



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

CERTIFICATION TEST REPORT

FOR

PORTABLE MEDIA PLAYER WITH BLUETOOTH RADIO

MODEL NUMBER: A1446

FCC ID: BCG-A1446A
IC: 579C-A1446A

REPORT NUMBER: 12U14520-1

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Prepared for
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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: Portable media player with Bluetooth radio

MODEL: A1446

SERIAL NUMBER: Radiated: DVYJ1077F6VQ
Conducted: DCYHQ0A3F5GQ

DATE TESTED: JUNE 24 - JULY 27, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

UL CCS tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:



TIM LEE
STAFF ENGINEER
UL CCS

Tested By:



TOM CHEN
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, 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:

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

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 EUT is a Portable media player that incorporated flash memory, FM radio, pedometer, touchscreen display, and a Bluetooth radio. The unit is battery powered.

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	13.16	20.70
2402 - 2480	Enhanced 8PSK	13.16	20.70

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of -2.8 dBi in the 2.4 GHz band.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 37A00374.

5.5. WORST-CASE CONFIGURATION AND MODE

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

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

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

Worst-case data rates were:

GFSK mode: DH1

8PSK mode: 3-DH5

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	Manufacturer	Model	Serial Number
AC Adapter	Apple	A1344	NA
Laptop PC	Apple	MacBook Pro	NA
Directional Coupler	RF-Lambda	RFDC5M06G15	NA
Headset	Apple	NA	NA

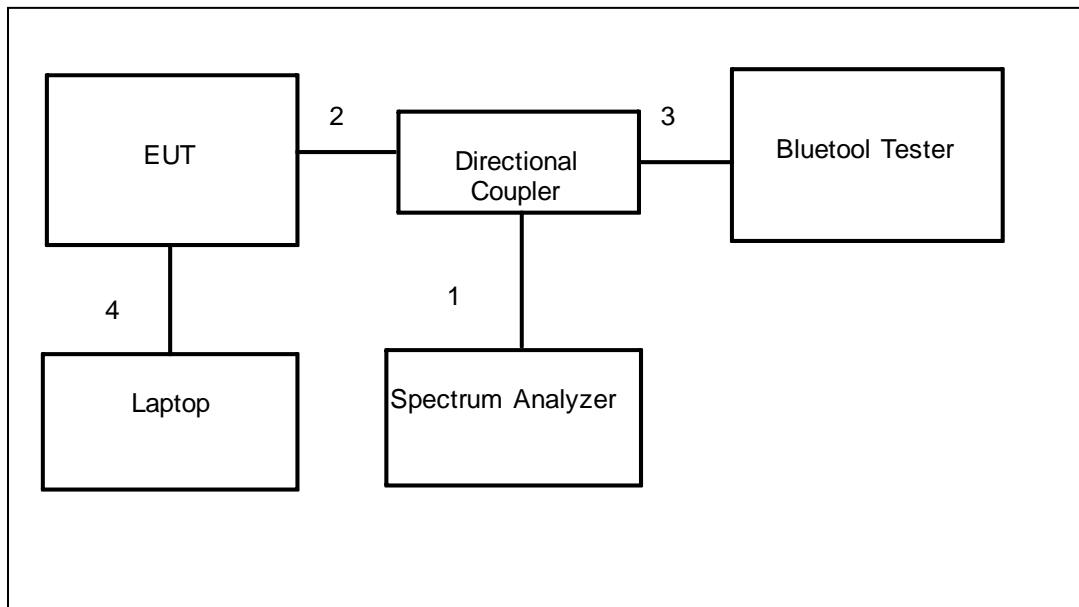
I/O CABLES (Conducted Setup)

Cable No.	Port	# of Identic Ports	Connector Type	Cable Type	Cable Length	Remarks
1	In/Out	1	SMA	Shielded	0.2m	NA
2	In/Out	1	SMA	Shielded	0.6m	NA
3	Antenna Port	1	SMA	Shielded	0.1m	NA
4	Laptop	1	USB	Un-shielded	1m	NA

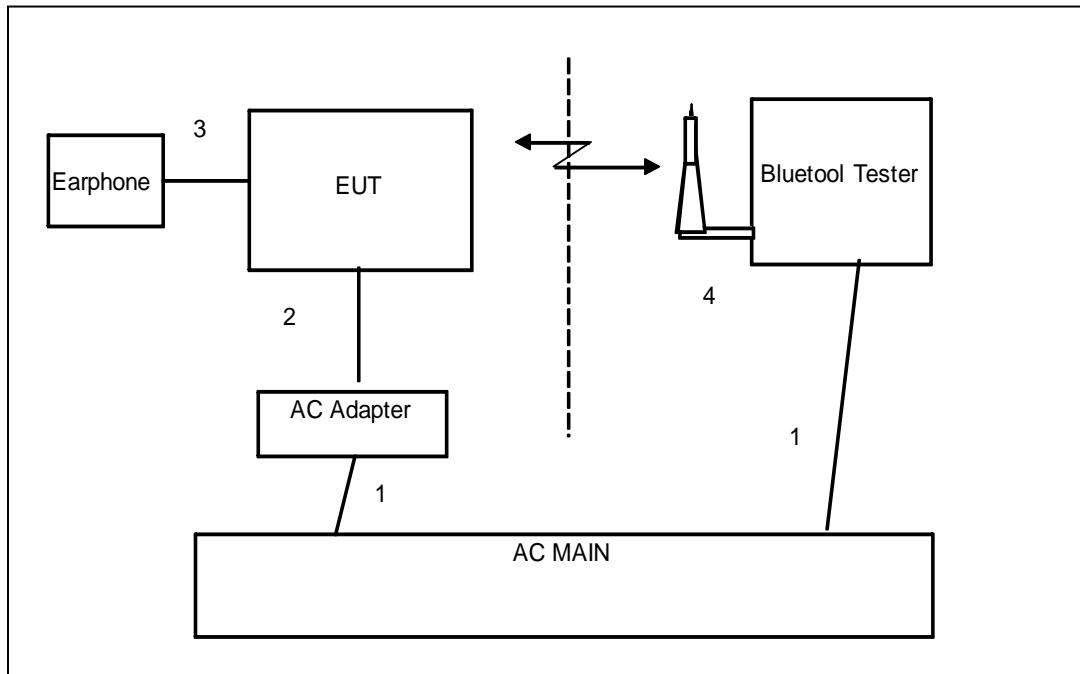
I/O CABLES (Radiated Setup)

I/O CABLE LIST						
Cable No.	Port	# of Identic Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115VAC	Un-Shielded	2m	NA
2	DC	1	DC	Un-Shielded	1m	NA
3	Jack	1	Earphone	Shielded	0.5m	NA
4	Antenna Port	1	Horn	Un-shielded	2m	NA

SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/14/13
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	11/11/12
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/13
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/13
Reject Filter, 2.0-2.9 GHz	Micro-Tronics	BRM50702	N02684	CNR
High Pass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	04/09/13
Peak Power Meter	Agilent	N1911A	1260847C	09/04/12
Peak Power Sensor	Agilent	E9323A	1244073F	09/04/12
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02676	CNR
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR

ANTENNA PORT TEST RESULTS

6.1. BASIC DATA RATE GFSK MODULATION

6.1.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

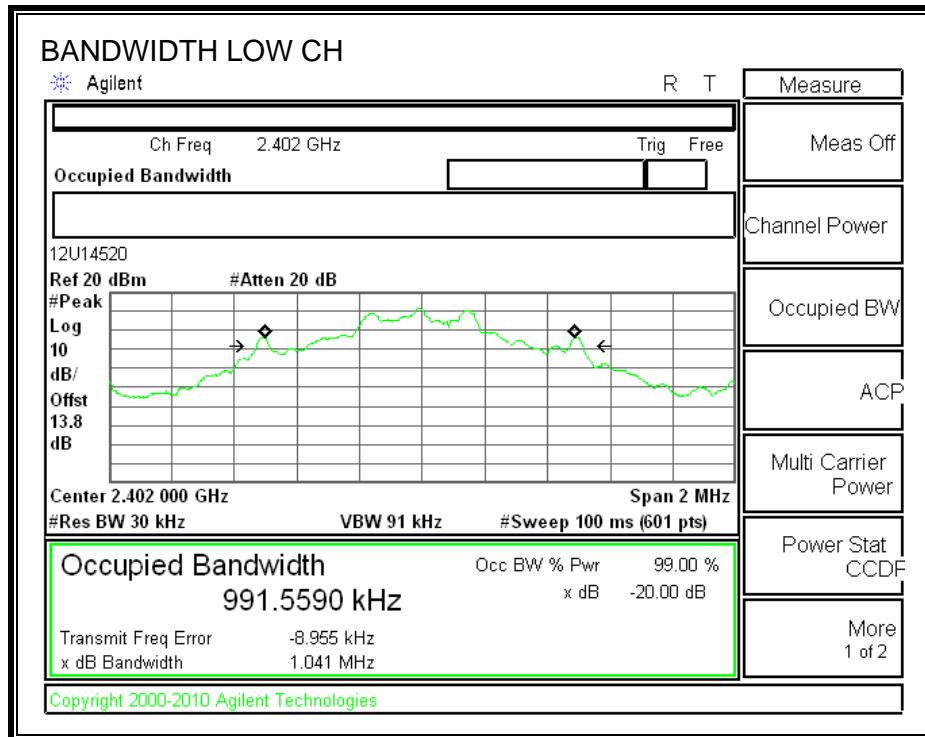
TEST PROCEDURE

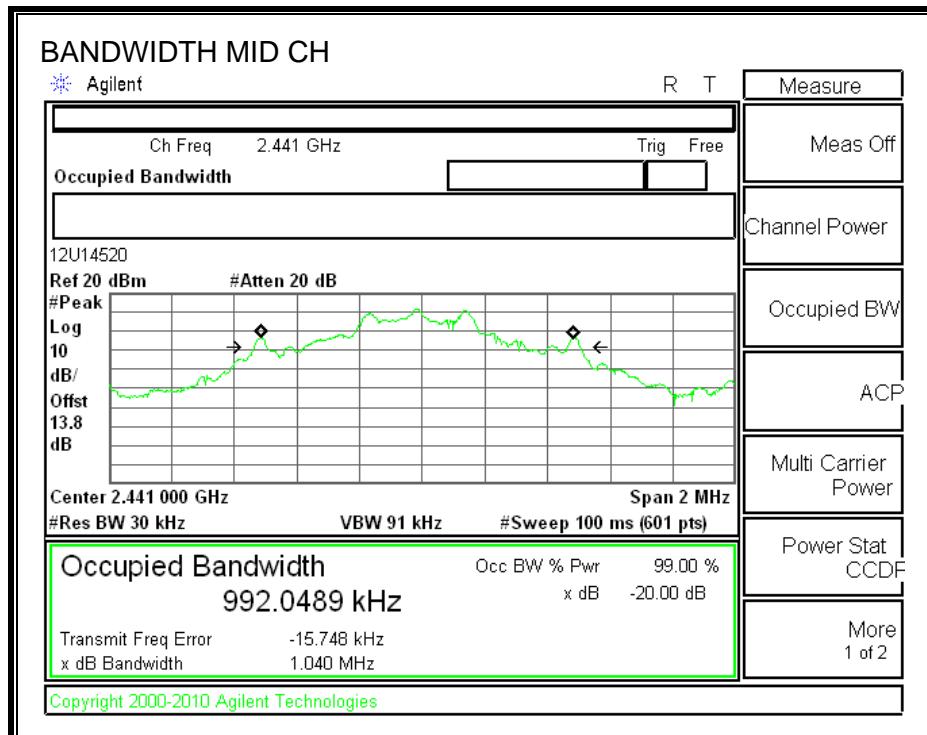
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled

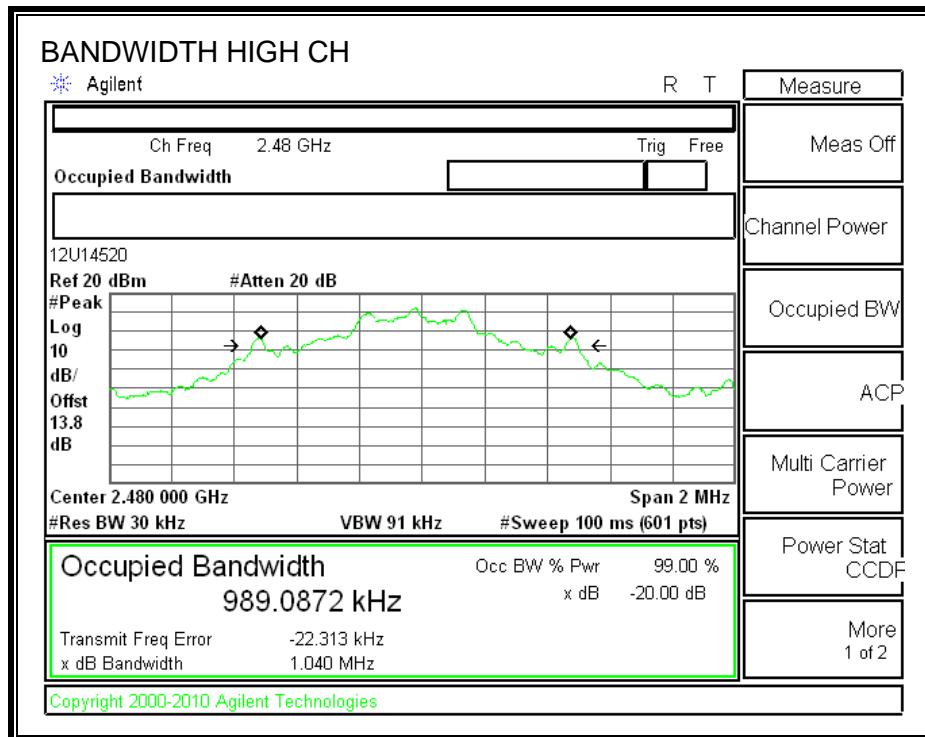
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1041	1010
Middle	2441	1040	1008
High	2480	1040	1011

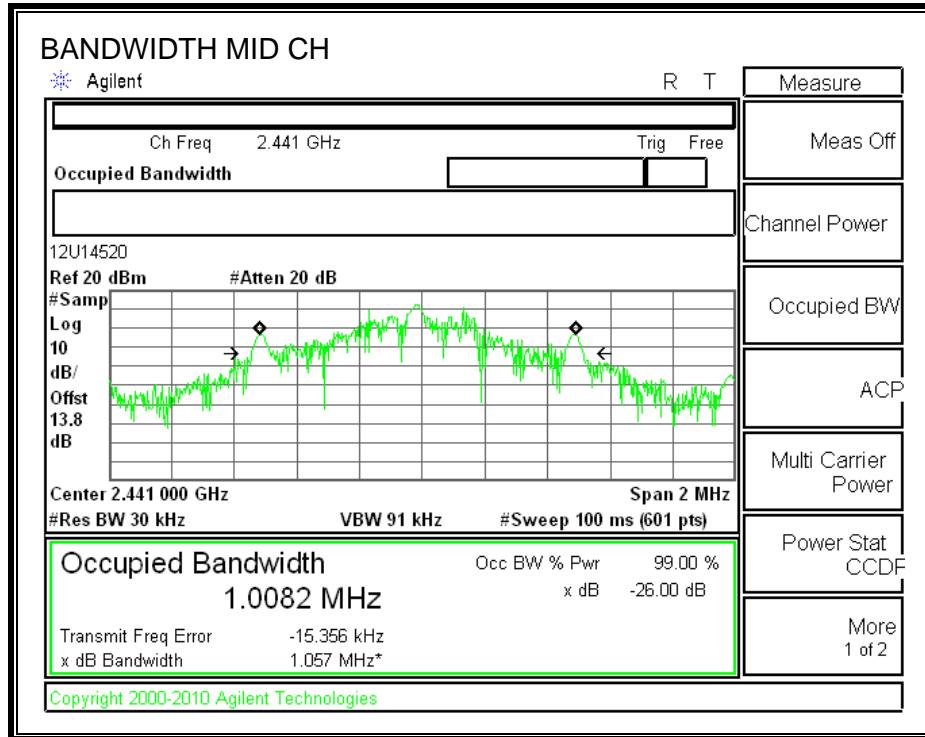
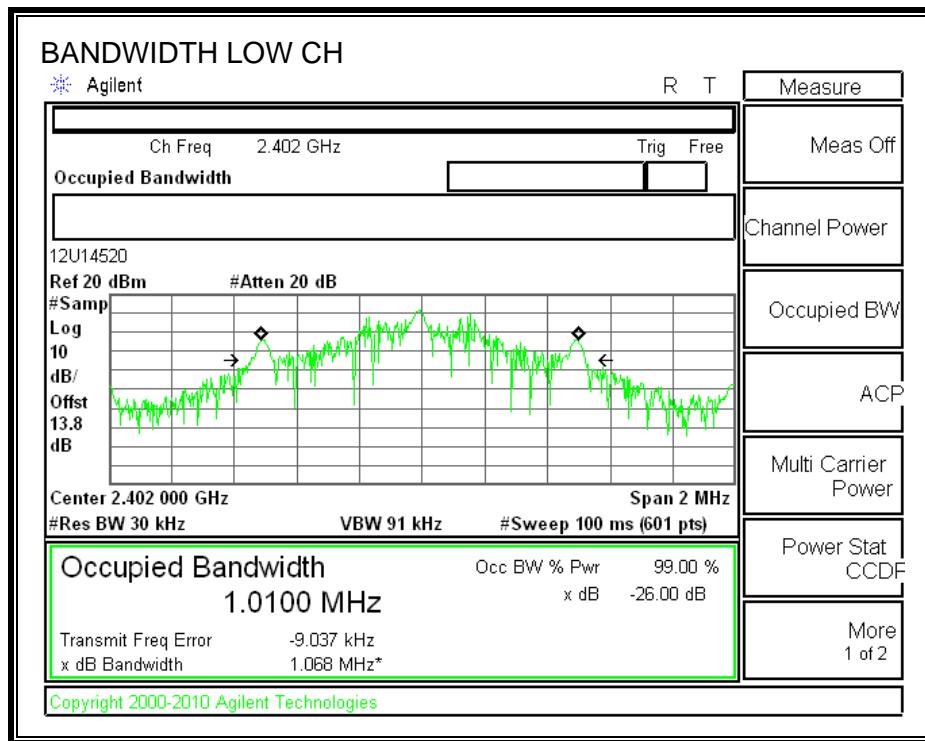
20 dB BANDWIDTH

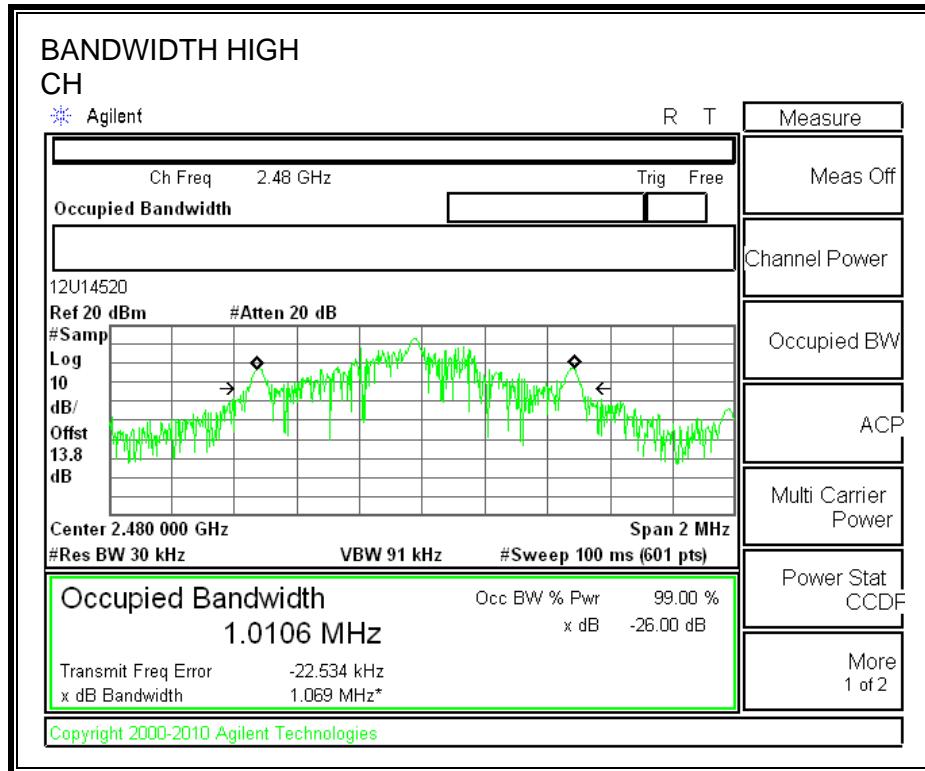






99% BANDWIDTH





6.1.2. 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 hoping channel, whichever is greater.

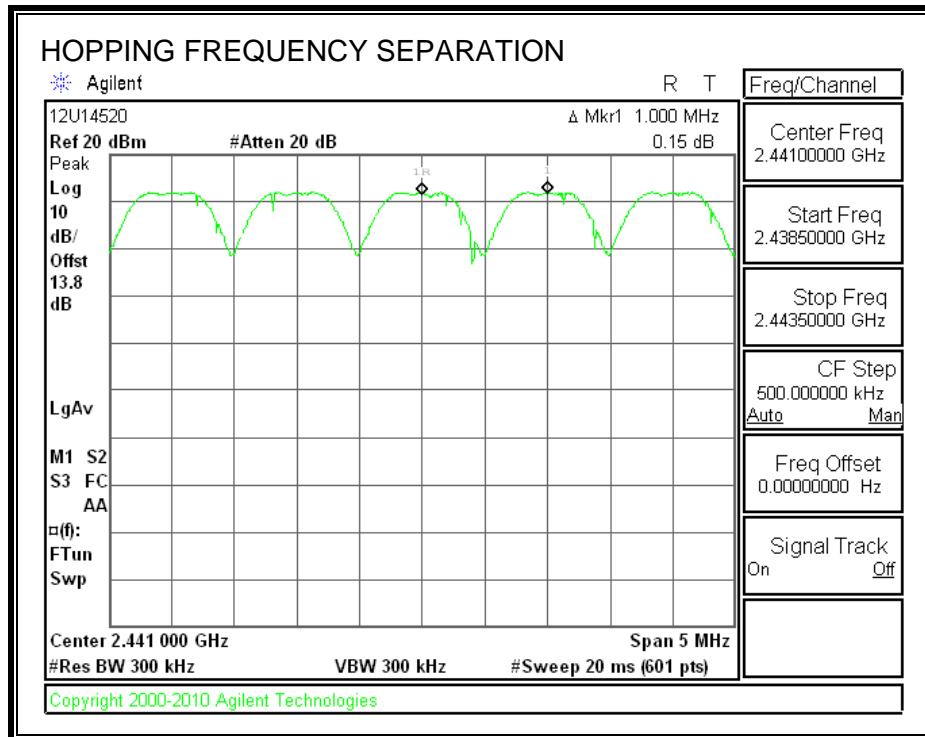
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



6.1.3. 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.

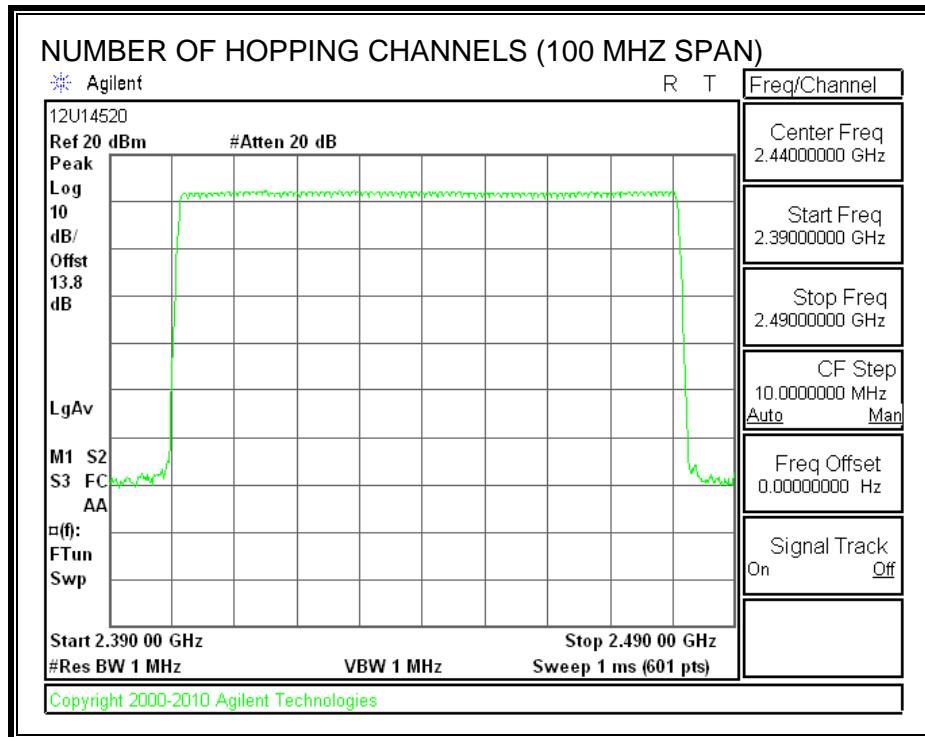
TEST PROCEDURE

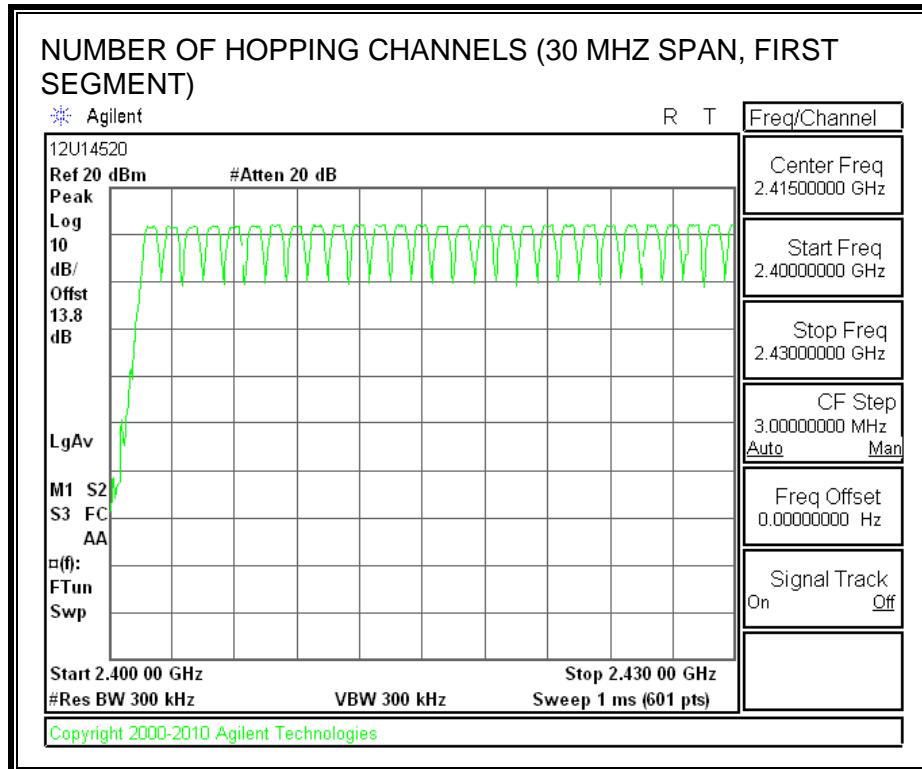
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

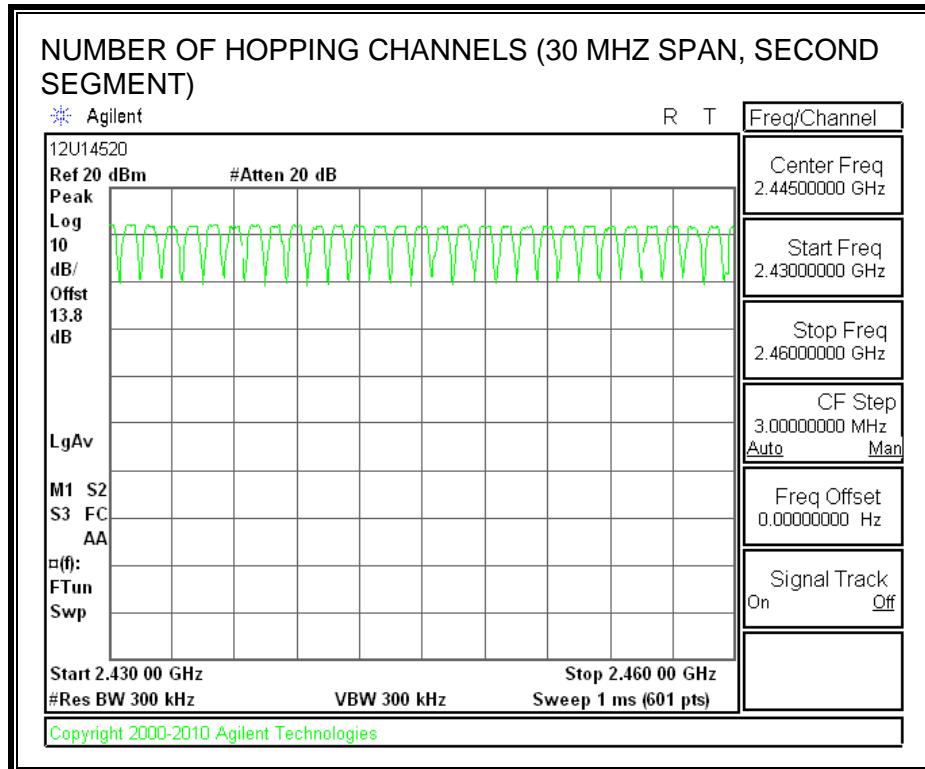
RESULTS

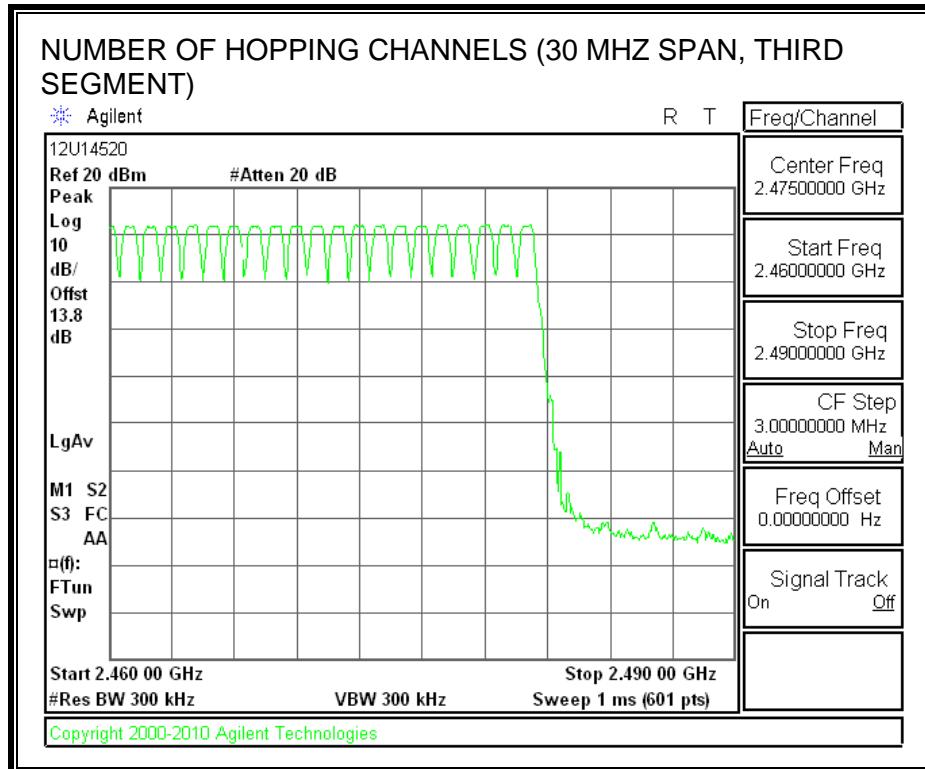
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS









6.1.4. 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.

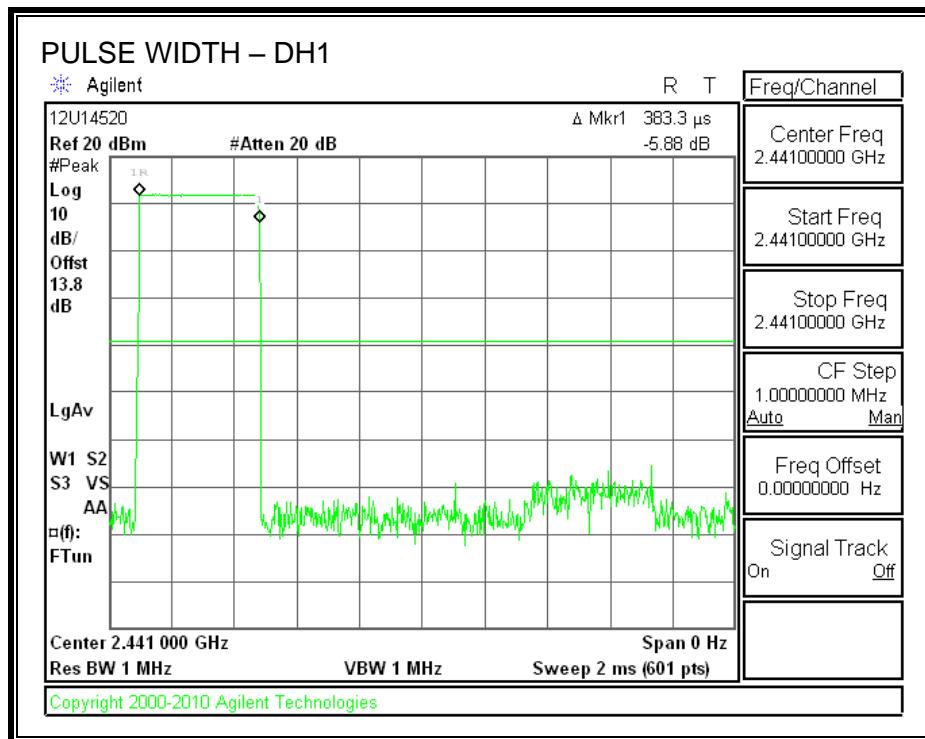
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

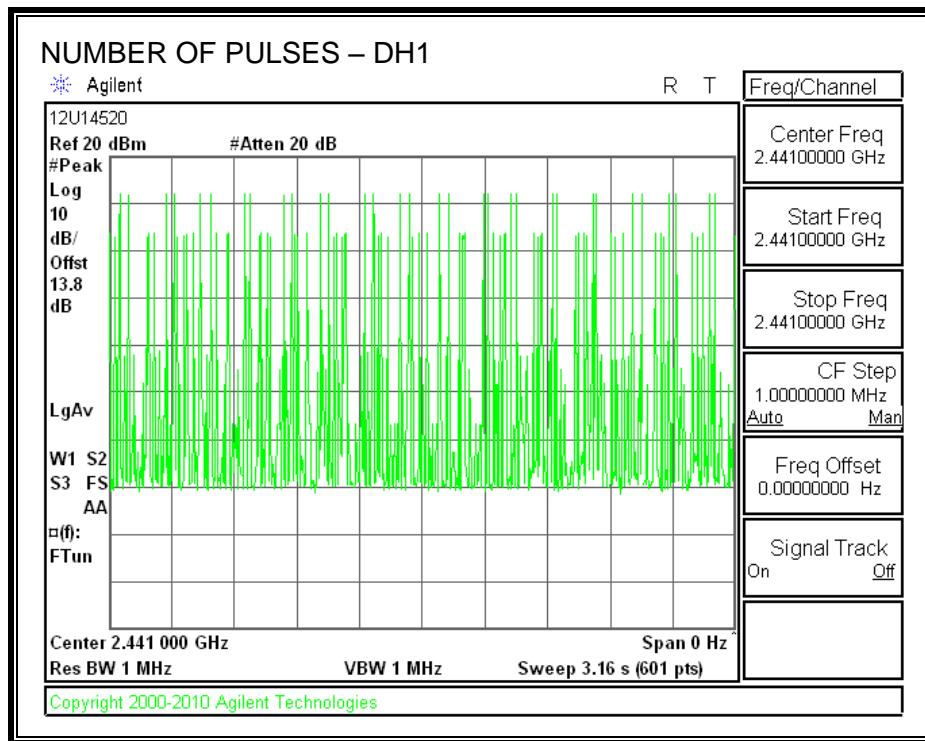
RESULTS

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	0.3833	32	0.123	0.4	-0.277
DH3	1.625	16	0.260	0.4	-0.140
DH5	2.883	4	0.115	0.4	-0.285

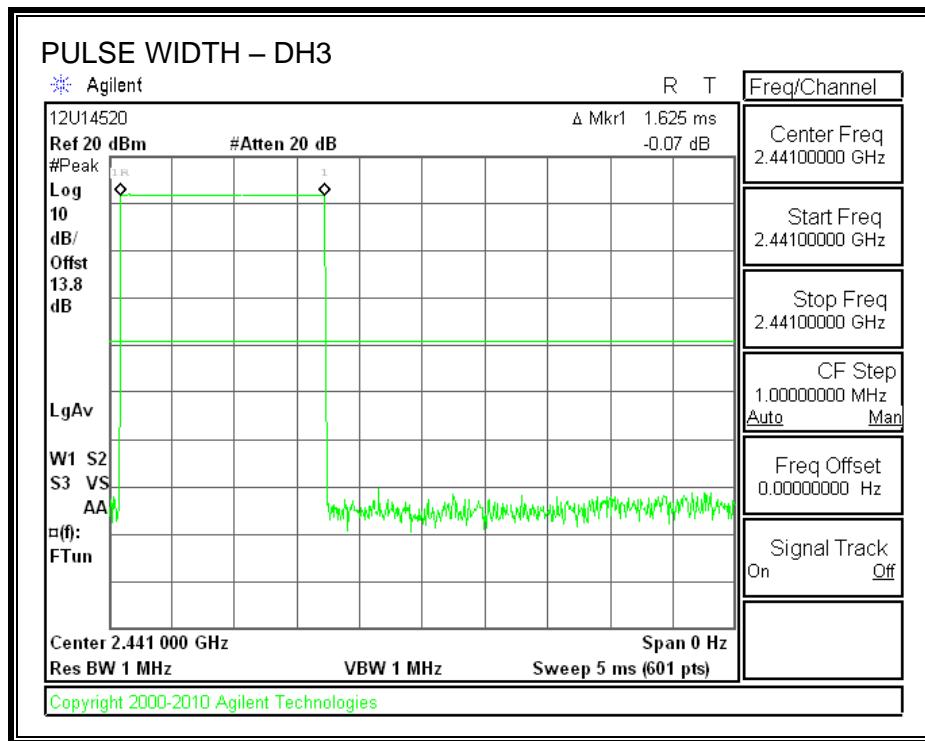
PULSE WIDTH - DH1



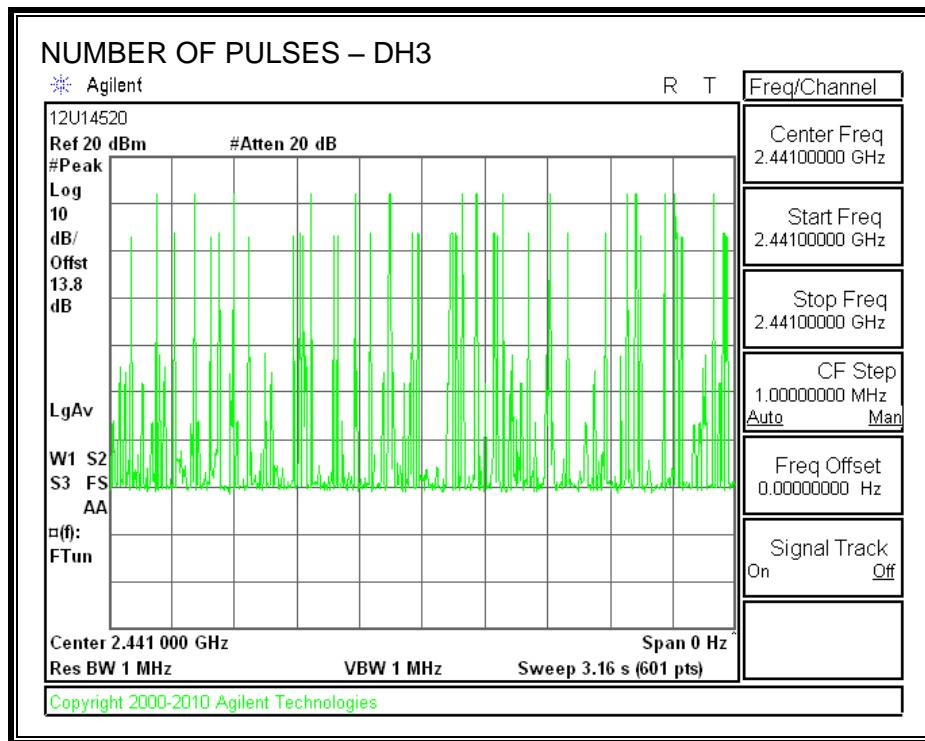
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



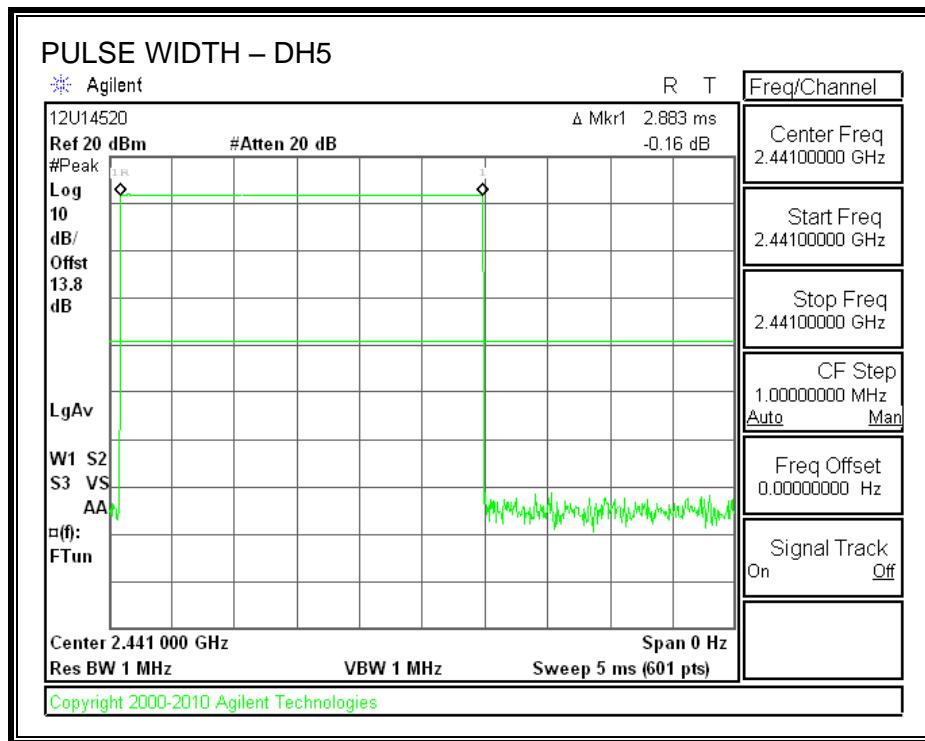
PULSE WIDTH – DH3



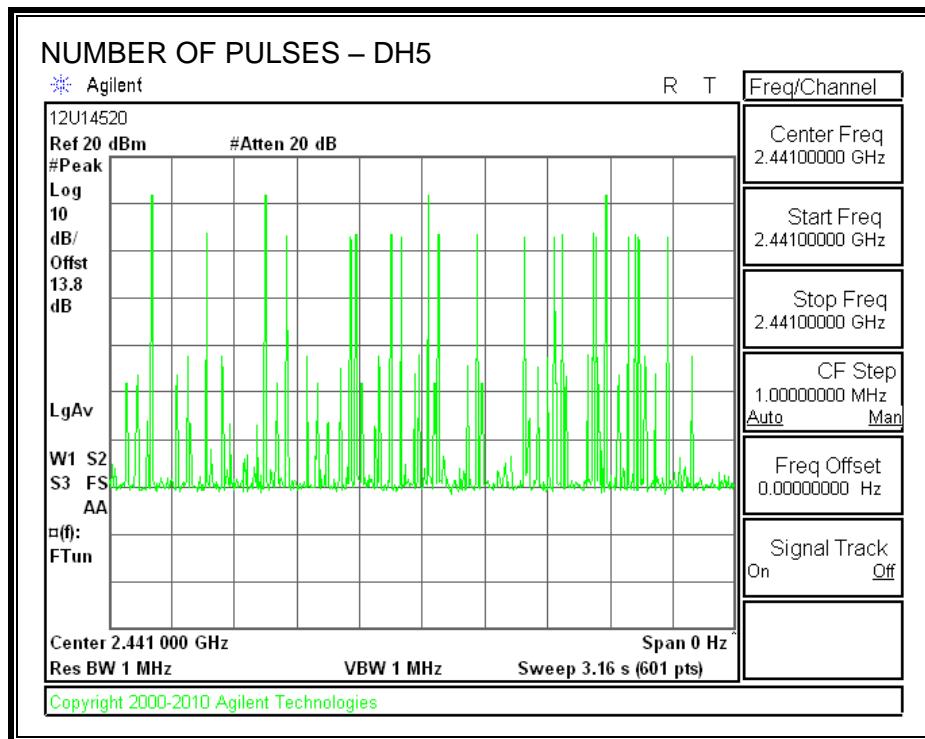
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



6.1.5. 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 30 dBm.

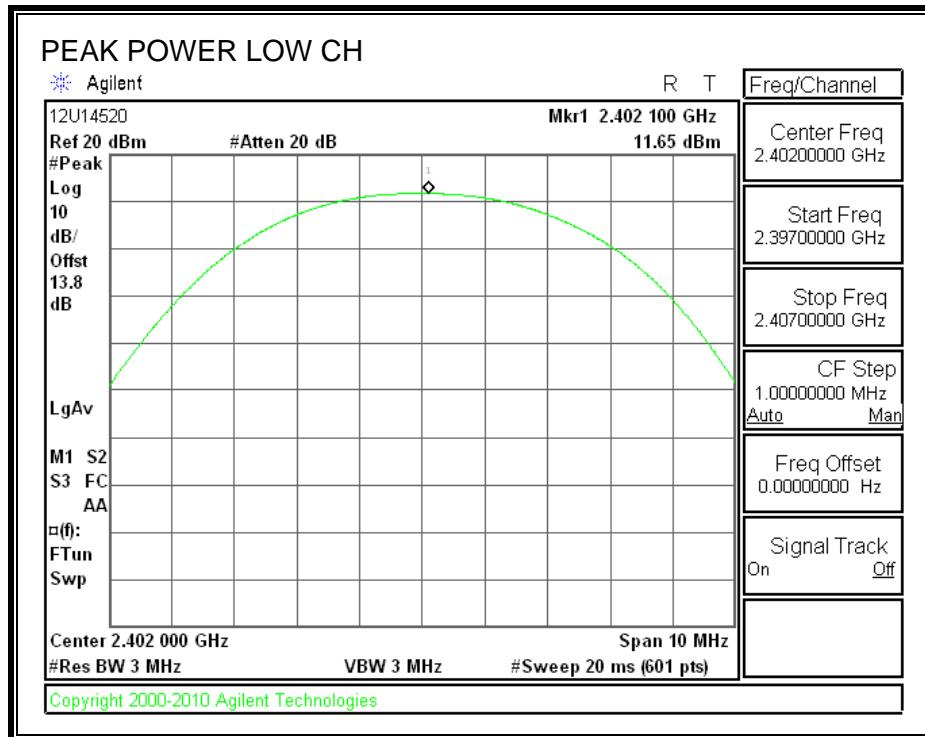
TEST PROCEDURE

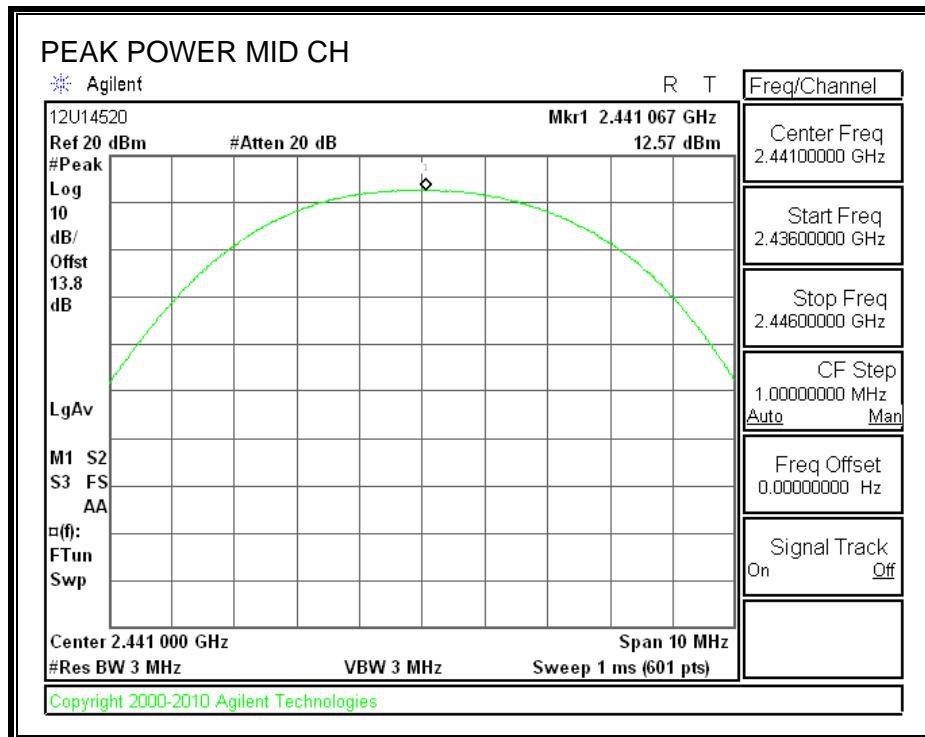
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

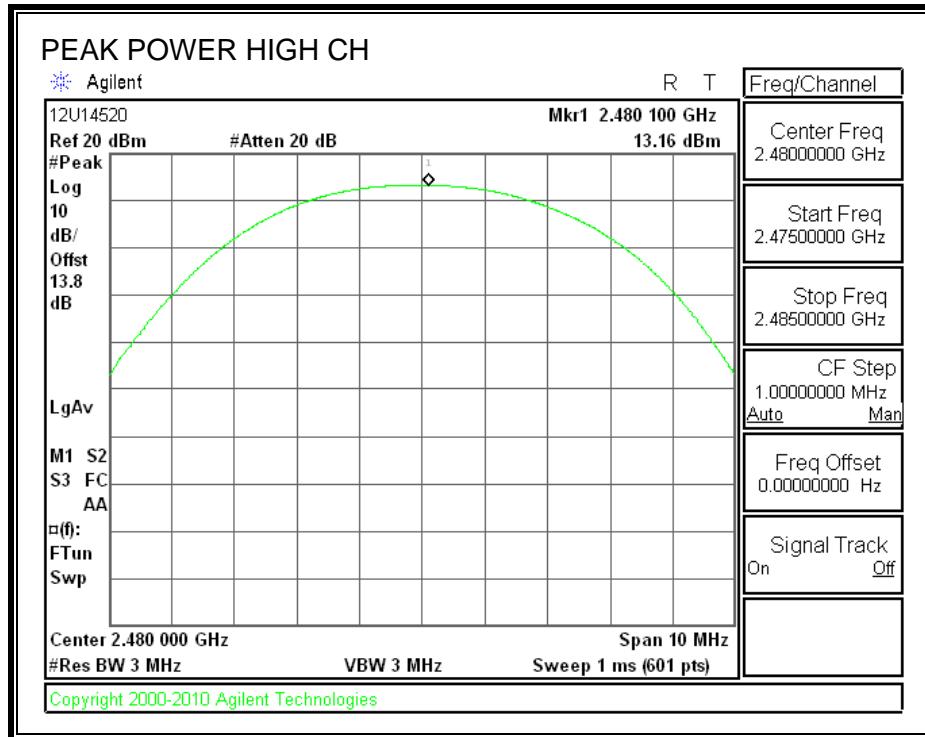
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.65	30	-18.35
Middle	2441	12.57	30	-17.43
High	2480	13.16	30	-16.84

OUTPUT POWER







6.1.6. 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 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)	Average Power (dBm)
Low	2402	11.50
Middle	2441	12.00
High	2480	12.20

6.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

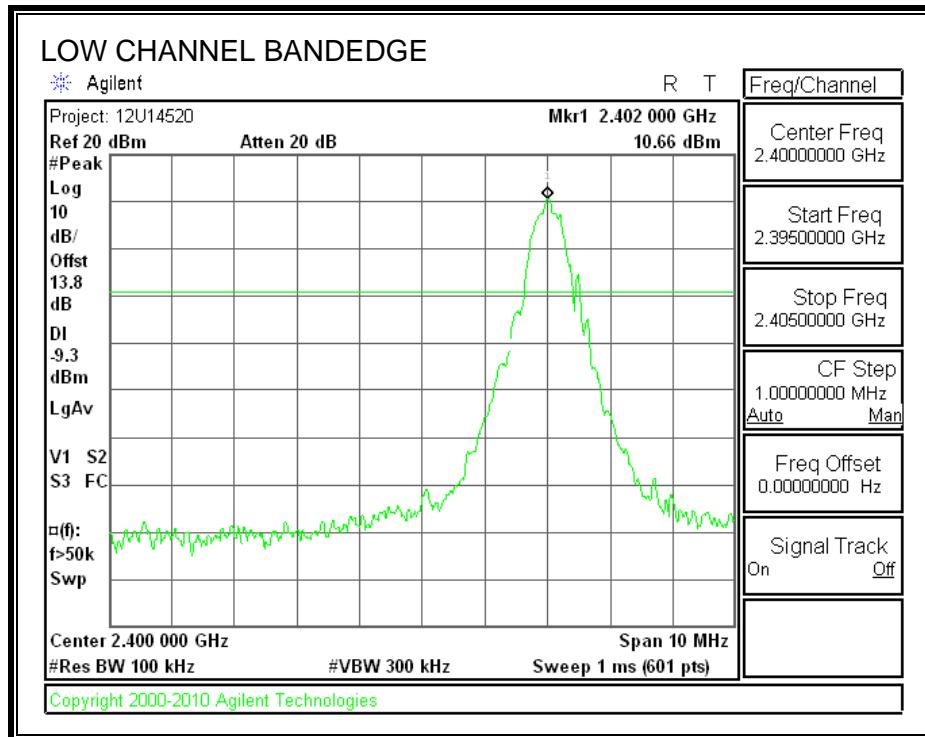
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

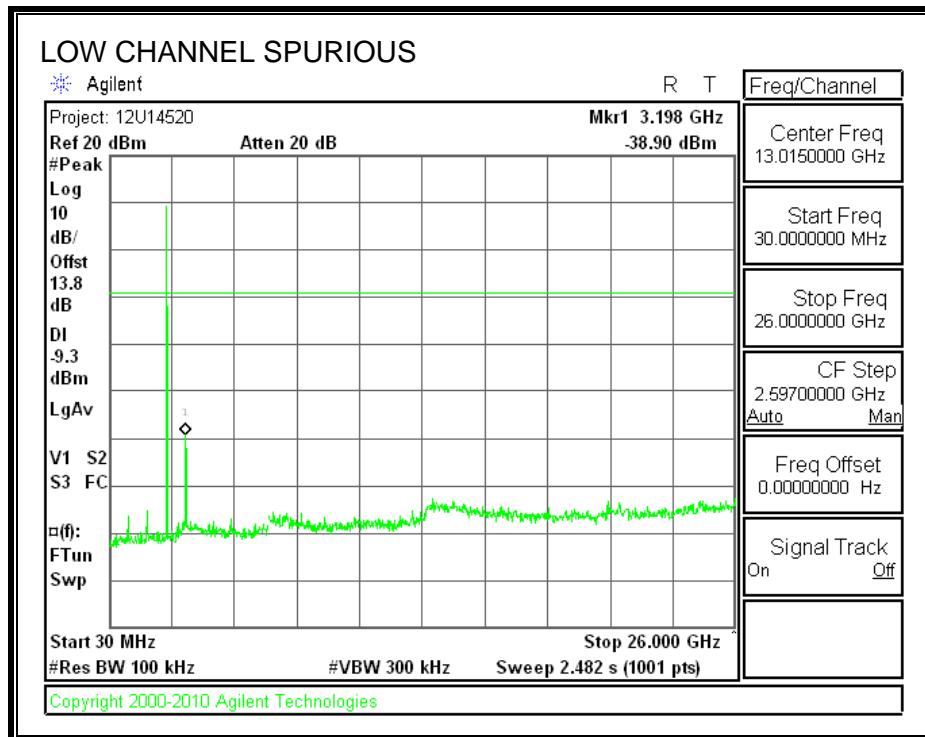
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

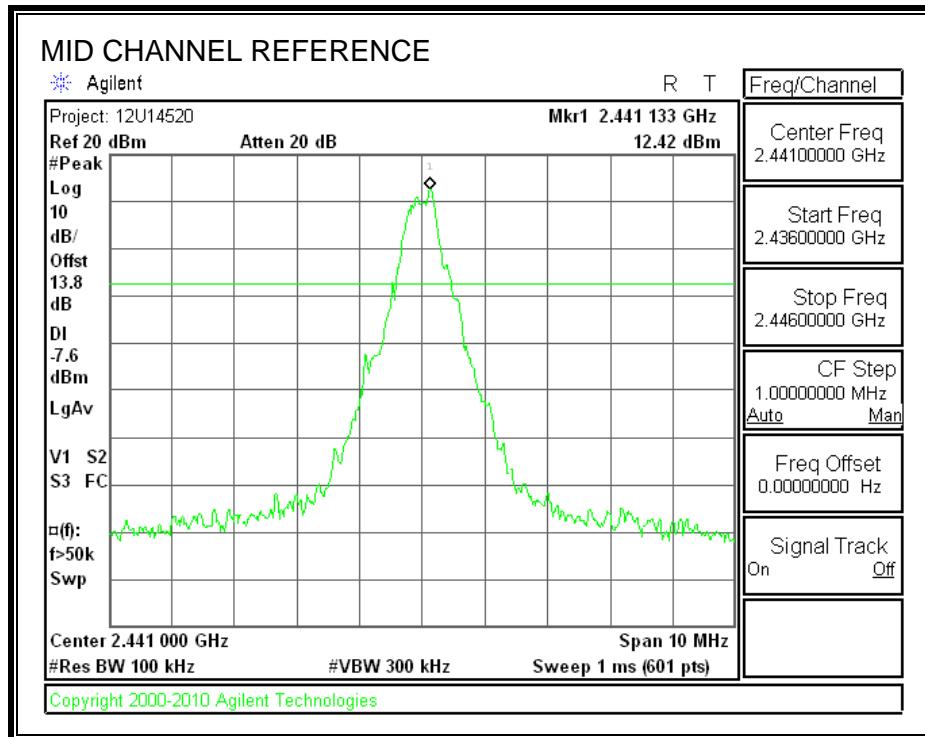
RESULTS

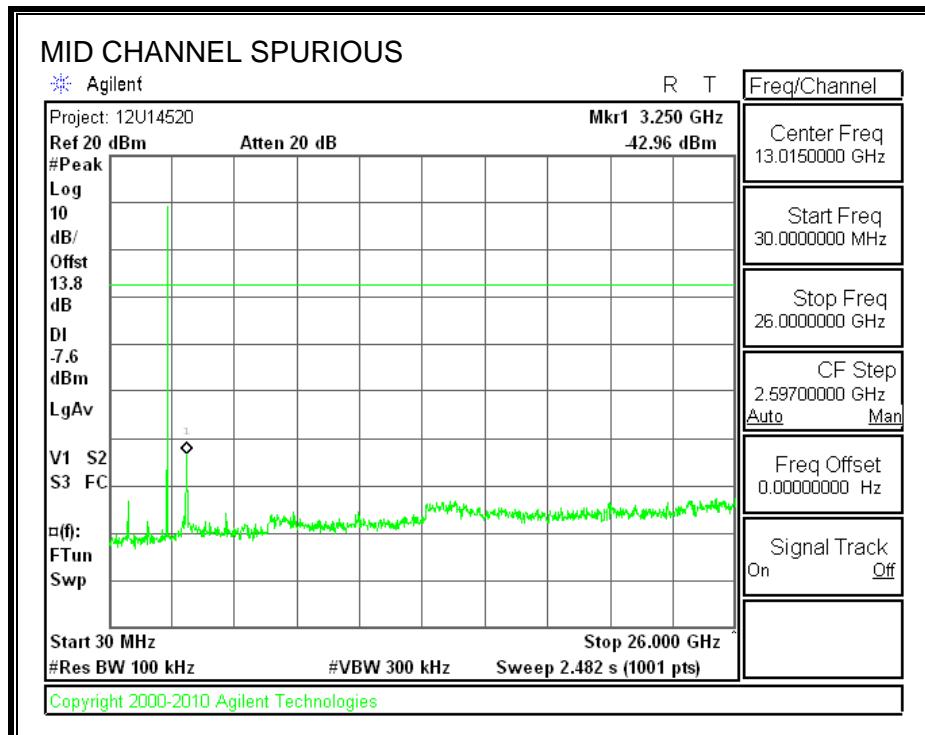
SPURIOUS EMISSIONS, LOW CHANNEL



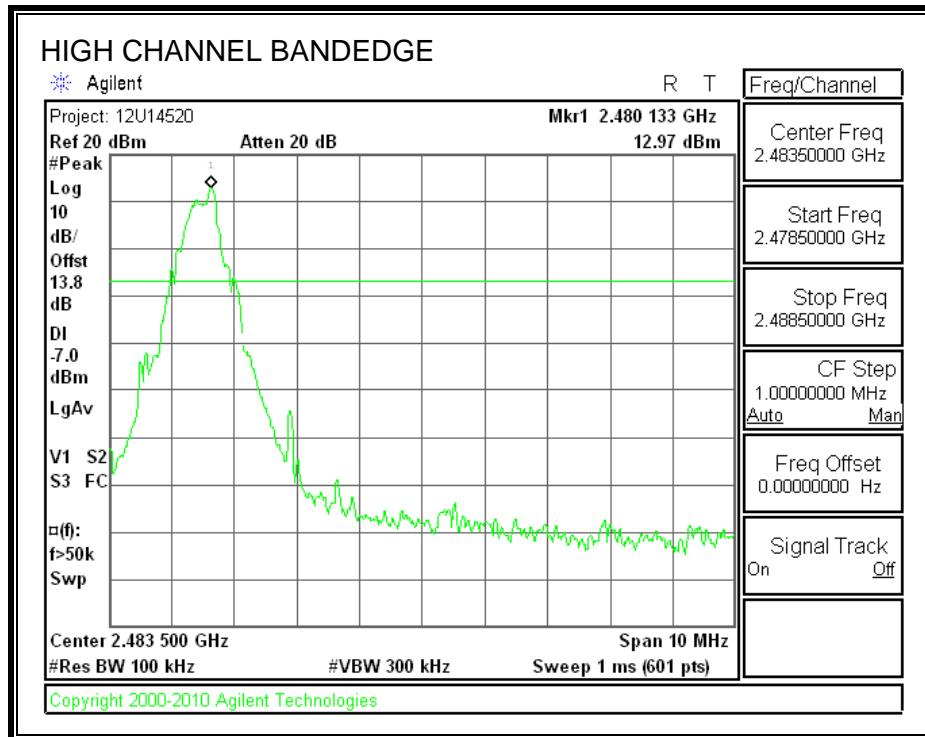


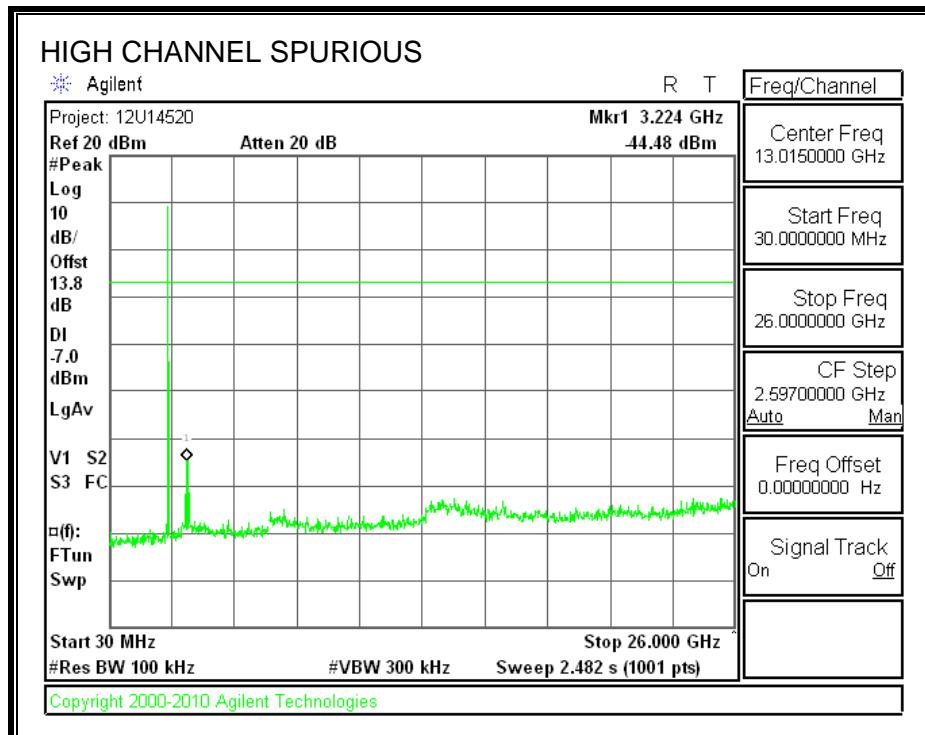
SPURIOUS EMISSIONS, MID CHANNEL



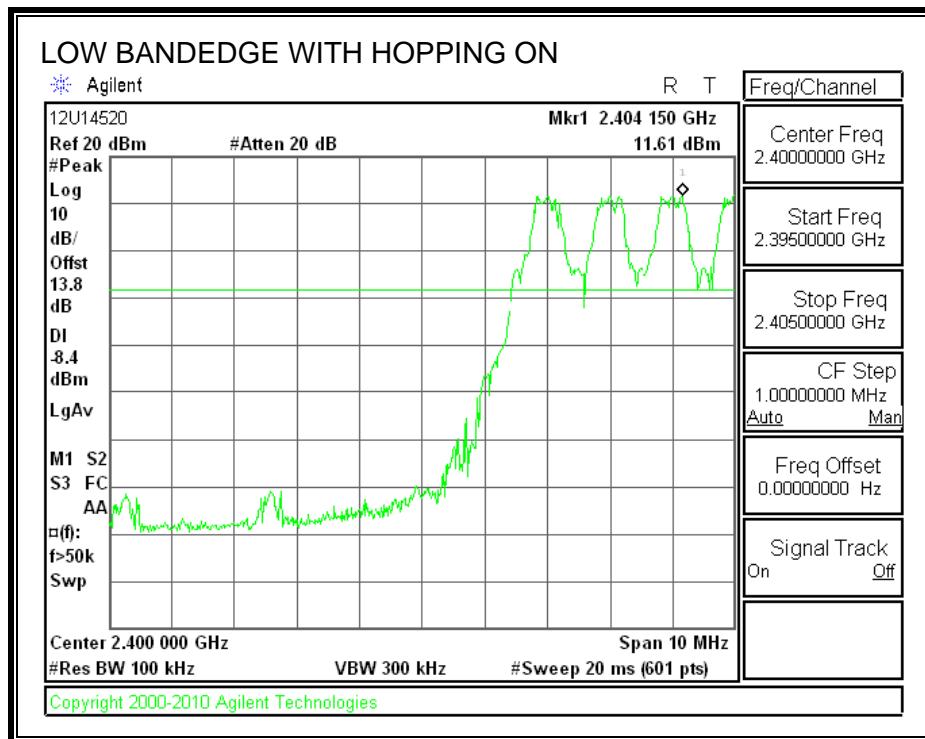


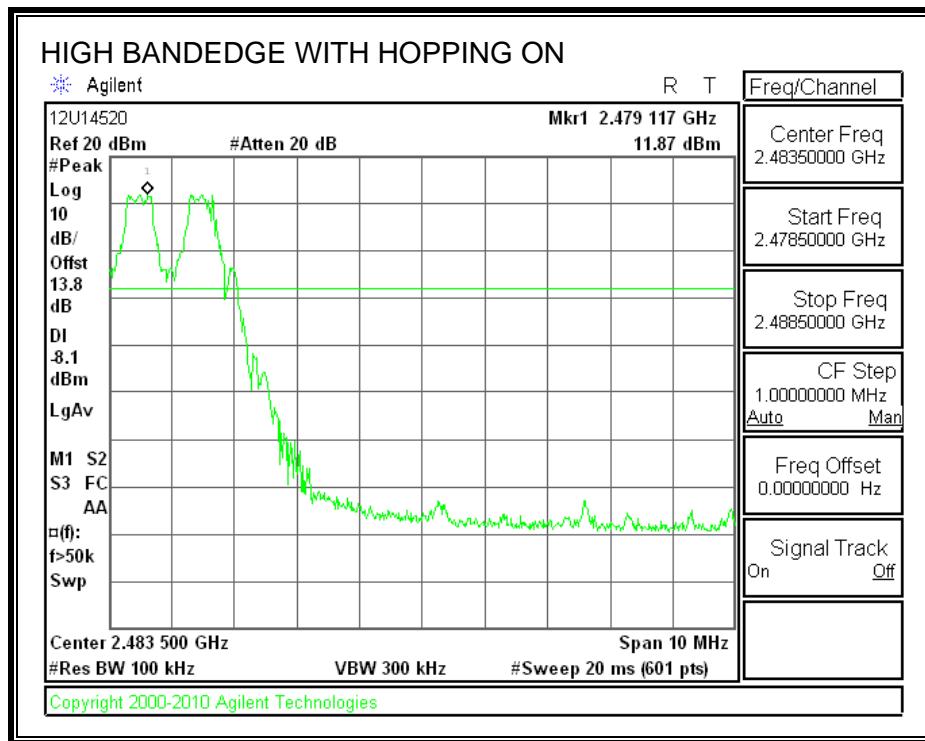
SPURIOUS EMISSIONS, HIGH CHANNEL





SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





6.2. ENHANCED DATA RATE 8PSK MODULATION

6.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

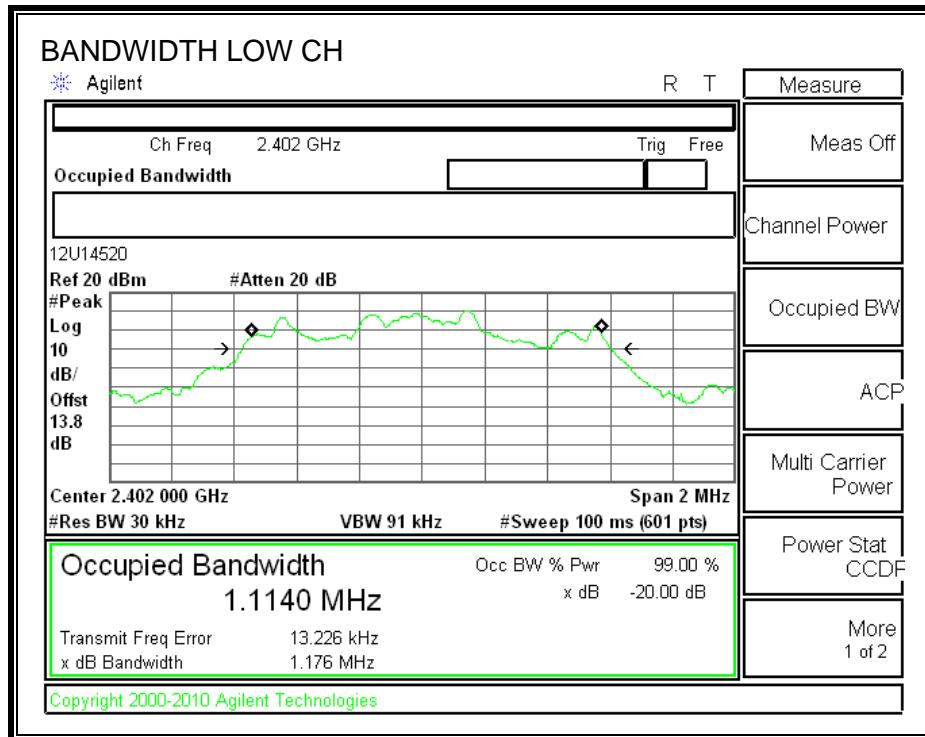
TEST PROCEDURE

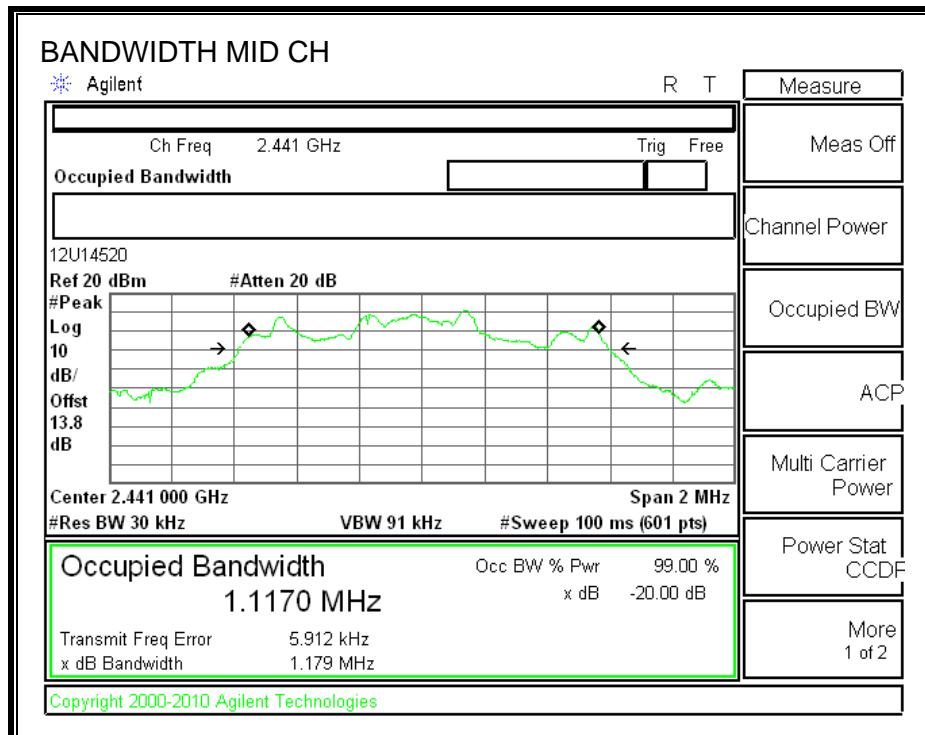
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

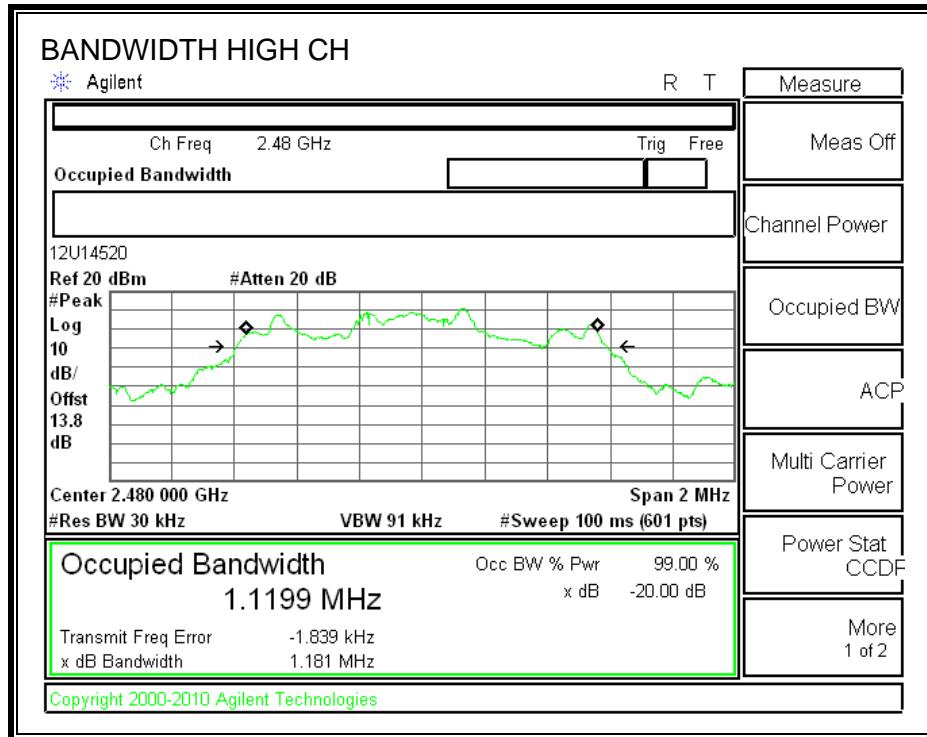
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1176	1108
Middle	2441	1179	1115
High	2480	1181	1111

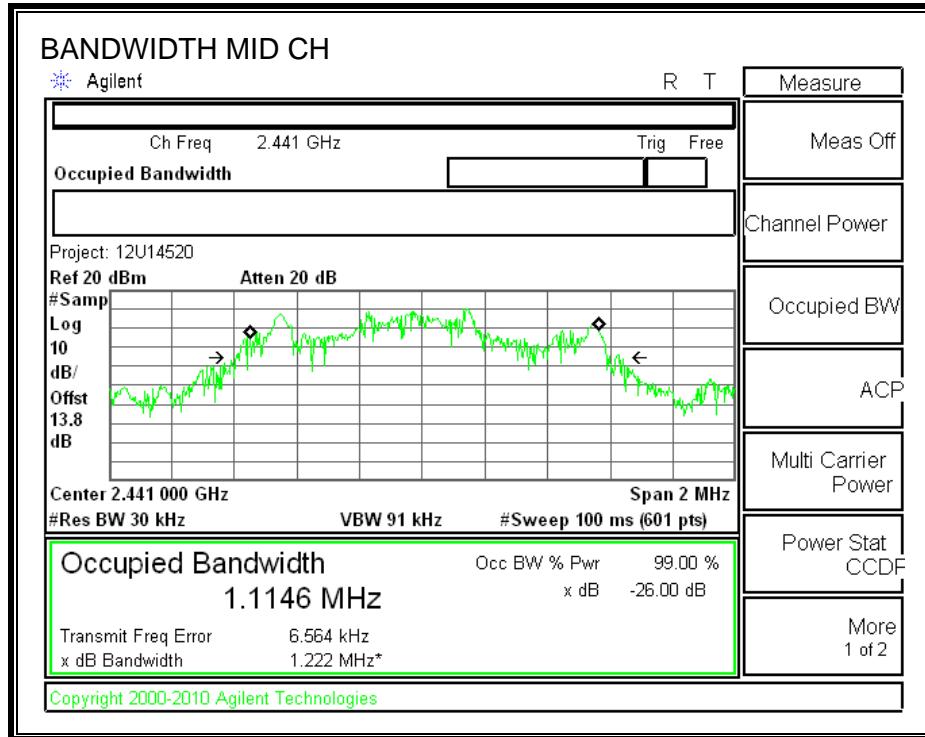
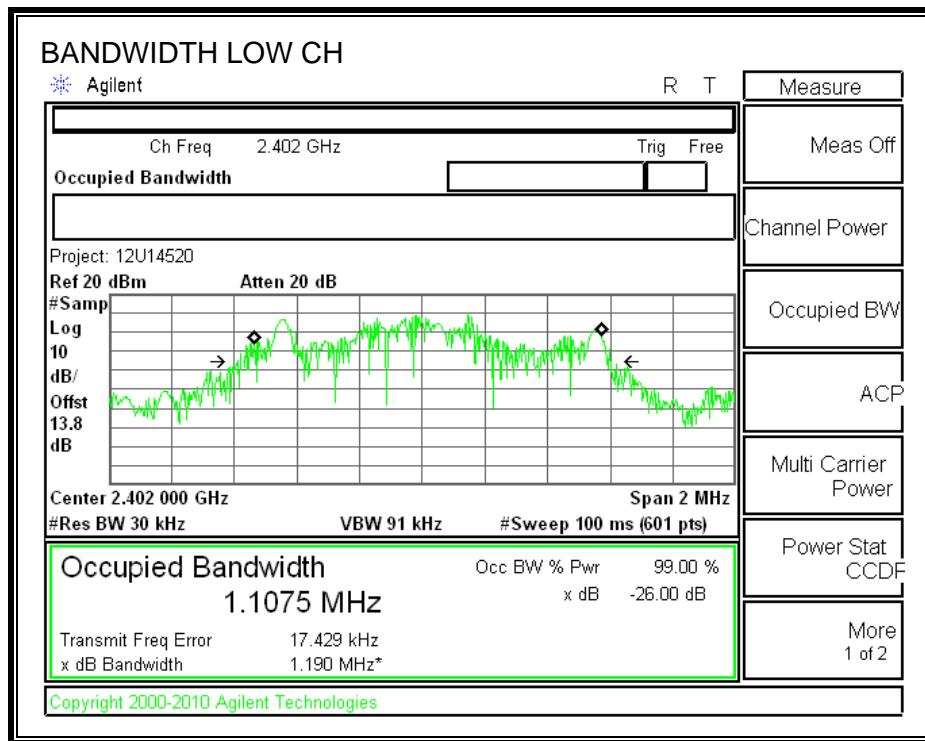
20 dB BANDWIDTH

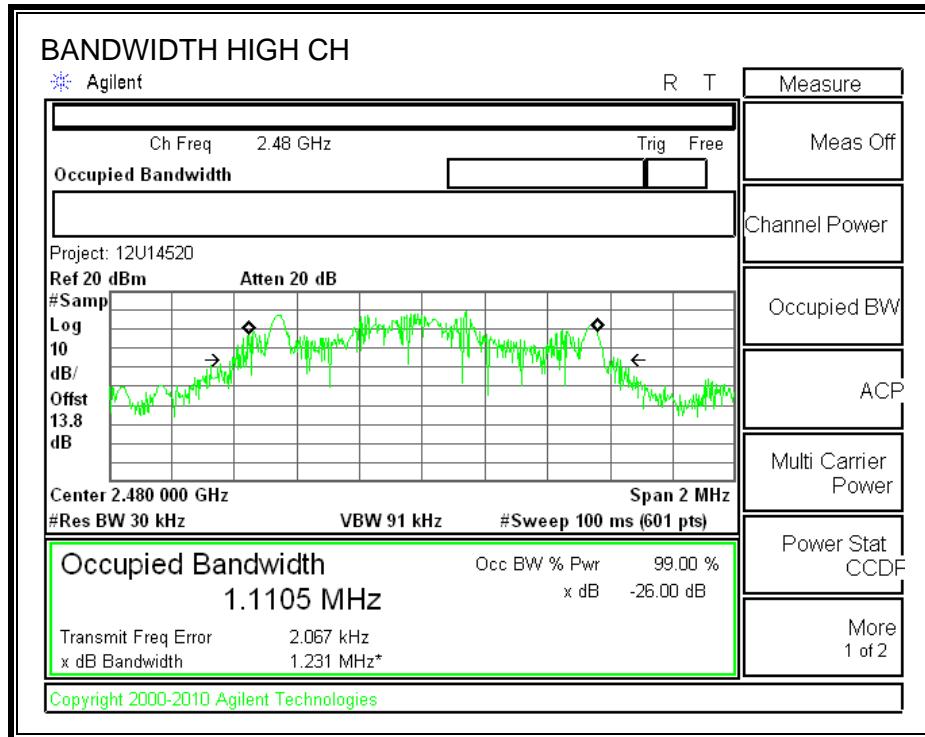






99% BANDWIDTH





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 hoping channel, whichever is greater.

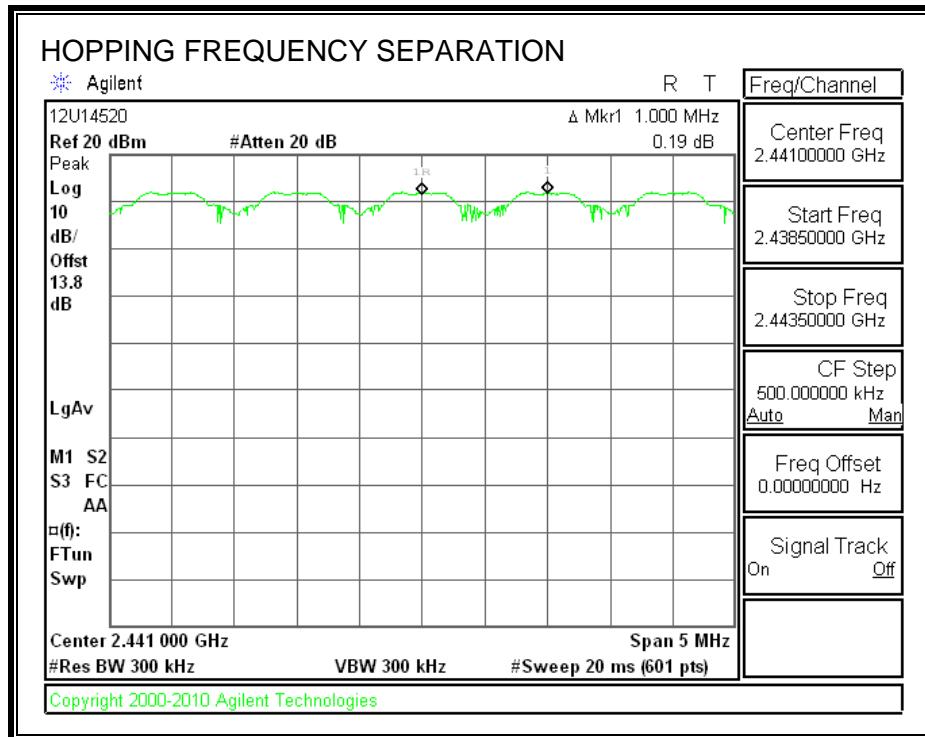
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



6.2.2. 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.

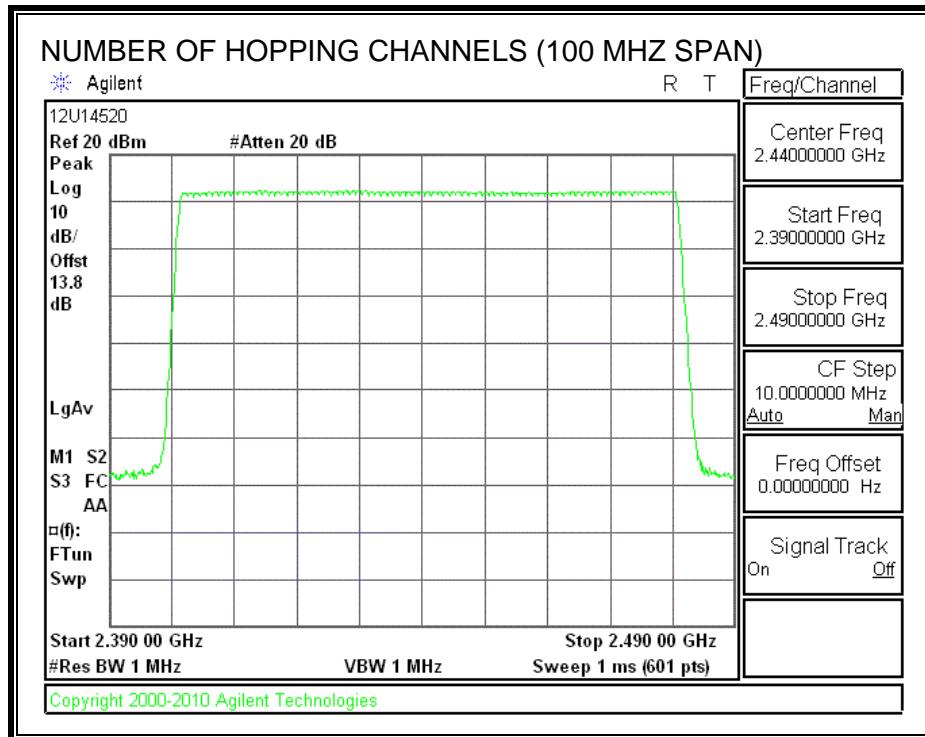
TEST PROCEDURE

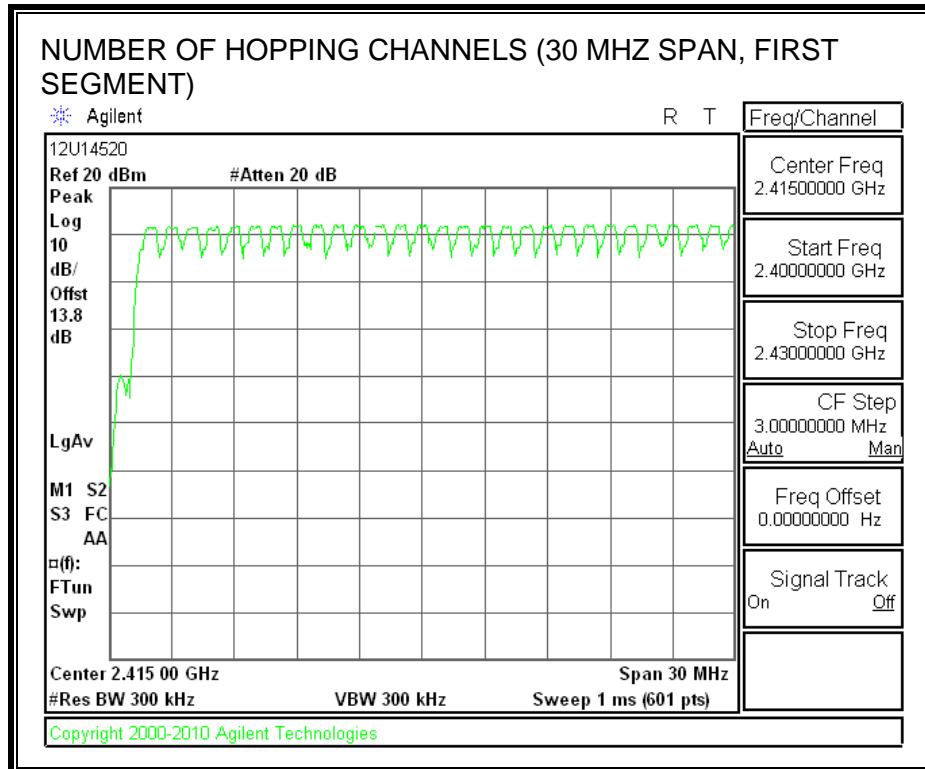
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

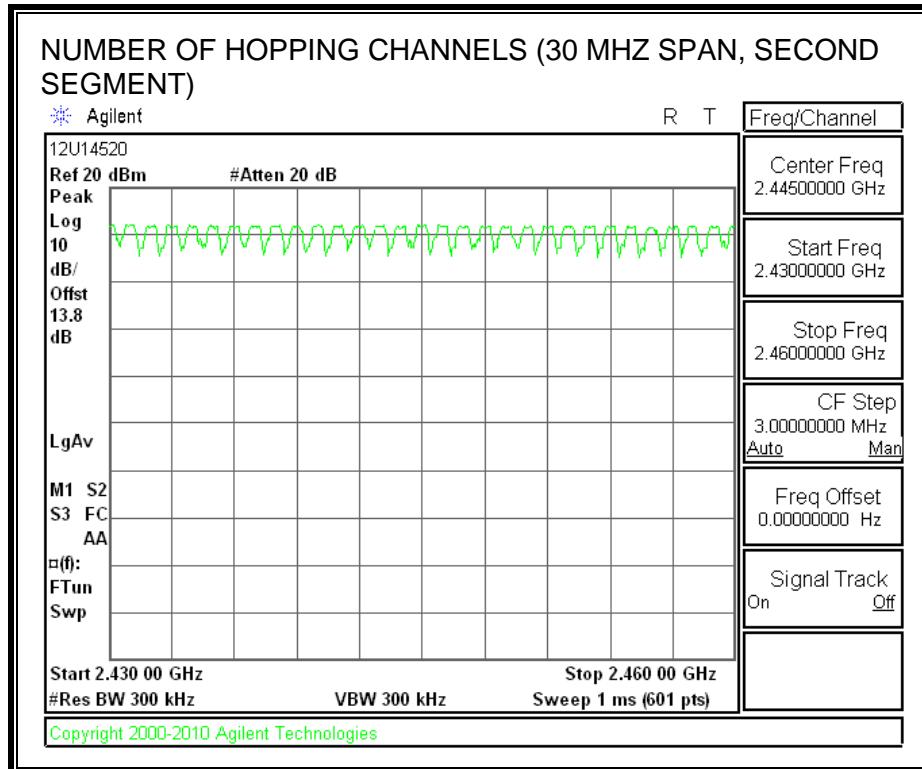
RESULTS

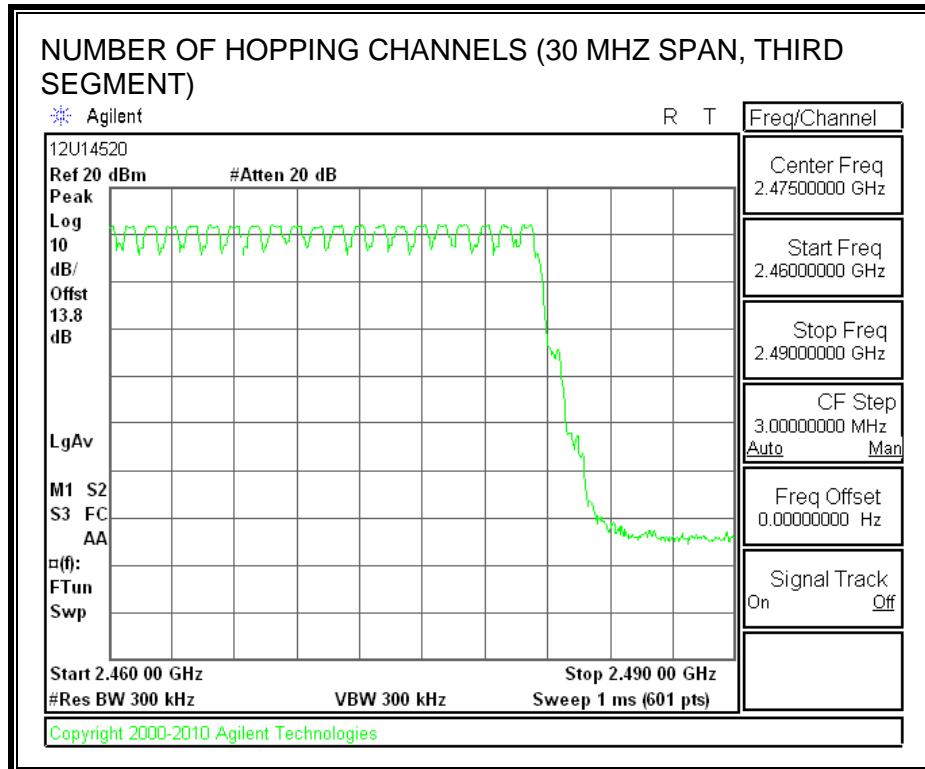
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS









6.2.3. 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.

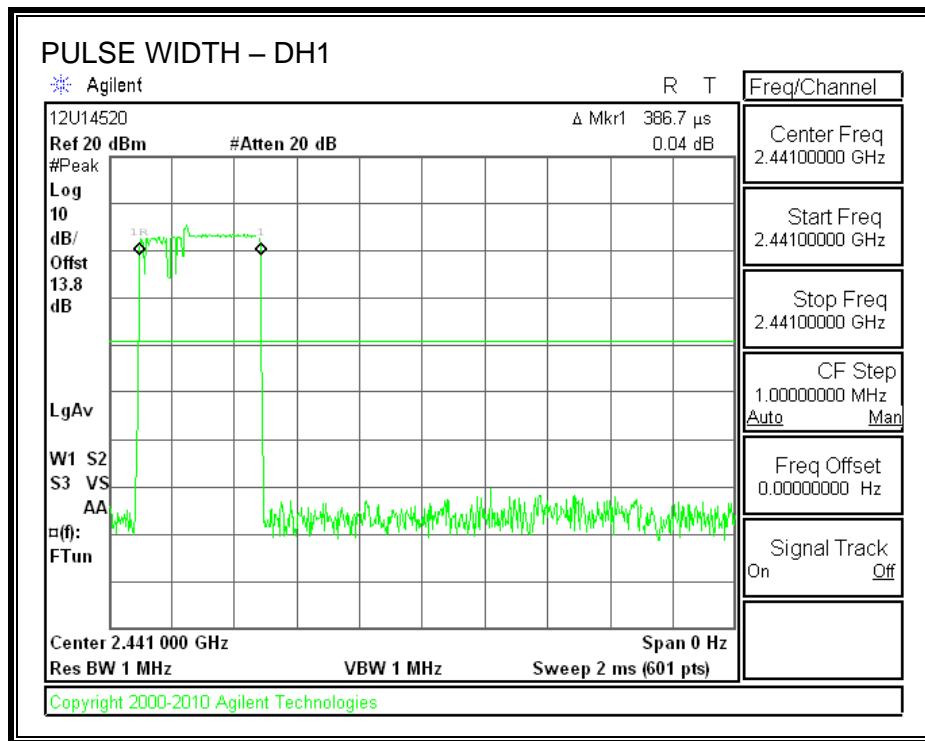
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

RESULTS

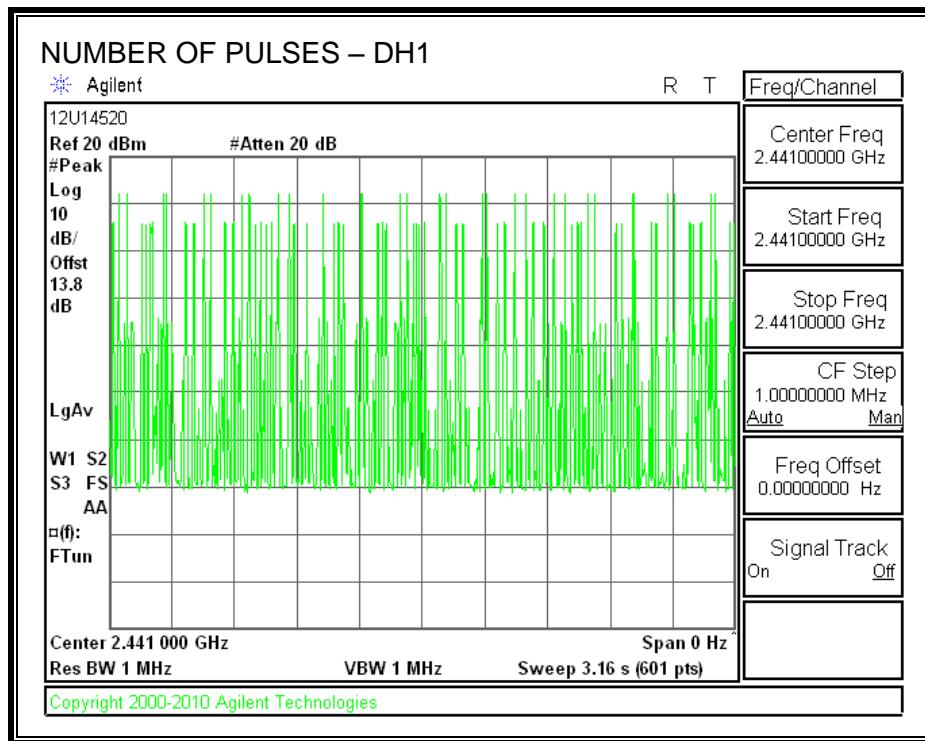
8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.3867	29	0.112	0.4	-0.288
DH3	1.633	11	0.180	0.4	-0.220
DH5	2.892	6	0.174	0.4	-0.226

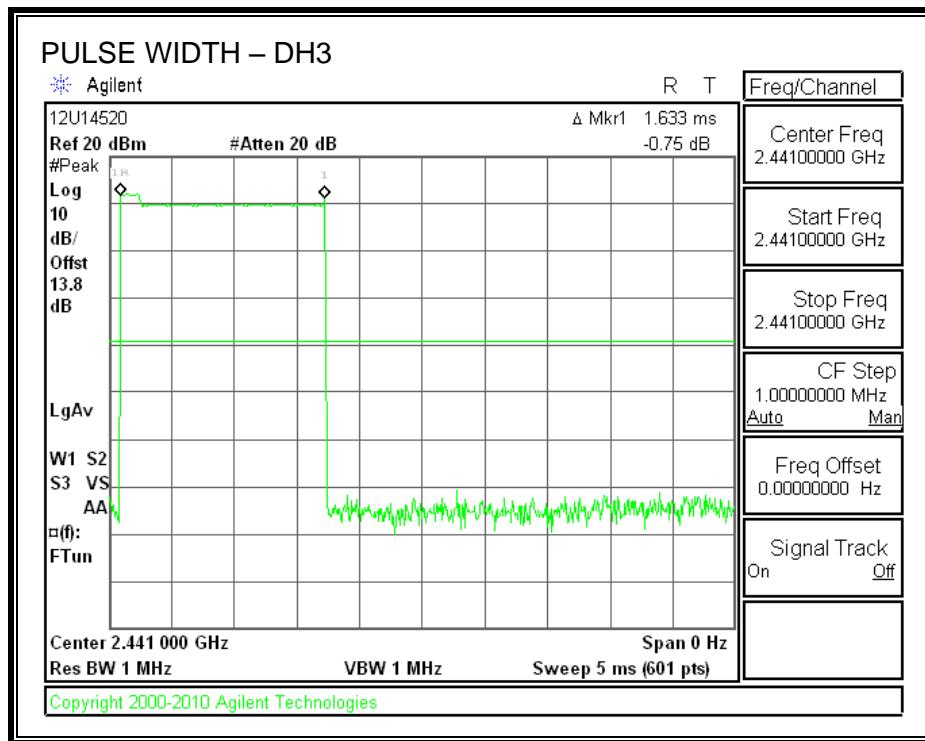
PULSE WIDTH - DH1



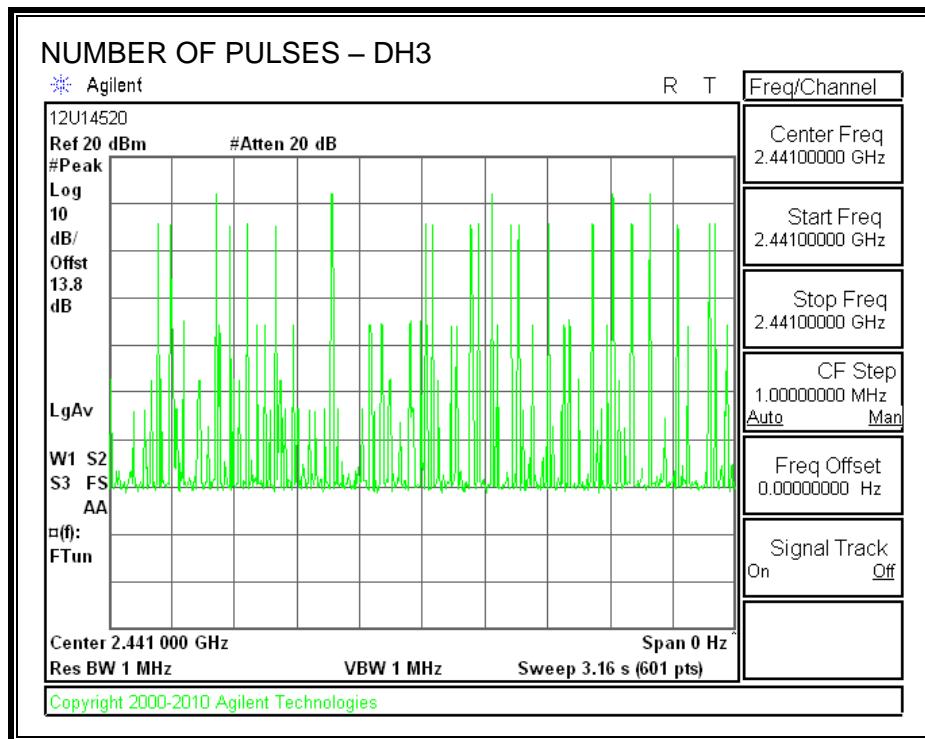
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



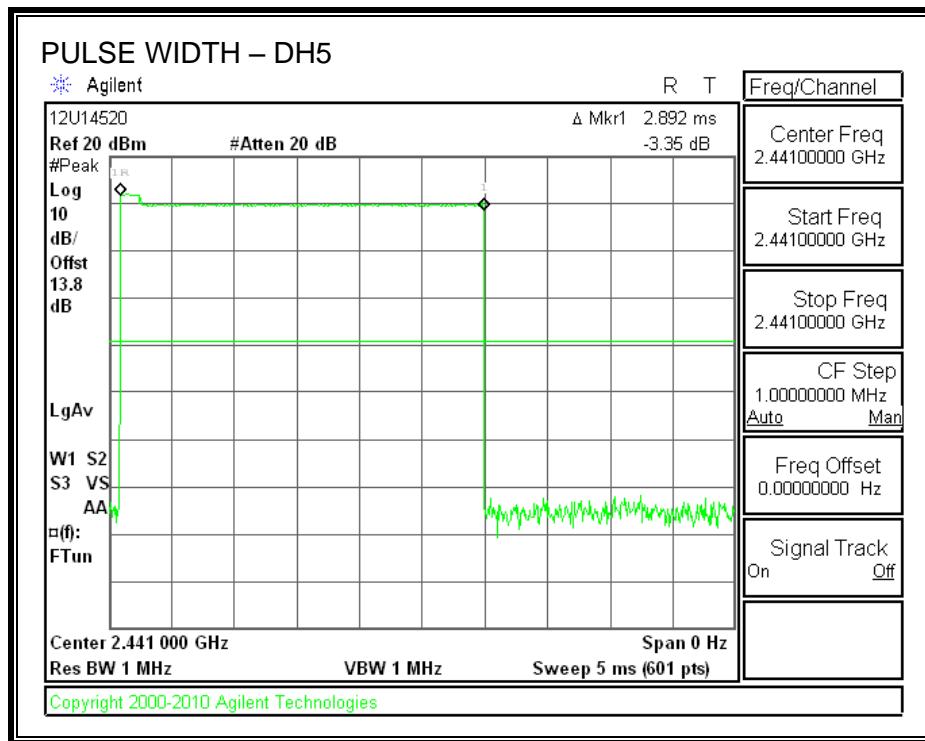
PULSE WIDTH – DH3



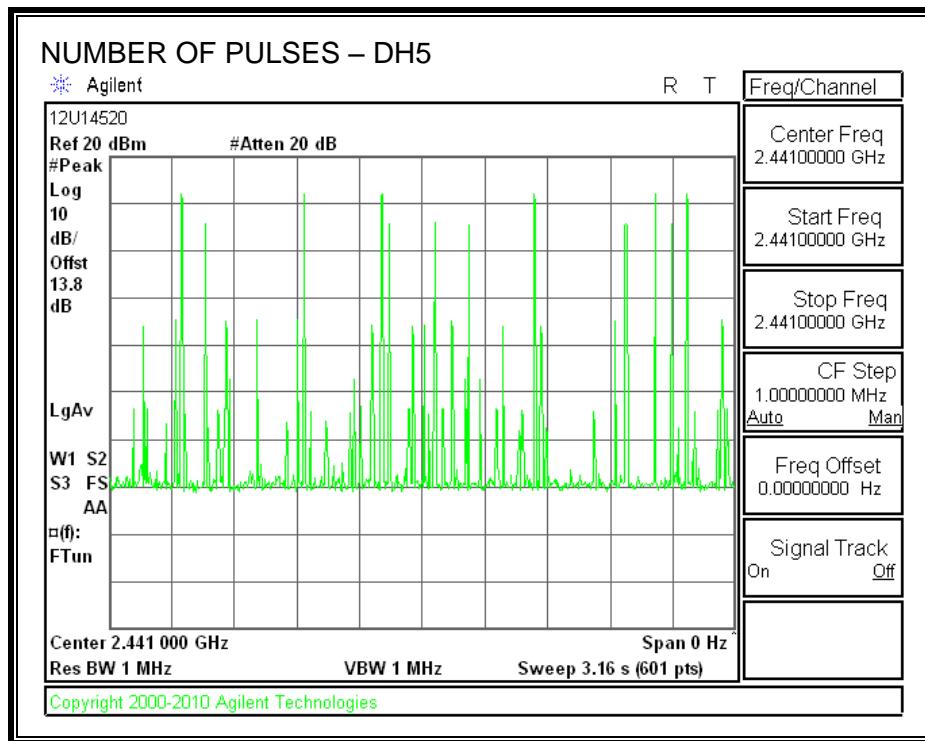
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



6.2.4. 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 30 dBm.

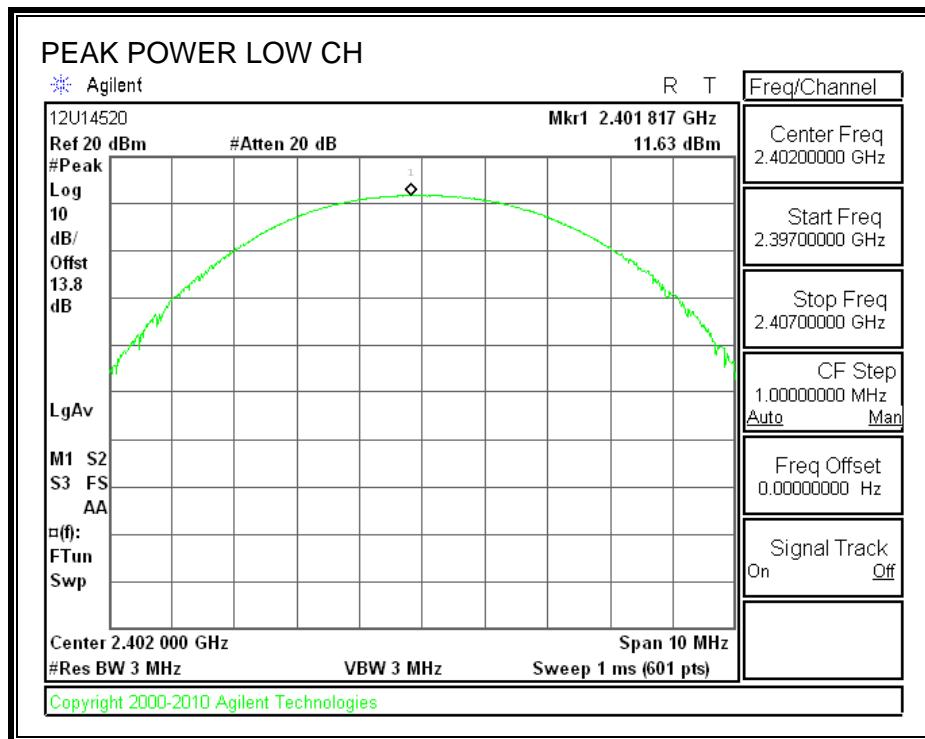
TEST PROCEDURE

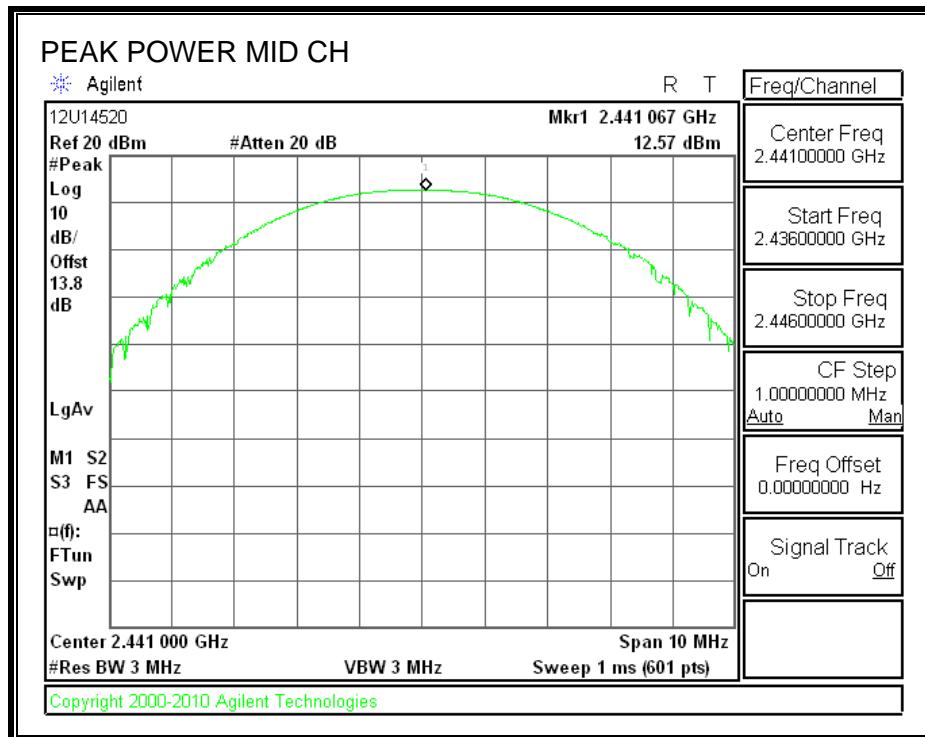
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

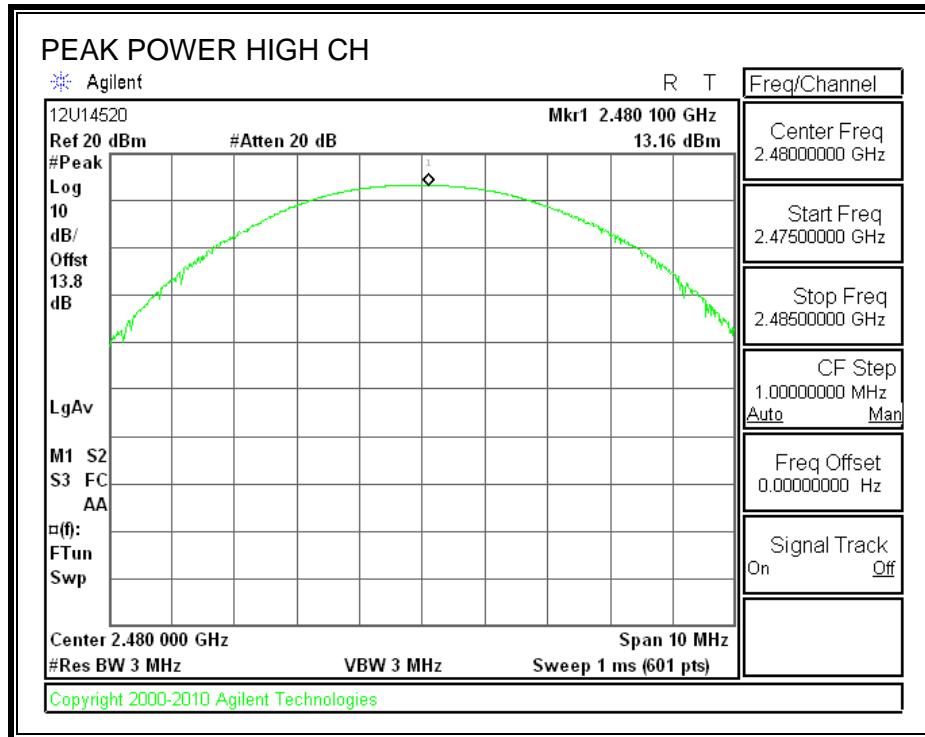
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.63	30	-18.37
Middle	2441	12.57	30	-17.43
High	2480	13.16	30	-16.84

OUTPUT POWER







6.2.5. 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 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)	Average Power (dBm)
Low	2402	9.70
Middle	2441	10.10
High	2480	10.60

6.2.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

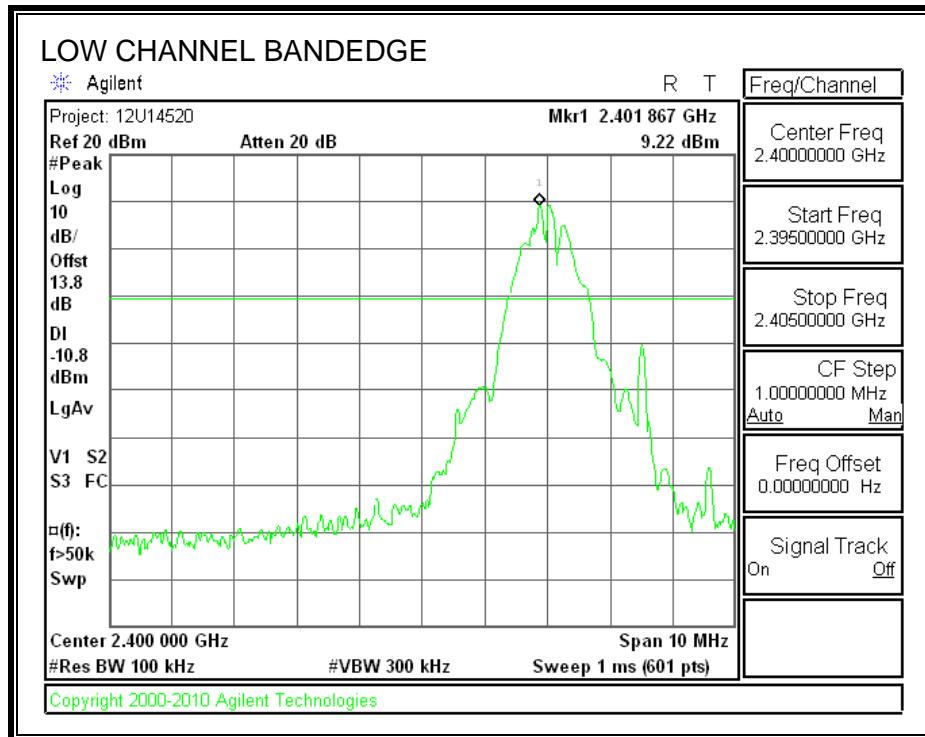
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

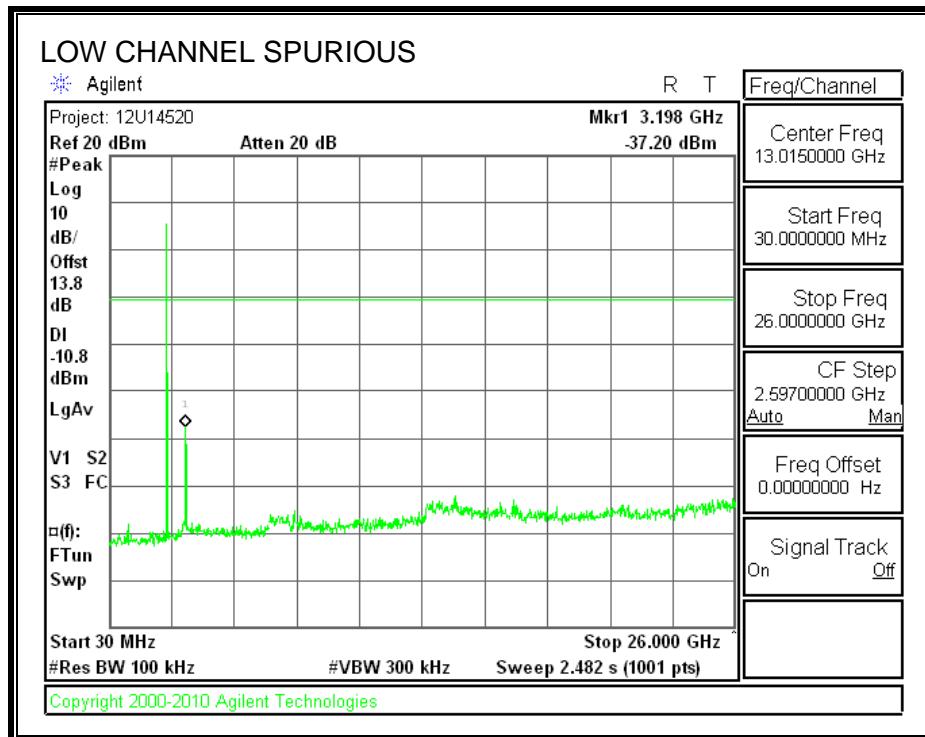
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

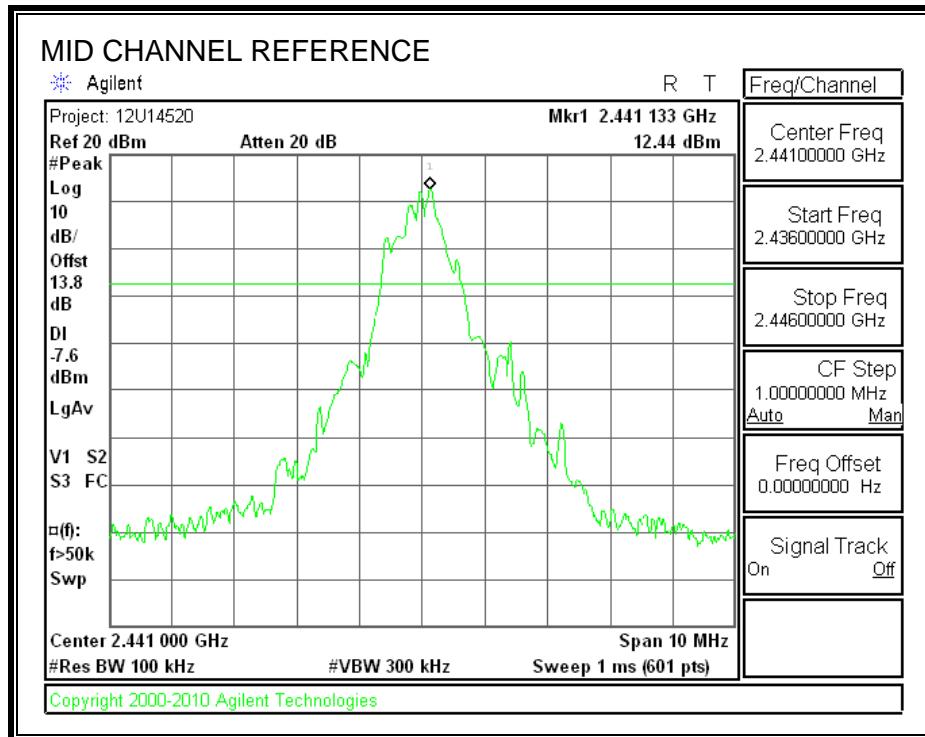
RESULTS

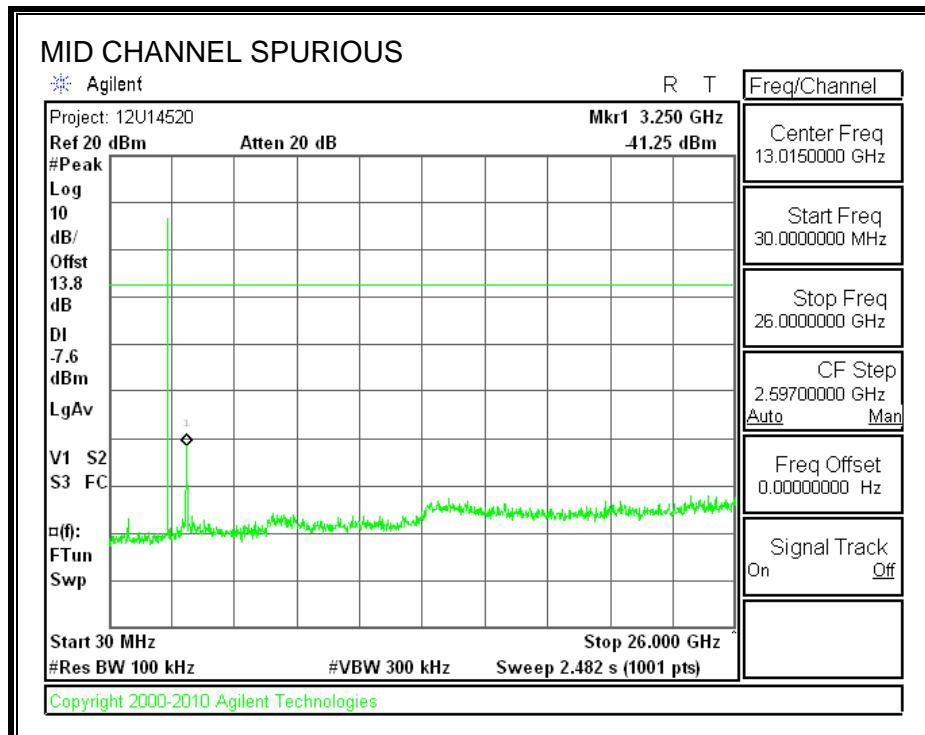
SPURIOUS EMISSIONS, LOW CHANNEL



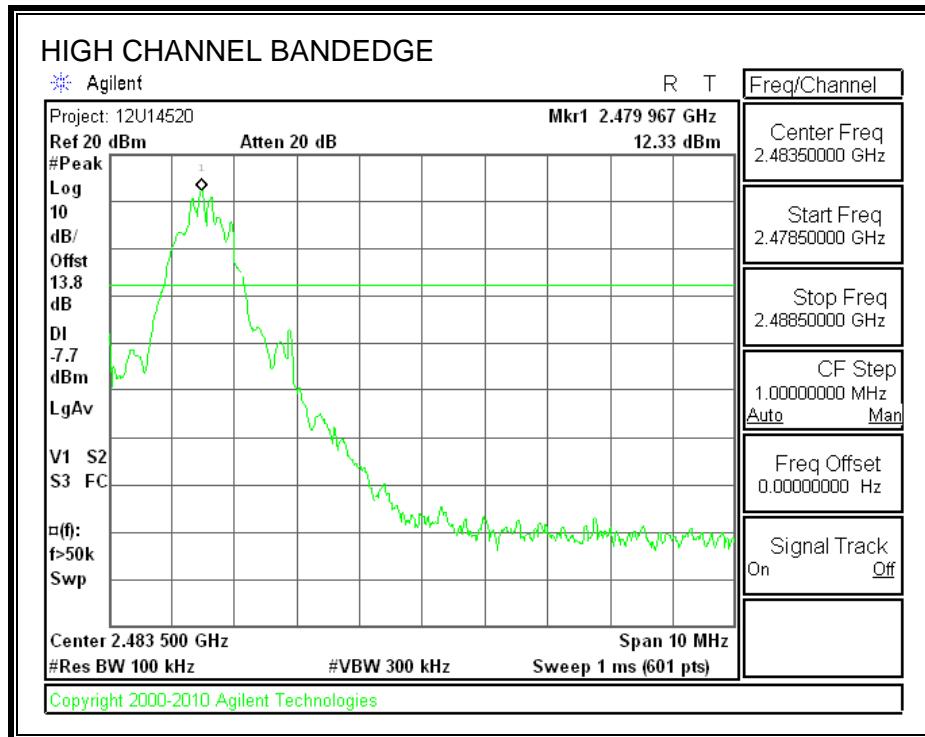


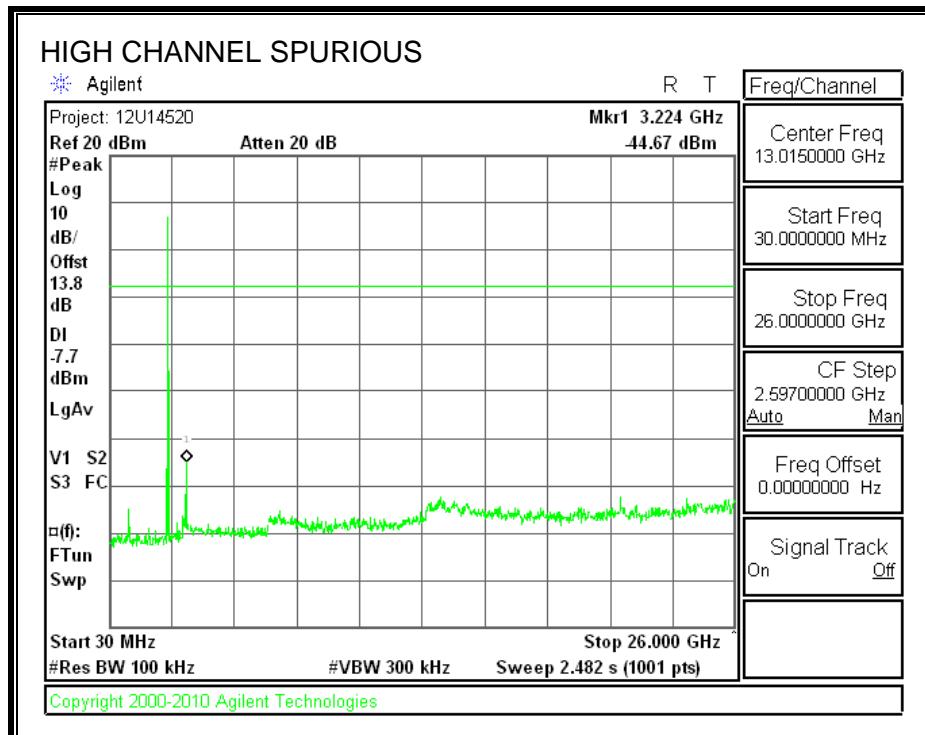
SPURIOUS EMISSIONS, MID CHANNEL



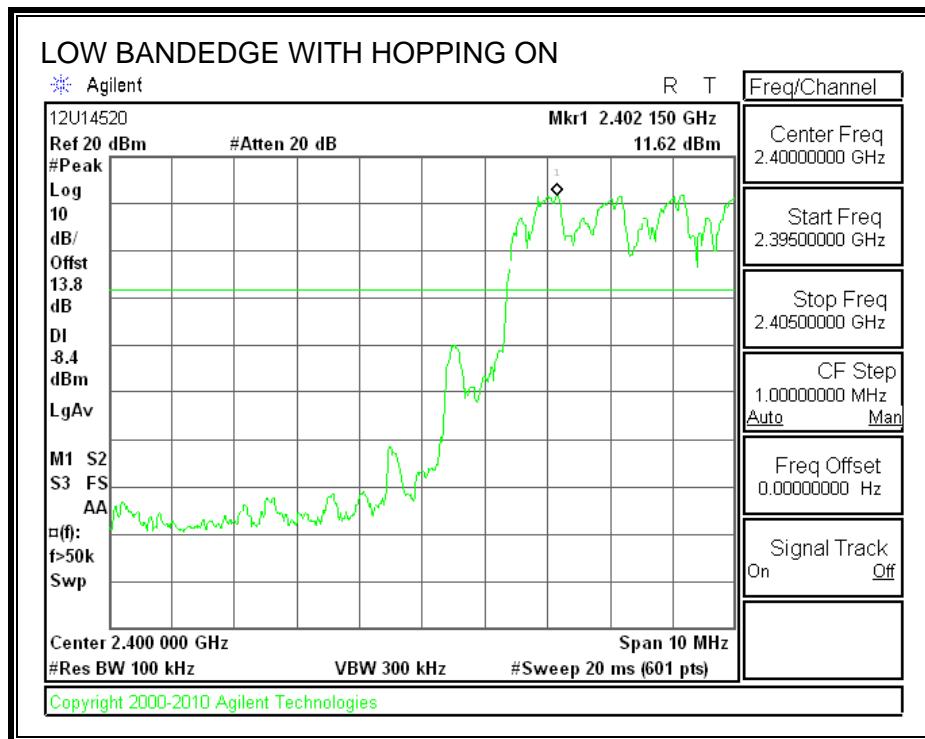


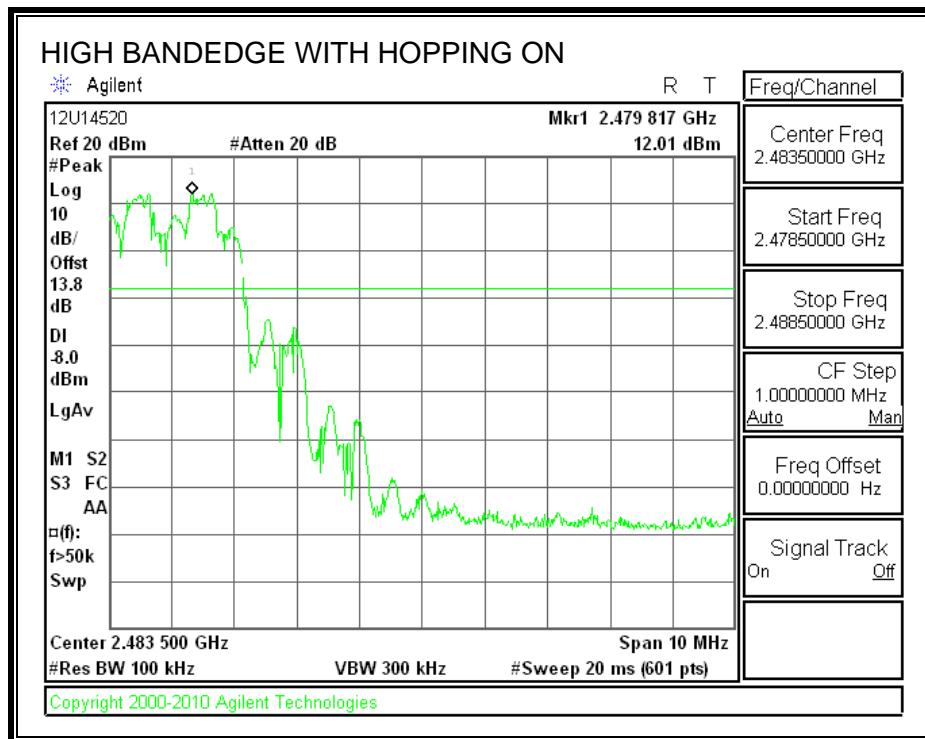
SPURIOUS EMISSIONS, HIGH CHANNEL





SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





7. RADIATED TEST RESULTS

7.1. 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.

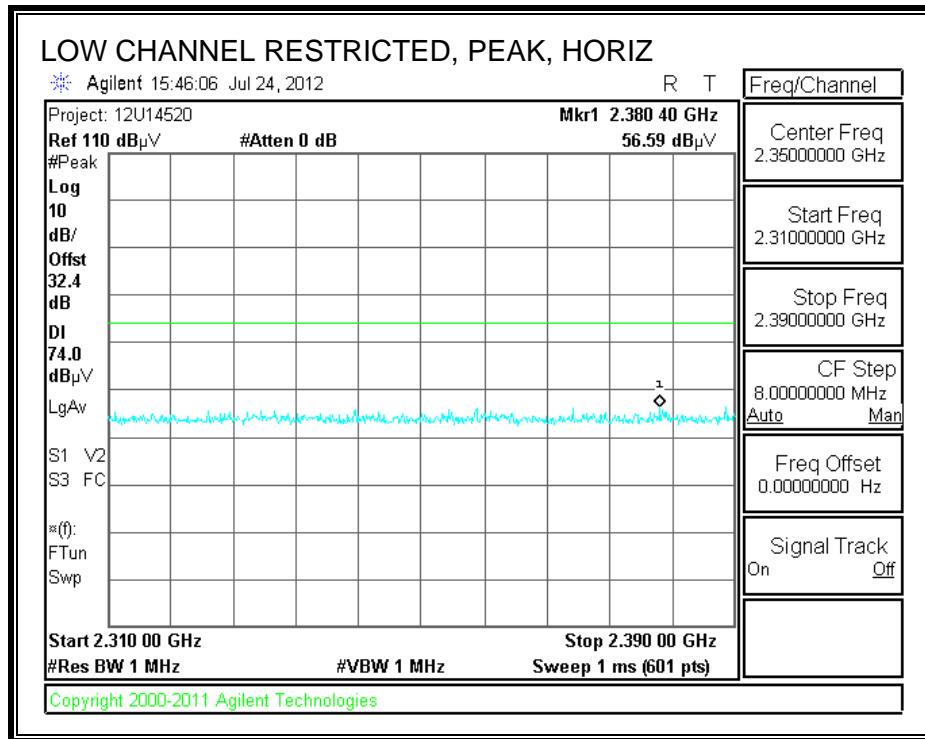
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

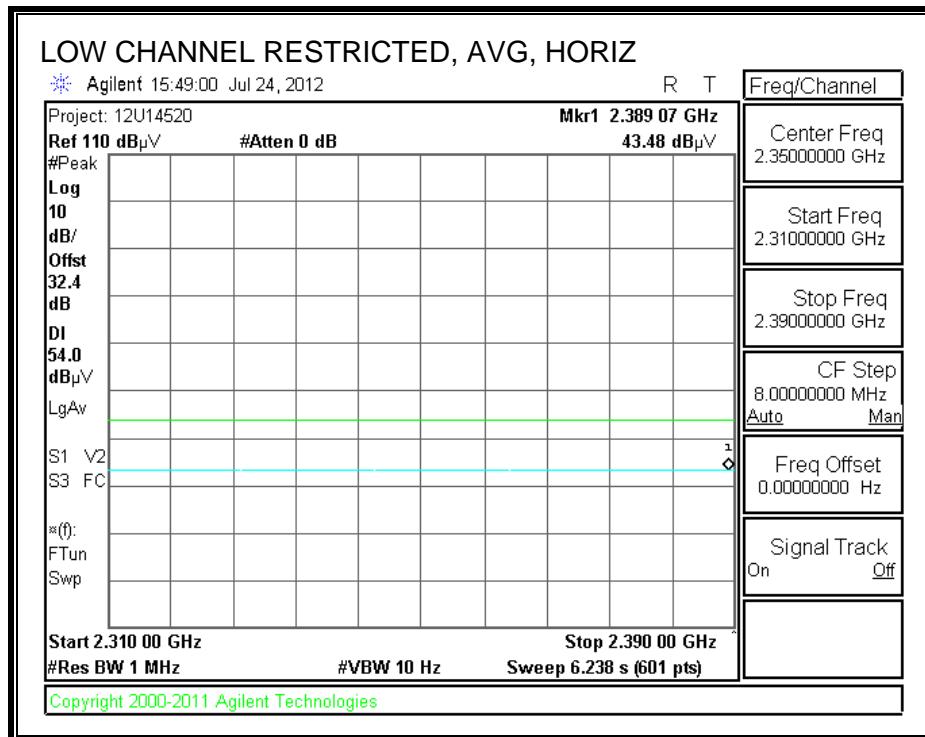
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

7.2. TRANSMITTER ABOVE 1 GHz

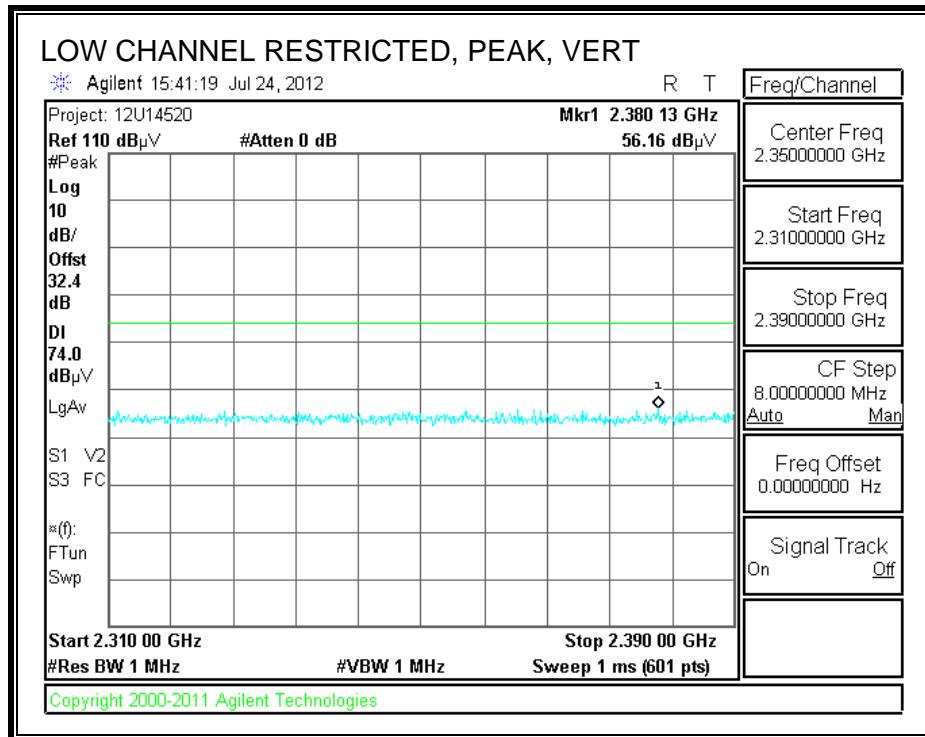
7.2.1. BASIC DATA RATE GFSK MODULATION

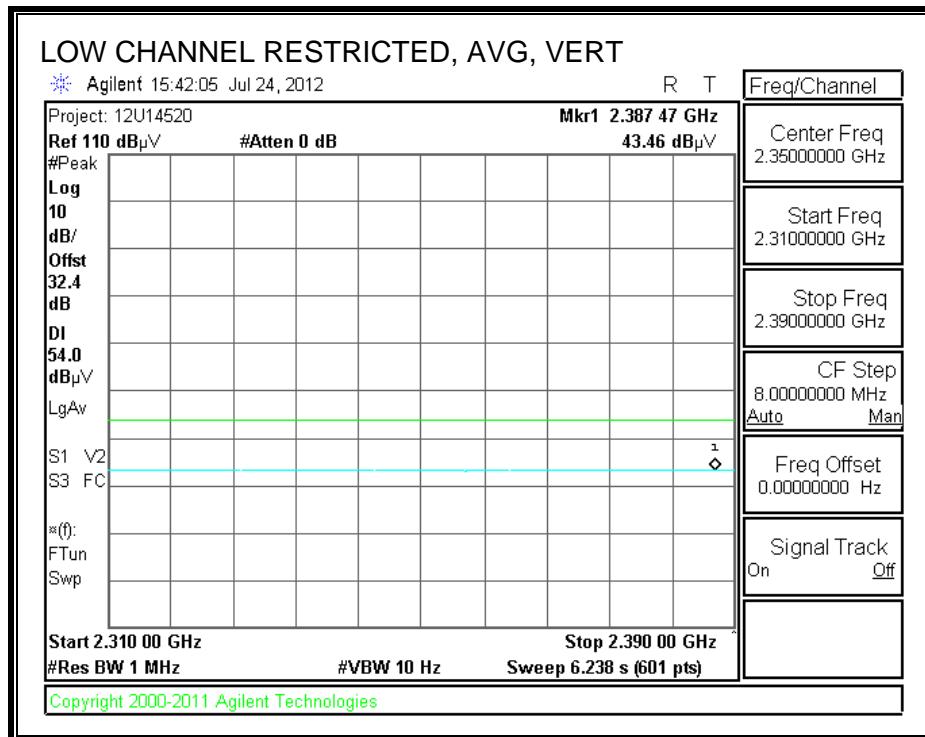
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



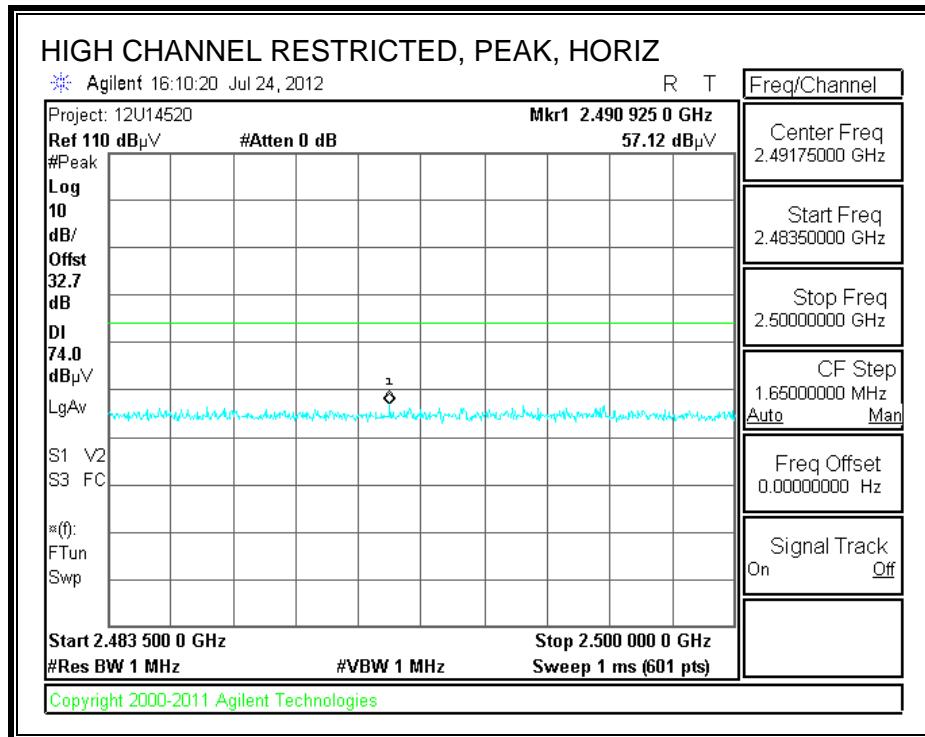


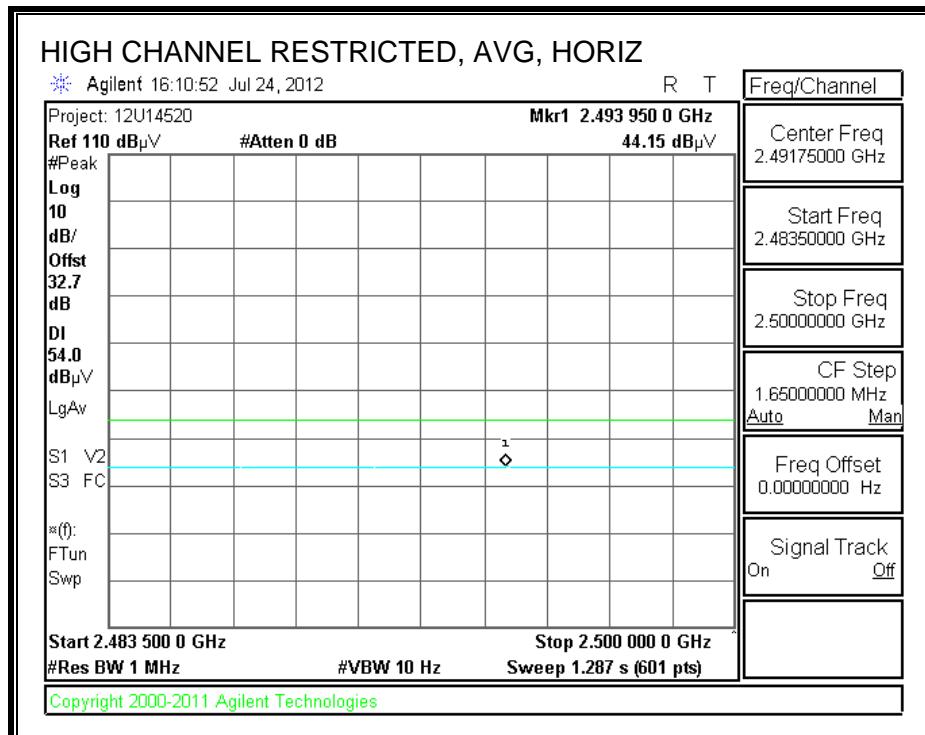
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



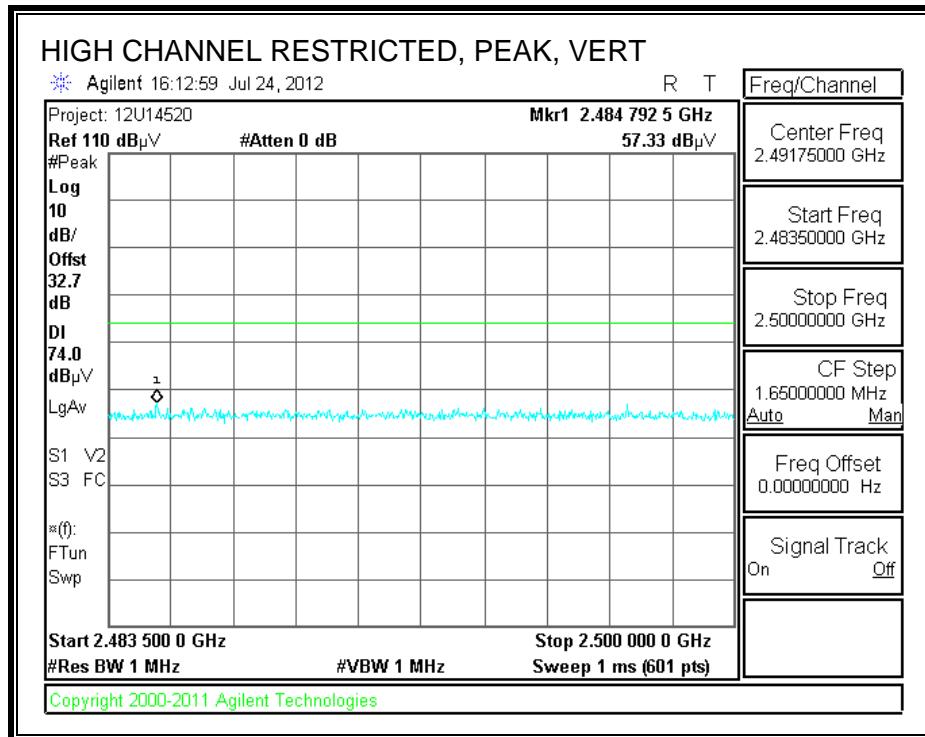


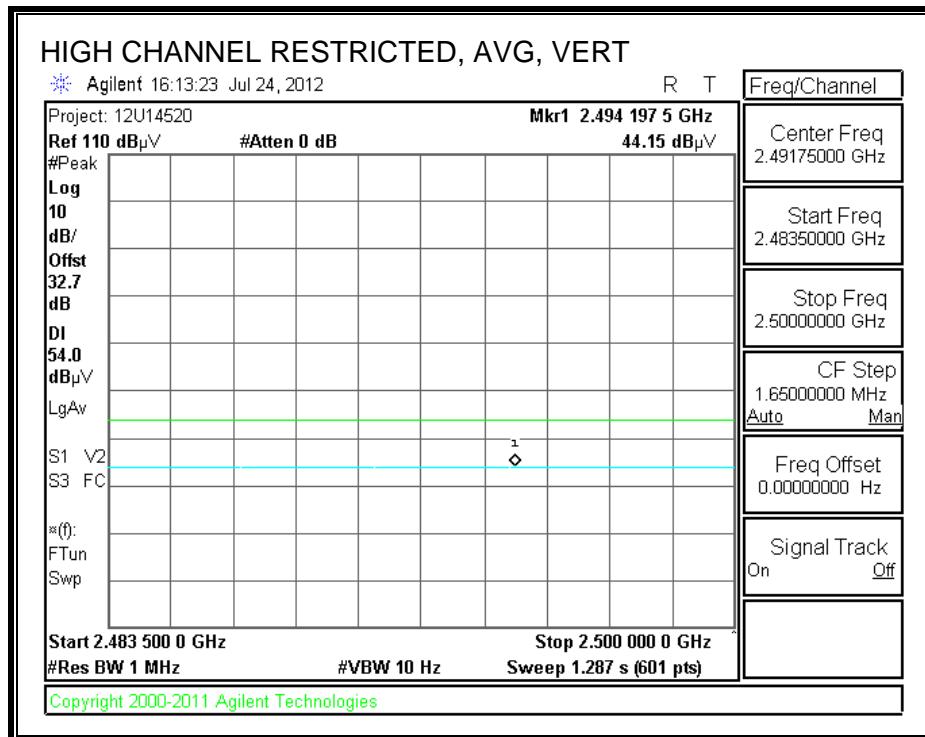
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 07/25/12
Project #: 12U14520
Company: Apple Inc.
Test Target: FCC Class B
Mode Oper: Bluetooth GFSK, TX mode

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

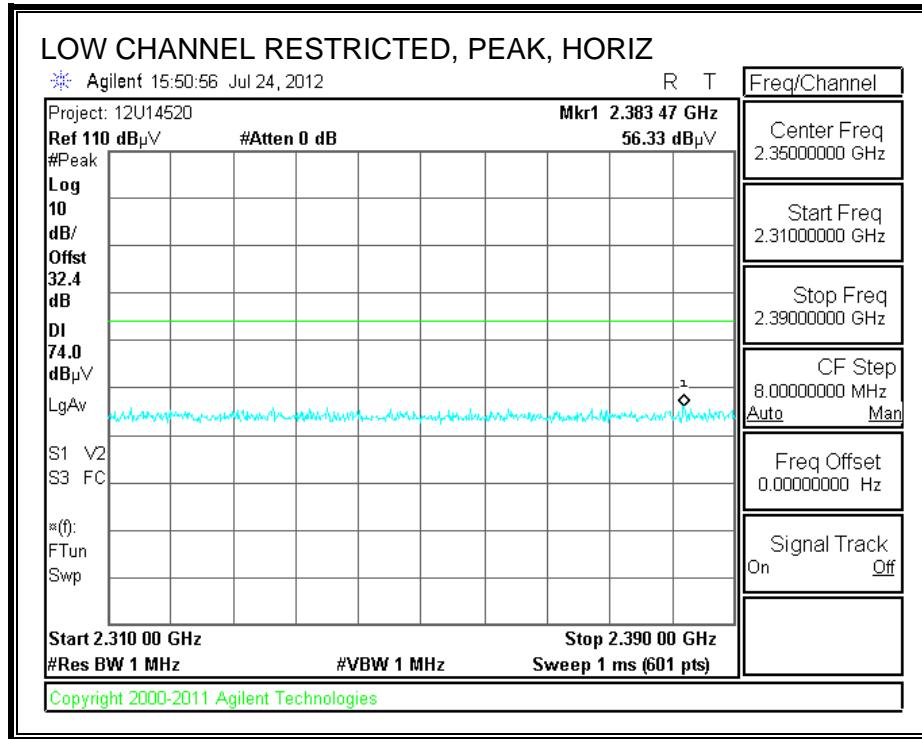
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2402MHz GFSK													
4.804	3.0	41.3	33.1	6.3	-34.8	0.0	0.0	45.9	74.0	-28.1	H	P	
4.804	3.0	30.2	33.1	6.3	-34.8	0.0	0.0	34.8	54.0	-19.2	H	A	
4.804	3.0	42.2	33.1	6.3	-34.8	0.0	0.0	46.8	74.0	-27.2	V	P	
4.804	3.0	31.0	33.1	6.3	-34.8	0.0	0.0	35.5	54.0	-18.5	V	A	
2441MHz GFSK													
4.882	3.0	44.2	33.1	6.3	-34.8	0.0	0.0	48.9	74.0	-25.1	V	P	
4.882	3.0	32.7	33.1	6.3	-34.8	0.0	0.0	37.3	54.0	-16.7	V	A	
4.882	3.0	42.8	33.1	6.3	-34.8	0.0	0.0	47.4	74.0	-26.6	H	P	
4.882	3.0	31.8	33.1	6.3	-34.8	0.0	0.0	36.4	54.0	-17.6	H	A	
2480MHz GFSK													
4.960	3.0	44.1	33.2	6.4	-34.8	0.0	0.0	48.9	74.0	-25.1	V	P	
4.960	3.0	32.8	33.2	6.4	-34.8	0.0	0.0	37.6	54.0	-16.4	V	A	
4.960	3.0	42.2	33.2	6.4	-34.8	0.0	0.0	47.0	74.0	-27.0	H	P	
4.960	3.0	31.8	33.2	6.4	-34.8	0.0	0.0	36.5	54.0	-17.5	H	A	

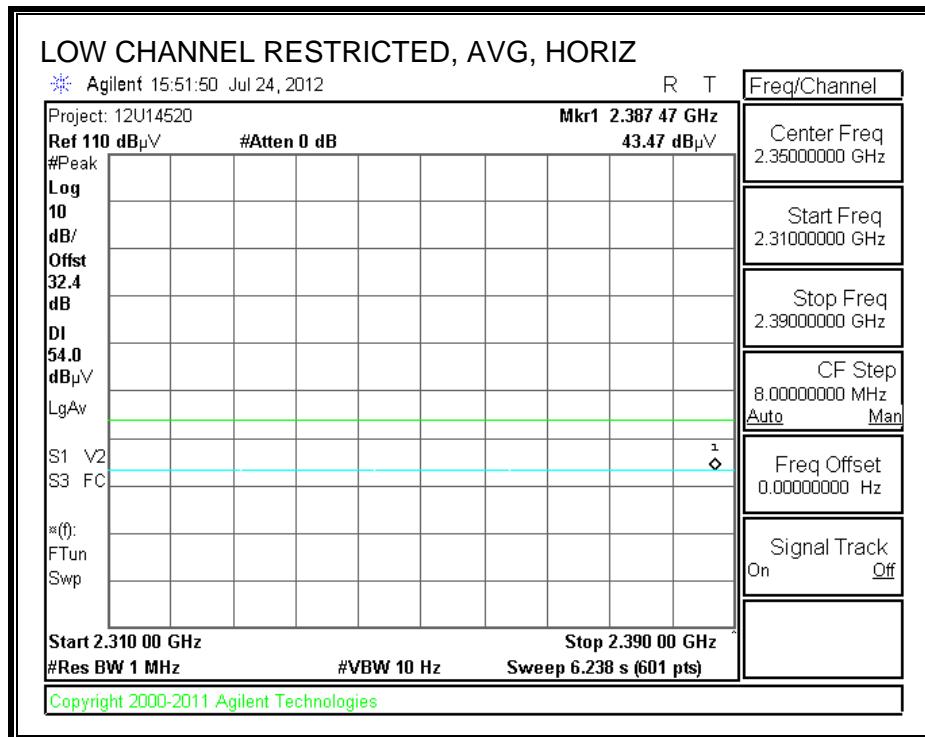
Rev. 4.1.2.7

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

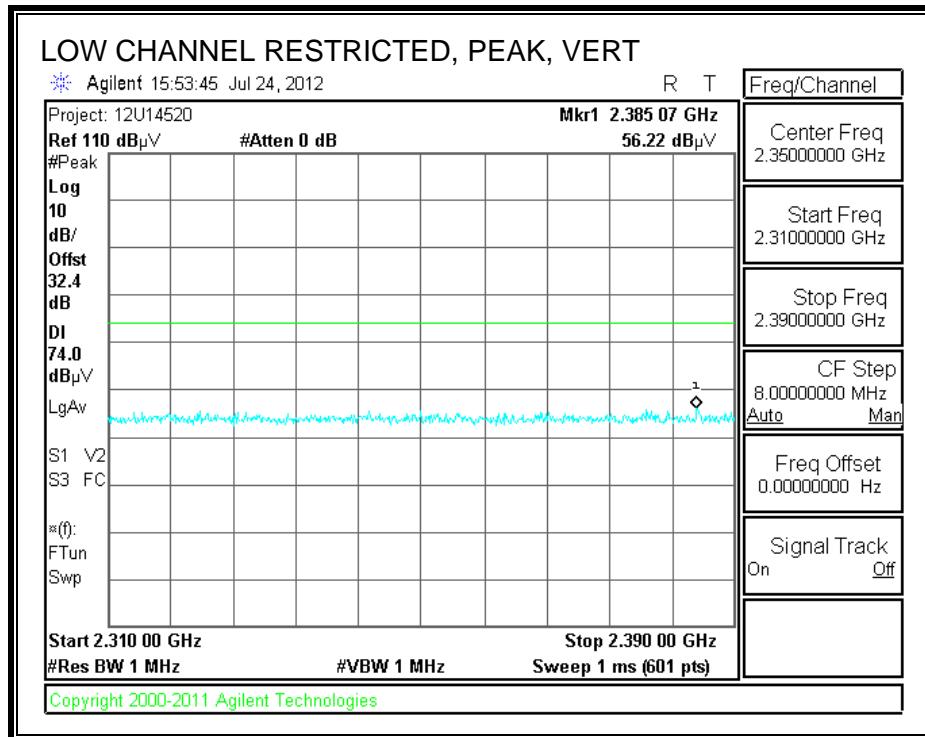
7.2.2. ENHANCED DATA RATE 8PSK MODULATION

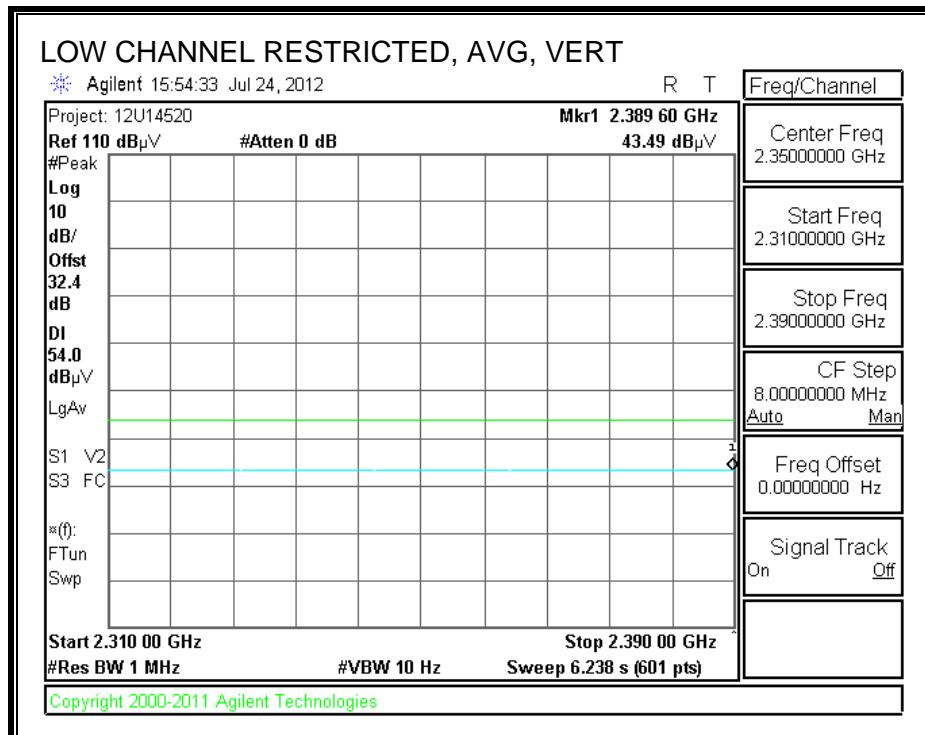
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



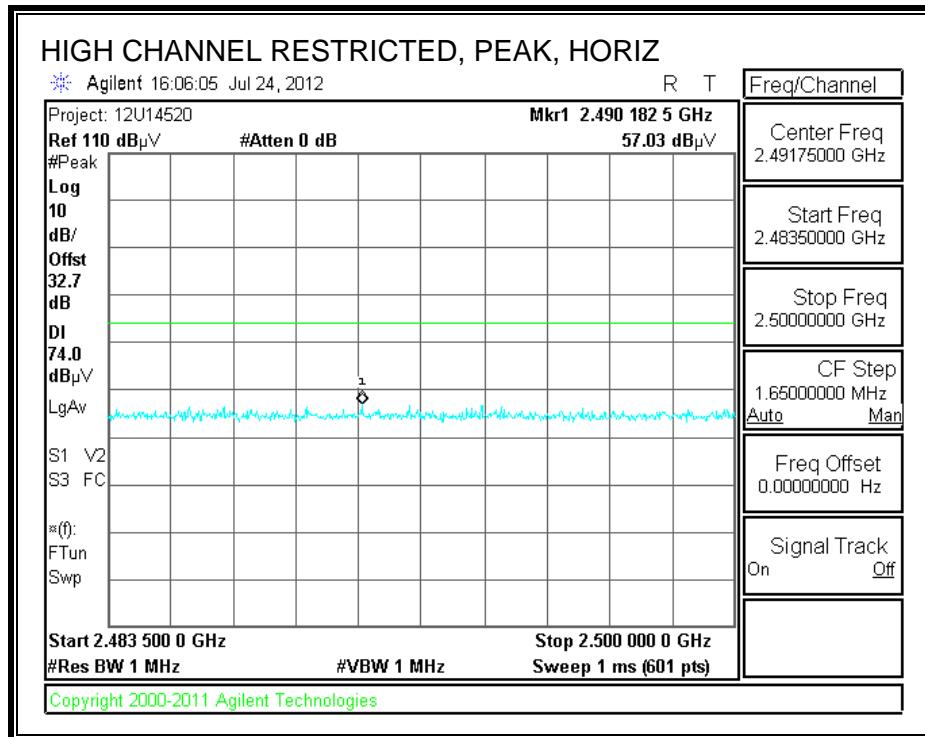


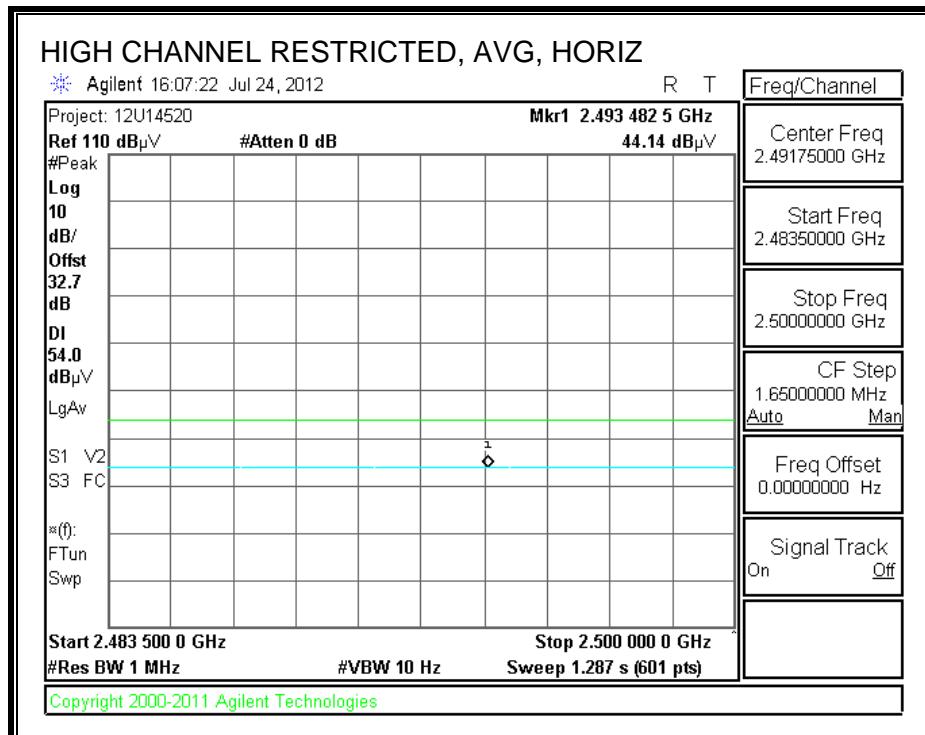
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



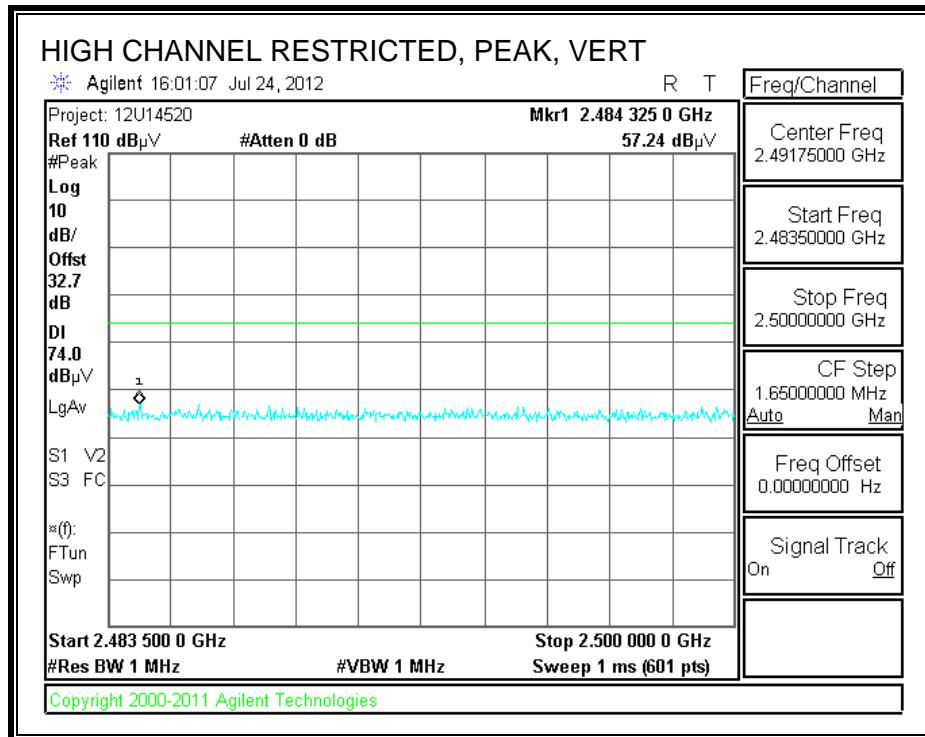


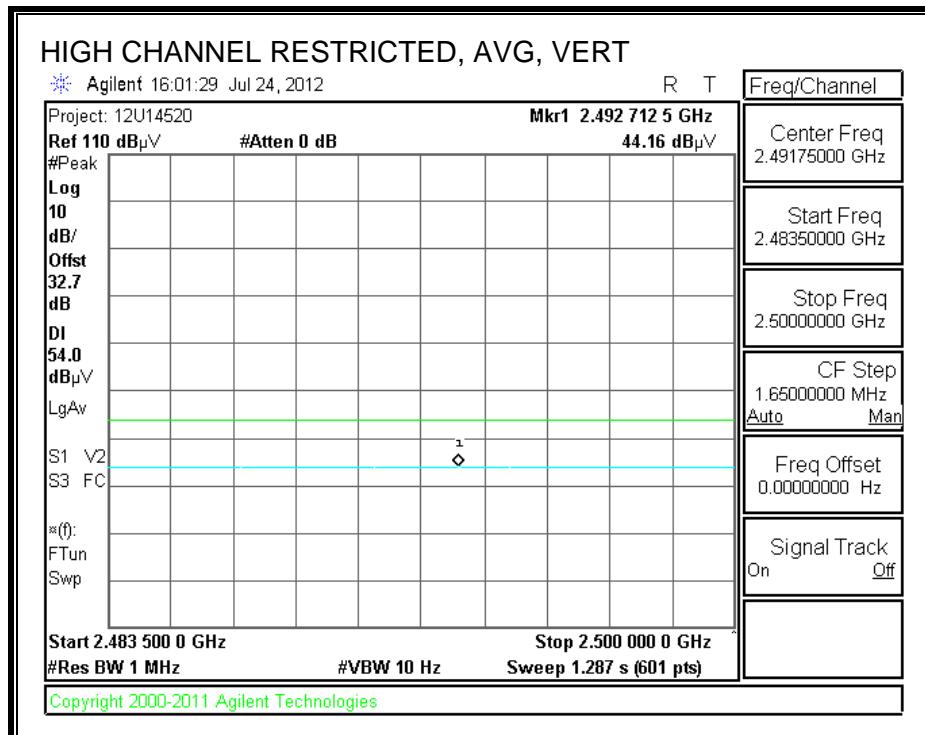
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 07/25/12
Project #: 12U14520
Company: Apple Inc.
Test Target: FCC Class B
Mode Oper: Bluetooth 8PSK, TX mode

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

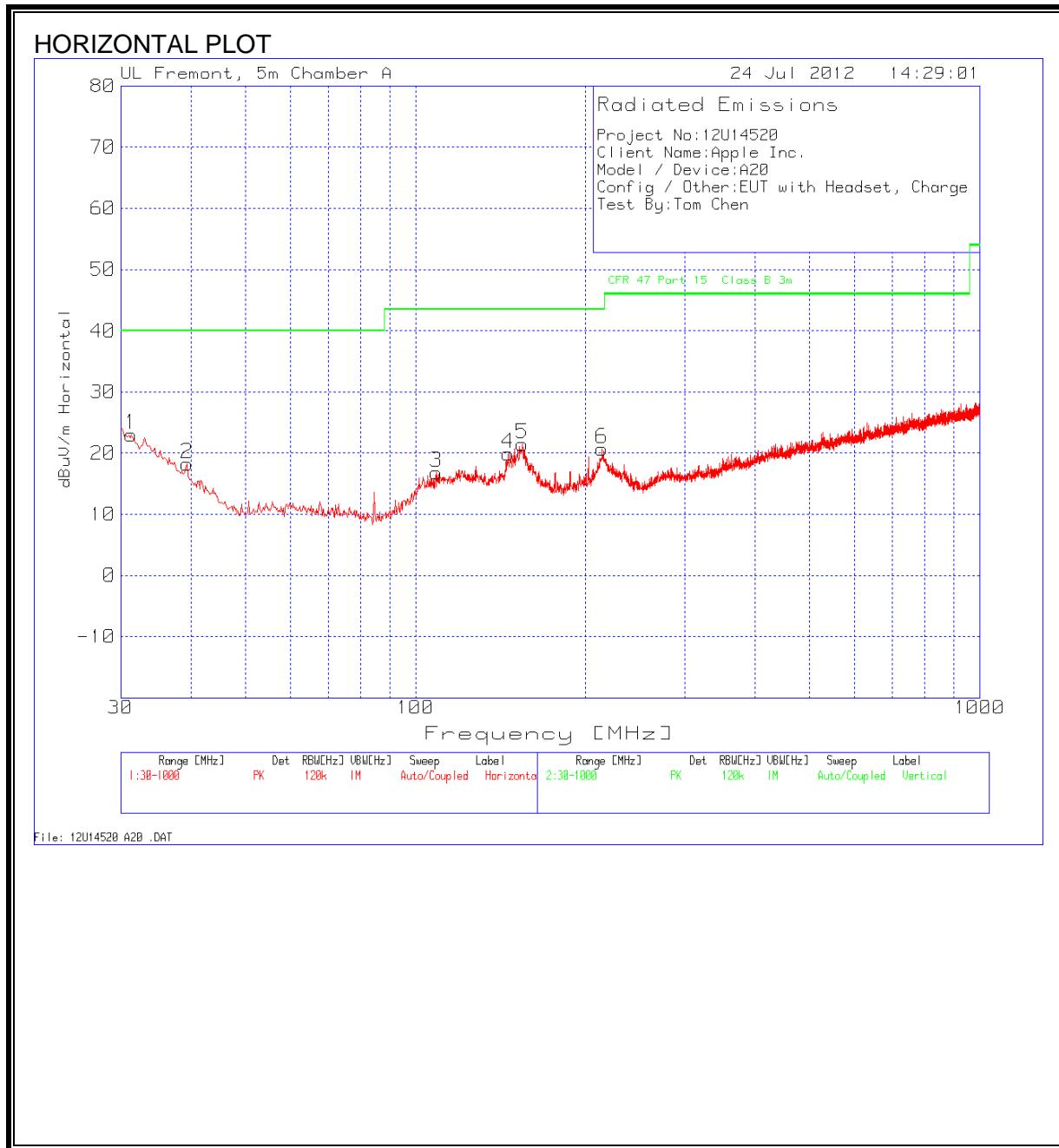
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2402MHz 8PSK													
4.804	3.0	43.2	33.1	6.3	-34.8	0.0	0.0	47.7	74.0	-26.3	V	P	
4.804	3.0	29.9	33.1	6.3	-34.8	0.0	0.0	34.5	54.0	-19.5	V	A	
4.804	3.0	40.6	33.1	6.3	-34.8	0.0	0.0	45.1	74.0	-28.9	H	P	
4.804	3.0	29.2	33.1	6.3	-34.8	0.0	0.0	33.7	54.0	-20.3	H	A	
2441MHz 8PSK													
4.882	3.0	42.8	33.1	6.3	-34.8	0.0	0.0	47.5	74.0	-26.5	H	P	
4.882	3.0	29.8	33.1	6.3	-34.8	0.0	0.0	34.4	54.0	-19.6	H	A	
4.882	3.0	43.8	33.1	6.3	-34.8	0.0	0.0	48.4	74.0	-25.6	V	P	
4.882	3.0	30.6	33.1	6.3	-34.8	0.0	0.0	35.3	54.0	-18.7	V	A	
2480MHz 8PSK													
4.960	3.0	42.3	33.2	6.4	-34.8	0.0	0.0	47.0	74.0	-27.0	H	P	
4.960	3.0	29.5	33.2	6.4	-34.8	0.0	0.0	34.2	54.0	-19.8	H	A	
4.960	3.0	43.2	33.2	6.4	-34.8	0.0	0.0	48.0	74.0	-26.0	V	P	
4.960	3.0	30.6	33.2	6.4	-34.8	0.0	0.0	35.4	54.0	-18.6	V	A	

Rev. 4.1.2.7

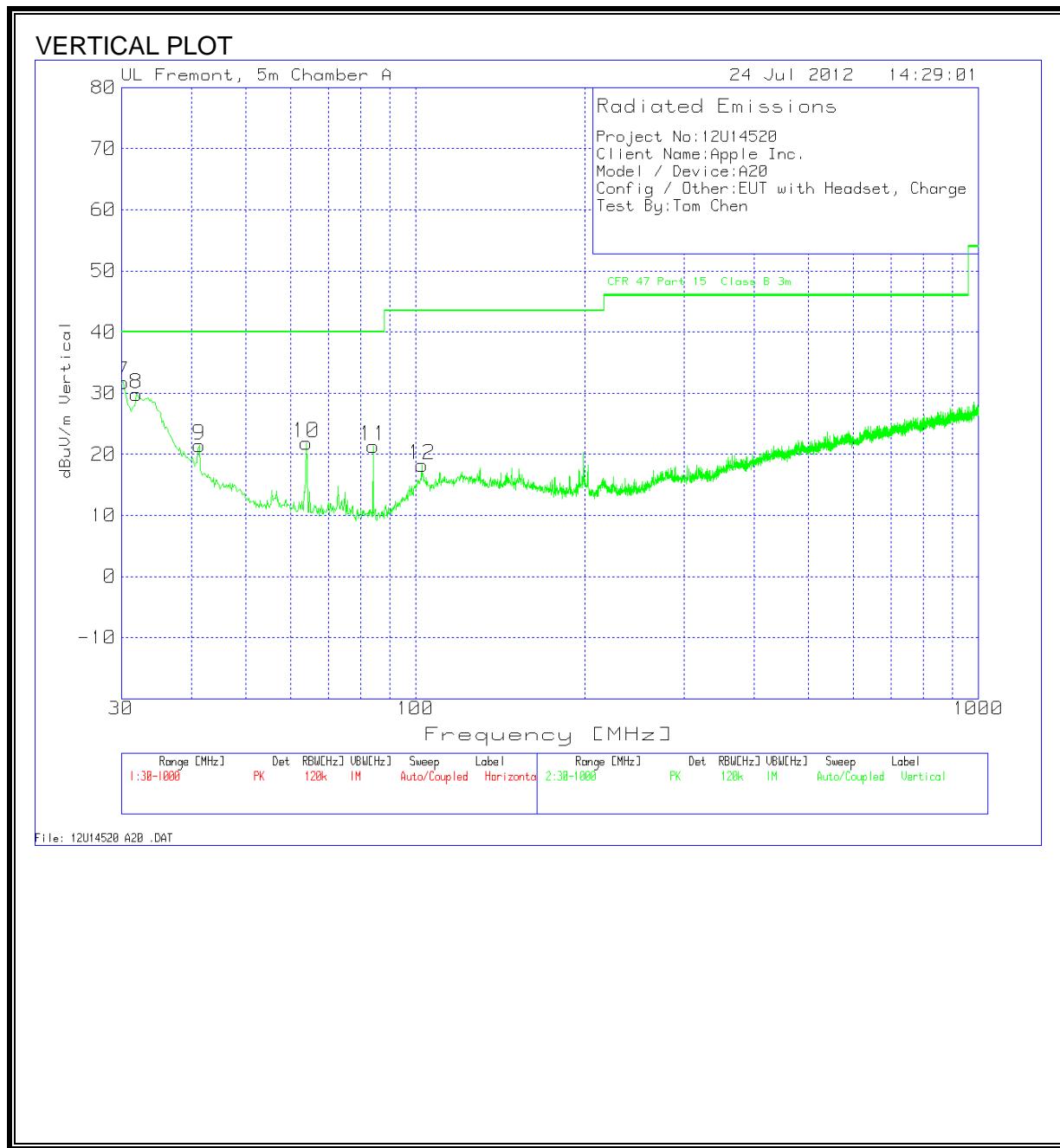
Note: No other emissions were detected above the system noise floor.

7.3. 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:12U14520

Client Name:Apple Inc.

Model / Device: A1446

Config / Other:EUT with Headset

Test By:Tom Chen

Horizontal 30 - 1000MHz

Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	CFR 47 Part 15 Class B 3m	Margin	Polarity
31.3569	30.29	PK	-27.5	20.2	22.99	40	-17.01 Horz
39.3046	31.17	PK	-27.4	14.5	18.27	40	-21.73 Horz
108.701	31.22	PK	-26.8	12.4	16.82	43.5	-26.68 Horz
145.9193	34.08	PK	-26.6	12.4	19.88	43.5	-23.62 Horz
154.6423	35.96	PK	-26.5	12	21.46	43.5	-22.04 Horz
213.9588	36.34	PK	-26.1	10.5	20.74	43.5	-22.76 Horz

Vertical 30 - 1000MHz

Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	CFR 47 Part 15 Class B 3m	Margin	Polarity
30.1938	38.14	PK	-27.5	21.1	31.74	40	-8.26 Vert
31.9384	37.56	PK	-27.5	19.8	29.86	40	-10.14 Vert
41.243	35.71	PK	-27.4	13.1	21.41	40	-18.59 Vert
63.9229	41.45	PK	-27.2	7.6	21.85	40	-18.15 Vert
84.0827	41.03	PK	-27.1	7.4	21.33	40	-18.67 Vert
102.6918	34.2	PK	-26.9	10.9	18.2	43.5	-25.3 Vert

8. 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.

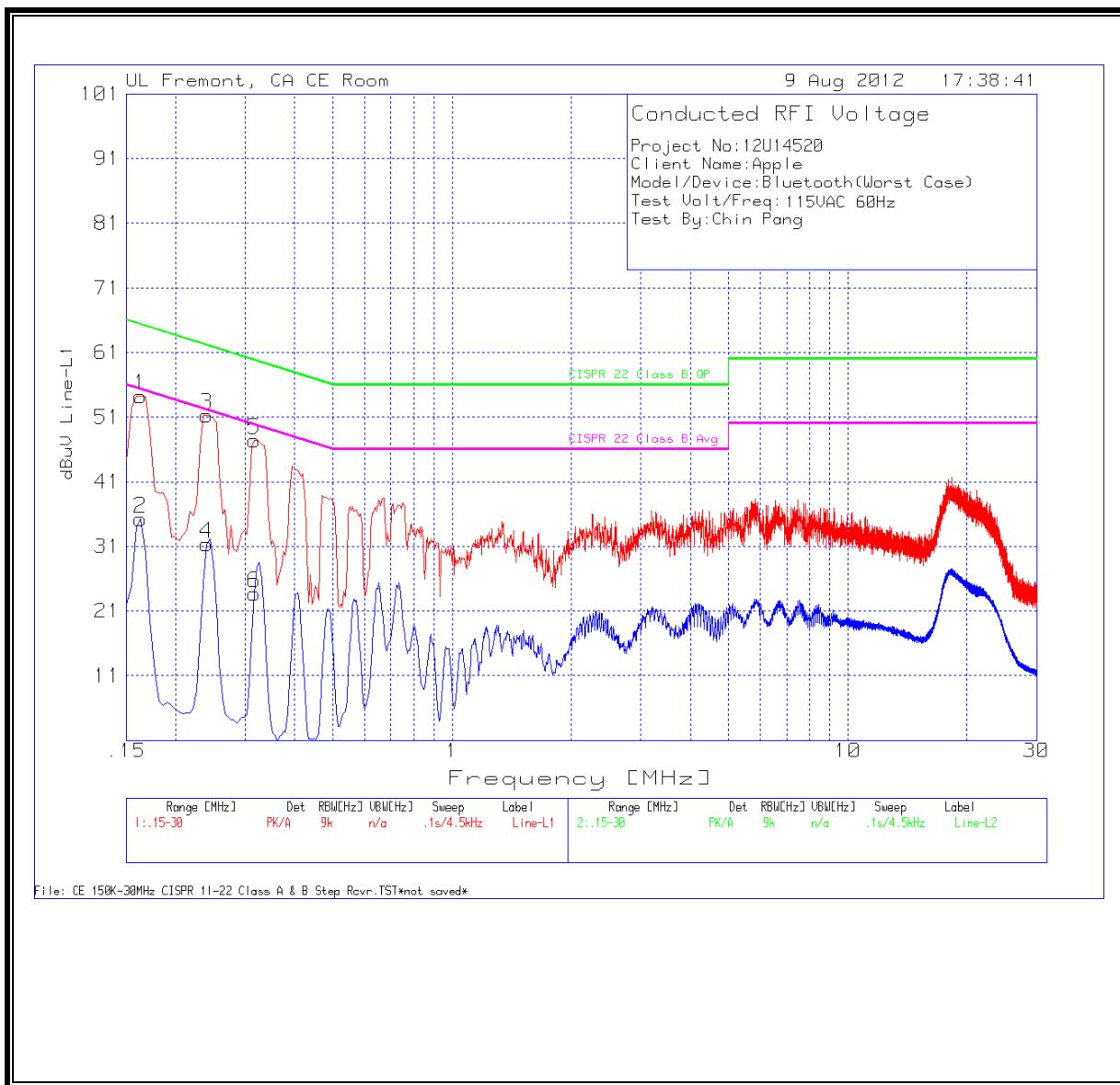
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

6 WORST EMISSIONS

Project No:12U14520									
Client Name:Apple									
Model/Device:									
Test Volt/Freq:15VAC 60Hz									
Test By:Chin Pang									
Line-L1 .15 - 30MHz									
Frequency	Reading	Detector	T24 IL L1.	LC Cables	dBuV	CISPR 22B QP	Margin	CISPR 22B Avg	Margin
0.1635	54.18	PK	0.1	0	54.28	65.3	-11.02	-	-
0.1635	35.15	Av	0.1	0	35.25	-	-	55.3	-20.05
0.24	51.25	PK	0.1	0	51.35	62.1	-10.75	-	-
0.24	31.27	Av	0.1	0	31.37	-	-	52.1	-20.73
0.3165	47.34	PK	0.1	0	47.44	59.8	-12.36	-	-
0.3165	23.64	Av	0.1	0	23.74	-	-	49.8	-26.06
Line-L2 .15 - 30MHz									
Frequency	Reading	Detector	T24 IL L1.	LC Cables	dBuV	CISPR 22B QP	Margin	CISPR 22B Avg	Margin
0.1635	52	PK	0.1	0	52.1	65.3	-13.2	-	-
0.1635	31.54	Av	0.1	0	31.64	-	-	55.3	-23.66
0.2445	49.18	PK	0.1	0	49.28	61.9	-12.62	-	-
0.2445	28.93	Av	0.1	0	29.03	-	-	51.9	-22.87
0.312	46	PK	0.1	0	46.1	59.9	-13.8	-	-
0.312	18.04	Av	0.1	0	18.14	-	-	49.9	-31.76
Project No:12U14520									
Client Name:Apple									
Model/Device:									
Test Volt/Freq:15VAC 60Hz									
Test By:Chin Pang									

LINE 1 RESULTS



LINE 2 RESULTS

