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

CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n WiFi AND BLUETOOTH AUDIO/VIDEO DIVICE

MODEL NUMBER: W1

FCC ID: A4R-W1

REPORT NUMBER: 11U14119-3

ISSUE DATE: MAY 17, 2012

Prepared for
GOOGLE INC.
1600 AMPHITHEATRE PARKWAY
MONTAINVIEW
CA, 94043, U.S.A

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	05/17/2012	Initial Issue	T. LEE

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	GOOGLE INC. 1600 AMPHITHEATRE PARKWAY MOUNTAIN VIEW, CA, 94043, U.S.A
EUT DESCRIPTION:	802.11a/b/g/n and Bluetooth Audio /Video Device
MODEL:	W1
SERIAL NUMBER:	AD5C12120004, AD5C12020005
DATE TESTED:	MARCH 29~MAY 16, 2012

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

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

Approved & Released For UL CCS By:

TIM LEE
STAFF ENGINEER
UL CCS

Tested By:

THANH NGUYEN
EMC ENGINEER
UL CCS

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 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.

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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 an audio/video device incorporating 802.11 a/b/g/n, Bluetooth, and near field communicator technology. The EUT has TOSLINK, audio, Ethernet, HDMI, and USB ports.

The EUT operates only at the Enhanced 8PSK mode.

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	Enhanced 8PSK	11.51	14.16

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PCB antenna, with a maximum gain of 2.3 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was rev. 1.0.

The EUT driver software installed in the equipment during testing was rev. 1.0.

The test utility software used during testing was rev. 1.0.

5.5. WORST-CASE CONFIGURATION AND MODE

For Radiated Emissions below 1 GHz and Power line Conducted Emissions, the channel with the highest conducted output power was selected as worst-case scenario.

Worst-case data rates as provided by the manufacturer are:
For 8PSK mode: DH5

5.6 DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

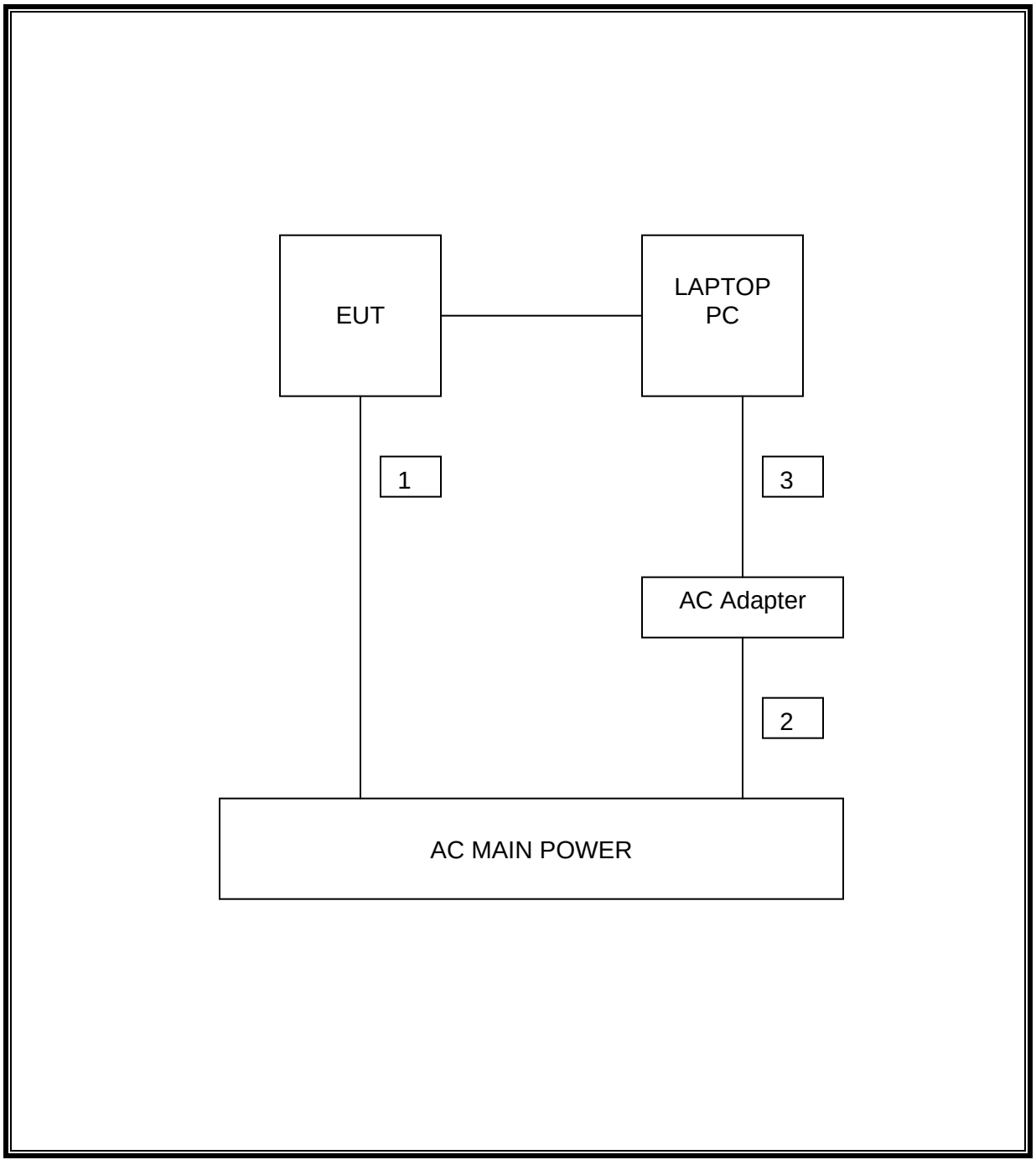
PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	2768-HH4	R8-PCNFE 210124	DoC
Laptop AC Adapter	Lenovo	92P1109	Z1ZBTZ85V M 0	DoC

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	1.8m	N/A
2	AC	1	US 115V	Un-shielded	1m	N/A
3	DC	1	DC	Un-shielded	1.8m	N/A
4	USB	1	Mini USB	Un-shielded	1.2m	Connect to Laptop

TEST SETUP

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**Asset**	**Cal Date**	**Cal Due**
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	08/04/11	08/04/12
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01176	08/04/11	08/04/12
Antenna, Horn, 18 GHz	EMCO	3115	C00872	06/29/11	06/29/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	07/18/11	07/18/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01171	07/16/11	07/16/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	11/11/11	11/11/12
Peak Power Meter	Agilent / HP	N1911A	1282124A	08/04/11	08/04/12
Peak and Avg Power Sensor	Agilent / HP	E9323A	1240537J	08/04/11	08/04/12
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	7/6/2011	7/6/2012
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/10/11	11/10/12
Horn Antenna, 26 GHz	ARA	MWH-1826/B	C00589	07/28/11	07/28/12
Horn Antenna, 40 GHz	ARA	MWH-2640/B	C00981	06/14/11	06/14/12
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/12/11	08/12/12

7. ANTENNA PORT TEST RESULTS

7.1. ENHANCED DATA RATE 8PSK MODULATION

7.1.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

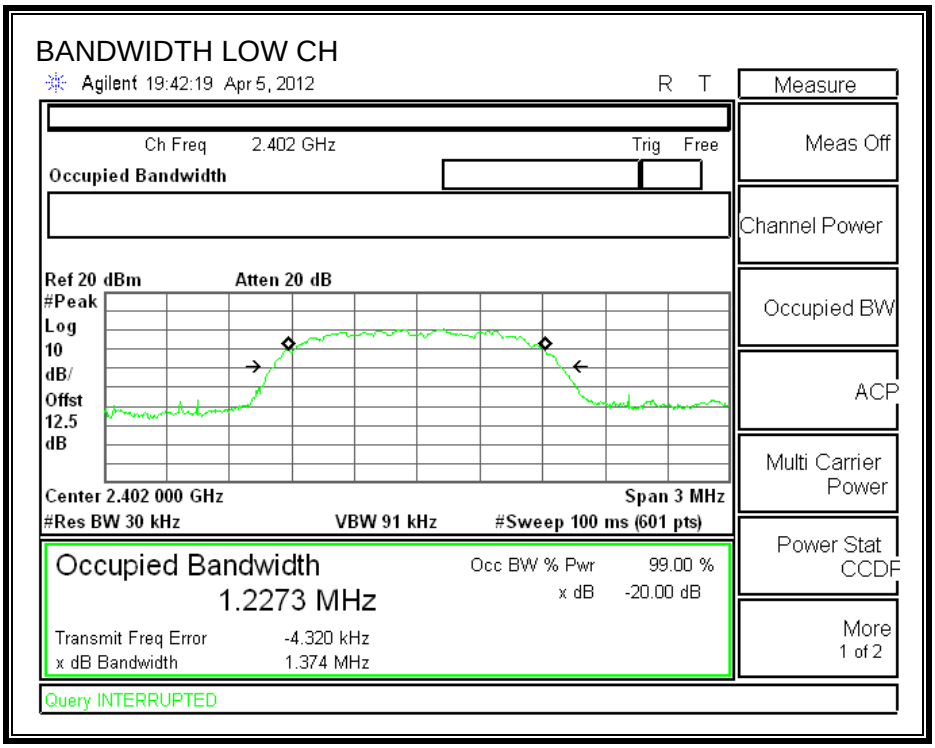
TEST PROCEDURE

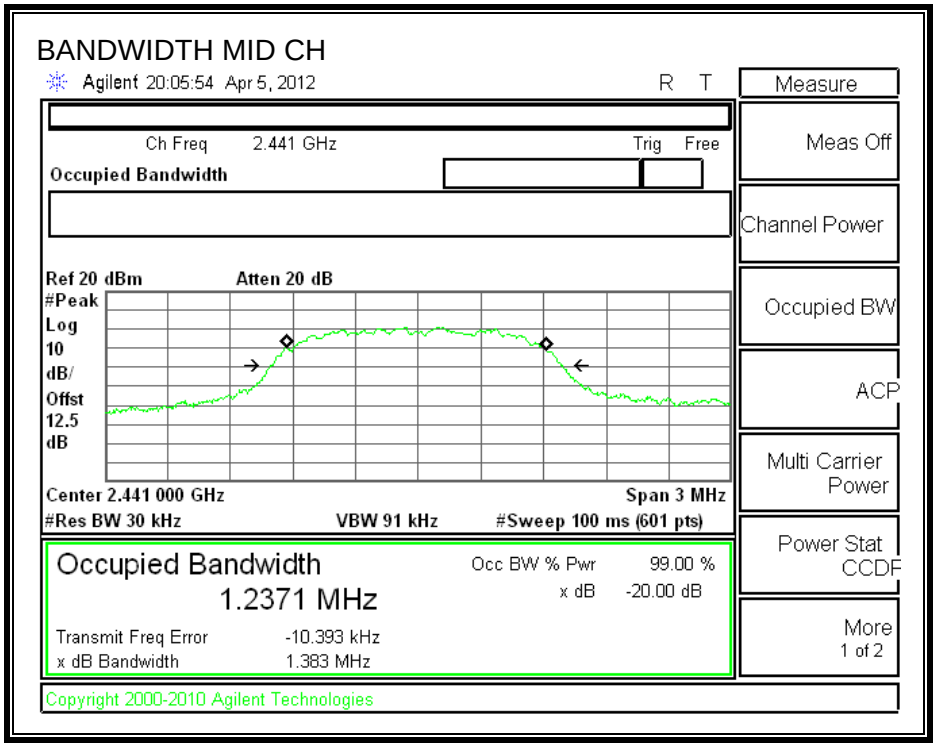
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

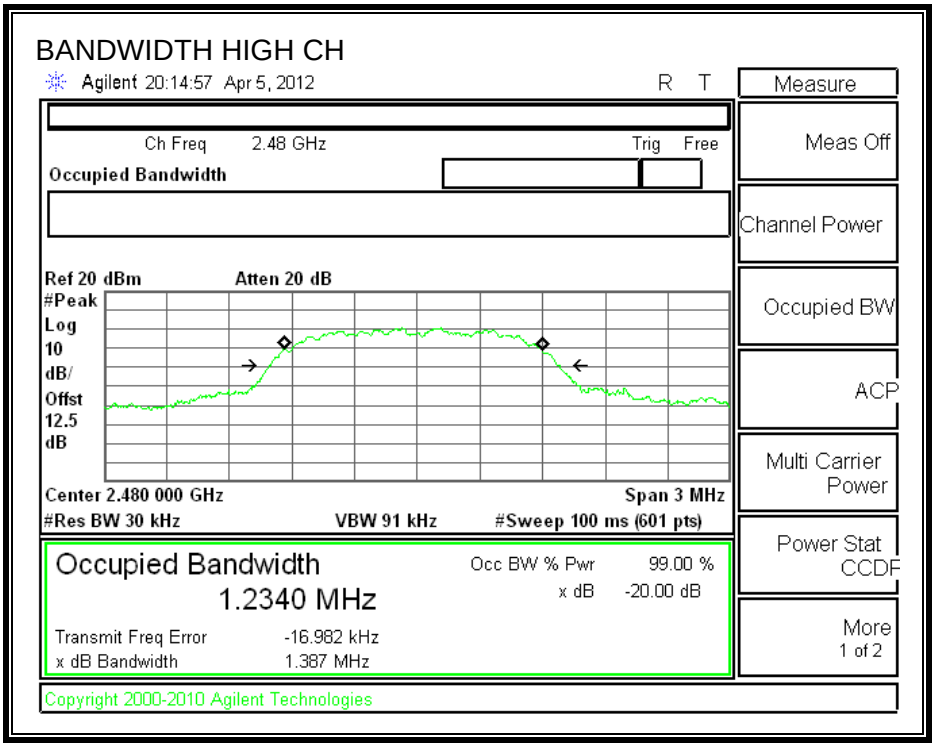
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1374	1236.1
Middle	2441	1383	1236.1
High	2480	1387	1221.2

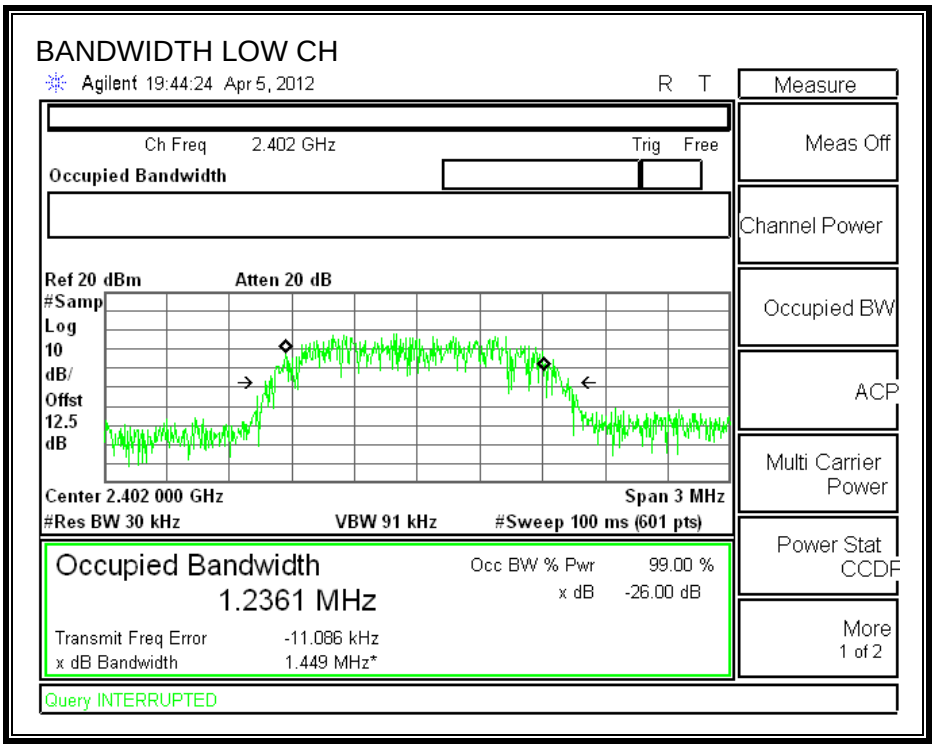
20 dB BANDWIDTH

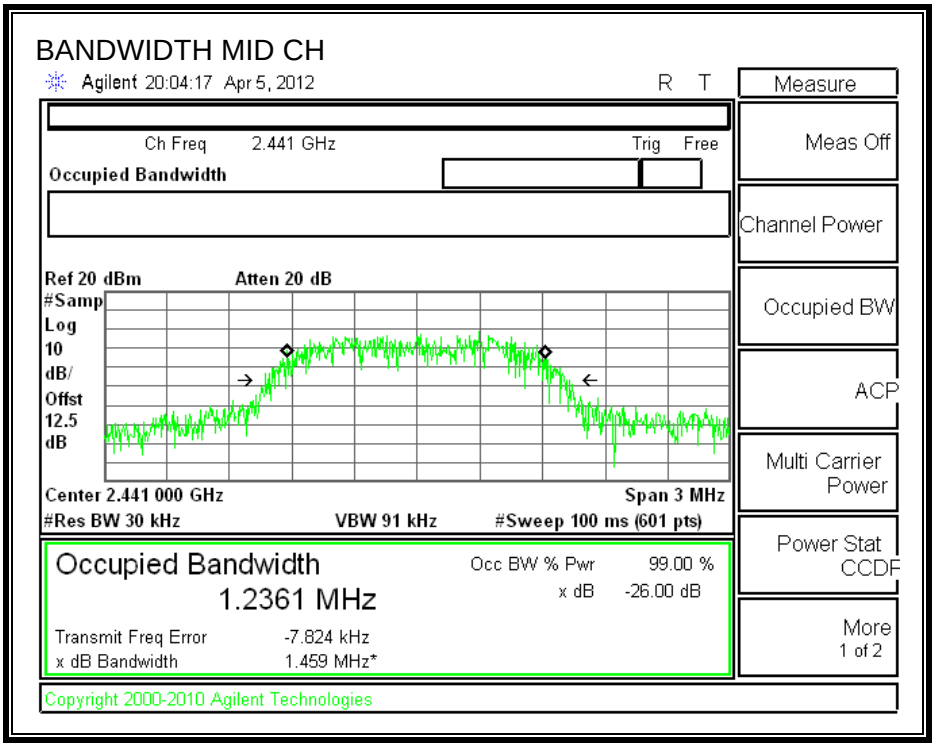


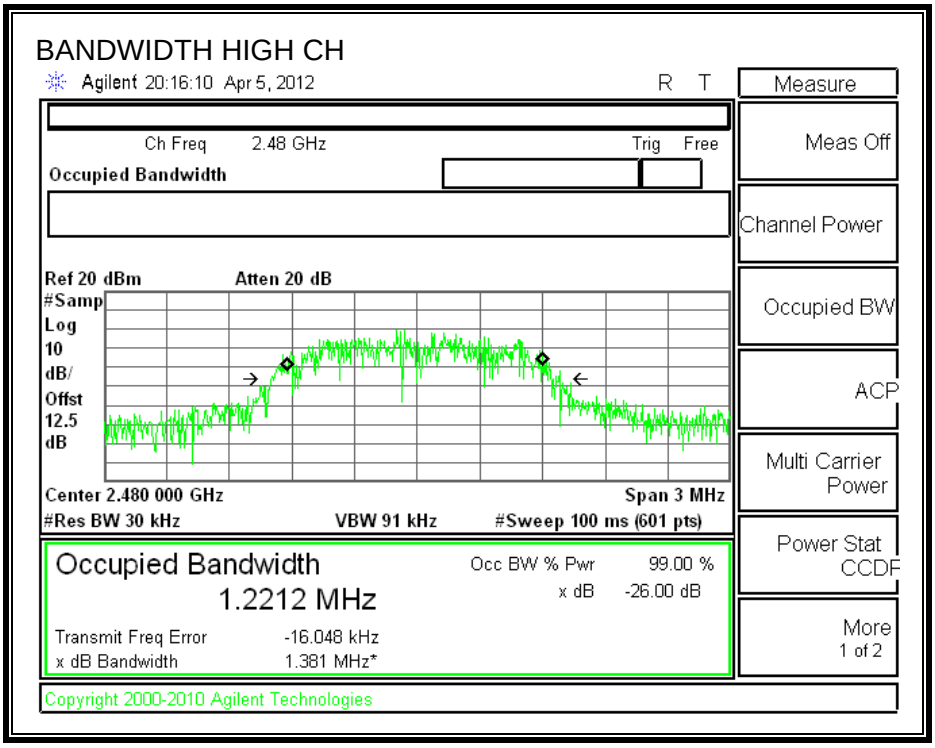




99% BANDWIDTH







7.1.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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

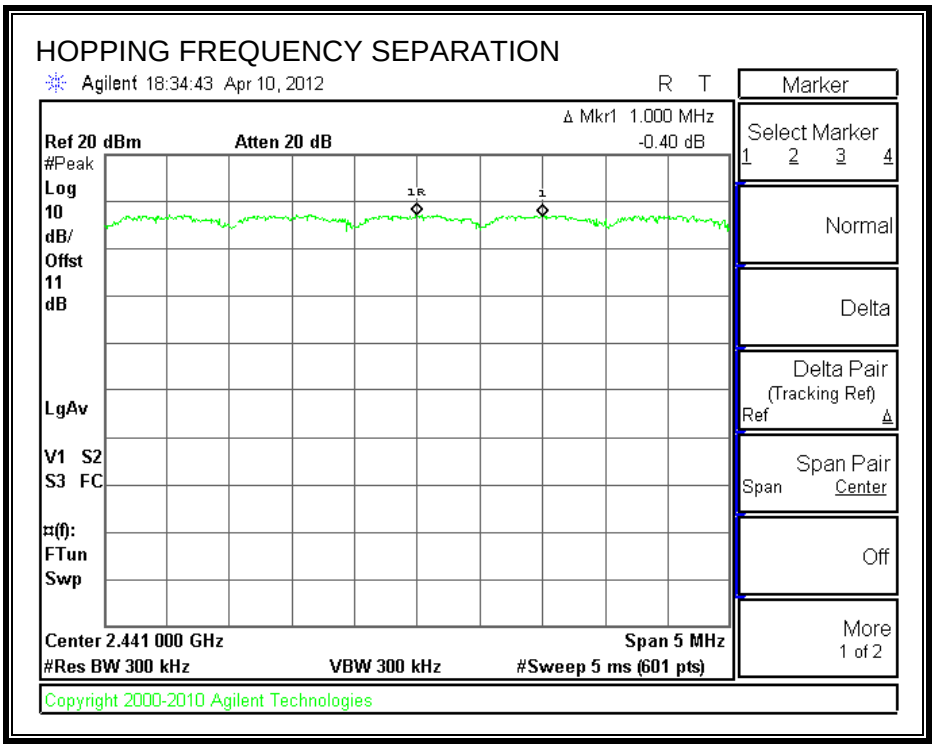
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

RESULTS

HOPPING FREQUENCY SEPARATION



7.1.3. 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.

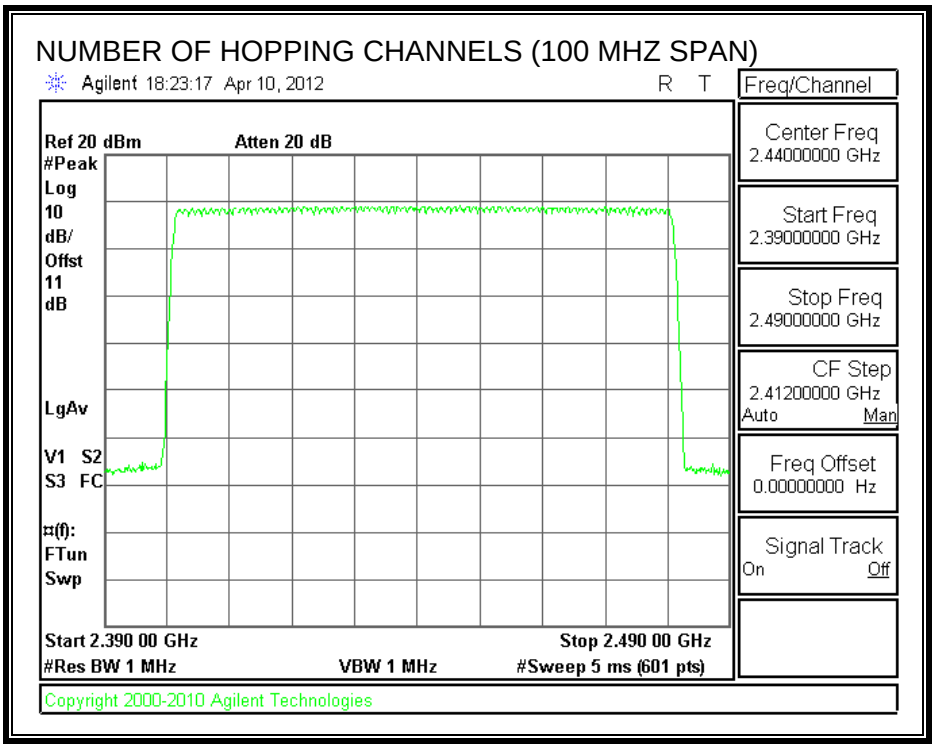
TEST PROCEDURE

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.

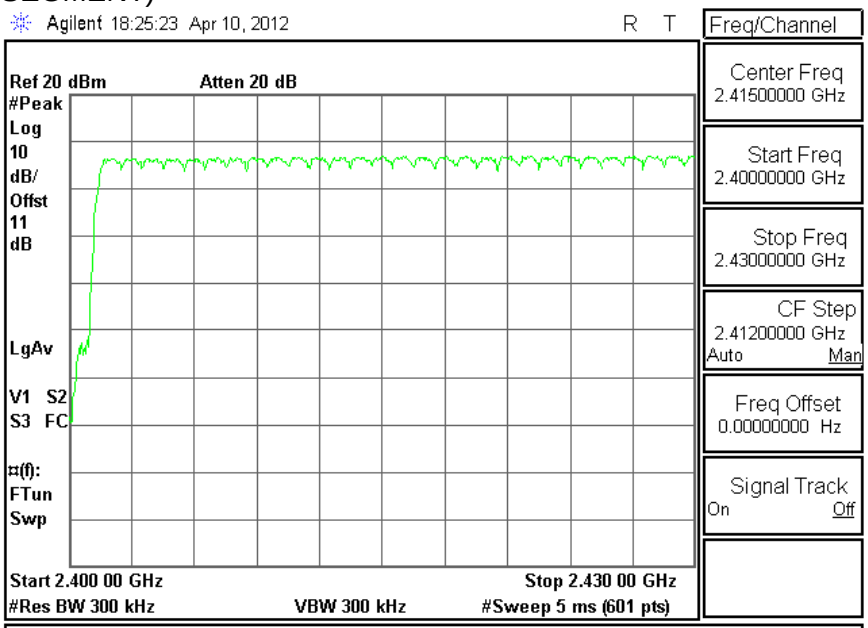
RESULTS

79 Channels observed.

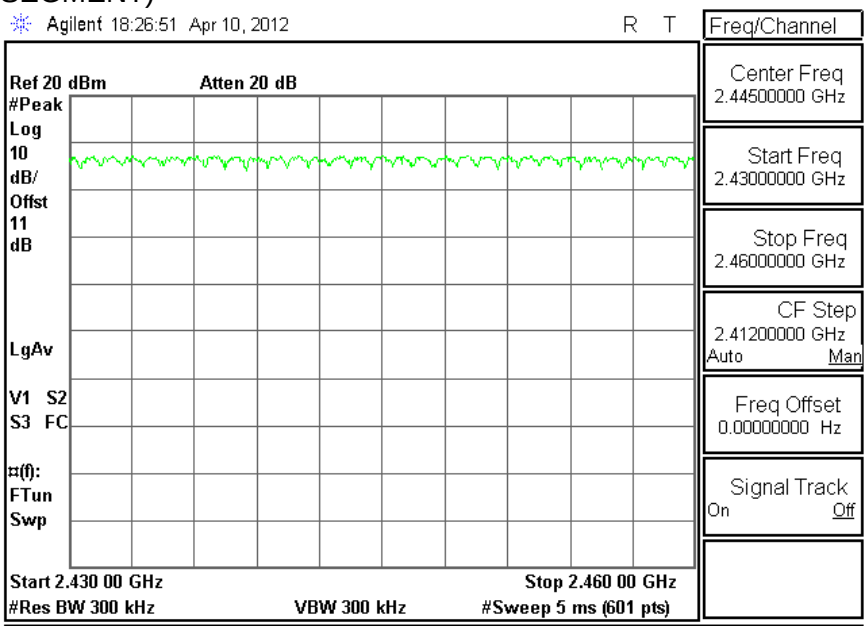
NUMBER OF HOPPING CHANNELS



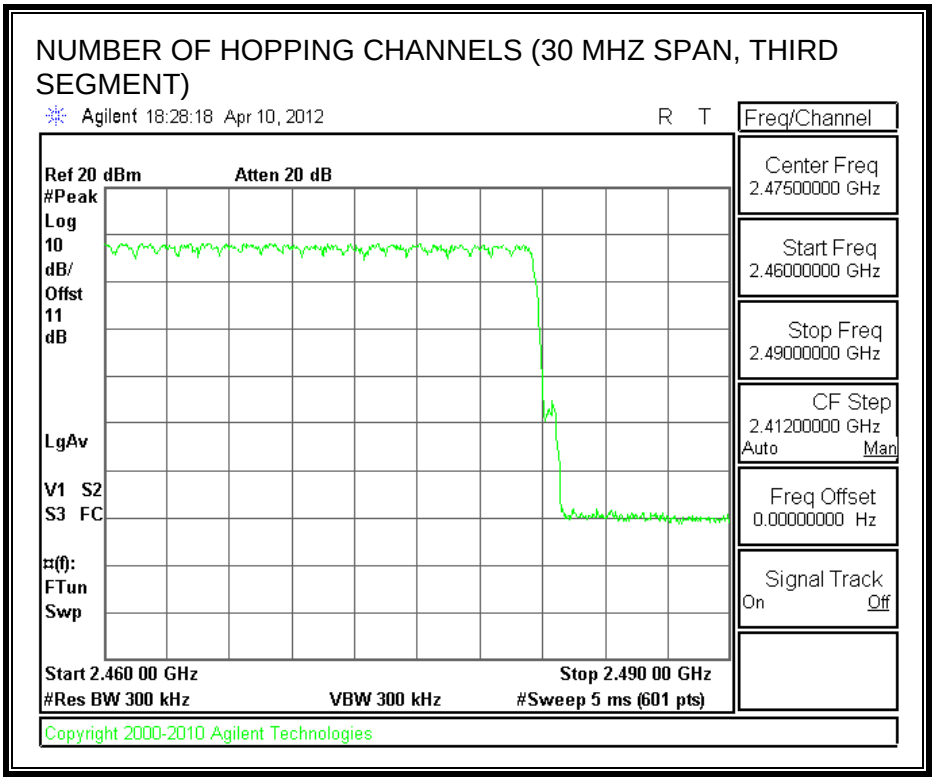
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



7.1.4. 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.

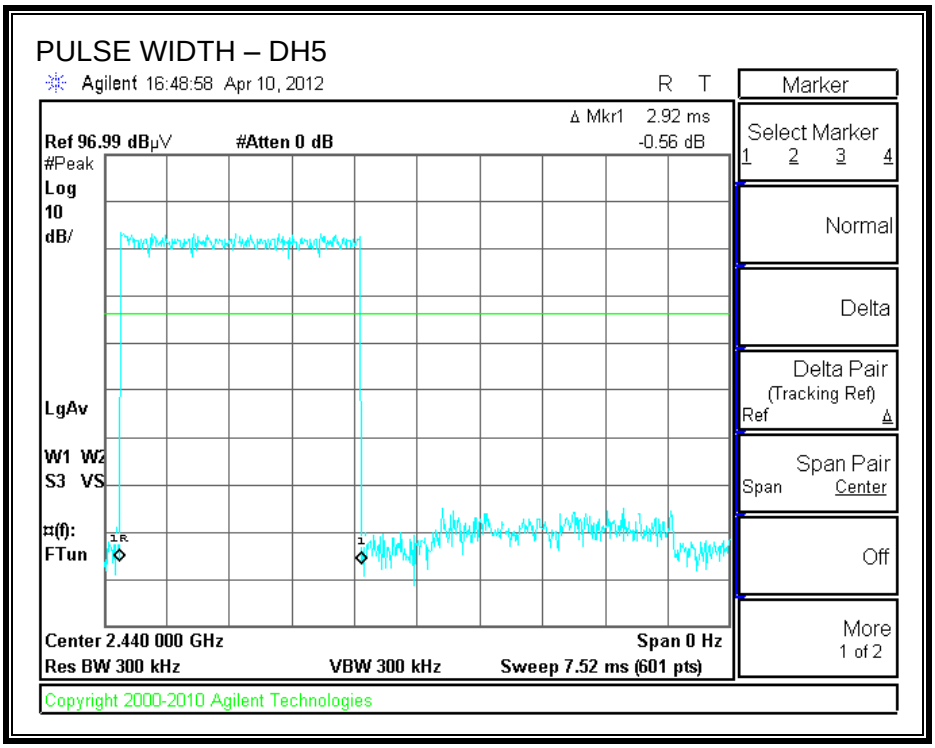
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

RESULTS

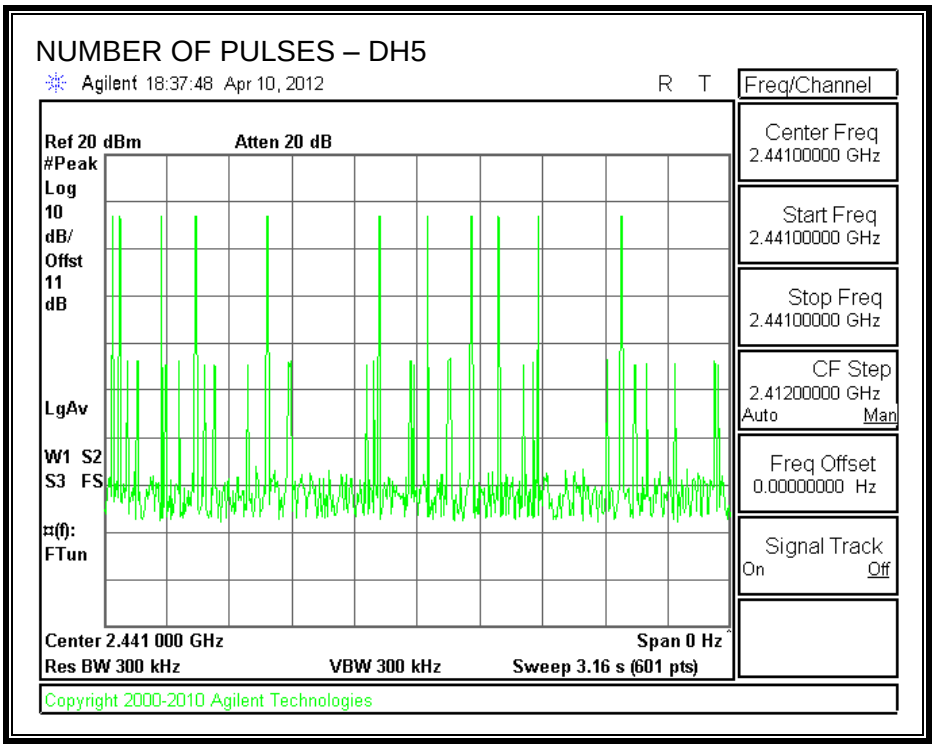
Time Of Occupancy = 10 * xx pulses * yy msec = zz msec

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH5	2.92	11	0.321	0.4	-0.079

PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



7.1.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

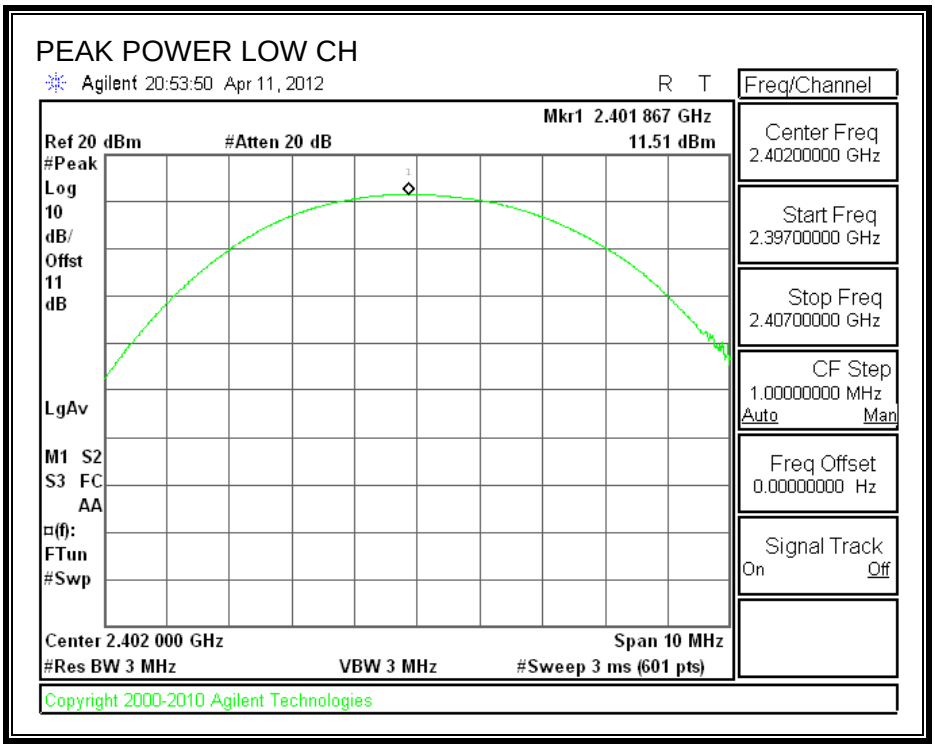
TEST PROCEDURE

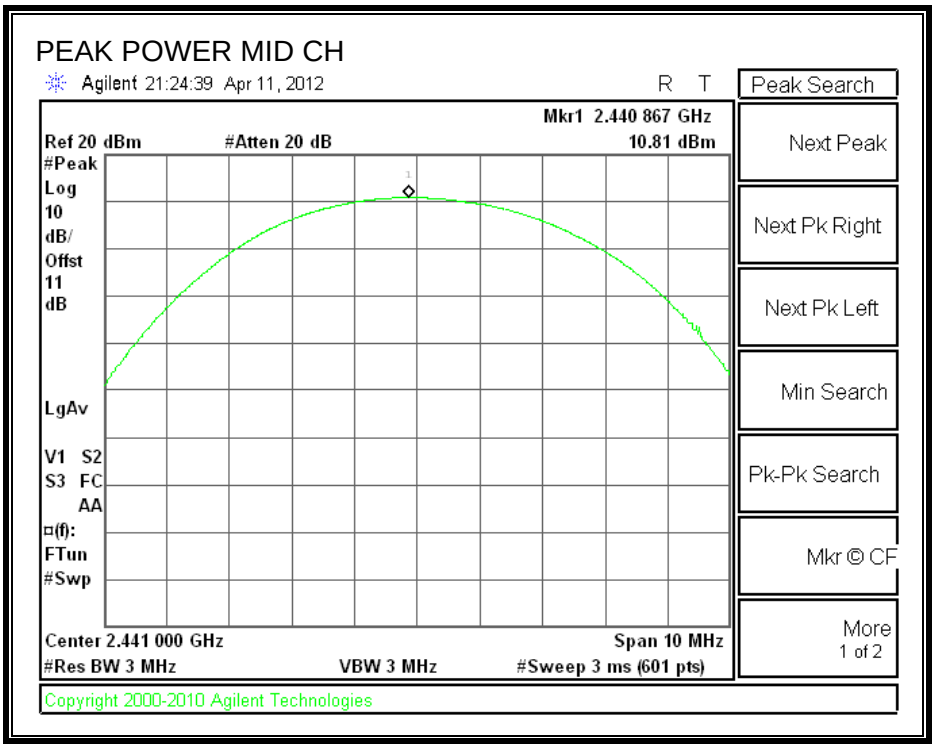
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

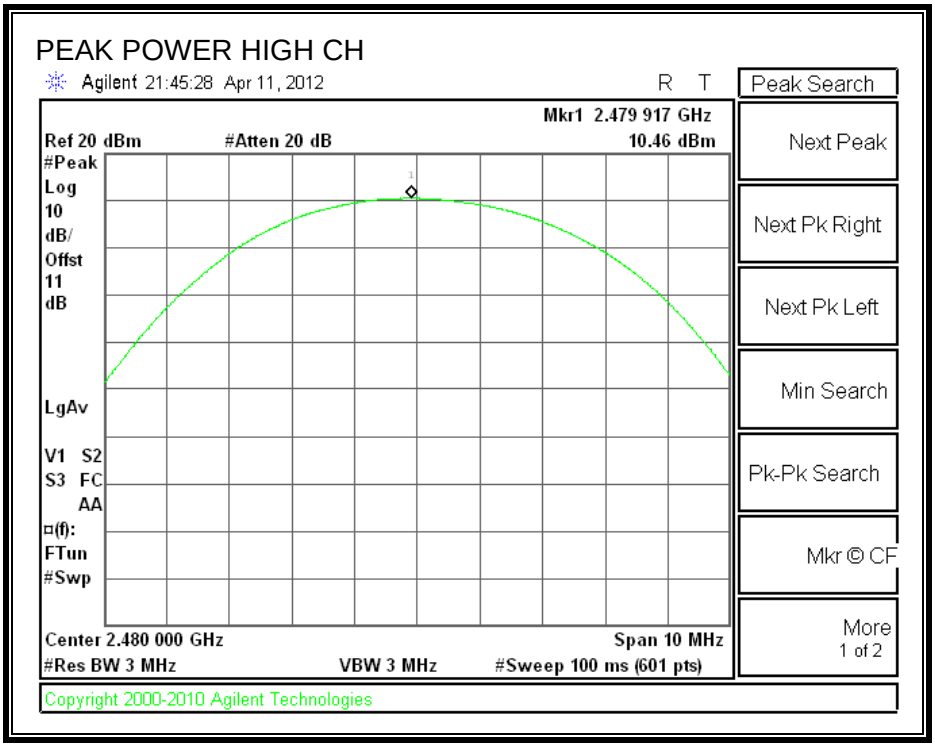
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.51	30	-18.49
Middle	2441	10.81	30	-19.19
High	2480	10.46	30	-19.54

OUTPUT POWER







7.1.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.27
Middle	2441	6.70
High	2480	6.40

7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

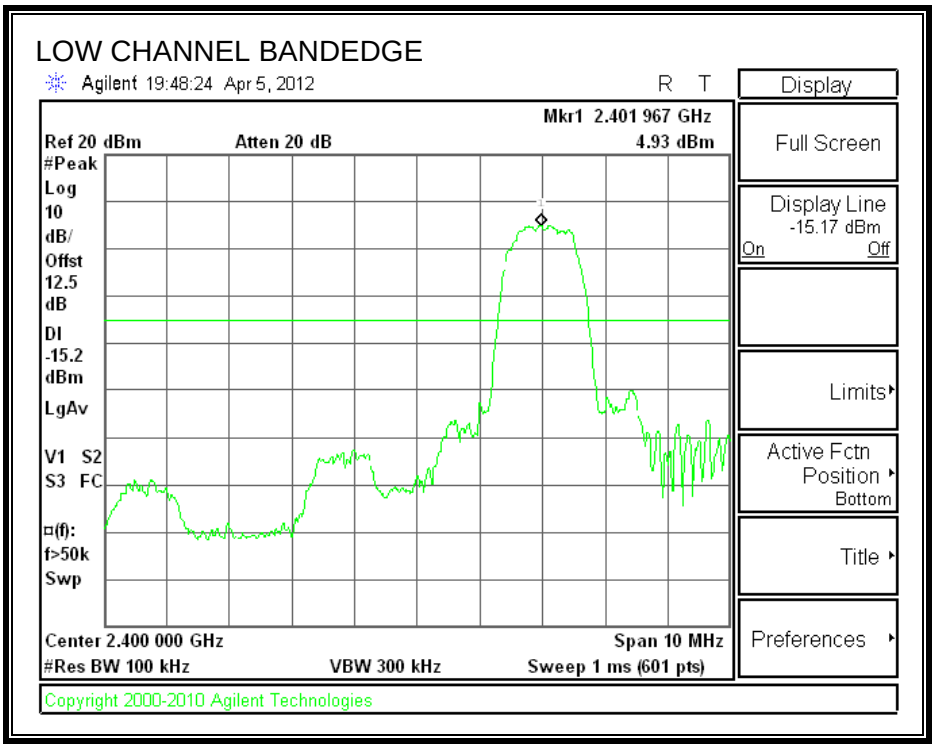
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

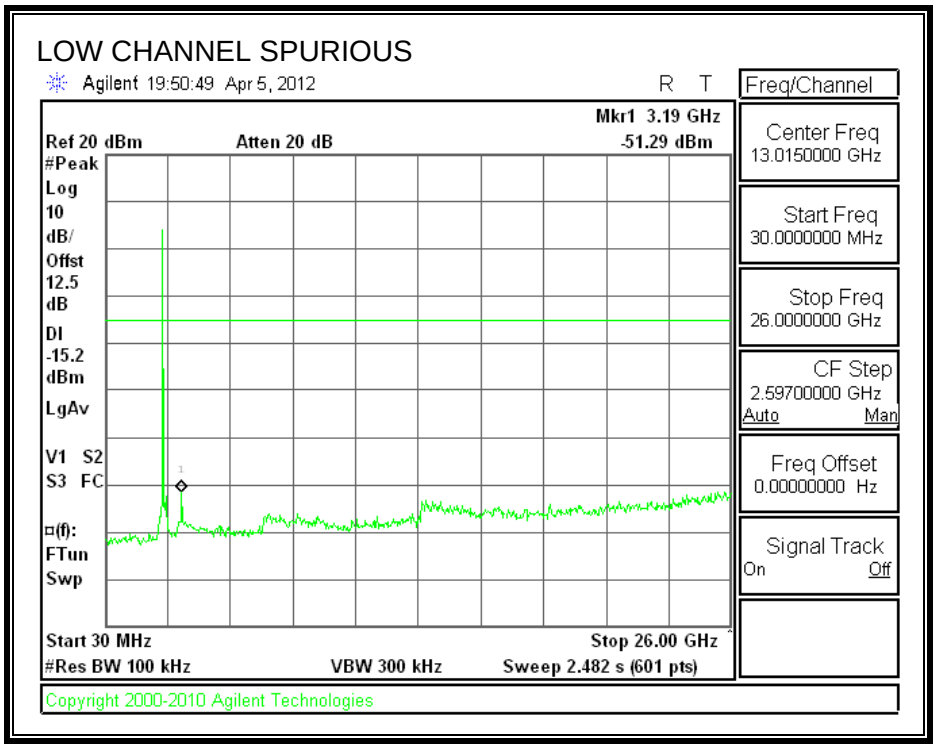
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

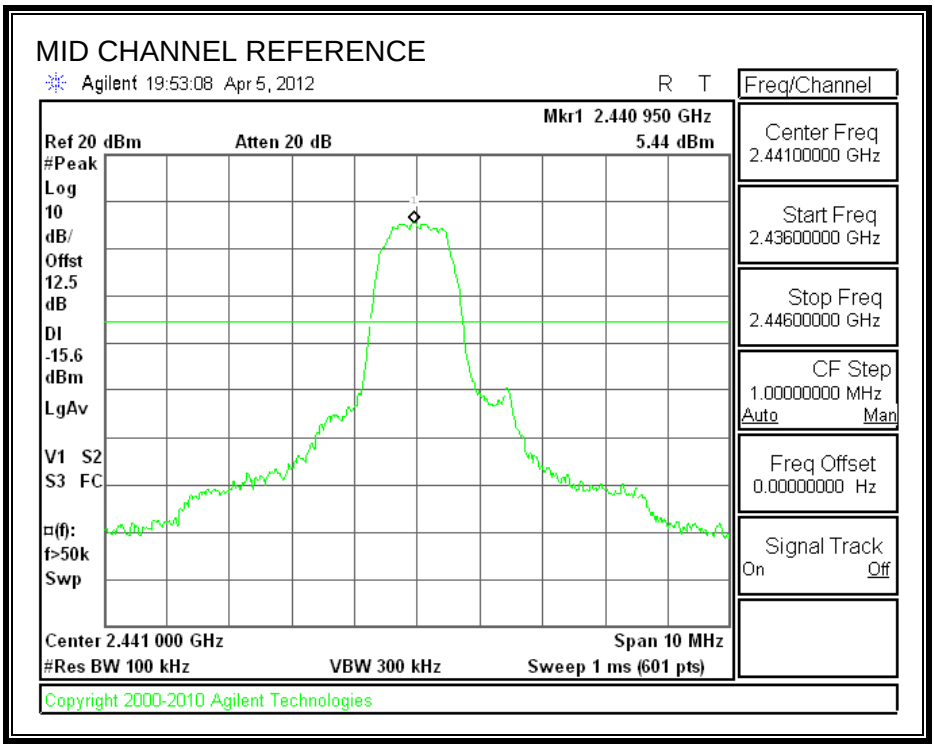
RESULTS

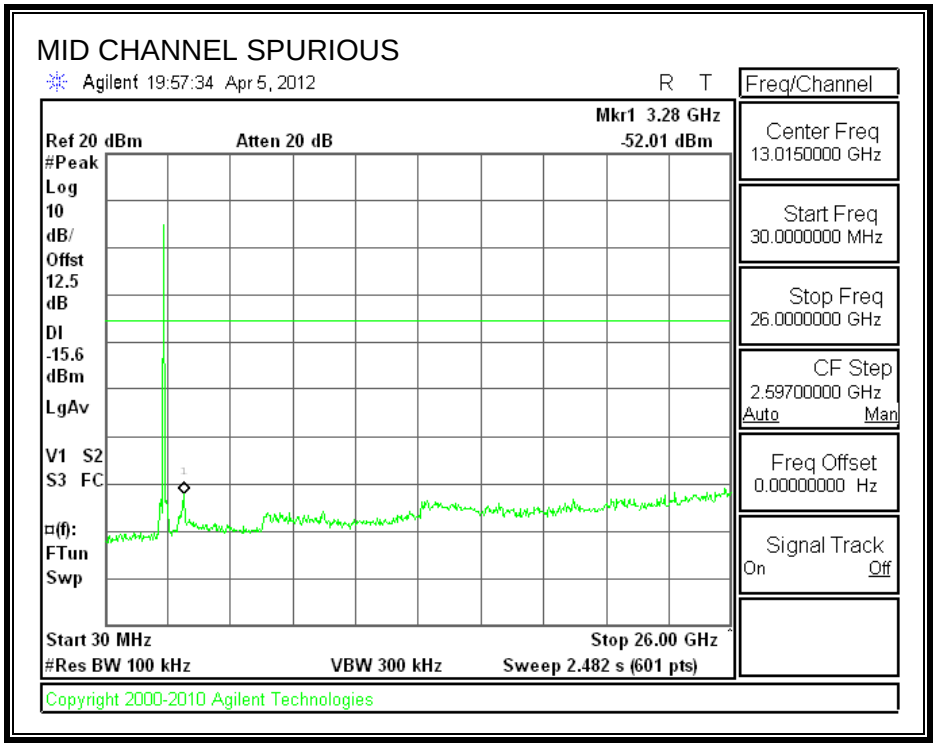
SPURIOUS EMISSIONS, LOW CHANNEL



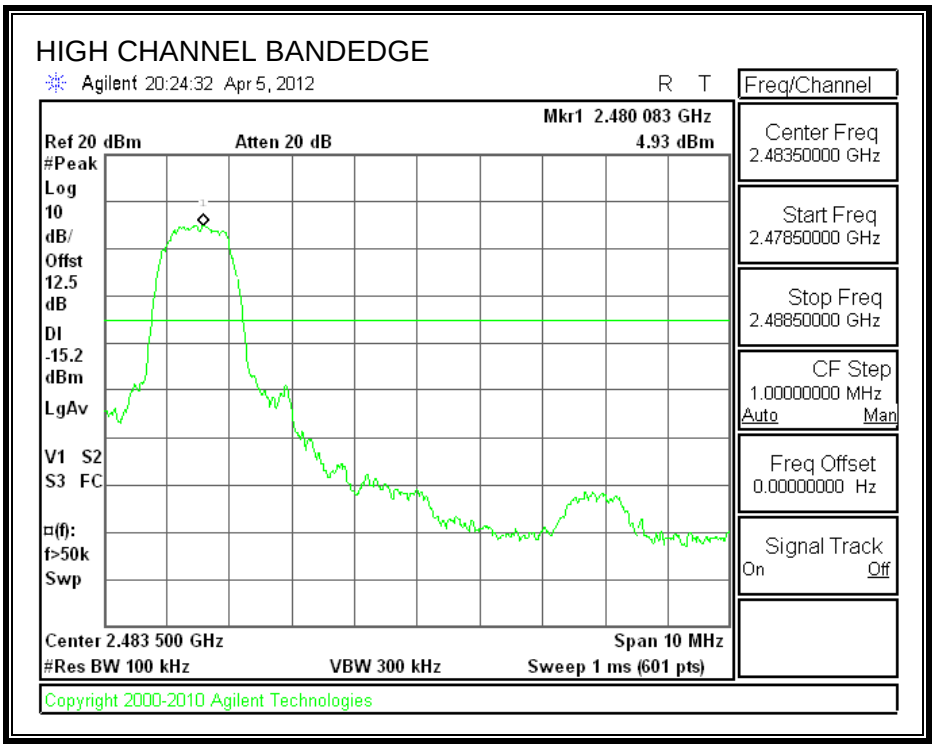


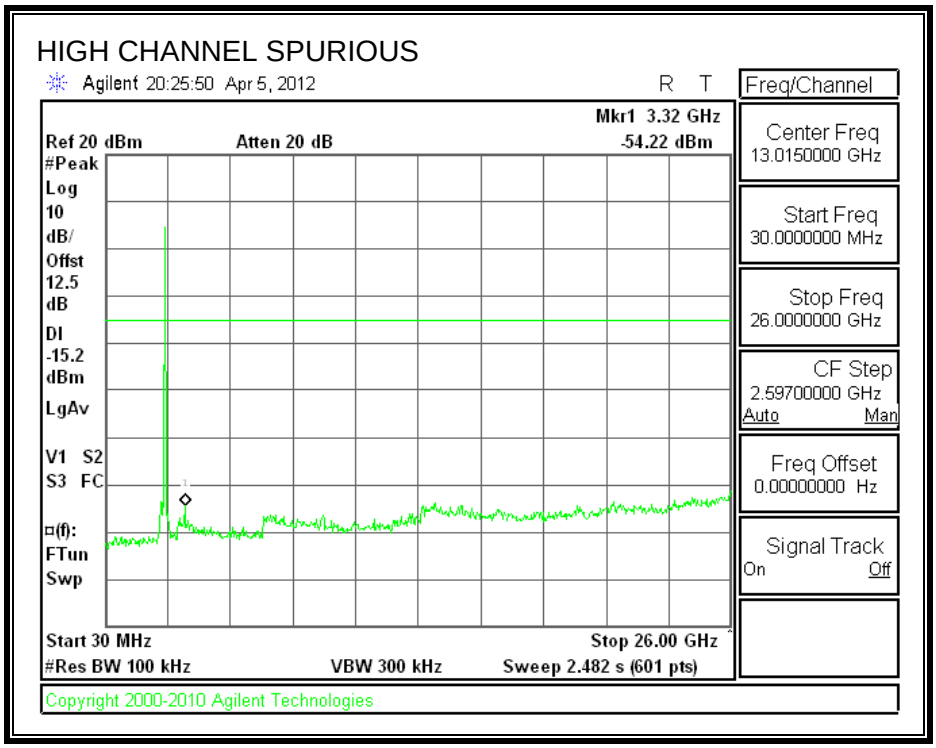
SPURIOUS EMISSIONS, MID CHANNEL



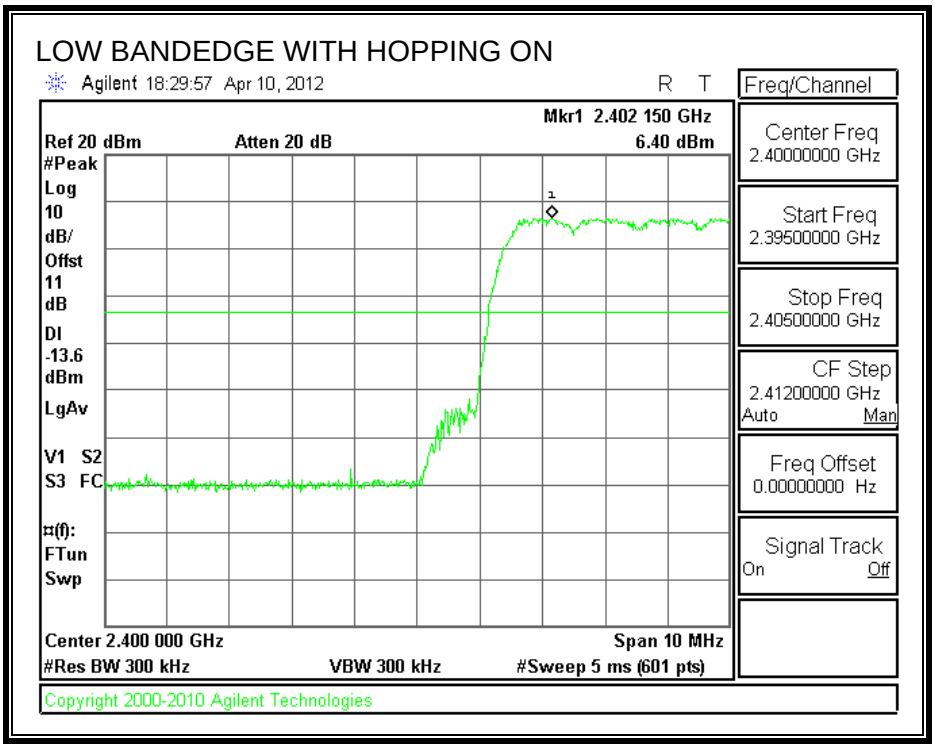


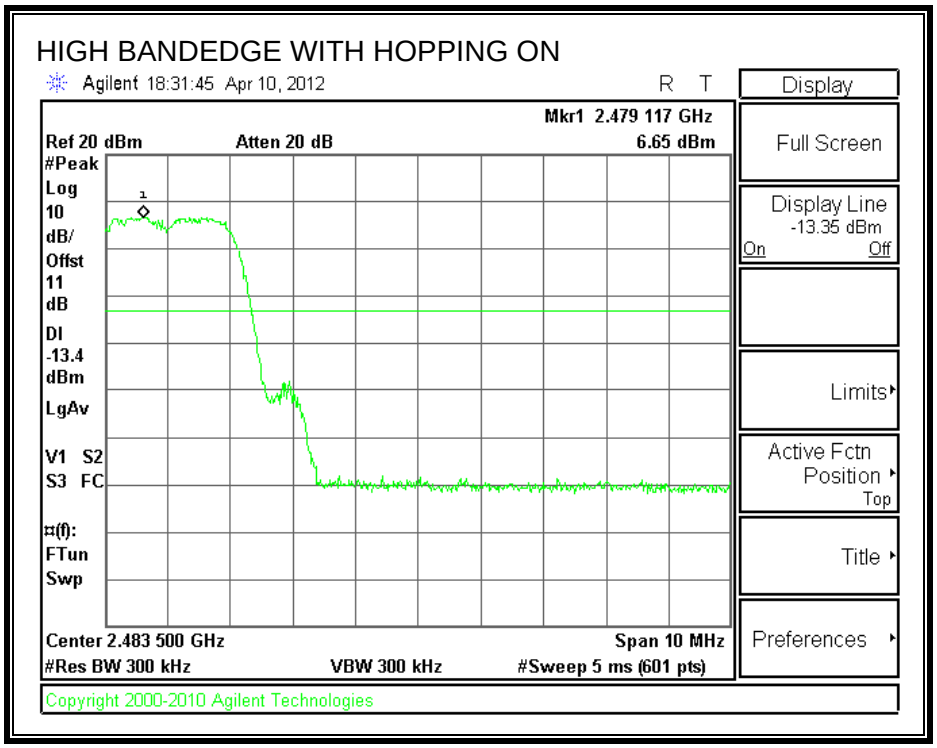
SPURIOUS EMISSIONS, HIGH CHANNEL





SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

TEST PROCEDURE

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

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

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

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

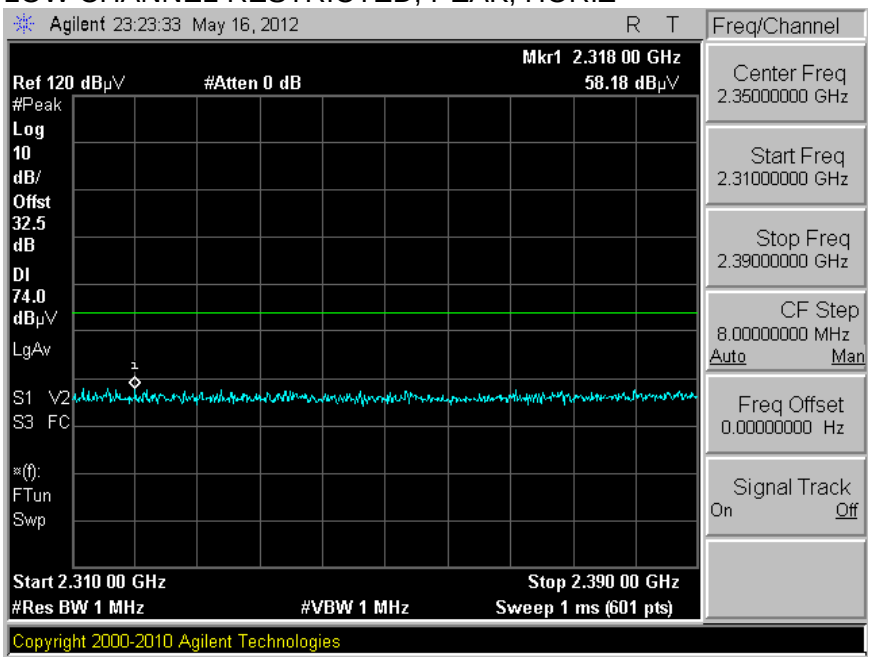
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

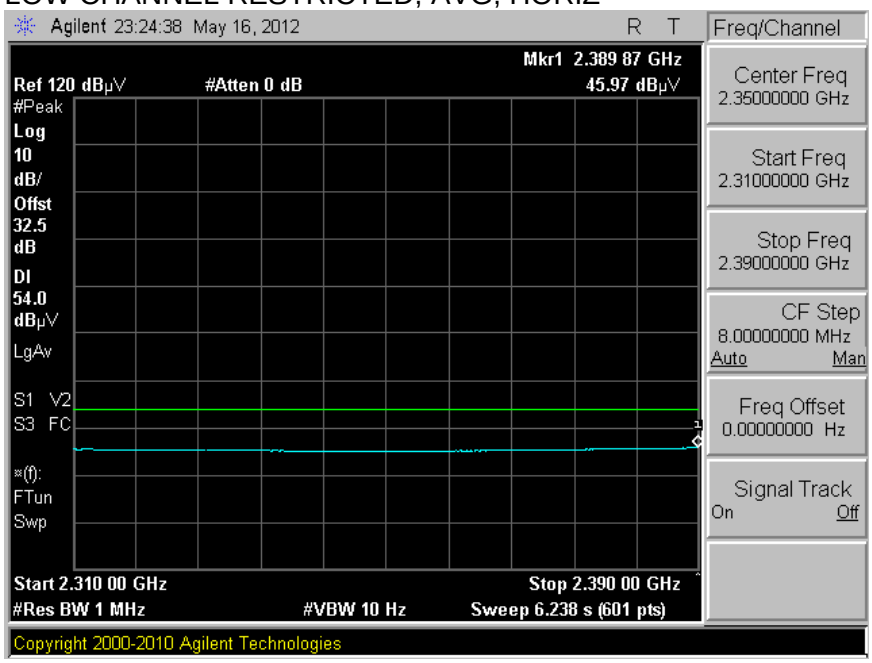
ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

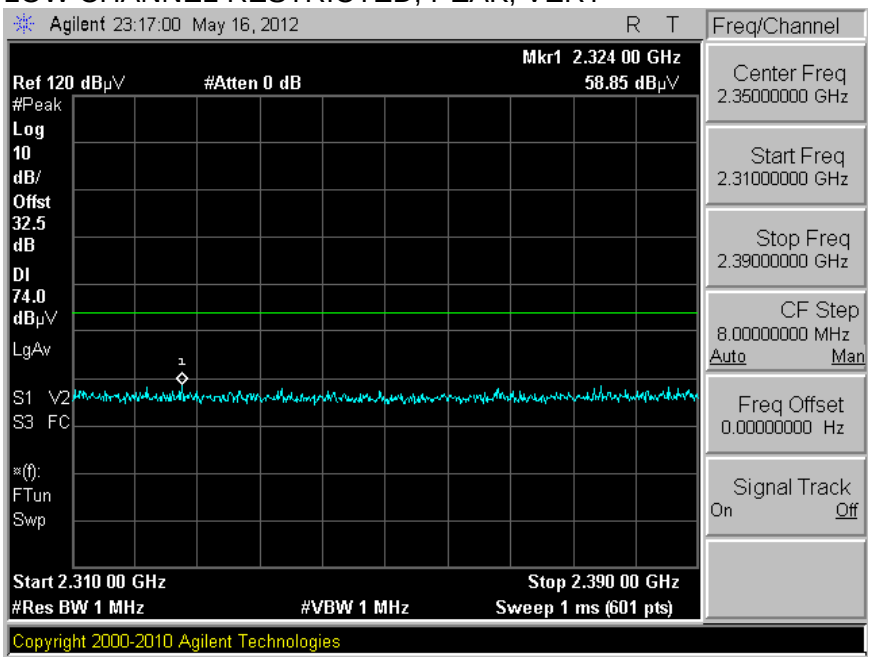


LOW CHANNEL RESTRICTED, AVG, HORIZ

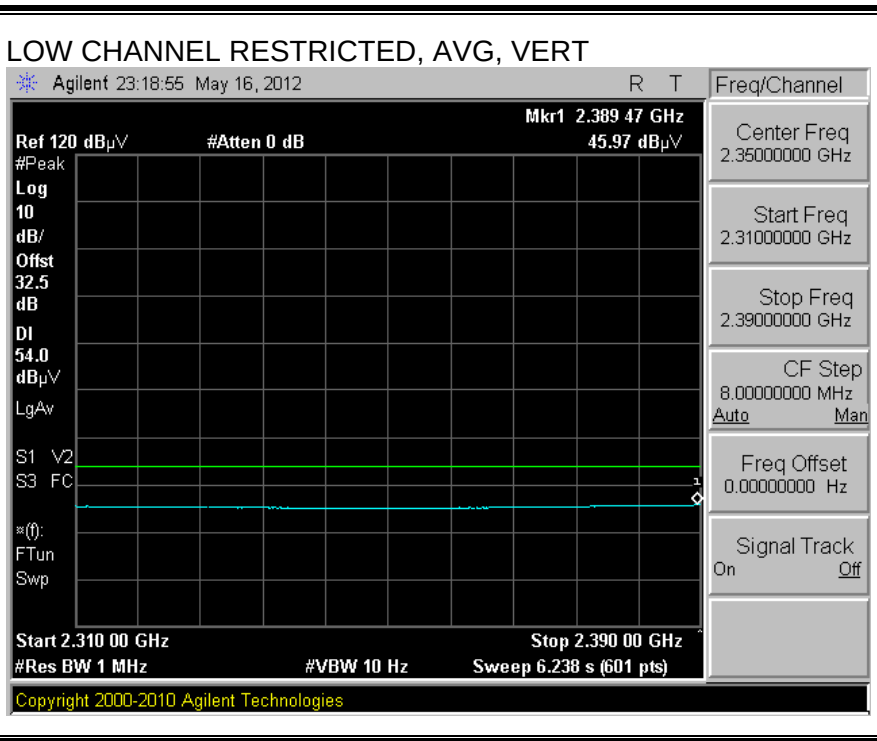


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT

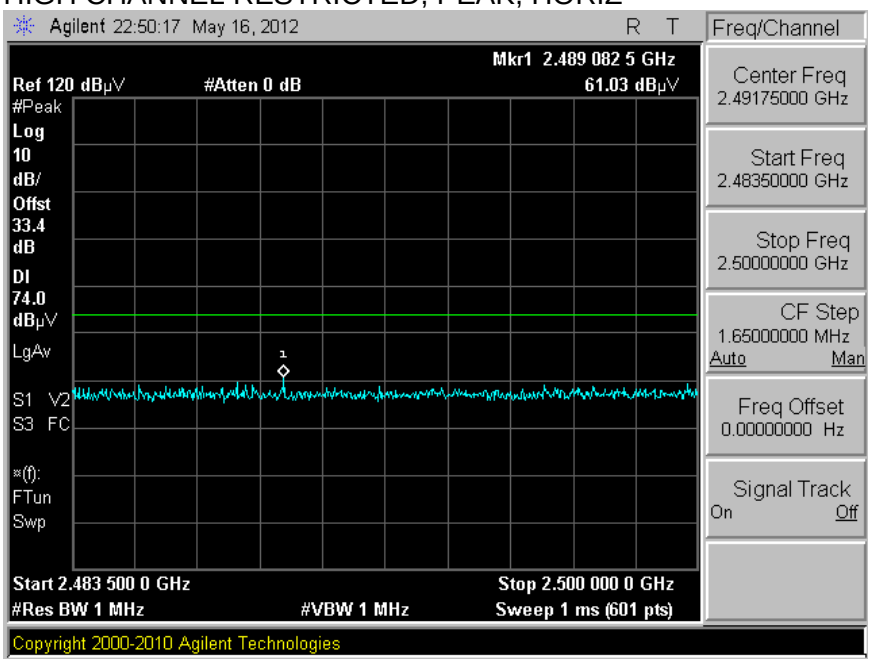


LOW CHANNEL RESTRICTED, AVG, VERT

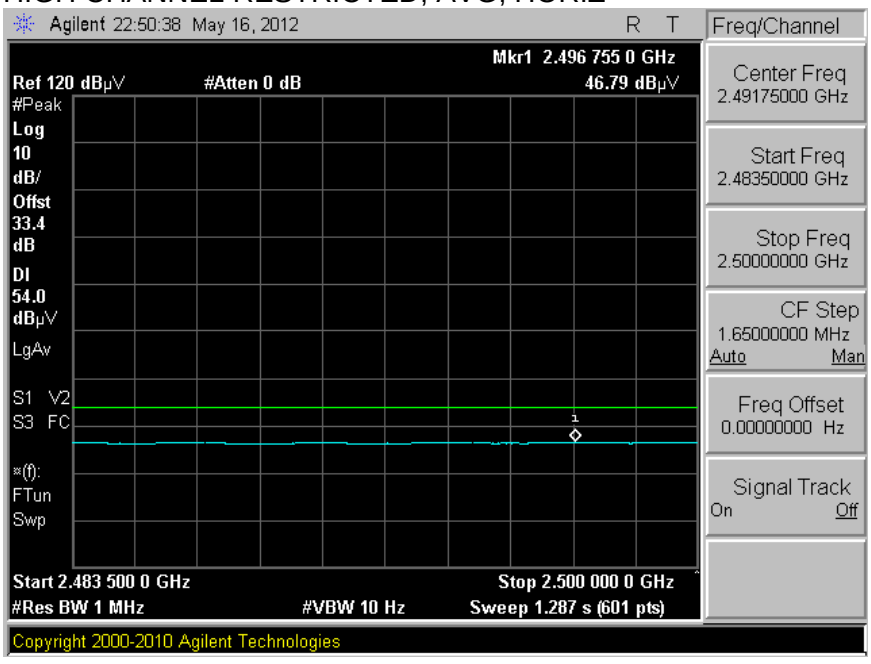


RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ

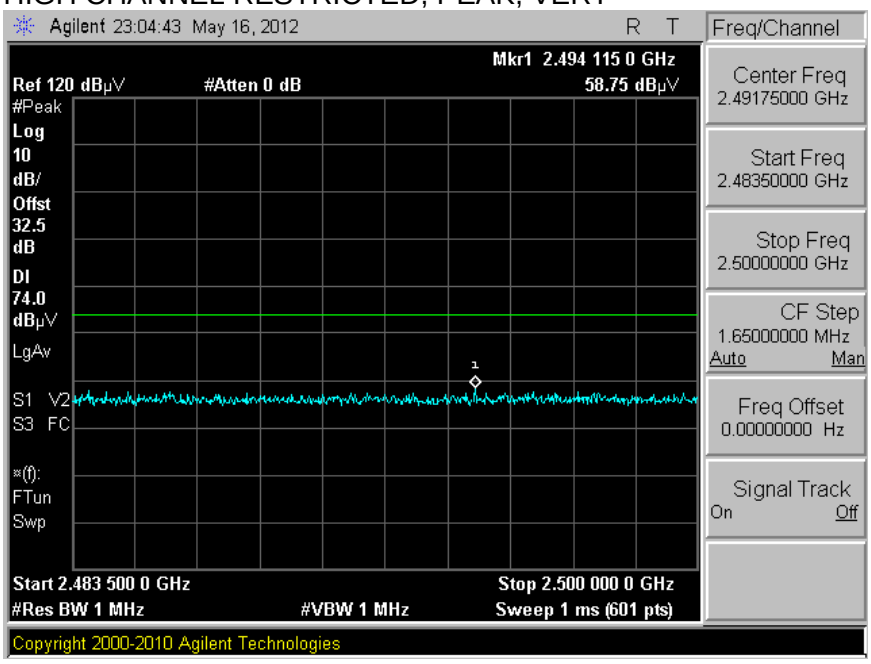


HIGH CHANNEL RESTRICTED, AVG, HORIZ

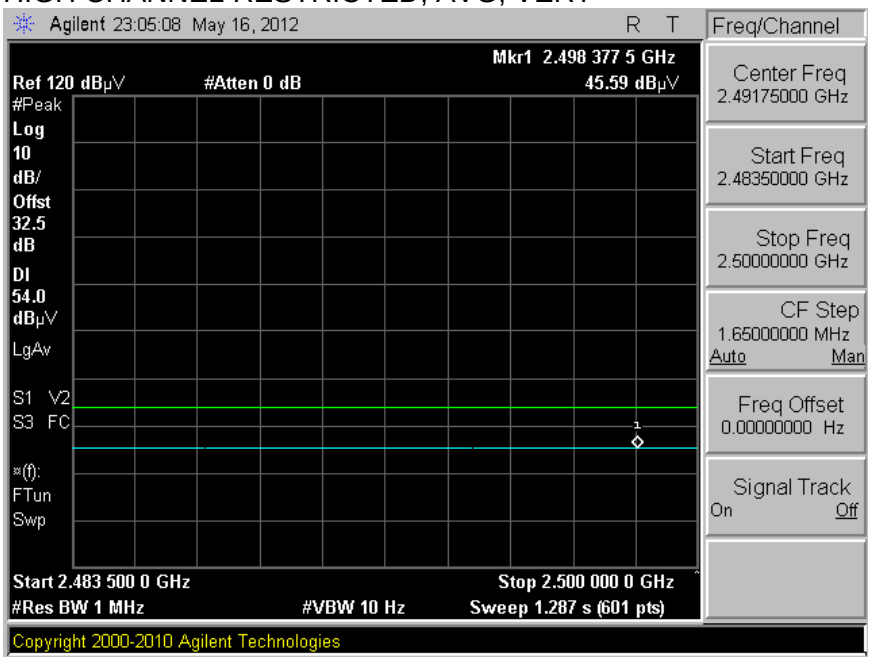


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Company: GOOGLE
Project #: 11U14119
Date: 5/16/2012
Test Engineer: Thanh Nguyen
Configuration: EUT only
Mode: Tx 8PSK

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B		T125; ARA 18-26GHz; S/N:1007	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_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 ch															
4.804	3.0	40.8	29.6	33.1	6.8	-34.1	0.0	0.0	46.6	35.4	74	54	-27.4	-18.6	V
4.804	3.0	43.7	30.6	33.1	6.8	-34.1	0.0	0.0	49.5	36.4	74	54	-24.5	-17.6	H
Mid ch															
4.882	3.0	42.6	30.4	33.2	6.8	-34.0	0.0	0.0	48.5	36.3	74	54	-25.5	-17.7	V
7.323	3.0	34.3	23.5	36.3	9.1	-33.1	0.0	0.0	46.6	35.8	74	54	-27.4	-18.2	Noise floo
4.882	3.0	45.3	33.6	33.2	6.8	-34.0	0.0	0.0	51.2	39.5	74	54	-22.8	-14.5	H
7.323	3.0	35.3	23.5	36.3	9.1	-33.1	0.0	0.0	47.6	35.8	74	54	-26.4	-18.2	Noise floo
High Ch															
4.960	3.0	43.3	30.9	33.2	6.9	-34.0	0.0	0.0	49.4	37.0	74	54	-24.6	-17.0	V
7.440	3.0	32.4	23.7	36.5	9.1	-33.0	0.0	0.0	44.9	36.2	74	54	-29.1	-17.8	Noise floo
4.960	3.0	44.6	31.7	33.2	6.9	-34.0	0.0	0.0	50.6	37.8	74	54	-23.4	-16.2	H
7.440	3.0	35.6	23.3	36.5	9.1	-33.0	0.0	0.0	48.1	35.9	74	54	-25.9	-18.1	Noise floo

Rev. 07.08.11

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. RECEIVER ABOVE 1 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber-B

Company: Google
Project #: 11U14119
Date: 03/30/12
Test Engineer: Thanh nguyen
Configuration: EUT alone
Mode: Receive

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A0056			RX RSS 210

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)
1.126	3.0	47.9	32.0	24.4	2.8	-35.9	0.0	0.0	39.1	23.3	74	54	-34.9	-30.7	V
1.850	3.0	45.3	28.8	27.7	3.6	-35.5	0.0	0.0	41.2	24.6	74	54	-32.8	-29.4	V
2.500	3.0	43.4	28.7	28.8	4.4	-35.2	0.0	0.0	41.4	26.6	74	54	-32.6	-27.4	V
1.120	3.0	50.2	33.2	24.4	2.8	-35.9	0.0	0.0	41.5	24.5	74	54	-32.5	-29.5	H
1.765	3.0	45.2	30.2	27.3	3.5	-35.5	0.0	0.0	40.5	25.5	74	54	-33.5	-28.5	H
2.460	3.0	44.7	28.3	28.7	4.3	-35.2	0.0	0.0	42.5	26.1	74	54	-31.5	-27.9	H

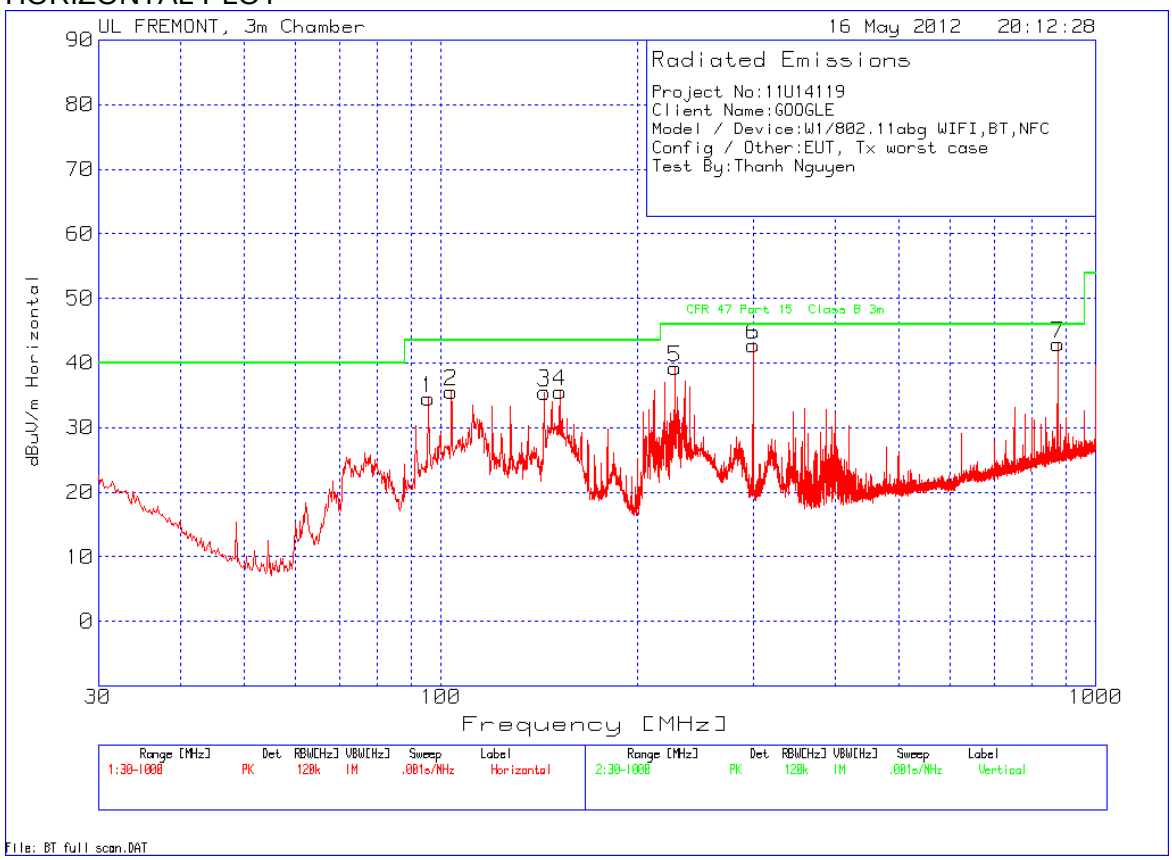
Rev. 07.08.11

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		

8.4. WORST-CASE BELOW 1 GHz

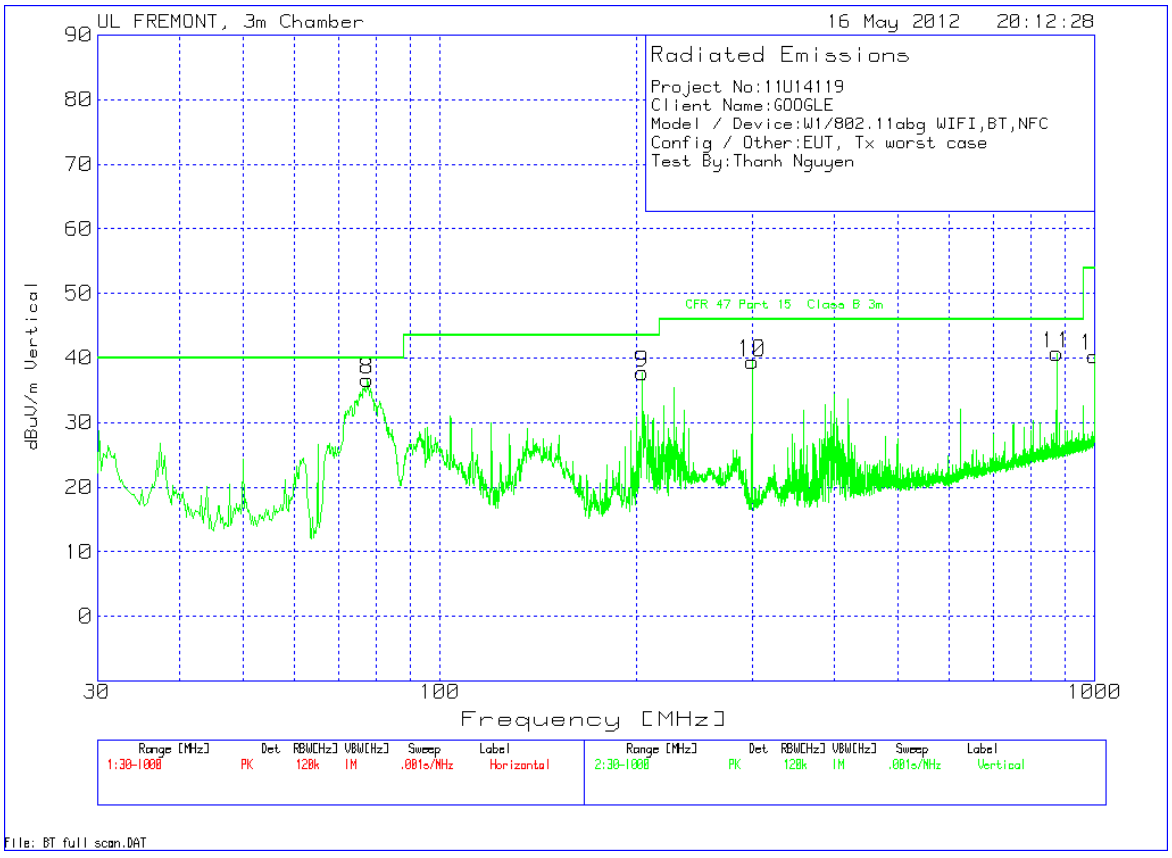
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL & VERTICAL DATA

Project No:11U14119
Client Name:GOOGLE
Model / Device:W1/802.11abg WIFI,BT,NFC
Config / Other:EUT, Tx worst case
Test By:Thanh Nguyen

Horizontal 30 - 1000MHz

Test Frequency	Meter Reading	Detector	PreAmp Factor (dB)	Antenna gain (dB)	EMI(dBu V/m)	FCC Class B 3m	Margin	Height [cm]	Polarity
103.8549	51.26	PK	-26.8	11.1	35.56	43.5	-7.94	201	Horz
143.9808	49.18	PK	-26.4	12.7	35.48	43.5	-8.02	301	Horz
151.9285	49.57	PK	-26.3	12.3	35.57	43.5	-7.93	201	Horz
227.9157	53.82	PK	-25.6	11	39.22	46	-6.78	100	Horz
300.026	54.71	PK	-25.2	13.3	42.81	46	-3.19	100	Horz
875.1639	45.22	PK	-24.2	21.9	42.92	46	-3.08	100	Horz

Vertical 30 - 1000MHz

Test Frequency	Meter Reading	Detector	PreAmp Factor (dB)	Antenna gain (dB)	EMI(dBu V/m)	FCC Class B 3m	Margin	Height [cm]	Polarity
77.492	55.75	PK	-27.1	8	36.65	40	-3.35	99	Vert
203.8789	51.92	PK	-25.8	11.6	37.72	43.5	-5.78	99	Vert
300.026	51.29	PK	-25.2	13.3	39.39	46	-6.61	201	Vert
875.1639	43.03	PK	-24.2	21.9	40.73	46	-5.27	99	Vert
1000	40.43	PK	-23.4	23.3	40.33	54	-13.67	99	Vert

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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

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

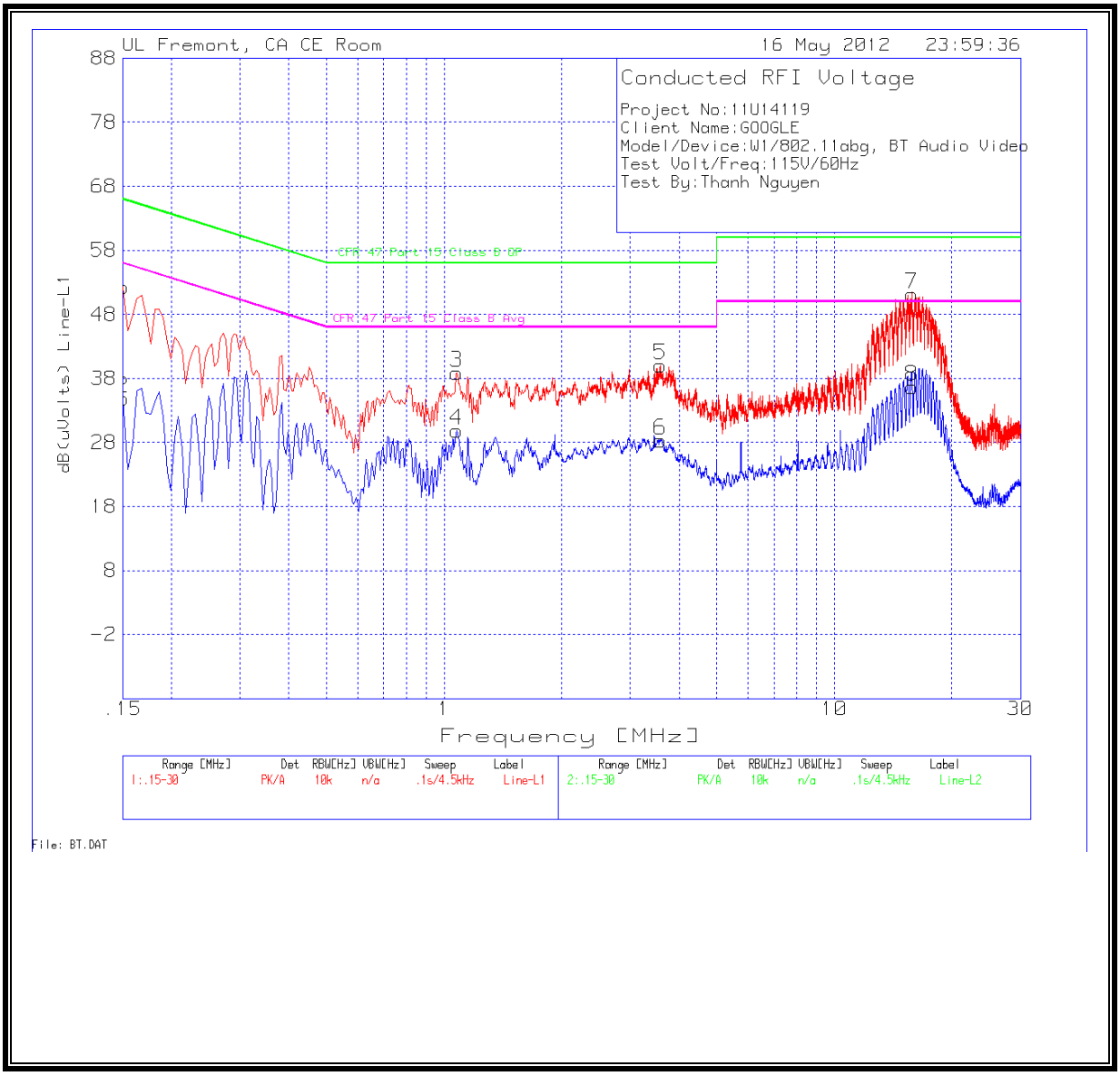
RESULTS

6 WORST EMISSIONS

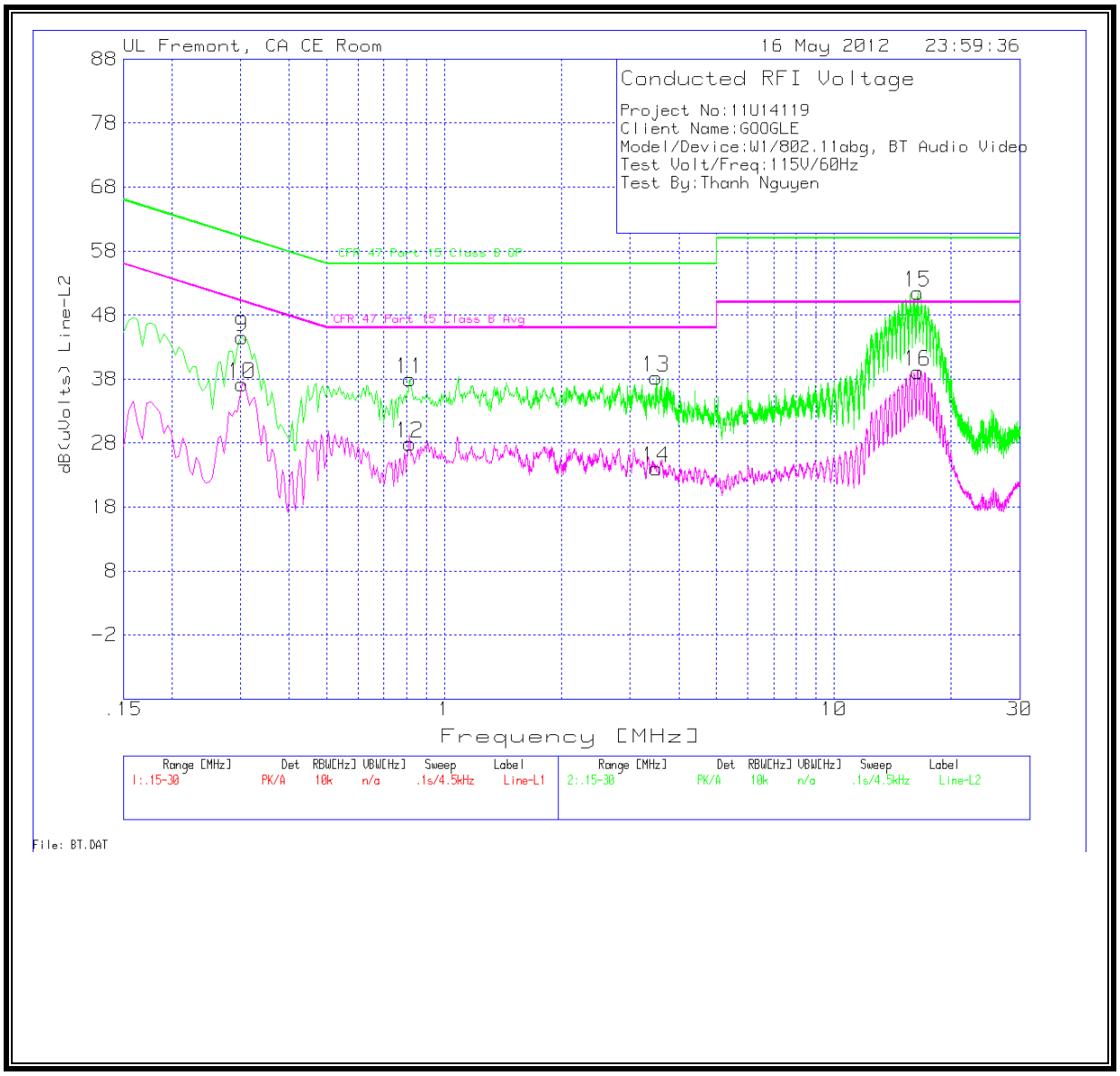
Project No:11U14119
Client Name:GOOGLE
Model/Device:W1/802.11abg, BT Audio Video
Test Volt/Freq:115V/60Hz
Test By:Thanh Nguyen

Line-L1 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	Value dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.15	52.16	PK	0.1	0	52.26	66	-13.74	-	-
0.15	34.83	Av	0.1	0	34.93	-	-	56	-21.07
1.077	38.83	PK	0.1	0	38.93	56	-17.07	-	-
1.077	29.71	Av	0.1	0	29.81	-	-	46	-16.19
3.579	39.79	PK	0.2	0.1	40.09	56	-15.91	-	-
3.579	28.01	Av	0.2	0.1	28.31	-	-	46	-17.69
15.8325	50.71	PK	0.2	0.2	51.11	60	-8.89	-	-
15.8325	36.34	Av	0.2	0.2	36.74	-	-	50	-13.26
Line-L2 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	Value dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.303	44.47	PK	0.1	0	44.57	60.2	-15.63	-	-
0.303	37.15	Av	0.1	0	37.25	-	-	50.2	-12.95
0.816	37.93	PK	0.1	0	38.03	56	-17.97	-	-
0.816	27.87	Av	0.1	0	27.97	-	-	46	-18.03
3.5025	38.01	PK	0.1	0.1	38.21	56	-17.79	-	-
3.5025	23.86	Av	0.1	0.1	24.06	-	-	46	-21.94
16.395	51.12	PK	0.2	0.2	51.52	60	-8.48	-	-
16.395	38.75	Av	0.2	0.2	39.15	-	-	50	-10.85

LINE 1 RESULTS



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).

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

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

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m^2)	FCC Power Density (mW/cm^2)
2.4 GHz	Bluetooth	0.20	6.60	2.30	0.02	0.002