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

CERTIFICATION TEST REPORT

FOR

WIRELESS CONTROLLER

MODEL NUMBER: 1537

FCC ID: C3K1537
IC: 3048A-1537

REPORT NUMBER: 13U14963C

ISSUE DATE: 2013-07-19

Prepared for
MICROSOFT
1 MICROSOFT WAY
REDMOND
WA, 98052, USA

Prepared by
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NVLAP LAB CODE 100255-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	5/21/13	Initial Issue	M. Antola
A	6/21/13	Updated peak power section with re-measured results.	M. Antola
B	7/3/13	Maximum target output power reduced from 9dBm to 8dBm. Re-measured Peak and Average power and updated sections accordingly.	M. Antola
C	7/19/13	Added clarification to Radiated test section to address testing per 15.407	M. Antola

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: MICROSOFT
1 MICROSOFT WAY
REDMOND, WA, 98052, USA

EUT DESCRIPTION: WIRELESS CONTROLLER

MODEL: 1537

SERIAL NUMBER: NON-SERIALIZED PRODUCTION UNITS

DATE TESTED: 2013-04-08 to 2013-07-03

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 9	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

UL LLC 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 LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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:

Bob DeLisi
WiSE Principal Engineer
UL LLC

Tested By:

Mike Antola
WiSE Project Lead
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, ANSI C63.4-2003, 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 1285 Walt Whitman Road, Melville, New York, USA.

UL LLC is accredited by NVLAP, Laboratory Code 100255-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/1002550.htm.

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
Radiated Emissions, 1-26GHz (worst case, Ground Plane)	± 5.7dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11a/n transceiver, Model: 1537.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5240	802.11a	7.99	6.30
5180 - 5240	802.11n HT20	7.85	6.10

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integral antenna, with a maximum gain of 1 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT uses network adapter Atheros AR6006 USB ART_MDK.

The EUT driver software installed during testing was Atheros, ver. 1.0.1.1019.

The test utility software used during testing was Atheros Radio Test 2 (ART2-GUI), ver. 2.3.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Based on the baseline scan, the worst-case data rates were:

802.11a mode: 6 Mbps
802.11n HT20mode: MCS0

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List			
Description	**Manufacturer**	**Model**	**FCC ID**
Laptop	Dell	Latitude D830	DoC

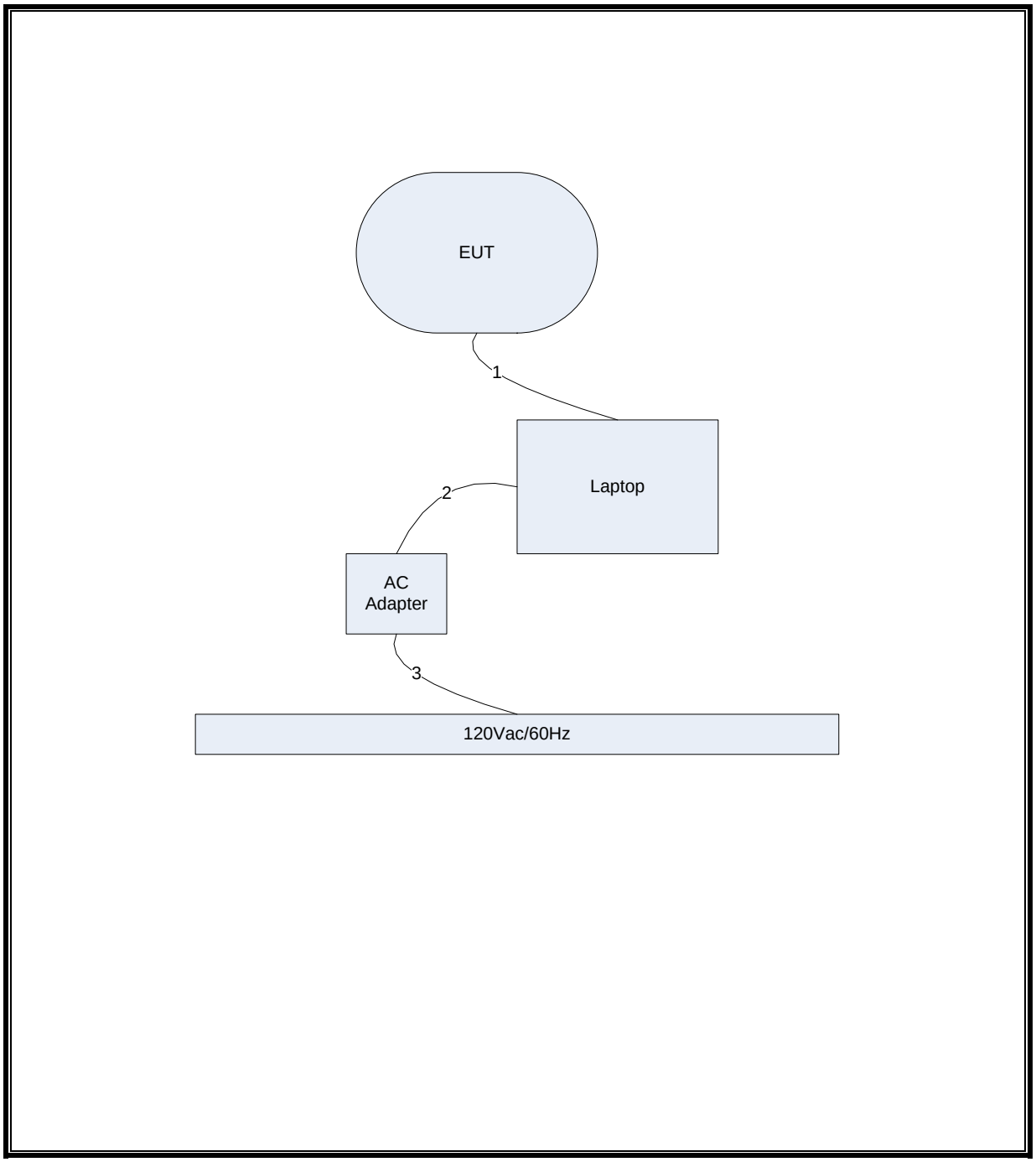
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	USB	Shielded	<3M	None
2	DC	1	Mains	Unshielded	<3M	None
3	AC	1	Mains	Unshielded	<3M	None

TEST SETUP

The EUT is a wireless controller used as a stand-alone device. Test software exercised the radio module.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Radiated Emissions					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
30-1000MHz					
EMI Receiver	Rohde & Schwarz	ESIB26	ME5B-081	2013-01-29	2014-01-31
Log-P Antenna	Schaffner	UPA6109	44068	2013-04-03	2014-04-03
Bicon Antenna	Schaffner	VBA6106A	54	2013-04-03	2014-04-03
Switch Driver	HP	11713A	ME7A-627	N/A	N/A
System Controller	Sunol Sciences	SC99V	44396	N/A	N/A
Camera Controller	Panasonic	WV-CU254	44395	N/A	N/A
RF Switch Box	UL	1	44398	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22
Multimeter	Fluke	83III	ME5B-305	2013-01-28	2014-01-31
Above 1GHz (Band Optimized System)					
EMI Receiver	Rohde & Schwarz	ESIB40	34968	2013-01-30	2014-01-31
Horn Antenna (1-2 GHz)	ETS	3161-01 (26°)**	51442	2008-03-28	See * below
Horn Antenna (2-4 GHz)	ETS	3161-02 (22°)**	48107	2007-09-27	See * below
Horn Antenna (4-8 GHz)	ETS	3161-03 (22°)**	48106	2007-09-27	See * below
Horn Antenna (8-12 GHz)	ETS	3160-07 (26°)**	8933	2008-11-24	See * below
Horn Antenna (12-18 GHz)	ETS	3160-08 (26°)**	8932	2007-09-27	See * below
Horn Antenna (18-26.5 GHz)	ETS	3160-09 (27°)**	8947	2007-09-26	See * below
Horn Antenna (26.5-40 GHz)	ETS	3160-10 (27°)**	73004	2007-09-26	See * below
Signal Path Controller	HP	11713A	50250	N/A	N/A
Gain Controller	HP	11713A	50251	N/A	N/A
RF Switch / Preamp Fixture	UL	BOMS1	50249	N/A	N/A
System Controller	UL	BOMS2	50252	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22
Multimeter	Fluke	83III	ME5B-305	2013-01-28	2014-01-31

Radiated Emissions					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
* - Note: As allowed by the calibration standard ANSI C63.4 Section 4.4.2, standard gain horns need only a one-time calibration. Only if physical damage occurs will the horn antenna require re-calibration. Gain standard horn antennas (sometimes called standard gain horn antennas) need not be calibrated beyond that which is provided by the manufacturer unless they are damaged or deterioration is suspected, or they are used at a distance closer than $2D^2/\lambda$. Gain standard horn antennas have gains that are fixed by their dimensions and dimensional tolerances. ** - Number in parentheses denotes antenna beam width.					

Conducted Emissions					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Conducted Emissions – GP 1					
EMI Receiver	Rohde & Schwarz	ESCI 7	75141	2013-01-30	2014-01-31
LISN	Solar	9252-50-R-24-BNC	ME5A-636	2013-01-31	2014-01-31
Switch Driver	HP	11713A	44397	N/A	N/A
RF Switch Box	UL	4	44404	N/A	N/A
Measurement Software	UL	Version 9.5	44736	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	43734	2012-03-13	2014-03-13
Multimeter	Fluke	87V	79648	2013-01-29	2014-01-31

Bench Tests					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
RF Room 2					
Spectrum Analyzer	Agilent	E4446A	72822	2013-01-29	2014-01-31
Power Sensor	Rohde & Schwarz	NRP-Z81	75345	2013-01-30	2014-01-31
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 D01 V01r03 Zero-Span Spectrum Analyzer Method.

7.1.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11a 20 MHz	2.03	2	0.953	95.3%	0.21	0.494
802.11n HT20	1.89	2	0.947	94.7%	0.23	0.529

7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD

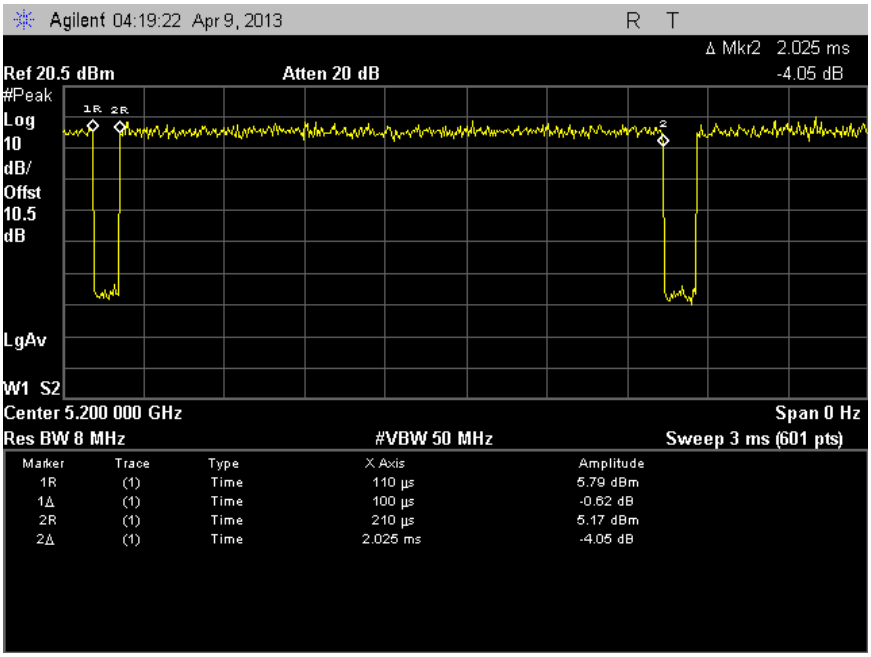
The Duty Cycle is less than 98% and consistent therefore KDB 789033 D01 V01r03 Method SA-2 is used.

7.1.3. MEASUREMENT METHOD FOR AVG SPURIOUS EMISSIONS > 1 GHz

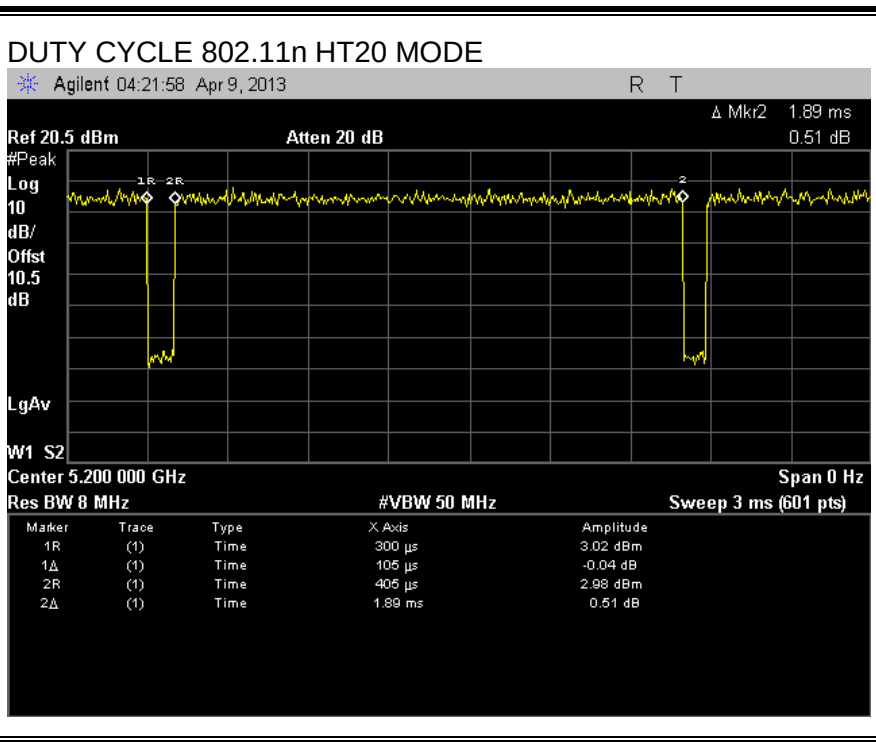
The Duty Cycle is less than 98% and consistent, KDB 789033 D01 V01r03 Method AD with Power RMS Averaging and VB with reduced video bandwidth Averaging and duty cycle correction is used.

7.1.4. DUTY CYCLE PLOTS

DUTY CYCLE 802.11a MODE



DUTY CYCLE 802.11n HT20 MODE



8. ANTENNA PORT TEST RESULTS

8.1. 802.11a MODE IN THE 5.2 GHz BAND

8.1.1. 26 dB BANDWIDTH

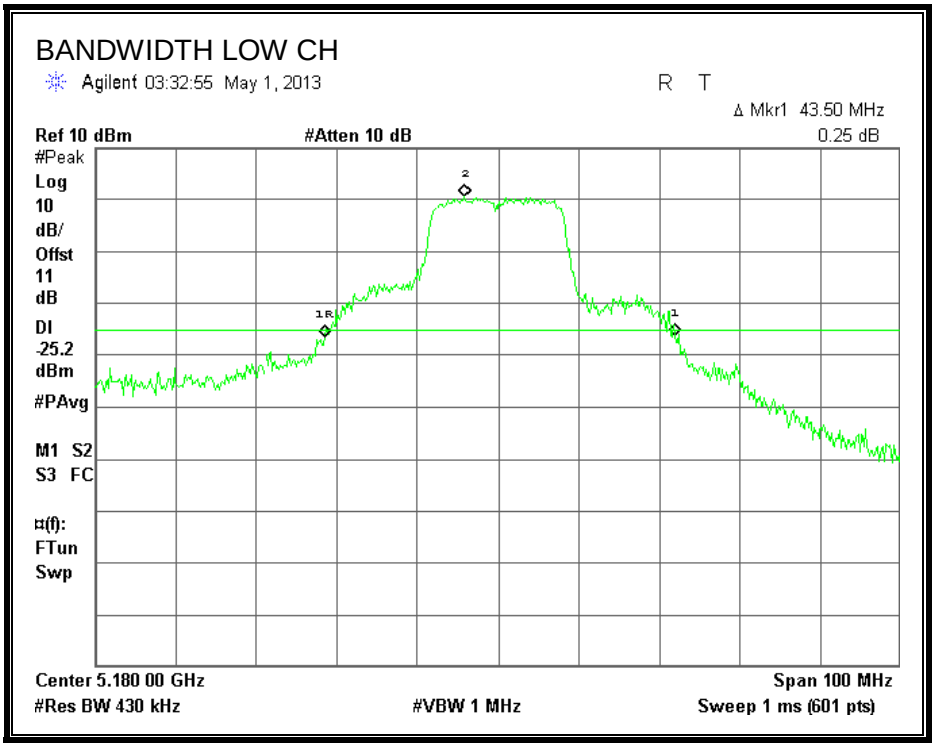
LIMITS

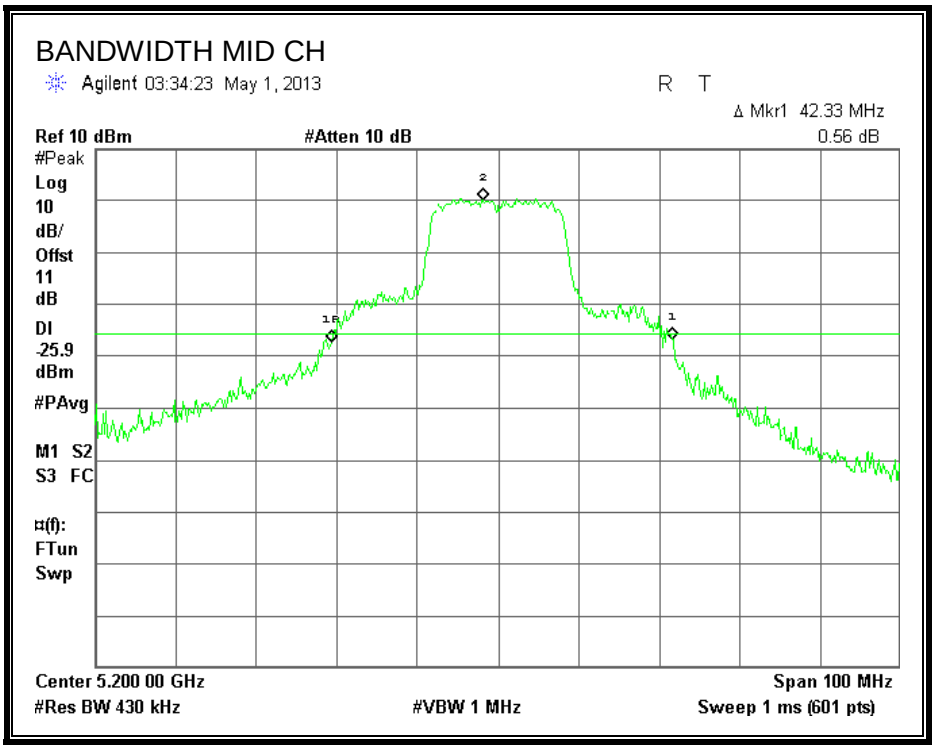
None; for reporting purposes only.

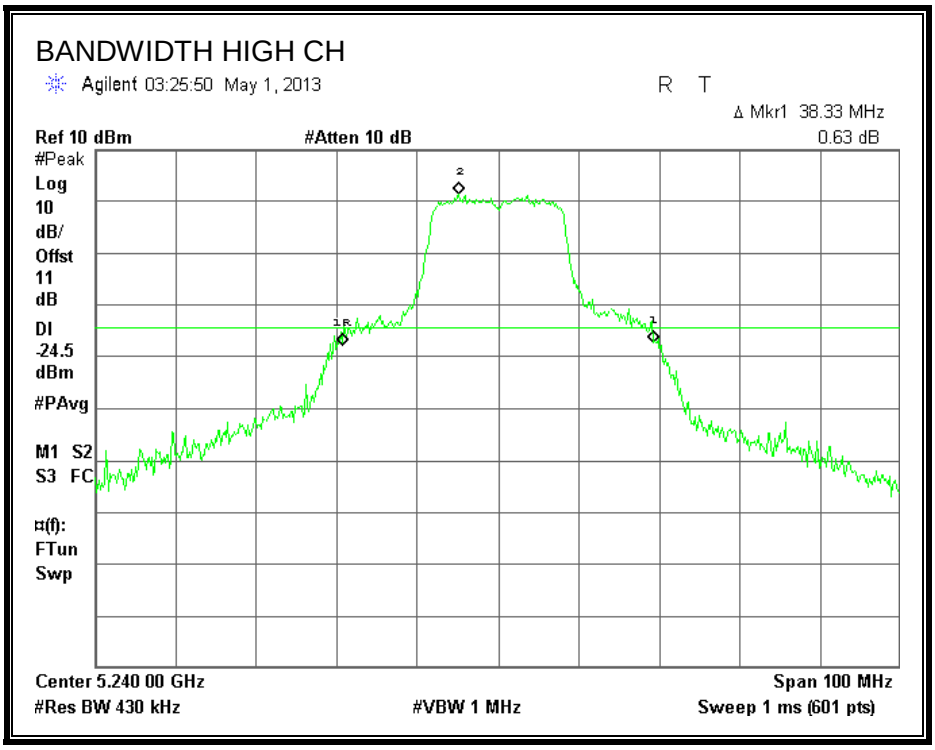
RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	43.5
Mid	5200	42.3
High	5240	38.3

26 dB BANDWIDTH







8.1.2. 99% BANDWIDTH

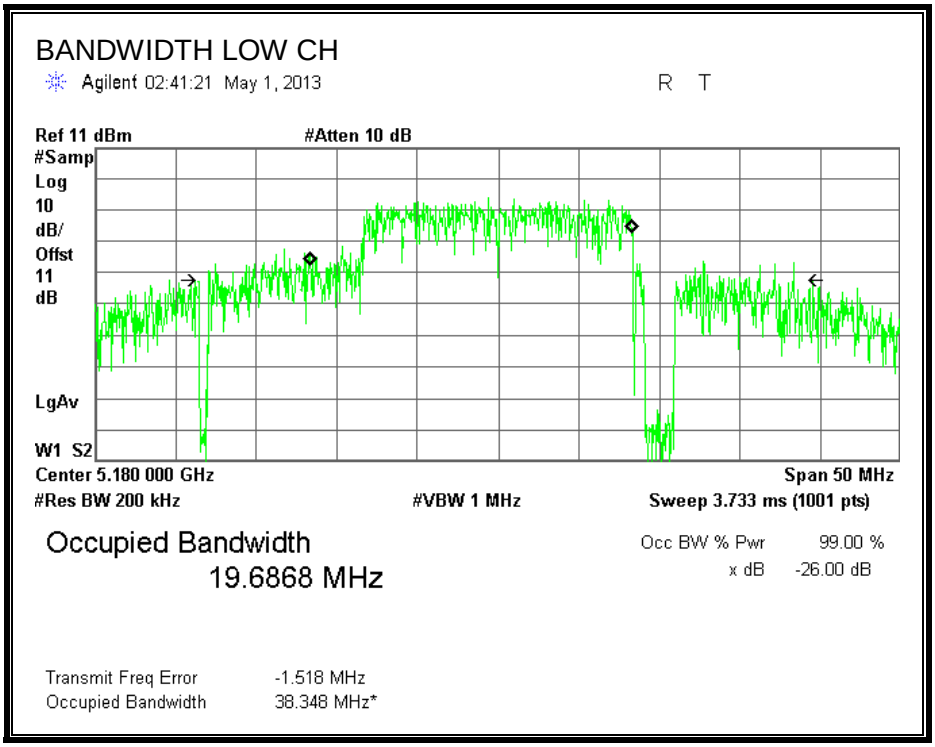
LIMITS

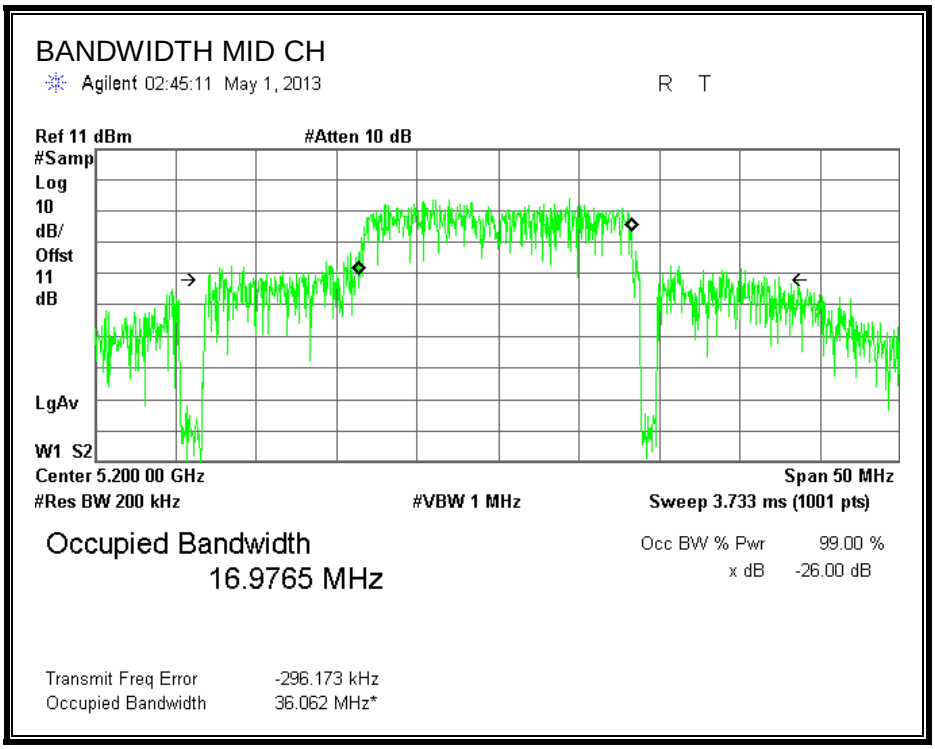
None; for reporting purposes only.

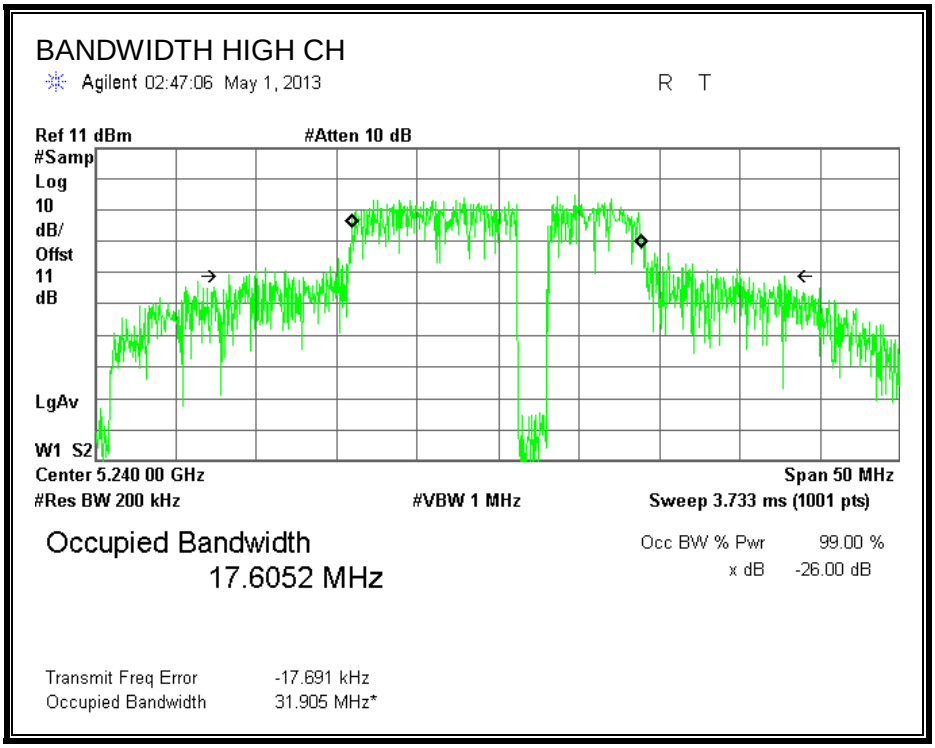
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	19.7
Mid	5200	17.0
High	5240	17.6

99% BANDWIDTH







8.1.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

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

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5180	7.3
Mid	5200	7.2
High	5240	7.3

8.1.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, 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. In addition, 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 maximum conducted output 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.

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The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10 B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain (dBi)
Low	5180	43.5	19.7	1.00
Mid	5200	42.3	17.0	1.00
High	5240	38.3	17.6	1.00

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PSD Limit (dBm)	IC eirp PSD Limit (dBm)	PSD Limit (dBm)
Low	5180	17.00	22.94	21.94	17.00	4.00	10.00	4.00
Mid	5200	17.00	22.30	21.30	17.00	4.00	10.00	4.00
High	5240	17.00	22.46	21.46	17.00	4.00	10.00	4.00

Duty Cycle CF (dB)	0.20	Included in Calculations of Corr'd Power & PSD

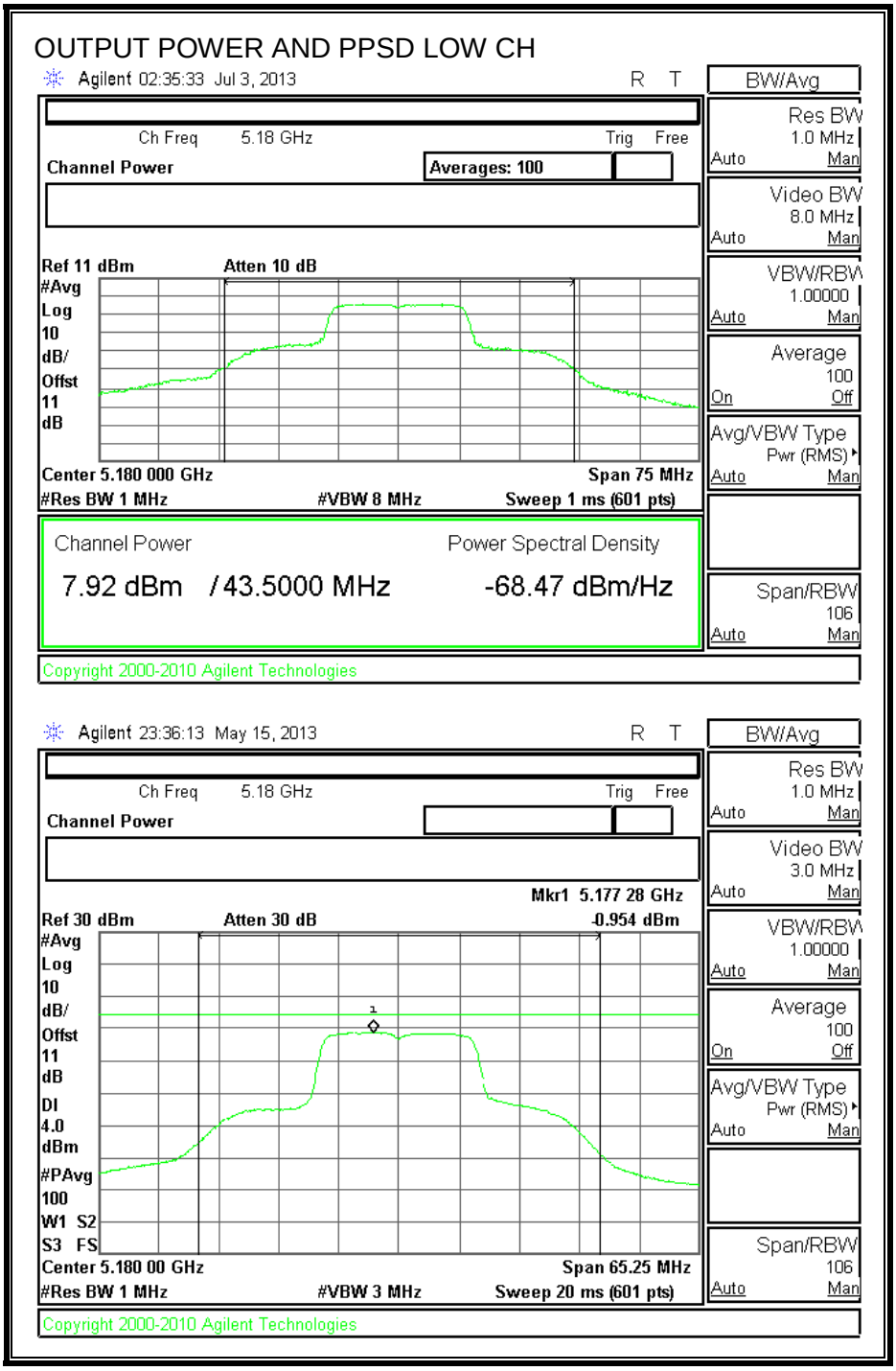
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	7.92	8.12	17.00	-8.88
Mid	5200	7.99	8.19	17.00	-8.81
High	5240	7.71	7.91	17.00	-9.09

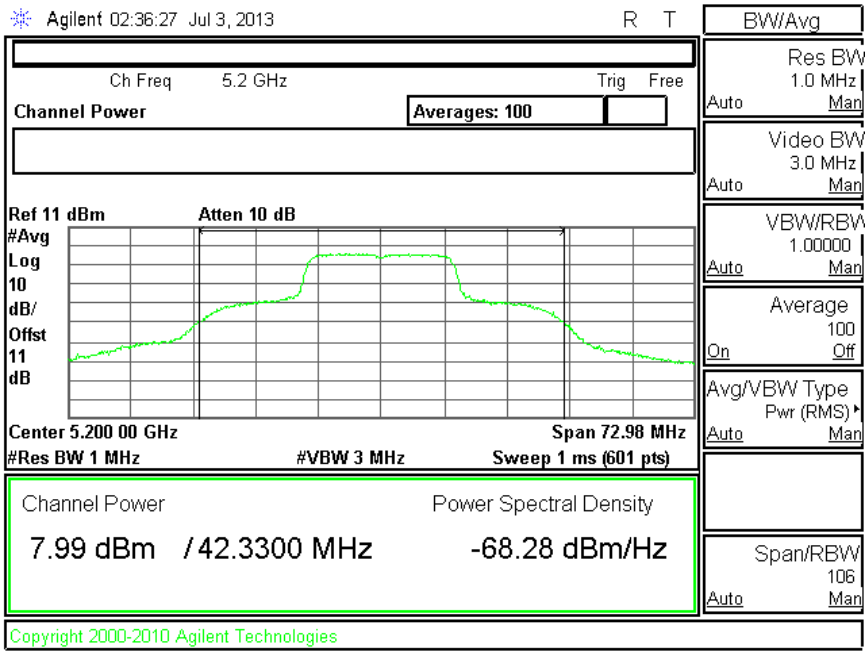
PSD Results

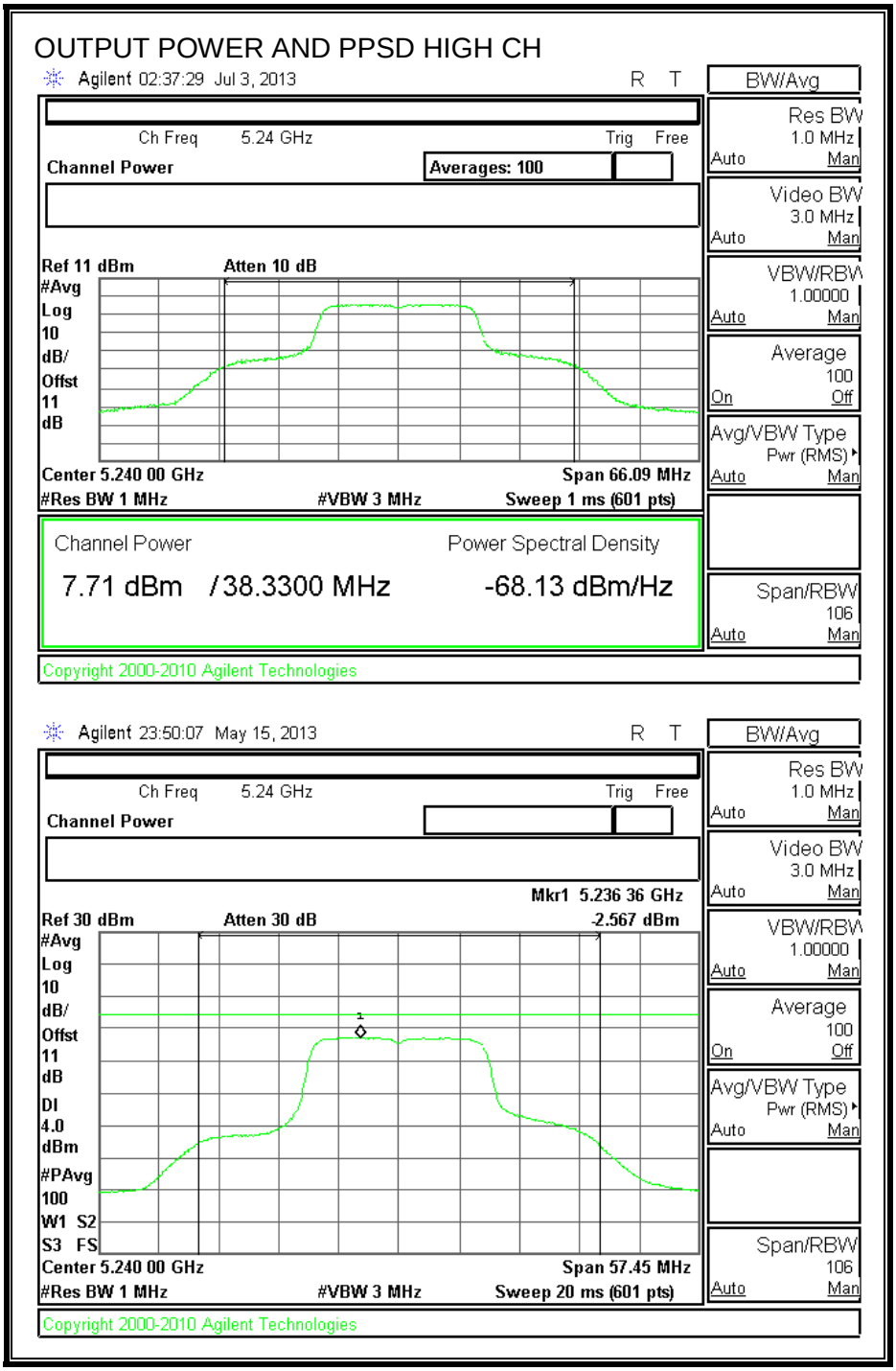
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	-0.95	-0.75	4.00	-4.75
Mid	5200	-1.52	-1.32	4.00	-5.32
High	5240	-2.57	-2.37	4.00	-6.37

OUTPUT POWER AND PPSD



OUTPUT POWER AND PPSD MID CH





8.1.5. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

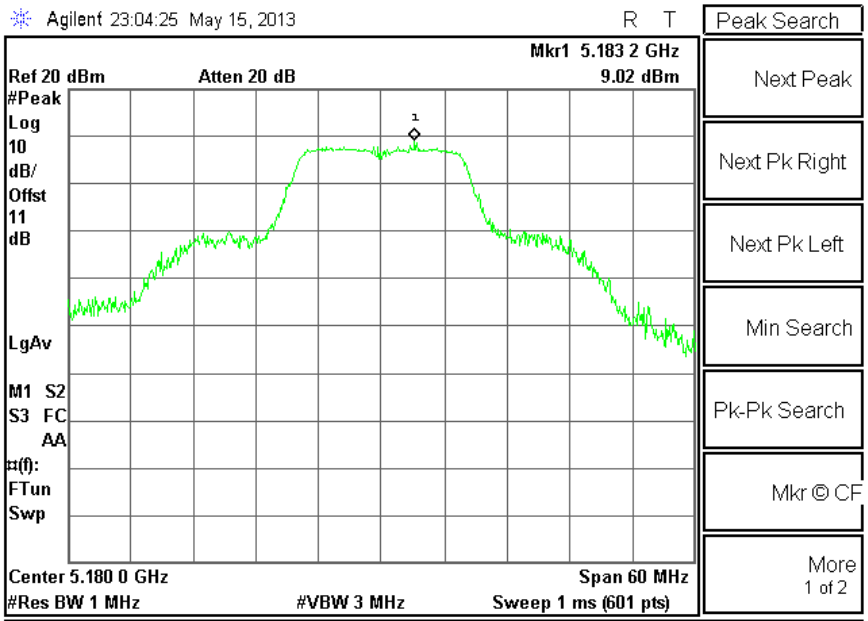
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

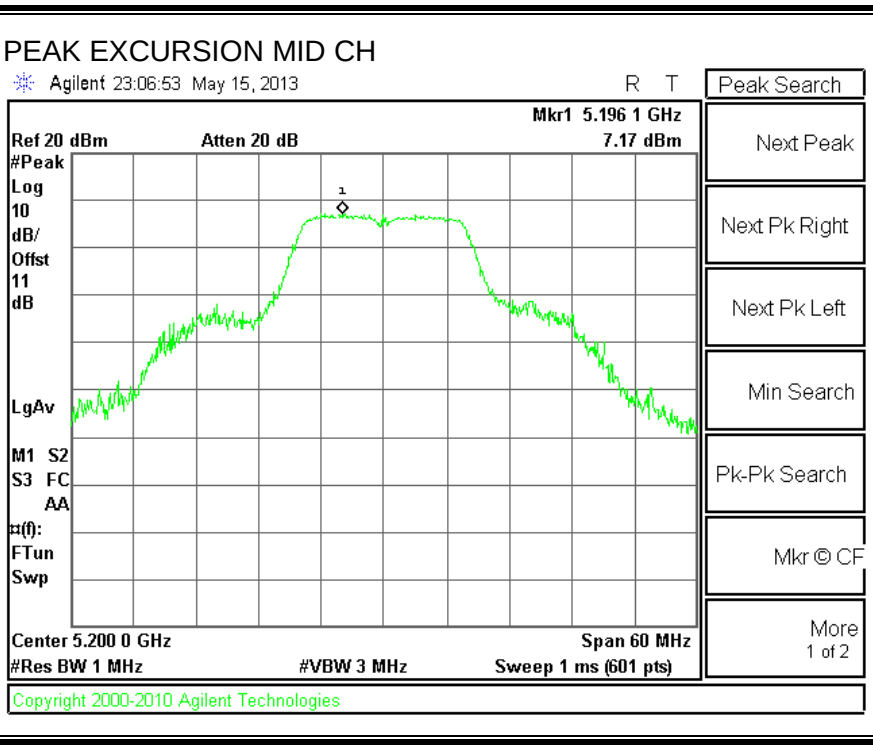
Channel	Frequency (MHz)	PK Level (dBm)	PSD (dBm)	DCCF (dB)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	9.02	-0.95	0.20	9.77	13	-3.23
Mid	5200	7.17	-1.52	0.20	8.49	13	-4.51
High	5240	6.16	-2.57	0.20	8.53	13	-4.47

PEAK EXCURSION

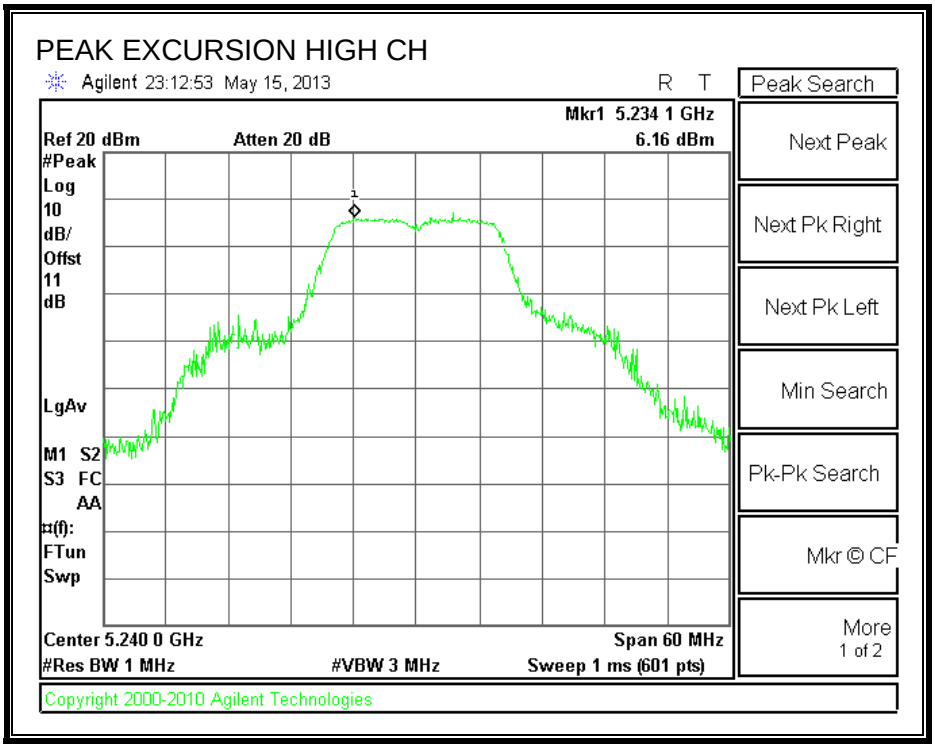
PEAK EXCURSION LOW CH



PEAK EXCURSION MID CH



PEAK EXCURSION HIGH CH



8.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

8.2.1. 26 dB BANDWIDTH

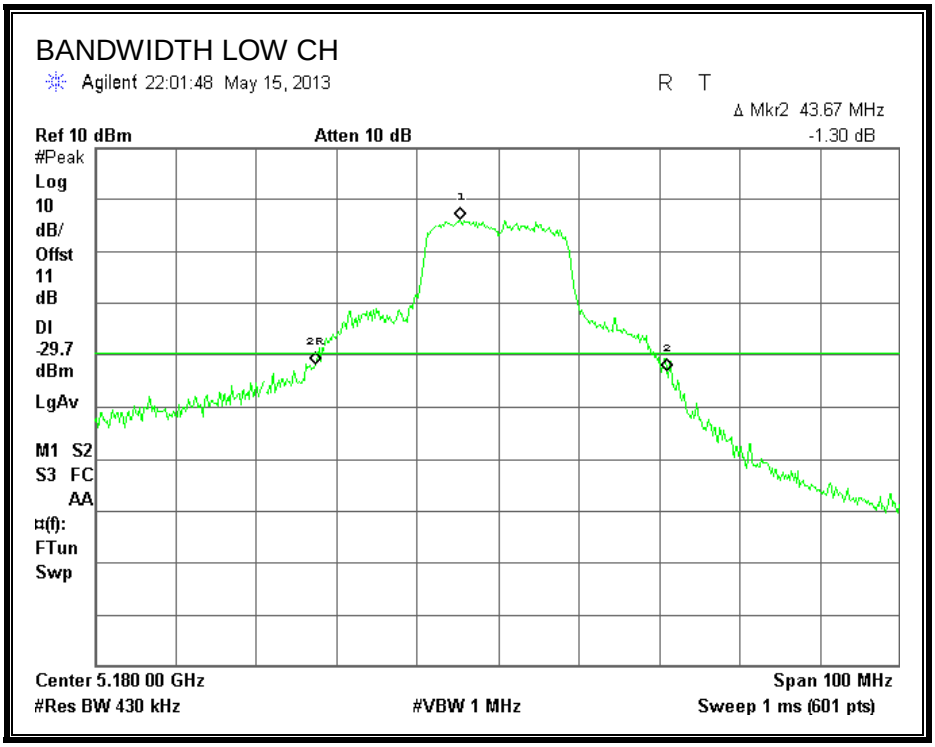
LIMITS

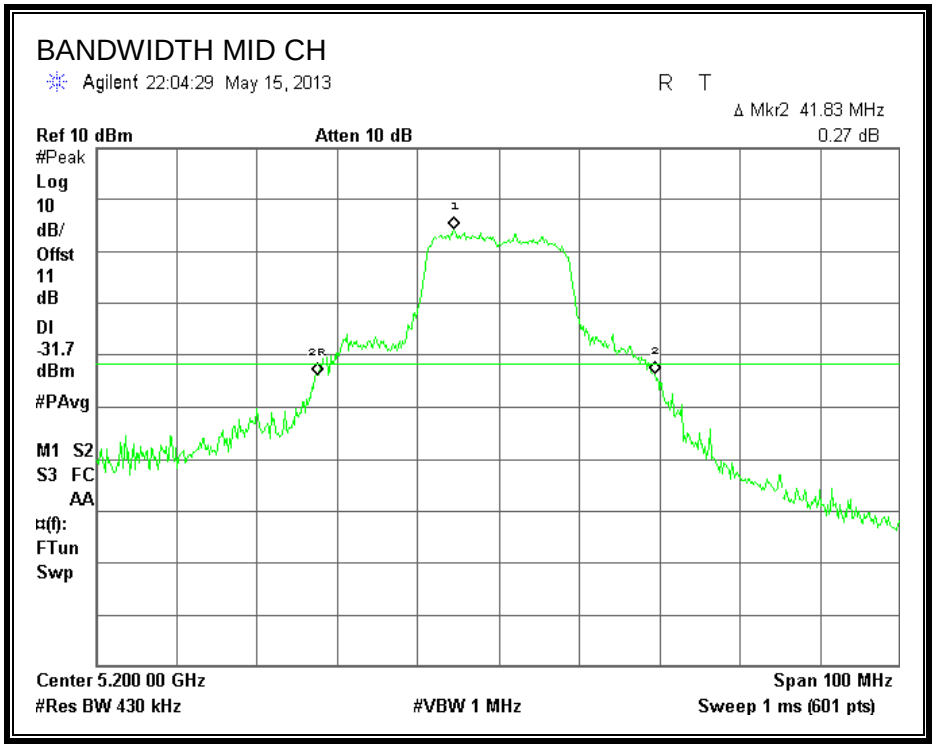
None; for reporting purposes only.

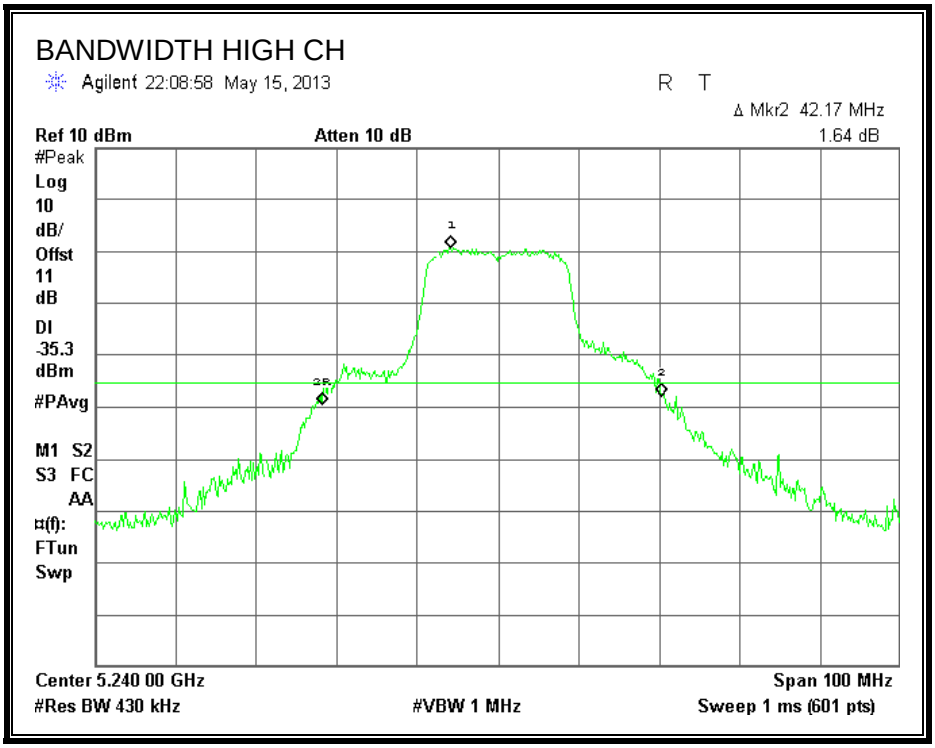
RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	43.7
Mid	5200	41.8
High	5240	42.2

26 dB BANDWIDTH







8.2.2. 99% BANDWIDTH

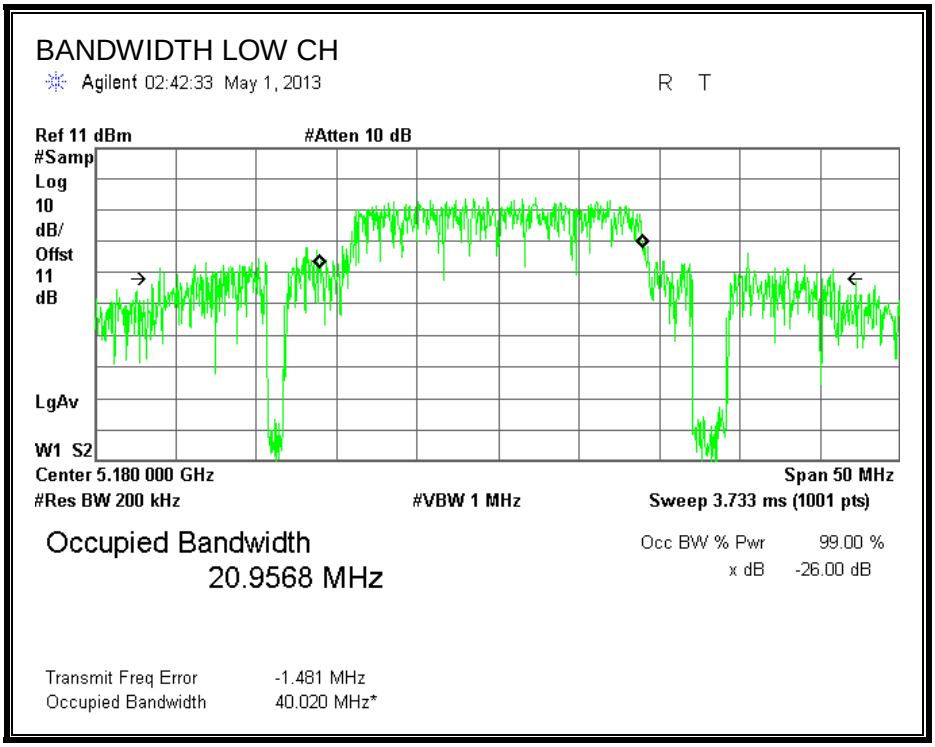
LIMITS

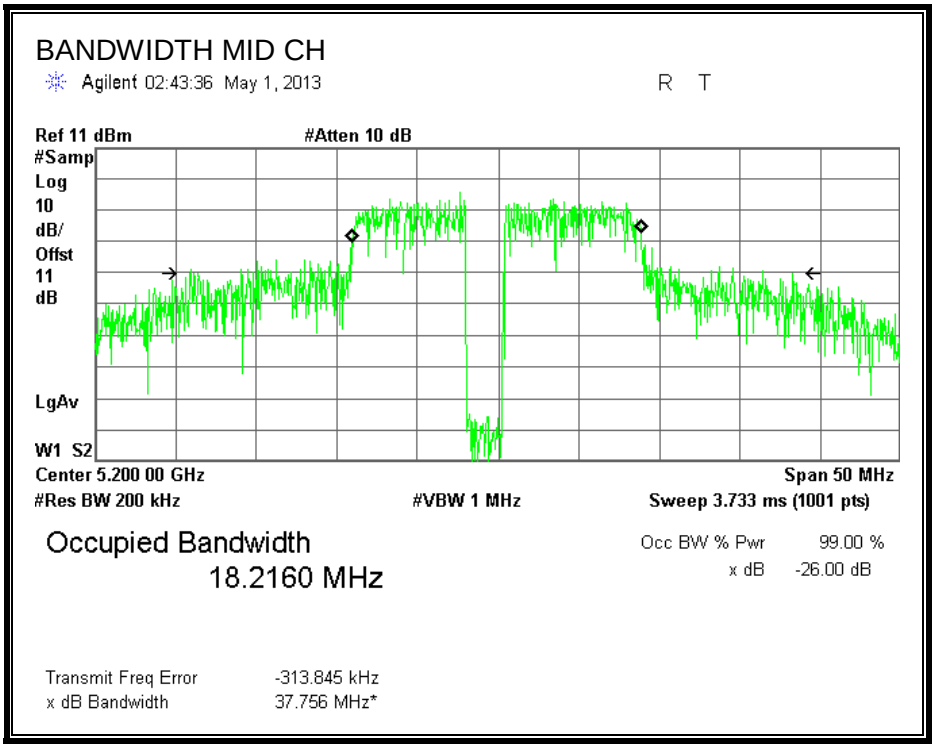
None; for reporting purposes only.

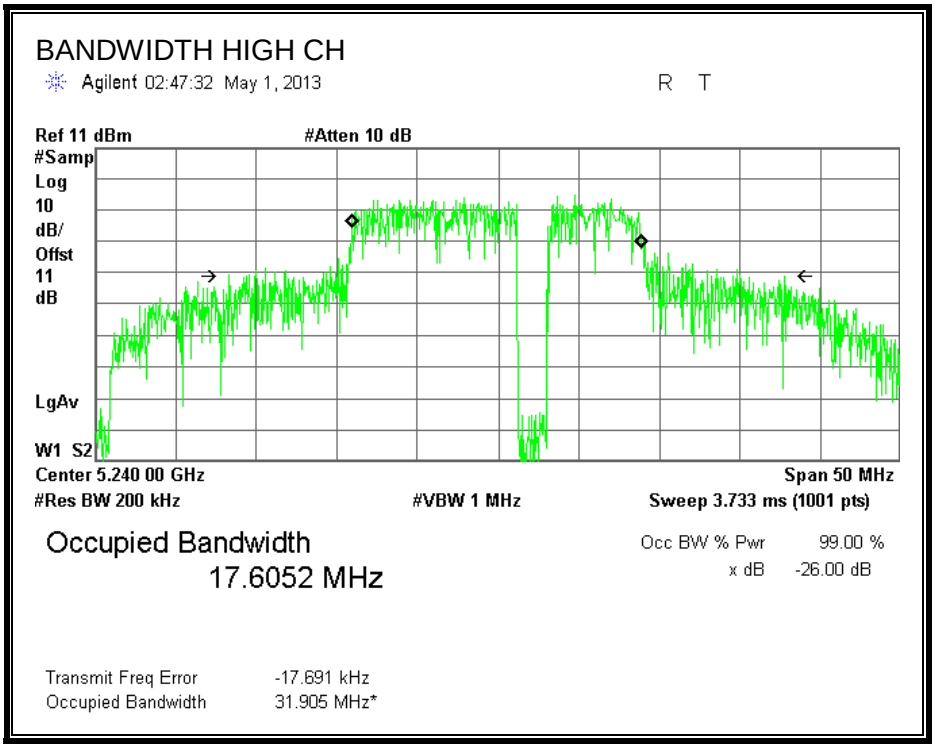
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	21.0
Mid	5200	18.2
High	5240	17.6

99% BANDWIDTH







8.2.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

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

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5180	7.2
Mid	5200	7.0
High	5240	7.2

8.2.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, 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. In addition, 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 maximum conducted output 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.

IC RSS-210 A9.2 (1)

The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10 B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain (dBi)
Low	5180	43.7	21.0	1.00
Mid	5200	41.8	18.2	1.00
High	5240	42.2	17.6	1.00

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PSD Limit (dBm)	IC eirp PSD Limit (dBm)	PSD Limit (dBm)
Low	5180	17.00	23.00	22.00	17.00	4.00	10.00	4.00
Mid	5200	17.00	22.61	21.61	17.00	4.00	10.00	4.00
High	5240	17.00	22.46	21.46	17.00	4.00	10.00	4.00

Duty Cycle CF (dB)	0.20	Included in Calculations of Corr'd Power & PSD

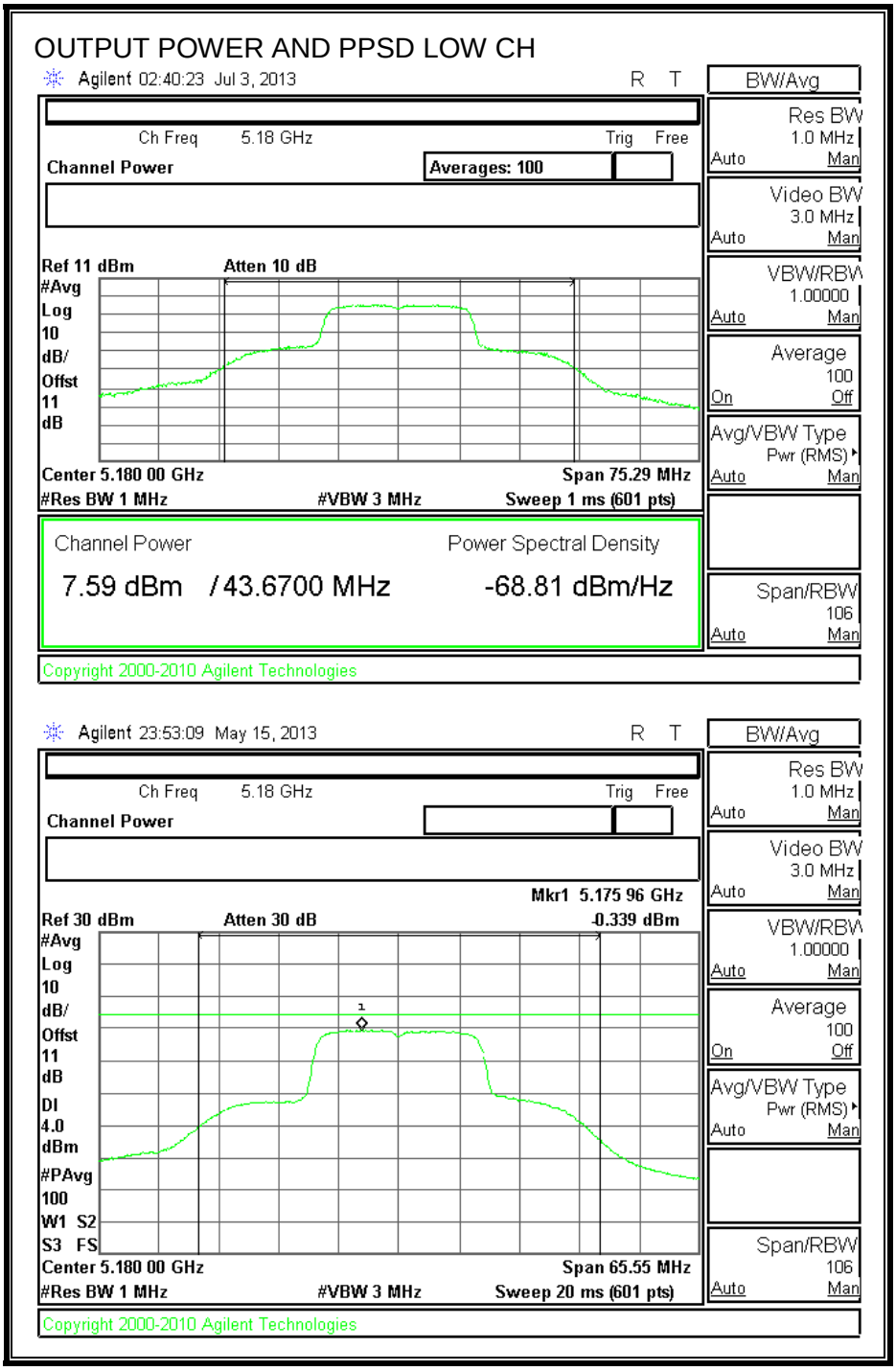
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	7.59	7.79	17.00	-9.21
Mid	5200	7.85	8.05	17.00	-8.95
High	5240	7.63	7.83	17.00	-9.17

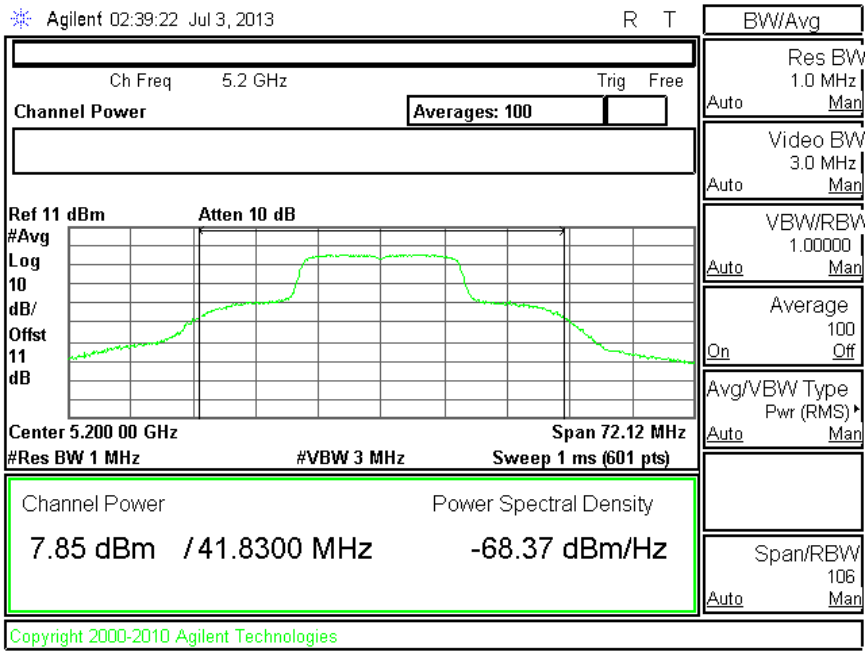
PSD Results

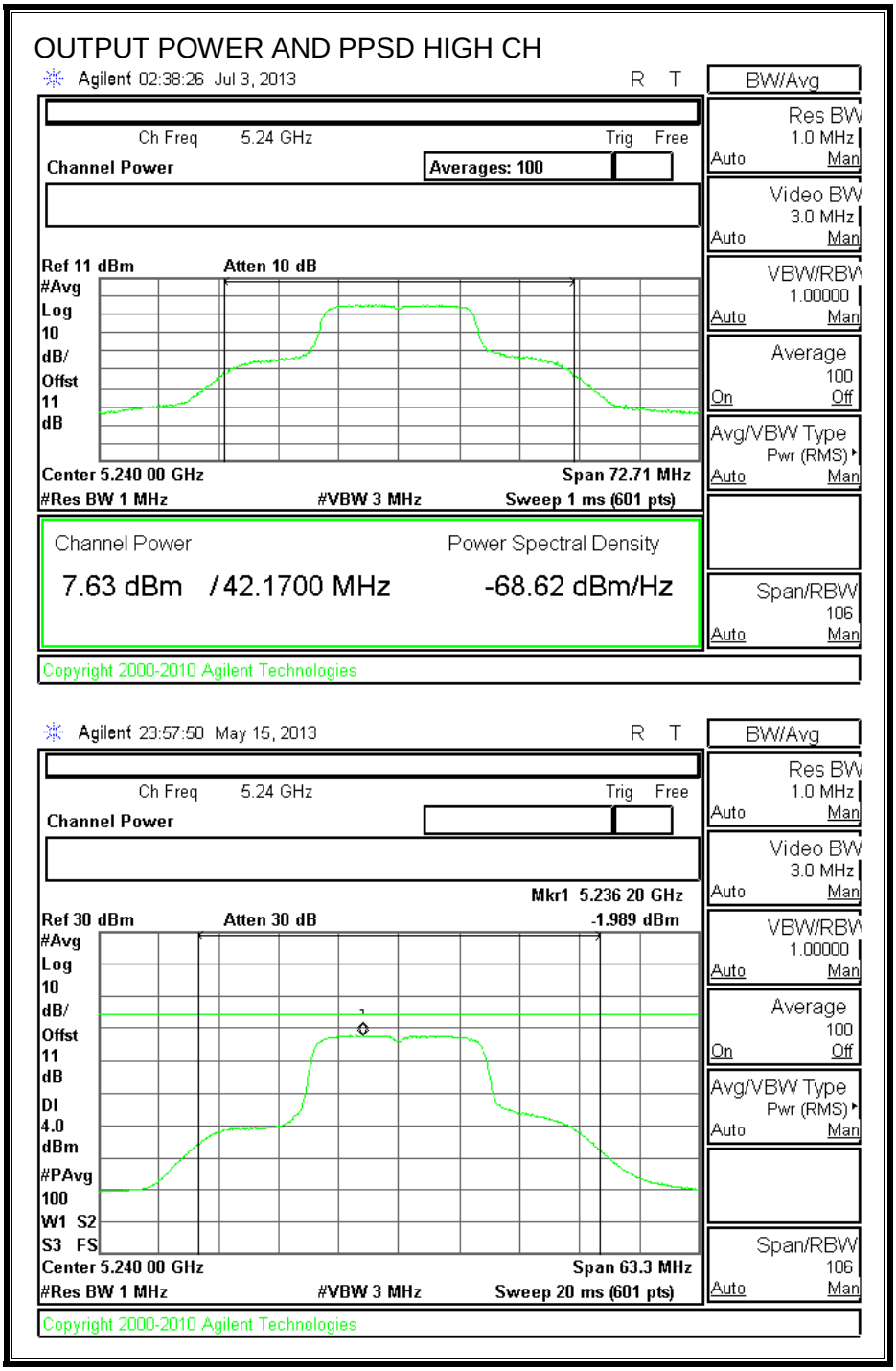
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	-0.34	-0.14	4.00	-4.14
Mid	5200	-1.38	-1.18	4.00	-5.18
High	5240	-1.99	-1.79	4.00	-5.79

OUTPUT POWER AND PPSD



OUTPUT POWER AND PPSD MID CH





8.2.5. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

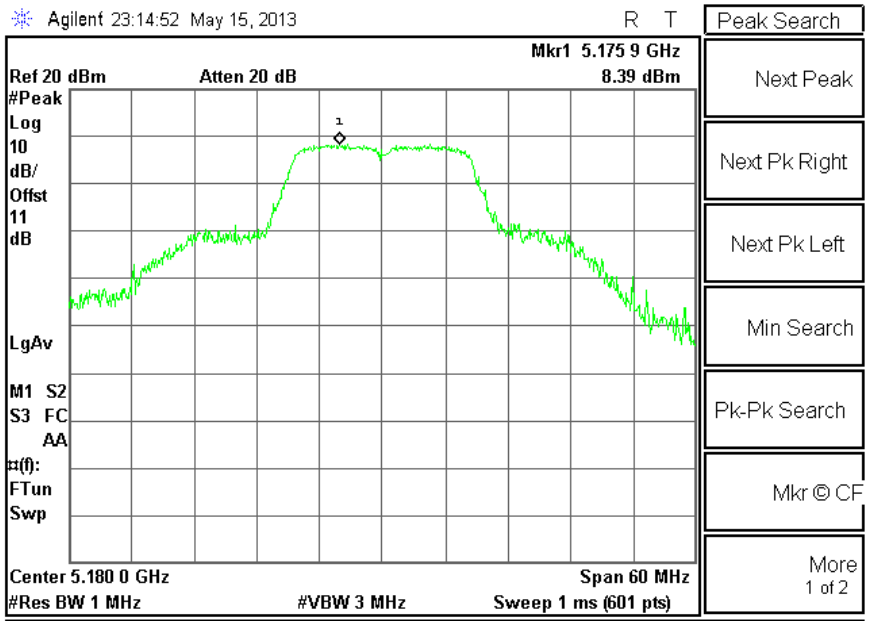
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

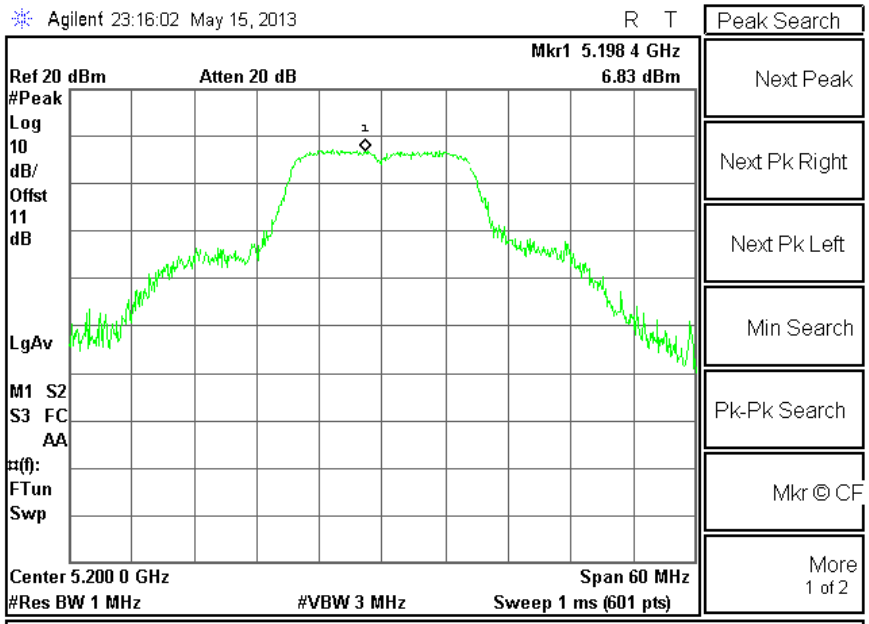
Channel	Frequency (MHz)	PK Level (dBm)	PSD (dBm)	DCCF (dB)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	8.39	-0.34	0.20	8.53	13	-4.47
Mid	5200	6.83	-1.38	0.20	8.01	13	-4.99
High	5240	6.36	-1.99	0.20	8.15	13	-4.85

PEAK EXCURSION

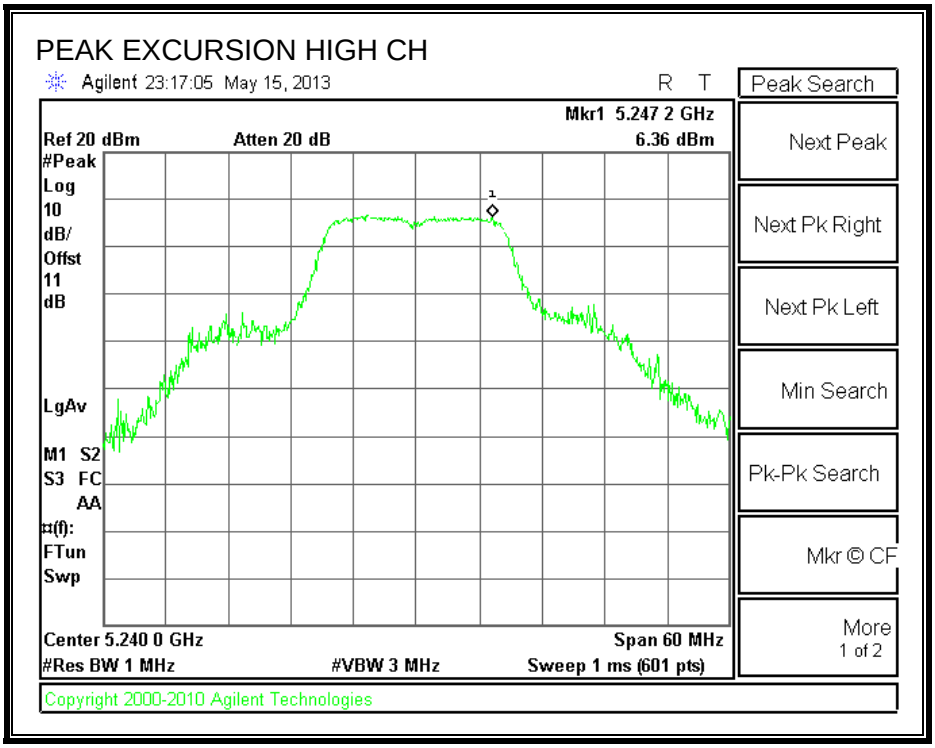
PEAK EXCURSION LOW CH



PEAK EXCURSION MID CH



PEAK EXCURSION HIGH CH



9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205, §15.209 and §15.407(b)

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.

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; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements (see below).

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.

Based on the duty cycle of this EUT, the VBW used during all average measurements was 1kHz.

The -27dBm EIRP limit per 15.407(b)(1) was converted to field strength based on the following formula, taken from AS/NZS 4268: 2003:

$$E_{lim} = 20*\log_{10} [(\sqrt{30P_{lim}})/d] + 120$$

Where
E_{lim} = Electric Field Strength Limit, in dBµV/m
P_{lim} = EIRP Limit, in Watts
d = Measurement distance, in meters

Sample Calculations

$$E_{lim} = 20*\log_{10} [(\sqrt{30}*2.0E-6)/3] + 120 = 68.2 \text{ dBµV/m}$$

Where
P_{lim} = -27dBm (2.0E-6 Watts)
d = 3 meters

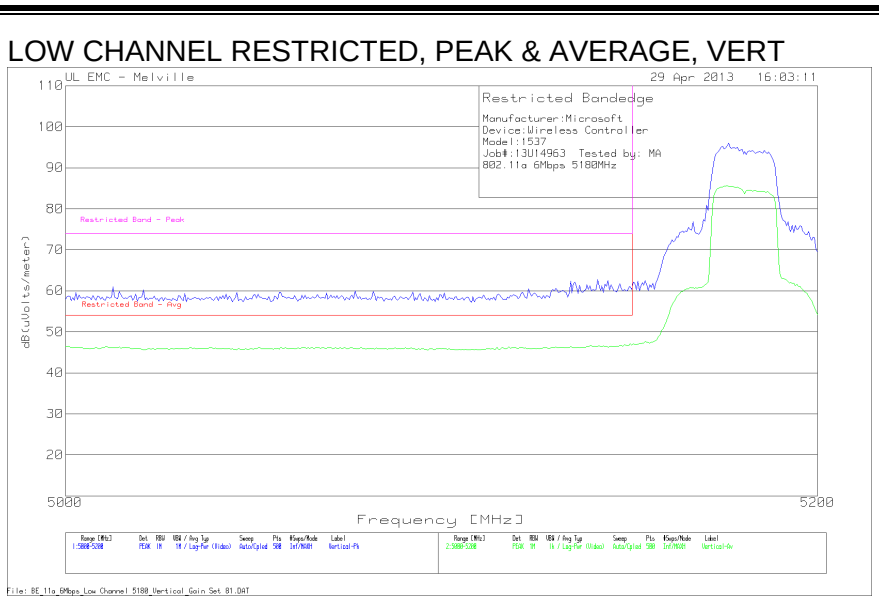
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. TX ABOVE 1 GHz 802.11a MODE IN THE 5.2 GHz BAND

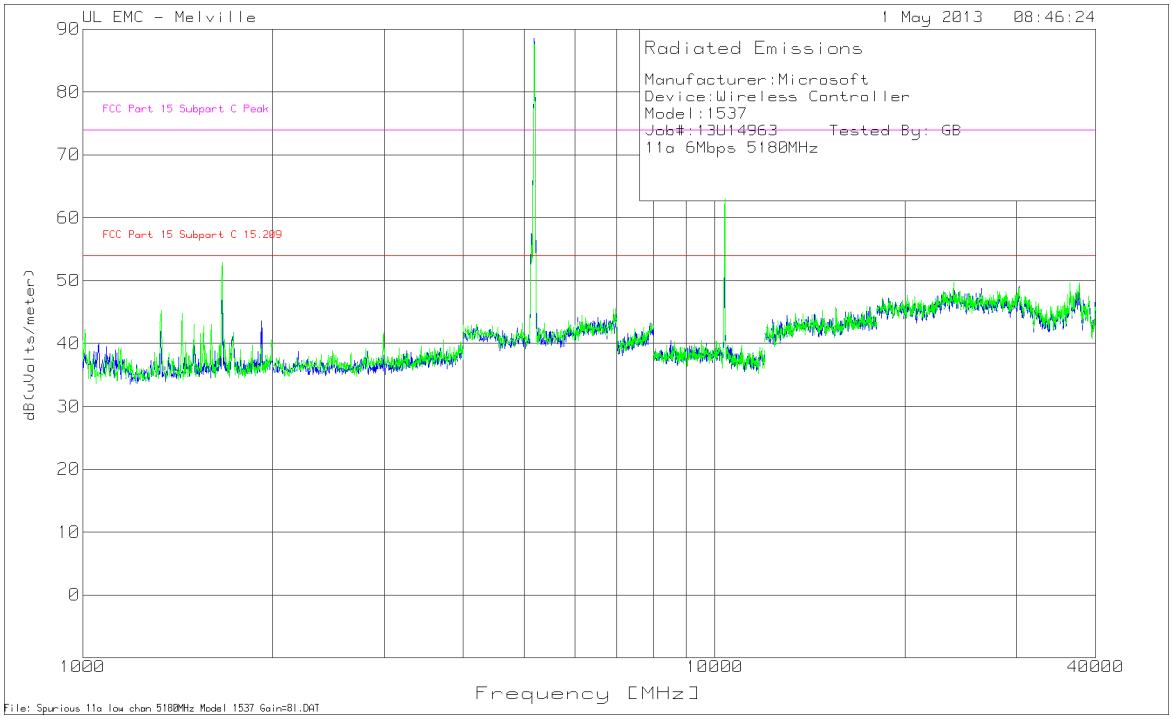
RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, PEAK & AVERAGE, HORIZ

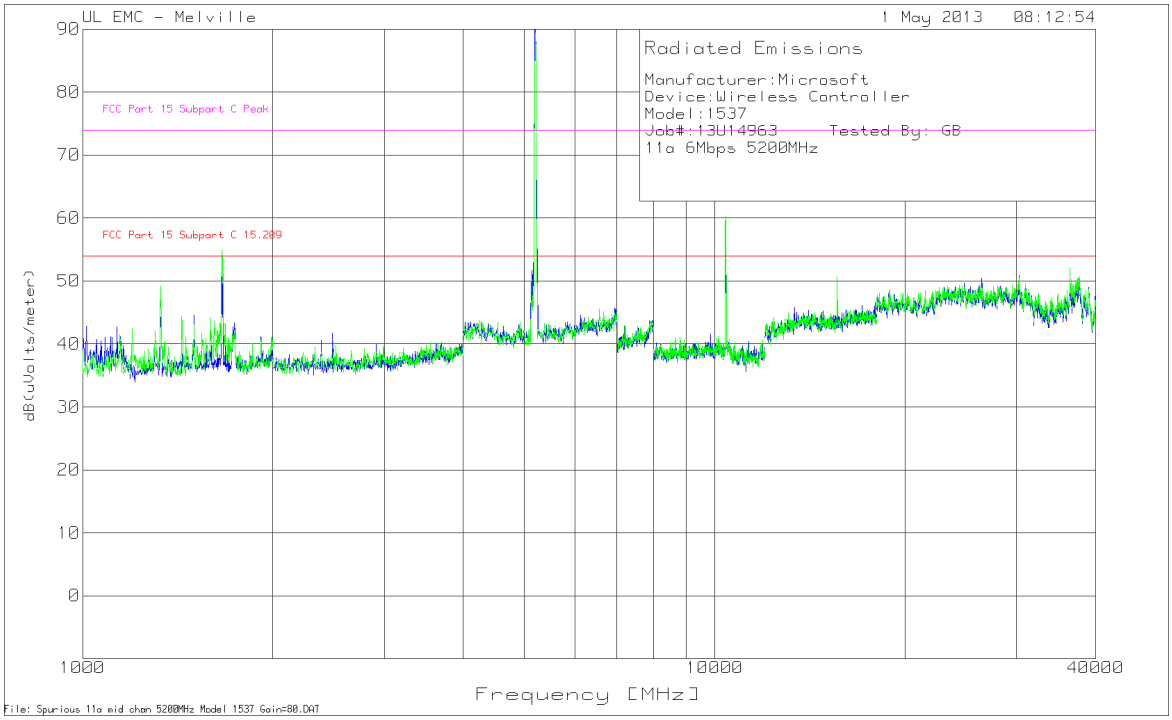
LOW CHANNEL RESTRICTED, PEAK & AVERAGE, VERT



HARMONICS AND SPURIOUS EMISSIONS

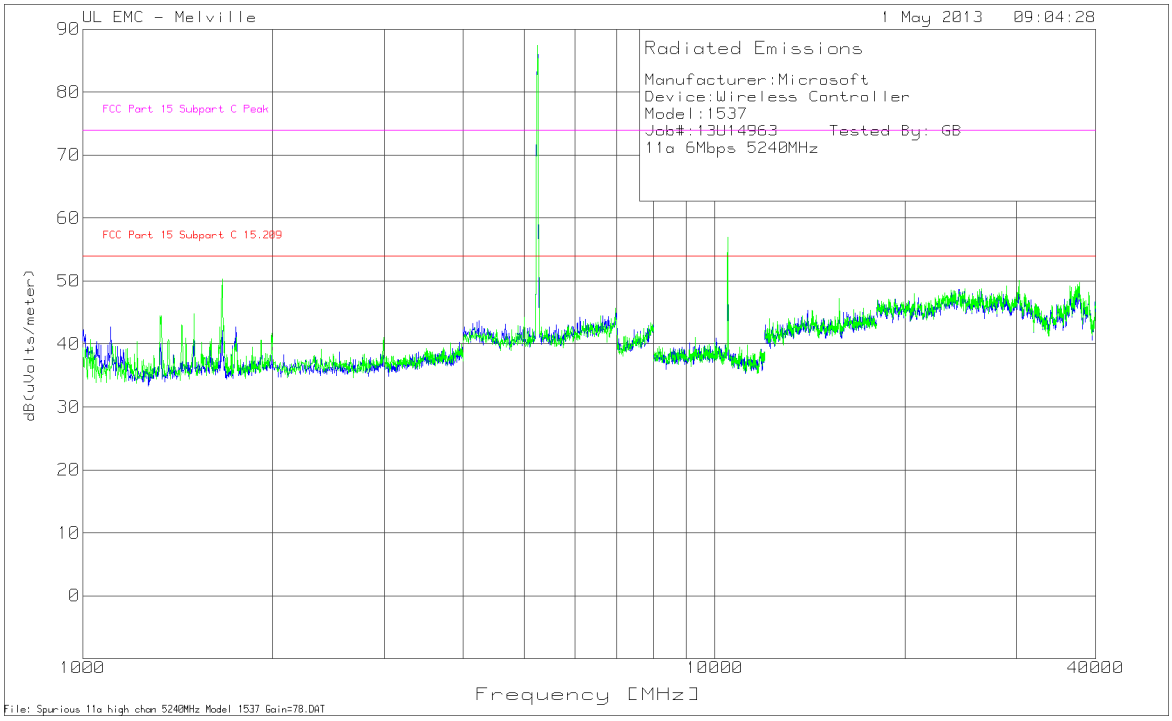


Low Channel



Mid Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)



High Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)

Manufacturer:Microsoft
Device:Wireless Controller
Model:1537
Job#:13U14963 Tested By: GB
11a 6Mbps

Low Channel - 5180MHz

Test Frequency	Meter Reading	Detector	AF-8932 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	EIRP Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
10364.729	71.19	PK	33.3	-47.62	56.87	-	-	-	-	68.2	-11.33	207	100	Horz
10364.729	77.38	PK	33.3	-47.62	63.06	-	-	-	-	68.2	-5.14	172	100	Vert
15546.413	65.3	PK	37.3	-47.98	54.62	-	-	74	-19.38	-	-	321	173	Horz
15546.894	66.61	PK	37.3	-48.01	55.9	-	-	74	-18.1	-	-	237	278	Vert
15546.413	49.67	LnAv	37.3	-47.98	38.99	54	-15.01	-	-	-	-	321	173	Horz
15546.894	51.02	LnAv	37.3	-48.01	40.31	54	-13.69	-	-	-	-	237	278	Vert

Mid Channel - 5200MHz

Test Frequency	Meter Reading	Detector	AF-8932 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	EIRP Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
10404.81	69.36	PK	33.2	-47.04	55.52	-	-	-	-	68.2	-12.68	112	100	Horz
10396.794	74.3	PK	33.2	-47.19	60.31	-	-	-	-	68.2	-7.89	200	100	Vert
15602.485	64.34	PK	37.3	-47.81	53.83	-	-	74	-20.17	-	-	242	328	Vert
15591.663	65.75	PK	37.3	-47.82	55.23	-	-	74	-18.77	-	-	136	384	Horz
15602.485	50.58	LnAv	37.3	-47.81	40.07	54	-13.93	-	-	-	-	242	328	Vert
15591.663	50.16	LnAv	37.3	-47.82	39.64	54	-14.36	-	-	-	-	136	384	Horz

High Channel - 5240MHz

Test Frequency	Meter Reading	Detector	AF-8932 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	EIRP Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
10484.97	66.31	PK	33.2	-47.4	52.11	-	-	-	-	68.2	-16.09	225	100	Horz
10484.97	66.31	PK	33.2	-47.4	52.11	-	-	-	-	68.2	-16.09	225	100	Vert
15727.014	64.75	PK	37.4	-47.59	54.56	-	-	74	-19.44	-	-	6	340	Vert
15721.563	64.26	PK	37.4	-47.65	54.01	-	-	74	-19.99	-	-	153	321	Horz
15727.014	49.5	LnAv	37.4	-47.59	39.31	54	-14.69	-	-	-	-	6	340	Vert
15721.563	50.44	LnAv	37.4	-47.65	40.19	54	-13.81	-	-	-	-	153	321	Horz

PK - Peak detector
LnAv - Linear Average detector

NOTE: No additional emissions detected above the system noise floor.

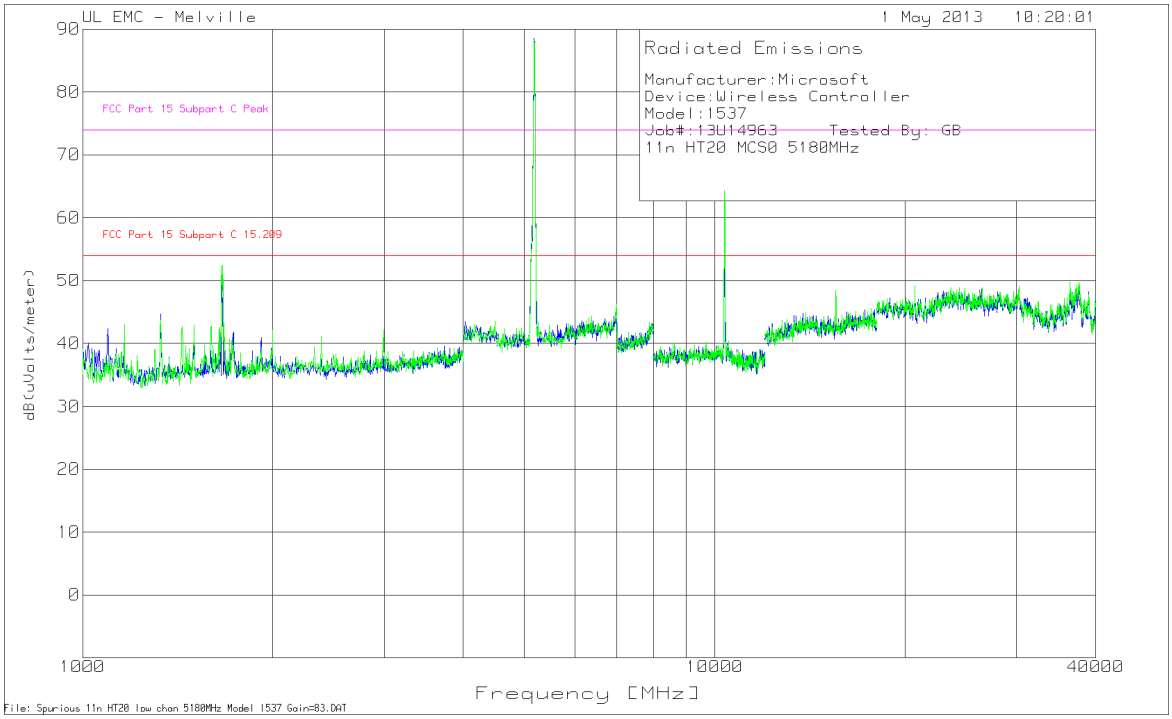
9.2.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

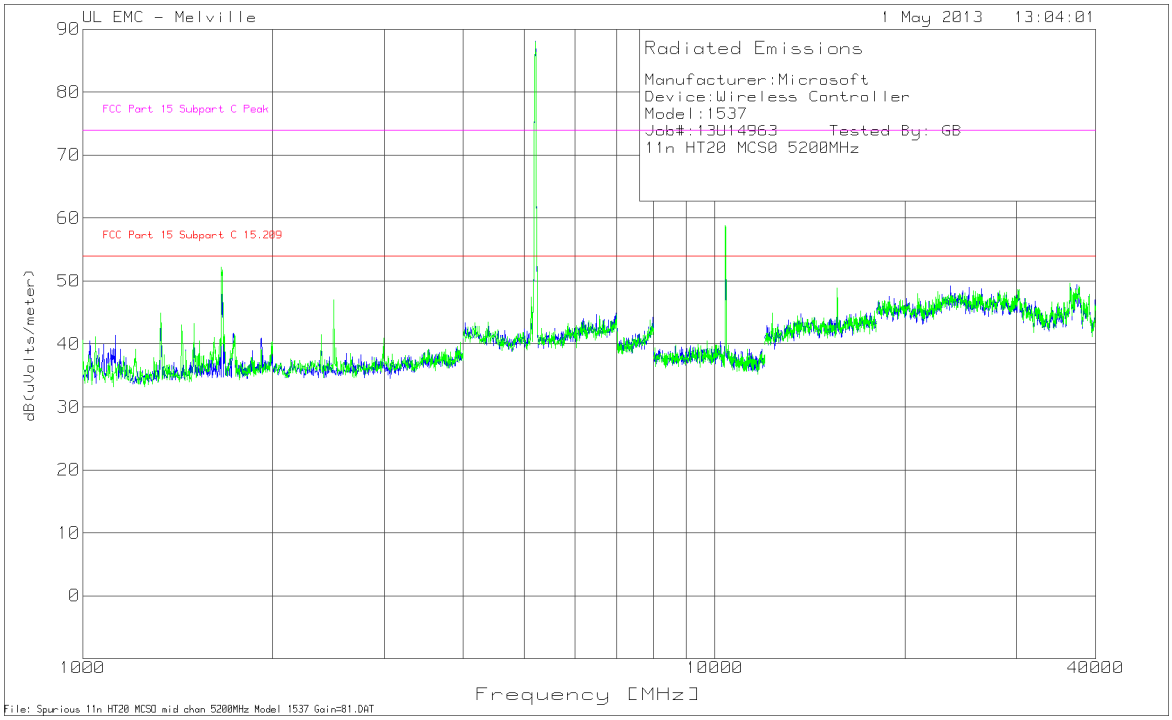
LOW CHANNEL RESTRICTED, PEAK & AVERAGE, HORIZ

LOW CHANNEL RESTRICTED, PEAK & AVERAGE, VERT

HARMONICS AND SPURIOUS EMISSIONS

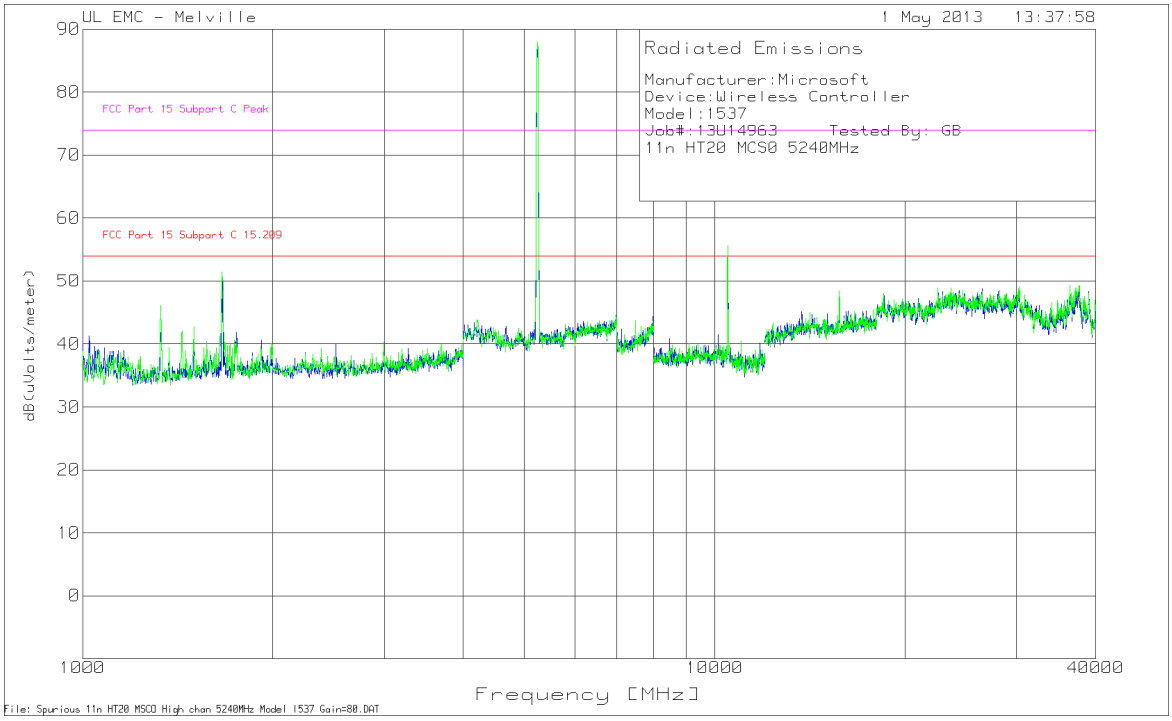


Low Channel



Mid Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)



High Channel

HARMONICS AND SPURIOUS EMISSIONS (CONT)

Manufacturer:Microsoft
Device:Wireless Controller
Model:1537
Job#:13U14963 Tested By: GB
11n HT20 MCS0

Low Channel - 5180MHz

Test Frequency	Meter Reading	Detector	AF-8932 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	EIRP Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
10356.713	75.22	PK	33.3	-48.03	60.49	-	-	-	-	68.2	-7.71	154	100	Horz
10356.713	79.13	PK	33.3	-48.03	64.4	-	-	-	-	68.2	-3.8	172	100	Vert
15541.152	64.98	PK	37.3	-47.56	54.72	-	-	74	-19.28	-	-	286	260	Horz
15533.236	65.23	PK	37.3	-47.59	54.94	-	-	74	-19.06	-	-	37	358	Vert
15541.152	49	LnAv	37.3	-47.56	38.74	54	-15.26	-	-	-	-	286	260	Horz
15533.236	51.48	LnAv	37.3	-47.59	41.19	54	-12.81	-	-	-	-	37	358	Vert

Mid Channel - 5200MHz

Test Frequency	Meter Reading	Detector	AF-8932 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	EIRP Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
10404.81	68.5	PK	33.2	-47.04	54.66	-	-	-	-	68.2	-13.54	112	100	Horz
10396.794	74.3	PK	33.2	-47.19	60.31	-	-	-	-	68.2	-7.89	200	100	Vert
15596.844	65.32	PK	37.3	-47.8	54.82	-	-	74	-19.18	-	-	227	352	Vert
15605.411	64.4	PK	37.3	-47.84	53.86	-	-	74	-20.14	-	-	171	385	Horz
15596.844	49.54	LnAv	37.3	-47.8	39.04	54	-14.96	-	-	-	-	227	352	Vert
15605.411	49.48	LnAv	37.3	-47.84	38.94	54	-15.06	-	-	-	-	171	385	Horz

High Channel - 5240MHz

Test Frequency	Meter Reading	Detector	AF-8932 [dB/m]	BOMS Factor [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	FCC Part 15 Subpart C Peak	Margin (dB)	EIRP Peak	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
10484.97	66.8	PK	33.2	-47.4	52.6	-	-	-	-	68.2	-15.6	225	100	Horz
10484.97	66.8	PK	33.2	-47.4	52.6	-	-	-	-	68.2	-15.6	13	100	Vert
15720	61.72	PK	37.4	-47.67	51.45	-	-	74	-22.55	-	-	169	362	Horz
15720	62.45	PK	37.4	-47.67	52.18	-	-	74	-21.82	-	-	224	261	Vert
15720	47.81	LnAv	37.4	-47.67	37.54	54	-16.46	-	-	-	-	169	362	Horz
15720	47.89	LnAv	37.4	-47.67	37.62	54	-16.38	-	-	-	-	224	261	Vert

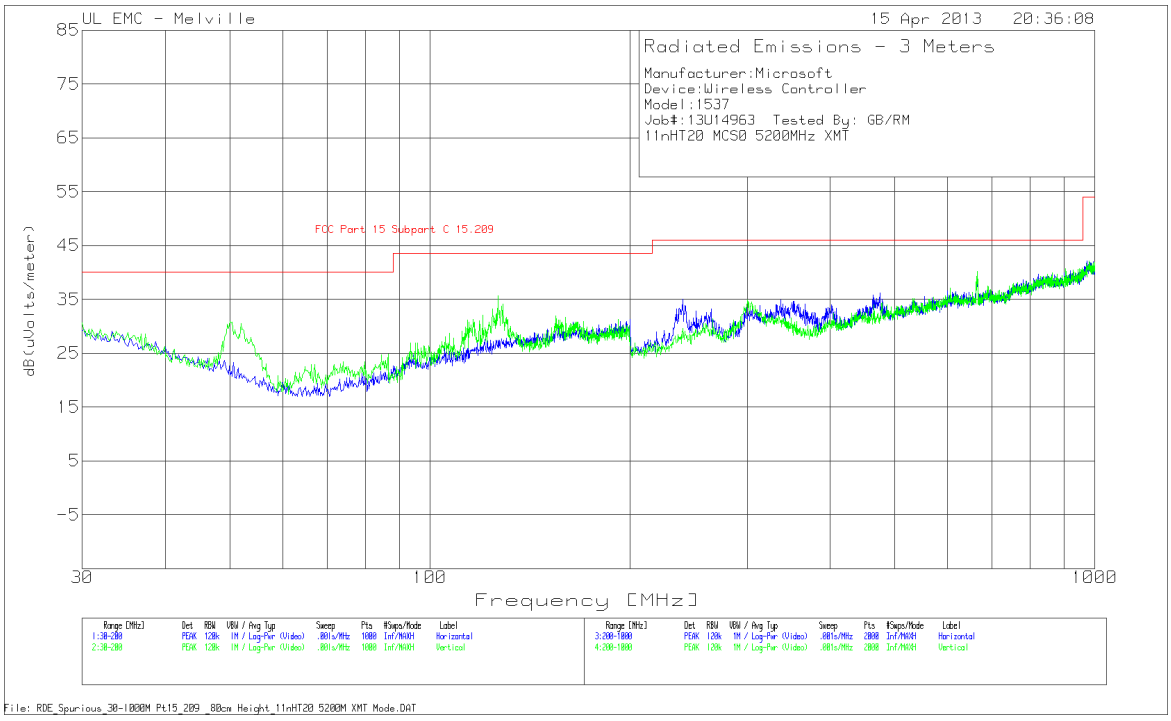
PK - Peak detector
LnAv - Linear Average detector

NOTE: No additional emissions detected above the system noise floor.

9.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (5.2GHZ BAND WORST-CASE CONFIGURATION)

HORIZONTAL & VERTICAL PLOT



HORIZONTAL & VERTICAL DATA

Manufacturer:Microsoft										
Device:Wireless Controller										
Model:1537										
Job#:13U14963 Tested By: GB/RM										
11nHT20 MCS0 5200MHz XMT										
Vertical 30 - 200MHz										
Test Frequency	Meter Reading	Detector	AF-43441 [dB/m]	GL-3M [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
50.0249	18.45	QP	10.2	0.1	28.75	40	-11.25	270	100	Vert
113.8404	15.56	QP	12.5	0.4	28.46	43.5	-15.04	42	102	Vert
126.5521	17	QP	13.7	0.5	31.2	43.5	-12.3	52	103	Vert
Horizontal 200 - 1000MHz										
Test Frequency	Meter Reading	Detector	AF-44067 [dB/m]	GL-3M [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
240.0015	23.01	QP	11.2	0.8	35.01	46	-10.99	177	120	Horz
665.0524	14.01	QP	20.1	1.9	36.01	46	-9.99	337	110	Horz
Vertical 200 - 1000MHz										
Test Frequency	Meter Reading	Detector	AF-44067 [dB/m]	GL-3M [dB]	dB(uVolts/meter)	FCC Part 15 Subpart C 15.209	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
665.0372	15.44	QP	20.1	1.9	37.44	46	-8.56	360	101	Vert
QP - Quasi-Peak detector										

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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

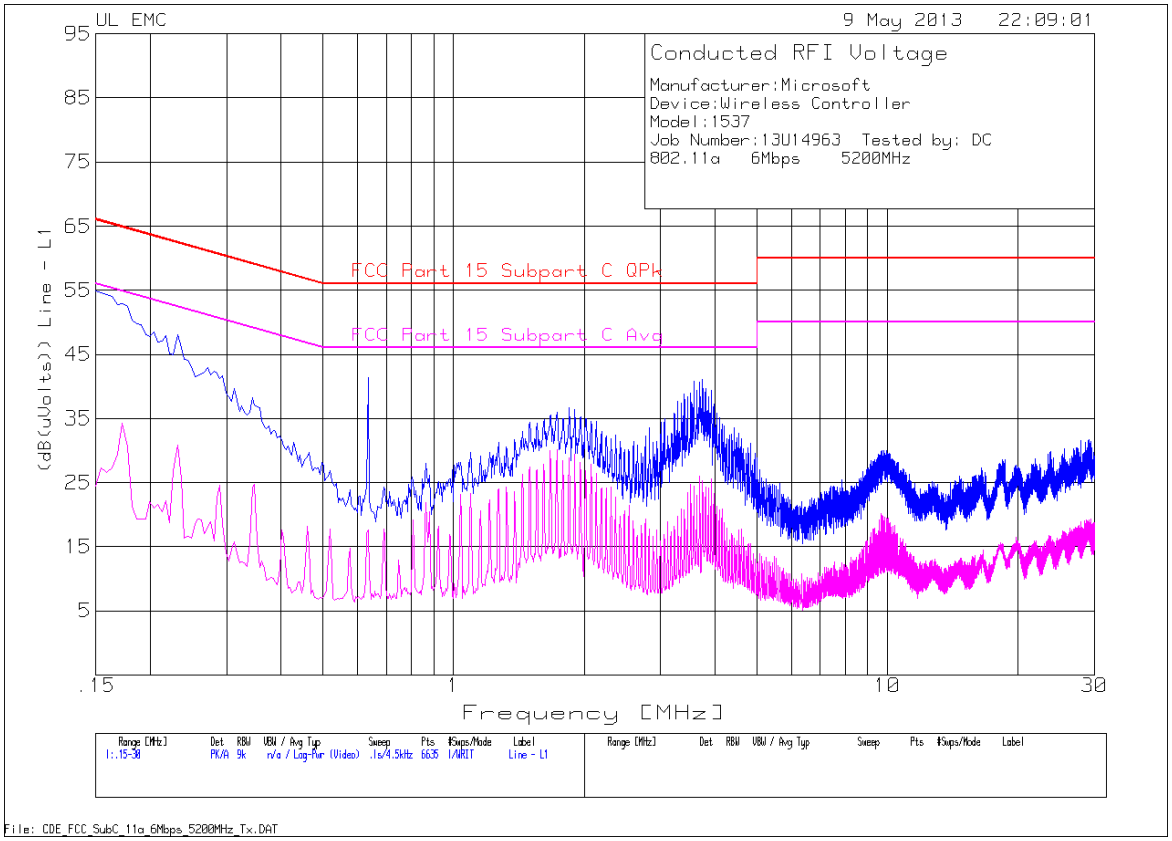
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

6 WORST EMISSIONS

Manufacturer:Microsoft								
Device:Wireless Controller								
Model:1537								
Job Number:13U14963 Tested by: DC								
802.11a 6Mbps 5200MHz								
Line - L1 .15 - 30MHz								
Test Frequency	Meter Reading	Detector	5A636 L1 [dB]	(dB(uVolts))	FCC Part 15 Subpart C QPk	Margin (dB)	FCC Part 15 Subpart C Avg	Margin (dB)
0.15	44.92	PK	10	54.92	66	-11.08	56	-1.08
0.15	14.48	Av	10	24.48	66	-41.52	56	-31.52
0.1725	42.89	PK	10	52.89	64.84	-11.95	54.84	-1.95
0.1725	24.24	Av	10	34.24	64.84	-30.6	54.84	-20.6
0.231	38.05	PK	10	48.05	62.41	-14.36	52.41	-4.36
0.231	20.87	Av	10	30.87	62.41	-31.54	52.41	-21.54
0.636	31.33	PK	10	41.33	56	-14.67	46	-4.67
0.636	7.64	Av	10	17.64	56	-38.36	46	-28.36
1.8465	26.59	PK	10.1	36.69	56	-19.31	46	-9.31
1.8465	18.77	Av	10.1	28.87	56	-27.13	46	-17.13
3.75	30.93	PK	10.1	41.03	56	-14.97	46	-4.97
3.75	15.23	Av	10.1	25.33	56	-30.67	46	-20.67
Neutral .15 - 30MHz								
Test Frequency	Meter Reading	Detector	5A636 L4Neut [dB]	(dB(uVolts))	FCC Part 15 Subpart C QPk	Margin (dB)	FCC Part 15 Subpart C Avg	Margin (dB)
0.1635	45.05	PK	10	55.05	65.28	-10.23	55.28	-0.23
0.1635	17.57	Av	10	27.57	65.28	-37.71	55.28	-27.71
0.2085	39.25	PK	10	49.25	63.26	-14.01	53.26	-4.01
0.2085	11.01	Av	10	21.01	63.26	-42.25	53.26	-32.25
0.33	31.67	PK	10	41.67	59.45	-17.78	49.45	-7.78
0.33	4.01	Av	10	14.01	59.45	-45.44	49.45	-35.44
0.5775	21.6	PK	10.1	31.7	56	-24.3	46	-14.3
0.5775	15.99	Av	10.1	26.09	56	-29.91	46	-19.91
1.734	26.06	PK	10.1	36.16	56	-19.84	46	-9.84
1.734	17.03	Av	10.1	27.13	56	-28.87	46	-18.87
3.7005	33.02	PK	10.2	43.22	56	-12.78	46	-2.78
3.7005	14.46	Av	10.2	24.66	56	-31.34	46	-21.34
PK - Peak detector								
Av - Average detector								

LINE 1 RESULTS



LINE 2 RESULTS