



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

**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: 12U14680-9, Revision A**

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**NVLAP LAB CODE 200065-0**

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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 15-29, 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:

Tested By:



FRANK IBRAHIM  
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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	Basic GFSK	11.13	12.97
2402 - 2480	DQPSK	12.68	18.54
2402 - 2480	Enhanced 8PSK	12.73	18.75

### 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.

The worst-case data rate for each mode is determined to be as follows, based on input from the manufacturer of the radio.

All final tests in the GFSK mode were made at 1 Mb/s.  
All final tests in the 8PSK mode were made at 3 Mb/s.

For radiated emissions below 1 GHz and power line conducted emissions the channel with the highest output power was selected as worst-case scenario.



## 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

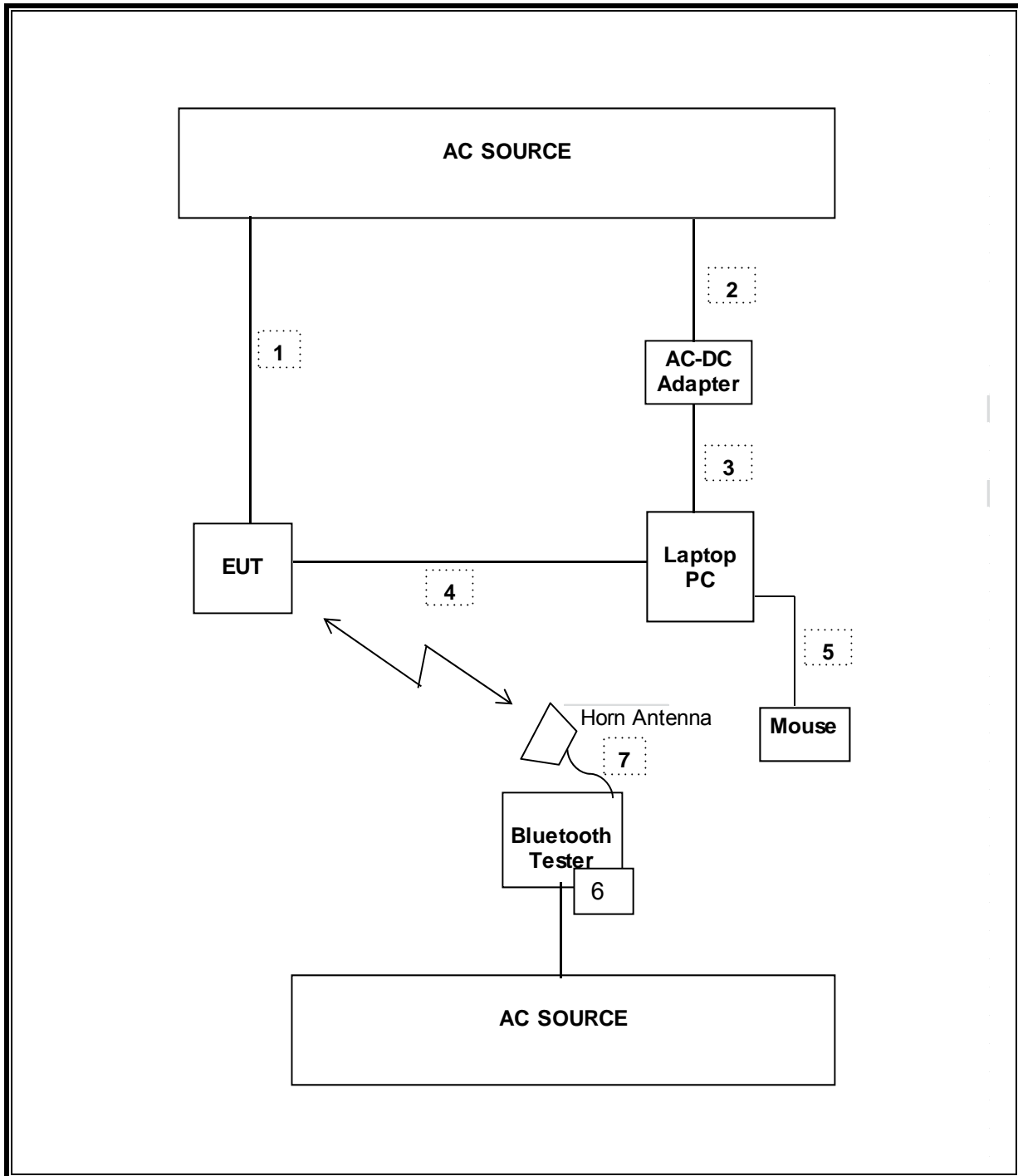
### I/O CABLES

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
Horn Antenna, 18 GHz	ARA	MWH-1826/B	C00980	11/14/12	11/14/13

## 7. ANTENNA PORT TEST RESULTS

### 7.1. BASIC DATA RATE GFSK MODULATION

#### 7.1.1. 20 dB AND 99% BANDWIDTH

##### LIMIT

None; for reporting purposes only.

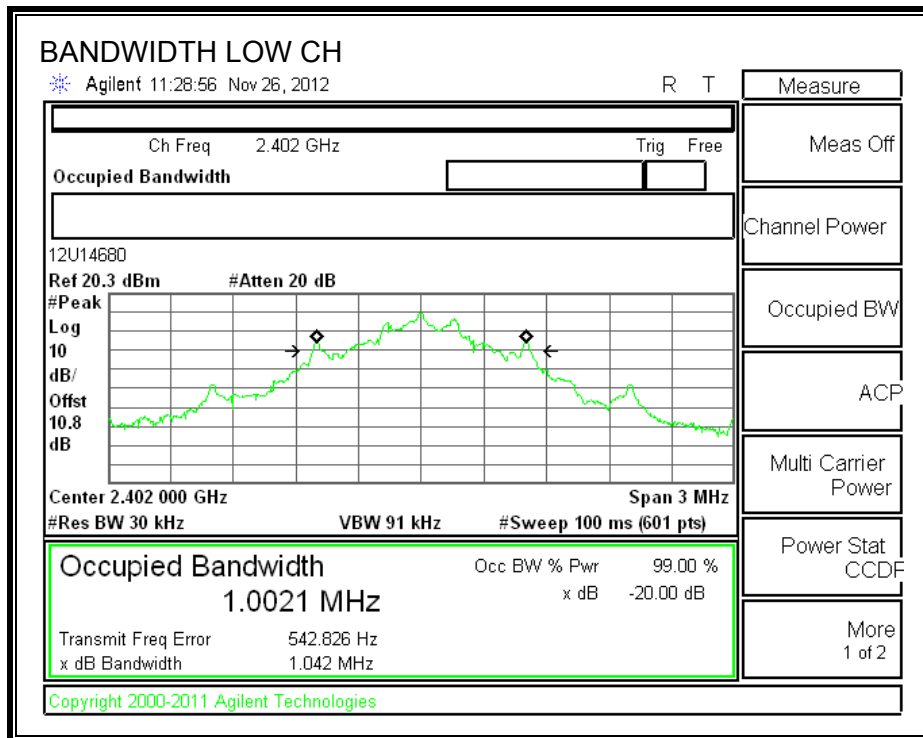
##### TEST PROCEDURE

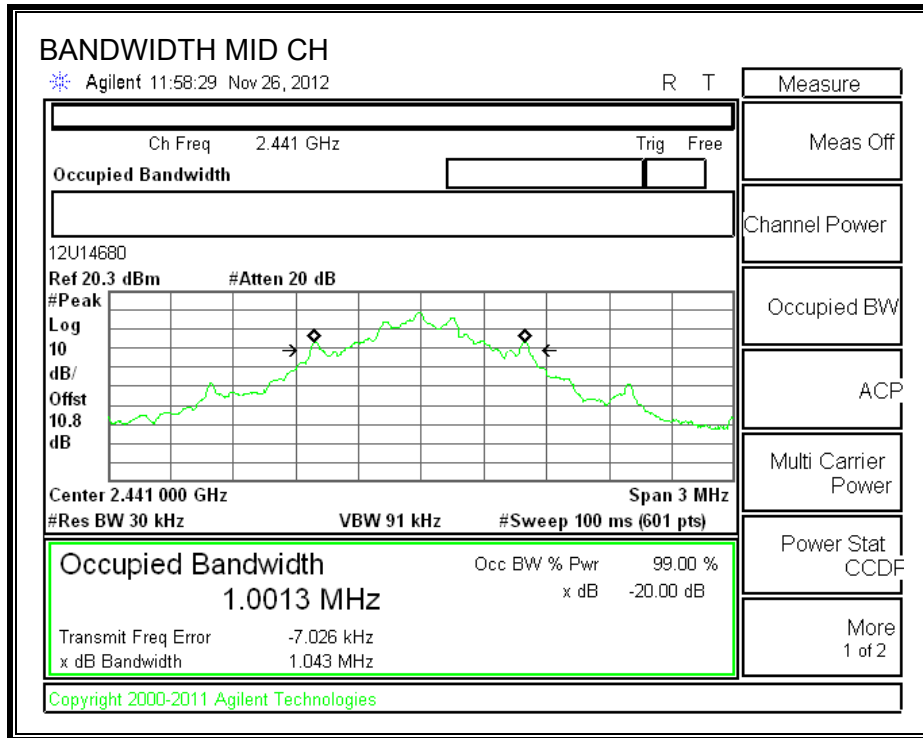
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

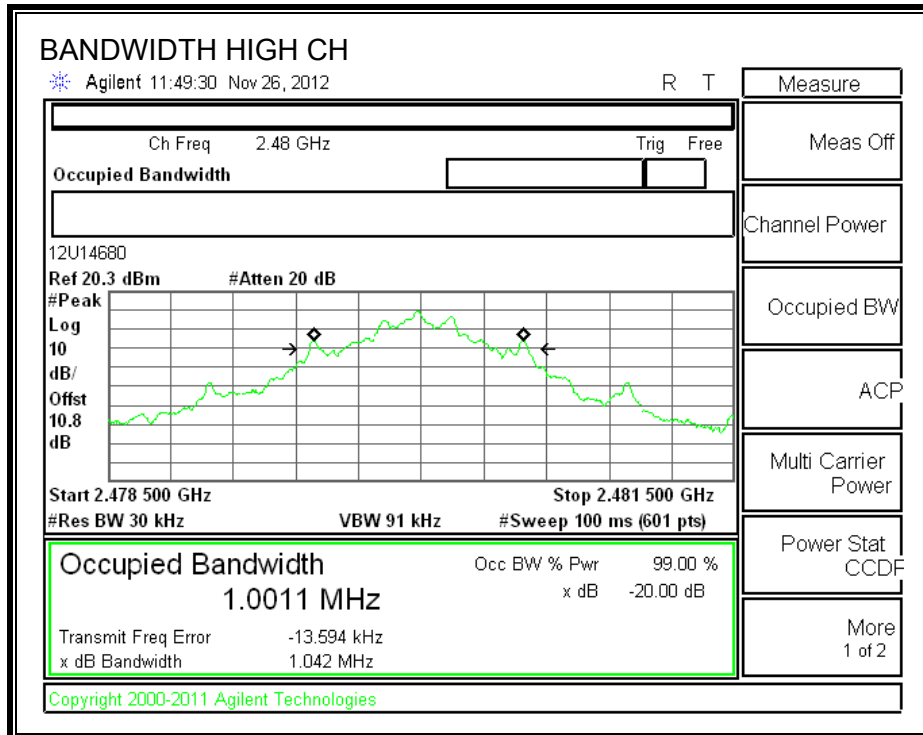
##### RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1042	1006.0
Middle	2441	1043	1008.0
High	2480	1042	1006.8

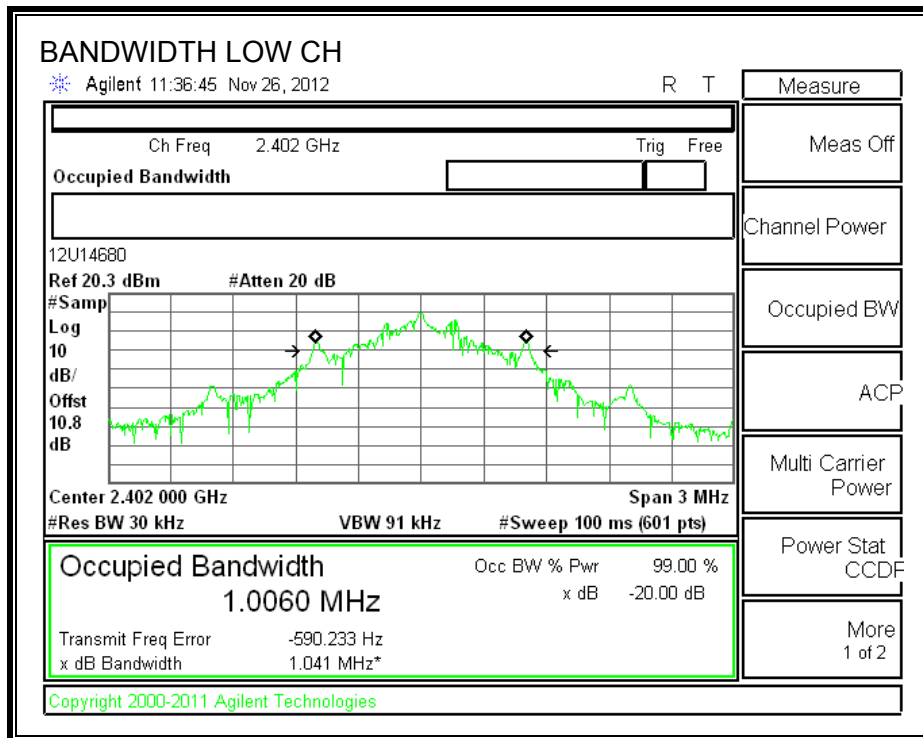
**20 dB BANDWIDTH**



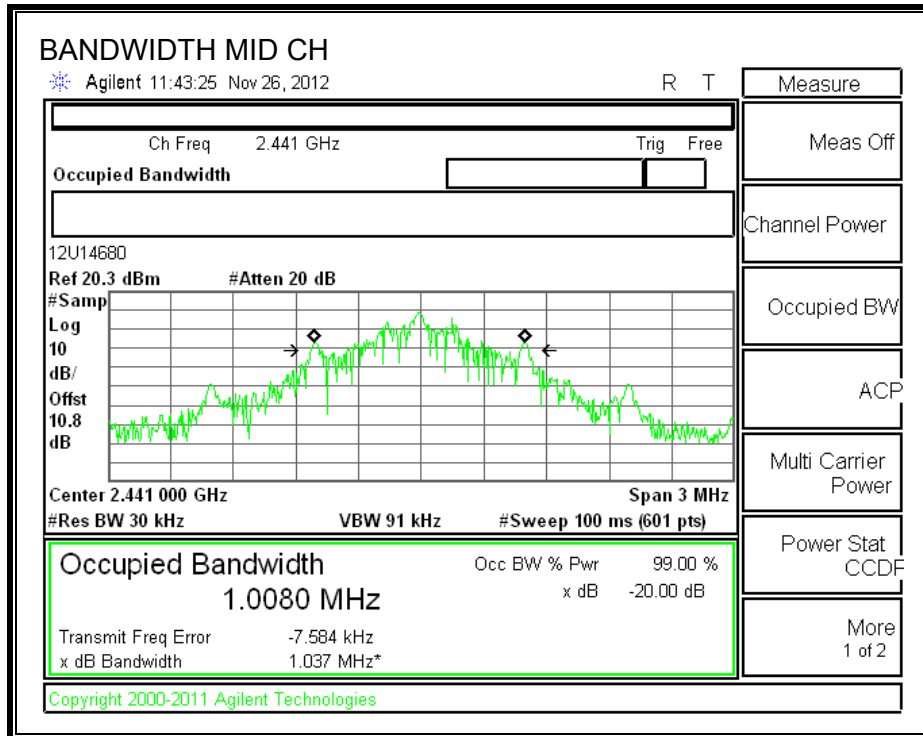


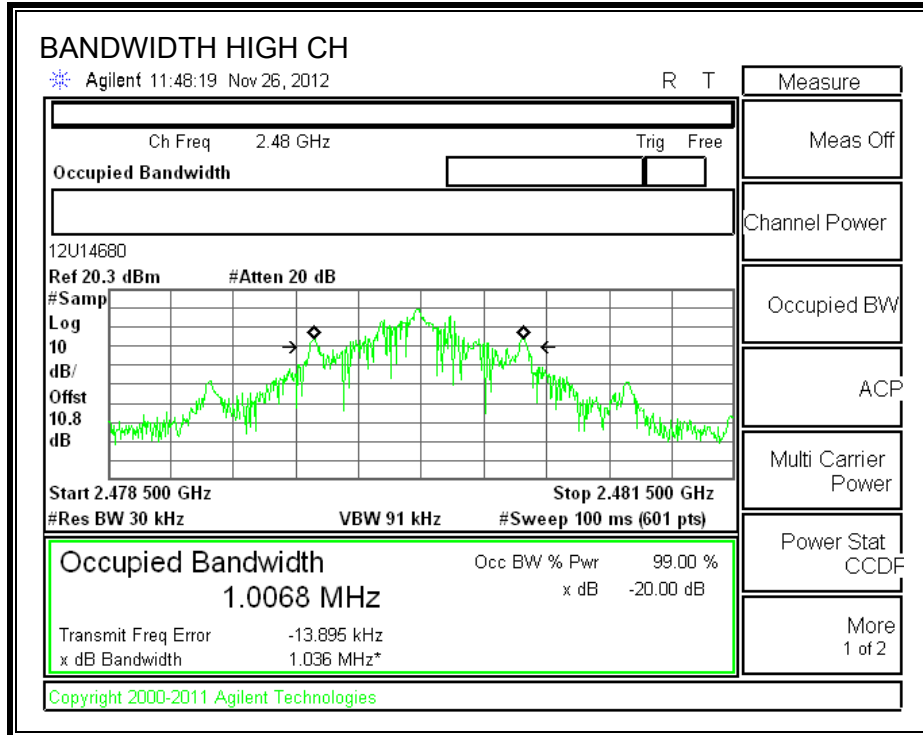


**99% BANDWIDTH**









## 7.1.2. HOPPING FREQUENCY SEPARATION

### LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

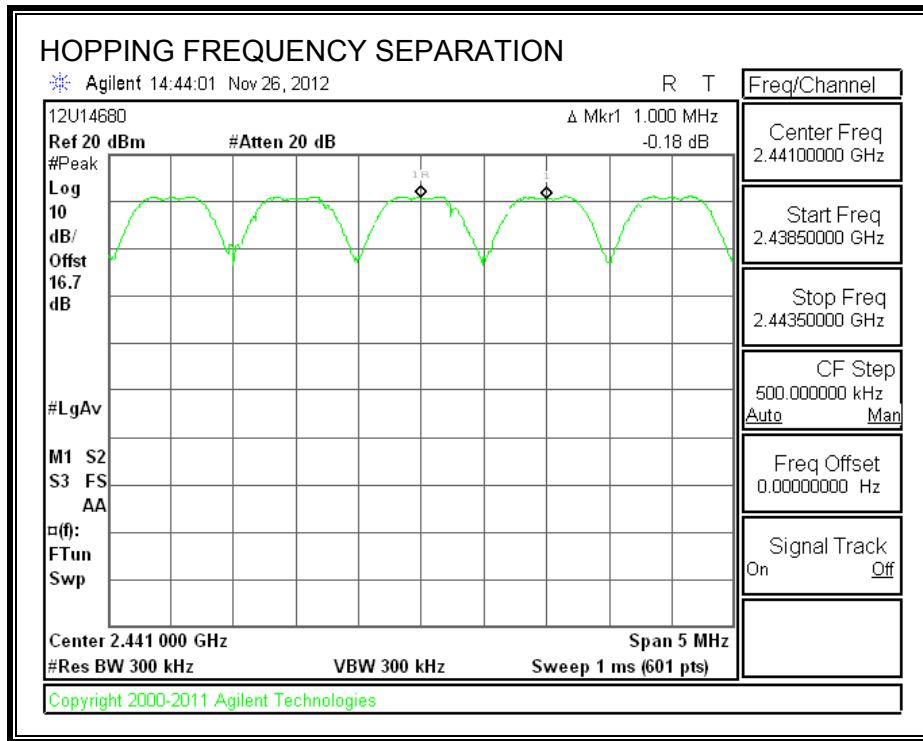
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

**RESULTS**

**HOPPING FREQUENCY SEPARATION**



### **7.1.3. NUMBER OF HOPPING CHANNELS**

#### **LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

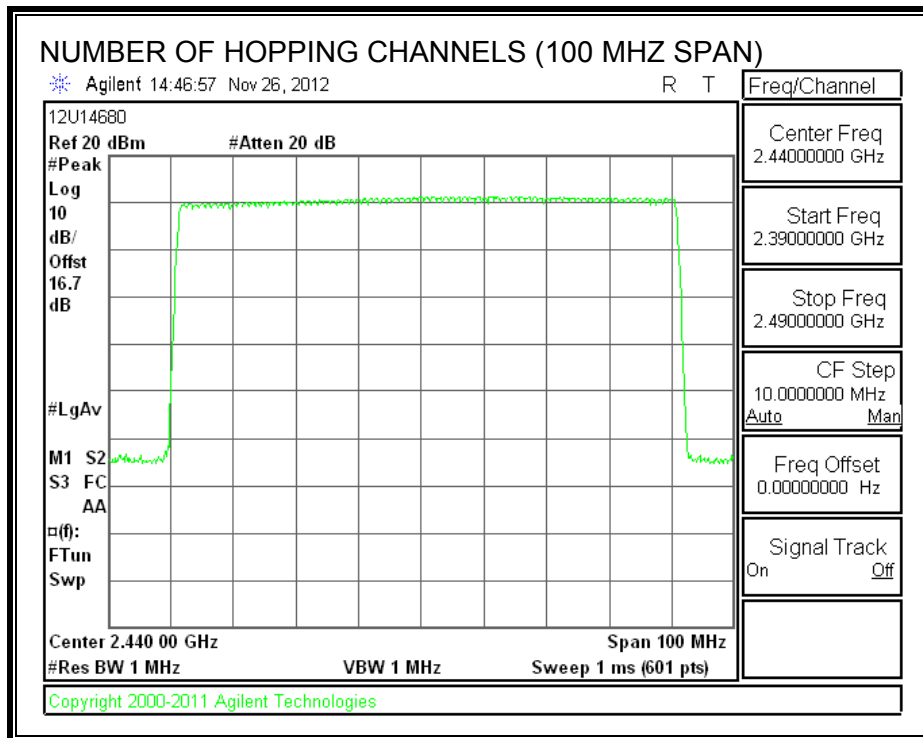
#### **TEST PROCEDURE**

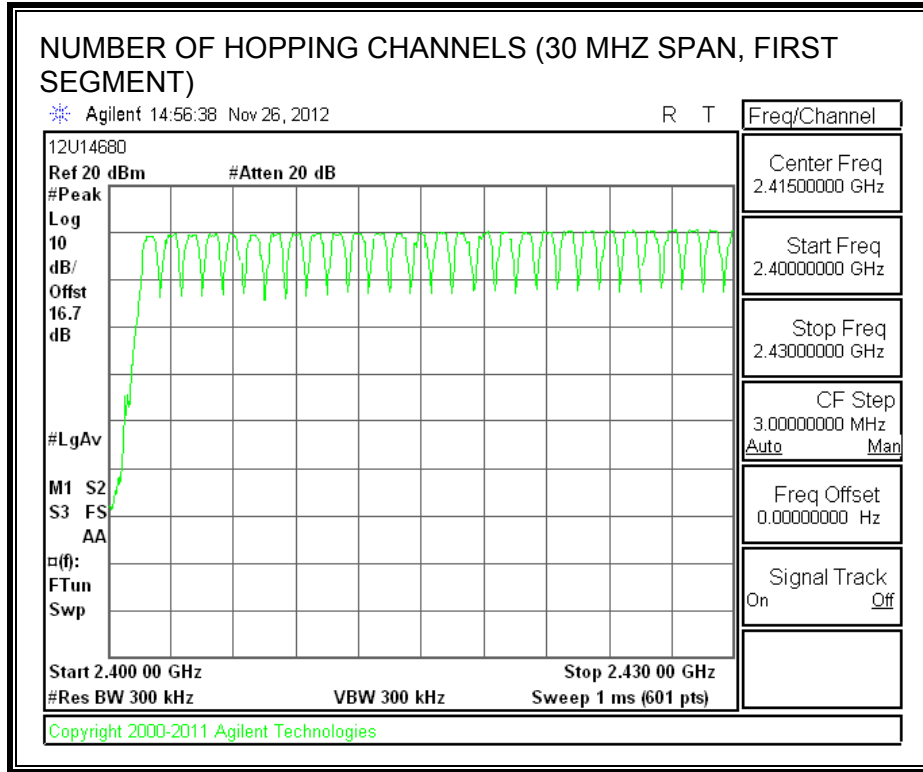
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

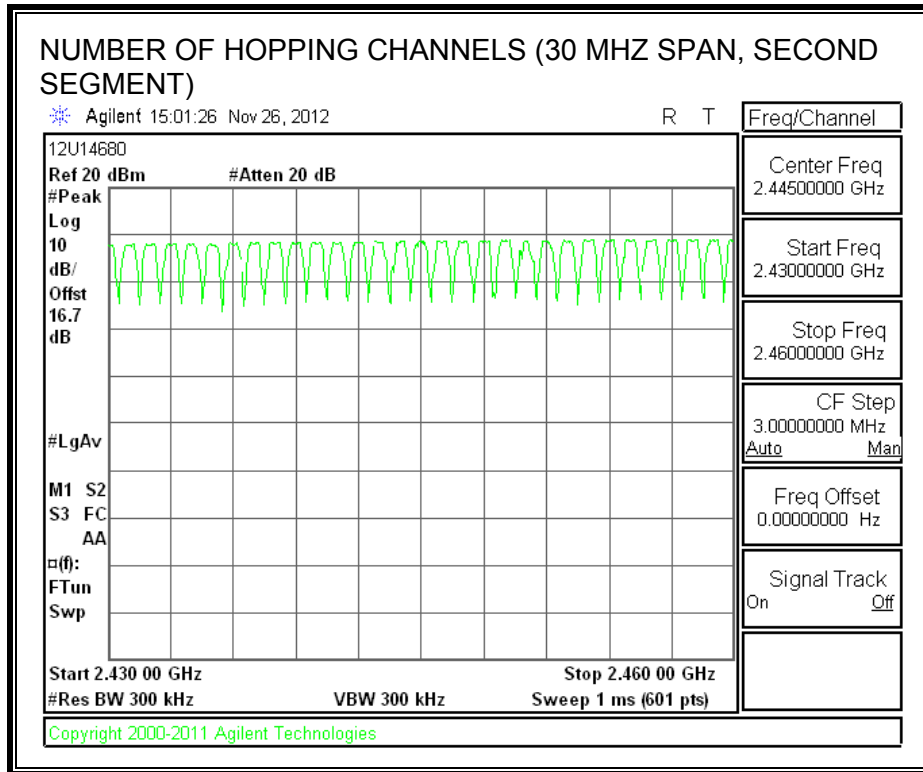
#### **RESULTS**

Normal Mode: 79 Channels observed.  
AFH Mode supports 20 Channels.

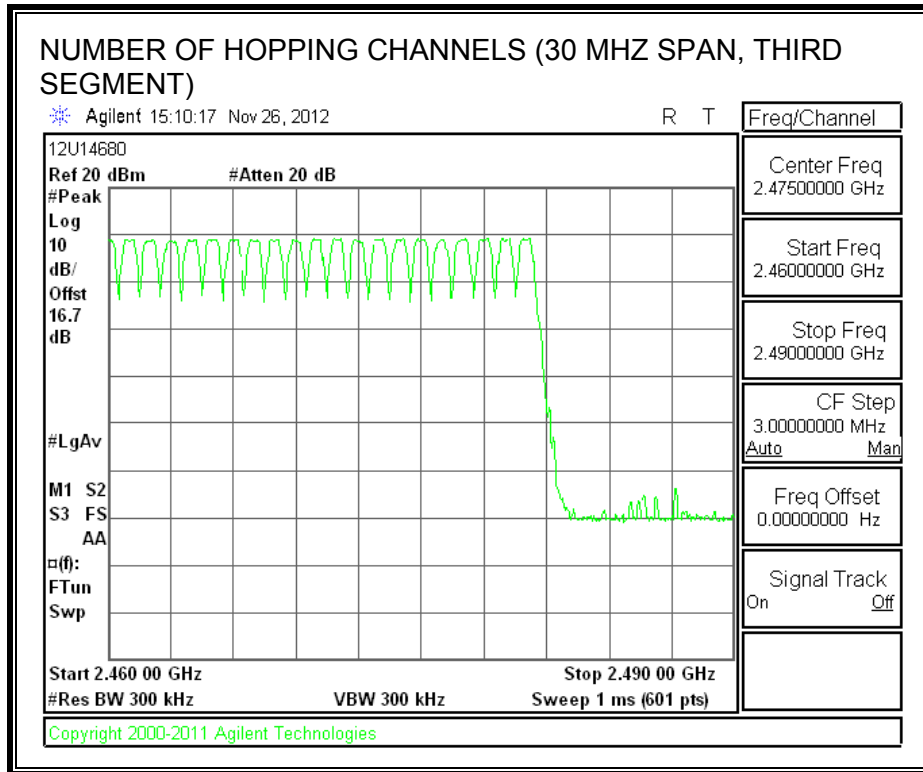
**NUMBER OF HOPPING CHANNELS**











### 7.1.4. AVERAGE TIME OF OCCUPANCY

#### LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$ .

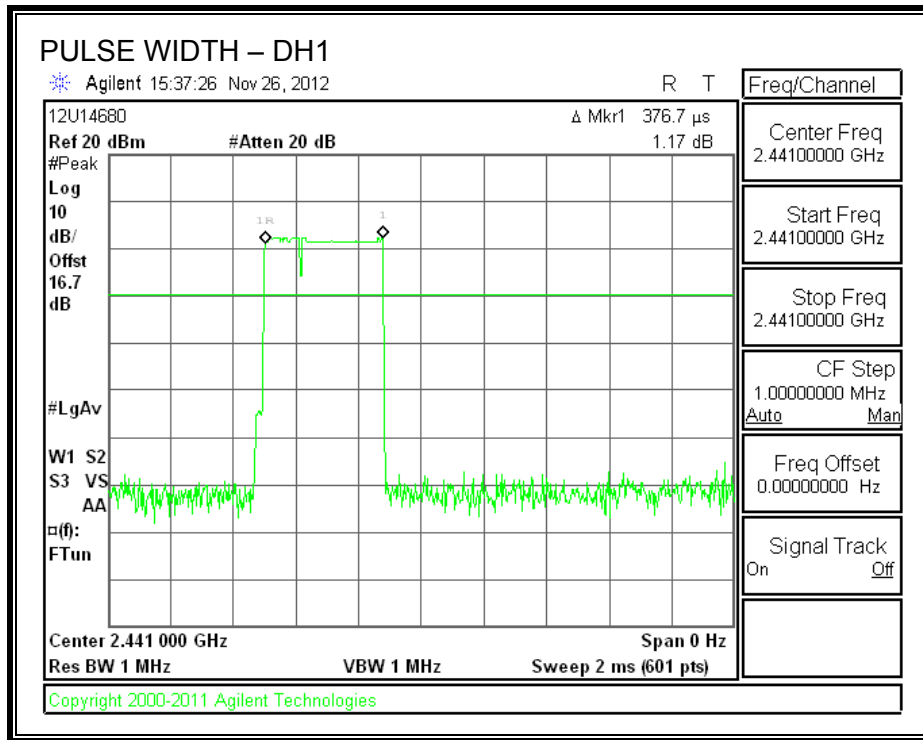
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels \* 0.4 seconds) is equal to  $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{ pulse width}$ .

#### RESULTS

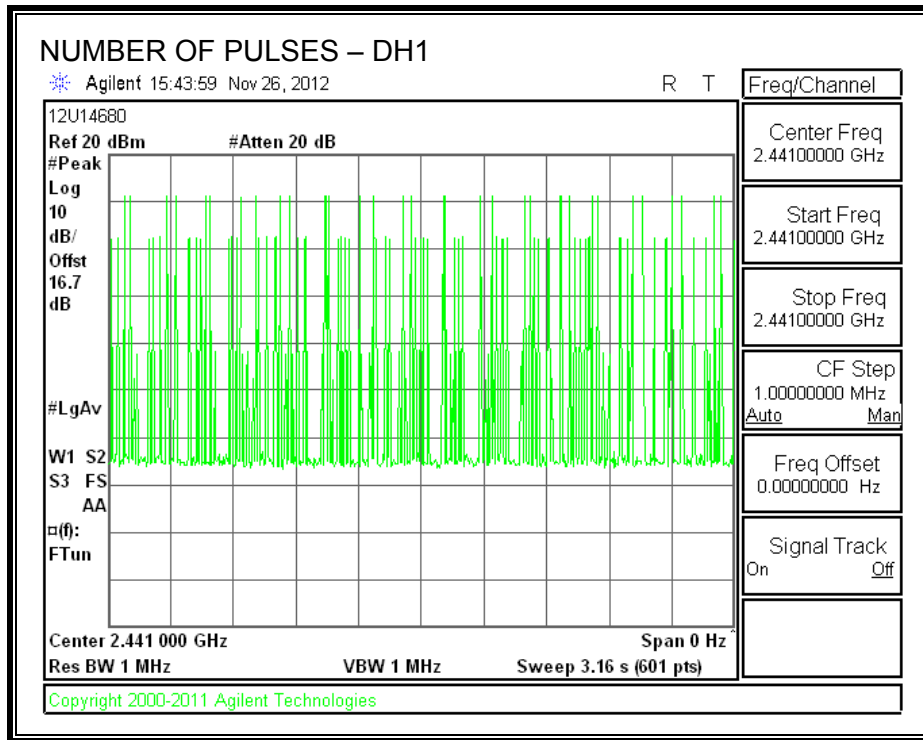
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.3767	31	0.117	0.4	-0.283
DH3	1.633	15	0.245	0.4	-0.155
DH5	2.88	10	0.288	0.4	-0.112

DH Packet	Pulse Width (msec)	Number of Pulses in 0.8	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.3767	64	0.241	0.4	-0.159
DH3	1.633	21	0.343	0.4	-0.057
DH5	2.88	13	0.374	0.4	-0.026

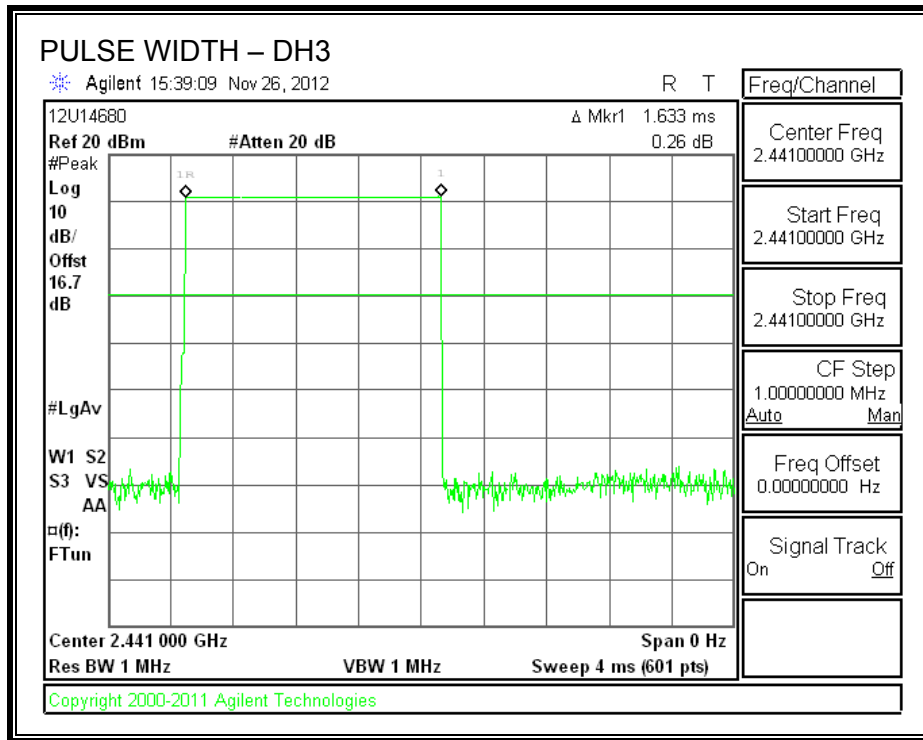
**PULSE WIDTH - DH1**



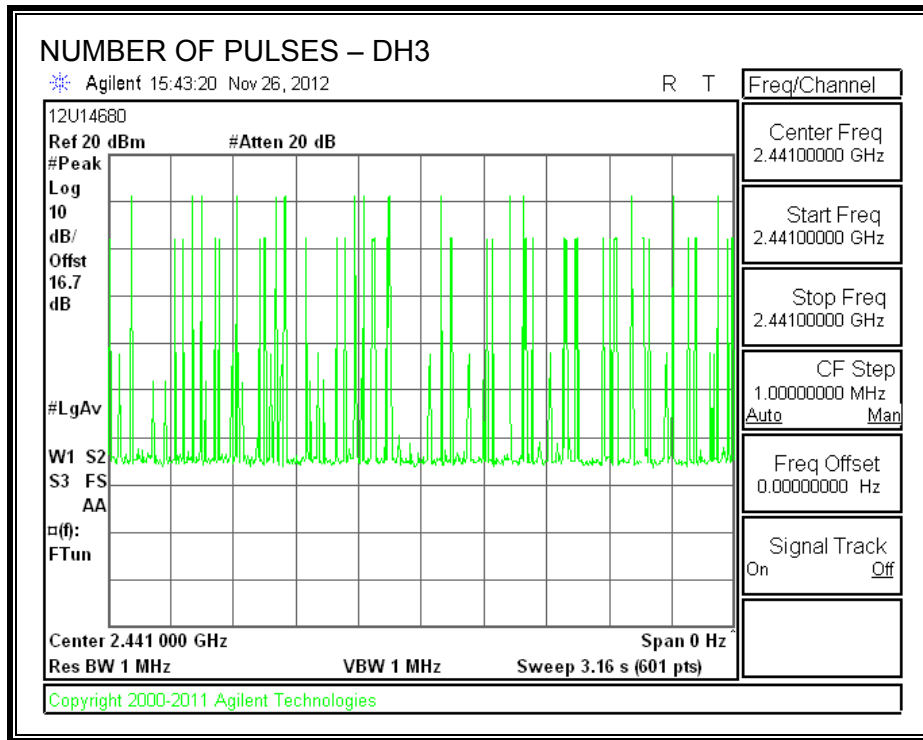
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**



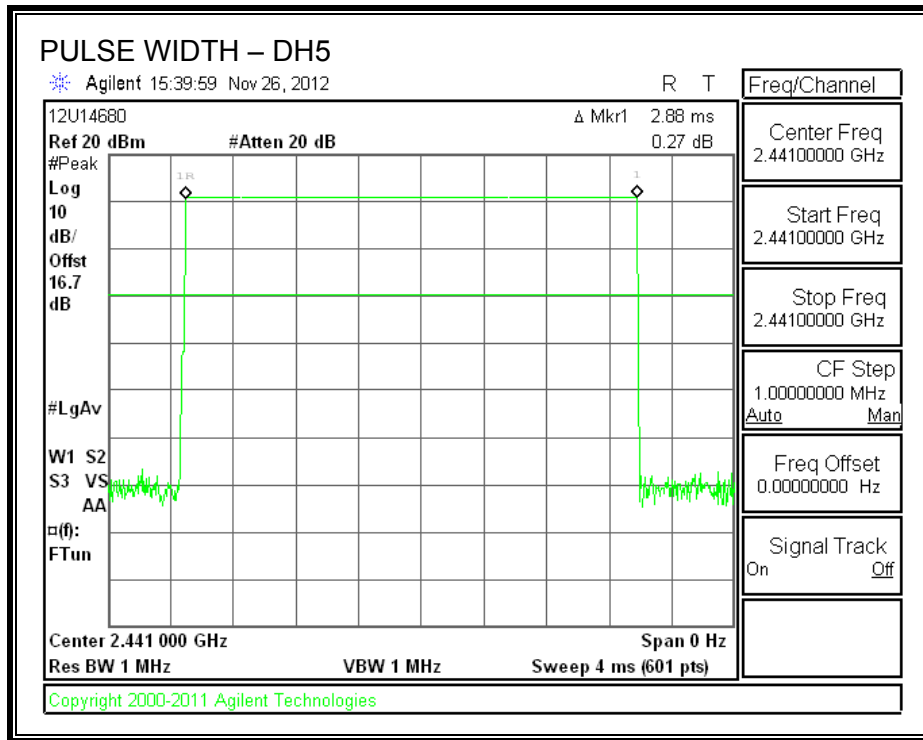
**PULSE WIDTH – DH3**



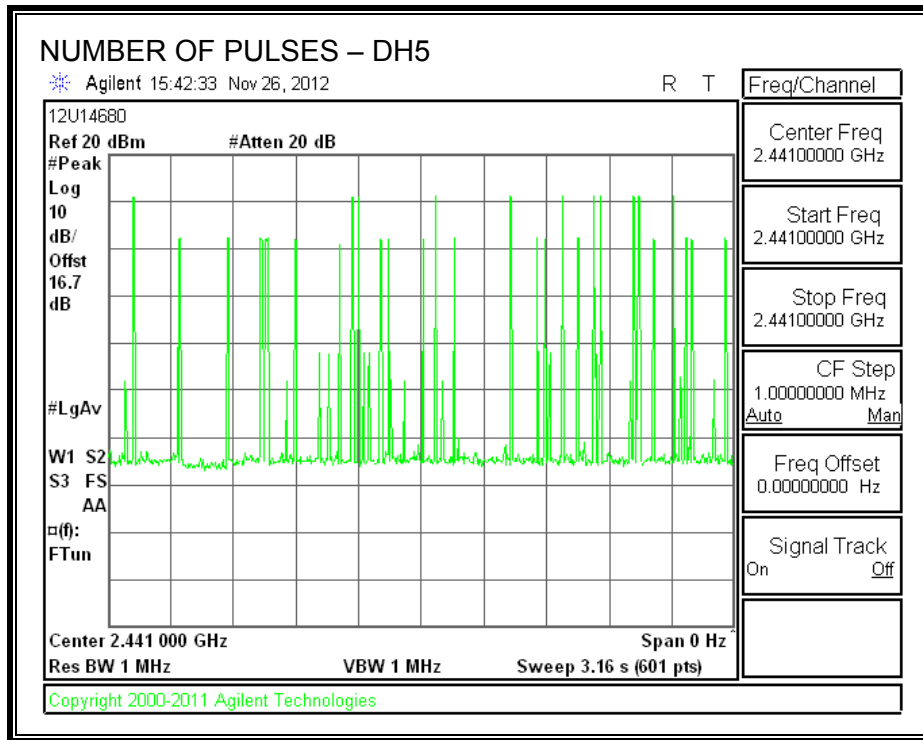
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**



**PULSE WIDTH – DH5**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**





### 7.1.5. OUTPUT POWER

#### LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 20.97 dBm.

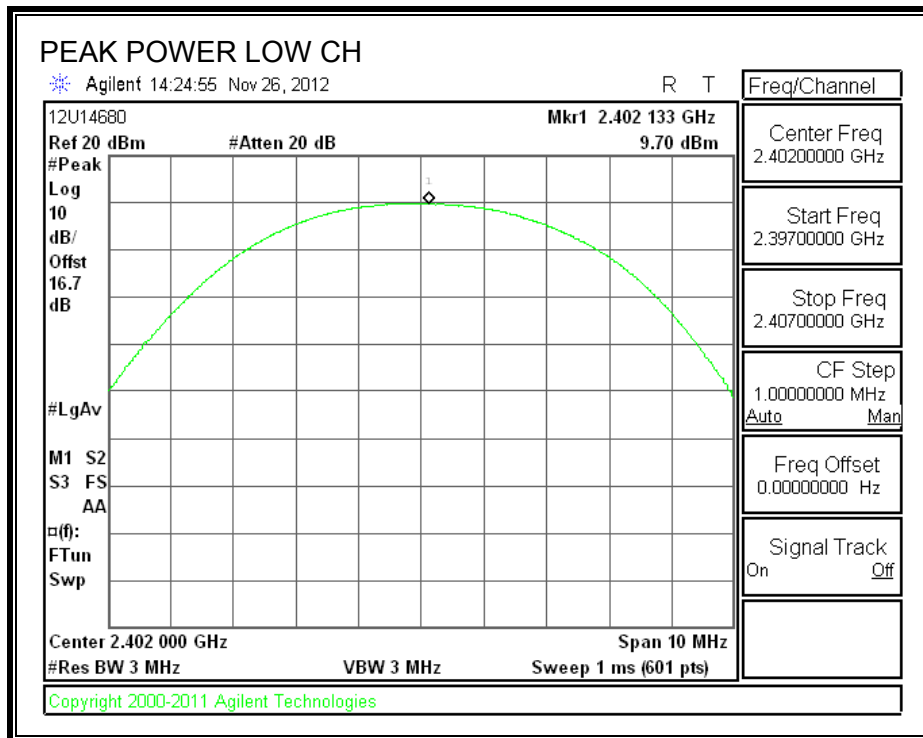
#### TEST PROCEDURE

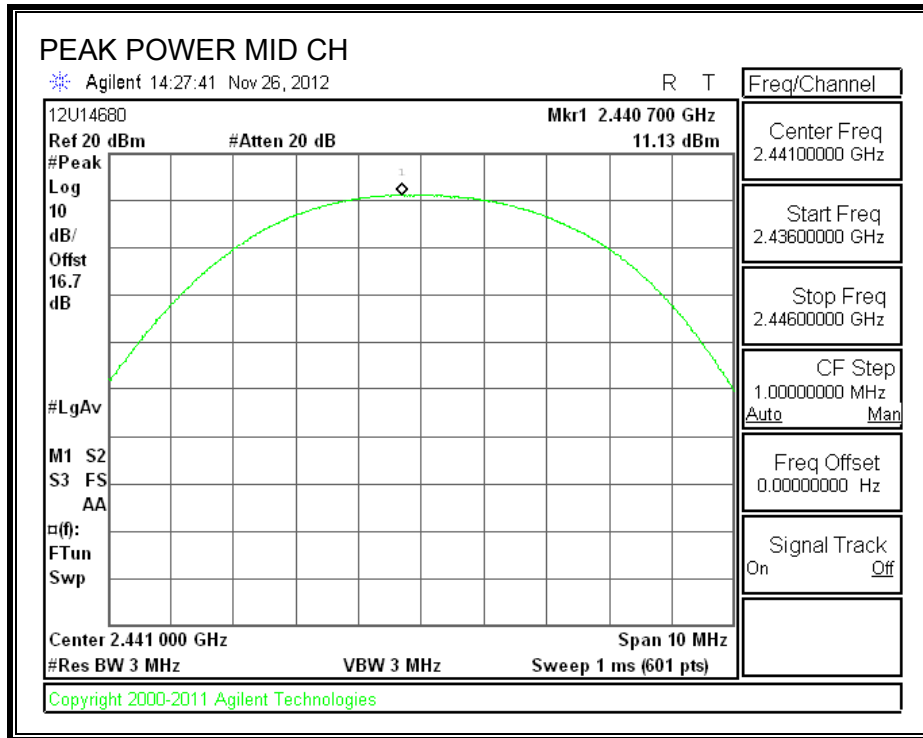
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

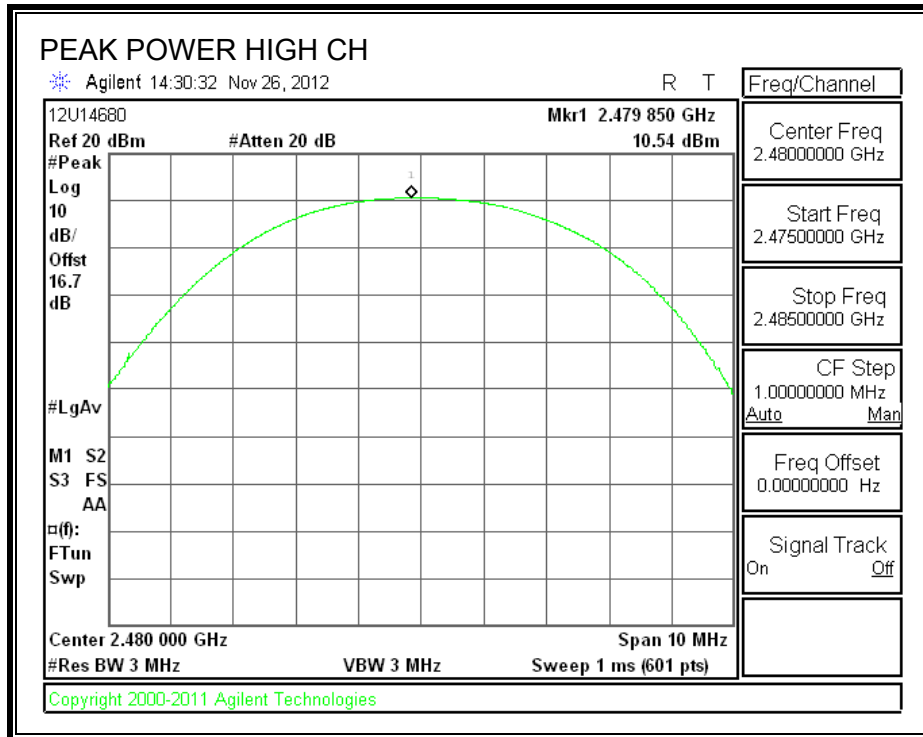
#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.70	20.97	-11.27
Middle	2441	11.13	20.97	-9.84
High	2480	10.54	20.97	-10.43

**OUTPUT POWER**







### 7.1.6. AVERAGE POWER

#### LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.20
Middle	2441	10.40
High	2480	9.90

## 7.1.7. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

### TEST PROCEDURE

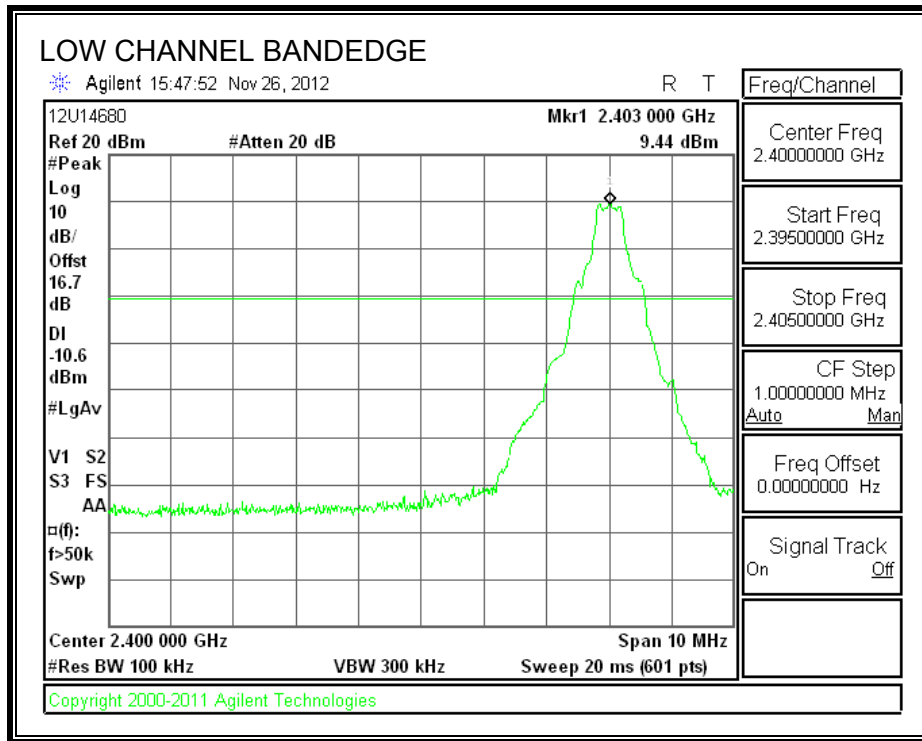
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

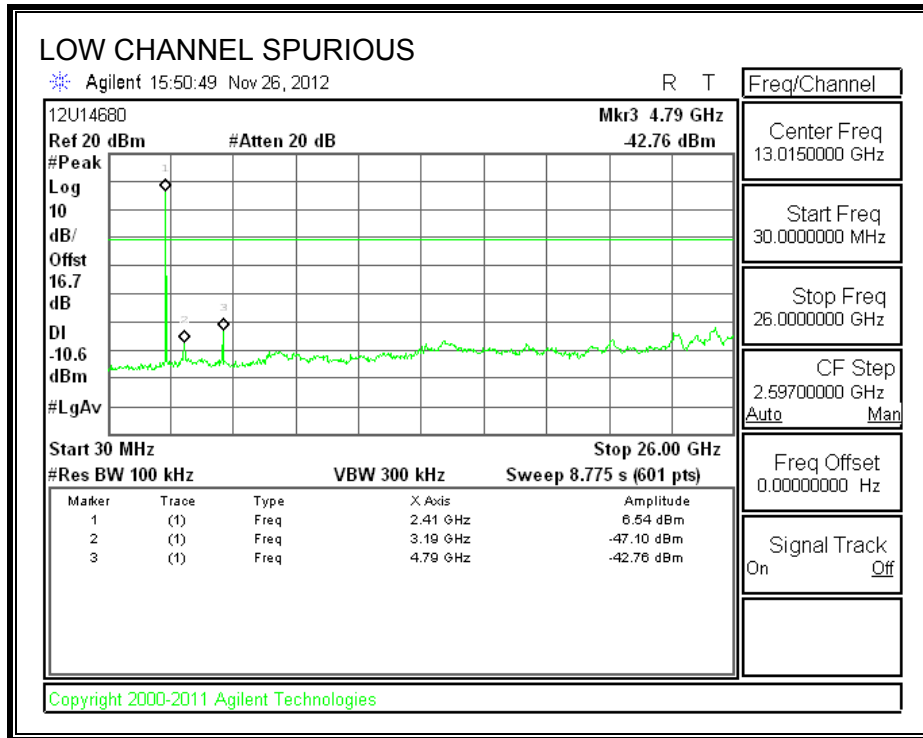
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

**RESULTS**

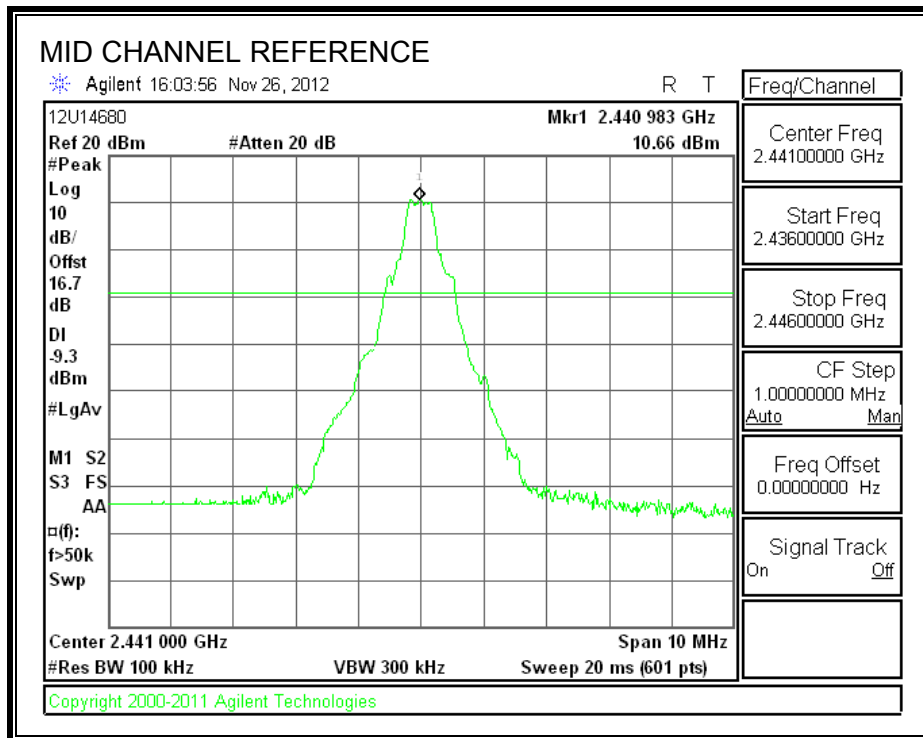
**SPURIOUS EMISSIONS, LOW CHANNEL**

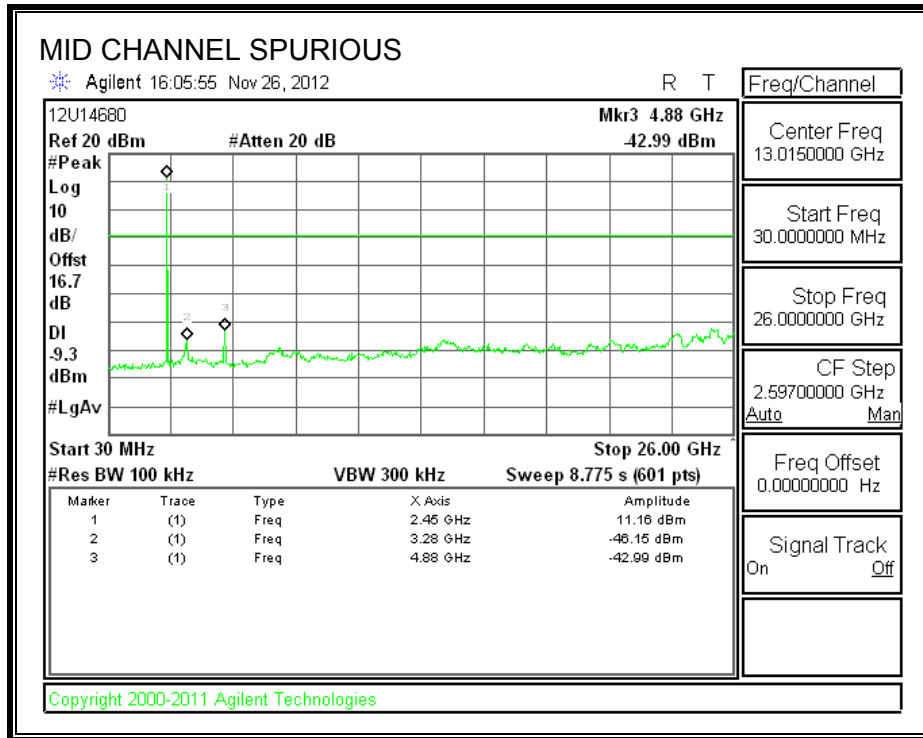




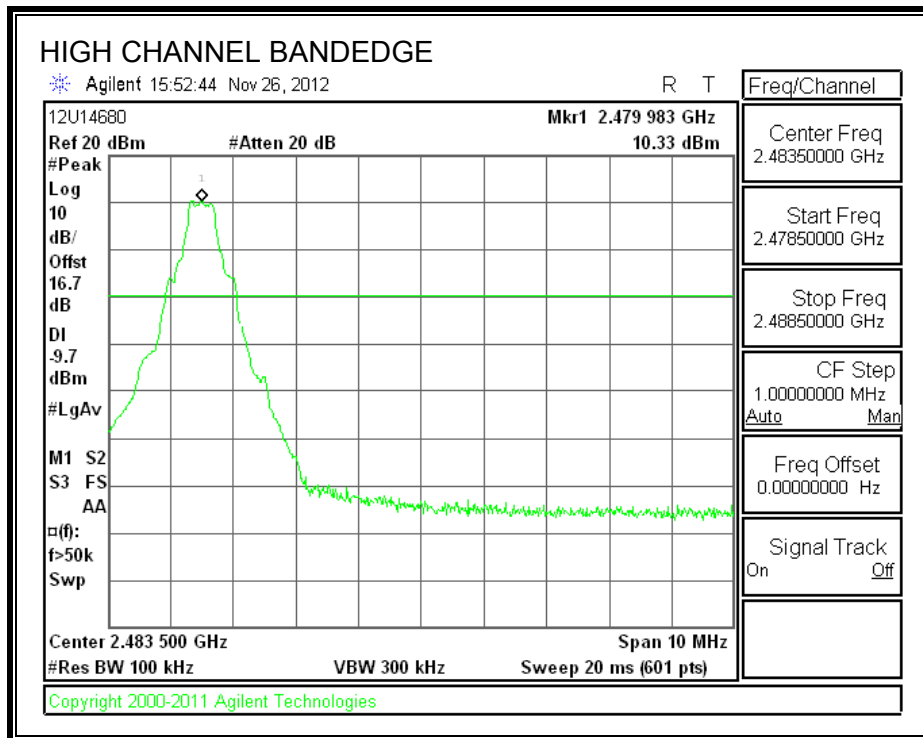


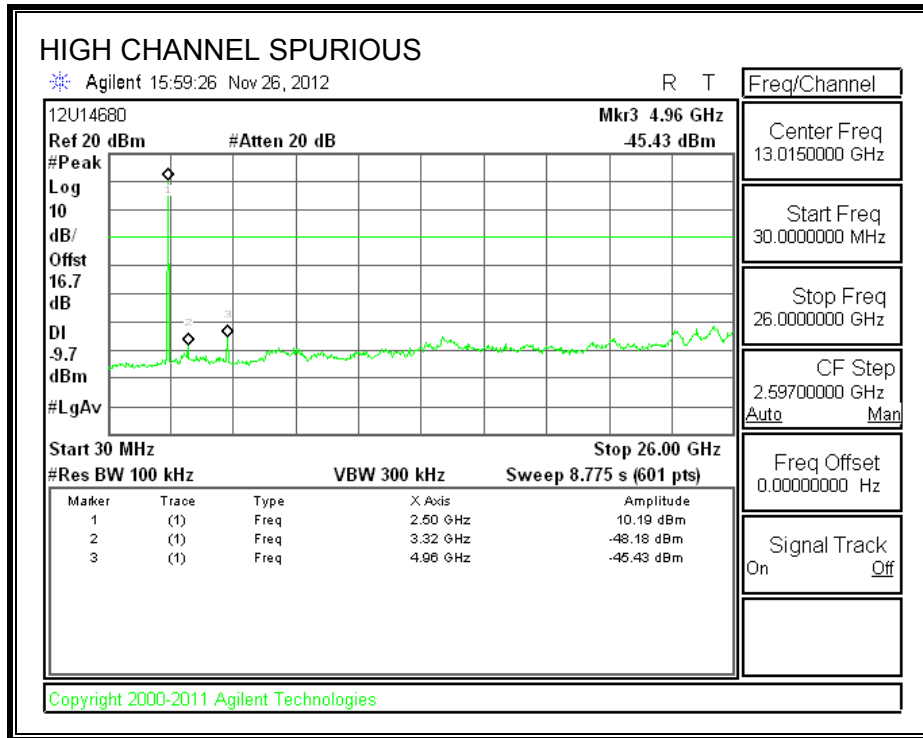
**SPURIOUS EMISSIONS, MID CHANNEL**



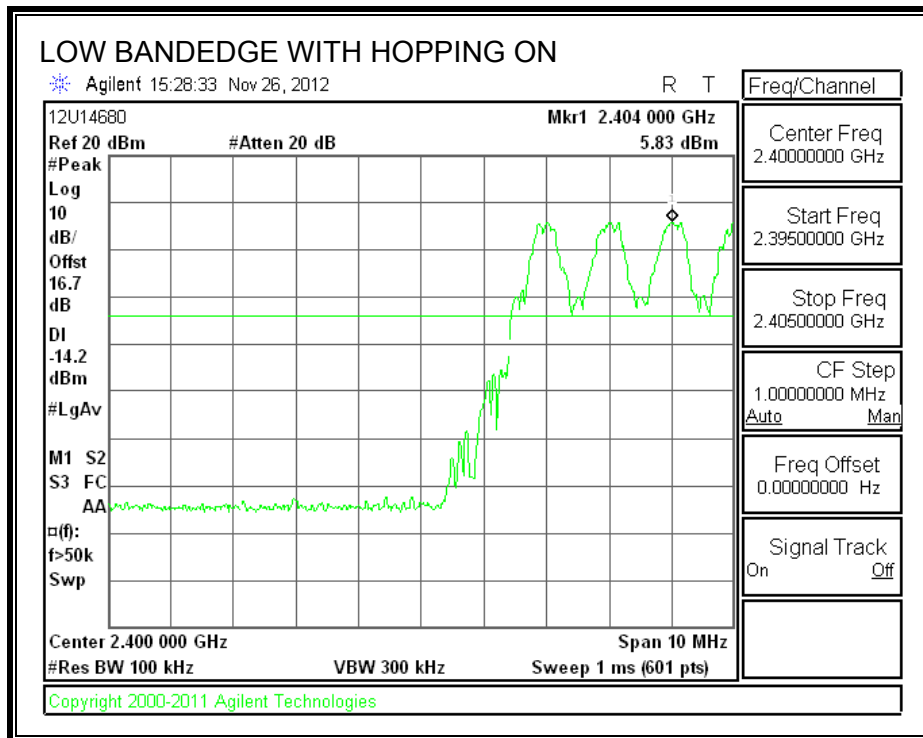


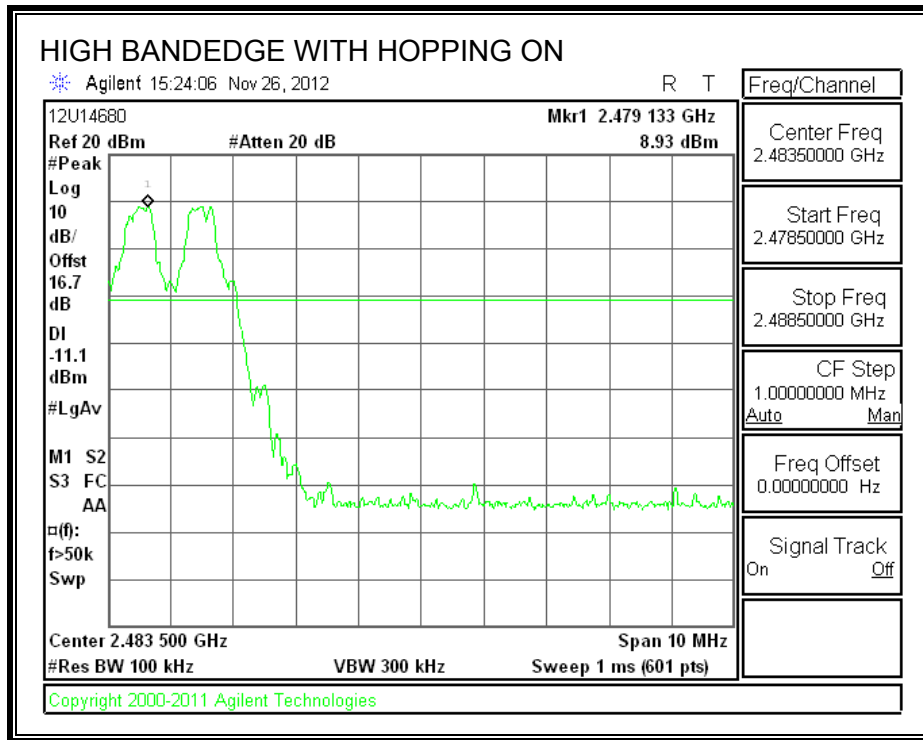
**SPURIOUS EMISSIONS, HIGH CHANNEL**





**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**





## 7.2. ENHANCED DATA RATE QPSK MODULATION

### 7.2.1. OUTPUT POWER

#### LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 20.97 dBm.

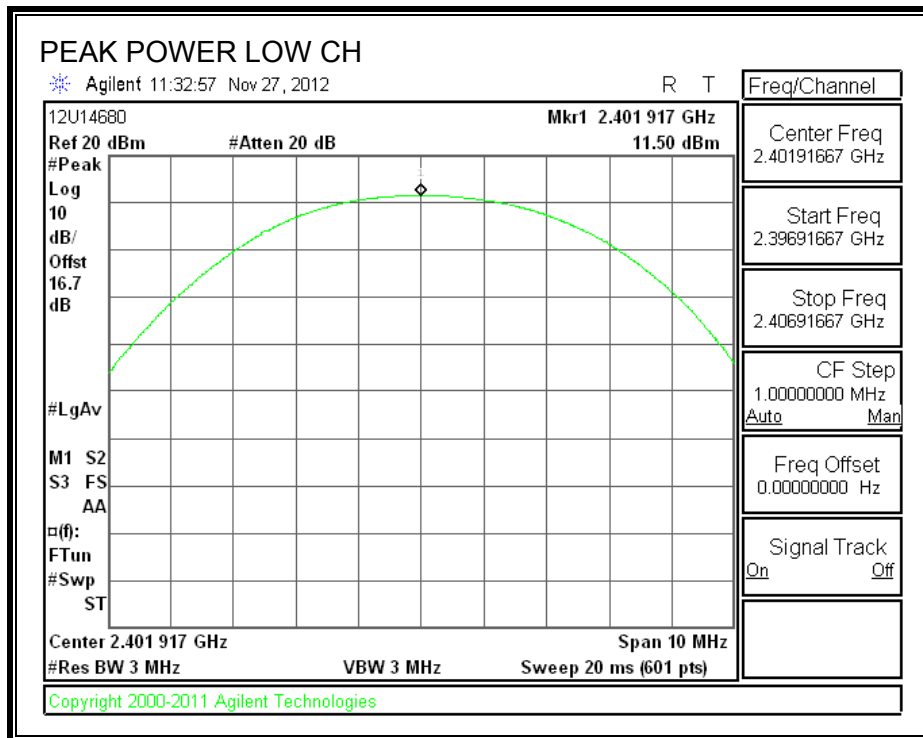
#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

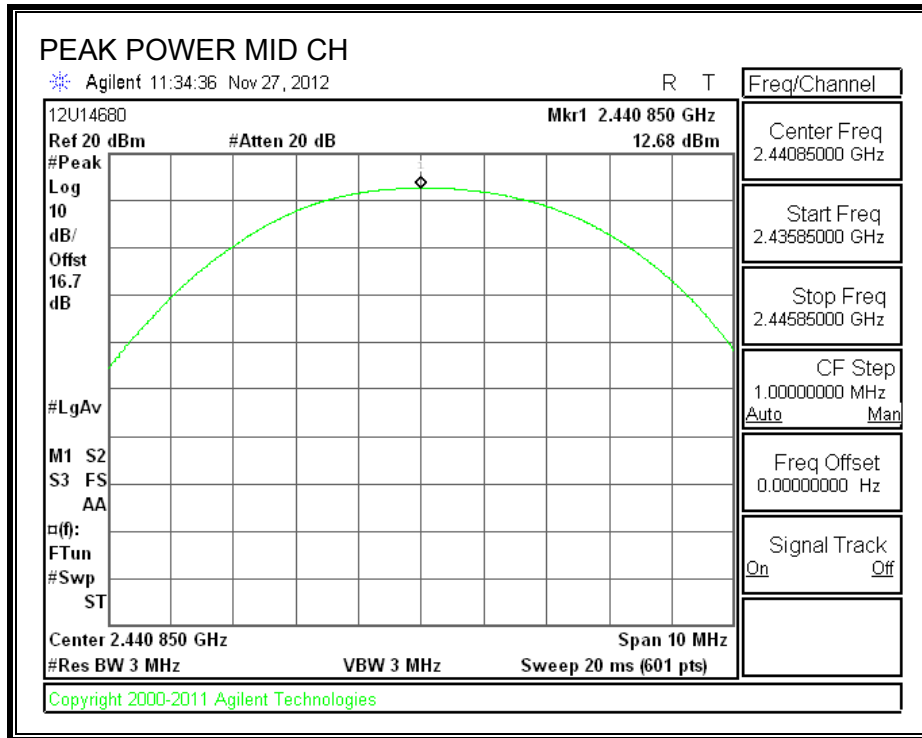
#### RESULTS

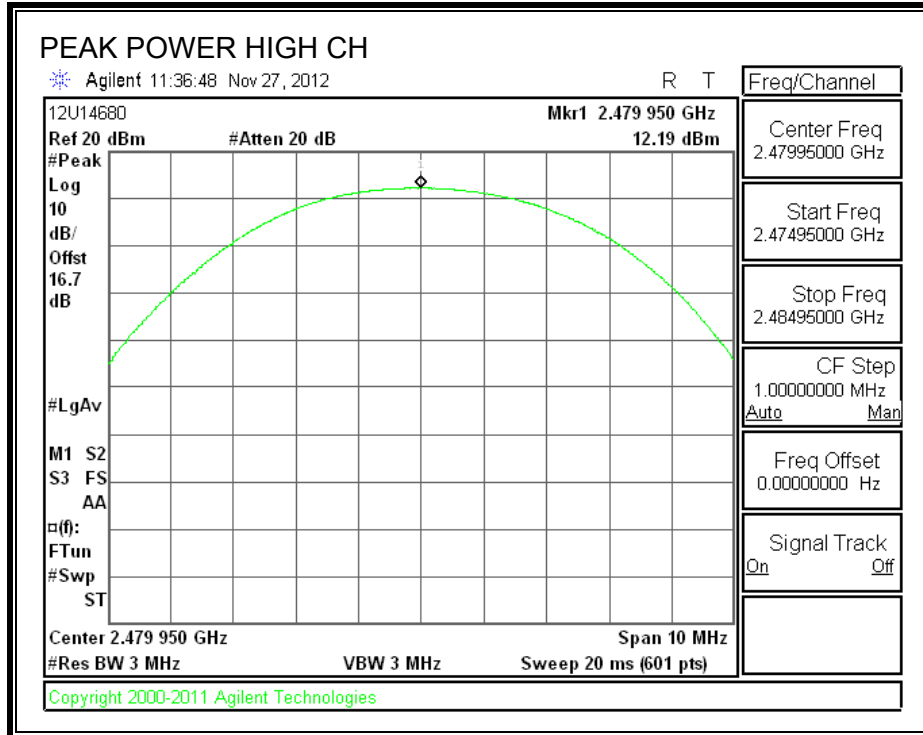
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.50	20.97	-9.47
Middle	2441	12.68	20.97	-8.29
High	2480	12.19	20.97	-8.78

**OUTPUT POWER**









## 7.2.2. AVERAGE POWER

### LIMIT

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

### RESULTS

The cable assembly insertion loss of 10 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.30
Middle	2441	10.40
High	2480	9.60

### 7.3. ENHANCED DATA RATE 8PSK MODULATION

#### 7.3.1. 20 dB AND 99% BANDWIDTH

##### LIMIT

None; for reporting purposes only.

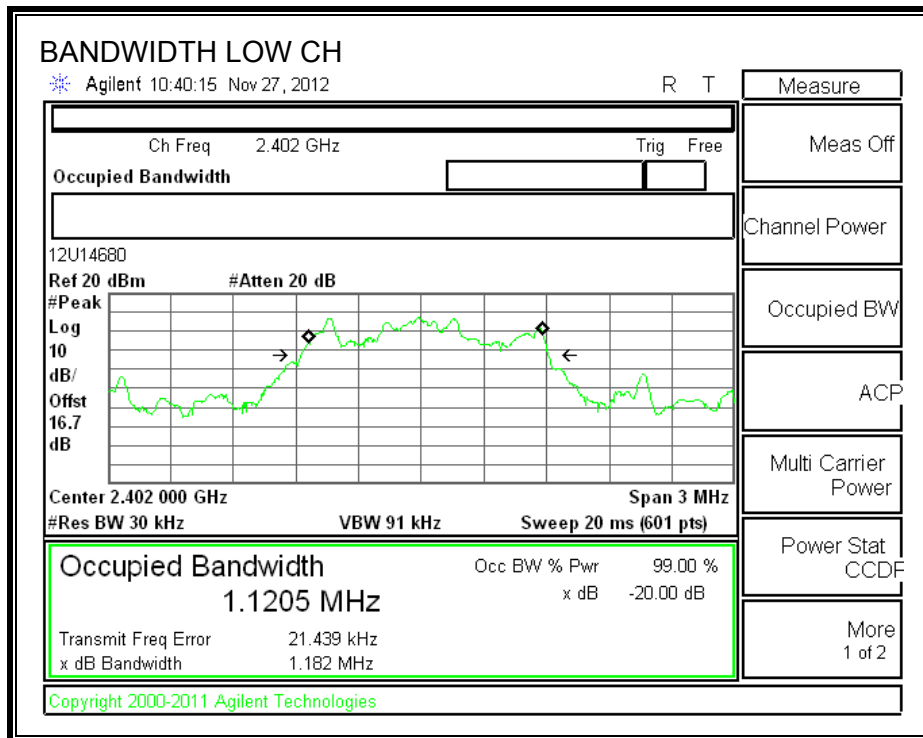
##### TEST PROCEDURE

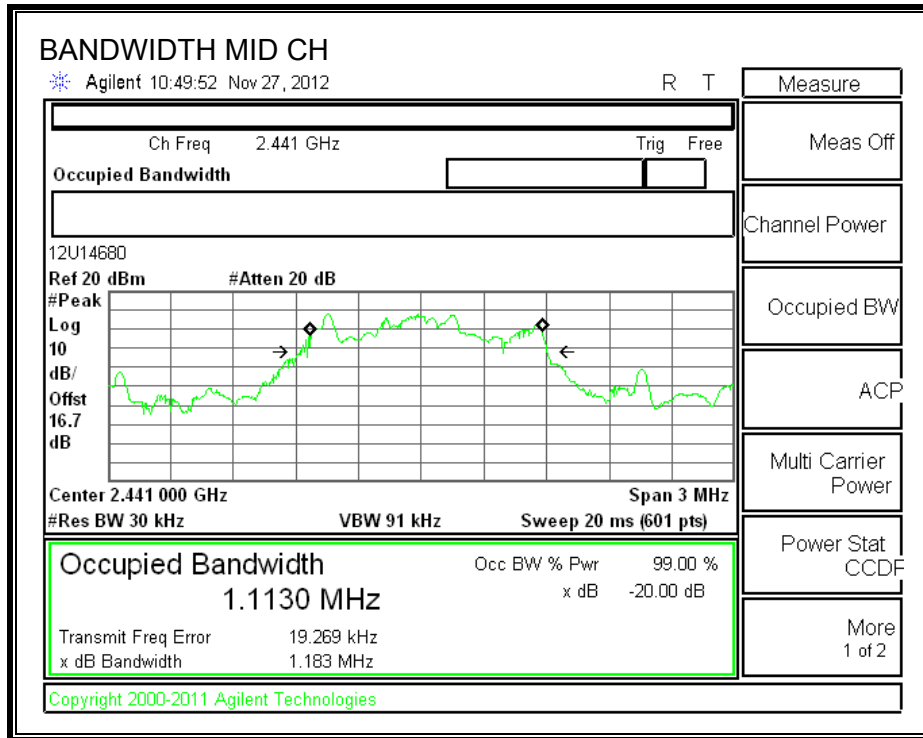
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

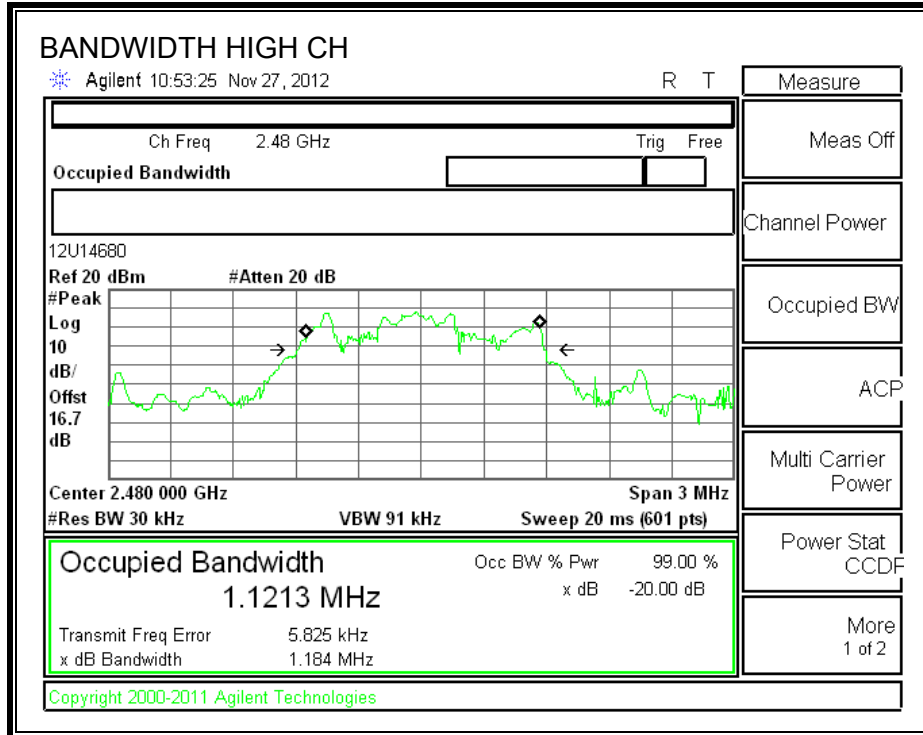
##### RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1182	1098.5
Middle	2441	1183	1071.6
High	2480	1184	1115.1

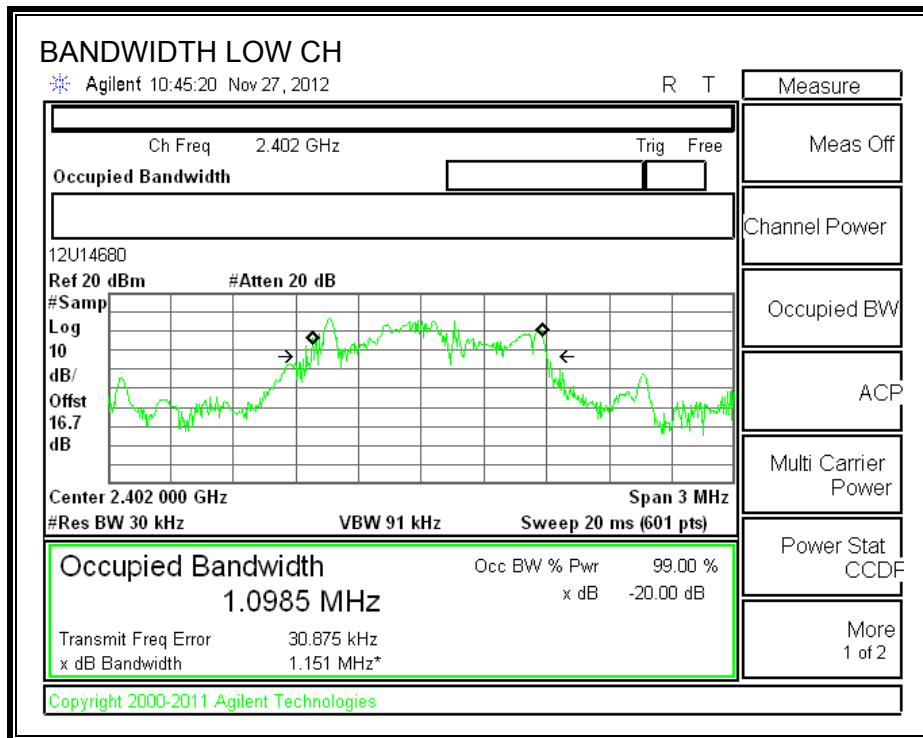
**20 dB BANDWIDTH**



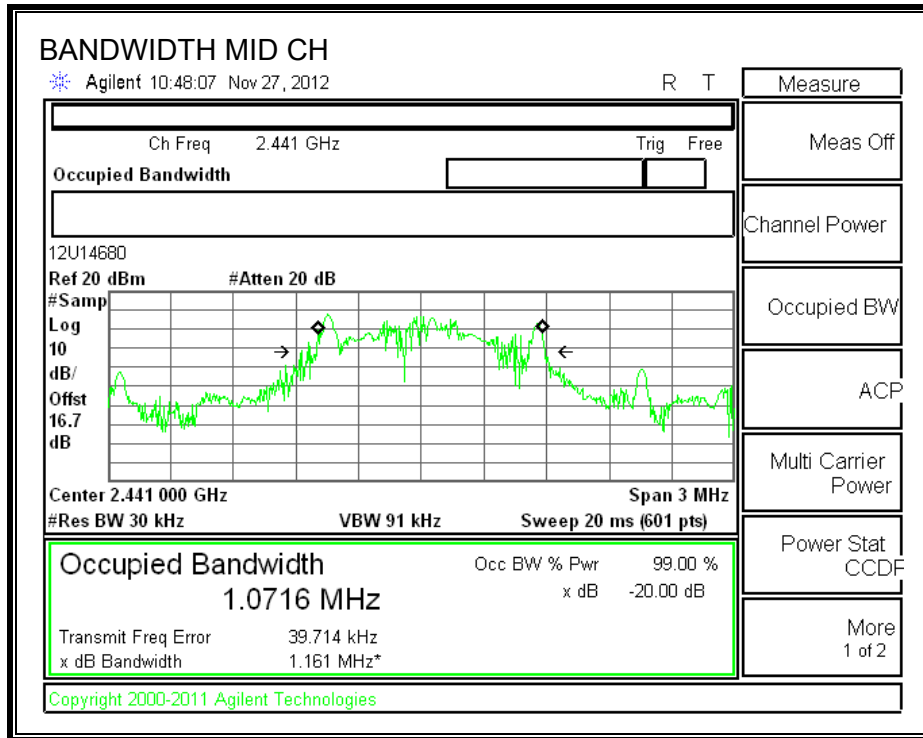


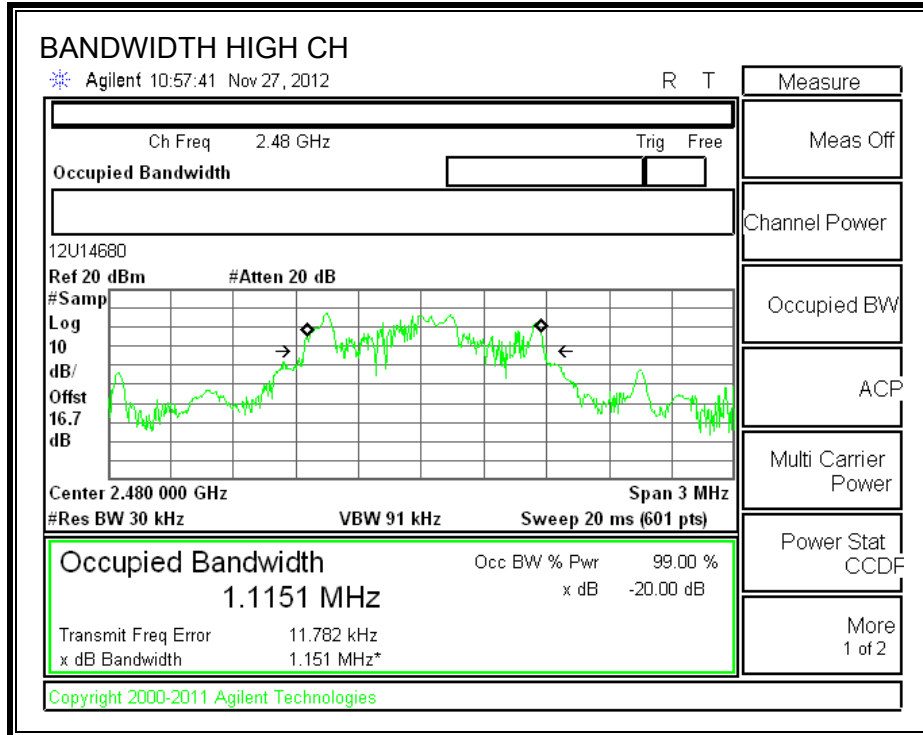


**99% BANDWIDTH**









### **7.3.2. HOPPING FREQUENCY SEPARATION**

#### **LIMIT**

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

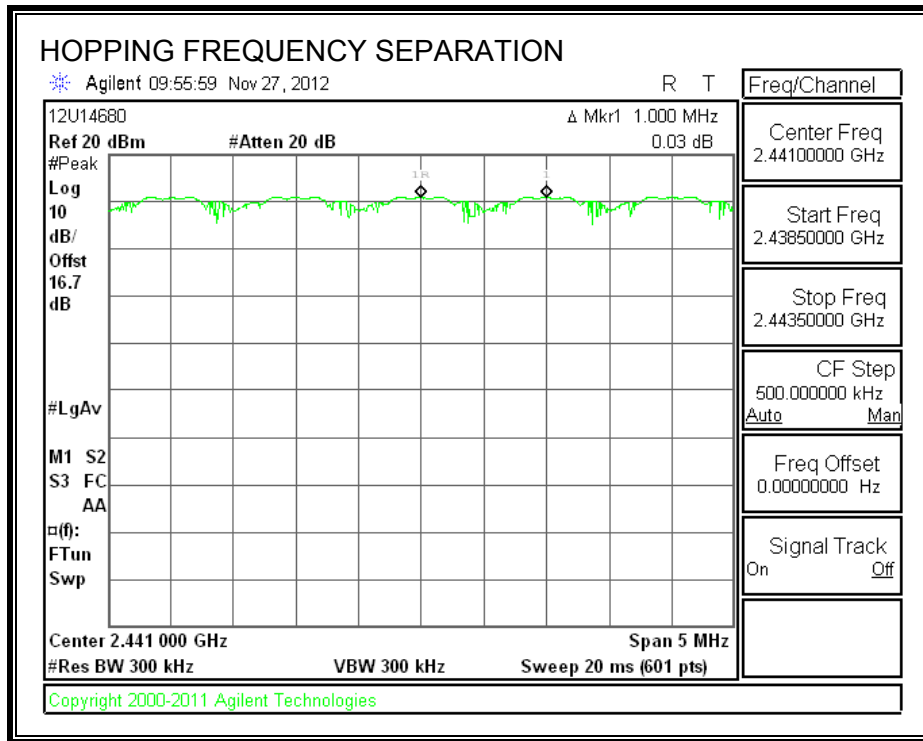
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

**RESULTS**

**HOPPING FREQUENCY SEPARATION**



### **7.3.3. NUMBER OF HOPPING CHANNELS**

#### **LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

#### **TEST PROCEDURE**

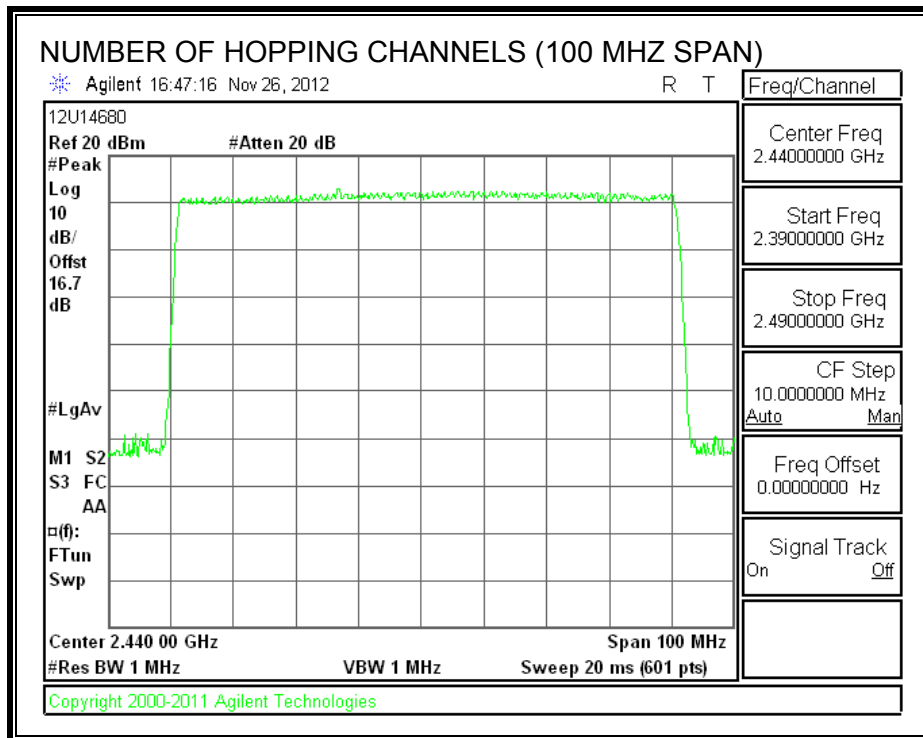
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

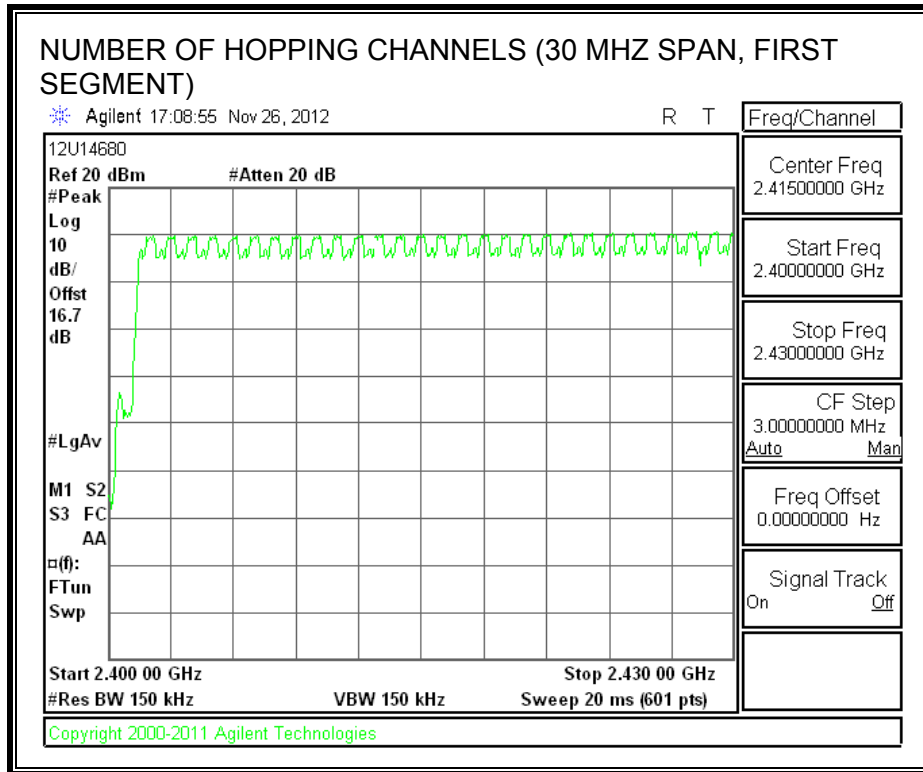
#### **RESULTS**

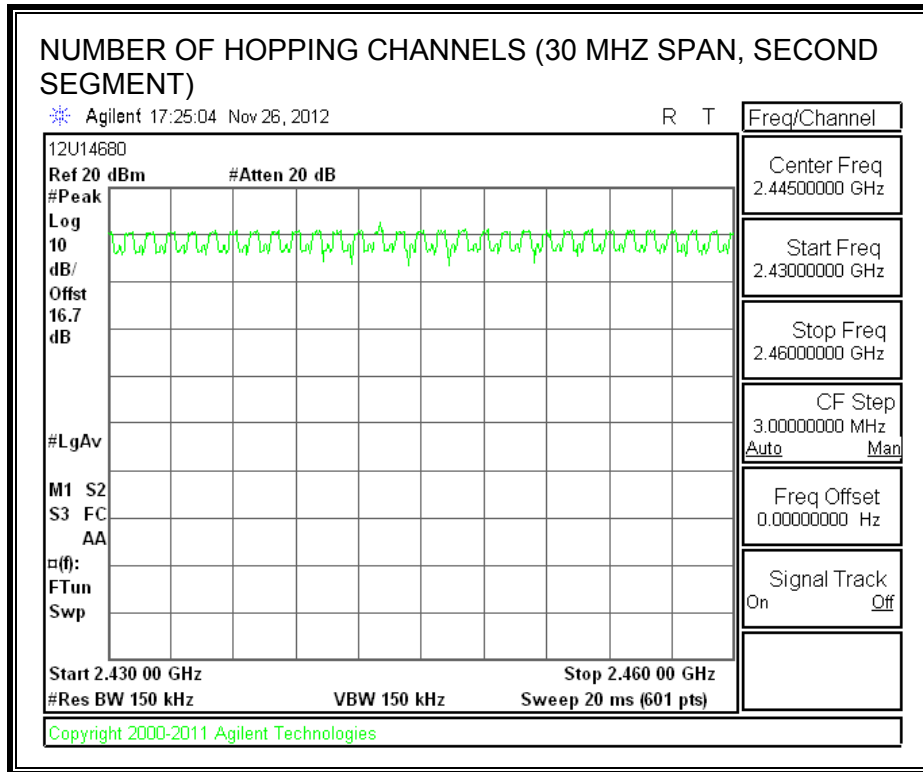
Normal Mode: 79 Channels observed.

AFH Mode: 20 Channels declared.

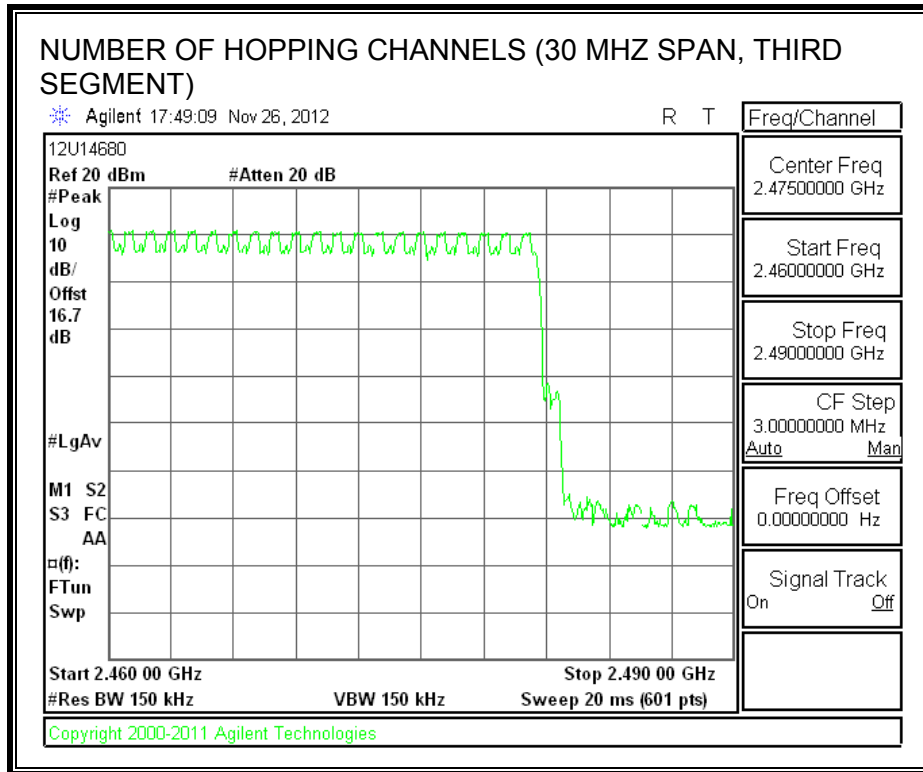
**NUMBER OF HOPPING CHANNELS**











### 7.3.4. AVERAGE TIME OF OCCUPANCY

#### LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$ .

#### RESULTS

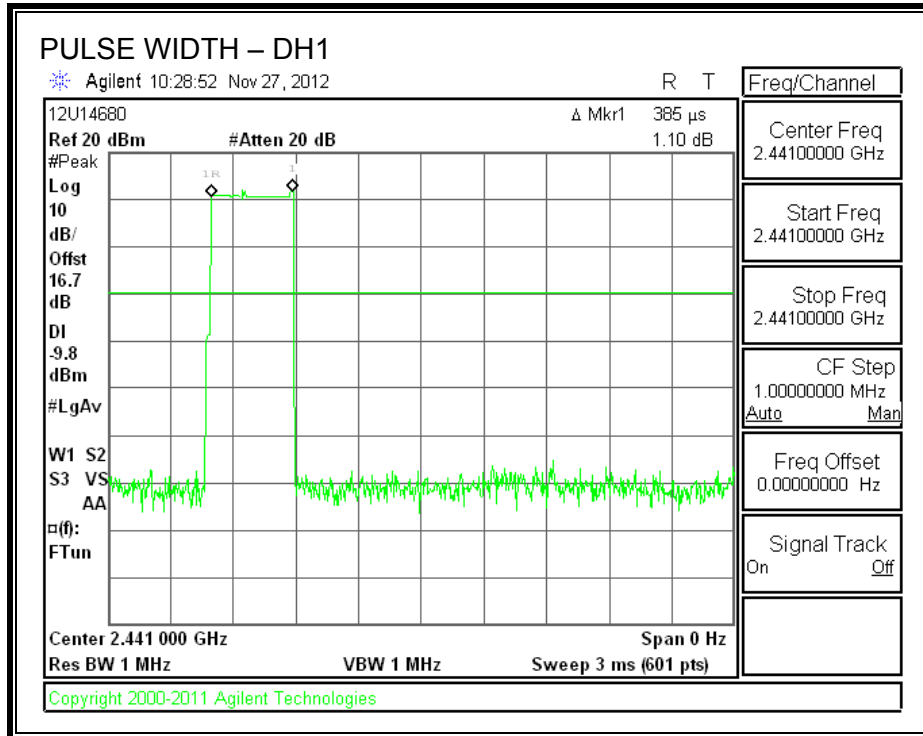
Time Of Occupancy =  $10 * xx \text{ pulses} * yy \text{ msec} = zz \text{ msec}$

#### 8PSK (EDR) Mode

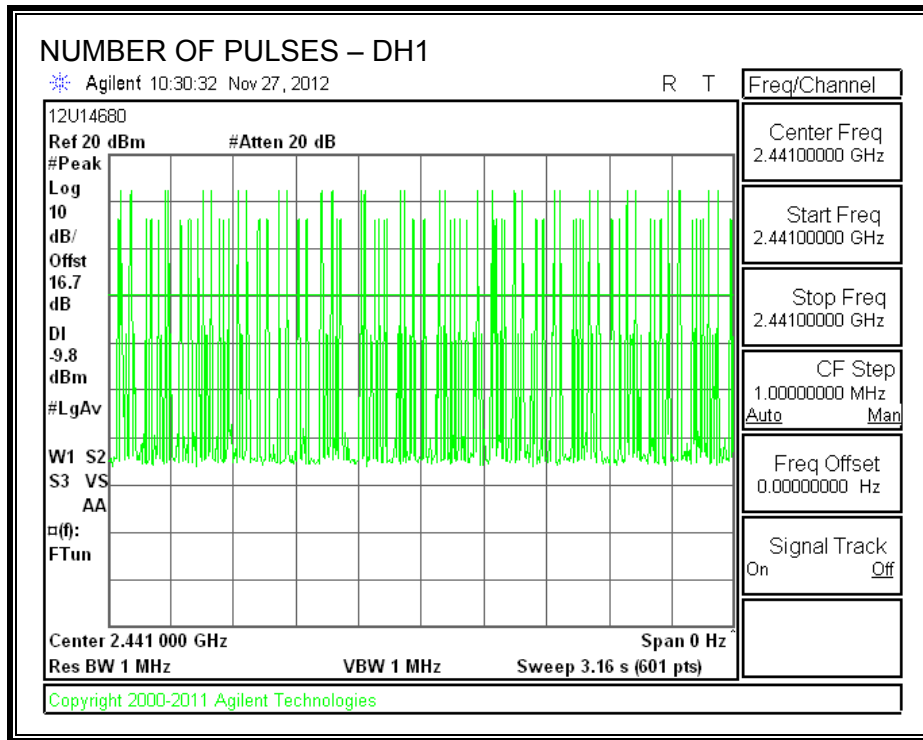
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.385	32	0.123	0.4	-0.277
DH3	1.642	18	0.296	0.4	-0.104
DH5	2.892	10	0.289	0.4	-0.111

**Note:** for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate on page 26 demonstrates compliance with channel occupancy when AFH is employed.

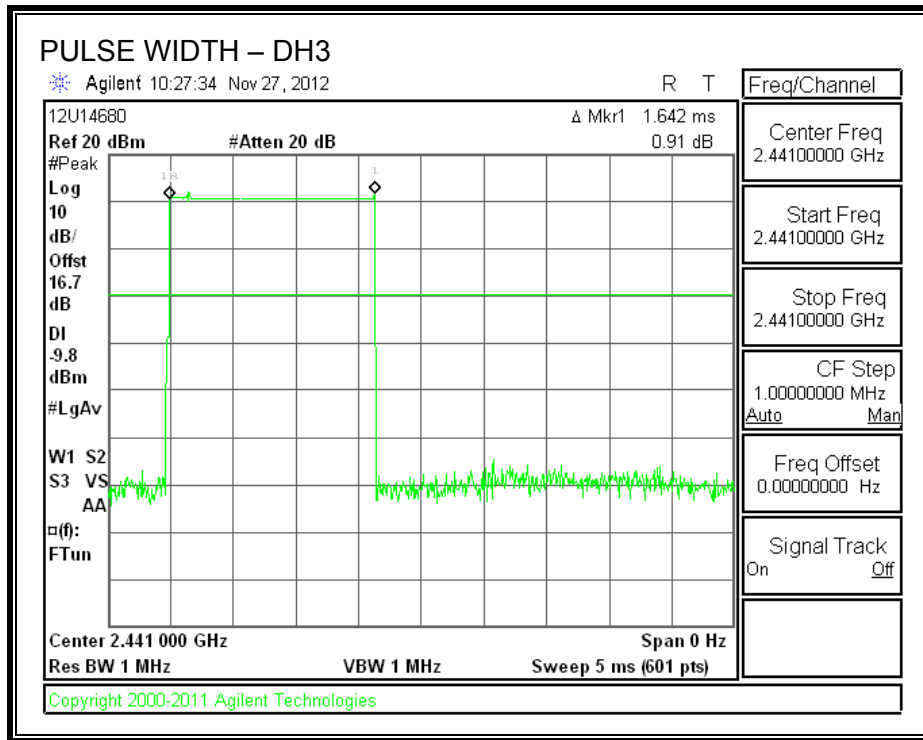
**PULSE WIDTH - DH1**



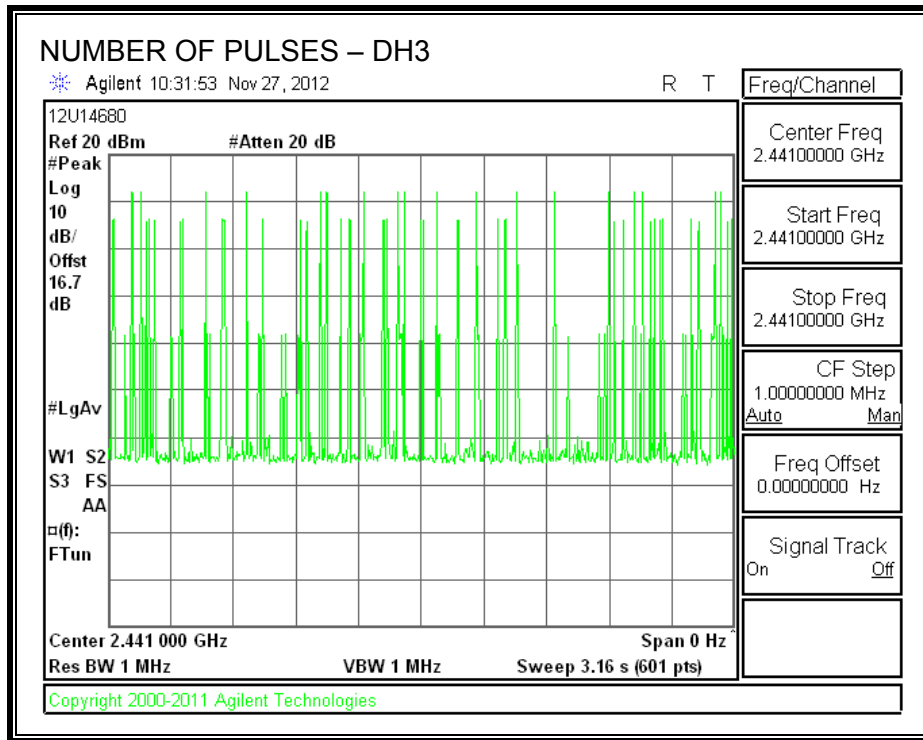
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**



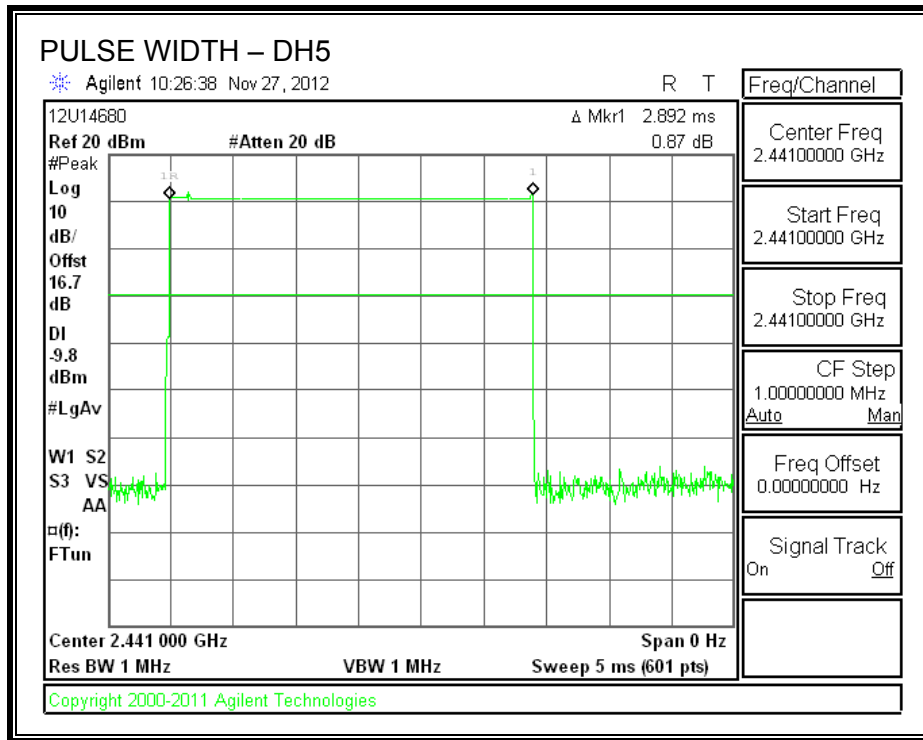
**PULSE WIDTH – DH3**



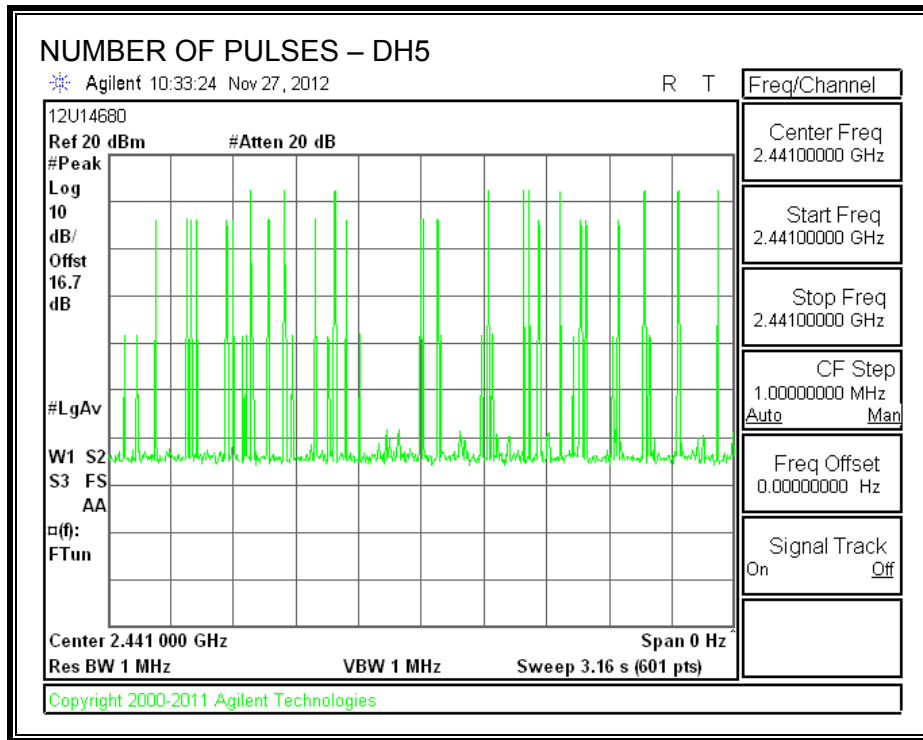
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**



**PULSE WIDTH – DH5**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**





### 7.3.5. OUTPUT POWER

#### LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 20.97 dBm.

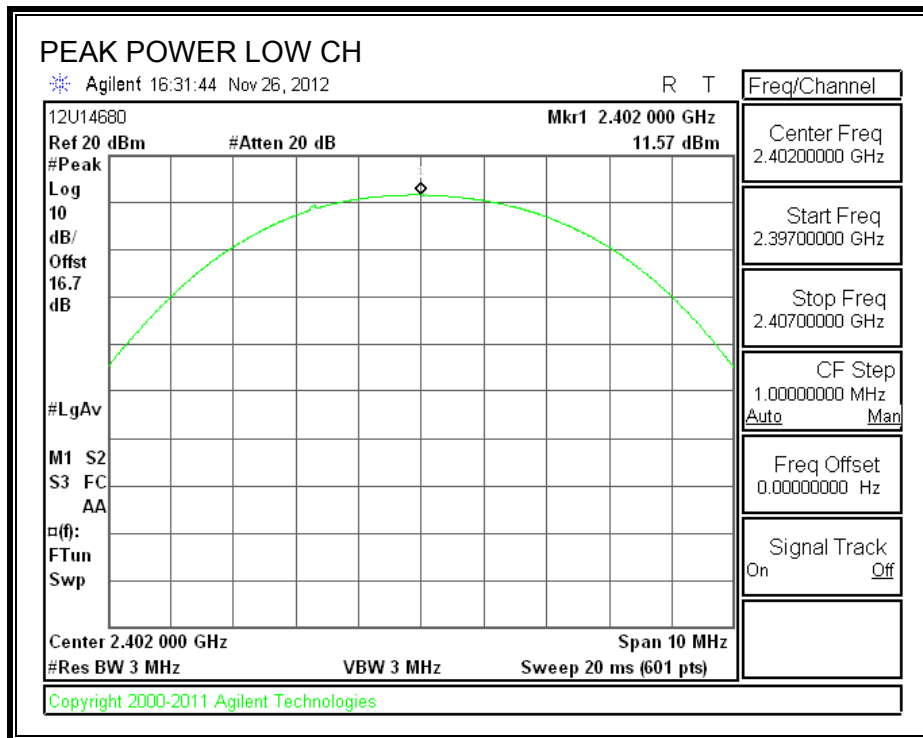
#### TEST PROCEDURE

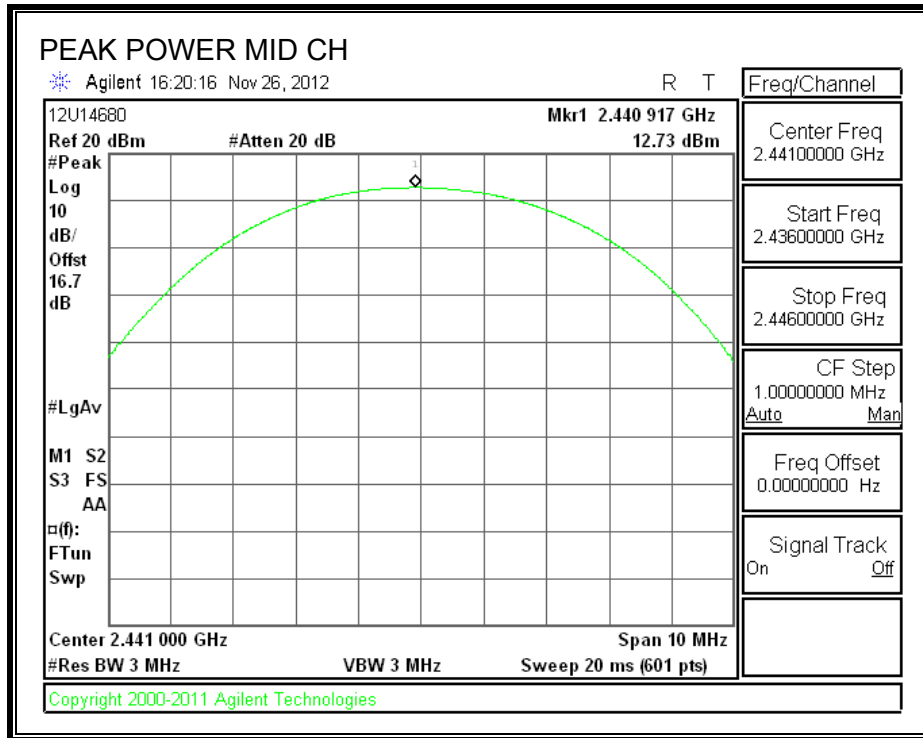
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

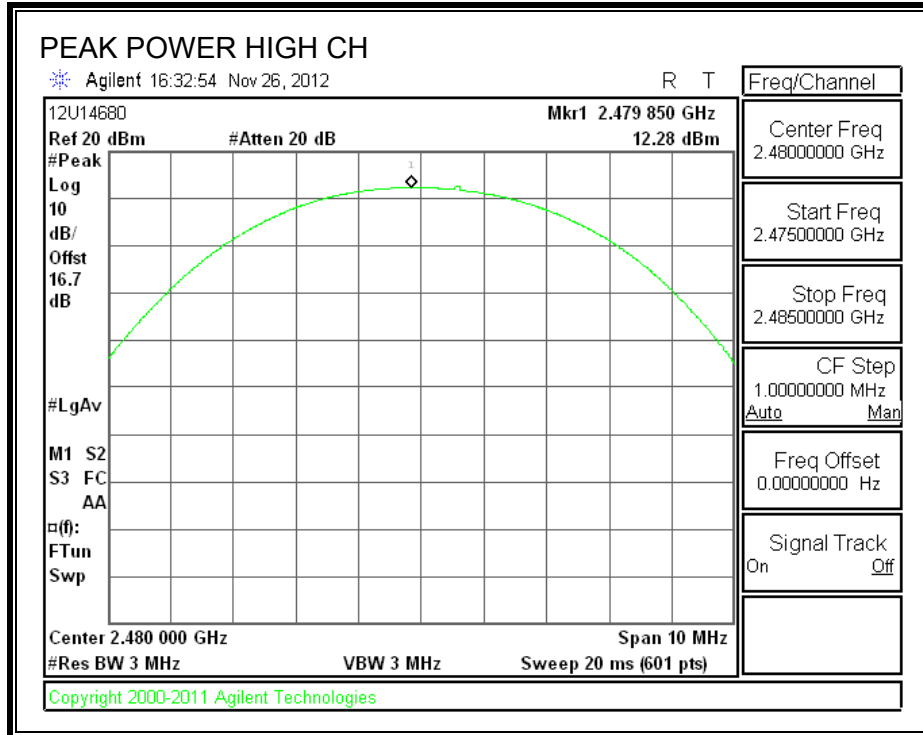
#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.57	20.97	-9.40
Middle	2441	12.73	20.97	-8.24
High	2480	12.28	20.97	-8.69

**OUTPUT POWER**







### 7.3.6. AVERAGE POWER

#### LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	9.30
Middle	2441	10.40
High	2480	9.70

### **7.3.7. CONDUCTED SPURIOUS EMISSIONS**

#### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

#### **TEST PROCEDURE**

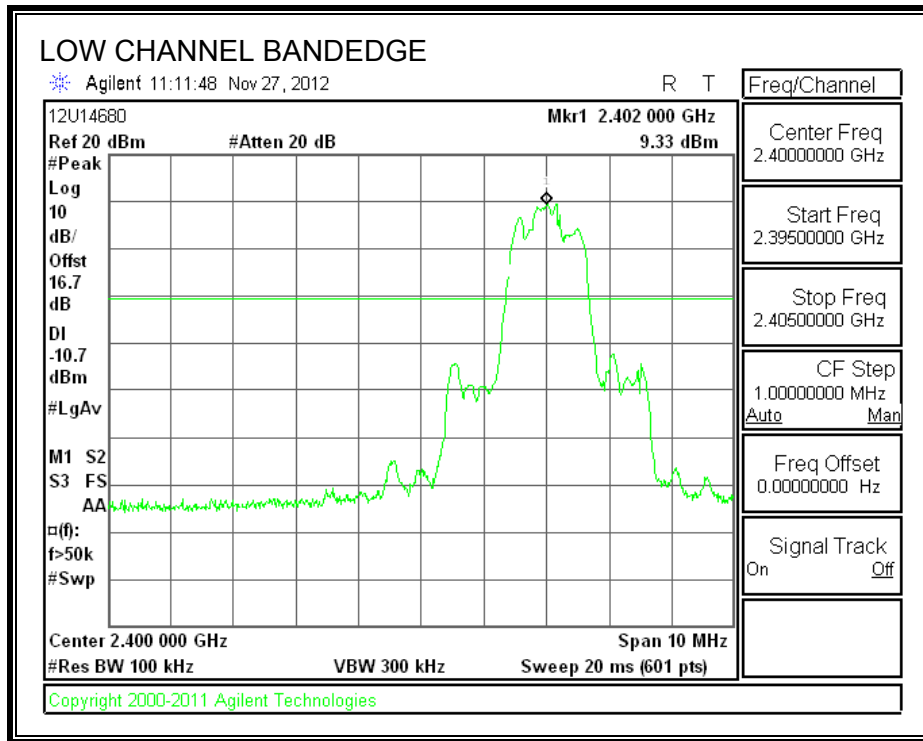
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

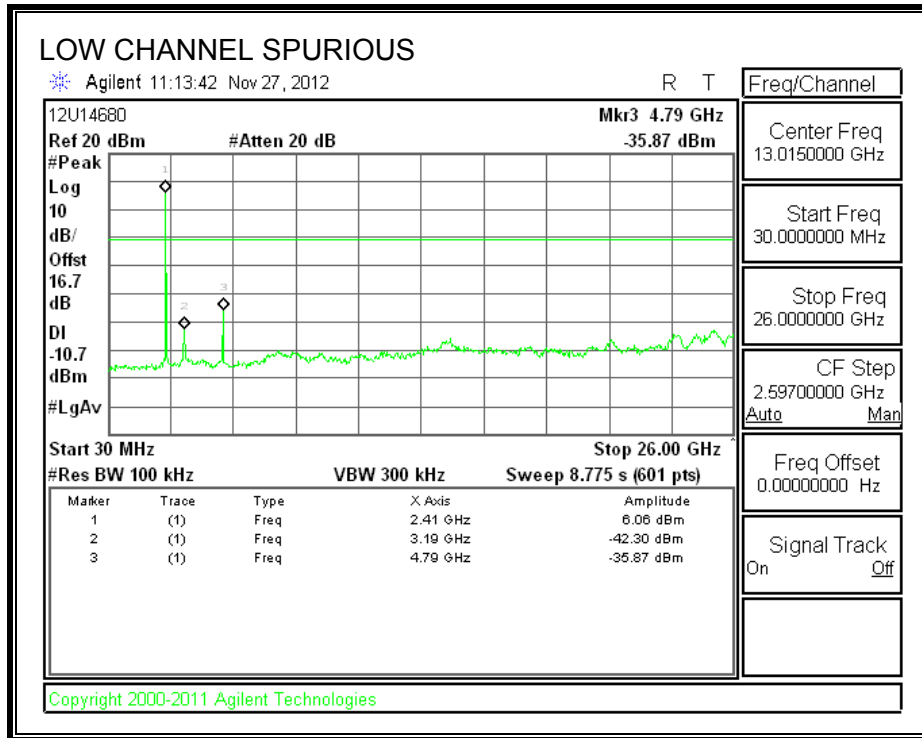
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

**RESULTS**

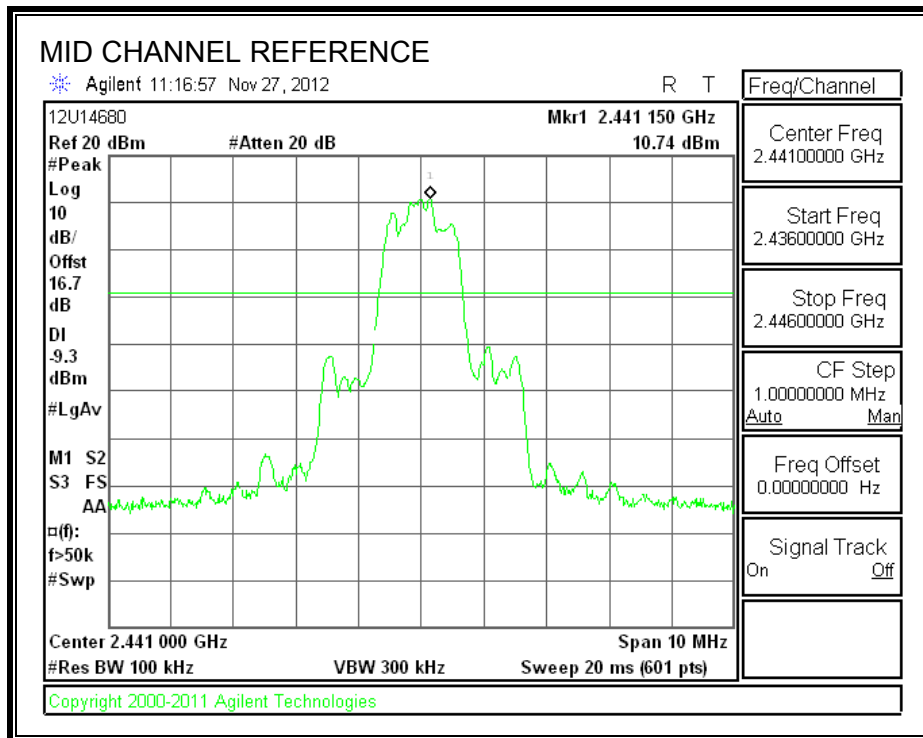
**SPURIOUS EMISSIONS, LOW CHANNEL**

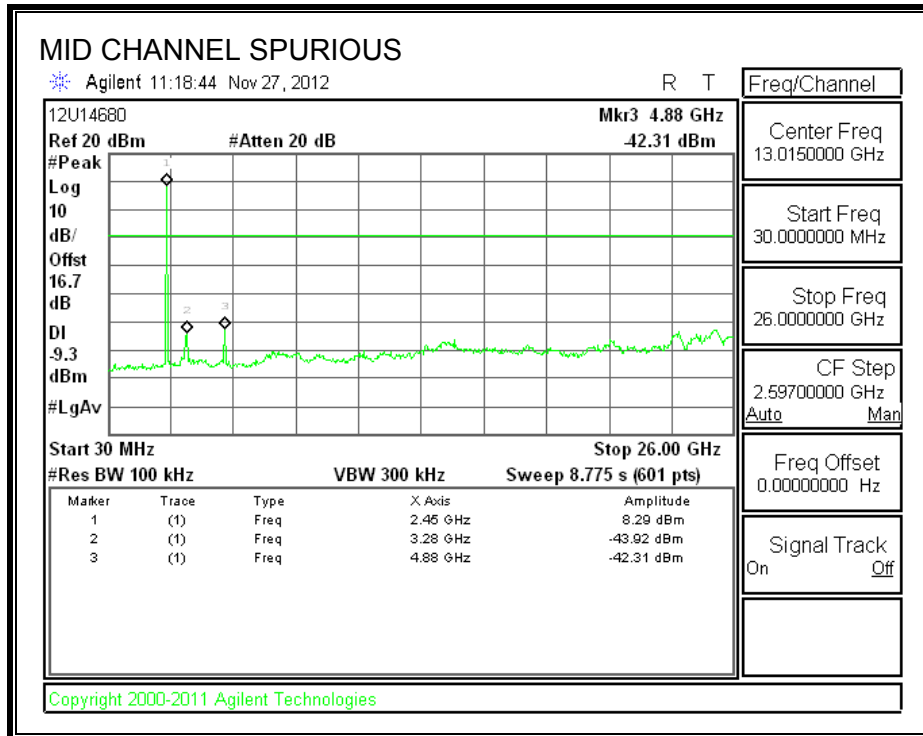




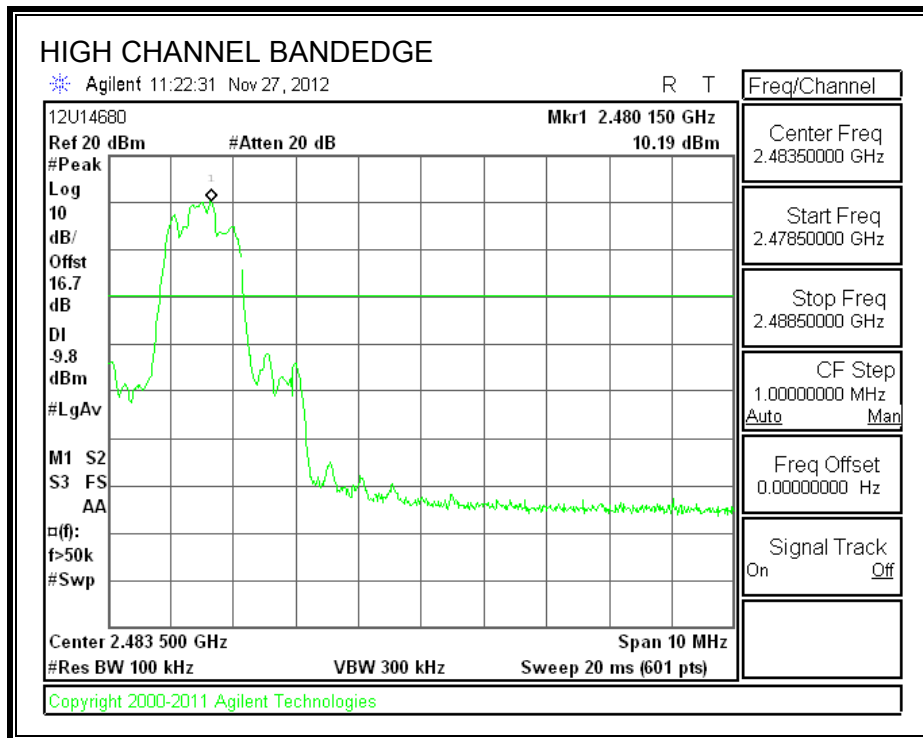


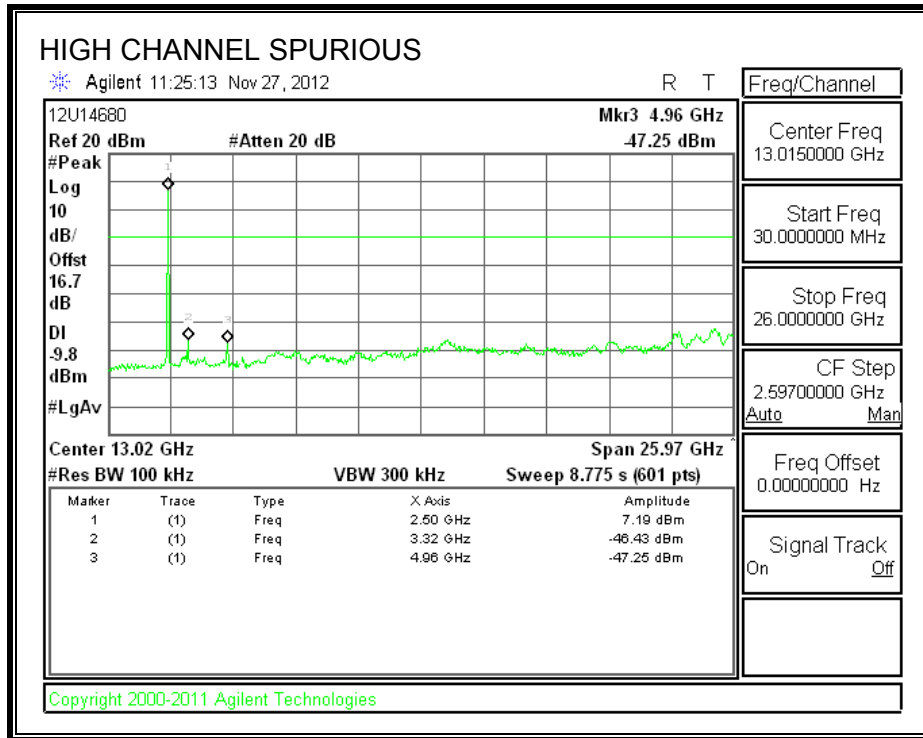
**SPURIOUS EMISSIONS, MID CHANNEL**



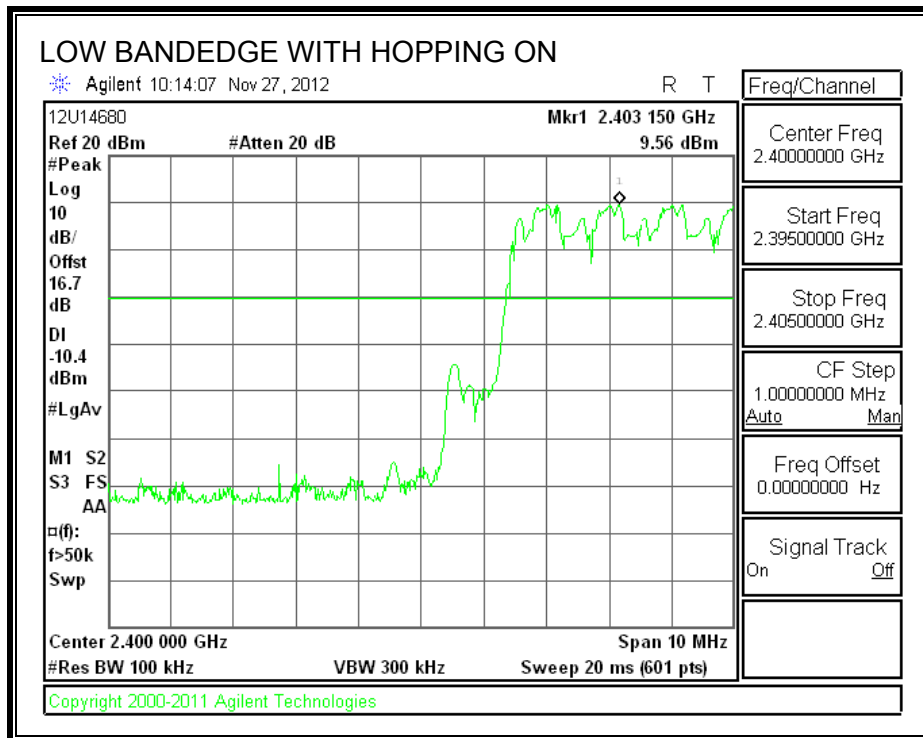


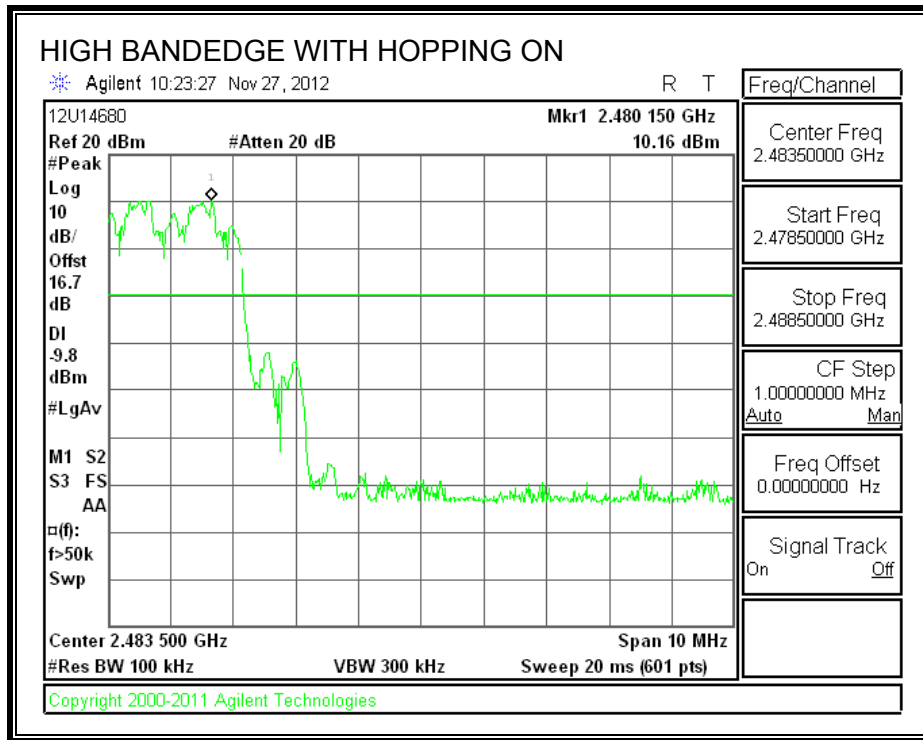
**SPURIOUS EMISSIONS, HIGH CHANNEL**





**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**





## 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.

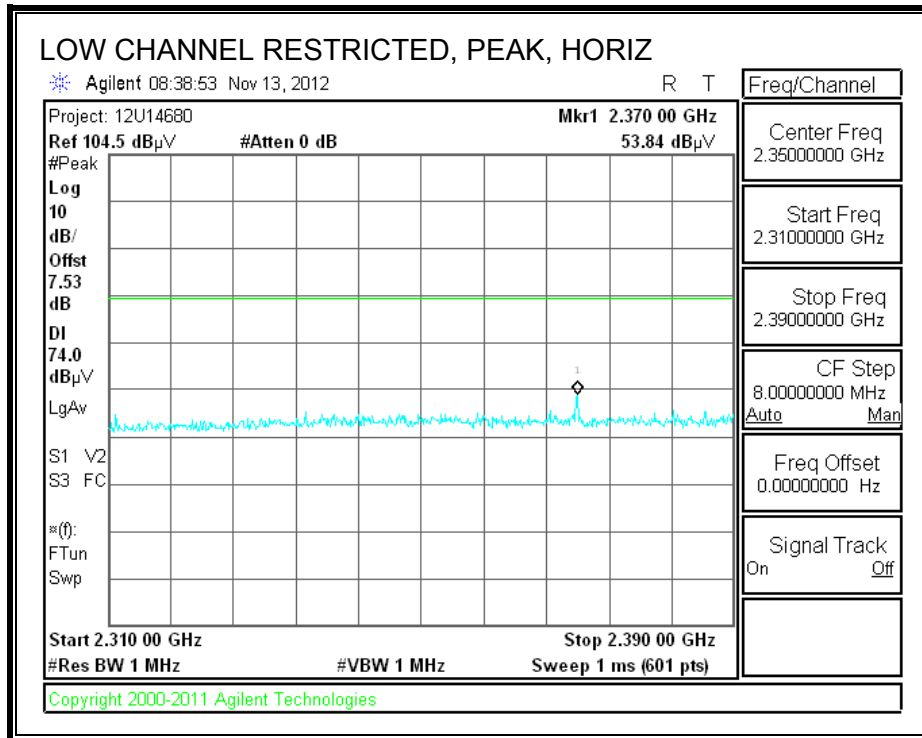
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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

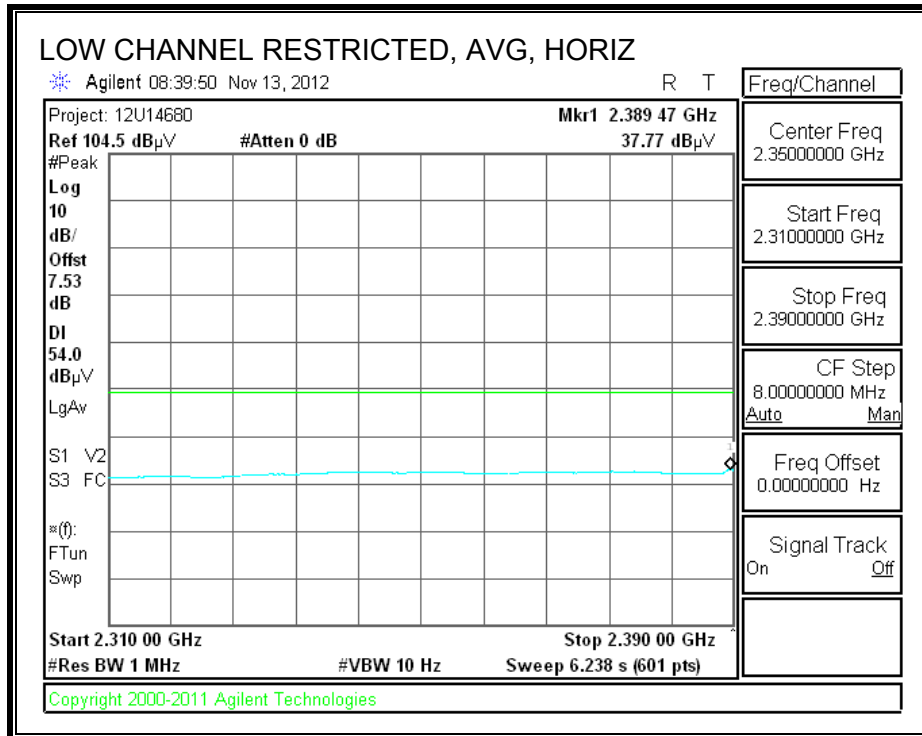
## 8.2. TRANSMITTER ABOVE 1 GHz

### 8.2.1. BASIC DATA RATE GFSK MODULATION

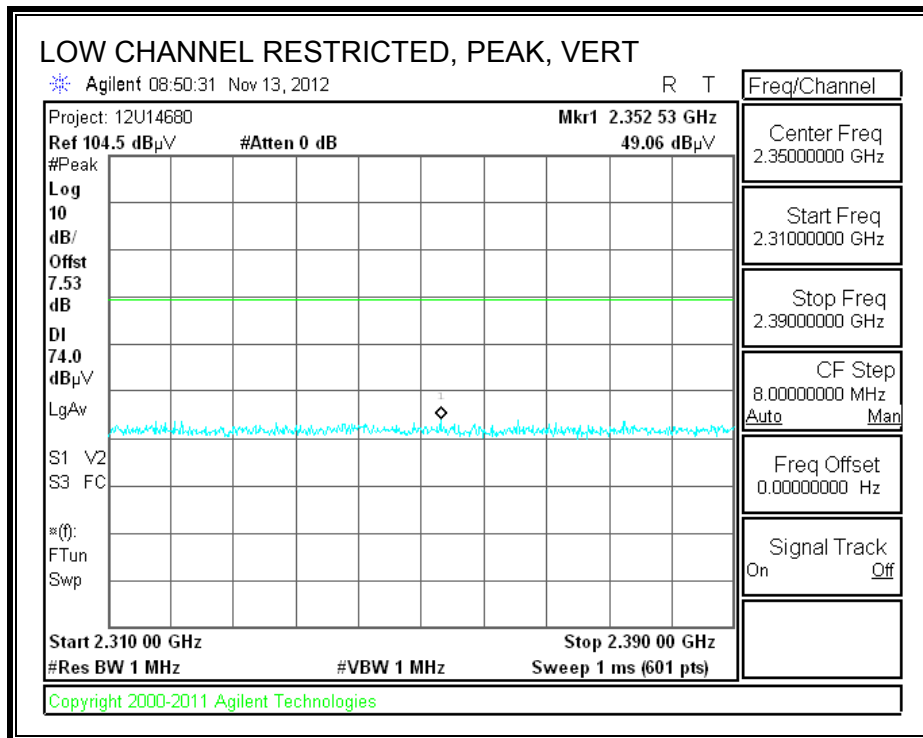
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

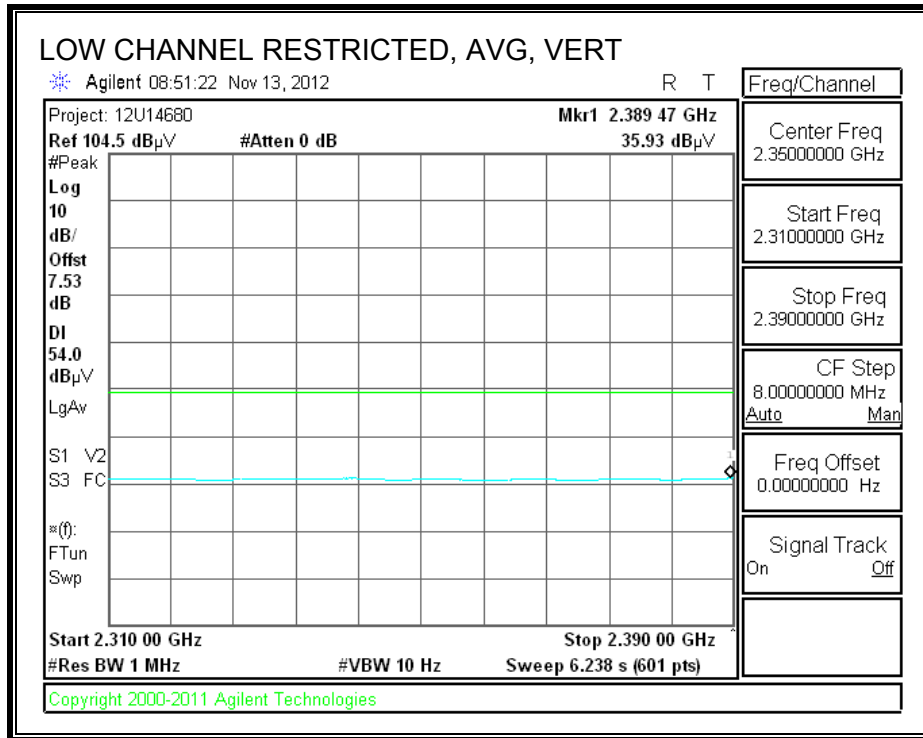




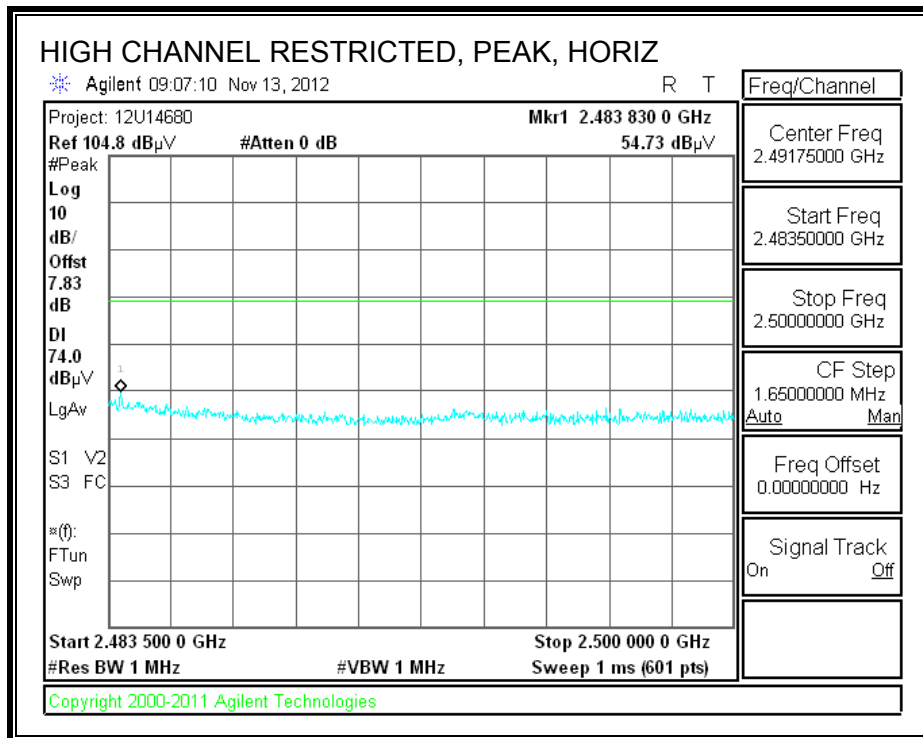


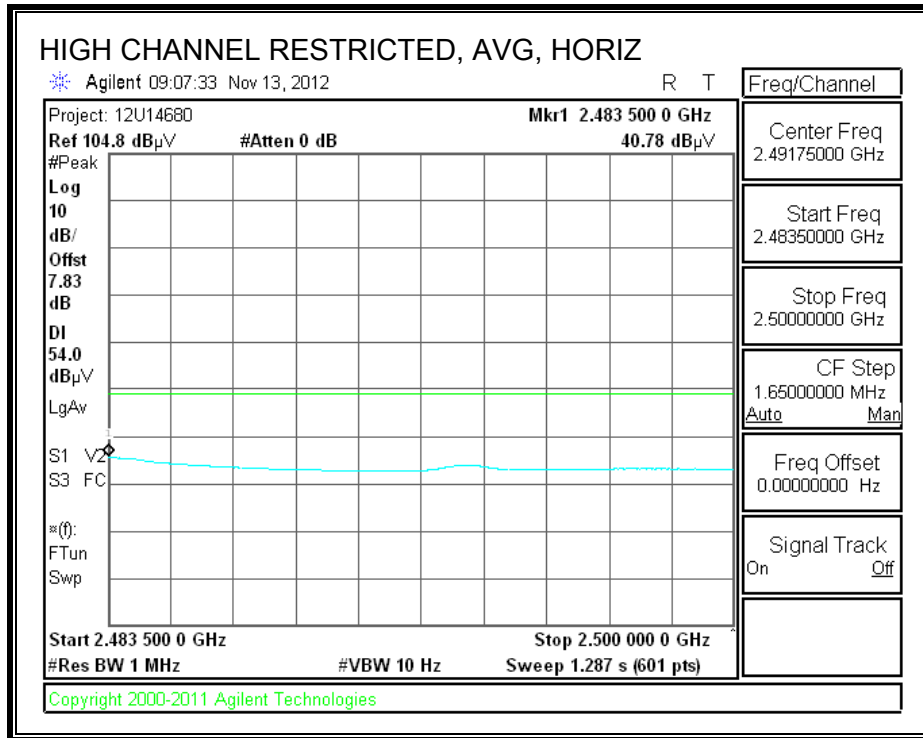
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



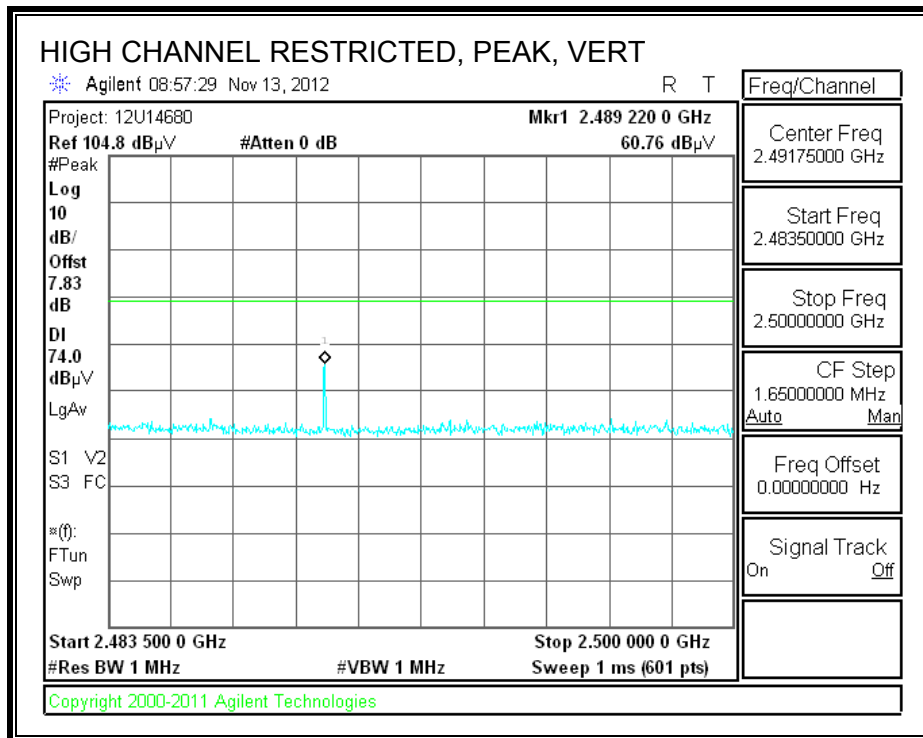


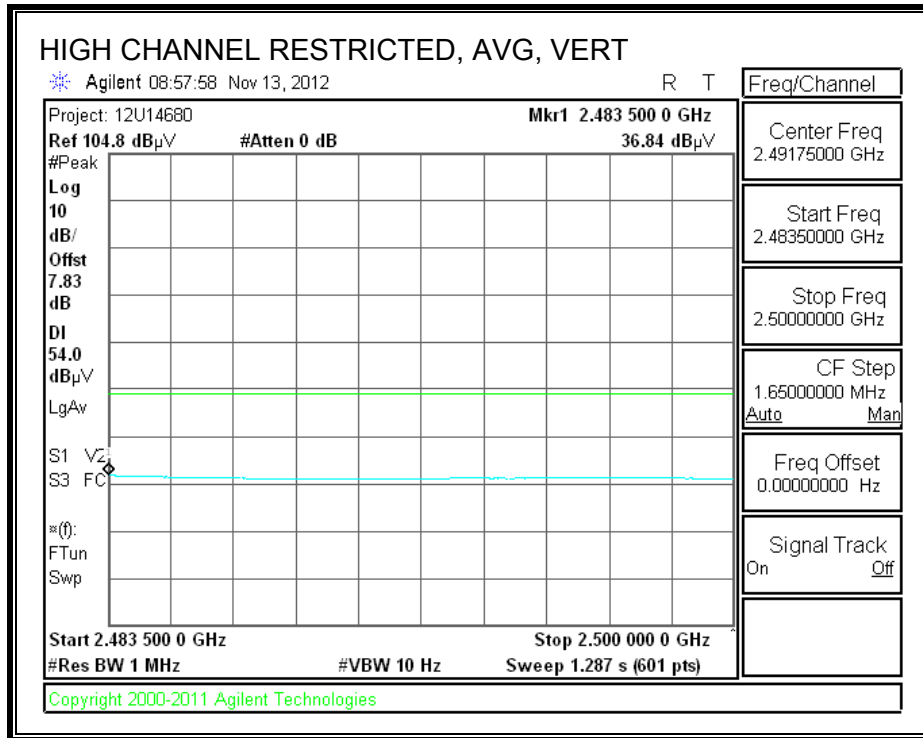
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Oliver Su  
 Date: 11/13/12  
 Project #: 12U14680  
 Company: Apple  
 Test Target: FCC 15.247  
 Mode Oper: Bluetooth GFSK, Tx

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	Notes
<b>Low Ch (2402MHz)</b>													
4.804	3.0	54.2	33.1	6.3	-34.8	0.0	0.0	58.7	74.0	-15.3	H	P	
4.804	3.0	47.3	33.1	6.3	-34.8	0.0	0.0	49.4	54.0	-4.6	H	A	
4.804	3.0	55.2	33.1	6.3	-34.8	0.0	0.0	59.7	74.0	-14.3	V	P	
4.804	3.0	47.9	33.1	6.3	-34.8	0.0	0.0	50.1	54.0	-3.9	V	A	
<b>Mid Ch (2441MHz)</b>													
4.882	3.0	52.0	33.1	6.3	-34.8	0.0	0.0	56.6	74.0	-17.4	V	P	
4.882	3.0	45.3	33.1	6.3	-34.8	0.0	0.0	47.5	54.0	-6.5	V	A	
4.882	3.0	51.8	33.1	6.3	-34.8	0.0	0.0	56.4	74.0	-17.6	H	P	
4.882	3.0	45.0	33.1	6.3	-34.8	0.0	0.0	47.3	54.0	-6.7	H	A	
<b>High Ch (2480MHz)</b>													
4.960	3.0	49.9	33.2	6.4	-34.8	0.0	0.0	54.7	74.0	-19.3	H	P	
4.960	3.0	43.5	33.2	6.4	-34.8	0.0	0.0	45.9	54.0	-8.1	H	A	
4.960	3.0	49.2	33.2	6.4	-34.8	0.0	0.0	54.0	74.0	-20.0	V	P	
4.960	3.0	42.7	33.2	6.4	-34.8	0.0	0.0	45.1	54.0	-8.9	V	A	

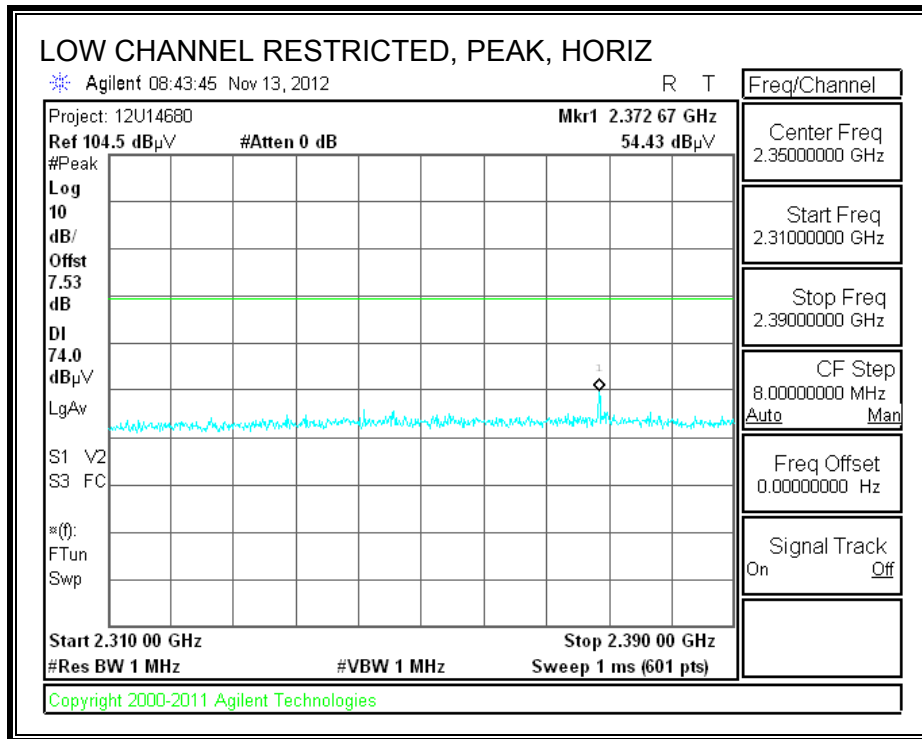
Rev. 4.1.2.7

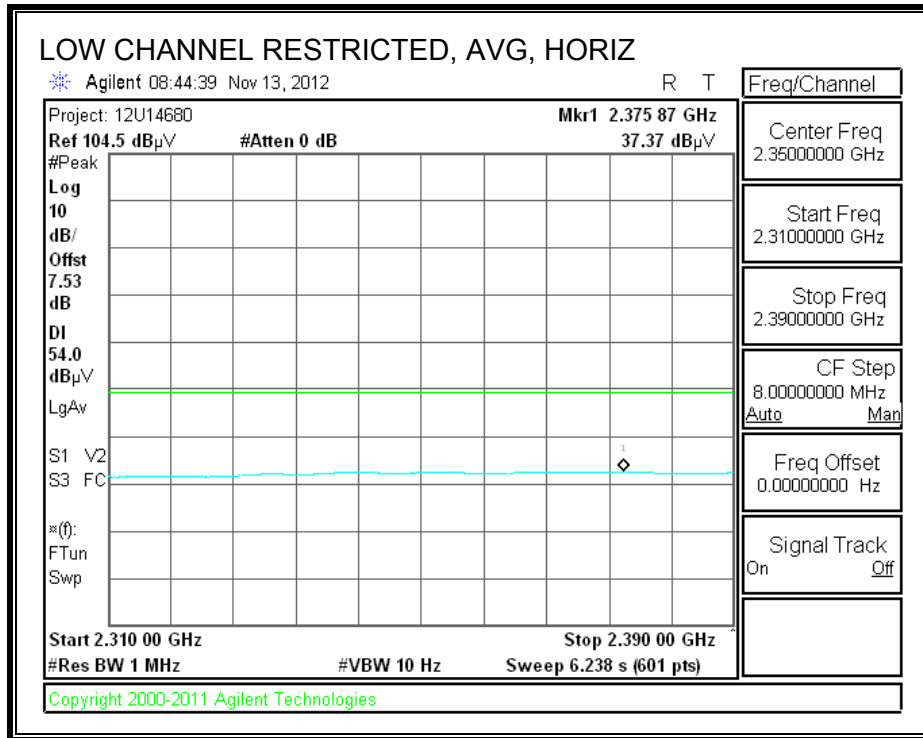
Note: No other emissions were detected above the system noise floor.



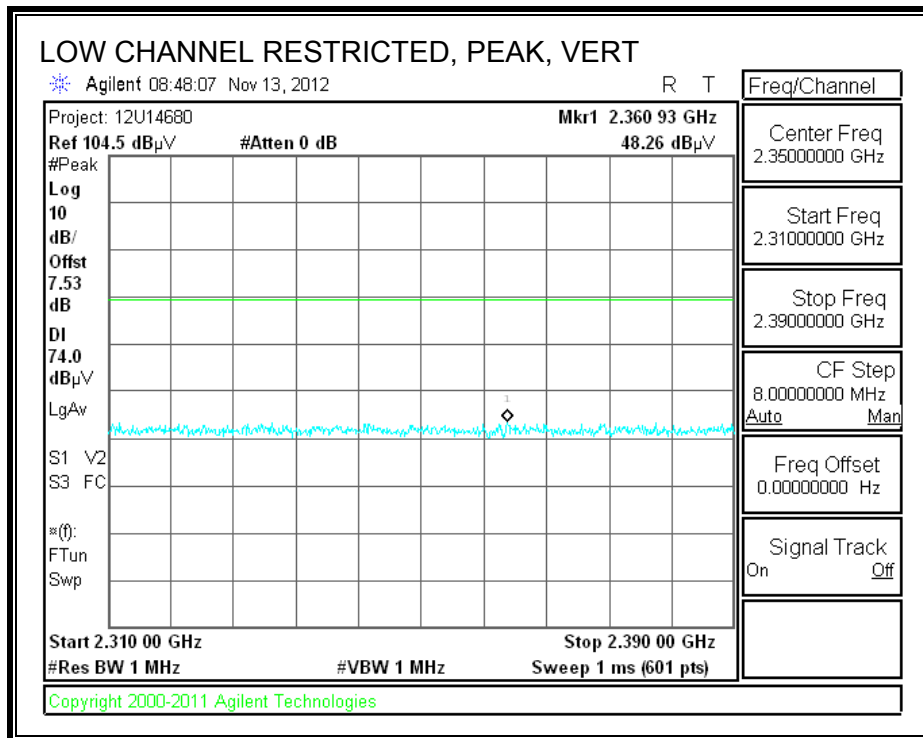
### 8.2.2. ENHANCED DATA RATE 8PSK MODULATION

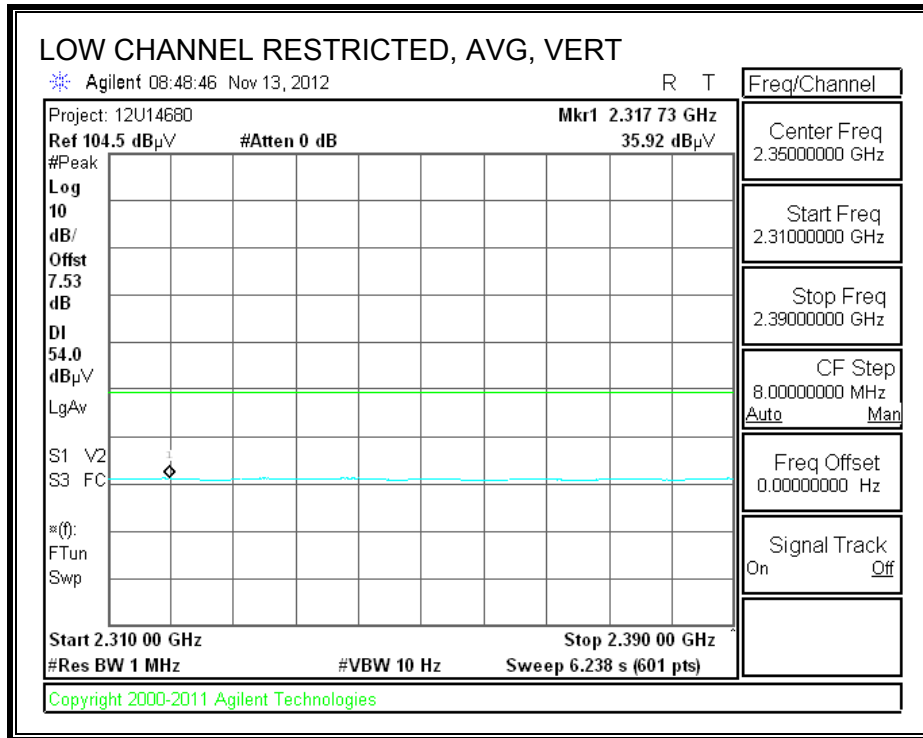
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



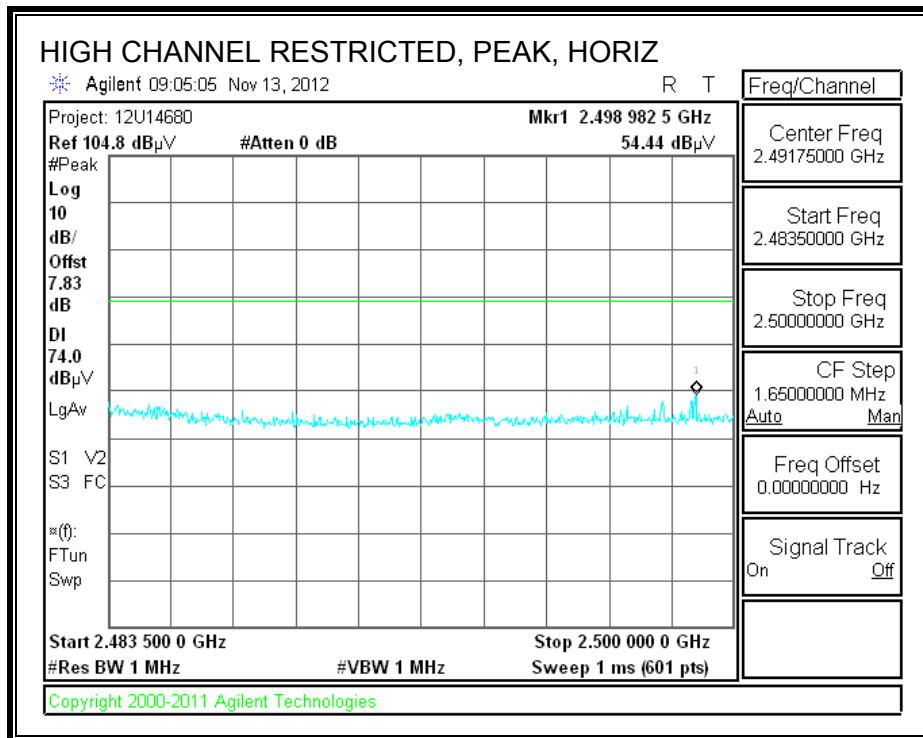


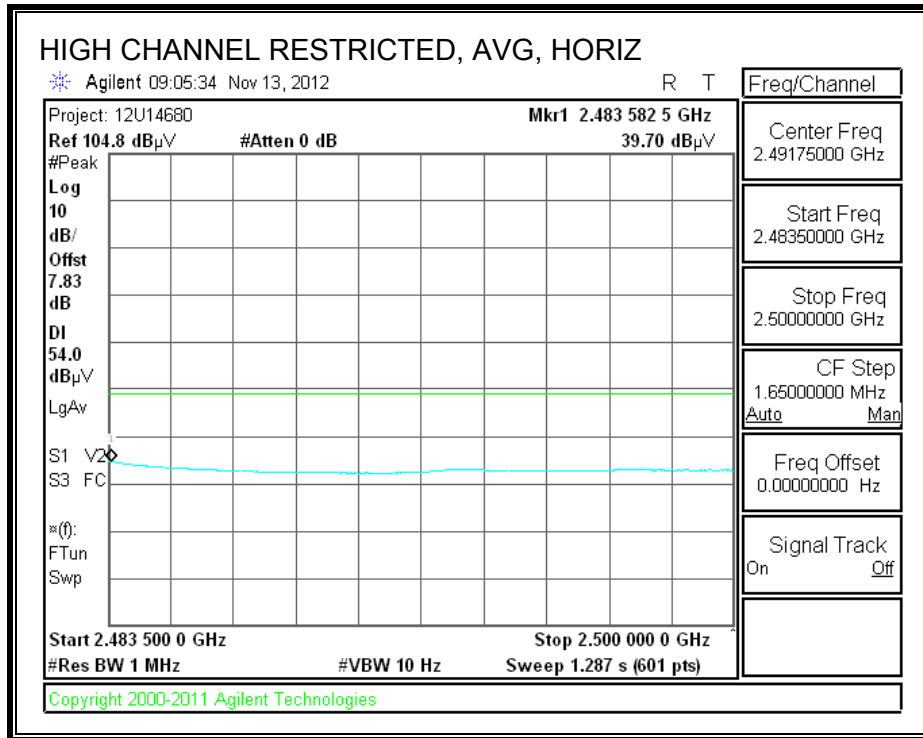
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



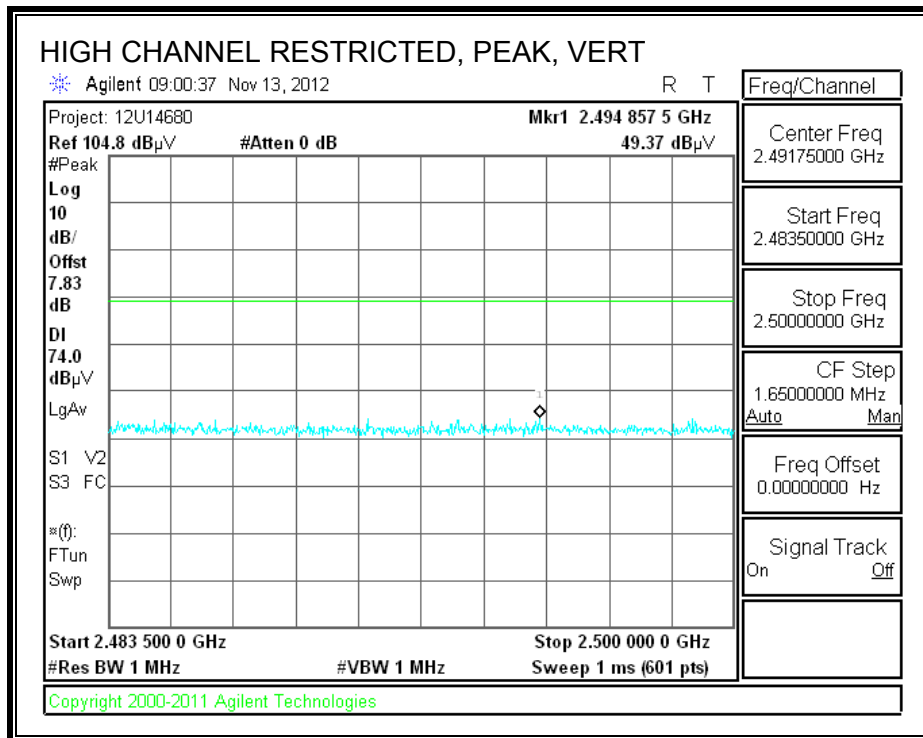


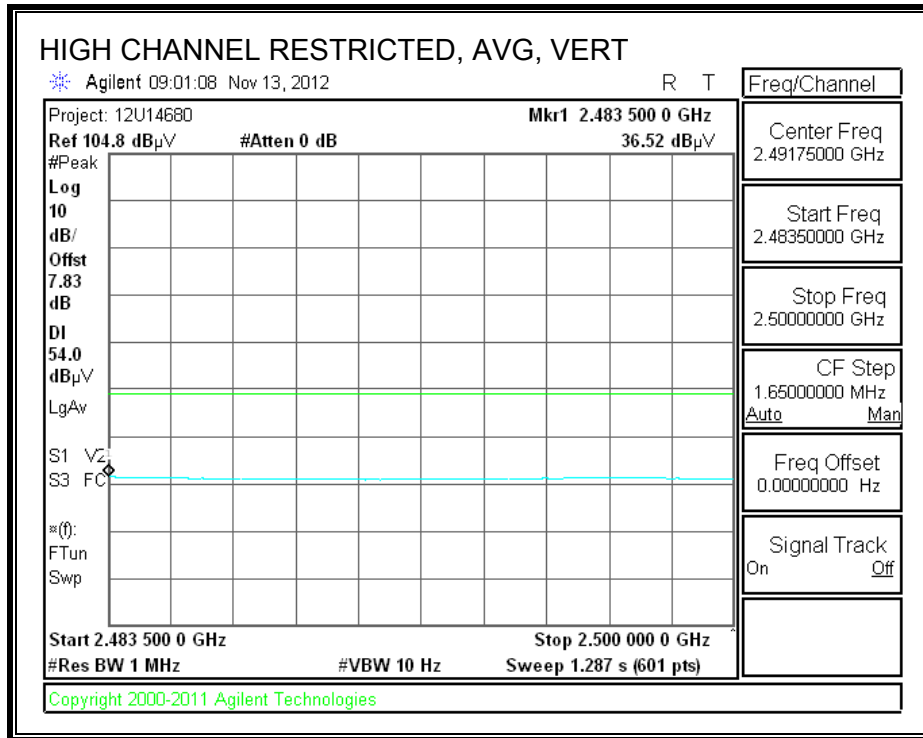
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





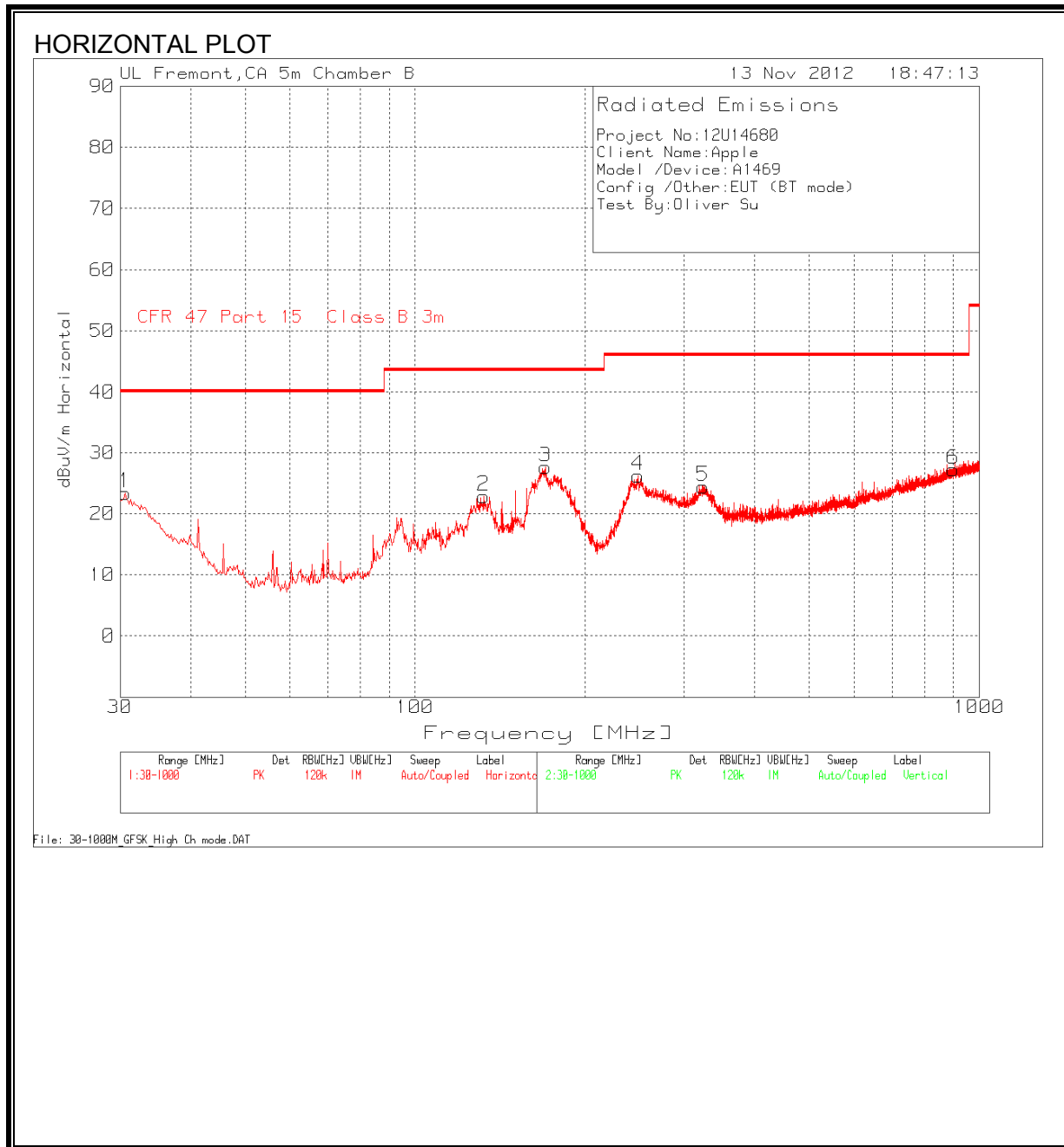


**HARMONICS AND SPURIOUS EMISSIONS**

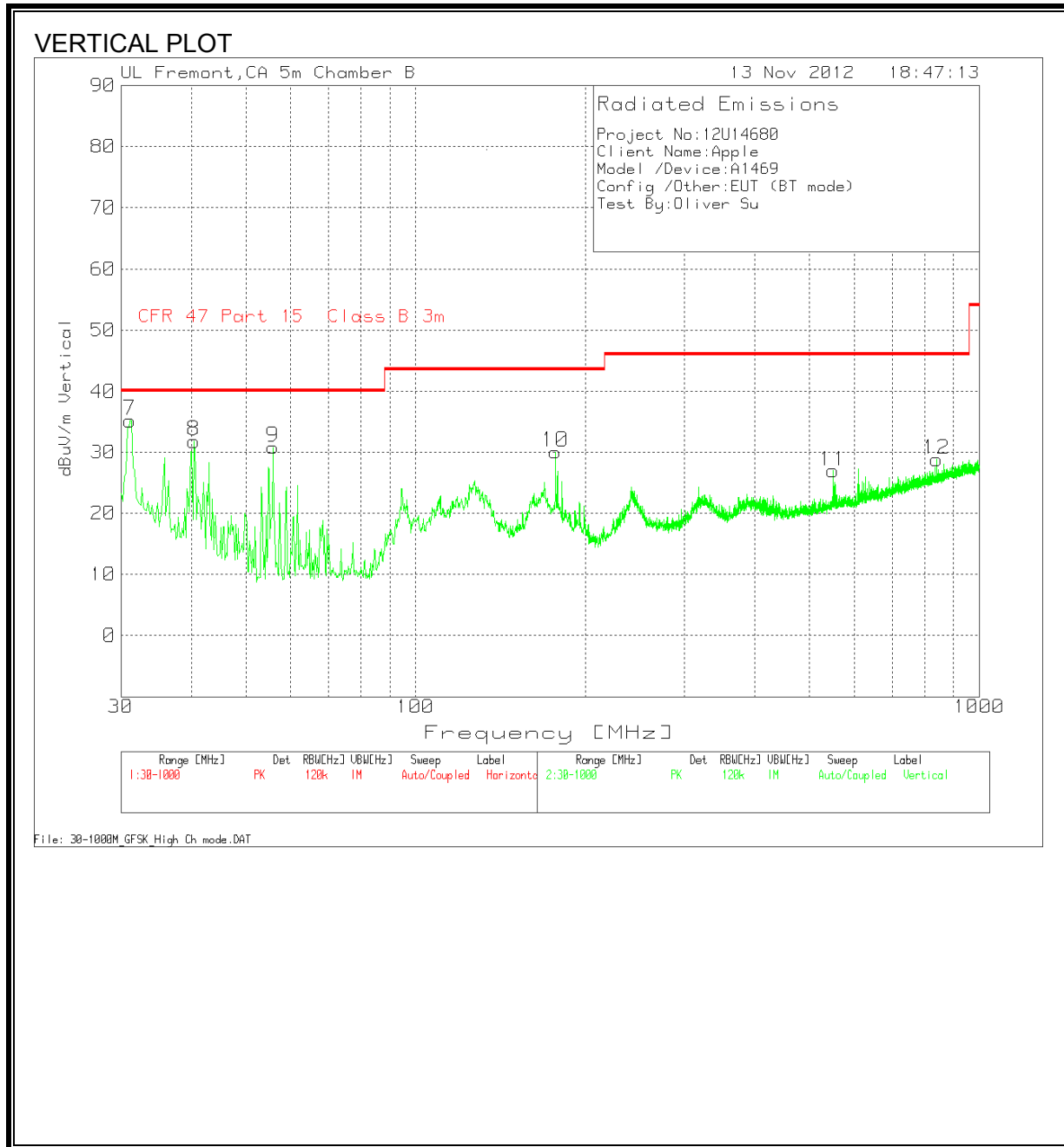
High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Oliver Su											
Date:		11/13/12											
Project #:		12U14680											
Company:		Apple											
Test Target:		FCC 15.247											
Mode Oper:		Bluetooth 8PSK, Tx											
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	Dist	Read	AF	CL	Amp	D Corr	Ftr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/Q/P	
<b>Low Ch (2402MHz)</b>													
4.804	3.0	51.6	33.1	6.3	-34.8	0.0	0.0	56.2	74.0	-17.8	V	P	
4.804	3.0	43.4	33.1	6.3	-34.8	0.0	0.0	47.9	54.0	-6.1	V	A	
4.804	3.0	48.8	33.1	6.3	-34.8	0.0	0.0	53.4	74.0	-20.6	H	P	
4.804	3.0	41.0	33.1	6.3	-34.8	0.0	0.0	45.6	54.0	-8.4	H	A	
<b>Mid Ch (2441MHz)</b>													
4.882	3.0	47.6	33.1	6.3	-34.8	0.0	0.0	52.3	74.0	-21.7	H	P	
4.882	3.0	40.2	33.1	6.3	-34.8	0.0	0.0	44.9	54.0	-9.1	H	A	
4.882	3.0	49.5	33.1	6.3	-34.8	0.0	0.0	54.2	74.0	-19.8	V	P	
4.882	3.0	41.6	33.1	6.3	-34.8	0.0	0.0	46.3	54.0	-7.7	V	A	
<b>High Ch (2480MHz)</b>													
4.960	3.0	45.1	33.2	6.4	-34.8	0.0	0.0	49.9	74.0	-24.1	V	P	
4.960	3.0	37.4	33.2	6.4	-34.8	0.0	0.0	42.2	54.0	-11.8	V	A	
4.960	3.0	44.9	33.2	6.4	-34.8	0.0	0.0	49.7	74.0	-24.3	H	P	
4.960	3.0	37.1	33.2	6.4	-34.8	0.0	0.0	41.9	54.0	-12.2	H	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

### 8.3. WORST-CASE BELOW 1 GHz

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



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



**HORIZONTAL AND VERTICAL DATA**

Project No:12U14680  
 Client Name:Apple  
 Model /Device:A1469  
 Config /Other:EUT (BT mode)  
 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
30.5815	31.69	PK	21	-29.3	23.39	40	-16.61	Horz
132.1563	37.08	PK	13.9	-28.2	22.78	43.5	-20.72	Horz
170.3437	43.6	PK	11.8	-27.8	27.6	43.5	-15.9	Horz
248.4632	41.81	PK	11.6	-27.2	26.21	46	-19.79	Horz
324.2566	37.23	PK	13.9	-26.8	24.33	46	-21.67	Horz
899.3945	29.62	PK	22.3	-24.7	27.22	46	-18.78	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
31.3164	25.67	QP	20.4	-29.3	16.77	40	-23.23	Vert
40.4676	47.6	PK	13.4	-29.1	31.9	40	-8.1	Vert
55.7814	52.62	PK	7.2	-29	30.82	40	-9.18	Vert
176.9345	46.42	PK	11.3	-27.7	30.02	43.5	-13.48	Vert
550.0859	35.4	PK	18.3	-26.8	26.9	46	-19.1	Vert
840.0779	32.25	PK	21.7	-25.2	28.75	46	-17.25	Vert

## 9. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

\*Decreases with the logarithm of the frequency.

### TEST PROCEDURE

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

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

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

**RESULTS**

**6 WORST EMISSIONS**

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

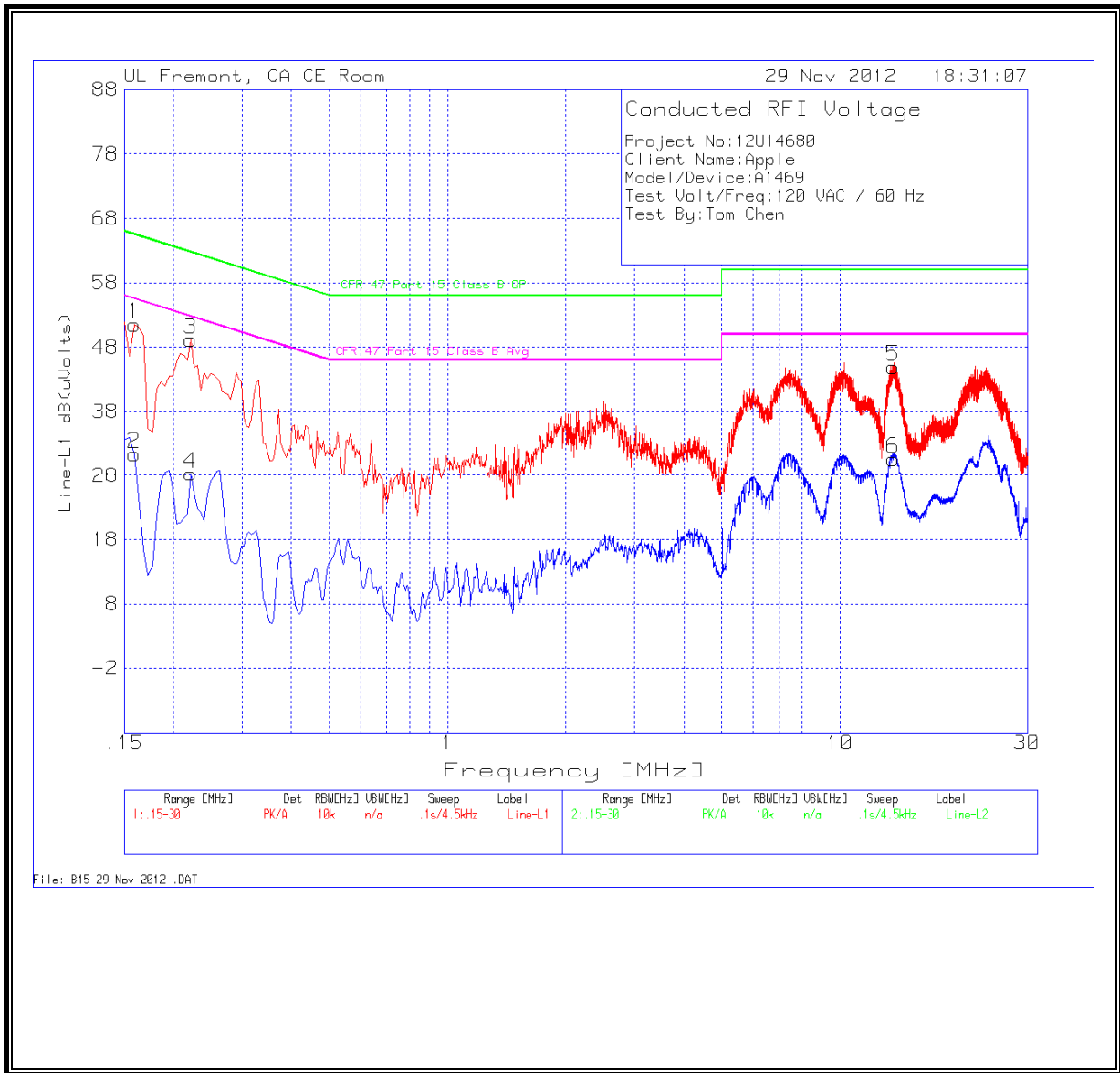
Line-L1 .15 - 30MHz

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**

