

# FCC CFR47 PART 15 SUBPART E INDUSTRY CANADA RSS-210 ISSUE 7 CLASS II PERMISSIVE CHANGE TEST REPORT

#### **FOR**

# INTEL WI-FI LINK 5100 SERIES INSTALLED INSIDE HP TABLET COMPUTER MODEL: HSTNN-W47C

FCC Model: 512AN\_MMW

IC Model: 512ANMU

FCC ID: PD9512ANMU IC: 1000M-9512ANMU

REPORT NUMBER: 07U11778-2A

ISSUE DATE: July 2, 2008

Prepared for

INTEL CORPORATION
2111 NE 25TH AVENUE
HILLSBORO, OREGON 97124, USA

Prepared by

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# **Revision History**

Rev.	Issue Date	Revisions	Revised By
	5-16-08	Initial Issue	Sunny Shih
Α	7-2-08	Revised host device description and model name	Sunny Shih

# DATE: July 2, 2008 IC: 1000M-9512ANMU

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** INTEL CORPORATION

2111 N. E. 25<sup>TH</sup> AVE

HILLSBORO, OR. 97124, USA

**EUT DESCRIPTION:** INTEL WI-FI LINK 5100 SERIES INSTALLED INSIDE HP TABLET

COMPUTER MODEL: HSTNN-W47C

FCC MODEL: 512AN MMW

IC MODEL: 512ANMU

SERIAL NUMBER: MAC 0016EA01D95A

**DATE TESTED:** May 01 to 15, 2008

#### **APPLICABLE STANDARDS**

STANDARD TEST RESULTS

CFR 47 Part 15 Subpart E

RSS-210 Issue 7 Annex 9 and 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 expressions of Pass/Fail in this report are opinions expressed by CCS based on interpretations of the test results. 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 Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By: Tested By:

HSIN FU SHIH VIEN TRAN EMC SUPERVISOR EMC ENGINEER

COMPLIANCE CERTIFICATION SERVICES COMPLIANCE CERTIFICATION SERVICES

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Hsin-Fa Shih

Pass

#### 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, and FCC MO&O 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 <a href="http://www.ccsemc.com">http://www.ccsemc.com</a>.

#### 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. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY		
Power Line Conducted Emission	+/- 2.3 dB		
Radiated Emission	+/- 3.4 dB		

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

# 5. EQUIPMENT UNDER TEST

# 5.1. DESCRIPTION OF EUT

The EUT is an INTEL WI-FI LINK 5100 SERIES INSTALLED INSIDE HP TABLET COMPUTER MODEL: HSTNN-W47C

The radio module is manufactured by Intel and model number is 512AN-MMW/512ANMU.

# 5.2. DESCRIPTION OF CLASS II CHANGE

The major changes filed under this application are:

Adding HP Tablet computer, model HSTNN-W47C.

Only the Radiated Emission and AC mains line conduction tests are performed.

# 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The following antennas were added:

<u>Antenna Supplier</u> <u>Type</u> <u>Model number</u>

Wistron NeWeb Corp PIFA Main Antenna: 81.EGG15.003 (WNC) Aux Antenna: 81.EGG15.004

#### 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was CRTU version 5.0.51.000 The EUT driver installed during testing was Intel version 12.0.0.54

## 5.5. WORST-CASE CONFIGURATION AND MODE

Mobile (Normal Notebook) and Portable (Tablet PC) configurations have been investigated. The worst case is to evaluate at Mobile configuration.

The worst-case data rate for each mode is determined to be as follows, based on preliminary tests of the chipset utilized in this radio.

All final tests in the 802.11a mode were made at 6 Mb/s.

All final tests in the 802.11n HT20 mode were made at HT0.

All final tests in the 802.11n HT40 (Wide) mode were made at HT0.

For radiated emissions below 1 GHz the worst-case configuration is determined to be the mode and channel with the highest output power.

## 5.6. DESCRIPTION OF TEST SETUP

#### **SUPPORT EQUIPMENT**

PERIPHERAL SUPPORT EQUIPMENT LIST					
Description	Manufacturer	Model	Serial Number	FCC ID	
Laptop	HP	Compaq 2730P	2CE8080PBC	DoC	
AC Adapter	HP	PPP0009L	WACLNX2LLVL04J	DoC	

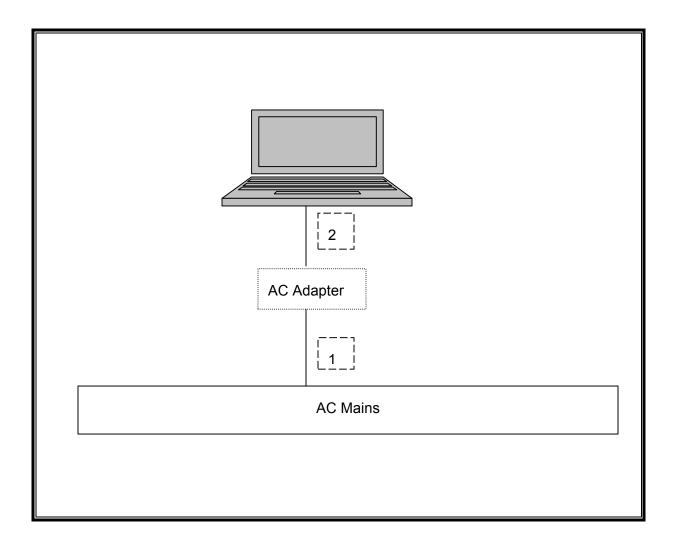
#### **I/O CABLES**

	I/O CABLE LIST					
Cable No.	Port	# of Identica Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Unshielded	1.5 m	N/A
2	DC	1	DC	Unshielded	1.5 m	N/A

#### **TEST SETUP**

The EUT is installed in a host laptop computer 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
EMI Receiver, 2.9 GHz	Agilent / HP	8542E	C00957	02/06/07	06/12/08
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	C00958	02/06/07	06/12/08
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	05/09/08	05/09/09
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/25/07	10/25/08
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/25/07	10/25/08
EMI Test Receiver, 30 MHz	R&S	ESHS 20	N02396	10/16/07	01/27/09
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	05/02/06	08/07/08
Antenna, Horn, 18 GHz	ETS	3117	C01006	04/15/08	4/15/09
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	08/03/07	8/3/08
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	10/13/07	10/13/08
Peak Power Meter	Agilent / HP	E4416A	C00963	02/14/07	12/02/08
Peak / Average Power Sensor	Agilent	E9327A	C00964	02/14/07	12/02/08
Antenna, Horn 26 ~ 40 GHz	ARA	MWH-2640/B	C01009	04/13/08	04/13/09
7.6 GHz High Pass Filter	Micro Tronics	HPM13350	N/A	N/A	N/A
5.75 - 5.8 Reject Filter	Micro Tronics	BRC13192	N/A	N/A	N/A

#### 7. RADIATED TEST RESULTS

# 7.1. 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	Field Strength Limit	Field Strength Limit	
(MHz)	(uV/m) at 3 m	(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.

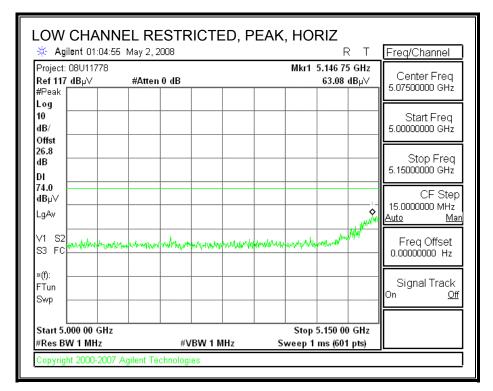
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 5 GHz band.

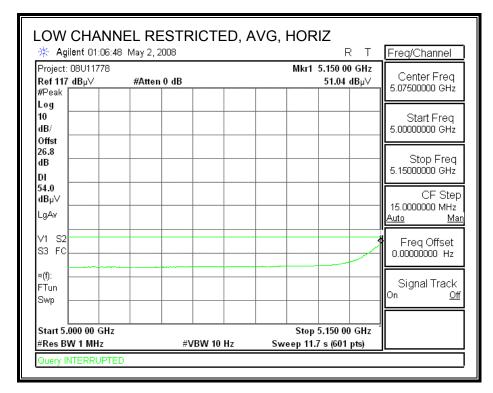
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

#### TRANSMITTER ABOVE 1 GHZ FOR THE BAND 5.15-5.25 GHZ 7.2.

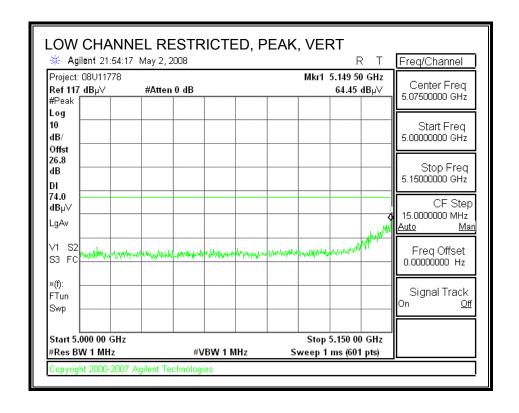
#### 7.2.1. 802.11a MODE

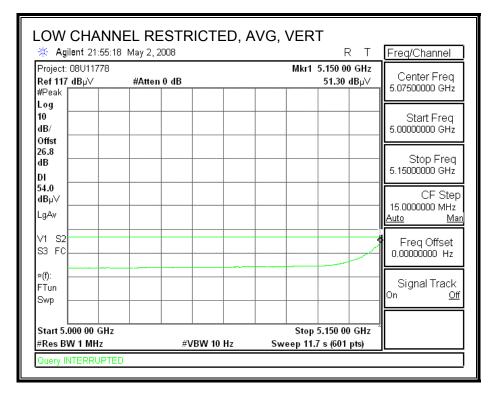
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





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

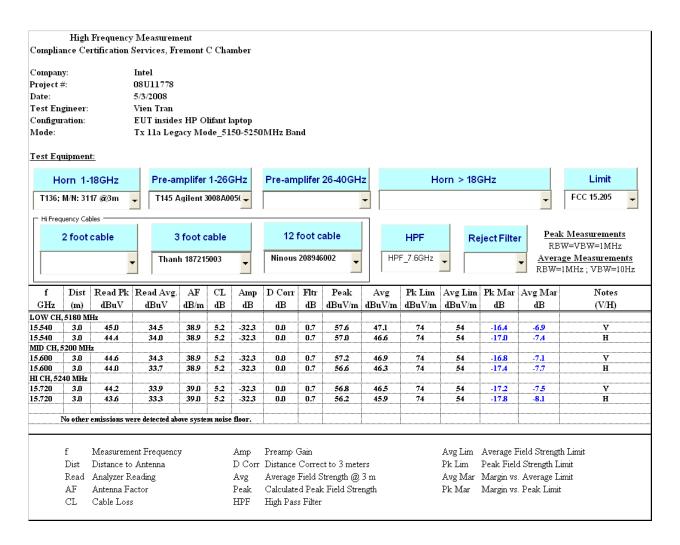




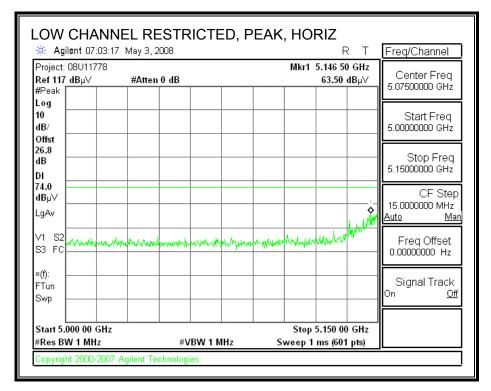
# **AUTHORIZED BANDEDGE (HIGH CHANNEL)**

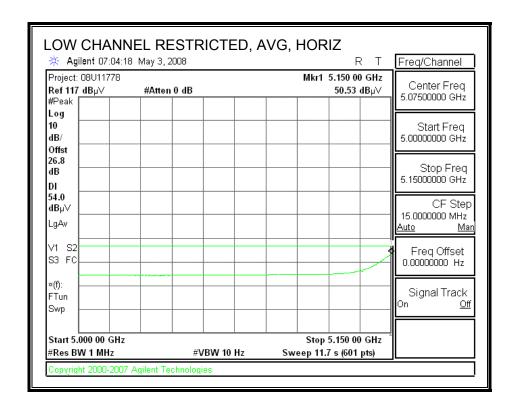
Please see high channels 5320 MHz (5250-5350 MHz band).

#### **HARMONICS AND SPURIOUS EMISSIONS**

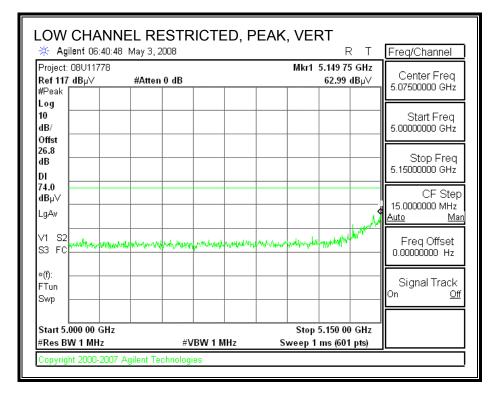


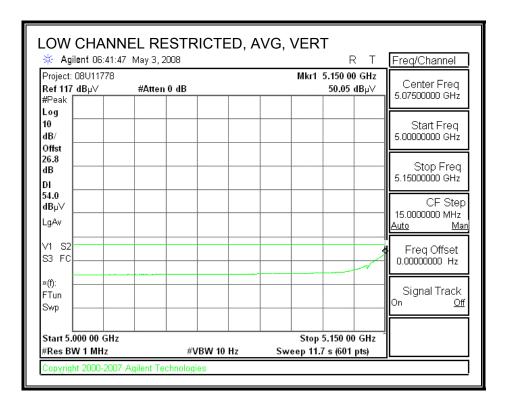
7.2.2. 802.11n HT20 MODE
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





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

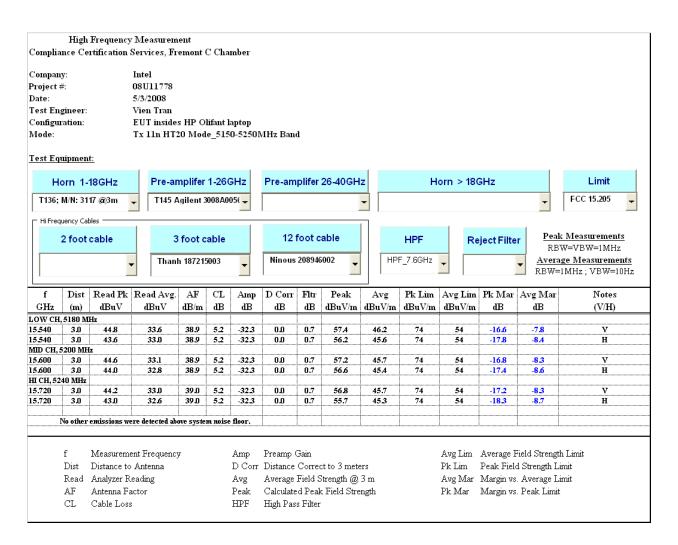




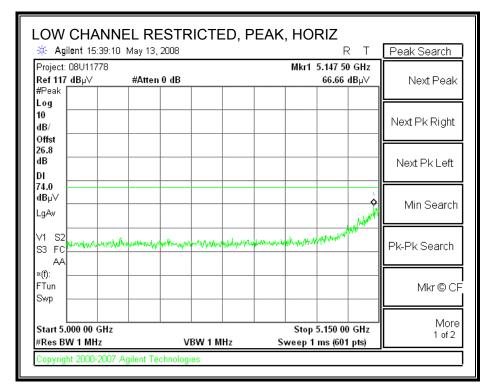
# **AUTHORIZED BANDEDGE (HIGH CHANNEL)**

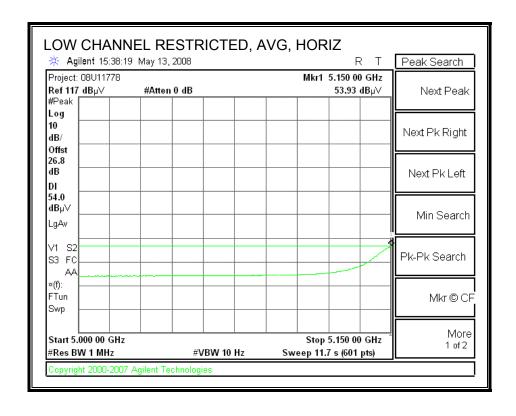
Please see high channels 5320 MHz (5250-5350 MHz band).

#### **HARMONICS AND SPURIOUS EMISSIONS**

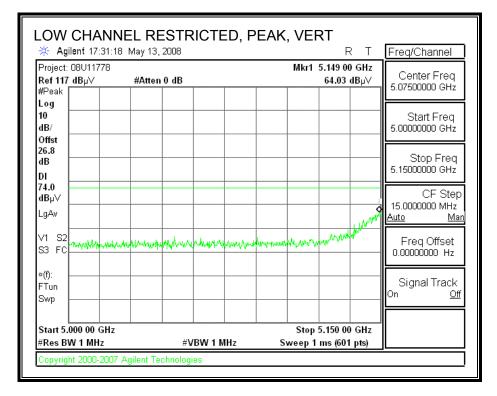


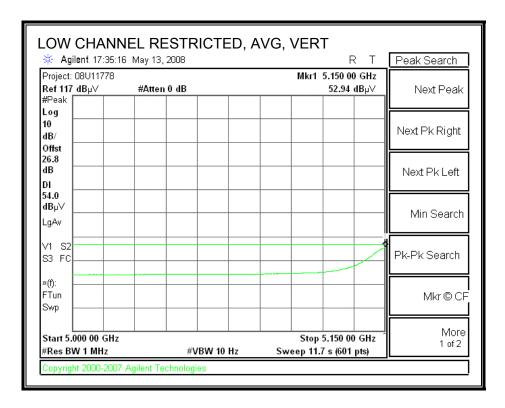
7.2.3. 802.11n HT40 MODE
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





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

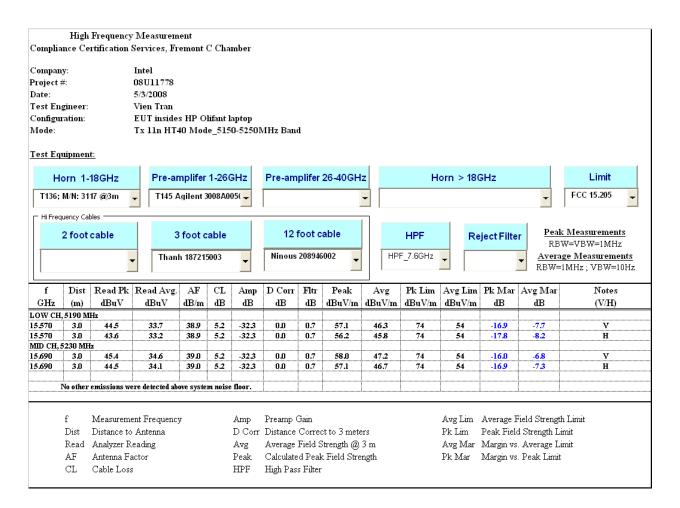




# **AUTHORIZED BANDEDGE (HIGH CHANNEL)**

Please see high channels 5310 MHz (5250-5350 MHz band).

#### **HARMONICS AND SPURIOUS EMISSIONS**



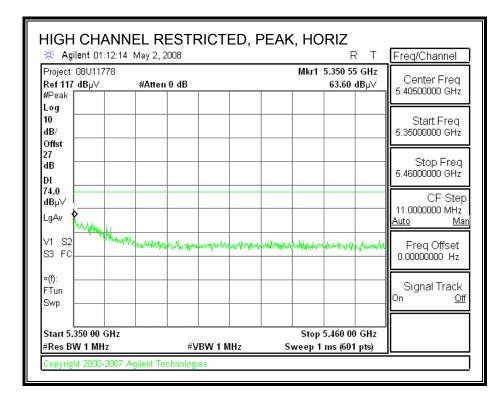
# 7.3. TRANSMITTER ABOVE 1 GHZ FOR THE BAND 5.25–5.35 GHZ

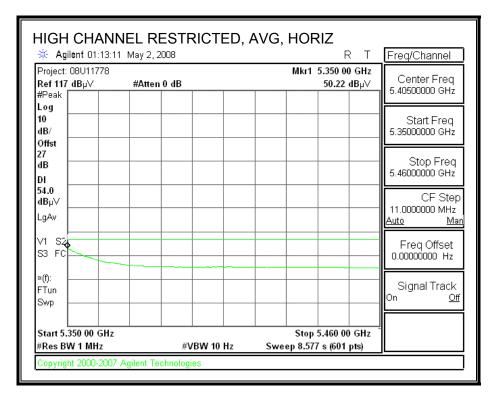
## 7.3.1. 802.11a MODE

# **AUTHORIZED BANDEDGE (LOW CHANNEL)**

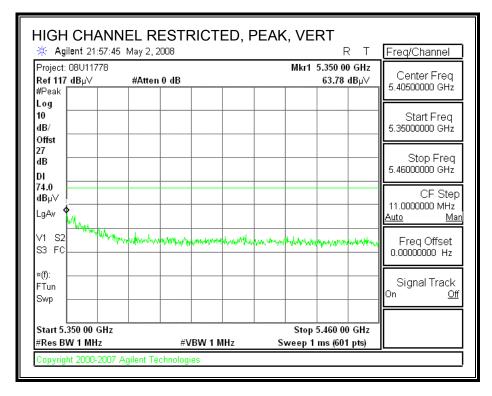
Please see low channels 5180 MHz (5150-5250 MHz band).

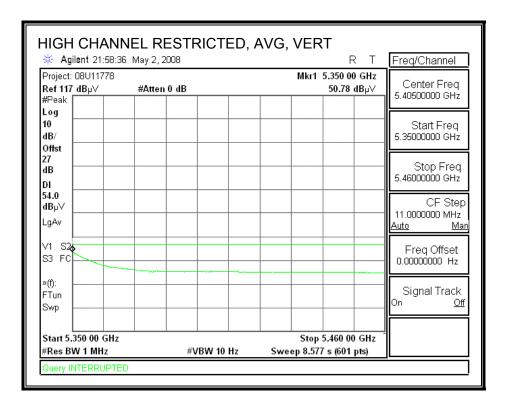
#### RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



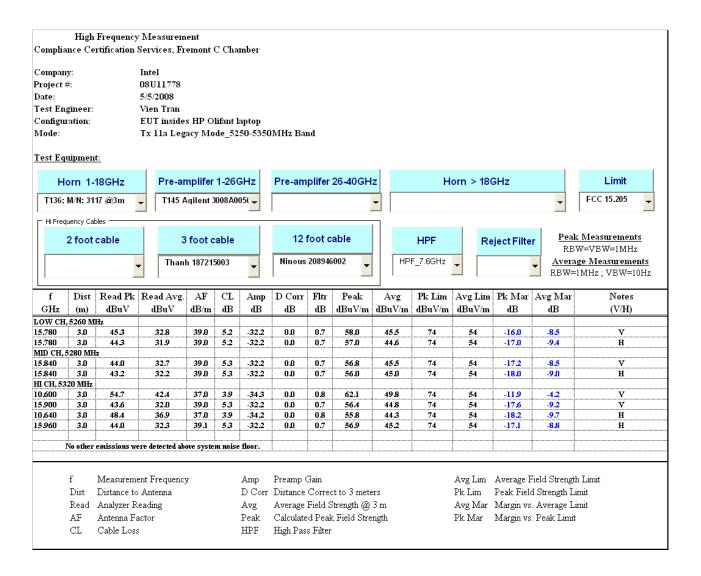


# **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





#### **HARMONICS AND SPURIOUS EMISSIONS**

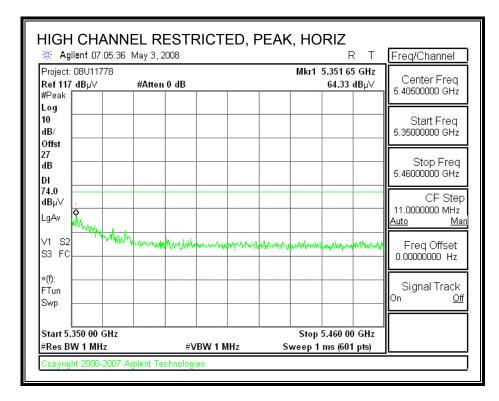


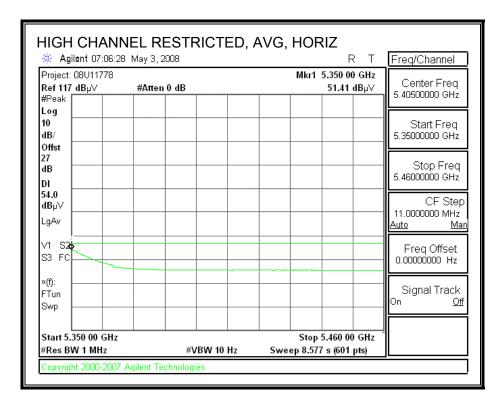
## 7.3.2. 802.11n HT20 MODE

# **AUTHORIZED BANDEDGE (LOW CHANNEL)**

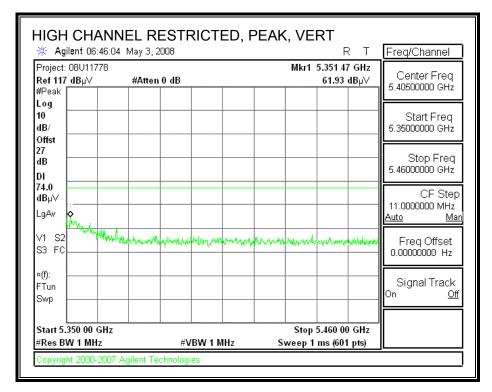
Please see low channels 5180 MHz (5150-5250 MHz band).

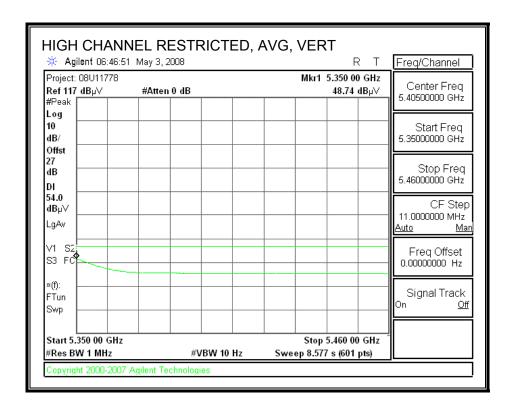
#### RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



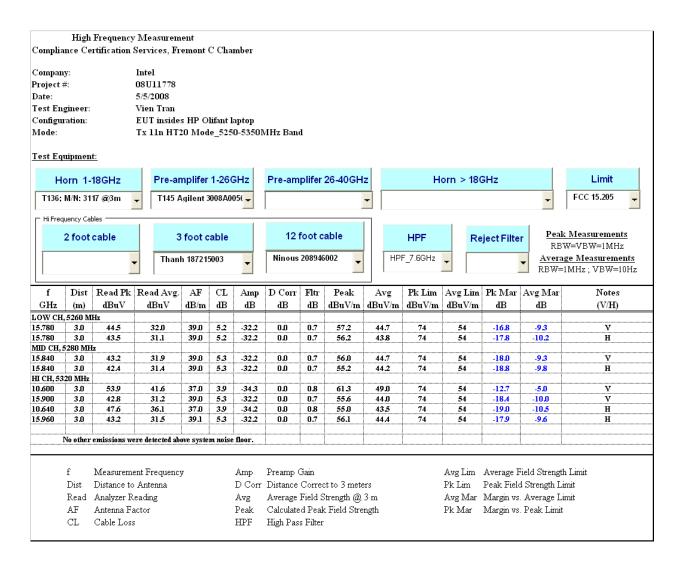


# **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





#### **HARMONICS AND SPURIOUS EMISSIONS**

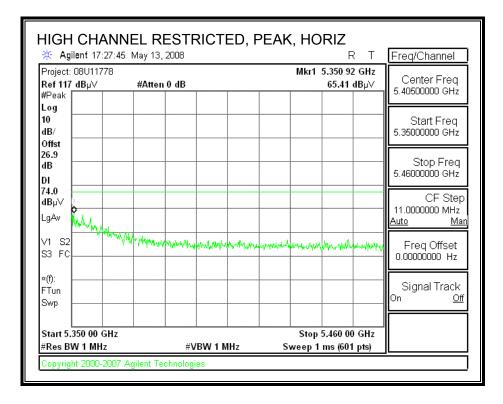


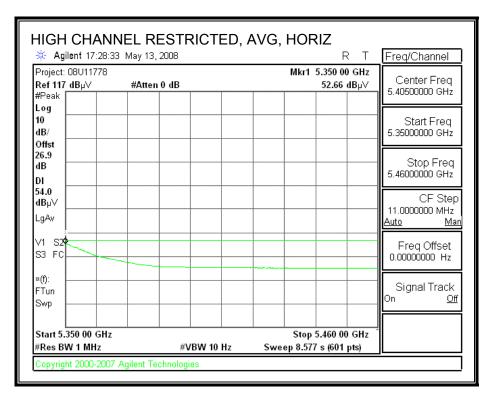
## 7.3.3. 802.11n HT40 MODE

# **AUTHORIZED BANDEDGE (LOW CHANNEL)**

Please see low channels 5190 MHz (5150-5250 MHz band).

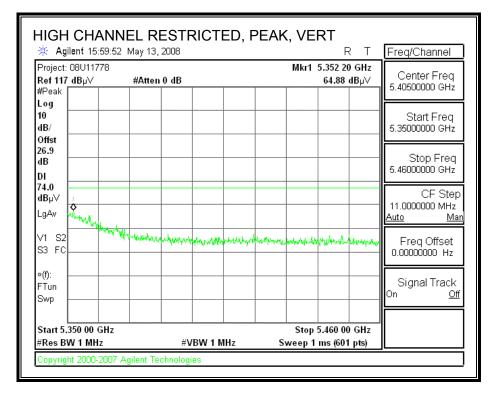
#### RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

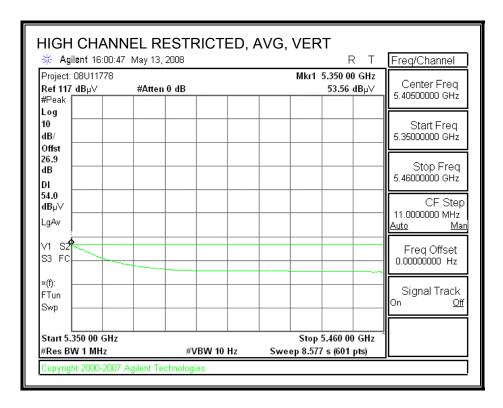




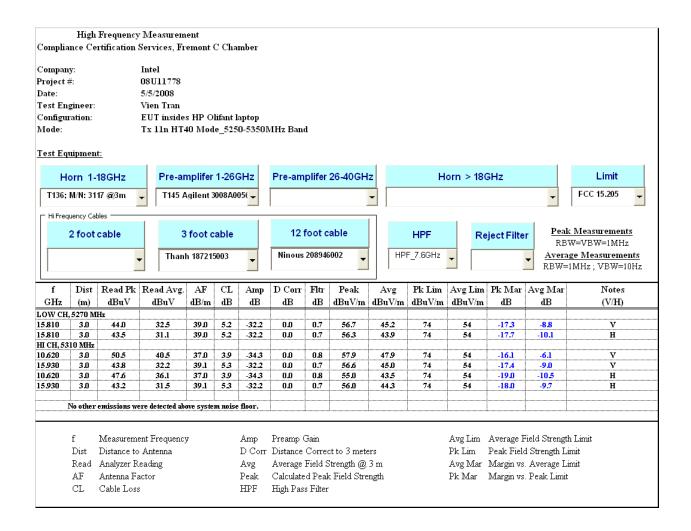
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# **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





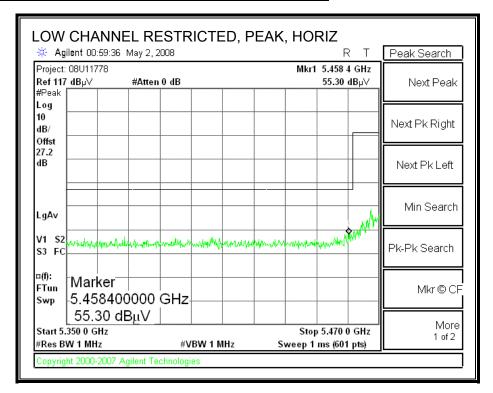
#### **HARMONICS AND SPURIOUS EMISSIONS**

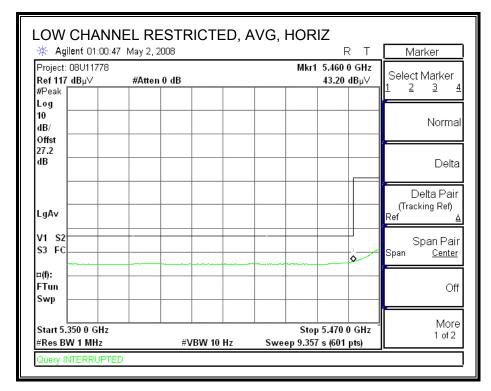


# 7.4. TRANSMITTER ABOVE 1 GHZ FOR 5.47-5.725 GHZ BAND

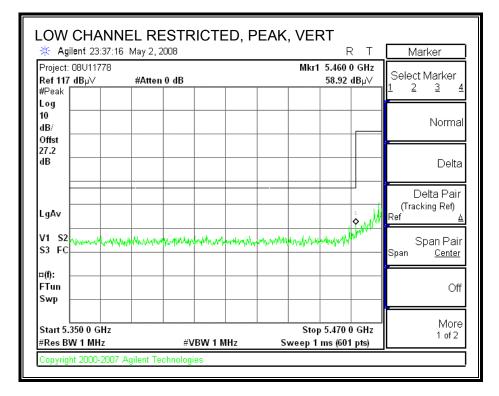
#### 7.4.1. 802.11a MODE

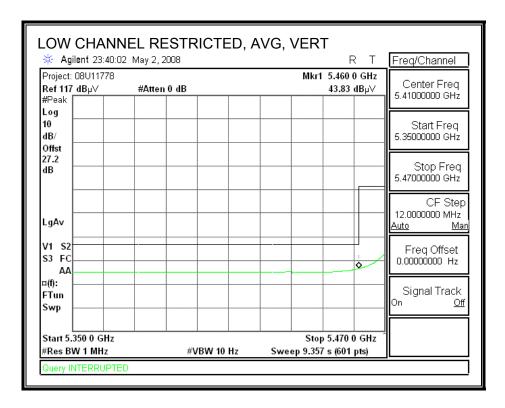
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



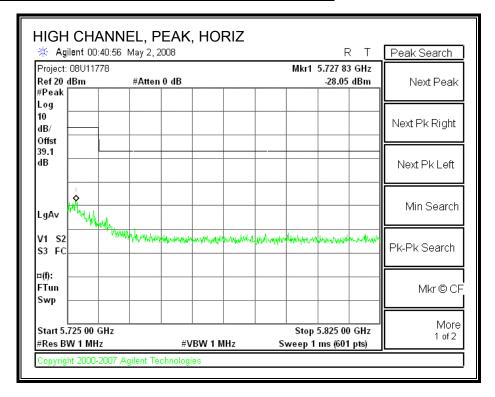


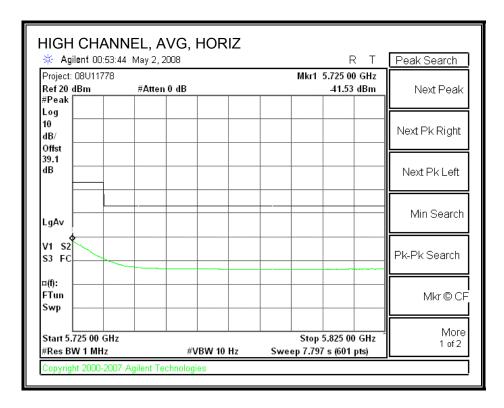
## RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



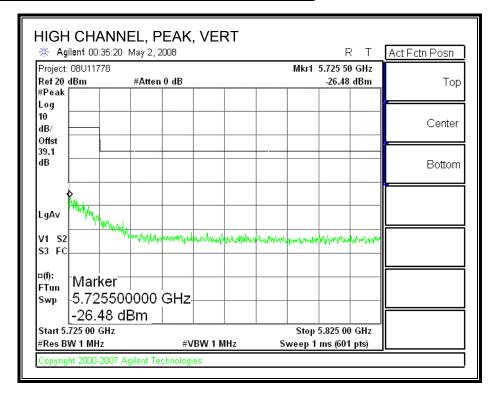


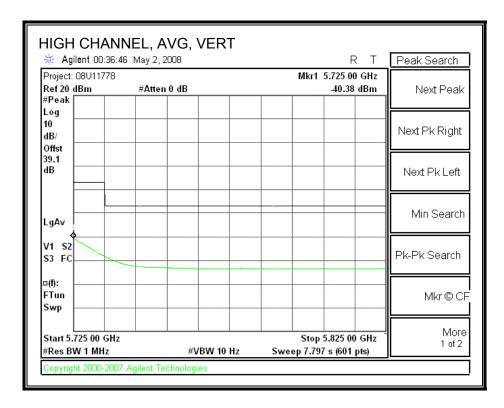
#### **AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



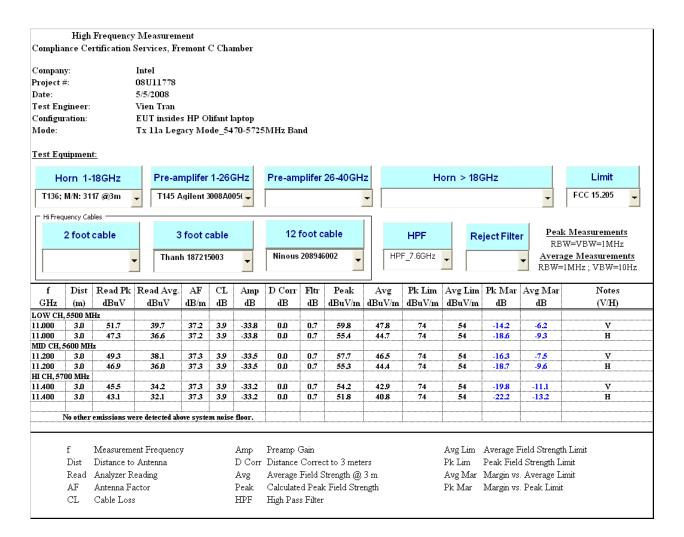


#### **AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)**

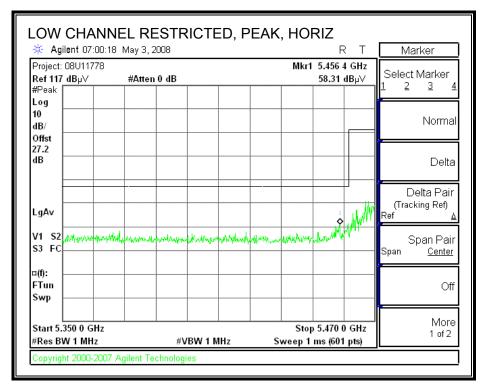


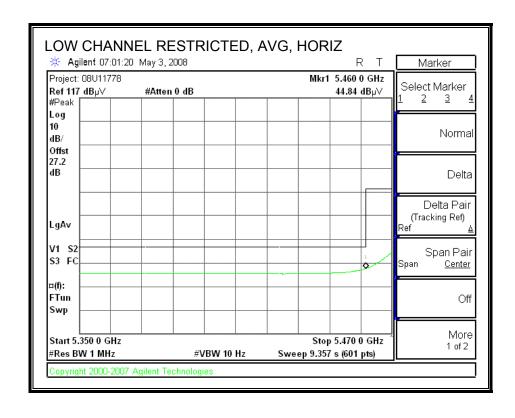


## **HARMONICS AND SPURIOUS EMISSIONS**

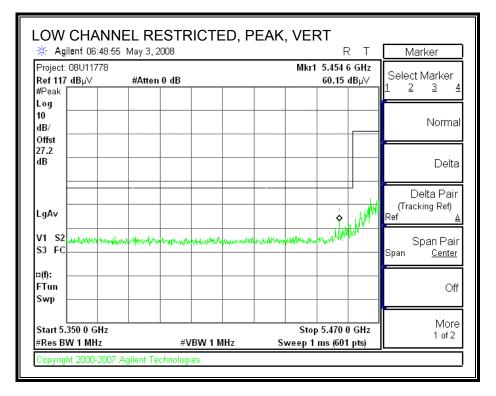


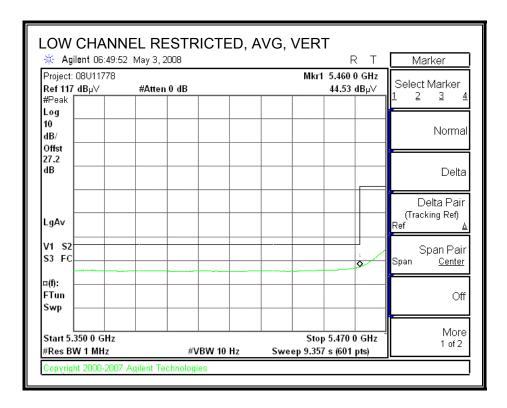
7.4.2. 802.11n HT20 MODE RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



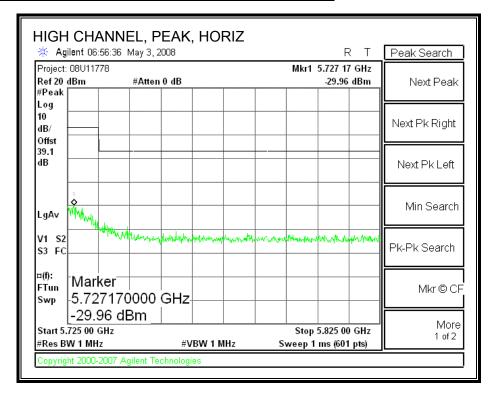


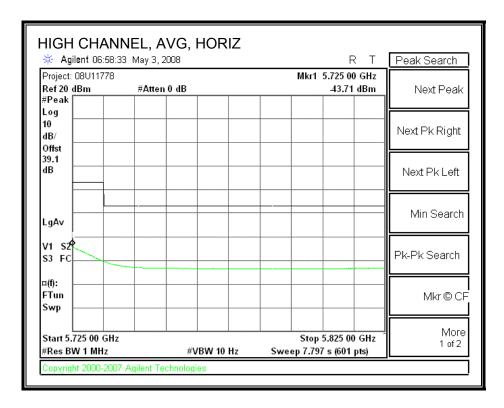
## RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



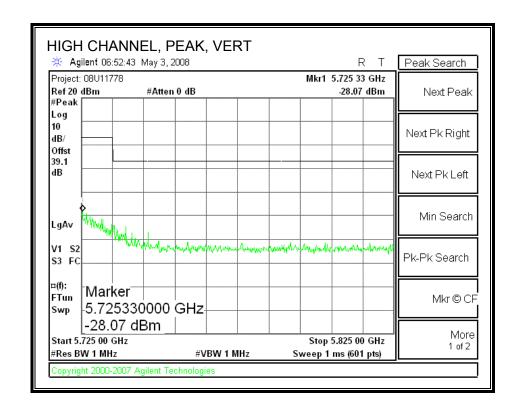


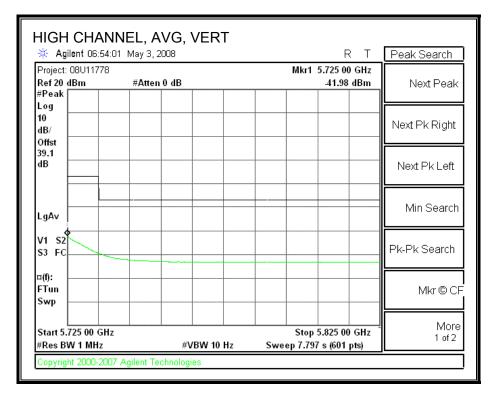
#### **AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



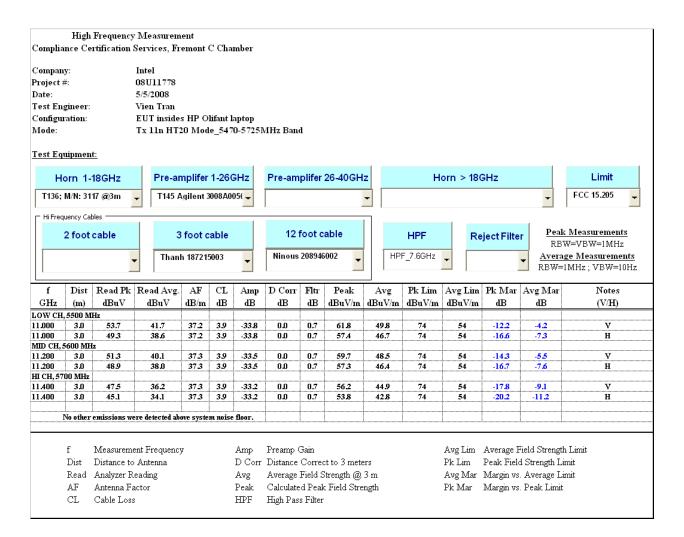


#### **AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)**

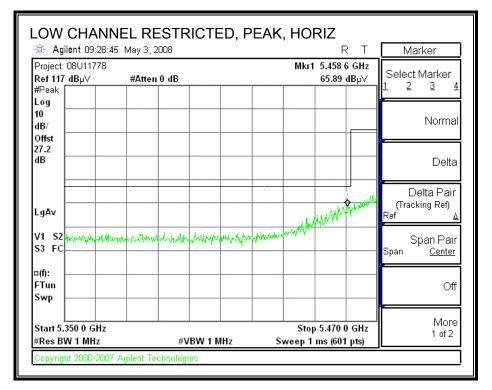


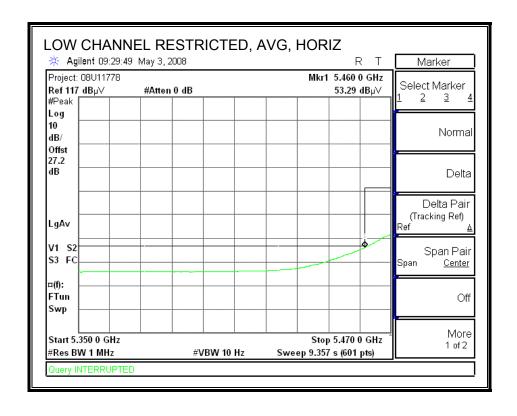


## **HARMONICS AND SPURIOUS EMISSIONS**

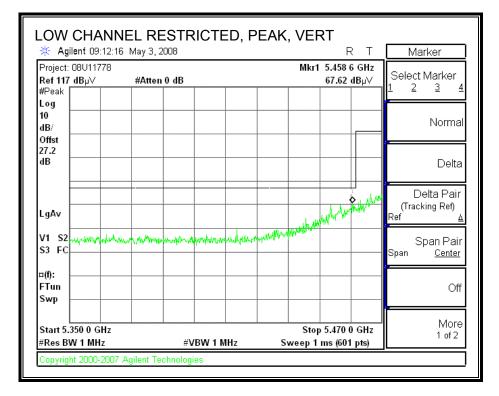


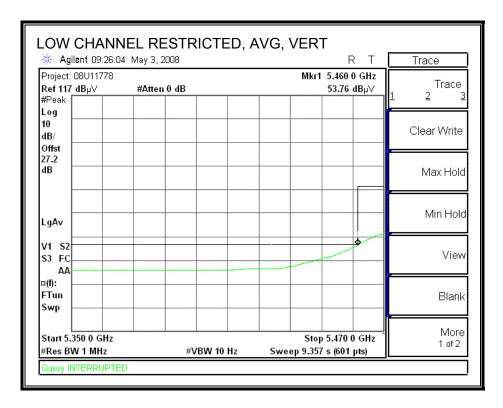
7.4.3. 802.11n HT40 MODE RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



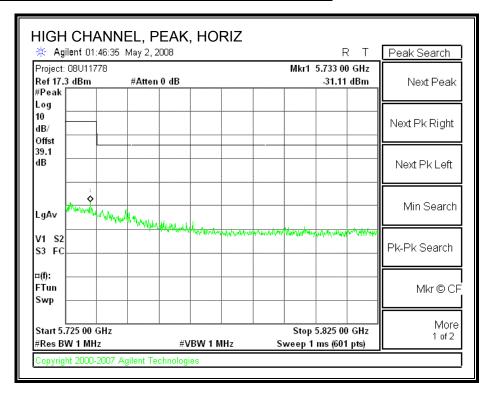


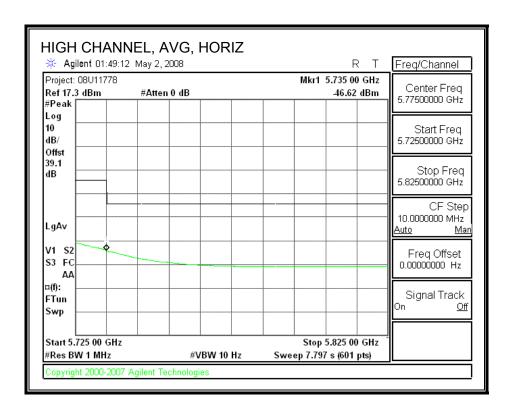
## RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



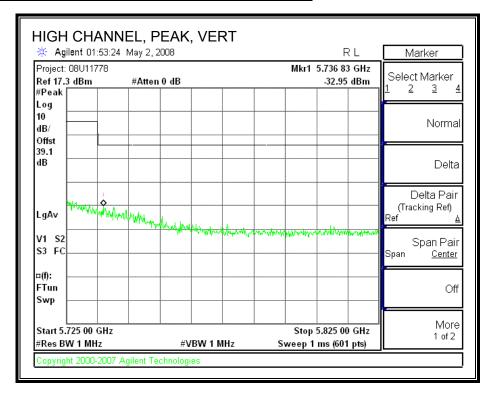


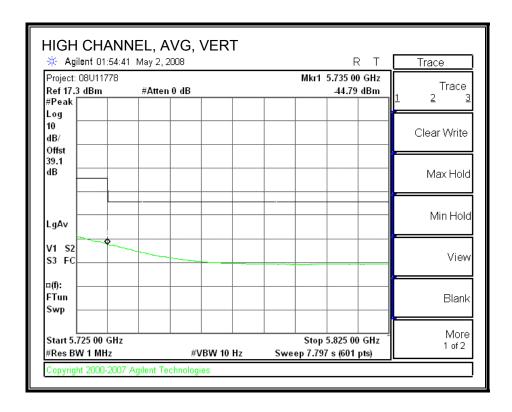
#### **AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



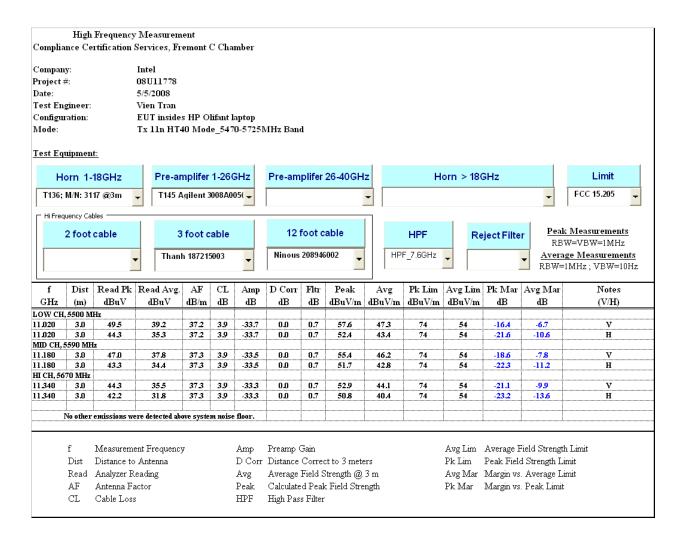


#### **AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)**

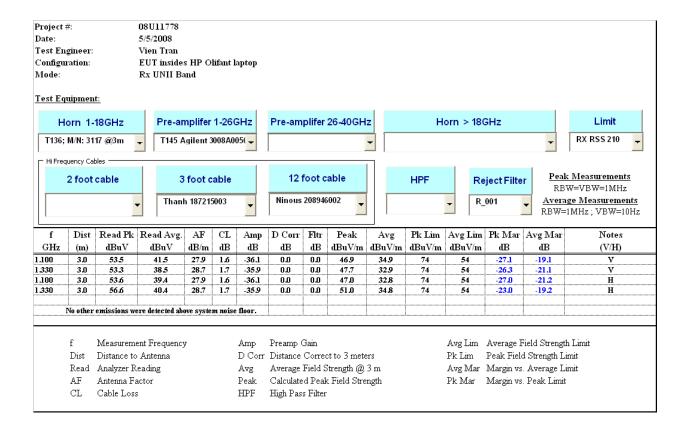




## **HARMONICS AND SPURIOUS EMISSIONS**



## 7.5. RECEIVER ABOVE 1 GHZ



## 7.5.1. WORST-CASE BELOW 1 GHz

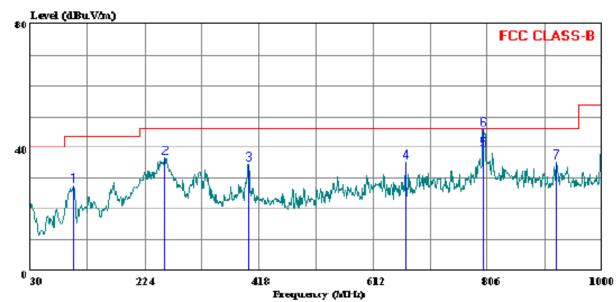
## SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



Compliance Certification Service:

47173 Benicia Street Fremont, CA 94538 Tel: (510) 771-1000 Fax: (510) 661-0888

Data#: 15 File#: 08u11778.EMI Date: 05-06-2008 Time: 10:38:18



Trace: 12 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL

Test Operator:: Devin Chang Project #: : 08U11778 Company: : Intel

Configuration:: EUT/Support Equipment

Mode: : 5GHz Worst case Target: : FCC Class B

Page: 1
Read Limit Over

	Freq	Level	Factor	Level	Line	Limit	Remark
	MHz	dBuV	——dB	dBuV/m	$\overline{\text{dBuV/m}}$	dB	
1 2	103.720 258.920		-19.78 -17.39	27.56 36.77		-15.94 -9.23	
3	400.540		-13.46	34.54	46.00	-11.46	Peak
4 5	666.320 798.240		-8.94 -6.87	35.22 39.56	-	-10.78 -6.44	
6 *	798.240 923.370	52.92	-6.87 -4.56	46.05 35.27		0.05 -10.73	

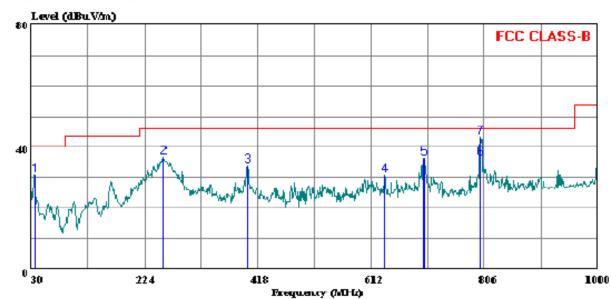
## SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



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Fremont, CA 94538 Tel: (510) 771-1000 Fax: (510) 661-0888

Data#: 19 File#: 08u11778.EMI Date: 05-06-2008 Time: 10:50:29



Trace: 16 Ref Trace:

Condition: FCC CLASS-B VERTICAL Test Operator:: Devin Chang Project #: : 08U11778 Company: : Intel

Configuration:: EUT/Support Equipment

Mode : : 5GHz Worst case Target: : FCC Class B

Page: 1

	Freq	Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
3 4 5	35.820 256.010 401.510 636.250 702.210 799.210	54.33 47.17 40.17	-12.14 -17.53 -13.39 -9.37 -8.41 -6.87	33.78 30.80	46.00 46.00 46.00 46.00	-9.29 -9.20 -12.22 -15.20 -9.58 -9.57	Peak Peak Peak Peak

# 8. 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**

	CONDUCTED EMISSIONS DATA (115VAC 60Hz)								
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV(dB)	L1/L2
0.19	49.33		37.32	0.00	63.95	53.95	-14.62	-16.63	L1
0.52	41.11		36.46	0.00	56.00	46.00	-14.89	-9.54	L1
18.33	51.50		35.70	0.00	60.00	50.00	-8.50	-14.30	L1
0.19	49.63		37.04	0.00	63.95	53.95	-14.32	-16.91	L2
0.52	41.06		36.33	0.00	56.00	46.00	-14.94	-9.67	L2
18.33	51.29		35.62	0.00	60.00	50.00	-8.71	-14.38	L2
6 Worst l	 Data 								

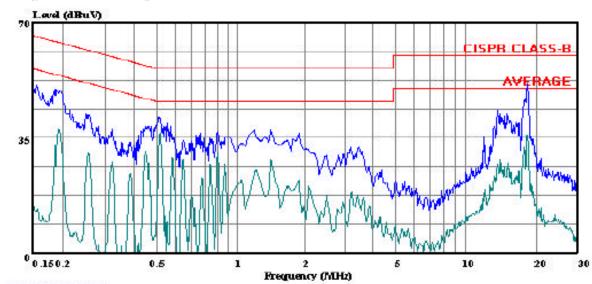
### **LINE 1 RESULTS**



Compliance Certification Services

47173 Benicia Street Fremont, CA 94538 Tel: (510) 771-1000 Fax: (510) 661-0888

Data#: 7 File#: 08U11778 LC.EMI Date: 05-06-2008 Time: 11:02:19



(Line Conduction)

Trace: 5 Ref Trace:

Condition: CISPR CLASS-B Test Operator:: Vien Tran Project #: : 08U11778 Company: : Intel

Configuration:: Intel WiFi Link 5100 installed inside

: HP Olifant portable tablet

Mode: : Tx Worst-case Target: : FCC Class B Voltage: : 115VAC / 60Hz

: Line 1: Peak (Blue), Average (Green)

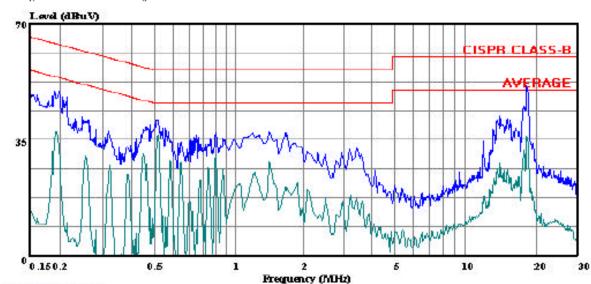
### **LINE 2 RESULTS**



Compliance Certification Services

47173 Benicia Street Fremont, CA 94538 Tel: (510) 771-1000 Fax: (510) 661-0888

Data#: 14 File#: 08U11778 LC.EMI Date: 05-06-2008 Time: 11:11:59



(Line Conduction)

Trace: 12 Ref Trace:

Condition: CISPR CLASS-B Test Operator:: Vien Tran Project #: : 08U11778 Company: : Intel

Configuration:: Intel WiFi Link 5100 installed inside

: HP Olifant portable tablet

Mode: : Tx Worst-case Target: : FCC Class B Voltage: : 115VAC / 60Hz

: Line 2: Peak (Blue), Average (Green)