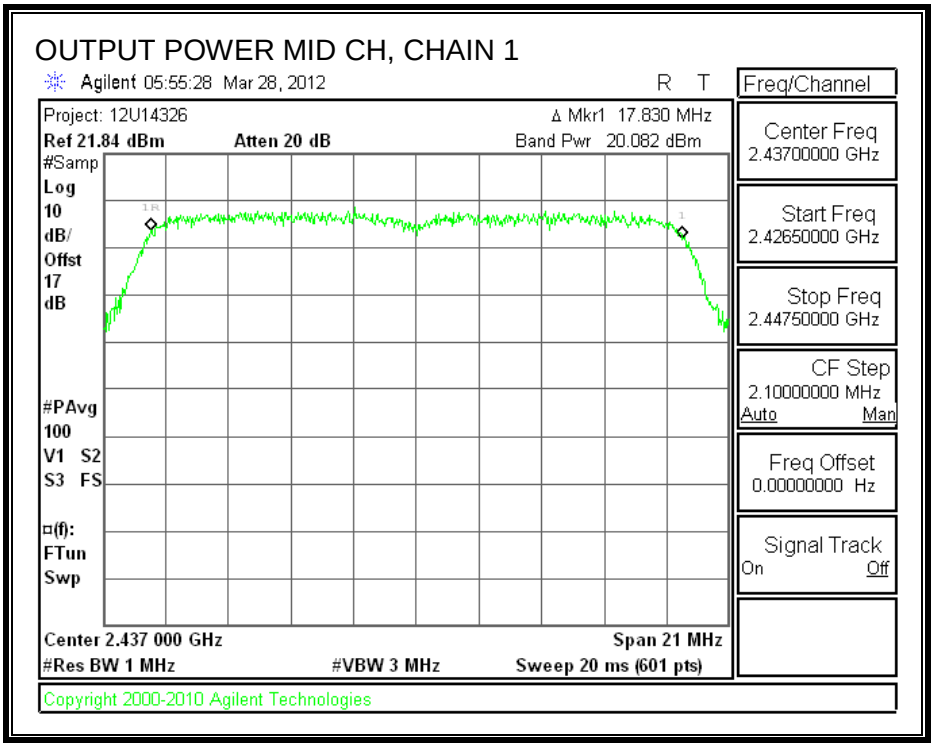
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

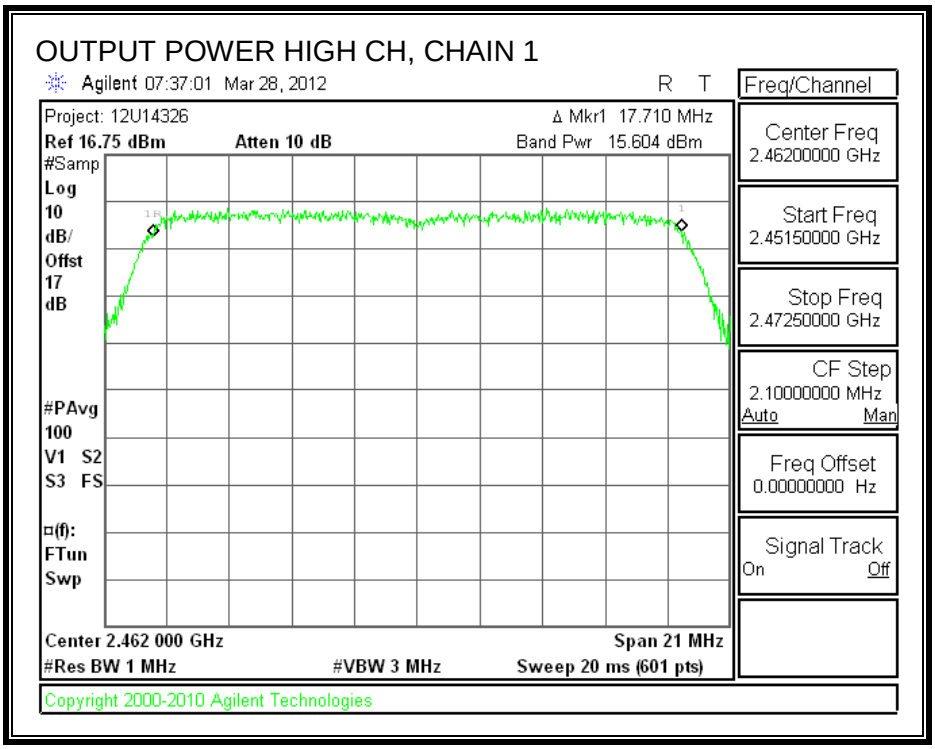
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	15.953	16.026	0.00	19.000	30.00	-11.000
Mid	2437	20.082	20.550	0.00	23.333	30.00	-6.667
High	2462	15.604	15.701	0.00	18.663	30.00	-11.337

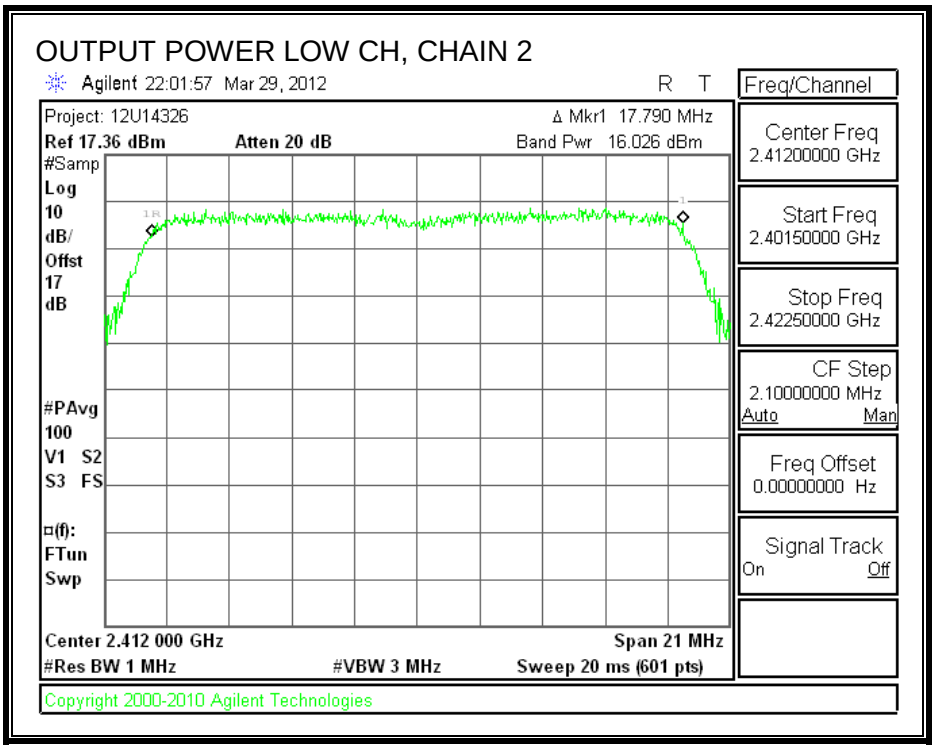
CHAIN 1 OUTPUT POWER



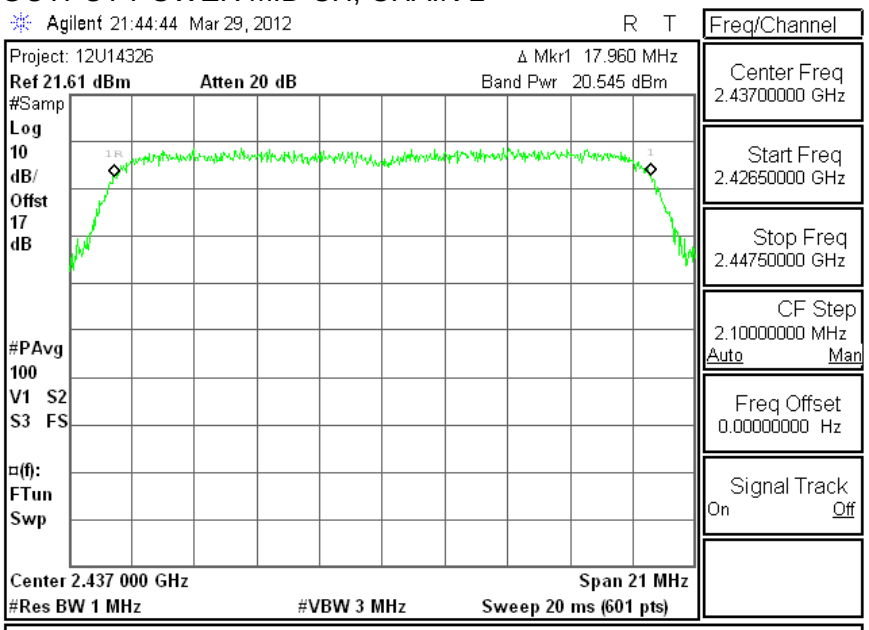


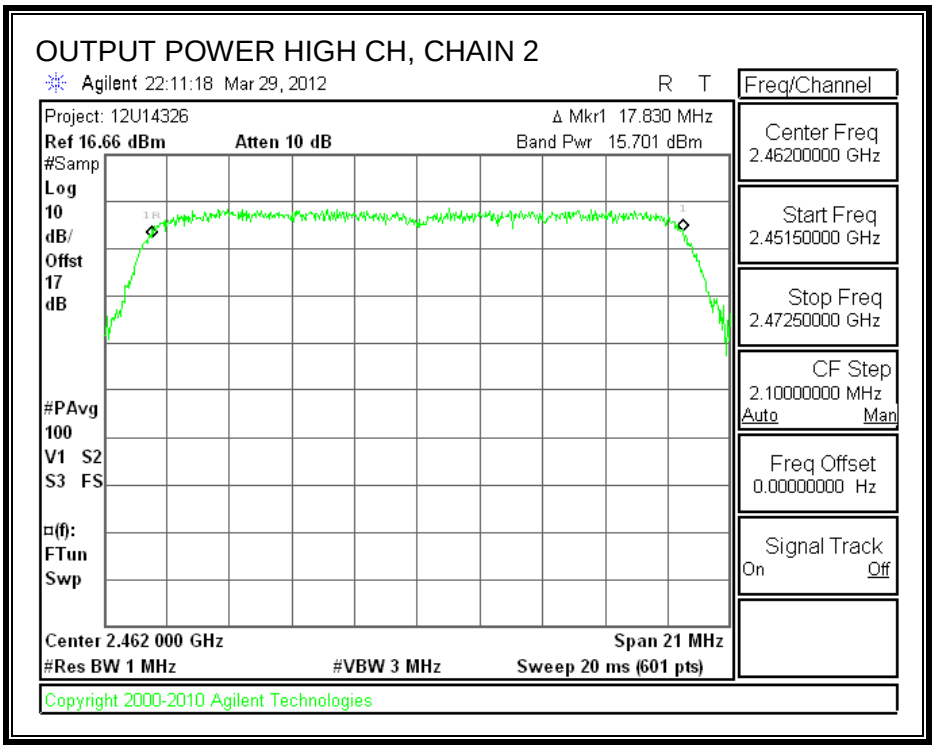


CHAIN 2 OUTPUT POWER



OUTPUT POWER MID CH, CHAIN 2





7.3.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	2412	14.90	15.30	18.11
Middle	2437	19.80	20.10	22.96
High	2462	15.50	15.10	18.31

7.3.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

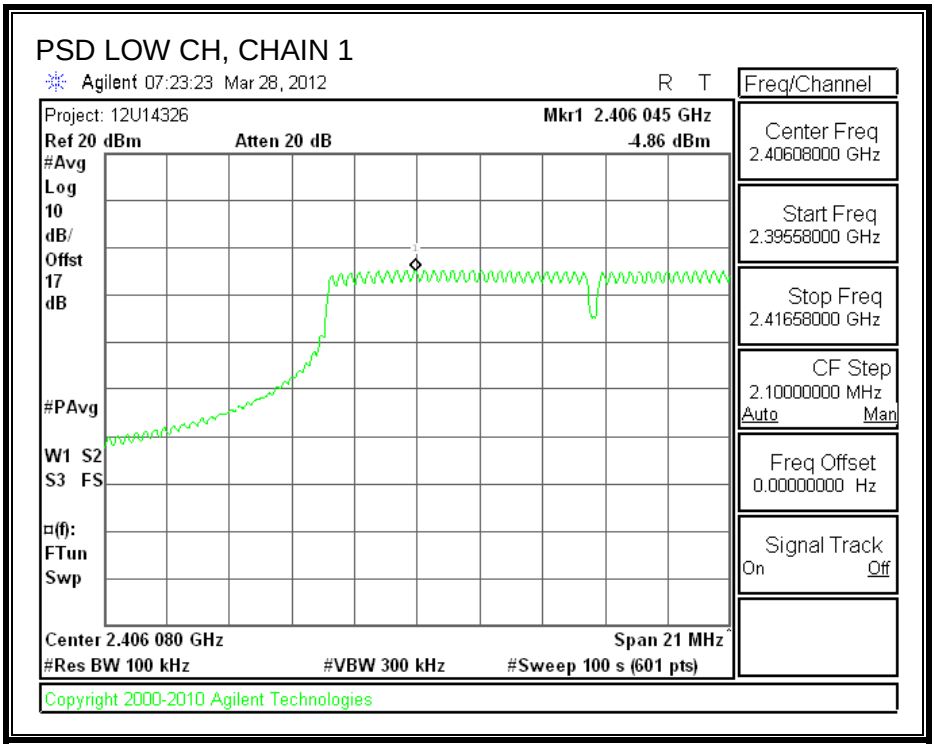
TEST PROCEDURE

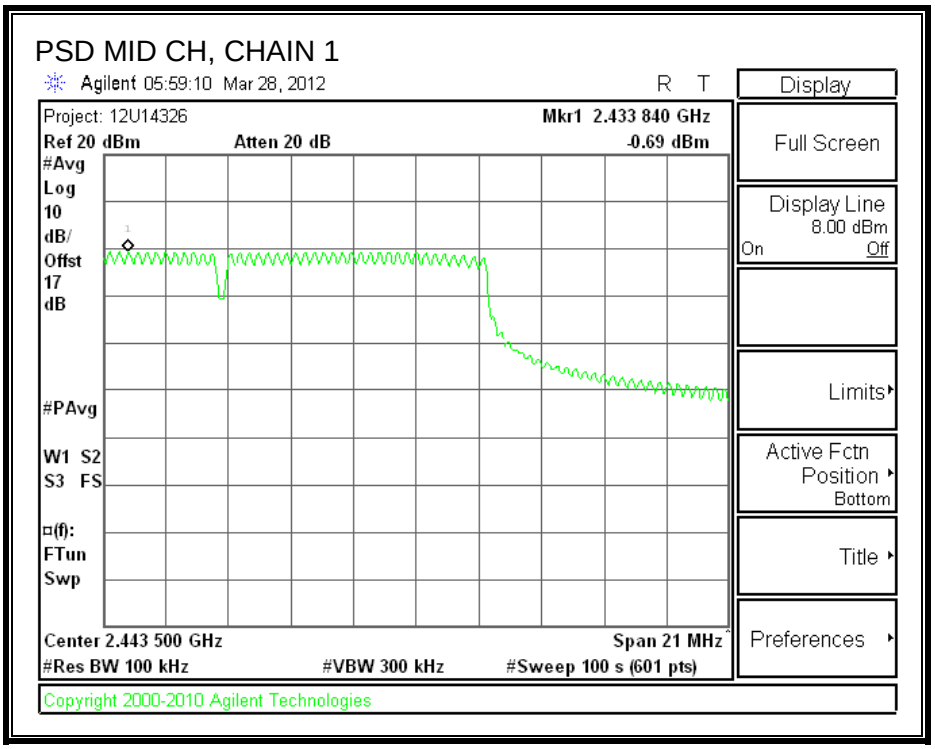
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

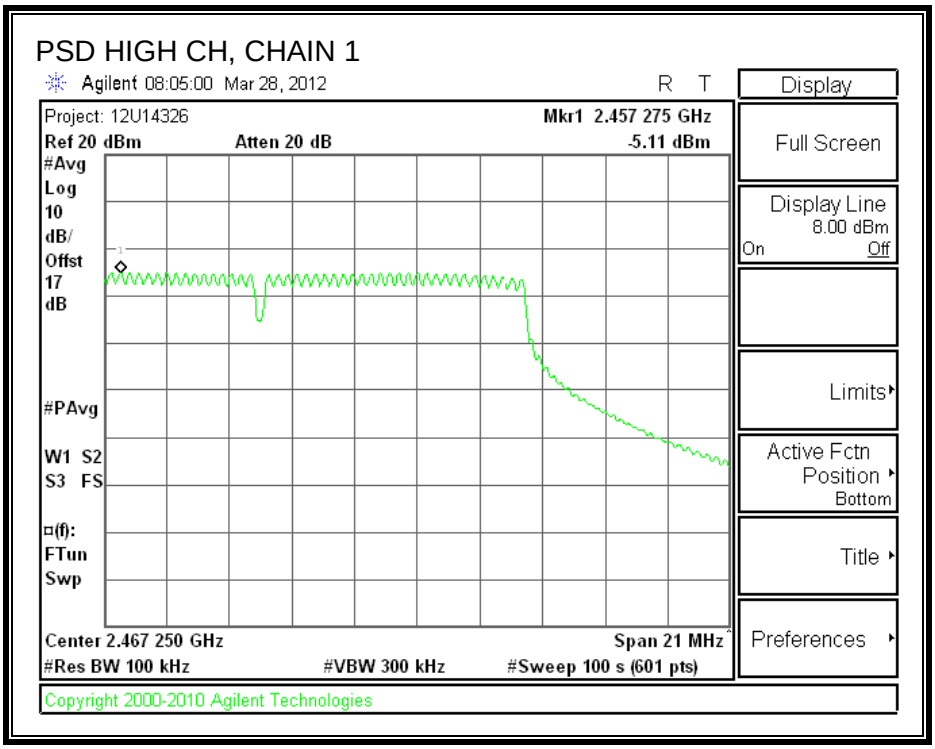
RESULTS

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	10log(3kHz/ 100kHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-4.86	-4.45	-15.20	-16.84	8	-24.84
Middle	2437	-0.69	-0.14	-15.20	-12.60	8	-20.60
High	2462	-5.11	-5.10	-15.20	-17.29	8	-25.29

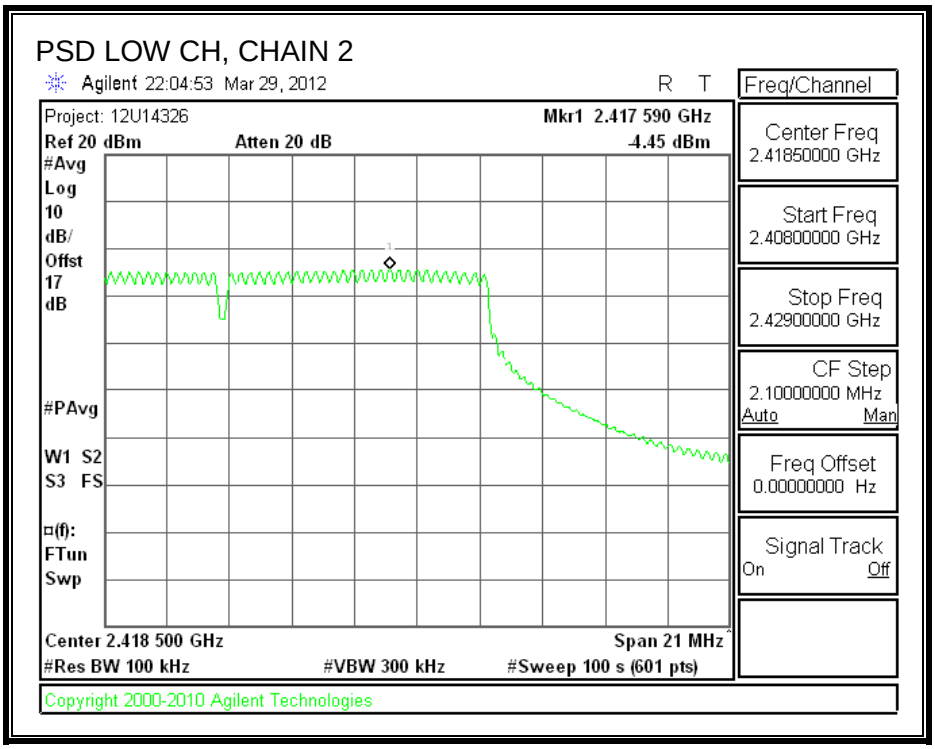
POWER SPECTRAL DENSITY, CHAIN 1

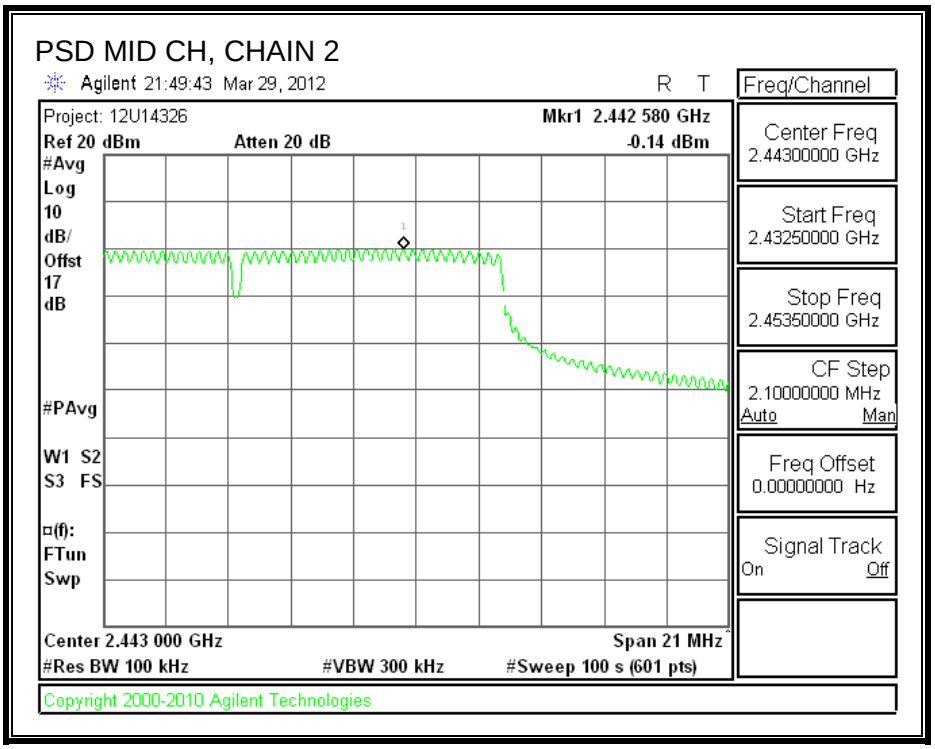


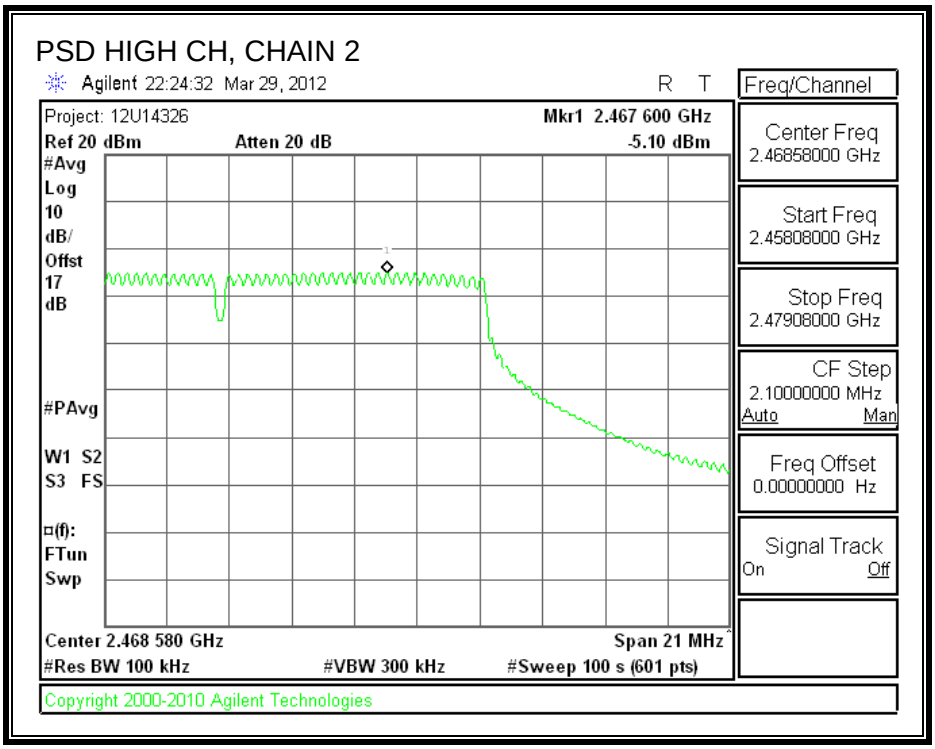




POWER SPECTRAL DENSITY, CHAIN 2







7.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

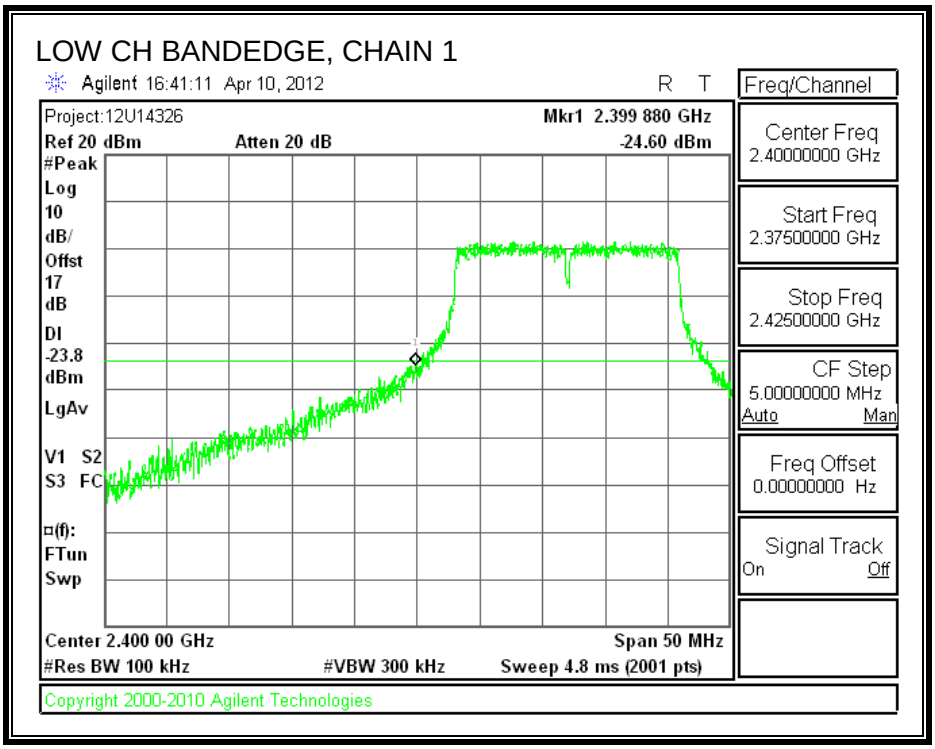
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

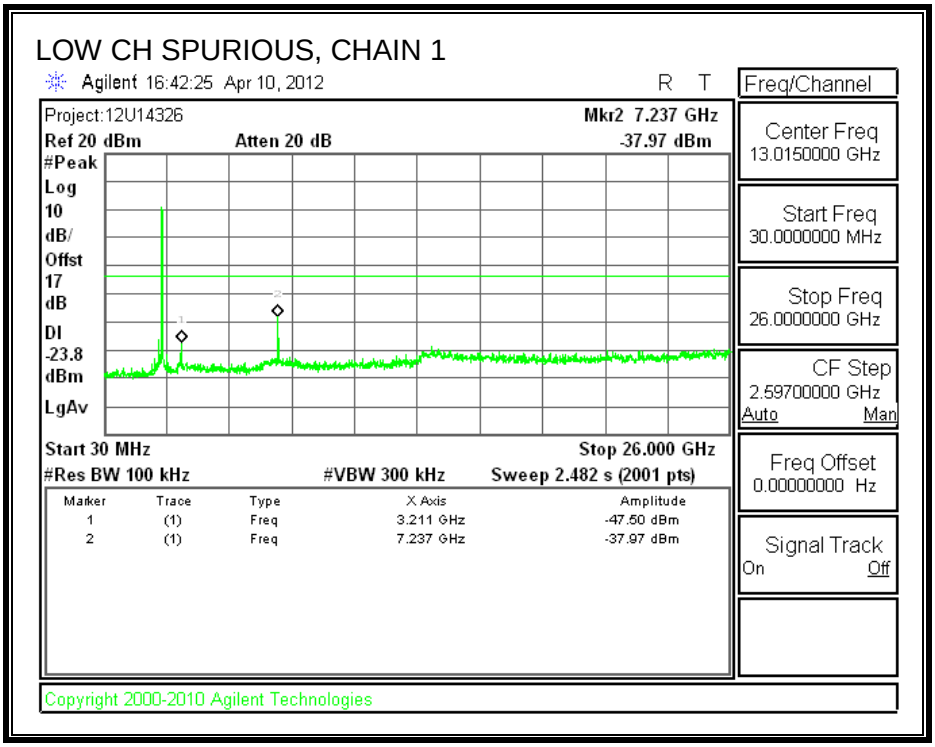
TEST PROCEDURE

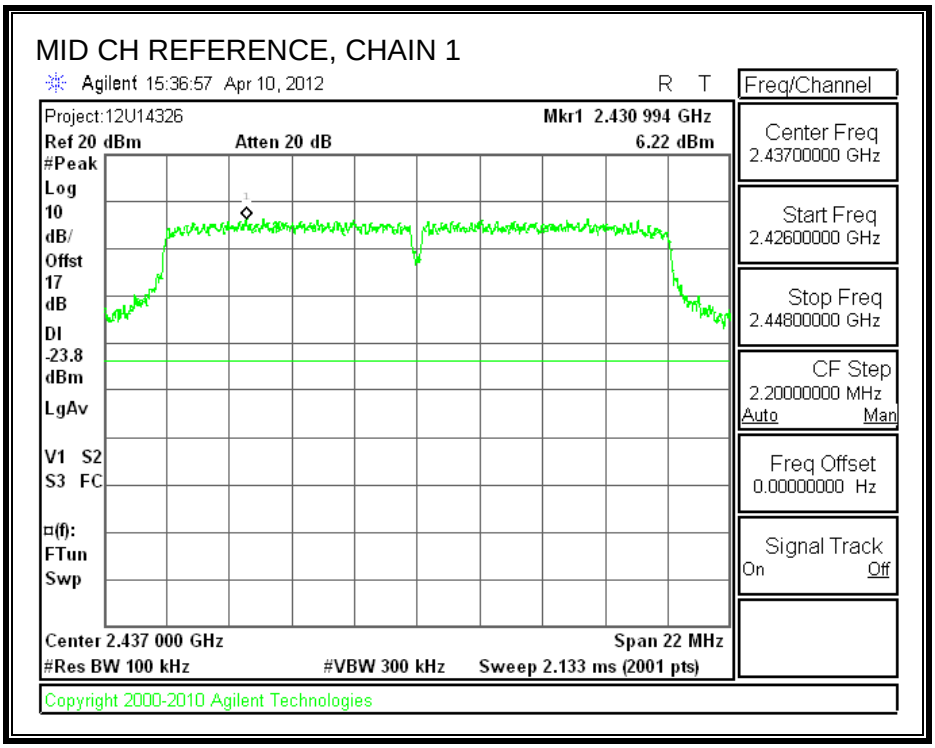
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

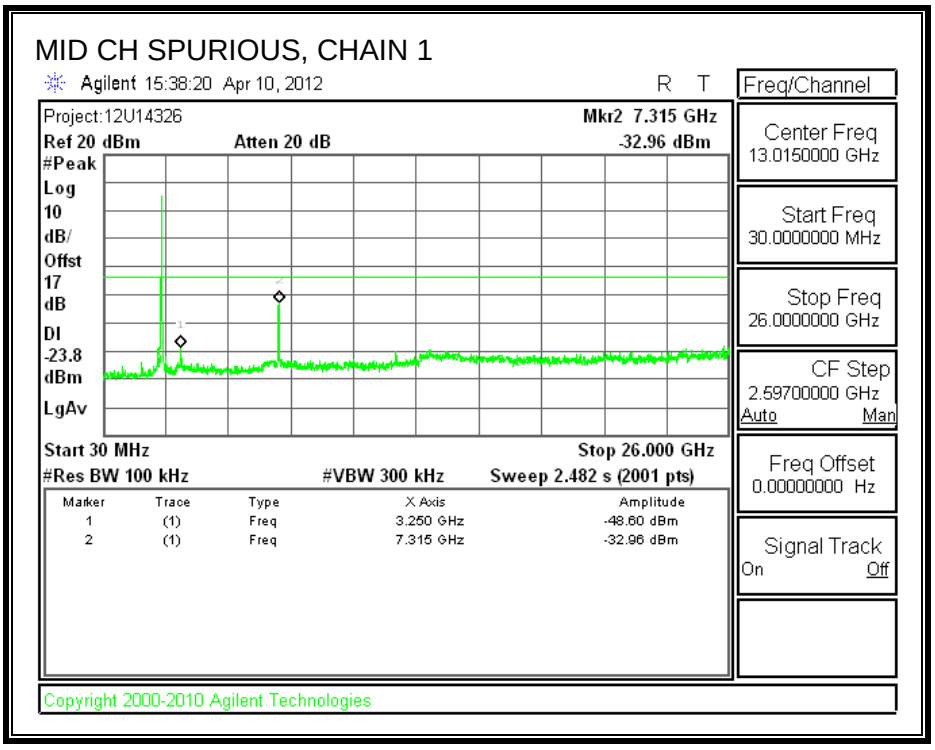
RESULTS

CHAIN 1 SPURIOUS EMISSIONS

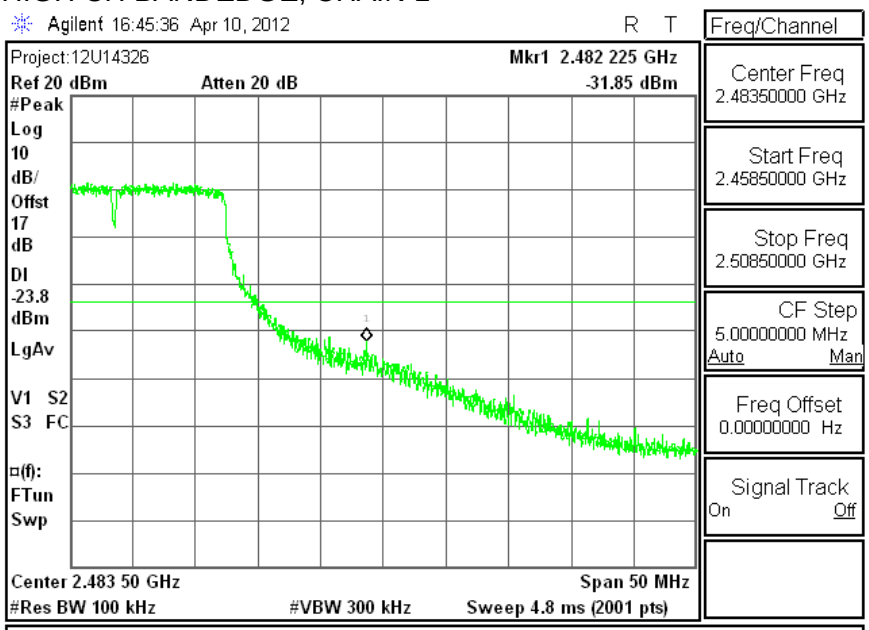




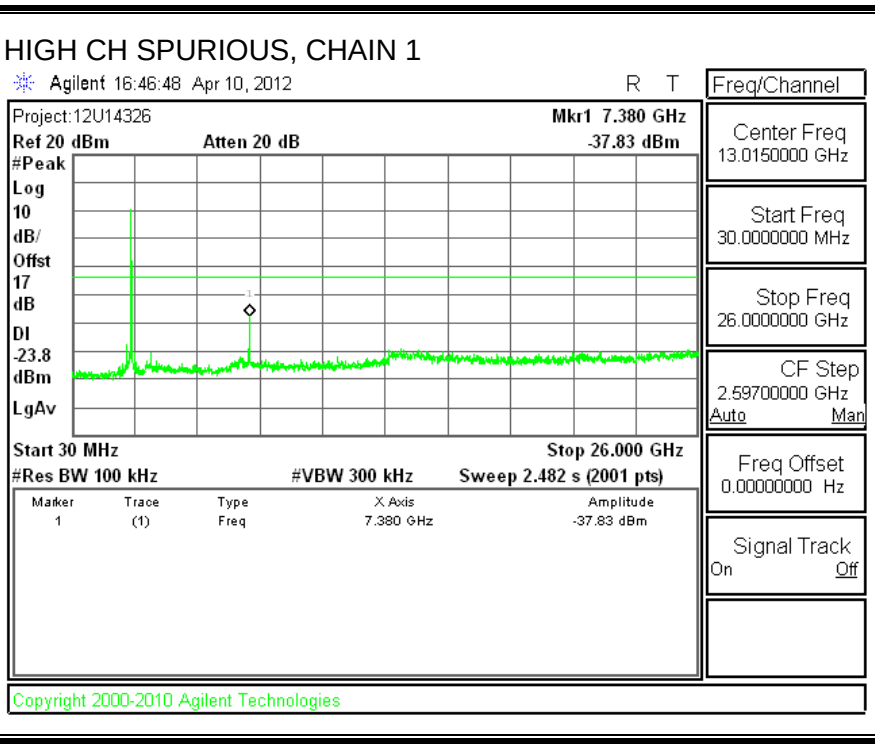




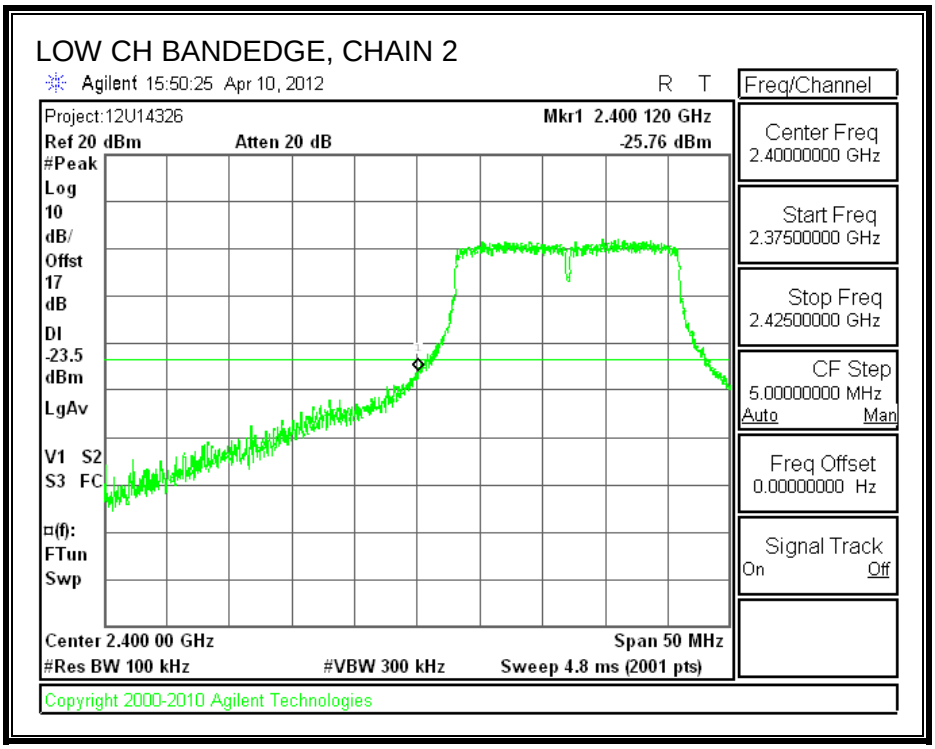
HIGH CH BANDEDGE, CHAIN 1

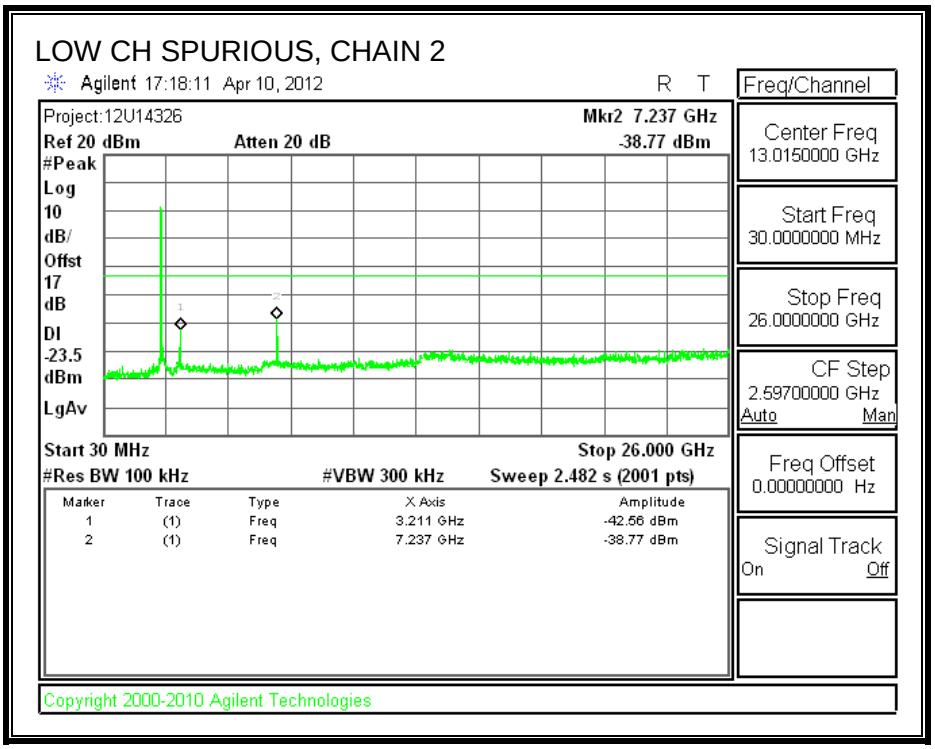


HIGH CH SPURIOUS, CHAIN 1

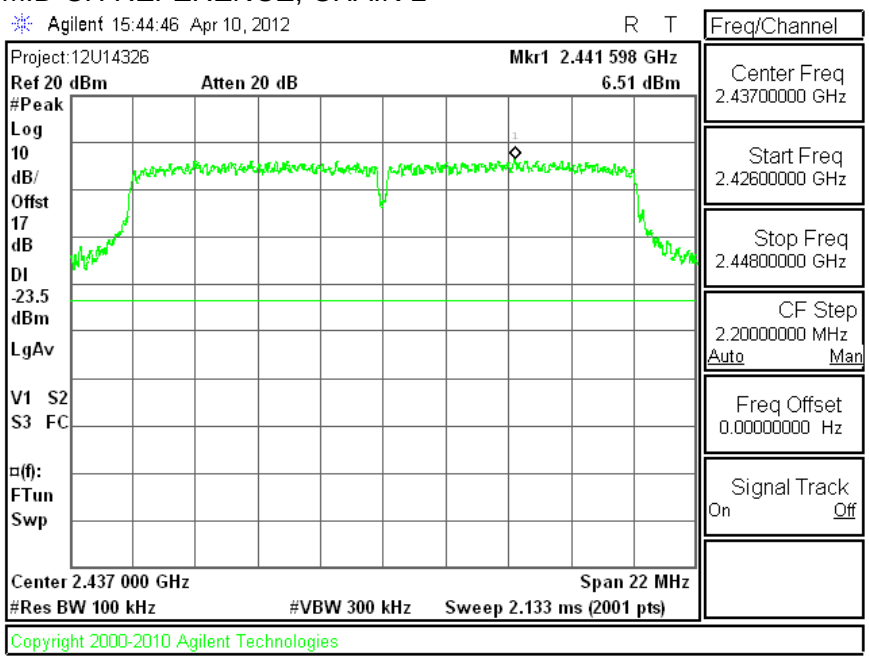


CHAIN 2 SPURIOUS EMISSIONS

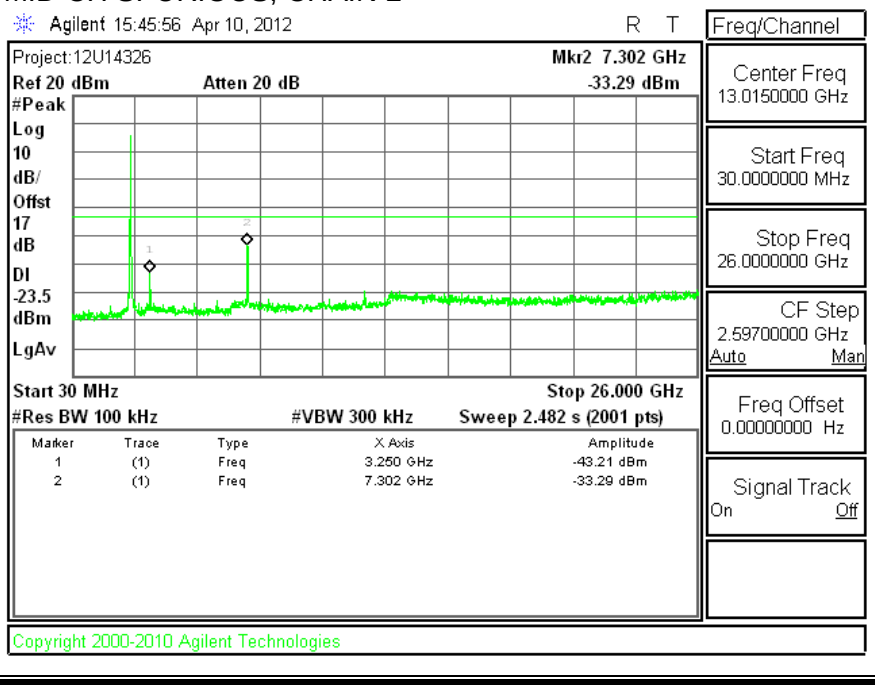




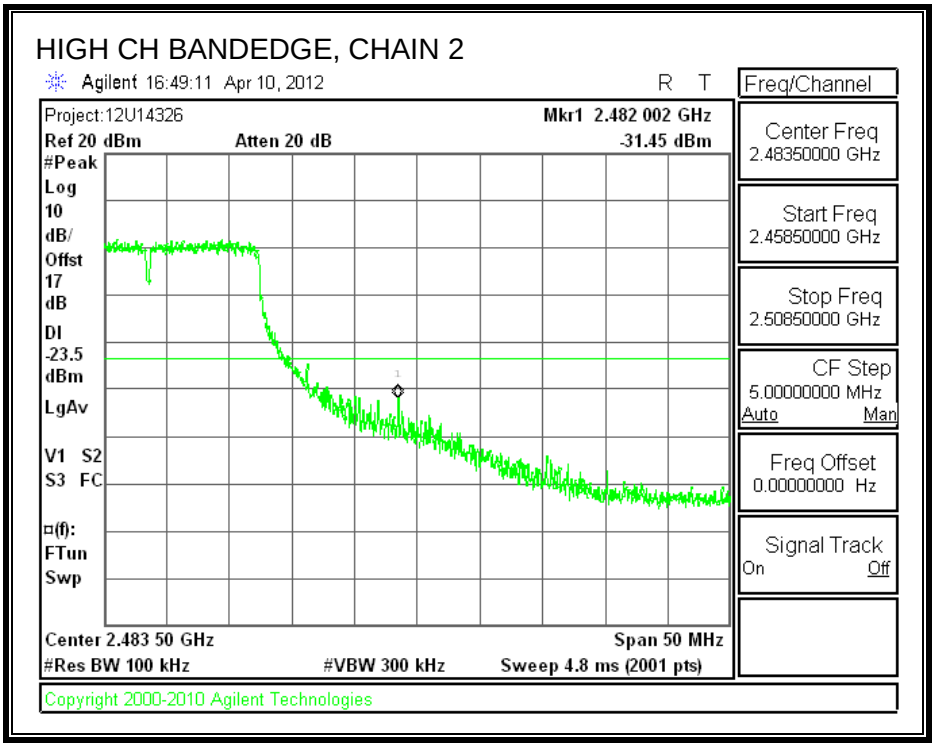
MID CH REFERENCE, CHAIN 2



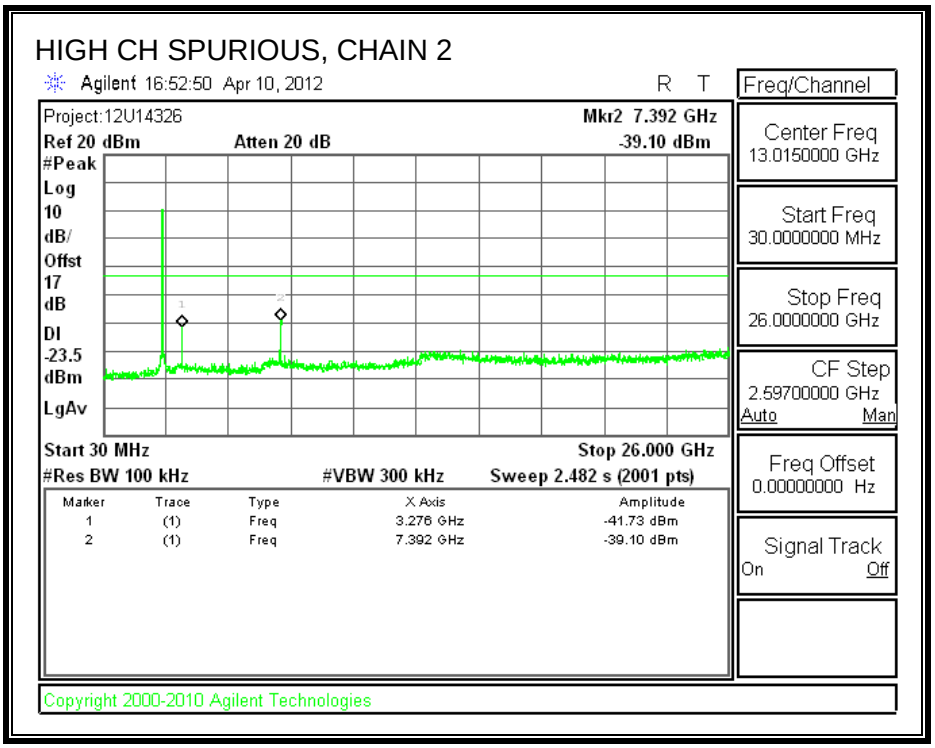
MID CH SPURIOUS, CHAIN 2



HIGH CH BANDEDGE, CHAIN 2



HIGH CH SPURIOUS, CHAIN 2



7.4. 802.11a 2TX 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.

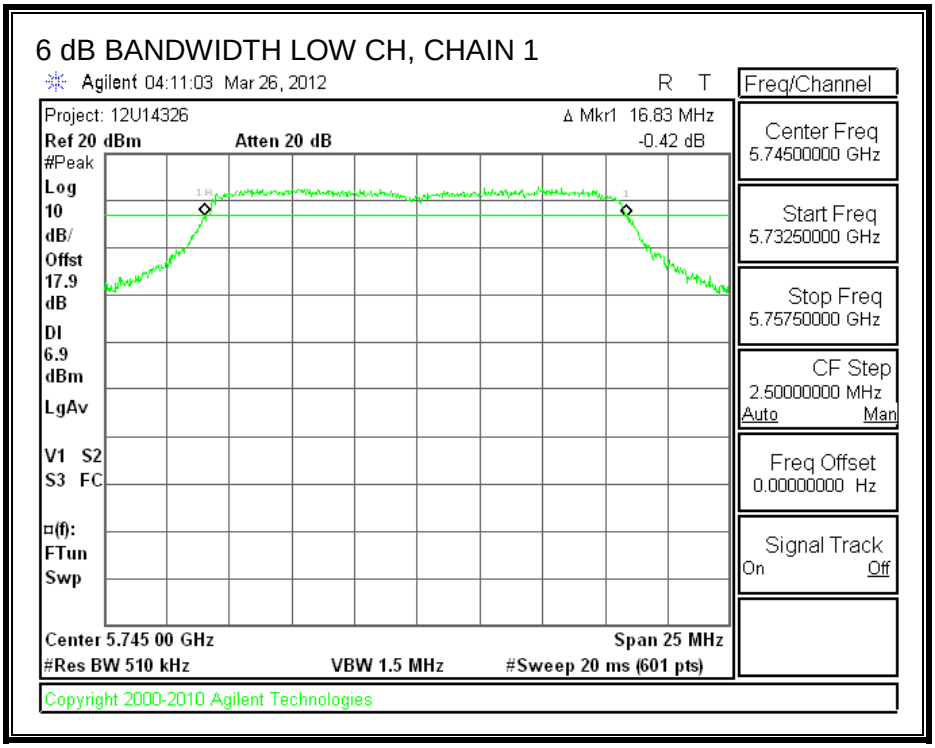
TEST PROCEDURE

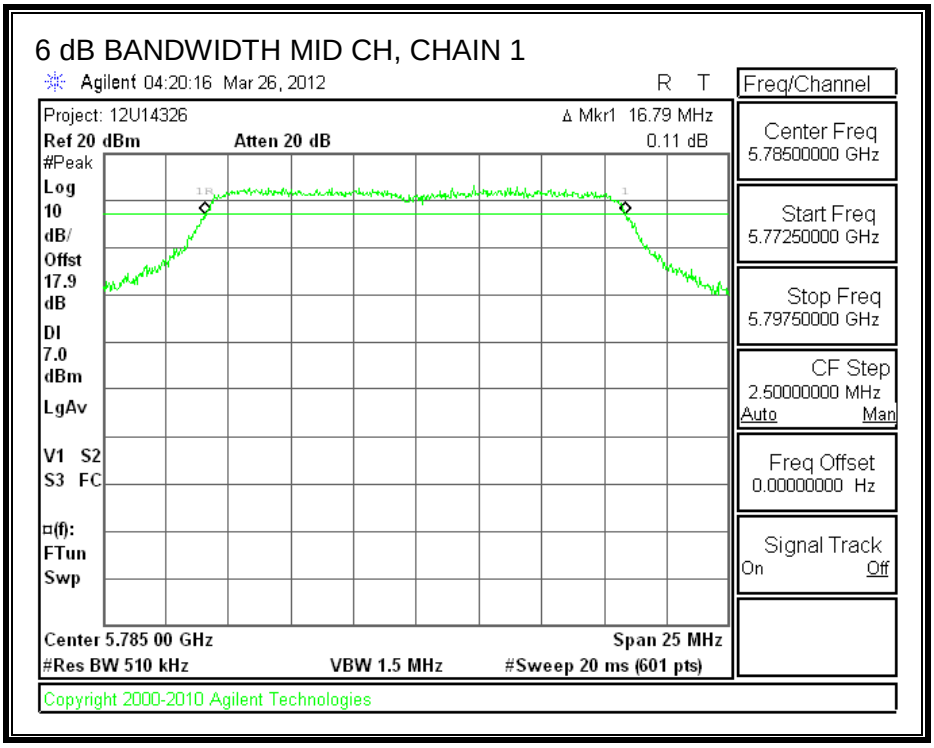
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

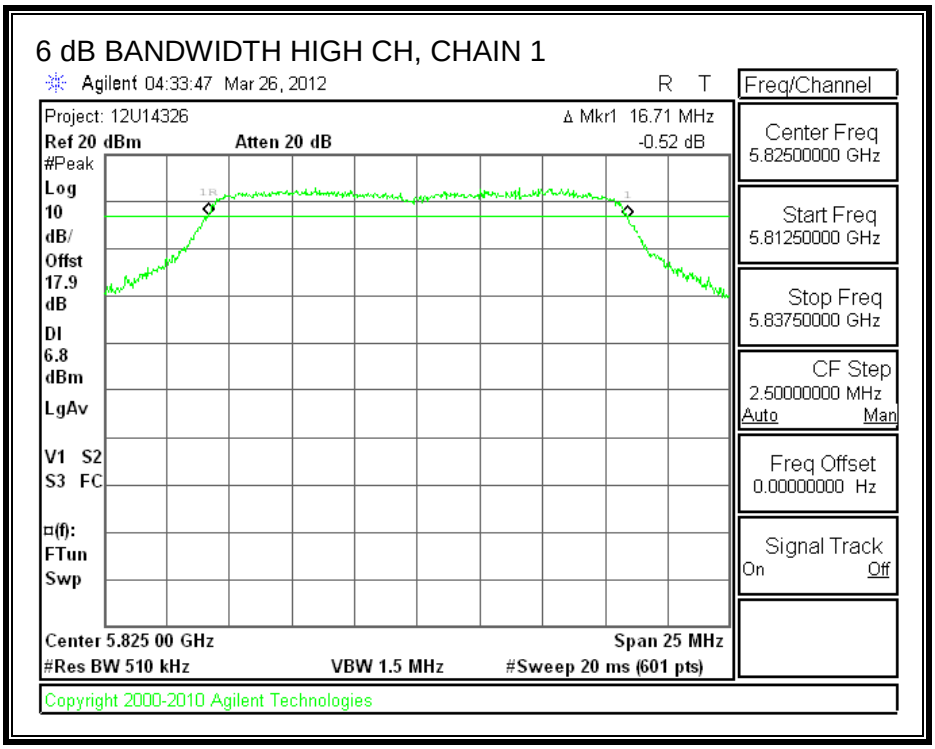
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5745	16.83	16.62	0.5
Middle	5785	16.79	16.67	0.5
High	5825	16.71	16.58	0.5

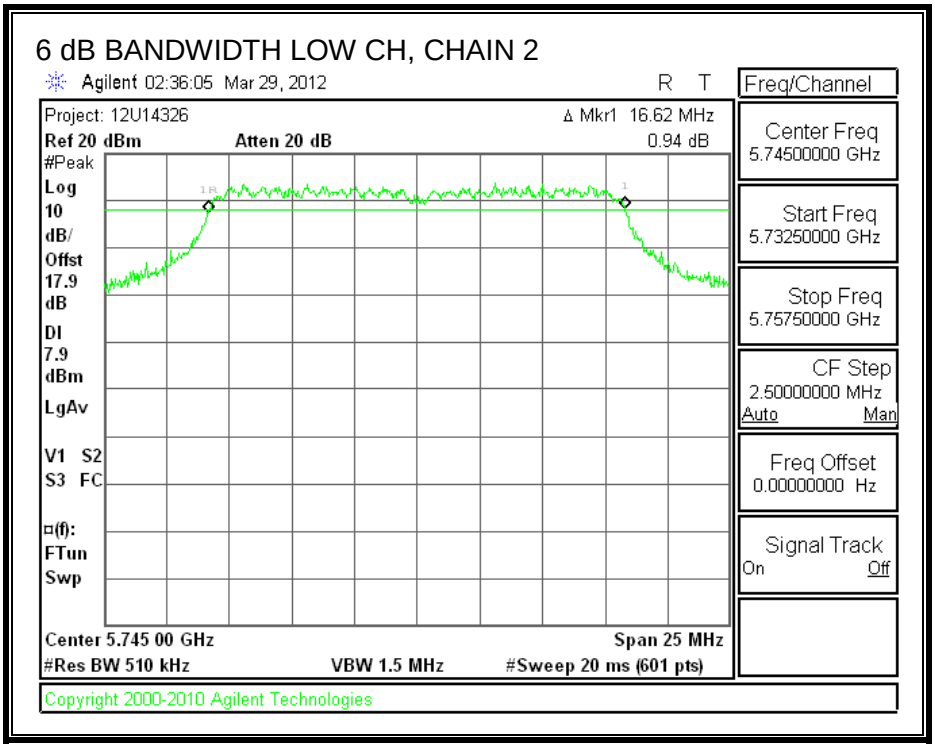
6 dB BANDWIDTH, CHAIN 1

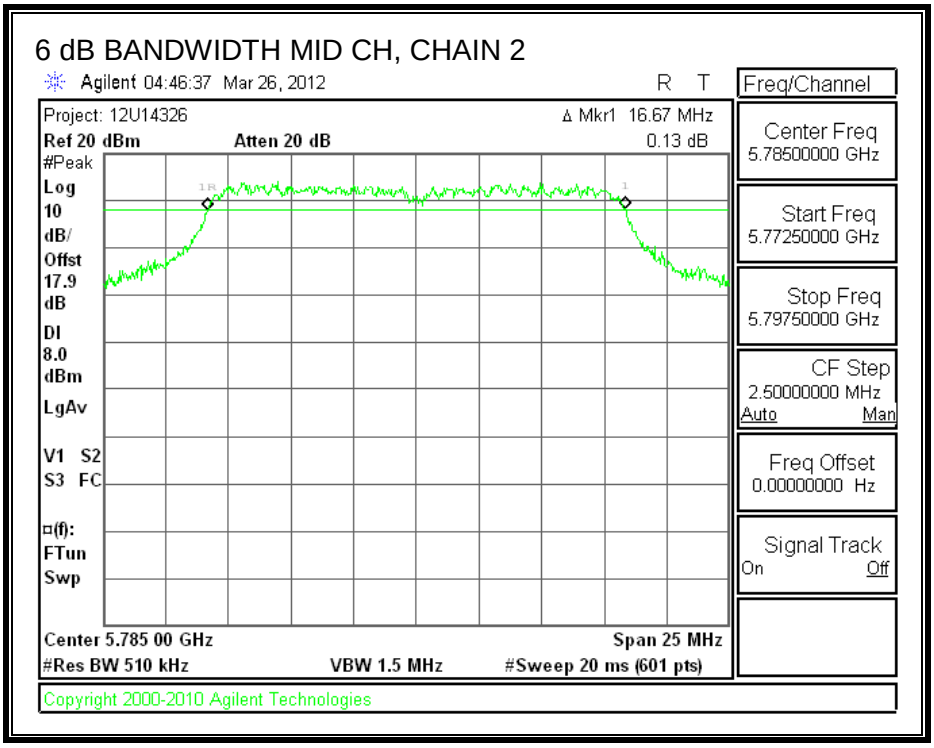


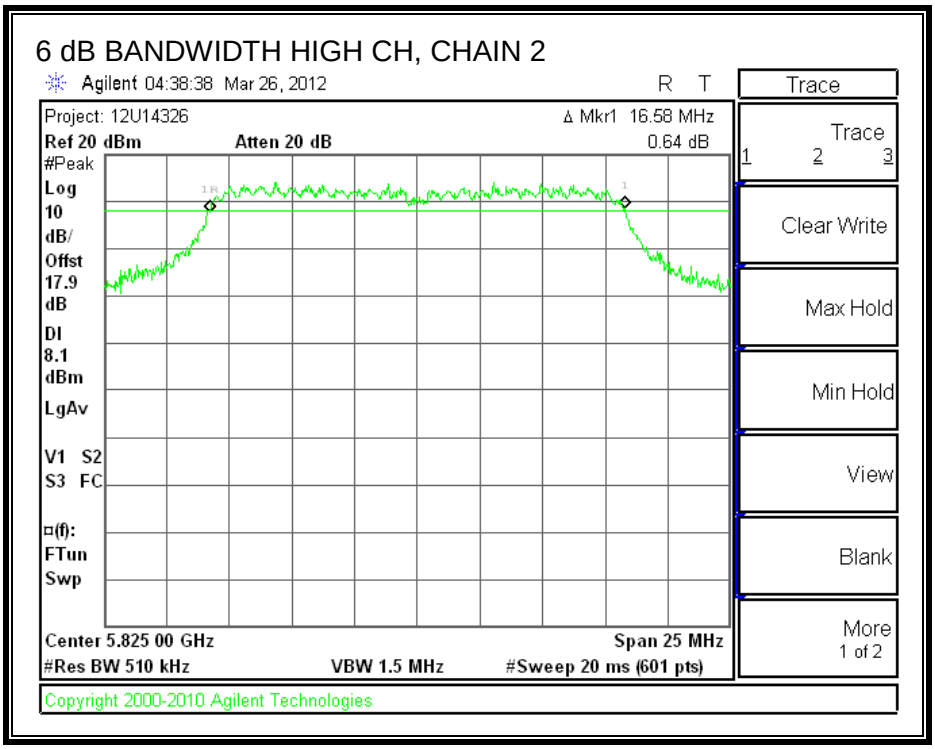




6 dB BANDWIDTH, CHAIN 2







7.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

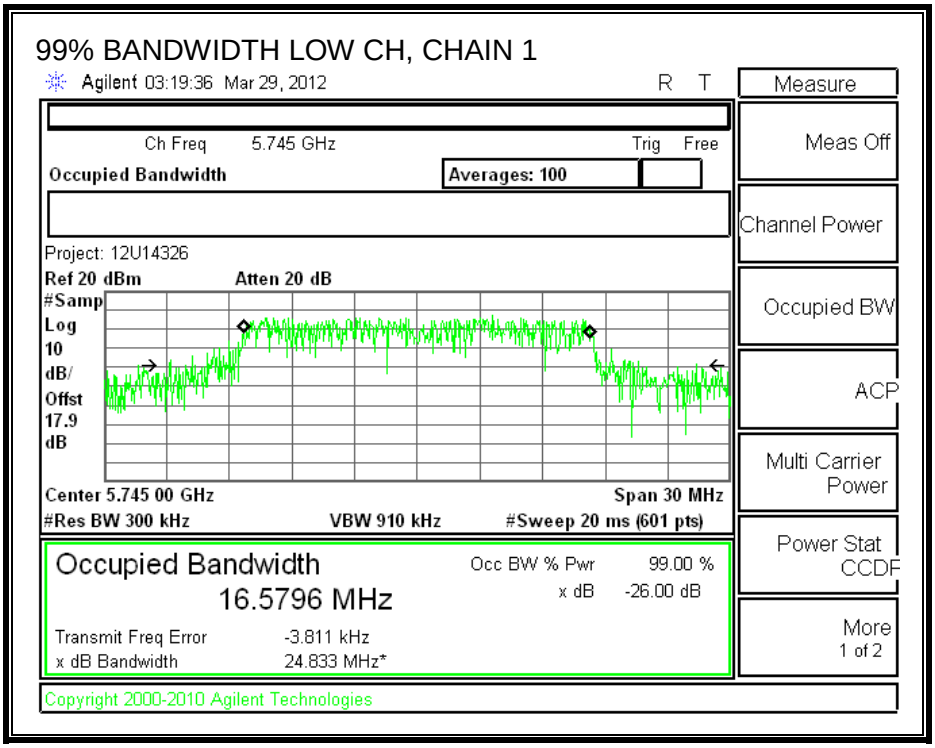
TEST PROCEDURE

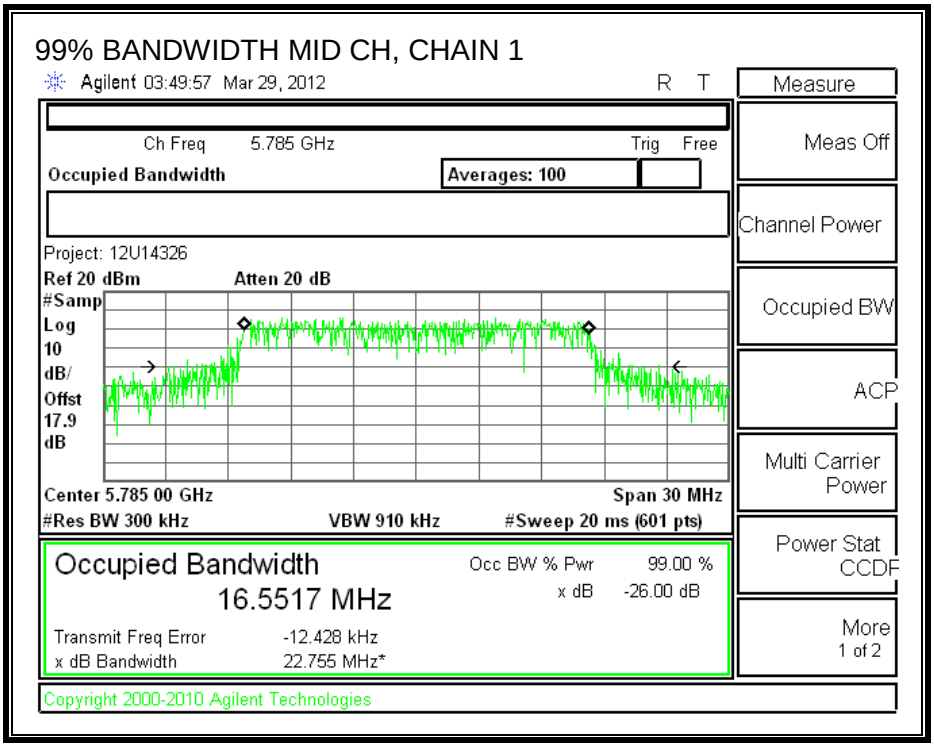
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

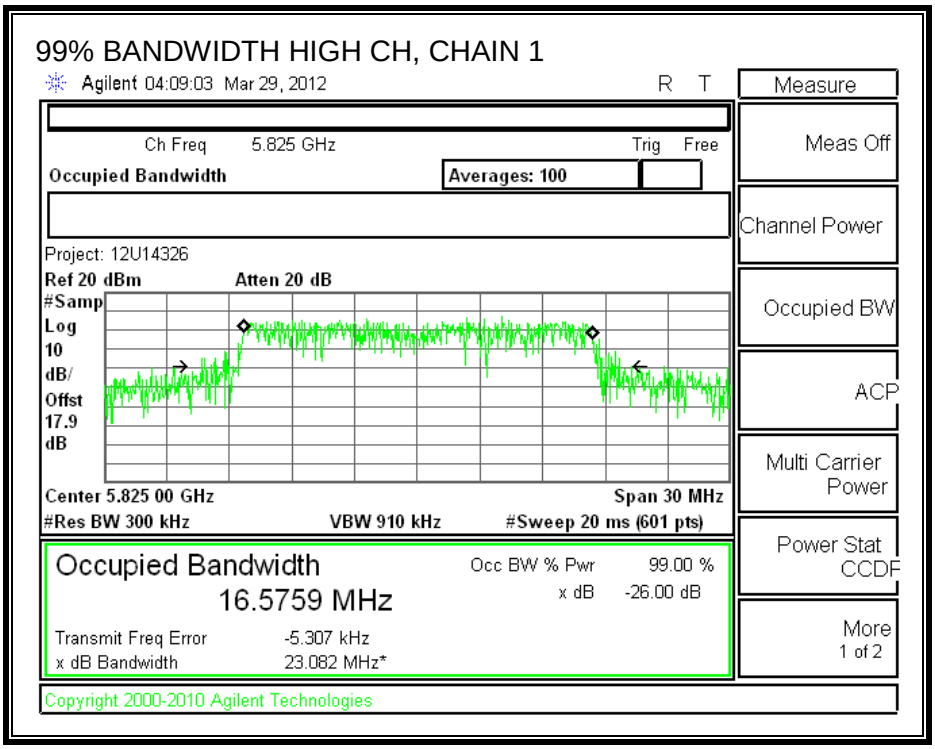
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	5745	16.5796	16.6561
Middle	5785	16.5517	16.6008
High	5825	16.5759	16.5871

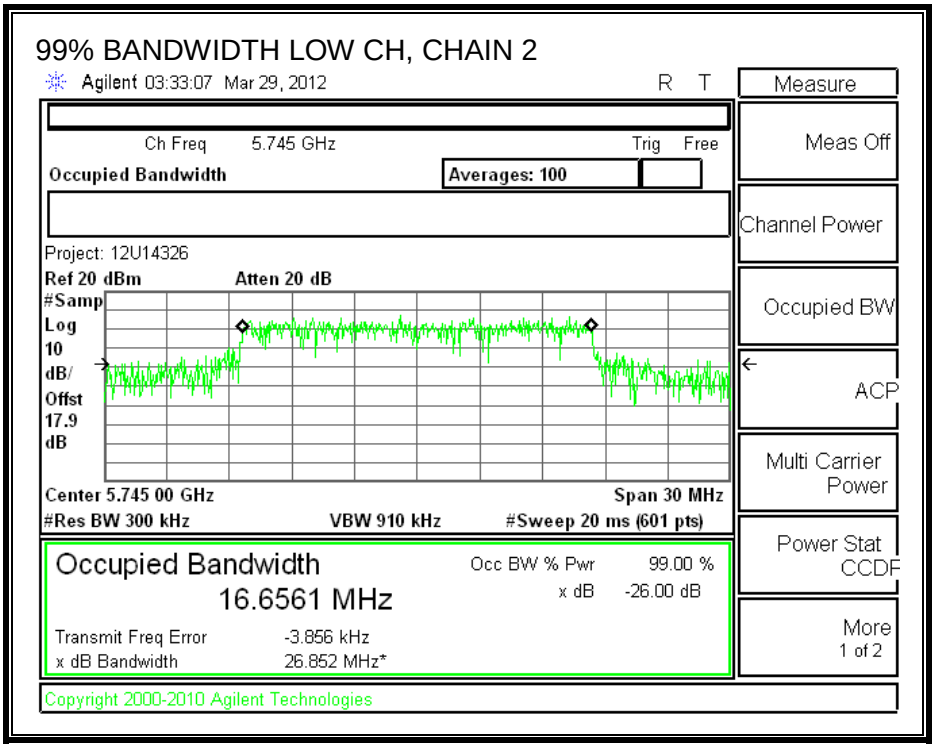
99% BANDWIDTH, CHAIN 1

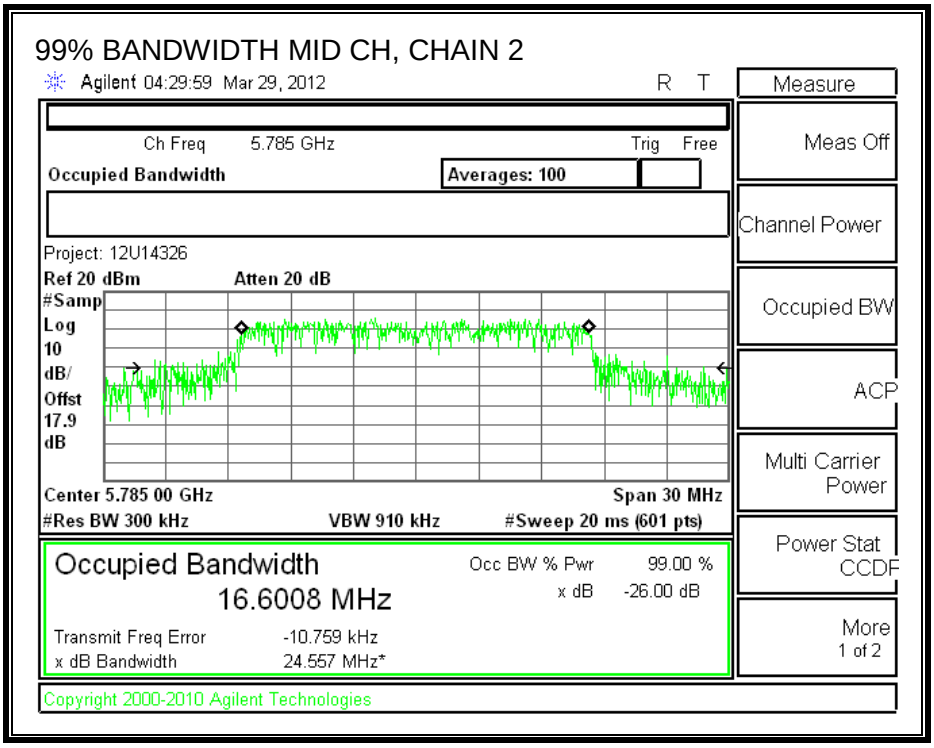


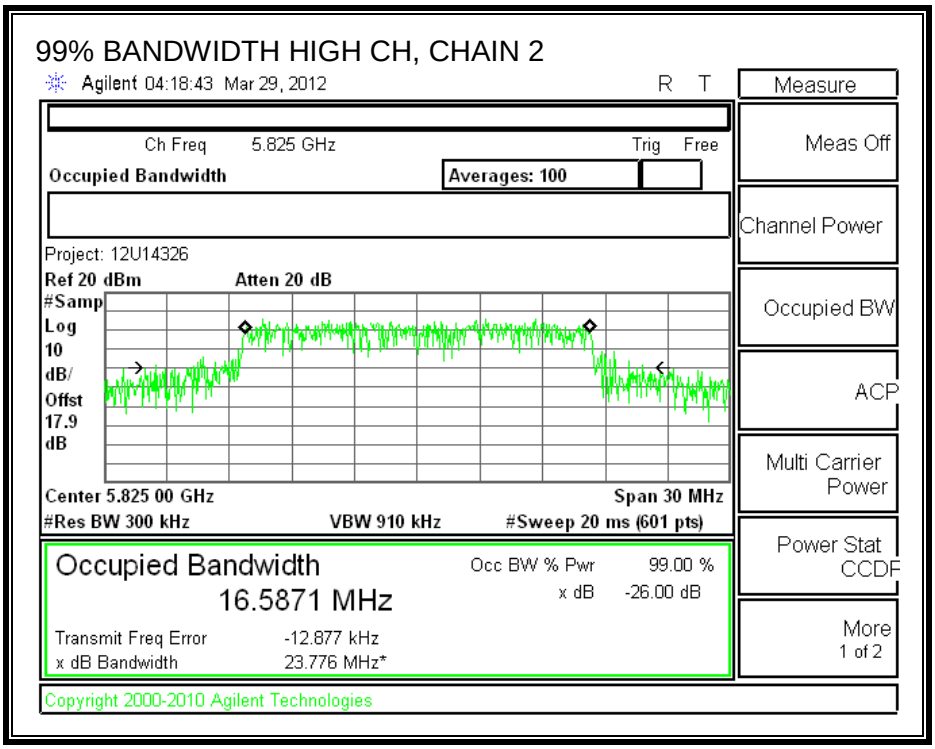




99% BANDWIDTH, CHAIN 2







7.4.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
2.74	3.11	5.94

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

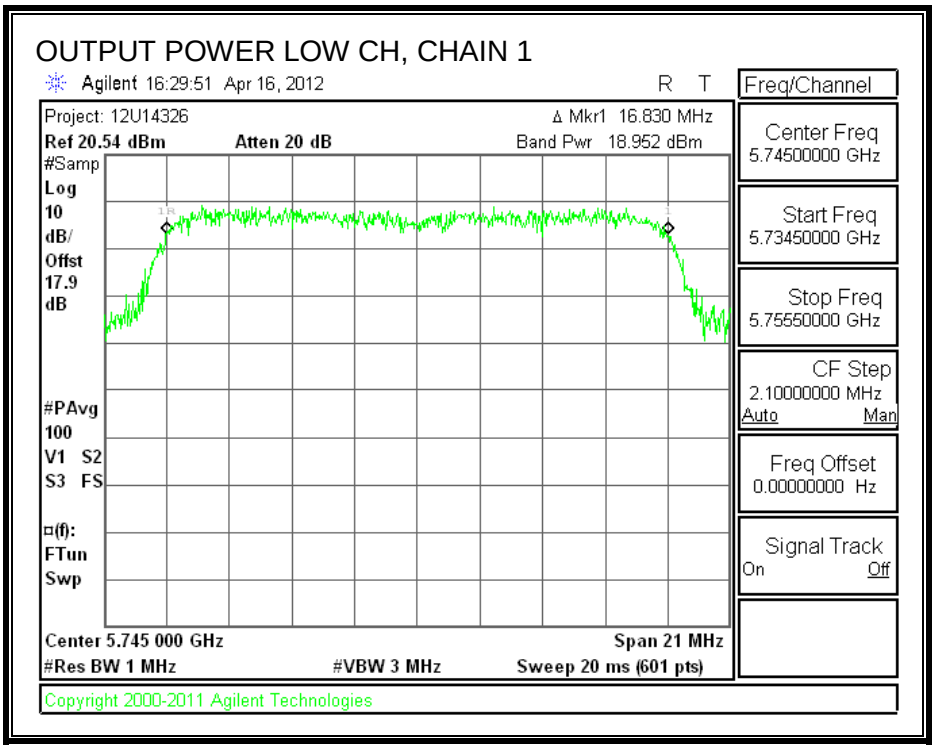
TEST PROCEDURE

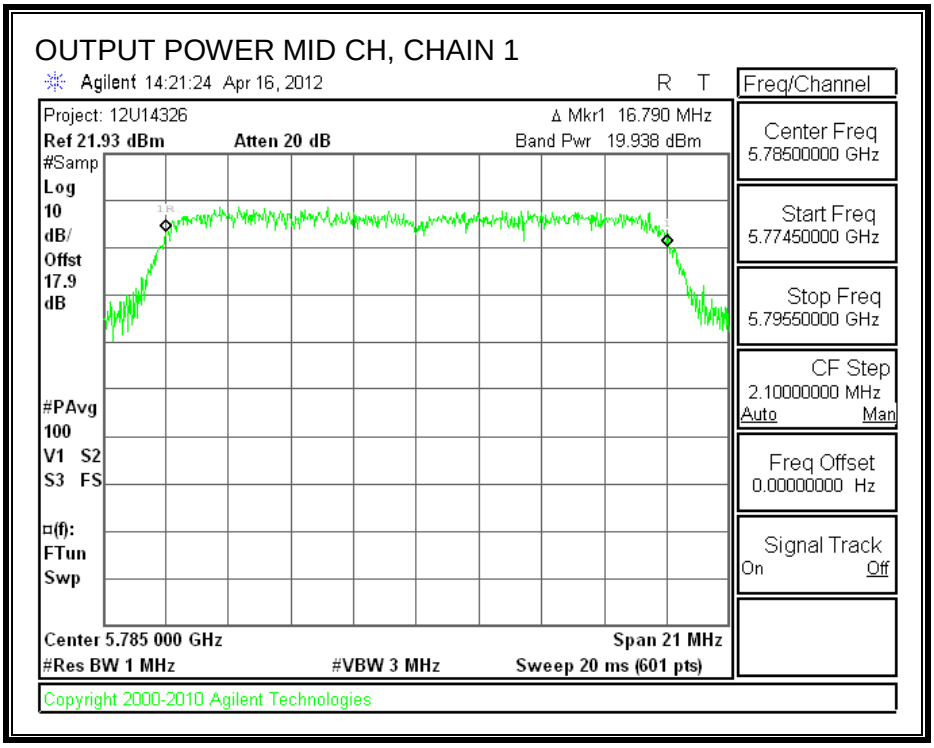
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

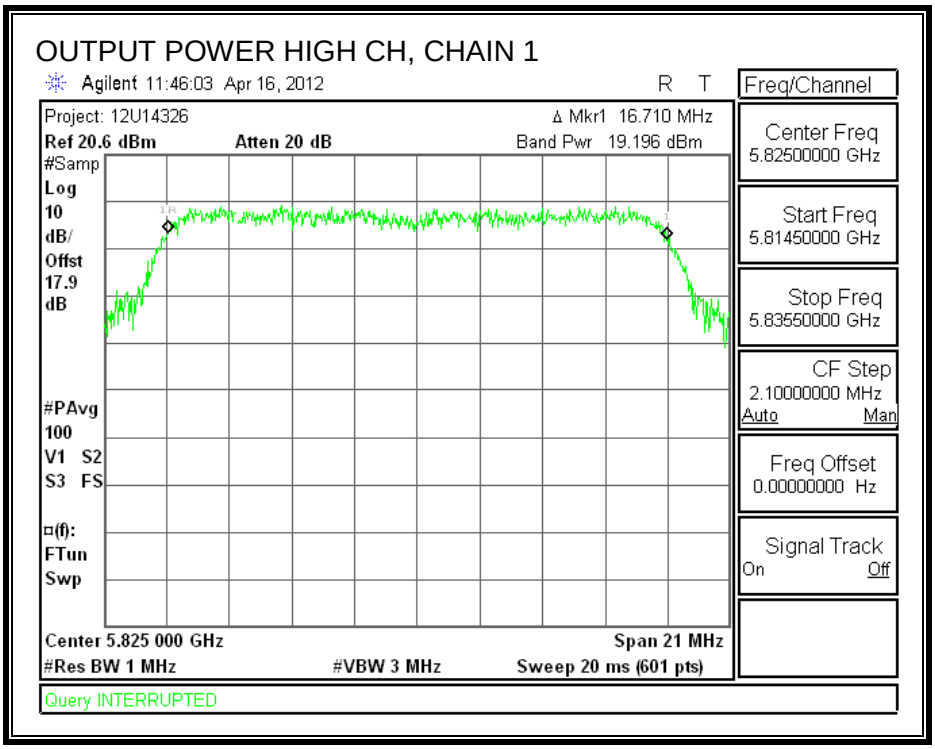
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	18.952	18.212	0.00	21.608	30.00	-8.392
Mid	5785	19.938	19.361	0.00	22.669	30.00	-7.331
High	5825	19.196	18.813	0.00	22.019	30.00	-7.981

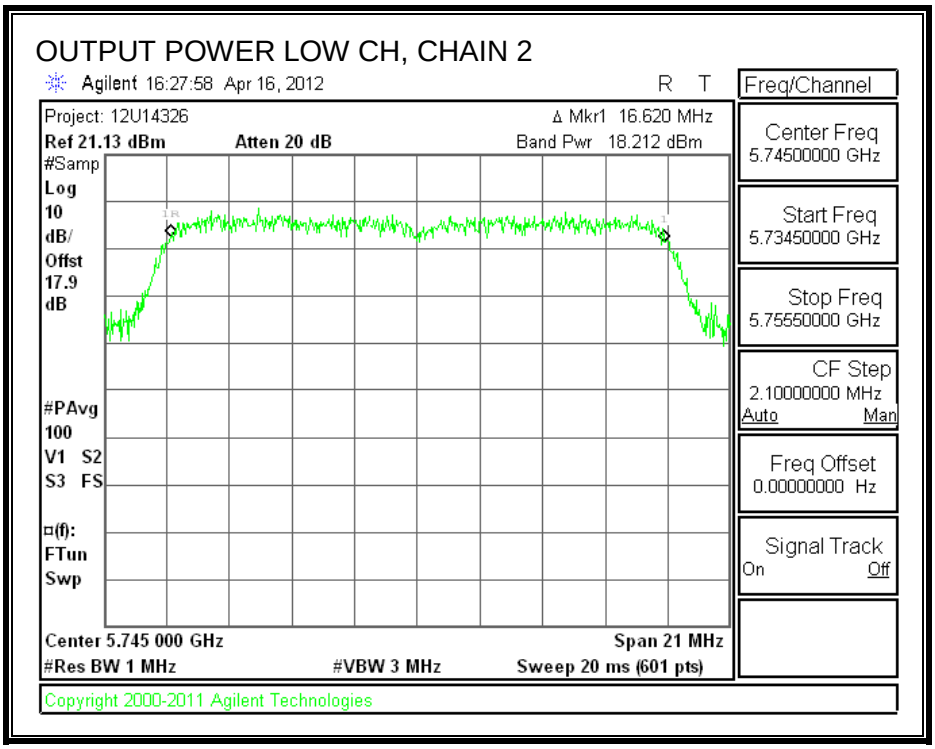
CHAIN 1 OUTPUT POWER



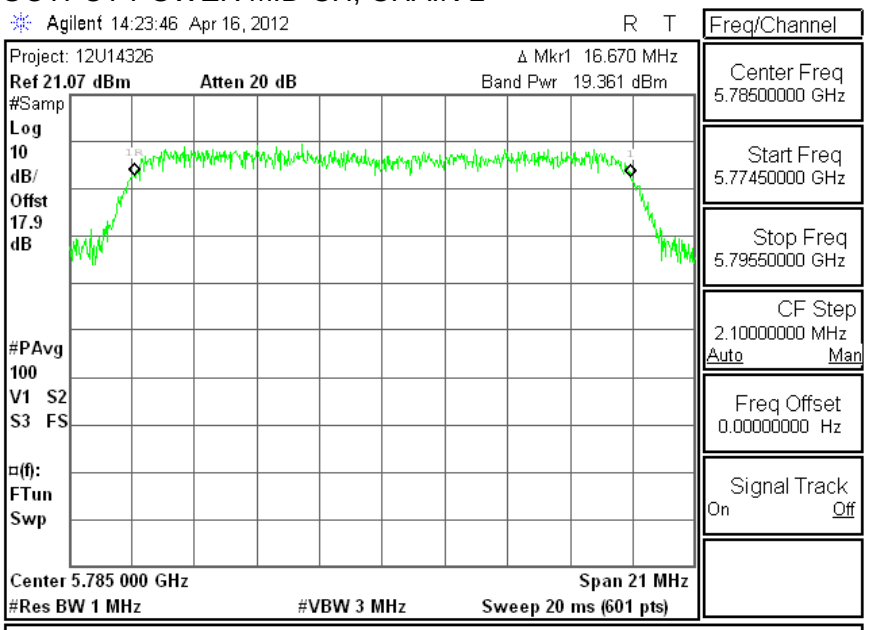


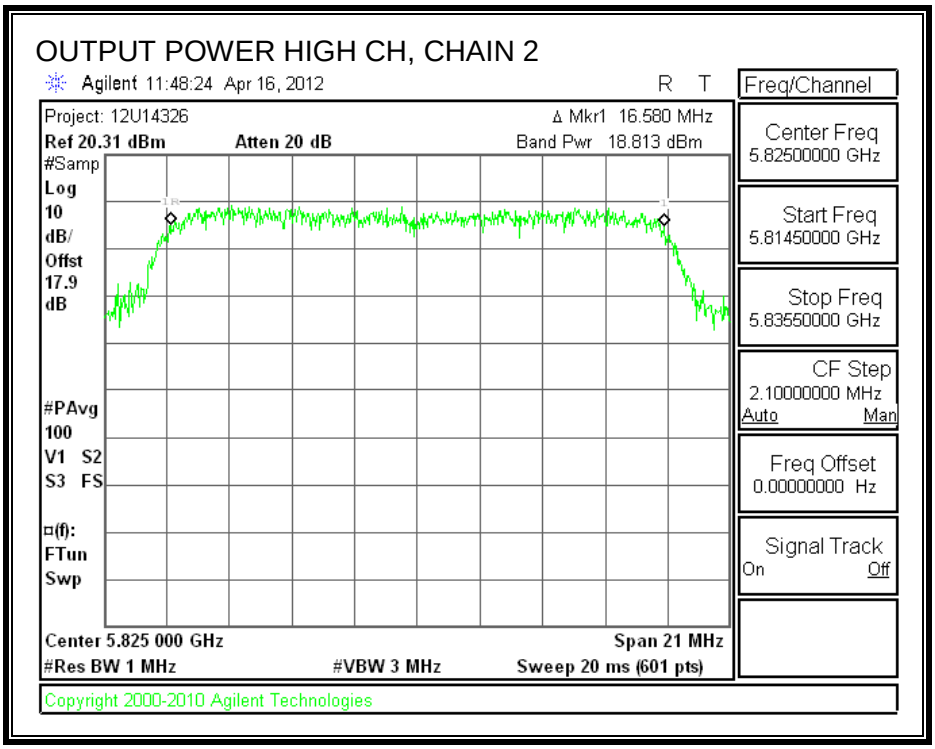


CHAIN 2 OUTPUT POWER



OUTPUT POWER MID CH, CHAIN 2





7.4.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	5745	18.60	17.60	21.14
Middle	5785	18.70	18.10	21.42
High	5825	18.20	18.30	21.26

7.4.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

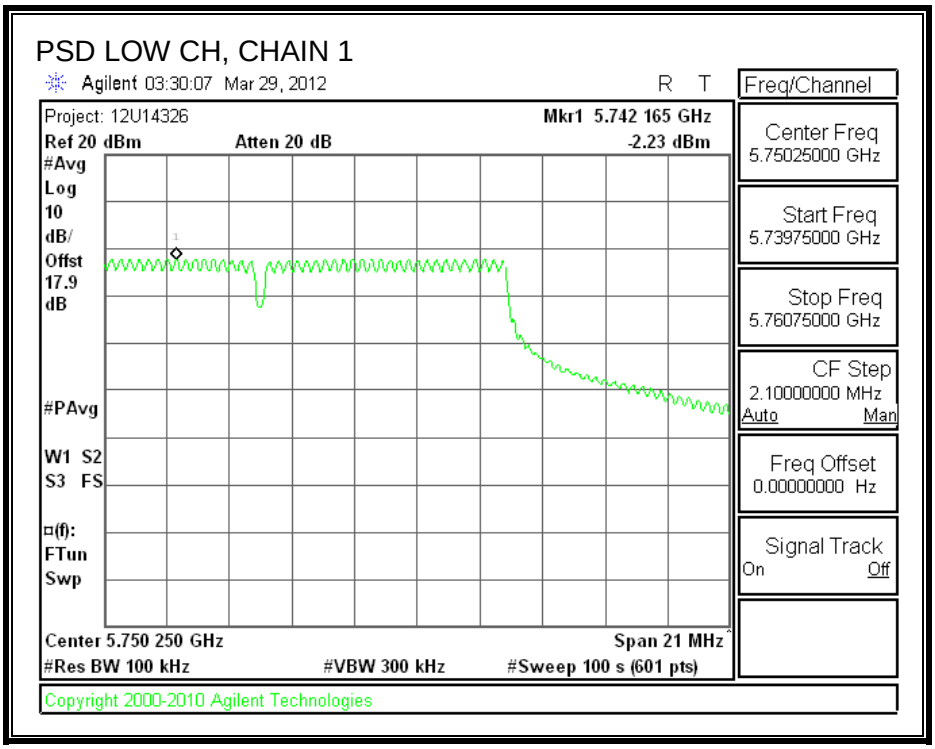
TEST PROCEDURE

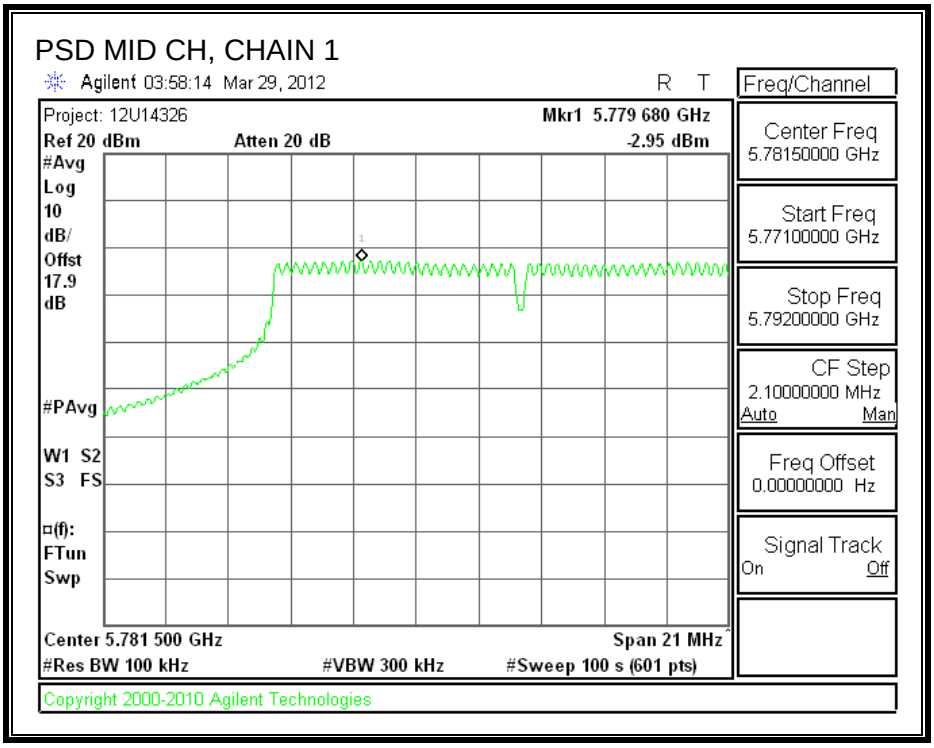
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

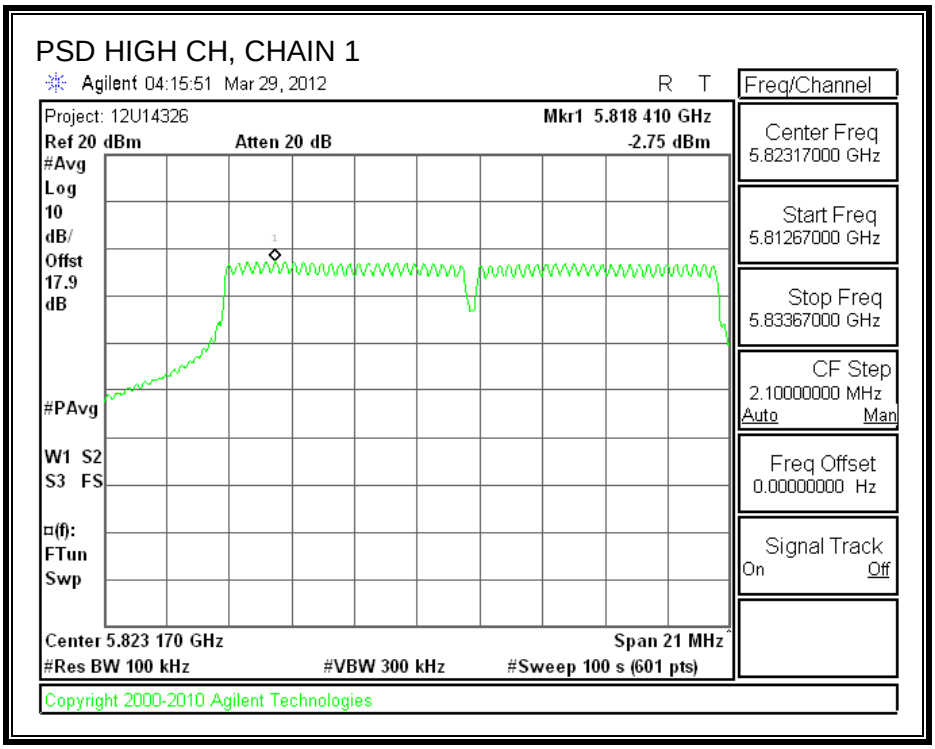
RESULTS:

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	10log(3kHz/ 100kHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-2.23	-2.35	-15.20	-14.48	8	-22.48
Middle	5785	-2.95	-3.00	-15.20	-15.16	8	-23.16
High	5825	-2.75	-3.25	-15.20	-15.18	8	-23.18

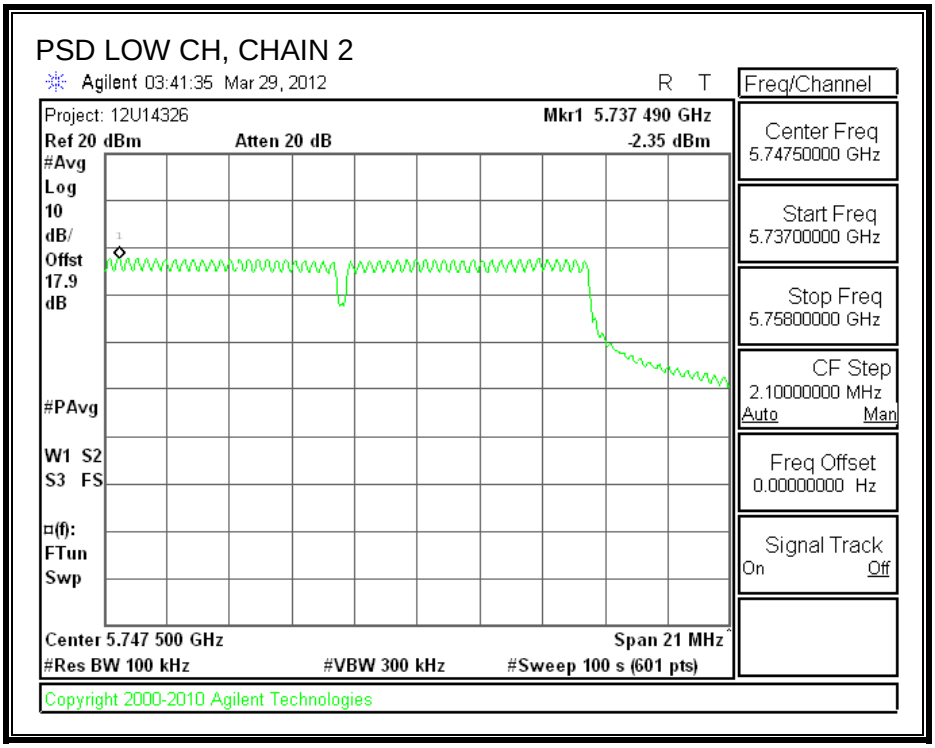
POWER SPECTRAL DENSITY, CHAIN 1

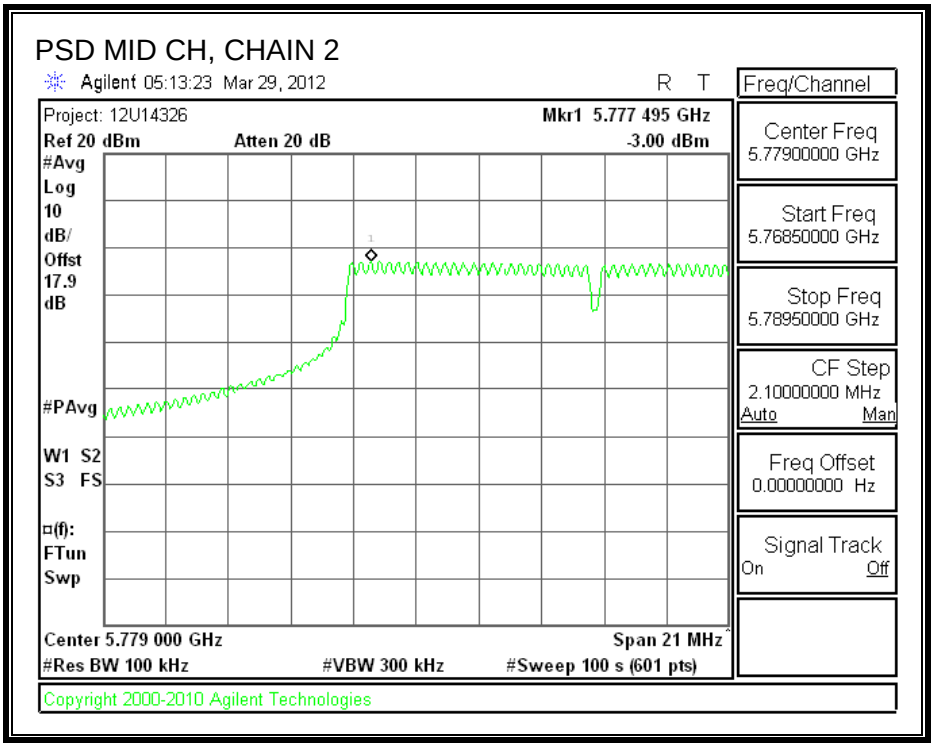


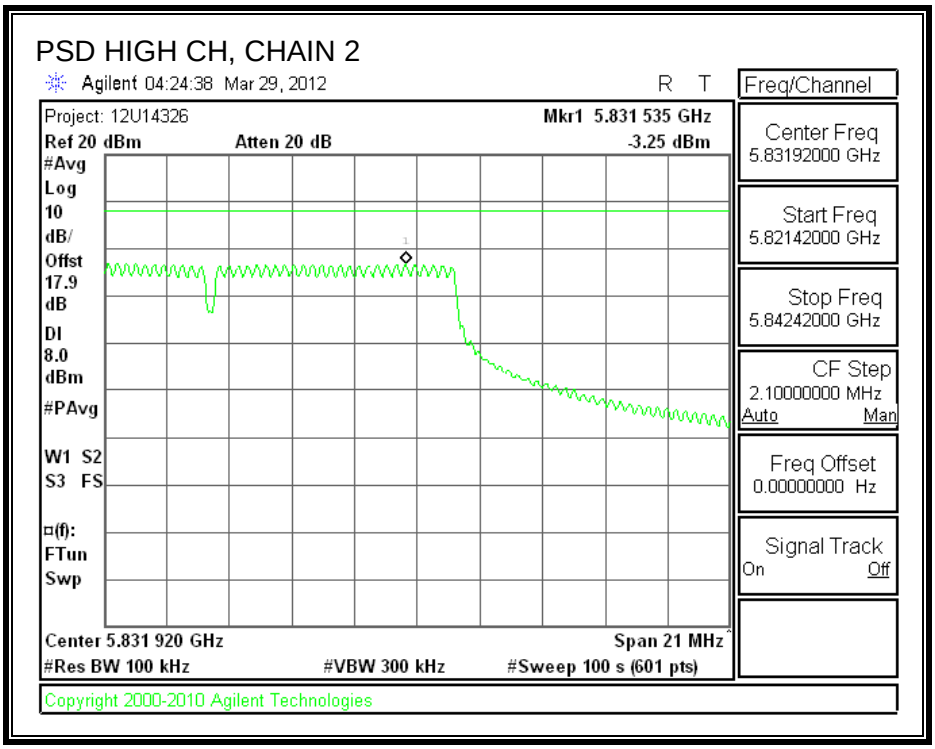




POWER SPECTRAL DENSITY, CHAIN 2







7.4.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

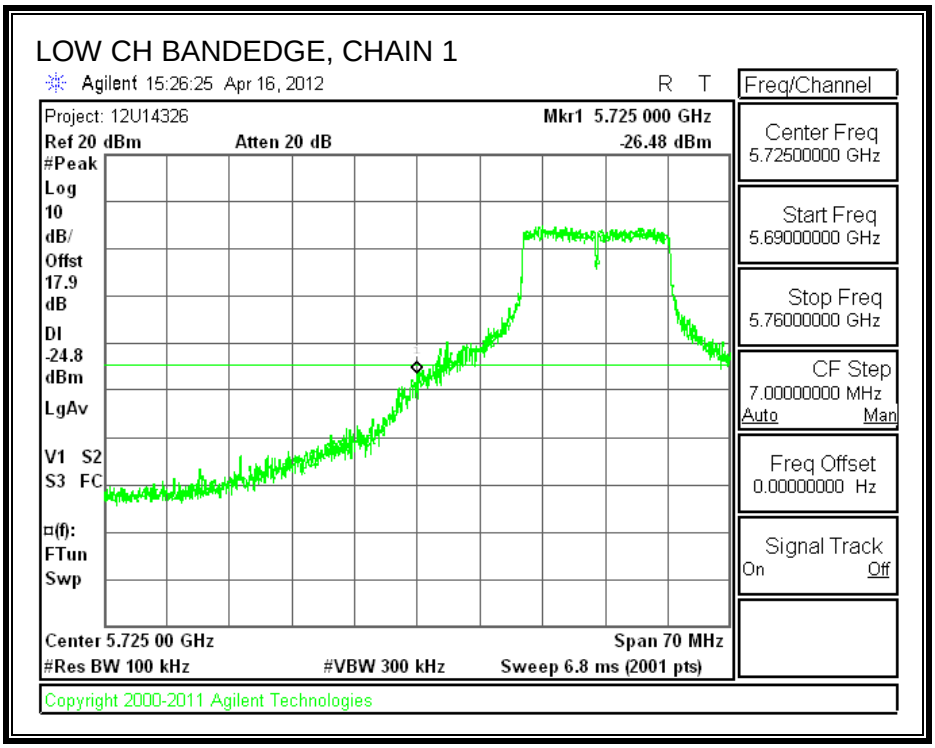
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

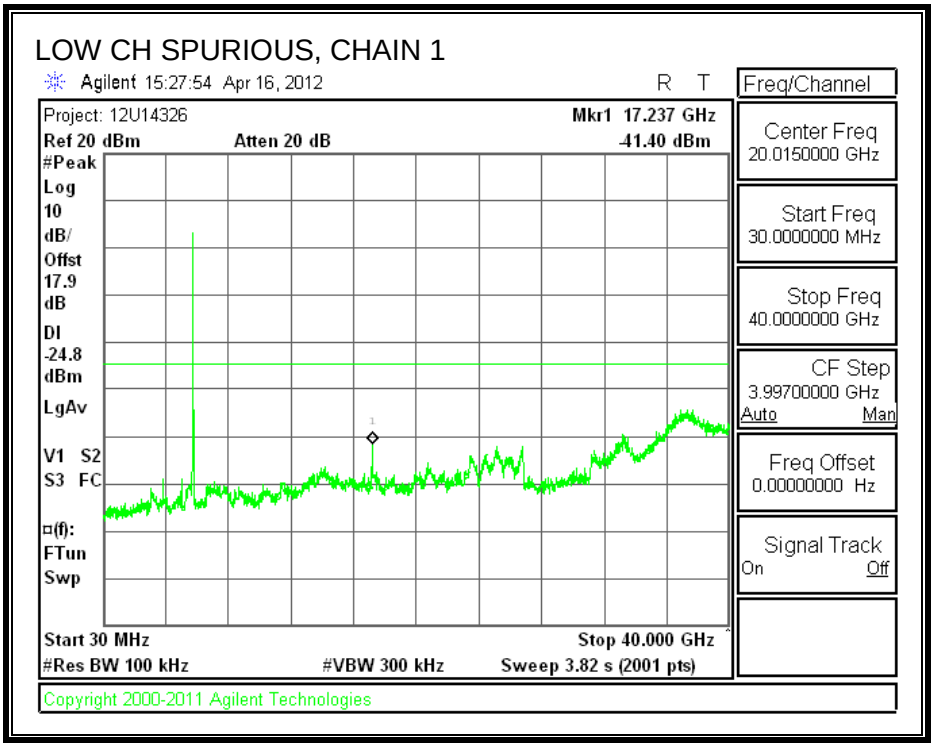
TEST PROCEDURE

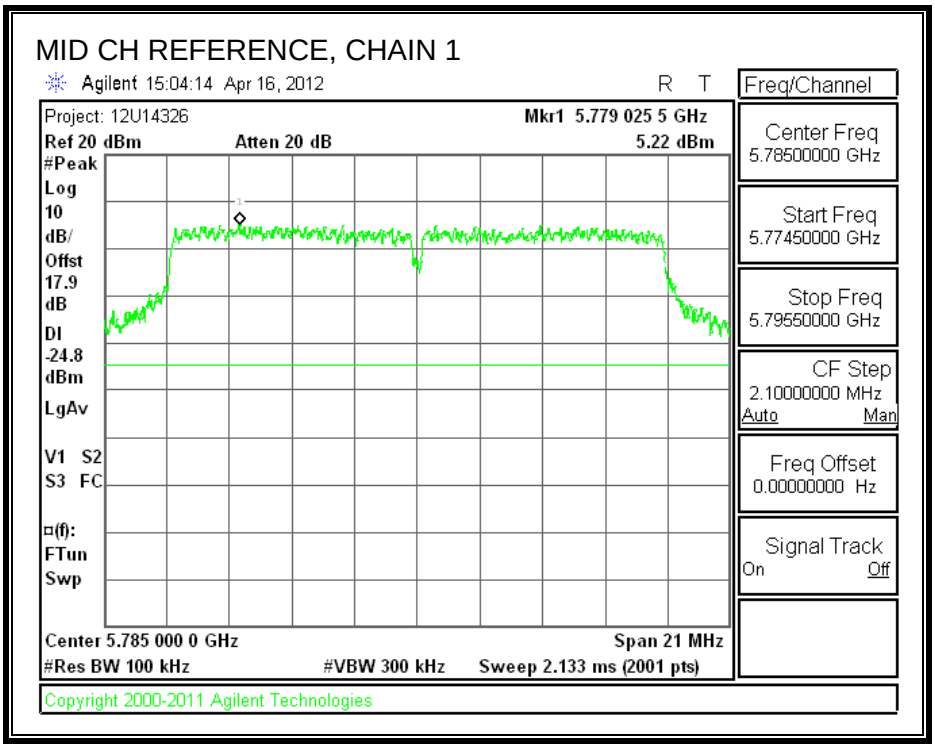
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

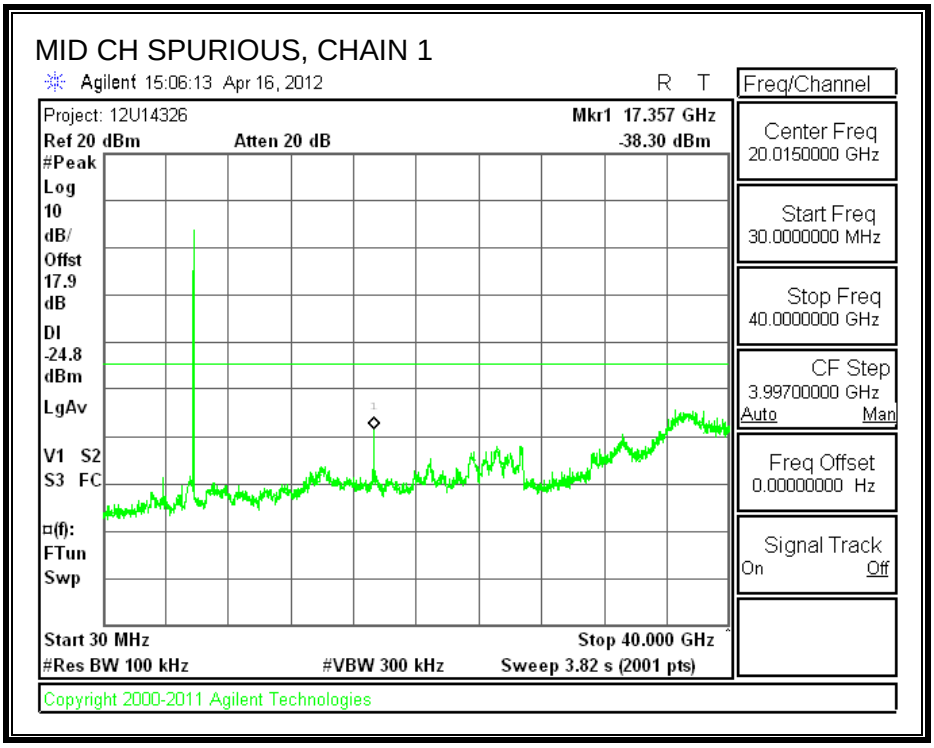
RESULTS

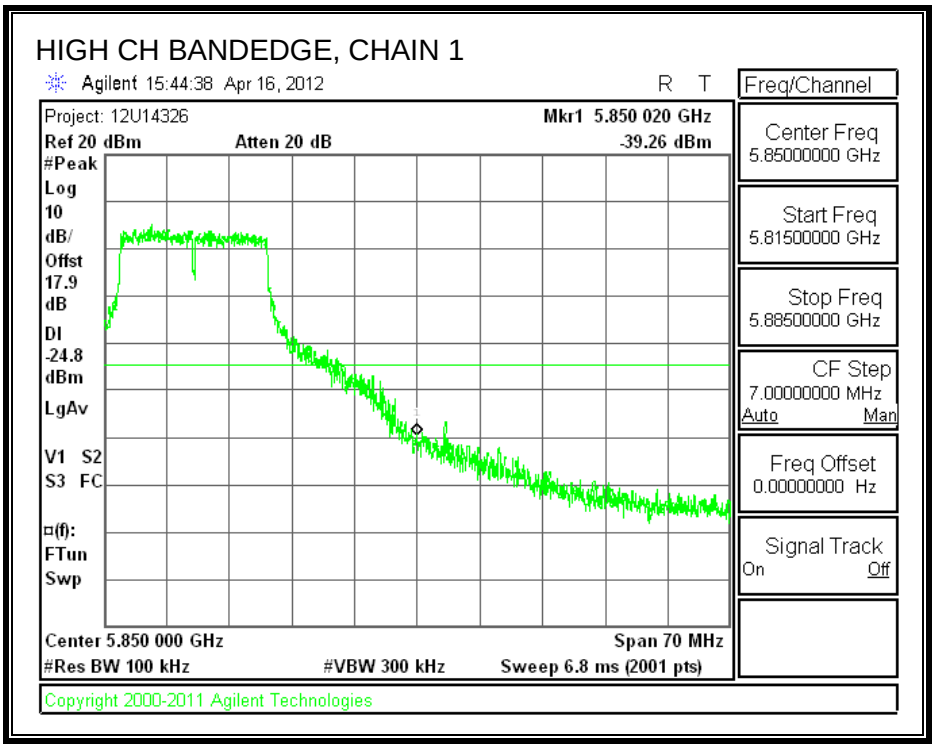
CHAIN 1 SPURIOUS EMISSIONS

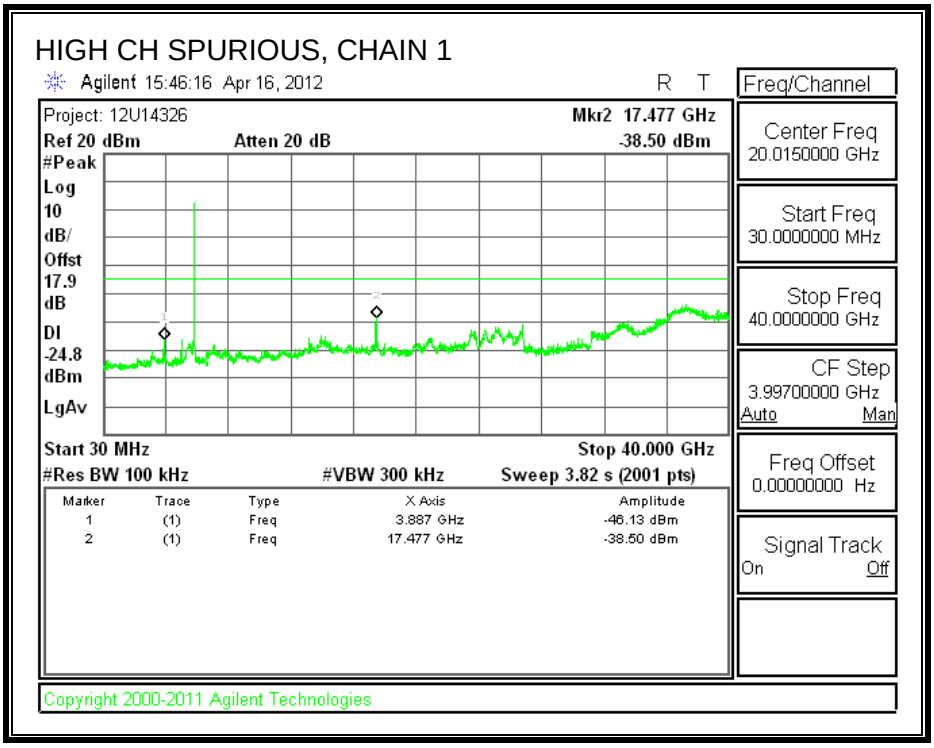




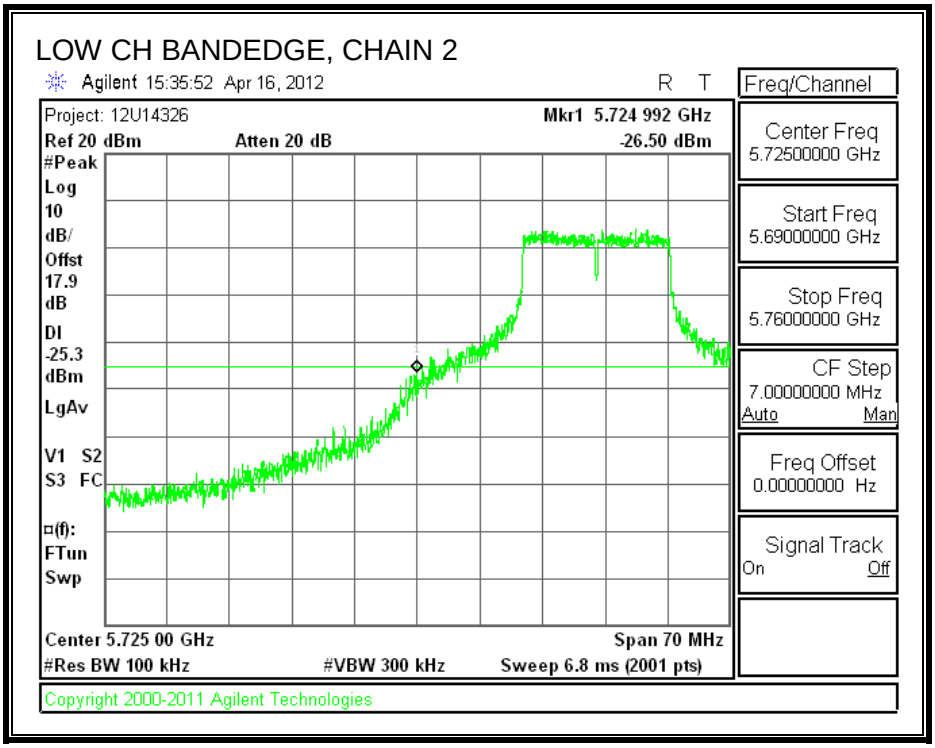


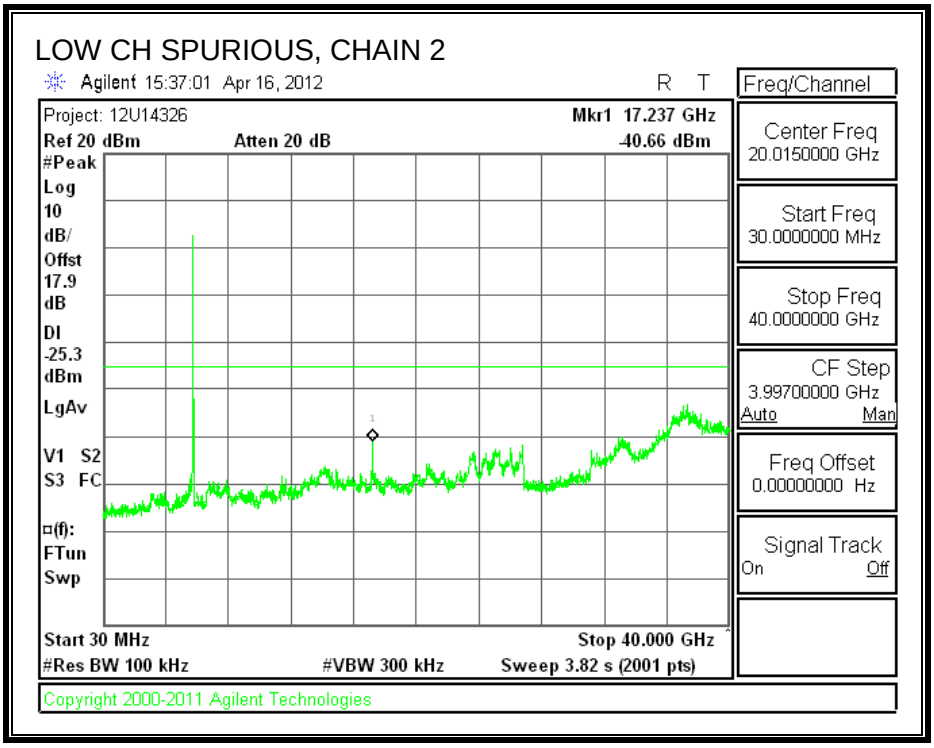




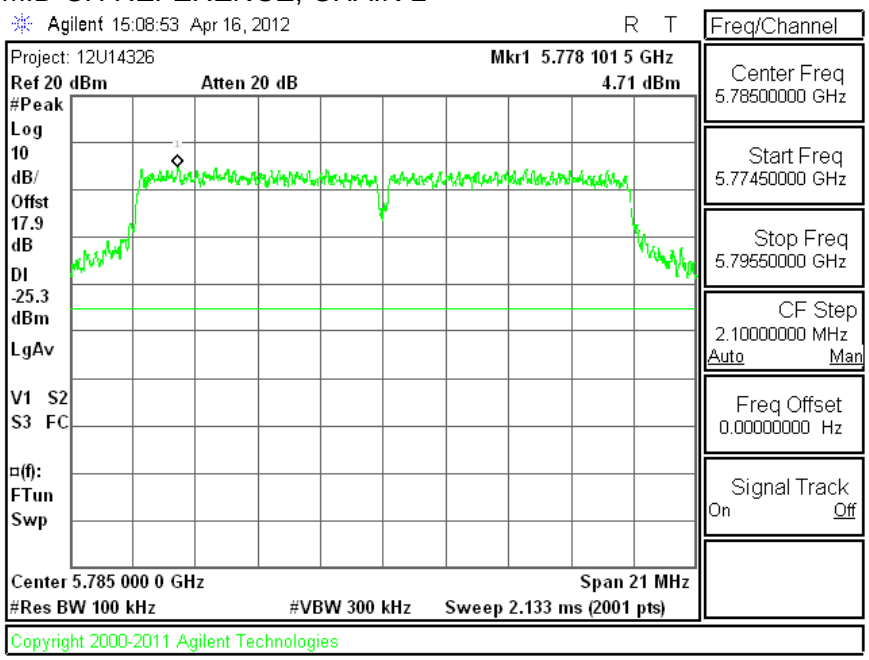


CHAIN 2 SPURIOUS EMISSIONS

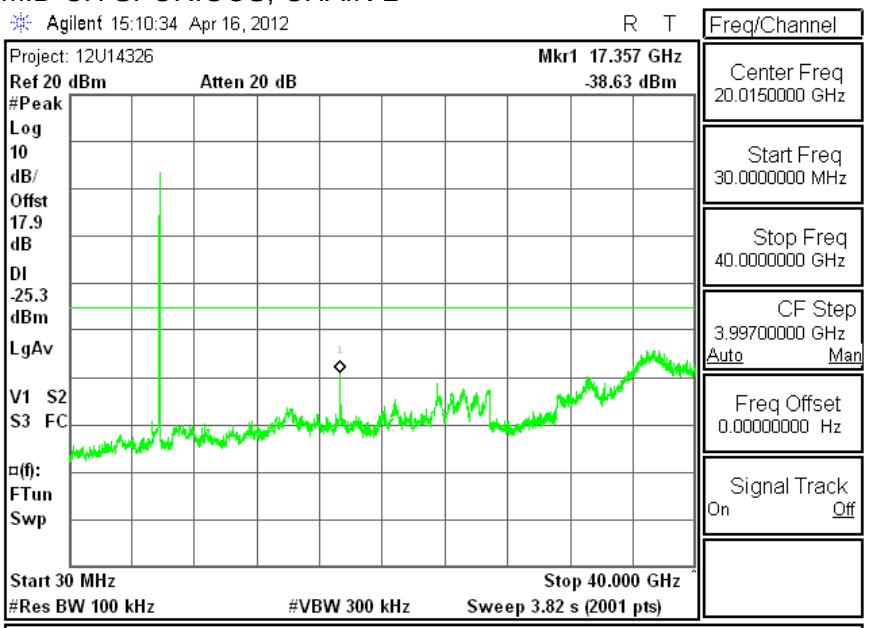


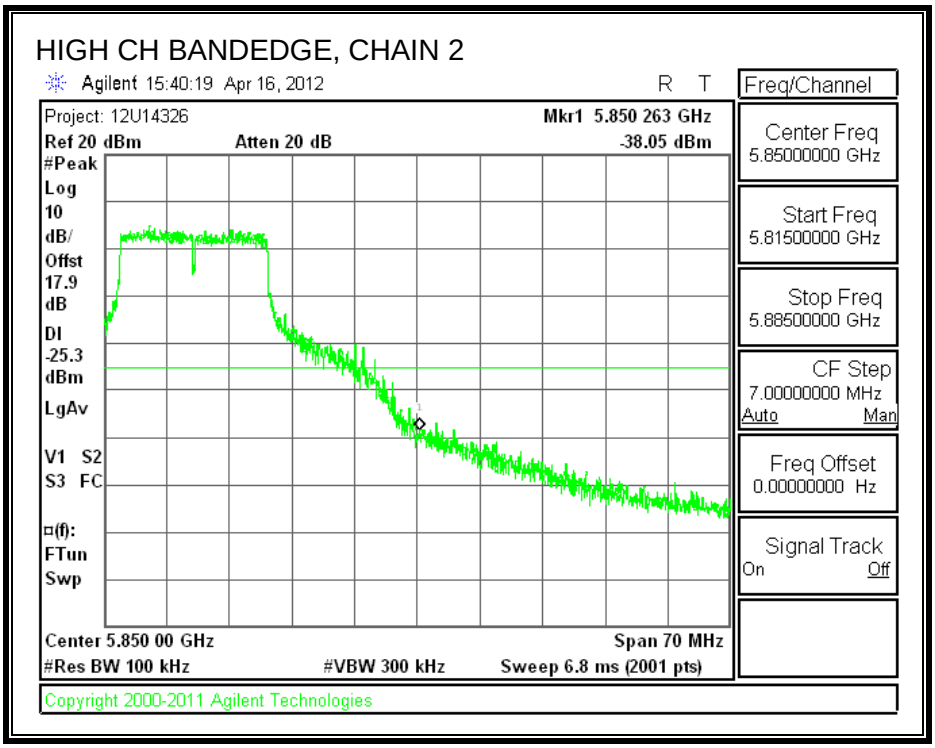


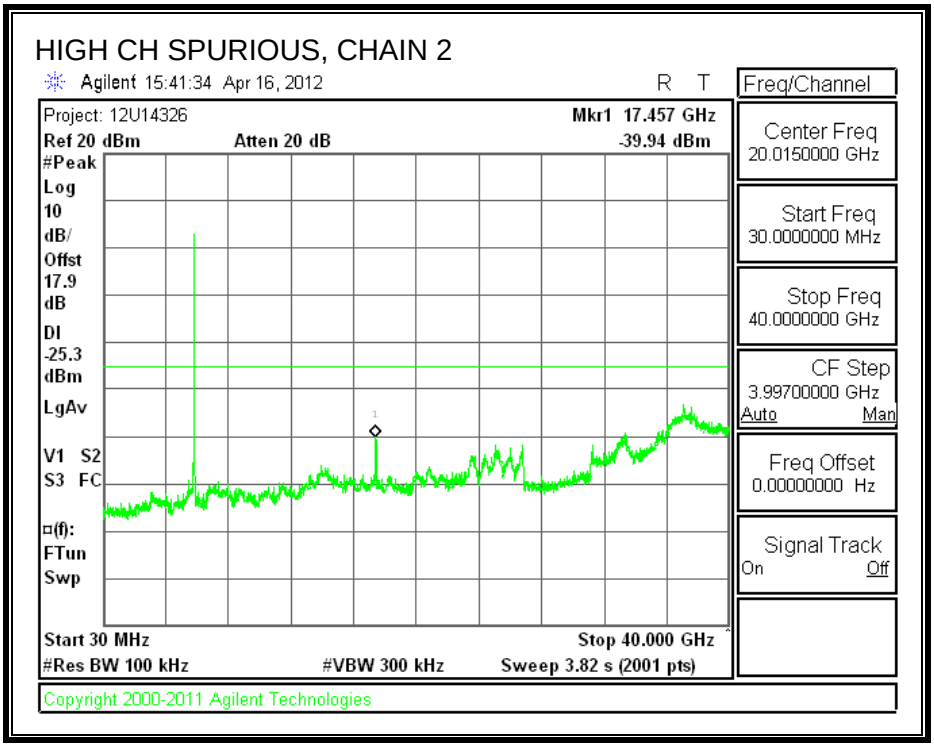
MID CH REFERENCE, CHAIN 2



MID CH SPURIOUS, CHAIN 2







7.5. 802.11n HT20 2TX 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.

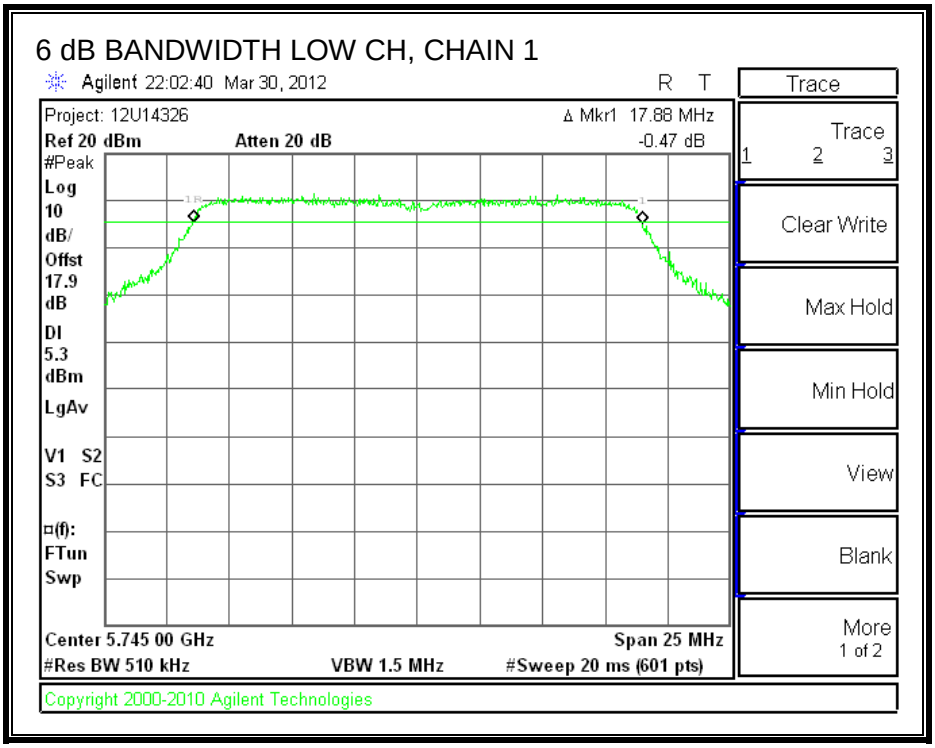
TEST PROCEDURE

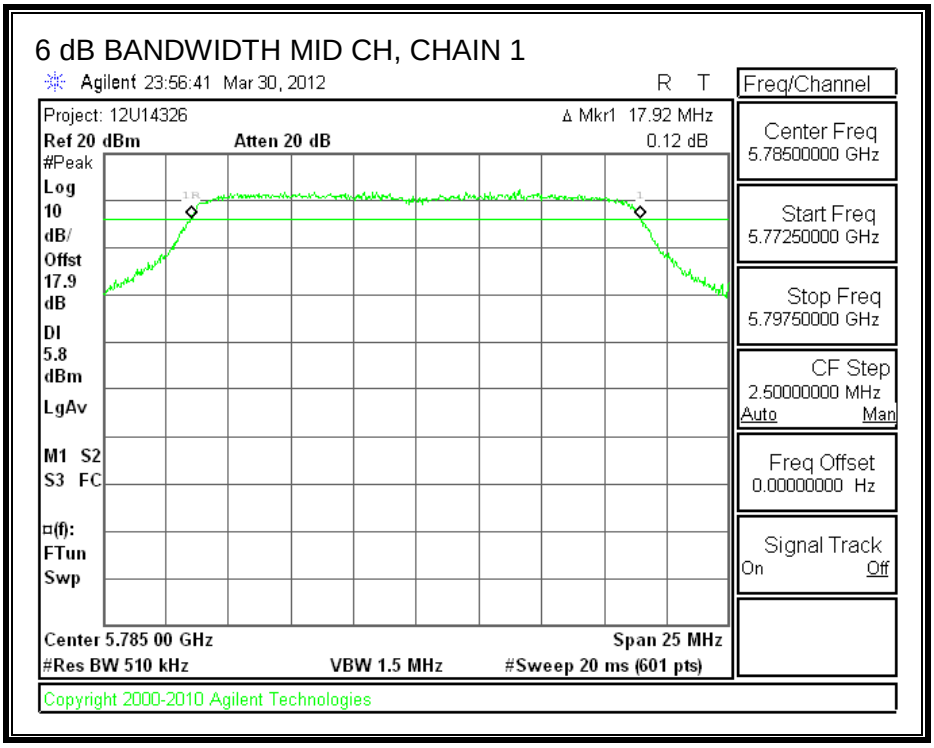
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

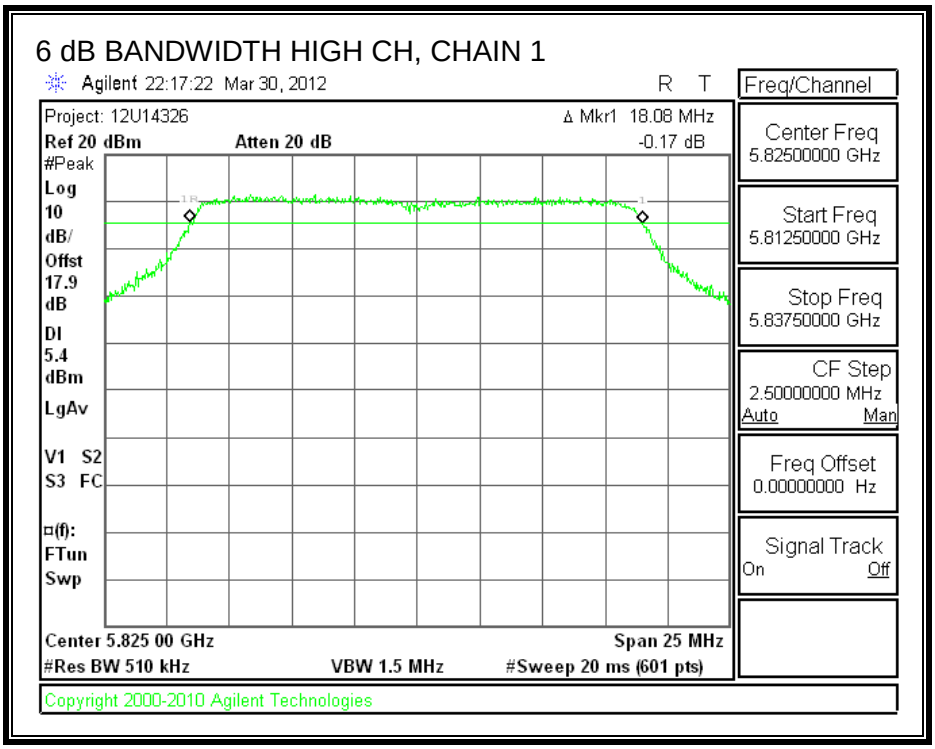
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5745	17.88	18.04	0.5
Middle	5785	17.92	18.00	0.5
High	5825	18.08	18.00	0.5

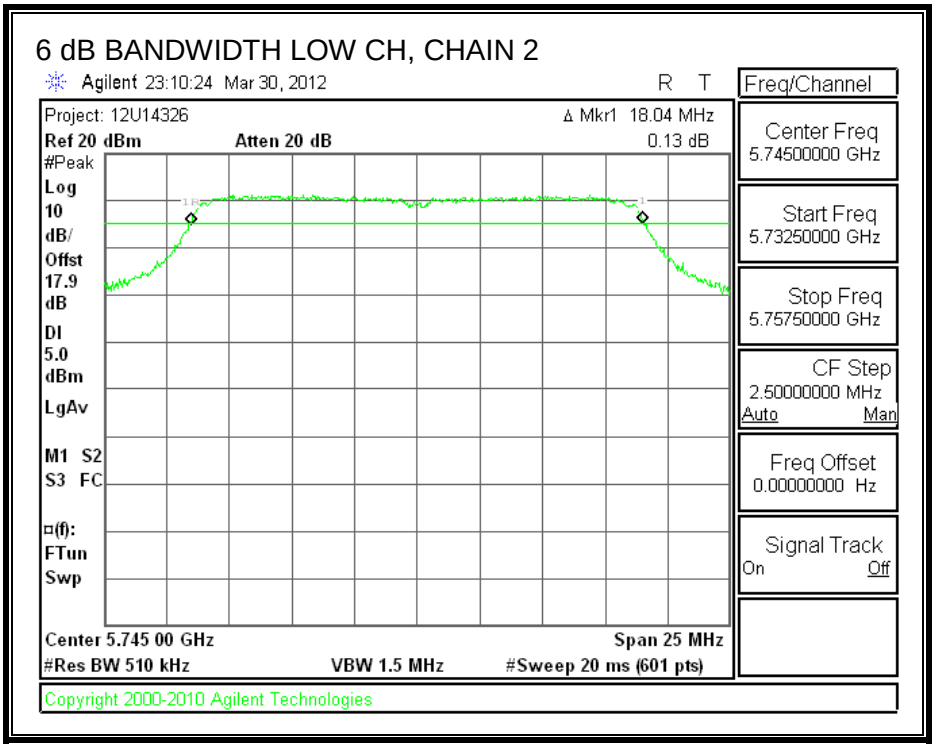
6 dB BANDWIDTH, CHAIN 1

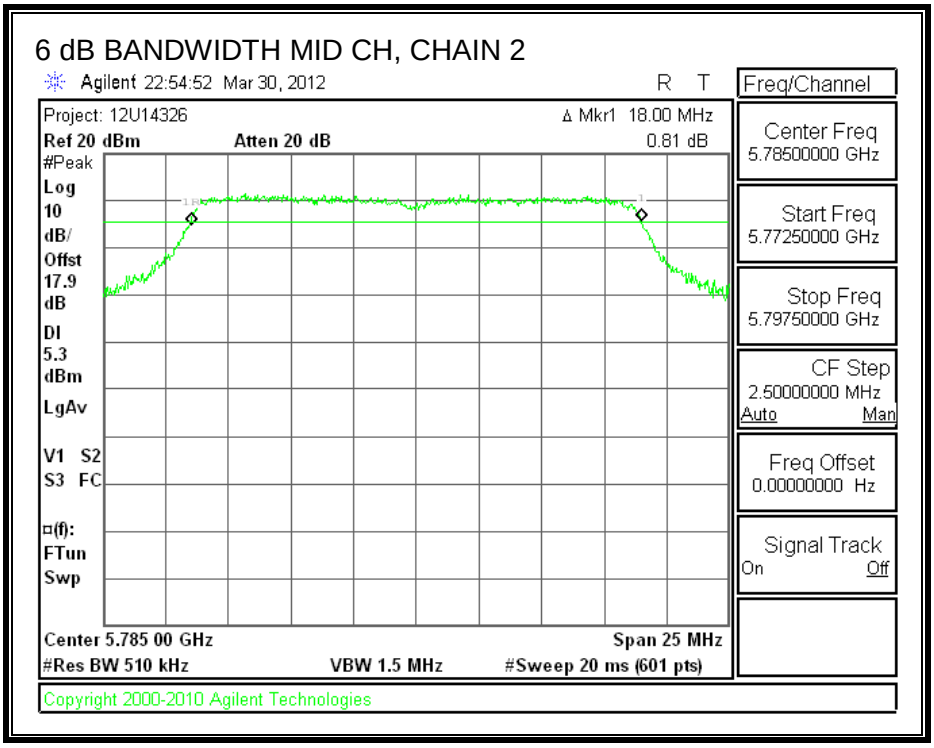


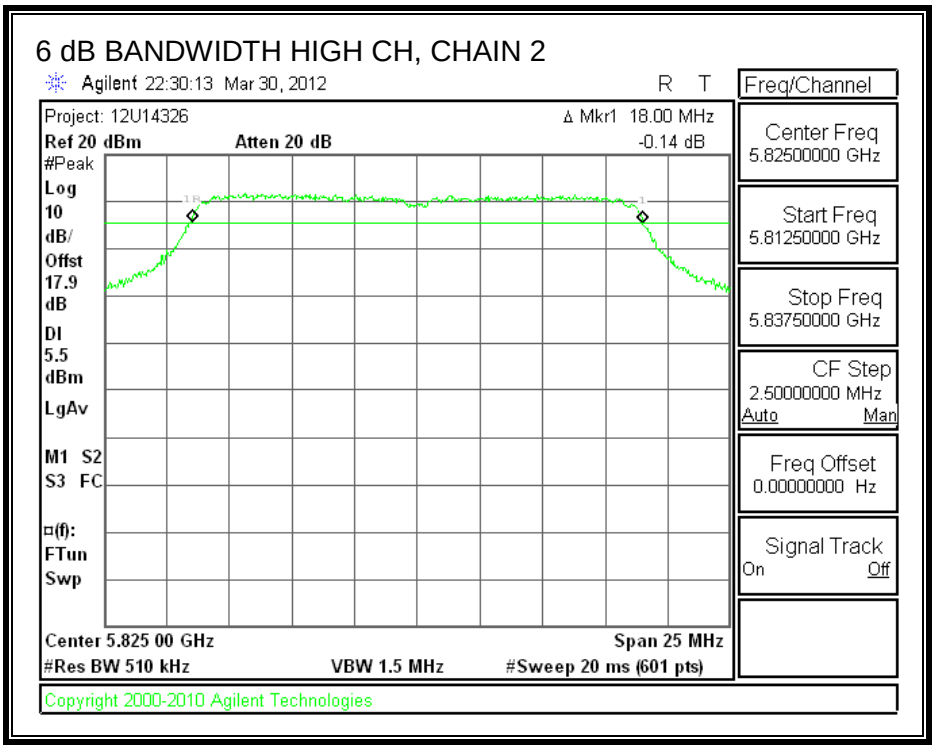




6 dB BANDWIDTH, CHAIN 2







7.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

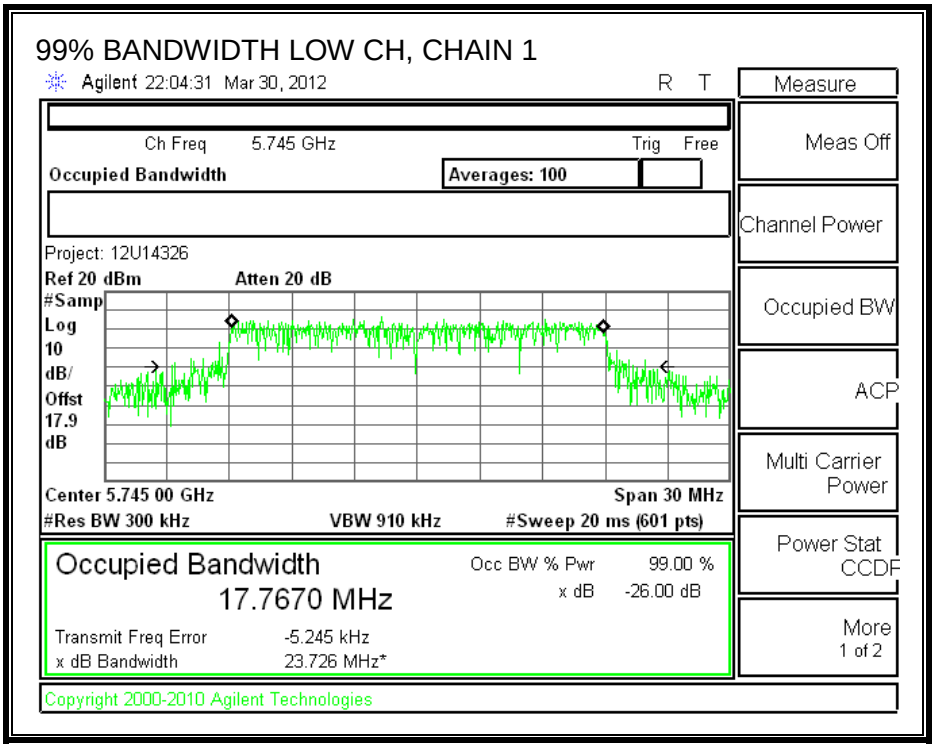
TEST PROCEDURE

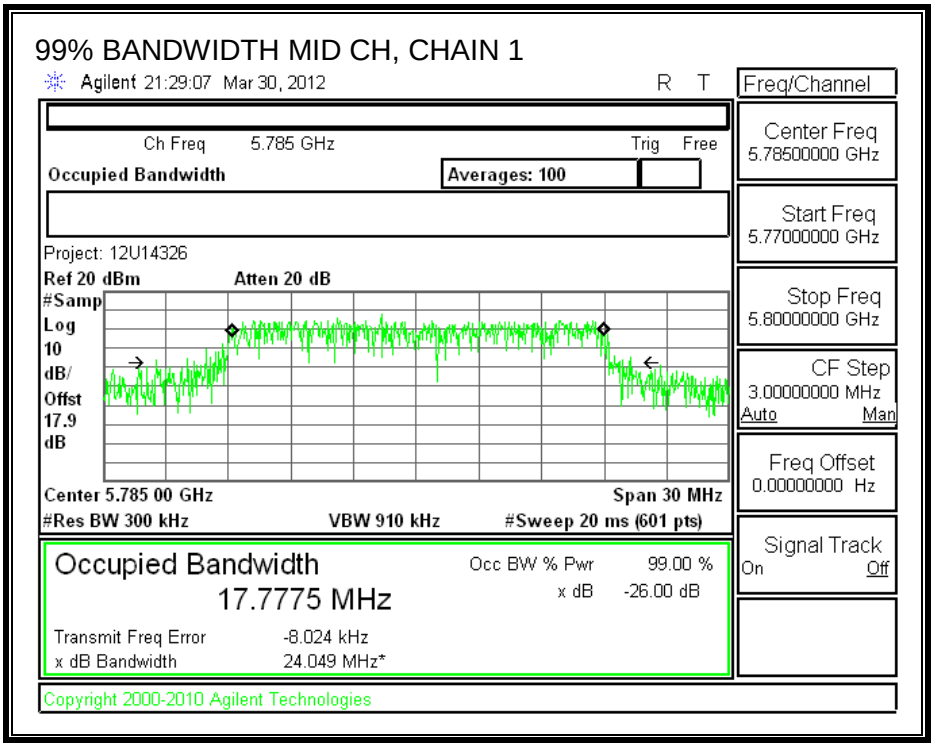
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

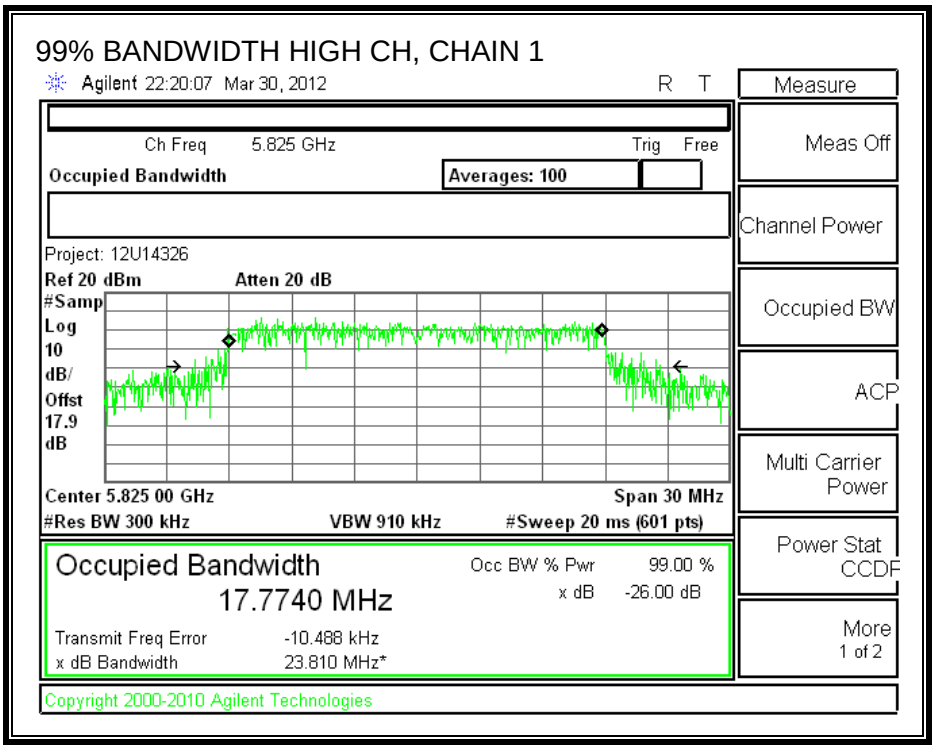
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	5745	17.7670	17.7940
Middle	5785	17.7775	17.7988
High	5825	17.7740	17.7969

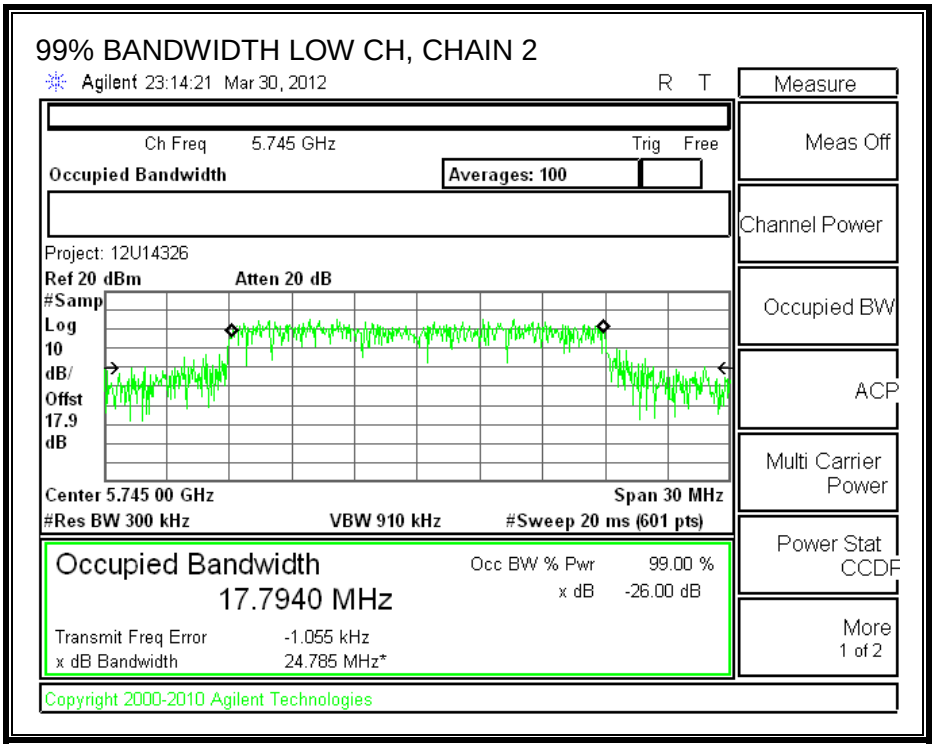
99% BANDWIDTH, CHAIN 1

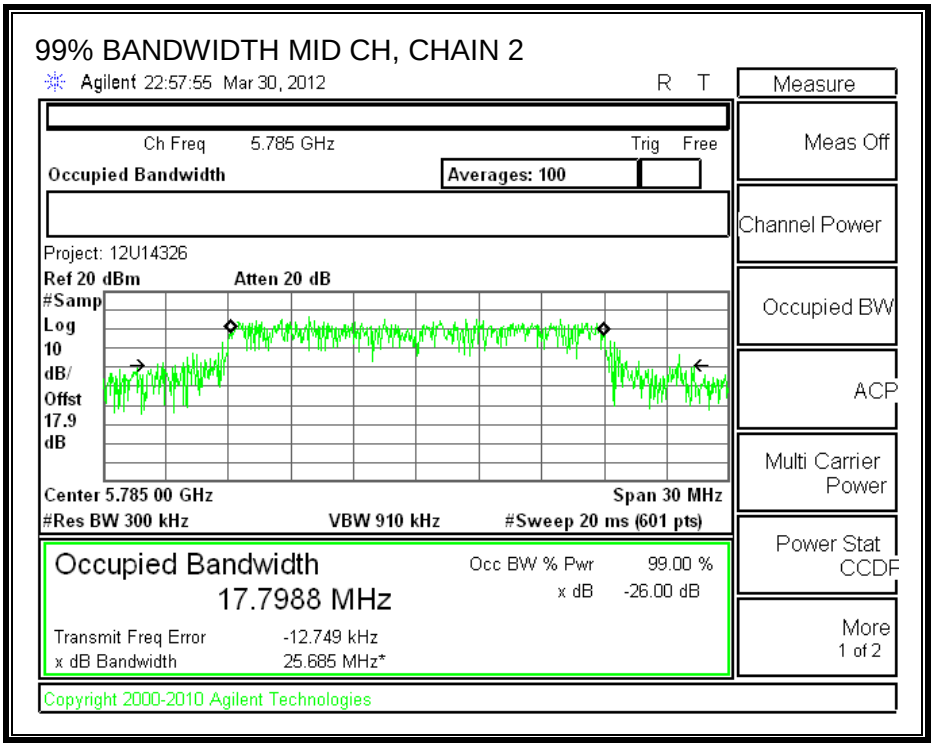


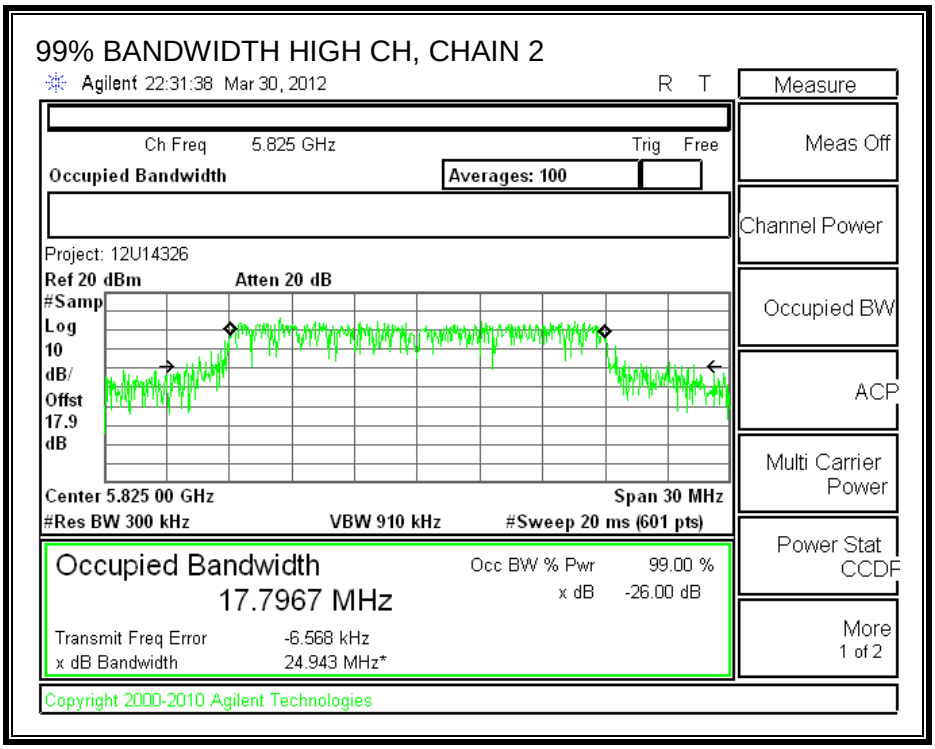




99% BANDWIDTH, CHAIN 2







7.5.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.74	3.11	2.93

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

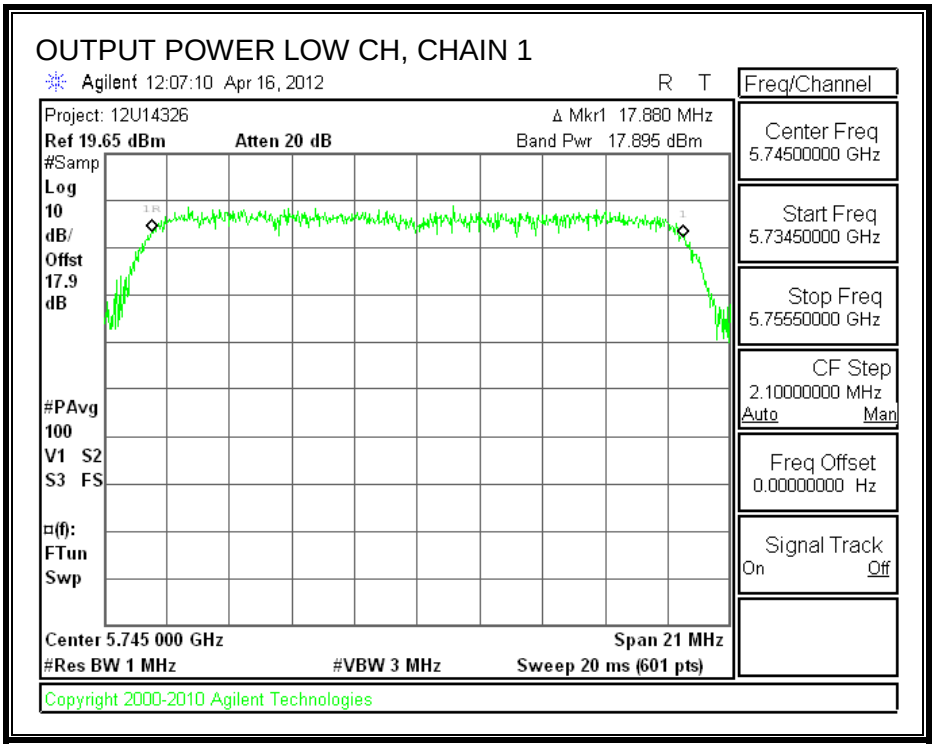
TEST PROCEDURE

KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

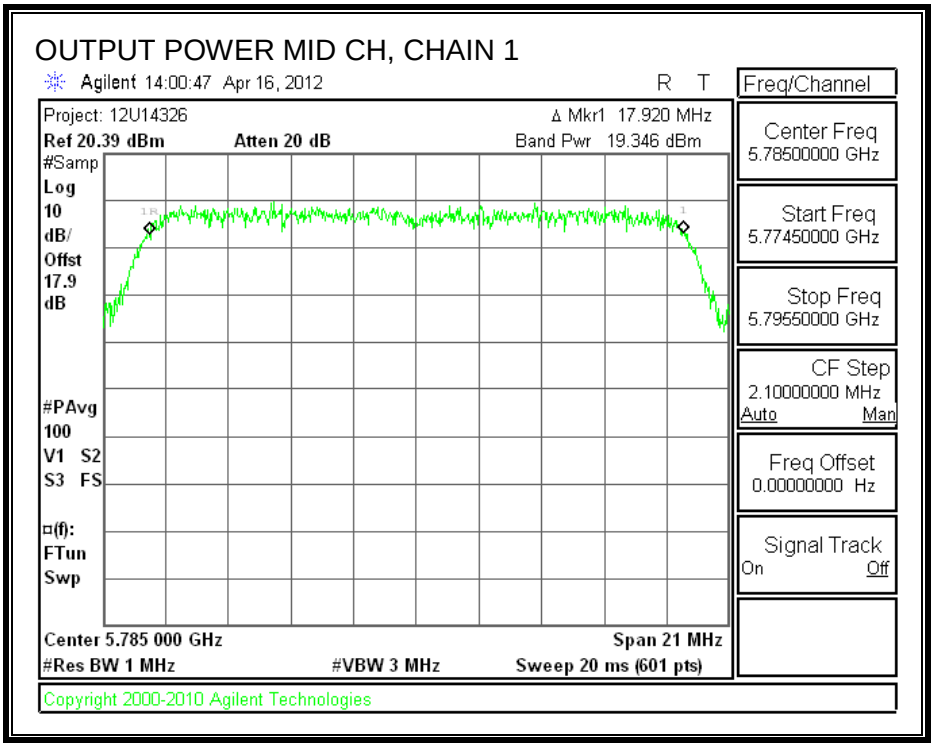
RESULTS

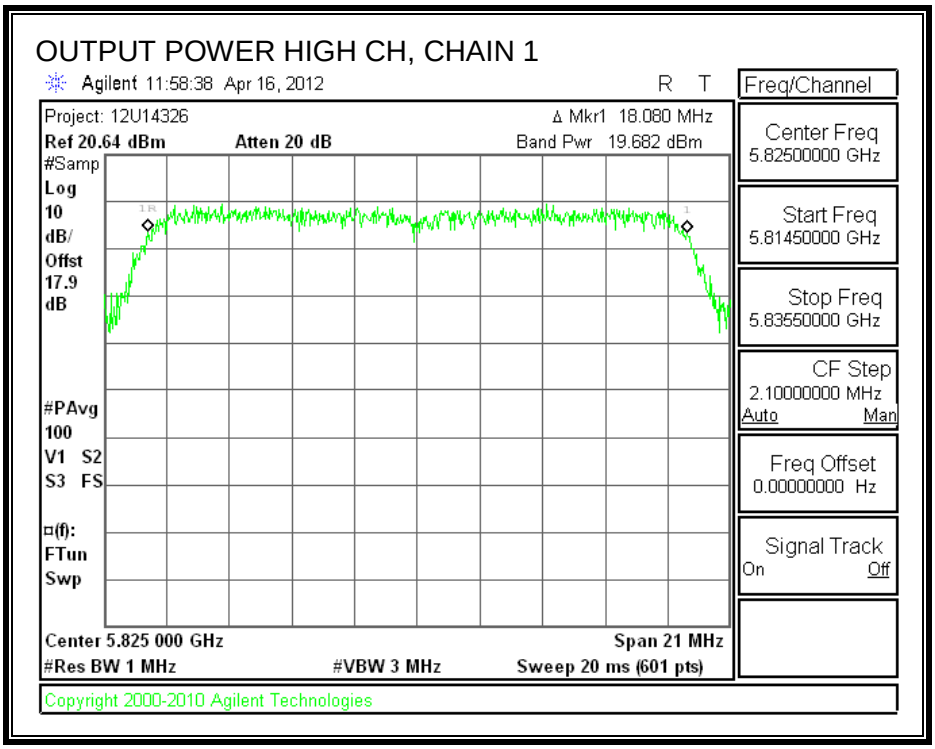
Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	17.895	17.929	0.00	20.922	30.00	-9.078
Mid	5785	19.346	18.922	0.00	22.149	30.00	-7.851
High	5825	19.682	18.965	0.00	22.349	30.00	-7.651

CHAIN 1 OUTPUT POWER

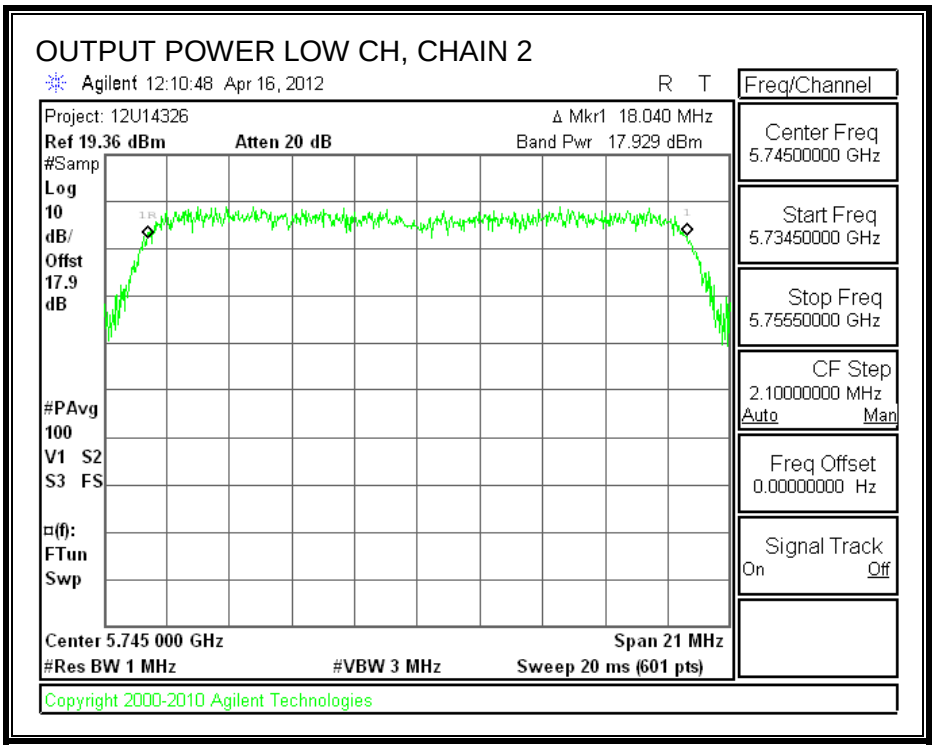


OUTPUT POWER MID CH, CHAIN 1

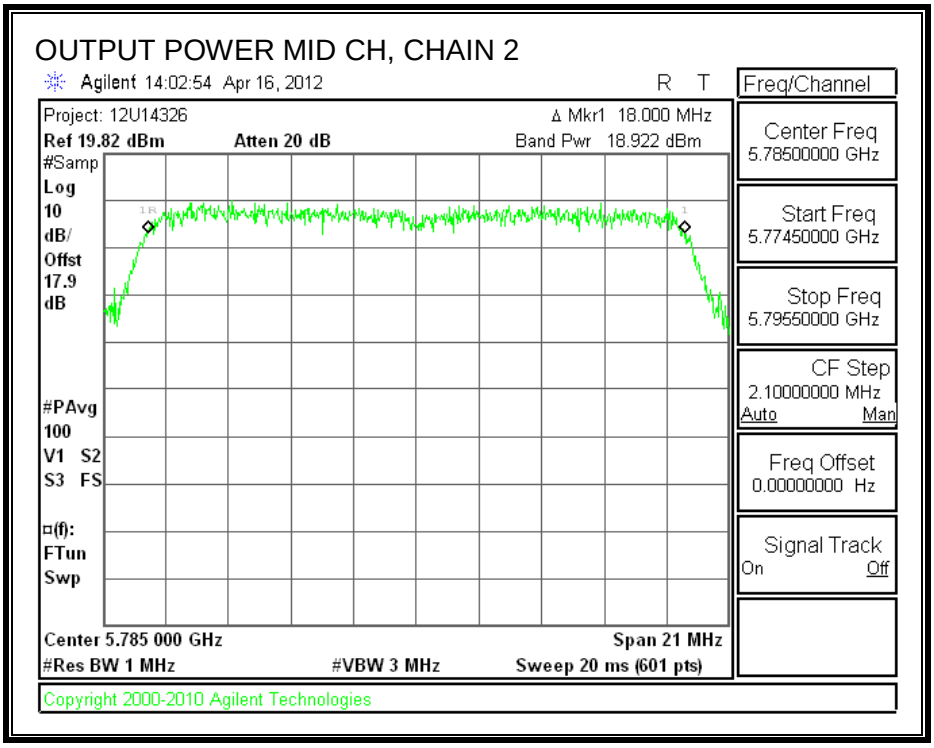


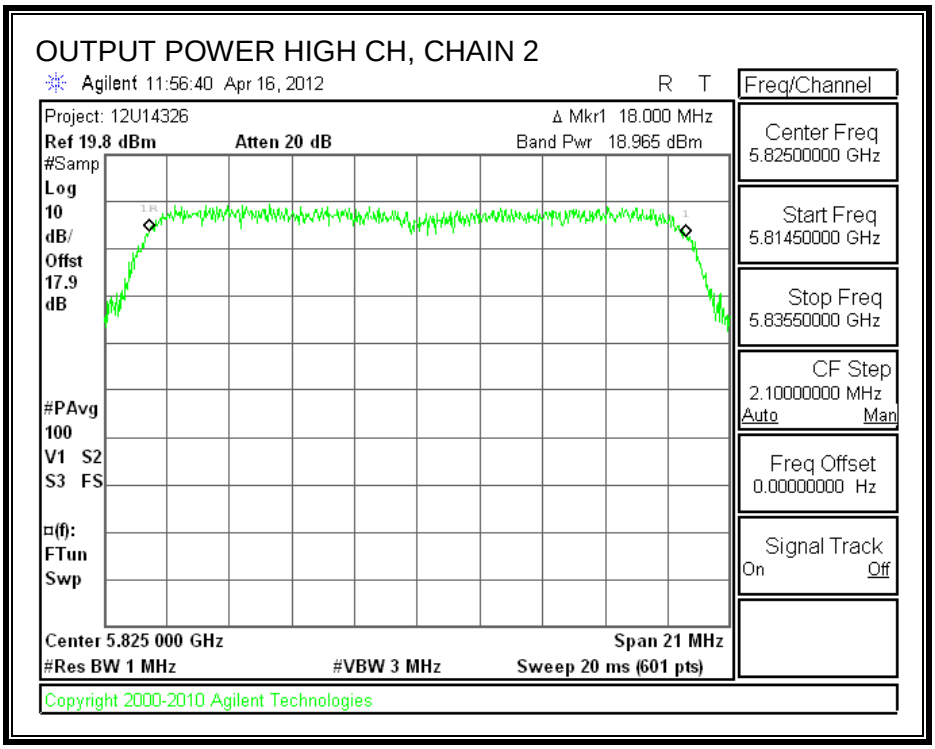


CHAIN 2 OUTPUT POWER



OUTPUT POWER MID CH, CHAIN 2





7.5.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	5745	17.40	16.70	20.07
Middle	5785	18.50	17.70	21.13
High	5825	18.60	18.30	21.46

7.5.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

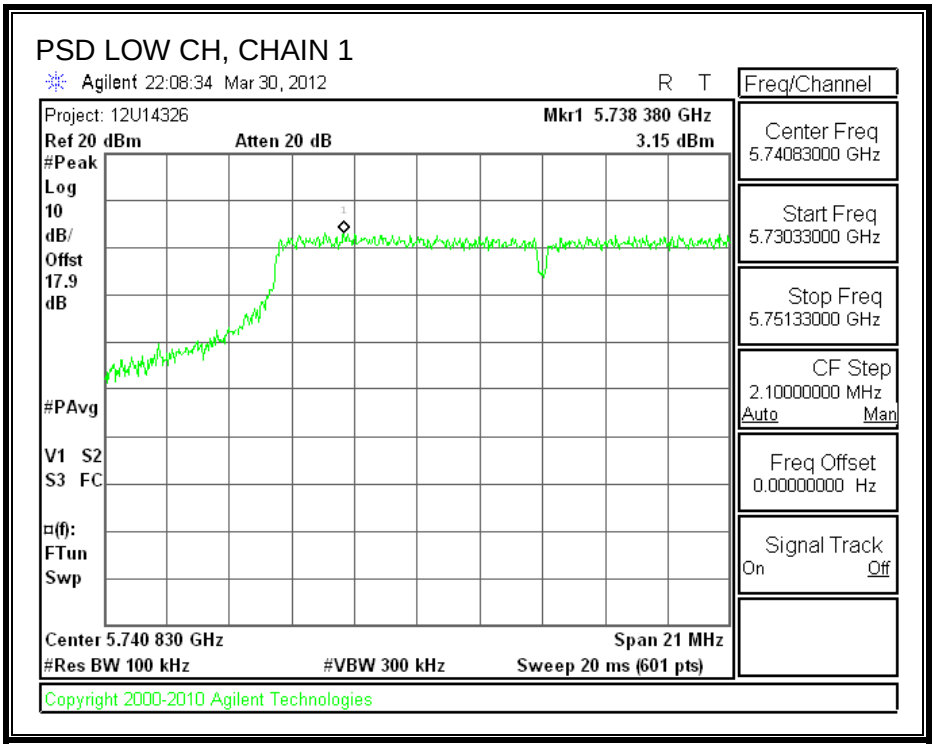
TEST PROCEDURE

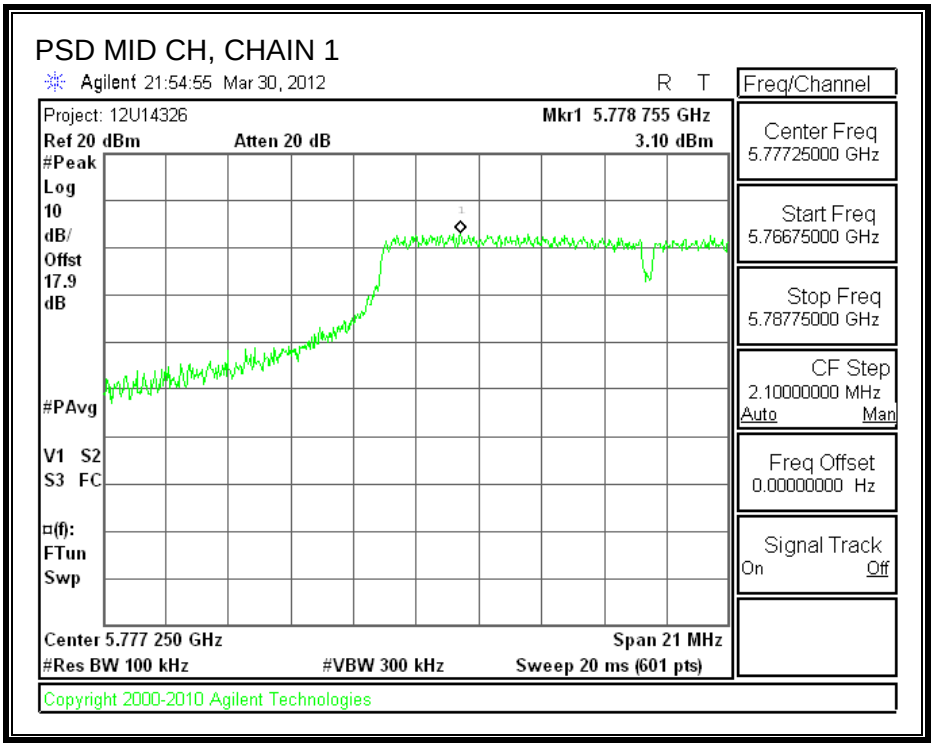
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

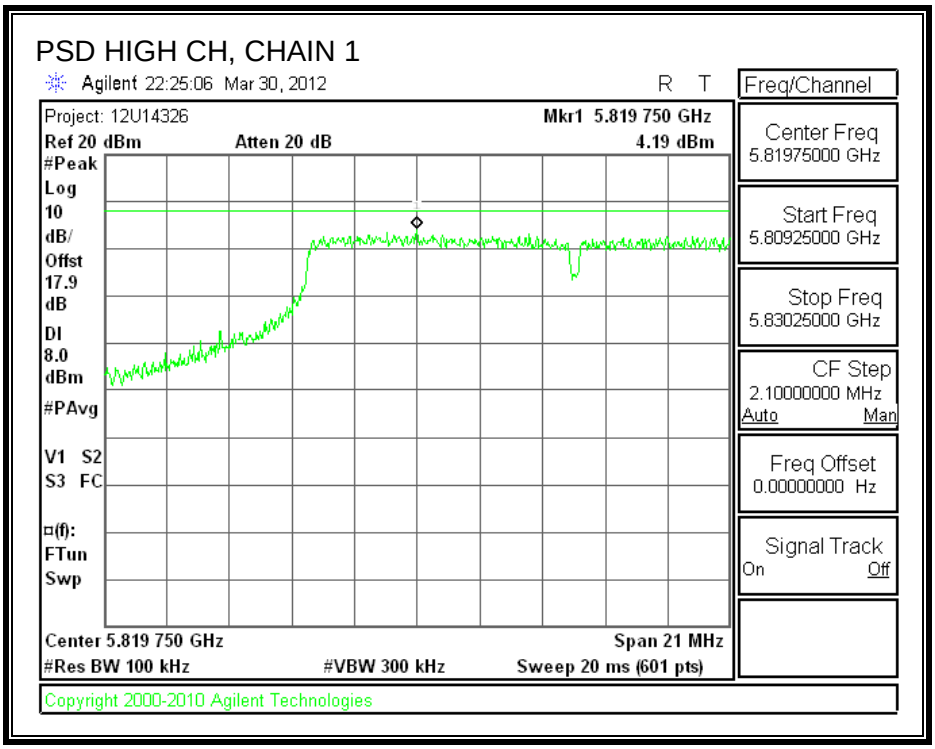
RESULTS:

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	10log(3kHz/ 100kHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	3.15	2.79	-15.20	-9.22	8	-17.22
Middle	5785	3.10	2.80	-15.20	-9.24	8	-17.24
High	5825	4.19	2.95	-15.20	-8.58	8	-16.58

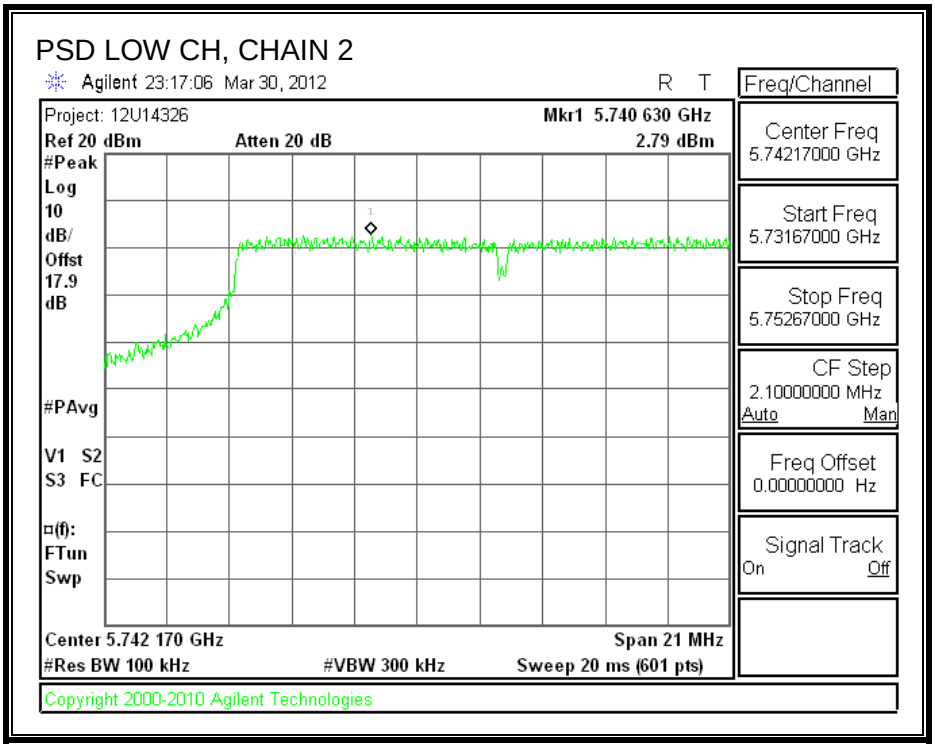
POWER SPECTRAL DENSITY, CHAIN 1

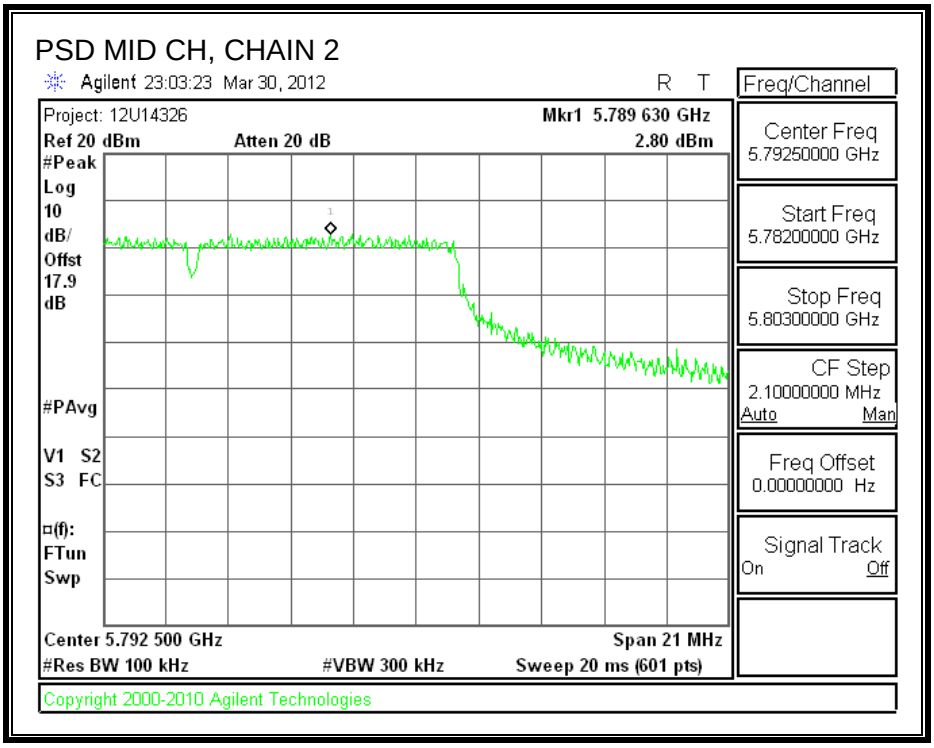




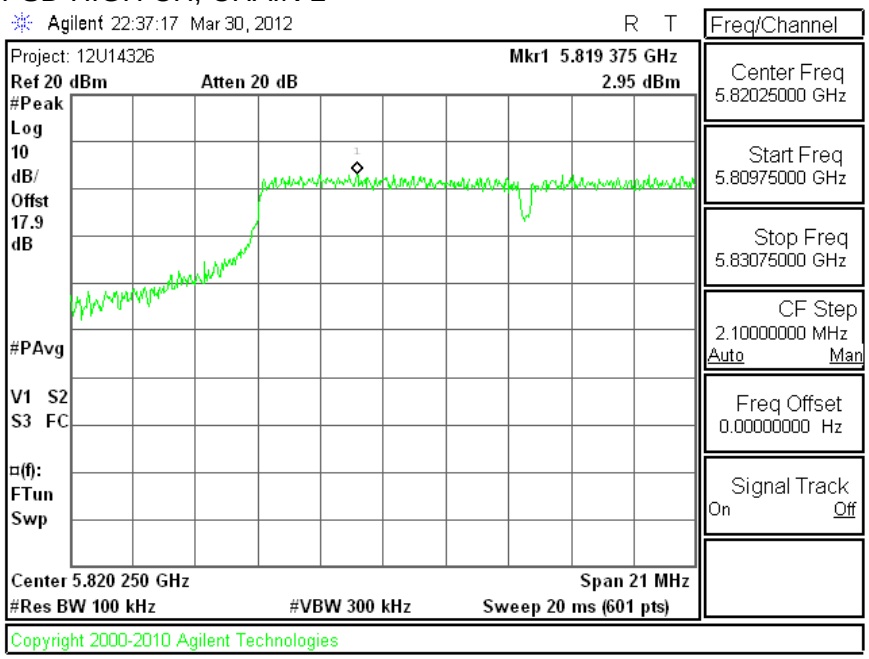


POWER SPECTRAL DENSITY, CHAIN 2





PSD HIGH CH, CHAIN 2



7.5.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

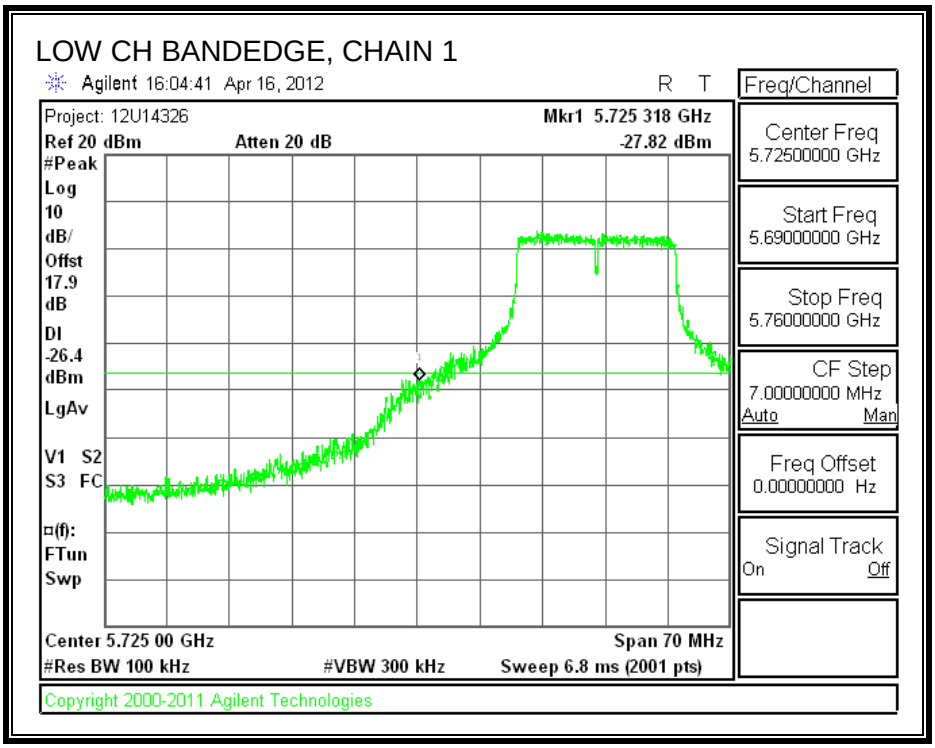
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

TEST PROCEDURE

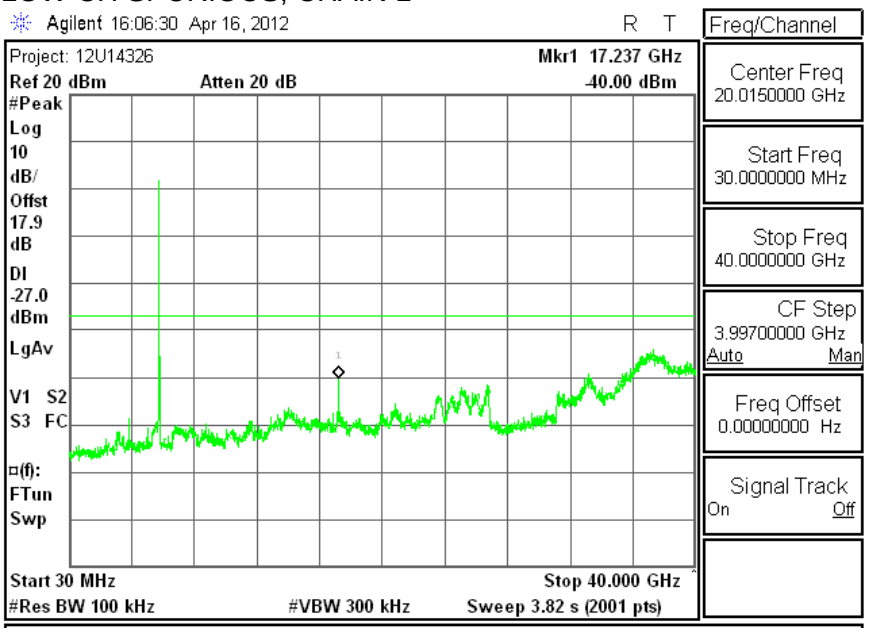
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

RESULTS

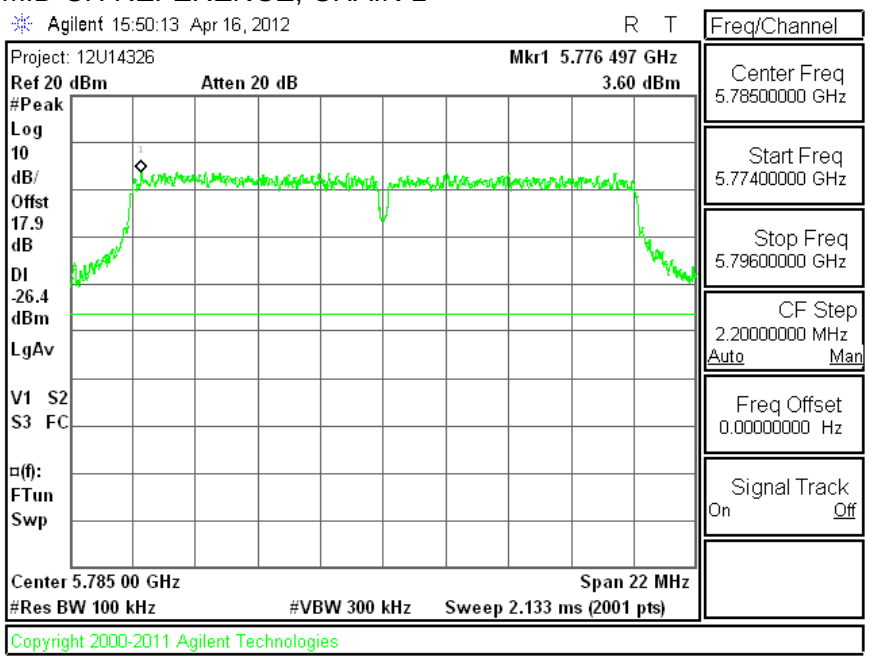
CHAIN 1 SPURIOUS EMISSIONS

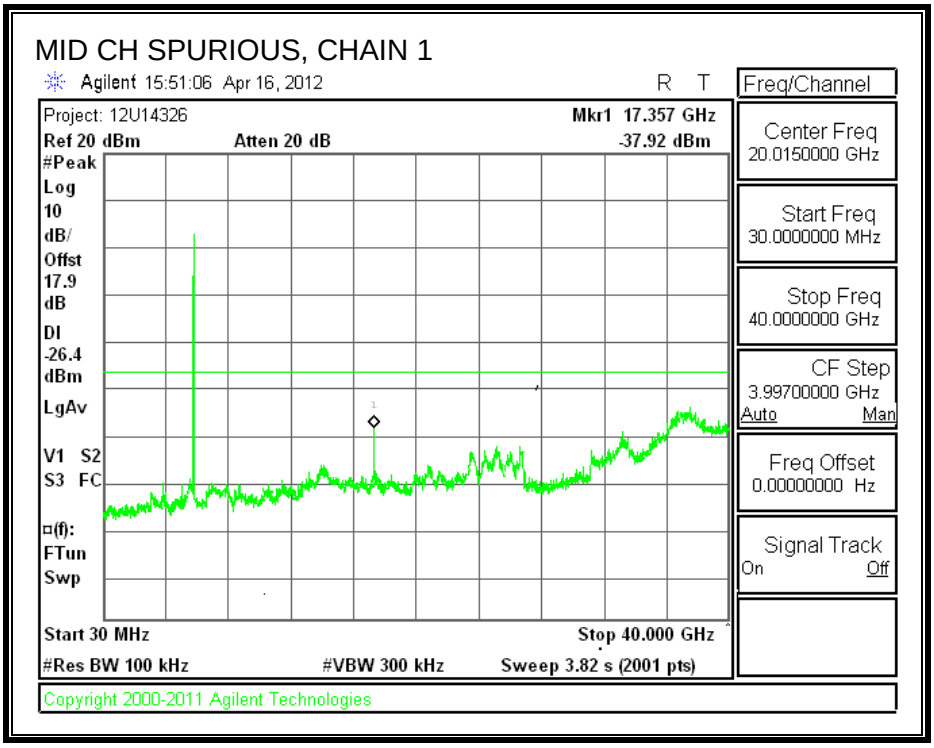


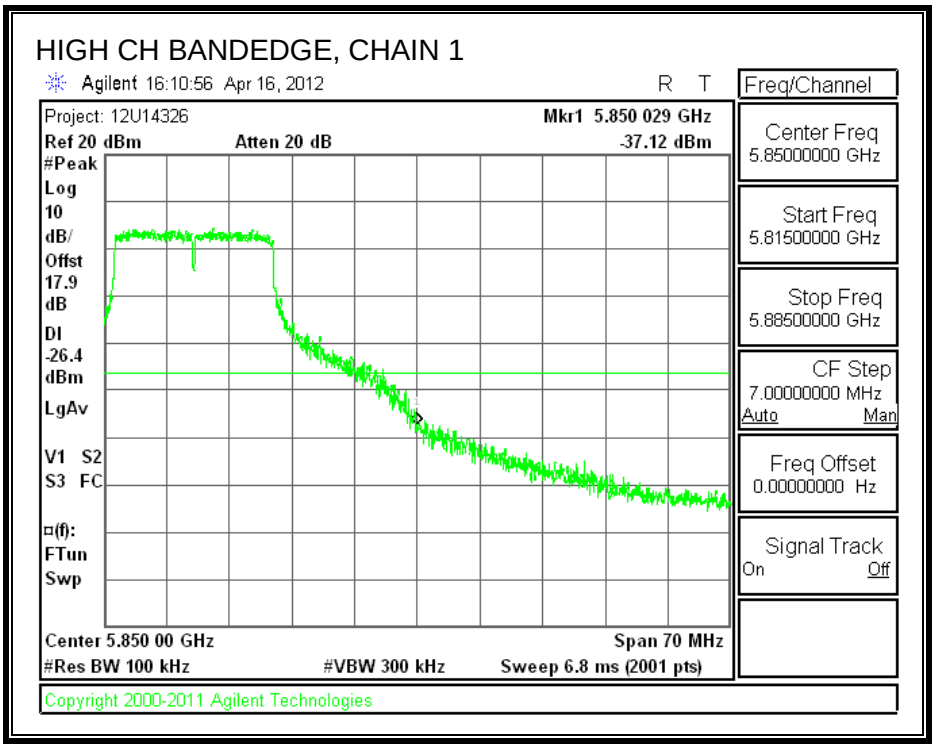
LOW CH SPURIOUS, CHAIN 1

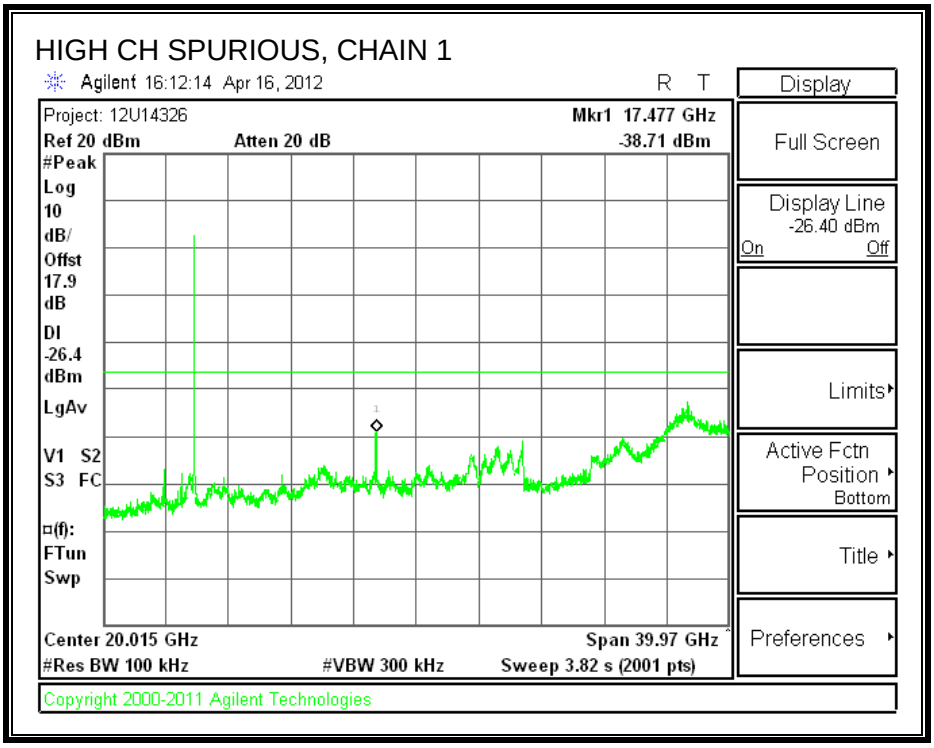


MID CH REFERENCE, CHAIN 1

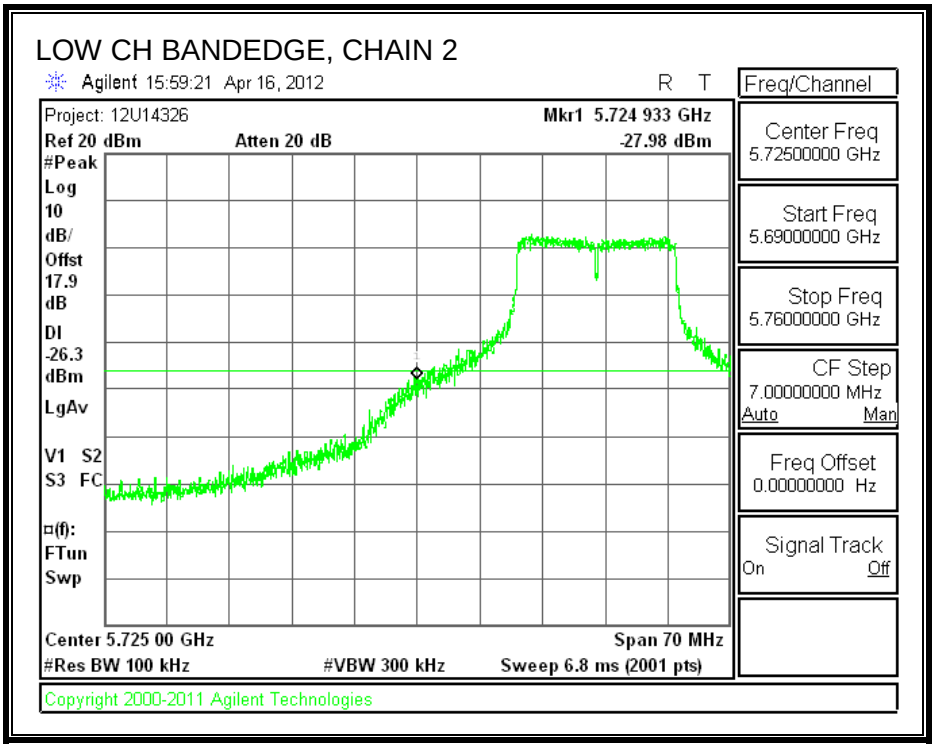


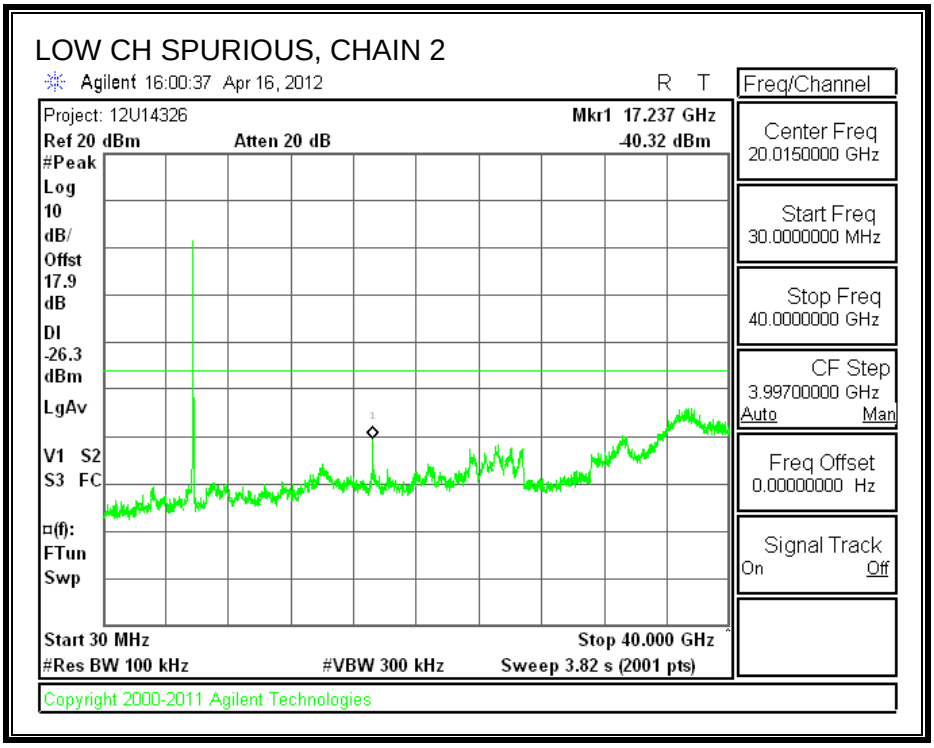




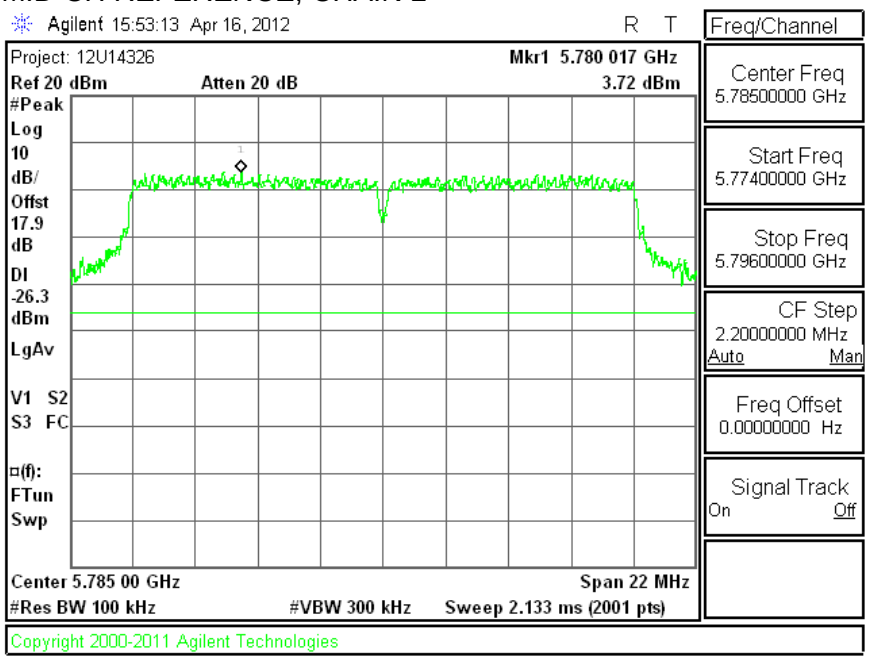


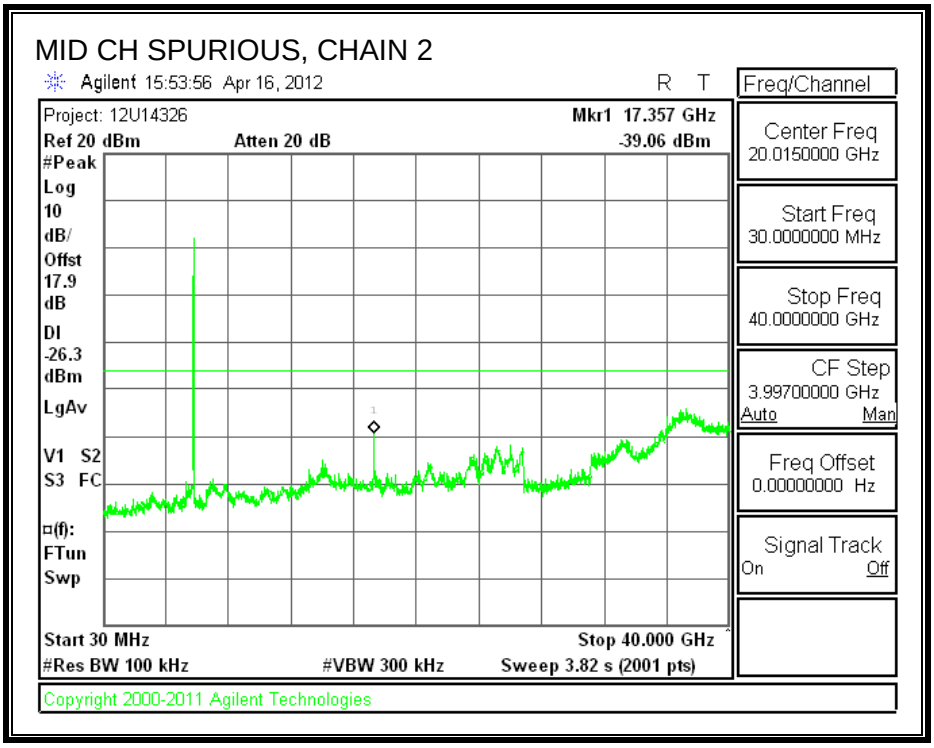
CHAIN 2 SPURIOUS EMISSIONS

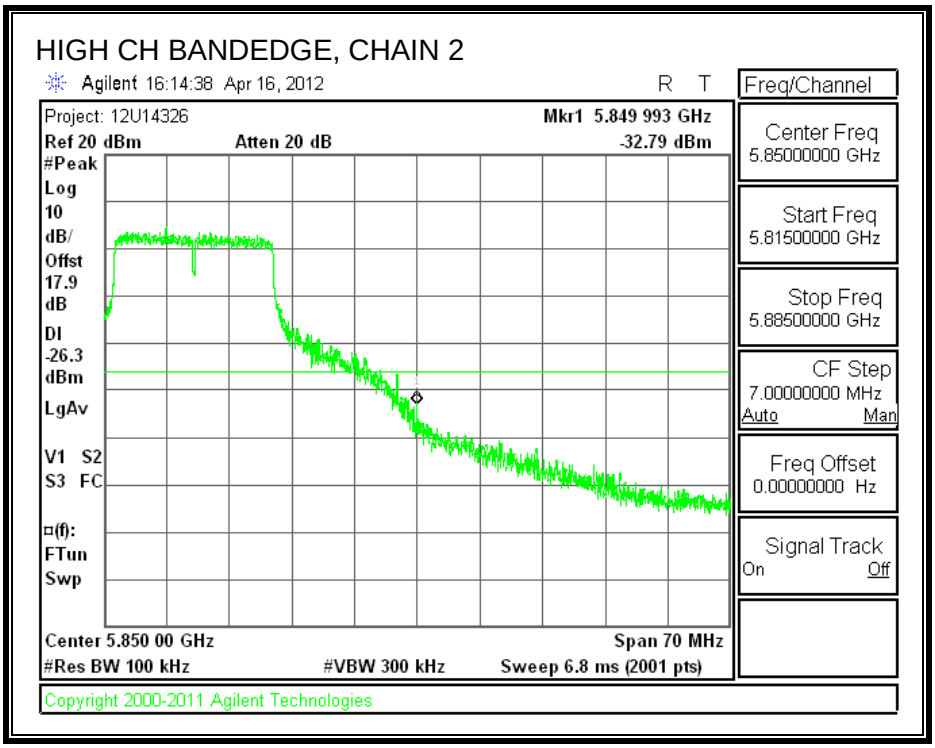


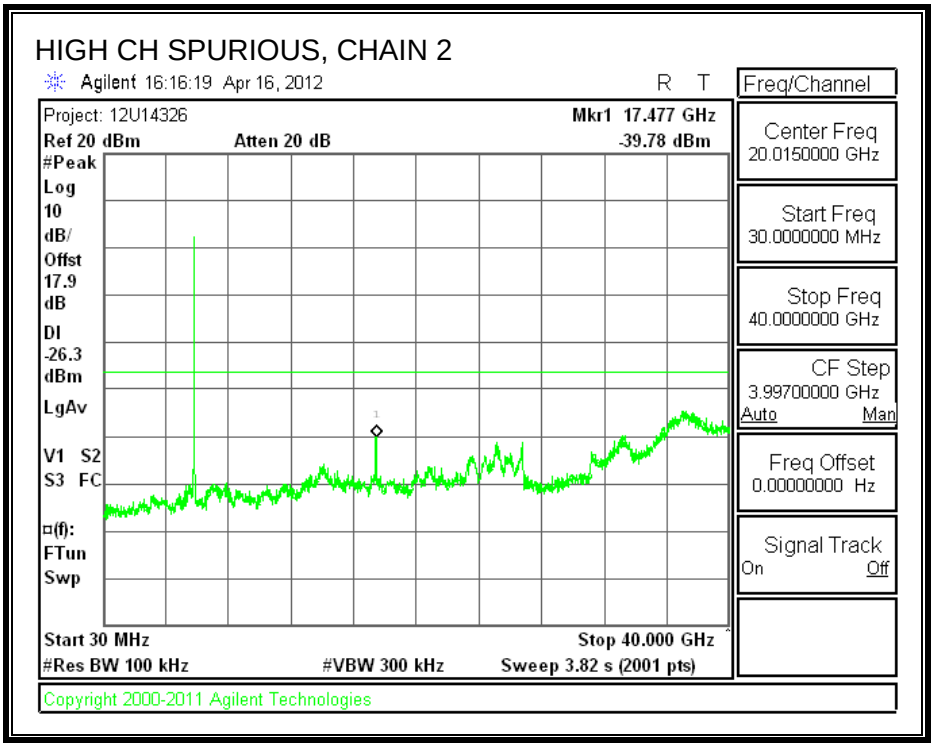


MID CH REFERENCE, CHAIN 2









7.6. 802.11n HT40 2TX MODE IN THE 5.8 GHz BAND

7.6.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

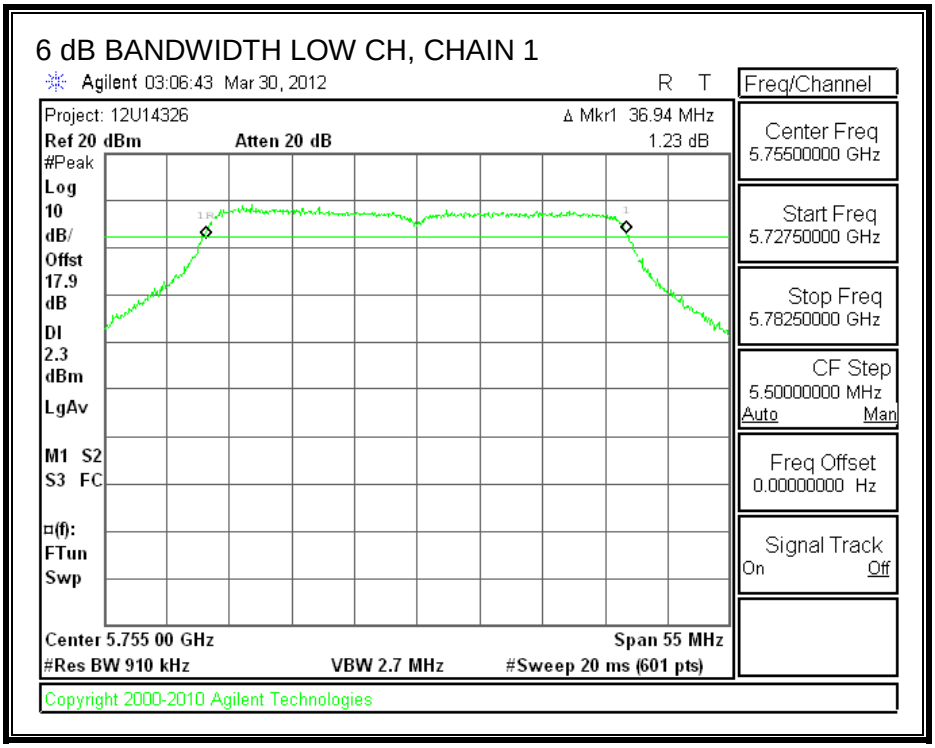
TEST PROCEDURE

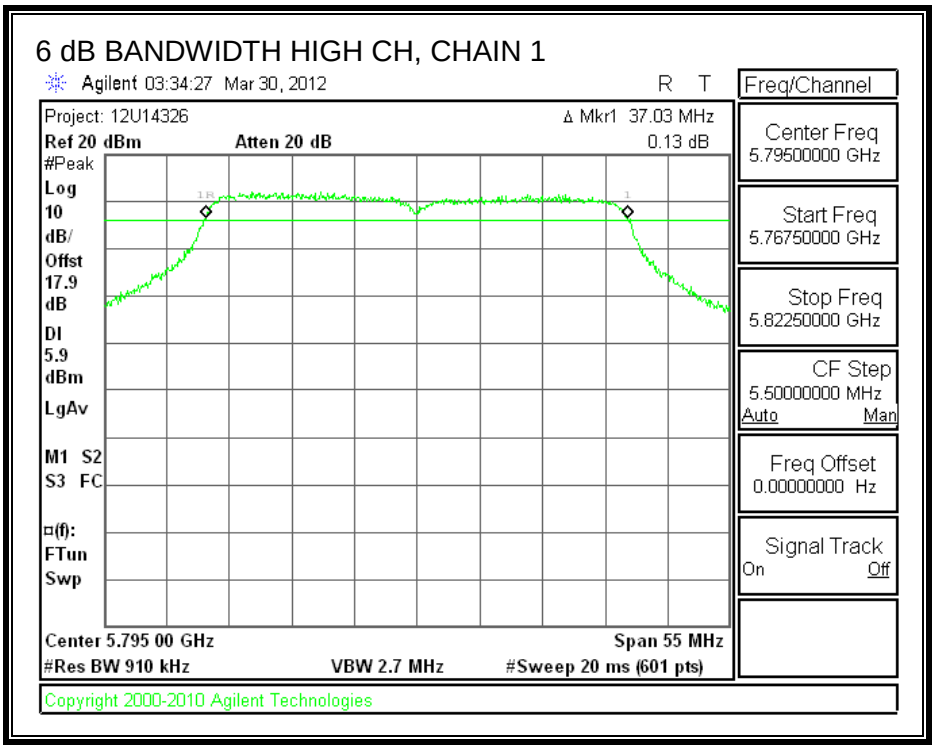
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

RESULTS

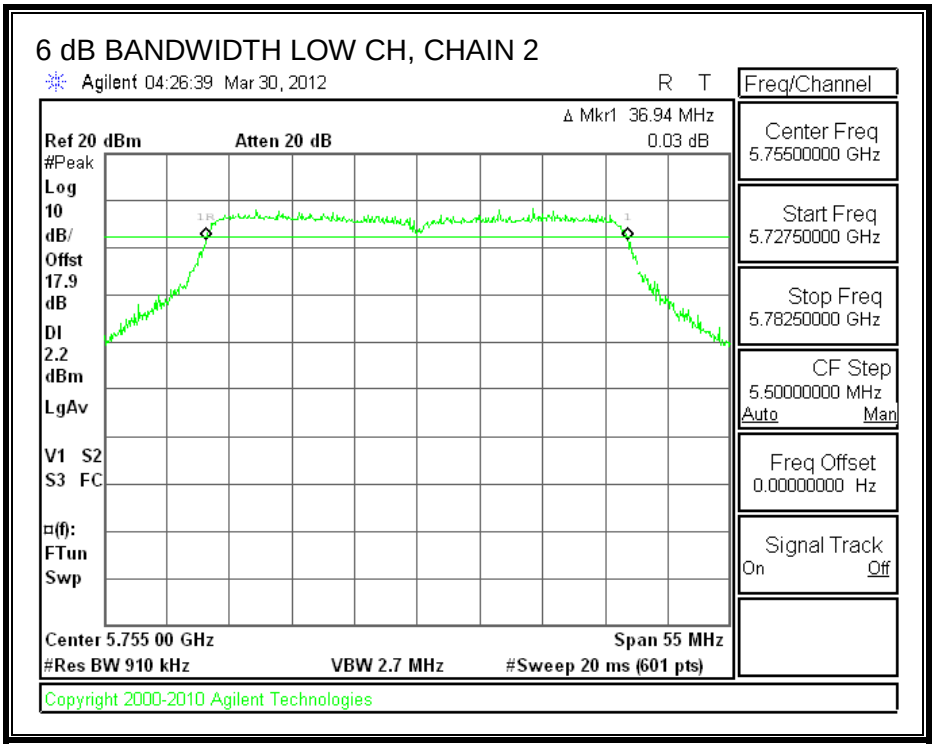
Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5755	36.94	36.94	0.5
High	5795	37.03	36.94	0.5

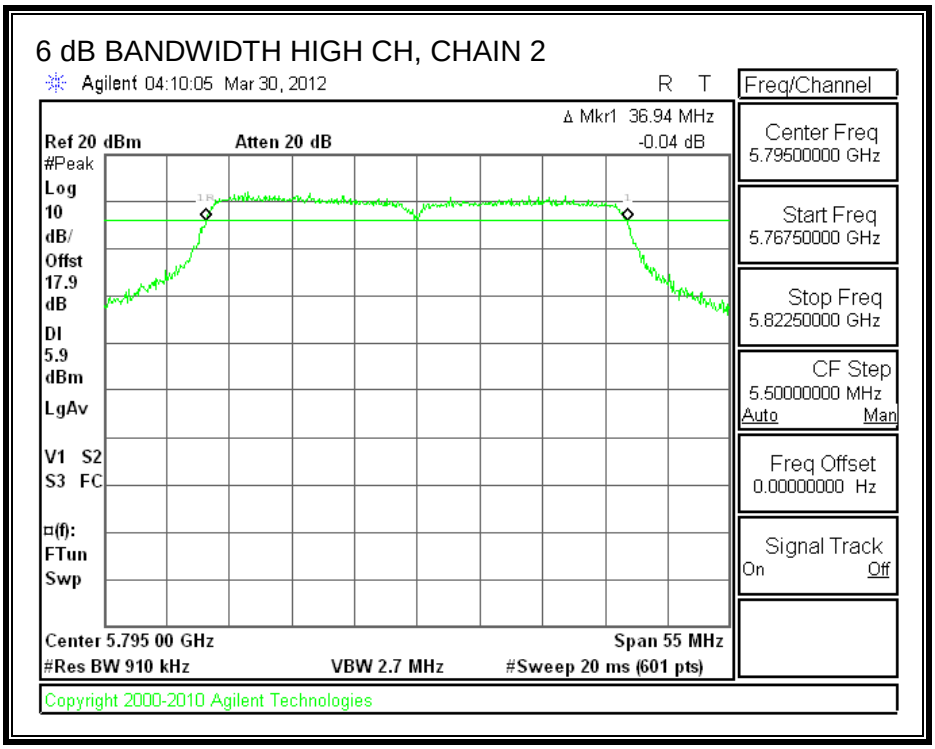
6 dB BANDWIDTH, CHAIN 1





6 dB BANDWIDTH, CHAIN 2





7.6.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

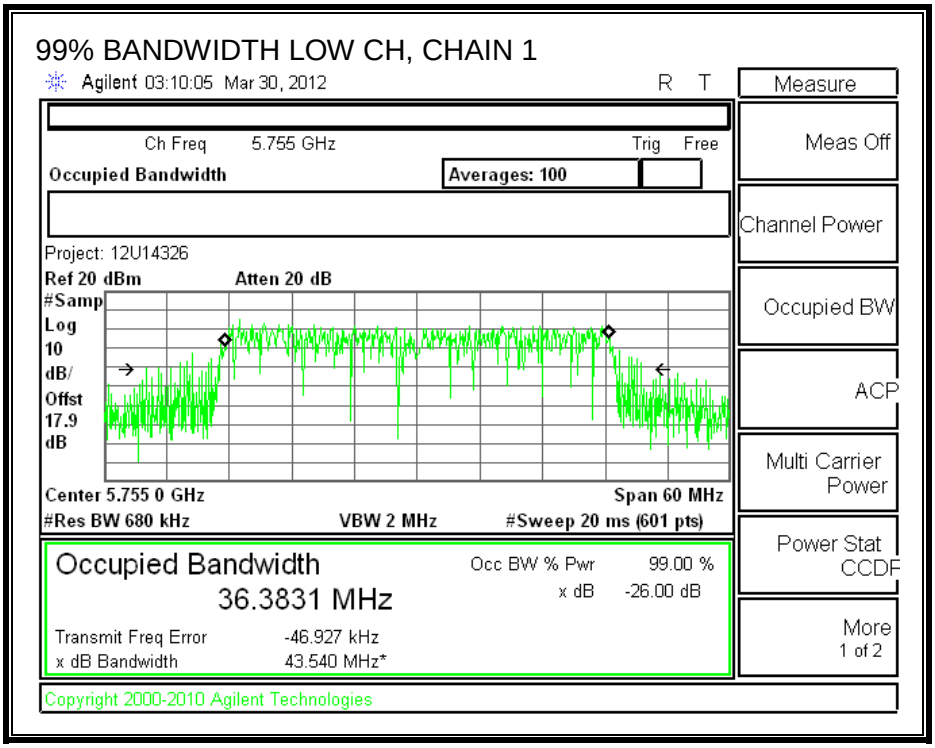
TEST PROCEDURE

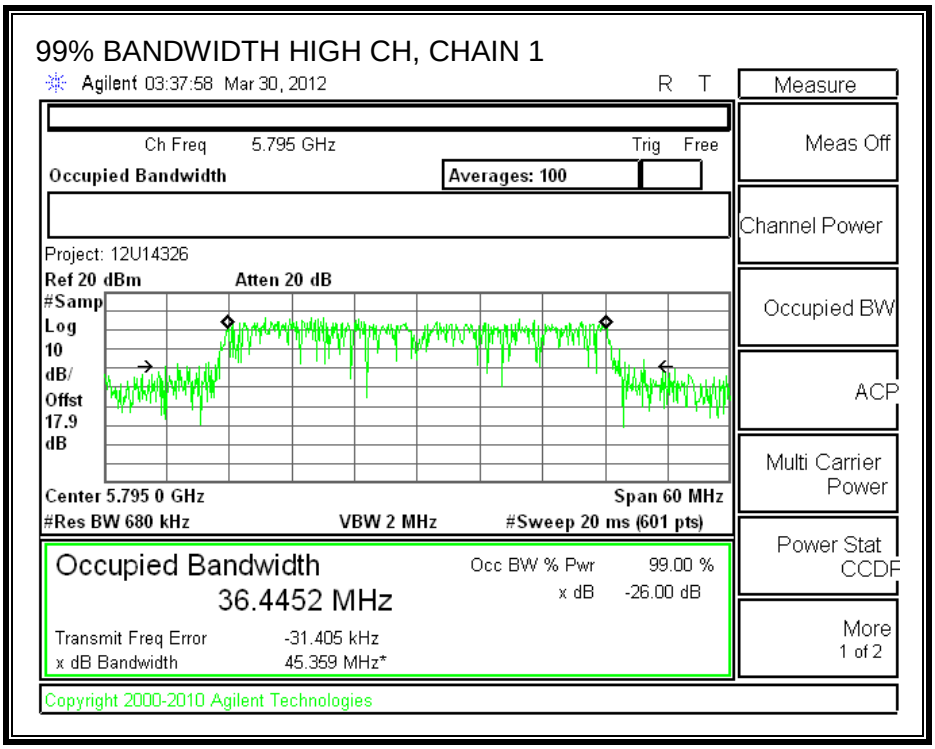
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

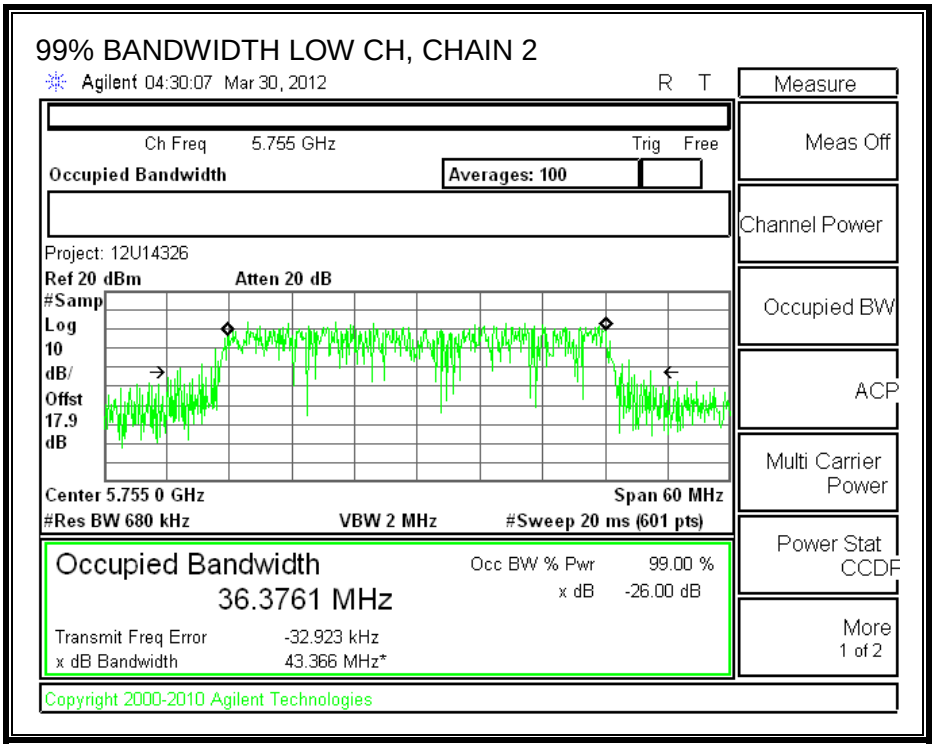
Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	5755	36.3831	36.3761
High	5795	36.4452	36.4944

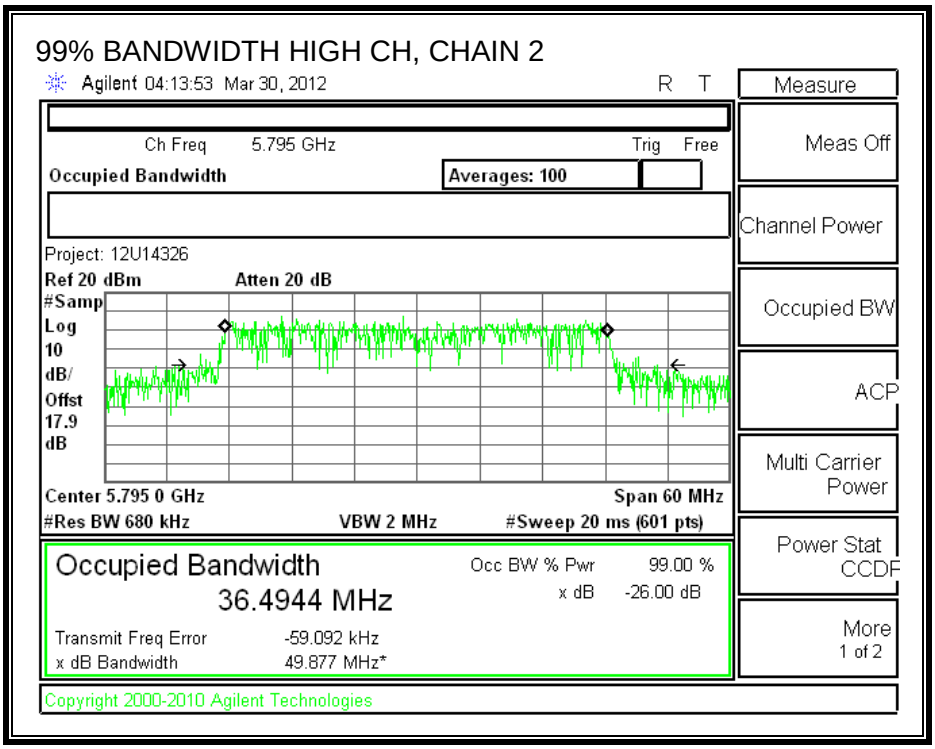
99% BANDWIDTH, CHAIN 1





99% BANDWIDTH, CHAIN 2





7.6.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

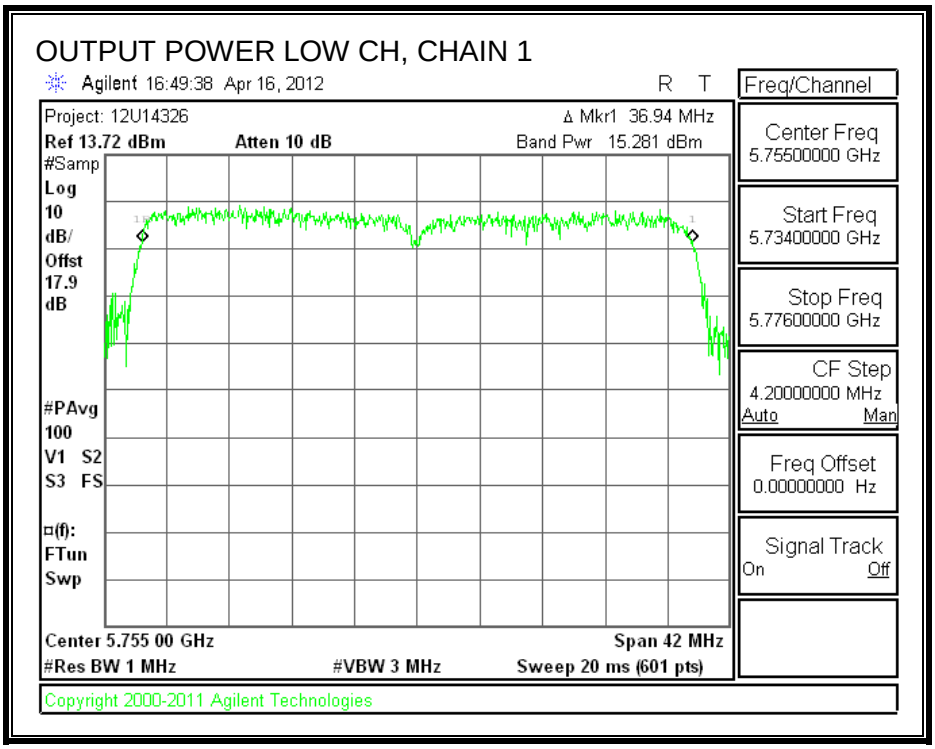
TEST PROCEDURE

KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

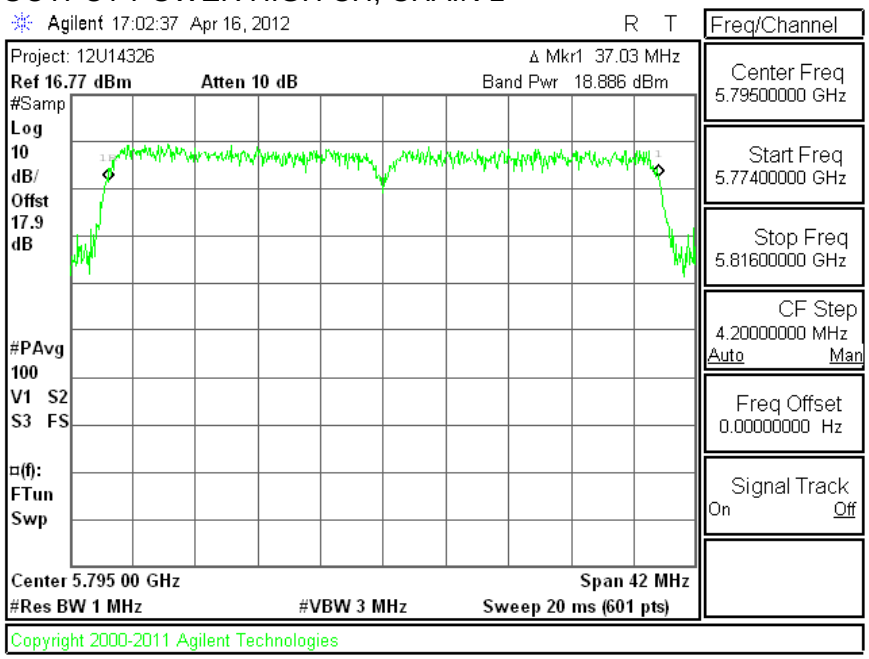
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5755	15.281	15.378	0.00	18.340	30.00	-11.660
High	5795	18.886	18.645	0.00	21.777	30.00	-8.223

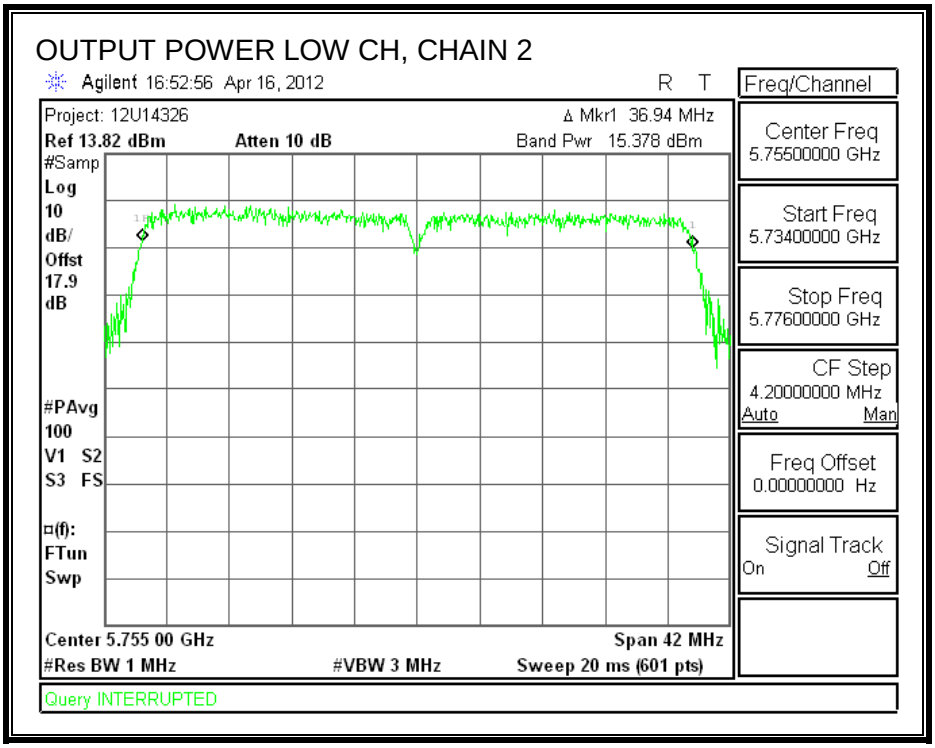
CHAIN 1 OUTPUT POWER



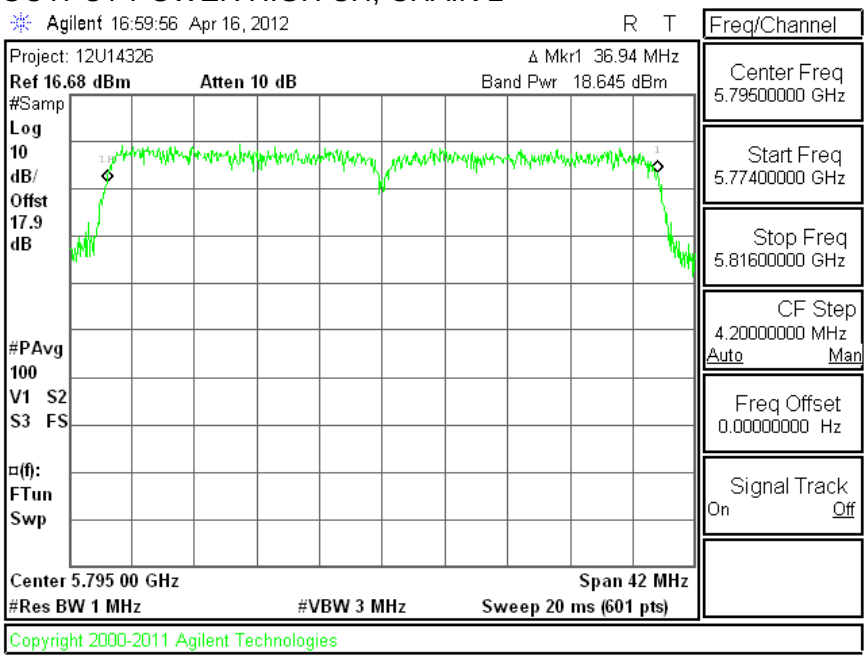
OUTPUT POWER HIGH CH, CHAIN 1



CHAIN 2 OUTPUT POWER



OUTPUT POWER HIGH CH, CHAIN 2



7.6.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	5755	15.00	15.00	18.01
High	5795	18.60	18.50	21.56

7.6.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

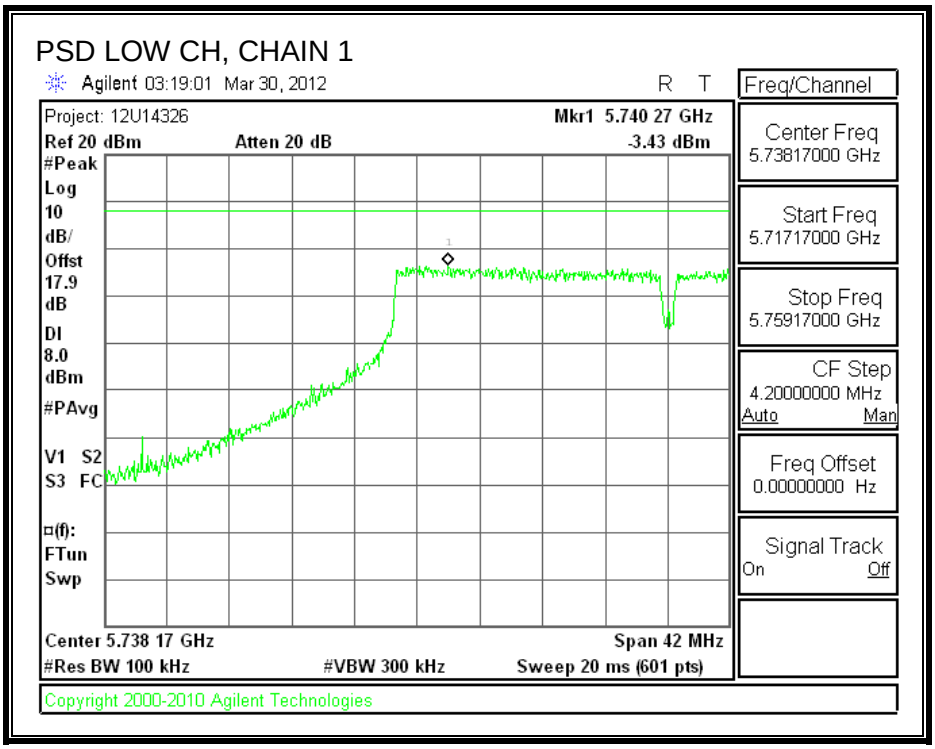
TEST PROCEDURE

KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

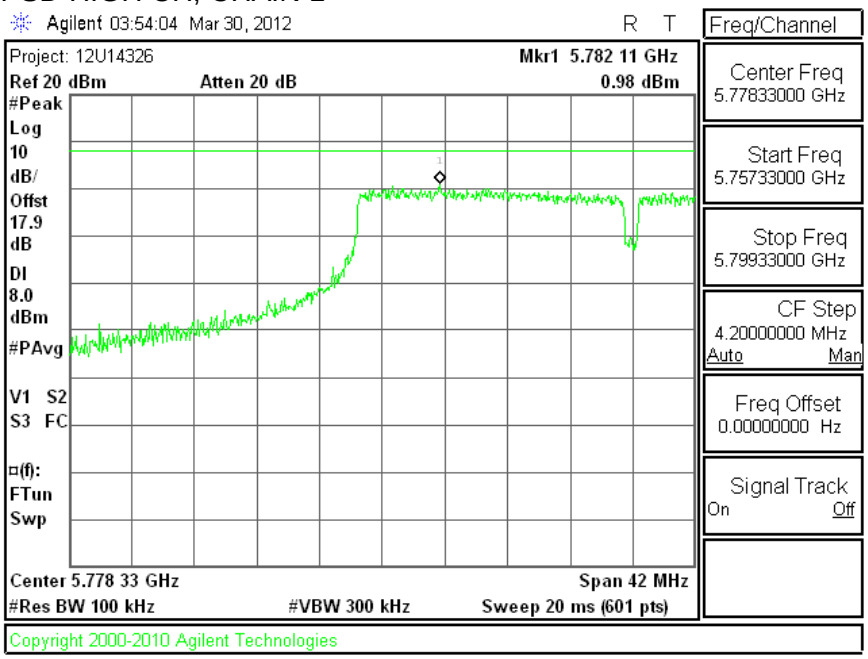
RESULTS:

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	10log(3kHz/ 100kHz)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5755	-3.43	-3.30	-15.20	-15.55	8	-23.55
High	5795	0.98	0.47	-15.20	-11.46	8	-19.46

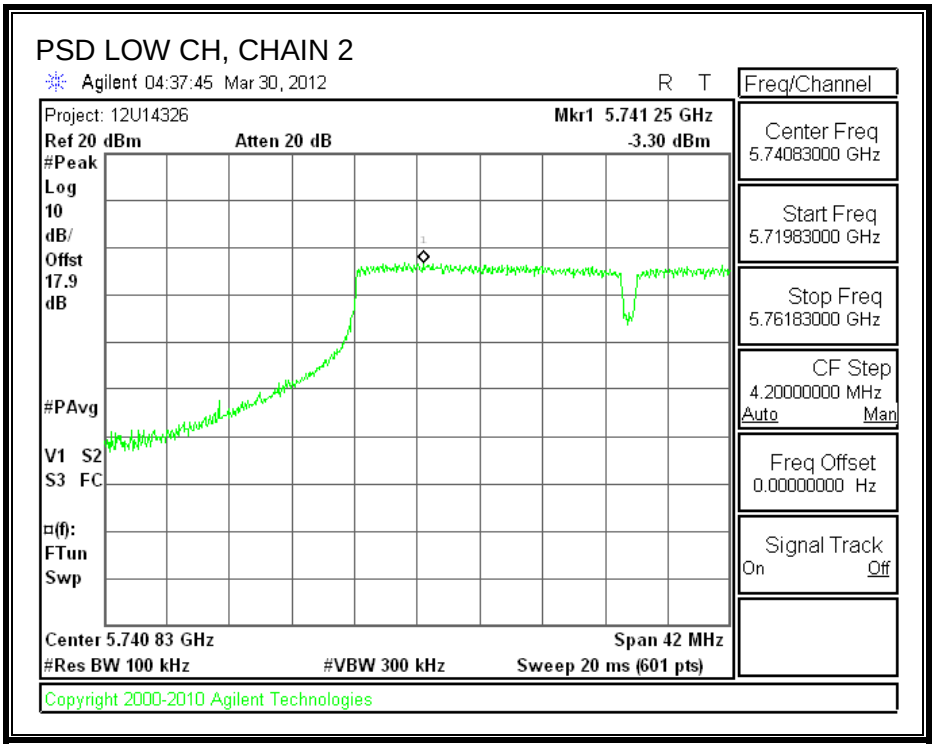
POWER SPECTRAL DENSITY, CHAIN 1



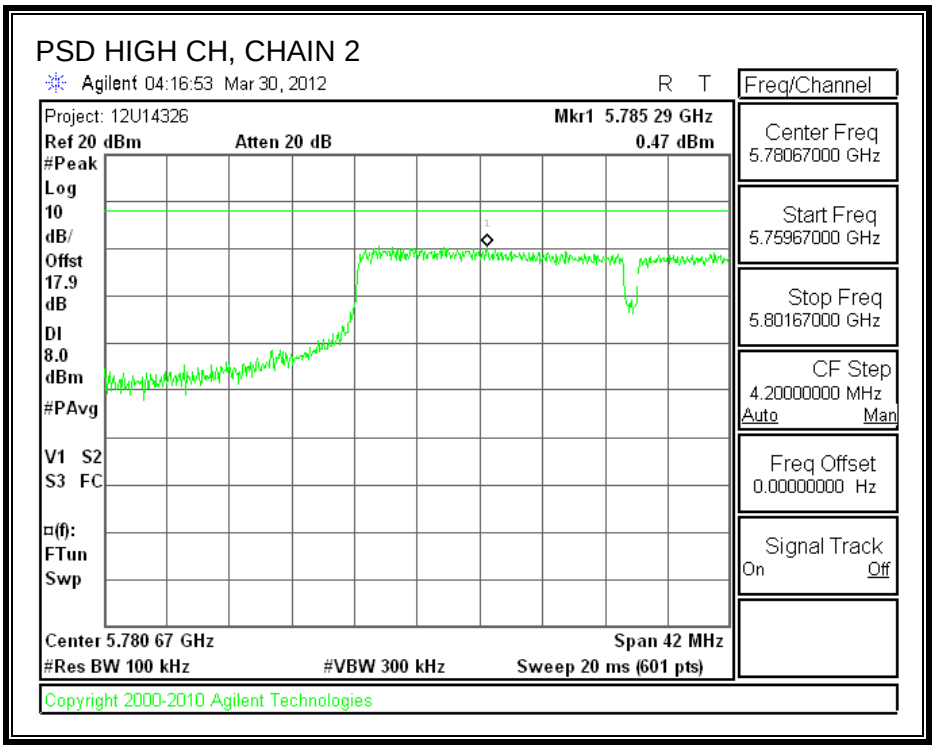
PSD HIGH CH, CHAIN 1



POWER SPECTRAL DENSITY, CHAIN 2



PSD HIGH CH, CHAIN 2



7.6.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

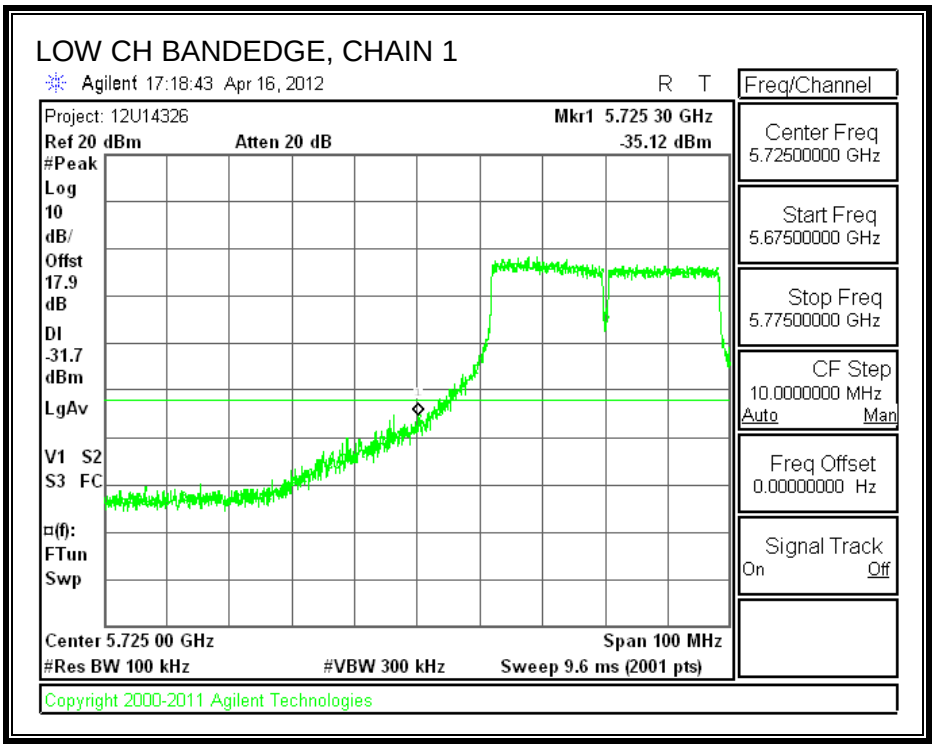
Output power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

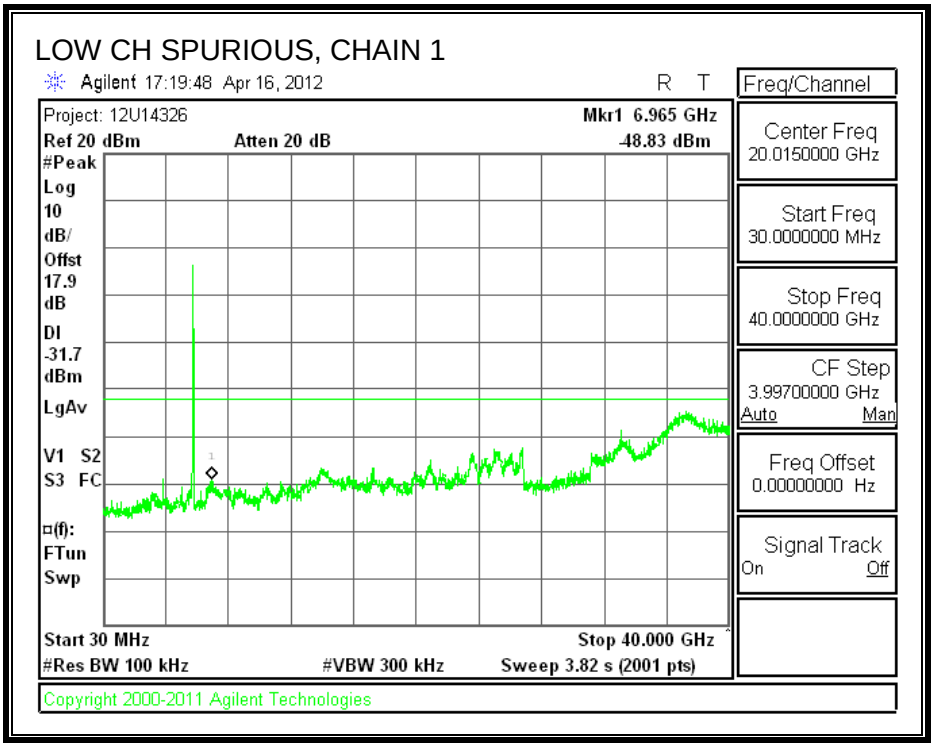
TEST PROCEDURE

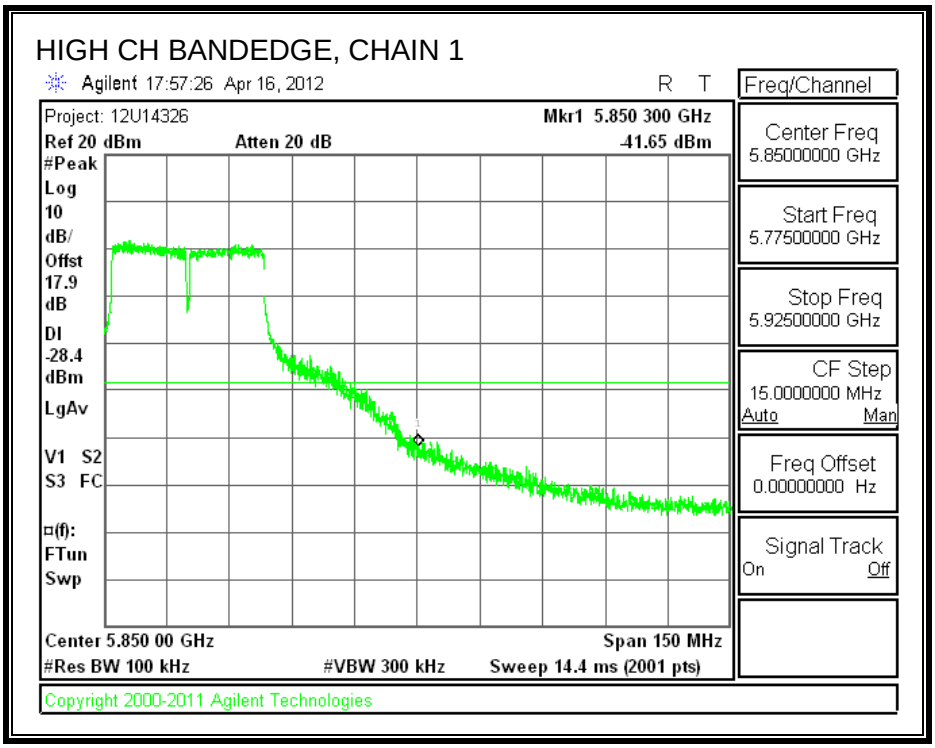
KDB 558074 D01 DTS Meas Guidance v01, dated 1/18/2012:
"Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247."

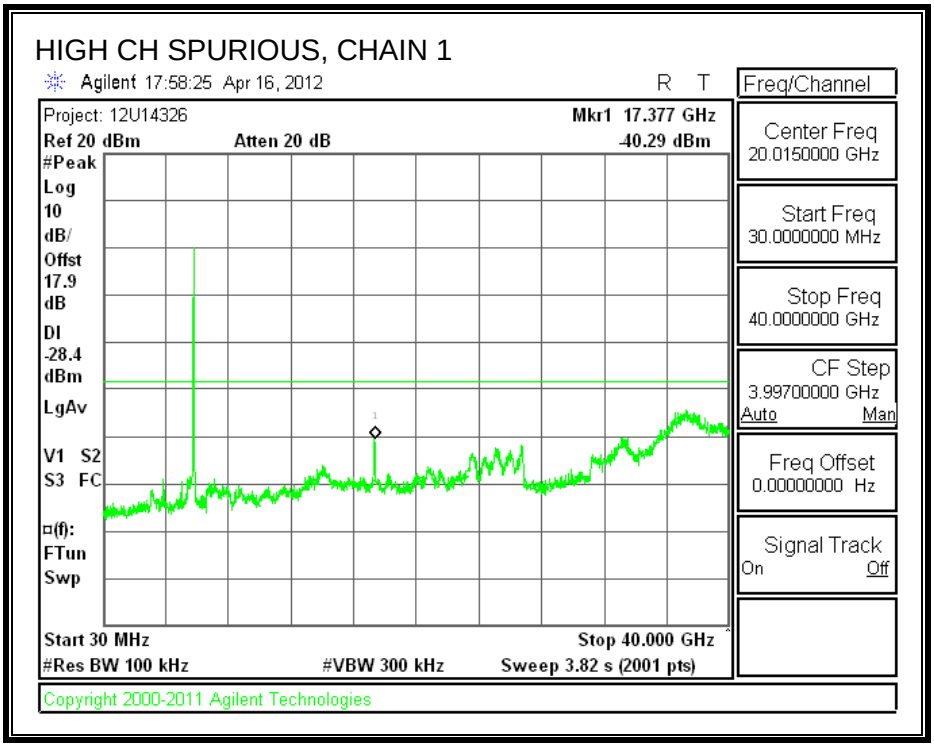
RESULTS

CHAIN 1 SPURIOUS EMISSIONS

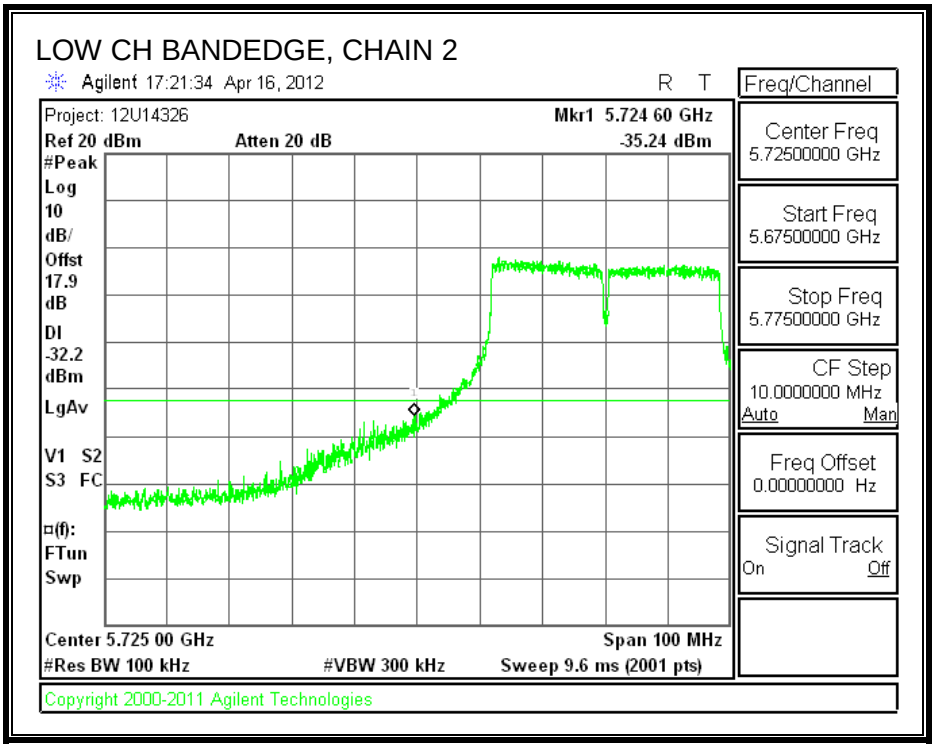


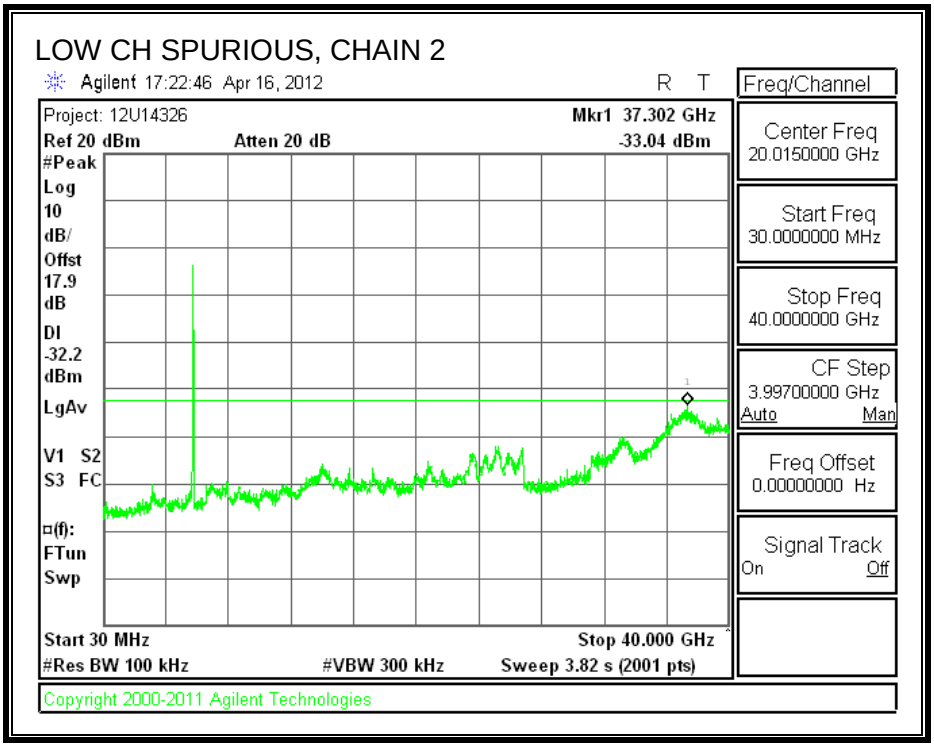


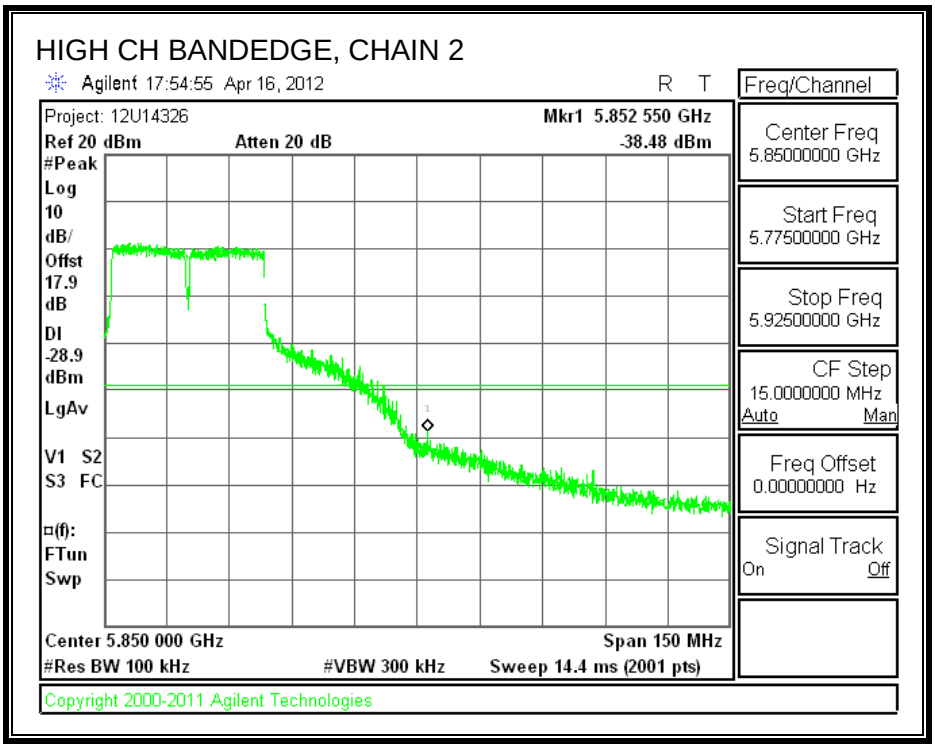


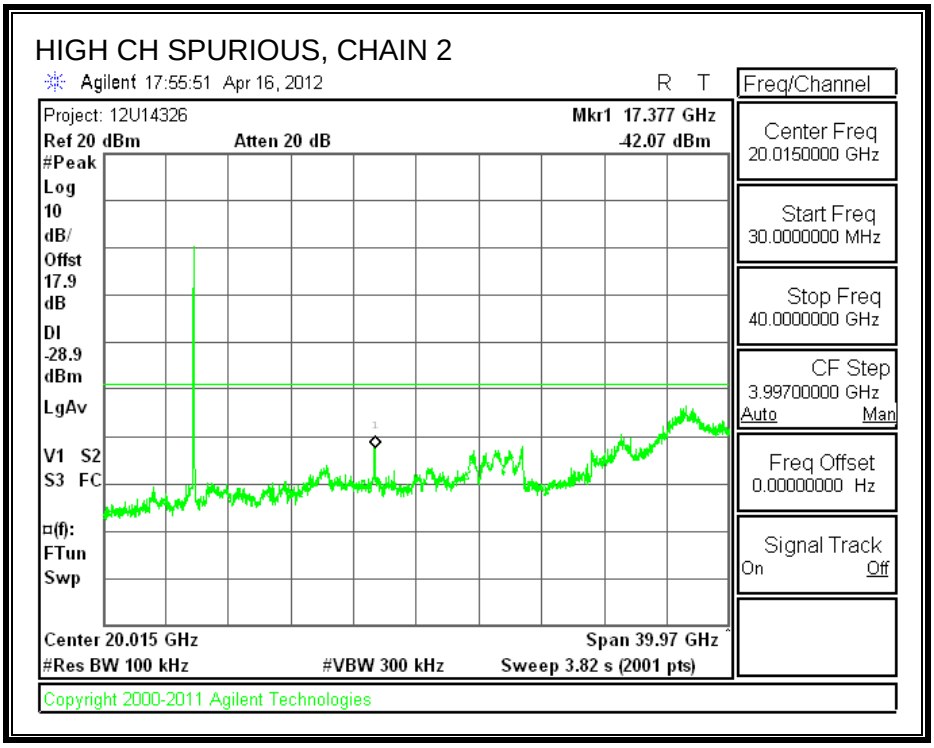


CHAIN 2 SPURIOUS EMISSIONS









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.

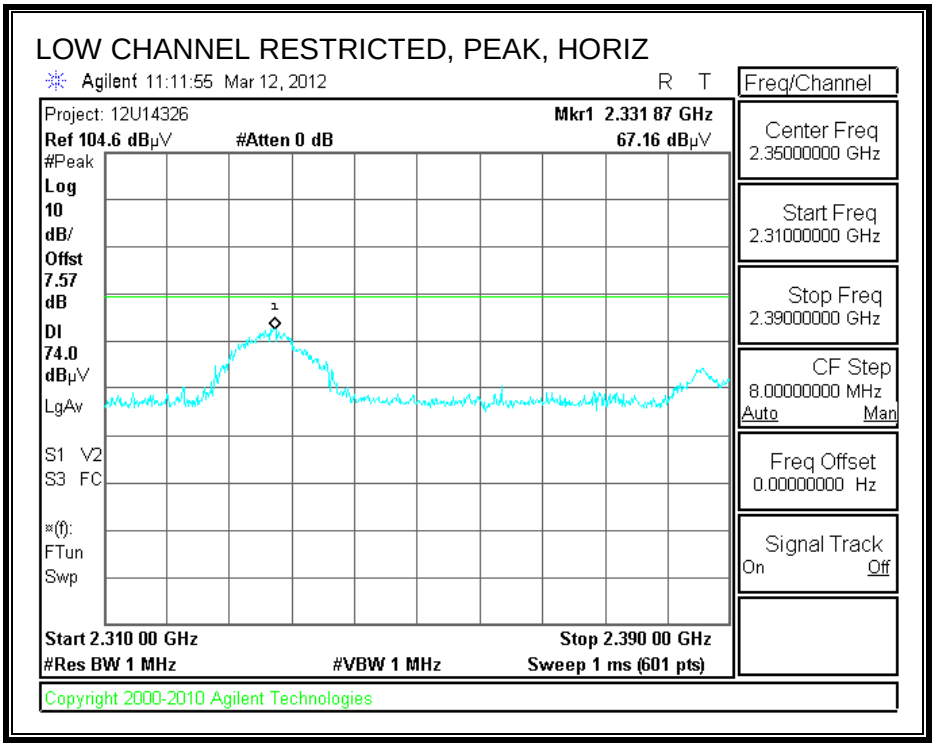
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

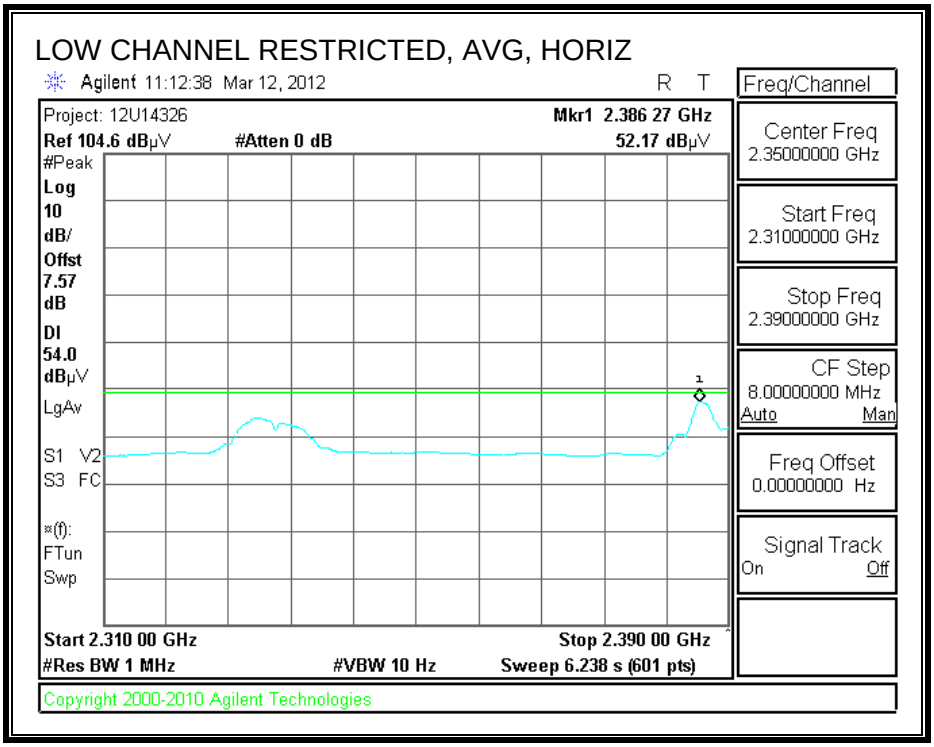
8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. TX ABOVE 1 GHz (802.11b 2TX LEGACY MODE IN THE 2.4 GHz BAND)

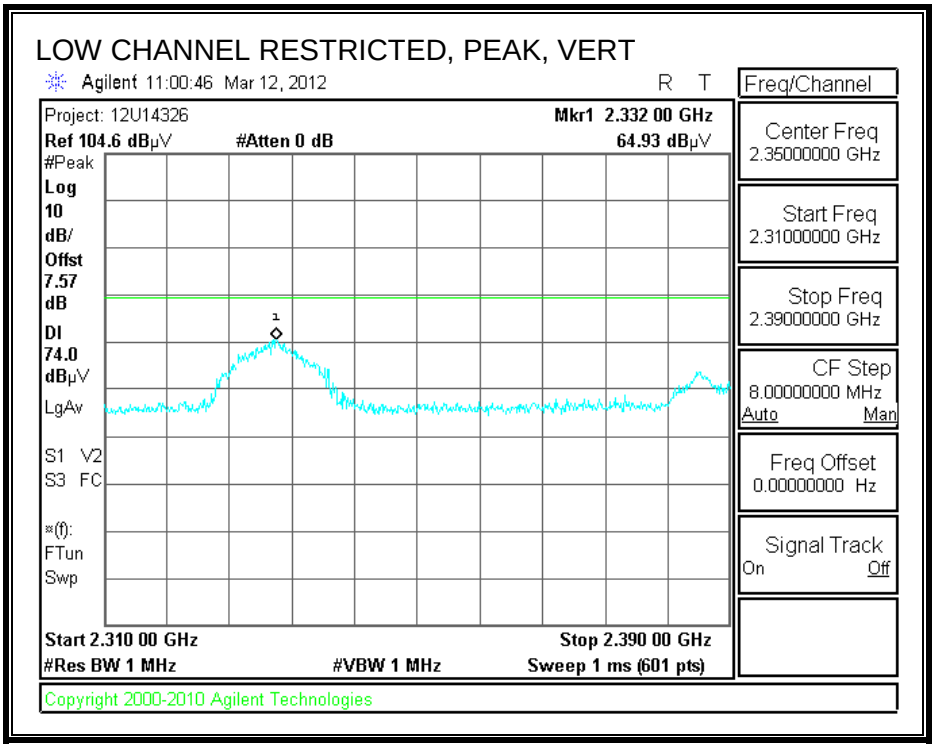
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



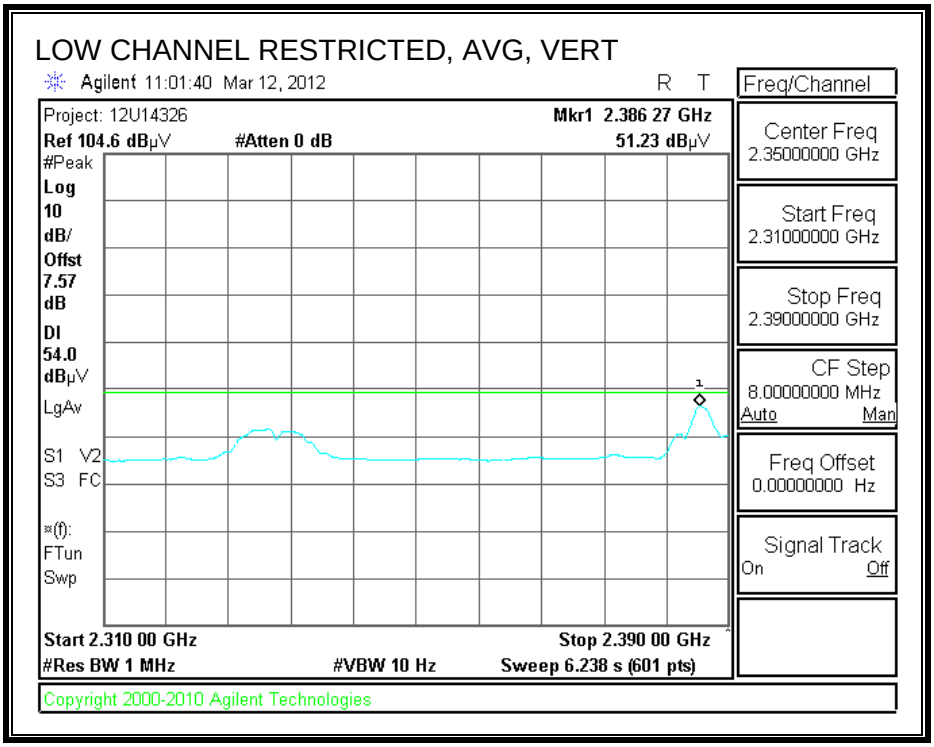
LOW CHANNEL RESTRICTED, AVG, HORIZ



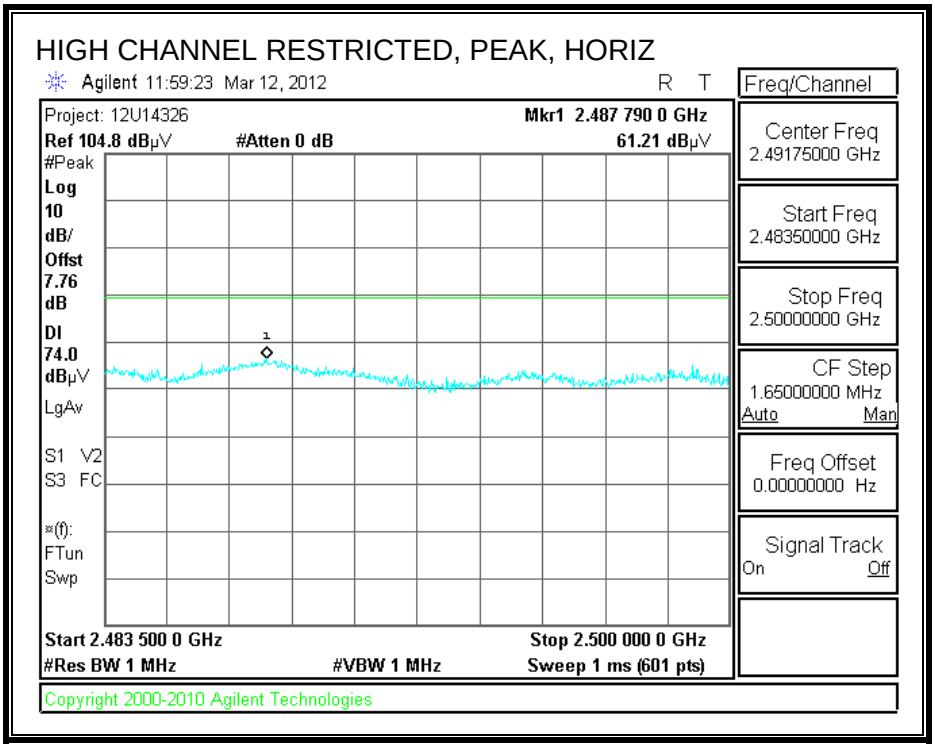
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



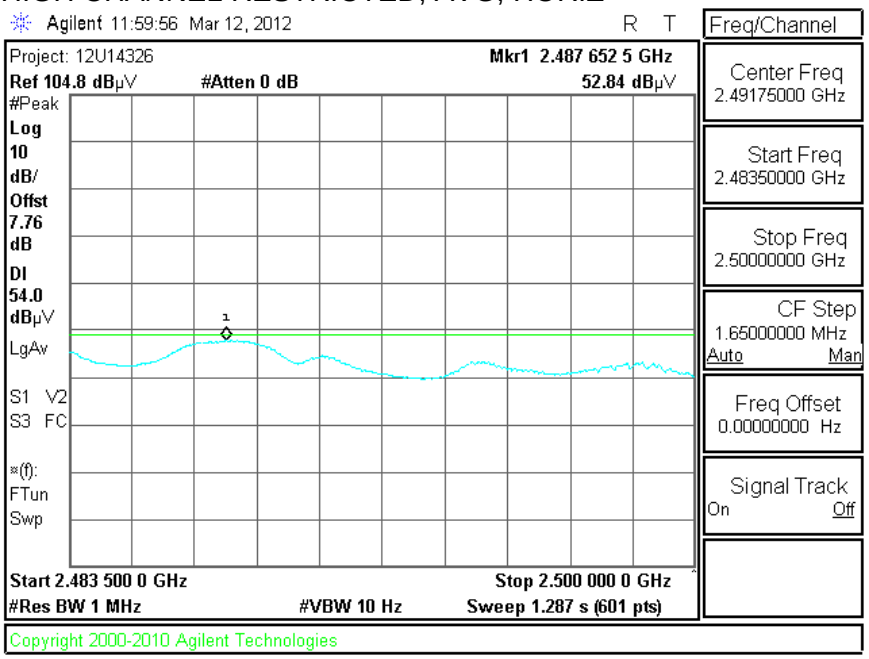
LOW CHANNEL RESTRICTED, AVG, VERT



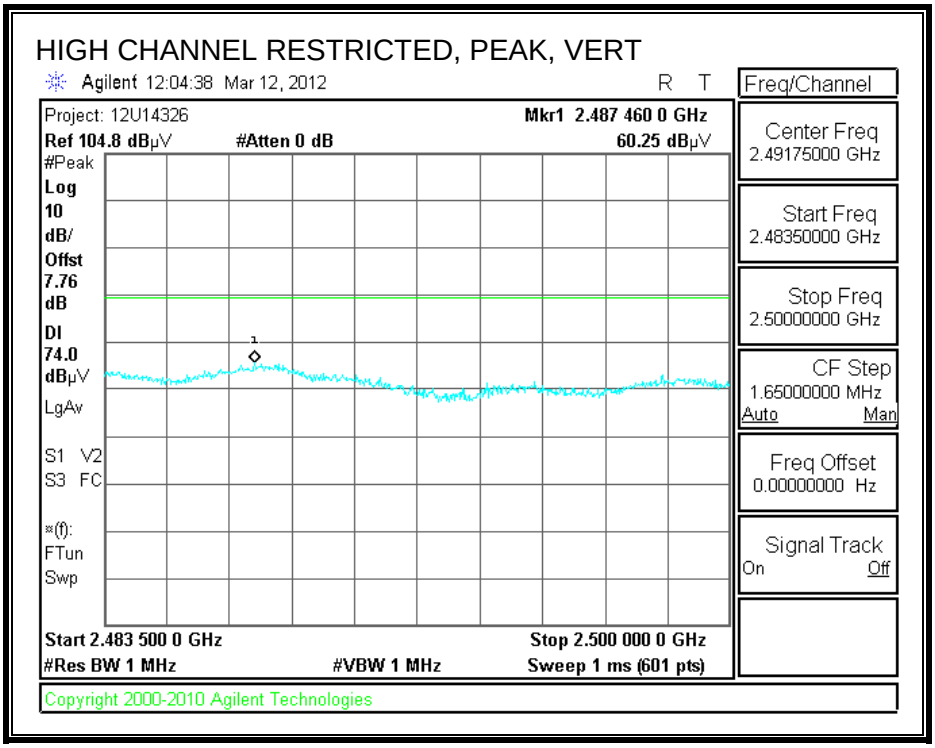
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



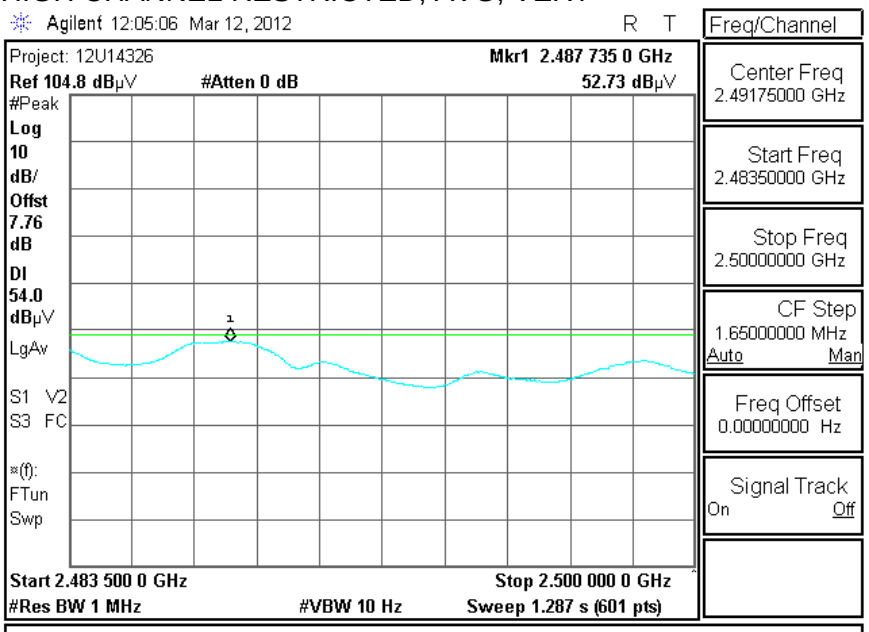
HIGH CHANNEL RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/17/12
Project #: 12U14326
Company: Apple Computer Inc,.
Test Target: FCC Class B
Mode Oper: 802.11b TX mode

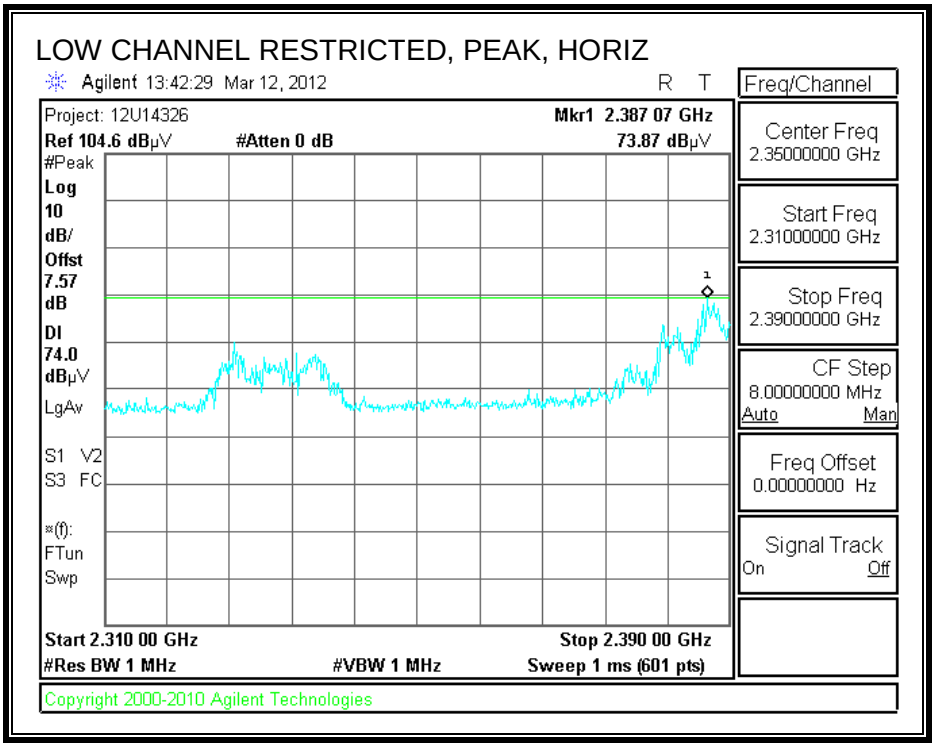
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs.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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2412 MHz 11b													
4.824	3.0	43.4	33.1	6.3	-34.8	0.0	0.0	47.9	74.0	-26.1	V	P	
4.824	3.0	39.2	33.1	6.3	-34.8	0.0	0.0	43.8	54.0	-10.2	V	A	
4.824	3.0	40.8	33.1	6.3	-34.8	0.0	0.0	45.3	74.0	-28.7	H	P	
4.824	3.0	34.9	33.1	6.3	-34.8	0.0	0.0	39.4	54.0	-14.6	H	A	
2437 MHz 11b													
4.874	3.0	40.3	33.1	6.3	-34.8	0.0	0.0	44.9	74.0	-29.1	H	P	
4.874	3.0	34.8	33.1	6.3	-34.8	0.0	0.0	39.4	54.0	-14.6	H	A	
4.874	3.0	42.1	33.1	6.3	-34.8	0.0	0.0	46.7	74.0	-27.3	V	P	
4.874	3.0	37.4	33.1	6.3	-34.8	0.0	0.0	42.0	54.0	-12.0	V	A	
2462 MHz 11b													
4.924	3.0	41.4	33.2	6.3	-34.8	0.0	0.0	46.1	74.0	-27.9	V	P	
4.924	3.0	36.4	33.2	6.3	-34.8	0.0	0.0	41.1	54.0	-12.9	V	A	
4.924	3.0	40.4	33.2	6.3	-34.8	0.0	0.0	45.1	74.0	-28.9	H	P	
4.924	3.0	32.7	33.2	6.3	-34.8	0.0	0.0	37.4	54.0	-16.6	H	A	

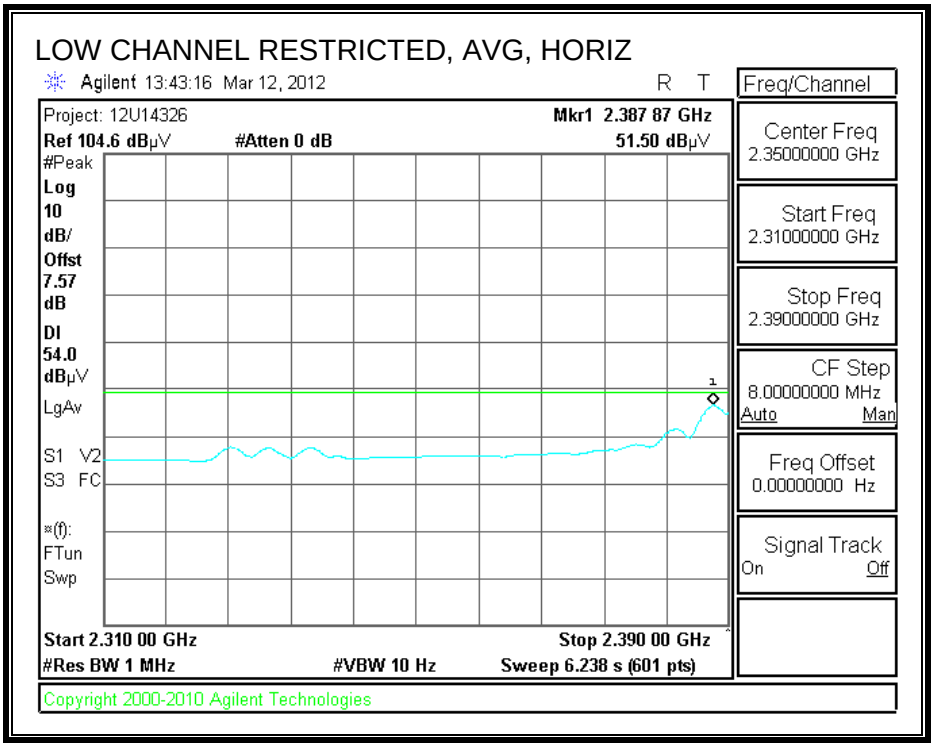
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.2.2. TX ABOVE 1 GHz (802.11g 2TX LEGACY MODE IN THE 2.4 GHz BAND)

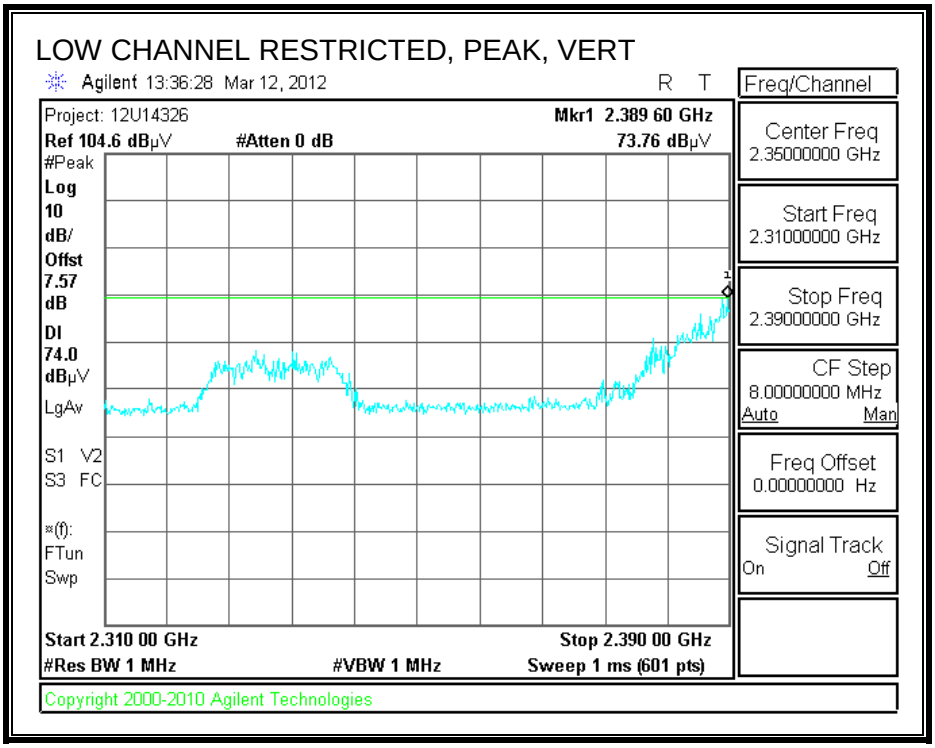
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



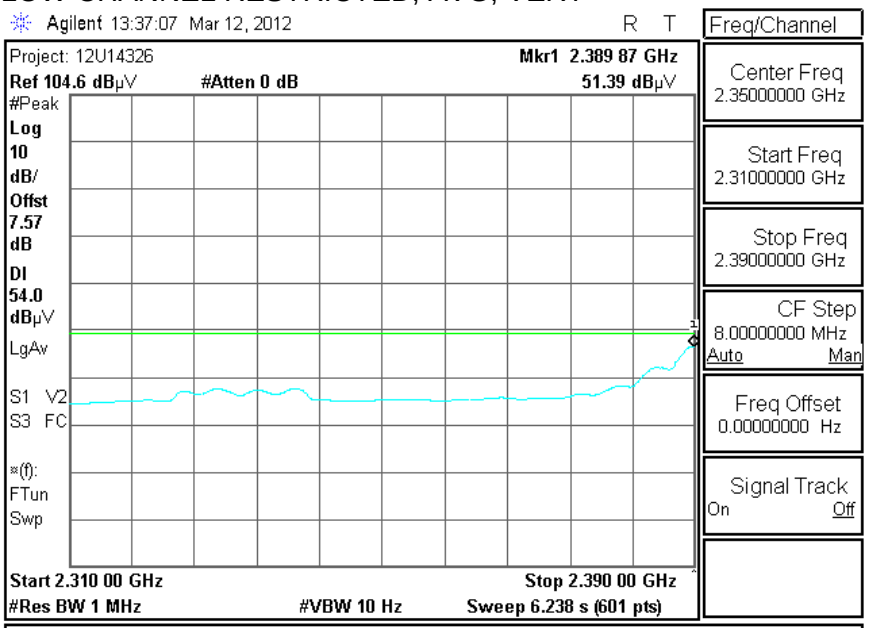
LOW CHANNEL RESTRICTED, AVG, HORIZ



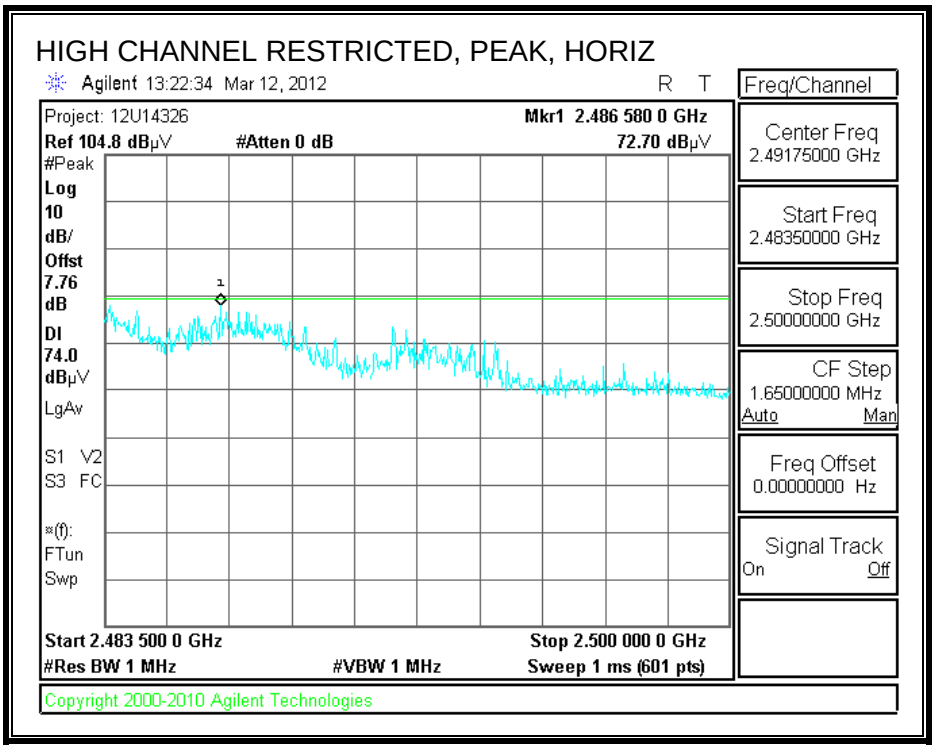
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



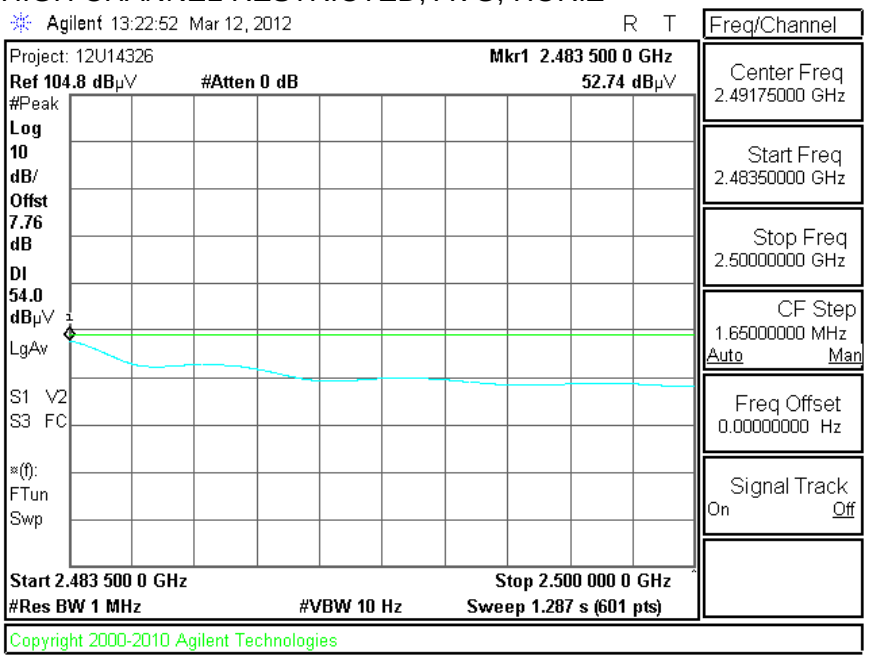
LOW CHANNEL RESTRICTED, AVG, VERT



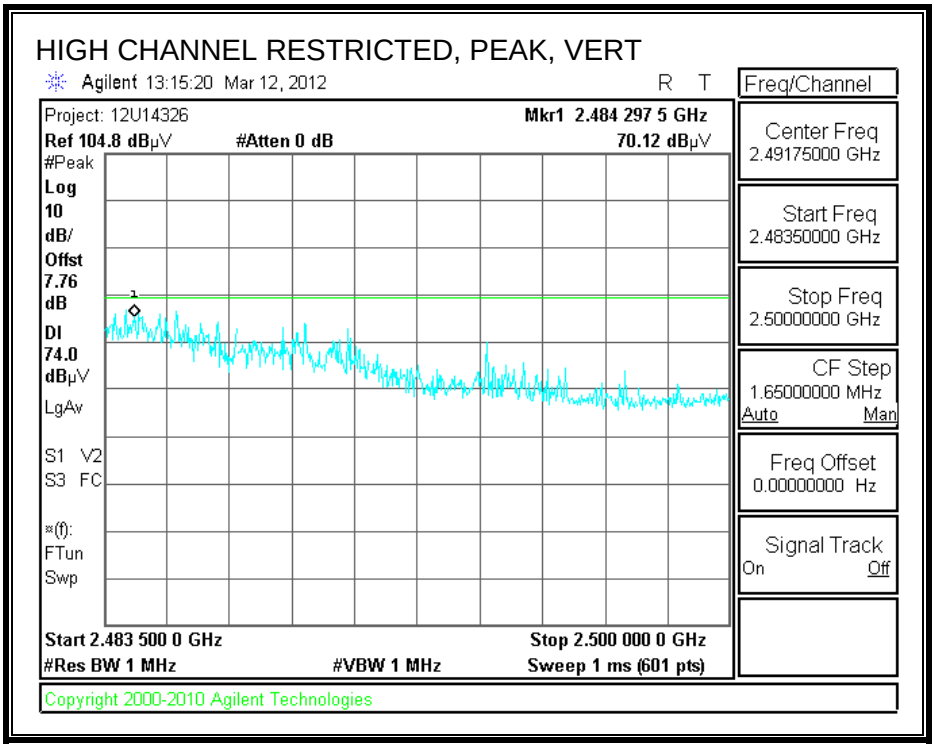
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



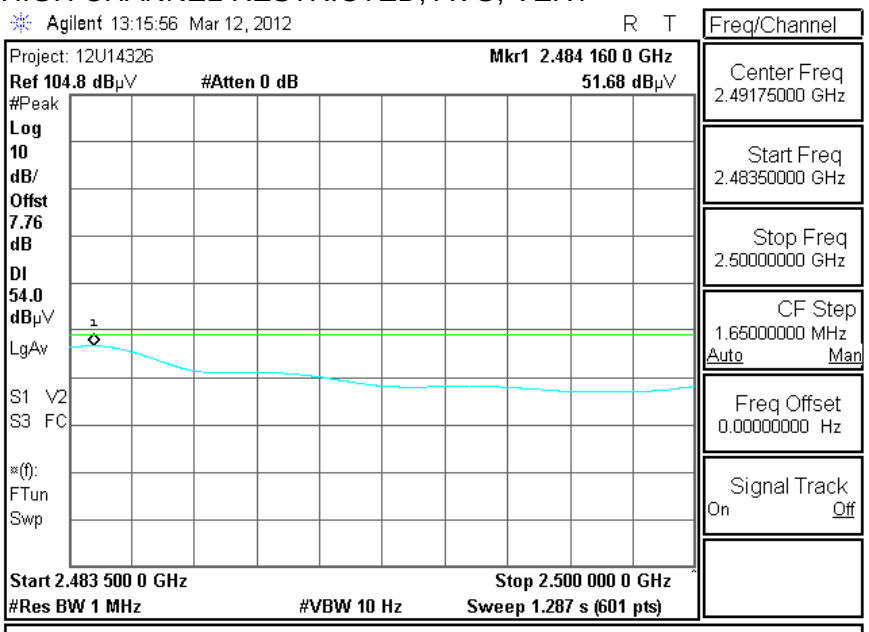
HIGH CHANNEL RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/17/12
Project #: 12U14326
Company: Apple Computer Inc,.
Test Target: FCC Class B
Mode Oper: 802.11g TX mode

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

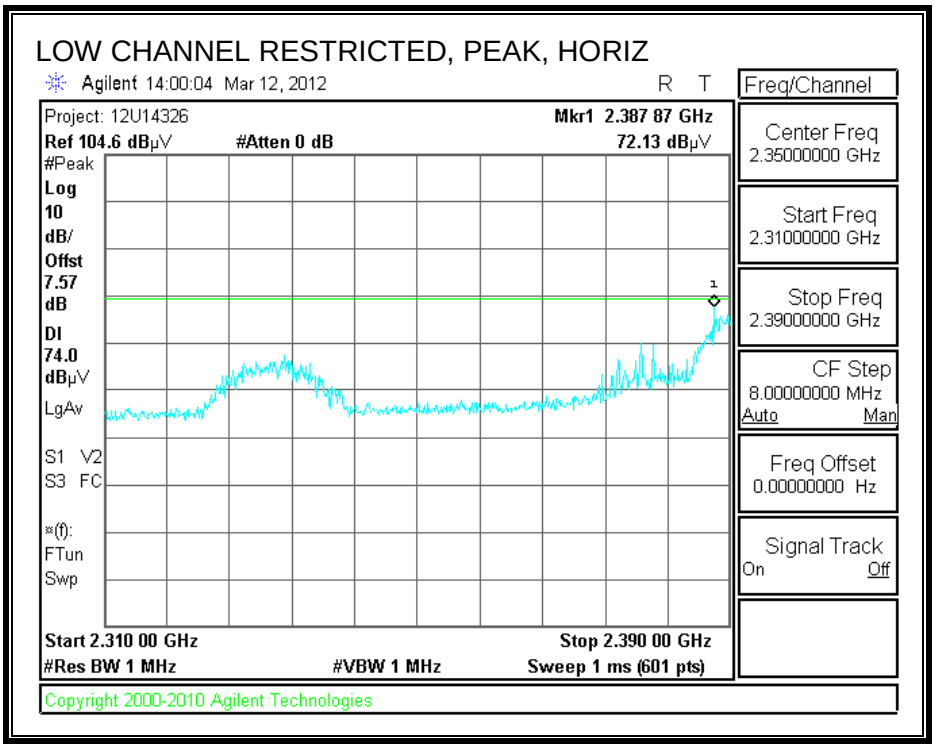
Average Field Strength Limit
Peak Field Strength Limit
Margin vs. Average Limit
Margin vs. Peak Limit

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2412 MHz 11g													
4.824	3.0	38.8	33.1	6.3	-34.8	0.0	0.0	43.4	74.0	-30.6	H	P	
4.824	3.0	26.2	33.1	6.3	-34.8	0.0	0.0	30.7	54.0	-23.3	H	A	
4.824	3.0	39.3	33.1	6.3	-34.8	0.0	0.0	43.8	74.0	-30.2	V	P	
4.824	3.0	27.0	33.1	6.3	-34.8	0.0	0.0	31.5	54.0	-22.5	V	A	
2437 MHz 11g													
4.874	3.0	38.6	33.1	6.3	-34.8	0.0	0.0	43.3	74.0	-30.7	V	P	
4.874	3.0	27.1	33.1	6.3	-34.8	0.0	0.0	31.8	54.0	-22.2	V	A	
4.874	3.0	38.0	33.1	6.3	-34.8	0.0	0.0	42.7	74.0	-31.3	H	P	
4.874	3.0	25.9	33.1	6.3	-34.8	0.0	0.0	30.5	54.0	-23.5	H	A	
2462 MHz 11g													
4.924	3.0	37.6	33.2	6.3	-34.8	0.0	0.0	42.3	74.0	-31.7	H	P	
4.924	3.0	25.4	33.2	6.3	-34.8	0.0	0.0	30.1	54.0	-23.9	H	A	
4.924	3.0	38.1	33.2	6.3	-34.8	0.0	0.0	42.9	74.0	-31.1	V	P	
4.924	3.0	25.6	33.2	6.3	-34.8	0.0	0.0	30.4	54.0	-23.6	V	A	

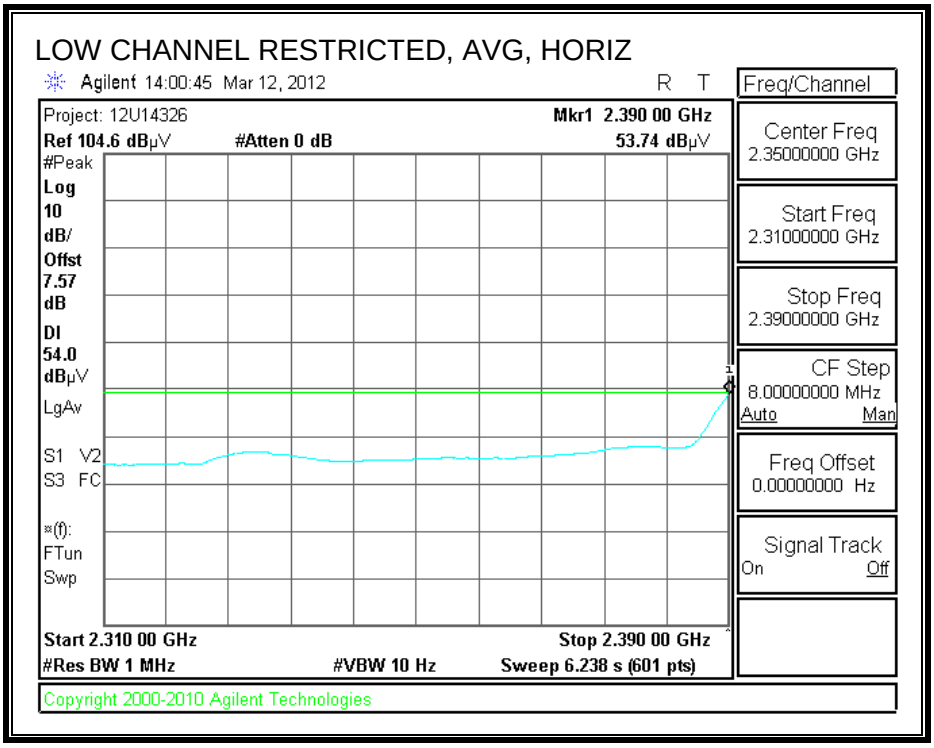
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.2.3. TX ABOVE 1 GHz (802.11n HT20 2TX MODE IN THE 2.4 GHz BAND)

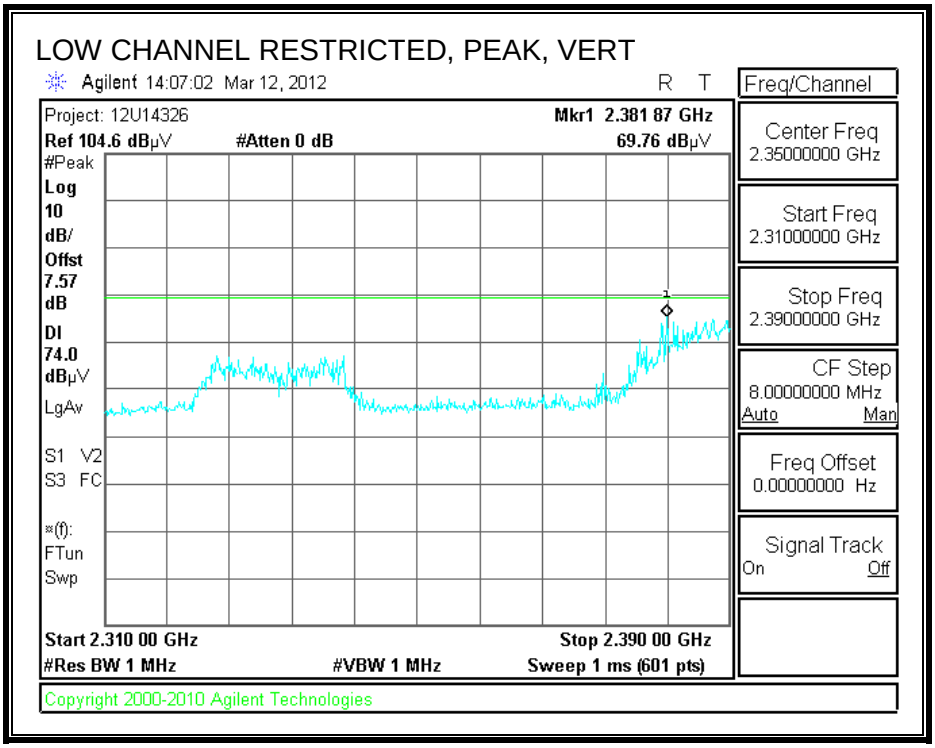
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



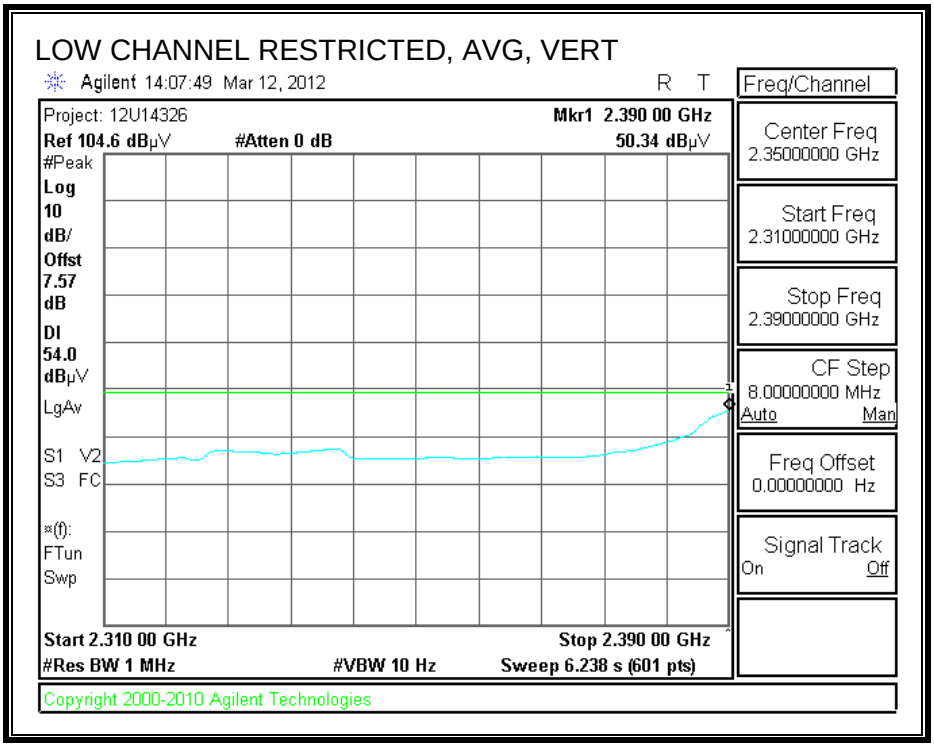
LOW CHANNEL RESTRICTED, AVG, HORIZ



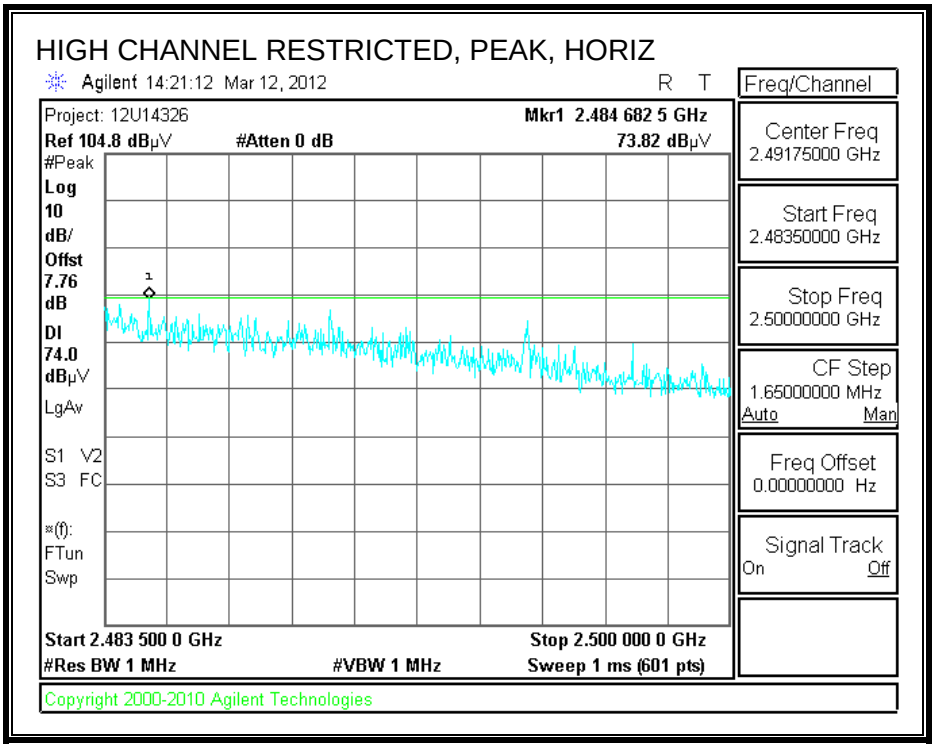
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



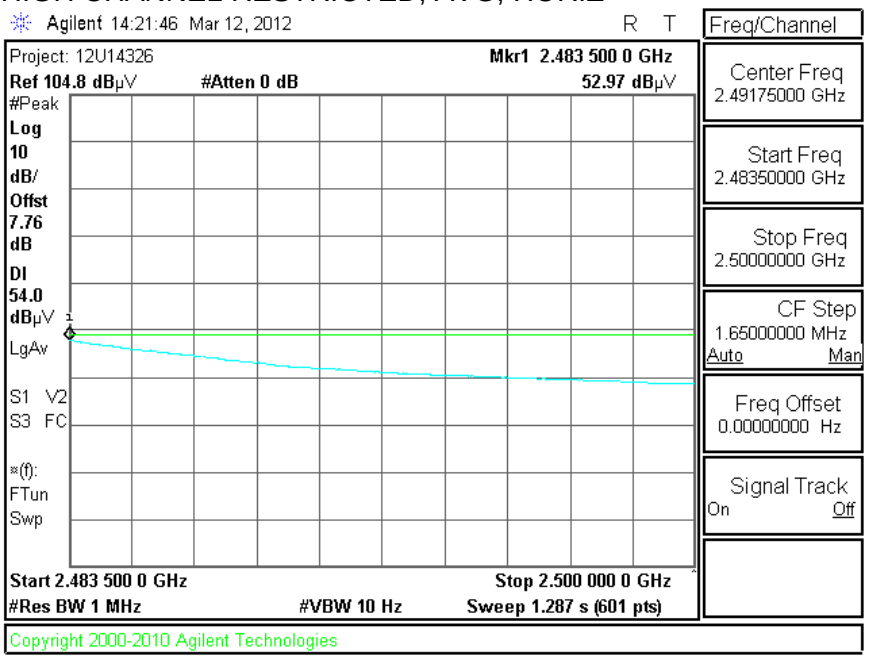
LOW CHANNEL RESTRICTED, AVG, VERT



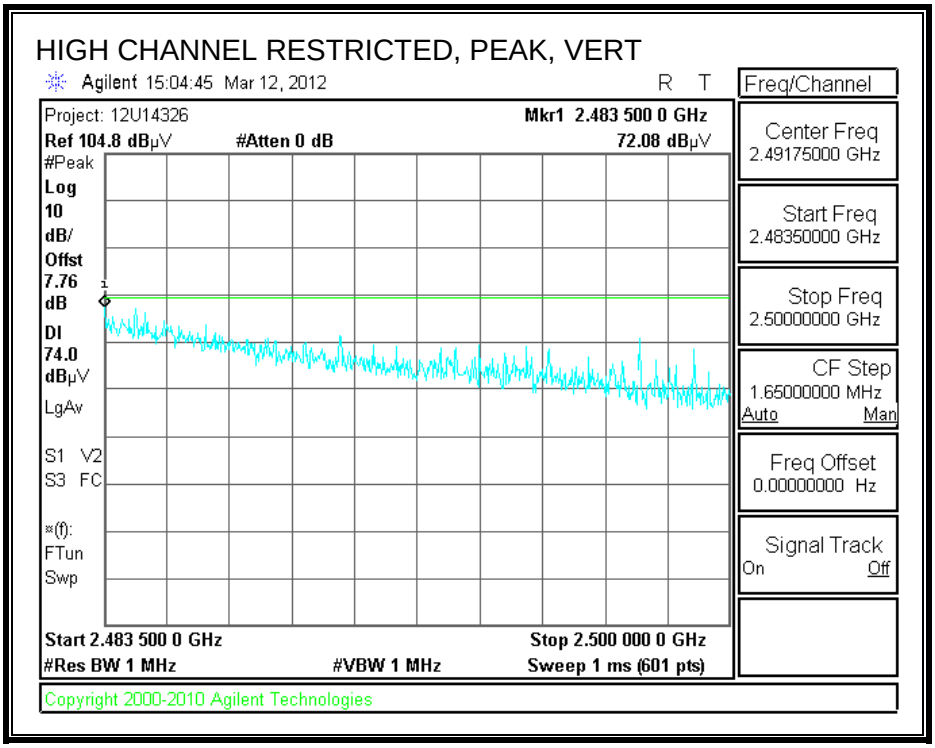
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



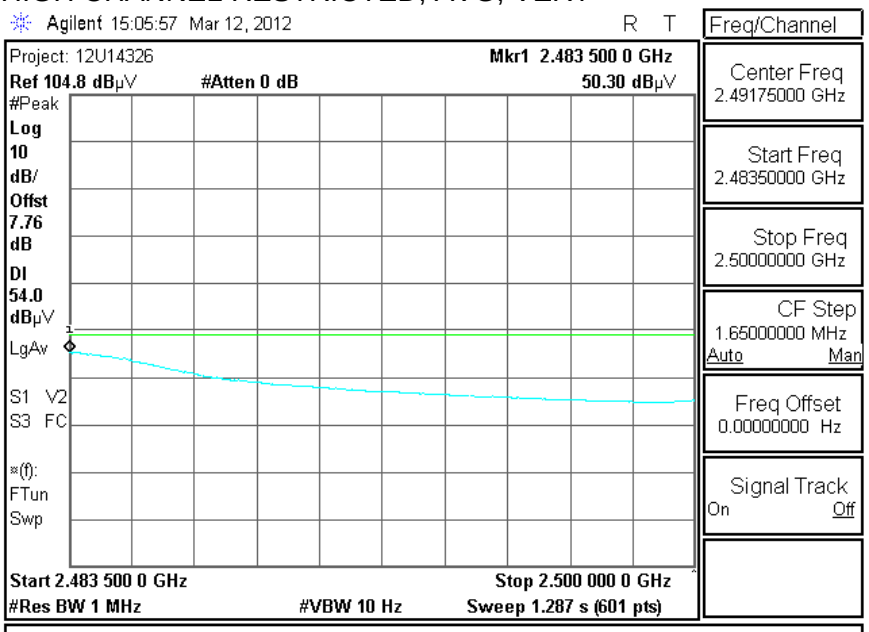
HIGH CHANNEL RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/17/12
Project #: 12U14326
Company: Apple Computer Inc,.
Test Target: FCC Class B
Mode Oper: 802.11n HT20 TX mode

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2412 MHz HT20													
4.824	3.0	38.1	33.1	6.3	-34.8	0.0	0.0	42.6	74.0	-31.4	H	P	
4.824	3.0	25.8	33.1	6.3	-34.8	0.0	0.0	30.4	54.0	-23.6	H	A	
4.824	3.0	38.5	33.1	6.3	-34.8	0.0	0.0	43.0	74.0	-31.0	V	P	
4.824	3.0	26.5	33.1	6.3	-34.8	0.0	0.0	31.0	54.0	-23.0	V	A	
2437 MHz HT20													
4.874	3.0	38.7	33.1	6.3	-34.8	0.0	0.0	43.4	74.0	-30.6	V	P	
4.874	3.0	27.2	33.1	6.3	-34.8	0.0	0.0	31.8	54.0	-22.2	V	A	
4.874	3.0	38.1	33.1	6.3	-34.8	0.0	0.0	42.8	74.0	-31.2	H	P	
4.874	3.0	25.9	33.1	6.3	-34.8	0.0	0.0	30.5	54.0	-23.5	H	A	
2462 MHz HT20													
4.924	3.0	37.6	33.2	6.3	-34.8	0.0	0.0	42.3	74.0	-31.7	H	P	
4.924	3.0	25.5	33.2	6.3	-34.8	0.0	0.0	30.2	54.0	-23.8	H	A	
4.924	3.0	37.2	33.2	6.3	-34.8	0.0	0.0	41.9	74.0	-32.1	V	P	
4.924	3.0	25.3	33.2	6.3	-34.8	0.0	0.0	30.1	54.0	-23.9	V	A	

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

8.2.4. TX ABOVE 1 GHz (802.11a 2TX LEGACY MODE IN THE 5.8 GHz BAND)

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/17/12
Project #: 12U14326
Company: Apple Computer Inc,.
Test Target: FCC Class B
Mode Oper: 802.11a TX mode 5.8G

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
5745 MHz 11a													
11.490	3.0	41.1	38.8	10.5	-32.9	0.0	0.7	58.3	74.0	-15.7	V	P	
11.490	3.0	27.0	38.8	10.5	-32.9	0.0	0.7	44.2	54.0	-9.8	V	A	
11.490	3.0	38.7	38.8	10.5	-32.9	0.0	0.7	55.9	74.0	-18.1	H	P	
11.490	3.0	25.3	38.8	10.5	-32.9	0.0	0.7	42.5	54.0	-11.5	H	A	
5785 MHz 11a													
11.570	3.0	40.0	38.9	10.6	-32.8	0.0	0.7	56.4	74.0	-17.6	H	P	
11.570	3.0	25.4	38.9	10.6	-32.8	0.0	0.7	42.8	54.0	-11.2	H	A	
11.570	3.0	40.2	38.9	10.6	-32.8	0.0	0.7	57.6	74.0	-16.4	V	P	
11.570	3.0	26.4	38.9	10.6	-32.8	0.0	0.7	43.9	54.0	-10.1	V	A	
5825 MHz 11a													
11.650	3.0	39.0	39.0	10.7	-32.7	0.0	0.7	56.7	74.0	-17.3	V	P	
11.650	3.0	25.6	39.0	10.7	-32.7	0.0	0.7	43.2	54.0	-10.8	V	A	
11.650	3.0	39.3	39.0	10.7	-32.7	0.0	0.7	57.0	74.0	-17.0	H	P	
11.650	3.0	25.1	39.0	10.7	-32.7	0.0	0.7	42.8	54.0	-11.2	H	A	

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

8.2.5. TX ABOVE 1 GHz (802.11n HT20 2TX MODE IN THE 5.8 GHz BAND)

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/19/12
Project #: 12U14326
Company: Apple Computer Inc,.
Test Target: FCC Class B
Mode Oper: 802.11n HT20 TX mode 5.8G

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5745 MHz 11a													
11.490	3.0	42.8	38.8	10.5	-32.9	0.0	0.7	60.0	74.0	-14.0	V	P	
11.490	3.0	28.8	38.8	10.5	-32.9	0.0	0.7	46.0	54.0	-8.0	V	A	
11.490	3.0	40.4	38.8	10.5	-32.9	0.0	0.7	57.6	74.0	-16.4	H	P	
11.490	3.0	27.0	38.8	10.5	-32.9	0.0	0.7	44.2	54.0	-9.8	H	A	
5785 MHz 11a													
11.570	3.0	41.7	38.9	10.6	-32.8	0.0	0.7	58.1	74.0	-15.9	H	P	
11.570	3.0	27.1	38.9	10.6	-32.8	0.0	0.7	44.5	54.0	-9.5	H	A	
11.570	3.0	41.9	38.9	10.6	-32.8	0.0	0.7	59.3	74.0	-14.7	V	P	
11.570	3.0	28.2	38.9	10.6	-32.8	0.0	0.7	45.6	54.0	-8.4	V	A	
5825 MHz 11a													
11.650	3.0	40.7	39.0	10.7	-32.7	0.0	0.7	58.4	74.0	-15.6	V	P	
11.650	3.0	27.3	39.0	10.7	-32.7	0.0	0.7	45.0	54.0	-9.0	V	A	
11.650	3.0	41.0	39.0	10.7	-32.7	0.0	0.7	58.7	74.0	-15.3	H	P	
11.650	3.0	26.9	39.0	10.7	-32.7	0.0	0.7	44.5	54.0	-9.5	H	A	

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

8.2.6. TX ABOVE 1 GHz (802.11n HT40 2TX MODE IN THE 5.8 GHz BAND)

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 03/20/12
Project #: 12U14326
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n HT40, 5.8G TX mode

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5755 MHz HT40													
11.510	3.0	36.4	38.8	10.6	-32.8	0.0	0.7	53.7	74.0	-20.3	V	P	
11.510	3.0	22.7	38.8	10.6	-32.8	0.0	0.7	40.0	54.0	-14.0	V	A	
5755 MHz HT40													
11.510	3.0	34.5	38.8	10.6	-32.8	0.0	0.7	51.7	74.0	-22.3	H	P	
11.510	3.0	22.7	38.8	10.6	-32.8	0.0	0.7	39.9	54.0	-14.1	H	A	
5795 MHz HT40													
11.590	3.0	37.1	38.9	10.6	-32.7	0.0	0.7	54.6	74.0	-19.4	H	P	
11.590	3.0	24.3	38.9	10.6	-32.7	0.0	0.7	41.8	54.0	-12.2	H	A	
5795 MHz HT40													
11.590	3.0	39.3	38.9	10.6	-32.7	0.0	0.7	56.8	74.0	-17.2	V	P	
11.590	3.0	25.0	38.9	10.6	-32.7	0.0	0.7	42.5	54.0	-11.5	V	A	

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

8.3. RECEIVER ABOVE 1 GHz

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

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

Company: Apple
Project #: 12U14326
Date: 3/22/2012
Test Engineer: Tom Chen
Configuration: EUT alone
Mode: RX mode

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A0056			RX RSS 210

Hi Frequency Cables

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

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

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.126	3.0	46.3	32.5	24.5	2.8	-35.9	0.0	0.0	37.8	24.0	74	54	-36.2	-30.0	V
1.855	3.0	47.3	31.7	27.1	3.6	-35.5	0.0	0.0	42.5	26.9	74	54	-31.5	-27.1	V
3.988	3.0	41.1	29.7	32.4	5.7	-34.9	0.0	0.0	44.3	32.9	74	54	-29.7	-21.1	V
1.045	3.0	44.4	31.4	24.2	2.7	-35.9	0.0	0.0	35.4	22.4	74	54	-38.6	-31.6	H
1.441	3.0	46.2	32.9	25.6	3.1	-35.7	0.0	0.0	39.2	25.9	74	54	-34.8	-28.1	H
2.836	3.0	42.8	29.9	29.8	4.7	-35.2	0.0	0.0	42.0	29.1	74	54	-32.0	-24.9	H

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		

8.3.2. RX ABOVE 1 GHz FOR 40 MHz BANDWIDTH IN THE 2.4 GHz BAND

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

Company:	Apple
Project #:	12U14326
Date:	3/22/2012
Test Engineer:	Tom Chen
Configuration:	EUT alone
Mode:	RX mode

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A0056			RX RSS 210

Hi Frequency Cables

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

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

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.126	3.0	48.2	34.4	24.5	2.8	-35.9	0.0	0.0	39.6	25.8	74	54	-34.4	-28.2	V
1.855	3.0	49.2	33.5	27.1	3.6	-35.5	0.0	0.0	44.4	28.7	74	54	-29.6	-25.3	V
3.988	3.0	43.0	31.5	32.4	5.7	-34.9	0.0	0.0	46.1	34.7	74	54	-27.9	-19.3	V
1.045	3.0	46.3	33.3	24.2	2.7	-35.9	0.0	0.0	37.3	24.3	74	54	-36.7	-29.7	H
1.441	3.0	48.0	34.7	25.6	3.1	-35.7	0.0	0.0	41.1	27.8	74	54	-32.9	-26.2	H
2.836	3.0	44.6	31.7	29.8	4.7	-35.2	0.0	0.0	43.8	30.9	74	54	-30.2	-23.1	H

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		

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

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

Company: Apple
Project #: 12U14326
Date: 3/22/2012
Test Engineer: Tom Chen
Configuration: EUT alone
Mode: RX mode

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A0056			RX RSS 210

Hi Frequency Cables

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

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

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.126	3.0	46.3	32.5	24.5	2.8	-35.9	0.0	0.0	37.8	24.0	74	54	-36.2	-30.0	V
3.988	3.0	41.1	29.7	32.4	5.7	-34.9	0.0	0.0	44.3	32.9	74	54	-29.7	-21.1	V
1.045	3.0	44.4	31.4	24.2	2.7	-35.9	0.0	0.0	35.4	22.4	74	54	-38.6	-31.6	H
2.836	3.0	42.8	29.9	29.8	4.7	-35.2	0.0	0.0	42.0	29.1	74	54	-32.0	-24.9	H

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		

8.3.4. RX ABOVE 1 GHz FOR 40 MHz BANDWIDTH IN THE 5.8 GHz BAND

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

r:	Apple
:	12U14326
	3/22/2012
gineer:	Tom Chen
ation:	EUT alone
	RX mode

ipment:

orn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
/N: 3245 @3m	T145 Agilent 3008A005			RX RSS 210

uency Cables

able 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
ble 22807700	12' cable 22807600	20' cable 22807500		

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

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)
3.0	48.5	34.7	24.5	2.8	-35.9	0.0	0.0	39.9	26.1	74	54	-34.1	-27.9	V
3.0	43.2	31.8	32.4	5.7	-34.9	0.0	0.0	46.4	35.0	74	54	-27.6	-19.0	V
3.0	46.5	33.6	24.2	2.7	-35.9	0.0	0.0	37.5	24.6	74	54	-36.5	-29.4	H
3.0	44.9	32.0	29.8	4.7	-35.2	0.0	0.0	44.1	31.2	74	54	-29.9	-22.8	H

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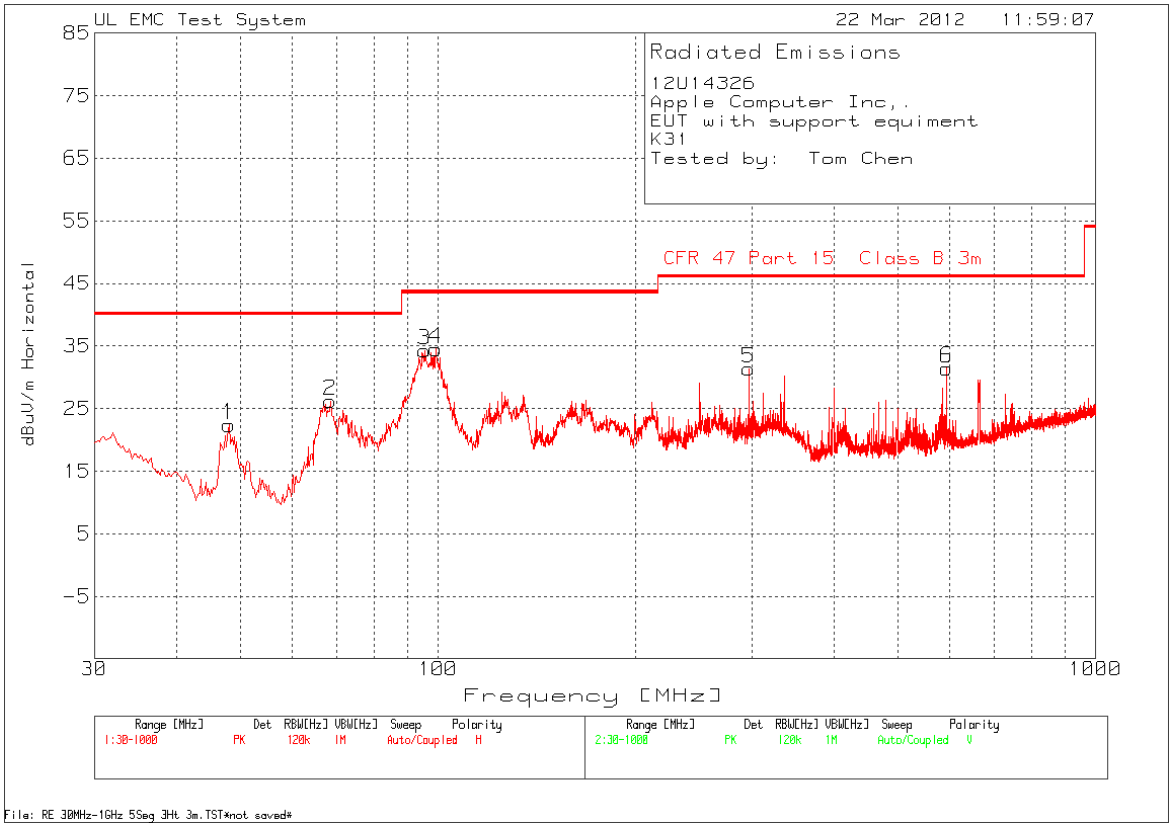
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

8.4. WORST-CASE BELOW 1 GHz

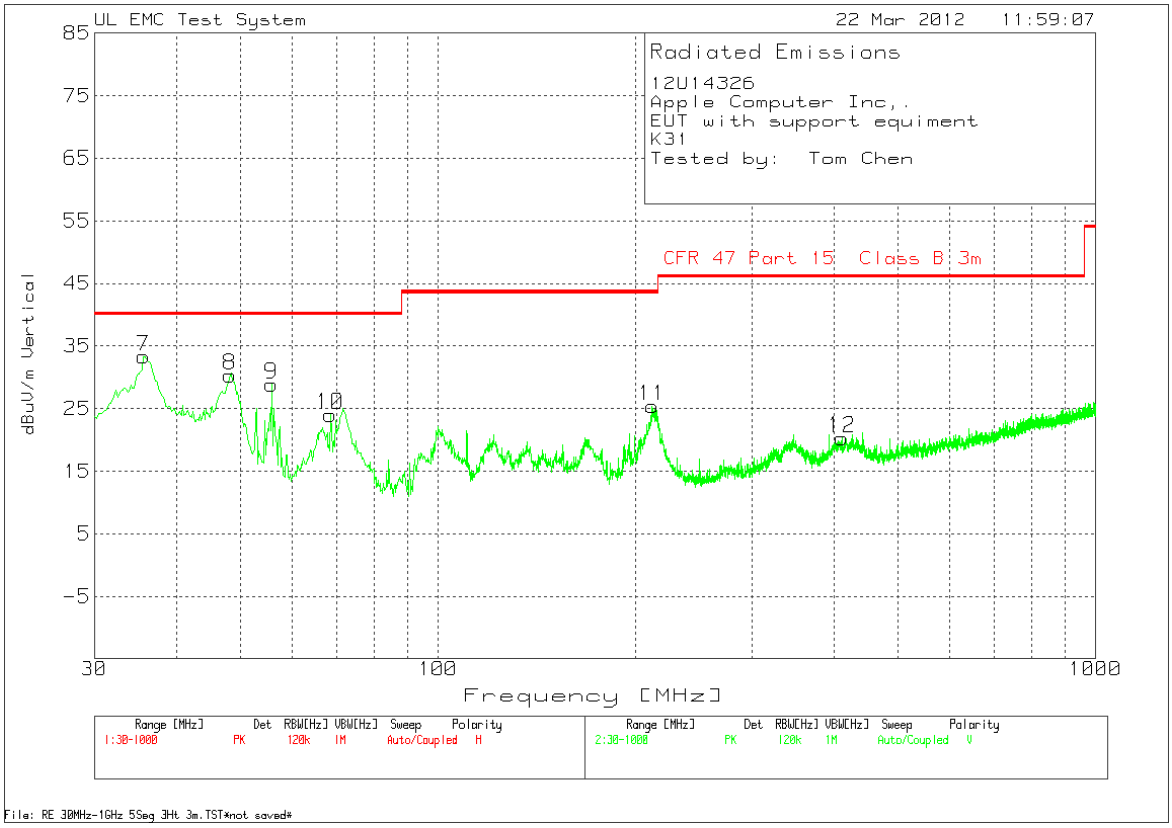
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

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

Range 1 30 - 1000MHz

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

Range 2 30 - 1000MHz

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

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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

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

RESULTS

6 WORST EMISSIONS

Project No:12U14326
Client Name:Apple computer Inc,.
Model/Device:K31
Test Volt/Freq:FCC Class B 120VAC 60 Hz
Test By:Tom Chen

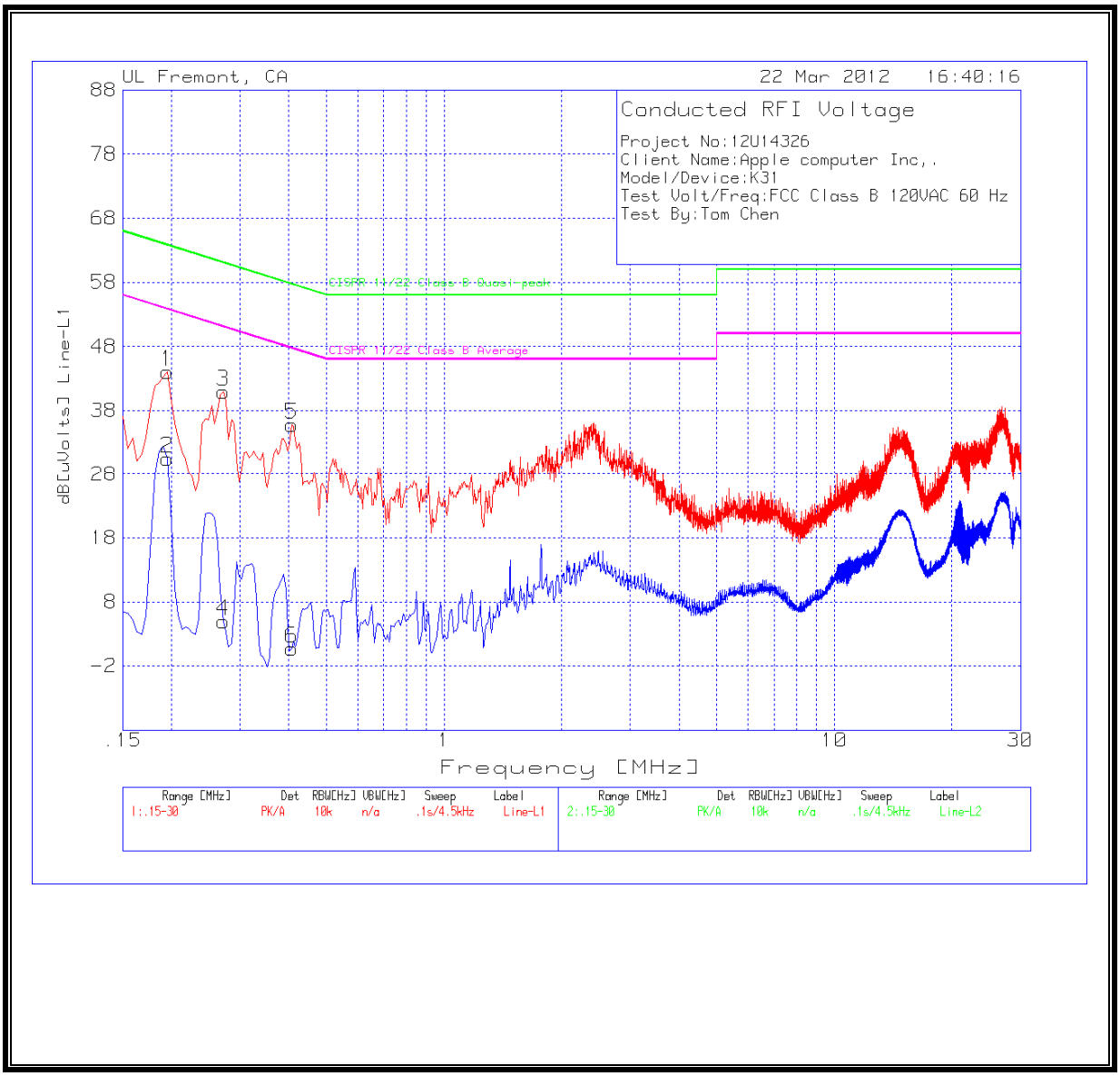
Line-L1 .15 - 30MHz

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

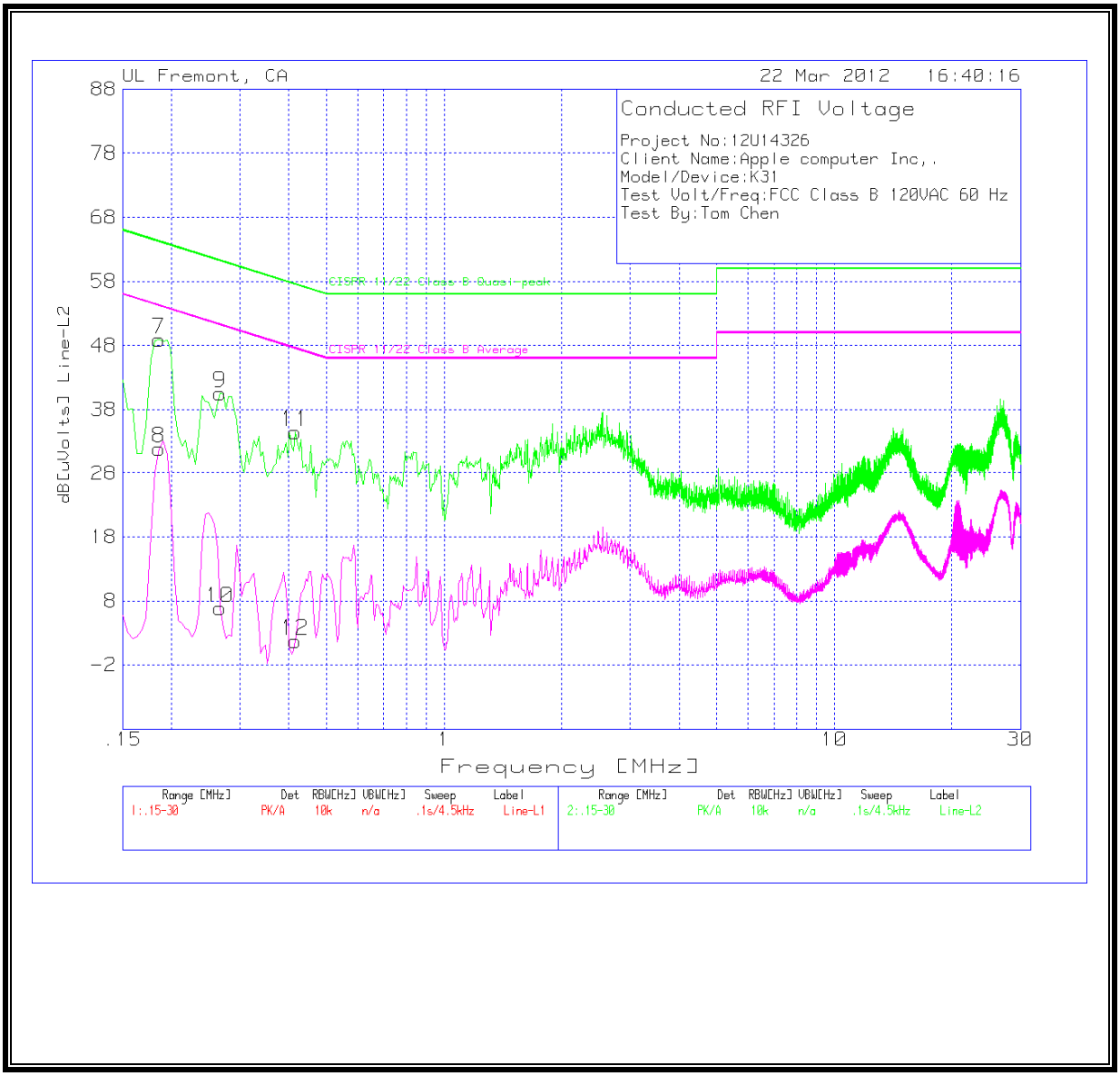
Line-L2 .15 - 30MHz

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

LINE 1 RESULTS



LINE 2 RESULTS



10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

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

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

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

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

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

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

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

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

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

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

Source-based time-averaged EIRP = (DC / 100) * EIRP

where

DC = Duty Cycle in %, as applicable
EIRP = Equivalent Isotropic Radiated Power in W

For multiple chain devices, and colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply, a fraction of the exposure limit is established for each band, such that the sum of the fractions is less than or equal to one.

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

LIMITS

For mobile radio equipment operating in the cellular phone band, the lowest power density limit is calculated using the lowest frequency, as 824 MHz / 1500 = 0.55 mW/cm^2 (FCC) and 824 MHz / 150 = 5.5 W/m^2 (IC).

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

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

RESULTS

Multiple chain or colocated transmitters								
Band	**Mode**	**Chain for MIMO**	**Separation Distance (m)**	**Output AV Power (dBm)**	**Antenna Gain (dBi)**	**Duty Cycle (%)**	**IC Power Density (W/m^2)**	**FCC Power Density (mW/cm^2)**
2.4 GHz	WLAN	1		20.50	1.49	100		
2.4 GHz	WLAN	2		20.65	1.82	100		
Combined			0.20				0.67	0.067

Multiple chain or colocated transmitters								
Band	**Mode**	**Chain for MIMO**	**Separation Distance (m)**	**Output AV Power (dBm)**	**Antenna Gain (dBi)**	**Duty Cycle (%)**	**IC Power Density (W/m^2)**	**FCC Power Density (mW/cm^2)**
5 GHz	WLAN	1		18.20	2.74	100		
5 GHz	WLAN	2		17.80	3.11	100		
Combined			0.20				0.49	0.049

Multiple chain or colocated transmitters									
Band	**Mode**	**Chain for MIMO**	**Separation Distance (m)**	**Output Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**EIRP (W)**	**IC Power Density (W/m^2)**	**FCC Power Density (mW/cm^2)**
2.4 GHz	WLAN	1		20.50	1.49	21.99	0.16		
2.4 GHz	WLAN	2		20.65	1.82	22.47	0.18		
5 GHz	WLAN	1		18.20	2.74	20.94	0.12		
5 GHz	WLAN	2		17.80	3.11	20.91	0.12		
Combined			0.20				0.58	1.16	0.116