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

CERTIFICATION TEST REPORT

FOR

2x2 802.11a/b/g/n +BT Module (SiP)

MODEL NUMBER: QCA6234

FCC ID: PPD-QCA6234
IC: 4104A-QCA6234

REPORT NUMBER: 13U14995-3, Revision A

ISSUE DATE: JULY 1, 2013

Prepared for
QUALCOMM ATHEROS, INC.
1700 TECHNOLOGY DRIVE
SAN JOSE, CA 95100

Prepared by
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	06/28/13	Initial Issue	F. Ibrahim
A	07/01/13	Corrected EUT Description	AAumentado

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: QUALCOMM ATHEROS, INC
1700 TECHNOLOGY DRIVE
SAN JOSE, CA 95100

EUT DESCRIPTION: 2x2 802.11a/b/g/n +BT Module (SiP)

MODEL: QCA6234

SERIAL NUMBER: 75720088, 75720080

DATE TESTED: MAY 17, 2013 – May 31, 2013

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 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 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:

FRANK IBRAHIM
WiSE PROGRAM MANAGER
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 Benicia Street, Fremont, California, USA.

UL Verification Services Inc. 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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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 2x2 802.11a/b/g/n +BT Module (SiP).

Three board variants are provided, no filter version, 3G filter version and LTE filter version. Test was done to worst case among the three boards.

The radio module is manufactured by Qualcomm Atheros, Inc.

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	8.84	7.66
2402 - 2480	DQPSK	10.86	12.19
2402 - 2480	Enhanced 8PSK	11.15	13.03

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA 802.11a/b/g/n WLAN/BT antenna, with a maximum gain of 3 dBi.

5.4. SOFTWARE AND FIRMWARE

Not Applicable.

5.5. WORST-CASE CONFIGURATION AND MODE

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

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

The EUT was tested as an external module installed in a test jig board connected to a host Laptop PC. The EUT was oriented in a flat orientation, similar to the orientation it would have in real installations; see setup photos for details.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T430 Thinkpad	QCA-REG17	N/A
Bluetooth to USB	Qualcomm Atheros	TB639-030-D0277	250-02293-C30	N/A
AC Adapter, Laptop	Lenovo	42T4430	11S42T4430Z1ZGWE07WE1V	N/A
AC Adapter, EUT	CUI, Inc.	3A-161WU65A	N/A	N/A

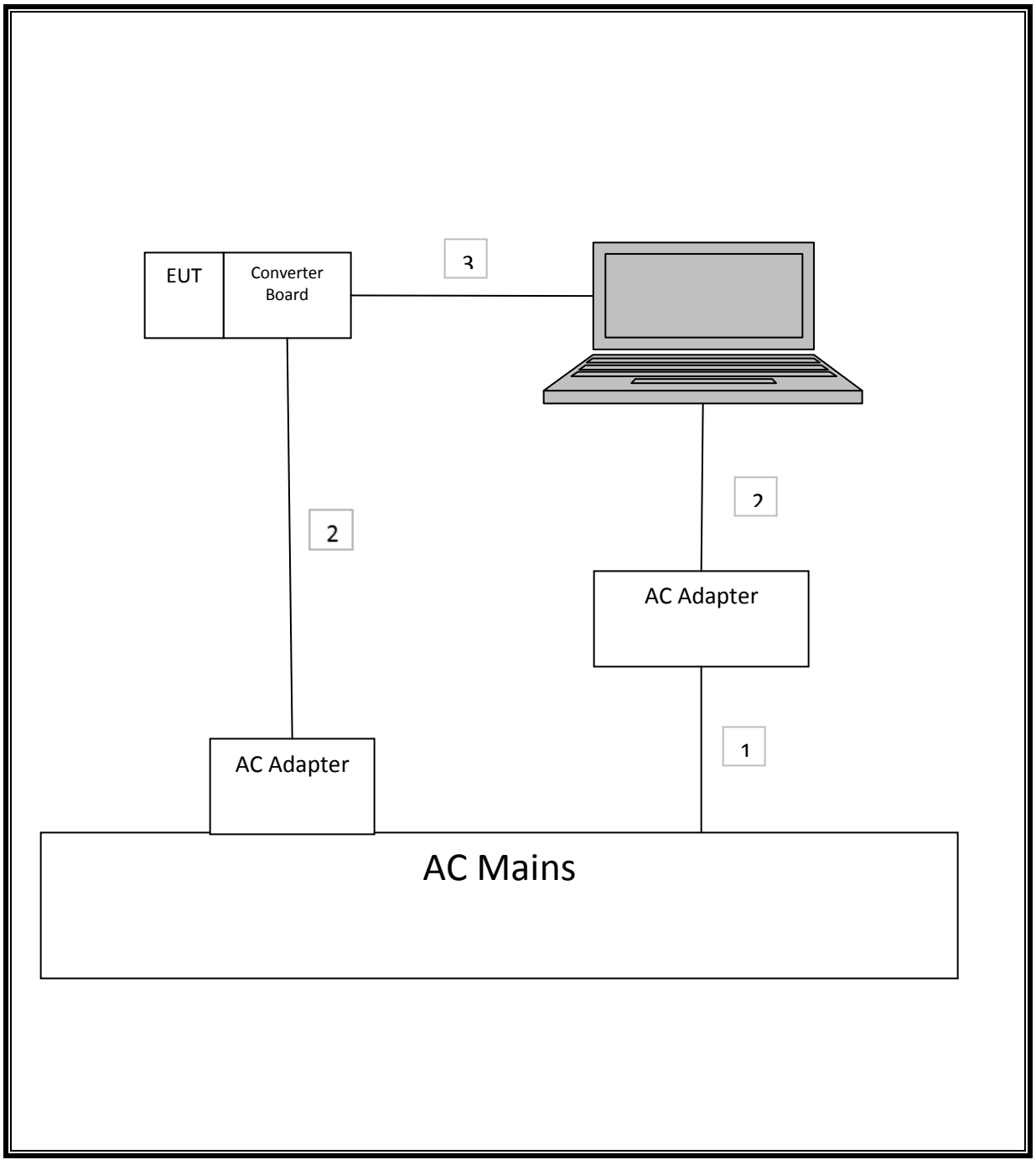
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	AC	Un-Shielded	1.5	n/a
2	DC	2	DC	Shielded	1.5	n/a
3	USB	1	USB	Shielded	1.5	n/a

TEST SETUP

The EUT is installed on a jig board which is connected to a host computer with a USB cable. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List					
Description	**Manufacturer**	**Model**	**Asset**	**Cal Date**	**Cal Due**
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/20/12	12/20/13
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	02/26/13	02/26/14
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C01171	02/13/13	02/13/14
Horn Antenna, 1-18GHz	ETS Lindgren	3117	F00131	02/19/13	02/19/14
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	11/14/12	11/14/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	03/23/13	03/23/14
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	10/22/12	10/22/13
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/12	12/13/13
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/12	12/13/13
Directional Coupler, 18 GHz	Krytar	1817	N02656	CNR	CNR
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/13	01/14/14
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/08/12	08/08/13

7. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

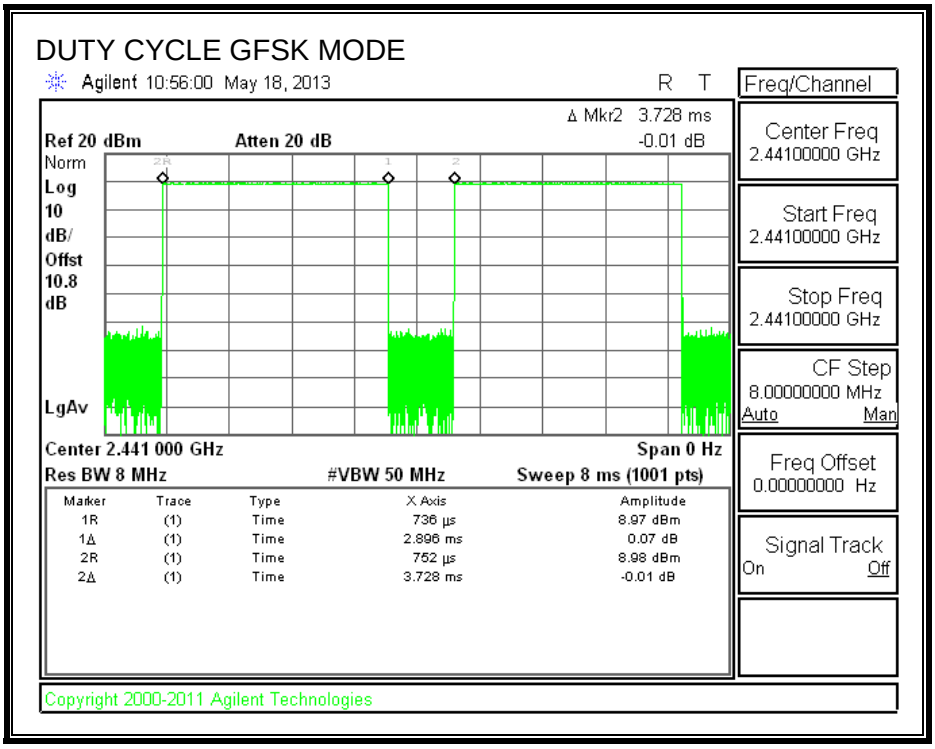
Zero-Span Spectrum Analyzer Method.

7.1. ON TIME AND DUTY CYCLE RESULTS

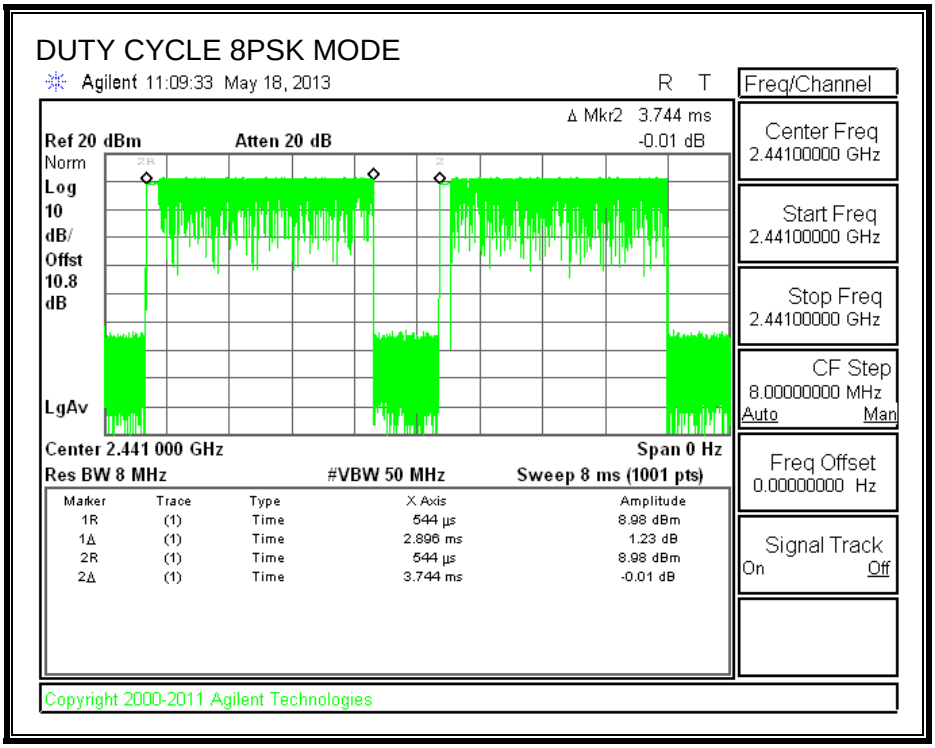
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
GFSK	2.896	3.728	0.777	77.682%	1.10	0.345
8PSK	2.896	3.774	0.767	76.736%	1.15	0.345

7.2. DUTY CYCLE PLOTS

DUTY CYCLE GFSK MODE



DUTY CYCLE 8PSK MODE



8. ANTENNA PORT TEST RESULTS

8.1. BASIC DATA RATE GFSK MODULATION

8.1.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

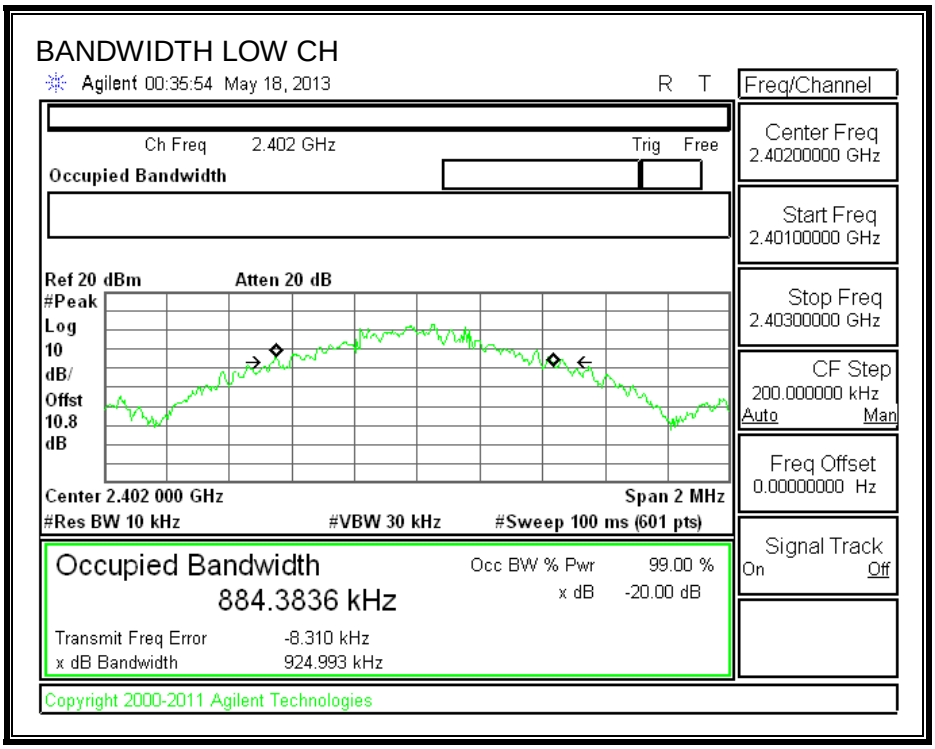
TEST PROCEDURE

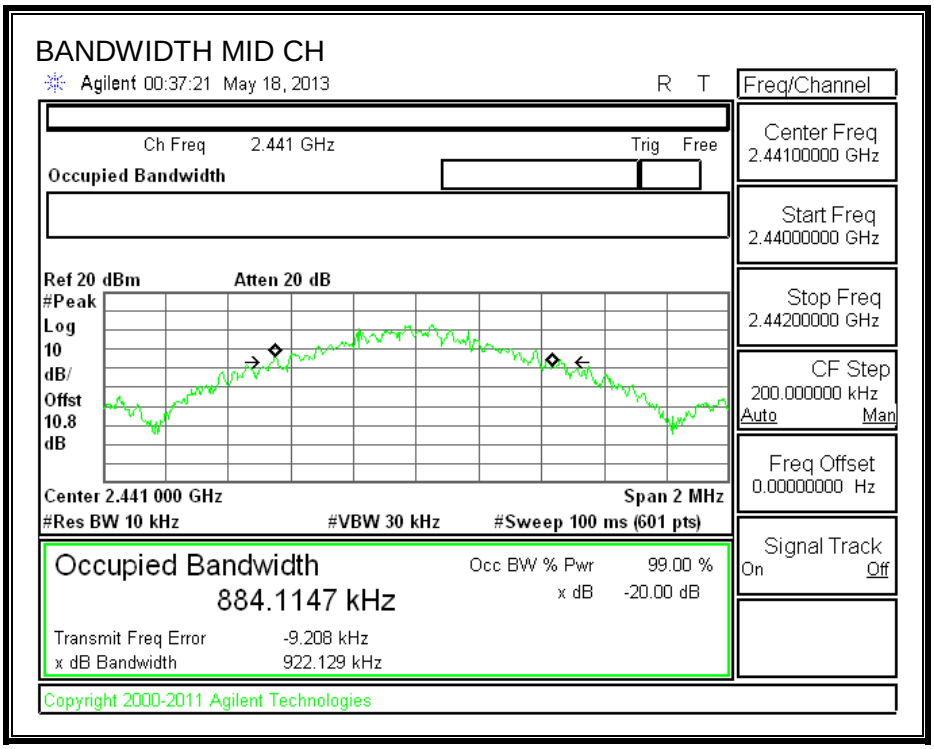
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

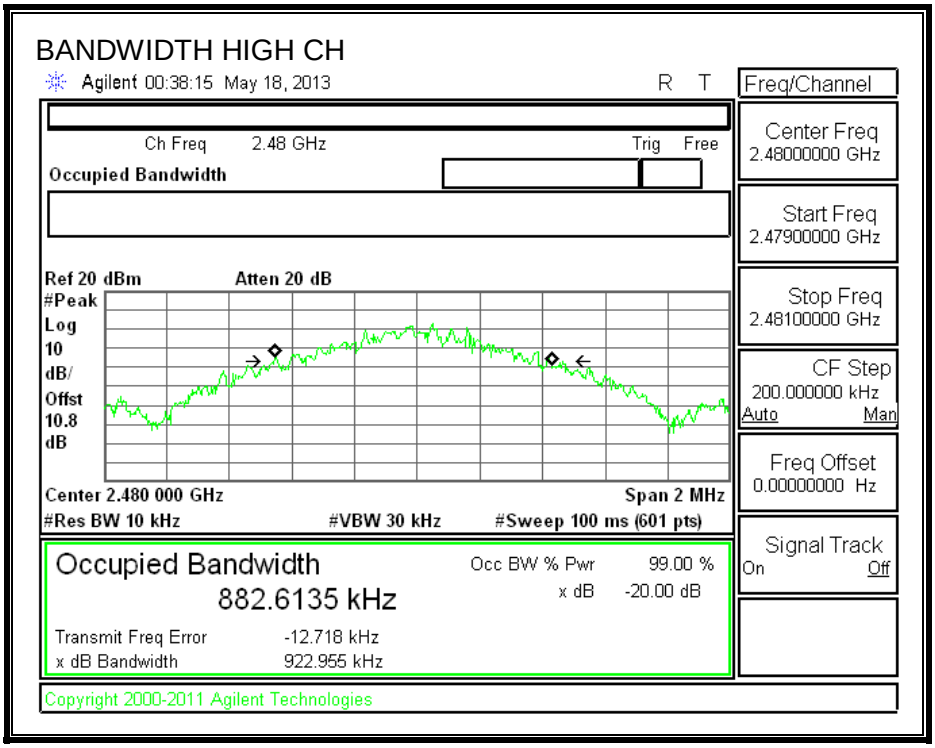
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	924.993	939.6201
Middle	2441	922.129	933.1215
High	2480	922.955	942.5606

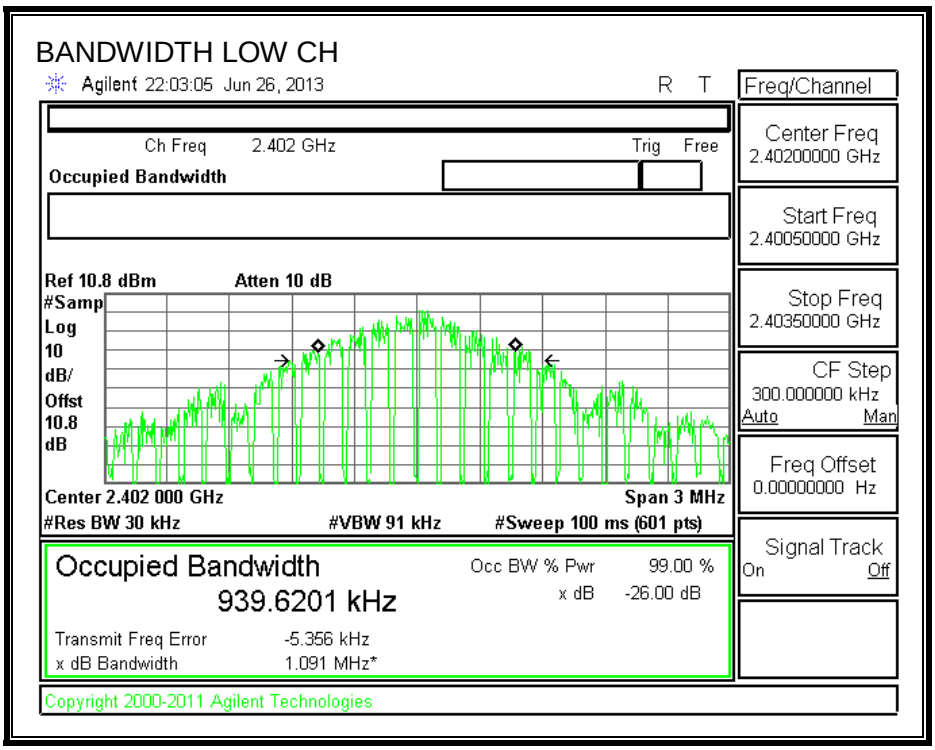
20 dB BANDWIDTH



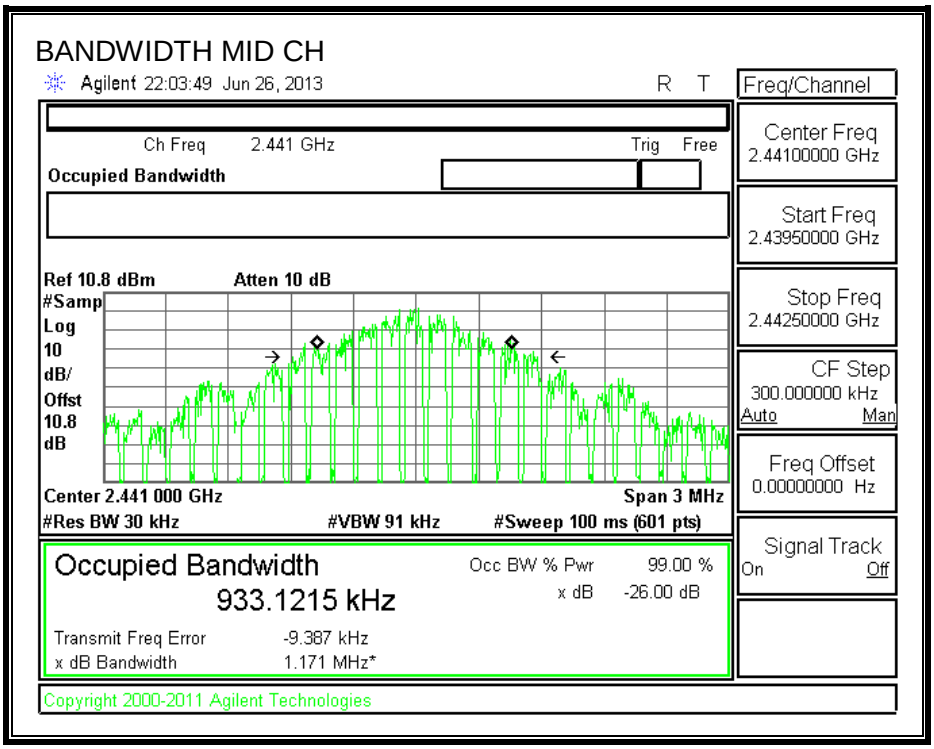




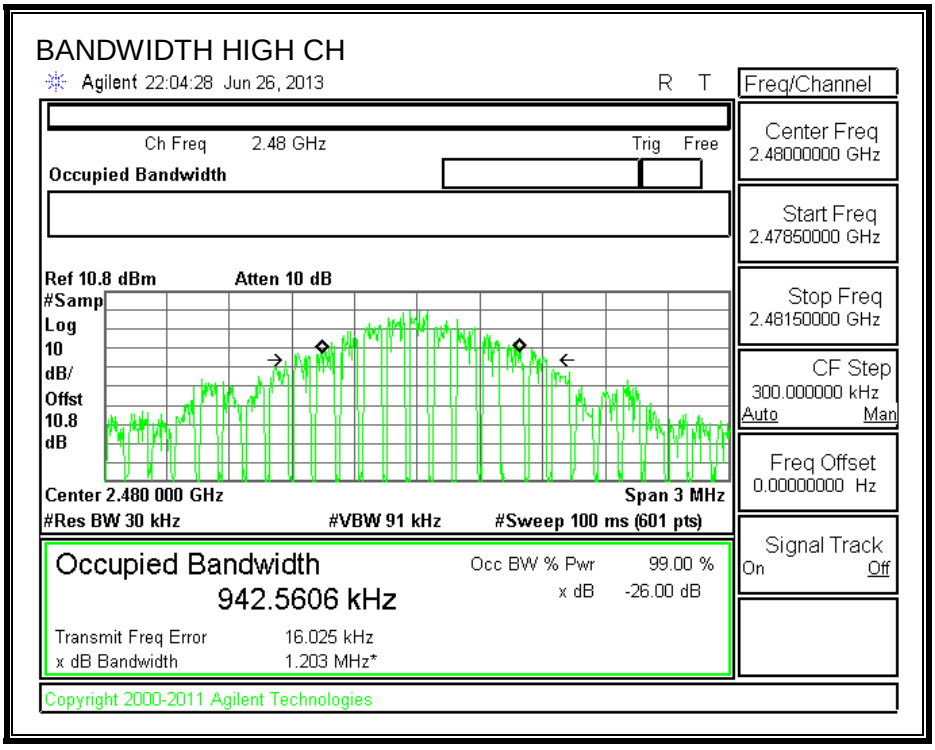
99% BANDWIDTH



BANDWIDTH MID CH



BANDWIDTH HIGH CH



8.1.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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

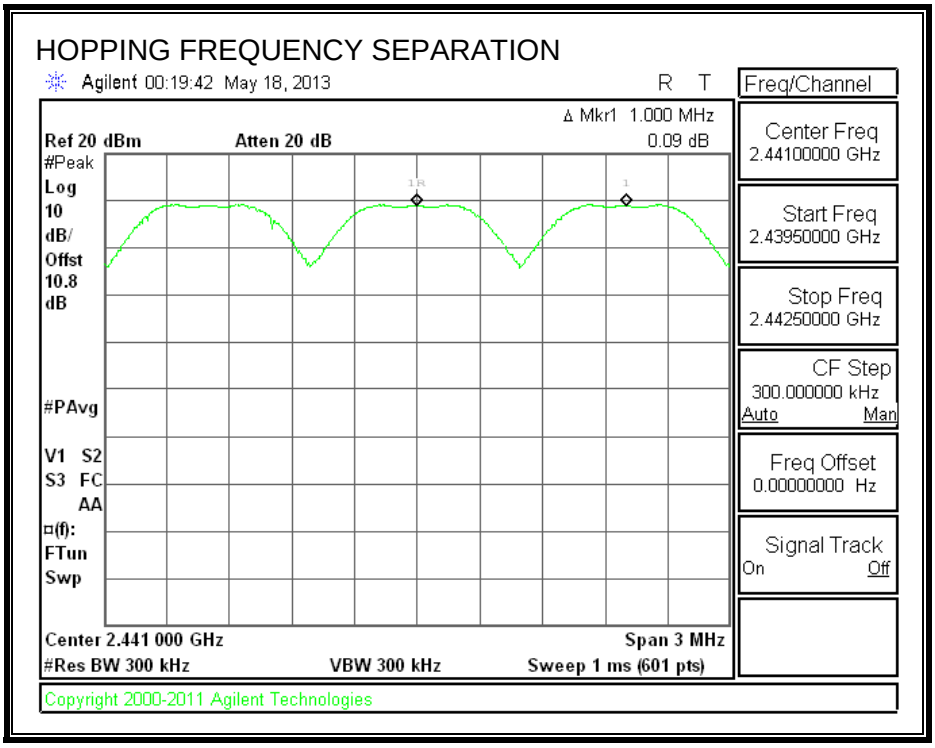
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

RESULTS

HOPPING FREQUENCY SEPARATION



8.1.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

TEST PROCEDURE

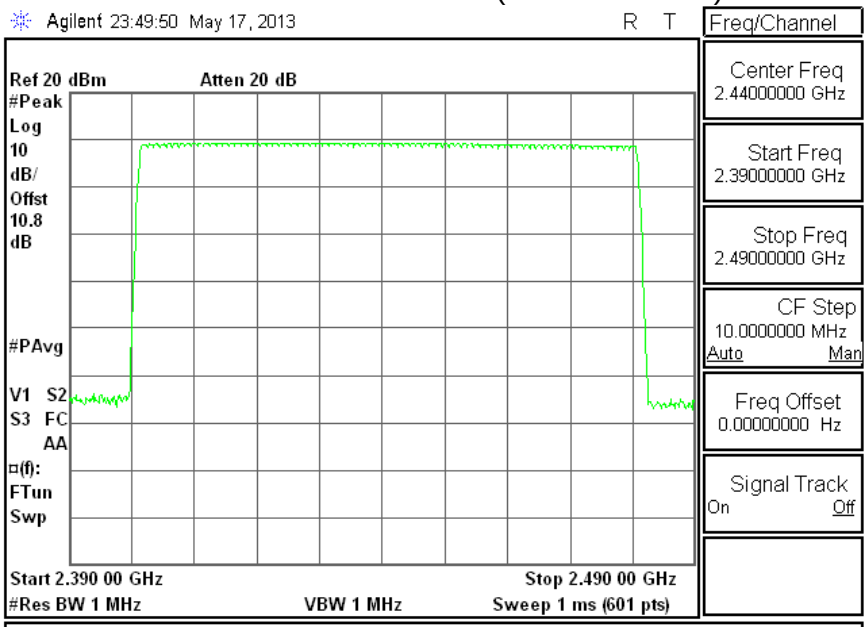
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

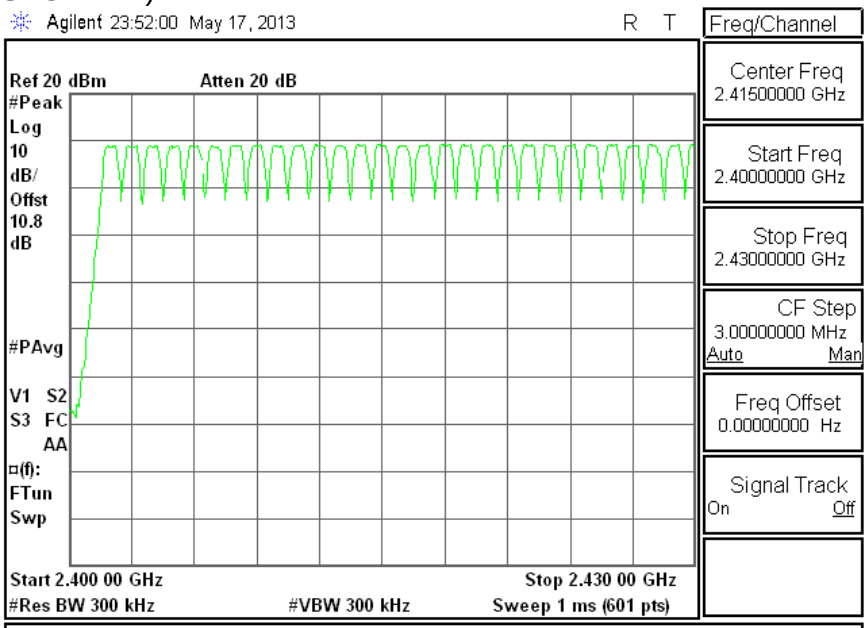
Normal Mode: 79 Channels observed.
AFH mode: 79 Channels declared by the manufacturer.

NUMBER OF HOPPING CHANNELS

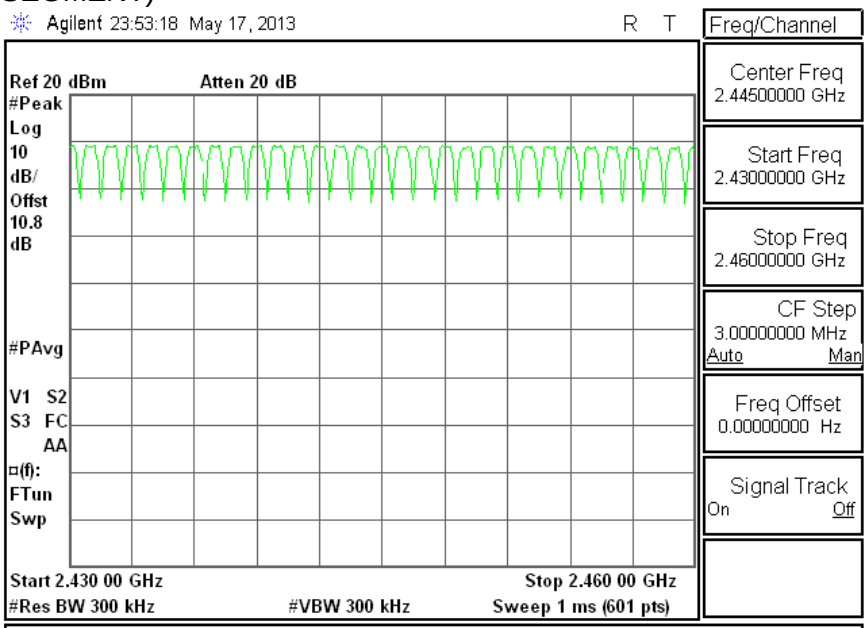
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



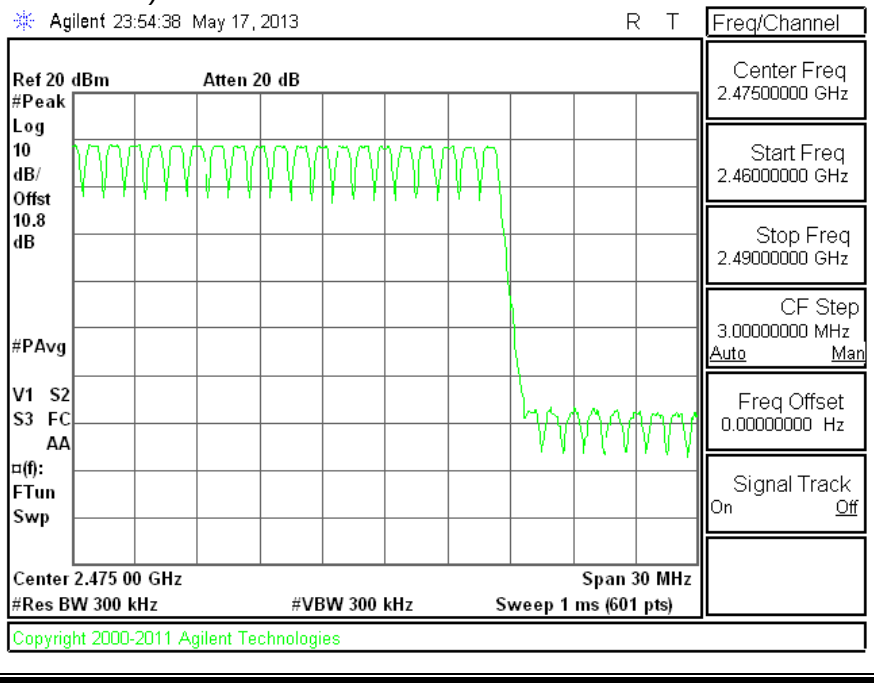
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



8.1.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

TEST PROCEDURE

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

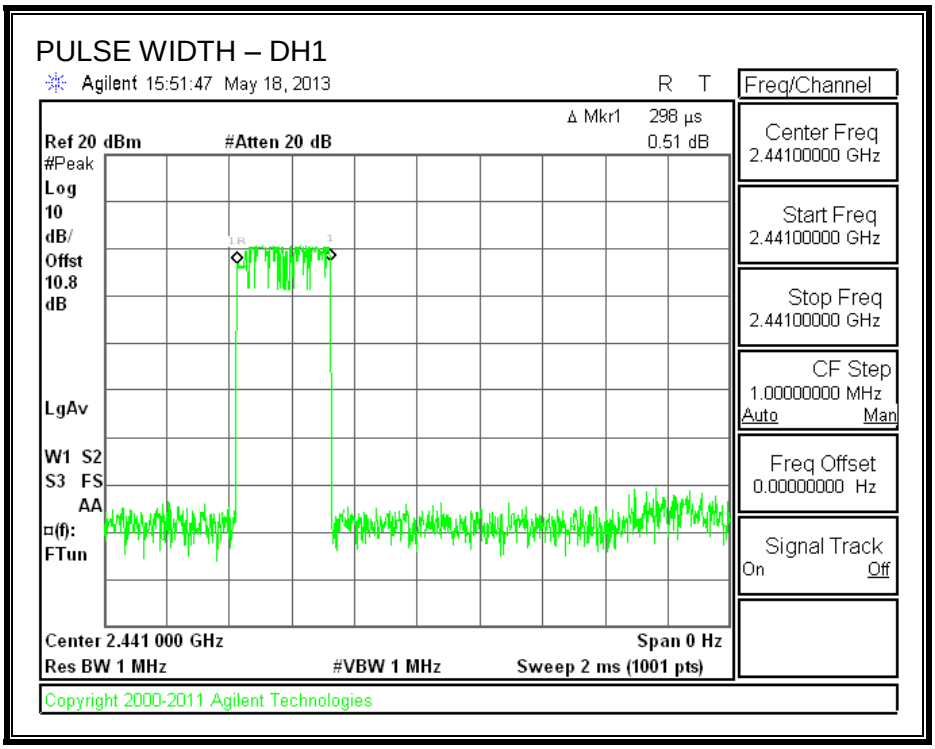
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

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

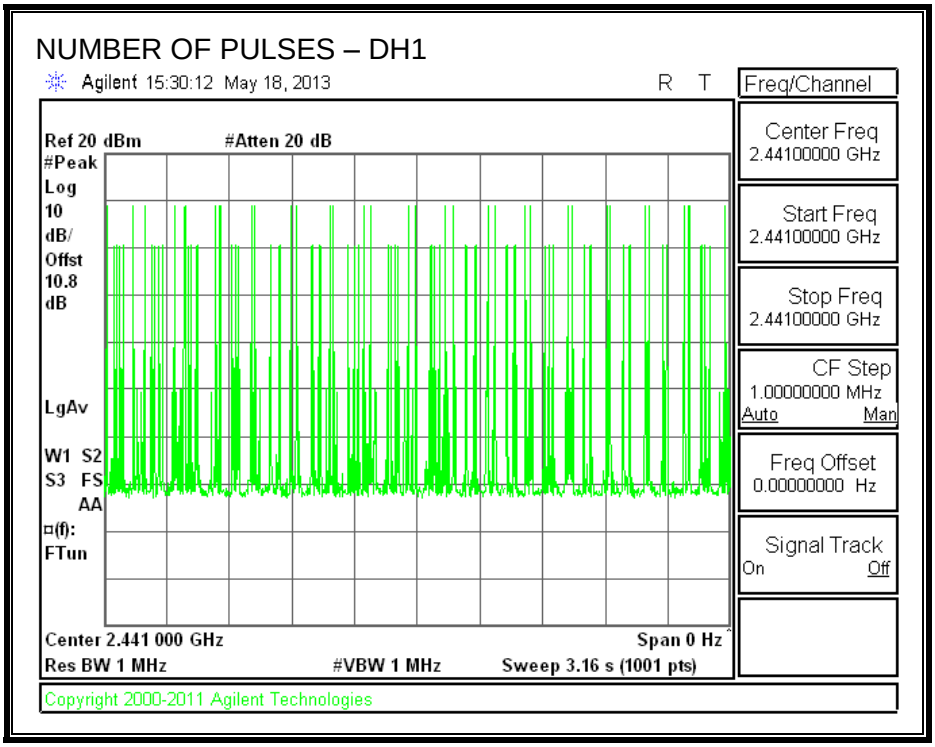
RESULTS

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	0.298	35	0.104	0.4	-0.296
DH3	1.62	22	0.356	0.4	-0.044
DH5	2.904	9	0.261	0.4	-0.139
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	0.298	64	0.191	0.4	-0.209
DH3	1.62	21	0.340	0.4	-0.060
DH5	2.904	13	0.378	0.4	-0.022

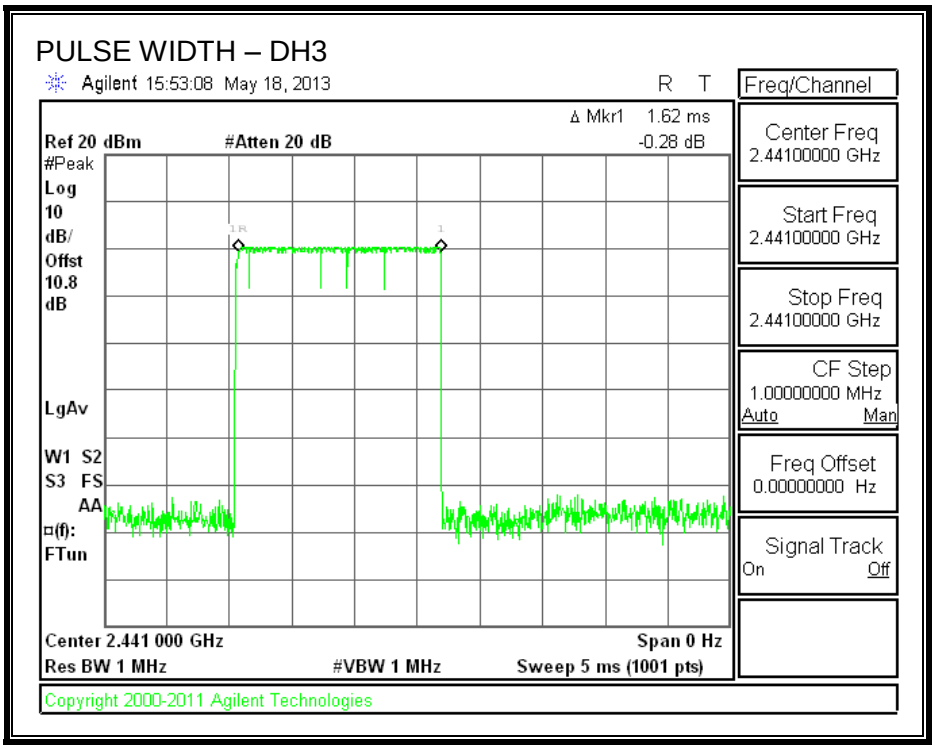
PULSE WIDTH - DH1



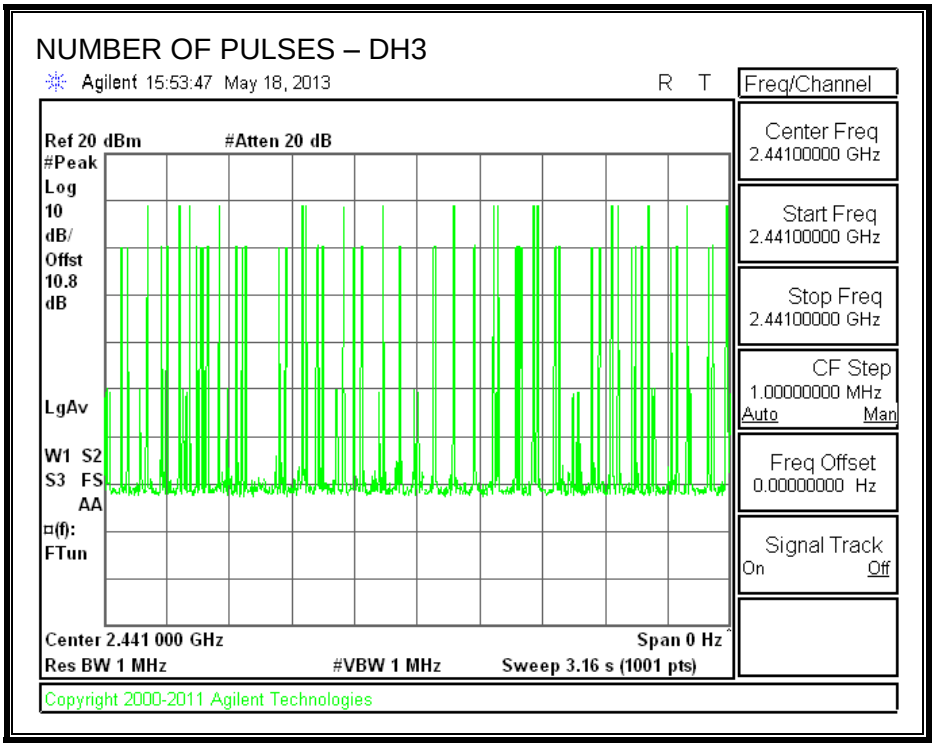
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



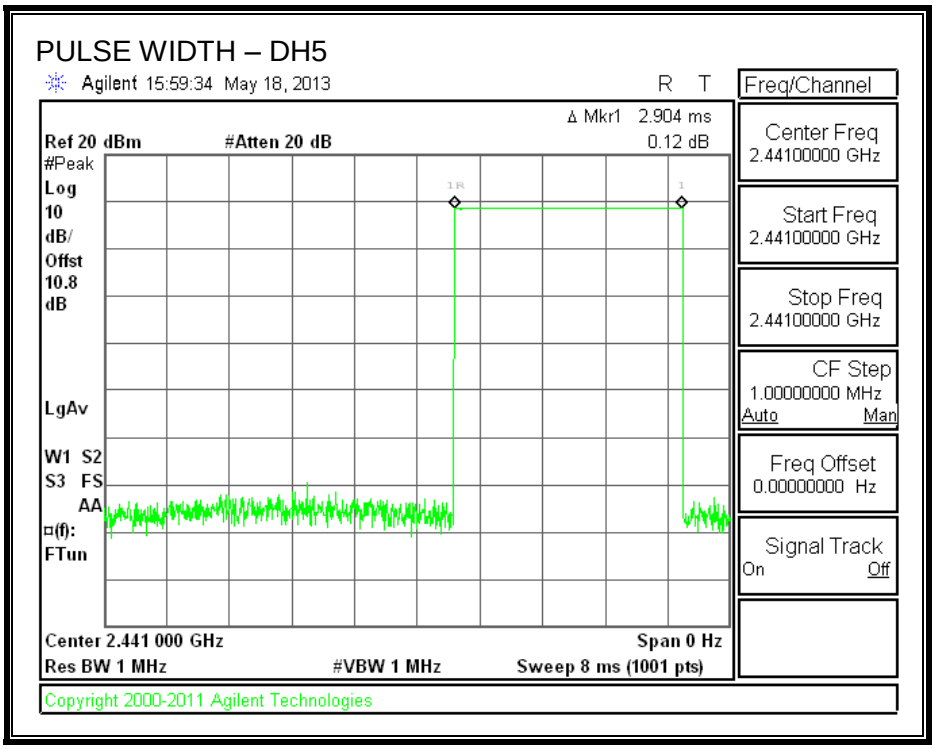
PULSE WIDTH – DH3



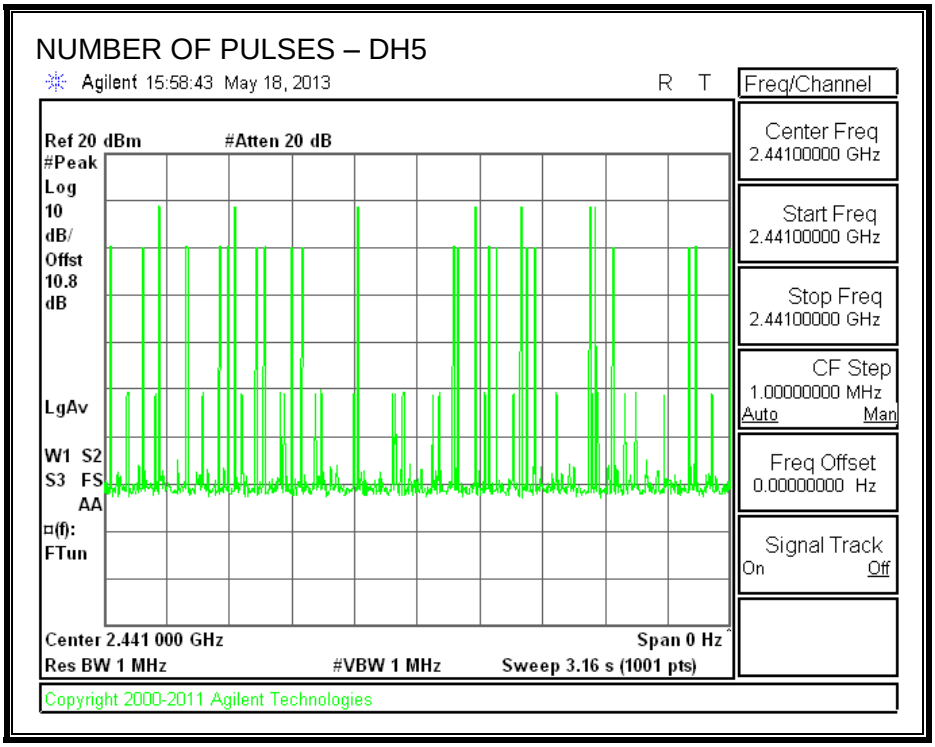
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.1.5. 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.

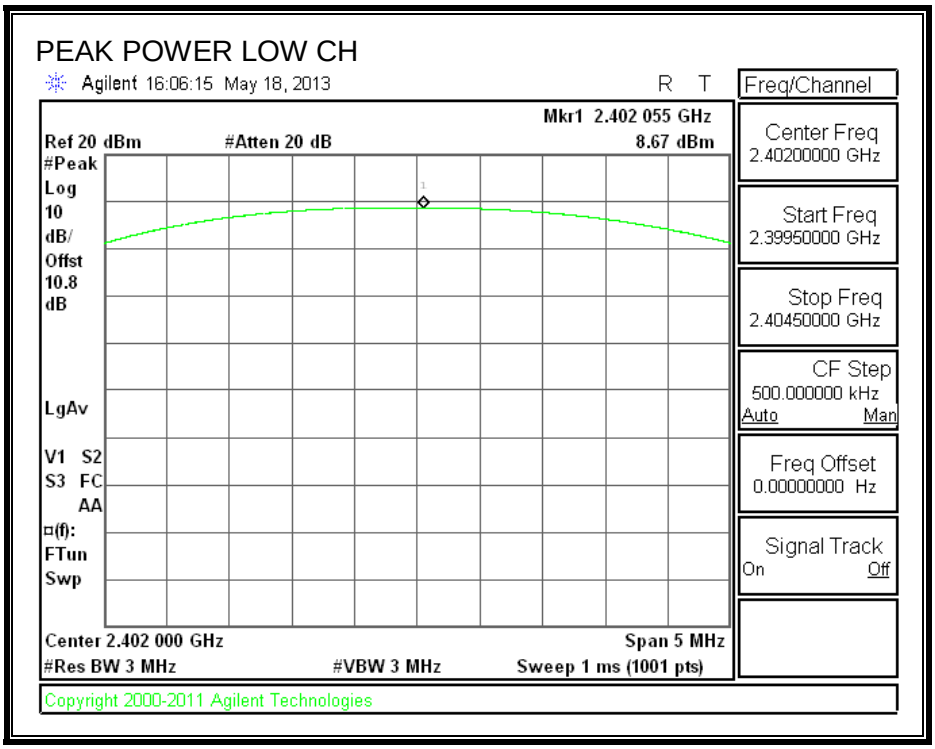
TEST PROCEDURE

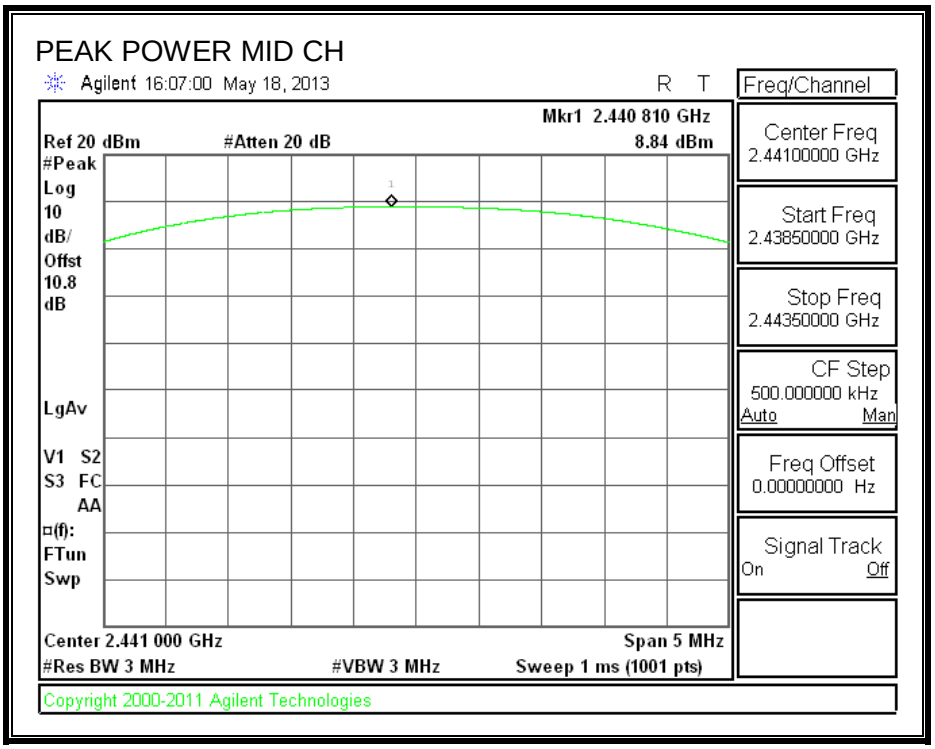
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

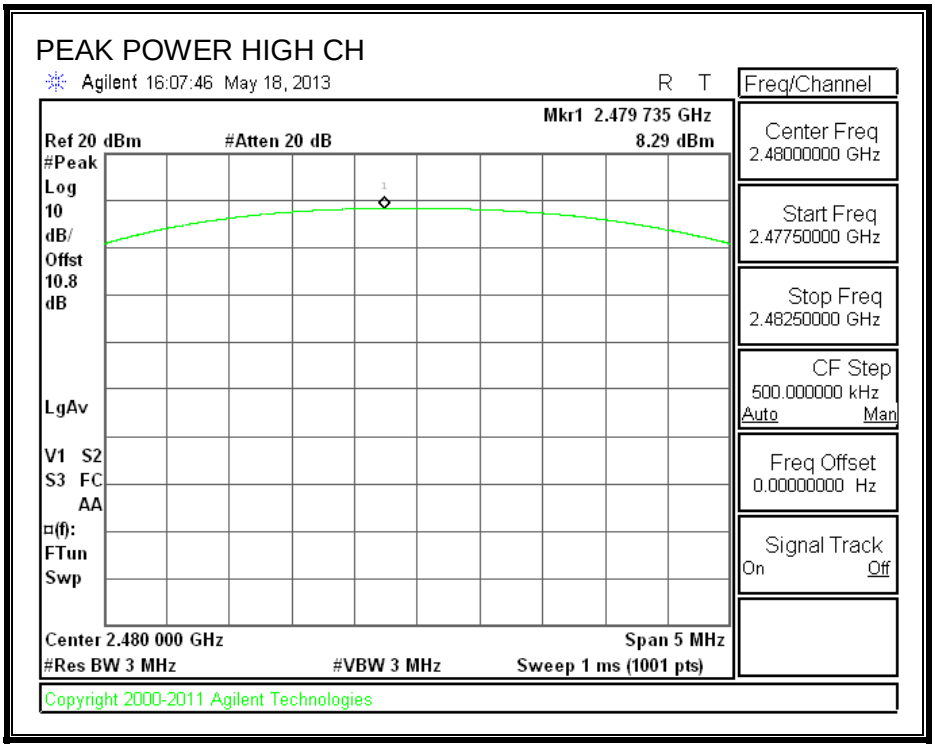
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.67	30	-21.33
Middle	2441	8.84	30	-21.16
High	2480	8.29	30	-21.71

OUTPUT POWER







8.1.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.97
Middle	2441	7.24
High	2480	6.82

8.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

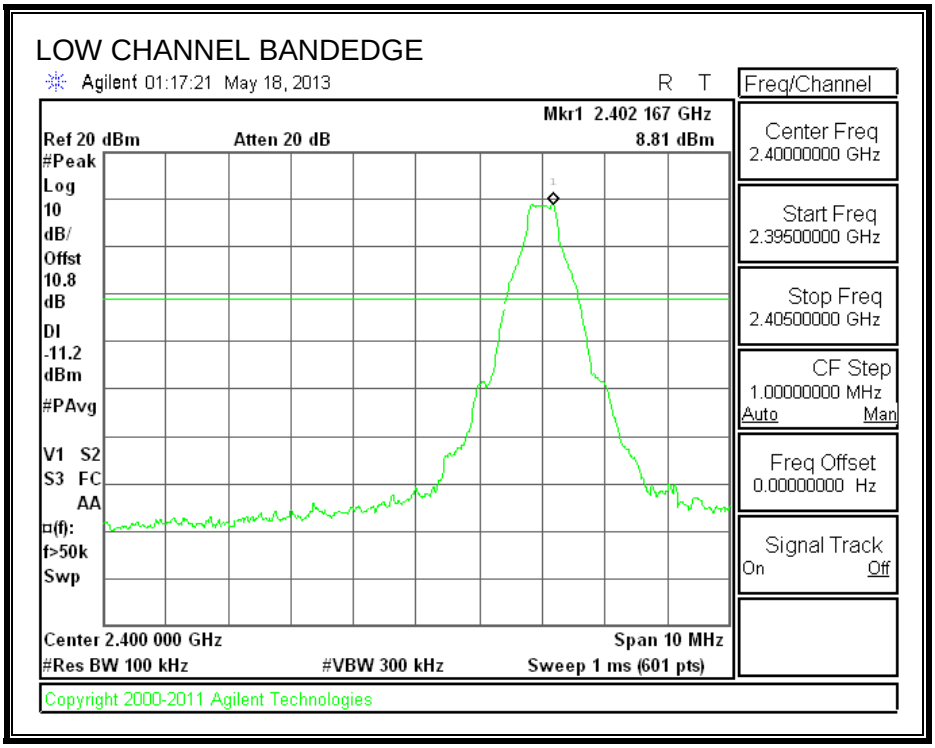
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

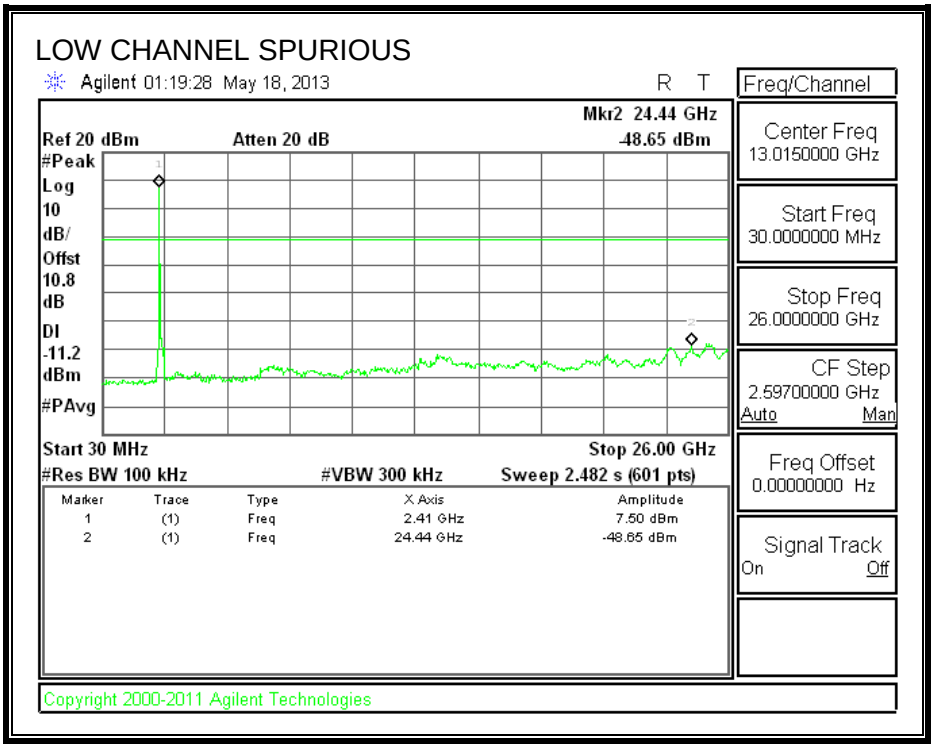
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

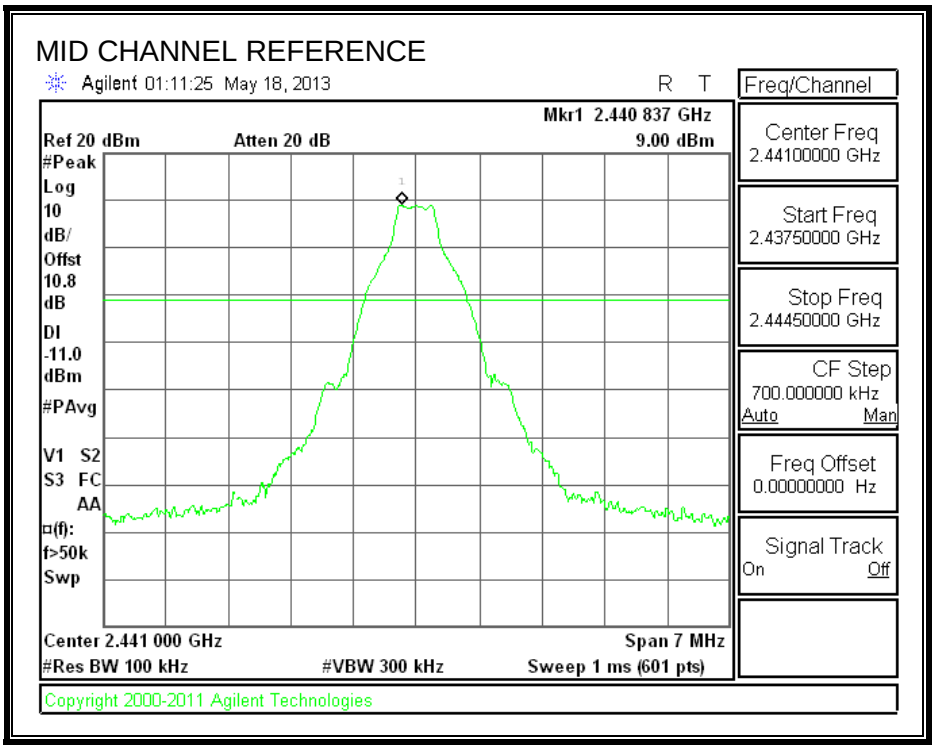
RESULTS

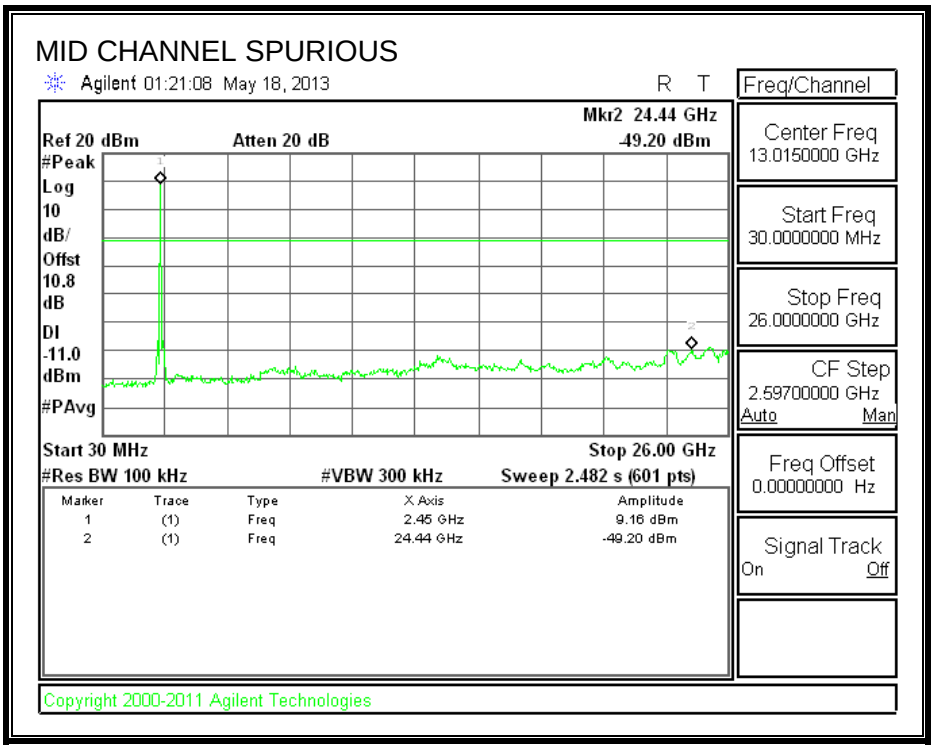
SPURIOUS EMISSIONS, LOW CHANNEL



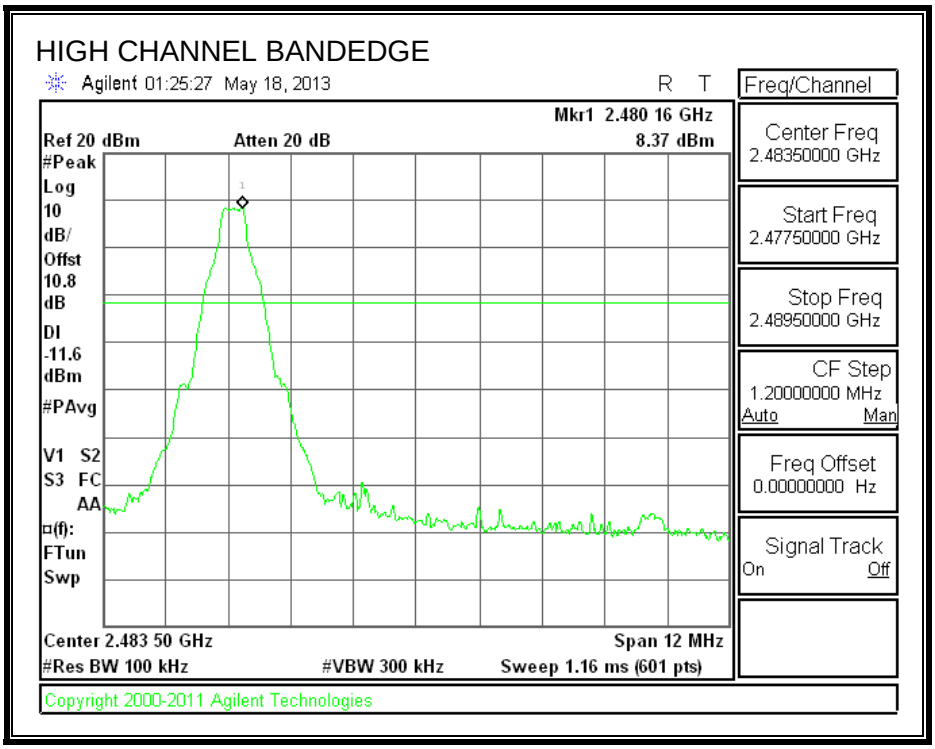


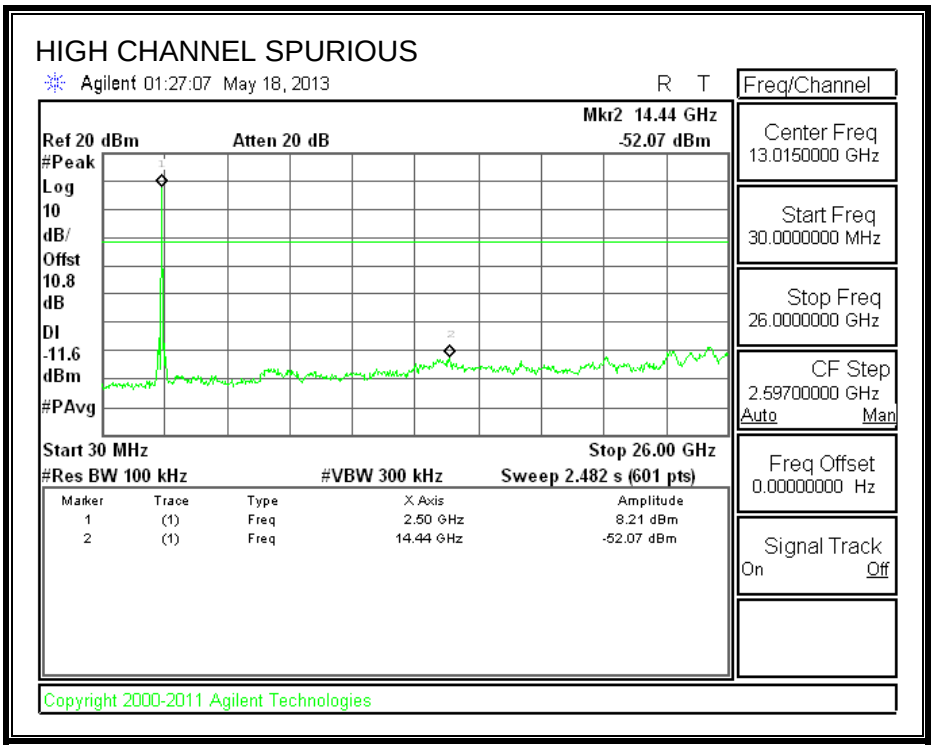
SPURIOUS EMISSIONS, MID CHANNEL





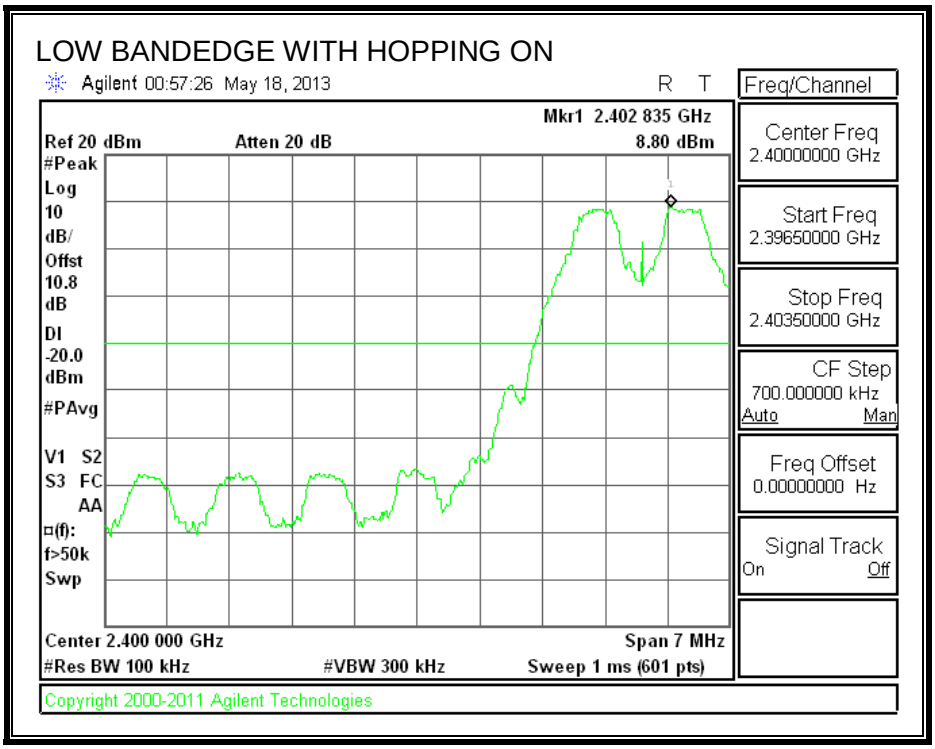
SPURIOUS EMISSIONS, HIGH CHANNEL



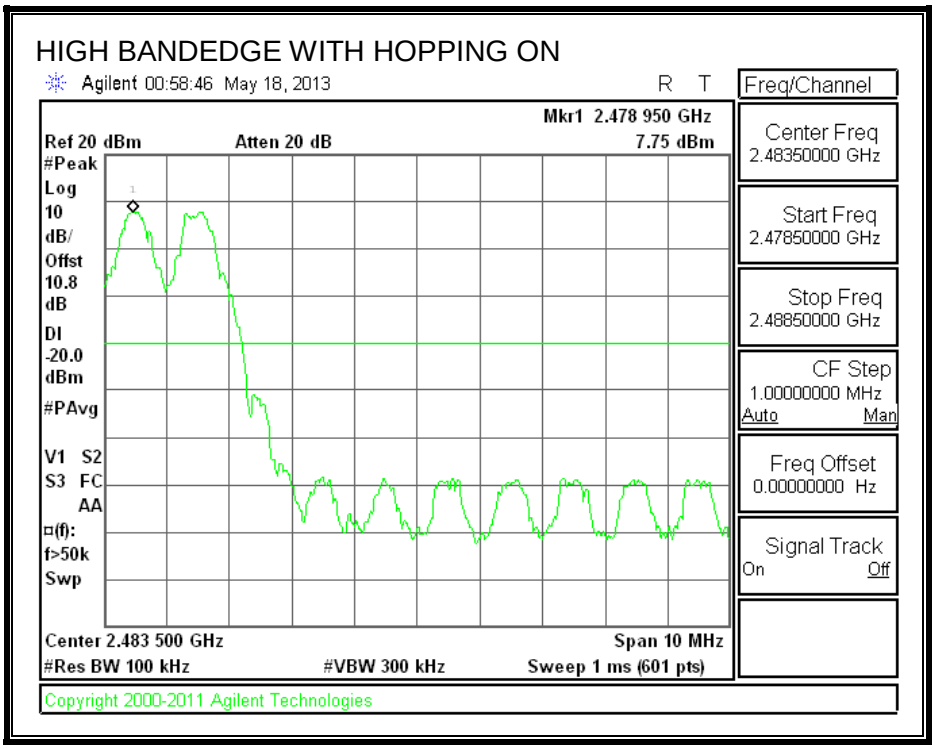


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



8.2. ENHANCED DATA RATE QPSK MODULATION

8.2.1. 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 * (# of pulses in 3.16 s) * pulse width.

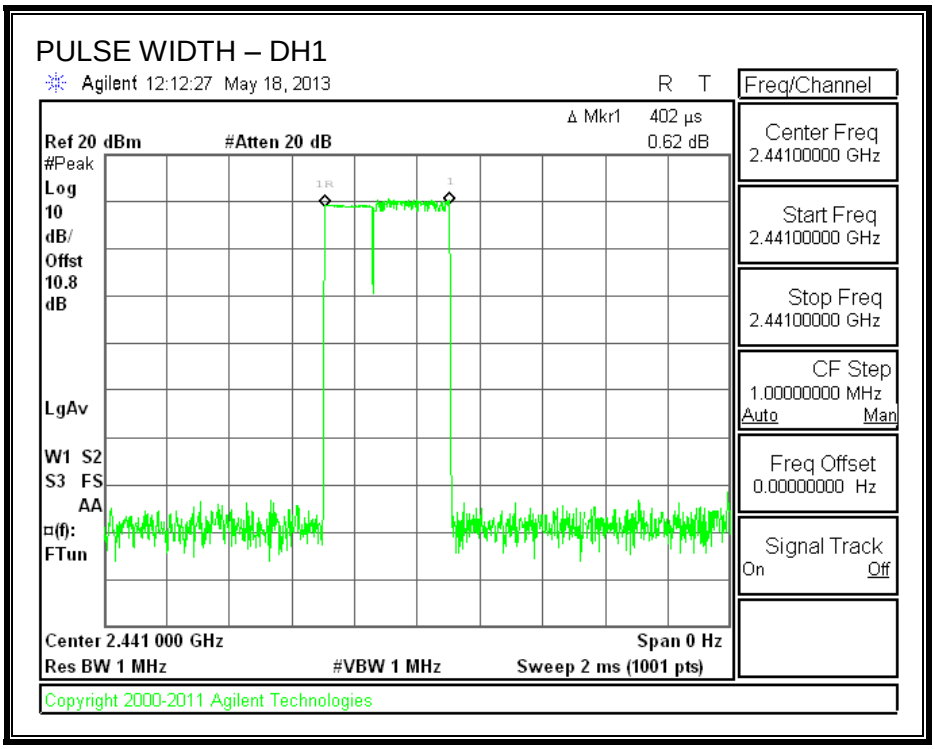
RESULTS

Time Of Occupancy = 10 * xx pulses * yy msec = zz msec

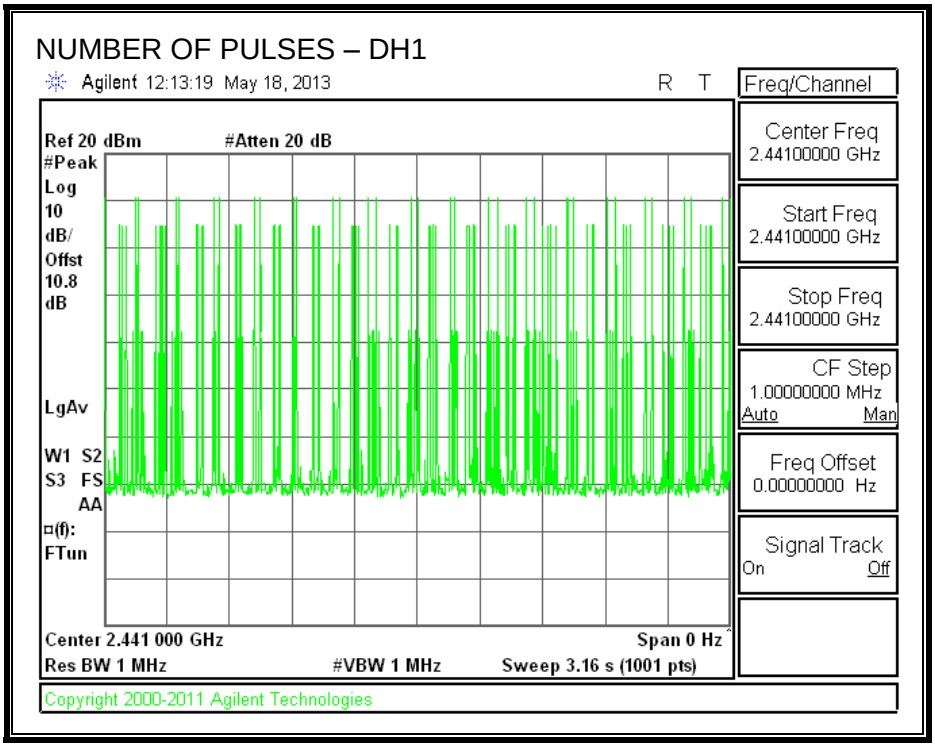
DQPSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.402	34	0.137	0.4	-0.263
DH3	1.653	19	0.314	0.4	-0.086
DH5	2.85	9	0.257	0.4	-0.144

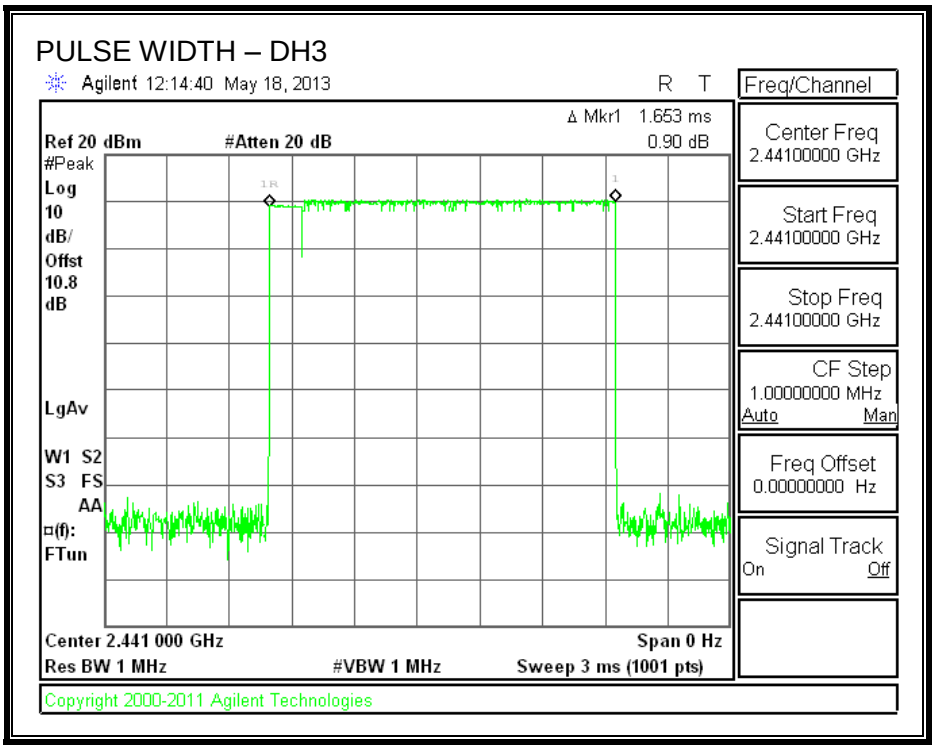
PULSE WIDTH - DH1



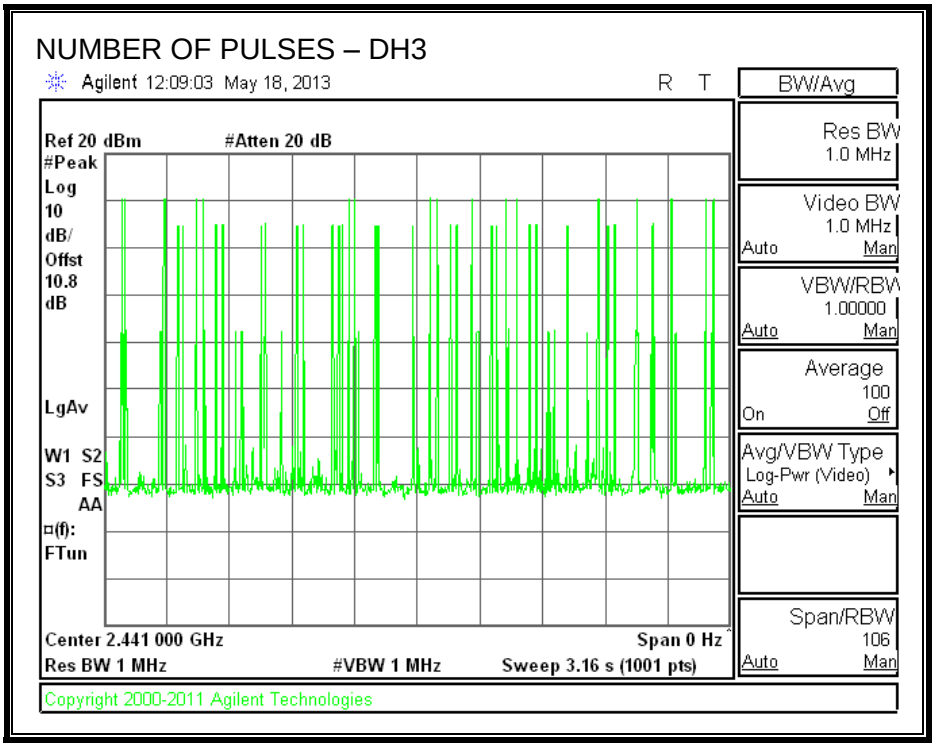
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



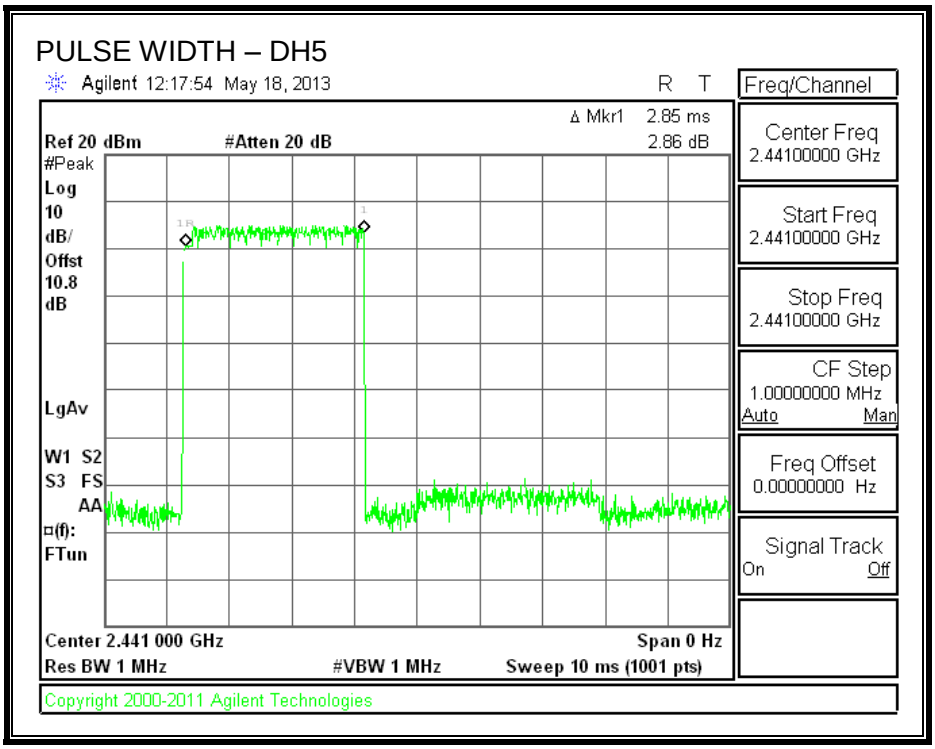
PULSE WIDTH – DH3



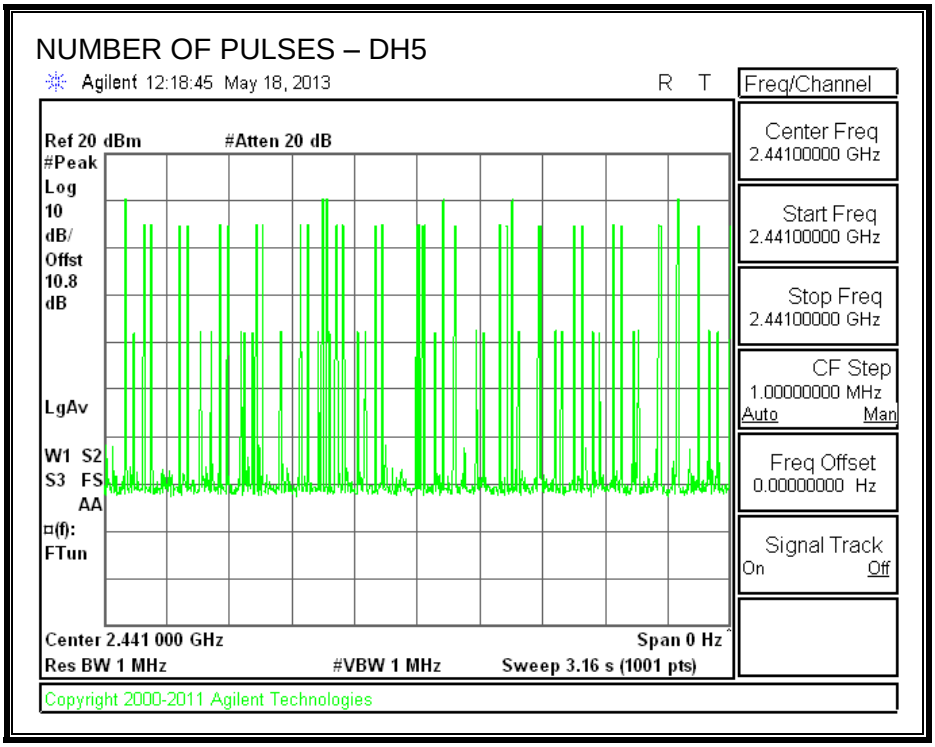
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.2.2. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

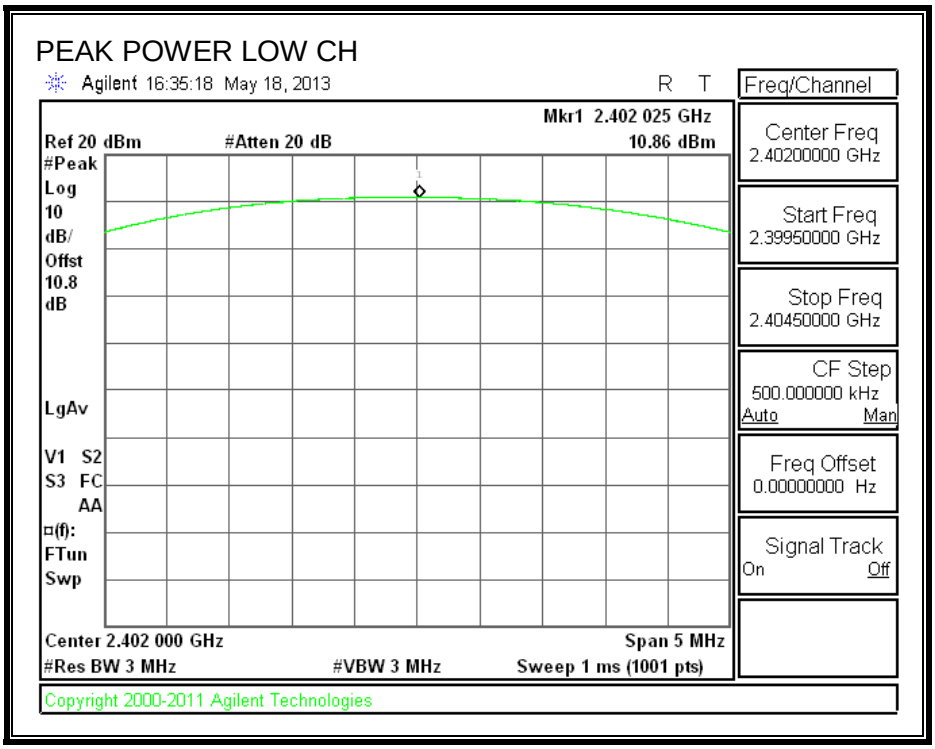
TEST PROCEDURE

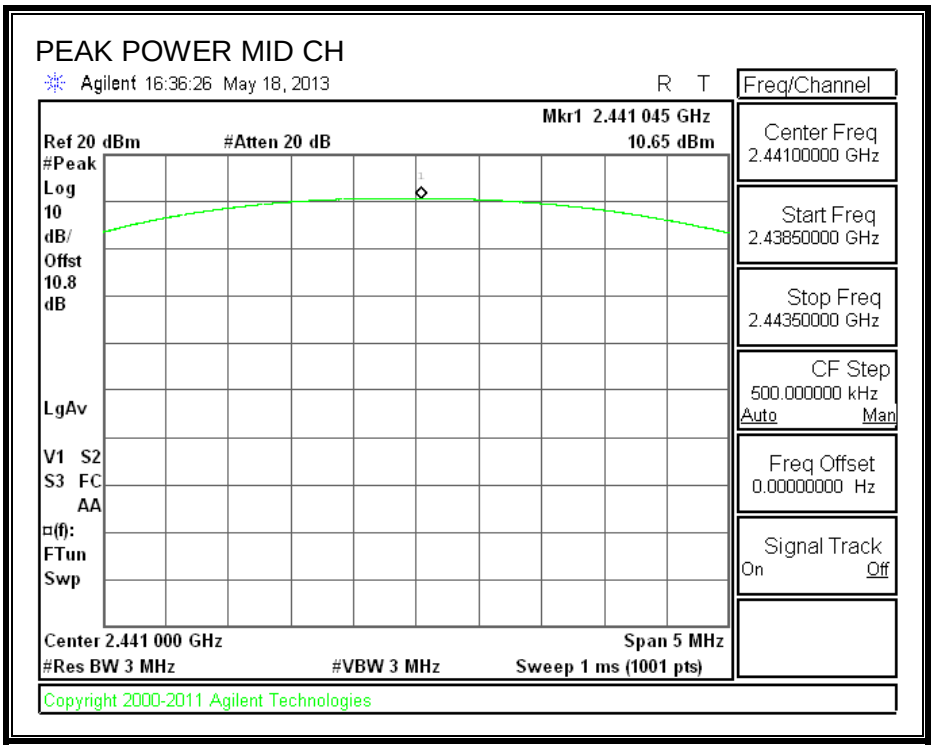
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

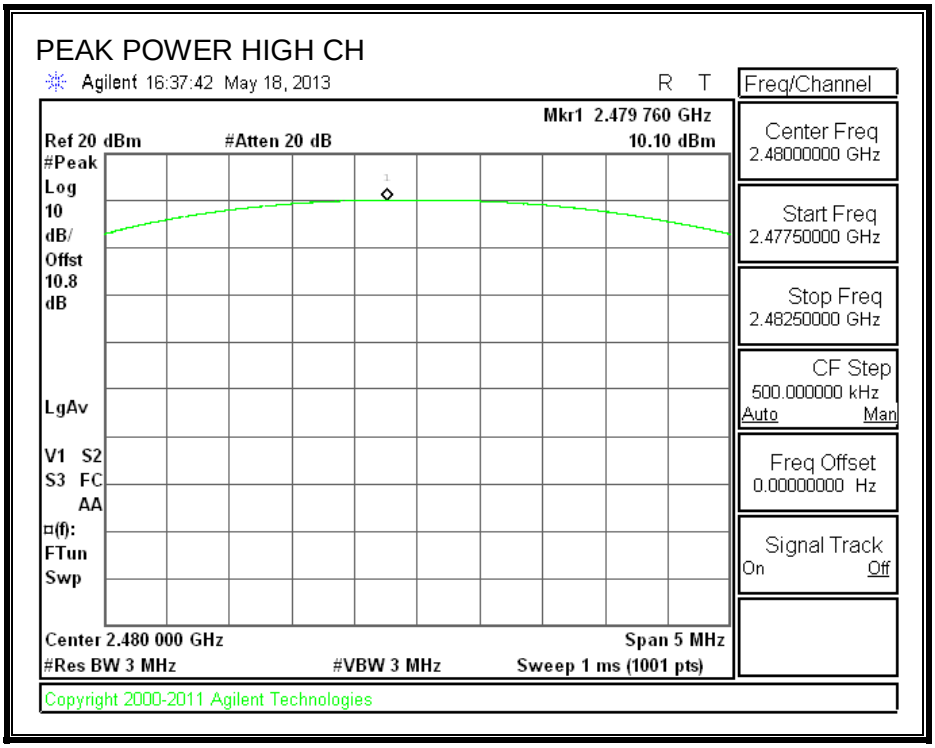
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.86	30	-19.14
Middle	2441	10.65	30	-19.35
High	2480	10.10	30	-19.90

OUTPUT POWER







8.2.3. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.02
Middle	2441	7.21
High	2480	6.81

8.3. ENHANCED DATA RATE 8PSK MODULATION

8.3.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

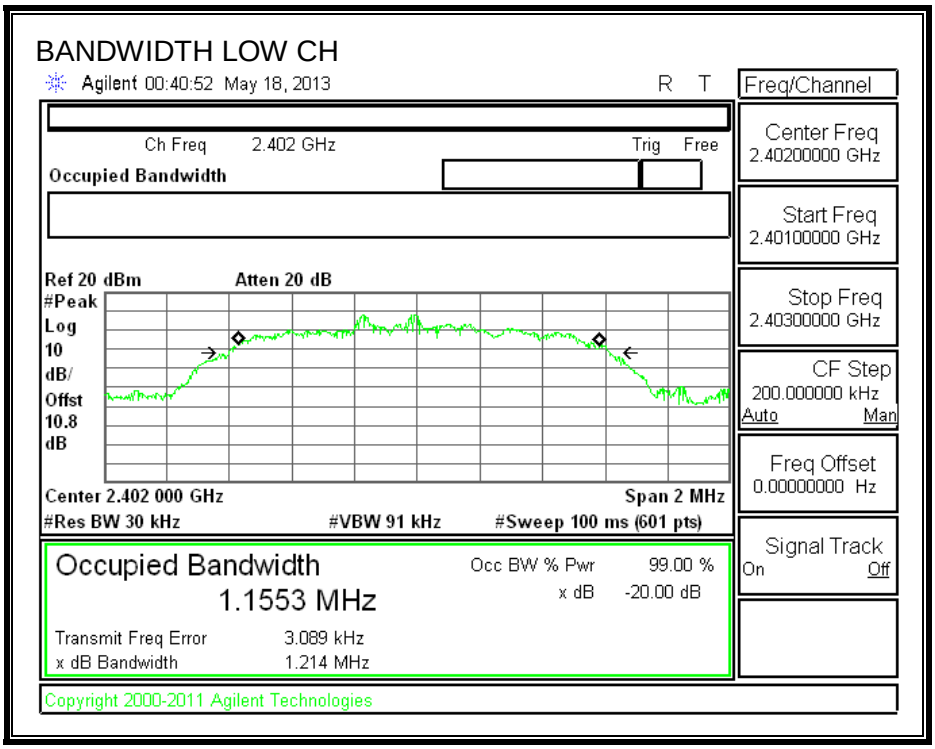
TEST PROCEDURE

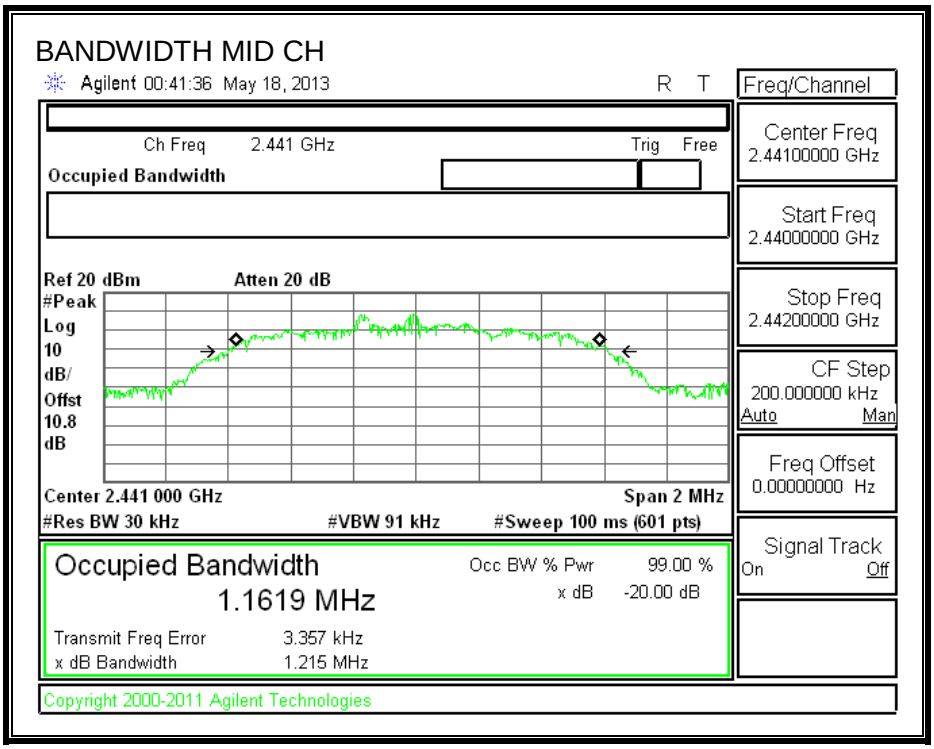
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

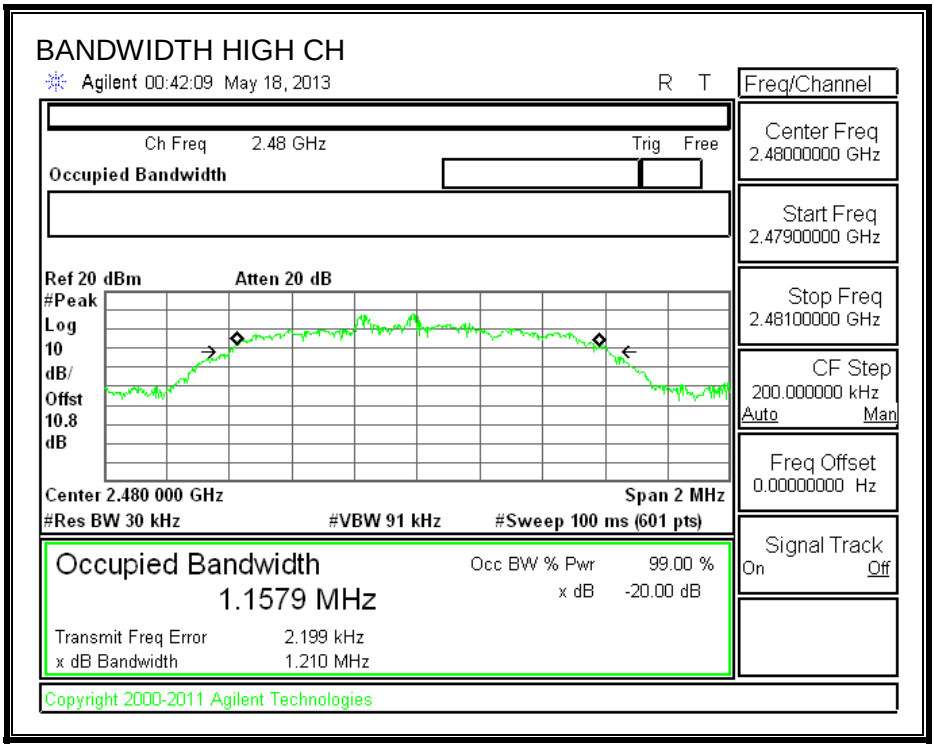
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1214	1167.8
Middle	2441	1215	1179.9
High	2480	1210	1220.2

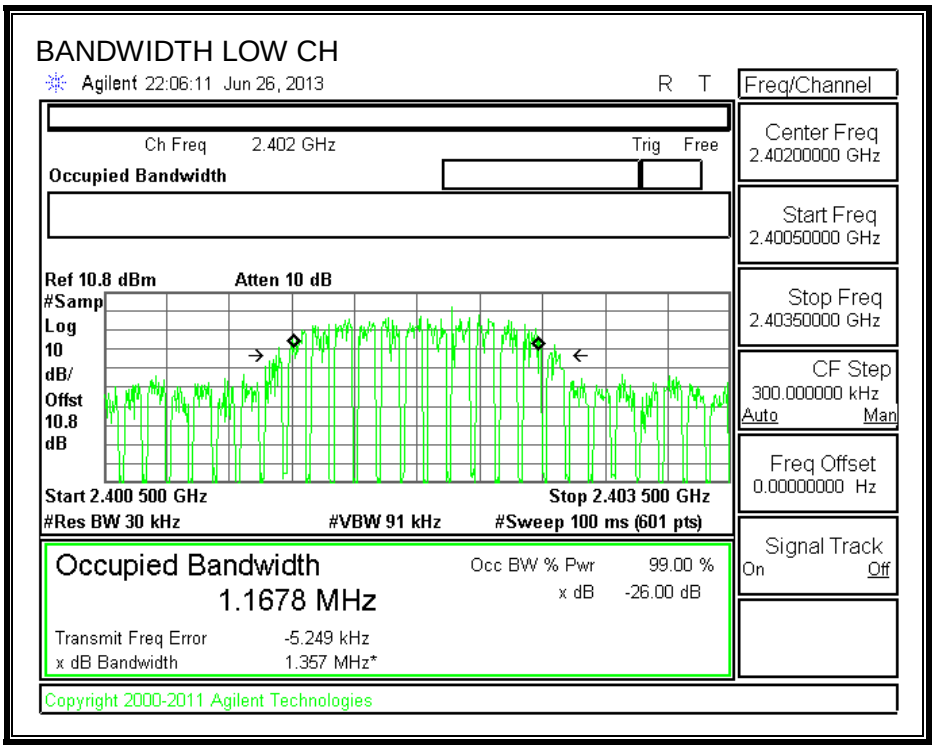
20 dB BANDWIDTH



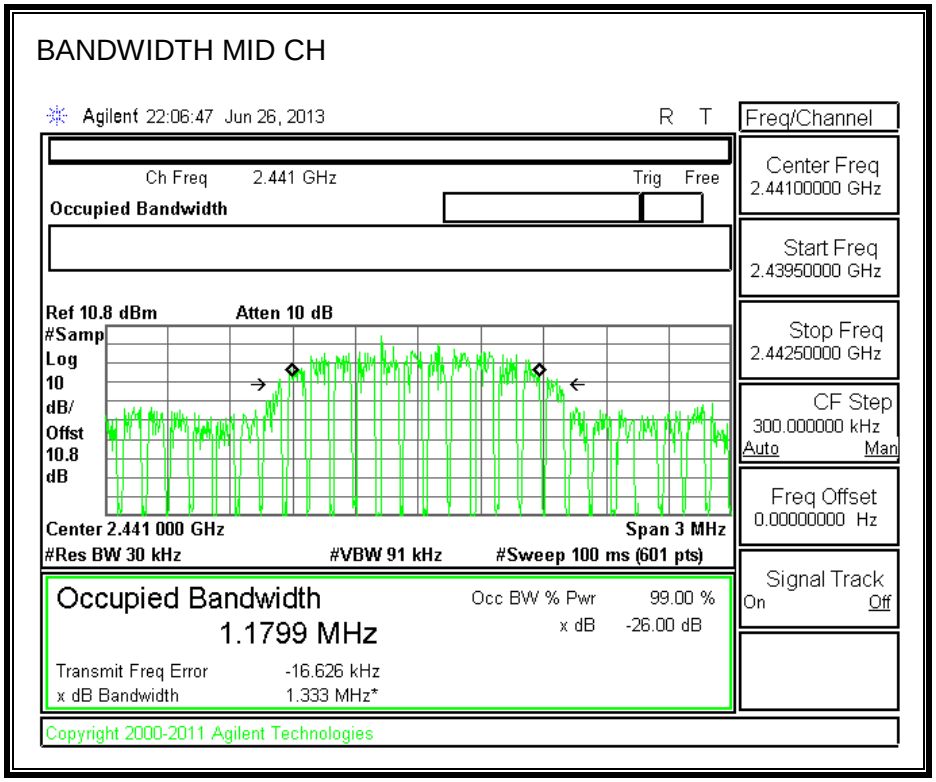




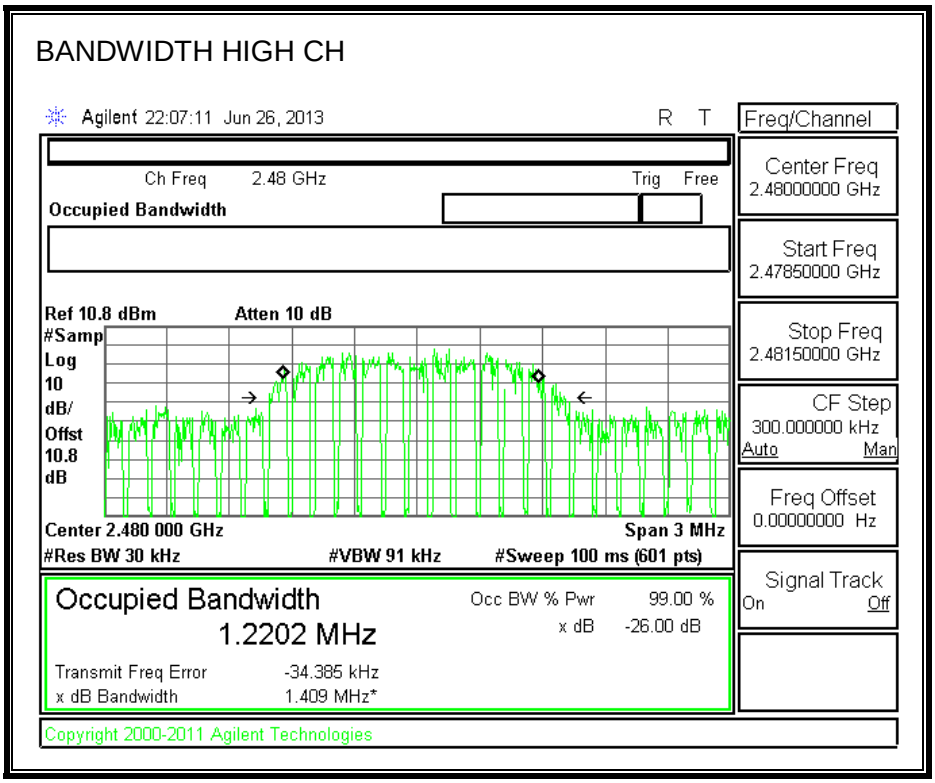
99% BANDWIDTH



BANDWIDTH MID CH



BANDWIDTH HIGH CH



8.3.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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

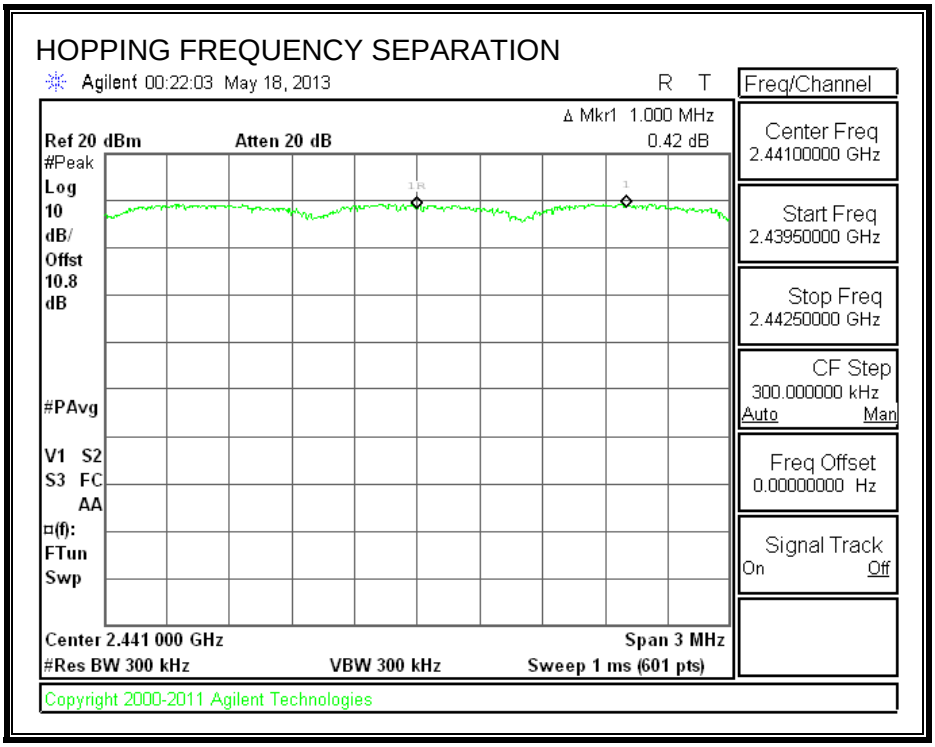
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

RESULTS

HOPPING FREQUENCY SEPARATION



8.3.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

TEST PROCEDURE

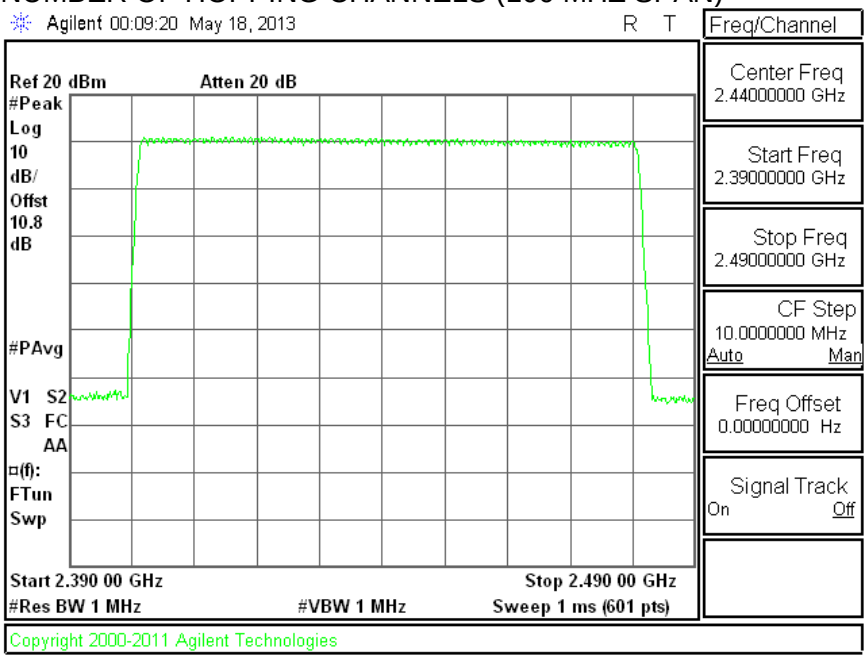
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

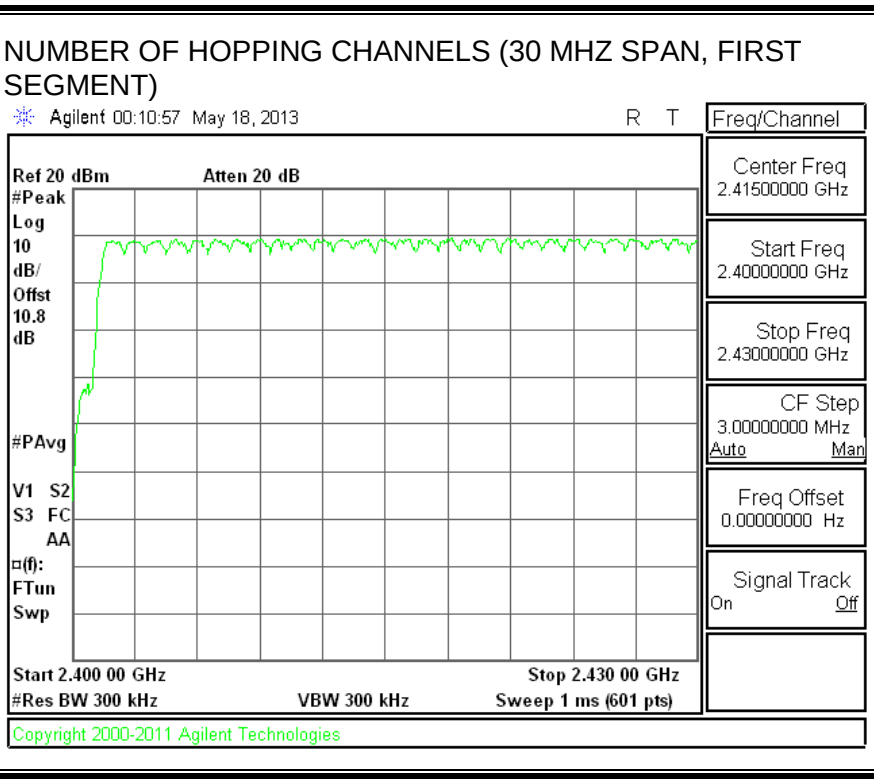
Normal Mode: 79 Channels observed.
AFH Mode: 79 Channels declared by the manufacturer.

NUMBER OF HOPPING CHANNELS

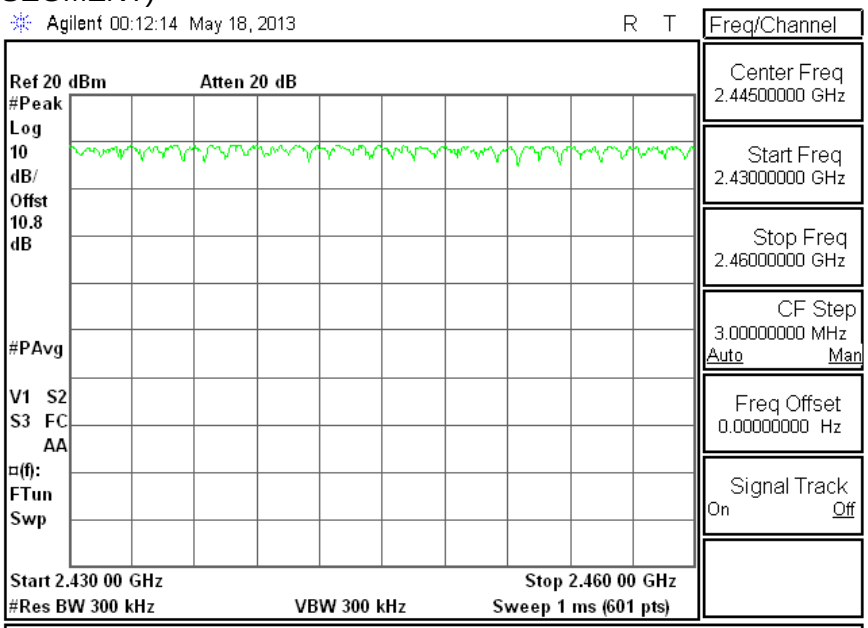
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



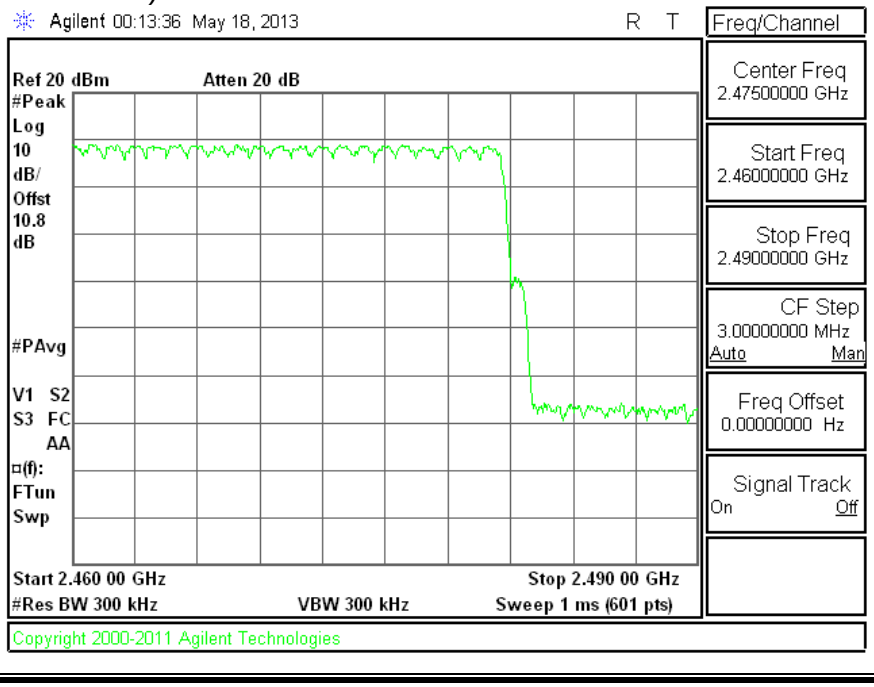
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



8.3.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

TEST PROCEDURE

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

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

RESULTS

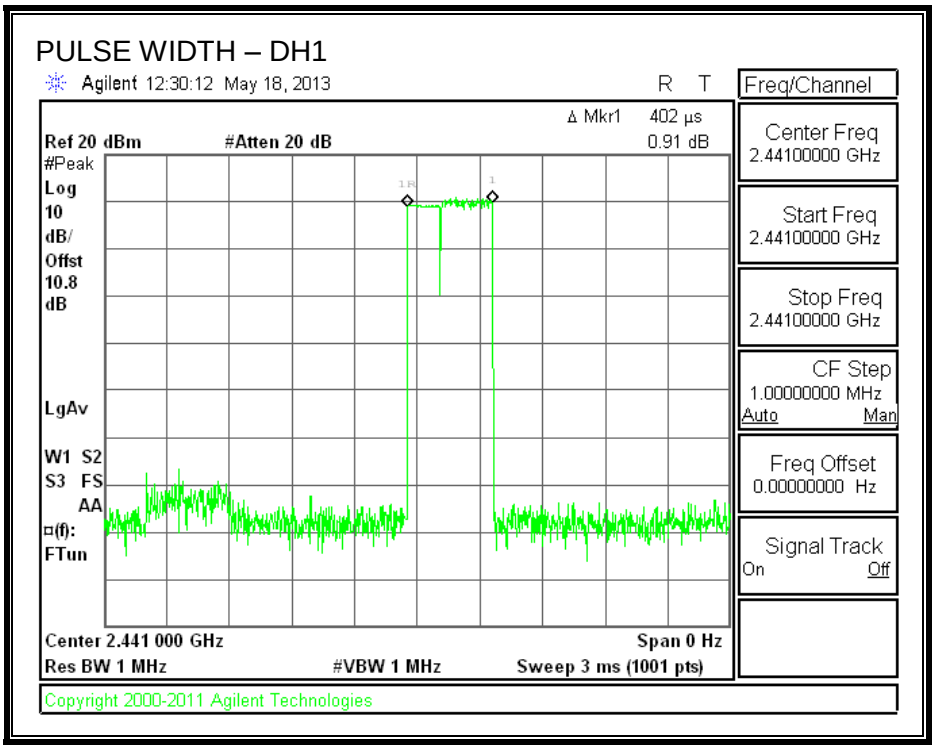
Time Of Occupancy = 10 * xx pulses * yy msec = zz msec

8PSK (EDR) Mode

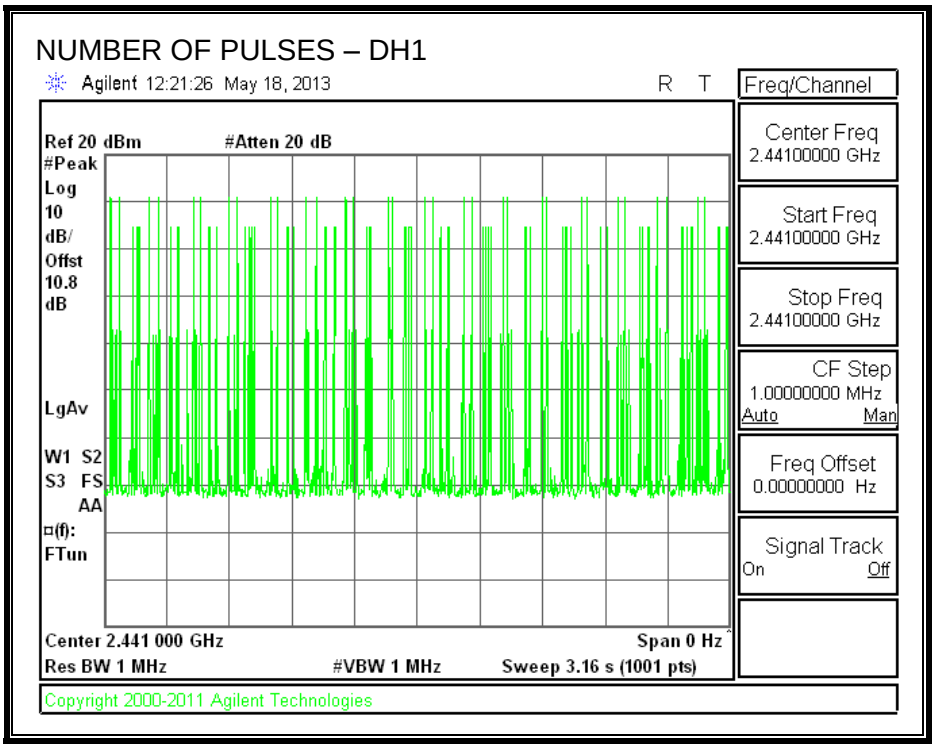
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.402	34	0.137	0.4	-0.263
DH3	1.653	18	0.298	0.4	-0.102
DH5	2.9	9	0.261	0.4	-0.139

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 in section 7.1.4 demonstrates compliance with channel occupancy when AFH is employed.

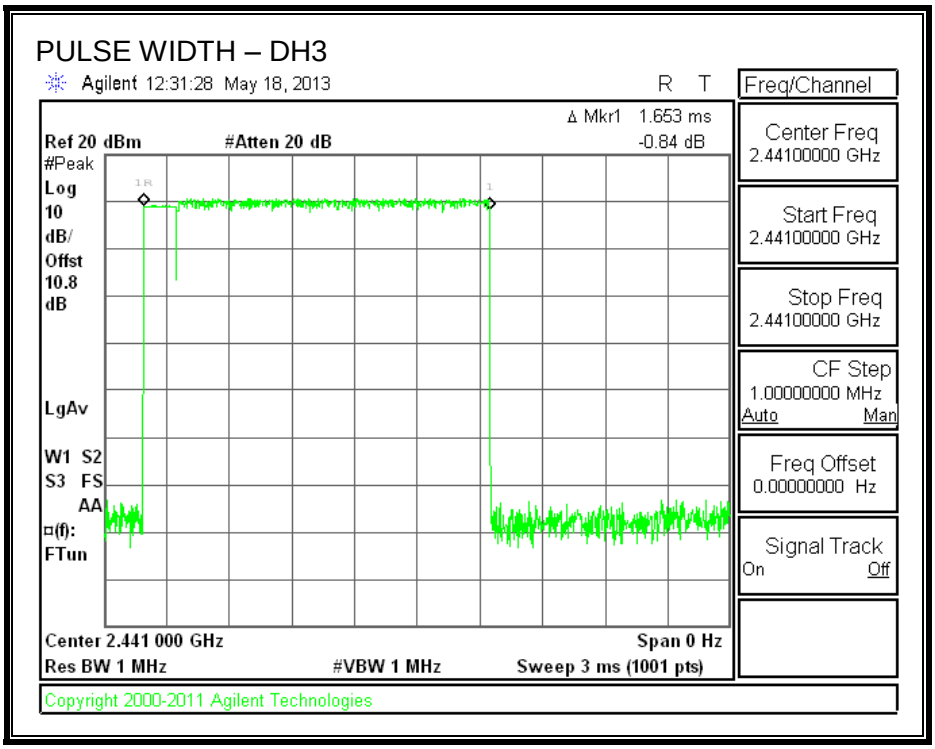
PULSE WIDTH - DH1



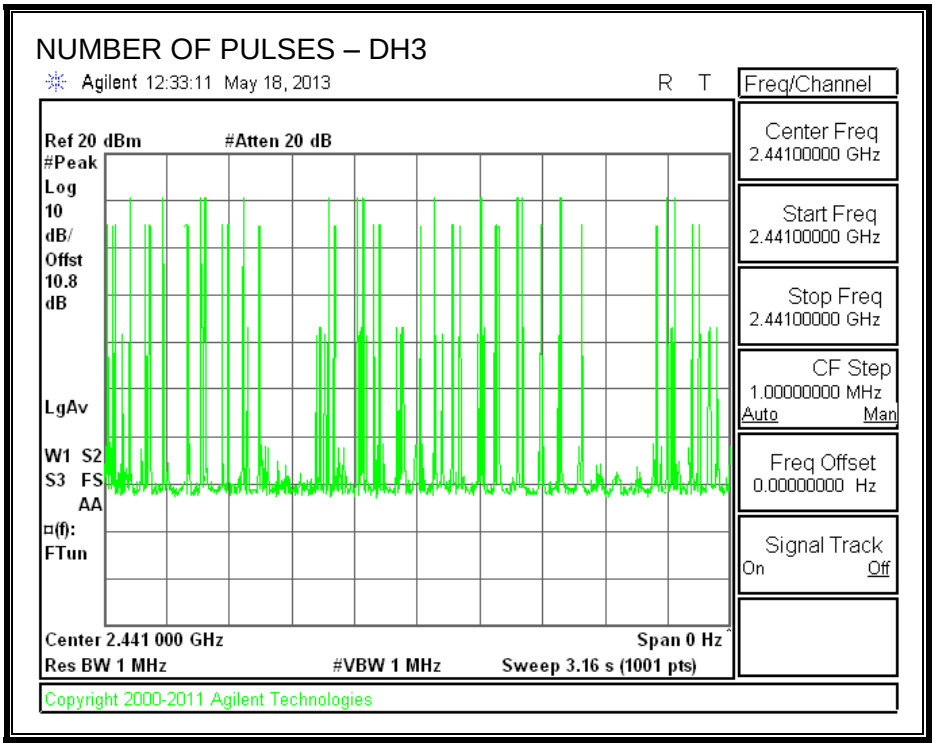
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



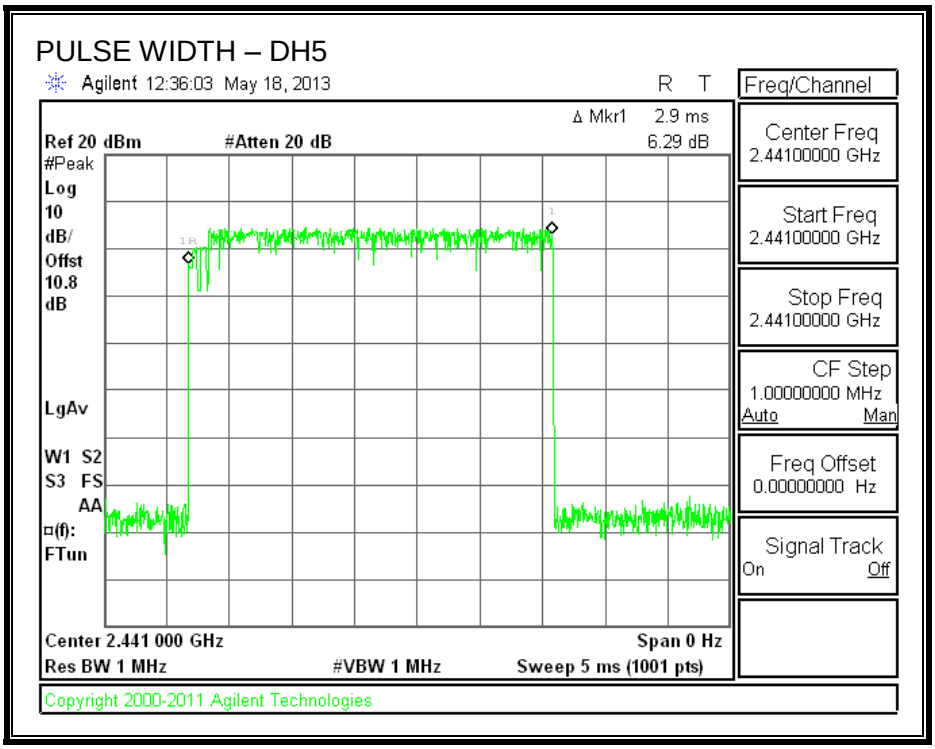
PULSE WIDTH – DH3



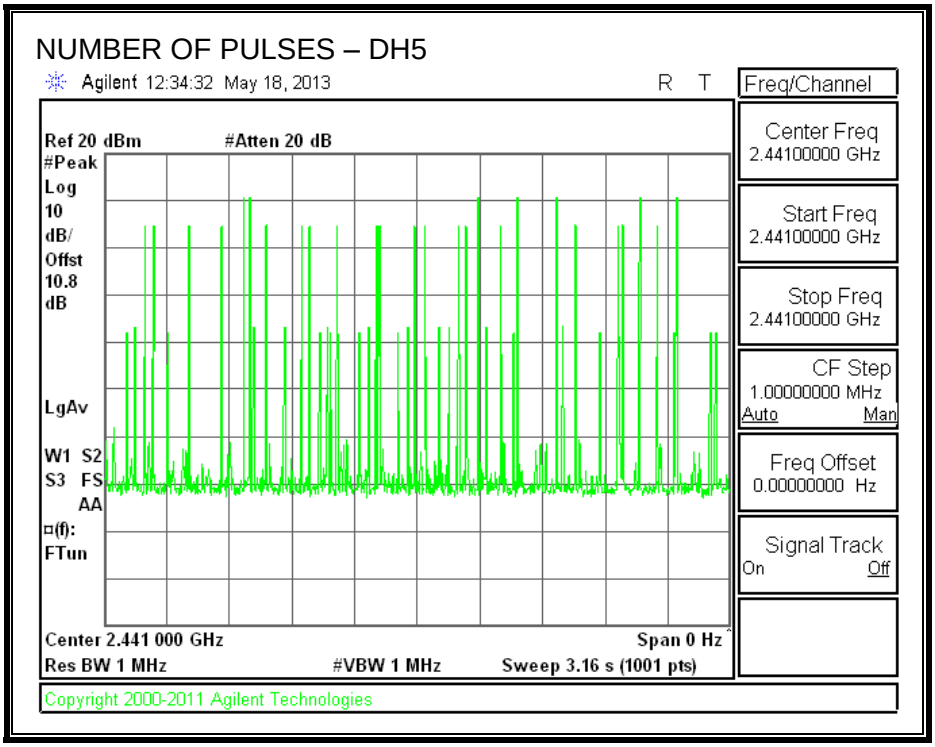
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.3.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

TEST PROCEDURE

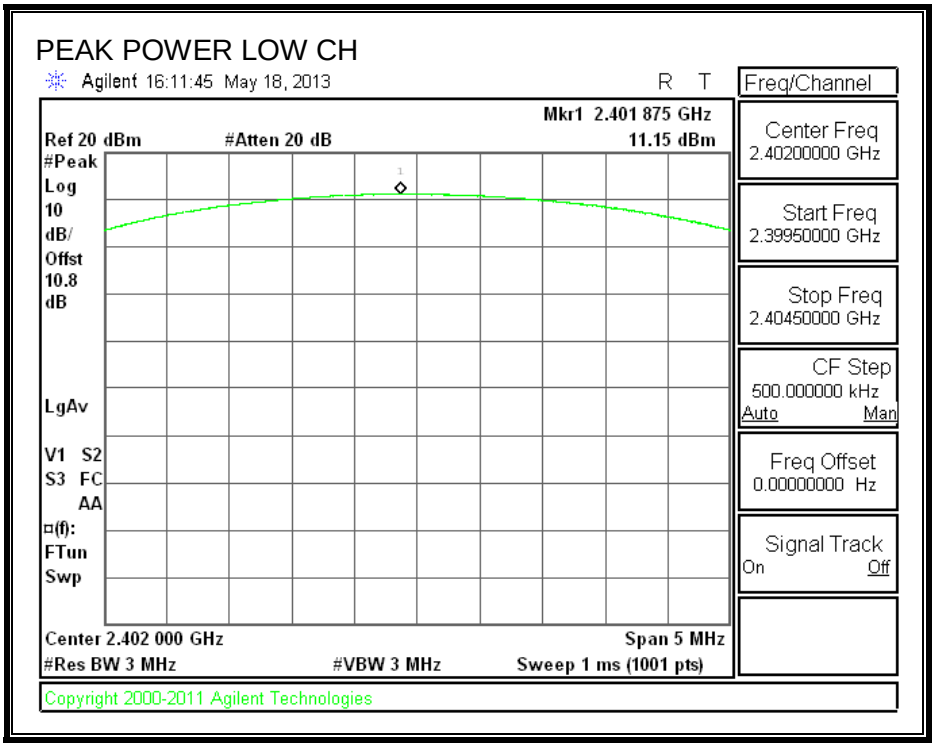
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

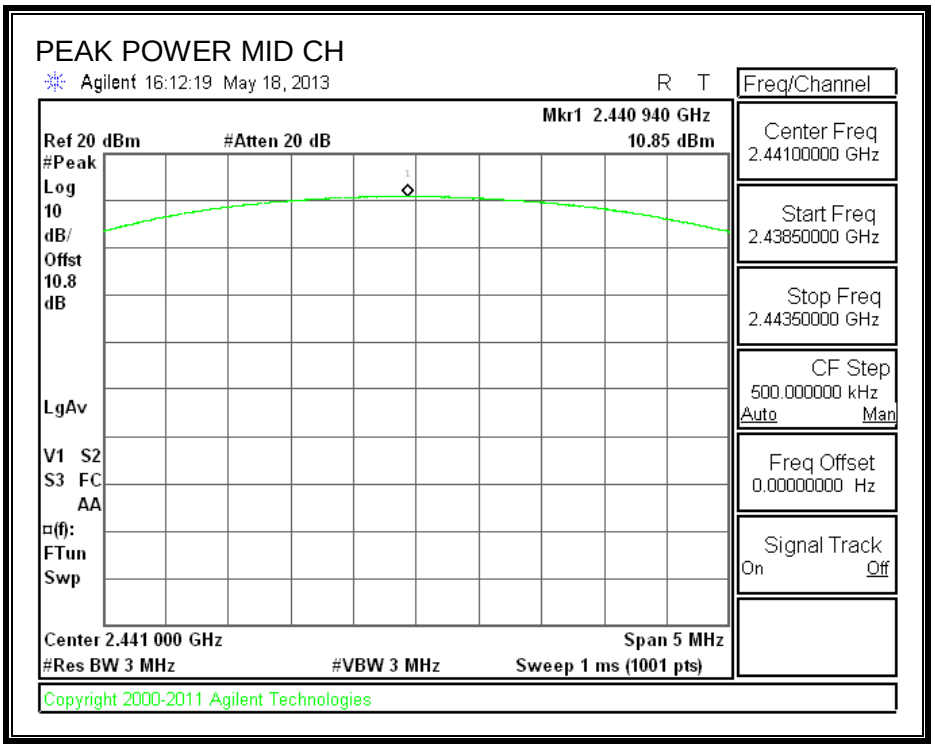
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.15	20.97	-9.82
Middle	2441	10.85	20.97	-10.12
High	2480	10.32	20.97	-10.65

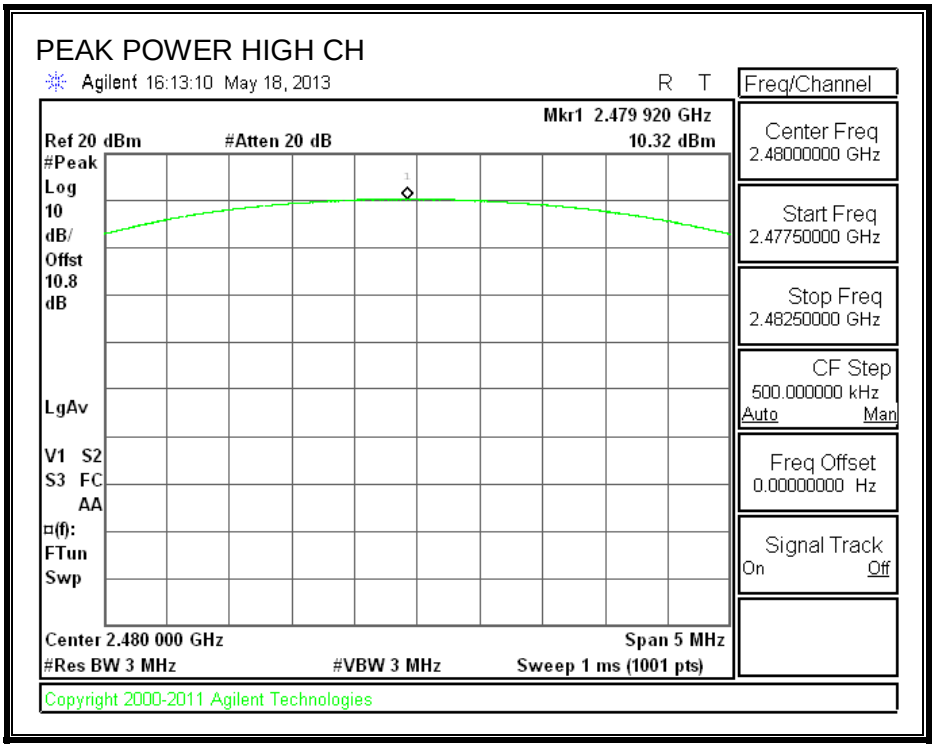
OUTPUT POWER

PEAK POWER LOW CH



PEAK POWER MID CH





8.3.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.02
Middle	2441	7.23
High	2480	6.81

8.3.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

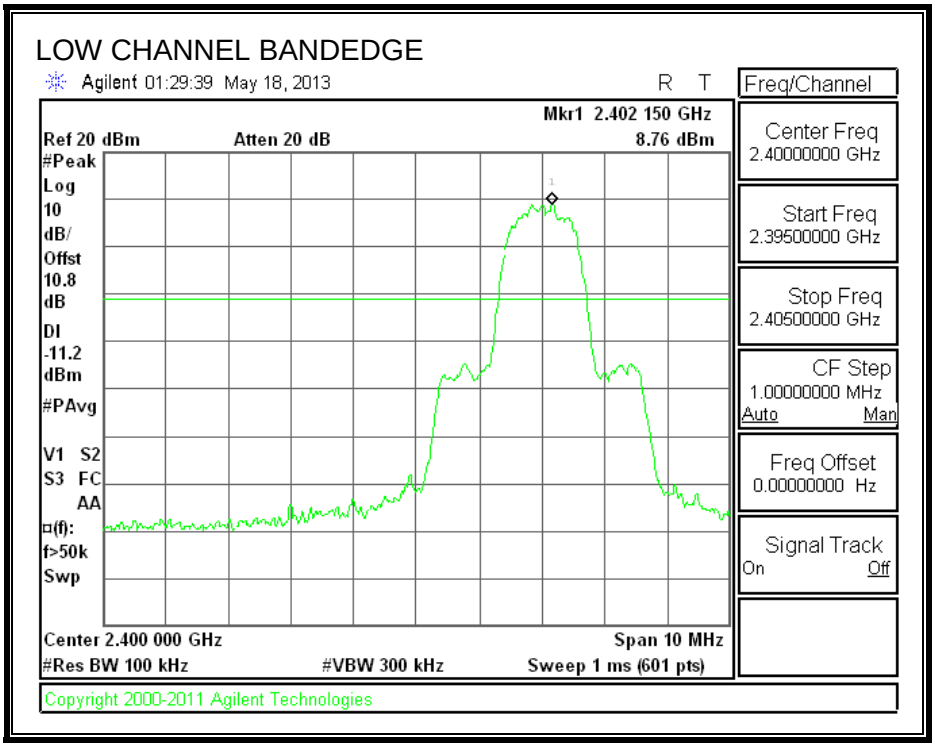
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

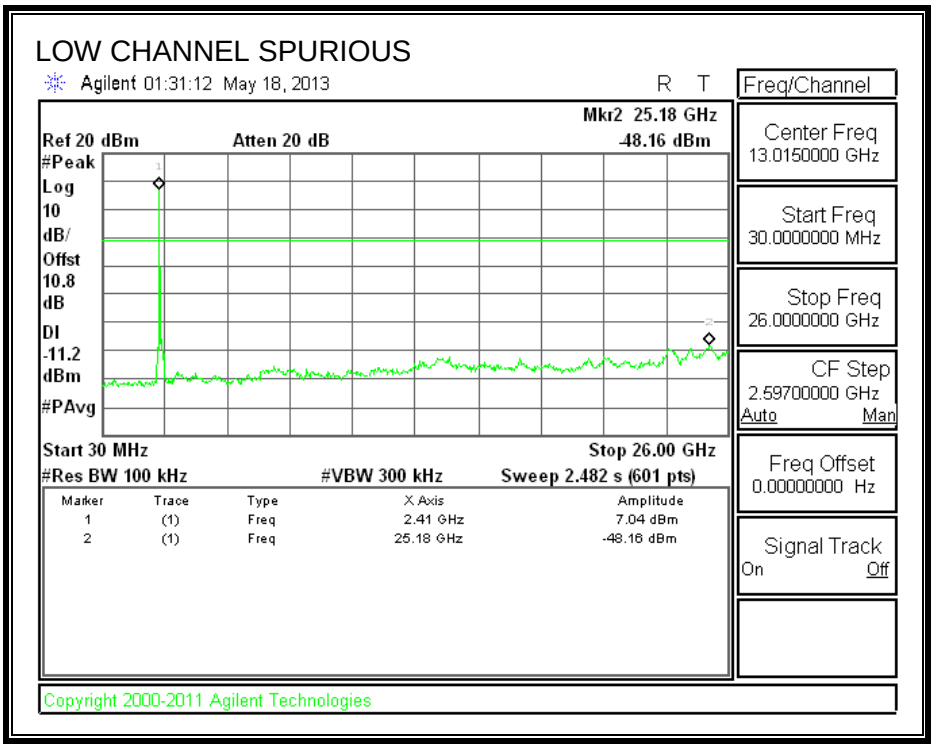
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

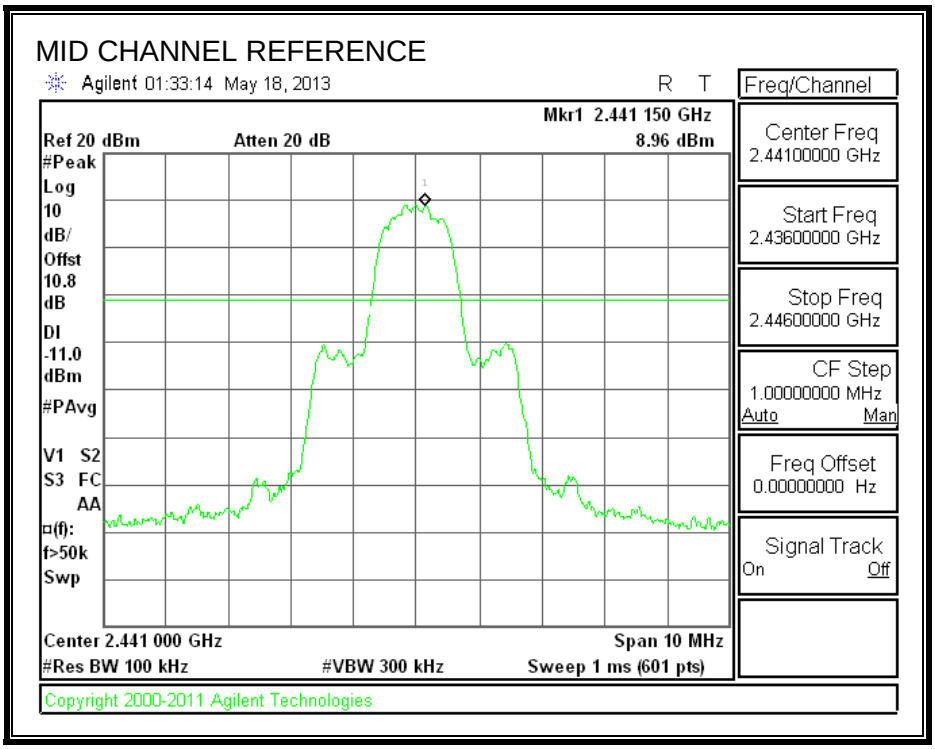
RESULTS

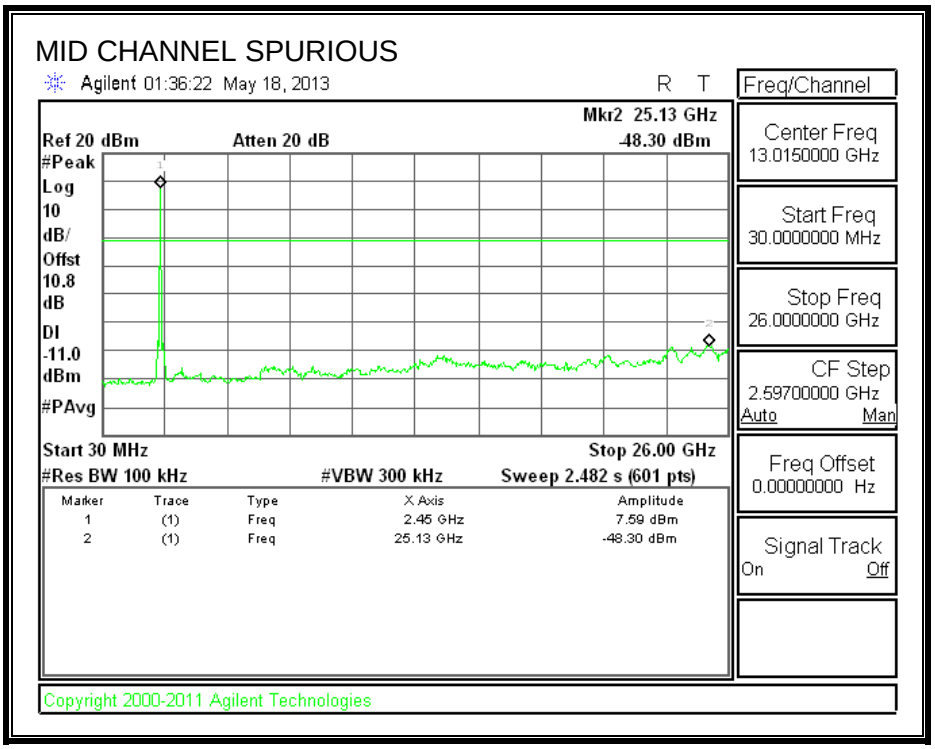
SPURIOUS EMISSIONS, LOW CHANNEL



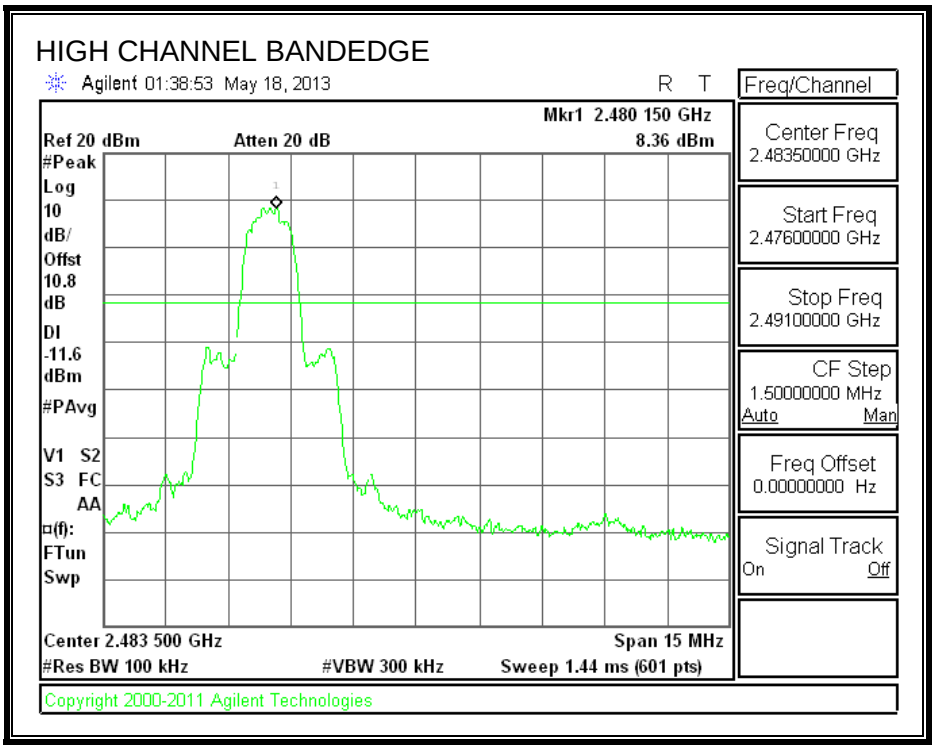


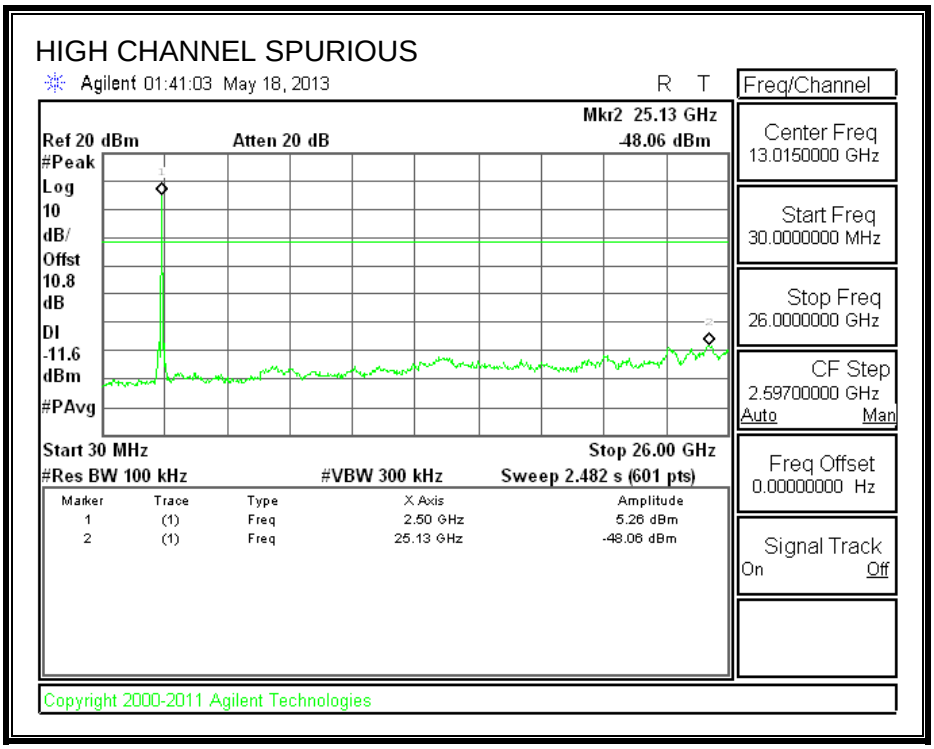
SPURIOUS EMISSIONS, MID CHANNEL





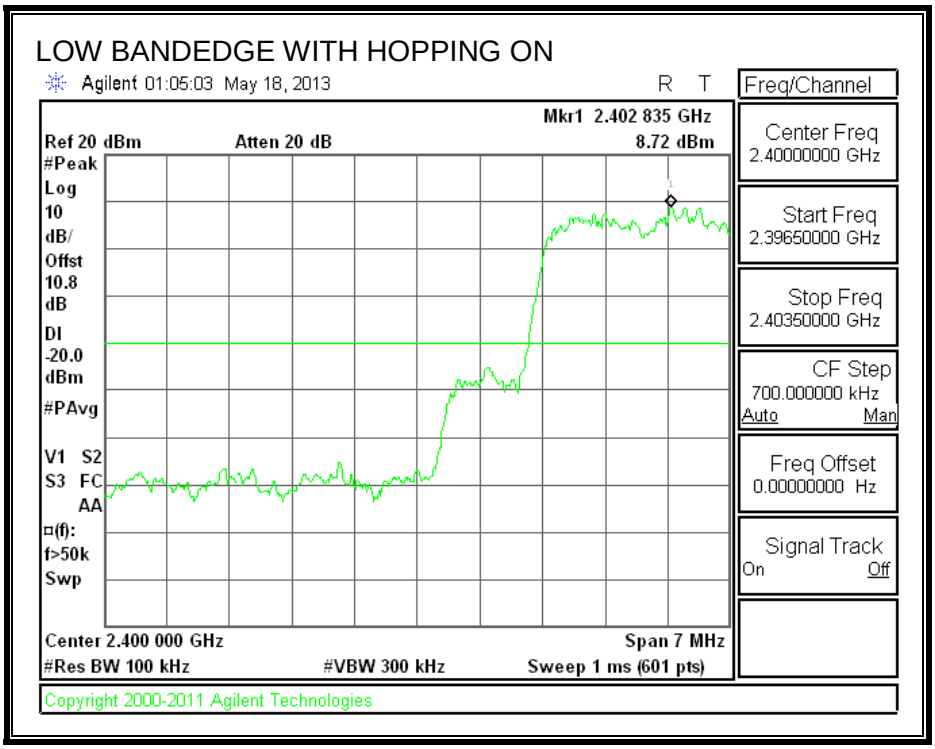
SPURIOUS EMISSIONS, HIGH CHANNEL



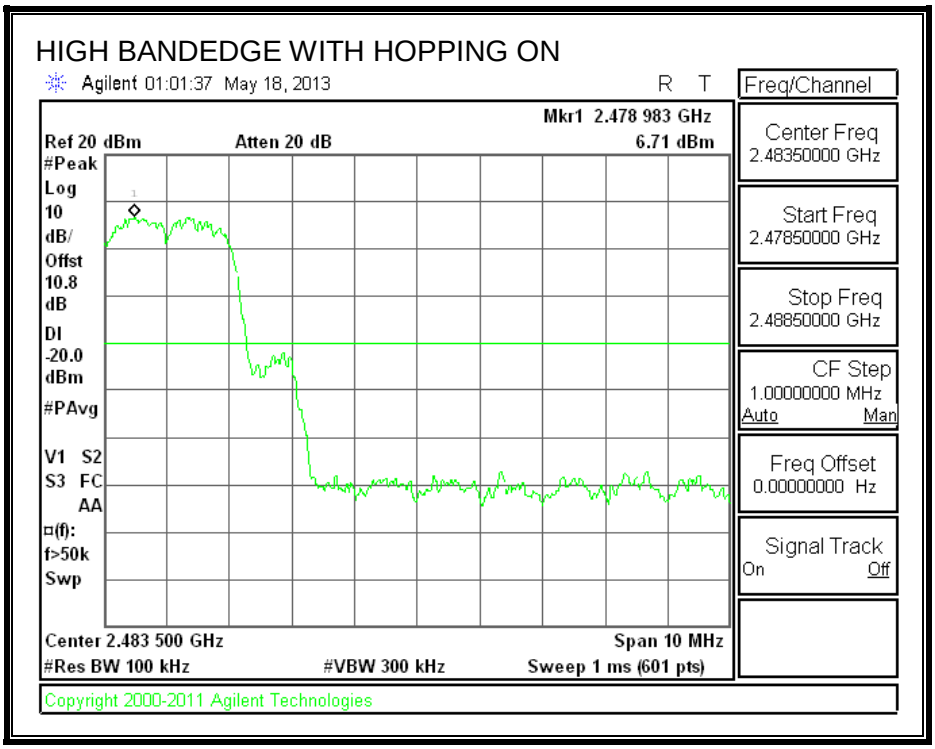


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



9. RADIATED TEST RESULTS

9.1. 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.

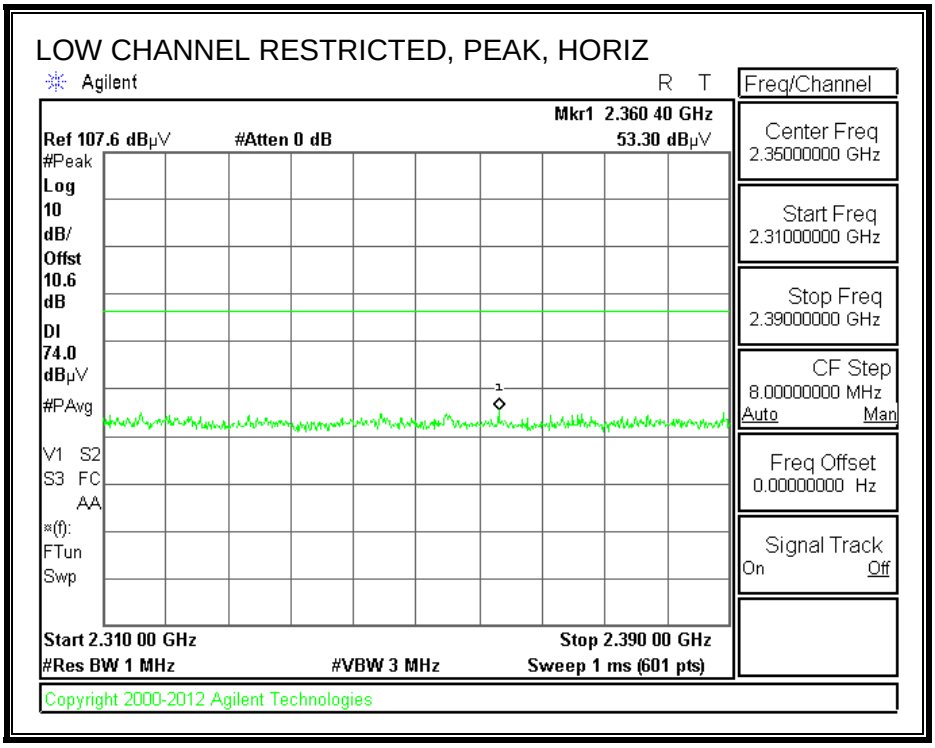
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

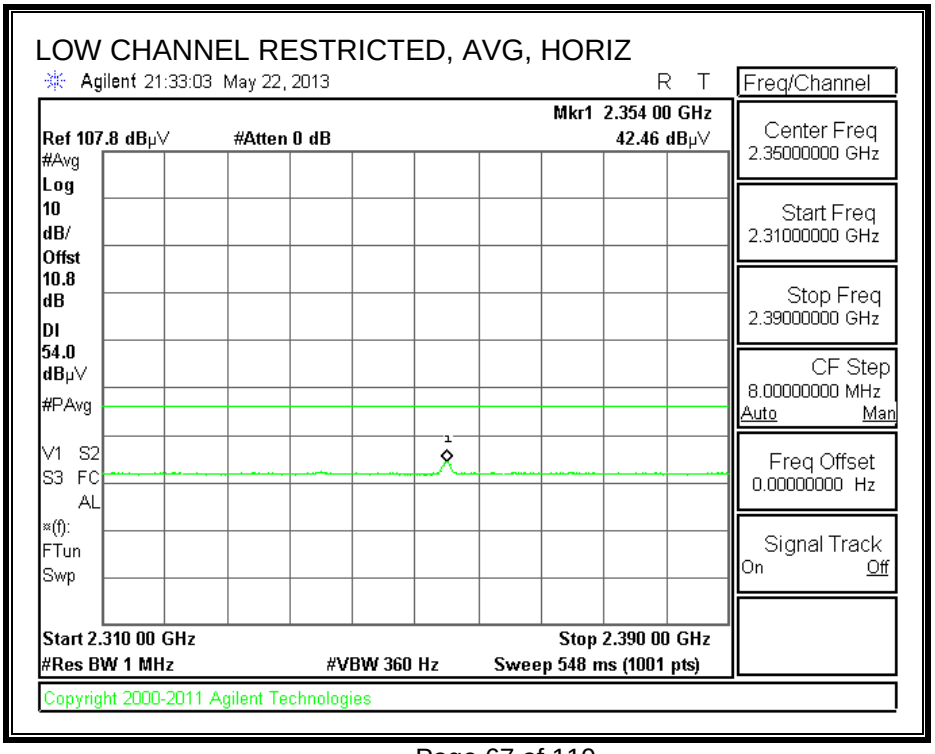
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

9.2. TRANSMITTER ABOVE 1 GHz

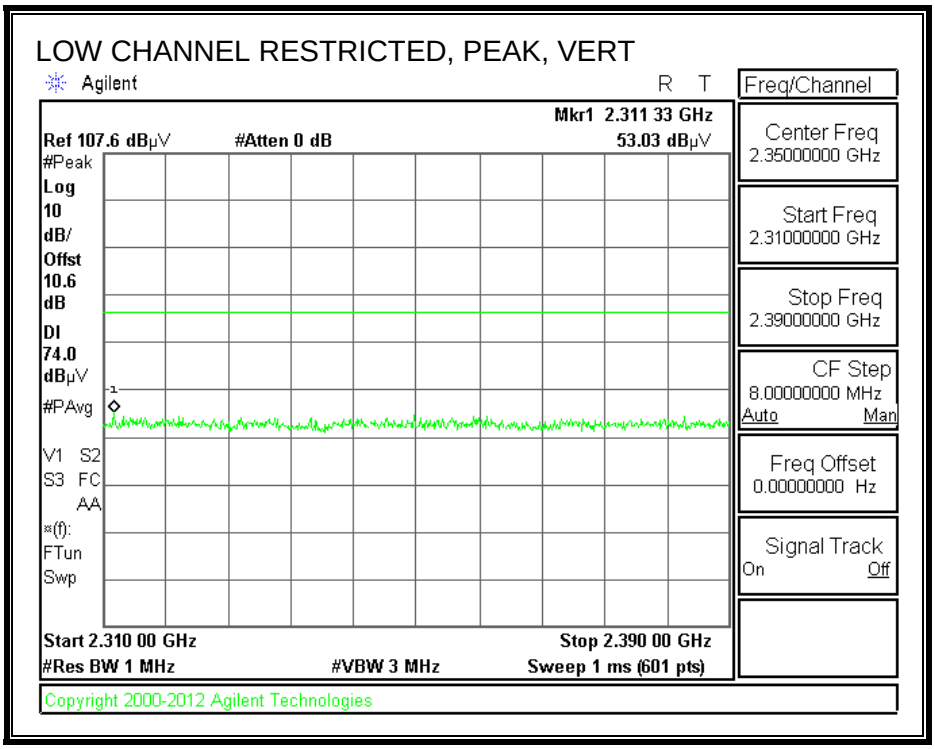
9.2.1. BASIC DATA RATE GFSK MODULATION

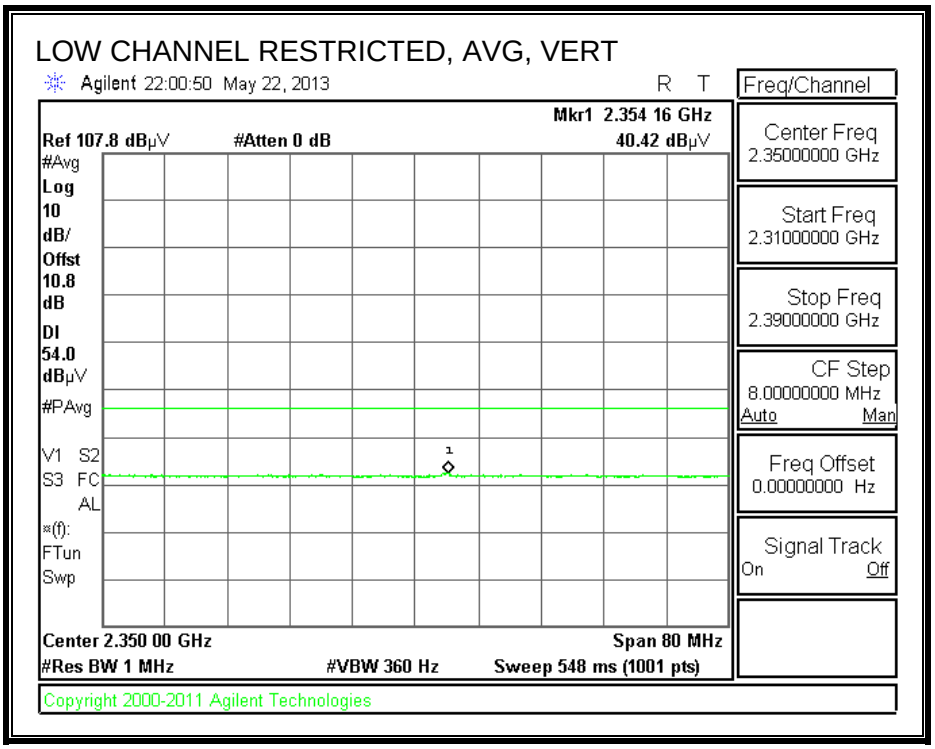
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



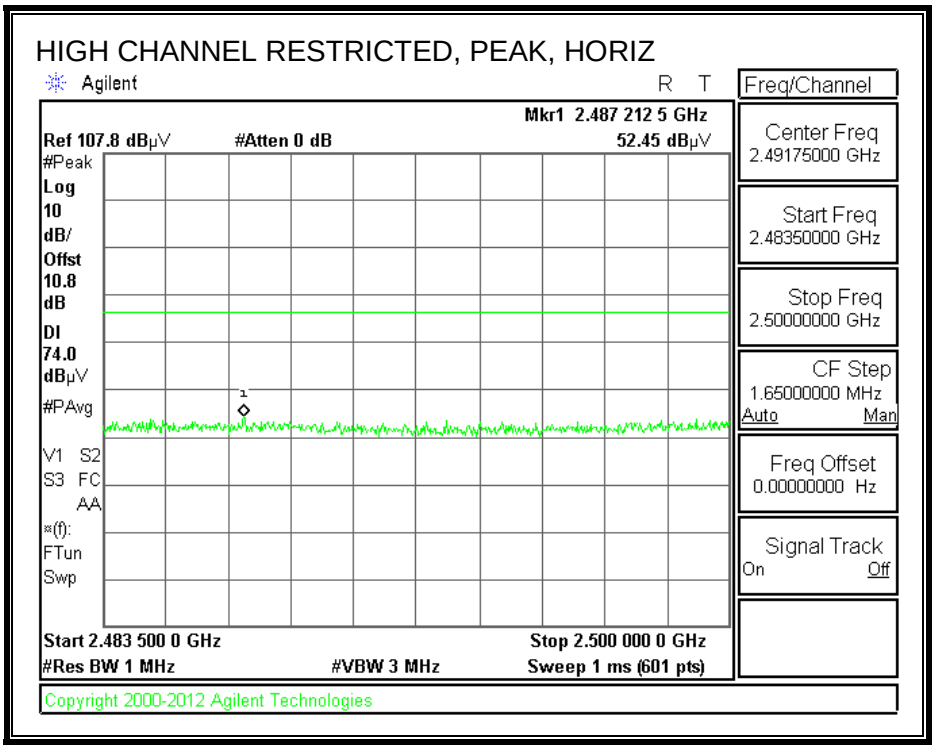


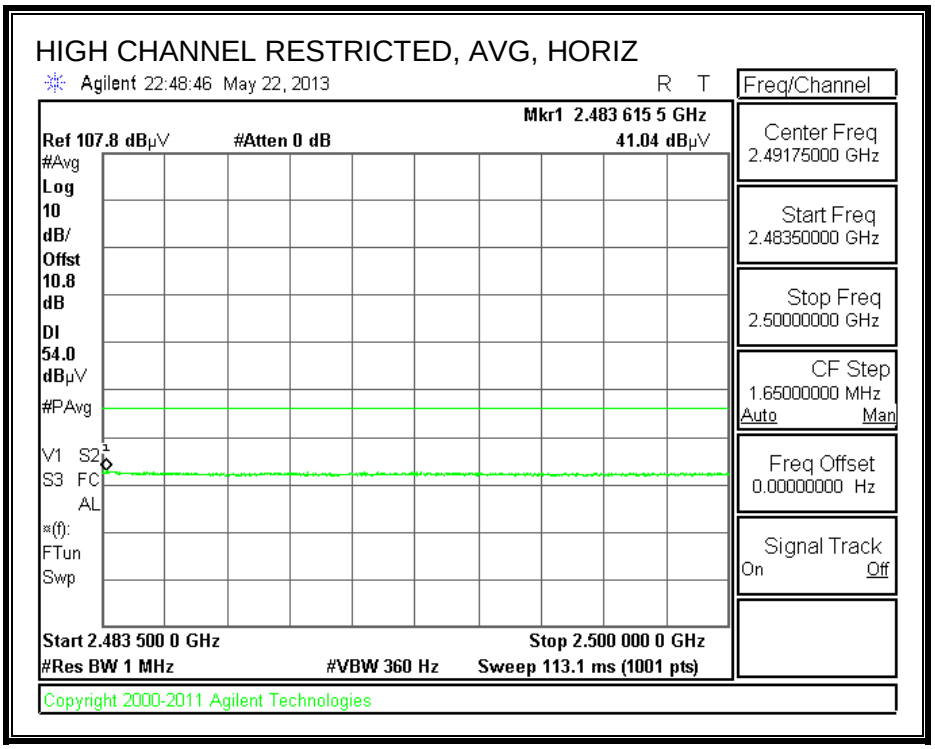
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



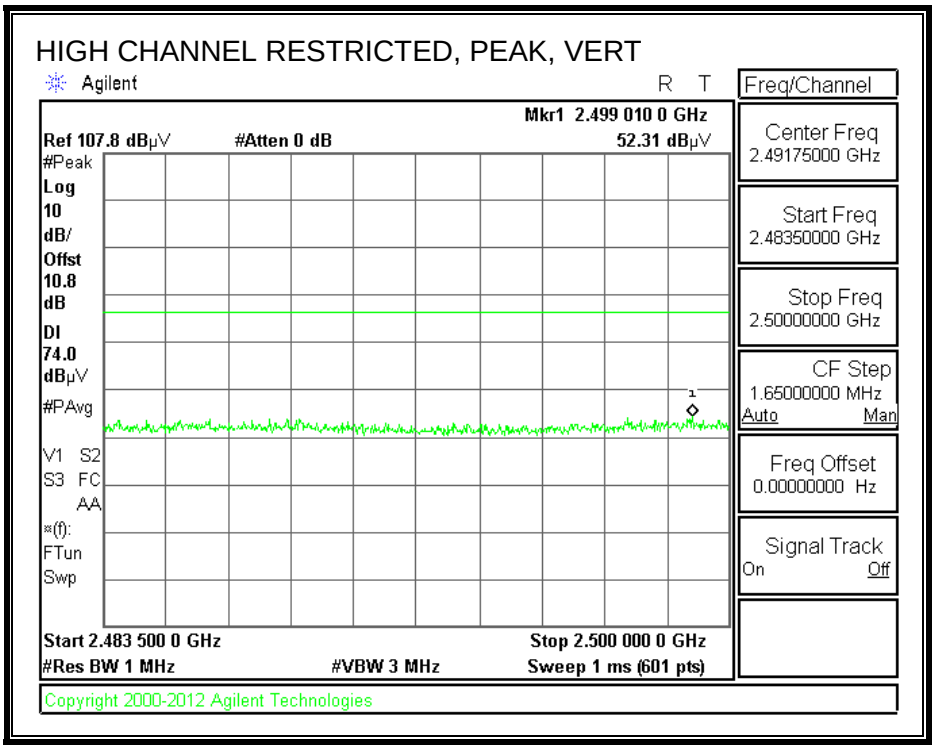


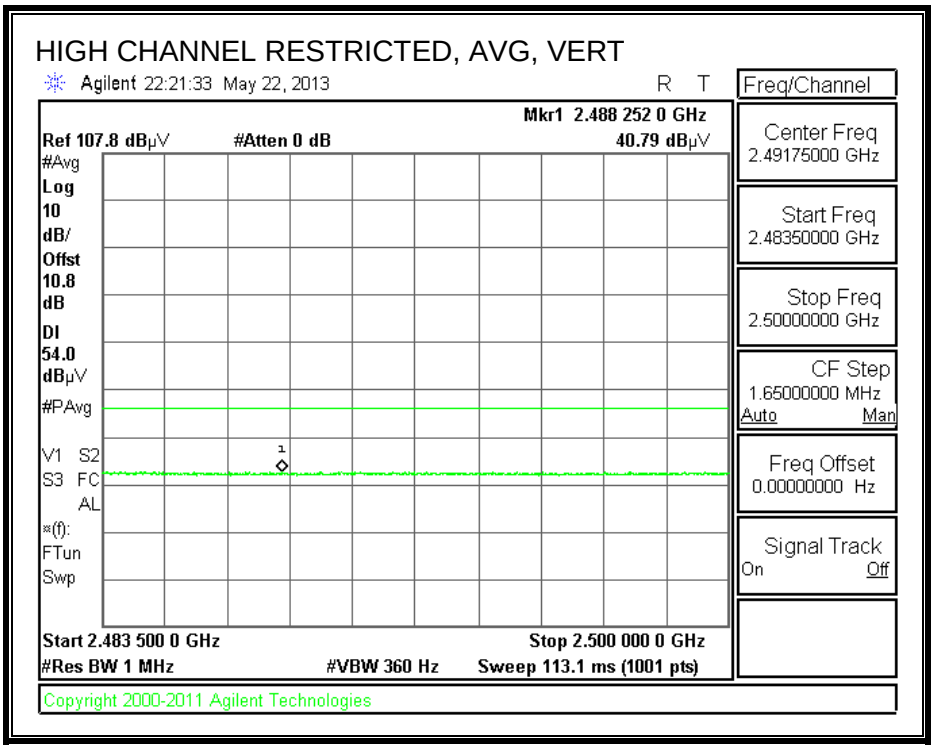
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

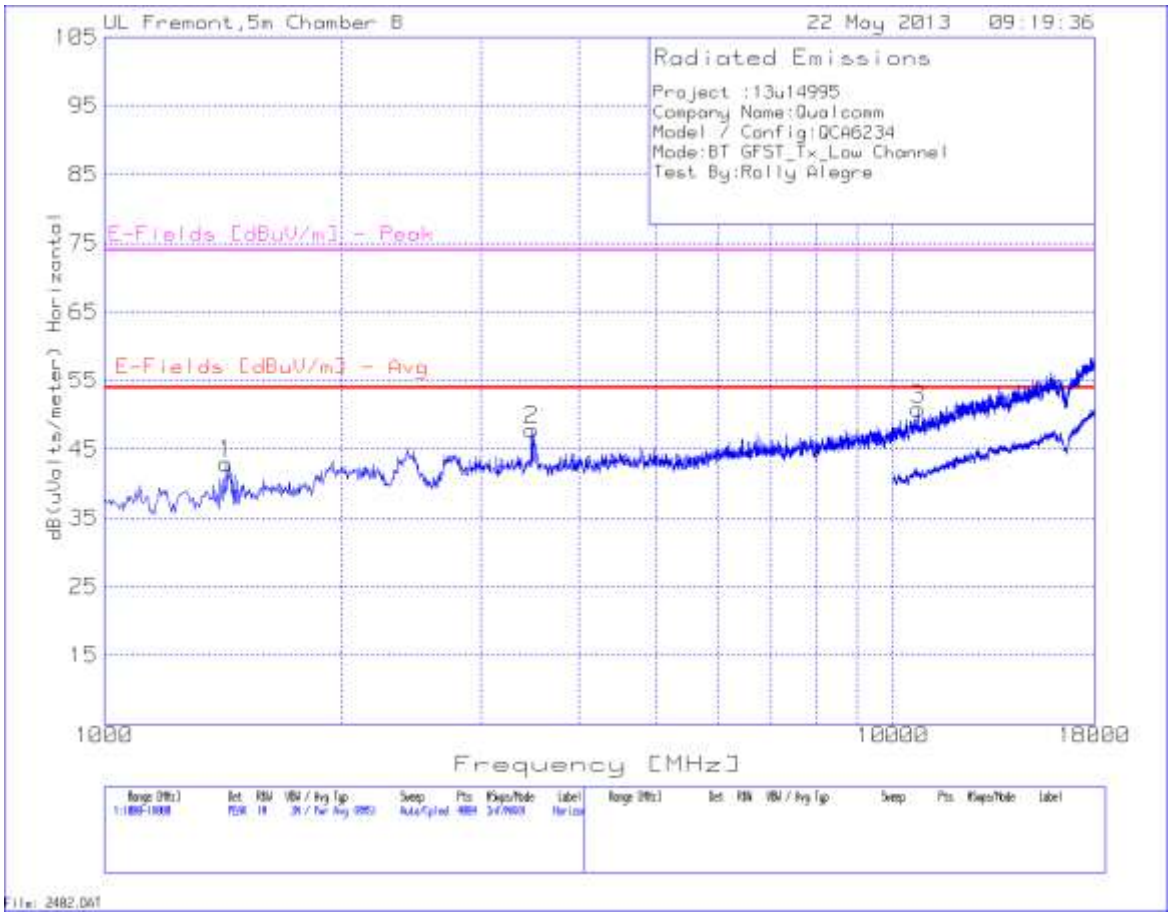




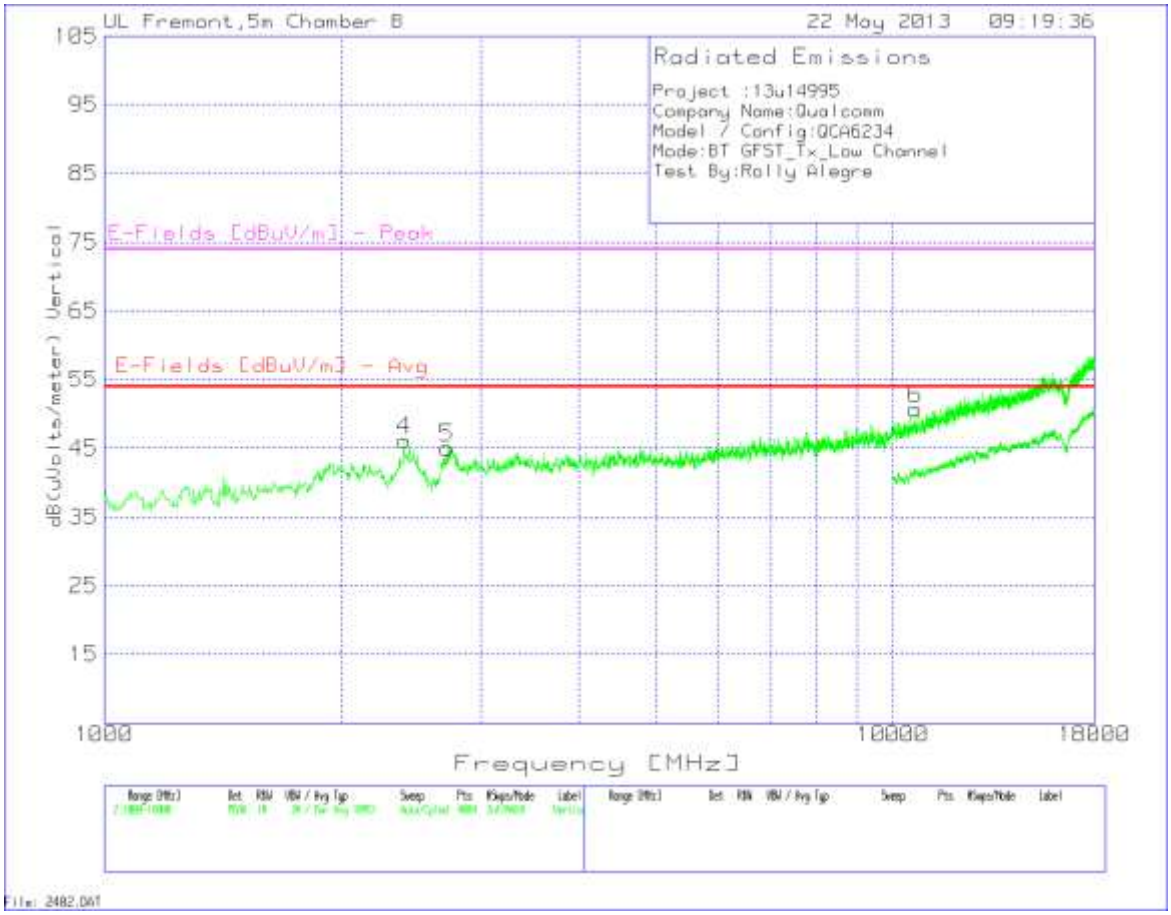
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL

HORIZONTAL PLOT



VERTICAL PLOT



DATA

Project :13u14995
Company Name:Qualcomm
Model / Config: QCA6234
Mode:BT GFSK_Tx_Low Channel
Test By:Rolly Alegre

Horizontal 1000 - 18000MHz

Marker No.	Test Frequenc	Meter Reading	Detector	T345 Ant Factor	T145 Preamp	Cable Factor	T160 BRF [dB]	dB(uVolt s/meter)	E-Fields [dBuV/m	Margin (dB)	E-Fields [dBuV/m	Margin (dB)	Height [cm]	Polarity
1	1428.928	45.88	PK	28.3	-35.3	3.6	0.4	42.88	53.97	-11.09	74	-31.12	101	Horz
2	3480.14	43.55	PK	33.2	-35	5.7	0.4	47.85	53.97	-6.12	74	-26.15	101	Horz
3	10771.92	35.18	PK	38.3	-34.1	10.9	0.6	50.88	53.97	-3.09	74	-23.12	101	Horz

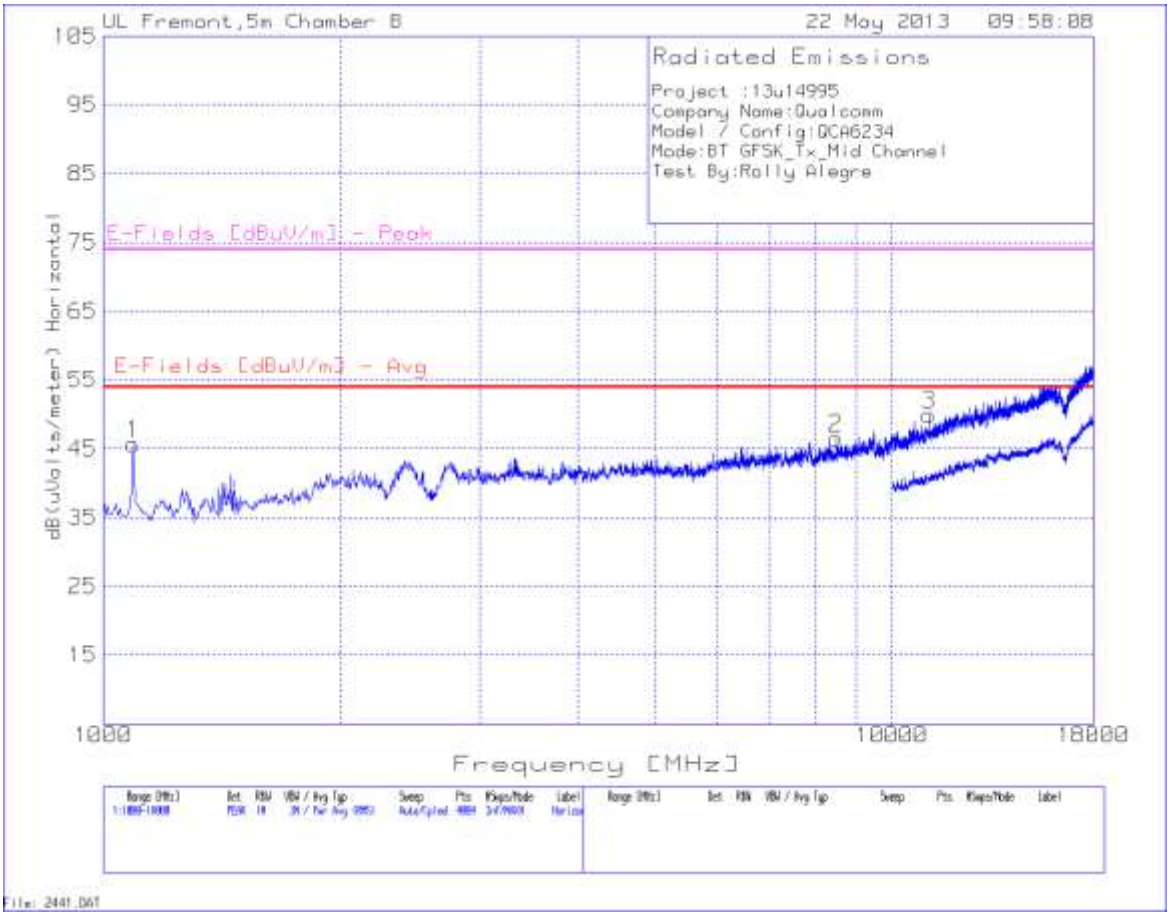
Vertical 1000 - 18000MHz

Marker No.	Test Frequenc	Meter Reading	Detector	T345 Ant Factor	T145 Preamp	Cable Factor	T160 BRF [dB]	dB(uVolt s/meter)	E-Fields [dBuV/m	Margin (dB)	E-Fields [dBuV/m	Margin (dB)	Height [cm]	Polarity
4	2401.449	43.27	PK	32.3	-35	4.6	0.9	46.07	53.97	-7.9	74	-27.93	101	Vert
5	2719.96	41.5	PK	32.8	-35.1	5	0.9	45.1	53.97	-8.87	74	-28.9	200	Vert
6	10686.99	35.28	PK	38.3	-34.2	10.8	0.6	50.78	53.97	-3.19	74	-23.22	101	Vert

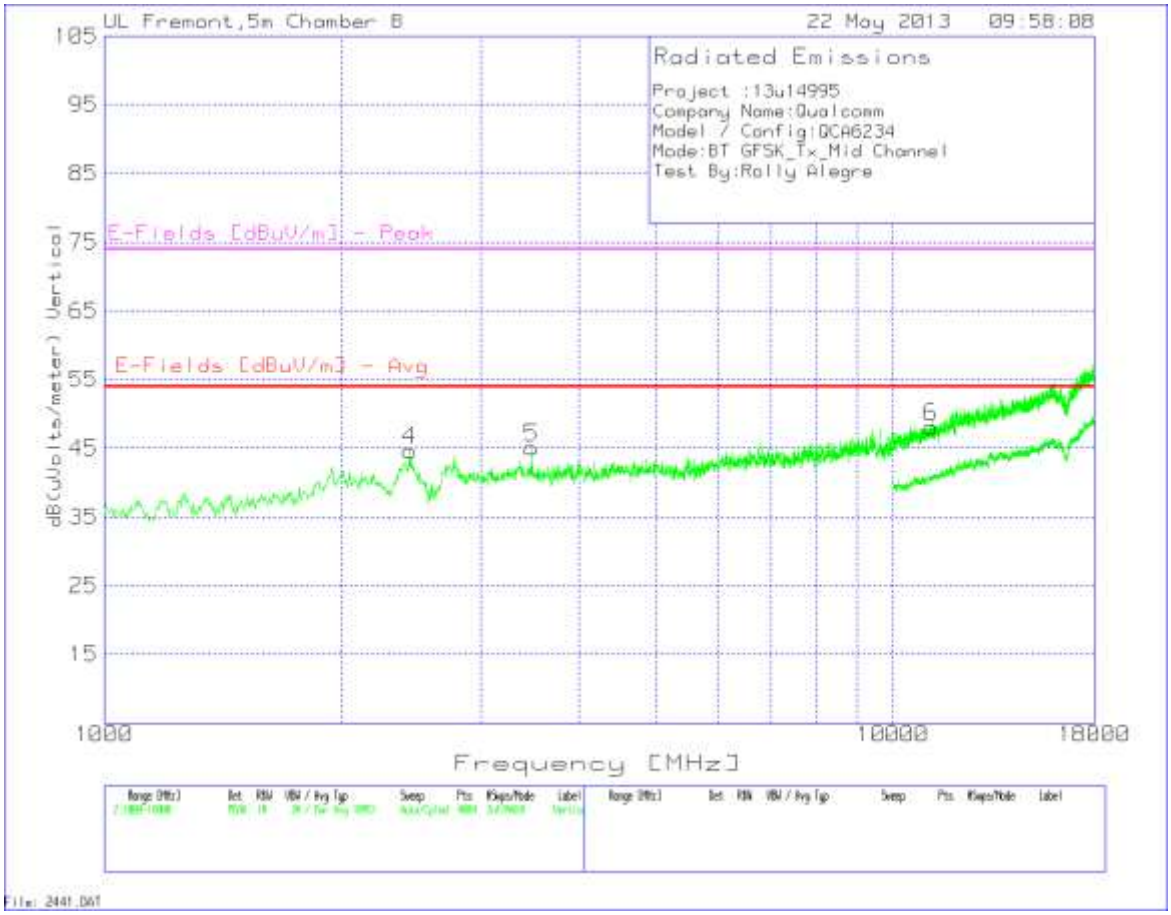
PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector

MID CHANNEL

HORIZONTAL PLOT



VERTICAL PLOT



DATA

Project :13u14995
Company Name:Qualcomm
Model / Config: QCA6234
Mode:BT GFSK_Tx_Mid Channel
Test By:Rolly Alegre

Horizontal 1000 - 18000MHz

Marker No.	Test Frequenc	Meter Reading	Detector	T345 Ant Factor	T145 Preamp	Cable Factor	T160 BRF [dB]	dB(uVolts/meter)	E-Fields [dBuV/m	Margin (dB)	E-Fields [dBuV/m	Margin (dB)	Height [cm]	Polarity
1	1093.43	50.23	PK	27.8	-35.9	3.3	0.3	45.73	53.97	-8.24	74	-28.27	124	Horz
2	8508.369	35.63	PK	36.2	-35.2	9.6	0.3	46.53	53.97	-7.44	74	-27.47	124	Horz
3	11149.89	33.67	PK	38.4	-33.8	11.1	0.6	49.97	53.97	-4	74	-24.03	200	Horz

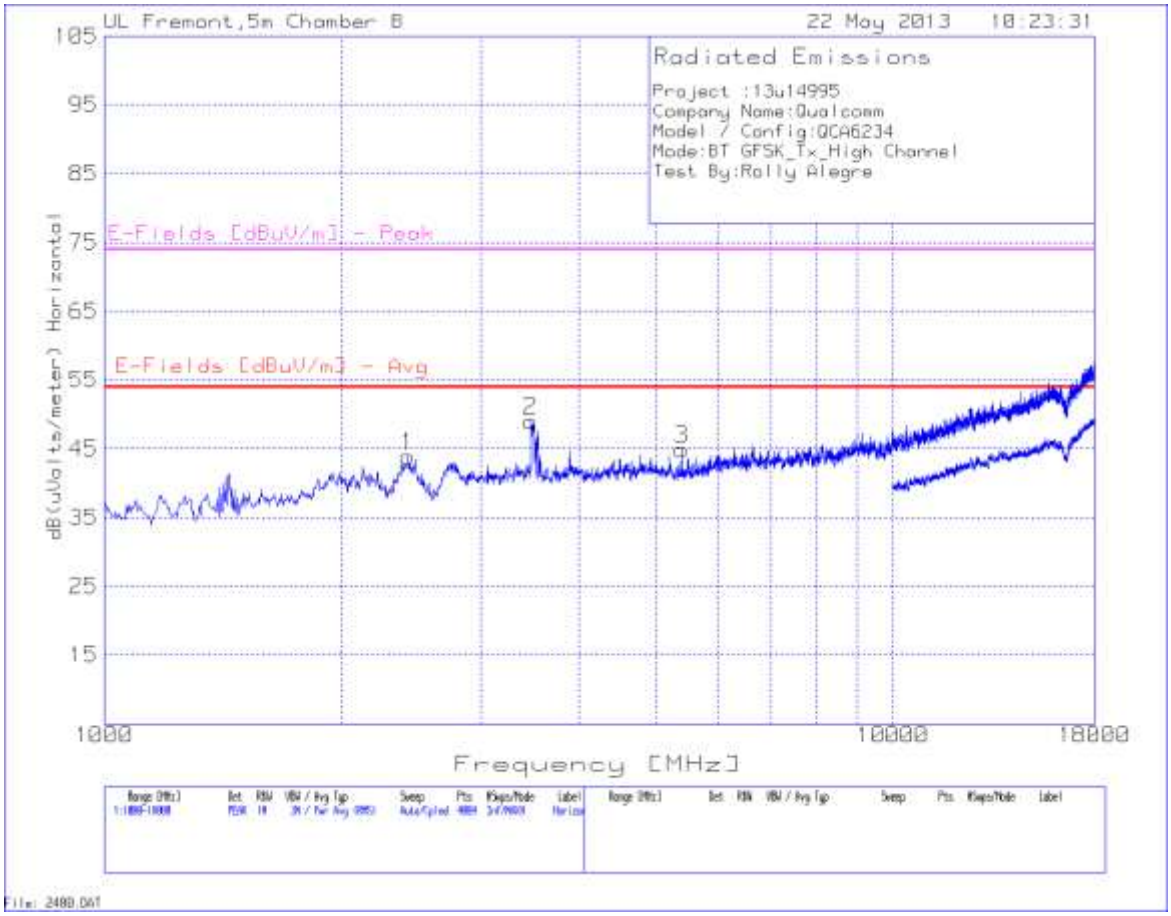
Vertical 1000 - 18000MHz

Marker No.	Test Frequenc	Meter Reading	Detector	T345 Ant Factor	T145 Preamp	Cable Factor	T160 BRF [dB]	dB(uVolts/meter)	E-Fields [dBuV/m	Margin (dB)	E-Fields [dBuV/m	Margin (dB)	Height [cm]	Polarity
4	2439.67	41.66	PK	32.4	-35	4.7	0.9	44.66	53.97	-9.31	74	-29.34	101	Vert
5	3488.634	40.81	PK	33.2	-35	5.7	0.4	45.11	53.97	-8.86	74	-28.89	200	Vert
6	11162.63	31.79	PK	38.4	-33.8	11.1	0.6	48.09	53.97	-5.88	74	-25.91	101	Vert

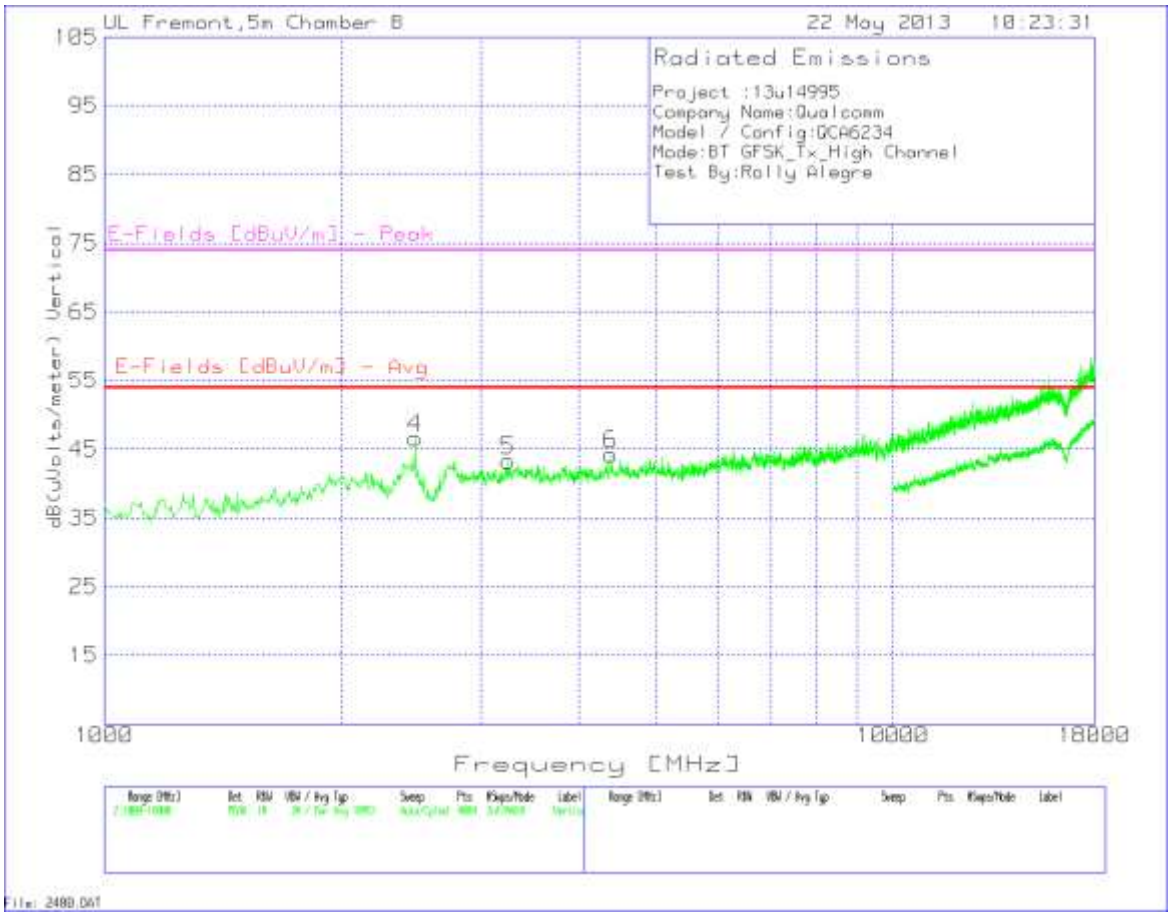
PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector

HIGH CHANNEL

HORIZONTAL PLOT



VERTICAL PLOT



DATA

Project :13u14995
Company Name:Qualcomm
Model / Config:QCA6234
Mode:BT GFSK_Tx_High Channel
Test By:Rolly Alegre

Horizontal 1000 - 18000MHz

Marker No.	Test Frequency	Meter Reading	Detector	T345 Ant Factor [dB/m]	T145 Preamp Gain [dB]	Cable Factor [dB]	T160 BRF [dB]	dB(uVolts /meter)	E-Fields [dBuV/m] - Avg	Margin (dB)	E-Fields [dBuV/m] Peak	Margin (dB)	Height [cm]	Polarity
1	2431.177	40.89	PK	32.4	-35	4.7	0.9	43.89	53.97	-10.08	74	-30.11	200	Horz
2	3475.893	44.74	PK	33.2	-35	5.7	0.4	49.04	53.97	-4.93	74	-24.96	200	Horz
3	5395.453	37.17	PK	34.9	-34.9	7.5	0.2	44.87	53.97	-9.1	74	-29.13	200	Horz

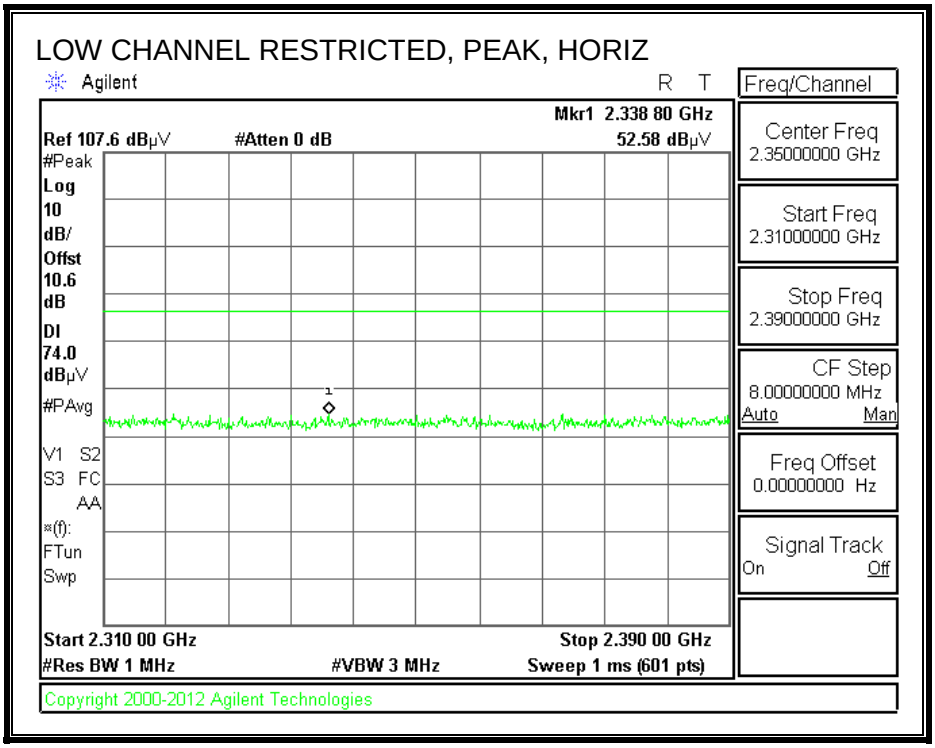
Vertical 1000 - 18000MHz

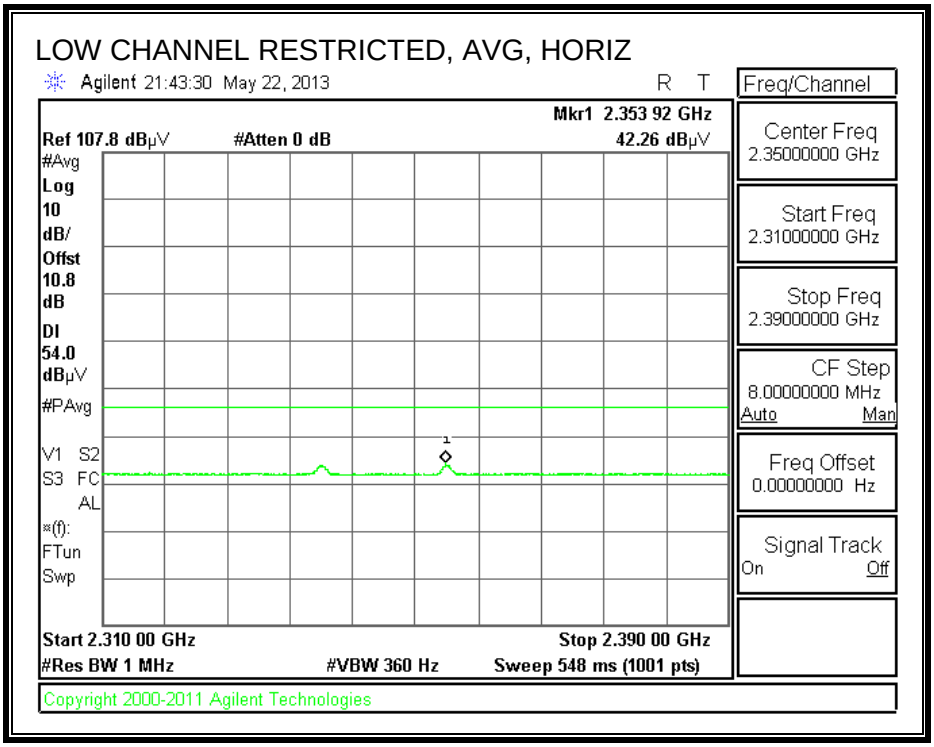
Marker No.	Test Frequency	Meter Reading	Detector	T345 Ant Factor [dB/m]	T145 Preamp Gain [dB]	Cable Factor [dB]	T160 BRF [dB]	dB(uVolts /meter)	E-Fields [dBuV/m] - Avg	Margin (dB)	E-Fields [dBuV/m] Peak	Margin (dB)	Height [cm]	Polarity
4	2477.892	43.55	PK	32.5	-35	4.7	0.9	46.65	53.97	-7.32	74	-27.35	200	Vert
5	3255.059	39.18	PK	33.3	-35.1	5.5	0.5	43.38	53.97	-10.59	74	-30.62	200	Vert
6	4393.205	37.99	PK	34.3	-34.9	6.6	0.3	44.29	53.97	-9.68	74	-29.71	200	Vert

PK - Peak detector

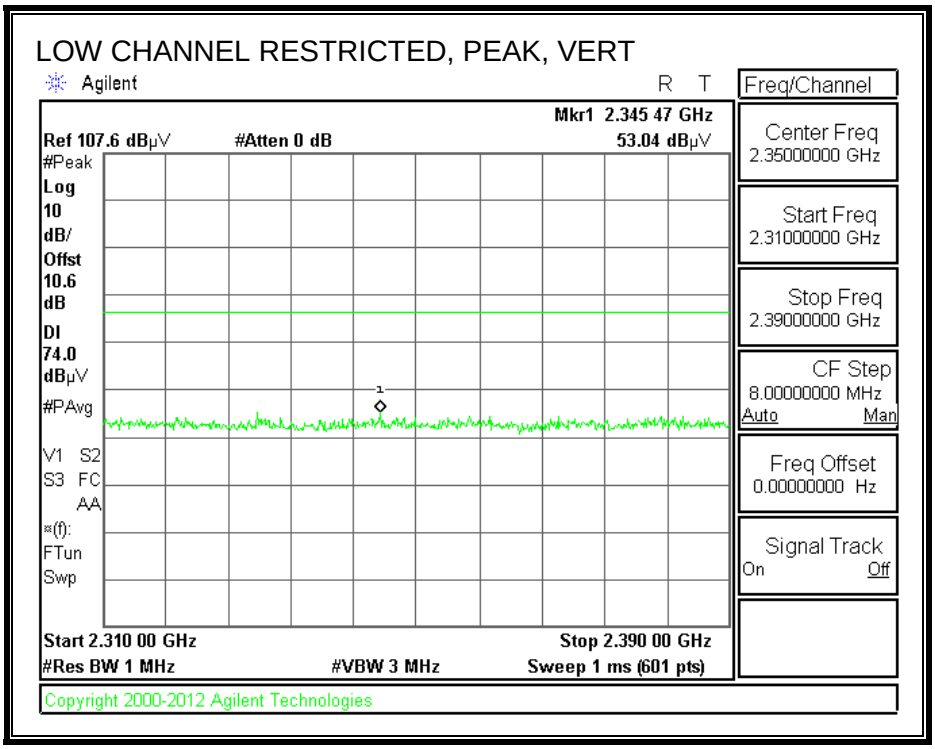
9.2.2. ENHANCED DATA RATE 8PSK MODULATION

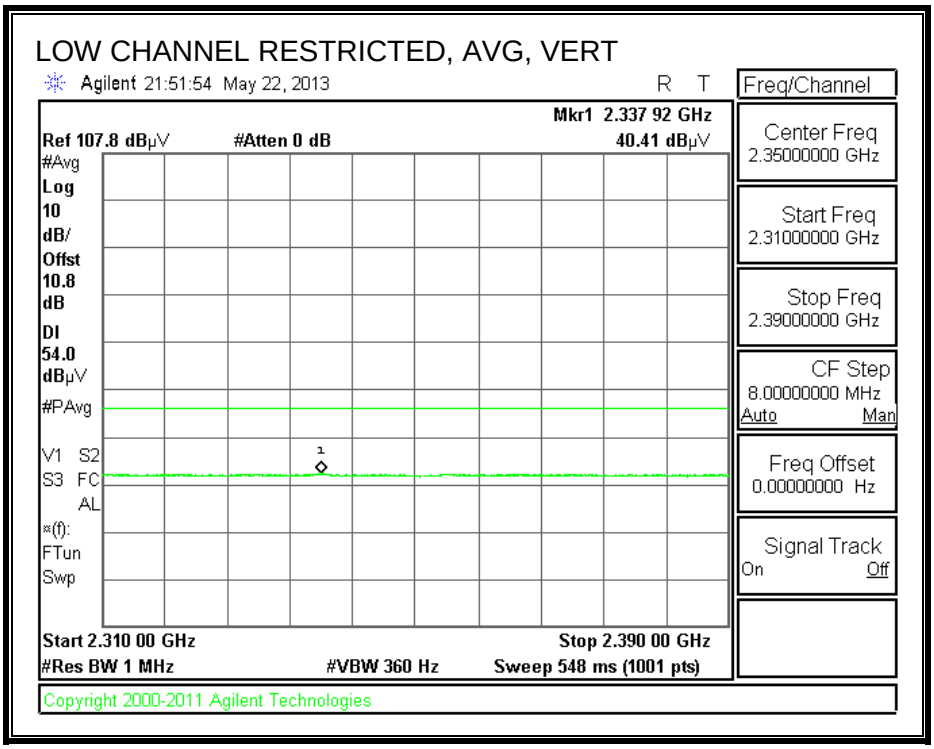
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



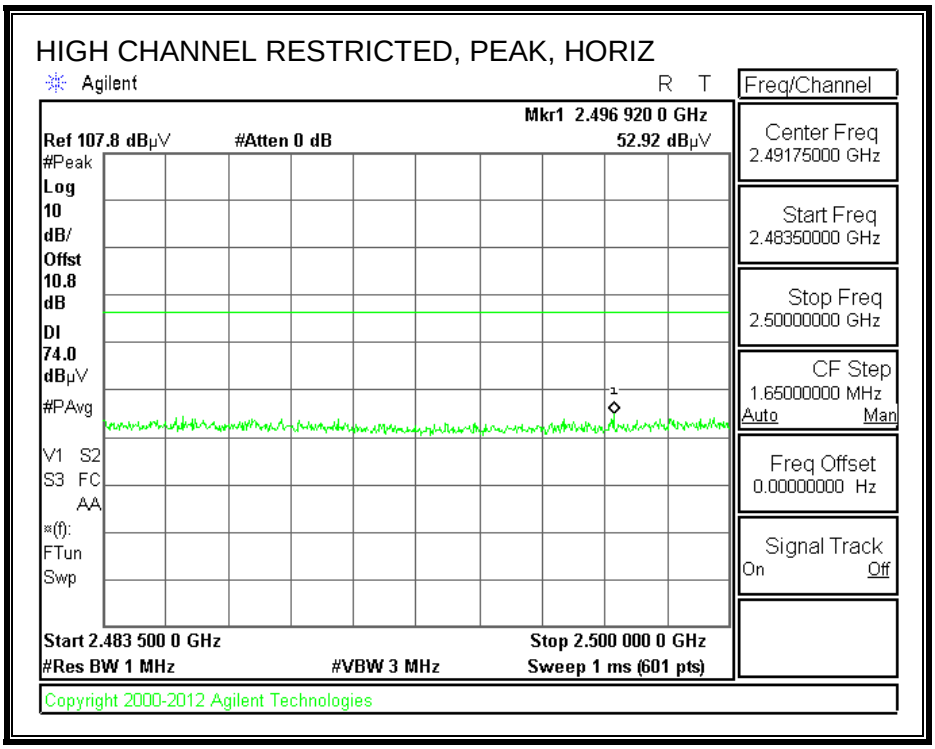


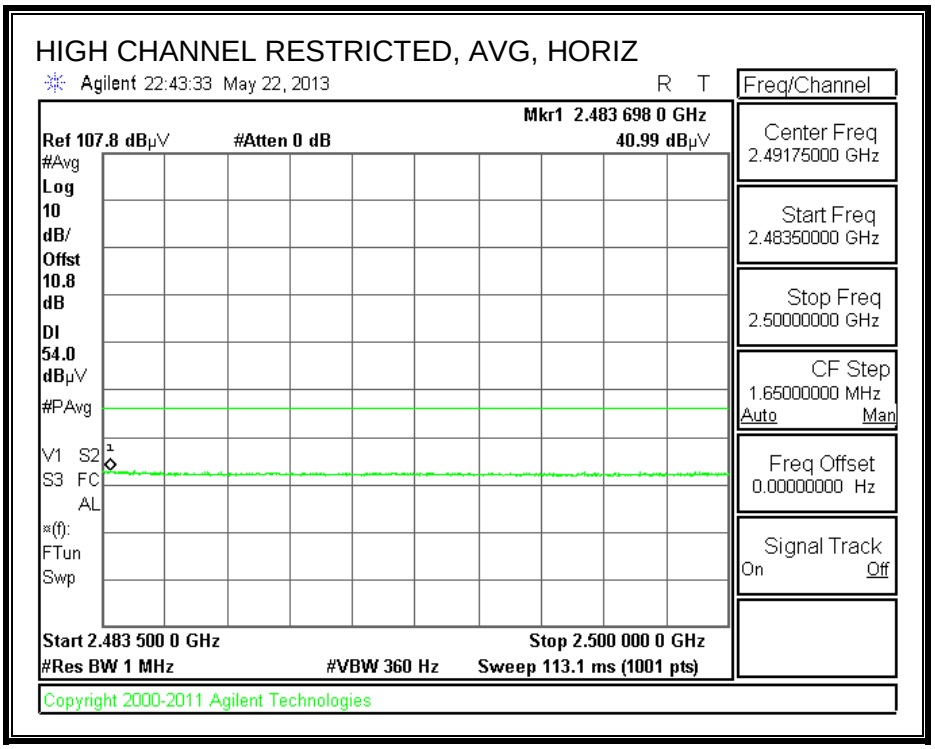
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



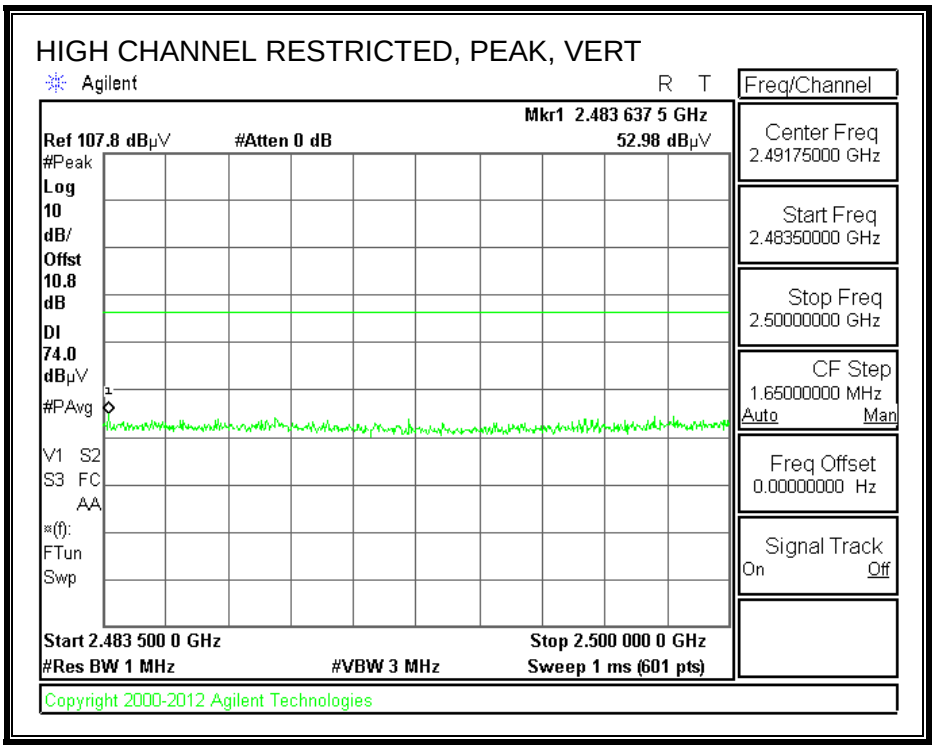


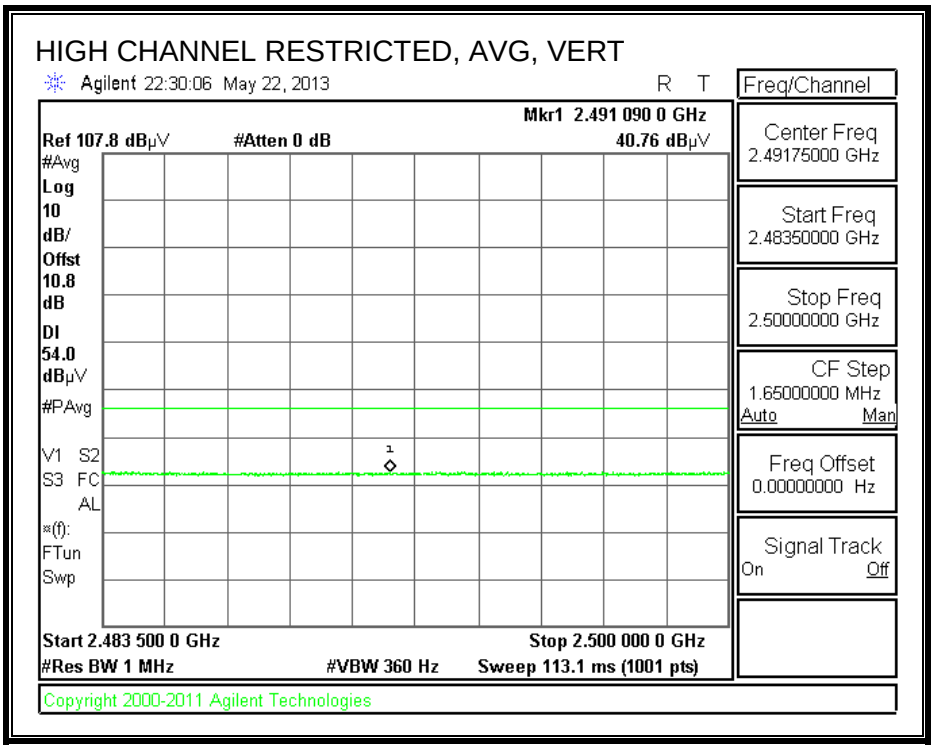
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

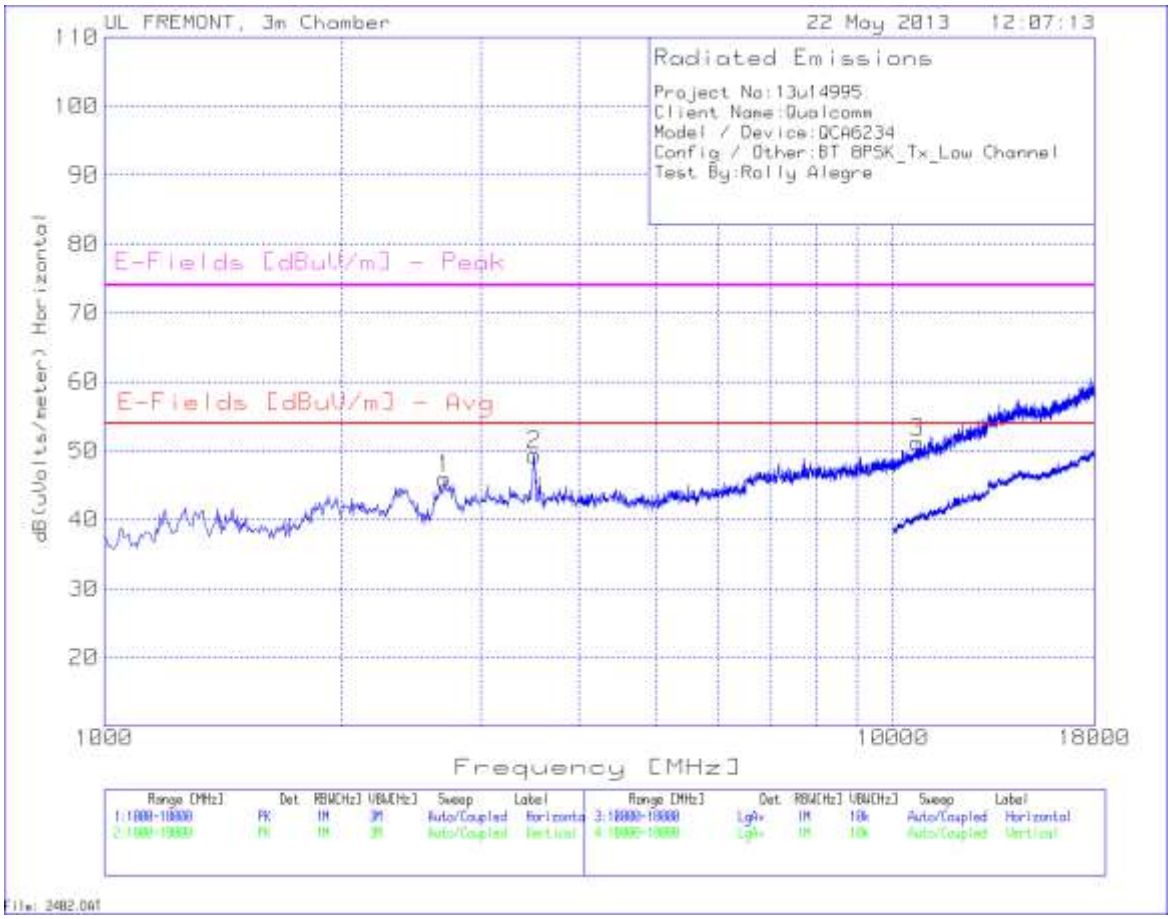




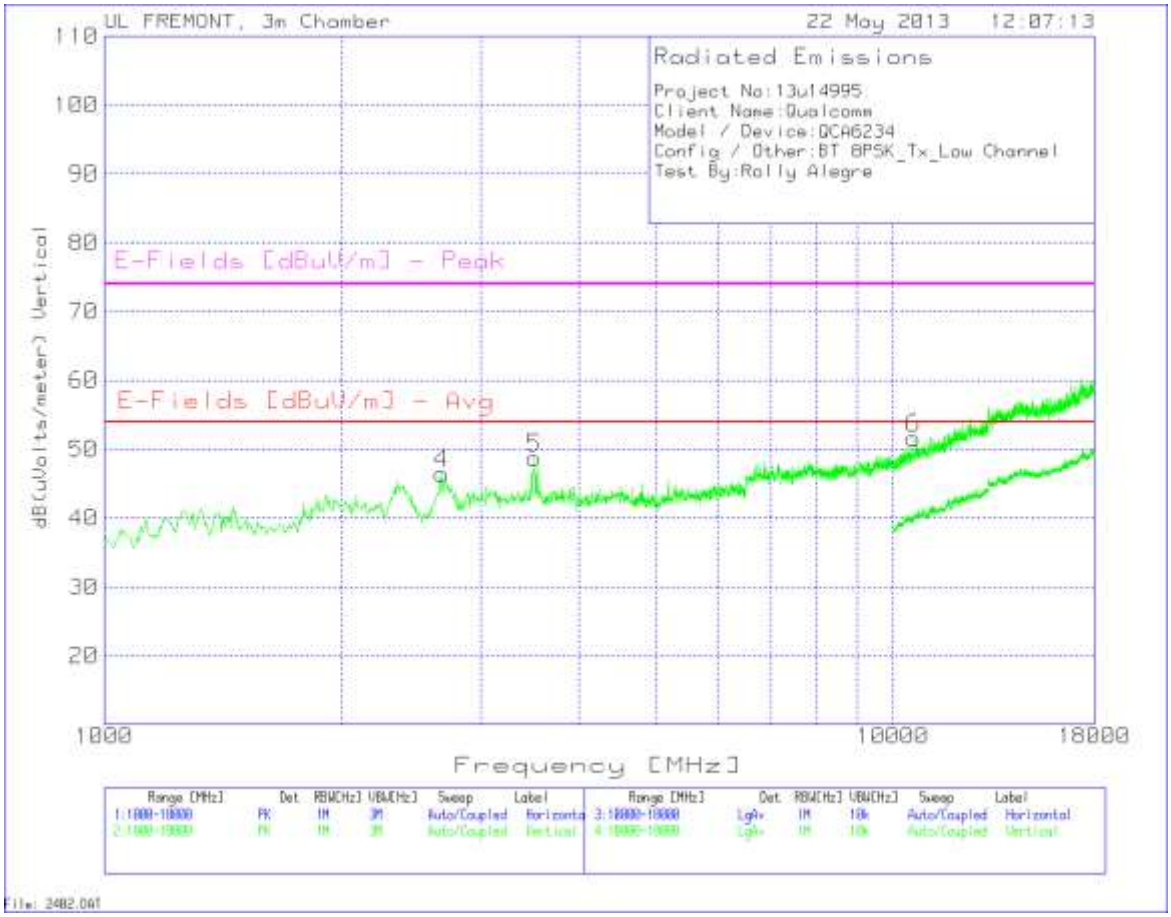
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL

HORIZONTAL PLOT



VERTICAL PLOT



DATA

Project No:13u14995
Client Name:Qualcomm
Model / Device: QCA6234
Config / Other:BT 8PSK_Tx_Low Channel
Test By:Rolly Alegre

Horizontal 1000 - 18000MHz

Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m] (dB)	T34 Preamp/ Cable Loss [dB] (dB)	T160 BRF [dB] (dB)	dB(uVolts /meter)	E-Fields [dBuV/m] - Avg	Margin	E-Fields [dBuV/m] - Peak	Margin
1	2698.867	41.4	PK	32.6	-29	0.9	45.9	54	-8.1	74	-28.1
2	3514.324	43.23	PK	33	-27.2	0.4	49.43	54	-4.57	74	-24.57
3	10723.185	32.93	PK	37.9	-20.3	0.7	51.23	54	-2.77	74	-22.77

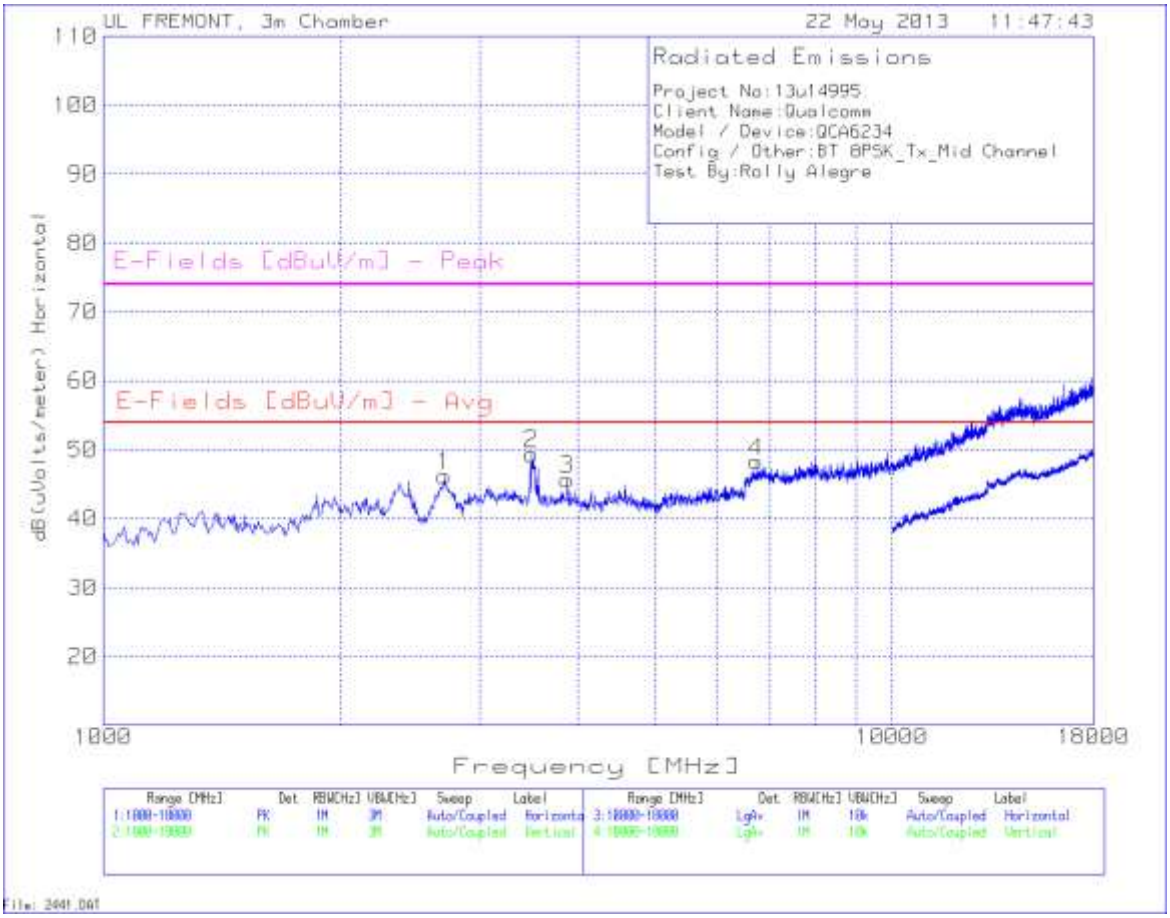
Vertical 1000 - 18000MHz

Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m] (dB)	T34 Preamp/ Cable Loss [dB] (dB)	T160 BRF [dB] (dB)	dB(uVolts /meter)	E-Fields [dBuV/m] - Avg	Margin	E-Fields [dBuV/m] - Peak	Margin
4	2676.216	42.15	PK	32.6	-29.1	0.9	46.55	54	-7.45	74	-27.45
5	3514.324	42.59	PK	33	-27.2	0.4	48.79	54	-5.21	74	-25.21
6	10626.915	33.67	PK	37.7	-20.3	0.6	51.67	54	-2.33	74	-22.33

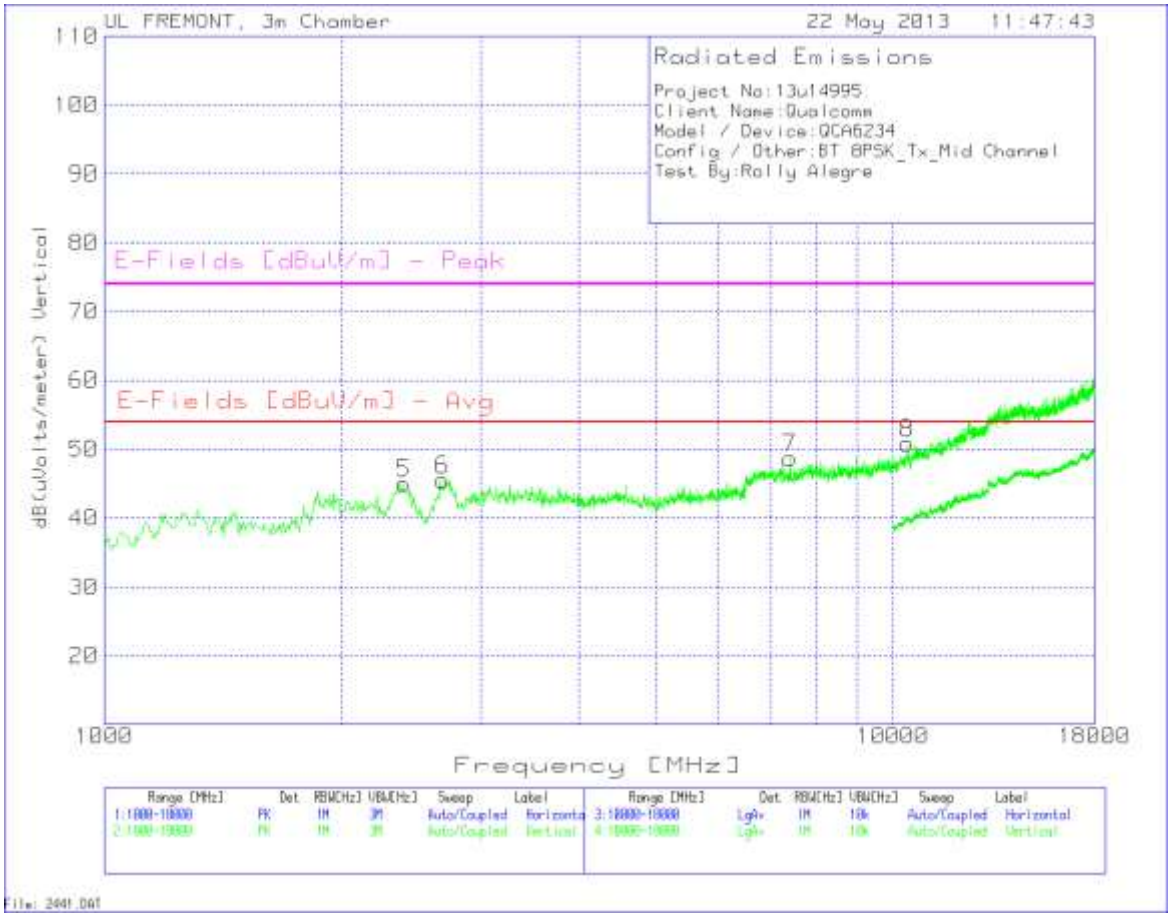
PK - Peak detector

MID CHANNEL

HORIZONTAL PLOT



VERTICAL PLOT



DATA

Project No:13u14995
Client Name:Qualcomm
Model / Device: QCA6234
Config / Other:BT 8PSK_Tx_Mid Channel
Test By:Rolly Alegre

Horizontal 1000 - 18000MHz

Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m] (dB)	T34 Preamp/ Cable Loss [dB] (dB)	T160 BRF [dB] (dB)	dB(uVolts /meter)	E-Fields [dBuV/m] - Avg	Margin	E-Fields [dBuV/m] - Peak	Margin
1	2704.53	41.77	PK	32.6	-29	0.9	46.27	54	-7.73	74	-27.73
2	3491.672	43.09	PK	33	-27.2	0.5	49.39	54	-4.61	74	-24.61
3	3876.749	38.64	PK	33.2	-26.5	0.3	45.64	54	-8.36	74	-28.36
4	6725.183	35.67	PK	35.6	-23.3	0.3	48.27	54	-5.73	74	-25.73

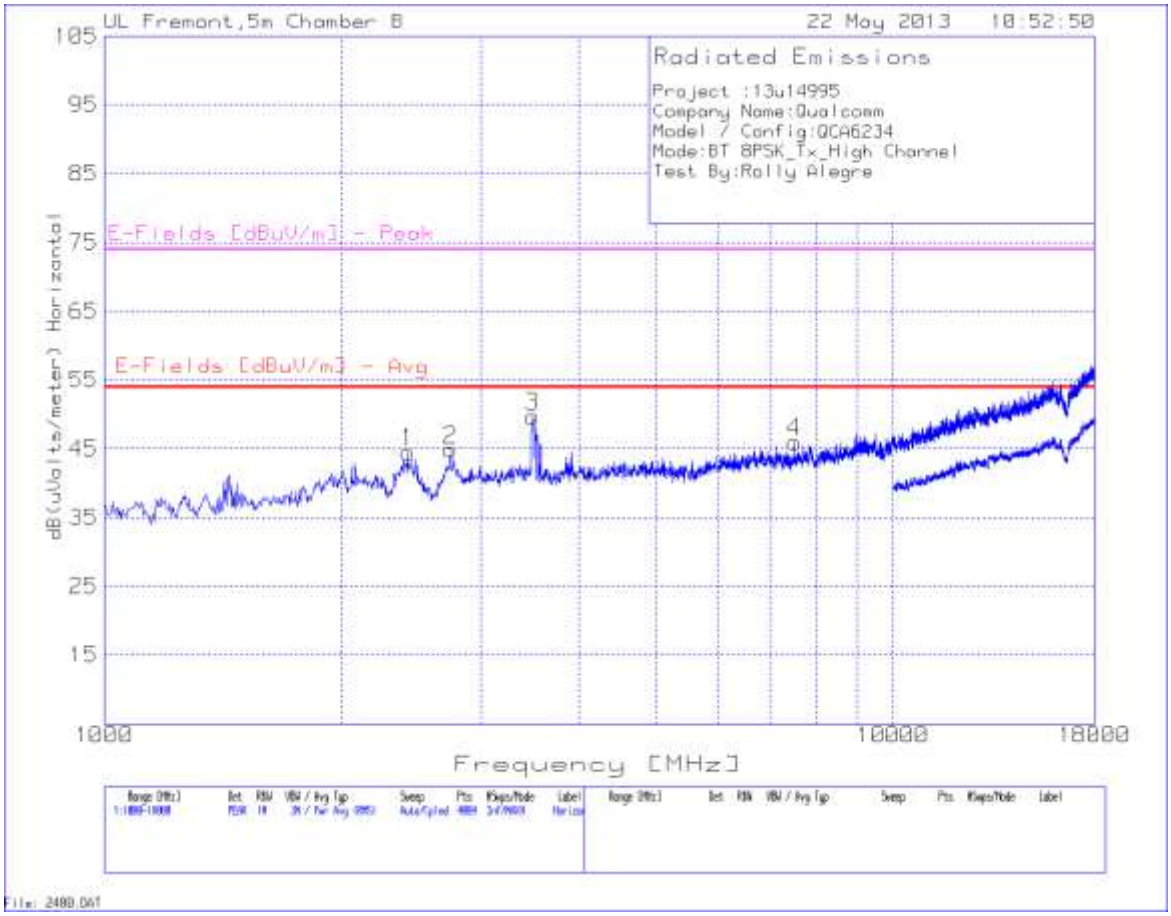
Vertical 1000 - 18000MHz

Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m] (dB)	T34 Preamp/ Cable Loss [dB] (dB)	T160 BRF [dB] (dB)	dB(uVolts /meter)	E-Fields [dBuV/m] - Avg	Margin	E-Fields [dBuV/m] - Peak	Margin
5	2398.734	41.71	PK	32.1	-29.7	0.9	45.01	54	-8.99	74	-28.99
6	2687.542	41.01	PK	32.6	-29	0.9	45.51	54	-8.49	74	-28.49
7	7410.393	35.72	PK	35.7	-23	0.3	48.72	54	-5.28	74	-25.28
8	10428.714	33.62	PK	37.4	-20.7	0.5	50.82	54	-3.18	74	-23.18

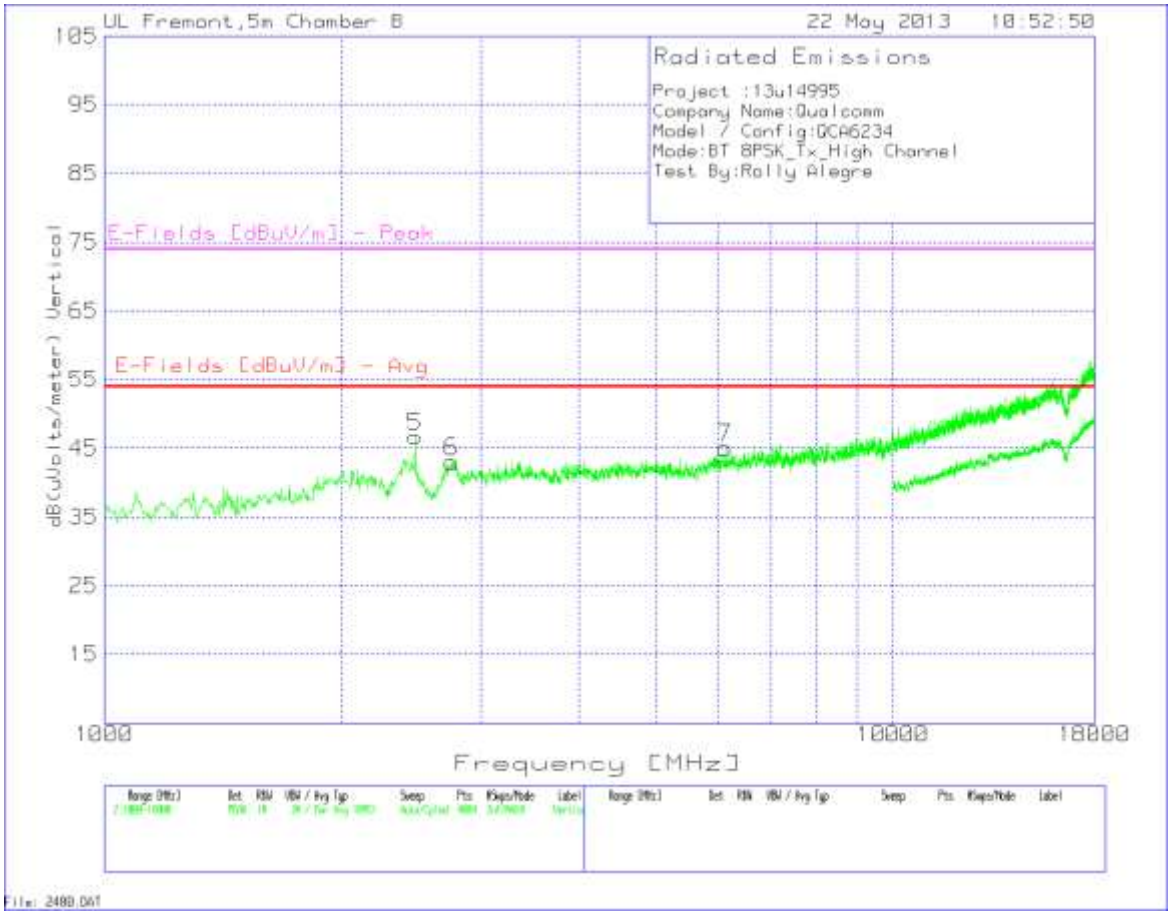
PK - Peak detector

HIGH CHANNEL

HORIZONTAL PLOT



VERTICAL PLOT



DATA

Project :13u14995
Company Name:Qualcomm
Model / Config: QCA6234
Mode:BT 8PSK_Tx_High Channel
Test By:Rolly Alegre

Horizontal 1000 - 18000MHz

Marker No.	Test Frequency	Meter Reading	Detector	T345 Ant Factor [dB/m]	T145 Preamp Gain [dB]	Cable Factor [dB]	T160 BRF [dB]	dB(uVolts /meter)	E-Fields [dBuV/m] Avg	Margin (dB)	E-Fields [dBuV/m] Peak	Margin (dB)	Height [cm]	Polarity
1	2426.93	41.49	PK	32.4	-35	4.7	0.9	44.49	53.97	-9.48	74	-29.51	200	Horz
2	2749.688	41.25	PK	32.8	-35.1	5	0.9	44.85	53.97	-9.12	74	-29.15	200	Horz
3	3492.88	45.3	PK	33.2	-35	5.7	0.5	49.7	53.97	-4.27	74	-24.3	200	Horz
4	7497.627	35.64	PK	36	-35	9	0.3	45.94	53.97	-8.03	74	-28.06	101	Horz

Vertical 1000 - 18000MHz

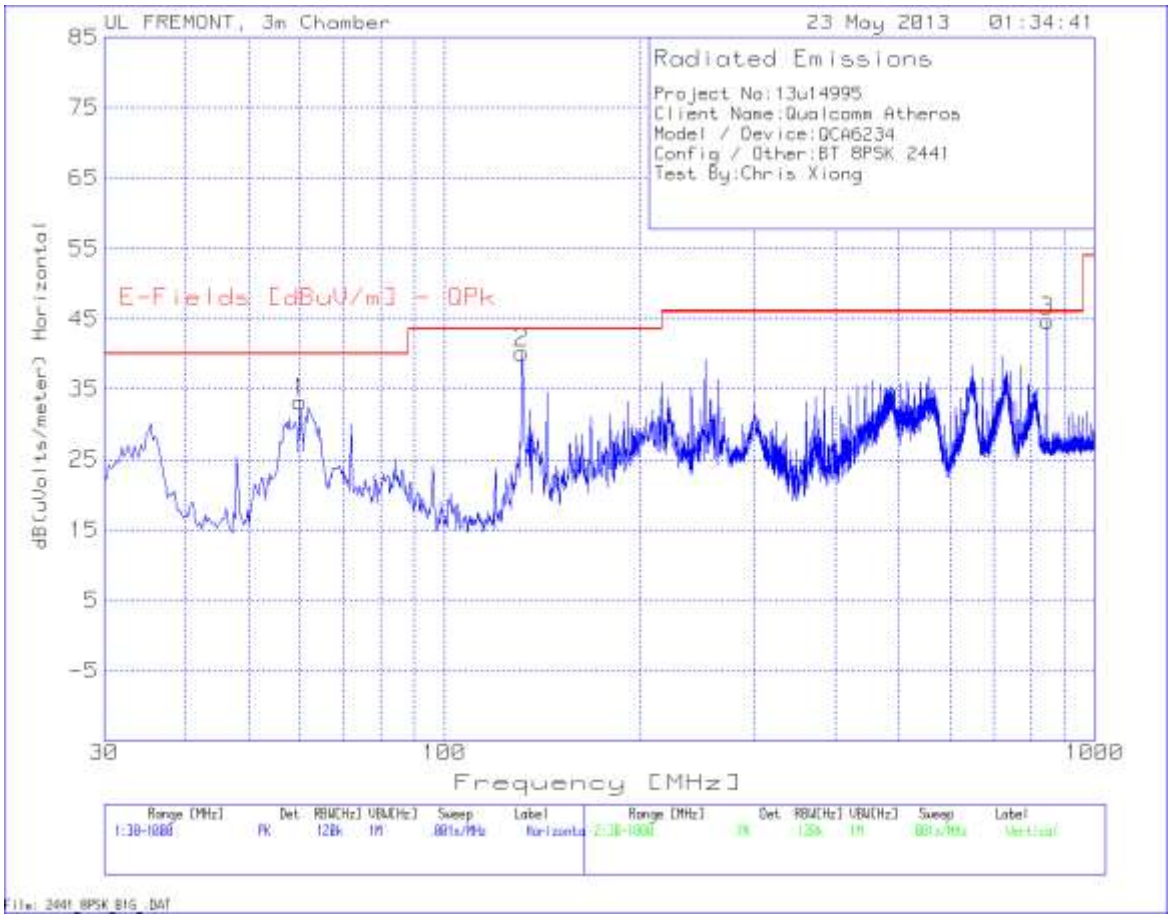
Marker No.	Test Frequency	Meter Reading	Detector	T345 Ant Factor [dB/m]	T145 Preamp Gain [dB]	Cable Factor [dB]	T160 BRF [dB]	dB(uVolts /meter)	E-Fields [dBuV/m] Avg	Margin (dB)	E-Fields [dBuV/m] Peak	Margin (dB)	Height [cm]	Polarity
5	2477.892	43.6	PK	32.5	-35	4.7	0.9	46.7	53.97	-7.27	74	-27.3	200	Vert
6	2758.181	39.41	PK	32.8	-35.1	5	0.9	43.01	53.97	-10.96	74	-30.99	101	Vert
7	6130.152	35.78	PK	36	-34.9	8	0.2	45.08	53.97	-8.89	74	-28.92	200	Vert

PK - Peak detector

9.3. WORST-CASE BELOW 1 GHz

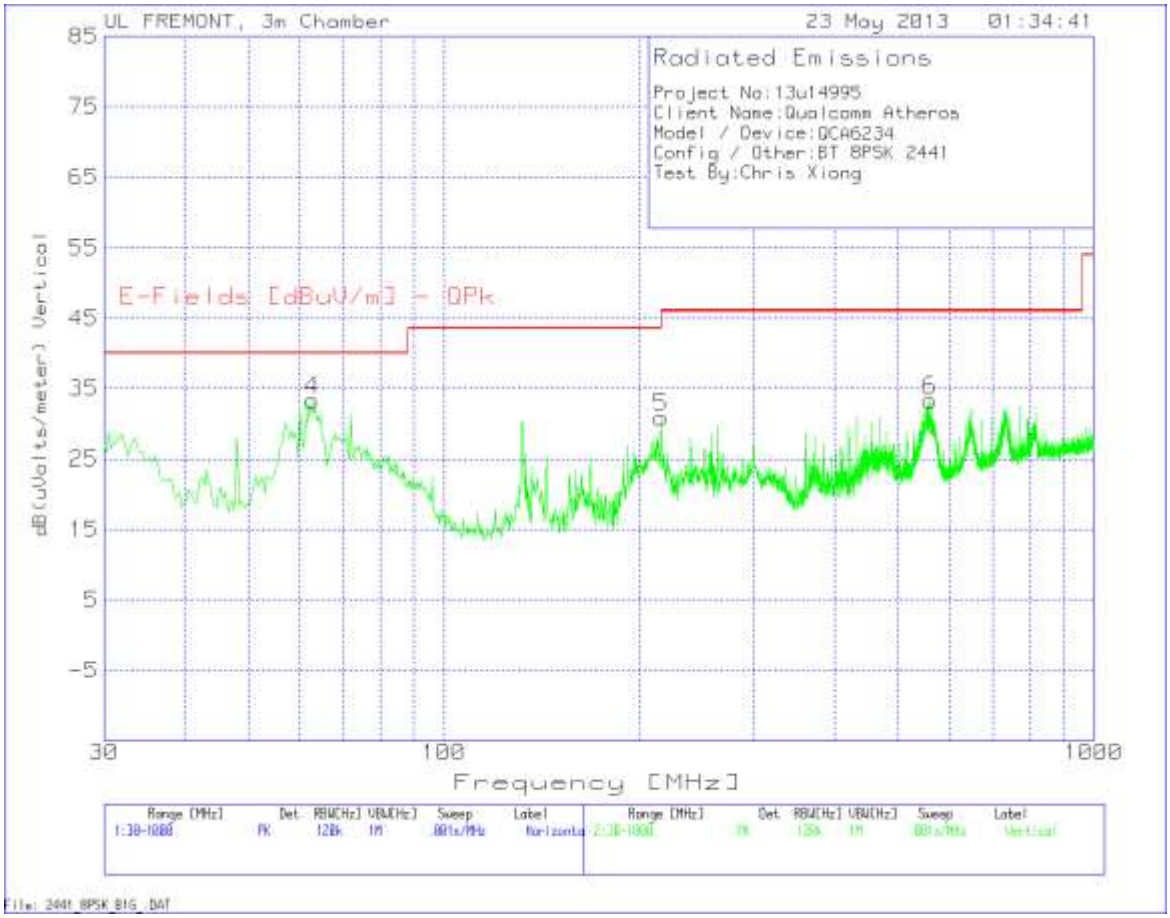
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Project No:13u14995
Client Name:Qualcomm Atheros
Model / Device: QCA6234
Config / Other:BT 8PSK 2441
Test By:Chris Xiong

Horizontal 30 - 1000MHz

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	T130 Ant Factor [dB/m] (dB)	T64 preamp/ cable loss [dB] (dB)	dB(uVolts/ meter)	E-Fields [dBuV/m] - QPk	Margin	Height [cm]	Polarity
1	60.0475	53.15	PK	7.4	-27.3	33.25	40	-6.75	301	Horz
2	131.7737	53.25	PK	13.7	-26.8	40.15	43.5	-3.35	301	Horz
3	845.8856	45.61	PK	21.9	-22.8	44.71	46	-1.29	301	Horz

Vertical 30 - 1000MHz

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Detector	T130 Ant Factor [dB/m] (dB)	T64 preamp/ cable loss [dB] (dB)	dB(uVolts/ meter)	E-Fields [dBuV/m] - QPk	Margin	Height [cm]	Polarity
4	62.713	52.91	PK	7.7	-27.3	33.31	40	-6.69	199	Vert
5	215.8581	46.4	PK	10.6	-26.1	30.9	43.5	-12.6	199	Vert
6	560.1924	38.84	PK	18.6	-24.1	33.34	46	-12.66	199	Vert

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

6 WORST EMISSIONS

Project No:	13U14995
Client Name:	Qualcomm Atheros
Model/Device:	QCA6234
Test Volt/Freq:	120VAC/60Hz
Test By:	Chris Xiong
Mode:	Blutooth Worst Case, Blutooth AC adapter to Bluetooth test board

Line-L1 .15 - 30MHz

Test Frequency (MHz)	Meter Reading (dBuV)	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin	CISPR 11/22 Class B Average	Margin
0.4515	33.41	PK	0.1	0	33.51	56.8	-23.29	-	-
0.4515	27.33	Av	0.1	0	27.43	-	-	46.8	-19.37
3.444	23.26	PK	0.1	0.1	23.46	56	-32.54	-	-
3.444	10.81	Av	0.1	0.1	11.01	-	-	46	-34.99
16.5435	35.45	PK	0.2	0.2	35.85	60	-24.15	-	-
16.5435	24.31	Av	0.2	0.2	24.71	-	-	50	-25.29

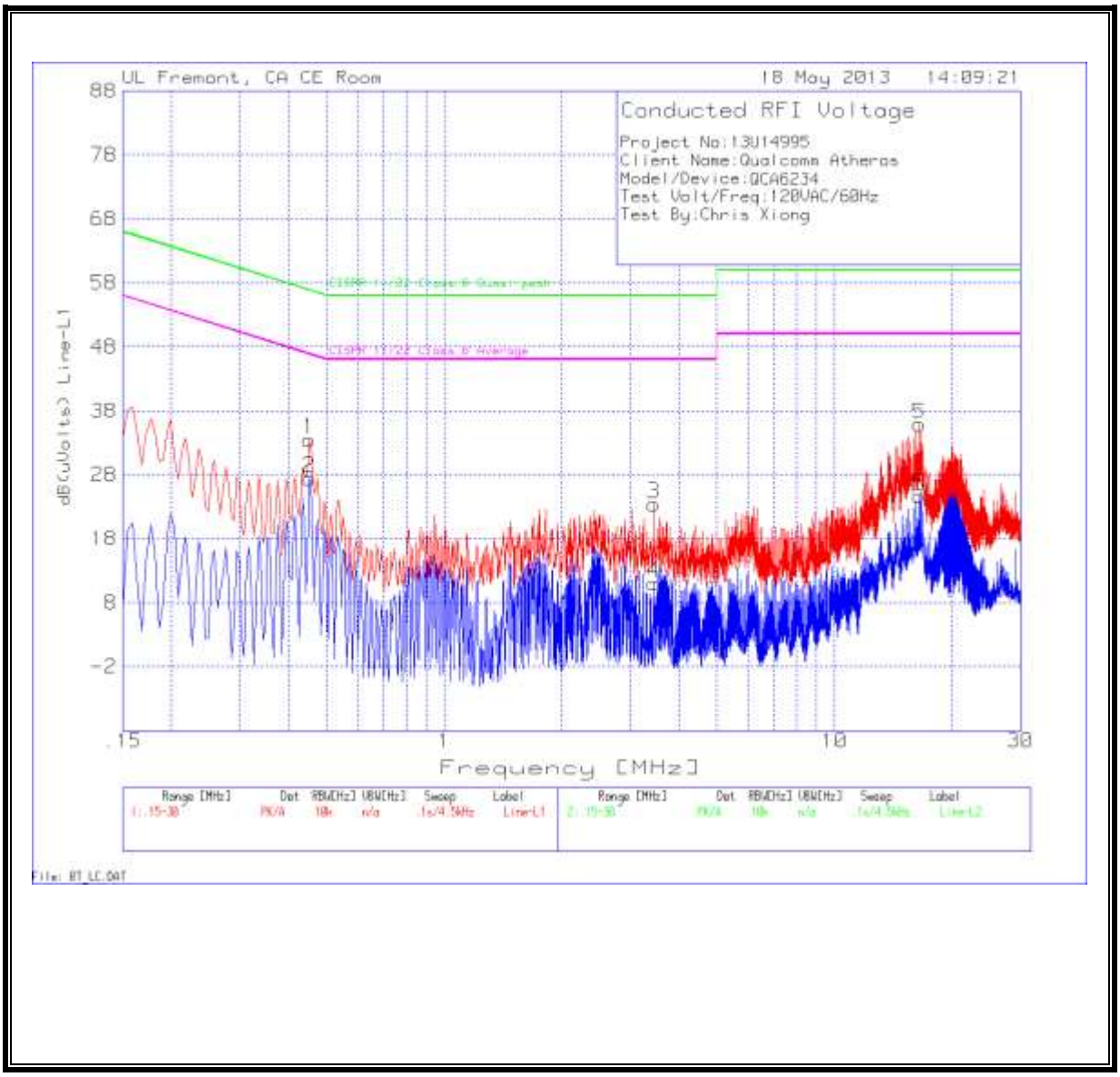
Line-L2 .15 - 30MHz

Test Frequency (MHz)	Meter Reading (dBuV)	Detector	T24 IL L2.TXT (dB)	LC Cables 2&3.TXT (dB)	dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin	CISPR 11/22 Class B Average	Margin
0.159	39.53	PK	0.1	0	39.63	65.5	-25.87	-	-
0.159	19.71	Av	0.1	0	19.81	-	-	55.5	-35.69
2.3685	23.98	PK	0.1	0.1	24.18	56	-31.82	-	-
2.3685	18.43	Av	0.1	0.1	18.63	-	-	46	-27.37
16.6875	34.8	PK	0.2	0.2	35.2	60	-24.8	-	-
16.6875	24.98	Av	0.2	0.2	25.38	-	-	50	-24.62

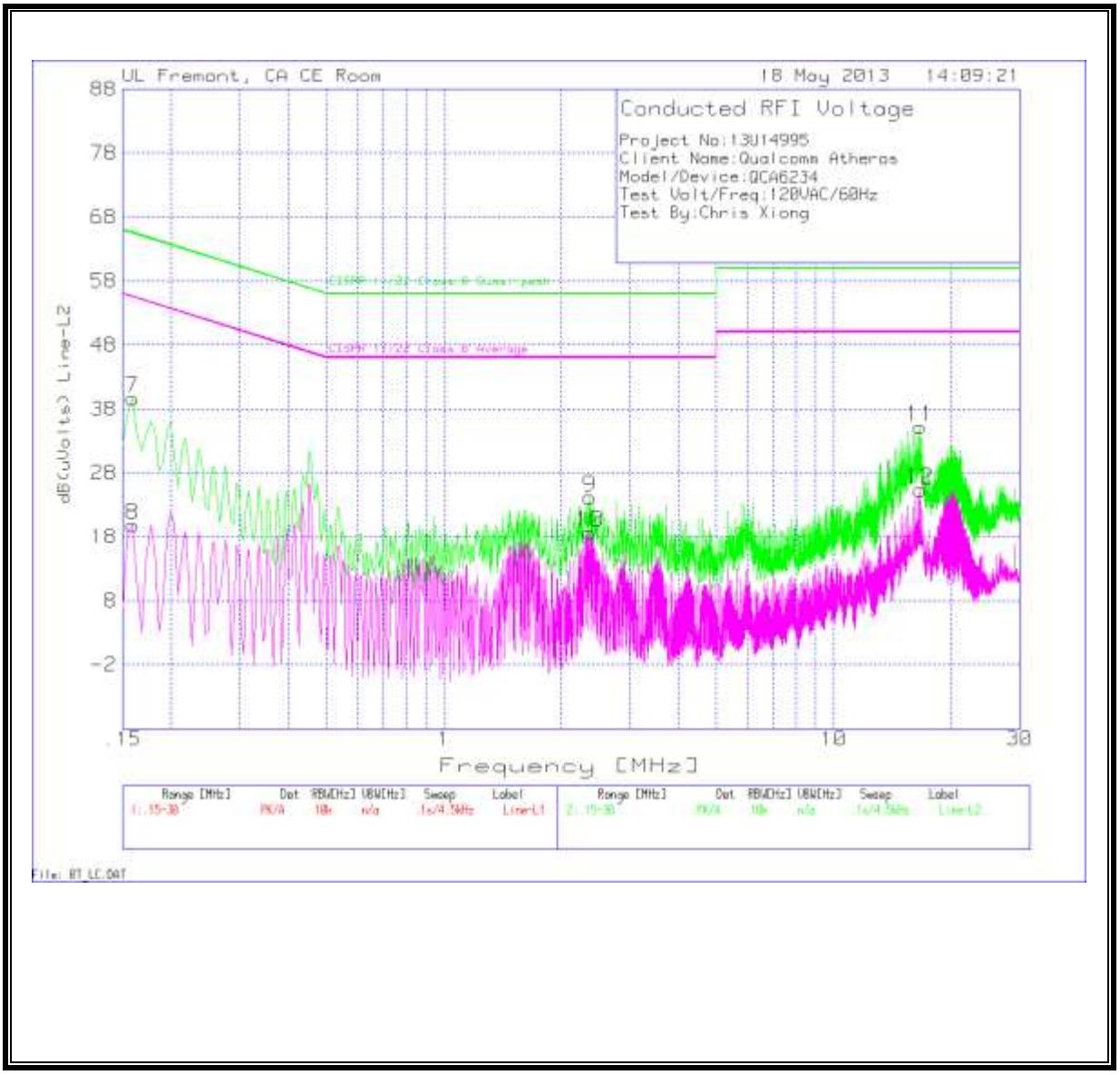
PK - Peak detector
QP - Quasi-Peak detector
Av - Average detector

LINE 1 RESULTS

Laptop with EUT connected via USB cable



LINE 2 RESULTS



Laptop with EUT connected via USB cable

Project No:	13U14995
Client Name:	Qualcomm Atheros
Model/Device:	QCA6234
Test Volt/Freq:	120VAC/60Hz
Test By:	Chris Xiong
Mode:	Blutooth Worst Case, Laptop with USB cable to Bluetooth adapter board

Line-L1 .15 - 30MHz

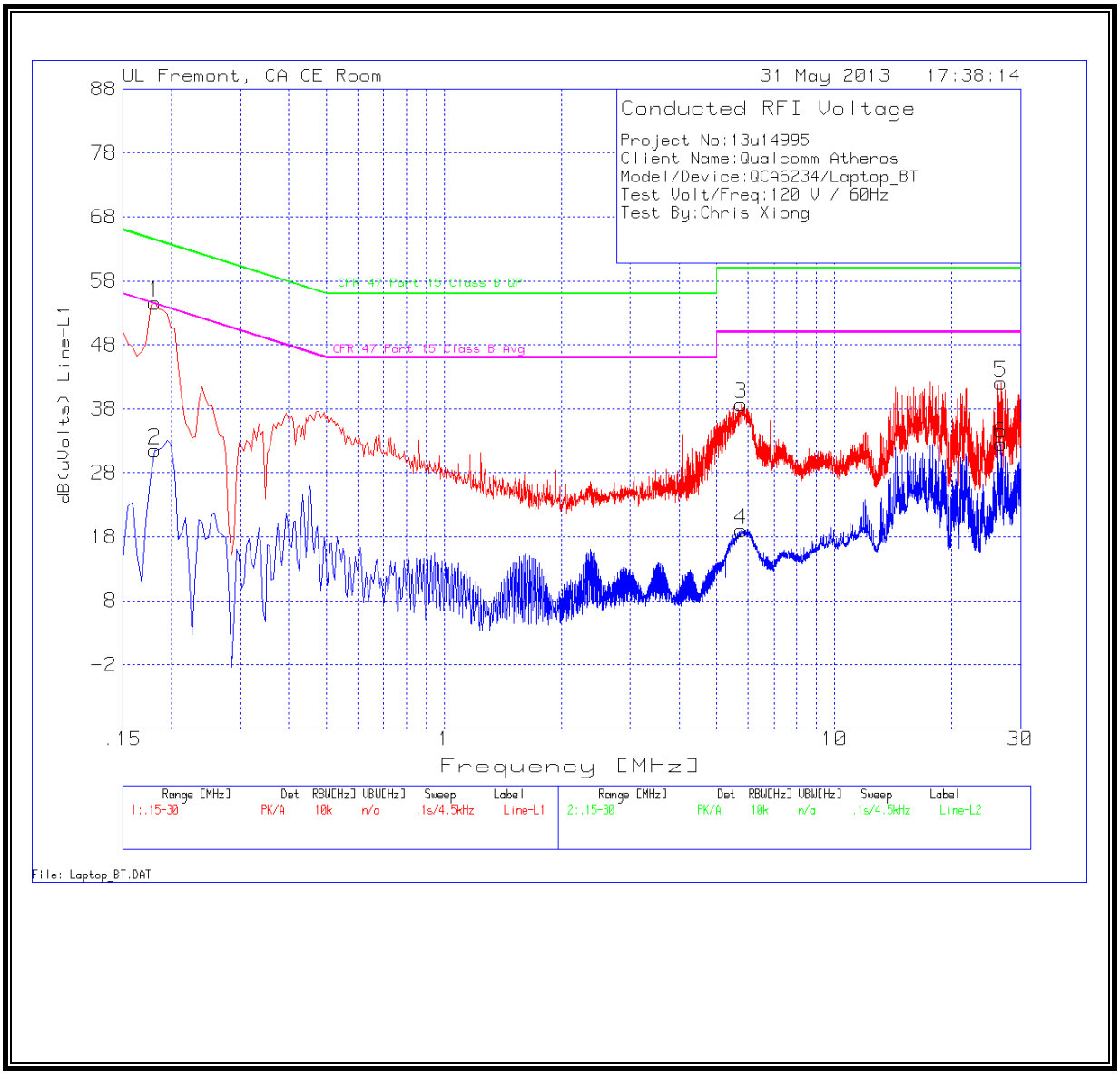
Test Frequency MHz	Meter Reading dBuv	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.1815	54.54	PK	0.1	0	54.64	64.4	-9.76	-	-
0.1815	31.46	Av	0.1	0	31.56	-	-	54.4	-22.84
5.775	38.51	PK	0.1	0.1	38.71	60	-21.29	-	-
5.775	18.79	Av	0.1	0.1	18.99	-	-	50	-31.01
26.7855	41.31	PK	0.5	0.3	42.11	60	-17.89	-	-
26.7855	31.74	Av	0.5	0.3	32.54	-	-	50	-17.46

Line-L2 .15 - 30MHz

Test Frequency MHz	Meter Reading dBuv	Detector	T24 IL L2.TXT (dB)	LC Cables 2&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.1815	53.36	PK	0.1	0	53.46	64.4	-10.94	-	-
0.1815	27.58	Av	0.1	0	27.68	-	-	54.4	-26.72
0.4515	38.5	PK	0.1	0	38.6	56.8	-18.2	-	-
0.4515	26.26	Av	0.1	0	26.36	-	-	46.8	-20.44
6.108	39.44	PK	0.1	0.1	39.64	60	-20.36	-	-
6.108	20.19	Av	0.1	0.1	20.39	-	-	50	-29.61

PK - Peak detector
QP - Quasi-Peak detector
Av - Average detector

LINE 1 RESULTS



LINE 2 RESULTS