



**FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

CERTIFICATION TEST REPORT

FOR

2.4 GHz ZigBee Radio Module

MODEL NUMBER: AIR-CAP1552Sx-A-K9

**FCC ID: LDK102078P
IC: 2461B-102078P**

REPORT NUMBER: 11U13912-2, Revision C

ISSUE DATE: DECEMBER 02, 2011

Prepared for
**CISCO SYSTEMS, INC.
170 WEST TASMAN DRIVE
SAN JOSE, CA 95134**

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	08/08/11	Initial Issue	F. Ibrahim
A	09/30/11	Revised FCC and IC ID	A. Zaffar
B	10/07/11	Update client address	A. Zaffar
C	12/02/11	Added one more table for MPE	F. Ibrahim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: CISCO SYSTEMS, INC.
170 WEST TASMAN DRIVE
SAN JOSE, CA 95134

EUT DESCRIPTION: 2.4 GHz ZigBee Radio Module

MODEL: AIR-CAP1552Sx-A-K9

SERIAL NUMBER: 47-24455-01 (#26)
NSN (#19) – used for Radiated Emissions 30M-1GHz

DATE TESTED: July 13 – Aug 8, 2011

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

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.

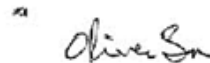
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this 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:



FRANK IBRAHIM
EMC SUPERVISOR
UL CCS

Tested By:



OLIVER SU
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 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

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

UL 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 802.15.4 (ZigBee) transceiver.

The radio module is manufactured by Honeywell.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range	Mode	Output Power (dBm)	Output Power (mW)
2405 - 2475	802.15.4 (ZigBee)	18.34	68.23

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an omni-directional antenna, with a maximum peak gain of 5 dBi.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was BRR_SimpleIR, rev. 5.5.2.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. Radiated Emissions 30-1000 MHz and Power Line Conducted Emissions were performed with the EUT set to transmit continuously at the channel with highest output power.

There's only one valid mounting configuration: WiFi Antenna Pointing up and ZigBee Antenna pointing down.

There is only one modulation for this device, which is OQPSK-DSSS, and one data rate, which is 250 kbps.

5.6. DESCRIPTION OF TEST SETUP

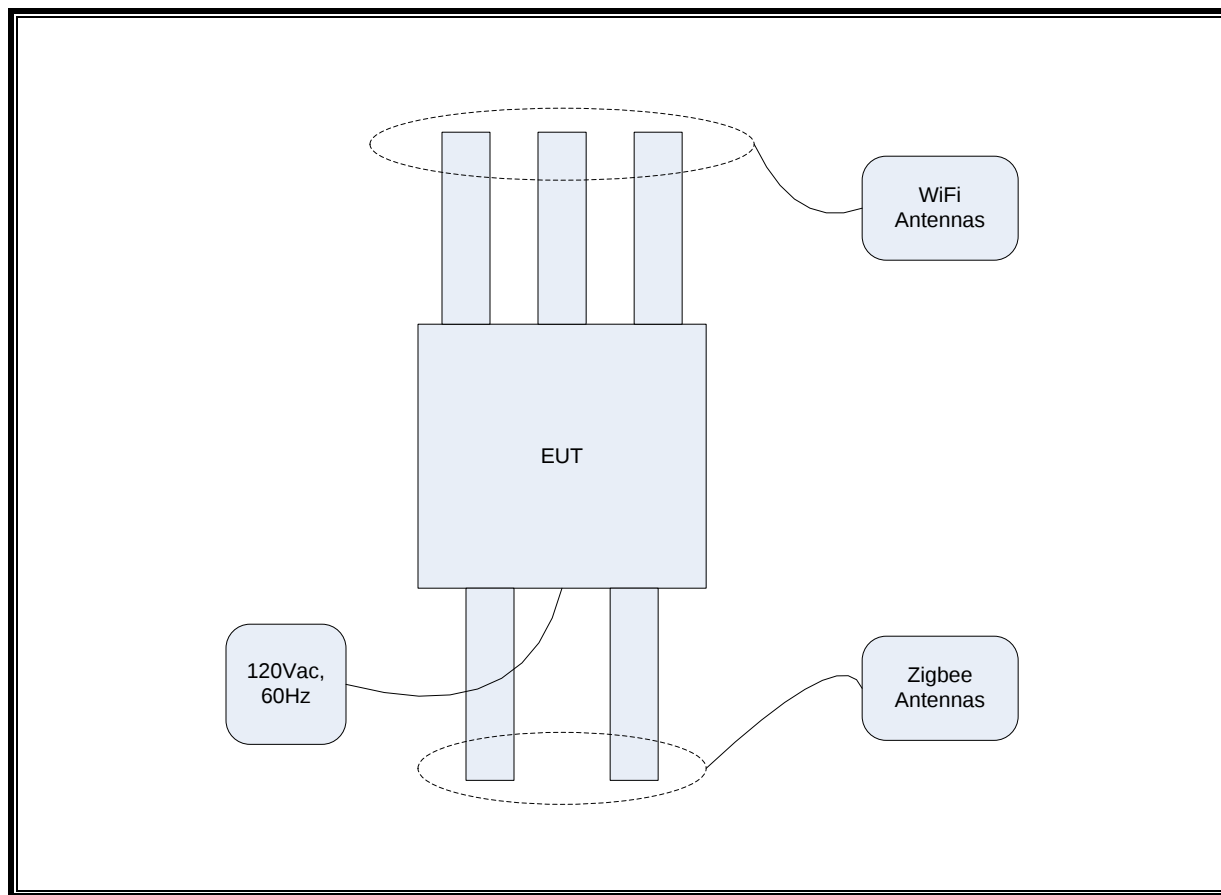
SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Latitude D620	HF974 A02	E2KWM3945ABG
AC Adapter	Dell	PA-1650-05D	CN-05U092-71615-4BL-02DA	DoC

TEST SETUP

The EUT is installed in a host enclosure during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	Asset	Cal Date	Cal Due
Spectrum Analyzer, 44GHz	Agilent	E4446A	T99	05/04/11	11/04/12
Power Meter	HP	438A	T147	06/17/11	09/17/12
Power Sensor	Agilent	8481A	CCS-0078	10/28/09	07/28/11
Spectrum Analyzer, 44GHz	Agilent	E4446A	T146	04/07/11	04/07/12
Preamplifier, 1300MHz	HP	8447D	T15	01/27/11	01/27/12
Antenna, Bilog, 2GHz	Sunol	JB1	T185	07/16/11	07/16/12
Antenna, Horn, 18GHz	EMCO	3115	T60	06/09/11	06/09/12
Antenna, Horn, 26.5GHz	ARA	SWH-28	T125	07/28/11	07/28/12
Preamplifier, 26.5GHz	HP	8449B	T34	07/18/11	07/18/12
EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	T212	07/06/11	07/06/12
LISN, 30MHz (EUT)	Fisher Comm Corp	LISN-50/250-25-2	T25	11/10/10	11/10/11
LISN, 10kHz-30MHz (Support)	Solar	8012-50-R-24-BNC	T29	11/10/10	11/10/11

7. ANTENNA PORT TEST RESULTS

7.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

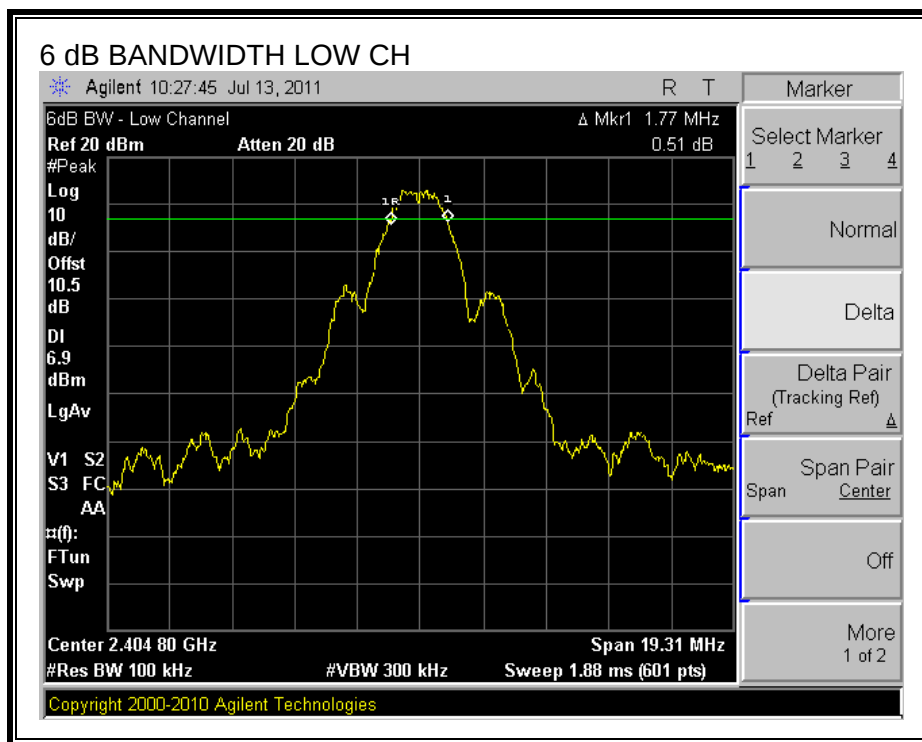
TEST PROCEDURE

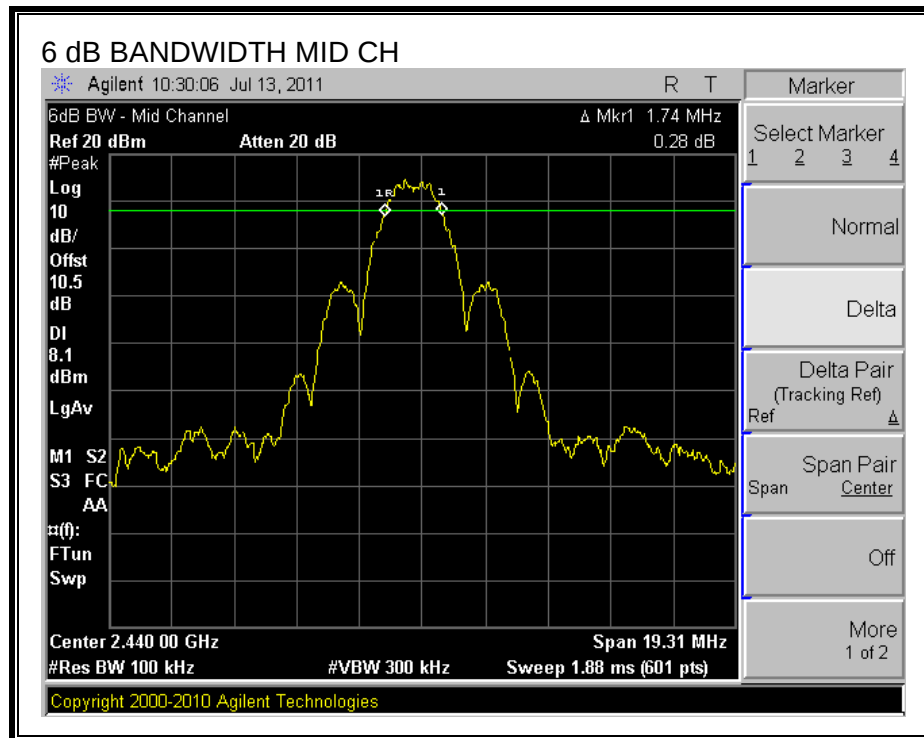
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

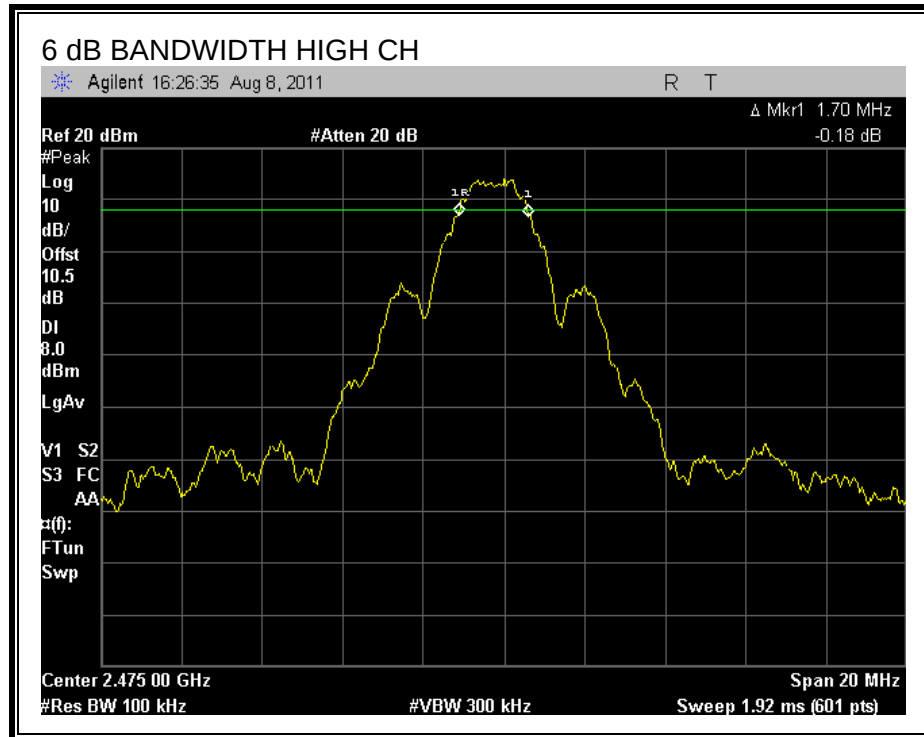
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.77	0.5
Middle	2440	1.74	0.5
High	2475	1.7	0.5

6 dB BANDWIDTH







7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

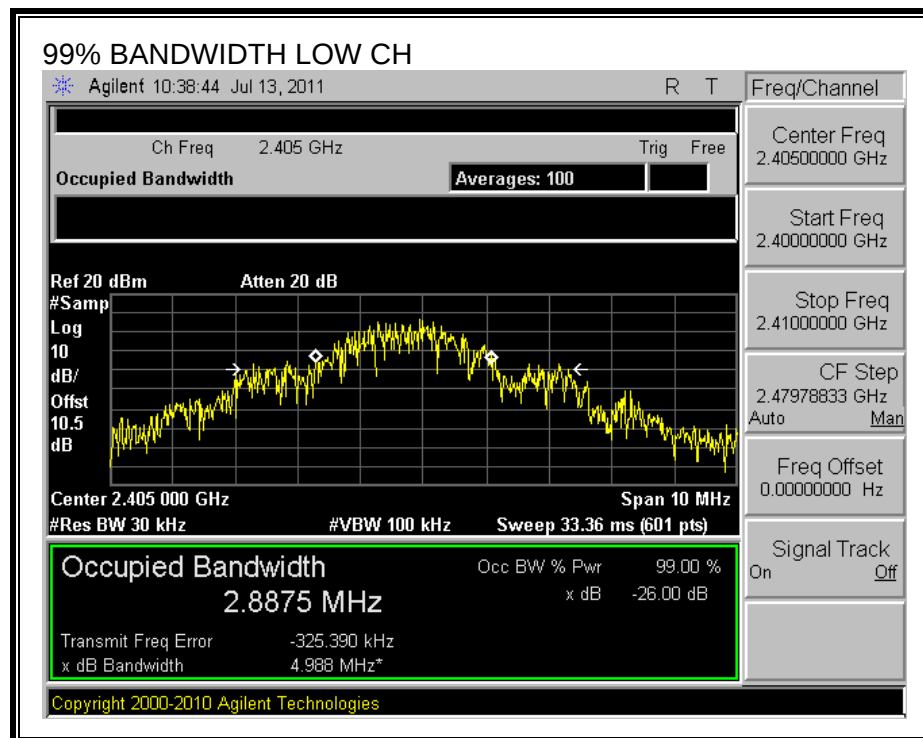
TEST PROCEDURE

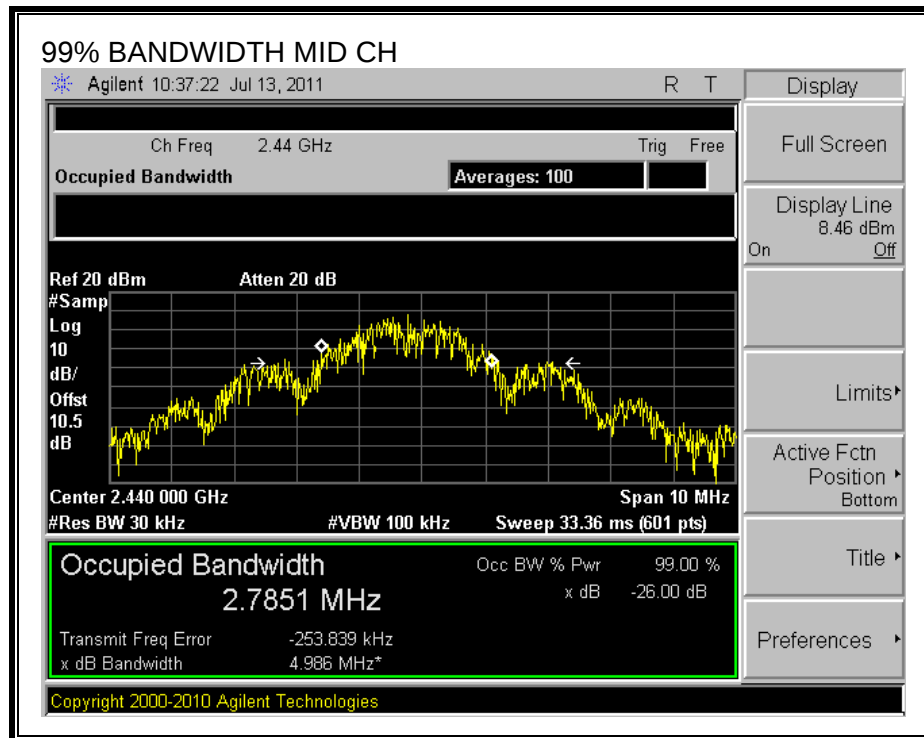
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

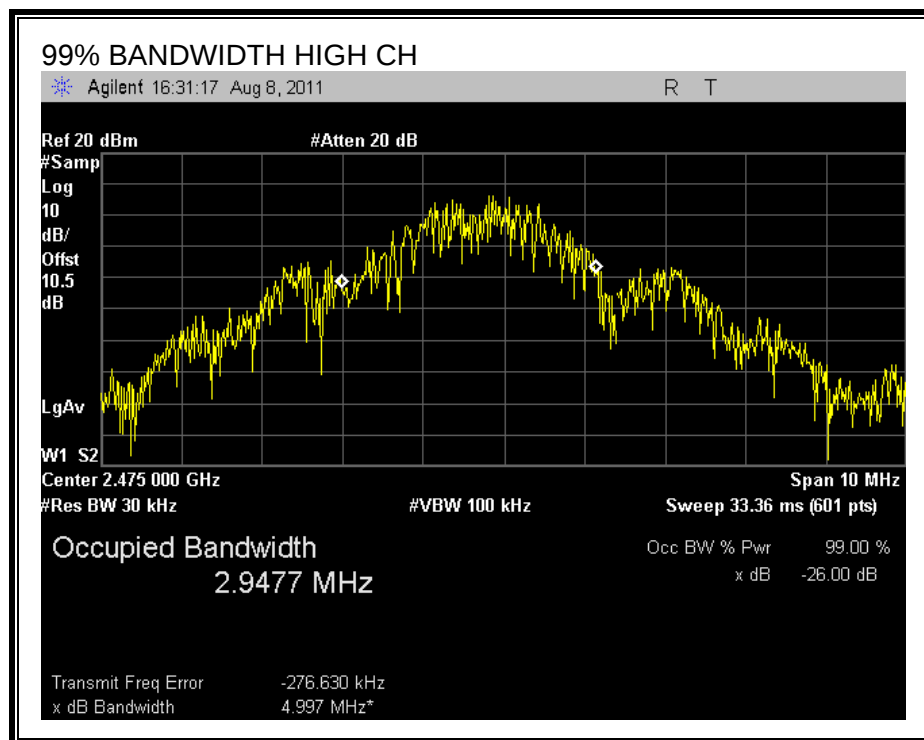
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.8875
Middle	2440	2.7851
High	2475	2.9477

99% BANDWIDTH







7.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

TEST PROCEDURE

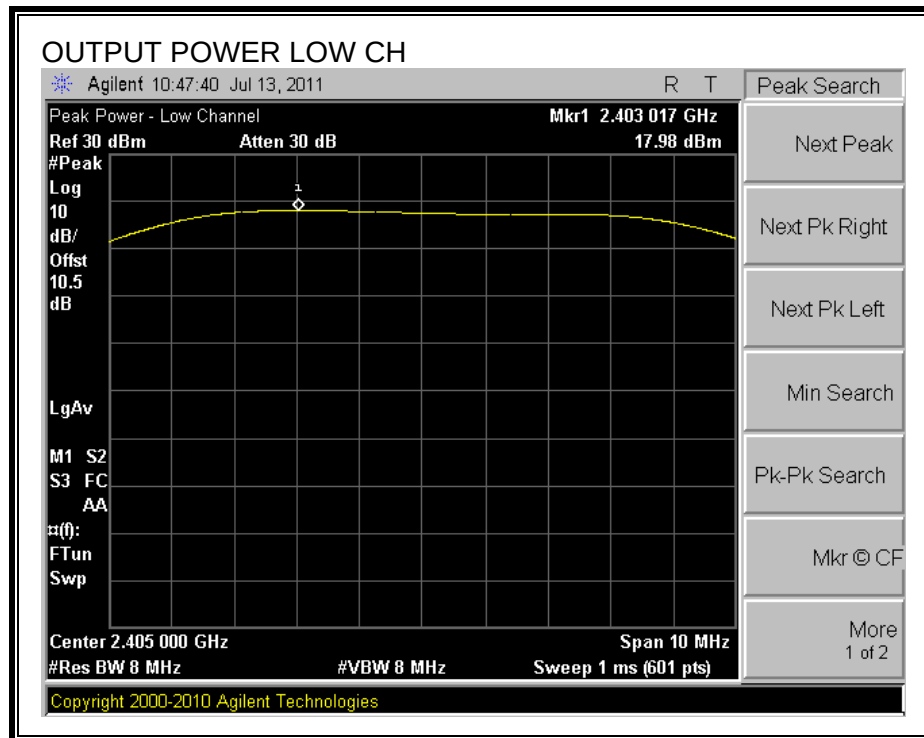
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

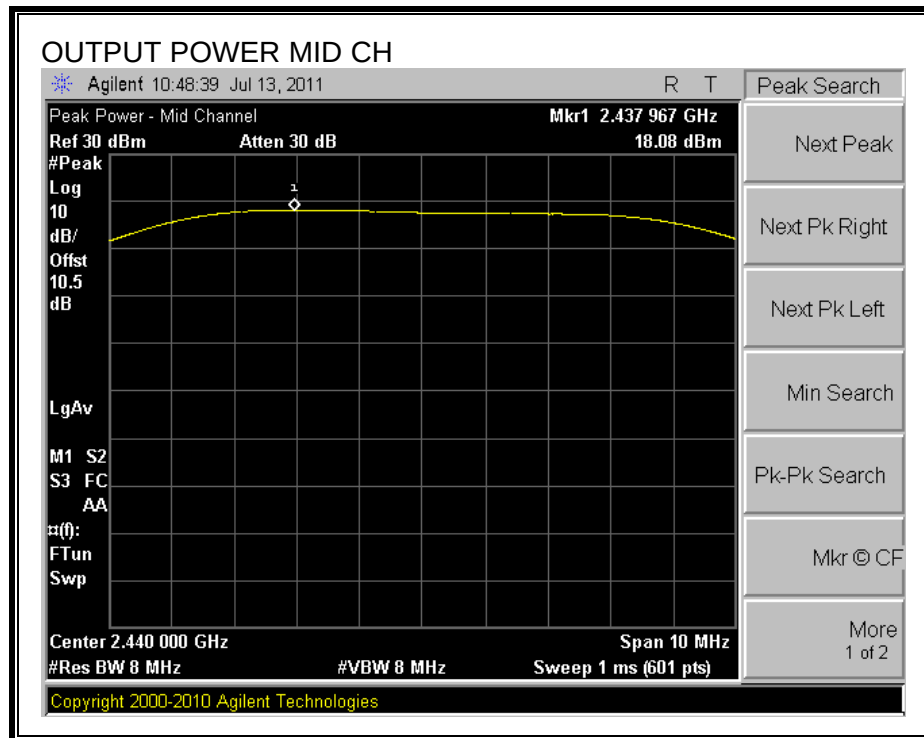
RESULTS

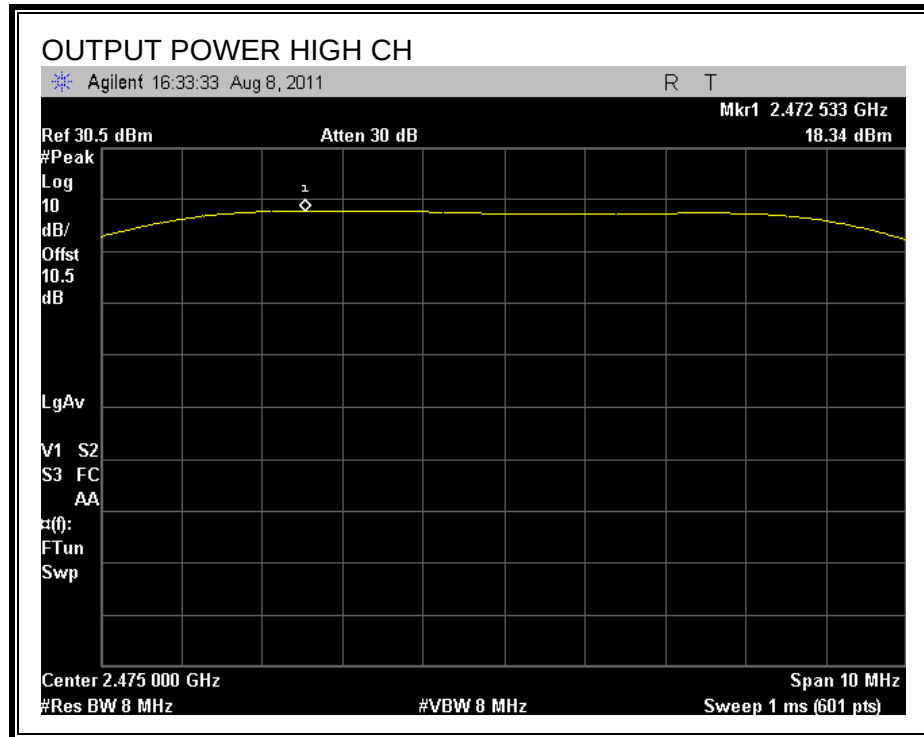
Channel	Frequency (MHz)	Peak Power Reading (dBm)	Attenuator and Cable Offset (dB)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2405	17.98	0	17.98	30	-12.02
Middle	2440	18.08	0	18.08	30	-11.92
High	2475	18.34	0	18.34	30	-11.66

Note: Attenuator/cable offset was included in the spectrum analyzer measurement.

OUTPUT POWER







7.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.54 dB (including 10 dB pad and 0.54 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	2405	16.89
Middle	2440	16.90
High	2475	17.20

7.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

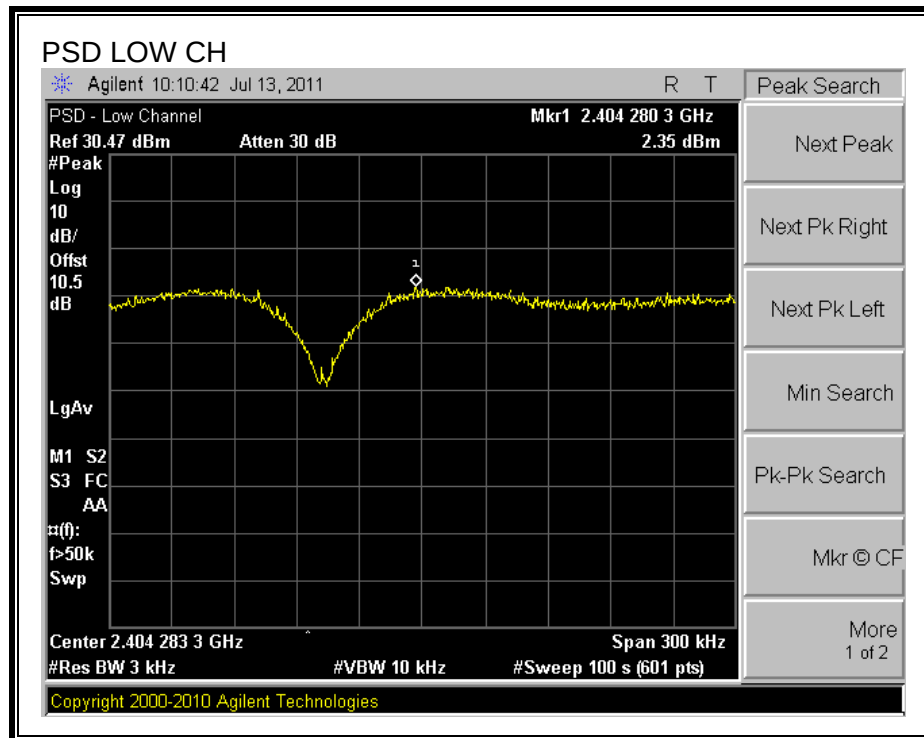
TEST PROCEDURE

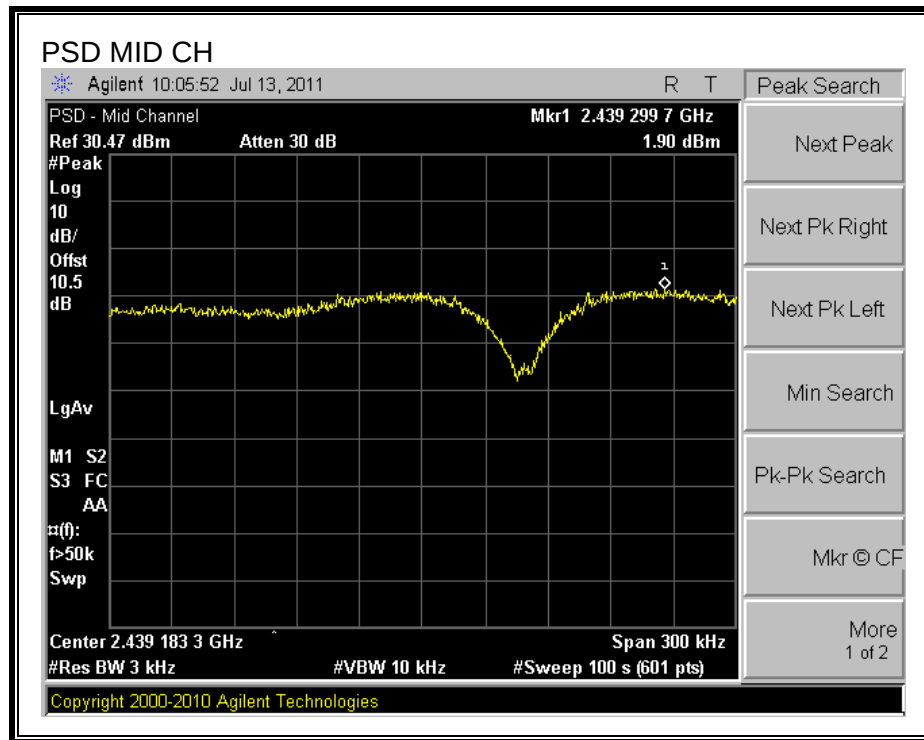
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

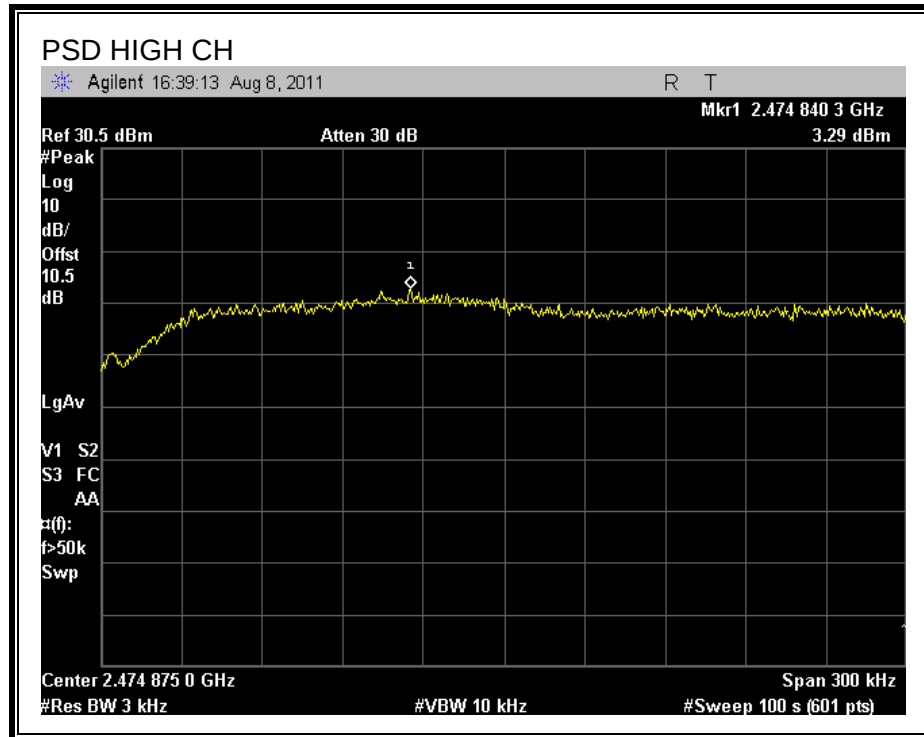
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2405	2.35	8	-5.65
Middle	2440	1.90	8	-6.10
High	2475	3.29	8	-4.71

POWER SPECTRAL DENSITY







7.6. CONDUCTED TX SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

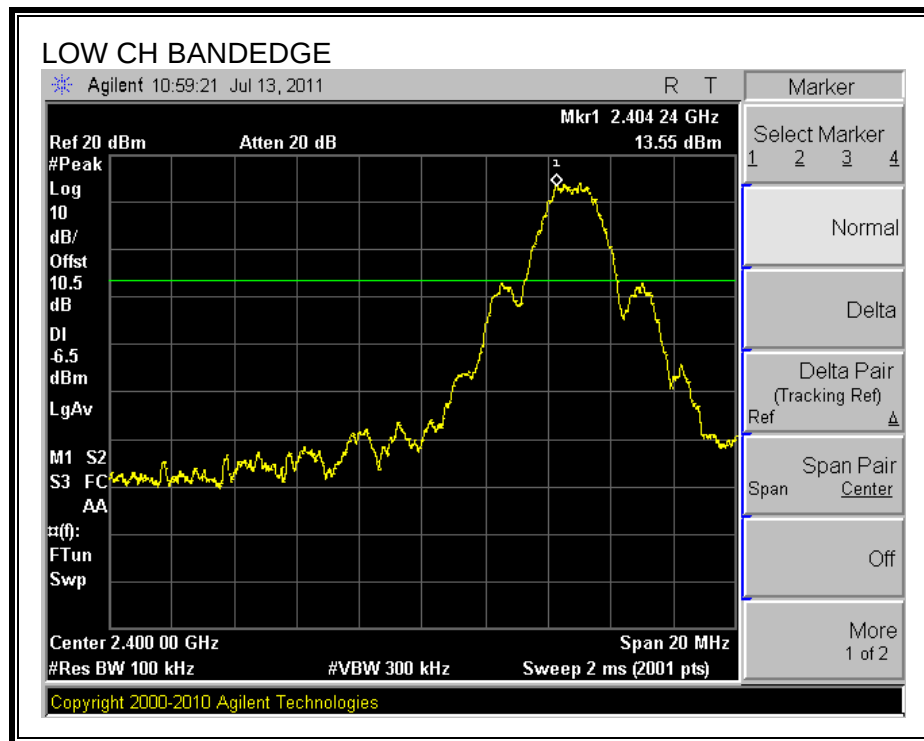
TEST PROCEDURE

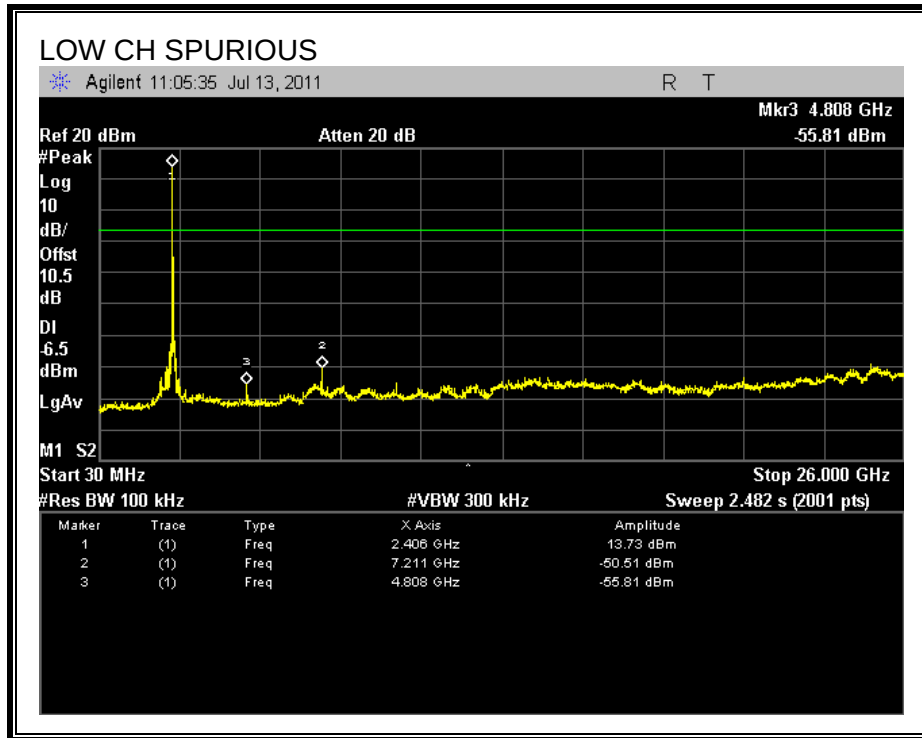
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

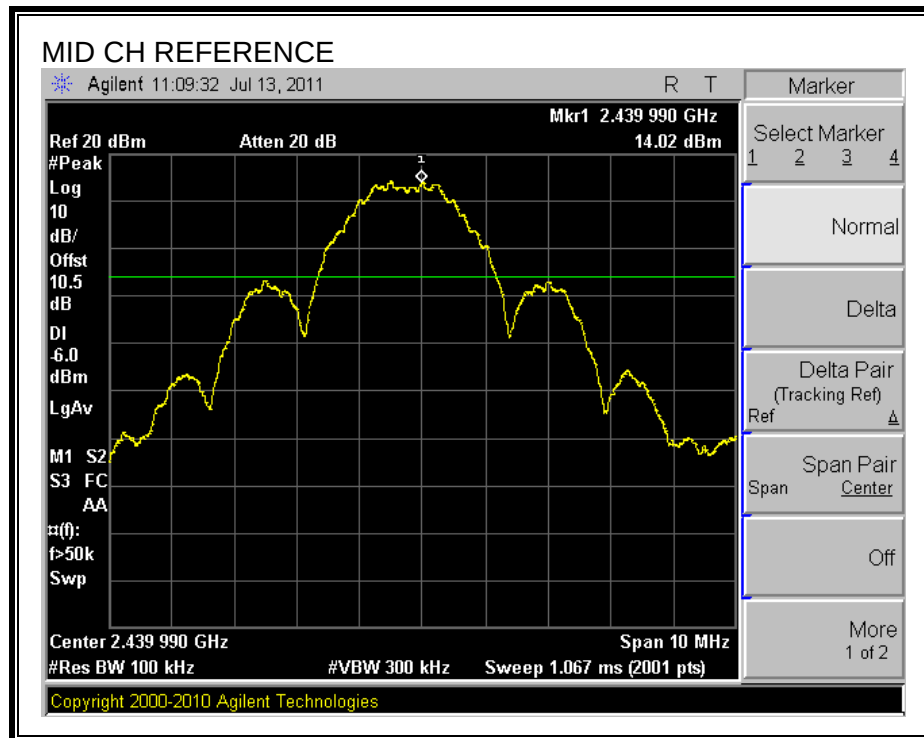
RESULTS

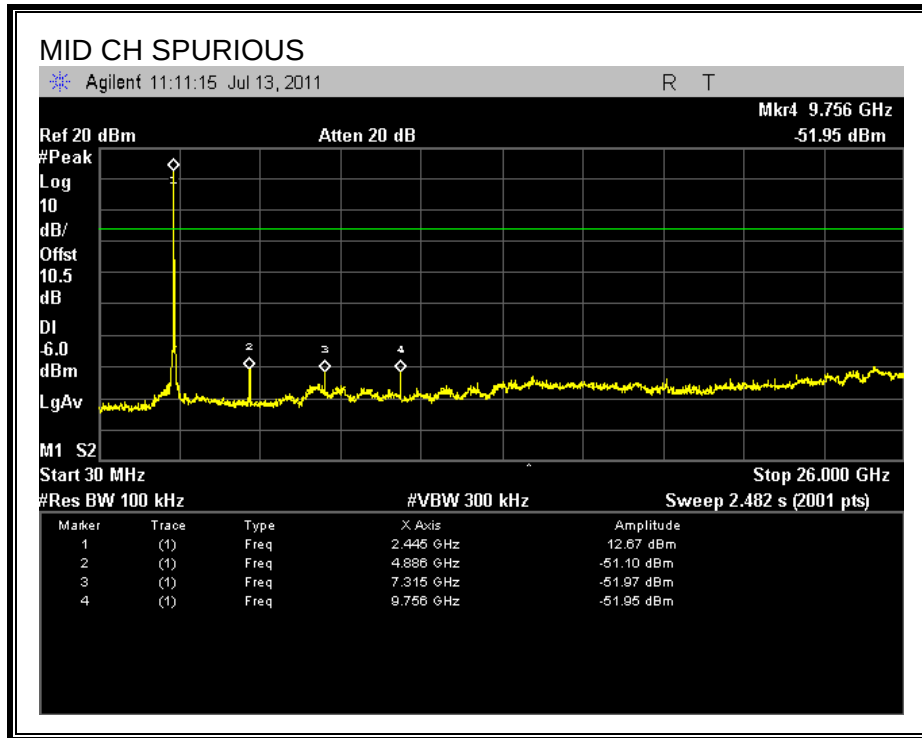
SPURIOUS EMISSIONS, LOW CHANNEL



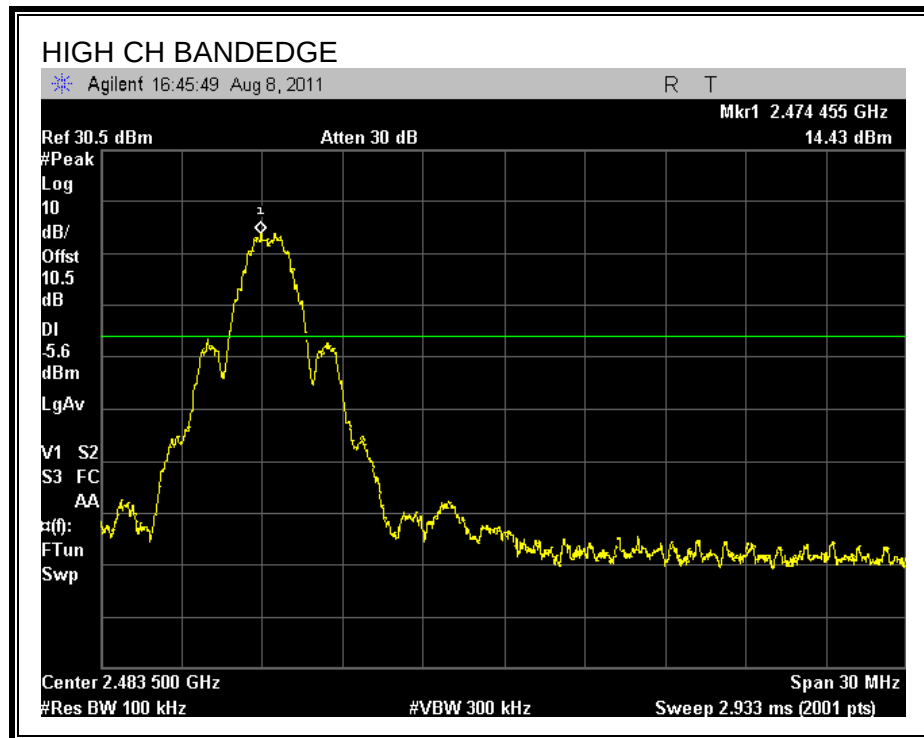


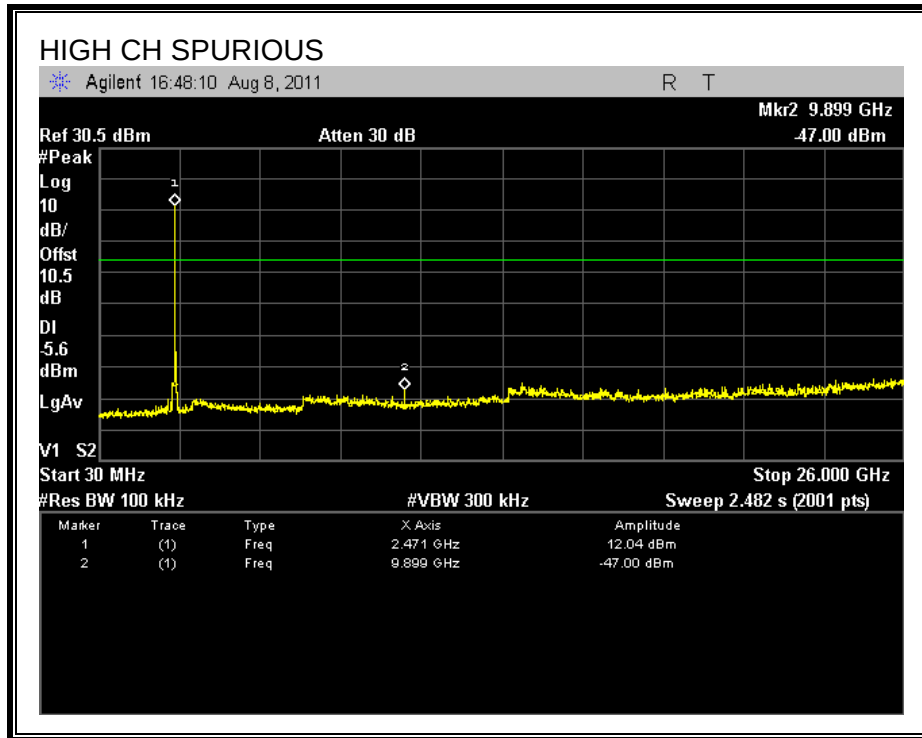
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





7.7. CONDUCTED RX SPURIOUS EMISSIONS

LIMITS

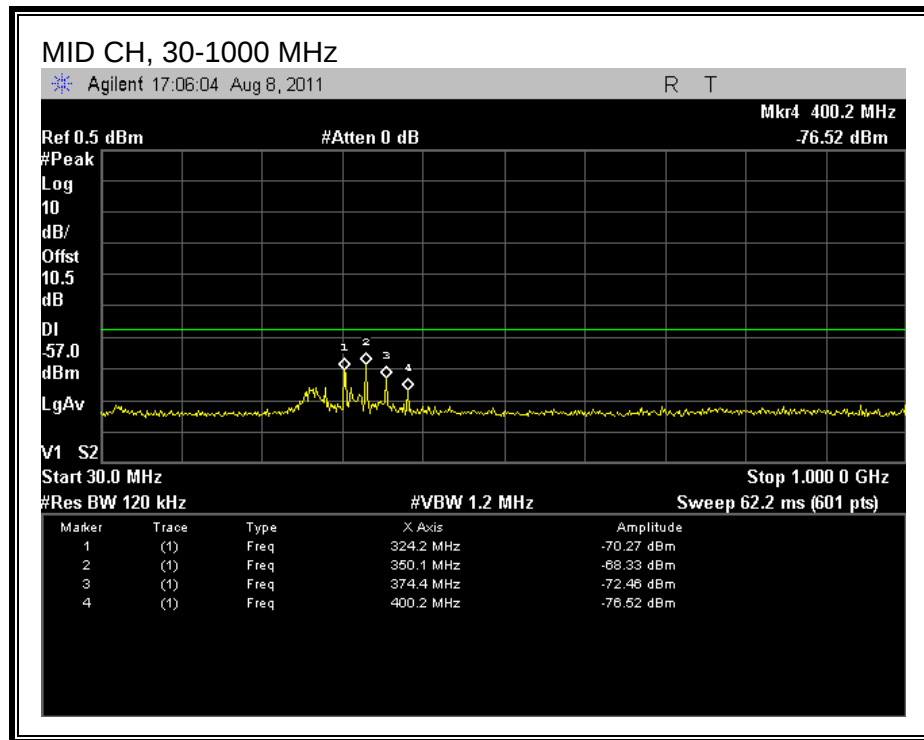
IC RSS-Gen Section 6.2 (Antenna Conducted Limits)

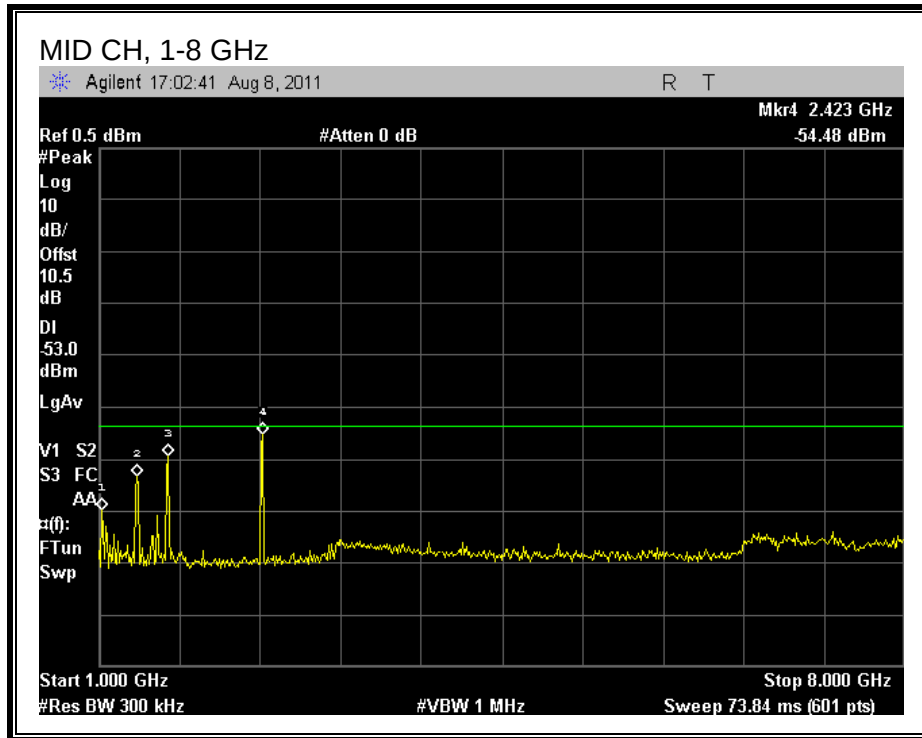
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. For the frequency range of 30-1000 MHz, the resolution bandwidth is set to 120 kHz, video bandwidth is set to 1.2 MHz. For the frequency range of 1000-8000 MHz, the resolution bandwidth is set to 300 kHz, video bandwidth is set to 1 MHz.

The spectrum from 30 MHz to 8 GHz is investigated with the receiver set to the middle channel.

RX SPURIOUS EMISSIONS, MID CHANNEL





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.

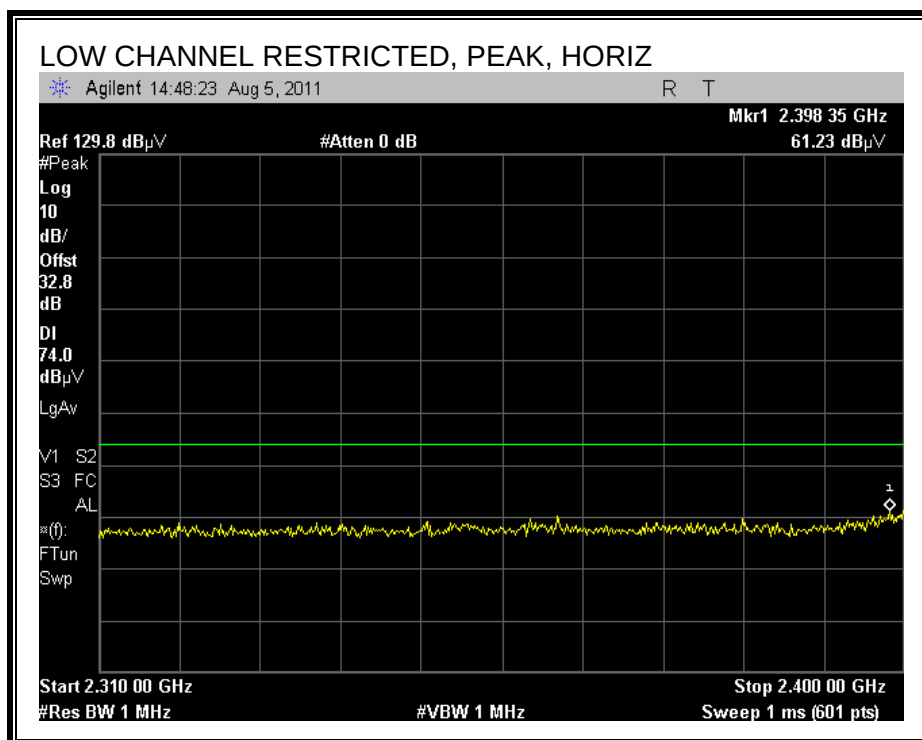
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

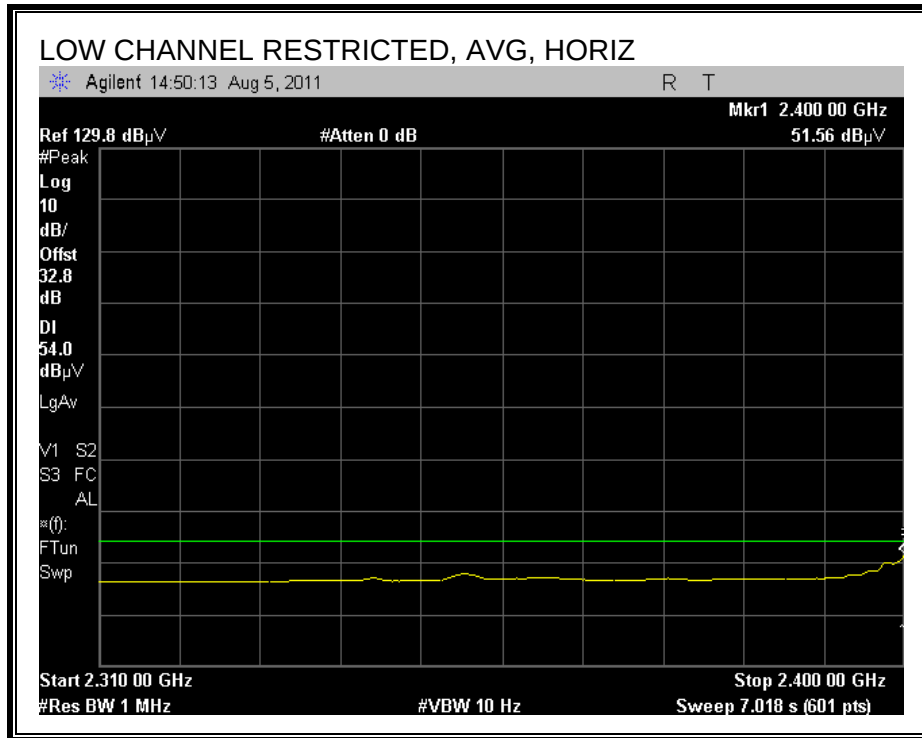
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

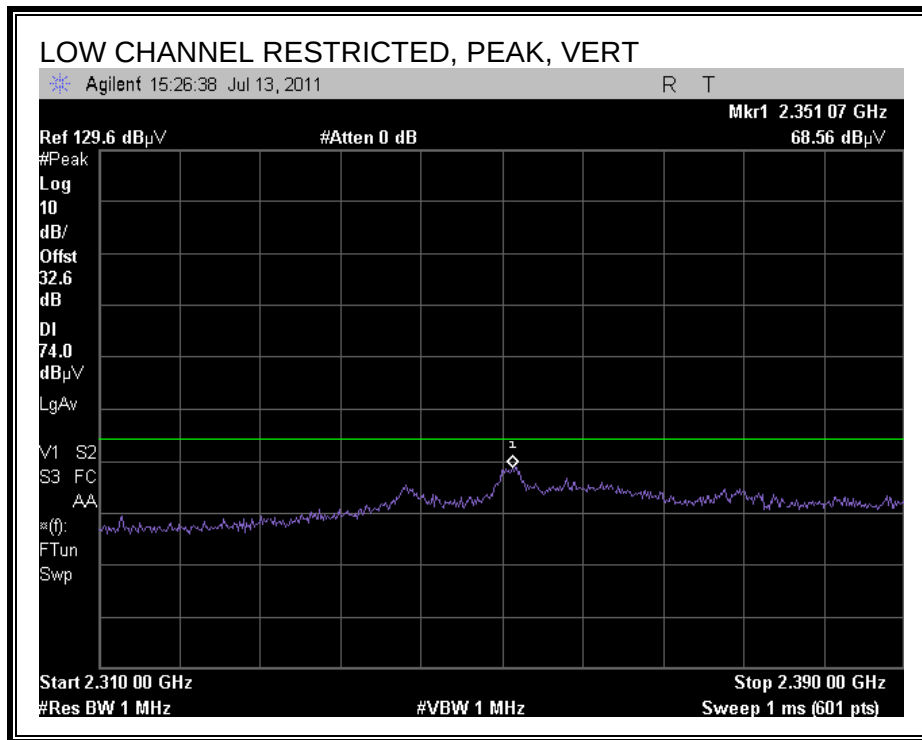
8.2. TRANSMITTER ABOVE 1 GHz

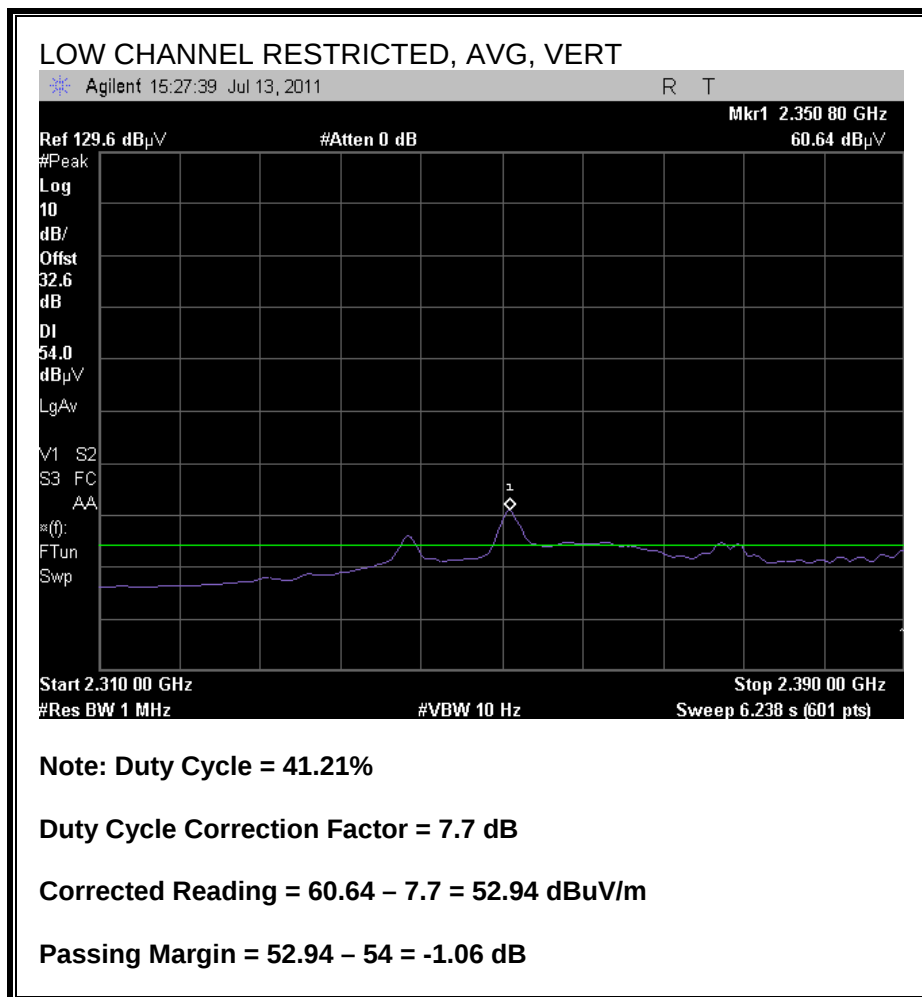
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



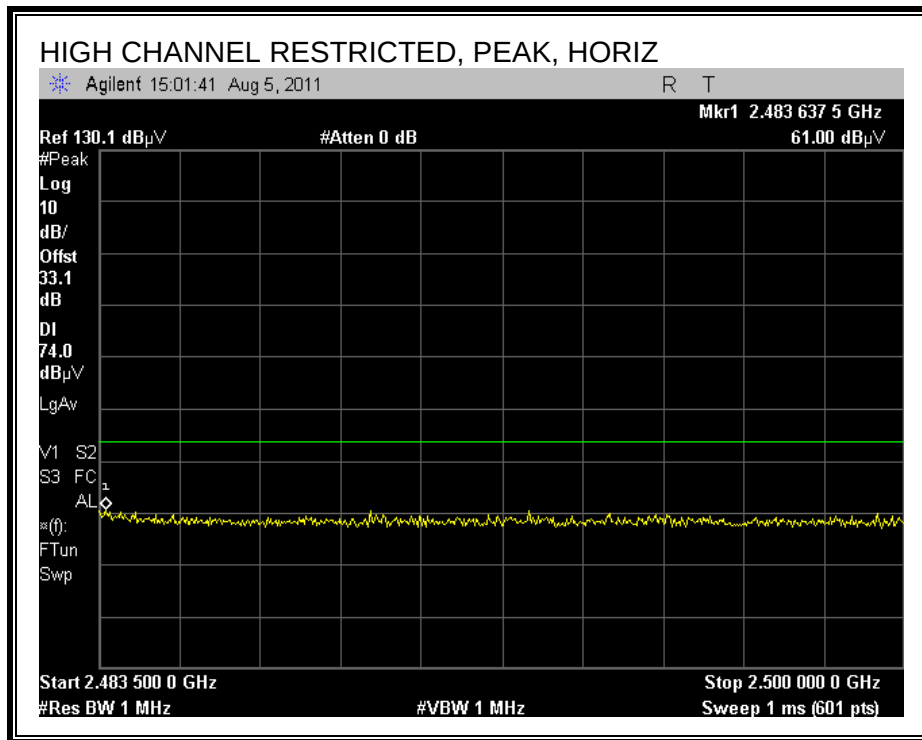


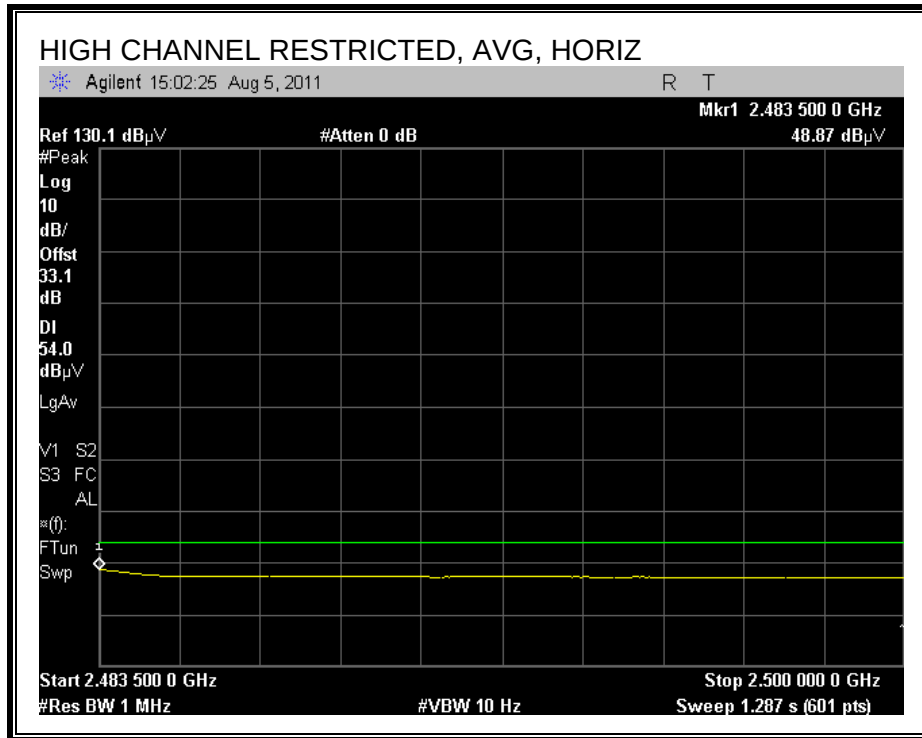
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



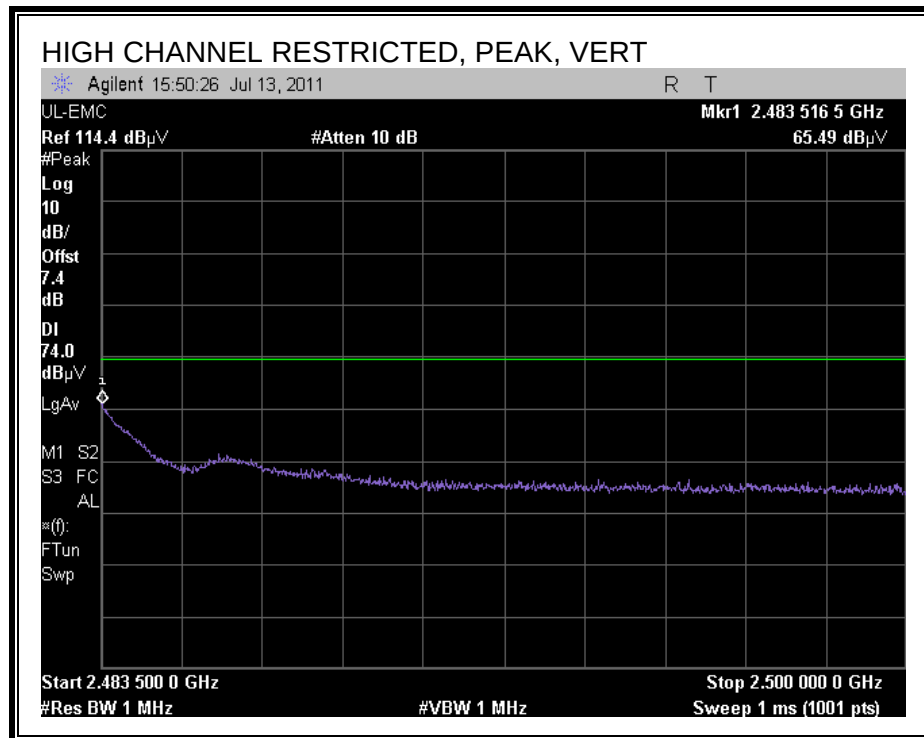


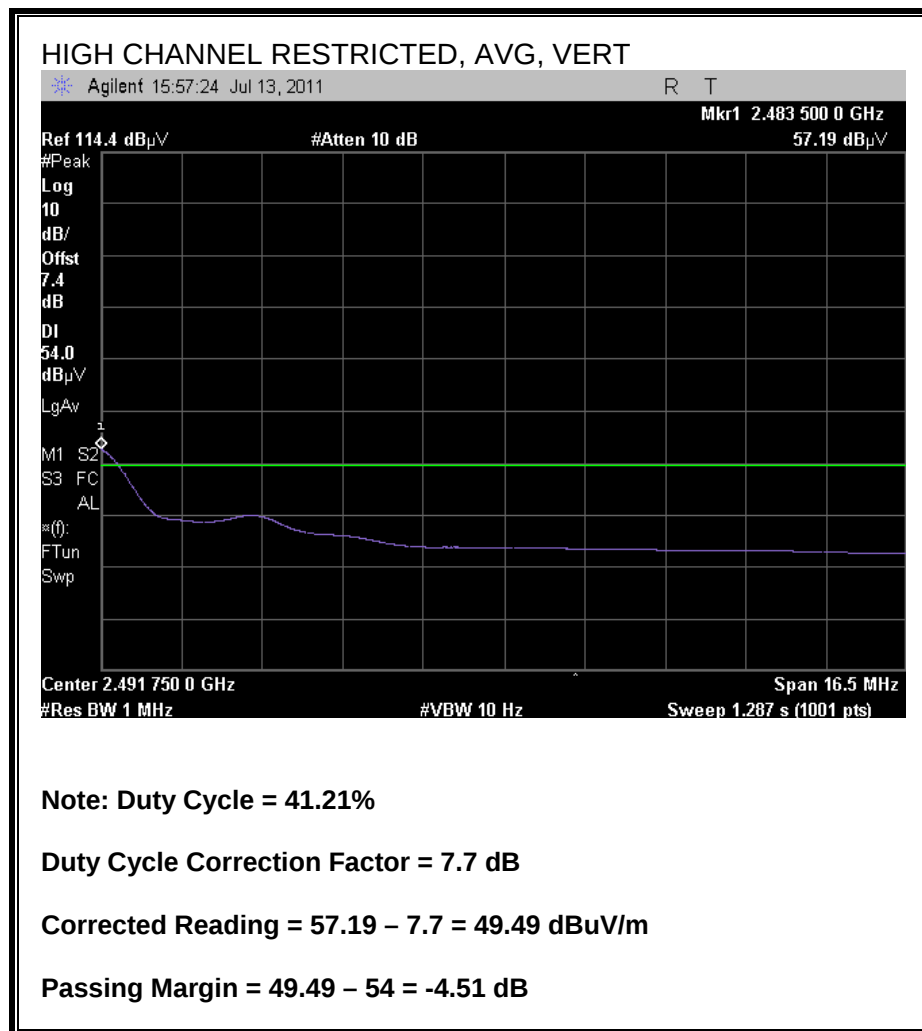
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)



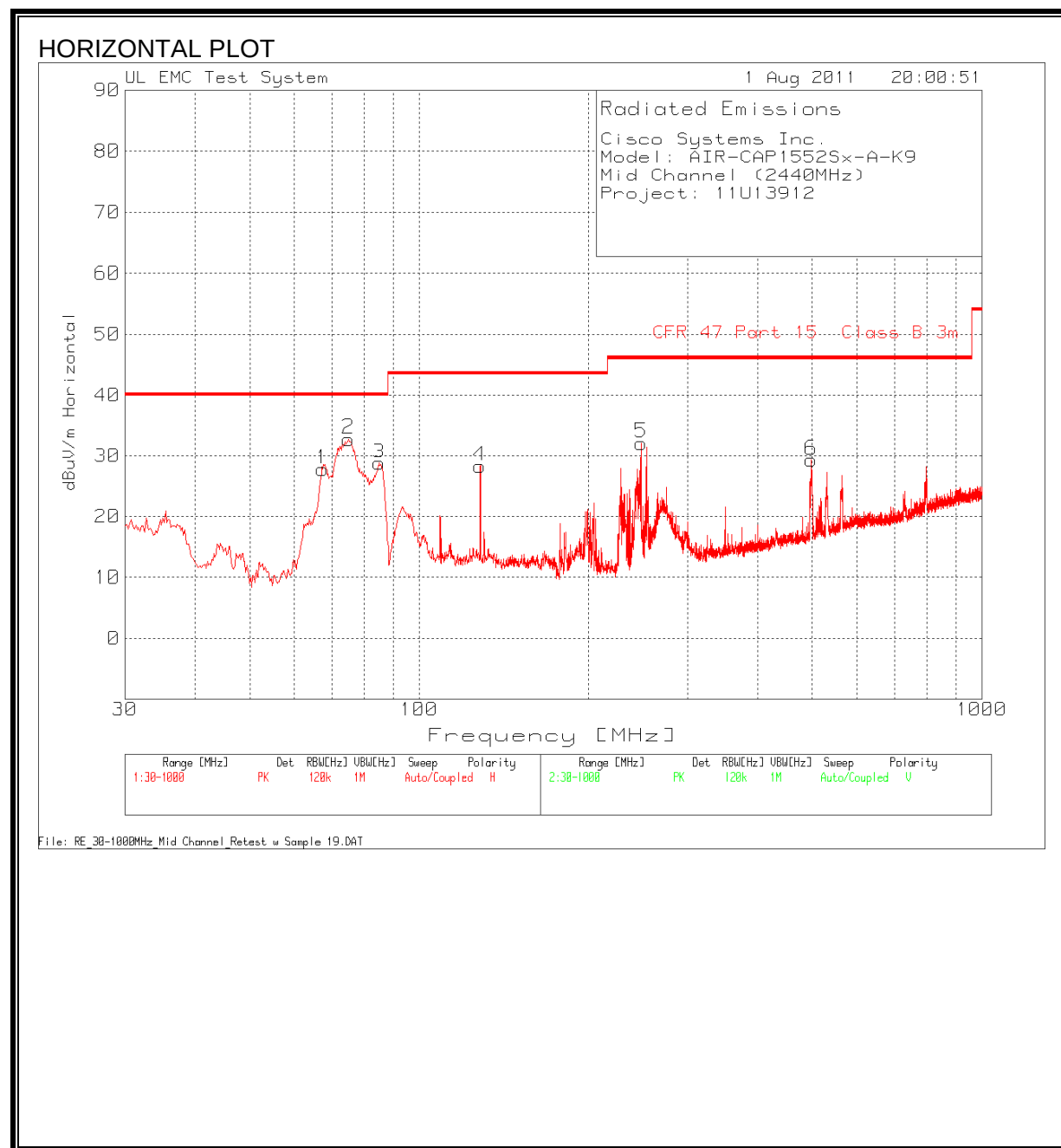


HARMONICS AND SPURIOUS EMISSIONS

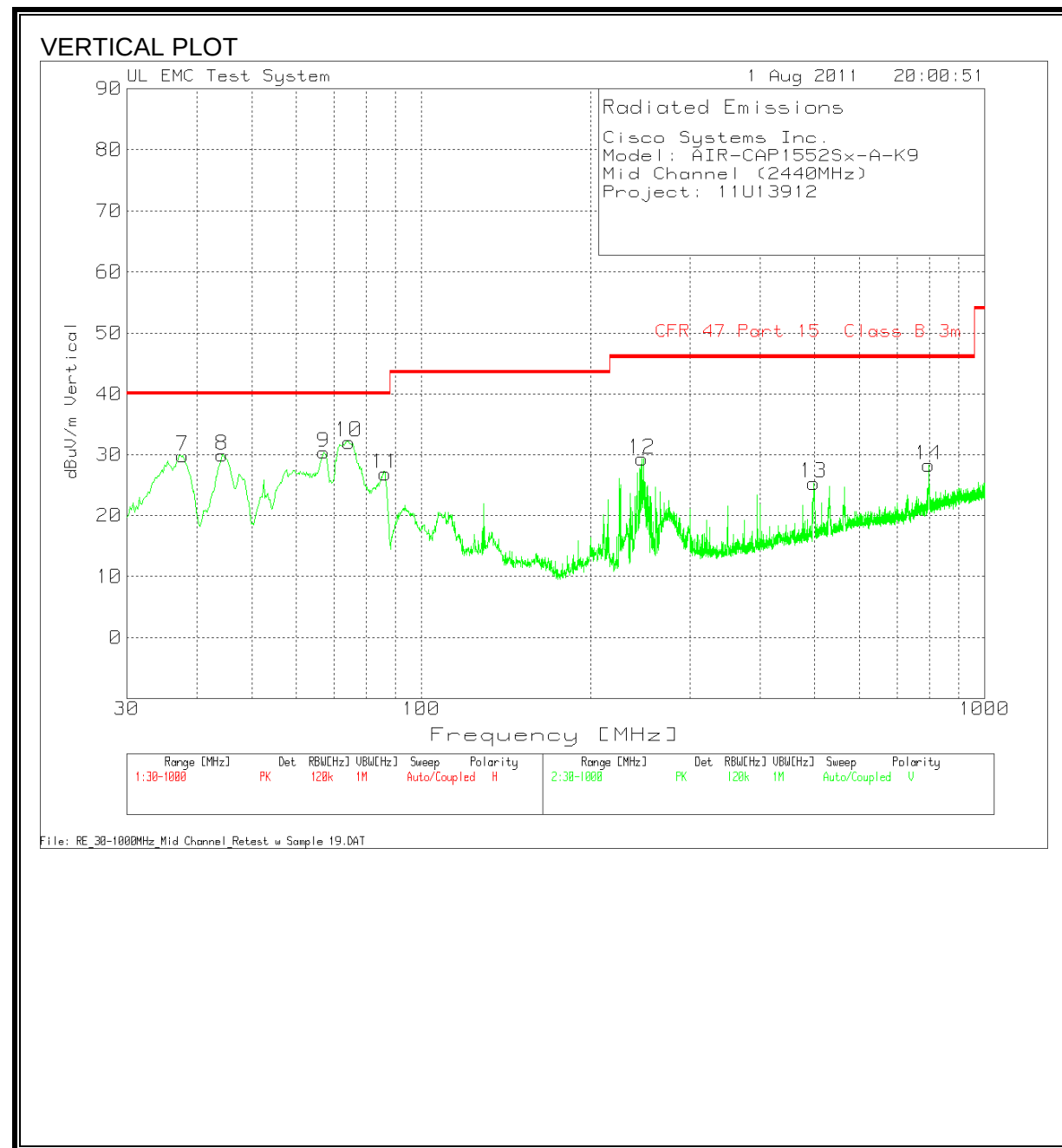
High Frequency Measurement																	
Compliance Certification Services, Fremont 3m Chamber																	
Company:		Cisco															
Project #:		11U13912															
Date:		07/13/11															
Test Engineer:		Michael Antola															
Configuration:		Stand-alone EUT															
Mode:		TX ON, Zigbee radio															
Test Equipment:																	
Horn 1-18GHz				Pre-amplifier 1-26GHz				Pre-amplifier 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	Ftr 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 (2405 MHz)																	
4.810	3.0	39.8	29.1	32.7	6.8	-34.8	0.0	0.0	44.4	33.7	74	54	-29.6	-20.3	H		
12.025	3.0	37.2	25.3	38.5	11.9	-32.5	0.0	0.0	55.2	43.3	74	54	-18.8	-10.7	H (Noise Floor)		
4.810	3.0	47.9	38.6	32.7	6.8	-34.8	0.0	0.0	52.5	43.2	74	54	-21.5	-10.8	V		
12.025	3.0	38.3	25.3	38.5	11.9	-32.5	0.0	0.0	56.3	43.3	74	54	-17.7	-10.7	V (Noise Floor)		
Mid Channel (2440 MHz)																	
4.880	3.0	49.0	35.6	32.7	6.8	-34.8	0.0	0.0	53.7	40.3	74	54	-20.3	-13.7	V		
7.320	3.0	46.0	36.2	35.5	9.1	-34.1	0.0	0.0	56.5	46.7	74	54	-17.5	-7.3	V		
12.200	3.0	38.9	26.2	38.5	12.0	-32.5	0.0	0.0	56.8	44.2	74	54	-17.2	-9.8	V (Noise Floor)		
4.880	3.0	46.3	36.9	32.7	6.8	-34.8	0.0	0.0	51.0	41.6	74	54	-23.0	-12.4	H		
7.320	3.0	43.9	33.1	35.5	9.1	-34.1	0.0	0.0	54.3	43.6	74	54	-19.7	-10.4	H		
12.200	3.0	38.2	25.9	38.5	12.0	-32.5	0.0	0.0	56.2	43.8	74	54	-17.8	-10.2	H (Noise Floor)		
High Channel (2475 MHz)																	
4.950	3.0	40.4	29.2	32.8	6.9	-34.8	0.0	0.0	45.2	34.0	74	54	-28.8	-20.0	H		
7.425	3.0	40.2	28.8	35.6	9.1	-34.1	0.0	0.0	50.8	39.4	74	54	-23.2	-14.6	H		
12.375	3.0	39.0	25.8	38.4	12.0	-32.5	0.0	0.0	57.0	43.8	74	54	-17.0	-10.2	H (Noise Floor)		
4.950	3.0	45.4	35.9	32.8	6.9	-34.8	0.0	0.0	50.2	40.7	74	54	-23.8	-13.3	V		
7.425	3.0	44.2	33.2	35.6	9.1	-34.1	0.0	0.0	54.8	43.8	74	54	-19.2	-10.2	V		
12.375	3.0	37.7	25.7	38.4	12.0	-32.5	0.0	0.0	55.7	43.7	74	54	-18.3	-10.3	V (Noise Floor)		
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. WORST-CASE BELOW 1 GHz

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



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



DATA

Cisco Systems Inc.

Model: AIR-CAP1552Sx-A-K9

Mid Channel (2440MHz)

Project: 11U13912

Horizontal 30 - 1000MHz

Test Frequency [MHz]	Meter Reading [dBuV/m]	Detector	Cable Loss [dB]	Preamp Gain [dB]	Antenna [dB]	Corrected Reading [dBuV/m]	FCC Class B 3m	Margin	Height [cm]	Polarity
67.4121	46.91	PK	0.9	-28.2	8.2	27.81	40	-12.19	176	Horz
74.972	51.82	PK	1	-28.1	8.1	32.82	40	-7.18	251	Horz
84.8581	48.22	PK	1	-28.1	7.6	28.72	40	-11.28	251	Horz
128.2794	41.13	PK	1.1	-27.9	13.9	28.23	43.5	-15.27	251	Horz
247.8817	46.3	PK	1.6	-27.5	11.8	32.2	46	-13.8	251	Horz
497.554	38.79	PK	2.2	-28.5	16.8	29.29	46	-16.71	100	Horz

Vertical 30 - 1000MHz

Test Frequency [MHz]	Meter Reading [dBuV/m]	Detector	Cable Loss [dB]	Preamp Gain [dB]	Antenna [dB]	Corrected Reading [dBuV/m]	FCC Class B 3m	Margin	Height [cm]	Polarity
37.7538	42.11	PK	0.7	-28.2	15.2	29.81	40	-10.19	101	Vert
44.3445	45.5	PK	0.7	-28.2	12	30	40	-10	101	Vert
67.0244	49.6	PK	0.9	-28.2	8.1	30.4	40	-9.6	101	Vert
74.3905	51.18	PK	1	-28.1	8.1	32.18	40	-7.82	101	Vert
86.215	46.39	PK	1	-28.1	7.6	26.89	40	-13.11	176	Vert
246.3309	43.42	PK	1.6	-27.5	11.8	29.32	46	-16.68	251	Vert
497.554	34.79	PK	2.2	-28.5	16.8	25.29	46	-20.71	101	Vert
796.6567	32.56	PK	2.9	-28	20.8	28.26	46	-17.74	101	Vert

PK - Peak detector

QP - Quasi-Peak detector

LnAv - Linear Average detector

LgAv - Log Average detector

Av - Average detector

CAV - CISPR Average detector

RMS - RMS detection

CRMS - CISPR RMS detection

Text File: RE_30-1000MHz_Mid Channel_Retest w Sample 19.TXT

File: RE_30-1000MHz_Mid Channel_Retest w Sample 19.DAT

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

ANSI C63.4

RESULTS

Cisco Systems Inc.
Model: AIR-CAP1552Sx-A-K9
Mid Channel (2440MHz)
Project 11U13912
120V 60Hz

Line-L1 .15 - 30MHz

Test Frequency [MHz]	Meter Reading [dBuV]	Detector	LISN Loss [dB]	Cable Loss [dB]	Corrected Reading [dBuV]	Class B QPK Limit	Margin	Class B AVG Limit	Margin
0.1905	30.08	PK	0	0	30.08	64	-33.92	54	-23.92
0.1905	20.52	Av	0	0	20.52	64	-43.48	54	-33.48
0.852	26.29	PK	0	0	26.29	56	-29.71	46	-19.71
0.852	21.48	Av	0	0	21.48	56	-34.52	46	-24.52
13.533	42.54	PK	0	0	42.54	60	-17.46	50	-7.46
13.533	30.09	Av	0	0	30.09	60	-29.91	50	-19.91
14.154	42.53	PK	0	0	42.53	60	-17.47	50	-7.47
14.154	30.19	Av	0	0	30.19	60	-29.81	50	-19.81

Line-L2 .15 - 30MHz

Test Frequency [MHz]	Meter Reading [dBuV]	Detector	LISN Loss [dB]	Cable Loss [dB]	Corrected Reading [dBuV]	Class B QPK Limit	Margin	Class B AVG Limit	Margin
0.285	30.95	PK	0	0	30.95	60.7	-29.75	50.7	-19.75
0.285	23.43	Av	0	0	23.43	60.7	-37.27	50.7	-27.27
3.273	29.51	PK	0	0	29.51	56	-26.49	46	-16.49
3.273	18.21	Av	0	0	18.21	56	-37.79	46	-27.79
13.1685	43.37	PK	0	0	43.37	60	-16.63	50	-6.63
13.1685	29.14	Av	0	0	29.14	60	-30.86	50	-20.86
13.5015	42.86	PK	0	0	42.86	60	-17.14	50	-7.14
13.5015	32.75	Av	0	0	32.75	60	-27.25	50	-17.25

PK - Peak detector

QP - Quasi-Peak detector

LnAv - Linear Average detector

LgAv - Log Average detector

Av - Average detector

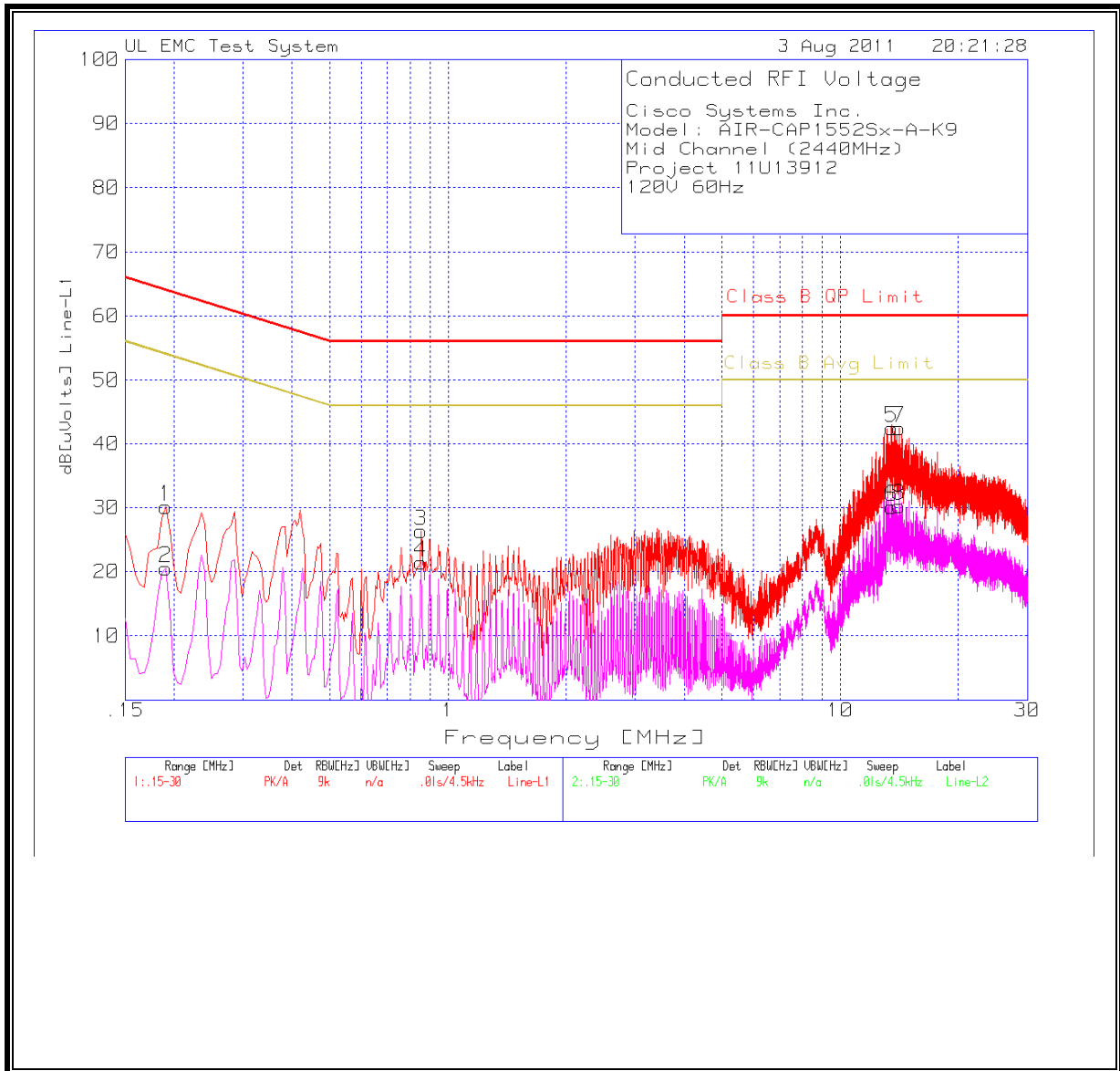
CAV - CISPR Average detector

RMS - RMS detection

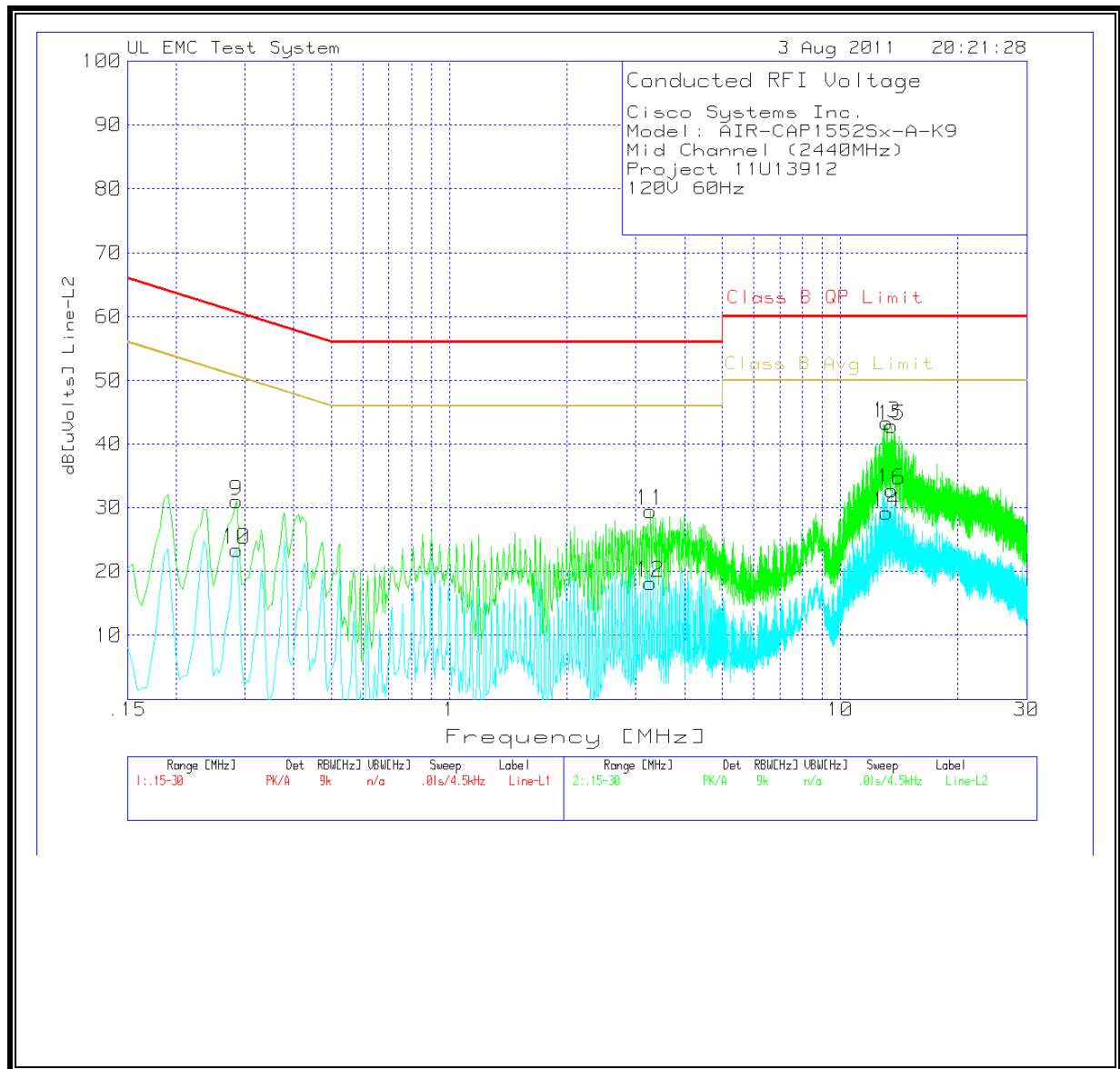
CRMS - CISPR RMS detection

Text File: CDE_150k-30MHz_FCC Part 15 Class B_Mid Channel 2440_Sample 19_120V 60Hz.TXT

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/m² is equivalent to 1 mW/cm².
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/m²

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Power density in units of W/m² is converted to units of mW/cm² by dividing by 10.

Distance is given by:

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

where

D = Separation distance in m

EIRP = Equivalent Isotropic Radiated Power in W

S = Power density in W/m²

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.

$$\text{Total EIRP} = (P_1 * G_1) + (P_2 * G_2) + \dots + (P_n * G_n)$$

where

P_x = Power of transmitter x

G_x = 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/cm²

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m²

RESULTS

2.4 GHz Band

Multiple chain or colocated transmitters									
Band	Mode	Chain for MIMO	Separation Distance (m)	Output AV Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	IC Power Density (W/m ²)	FCC Power Density (mW/cm ²)
2.4 GHz	Zigbee	N/A		17.20	5.00	22.20	0.17		
2.4 GHz	WLAN	1		25.00	4.00	29.00	0.79		
2.4 GHz	WLAN	2		25.00	4.00	29.00	0.79		
Combined			0.20				1.75	3.49	0.349

5.8 GHz Band

Multiple chain or colocated transmitters									
Band	Mode	Chain for MIMO	Separation Distance (m)	Output AV Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	IC Power Density (W/m ²)	FCC Power Density (mW/cm ²)
2.4 GHz	Zigbee	N/A		17.20	5.00	22.20	0.17		
5.8 GHz	WLAN	1		25.00	7.00	32.00	1.58		
5.8 GHz	WLAN	2		25.00	7.00	32.00	1.58		
Combined			0.20				3.34	6.64	0.664

2.4 GHz Band

Multiple chain or colocated transmitters									
Band	Mode	Chain for MIMO	Separation Distance (m)	Output AV Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	IC Power Density (W/m ²)	FCC Power Density (mW/cm ²)
2.4 GHz	Zigbee	N/A		16.46	14.00	30.46	1.11		
2.4 GHz	WLAN	1		25.00	4.00	29.00	0.79		
2.4 GHz	WLAN	2		25.00	4.00	29.00	0.79		
Combined			0.20				2.70	5.37	0.537

5.8 GHz Band

Multiple chain or colocated transmitters									
Band	Mode	Chain for MIMO	Separation Distance (m)	Output AV Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	IC Power Density (W/m ²)	FCC Power Density (mW/cm ²)
2.4 GHz	Zigbee	N/A		16.46	14.00	30.46	1.11		
5.8 GHz	WLAN	1		25.00	7.00	32.00	1.58		
5.8 GHz	WLAN	2		25.00	7.00	32.00	1.58		
Combined			0.20				4.28	8.52	0.852

Note:

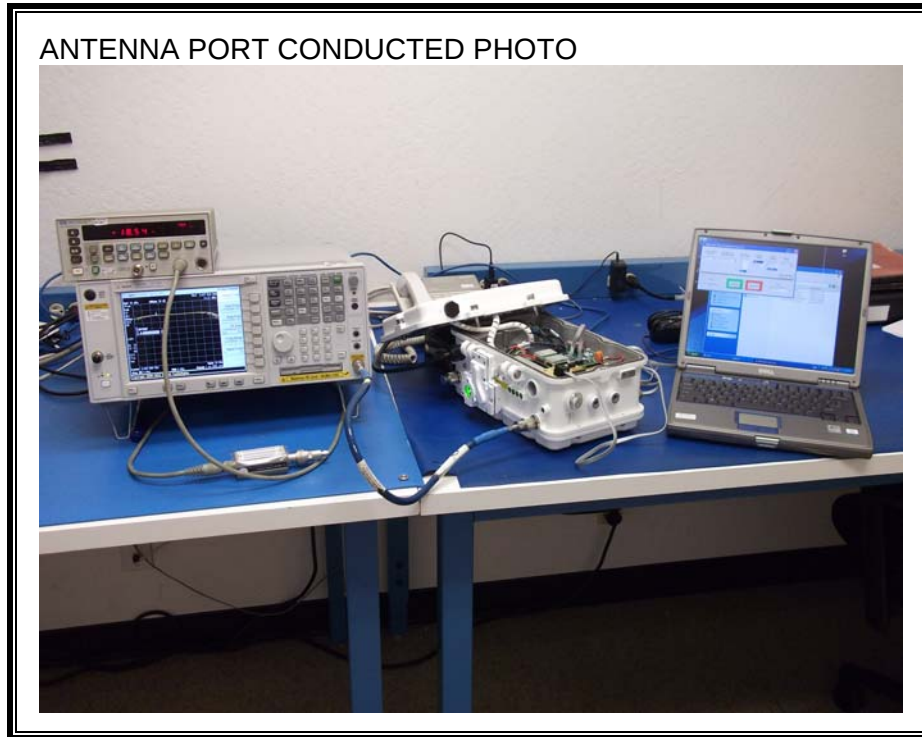
The AV output power for WLAN and the antenna gains for WLAN for both 2.4 GHz and 5.8 GHz bands are taken from the reports with the following numbers:

1552_Series_2400_2483.5_Test_Report.pdf

1552_Series_5725_5850_Test_Report.pdf

11. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

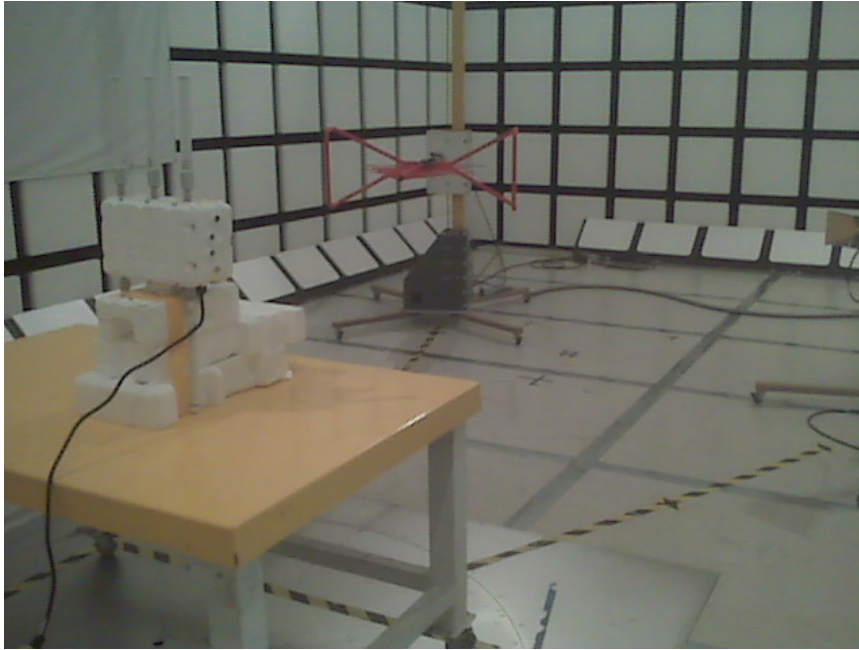


RADIATED RF MEASUREMENT SETUP

RADIATED FRONT PHOTO



RADIATED BACK PHOTO

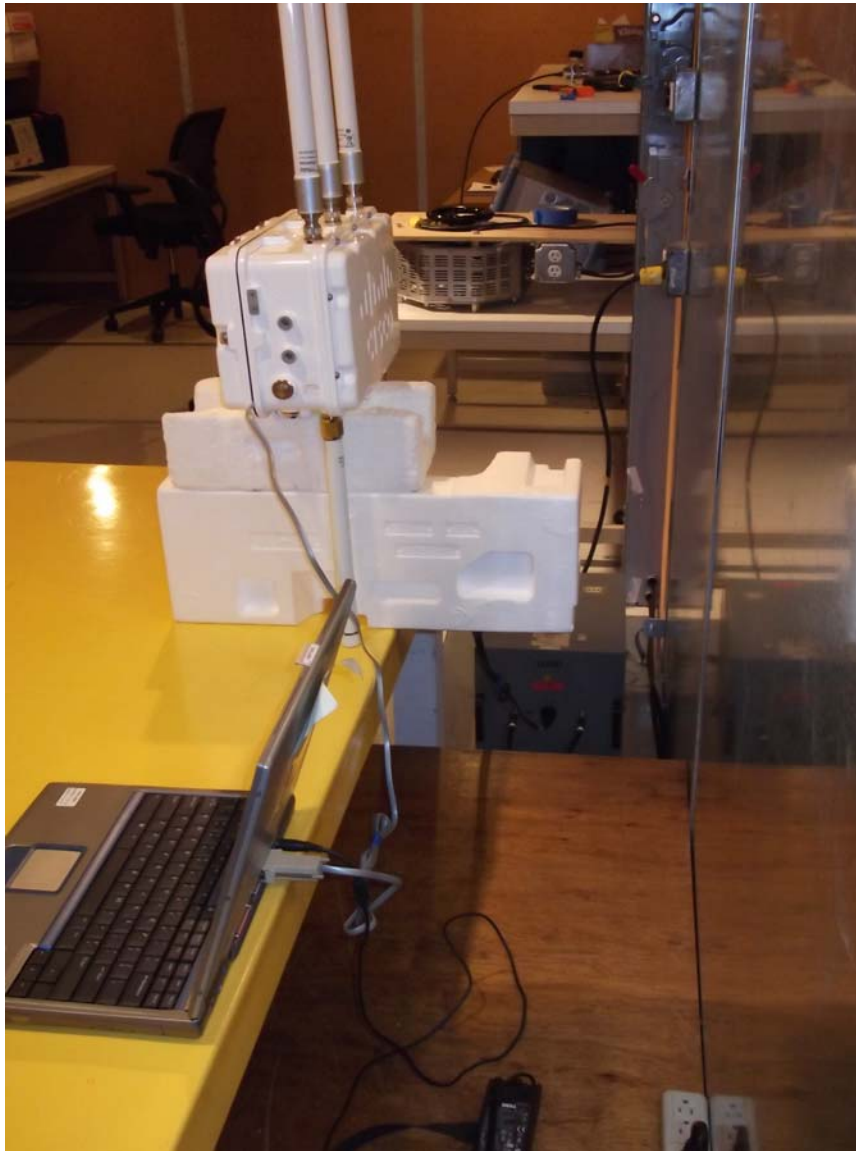


POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO



LINE CONDUCTED BACK PHOTO



END OF REPORT