



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

**CERTIFICATION TEST REPORT**

**FOR**

**eBook, with WLAN, Bluetooth, and USB Ports without WWAN**

**MODEL NUMBER: PLR001**

**FCC ID: WXP-PLR001**

**REPORT NUMBER: 09U12899-3**

**ISSUE DATE: JANUARY 05, 2010**

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**NVLAP LAB CODE 200065-0**

Revision History

Rev.	Issue Date	Revisions	Revised By
--	1/05/2010	Initial Issue	T. Chan

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** PLASTIC LOGIC  
650 CASTRO STREET  
MOUNTAIN VIEW, CA 94041, U.S.A.

**EUT DESCRIPTION:** eBook, with WLAN, Bluetooth, and USB Ports without WWAN

**MODEL:** PLR001

**SERIAL NUMBER:** 00031661400600

**DATE TESTED:** NOVEMBER 24 and DECEMBER 1, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	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. 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 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. 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 CCS By:



THU CHAN  
EMC MANAGER  
COMPLIANCE CERTIFICATION SERVICES

Tested By:



CHIN PANG  
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. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

### 4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

## **5. EQUIPMENT UNDER TEST**

### **5.1. DESCRIPTION OF EUT**

The EUT is an eBook with WiFi, Bluetooth and USB port device without WWAN.

### **5.2. MAXIMUM OUTPUT POWER**

The test measurement passed within  $\pm 0.5$ dBm output power of the original report 09U12883-3 and model: PLR-002 ( removed WWAN portion)

### **5.3. DESCRIPTION OF AVAILABLE ANTENNAS**

The radio utilizes a PIFA antenna, with a maximum peak gain of 2.0dBi.

### **5.4. SOFTWARE AND FIRMWARE**

The test utility software used during testing was MfgBTTest.exe

### **5.5. WORST-CASE CONFIGURATION AND MODE**

The worst-case channel is determined as the channel with the highest output power.

The EUT is a portable device that has three orientations; therefore X, Y and Z orientations have been investigated. The worst case was found to be Z orientation. Since this EUT just removed WWAN portion from the model PLR-002 and no change to the Bluetooth and WLAN portion, so we just did the test performance to verify the output power and spot check the worst case only based on the original report, 09U12883-3 of PLR-002.

## 5.6. DETAILS OF TESTED SYSTEM

### SUPPORT EQUIPMENT & PERIPHERALS

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	compaq 2510p	CNF8271TJ1	Doc
AC Adapter	HP	PPP009H	F1-09073355820A	Doc

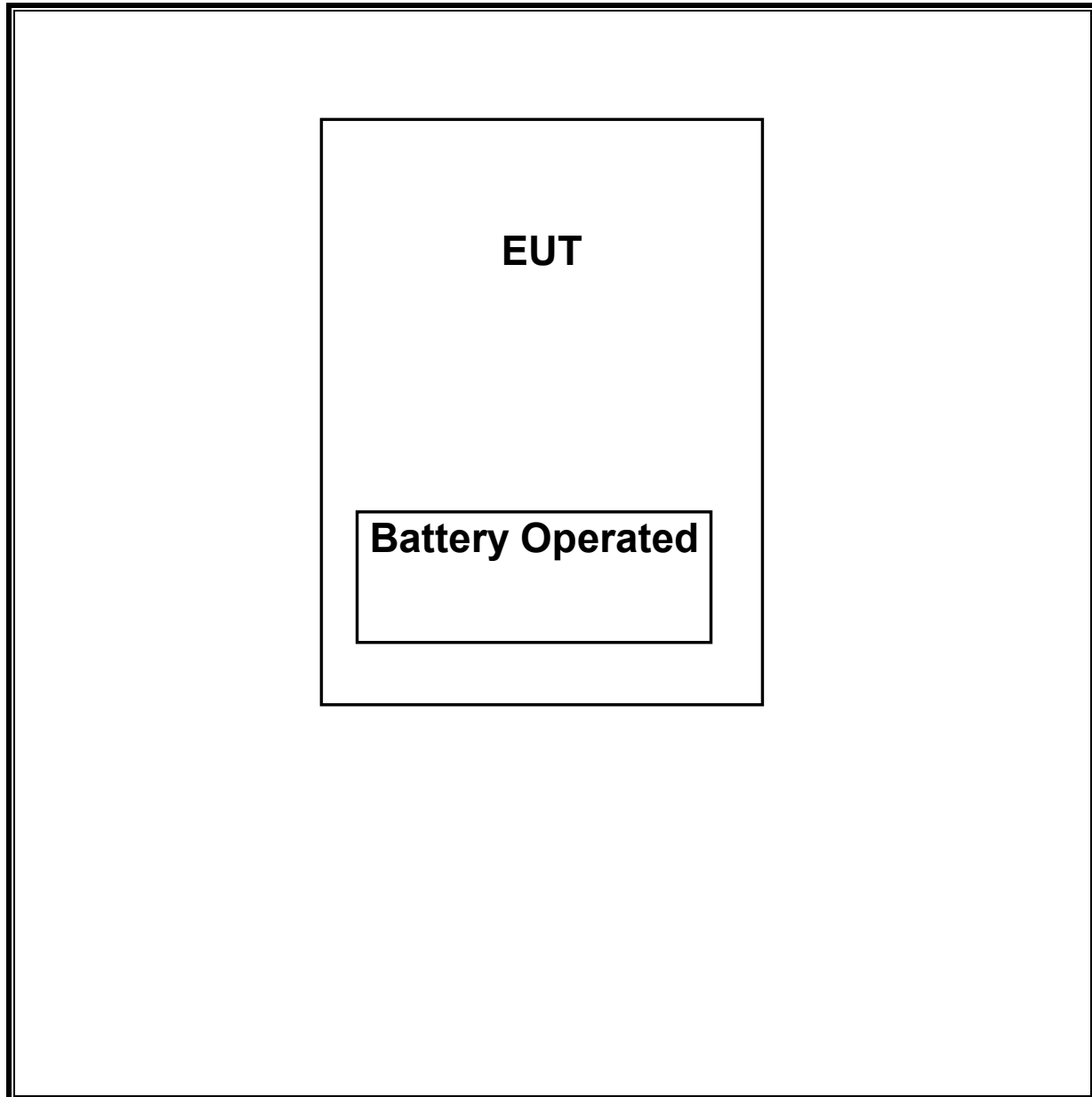
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	US 115V	Un-shielded	2m	NA
2	DC	1	DC	Un-shielded	2m	NA
3	USB	1	EUT	Un-shielded	2m	NA

### TEST SETUP

The EUT is installed in a typical configuration. Test software exercised the EUT.

**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
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	08/24/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	12/16/09
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	02/04/10
Antenna, Horn, 18 GHz	EMCO	3115	C00945	01/29/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	01/14/10
Peak Power Meter	Agilent / HP	E4416A	C00963	12/04/09
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/07/09
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR

## 7. ANTENNA PORT TEST RESULTS

### 7.1. BASIC DATA RATE GFSK MODULATION

#### 7.1.1. 20 dB AND 99% BANDWIDTH

##### LIMIT

None; for reporting purposes only.

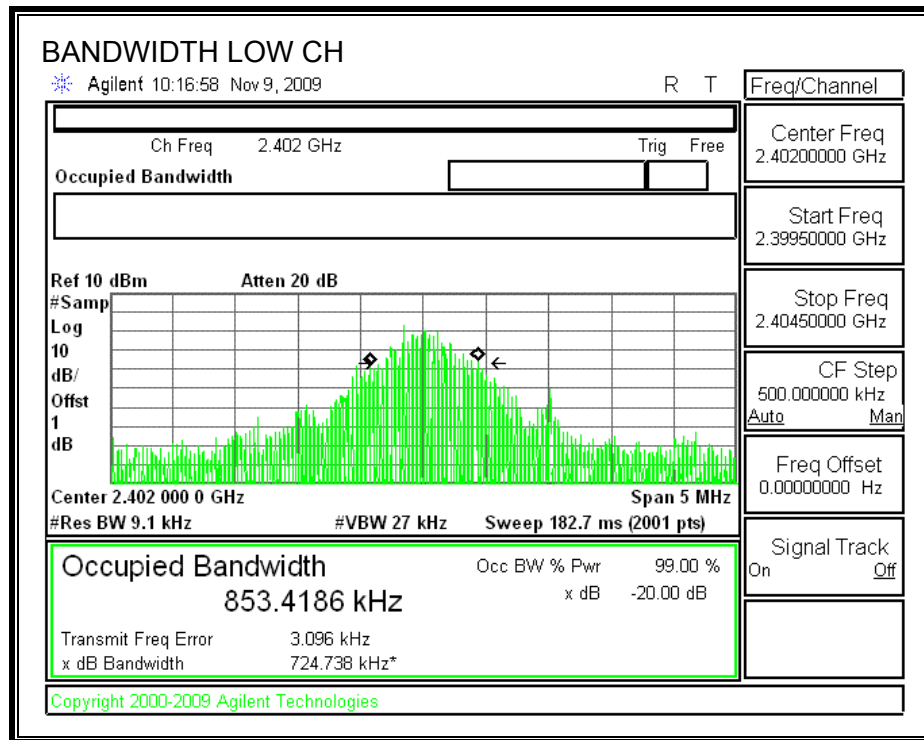
##### TEST PROCEDURE

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

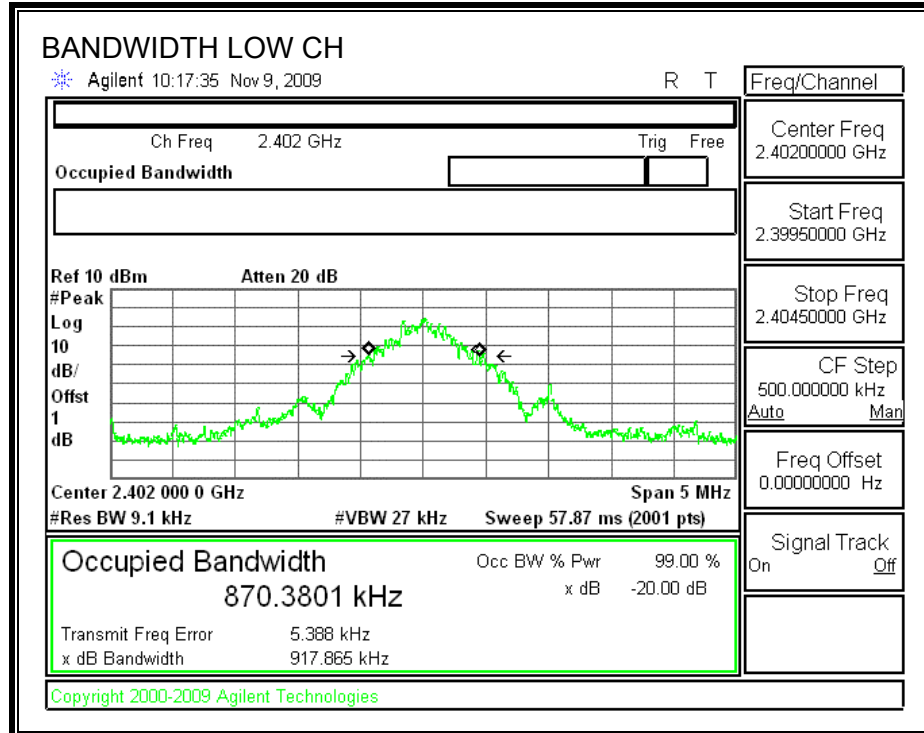
##### RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	917.865	853.4186
Middle	2441	916.430	827.5695
High	2480	916.829	851.6179

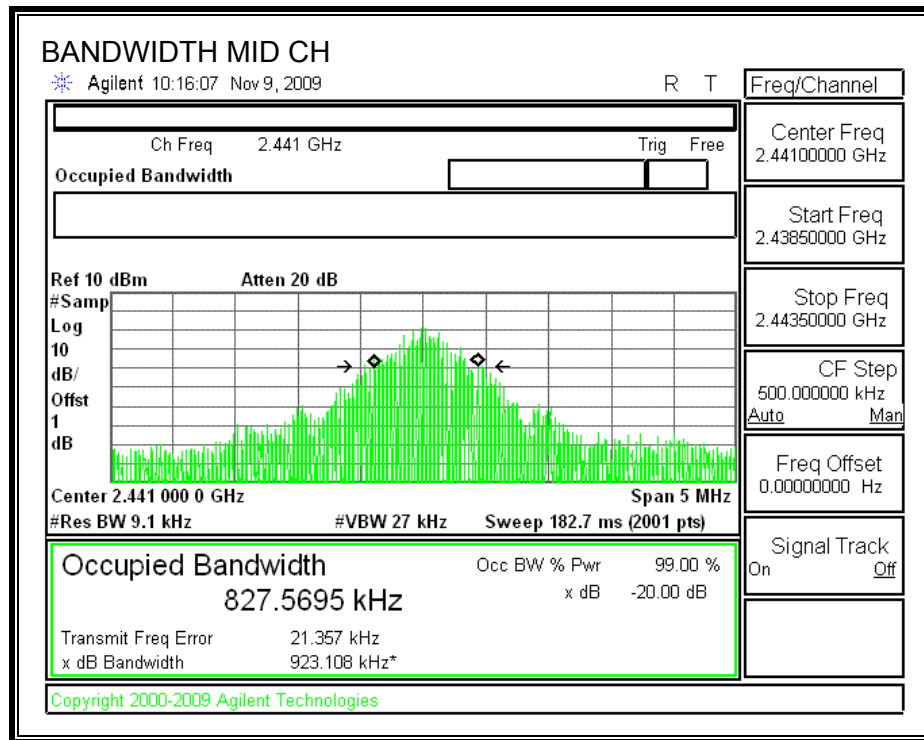
### 99% BANDWIDTH



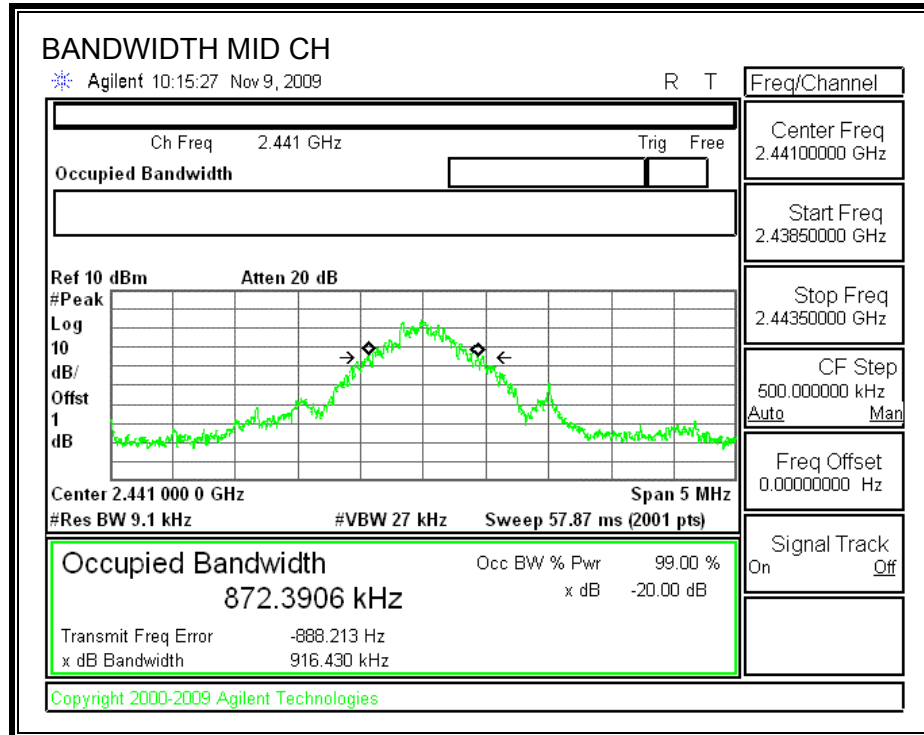
### 20dB BANDWIDTH



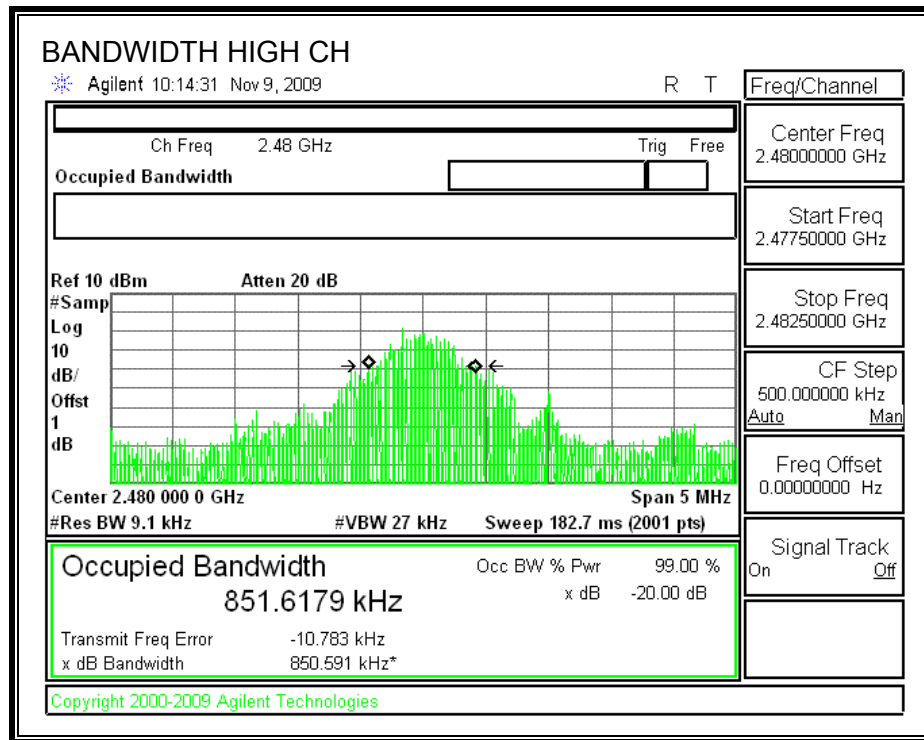
### 99% BANDWIDTH



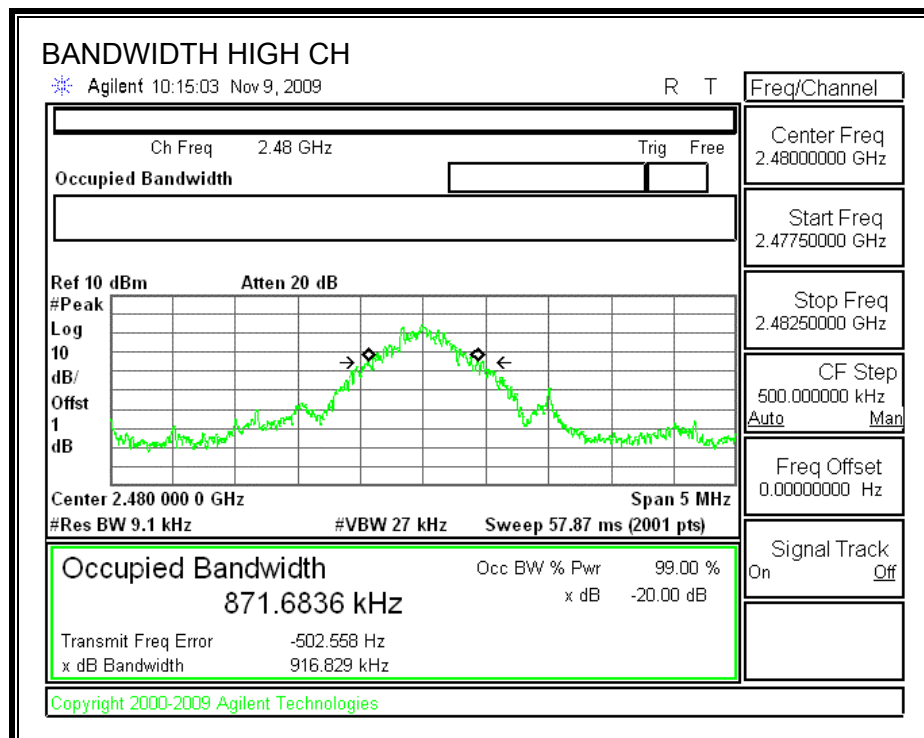
### 20dB BANDWIDTH



### 99% BANDWIDTH



### 20dB 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 hopping channel, whichever is greater.

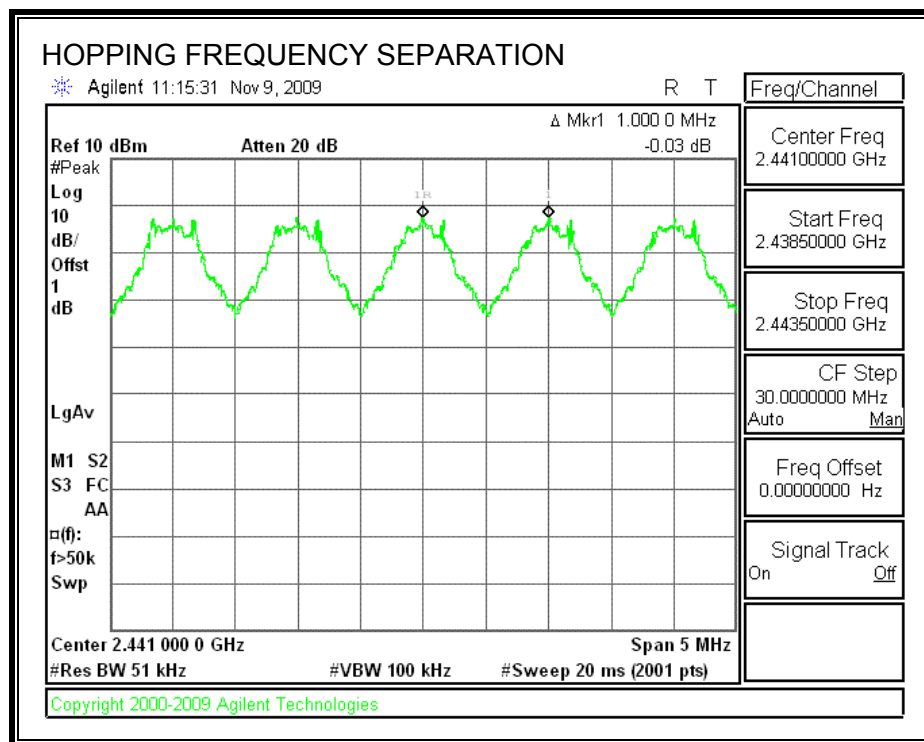
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

### TEST PROCEDURE

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

### RESULTS

#### HOPPING FREQUENCY SEPARATION



### **7.1.3. NUMBER OF HOPPING CHANNELS**

#### **LIMIT**

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

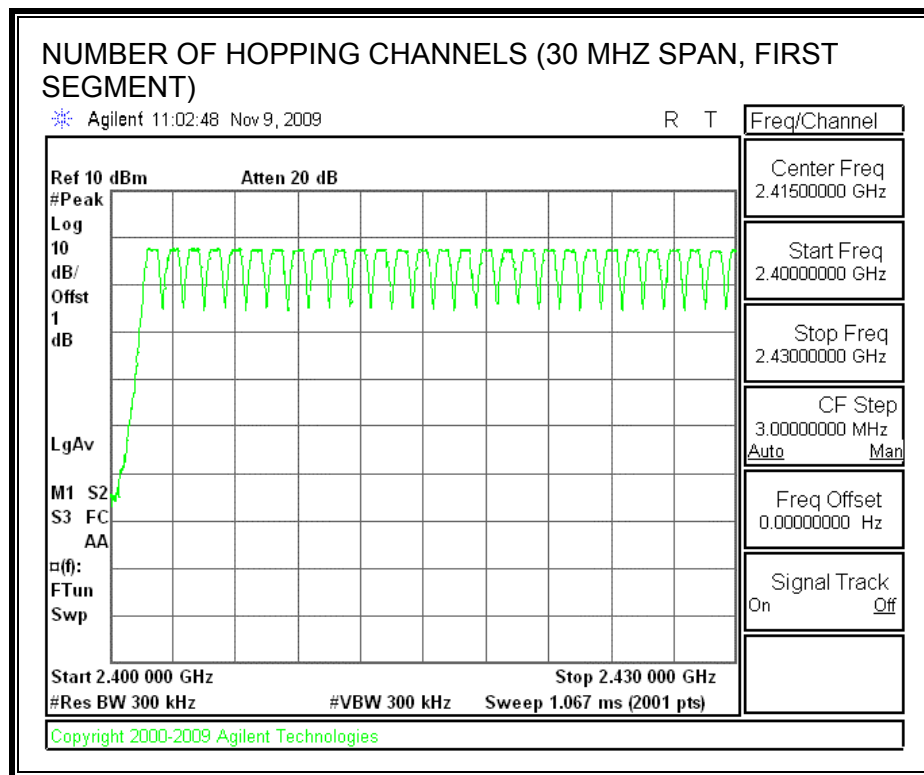
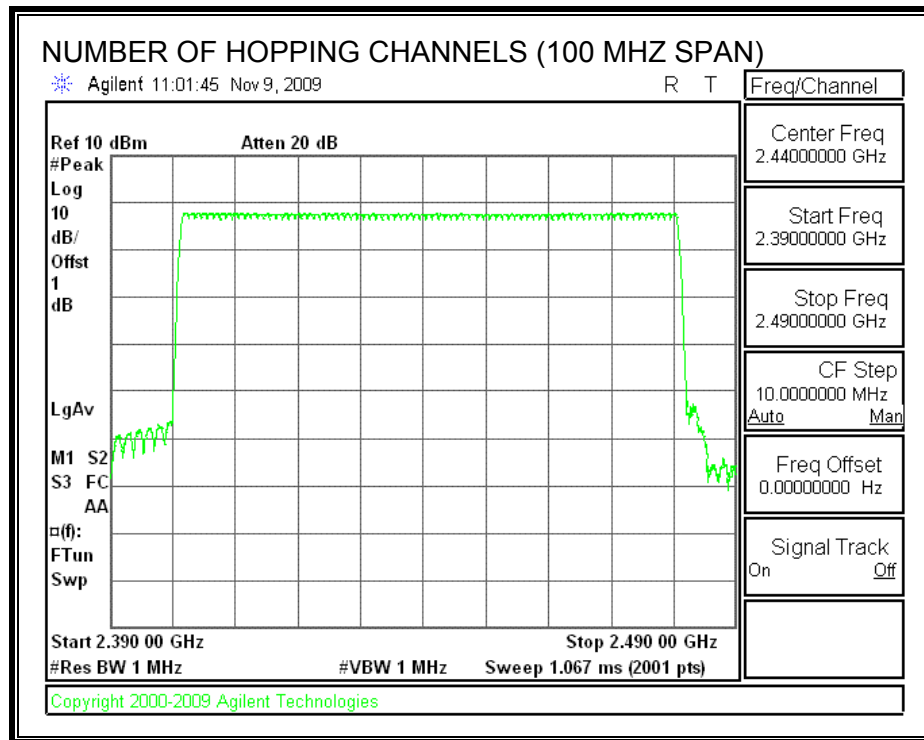
#### **TEST PROCEDURE**

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.

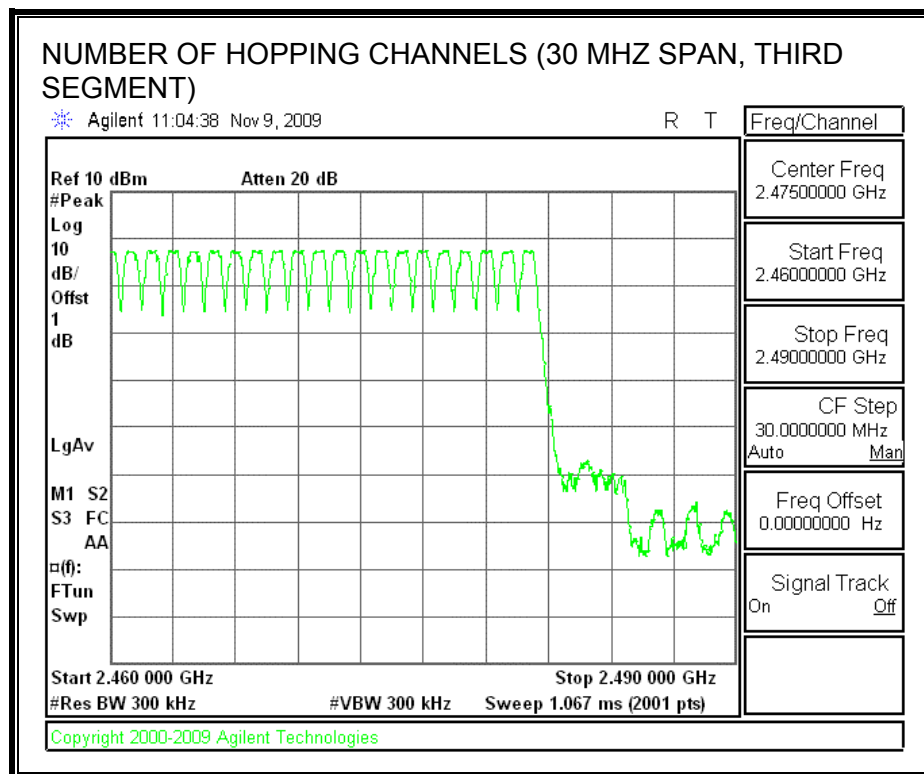
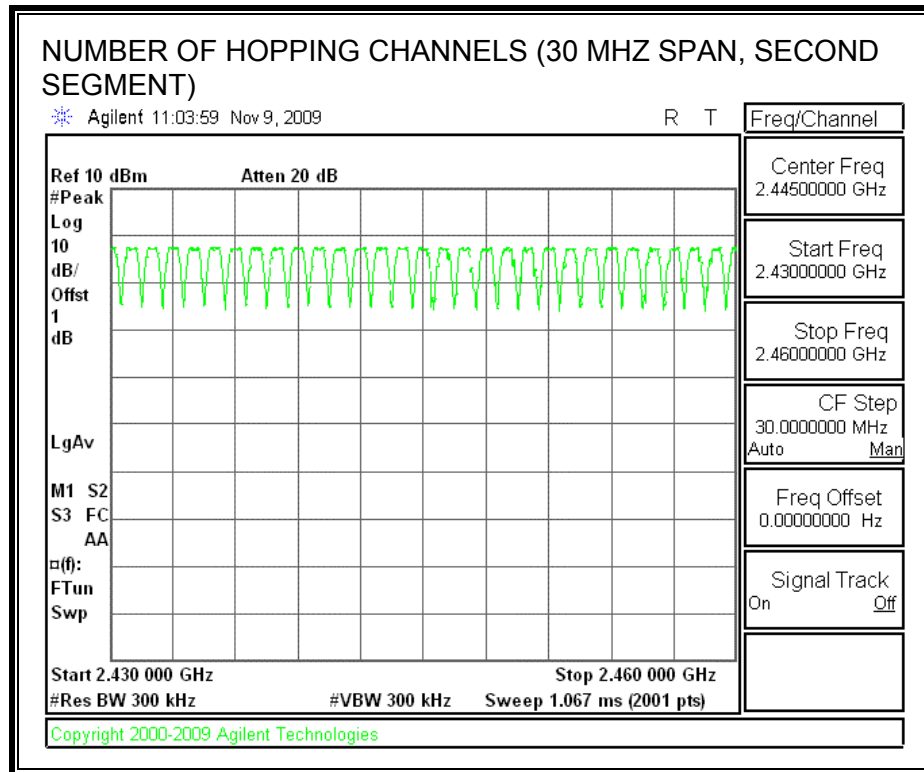
#### **RESULTS**

79 Channels observed.

## NUMBER OF HOPPING CHANNELS







#### 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  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$ .

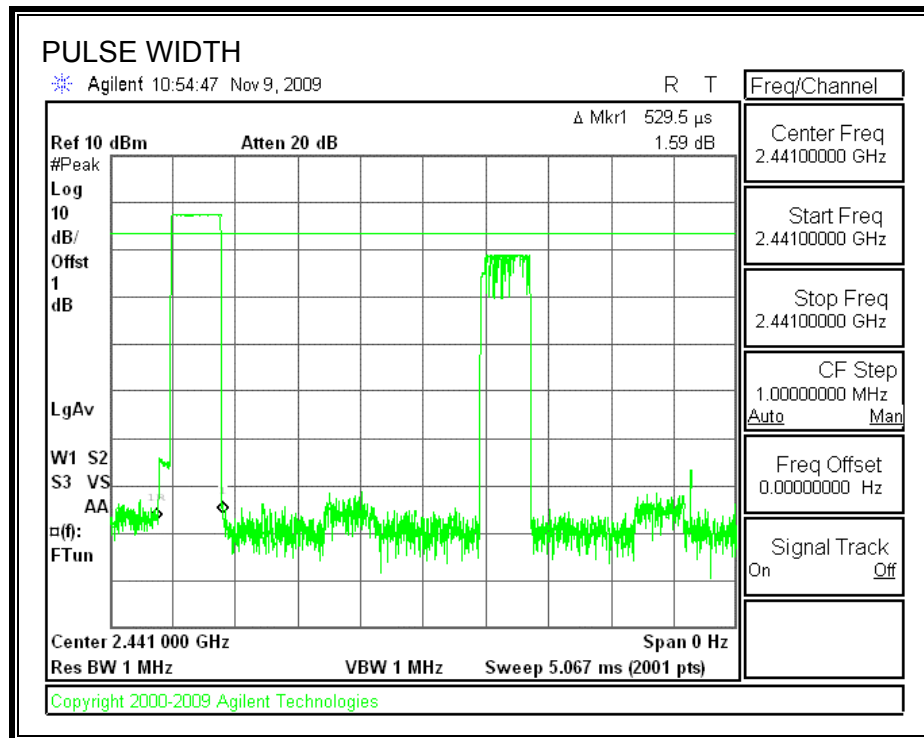
##### RESULTS

Time Of Occupancy = Pulse Width \* 10 \* Number of Pulses in 3.16 seconds

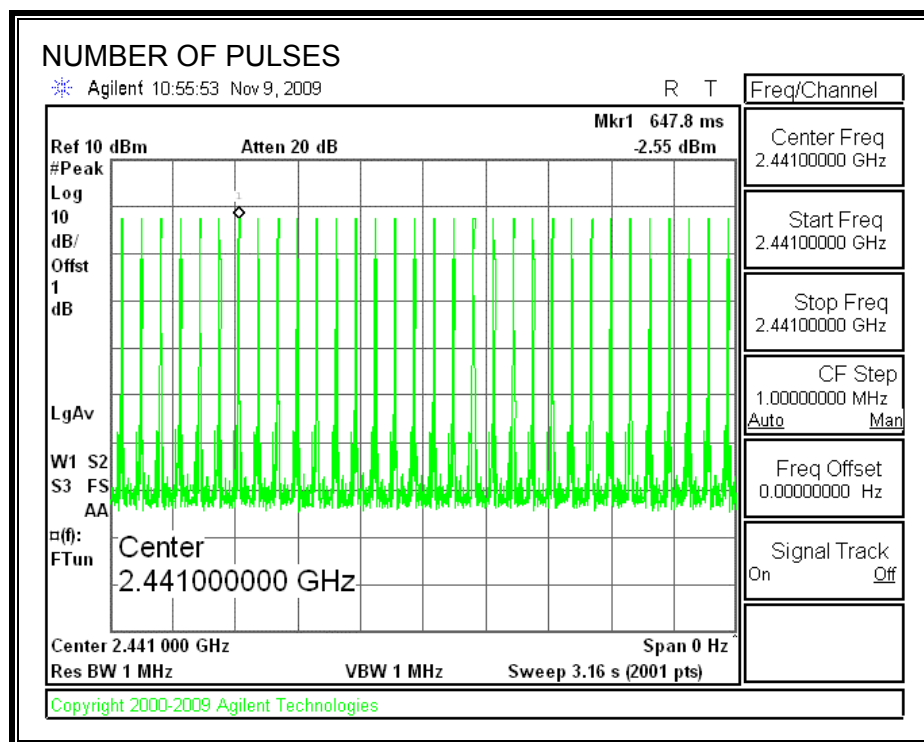
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.5295	33	0.175	0.4	0.225
DH3	1.783	17	0.303	0.4	0.097
DH5	3.032	11	0.334	0.4	0.066

**DH1**

**PULSE WIDTH**

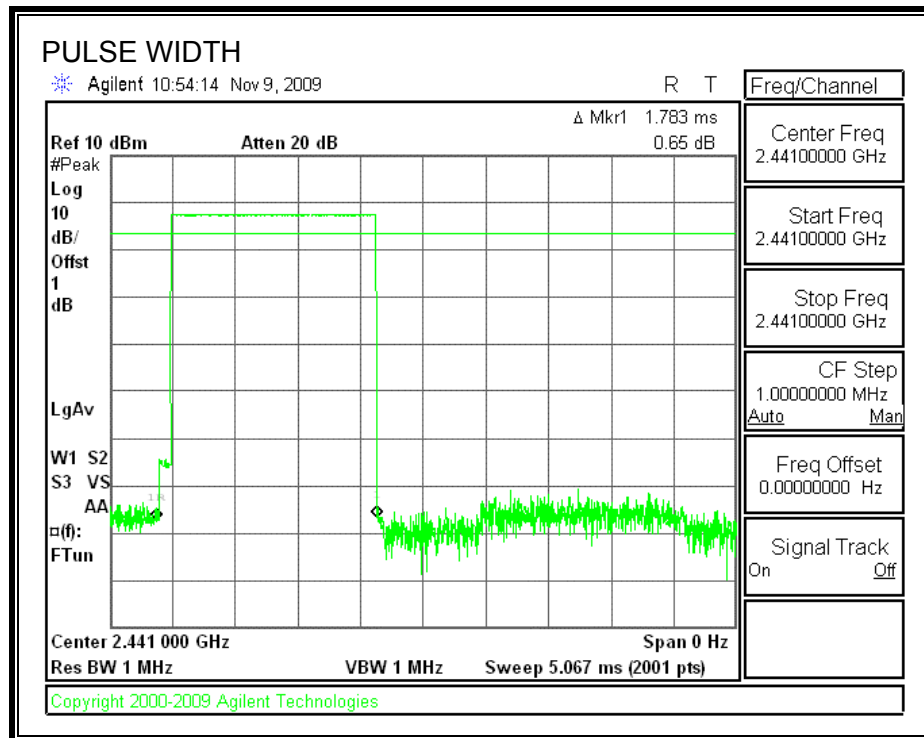


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**

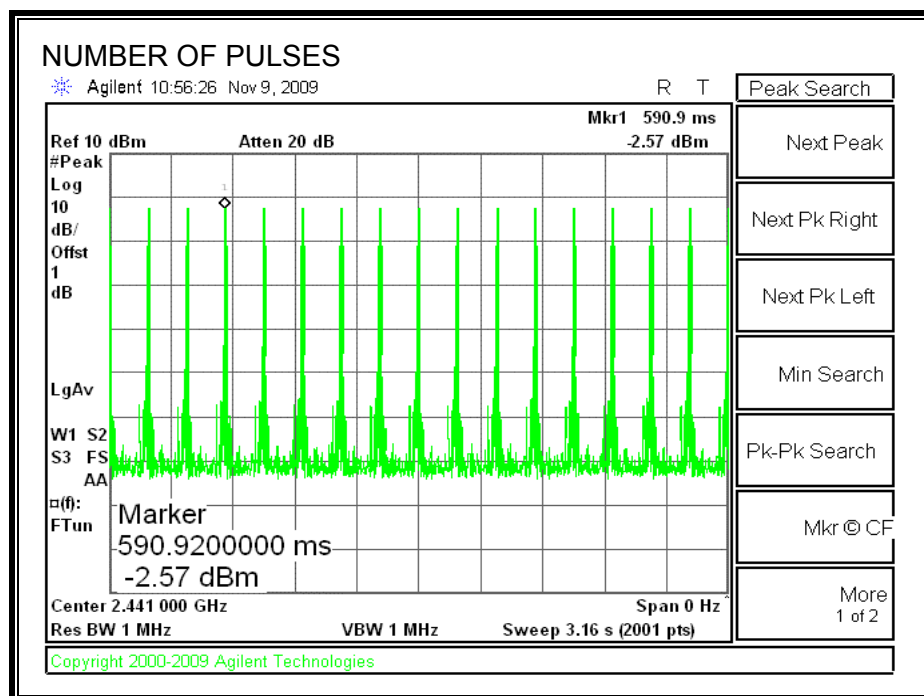


**DH3**

**PULSE WIDTH**

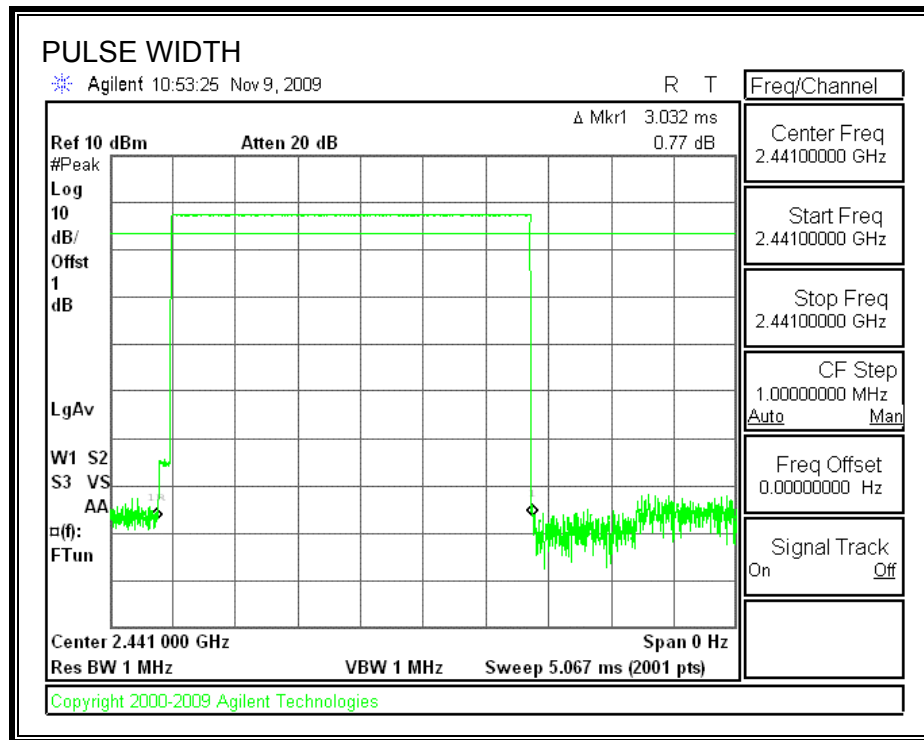


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**

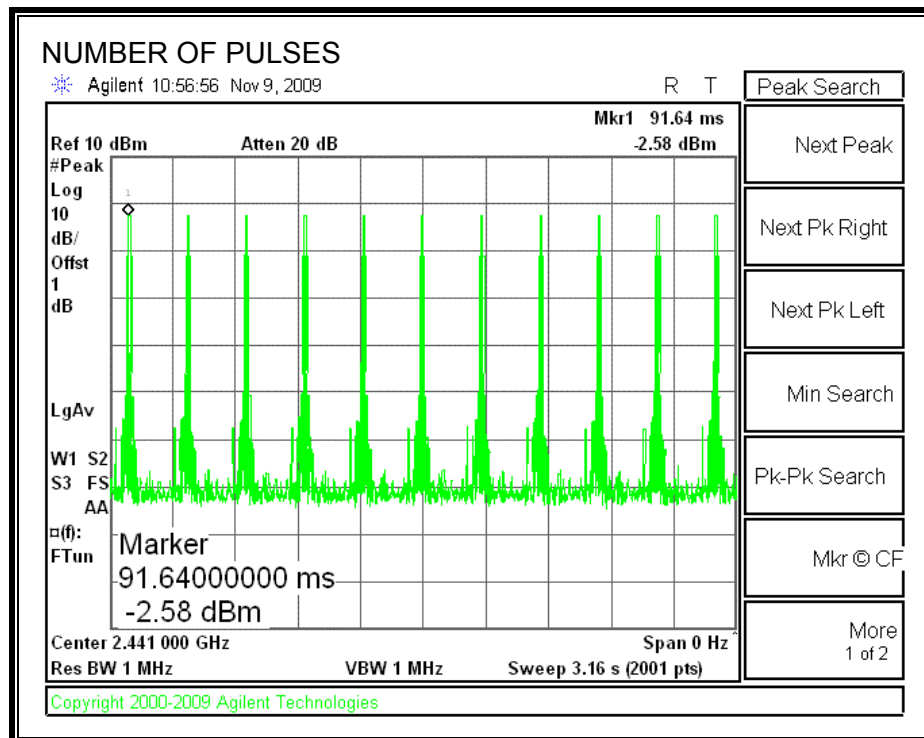


**DH5**

**PULSE WIDTH**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



### **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 power meter.

#### **RESULTS**

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	3.62	30	-26.38
Middle	2441	3.74	30	-26.26
High	2480	3.71	30	-26.29

### 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 1 dB (including 0 dB pad and 1dB 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	1.43
Middle	2441	1.48
High	2480	1.48

### **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.

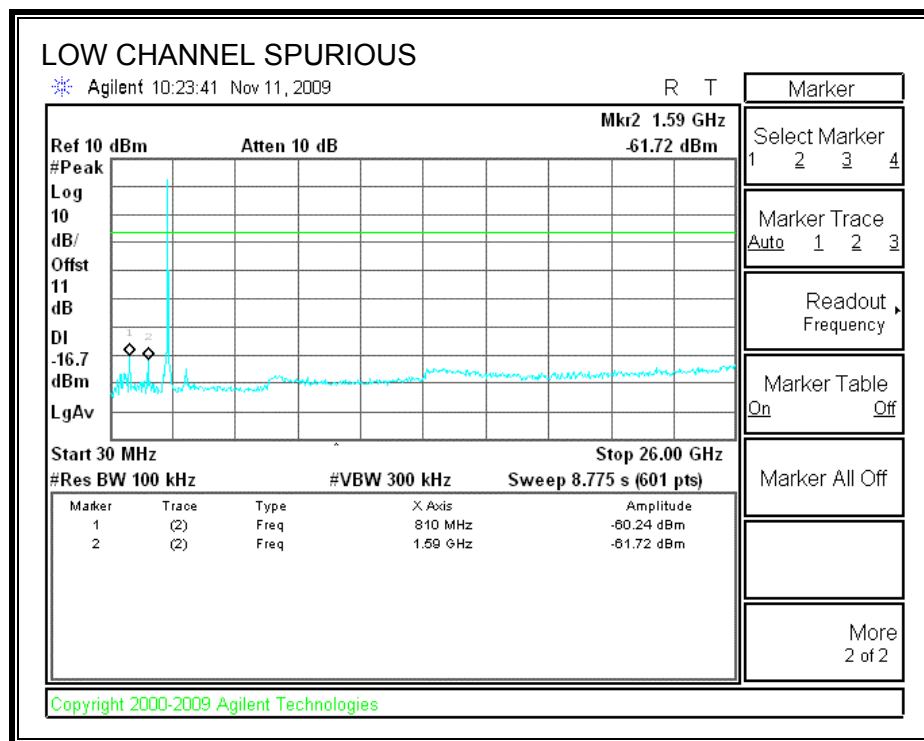
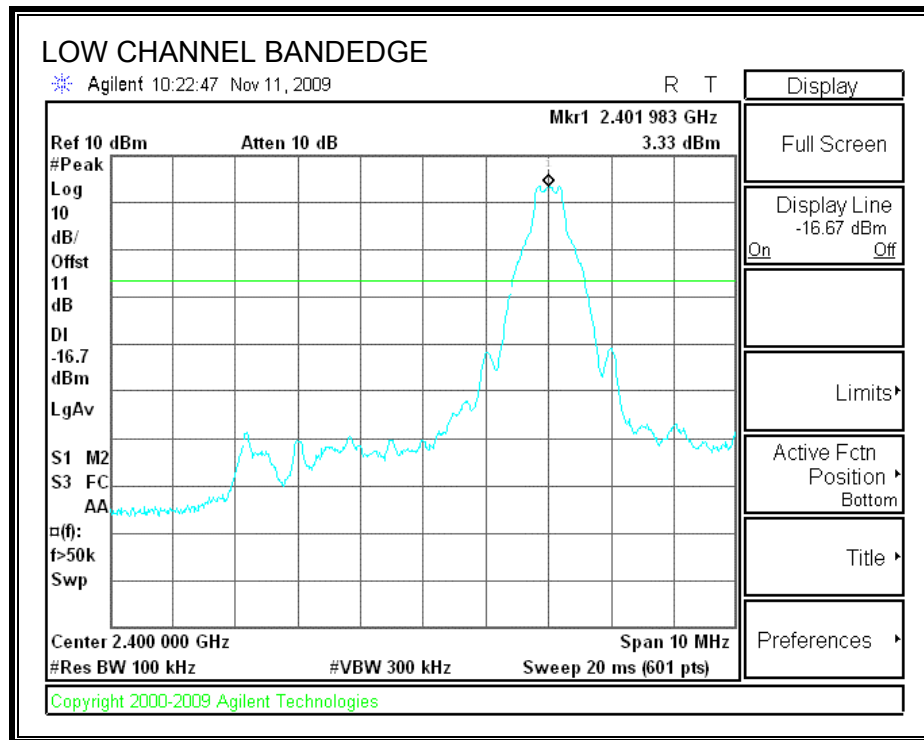
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

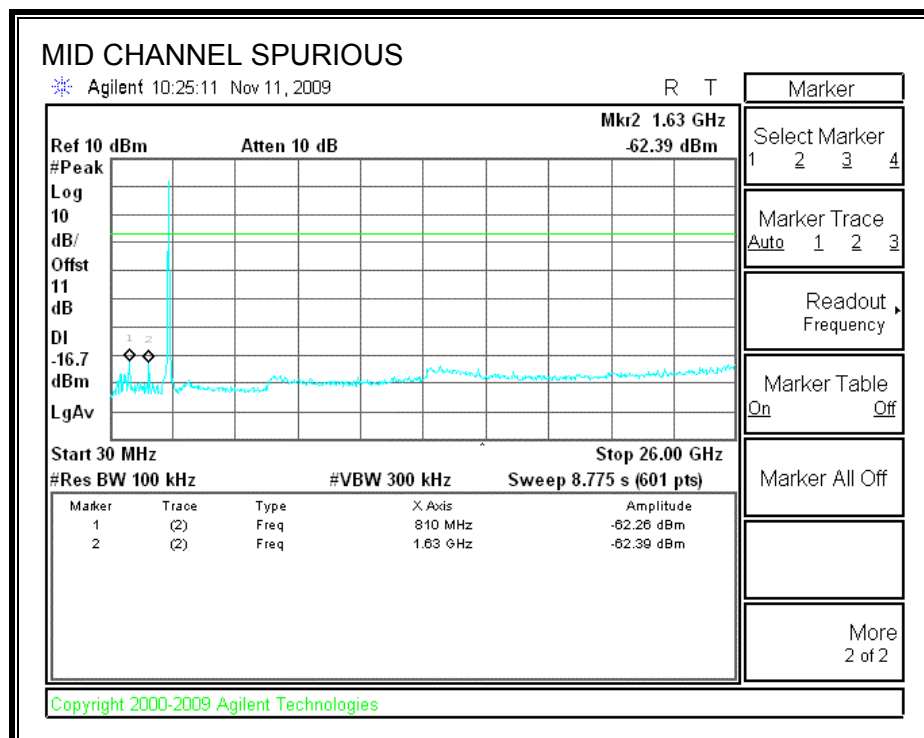
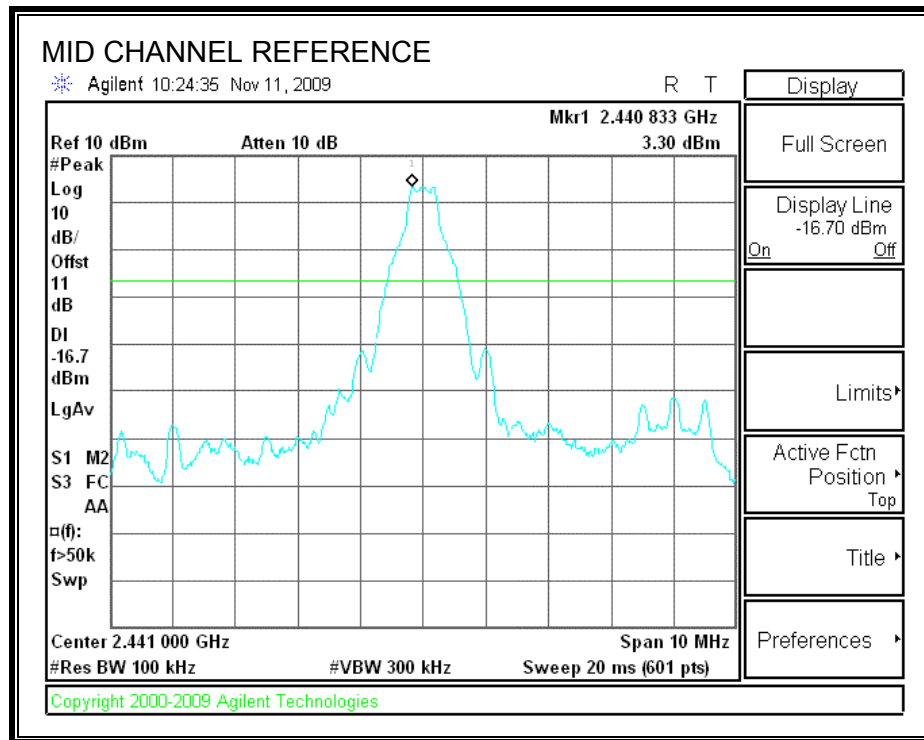
#### **RESULTS**



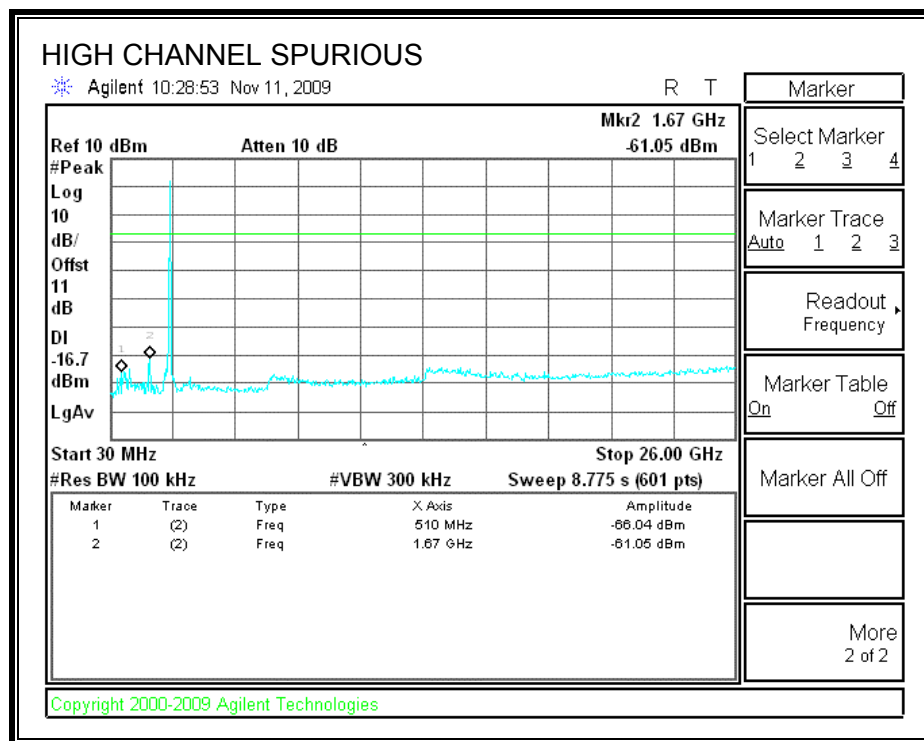
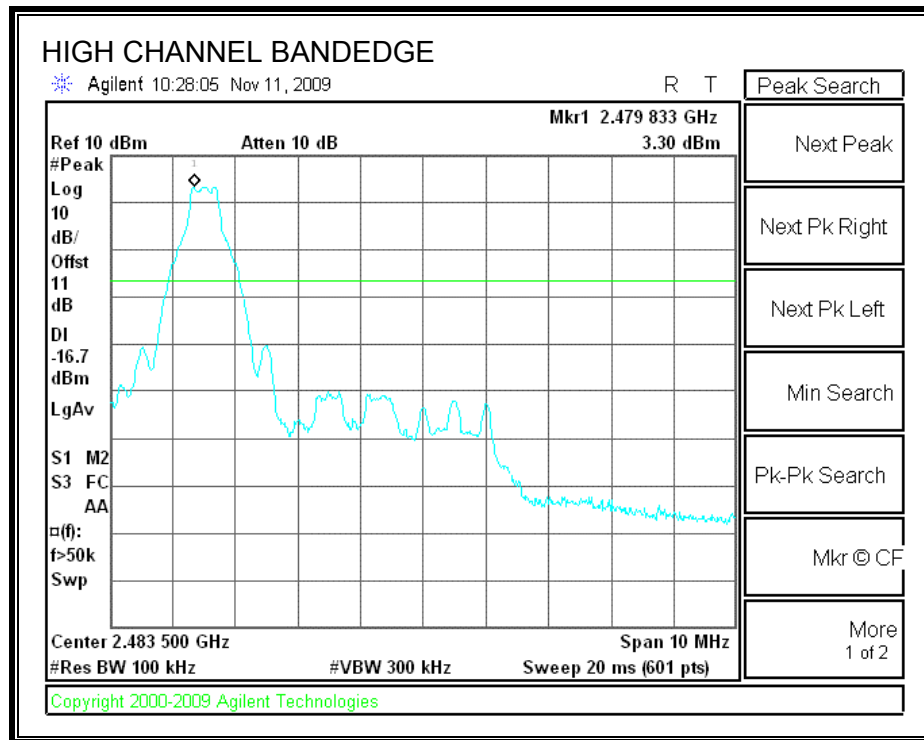
### SPURIOUS EMISSIONS, LOW CHANNEL



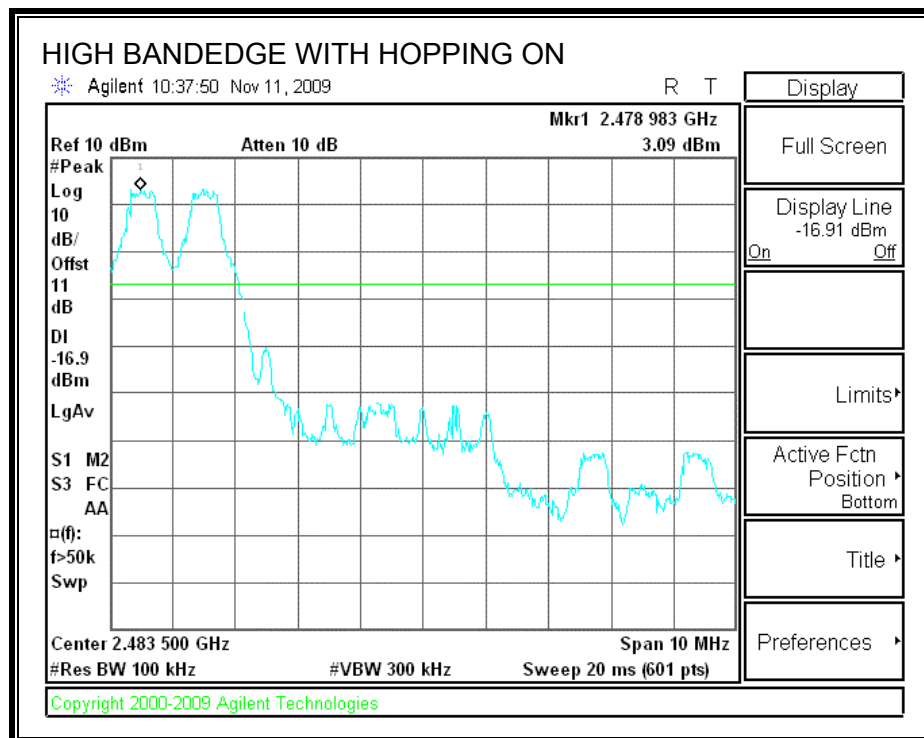
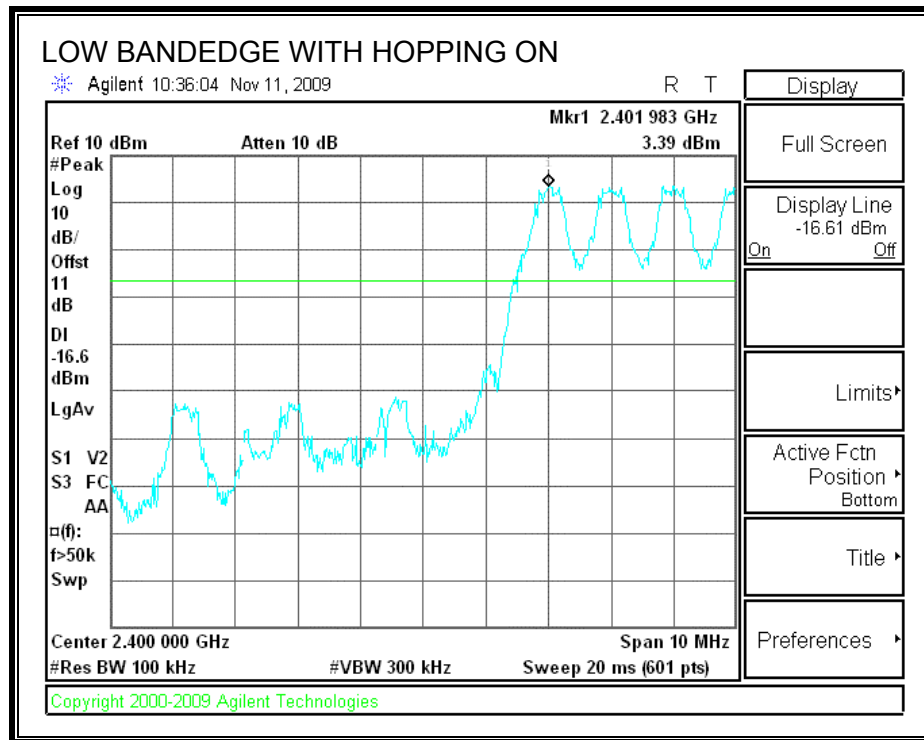
### SPURIOUS EMISSIONS, MID CHANNEL



### 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.

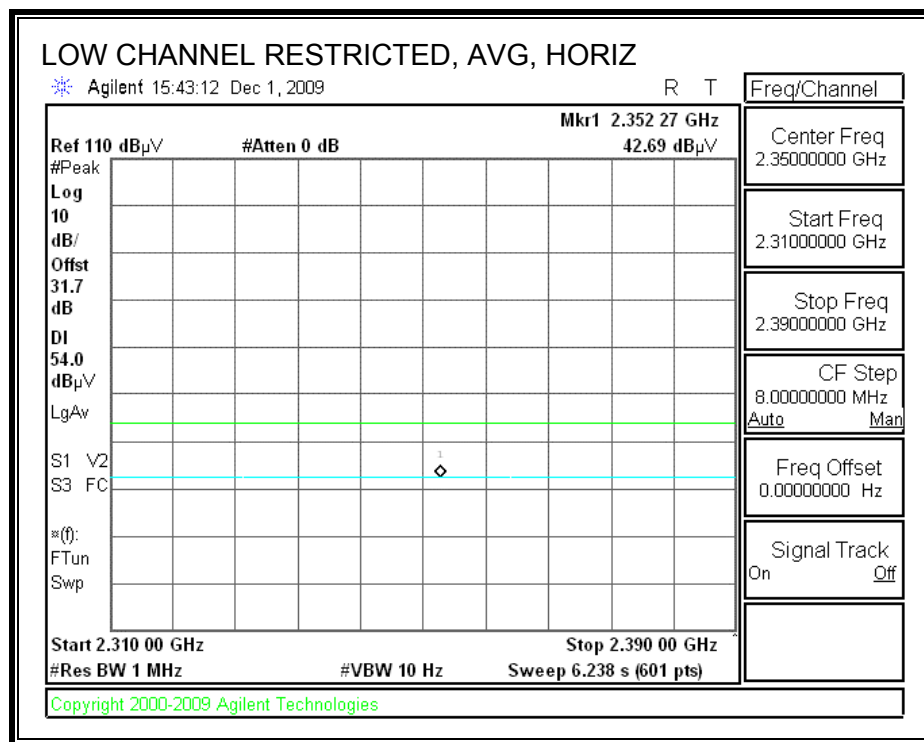
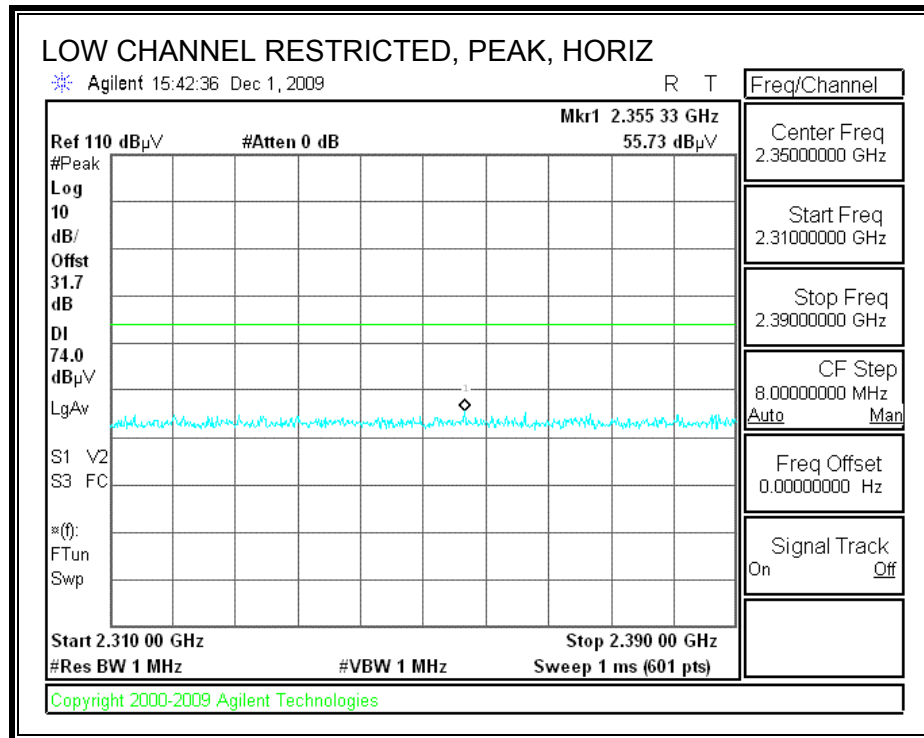
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

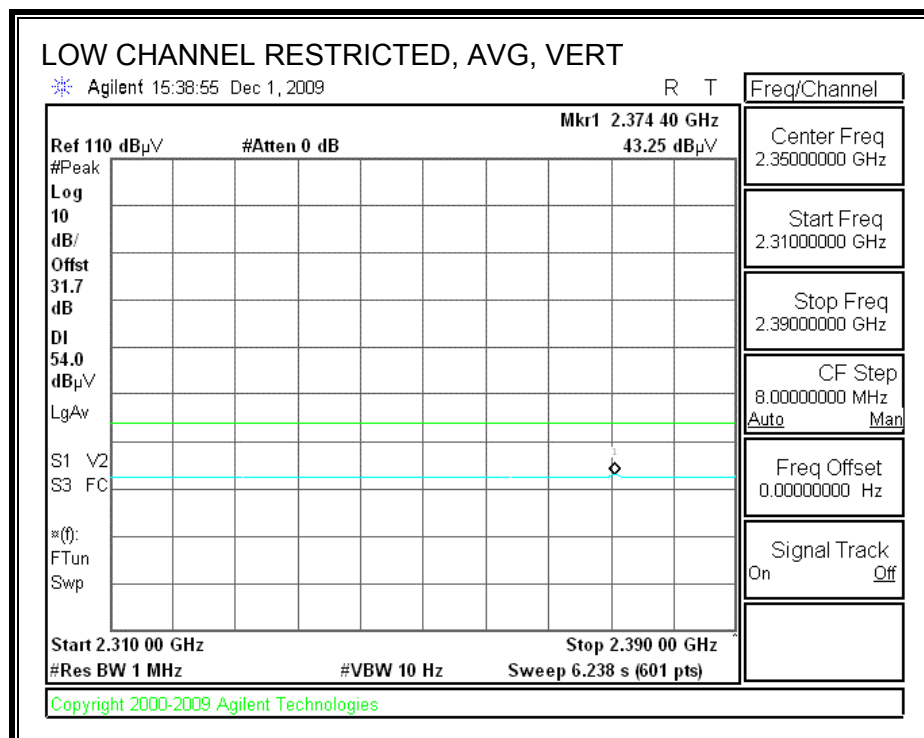
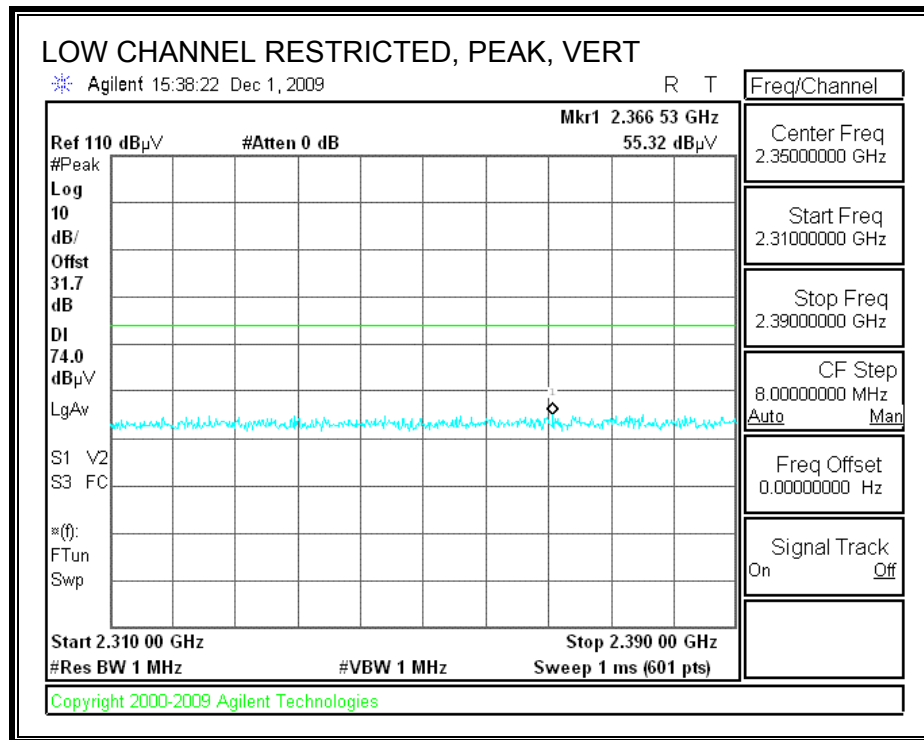
## 8.2. TRANSMITTER ABOVE 1 GHz

### 8.2.1. BASIC DATA RATE GFSK MODULATION

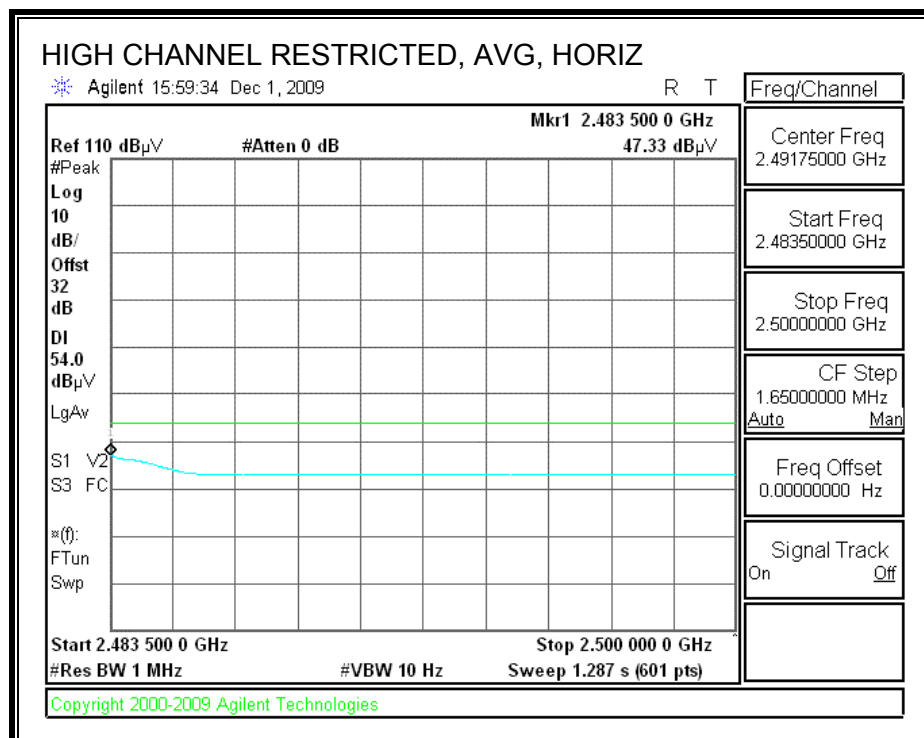
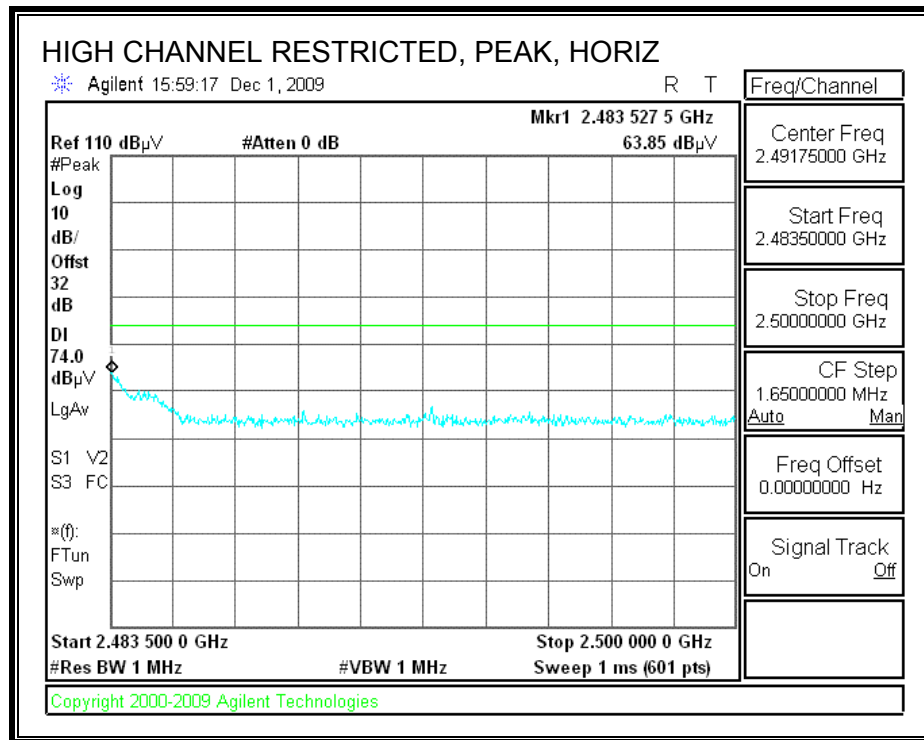
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

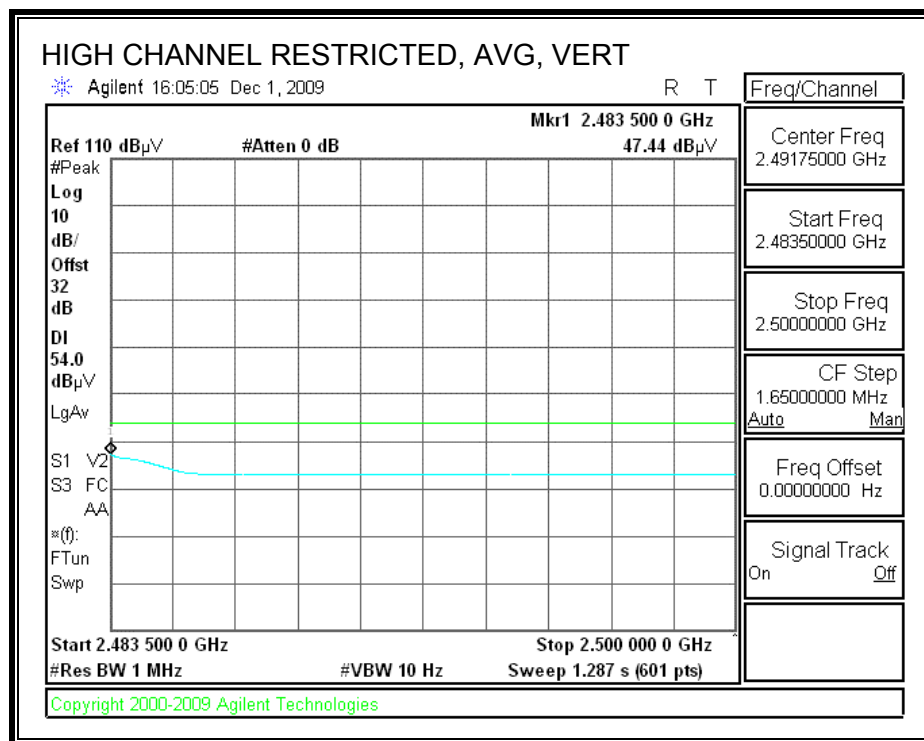
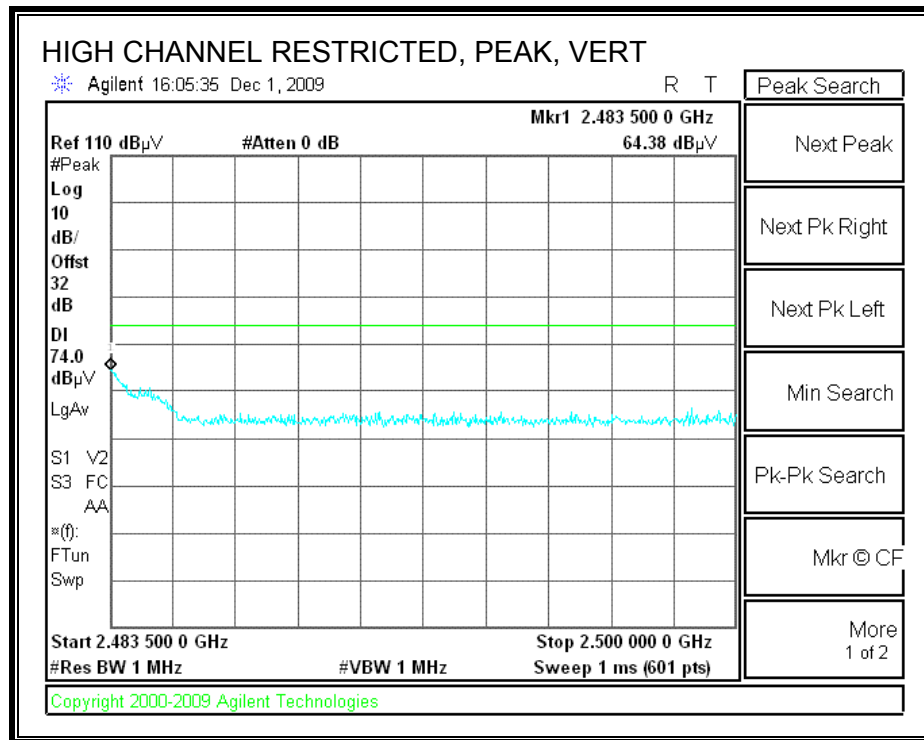


**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



# HARMONICS AND SPURIOUS EMISSIONS

## High Frequency Measurement

Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang  
Date: 12/01/09  
Project #: 09U12899  
Company: Plastic Logic  
EUT Description: eBook with Wlan, BT and USB Ports without WWAN  
EUT M/N: PLR001  
Test Target: FCC 15C  
Mode Oper: TX, BT

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol V/H	Det. P/A/QP	Notes
<b>Low Ch</b>													
4.804	3.0	38.5	32.8	5.8	-34.8	0.0	0.0	42.2	74.0	-31.8	V	P	
4.804	3.0	26.0	32.8	5.8	-34.8	0.0	0.0	29.6	54.0	-24.4	V	A	
4.804	3.0	38.6	32.8	5.8	-34.8	0.0	0.0	42.3	74.0	-31.7	H	P	
4.804	3.0	26.5	32.8	5.8	-34.8	0.0	0.0	30.1	54.0	-23.9	H	A	
<b>Mid Ch</b>													
4.882	3.0	38.5	32.8	5.8	-34.9	0.0	0.0	42.3	74.0	-31.7	V	P	
4.882	3.0	26.0	32.8	5.8	-34.9	0.0	0.0	29.8	54.0	-24.2	V	A	
7.323	3.0	37.9	35.2	7.3	-34.7	0.0	0.0	45.7	74.0	-28.3	V	P	
7.323	3.0	24.7	35.2	7.3	-34.7	0.0	0.0	32.6	54.0	-21.4	V	A	
4.882	3.0	38.1	32.8	5.8	-34.9	0.0	0.0	41.9	74.0	-32.1	H	P	
4.882	3.0	25.8	32.8	5.8	-34.9	0.0	0.0	29.6	54.0	-24.4	H	A	
7.323	3.0	37.1	35.2	7.3	-34.7	0.0	0.0	44.9	74.0	-29.1	H	P	
7.323	3.0	24.7	35.2	7.3	-34.7	0.0	0.0	32.5	54.0	-21.5	H	A	
<b>High Ch</b>													
4.960	3.0	38.1	32.9	5.9	-34.9	0.0	0.0	42.0	74.0	-32.0	V	P	
4.960	3.0	26.4	32.9	5.9	-34.9	0.0	0.0	30.3	54.0	-23.7	V	A	
7.440	3.0	37.3	35.4	7.3	-34.6	0.0	0.0	45.4	74.0	-28.6	V	P	
7.440	3.0	25.0	35.4	7.3	-34.6	0.0	0.0	33.1	54.0	-20.9	V	A	
4.960	3.0	38.2	32.9	5.9	-34.9	0.0	0.0	42.1	74.0	-31.9	H	P	
4.960	3.0	25.6	32.9	5.9	-34.9	0.0	0.0	29.5	54.0	-24.5	H	A	
7.440	3.0	37.5	35.4	7.3	-34.6	0.0	0.0	45.6	74.0	-28.4	H	P	
7.440	3.0	25.0	35.4	7.3	-34.6	0.0	0.0	33.1	54.0	-20.9	H	A	

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

**8.3. RECEIVER ABOVE 1 GHz****High Frequency Measurement**

Compliance Certification Services, Fremont 5m Chamber

Test Engr: Devin Chang

Date: 11/09/09

Project #: 09U12899

Company: Plastic Logic

EUT Description: EUT only

Mode Oper: Rx mode

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>2402MHz</b>													
1.774	3.0	46.2	26.8	3.2	-35.6	0.0	10.0	50.6	74.0	-23.4	H	P	
1.774	3.0	39.4	26.8	3.2	-35.6	0.0	10.0	43.9	54.0	-10.1	H	A	
1.774	3.0	45.4	26.8	3.2	-35.6	0.0	10.0	49.8	74.0	-24.2	V	P	
1.774	3.0	36.8	26.8	3.2	-35.6	0.0	10.0	41.3	54.0	-12.7	V	A	
<b>2441MHz</b>													
1.774	3.0	49.1	26.8	3.2	-35.6	0.0	10.0	53.6	74.0	-20.4	H	P	
1.774	3.0	45.4	26.8	3.2	-35.6	0.0	10.0	49.9	54.0	-4.1	H	A	
1.774	3.0	45.6	26.8	3.2	-35.6	0.0	10.0	50.1	74.0	-23.9	V	P	
1.774	3.0	38.5	26.8	3.2	-35.6	0.0	10.0	43.0	54.0	-11.0	V	A	
<b>2480MHz</b>													
1.774	3.0	48.9	26.8	3.2	-35.6	0.0	10.0	53.3	74.0	-20.7	H	P	
1.774	3.0	44.6	26.8	3.2	-35.6	0.0	10.0	49.1	54.0	-4.9	H	A	
1.774	3.0	43.1	26.8	3.2	-35.6	0.0	10.0	47.5	74.0	-26.5	V	P	
1.774	3.0	31.4	26.8	3.2	-35.6	0.0	10.0	35.9	54.0	-18.1	V	A	

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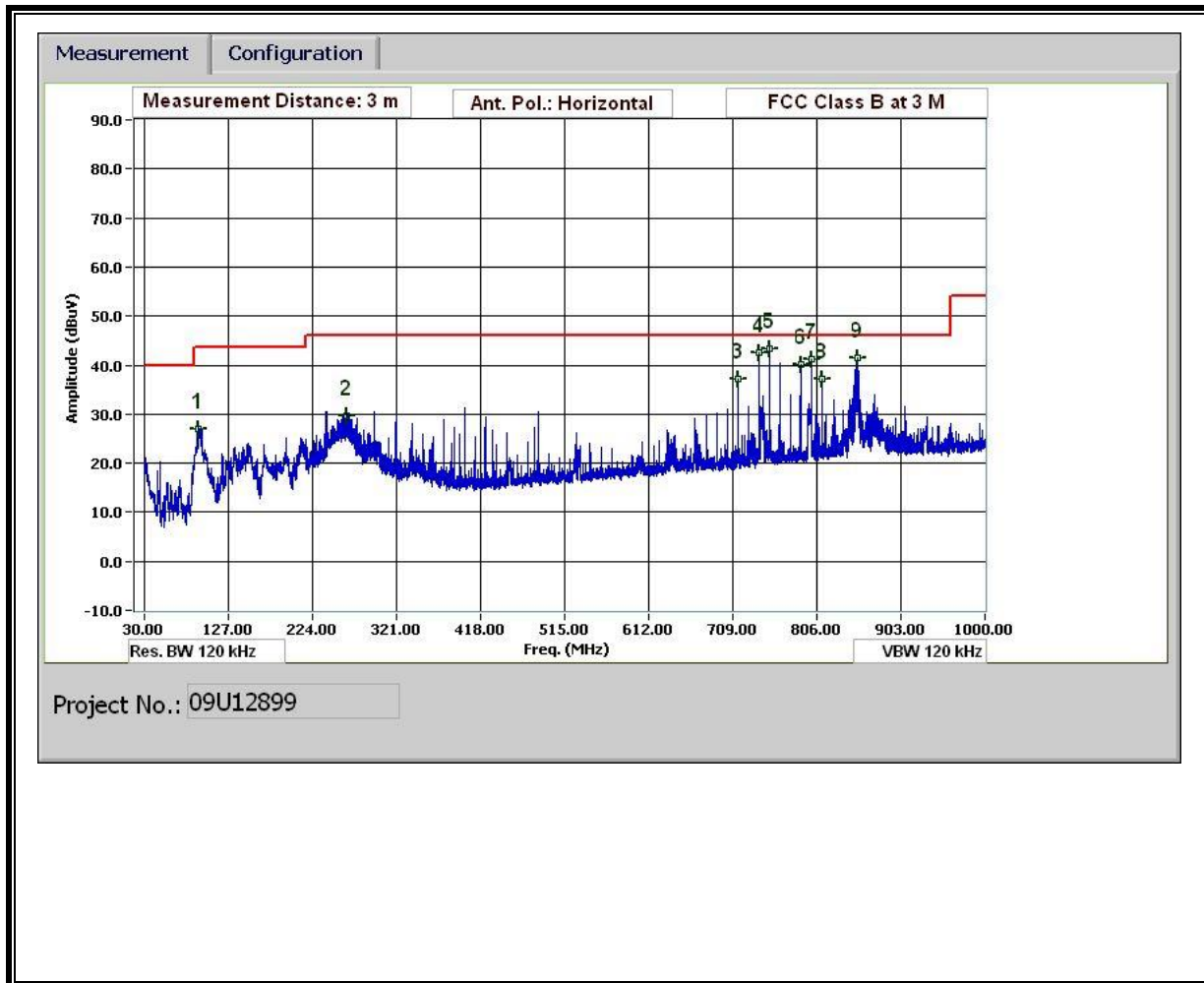
Note: No other emissions were detected above the system noise floor.

## 8.4. WORST-CASE BELOW 1 GHz

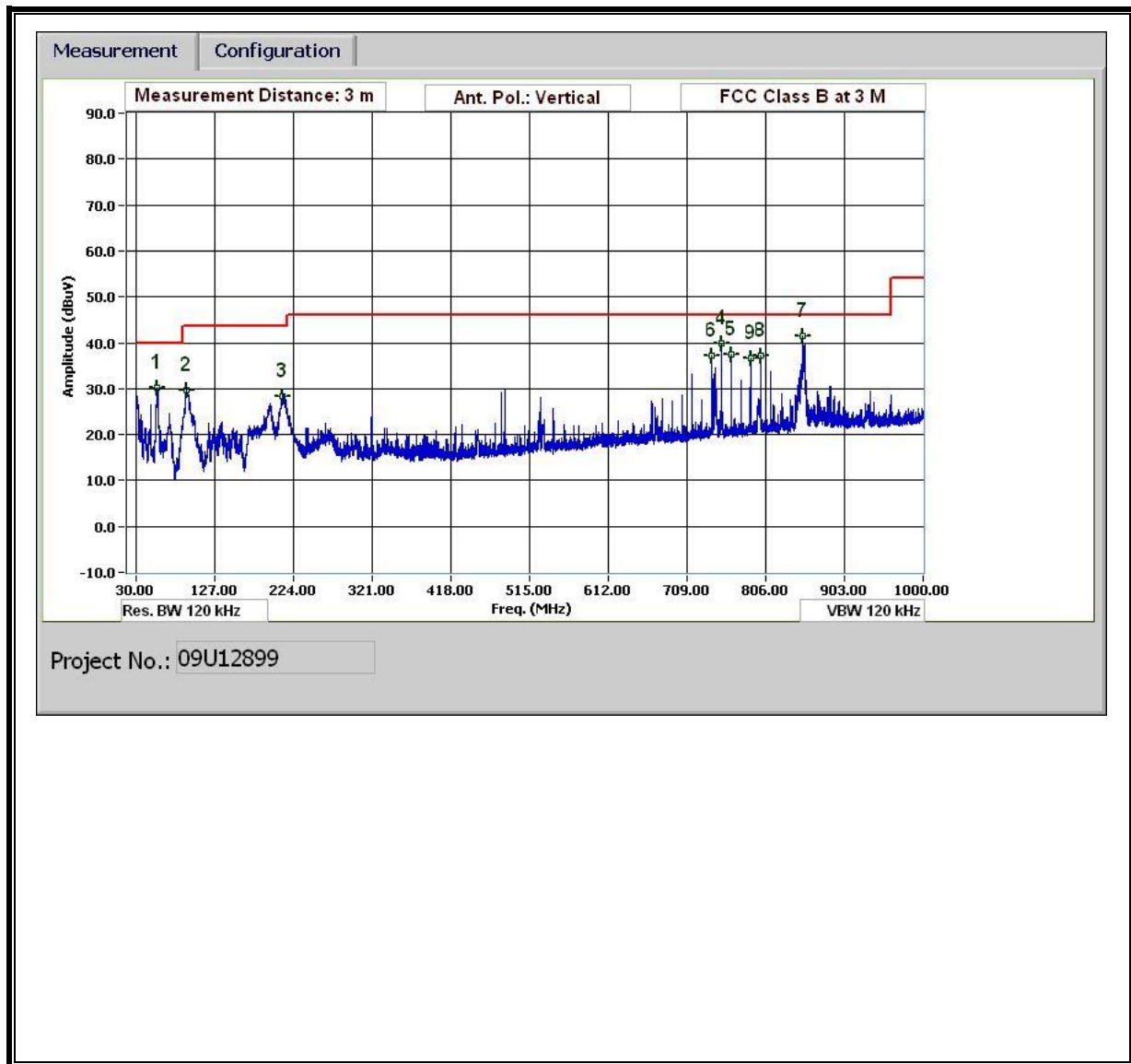
### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION))

30-1000MHz Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Chin Pang											
Date:		11/24/09											
Project #:		09U12899											
Company:		Plastic Logic											
EUT Description:		eBook, Wlan, BT and USB Ports without WWAN											
Configuration:		EUT Only											
EUT M/N:		PLR001											
Test Target:		FCC 15C											
Mode Oper:		TX ( Worst Case)											
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
horiz													
92.763	3.0	47.5	8.2	0.9	29.6	0.0	0.0	27.1	43.5	-16.4	H	P	
263.890	3.0	44.7	12.2	1.5	28.8	0.0	0.0	29.6	46.0	-16.4	H	P	
714.868	3.0	44.5	19.5	2.6	29.5	0.0	0.0	37.1	46.0	-8.9	H	P	
739.109	3.0	49.3	19.9	2.7	29.4	0.0	0.0	42.5	46.0	-3.5	H	P	
751.230	3.0	49.8	20.1	2.7	29.4	0.0	0.0	43.3	46.0	-2.7	H	P	
787.471	3.0	45.8	20.8	2.8	29.2	0.0	0.0	40.1	46.0	-5.9	H	P	
799.592	3.0	46.5	21.0	2.8	29.2	0.0	0.0	41.1	46.0	-4.9	H	P	
811.712	3.0	42.4	21.1	2.8	29.1	0.0	0.0	37.2	46.0	-8.8	H	P	
853.354	3.0	46.0	21.3	2.9	28.8	0.0	0.0	41.4	46.0	-4.6	H	P	
56.041	3.0	51.4	7.9	0.6	29.6	0.0	0.0	30.3	40.0	-9.7	V	P	
92.163	3.0	50.4	8.1	0.9	29.6	0.0	0.0	29.8	43.5	-13.7	V	P	
210.967	3.0	43.9	12.0	1.3	28.9	0.0	0.0	28.3	43.5	-15.2	V	P	
738.989	3.0	44.1	19.9	2.7	29.4	0.0	0.0	37.3	46.0	-8.7	V	P	
751.110	3.0	46.3	20.1	2.7	29.4	0.0	0.0	39.8	46.0	-6.2	V	P	
763.230	3.0	43.6	20.4	2.7	29.3	0.0	0.0	37.4	46.0	-8.7	V	P	
787.471	3.0	42.3	20.8	2.8	29.2	0.0	0.0	36.6	46.0	-9.4	V	P	
799.592	3.0	42.6	21.0	2.8	29.2	0.0	0.0	37.2	46.0	-8.8	V	P	
852.154	3.0	46.2	21.3	2.9	28.8	0.0	0.0	41.6	46.0	-4.4	V	P	

## HORIZONTAL PLOT



## VERTICAL PLOT



## 9. 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 <sup>2</sup> )	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 <sup>2</sup> )	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 <sup>2</sup> )	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 <sup>2</sup> )	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 <sup>2</sup> )	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> <sup>1.2</sup>
150 000–300 000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616 000 / <i>f</i> <sup>1.2</sup>

\* 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<sup>2</sup> is equivalent to 1 mW/cm<sup>2</sup>.  
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:

$$S = \text{EIRP} / (4 * \pi * D^2)$$

where

S = Power density in W/m<sup>2</sup>

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Power density in units of W/m<sup>2</sup> is converted to units of mW/cm<sup>2</sup> by dividing by 10.

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<sup>2</sup>

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

## **RESULTS**

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m <sup>2</sup> )	FCC Power Density (mW/cm <sup>2</sup> )
2.4 GHz	Bluetooth	0.20	0.51	2.00	0.0035	0.00035