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

CERTIFICATION TEST REPORT

FOR

The Apple iPad is a tablet device with multimedia functions (music, application support, and video), 802.11a/b/g/n radio, and Bluetooth radio functions

MODEL NUMBER: A1432, A1454, & A1455*

FCC ID: BCGA1432
IC: 579C-A1432

REPORT NUMBER: 12U14526-1, Revision A

ISSUE DATE: OCTOBER 03, 2012

Prepared for
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*Models differences are detailed within the body of this report

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	09/05/12	Initial Issue	F. Ibrahim
A	10/03/12	Detailed method was referenced for output power and PSD under test procedure titles	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: The Apple iPad is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, and Bluetooth radio functions.

MODEL: A1432, A1454, A1455

SERIAL NUMBER: PT758824

DATE TESTED: JULY 15 - AUGUST 22, 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:

FRANK IBRAHIM
WiSE PROJECT LEADER
UL CCS

Tested By:

TOM CHEN
EMC ENGINEER
UL CCS

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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%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Apple iPad is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, and Bluetooth radio functions.

5.2. DESCRIPTION OF MODELS DIFFERENCES

FCC ID: BCGA1432
IC ID: 579C-A1432
Model #: A1432

Model A1432, is a tablet with multimedia functions (music, application support, and video)IEEE 802.11a/b/g/n radio and Bluetooth radio. The rechargeable battery is not user accessible.

FCC ID: BCGA1454
IC ID: 579C-A1454
Model #: A1454

Model A1454 is a tablet with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n and Bluetooth radio. The rechargeable battery is not user accessible.

FCC ID: BCGA1455
IC ID: 579C-A1455
Model #: A1455

Model A1455, is a tablet with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/CDMA1xRTT/ EV-DO Rev 0, A, B / LTE radio, IEEE 802.11a/b/g/n radio and Bluetooth radio. The rechargeable battery is not user accessible.

5.3. 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	18.89	77.45
2412 - 2462	802.11g	25.47	352.37
2412 - 2462	802.11n HT20	25.31	339.63
5745 - 5825	802.11a	24.99	315.50
5745 - 5825	802.11n HT20	24.89	308.32
5755 - 5795	802.11n HT40	25.12	325.09

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5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain as shown below:

Frequency Band (GHz)	*Antenna Gain (dBi)*
2.4-2.4835	1.41
5.15-5.25	4.70
5.25-5.35	5.08
5.5-5.7	5.42
5.725-5.85	5.27

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 10A378

The EUT driver software installed during testing was Broadcom_Rel_6_10_56_166

The EUT is connected to the power meter.

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5.6. WORST-CASE CONFIGURATION AND MODE

For the fundamental investigation, since the EUT is a portable device that has three orientations; X, Y and Z orientations have been investigated, also with AC/DC adapter, and earphone, and the worst case was found to be at Y orientation without AC adapter and earphone for both 2.4GHz and 5GHz band.

For Radiated Emissions below 1 GHz and Power line Conducted Emissions, the channel with the highest conducted output power was selected as a worst-case scenario.

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

For 11b mode: 1Mbps
For 11g mode: 6Mbps
For 11n HT20: MCS0
For 11a mode: 6Mbps
For 11n HT20 (5.8 GHz band): MCS0
For 11n HT40 (5.8 GHz band): MCS0

For 2.4 GHz band, an investigation of the fundamental frequency on both Ant0 and Ant1 ports showed that Ant0 is worst-case; therefore, all final radiated testing was performed using Ant0.

For 5 GHz bands, an investigation of the fundamental frequency on both Ant0 and Ant1 ports showed that Ant1 is worst-case; therefore, all final radiated testing was performed using Ant1.

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5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter	Apple	A1401	D060812	DoC
Power Splitter	Krytar	158010	99250	N/A
Dc Power Supply	Agilent	E3610A	KR24104150	N/A
Laptop PC	Apple	MacBook Pro	AOU269116	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	AC	2	AC	Un-shielded	2.0m	N/A
2	DC	1	DC	Un-shielded	1.0m	N/A
3	Antenna Port	1	Splitter	Un-shielded	0.1m	N/A
4	RF out	1	Spectrum Analyzer	Un-Shielded	None	N/A
5	RF out	1	Power Meter	Shielded	None	NA

I/O CABLES (RADIATED SETUP)

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	1	MINI USB	UN-SHELDED	1.0m	N/A
2	AUDIO	1	MINI JACK	UN-SHELDED	1.0m	N/A

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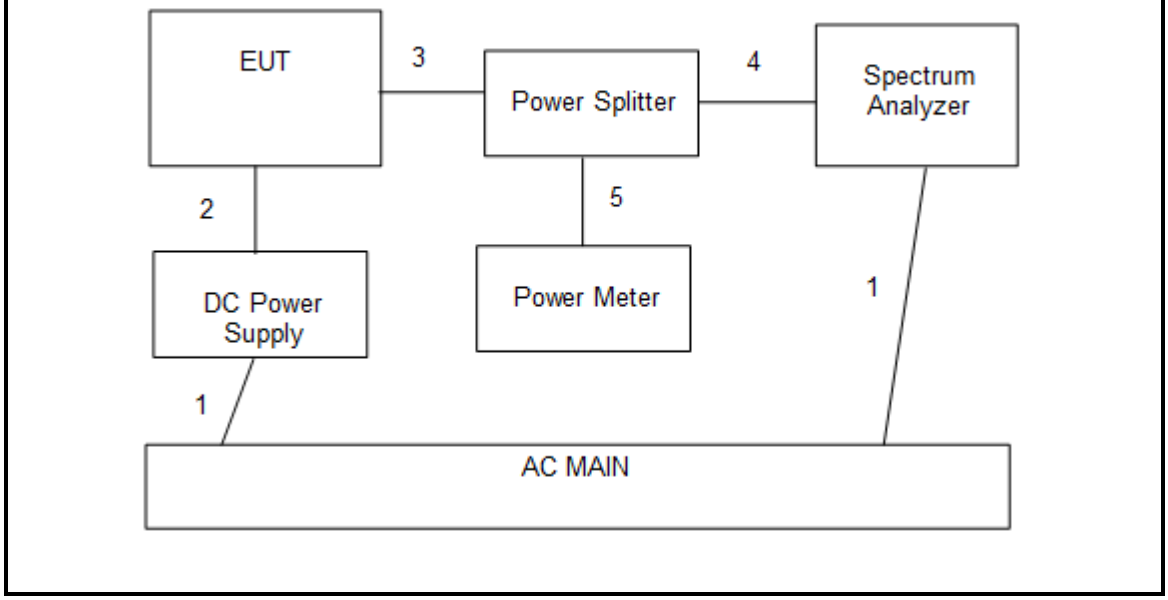
SETUP DIAGRAM FOR CONDUCTED TEST



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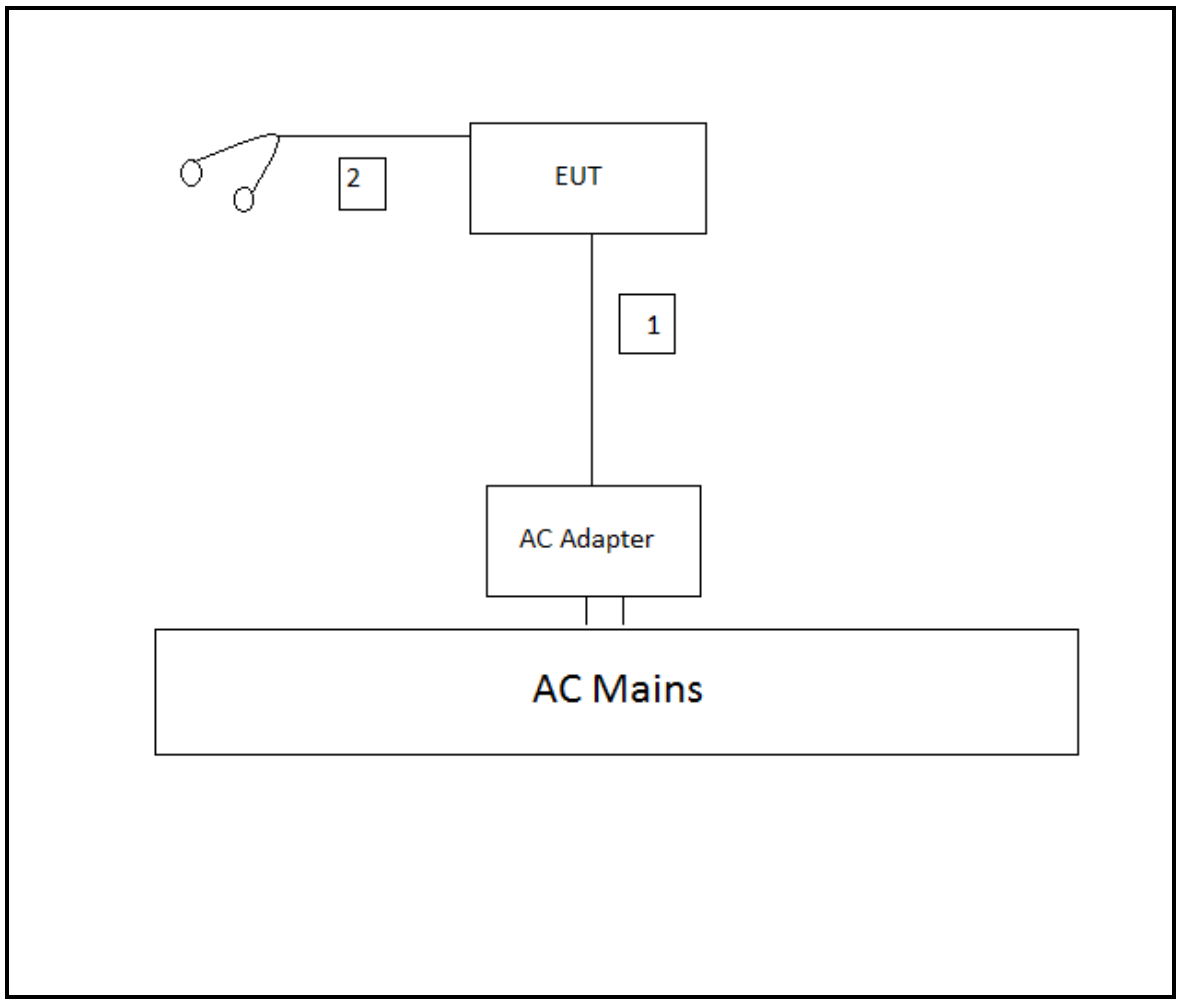
SETUP DIAGRAM FOR RADIATED TEST



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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	11/11/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	10/06/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	11/11/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1		02/07/13
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	04/23/13
Horn Antenna, 40 GHz	ARA	MWH-2640/B	C00981	06/14/13
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	C01069	12/15/12
E-Series Power Sensor 9 kHg~18 GHz	Agilent	E9304A	1260847C	05/23/13
P-Series single channel Power Meter	Agilent / HP	N1911A		07/27/13
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

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7. ANTENNA PORT TEST RESULTS

7.1. 802.11b 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 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	8.050	0.5
Middle	2437	8.050	0.5
High	2462	8.050	0.5

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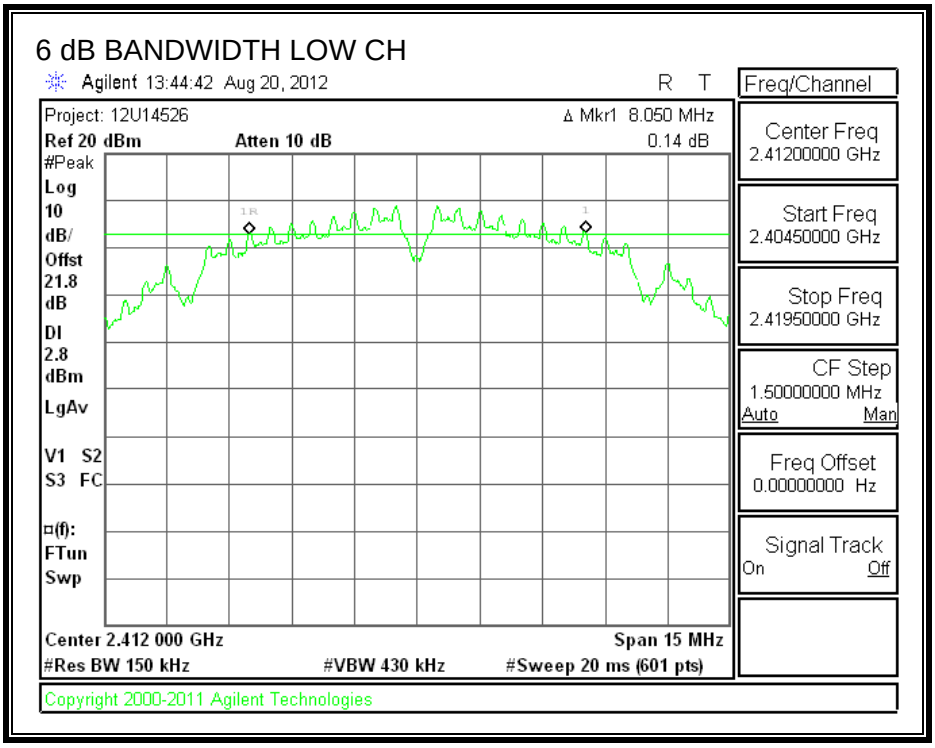
6 dB BANDWIDTH



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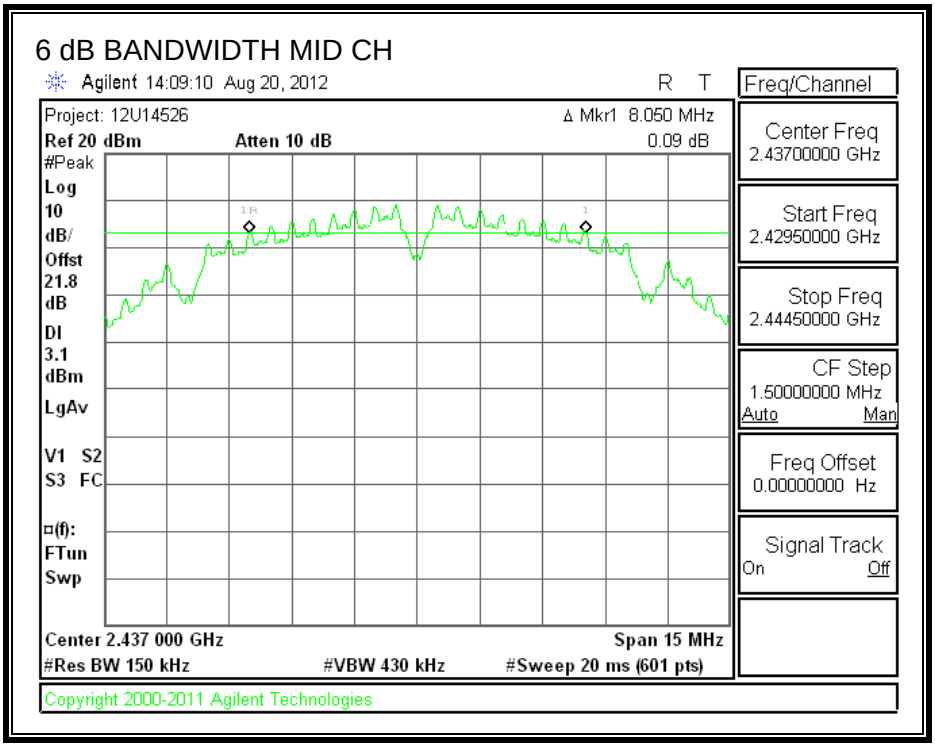

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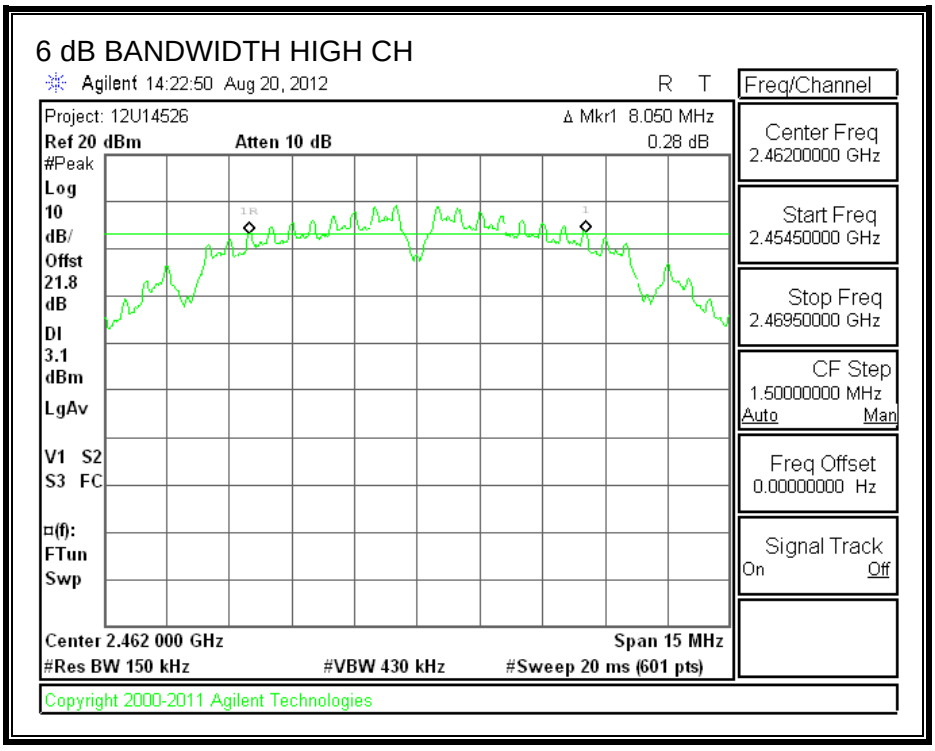

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7.1.2. 99% BANDWIDTH

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 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	12.3546
Middle	2437	12.3440
High	2462	12.3339

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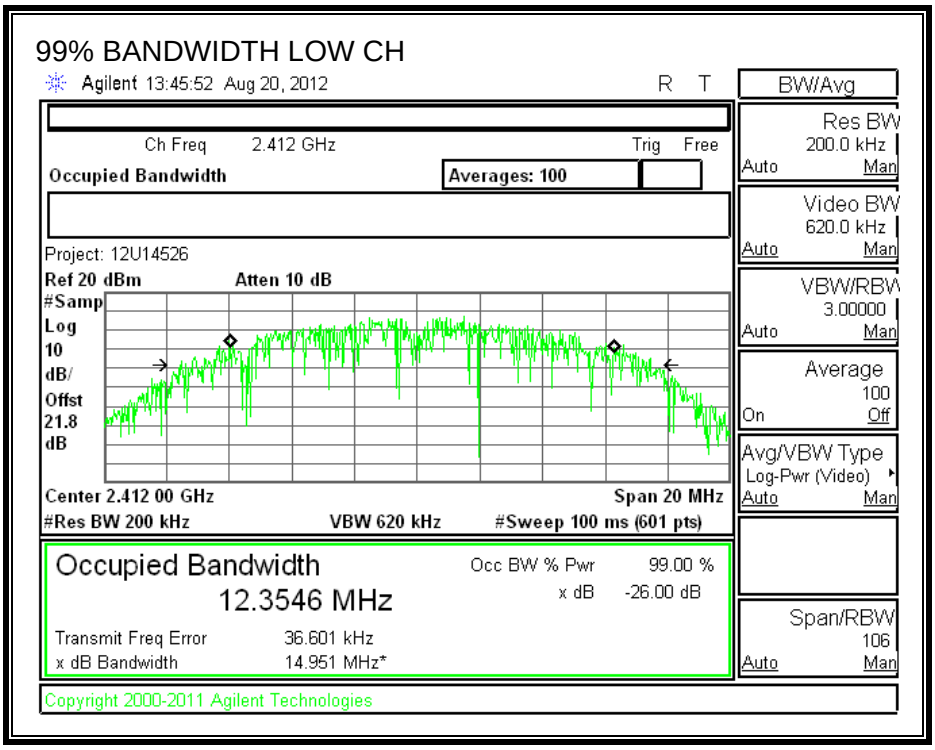
99% BANDWIDTH



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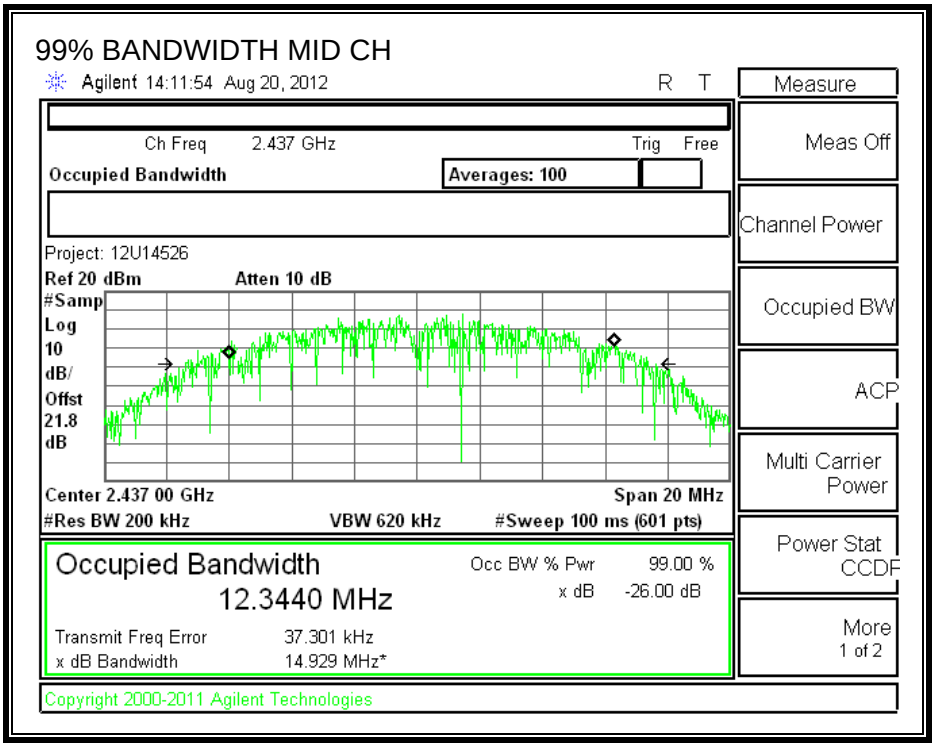

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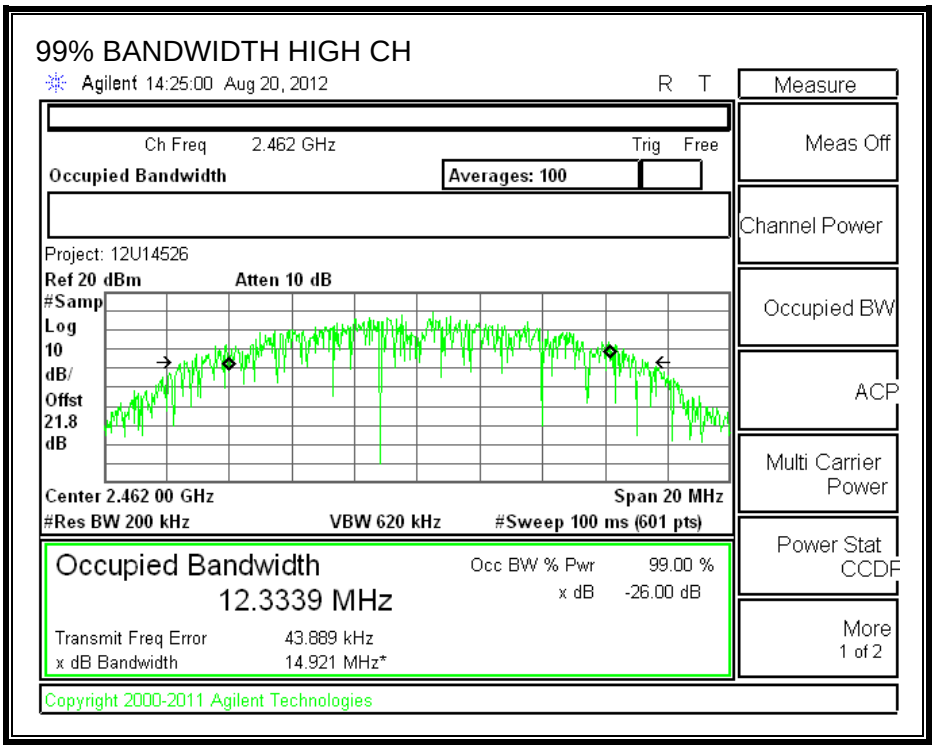

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7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

TEST PROCEDURE

KDB 558074 D01 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

Measurement Procedure PK2 as referenced by section 5.2.1.2 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	18.62	30	-11.38
Middle	2437	18.89	30	-11.11
High	2462	18.83	30	-11.17

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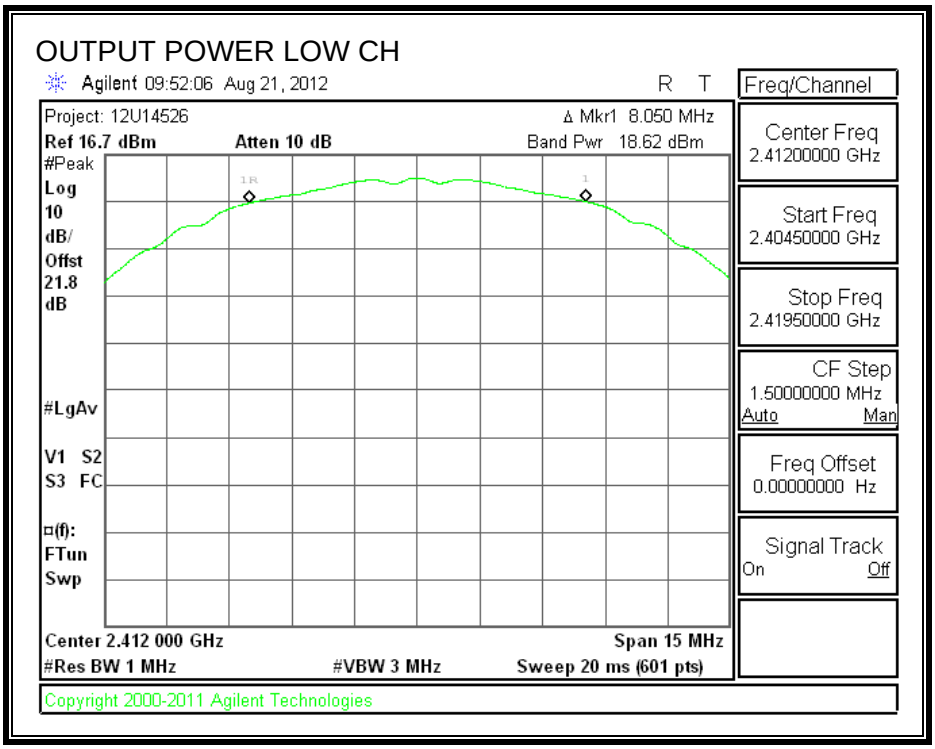
OUTPUT POWER



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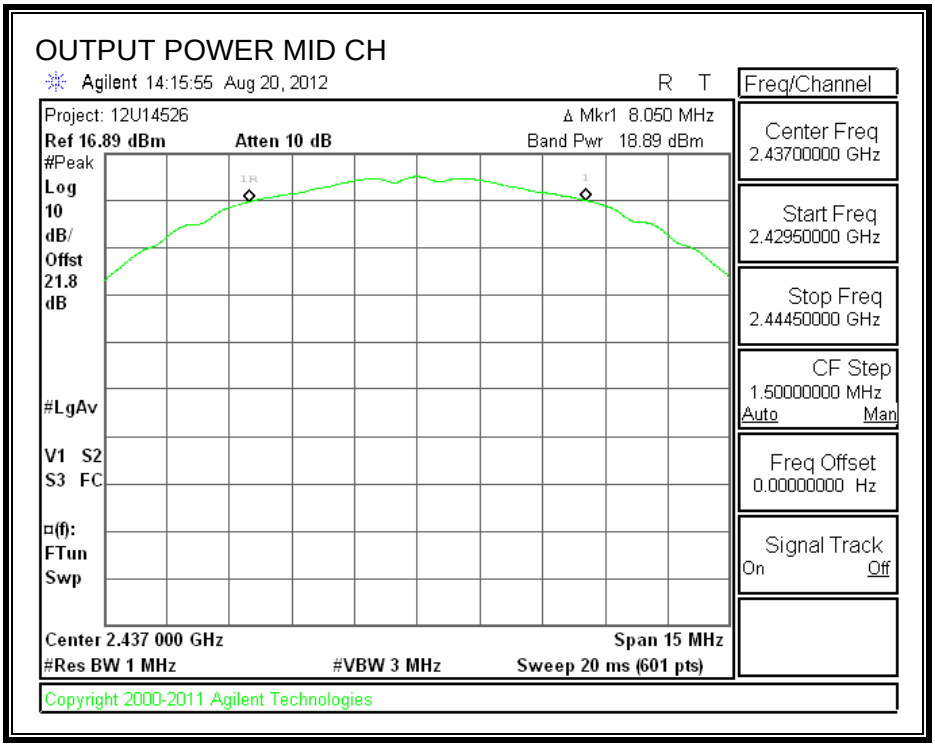

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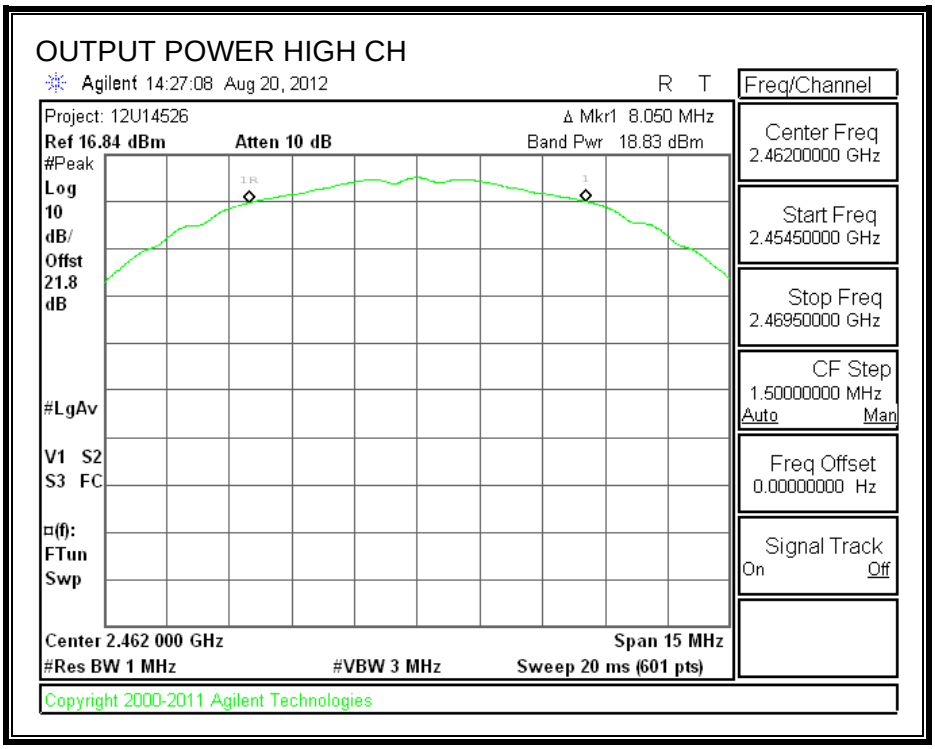

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7.1.4. AVERAGE POWER

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)	AV power (dBm)
Low	2412	15.93
Middle	2437	16.00
High	2462	15.95

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7.1.5. 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”, dated 01/18/2012.

Measurement Procedure PKPSD as referenced by section 5.3.1 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	PSD (dBm)	10log(3kHz/100kHz) (dBm)	Limit (dBm)	Margin (dB)
Low	2412	8.16	-15.2	8	-15.04
Middle	2437	8.79	-15.2	8	-14.41
High	2462	9.01	-15.2	8	-14.19

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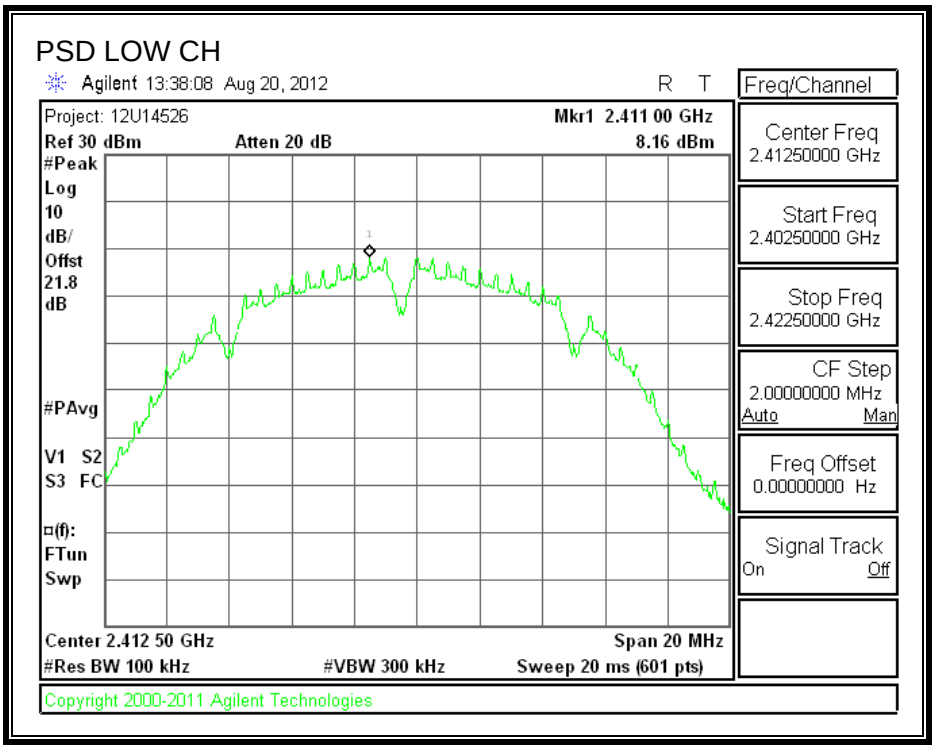
POWER SPECTRAL DENSITY



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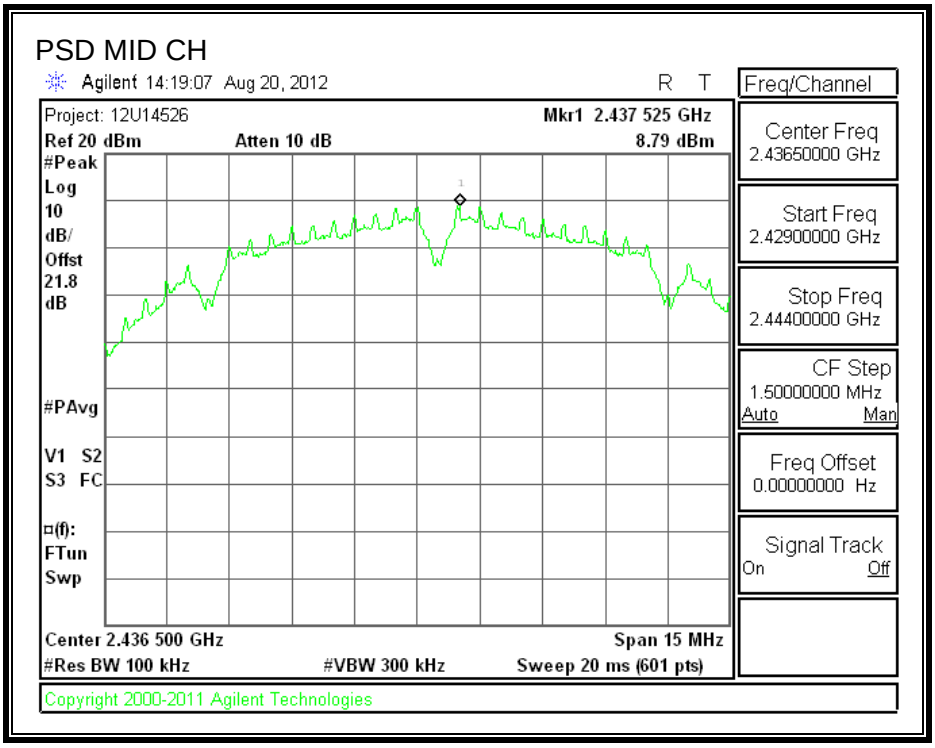
PSD MID CH



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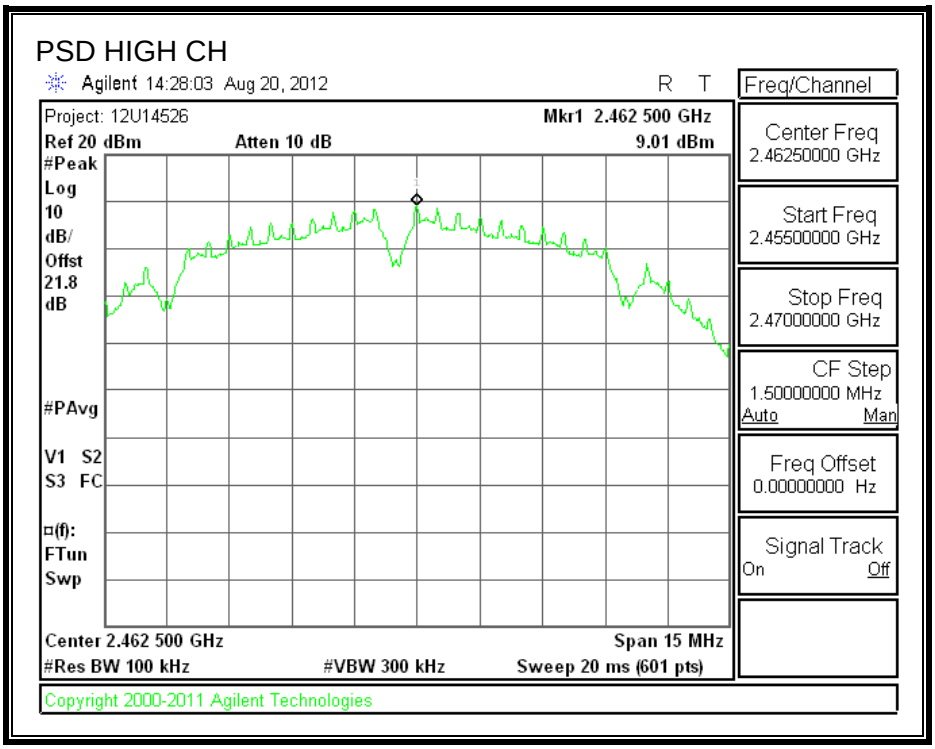
PSD HIGH CH



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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 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”, dated 01/18/2012.

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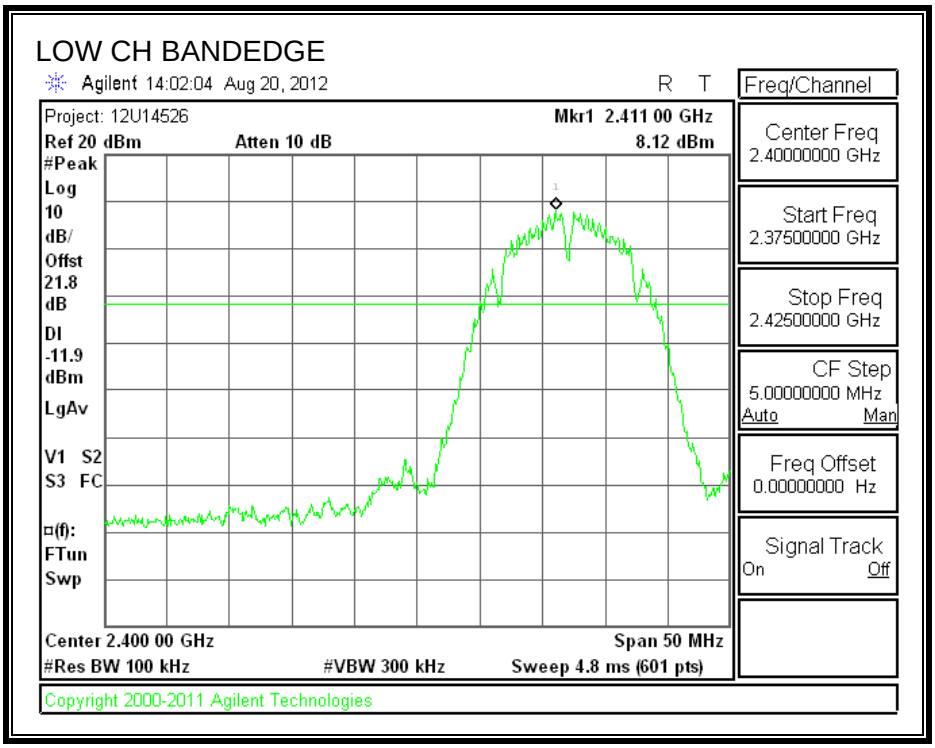
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



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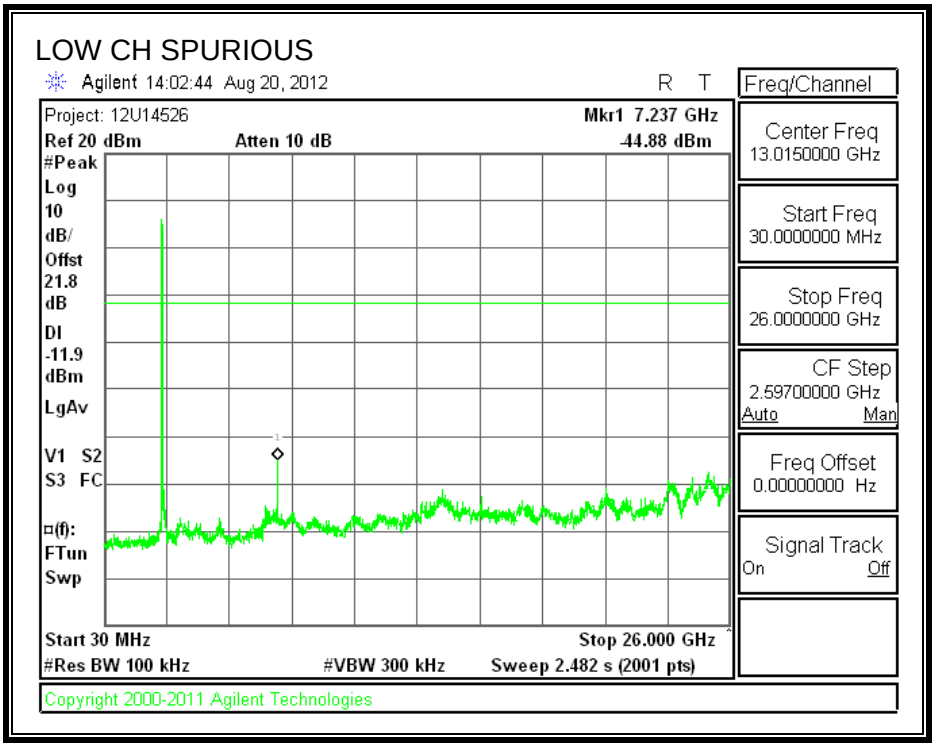
LOW CH SPURIOUS



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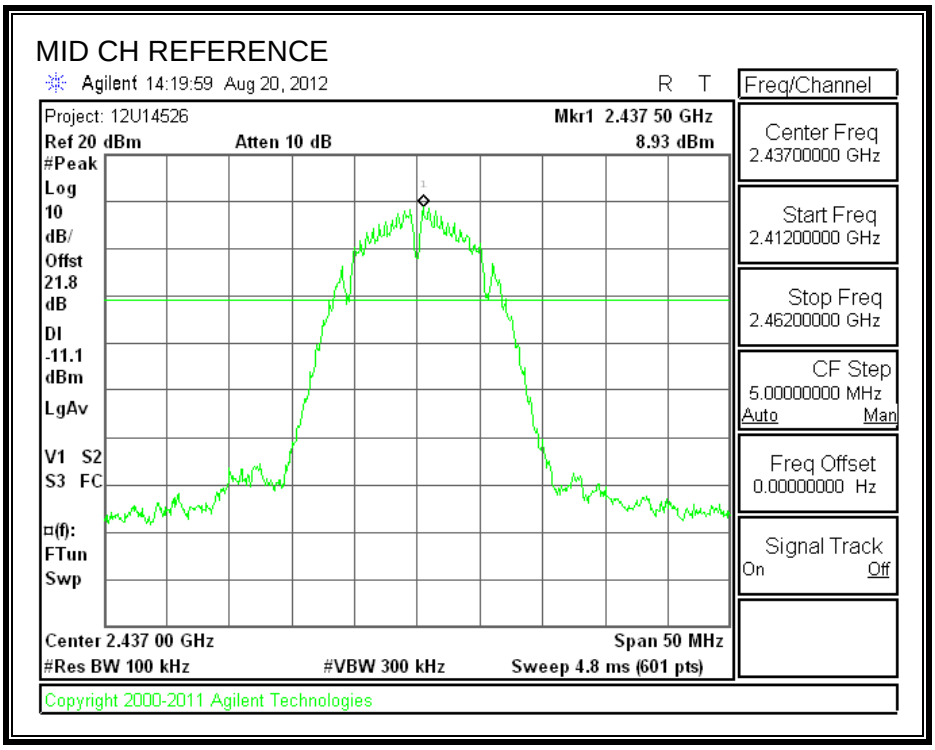
SPURIOUS EMISSIONS, MID CHANNEL



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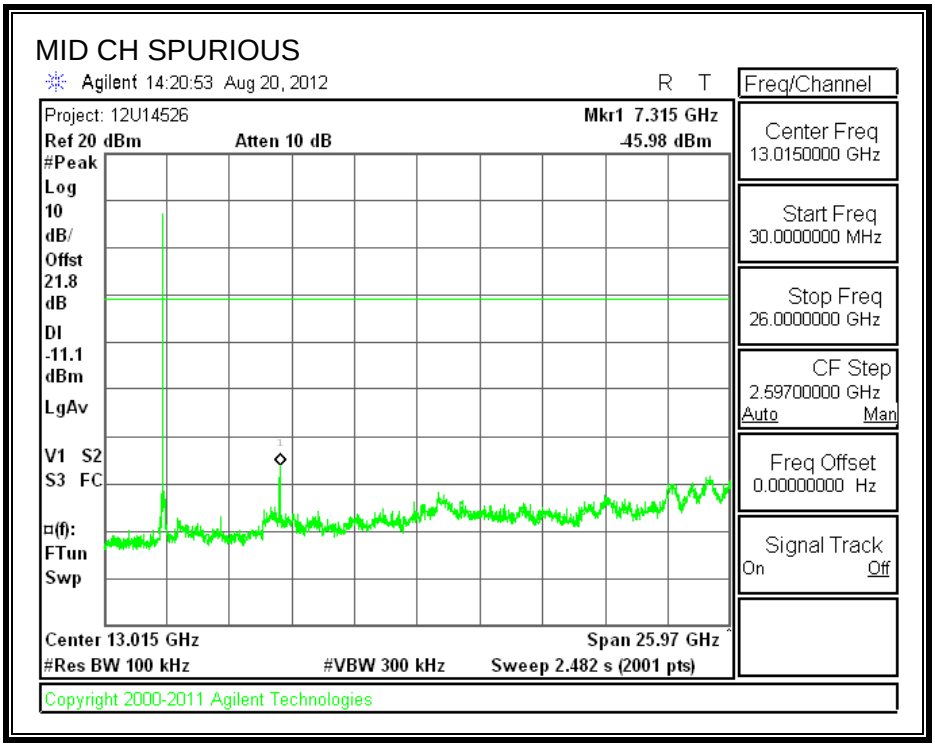

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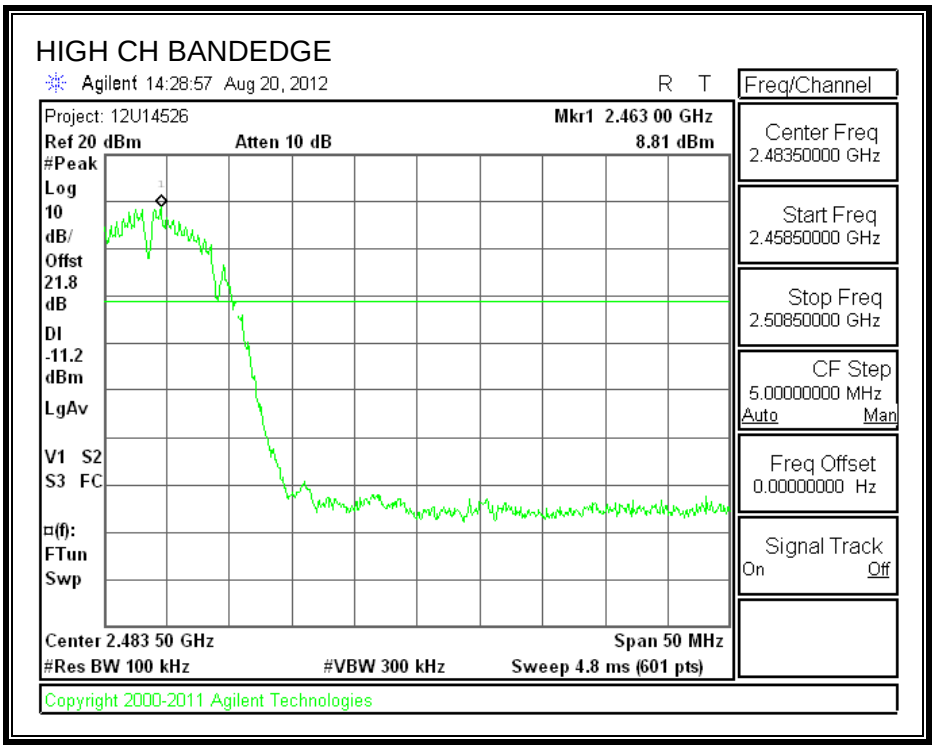
SPURIOUS EMISSIONS, HIGH CHANNEL



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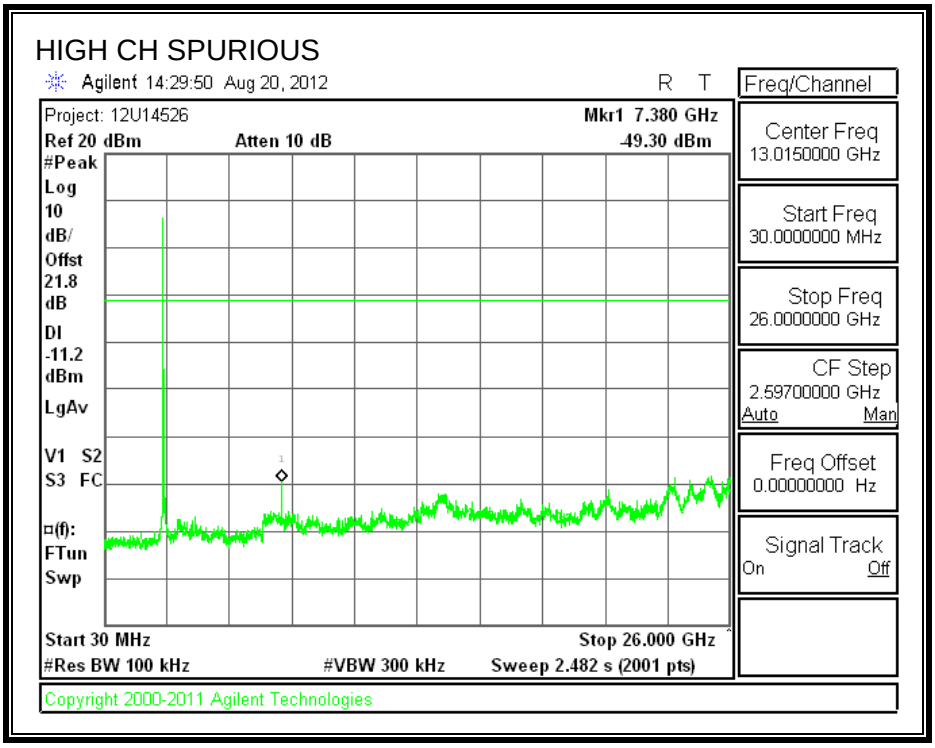

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7.2. 802.11g MODE IN THE 2.4 GHz BAND

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 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	15.54	0.5
Middle	2437	15.71	0.5
High	2462	15.92	0.5

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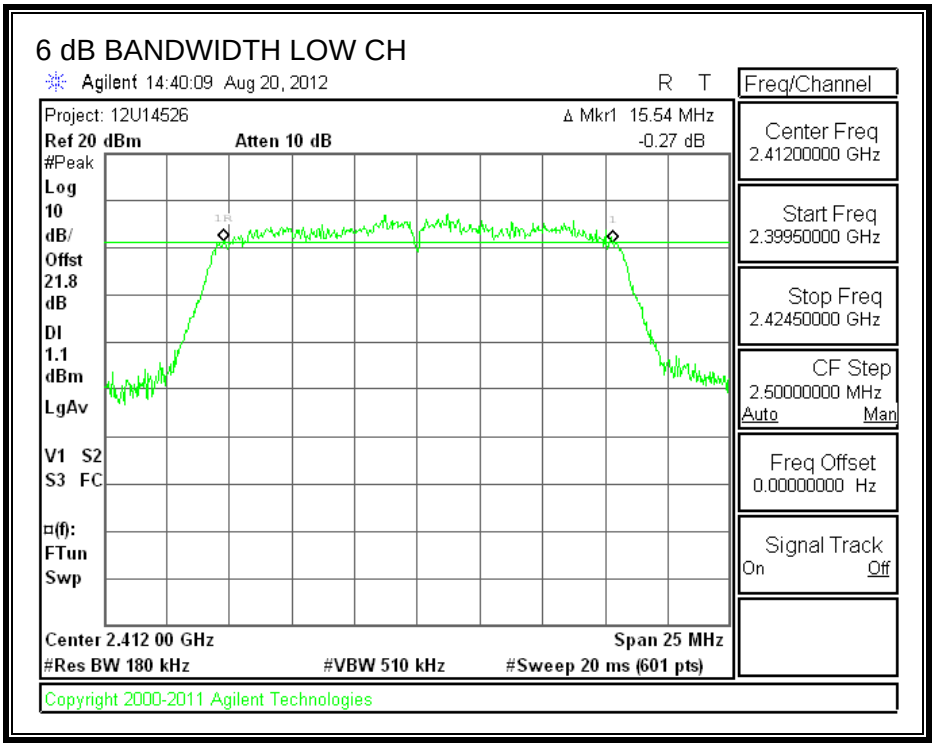
6 dB BANDWIDTH



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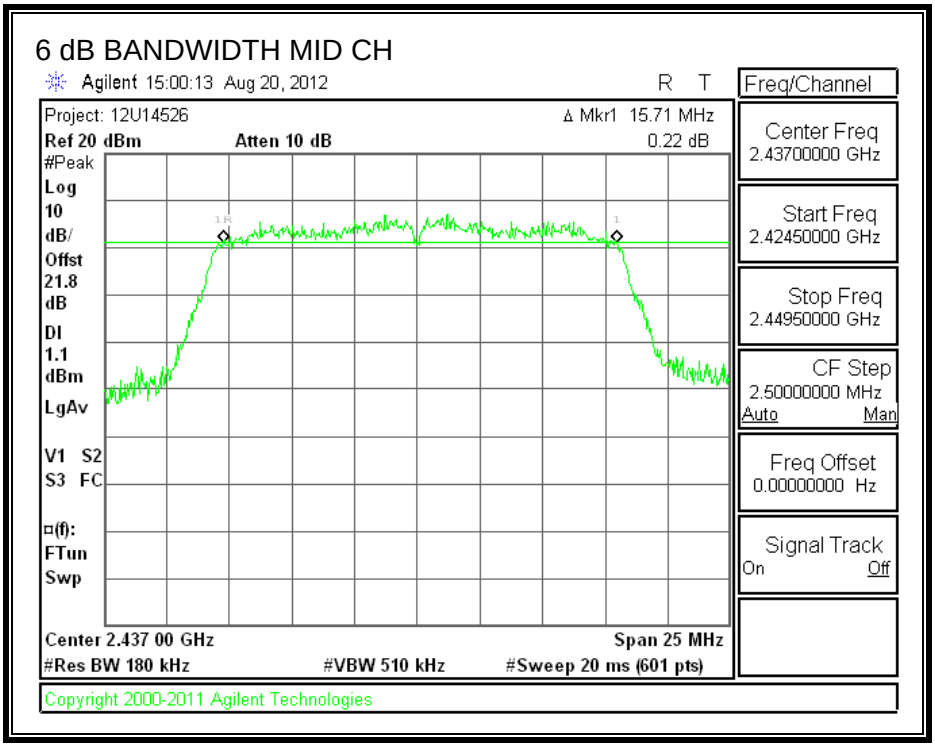
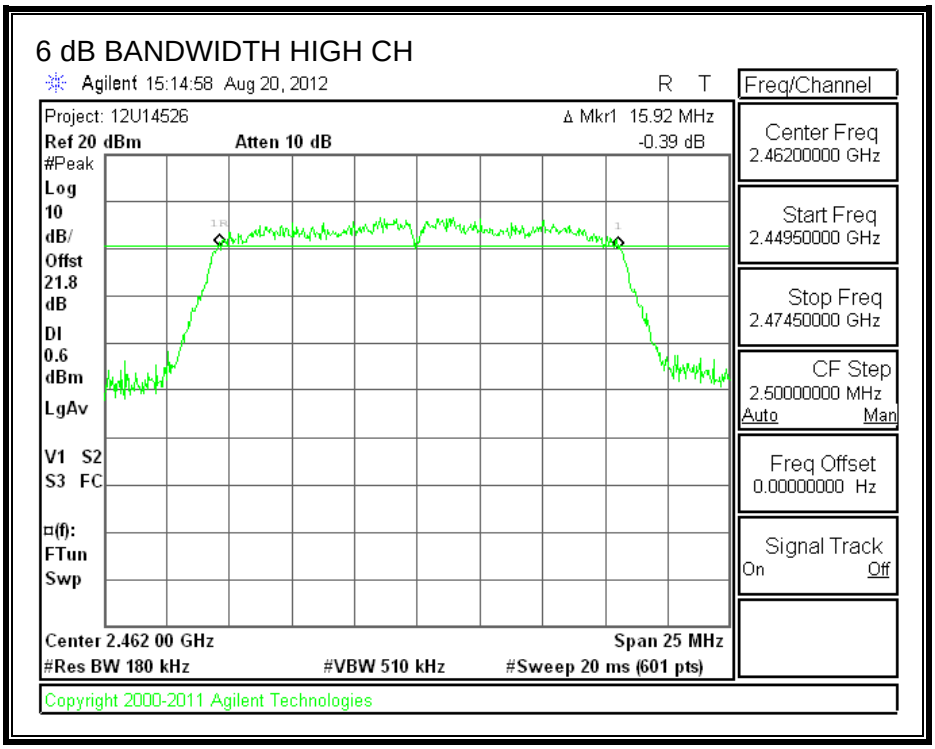


This report shall not be reproduced except in full, without the written approval of UL CCS.



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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)	99% Bandwidth (MHz)
Low	2412	16.3240
Middle	2437	16.3244
High	2462	16.3297

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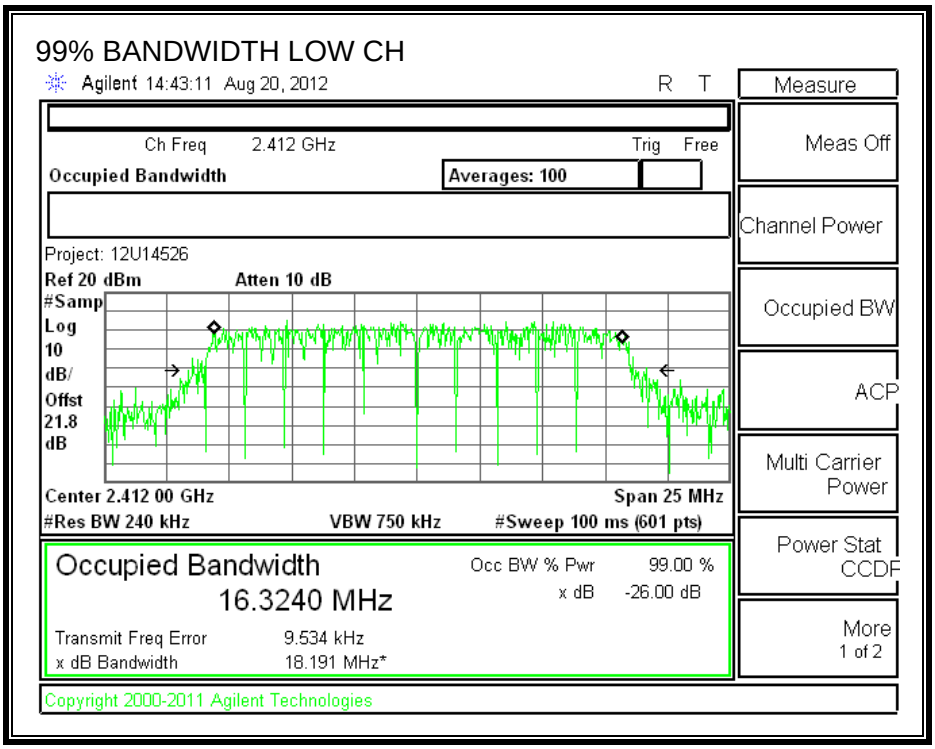
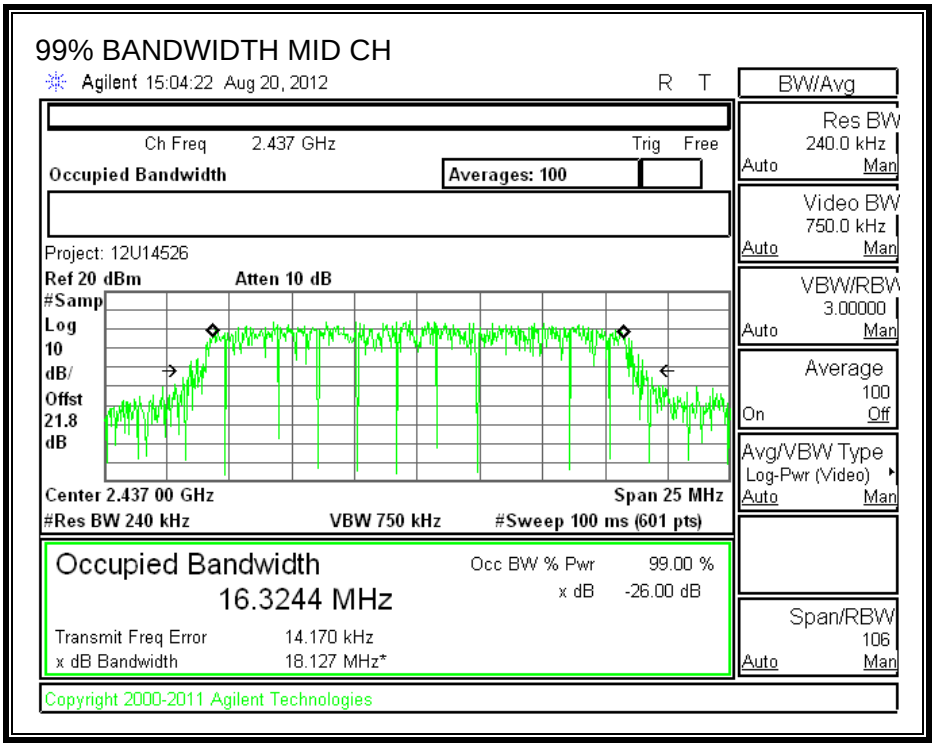
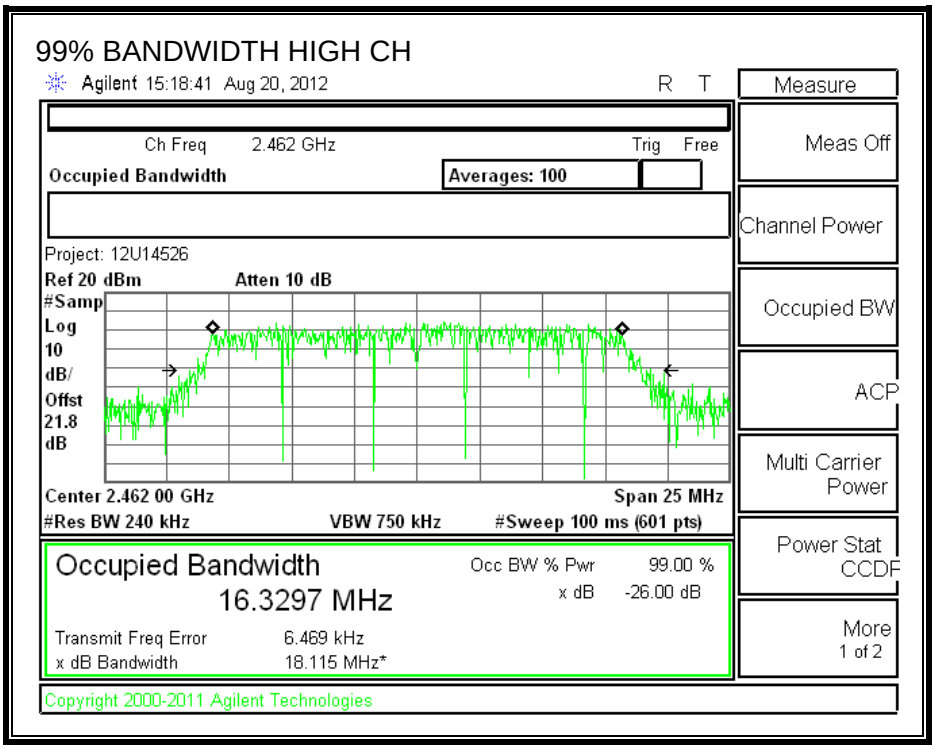
99% BANDWIDTH



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.



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7.2.3. 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”, dated 01/18/2012.

Measurement Procedure PK2 as referenced by section 5.2.1.2 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	25.16	30	-4.84
Middle	2437	25.15	30	-4.85
High	2462	25.47	30	-4.53

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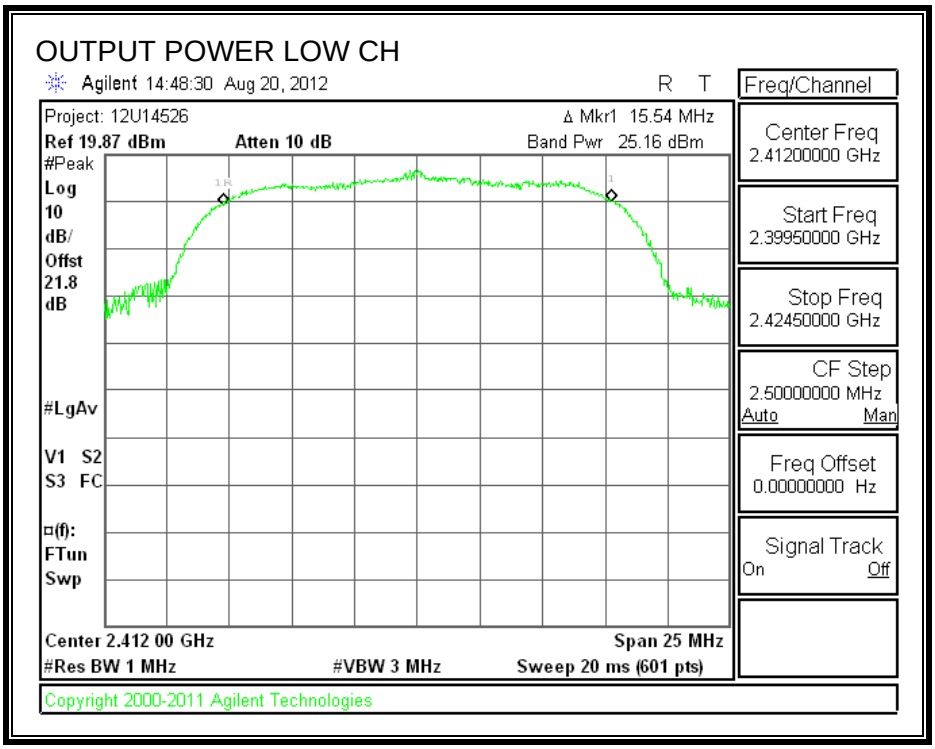
OUTPUT POWER



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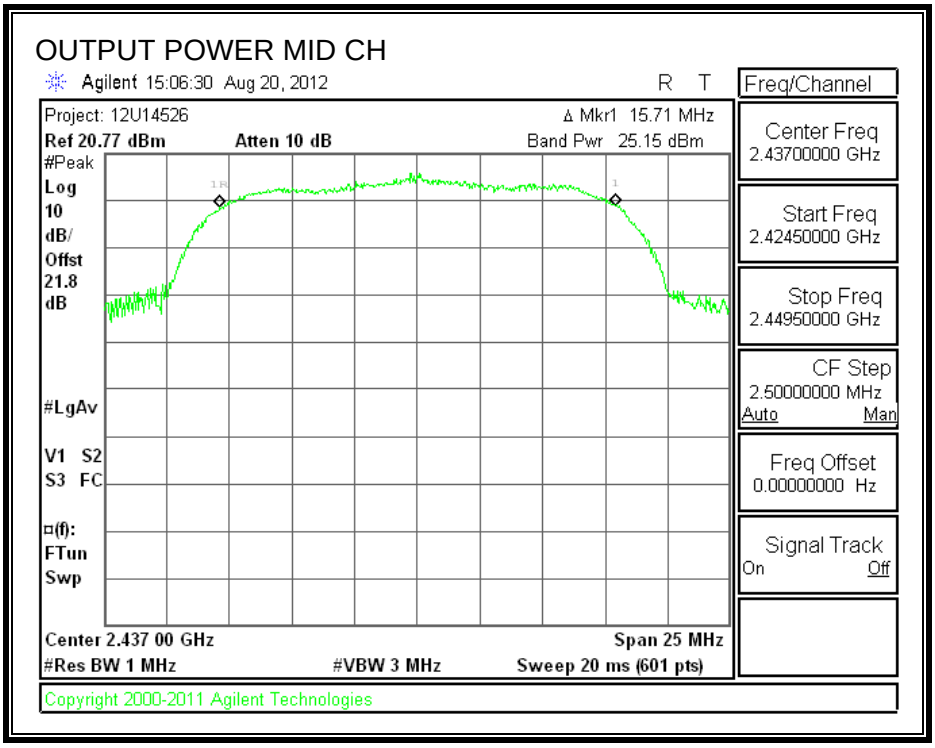
OUTPUT POWER MID CH



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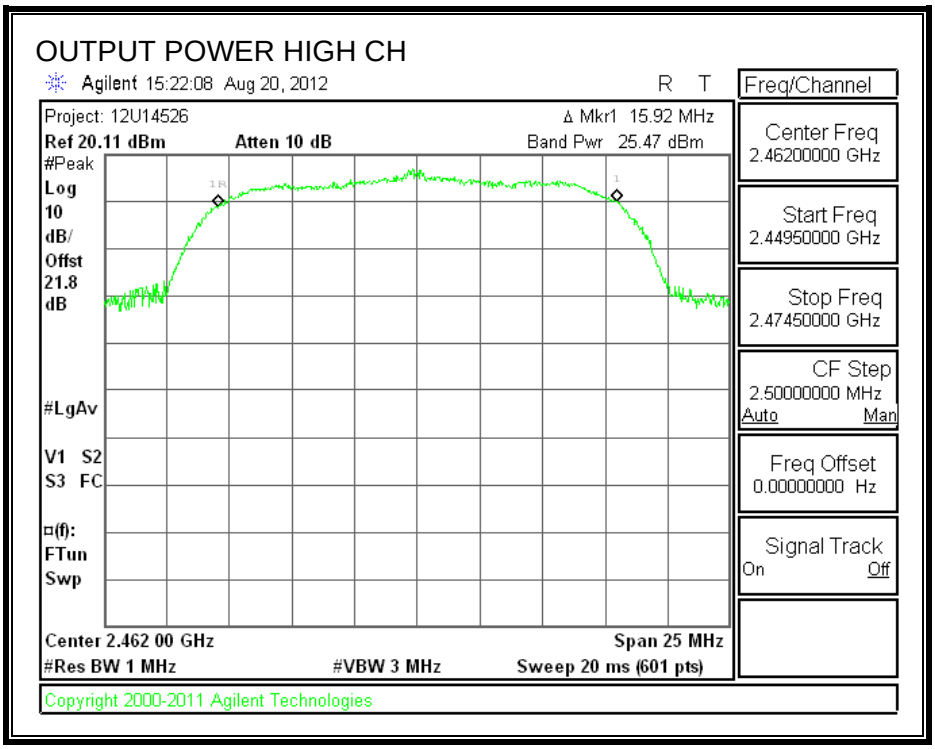

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7.2.4. AVERAGE POWER

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)	Power (dBm)
Low	2412	15.99
Middle	2437	15.94
High	2462	15.98

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7.2.5. 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”, dated 01/18/2012.

Measurement Procedure PKPSD as referenced by section 5.3.1 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	PSD (dBm)	10log(3kHz/100kHz) (dBm)	Limit (dBm)	Margin (dB)
Low	2412	5.71	-15.2	8	-17.49
Middle	2437	5.82	-15.2	8	-17.38
High	2462	6.15	-15.2	8	-17.05

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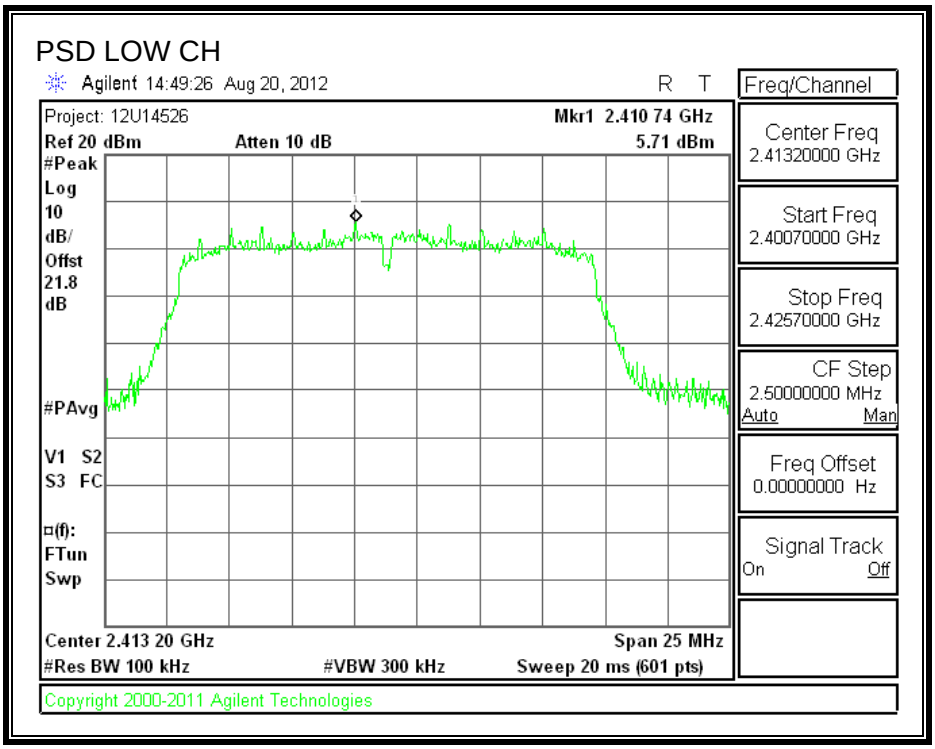
POWER SPECTRAL DENSITY



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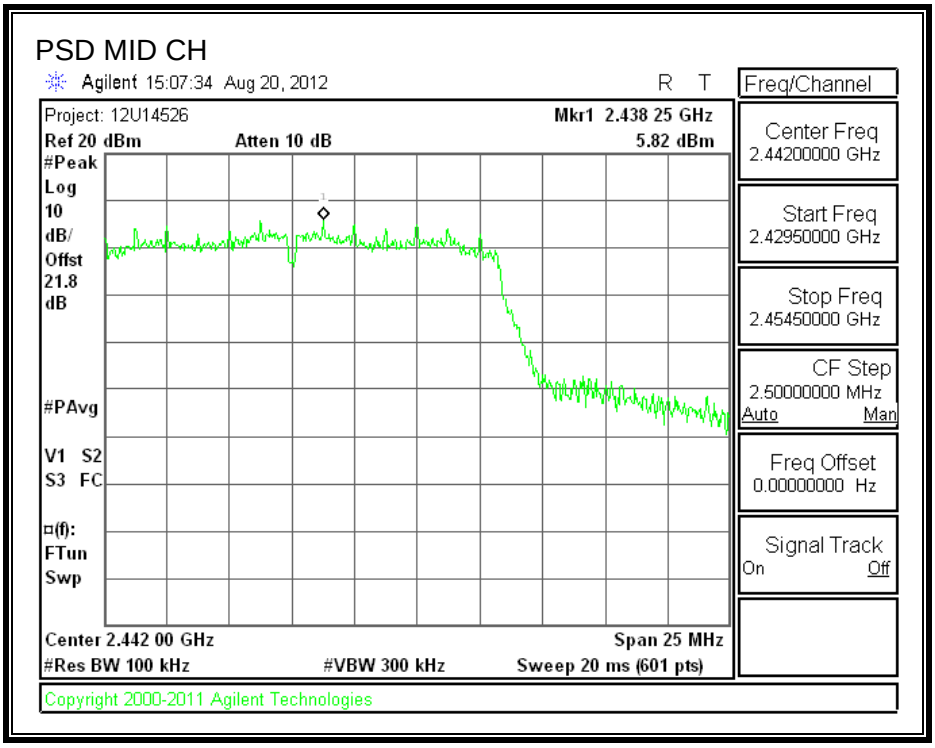
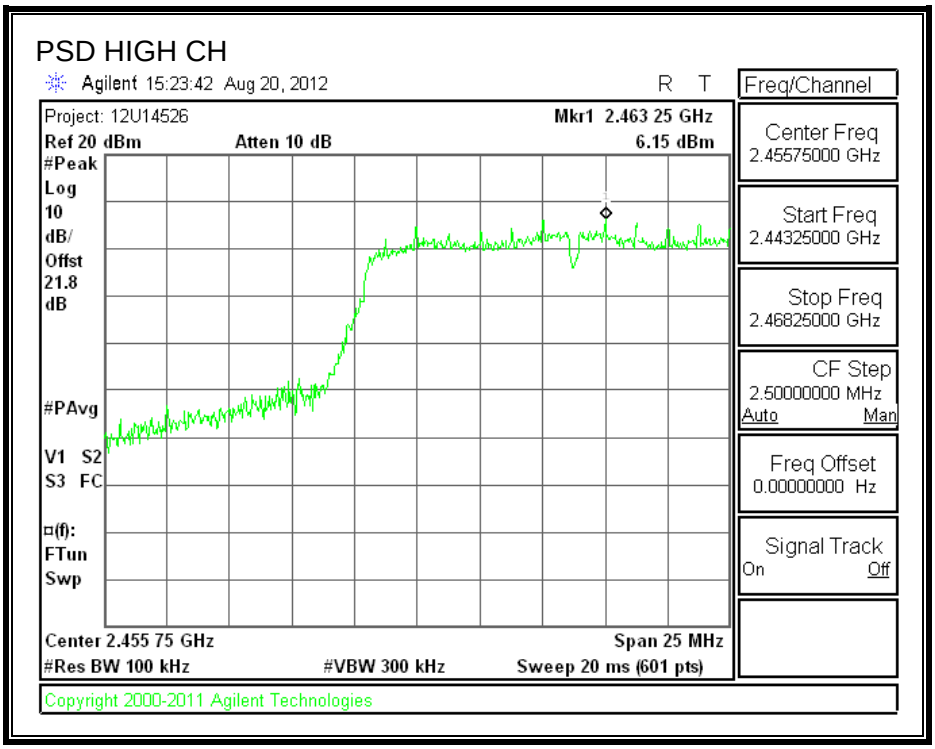


This report shall not be reproduced except in full, without the written approval of UL CCS.



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7.2.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

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

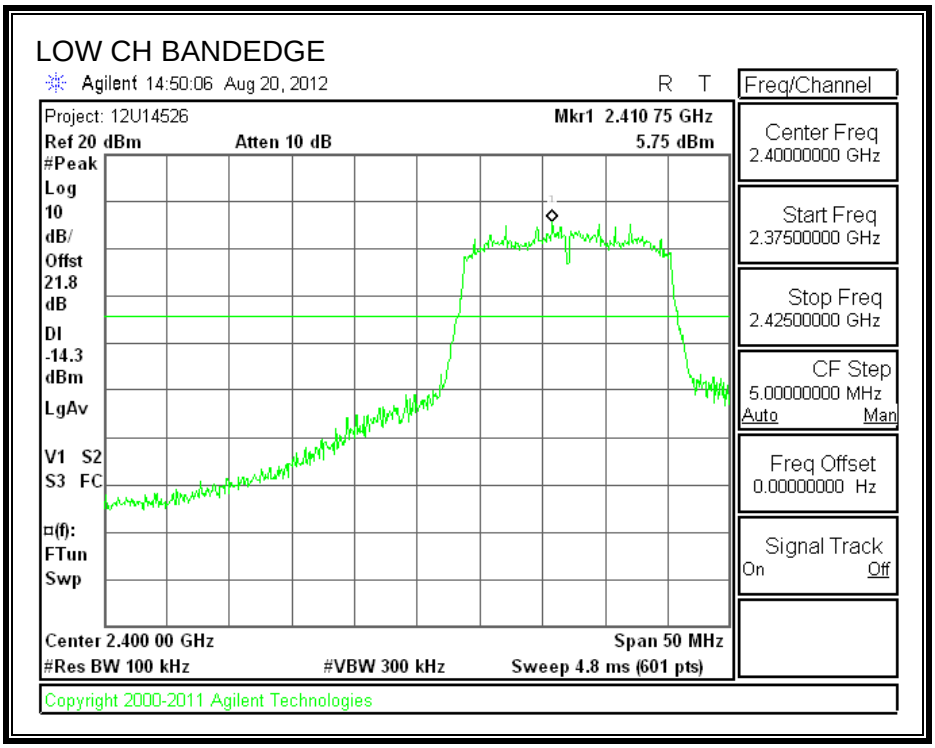
TEST PROCEDURE

KDB 558074 D01 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

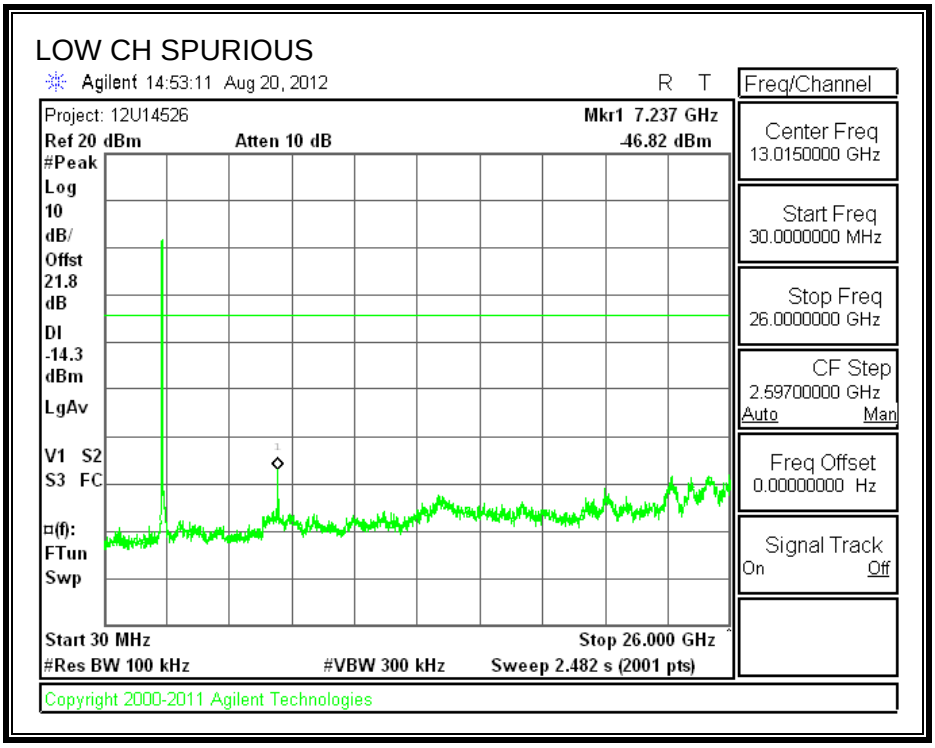
This report shall not be reproduced except in full, without the written approval of UL CCS.

RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



This report shall not be reproduced except in full, without the written approval of UL CCS.



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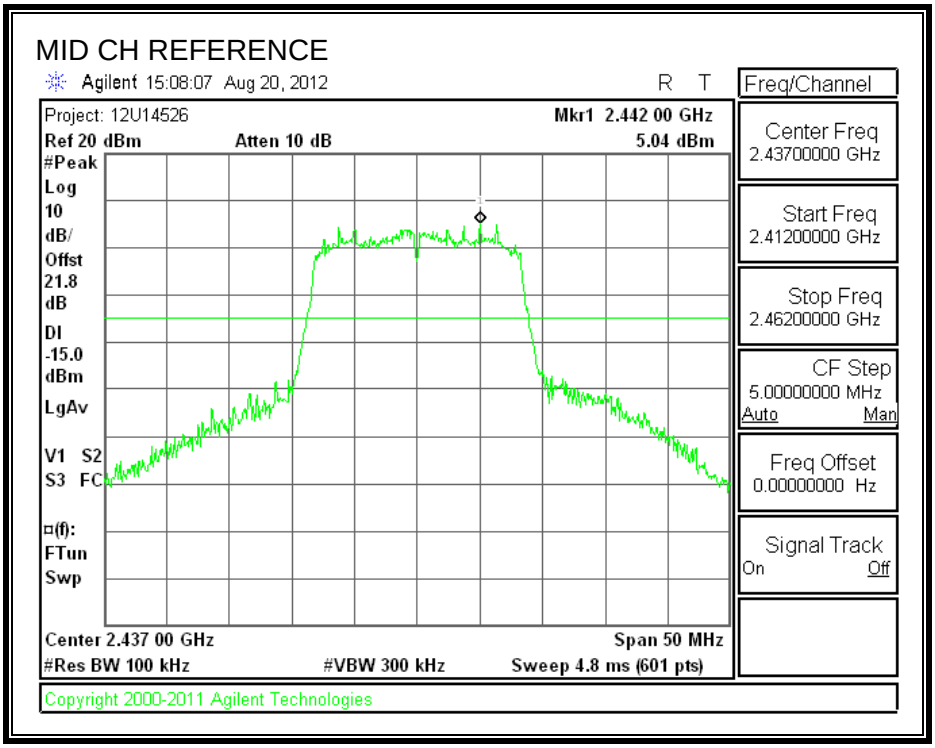
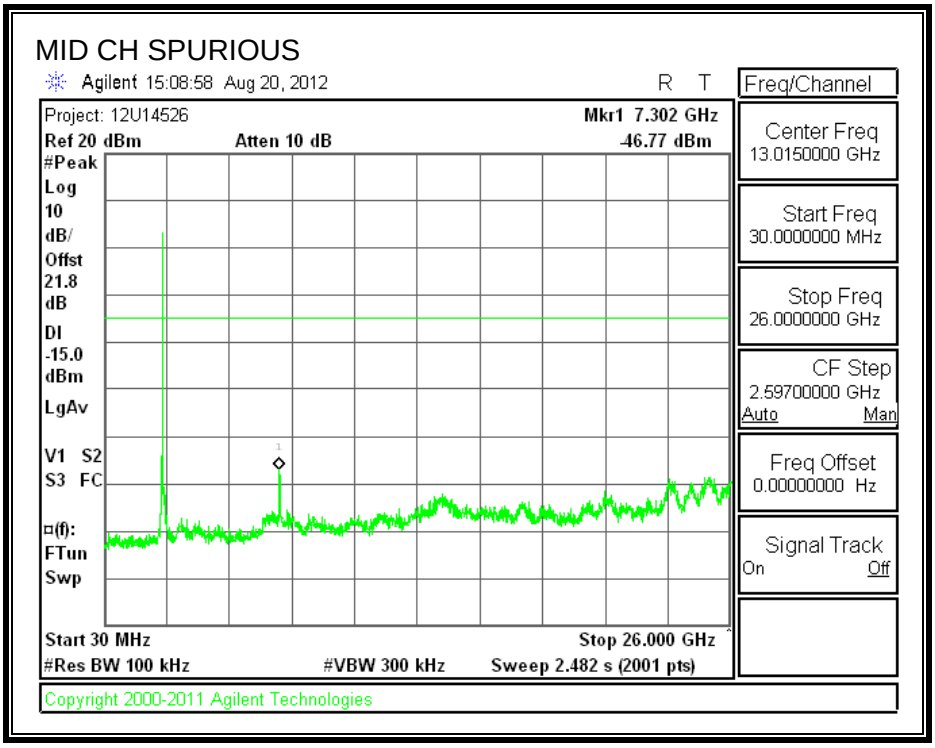
SPURIOUS EMISSIONS, MID CHANNEL



This report shall not be reproduced except in full, without the written approval of UL CCS.



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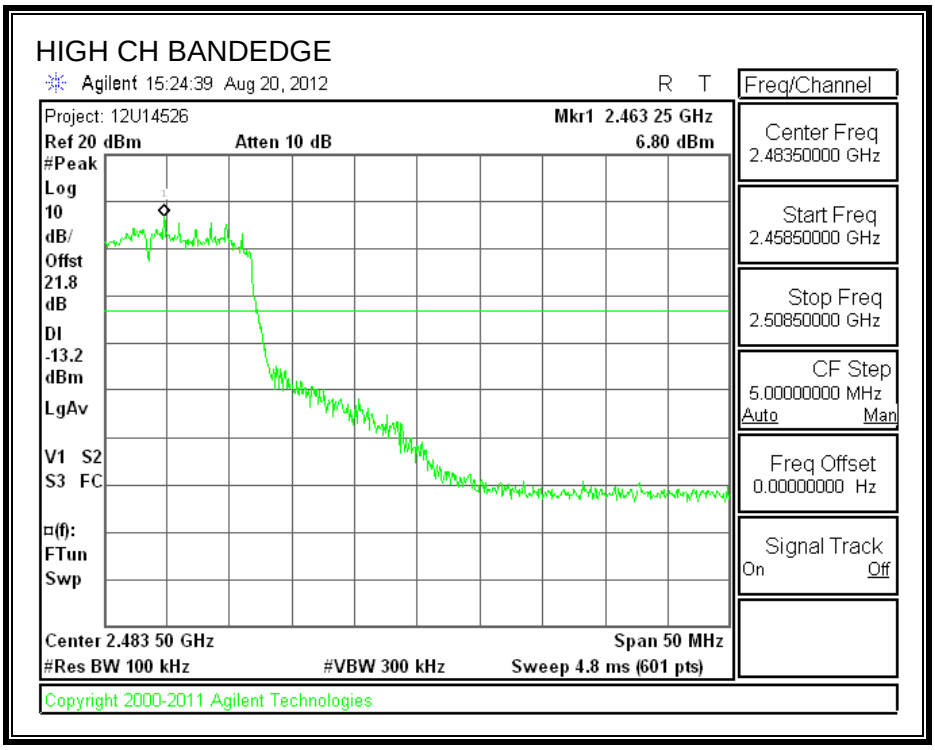
SPURIOUS EMISSIONS, HIGH CHANNEL



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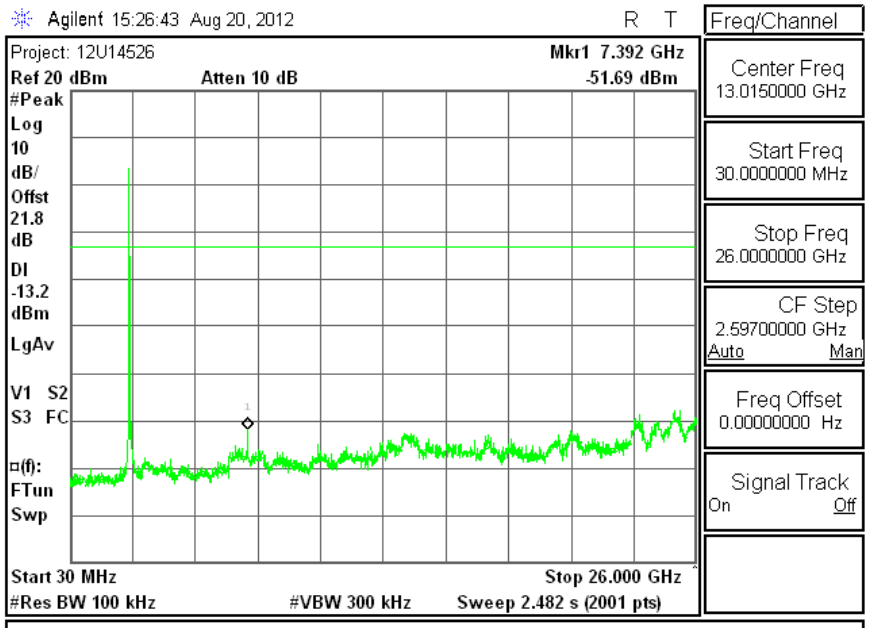
HIGH CH SPURIOUS



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7.3. 802.11n HT20 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 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	17.25	0.5
Middle	2437	17.21	0.5
High	2462	17.17	0.5

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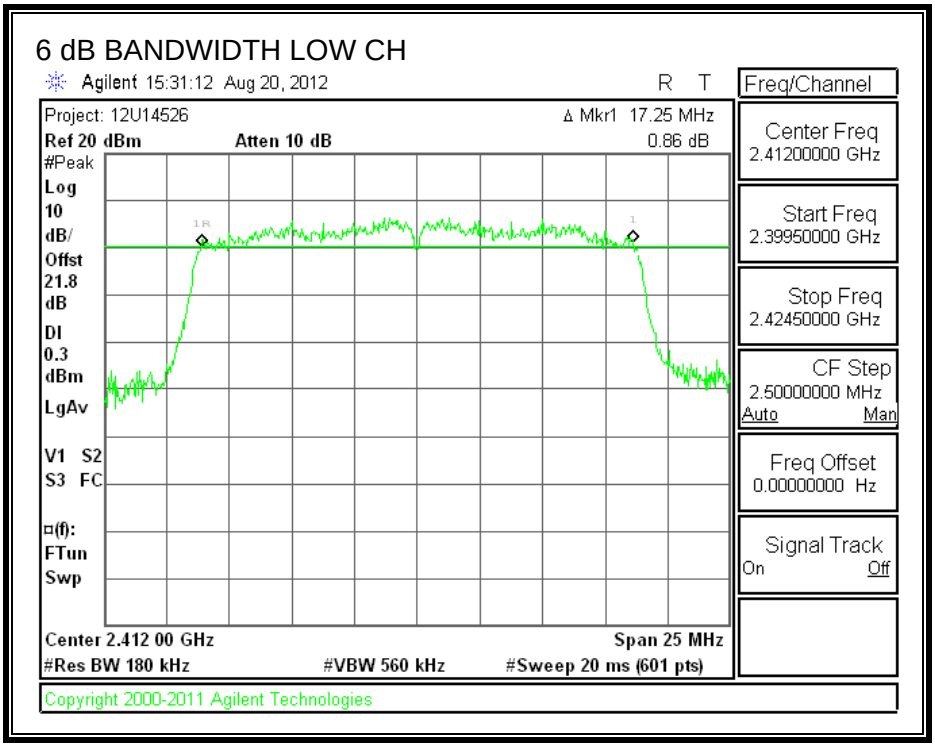
6 dB BANDWIDTH



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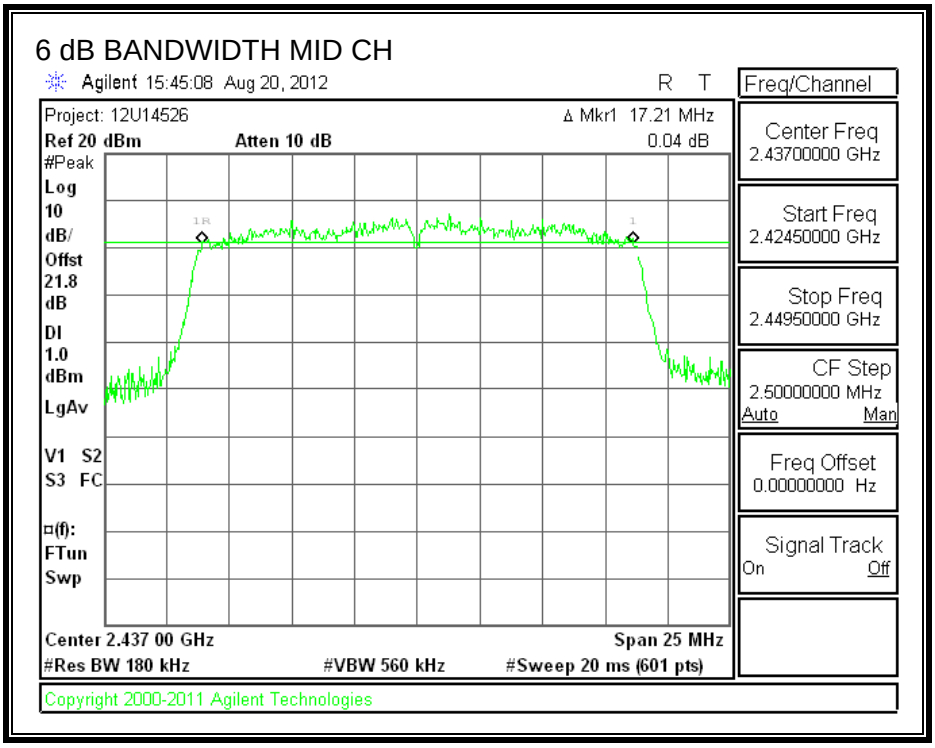
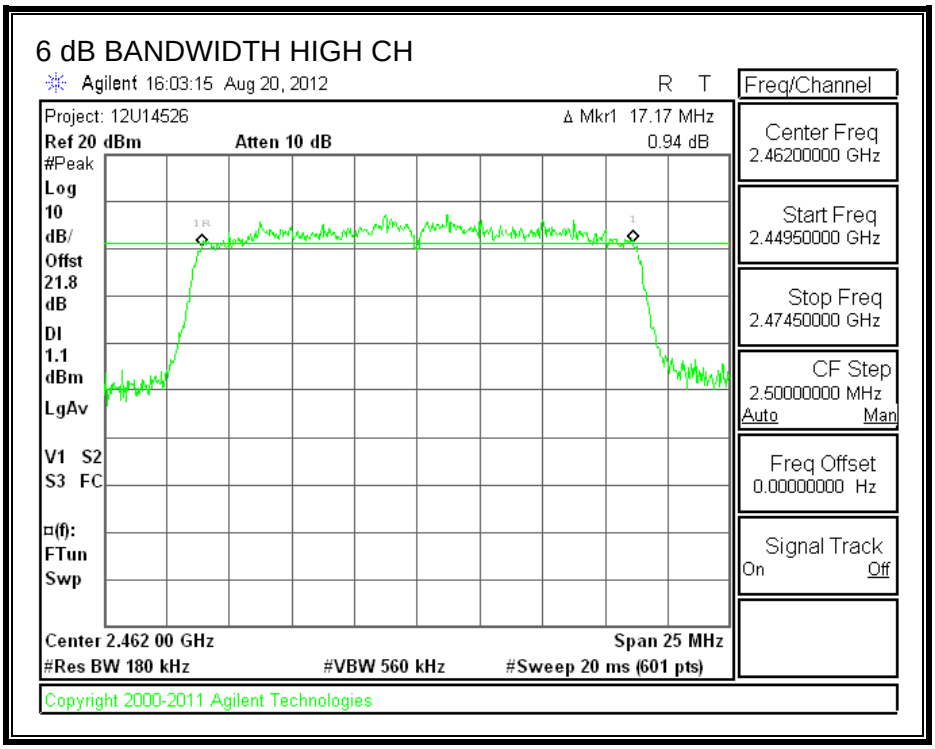


This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.

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)	Power (dBm)
Low	2412	15.96
Middle	2437	16.00
High	2462	15.93

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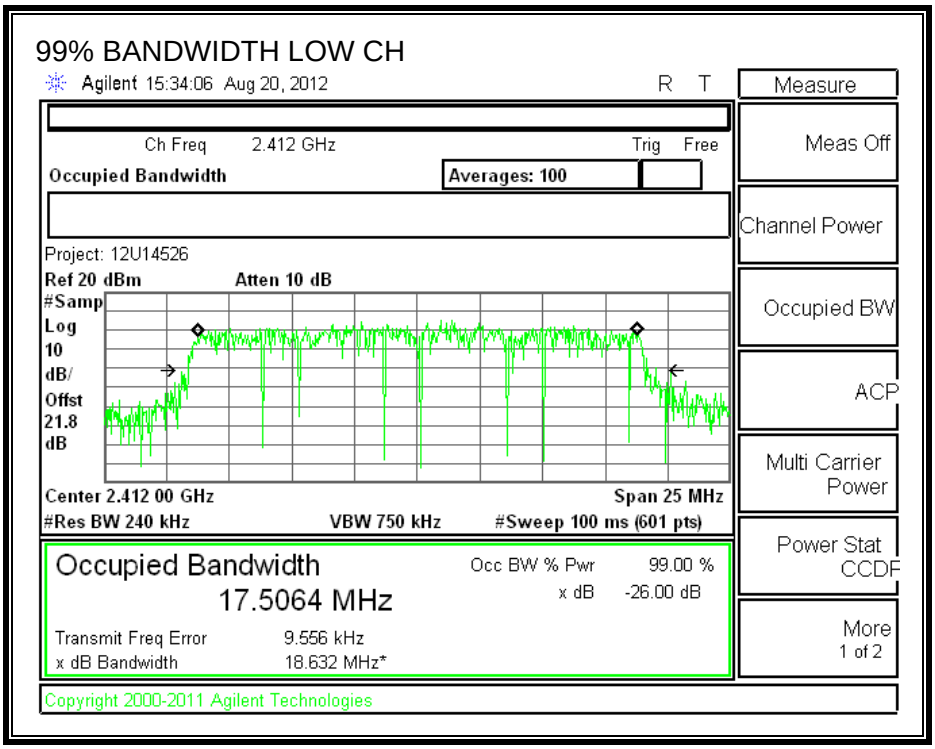
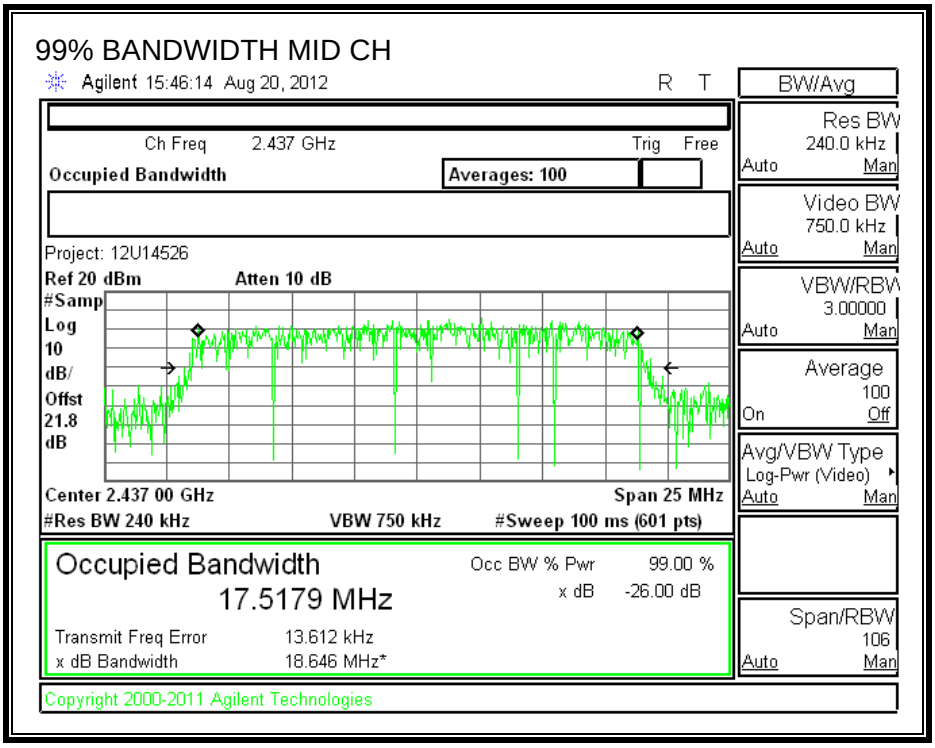
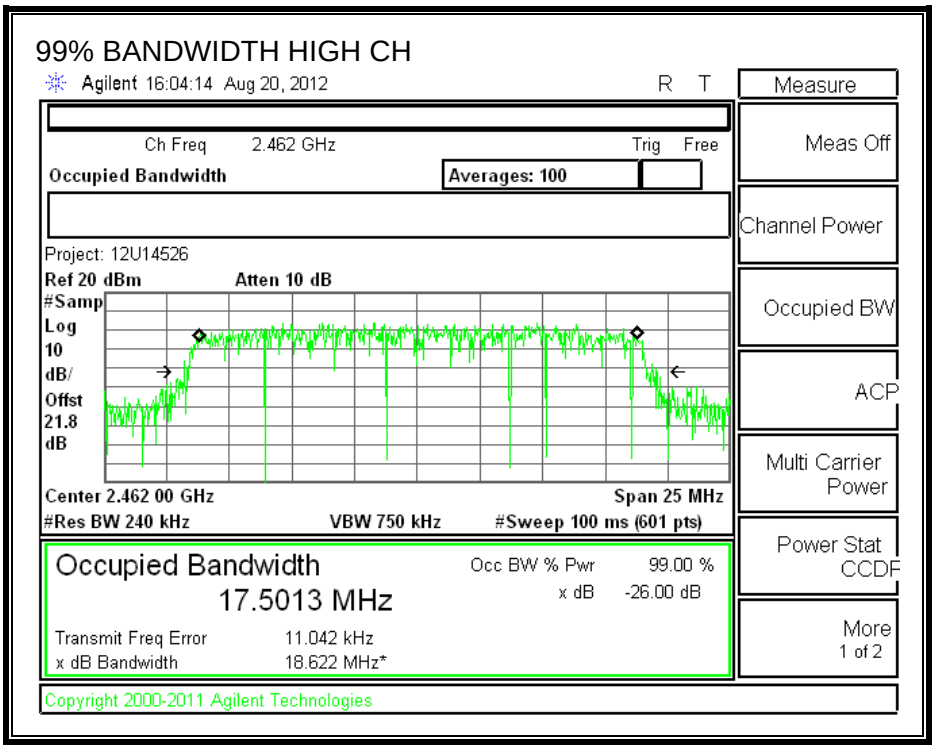
99% BANDWIDTH



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.



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7.3.3. 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”, dated 01/18/2012.

Measurement Procedure PK2 as referenced by section 5.2.1.2 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	25.05	30	-4.95
Middle	2437	25.31	30	-4.69
High	2462	25.19	30	-4.81

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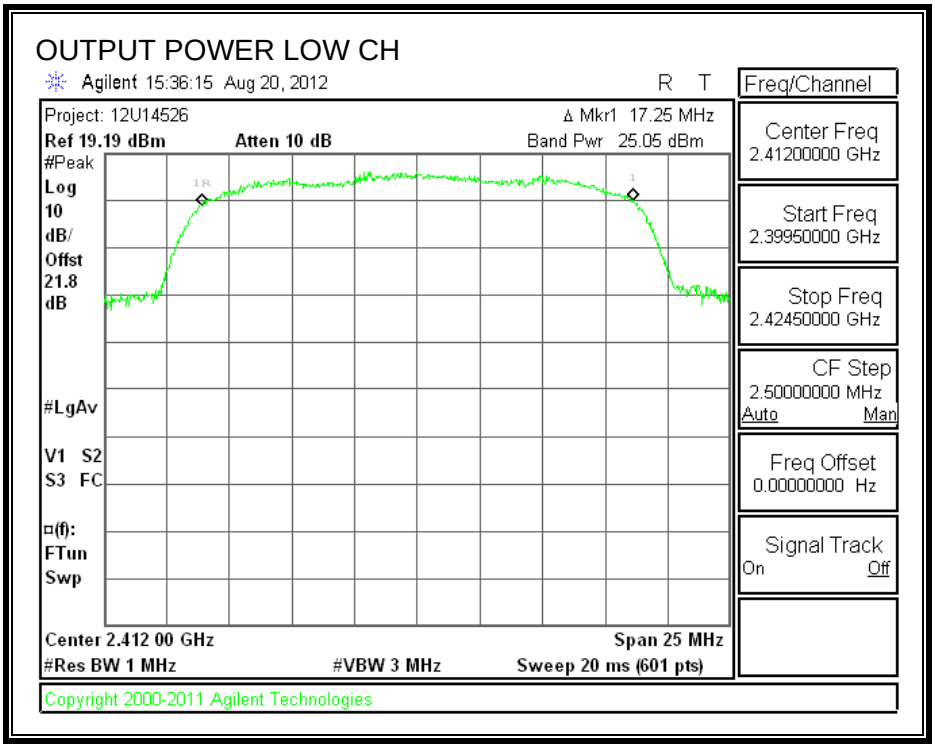
OUTPUT POWER



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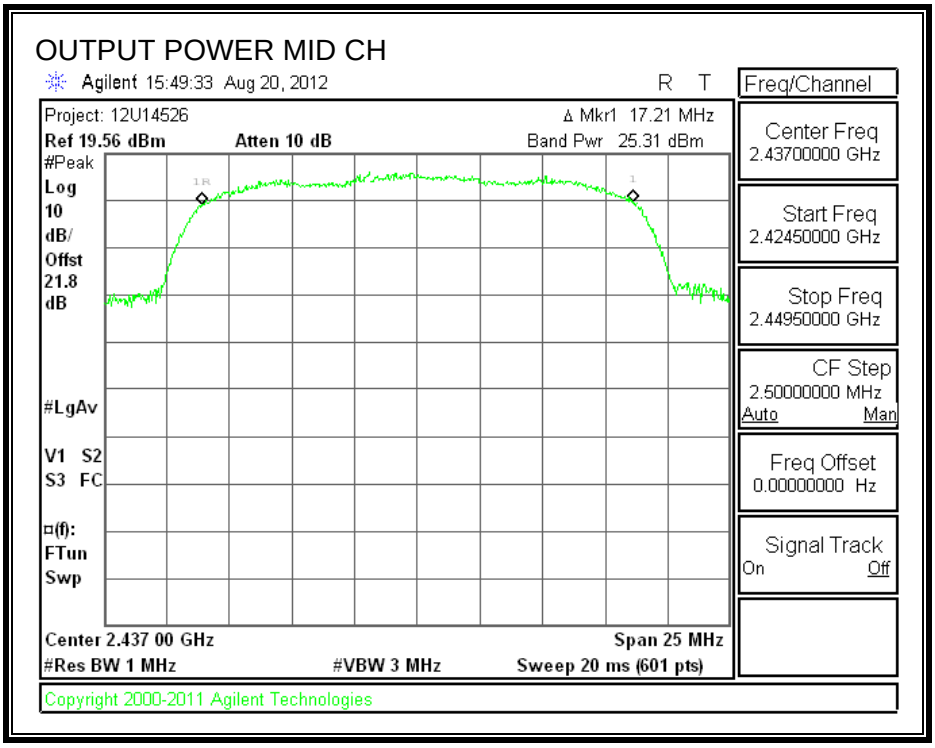
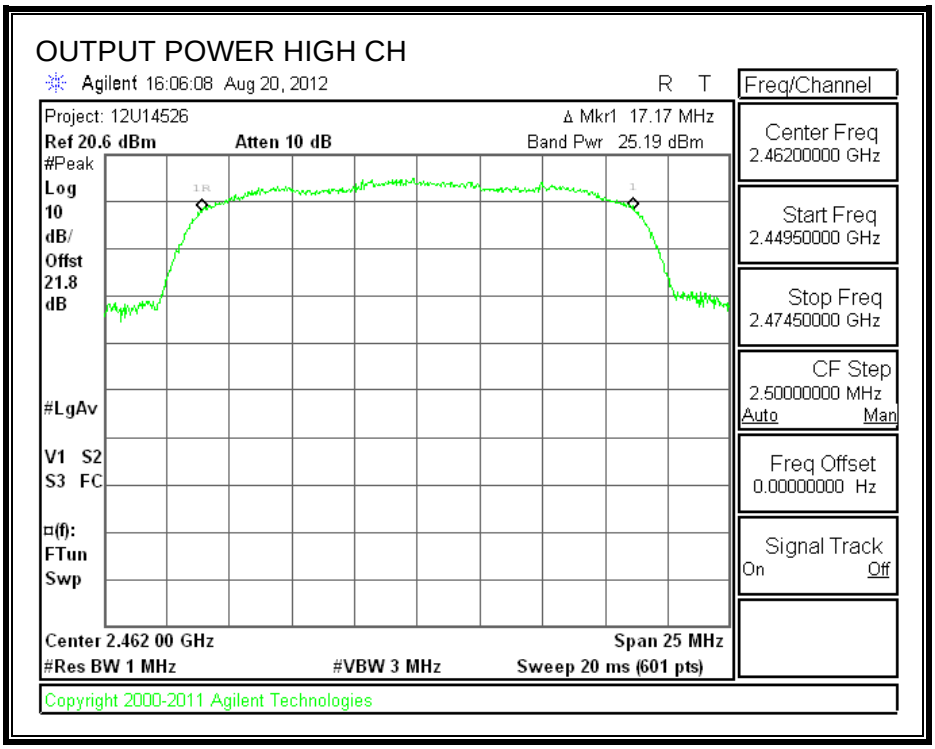
OUTPUT POWER MID CH



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.

7.3.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Power (dBm)
Low	2412	15.96
Middle	2437	16.00
High	2462	15.93

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7.3.5. 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”, dated 01/18/2012.

Measurement Procedure PKPSD as referenced by section 5.3.1 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	PSD (dBm)	10log(3kHz/100kHz) (dBm)	Limit (dBm)	Margin (dB)
Low	2412	5.92	-15.2	8	-17.28
Middle	2437	6.16	-15.2	8	-17.04
High	2462	6.14	-15.2	8	-17.06

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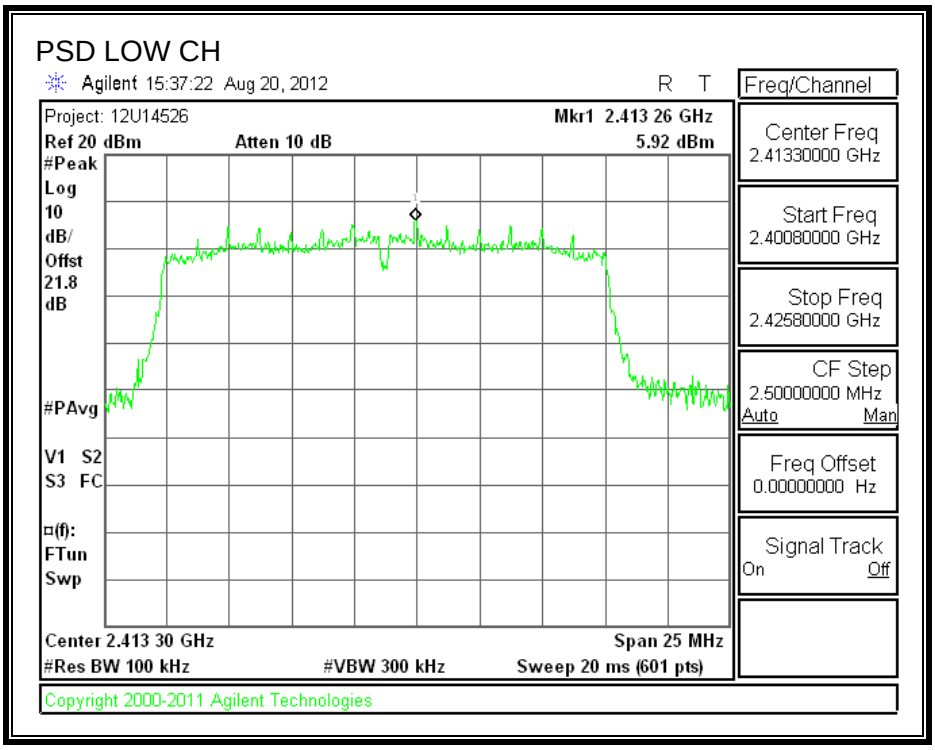
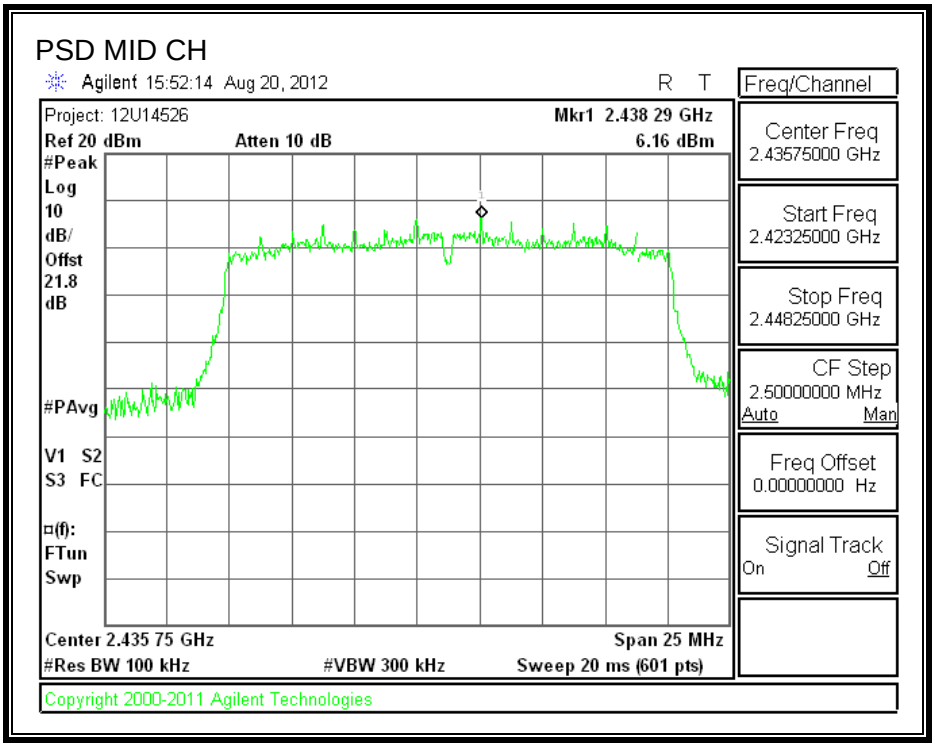
POWER SPECTRAL DENSITY



This report shall not be reproduced except in full, without the written approval of UL CCS.



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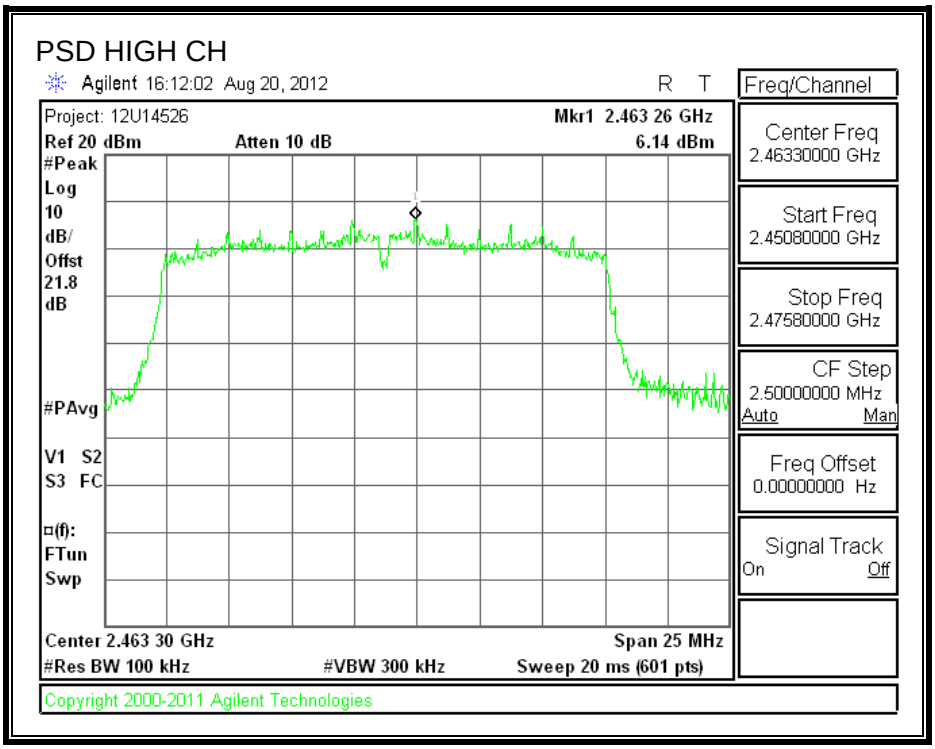

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7.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

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

TEST PROCEDURE

KDB 558074 D01 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

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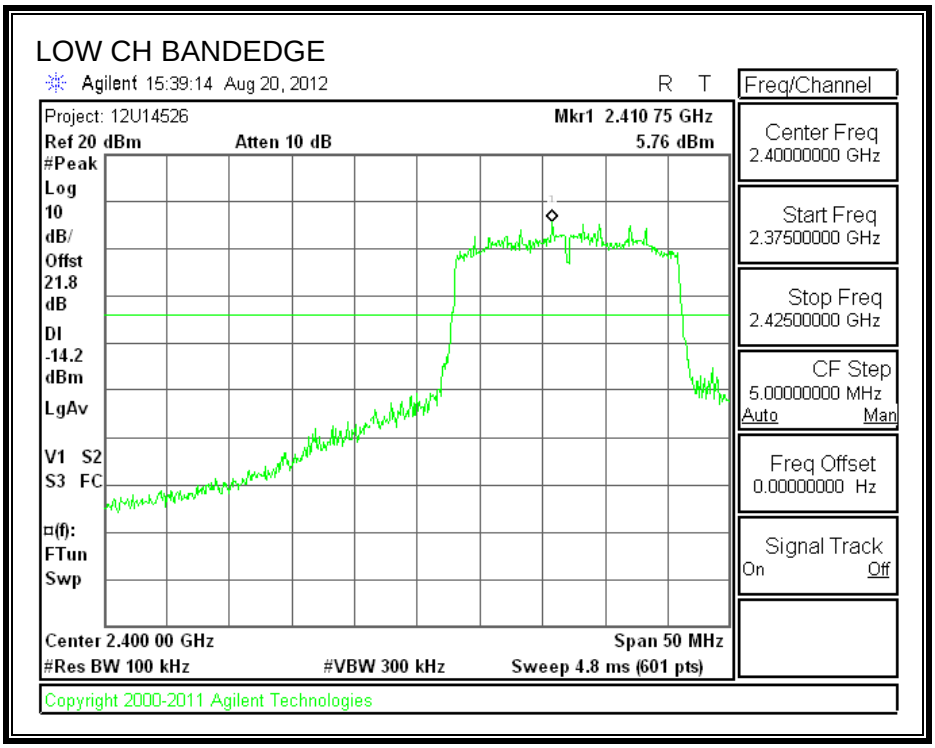
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



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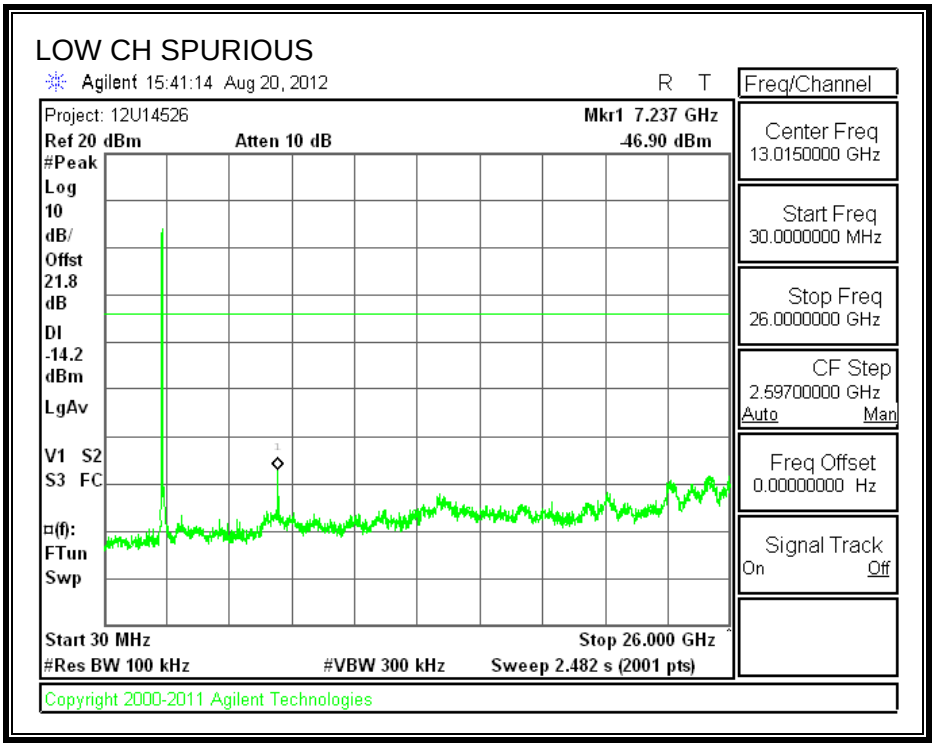

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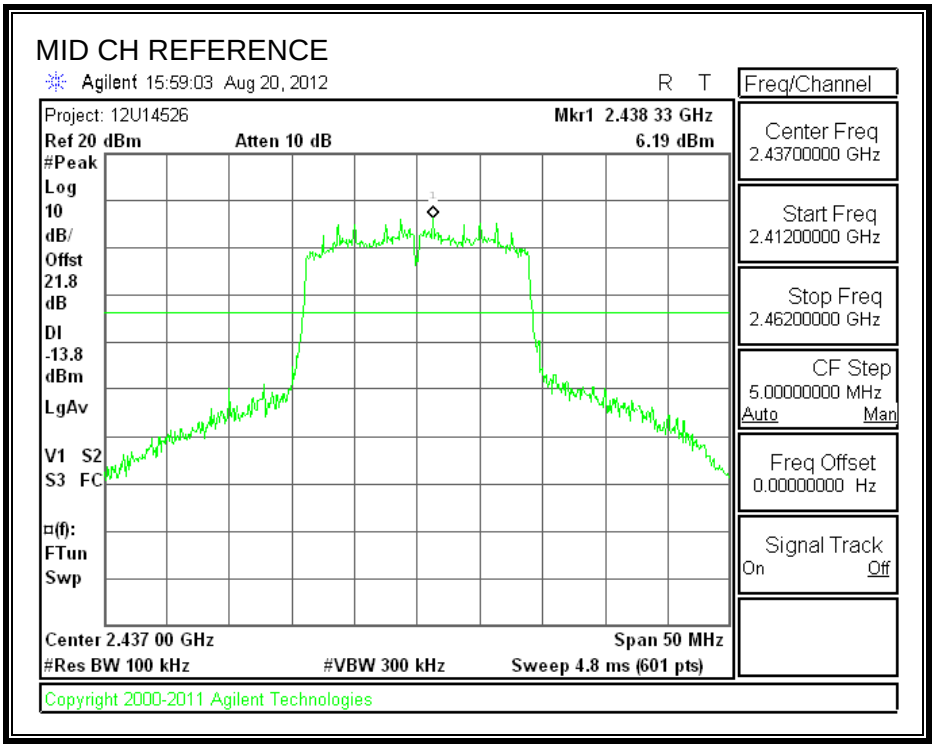
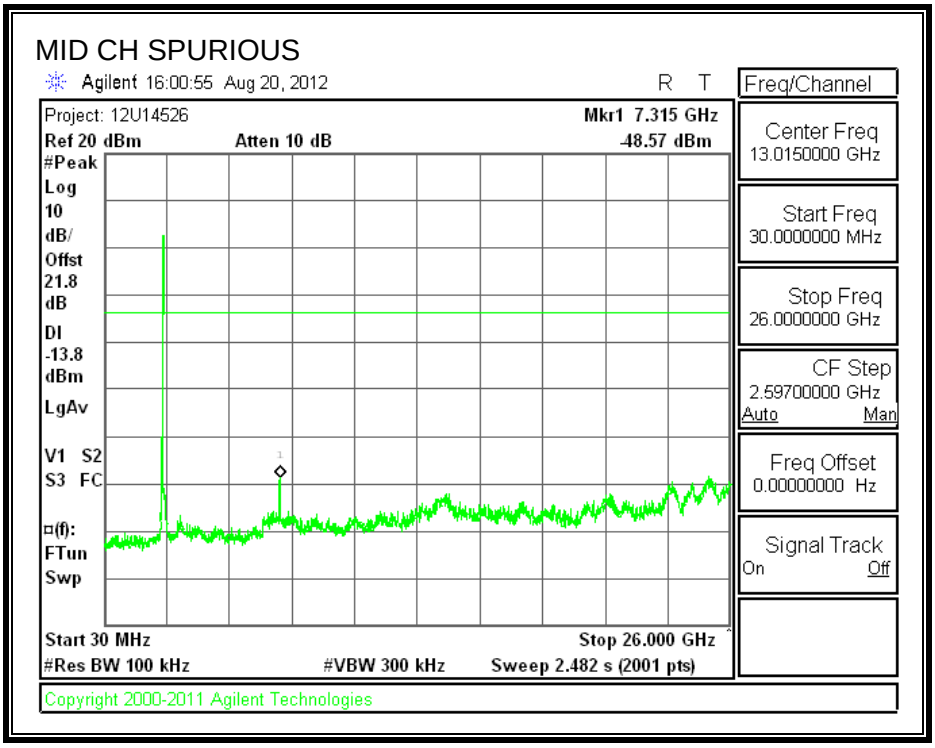
SPURIOUS EMISSIONS, MID CHANNEL



This report shall not be reproduced except in full, without the written approval of UL CCS.



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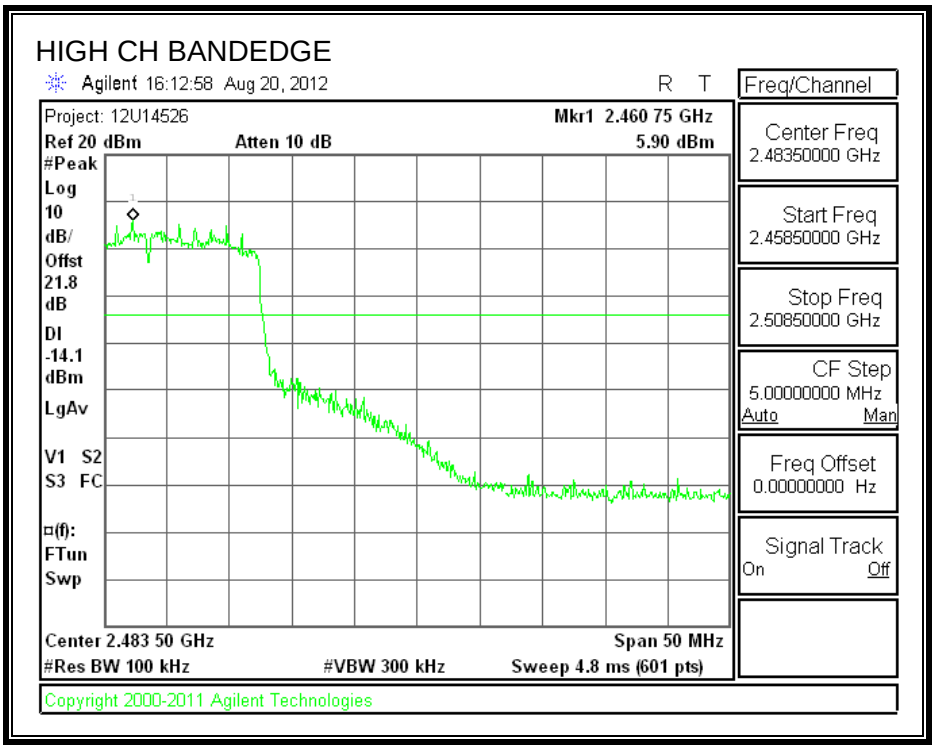
SPURIOUS EMISSIONS, HIGH CHANNEL



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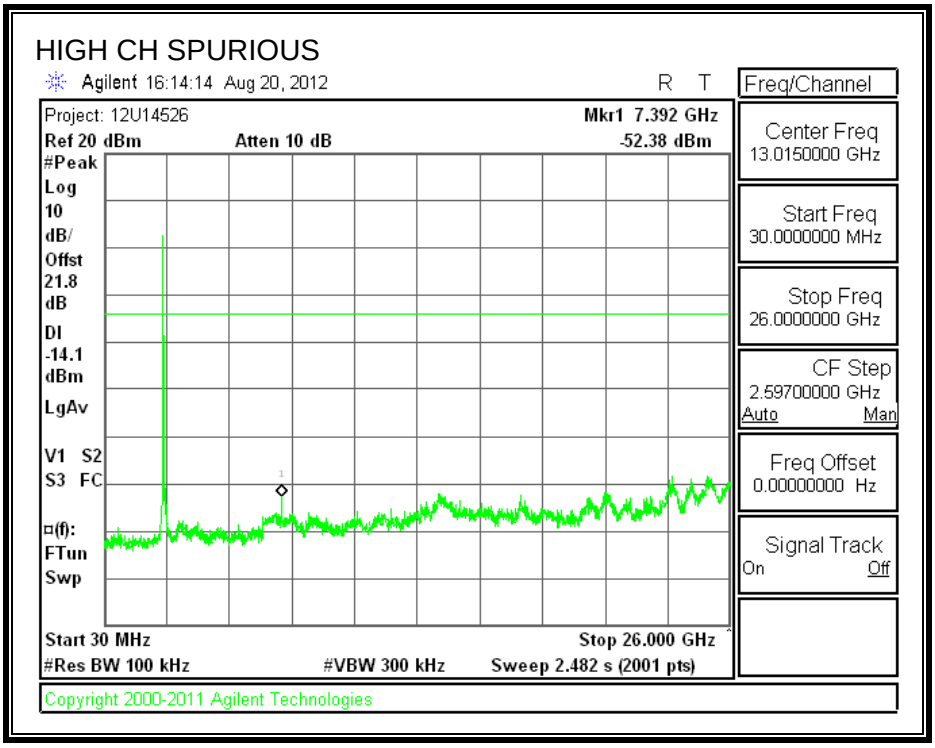
HIGH CH SPURIOUS



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7.4. 802.11a 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 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5745	15.79	0.5
Middle	5785	15.88	0.5
High	5825	15.96	0.5

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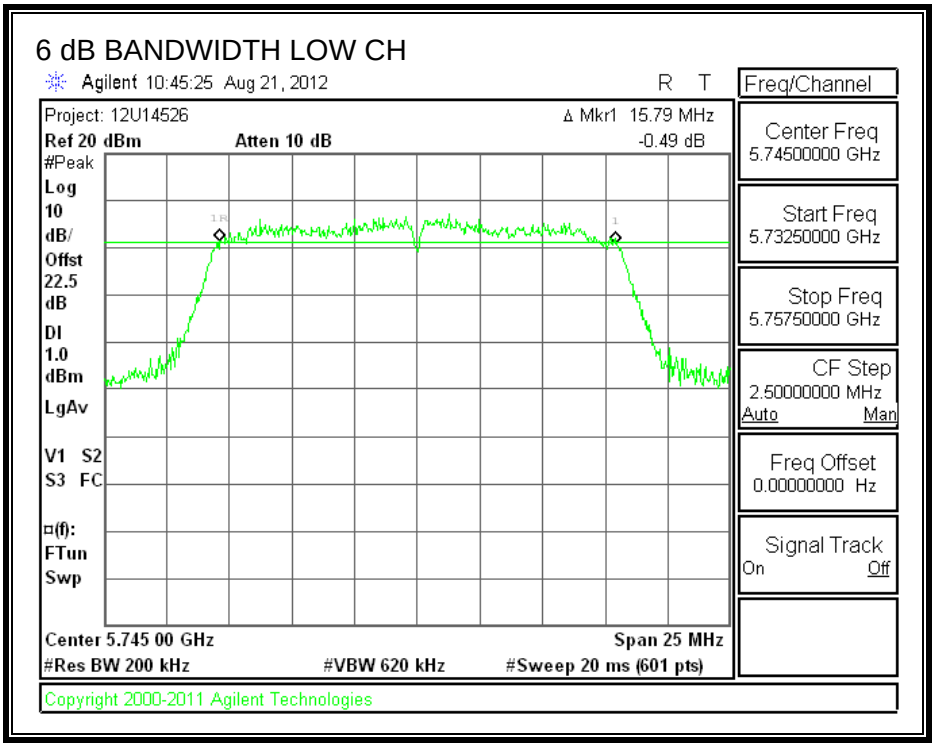
6 dB BANDWIDTH



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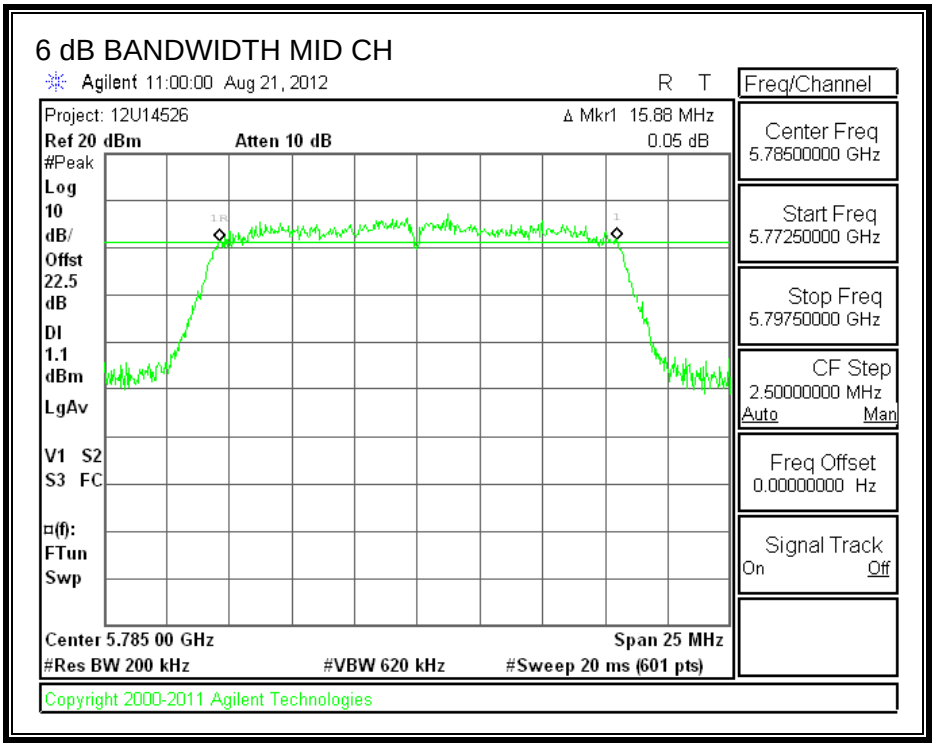

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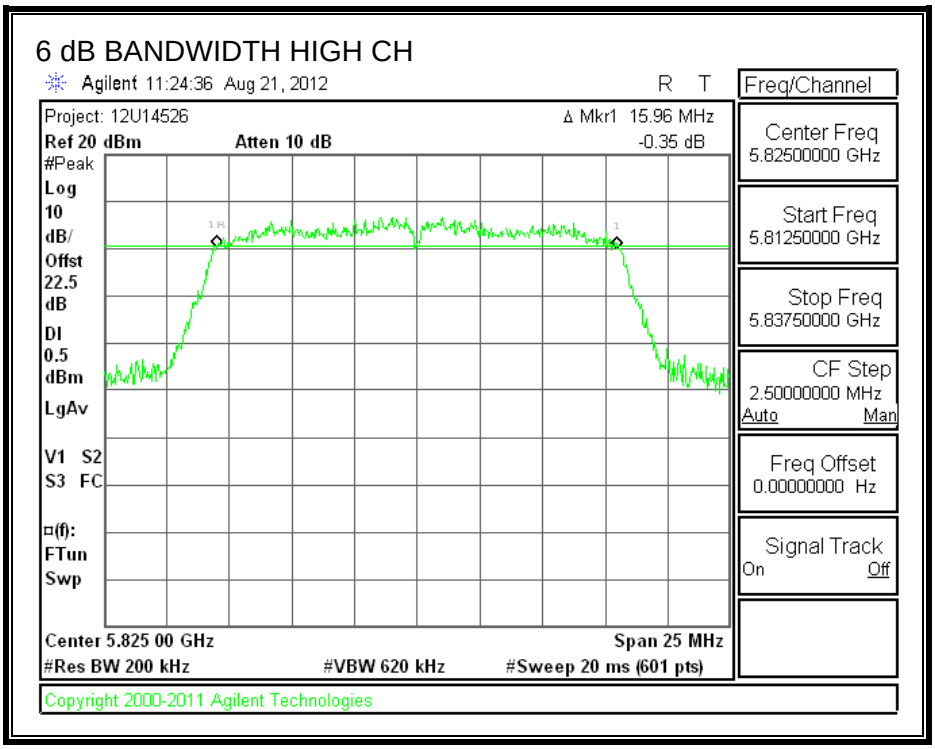

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7.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

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

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	16.3187
Middle	5785	16.3261
High	5825	16.3253

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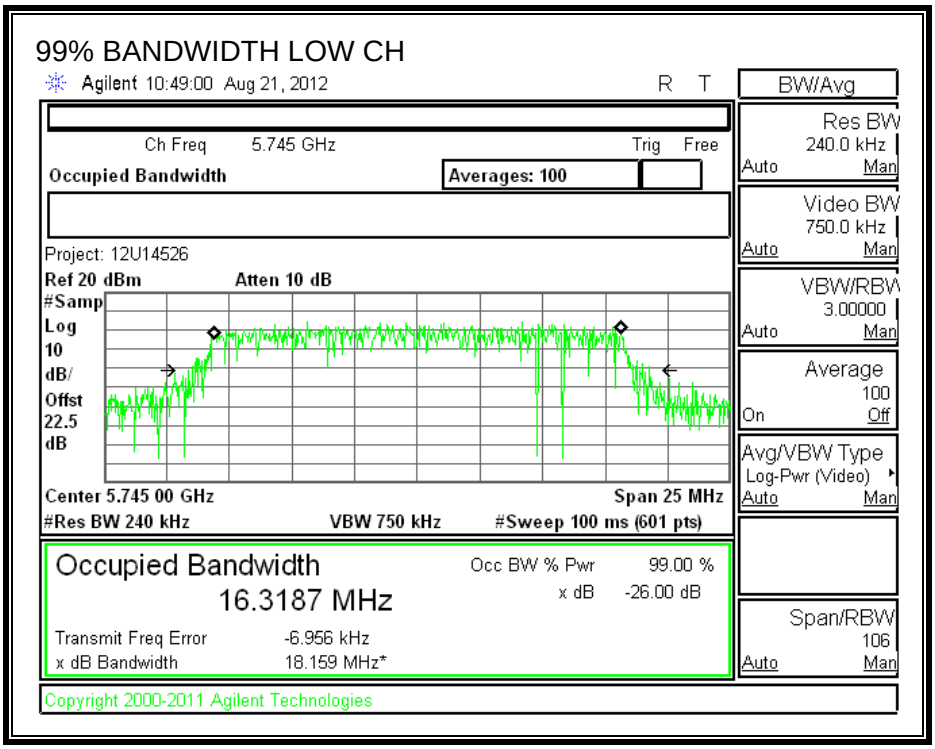
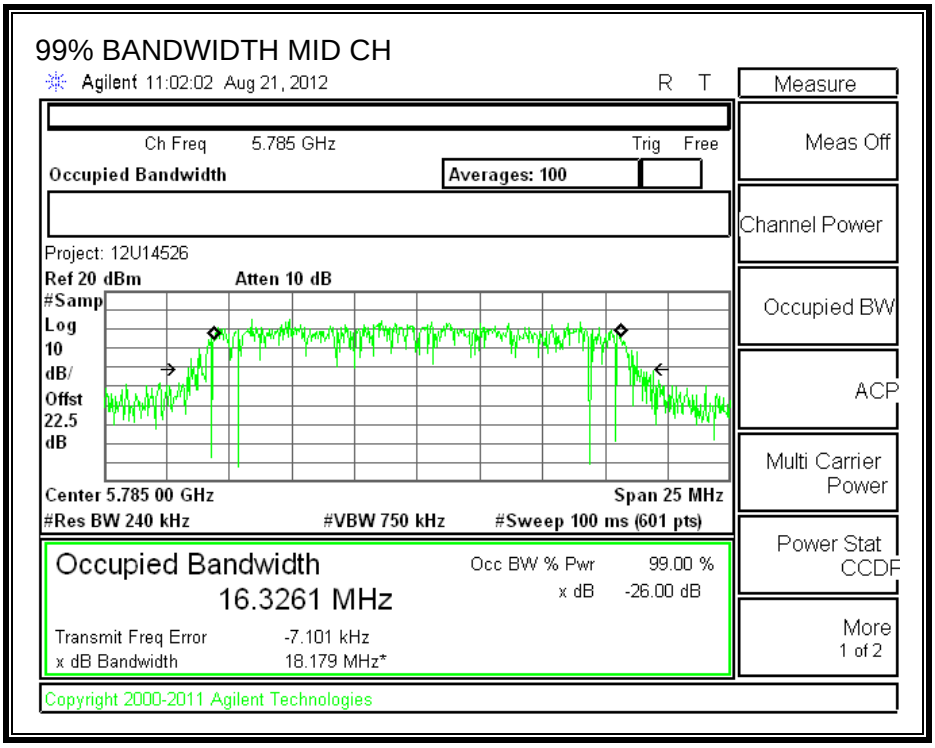
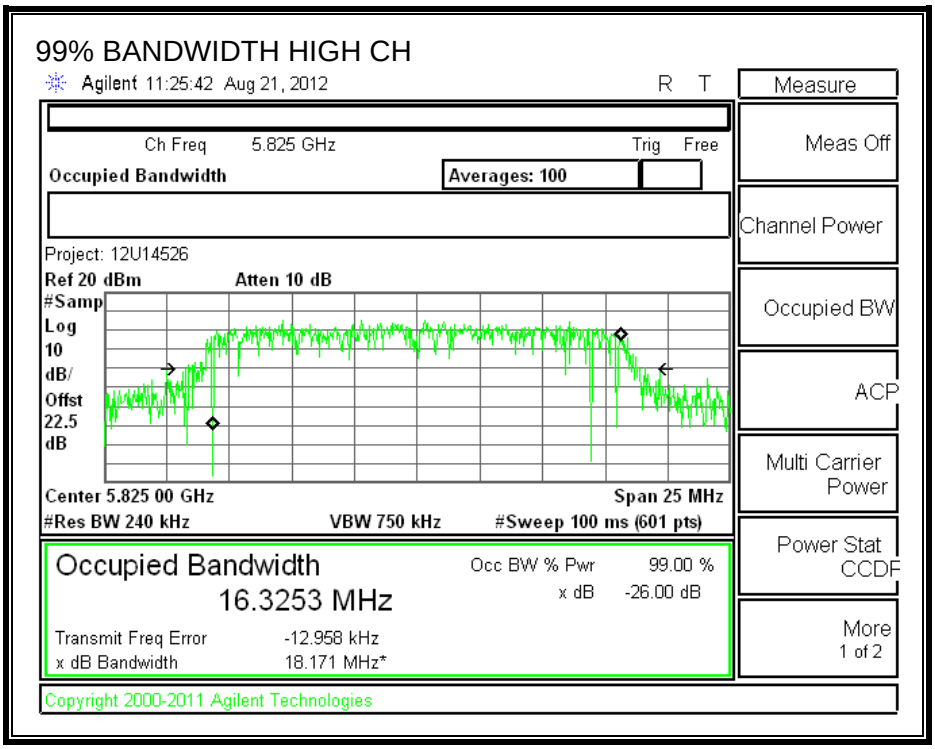
99% BANDWIDTH



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.



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7.4.3. 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”, dated 01/18/2012.

Measurement Procedure PK2 as referenced by section 5.2.1.2 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	5745	24.88	30	-5.12
Middle	5785	24.38	30	-5.62
High	5825	24.99	30	-5.01

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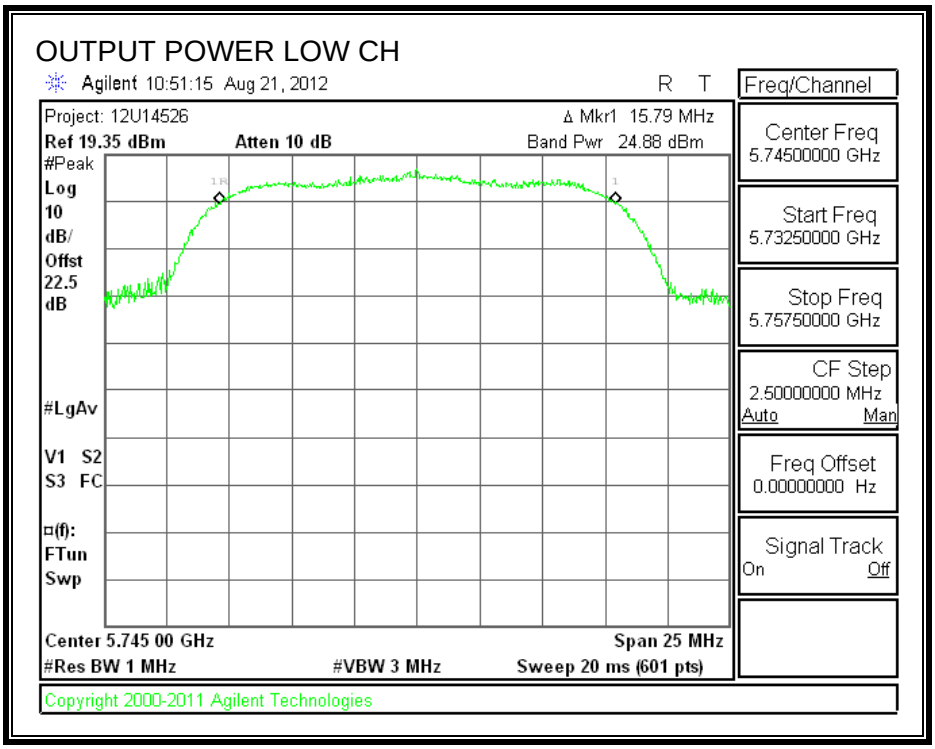
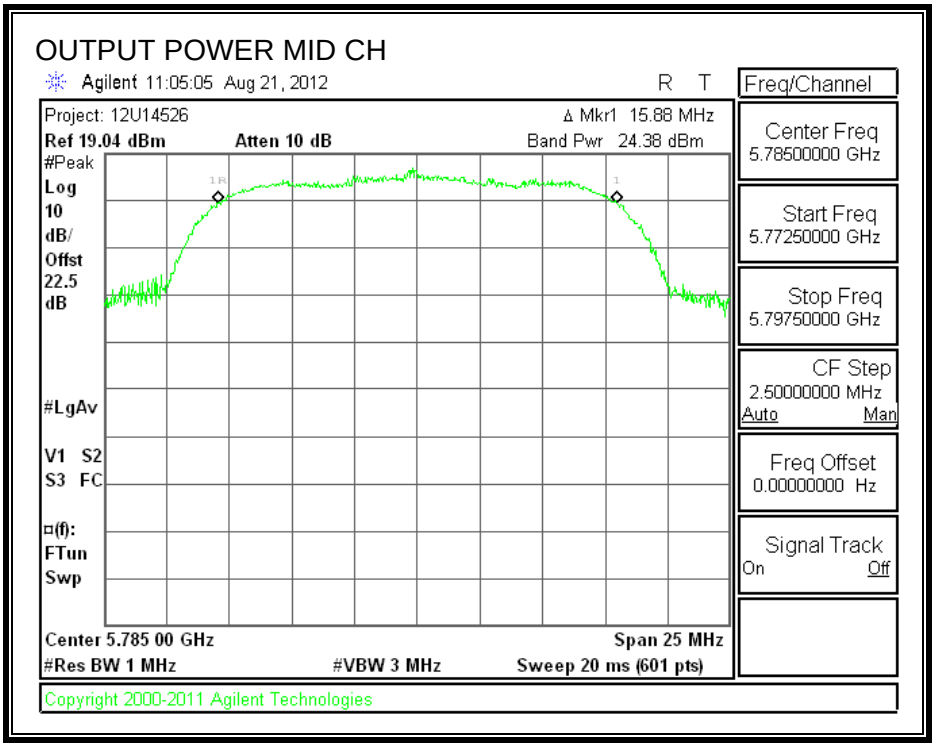
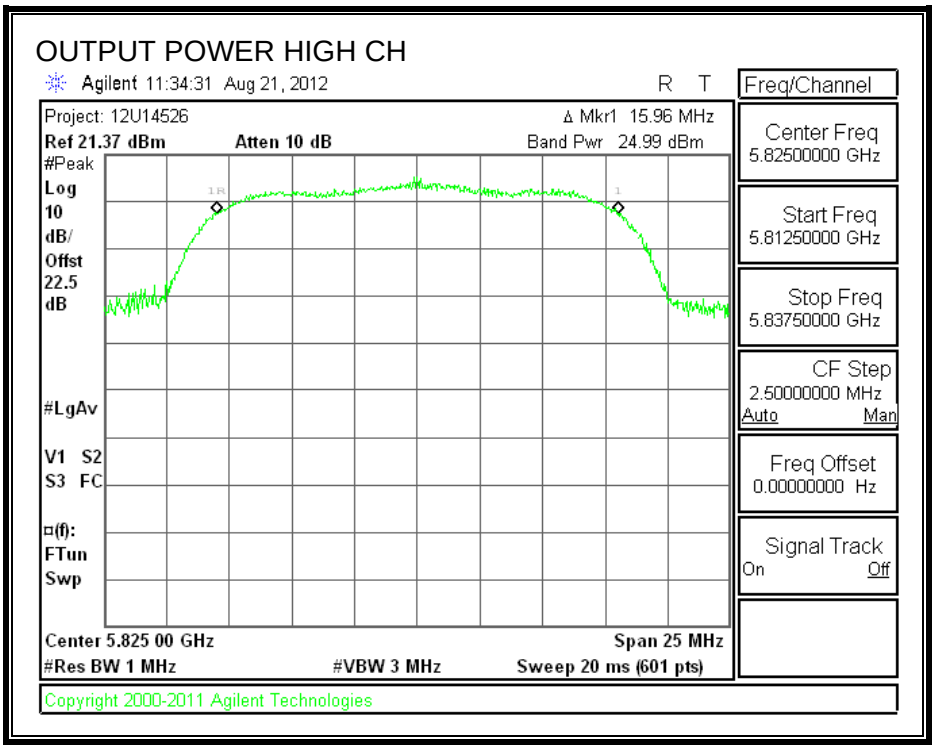
OUTPUT POWER



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.



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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 11.5 dB (including 10 dB pad and 1.5 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	15.91
Middle	5785	15.94
High	5825	15.96

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7.4.5. 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”, dated 01/18/2012.

Measurement Procedure PKPSD as referenced by section 5.3.1 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	Analyzer Reading (dBm)	10log(3kHz/100kHz) (dB)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	5.97	-15.2	-9.23	8	-17.23
Middle	5785	5.77	-15.2	-9.43	8	-17.43
High	5825	6.09	-15.2	-9.11	8	-17.11

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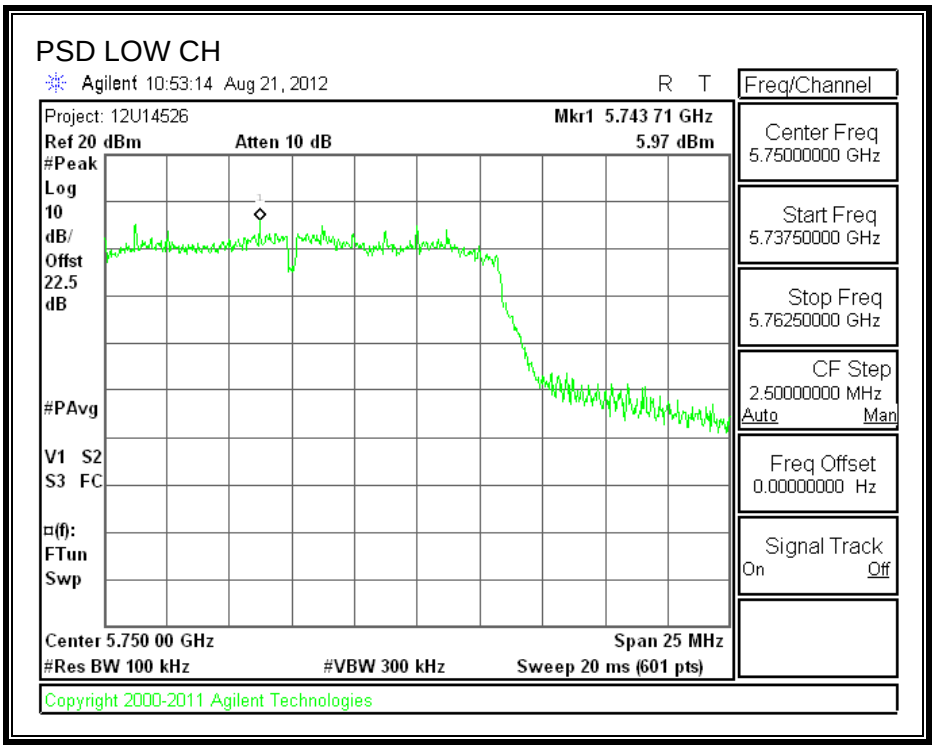
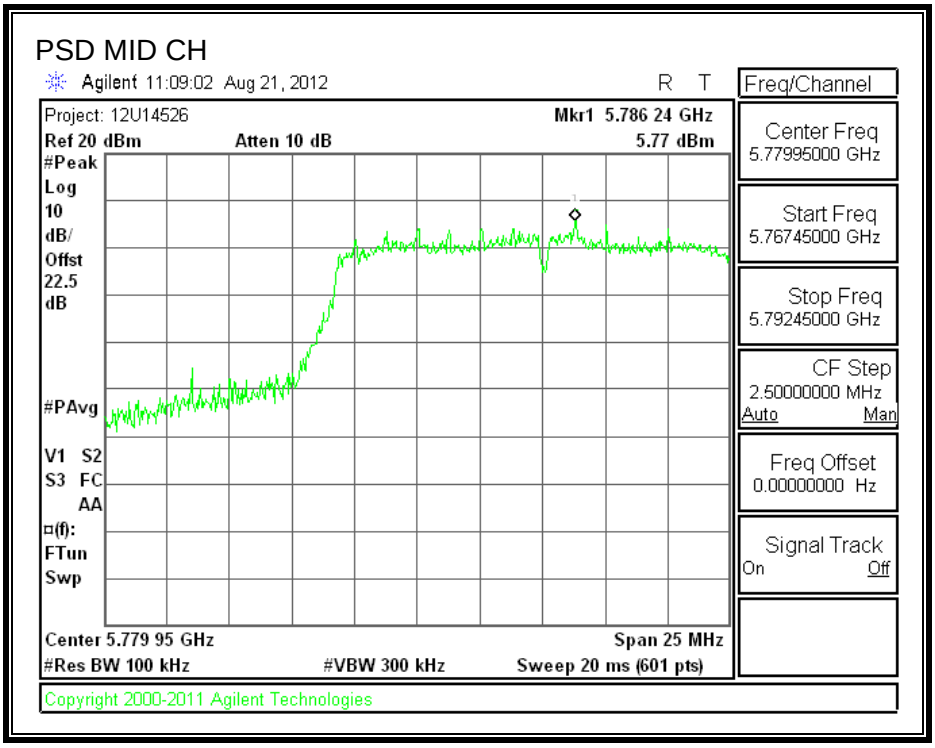
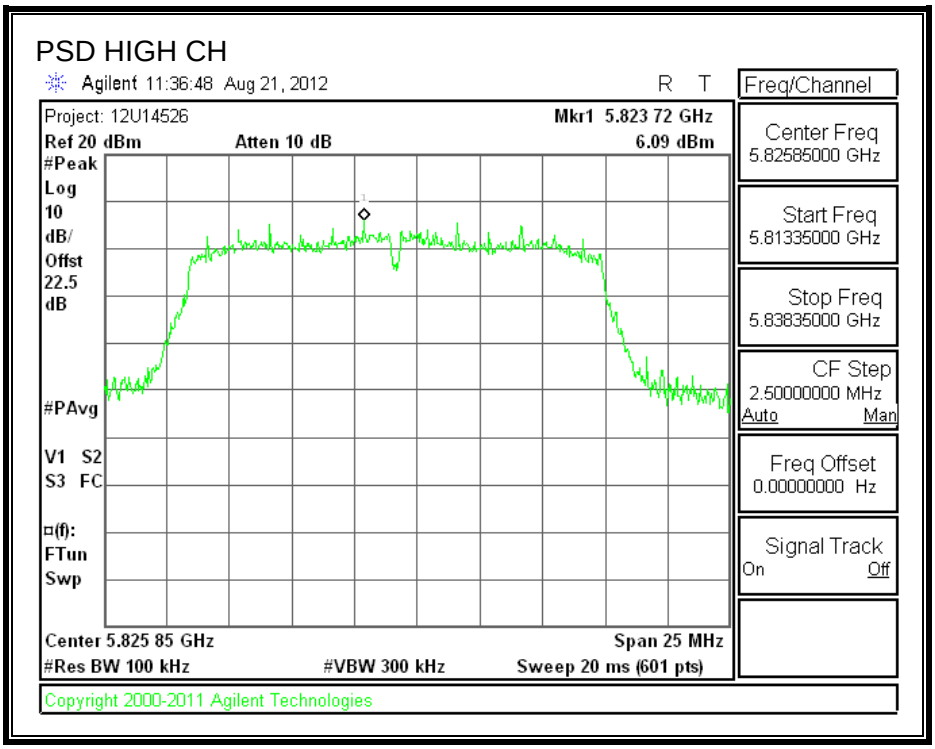
POWER SPECTRAL DENSITY



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.

7.4.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

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

TEST PROCEDURE

KDB 558074 D01 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

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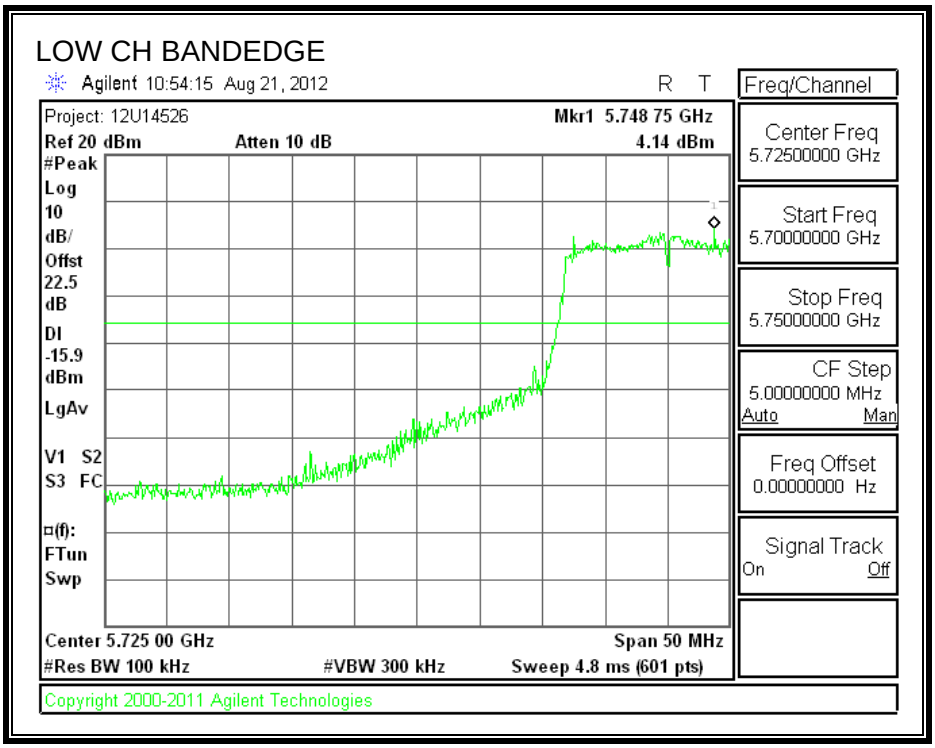
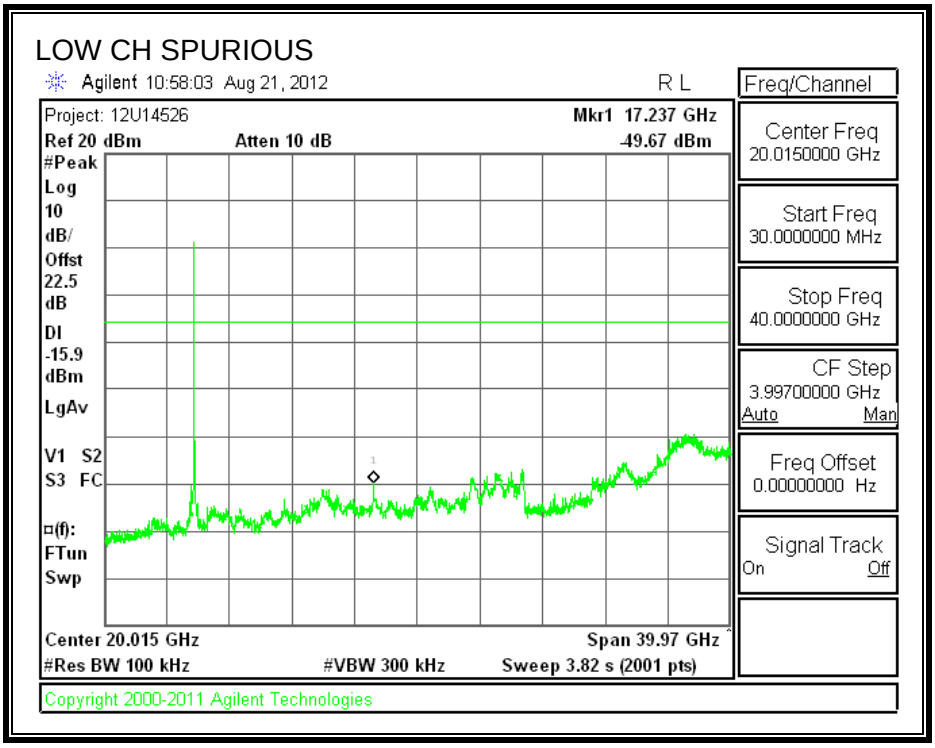
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



This report shall not be reproduced except in full, without the written approval of UL CCS.



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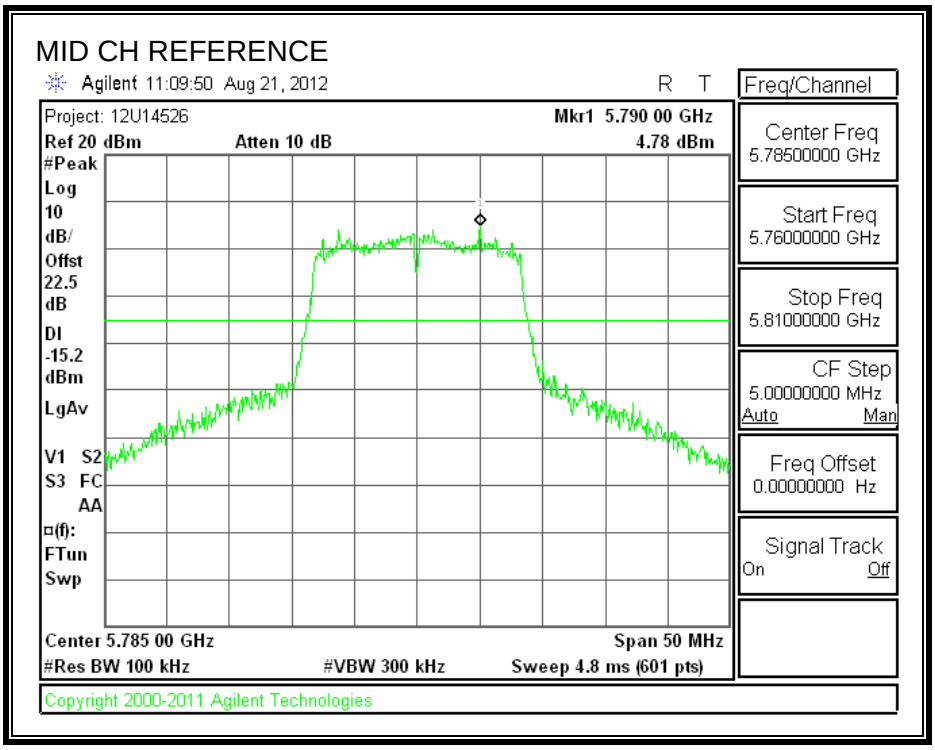
SPURIOUS EMISSIONS, MID CHANNEL



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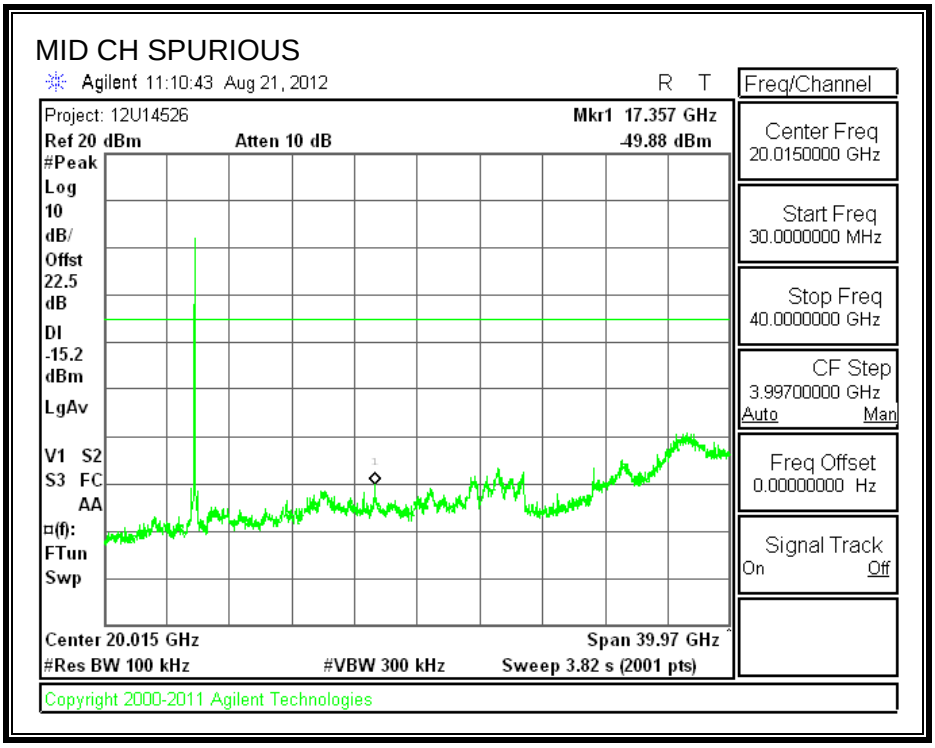

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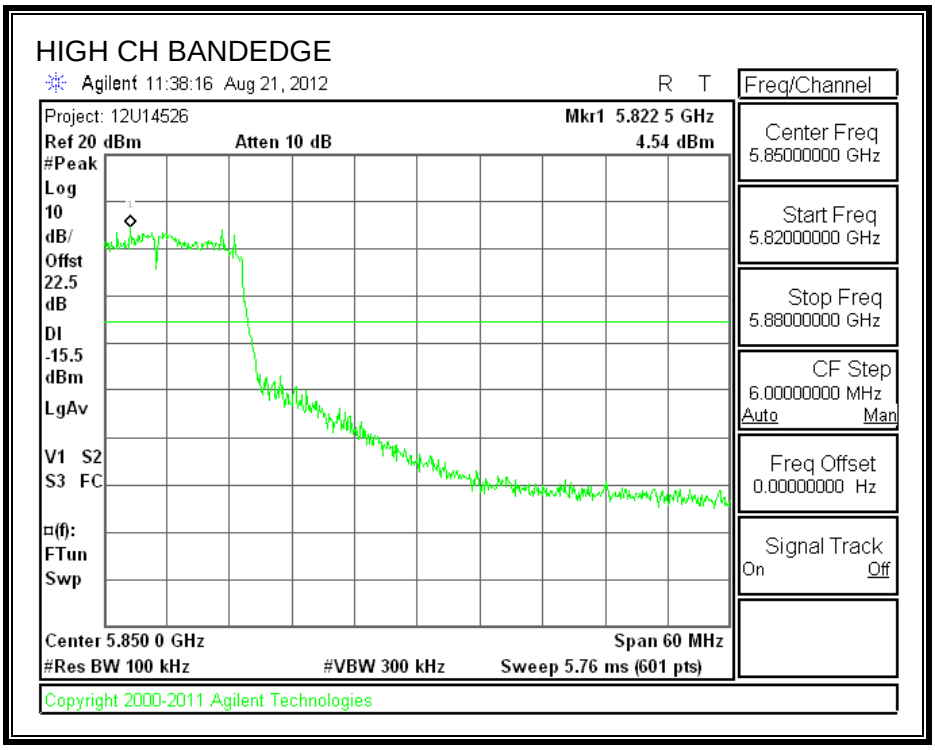
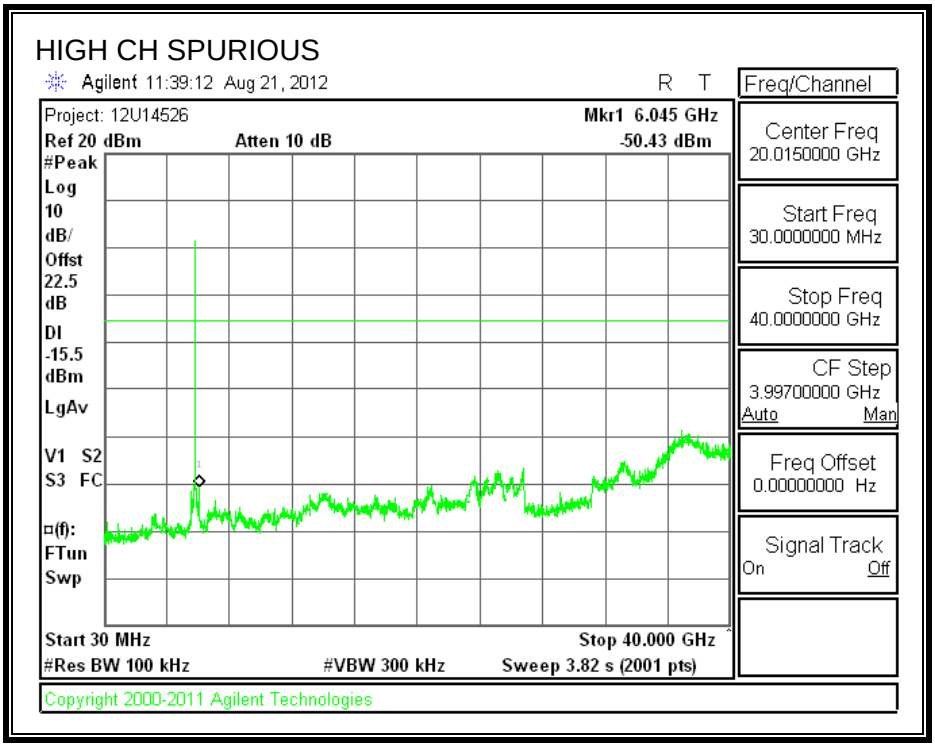
SPURIOUS EMISSIONS, HIGH CHANNEL



This report shall not be reproduced except in full, without the written approval of UL CCS.



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7.5. 802.11n HT20 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 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

RESULTS

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

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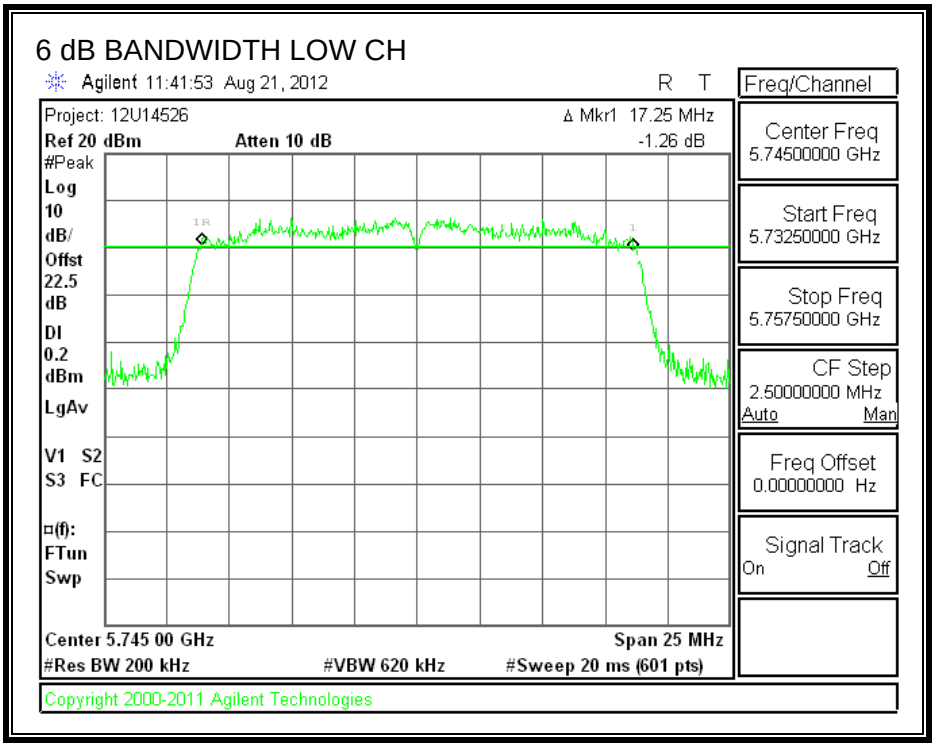
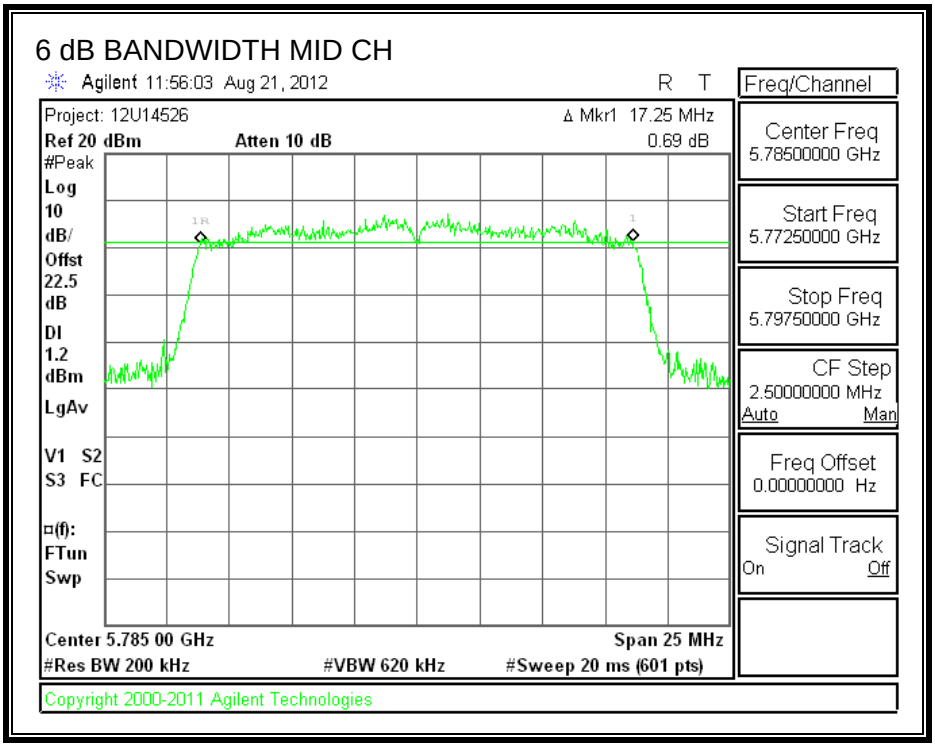
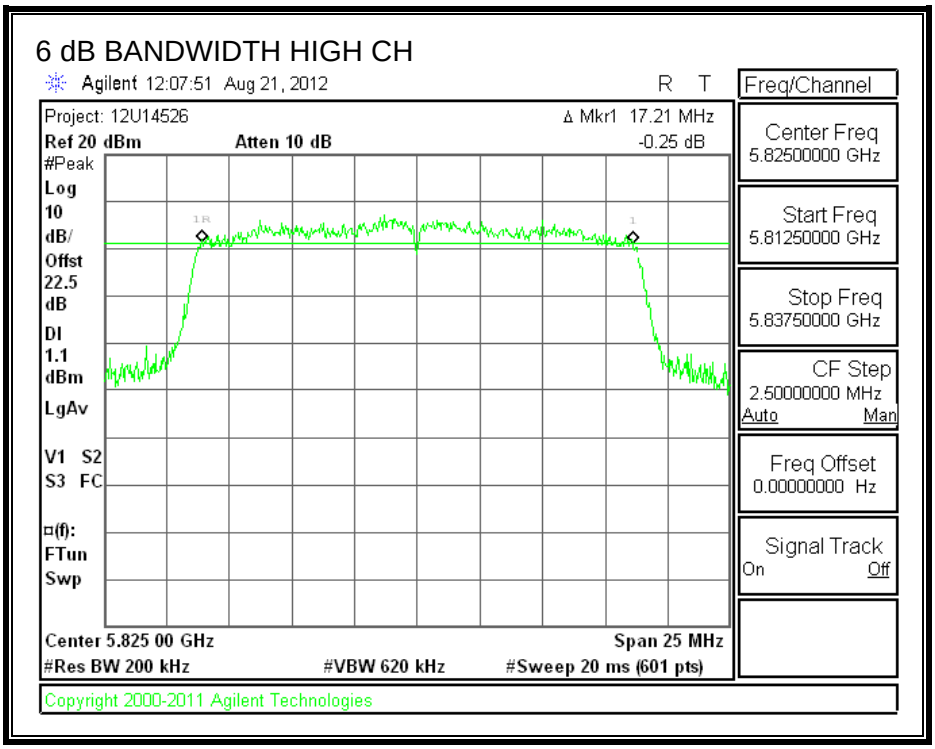
6 dB BANDWIDTH



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.

7.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

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

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.5209
Middle	5785	17.5179
High	5825	17.5157

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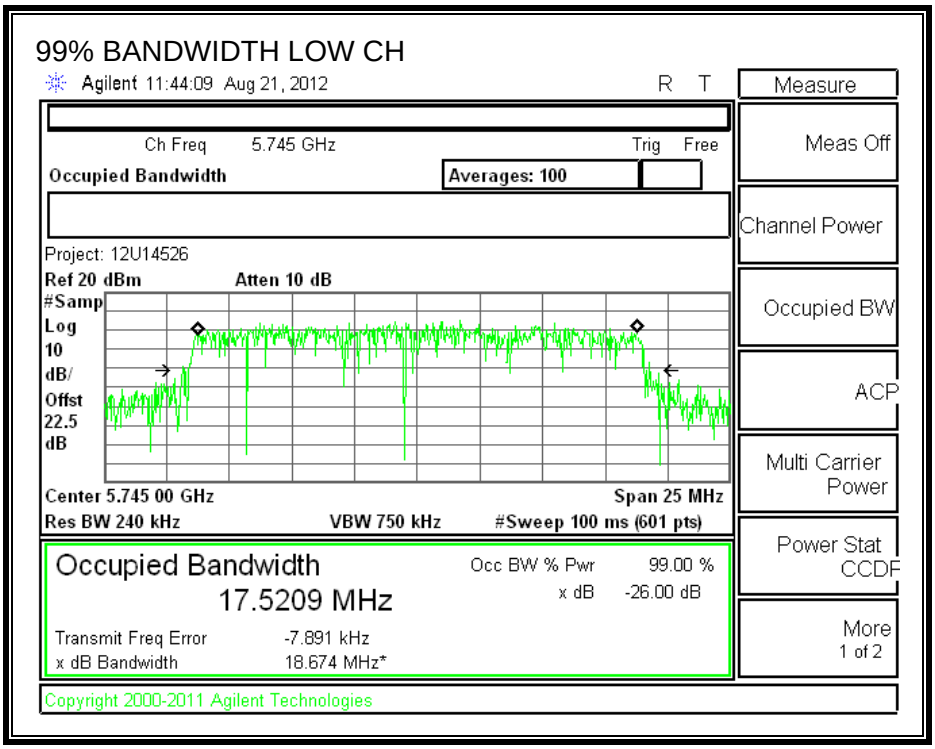
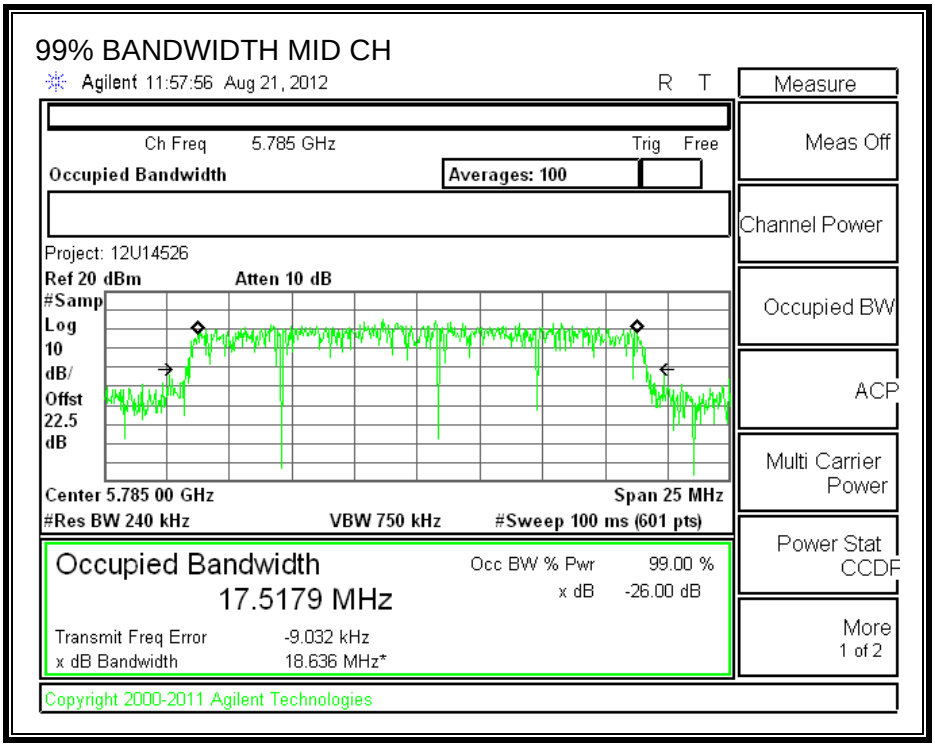
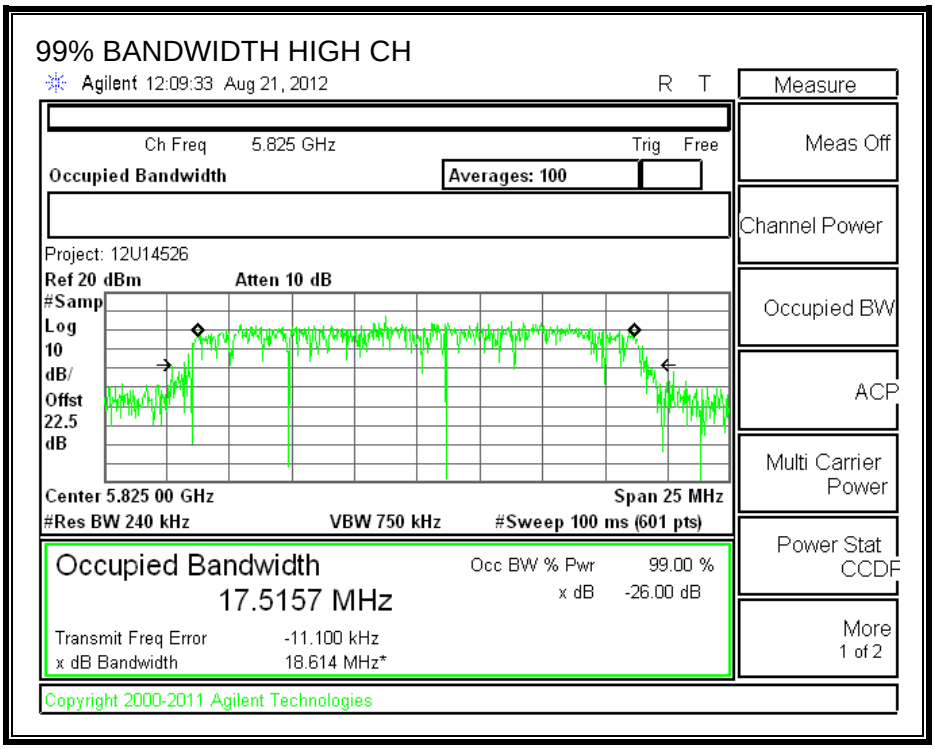
99% BANDWIDTH



This report shall not be reproduced except in full, without the written approval of UL CCS.



This report shall not be reproduced except in full, without the written approval of UL CCS.



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7.5.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

TEST PROCEDURE

KDB 558074 D01 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

Measurement Procedure PK2 as referenced by section 5.2.1.2 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	5745	24.89	30	-5.11
Middle	5785	24.80	30	-5.20
High	5825	24.75	30	-5.25

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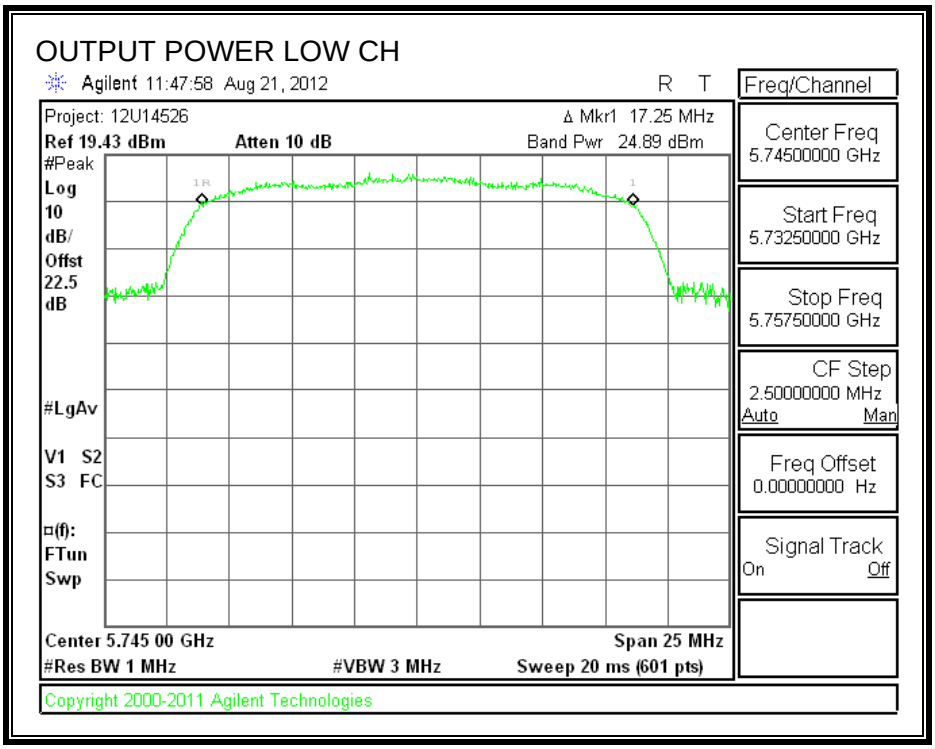
OUTPUT POWER



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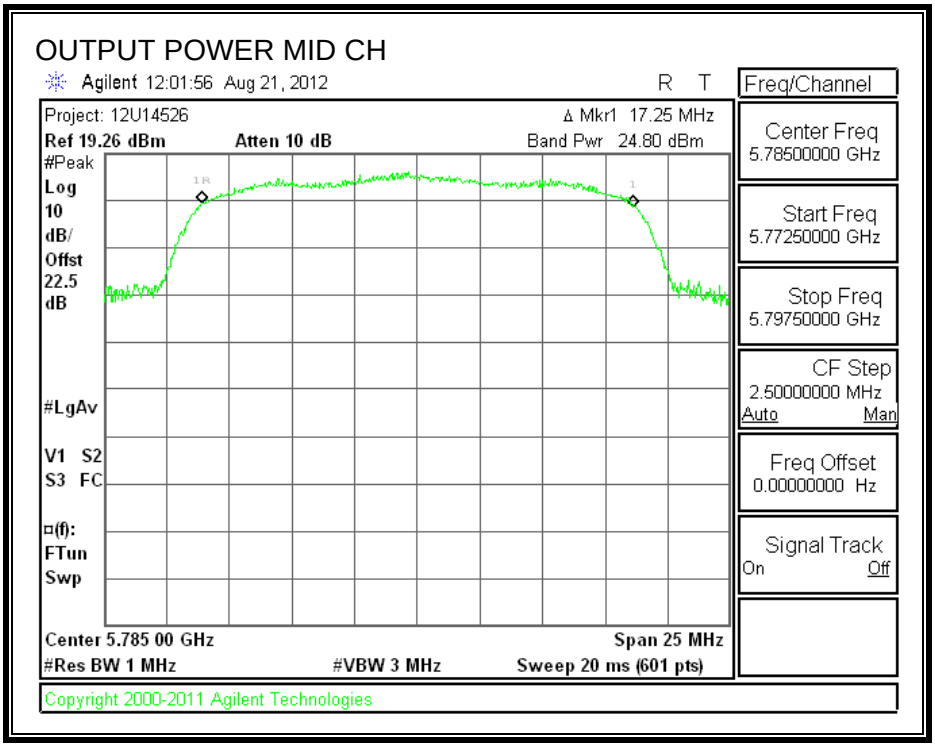
OUTPUT POWER MID CH



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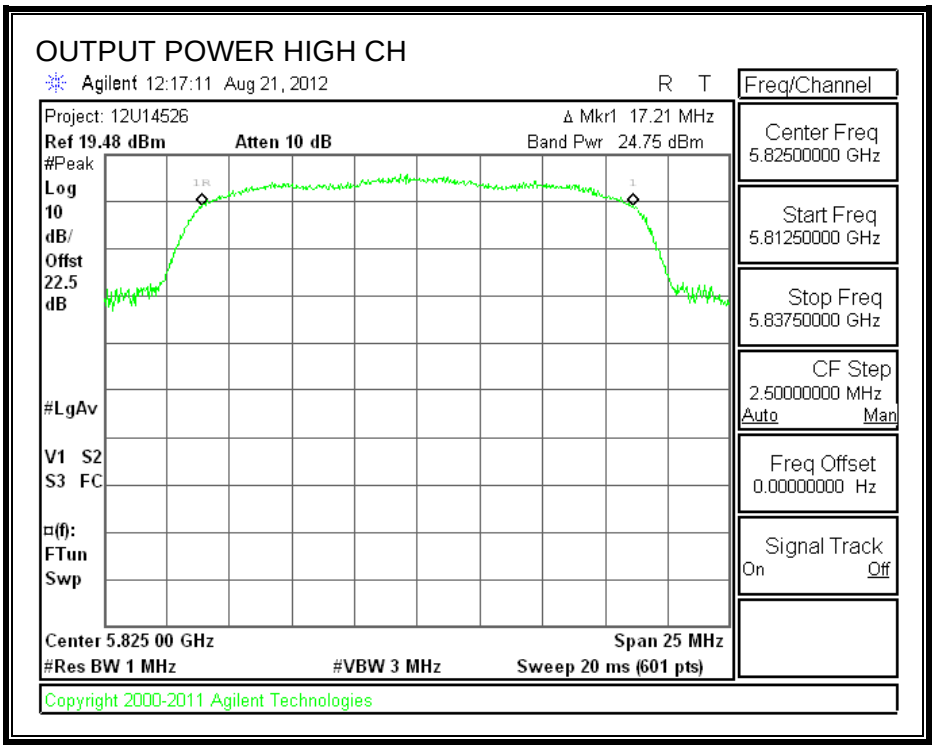

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7.5.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 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	15.97
Middle	5785	15.99
High	5825	15.99

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7.5.5. 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”, dated 01/18/2012.

Measurement Procedure PKPSD as referenced by section 5.3.1 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	Analyzer Reading (dBm)	10log(3kHz/100kHz) (dB)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	6.17	-15.2	-9.03	8	-17.03
Middle	5785	6.14	-15.2	-9.06	8	-17.06
High	5825	6.20	-15.2	-9.00	8	-17.00

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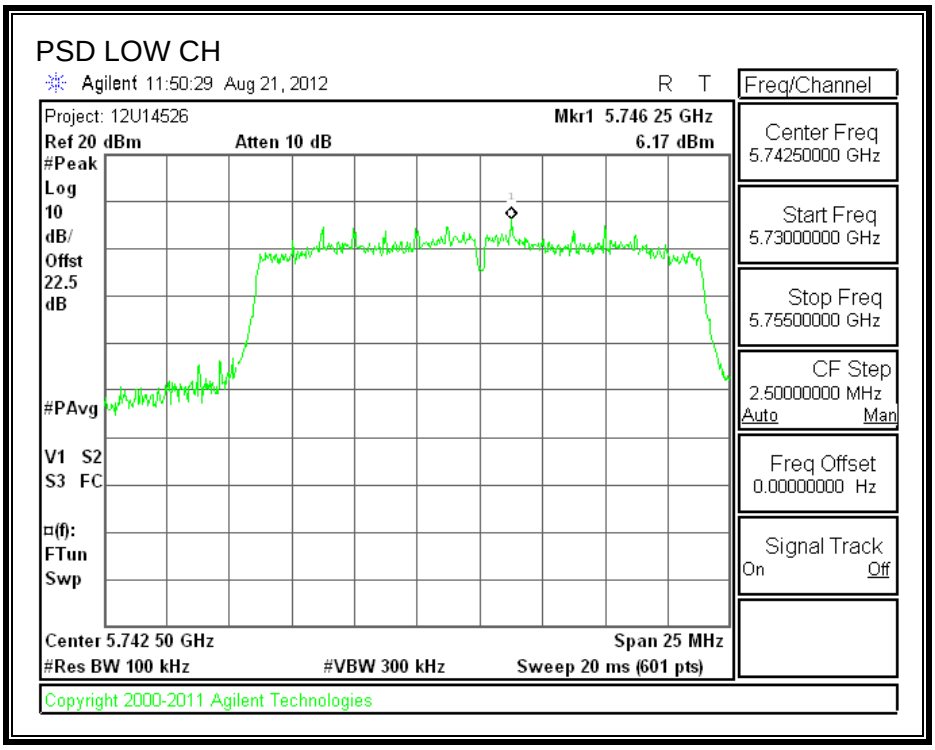
POWER SPECTRAL DENSITY



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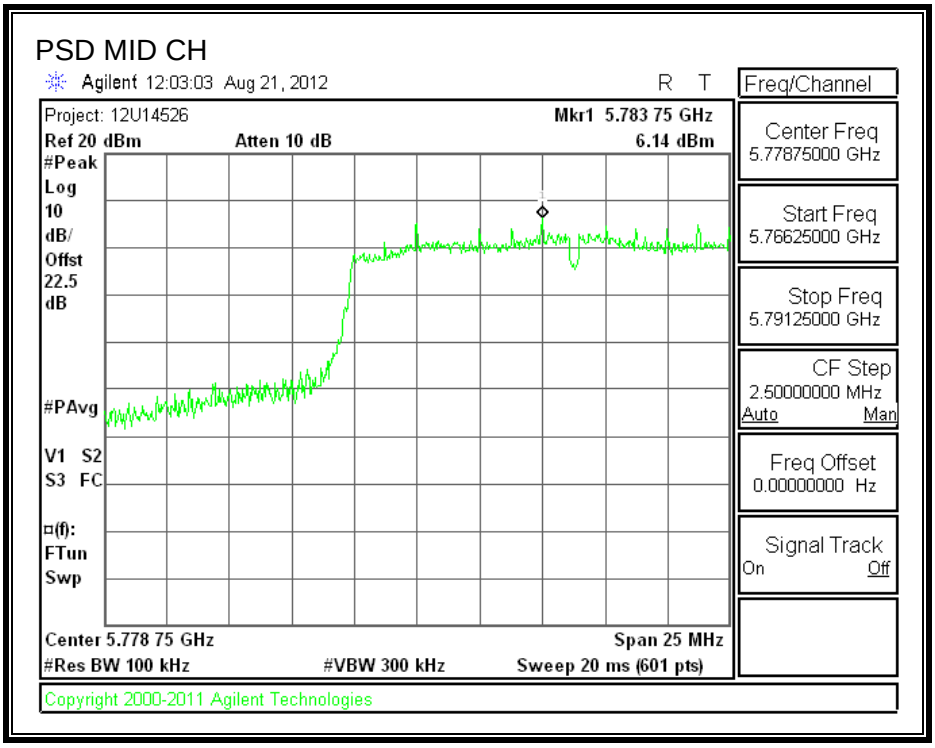
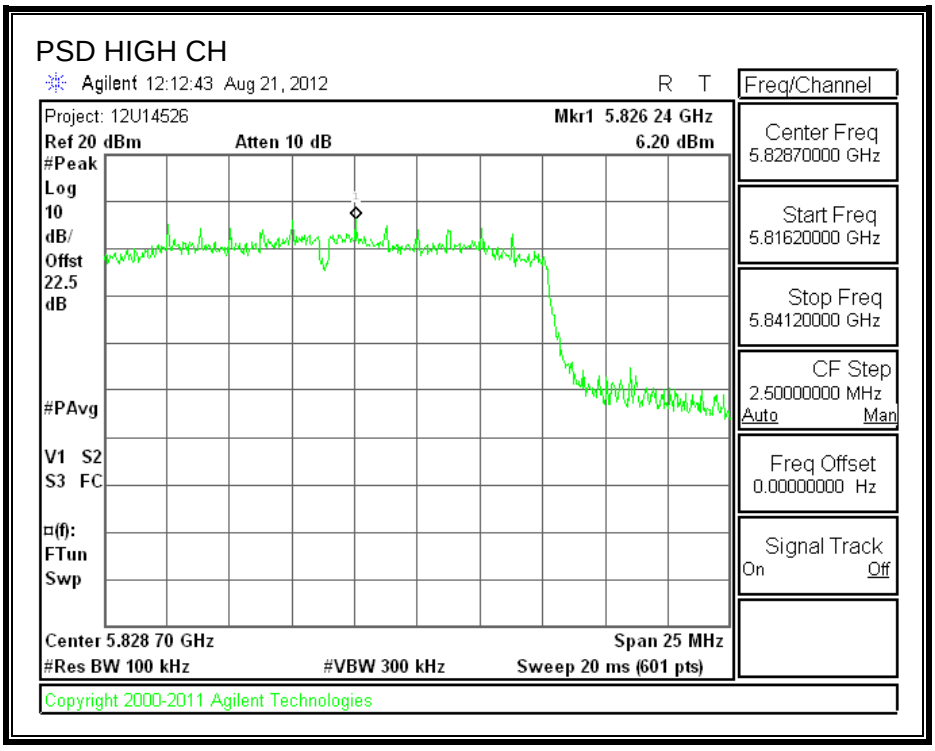
PSD MID CH



This report shall not be reproduced except in full, without the written approval of UL CCS.



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7.5.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

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

TEST PROCEDURE

KDB 558074 D01 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

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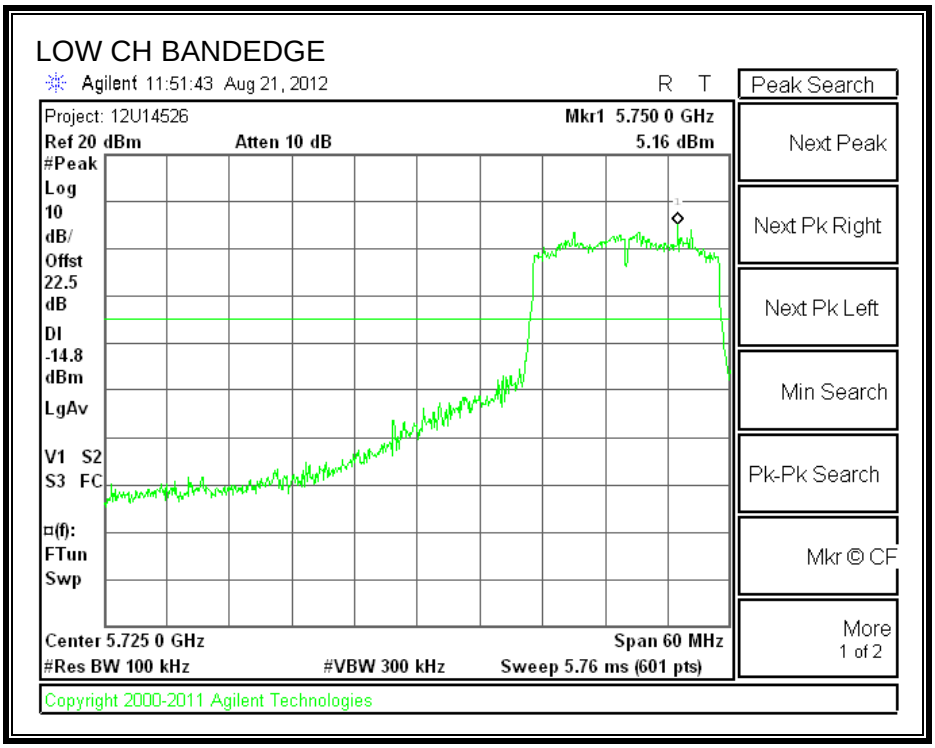
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



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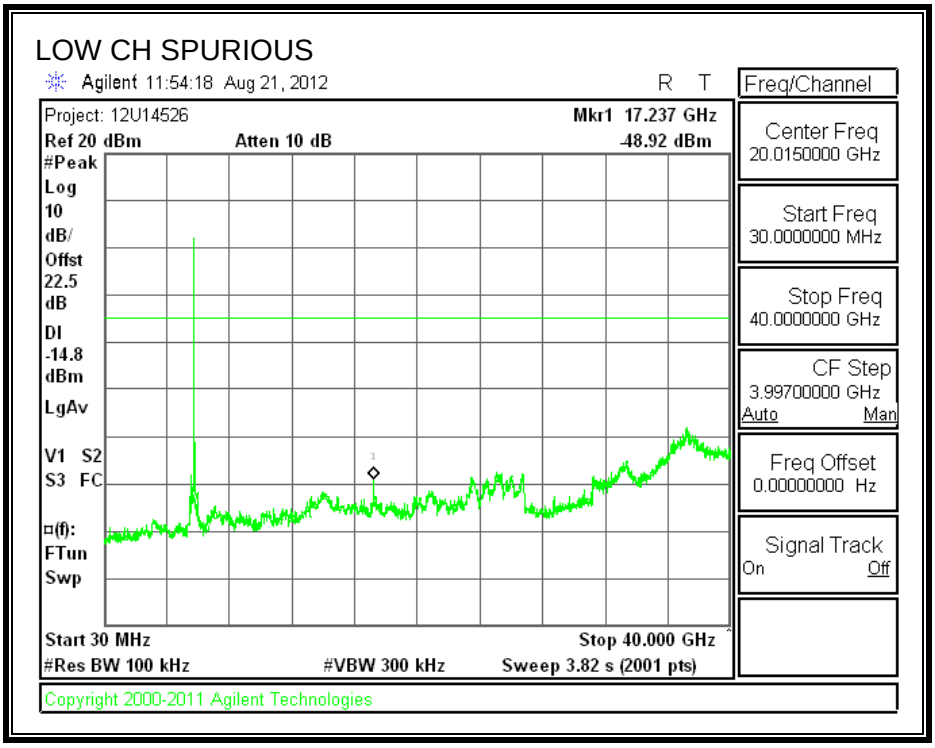

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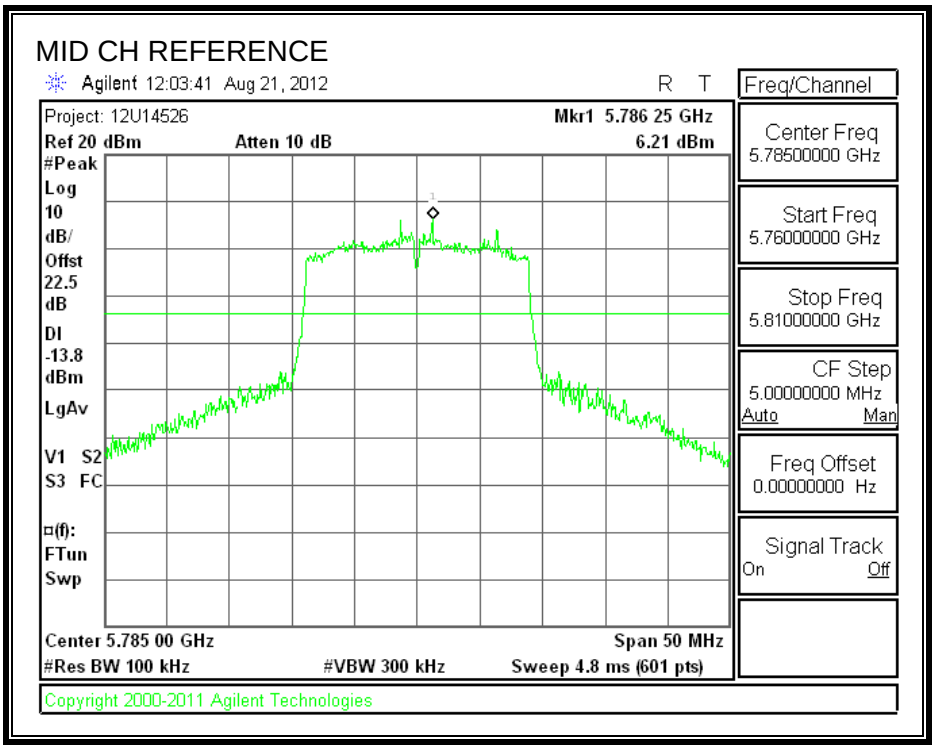
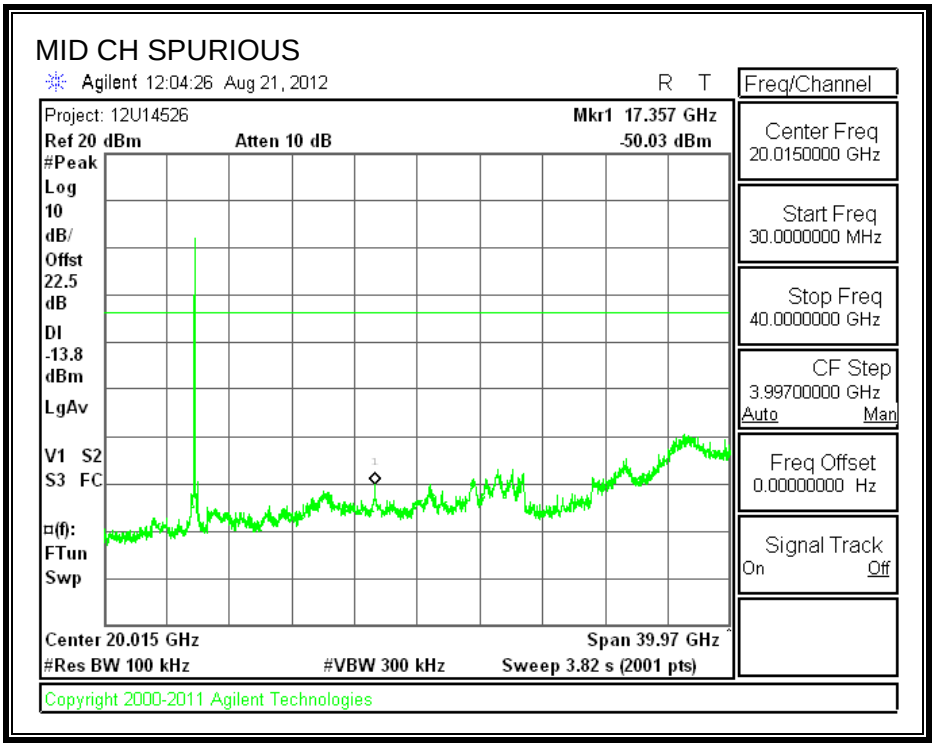
SPURIOUS EMISSIONS, MID CHANNEL



This report shall not be reproduced except in full, without the written approval of UL CCS.



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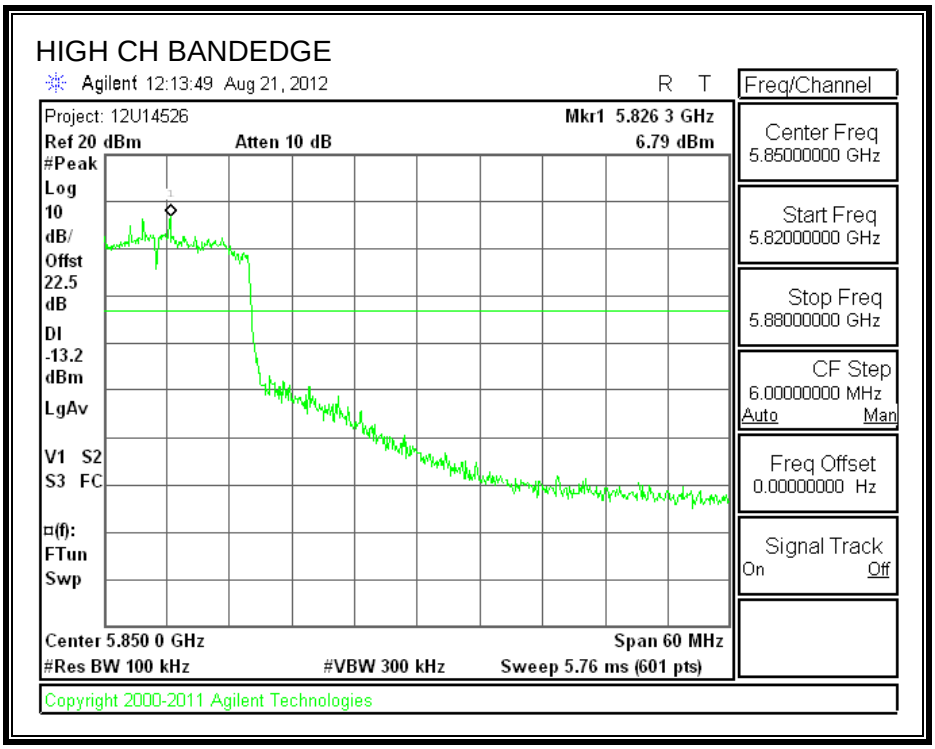
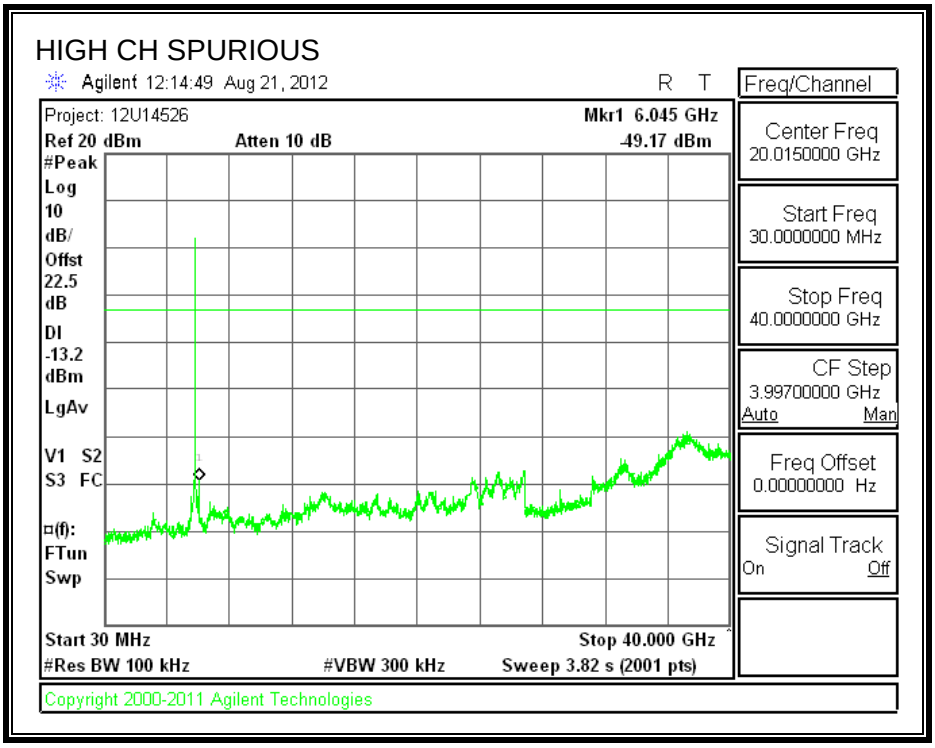
SPURIOUS EMISSIONS, HIGH CHANNEL



This report shall not be reproduced except in full, without the written approval of UL CCS.



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7.6. 802.11n HT40 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 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	5755	35.58	0.5
High	5795	35.33	0.5

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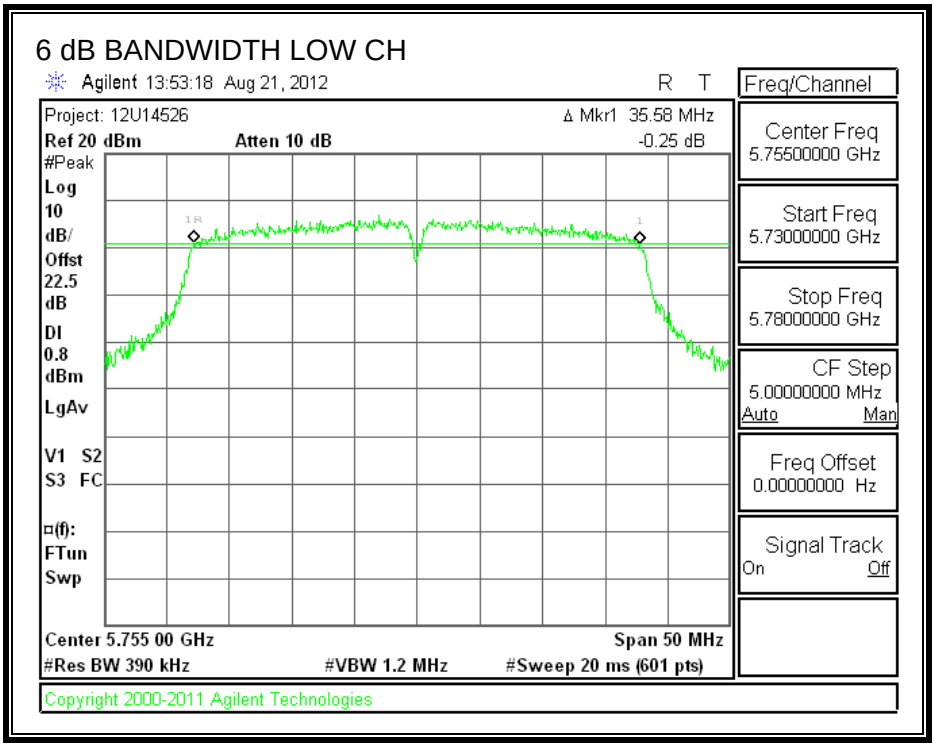
6 dB BANDWIDTH



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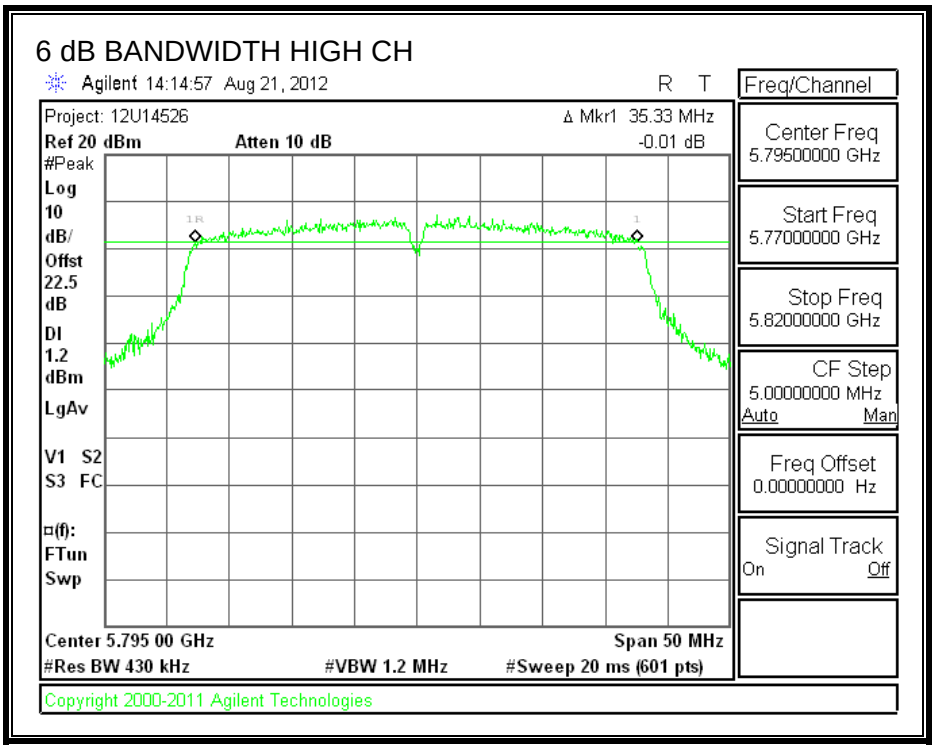

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7.6.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

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

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	35.8653
High	5795	35.8203

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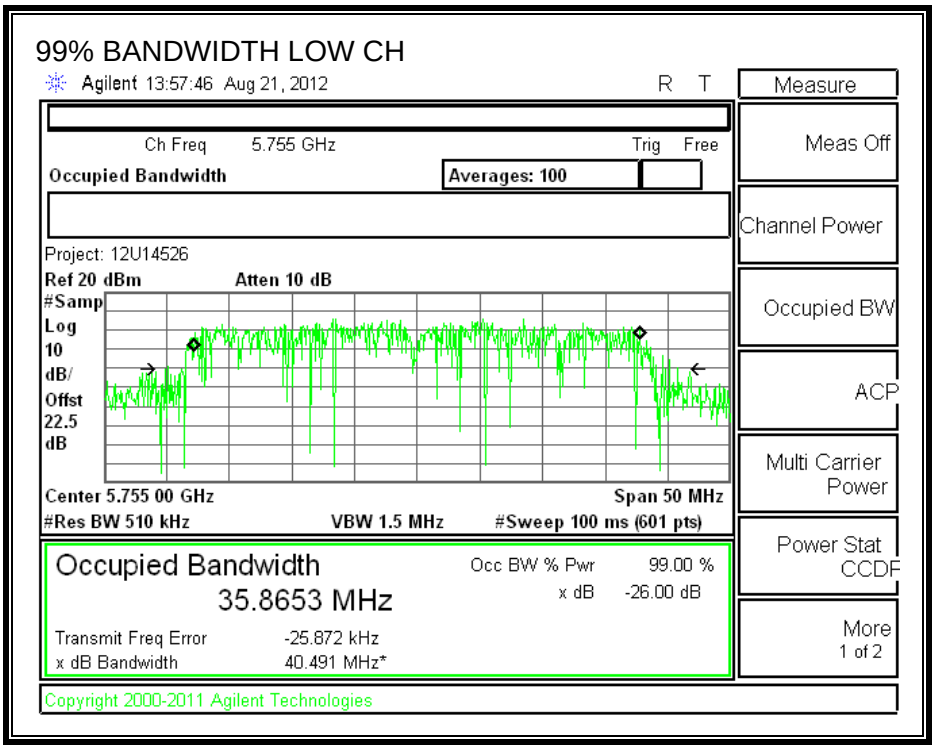
99% BANDWIDTH



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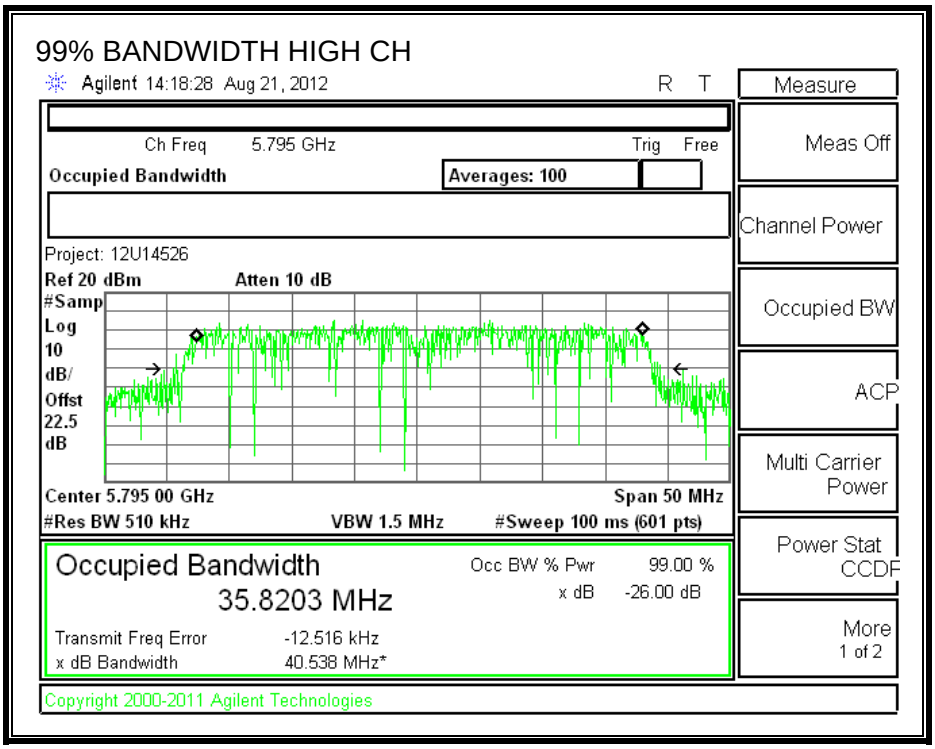

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7.6.3. OUTPUT POWER

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 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

Measurement Procedure PK2 as referenced by section 5.2.1.2 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	5755	25.12	30	-4.88
High	5795	25.03	30	-4.97

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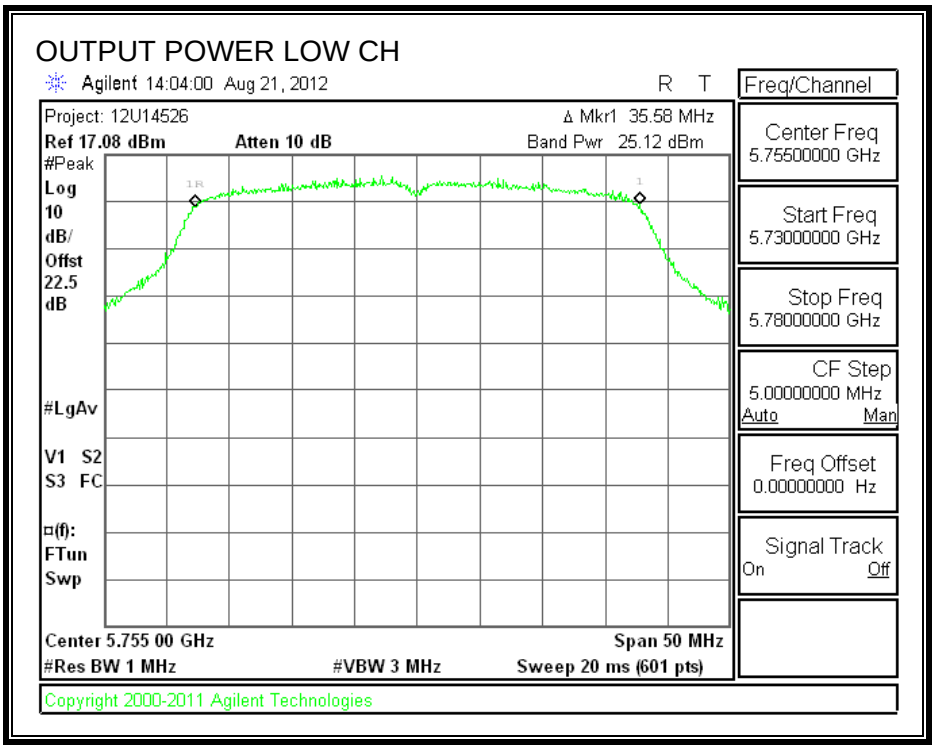
OUTPUT POWER



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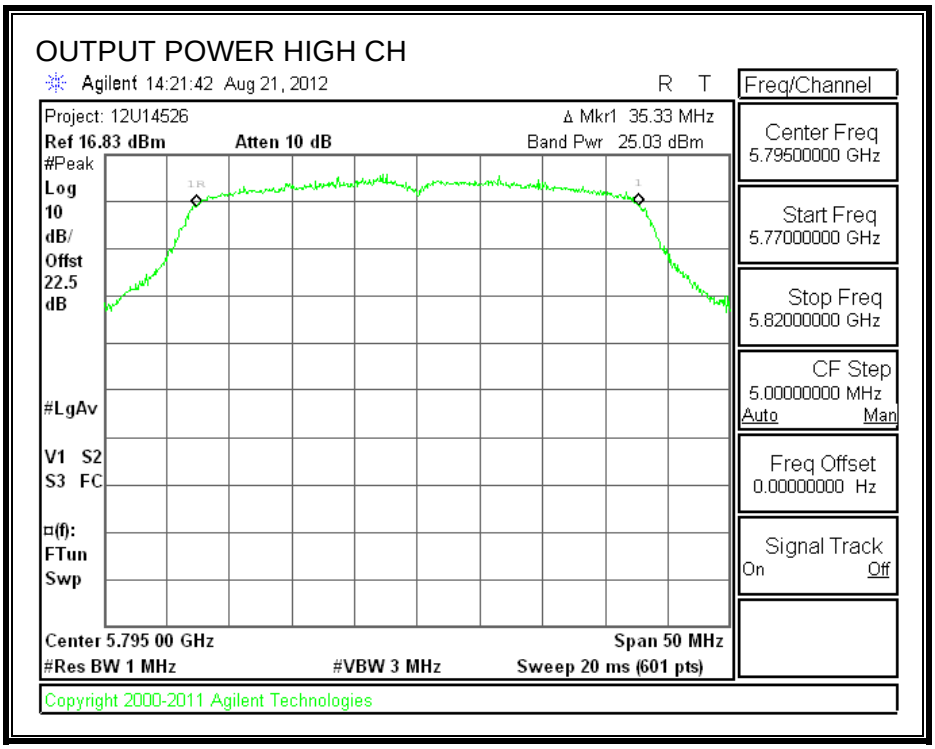

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7.6.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 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	15.95
High	5795	15.93

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7.6.5. 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”, dated 01/18/2012.

Measurement Procedure PKPSD as referenced by section 5.3.1 of the KDB mentioned above was used.

RESULTS

Channel	Frequency (MHz)	Analyzer Reading (dBm)	10log(3kHz/100kHz) (dB)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5755	3.05	-15.2	-12.15	8	-20.15
High	5795	2.87	-15.2	-12.33	8	-20.33

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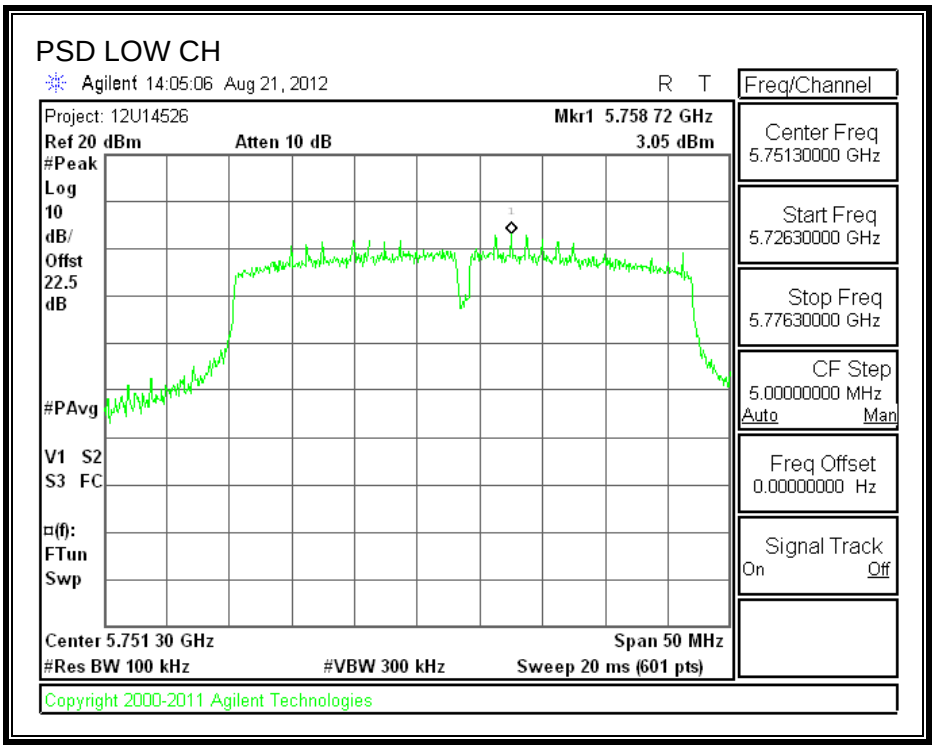
POWER SPECTRAL DENSITY



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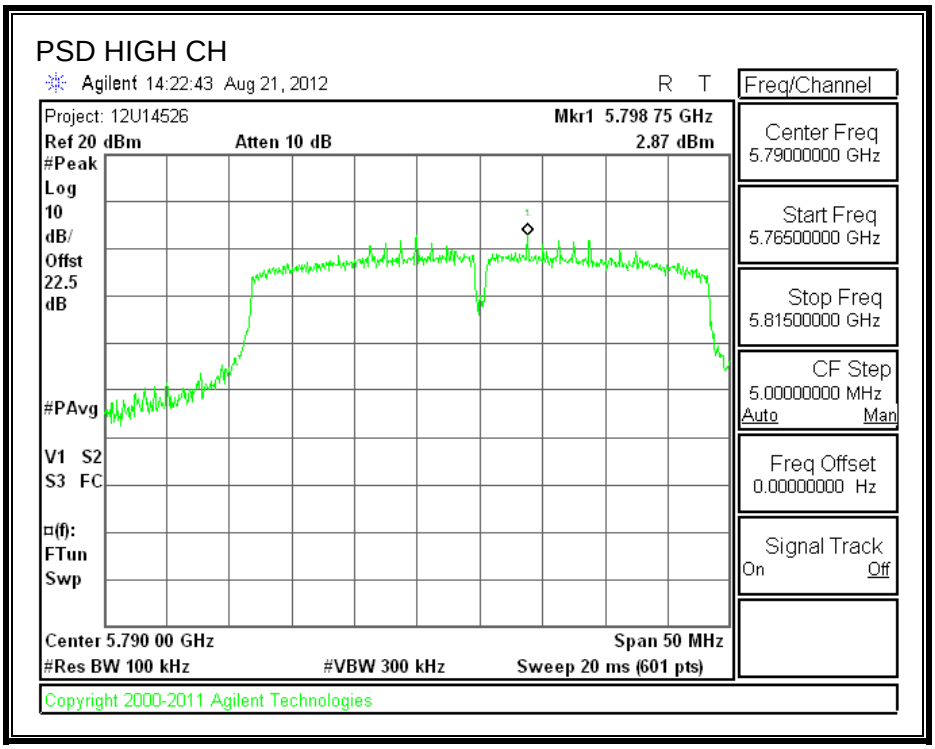
PSD HIGH CH



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7.6.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

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

TEST PROCEDURE

KDB 558074 D01 V01 “Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247”, dated 01/18/2012.

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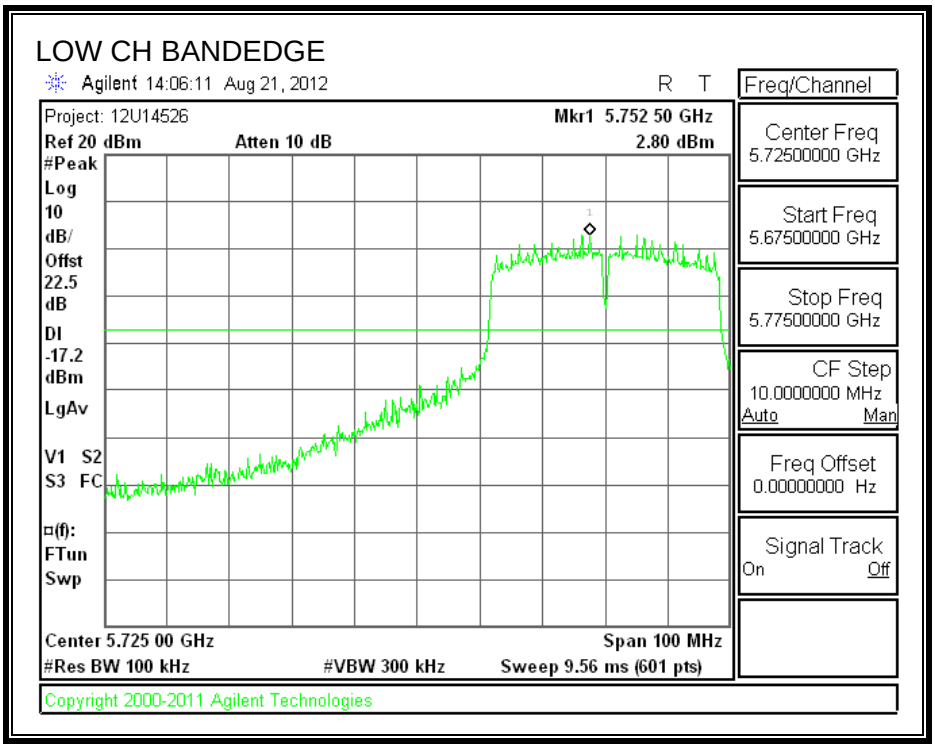
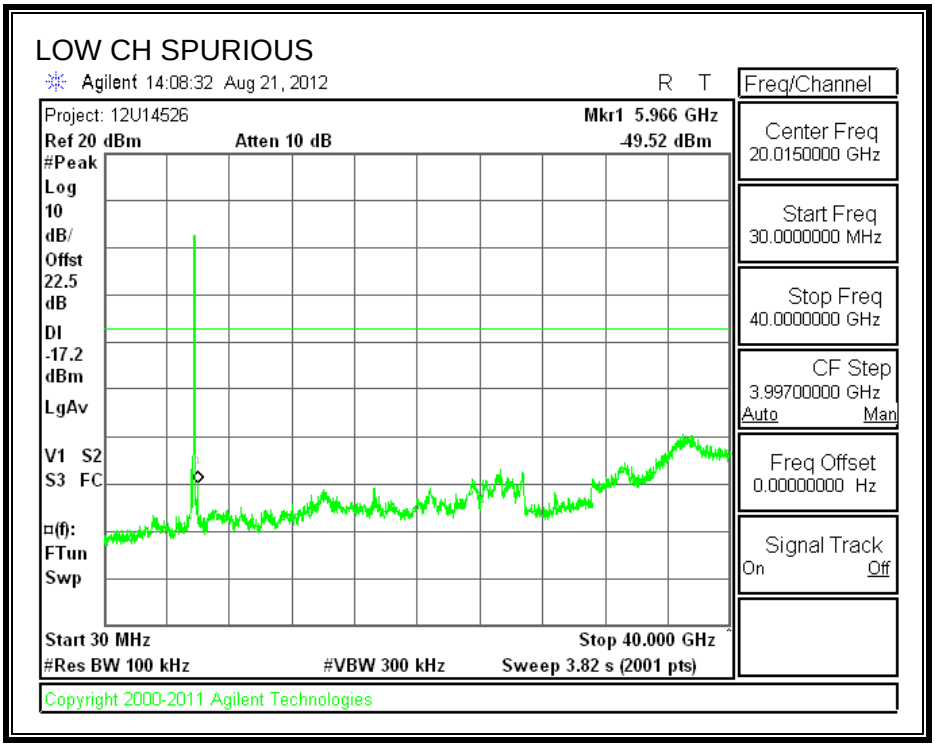
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

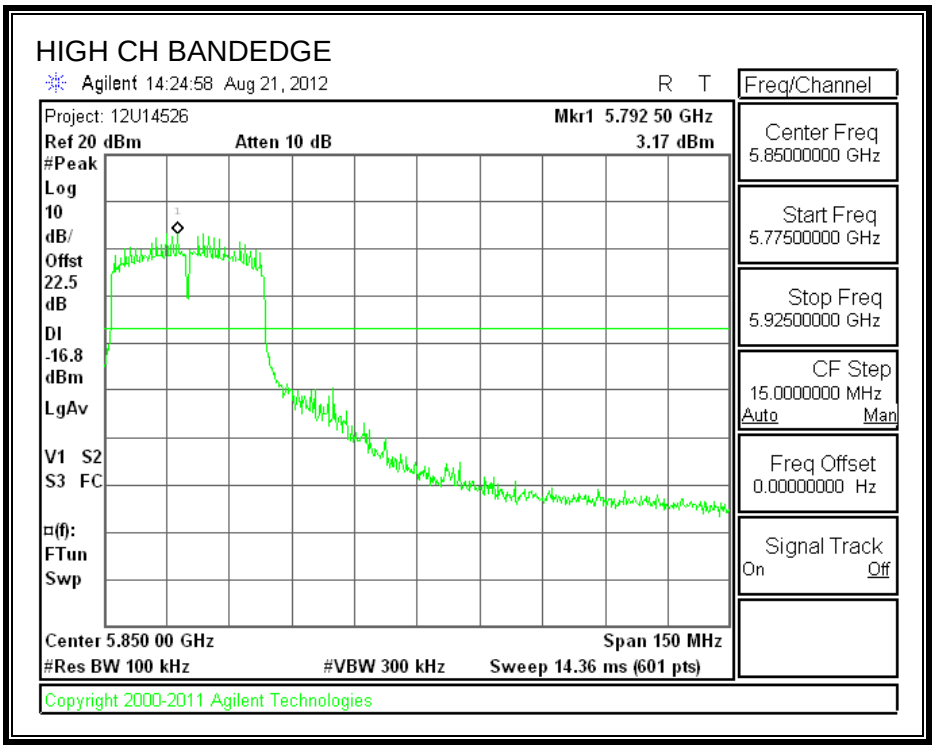


This report shall not be reproduced except in full, without the written approval of UL CCS.

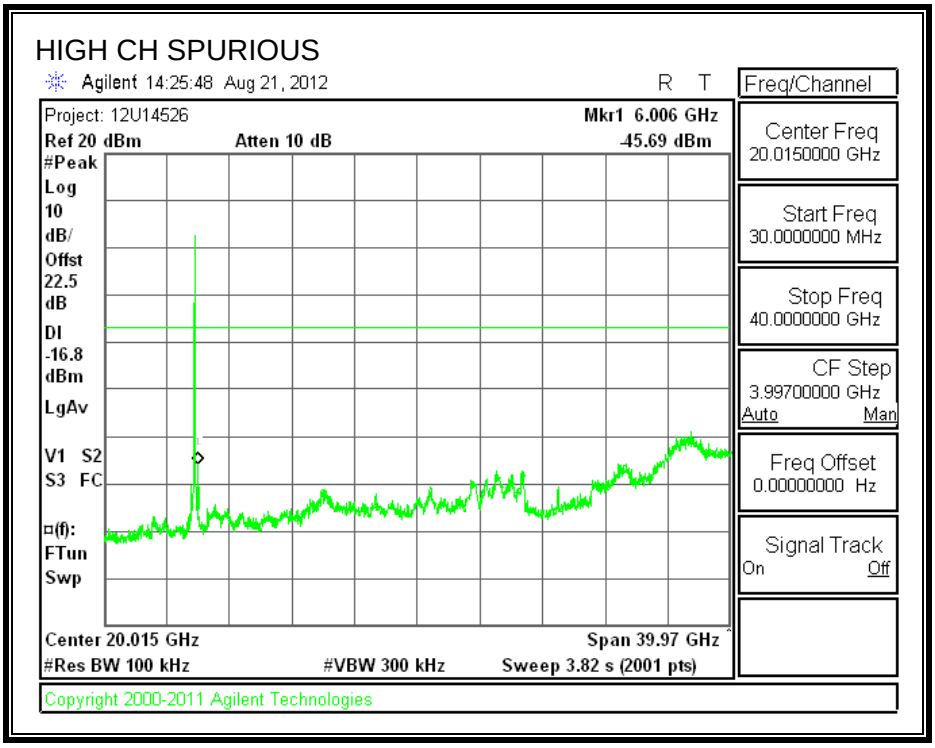


This report shall not be reproduced except in full, without the written approval of UL CCS.

SPURIOUS EMISSIONS, HIGH CHANNEL



This report shall not be reproduced except in full, without the written approval of UL CCS.



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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.

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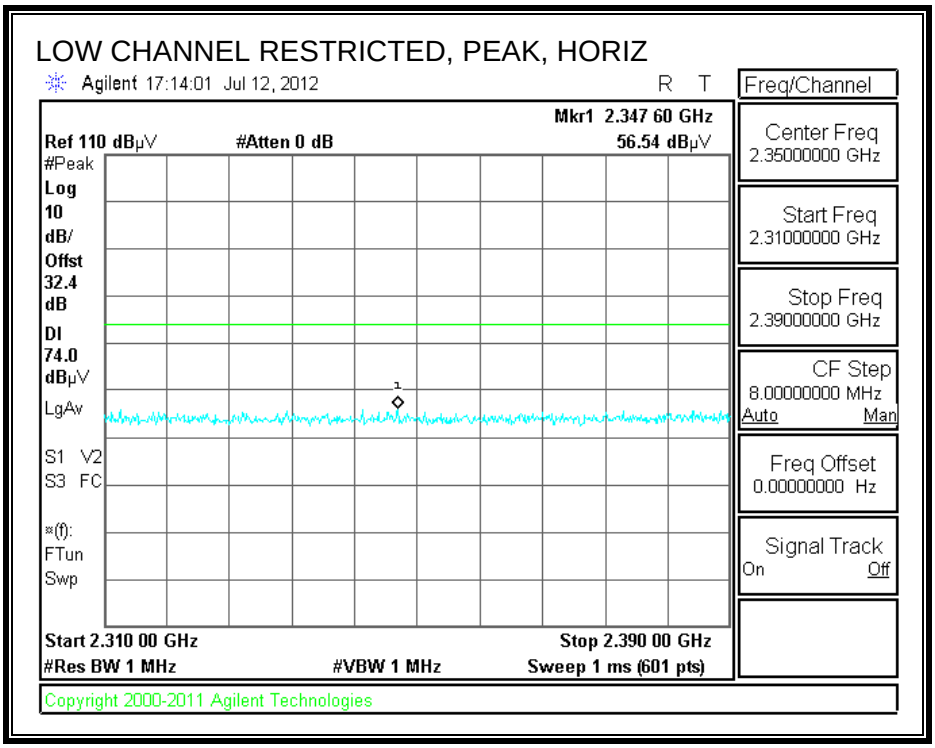
8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. TX ABOVE 1 GHz, 802.11b 1TX MODE, 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



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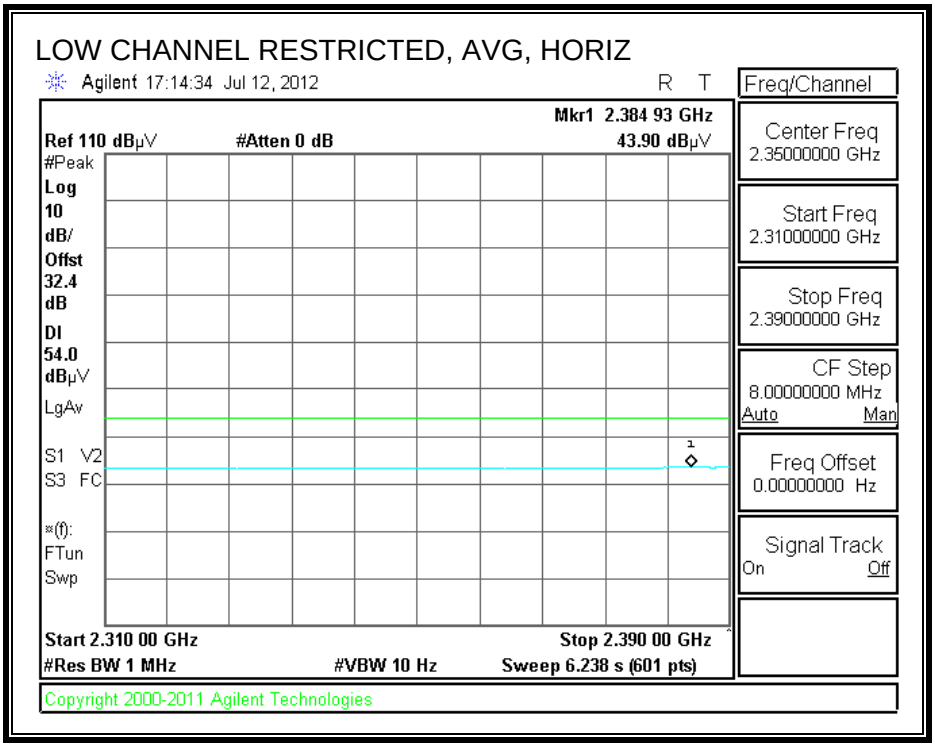

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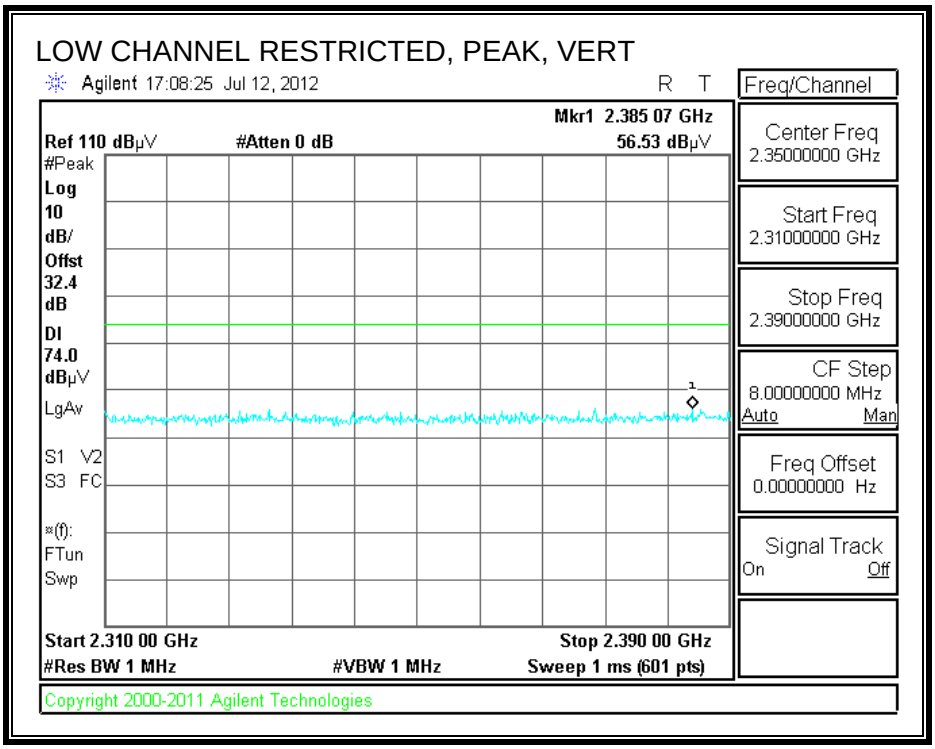
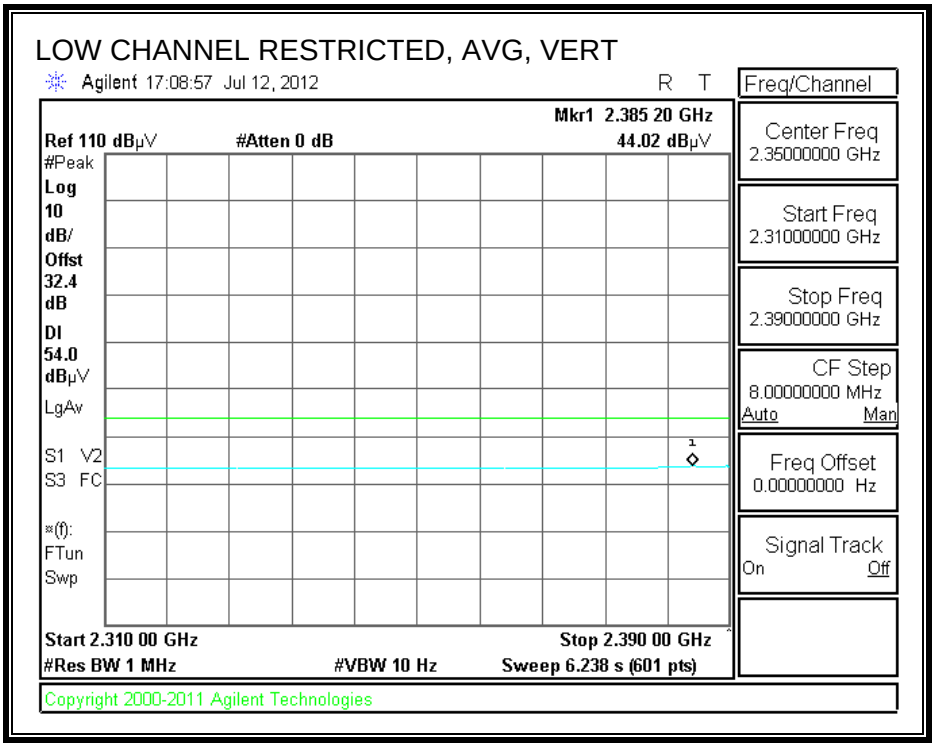
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



This report shall not be reproduced except in full, without the written approval of UL CCS.



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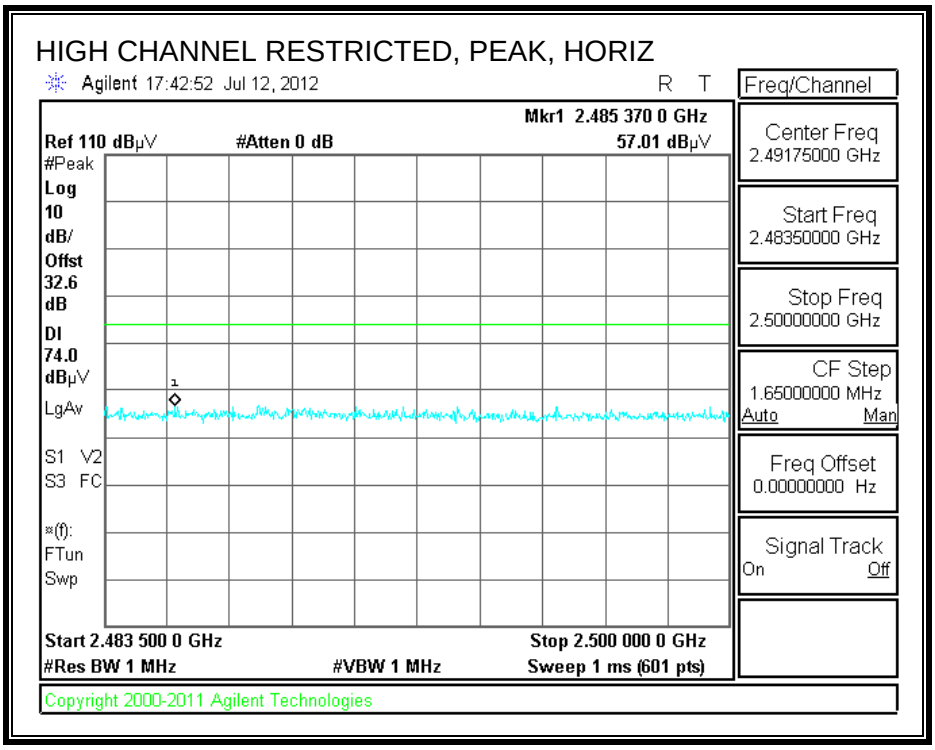
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



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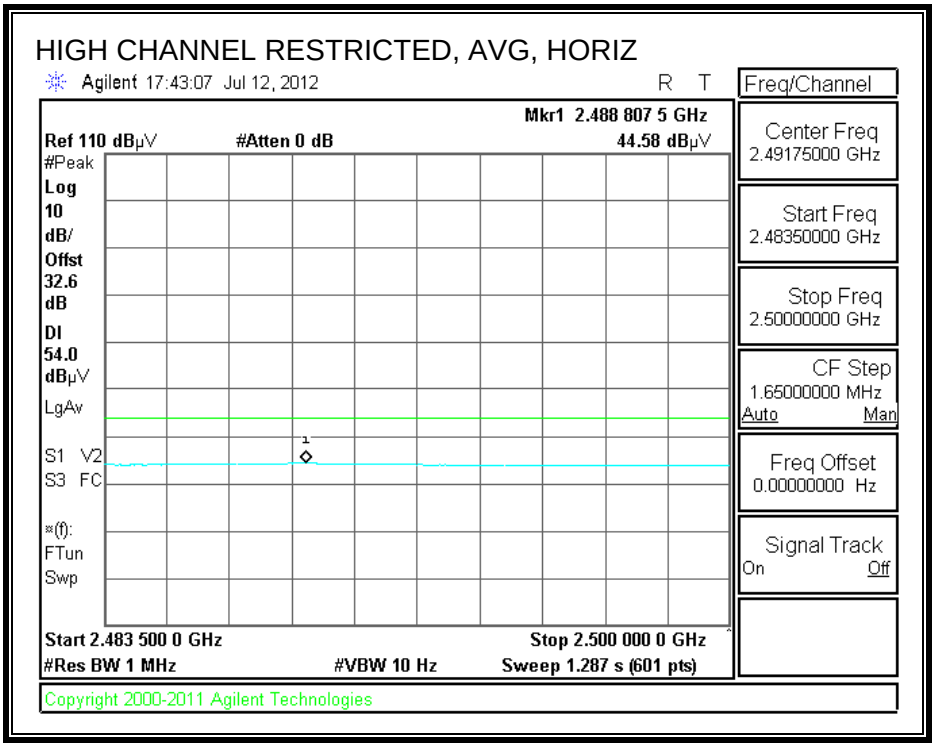

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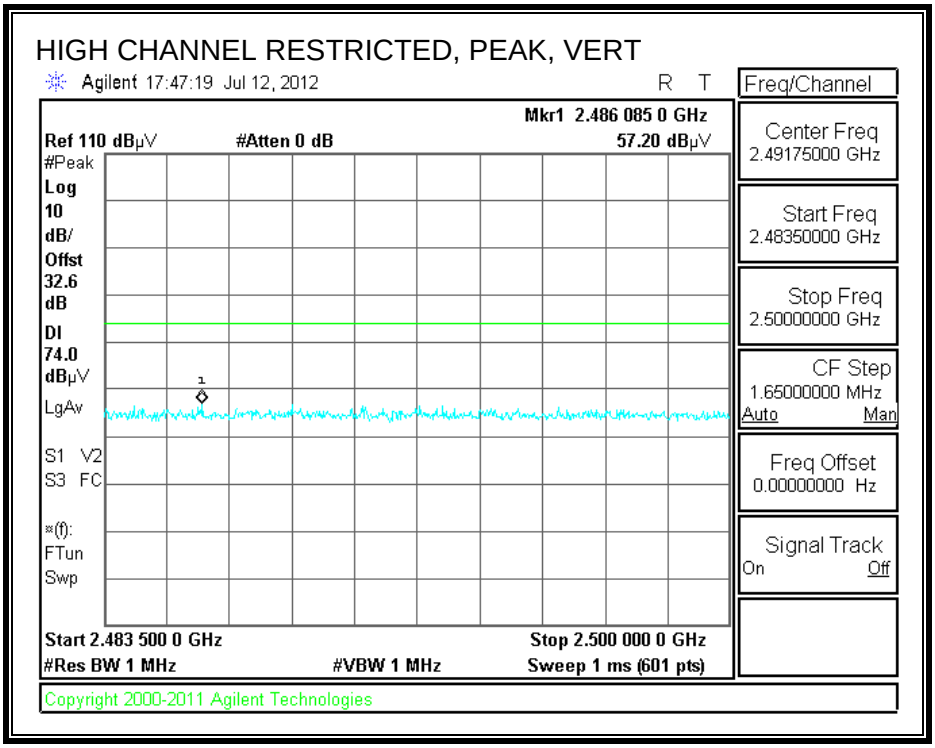
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



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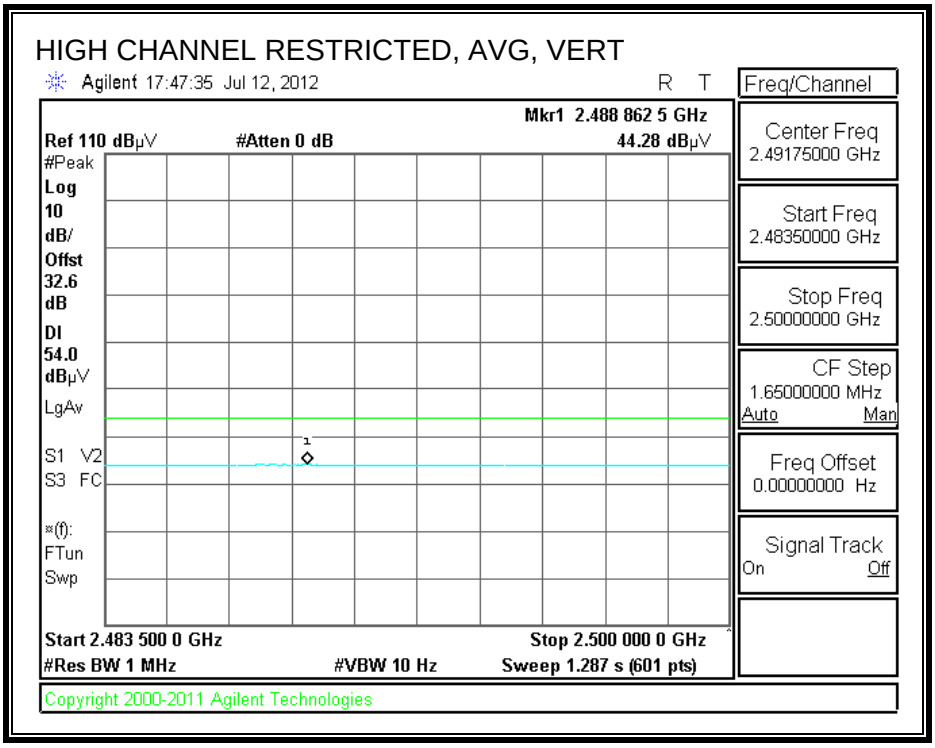

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HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 08/13/12
Project #: 12U14526
Company: Apple
Test Target: FCC 15.247
Mode Oper: b mode, TX (Worst Case)

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 2412MHz													
4.824	3.0	37.0	33.4	6.3	-35.5	0.0	0.0	41.2	74.0	-32.8	V	P	
4.824	3.0	24.7	33.4	6.3	-35.5	0.0	0.0	28.9	54.0	-25.1	V	A	
4.824	3.0	38.4	33.4	6.3	-35.5	0.0	0.0	42.6	74.0	-31.4	H	P	
4.824	3.0	30.1	33.4	6.3	-35.5	0.0	0.0	34.3	54.0	-19.7	H	A	
Mid Ch, 2437MHz													
4.874	3.0	37.1	33.5	6.3	-35.5	0.0	0.0	41.4	74.0	-32.6	V	P	
4.874	3.0	24.1	33.5	6.3	-35.5	0.0	0.0	28.4	54.0	-25.6	V	A	
7.311	3.0	35.5	35.7	8.5	-35.4	0.0	0.0	44.3	74.0	-29.7	V	P	
7.311	3.0	23.4	35.7	8.5	-35.4	0.0	0.0	32.2	54.0	-21.8	V	A	
4.874	3.0	41.4	33.5	6.3	-35.5	0.0	0.0	45.7	74.0	-28.3	H	P	
4.874	3.0	38.2	33.5	6.3	-35.5	0.0	0.0	42.5	54.0	-11.5	H	A	
7.311	3.0	35.9	35.7	8.5	-35.4	0.0	0.0	44.6	74.0	-29.4	H	P	
7.311	3.0	23.6	35.7	8.5	-35.4	0.0	0.0	32.4	54.0	-21.6	H	A	
High Ch, 2462MHz													
4.924	3.0	36.4	33.5	6.3	-35.5	0.0	0.0	40.8	74.0	-33.2	V	P	
4.924	3.0	24.2	33.5	6.3	-35.5	0.0	0.0	28.6	54.0	-25.4	V	A	
7.386	3.0	36.1	35.8	8.5	-35.5	0.0	0.0	45.0	74.0	-29.0	V	P	
7.386	3.0	23.6	35.8	8.5	-35.5	0.0	0.0	32.5	54.0	-21.5	V	A	
4.924	3.0	37.4	33.5	6.3	-35.5	0.0	0.0	41.8	74.0	-32.2	H	P	
4.924	3.0	29.2	33.5	6.3	-35.5	0.0	0.0	33.6	54.0	-20.4	H	A	
7.386	3.0	36.8	35.8	8.5	-35.5	0.0	0.0	45.7	74.0	-28.3	H	P	
7.386	3.0	25.4	35.8	8.5	-35.5	0.0	0.0	34.3	54.0	-19.7	H	A	

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

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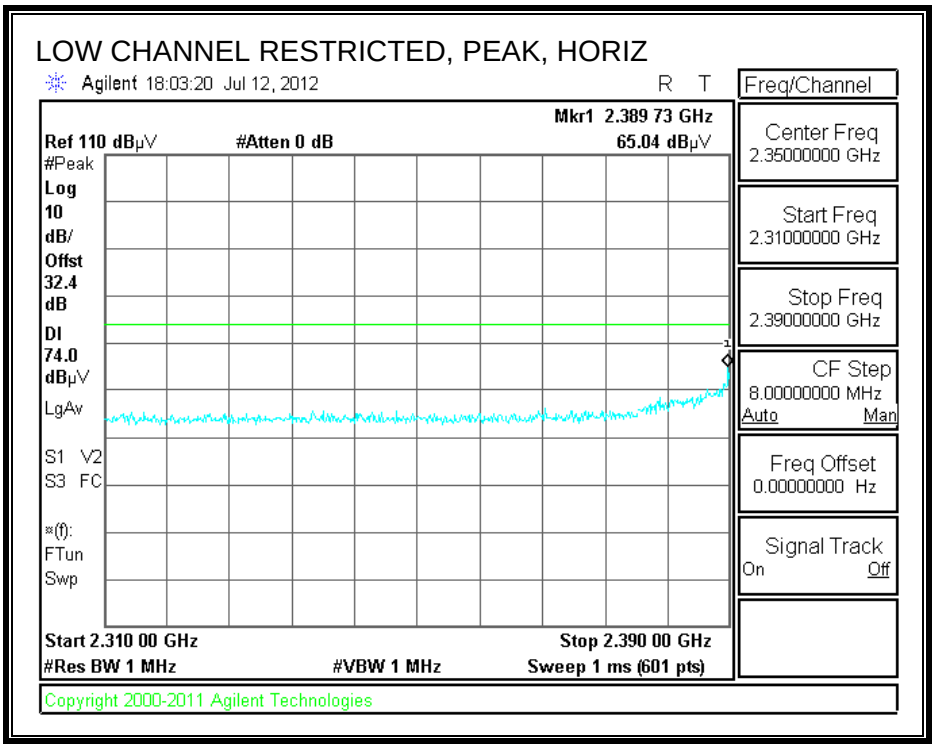
8.2.2. TX ABOVE 1 GHz, 802.11g 1TX MODE, 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



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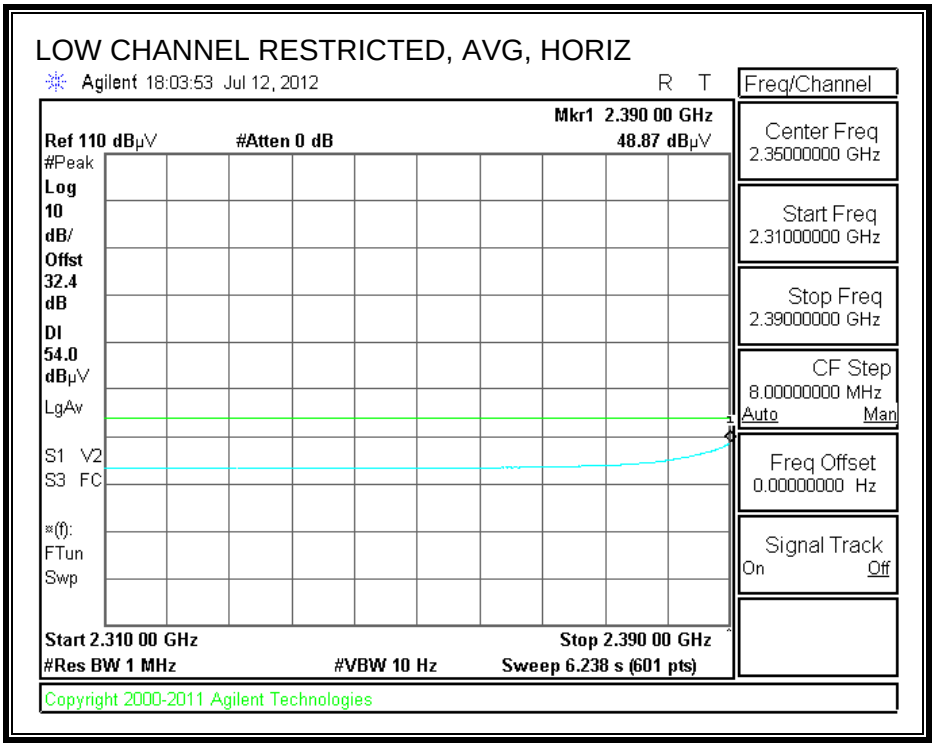

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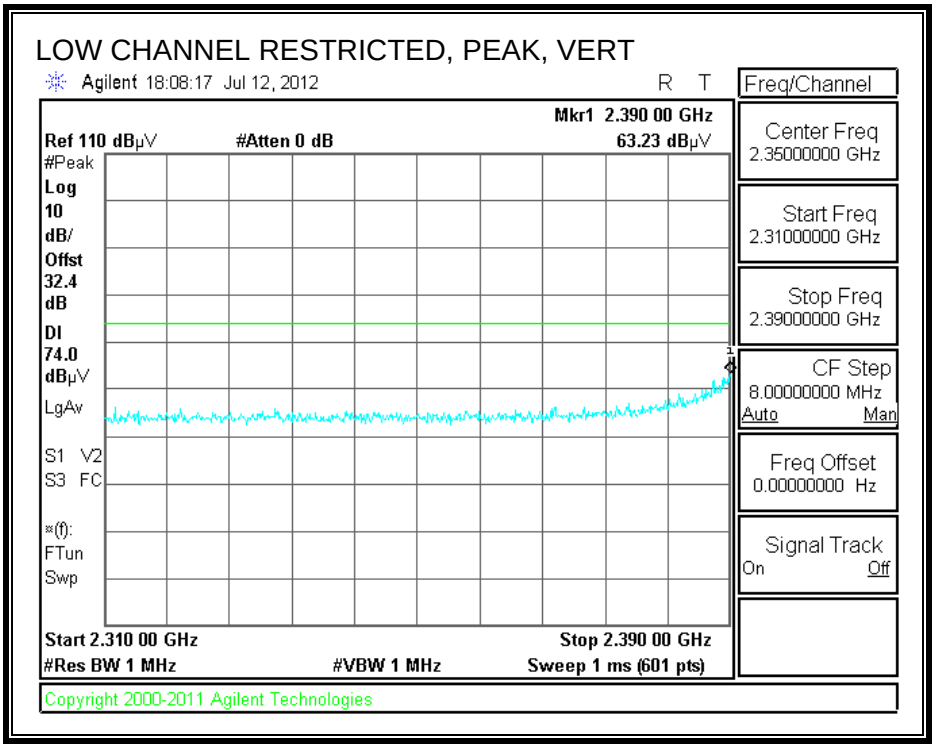
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



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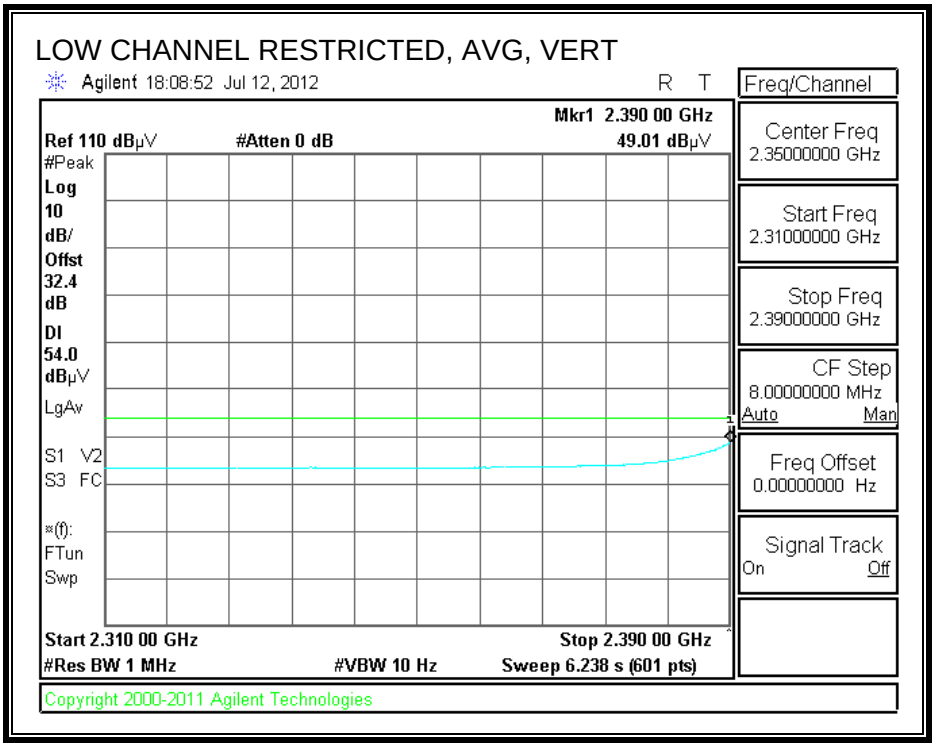

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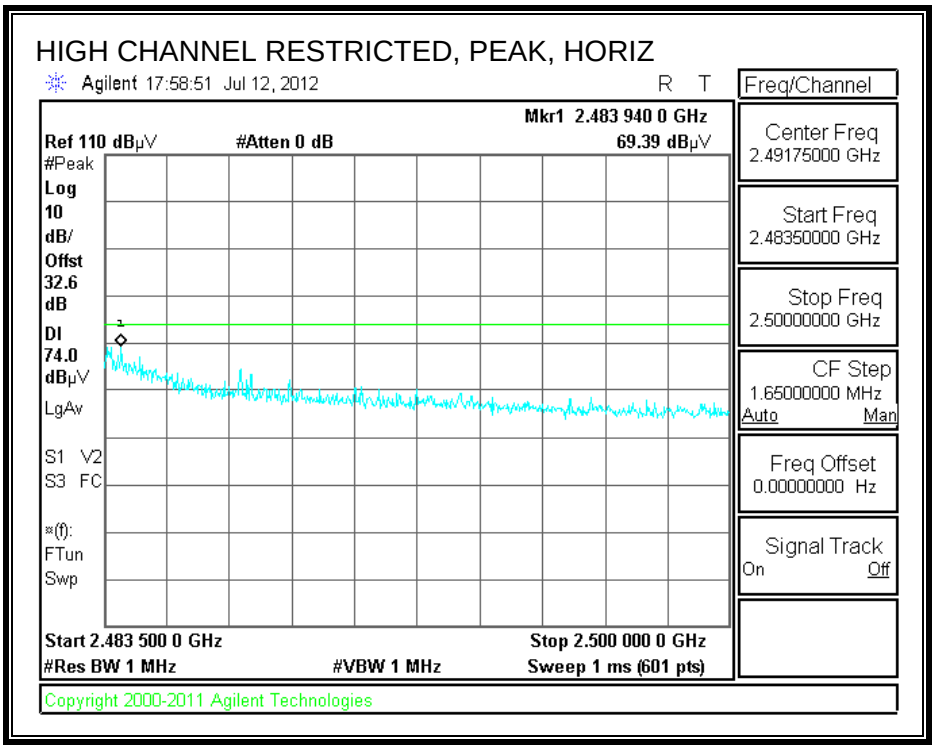
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



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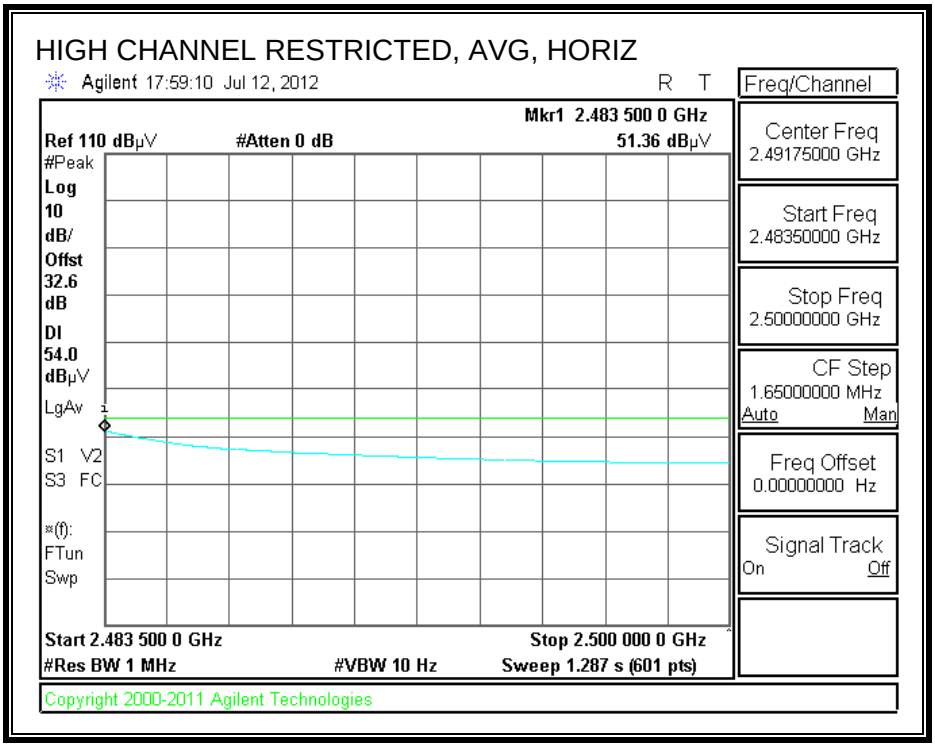

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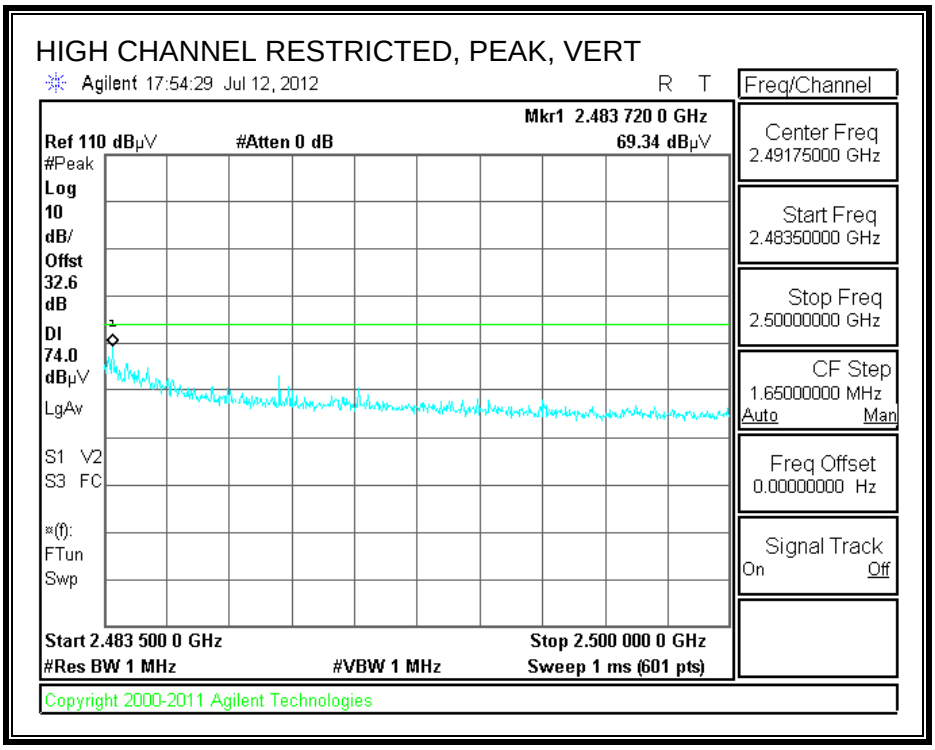
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



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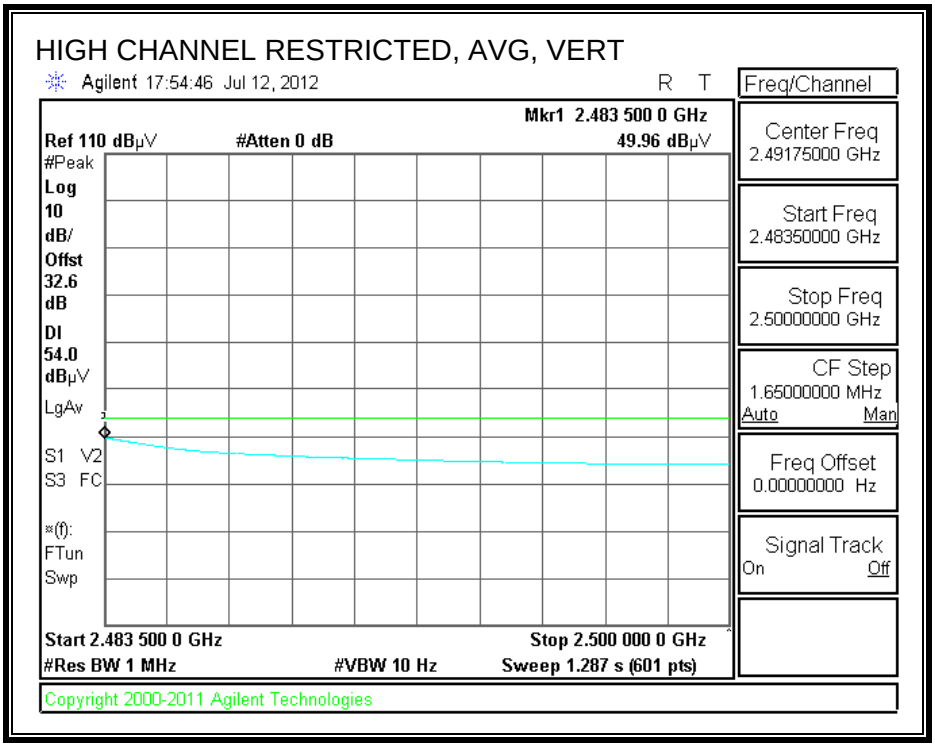

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HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 08/13/12
Project #: 12U14526
Company: Apple
Test Target: FCC 15.247
Mode Oper: HT20, TX(Worst Case)

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 2412MHz													
4.824	3.0	36.2	33.4	6.3	-35.5	0.0	0.0	40.4	74.0	-33.6	V	P	
4.824	3.0	24.4	33.4	6.3	-35.5	0.0	0.0	28.6	54.0	-25.4	V	A	
4.824	3.0	37.4	33.4	6.3	-35.5	0.0	0.0	41.6	74.0	-32.4	H	P	
4.824	3.0	25.6	33.4	6.3	-35.5	0.0	0.0	29.8	54.0	-24.2	H	A	
Mid Ch, 2437MHz													
4.874	3.0	37.2	33.5	6.3	-35.5	0.0	0.0	41.5	74.0	-32.5	V	P	
4.874	3.0	23.9	33.5	6.3	-35.5	0.0	0.0	28.2	54.0	-25.8	V	A	
7.311	3.0	35.1	35.7	8.5	-35.4	0.0	0.0	43.9	74.0	-30.1	V	P	
7.311	3.0	23.2	35.7	8.5	-35.4	0.0	0.0	32.0	54.0	-22.0	V	A	
4.874	3.0	35.8	33.5	6.3	-35.5	0.0	0.0	40.1	74.0	-33.9	H	P	
4.874	3.0	23.7	33.5	6.3	-35.5	0.0	0.0	28.0	54.0	-26.0	H	A	
7.311	3.0	35.7	35.7	8.5	-35.4	0.0	0.0	44.5	74.0	-29.5	H	P	
7.311	3.0	23.5	35.7	8.5	-35.4	0.0	0.0	32.3	54.0	-21.7	H	A	
High Ch, 2462MHz													
4.924	3.0	36.2	33.5	6.3	-35.5	0.0	0.0	40.6	74.0	-33.4	V	P	
4.924	3.0	23.8	33.5	6.3	-35.5	0.0	0.0	28.2	54.0	-25.8	V	A	
7.386	3.0	36.3	35.8	8.5	-35.5	0.0	0.0	45.2	74.0	-28.8	V	P	
7.386	3.0	23.4	35.8	8.5	-35.5	0.0	0.0	32.3	54.0	-21.7	V	A	
4.924	3.0	38.9	33.5	6.3	-35.5	0.0	0.0	43.3	74.0	-30.7	H	P	
4.924	3.0	26.5	33.5	6.3	-35.5	0.0	0.0	30.9	54.0	-23.1	H	A	
7.386	3.0	35.8	35.8	8.5	-35.5	0.0	0.0	44.7	74.0	-29.3	H	P	
7.386	3.0	23.7	35.8	8.5	-35.5	0.0	0.0	32.7	54.0	-21.3	H	A	

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

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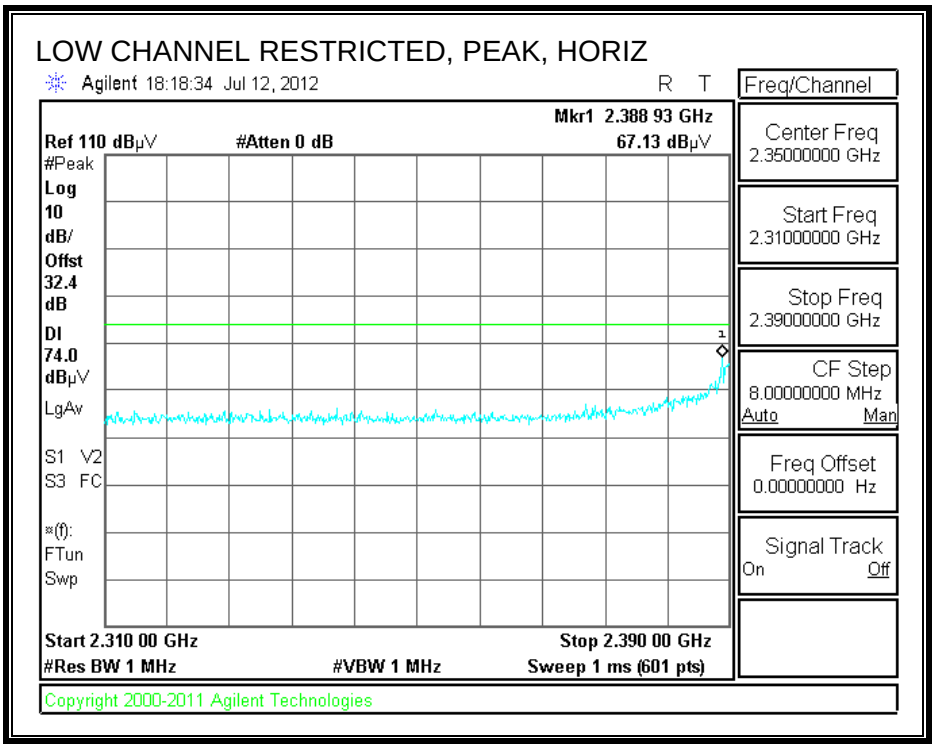
8.2.3. TX ABOVE 1 GHz, 802.11n HT20 1TX MODE, 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



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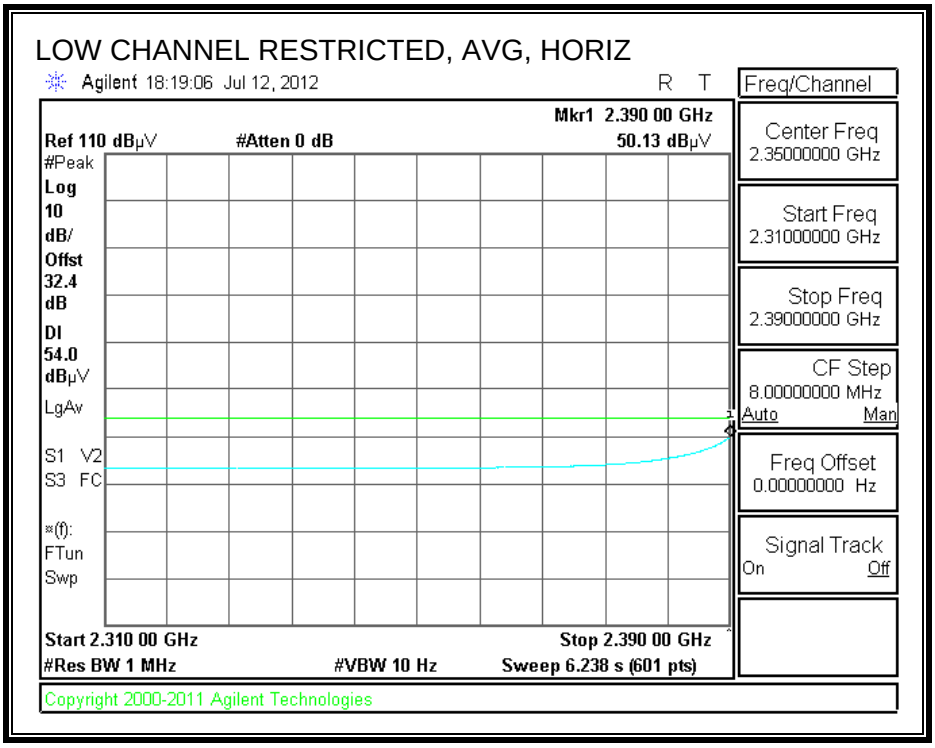

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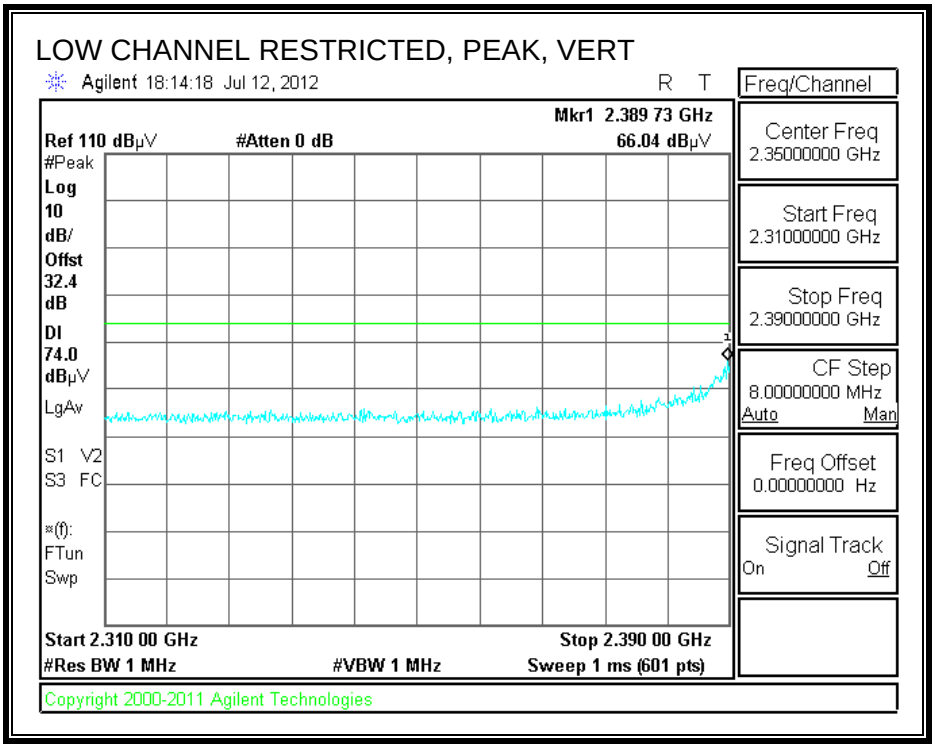
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



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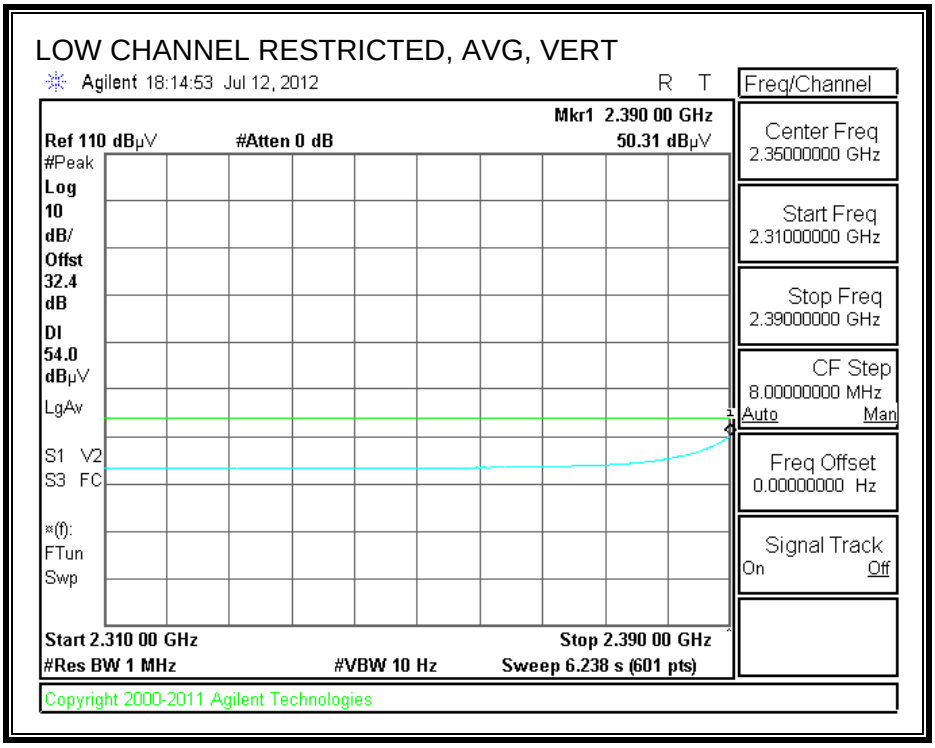

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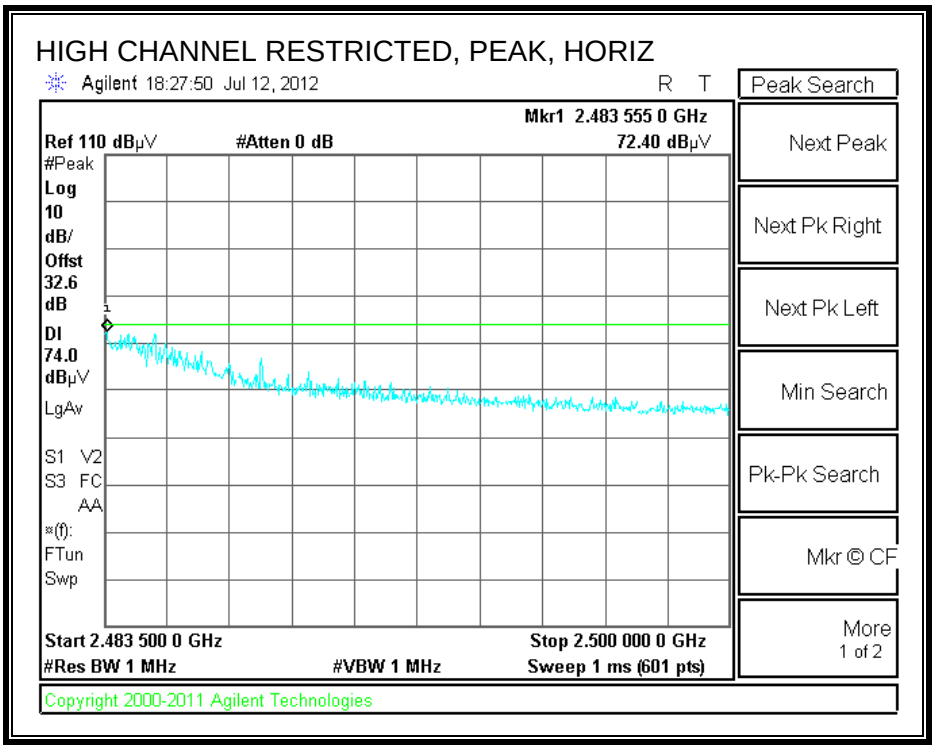
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



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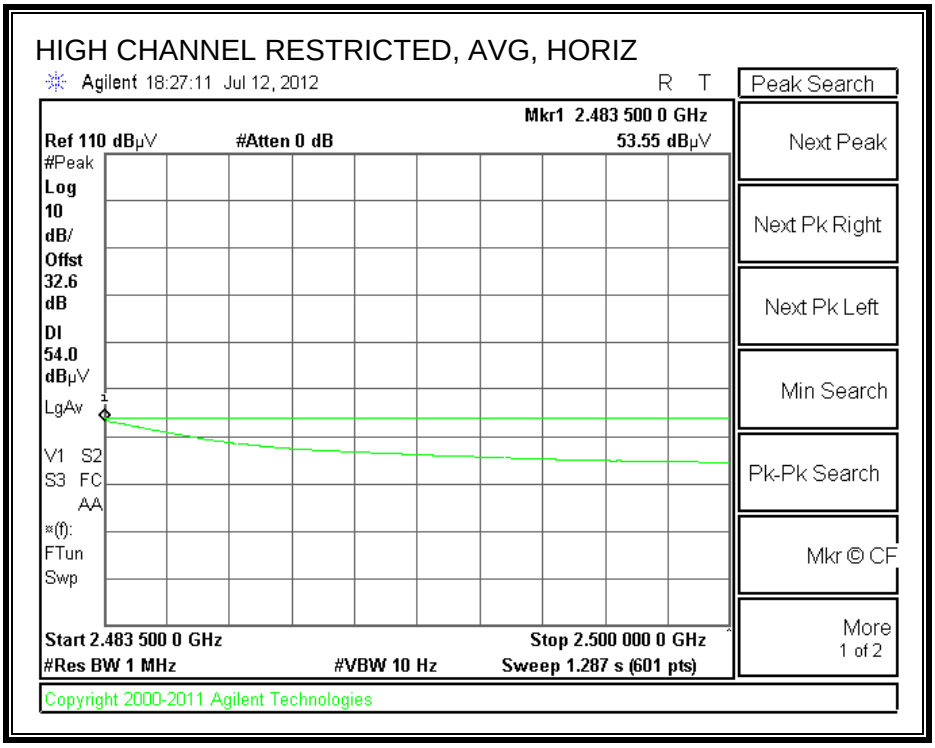

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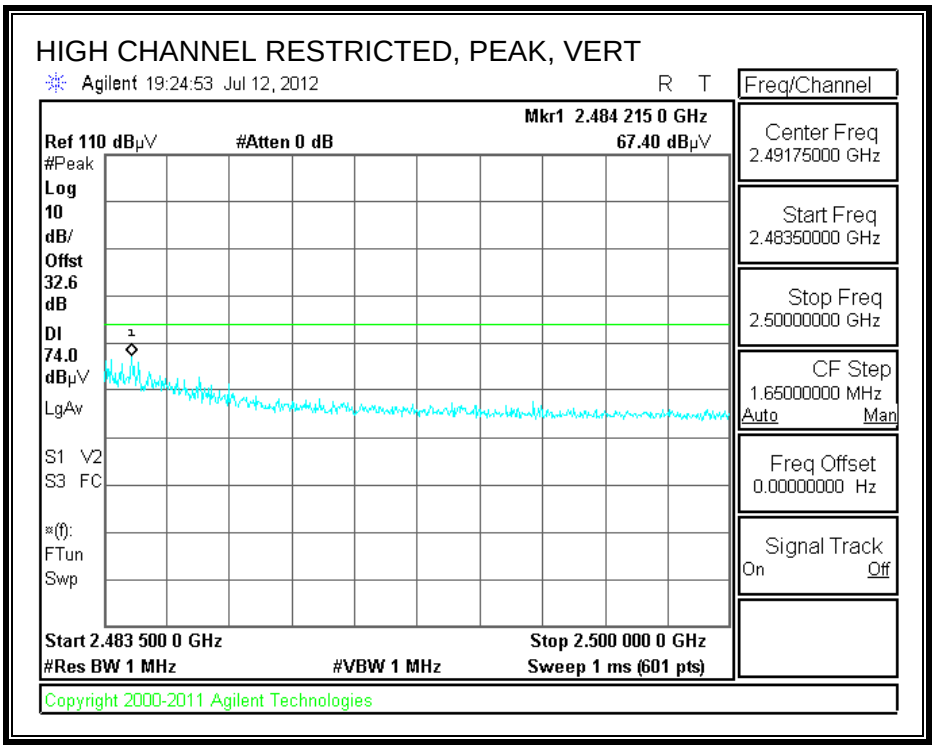
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



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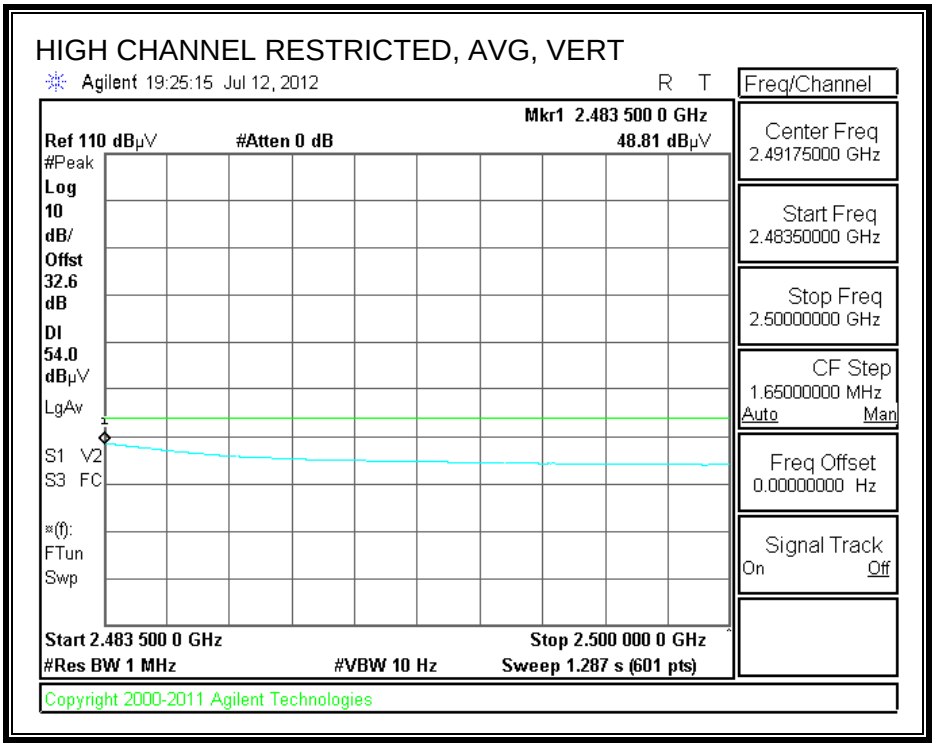

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HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 08/13/12
Project #: 12U14526
Company: Apple
Test Target: FCC 15.247
Mode Oper: g mode, TX (Worst case)

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 2412MHz													
4.824	3.0	37.1	33.4	6.3	-35.5	0.0	0.0	41.3	74.0	-32.7	V	P	
4.824	3.0	24.3	33.4	6.3	-35.5	0.0	0.0	28.5	54.0	-25.5	V	A	
4.824	3.0	38.9	33.4	6.3	-35.5	0.0	0.0	43.1	74.0	-30.9	H	P	
4.824	3.0	26.1	33.4	6.3	-35.5	0.0	0.0	30.3	54.0	-23.7	H	A	
Mid Ch, 2437MHz													
4.874	3.0	36.4	33.5	6.3	-35.5	0.0	0.0	40.7	74.0	-33.3	V	P	
4.874	3.0	24.0	33.5	6.3	-35.5	0.0	0.0	28.3	54.0	-25.7	V	A	
7.311	3.0	35.8	35.7	8.5	-35.4	0.0	0.0	44.6	74.0	-29.4	V	P	
7.311	3.0	23.5	35.7	8.5	-35.4	0.0	0.0	32.3	54.0	-21.7	V	A	
4.874	3.0	39.9	33.5	6.3	-35.5	0.0	0.0	44.2	74.0	-29.8	H	P	
4.874	3.0	27.8	33.5	6.3	-35.5	0.0	0.0	32.1	54.0	-21.9	H	A	
7.311	3.0	36.0	35.7	8.5	-35.4	0.0	0.0	44.8	74.0	-29.2	H	P	
7.311	3.0	23.5	35.7	8.5	-35.4	0.0	0.0	32.3	54.0	-21.7	H	A	
High Ch, 2462MHz													
4.924	3.0	35.9	33.5	6.3	-35.5	0.0	0.0	40.3	74.0	-33.7	V	P	
4.924	3.0	24.0	33.5	6.3	-35.5	0.0	0.0	28.4	54.0	-25.6	V	A	
7.386	3.0	35.7	35.8	8.5	-35.5	0.0	0.0	44.7	74.0	-29.3	V	P	
7.386	3.0	23.6	35.8	8.5	-35.5	0.0	0.0	32.5	54.0	-21.5	V	A	
4.924	3.0	37.2	33.5	6.3	-35.5	0.0	0.0	41.6	74.0	-32.4	H	P	
4.924	3.0	25.1	33.5	6.3	-35.5	0.0	0.0	29.5	54.0	-24.5	H	A	
7.386	3.0	37.4	35.8	8.5	-35.5	0.0	0.0	46.3	74.0	-27.7	H	P	
7.386	3.0	23.8	35.8	8.5	-35.5	0.0	0.0	32.7	54.0	-21.3	H	A	

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

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8.2.4. TX ABOVE 1 GHz, 802.11a MODE, 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 08/14/12
Project #: 12U14526
Company: Apple
Test Target: FCC 15.247
Mode Oper: a mode, 5.8GHz, TX (Worst Case)

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 5745MHz													
11.490	3.0	35.0	38.8	10.5	-35.5	0.0	0.7	49.5	74.0	-24.5	V	P	
11.490	3.0	22.5	38.8	10.5	-35.5	0.0	0.7	37.0	54.0	-17.0	V	A	
11.490	3.0	35.0	38.8	10.5	-35.5	0.0	0.7	49.5	74.0	-24.5	H	P	
11.490	3.0	22.5	38.8	10.5	-35.5	0.0	0.7	37.0	54.0	-17.0	H	A	
Mid Ch, 5785MHz													
11.570	3.0	35.5	38.9	10.6	-35.5	0.0	0.7	50.2	74.0	-23.8	V	P	
11.570	3.0	22.2	38.9	10.6	-35.5	0.0	0.7	36.9	54.0	-17.1	V	A	
11.570	3.0	35.3	38.9	10.6	-35.5	0.0	0.7	49.9	74.0	-24.1	H	P	
11.570	3.0	22.1	38.9	10.6	-35.5	0.0	0.7	36.8	54.0	-17.2	H	A	
High Ch, 5825MHz													
11.650	3.0	35.8	39.0	10.7	-35.5	0.0	0.7	50.6	74.0	-23.4	V	P	
11.650	3.0	22.5	39.0	10.7	-35.5	0.0	0.7	37.3	54.0	-16.7	V	A	
11.650	3.0	35.2	39.0	10.7	-35.5	0.0	0.7	50.1	74.0	-23.9	H	P	
11.650	3.0	22.4	39.0	10.7	-35.5	0.0	0.7	37.3	54.0	-16.7	H	A	

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

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8.2.5. TX ABOVE 1 GHz, 802.11n HT20 MODE, 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 08/14/12
Project #: 12U14526
Company: Apple
Test Target: FCC 15.247
Mode Oper: HT20 mode, 5.8GHz, TX (Worst Case)

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

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 5745MHz													
11.490	3.0	35.3	38.8	10.5	-35.5	0.0	0.7	49.8	74.0	-24.2	V	P	
11.490	3.0	22.5	38.8	10.5	-35.5	0.0	0.7	37.1	54.0	-16.9	V	A	
11.490	3.0	35.9	38.8	10.5	-35.5	0.0	0.7	50.5	74.0	-23.5	H	P	
11.490	3.0	22.5	38.8	10.5	-35.5	0.0	0.7	37.0	54.0	-17.0	H	A	
Mid Ch, 5785MHz													
11.570	3.0	35.2	38.9	10.6	-35.5	0.0	0.7	49.9	74.0	-24.1	V	P	
11.570	3.0	22.1	38.9	10.6	-35.5	0.0	0.7	36.8	54.0	-17.2	V	A	
11.570	3.0	34.5	38.9	10.6	-35.5	0.0	0.7	49.2	74.0	-24.8	H	P	
11.570	3.0	22.1	38.9	10.6	-35.5	0.0	0.7	36.8	54.0	-17.2	H	A	
High Ch, 5825MHz													
11.650	3.0	35.8	39.0	10.7	-35.5	0.0	0.7	50.7	74.0	-23.3	V	P	
11.650	3.0	22.4	39.0	10.7	-35.5	0.0	0.7	37.2	54.0	-16.8	V	A	
11.650	3.0	35.5	39.0	10.7	-35.5	0.0	0.7	50.3	74.0	-23.7	H	P	
11.650	3.0	22.4	39.0	10.7	-35.5	0.0	0.7	37.2	54.0	-16.8	H	A	

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

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8.2.6. TX ABOVE 1 GHz, 802.11n HT40 MODE, 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 08/14/12
Project #: 12U14526
Company: Apple
Test Target: FCC 15.247
Mode Oper: HT40, 5.8GHz, TX (Worst Case)

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

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 5755MHz													
11.510	3.0	35.1	38.8	10.6	-35.5	0.0	0.7	49.7	74.0	-24.3	V	P	
11.510	3.0	22.4	38.8	10.6	-35.5	0.0	0.7	37.0	54.0	-17.0	V	A	
11.510	3.0	35.8	38.8	10.6	-35.5	0.0	0.7	50.4	74.0	-23.6	H	P	
11.510	3.0	22.4	38.8	10.6	-35.5	0.0	0.7	37.0	54.0	-17.0	H	A	
High Ch, 5795MHz													
11.590	3.0	35.3	38.9	10.6	-35.5	0.0	0.7	50.0	74.0	-24.0	V	P	
11.590	3.0	22.2	38.9	10.6	-35.5	0.0	0.7	37.0	54.0	-17.0	V	A	
11.590	3.0	34.7	38.9	10.6	-35.5	0.0	0.7	49.5	74.0	-24.5	H	P	
11.590	3.0	22.3	38.9	10.6	-35.5	0.0	0.7	37.0	54.0	-17.0	H	A	

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

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47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
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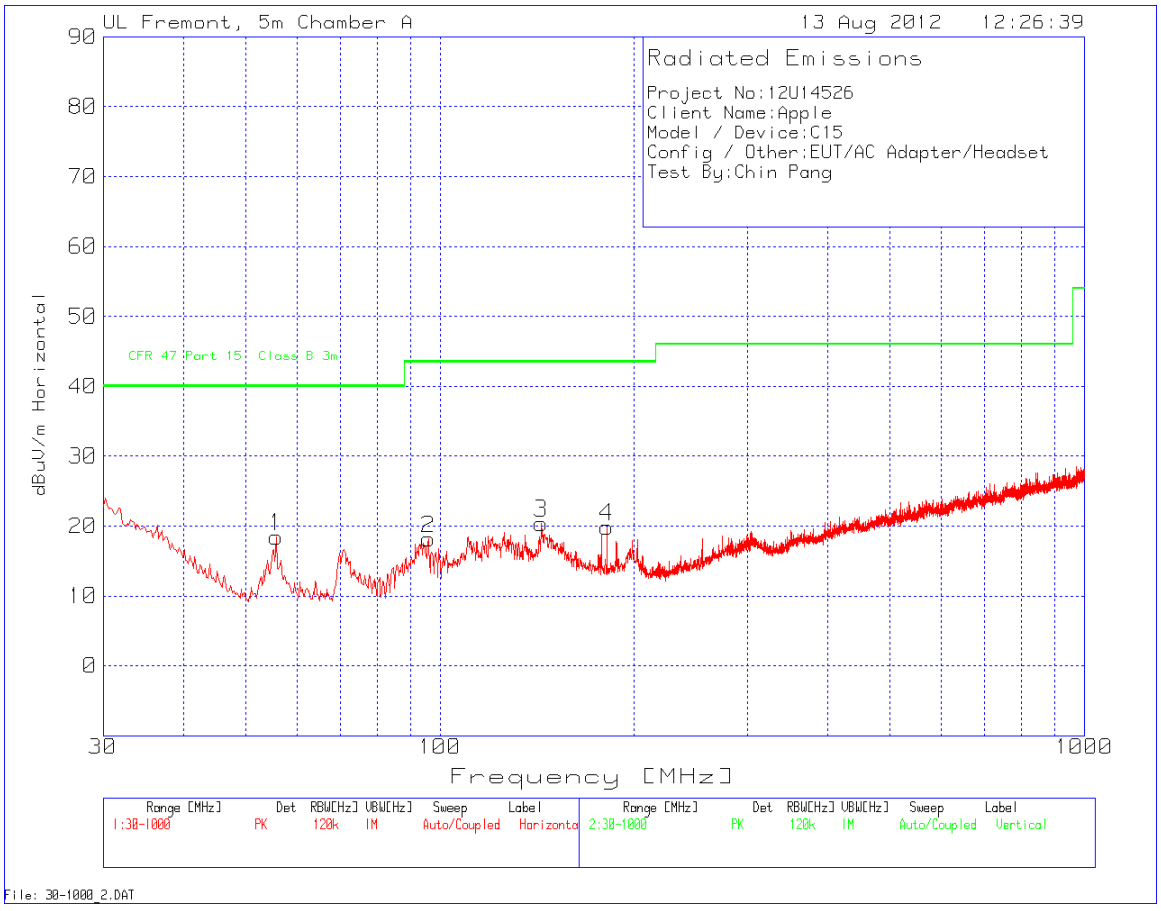
8.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



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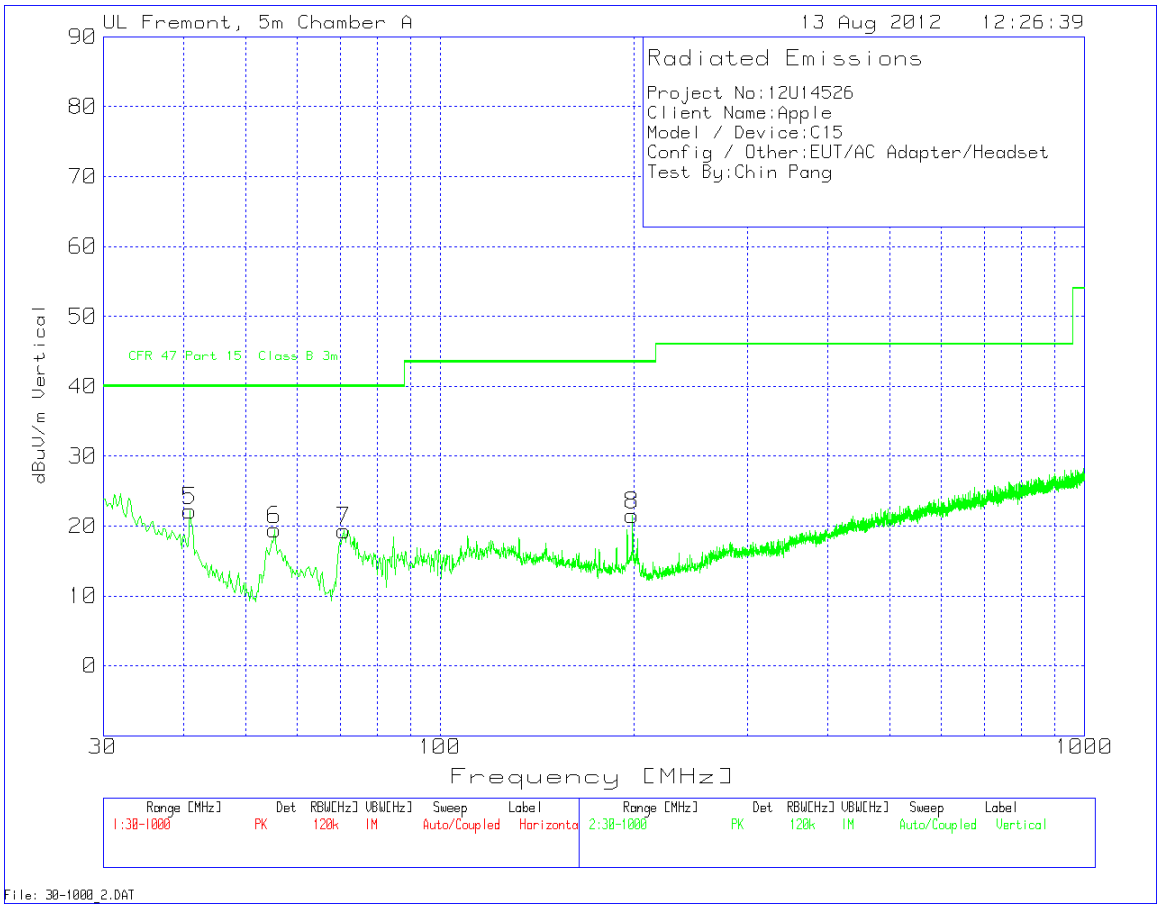
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



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HORIZONTAL AND VERTICAL DATA

Project No:12U14526
Client Name:Apple
Model / Device:C15
Config / Other:EUT/AC Adapter/Headset
Test By:Chin Pang

Horizontal 30 - 1000MHz

Frequency	Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	dBuV/m	CFR 47 Part 15B 3m	Margin	Polarity
55.7814	38.68	PK	-27.3	7.1	18.48	40	-21.52	Horz
95.9073	35.93	PK	-26.9	9.1	18.13	43.5	-25.37	Horz
143.787	34.53	PK	-26.6	12.5	20.43	43.5	-23.07	Horz
181.5867	35.05	PK	-26.4	11.2	19.85	43.5	-23.65	Horz

Vertical 30 - 1000MHz

Frequency	Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	dBuV/m	CFR 47 Part 15B 3m	Margin	Polarity
40.8553	36.22	PK	-27.4	13.4	22.22	40	-17.78	Vert
55.3937	39.71	PK	-27.3	7.1	19.51	40	-20.49	Vert
70.9013	38.37	PK	-27.1	8.1	19.37	40	-20.63	Vert
198.8389	35.56	PK	-26.2	12.2	21.56	43.5	-21.94	Vert

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9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

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RESULTS

6 WORST EMISSIONS

Project No:12U14526									
Client Name:Apple									
Model/Device:2.4GHz (Worst Case)									
Test Volt/Freq:115VAC 60Hz									
Test By:Chin Pang									
Line-L1 .15 - 30MHz									
Frequency	Reading	Detector	T24 IL L1.1	LC Cables 1	dBuV	CISPR 22B QI	Margin	CISPR 22B	Margin
0.1635	62.39	PK	0.1	0	62.49	65.3	-2.81	-	-
0.1635	48.07	Av	0.1	0	48.17	-	-	55.3	-7.13
0.24	55.06	PK	0.1	0	55.16	62.1	-6.94	-	-
0.24	32.43	Av	0.1	0	32.53	-	-	52.1	-19.57
0.321	51.78	PK	0.1	0	51.88	59.7	-7.82	-	-
0.321	28.15	Av	0.1	0	28.25	-	-	49.7	-21.45
Line-L2 .15 - 30MHz									
Frequency	Reading	Detector	T24 IL L1.1	LC Cables 1	dBuV	CISPR 22B QI	Margin	CISPR 22B	Margin
0.1545	52.48	PK	0.1	0	52.58	65.8	-13.22	-	-
0.1545	33.96	Av	0.1	0	34.06	-	-	55.8	-21.74
0.2355	44.83	PK	0.1	0	44.93	62.3	-17.37	-	-
0.2355	29.13	Av	0.1	0	29.23	-	-	52.3	-23.07
0.3165	42.07	PK	0.1	0	42.17	59.8	-17.63	-	-
0.3165	27.41	Av	0.1	0	27.51	-	-	49.8	-22.29

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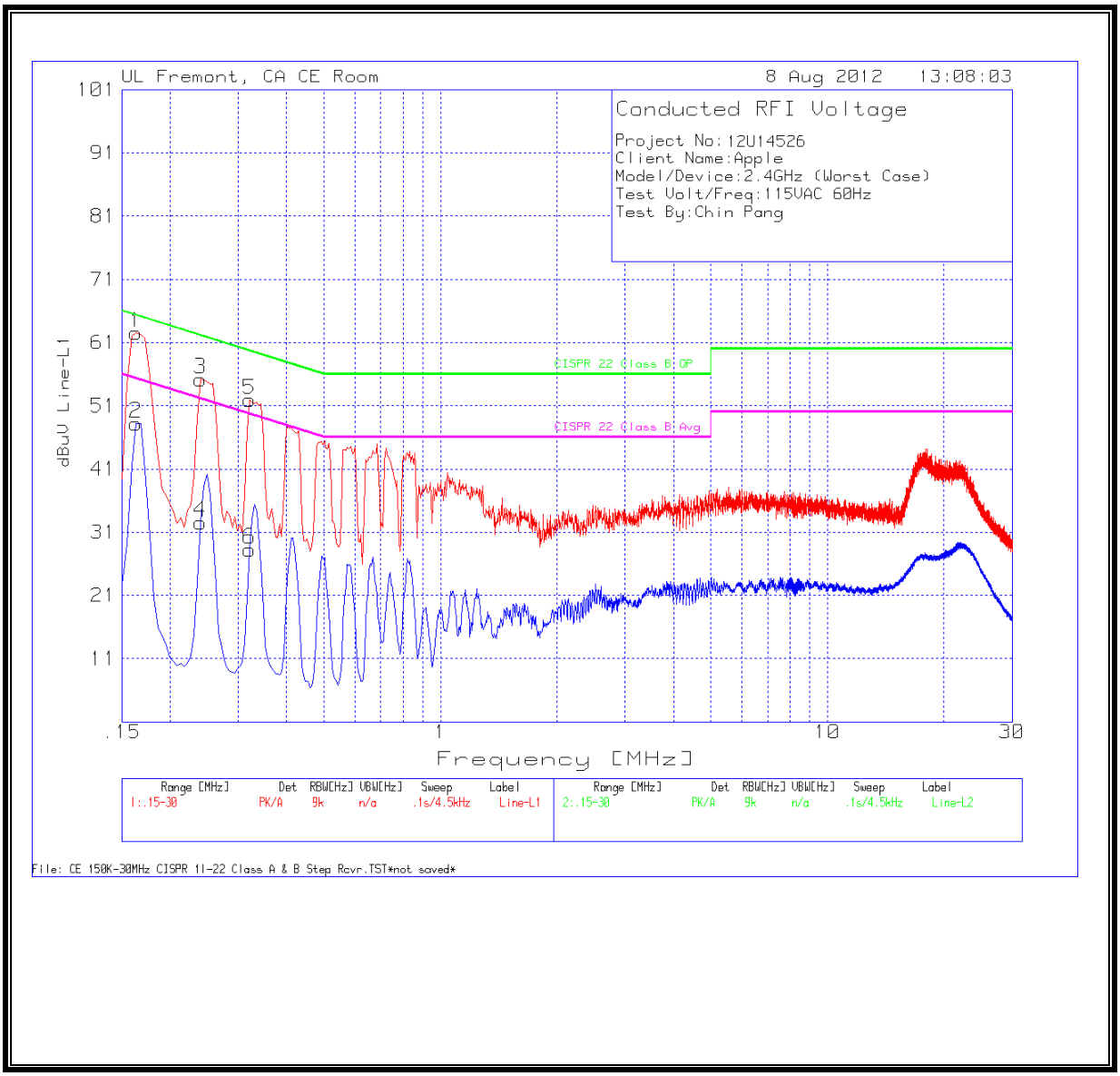
LINE 1 RESULTS



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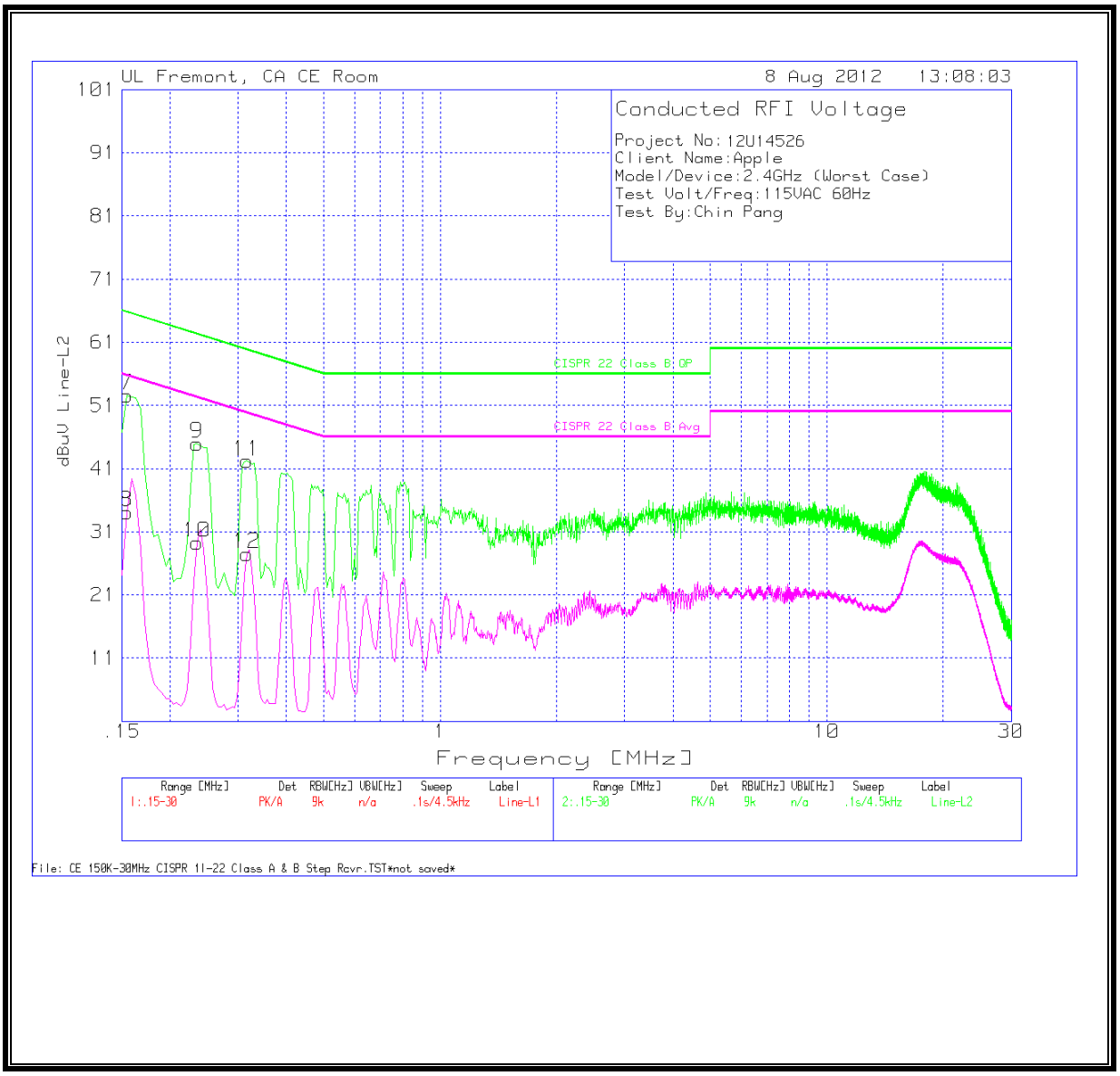
LINE 2 RESULTS



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