



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

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER: A1458, A1459, A1460*

FCC ID: BCGA1458

IC: 579C-A1458

REPORT NUMBER: 12U14507-3

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*Models differences are detailed within the body of this report



NVLAP LAB CODE 200065-0

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1. ATTESTATION OF TEST RESULTS

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

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

MODEL: A1458, A1459, A1460

SERIAL NUMBER: 20558

DATE TESTED: AUGUST 03-15, 2012

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

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

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

Approved & Released For UL CCS By:

Tested By:



FRANK IBRAHIM
EMC SUPERVISOR
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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

5.2. DESCRIPTION OF MODELS DIFFERENCES

FCC ID: BCGA1458
IC ID: 579C-A1458
Model #: A1458

Model A1458, is a tablet with multimedia functions (music, application support, and video) IEEE 802.11a/b/g/n radio and Bluetooth radio. The rechargeable battery is not user accessible.

FCC ID: BCGA1459
IC ID: 579C-A1459
Model #: A1459

Model A1459, is a tablet with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n and Bluetooth radio. The rechargeable battery is not user accessible.

FCC ID: BCGA1460
IC ID: 579C-A1460
Model #: A1460

Model A1460, is a tablet with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/CDMA1xRTT/ EV-DO Rev 0, A, B / LTE radio, IEEE 802.11a/b/g/n radio and Bluetooth radio. The rechargeable battery is not user accessible.

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	13.44	22.08
2402 - 2480	Enhanced 8PSK	12.97	19.82

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

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

<i>Frequency Band (GHz)</i>	<i>Antenna Gain (dBi)</i>
2.4-2.4835	-0.26
5.15-5.25	4.63
5.25-5.35	4.25
5.5-5.7	4.51
5.725-5.85	4.90

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 10A378

The EUT driver software installed during testing was Broadcom_Rel_6_10_56_172

The test utility software used during testing was BlueTool

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

5.6. WORST-CASE CONFIGURATION AND MODE

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

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.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Apple	A1401	D60812	N/A
Laptop PC	Apple	MacBook Pro	N/A	N/A
Power Splitter	Aroflex	1834	N/A	N/A
Headset	Apple	NA	N/A	N/A
BT Tester	Rohde & Schwarz	CBT	100429	N/A

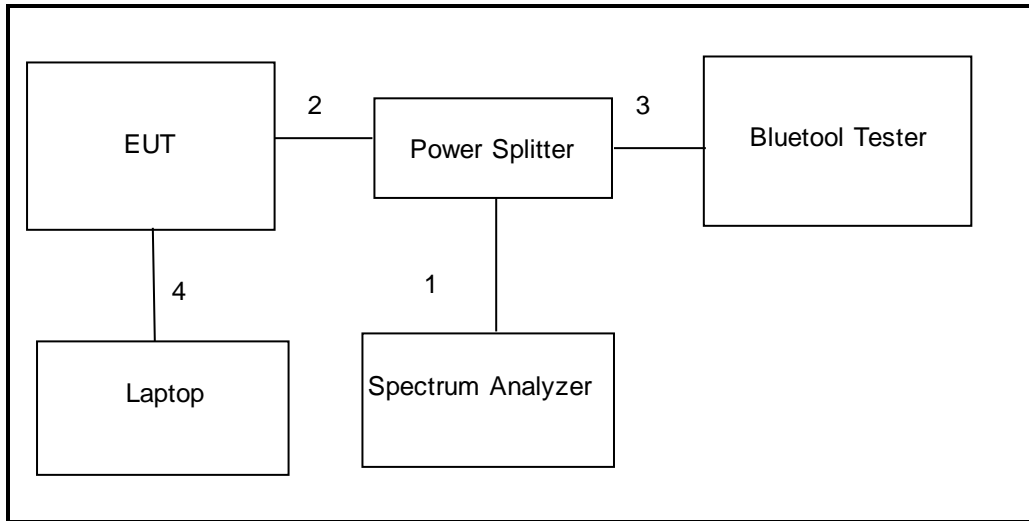
I/O CABLES (Conducted Setup)

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

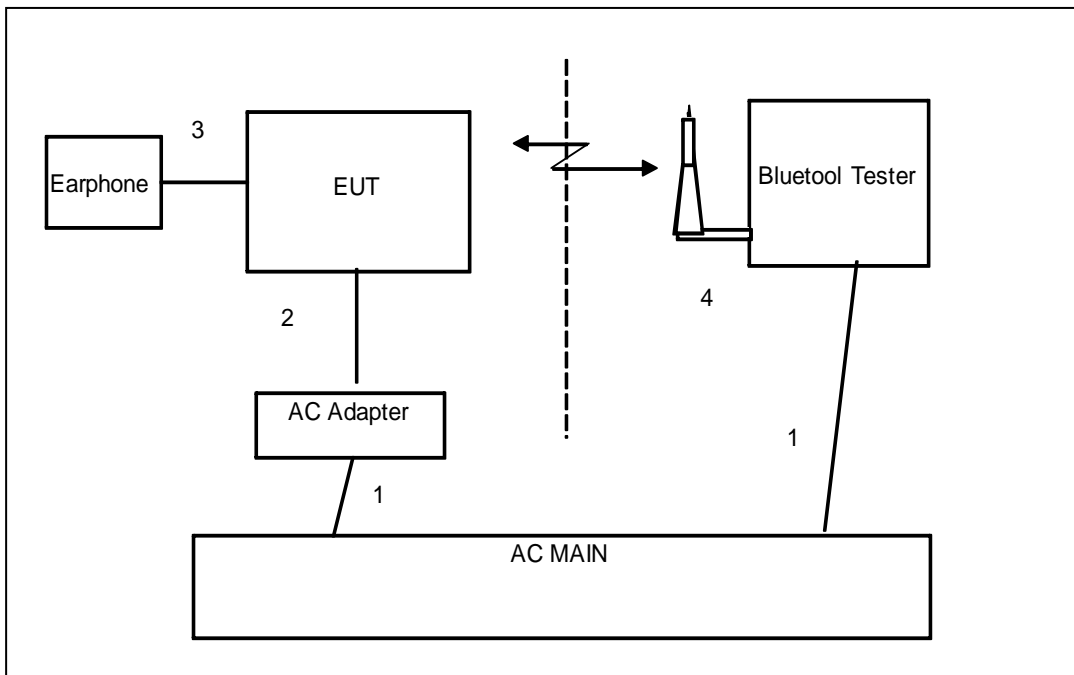
I/O CABLES (Radiated Setup)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	US1 15VAC	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 CONDUCTED 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
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/13
Horn Antenna, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/13
Horn Antenna, 40 GHz	ARA	MWH-2640/B	C00981	05/10/13
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	03/14/13
Reject Filter, 2.0-2.9 GHz	Micro-Tronics	BRM50702	N02684	CNR
High Pass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	04/09/13
CBT Bluetooth tester	Rohde Schwarz	CBT	10090	05/15/2013
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02676	CNR
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
EMI Test Receiver, 30MHz	R & S	ESHS 20	N02396	08/19/13
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	12/13/12

7. ANTENNA PORT TEST RESULTS

7.1. BASIC DATA RATE GFSK MODULATION

7.1.1. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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

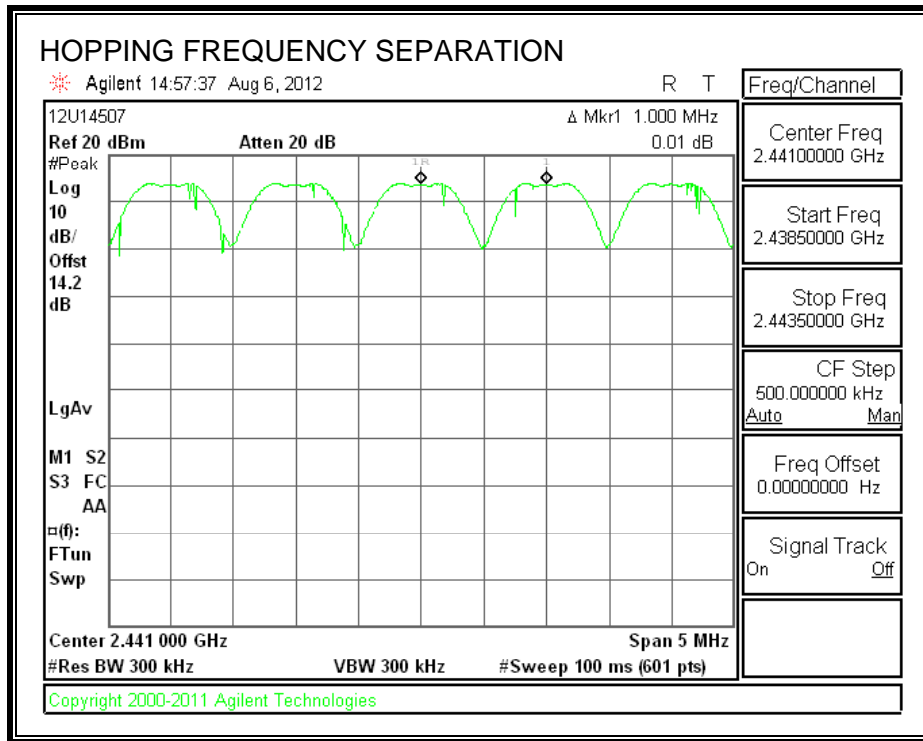
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

RESULTS

HOPPING FREQUENCY SEPARATION



7.1.2. 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.

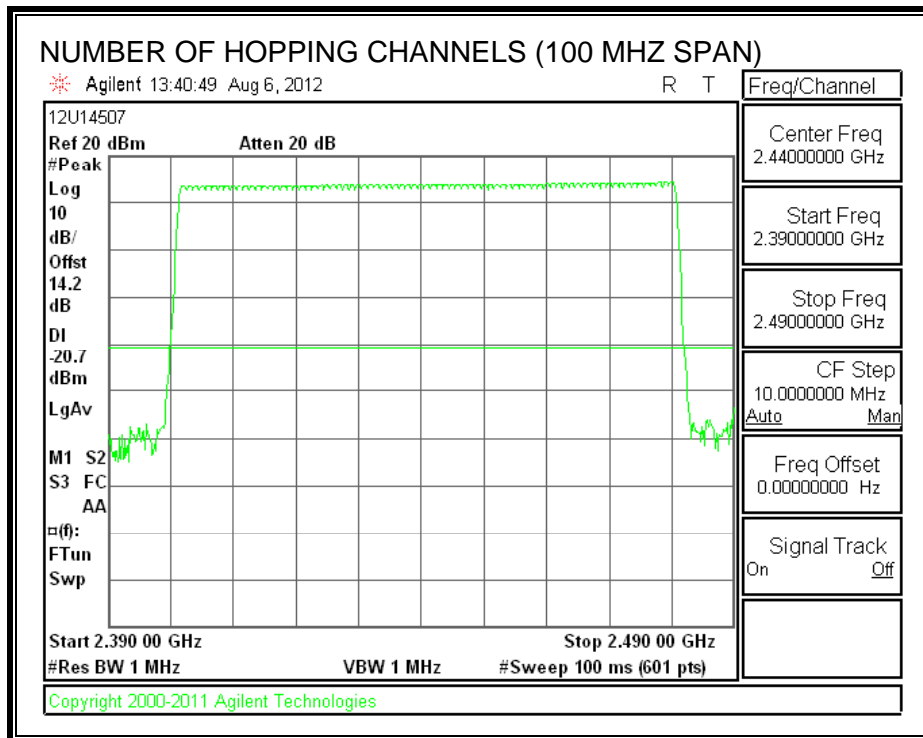
TEST PROCEDURE

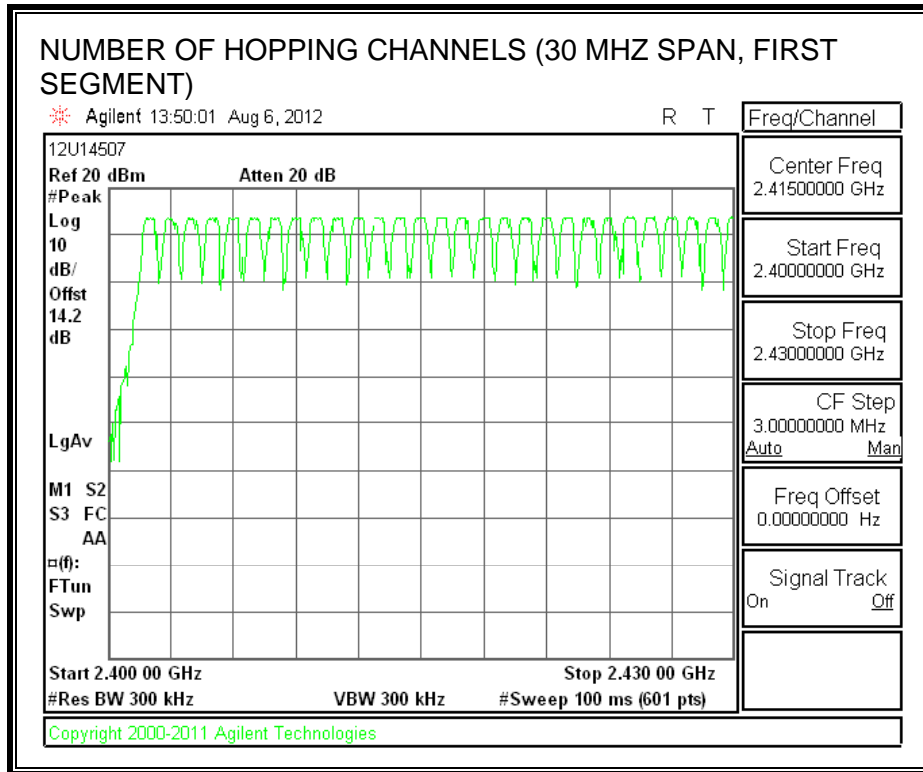
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

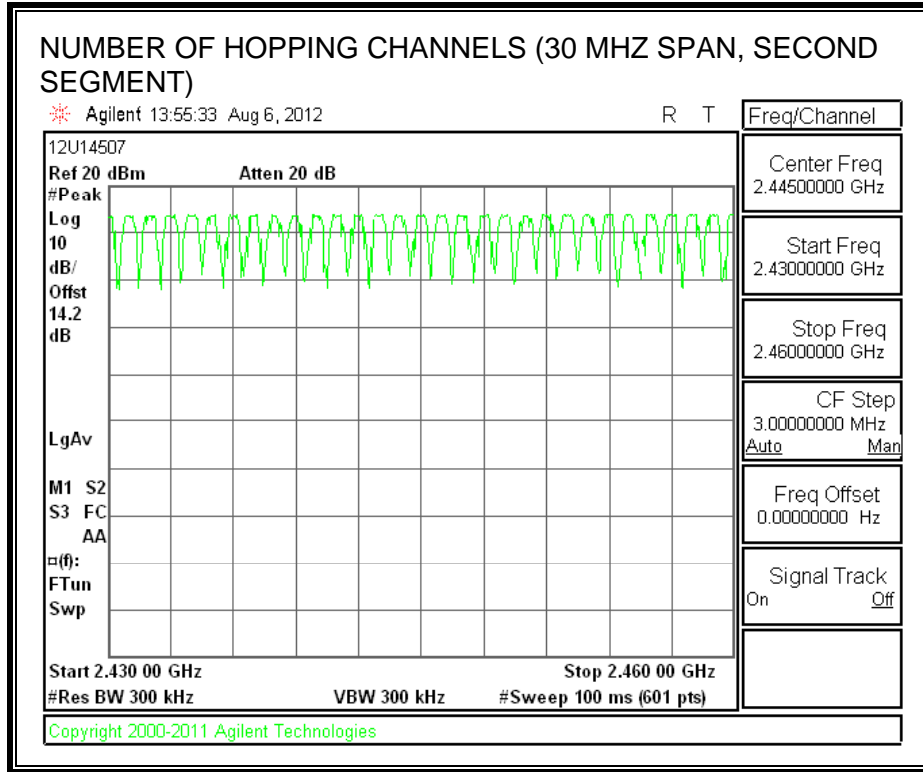
RESULTS

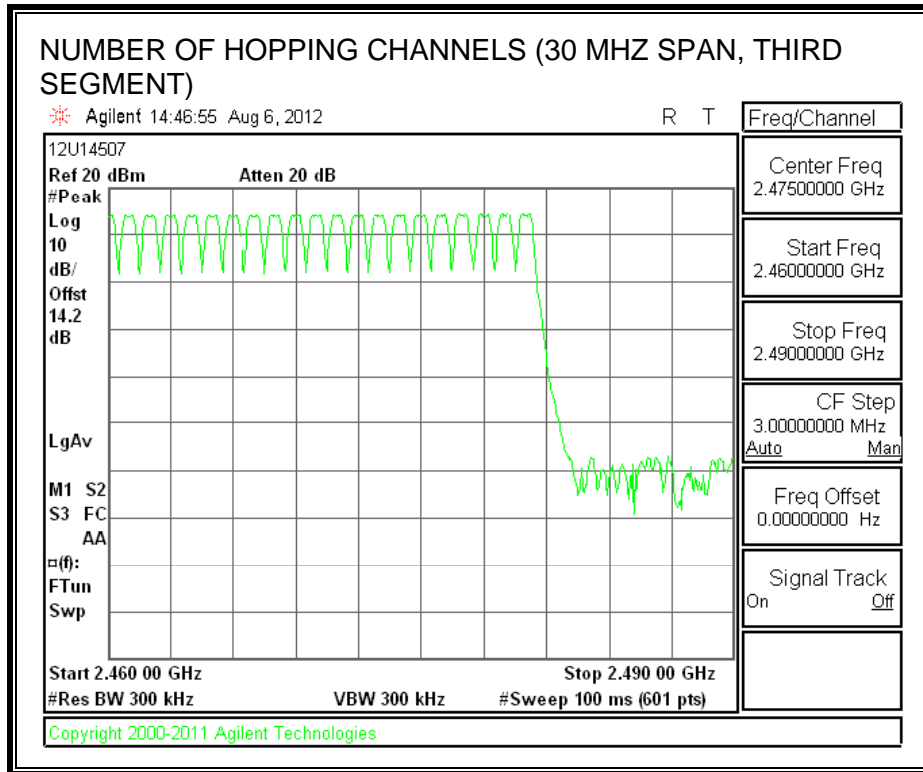
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS









7.1.3. 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.

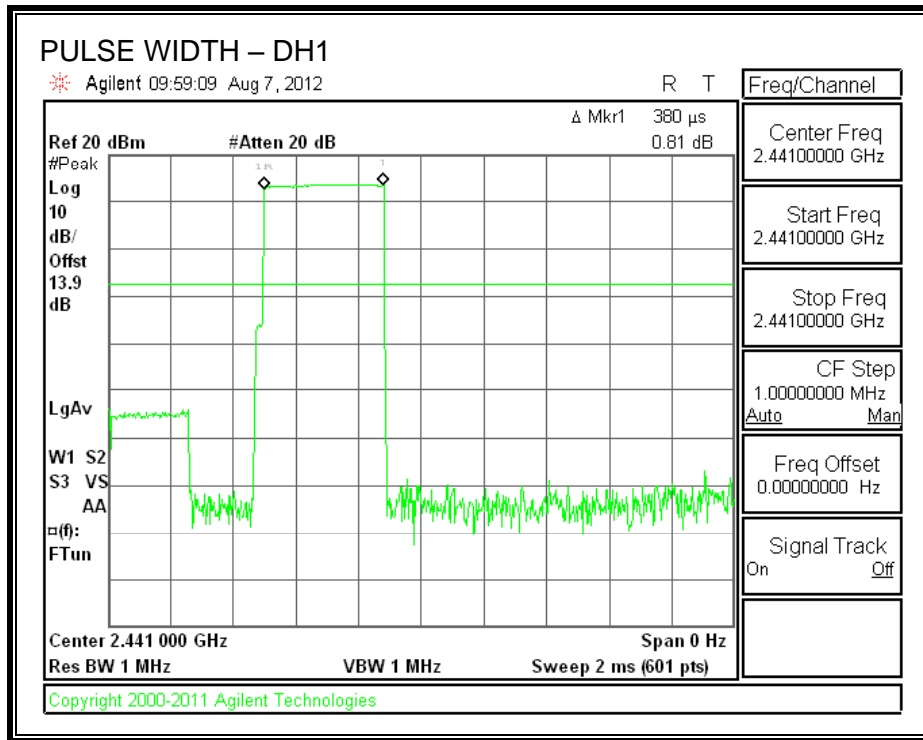
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$.

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

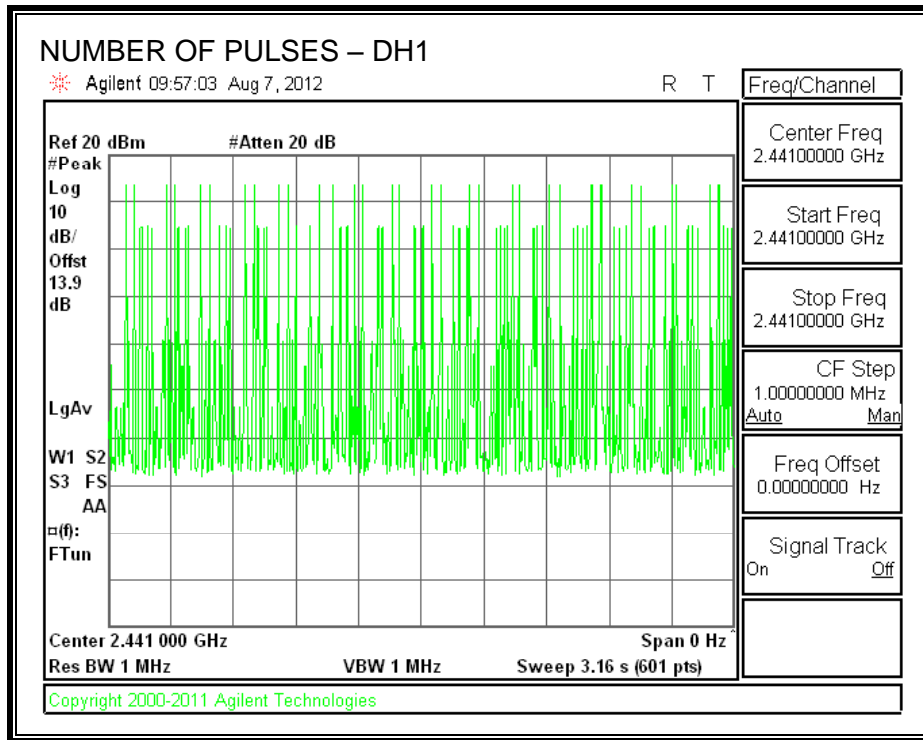
RESULTS

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	0.380	32	0.122	0.4	-0.278
DH3	1.640	17	0.279	0.4	-0.121
DH5	2.883	6	0.173	0.4	-0.227
GFSK AFH Mode					
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.380	64	0.243	0.4	-0.157
DH3	1.640	21	0.344	0.4	-0.056
DH5	2.883	13	0.375	0.4	-0.025

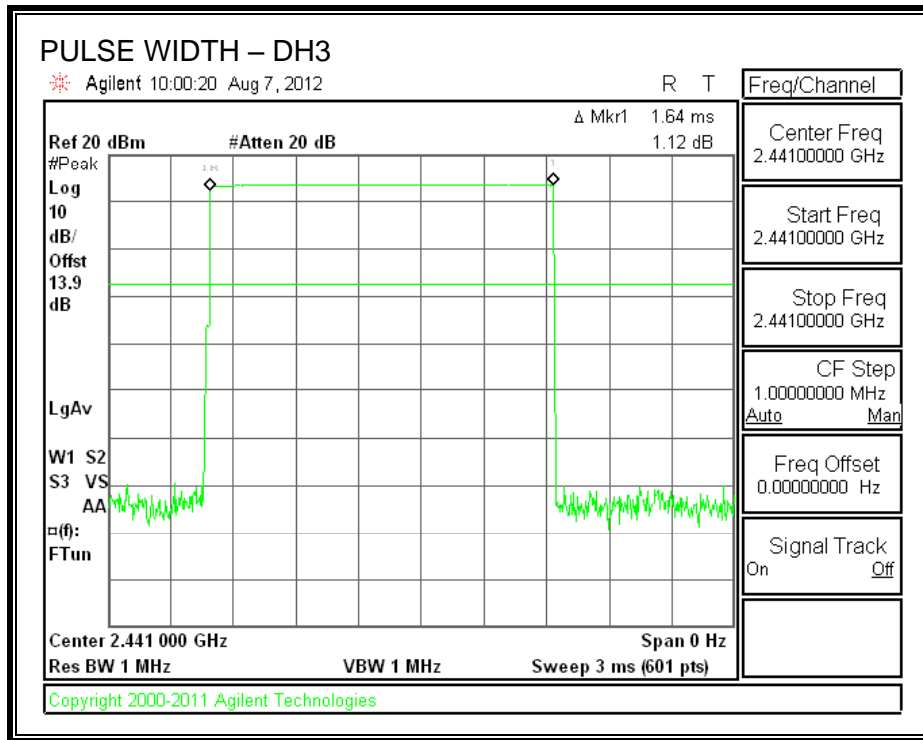
PULSE WIDTH - DH1



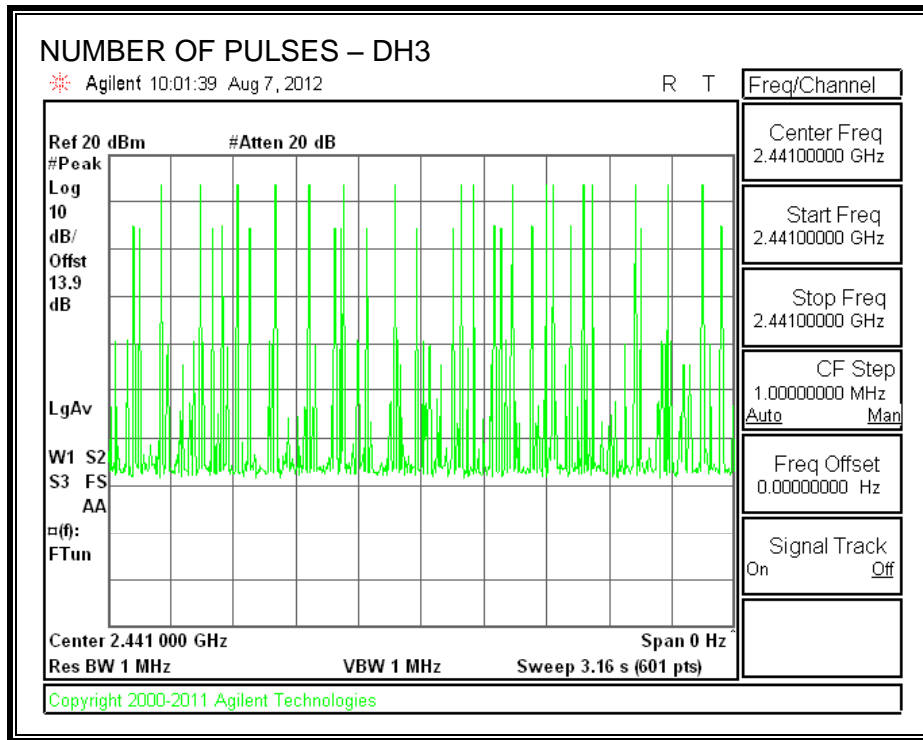
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



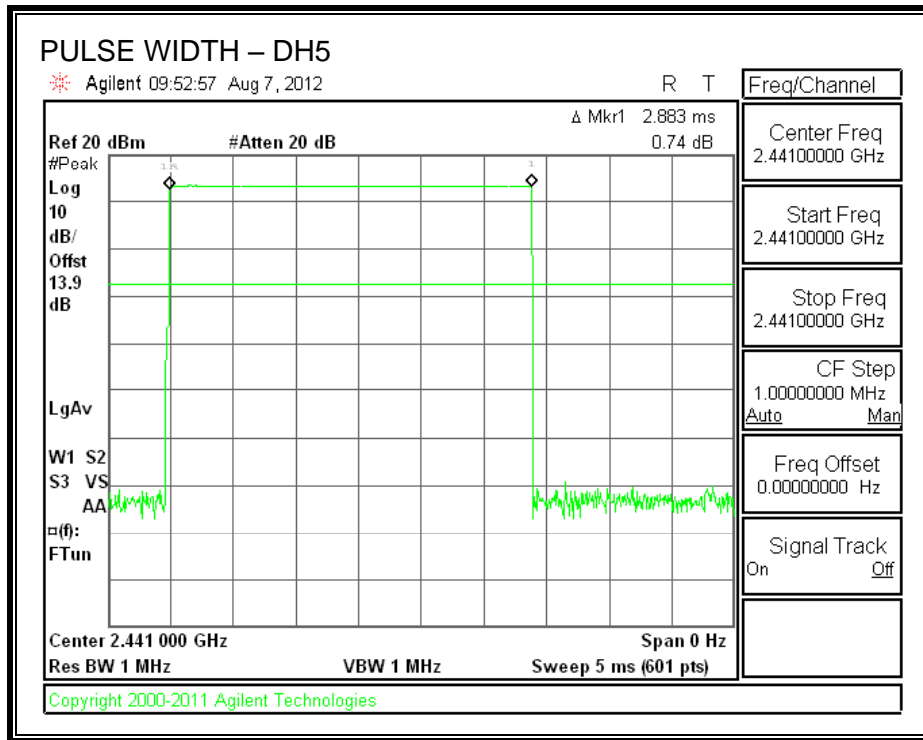
PULSE WIDTH – DH3



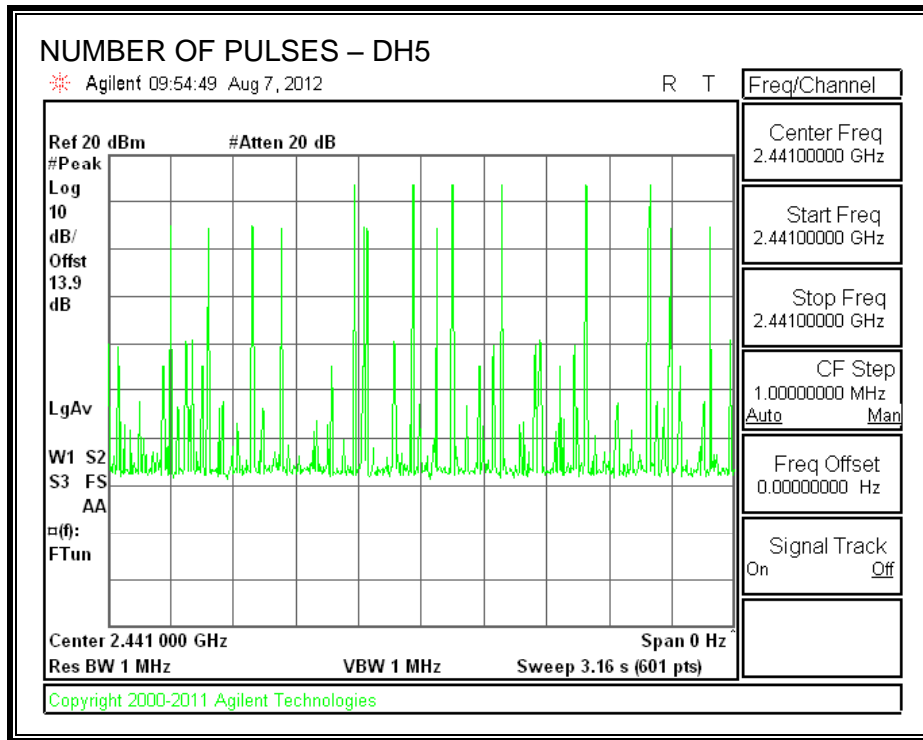
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



7.1.4. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

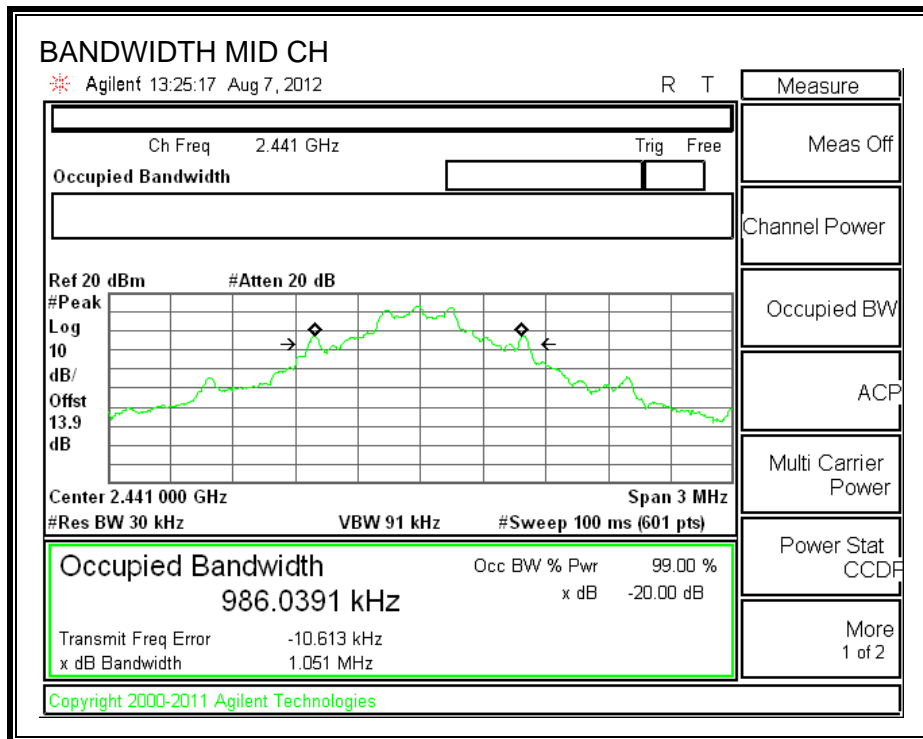
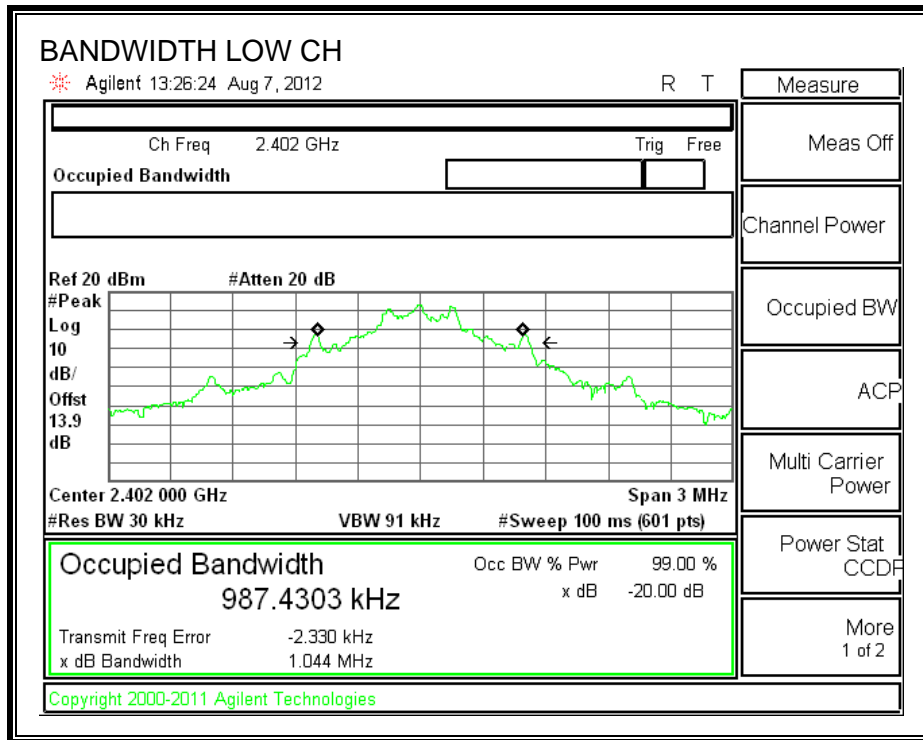
TEST PROCEDURE

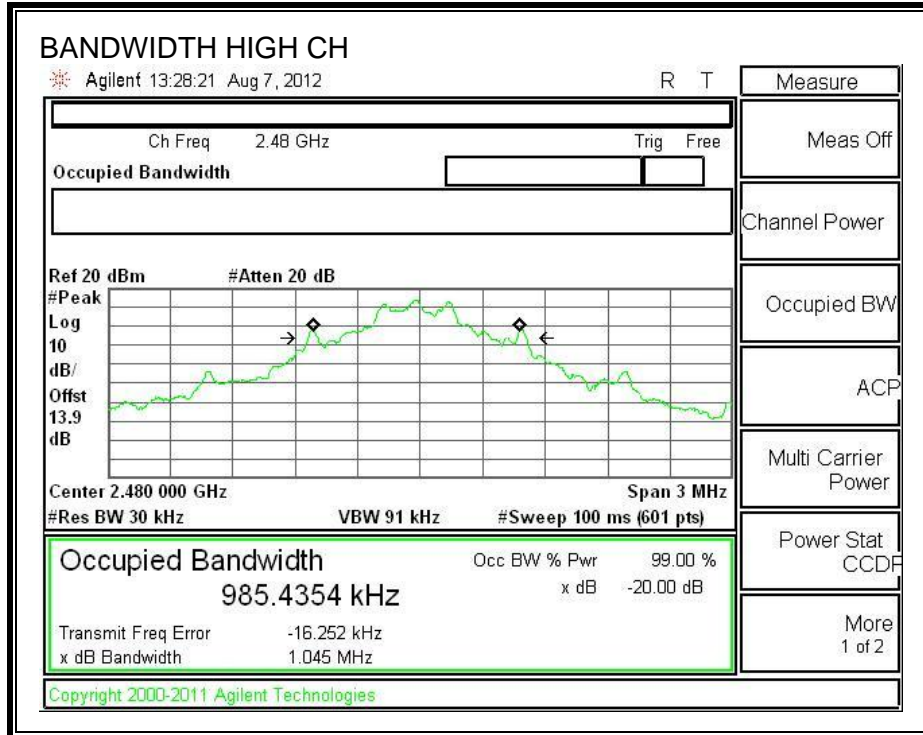
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

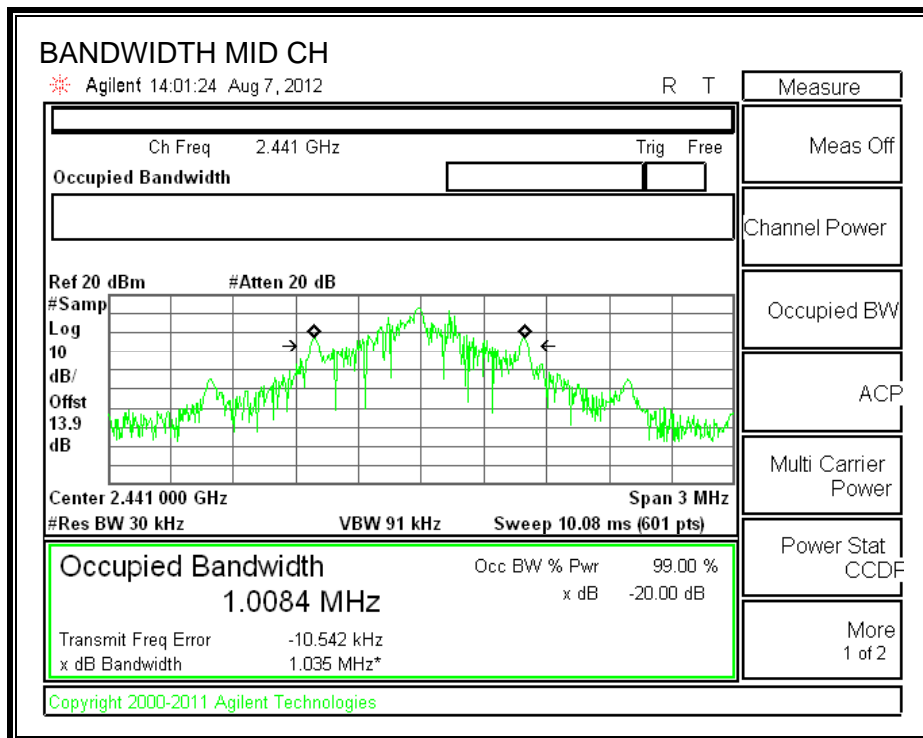
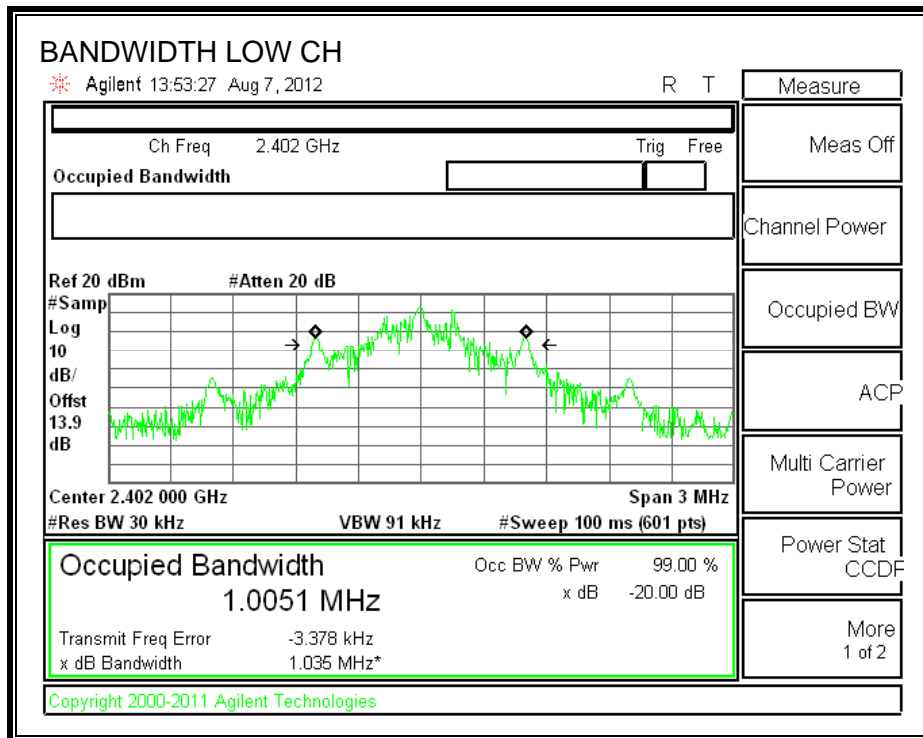
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1044	1005.1
Middle	2441	1051	1008.4
High	2480	1045	1008.3

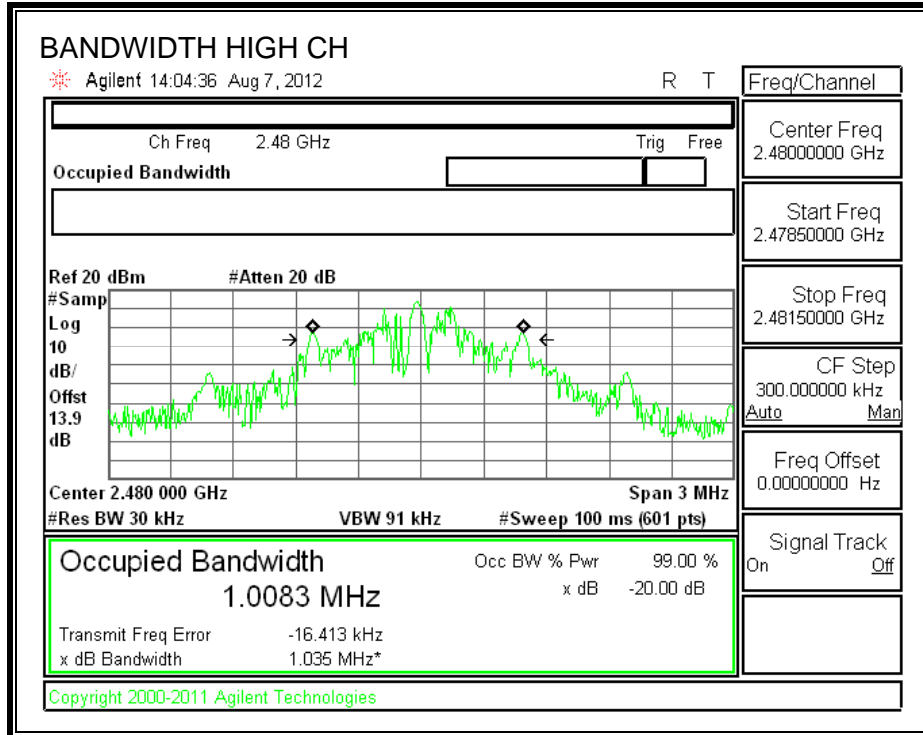
20 dB AND 99% BANDWIDTH





99% BANDWIDTH





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.

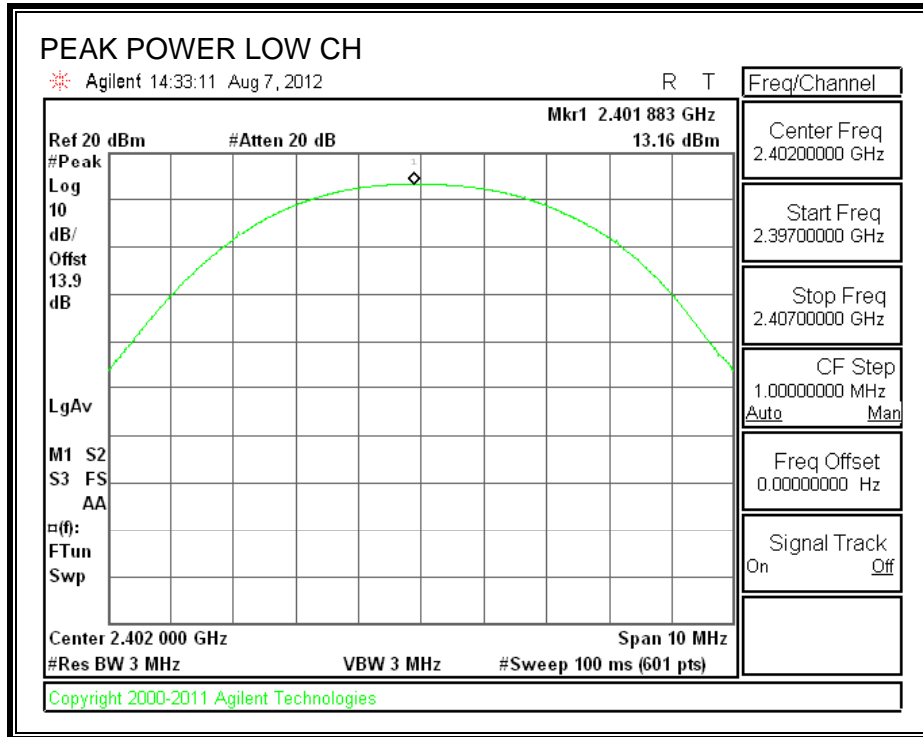
TEST PROCEDURE

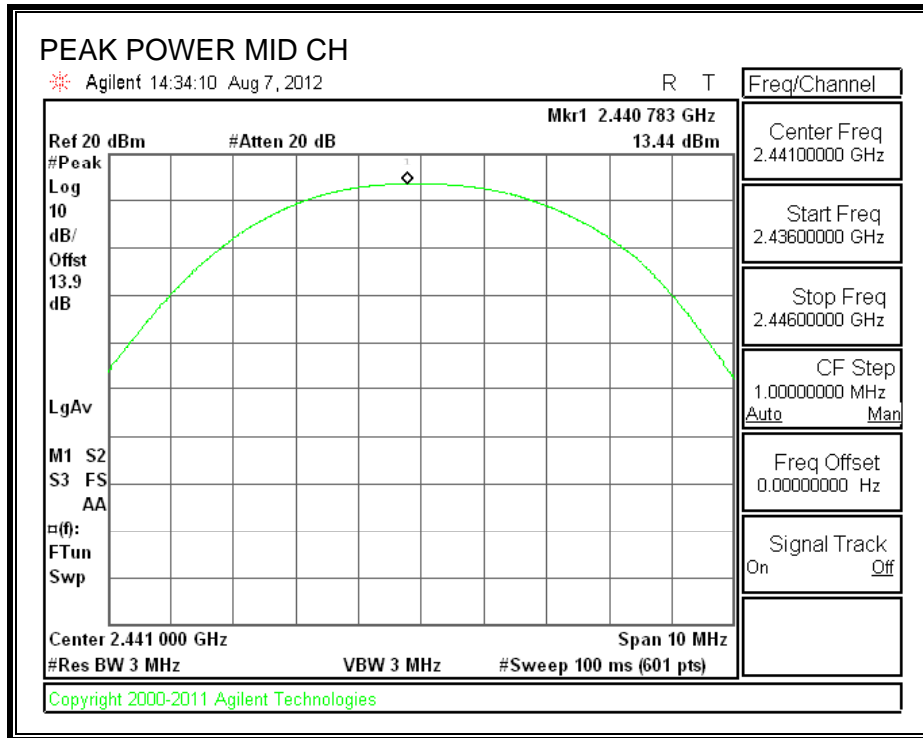
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

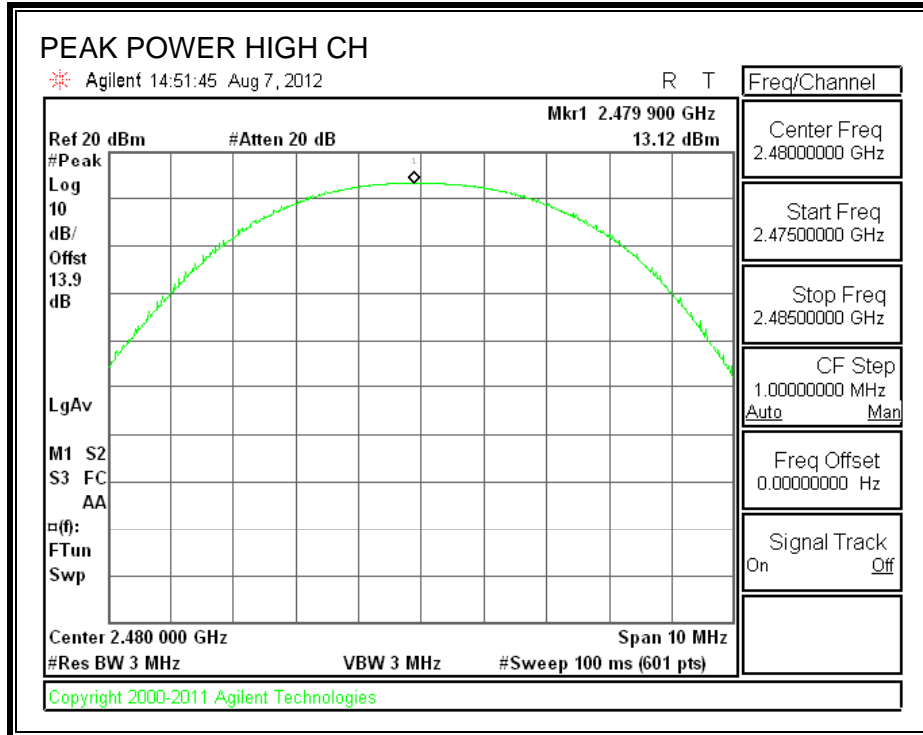
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	13.16	20.97	-7.81
Middle	2441	13.44	20.97	-7.53
High	2480	13.12	20.97	-7.85

OUTPUT POWER







7.1.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to Rohde & Schwarz CBT Test box.

RESULTS

The cable assembly insertion loss of 13.9 dB (including 12.5 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	12.50
Middle	2441	13.00
High	2480	12.70

7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

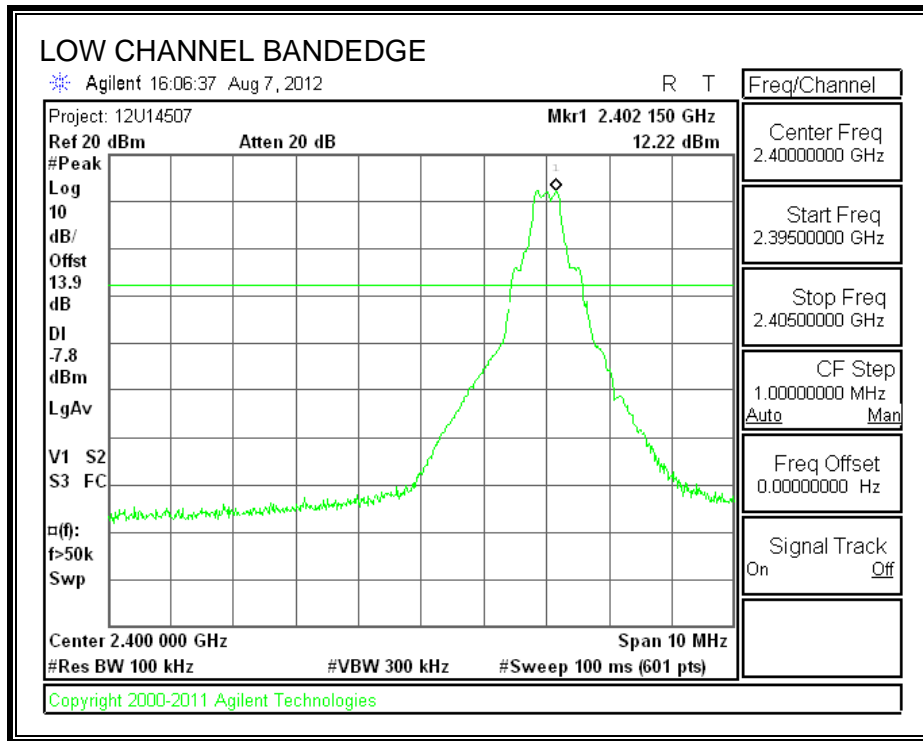
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

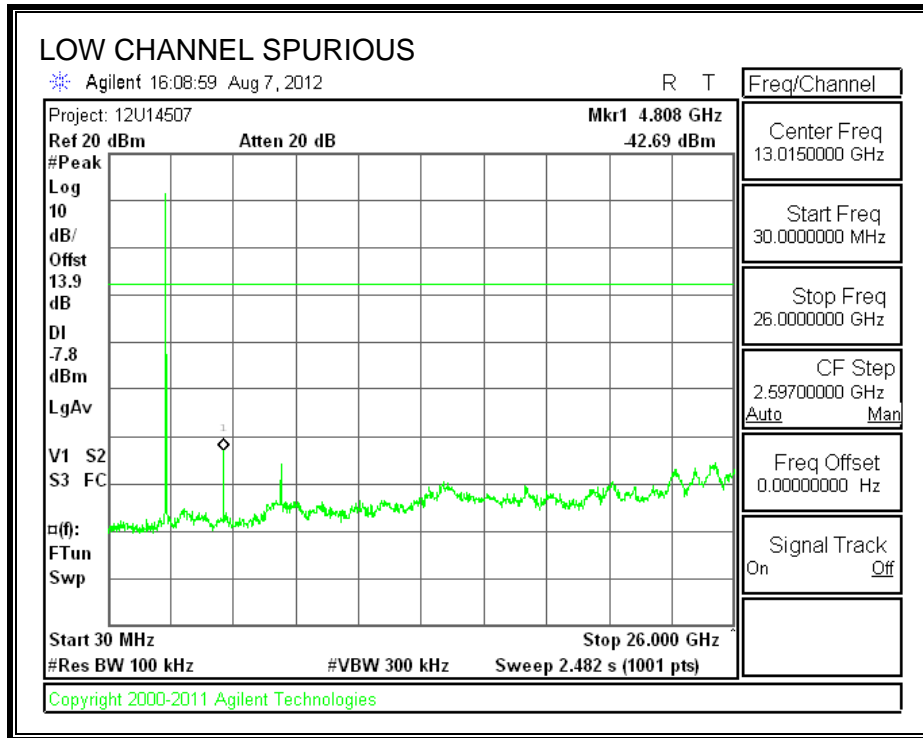
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

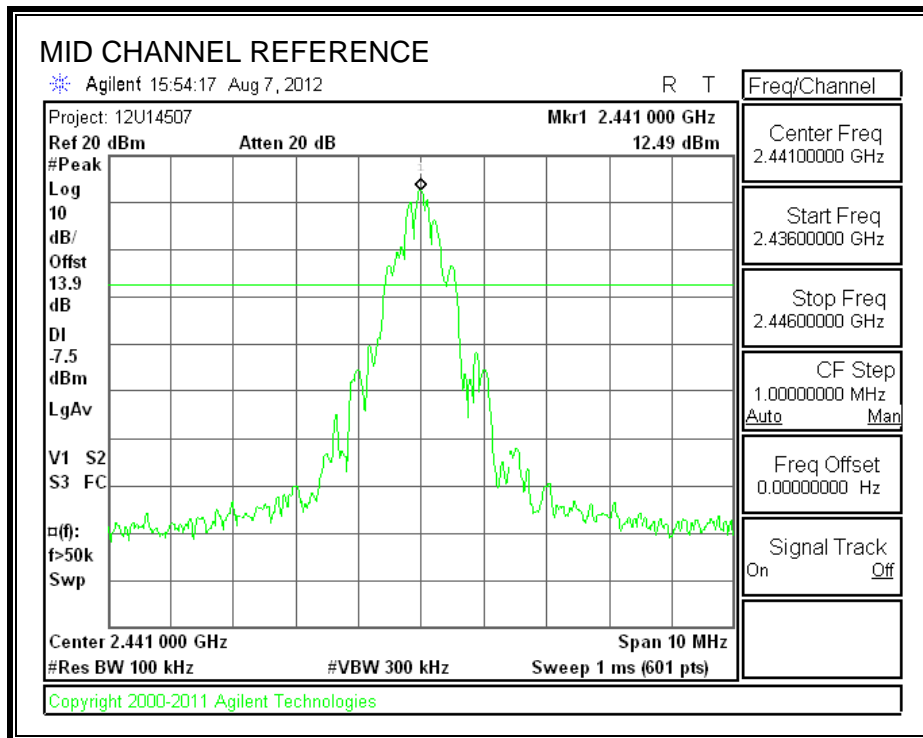
RESULTS

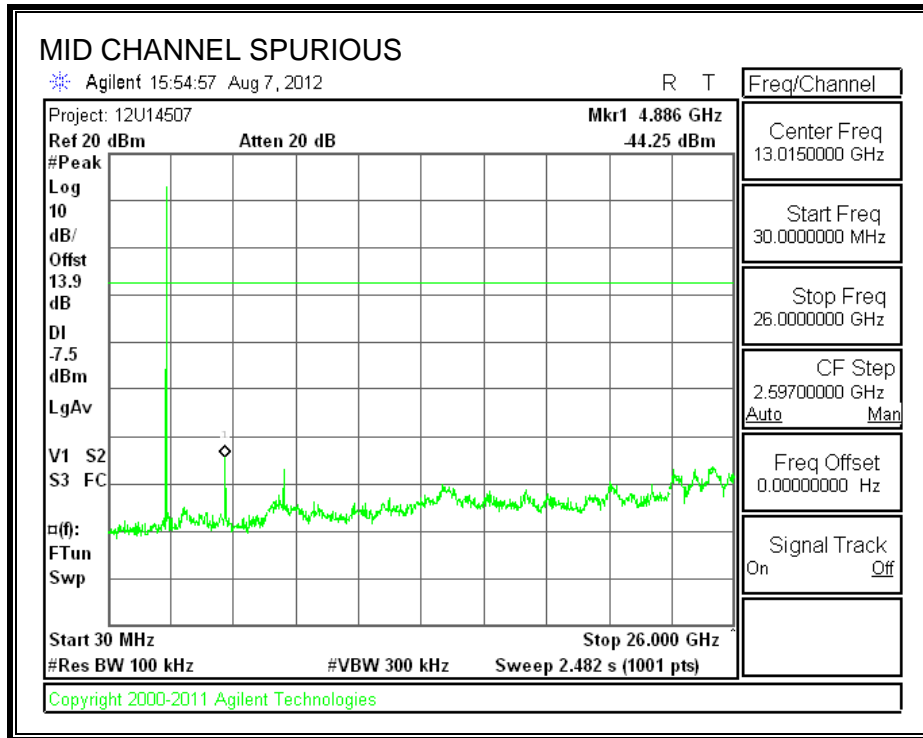
SPURIOUS EMISSIONS, LOW CHANNEL



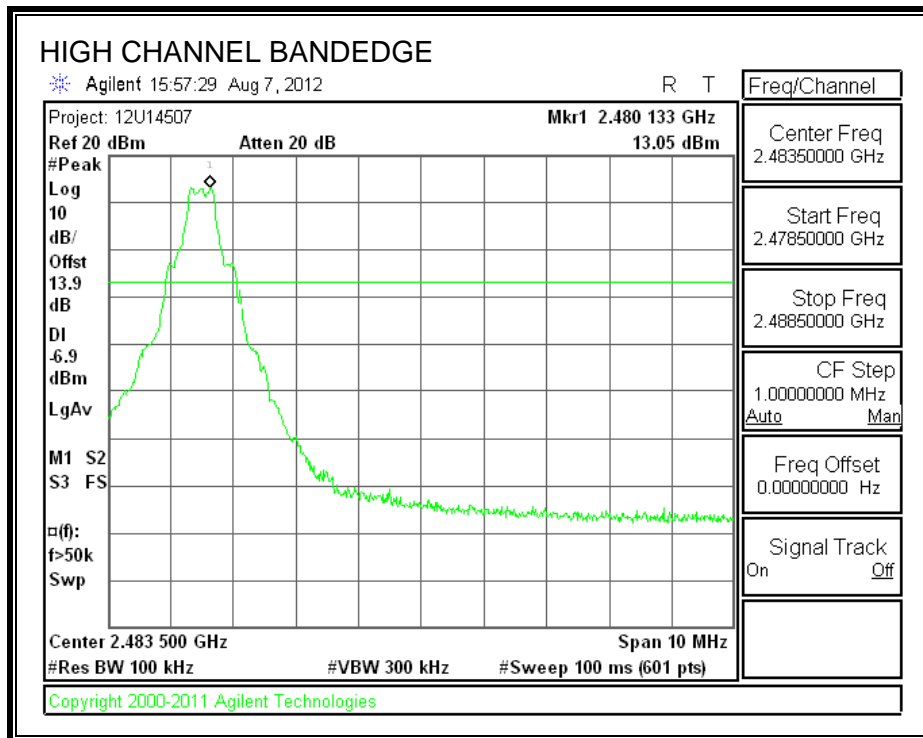


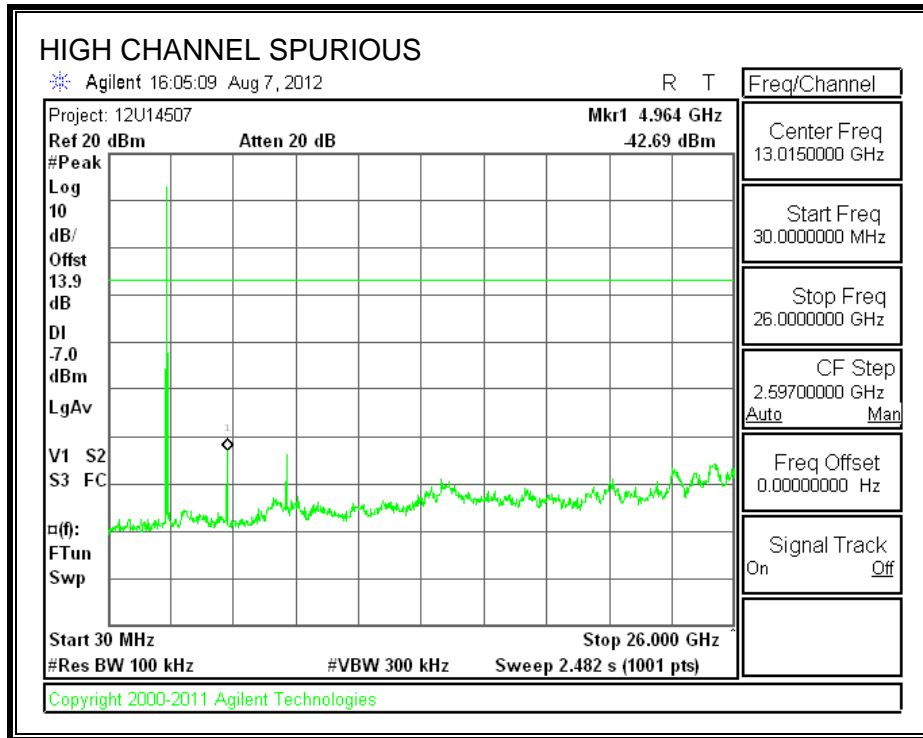
SPURIOUS EMISSIONS, MID CHANNEL



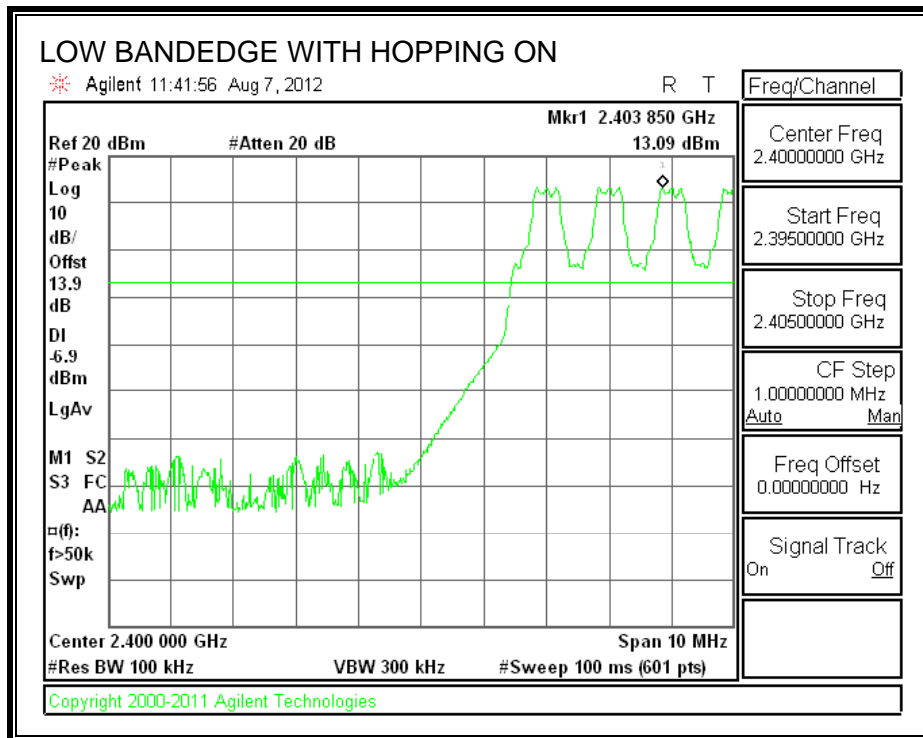


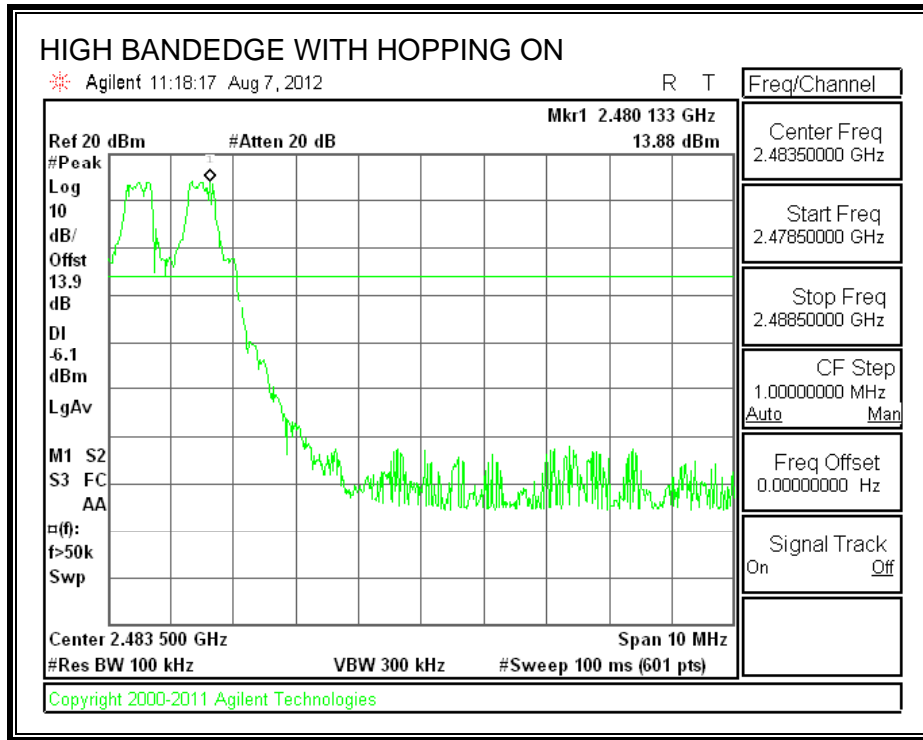
SPURIOUS EMISSIONS, HIGH CHANNEL





SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





7.2. ENHANCED DATA RATE QPSK MODULATION

7.2.1. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

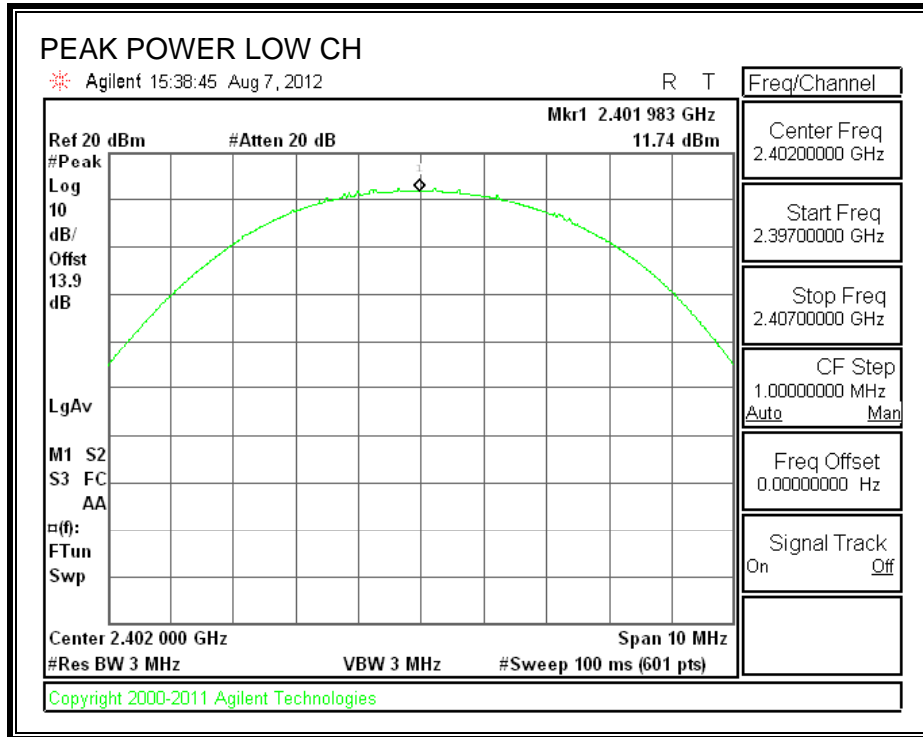
TEST PROCEDURE

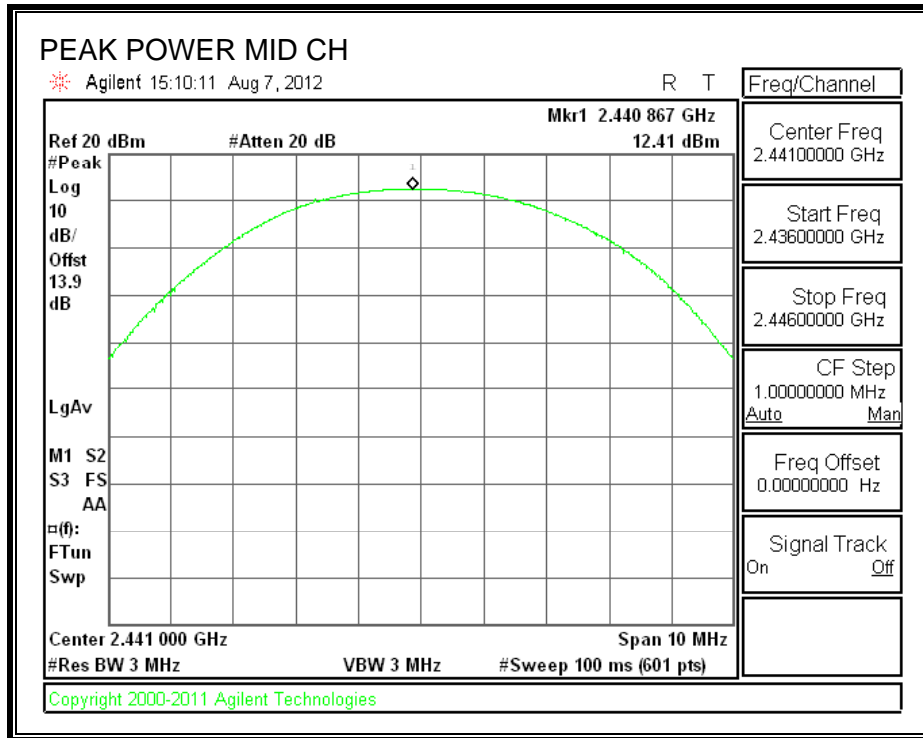
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

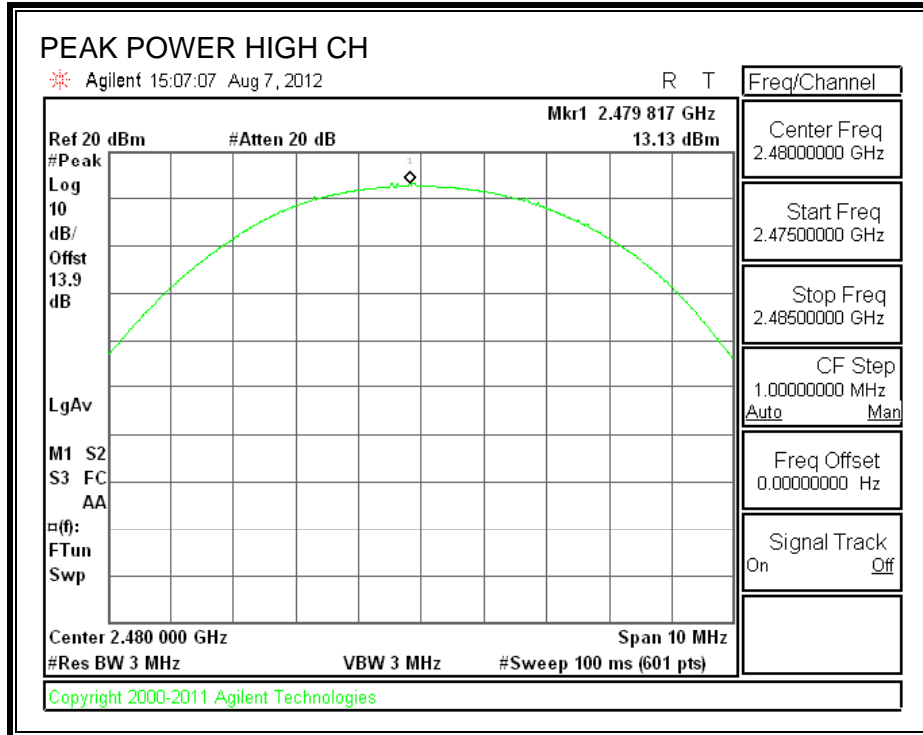
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.74	20.97	-9.23
Middle	2441	12.41	20.97	-8.56
High	2480	13.13	20.97	-7.84

OUTPUT POWER







7.2.2. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to Rohde & Schwarz CBT Test box.

RESULTS

The cable assembly insertion loss of 13.9 dB (including 12.5 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	9.20
Middle	2441	10.30
High	2480	10.50

7.3. ENHANCED DATA RATE 8PSK MODULATION

7.3.1. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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

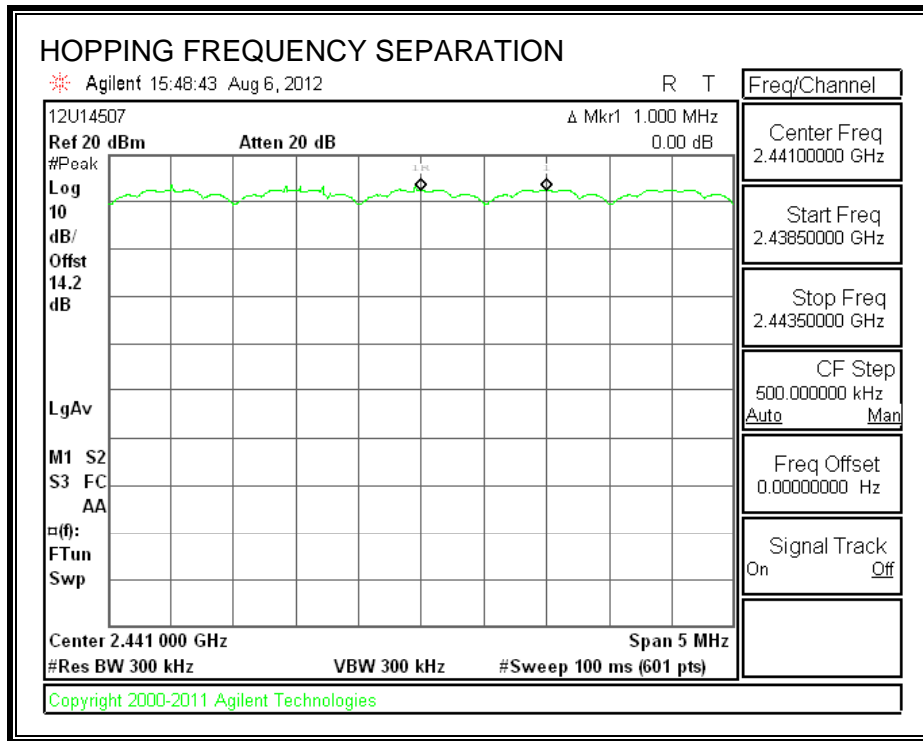
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

RESULTS

HOPPING FREQUENCY SEPARATION



7.3.2. 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.

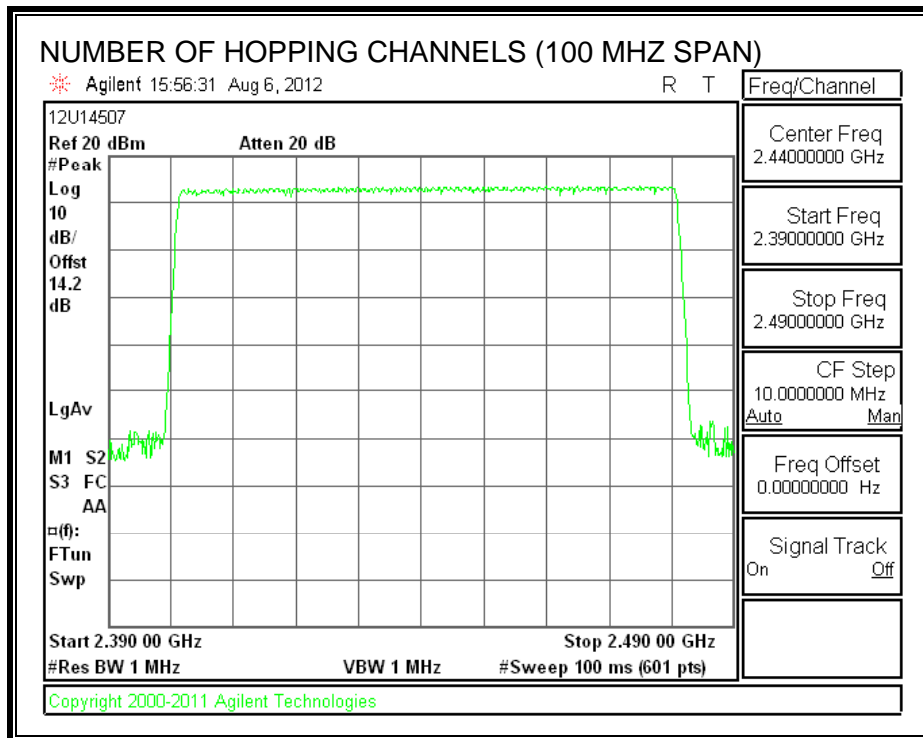
TEST PROCEDURE

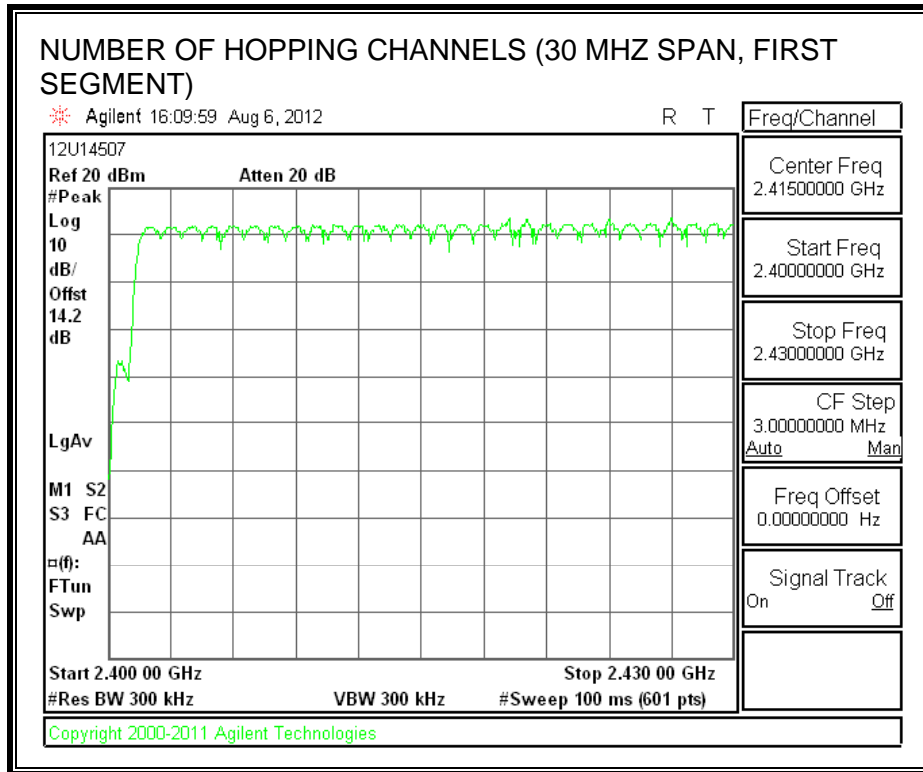
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

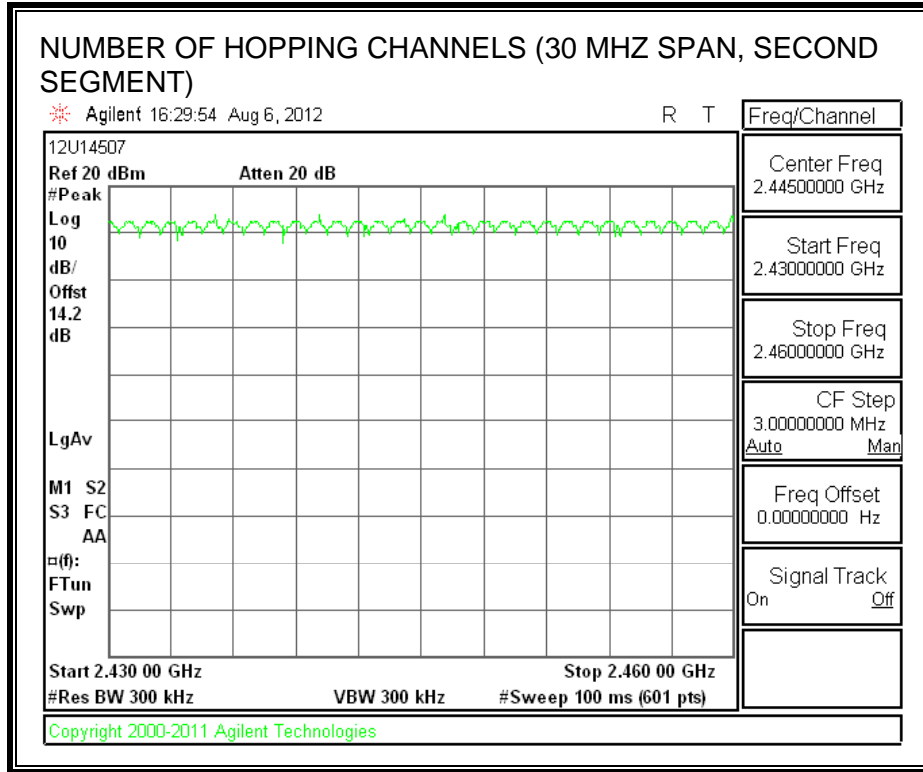
RESULTS

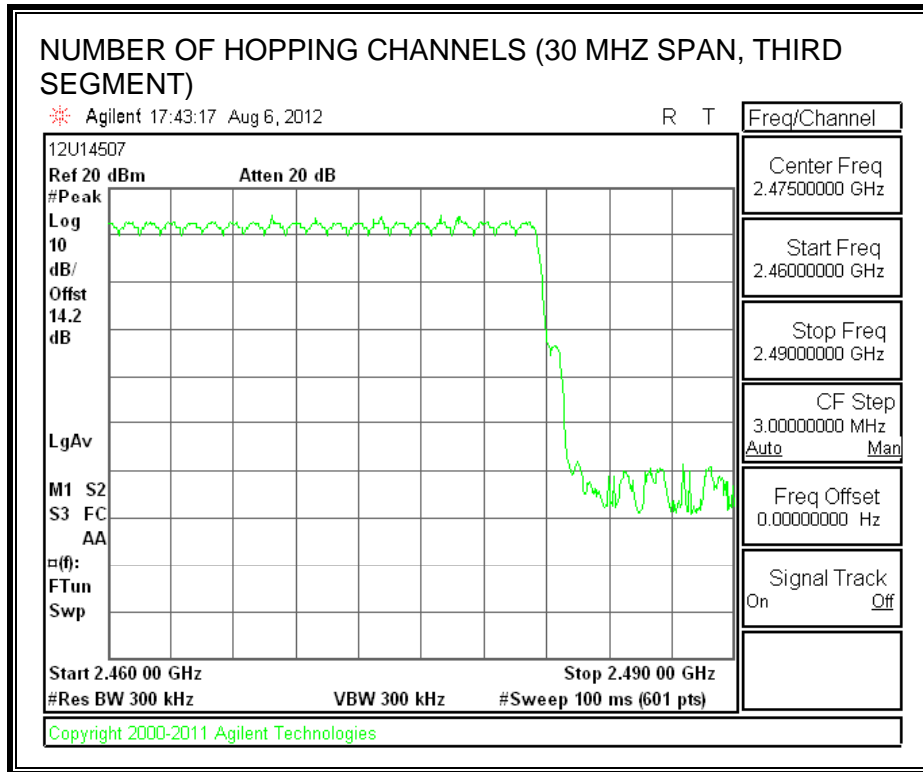
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS









7.3.3. 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 $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$.

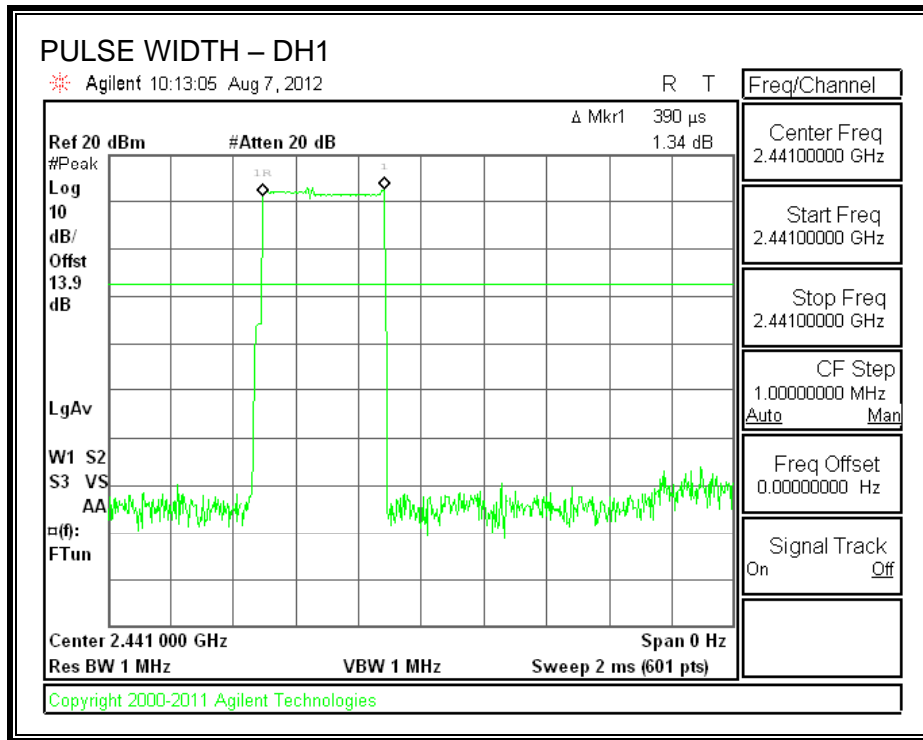
RESULTS

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

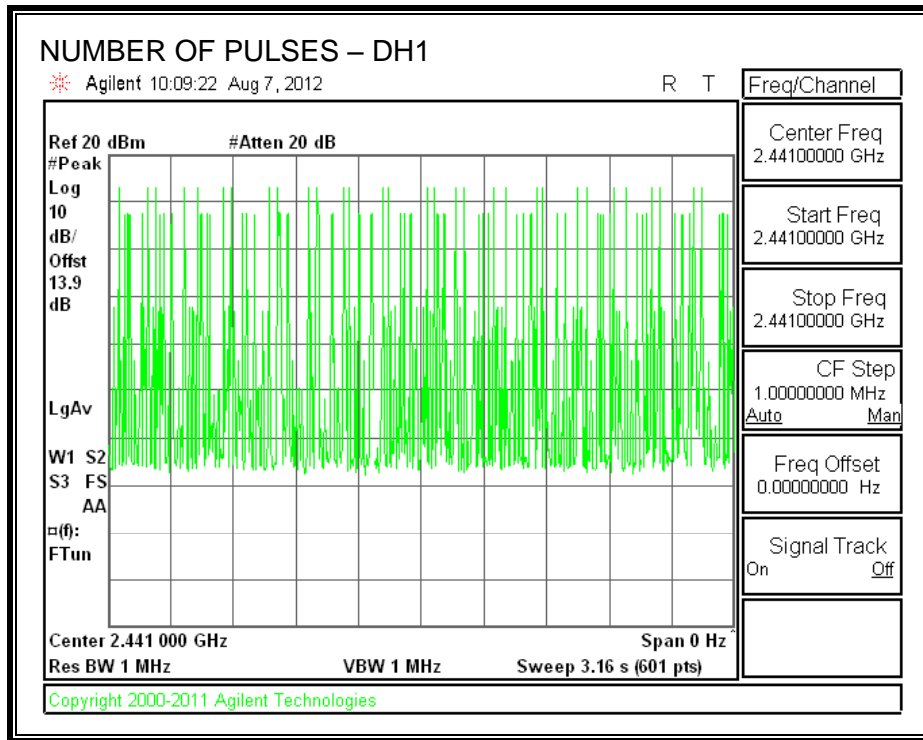
8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.390	31	0.121	0.4	-0.279
DH3	1.625	15	0.244	0.4	-0.156
DH5	2.892	10	0.289	0.4	-0.111

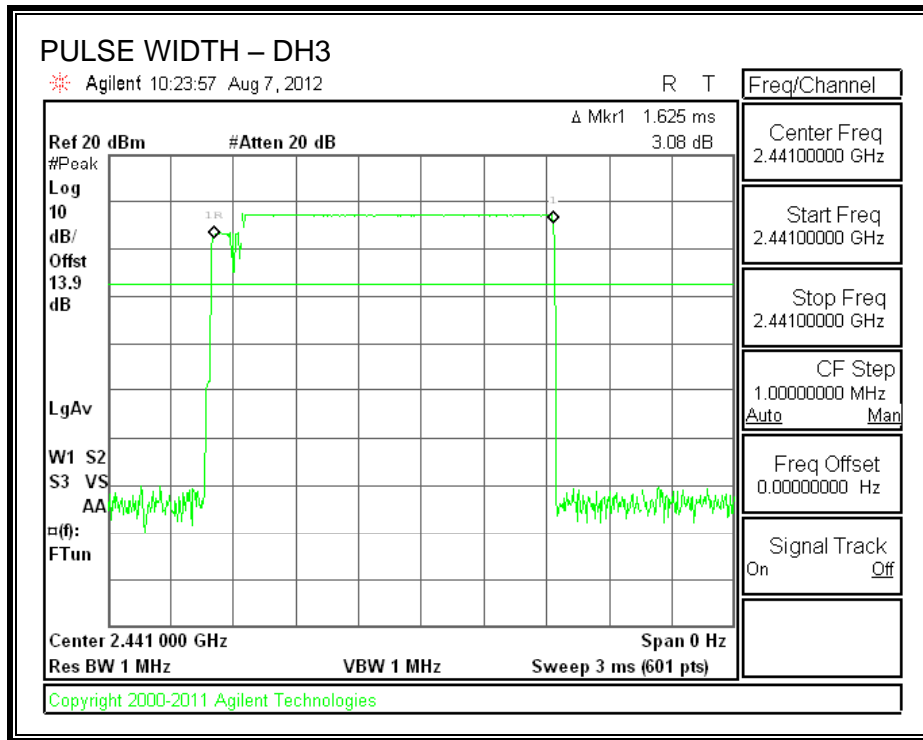
PULSE WIDTH - DH1



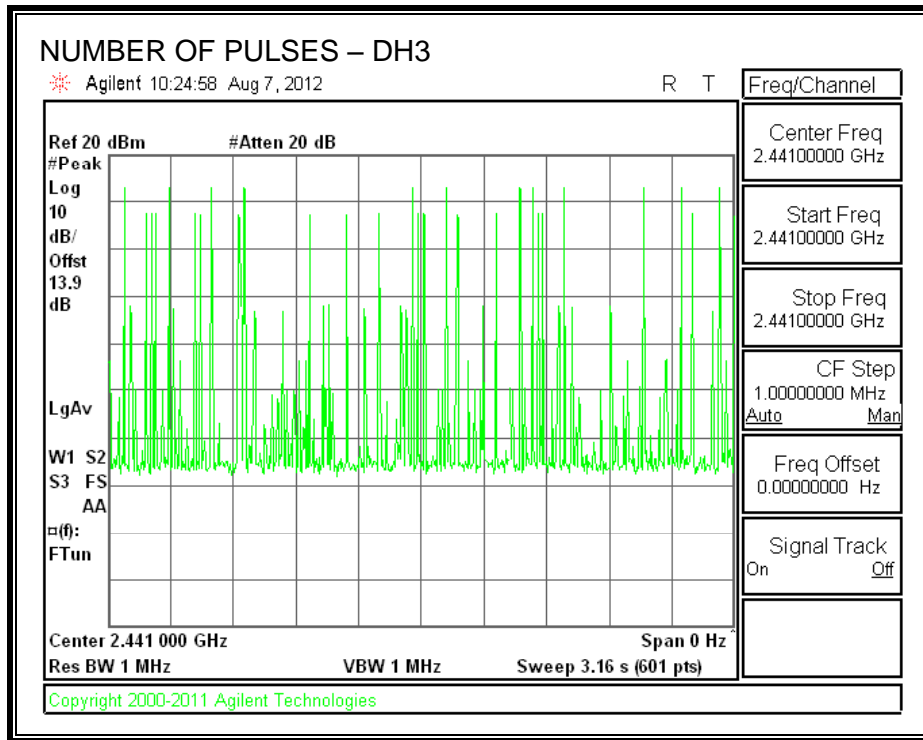
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



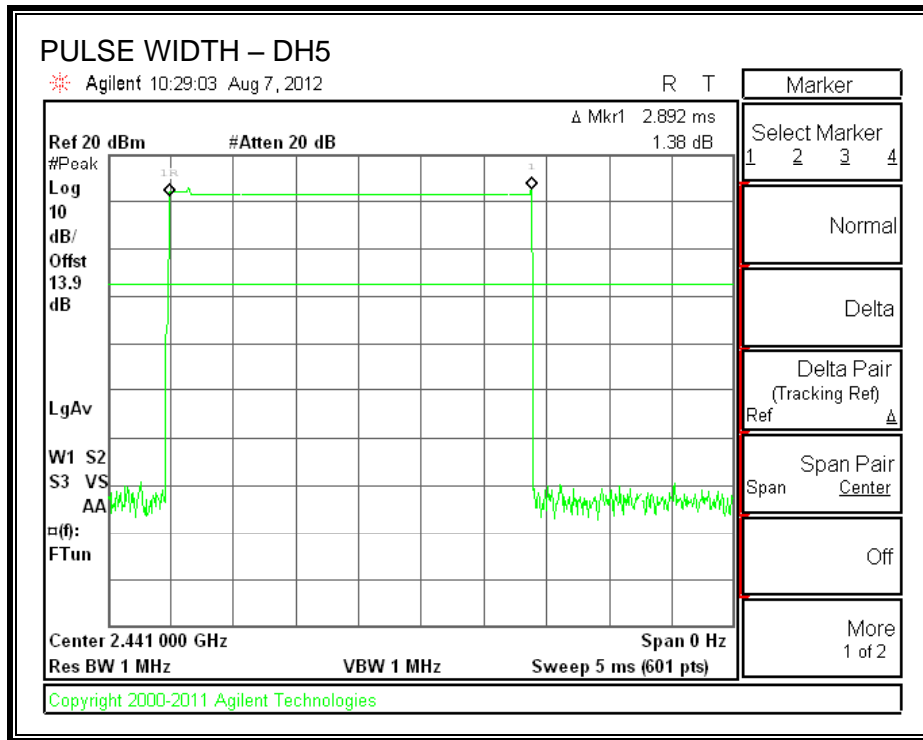
PULSE WIDTH – DH3



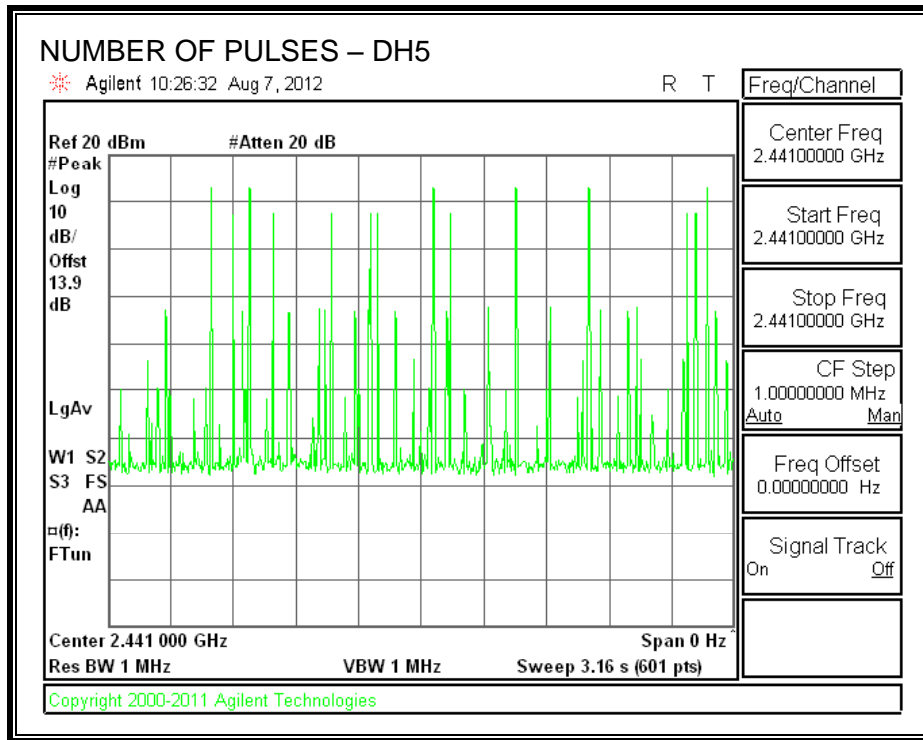
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



7.3.4. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

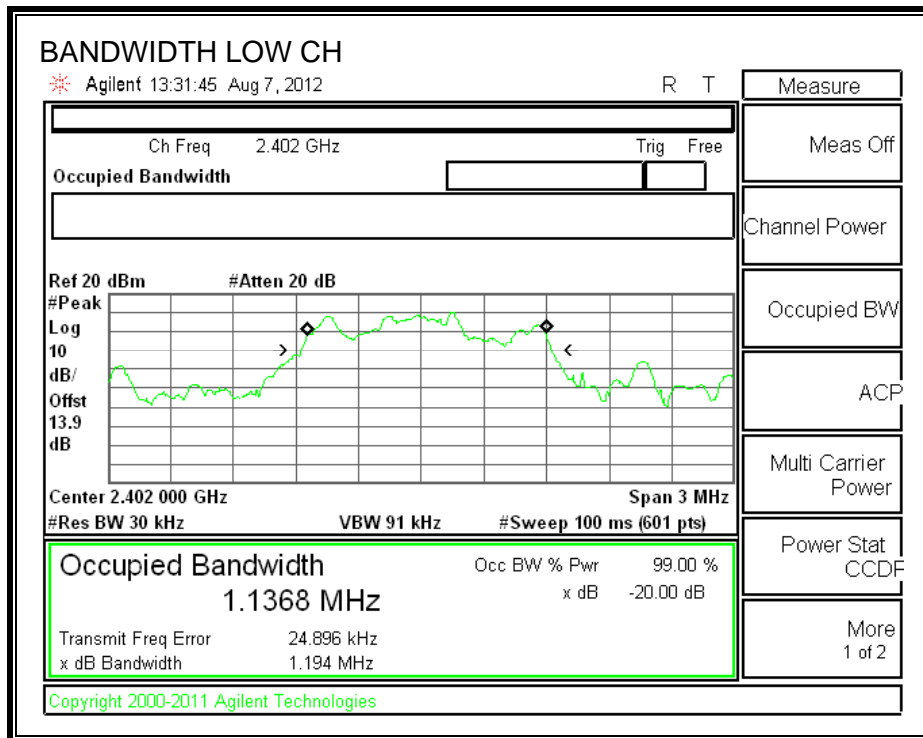
TEST PROCEDURE

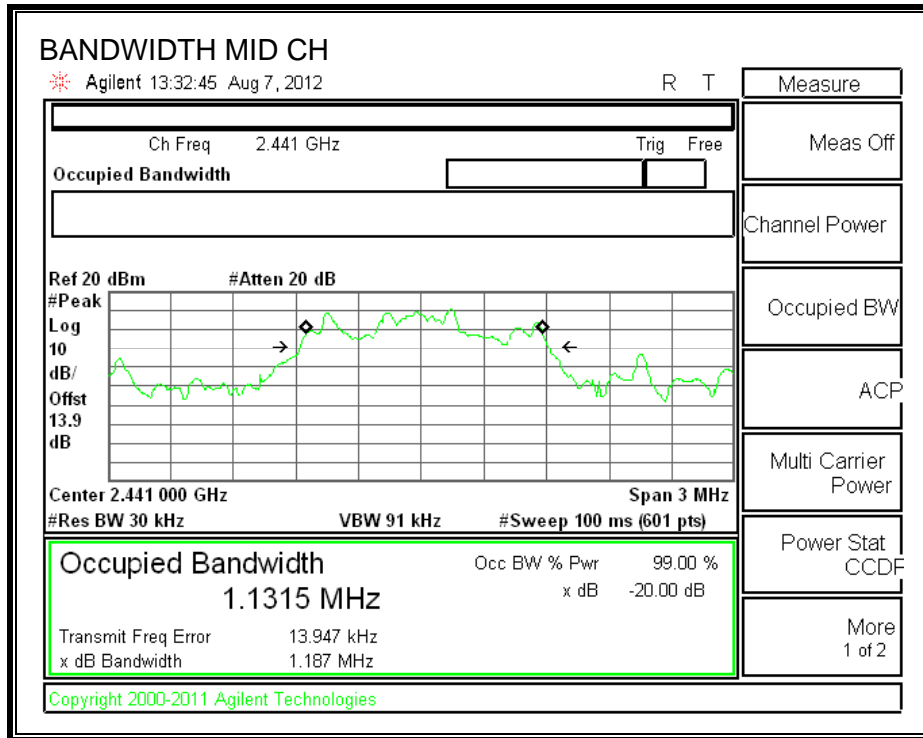
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

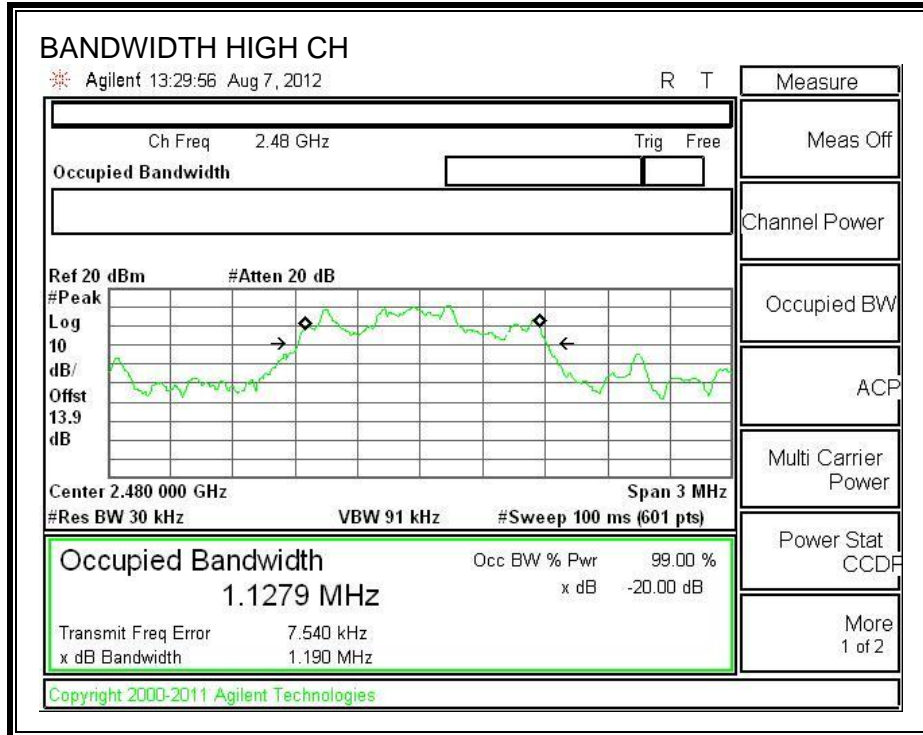
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1194	1101.6
Middle	2441	1187	1104.2
High	2480	1190	1133.1

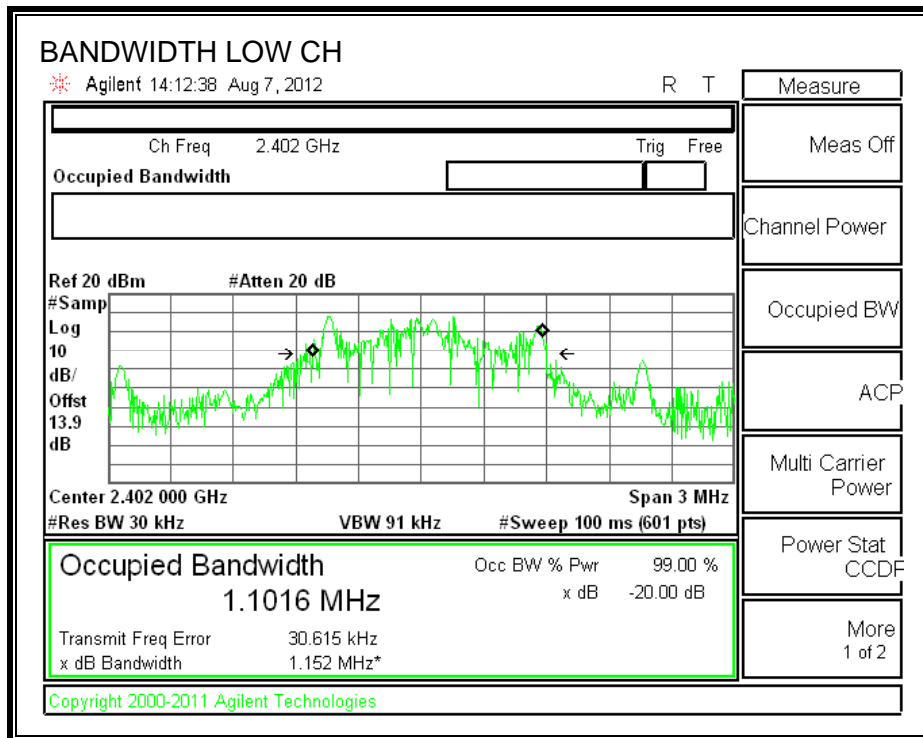
20 dB BANDWIDTH

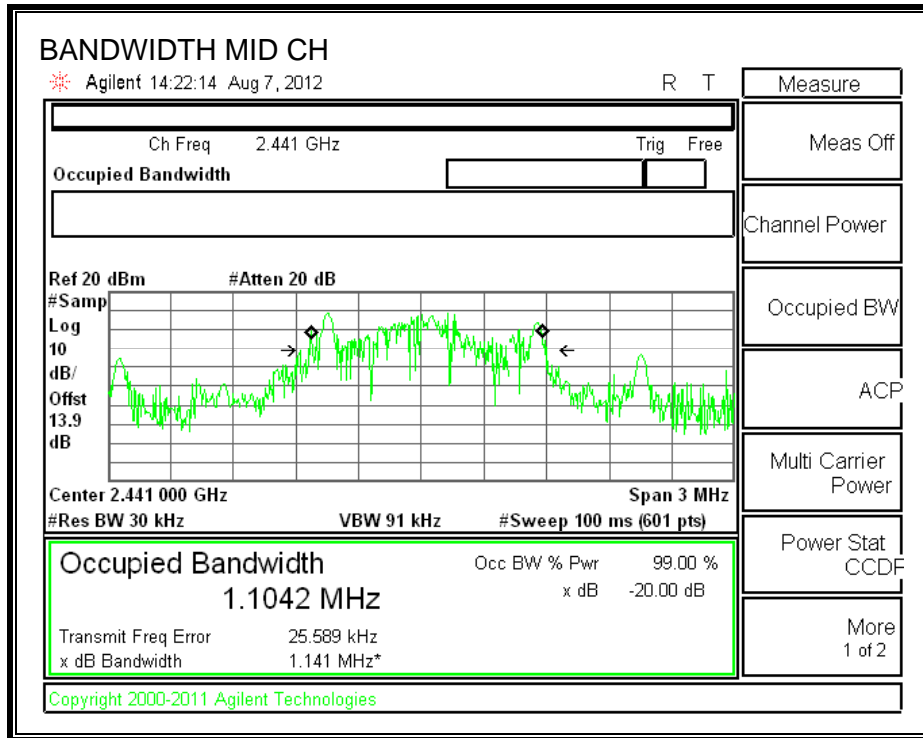


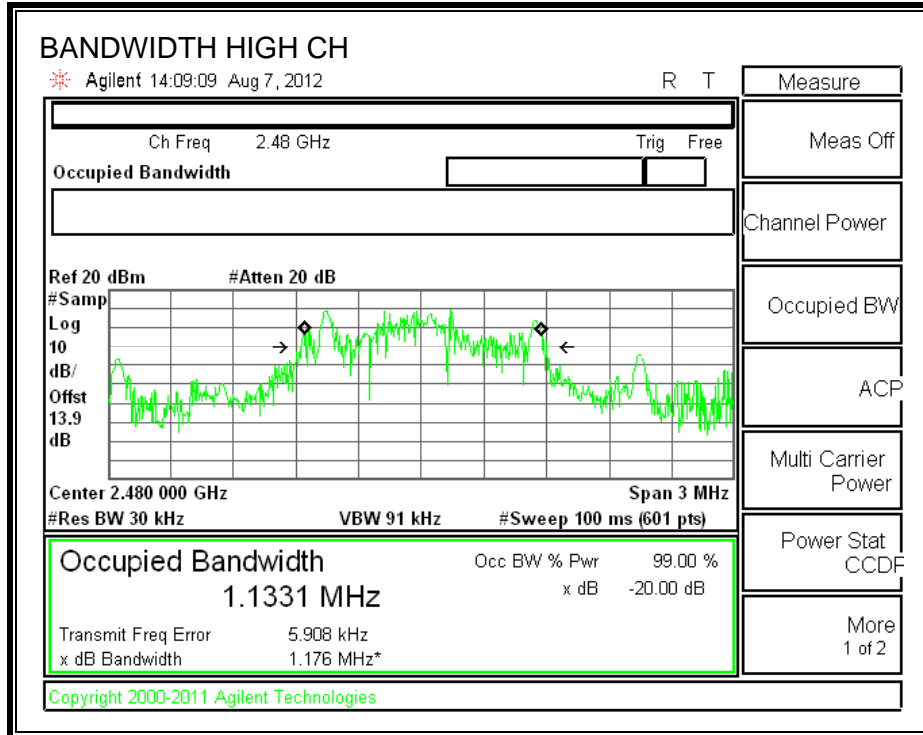




99% BANDWIDTH







7.3.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

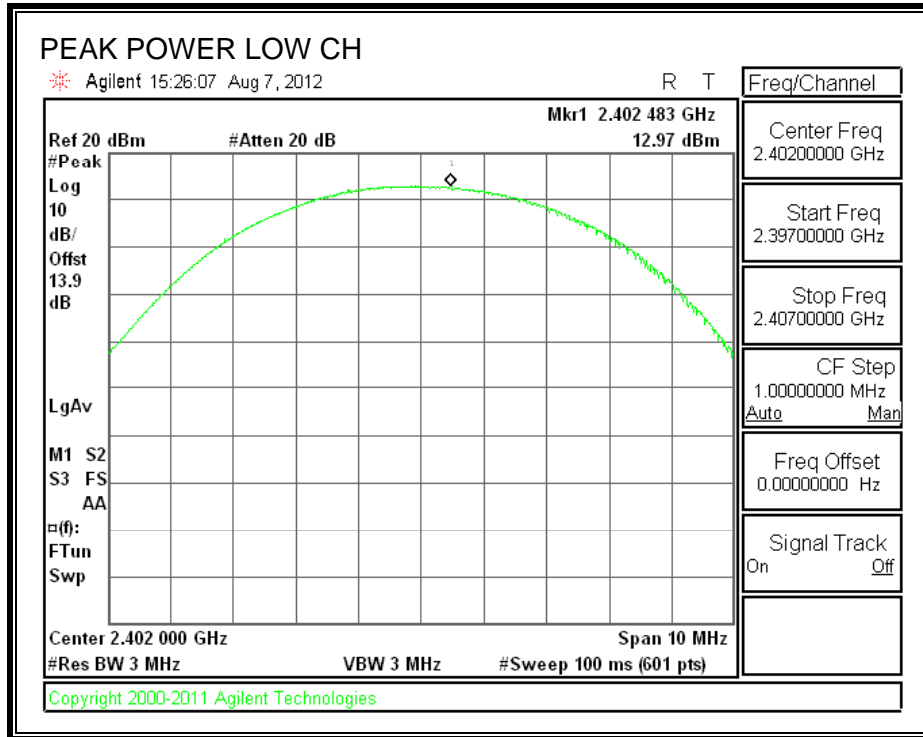
TEST PROCEDURE

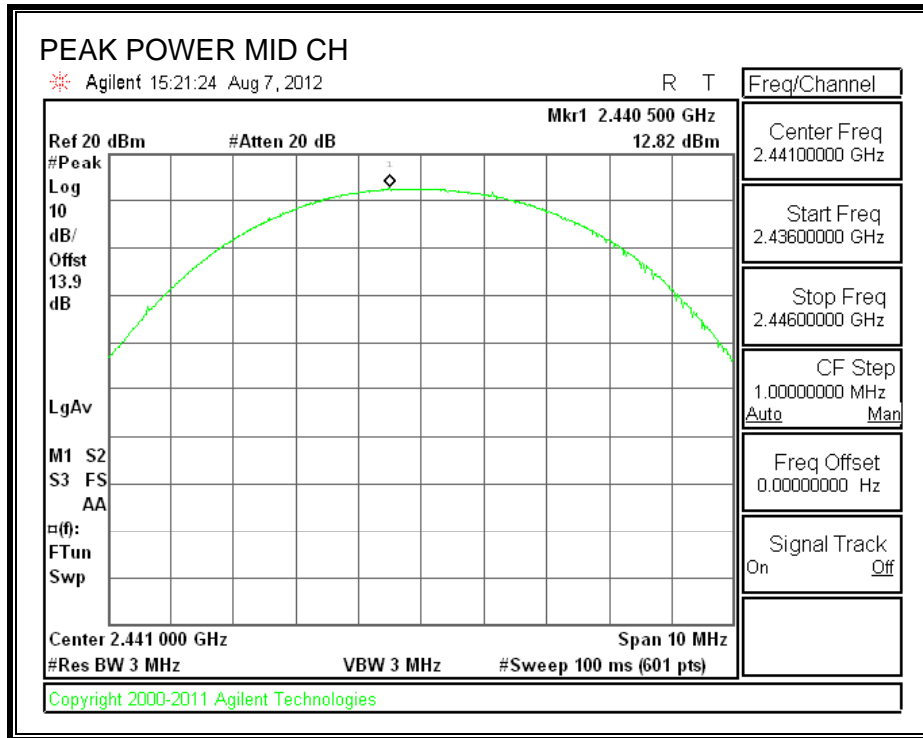
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

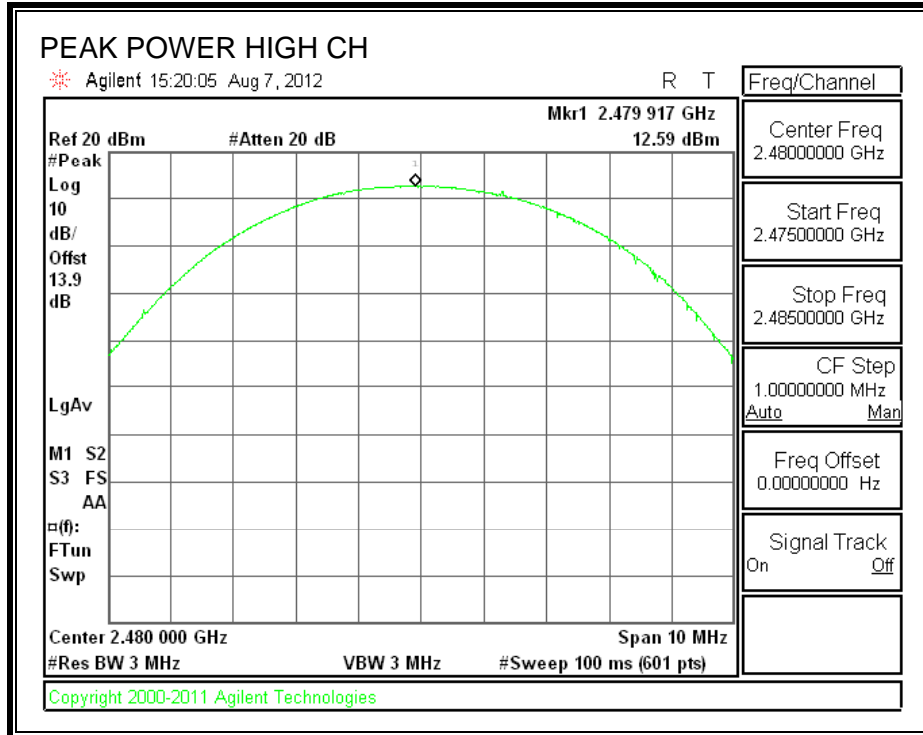
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.97	20.97	-8.00
Middle	2441	12.82	20.97	-8.15
High	2480	12.59	20.97	-8.38

OUTPUT POWER







7.3.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to Rohde & Schwarz CBT Test box.

RESULTS

The cable assembly insertion loss of 13.9 dB (including 12.5 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	10.30
Middle	2441	10.20
High	2480	10.40

7.3.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

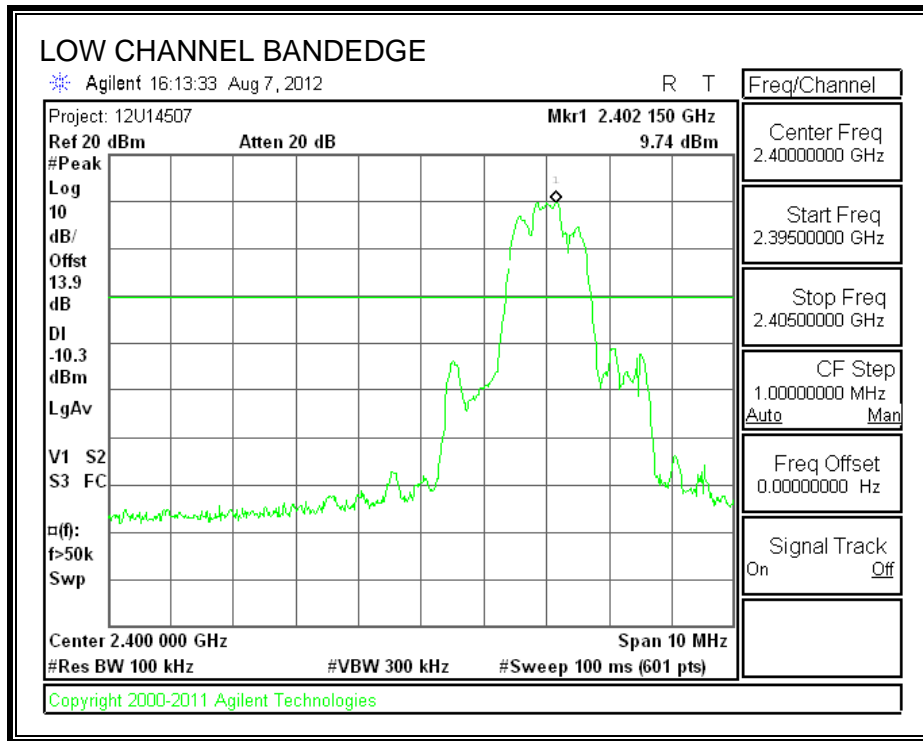
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

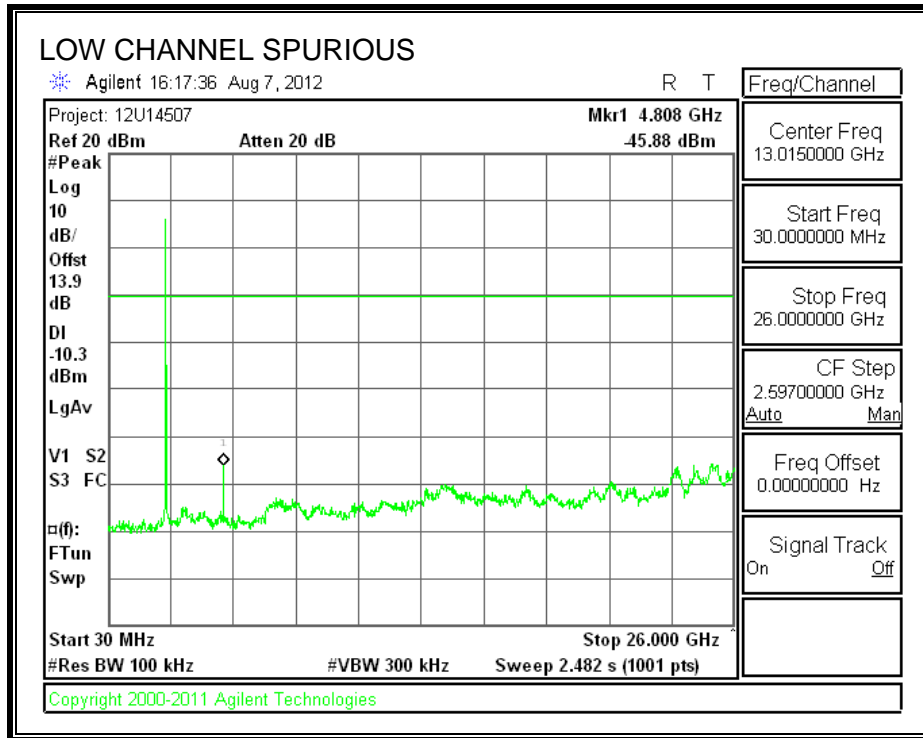
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

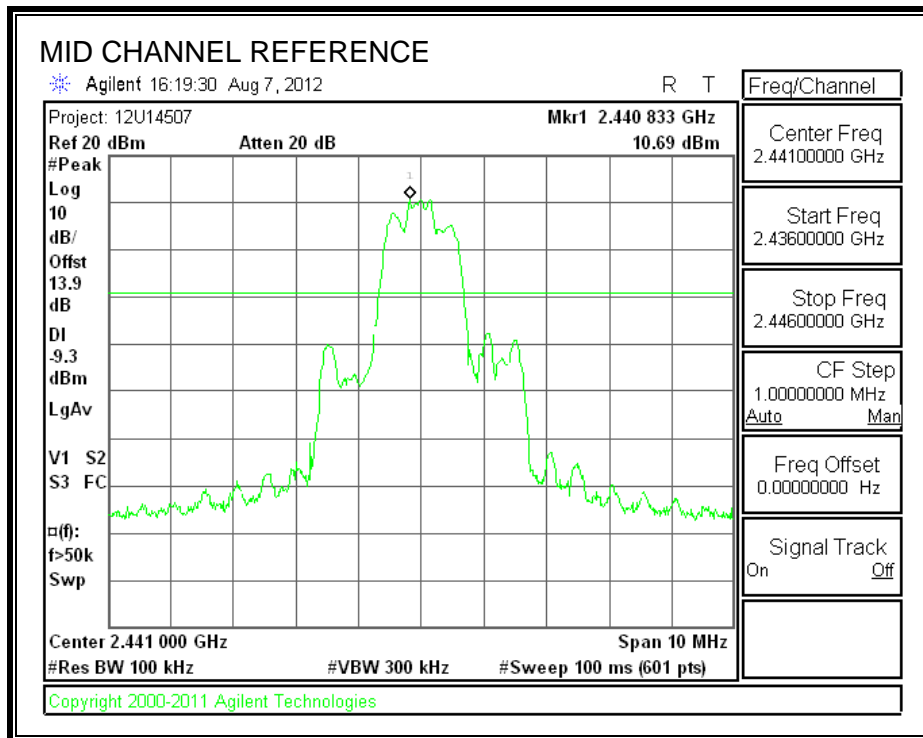
RESULTS

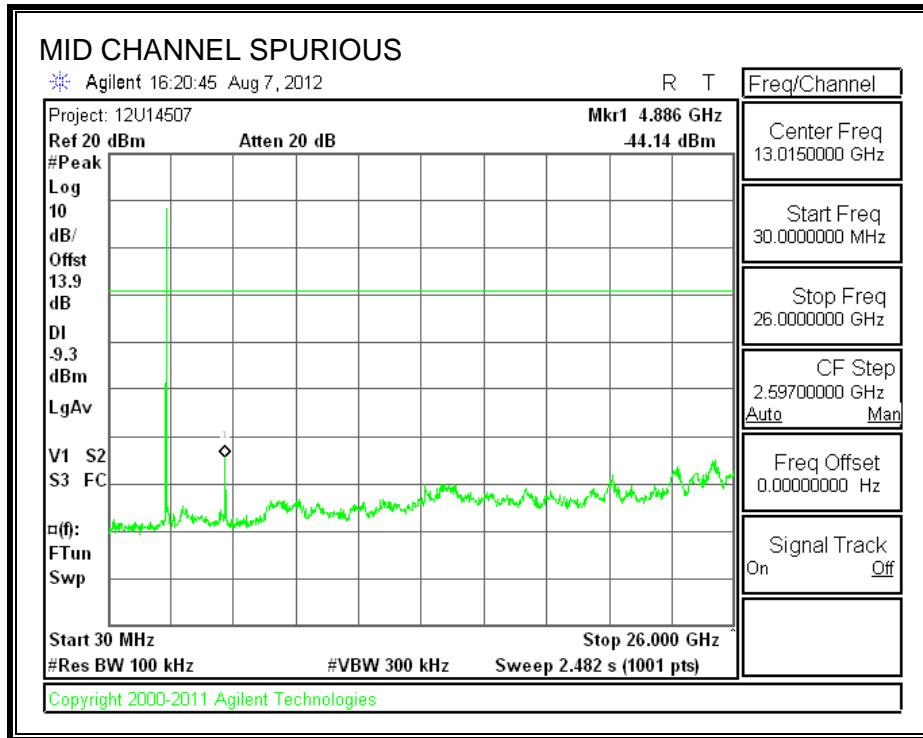
SPURIOUS EMISSIONS, LOW CHANNEL



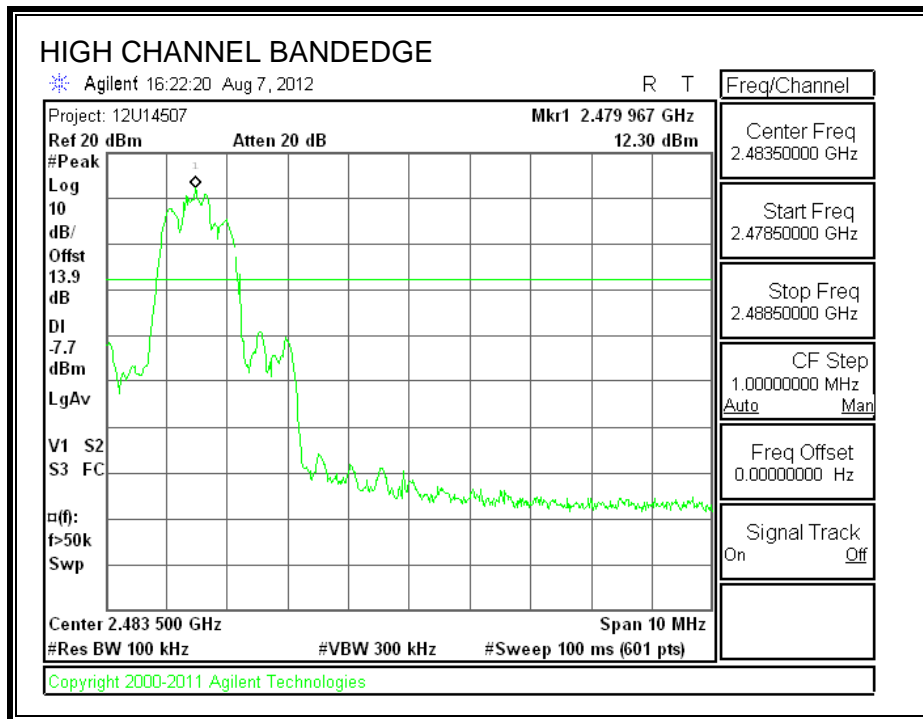


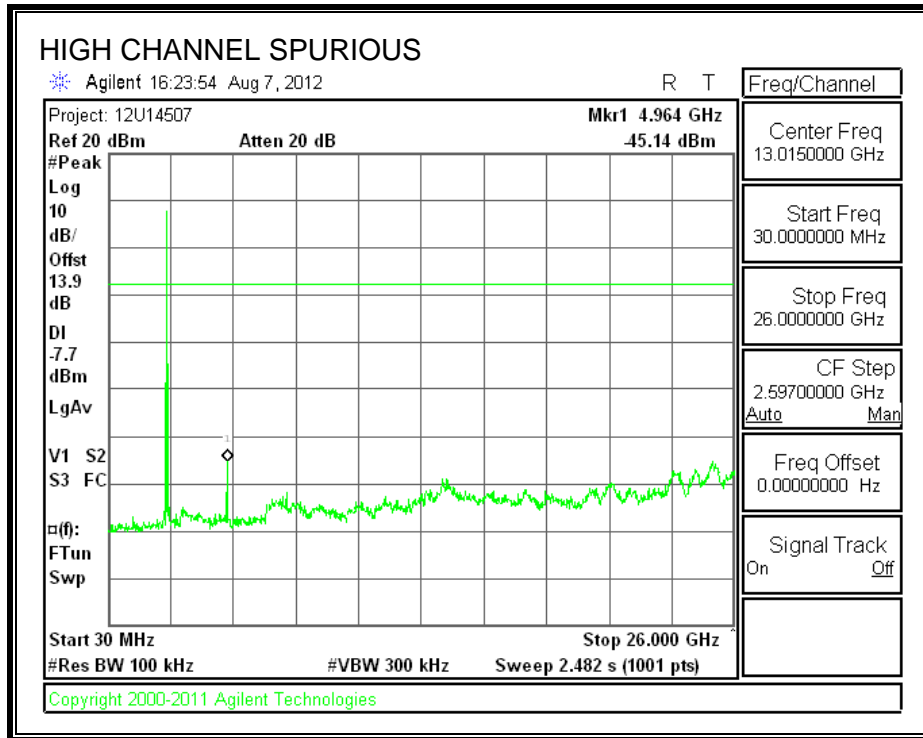
SPURIOUS EMISSIONS, MID CHANNEL



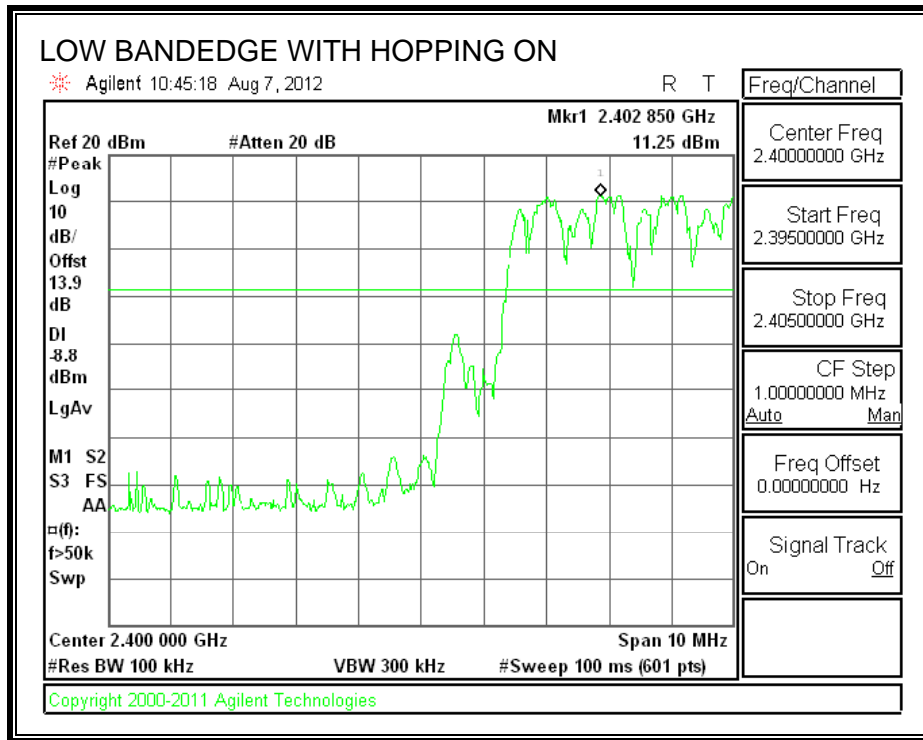


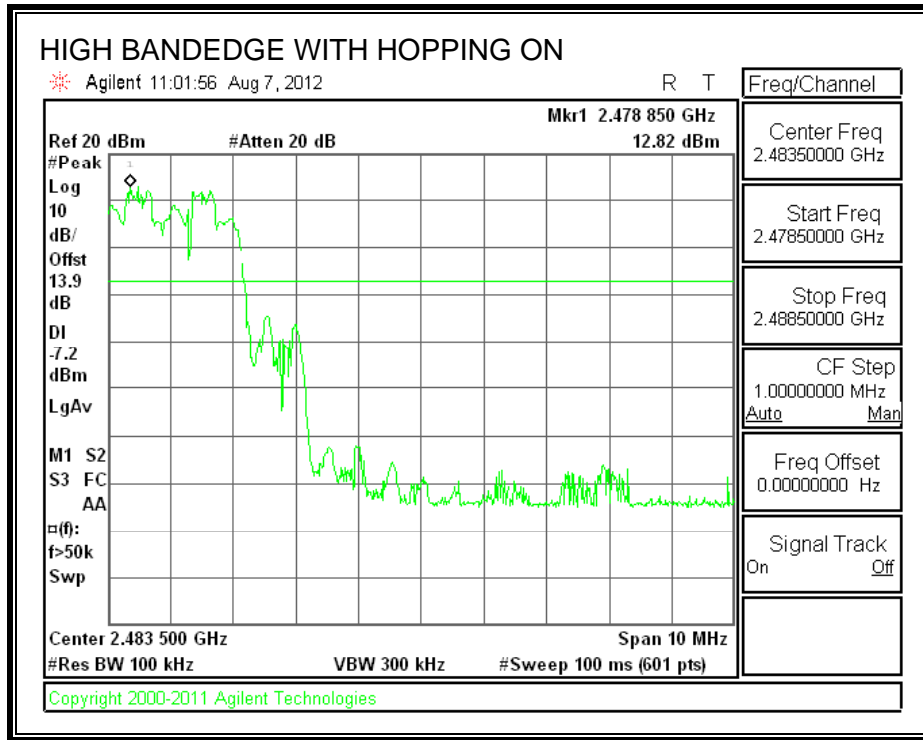
SPURIOUS EMISSIONS, HIGH CHANNEL





SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

TEST PROCEDURE

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

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

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

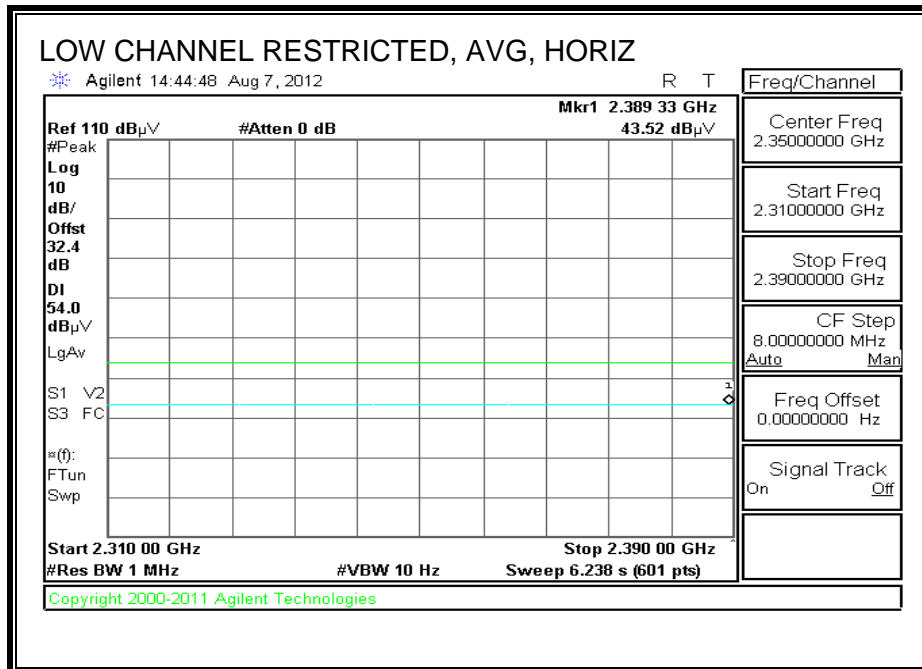
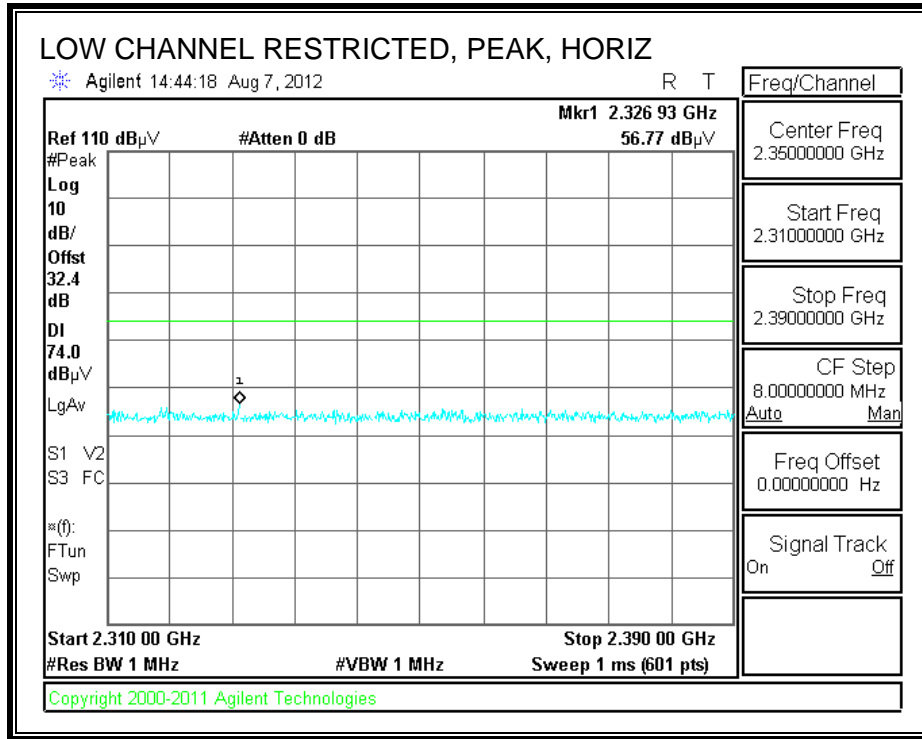
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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

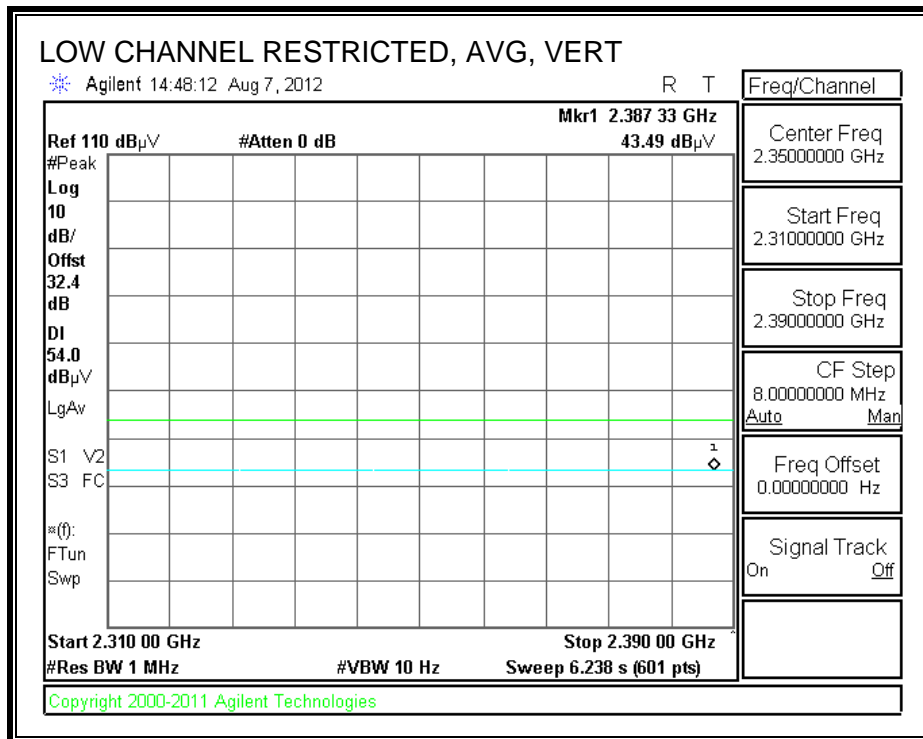
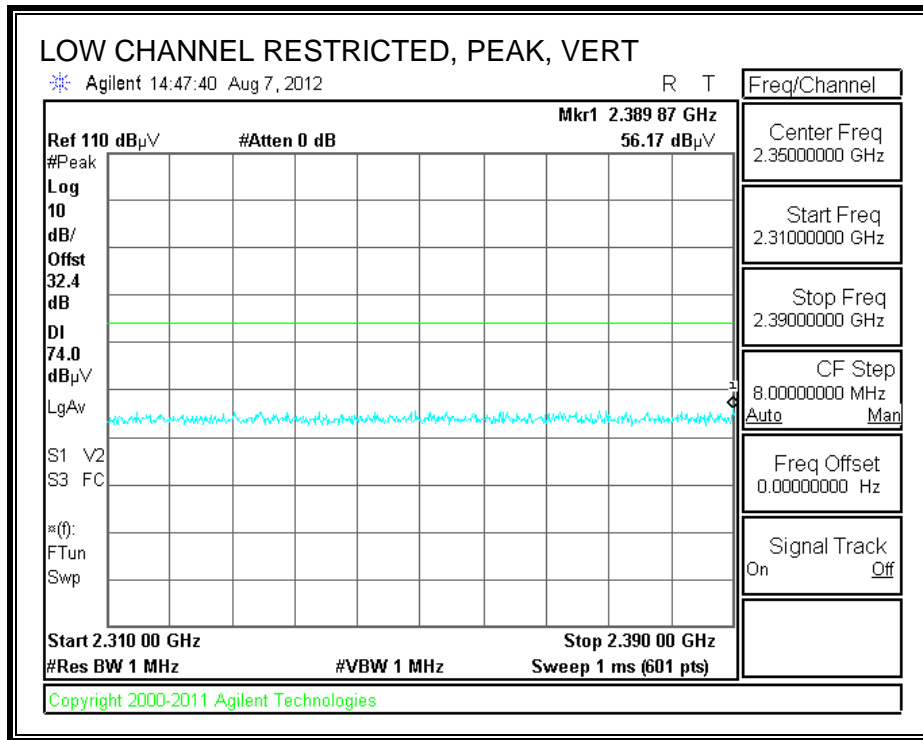
8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. BASIC DATA RATE GFSK MODULATION

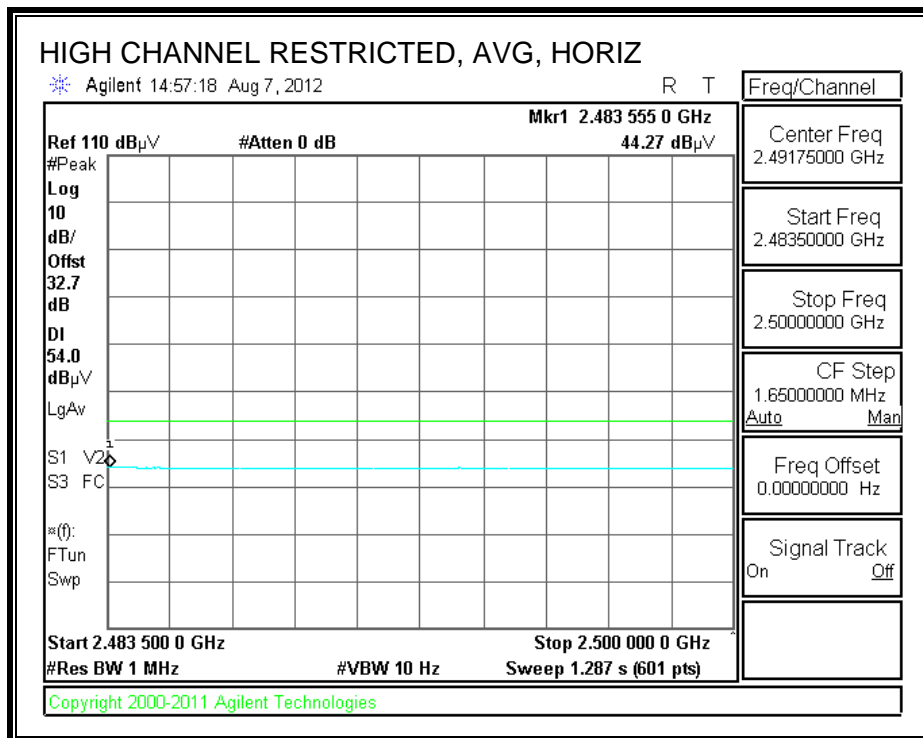
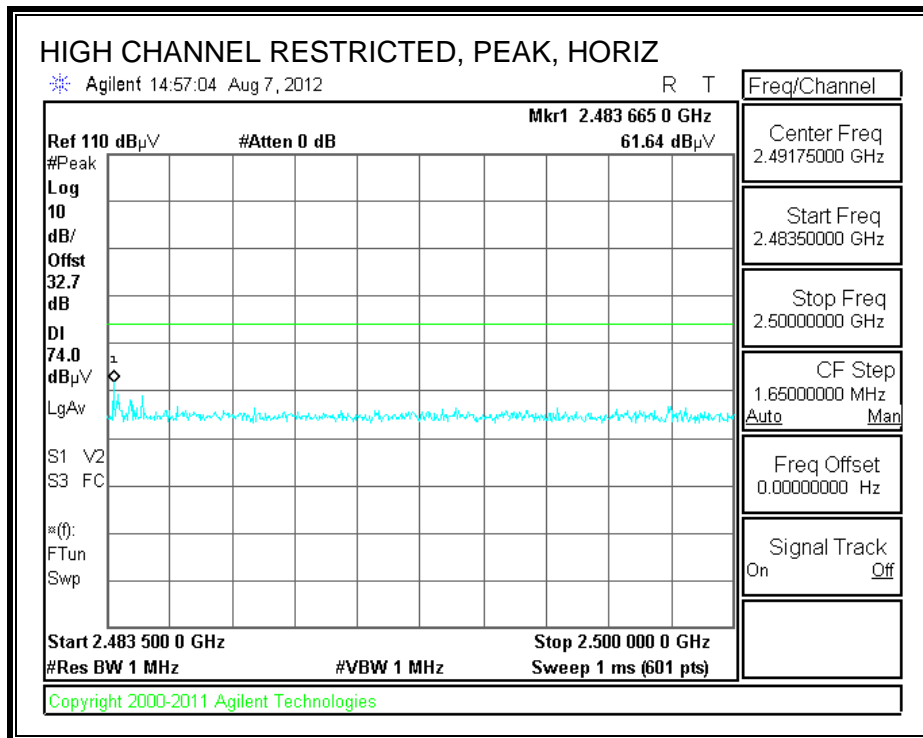
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



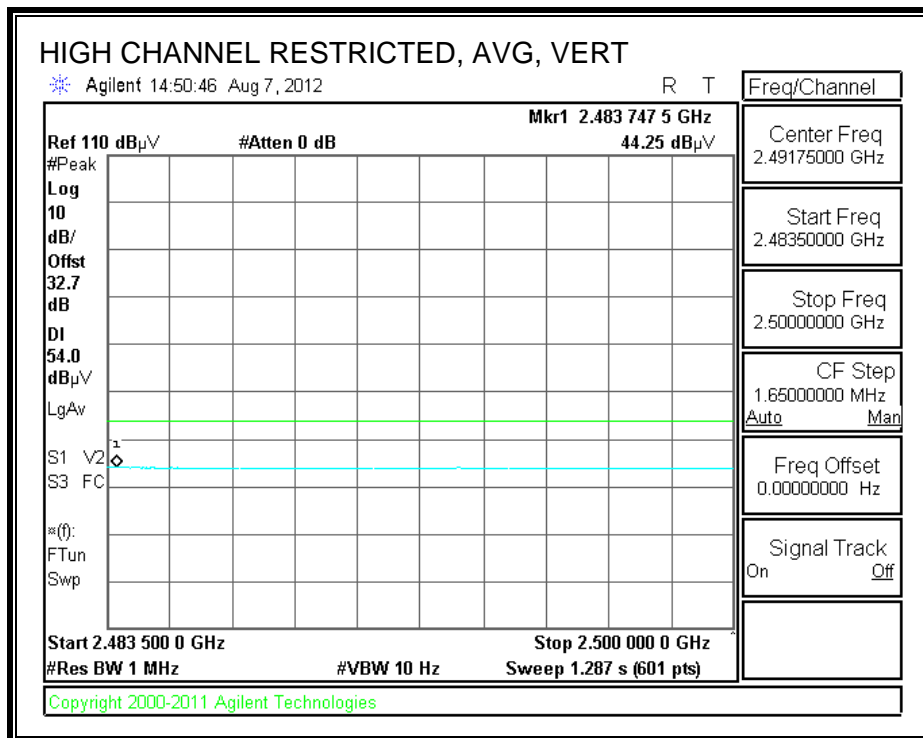
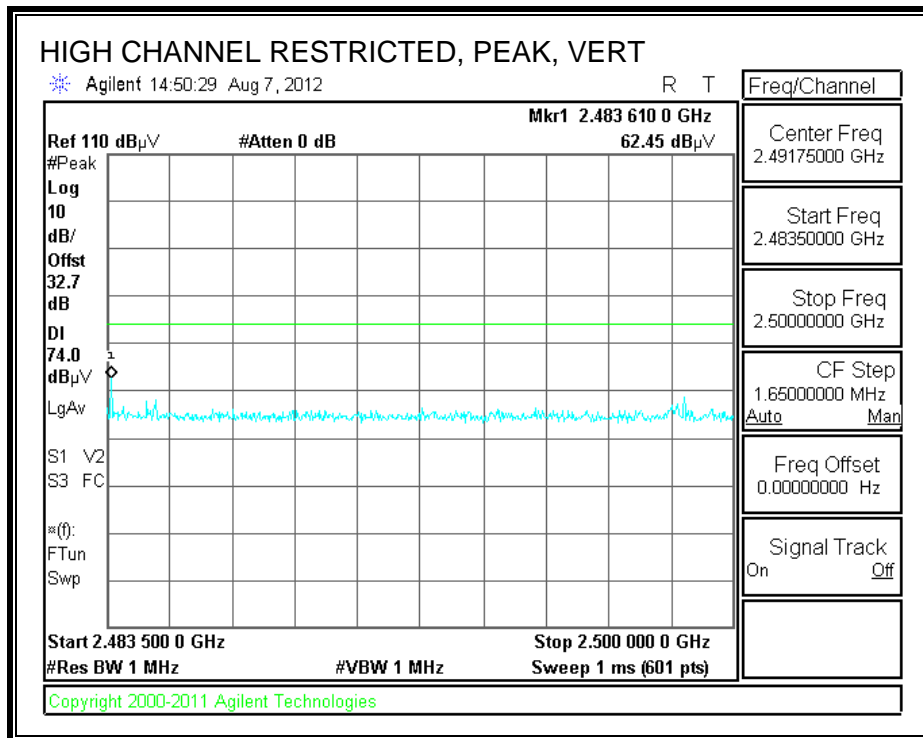
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

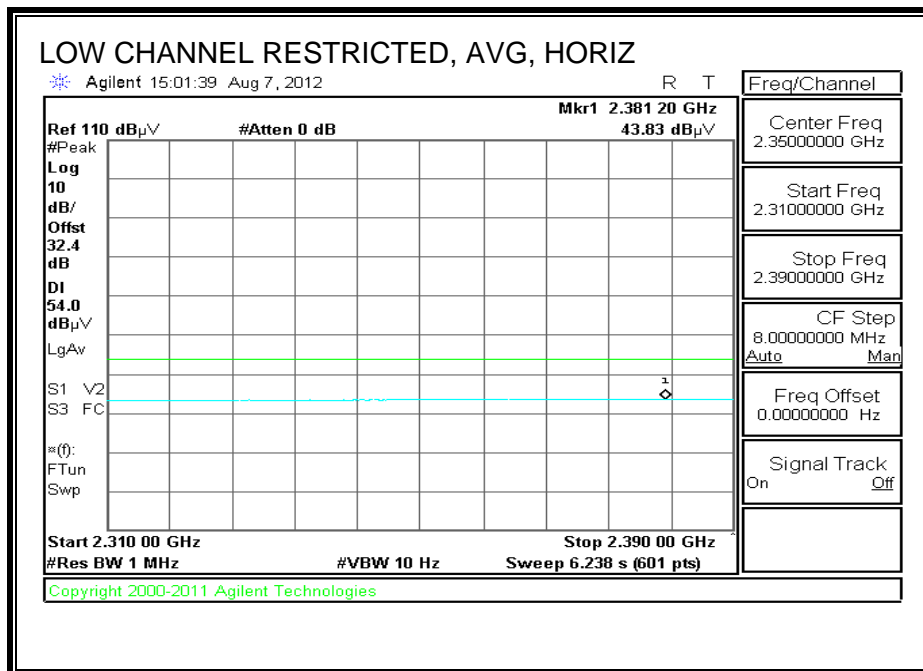
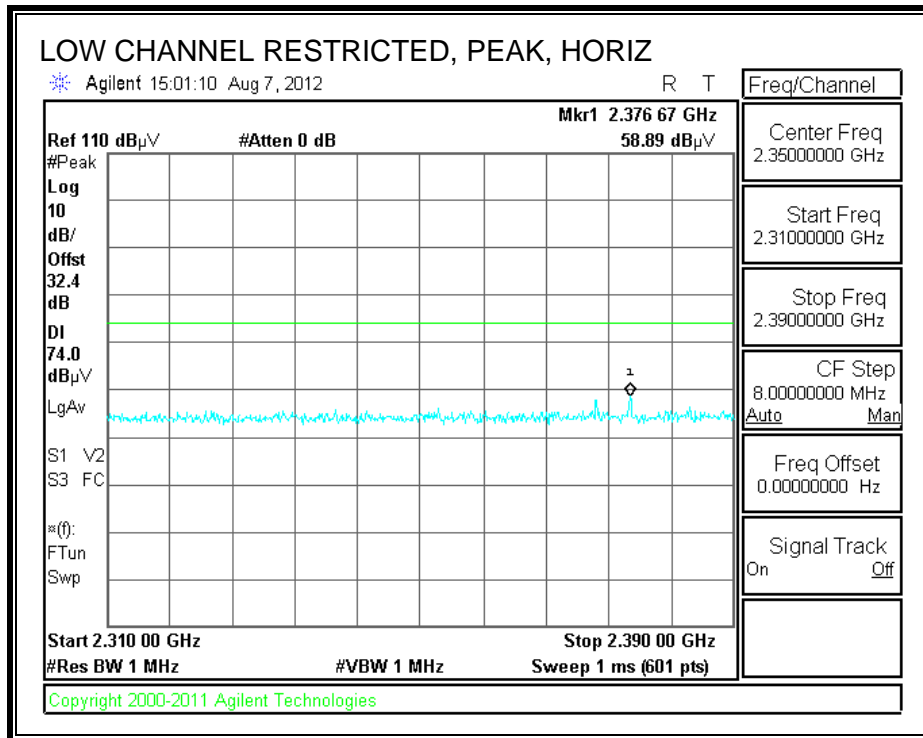


HARMONICS AND SPURIOUS EMISSIONS

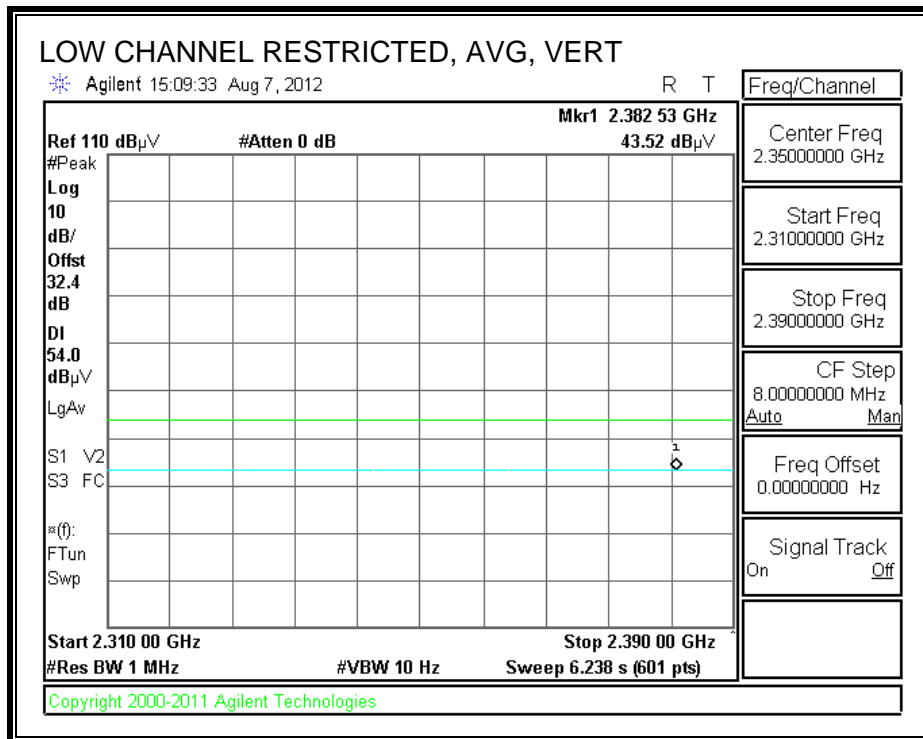
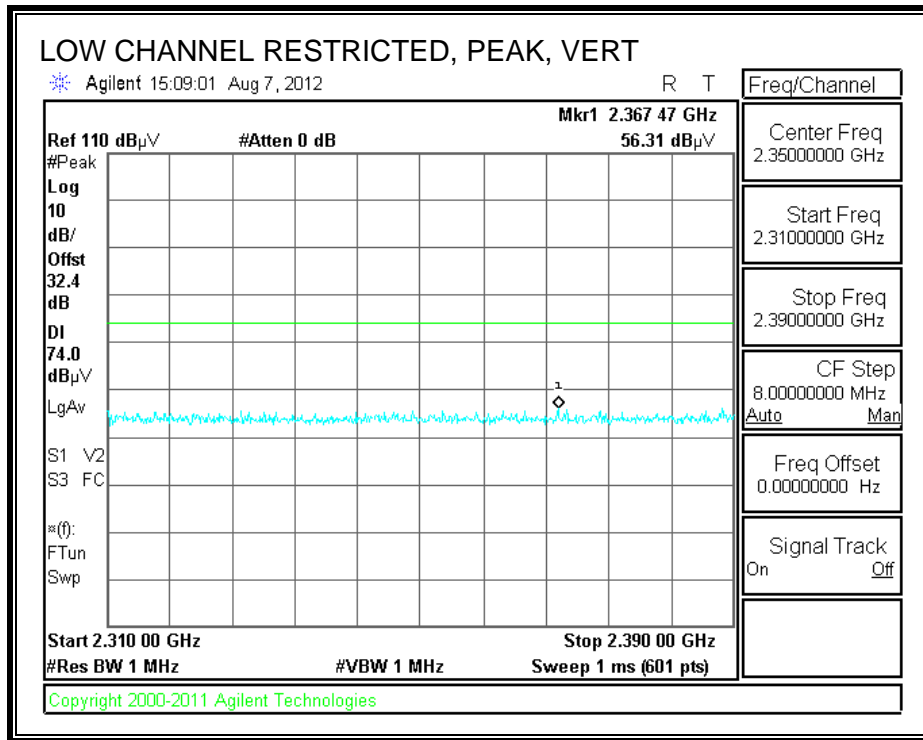
High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Chin Pang											
Date:		08/07/12											
Project #:		12U14507											
Company:		Apple											
Test Target:		FCC 15.247											
Mode Oper:		BT, GFSK											
f	Measurement Frequency	Amp	Preamp Gain					Average Field Strength Limit					
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters					Peak Field Strength Limit					
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m					Margin vs. Average Limit					
AF	Antenna Factor	Peak	Calculated Peak Field Strength					Margin vs. Peak Limit					
CL	Cable Loss	HPF	High Pass Filter										
f	Dist	Read	AF	CL	Amp	D Corr	Fltr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP	
Low Ch, 2402MHz													
4.804	3.0	50.9	33.4	6.3	-35.5	0.0	0.0	55.0	74.0	-19.0	V	P	
4.804	3.0	37.3	33.4	6.3	-35.5	0.0	0.0	41.5	54.0	-12.5	V	A	
4.804	3.0	53.0	33.4	6.3	-35.5	0.0	0.0	57.2	74.0	-16.8	H	P	
4.804	3.0	38.6	33.4	6.3	-35.5	0.0	0.0	42.8	54.0	-11.2	H	A	
Mid Ch, 2441MHz													
4.882	3.0	52.1	33.5	6.3	-35.5	0.0	0.0	56.5	74.0	-17.6	V	P	
4.882	3.0	37.9	33.5	6.3	-35.5	0.0	0.0	42.2	54.0	-11.8	V	A	
7.323	3.0	44.7	35.7	8.5	-35.4	0.0	0.0	53.5	74.0	-20.5	V	P	
7.323	3.0	32.8	35.7	8.5	-35.4	0.0	0.0	41.6	54.0	-12.4	V	A	
4.882	3.0	57.7	33.5	6.3	-35.5	0.0	0.0	62.0	74.0	-12.0	H	P	
4.882	3.0	41.1	33.5	6.3	-35.5	0.0	0.0	45.5	54.0	-8.5	H	A	
7.323	3.0	45.3	35.7	8.5	-35.4	0.0	0.0	54.2	74.0	-19.8	H	P	
7.323	3.0	33.4	35.7	8.5	-35.4	0.0	0.0	42.2	54.0	-11.8	H	A	
High Ch, 2480MHz													
4.960	3.0	52.4	33.6	6.4	-35.5	0.0	0.0	56.8	74.0	-17.2	V	P	
4.960	3.0	37.9	33.6	6.4	-35.5	0.0	0.0	42.4	54.0	-11.6	V	A	
7.440	3.0	44.8	35.9	8.5	-35.5	0.0	0.0	53.8	74.0	-20.2	V	P	
7.440	3.0	32.9	35.9	8.5	-35.5	0.0	0.0	41.9	54.0	-12.1	V	A	
4.960	3.0	52.6	33.6	6.4	-35.5	0.0	0.0	57.1	74.0	-16.9	H	P	
4.960	3.0	38.0	33.6	6.4	-35.5	0.0	0.0	42.5	54.0	-11.5	H	A	
7.440	3.0	48.9	35.9	8.5	-35.5	0.0	0.0	57.9	74.0	-16.1	H	P	
7.440	3.0	35.3	35.9	8.5	-35.5	0.0	0.0	44.3	54.0	-9.7	H	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

8.2.2. ENHANCED DATA RATE 8PSK MODULATION

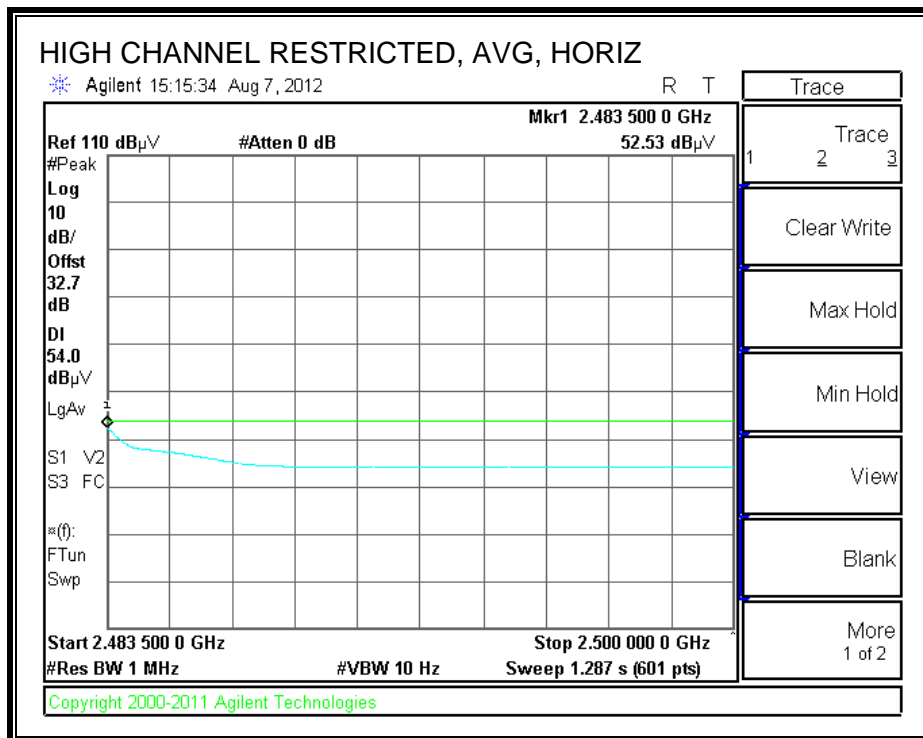
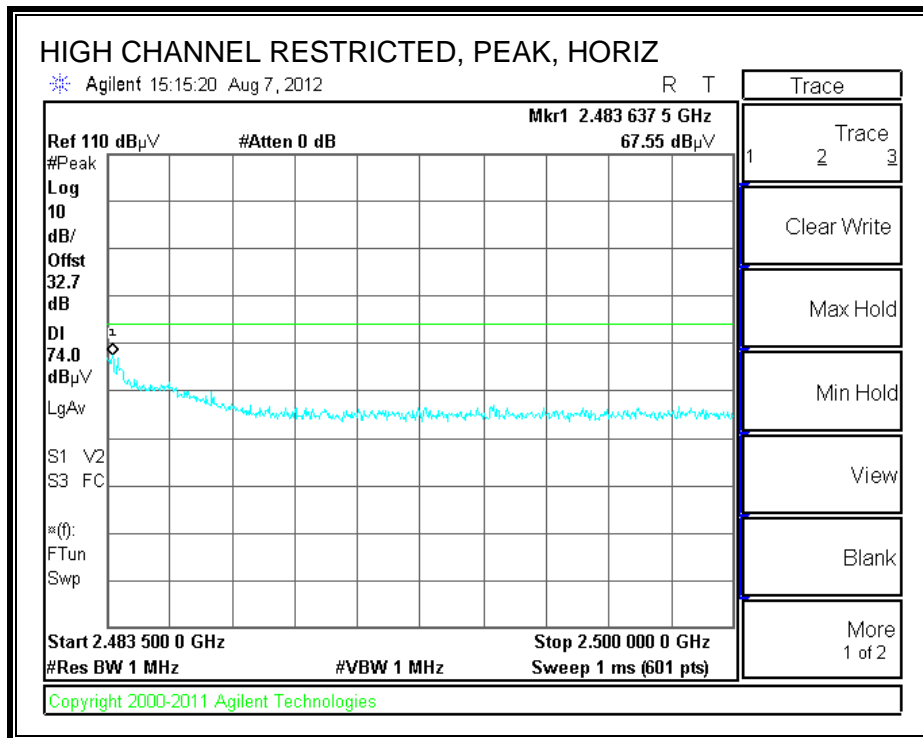
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



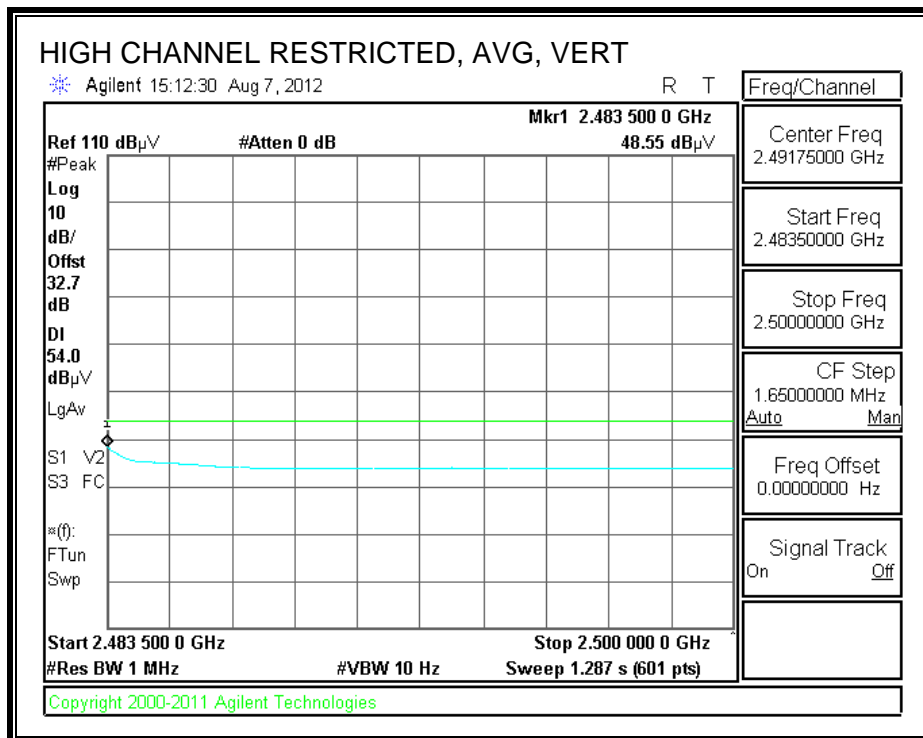
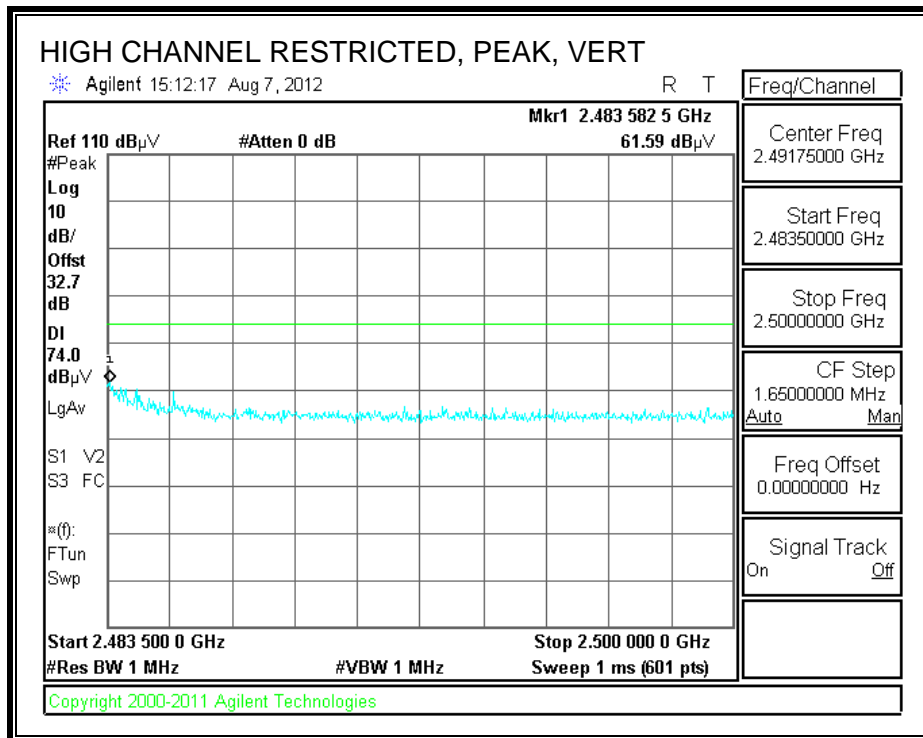
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement

Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
 Date: 08/07/12
 Project #: 12U14507
 Company: Apple
 Test Target: FCC 15.247
 Mode Oper: 8PSK, TX

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

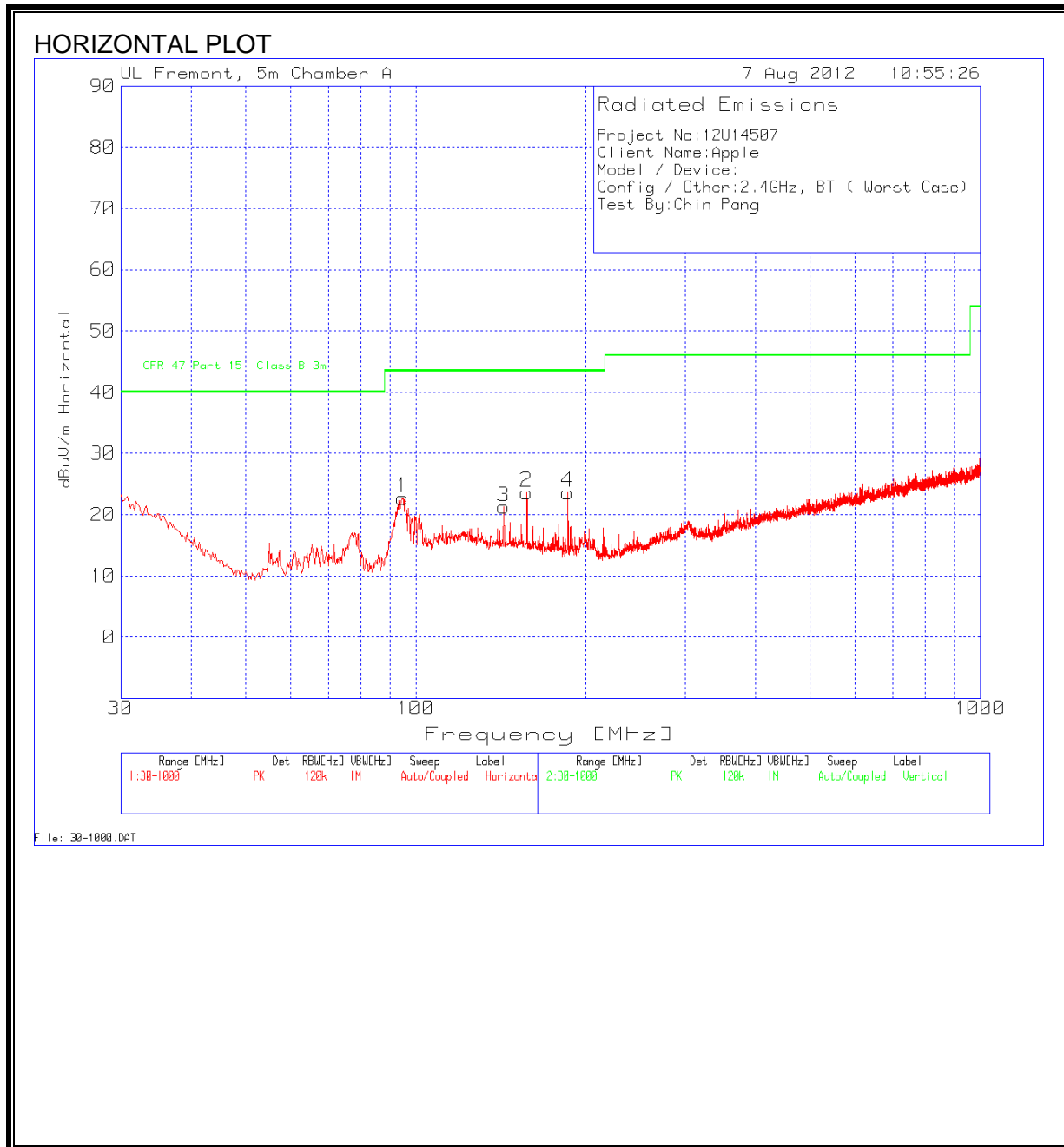
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 2402MHz													
4.804	3.0	49.2	33.4	6.3	-35.5	0.0	0.0	53.4	74.0	-20.6	V	P	
4.804	3.0	35.6	33.4	6.3	-35.5	0.0	0.0	39.8	54.0	-14.2	V	A	
4.804	3.0	54.1	33.4	6.3	-35.5	0.0	0.0	58.3	74.0	-15.7	H	P	
4.804	3.0	38.5	33.4	6.3	-35.5	0.0	0.0	42.6	54.0	-11.4	H	A	
Mid Ch, 2441MHz													
4.882	3.0	49.9	33.5	6.3	-35.5	0.0	0.0	54.3	74.0	-19.7	V	P	
4.882	3.0	36.0	33.5	6.3	-35.5	0.0	0.0	40.3	54.0	-13.7	V	A	
7.323	3.0	40.1	35.7	8.5	-35.4	0.0	0.0	48.9	74.0	-25.1	V	P	
7.323	3.0	28.1	35.7	8.5	-35.4	0.0	0.0	36.9	54.0	-17.1	V	A	
4.882	3.0	53.3	33.5	6.3	-35.5	0.0	0.0	57.7	74.0	-16.3	H	P	
4.882	3.0	37.8	33.5	6.3	-35.5	0.0	0.0	42.1	54.0	-11.9	H	A	
7.323	3.0	38.5	35.7	8.5	-35.4	0.0	0.0	47.3	74.0	-26.7	H	P	
7.323	3.0	27.6	35.7	8.5	-35.4	0.0	0.0	36.4	54.0	-17.6	H	A	
High Ch, 2480MHz													
4.960	3.0	49.8	33.6	6.4	-35.5	0.0	0.0	54.2	74.0	-19.8	V	P	
4.960	3.0	35.5	33.6	6.4	-35.5	0.0	0.0	39.9	54.0	-14.1	V	A	
7.440	3.0	41.3	35.9	8.5	-35.5	0.0	0.0	50.3	74.0	-23.7	V	P	
7.440	3.0	28.8	35.9	8.5	-35.5	0.0	0.0	37.8	54.0	-16.2	V	A	
4.960	3.0	49.1	33.6	6.4	-35.5	0.0	0.0	53.6	74.0	-20.5	H	P	
4.960	3.0	35.0	33.6	6.4	-35.5	0.0	0.0	39.5	54.0	-14.5	H	A	
7.440	3.0	45.1	35.9	8.5	-35.5	0.0	0.0	54.1	74.0	-19.9	H	P	
7.440	3.0	31.1	35.9	8.5	-35.5	0.0	0.0	40.1	54.0	-13.9	H	A	

Rev. 4.1.2.7

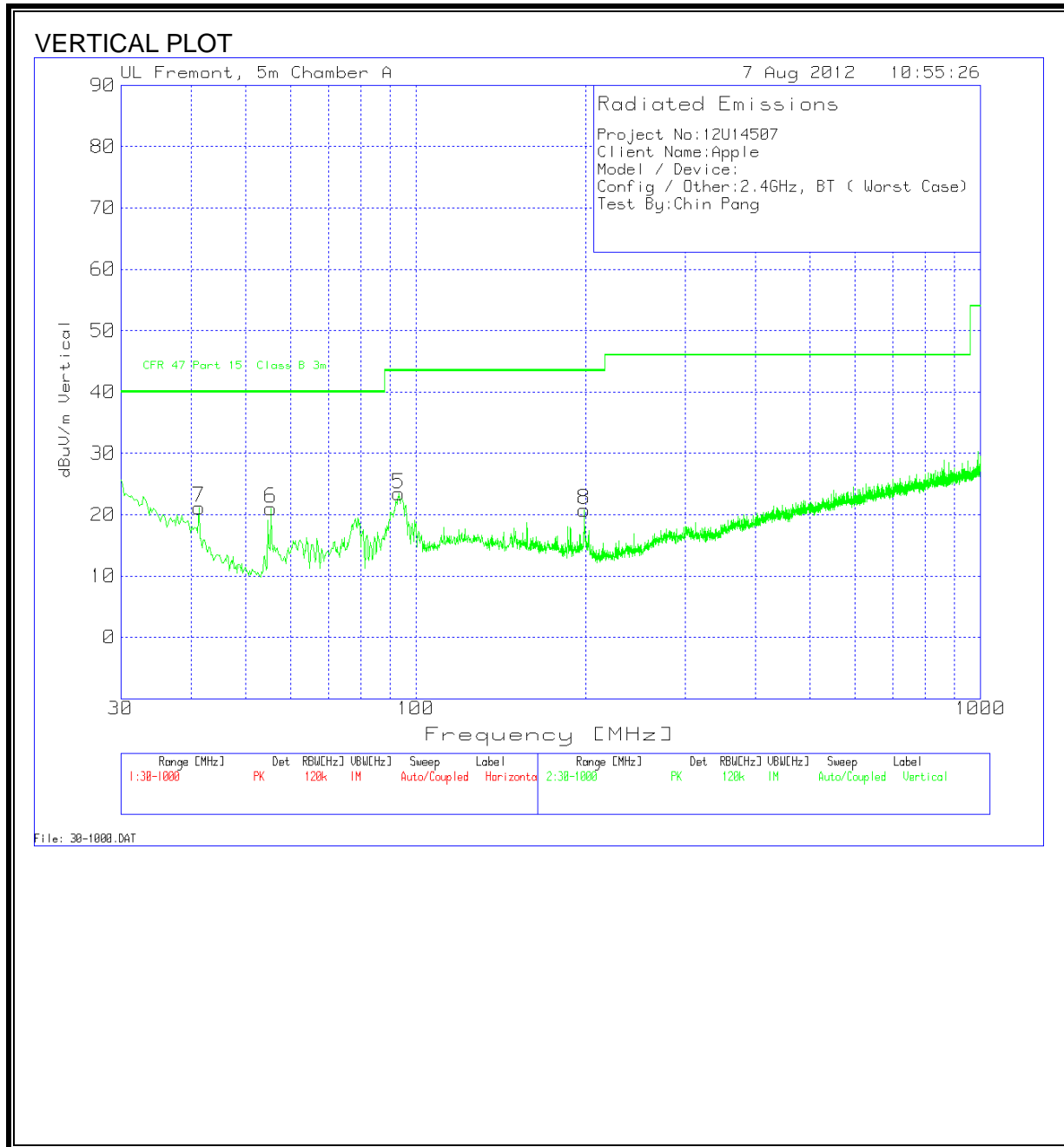
Note: No other emissions were detected above the system noise floor.

8.3. WORST-CASE BELOW 1 GHz

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



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



HORIZONTAL AND VERTICAL DATA

Project No:12U14507								
Client Name:Apple								
Model / Device:								
Config / Other:2.4GHz, BT (Worst Case)								
Test By:Chin Pang								

Horizontal 30 - 1000MHz

Test Freq	Meter Rea	Detector	25MHz-1G	T243	Suno	dBuV/m	CFR 47 Par	Margin	Polarity
94.9381	40.85	PK	-27	8.8	22.65	43.5	-20.85	Horz	
157.3561	38.12	PK	-26.5	12	23.62	43.5	-19.88	Horz	
143.0116	35.22	PK	-26.6	12.6	21.22	43.5	-22.28	Horz	
186.0452	38.83	PK	-26.4	11.2	23.63	43.5	-19.87	Horz	

Vertical 30 - 1000MHz

Test Freq	Meter Rea	Detector	25MHz-1G	T243	Suno	dBuV/m	CFR 47 Par	Margin	Polarity
93.3873	42.01	PK	-27	8.4	23.41	43.5	-20.09	Vert	
55.3937	41.27	PK	-27.3	7.1	21.07	40	-18.93	Vert	
41.243	35.44	PK	-27.4	13.1	21.14	40	-18.86	Vert	
199.0328	34.82	PK	-26.2	12.2	20.82	43.5	-22.68	Vert	

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

*Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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

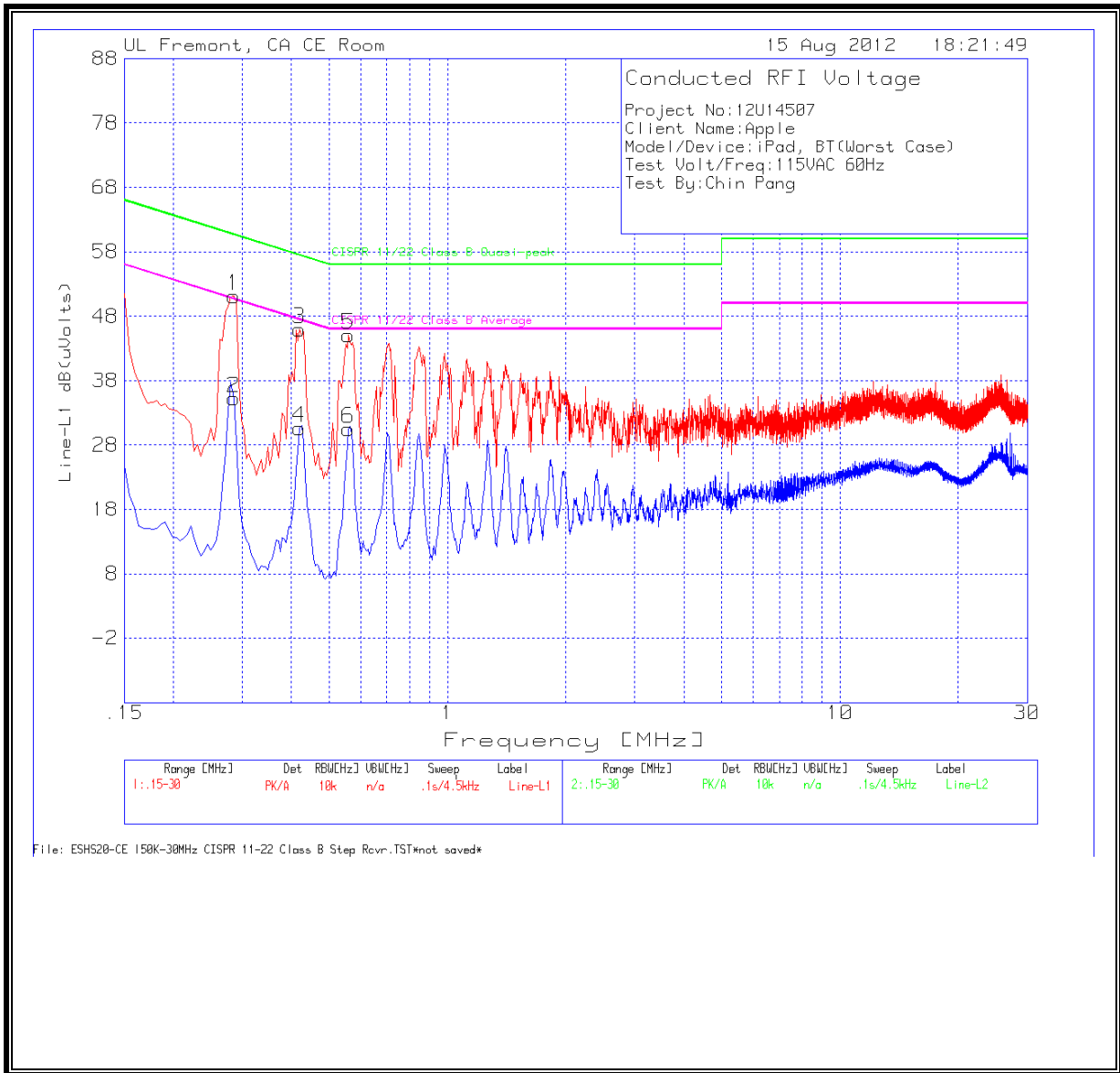
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

6 WORST EMISSIONS

Project No:12U14507									
Client Name:Apple									
Model/Device:iPad, BT(Worst Case)									
Test Volt/Freq:115VAC 60Hz									
Test By:Chin Pang									
Line-L1 .15 - 30MHz									
Frequency	Reading	Detector	T24 IL L1.	LC Cables	dB(uVolts	CISPR B Q-p	Margin	CISPR B Avg	Margin
0.285	51.08	PK	0.1	0	51.18	60.7	-9.52	-	-
0.285	35.11	Av	0.1	0	35.21	-	-	50.7	-15.49
0.42	45.81	PK	0.1	0	45.91	57.4	-11.49	-	-
0.42	30.55	Av	0.1	0	30.65	-	-	47.4	-16.75
0.5595	44.96	PK	0.1	0	45.06	56	-10.94	-	-
0.5595	30.41	Av	0.1	0	30.51	-	-	46	-15.49
Line-L2 .15 - 30MHz									
Frequency	Reading	Detector	T24 IL L1.	LC Cables	dB(uVolts	CISPR B Q-p	Margin	CISPR B Avg	Margin
0.2805	51.45	PK	0.1	0	51.55	60.8	-9.25	-	-
0.2805	37.51	Av	0.1	0	37.61	-	-	50.8	-13.19
0.411	46.23	PK	0.1	0	46.33	57.6	-11.27	-	-
0.411	23.57	Av	0.1	0	23.67	-	-	47.6	-23.93
0.5595	45.68	PK	0.1	0	45.78	56	-10.22	-	-
0.5595	29.37	Av	0.1	0	29.47	-	-	46	-16.53

LINE 1 RESULTS



LINE 2 RESULTS

