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

CERTIFICATION TEST REPORT

FOR

2.4 GHZ SHORT RANGE RF MODULE

MODEL NUMBER: 1410

FCC ID: C3K1410
IC: 3048A-1410

REPORT NUMBER: 09U12932-7, Revision A

ISSUE DATE: FEBRUARY 18, 2010

Prepared for
MICROSOFT CORPORATION
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	02/18/10	Initial Issue	F. Ibrahim
A	02/18/10	Revised radiated emissions data above 1 GHz, BE data, Worst-case configuration, EUT description, setup diagram and radiated emissions setup photos	F. Ibrahim

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 2.4 GHZ SHORT RANGE RF MODULE.

MODEL: 1410

SERIAL NUMBER: X821256-006:-EV38 SB136 (CONDUCTED UNITS)
X821256-006:-EV3B SA003 (RADIATED UNITS)
Host: 906444F1150088600305 (RADIATED TEST ONLY)

DATE TESTED: NOVEMBER 17 - DECEMBER 01, 2009
FEBRUARY 16, 2010

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

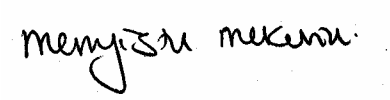
Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

FRANK IBRAHIM
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:



MENGISTU MEKURIA
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Power Line Conducted Emission	+/- 2.3 dB
Radiated Emission	+/- 3.4 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 2.4 GHz Short Range RF frequency hopping transceiver Module.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	EUT	Output Power (dBm)	Output Power (mW)
2402 - 2482	EV38 SB136	3.56	2.27

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Patch Antenna that soldered to the printed circuit board.
The antenna has a maximum gain of 5.0 dBi

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Wireless Device Test v1.1.2.
The driver used during the test is version 3.20.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at 2402 MHz.

The EUT is a desktop device. All radiated tests were conducted based on the normal or natural orientation of the EUT.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
NoteBook	DELL	PP10S	CN-0C8862-48643-57L-1789
AC Adaptor	DELL	N5825	CN-0N5825-48661-575-A028
NoteBook	DELL	D620	(01)7898349890528
AC Adaptor	DELL	LA65NS0-00	CN-0DF263-71615-72M-2925
Level Converter with USB	MICROSOFT	N/A	N/A

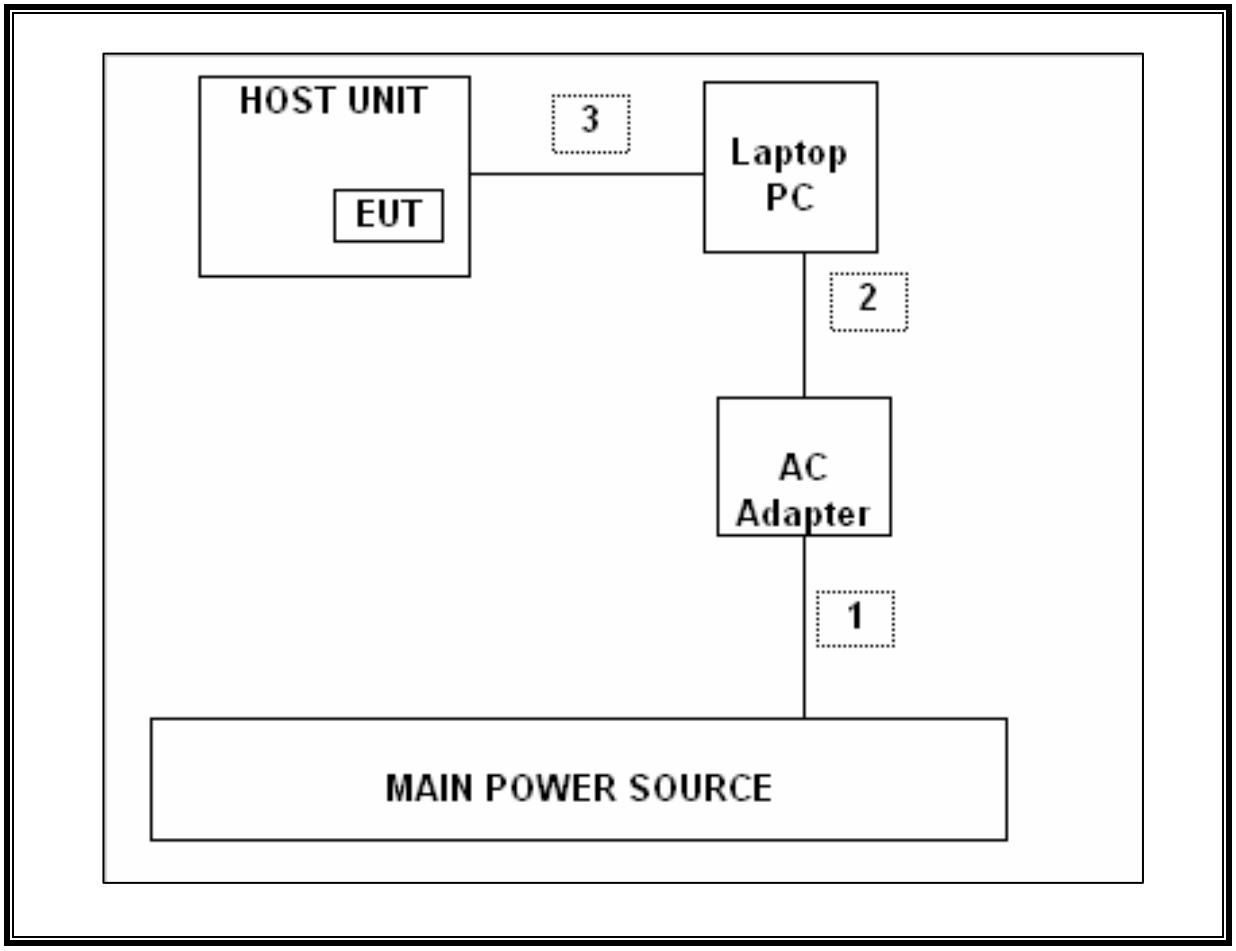
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	US 115V	Un-shielded	0.9 m	N/A
2	DC	1	DC	Un-shielded	1.8m	N/A
3	USB	1	USB	Un-shielded	0.6m	N/A

TEST SETUP

The EUT is test as stand alone unit.

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 Due**
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	08/04/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	08/04/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	07/06/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00778	07/06/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	08/04/10
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	08/24/10
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/31/10
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01161	12/09/10
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	05/06/11
Antenna, Horn, 18 GHz	EMCO	3115	C00783	07/29/10
Antenna, Horn, 18 GHz	EMCO	3115	C00945	07/29/10
Antenna, Horn, 18 GHz	EMCO	3115	C00872	07/29/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01171	07/14/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/14/10
Peak Power Sensor	Boonton	57318	N/A	02/02/10
Peak Power Meter	Boonton	4541	C01186	01/19/10
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/06/10

7. ANTENNA PORT TEST RESULTS

7.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

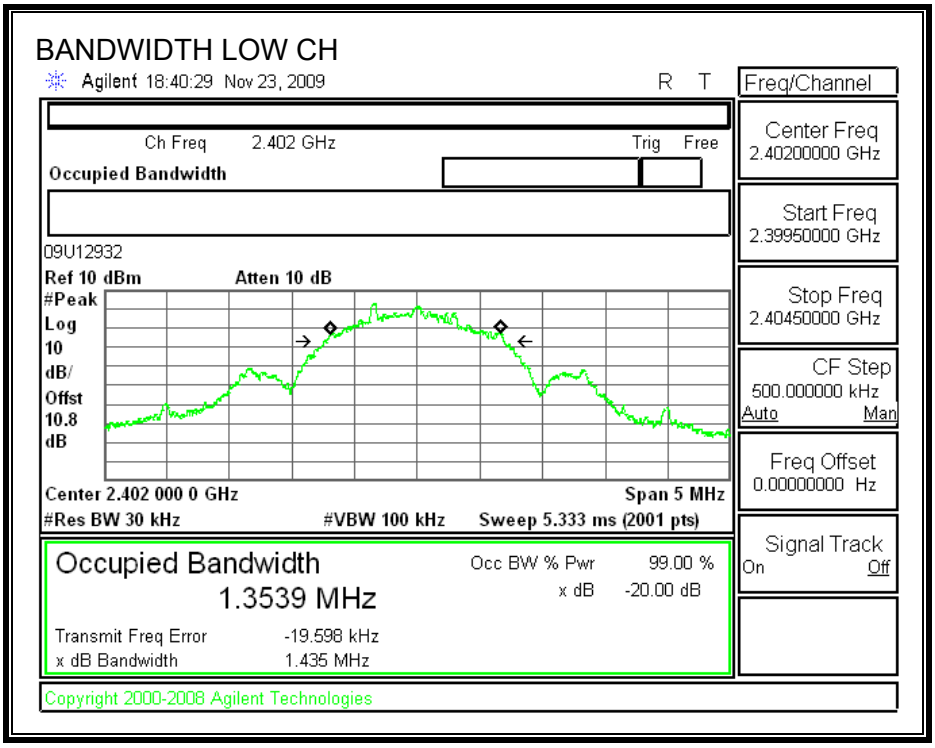
TEST PROCEDURE

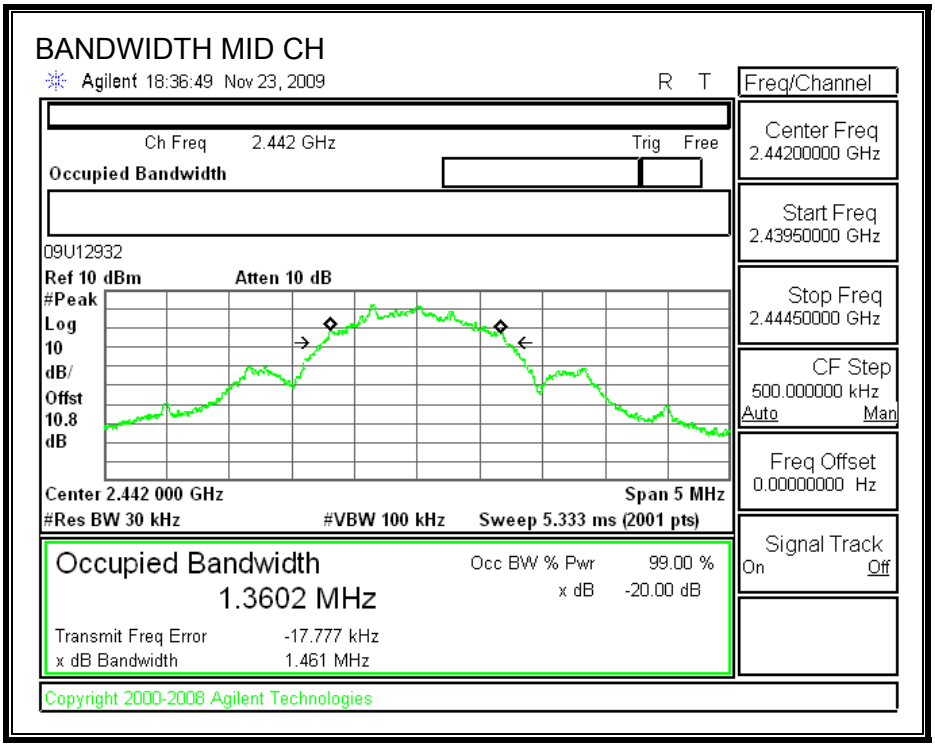
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

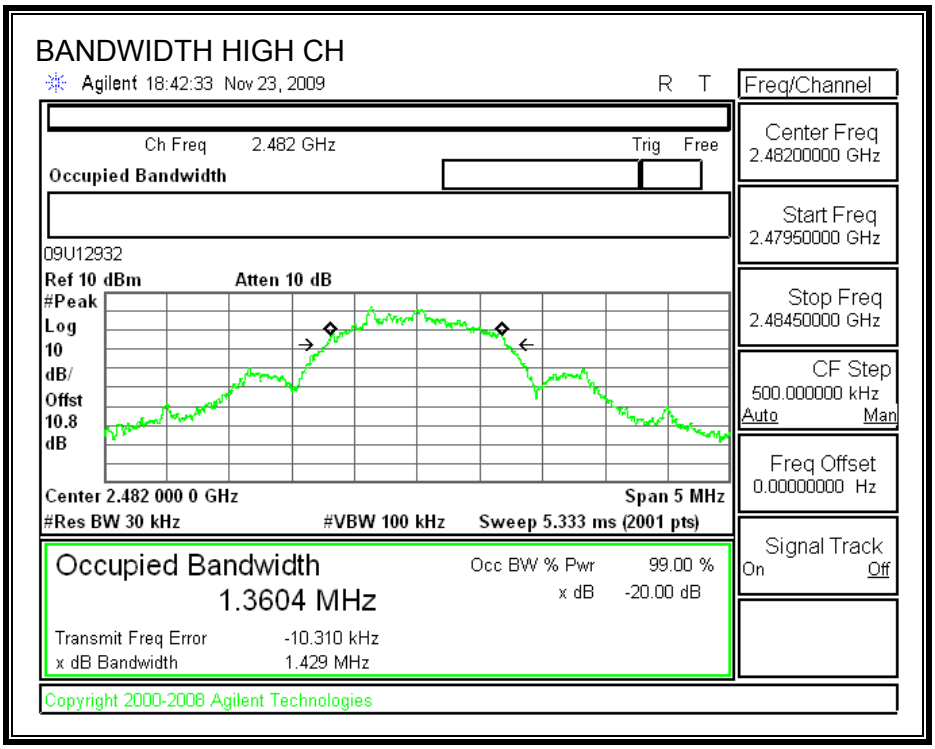
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.435	1.3325
Middle	2442	1.461	1.3325
High	2482	1.429	1.3329

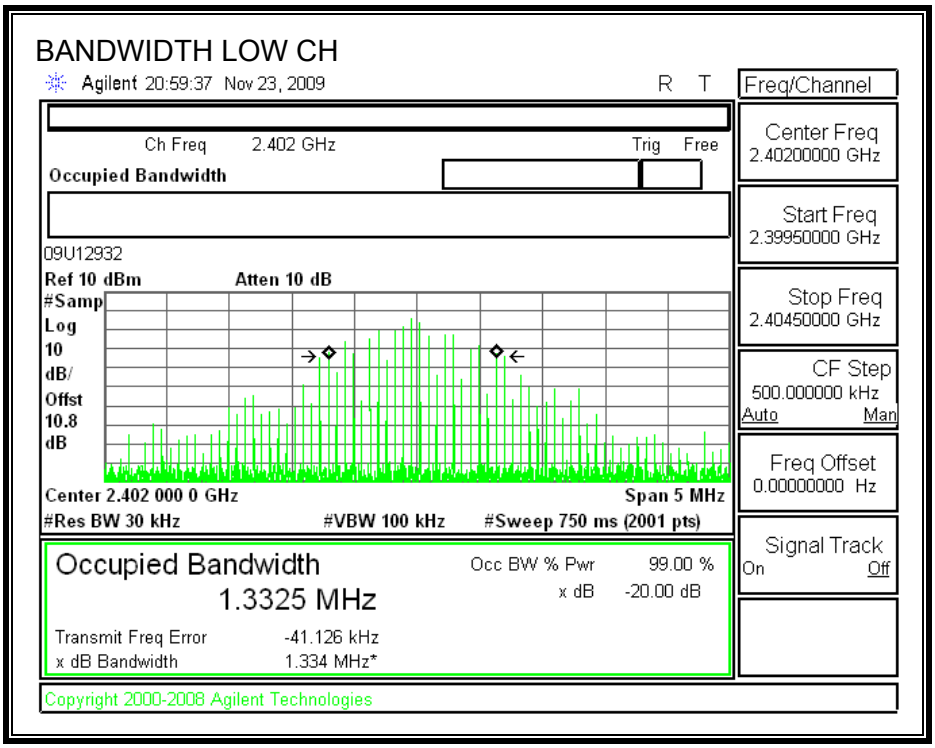
20 dB BANDWIDTH



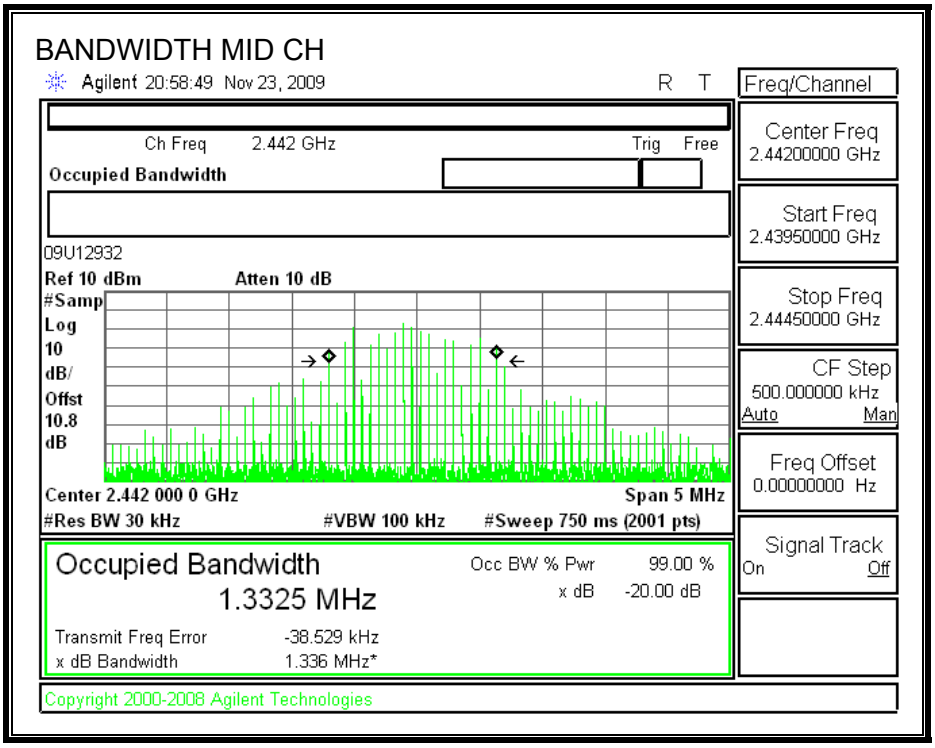




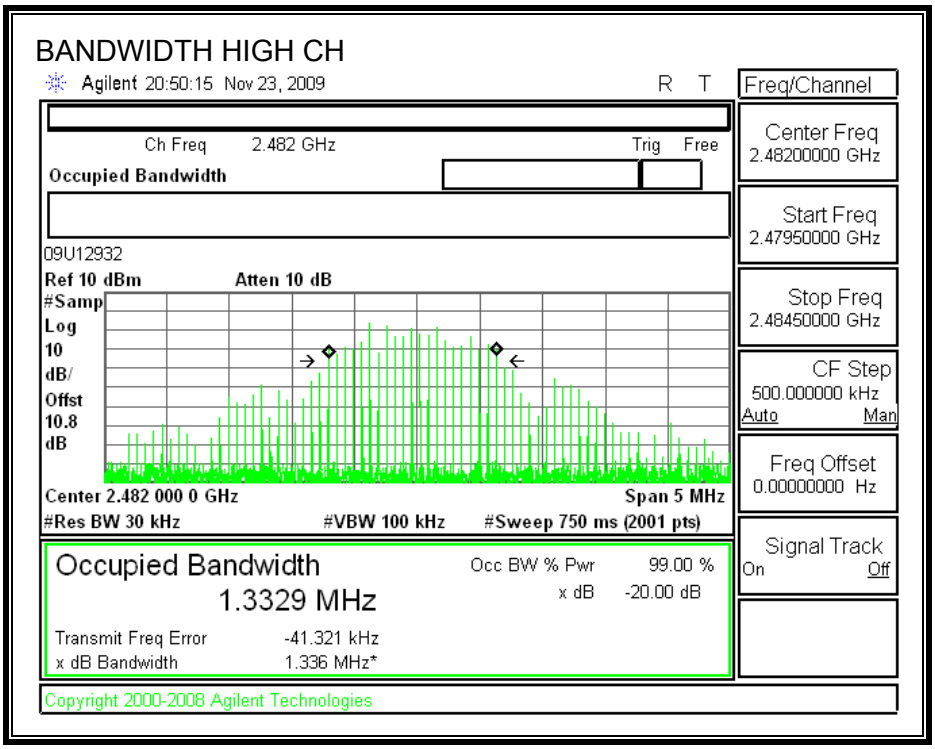
99% BANDWIDTH



BANDWIDTH MID CH



BANDWIDTH HIGH CH



7.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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

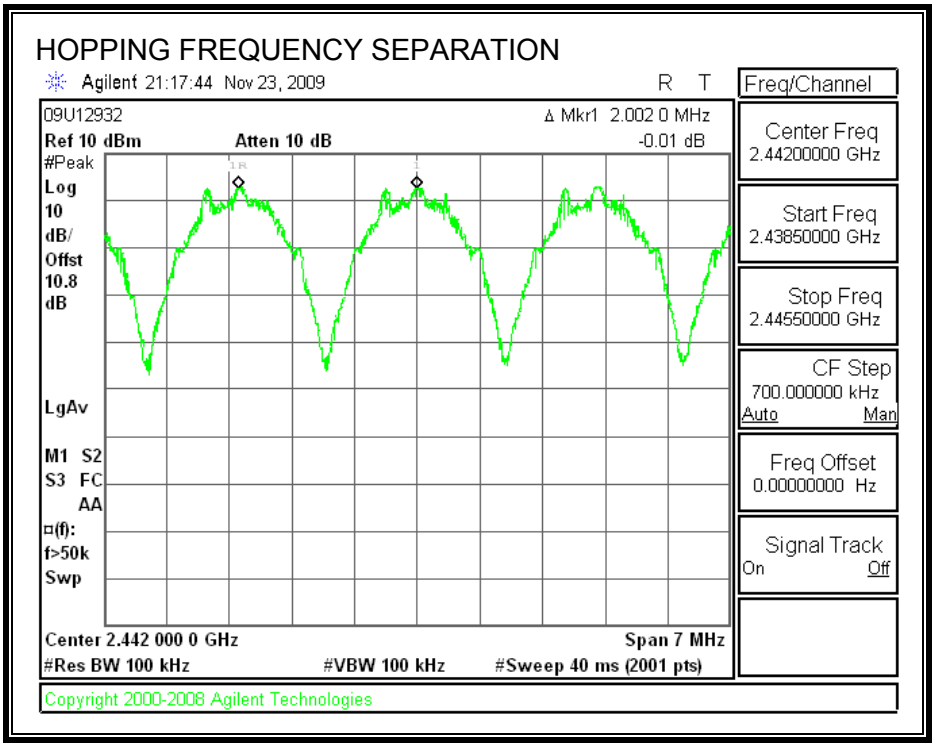
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

RESULTS

HOPPING FREQUENCY SEPARATION



7.3. 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

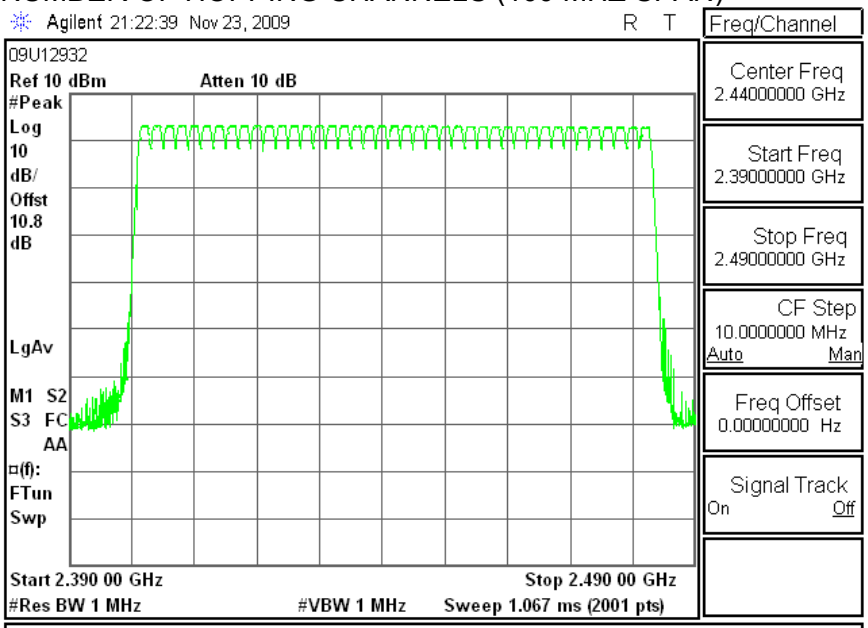
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

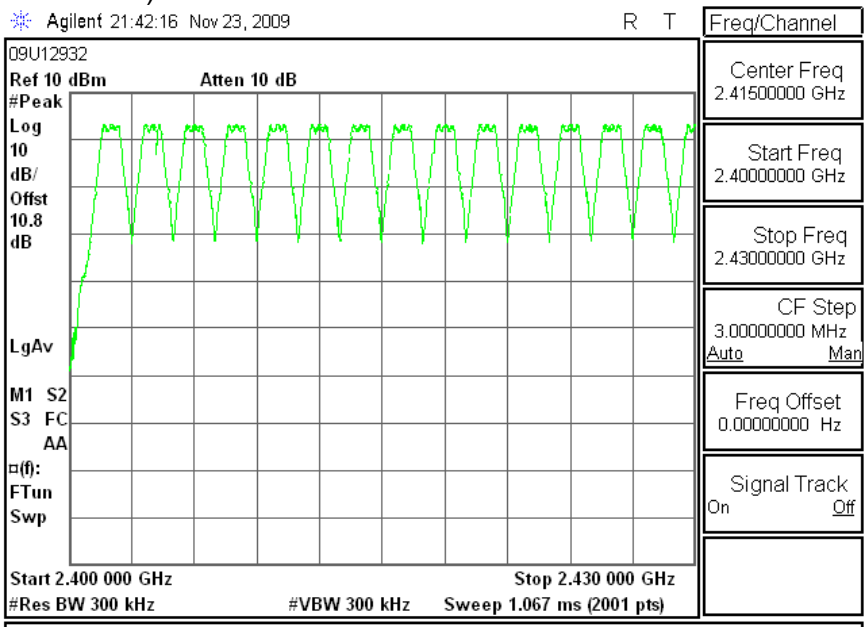
Total of number of hopping channel: 41.

NUMBER OF HOPPING CHANNELS

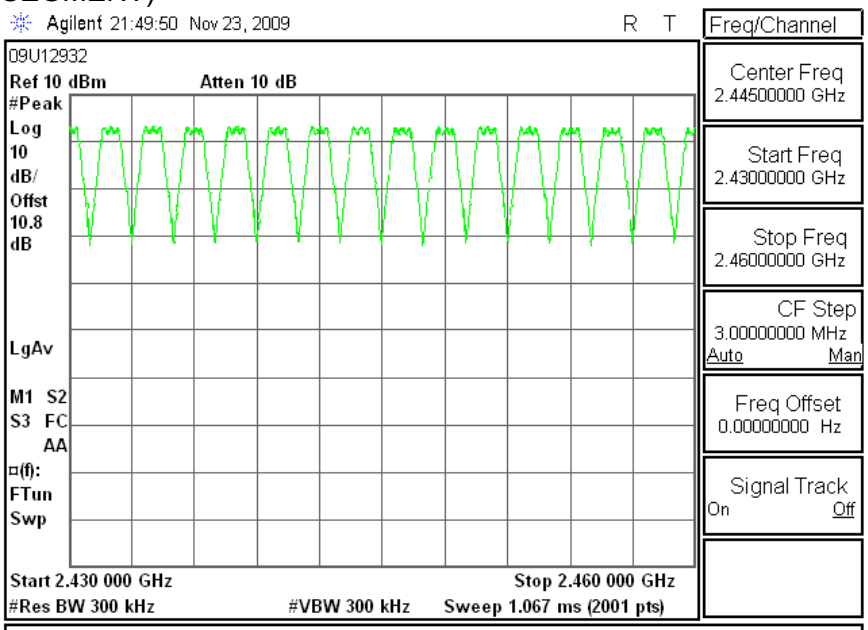
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



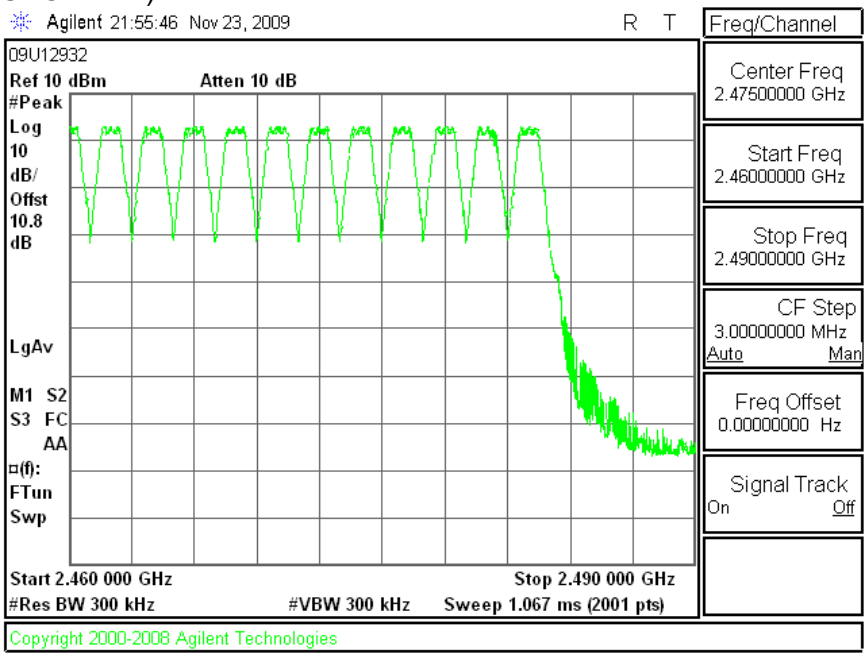
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



7.4. 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 1.64 second scan, to enable resolution of each occurrence.

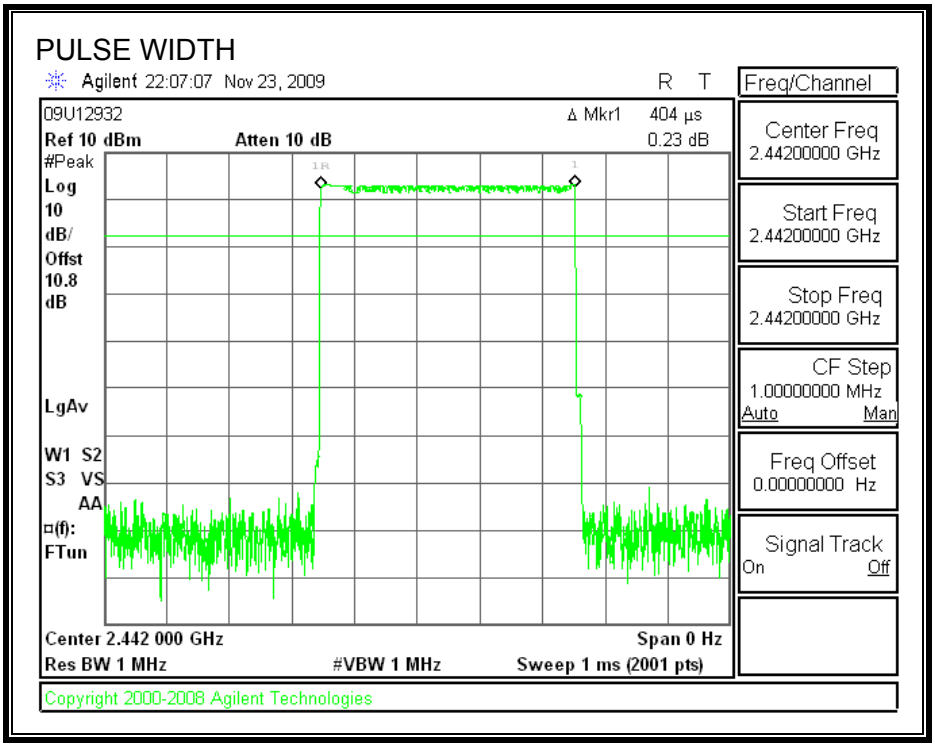
The average time of occupancy in the specified 16.4 second period (41 channels * 0.4 s) is equal to 10 * (# of pulses in 1.64 s) * pulse width.

RESULTS

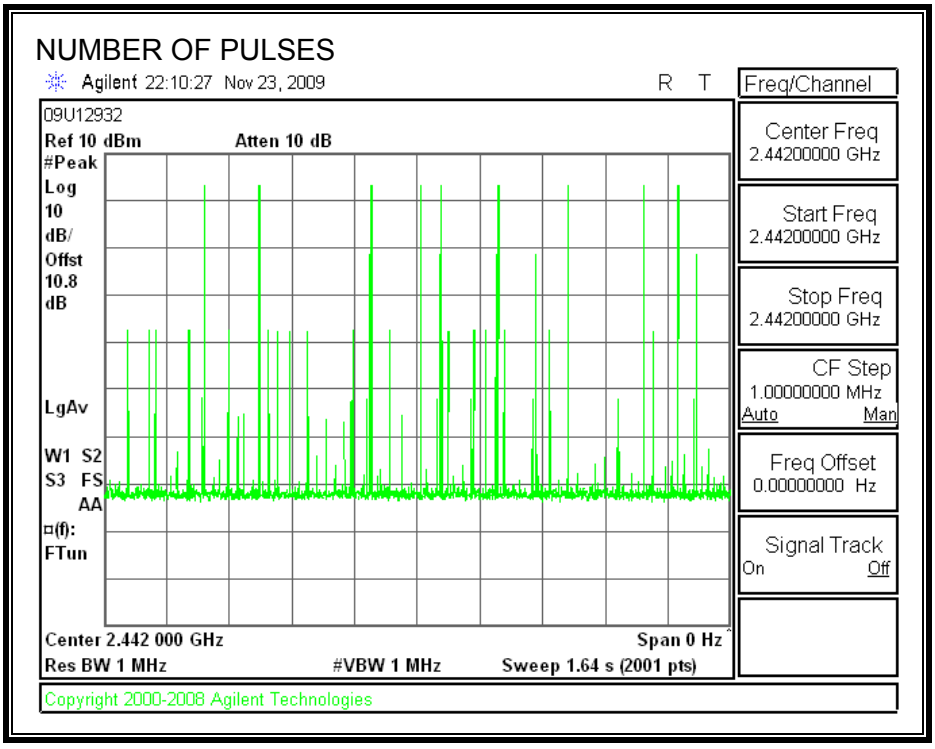
Time Of Occupancy = 10 * 34 pulses * 0.404 msec = 0.13736 Seconds

Pulse Width (msec)	Number of Pulses in 1.64 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
0.404	34	0.13736	0.4	0.263

PULSE WIDTH



NUMBER OF PULSES IN 1.64 SECOND OBSERVATION PERIOD



7.5. 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.

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 peak power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	3.56	21	-17.41
Middle	2442	3.55	21	-17.42
High	2482	3.36	21	-17.61

7.6. 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	3.22
Middle	2442	3.21
High	2482	2.99

7.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

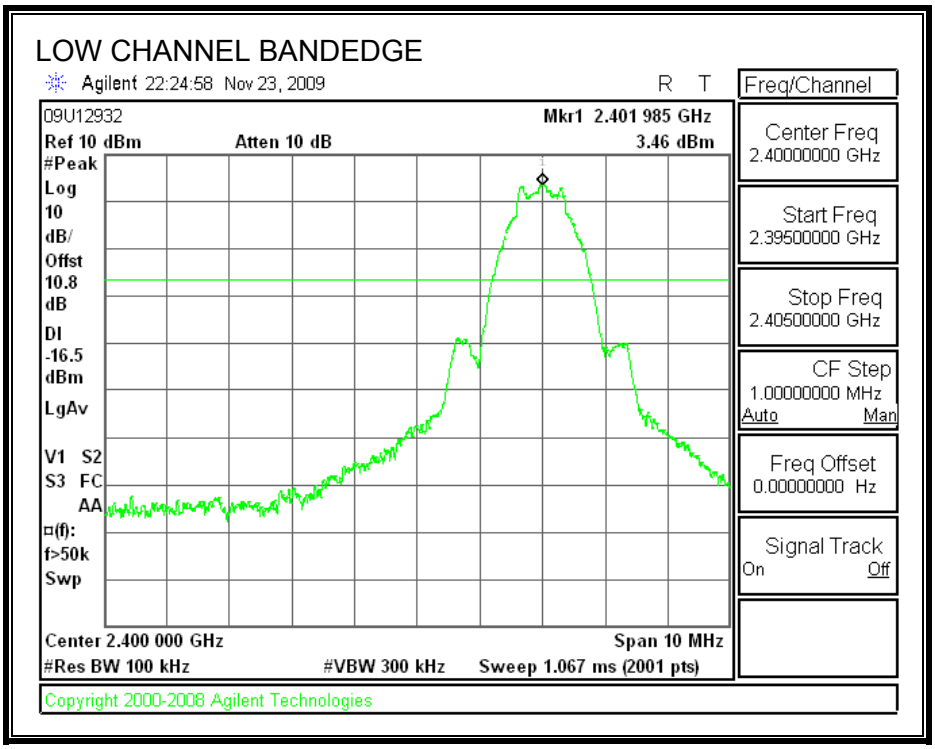
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

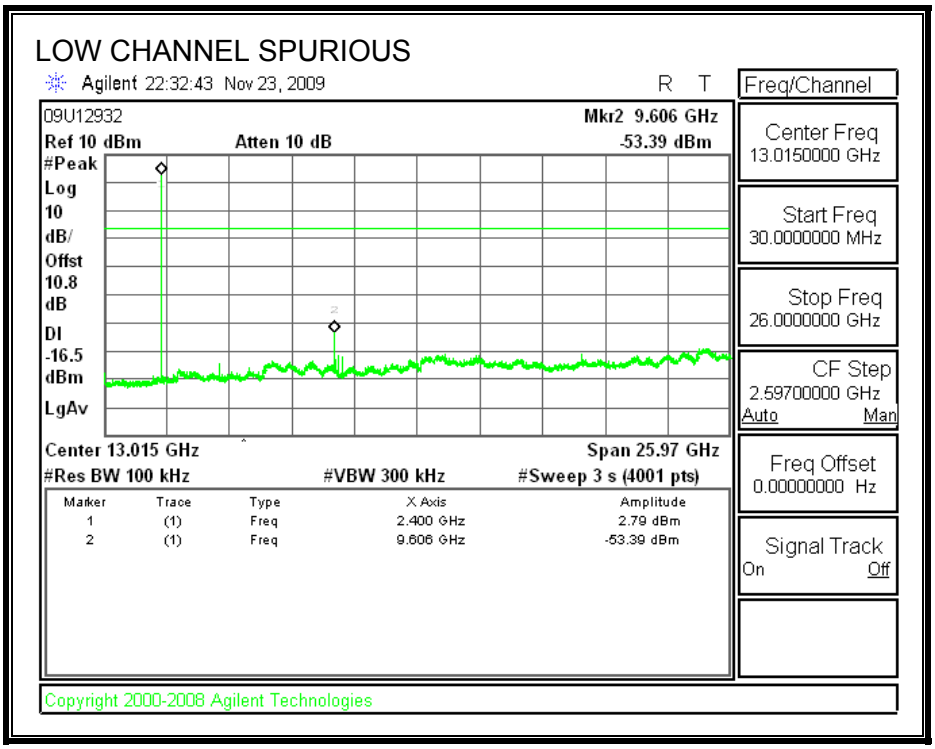
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

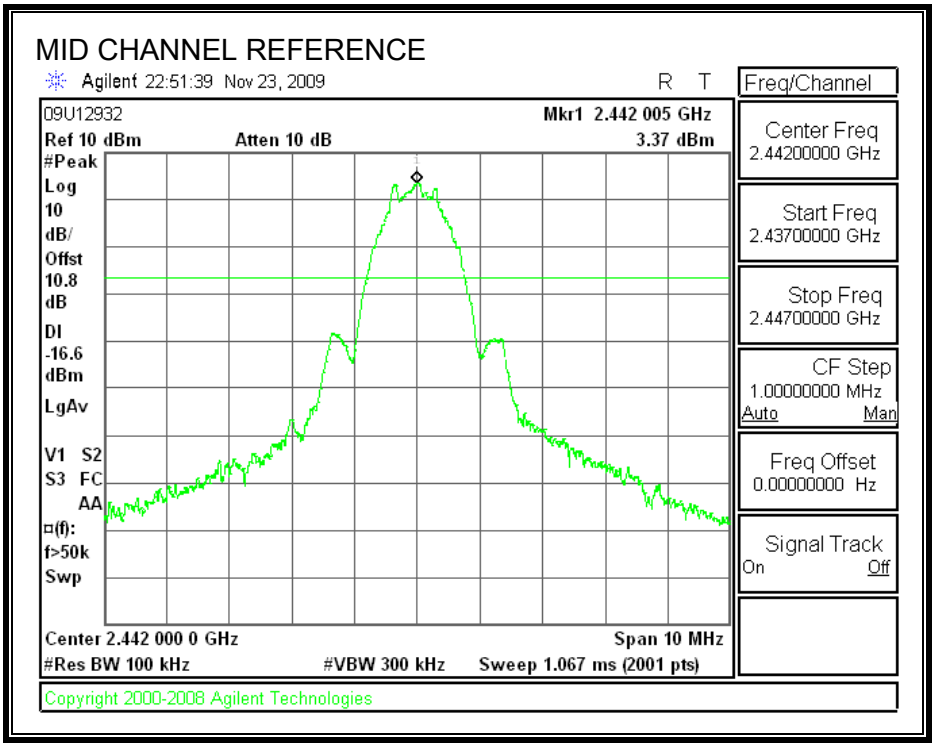
RESULTS

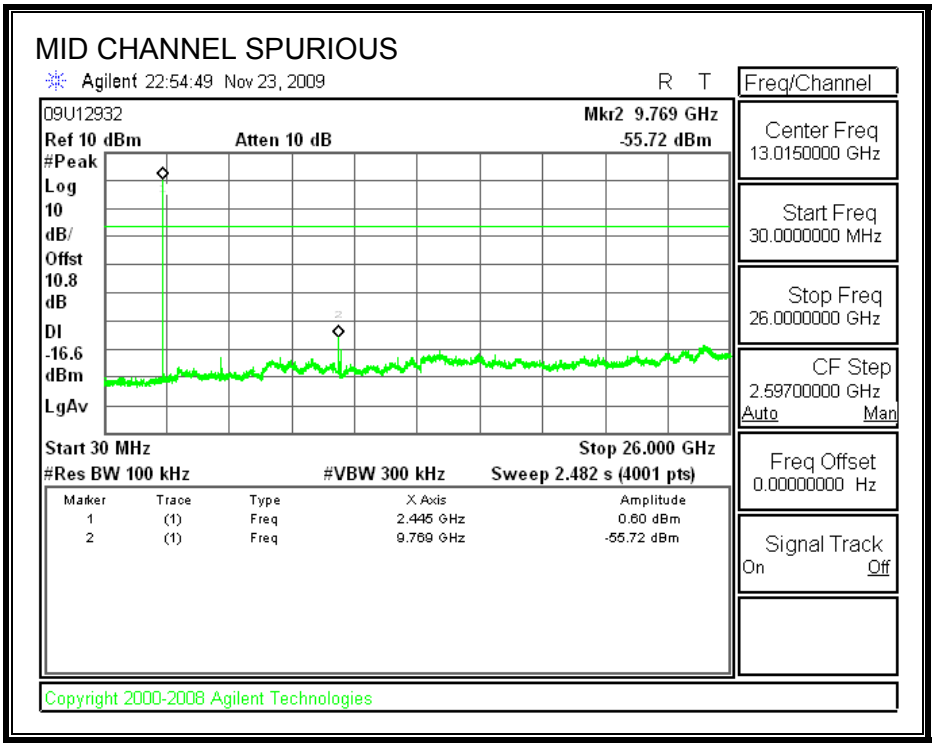
SPURIOUS EMISSIONS, LOW CHANNEL



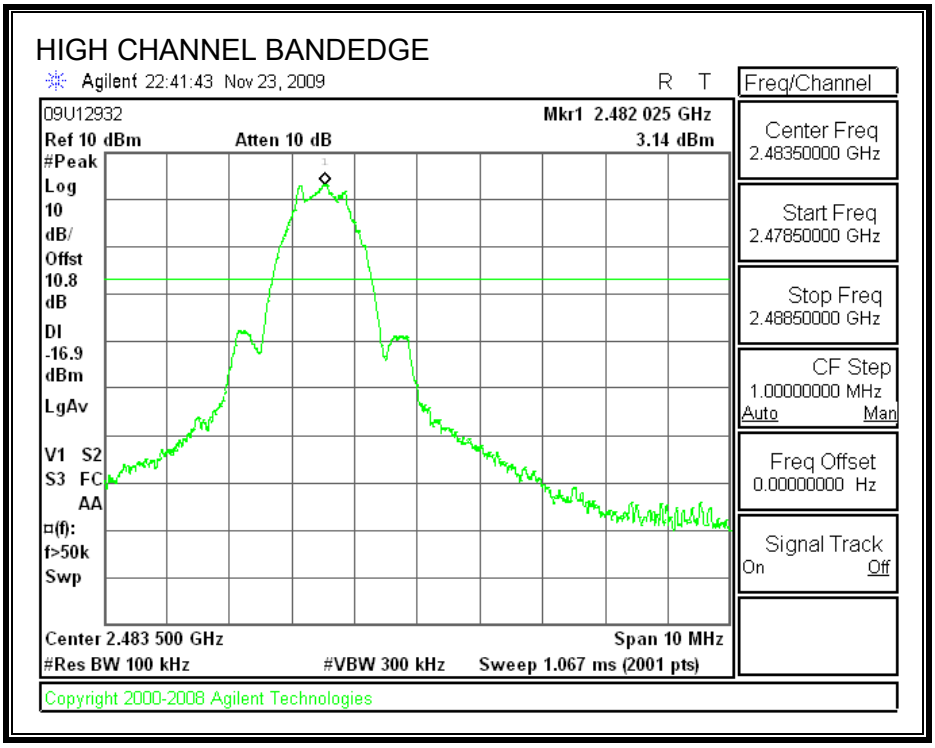


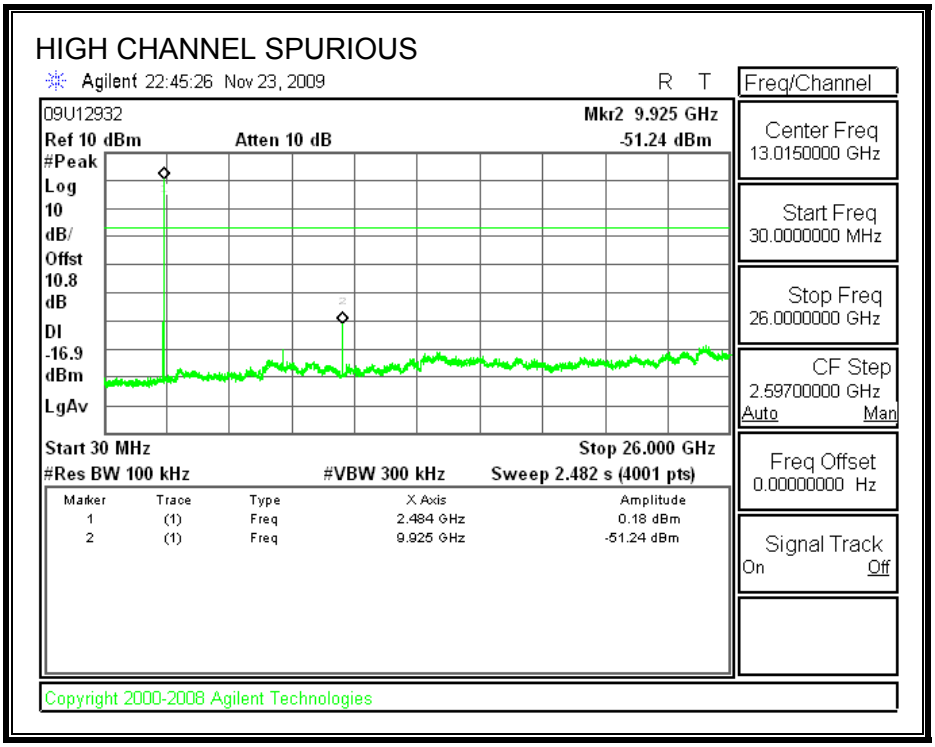
SPURIOUS EMISSIONS, MID CHANNEL





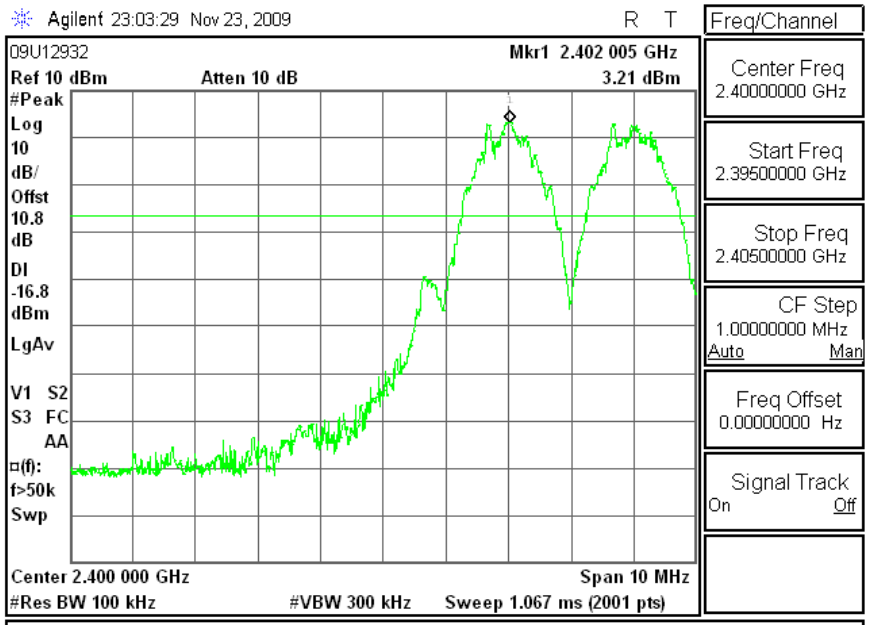
SPURIOUS EMISSIONS, HIGH CHANNEL



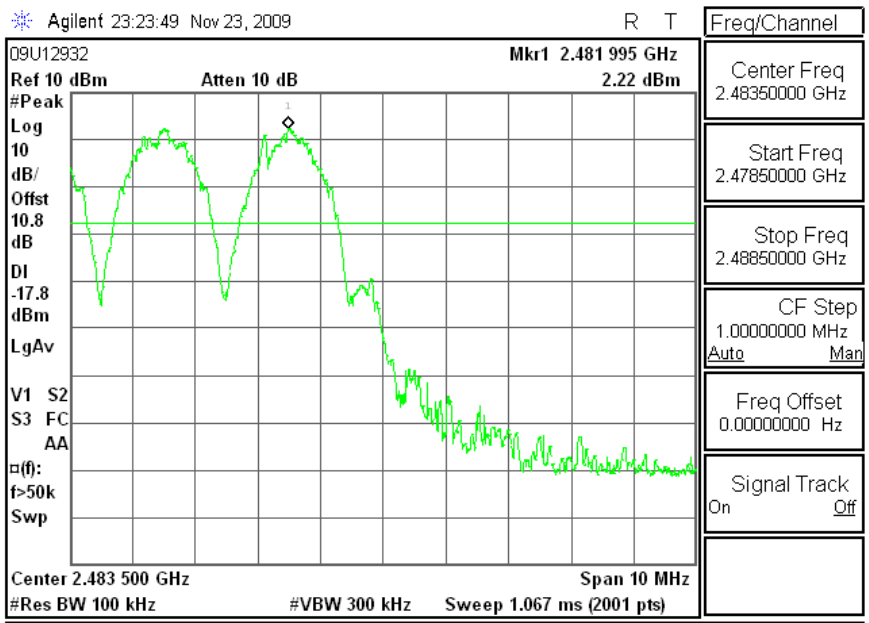


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

TEST PROCEDURE

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

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

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

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

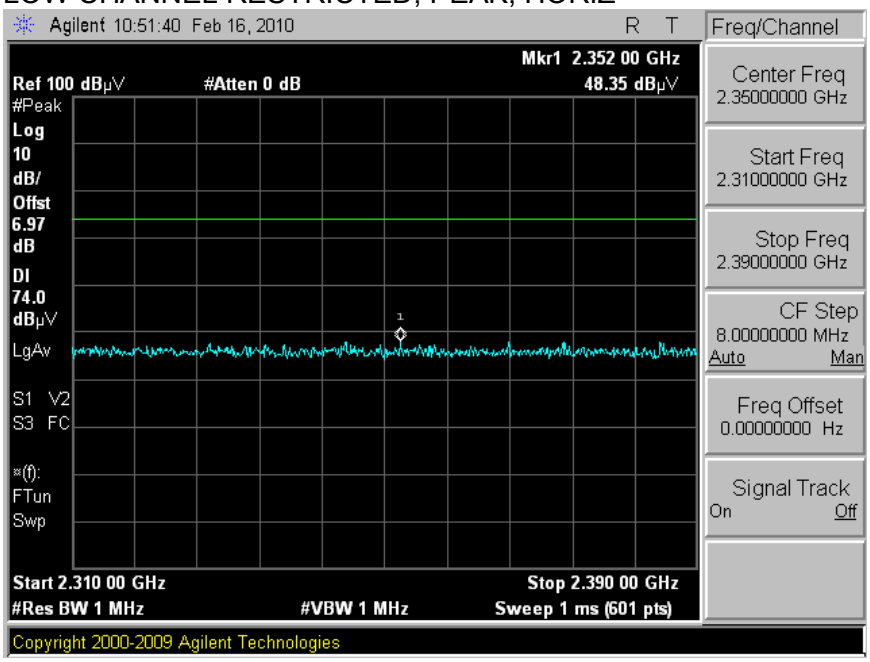
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. RADIO MODULE INSIDE ENCLOSURE

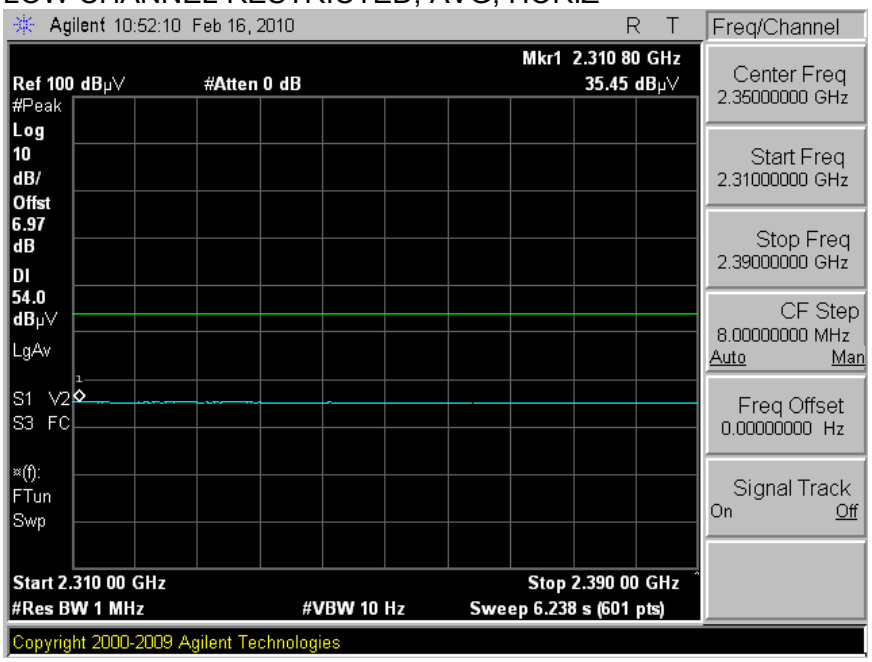
8.2.1. TRANSMITTER ABOVE 1 GHz

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

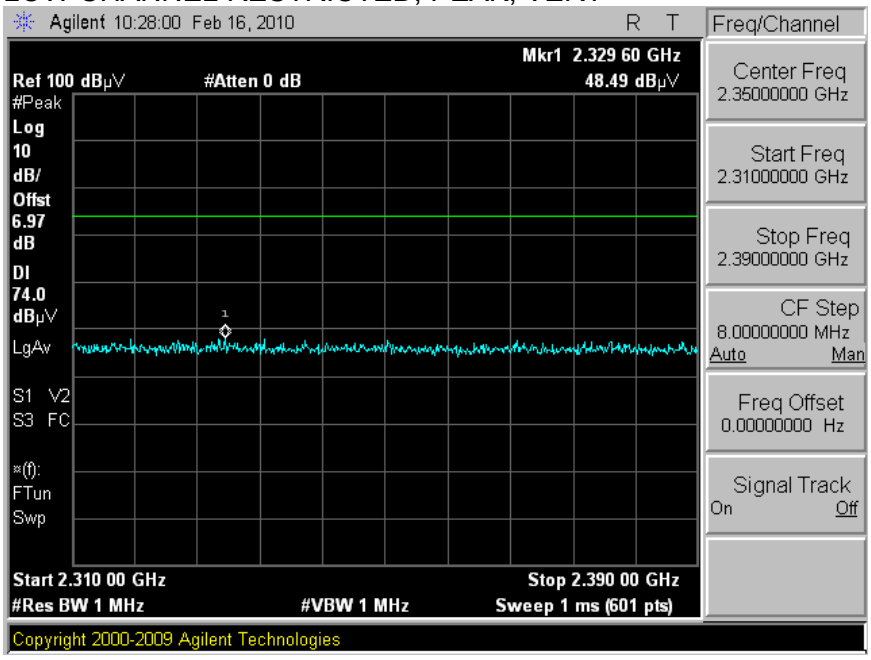


LOW CHANNEL RESTRICTED, AVG, HORIZ

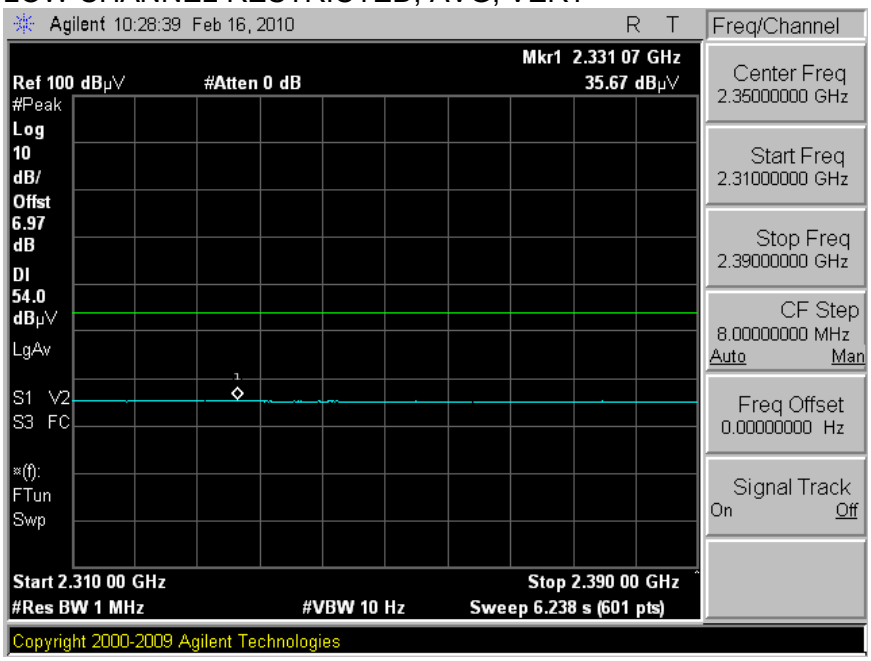


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT



LOW CHANNEL RESTRICTED, AVG, VERT

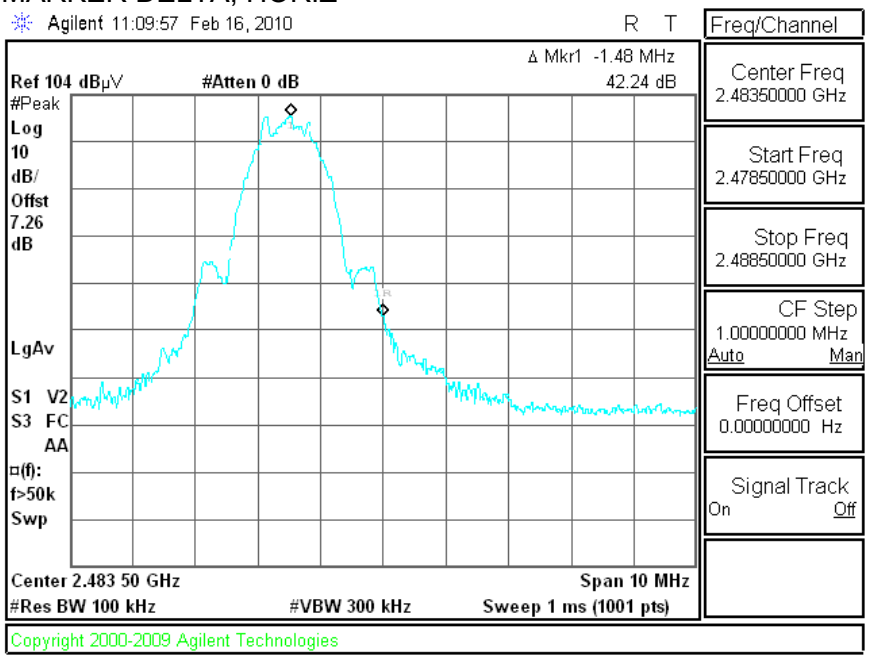


RESTRICTED BANDEDGE (HIGH CHANNEL, MARKER DELTA)

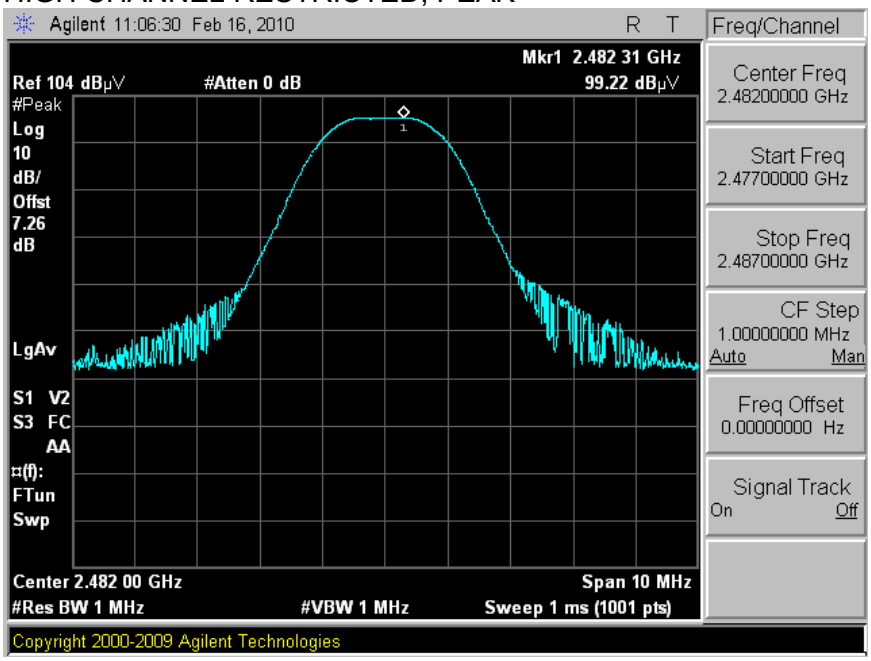
Tabular Results:

Freq (MHz)	Polarization	Detector	Reading (dBuV/m)	Delta Applied (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.5	H	PK	99.22	42.24	56.98	74	-17.02
2483.5	H	AV	38.28	42.24	-3.96	54	-57.96
2483.5	V	PK	104.59	43.64	60.95	74	-13.05
2483.5	V	AV	38.78	43.64	-4.86	54	-58.86

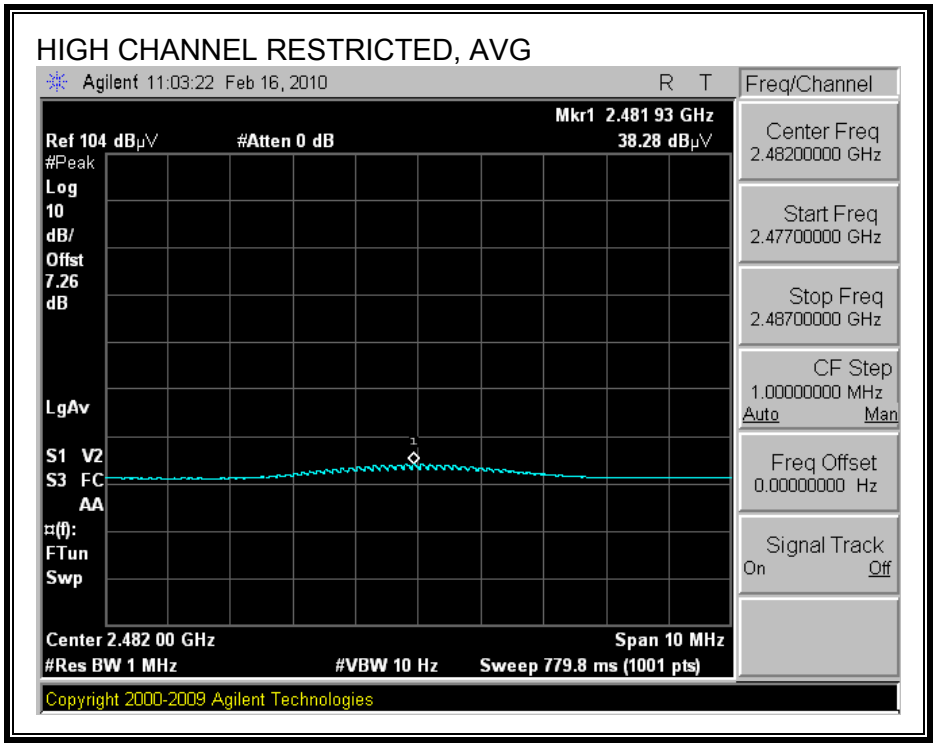
MARKER DELTA, HORIZ



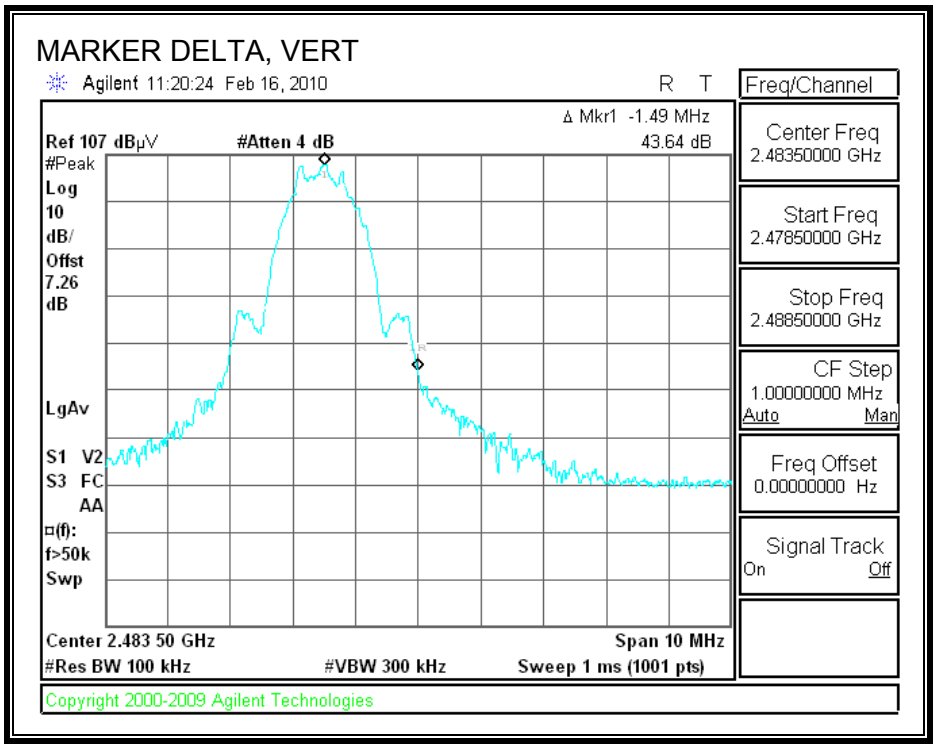
HIGH CHANNEL RESTRICTED, PEAK

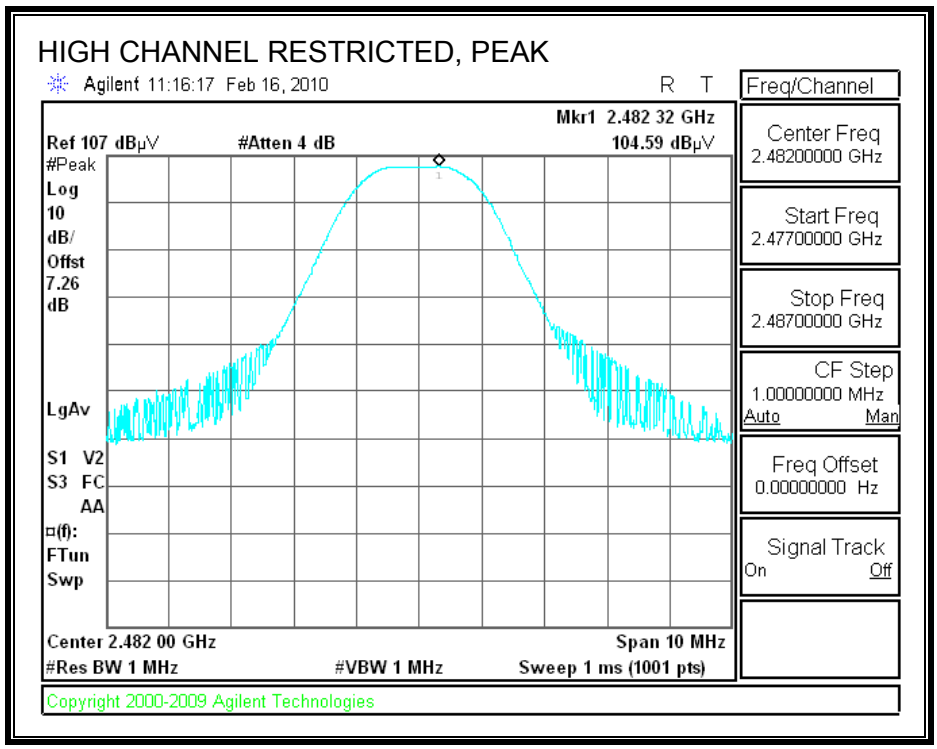


HIGH CHANNEL RESTRICTED, AVG

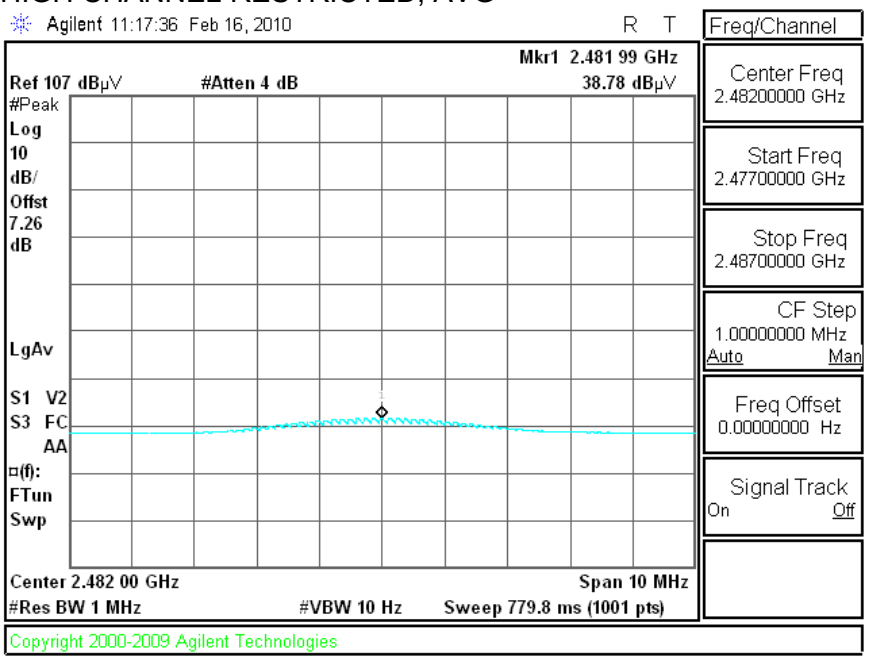


RESTRICTED BANDEDGE (HIGH CHANNEL, MARKER DELTA)





HIGH CHANNEL RESTRICTED, AVG



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: MICROSOFT CORPORATIONS
Project #: 10U13071
Date: 2/16/2010
Test Engineer: MENGISTU MEKURIA
Configuration: EUT INSIDE HOST AND POWERED FROM THE LAPTOP
Mode: TX MODE

Test Equipment:

Horn 1-18GHz: T59; S/N: 3245 @3m
Pre-amplifer 1-26GHz: T145 Agilent 3008A005(
Pre-amplifer 26-40GHz:
Horn > 18GHz:
Limit: FCC 15.209

Hi Frequency Cables
3' cable 22807700: 3' cable 22807700
12' cable 22807600: 12' cable 22807600
20' cable 22807500: 20' cable 22807500

HPF:
Reject Filter: R_001

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Channel (2402 MHz)															
4.804	3.0	61.5	26.8	32.8	5.8	-34.8	0.0	0.0	65.2	30.4	74	54	-8.8	-23.6	V
7.206	3.0	49.4	26.0	35.0	7.2	-34.7	0.0	0.0	57.0	33.6	74	54	-17.0	-20.4	V
9.608	3.0	55.6	24.9	37.1	8.5	-35.0	0.0	0.0	66.2	35.6	74	54	-7.8	-18.4	V
4.804	3.0	62.5	27.1	32.8	5.8	-34.8	0.0	0.0	66.2	30.8	74	54	-7.8	-23.2	H
7.206	3.0	50.7	25.9	35.0	7.2	-34.7	0.0	0.0	58.3	33.5	74	54	-15.7	-20.5	H
9.608	3.0	53.9	24.6	37.1	8.5	-35.0	0.0	0.0	64.6	35.2	74	54	-9.4	-18.8	H
Mid Channel (2442 MHz)															
4.884	3.0	60.8	26.6	32.8	5.8	-34.9	0.0	0.0	64.6	30.4	74	54	-9.4	-23.6	V
7.326	3.0	50.5	25.4	35.2	7.3	-34.7	0.0	0.0	58.3	33.2	74	54	-15.7	-20.8	V
9.768	3.0	55.6	24.9	37.2	8.6	-35.0	0.0	0.0	66.3	35.6	74	54	-7.7	-18.4	V
4.884	3.0	61.3	26.8	32.8	5.8	-34.9	0.0	0.0	65.1	30.6	74	54	-8.9	-23.4	H
7.326	3.0	47.9	25.2	35.2	7.3	-34.7	0.0	0.0	55.8	33.0	74	54	-18.2	-21.0	H
9.768	3.0	54.3	24.6	37.2	8.6	-35.0	0.0	0.0	65.0	35.3	74	54	-9.0	-18.7	H
Hi Channel (2482 MHz)															
1.225	3.0	54.1	34.5	24.8	2.6	-36.0	0.0	0.0	45.5	25.9	74	54	-28.5	-28.1	V
1.330	3.0	57.7	33.6	25.2	2.7	-35.9	0.0	0.0	49.7	25.6	74	54	-24.3	-28.4	V
1.450	3.0	54.5	35.8	25.6	2.9	-35.8	0.0	0.0	47.1	28.5	74	54	-26.9	-25.5	V
1.995	3.0	49.9	30.6	27.6	3.5	-35.4	0.0	0.0	45.5	26.2	74	54	-28.5	-27.8	V
4.964	3.0	56.3	26.7	32.9	5.9	-34.9	0.0	0.0	60.2	30.6	74	54	-13.8	-23.4	V
7.446	3.0	48.7	25.5	35.4	7.3	-34.6	0.0	0.0	56.8	33.6	74	54	-17.2	-20.4	V
9.928	3.0	55.1	24.9	37.2	8.7	-35.1	0.0	0.0	66.0	35.7	74	54	-8.0	-18.3	V
1.225	3.0	56.5	36.1	24.8	2.6	-36.0	0.0	0.0	47.9	27.5	74	54	-26.1	-26.5	H
1.330	3.0	53.3	33.5	25.2	2.7	-35.9	0.0	0.0	45.3	25.5	74	54	-28.7	-28.5	H
1.450	3.0	53.1	35.5	25.6	2.9	-35.8	0.0	0.0	45.8	28.2	74	54	-28.2	-25.8	H
4.964	3.0	60.2	26.8	32.9	5.9	-34.9	0.0	0.0	64.1	30.7	74	54	-9.9	-23.3	H
7.446	3.0	49.0	25.4	35.4	7.3	-34.6	0.0	0.0	57.1	33.5	74	54	-16.9	-20.5	H
9.928	3.0	56.6	24.9	37.2	8.7	-35.1	0.0	0.0	67.5	35.8	74	54	-6.5	-18.2	H

Rev. 07.22.09

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

8.2.2. RECEIVER ABOVE 1 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: MICROSOFT CORPORATIONS
Project #: 10U13071
Date: 2/16/2010
Test Engineer: MENGISTU MEKURIA
Configuration: EUT INSIDE HOST AND POWERED FROM THE LAPTOP
Mode: RX MODE

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A005(			FCC 15.209

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Mid Channel (2442 MHz)															
1.225	3.0	58.4	36.8	24.8	2.6	-36.0	0.0	0.0	49.8	28.3	74	54	-24.2	-25.7	V
1.330	3.0	59.2	33.9	25.2	2.7	-35.9	0.0	0.0	51.2	25.9	74	54	-22.8	-28.1	V
1.450	3.0	53.7	36.1	25.6	2.9	-35.8	0.0	0.0	46.4	28.7	74	54	-27.6	-25.3	V
1.995	3.0	49.9	30.6	27.6	3.5	-35.4	0.0	0.0	45.5	26.2	74	54	-28.5	-27.8	V
1.225	3.0	57.1	36.2	24.8	2.6	-36.0	0.0	0.0	48.5	27.6	74	54	-25.5	-26.4	H
1.330	3.0	51.9	33.4	25.2	2.7	-35.9	0.0	0.0	43.9	25.4	74	54	-30.1	-28.6	H
1.450	3.0	53.5	36.6	25.6	2.9	-35.8	0.0	0.0	46.2	29.3	74	54	-27.8	-24.7	H
1.995	3.0	46.7	29.1	27.6	3.5	-35.4	0.0	0.0	42.4	24.8	74	54	-31.6	-29.2	H

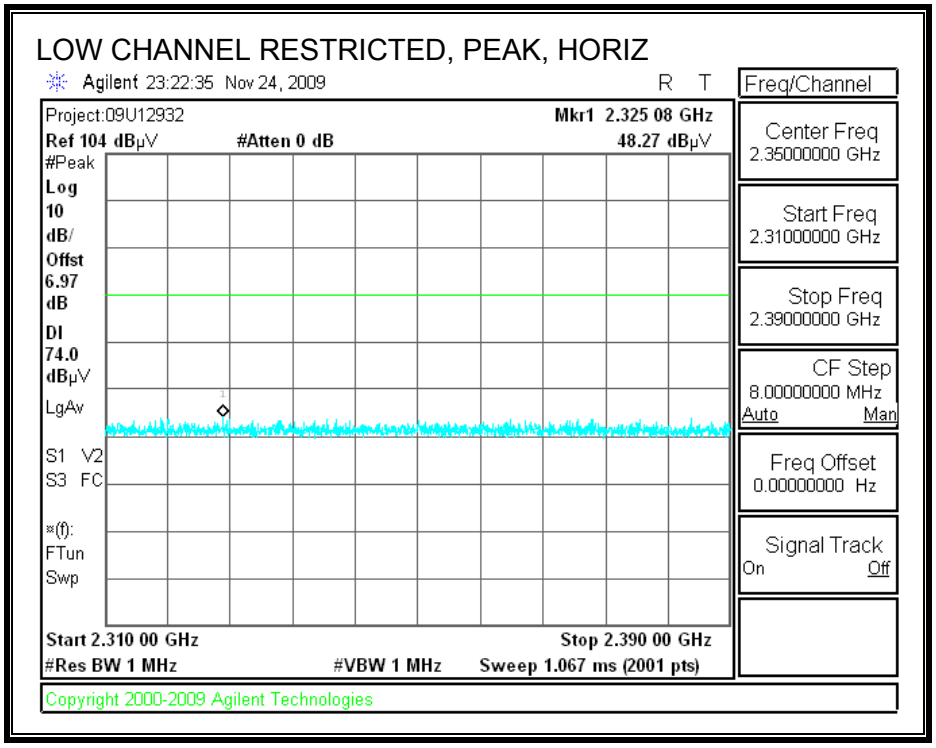
Rev. 07.22.09

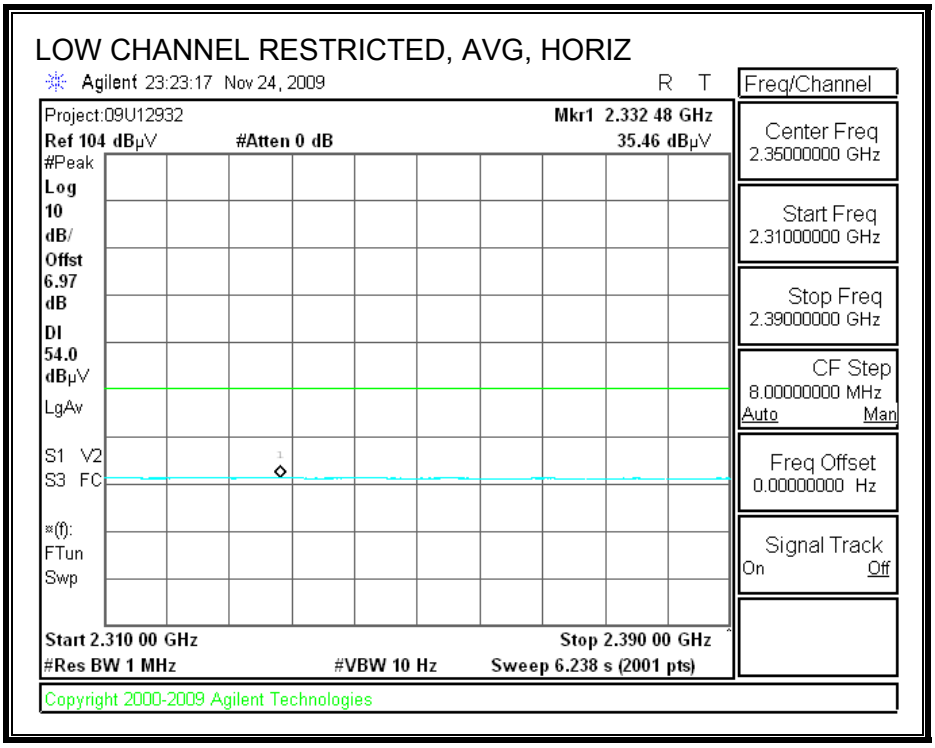
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

8.3. RADIO MODULE OUTSIDE ENCLOSURE

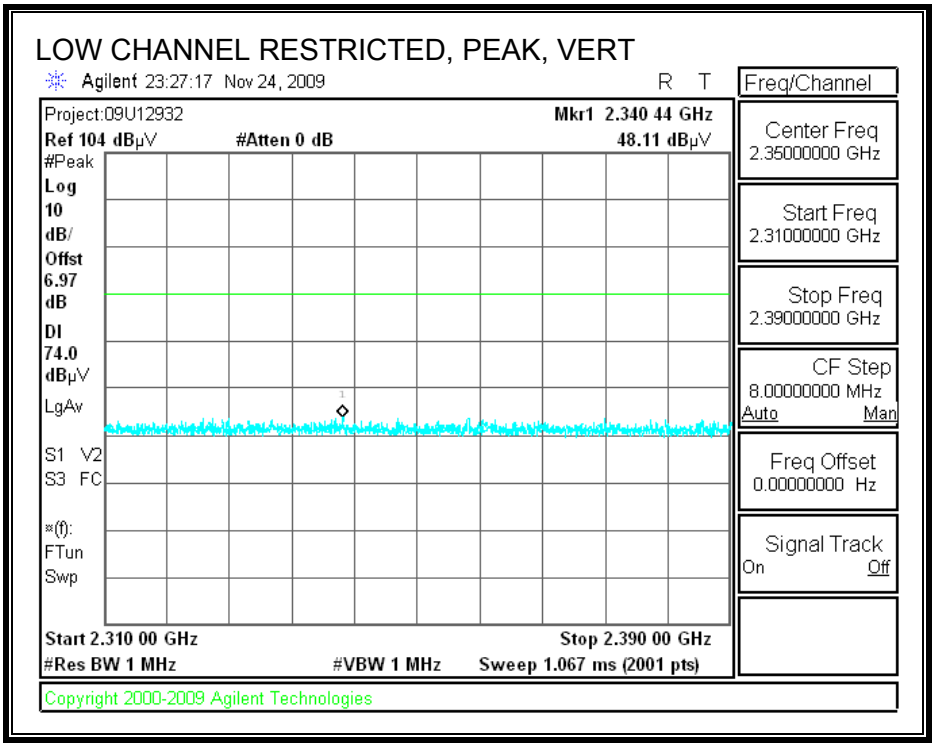
8.3.1. TRANSMITTER ABOVE 1 GHz

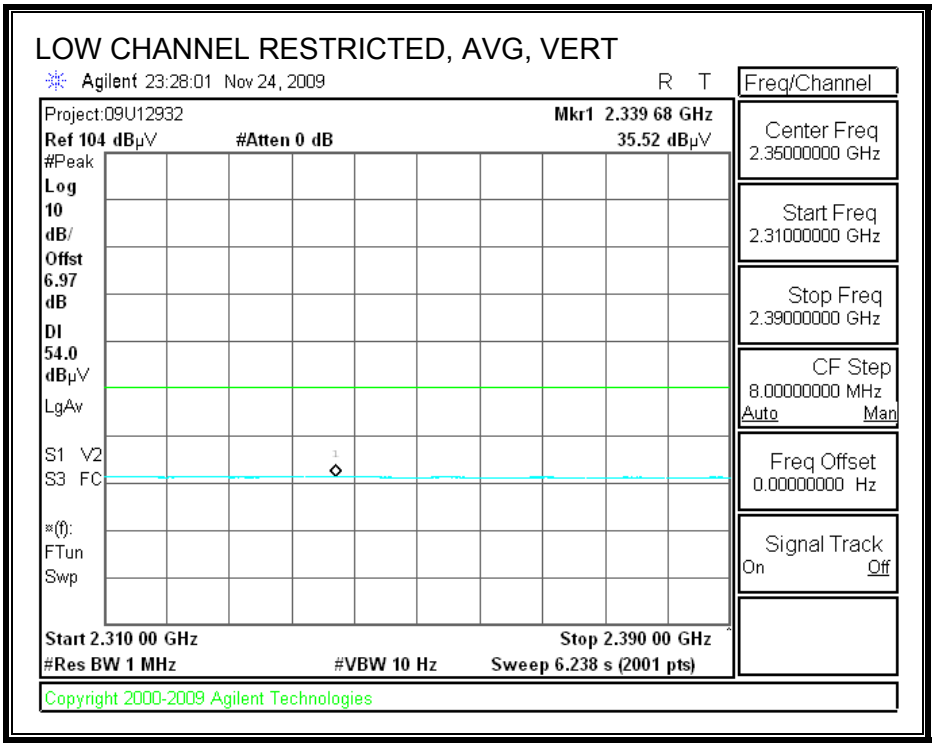
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



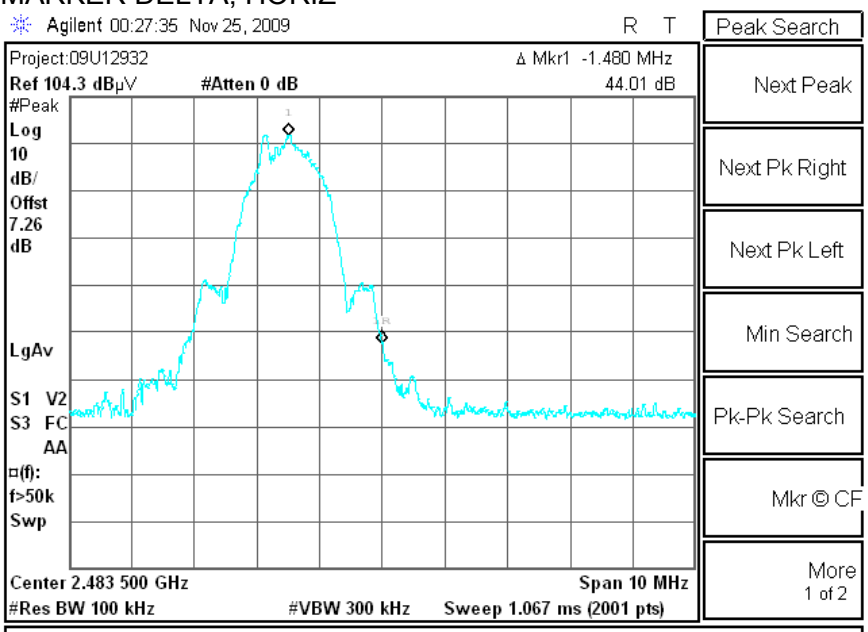


RESTRICTED BANDEDGE (HIGH CHANNEL, MARKER DELTA)

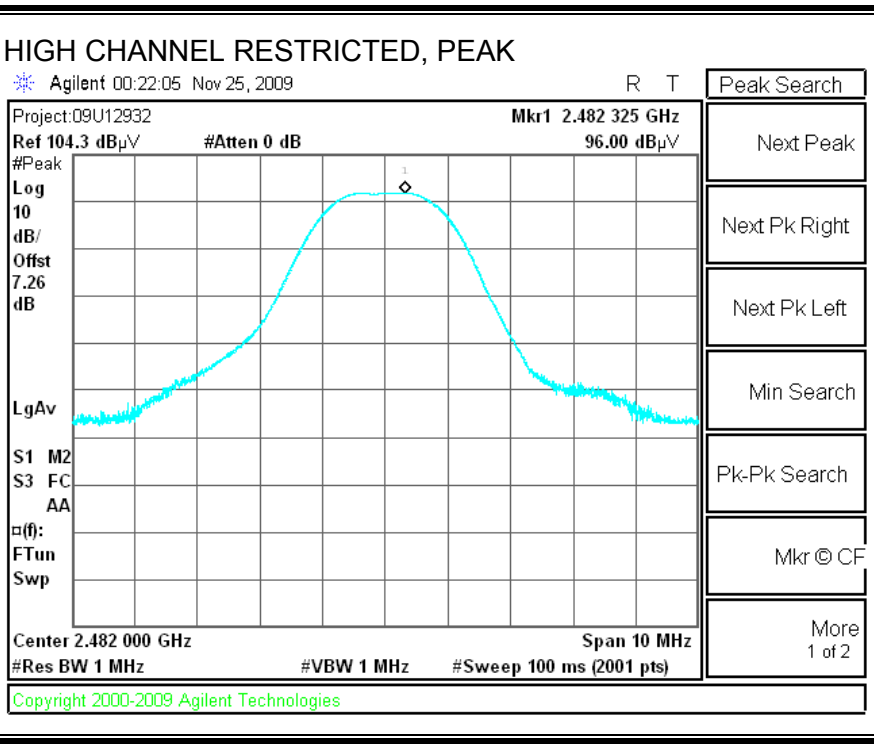
Tabular Results:

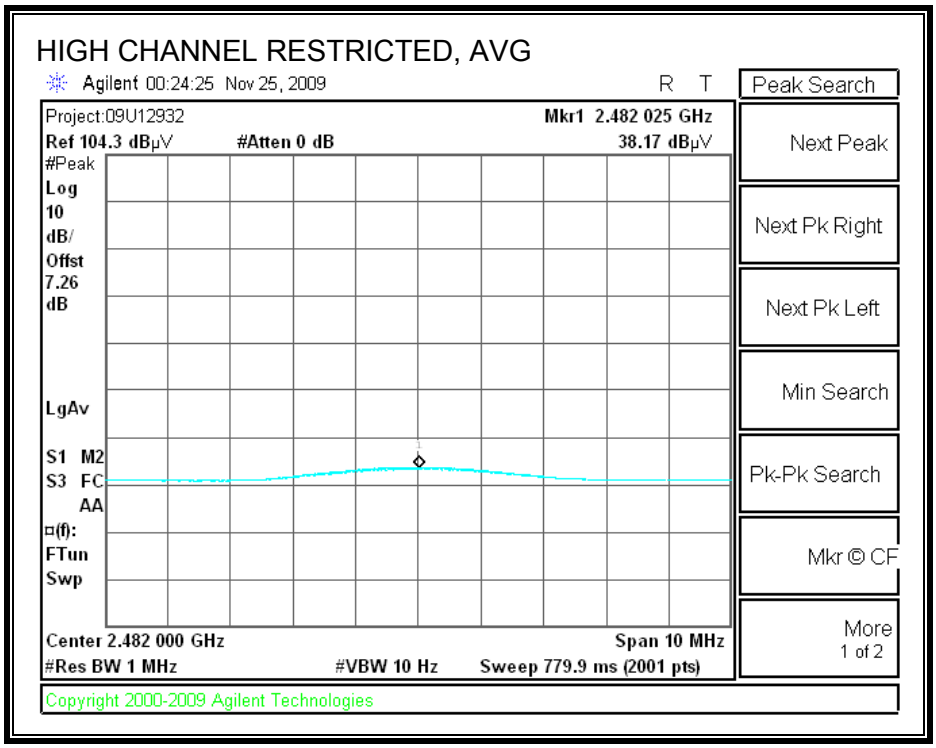
Freq (MHz)	Polarization	Detector	Reading (dBuV/m)	Delta Applied (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.5	H	PK	96.00	44.01	51.99	74	-22.01
2483.5	H	AV	38.17	44.01	-5.84	54	-59.84
2483.5	V	PK	98.93	45.17	53.76	74	-20.24
2483.5	V	AV	38.32	45.17	-6.85	54	-60.85

MARKER DELTA, HORIZ

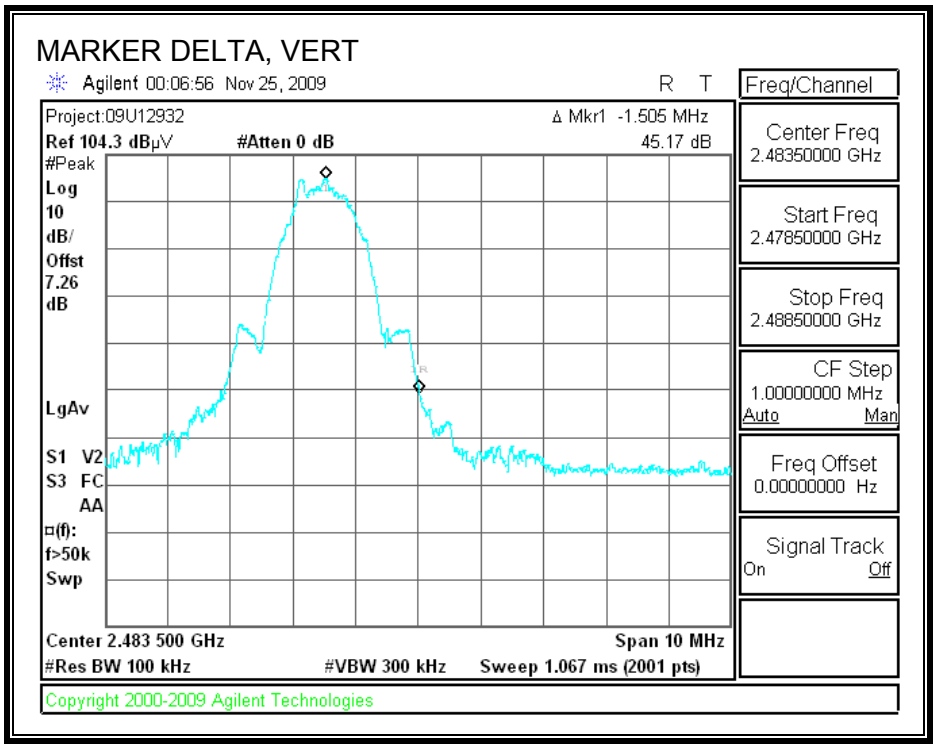


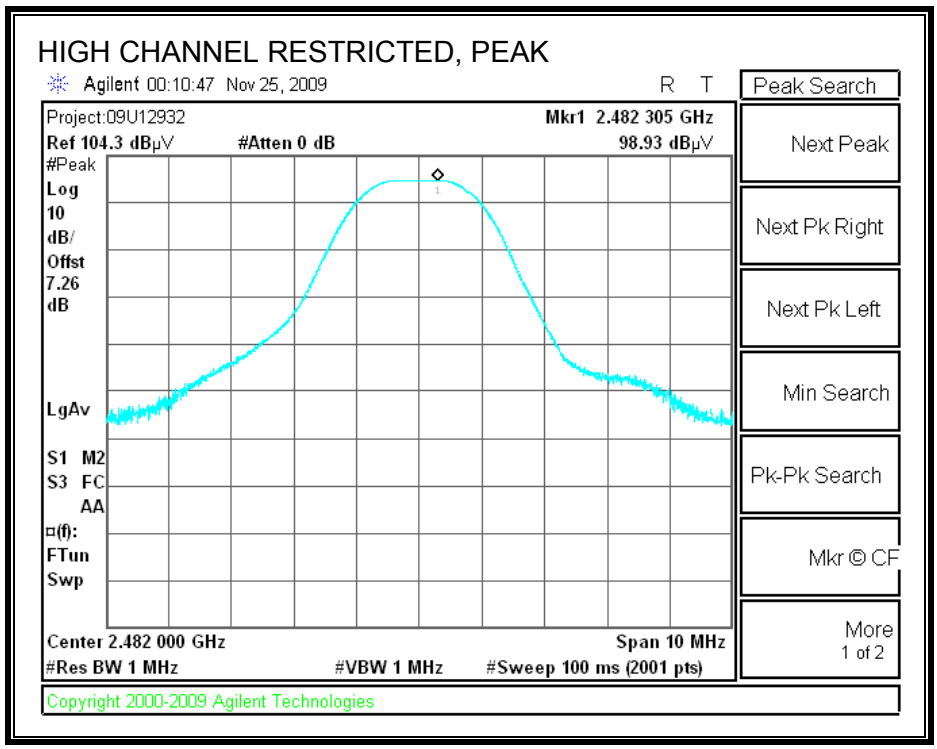
HIGH CHANNEL RESTRICTED, PEAK

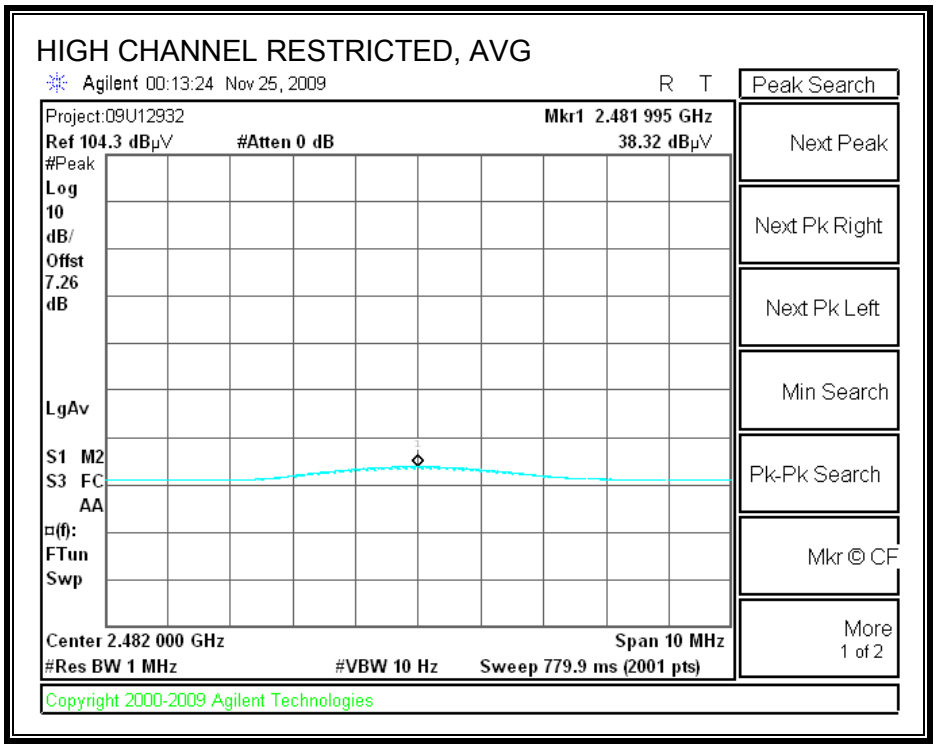




RESTRICTED BANDEDGE (HIGH CHANNEL, MARKER DELTA)







HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Microsoft
Project #: 09U12932
Date: 11/23/2009
Test Engineer: Mengistu Mekuria
Configuration: EUT (EV3B SA003) and Support Laptop
Mode: TX Mode

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T144 Miteq 3008A00931			FCC 15.205

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_002

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
LOW CH (2402.00MHz)															
4.804	3.0	50.1	29.2	33.0	5.8	-36.5	0.0	0.0	52.4	31.5	74	54	-21.6	-22.5	V
4.804	3.0	59.3	32.1	33.0	5.8	-36.5	0.0	0.0	61.6	34.5	74	54	-12.4	-19.5	H
MID CH (2442.00MHz)															
4.884	3.0	51.4	30.1	33.1	5.8	-36.5	0.0	0.0	53.9	32.6	74	54	-20.1	-21.4	V
7.326	3.0	45.4	27.1	35.3	7.3	-36.2	0.0	0.0	51.7	33.5	74	54	-22.3	-20.5	V
4.884	3.0	60.5	33.4	33.1	5.8	-36.5	0.0	0.0	63.0	35.9	74	54	-11.0	-18.1	H
7.326	3.0	47.8	28.2	35.3	7.3	-36.2	0.0	0.0	54.2	34.6	74	54	-19.8	-19.4	H
HI CH (2482.00MHz)															
4.964	3.0	49.9	30.5	33.2	5.9	-36.5	0.0	0.0	52.5	33.1	74	54	-21.5	-20.9	V
7.446	3.0	43.2	28.3	35.5	7.3	-36.2	0.0	0.0	49.8	35.0	74	54	-24.2	-19.0	V
4.964	3.0	57.9	32.0	33.2	5.9	-36.5	0.0	0.0	60.5	34.7	74	54	-13.5	-19.3	H
7.446	3.0	46.4	29.4	35.5	7.3	-36.2	0.0	0.0	53.0	36.0	74	54	-21.0	-18.0	H
							0.0								

Rev. 11.10.08

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

8.3.2. RECEIVER ABOVE 1 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Microsoft
Project #: 09U12932
Date: 11/30/09
Test Engineer: Monica Harrison
Configuration: Laptop w/USB
Mode: RX SA003

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			FCC 15.209

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
No Emmisions above the Noise Floor were found															

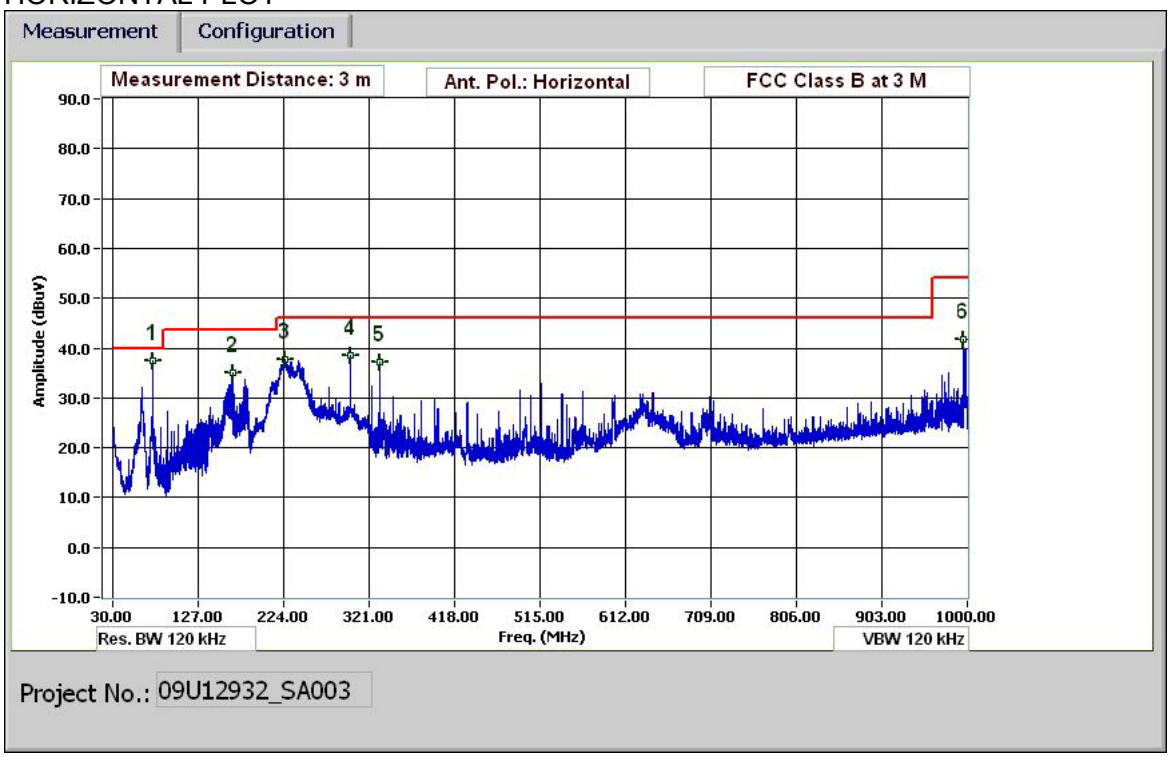
Rev. 11.10.08

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

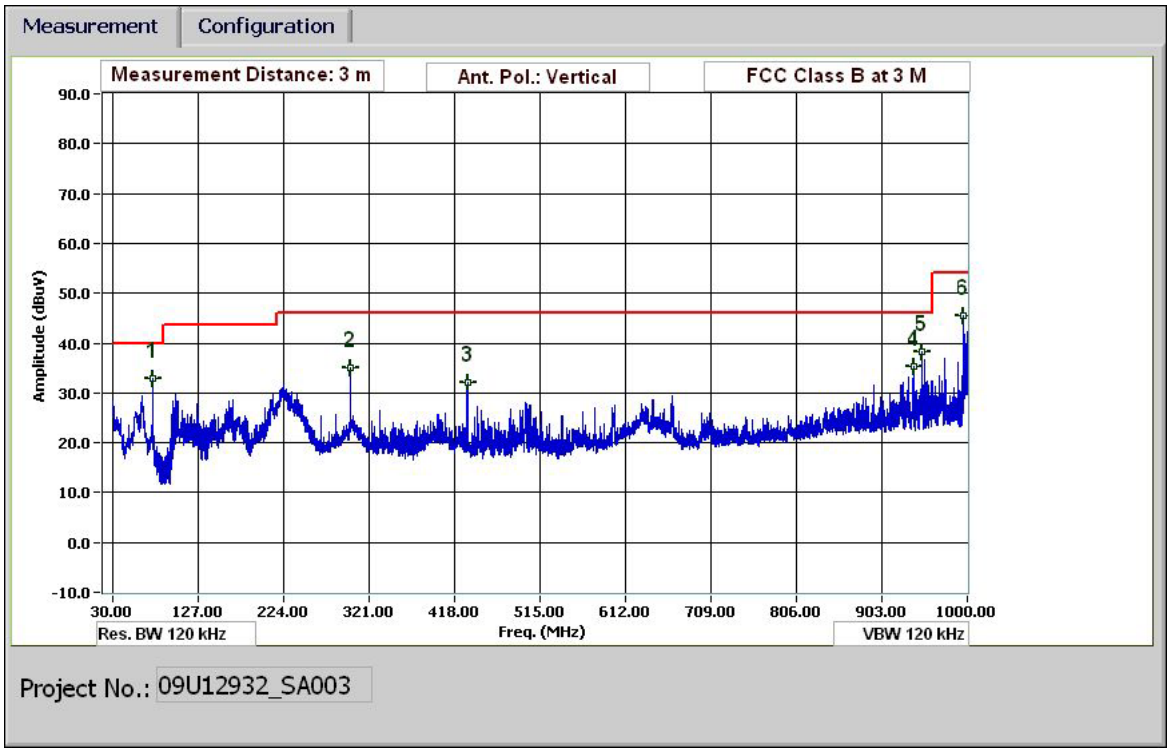
8.3.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

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

Test Engr: Monica Harrison
Date: 11/25/09
Project #: 09U12932_SA003
Company: Microsoft
EUT Description: FHSS Module
Test Target: FCC B
Mode Oper: TX

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

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
75.362	3.0	56.9	8.1	0.7	28.3	0.0	0.0	37.4	40.0	-2.6	H	P	
75.173	3.0	54.0	8.1	0.7	28.3	0.0	0.0	34.5	40.0	-5.5	H	QP	
165.966	3.0	49.7	12.0	1.1	27.7	0.0	0.0	35.1	43.5	-8.4	H	P	
225.608	3.0	51.9	11.9	1.3	27.4	0.0	0.0	37.6	46.0	-8.4	H	P	
299.411	3.0	50.9	13.5	1.5	27.4	0.0	0.0	38.5	46.0	-7.5	H	P	
332.532	3.0	49.4	14.0	1.6	27.6	0.0	0.0	37.3	46.0	-8.7	H	P	
995.800	3.0	43.9	22.7	2.9	27.6	0.0	0.0	41.8	54.0	-12.2	H	P	
75.002	3.0	52.5	8.1	0.7	28.3	0.0	0.0	33.0	40.0	-7.0	V	P	
299.291	3.0	47.4	13.5	1.5	27.4	0.0	0.0	34.9	46.0	-11.1	V	P	
432.977	3.0	42.8	15.6	1.8	28.2	0.0	0.0	32.1	46.0	-13.9	V	P	
939.998	3.0	37.8	22.3	2.8	27.8	0.0	0.0	35.2	46.0	-10.8	V	P	
948.518	3.0	40.8	22.4	2.8	27.7	0.0	0.0	38.3	46.0	-7.7	V	P	
996.040	3.0	47.5	22.7	2.9	27.6	0.0	0.0	45.4	54.0	-8.6	V	P	

Rev. 1.27.09
Note: No other emissions were detected above the system noise floor.

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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

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

RESULTS

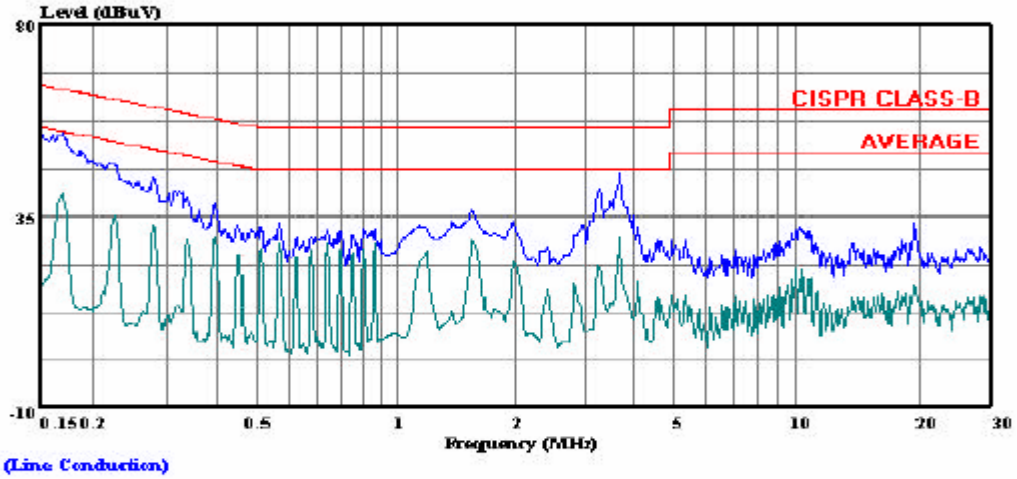
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.17	54.54	--	54.54	0.00	65.01	55.01	-10.47	-0.47	L1
1.66	36.49	--	36.49	0.00	56.00	46.00	-19.51	-9.51	L1
3.80	45.19	--	45.19	0.00	56.00	46.00	-10.81	-0.81	L1
0.15	53.46	--	37.77	0.00	65.89	55.89	-12.43	-18.12	L2
0.22	47.83	--	35.14	0.00	62.67	52.67	-14.84	-17.53	L2
3.80	42.16	--	29.50	0.00	56.00	46.00	-13.84	-16.50	L2
6 Worst Data									

LINE 1 RESULTS

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 7 File#: L1_01_00EV3B_IC282.EMI
Date: 11-25-2009 Time: 19:06:31

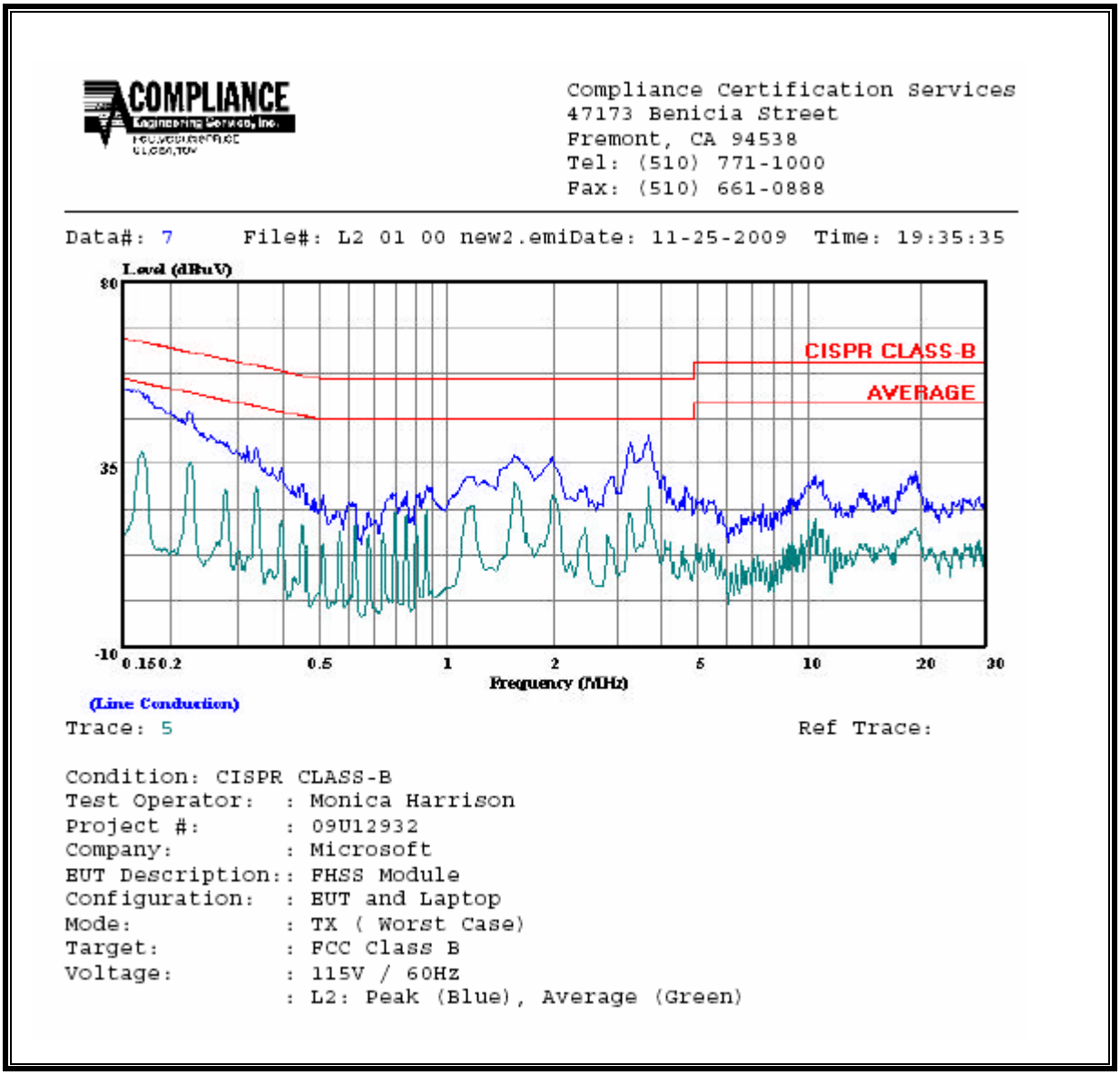


(Line Conduction)

Trace: 5 Ref Trace:

Condition: CISPR CLASS-B
Test Operator: : Monica Harrison
Project #: : 09U12932
Company: : Microsoft
EUT Description:: FHSS Module
Configuration: : EUT and Laptop
Mode: : TX (Worst Case)
Target: : FCC Class B
Voltage: : 115V / 60Hz
: L1: Peak (Blue), Average (Green)

LINE 2 RESULTS



10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

CALCULATIONS

Given

$E = \sqrt{(30 * P * G) / d}$

and

$S = E ^ 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations, rearranging the terms to express the distance as a function of the remaining variables, changing to units of Power to mW and Distance to cm, and substituting the logarithmic form of power and gain yields:

$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Rearranging terms to calculate the power density at a specific distance yields

$S = 0.0795 * 10 ^ ((P + G) / 10) / (d^2)$

The power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by a factor of 10.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm^2)	IC Power Density (W/m^2)
FHSS	2.4 GHz	20.0	3.56	5.00	0.0014	0.0143

END OF REPORT