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

CERTIFICATION TEST REPORT

FOR

AVIONICS CABIN WIRELESS ACCESS POINT

MODEL NUMBER: MCWAP- 0122

FCC ID: WPX-MCWAP
IC: 8014A- MCWAP

REPORT NUMBER: 10U13240-2

ISSUE DATE: JUNE 15, 2010

Prepared for
AIRCELL LLC
1250 N. ARLINGTON HEIGHTS RD., ITASCA
ILLINOIS, 60143, USA

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	06/15/10	Initial Issue	F. Ibrahim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: AIRCELL LLC
1250 N.ARLINGTON HEIGHTS Rd., ITASCA
ILLINOIS, 60143, USA

EUT DESCRIPTION: Avionics Cabin Wireless Access Point

MODEL: MCWAP-0122

SERIAL NUMBER: PROTO 0001

DATE TESTED: May 28 to June 08, 2010

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 9	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass

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

FRANK IBRAHIM
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

TOM CHEN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

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, FCC 06-96, 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:

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 Avionics Cabin Wireless Access Point, 802.11a/b/g transceiver MCWAP.

The radio module is manufactured by Aircell LLC.

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)
5180 - 5240	802.11a	8.62	7.28

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Monopole antenna, with a maximum gain of 2.7dBi in the 2.4 GHz band and 6.7dBi in the 5 GHz band.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was ART, rev. 4.6 #6 and PuTTY ver 0.06, Tftpd32 ver 3.35.0.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. Radiated emission 30-1000 MHz was performed with the EUT set to the worst-case channel.

The following worst-case data rates were used based on input from the client:

For 11A: 54Mbps

X and Y orientations were investigated and orientation Y was found to be worst-case.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Notebook PC	Dell	PP18L	7330873681.00	DoC
AC Adapter (PC)	Hi Pro Electronics	HA65NS1-00	CN-OHN662-47890-84R-C14R	DoC
Patch Antenna 1 (2400-5875 MHz)	Huber + Suhner	SWA 2459/360/4/45/V	716655	N/A
Patch Antenna 2 (2400-5935 MHz)	Huber + Suhner	SWA 2459/360/7/20/V_1	717255	N/A

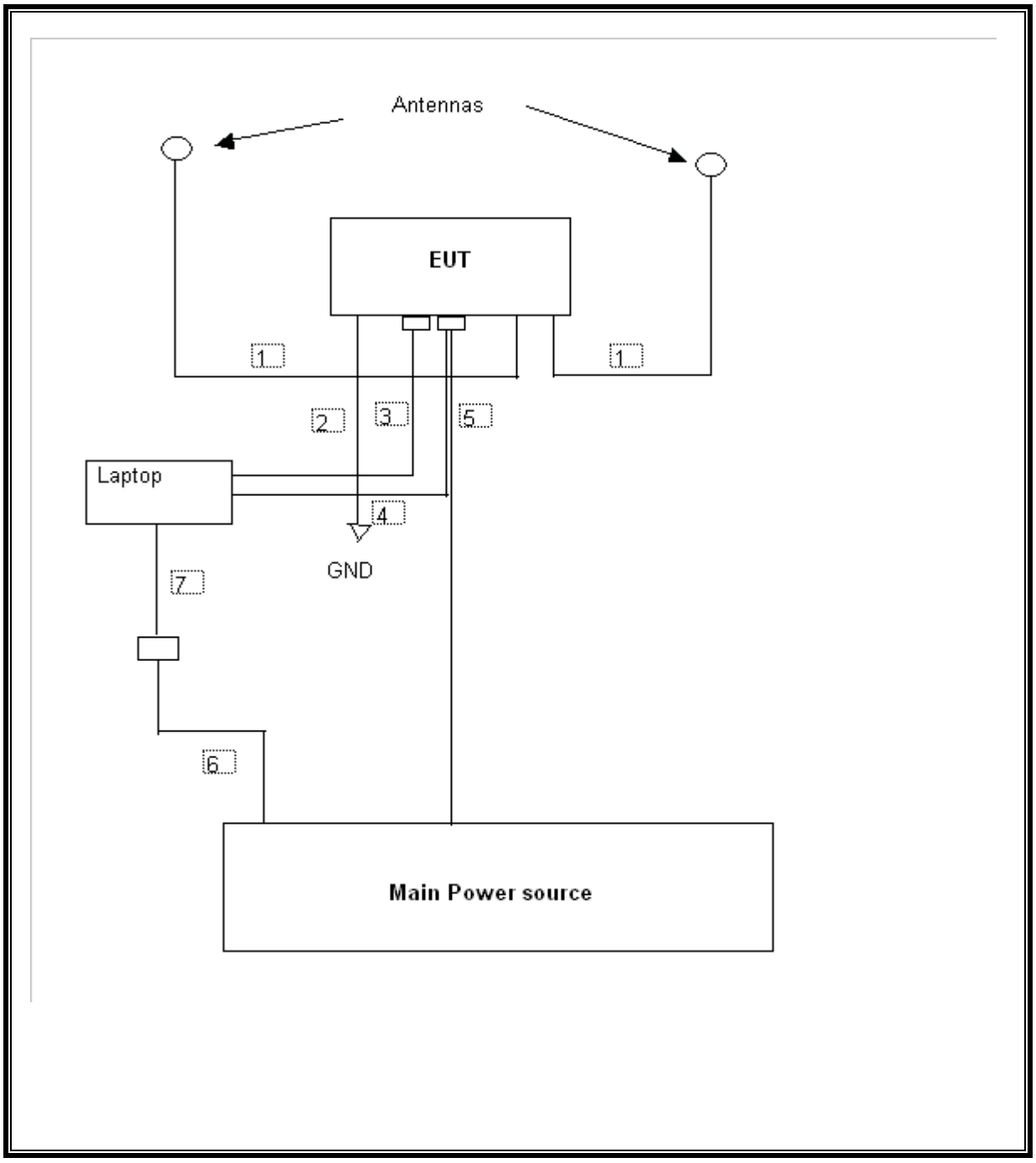
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	Antenna	2	TNC	Shielded	1meter	N/A
2	GND	1	Screw	Braid	2 meters	N/A
3	LAN	1	RJ45	Unshielded	2 meters	N/A
4	Serial	1	DB9	Unshielded	2meters	N/A
5	AC	1	US115V	Unshielded	2 meters	N/A
6	AC	1	US115V	Unshielded	2 meters	N/A
7	DC	1	DC	Unshielded	1.5 meter	N/A

TEST SETUP

The EUT is an Avionics Cabin Wireless Access Point.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**Asset**	**Cal Date**	**Cal Due**
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	01/14/09	07/14/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/06/10	07/06/10
Horn Antenna 18GHz	EMCO	3115	C00783	01/29/09	07/29/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	02/04/09	08/04/10
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	02/05/10	05/05/11
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	01/07/10	12/04/11
Peak Power Meter	Agilent / HP	E4416A	C00963	12/04/09	12/04/11
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/06/09	05/06/11
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/06/09	11/06/10
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	11/05/09	11/05/10

7. ANTENNA PORT TEST RESULTS

7.1. 802.11a MODE IN THE 5.2 GHz BAND

7.1.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

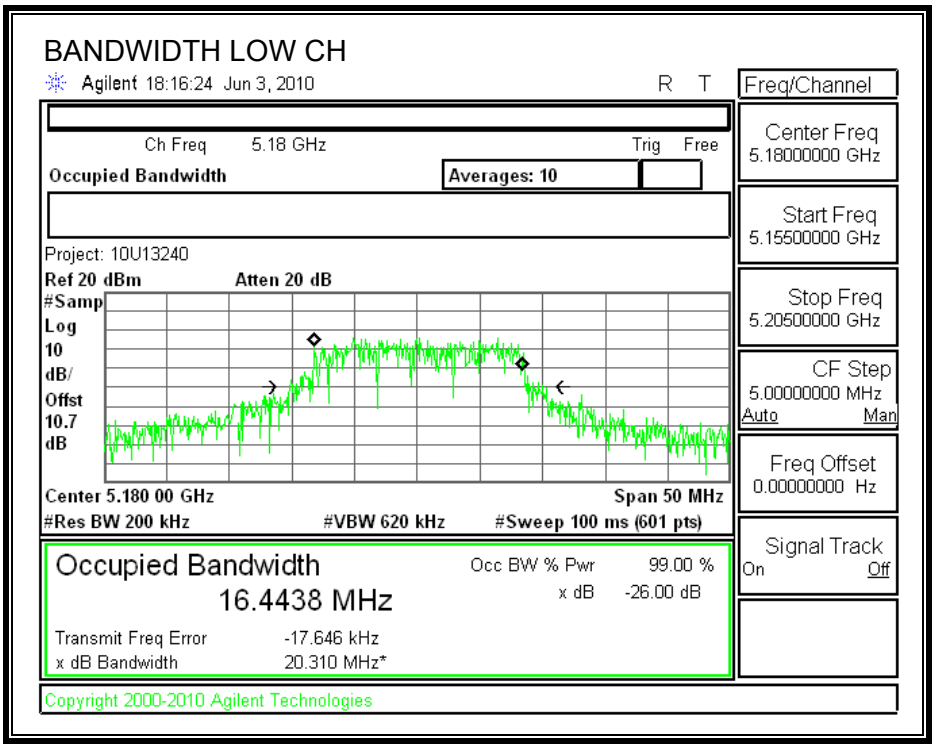
TEST PROCEDURE

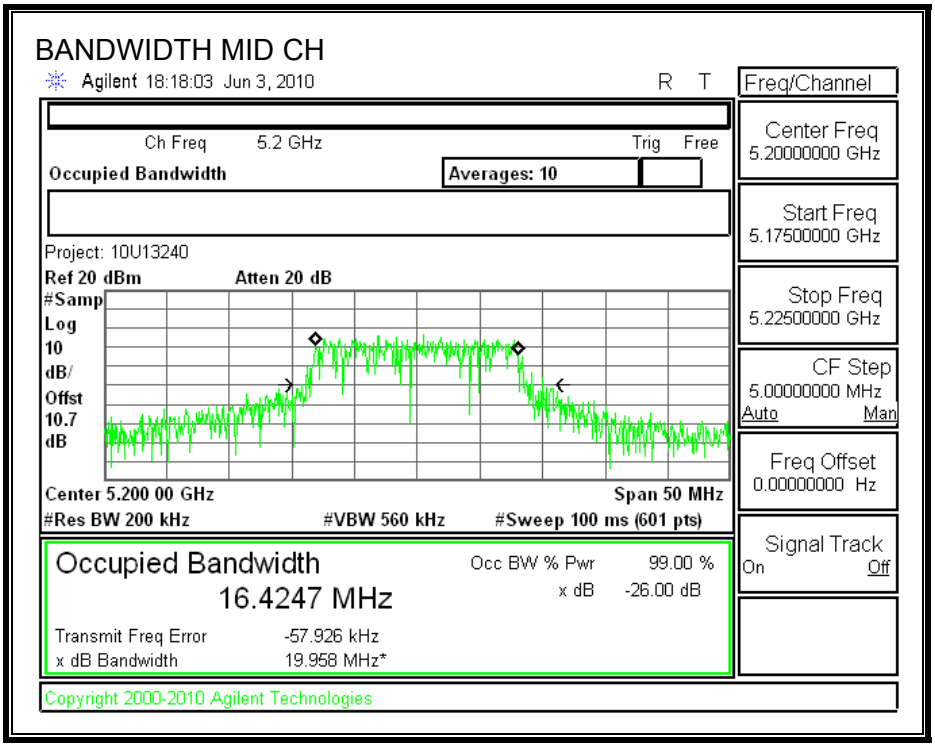
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

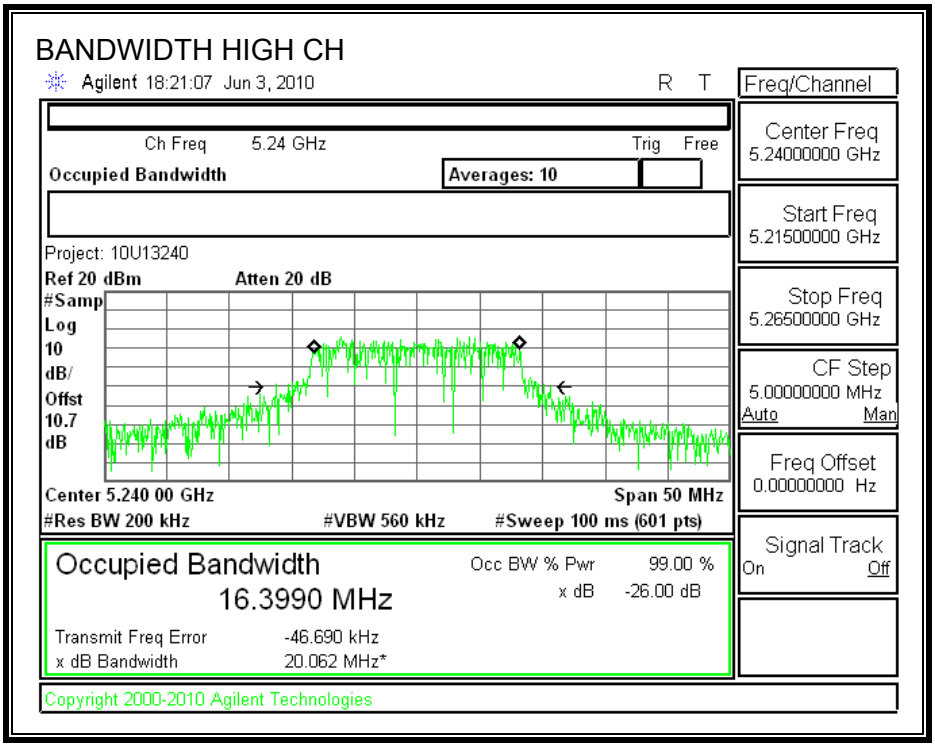
RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	20.310	16.4438
Middle	5200	19.958	16.4247
High	5240	20.062	16.3990

26 dB and 99% BANDWIDTH







7.1.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

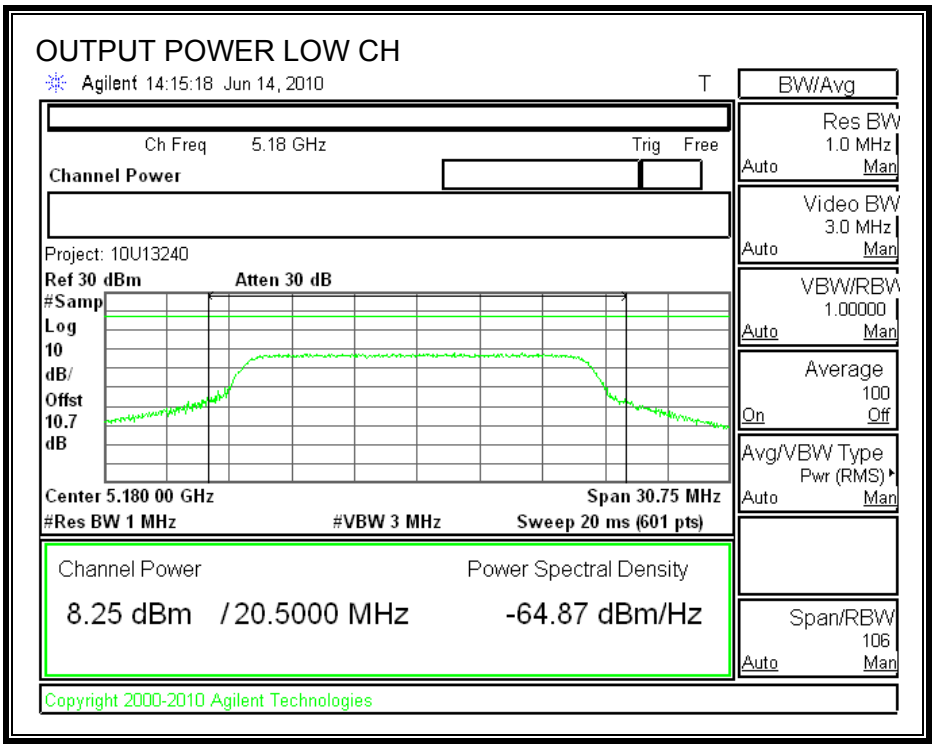
Limit

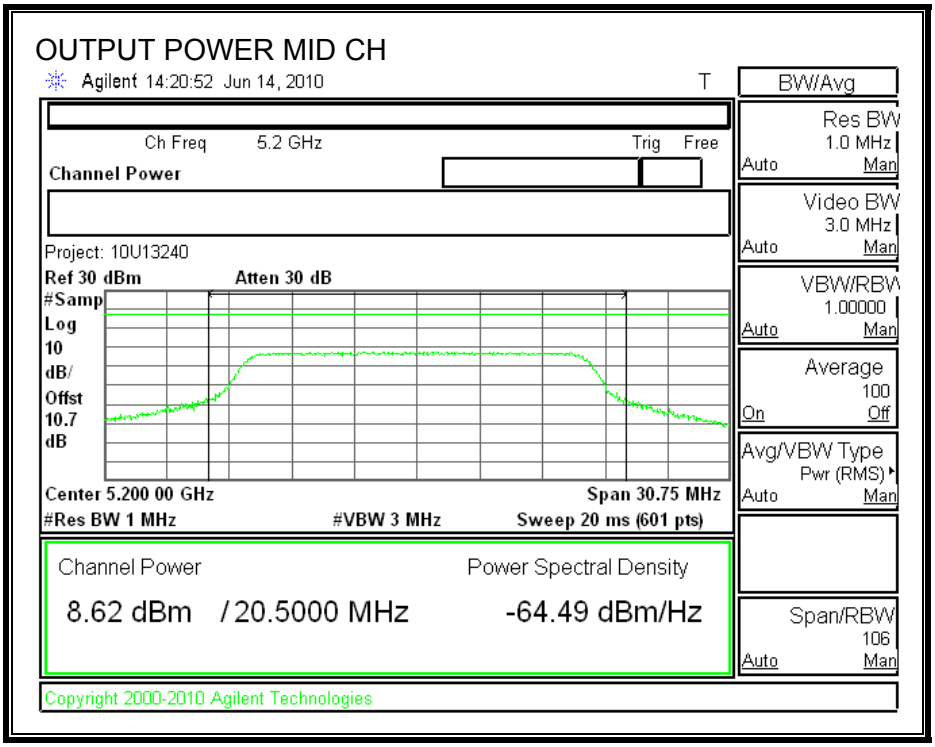
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	17	20.31	17.08	3.70	17.00
Mid	5200	17	19.958	17.00	3.70	17.00
High	5240	17	20.062	17.02	3.70	17.00

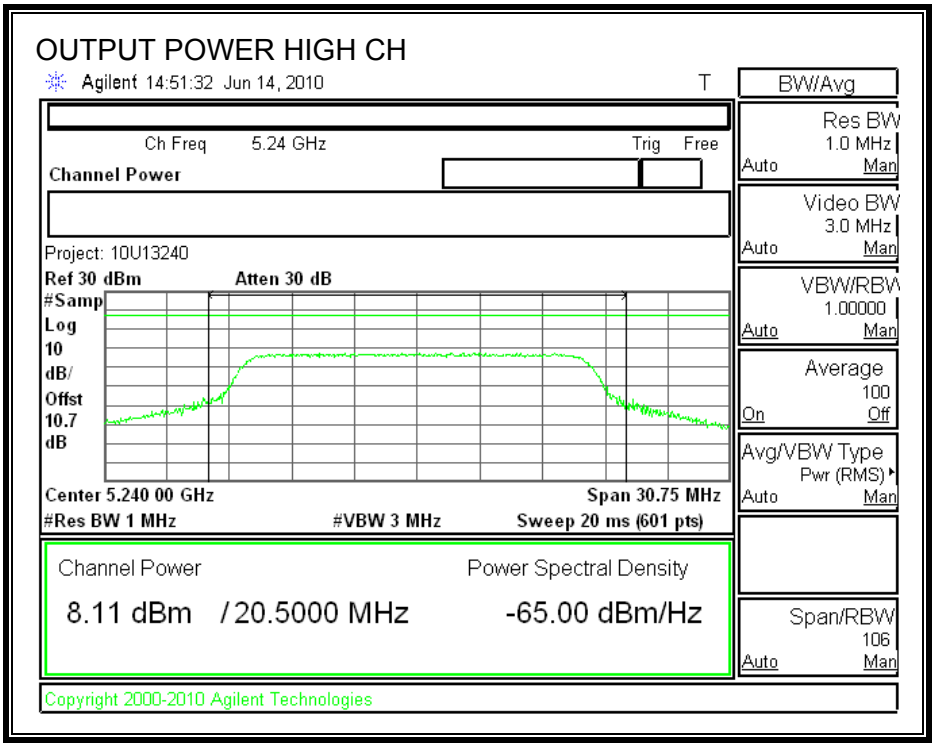
Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	8.25	17.00	-8.75
Mid	5200	8.62	17.00	-8.38
High	5240	8.11	17.00	-8.89

OUTPUT POWER







7.1.3. 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 10.78 dB (including 10 dB pad and 0.78 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	5180	8.52
Middle	5200	8.58
High	5240	8.63

7.1.4. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 4 dBm.

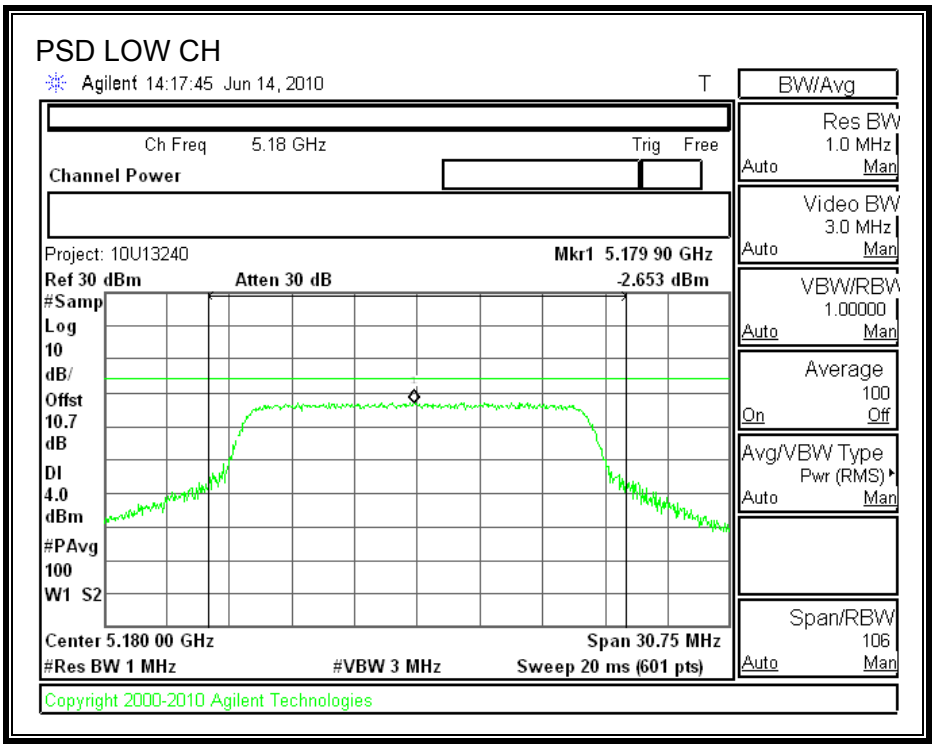
TEST PROCEDURE

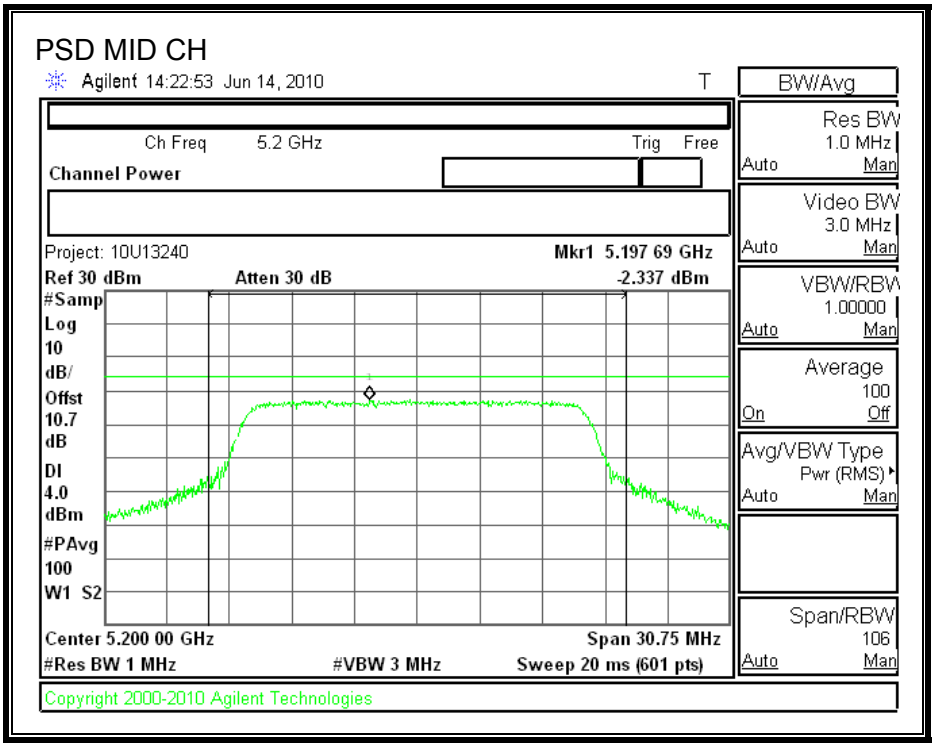
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

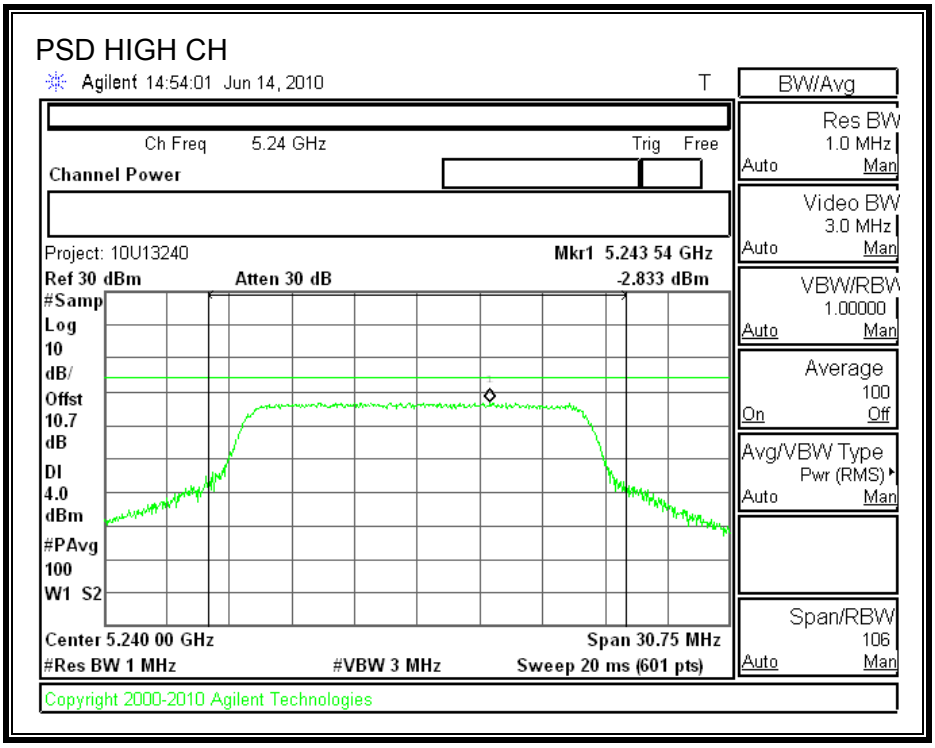
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	-2.653	4	-6.653
Middle	5200	-2.337	4	-6.337
High	5240	-2.833	4	-6.833

POWER SPECTRAL DENSITY







7.1.5. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

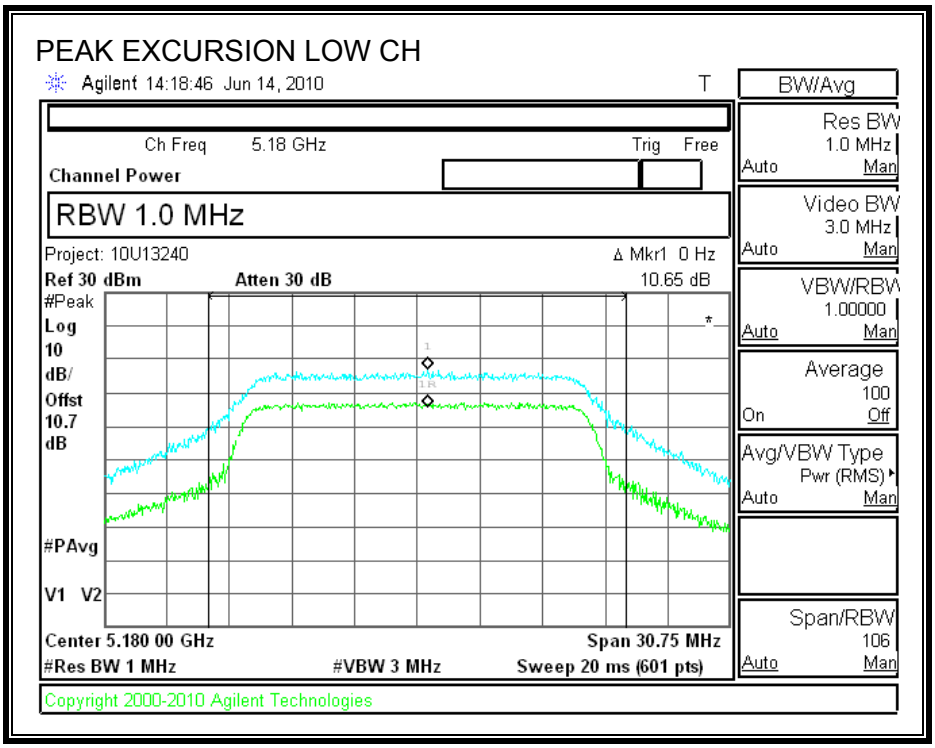
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

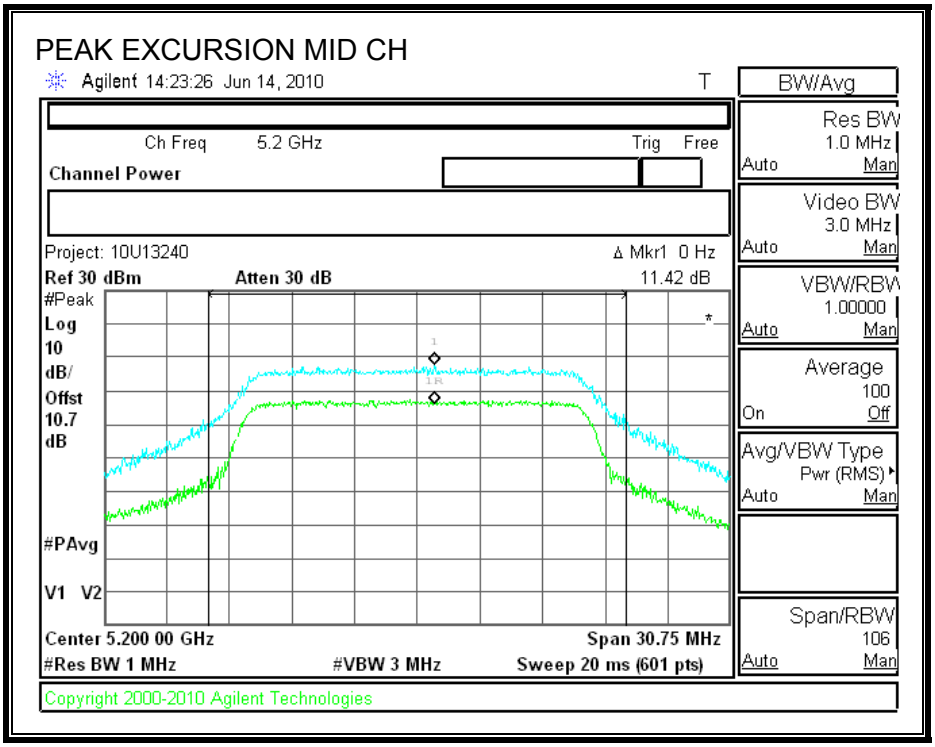
RESULTS

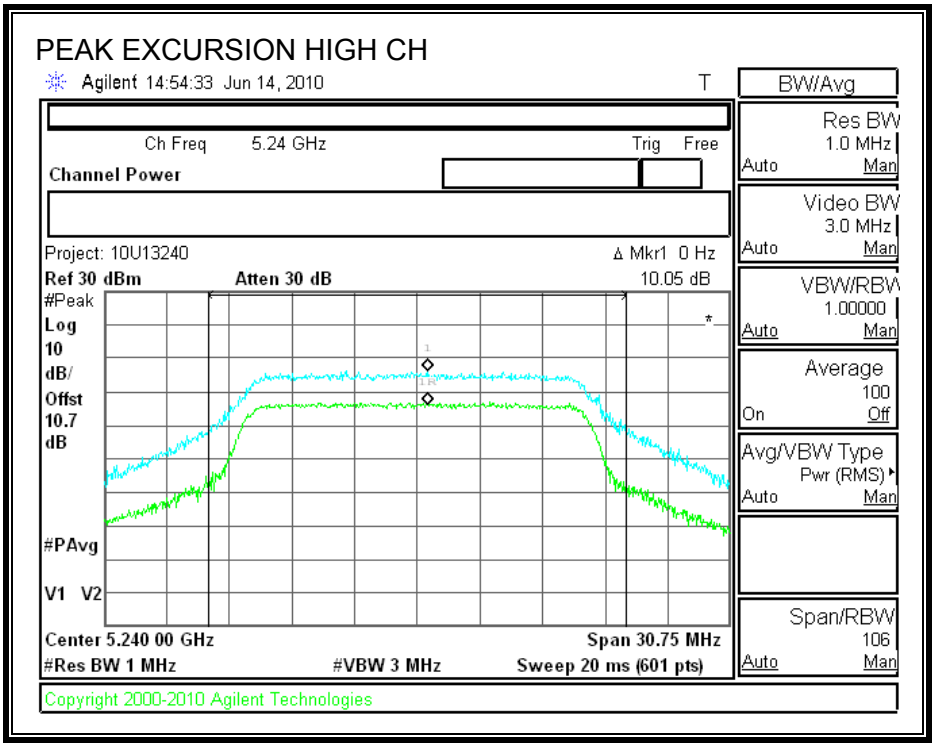
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	10.65	13	-2.35
Middle	5200	11.42	13	-1.58
High	5240	10.05	13	-2.95

PEAK EXCURSION



PEAK EXCURSION MID CH





7.1.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

TEST PROCEDURE

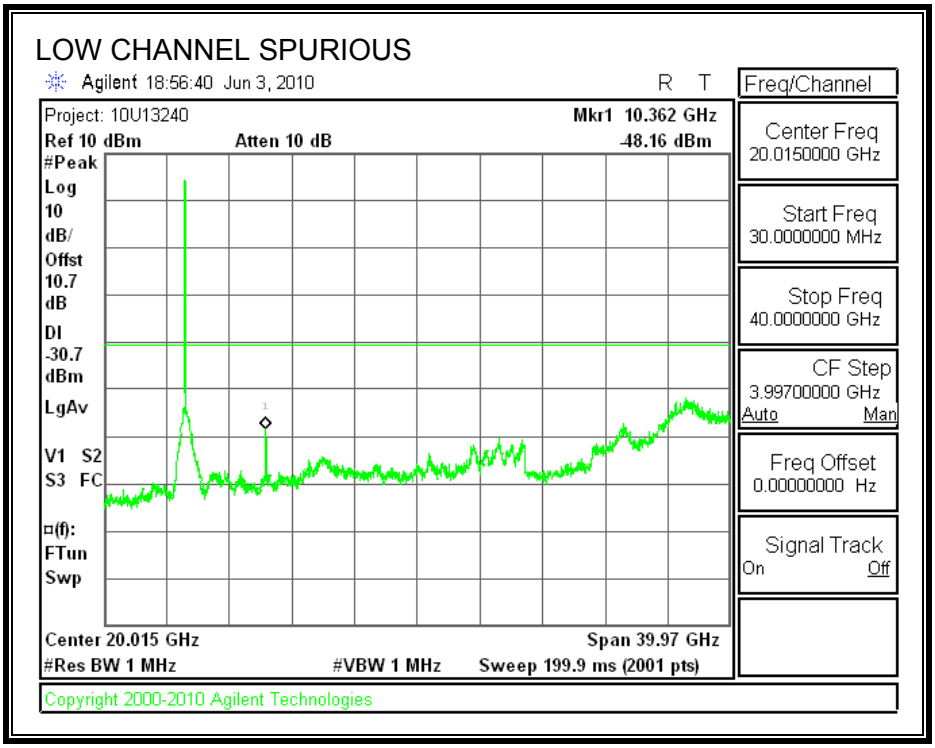
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

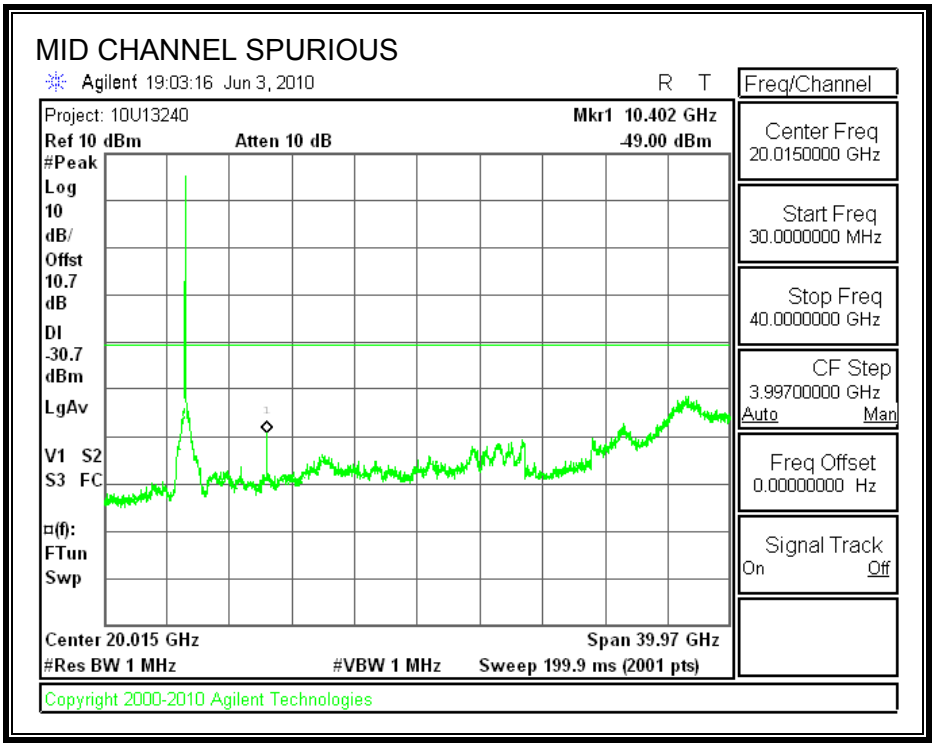
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

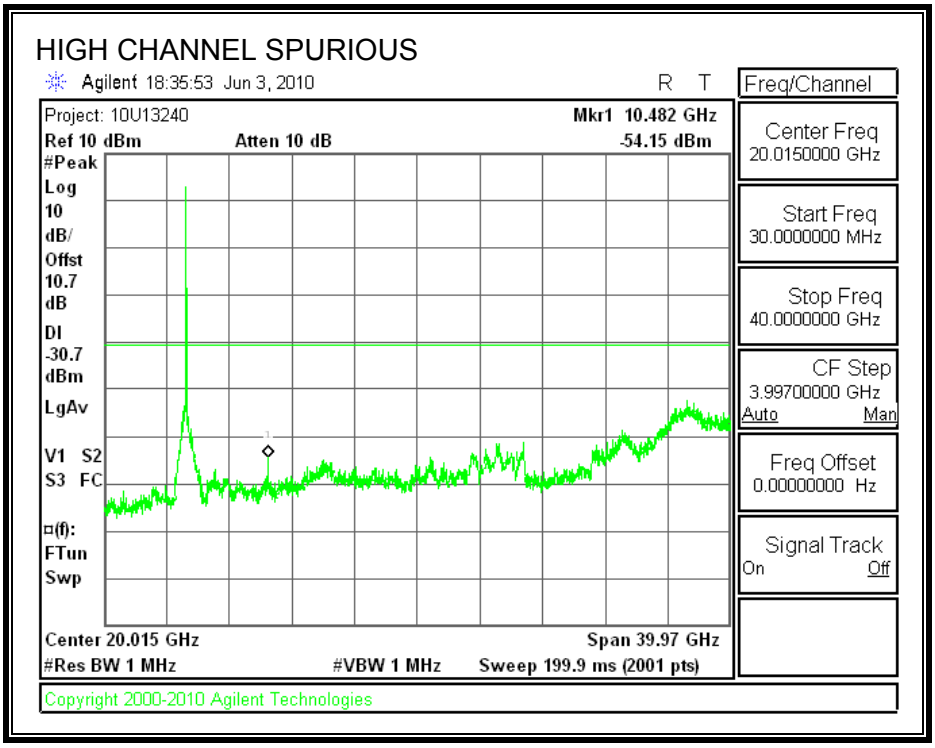
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

RESULTS

SPURIOUS EMISSIONS







7.1.7. RECEIVER CONDUCTED SPURIOUS EMISSIONS

LIMITS

IC RSS-GEN 7.2.3.1

Antenna Conducted Measurement: Receiver spurious emissions at any discrete frequency shall not exceed 2 nanowatts (-57 dBm) in the band 30-1000 MHz, or 5 nanowatts (-53 dBm) above 1 GHz.

TEST PROCEDURE

IC RSS-GEN 4.10, Conducted Method

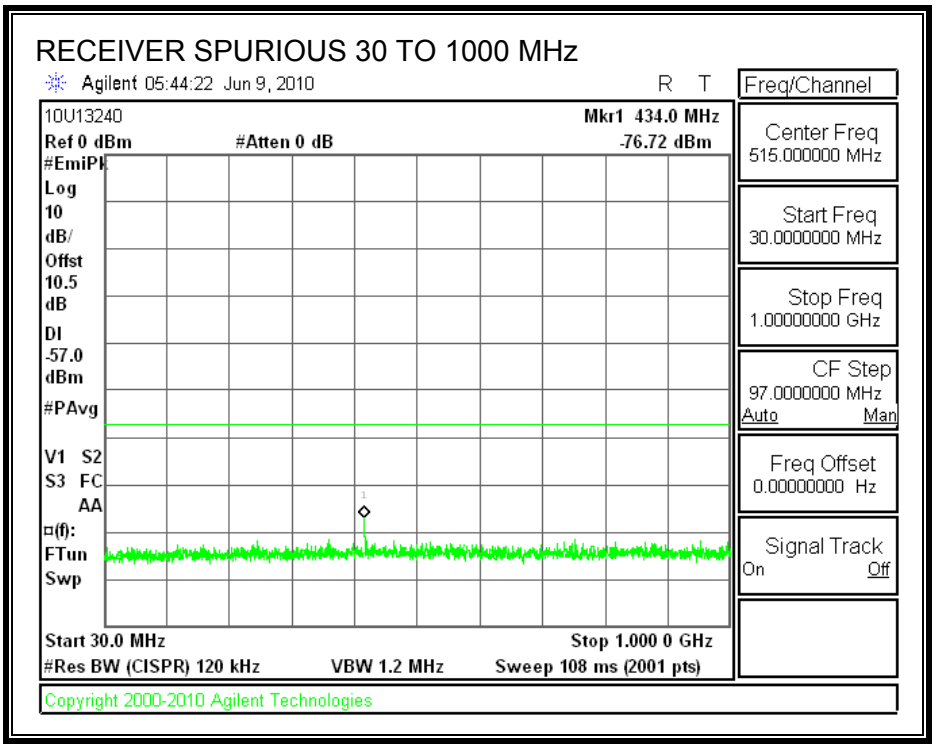
The receiver antenna port is connected to a spectrum analyzer.

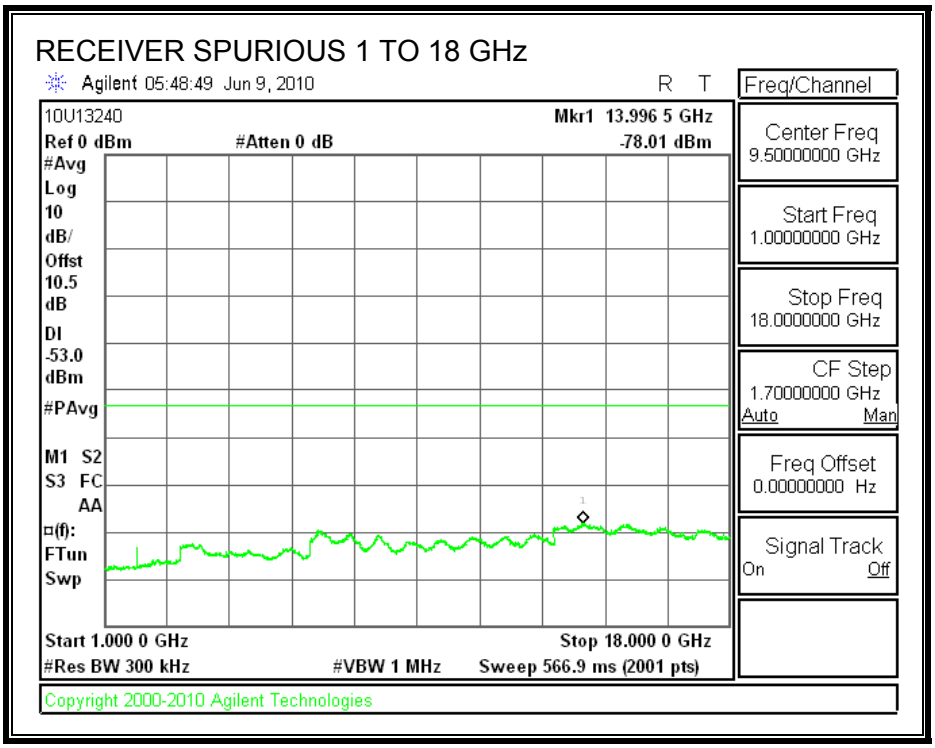
The spectrum from 30 MHz to 8 GHz is investigated with the receiver set to the middle channel of the 2.4 GHz band.

The spectrum from 30 MHz to 18 GHz is investigated with the receiver set to the middle channel of each 5 GHz band.

Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

RECEIVER SPURIOUS EMISSIONS IN THE 5.2 GHz BAND





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.

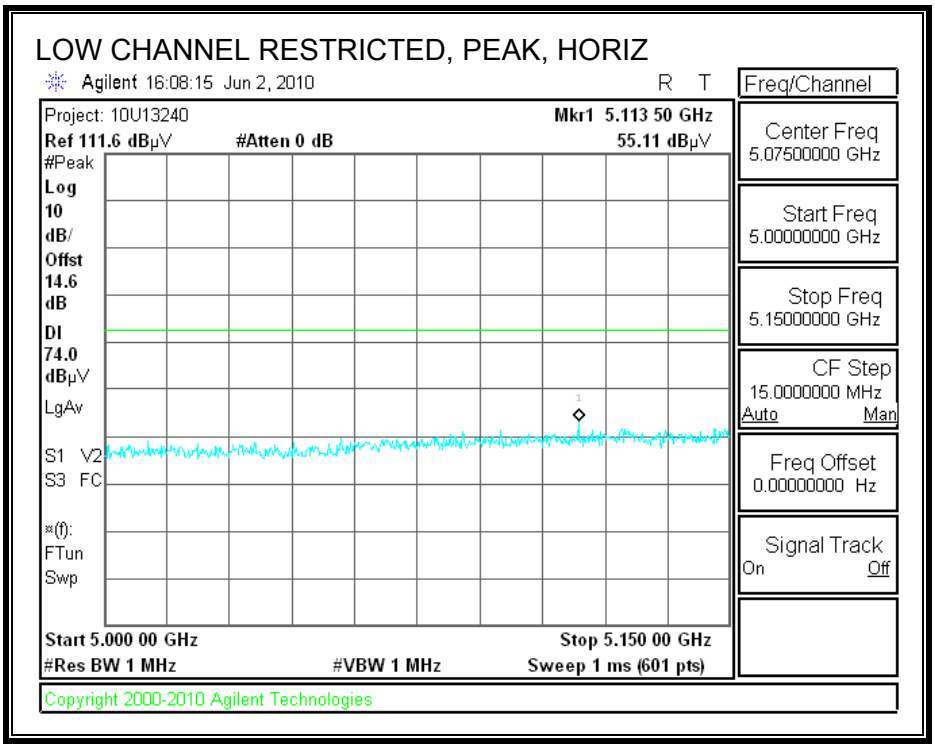
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

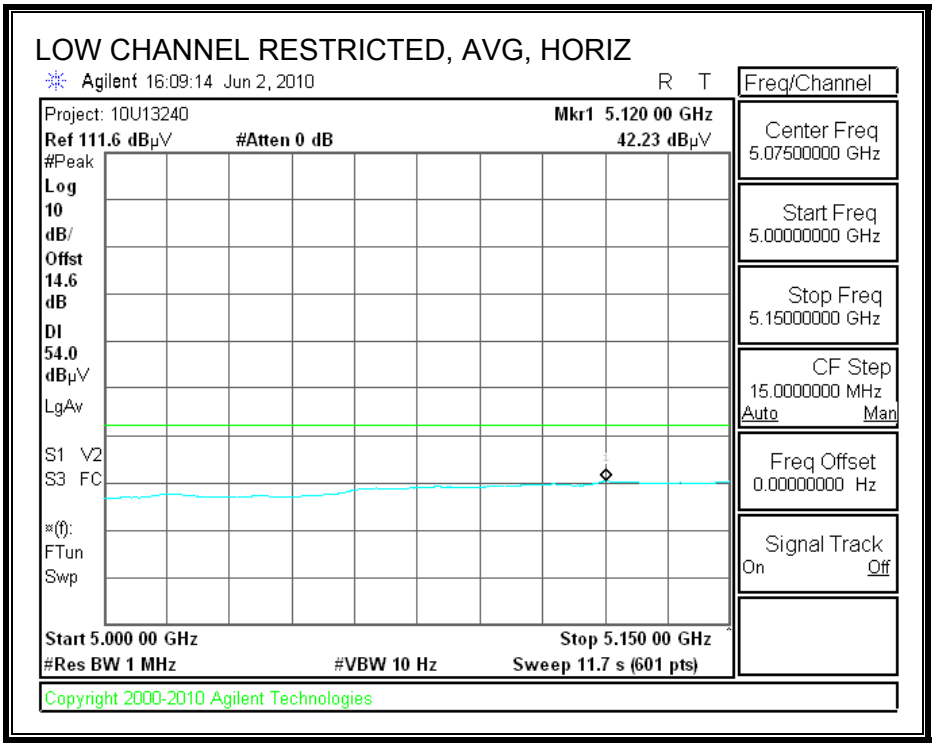
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

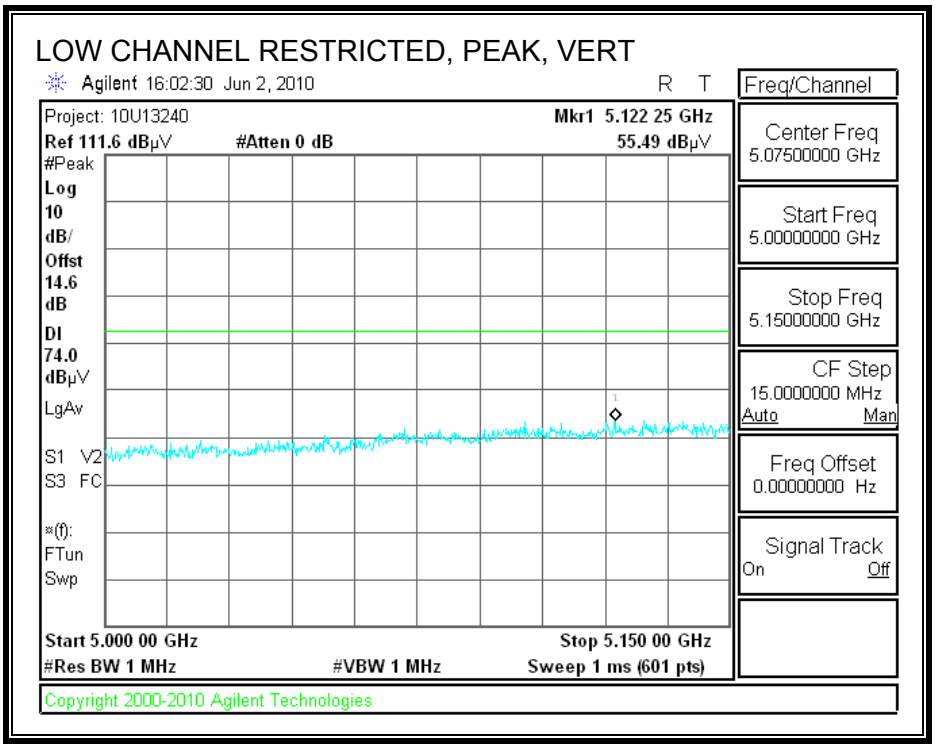
8.2. TX ABOVE 1 GHz FOR 802.11a MODE IN THE LOWER 5.2 GHz BAND

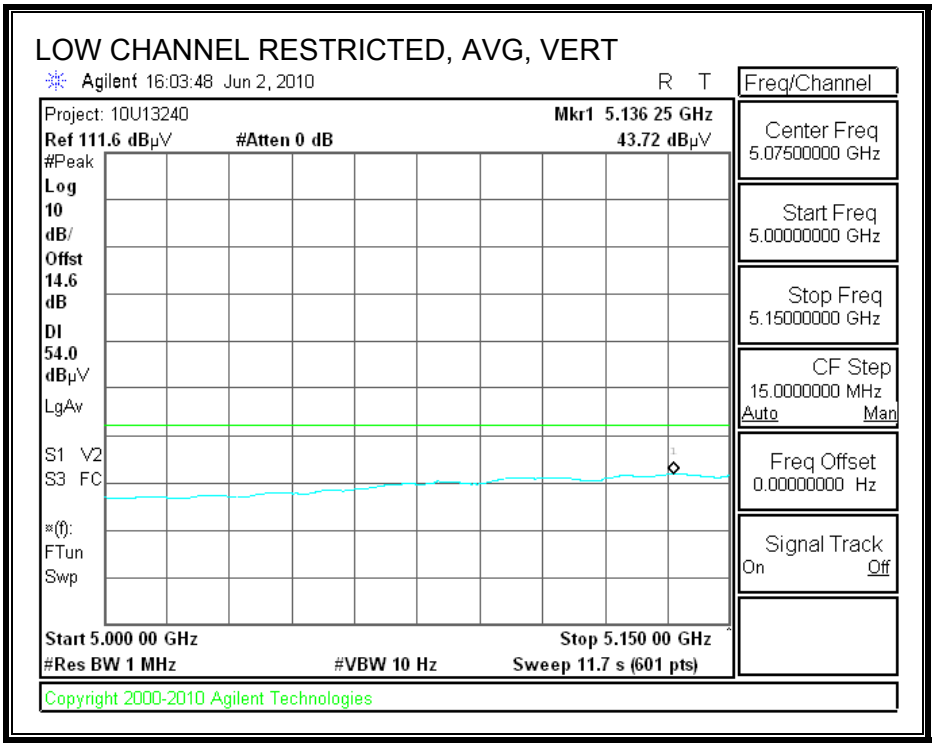
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



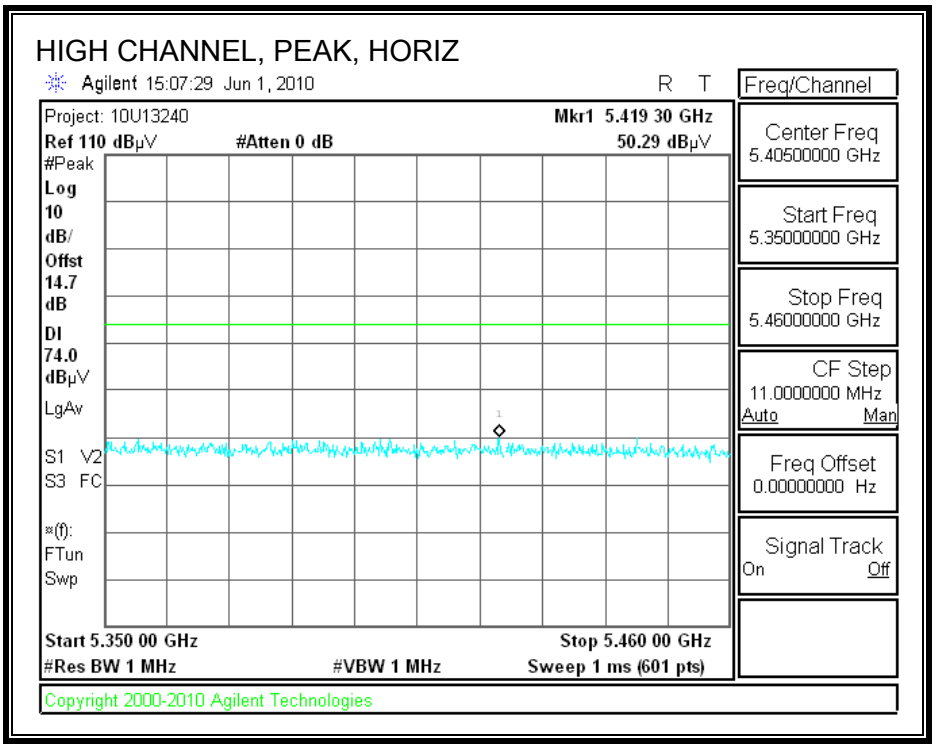


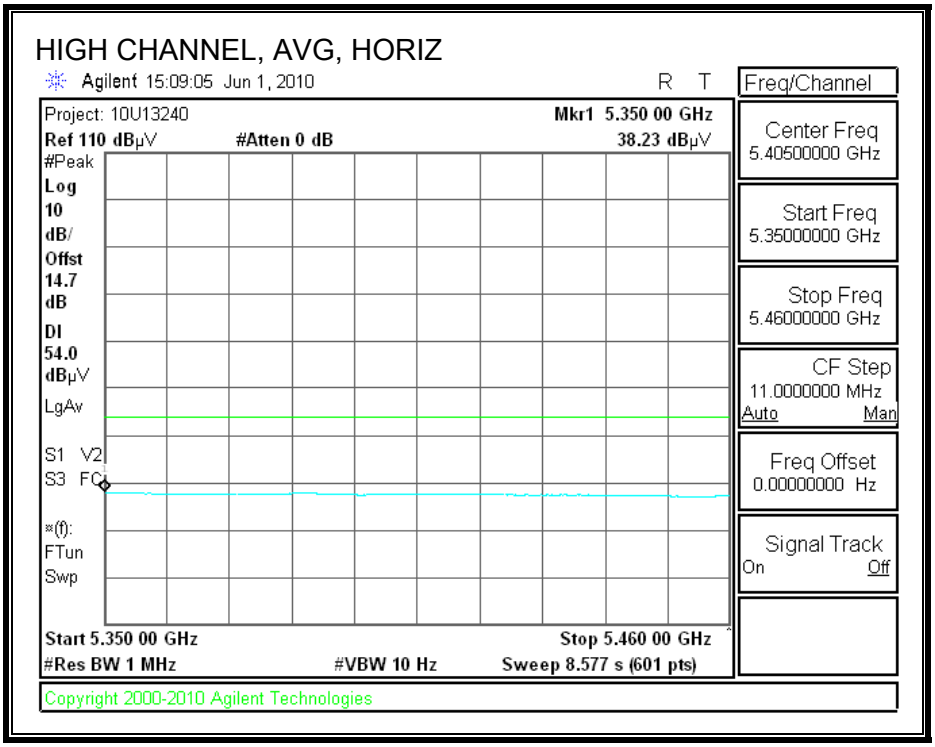
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



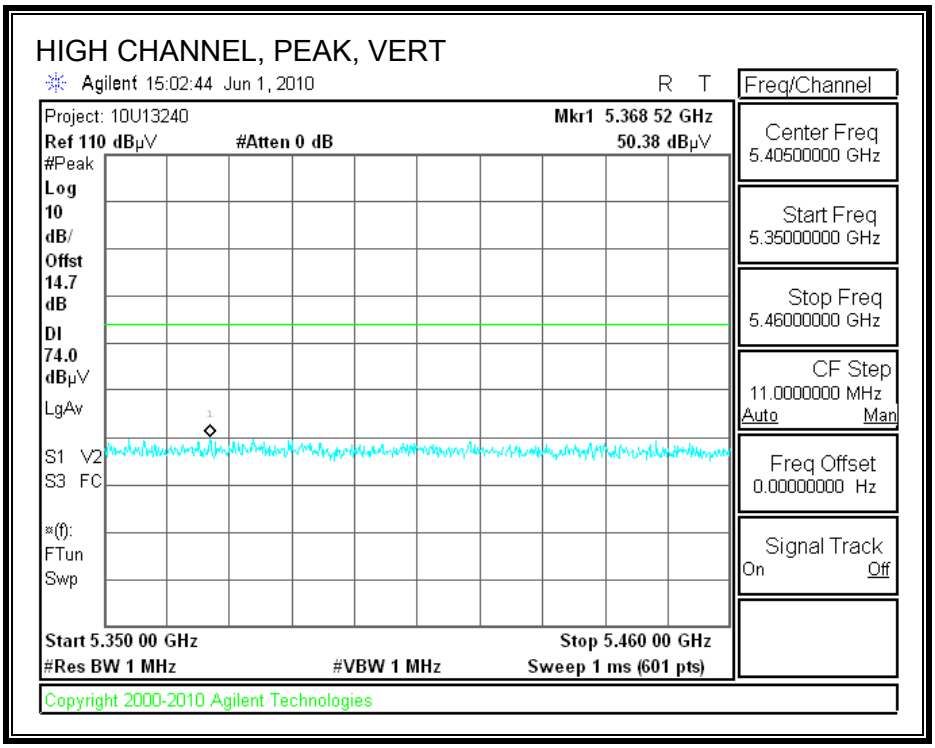


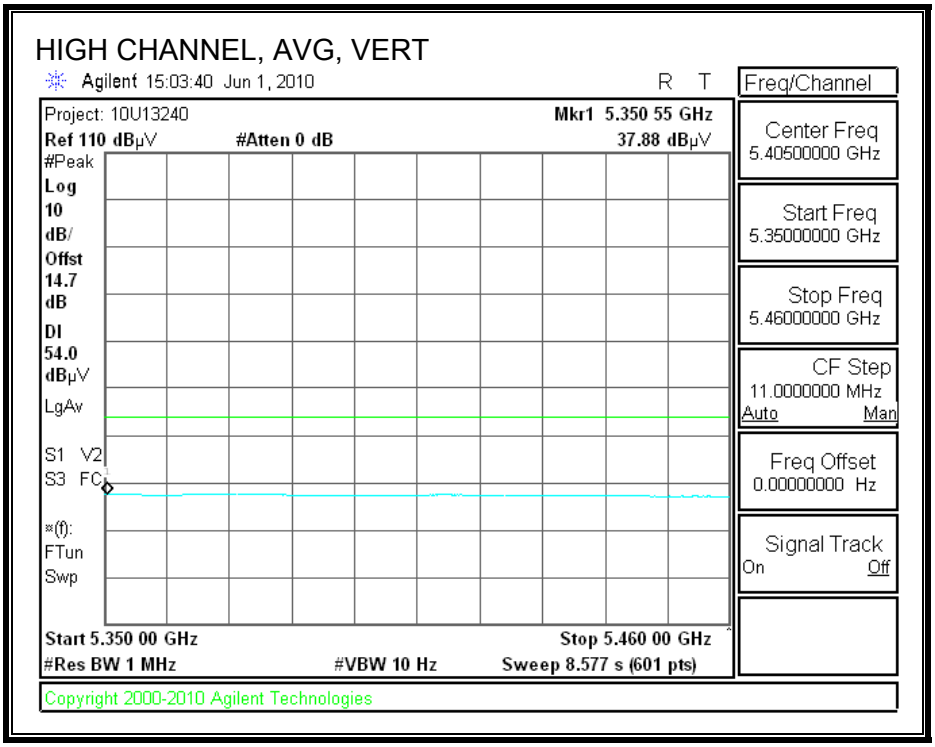
AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 06/01/10
Project #: 10U13240
Company: Aircell
EUT Description: Cabin Wireless Acess Point
EUT M/N: EUT with support laptop PC
Test Target: FCC Class B
Mode Oper: Continuously TX

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	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low CH 5180MHz													
10.360	3.0	38.5	37.6	8.9	-32.6	0.0	0.8	53.1	74.0	-20.9	H	P	
10.360	3.0	26.2	37.6	8.9	-32.6	0.0	0.8	40.9	54.0	-13.1	H	A	
15.540	3.0	33.7	38.5	11.3	-32.2	0.0	0.7	52.1	74.0	-21.9	H	P	
15.540	3.0	20.8	38.5	11.3	-32.2	0.0	0.7	39.2	54.0	-14.8	H	A	
10.360	3.0	37.7	37.6	8.9	-32.6	0.0	0.8	52.3	74.0	-21.7	V	P	
10.360	3.0	25.7	37.6	8.9	-32.6	0.0	0.8	40.3	54.0	-13.7	V	A	
15.540	3.0	33.6	38.5	11.3	-32.2	0.0	0.7	52.0	74.0	-22.0	V	P	
15.540	3.0	20.9	38.5	11.3	-32.2	0.0	0.7	39.2	54.0	-14.8	V	A	
Mid CH 5200MHz													
10.400	3.0	36.9	37.6	8.9	-32.6	0.0	0.8	51.5	74.0	-22.5	H	P	
10.400	3.0	25.1	37.6	8.9	-32.6	0.0	0.8	39.8	54.0	-14.2	H	A	
15.600	3.0	33.5	38.3	11.4	-32.2	0.0	0.7	51.7	74.0	-22.3	H	P	
15.600	3.0	20.8	38.3	11.4	-32.2	0.0	0.7	39.0	54.0	-15.0	H	A	
10.400	3.0	37.0	37.6	8.9	-32.6	0.0	0.8	51.7	74.0	-22.3	V	P	
10.400	3.0	24.9	37.6	8.9	-32.6	0.0	0.8	39.5	54.0	-14.5	V	A	
15.600	3.0	32.7	38.3	11.4	-32.2	0.0	0.7	51.0	74.0	-23.0	V	P	
15.600	3.0	20.8	38.3	11.4	-32.2	0.0	0.7	39.1	54.0	-14.9	V	A	
High CH 5240MHz													
10.480	3.0	34.7	37.6	9.0	-32.6	0.0	0.8	49.5	74.0	-24.5	H	P	
10.480	3.0	22.5	37.6	9.0	-32.6	0.0	0.8	37.2	54.0	-16.8	H	A	
15.720	3.0	32.6	38.0	11.4	-32.2	0.0	0.7	50.6	74.0	-23.4	H	P	
15.720	3.0	20.8	38.0	11.4	-32.2	0.0	0.7	38.8	54.0	-15.2	H	A	
10.480	3.0	34.0	37.6	9.0	-32.6	0.0	0.8	48.8	74.0	-25.2	V	P	
10.480	3.0	22.0	37.6	9.0	-32.6	0.0	0.8	36.7	54.0	-17.3	V	A	
15.720	3.0	33.1	38.0	11.4	-32.2	0.0	0.7	51.0	74.0	-23.0	V	P	
15.720	3.0	20.6	38.0	11.4	-32.2	0.0	0.7	38.6	54.0	-15.4	V	A	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.3. RX ABOVE 1 GHz FOR 20 MHz BANDWIDTH IN THE 5.2 GHz BAND

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Aircell LLC.,
Project #: 10U13240
Date: 6/4/2010
Test Engineer: Tom Chen
Configuration: EUT with Support Lap top PC
Mode: RX mode

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A005(			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)
1.054	3.0	44.7	31.3	24.1	2.4	-36.1	0.0	0.0	35.2	21.7	74	54	-38.8	-32.3	H
1.154	3.0	44.9	31.4	24.5	2.5	-36.0	0.0	0.0	35.9	22.4	74	54	-38.1	-31.6	H
1.784	3.0	43.7	30.3	26.8	3.2	-35.6	0.0	0.0	38.2	24.8	74	54	-35.8	-29.2	H
2.652	3.0	41.5	28.0	29.0	4.1	-35.1	0.0	0.0	39.4	25.9	74	54	-34.6	-28.1	H
3.364	3.0	43.2	29.7	30.8	4.6	-35.0	0.0	0.0	43.6	30.1	74	54	-30.4	-23.9	H
4.575	3.0	39.8	26.3	32.6	5.6	-34.8	0.0	0.0	43.1	29.7	74	54	-30.9	-24.3	H
1.046	3.0	45.3	31.8	24.1	2.4	-36.1	0.0	0.0	35.7	22.2	74	54	-38.3	-31.8	V
1.224	3.0	44.2	30.7	24.8	2.6	-36.0	0.0	0.0	35.6	22.1	74	54	-38.4	-31.9	V
2.186	3.0	42.5	29.0	27.9	3.6	-35.3	0.0	0.0	38.7	25.3	74	54	-35.3	-28.7	V
3.175	3.0	42.6	29.1	30.4	4.5	-35.1	0.0	0.0	42.3	28.9	74	54	-31.7	-25.1	V
4.694	3.0	40.9	27.5	32.7	5.7	-34.8	0.0	0.0	44.5	31.0	74	54	-29.5	-23.0	V

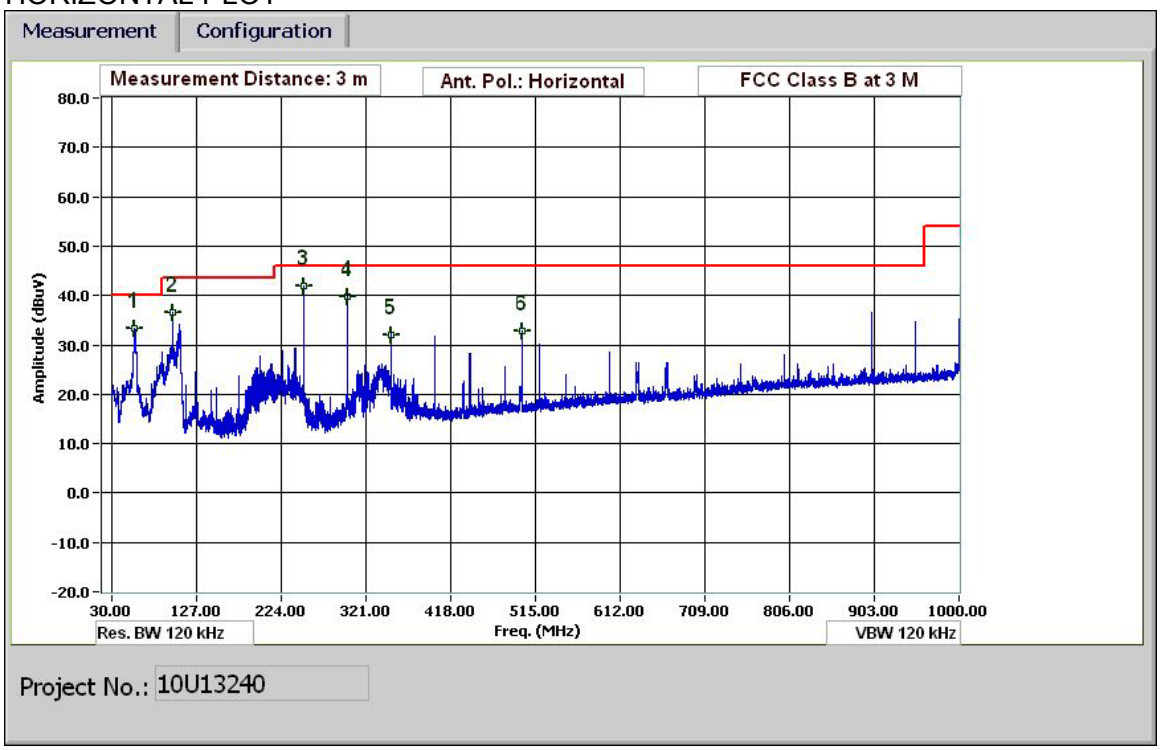
Rev. 07.22.09

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

8.4. WORST-CASE BELOW 1 GHz

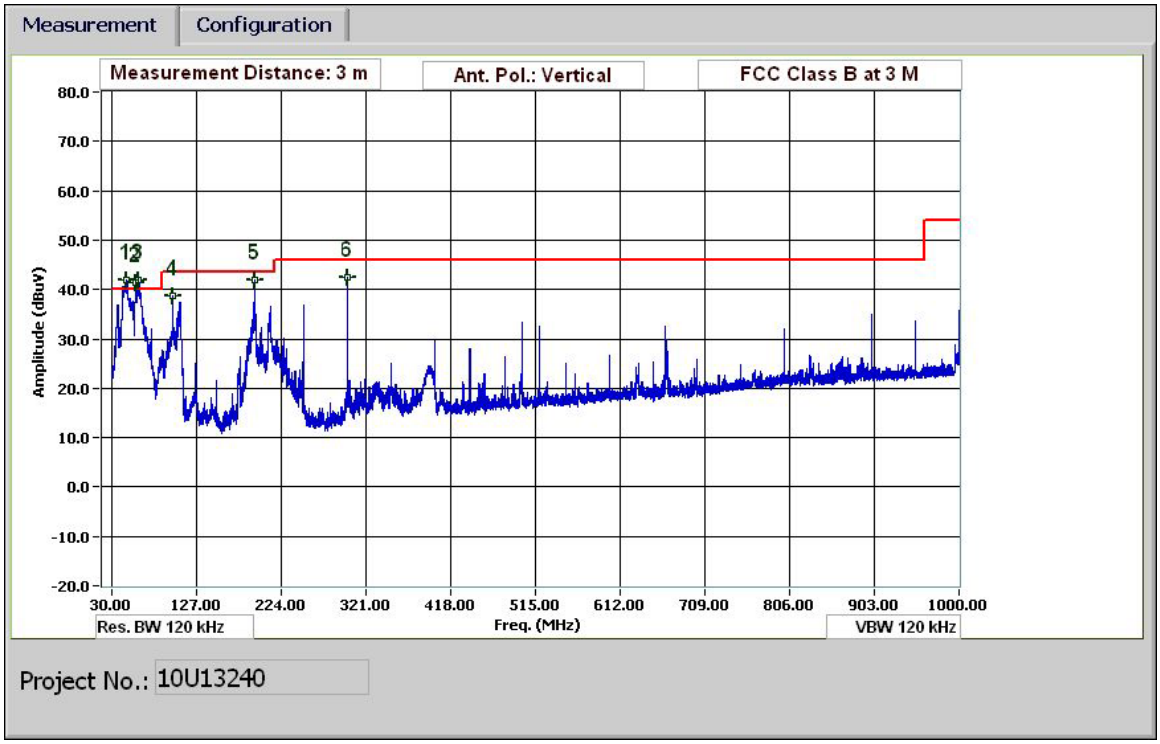
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



HORIZONTAL AND VERTICAL DATA

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

Test Engr: Tom Chen
Date: 06/04/10
Project #: 10U13240
Company: Aircell
Test Target: FCC-B
Mode Oper: TX ON

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
Horizontal													
56.041	3.0	54.5	7.9	0.6	29.6	0.0	0.0	33.4	40.0	-6.6	H	P	
99.963	3.0	55.3	10.1	0.9	29.5	0.0	0.0	36.7	43.5	-6.8	H	P	
249.969	3.0	57.6	11.8	1.4	28.8	0.0	0.0	42.0	46.0	-4.0	H	P	
300.011	3.0	53.6	13.3	1.6	28.8	0.0	0.0	39.7	46.0	-6.3	H	P	
349.933	3.0	45.2	14.2	1.8	29.0	0.0	0.0	32.1	46.0	-13.9	H	P	
499.939	3.0	43.5	16.8	2.1	29.7	0.0	0.0	32.7	46.0	-13.3	H	P	
Vertical													
99.963	3.0	57.3	10.1	0.9	29.5	0.0	0.0	38.7	43.5	-4.8	V	P	
193.087	3.0	58.1	11.4	1.2	29.0	0.0	0.0	41.9	43.5	-1.6	V	P	
300.011	3.0	56.3	13.3	1.6	28.8	0.0	0.0	42.4	46.0	-3.6	V	P	

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

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^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

(MPE distance equals 20 cm)

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m^2)	FCC Power Density (mW/cm^2)
5 GHz	WLAN	0.20	8.62	3.70	0.03	0.003