



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

BLUETHOOOTH CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n and Bluetooth Audio /Video Device

MODEL NUMBER: W2

**FCC ID: A4R-W2
IC: 10395A-W2**

REPORT NUMBER: 14U17400-4 Revision A

ISSUE DATE: June 10, 2014

Prepared for
GOOGLE
1600 AMPHITHEATRE PARKWAY
MOUNTAIN VIEW
CA, 94043, US

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	4-28-14	Initial Issue	F.de Anda
A	6-10-14	Update to antenna gain to 3.6 dBi	F.de Anda

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: GOOGLE
1600 AMPHITHEATRE PARKWAY
MOUNTAIN VIEW, CA, 94043 US

EUT DESCRIPTION: 802.11a/b/g/n and Bluetooth Audio /Video Device

MODEL: W2

SERIAL NUMBER: Conducted: AD3Z1410029F
Radiated: AD3Z141002FC

DATE TESTED: April 2 to April 11, 2014

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 Verification Services Inc. 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 Verification Services Inc. 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.

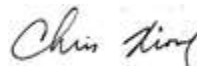
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 Verification Services Inc. By:



FRANCISCO DE ANDA
PROJECT LEAD
UL Verification Services Inc.

Tested By:



CHRIS XIONG
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

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

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input checked="" type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input checked="" type="checkbox"/> Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

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:

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

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 an Access Point(AP) set top box device that supports WLAN, Bluetooth and 4k media.

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	5.69	3.71
2402 - 2480	Enhanced 8PSK	7.59	5.74

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of 3.6 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed in the HOST/SUPPORT equipment during testing was DUT LabTool Version 1.0.8.26.

The test utility software used during testing was WIFI Tool Version 1.0.8.

5.5. WORST-CASE CONFIGURATION AND MODE

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

The EUT was investigated in its normal operation position (X), all final radiated testing was performed with the EUT in this orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	LENOVO	Thinkpad	R8-PCNFE	NA
AC-DC Adapter	LENOVO	42T4428	11S42T4428Z1ZF3G98A2Y7	DoC
Laptop MacBook Pro	APPLE	A1286	187512	DoC
AC-DC Adapter	APPLE	A1343	C0411820C6XDJ92AF	DoC

I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	3 prong	UN-Shielded	1.8	None
2	DC	1	Barrel	UN-Shielded	1.5	None
3	DC	1	Barrel	UN-Shielded	1.5	None
4	USB Splitter Cable	1	Mini-USB	Shielded	1	N/A
5	Ethernet	1	CAT5	UN-Shielded	1	N/A

TEST SETUP

The EUT is connected to host laptop computers via LAN port and USB port, and setup to transmit continuously.

SETUP DIAGRAM FOR CONDUCTED PORT TESTS

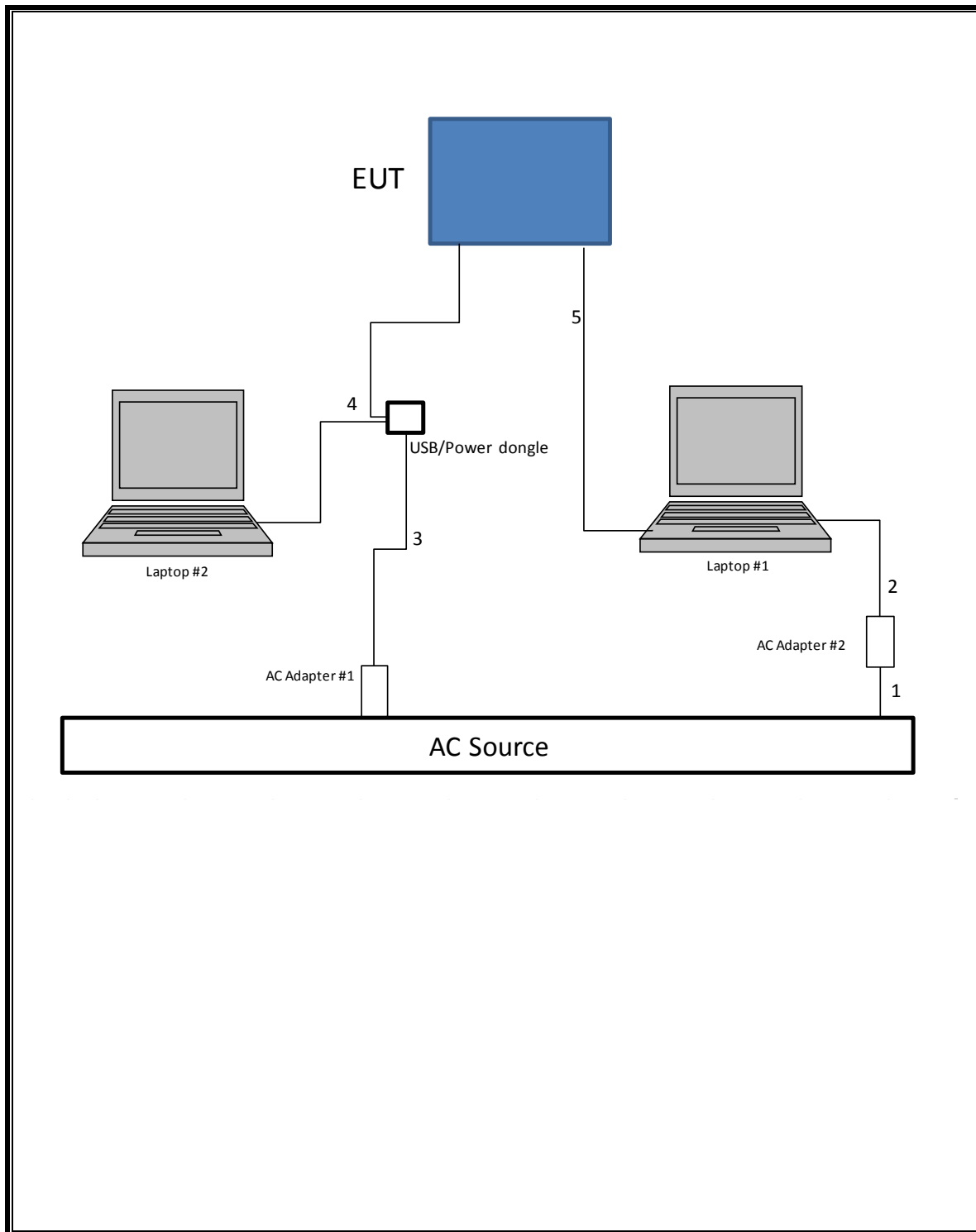
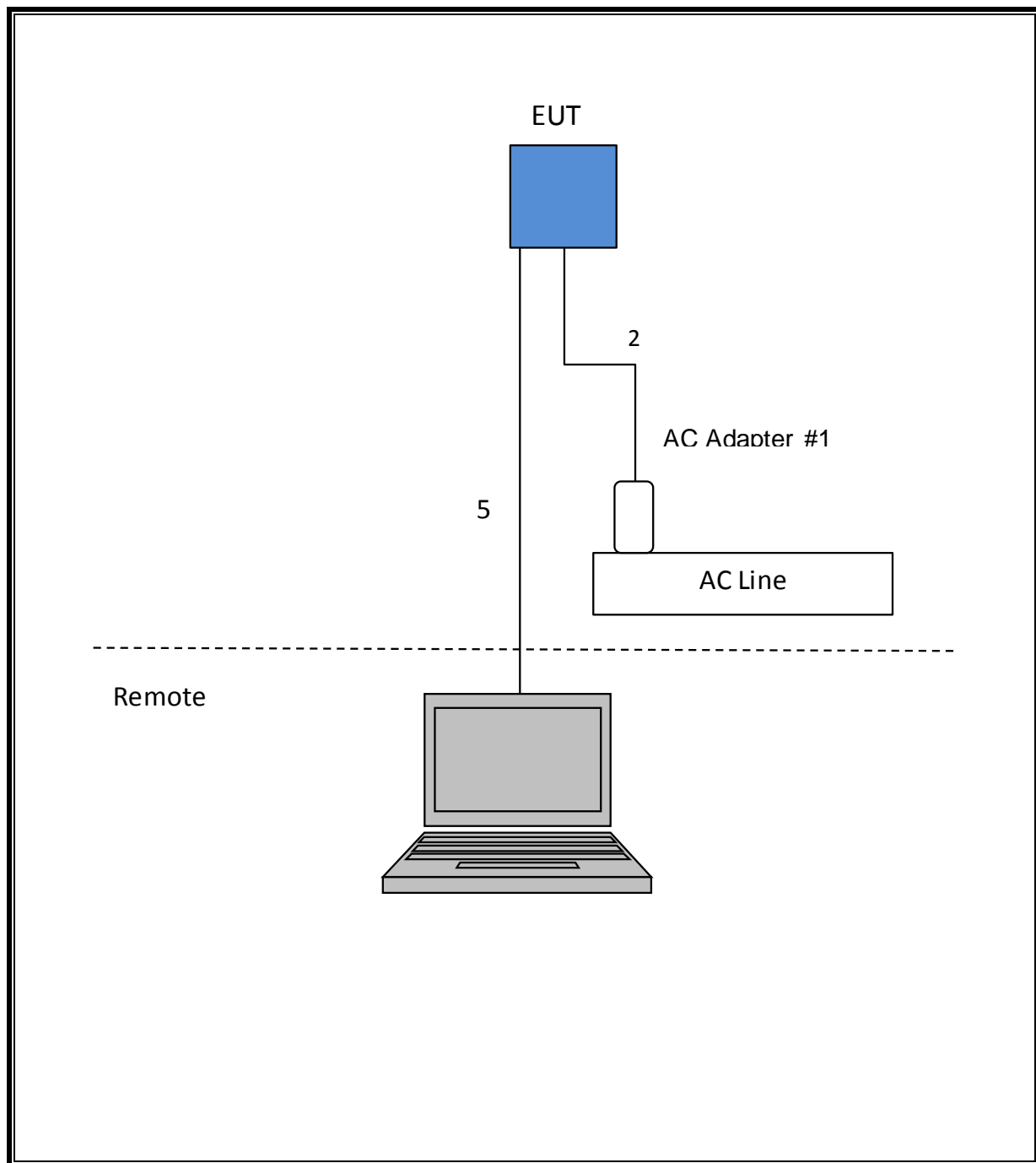


DIAGRAM FOR LINE CONDUCTED TESTS



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
PXA Signal Analyzer	Agilent	N9030A-544	RENTAL	05/10/14
Single Channel PK Power Meter	Agilent	N1911A	F00024	03/07/15
Wideband Power Sensor, 30MHz vide	Agilent	N1921A	F00358	03/10/15
Spectrum Analyzer	Agilent	N9030A	F00128	03/12/15
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	C01011	04/28/14
Antenna, Horn, 18GHz	ETS Lindgren	3117	--	06/24/14
Preamplifier, 1000MHz	Sonoma	310N	N02891	12/30/14
RF PreAmplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	F00354	08/24/14
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/17/15
EMI Test Receiver, 30 MHz	R & S	ESHS20	N02396	08/15/14
High Pass Filter, fc: 3.0GHz, 50 Ohms	Micro-Tronics	HPM17543	F00181	08/24/14
Low Pass Filter, fc: 5GHz, 50 Ohms	Micro-Tronics	LPS17541	F00175	08/24/14
High Pass Filter, fc: 6GHz, 50 Ohms	Micro-Tronics	HPS17542	F00179	08/24/14

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.

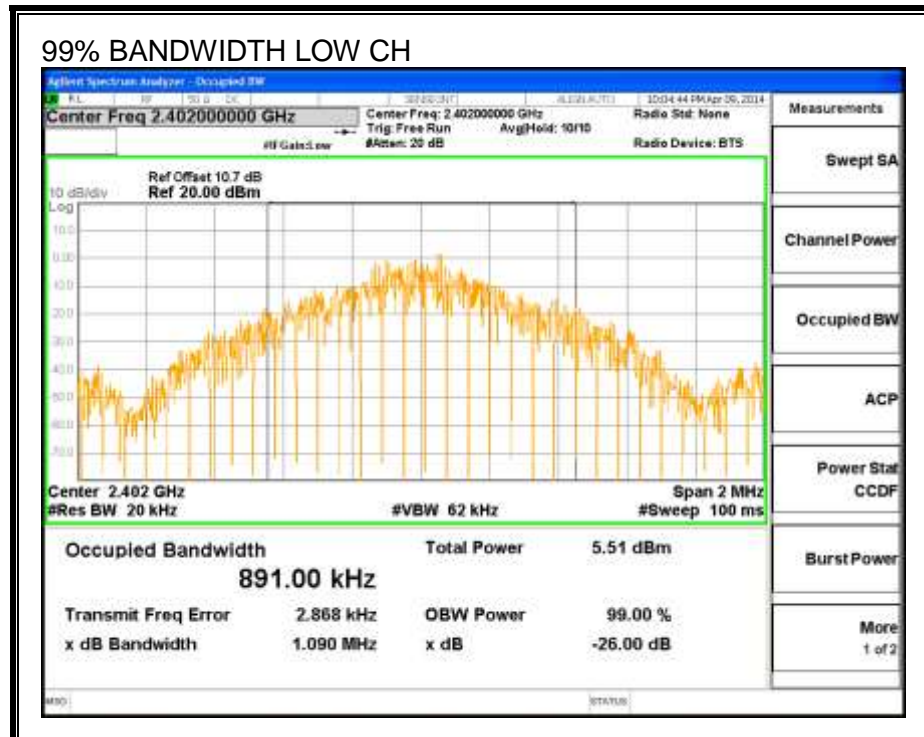
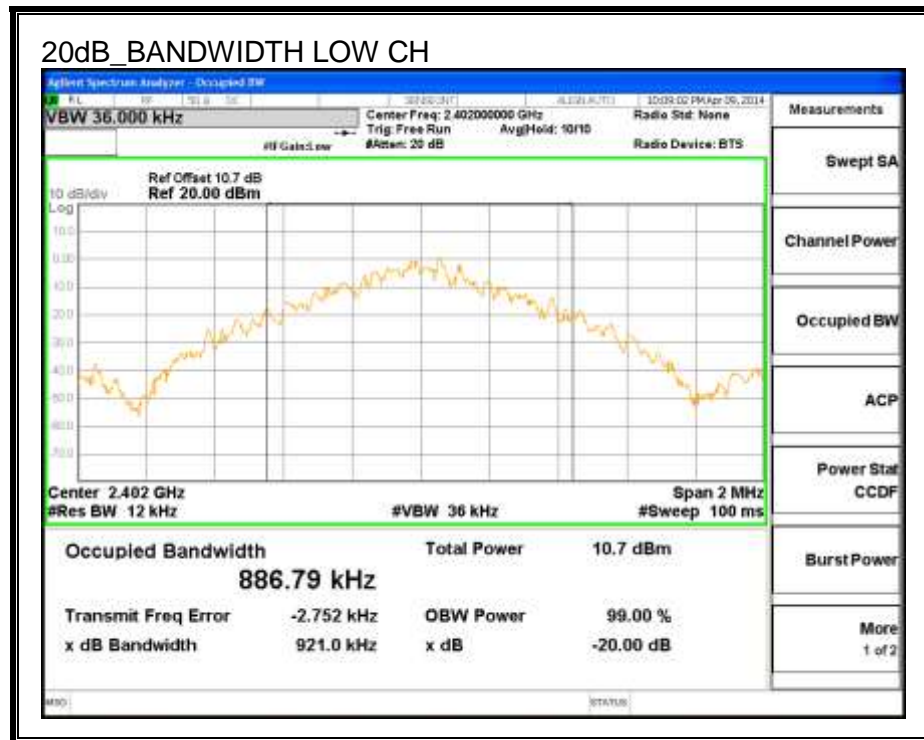
TEST PROCEDURE

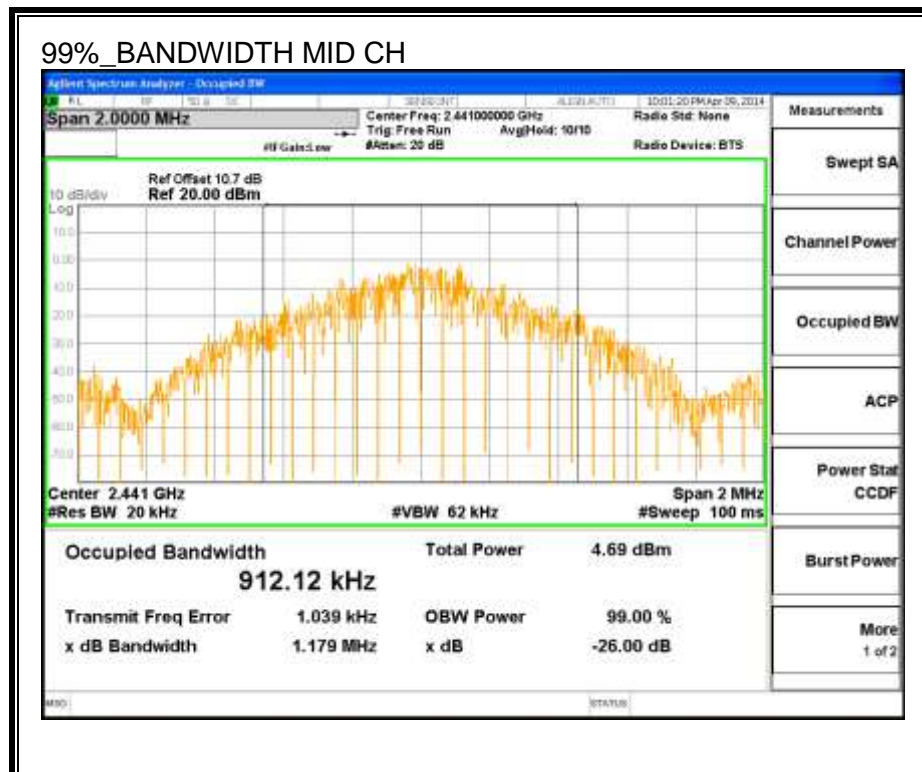
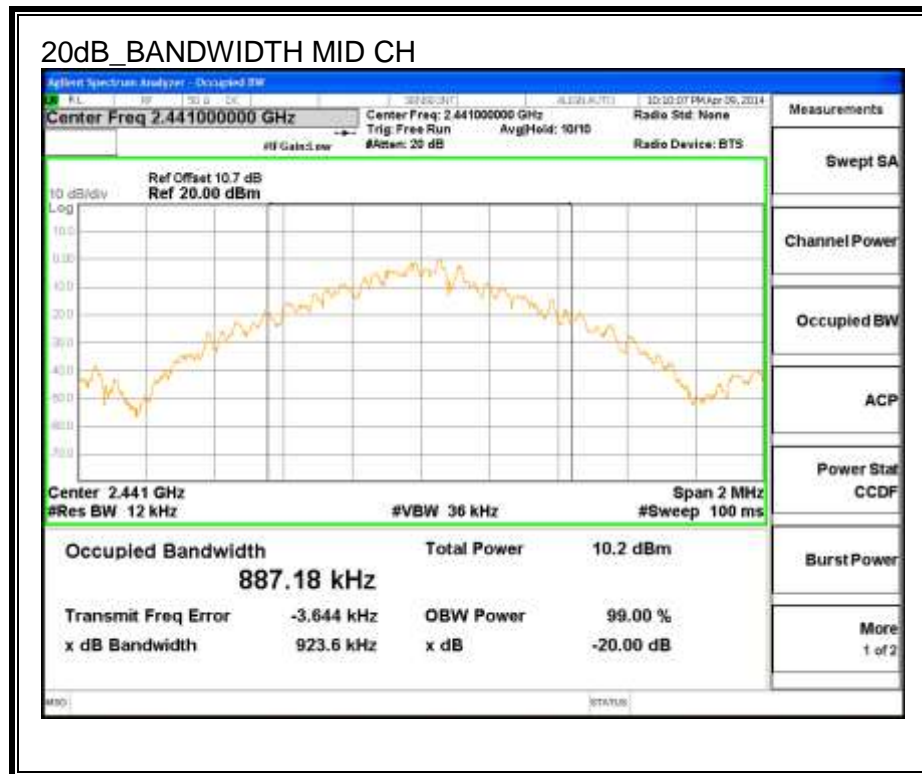
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

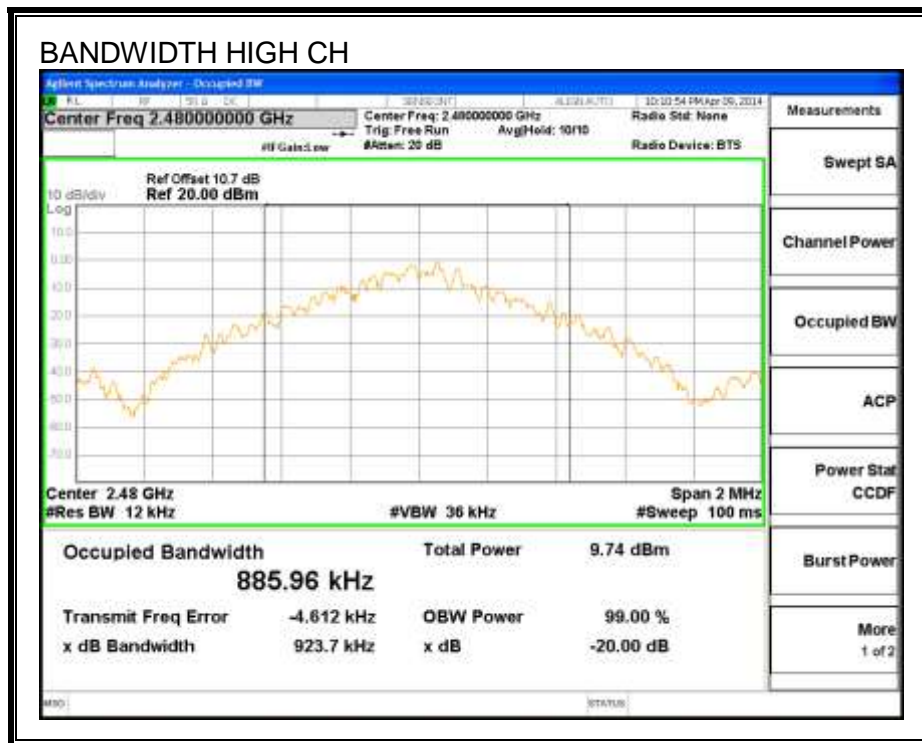
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	921.00	891.00
Middle	2441	923.60	912.12
High	2480	885.96	892.10

20 dB AND 99% BANDWIDTH

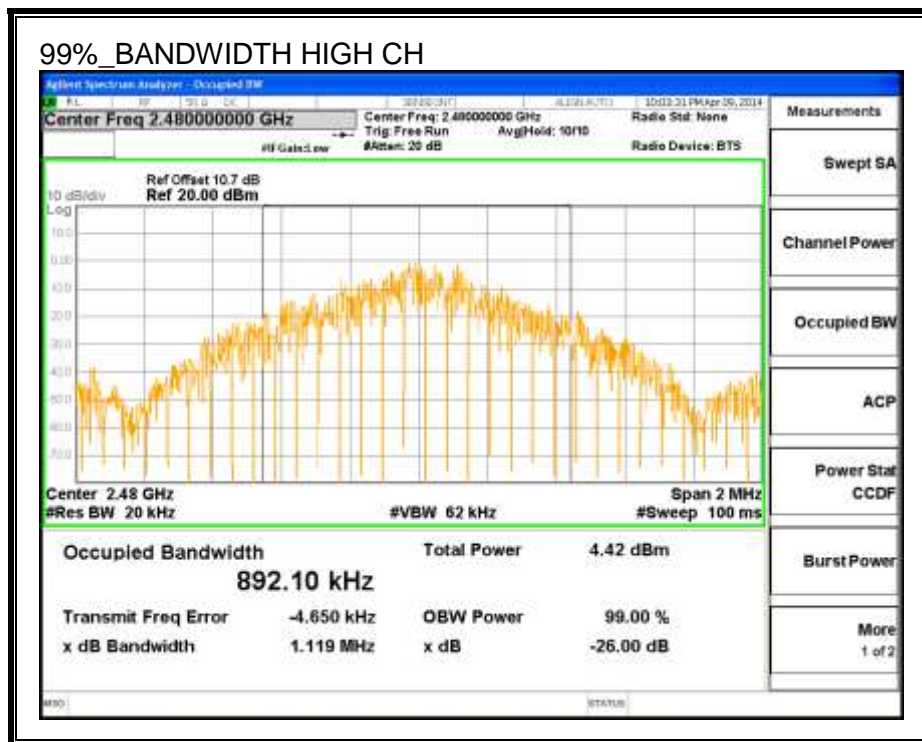




BANDWIDTH HIGH CH



99% BANDWIDTH HIGH CH



7.1.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

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.

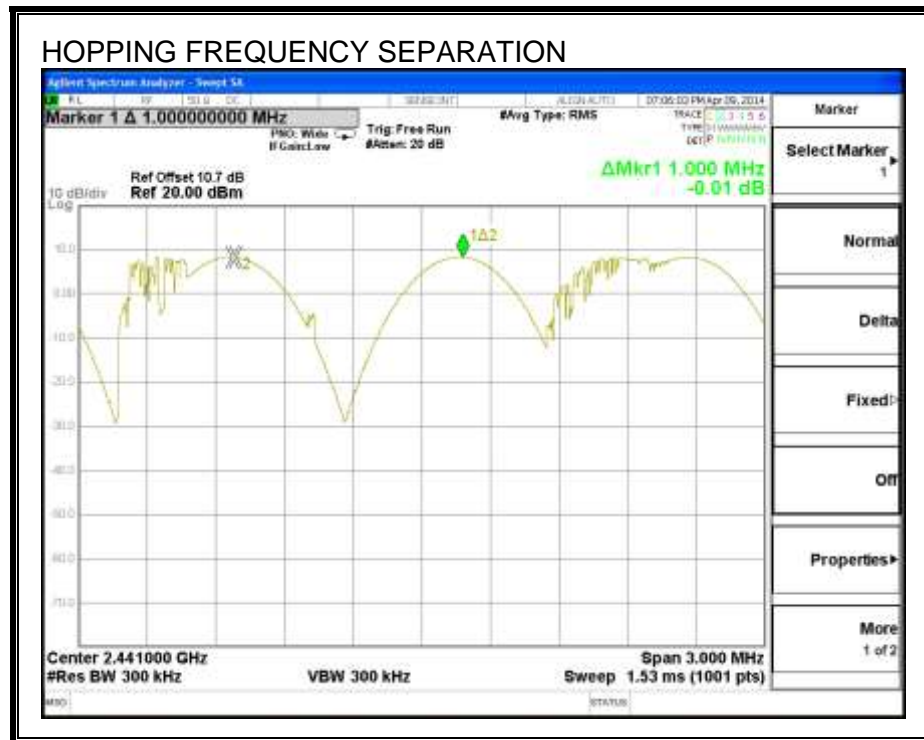
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 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)

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

TEST PROCEDURE

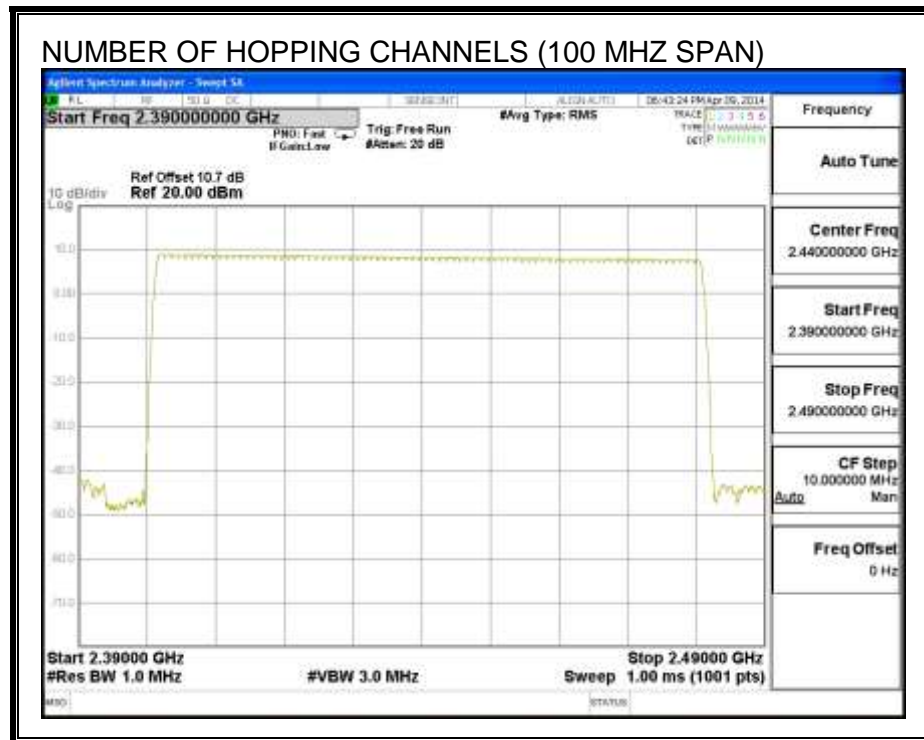
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

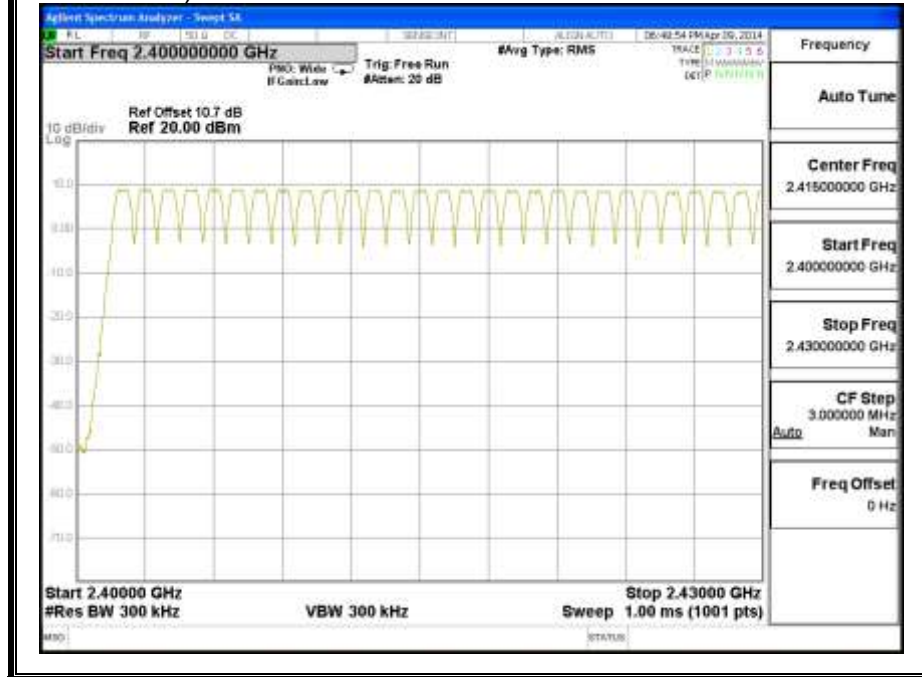
Normal Mode: 79 Channels observed.

AFH Mode: a minimum number of 20 channels declared by the client.

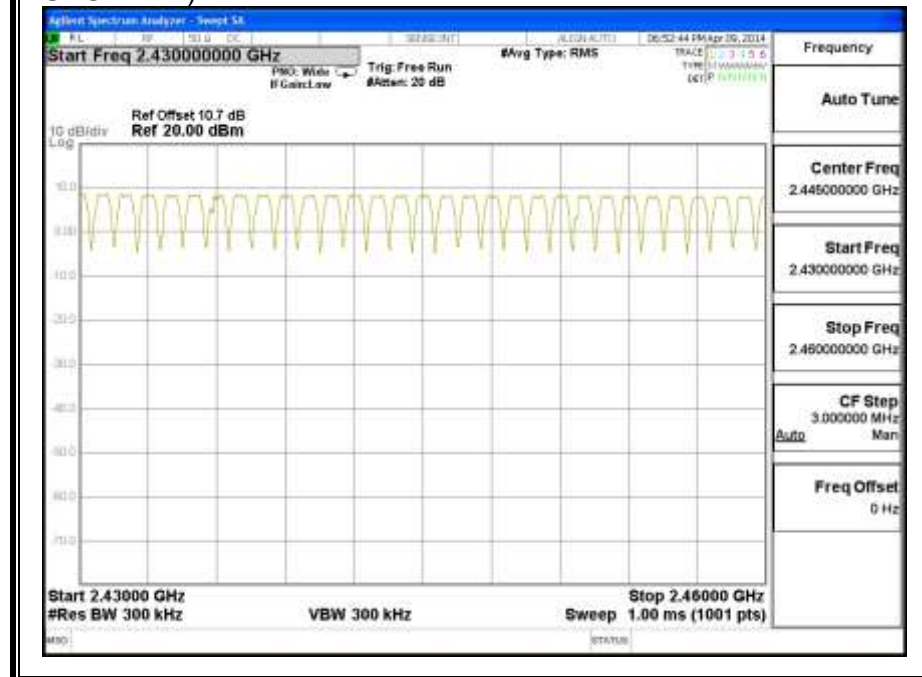
NUMBER OF HOPPING CHANNELS

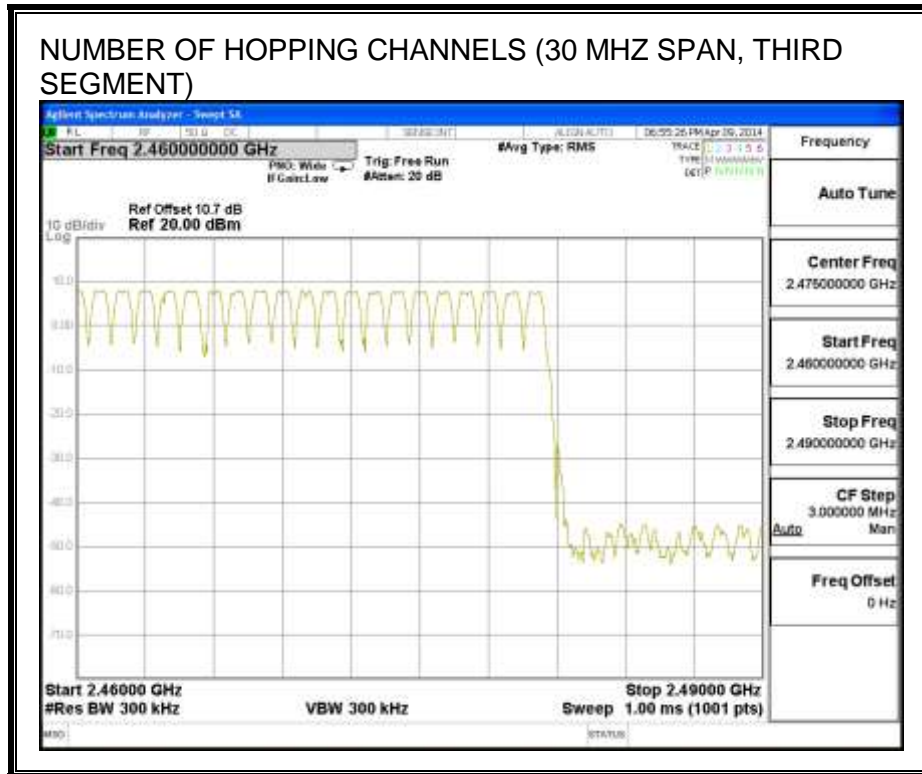


NUMBER OF HOPPING CHANNELS (30 MHz SPAN, FIRST SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHz SPAN, SECOND SEGMENT)





7.1.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

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.

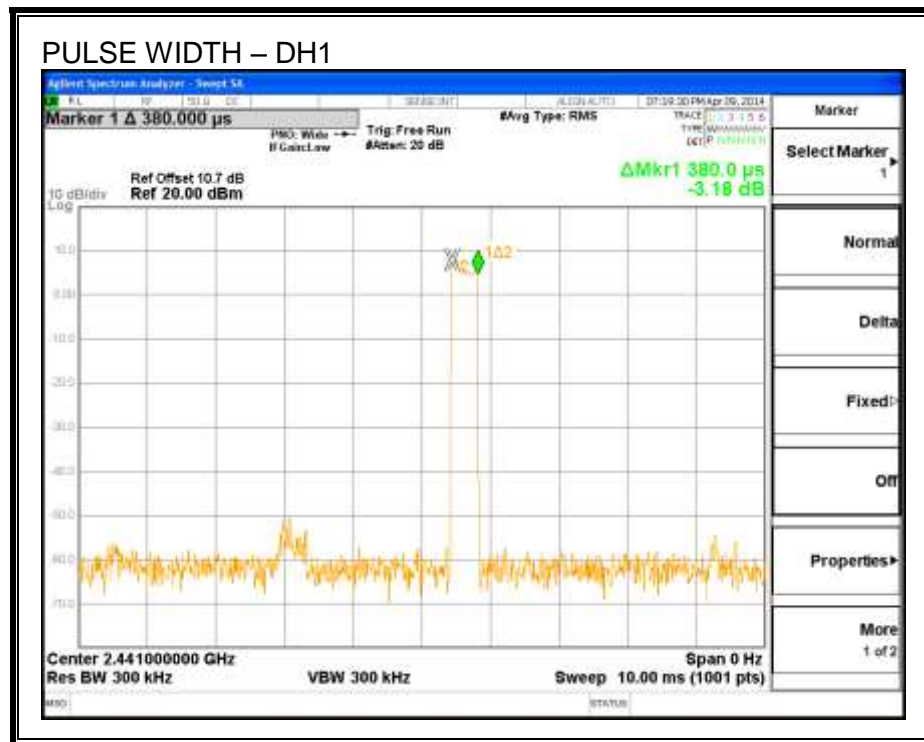
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

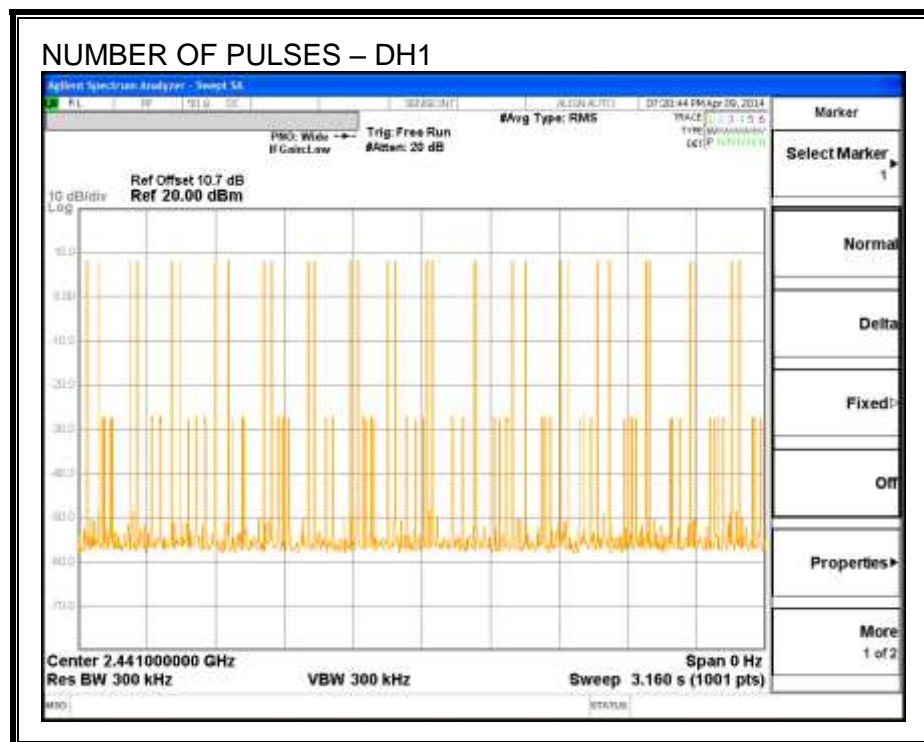
RESULTS

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	0.38	31	0.118	0.4	-0.282
DH3	1.64	16	0.262	0.4	-0.138
DH5	2.89	11	0.318	0.4	-0.082
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.38	7.75	0.029	0.4	-0.371
DH3	1.64	4	0.066	0.4	-0.334
DH5	2.89	2.75	0.079	0.4	-0.321

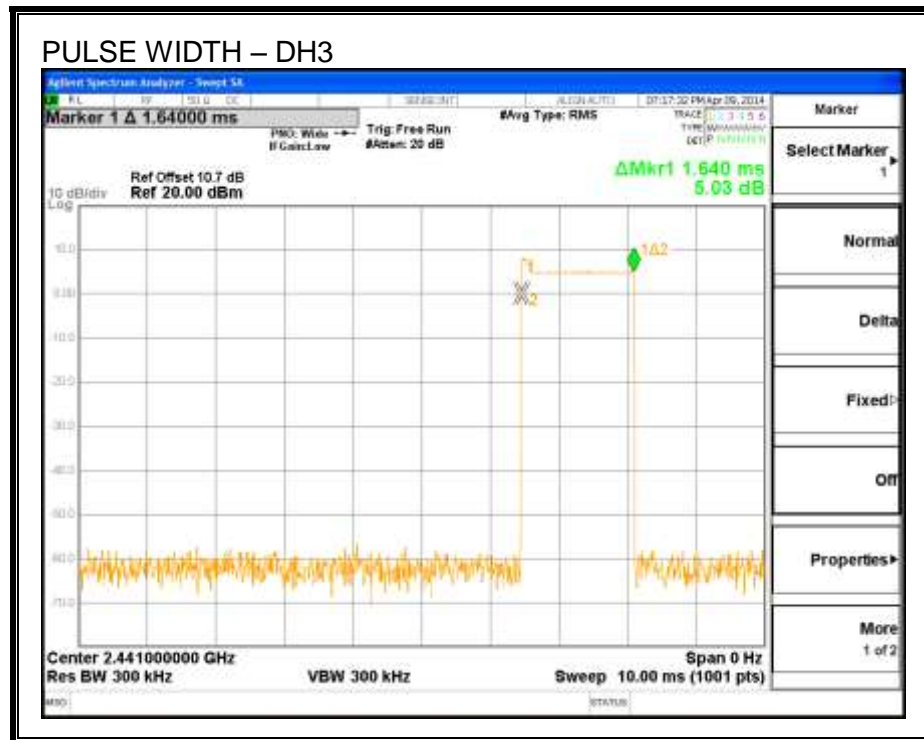
PULSE WIDTH - DH1



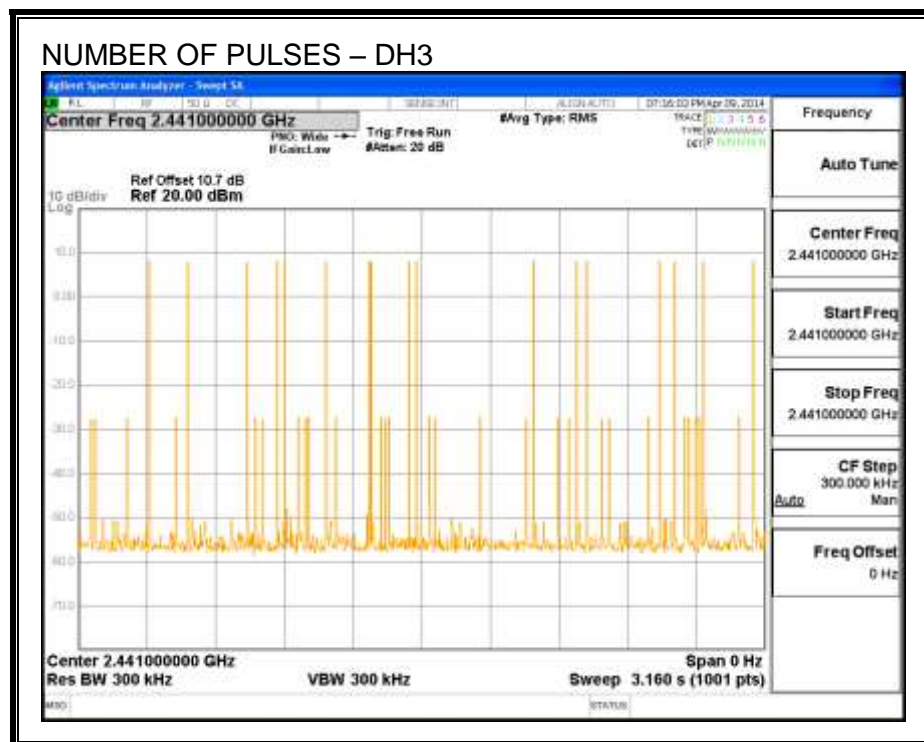
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



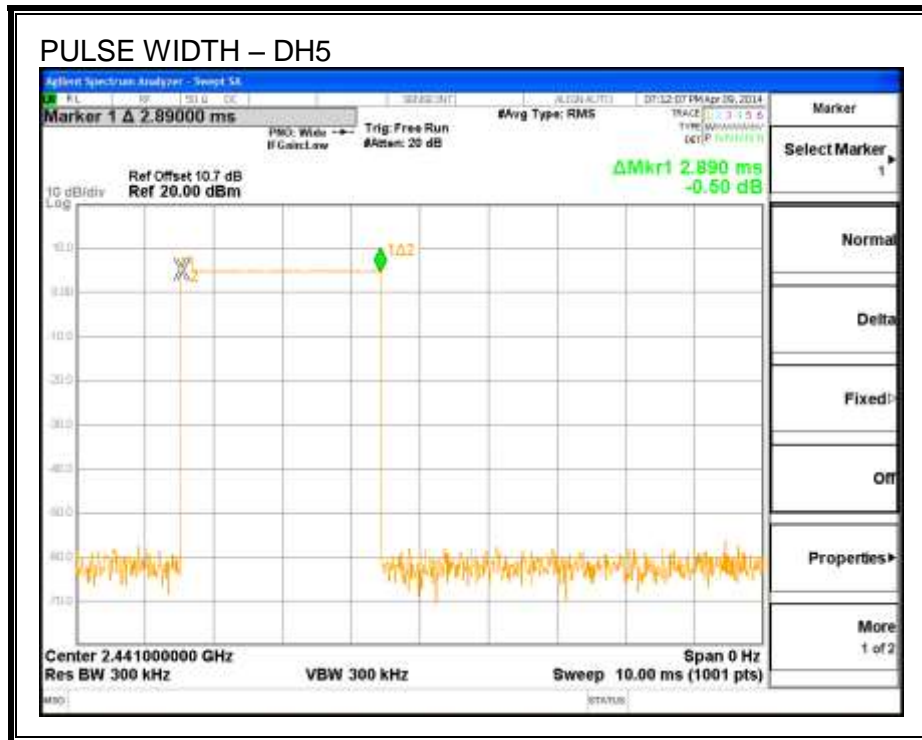
PULSE WIDTH – DH3



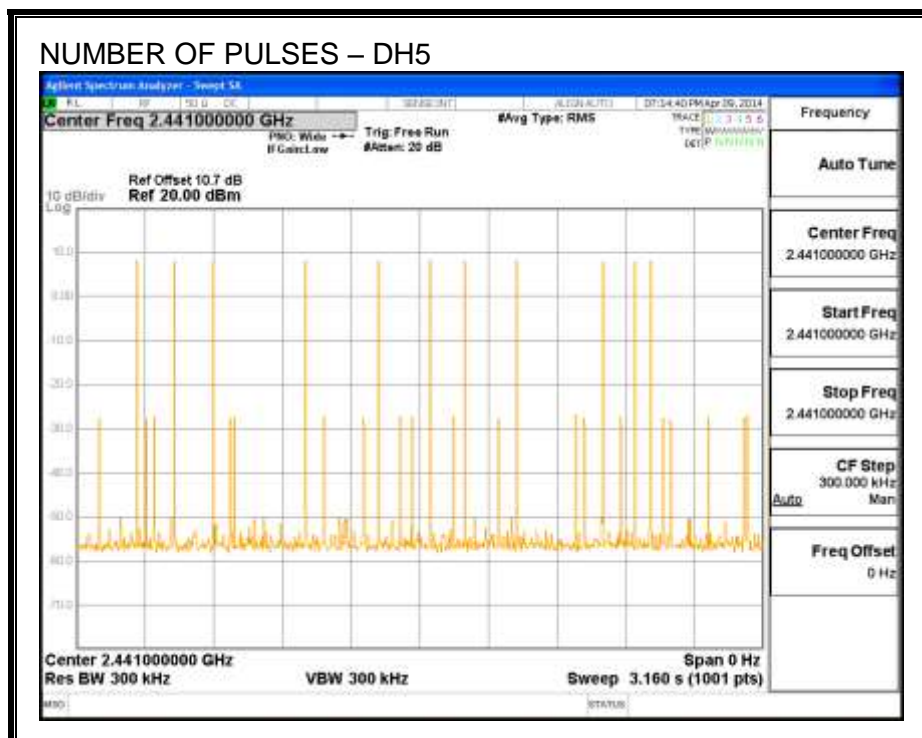
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



7.1.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

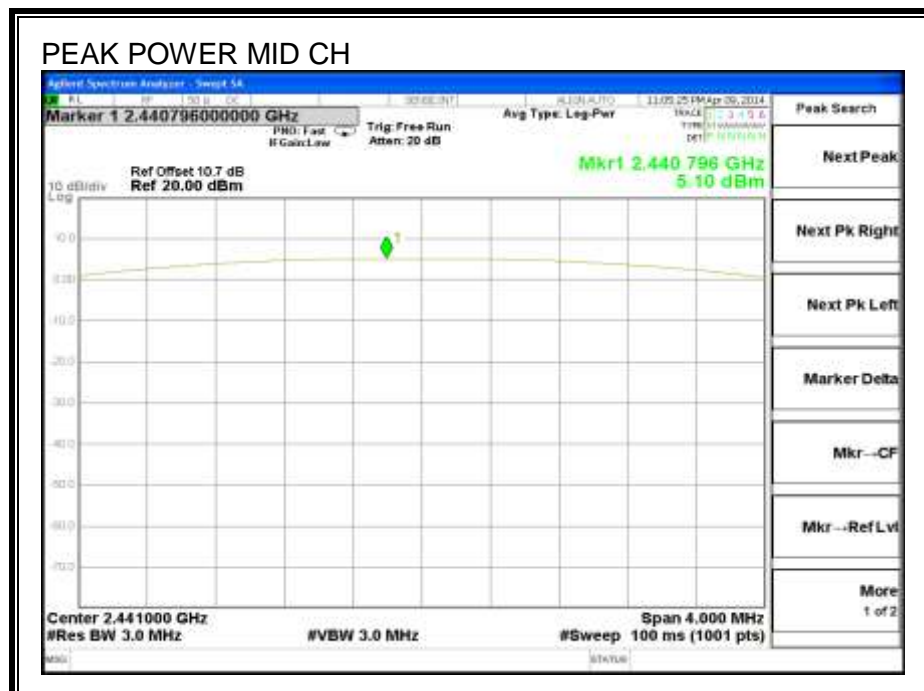
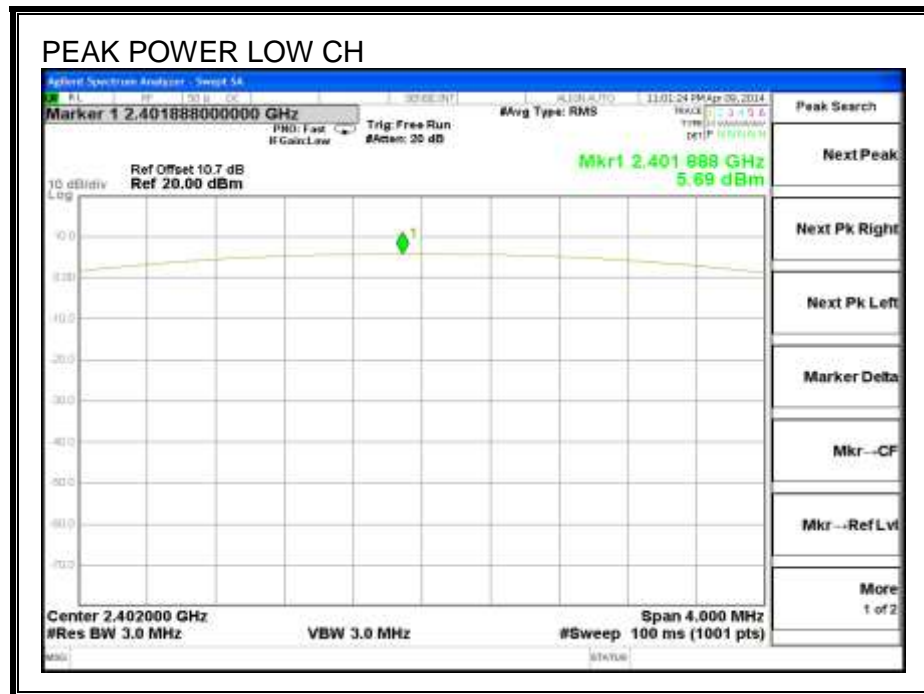
TEST PROCEDURE

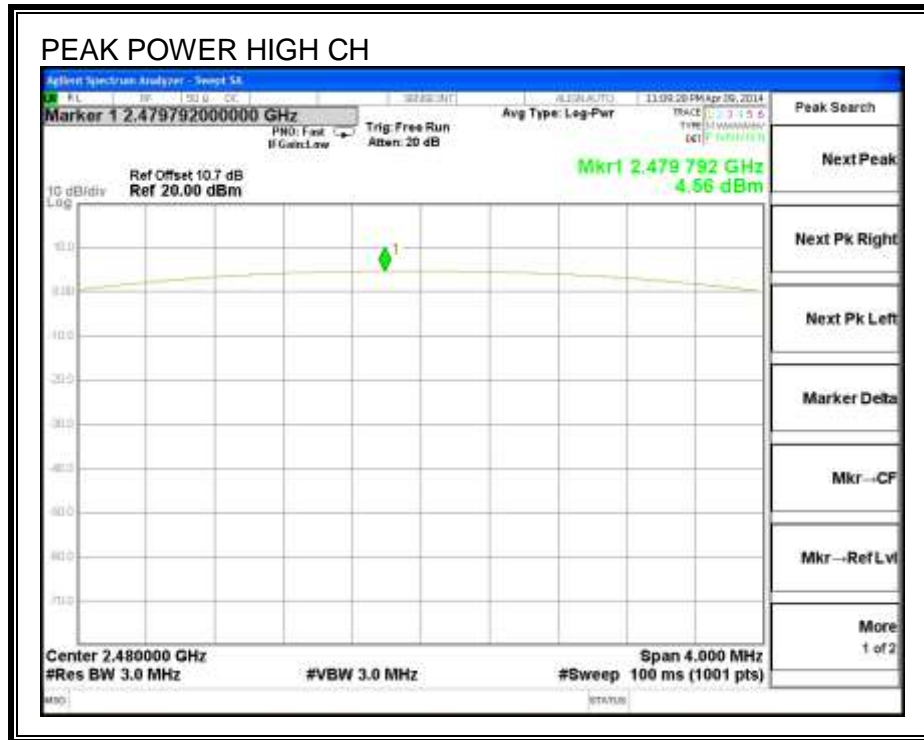
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.69	30	-24.31
Middle	2441	5.10	30	-24.90
High	2480	4.56	30	-25.44

OUTPUT POWER





7.1.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.7dB (including 10 dB pad and .7 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	3.91
Middle	2441	3.75
High	2480	3.68

7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

Limit = -20 dBc

TEST PROCEDURE

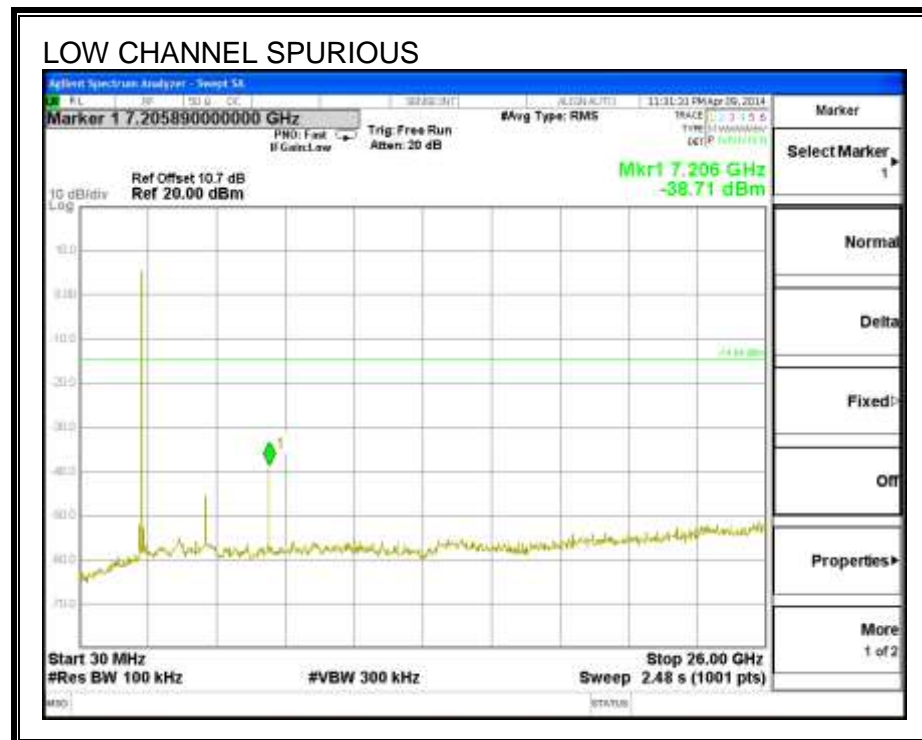
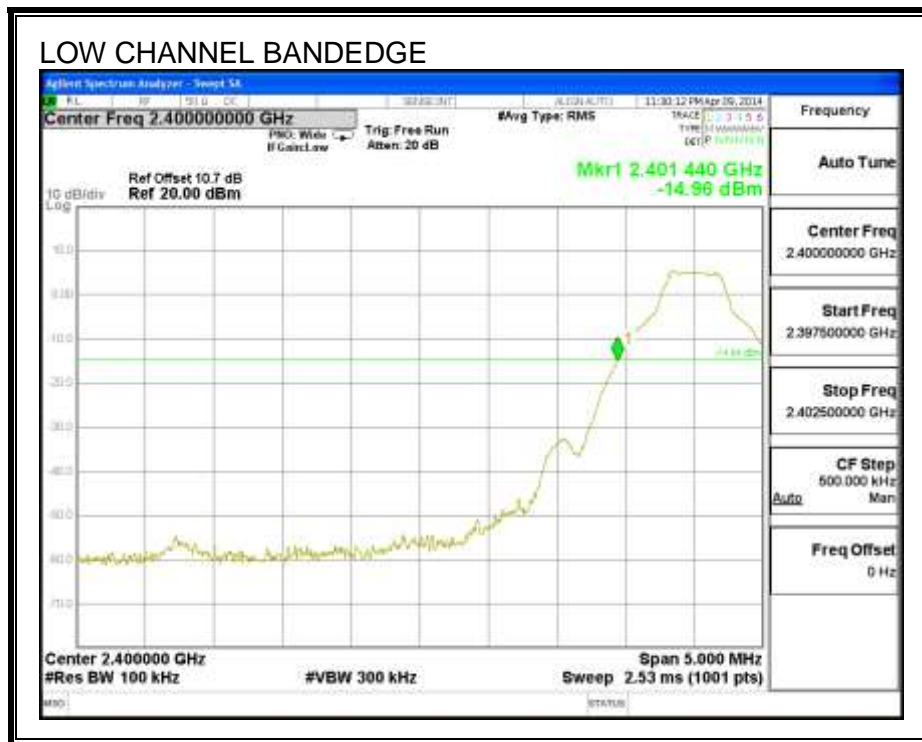
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

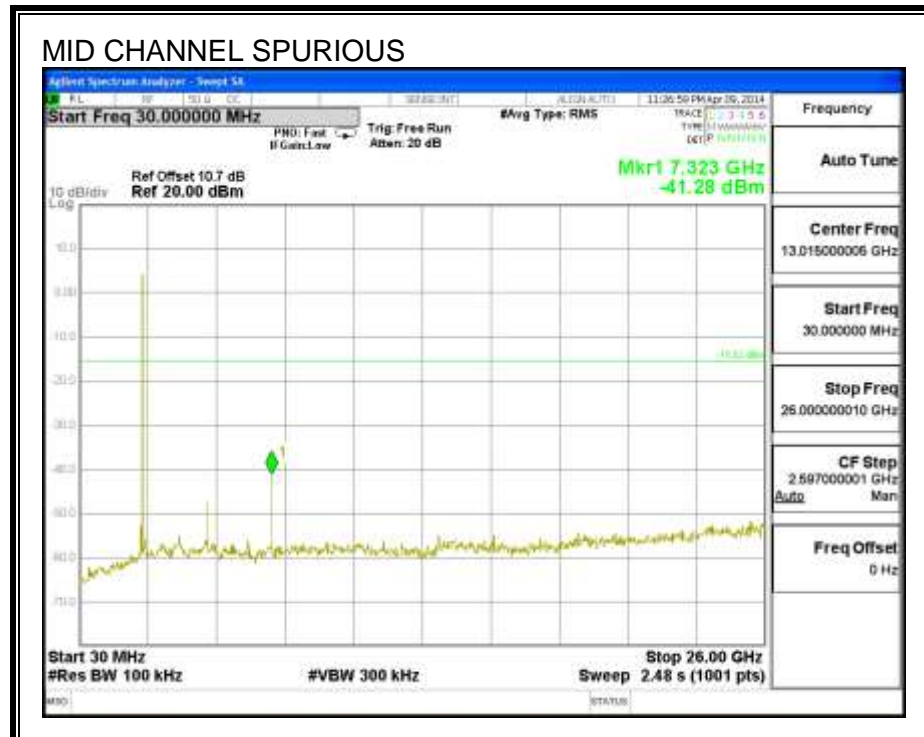
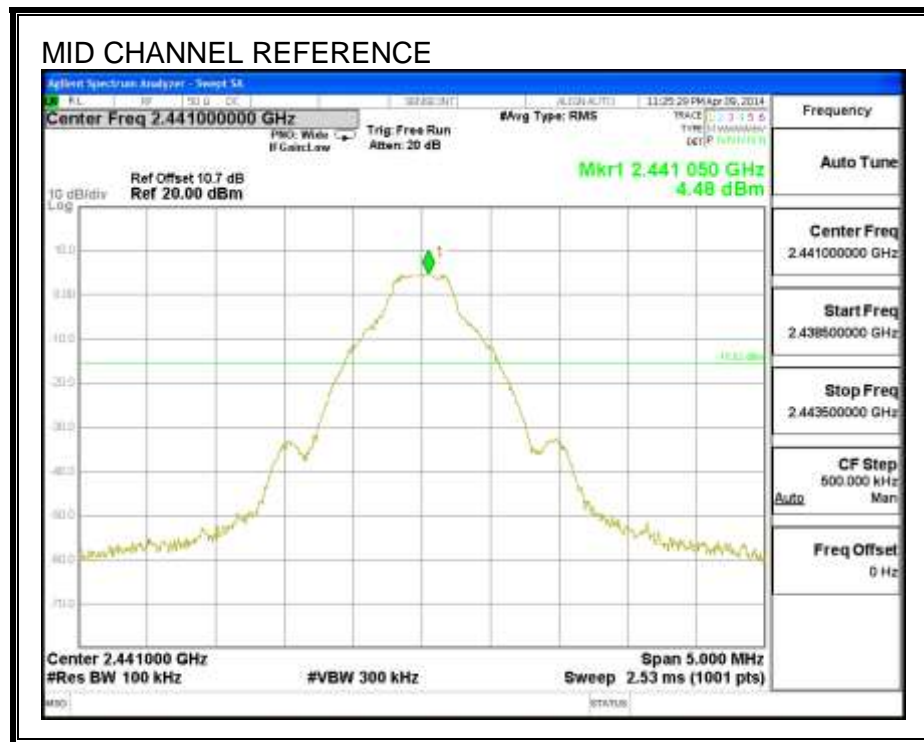
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

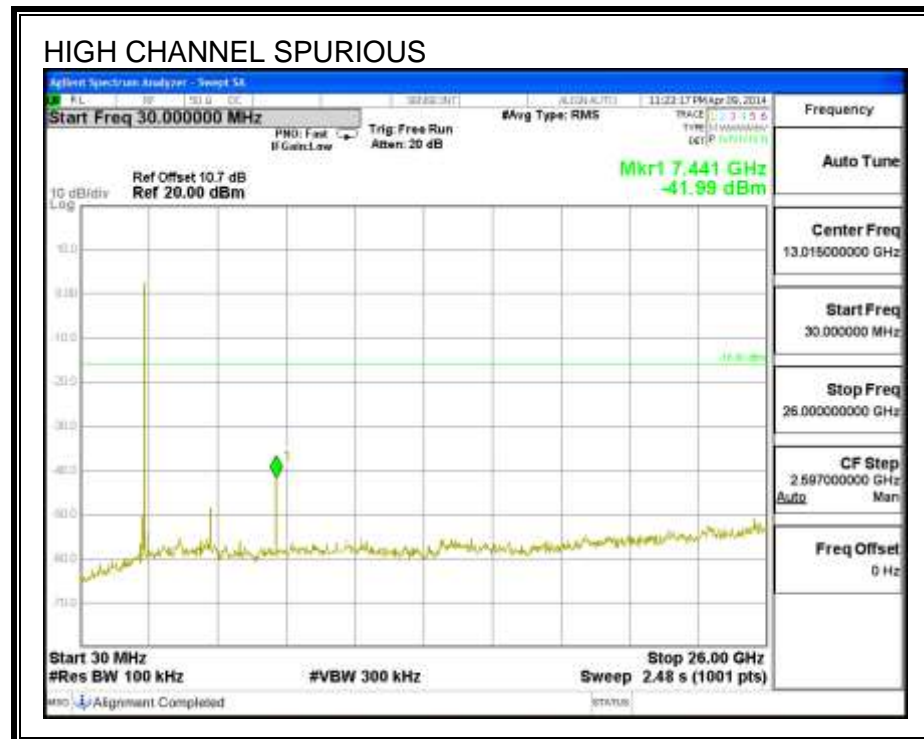
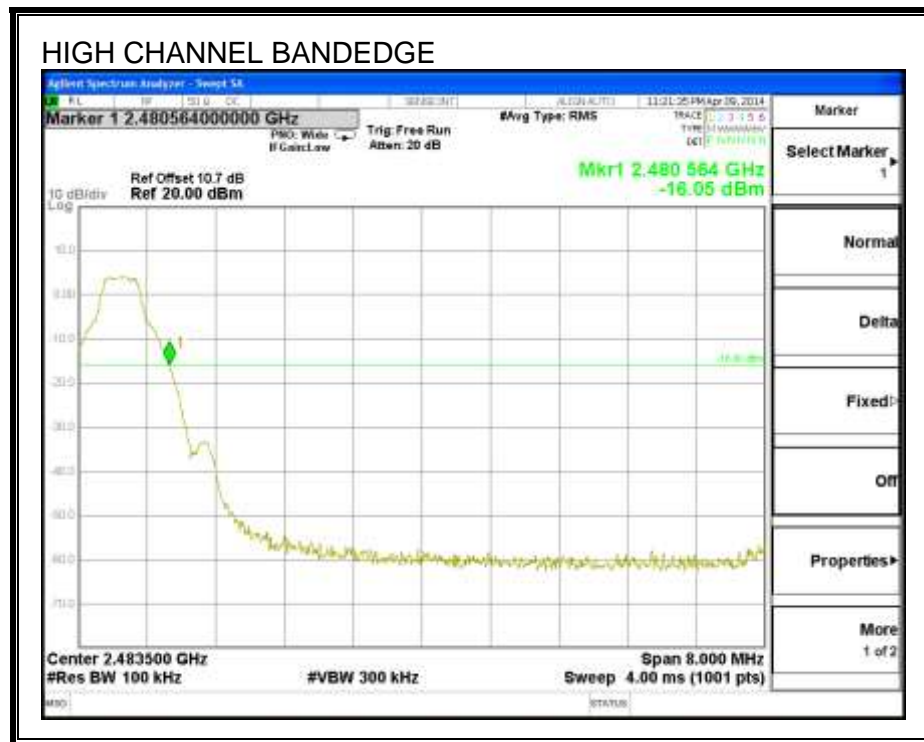
SPURIOUS EMISSIONS, LOW CHANNEL



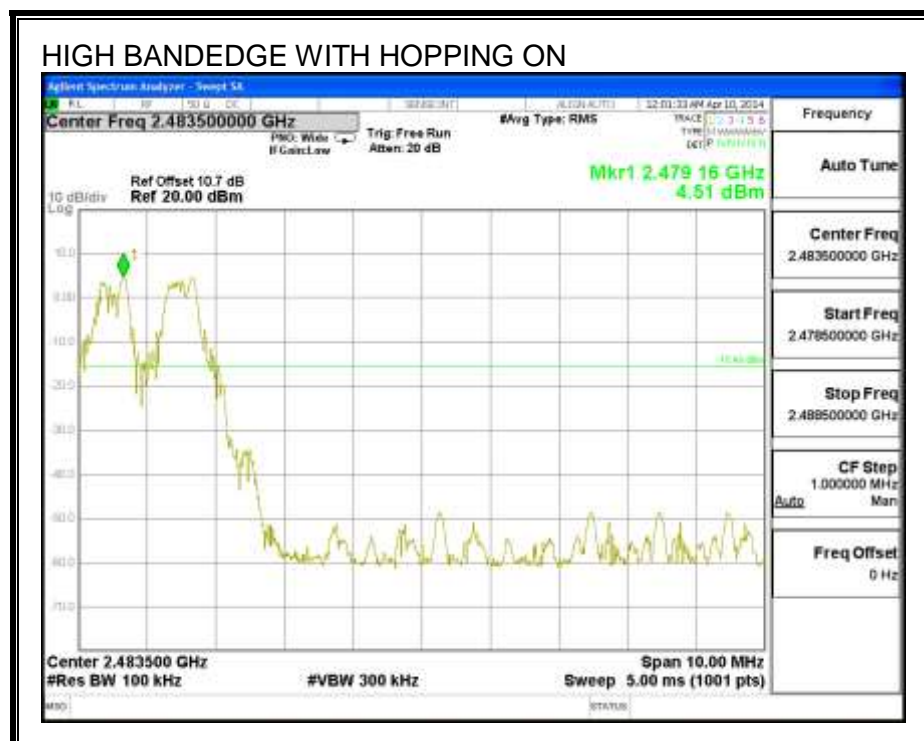
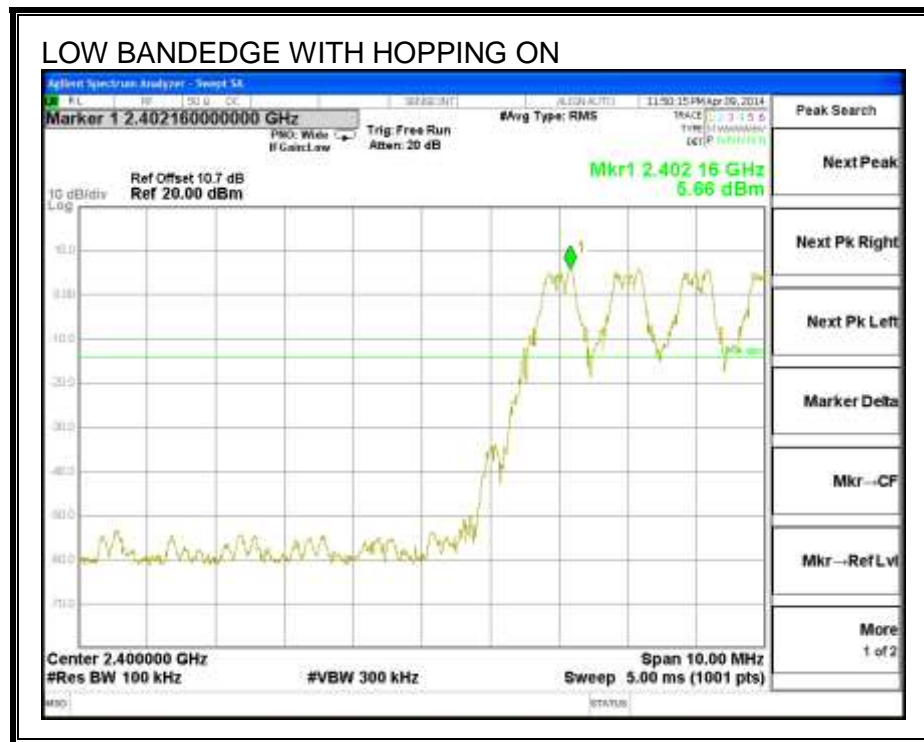
SPURIOUS EMISSIONS, MID CHANNEL



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.

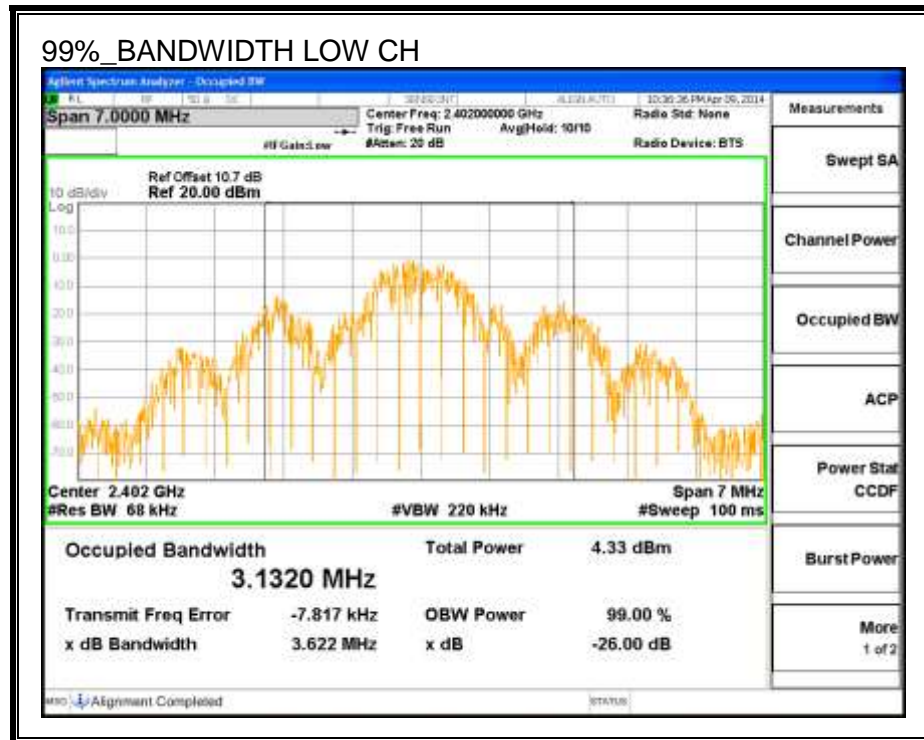
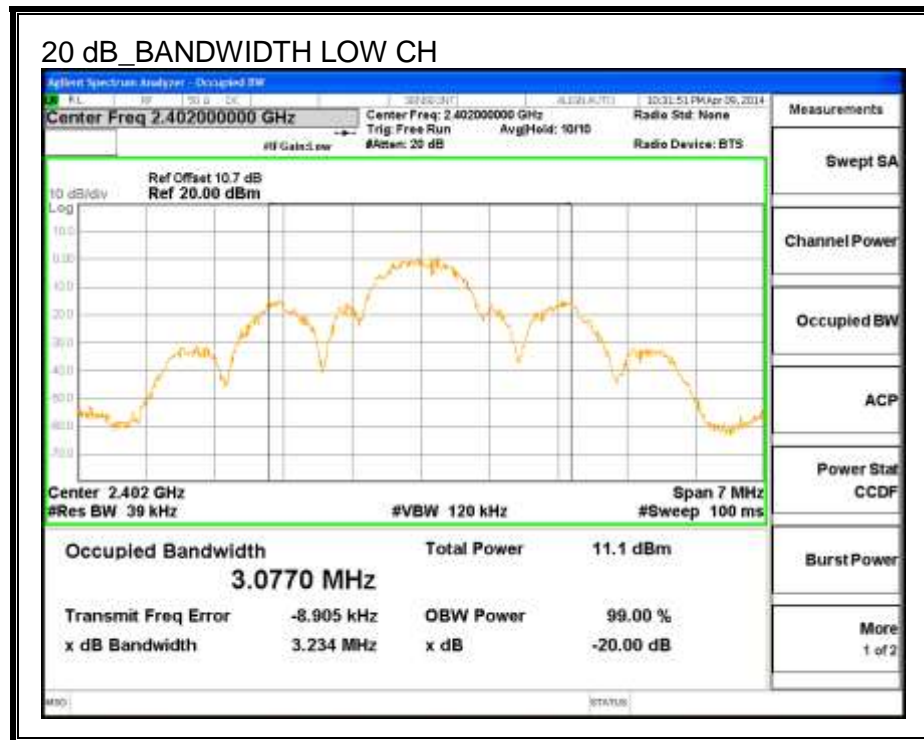
TEST PROCEDURE

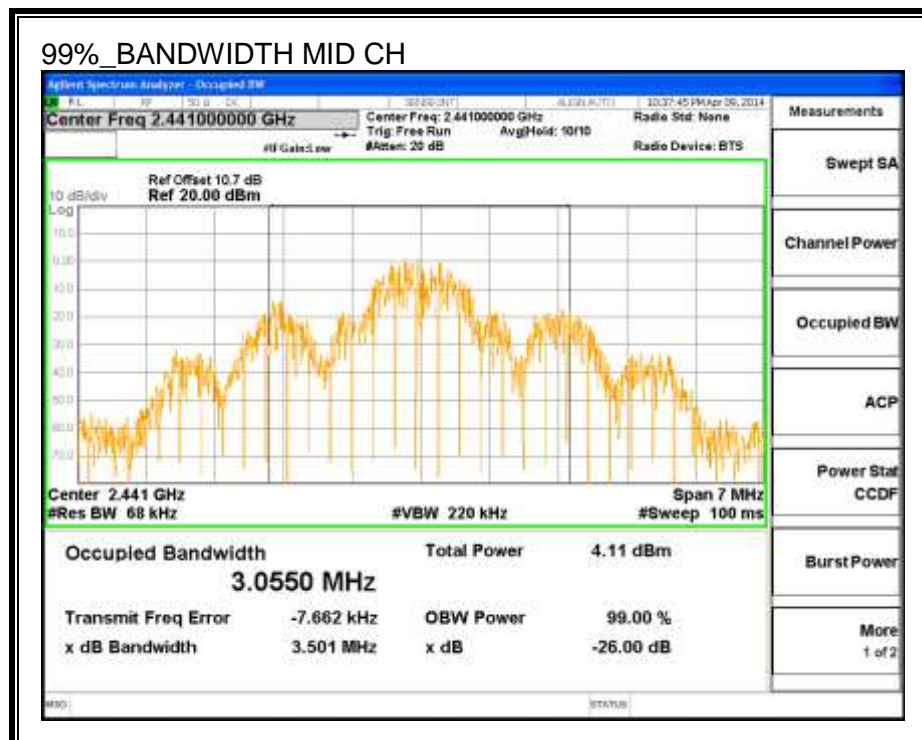
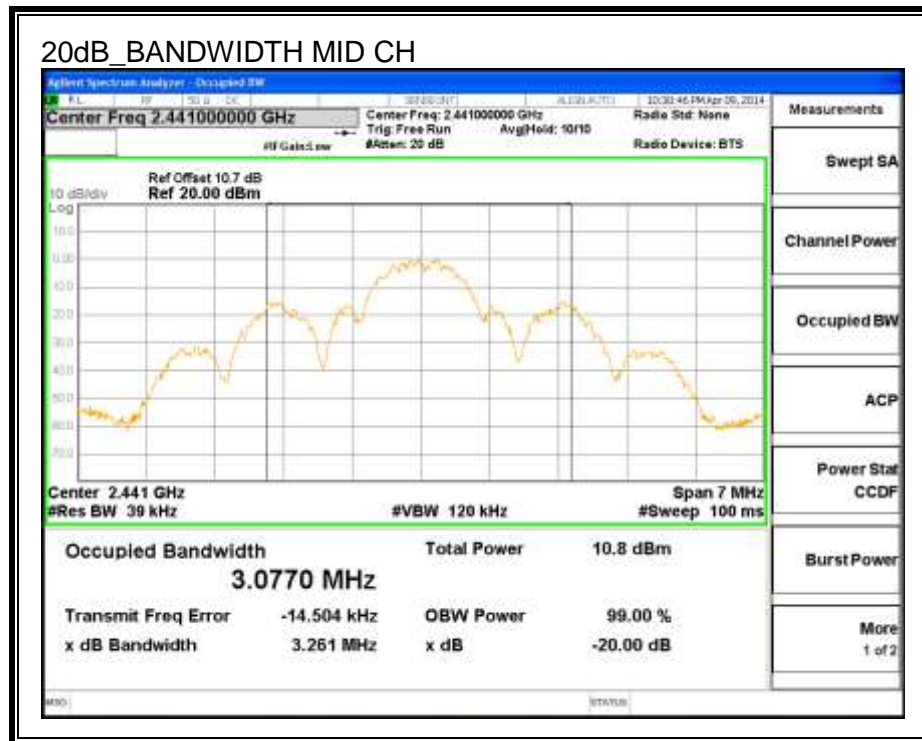
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

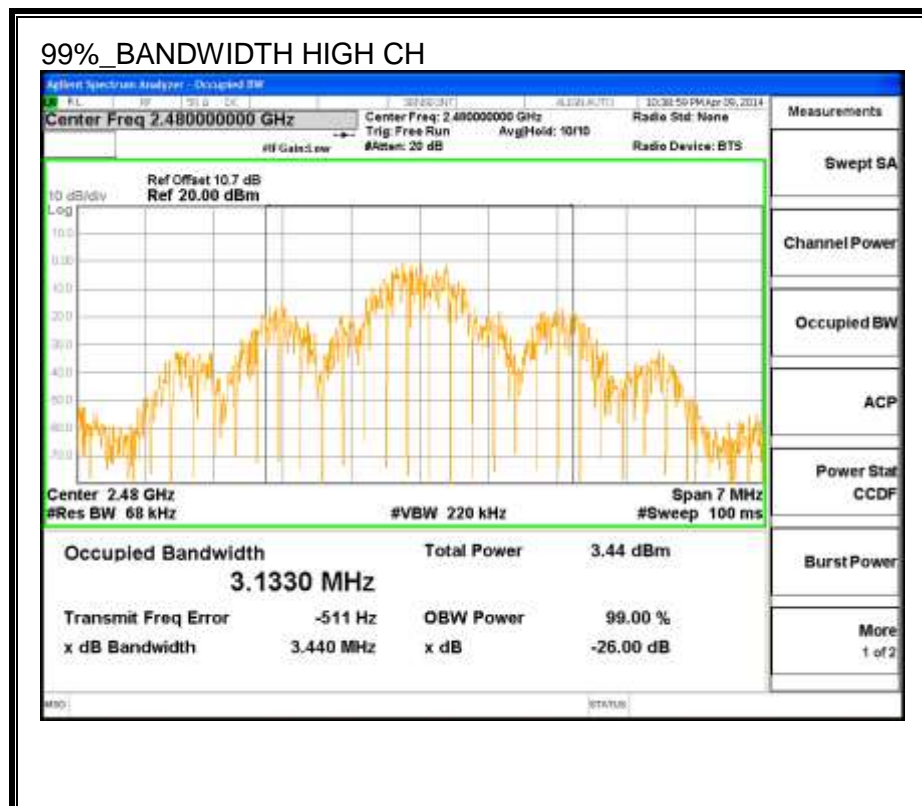
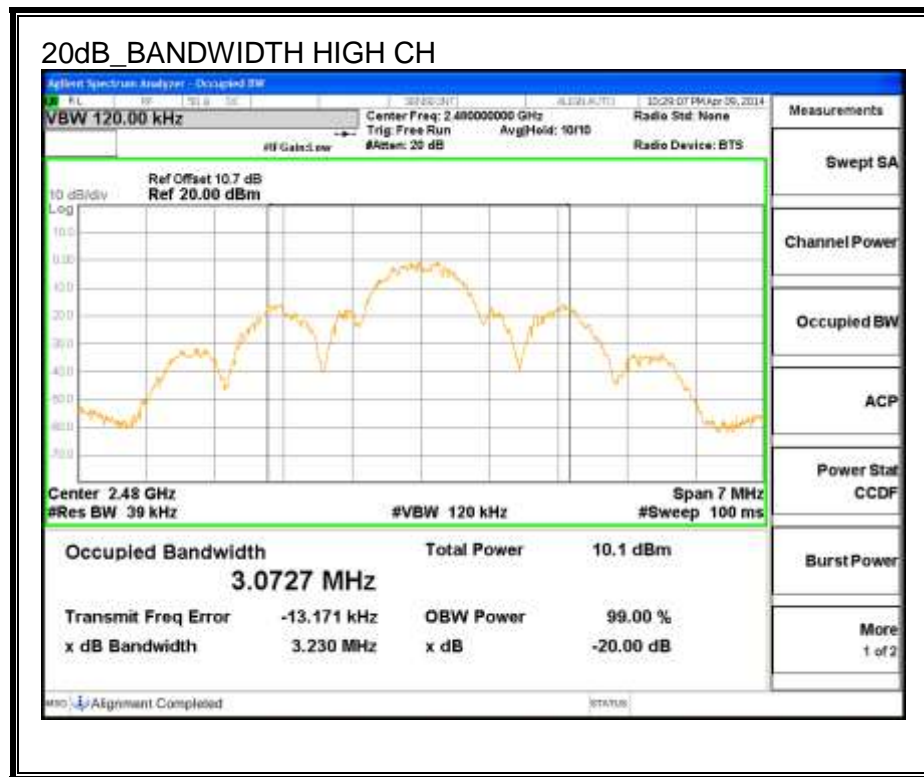
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	3.234	3.132
Middle	2441	3.261	3.055
High	2480	3.230	3.133

20 dB AND 99% BANDWIDTH







7.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

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.

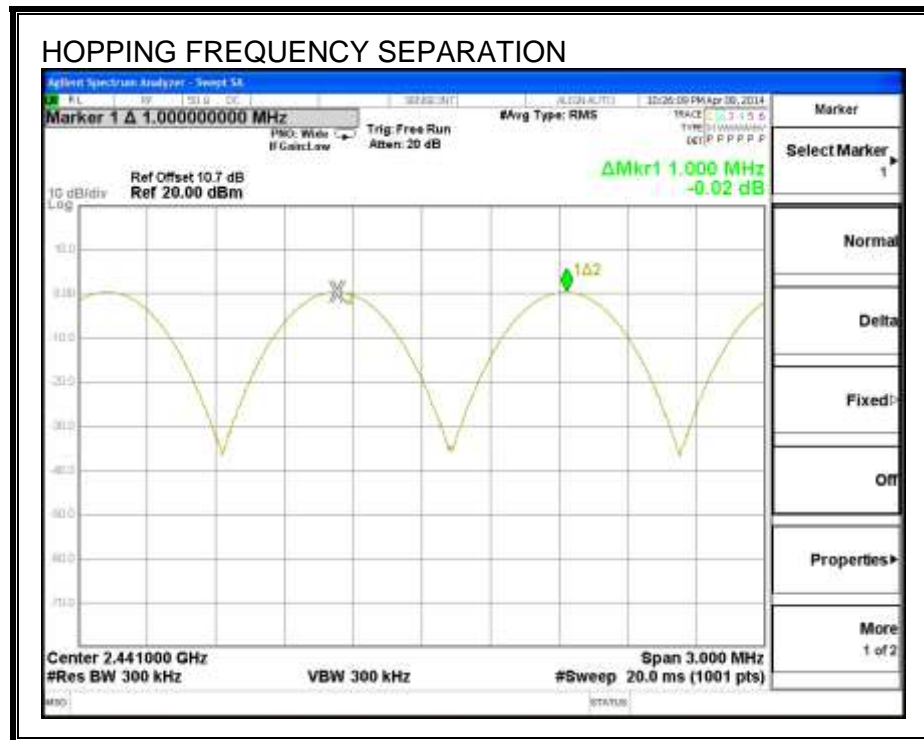
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 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)

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

TEST PROCEDURE

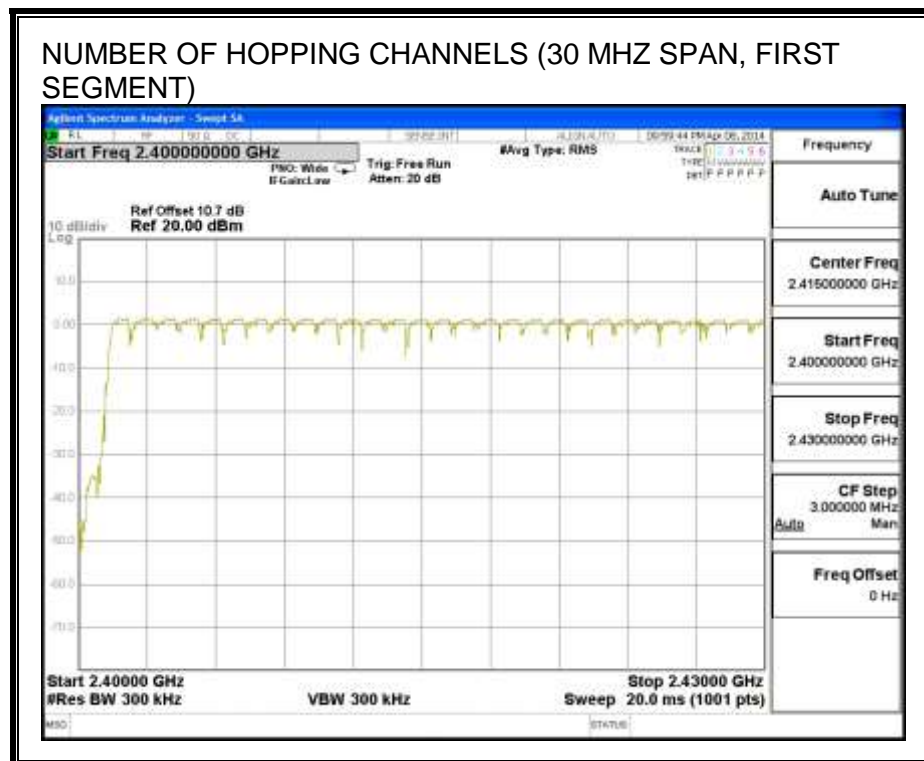
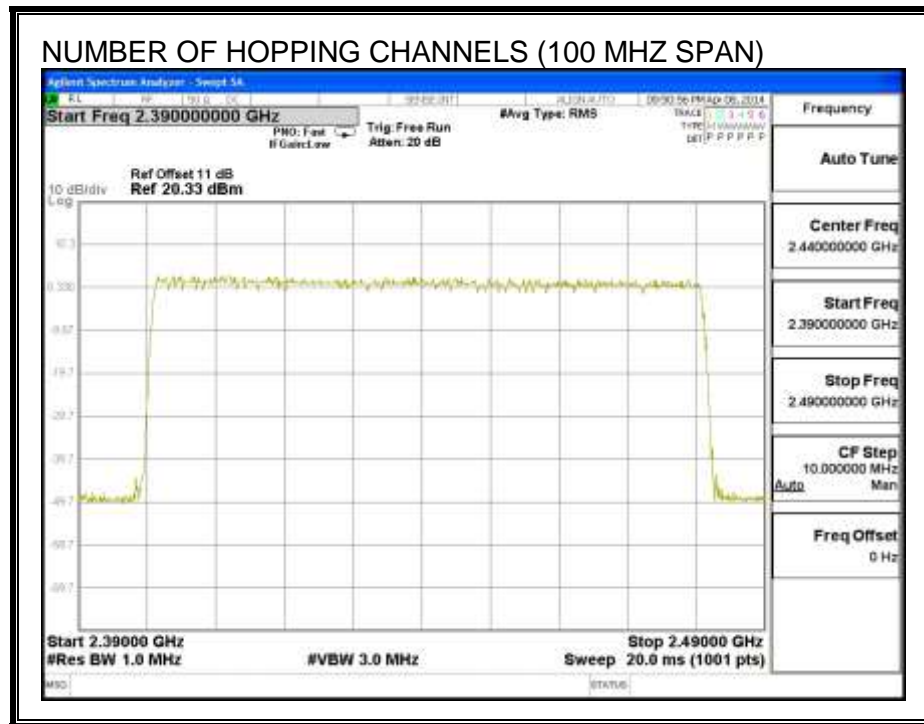
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

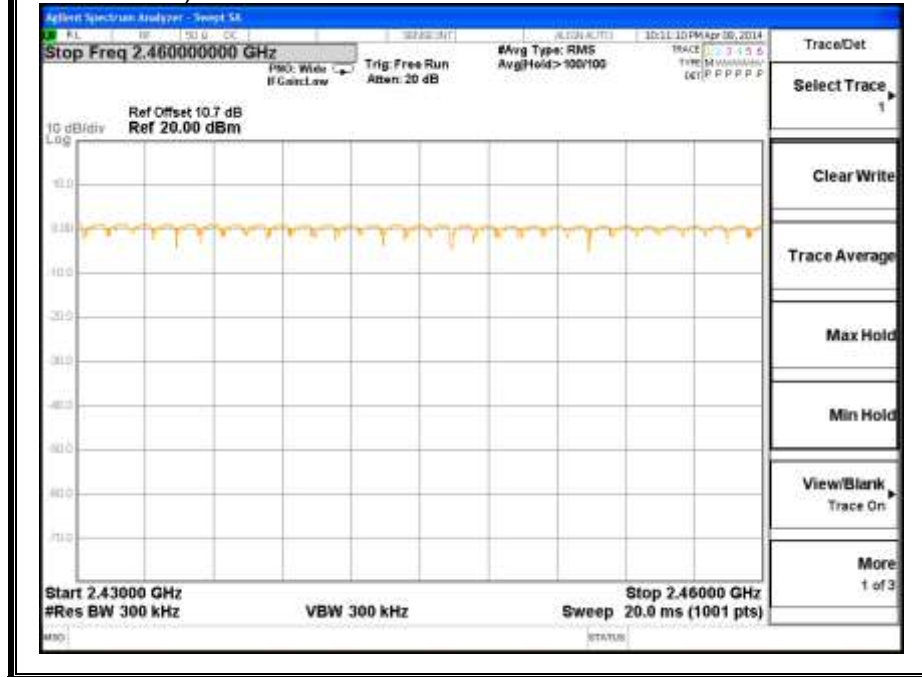
Normal Mode: 79 Channels observed.

AFH Mode: a minimum number of 20 channels declared by the client.

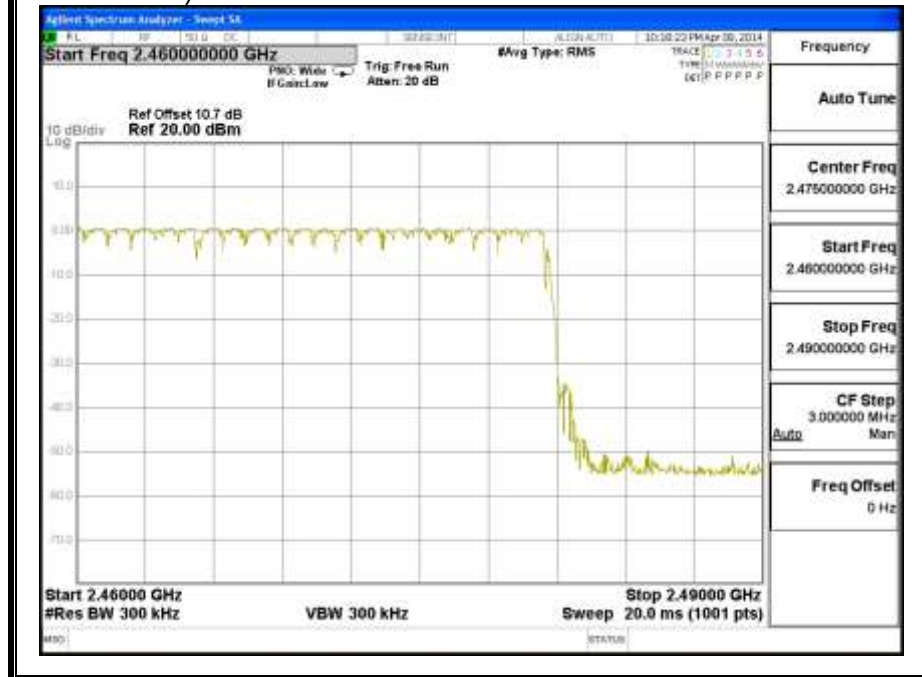
NUMBER OF HOPPING CHANNELS



NUMBER OF HOPPING CHANNELS (30 MHz SPAN, SECOND SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHz SPAN, THIRD SEGMENT)



7.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

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

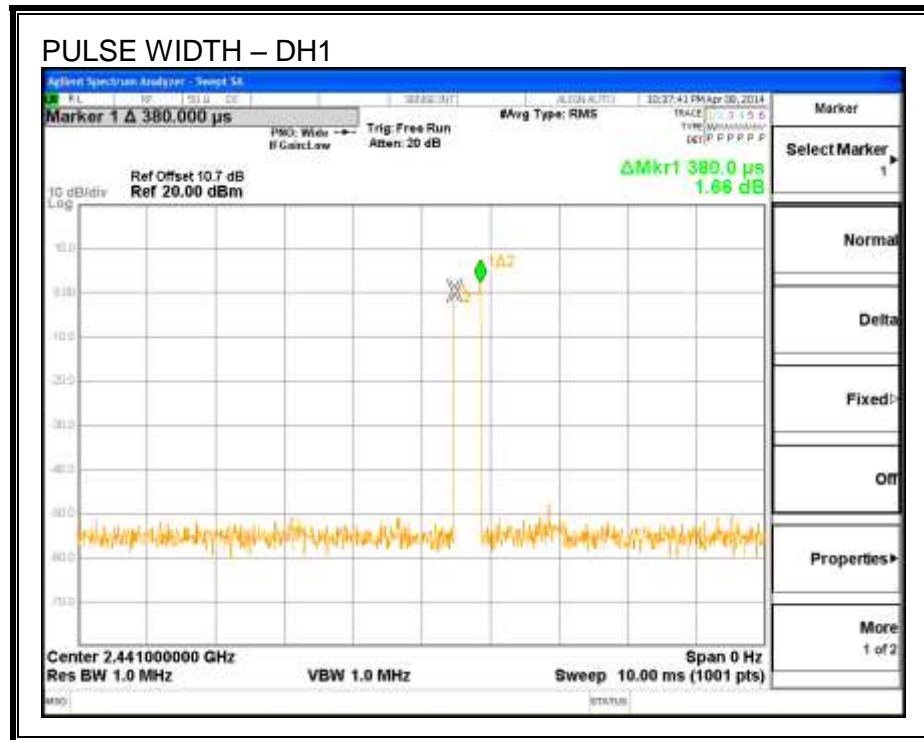
Time of Occupancy = $10 * xx \text{ pulses} * yy \text{ msec} = zz \text{ msec}$

8PSK (EDR) Mode

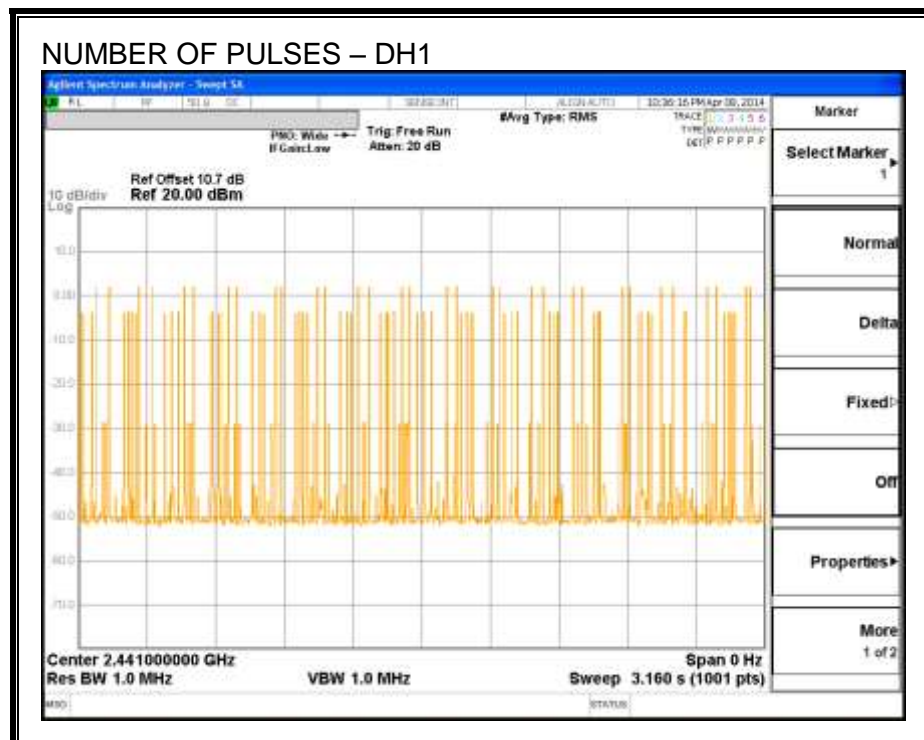
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.38	32	0.122	0.4	-0.278
DH3	1.64	16	0.262	0.4	-0.138
DH5	2.88	11	0.317	0.4	-0.083

Note: for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate on page 22, demonstrates compliance with channel occupancy when AFH is employed.

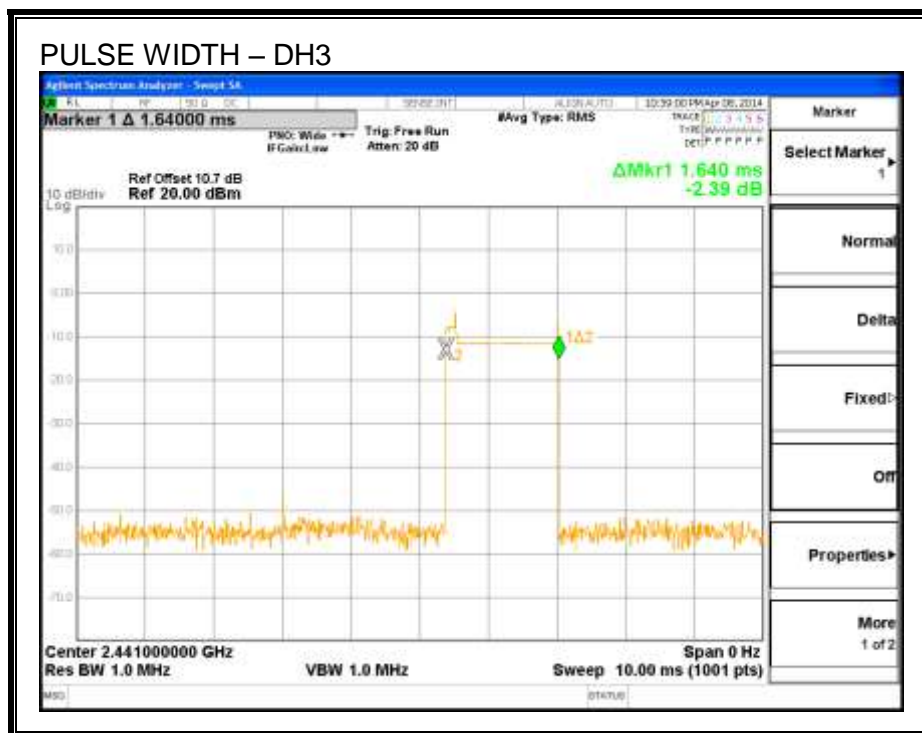
PULSE WIDTH - DH1



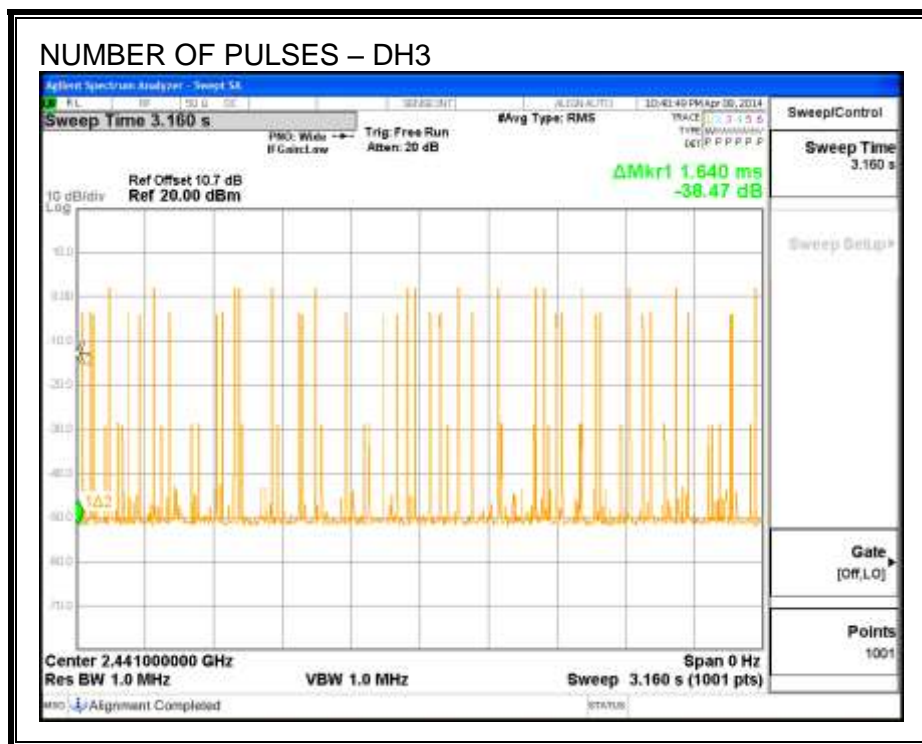
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



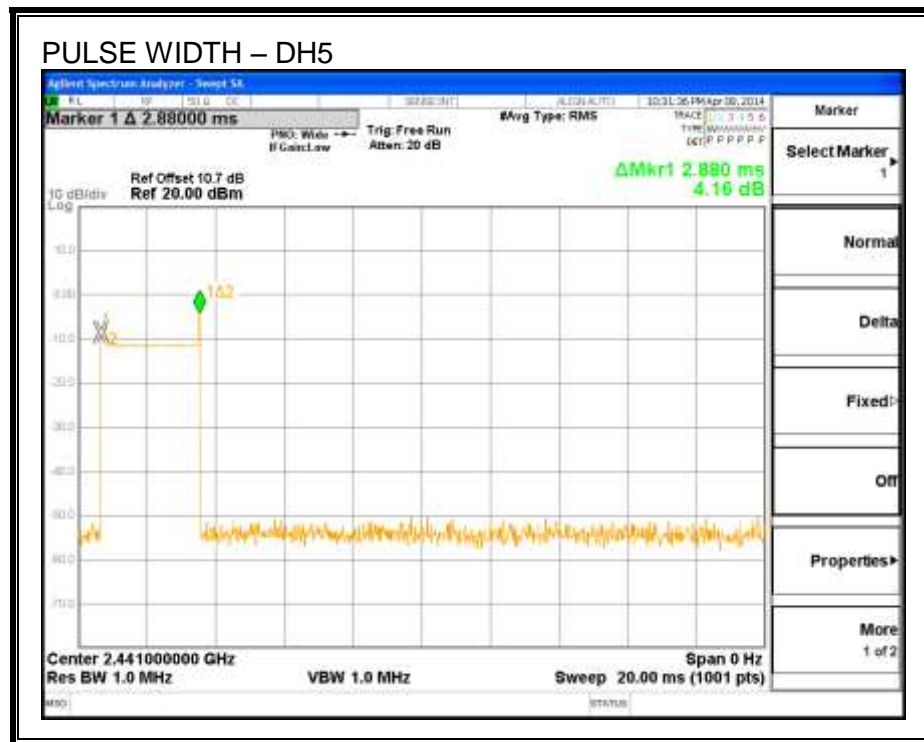
PULSE WIDTH – DH3



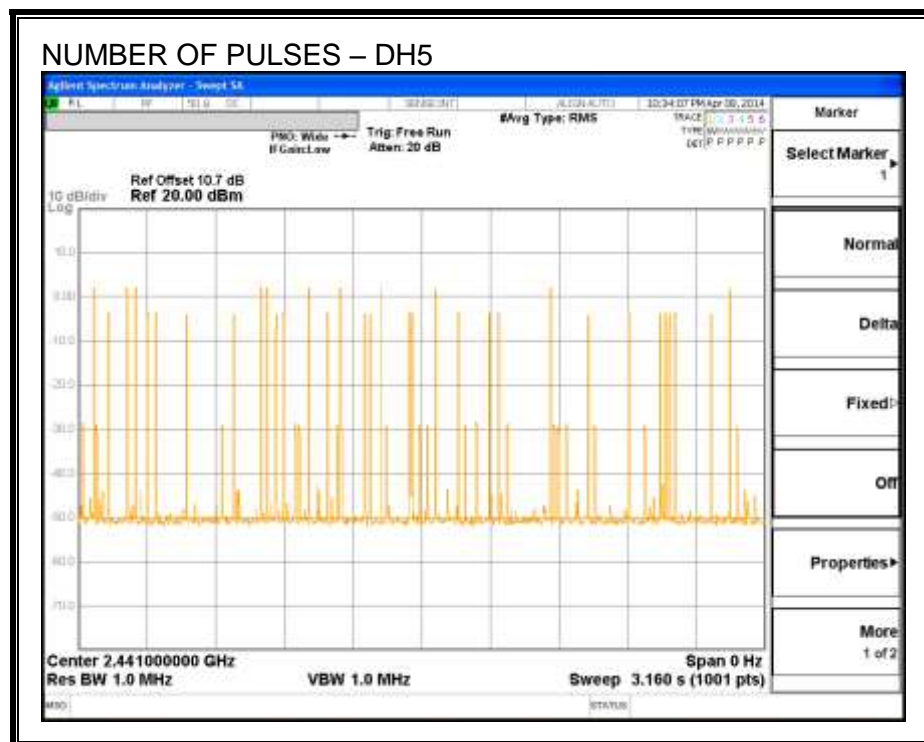
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



7.2.5. 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.

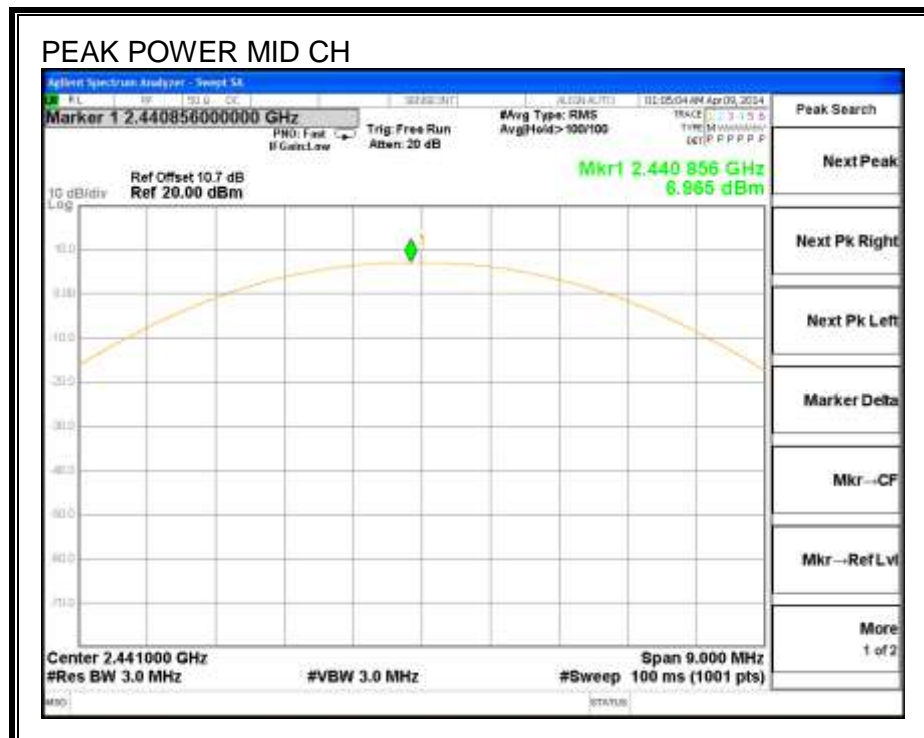
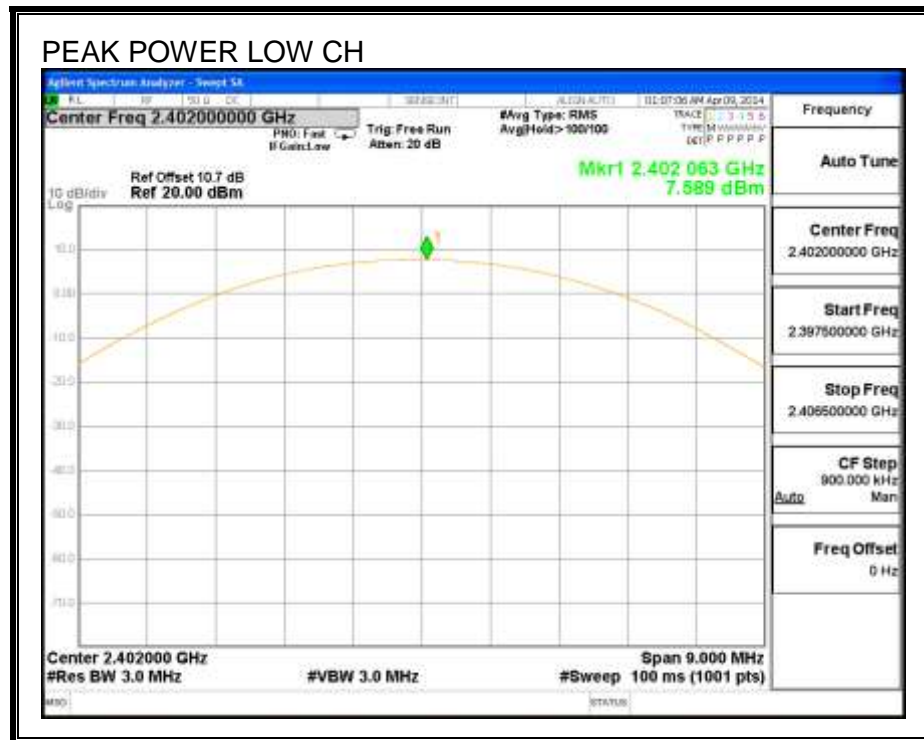
TEST PROCEDURE

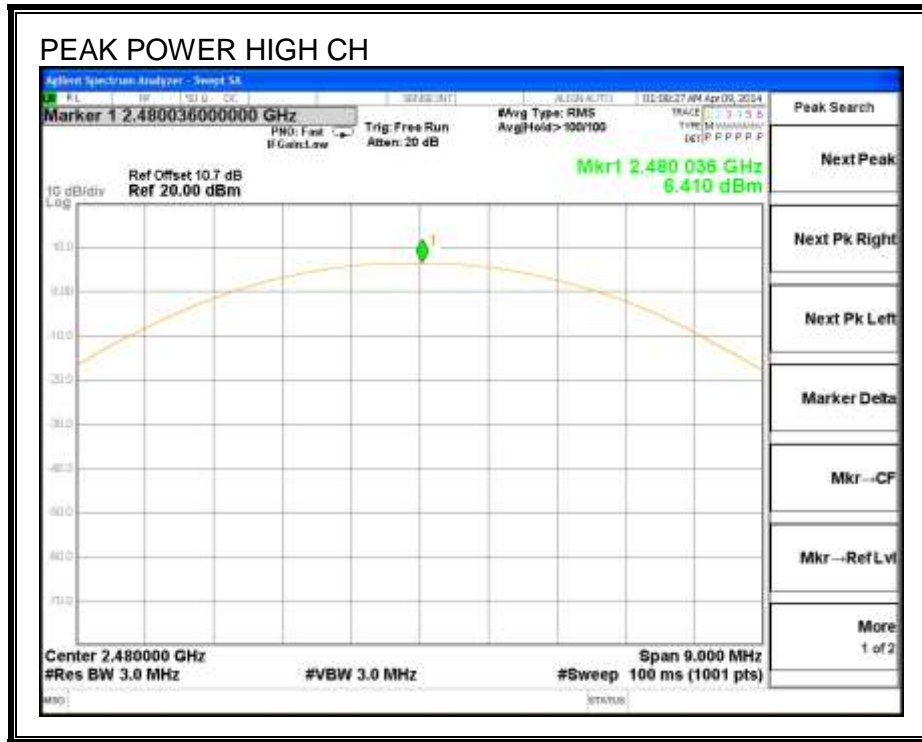
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.59	30	-22.41
Middle	2441	6.97	30	-23.04
High	2480	6.41	30	-23.59

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 10.7dB (including 10 dB pad and .7 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	3.83
Middle	2441	3.28
High	2480	3.87

7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

Limit = -20 dBc

TEST PROCEDURE

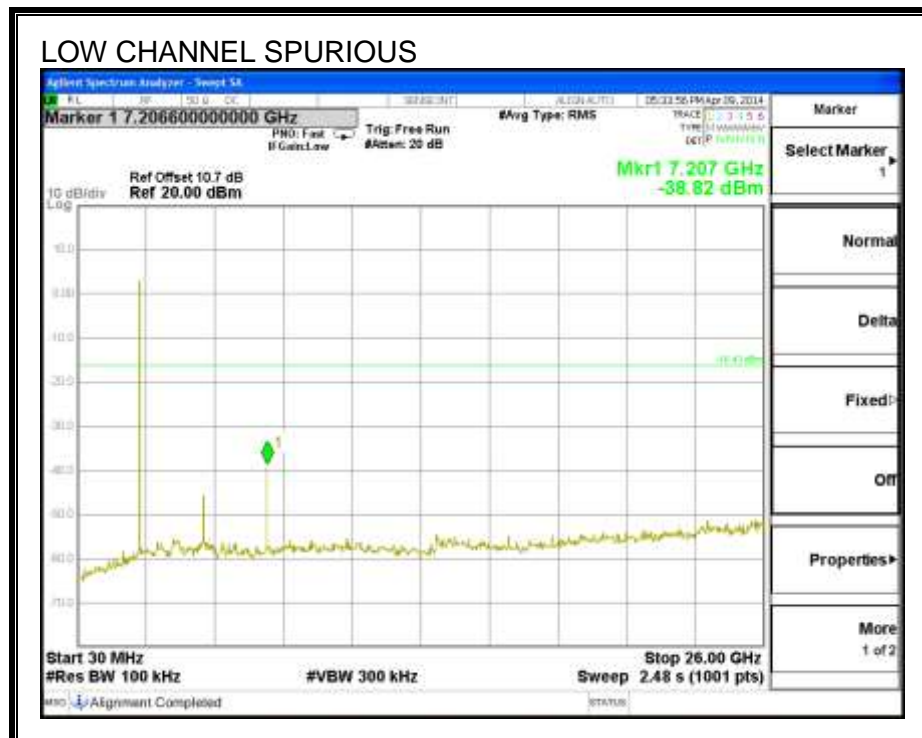
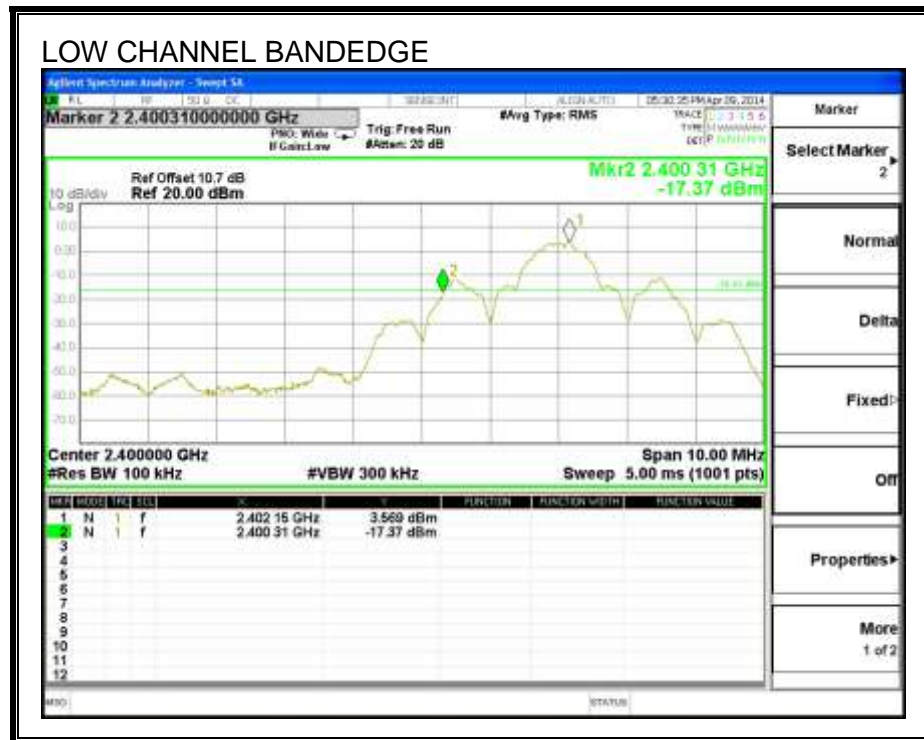
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

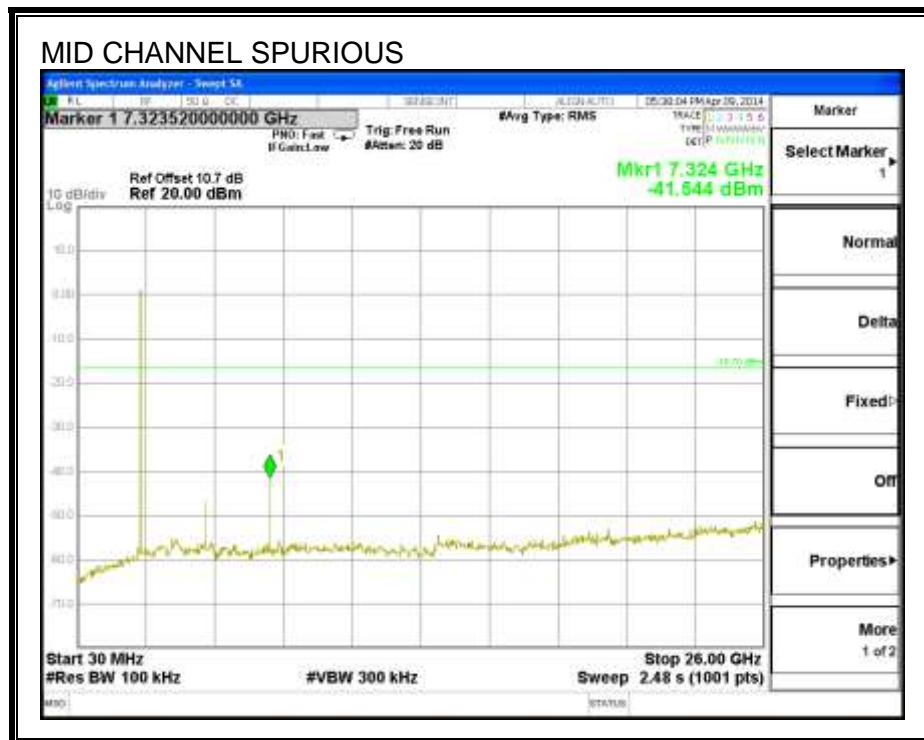
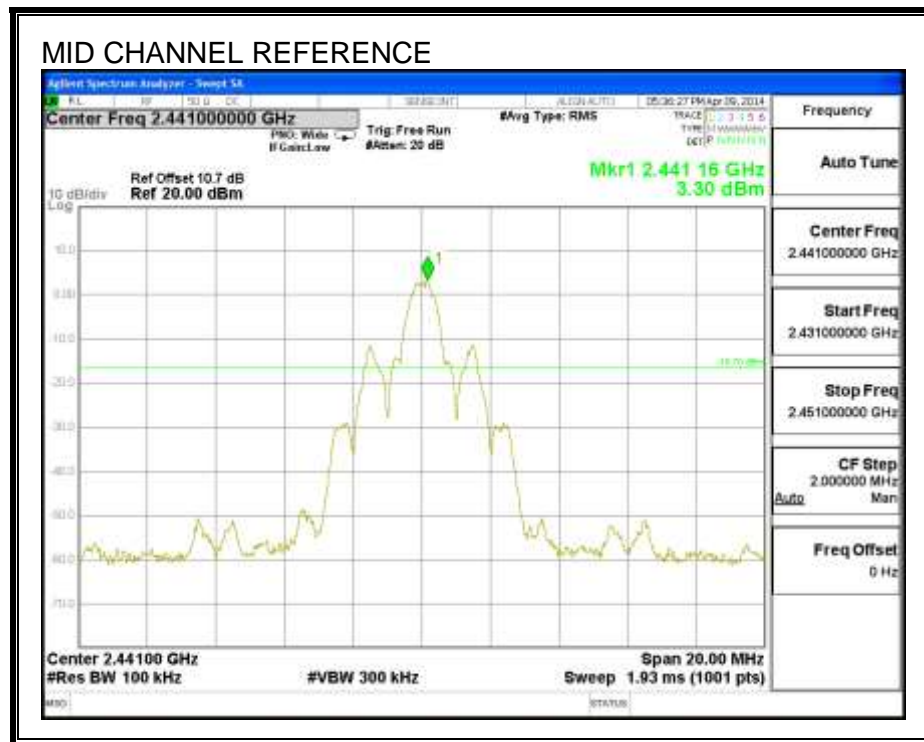
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

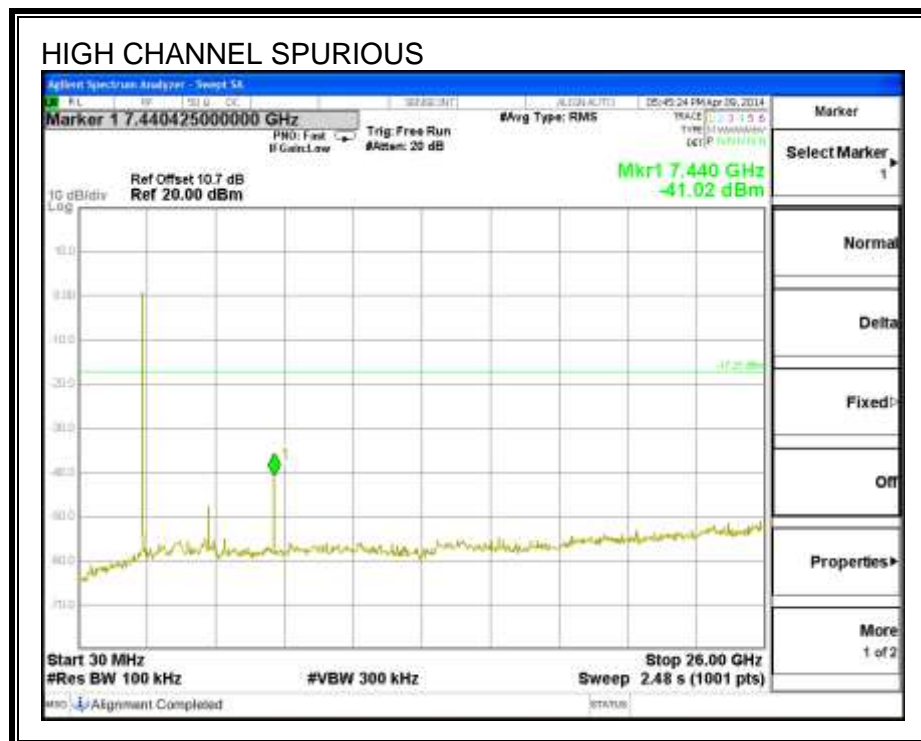
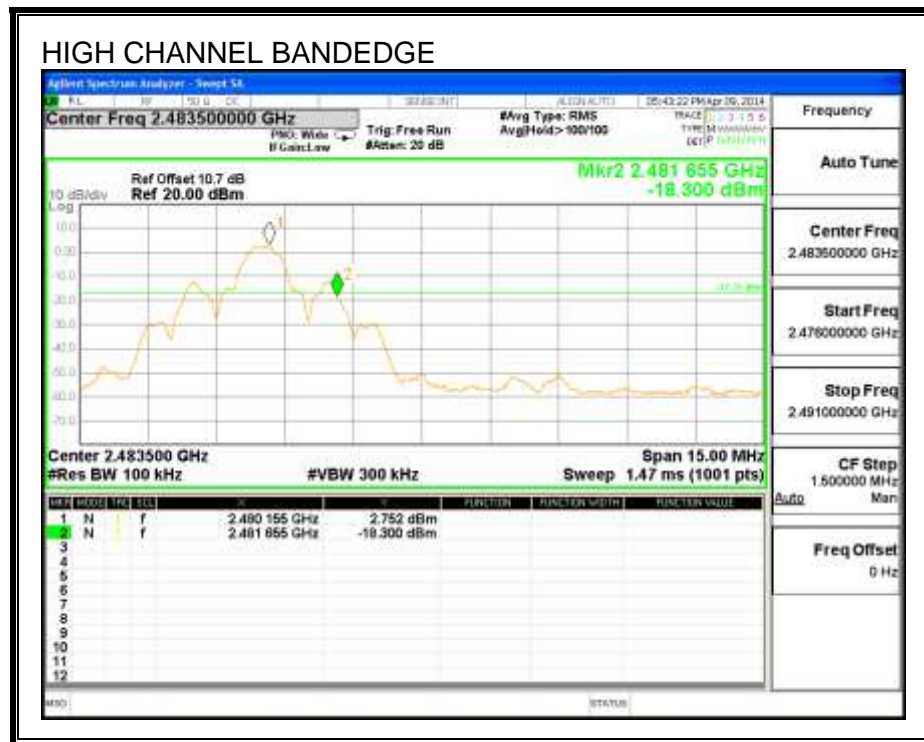
SPURIOUS EMISSIONS, LOW CHANNEL



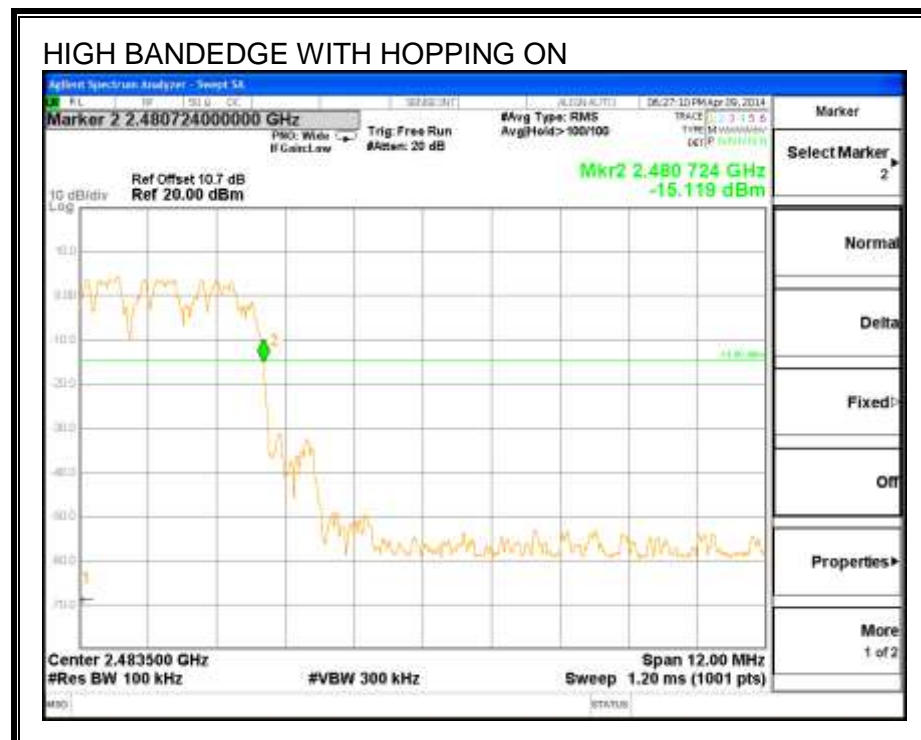
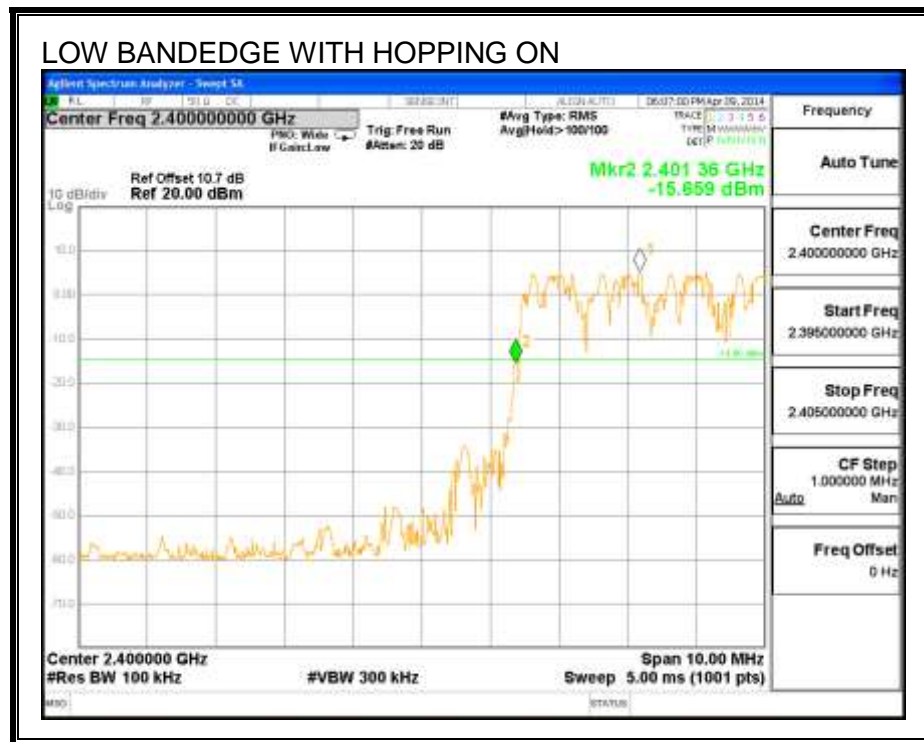
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



8. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

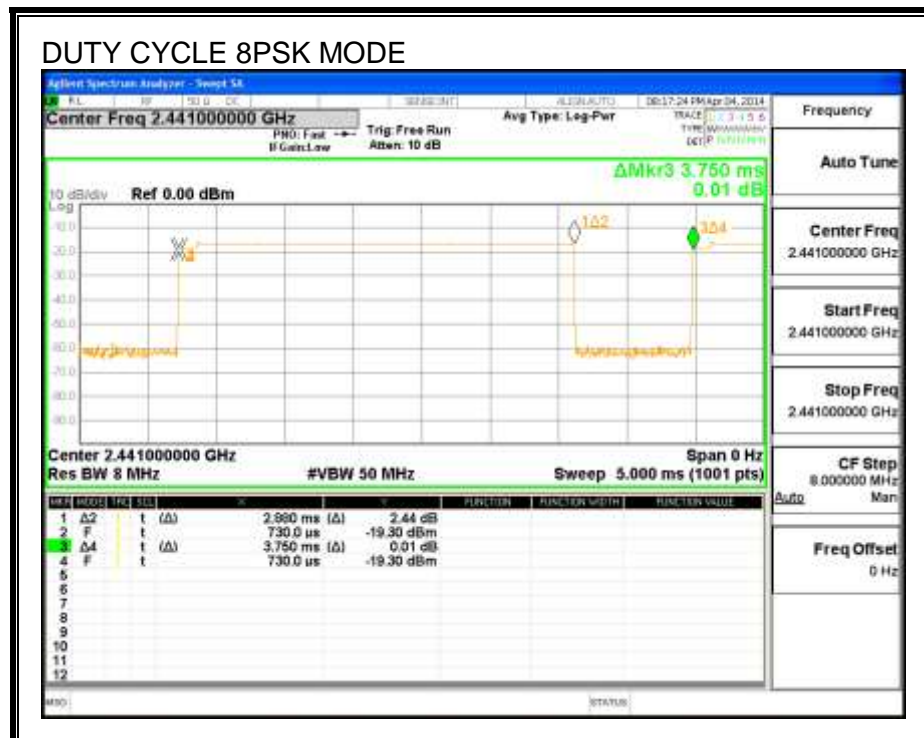
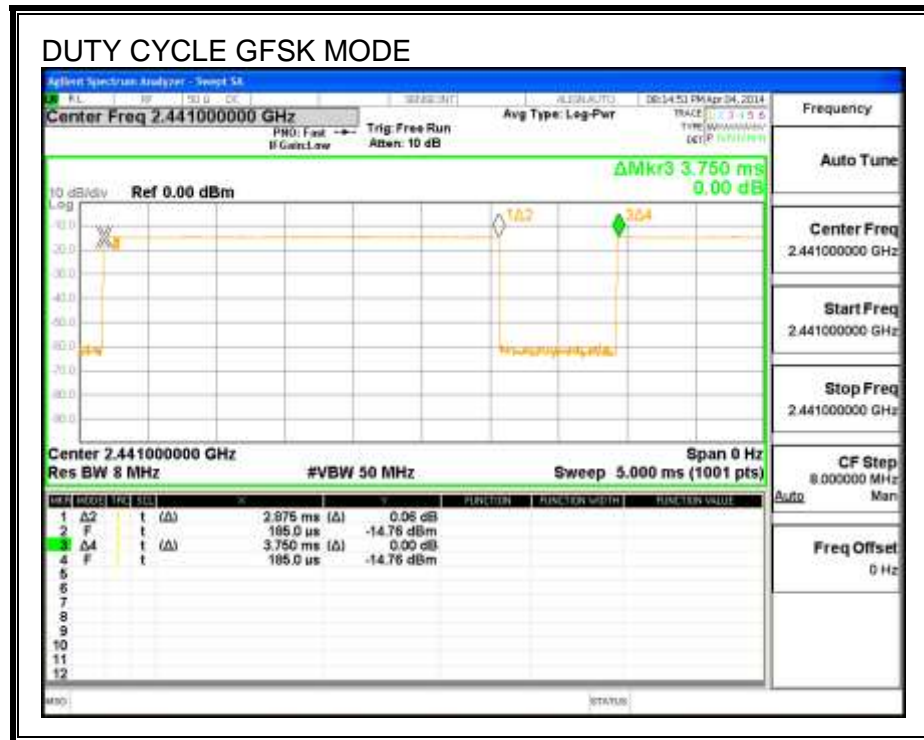
8.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4 GHz band (Hopping OFF)						
Bluetooth GFSK	2.875	3.750	0.767	76.67%	1.15	0.348
Bluetooth 8PSK	2.880	3.750	0.768	76.80%	1.15	0.347

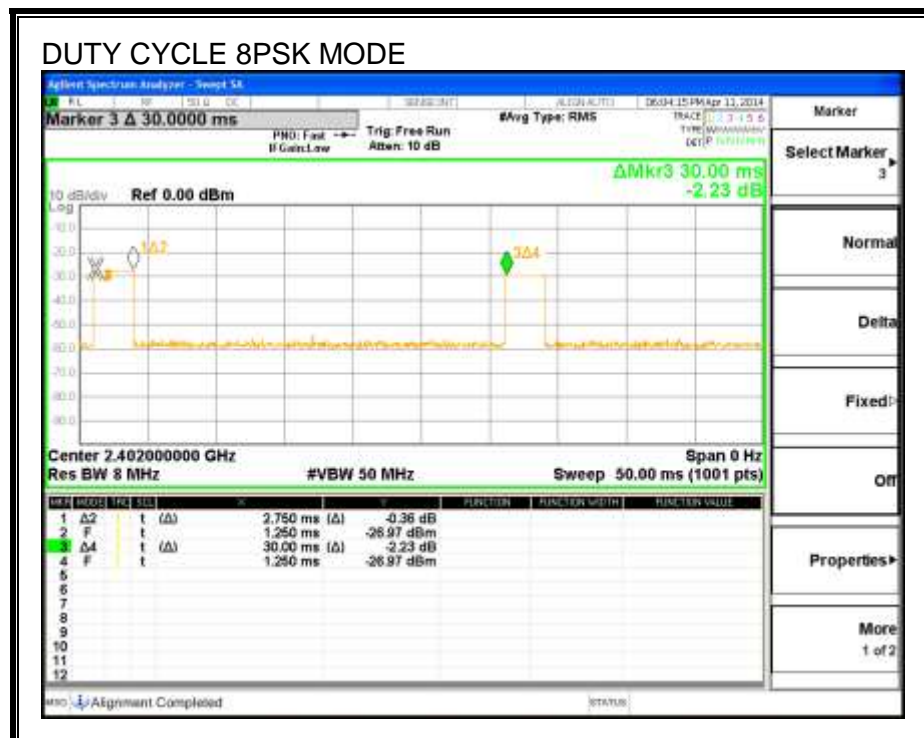
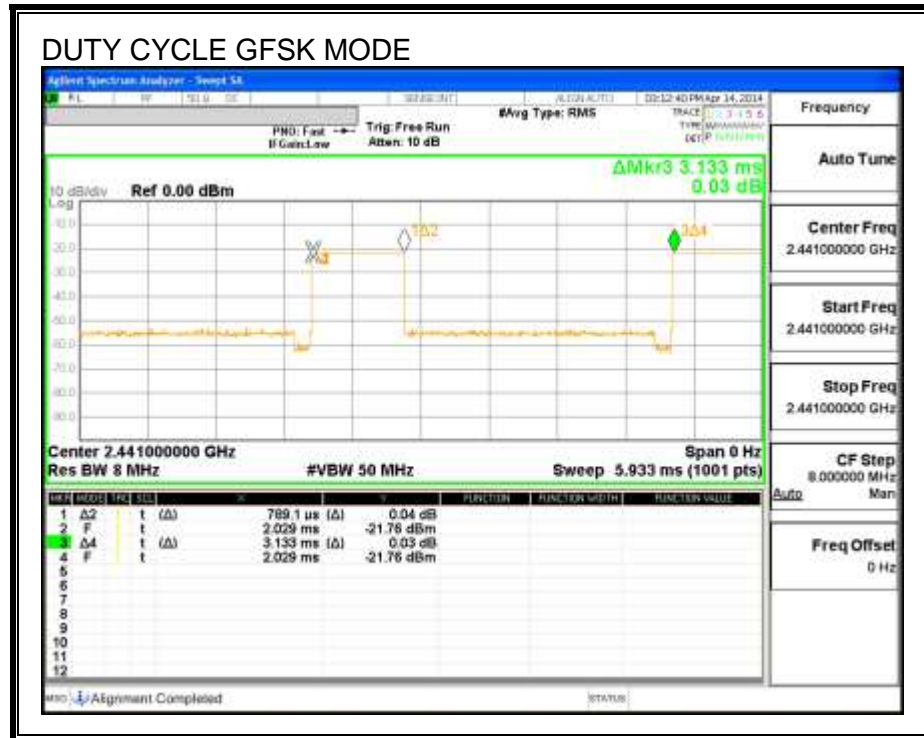
2.4 GHz band (Hopping ON)						
Bluetooth GFSK	0.789	3.13	0.252	25.18%	11.98	N/A
Bluetooth 8PSK	2.750	30	0.092	9.17%	20.76	N/A

8.2. DUTY CYCLE PLOTS

HOPPING OFF



HOPPING ON



9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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

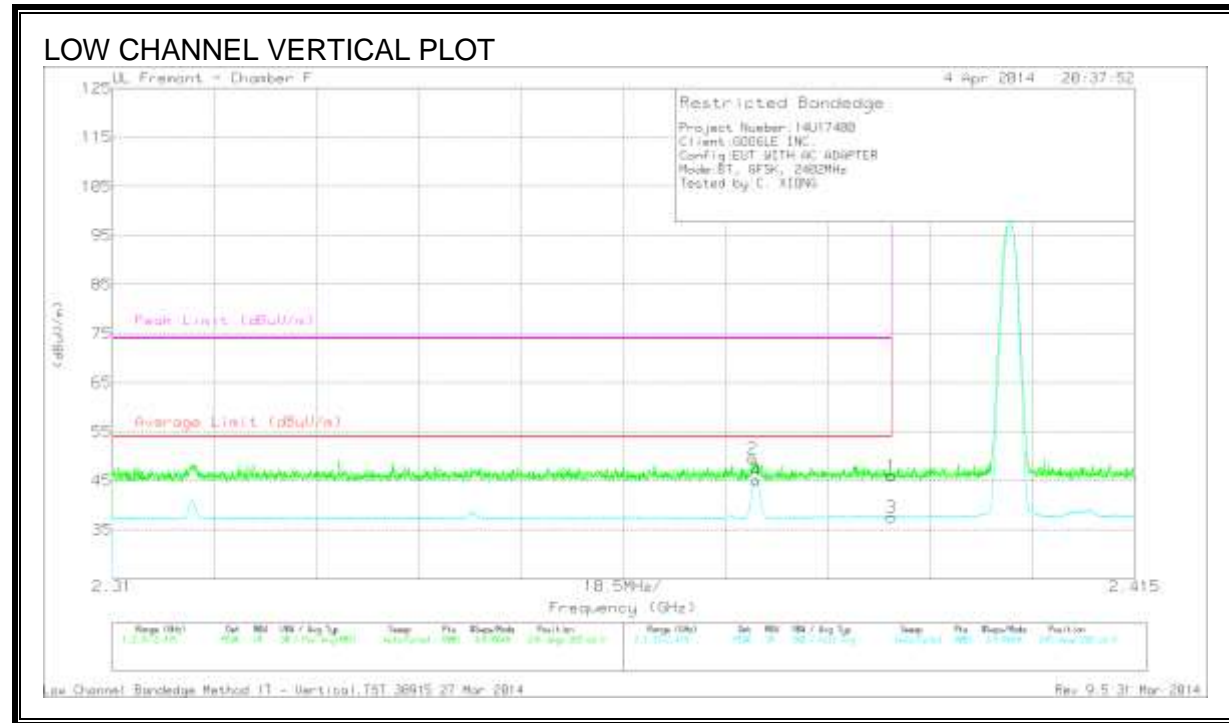
The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

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 3 MHz for peak measurements and 1 MHz resolution bandwidth with 3MHz video bandwidth with average detector 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.



DATA

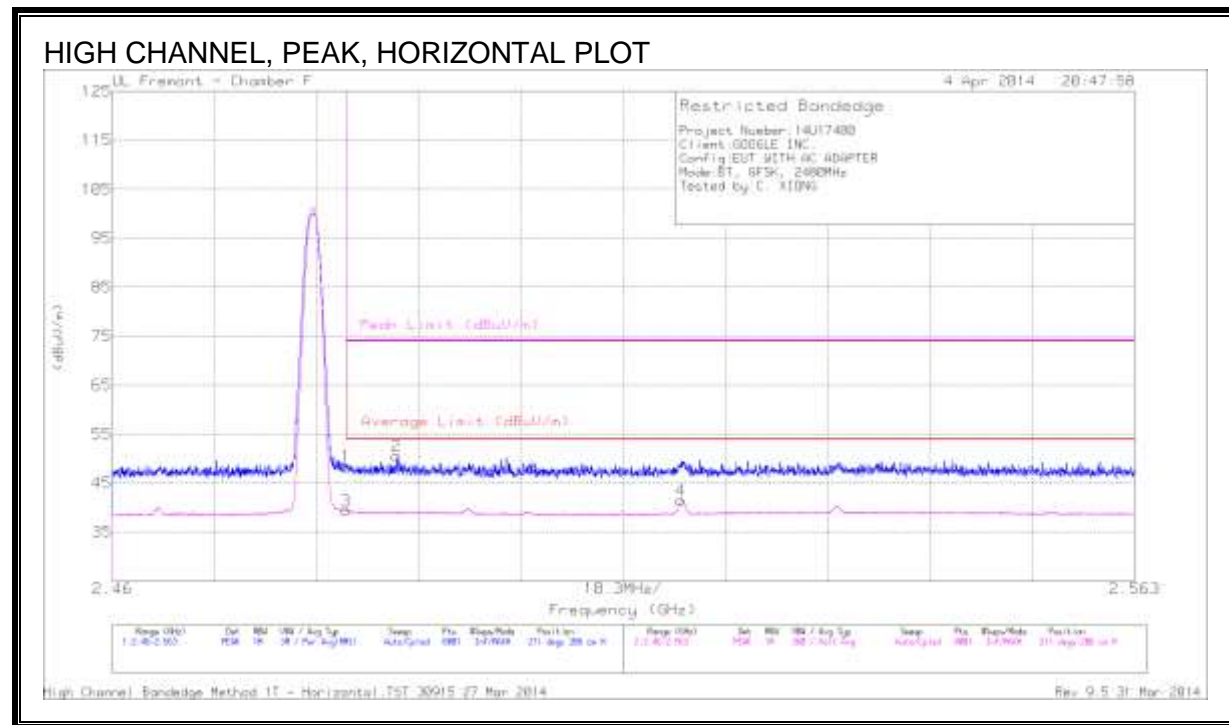
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	37.7	PK	32.2	-23.8	0	46.1	-	-	74	-27.9	241	265	V
2	* 2.376	41.37	PK	32.1	-23.9	0	49.57	-	-	74	-24.43	241	265	V
3	* 2.39	28.05	VB1T	32.2	-23.8	1.2	37.65	54	-16.35	-	-	241	265	V
4	* 2.376	35.73	VB1T	32.1	-23.9	1.2	45.13	54	-8.87	-	-	241	265	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

RESTRICTED BANDEDGE (HIGH CHANNEL)



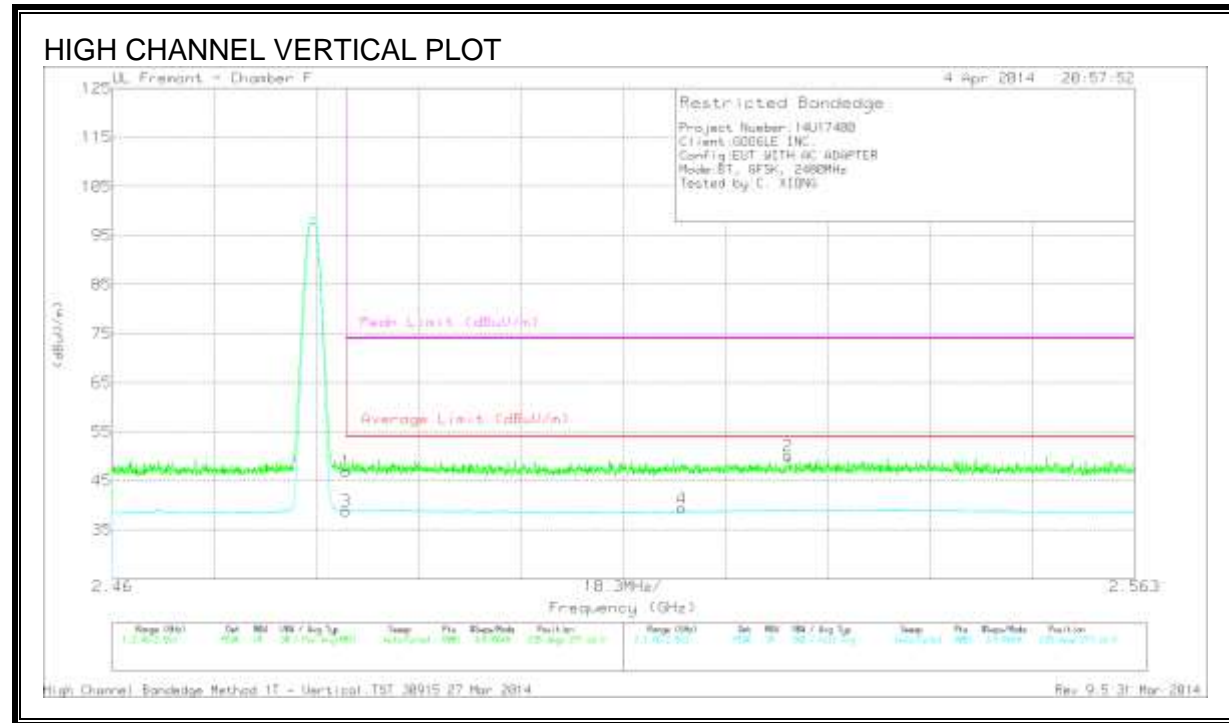
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cb/Fit r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	38.77	PK	32.6	-23	0	48.37	-	-	74	-25.63	211	206	H
2	* 2.489	40.71	PK	32.6	-22.8	0	50.51	-	-	74	-23.49	211	206	H
3	* 2.484	28.54	VB1T	32.6	-23	1.2	39.34	54	-14.66	-	-	211	206	H
4	2.517	30.61	VB1T	32.7	-23	1.2	41.51	54	-12.49	-	-	211	206	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet



DATA

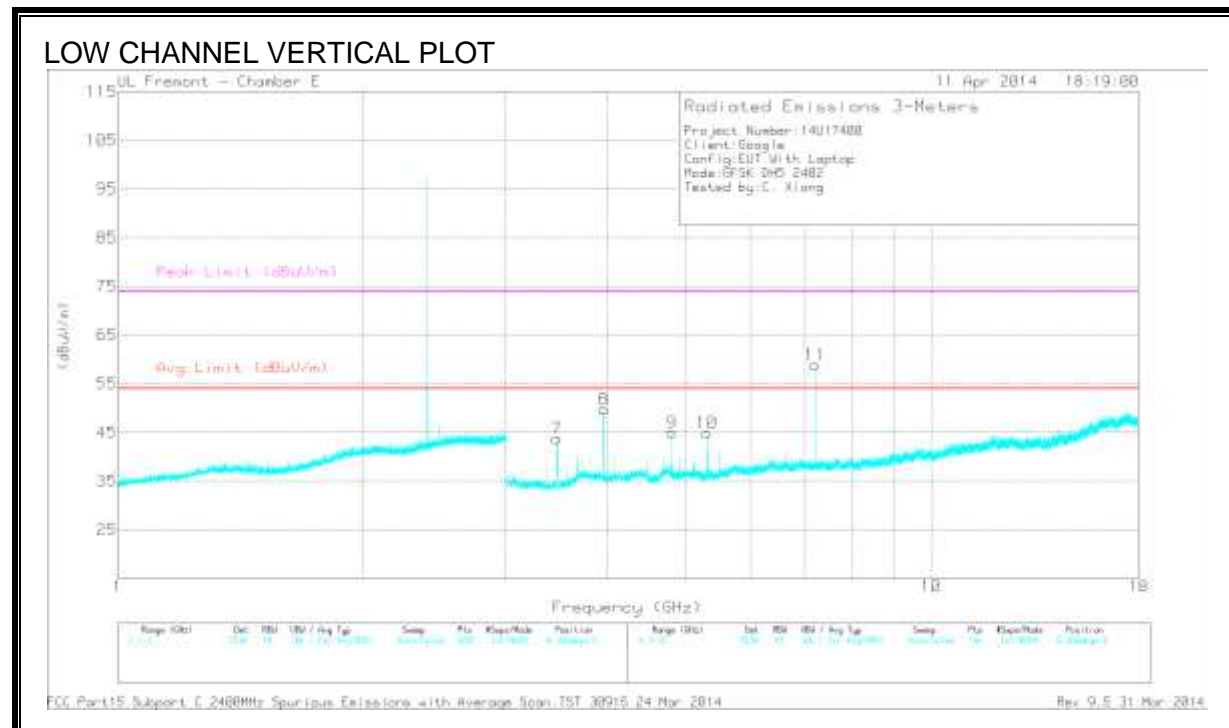
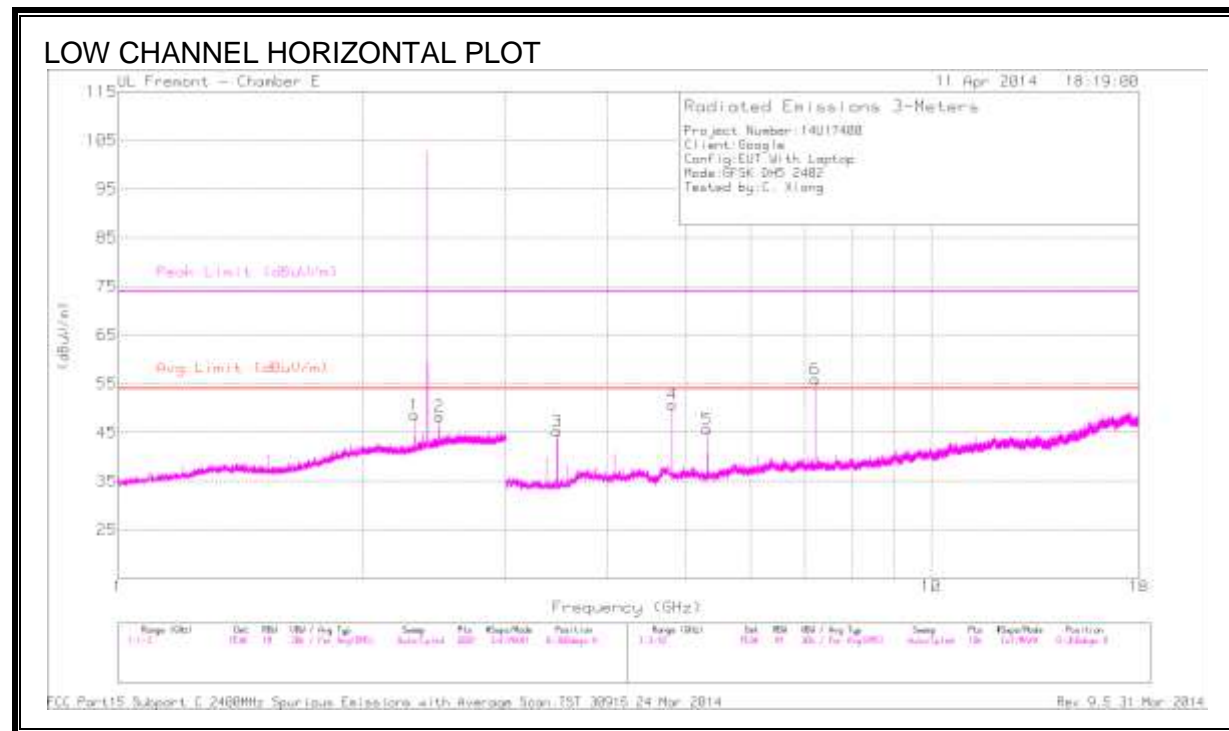
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	37.35	PK	32.6	-23	0	46.95	-	-	74	-27.05	235	271	V
2	2.528	40.22	PK	32.7	-22.9	0	50.02	-	-	74	-23.98	235	271	V
3	* 2.484	28.1	VB1T	32.6	-23	1.2	38.9	54	-15.1	-	-	235	271	V
4	2.517	28.44	VB1T	32.7	-23	1.2	39.34	54	-14.66	-	-	235	271	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS -LOW CHANNEL



DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.318	47.08	PK3	31.6	-25	0	53.68	-	-	74	-20.32	161	357	H
* 2.318	40.05	VB1T	31.6	-25	1.2	47.85	54	-6.15	-	-	161	357	H
* 2.486	45.93	PK3	32.3	-24.3	0	53.93	-	-	74	-20.07	212	302	H
* 2.486	38.35	VB1T	32.3	-24.3	1.2	47.55	54	-6.45	-	-	212	302	H
* 4.804	49.75	PK3	34.1	-30.9	0	52.95	-	-	74	-21.05	0	195	H
* 4.804	46.05	VB1T	34.1	-30.9	1.2	50.45	54	-3.55	-	-	0	195	H
* 3.965	41.03	PK3	33.5	-31	0	43.53	-	-	74	-30.47	184	125	V
* 3.962	29.59	VB1T	33.5	-31	1.2	33.29	54	-20.71	-	-	184	125	V
* 4.804	45.96	PK3	34.1	-30.9	0	49.16	-	-	74	-24.84	217	281	V
* 4.804	41.52	VB1T	34.1	-30.9	1.2	45.92	54	-8.08	-	-	217	281	V
3.468	43.78	PK3	32.8	-31.3	0	45.28	-	-	-	-	0-360	199	H
3.468	42.29	PK3	32.8	-31.3	0	43.79	-	-	-	-	0-360	200	V
5.304	41.79	PK3	34.3	-30.4	0	45.69	-	-	-	-	0-360	199	H
5.304	41.05	PK3	34.3	-30.4	0	44.95	-	-	-	-	0-360	200	V
7.206	48.56	PK3	35.8	-28.4	0	55.96	-	-	-	-	0-360	199	H
7.206	51.53	PK3	35.8	-28.4	0	58.93	-	-	-	-	0-360	200	V

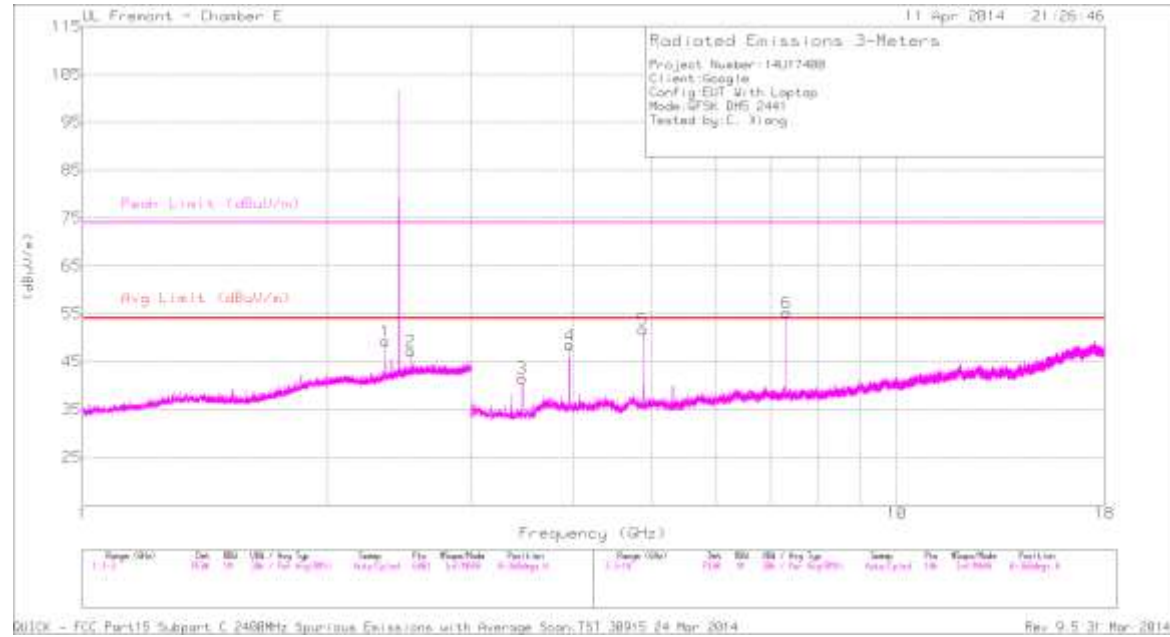
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

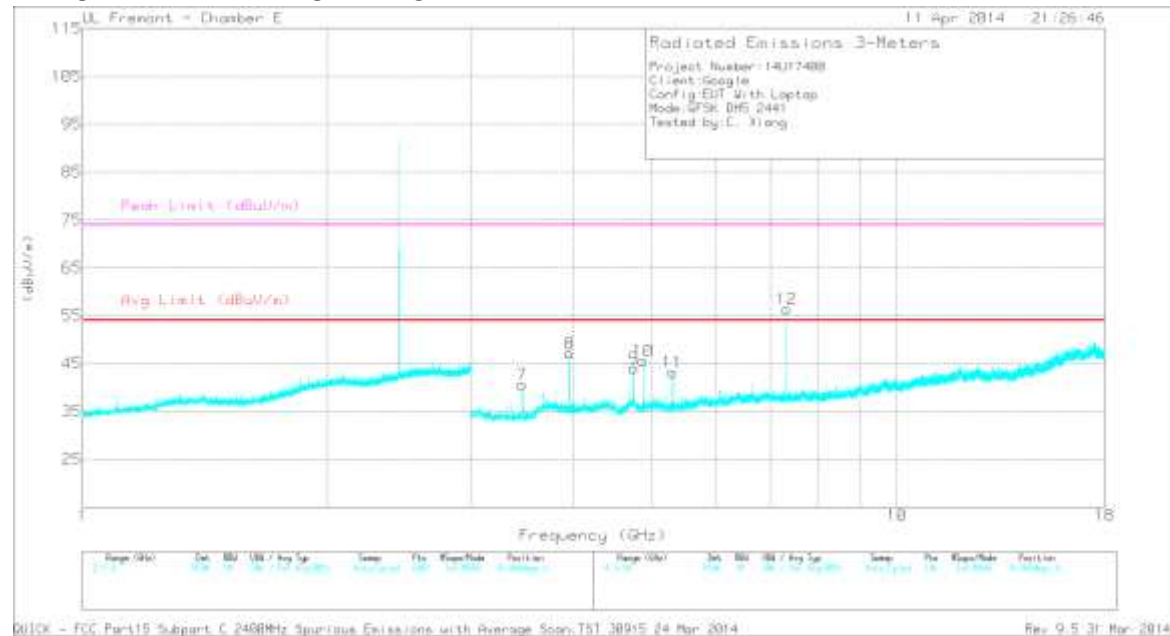
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS - MID CHANNEL

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



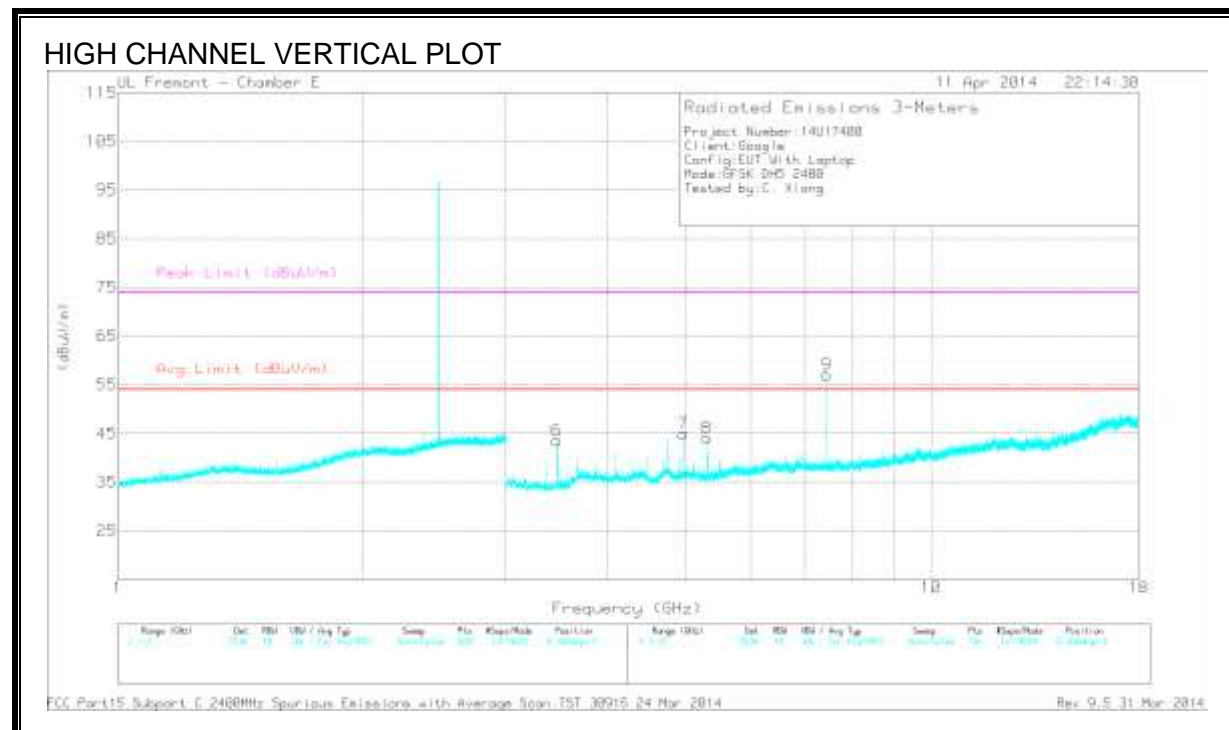
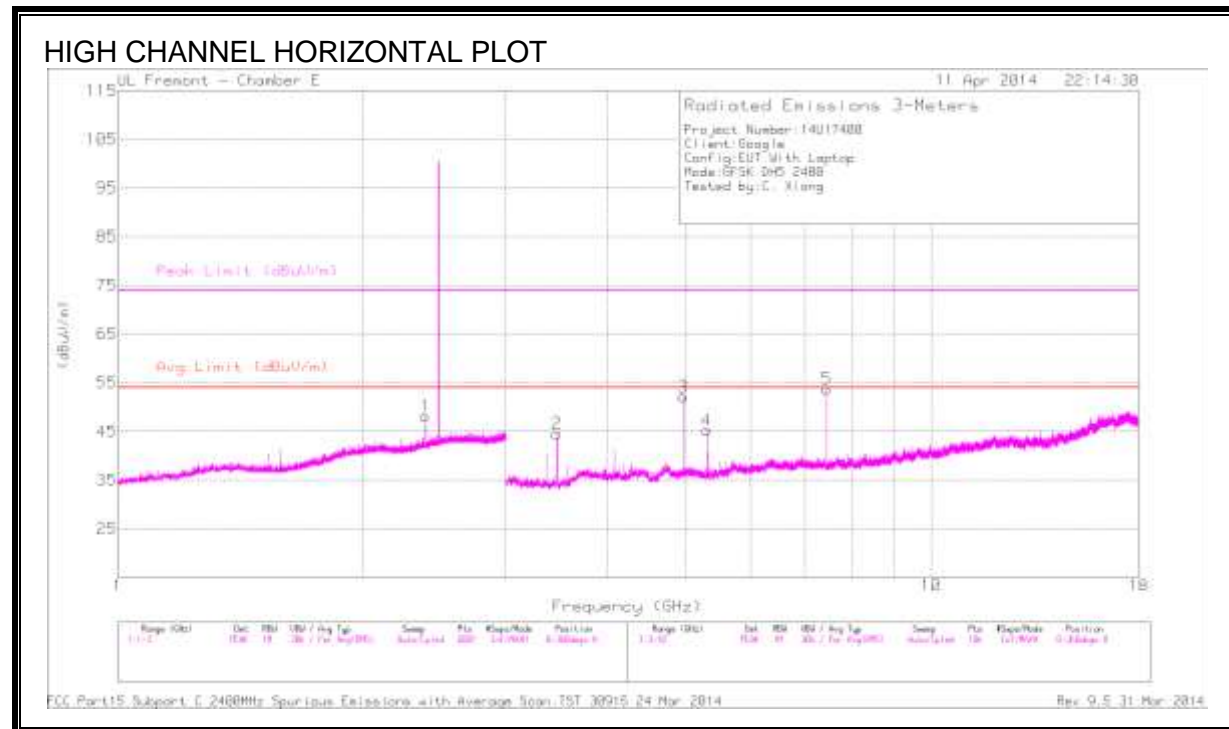
DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.354	47.19	PK3	31.8	-24.7	11.98	54.29	54	-11.69	74	-19.71	167	229	H
* 3.956	40.46	PK3	33.5	-31.1	11.98	42.86	54	-23.12	74	-31.14	169	350	H
* 4.882	51.78	PK3	34	-30.9	11.98	54.88	54	-11.1	74	-19.12	348	297	H
* 7.323	49	PK3	35.7	-27.6	11.98	57.1	54	-8.88	74	-16.9	12	132	H
* 3.958	40.89	PK3	33.5	-31.1	11.98	43.29	54	-22.69	74	-30.71	154	169	V
* 4.753	41.06	PK3	34.1	-30.9	11.98	44.26	54	-21.72	74	-29.74	116	359	V
* 4.882	48.5	PK3	34	-30.9	11.98	51.6	54	-14.38	74	-22.4	223	304	V
* 7.323	51.49	PK3	35.7	-27.6	11.98	59.59	54	-6.39	74	-14.41	305	395	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

HARMONICS AND SPURIOUS EMISSIONS -HIGH CHANNEL



DATA

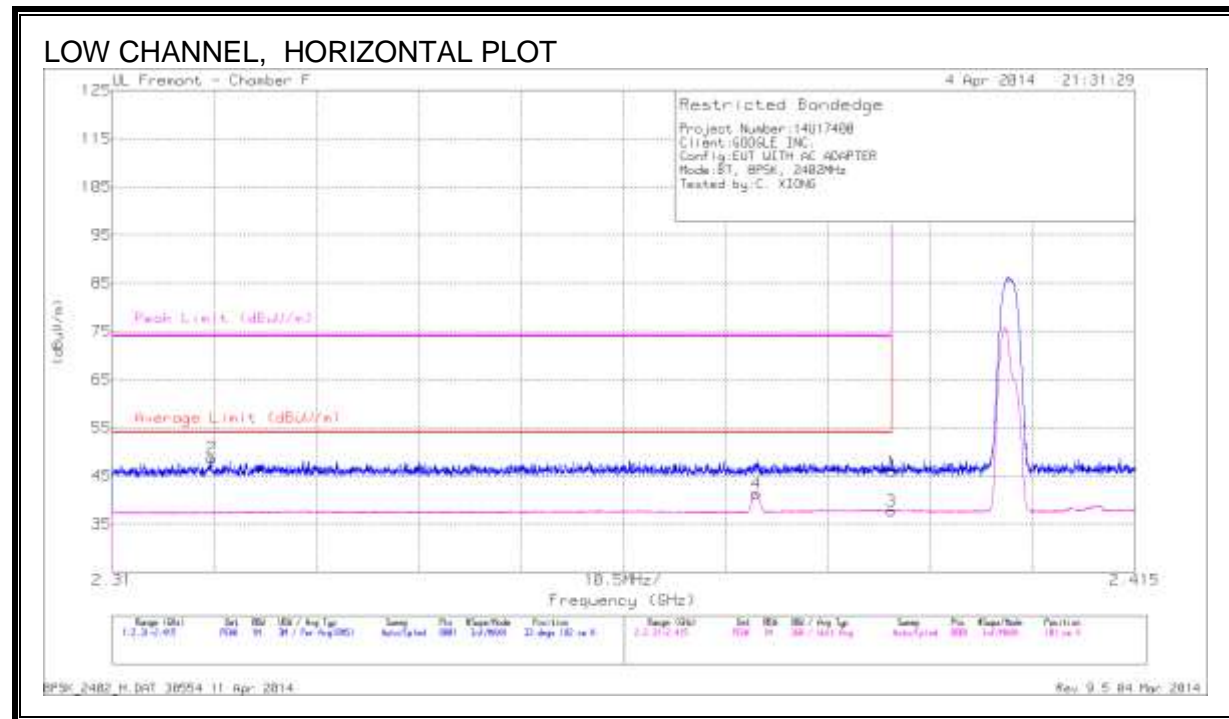
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl /Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.96	51.23	PK3	34.1	-30.2	11.98	55.13	54	-10.85	74	-18.87	332	360	H
* 7.439	51.44	PK3	35.7	-28.2	11.98	58.94	54	-7.04	74	-15.06	352	217	H
* 4.96	48.08	PK3	34.1	-30.2	11.98	51.98	54	-14	74	-22.02	220	270	V
* 7.439	54.61	PK3	35.7	-28.2	11.98	62.11	54	-3.87	74	-11.89	88	255	V
2.39	40.89	PK3	32	-24.7	11.98	48.19	54	-17.79	-	-	0-360	101	H
3.468	43.06	PK3	32.8	-31.3	11.98	44.56	54	-21.42	-	-	0-360	199	H
3.468	42.11	PK3	32.8	-31.3	11.98	43.61	54	-22.37	-	-	0-360	200	V
5.304	40.2	PK3	34.3	-30.4	11.98	44.1	54	-21.88	-	-	0-360	200	V
5.305	41.37	PK3	34.3	-30.4	11.98	45.27	54	-20.71	-	-	0-360	199	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

9.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)



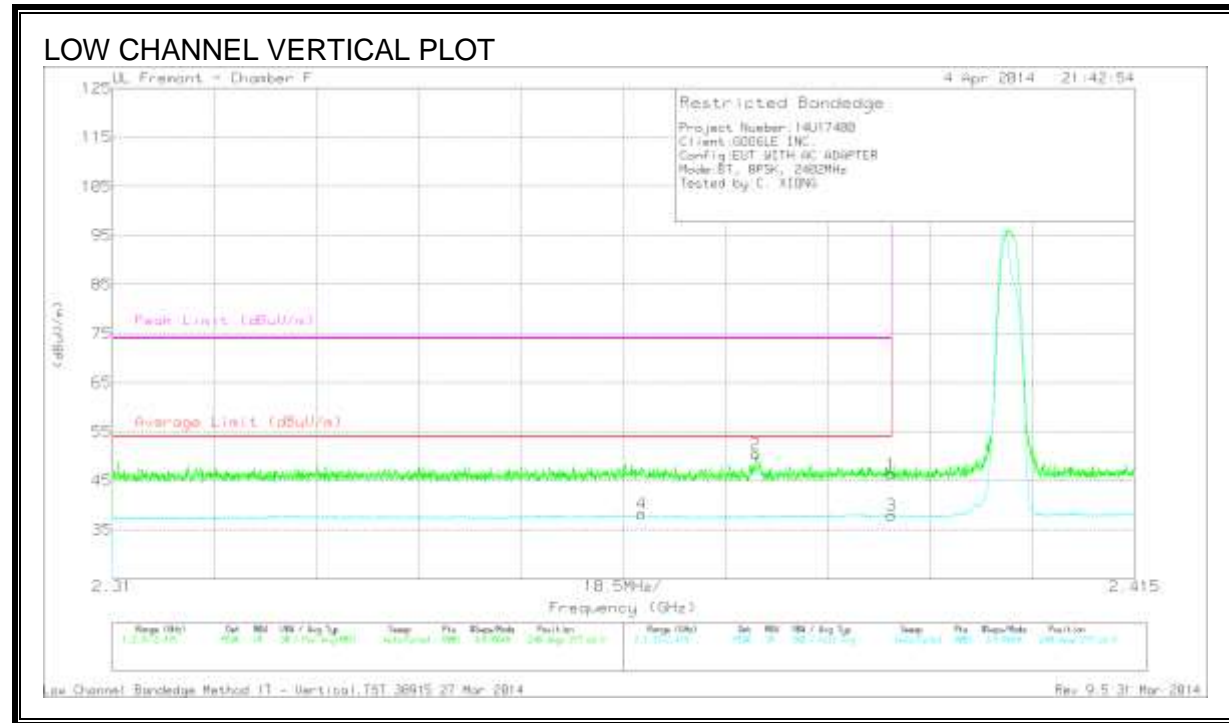
DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	37.59	PK	32.2	-23.8	0	45.99	-	-	74	-28.01	33	182	H
2	* 2.32	40.39	PK	31.9	-23.6	0	48.69	-	-	74	-25.31	33	182	H
3	* 2.39	28.13	VB1T	32.2	-23.8	1.2	37.73	54	-16.27	-	-	101	H	3
4	* 2.376	31.95	VB1T	32.1	-23.9	1.2	41.35	54	-12.65	-	-	101	H	4

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet



DATA

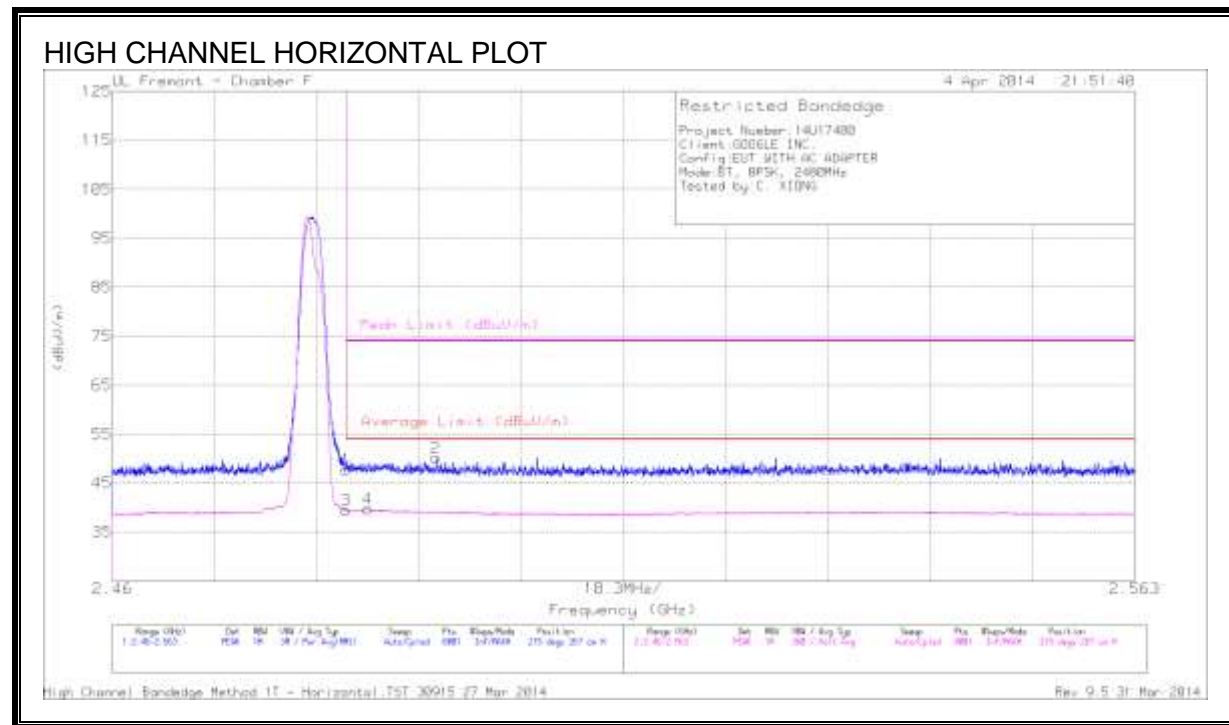
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	37.93	PK	32.2	-23.8	0	46.33	-	-	74	-27.67	240	277	V
2	* 2.376	42.16	PK	32.1	-23.9	0	50.36	-	-	74	-23.64	240	277	V
3	* 2.39	28.41	VB1T	32.2	-23.8	1.2	38.01	54	-15.99	-	-	240	277	V
4	* 2.364	28.72	VB1T	32.1	-23.8	1.2	38.22	54	-15.78	-	-	240	277	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

RESTRICTED BANDEGE (HIGH CHANNEL)



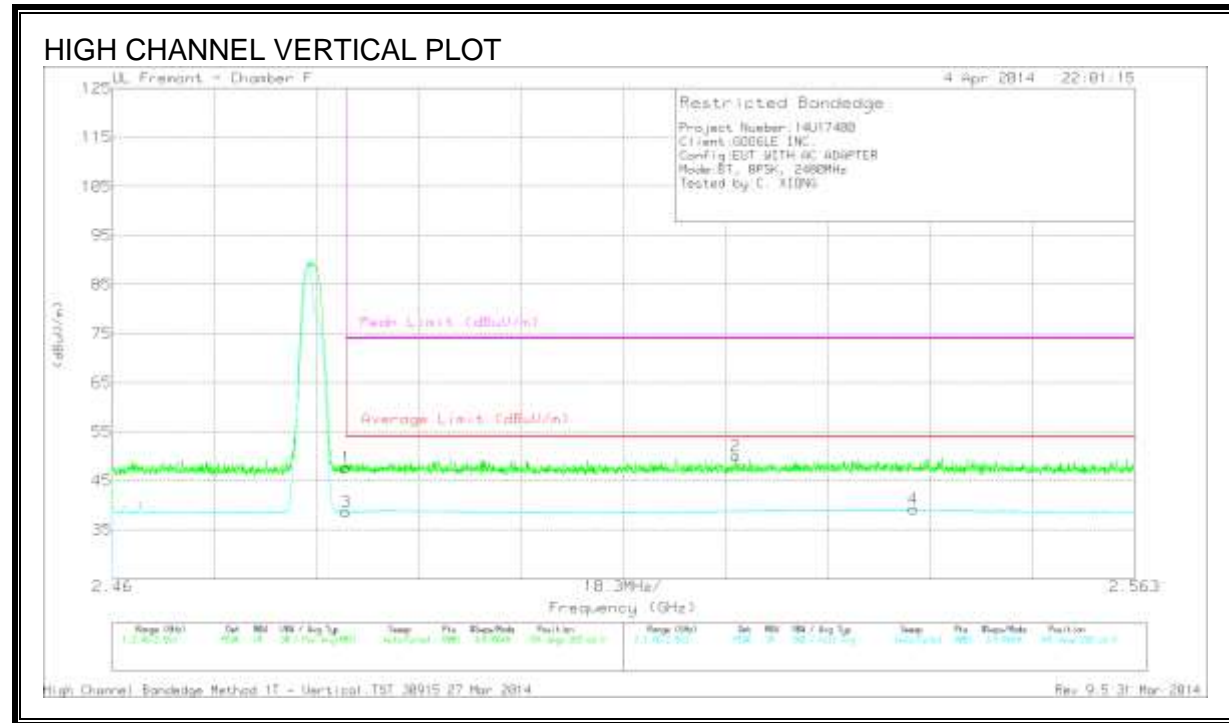
DATA

Marker	Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	38.2	PK	32.6	-23	0	47.8	-	-	74	-26.2	215	267	H
2	* 2.493	40.48	PK	32.6	-22.9	0	50.18	-	-	74	-23.82	215	267	H
3	* 2.484	28.65	VB1T	32.6	-23	1.2	39.45	54	-14.55	-	-	215	267	H
4	* 2.486	28.86	VB1T	32.6	-22.9	1.2	39.76	54	-14.24	-	-	215	267	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T120 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	38.09	PK	32.6	-23	0	47.69	-	-	74	-26.31	181	265	V
2	2.523	40.21	PK	32.7	-22.9	0	50.01	-	-	74	-23.99	181	265	V
3	* 2.484	27.78	VB1T	32.6	-23	1.2	38.58	54	-15.42	-	-	181	265	V
4	2.541	28.15	VB1T	32.7	-22.8	1.2	39.25	54	-14.75	-	-	181	265	V

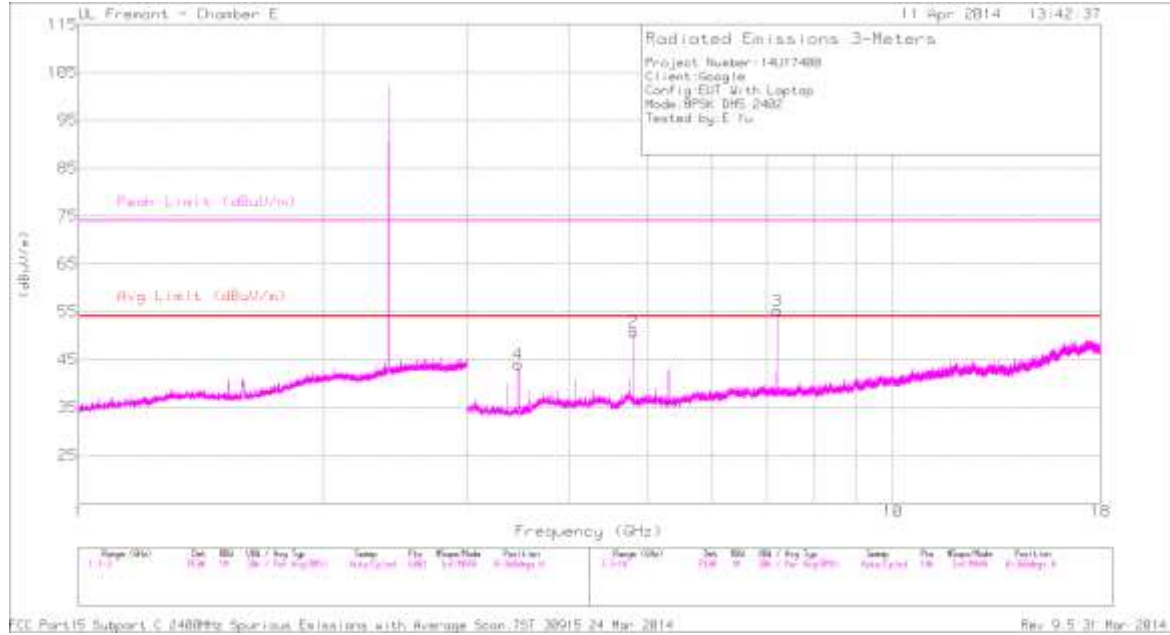
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

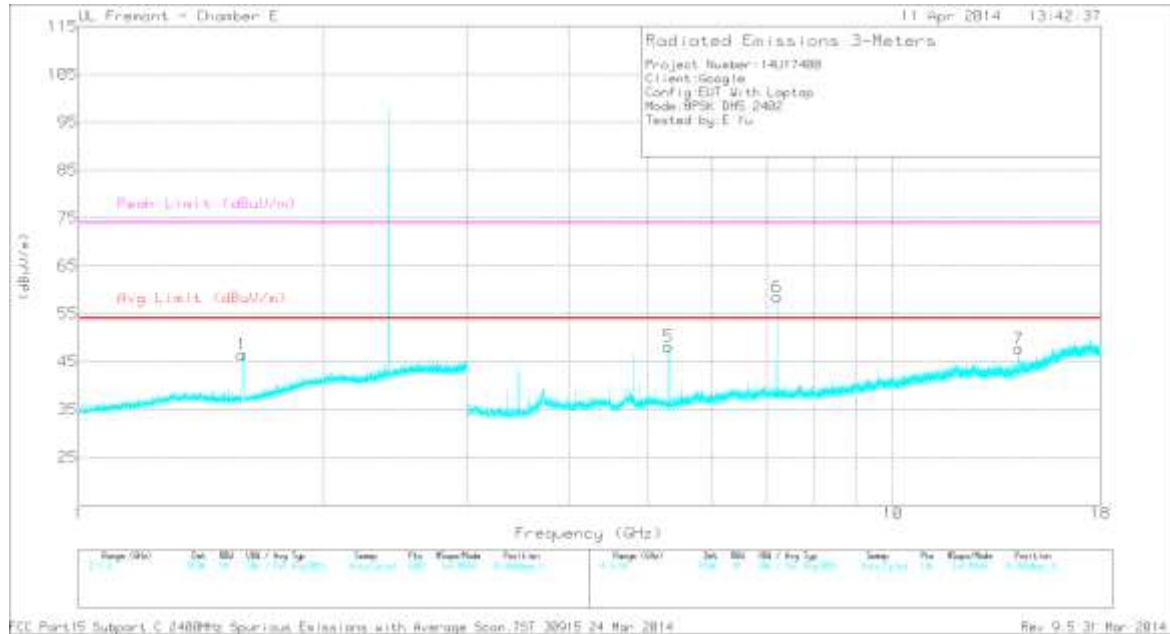
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



DATA

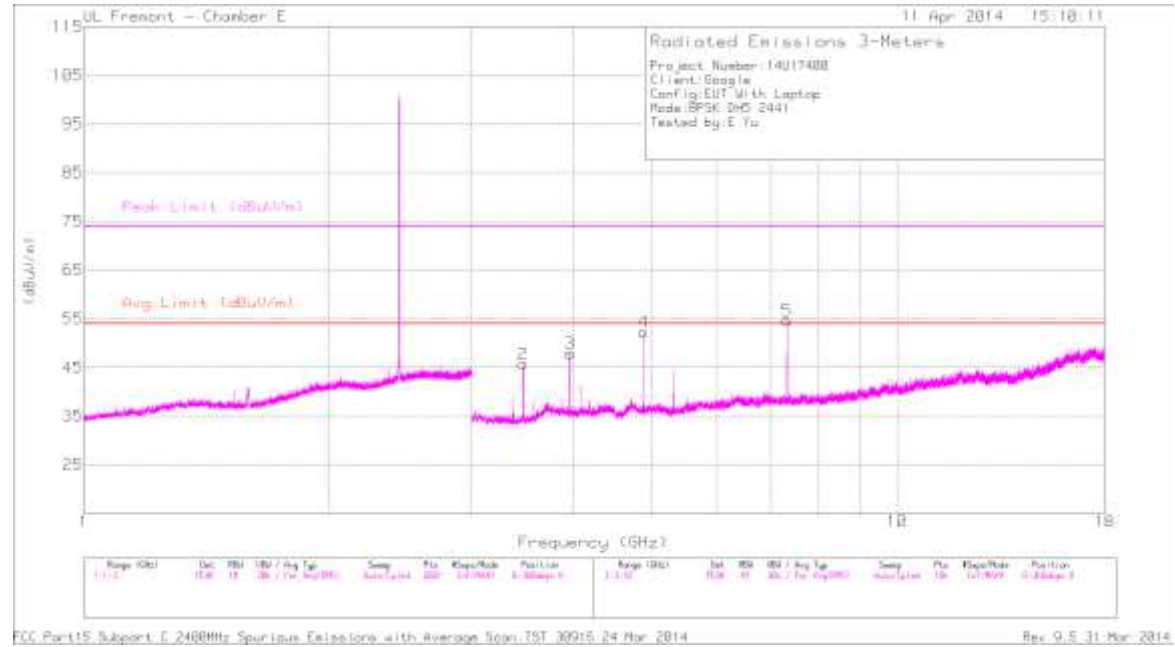
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/ Fitr/Pad (dB)	Avg DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.591	59.07	PK3	28.4	-26.4	20.76	61.07	54	-13.69	74	-12.93	136	118	V
* 4.803	50.93	PK3	34.1	-30.9	20.76	54.13	54	-20.63	74	-19.87	312	152	H
3.468	49.85	PK3	32.8	-31.3	20.76	51.35	54	-23.41	74	-22.65	24	302	H
5.304	50.23	PK3	34.3	-30.4	20.76	54.13	54	-20.63	74	-19.87	28	212	V
7.206	52.17	PK3	35.8	-28.4	20.76	59.57	54	-15.19	74	-14.43	94	250	H
7.206	55.44	PK3	35.8	-28.4	20.76	62.84	54	-11.92	74	-11.16	90	251	V
14.256	40.23	PK3	39	-25	20.76	54.23	54	-20.53	74	-19.77	126	249	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

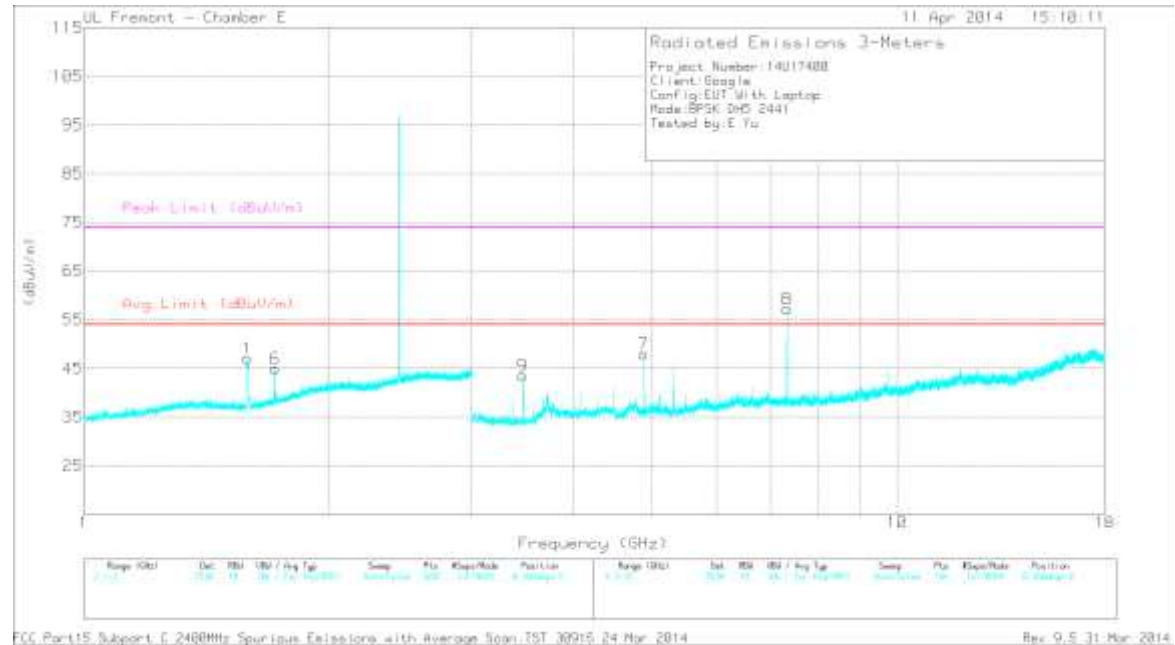
PK3 - FHSS Method: Maximum Peak

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



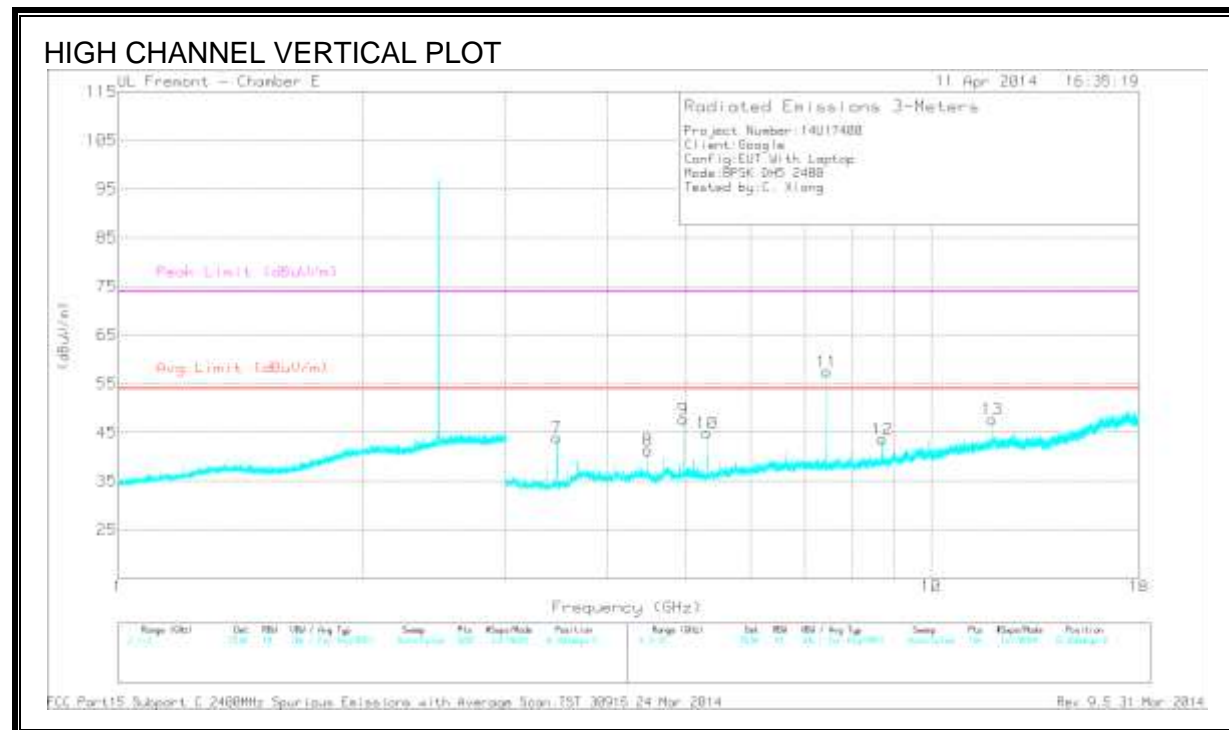
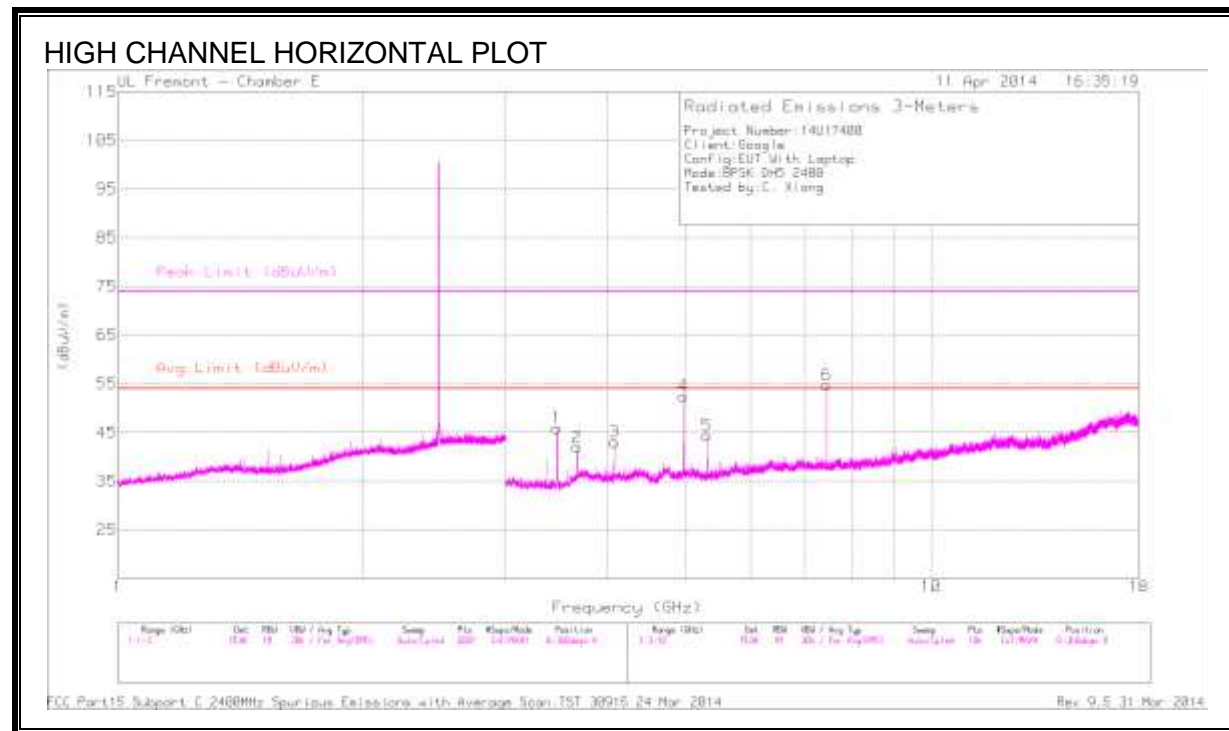
DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Avg DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.589	59.17	PK3	28.4	-26.4	20.76	61.17	54	-13.59	74	-12.83	137	117	V
* 1.719	43.38	PK3	29.3	-26.2	20.76	46.48	54	-28.28	74	-27.52	36	217	V
* 4.882	53.09	PK3	34	-30.9	20.76	56.19	54	-18.57	74	-17.81	360	302	H
* 7.323	51.48	PK3	35.7	-27.6	20.76	59.58	54	-15.18	74	-14.42	90	238	H
* 4.882	49.74	PK3	34	-30.9	20.76	52.84	54	-21.92	74	-21.16	219	301	V
* 7.323	55.31	PK3	35.7	-27.6	20.76	63.41	54	-11.35	74	-10.59	85	243	V
3.468	49.85	PK3	32.8	-31.3	20.76	51.35	54	-23.41	74	-22.65	16	274	H
3.468	49.28	PK3	32.8	-31.3	20.76	50.78	54	-23.98	74	-23.22	52	387	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

HARMONICS AND SPURIOUS EMISSIONS



DATA

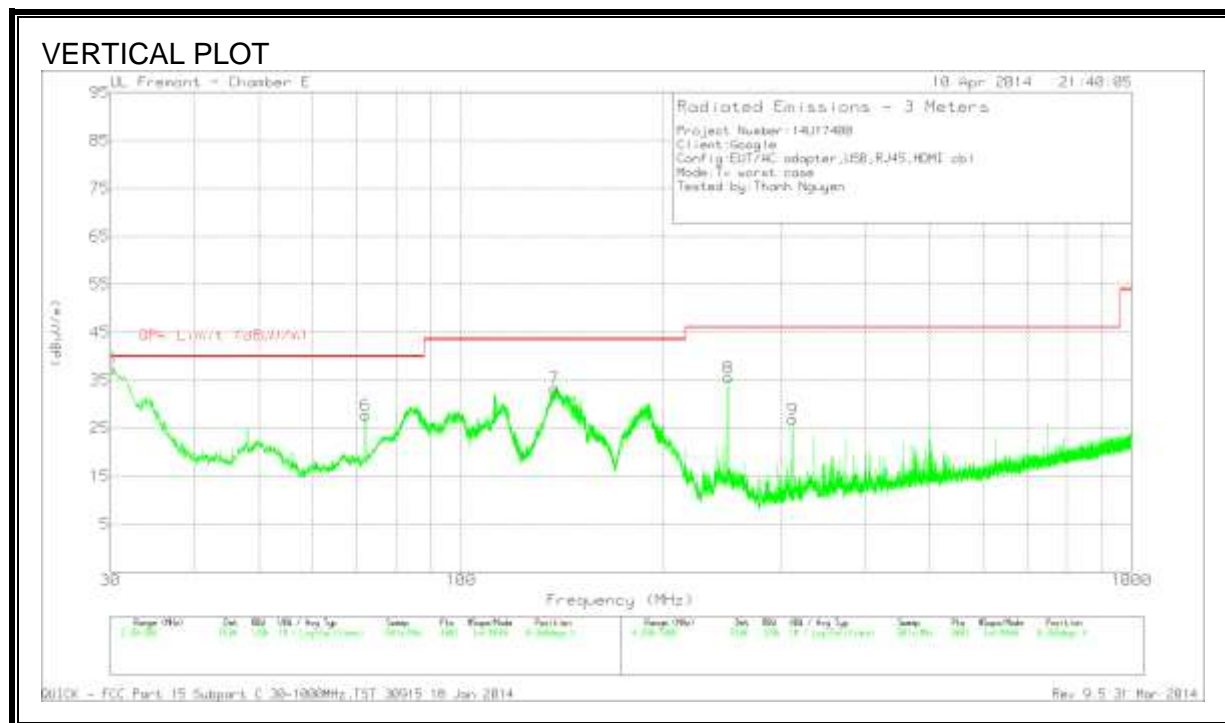
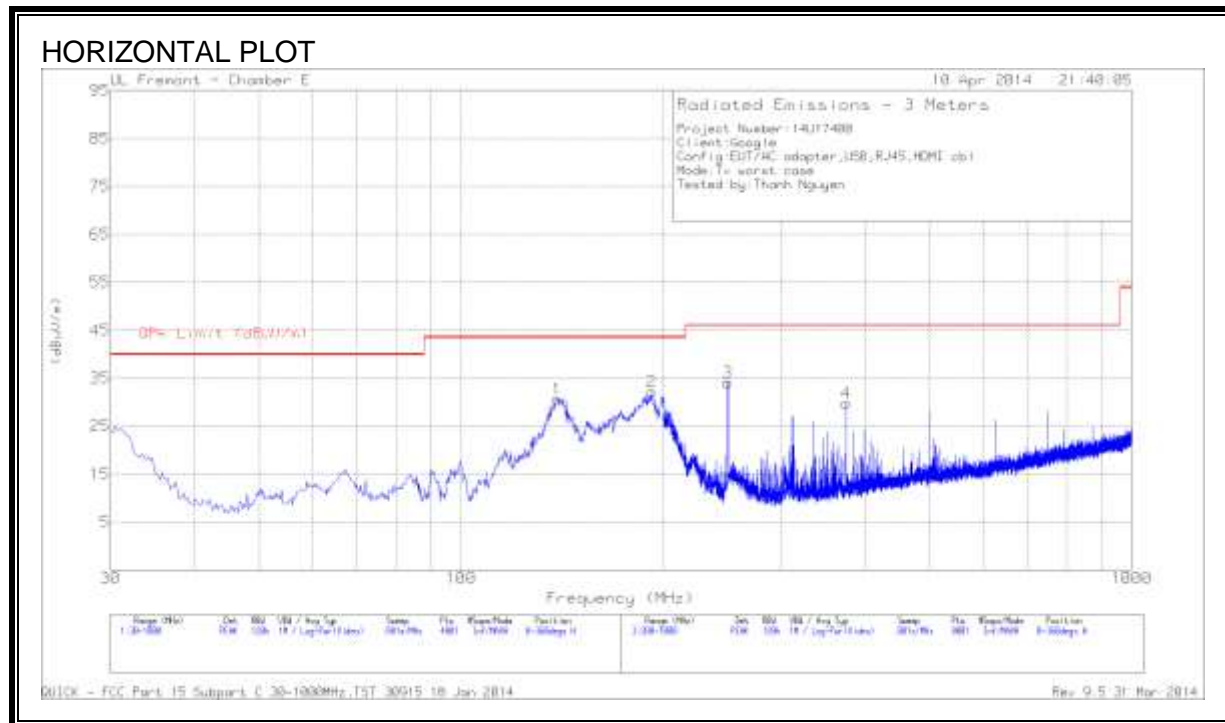
Frequen cy (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cb/ Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/ m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.96	53.71	PK3	34.1	-30.2	20.76	57.61	54	-17.15	74	-16.39	334	327	H
* 7.44	51.4	PK3	35.7	-28.2	20.76	58.9	54	-15.86	74	-15.1	343	333	H
* 3.677	41.74	PK3	33.3	-31	20.76	44.04	54	-30.72	74	-29.96	346	366	H
* 4.083	41.06	PK3	33.5	-30.6	20.76	43.96	54	-30.8	74	-30.04	274	102	H
* 7.44	55.23	PK3	35.7	-28.2	20.76	62.73	54	-12.03	74	-11.27	97	255	V
* 4.96	50.83	PK3	34.1	-30.2	20.76	54.73	54	-20.03	74	-19.27	217	240	V
* 11.881	35.9	PK3	38.5	-23.5	20.76	50.9	54	-23.86	74	-23.1	17	111	V
3.467	42.44	PK3	32.8	-31.3	20.76	43.94	54	-30.82	74	-30.06	0-360	200	V
3.468	44.44	PK3	32.8	-31.3	20.76	45.94	54	-28.82	74	-28.06	0-360	200	H
4.488	38.75	PK3	33.9	-31.3	20.76	41.35	54	-33.41	74	-32.65	0-360	200	V
5.304	40.97	PK3	34.3	-30.4	20.76	44.87	54	-29.89	74	-29.13	0-360	200	V
5.305	40.55	PK3	34.3	-30.4	20.76	44.45	54	-30.31	74	-29.55	0-360	200	H
8.712	33.04	PK3	36	-25.4	20.76	43.64	54	-31.12	74	-30.36	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

9.3. WORST-CASE BELOW 1 GHz

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



HORIZONTAL AND VERTICAL DATA

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T243 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degr)	Height (cm)	Polarity
30.4424	44.93	QP	21.1	-31.8	34.23	40	-5.77	342	107	V
139.6425	46.31	QP	13	-31.1	28.21	43.52	-15.31	149	203	H
30.0425	47.79	PK	21.4	-31.8	37.39	40	-2.61	0-360	100	V
71.99	51.15	PK	8.1	-31.5	27.75	40	-12.25	0-360	100	V
138.8825	48.64	PK	13.1	-31.1	30.64	43.52	-12.88	0-360	100	H
192.475	51.7	PK	11.3	-30.8	32.2	43.52	-11.32	0-360	100	H
311.9	43.46	PK	13.7	-30.3	26.86	46.02	-19.16	0-360	100	V
375.0775	44.74	PK	15	-30	29.74	46.02	-16.28	0-360	100	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
QP - Quasi-Peak detector
PK - Peak detector

10. 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

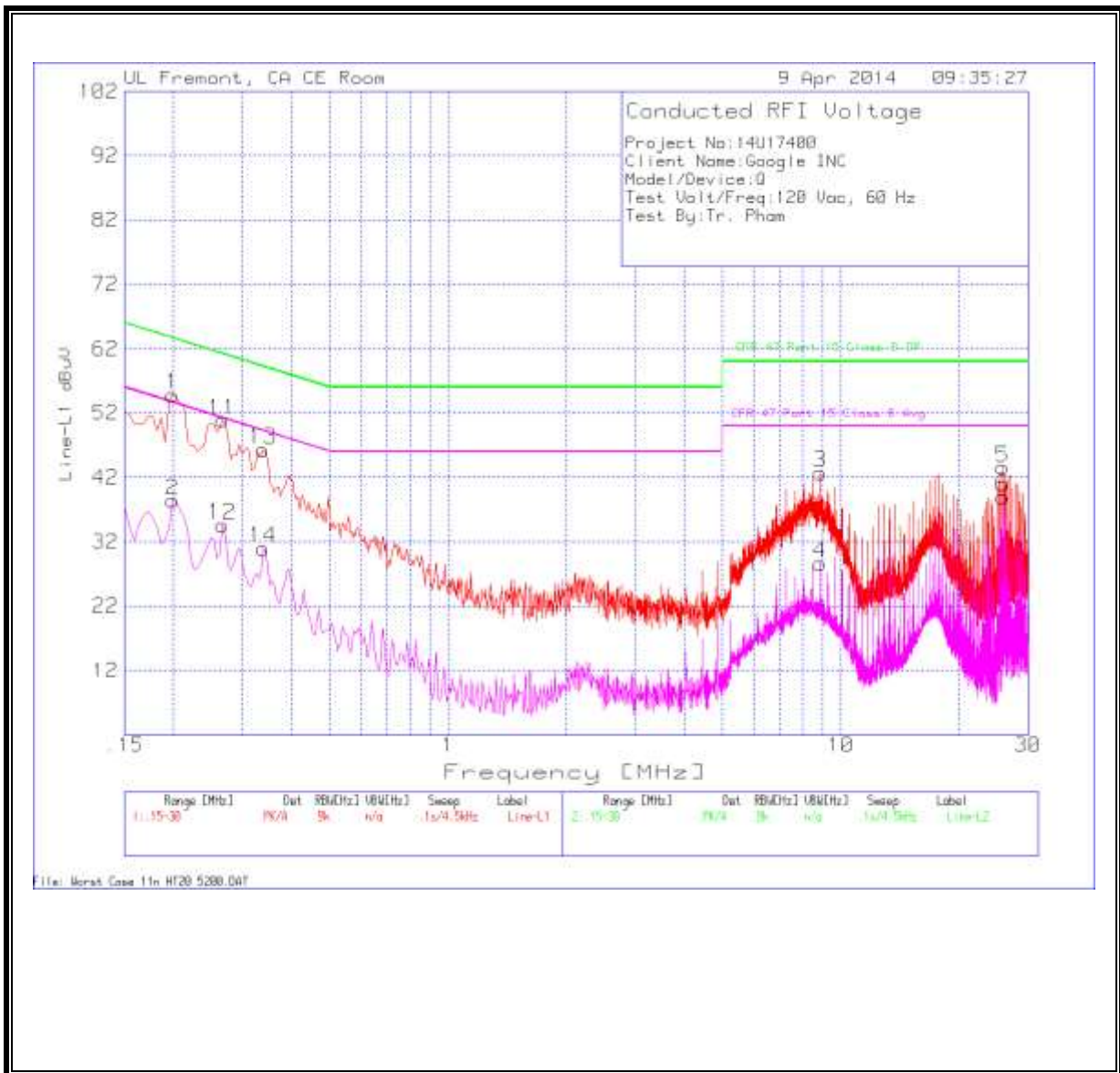
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

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

LINE 1 RESULTS



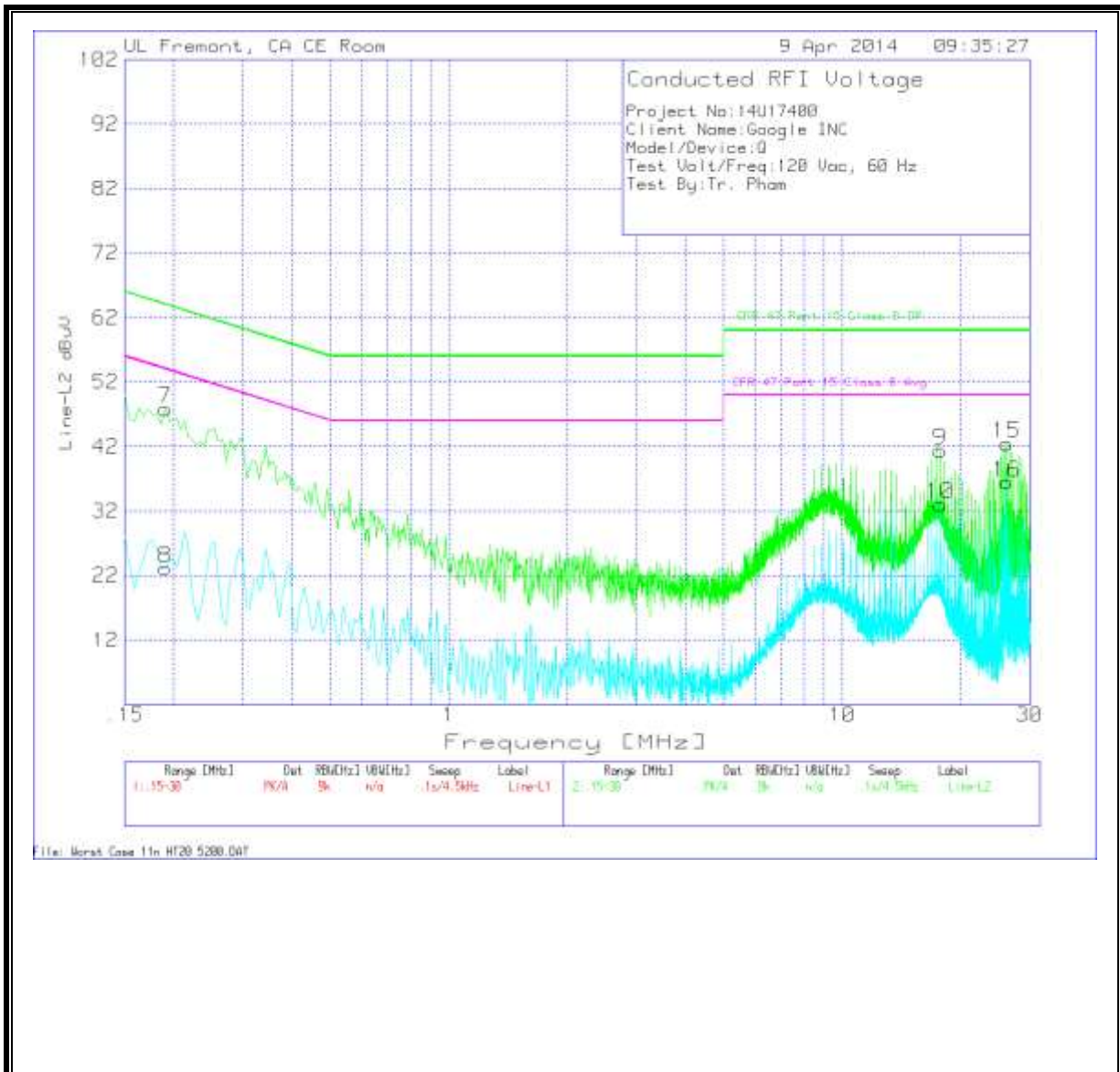
RESULTS

Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin to Limit (dB)	CFR 47 Part 15 Class B Avg	Margin to Limit (dB)
1	.1995	53.87	PK	.9	0	54.77	63.6	-8.83	--	--
2	.1995	37.48	Av	.9	0	38.38	--	--	53.6	-15.22
11	.267	50.28	PK	.6	0	50.88	61.2	-10.32	--	--
12	.267	33.92	Av	.6	0	34.52	--	--	51.2	-16.68
13	.339	45.76	PK	.5	0	46.26	59.2	-12.94	--	--
14	.339	30.51	Av	.5	0	31.01	--	--	49.2	-18.19
3	8.8665	42.39	PK	.2	.1	42.69	60	-17.31	--	--
4	8.8665	28.39	Av	.2	.1	28.69	--	--	50	-21.31
5	25.809	42.93	PK	.3	.3	43.53	60	-16.47	--	--
6	25.809	38.41	Av	.3	.3	39.01	--	--	50	-10.99

LINE 2 RESULTS



RESULTS

Line-L2 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin to Limit (dB)	CFR 47 Part 15 Class B Avg	Margin to Limit (dB)
7	.1905	46.77	PK	1.1	0	47.87	64	-16.13	--	--
8	.1905	22.06	Av	1.1	0	23.16	--	--	54	-30.84
9	17.7405	40.91	PK	.3	.2	41.41	60	-18.59	--	--
10	17.7405	32.49	Av	.3	.2	32.99	--	--	50	-17.01
15	26.2095	41.88	PK	.3	.3	42.48	60	-17.52	--	--
16	26.2095	35.84	Av	.3	.3	36.44	--	--	50	-13.56