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

CERTIFICATION TEST REPORT

FOR

IEEE 802.11a/b/g/n AND BLUETOOTH RADIO

MODEL NUMBER: A1421

FCC ID: BCG-A1421
IC ID: 579C-A1421

REPORT NUMBER: 12U14485-1, REVISION A

ISSUE DATE: AUGUST 09, 2012

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

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	07/06/12	Initial Issue	T. LEE
A	08/09/12	Corrected Average Power	T. LEE

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: IEEE 802.11a/b/g/n AND BLUETOOTH RADIO

MODEL: A1421

SERIAL NUMBER: CCQHT01CF4K3

DATE TESTED: JUNE 29 - JULY 09, 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

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:

TIM LEE
STAFF ENGINEER
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 C63.10-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Model A1421, is a iPod Touch with multimedia functions (music, application support, and video), IEEE 802.11a/b/g/n and Bluetooth radio. The rechargeable battery is not user accessible.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	19.63	91.83
2412 - 2462	802.11g	25.73	374.11
2412 - 2462	802.11n HT20	25.61	363.92
5745 - 5825	802.11a	22.29	169.43
5745 - 5825	802.11n HT20	22.56	180.30
5755 - 5795	802.11n HT40	23.60	229.09

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of -1.11dBi in the 2.4 GHz band, and a maximum gain of 2.66dBi in the 5.8 GHz band

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 10A351

The EUT driver software installed during testing was Broadcom_Rel_6_10_56_158

The test utility software used during testing was WL_tool.

6. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Based on the manufacturer's attestation that the nominal output power is reduced as the data rate increases, the data rates tested represent the highest power and worst-case with respect to EMC performance.

Worst-case data rates were:

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20mode: MCS0
802.11n HT40mode: MCS0

6.1. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

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

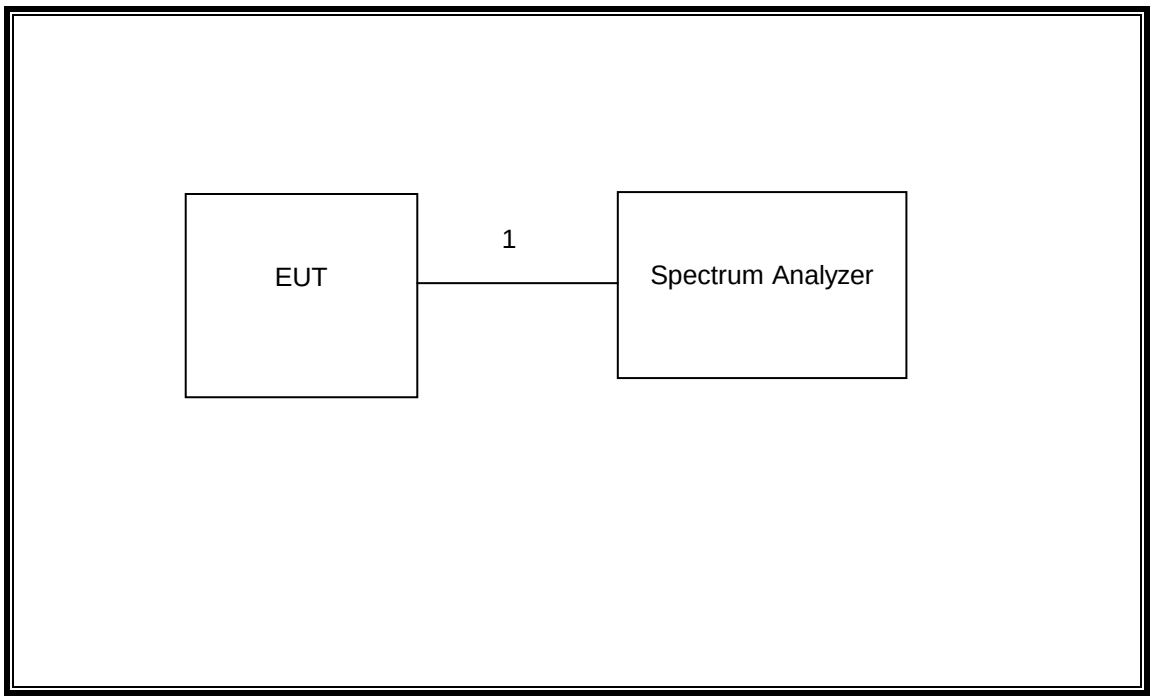
I/O CABLES (Conducted Setup)

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

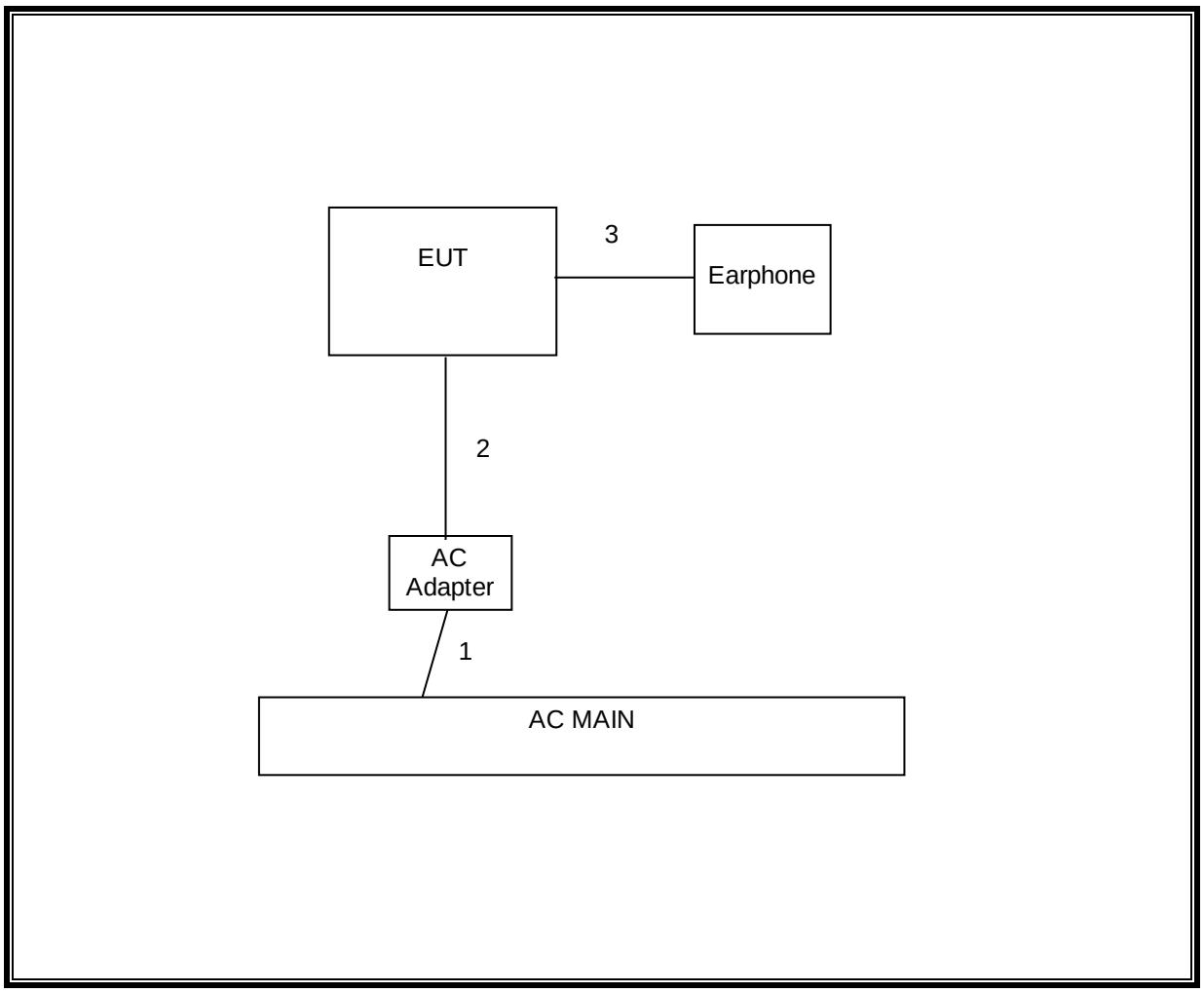
I/O CABLES (Radiated Setup)

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	AC	Unshielded	2m	N/A
2	DC	1	DC	Unshielded	1m	N/A
3	Jack	1	Earphone	Unshielded	0.5m	N/A

SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED EMISSIONS TESTS



7. 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	07/14/13
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	11/11/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/13
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/13
Horn Antenna, 40 GHz	ARA	MWH-2640/B	C00981	05/10/13
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	04/09/13
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

8. ANTENNA PORT TEST RESULTS

8.1. 802.11b MODE IN THE 2.4 GHz BAND

8.1.1. 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.

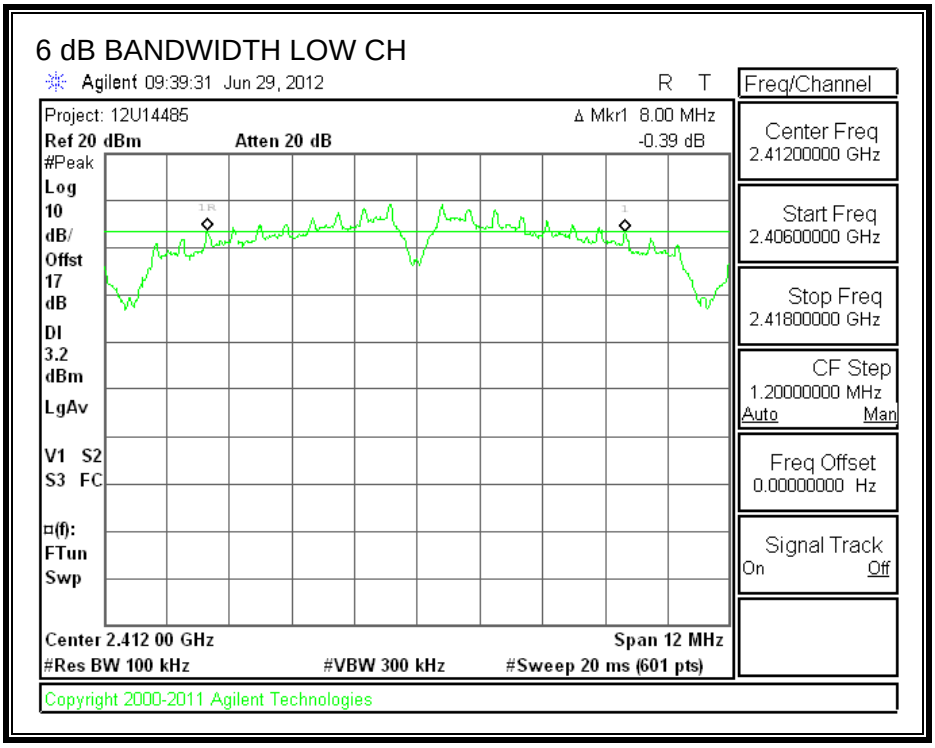
TEST PROCEDURE

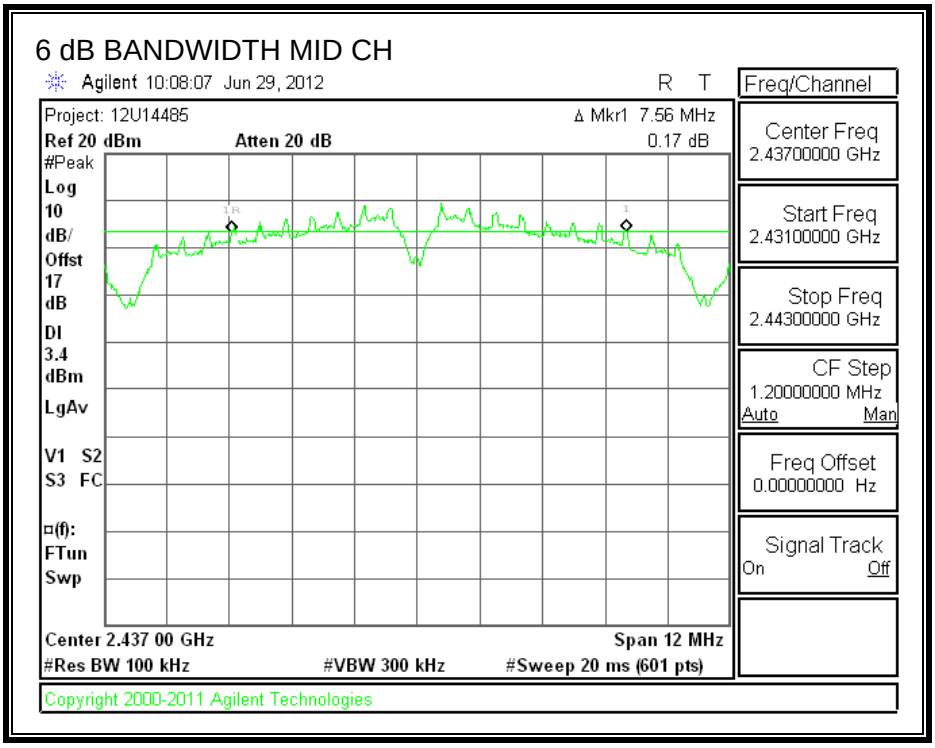
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

RESULTS

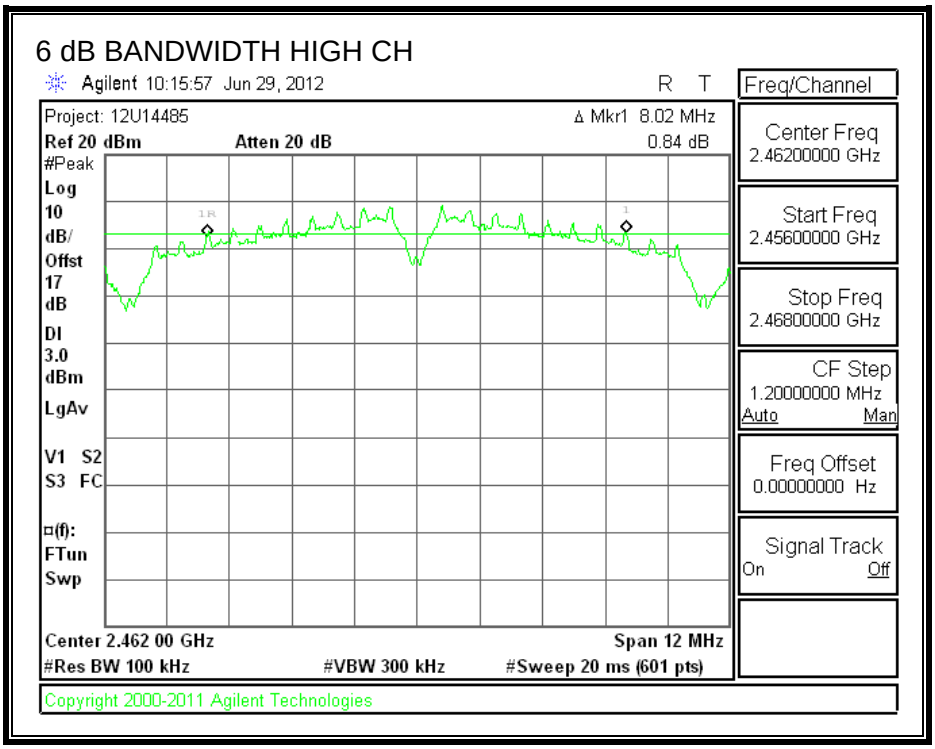
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	8.00	0.5
Middle	2437	7.56	0.5
High	2462	8.02	0.5

6 dB BANDWIDTH





6 dB BANDWIDTH HIGH CH



8.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

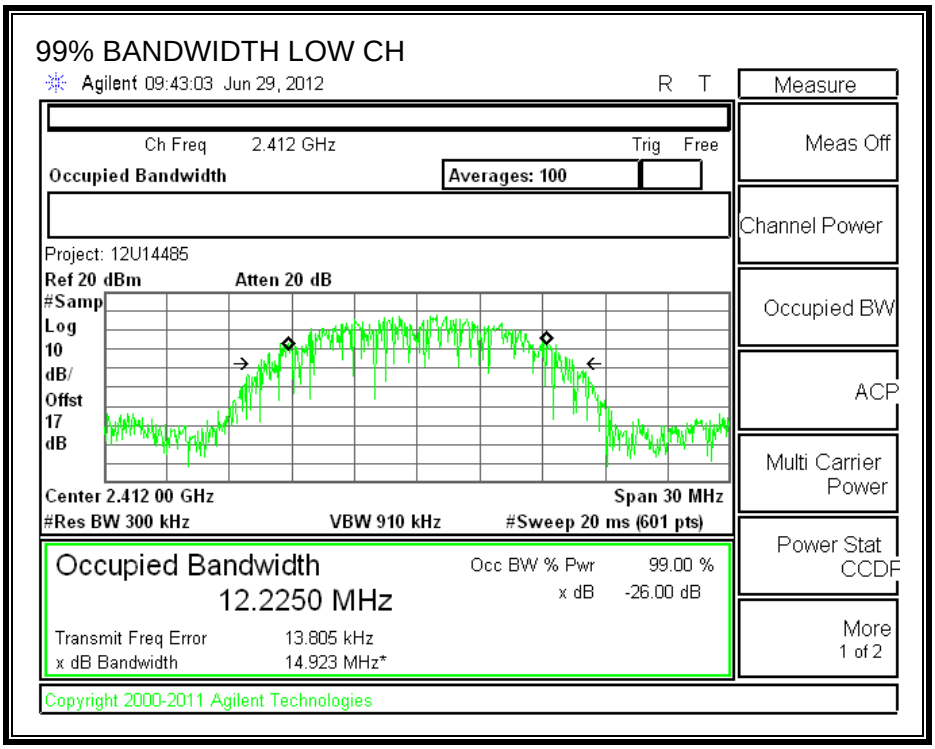
TEST PROCEDURE

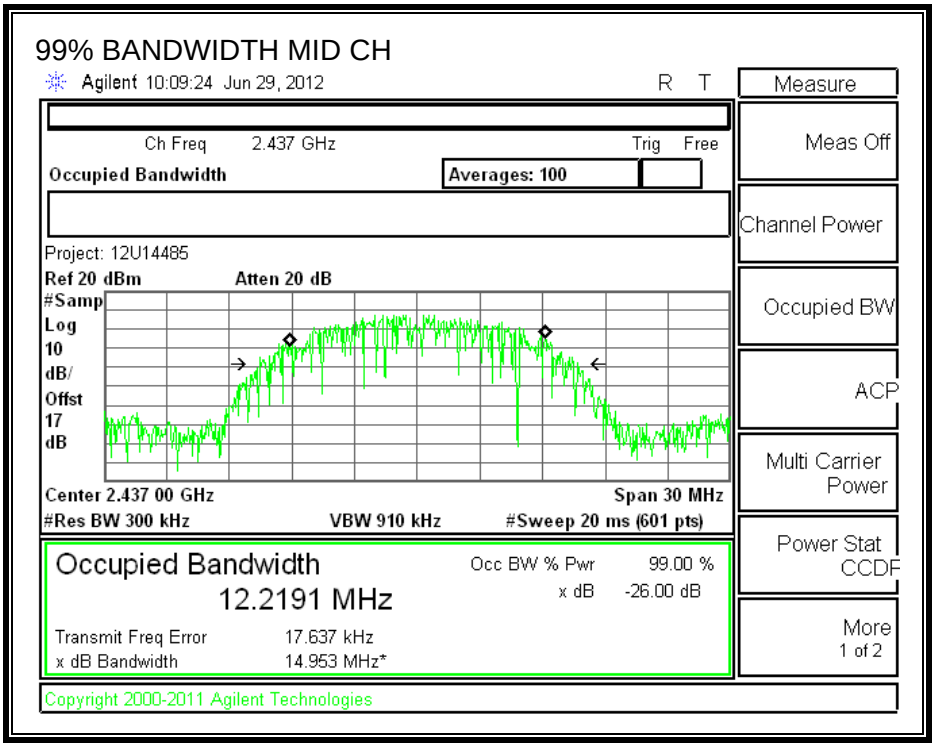
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

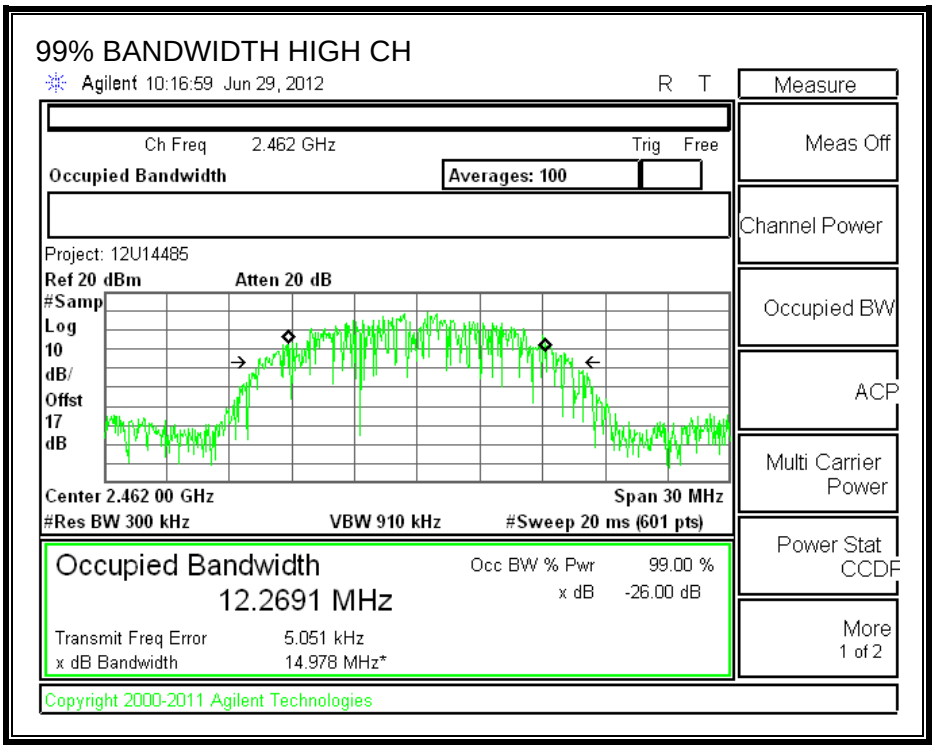
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	12.2250
Middle	2437	12.2191
High	2462	12.2691

99% BANDWIDTH







8.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

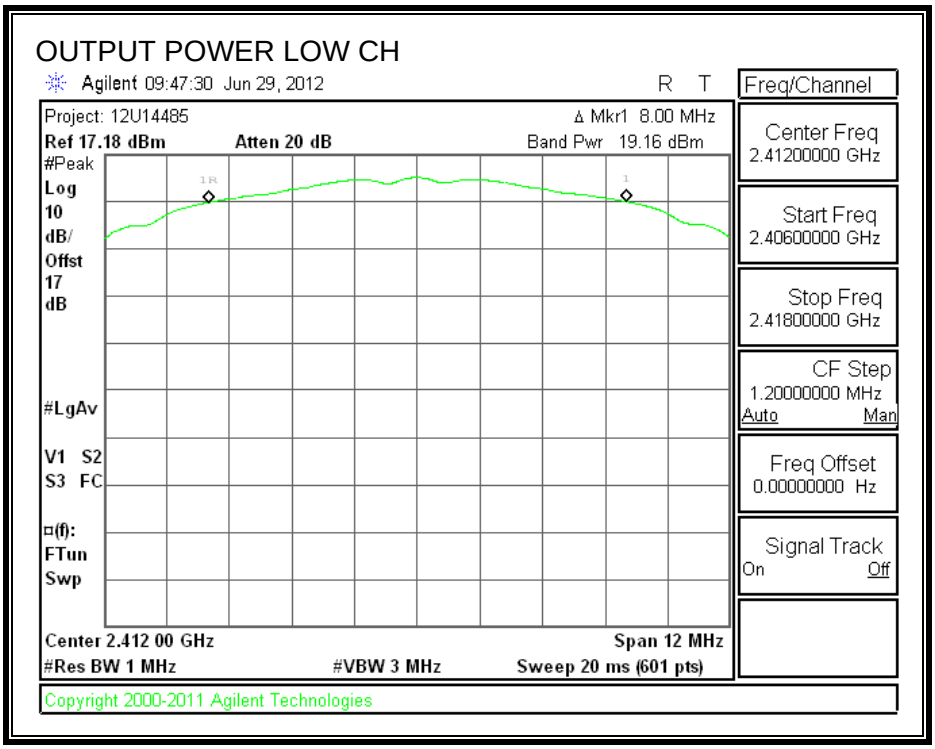
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

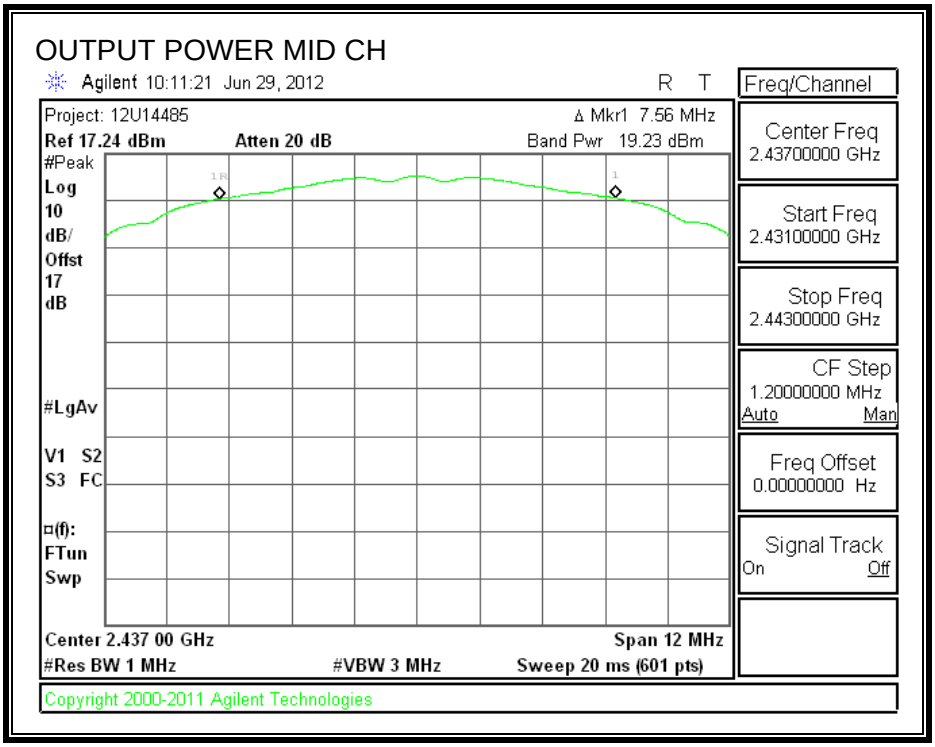
RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.16	30	-10.84
Middle	2437	19.23	30	-10.77
High	2462	19.63	30	-10.37

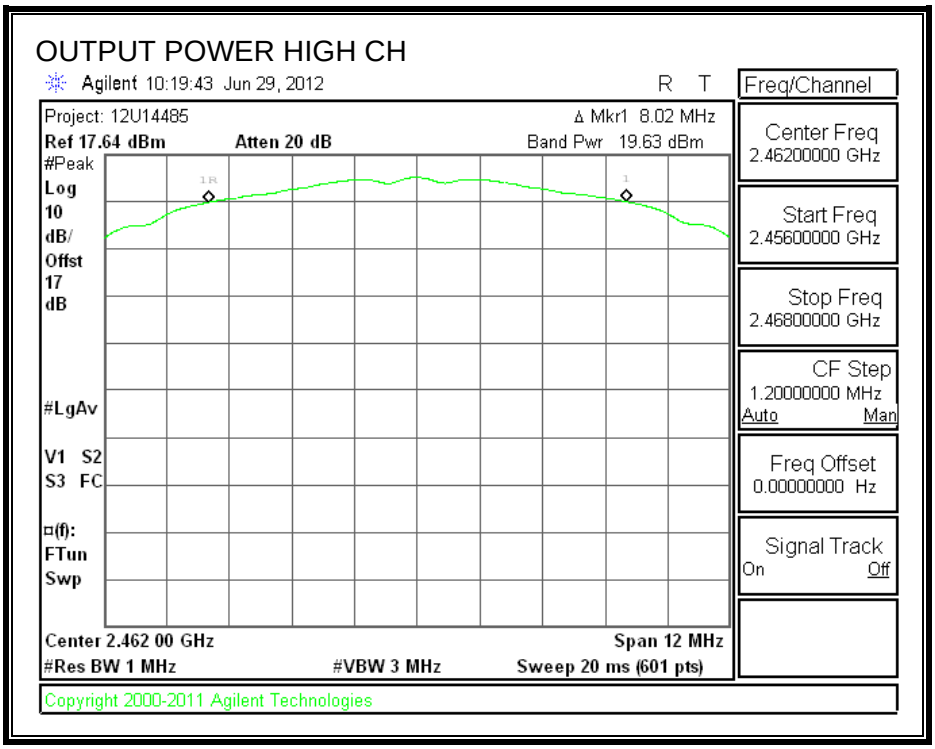
OUTPUT POWER



OUTPUT POWER MID CH



OUTPUT POWER HIGH CH



8.1.4. 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)	AV power (dBm)
Low	2412	16.49
Middle	2437	16.5
High	2462	16.48

8.1.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

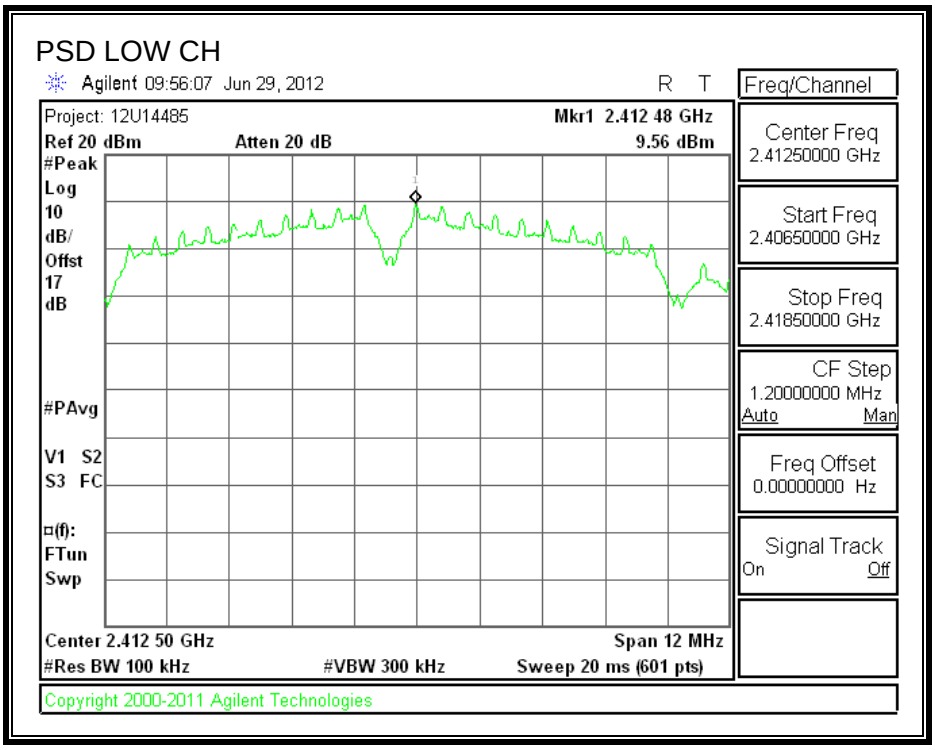
TEST PROCEDURE

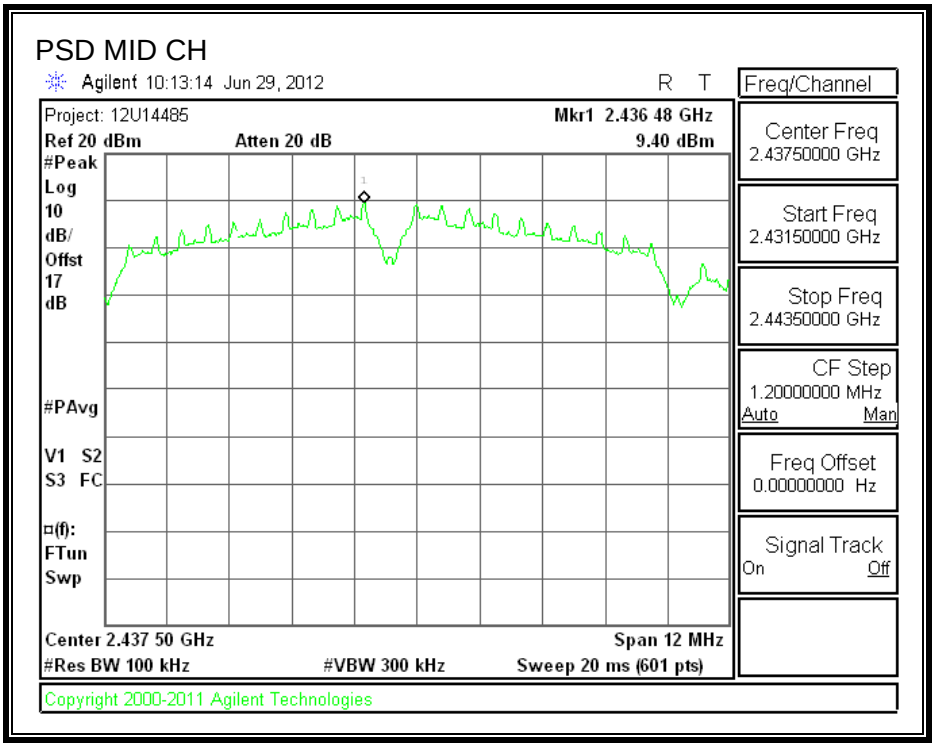
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

RESULTS

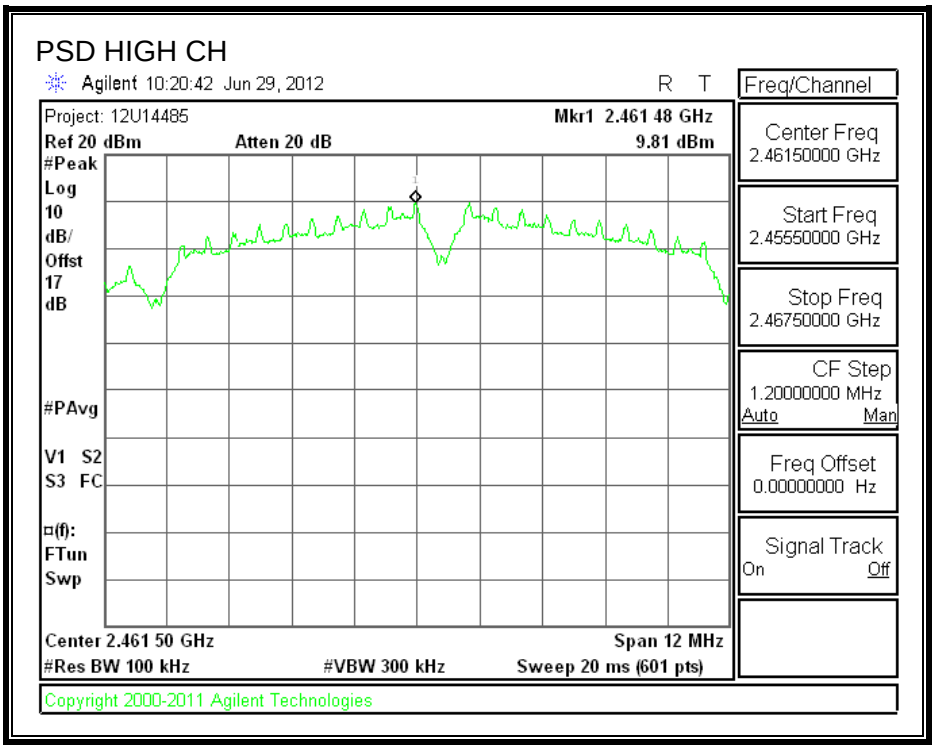
Channel	Frequency (MHz)	PSD (dBm)	10log(3kHz/100kHz) (dBm)	Limit (dBm)	Margin (dB)
Low	2412	9.56	-15.2	8	-13.64
Middle	2437	9.40	-15.2	8	-13.80
High	2462	9.81	-15.2	8	-13.39

POWER SPECTRAL DENSITY





PSD HIGH CH



8.1.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

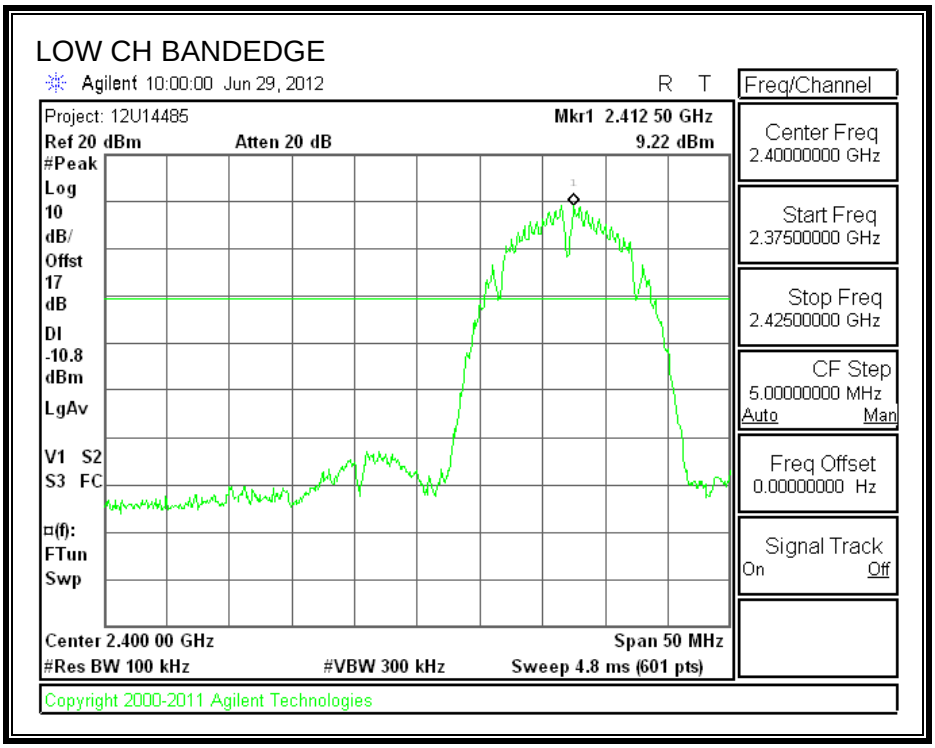
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

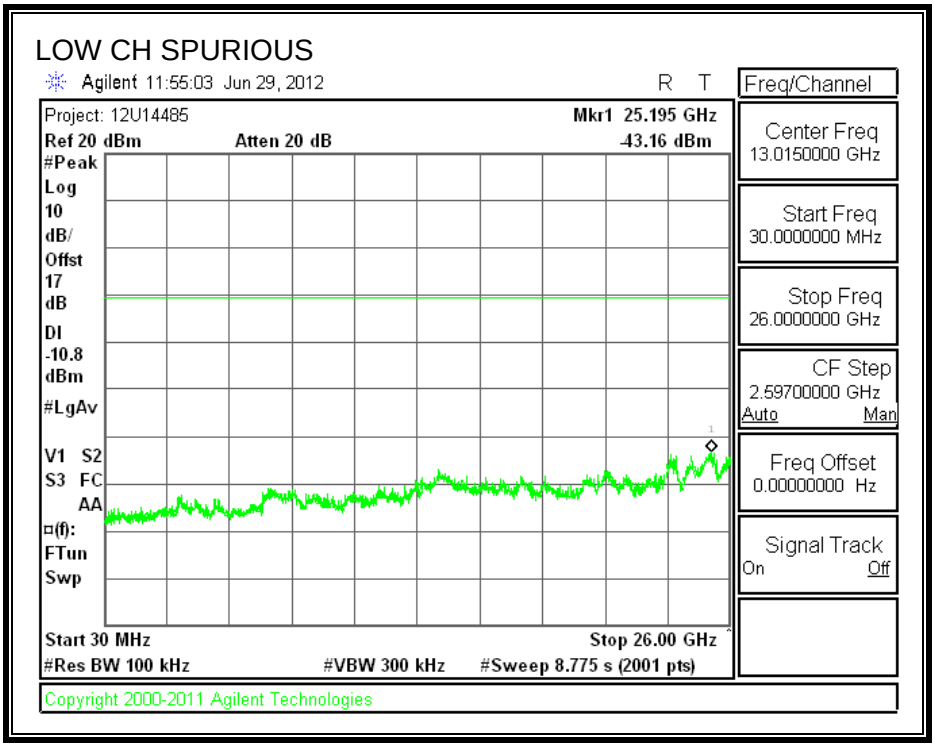
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

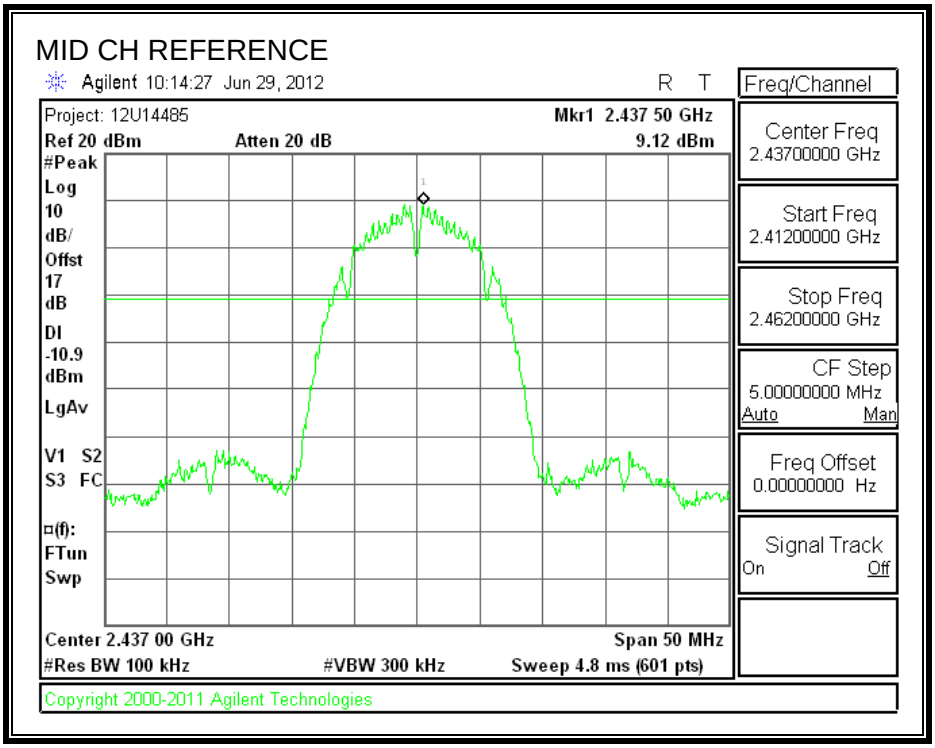
RESULTS

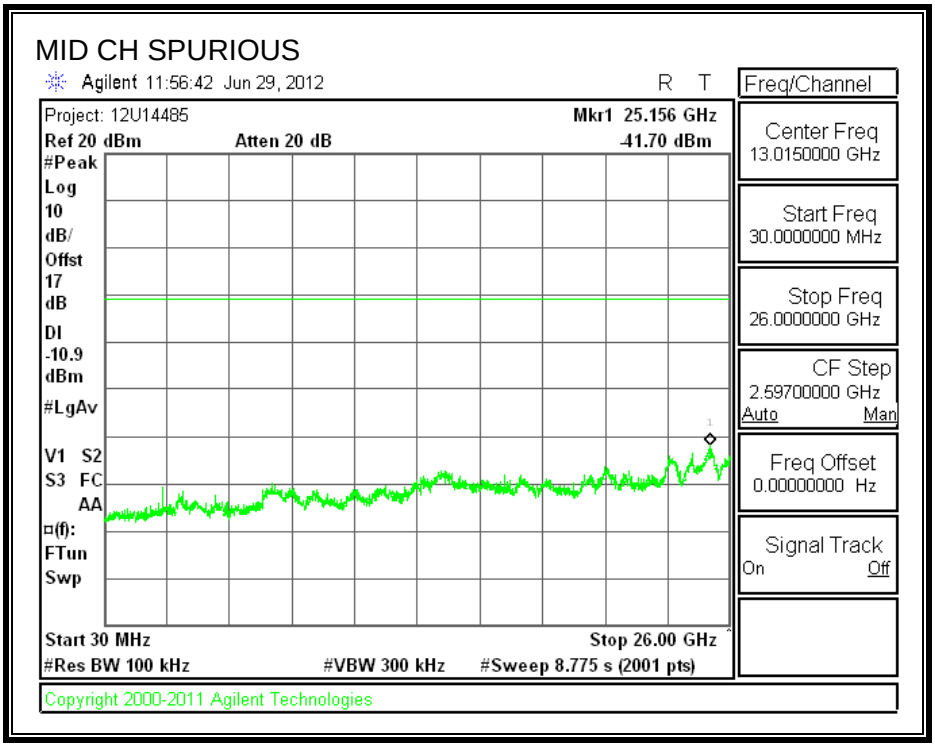
SPURIOUS EMISSIONS, LOW CHANNEL



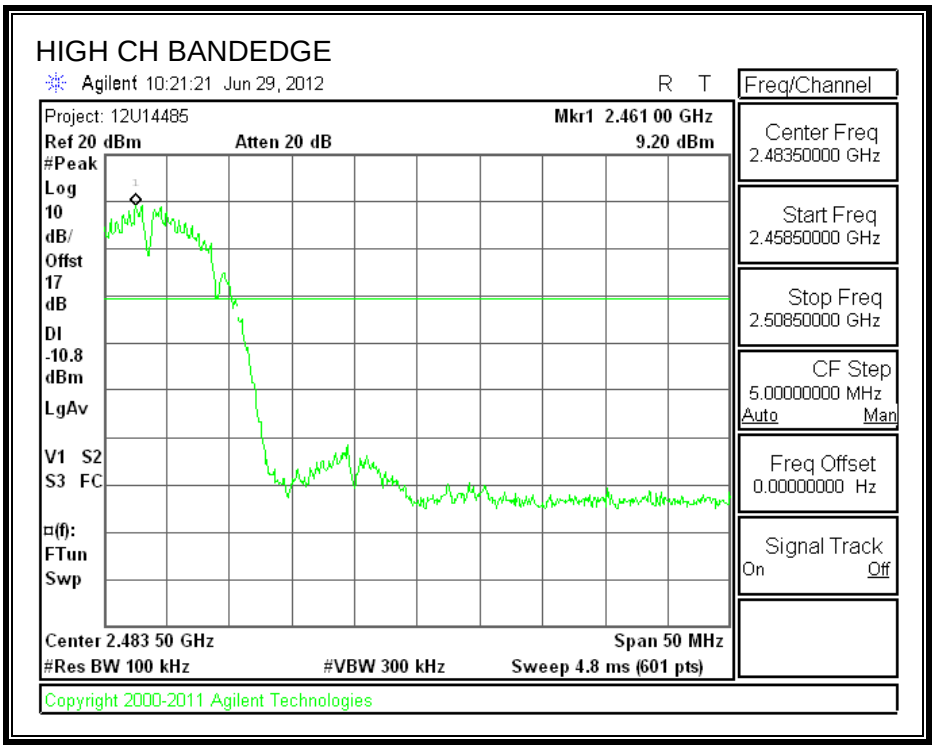


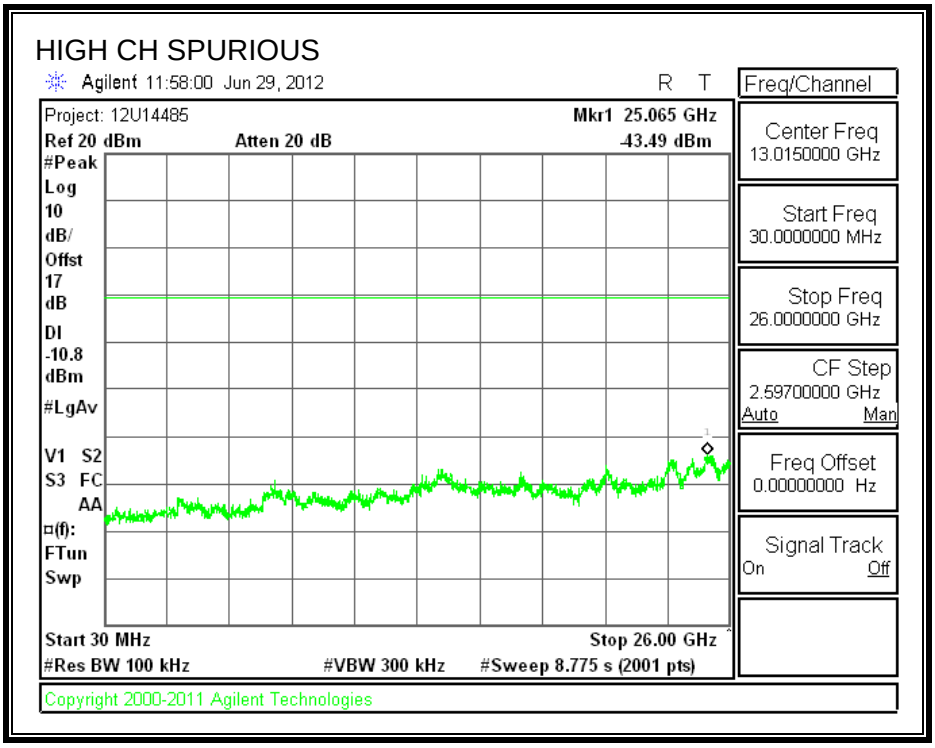
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





8.2. 802.11g MODE IN THE 2.4 GHz BAND

8.2.1. 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.

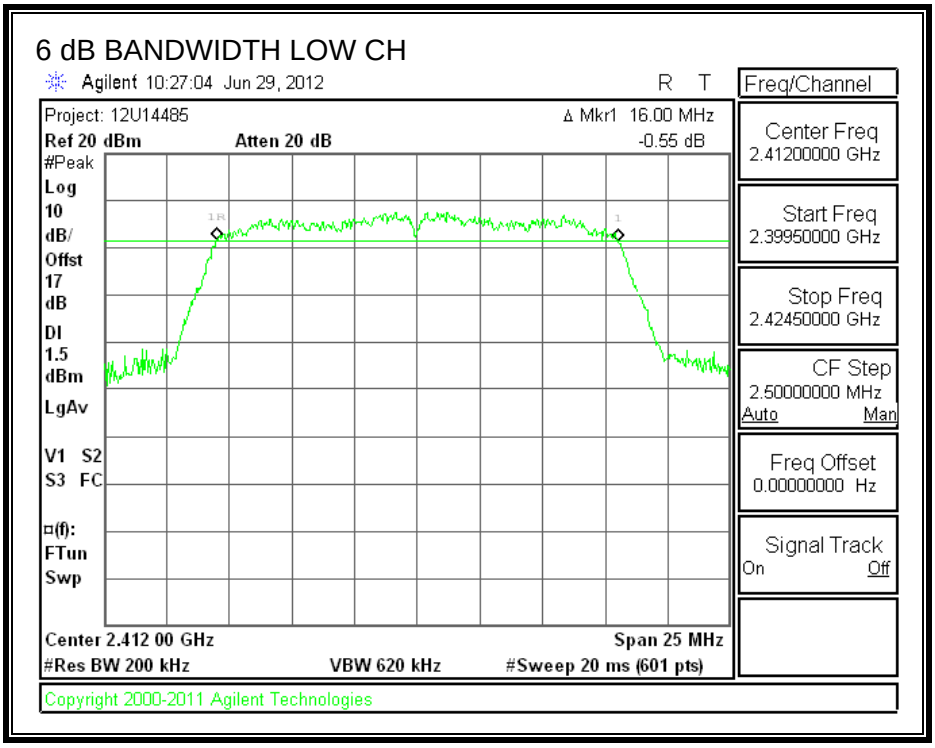
TEST PROCEDURE

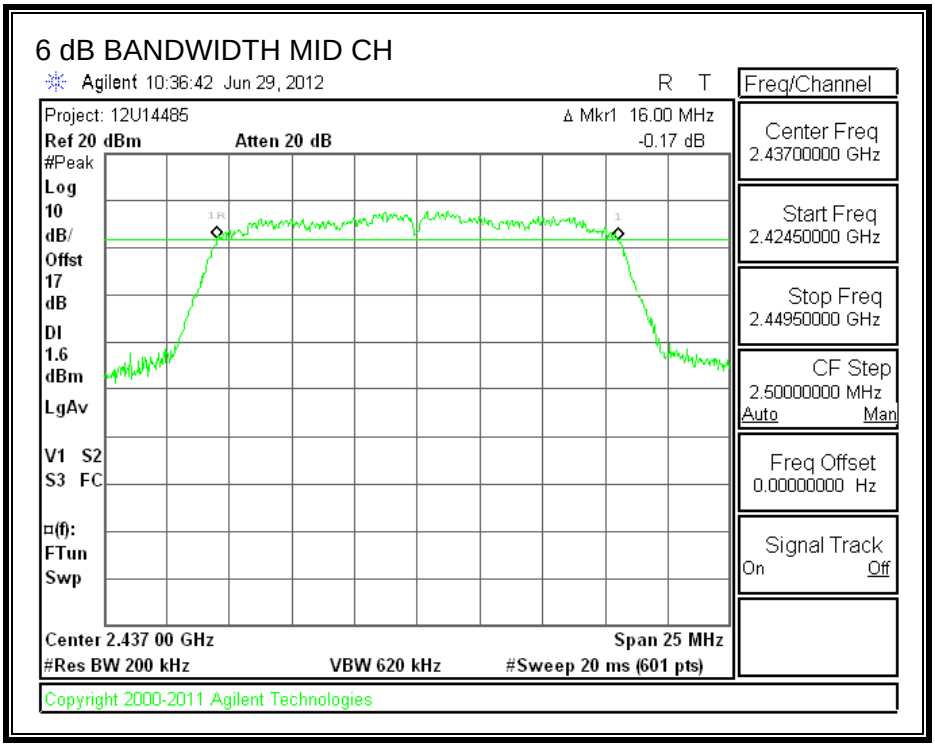
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

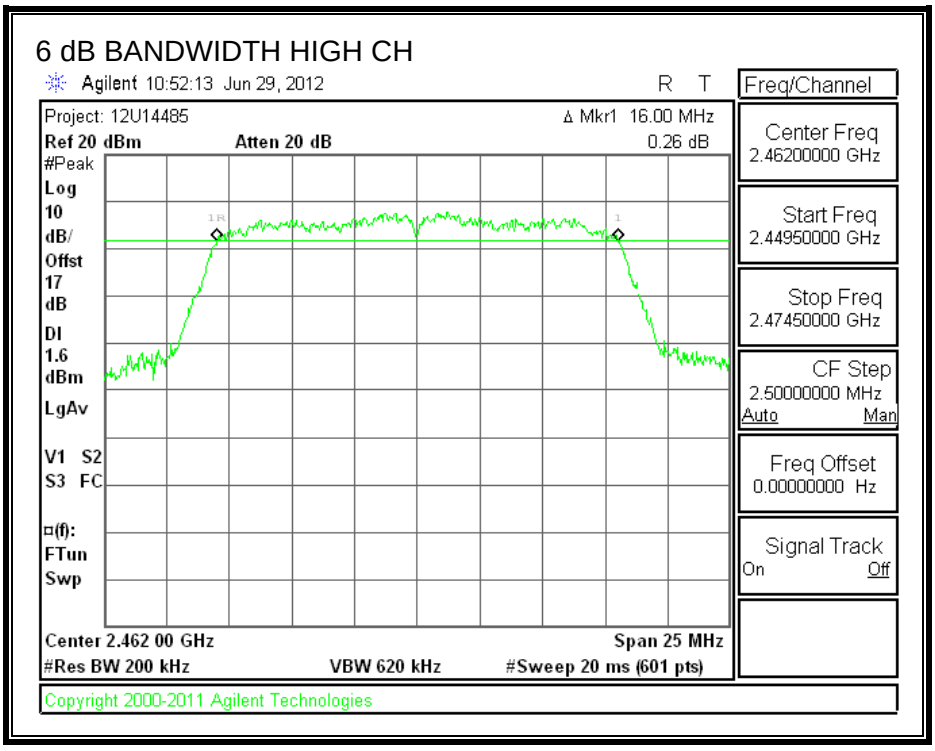
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	16.00	0.5
Middle	2437	16.00	0.5
High	2462	16.00	0.5

6 dB BANDWIDTH







8.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

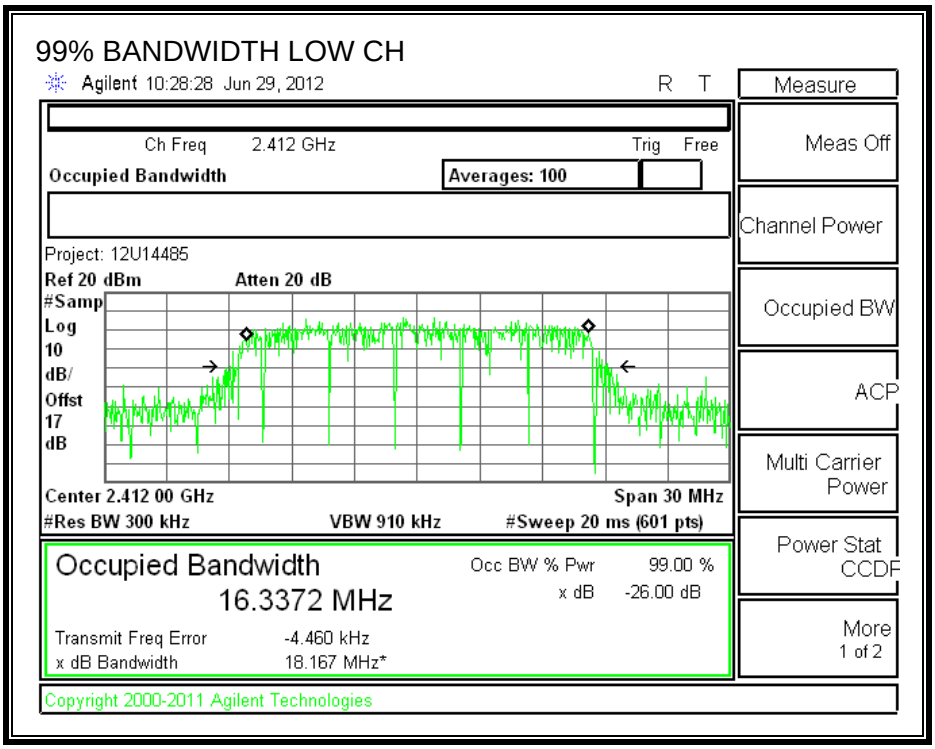
TEST PROCEDURE

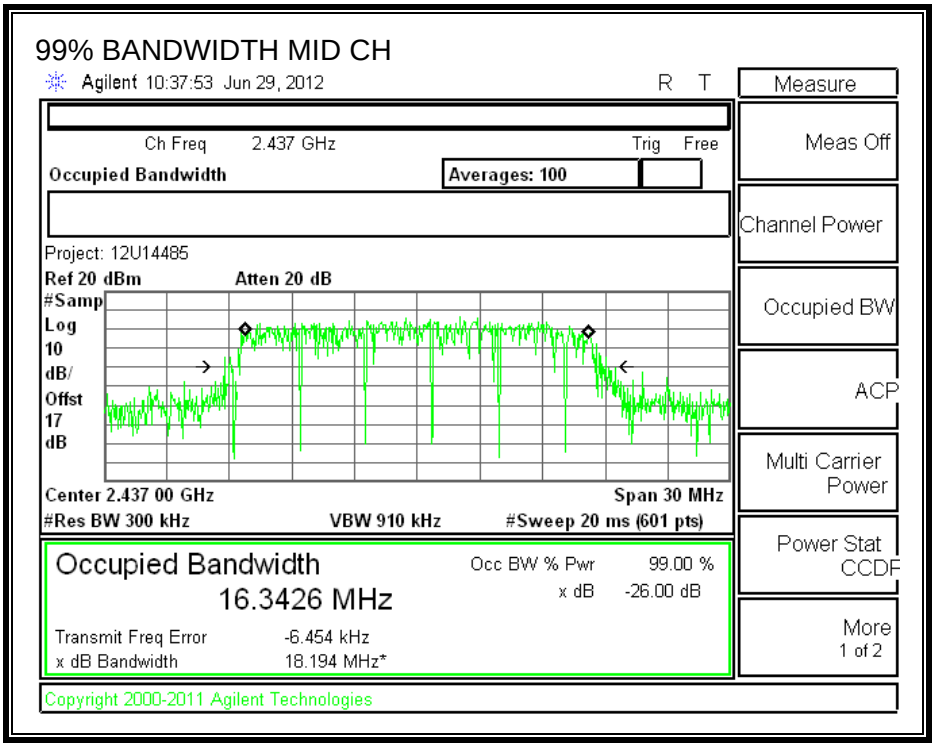
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

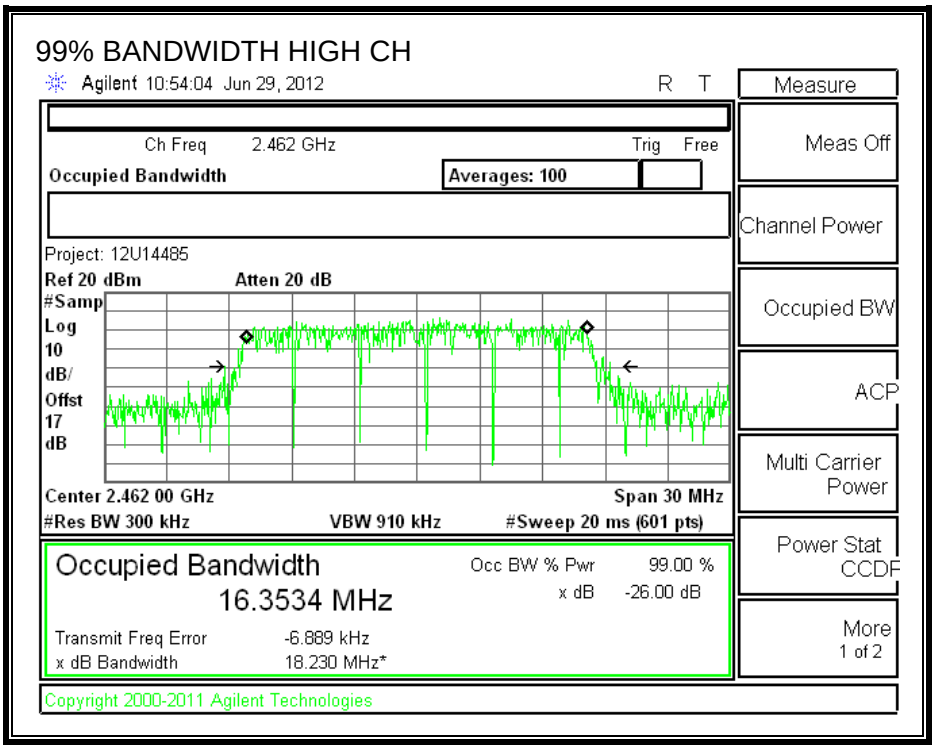
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.3372
Middle	2437	16.3426
High	2462	16.3534

99% BANDWIDTH







8.2.3. 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.

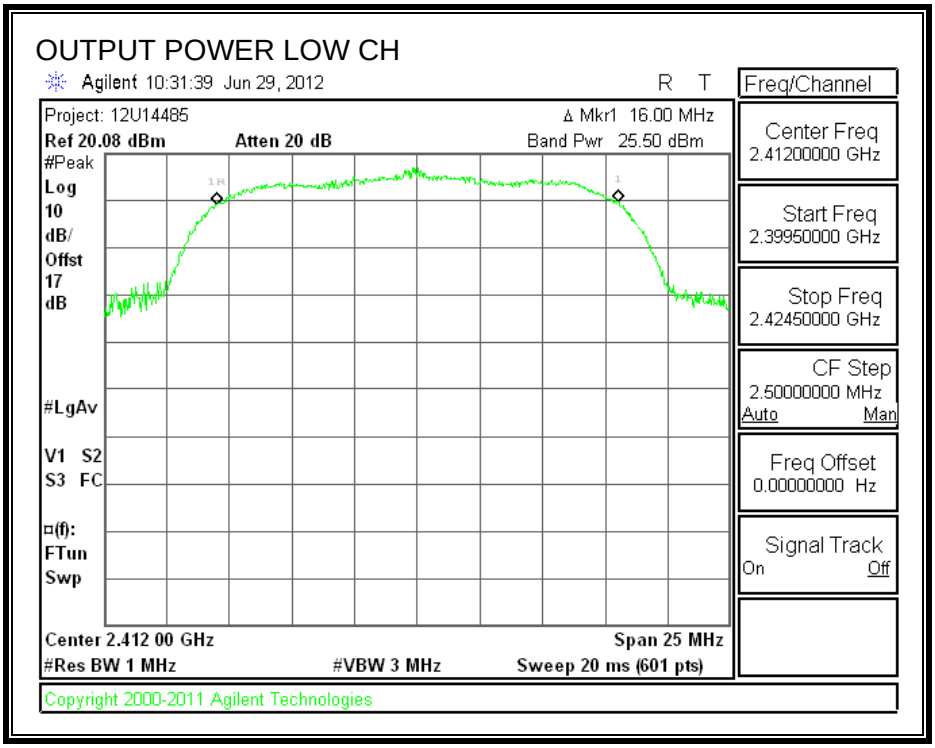
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

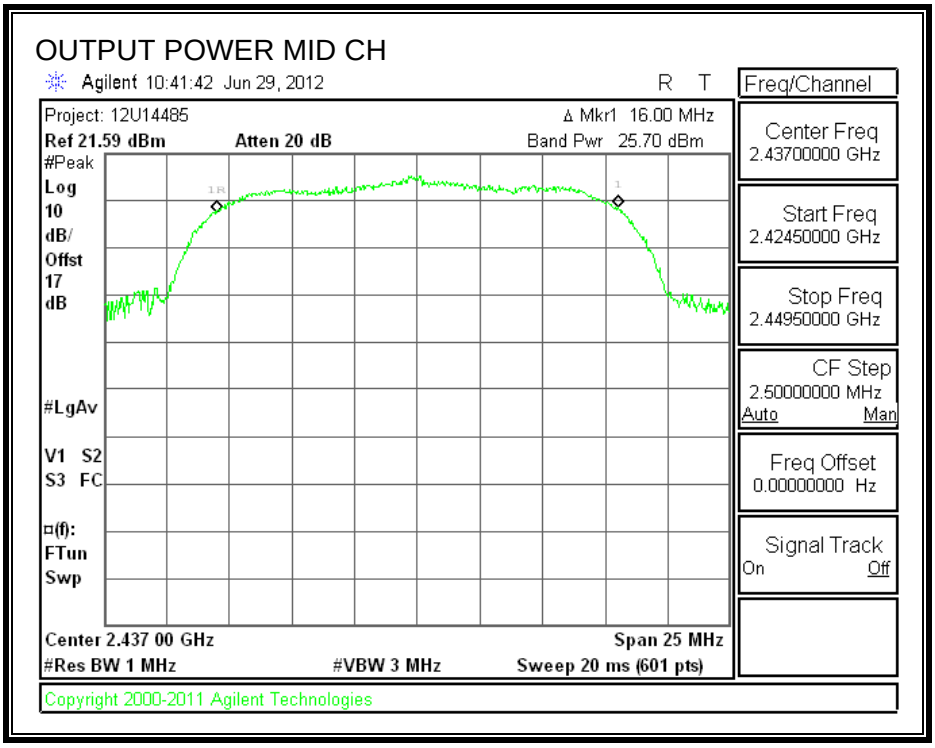
RESULTS

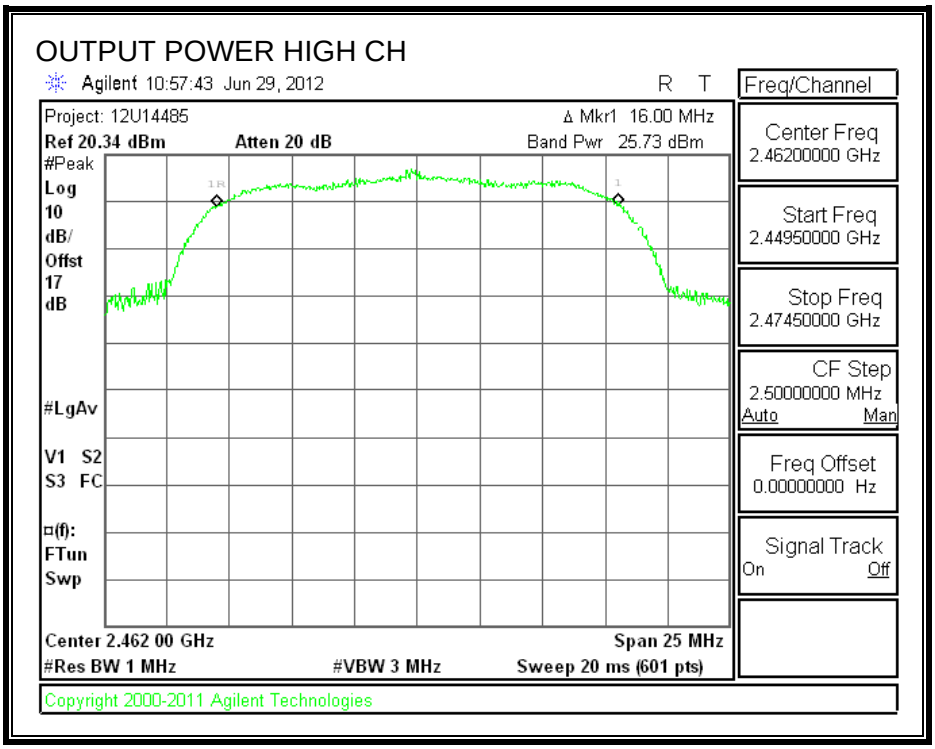
Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	25.50	30	-4.50
Middle	2437	25.70	30	-4.30
High	2462	25.73	30	-4.27

OUTPUT POWER



OUTPUT POWER MID CH





8.2.4. 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)	Power (dBm)
Low	2412	16.50
Middle	2437	16.45
High	2462	16.46

8.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

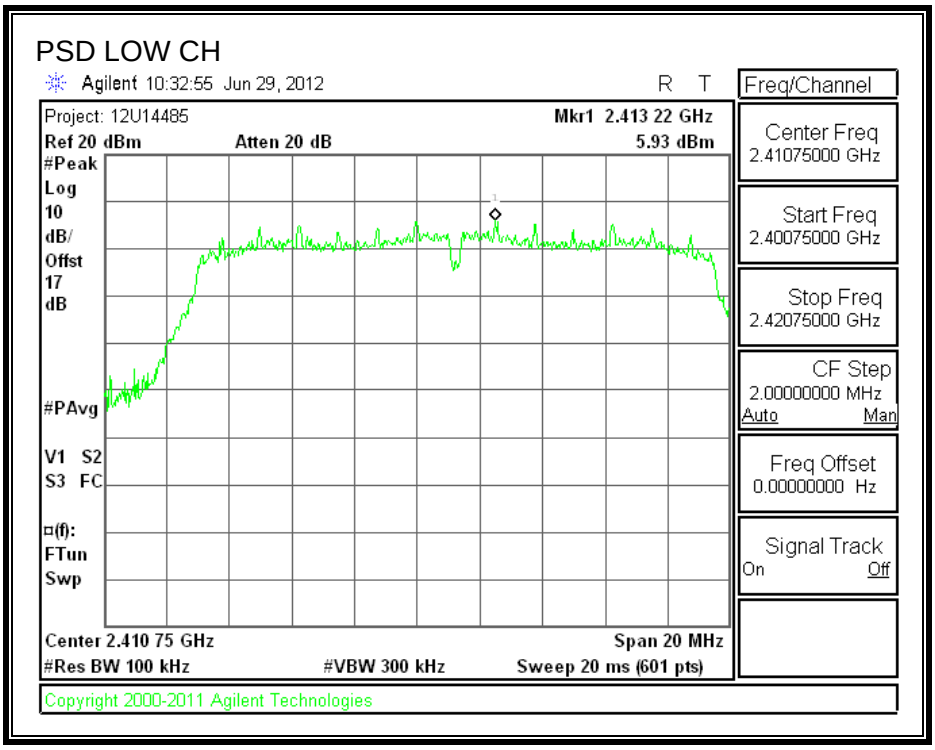
TEST PROCEDURE

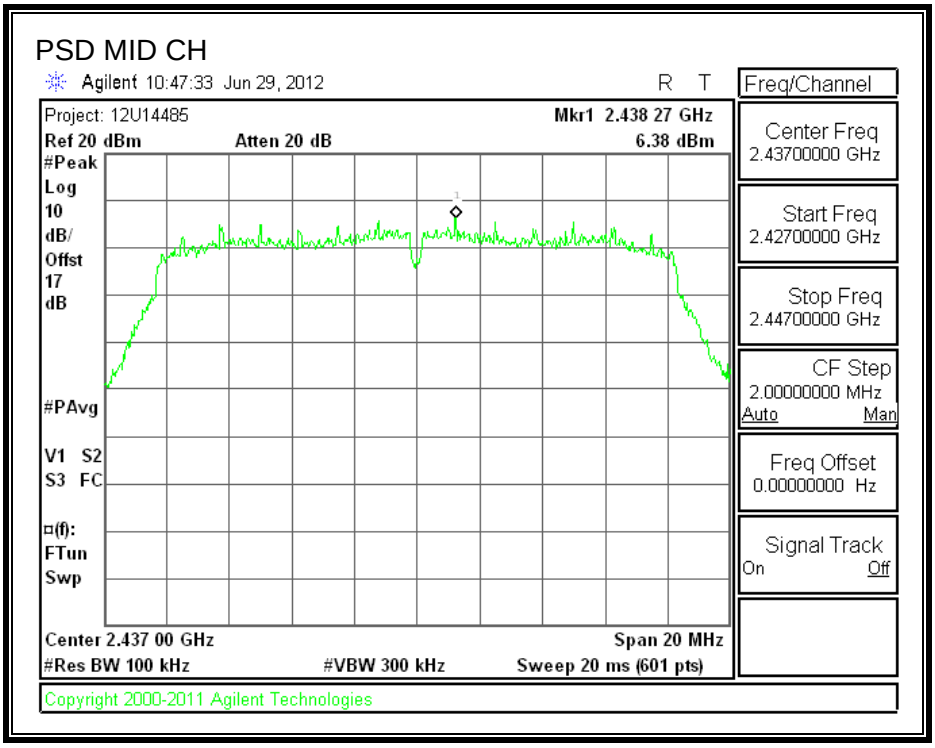
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

RESULTS

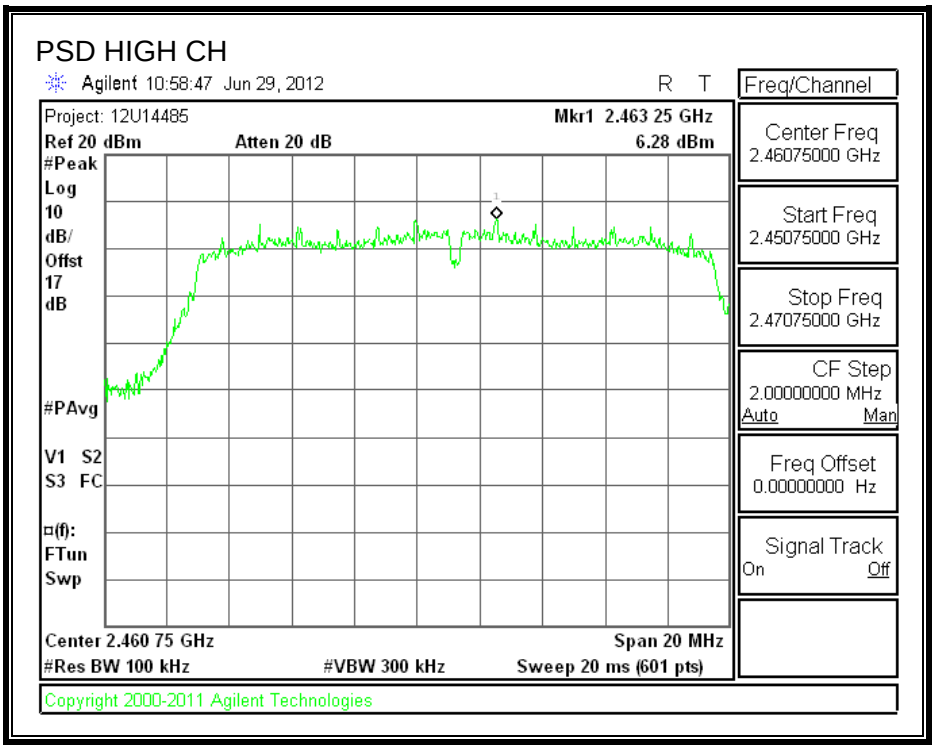
Channel	Frequency (MHz)	PSD (dBm)	10log(3kHz/100kHz) (dBm)	Limit (dBm)	Margin (dB)
Low	2412	5.93	-15.2	8	-17.27
Middle	2437	6.38	-15.2	8	-16.82
High	2462	6.28	-15.2	8	-16.92

POWER SPECTRAL DENSITY





PSD HIGH CH



8.2.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

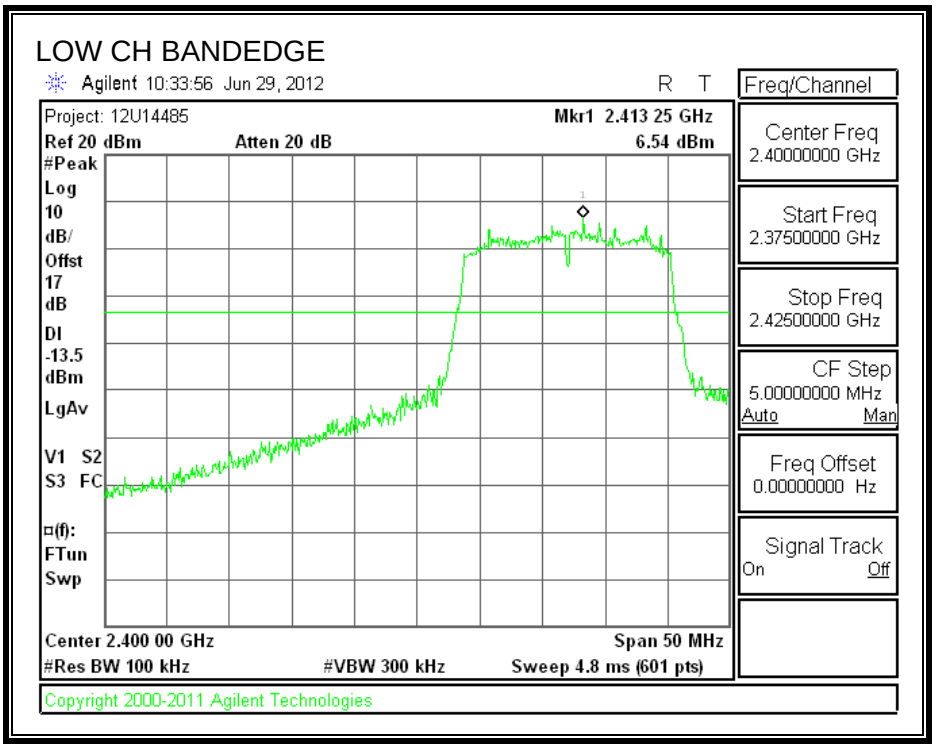
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

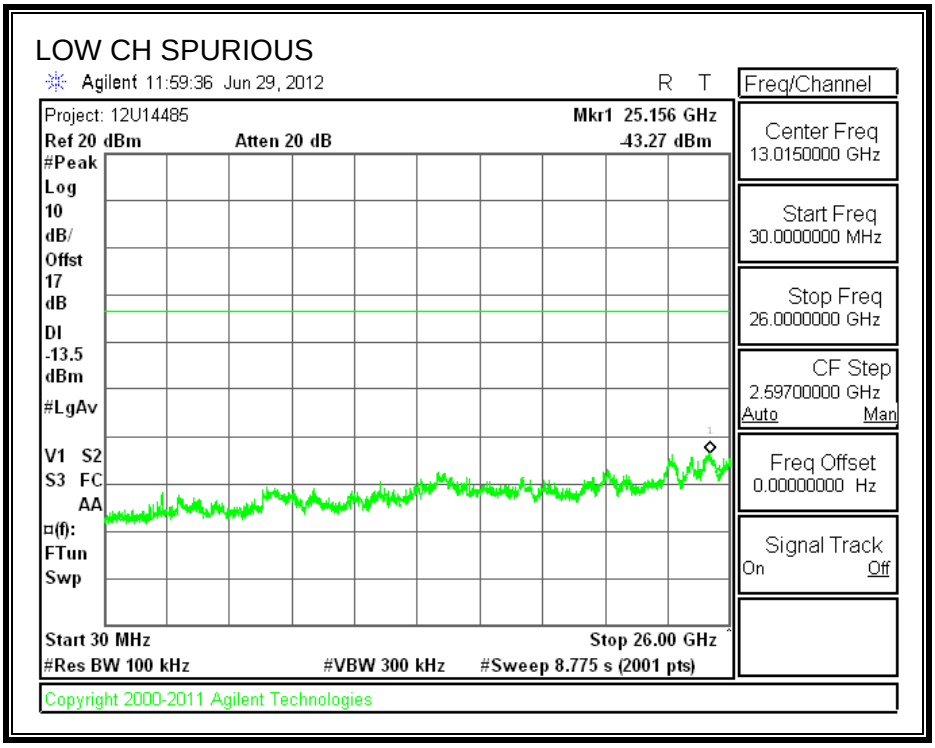
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

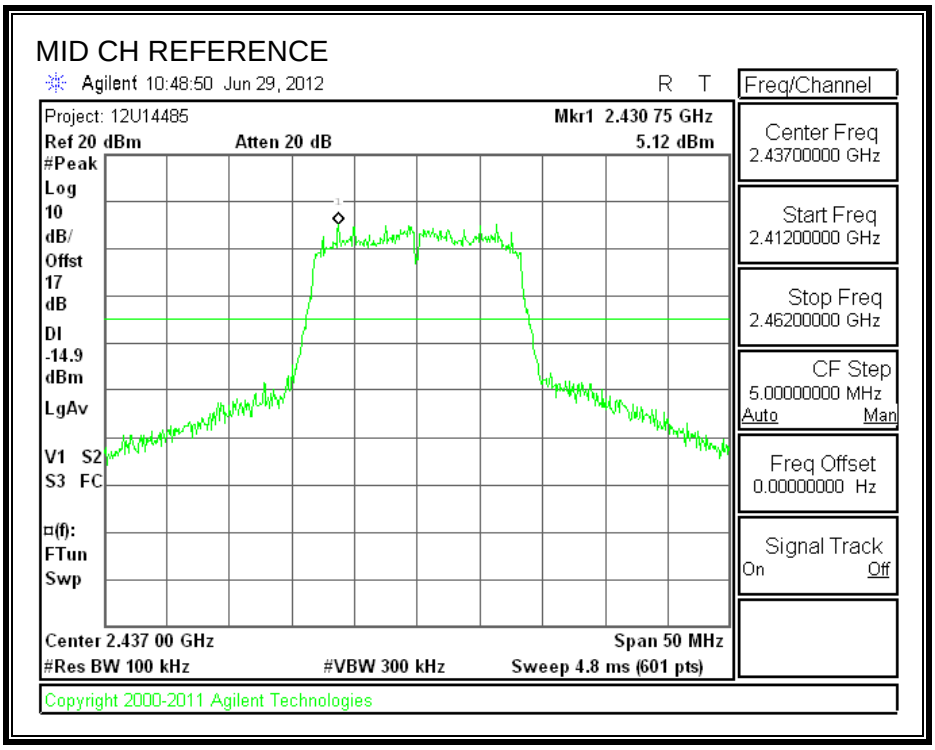
RESULTS

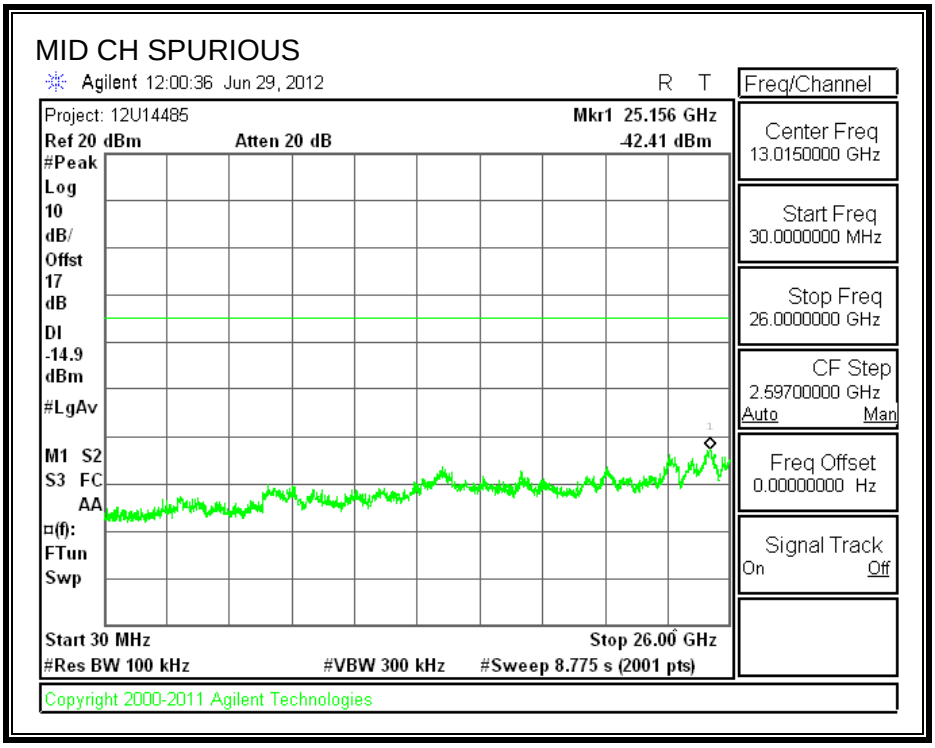
SPURIOUS EMISSIONS, LOW CHANNEL



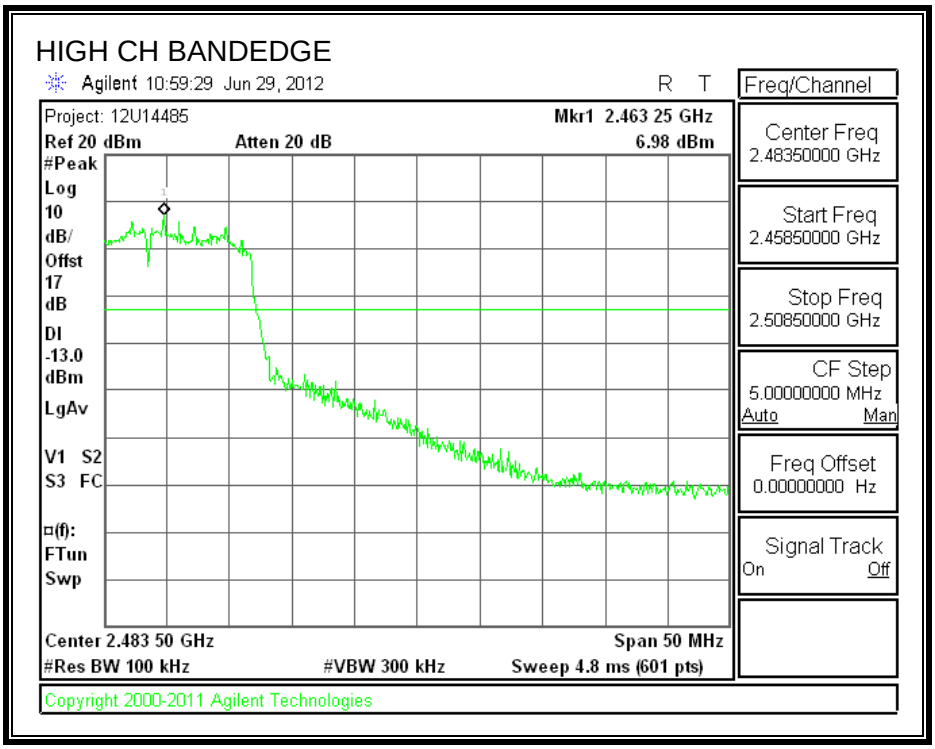


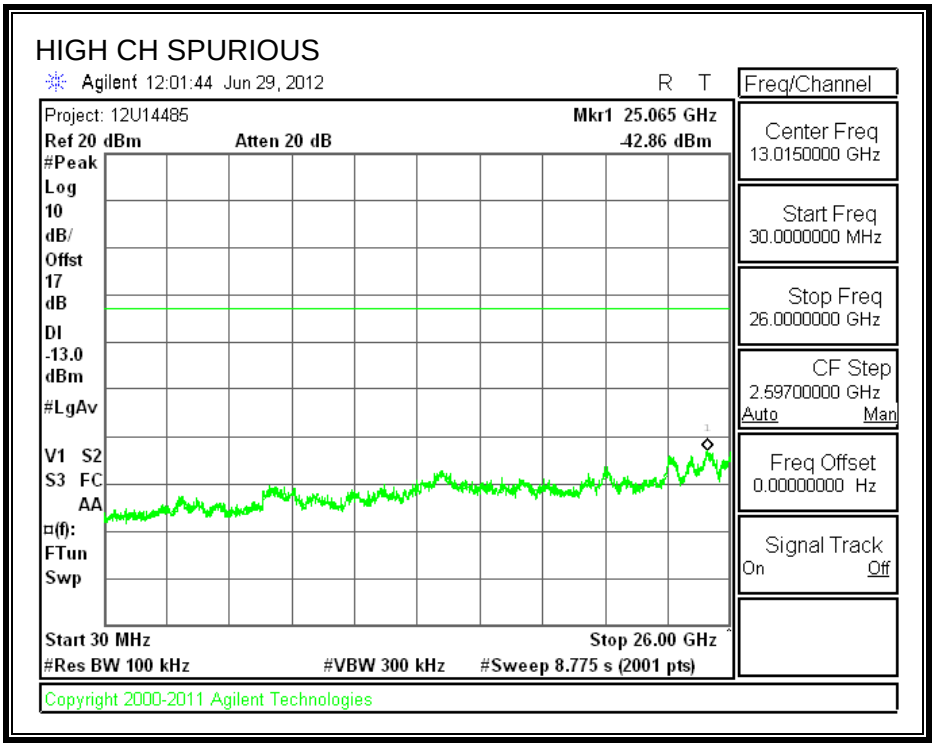
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





8.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

8.3.1. 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.

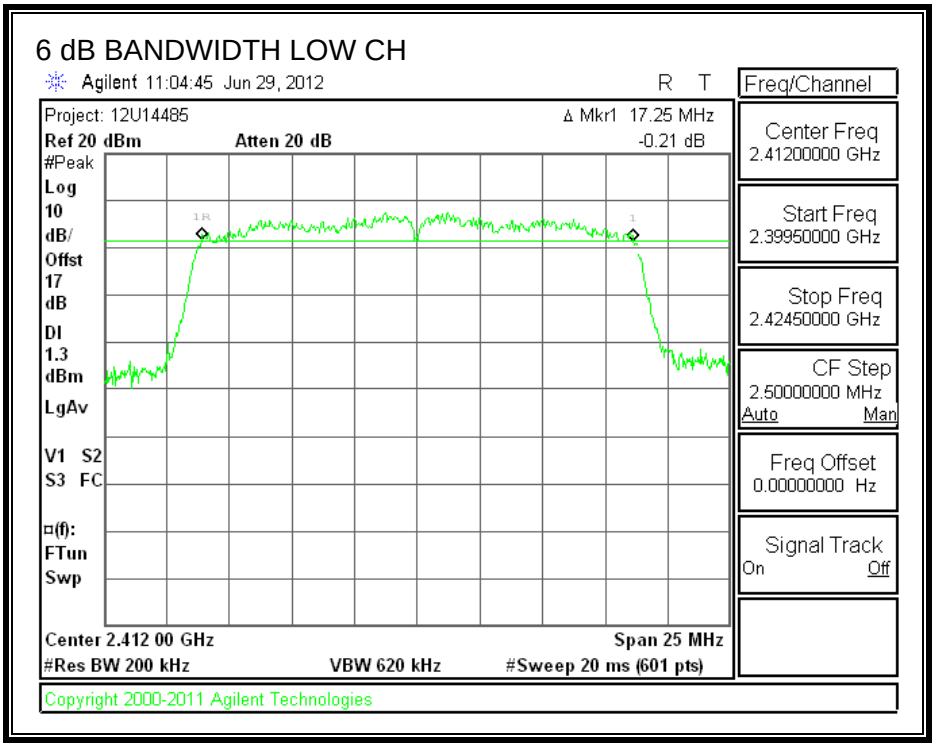
TEST PROCEDURE

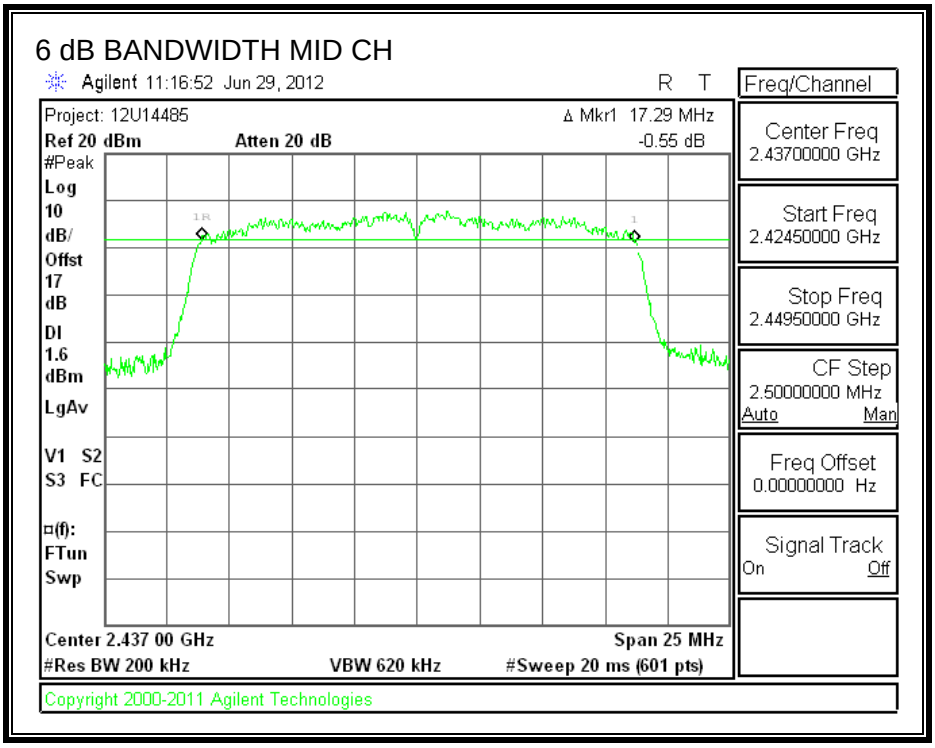
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

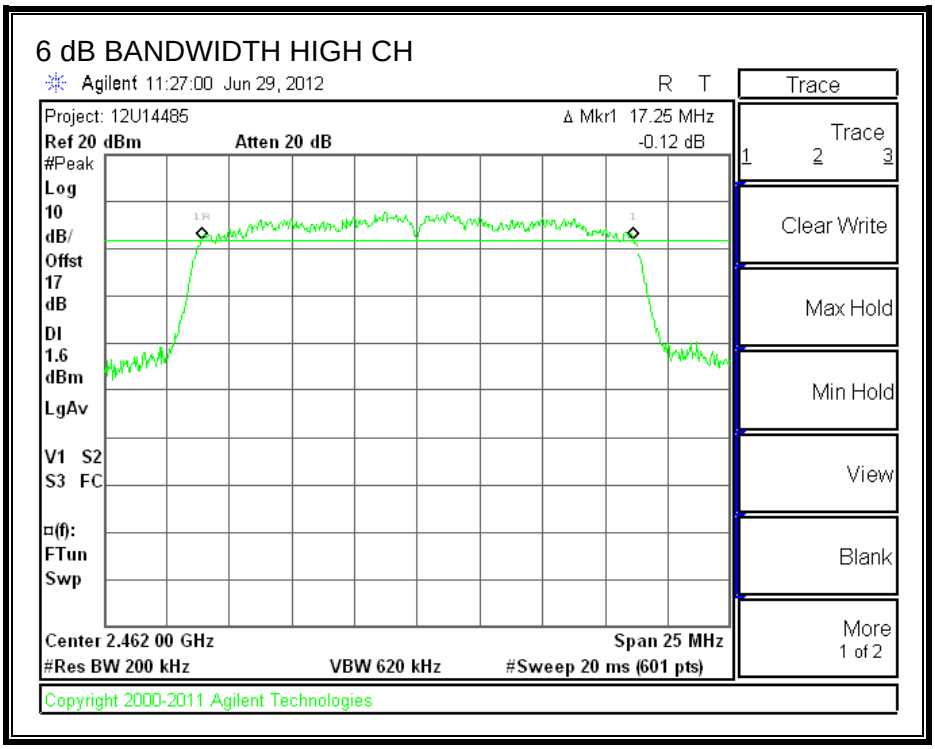
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	17.25	0.5
Middle	2437	17.29	0.5
High	2462	17.25	0.5

6 dB BANDWIDTH







8.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

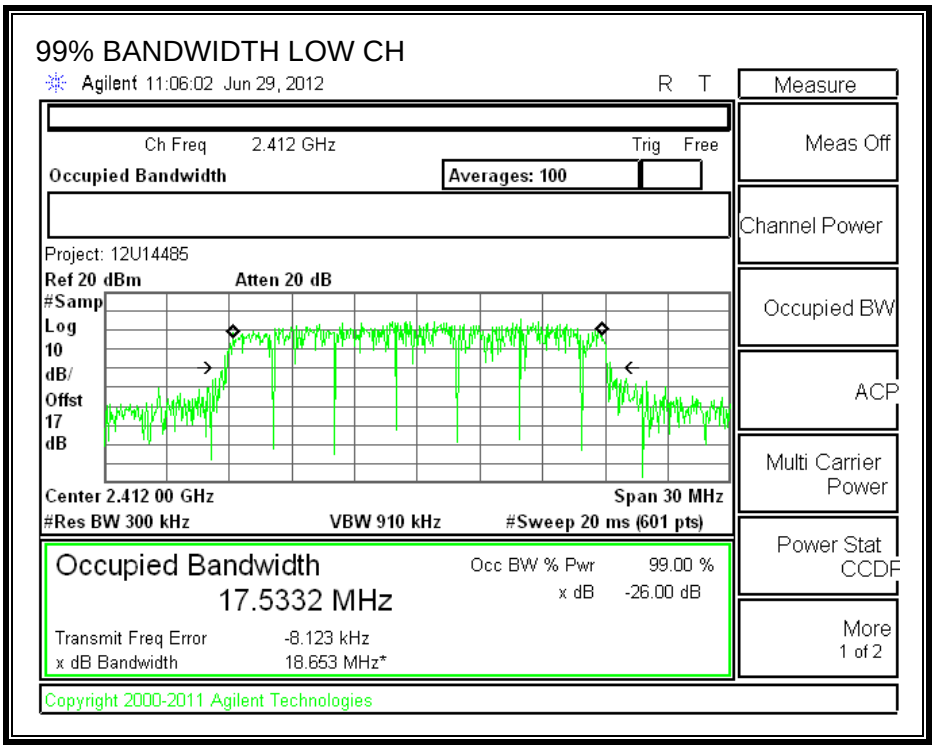
TEST PROCEDURE

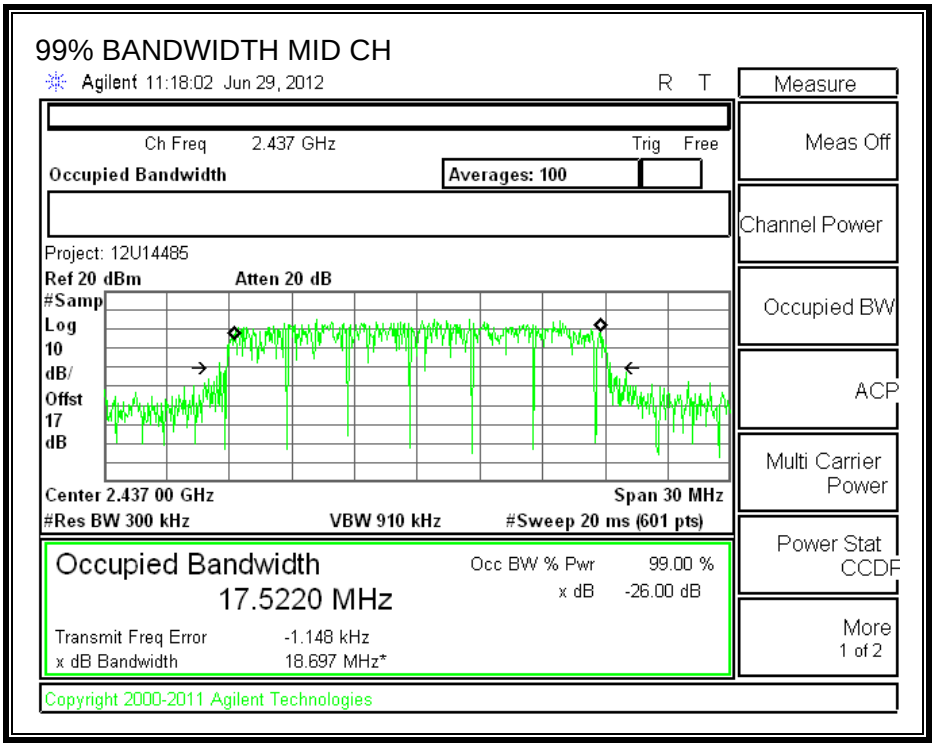
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

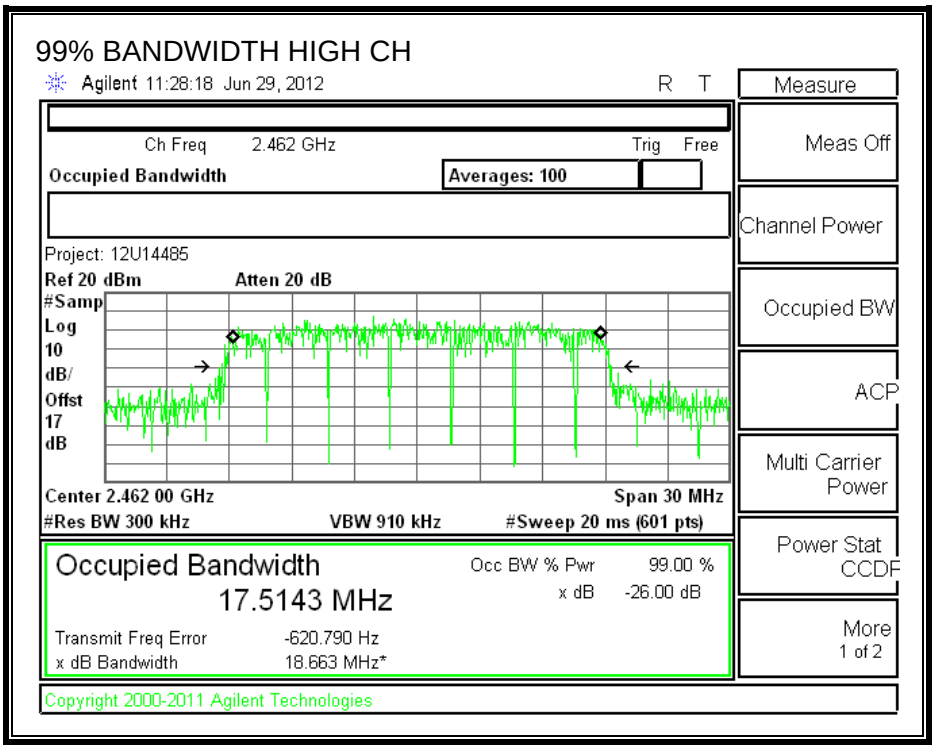
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	17.5332
Middle	2437	17.5220
High	2462	17.5143

99% BANDWIDTH







8.3.3. 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.

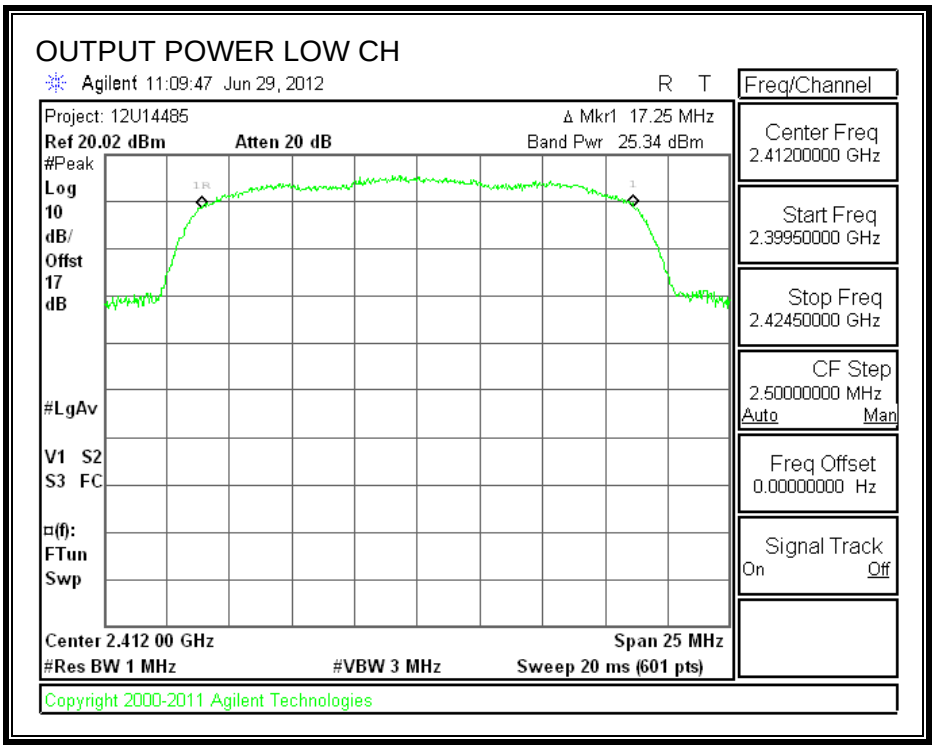
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

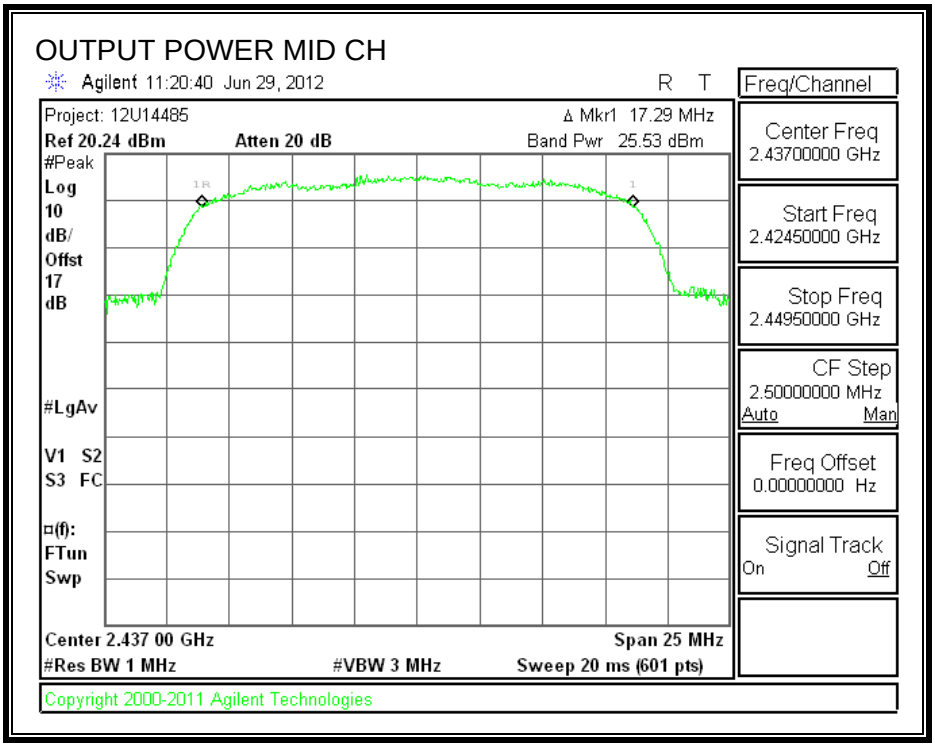
RESULTS

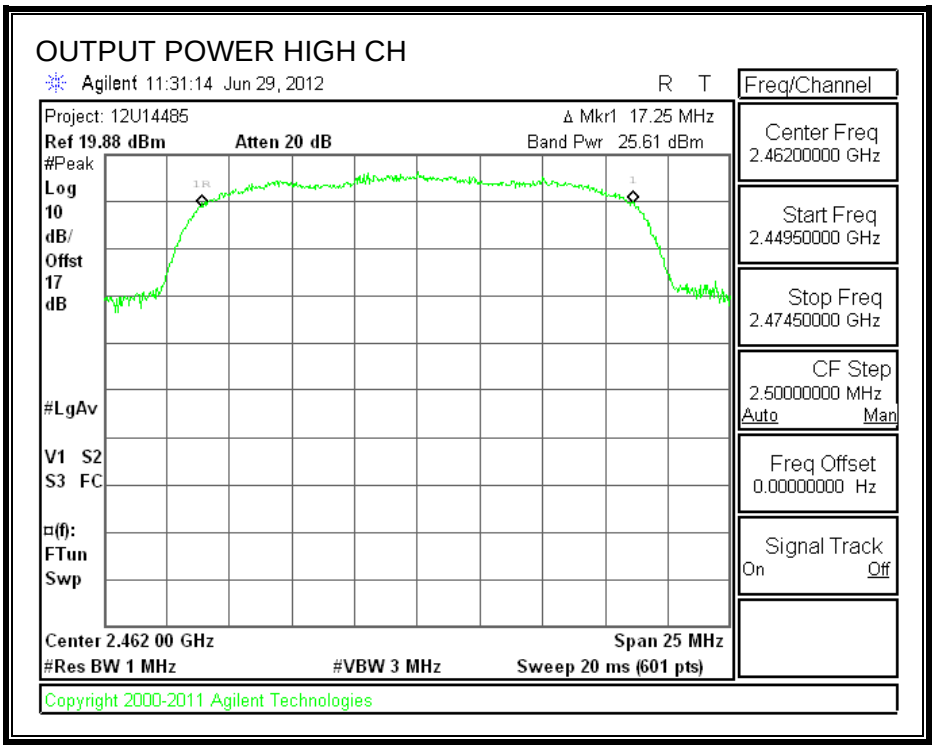
Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	25.34	30	-4.66
Middle	2437	25.53	30	-4.47
High	2462	25.61	30	-4.39

OUTPUT POWER



OUTPUT POWER MID CH





8.3.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Power (dBm)
Low	2412	16.47
Middle	2437	16.50
High	2462	15.96

8.3.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

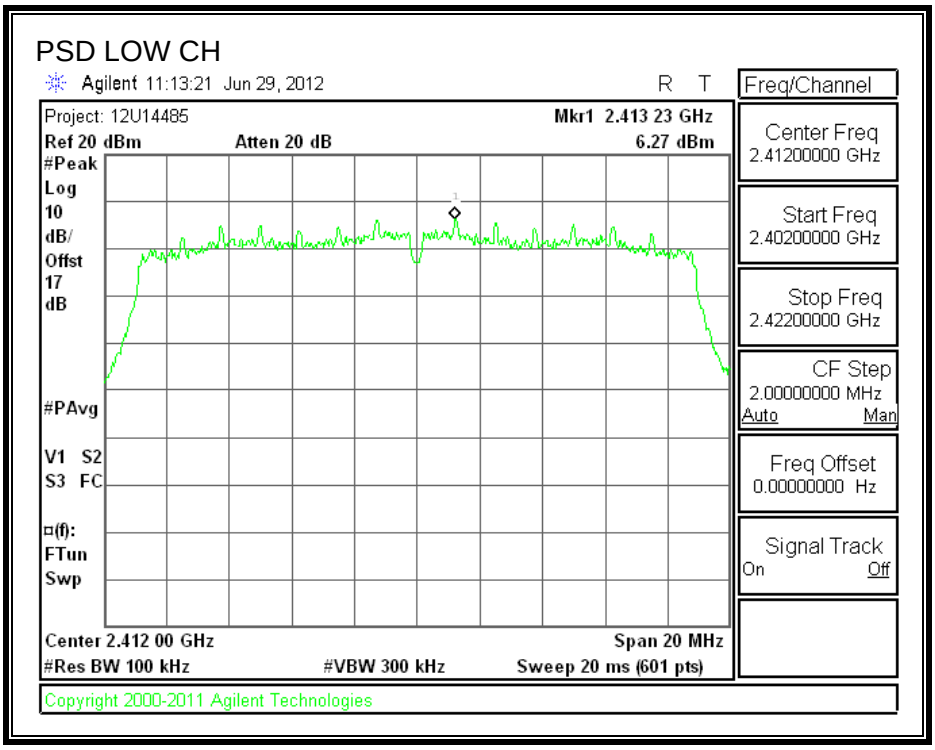
TEST PROCEDURE

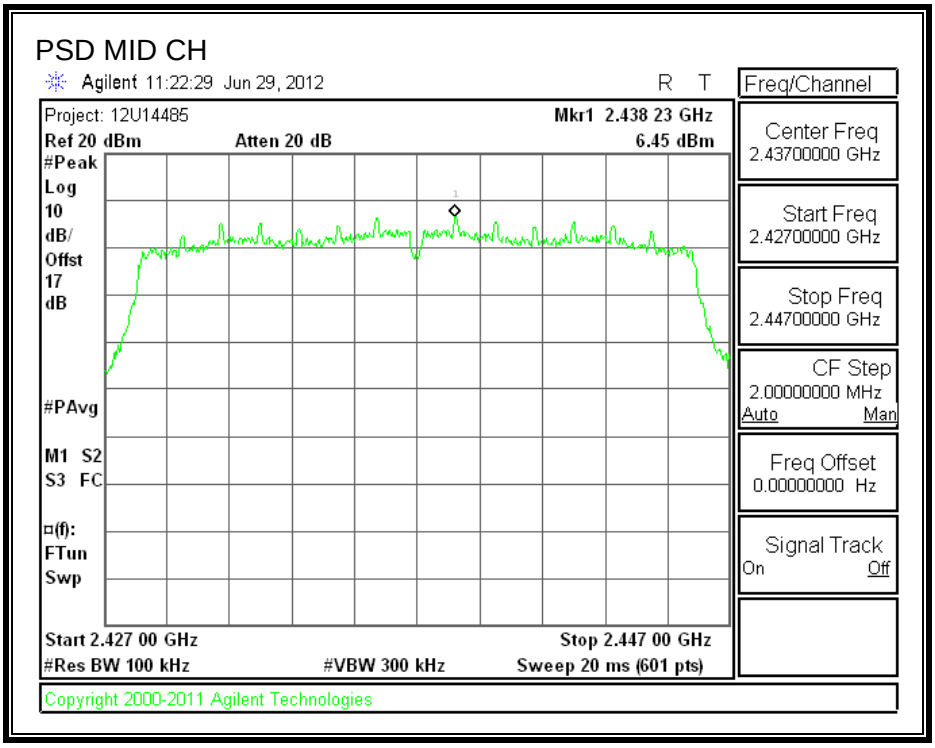
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

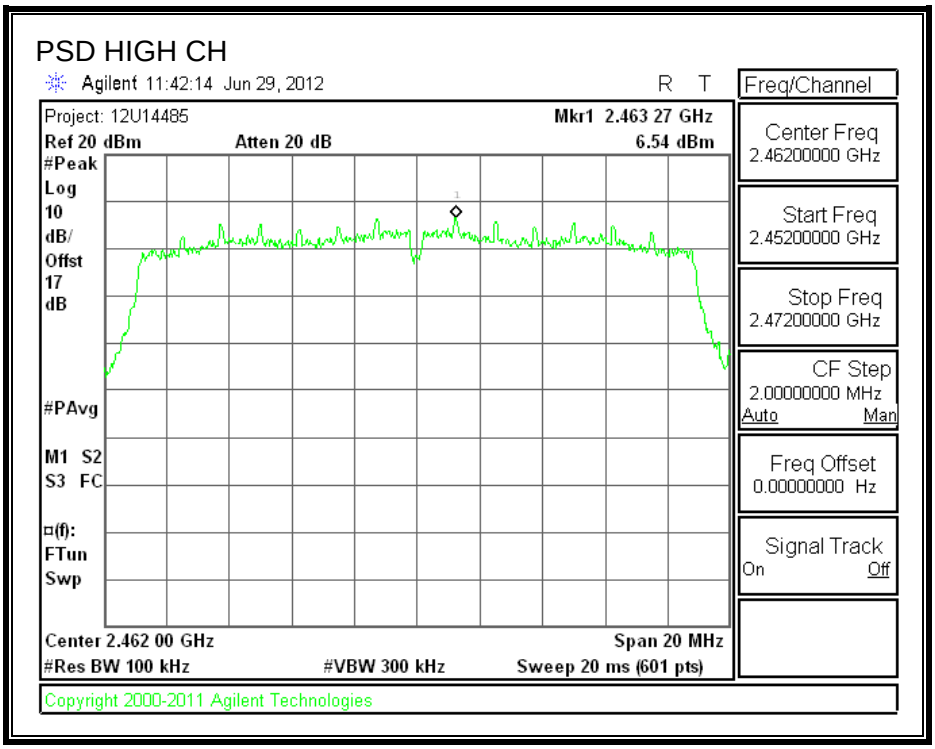
RESULTS

Channel	Frequency (MHz)	PSD (dBm)	10log(3kHz/100kHz) (dBm)	Limit (dBm)	Margin (dB)
Low	2412	6.27	-15.2	8	-16.93
Middle	2437	6.45	-15.2	8	-16.75
High	2462	6.54	-15.2	8	-16.66

POWER SPECTRAL DENSITY







8.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

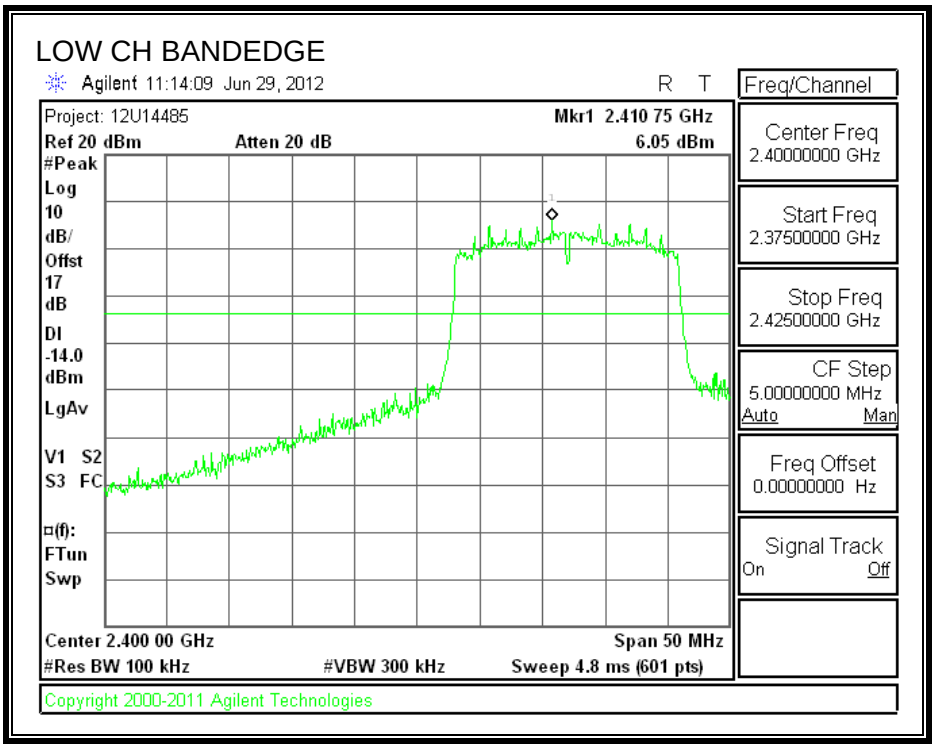
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

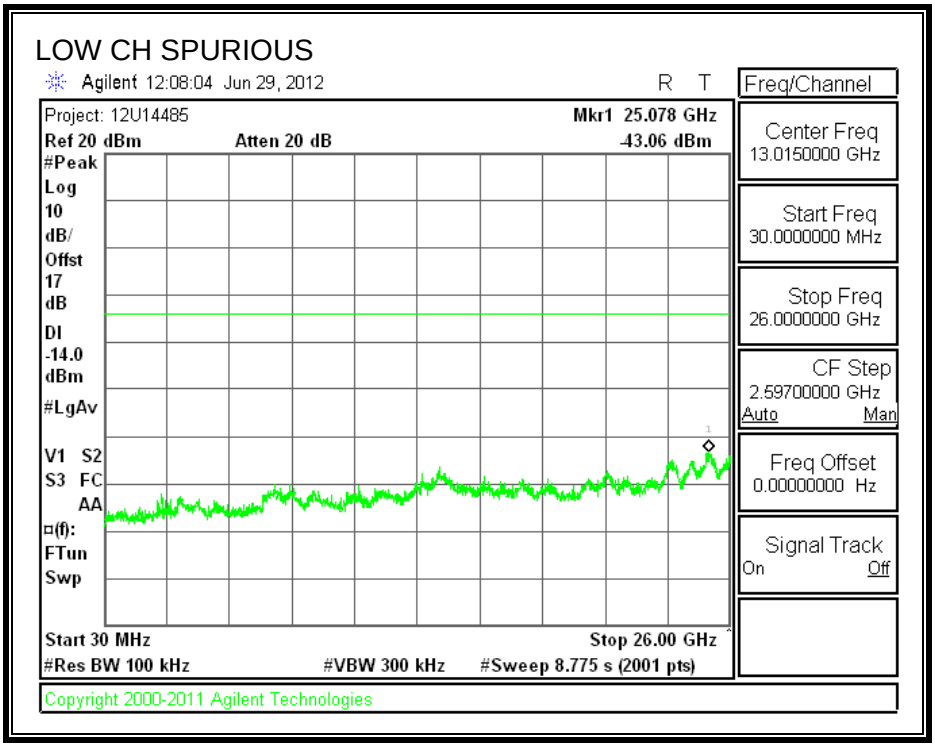
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

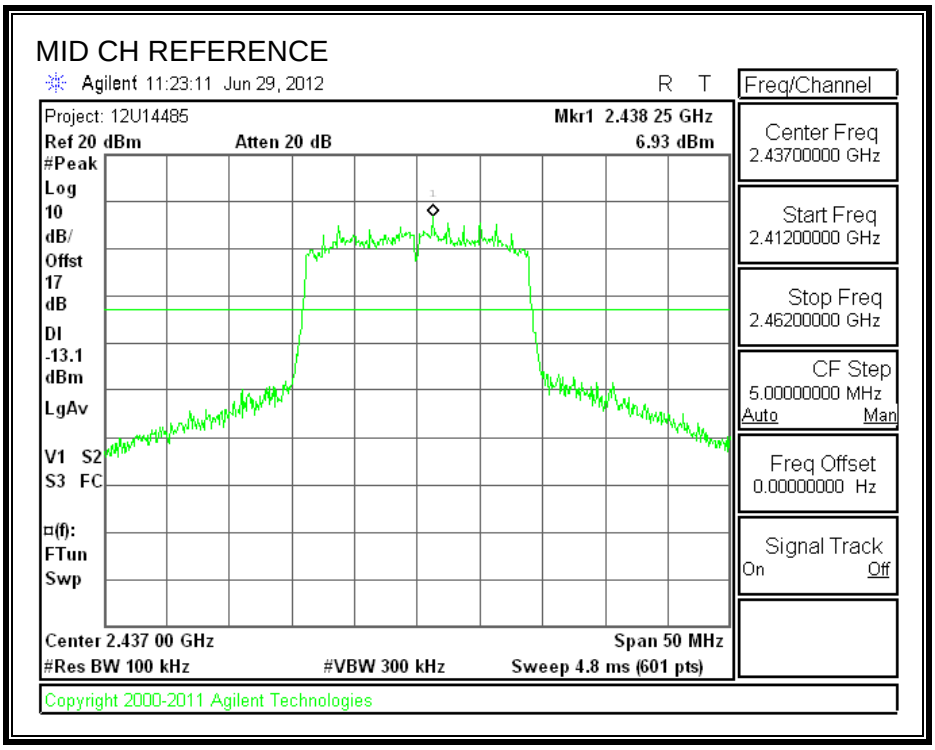
RESULTS

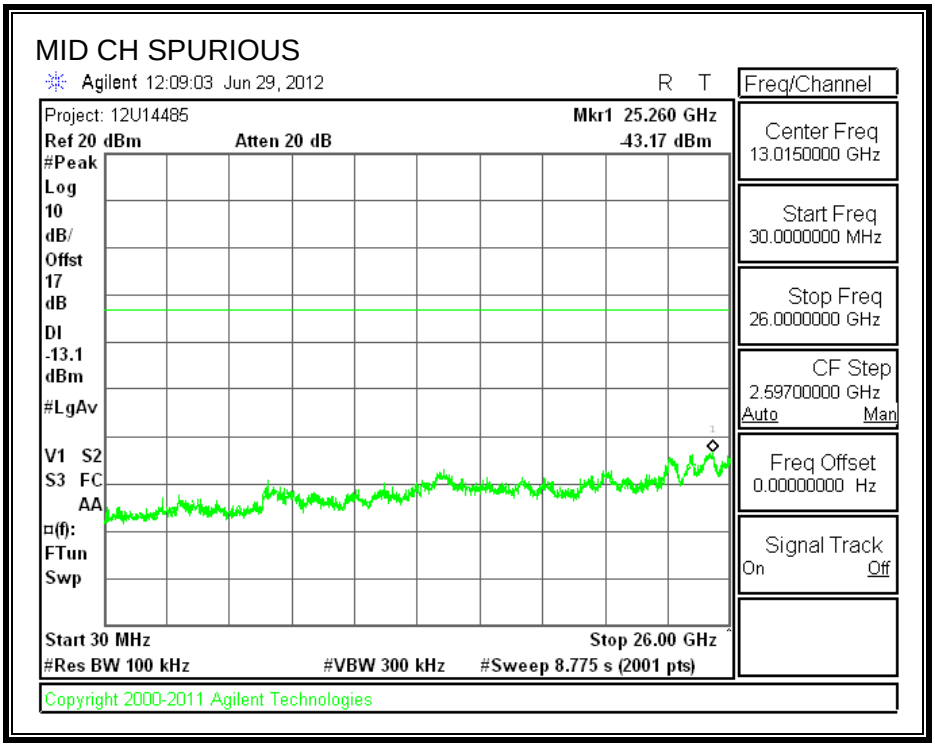
SPURIOUS EMISSIONS, LOW CHANNEL



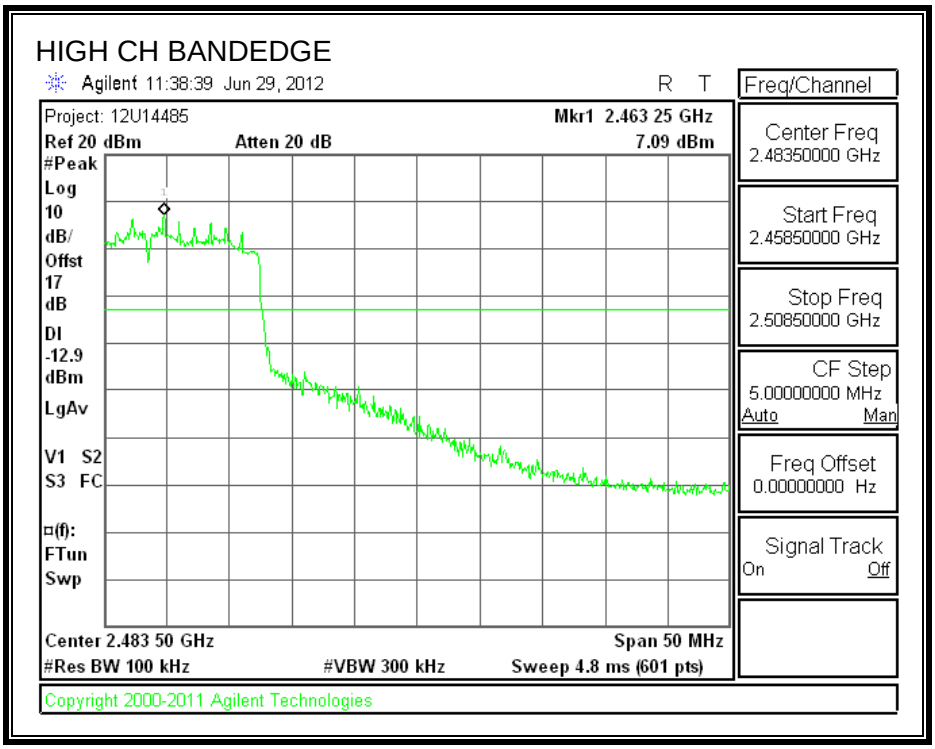


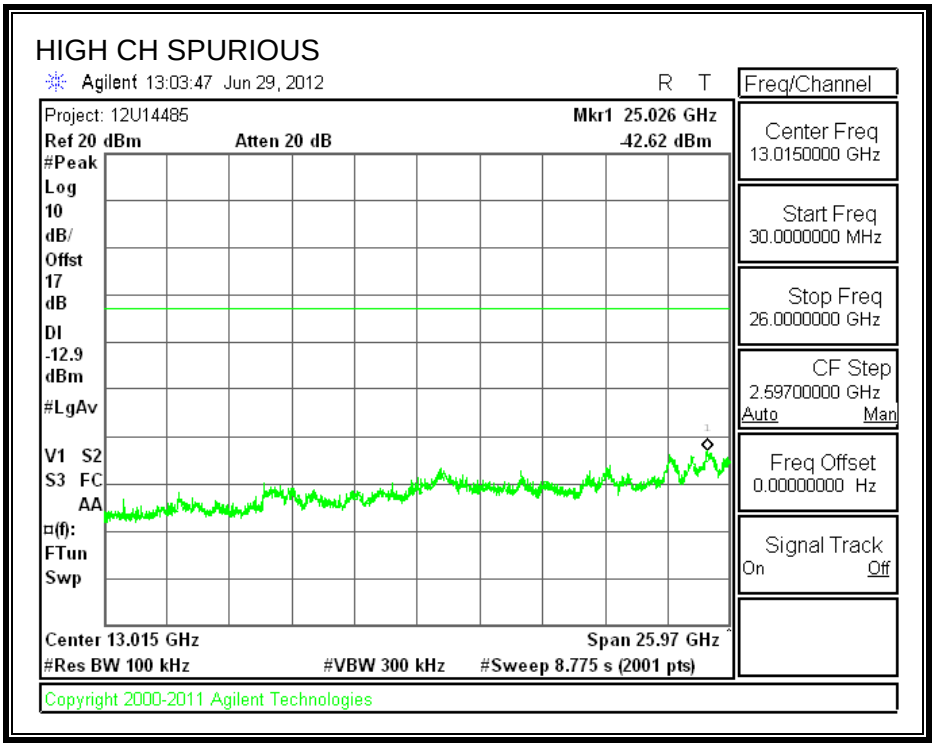
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





8.4. 802.11a MODE IN THE 5.8 GHz BAND

8.4.1. 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.

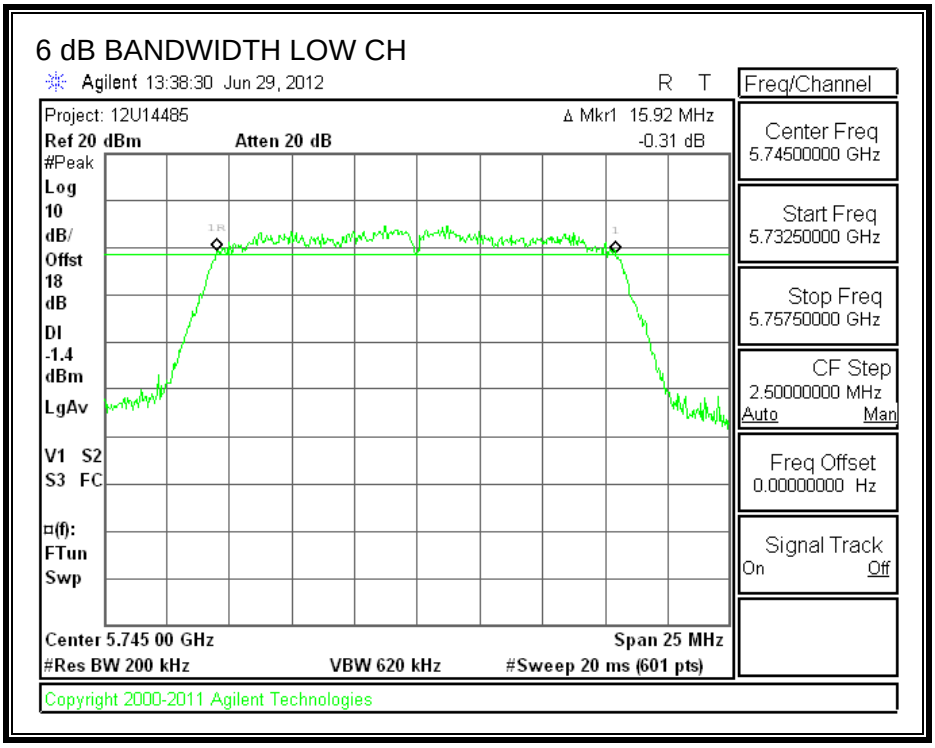
TEST PROCEDURE

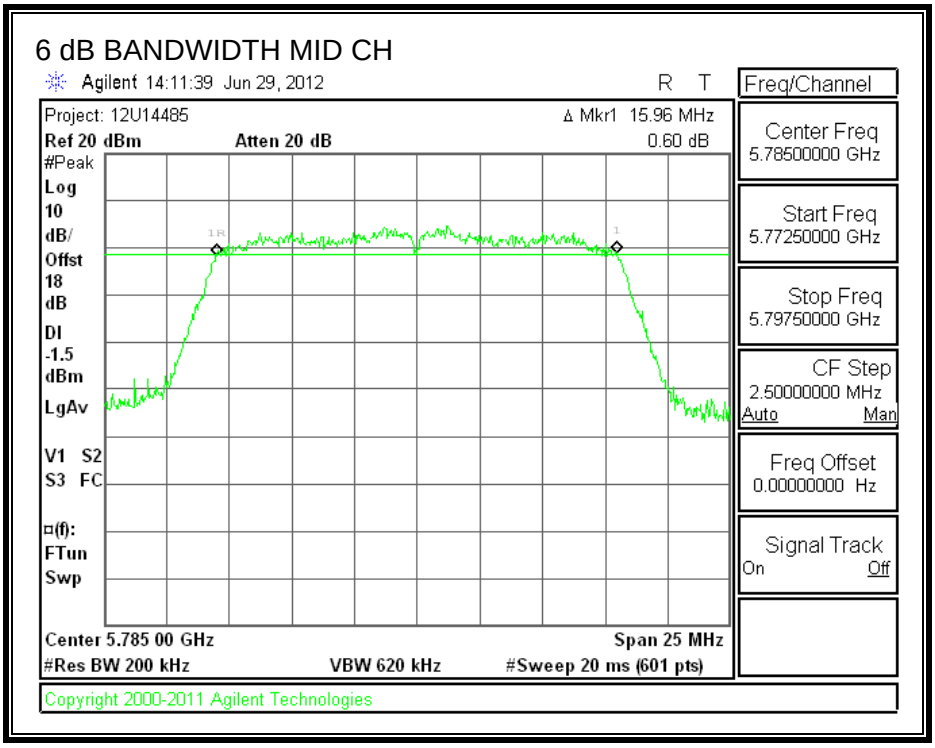
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

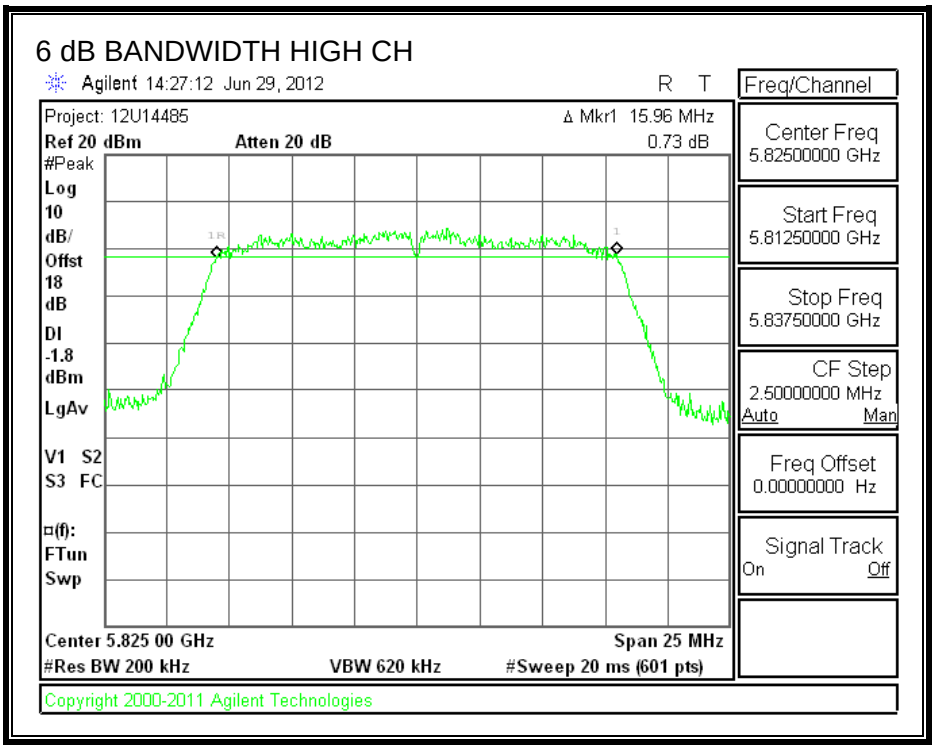
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5745	15.92	0.5
Middle	5785	15.96	0.5
High	5825	15.96	0.5

6 dB BANDWIDTH







8.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

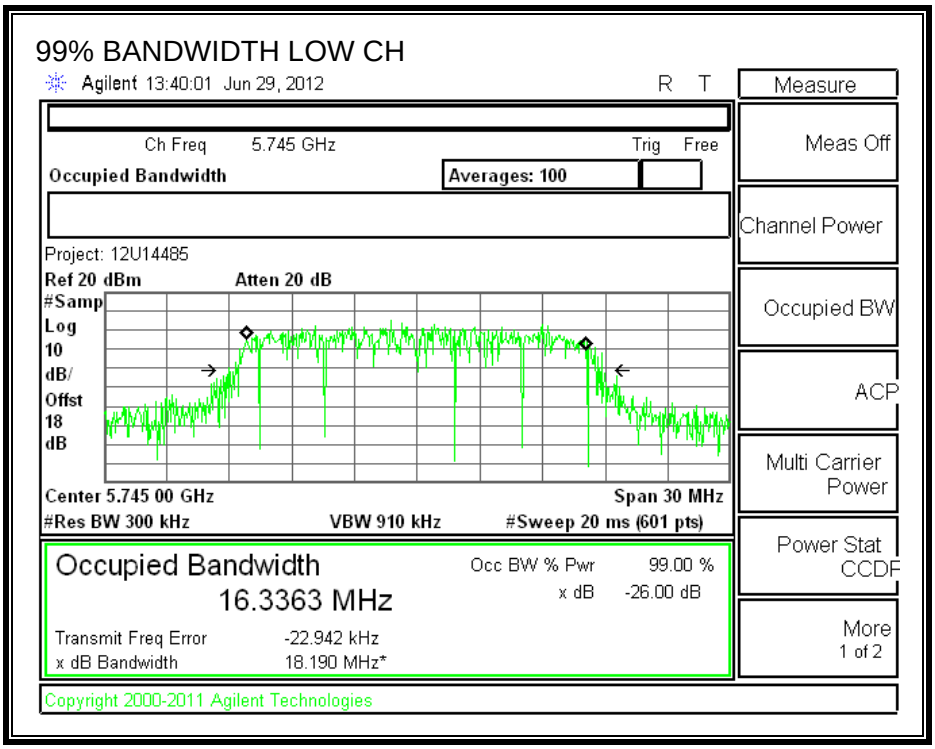
TEST PROCEDURE

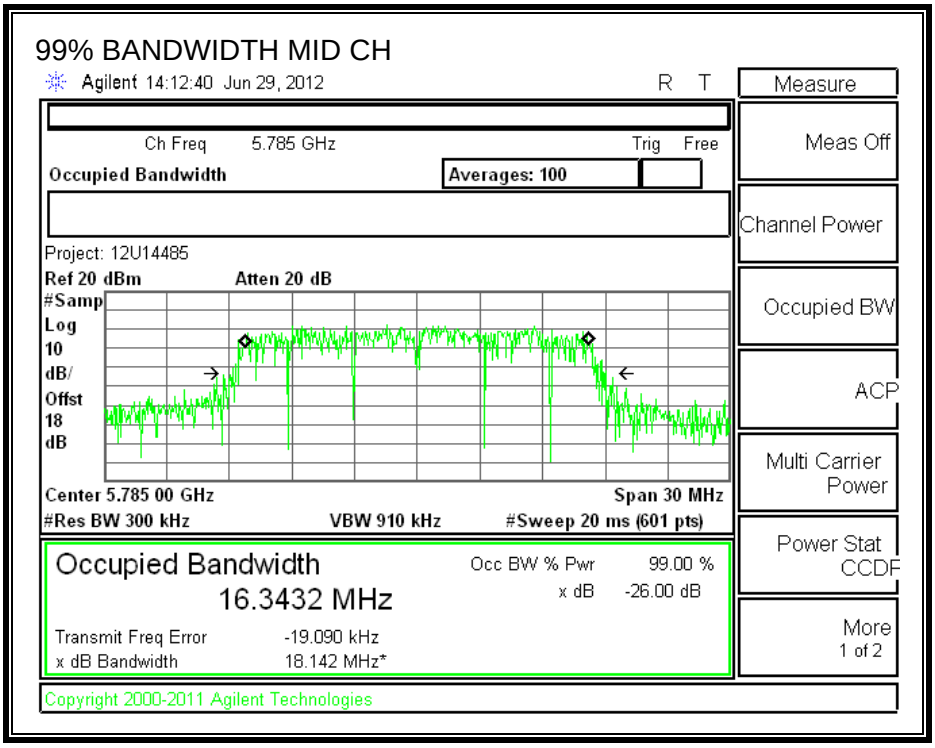
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

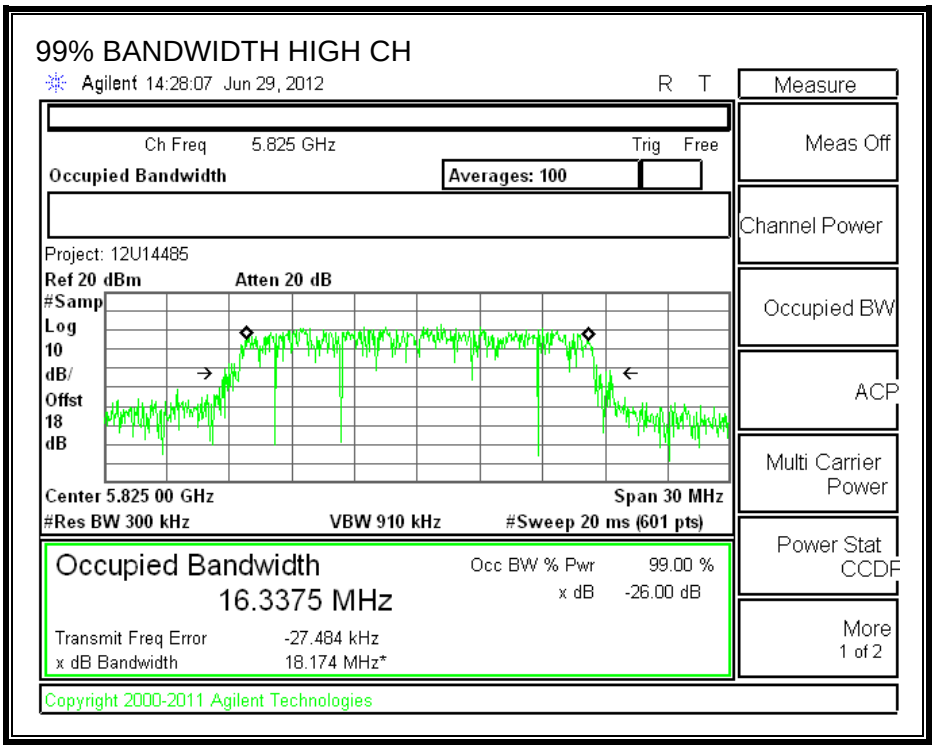
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	16.3363
Middle	5785	16.3432
High	5825	16.3375

99% BANDWIDTH







8.4.3. 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.

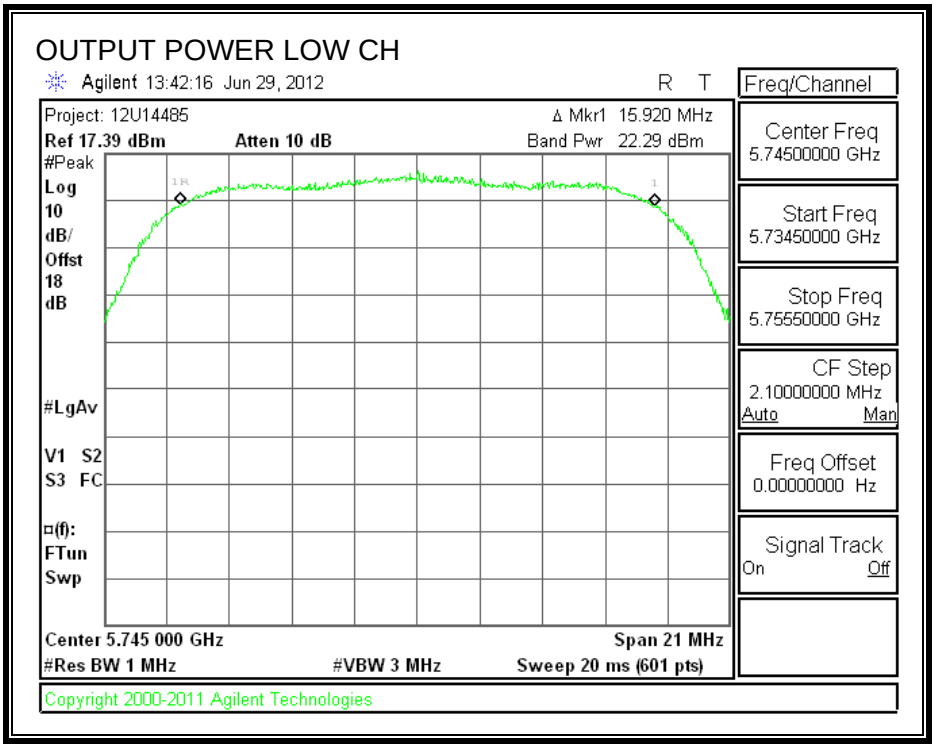
TEST PROCEDURE

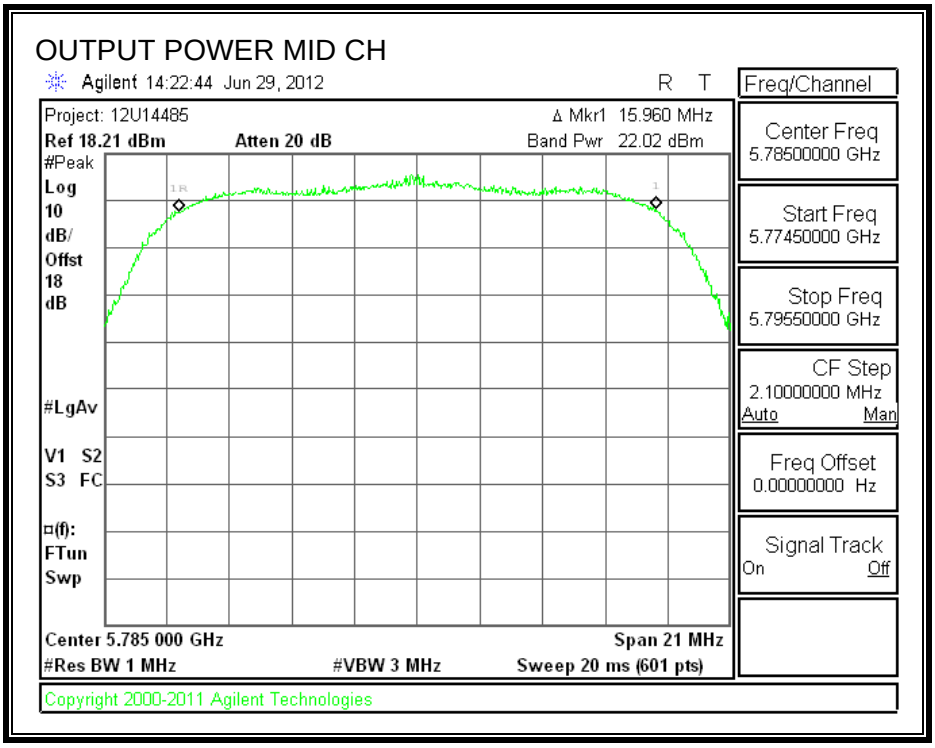
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

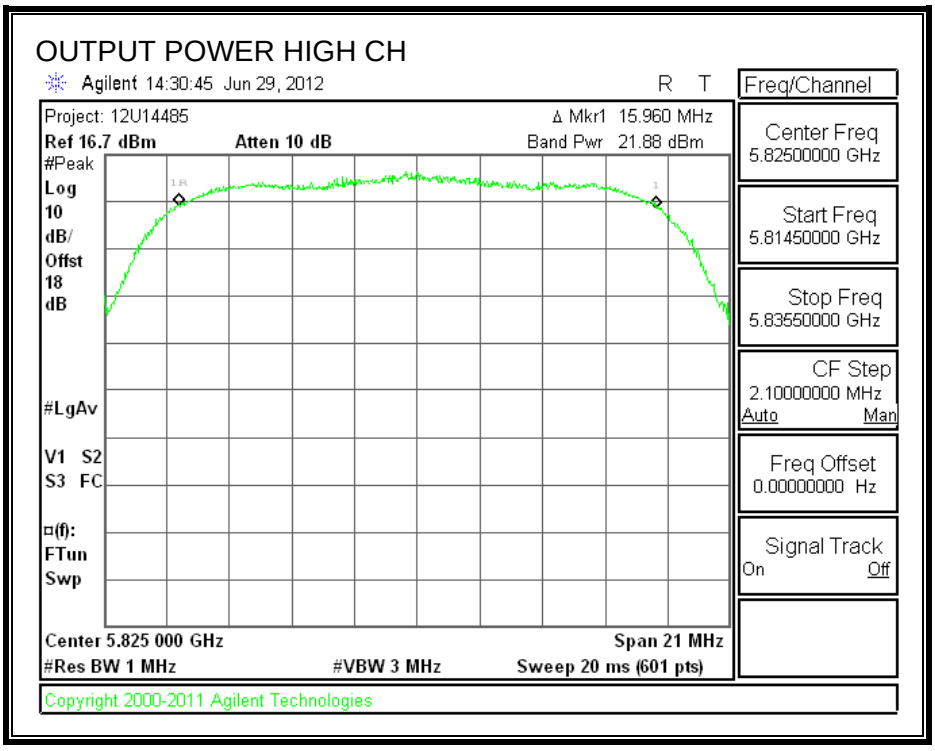
RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	5745	22.29	30	-7.71
Middle	5785	22.02	30	-7.98
High	5825	21.88	30	-8.12

OUTPUT POWER







8.4.4. 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)	Power (dBm)
Low	5745	13.50
Middle	5785	13.48
High	5825	13.45

8.4.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

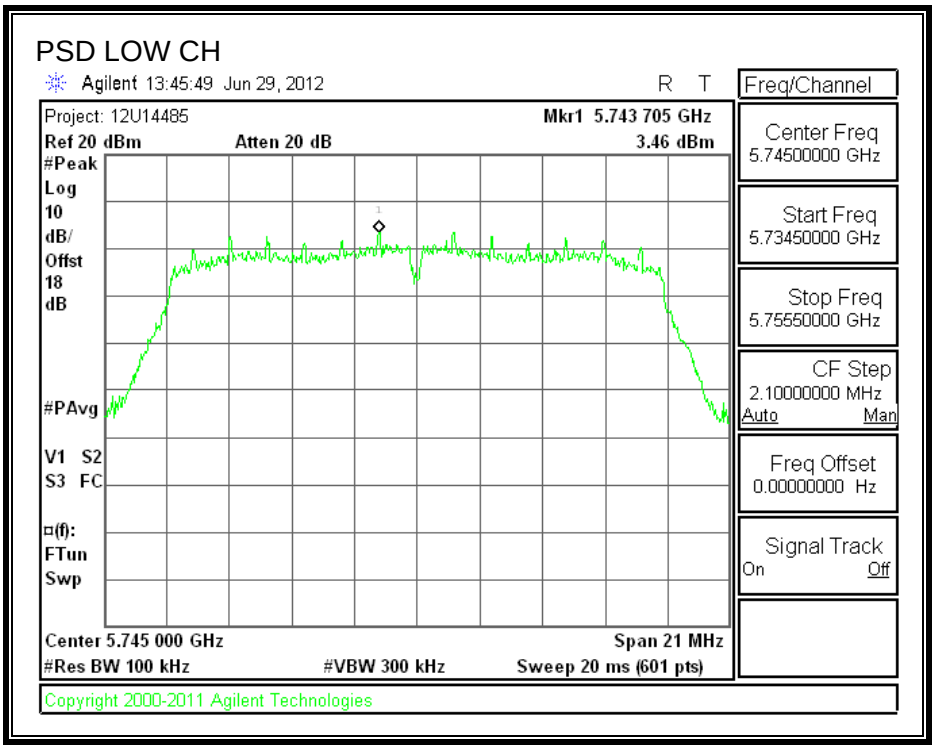
TEST PROCEDURE

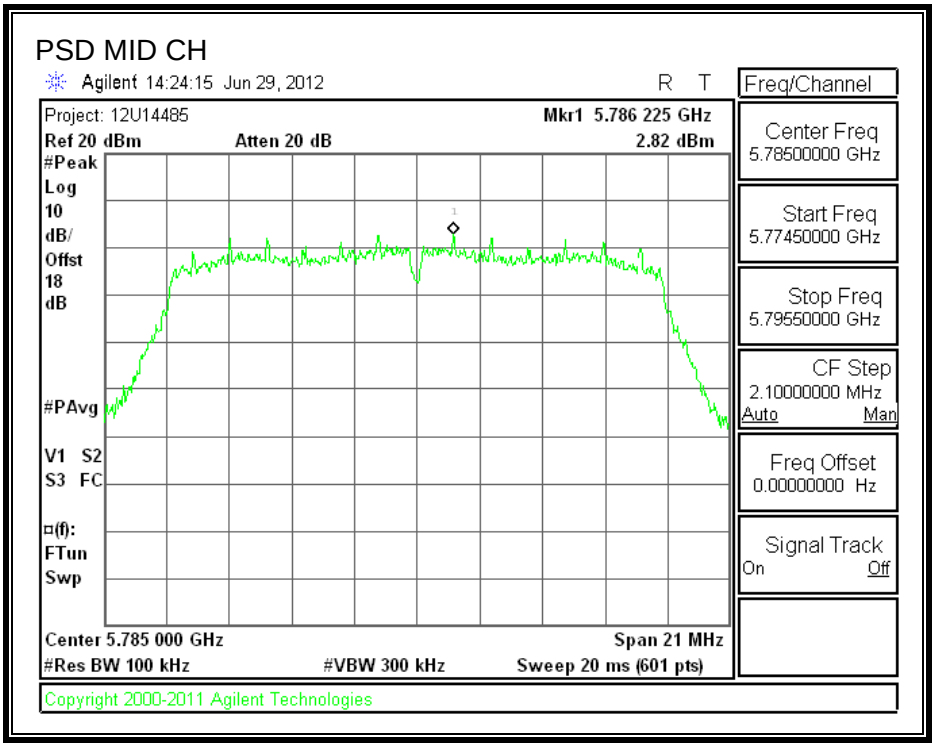
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

RESULTS

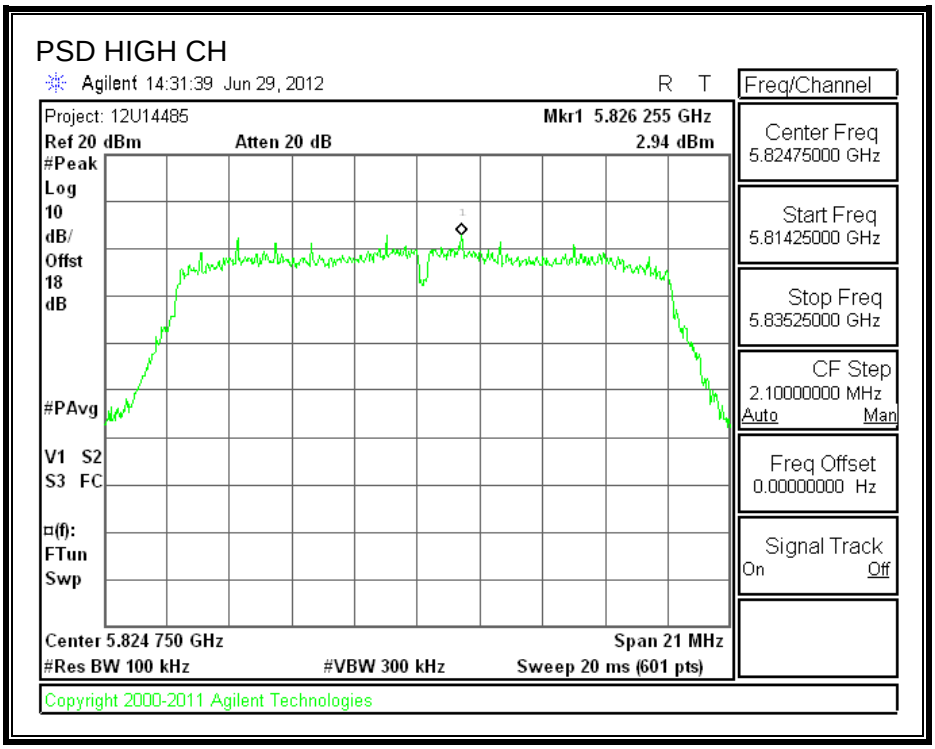
Channel	Frequency (MHz)	PSD (dBm)	10log(3kHz/100kHz) (dBm)	Limit (dBm)	Margin (dB)
Low	5745	3.46	-15.2	8	-19.74
Middle	5785	2.82	-15.2	8	-20.38
High	5825	2.94	-15.2	8	-20.26

POWER SPECTRAL DENSITY





PSD HIGH CH



8.4.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

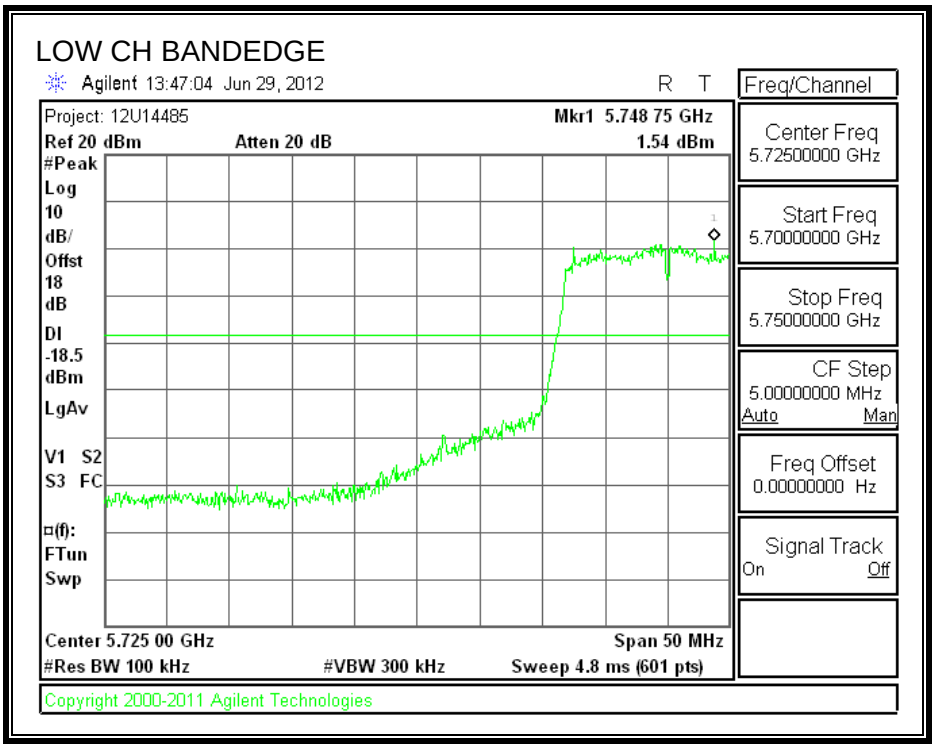
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

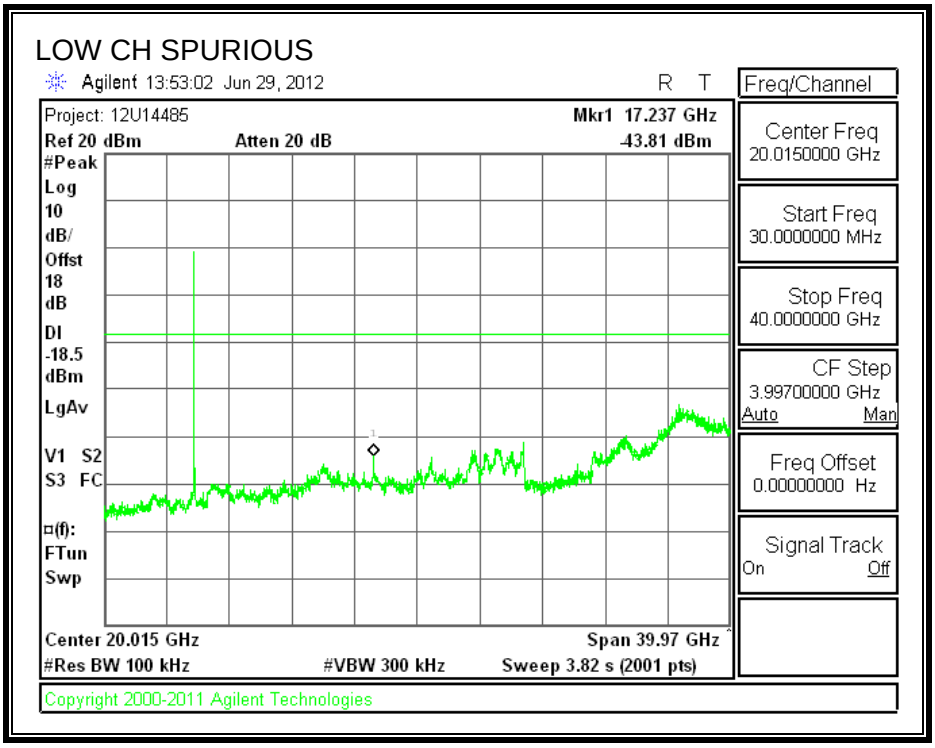
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

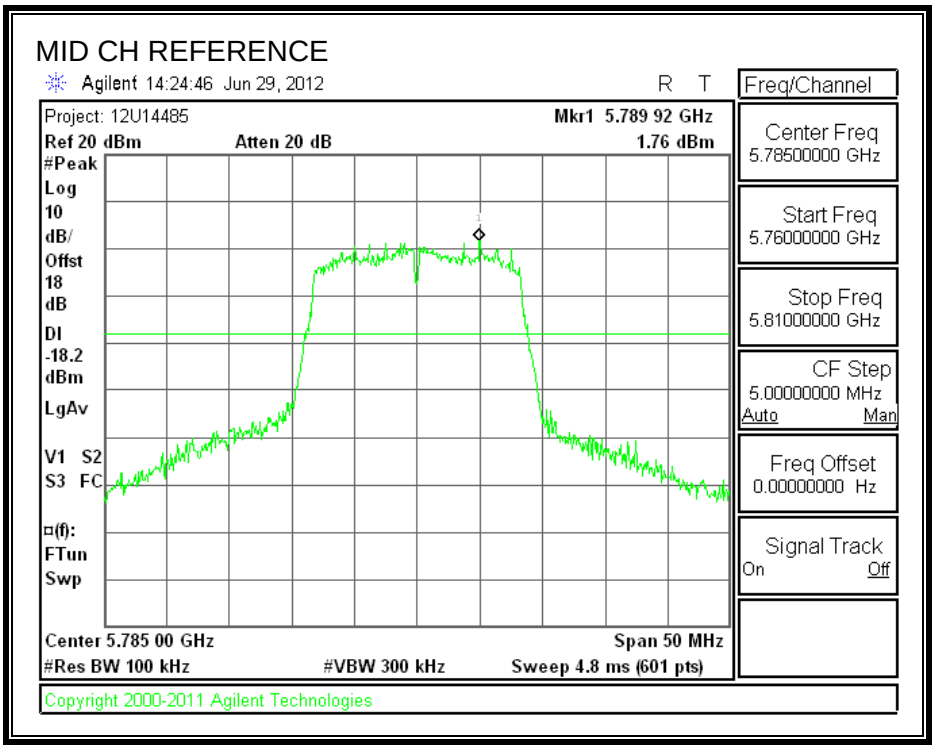
RESULTS

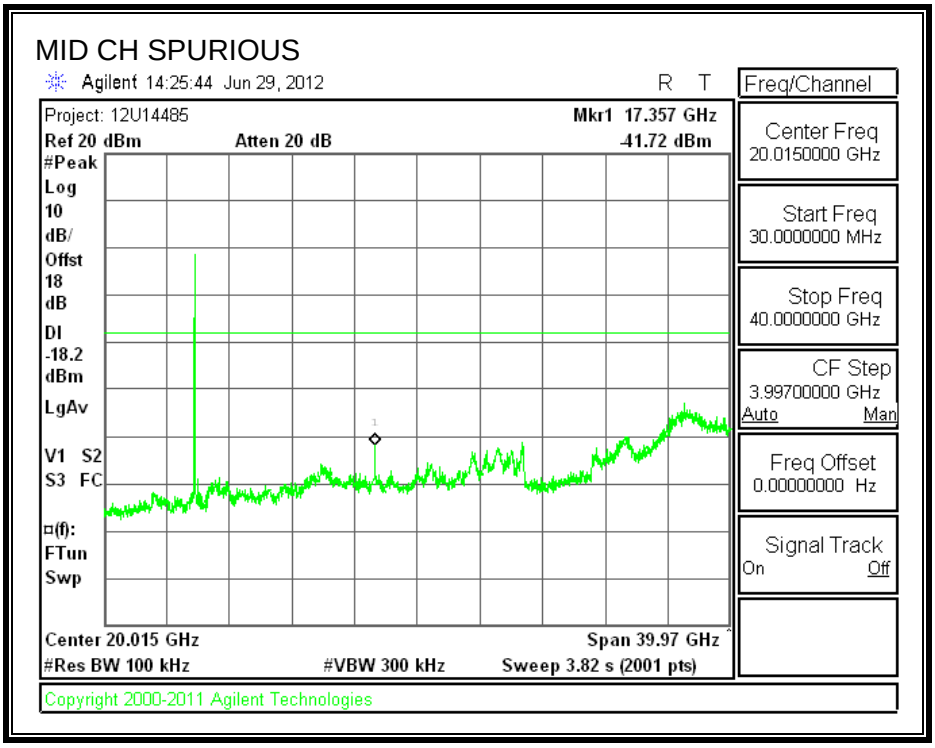
SPURIOUS EMISSIONS, LOW CHANNEL



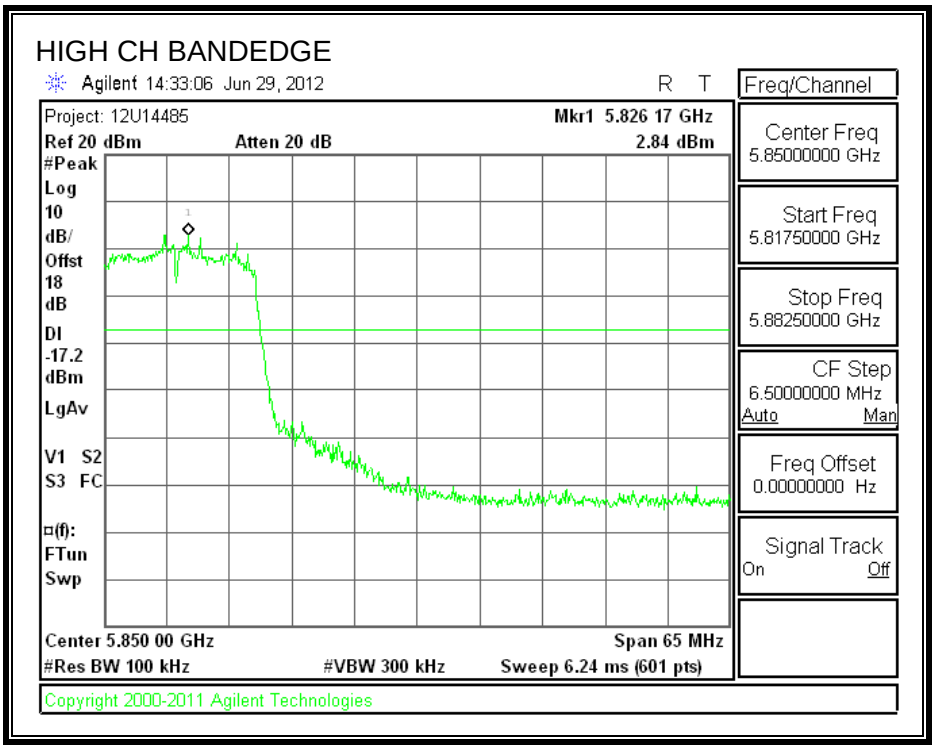


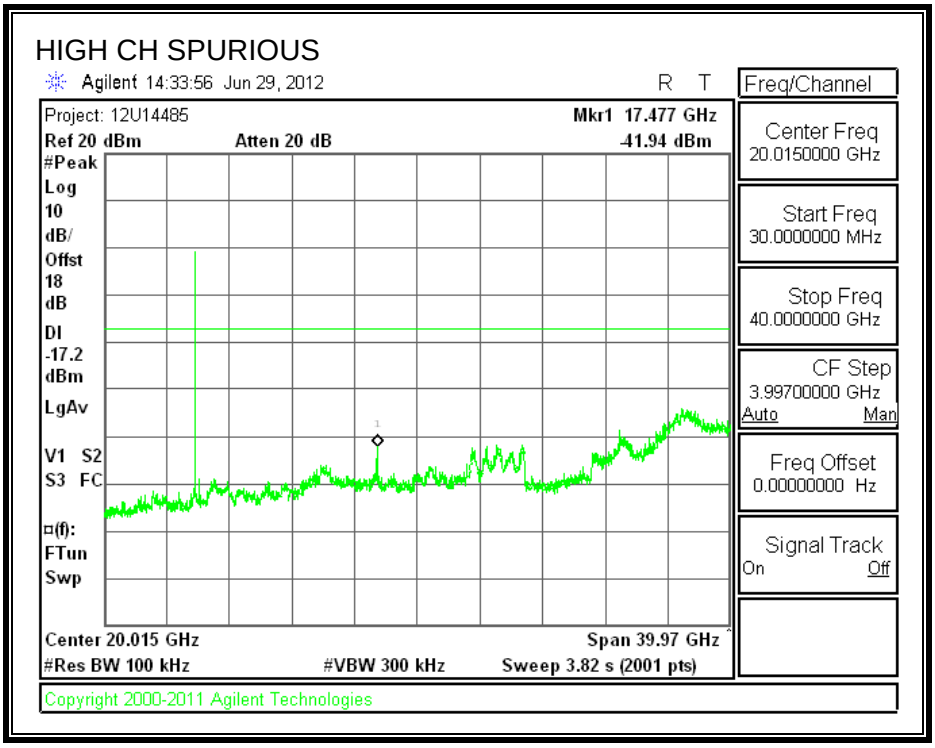
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





8.5. 802.11n HT20 MODE IN THE 5.8 GHz BAND

8.5.1. 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.

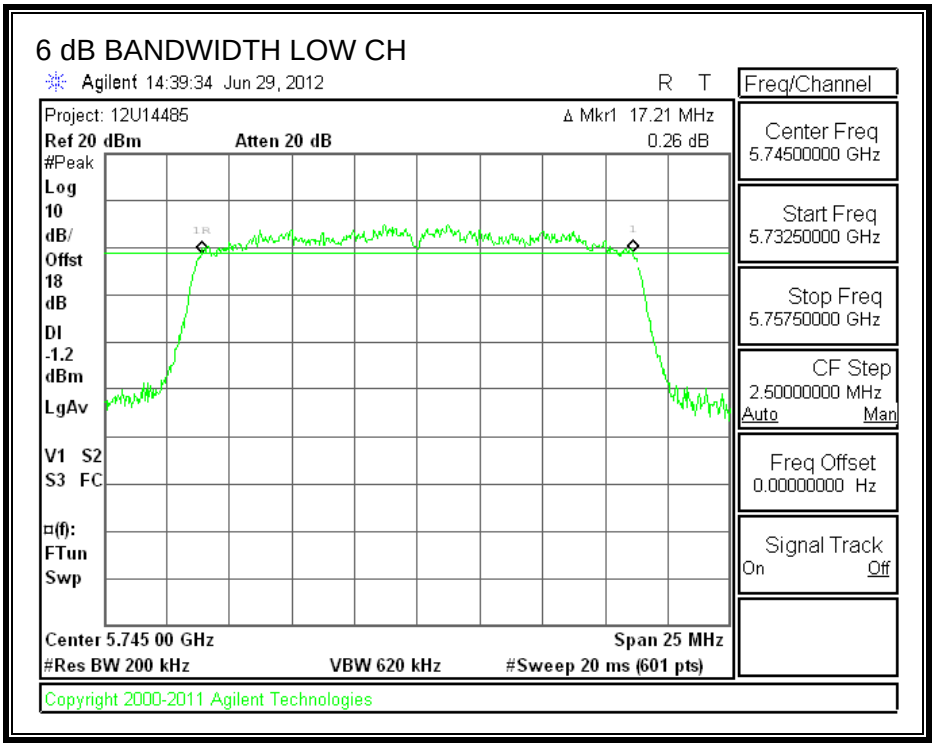
TEST PROCEDURE

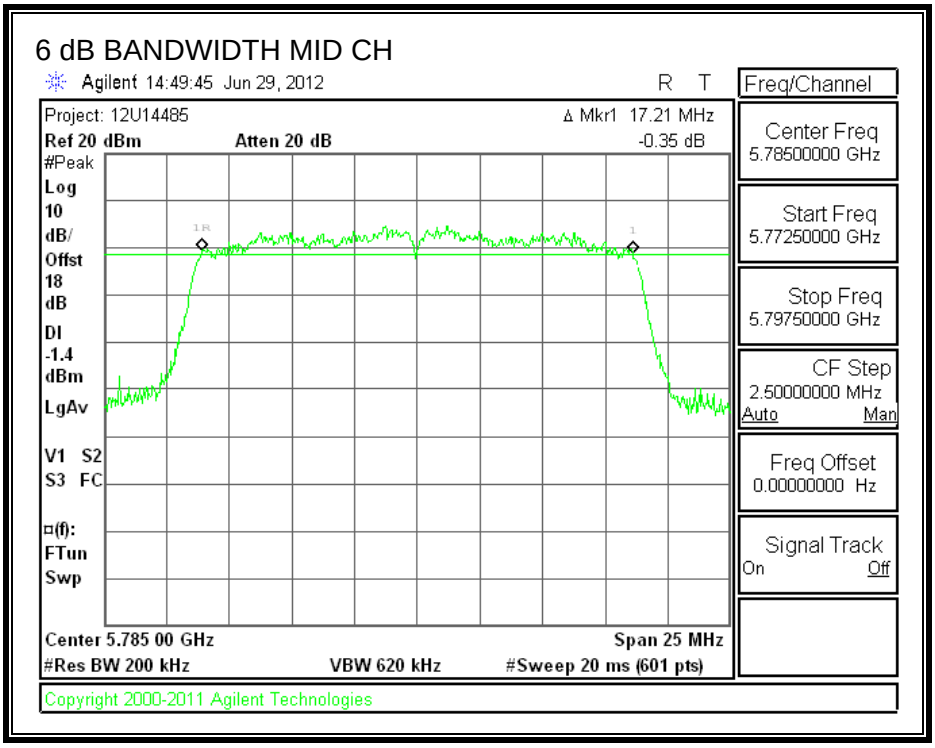
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

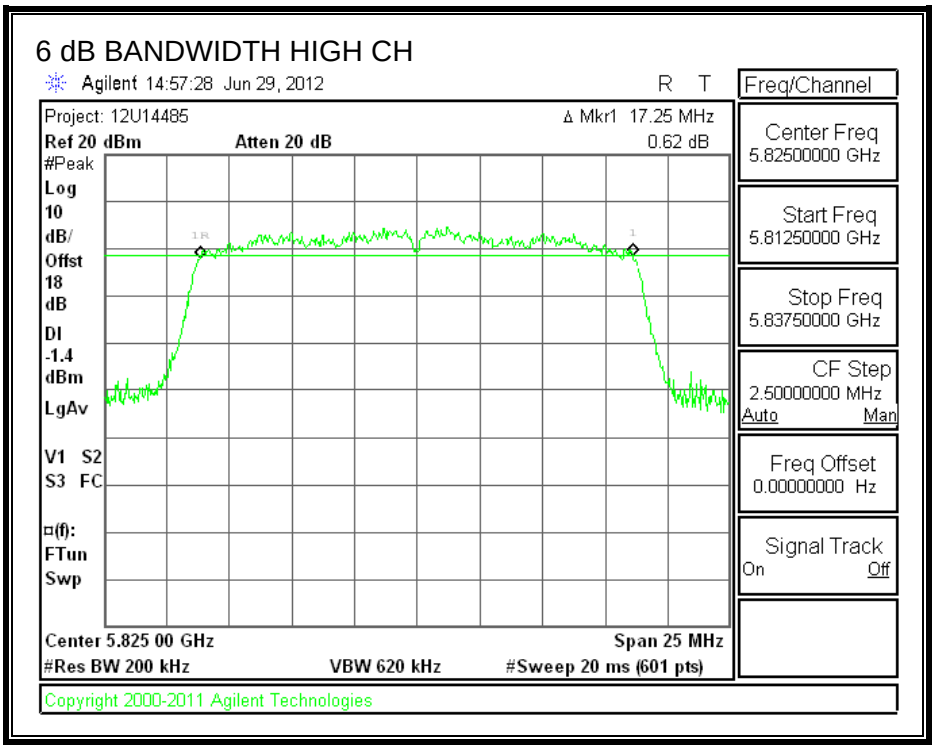
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5745	17.21	0.5
Middle	5785	17.21	0.5
High	5825	17.25	0.5

6 dB BANDWIDTH







8.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

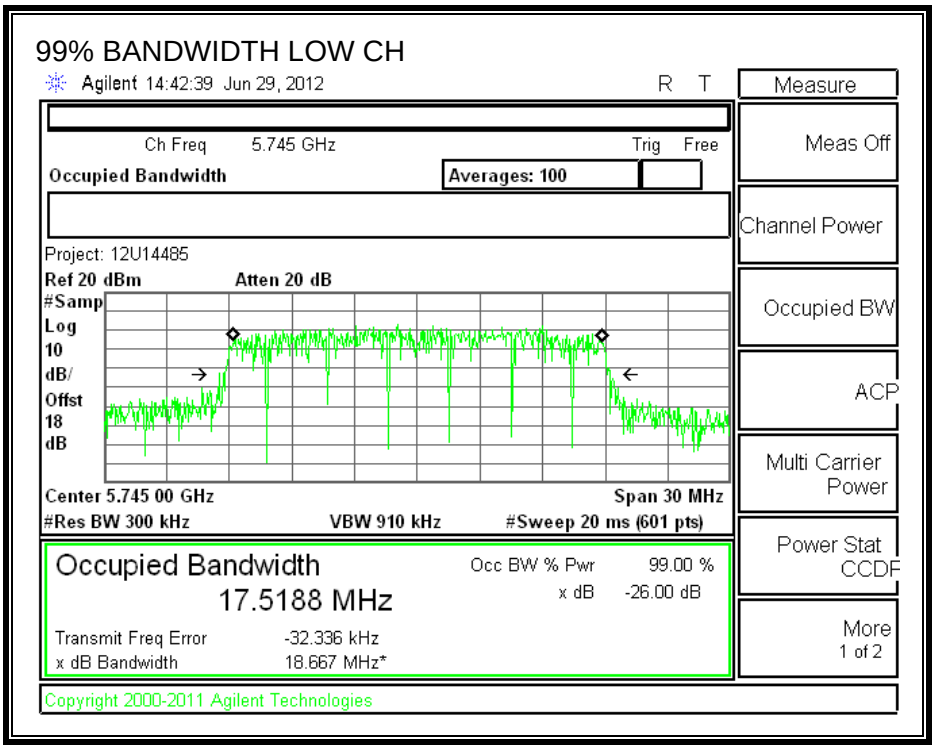
TEST PROCEDURE

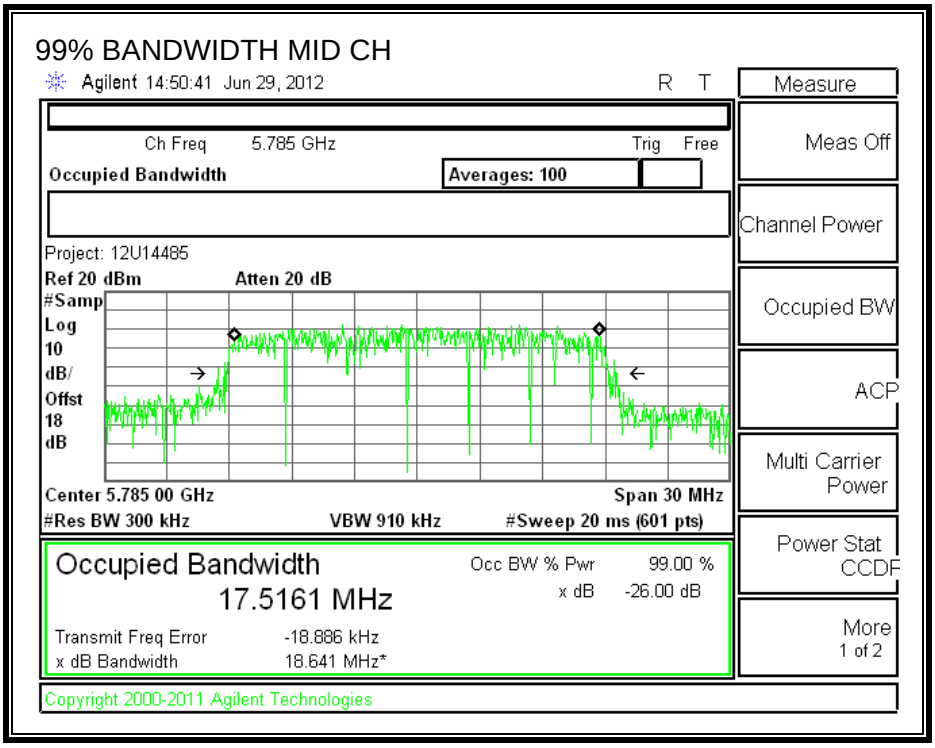
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

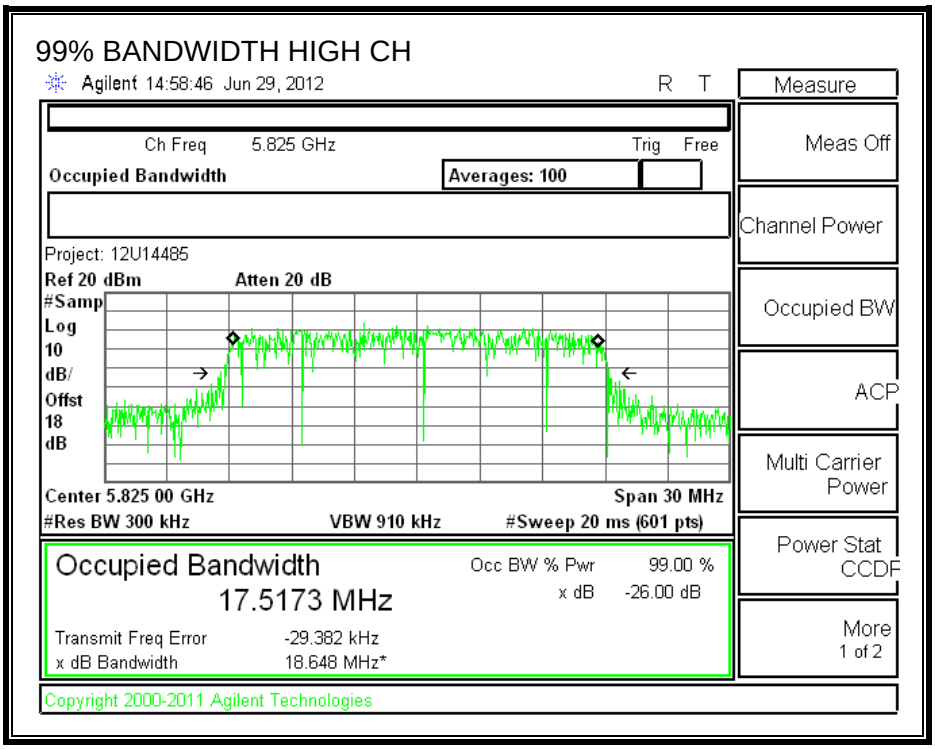
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.5188
Middle	5785	17.5161
High	5825	17.5173

99% BANDWIDTH







8.5.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

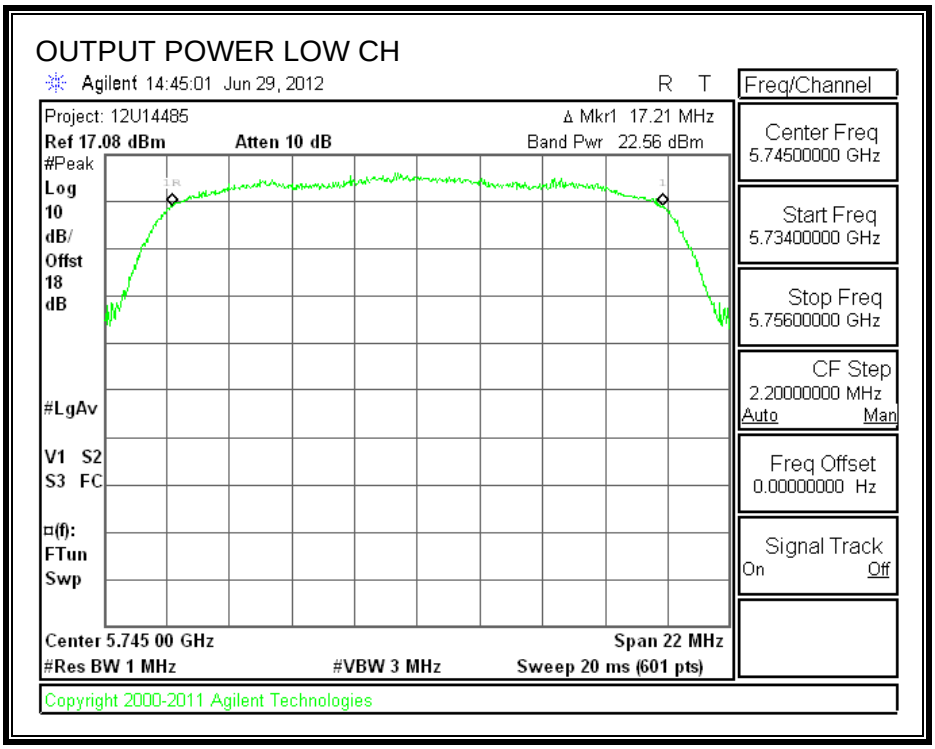
TEST PROCEDURE

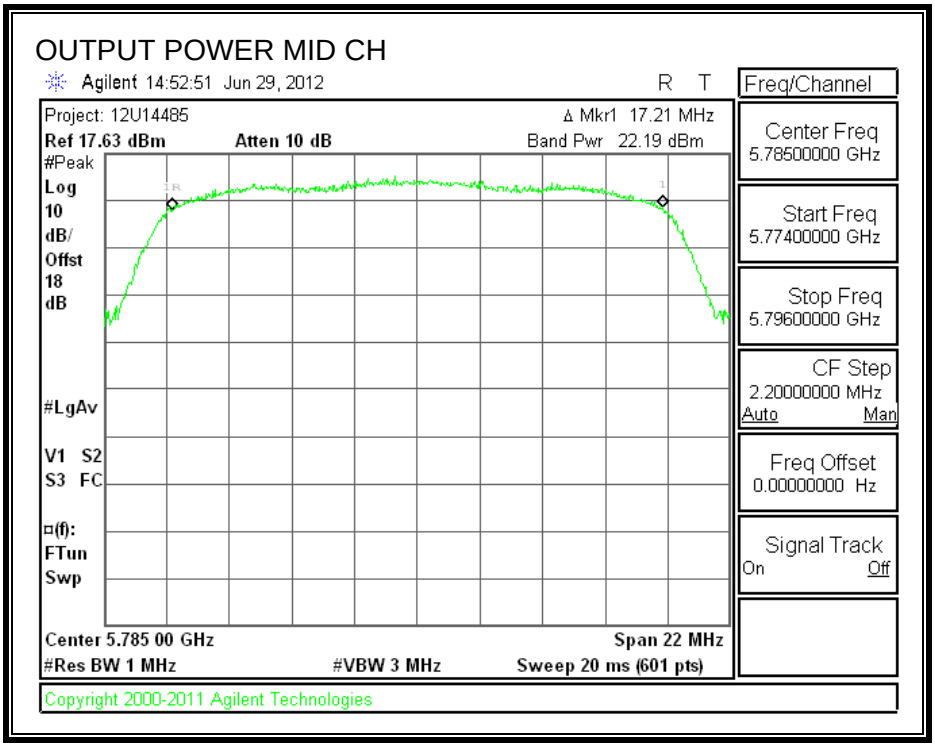
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

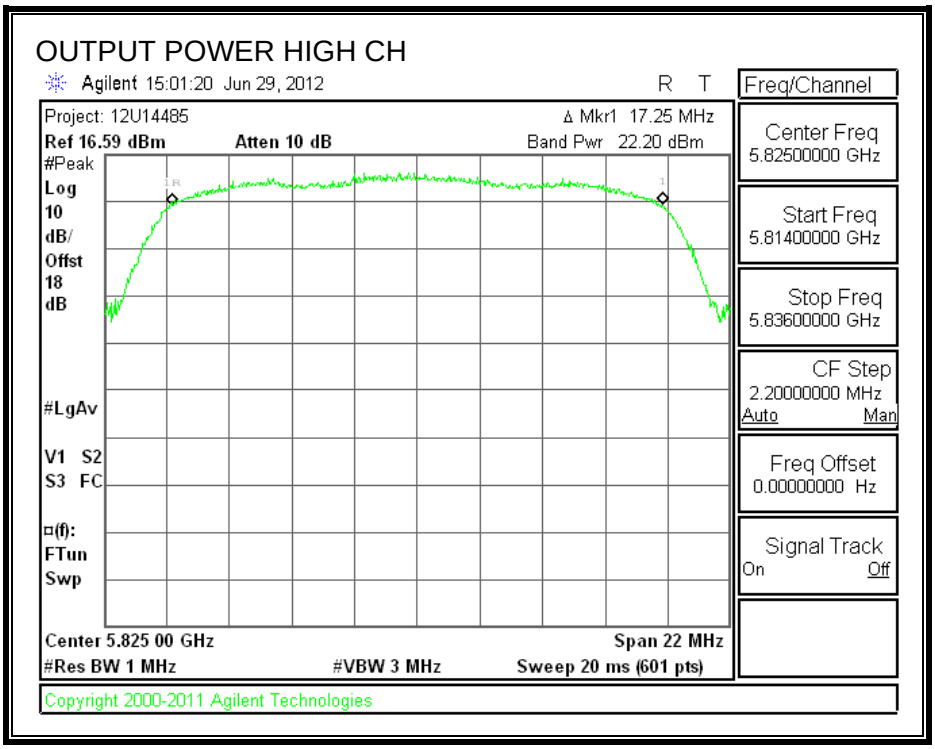
RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	5745	22.56	30	-7.44
Middle	5785	22.19	30	-7.81
High	5825	22.20	30	-7.80

OUTPUT POWER







8.5.4. 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)	Power (dBm)
Low	5745	13.49
Middle	5785	13.47
High	5825	13.46

8.5.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

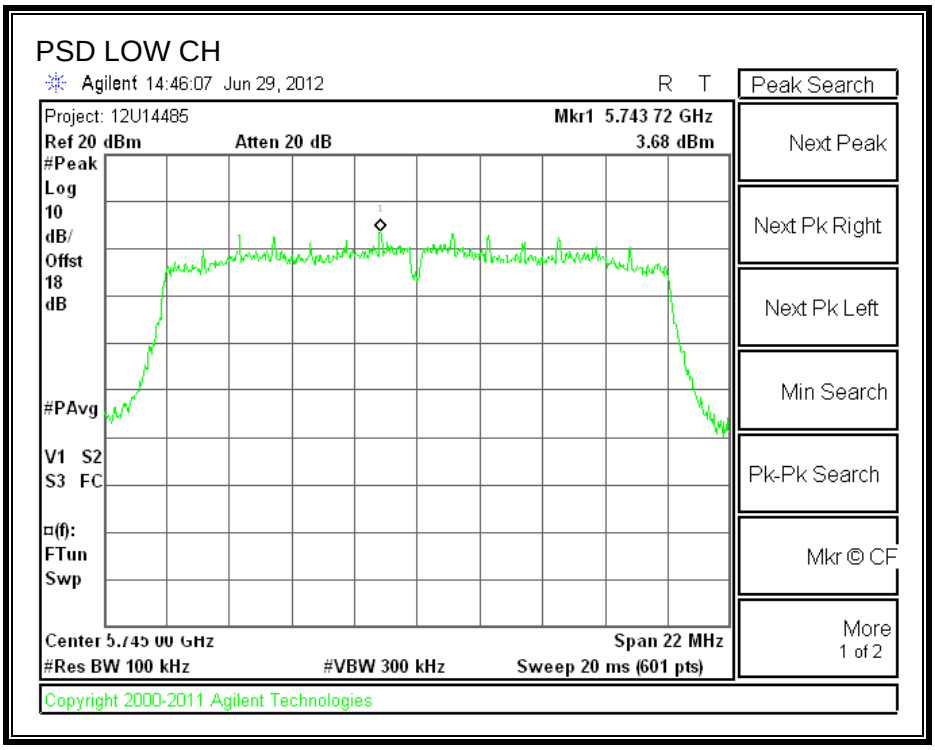
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

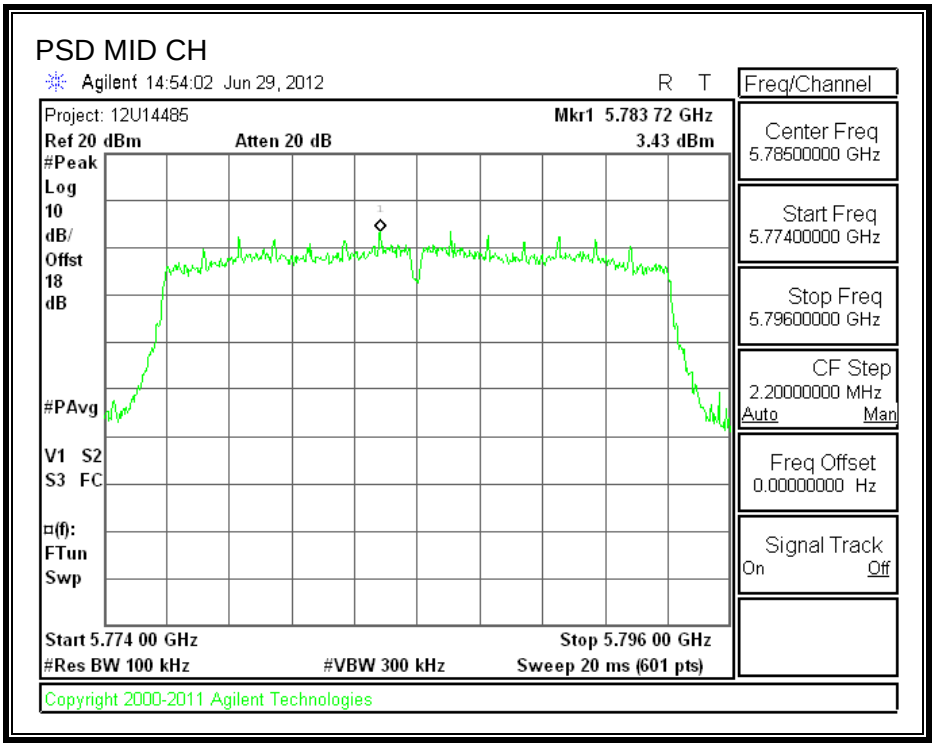
RESULTS

Channel	Frequency (MHz)	PSD (dBm)	10log(3kHz/100kHz) (dBm)	Limit (dBm)	Margin (dB)
Low	5745	3.68	-15.2	8	-19.52
Middle	5785	3.43	-15.2	8	-19.77
High	5825	3.46	-15.2	8	-19.74

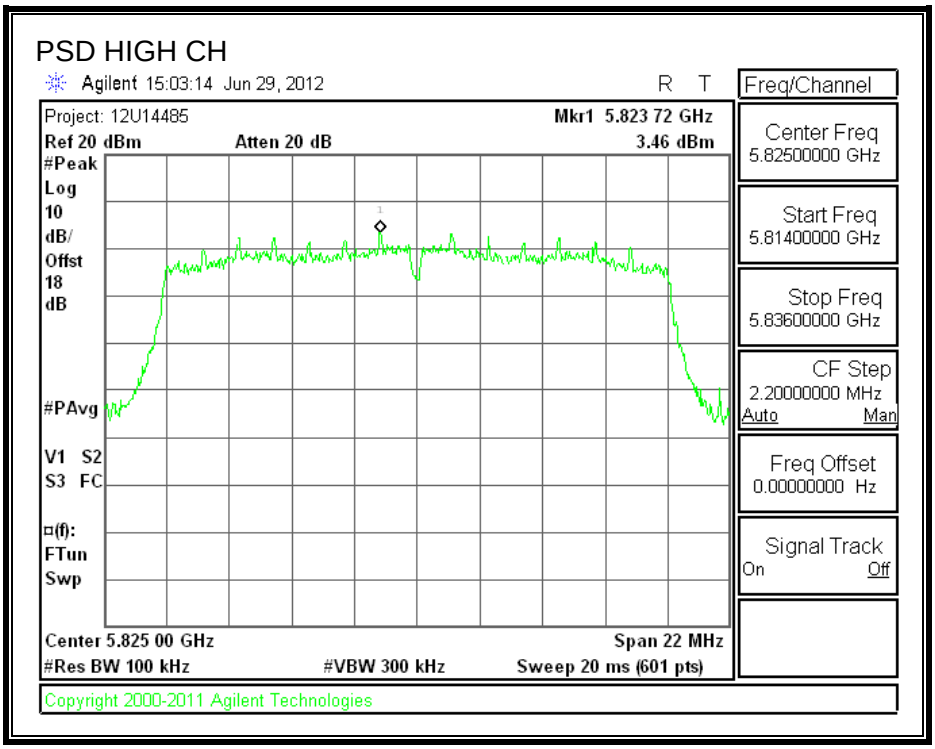
POWER SPECTRAL DENSITY



PSD MID CH



PSD HIGH CH



8.5.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

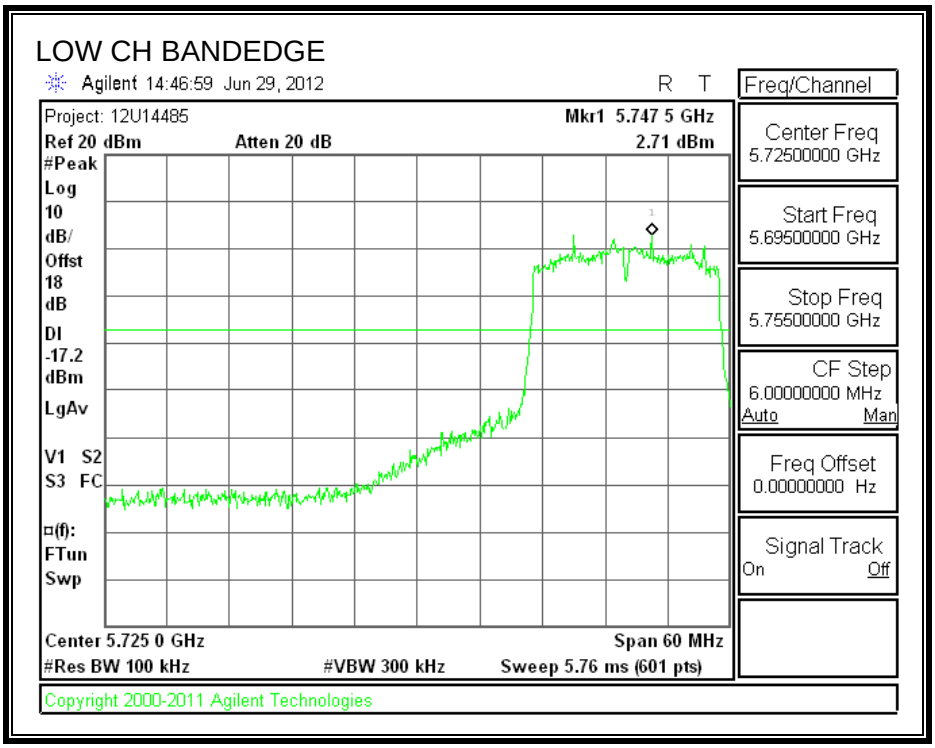
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

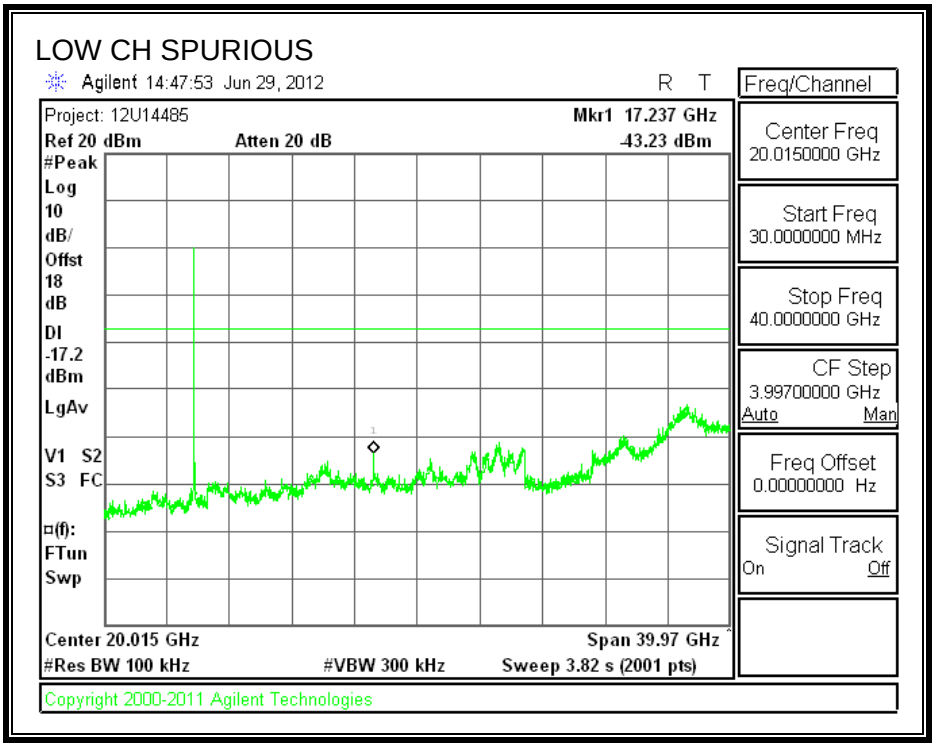
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

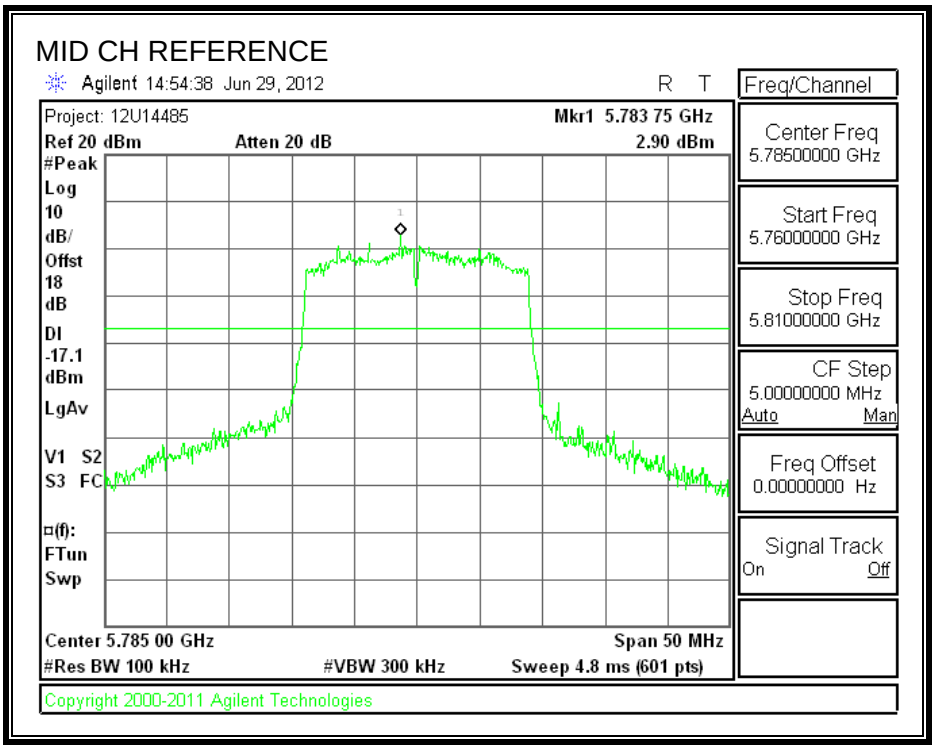
RESULTS

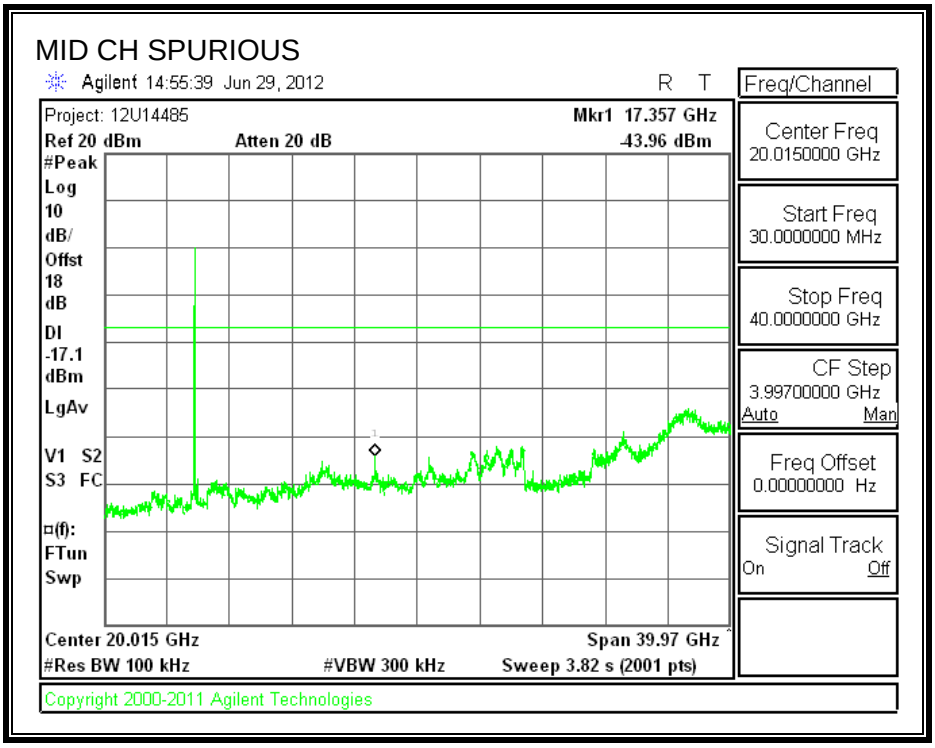
SPURIOUS EMISSIONS, LOW CHANNEL



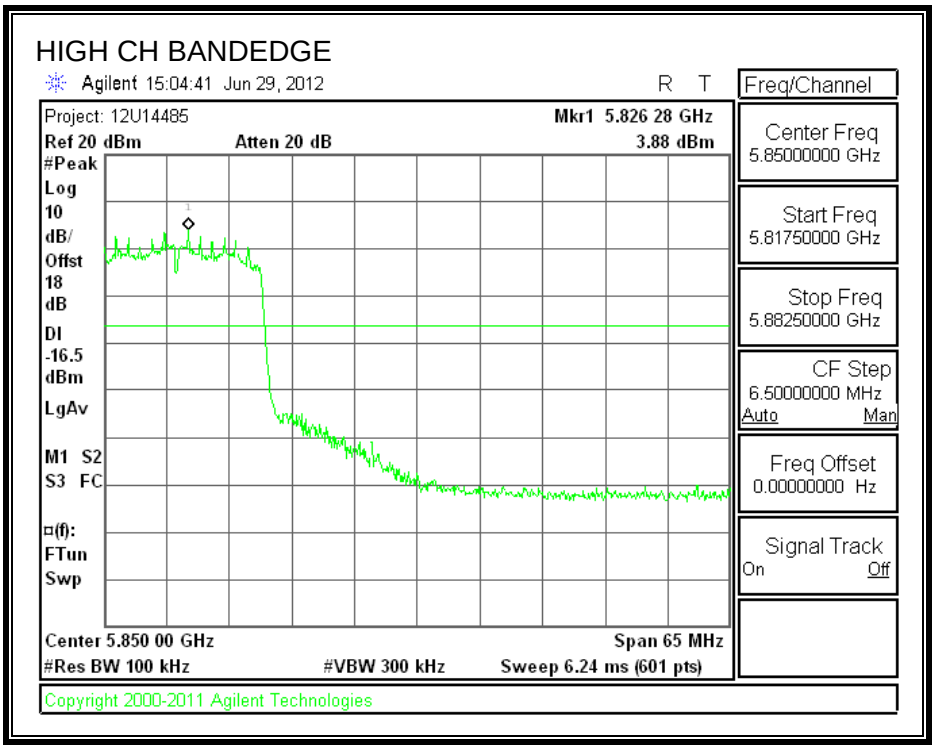


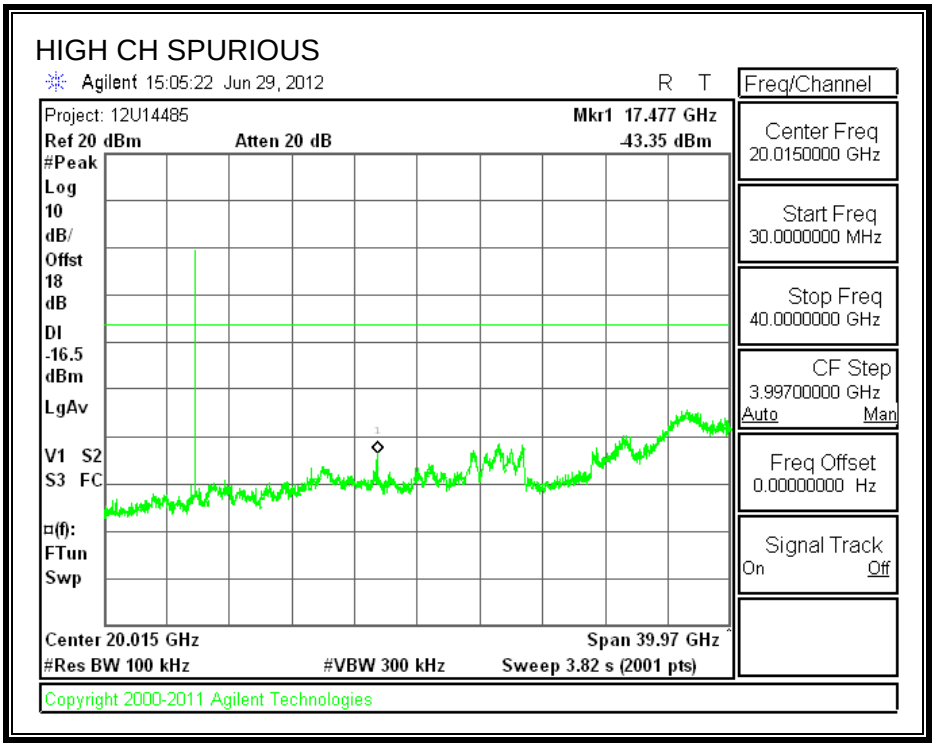
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





8.6. 802.11n HT40 MODE IN THE 5.8 GHz BAND

8.6.1. 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.

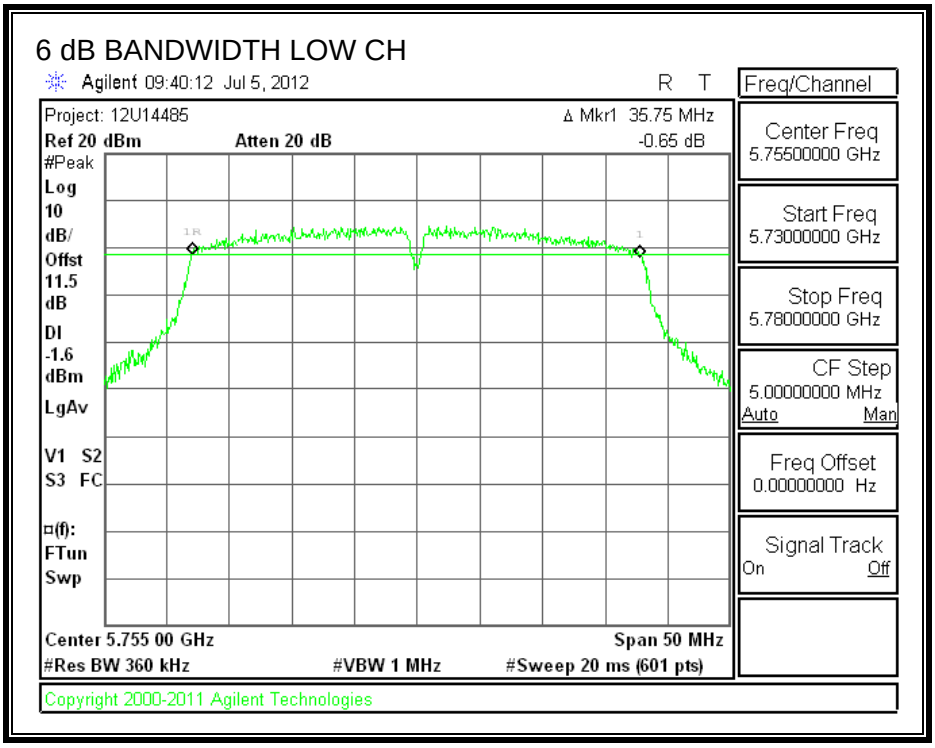
TEST PROCEDURE

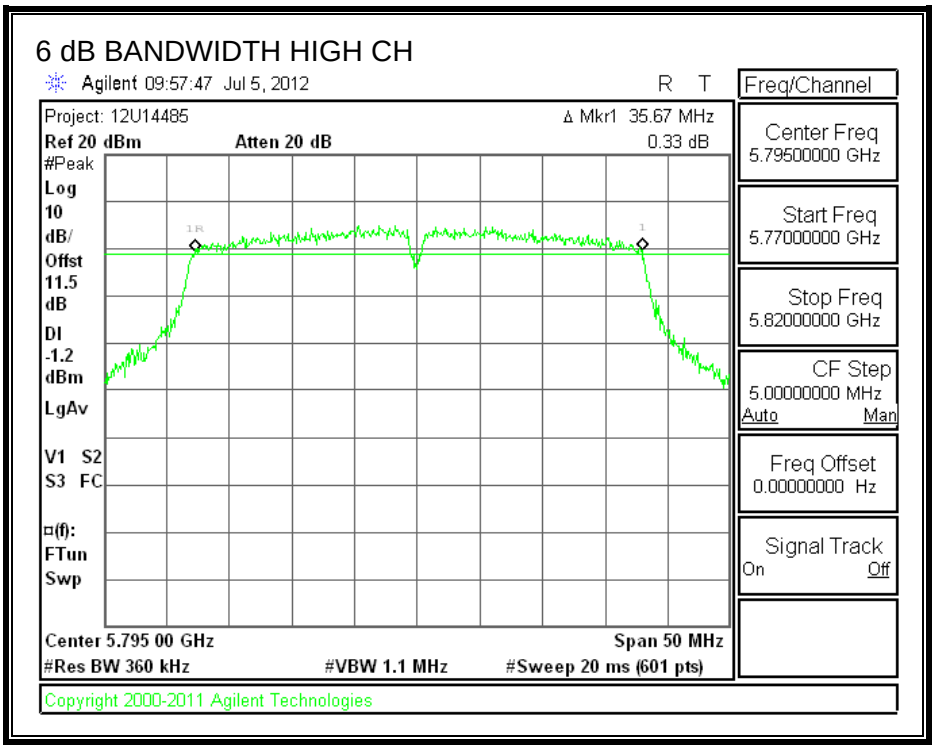
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5755	35.75	0.5
High	5795	35.67	0.5

6 dB BANDWIDTH





8.6.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

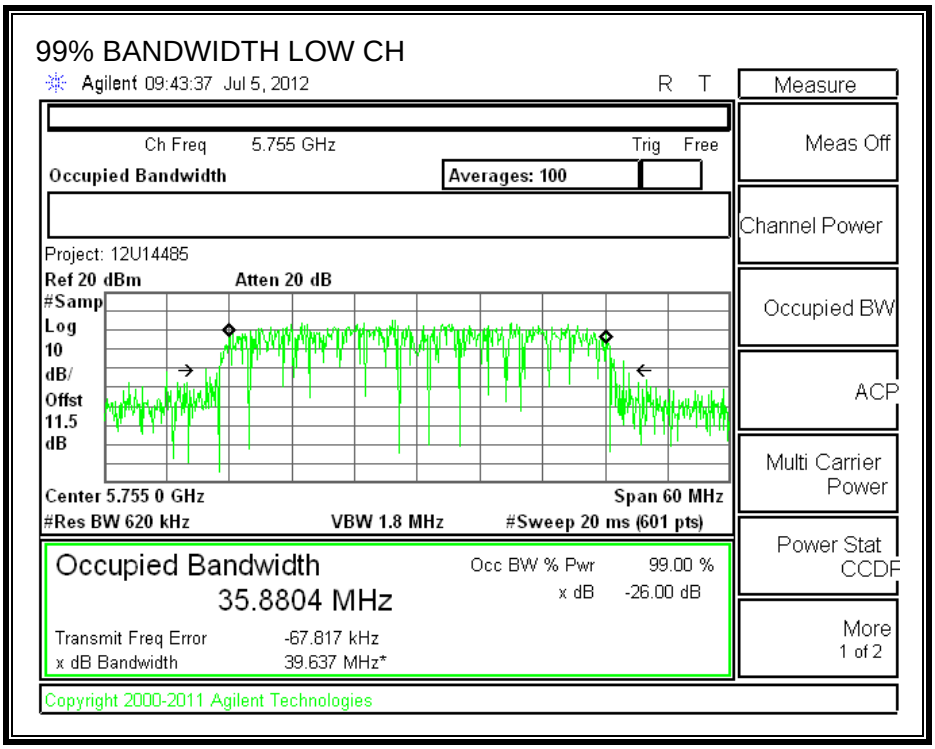
TEST PROCEDURE

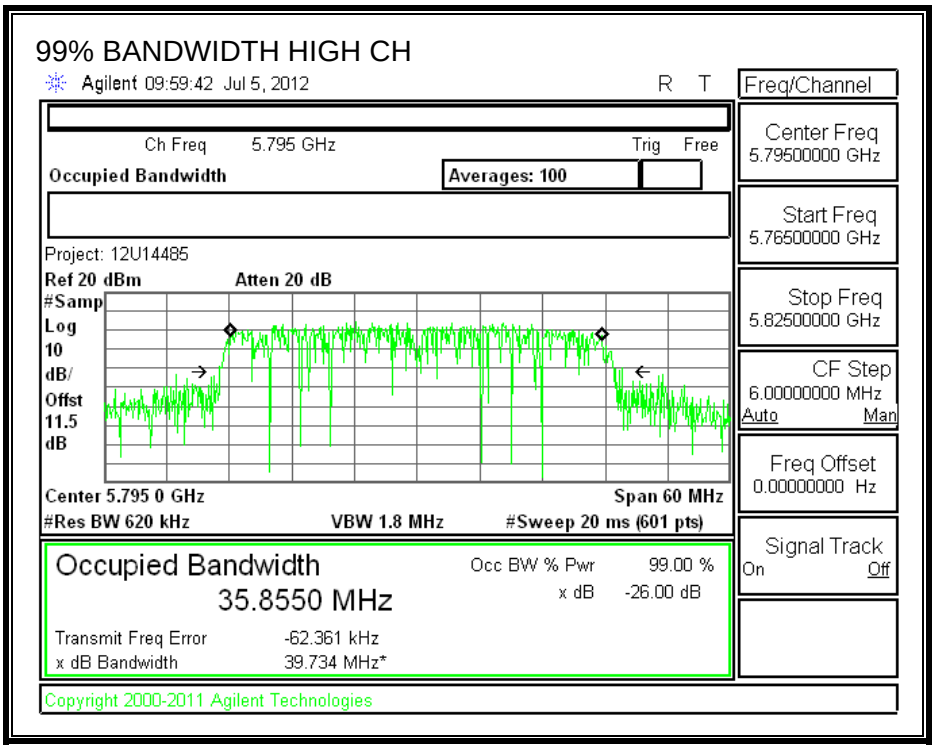
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	35.8804
High	5795	35.8550

99% BANDWIDTH





8.6.3. 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.

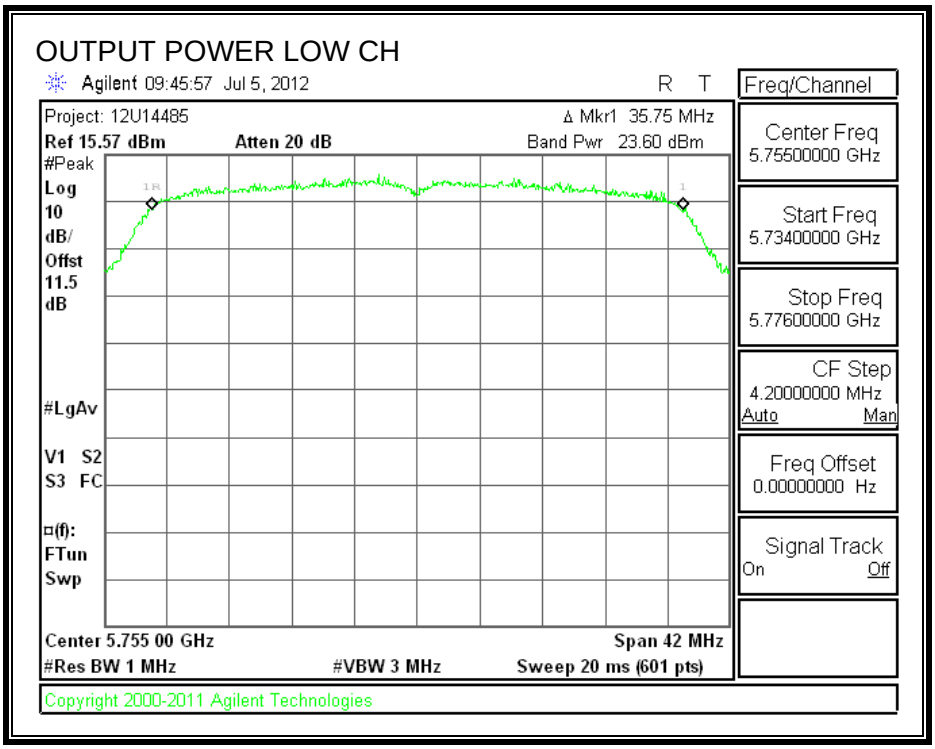
TEST PROCEDURE

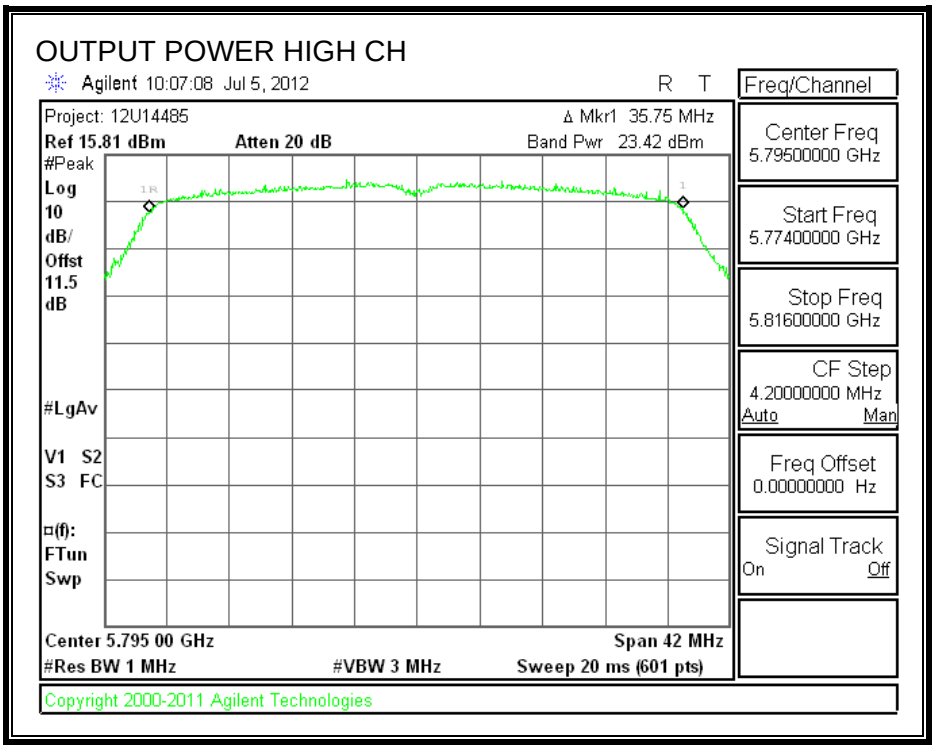
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	5755	23.60	30	-6.40
High	5795	23.42	30	-6.58

OUTPUT POWER





8.6.4. 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)	Power (dBm)
Low	5755	13.45
High	5795	13.46

8.6.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

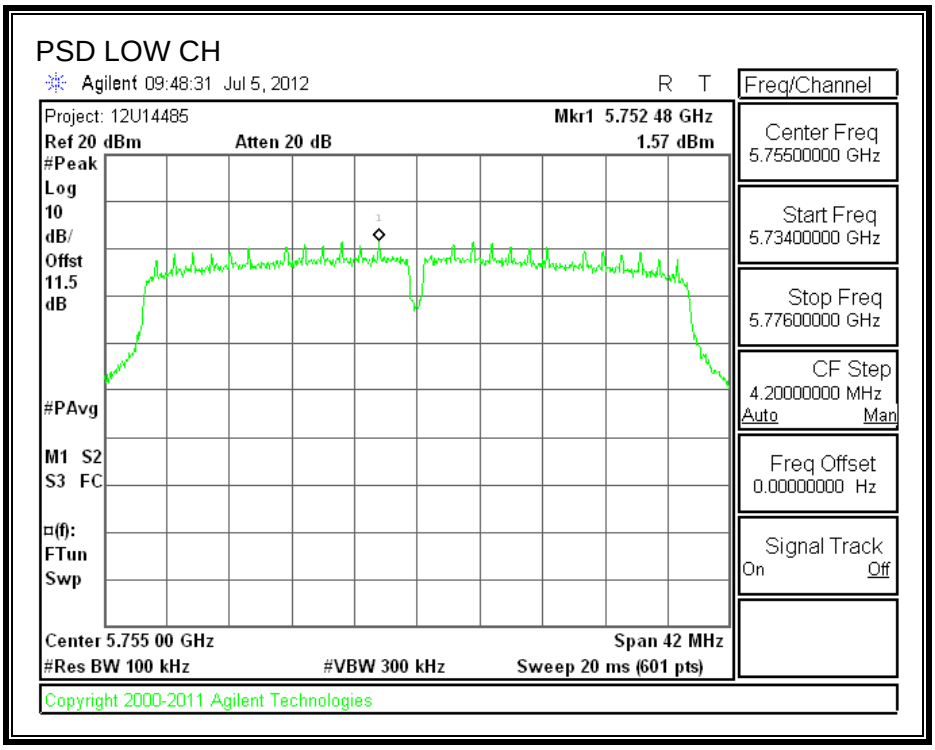
TEST PROCEDURE

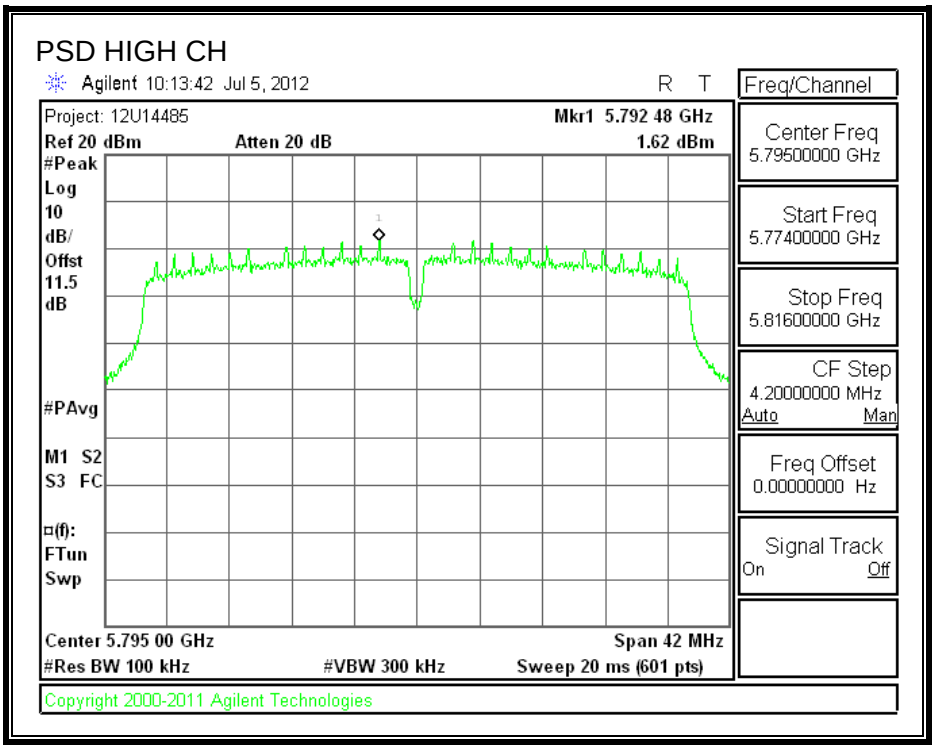
KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

RESULTS

Channel	Frequency (MHz)	PSD (dBm)	10log(3kHz/100kHz) (dBm)	Limit (dBm)	Margin (dB)
Low	5755	1.57	-15.2	8	-21.63
High	5795	1.62	-15.2	8	-21.58

POWER SPECTRAL DENSITY





8.6.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

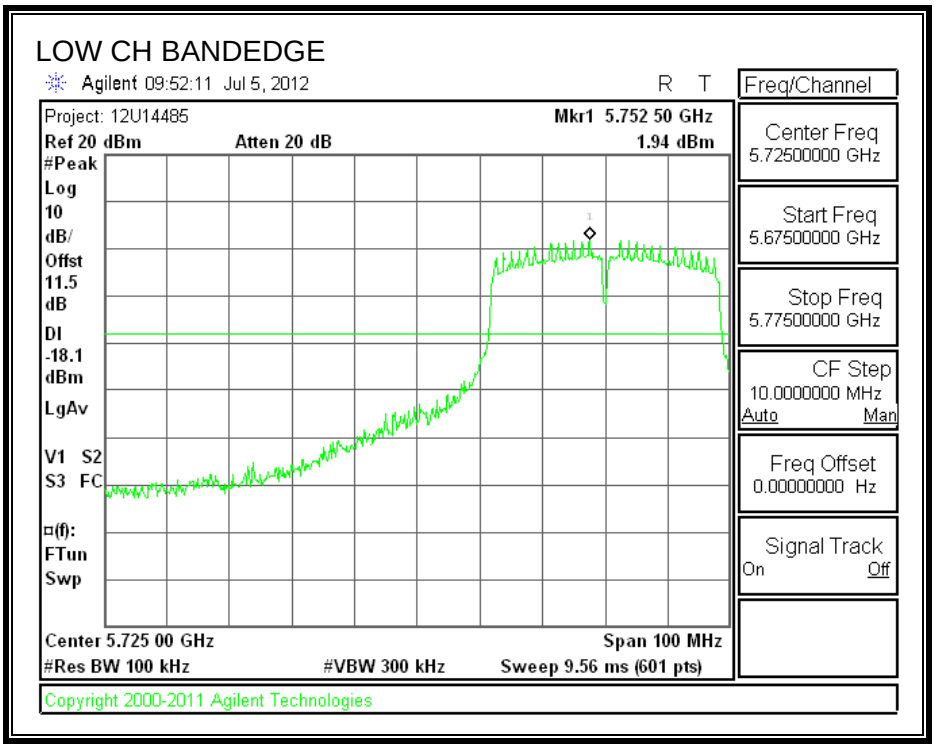
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

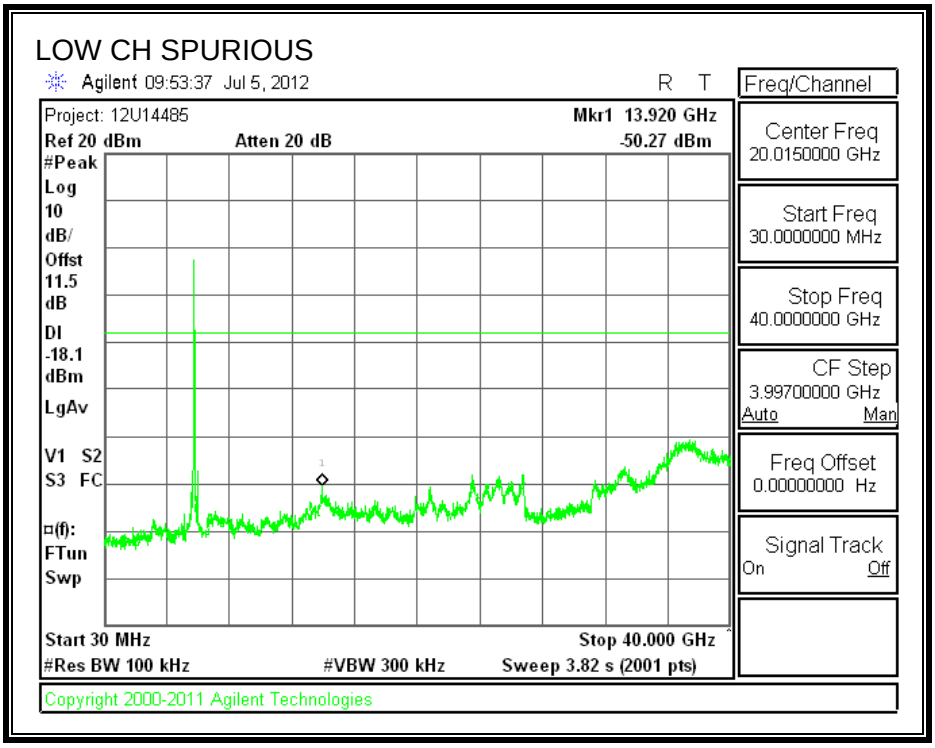
TEST PROCEDURE

KDB 558074 D01 v01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”.

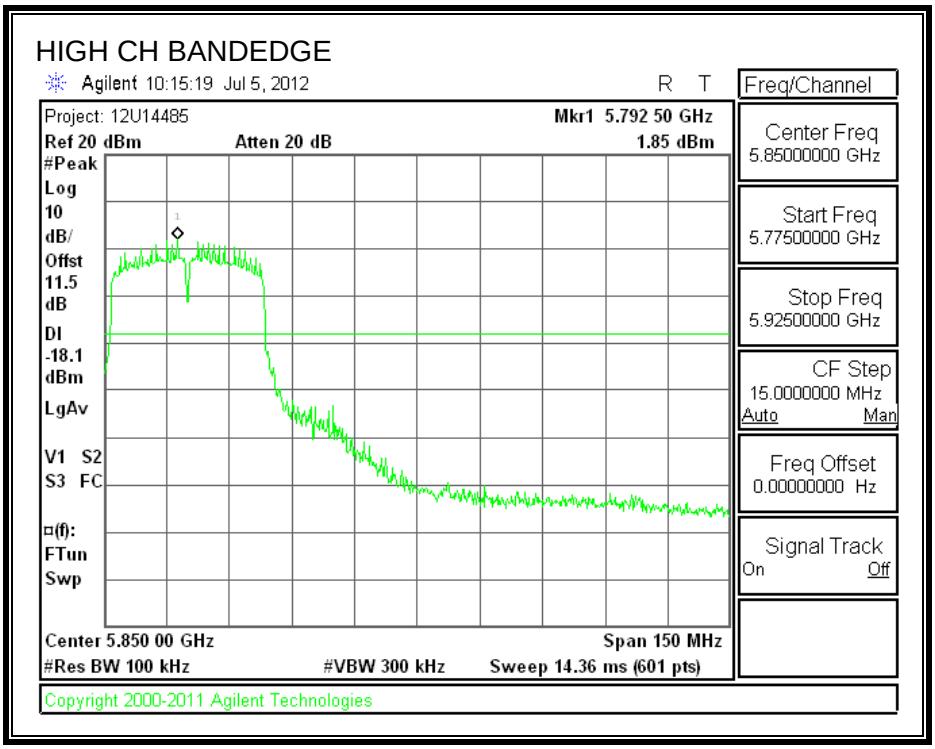
RESULTS

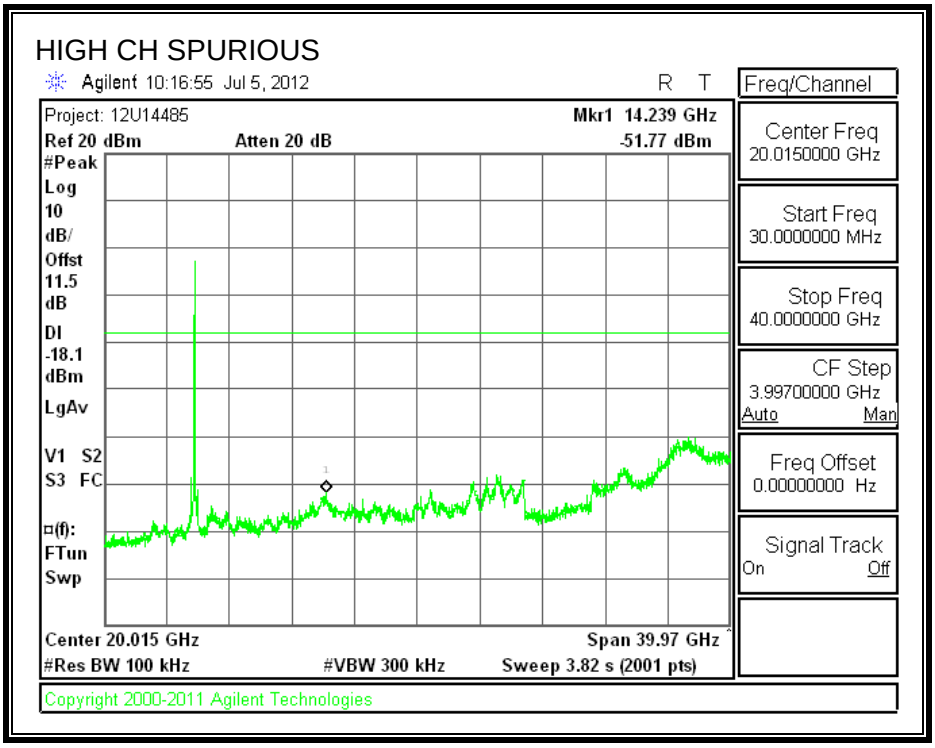
SPURIOUS EMISSIONS, LOW CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





9. RADIATED TEST RESULTS

9.1. 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.

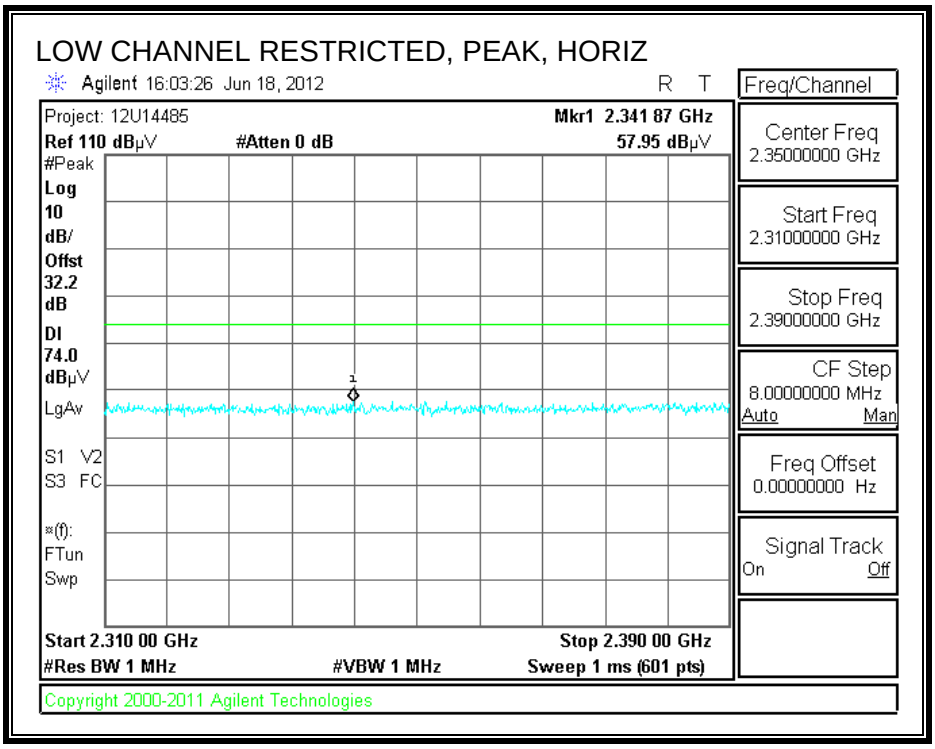
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

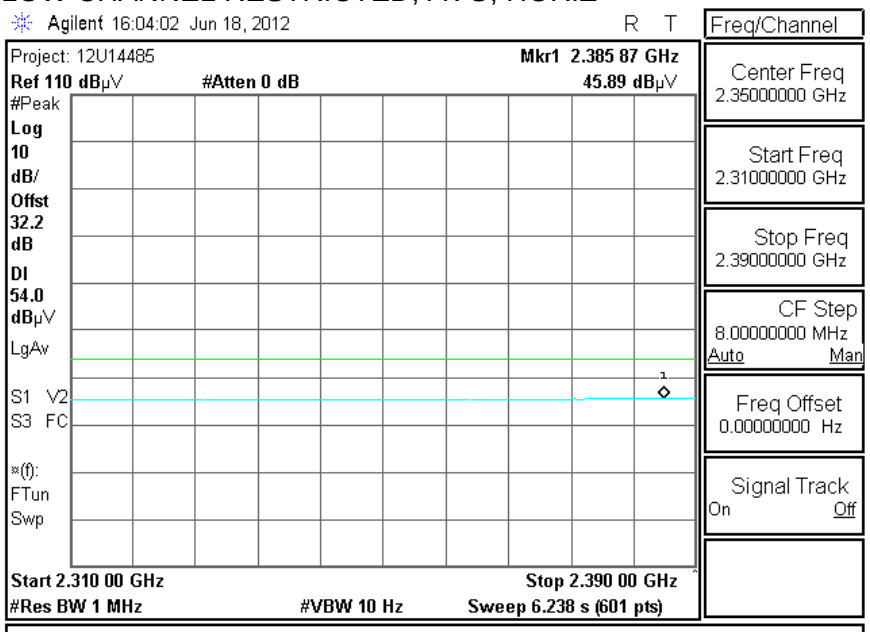
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. TX ABOVE 1 GHz FOR 802.11b 1TX MODE IN THE 2.4 GHz BAND

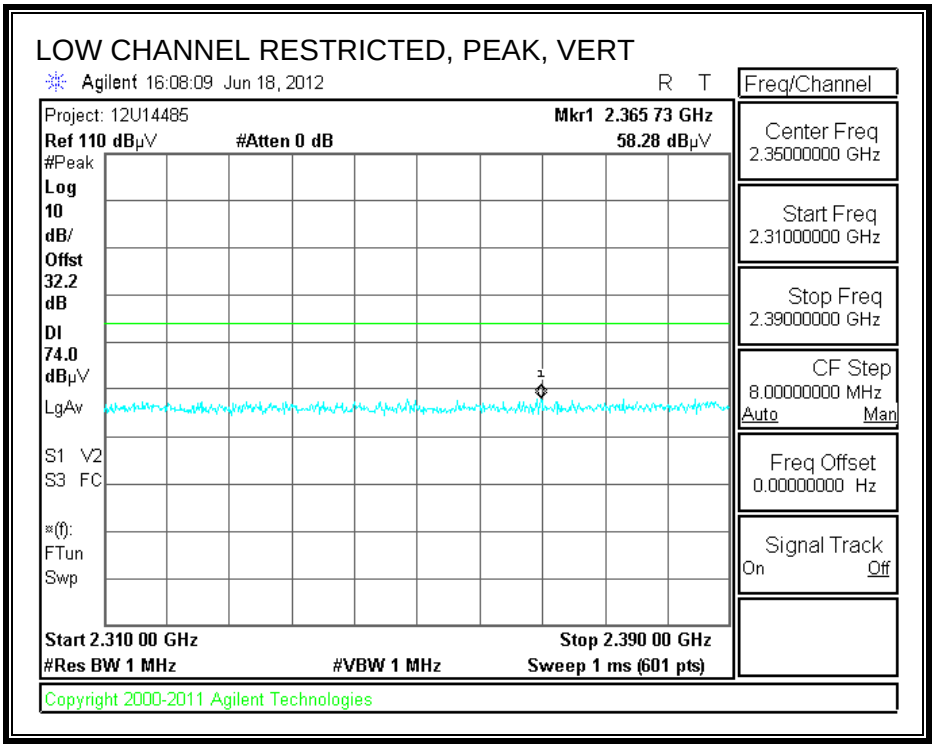
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

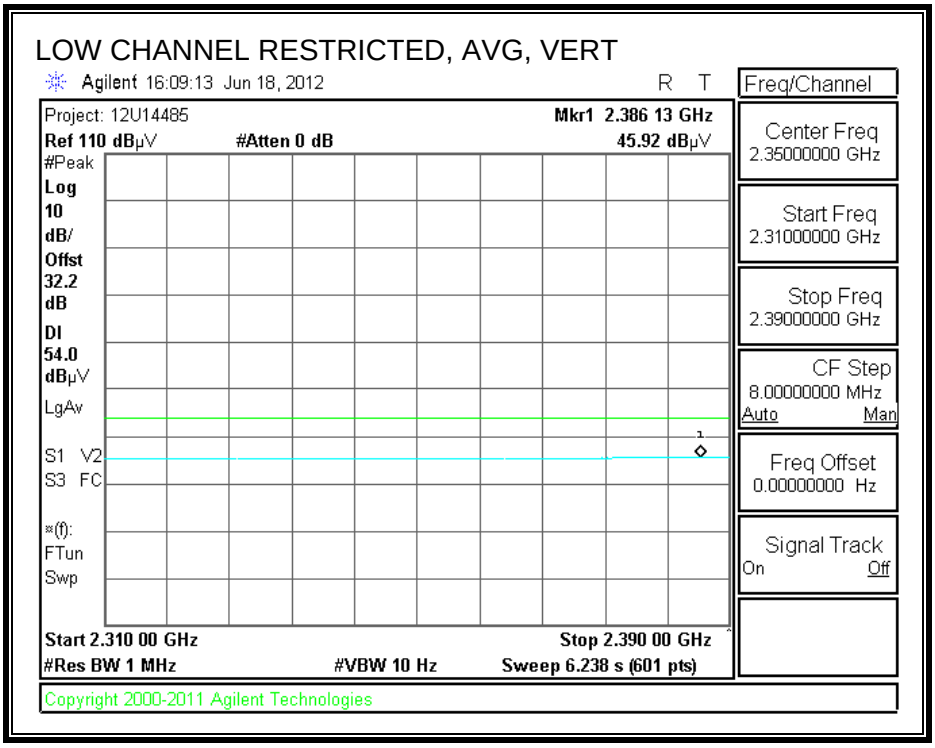


LOW CHANNEL RESTRICTED, AVG, HORIZ

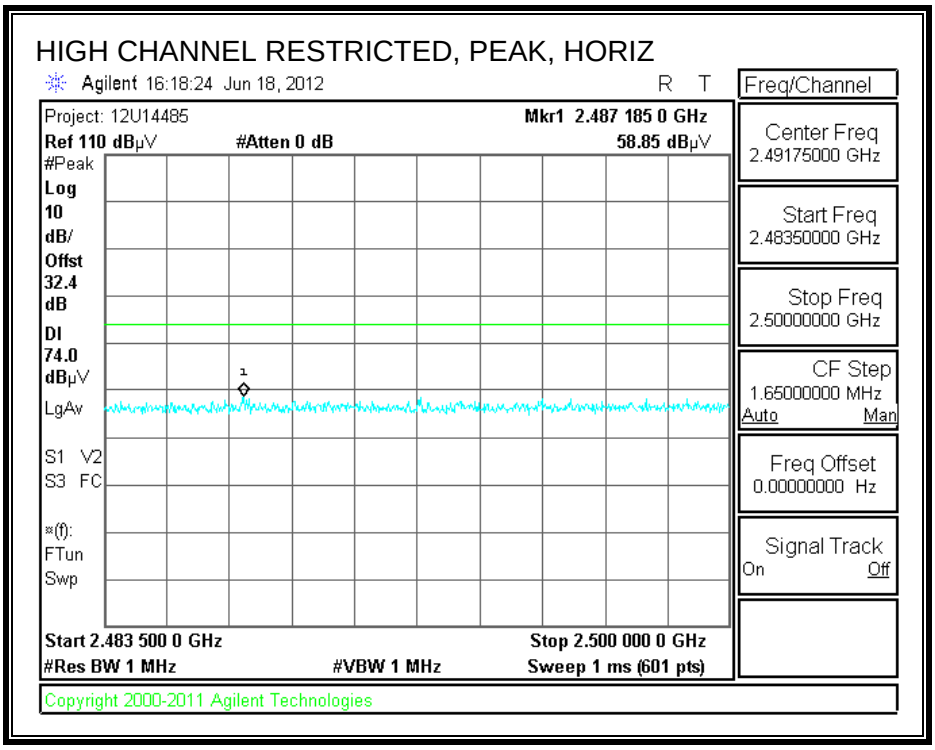


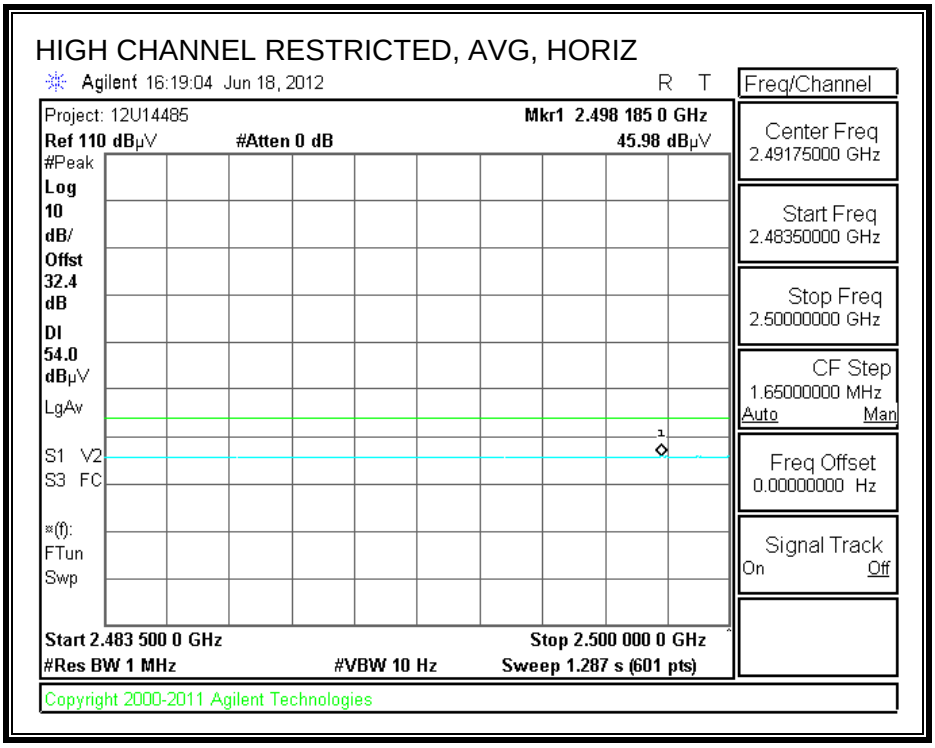
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



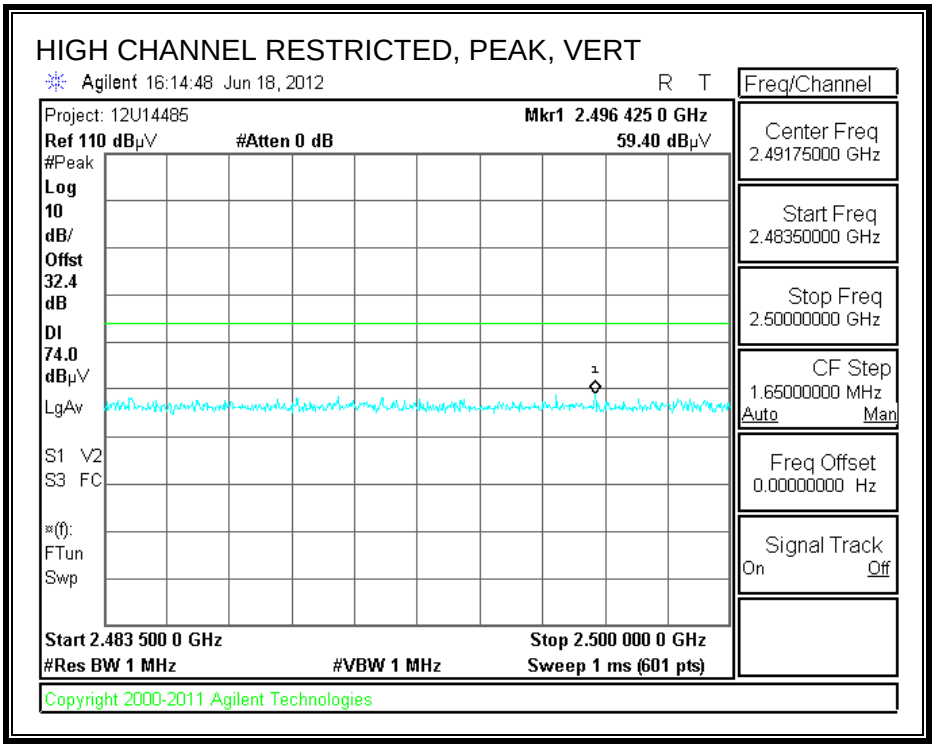


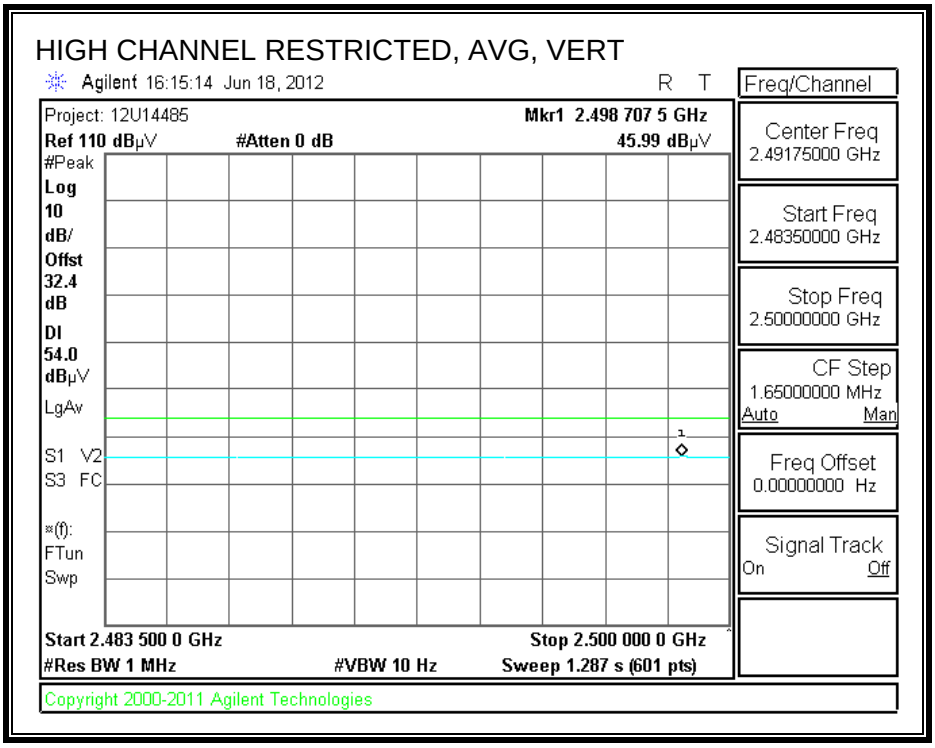
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 06/30/12
Project #: 12U14485
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11b TX mode

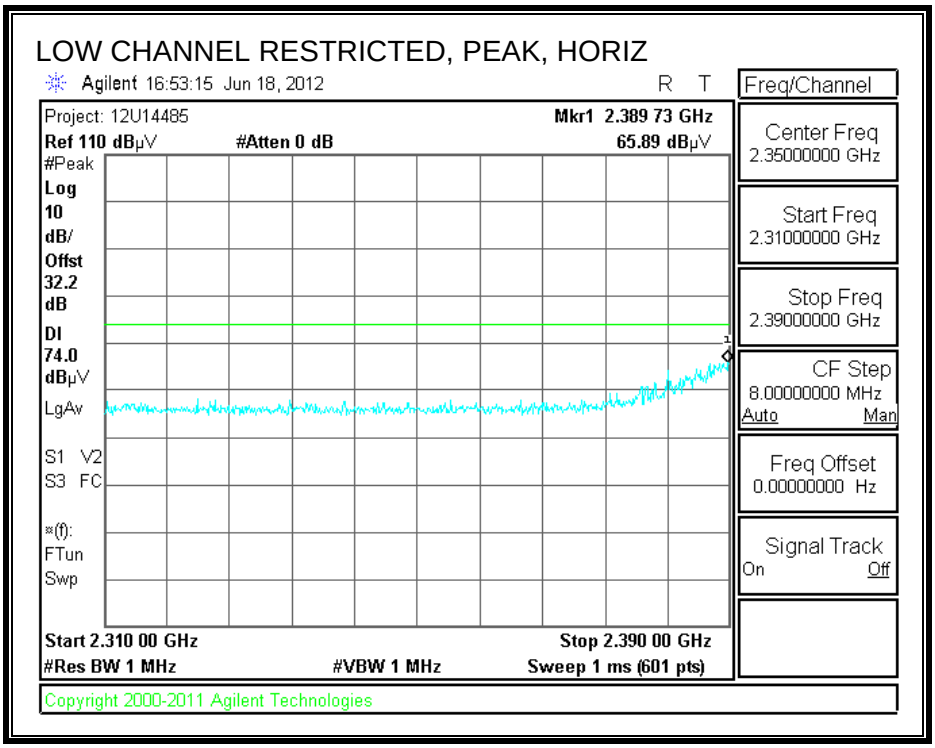
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs.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

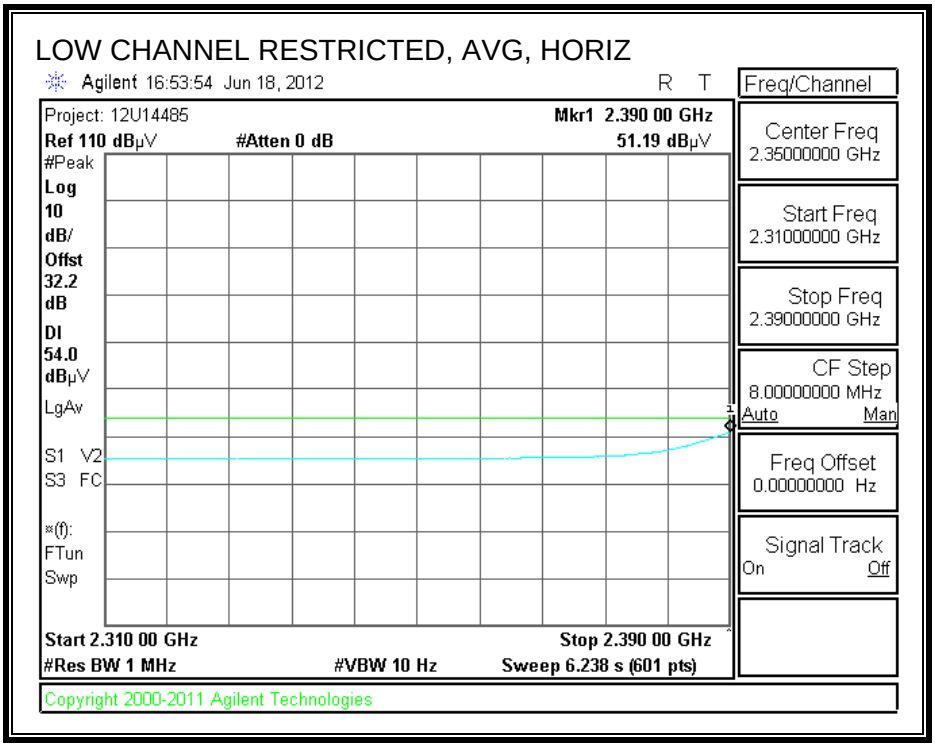
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2412 MHz b mode													
4.824	3.0	38.4	33.1	6.3	-34.8	0.0	0.0	42.9	74.0	-31.1	H	P	
4.824	3.0	25.2	33.1	6.3	-34.8	0.0	0.0	29.7	54.0	-24.3	H	A	
4.824	3.0	37.7	33.1	6.3	-34.8	0.0	0.0	42.3	74.0	-31.7	V	P	
4.824	3.0	25.2	33.1	6.3	-34.8	0.0	0.0	29.7	54.0	-24.3	V	A	
2437MHz 11b													
4.874	3.0	38.0	33.1	6.2	-34.8	0.0	0.0	42.6	74.0	-31.4	V	P	
4.874	3.0	24.9	33.1	6.2	-34.8	0.0	0.0	29.4	54.0	-24.6	V	A	
4.874	3.0	38.0	33.1	6.2	-34.8	0.0	0.0	42.6	74.0	-31.4	H	P	
4.874	3.0	24.9	33.1	6.2	-34.8	0.0	0.0	29.5	54.0	-24.5	H	A	
2462MHz 11b													
4.924	3.0	38.5	33.2	6.3	-34.8	0.0	0.0	43.2	74.0	-30.8	H	P	
4.924	3.0	25.4	33.2	6.3	-34.8	0.0	0.0	30.0	54.0	-24.0	H	A	
4.924	3.0	38.0	33.2	6.3	-34.8	0.0	0.0	42.7	74.0	-31.3	V	P	
4.924	3.0	25.3	33.2	6.3	-34.8	0.0	0.0	30.0	54.0	-24.0	V	A	

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

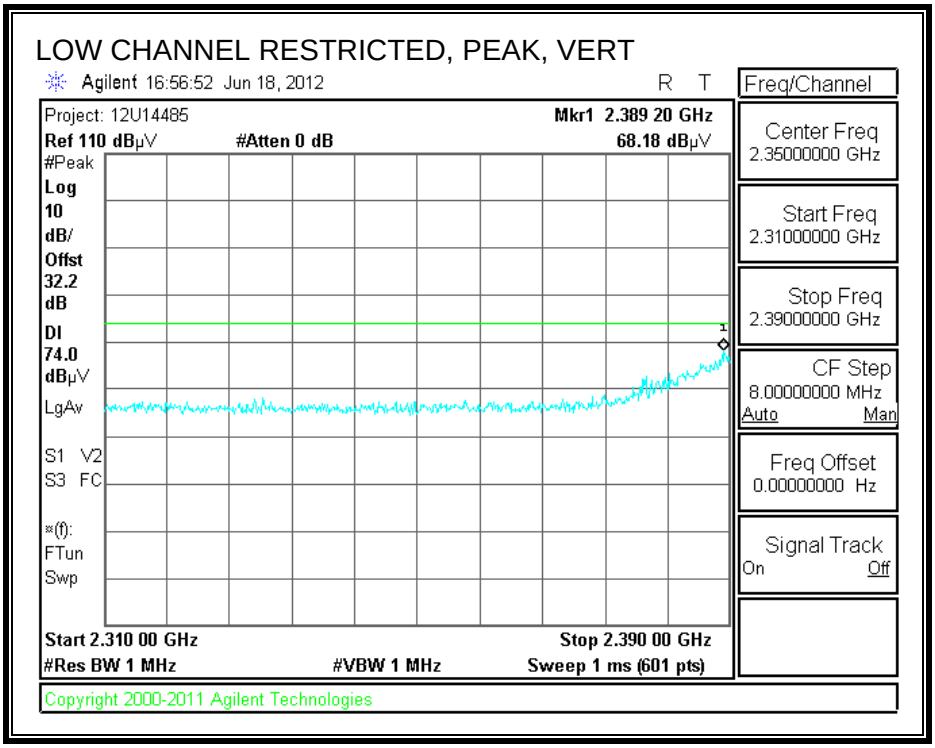
9.2.2. TX ABOVE 1 GHz FOR 802.11g 1TX MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

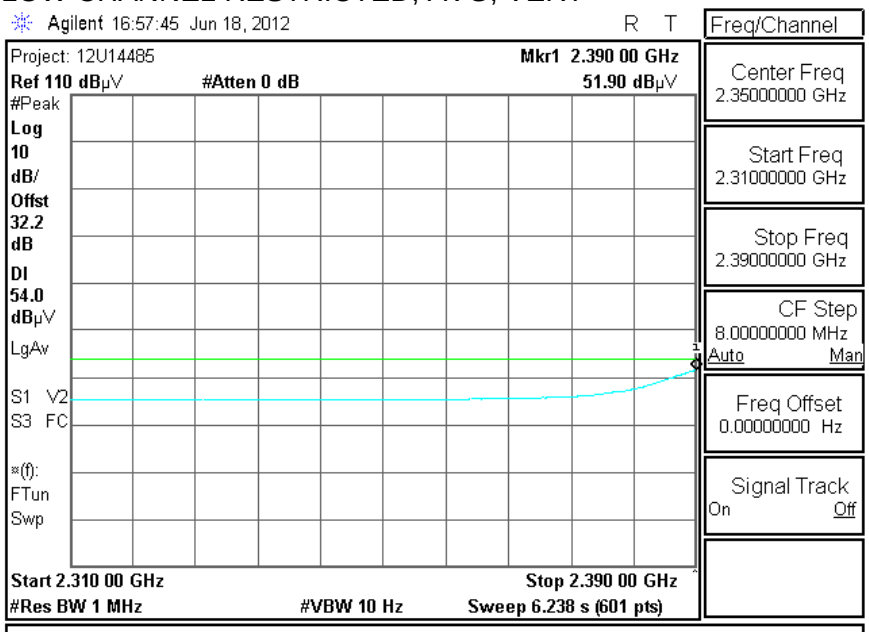




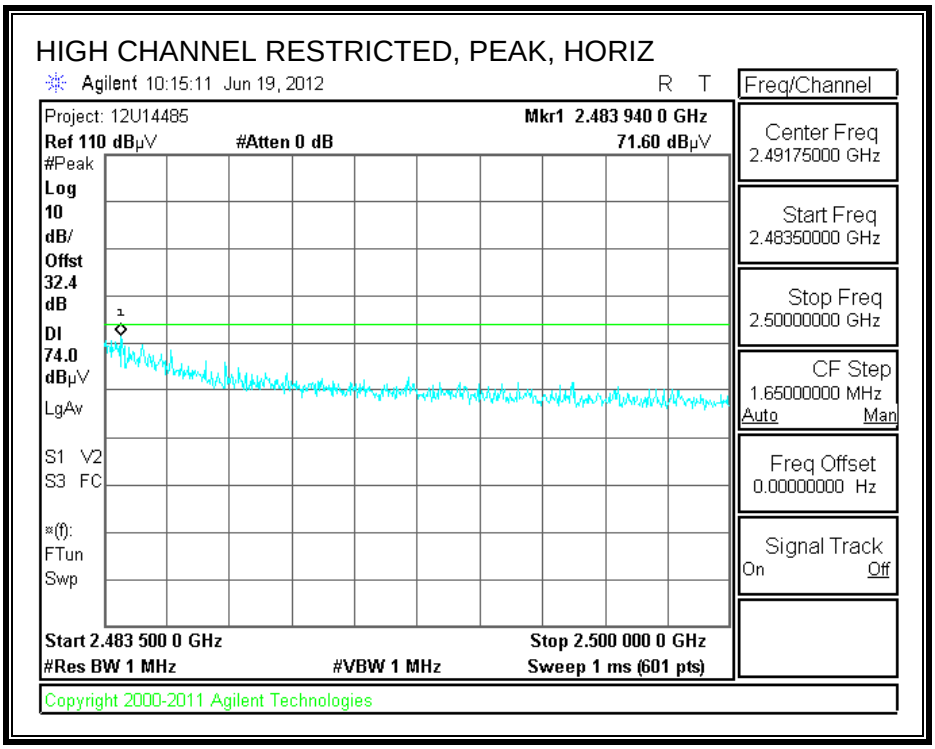
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



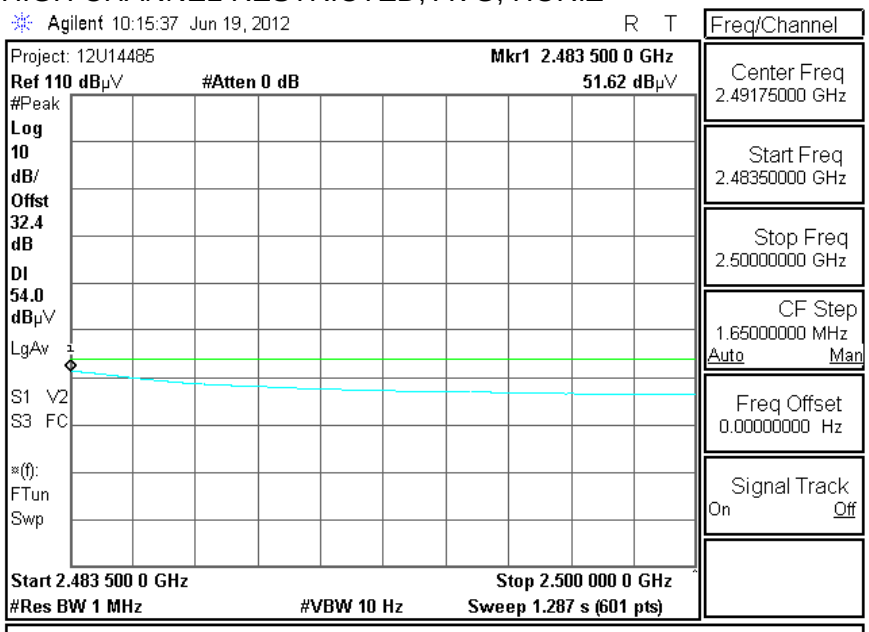
LOW CHANNEL RESTRICTED, AVG, VERT



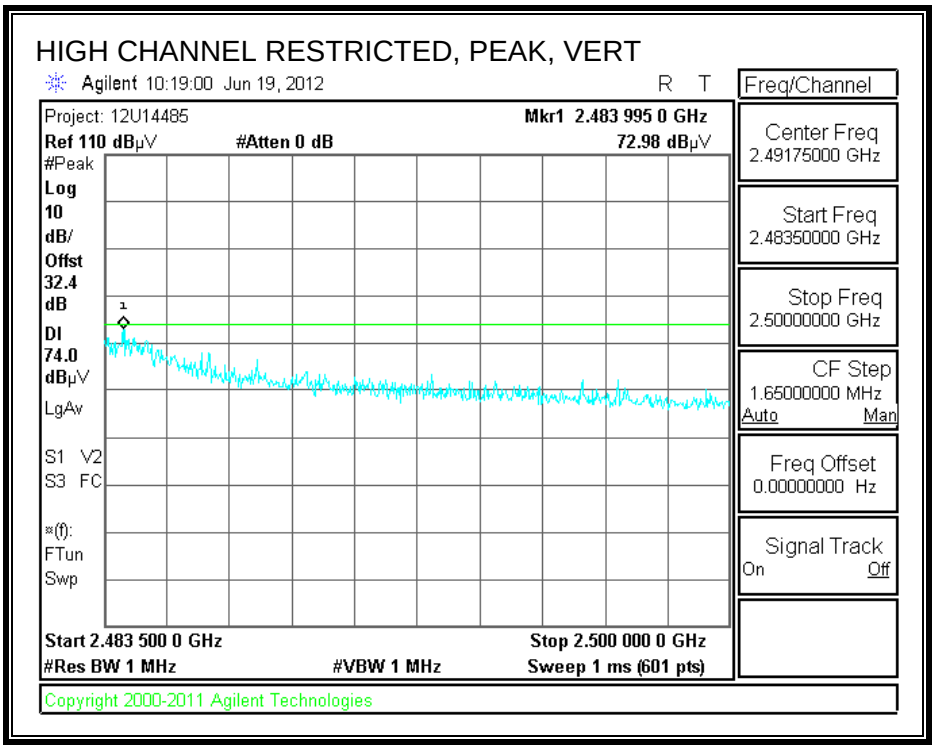
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



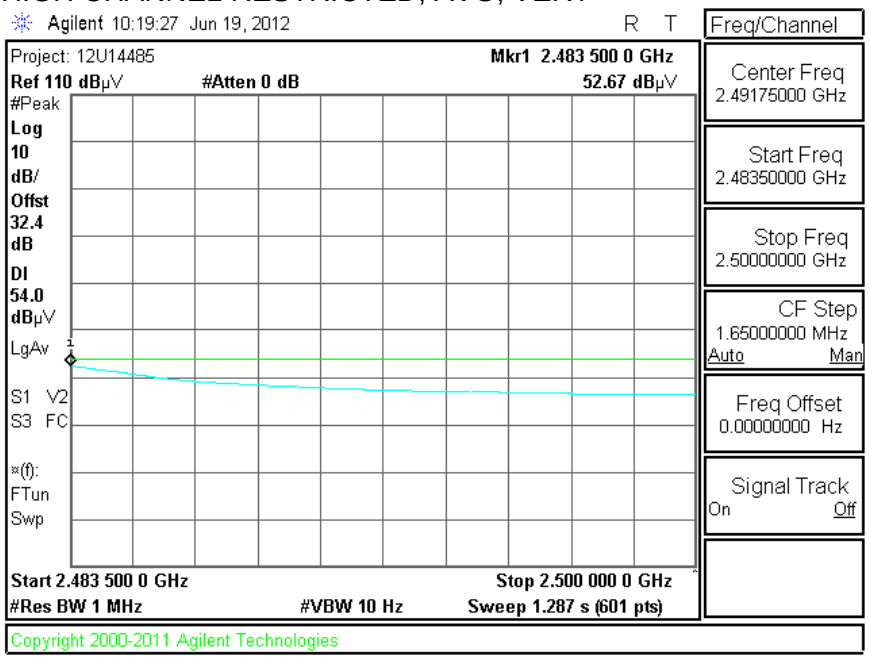
HIGH CHANNEL RESTRICTED, AVG, HORIZ



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: 06/30/12
Project #: 12U14485
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11g TX mode

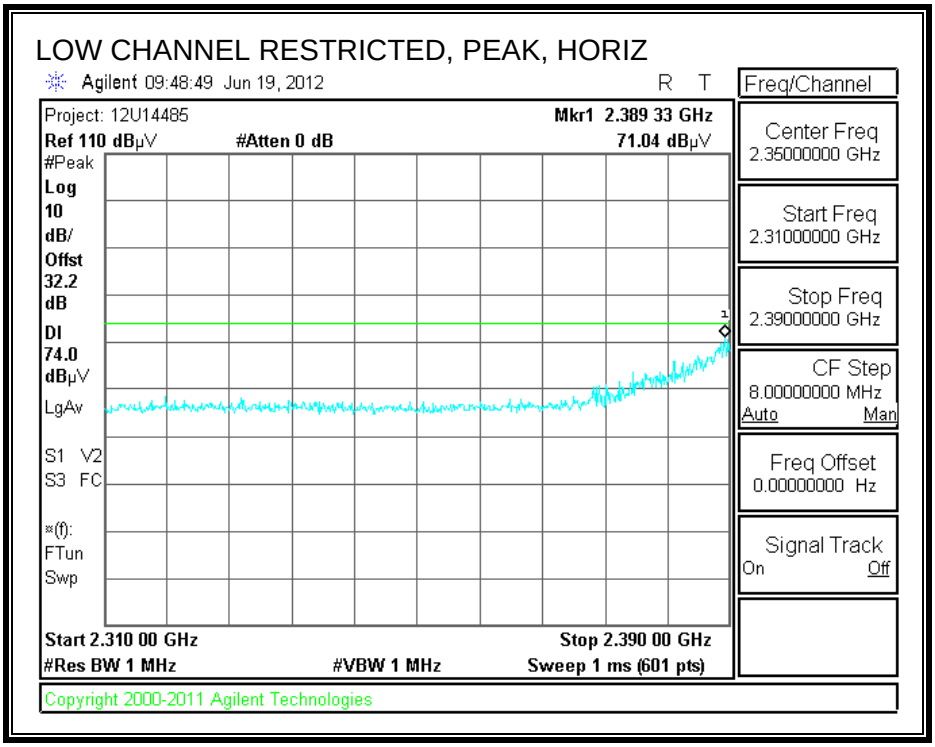
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

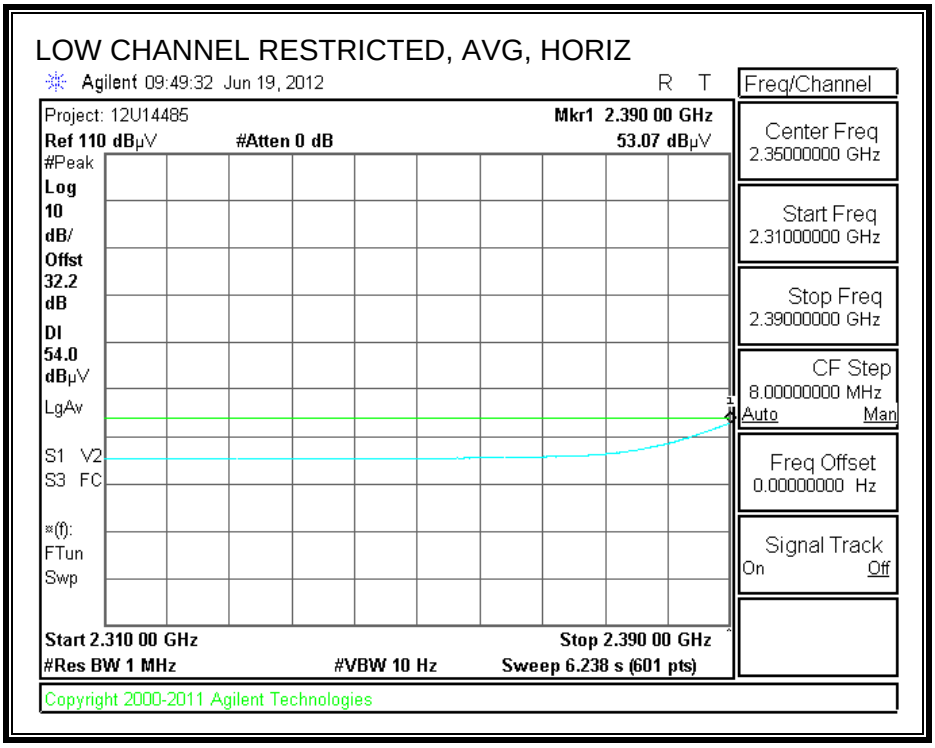
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2412MHz 11g													
4.824	3.0	38.8	33.1	6.2	-34.8	0.0	0.0	43.3	74.0	-30.7	V	P	
4.824	3.0	25.3	33.1	6.2	-34.8	0.0	0.0	29.8	54.0	-24.2	V	A	
4.824	3.0	38.8	33.1	6.2	-34.8	0.0	0.0	43.3	74.0	-30.7	H	P	
4.824	3.0	25.3	33.1	6.2	-34.8	0.0	0.0	29.8	54.0	-24.2	H	A	
2437MHz 11g													
4.874	3.0	37.6	33.1	6.2	-34.8	0.0	0.0	42.1	74.0	-31.9	H	P	
4.874	3.0	24.9	33.1	6.2	-34.8	0.0	0.0	29.5	54.0	-24.5	H	A	
4.874	3.0	37.5	33.1	6.2	-34.8	0.0	0.0	42.1	74.0	-31.9	V	P	
4.874	3.0	24.9	33.1	6.2	-34.8	0.0	0.0	29.5	54.0	-24.5	V	A	
2462MHz 11g													
4.924	3.0	38.3	33.2	6.3	-34.8	0.0	0.0	43.0	74.0	-31.0	V	P	
4.924	3.0	25.2	33.2	6.3	-34.8	0.0	0.0	29.8	54.0	-24.2	V	A	
4.924	3.0	37.9	33.2	6.3	-34.8	0.0	0.0	42.5	74.0	-31.5	H	P	
4.924	3.0	25.0	33.2	6.3	-34.8	0.0	0.0	29.6	54.0	-24.4	H	A	

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

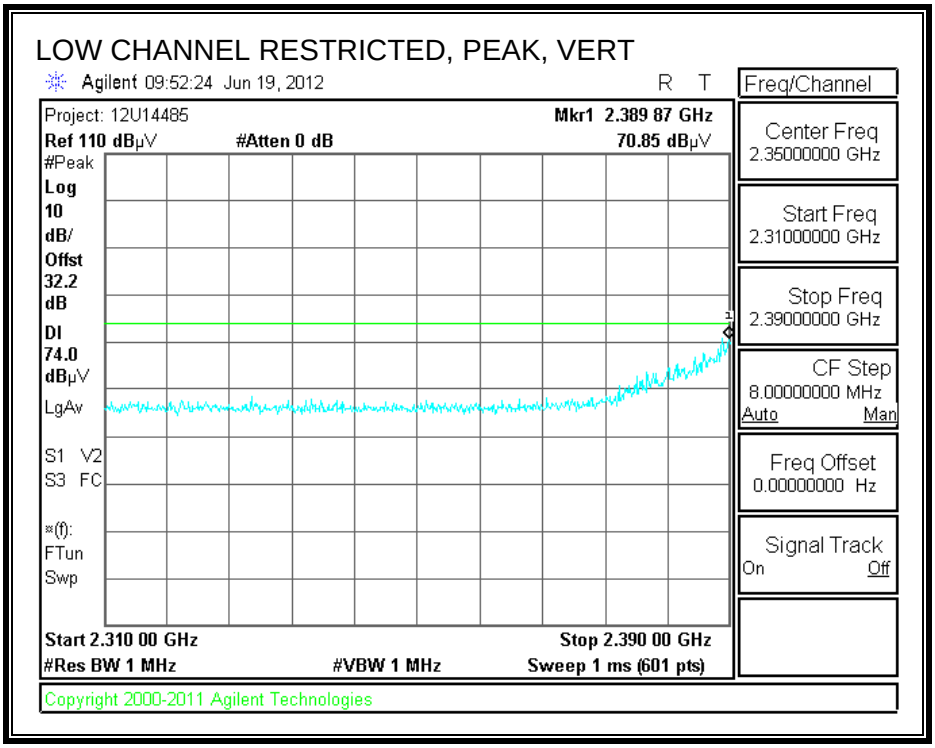
9.2.3. TX ABOVE 1 GHz FOR 802.11n HT20 1TX MODE IN THE 2.4 GHz BAND

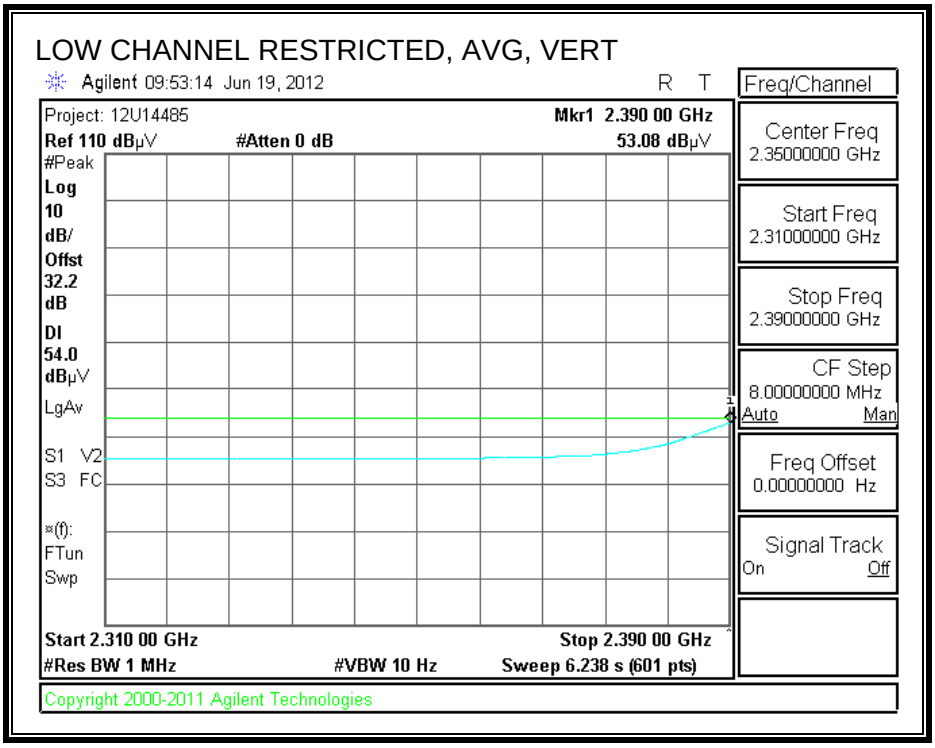
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



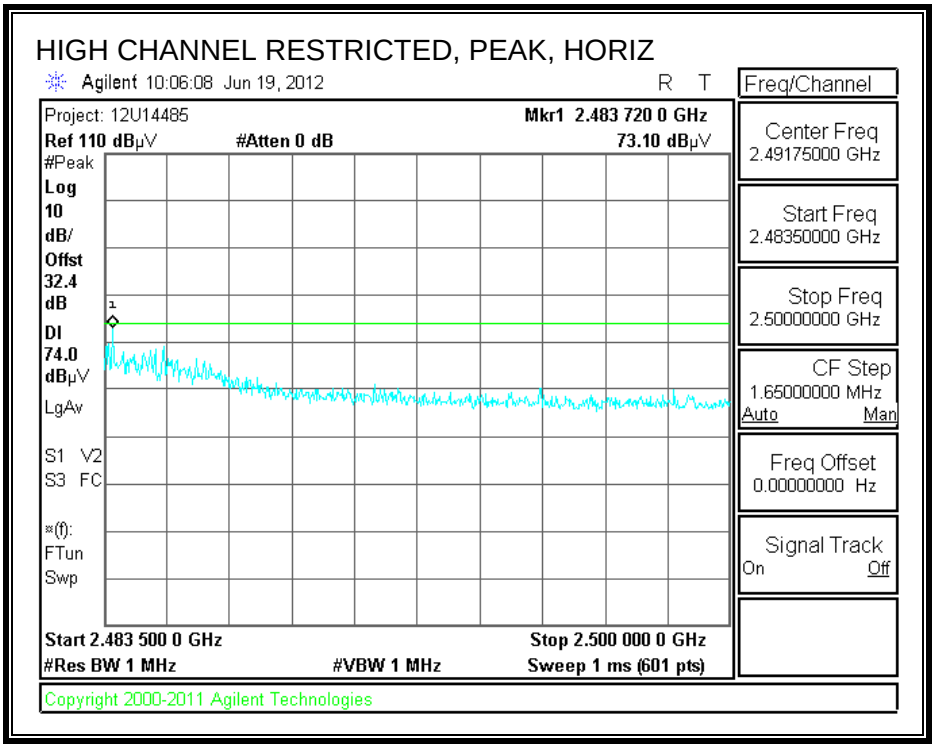


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

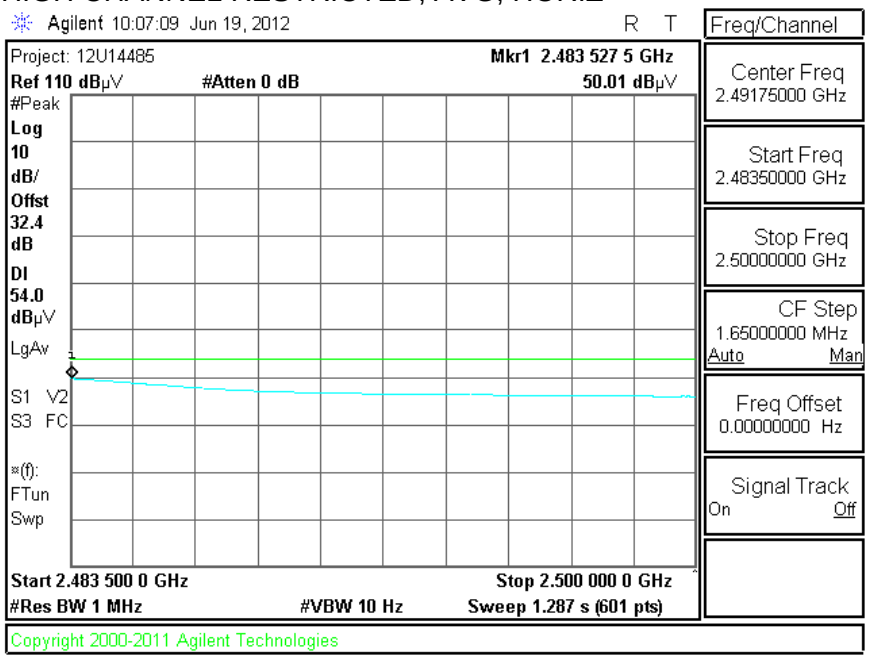




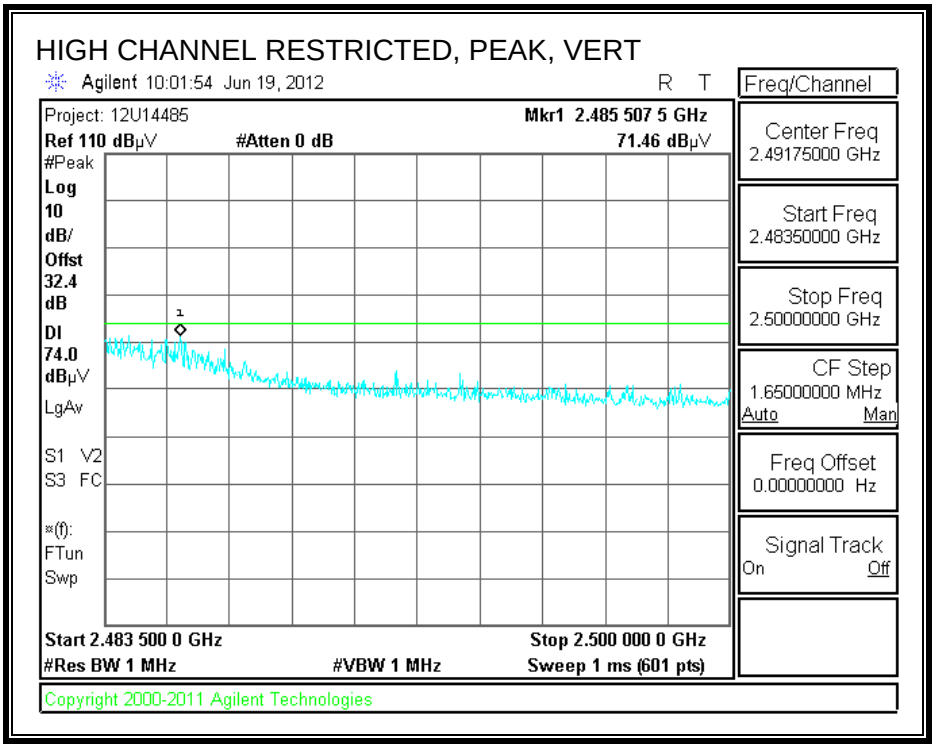
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



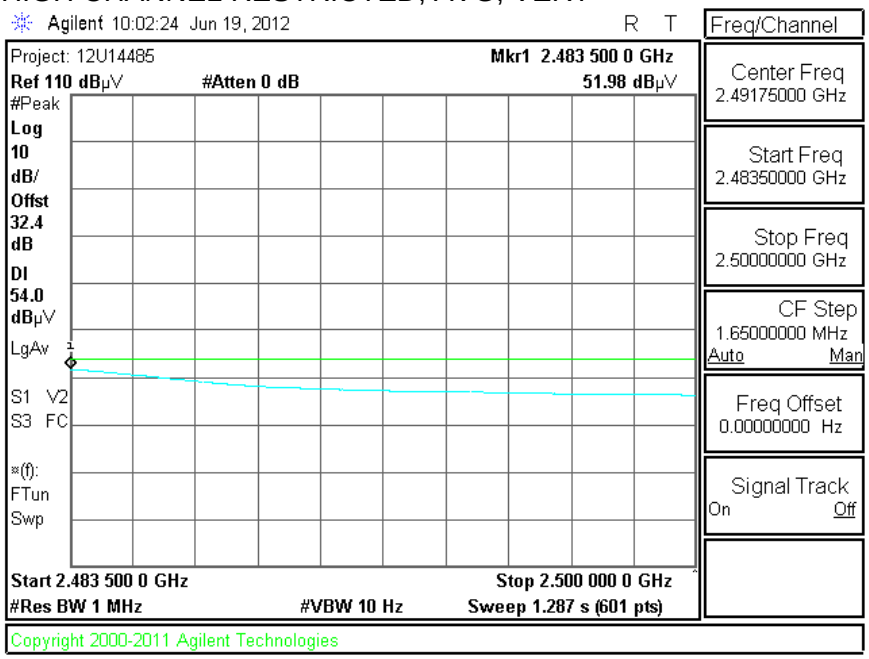
HIGH CHANNEL RESTRICTED, AVG, HORIZ



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: 06/30/12
Project #: 12U14485
Company: Apple
Test Target: FCC Class B
Mode Oper: 802.11n 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
2412MHz 11n													
4.824	3.0	38.3	33.1	6.2	-34.8	0.0	0.0	42.8	74.0	-31.2	H	P	
4.824	3.0	25.3	33.1	6.2	-34.8	0.0	0.0	29.8	54.0	-24.2	H	A	
4.824	3.0	38.5	33.1	6.2	-34.8	0.0	0.0	43.0	74.0	-31.0	V	P	
4.824	3.0	25.6	33.1	6.2	-34.8	0.0	0.0	30.1	54.0	-23.9	V	A	
2437MHz 11n													
4.874	3.0	38.5	33.1	6.2	-34.8	0.0	0.0	43.1	74.0	-30.9	V	P	
4.874	3.0	25.0	33.1	6.2	-34.8	0.0	0.0	29.6	54.0	-24.4	V	A	
4.874	3.0	38.1	33.1	6.2	-34.8	0.0	0.0	42.7	74.0	-31.3	H	P	
4.874	3.0	24.7	33.1	6.2	-34.8	0.0	0.0	29.3	54.0	-24.7	H	A	
2462MHz 11n													
4.924	3.0	37.9	33.2	6.3	-34.8	0.0	0.0	42.5	74.0	-31.5	H	P	
4.924	3.0	25.0	33.2	6.3	-34.8	0.0	0.0	29.7	54.0	-24.3	H	A	
4.924	3.0	38.1	33.2	6.3	-34.8	0.0	0.0	42.8	74.0	-31.2	V	P	
4.924	3.0	25.2	33.2	6.3	-34.8	0.0	0.0	29.8	54.0	-24.2	V	A	

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

9.2.4. TX ABOVE 1 GHz FOR 802.11a 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: 06/30/12
Project #: 12U14485
Company: Apple
Test Target: FCC Class B
Mode Oper: 5.8GHz 802.11a, 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
5745MHz 11a													
11.490	3.0	35.4	38.8	10.7	-32.9	0.0	0.7	52.8	74.0	-21.2	V	P	
11.490	3.0	22.3	38.8	10.7	-32.9	0.0	0.7	39.7	54.0	-14.3	V	A	
11.490	3.0	34.9	38.8	10.7	-32.9	0.0	0.7	52.3	74.0	-21.7	H	P	
11.490	3.0	22.3	38.8	10.7	-32.9	0.0	0.7	39.7	54.0	-14.3	H	A	
5785MHz 11a													
11.570	3.0	34.9	38.9	10.8	-32.8	0.0	0.7	52.5	74.0	-21.5	H	P	
11.570	3.0	22.4	38.9	10.8	-32.8	0.0	0.7	40.0	54.0	-14.0	H	A	
11.570	3.0	34.8	38.9	10.8	-32.8	0.0	0.7	52.4	74.0	-21.6	V	P	
11.570	3.0	22.2	38.9	10.8	-32.8	0.0	0.7	39.8	54.0	-14.2	V	A	
5825MHz 11a													
11.650	3.0	35.5	39.0	10.9	-32.7	0.0	0.7	53.4	74.0	-20.6	V	P	
11.650	3.0	22.6	39.0	10.9	-32.7	0.0	0.7	40.5	54.0	-13.5	V	A	
11.650	3.0	36.0	39.0	10.9	-32.7	0.0	0.7	53.8	74.0	-20.2	H	P	
11.650	3.0	22.6	39.0	10.9	-32.7	0.0	0.7	40.5	54.0	-13.5	H	A	

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

9.2.5. TX ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 06/30/12
Project #: 12U14485
Company: Apple
Test Target: FCC Class B
Mode Oper: 5.8GHz 802.11n, 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
5745MHz 11n													
11.490	3.0	34.9	38.8	10.7	-32.9	0.0	0.7	52.2	74.0	-21.8	H	P	
11.490	3.0	22.2	38.8	10.7	-32.9	0.0	0.7	39.6	54.0	-14.4	H	A	
11.490	3.0	34.8	38.8	10.7	-32.9	0.0	0.7	52.1	74.0	-21.9	V	P	
11.490	3.0	22.2	38.8	10.7	-32.9	0.0	0.7	39.6	54.0	-14.4	V	A	
5785MHz 11n													
11.570	3.0	35.0	38.9	10.8	-32.8	0.0	0.7	52.7	74.0	-21.3	V	P	
11.570	3.0	22.3	38.9	10.8	-32.8	0.0	0.7	39.9	54.0	-14.1	V	A	
11.570	3.0	35.4	38.9	10.8	-32.8	0.0	0.7	53.0	74.0	-21.0	H	P	
11.570	3.0	22.3	38.9	10.8	-32.8	0.0	0.7	39.9	54.0	-14.1	H	A	
5825MHz 11n													
11.650	3.0	35.1	39.0	10.9	-32.7	0.0	0.7	53.0	74.0	-21.0	H	P	
11.650	3.0	22.5	39.0	10.9	-32.7	0.0	0.7	40.4	54.0	-13.6	H	A	
11.650	3.0	35.7	39.0	10.9	-32.7	0.0	0.7	53.6	74.0	-20.4	V	P	
11.650	3.0	22.4	39.0	10.9	-32.7	0.0	0.7	40.3	54.0	-13.7	V	A	

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

9.2.6. TX ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 06/30/12
Project #: 12U14485
Company: Apple
Test Target: FCC Class B
Mode Oper: 5.8GHz 802.11n HT40, 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
5755MHz HT40													
11.510	3.0	35.5	38.8	10.7	-32.8	0.0	0.7	53.0	74.0	-21.0	V	P	
11.510	3.0	22.1	38.8	10.7	-32.8	0.0	0.7	39.6	54.0	-14.4	V	A	
11.510	3.0	34.7	38.8	10.7	-32.8	0.0	0.7	52.2	74.0	-21.8	H	P	
11.510	3.0	22.1	38.8	10.7	-32.8	0.0	0.7	39.5	54.0	-14.5	H	A	
5795MHz HT40													
11.590	3.0	35.5	38.9	10.8	-32.7	0.0	0.7	53.2	74.0	-20.8	H	P	
11.590	3.0	22.2	38.9	10.8	-32.7	0.0	0.7	39.9	54.0	-14.1	H	A	
11.590	3.0	35.3	38.9	10.8	-32.7	0.0	0.7	53.0	74.0	-21.0	V	P	
11.590	3.0	22.1	38.9	10.8	-32.7	0.0	0.7	39.8	54.0	-14.2	V	A	

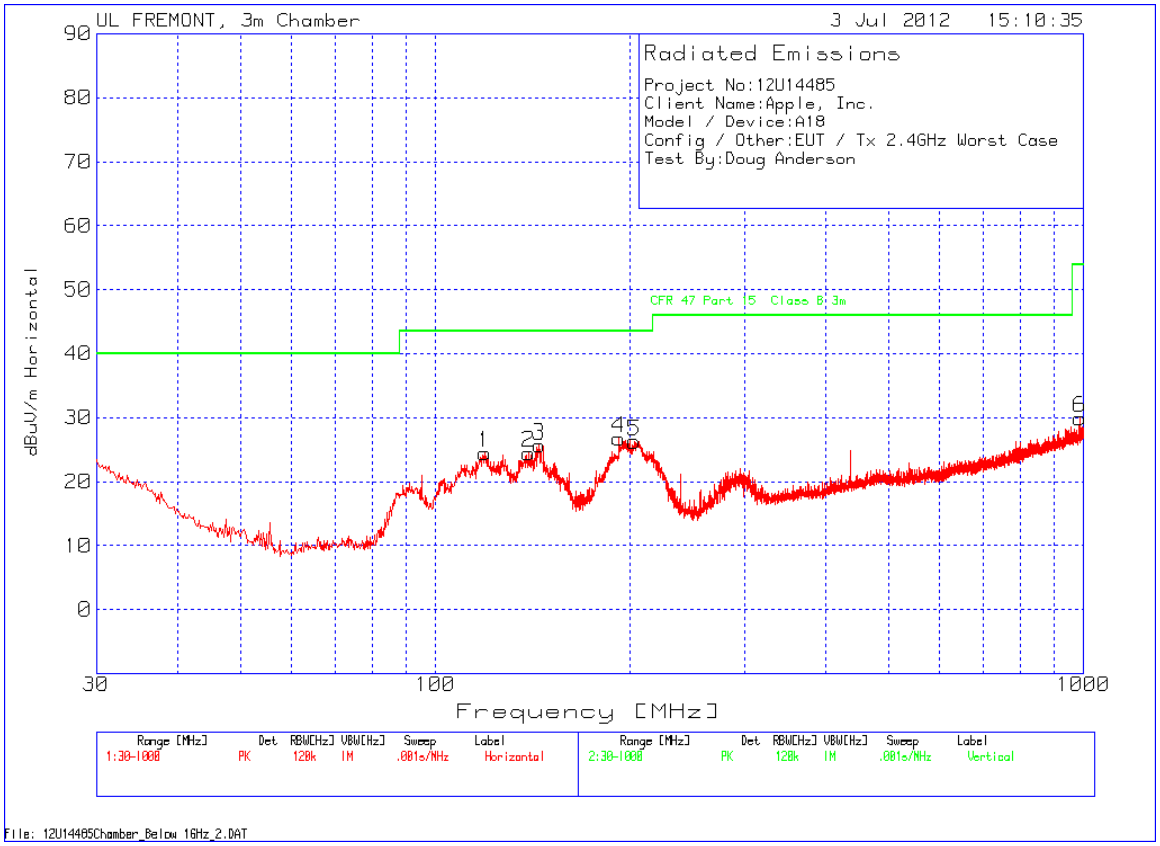
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

9.3. WORST-CASE BELOW 1 GHz

9.3.1. 2.4GHz BAND

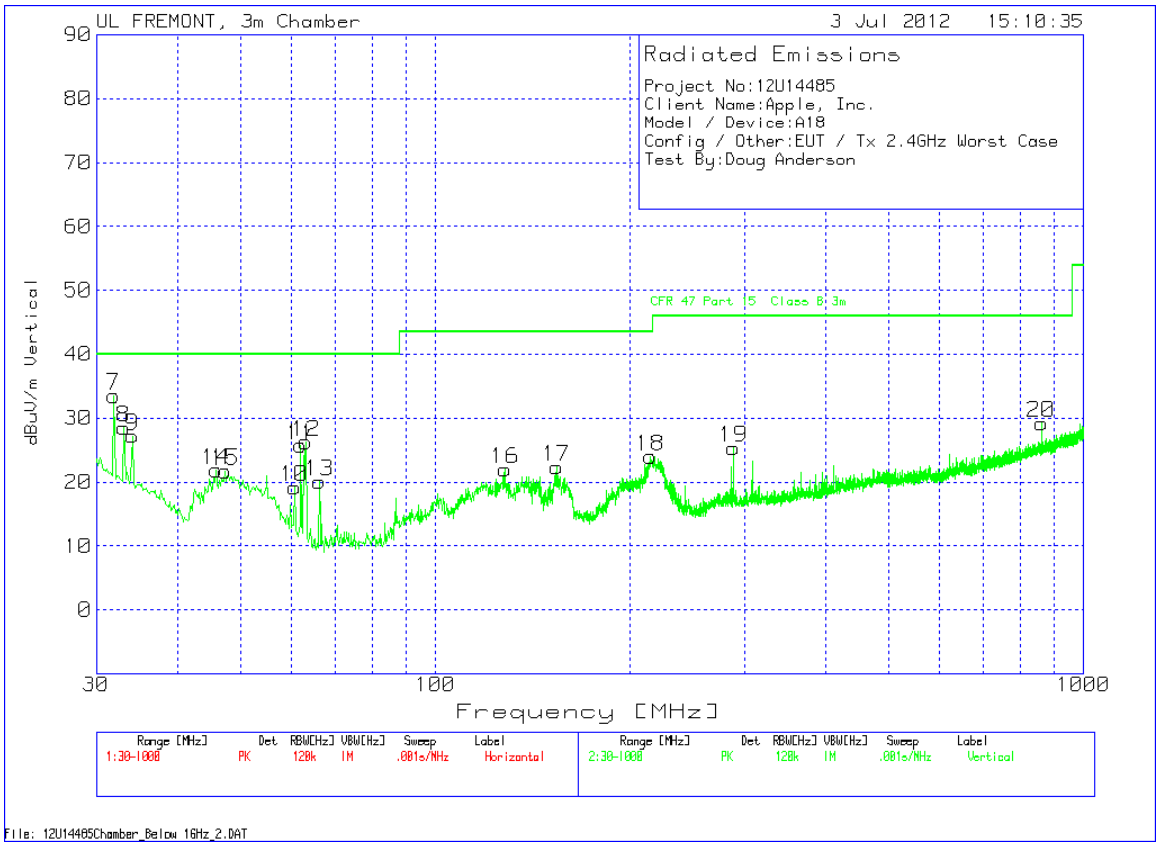
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Project No: 12U14485
Client Name: Apple, Inc.
Model / Device: A18
Config / Other: EUT / Tx 2.4GHz Band Worst Case
Test By: Doug Anderson

Range 1 30 - 1000MHz

Test Freq. MHz	Meter Reading dB(µV/m)	Detector	Chamber Pre-Amp Gain [dB] + Cable Loss dB	3m Chamber Antenna Factor (dB)	Corrected Reading dB(µV/m)	FCC Class B 3m Limit dB(µV/m)	Margin dB	Height cm	Polarity V/H
119.1687	37.4	PK	-26.6	13.7	24.5	43.5	-19	200	Horz
139.1347	37.7	PK	-26.5	13.3	24.5	43.5	-19	300	Horz
144.7562	39.36	PK	-26.4	12.7	25.66	43.5	-17.84	200	Horz
192.2482	41.55	PK	-25.9	11.1	26.75	43.5	-16.75	100	Horz
202.9097	40.3	PK	-25.8	11.8	26.3	43.5	-17.2	200	Horz
986.6247	30.33	PK	-23.4	23	29.93	54	-24.07	100	Horz

Range 2 30 - 1000MHz

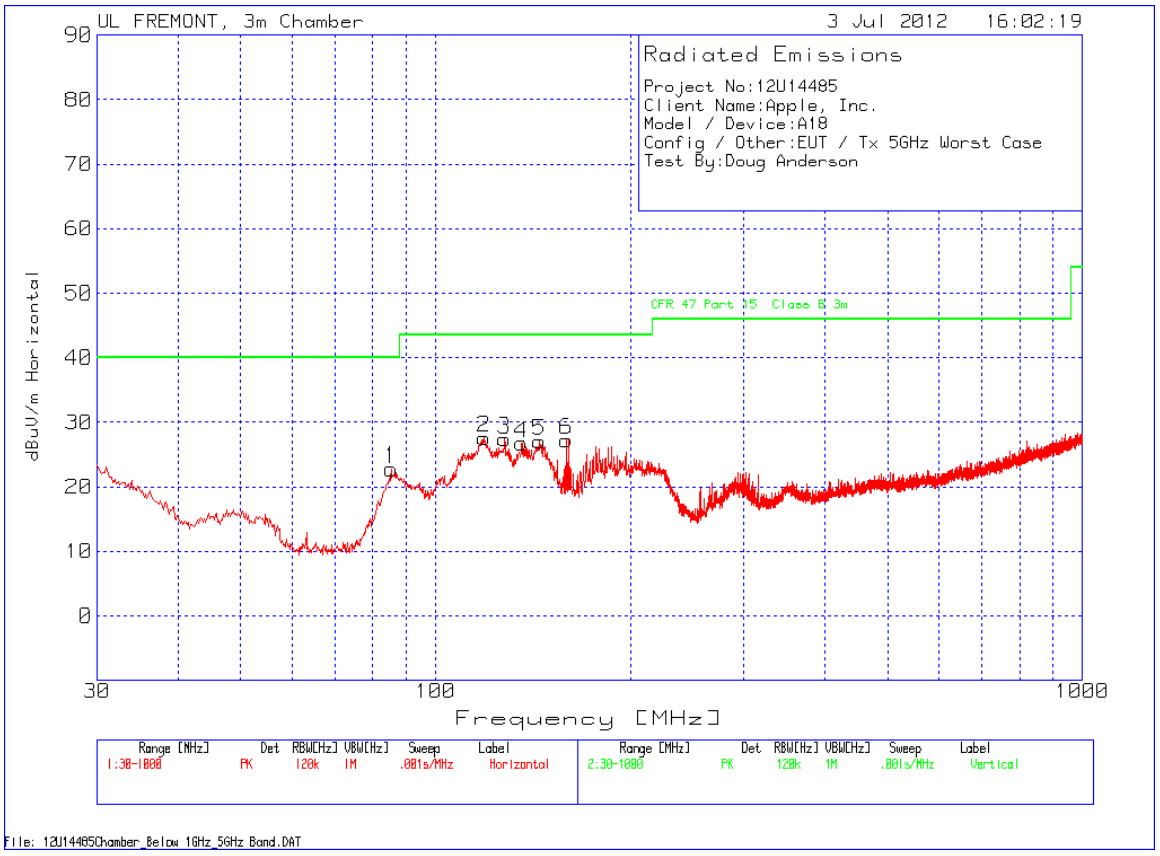
Test Freq. MHz	Meter Reading dB(µV/m)	Detector	Chamber Pre-Amp Gain [dB] + Cable Loss dB	3m Chamber Antenna Factor (dB)	Corrected Reading dB(µV/m)	FCC Class B 3m Limit dB(µV/m)	Margin dB	Height cm	Polarity V/H
Turntable Transient Emissions: Not EUT Related									
31.9384	41.25	PK	-27.5	19.8	33.55	40	-6.45	100	Vert
33.1015	37.11	PK	-27.5	18.9	28.51	40	-11.49	100	Vert
34.0707	36.53	PK	-27.5	18.2	27.23	40	-12.77	100	Vert
60.6275	39.07	PK	-27.2	7.3	19.17	40	-20.83	201	Vert
61.9844	45.46	PK	-27.2	7.5	25.76	40	-14.24	301	Vert
63.1475	45.99	PK	-27.2	7.5	26.29	40	-13.71	301	Vert
66.249	39.31	PK	-27.1	7.9	20.11	40	-19.89	201	Vert
EUT Related Emissions									
45.8953	39.39	PK	-27.3	9.8	21.89	40	-18.11	100	Vert
47.446	40.07	PK	-27.3	9	21.77	40	-18.23	100	Vert
128.0855	34.63	PK	-26.5	13.9	22.03	43.5	-21.47	100	Vert
153.8669	36.33	PK	-26.3	12.3	22.33	43.5	-21.17	100	Vert
214.9281	39.21	PK	-25.7	10.5	24.01	43.5	-19.49	100	Vert
288.3953	37.27	PK	-25.2	13.3	25.37	46	-20.63	100	Vert
861.7886	31.85	PK	-24.3	21.7	29.25	46	-16.75	100	Vert

PK - Peak detector
QP - Quasi-Peak detector

9.3.2. 5GHz BAND

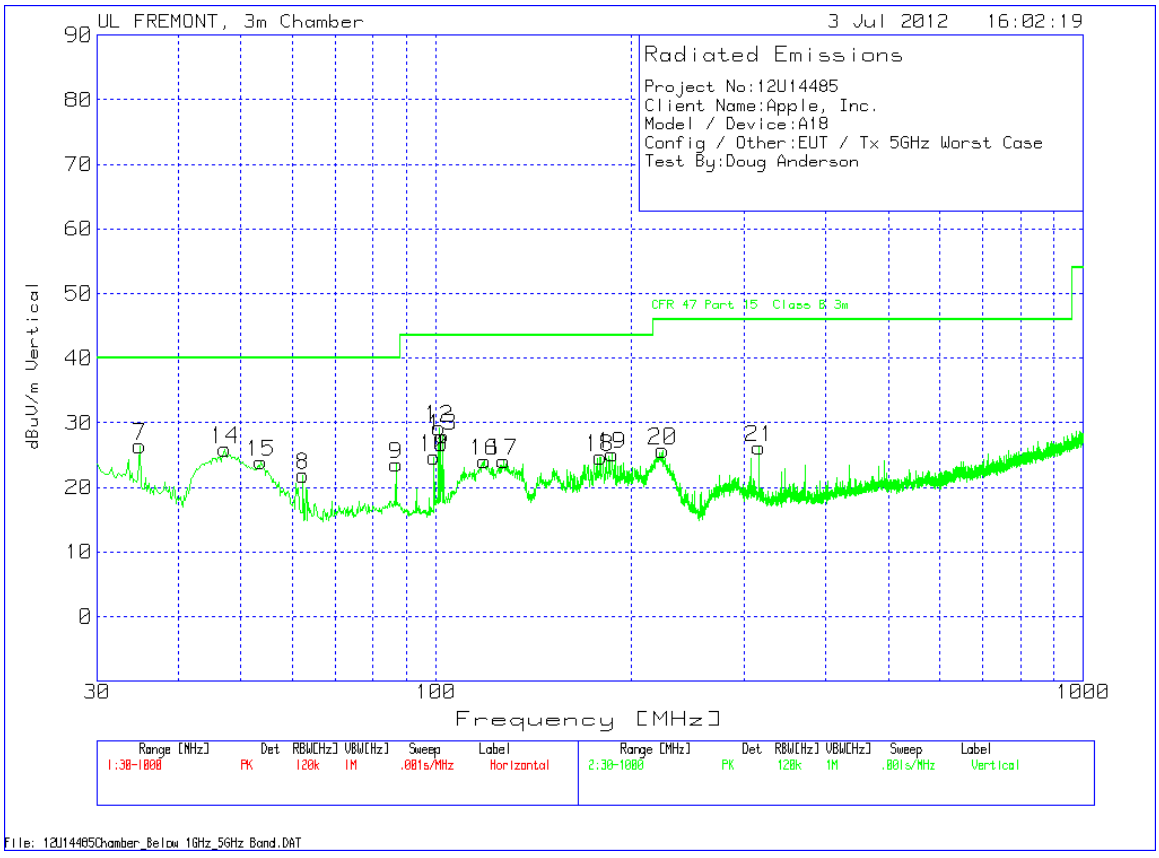
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Project No: 12U14485
Client Name: Apple, Inc.
Model / Device: A18
Config / Other: EUT / Tx 5GHz Band Worst Case
Test By: Doug Anderson

Range 1 30 - 1000MHz

Test Freq. MHz	Meter Reading dB(µV/m)	Detector	Chamber Pre-Amp Gain [dB] + Cable Loss dB	3m Chamber Antenna Factor (dB)	Corrected Reading dB(µV/m)	FCC Class B 3m Limit dB(µV/m)	Margin dB	Height cm	Polarity V/H
85.4396	42.37	PK	-27	7.4	22.77	40	-17.23	400	Horz
118.9748	40.48	PK	-26.6	13.7	27.58	43.5	-15.92	400	Horz
127.8917	39.97	PK	-26.5	13.9	27.37	43.5	-16.13	400	Horz
135.8393	39.86	PK	-26.5	13.4	26.76	43.5	-16.74	300	Horz
144.95	40.77	PK	-26.4	12.7	27.07	43.5	-16.43	300	Horz
159.2946	41.38	PK	-26.2	12.1	27.28	43.5	-16.22	100	Horz

Range 2 30 - 1000MHz

Test Freq. MHz	Meter Reading dB(µV/m)	Detector	Chamber Pre-Amp Gain [dB] + Cable Loss dB	3m Chamber Antenna Factor (dB)	Corrected Reading dB(µV/m)	FCC Class B 3m Limit dB(µV/m)	Margin dB	Height cm	Polarity V/H
Turntable Transient Emissions: Not EUT Related									
34.8461	36.42	PK	-27.5	17.5	26.42	40	-13.58	100	Vert
62.3721	41.62	PK	-27.2	7.5	21.92	40	-18.08	400	Vert
86.7966	43.13	PK	-27	7.4	23.53	40	-16.47	100	Vert
99.3965	41.78	PK	-26.8	9.7	24.68	43.5	-18.82	100	Vert
99.3965	41.78	PK	-26.8	9.7	24.68	43.5	-18.82	100	Vert
101.1411	45.72	PK	-26.8	10.3	29.22	43.5	-14.28	200	Vert
102.498	44.08	PK	-26.8	10.7	27.98	43.5	-15.52	100	Vert
EUT Related Emissions									
47.2522	44.14	PK	-27.3	9.1	25.94	40	-14.06	100	Vert
53.6491	44.16	PK	-27.3	7.1	23.96	40	-16.04	100	Vert
118.781	36.98	PK	-26.6	13.7	24.08	43.5	-19.42	100	Vert
127.504	36.68	PK	-26.5	13.9	24.08	43.5	-19.42	100	Vert
179.4544	39.82	PK	-26	10.9	24.72	43.5	-18.78	100	Vert
187.2082	40.1	PK	-25.9	10.9	25.1	43.5	-18.4	100	Vert
224.0388	40.44	PK	-25.6	10.9	25.74	46	-20.26	100	Vert
315.9213	37.71	PK	-25.2	13.7	26.21	46	-19.79	100	Vert

PK - Peak detector
QP - Quasi-Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

6 WORST EMISSIONS

Project No:12U14485
Client Name:Apple Inc.
Model/Device:WLAN worst case
Test Volt/Freq:120 VAC / 60Hz
Test By:Tom Chen

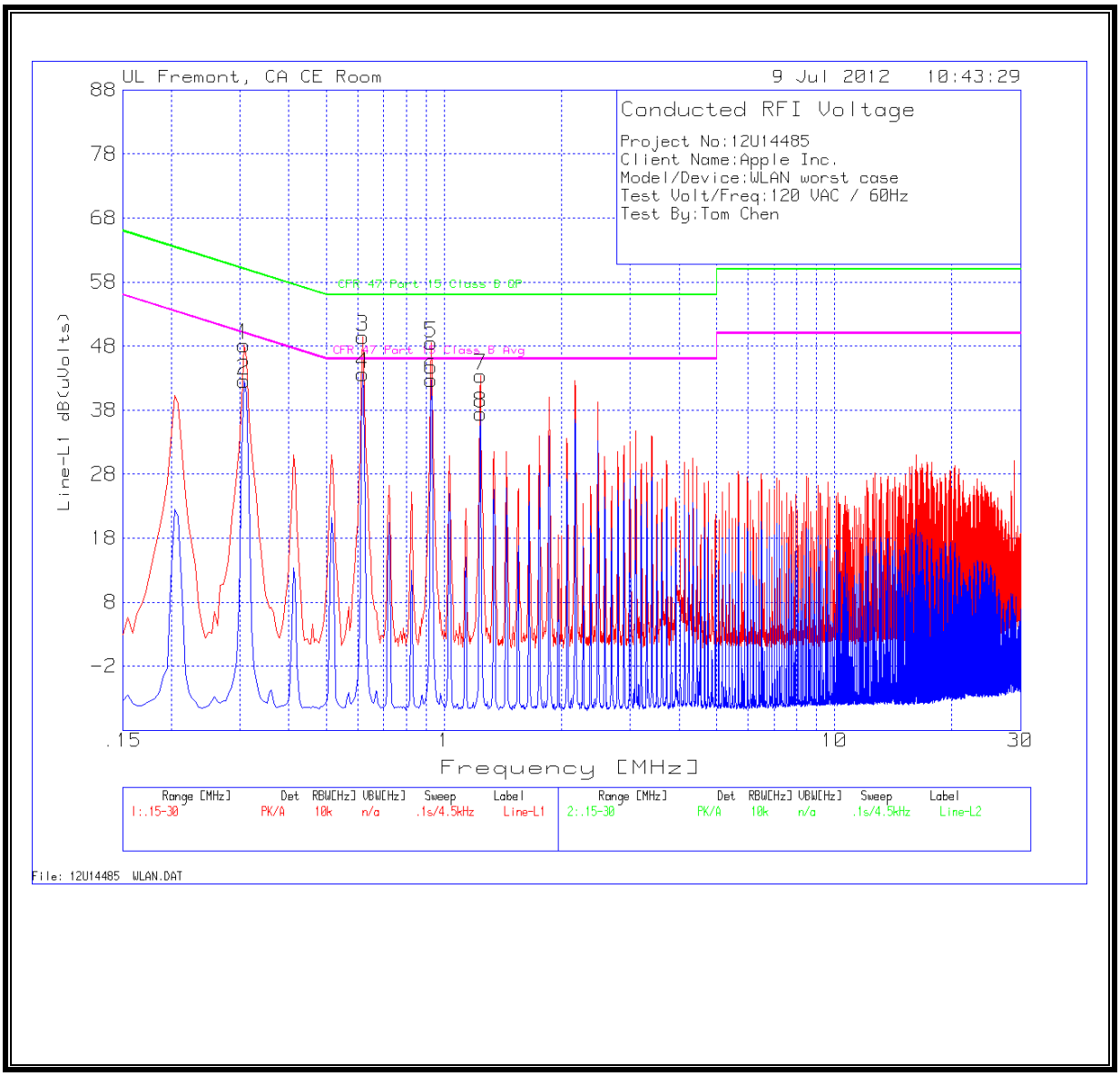
Line-L1 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.3075	48.01	PK	0.1	0	48.11	60	-11.89	-	-
0.3075	42.48	Av	0.1	0	42.58	-	-	50	-7.42
0.618	49.3	PK	0.1	0	49.4	56	-6.6	-	-
0.618	43.56	Av	0.1	0	43.66	-	-	46	-2.34
0.9285	48.38	PK	0.1	0	48.48	56	-7.52	-	-
0.9285	42.63	Av	0.1	0	42.73	-	-	46	-3.27
1.239	43.26	PK	0.1	0	43.36	56	-12.64	-	-
1.239	37.36	Av	0.1	0	37.46	-	-	46	-8.54

Line-L2 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L2.TXT (dB)	LC Cables 2&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.3075	40.93	PK	0.1	0	41.03	60	-18.97	-	-
0.3075	34.65	Av	0.1	0	34.75	-	-	50	-15.25
0.618	39.67	PK	0.1	0	39.77	56	-16.23	-	-
0.618	35.25	Av	0.1	0	35.35	-	-	46	-10.65
0.9285	38.83	PK	0.1	0	38.93	56	-17.07	-	-
0.9285	34.41	Av	0.1	0	34.51	-	-	46	-11.49
1.239	34.3	PK	0.1	0.1	34.5	56	-21.5	-	-
1.239	29.39	Av	0.1	0.1	29.59	-	-	46	-16.41

LINE 1 RESULTS



LINE 2 RESULTS