



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

**BLUETOOTH LOW ENERGY
CERTIFICATION TEST REPORT**

FOR

Apple TV device (digital media receiver) with WiFi and Bluetooth radios

MODEL NUMBER: A1469

**FCC ID: BCGA1469
IC: 579C-A1469**

REPORT NUMBER: 12U14680-8, Revision A

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Prepared for
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NVLAP[®]

NVLAP LAB CODE 200065-0

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--	12/12/12	Initial Issue	F. Ibrahim
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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: Apple TV device (digital media receiver) with WiFi and Bluetooth radios

MODEL: A1469

SERIAL NUMBER: PT800489

DATE TESTED: November 16 - December 12, 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 LEAD
UL CCS

Tested By:



OLIVER SU
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

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

3. FACILITIES AND ACCREDITATION

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Apple TV device is a digital media receiver designed to play internet content onto a TV through an HDMI port. It incorporates WiFi and Bluetooth radios.

The Bluetooth module is manufactured by Broadcom.

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)
2402 - 2480	BLE	6.31	4.28

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

Antenna Gain:	
Frequency (MHz)	Gain (dBi)
2412	3.4
5180	3.93
5260	3.16
5540	2.34
5745	2.62

5.4. SOFTWARE AND FIRMWARE

The EUT software installed during testing was Broadcom Bluetooth.

The firmware installed in the EUT during testing was BCM4334B0_002.001.013.0121.0000.

The EUT is also linked in Bluetooth Enable Test mode with Rohde & Schwarz CBT Test box.

5.5. WORST-CASE CONFIGURATION AND MODE

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

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	Apple	MacBook M42A	PT358811	DoC
AC-DC Adapter	Apple	A1343	N/A	N/A
Mouse	HP	MOAFUO	CT: FATSK0J9W0EFU4	DoC

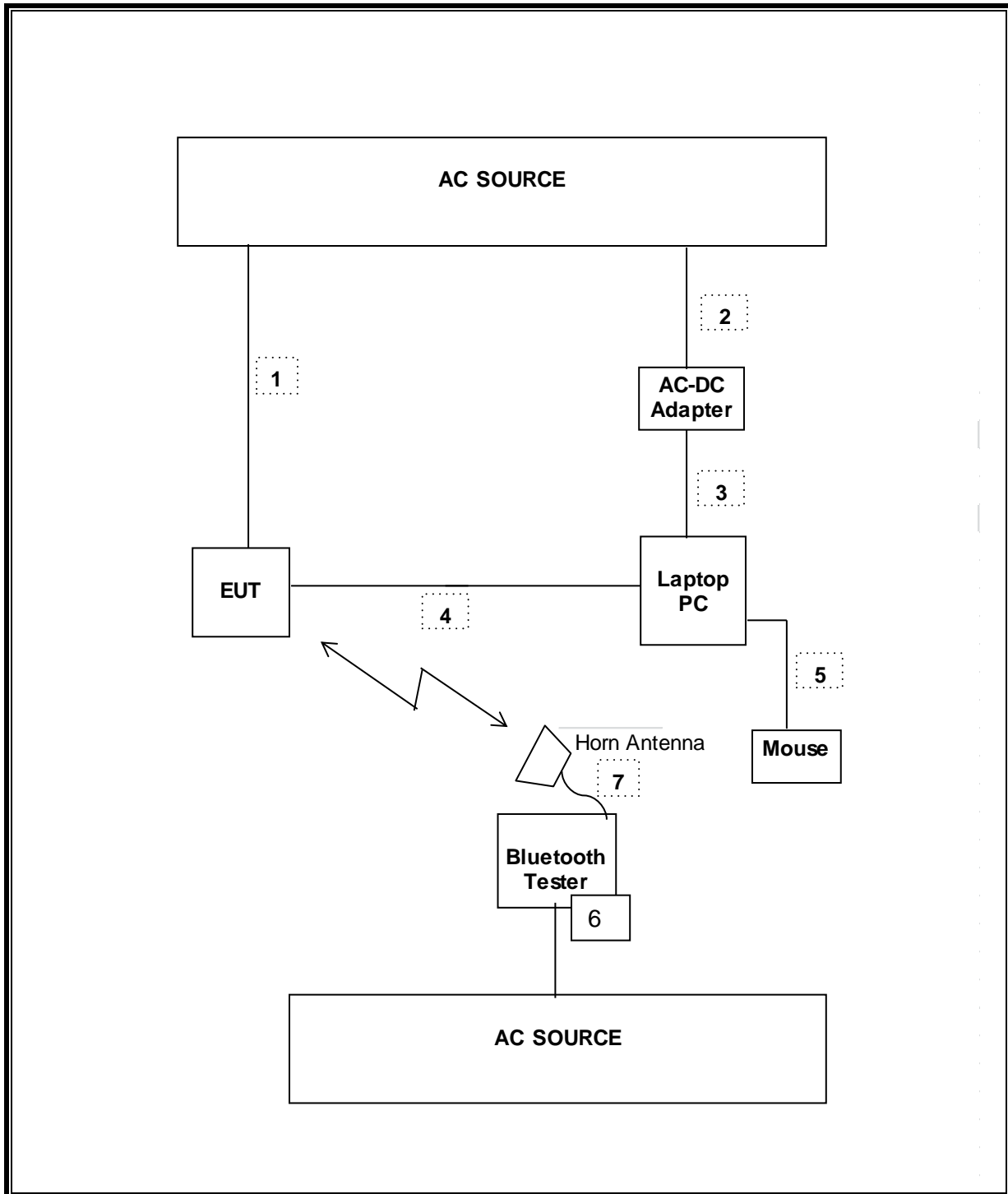
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	2P	Non-shielded	1.83	
2	AC	1	3P	Non-shielded	1.85	
3	DC	1	DC	Non-shielded	1.8	
4	USB	1	USB	Non-shielded	1.87	
5	USB	1	USB	Non-shielded	1.9	
6	AC	1	3P	Non-shielded	1.9	
7	SMA	1	SMA	Shielded	2.4	

TEST SETUP

The EUT is powered by AC source only during test. Test software exercised the Bluetooth card to link with the Bluetooth Tester through the air.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List					
Description	Manufacturer	Model	Asset	Cal Date	Cal Due
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C01011	03/23/12	03/23/13
Antenna, Horn, 18 GHz	EMCO	3115	C00783	10/25/12	10/25/13
Power Meter	Agilent / HP	437B	T226	07/25/12	07/25/13
Average Power Sensor	Agilent / HP	8481A	T269	07/26/12	07/26/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	12/30/12	12/30/13
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	10/22/12	10/22/13
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	02/16/12	02/16/13
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	03/22/12	03/22/13
Bluetooth Tester	R & S	CBT	T258	05/15/12	05/15/13
Horn Antenna, 18 GHz	EMCO	3115	C00943	CNR	CNR

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

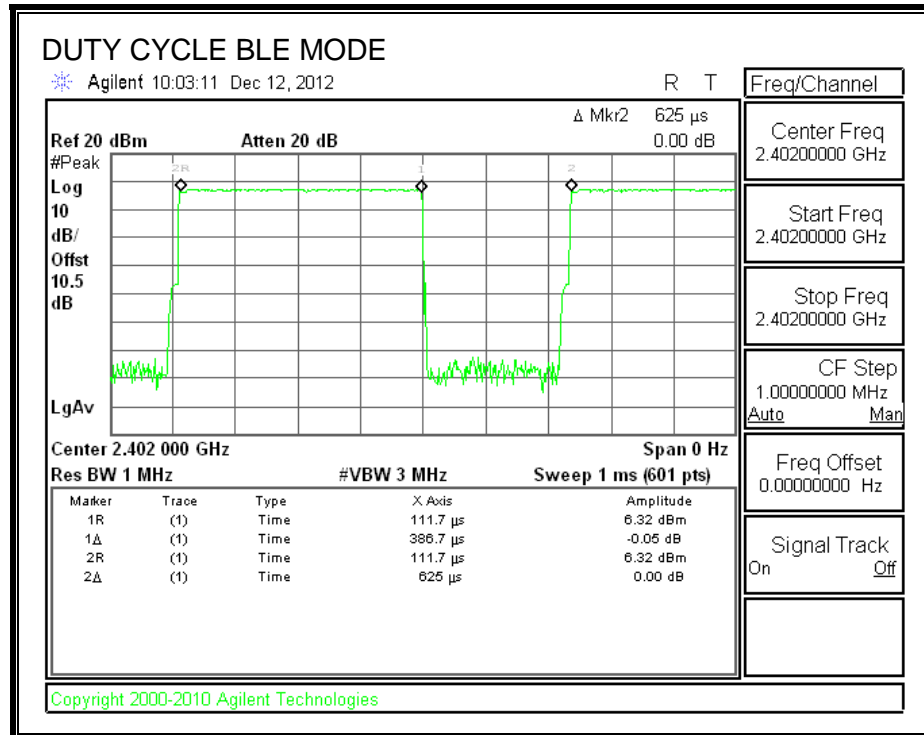
PROCEDURE

KDB 558074 D01 DTS Meas Guidance v02, dated 10/04/12.

7.2. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
BLE	0.3867	0.6250	0.619	61.9%	2.09

7.3. DUTY CYCLE PLOTS



7.4. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

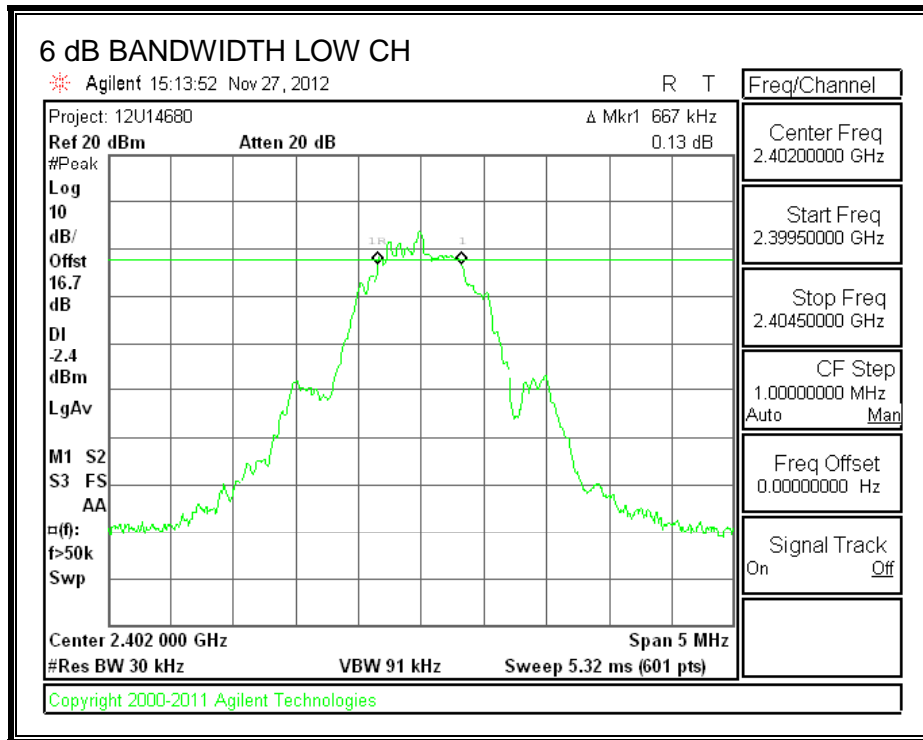
TEST PROCEDURE

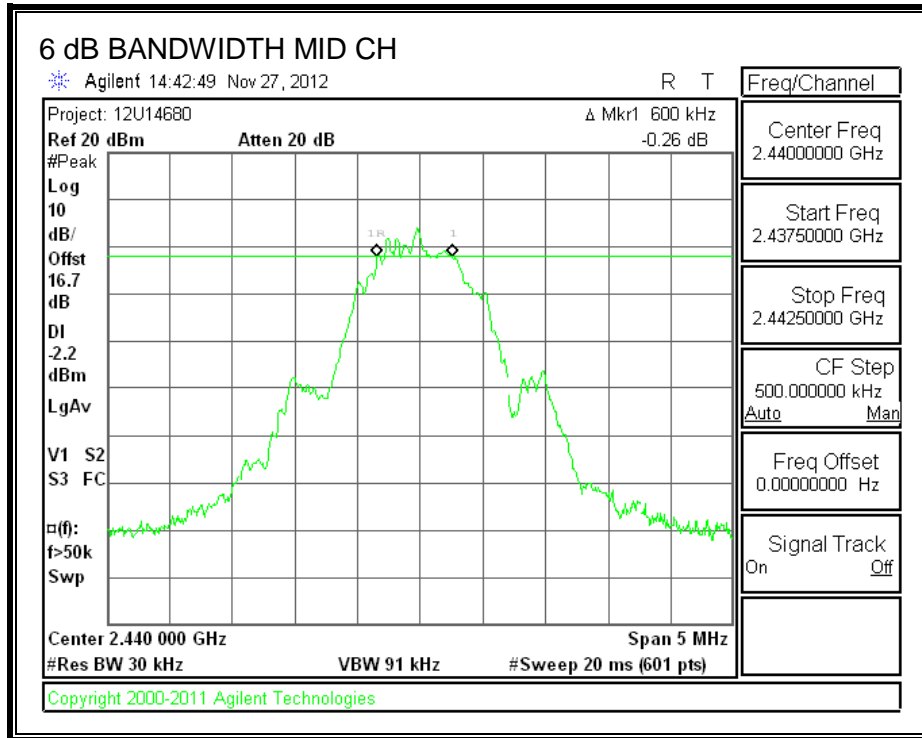
KDB 558074 D01 DTS Meas Guidance v02 "Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) Operating Under 15.247", dated 10/04/12".

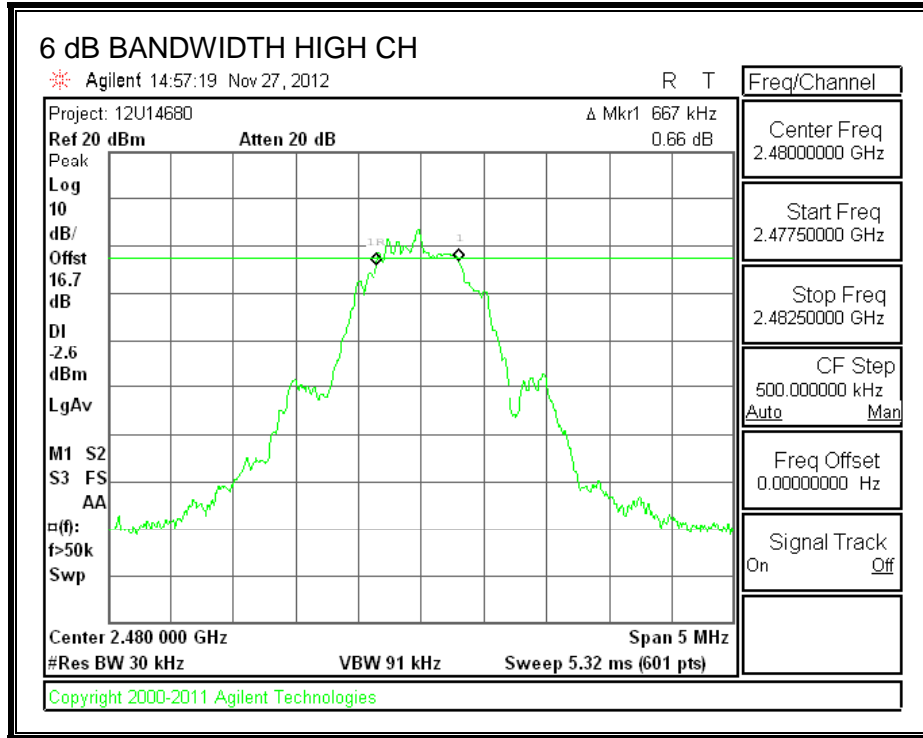
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.667	0.5
Middle	2440	0.600	0.5
High	2480	0.667	0.5

6 dB BANDWIDTH







7.5. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

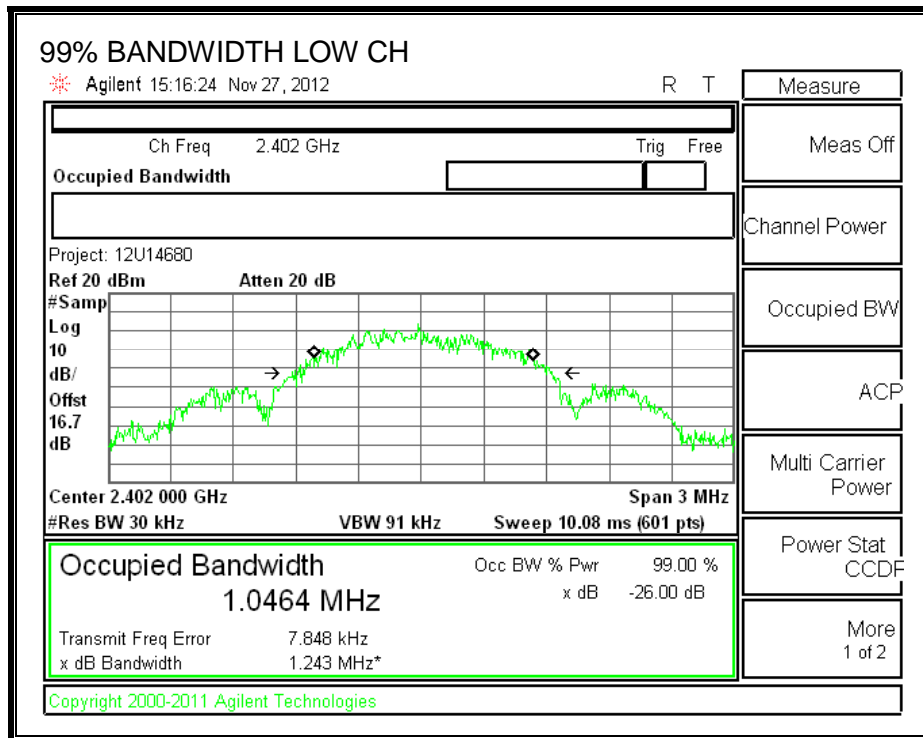
TEST PROCEDURE

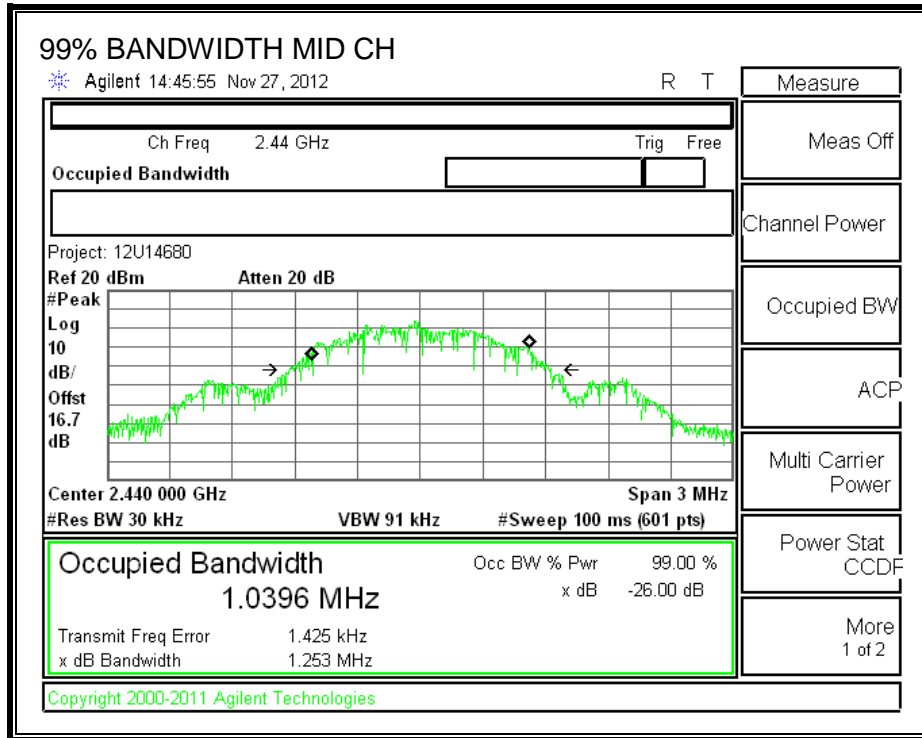
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

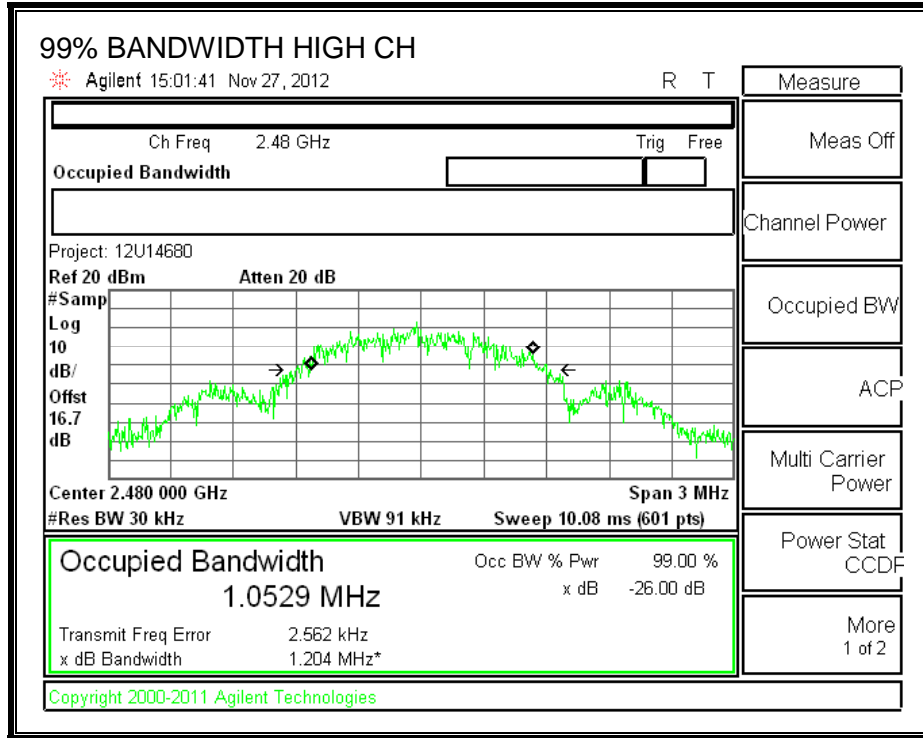
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0464
Middle	2440	1.0396
High	2480	1.0529

99% BANDWIDTH







7.6. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

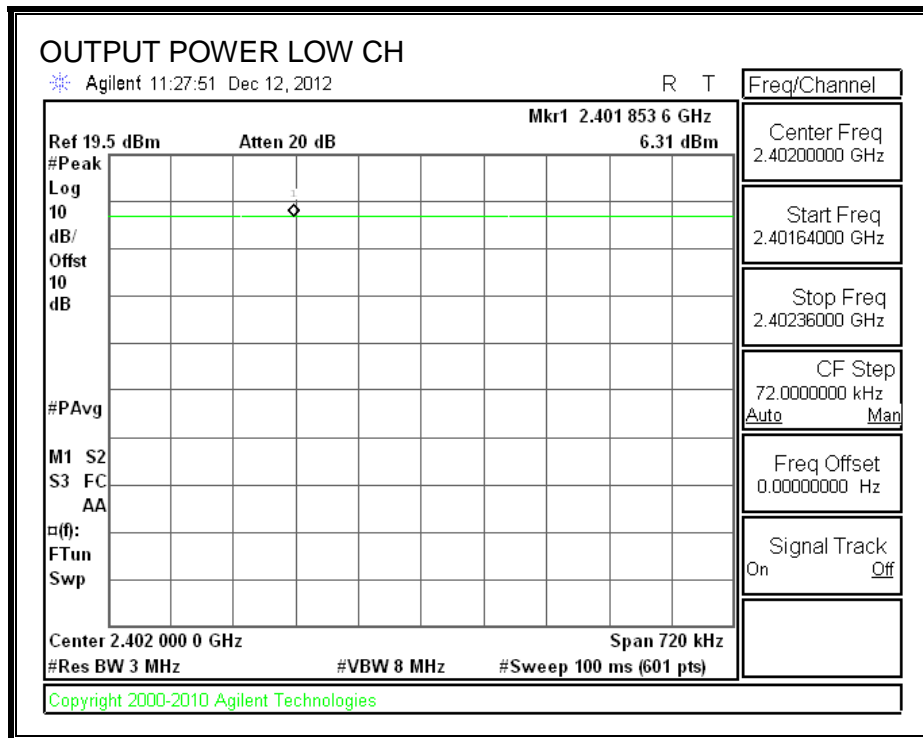
TEST PROCEDURE

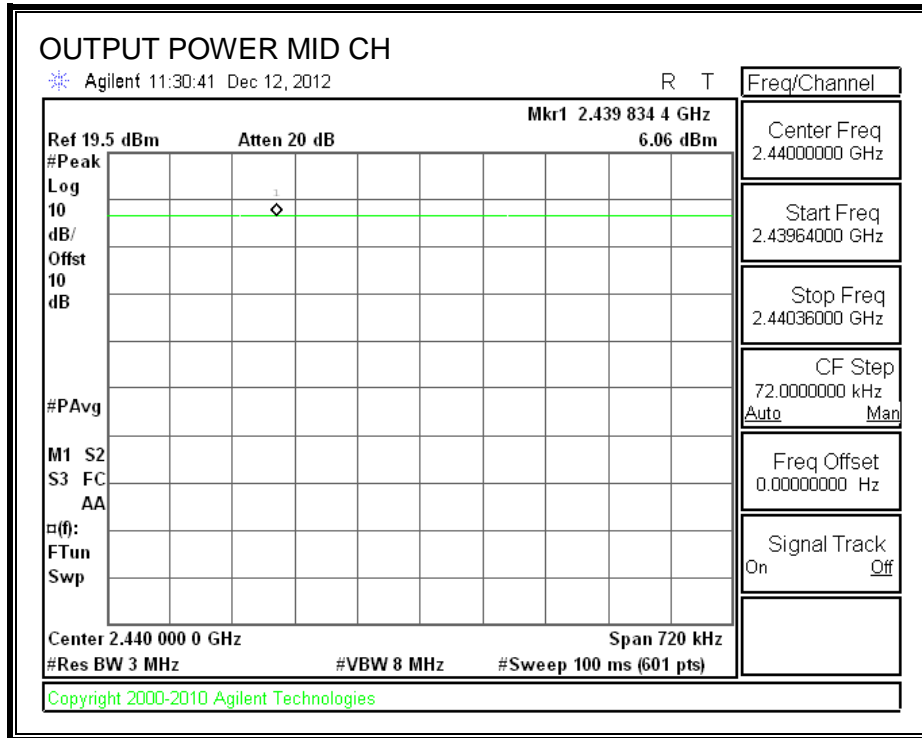
KDB 558074 D01 DTS Meas Guidance v02 "Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) Operating Under 15.247", dated 10/04/12".

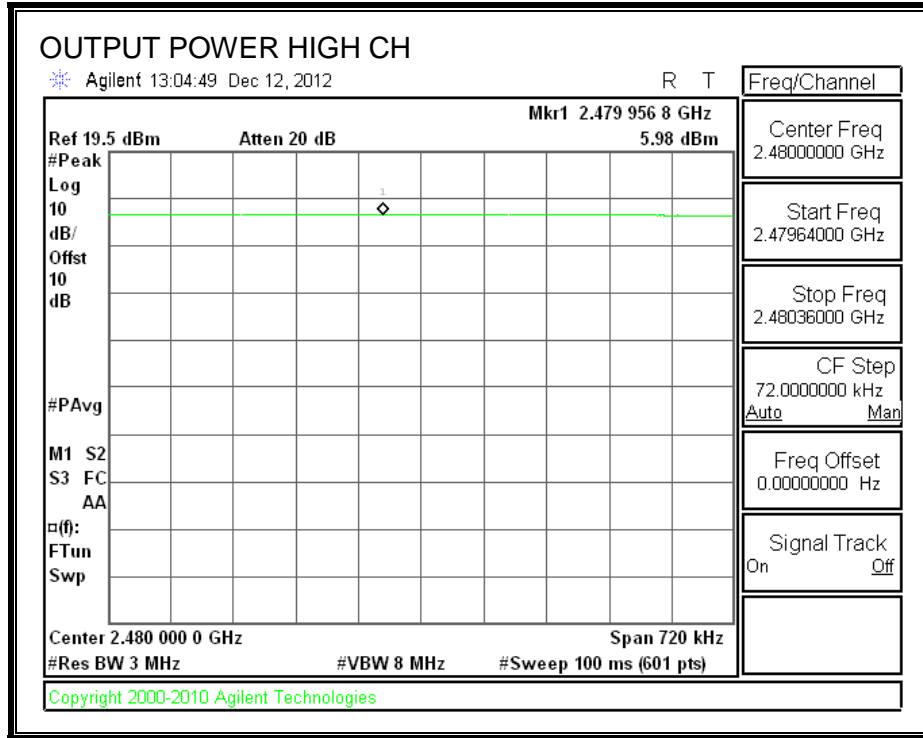
RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.31	30	-23.690
Middle	2440	6.06	30	-23.940
High	2480	5.98	30	-24.020

OUTPUT POWER







7.7. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

KDB 558074 D01 DTS Meas Guidance v02 "Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) Operating Under 15.247", dated 10/04/12".

RESULTS

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 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	2402	6.00
Middle	2440	6.20
High	2480	5.60

7.8. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

TEST PROCEDURE

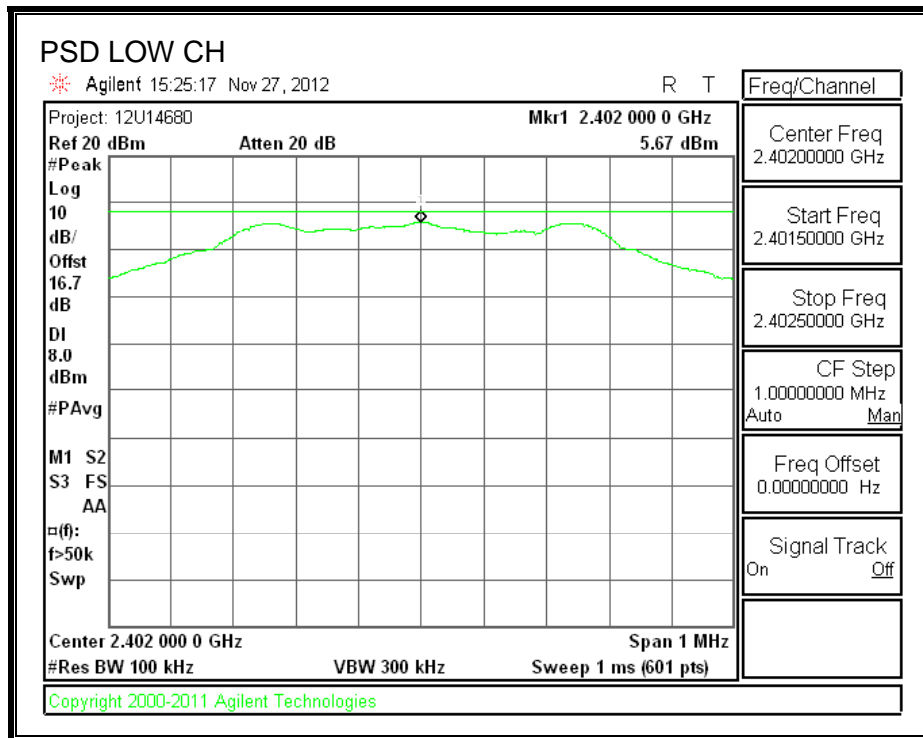
KDB 558074 D01 DTS Meas Guidance v02 "Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) Operating Under 15.247", dated 10/04/12".

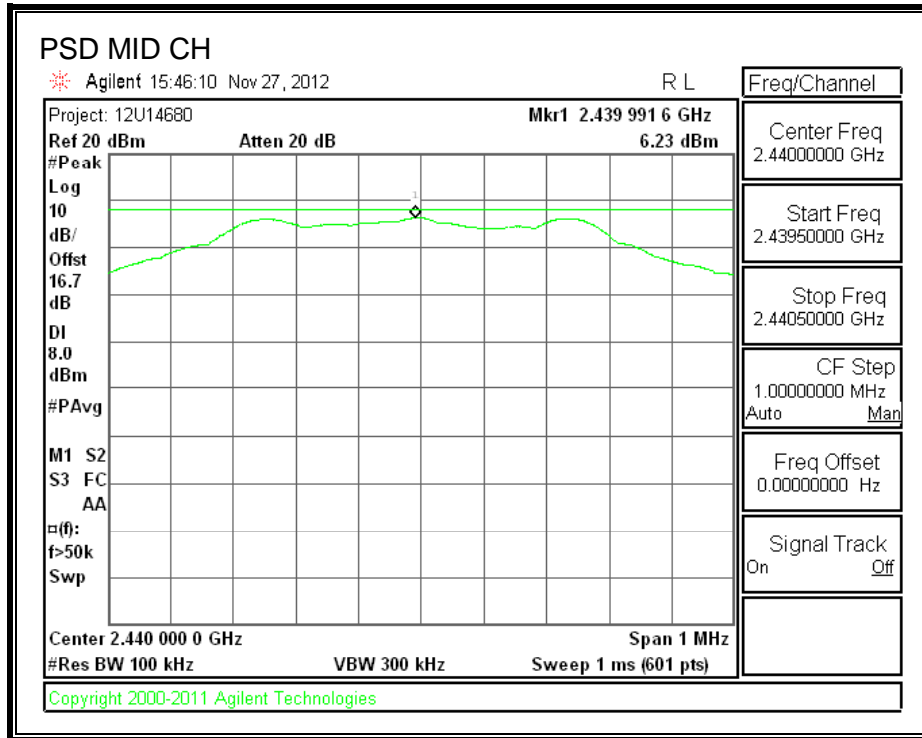
RESULTS

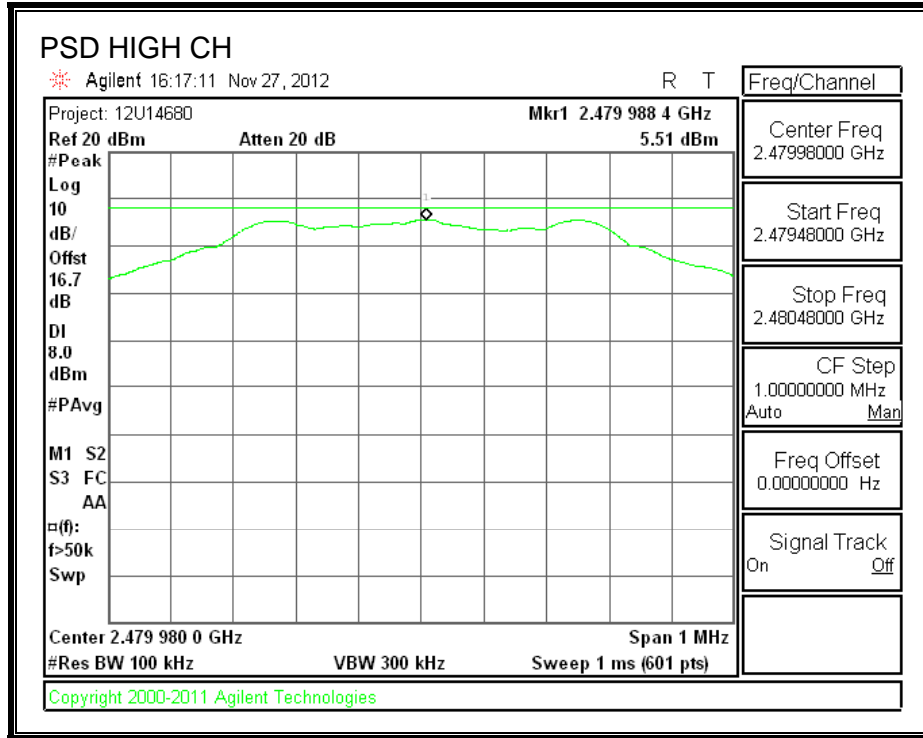
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.67	8	-2.33
Middle	2440	6.23	8	-1.77
High	2480	5.51	8	-2.49

Note: PSD as measured with 100 kHz RBW already passes the limit, so this is worst-case as compared to the measurement with 3 kHz RBW.

POWER SPECTRAL DENSITY







7.9. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

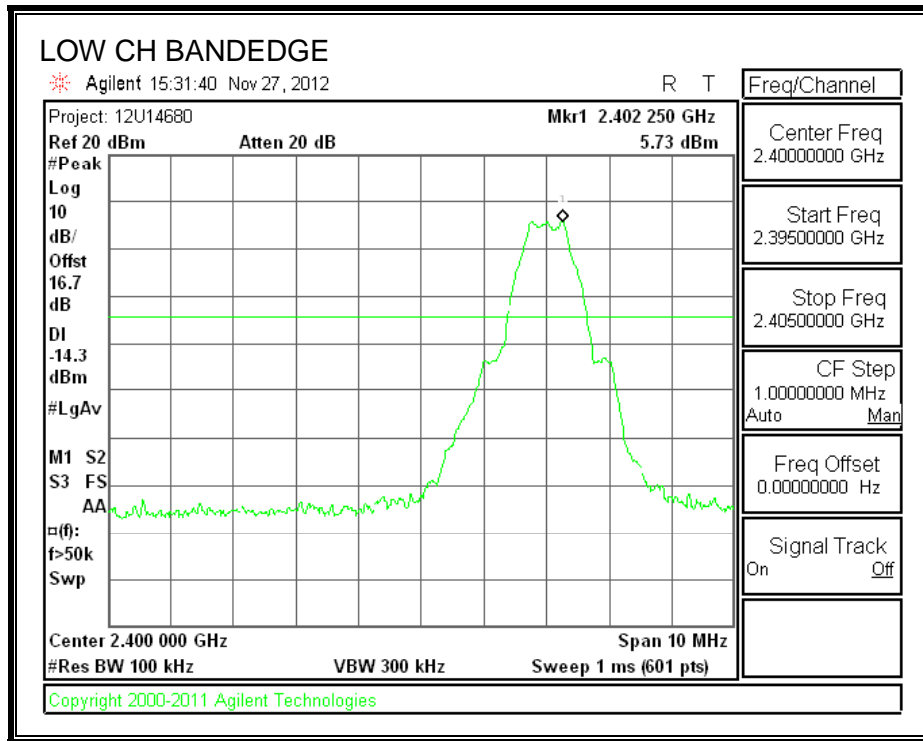
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

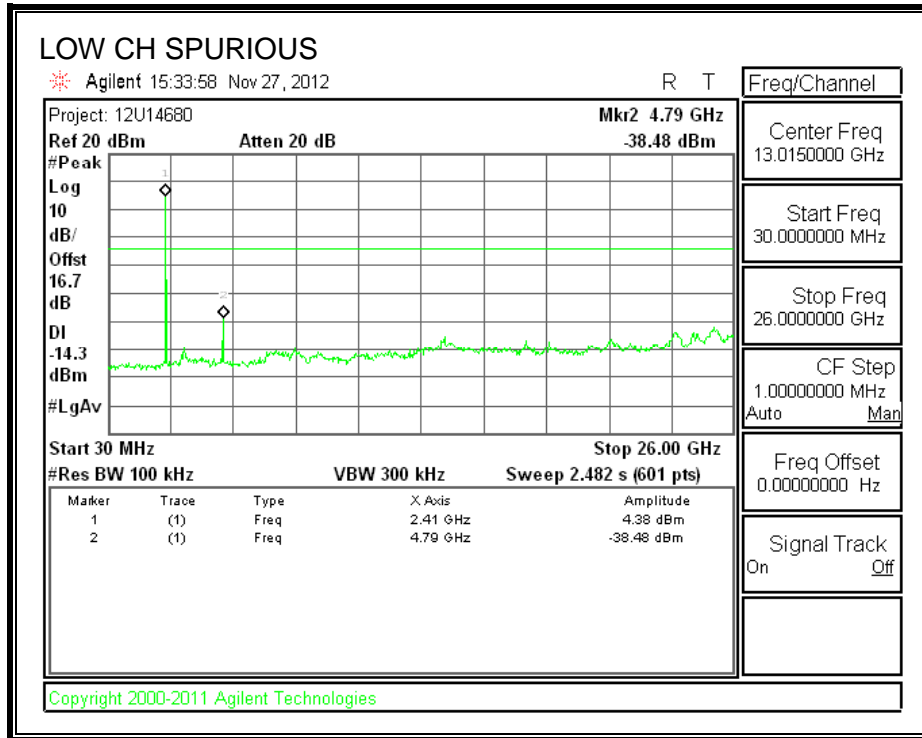
TEST PROCEDURE

KDB 558074 D01 DTS Meas Guidance v02 "Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) Operating Under 15.247", dated 10/04/12".

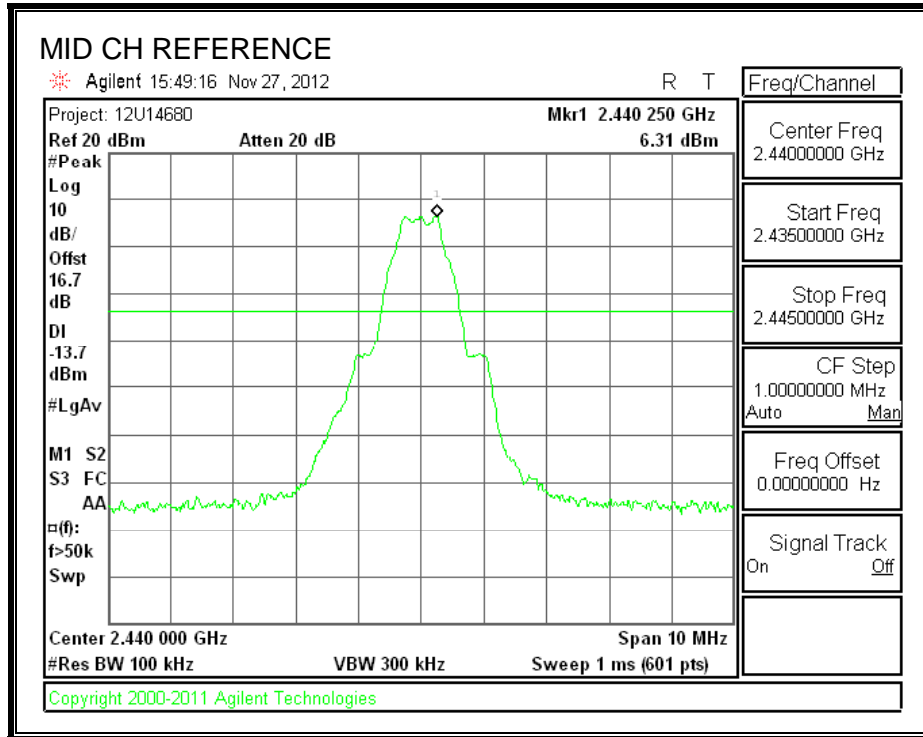
RESULTS

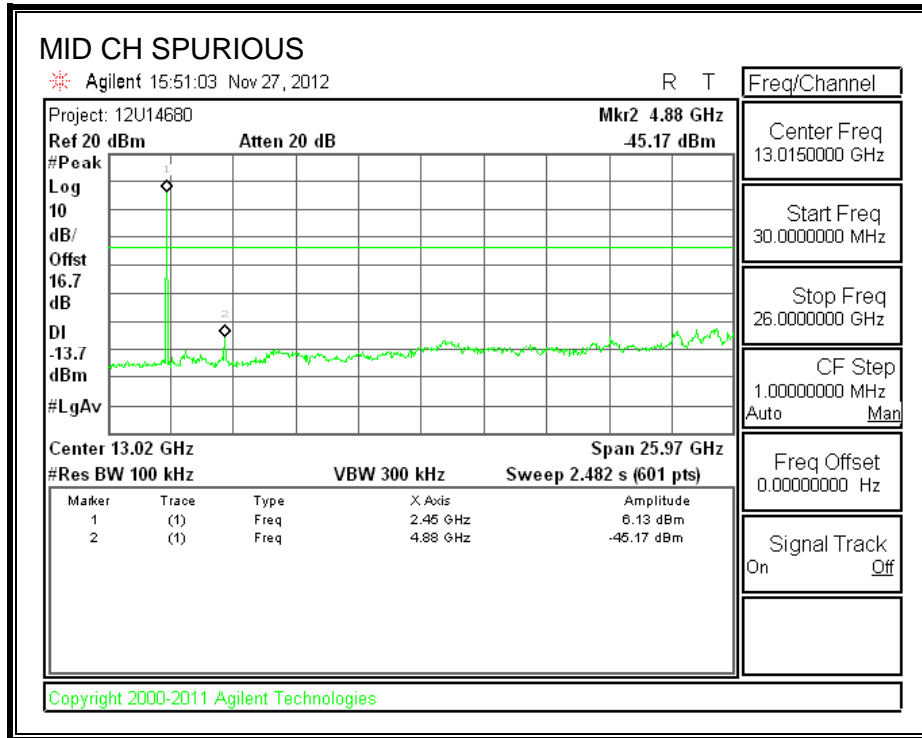
SPURIOUS EMISSIONS, LOW CHANNEL



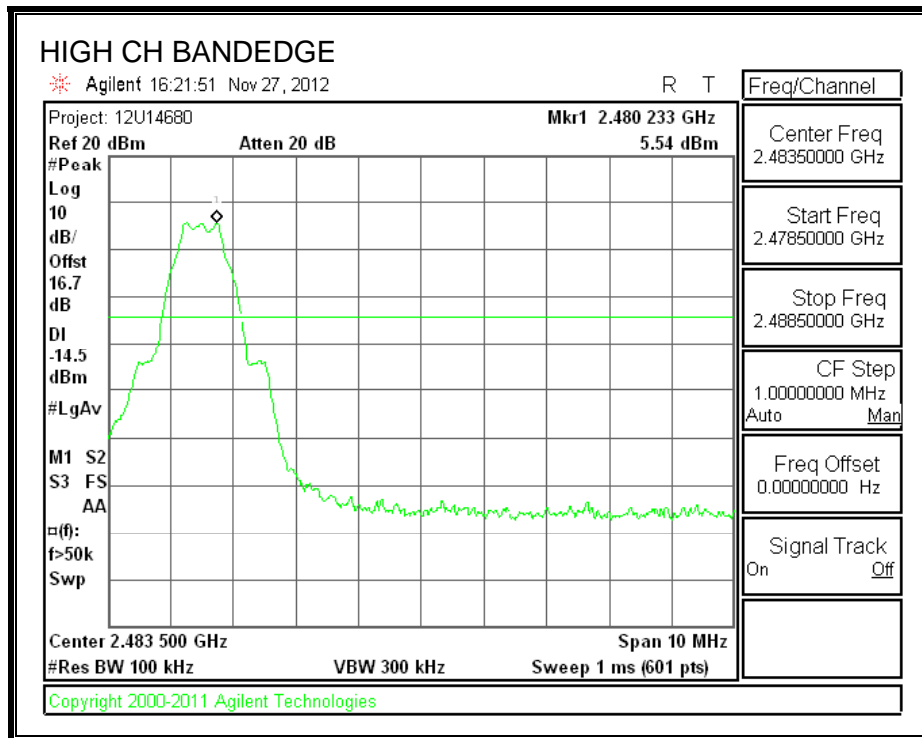


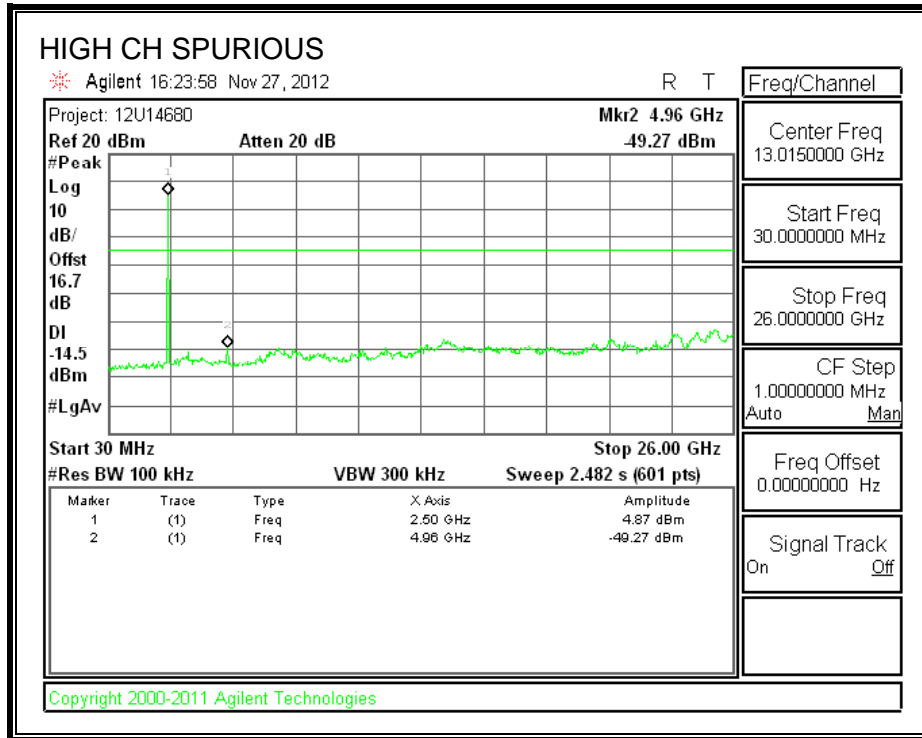
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

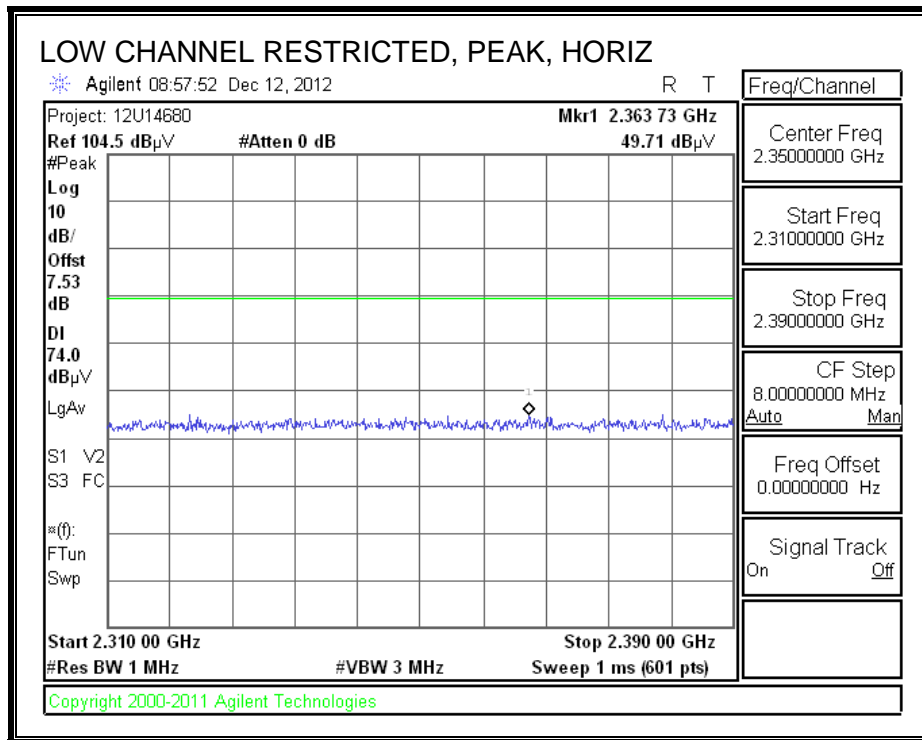
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

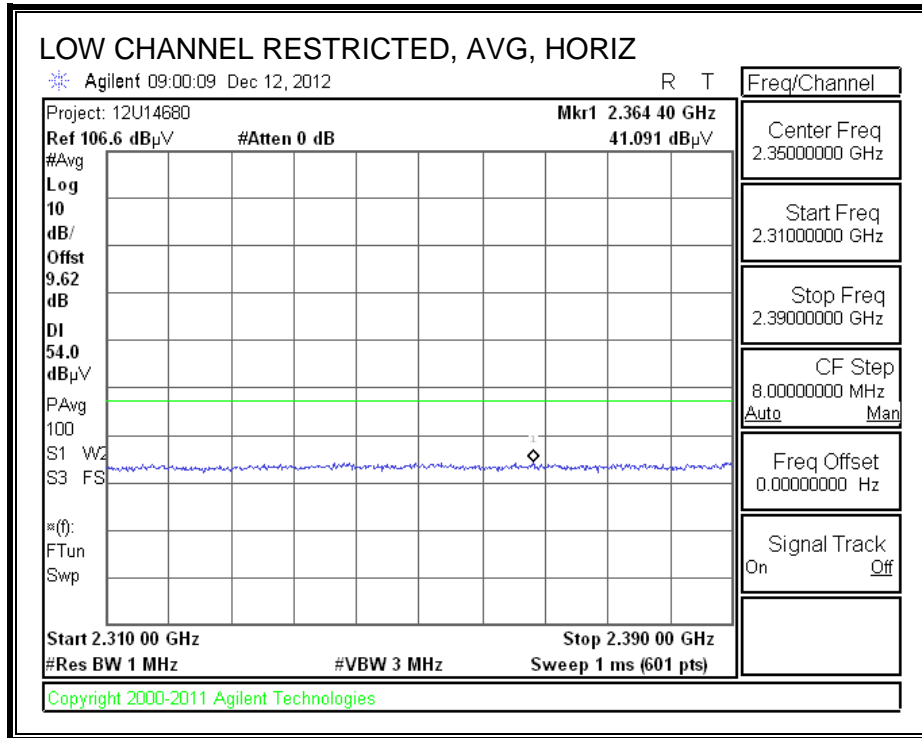
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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

8.2. TRANSMITTER ABOVE 1 GHz

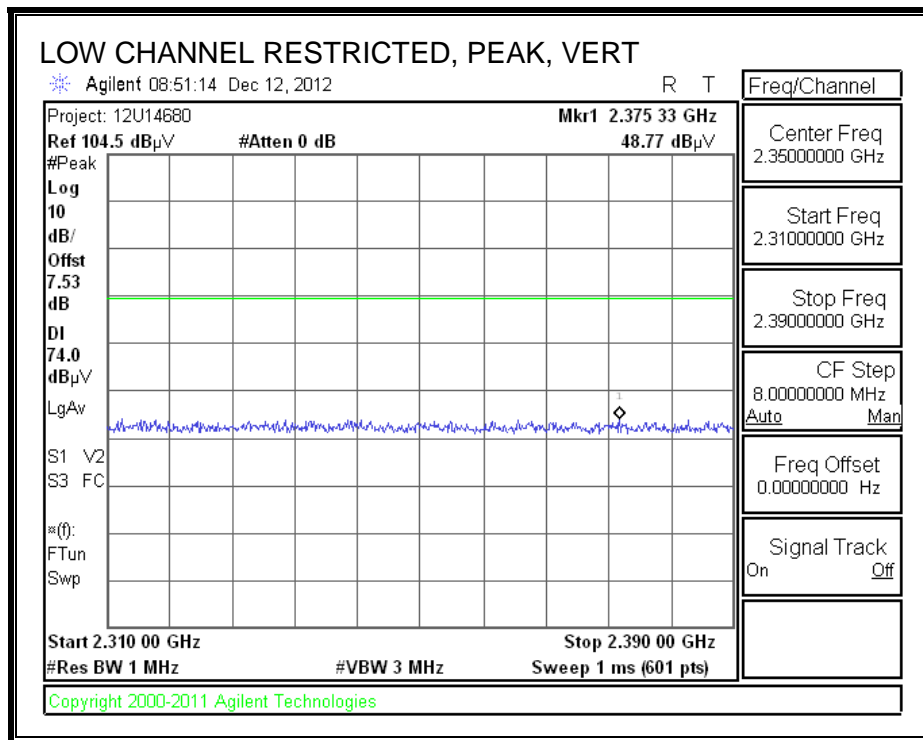
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

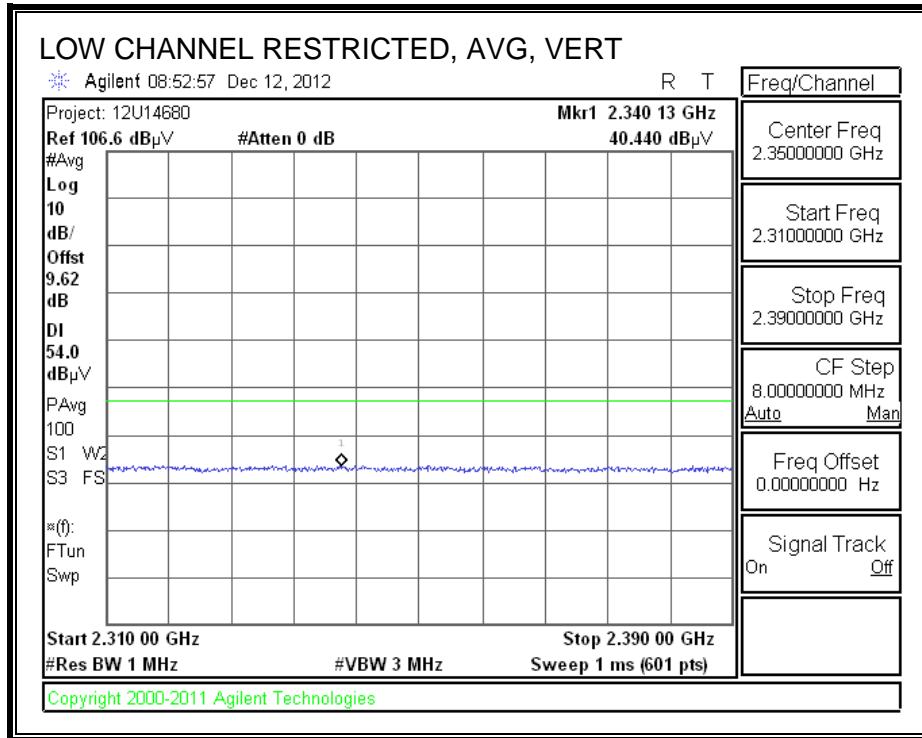




Note: Because the duty cycle is less than 98%, RL Offset for Average = AF + Cable Loss + attenuator – Amplifier Gain + 10 log (1/ duty cycle) = 7.53 + 2.09 = 9.62

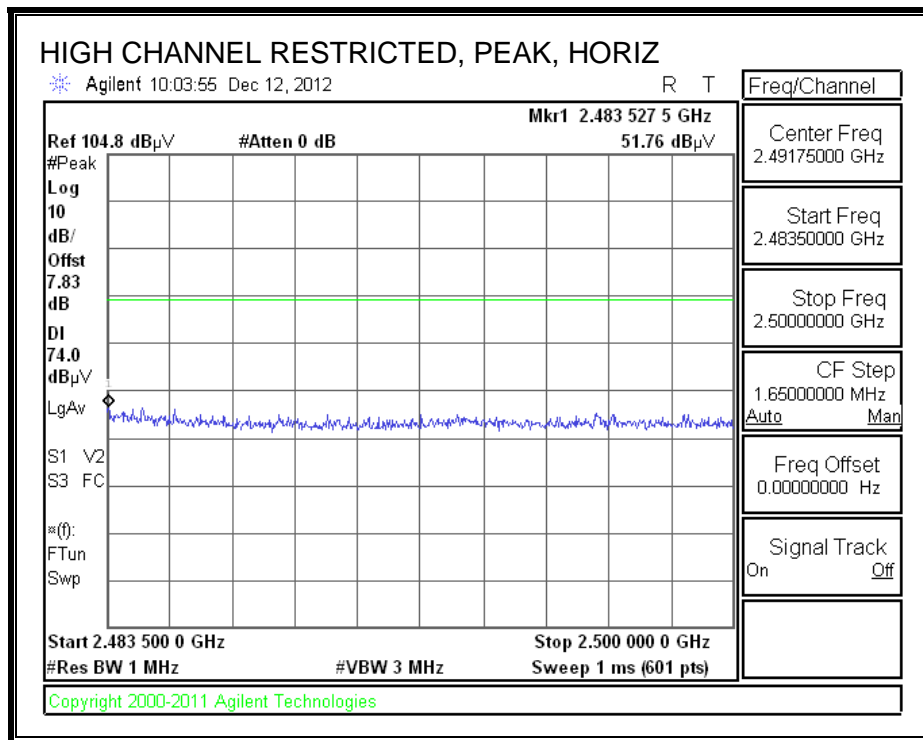
RESTRICTED BANDEGE (LOW CHANNEL, VERTICAL)

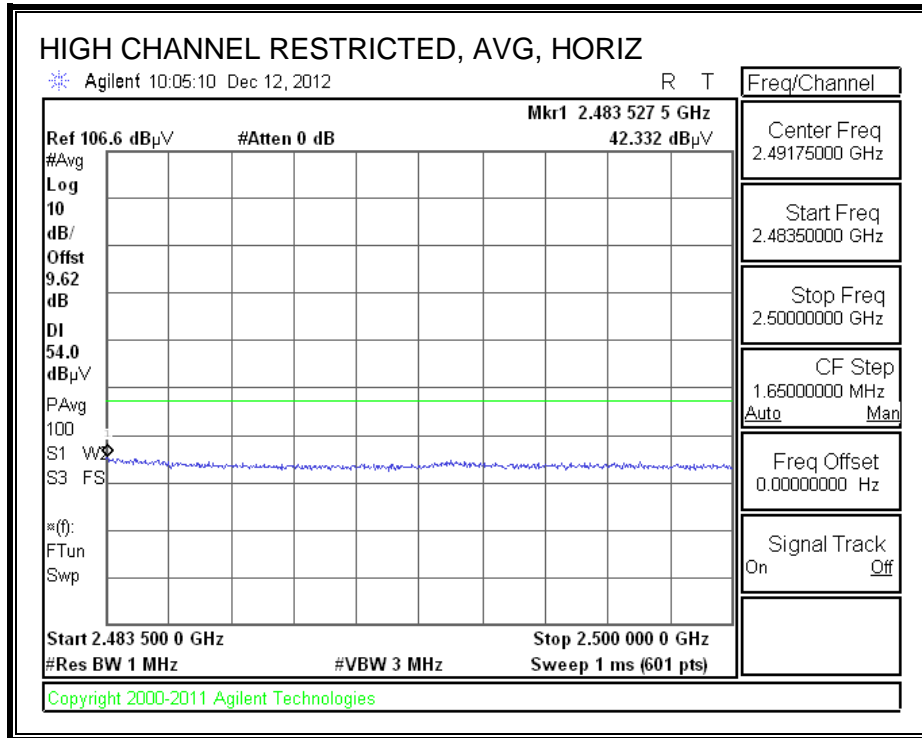




Note: Because the duty cycle is less than 98%, RL Offset for Average = AF + Cable Loss + attenuator – Amplifier Gain + 10 log (1/ duty cycle) = 7.53 + 2.09 = 9.62

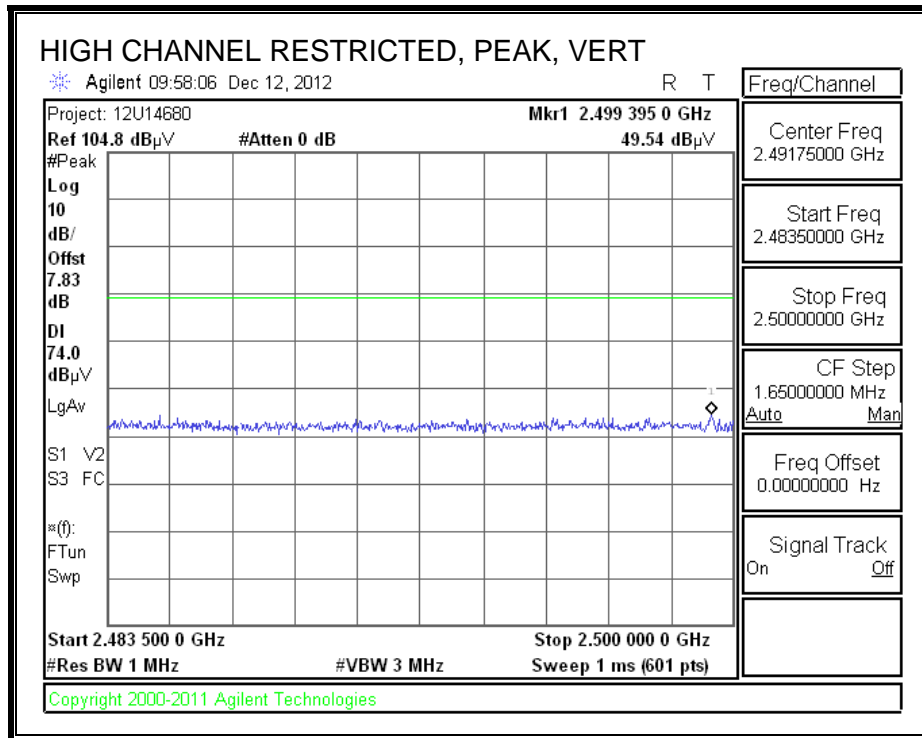
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

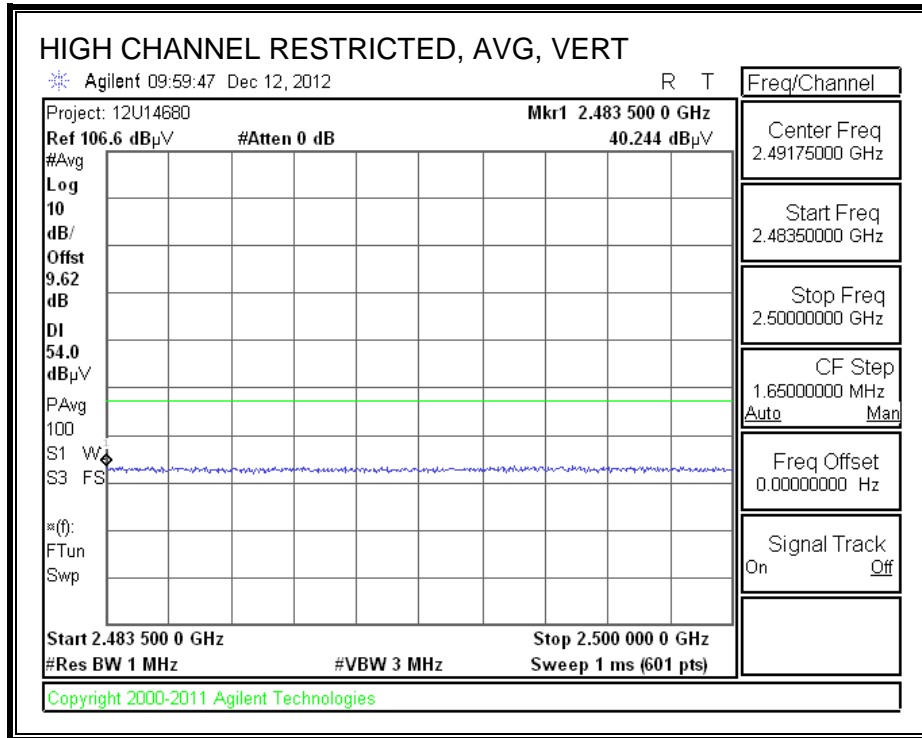




Note: Because the duty cycle is less than 98%, RL Offset for Average = AF + Cable Loss + attenuator – Amplifier Gain + 10 log (1/ duty cycle) = 7.53 + 2.09 = 9.62

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





Note: Because the duty cycle is less than 98%, RL Offset for Average = AF + Cable Loss + attenuator – Amplifier Gain + 10 log (1/ duty cycle) = 7.53 + 2.09 = 9.62

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Oliver Su
 Date: 11/28/12
 Project #: 12U14680
 Company: Apple
 Test Target: FCC IC
 Mode Oper: BTLE, Tx continuously

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

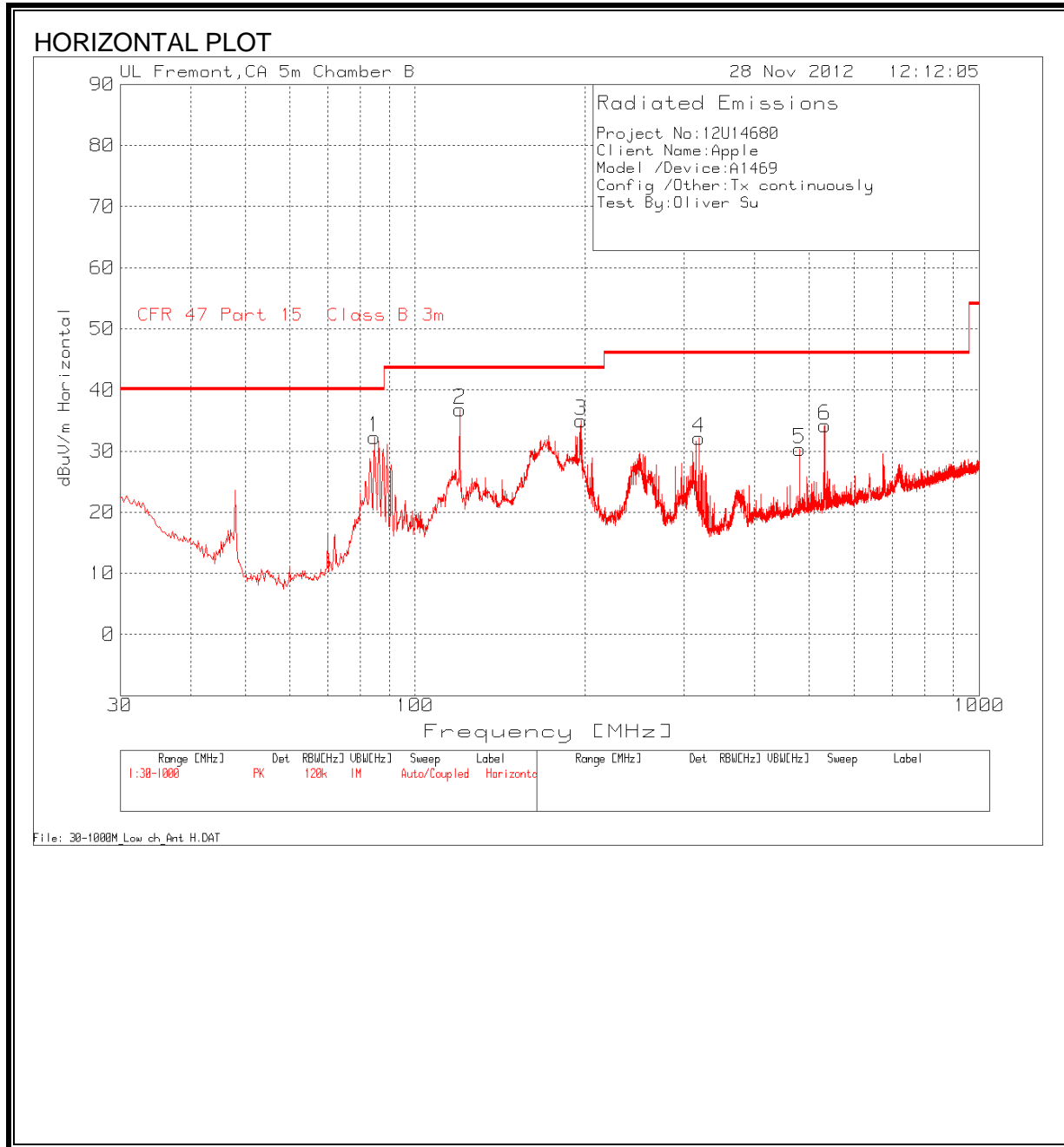
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/Q/P	Ant.High cm	Table Angle Degree	Notes
High Ch (2480MHz)															
4.960	3.0	46.7	33.2	6.4	-34.8	0.0	0.0	51.5	74.0	-22.5	H	P	100.4	225.9	
4.960	3.0	35.8	33.2	6.4	-34.8	0.0	0.0	40.6	54.0	-13.4	H	A	100.4	225.9	
4.960	3.0	46.8	33.2	6.4	-34.8	0.0	0.0	51.6	74.0	-22.4	V	P	104.4	326.9	
4.960	3.0	36.2	33.2	6.4	-34.8	0.0	0.0	41.0	54.0	-13.0	V	A	104.4	326.9	
Mid Ch (2440MHz)															
4.880	3.0	46.7	33.1	6.3	-34.8	0.0	0.0	51.4	74.0	-22.6	V	P	153.8	327.4	
4.880	3.0	35.9	33.1	6.3	-34.8	0.0	0.0	40.5	54.0	-13.5	V	A	153.8	327.4	
4.880	3.0	48.6	33.1	6.3	-34.8	0.0	0.0	53.2	74.0	-20.8	H	P	103.9	226.2	
4.880	3.0	37.5	33.1	6.3	-34.8	0.0	0.0	42.2	54.0	-11.8	H	A	103.9	226.2	
Low Ch (2402 MHz)															
4.804	3.0	51.3	33.1	6.3	-34.8	0.0	0.0	55.9	74.0	-18.1	H	P	130.5	227.9	
4.804	3.0	39.8	33.1	6.3	-34.8	0.0	0.0	44.3	54.0	-9.7	H	A	130.5	227.9	
4.804	3.0	50.3	33.1	6.3	-34.8	0.0	0.0	54.8	74.0	-19.2	V	P	102.6	334.3	
4.804	3.0	38.7	33.1	6.3	-34.8	0.0	0.0	43.2	54.0	-10.8	V	A	102.6	334.3	

Rev. 4.1.2.7

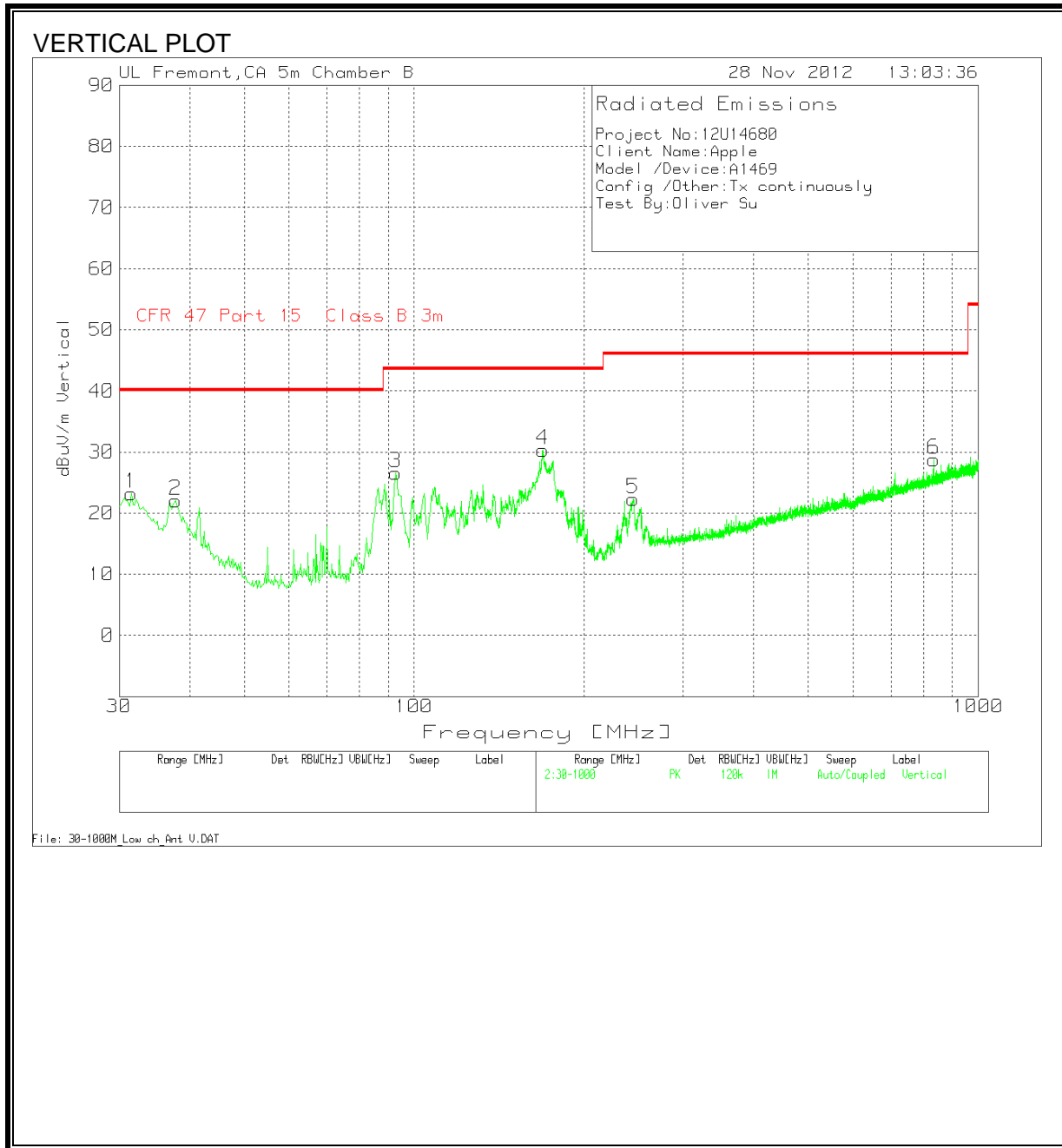
Note: No other emissions were detected above the system noise floor.

8.3. WORST-CASE BELOW 1 GHz

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



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



HORIZONTAL DATA AND VERTICAL DATA

Project No:12U14680
 Client Name:Apple
 Model /Device:A1469
 Config /Other:Tx continuously
 Test By:Oliver Su

Horizontal 30 - 1000MHz

Test Frequency	Meter Reading	Detector	T122 Sunol Bilog.TXT (dB)	5mB Amp Path 30-1000MHz (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Polarity
84.6643	53.32	PK	7.7	-28.7	32.32	40	-7.68	Horz
119.944	50.95	PK	14.1	-28.3	36.75	43.5	-6.75	Horz
197.0943	50.34	PK	12.3	-27.6	35.04	43.5	-8.46	Horz
318.6351	45.16	PK	13.8	-26.8	32.16	46	-13.84	Horz
480.1079	39.78	PK	17.6	-27	30.38	46	-15.62	Horz
532.8337	43.05	PK	18	-26.8	34.25	46	-11.75	Horz

Vertical 30 - 1000MHz

Test Frequency	Meter Reading	Detector	T122 Sunol Bilog.TXT (dB)	5mB Amp Path 30-1000MHz (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Polarity
31.5508	32.27	PK	20.3	-29.3	23.27	40	-16.73	Vert
37.7538	35.8	PK	15.5	-29.2	22.1	40	-17.9	Vert
92.6119	46.98	PK	8.2	-28.6	26.58	43.5	-16.92	Vert
169.1807	46.27	PK	11.9	-27.8	30.37	43.5	-13.13	Vert
244.7802	37.83	PK	11.7	-27.2	22.33	46	-23.67	Vert
833.6811	32.24	PK	21.7	-25.2	28.74	46	-17.26	Vert

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

6 WORST EMISSIONS

Project No:12U14680
 Client Name:Apple
 Model/Device:A1469
 Test Volt/Freq:120 VAC / 60 Hz
 Test By:Tom Chen

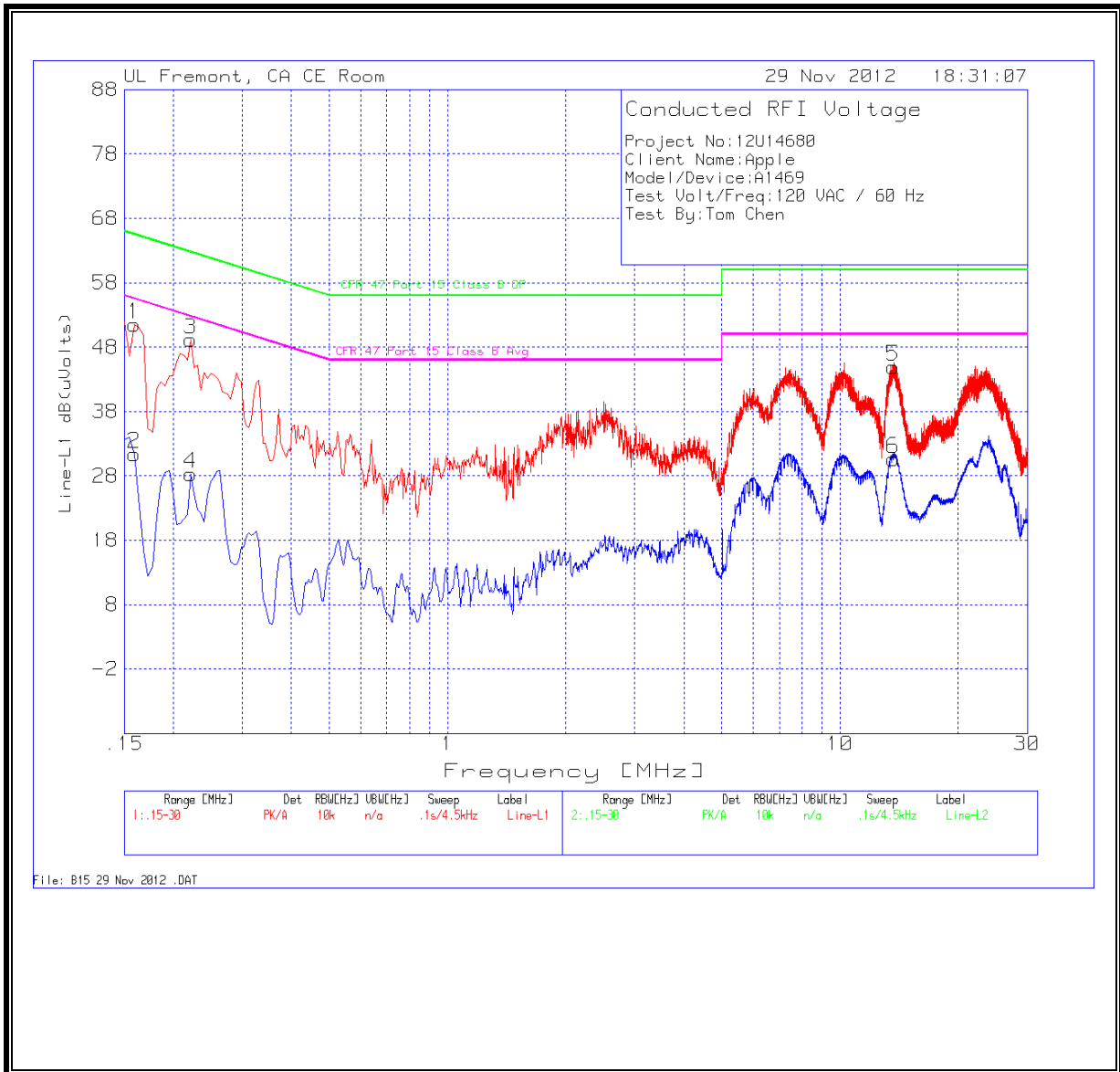
Line-L1 .15 - 30MHz

Test Frequency	Meter Reading	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.159	51.41	PK	0.1	0	51.51	65.5	-13.99	-	-
0.159	31.25	Av	0.1	0	31.35	-	-	55.5	-24.15
0.222	49.03	PK	0.1	0	49.13	62.7	-13.57	-	-
0.222	28.16	Av	0.1	0	28.26	-	-	52.7	-24.44
13.659	44.57	PK	0.2	0.2	44.97	60	-15.03	-	-
13.659	30.23	Av	0.2	0.2	30.63	-	-	50	-19.37

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
0.1995	46.71	PK	0.1	0	46.81	63.6	-16.79	-	-
0.1995	23.53	Av	0.1	0	23.63	-	-	53.6	-29.97
0.2625	45.57	PK	0.1	0	45.67	61.4	-15.73	-	-
0.2625	25.84	Av	0.1	0	25.94	-	-	51.4	-25.46
9.5235	42.43	PK	0.1	0.2	42.73	60	-17.27	-	-
9.5235	27.66	Av	0.1	0.2	27.96	-	-	50	-22.04

LINE 1 RESULTS



LINE 2 RESULTS

