



FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 7

CERTIFICATION TEST REPORT

FOR

HANDHELD TOUCH SCREEN IPOD MUSIC DEVICE WITH 802.11B/G AND
BLUETOOTH RADIO FUNCTIONS

MODEL NUMBER: A1318

FCC ID: BCG-2310
IC: 579C-2310

REPORT NUMBER: 09U12741-2

ISSUE DATE: AUGUST 14, 2009

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITY LOOP
CUPERTINO, CALIFORNIA 95014, U.S.A.

EUT DESCRIPTION: HANDHELD TOUCH SCREEN IPOD MUSIC DEVICE WITH 802.11B/G AND BLUETOOTH RADIO FUNCTIONS

MODEL: A1318

SERIAL NUMBER: A1-A 0044, A1-B 0004, D1-Y 0002

DATE TESTED: AUGUST 5-11, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass

Compliance Certification Services, Inc. (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 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by 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 CCS By:



FRANK IBRAHIM
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:



TOM CHEN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

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 2, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

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

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 Model Number A1318 is an iPod Touch product. This is a handheld touch screen iPod music device with 802.11b/g and Bluetooth radio functions. The A1318 measures 111.49 mm (4.389 inches) long x 62.29 mm (2.452 inches) wide x 8.2 5mm (0.325 inches) thick and weighs 107.7 grams (3.8 oz.). The rechargeable battery is not user accessible.

The Apple A1318 comes with one of two memory configurations, 32 / 64 Giga Bytes for storing music, video or data. The Apple A1318 function is fully compatible with Apple's iTunes software. The Apple A1318 in box materials include; Apple earbuds (no microphone), and 30pin to USB cable.

The radio module is manufactured by Murata.

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	10.73	11.83
2402 - 2480	Enhanced 8PSK	10.38	10.91

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an inverted F antenna, with a maximum gain of 1.2 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was mfgtest-seqcmds.bin
bcm94329OLYMPICN18

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was tested in three orthogonal orientations X, Y and Z. It was determined that Y orientation is worst-case; therefore orientation Y was used for all testing.

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 DH1 and 8PSK mode was 3-DH1.

For radiated emissions below 1 GHz and conducted emissions, the channel with highest power was used; this was determined to be Mid Channel in GFSK mode.

5.6. DESCRIPTION OF TEST SETUP

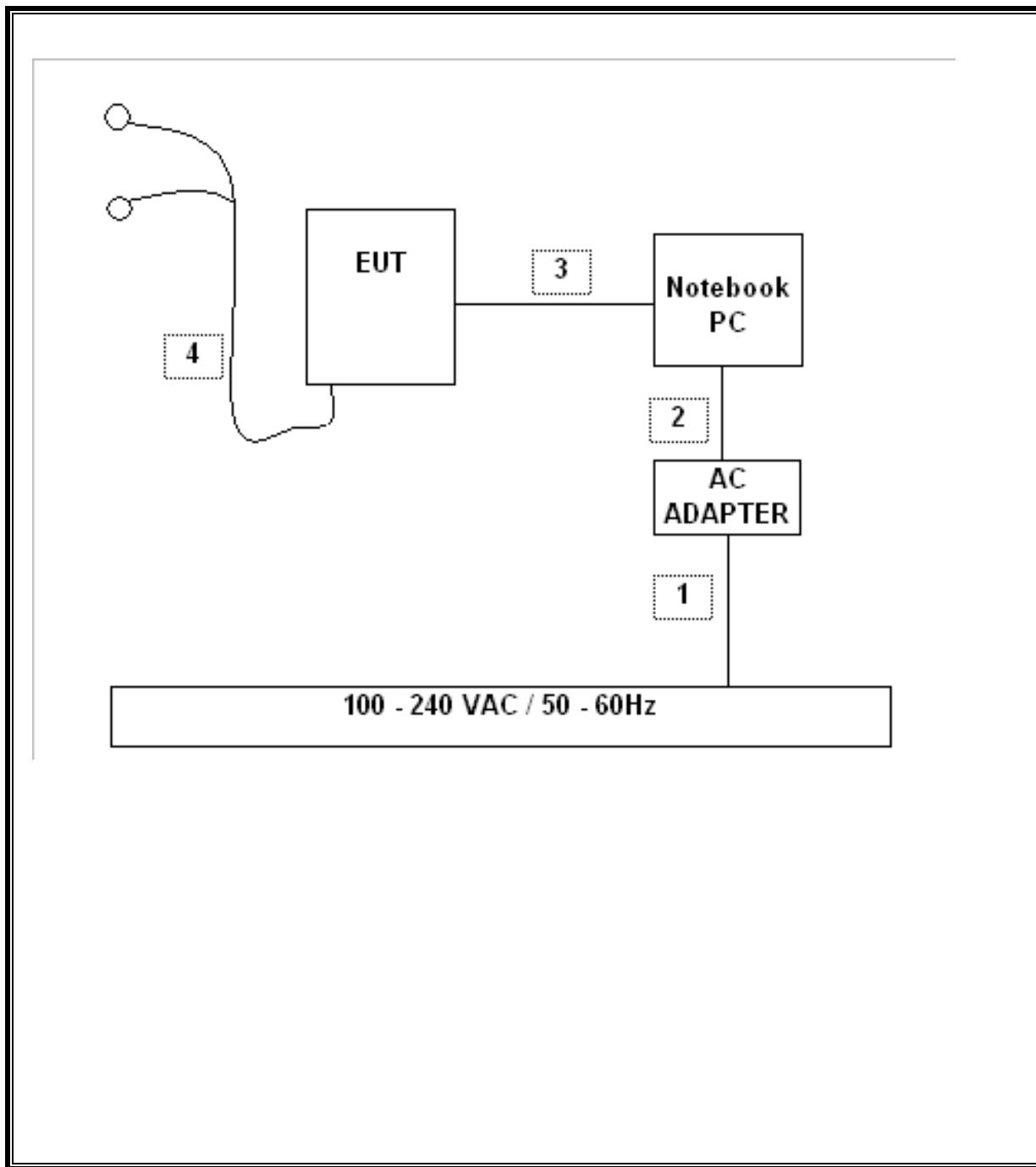
SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Mouse	Apple	A1152	KY6041L43U3MC	DoC
Laptop	Apple	MacBook	PT384939	DoC
AC/DC Adapter	Apple	A1184	N/A	DoC
Earphone	Apple	N/A	N/A	DoC

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	North America	Un-Shielded	1.5m	N/A
2	DC	1	DC Plug	Un-Shielded	1m	N/A
3	USB	1	Mini USB	Un-Shielded	1.5m	N/A
4	Audio	1	Ear Jack	Un-Shielded	1.2m	N/A

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	
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4407B	C01098	11/07/08	02/07/10	
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	12/01/08	12/01/09	
Horn Antenna	EMCO	3115	C00872	01/29/09	01/29/10	
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	11/07/08	02/07/10	
Power Meter	Agilent / HP	437B	N02778	11/04/08	08/04/10	
Antenna, BiLog, 2 GHz	Sund Sciences	JB1	C01011	01/14/09	01/14/10	
Power Sensor, 18 GHz	Agilent / HP	8481A	N02784	04/22/08	10/22/09	
Antenna, BiLog, 2 GHz	Sund Sciences	JB1	C01011	01/14/09	01/14/10	
Antenna, Hbm, 26.5 GHz	ARA	SWH28	C01015	09/29/07	11/29/09	
EMI Test Receiver, 30 MHz	R&S	ESHS20	N02386	04/06/08	09/06/09	
CBT BLUETOOTH TESTER	R&S	BLUETOOTH TESTER	100429	05/01/09	05/01/10	
LISN, 30 MHz	FCC	LISN-50/250-25-2	C00626	10/29/08	10/29/09	
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/29/08	10/29/09	

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.

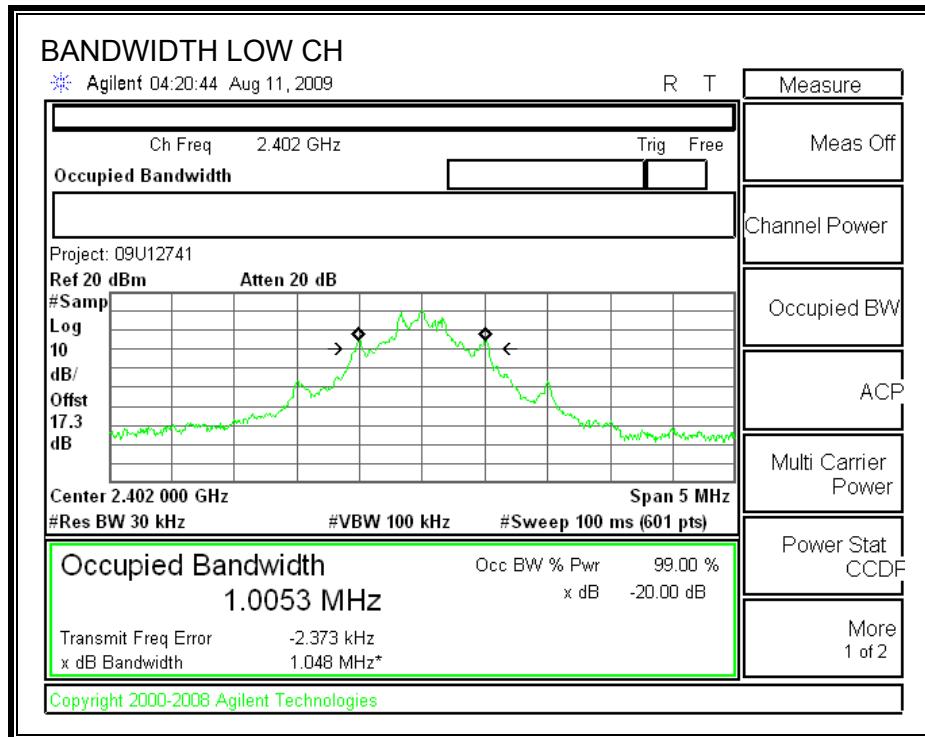
TEST PROCEDURE

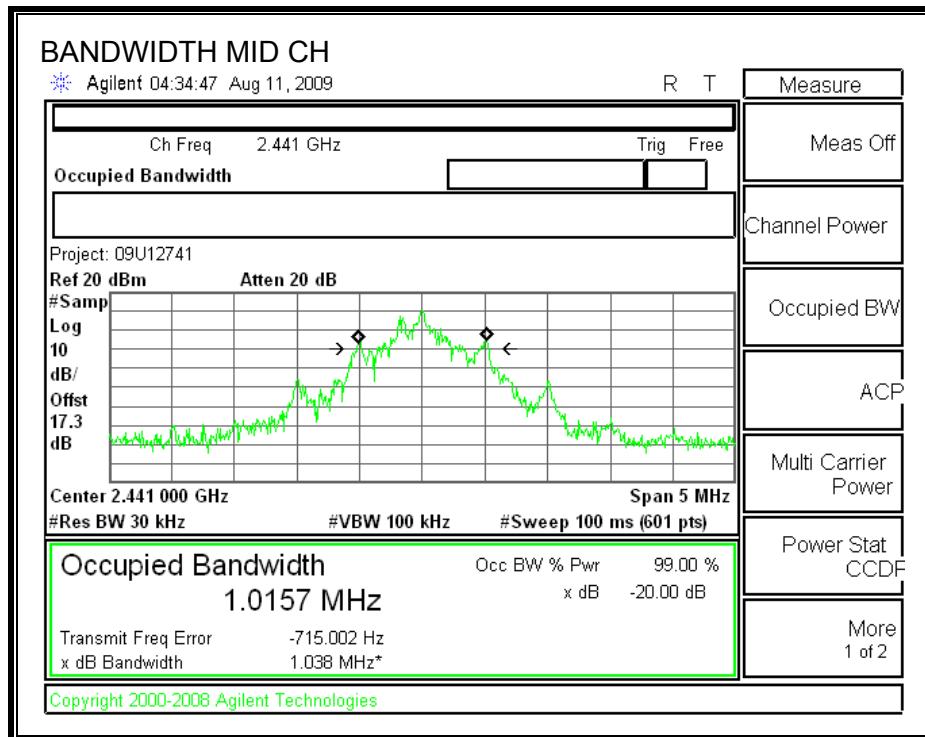
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

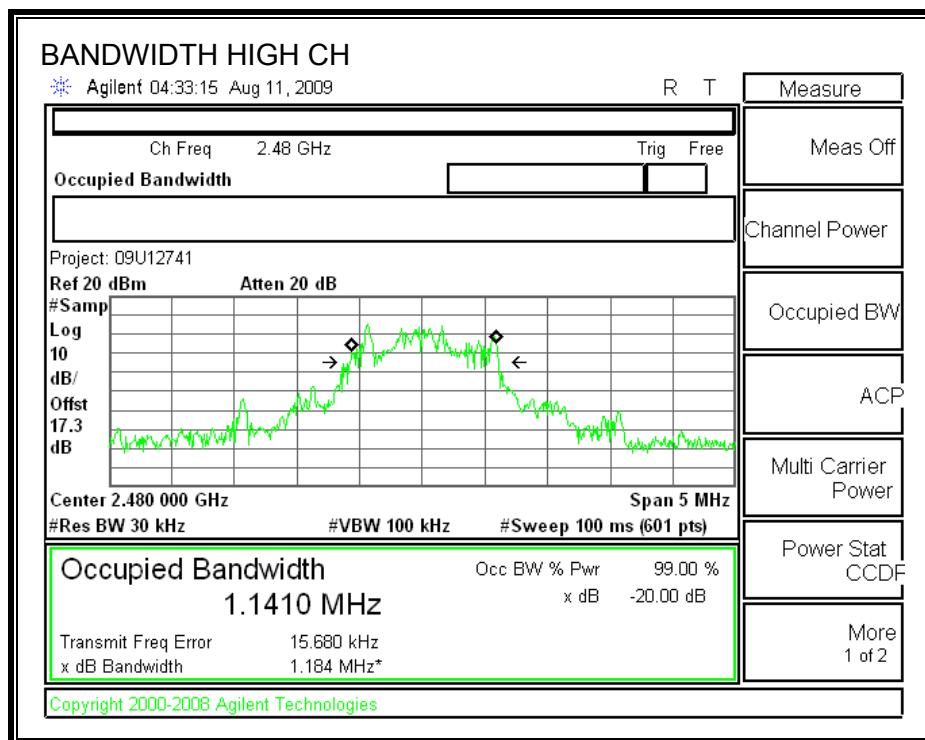
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1048	1005.3
Middle	2441	1038	1015.7
High	2480	1184	1141

20 dB AND 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 hoping channel, whichever is greater.

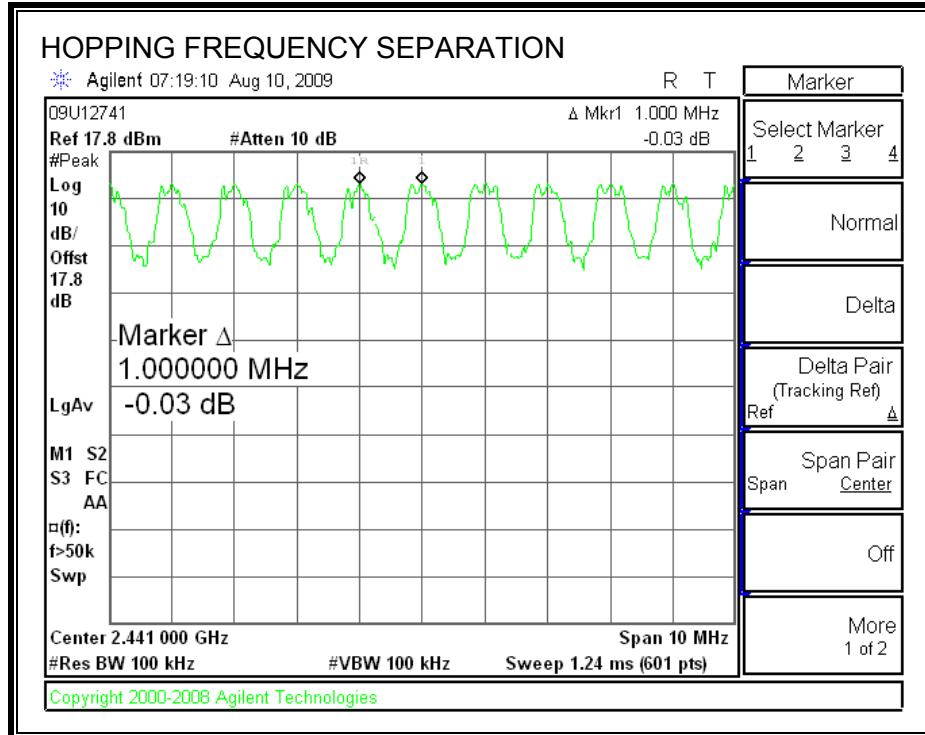
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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



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.

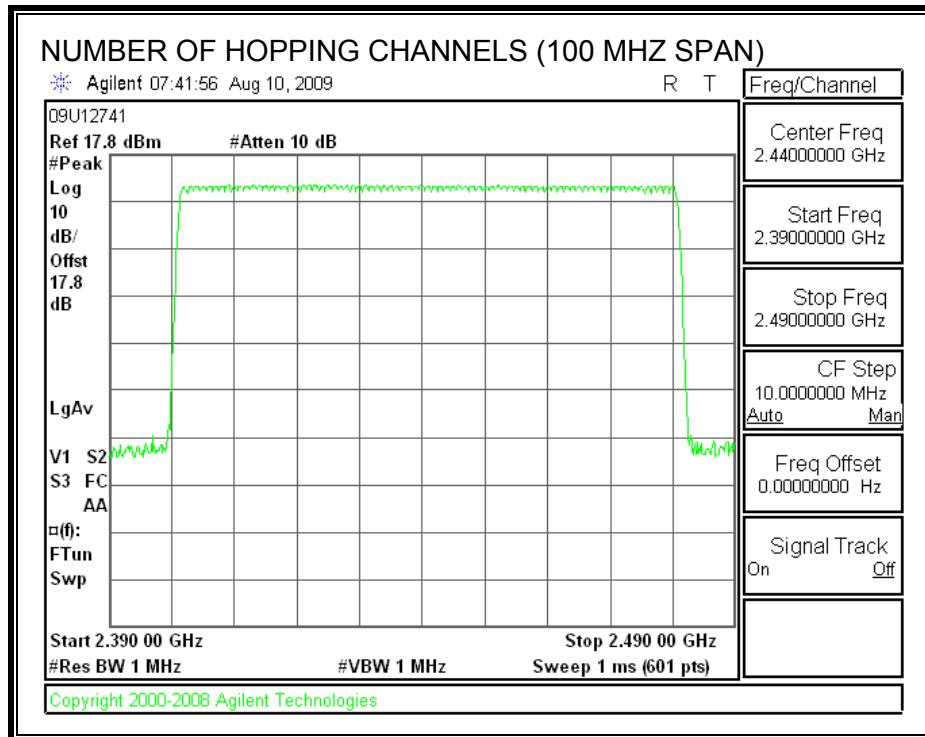
TEST PROCEDURE

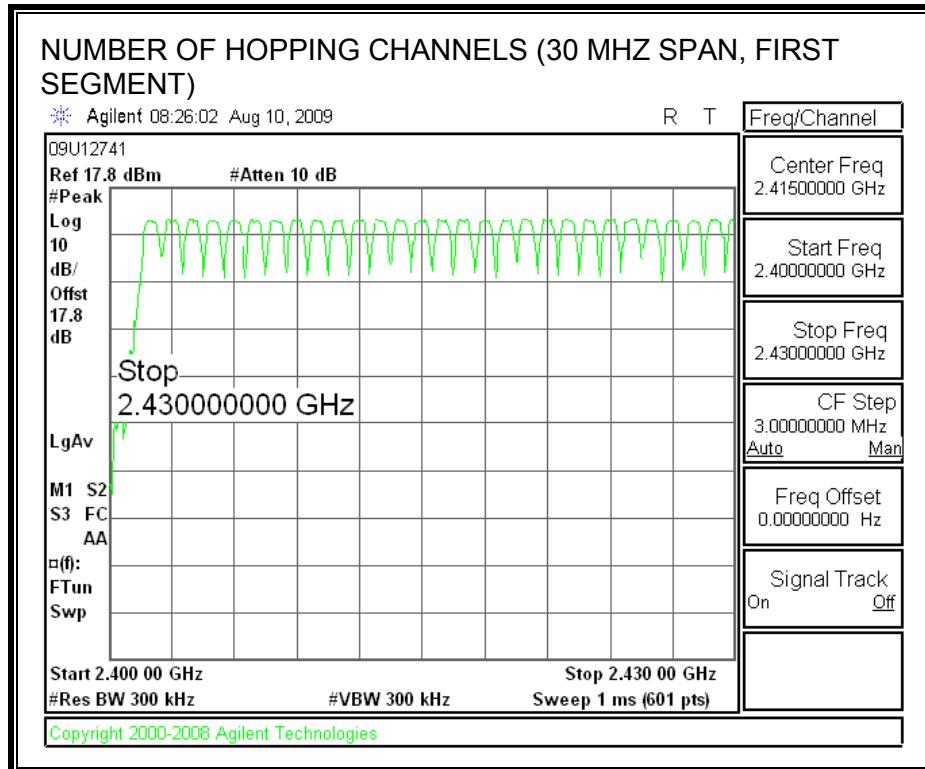
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

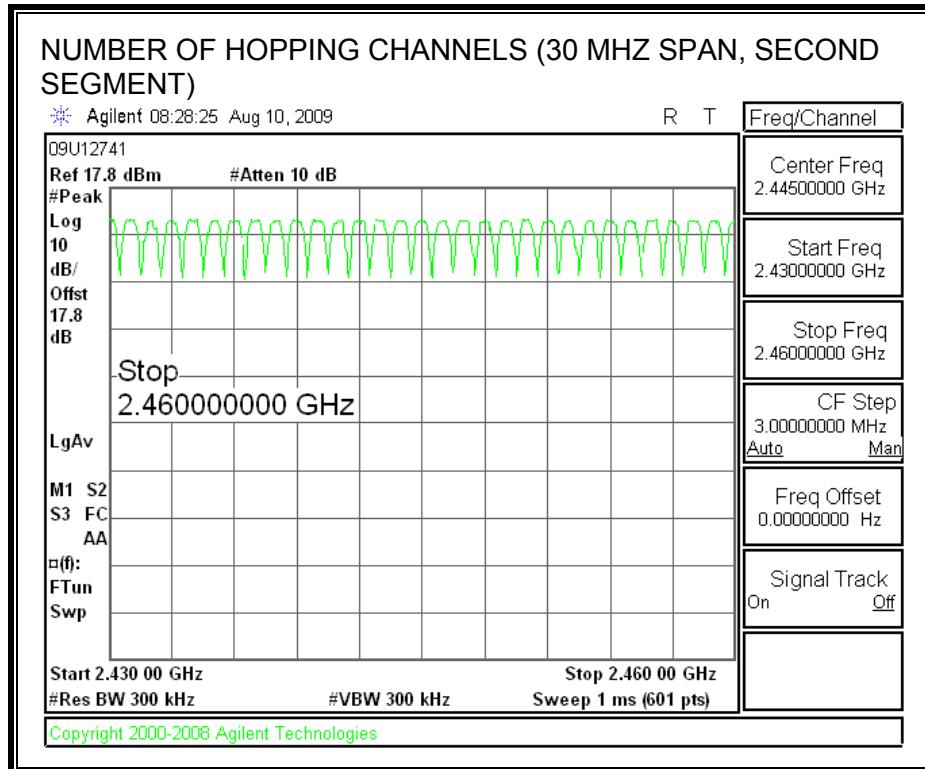
RESULTS

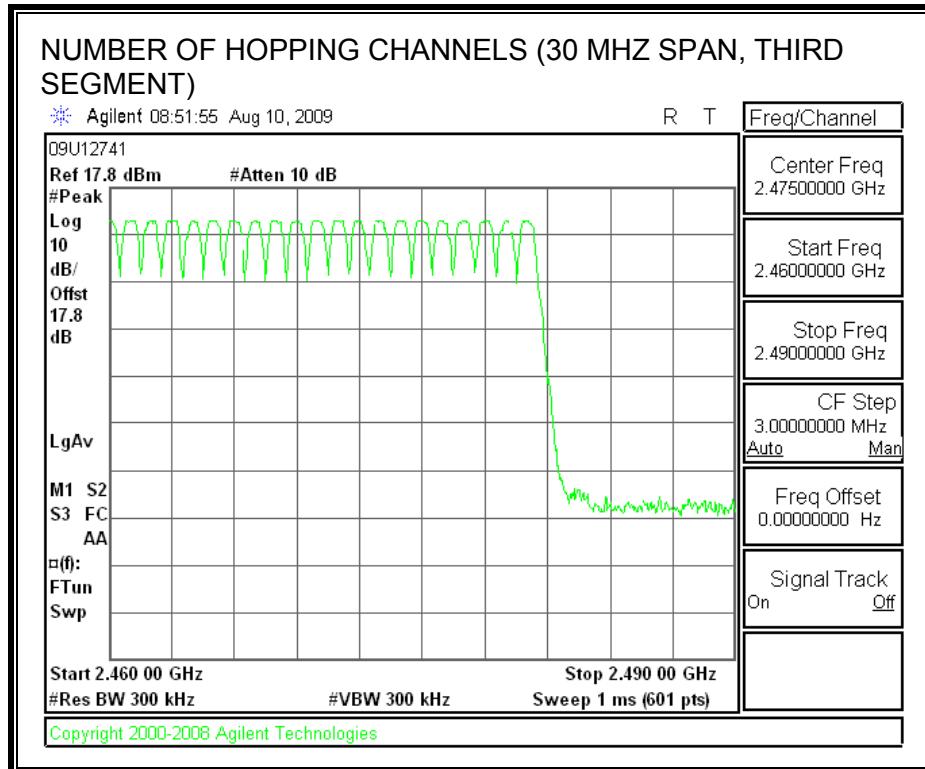
79 Channels observed.

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 $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

RESULTS

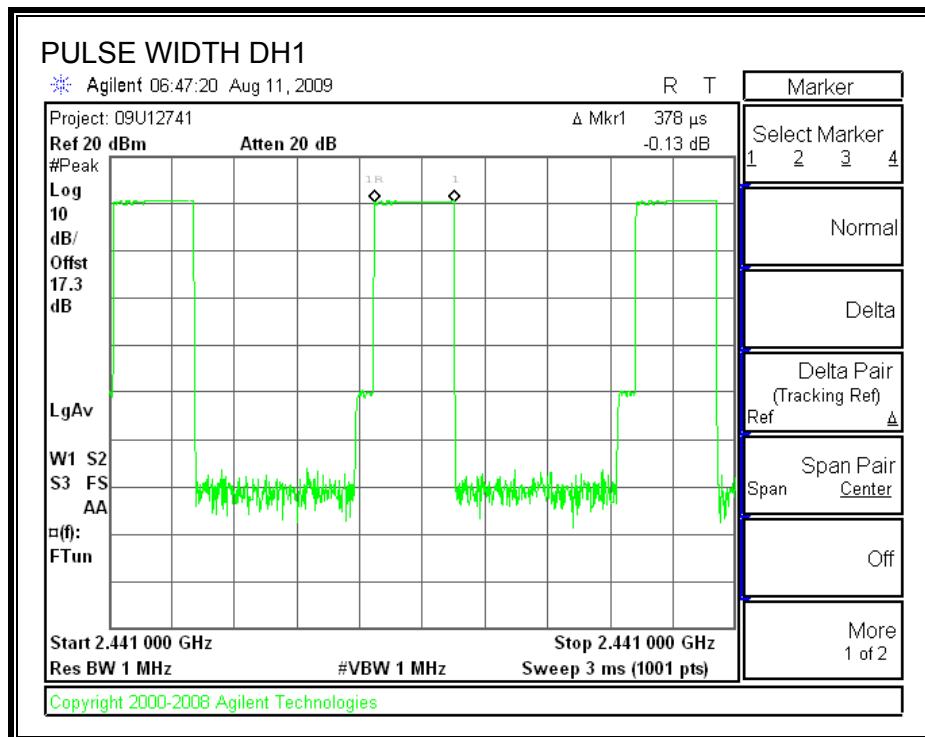
Time Of Occupancy = $10 * \text{xx pulses} * \text{yy msec} = \text{zz msec}$

GFSK Mode

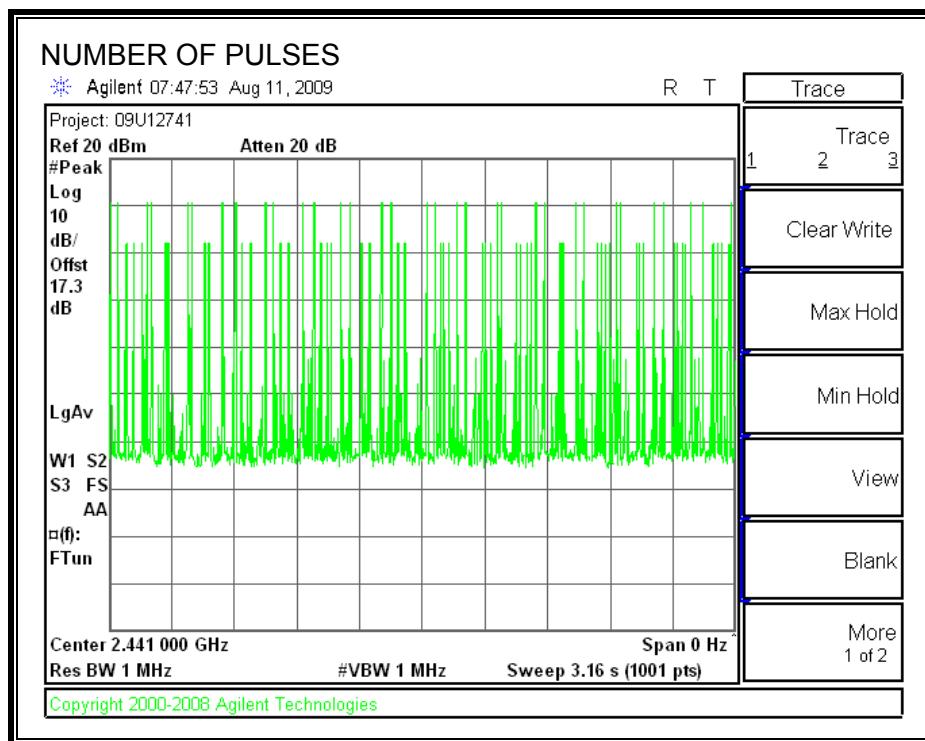
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.378	33	0.125	0.4	-0.275
DH3	1.642	12	0.197	0.4	-0.203
DH5	2.88	6	0.173	0.4	-0.227

GFSK MODE

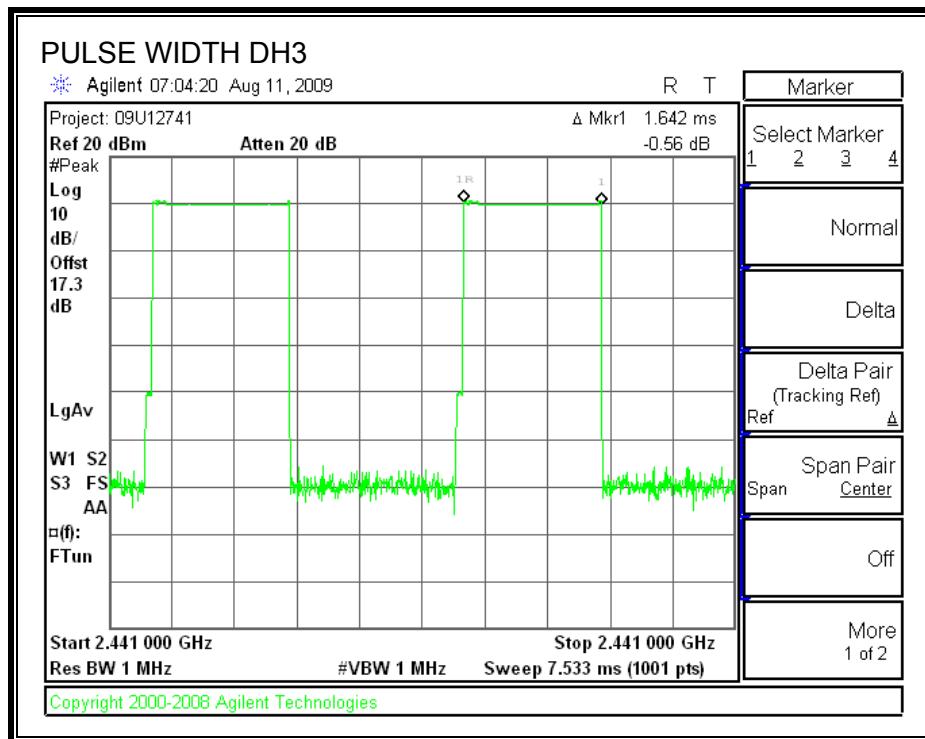
PULSE WIDTH



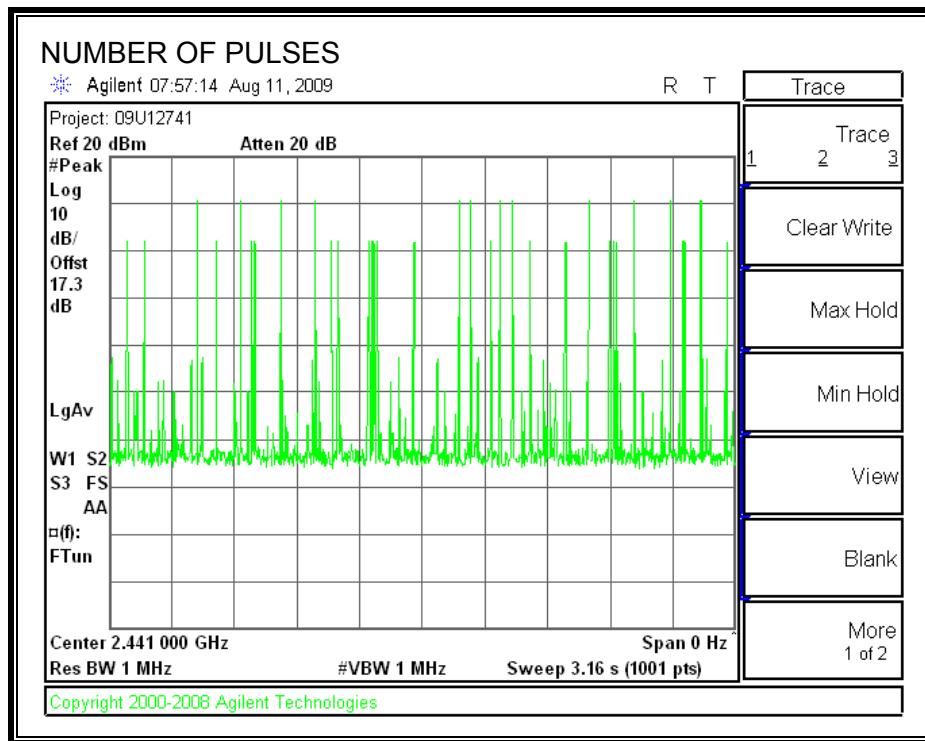
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



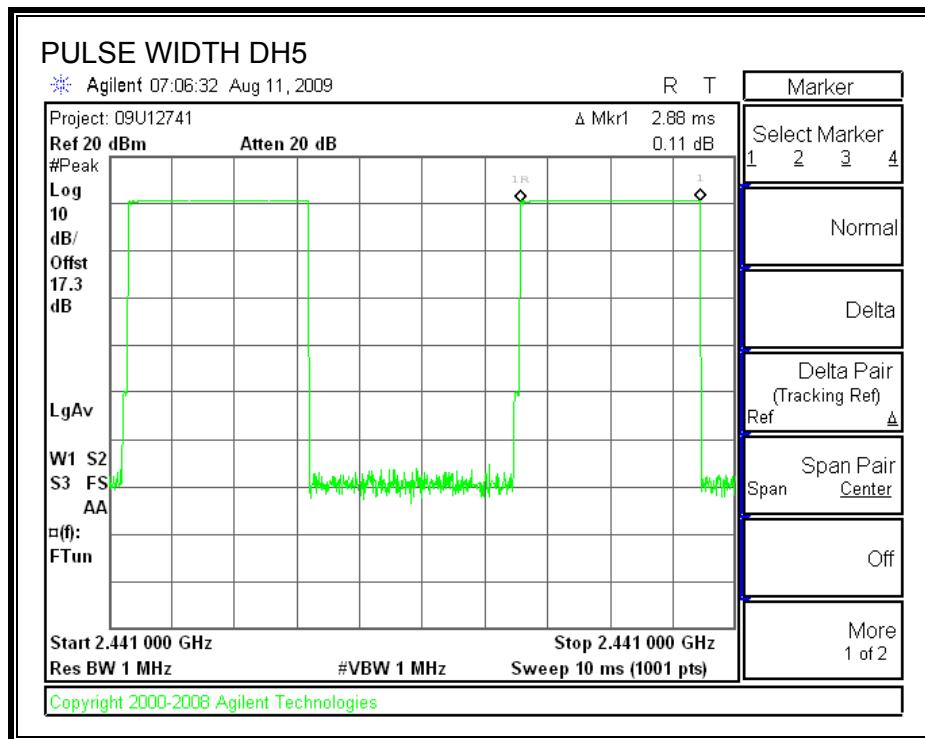
PULSE WIDTH



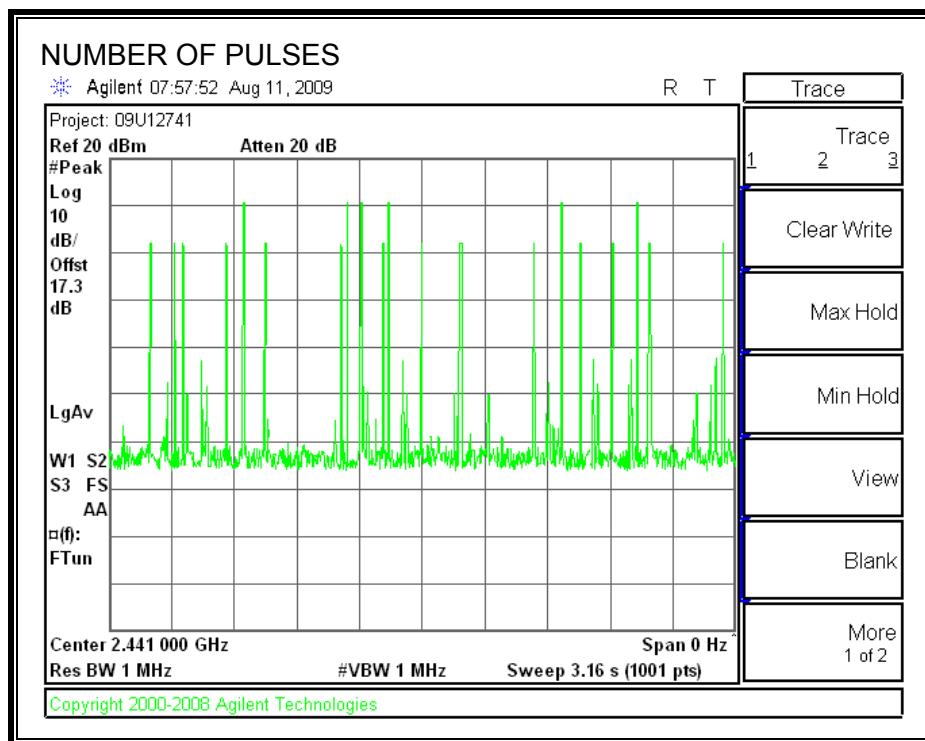
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



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 30 dBm.

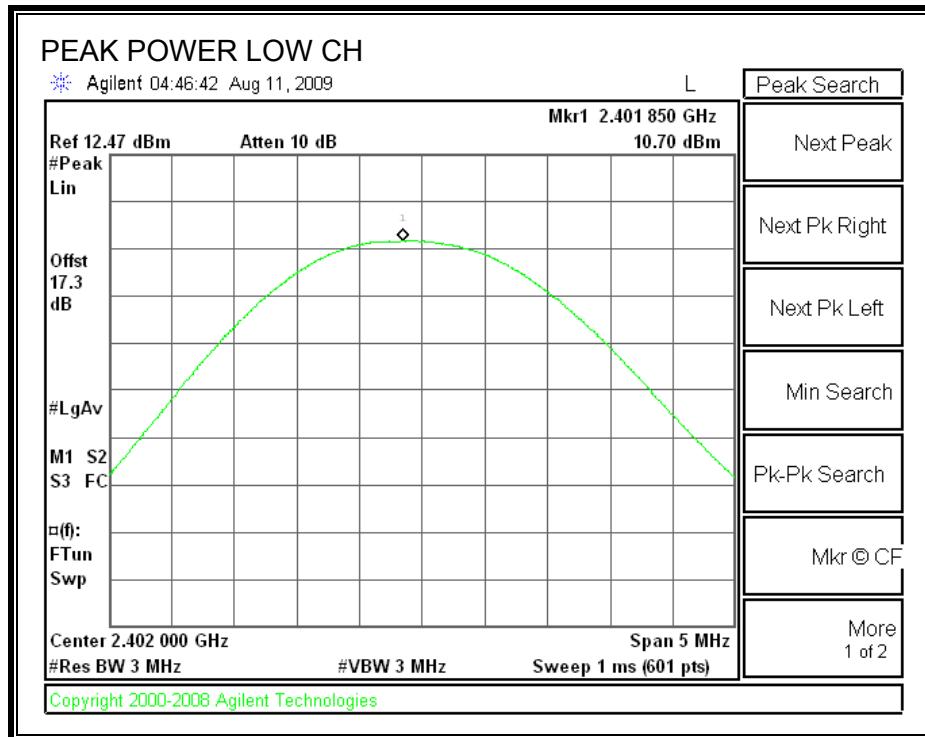
TEST PROCEDURE

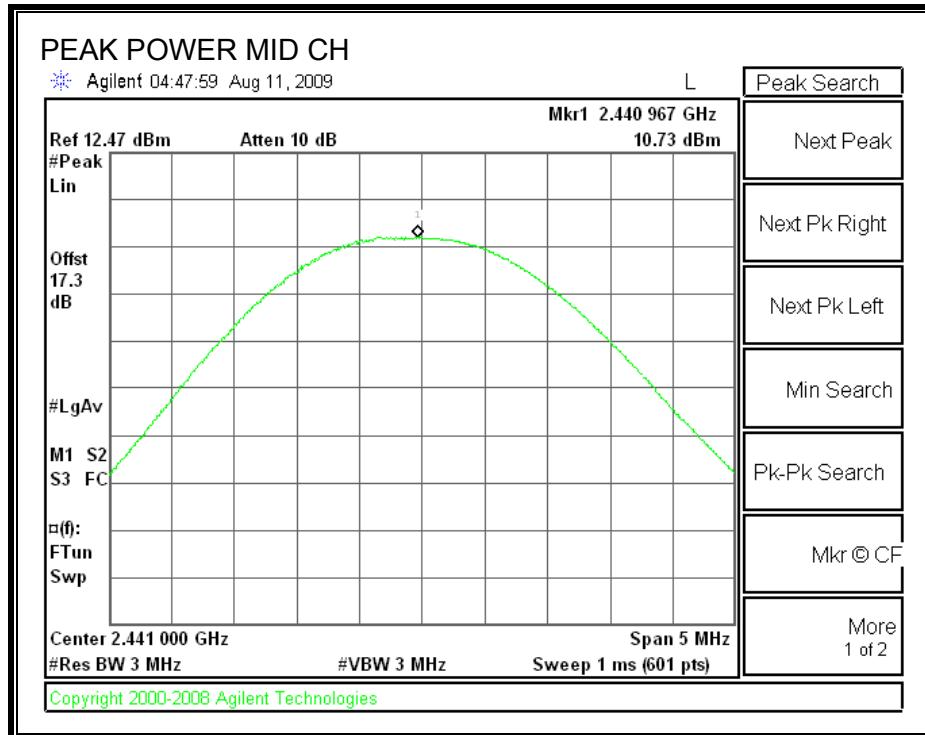
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

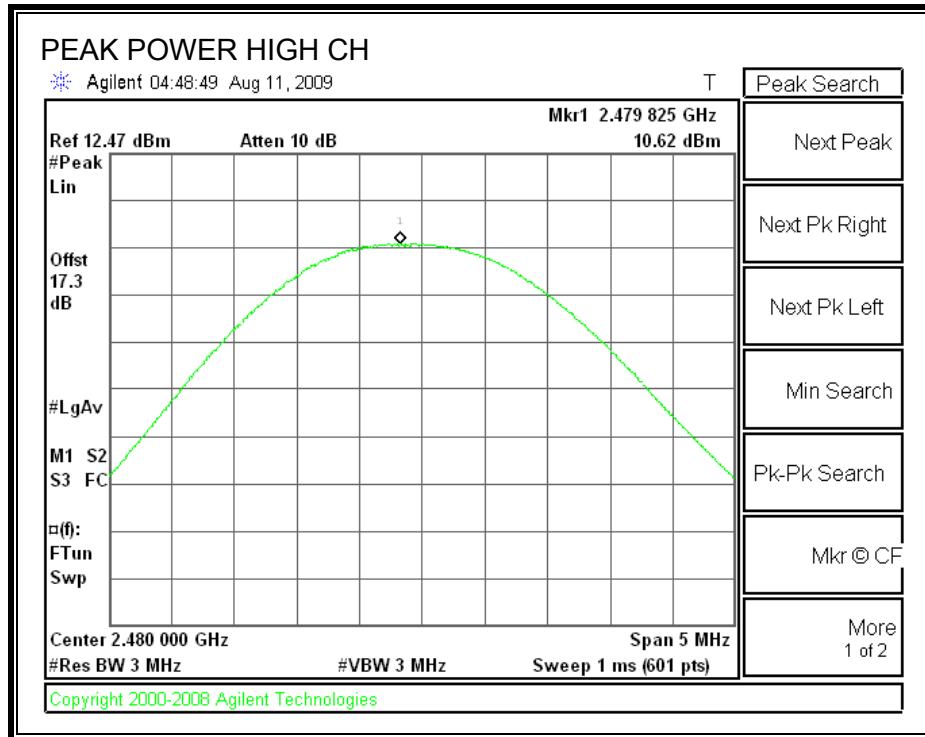
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.70	30	-19.30
Middle	2441	10.73	30	-19.27
High	2480	10.62	30	-19.38

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 17.9 dB (including 16.5 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	10.50
Middle	2441	10.50
High	2480	10.50

7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

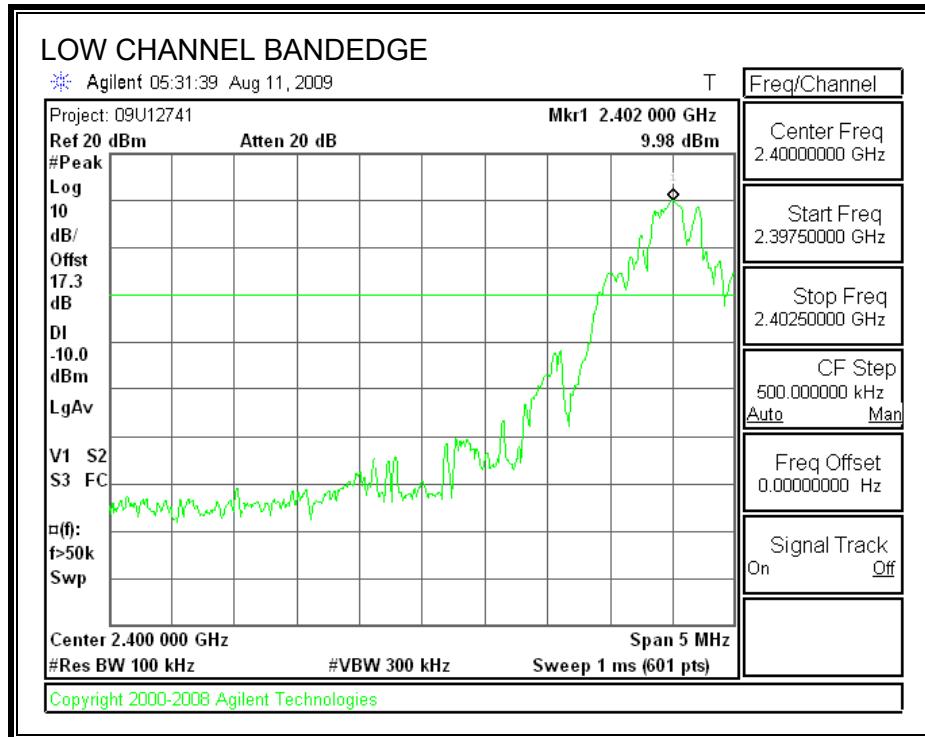
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

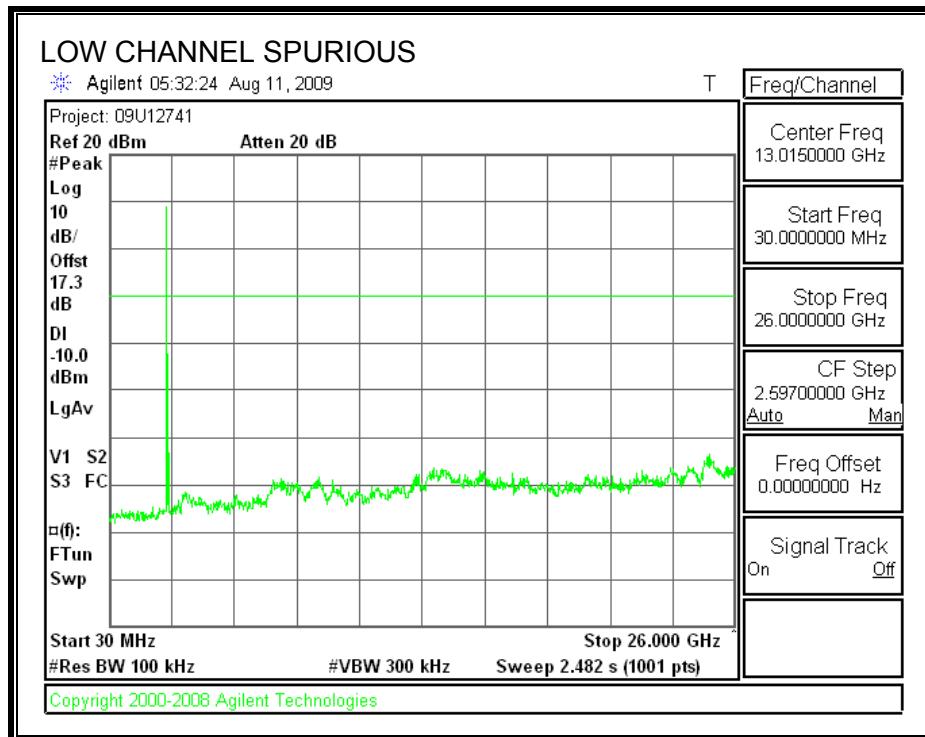
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

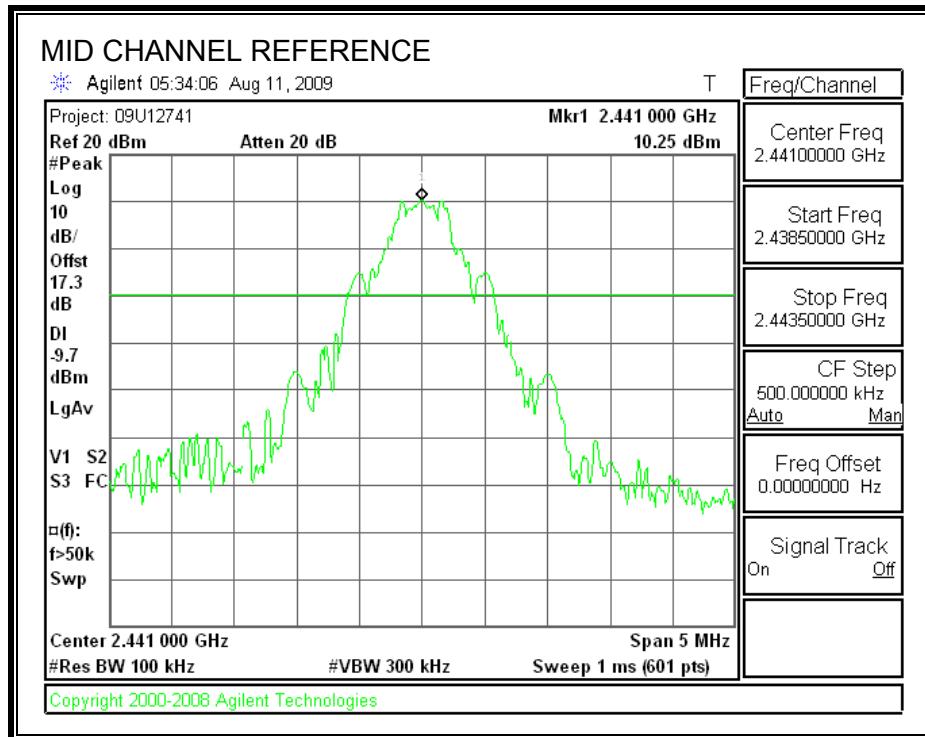
RESULTS

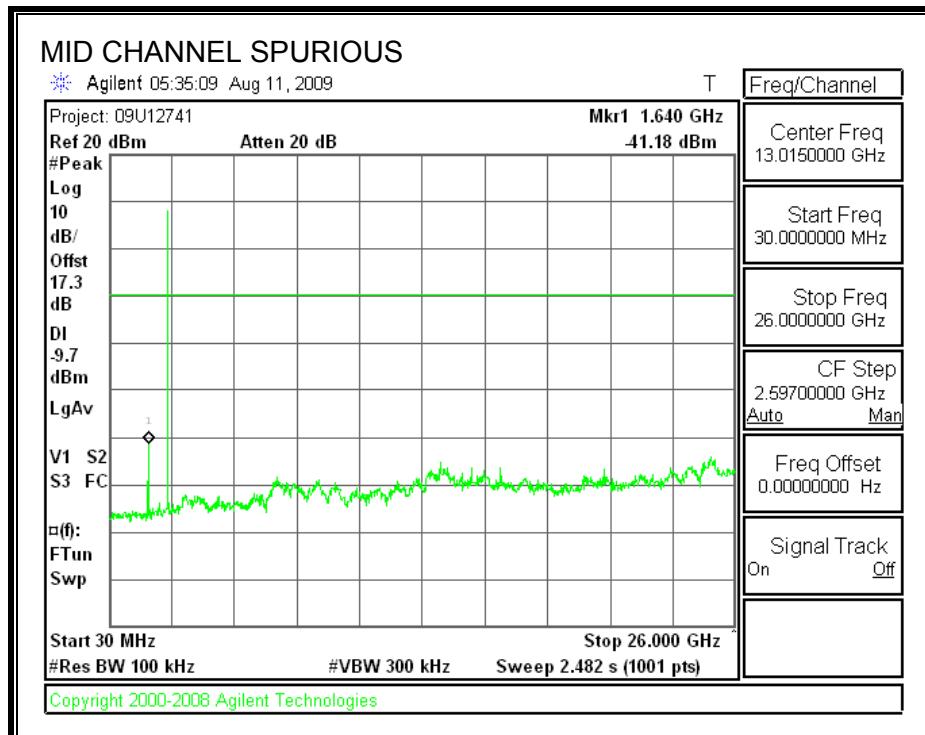
SPURIOUS EMISSIONS, LOW CHANNEL



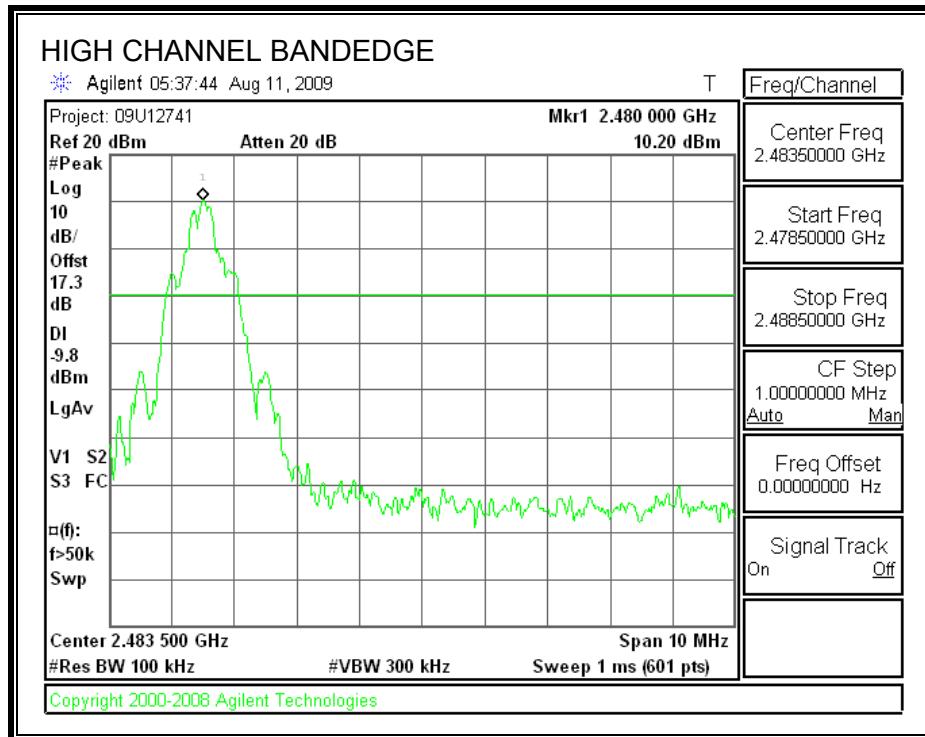


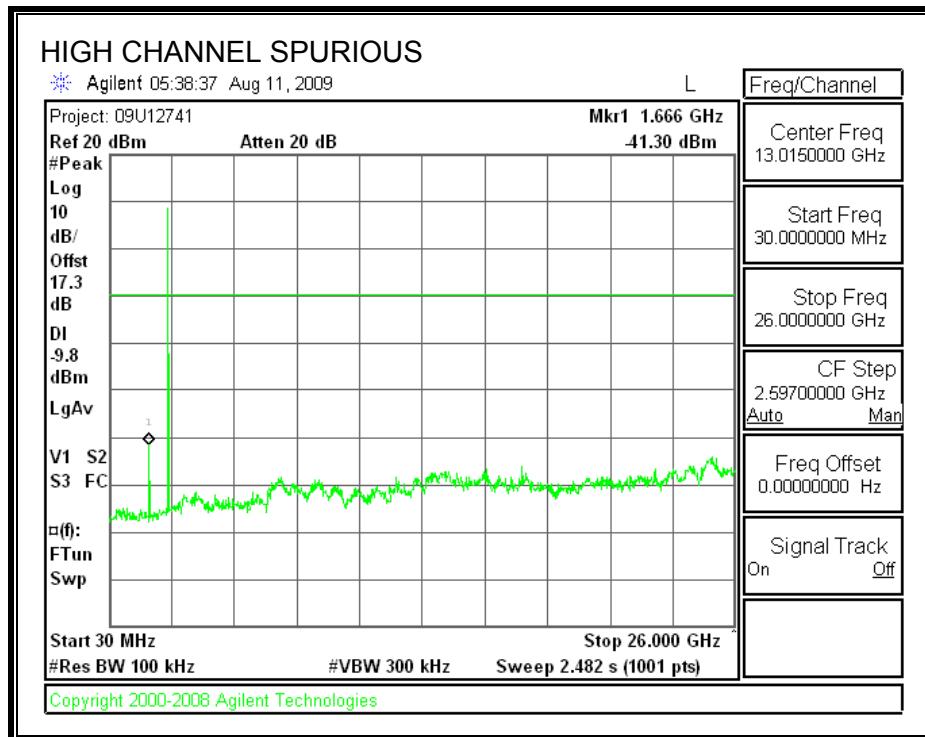
SPURIOUS EMISSIONS, MID CHANNEL



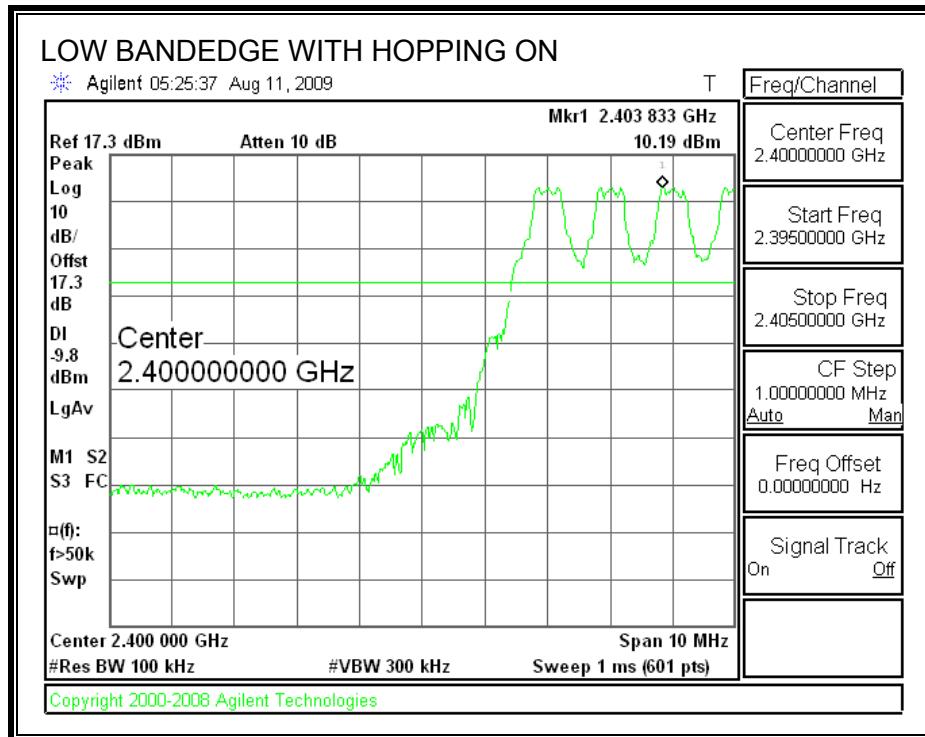


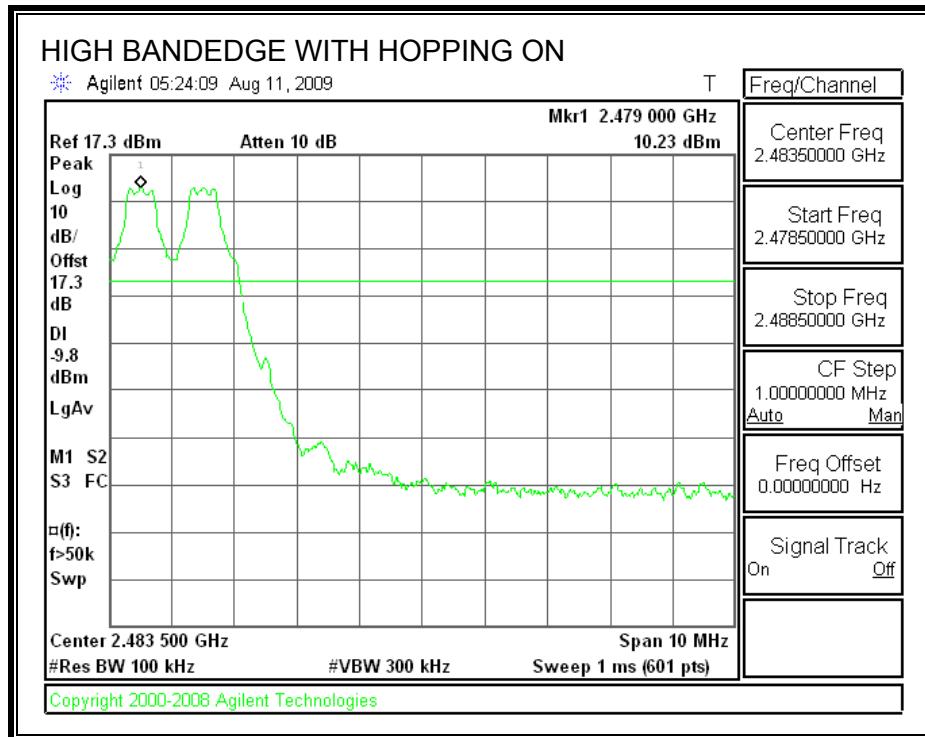
SPURIOUS EMISSIONS, HIGH CHANNEL





SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





7.2. ENHANCED DATA RATE 8PSK MODULATION

7.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

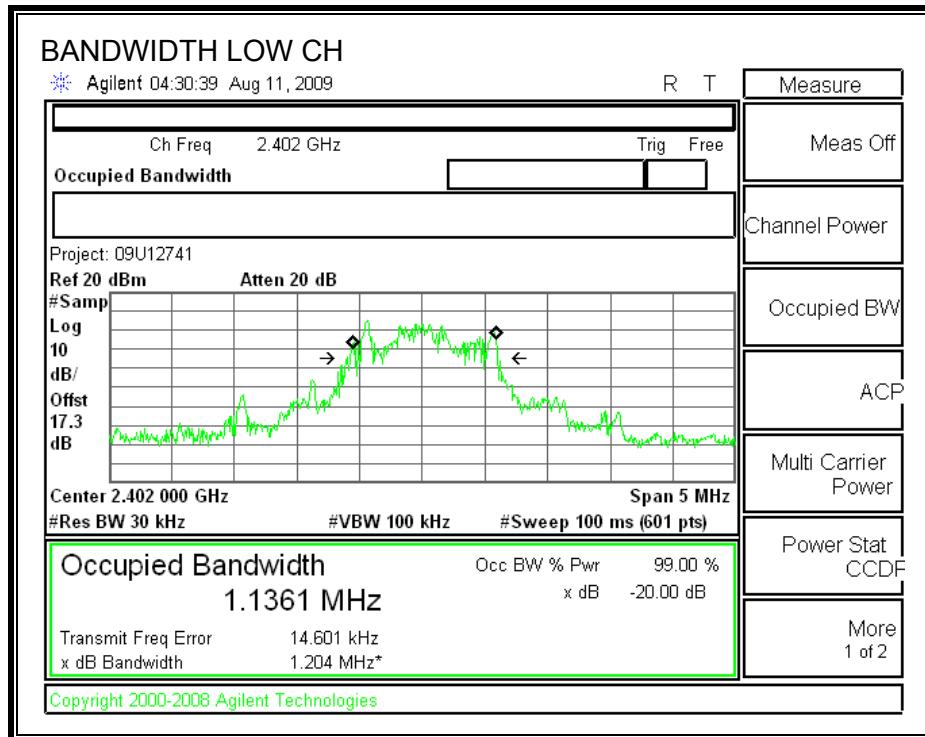
TEST PROCEDURE

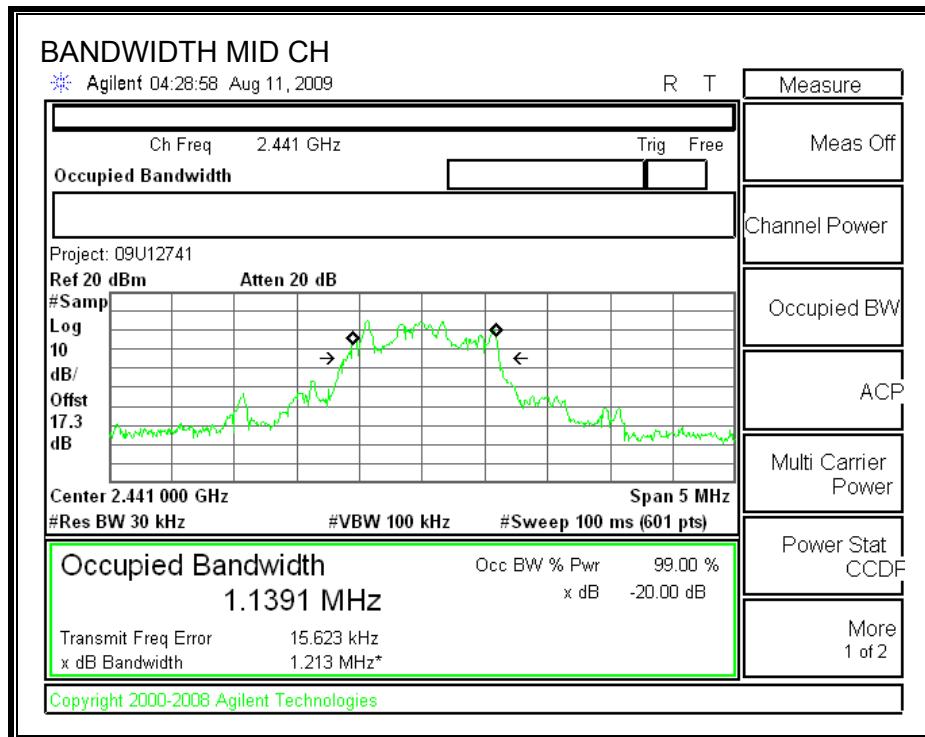
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

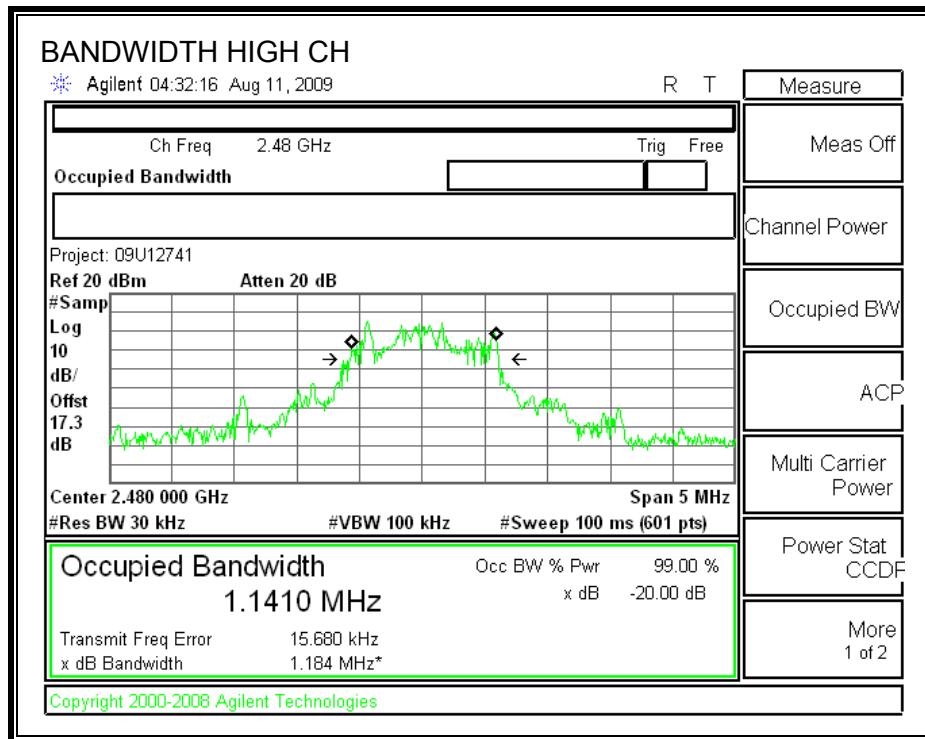
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1204	1136.1
Middle	2441	1213	1139.1
High	2480	1184	1141

20 dB AND 99% BANDWIDTH







7.2.2. 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.

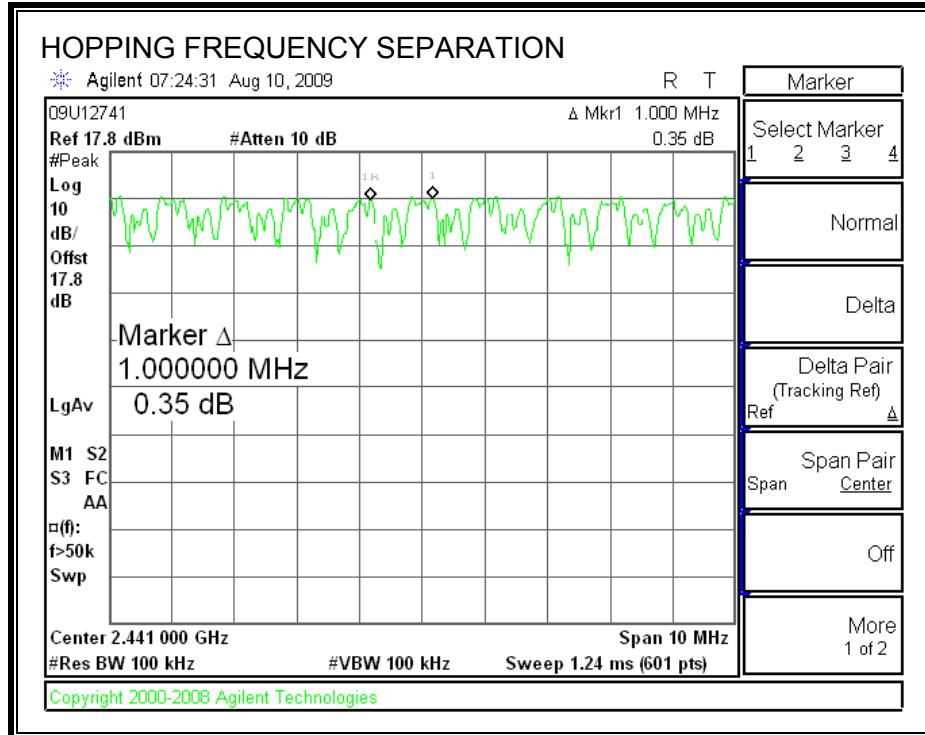
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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



7.2.3. 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.

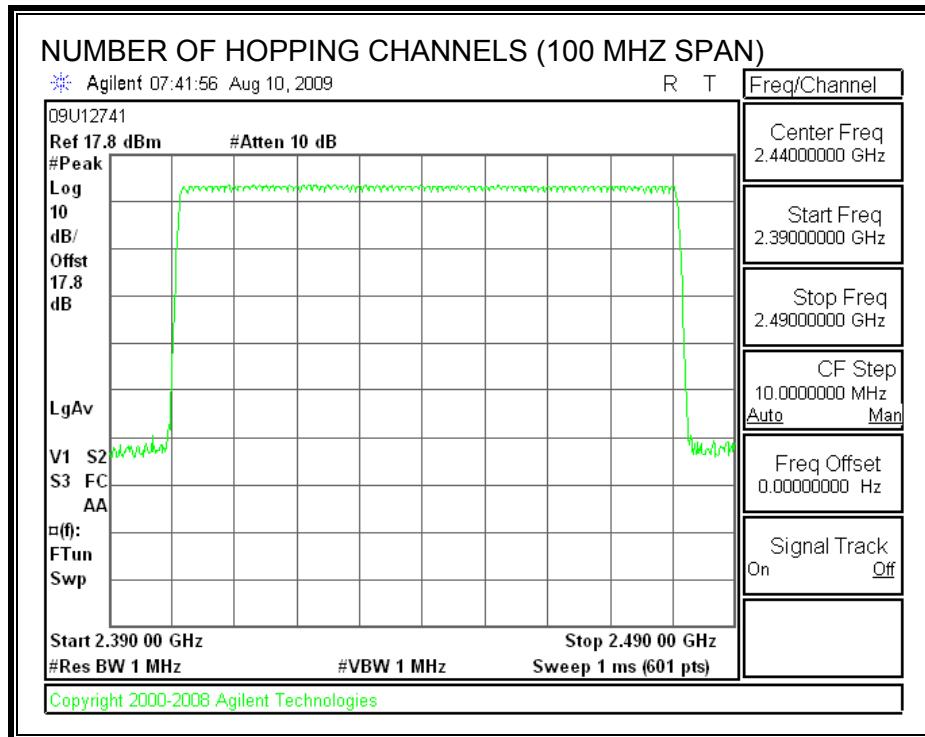
TEST PROCEDURE

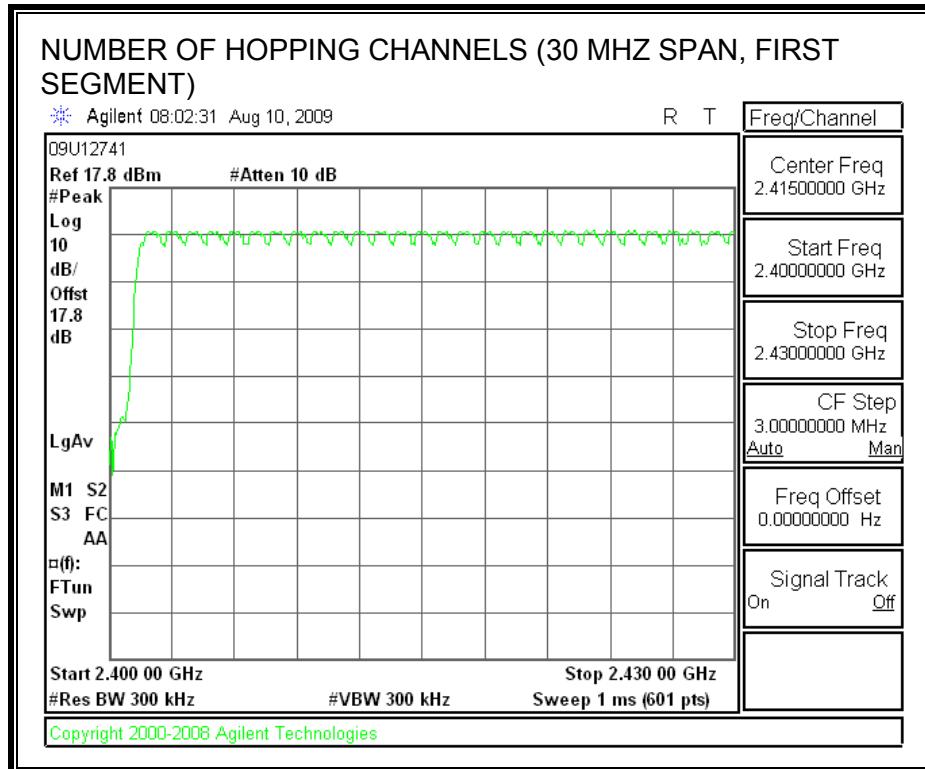
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

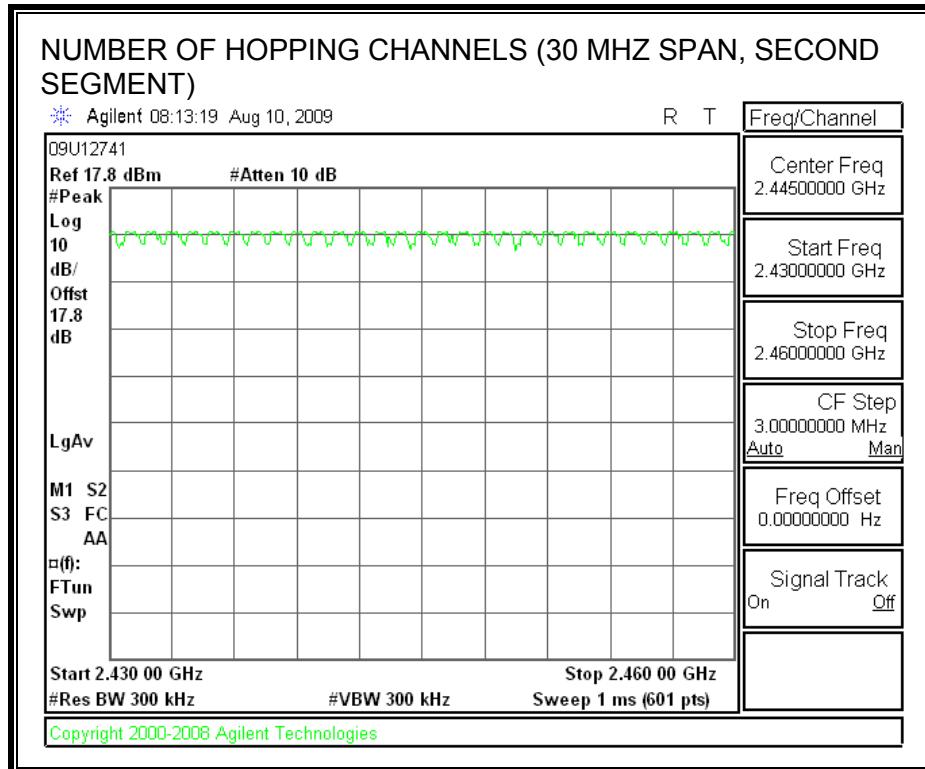
RESULTS

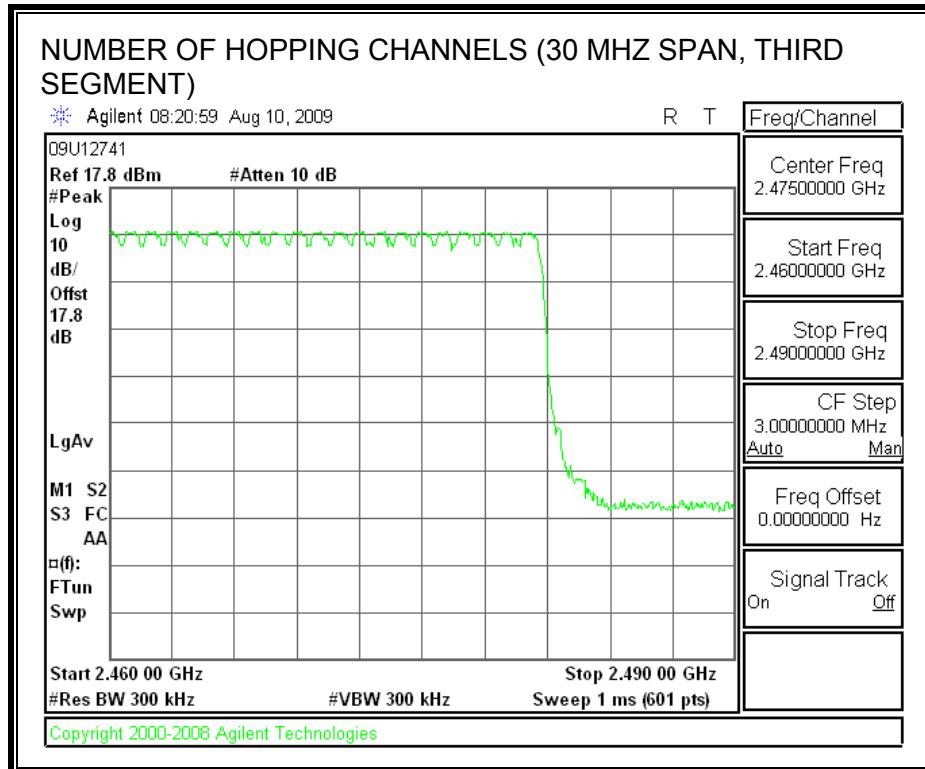
79 Channels observed.

NUMBER OF HOPPING CHANNELS









7.2.4. 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

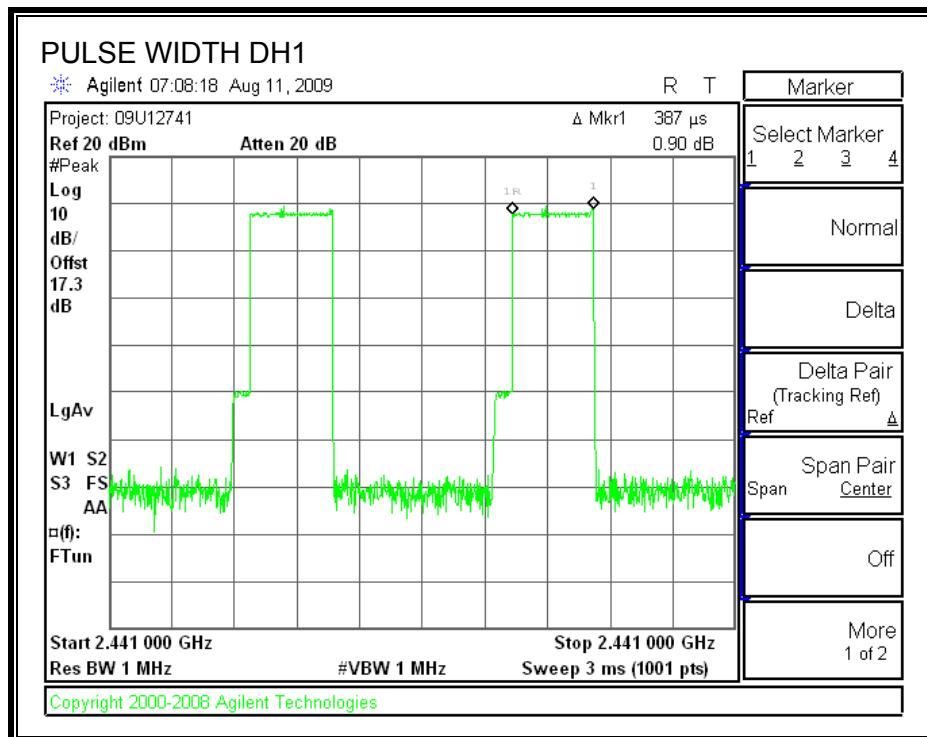
Time Of Occupancy = $10 * \text{xx pulses} * \text{yy msec} = \text{zz msec}$

8PSK Mode

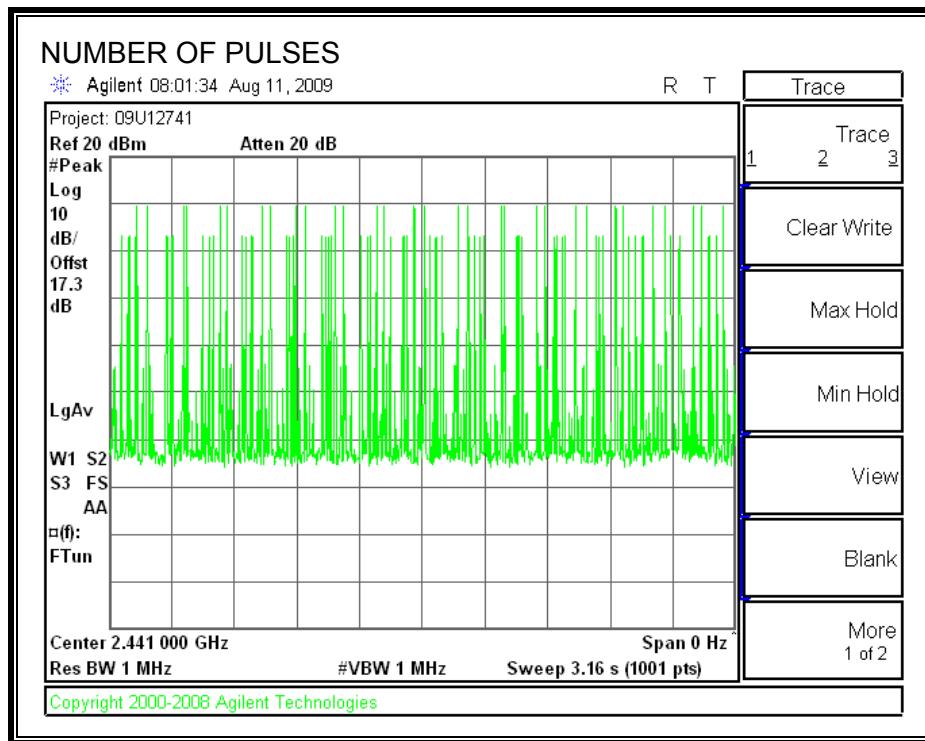
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.387	31	0.120	0.4	-0.280
DH3	1.634	7	0.114	0.4	-0.286
DH5	2.89	5	0.145	0.4	-0.256

8PSK MODE

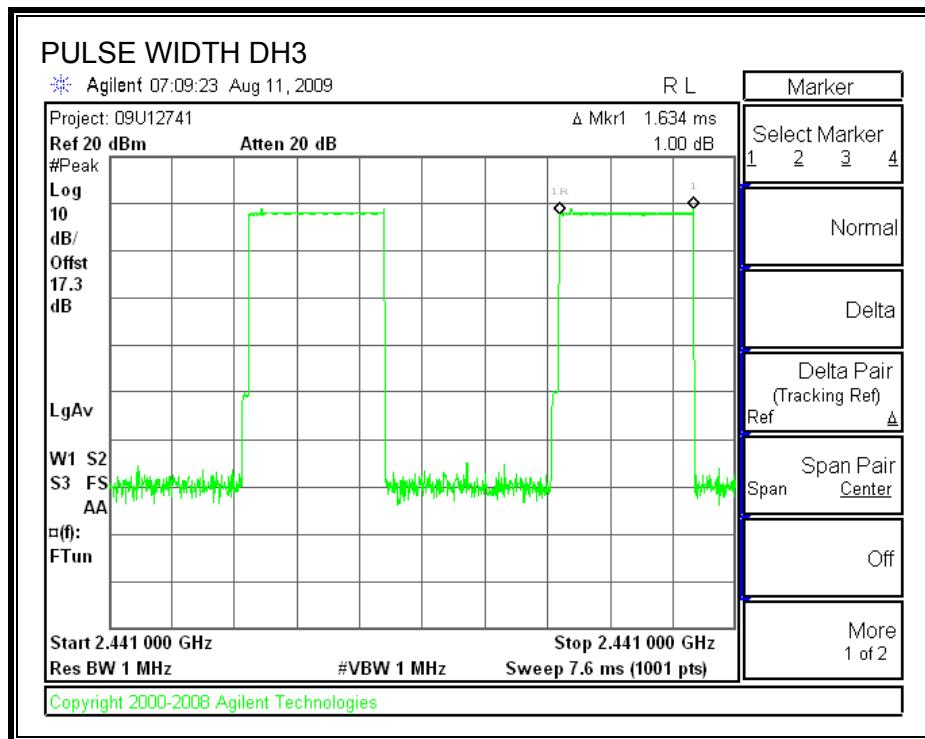
PULSE WIDTH



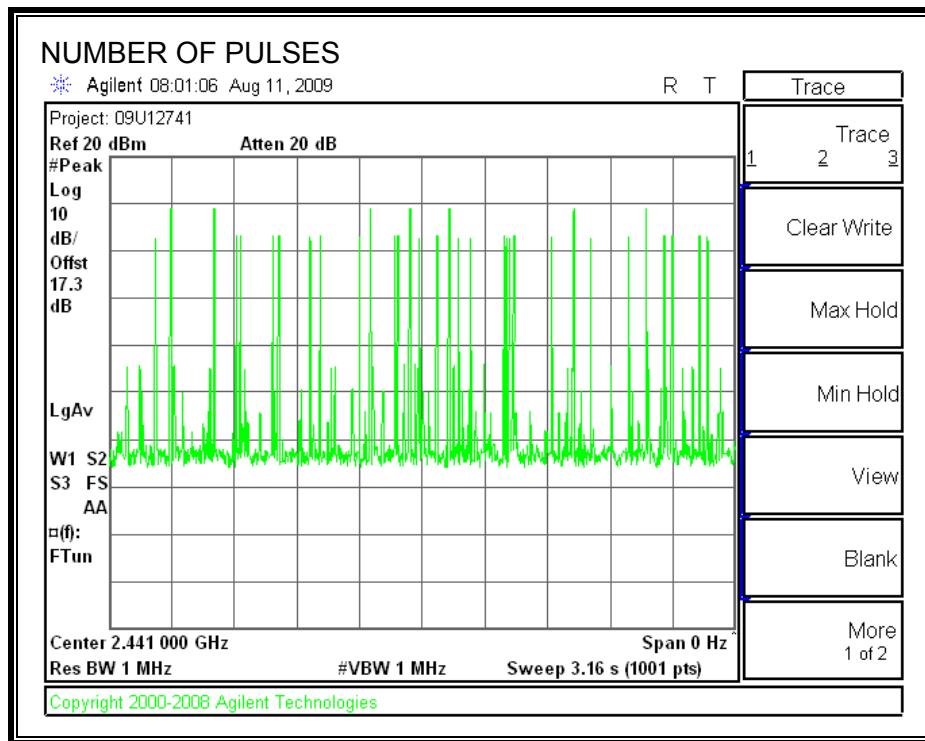
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



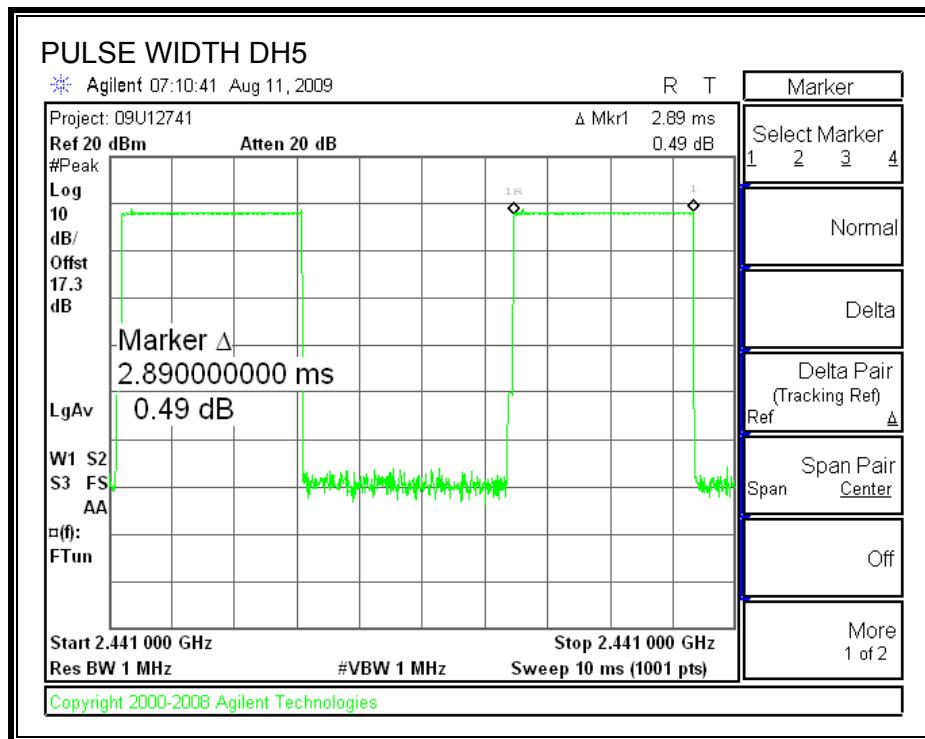
PULSE WIDTH



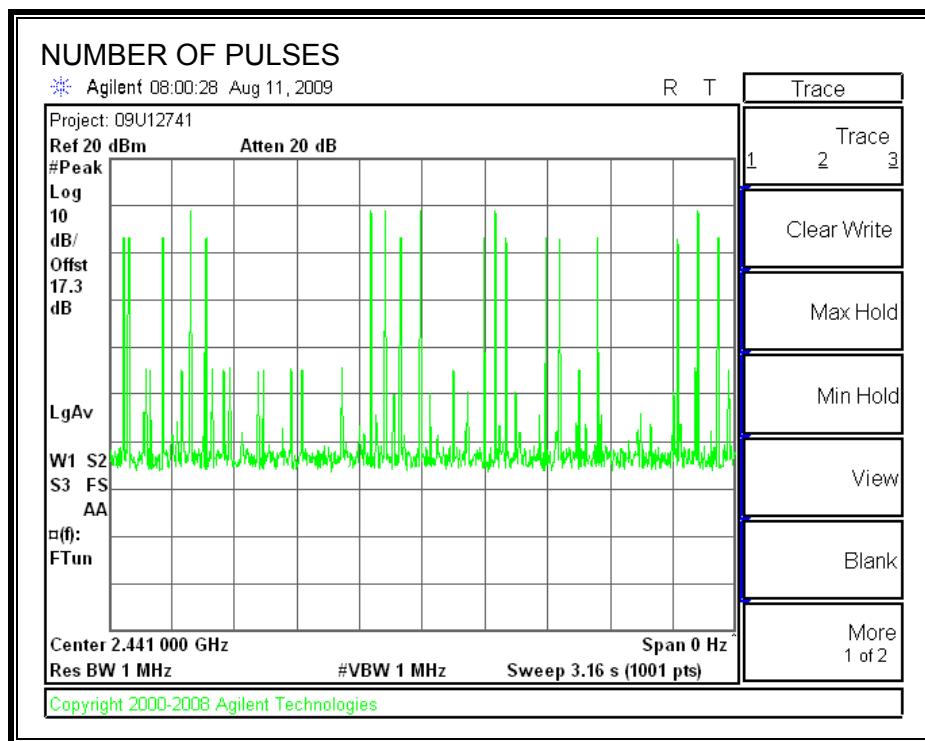
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



7.2.5. 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.

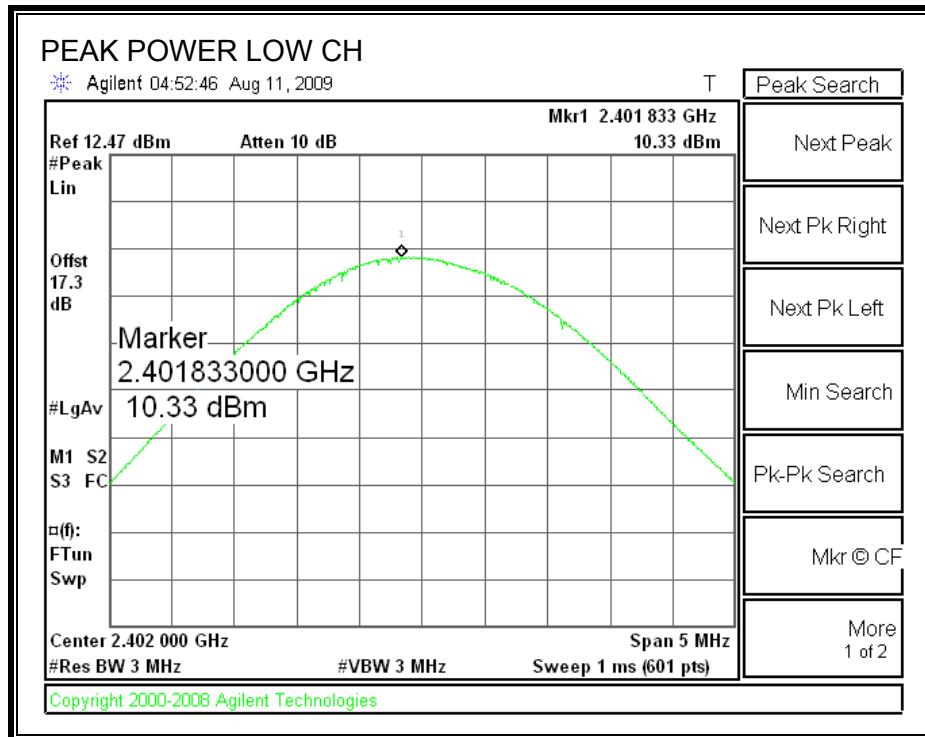
TEST PROCEDURE

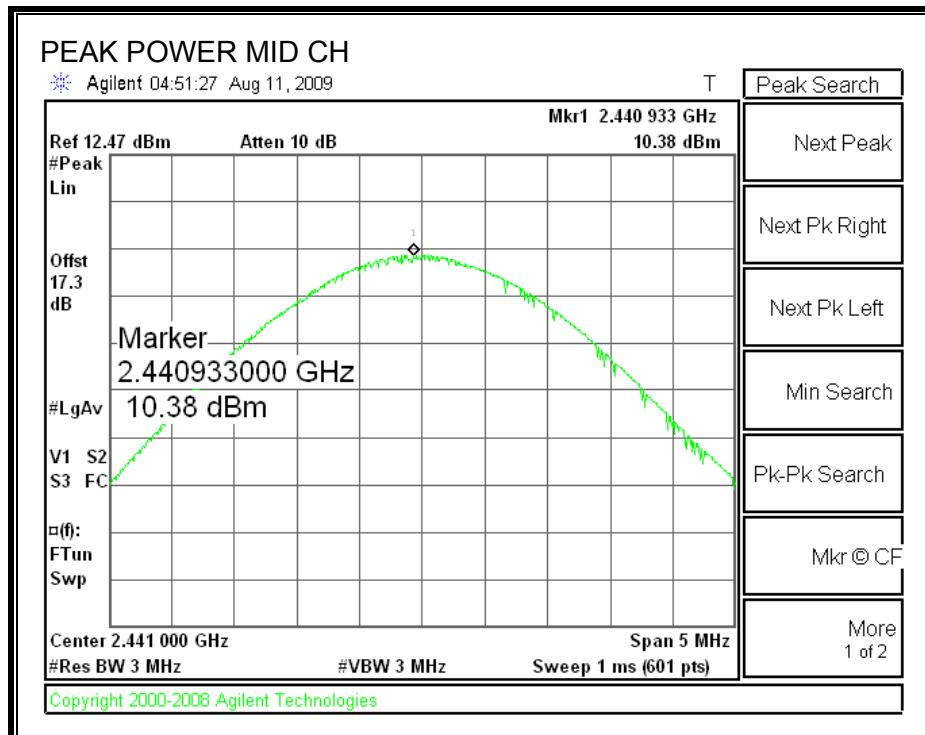
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

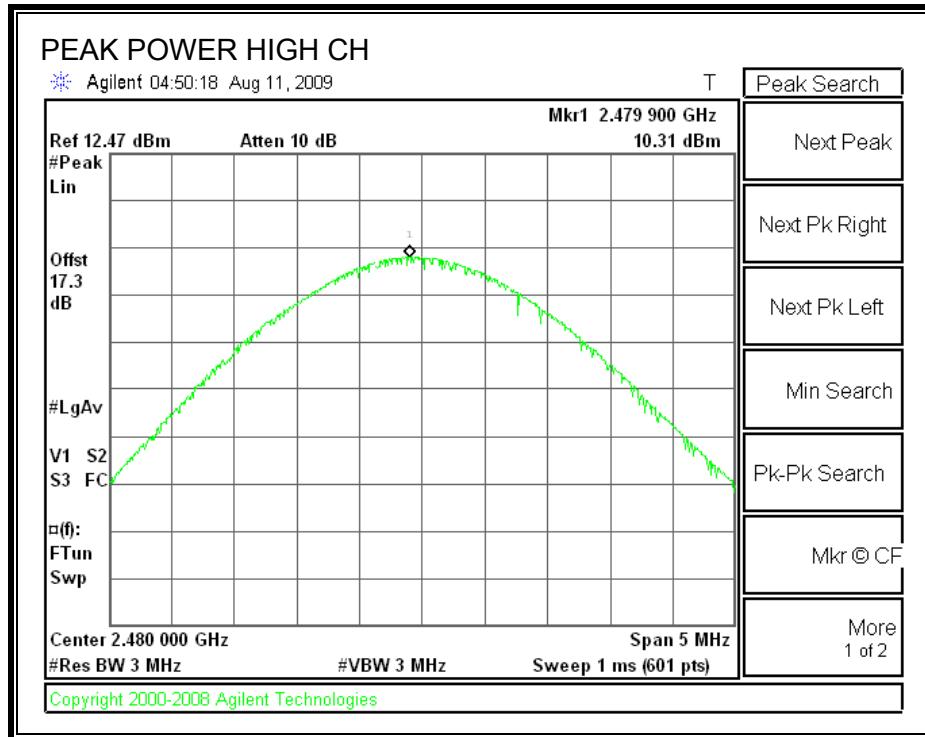
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.33	30	-19.67
Middle	2441	10.38	30	-19.62
High	2480	10.31	30	-19.69

OUTPUT POWER







7.2.6. 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 17.9 dB (including 16.5 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	8.00
Middle	2441	8.20
High	2480	7.90

7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

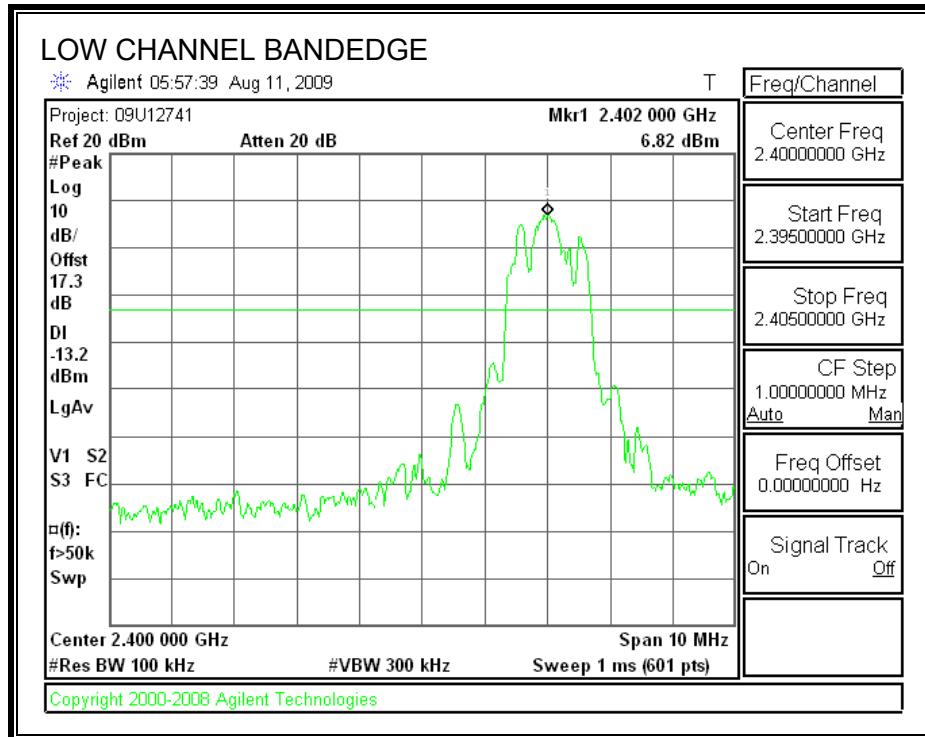
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

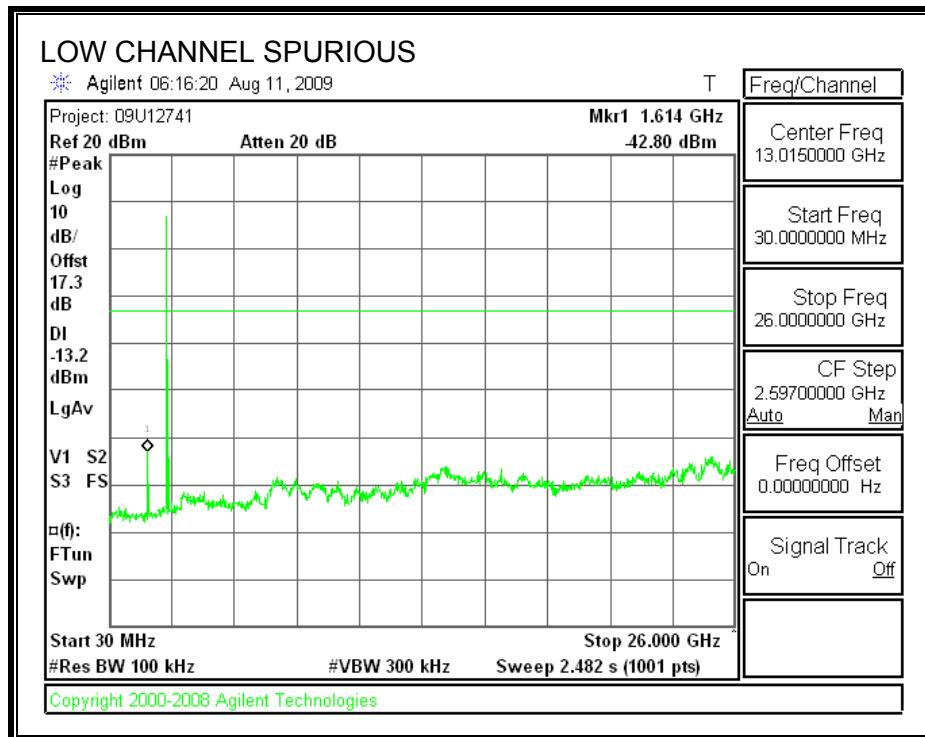
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

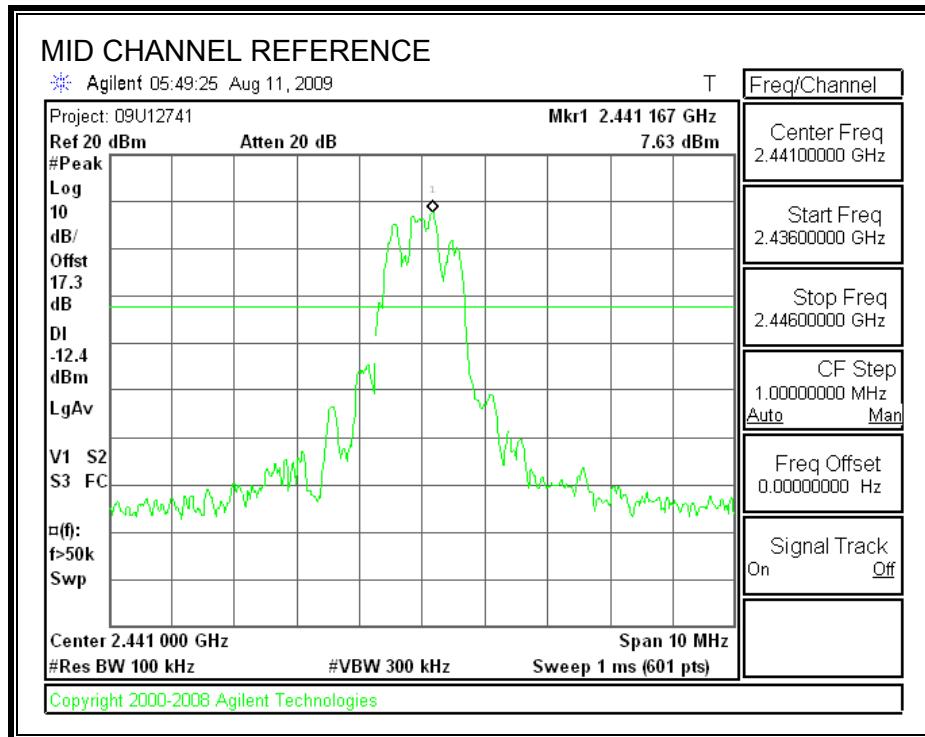
RESULTS

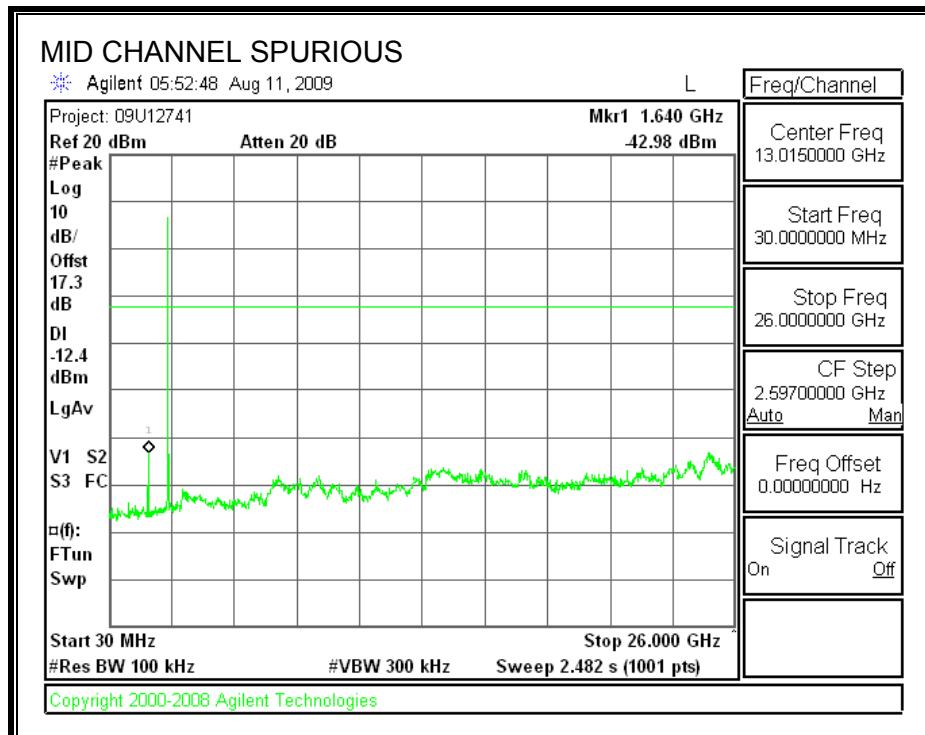
SPURIOUS EMISSIONS, LOW CHANNEL



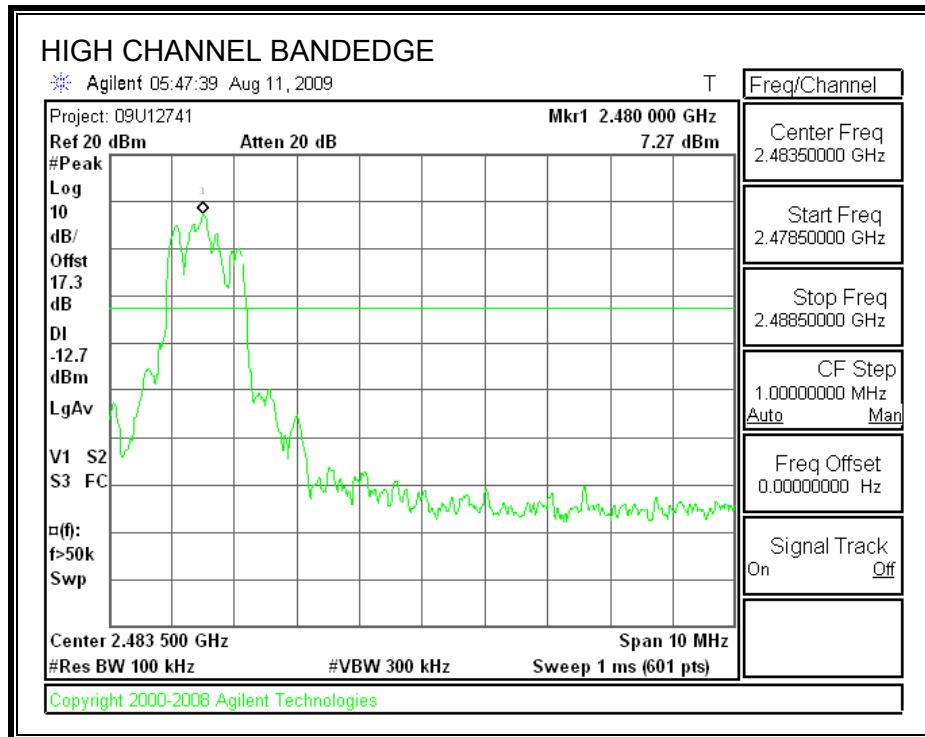


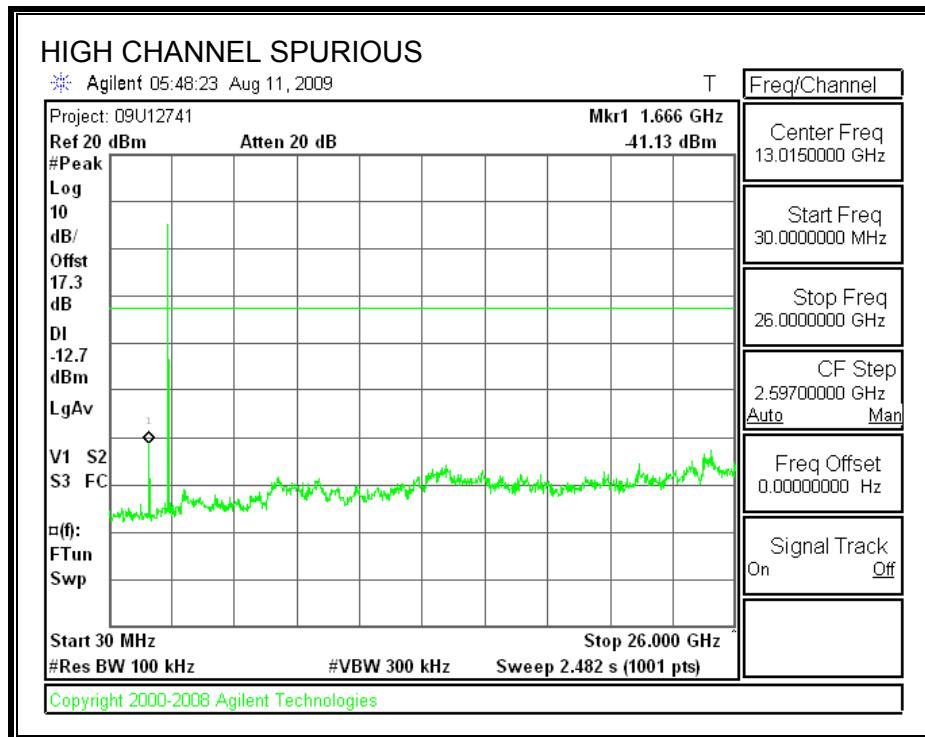
SPURIOUS EMISSIONS, MID CHANNEL



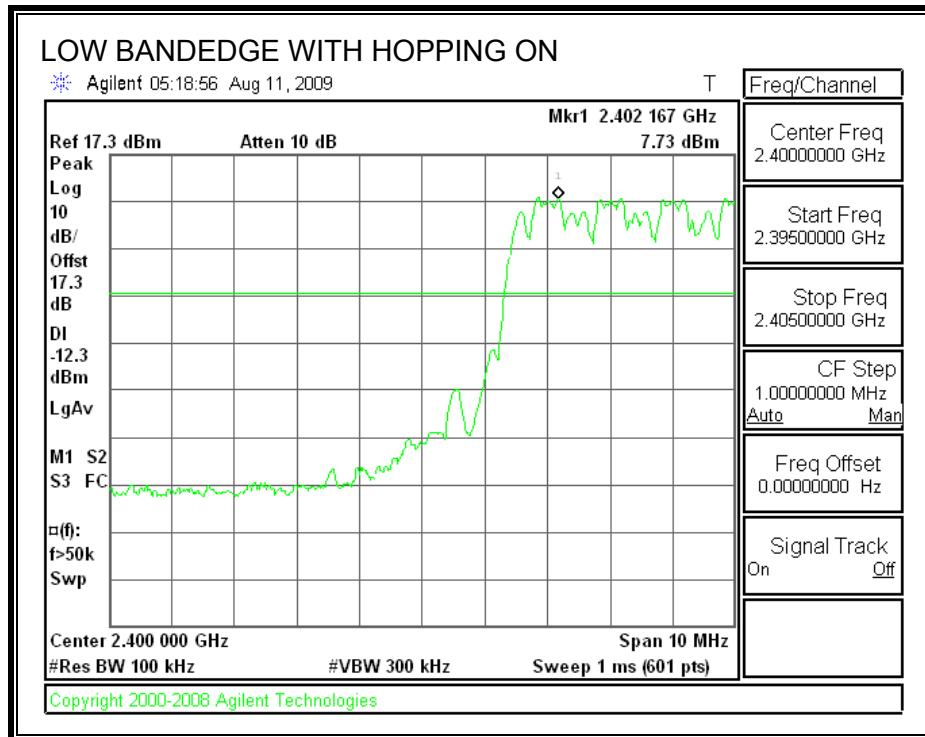


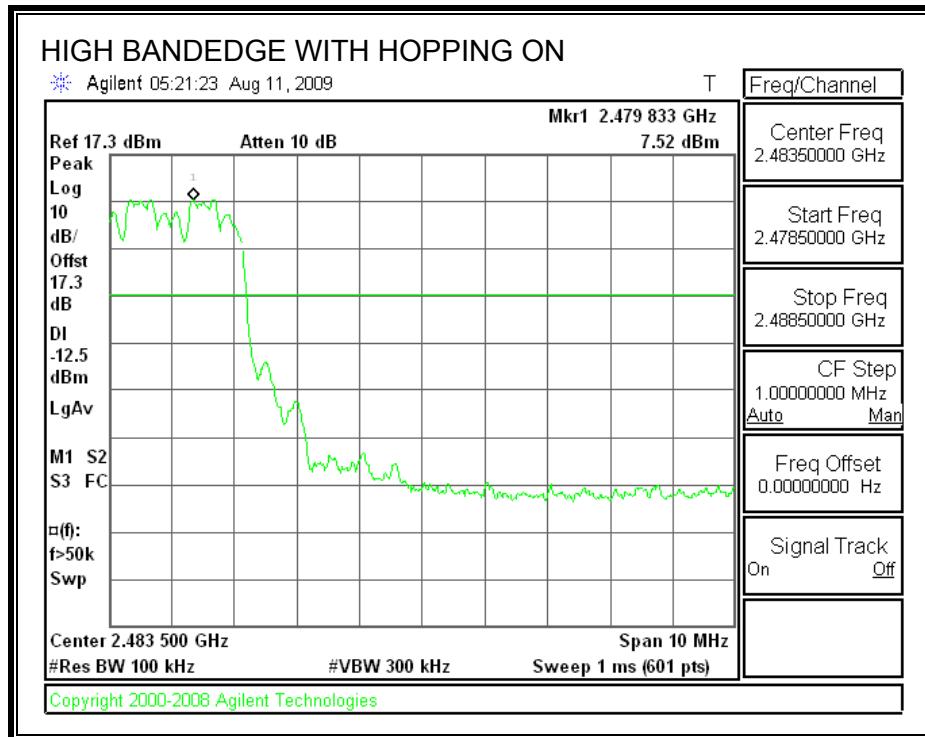
SPURIOUS EMISSIONS, HIGH CHANNEL





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.

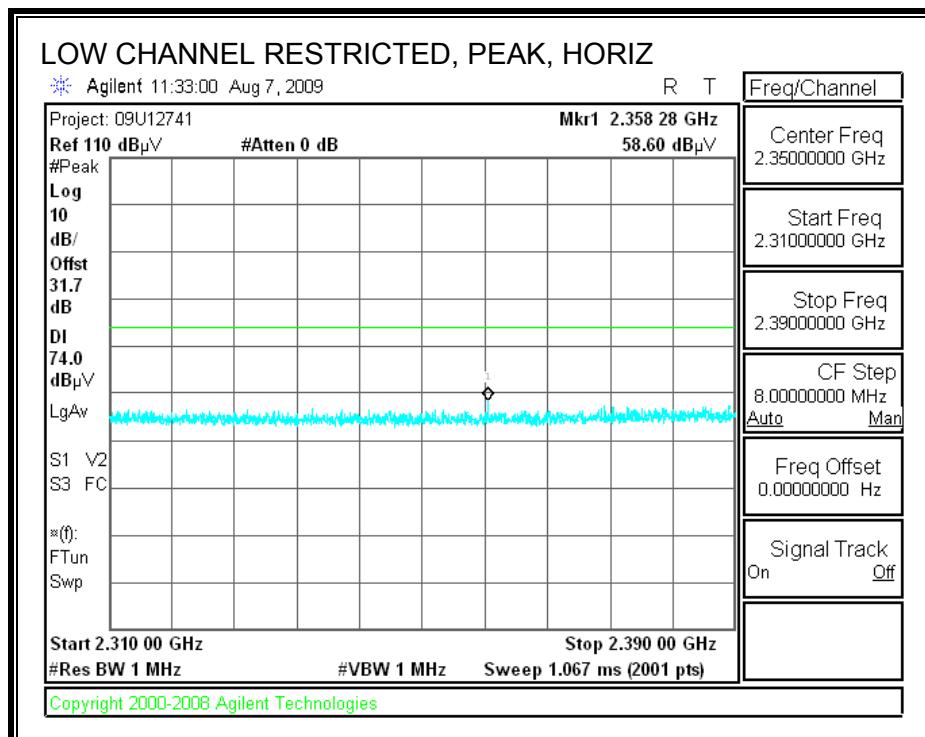
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

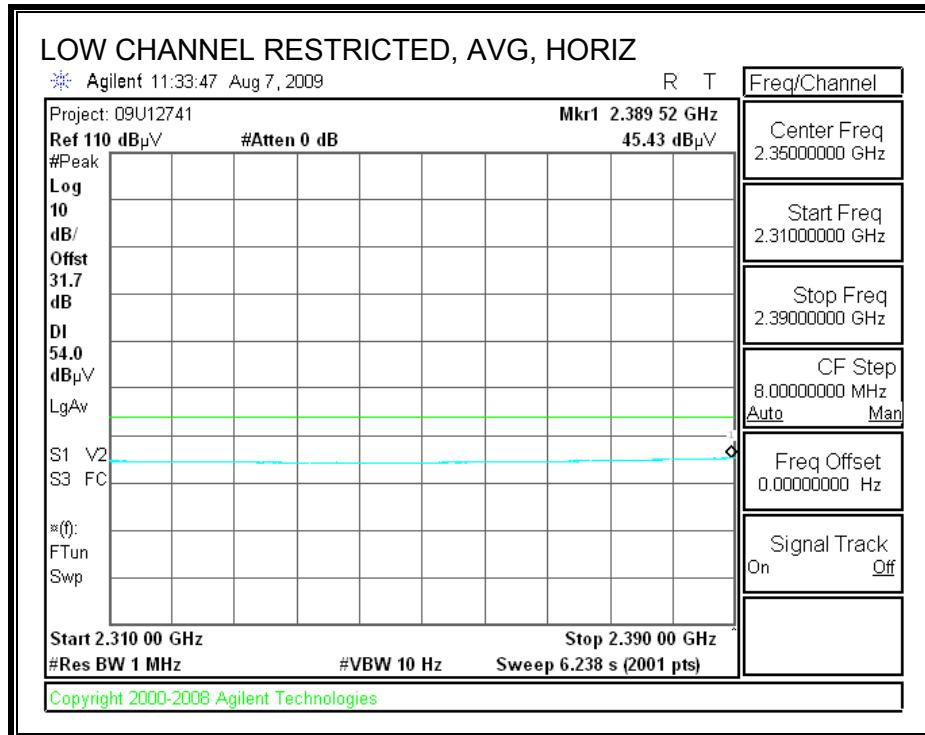
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

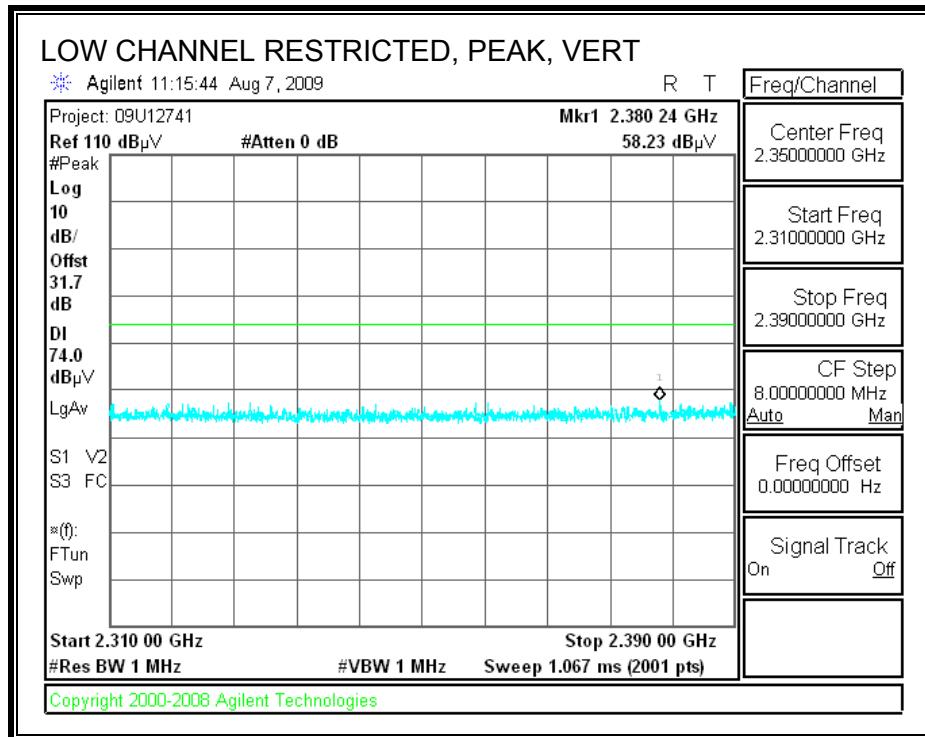
8.2.1. BASIC DATA RATE GFSK MODULATION

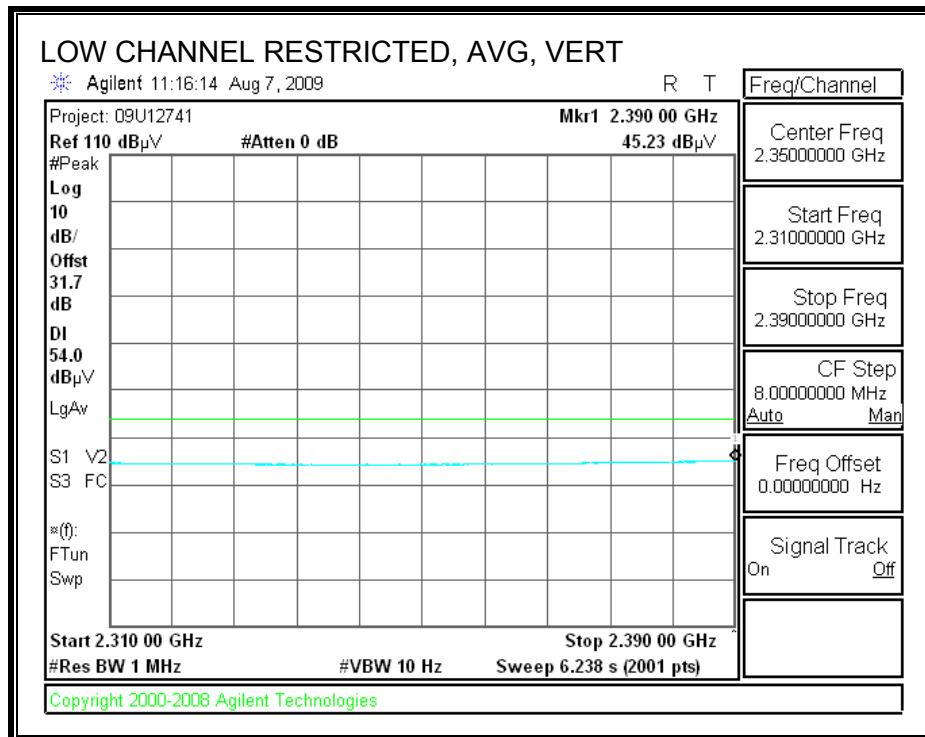
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



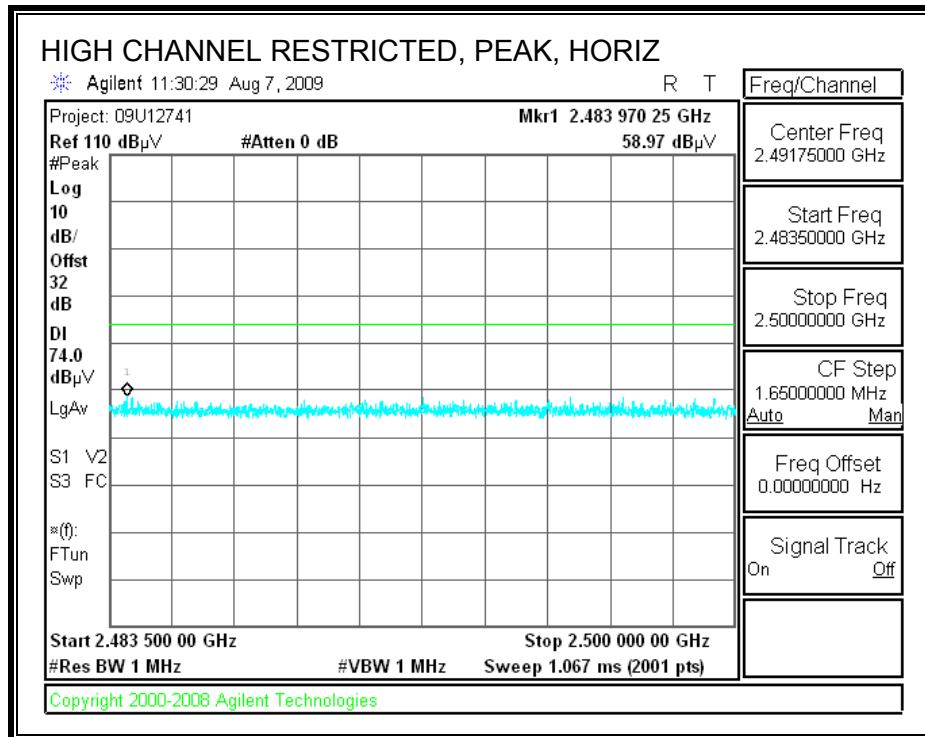


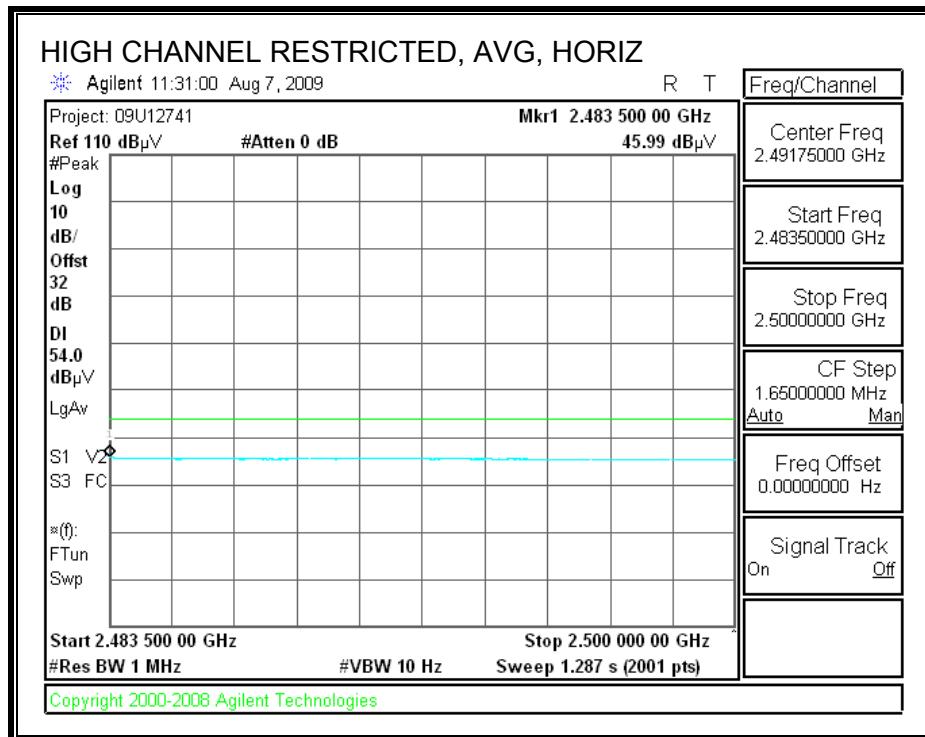
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



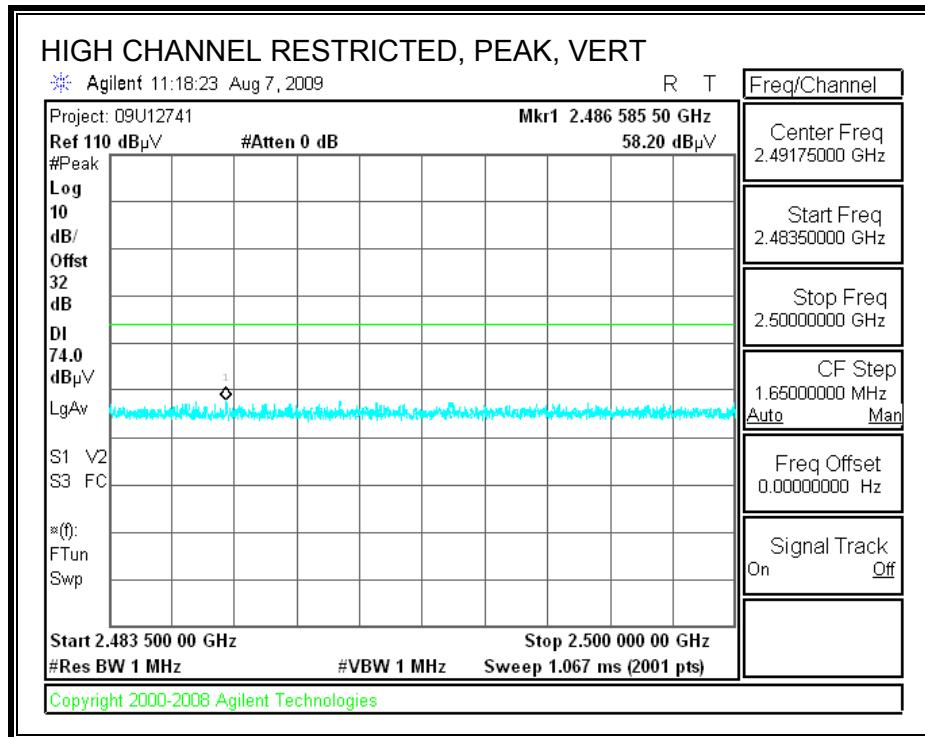


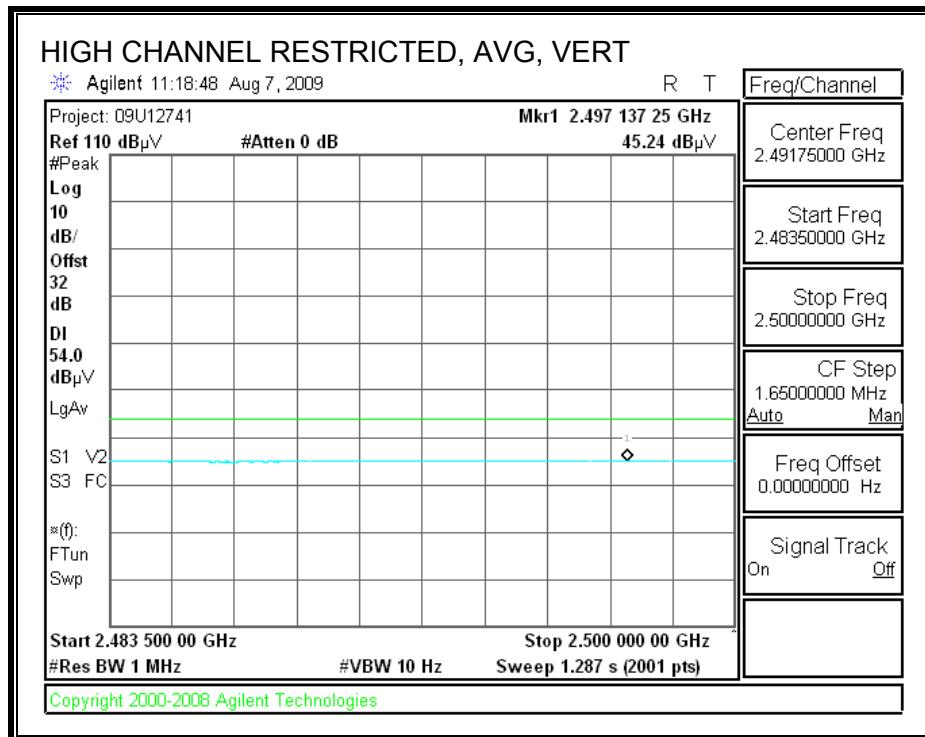
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen

Date: 08/07/09

Project #: 09U12741

Company: Apple Inc.

EUT Description: Handheld Device

EUT M/N: EUT with Notebook PC

Test Target: FCC Class B

Mode Oper: Transmit GFSK

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

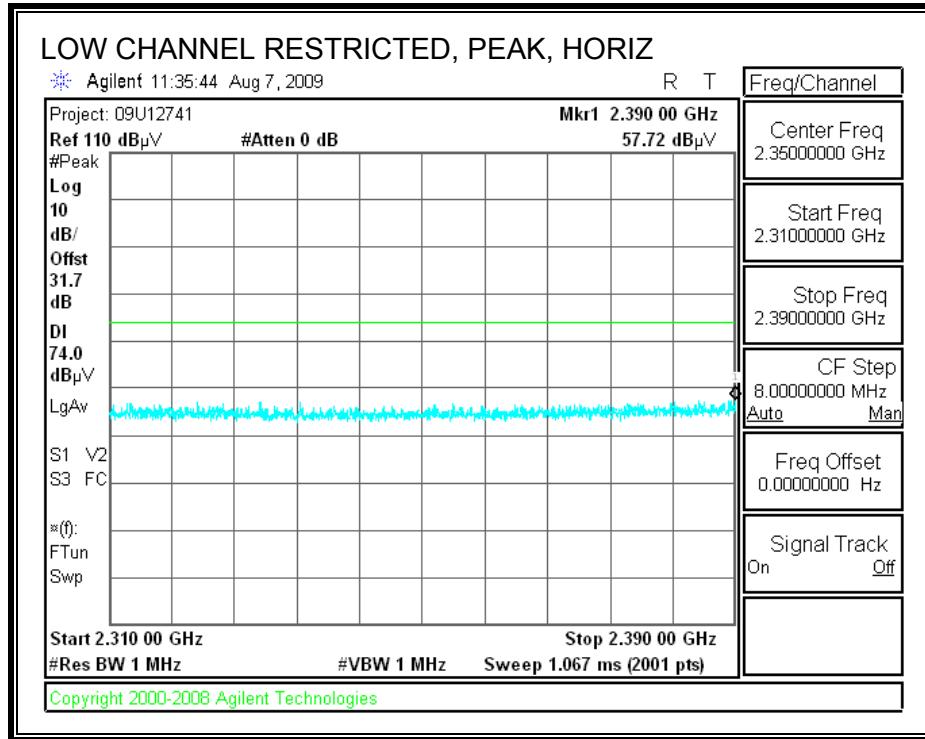
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
Low CH 2402 MHz															
4.804	3.0	43.1	33.0	5.8	-36.5	0.0	0.0	45.4	74.0	-28.6	H	P	100.0	47.1	Hori
4.804	3.0	35.9	33.0	5.8	-36.5	0.0	0.0	38.2	54.0	-15.8	H	A	100.0	47.1	Hori
4.804	3.0	47.7	33.0	5.8	-36.5	0.0	0.0	50.0	74.0	-24.0	V	P	105.5	62.7	Vert
4.804	3.0	43.7	33.0	5.8	-36.5	0.0	0.0	46.0	54.0	-8.0	V	A	105.5	62.7	Vert
7.206	3.0	41.8	35.1	7.2	-36.2	0.0	0.0	47.9	74.0	-26.1	V	P	105.5	62.7	Vert
7.206	3.0	33.5	35.1	7.2	-36.2	0.0	0.0	39.6	54.0	-14.4	V	A	105.5	62.7	Vert
Mid CH 2441 MHz															
4.882	3.0	41.8	33.1	5.8	-36.5	0.0	0.0	44.3	74.0	-29.7	H	P	100.0	47.1	Hori
4.882	3.0	34.1	33.1	5.8	-36.5	0.0	0.0	36.6	54.0	-17.4	H	A	100.0	47.1	Hori
4.882	3.0	47.7	33.1	5.8	-36.5	0.0	0.0	50.2	74.0	-23.8	V	P	105.5	62.7	Vert
4.882	3.0	43.7	33.1	5.8	-36.5	0.0	0.0	46.1	54.0	-7.9	V	A	105.5	62.7	Vert
7.323	3.0	42.5	35.3	7.3	-36.2	0.0	0.0	48.8	74.0	-25.2	V	P	105.5	62.7	Vert
7.323	3.0	35.3	35.3	7.3	-36.2	0.0	0.0	41.7	54.0	-12.3	V	A	105.5	62.7	Vert
High CH 2480 MHz															
4.960	3.0	42.5	33.2	5.9	-36.5	0.0	0.0	45.1	74.0	-28.9	H	P	100.0	345.3	Hori
4.960	3.0	34.4	33.2	5.9	-36.5	0.0	0.0	37.0	54.0	-17.0	H	A	100.0	345.3	Hori
4.960	3.0	47.2	33.2	5.9	-36.5	0.0	0.0	49.8	74.0	-24.2	V	P	105.5	62.7	Vert
4.960	3.0	43.0	33.2	5.9	-36.5	0.0	0.0	45.6	54.0	-8.4	V	A	105.5	62.7	Vert

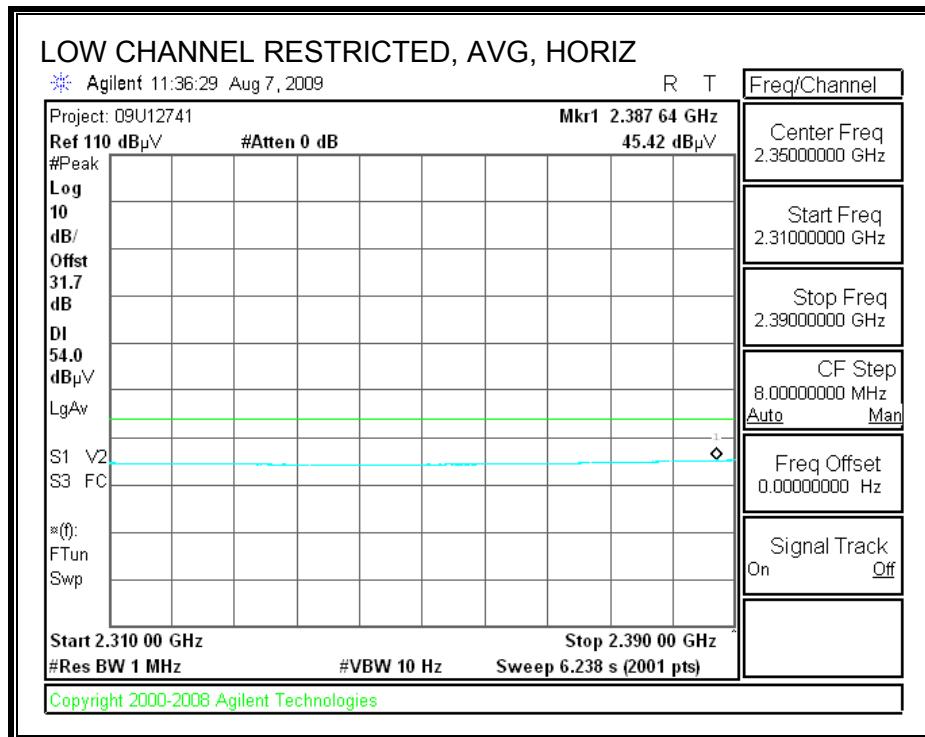
Rev. 4.1.2.7

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

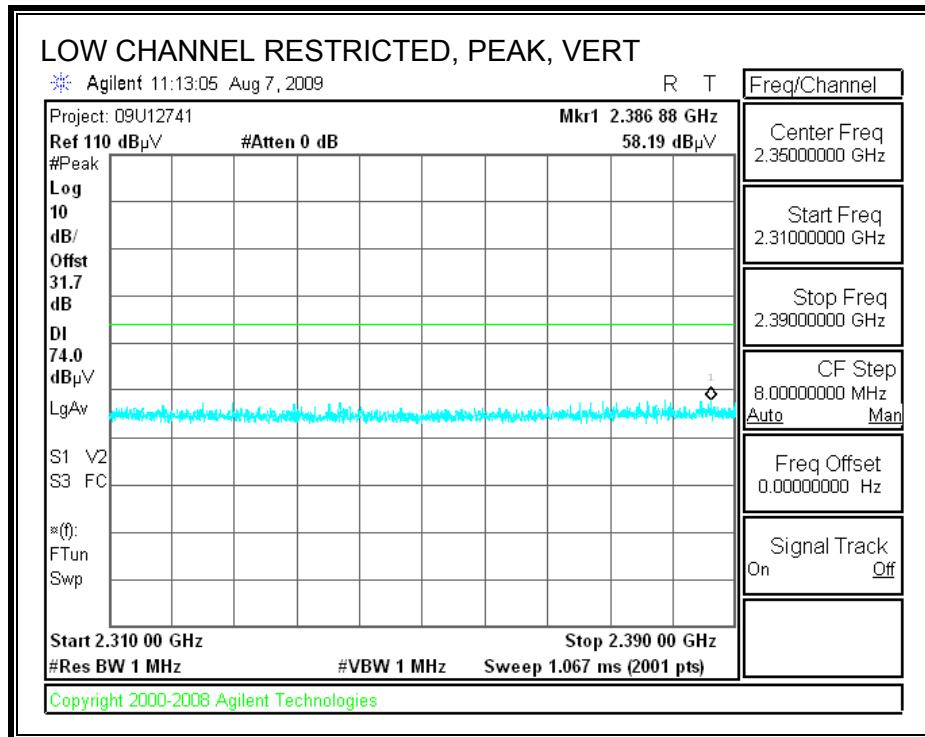
8.2.2. ENHANCED DATA RATE 8PSK MODULATION

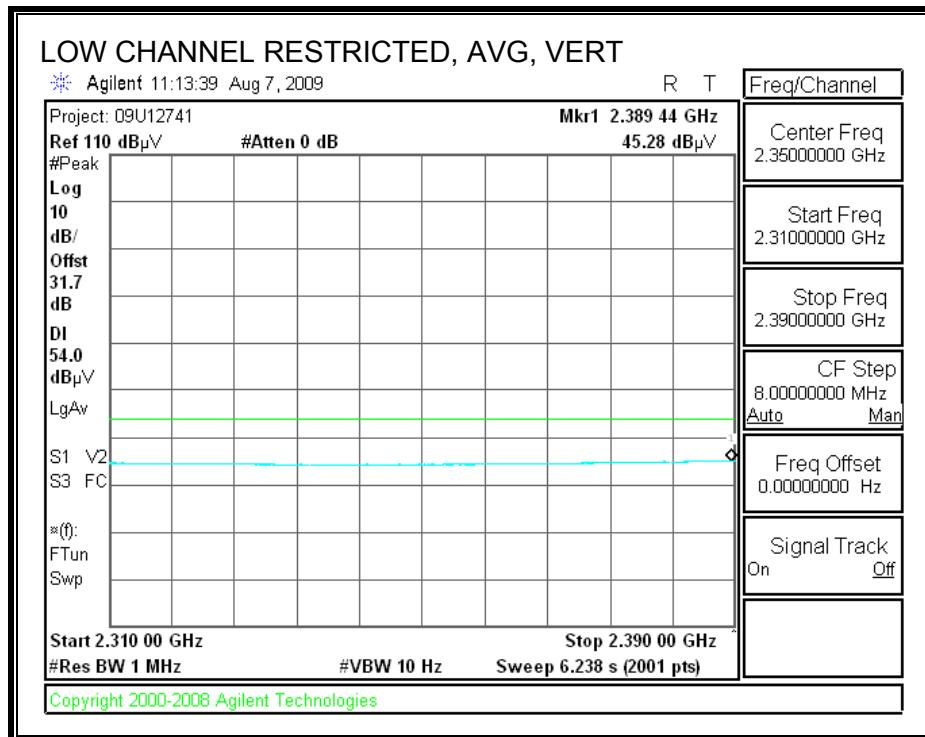
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



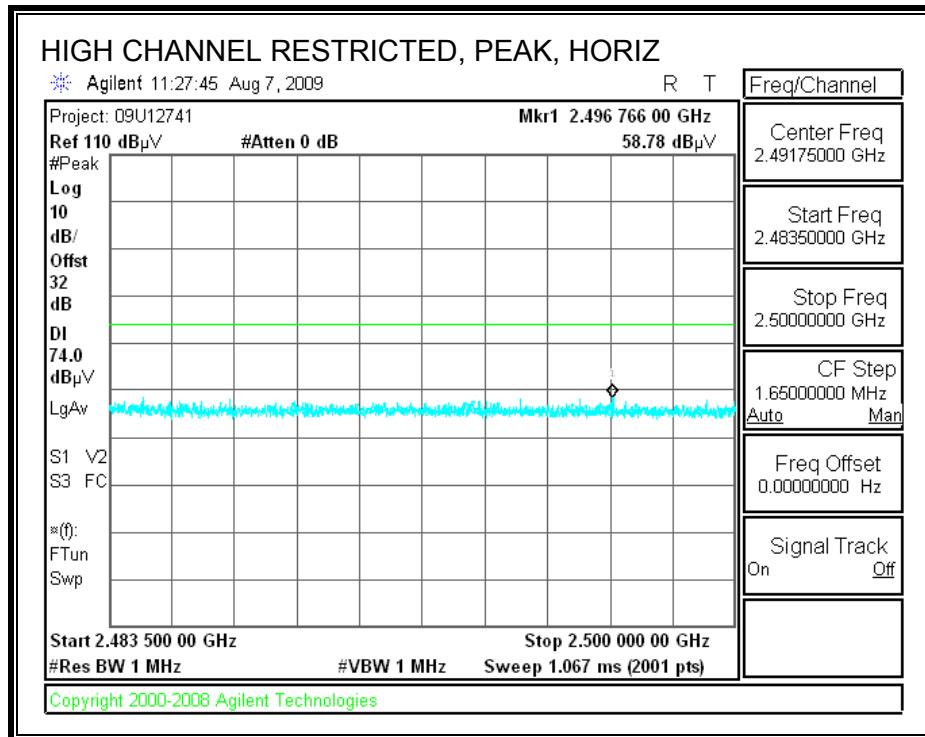


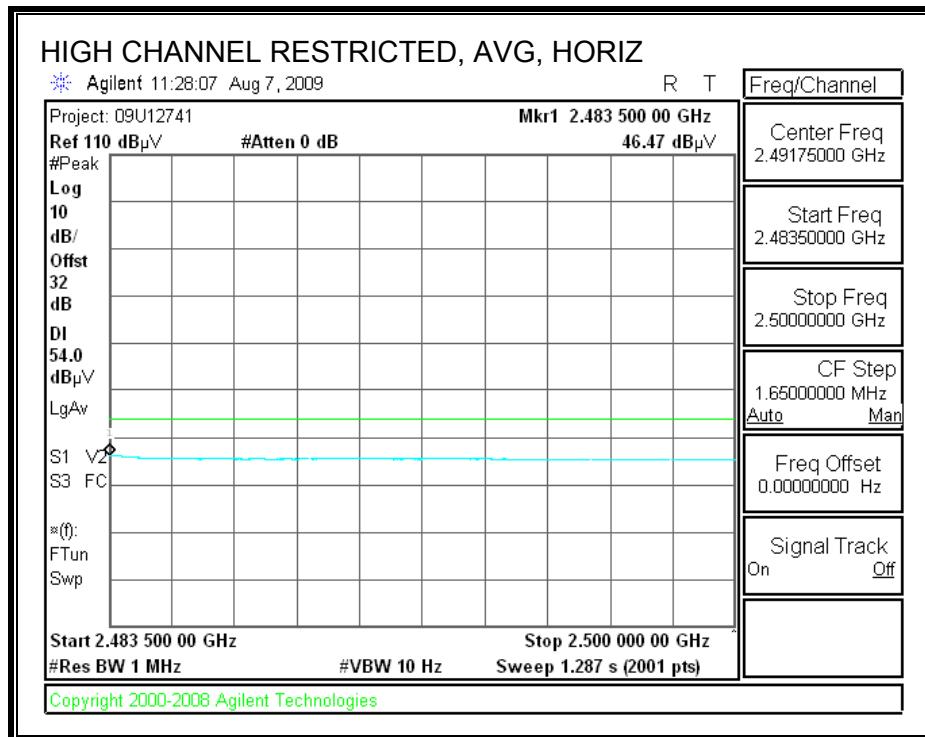
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



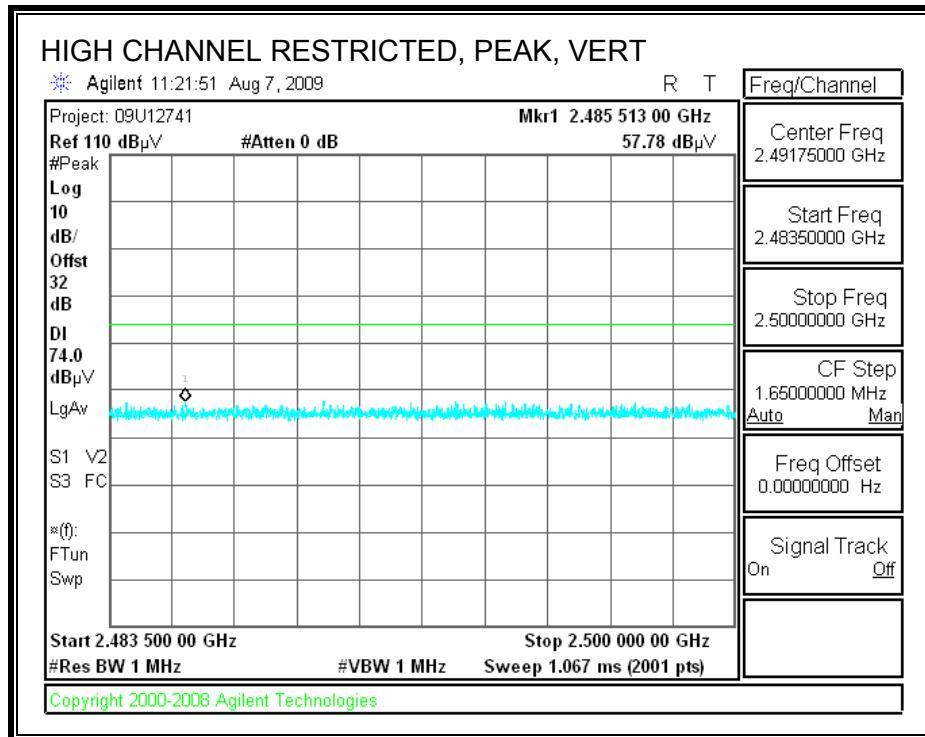


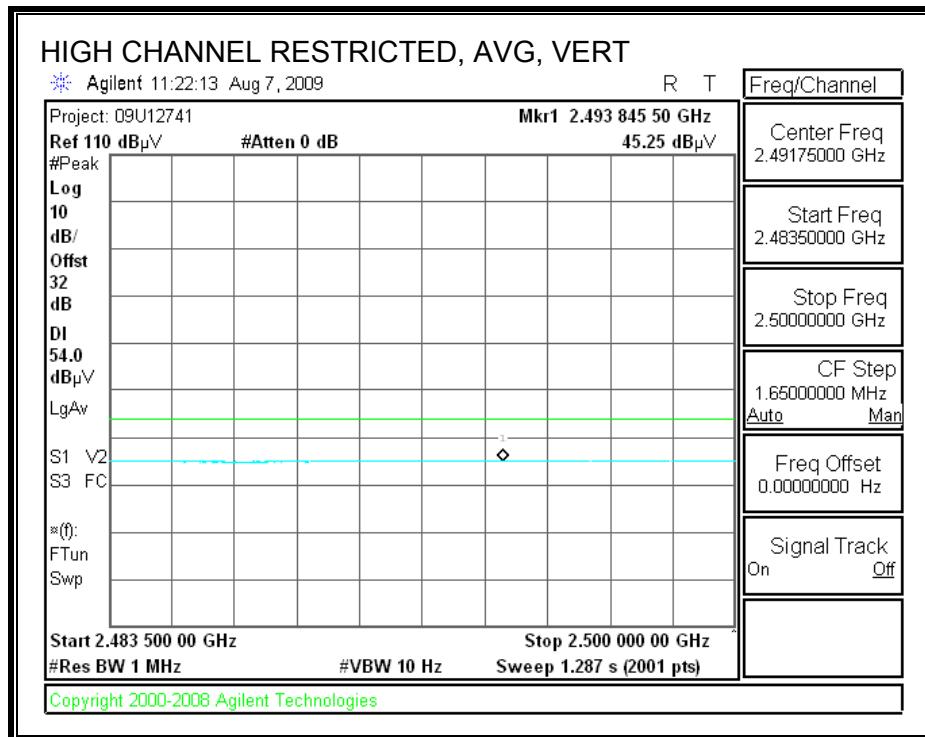
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

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

Test Engr: Tom Chen

Date: 08/07/09

Project #: 09U12741

Company: Apple Inc.

EUT Description: Handheld Device

EUT M/N: EUT with Notebook PC

Test Target: FCC Class B

Mode Oper: Transmit 8PSK

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	Ant.High cm	Table Angle Degree	Notes
Low CH 2402 MHz															
4.804	3.0	42.9	33.0	5.8	-36.5	0.0	0.0	45.2	74.0	-28.8	H	P	100.0	345.3	Horiz
4.804	3.0	33.7	33.0	5.8	-36.5	0.0	0.0	36.1	54.0	-17.9	H	A	100.0	345.3	Horiz
4.804	3.0	49.7	33.0	5.8	-36.5	0.0	0.0	52.0	74.0	-22.0	V	P	105.5	62.7	Vert
4.804	3.0	42.2	33.0	5.8	-36.5	0.0	0.0	44.5	54.0	-9.5	V	A	105.5	62.7	Vert
Mid CH 2441 MHz															
4.882	3.0	41.5	33.1	5.8	-36.5	0.0	0.0	43.9	74.0	-30.1	H	P	100.0	345.3	Horiz
4.882	3.0	31.8	33.1	5.8	-36.5	0.0	0.0	34.2	54.0	-19.8	H	A	100.0	345.3	Horiz
4.882	3.0	49.9	33.1	5.8	-36.5	0.0	0.0	52.3	74.0	-21.7	V	P	105.5	62.7	Vert
4.882	3.0	42.2	33.1	5.8	-36.5	0.0	0.0	44.7	54.0	-9.3	V	A	105.5	62.7	Vert
High CH 2480 MHz															
4.960	3.0	42.6	33.2	5.9	-36.5	0.0	0.0	45.2	74.0	-28.8	H	P	100.0	345.3	Horiz
4.960	3.0	33.2	33.2	5.9	-36.5	0.0	0.0	35.8	54.0	-18.2	H	A	100.0	345.3	Horiz
4.960	3.0	49.5	33.2	5.9	-36.5	0.0	0.0	52.1	74.0	-21.9	V	P	105.5	62.7	Vert
4.960	3.0	41.6	33.2	5.9	-36.5	0.0	0.0	44.2	54.0	-9.8	V	A	105.5	62.7	Vert

Rev. 4.1.2.7

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

8.3. RECEIVER ABOVE 1 GHz

8.3.1. RECEIVER ABOVE 1 GHz

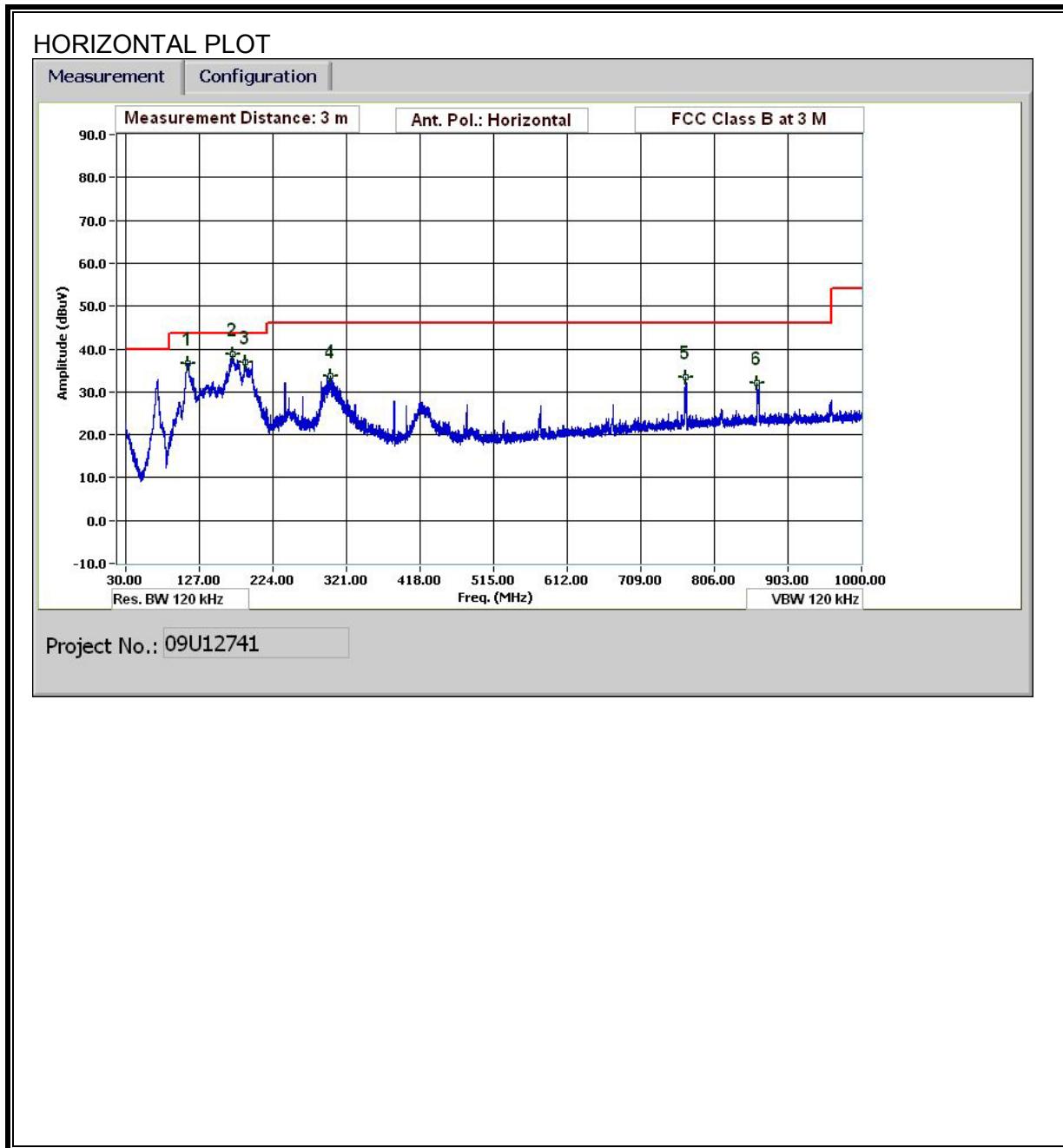
High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber																																																							
Company: Apple Inc. Project #: 09U12741 Date: 8/7/2009 Test Engineer: Tom Chen Configuration: EUT/Laptop Mode: Receive mode (Worst Case)																																																							
Test Equipment: <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Horn 1-18GHz</td> <td style="width: 25%;">Pre-amplifier 1-26GHz</td> <td style="width: 25%;">Pre-amplifier 26-40GHz</td> <td style="width: 25%;">Horn > 18GHz</td> <td style="width: 25%;">Limit</td> </tr> <tr> <td>T73; S/N: 6717 @3m</td> <td>T144 Miteq 3008A00931</td> <td></td> <td></td> <td>RX RSS 210</td> </tr> <tr> <td colspan="5"> Hi Frequency Cables <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">3' cable 22807700</td> <td style="width: 33%;">12' cable 22807600</td> <td style="width: 33%;">20' cable 22807500</td> </tr> <tr> <td>3' cable 22807700</td> <td>12' cable 22807600</td> <td>20' cable 22807500</td> </tr> </table> </td> </tr> <tr> <td colspan="5"></td> <td style="width: 25%;">HPF</td> <td style="width: 25%;">Reject Filter</td> <td colspan="10"> Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz, VBW=10Hz </td> </tr> </table>																		Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit	T73; S/N: 6717 @3m	T144 Miteq 3008A00931			RX RSS 210	Hi Frequency Cables <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">3' cable 22807700</td> <td style="width: 33%;">12' cable 22807600</td> <td style="width: 33%;">20' cable 22807500</td> </tr> <tr> <td>3' cable 22807700</td> <td>12' cable 22807600</td> <td>20' cable 22807500</td> </tr> </table>					3' cable 22807700	12' cable 22807600	20' cable 22807500	3' cable 22807700	12' cable 22807600	20' cable 22807500						HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz, VBW=10Hz									
Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit																																																			
T73; S/N: 6717 @3m	T144 Miteq 3008A00931			RX RSS 210																																																			
Hi Frequency Cables <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">3' cable 22807700</td> <td style="width: 33%;">12' cable 22807600</td> <td style="width: 33%;">20' cable 22807500</td> </tr> <tr> <td>3' cable 22807700</td> <td>12' cable 22807600</td> <td>20' cable 22807500</td> </tr> </table>					3' cable 22807700	12' cable 22807600	20' cable 22807500	3' cable 22807700	12' cable 22807600	20' cable 22807500																																													
3' cable 22807700	12' cable 22807600	20' cable 22807500																																																					
3' cable 22807700	12' cable 22807600	20' cable 22807500																																																					
					HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz, VBW=10Hz																																																
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)																																								
1.500	3.0	47.7	42.5	25.5	2.9	-38.8	0.0	0.0	37.4	32.2	74	54	-36.6	-21.8	H																																								
1.700	3.0	46.8	41.6	26.2	3.2	-38.5	0.0	0.0	37.7	32.5	74	54	-36.3	-21.5	H																																								
2.442	3.0	51.8	46.6	28.3	3.9	-37.5	0.0	0.0	46.5	41.3	74	54	-27.5	-12.7	H																																								
1.500	3.0	49.6	43.6	25.5	2.9	-38.8	0.0	0.0	39.3	33.3	74	54	-34.7	-20.7	V																																								
1.700	3.0	48.4	42.4	26.2	3.2	-38.5	0.0	0.0	39.3	33.3	74	54	-34.7	-20.7	V																																								
2.442	3.0	47.4	41.4	28.3	3.9	-37.5	0.0	0.0	42.1	36.1	74	54	-31.9	-17.9	V																																								
3.000	3.0	46.5	40.5	30.0	4.3	-37.4	0.0	0.0	43.5	37.5	74	54	-30.5	-16.5	V																																								

Rev. 11.10.08
Note: No other emissions were detected above the system noise floor.

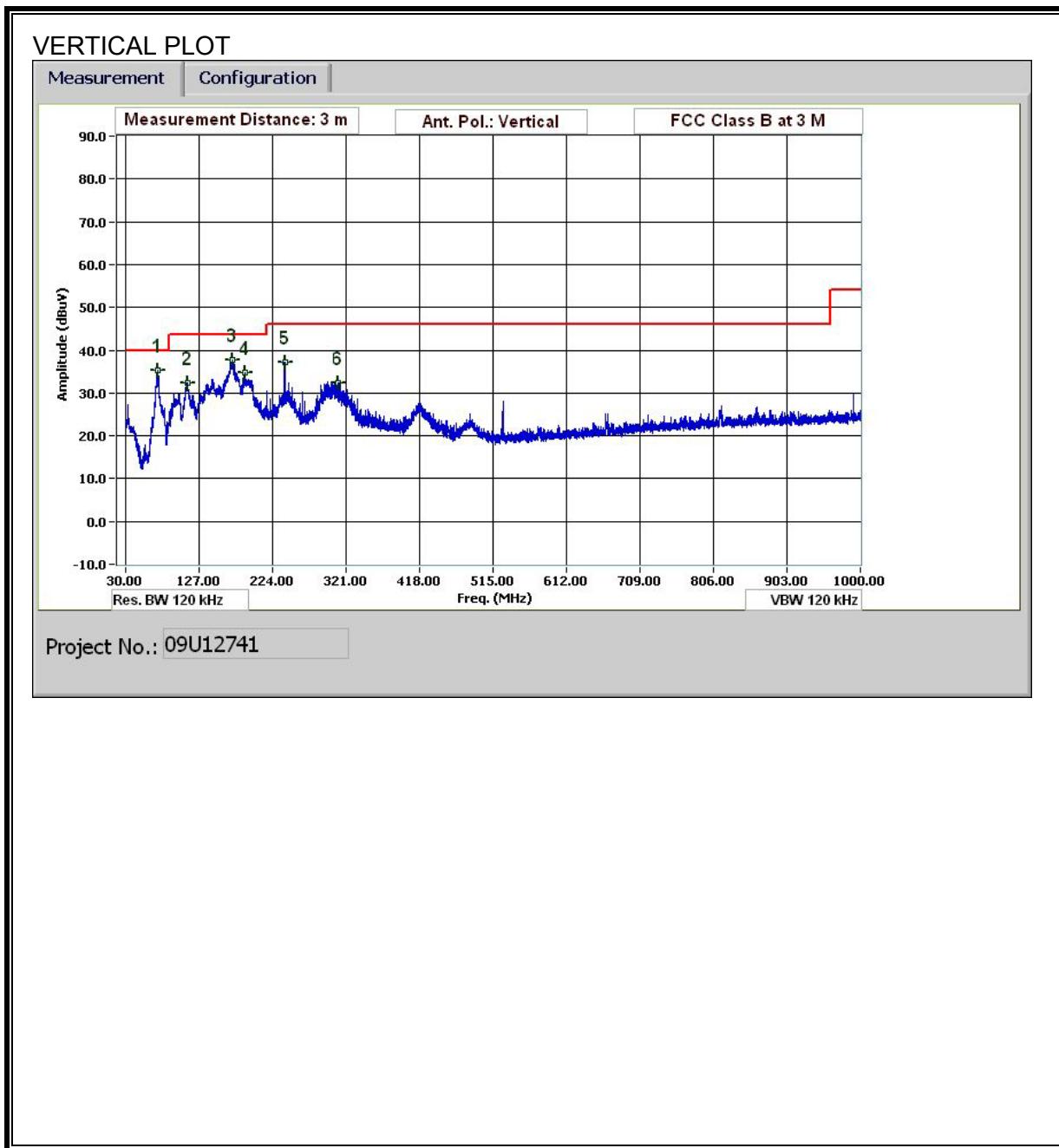
f Measurement Frequency	Amp Preamp Gain	Avg Lim Average Field Strength Limit
Dist Distance to Antenna	D Corr Distance Correct to 3 meters	Pk Lim Peak Field Strength Limit
Read Analyzer Reading	Avg Average Field Strength @ 3 m	Avg Mar Margin vs. Average Limit
AF Antenna Factor	Peak Calculated Peak Field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

8.4. 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

30-1000MHz Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 08/07/09
Project #: 09U12741
Company: Apple Inc.
EUT Description: Handheld Device
EUT M/N: EUT with Notebook PC
Test Target: FCC Class B
Mode Oper: Transmit 8PSK

f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		
Read	Analyzer Reading	Filter	Filter Insert Loss		
AF	Antenna Factor	Corr.	Calculated Field Strength		
CL	Cable Loss	Limit	Field Strength Limit		

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
Horizontal															
111.843	3.0	51.7	12.1	1.0	28.3	0.0	0.0	36.6	43.5	6.9	H	EP	100.0	0 - 360	Prescan
170.386	3.0	55.0	10.8	1.2	28.2	0.0	0.0	38.7	43.5	-4.8	H	EP	100.0	0 - 360	Prescan
188.047	3.0	52.7	11.3	1.2	28.2	0.0	0.0	36.9	43.5	-6.6	H	EP	100.0	0 - 360	Prescan
299.291	3.0	46.9	13.4	1.5	28.1	0.0	0.0	33.6	46.0	-12.4	H	EP	100.0	0 - 360	Prescan
768.750	3.0	37.6	20.5	2.6	27.4	0.0	0.0	33.3	46.0	-12.7	H	EP	100.0	0 - 360	Prescan
862.354	3.0	35.6	21.5	2.7	27.7	0.0	0.0	32.2	46.0	-13.8	H	EP	100.0	0 - 360	Prescan
Vertical															
72.002	3.0	55.0	7.9	0.7	28.3	0.0	0.0	35.3	40.0	-4.7	V	EP	100.0	0 - 360	Prescan
111.363	3.0	47.5	12.0	1.0	28.3	0.0	0.0	32.3	43.5	-11.3	V	EP	100.0	0 - 360	Prescan
170.526	3.0	54.1	10.8	1.2	28.2	0.0	0.0	37.8	43.5	-5.7	V	EP	100.0	0 - 360	Prescan
188.047	3.0	50.4	11.3	1.2	28.2	0.0	0.0	34.7	43.5	-8.8	V	EP	100.0	0 - 360	Prescan
240.009	3.0	52.3	11.8	1.3	28.2	0.0	0.0	37.2	46.0	-8.8	V	EP	100.0	0 - 360	Prescan
309.972	3.0	45.5	13.6	1.5	28.1	0.0	0.0	32.5	46.0	-13.5	V	EP	100.0	0 - 360	Prescan

Rev. 1.27.09

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

SPURIOUS EMISSIONS ABOVE 1000 MHz

HORIZONTAL AND VERTICAL DATA

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber															
Company: Apple Inc.	Project #: 09U12741	Date: 8/7/2009	Test Engineer: Tom Chen	Configuration: EUT/Laptop	Mode: Receive mode (Worst Case)										
Test Equipment:															
Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz					Limit							
T73; S/N: 6717 @3m	T144 Miteq 3008A00931							RX RSS 210							
Hi Frequency Cables															
3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF					Reject Filter					Peak Measurements		
3' cable 22807700	12' cable 22807600	20' cable 22807500											RBW=VBW=1MHz		
Average Measurements															
RBW=1MHz, VBW=10Hz															
f	Dist	Read Pk	Read Avg	AF	CL	Amp	D Corr	Fltr	Peak	Avg	Pk Lim	Avg Lim	Pk Mar	Avg Mar	Notes
GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)
1.500	3.0	47.7	42.5	25.5	2.9	-38.8	0.0	0.0	37.4	32.2	74	54	-36.6	-21.8	H
1.700	3.0	46.8	41.6	26.2	3.2	-38.5	0.0	0.0	37.7	32.5	74	54	-36.3	-21.5	H
2.442	3.0	51.8	46.6	28.3	3.9	-37.5	0.0	0.0	46.5	41.3	74	54	-27.5	-12.7	H
1.500	3.0	49.6	43.6	25.5	2.9	-38.8	0.0	0.0	39.3	33.3	74	54	-34.7	-20.7	V
1.700	3.0	48.4	42.4	26.2	3.2	-38.5	0.0	0.0	39.3	33.3	74	54	-34.7	-20.7	V
2.442	3.0	47.4	41.4	28.3	3.9	-37.5	0.0	0.0	42.1	36.1	74	54	-31.9	-17.9	V
3.000	3.0	46.5	40.5	30.0	4.3	-37.4	0.0	0.0	43.5	37.5	74	54	-30.5	-16.5	V

Rev. 11.10.08
Note: No other emissions were detected above the system noise floor.

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.

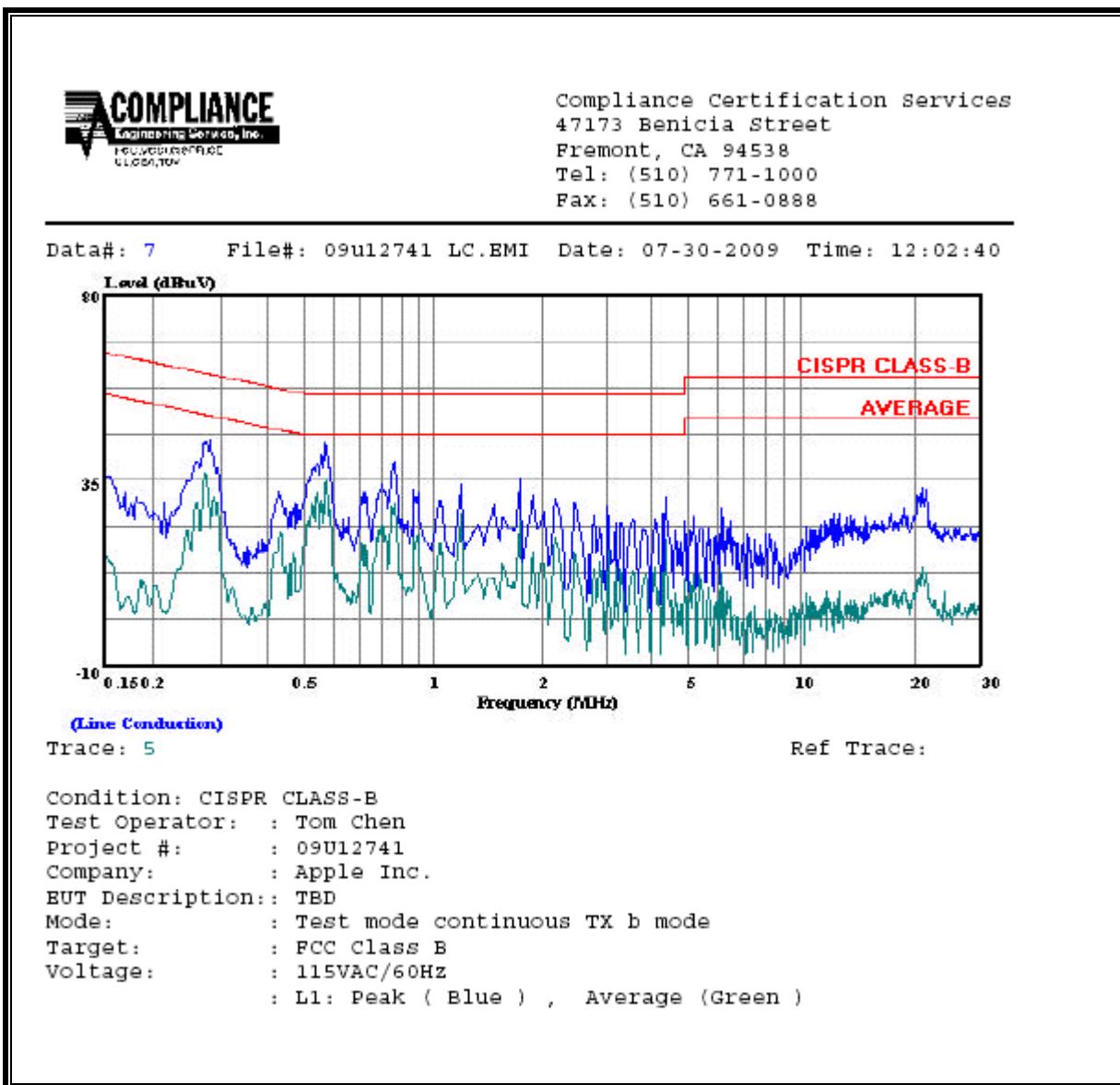
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)										
Freq. (MHz)	Reading			Closs (dB)	Limit	EN_B		Margin		Remark
	PK (dBuV)	QP (dBuV)	AV (dBuV)			QP	AV	QP (dB)	AV (dB)	
0.28	45.12	--	26.24	0.00	60.73	50.73	-15.61	-24.49	L1	
0.57	44.04	--	34.59	0.00	56.00	46.00	-11.96	-11.41	L1	
0.86	39.42	--	29.35	0.00	56.00	46.00	-16.58	-16.65	L1	
0.28	48.52	--	35.68	0.00	60.76	50.76	-12.24	-15.08	L2	
0.57	47.57	--	41.16	0.00	56.00	46.00	-8.43	-4.84	L2	
0.86	44.34	--	34.54	0.00	56.00	46.00	-11.66	-11.46	L2	
6 Worst Data										

LINE 1 RESULTS



LINE 2 RESULTS

