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

CERTIFICATION TEST REPORT

FOR

HANDHELD COMPUTING DEVICE

MODEL NUMBER: 1572

FCC ID: C3K1572
IC: 3048A-1572

REPORT NUMBER: 13U15414-3, Revision A

ISSUE DATE: SEPTEMBER 25, 2013

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	09/04/13	Initial Issue	T. Lee
A	09/25/13	Revised sections 5.1, 9.1 and 9.2.1.	D. Garcia

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: MICROSOFT CORPORATION
ONE MICROSOFT WAY
REDMOND, WA 98052, U.S.A.

EUT DESCRIPTION: HANDHELD COMPUTING DEVICE WITH 802.11 A/B/G/N WLAN AND BLUETOOTH RADIOS

MODEL: 1572

SERIAL NUMBER: 000604433152

DATE TESTED: AUGUST 21, 2013 – SEPTEMBER 4, 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 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:

TIMOTHY LEE
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 a hand held computing device with 802.11 a/b/g/n WLAN and Bluetooth radios.

The unit supports AFH mode. The manufacturer attested the following.

- It is in compliance with Bluetooth Specification 1.2 or later specification.
- The number of hopping channels in AFH mode is 20 channels
- The output power does not transmit over 125 mW
- The channel separation is based upon 2/3 of 20 dB channel bandwidth

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	8.93	7.82
2402 - 2480	Enhanced 8PSK	7.36	5.45

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of 3.1 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Window RT 8.1 Preview Build 943

The test utility software used during testing was Laptool 189.1.0.9.0\ WIFI Tool.exe

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.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
USB Ethernet Adaptor	CISCO	USB 300M	CU90MC02233	DoC
Laptop	Lenovo	L420	7854CT0	DoC
AC Adaptor (laptop)	Lenovo	92P1156	111S92P1156ZDXN272091	N/A

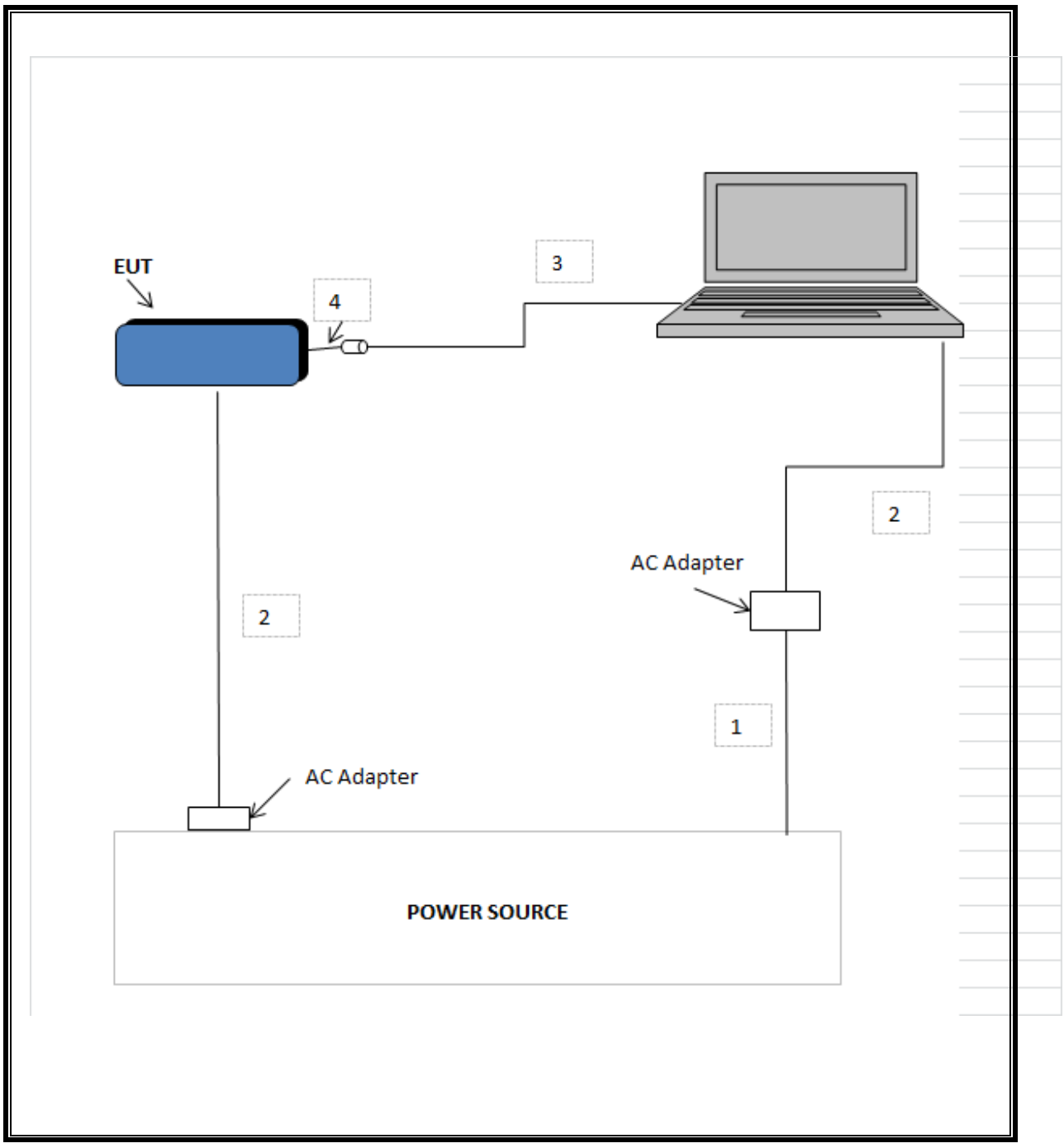
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	AC	Unshielded	1.8	AC adapter
2	USB	1	USB	Unshielded	0.1	USB to Ethernet adapter
3	DC	1	DC	Unshielded	1.8	
4	Ethernet	1	RJ 45	Unshielded	7.62	Connects to USB adapter

TEST SETUP

The EUT is a standalone wireless handheld computing device. Test software exercised the wireless module installed within the device under test.

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**
Antenna, Horn, 18 GHz	EMCO	3115	C00872	09/20/12	09/20/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	02/21/12	05/21/14
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRC13192	N02683	CNR	CNR
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	04/23/12	04/23/14
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	10/21/12	10/21/13
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	10/21/12	10/21/13
Bilog 30-1000MHz	Sunol	JB1	C01011	02/07/12	03/28/14
LISN, 30 MHz	FCC	LISN-50/250-25-	N02625	01/14/13	01/14/14
Power meter	Agilent	N119A	T198	06/25/12	12/13/13
Power Sensor	Agilent	E9323A	T397	06/26/12	04/02/14
Spectrum Analyzer, 26 GHz	Agilent / HP	E4440A	C01176	10/21/12	12/13/13

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

7.1.1. 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	2.884	3.751	0.769	76.9%	1.14	0.347
8PSK	2.869	3.751	0.765	76.5%	1.16	0.349

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.

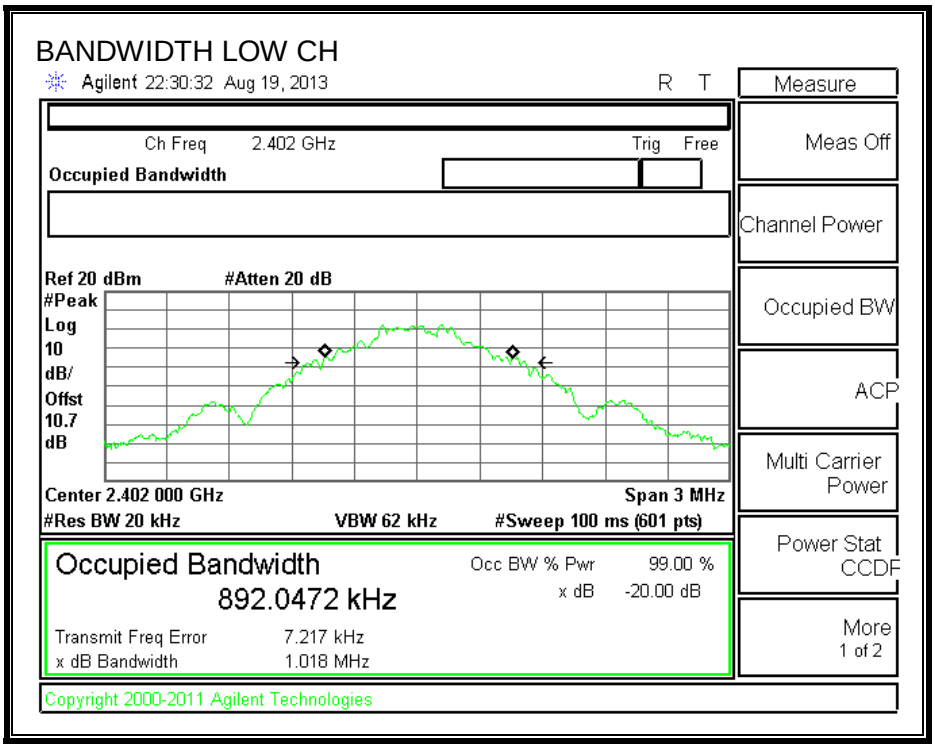
TEST PROCEDURE

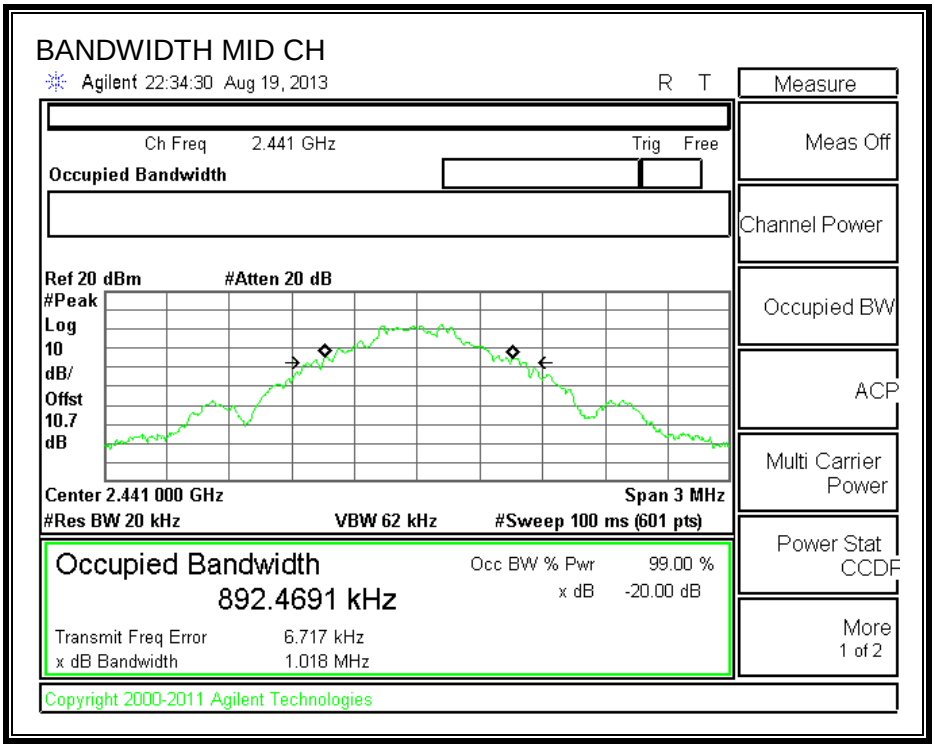
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

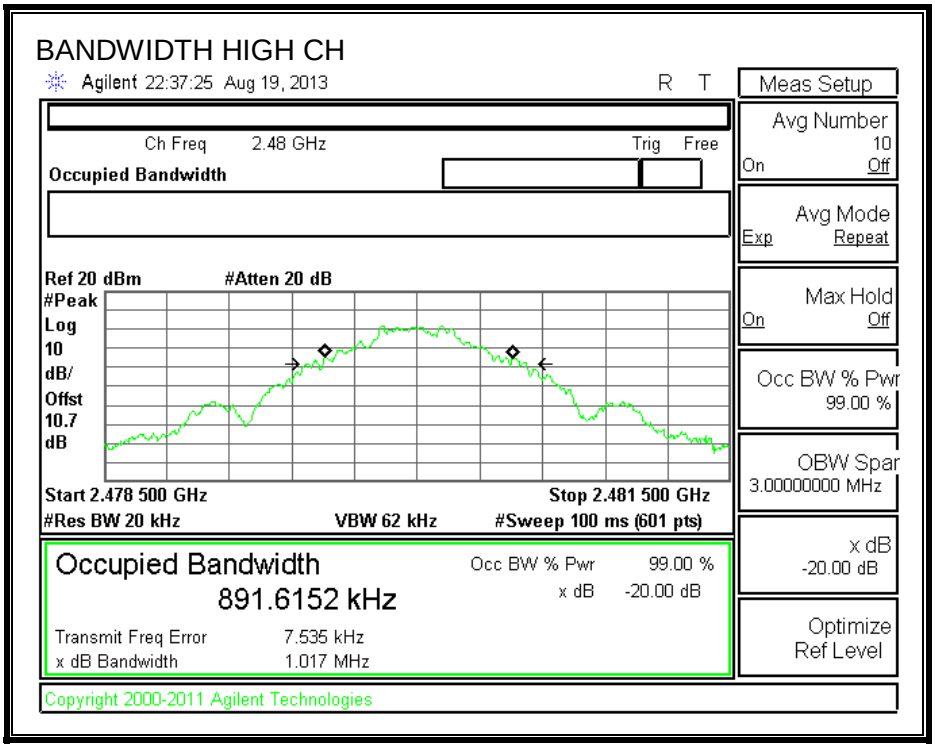
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1.018	826.1347
Middle	2441	1.018	847.7085
High	2480	1.017	826.4963

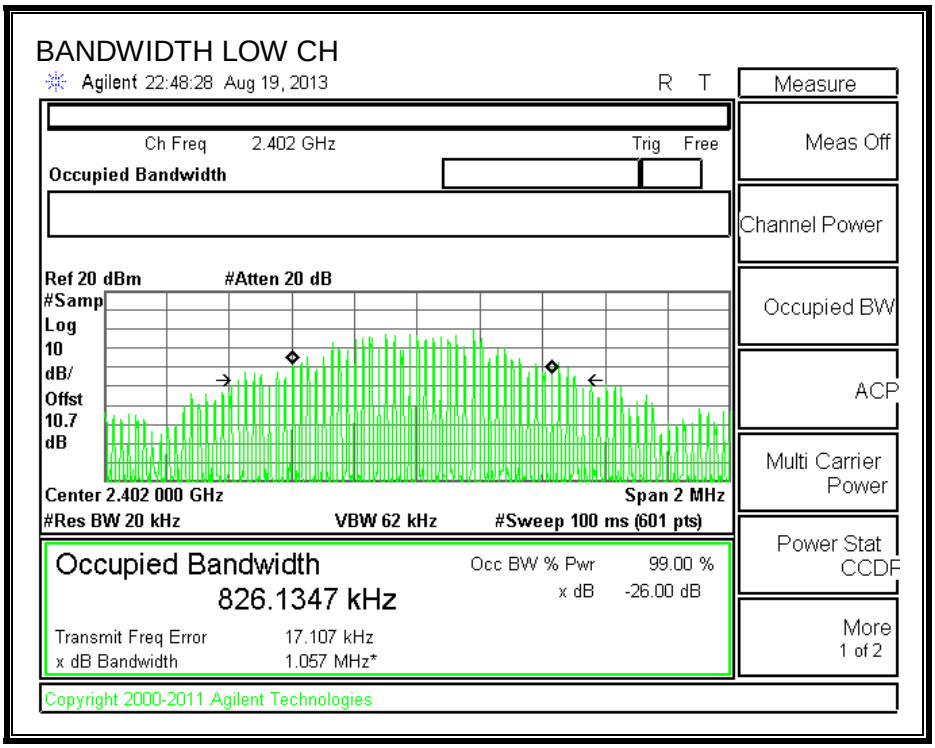
20 dB BANDWIDTH

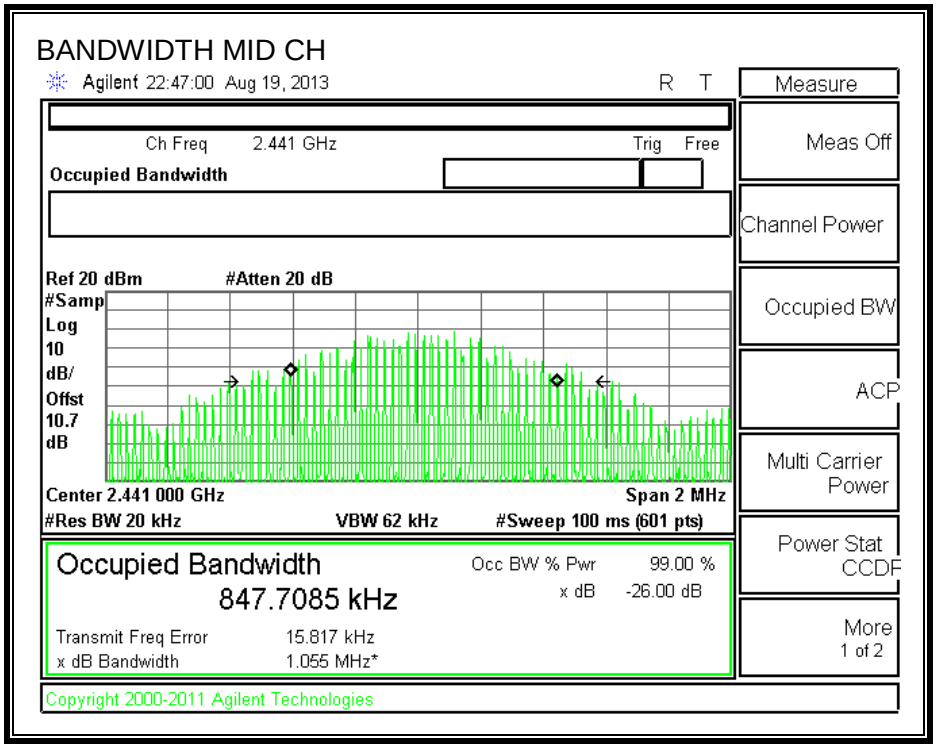


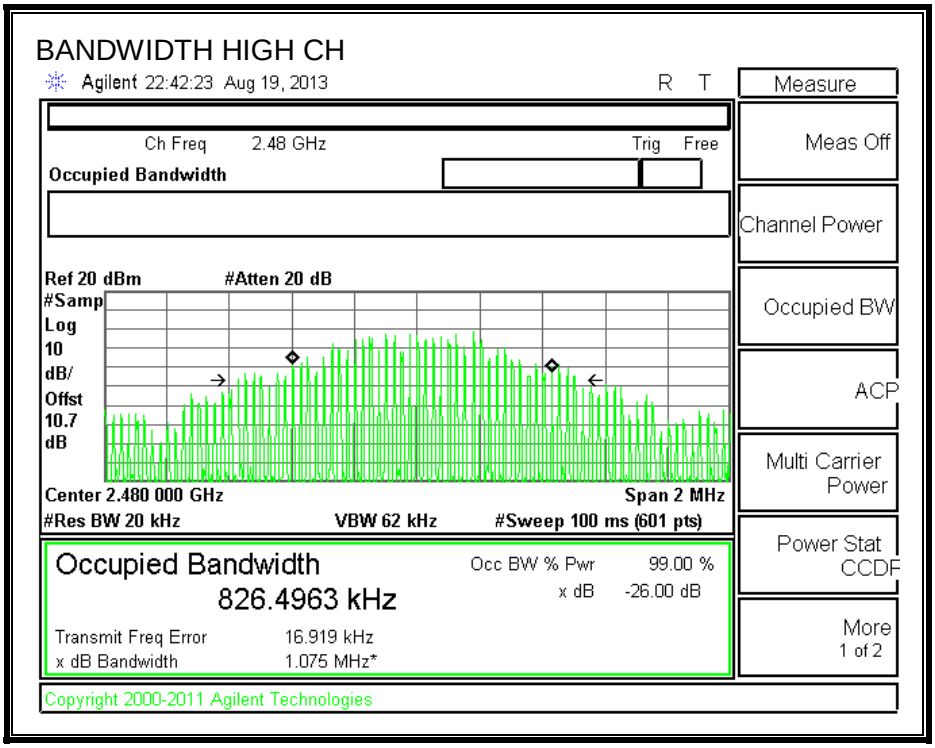




99% BANDWIDTH







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.

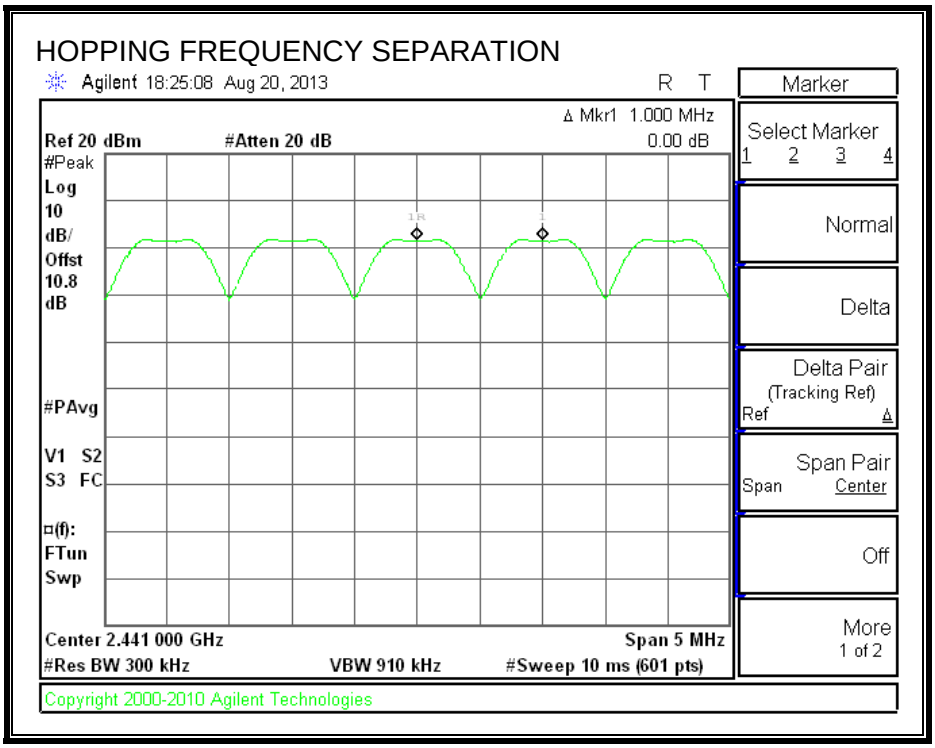
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

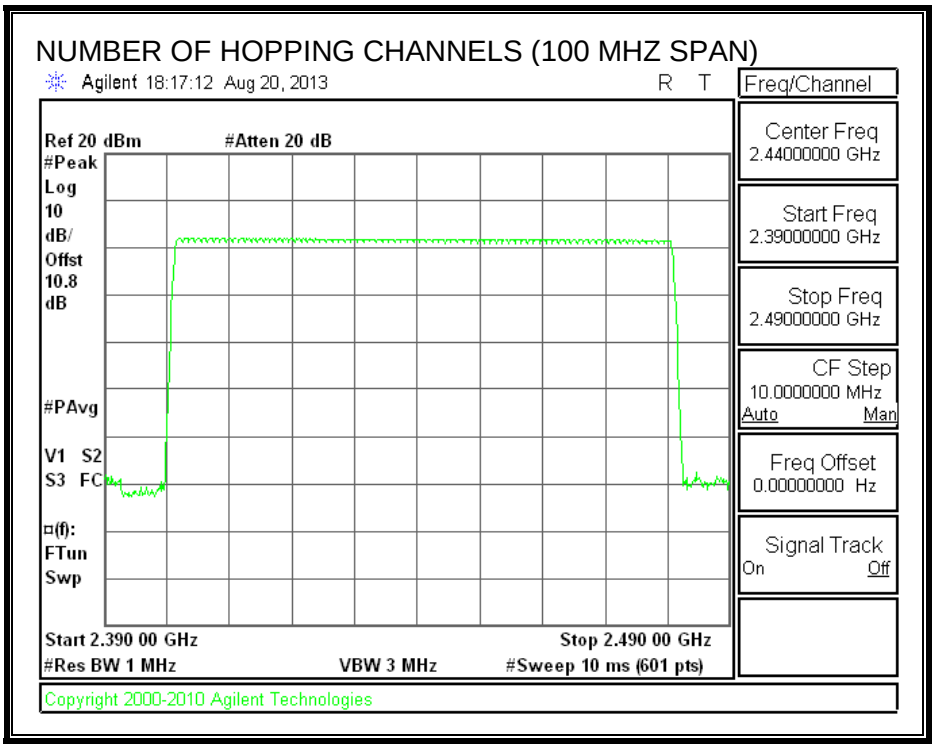
TEST PROCEDURE

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.

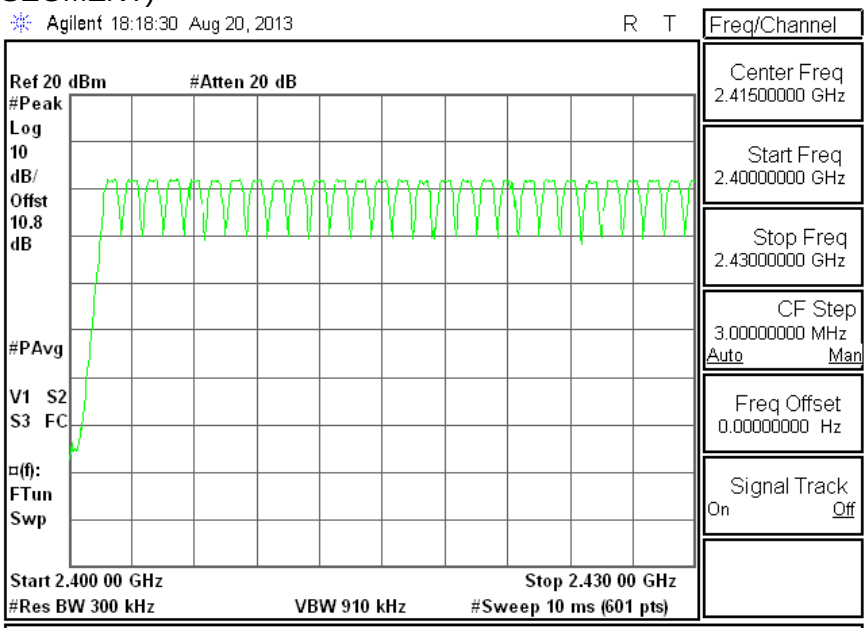
RESULTS

Normal Mode: 79 Channels observed.

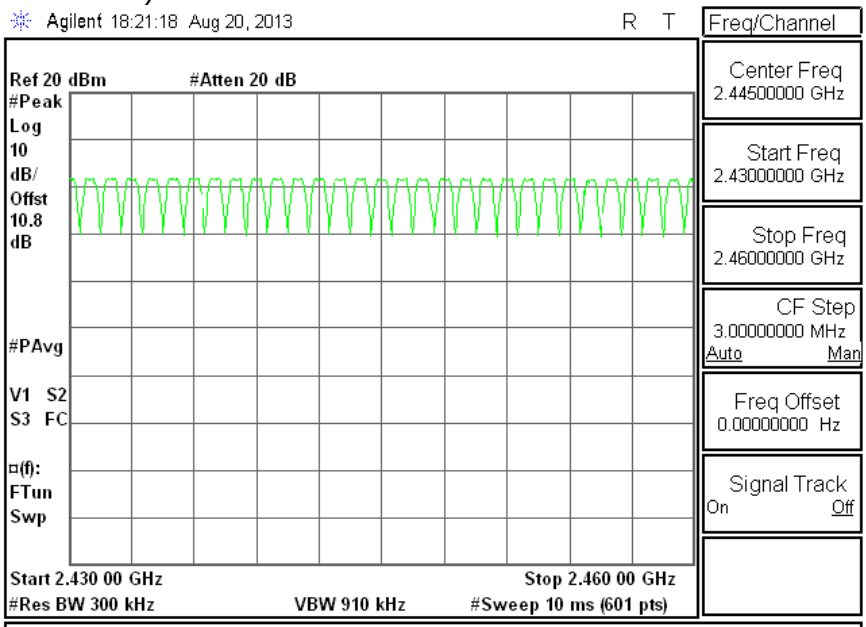
NUMBER OF HOPPING CHANNELS



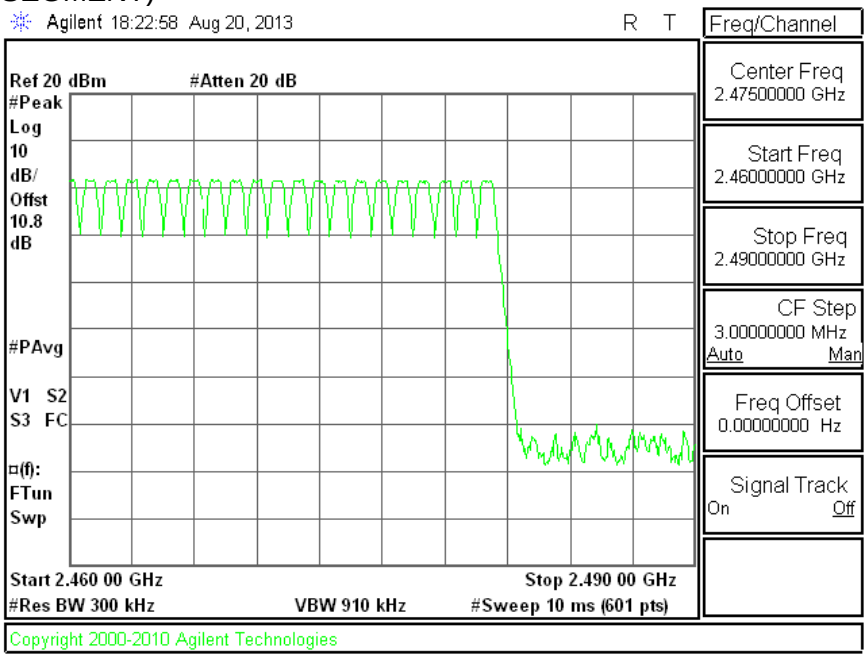
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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.

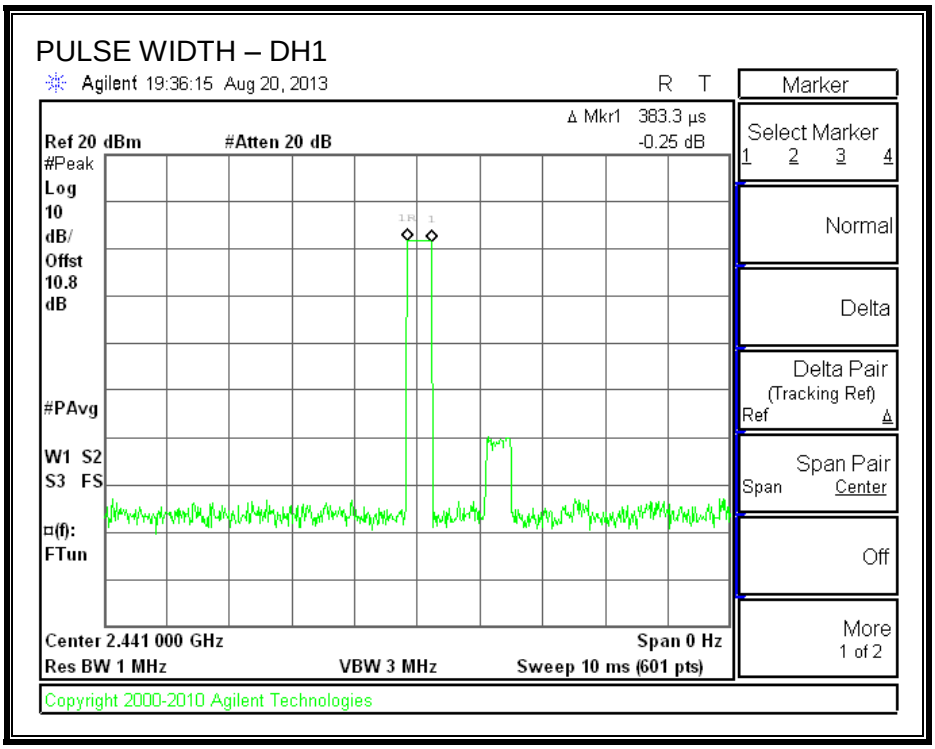
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

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.

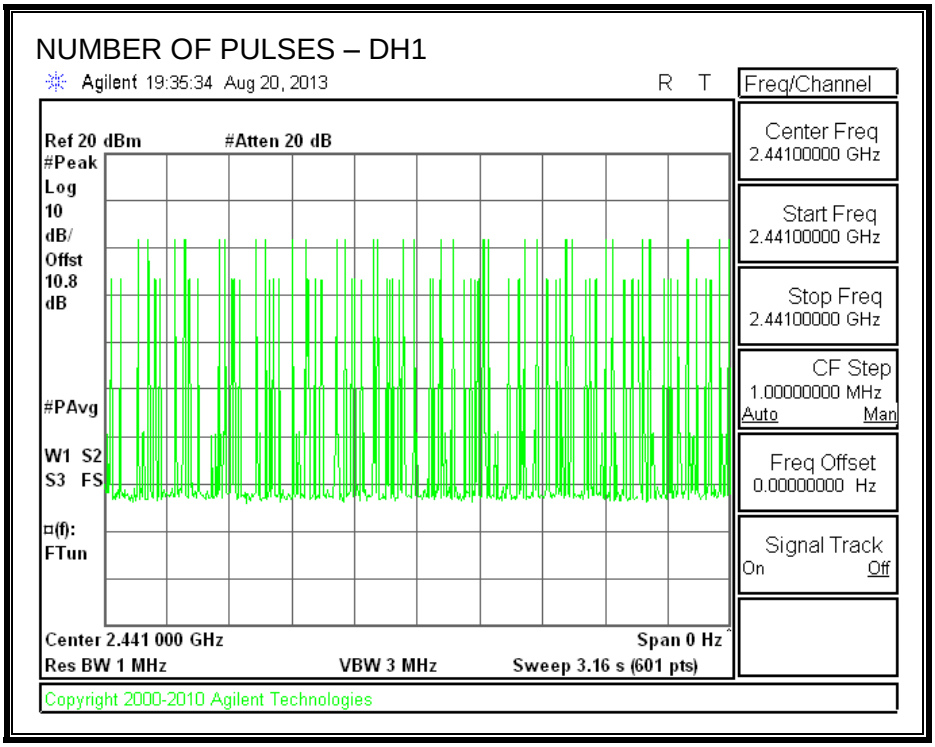
RESULTS

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	0.3833	32	0.123	0.4	-0.277
DH3	1.617	16	0.259	0.4	-0.141
DH5	2.833	10	0.283	0.4	-0.117

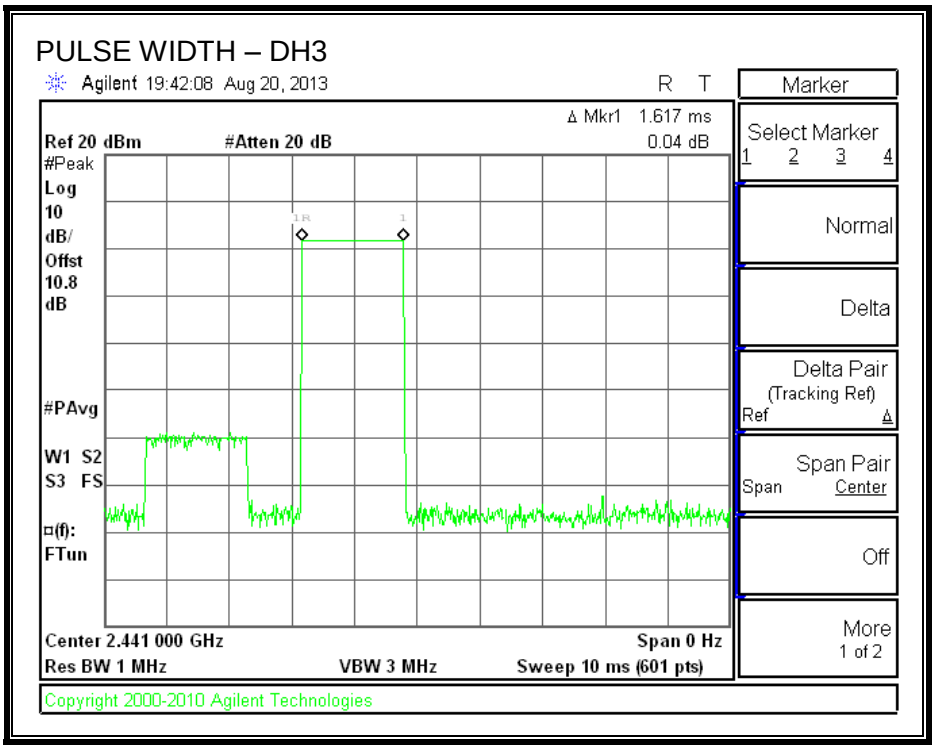
PULSE WIDTH - DH1



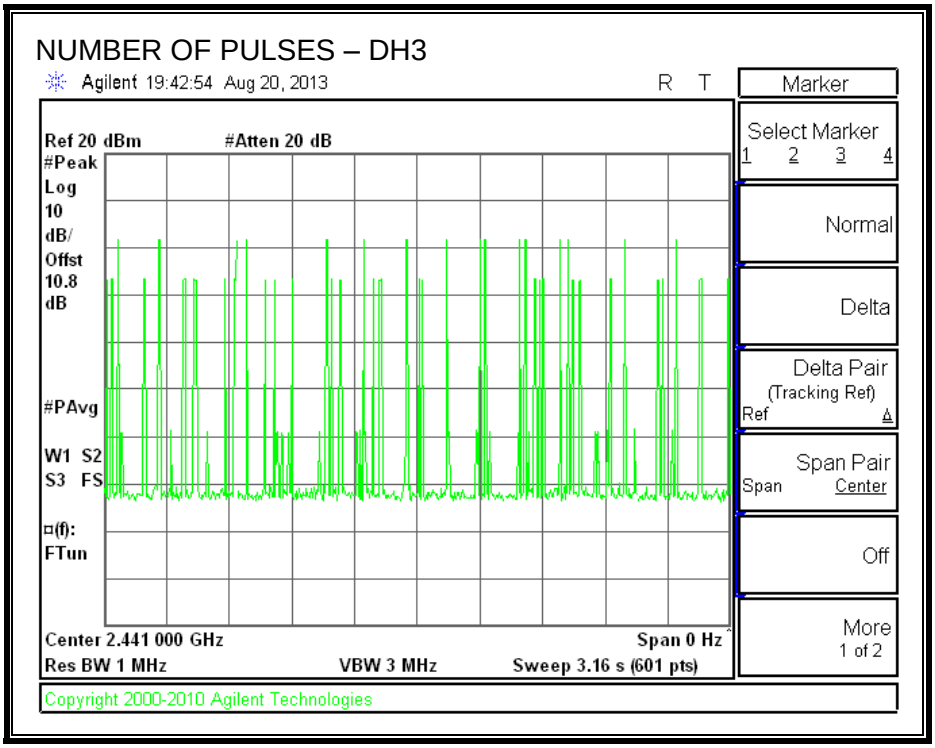
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



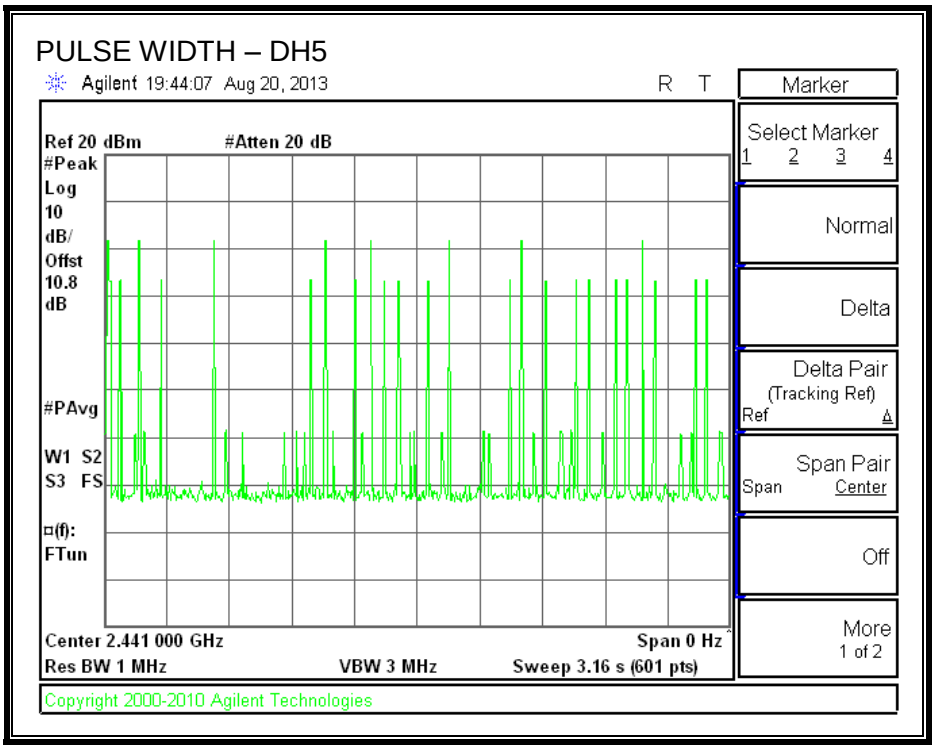
PULSE WIDTH – DH3



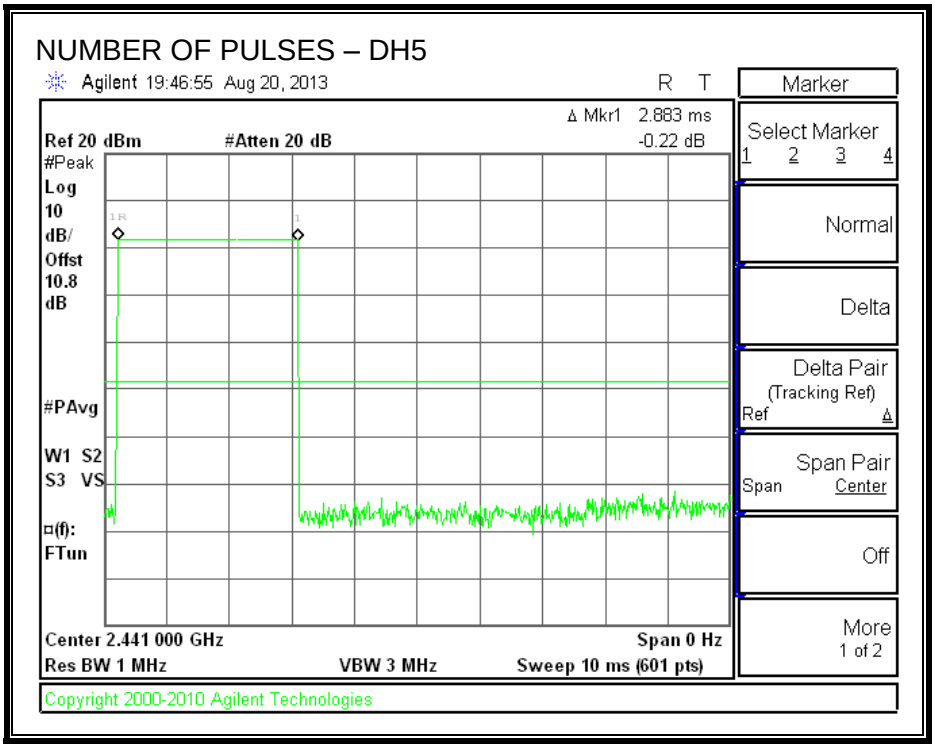
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



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

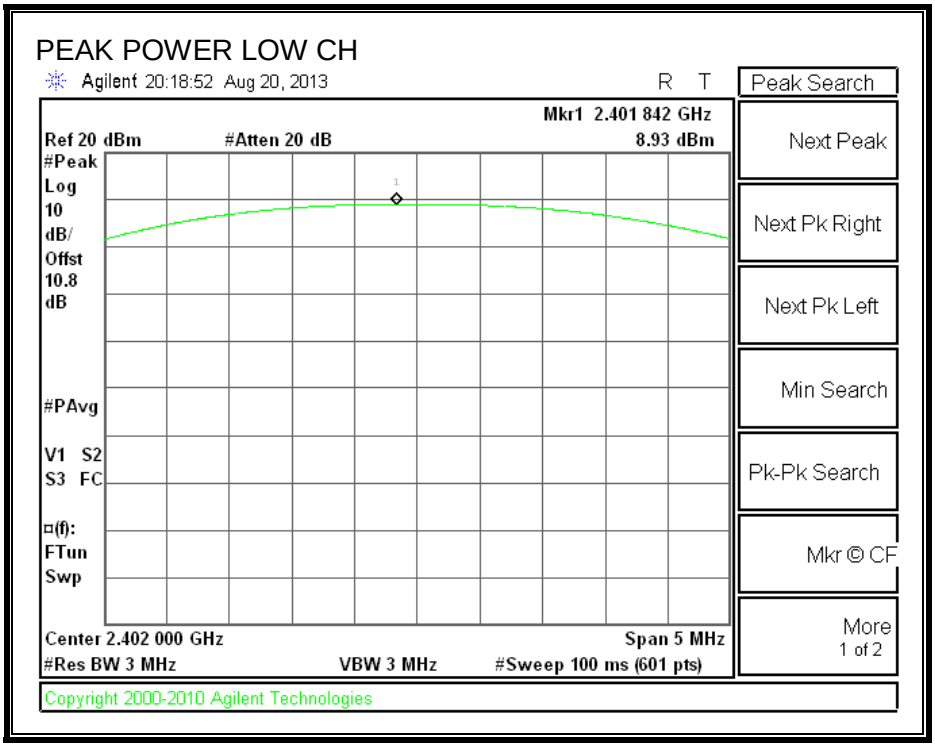
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

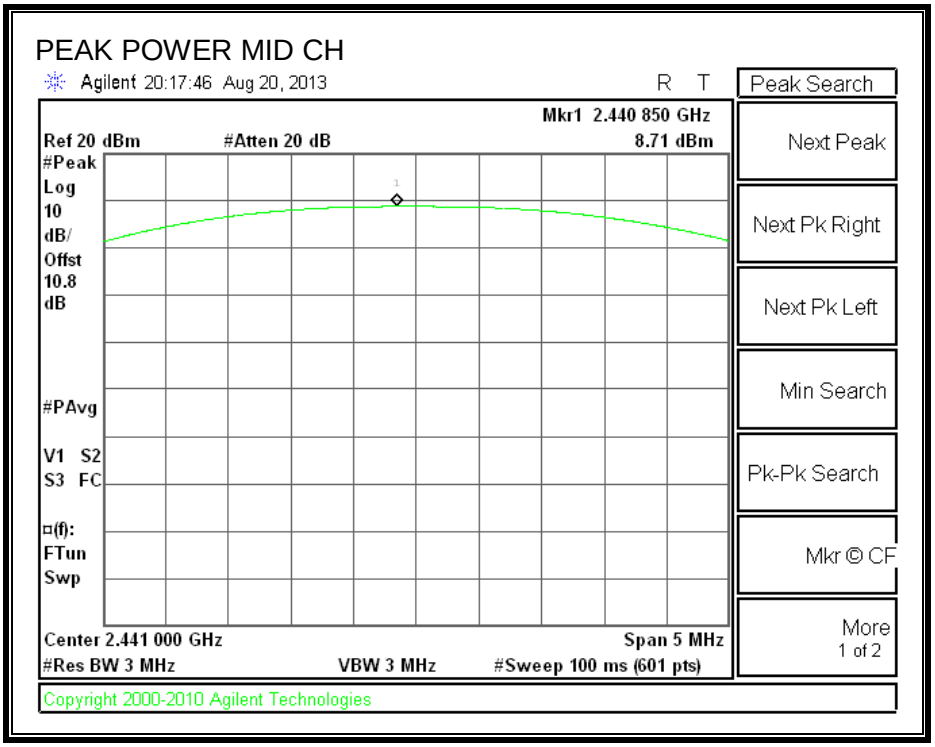
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.93	30	-21.07
Middle	2441	8.71	30	-21.29
High	2480	8.45	30	-21.55

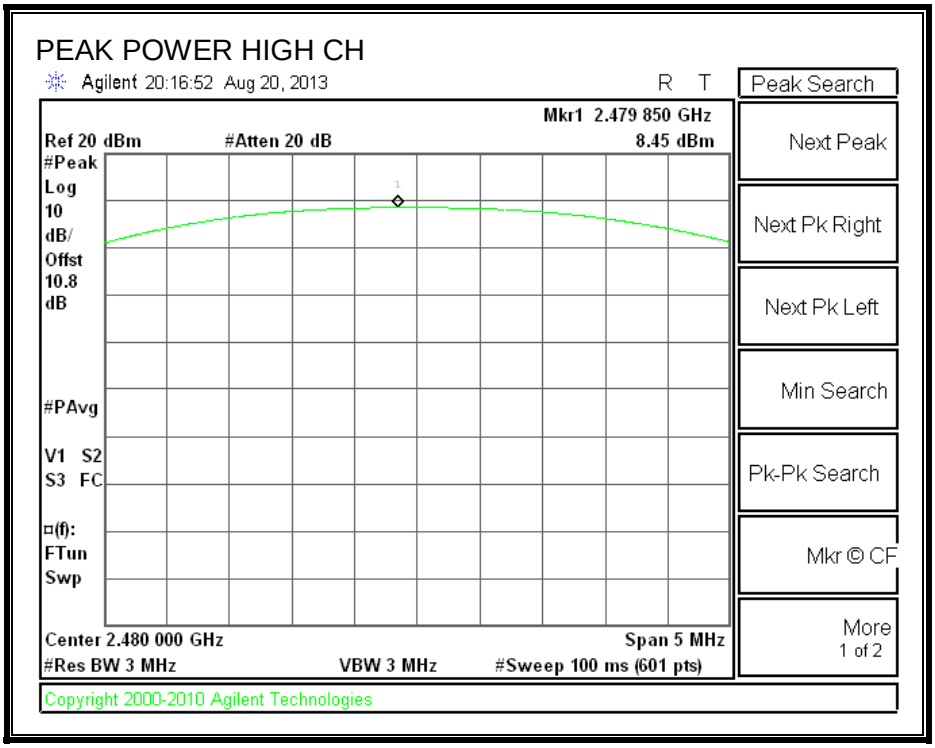
OUTPUT POWER

PEAK POWER LOW CH



PEAK POWER MID CH





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 10.75dB (including 10 dB pad and .75dB 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	7.62
Middle	2441	7.45
High	2480	7.18

8.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

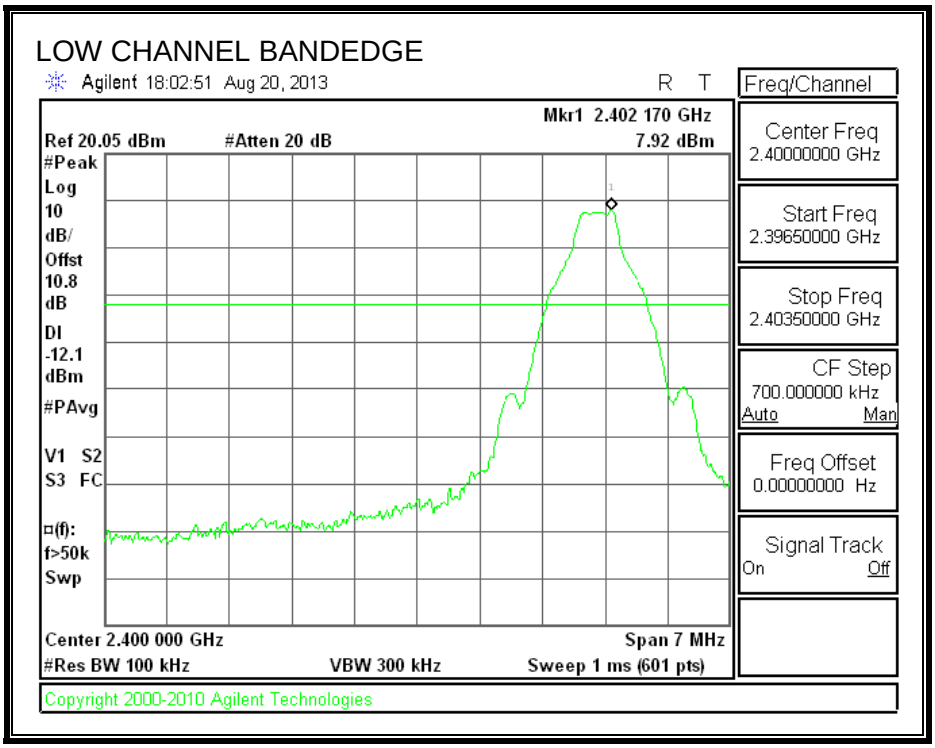
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

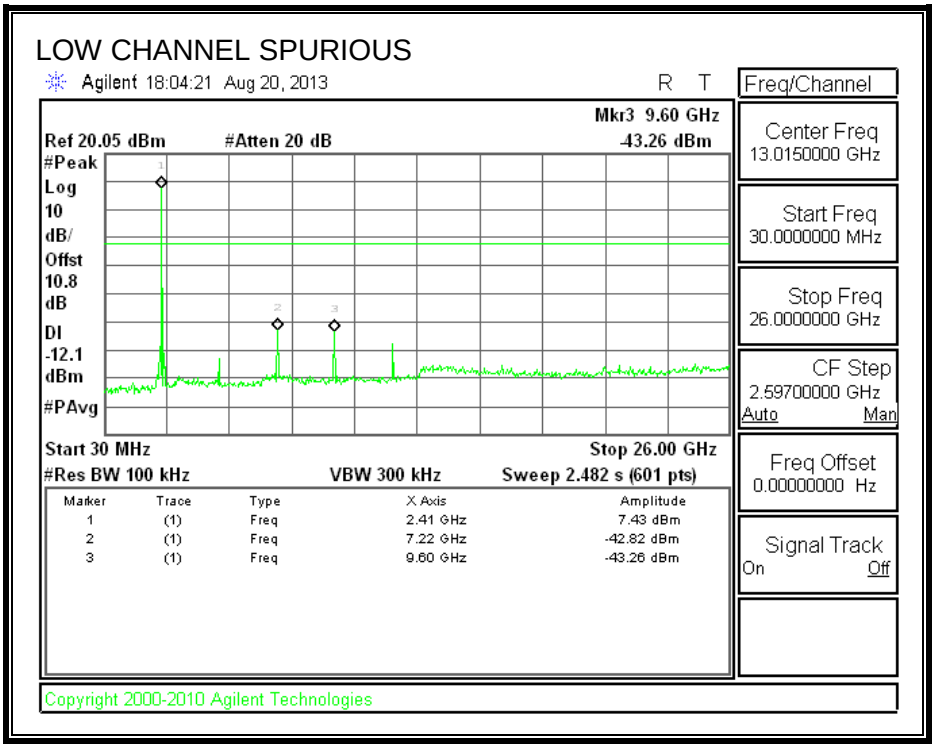
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

RESULTS

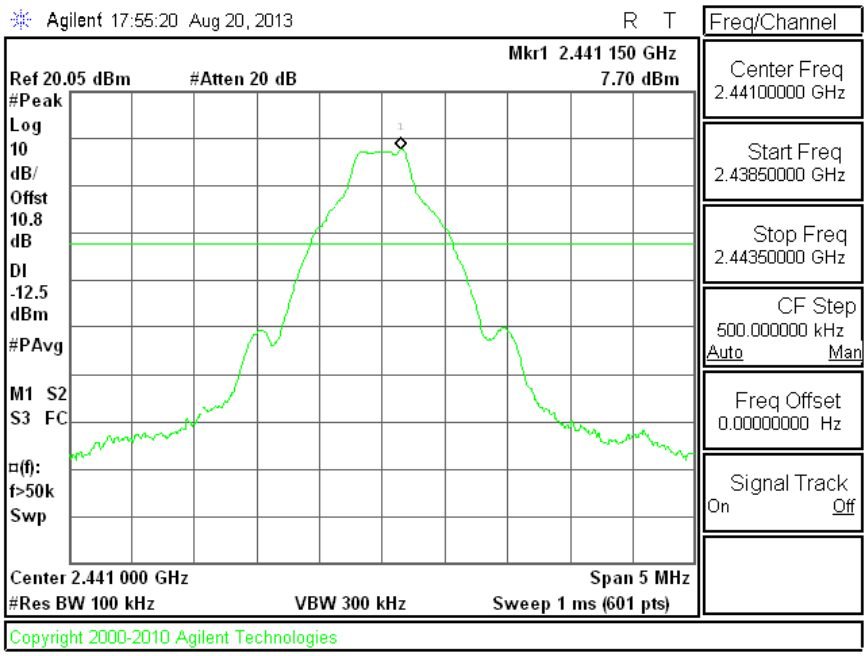
SPURIOUS EMISSIONS, LOW CHANNEL



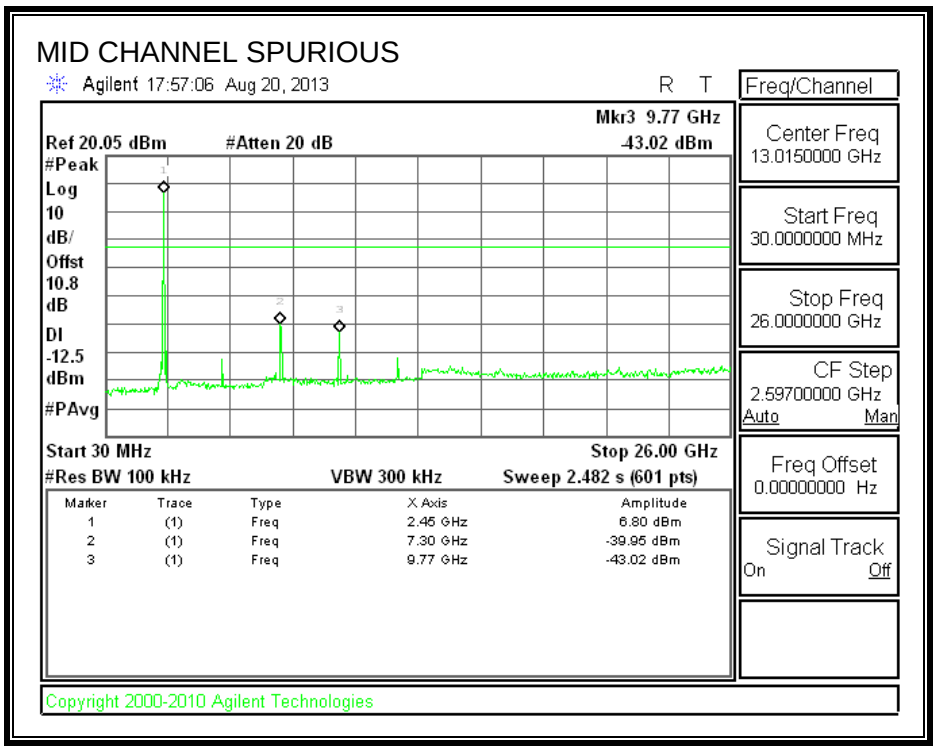


SPURIOUS EMISSIONS, MID CHANNEL

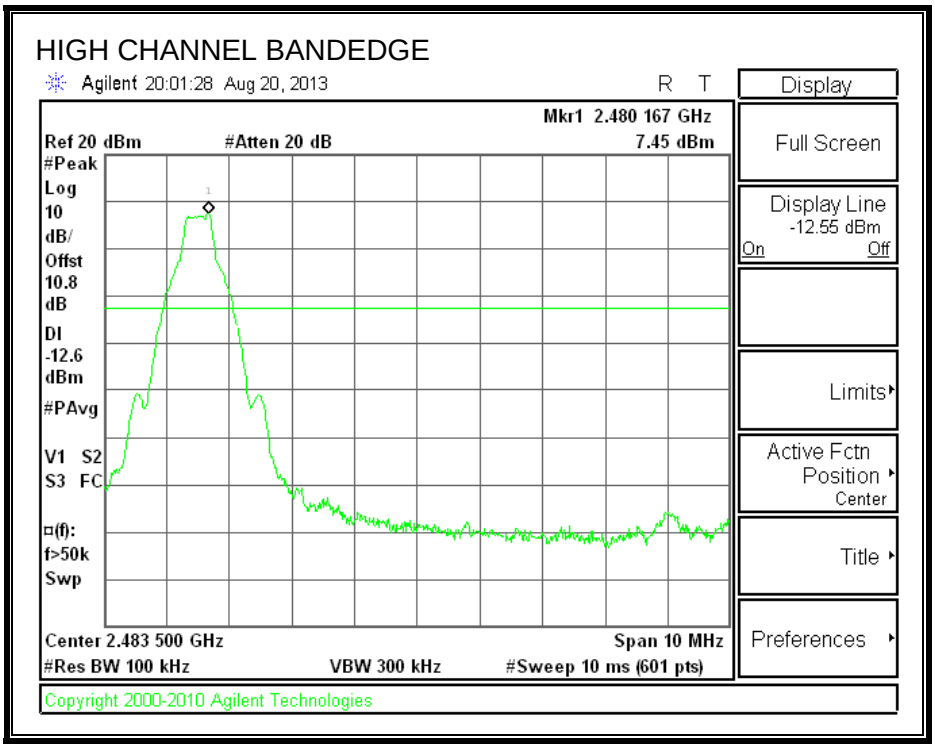
MID CHANNEL REFERENCE

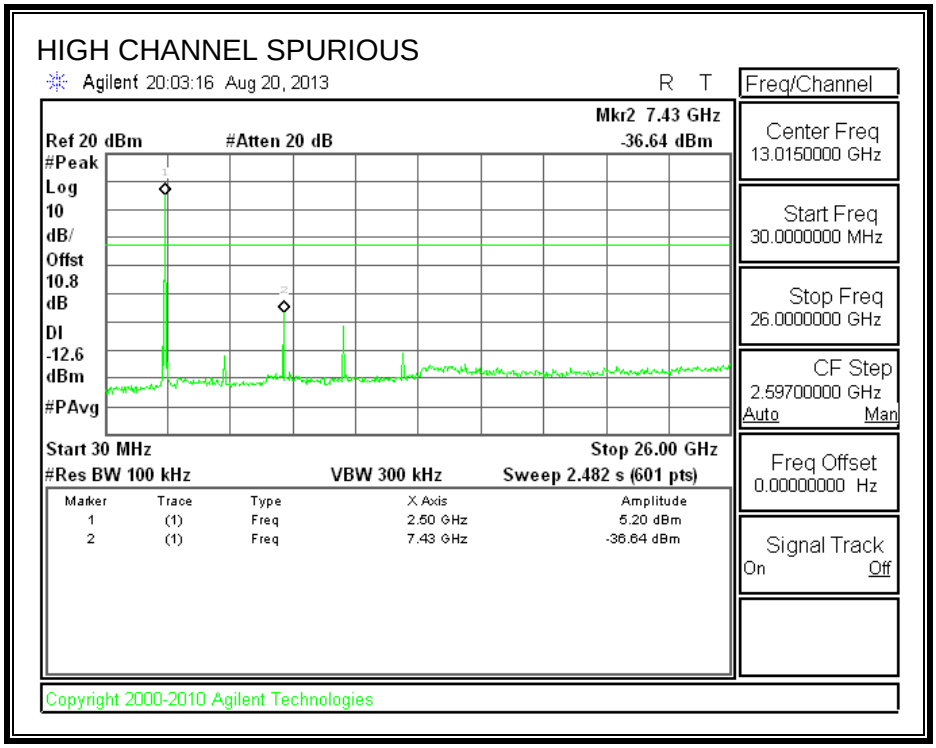


MID CHANNEL SPURIOUS



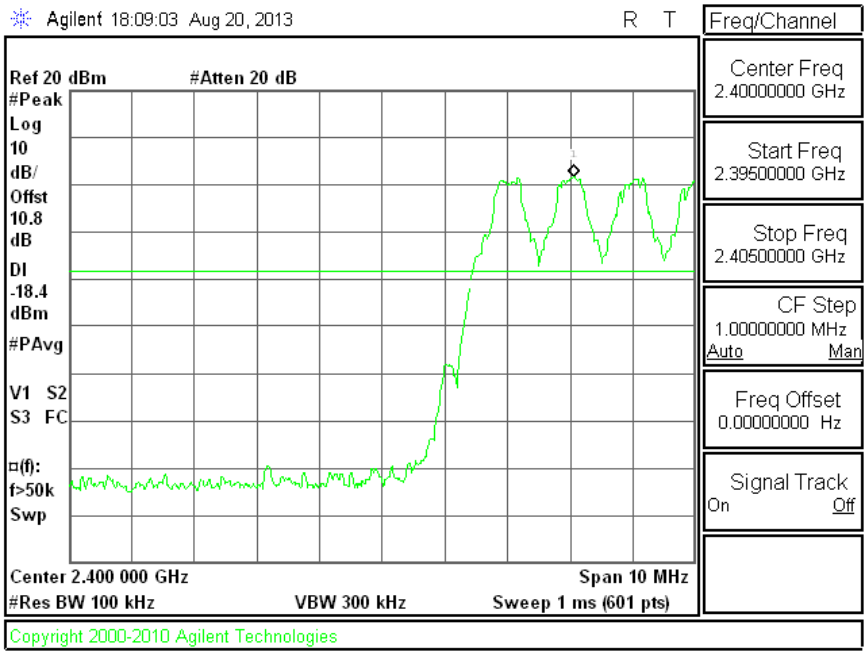
SPURIOUS EMISSIONS, HIGH CHANNEL



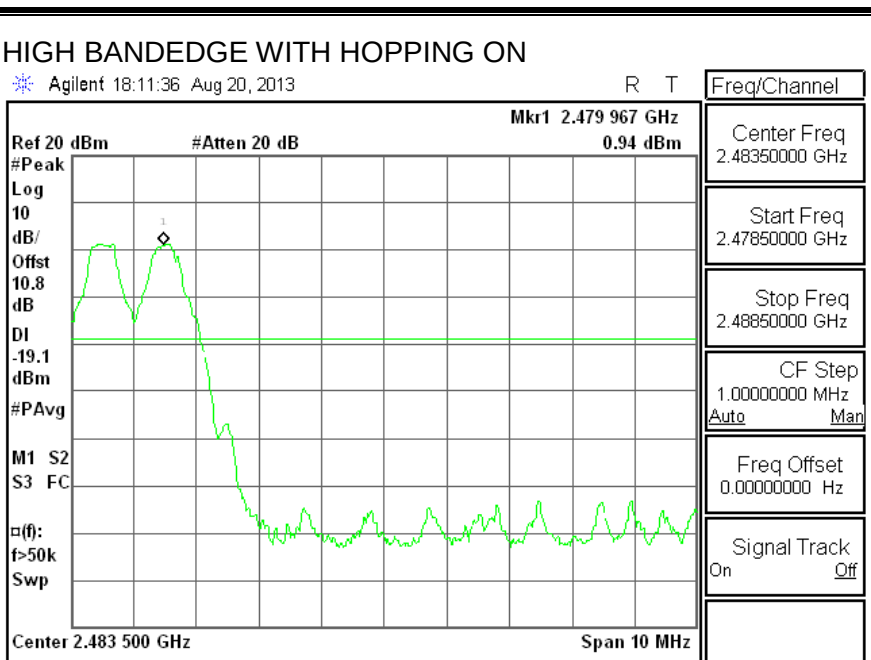


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



8.2. ENHANCED DATA RATE 8PSK MODULATION

8.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

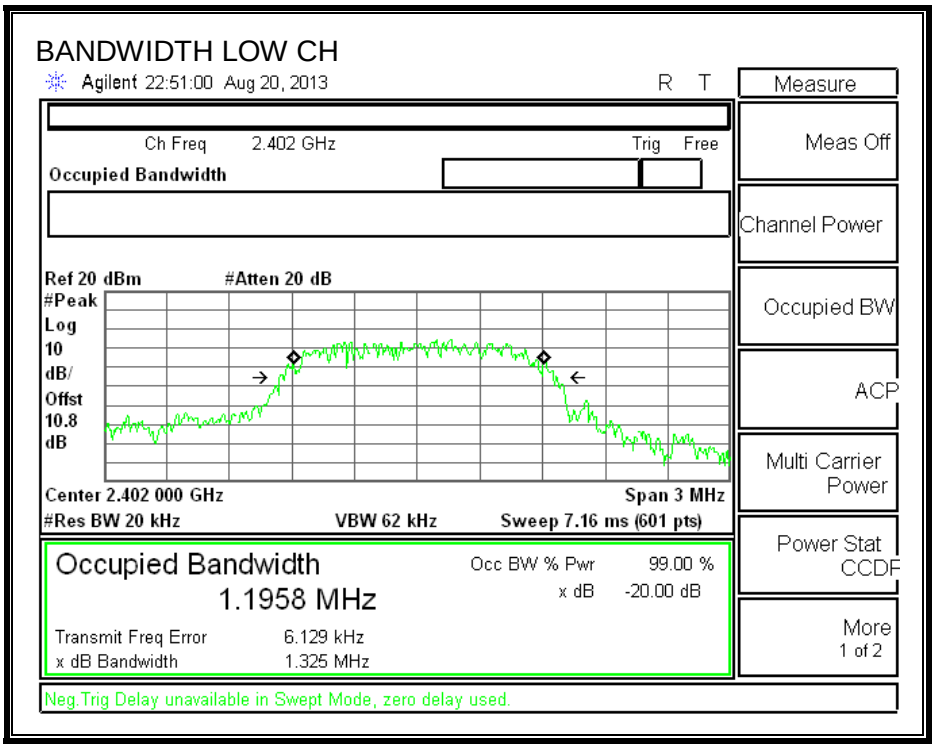
TEST PROCEDURE

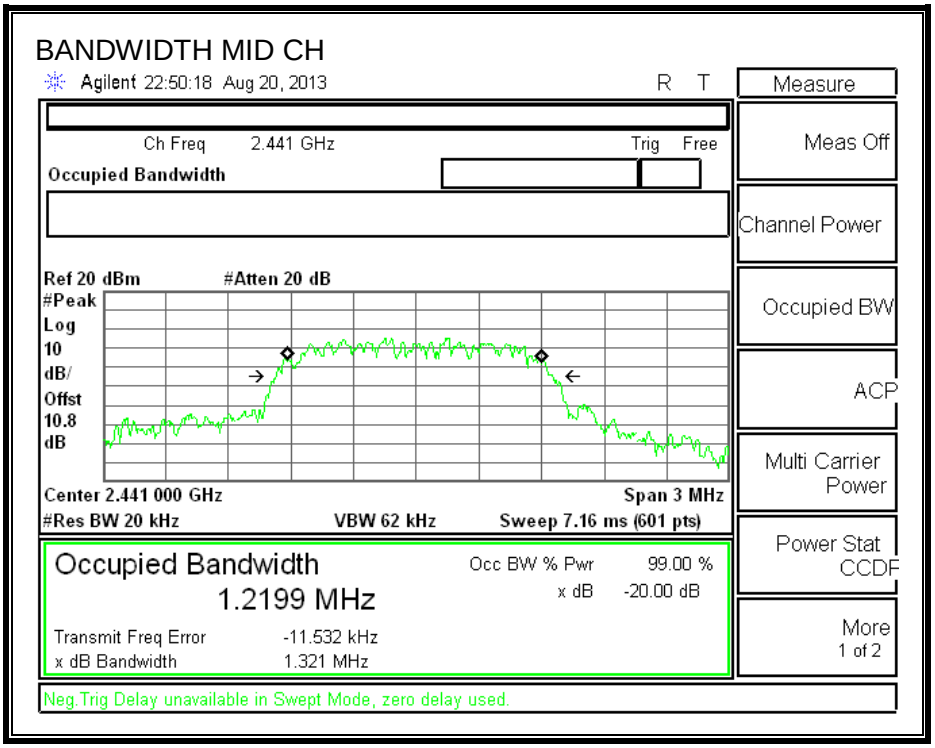
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

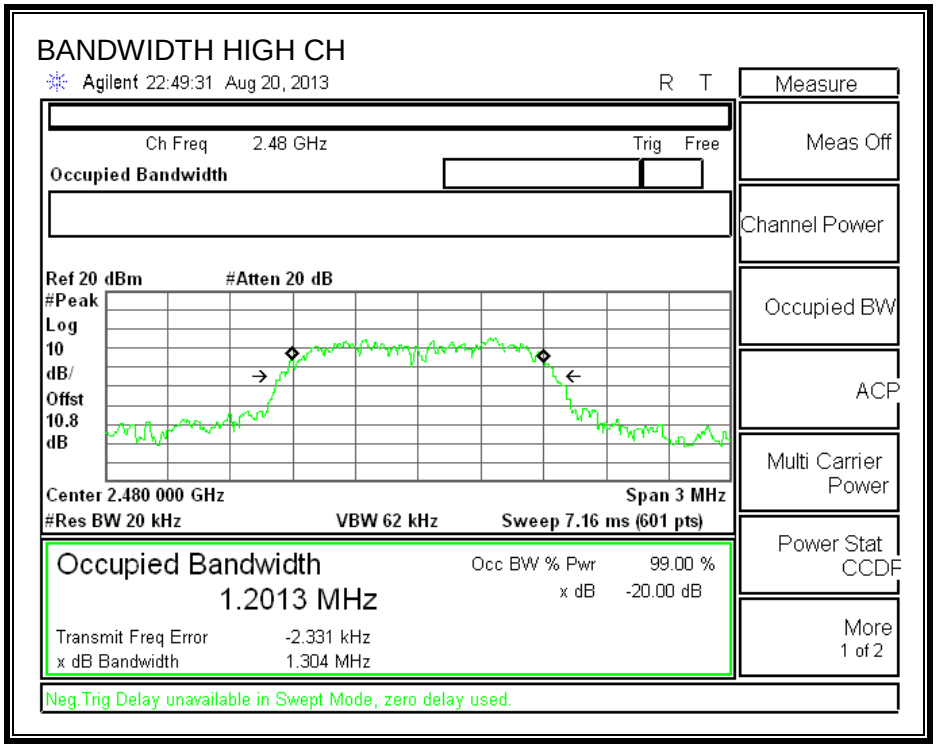
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1325	1186.8
Middle	2441	1321	1189.8
High	2480	1304	1216.2

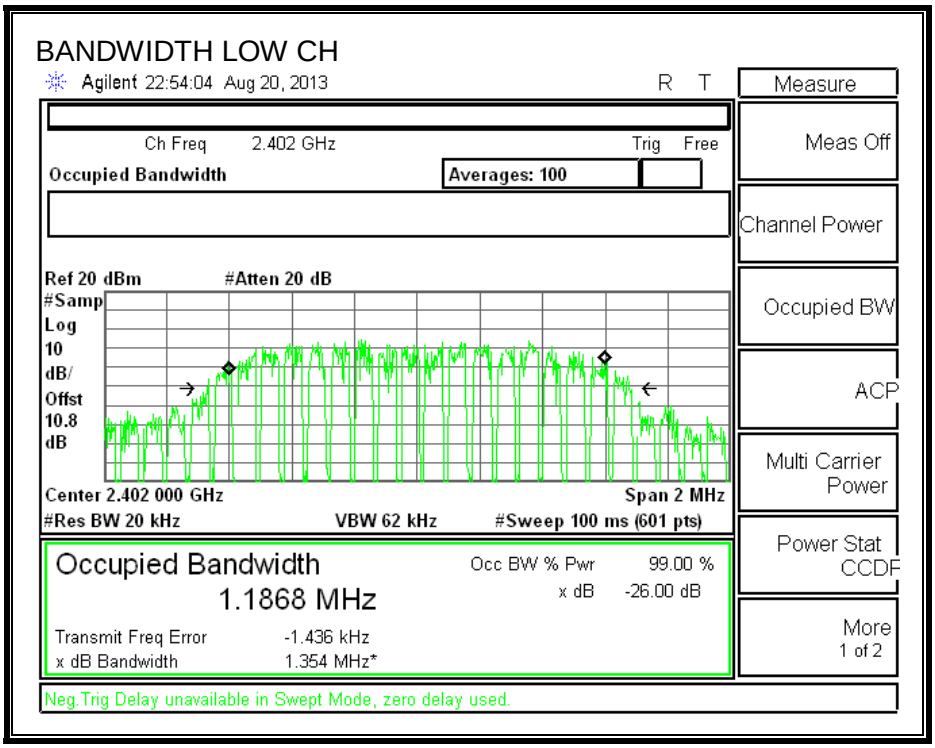
20 dB BANDWIDTH

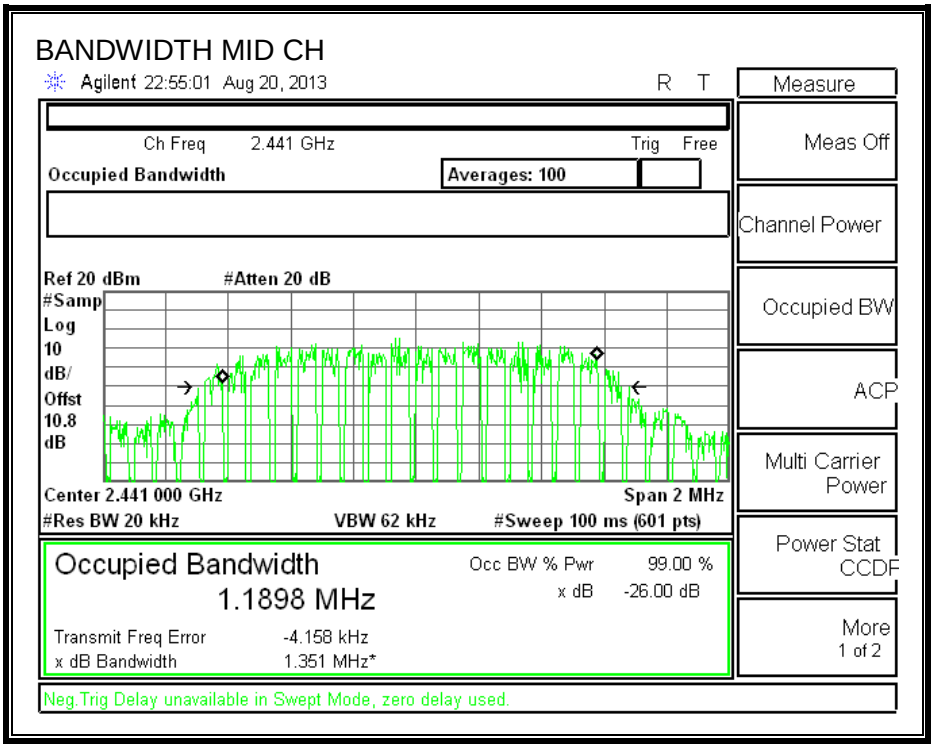


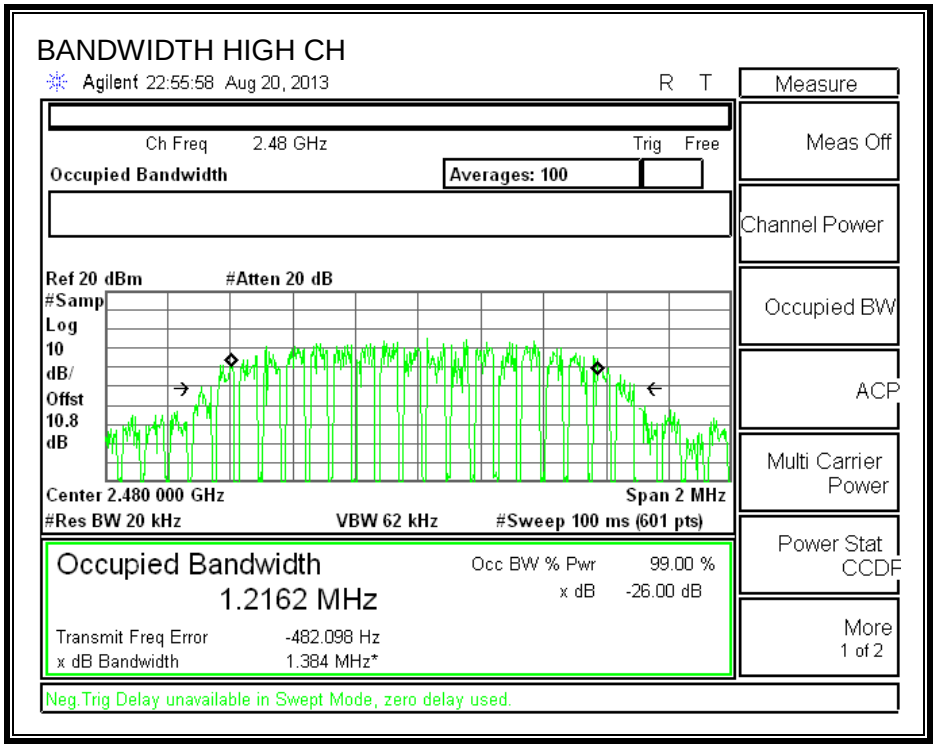




99% BANDWIDTH







8.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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

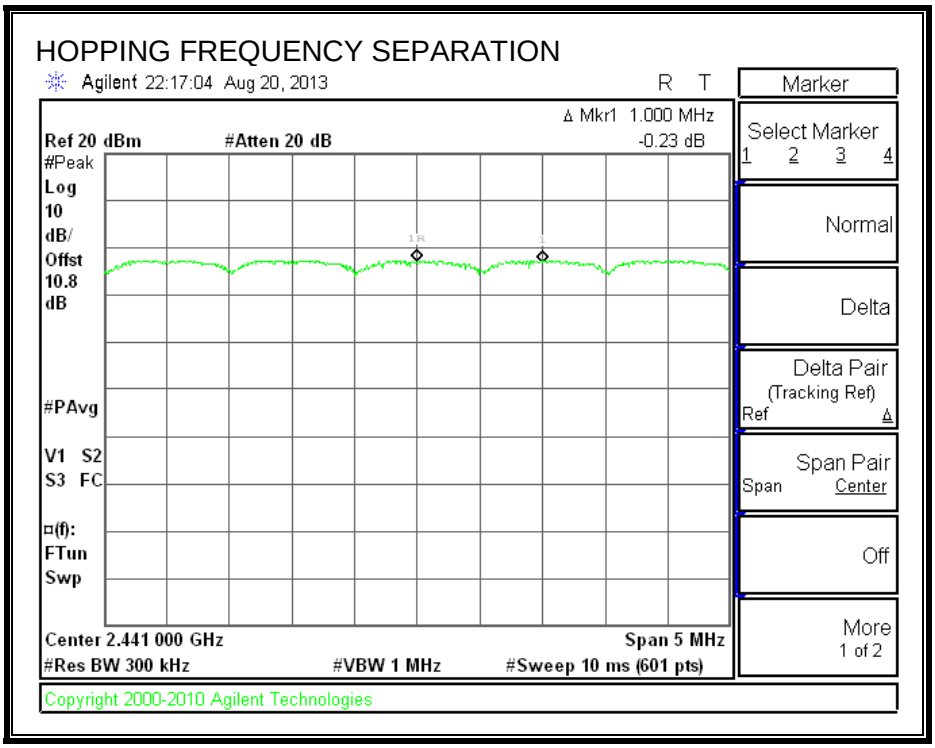
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

RESULTS

HOPPING FREQUENCY SEPARATION



8.2.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

TEST PROCEDURE

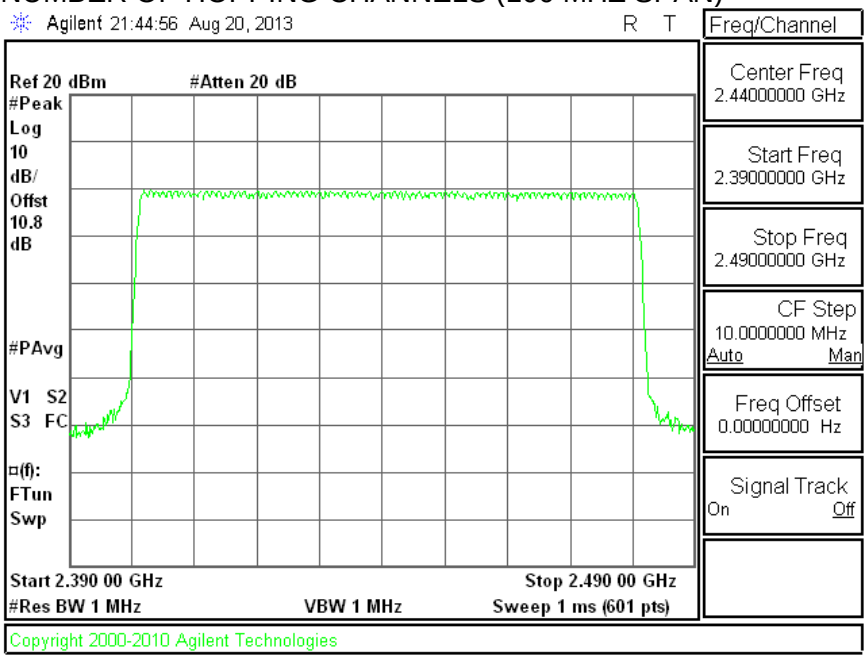
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

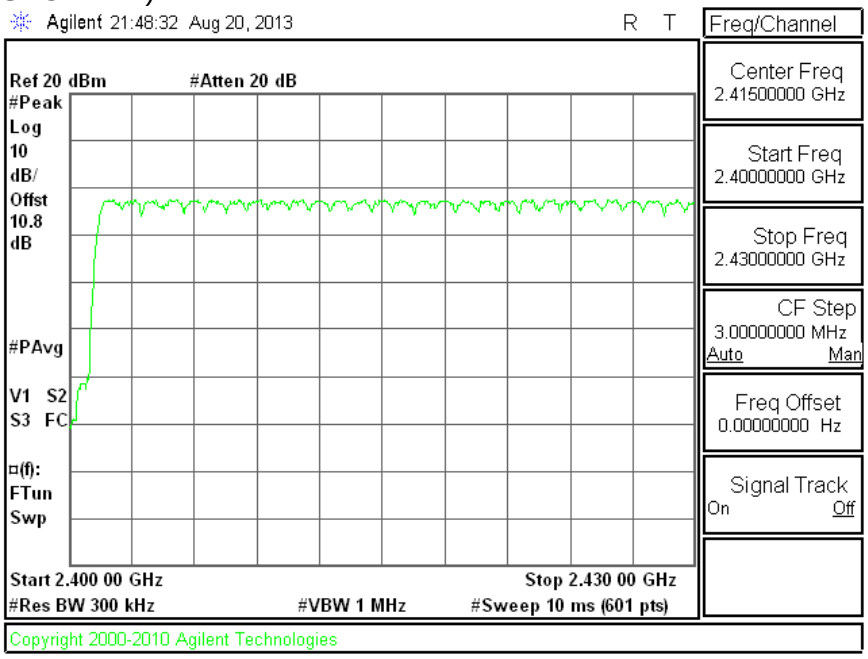
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS

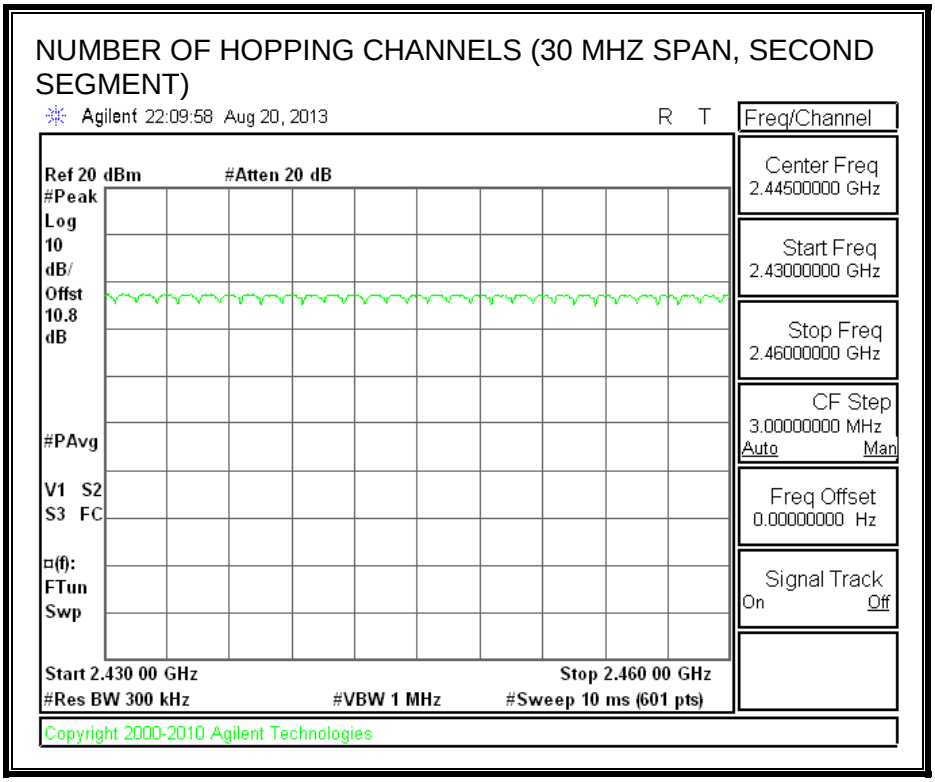
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



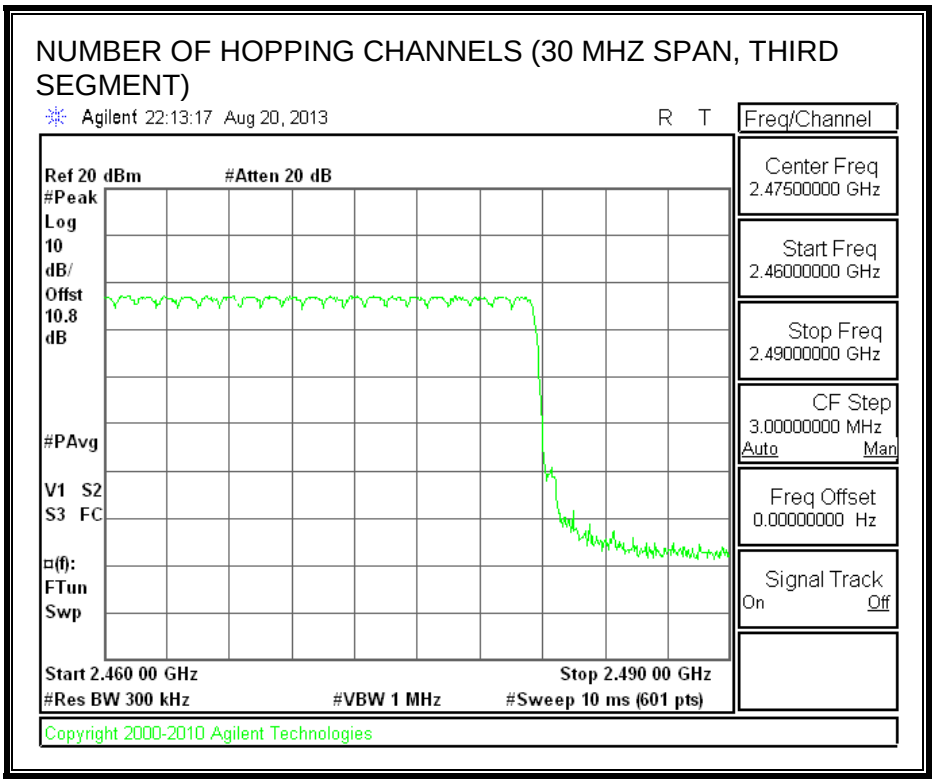
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



8.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

TEST PROCEDURE

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

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

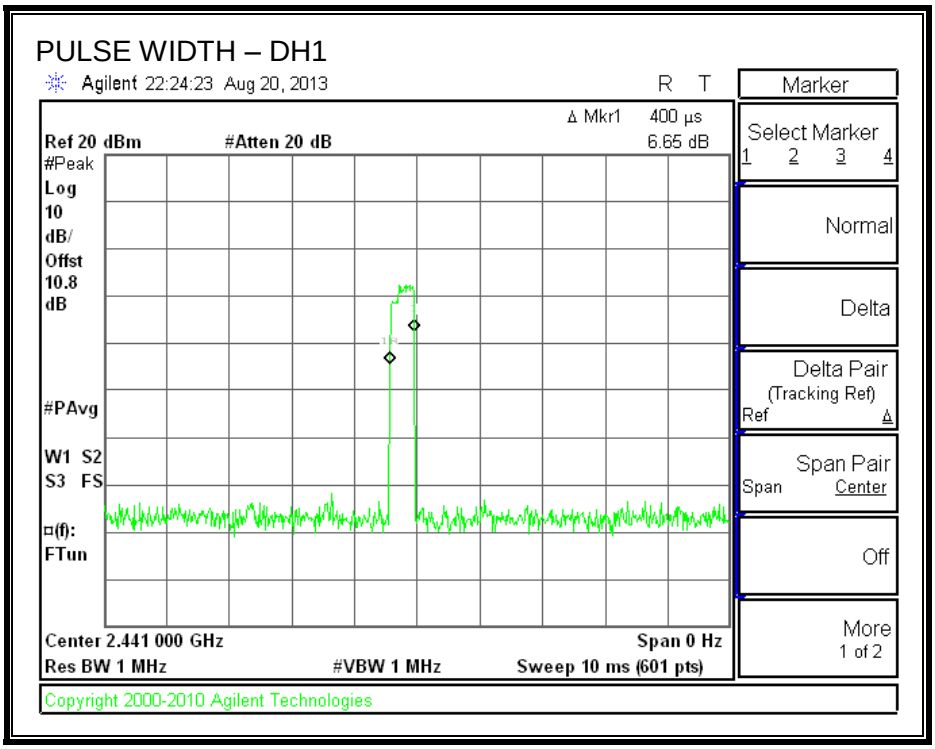
RESULTS

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

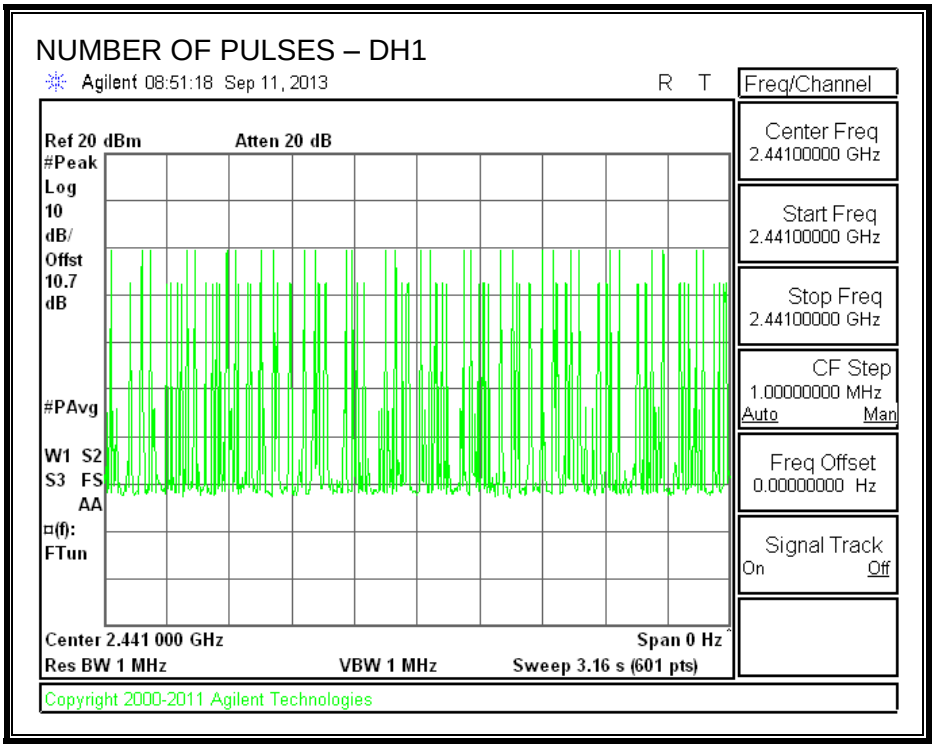
8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.40	33	0.132	0.4	-0.268
DH3	1.63	14	0.229	0.4	-0.171
DH5	2.86	10	0.286	0.4	-0.114

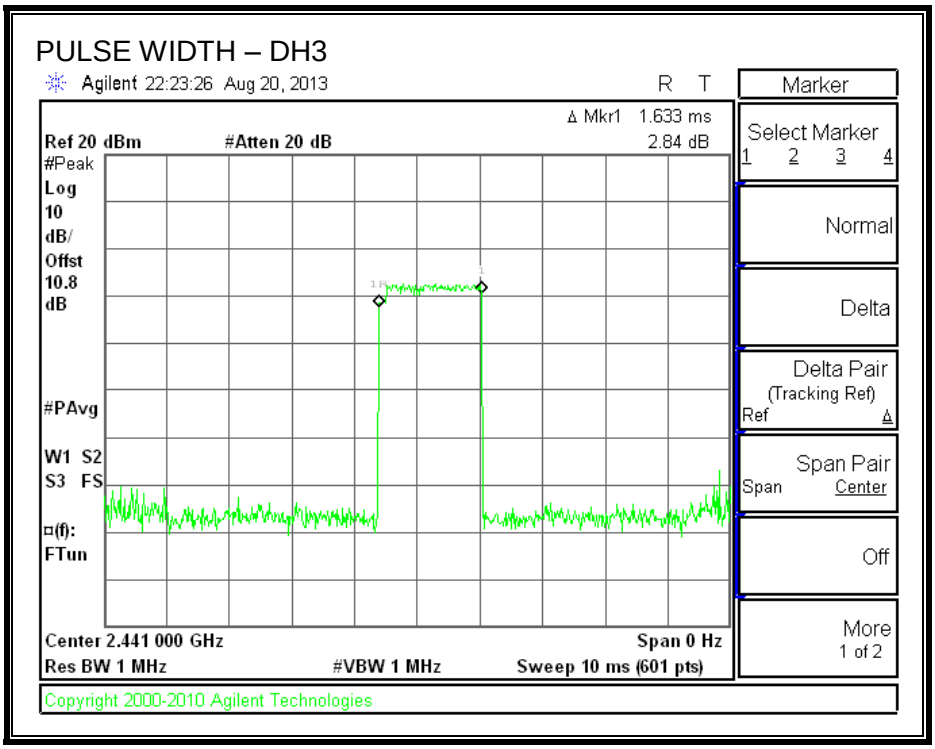
PULSE WIDTH - DH1



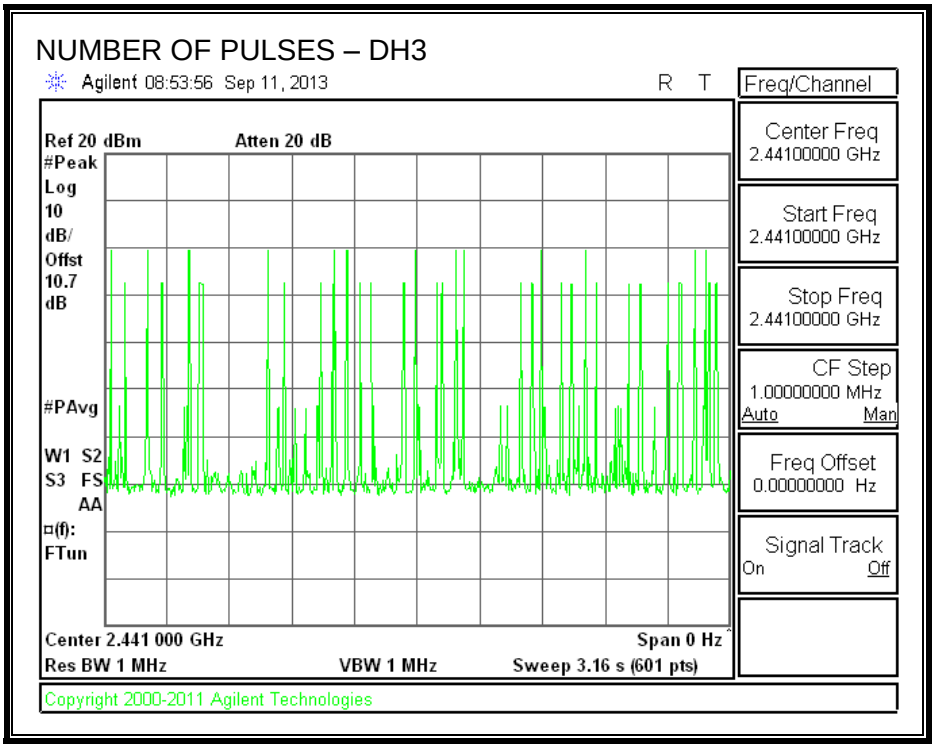
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



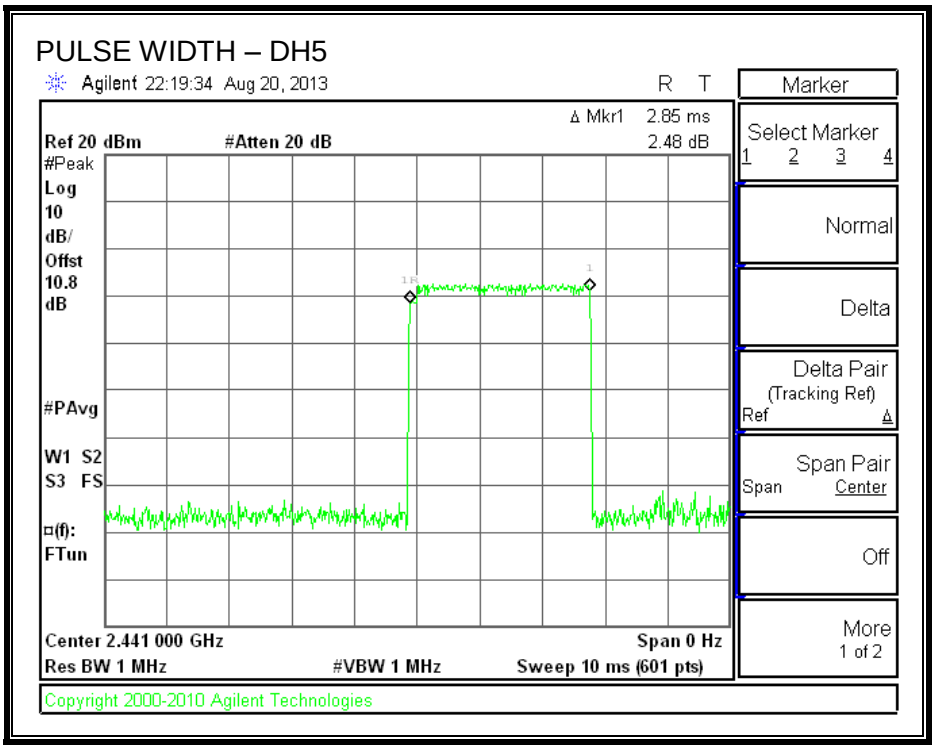
PULSE WIDTH – DH3



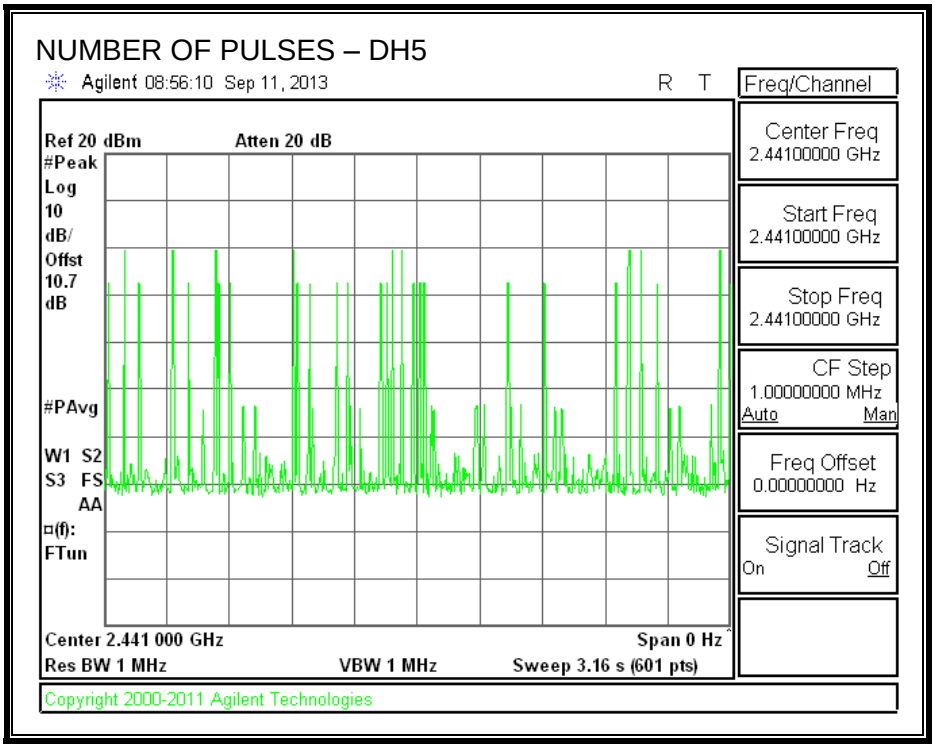
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.2.5. 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.

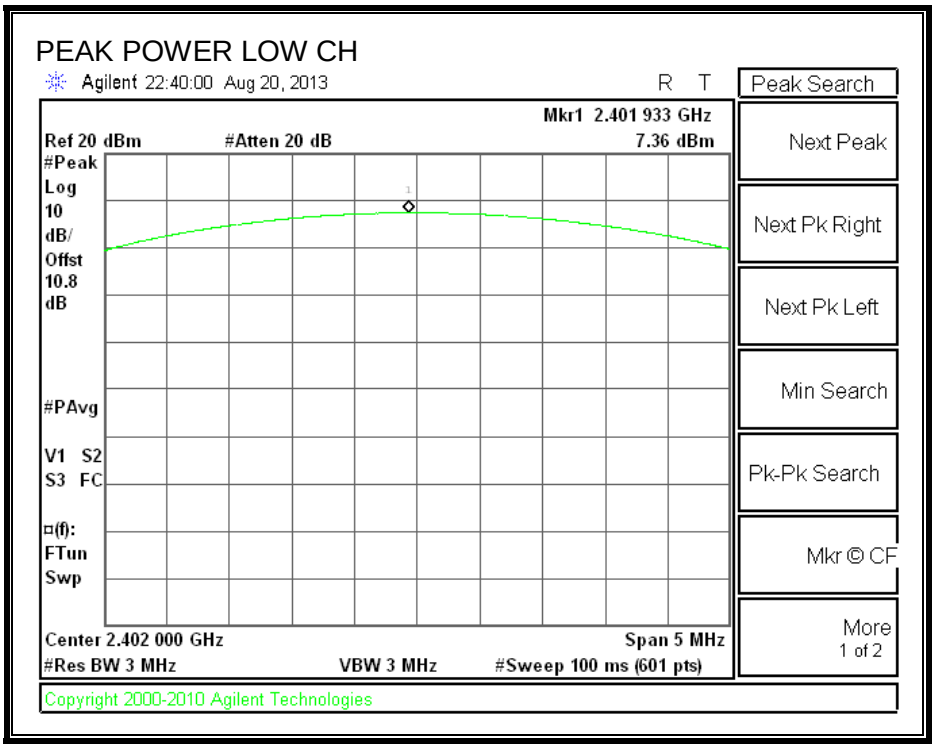
TEST PROCEDURE

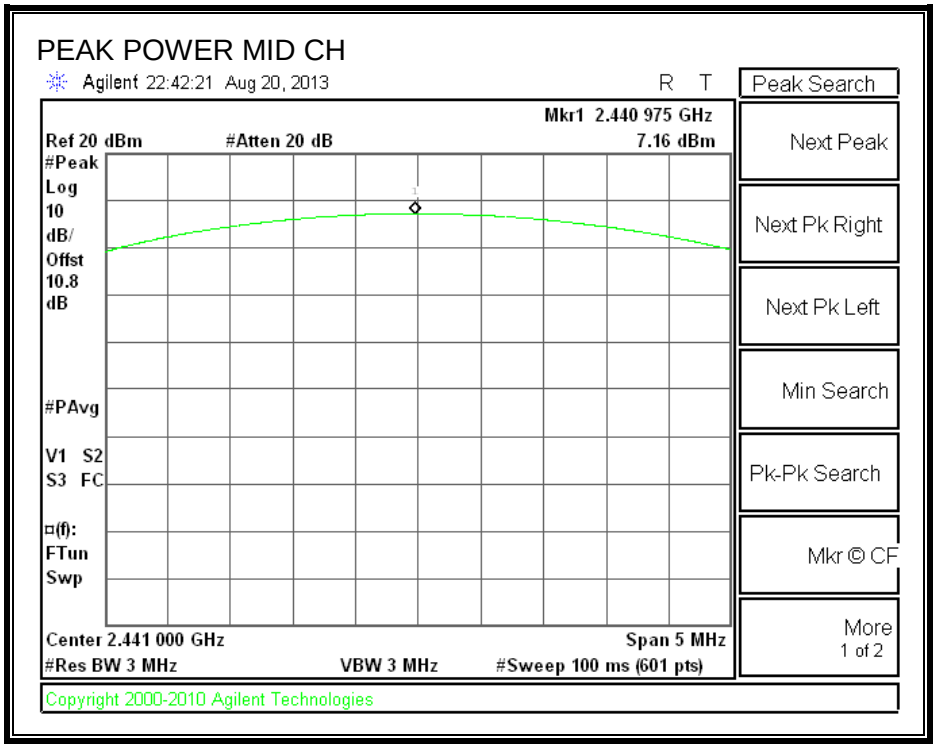
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

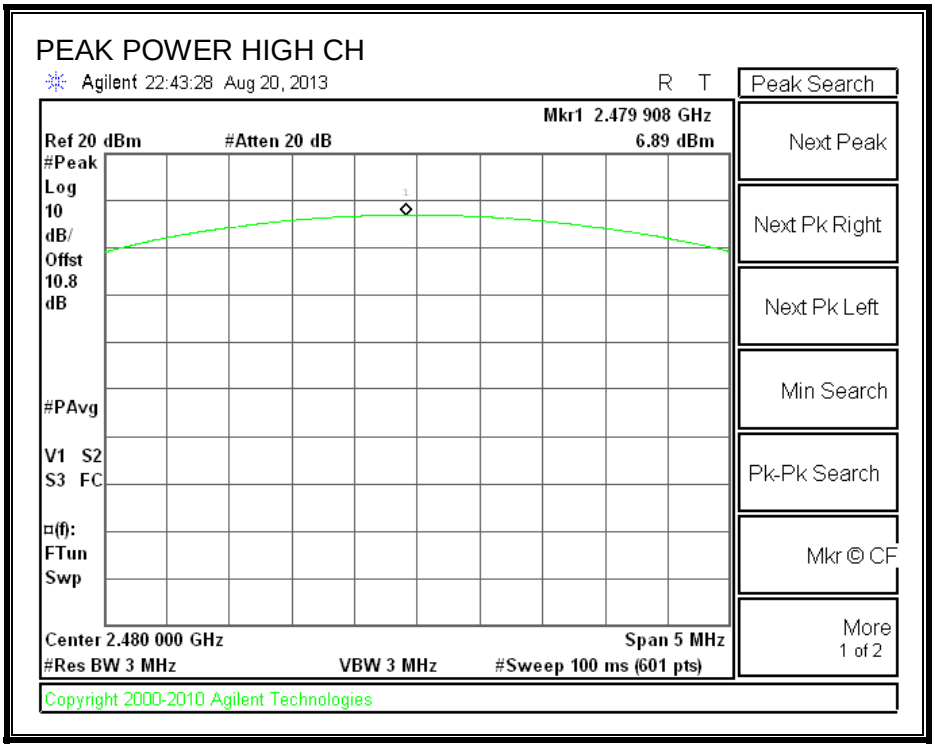
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.36	30	-22.64
Middle	2441	7.16	30	-22.84
High	2480	6.89	30	-23.11

OUTPUT POWER







8.2.6. 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 10.8dB (including 10 dB pad and .75dB 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	4.11
Middle	2441	3.92
High	2480	3.68

8.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

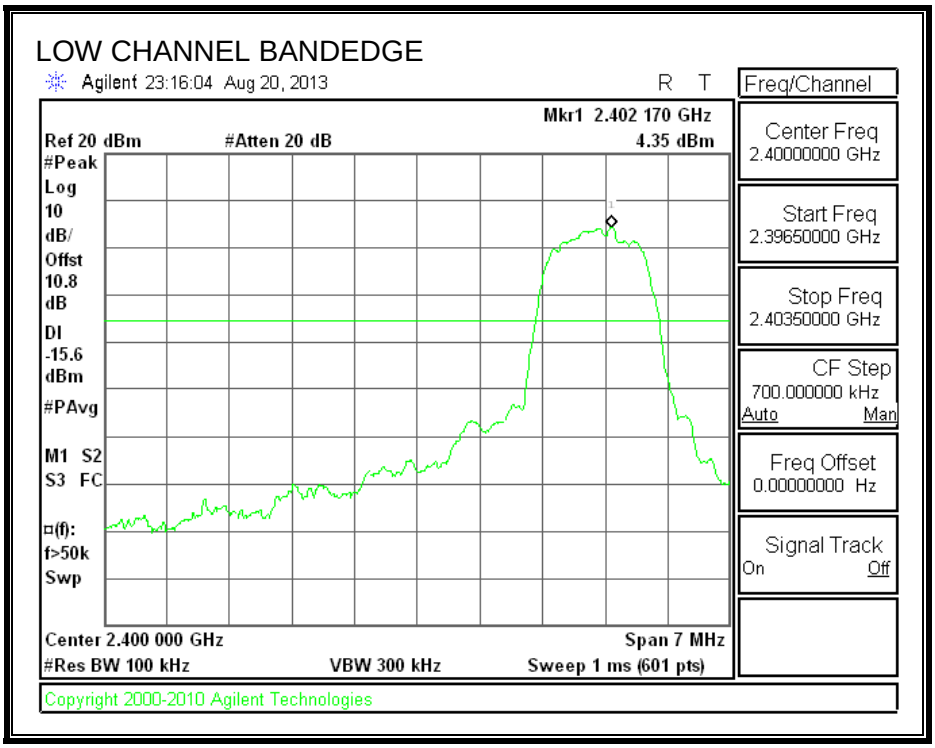
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

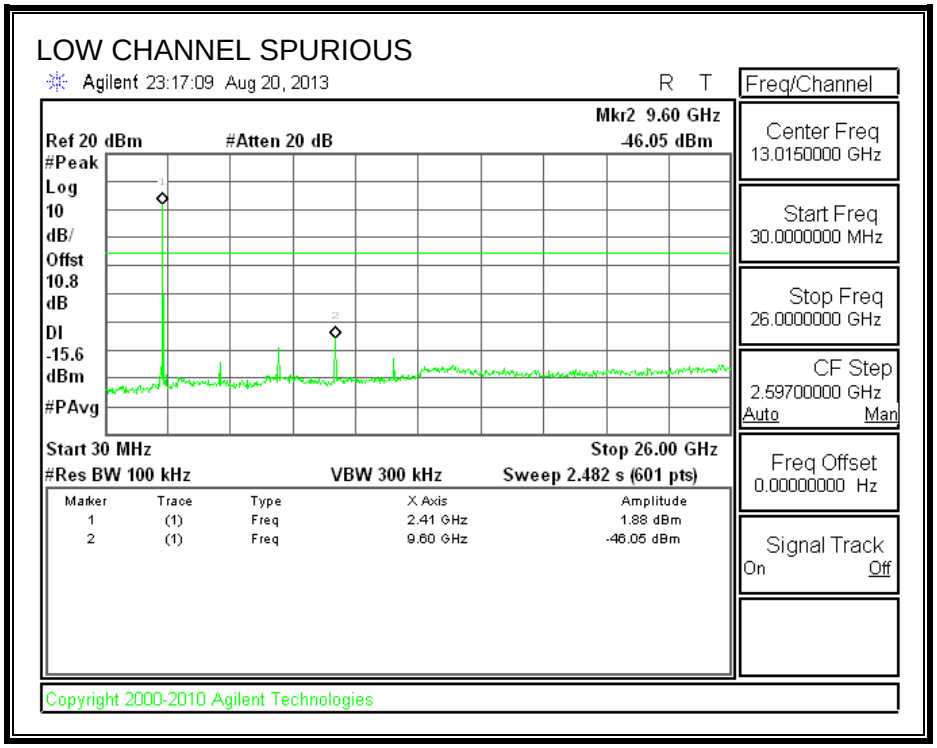
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

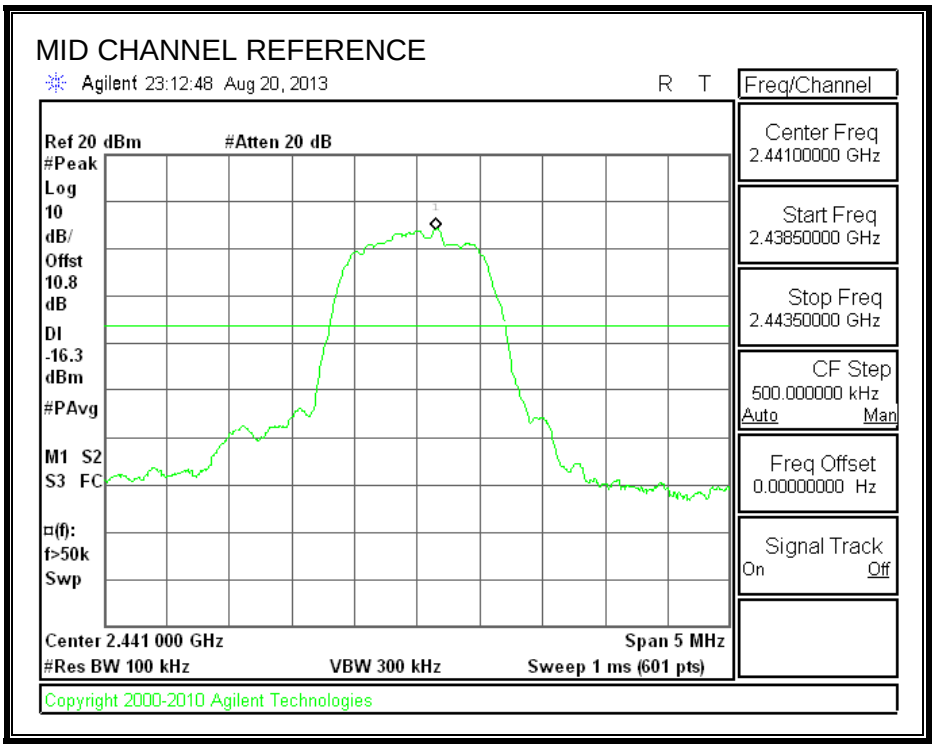
RESULTS

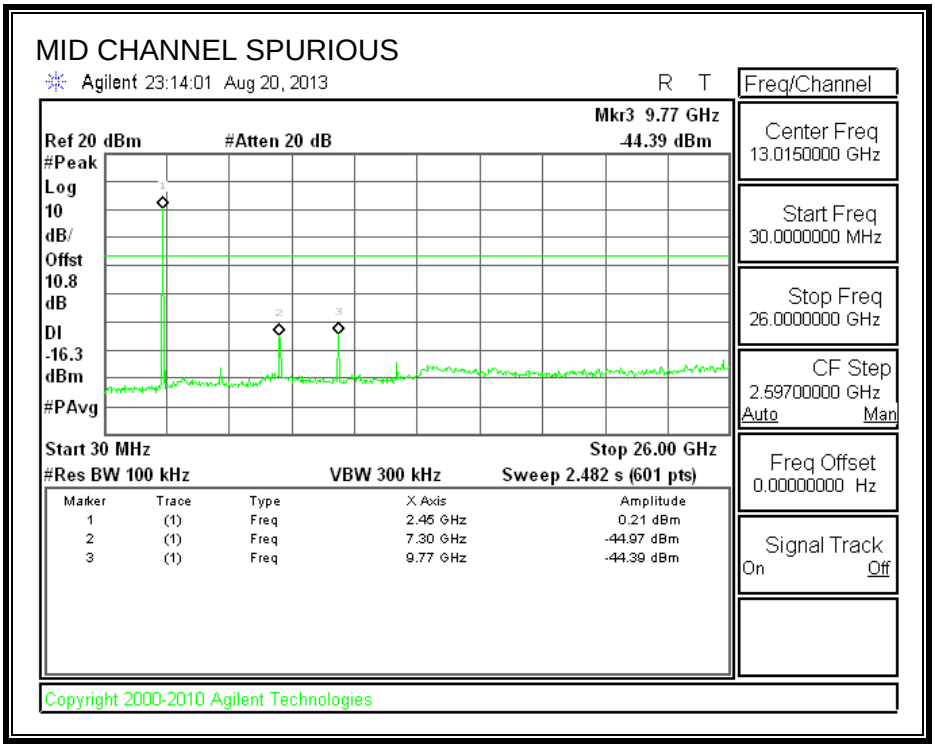
SPURIOUS EMISSIONS, LOW CHANNEL



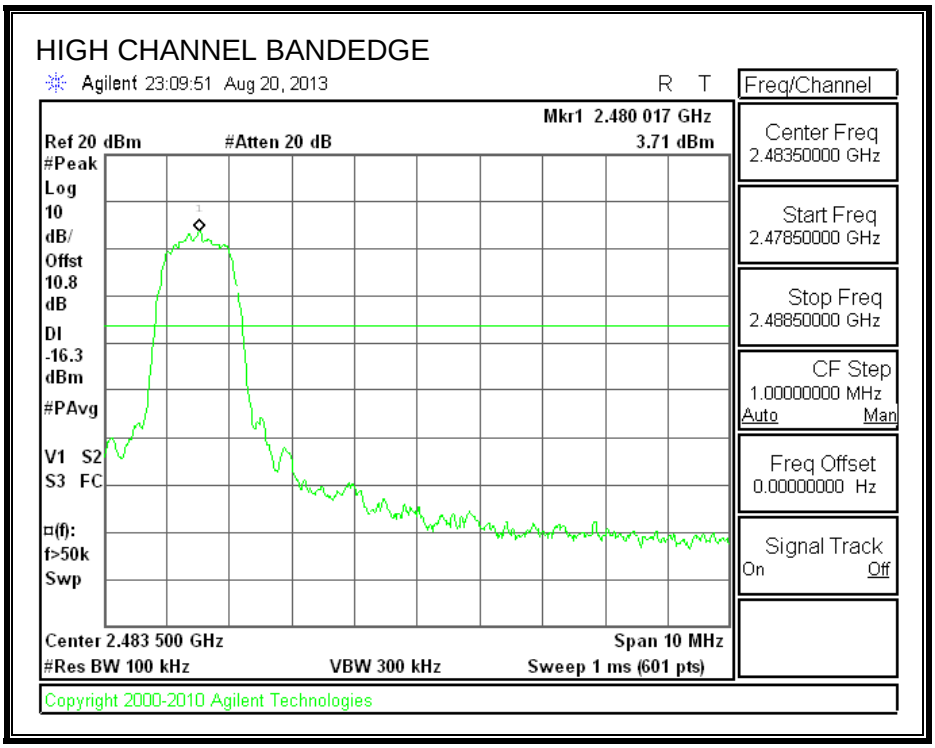


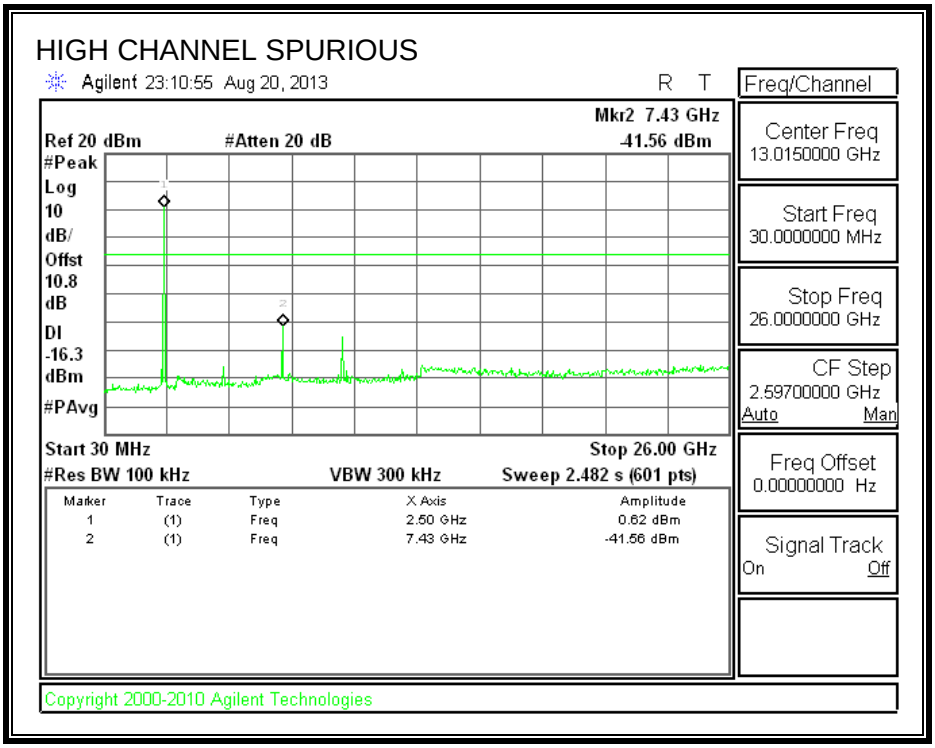
SPURIOUS EMISSIONS, MID CHANNEL





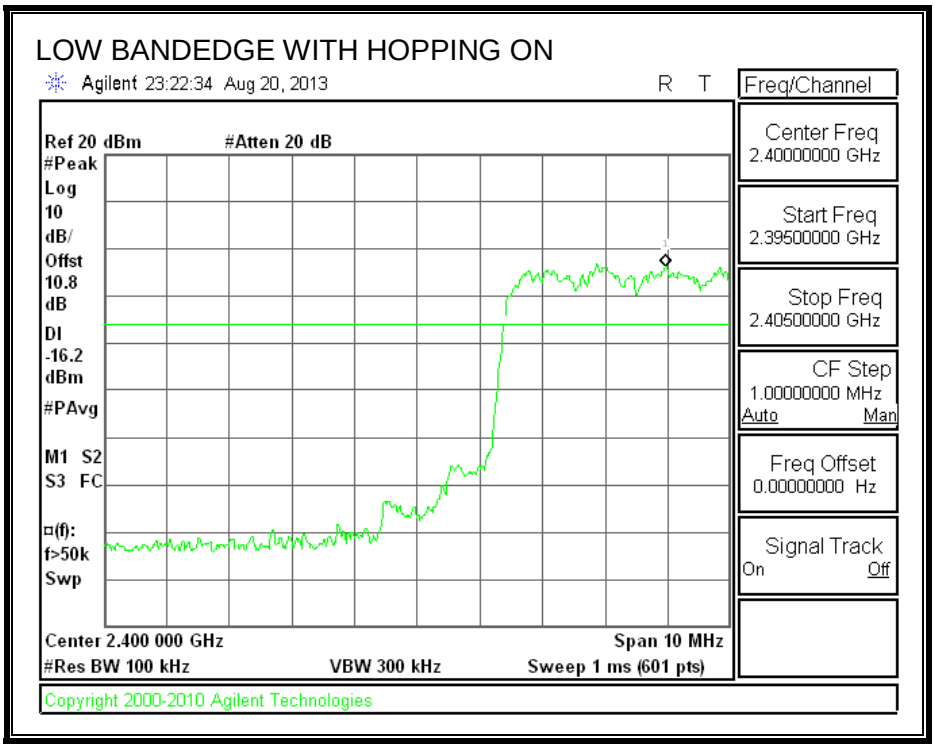
SPURIOUS EMISSIONS, HIGH CHANNEL



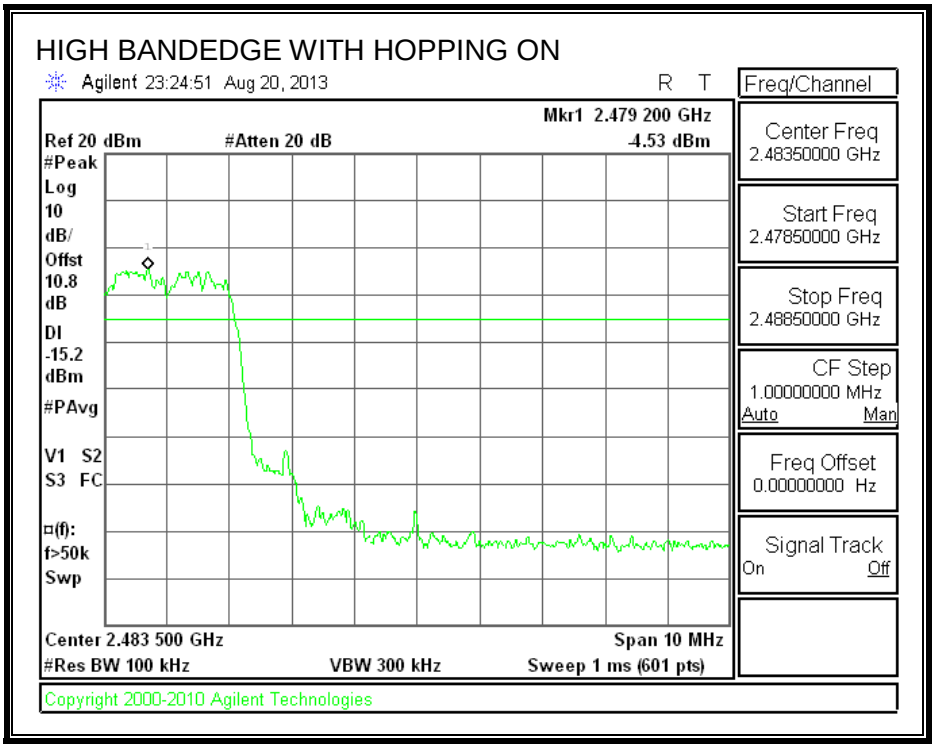


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

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 3 MHz for peak measurements and reduced video bandwidth technique for average measurements. The analyzer is set to power averaging mode for average measurements.

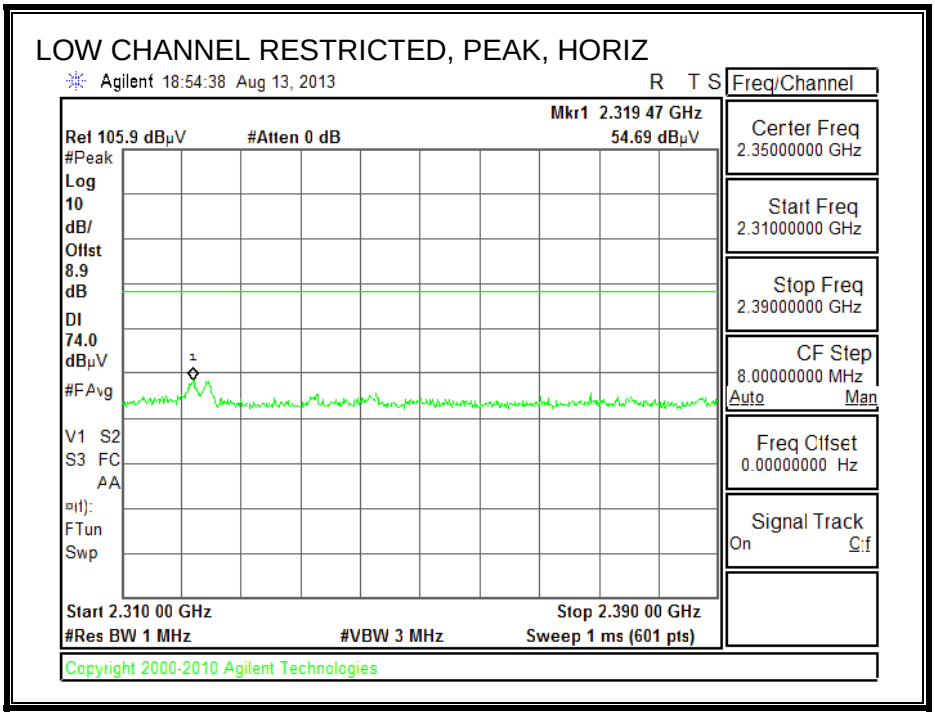
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

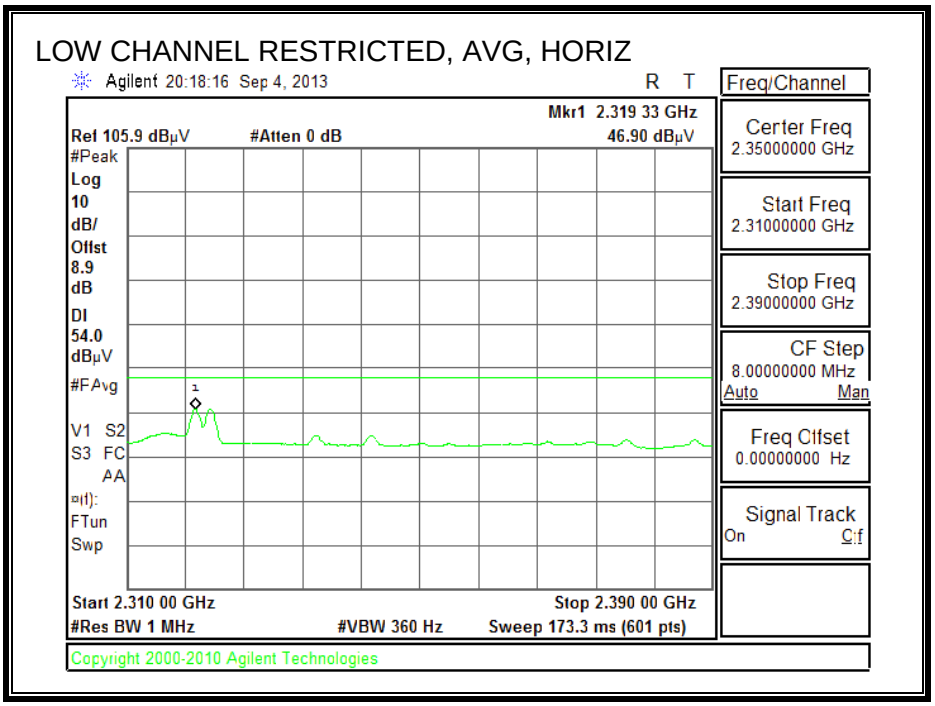
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

9.2. TRANSMITTER ABOVE 1 GHz

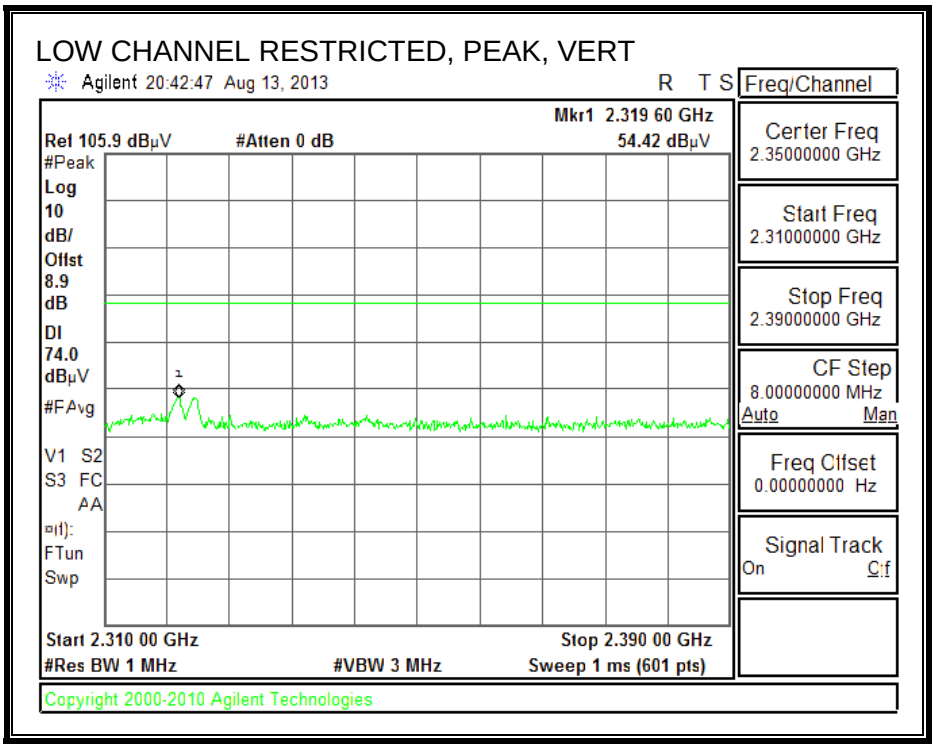
9.2.1. BASIC DATA RATE GFSK MODULATION

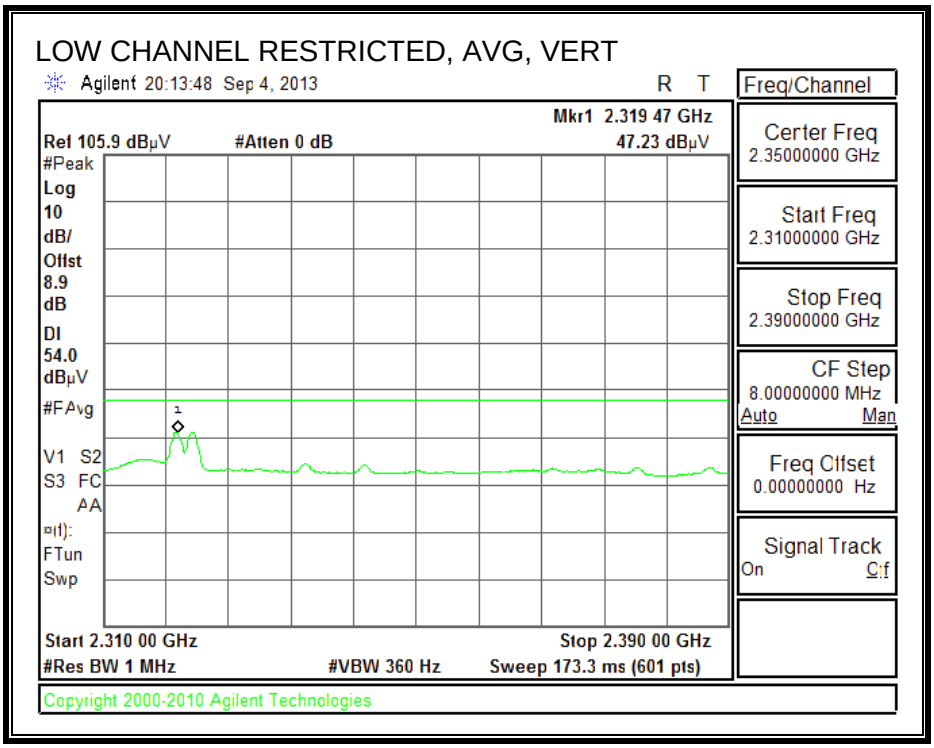
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



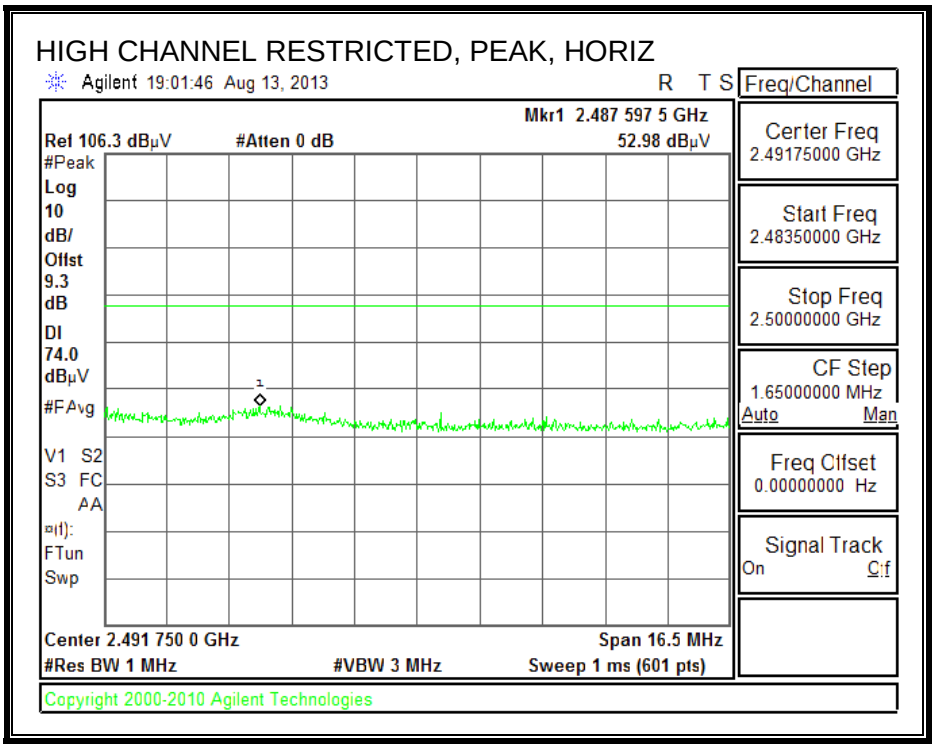


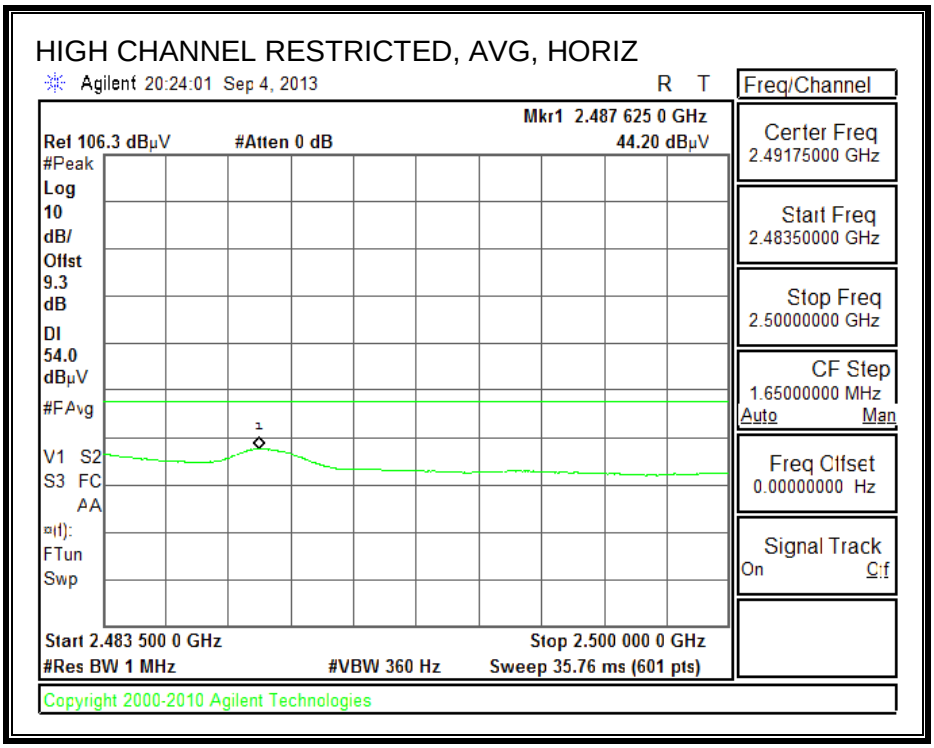
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



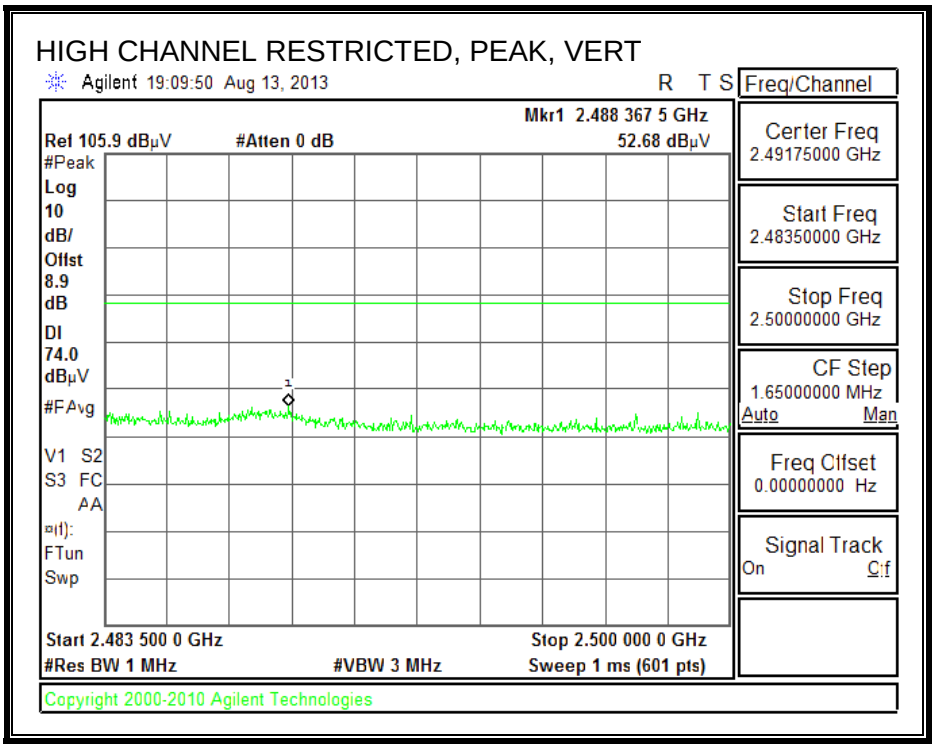


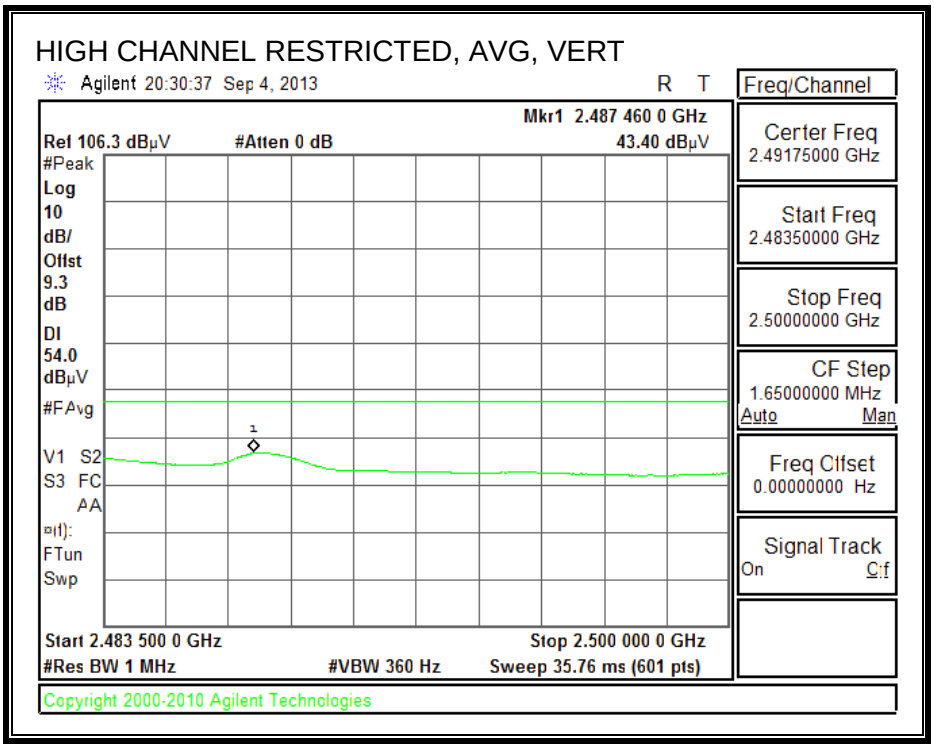
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

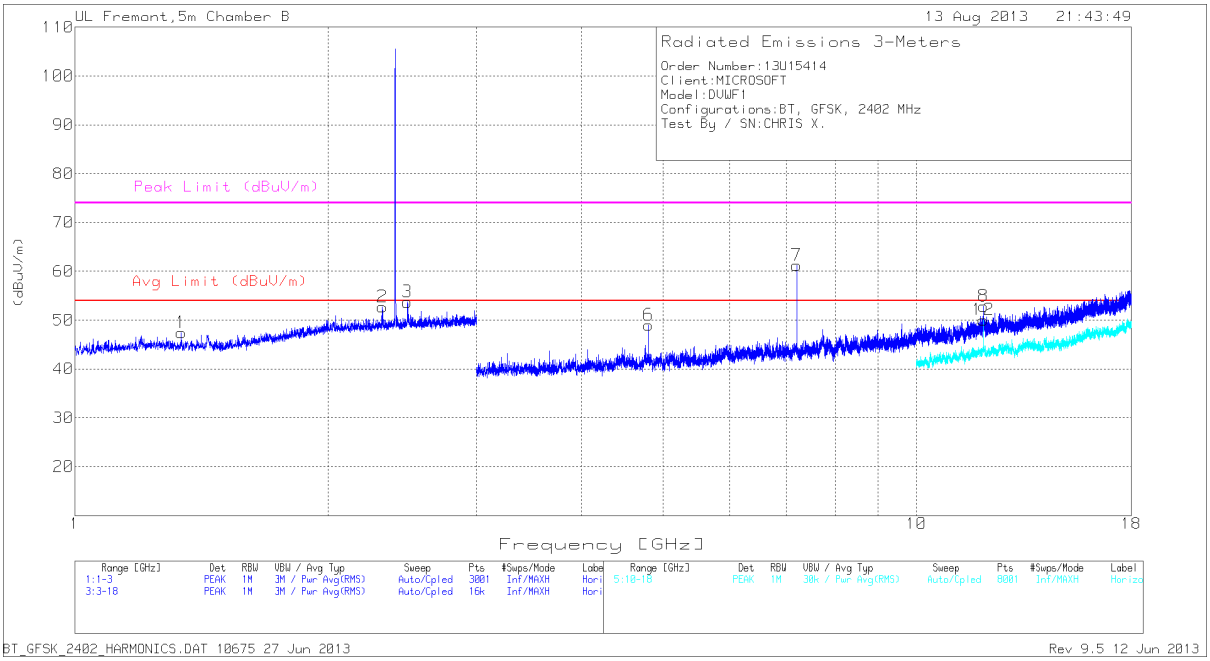




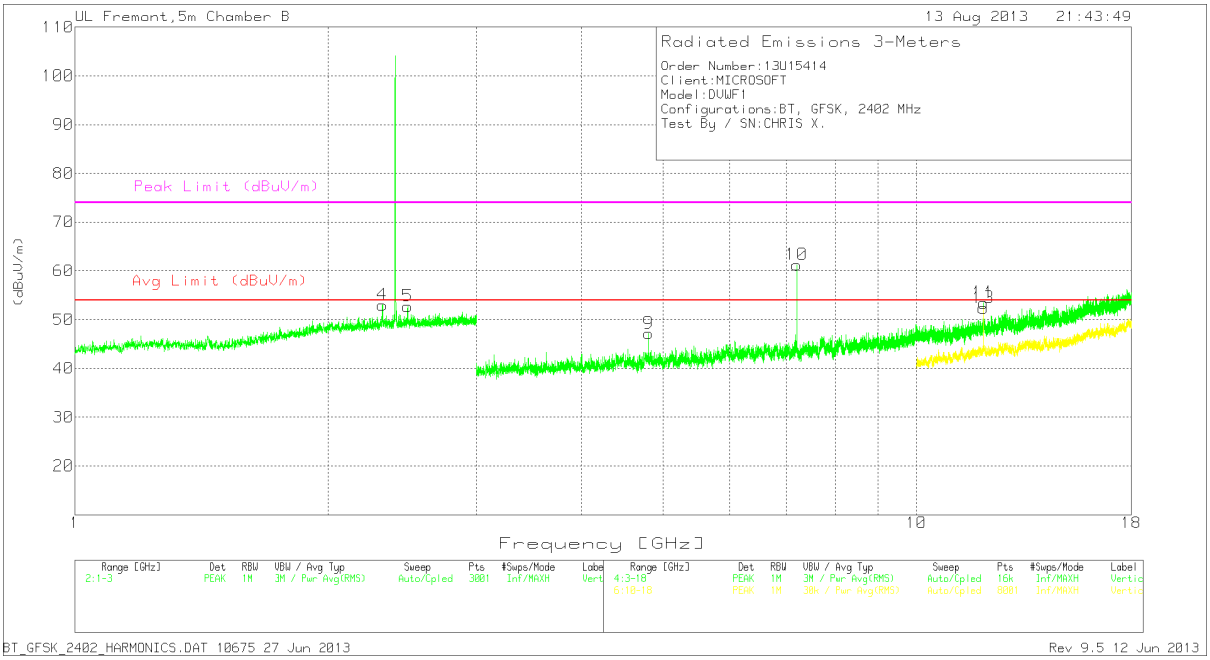
HARMONICS AND SPURIOUS EMISSIONS

GFSK, LOW CHANNEL, 2402 MHz

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.338	44.04	PK	28.5	-25.1	47.44	53.97	-6.53	74	-26.56	0-360	200	H
2.319	43.91	PK	32.2	-23.4	52.71	53.97	-1.26	74	-21.29	0-360	100	H
2.482*	44.41	PK	32.5	-23.2	-	-	-	-	-	0-360	200	H
2.319	44.17	PK	32.2	-23.4	52.97	53.97	-1	74	-21.03	0-360	200	V
2.485	43.46	PK	32.5	-23.2	52.76	53.97	-1.21	74	-21.24	0-360	200	V
4.804	43.67	PK	34.7	-29.4	48.97	53.97	-5	74	-25.03	0-360	200	H
7.205*	52.59	PK	35.8	-27.2	61.19	-	-	74	-12.81	0-360	100	H
12.011	35.86	PK	39.2	-22.2	52.86	-	-	74	-21.14	0-360	100	H
4.804	41.85	PK	34.7	-29.4	47.15	53.97	-6.82	74	-26.85	0-360	100	V
7.206*	52.57	PK	35.8	-27.1	61.27	-	-	74	-12.73	0-360	100	V
12.011	36.43	PK	39.2	-22.2	53.43	-	-	74	-20.57	0-360	100	V
12.009	33.04	PK	39.2	-22.2	50.04	53.97	-3.93	-	-	0-360	100	H
12.009	35.41	PK	39.2	-22.2	52.41	53.97	-1.56	-	-	0-360	100	V

PK - Peak detector
* - Non-Restricted Band – Covered by -20dBc conducted spurious

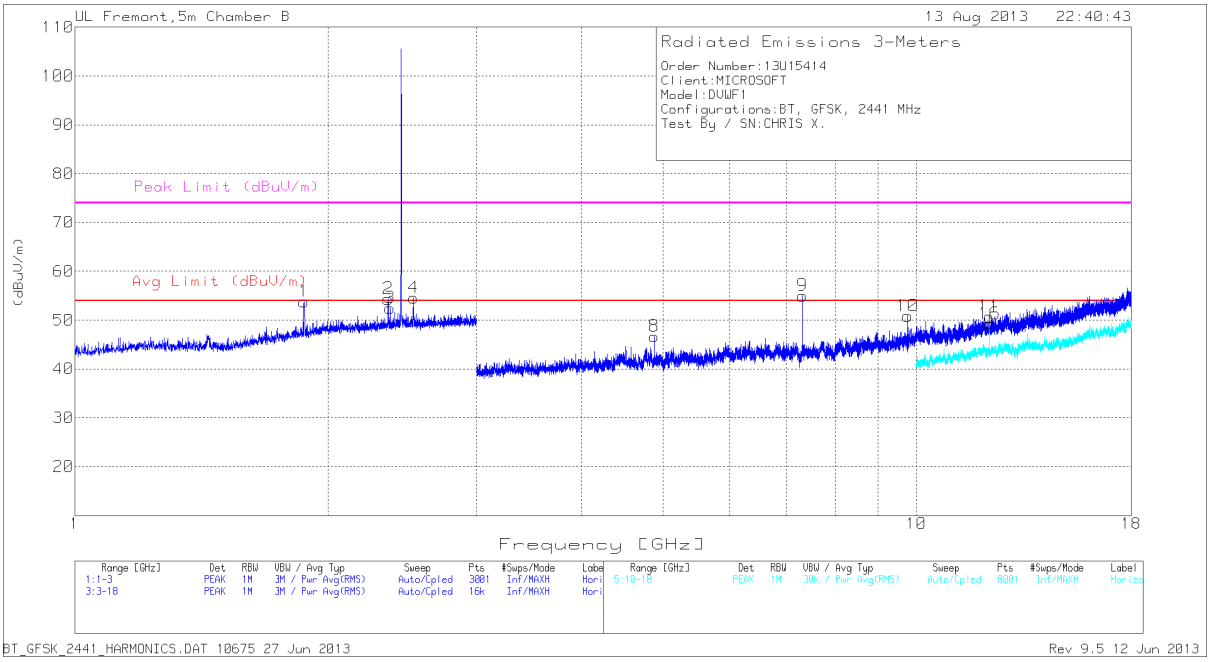
Average Measurements

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.321	37.13	PK	32.2	-23.4	45.93	53.97	-8.04	-	-	257	267	H
2.321	37.48	PK	32.2	-23.4	46.28	53.97	-7.69	-	-	300	196	V
2.484	32.33	PK	32.5	-23.2	41.63	53.97	-12.34	-	-	23	186	V
4.804	40.39	PK	34.7	-29.4	45.69	53.97	-8.28	-	-	163	102	H
12.011	21.61	PK	39.2	-22.2	38.61	53.97	-15.36	-	-	220	171	H
12.011	25.57	PK	39.2	-22.2	42.57	53.97	-11.4	-	-	231	108	V

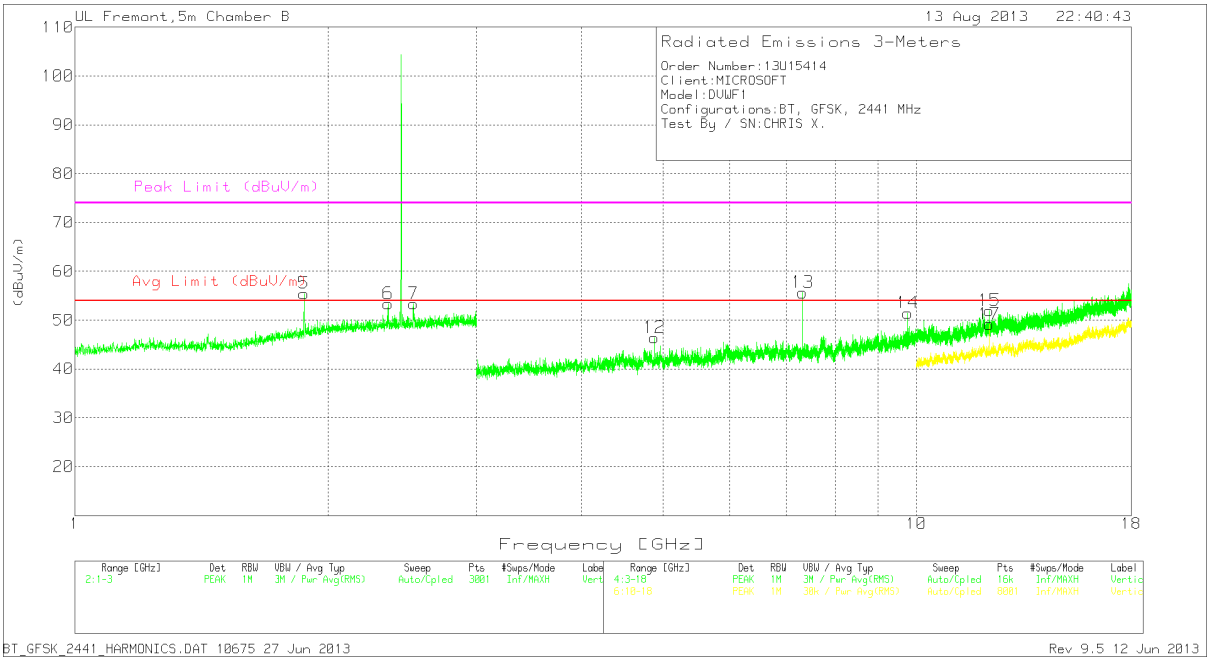
VB 1/T - Reduced Video Bandwidth

GFSK, MID CHANNEL, 2441 MHz

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.871*	47	PK	30.9	-24.1	53.8	-	-	-	-	0-360	200	H
2.356	45.33	PK	32.3	-23.3	54.33	53.97	.36	74	-19.67	0-360	100	H
2.369	43.49	PK	32.3	-23.3	52.49	53.97	-1.48	74	-21.51	0-360	200	H
2.527*	45.18	PK	32.5	-23.1	54.58	-	-	-	-	0-360	100	H
1.872*	48.77	PK	30.9	-24.2	55.47	-	-	-	-	0-360	100	V
2.356	44.37	PK	32.3	-23.3	53.37	53.97	-.6	74	-20.63	0-360	200	V
2.526*	43.84	PK	32.5	-23	53.34	-	-	-	-	0-360	200	V
4.881	43.05	PK	34.6	-31	46.65	53.97	-7.32	74	-27.35	0-360	100	H
7.323	47.29	PK	35.9	-28.2	54.99	53.97	1.02	74	-19.01	0-360	200	H
9.764*	37.35	PK	37.5	-24	50.85	-	-	-	-	0-360	100	H
12.206	34.23	PK	39.2	-22.7	50.73	-	-	74	-23.27	0-360	100	H
4.881	42.81	PK	34.6	-31	46.41	53.97	-7.56	74	-27.59	0-360	100	V
7.323	47.95	PK	35.9	-28.2	55.65	53.97	1.68	74	-18.35	0-360	100	V
9.765*	37.96	PK	37.5	-24	51.46	-	-	-	-	0-360	100	V
12.205	35.45	PK	39.2	-22.7	51.95	-	-	74	-22.05	0-360	100	V
12.206	32.76	PK	39.2	-22.7	49.26	53.97	-4.71	-	-	0-360	100	H
12.206	32.67	PK	39.2	-22.7	49.17	53.97	-4.8	-	-	0-360	100	V

PK - Peak detector
* - Non-Restricted Band – Covered by -20dBc conducted spurious

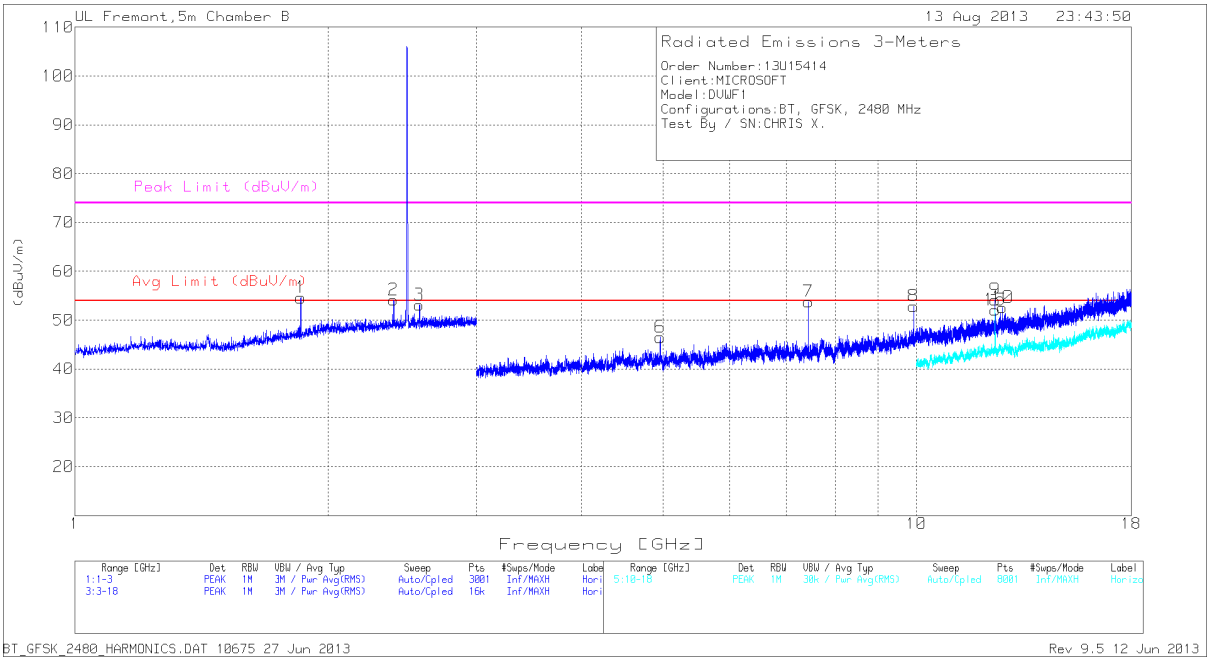
Average Measurements

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.356	36.84	VB1T	32.3	-23.3	45.84	53.97	-8.13	-	-	264	149	H
2.374	30.79	VB1T	32.3	-23.3	39.79	53.97	-14.18	-	-	353	400	H
2.356	32.54	VB1T	32.3	-23.3	41.54	53.97	-12.43	-	-	162	266	V
7.323	36.99	VB1T	35.9	-28.2	44.69	53.97	-9.28	-	-	337	136	H
12.204	29.31	VB1T	39.2	-22.7	45.81	53.97	-8.16	-	-	339	134	H
7.323	38.67	VB1T	35.9	-28.2	46.47	53.97	-7.5	-	-	357	104	V
12.206	28.09	VB1T	39.2	-22.7	44.59	53.97	-9.38	-	-	223	111	V

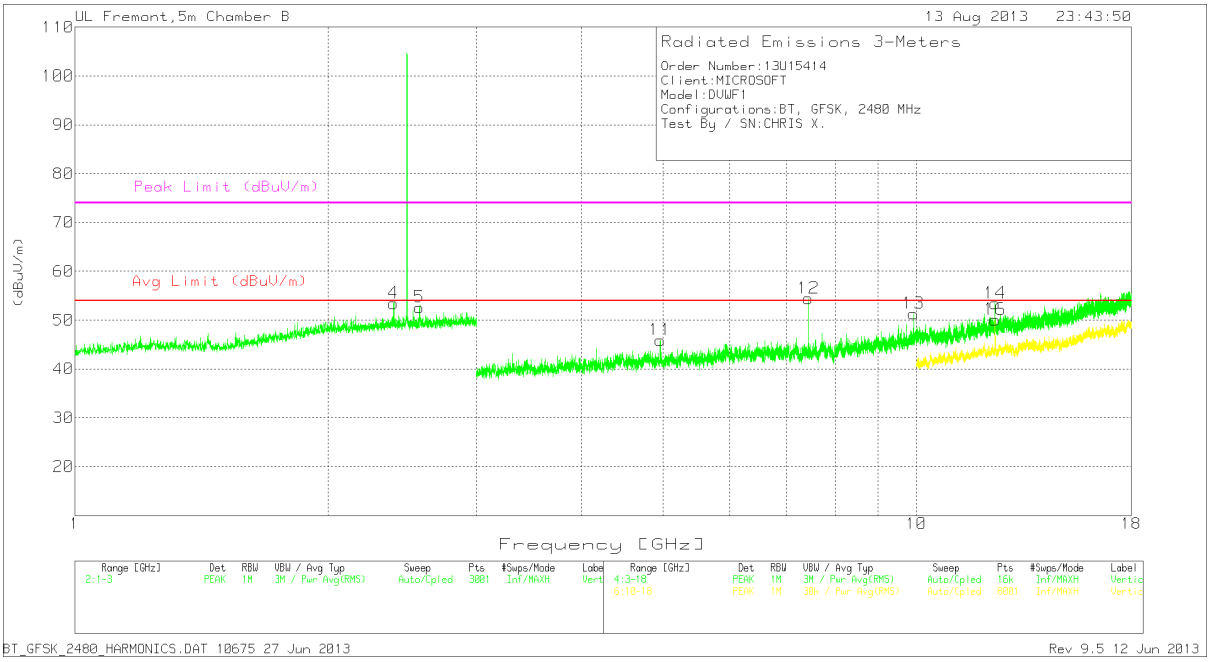
VB 1/T - Reduced Video Bandwidth

GFSK, HIGH CHANNEL, 2480 MHz

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.855*	47.89	PK	30.8	-24.1	54.59	-	-	-	-	0-360	100	H
2.391	45.23	PK	32.3	-23.4	54.13	53.97	.16	74	-19.87	0-360	100	H
2.566*	43.68	PK	32.6	-23.2	53.08	-	-	-	-	0-360	200	H
2.391	44.53	PK	32.3	-23.4	53.43	53.97	-.54	74	-20.57	0-360	100	V
2.566*	43.24	PK	32.6	-23.2	52.64	-	-	-	-	0-360	200	V
4.961	42.1	PK	34.6	-30.2	46.5	53.97	-7.47	74	-27.5	0-360	100	H
7.441	44.39	PK	36	-26.6	53.79	53.97	-.18	74	-20.21	0-360	200	H
9.919*	39.29	PK	37.7	-24.1	52.89	-	-	-	-	0-360	100	H
12.402	37.27	PK	39.2	-22.3	54.17	-	-	74	-19.83	0-360	100	H
12.653	35.19	PK	39.2	-21.8	52.59	53.97	-1.38	74	-21.41	0-360	100	H
4.96	41.64	PK	34.6	-30.3	45.94	53.97	-8.03	74	-28.06	0-360	100	V
7.44	45.05	PK	36	-26.6	54.45	53.97	.48	74	-19.55	0-360	100	V
9.919*	37.74	PK	37.7	-24.1	51.34	-	-	-	-	0-360	100	V
12.401	36.54	PK	39.2	-22.3	53.44	-	-	74	-20.56	0-360	100	V
12.39*	35.16	PK	39.2	-22.3	52.06	53.97	-1.91	-	-	0-360	100	H
12.4	33.2	PK	39.2	-22.3	50.1	53.97	-3.87	-	-	0-360	100	V

PK - Peak detector
* - Non-Restricted Band – Covered by -20dBc conducted spurious

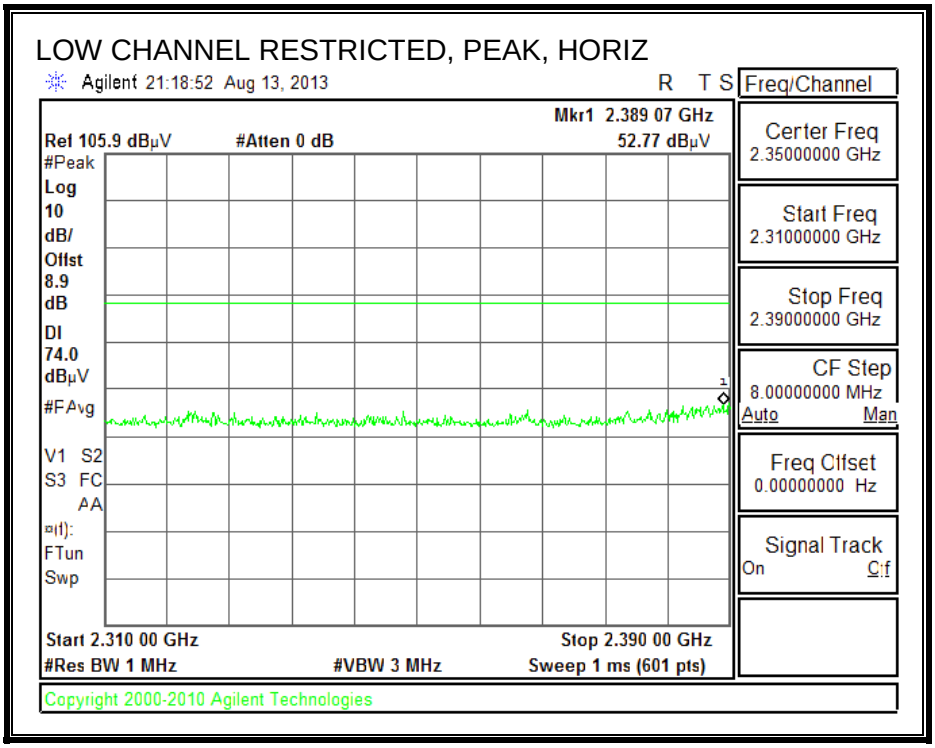
Average Measurements

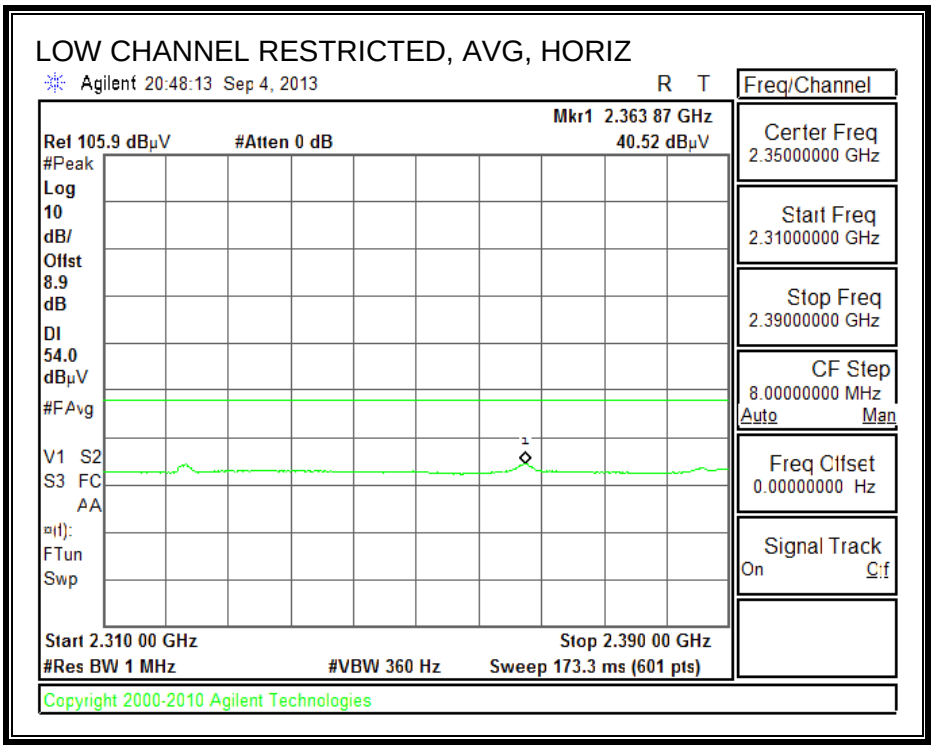
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.391	37.25	VB1T	32.3	-23.4	46.15	53.97	-7.82	-	-	246	214	H
2.391	36.35	VB1T	32.3	-23.4	45.25	53.97	-8.72	-	-	312	179	V
7.44	40.57	VB1T	36	-26.6	49.97	53.97	-4	-	-	5	178	H
12.401	30.56	VB1T	39.2	-22.3	47.46	53.97	-6.51	-	-	338	140	H
12.657	23.31	VB1T	39.2	-21.8	40.71	53.97	-13.26	-	-	312	268	H
7.44	32.54	VB1T	36	-26.6	41.94	53.97	-12.03	-	-	27	375	V
12.401	24.23	VB1T	39.2	-22.3	41.13	53.97	-12.84	-	-	108	118	V

VB 1/T - Reduced Video Bandwidth

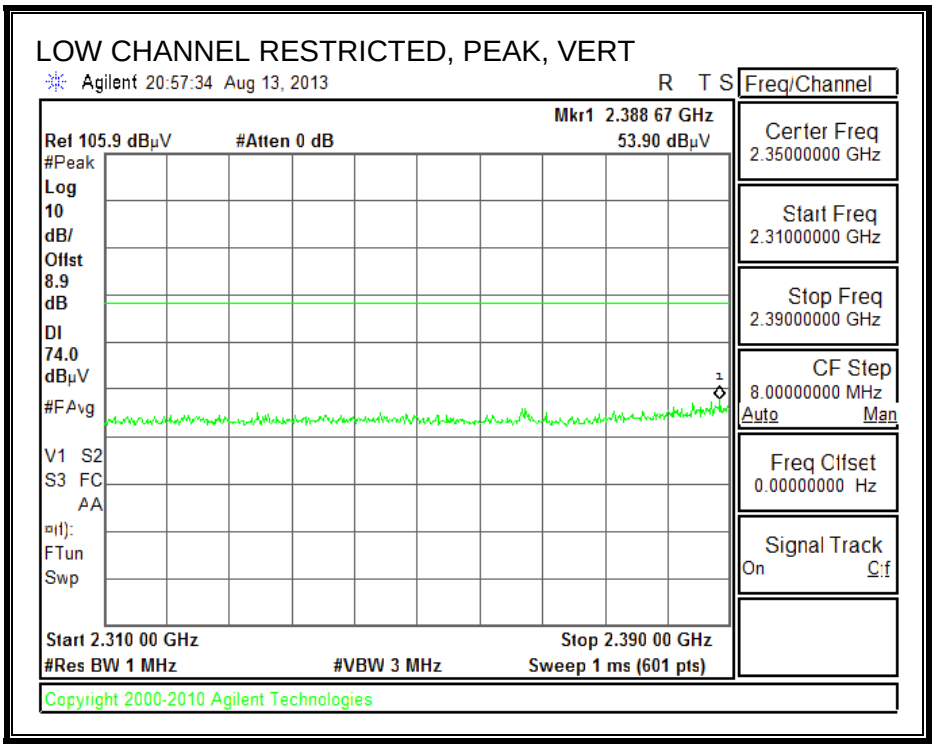
9.2.2. ENHANCED DATA RATE 8PSK MODULATION

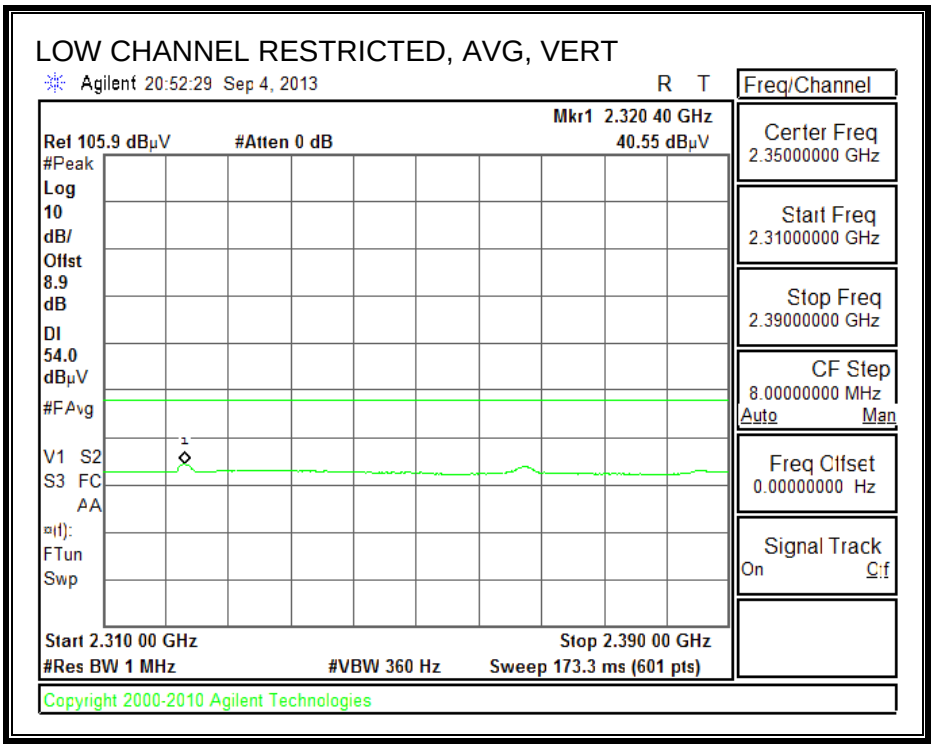
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



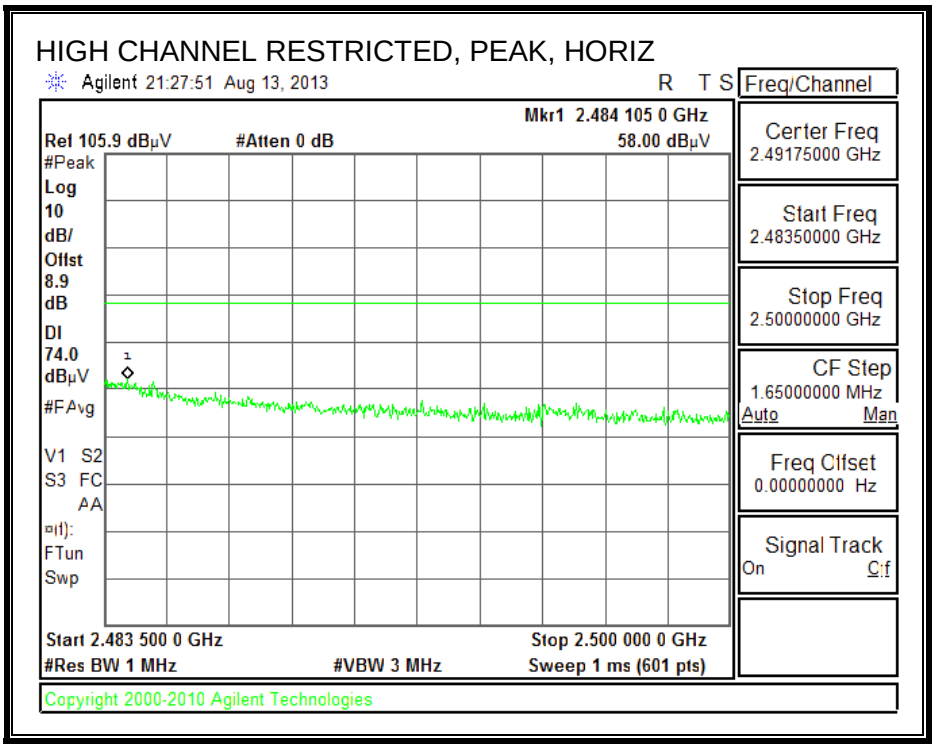


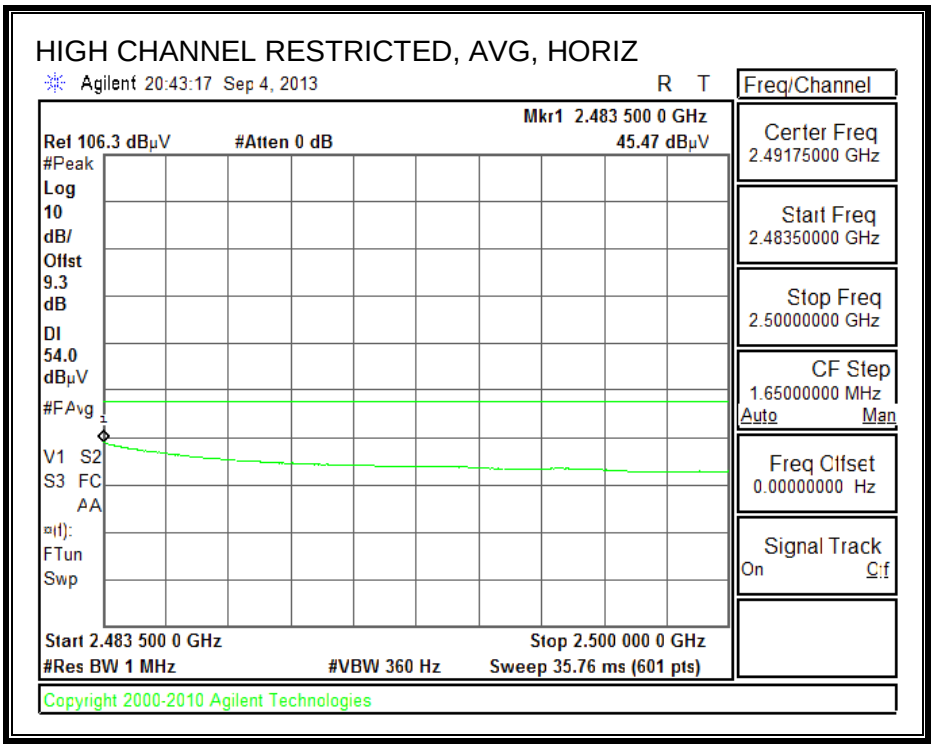
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



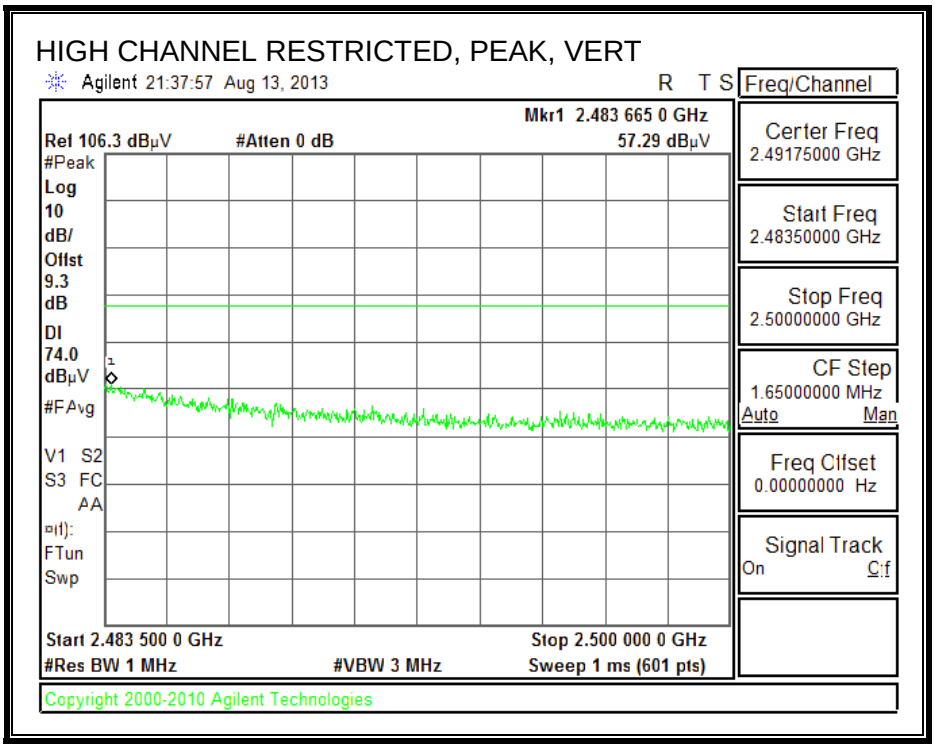


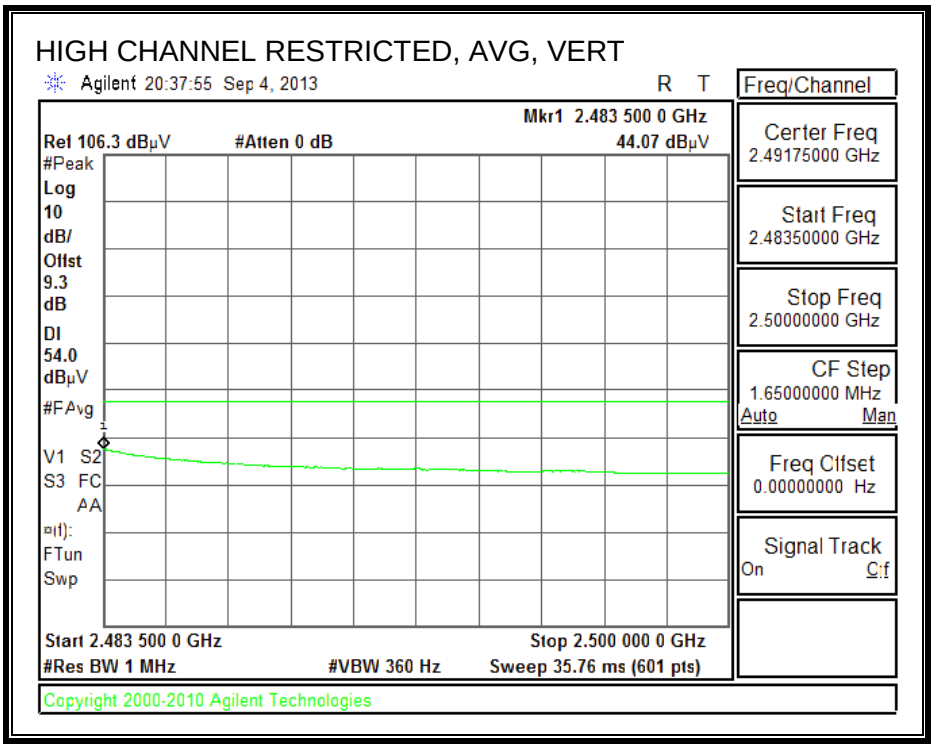
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

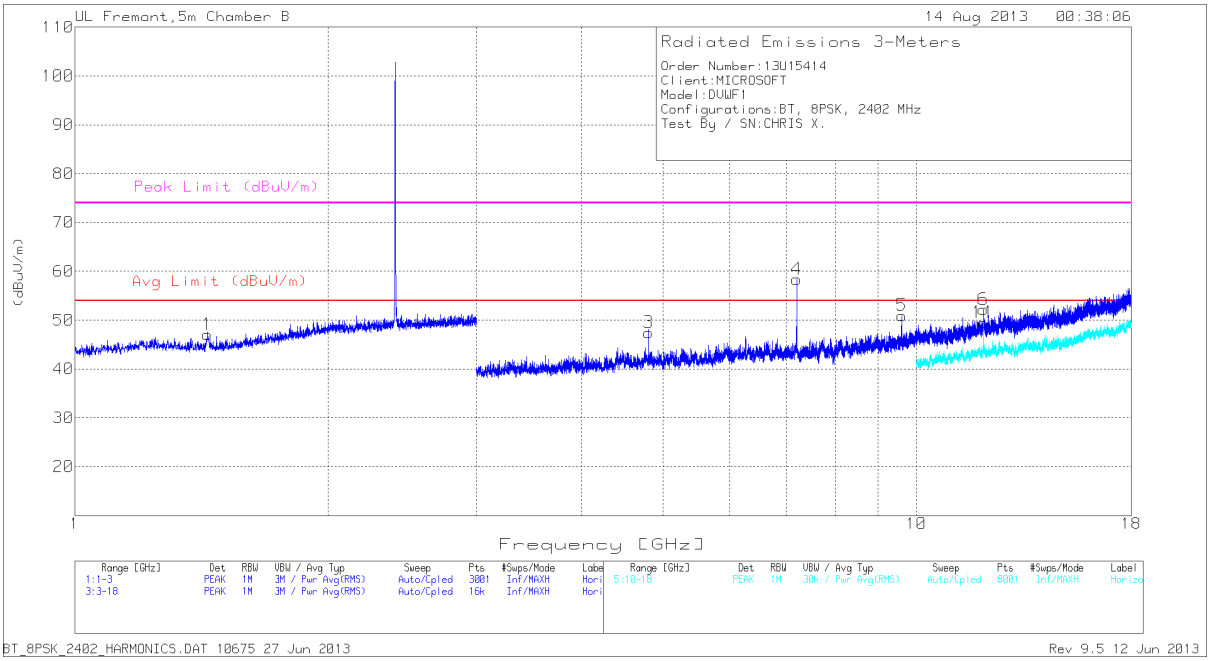




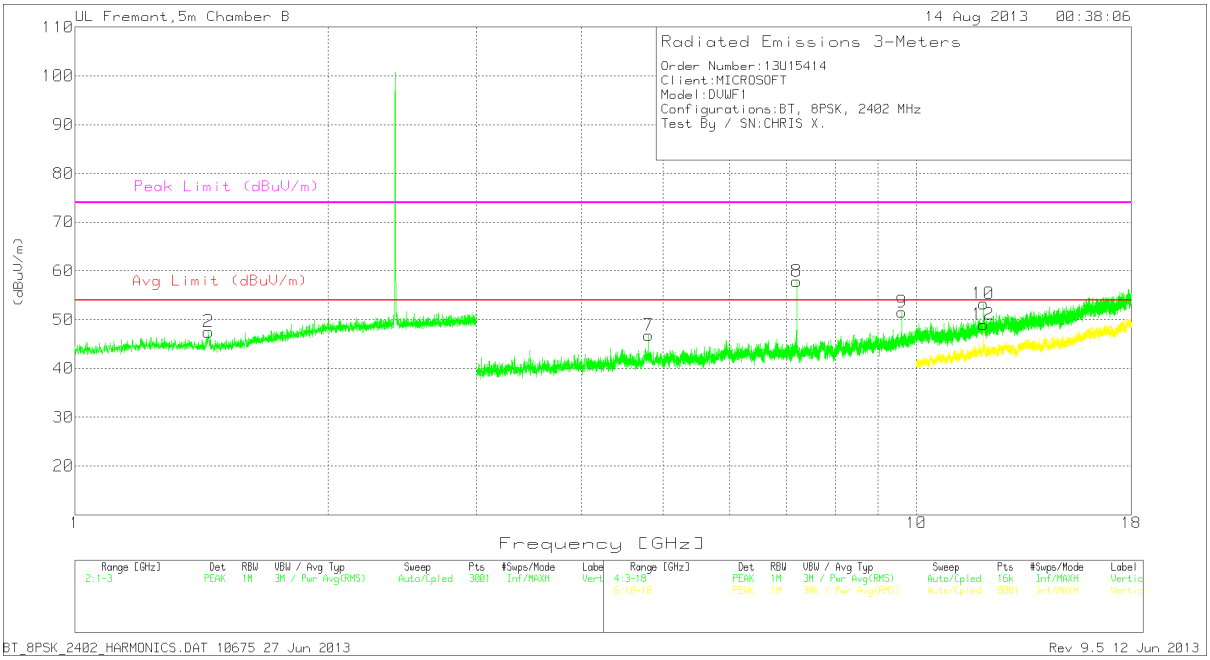
HARMONICS AND SPURIOUS EMISSIONS

8PSK, LOW CHANNEL, 2402 MHz

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.437	43.45	PK	28.3	-24.7	47.05	53.97	-6.92	74	-26.95	0-360	200	H
1.441	44.02	PK	28.3	-24.8	47.52	53.97	-6.45	74	-26.48	0-360	100	V
4.805	42.23	PK	34.7	-29.5	47.43	53.97	-6.54	74	-26.57	0-360	100	H
7.205*	49.76	PK	35.8	-27.2	58.36	-	-	-	-	0-360	100	H
9.606*	37.83	PK	37.3	-24.2	50.93	-	-	-	-	0-360	100	H
12.009	35.2	PK	39.2	-22.2	52.2	-	-	74	-21.8	0-360	100	H
4.804	41.49	PK	34.7	-29.4	46.79	53.97	-7.18	74	-27.21	0-360	200	V
7.205*	49.28	PK	35.8	-27.2	57.88	-	-	-	-	0-360	100	V
9.607*	38.44	PK	37.3	-24.2	51.54	-	-	-	-	0-360	100	V
12.01	36.29	PK	39.2	-22.2	53.29	-	-	74	-20.71	0-360	100	V
12.011	32.49	PK	39.2	-22.2	49.49	53.97	-4.48	-	-	0-360	100	H
12.011	32.02	PK	39.2	-22.2	49.02	53.97	-4.95	-	-	0-360	100	V

PK - Peak detector
* - Non-Restricted Band – Covered by -20dBc conducted spurious

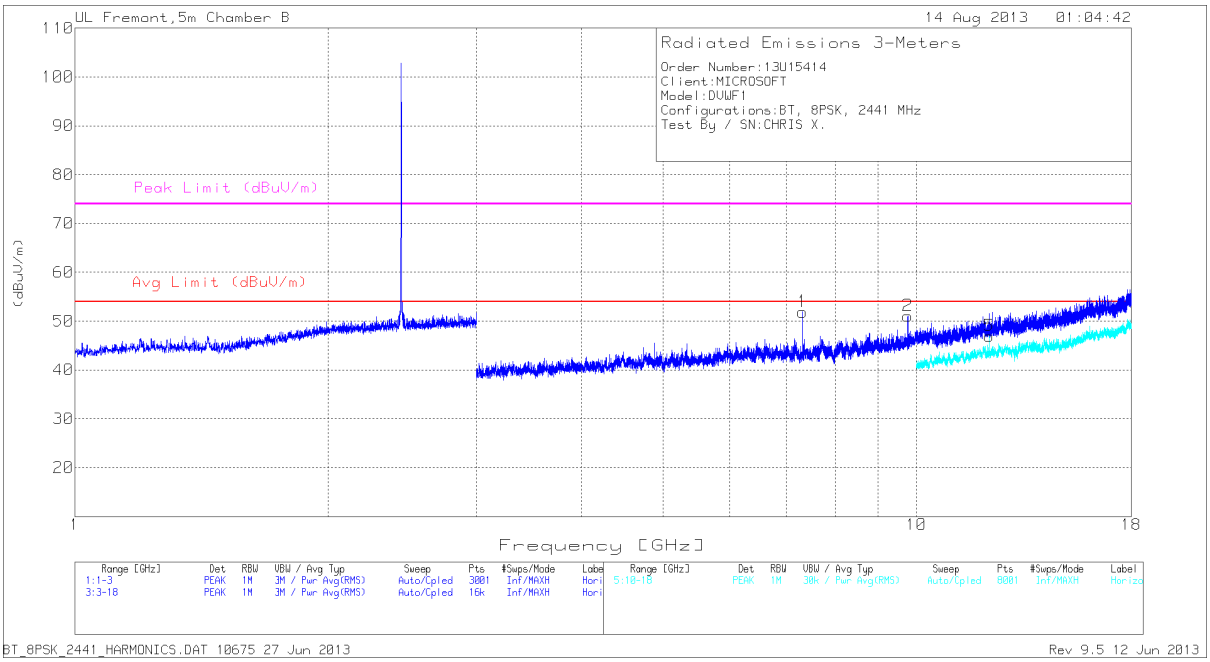
Average Measurements

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
12.01	26.63	VB1T	39.2	-22.2	43.63	53.97	-10.34	-	-	64	120	H
12.01	26.8	VB1T	39.2	-22.2	43.8	53.97	-10.17	-	-	130	104	V

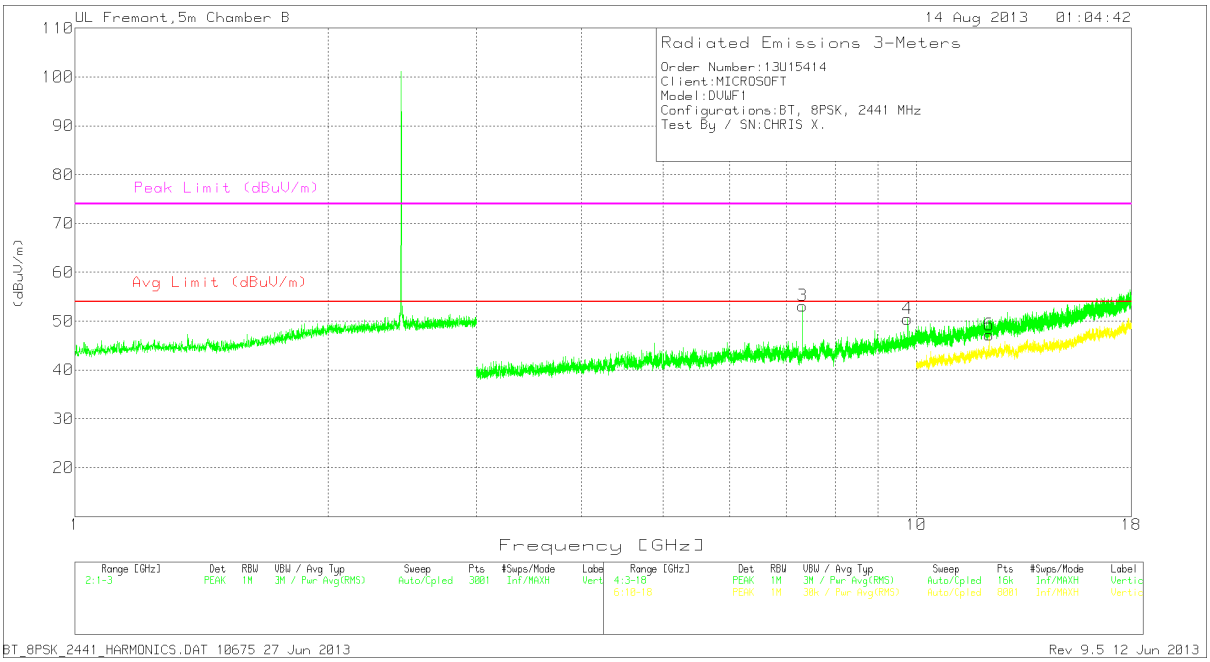
VB 1/T - Reduced Video Bandwidth

8PSK, MID CHANNEL, 2441 MHz

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7.323	44.2	PK	35.9	-28.2	51.9	53.97	-2.07	74	-22.1	0-360	200	H
9.766*	37.59	PK	37.5	-24	51.09	-	-	-	-	0-360	100	H
7.323	45.45	PK	35.9	-28.2	53.15	53.97	-.82	74	-20.85	0-360	100	V
9.762*	36.97	PK	37.5	-24	50.47	-	-	-	-	0-360	100	V
12.206	30.45	PK	39.2	-22.7	46.95	53.97	-7.02	74	-27.05	0-360	100	H
12.206	30.68	PK	39.2	-22.7	47.18	53.97	-6.79	74	-26.82	0-360	100	V

PK - Peak detector
* - Non-Restricted Band – Covered by -20dBc conducted spurious

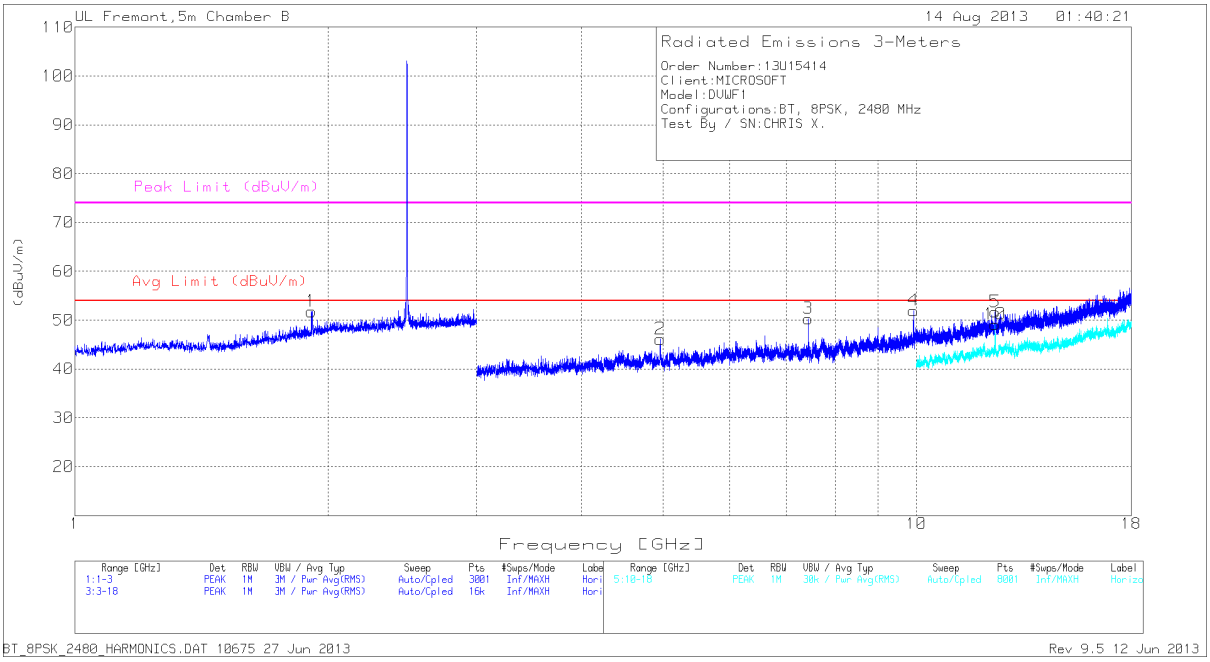
Average Measurements

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7.323	39.31	VB1T	35.9	-28.2	47.01	53.97	-6.96	-	-	228	151	H
7.323	38.09	VB1T	35.9	-28.2	45.79	53.97	-8.18	-	-	216	141	V

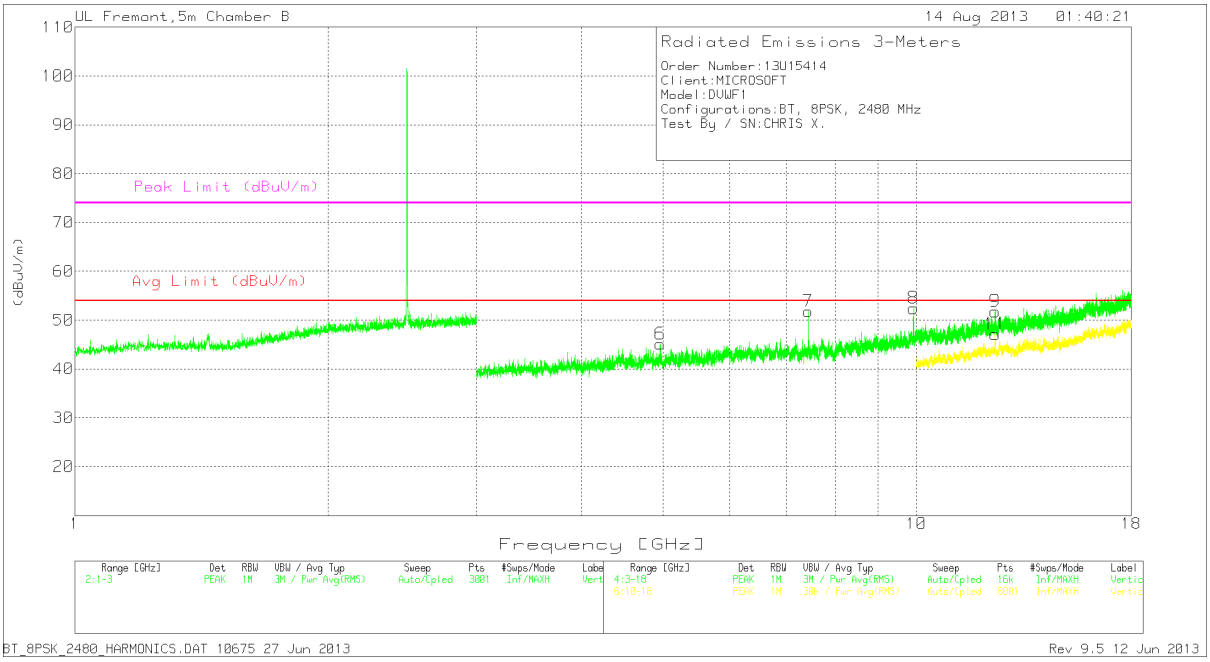
VB 1/T - Reduced Video Bandwidth

8PSK, HIGH CHANNEL, 2480 MHz

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.91*	44.68	PK	31.2	-24.1	51.78	-	-	-	-	0-360	200	H
4.96	41.8	PK	34.6	-30.3	46.1	53.97	-7.87	74	-27.9	0-360	100	H
7.44	40.92	PK	36	-26.6	50.32	53.97	-3.65	74	-23.68	0-360	100	H
9.919*	38.39	PK	37.7	-24.1	51.99	-	-	-	-	0-360	100	H
12.4	34.77	PK	39.2	-22.3	51.67	-	-	74	-22.33	0-360	100	H
4.96	40.83	PK	34.6	-30.3	45.13	53.97	-8.84	74	-28.87	0-360	200	V
7.44	42.41	PK	36	-26.6	51.81	53.97	-2.16	74	-22.19	0-360	100	V
9.92*	38.83	PK	37.7	-24.1	52.43	-	-	-	-	0-360	100	V
12.403	34.86	PK	39.2	-22.3	51.76	-	-	74	-22.24	0-360	200	V
12.4	32.24	PK	39.2	-22.3	49.14	53.97	-4.83	-	-	0-360	100	H
12.401	30.22	PK	39.2	-22.3	47.12	53.97	-6.85	74	-26.88	0-360	100	V

PK - Peak detector
* - Non-Restricted Band – Covered by -20dBc conducted spurious

Average Measurements

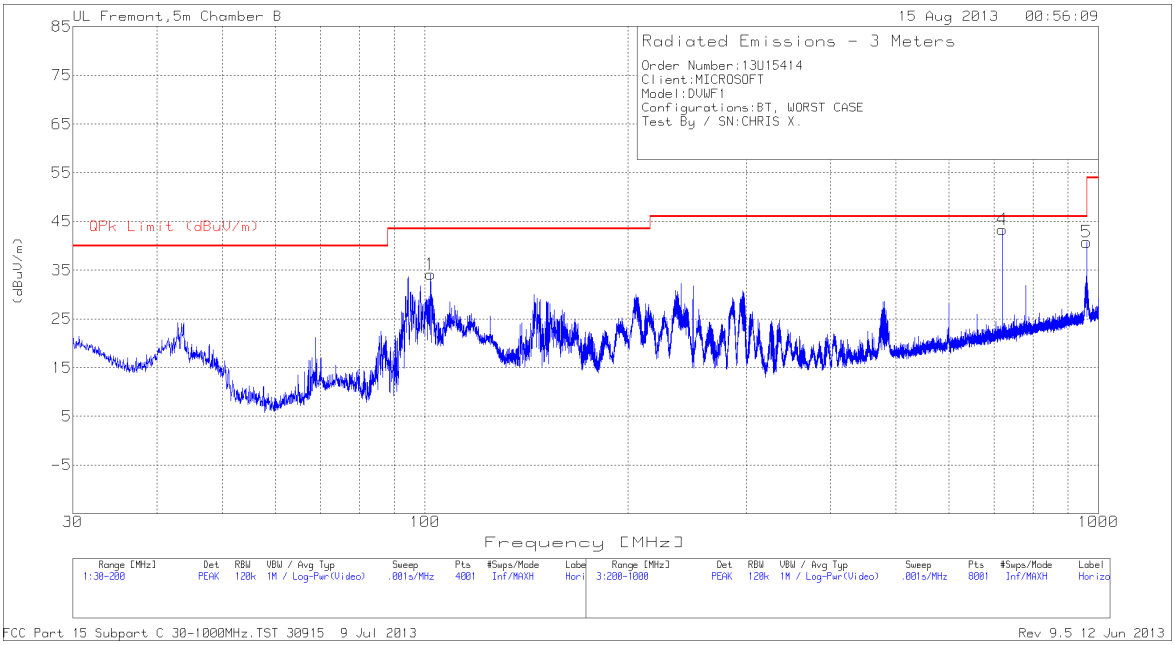
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7.44	37.76	VB1T	36	-26.6	47.16	53.97	-6.81	-	-	340	124	H
12.4	29.29	VB1T	39.2	-22.3	46.19	53.97	-7.78	-	-	233	124	H
7.44	37.94	VB1T	36	-26.6	47.34	53.97	-6.63	-	-	0	140	V
12.4	24.42	VB1T	39.2	-22.3	41.32	53.97	-12.65	-	-	290	180	V

VB 1/T - Reduced Video Bandwidth

9.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT

HORIZONTAL AND VERTICAL DATA

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T243 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
101.91	51.53	PK	10.6	-28	34.13	43.52	-9.39	0-360	300	H
43.8125*	53.31	PK	10.7	-28.7	35.31	-	-	0-360	100	V
145.26	50.42	PK	12.6	-27.6	35.42	43.52	-8.1	0-360	100	V
720*	47.64	PK	20.3	-24.6	43.34	-	-	0-360	100	H
960	40.78	PK	22.7	-22.7	40.78	46.02	-5.24	0-360	100	H
720	42.82	PK	20.3	-24.6	38.52	46.02	-7.5	0-360	200	V
960	39.18	PK	22.7	-22.7	39.18	46.02	-6.84	0-360	200	V

PK - Peak detector
* - Non-Restricted Band – Covered by -20dBc conducted spurious

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T243 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
960.0282	43.21	QP	22.7	-22.7	43.21	53.97	-	-	138	H

QP - Quasi-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

Line-L1 .15 - 30MHz

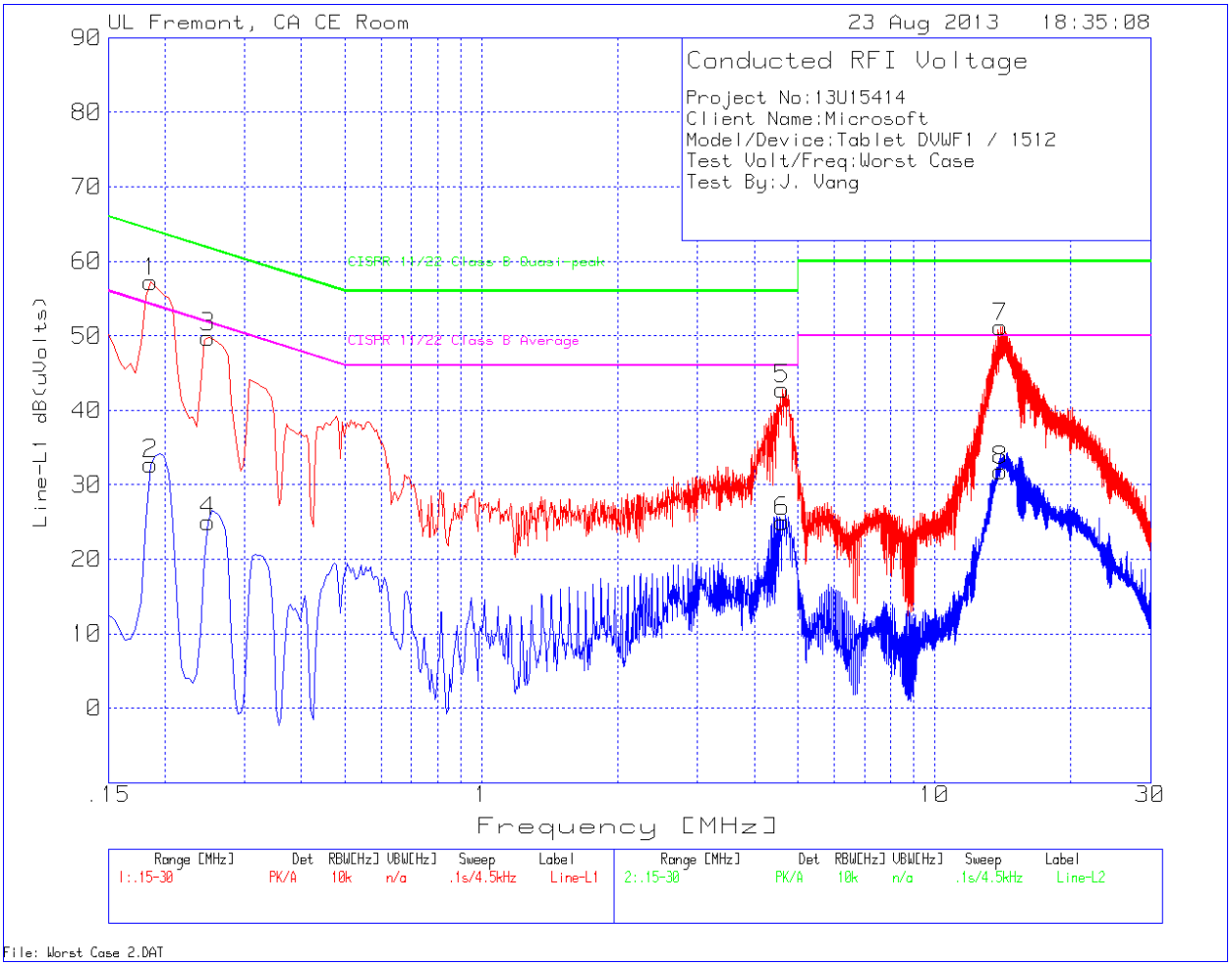
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin to Limit (dB)	CISPR 11/22 Class B Average	Margin to Limit (dB)
1	.186	57.09	PK	.1	0	57.19	64.2	-7.01	-	-
2	.186	32.63	Av	.1	0	32.73	-	-	54.2	-21.47
3	.249	49.72	PK	.1	0	49.82	61.8	-11.98	-	-
4	.249	24.89	Av	.1	0	24.99	-	-	51.8	-26.81
5	4.623	42.61	PK	.1	.1	42.81	56	-13.19	-	-
6	4.623	24.77	Av	.1	.1	24.97	-	-	46	-21.03
7	14.0145	50.73	PK	.2	.2	51.13	60	-8.87	-	-
8	14.0145	31.43	Av	.2	.2	31.83	-	-	50	-18.17

Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dB(uVolts)	CISPR 11/22 Class B Quasi-peak	Margin to Limit (dB)	CISPR 11/22 Class B Average	Margin to Limit (dB)
9	.186	57.51	PK	.1	0	57.61	64.2	-6.59	-	-
10	.186	33.68	Av	.1	0	33.78	-	-	54.2	-20.42
11	.249	49.88	PK	.1	0	49.98	61.8	-11.82	-	-
12	.249	26.27	Av	.1	0	26.37	-	-	51.8	-25.43
13	4.6905	41.47	PK	.1	.1	41.67	56	-14.33	-	-
14	4.6905	22.75	Av	.1	.1	22.95	-	-	46	-23.05
15	14.0055	49.21	PK	.2	.2	49.61	60	-10.39	-	-
16	14.0055	30.18	Av	.2	.2	30.58	-	-	50	-19.42

PK - Peak detector
Av - average detection

LINE 1 RESULTS



LINE 2 RESULTS