



**FCC CFR47 PART 27 SUBPART M
CLASS II PERMISSIVE CHANGE**

CERTIFICATION TEST REPORT

FOR

**INTEL WIFI/WIMAX LINK 5150 SERIES
(TESTED INSIDE OF LENOVO IDEAPAD S10-2)**

FCC MODEL: 512ANXMMW

FCC ID: PD9512ANXMU

REPORT NUMBER: 09U12587-1

ISSUE DATE: JUNE 03, 2009

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	06/03/09	Initial Issue	T. Chan

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	5
4.2. <i>SAMPLE CALCULATION</i>	5
4.3. <i>MEASUREMENT UNCERTAINTY</i>	5
5. EQUIPMENT UNDER TEST	6
5.1. <i>DESCRIPTION OF EUT</i>	6
5.2. <i>MAXIMUM OUTPUT POWER</i>	6
5.3. <i>DESCRIPTION OF CLASS II PERMISSIVE CHANGE</i>	6
5.4. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	6
5.5. <i>SOFTWARE AND FIRMWARE</i>	6
5.6. <i>WORST-CASE CONFIGURATION AND MODE</i>	6
5.7. <i>DESCRIPTION OF TEST SETUP</i>	7
6. TEST AND MEASUREMENT EQUIPMENT	9
7. LIMITS AND RESULTS	10
7.1. <i>OUTPUT POWER VERIFICATION</i>	10
7.2. <i>RADIATED OUTPUT POWER</i>	21
7.3. <i>FIELD STRENGTH OF SPURIOUS RADIATION</i>	24
8. AC POWER LINE CONDUCTED EMISSIONS	28
9. SETUP PHOTOS	31

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: INTEL WIFI/WIMAX LINK 5150

FCC MODEL: 512ANXMMW

SERIAL NUMBER: PK292009Q10

DATE TESTED: MAY 21-26 AND JUNE 02, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 27 SUBPART M	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. 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:



THU CHAN
EMC MANAGER
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EMC ENGINEER
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA/EIA 603C (2004), FCC CFR 47 Part 2, FCC CFR 47 Part 27M.

3. FACILITIES AND ACCREDITATION

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

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Intel WiFi/Wimax Link 5150 Series (Tested inside of LENOVO IdeaPad S10-2), a full mini PCI Express 802.11 a/b/g/draft N v. 2.0 board.

The WiFi/WiMax Link 5150 is manufactured by Intel.

5.2. MAXIMUM OUTPUT POWER

The test measurement passed within ± 0.5 dBm of the original output power.

5.3. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding Lenovo IdeaPad 5150 series.

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of -1.05dBi.

5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was WiMAX VaTU version 3.0.0.0

5.6. WORST-CASE CONFIGURATION AND MODE

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

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacture	Model	Serial Number	FCC ID
Laptop	Lenovo	Lenovo IdeaPad S10-2	NA	DoC
AC/DC Adapter	Lenovo	PA-1400-1AC	LAD36001653-X02-0923-L002T	DoC
Vector Signal Generator	Agilent	E4438C	US44271909	DoC

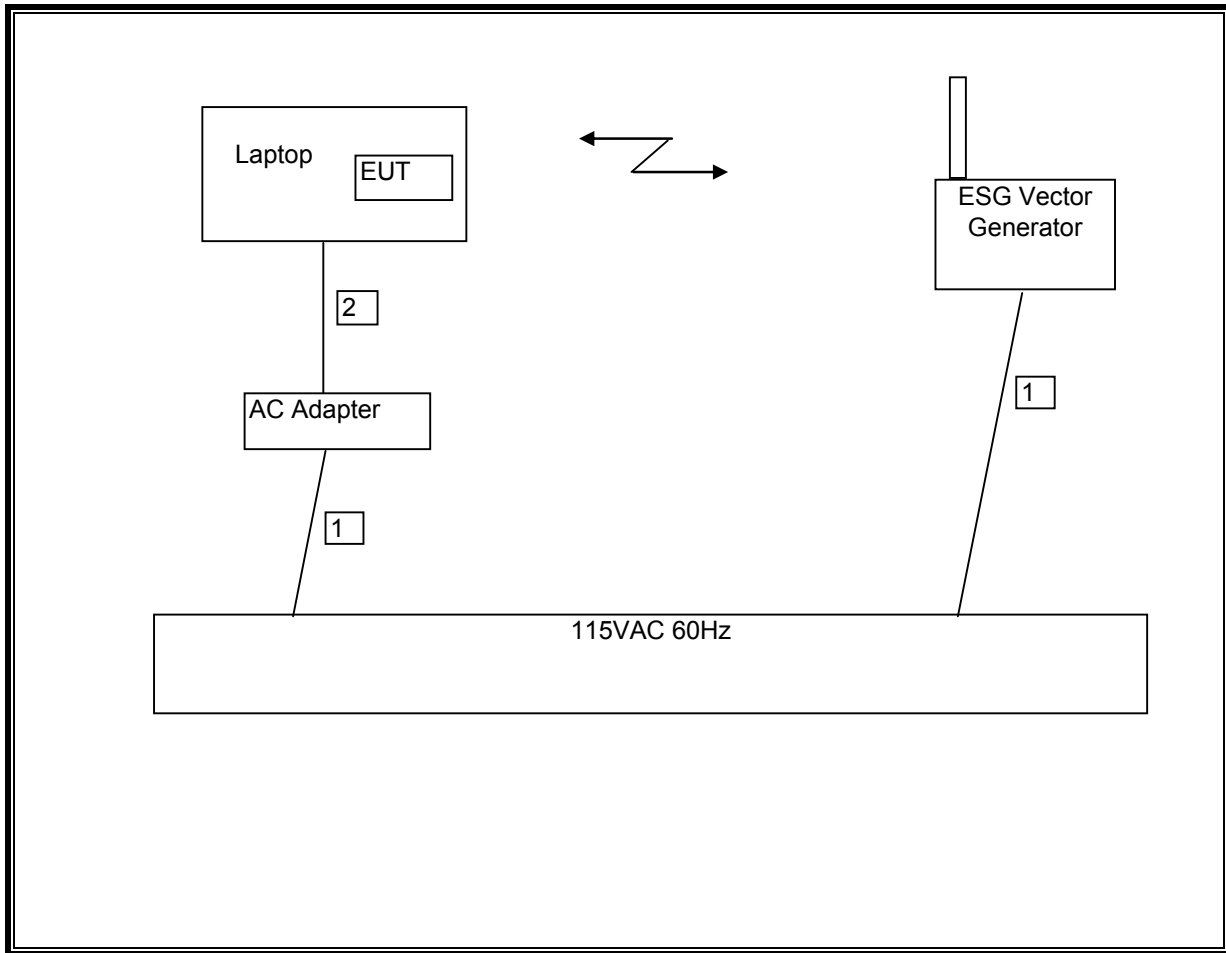
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	US 115V	Un-shielded	1.8m	NA
2	DC	1	DC	Un-shielded	1.8m	NA

TEST SETUP

The EUT is installed in a host laptop computer during the tests. The 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 Due
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	12/27/09
Antenna, Horn, 18 GHz	EMCO	3115	C00872	07/22/09
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	12/16/09
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	02/11/10
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/25/09
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/06/09
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	12/28/09
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	01/05/10
Highpass Filter, 4.0 GHz	Micro-Tronics	HPM13351	N02709	CNR
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	12/11/09
Antenna, Horn, 40 GHz	ARA	MVH-2640/B	C00981	07/29/09
ESG VECTOR SIGNAL GENERATOR	Agilent / HP	E4438C	US44271909	09/17/10

7. LIMITS AND RESULTS

7.1. OUTPUT POWER VERIFICATION

The max average conducted output power is measured for the uplink burst in the OFDM modulation and channel bandwidth. Conducted average output power were measured with the module connected to the test jig with over-the-air communication link to Vector Signal generator.

The EUT driver software installed in the host support equipment during testing was WiMAX VaTU, version: 3.0.0.0

The modes with highest output power channel were chosen for the conducted output power measurement.

10 MHz

Mode	Test Vector file name	DL:UL Ratio	Number of Control Symbol at reduced power	Number of UL Symbol + Control Symbol at Max. Burst Power
16QAM R1/2	DQ4_12_UQ16_12_10M	35:12	0	12
QPSK R1/2	DQ64_UQ4_12_21S_10M	26:21	0	21

5 MHz

Mode	Test Vector file name	DL:UL Ratio	Number of Control Symbol at reduced power	Number of UL Symbol + Control Symbol at Max. Burst Power
16QAM R3/4	DQ4_12_UQ16_34_5M	29:18	0	18
QPSK R1/2	DQ64_56_UQ4_12_5M	29:18	0	18

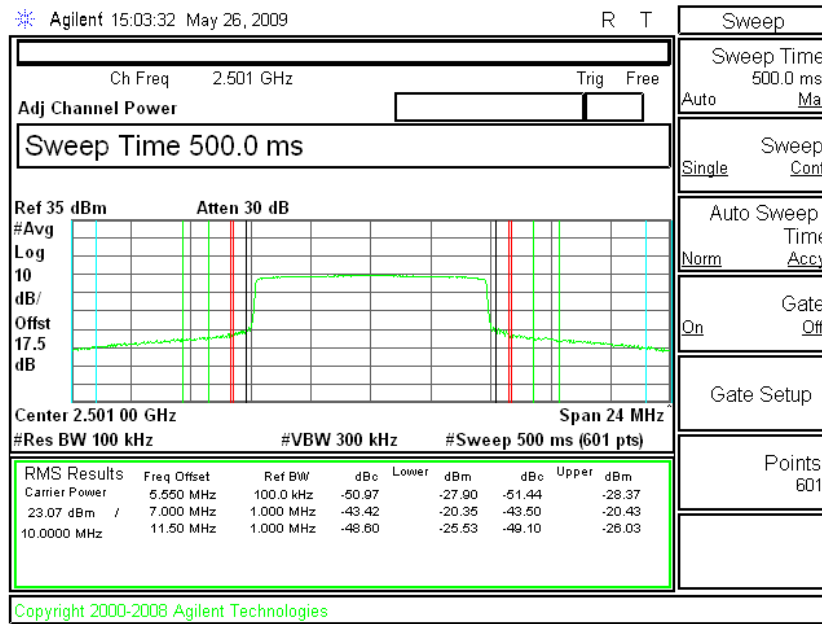
10 MHz

Mode	Test Vector file name	Ch. No	f (MHz)	Output power (dBm)	Output power (mW)
16QAM	DQ4_12_UQ16_12_10M	0	2501	23.07	202.77
		368	2593	22.62	182.81
		736	2685	22.77	189.23
QPSK	DQ64_UQ4_12_21S_10M	0	2501	23.38	217.77
		368	2593	22.65	184.08
		736	2685	22.84	192.31

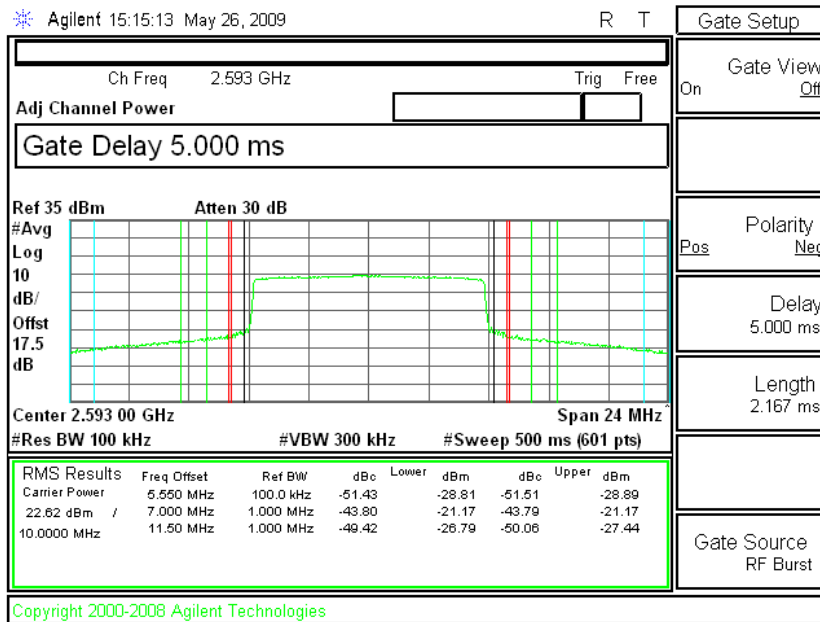
5 MHz

Mode	Test Vector file name	Ch. No	f (MHz)	Output Power (dBm)	Output Power (mW)
16QAM	DQ4_12_UQ16_34_5M	0	2498.5	23.68	233.35
		378	2593	23.40	218.78
		756	2687.5	23.38	217.77
QPSK	DQ64_56_UQ4_12_5M	0	2498.5	23.25	211.35
		378	2593	23.66	232.27
		756	2687.5	23.58	228.03

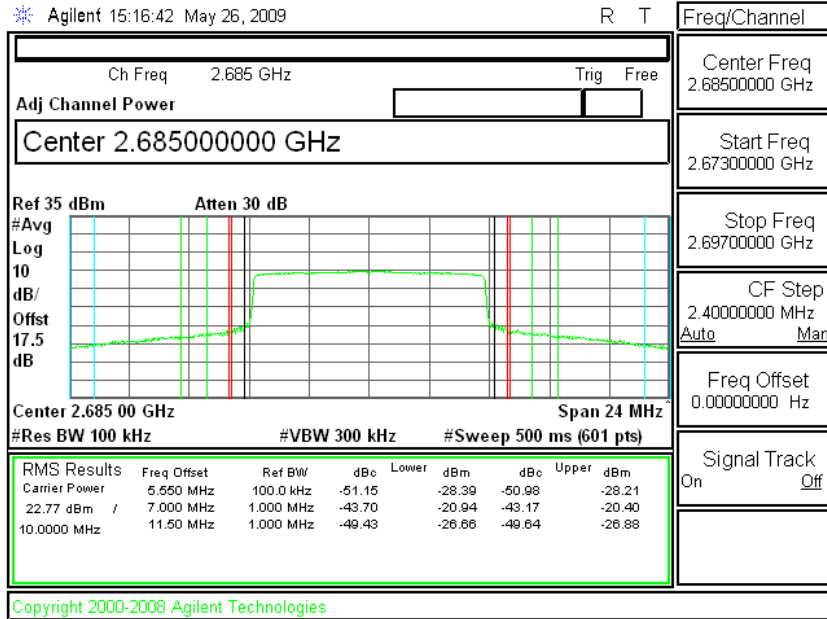
10MHz 16QAM Low CH



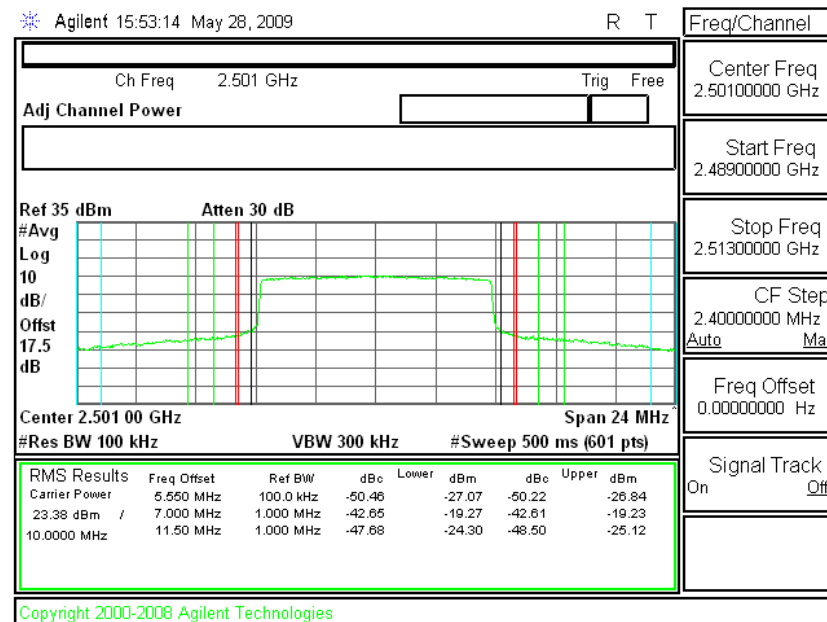
10MHz 16QAM Mid CH



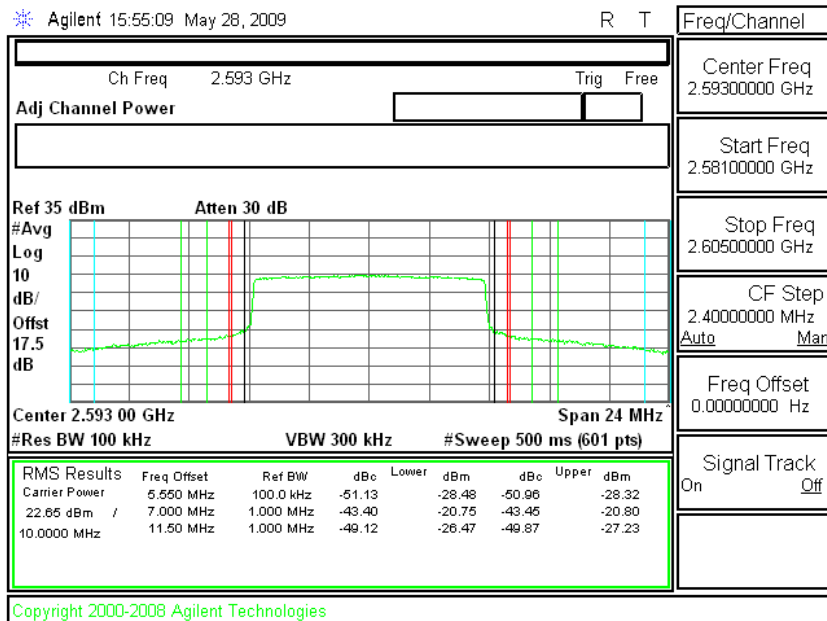
10MHz_16QAM High CH



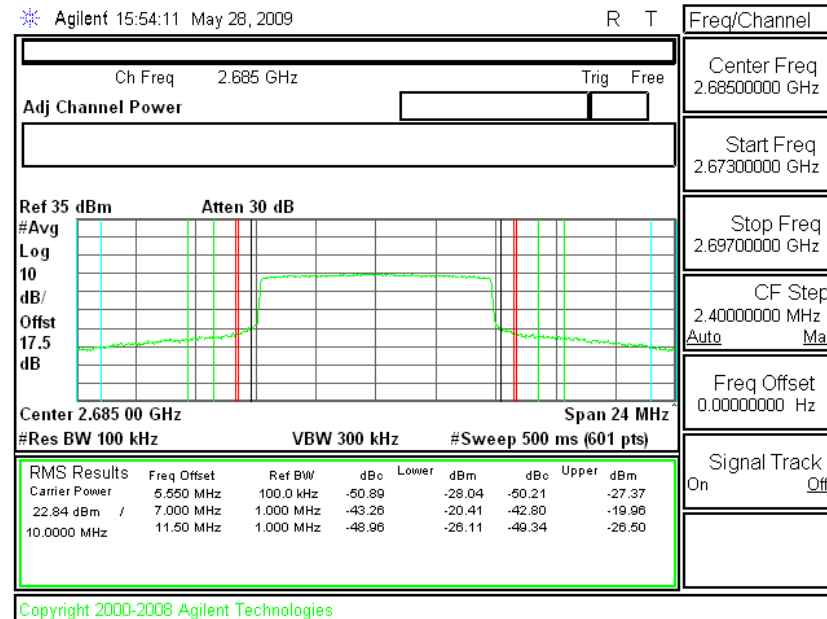
10MHz_QPSK Low CH



10MHz_QPSK Mid CH

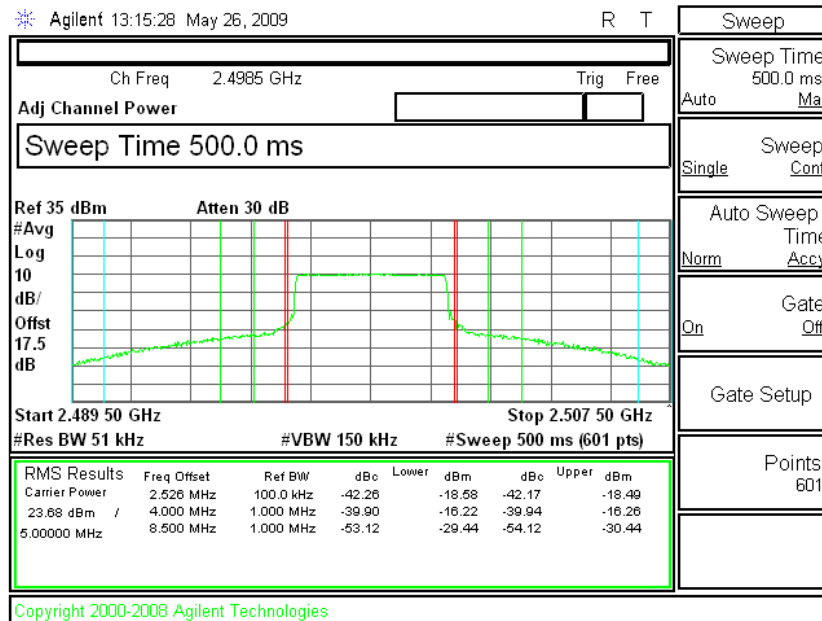


10MHz_QPSK High CH

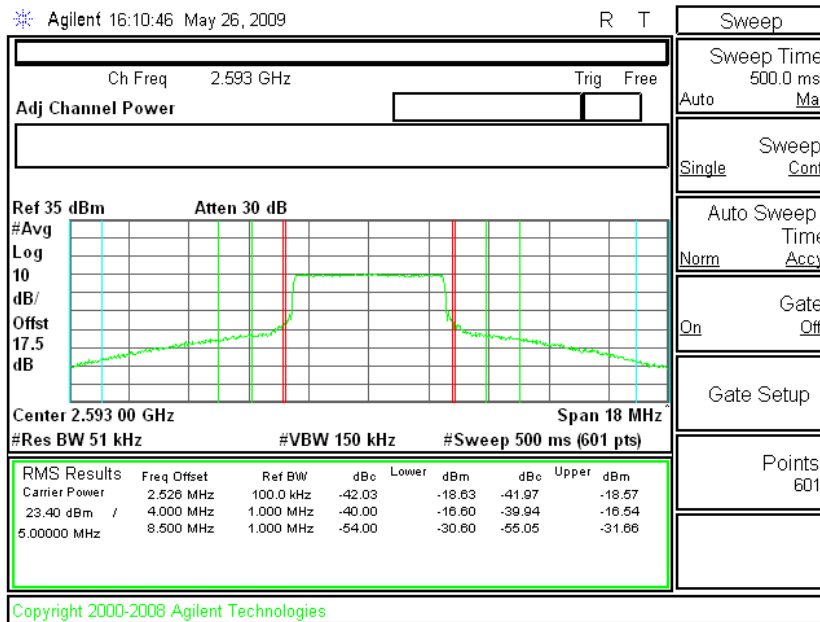


Power Plots 5 MHz

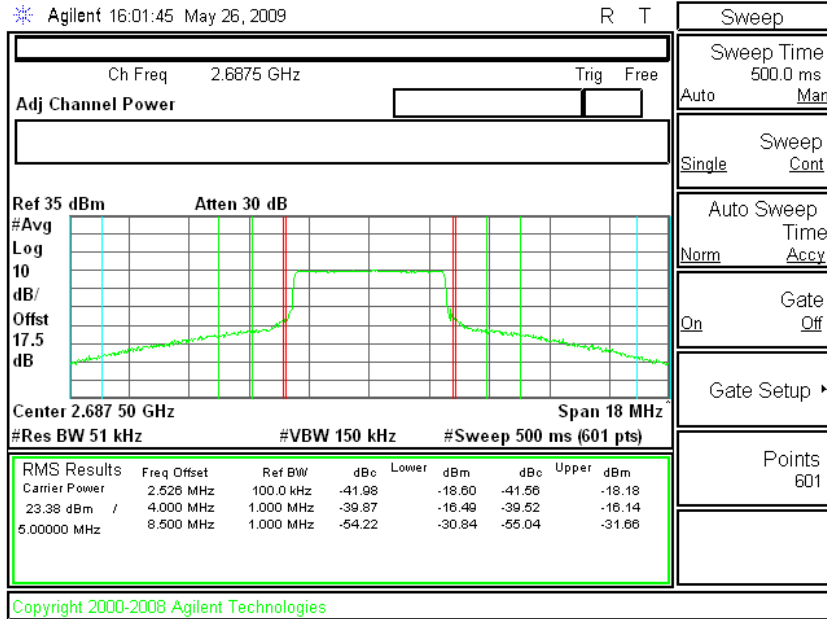
5MHz 16QAM Low CH



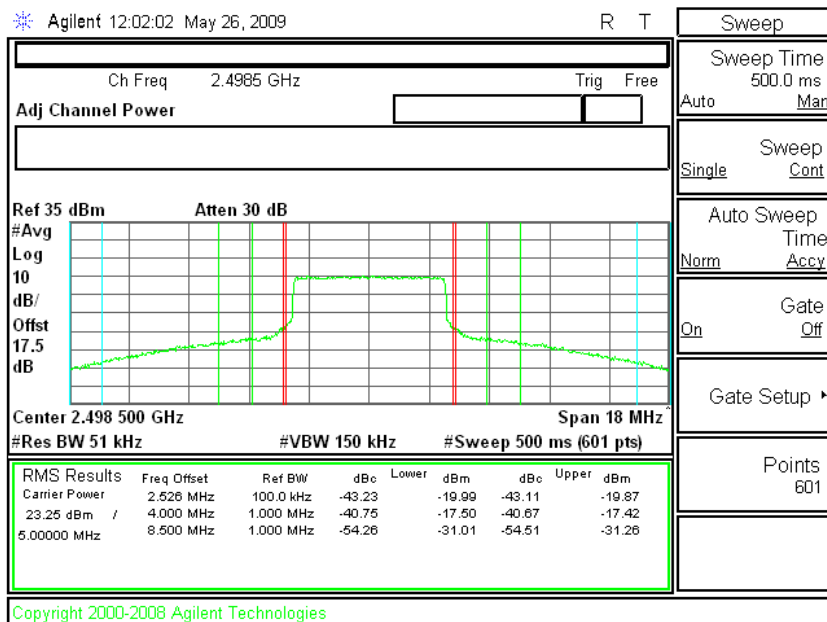
5MHz 16QAM Mid CH



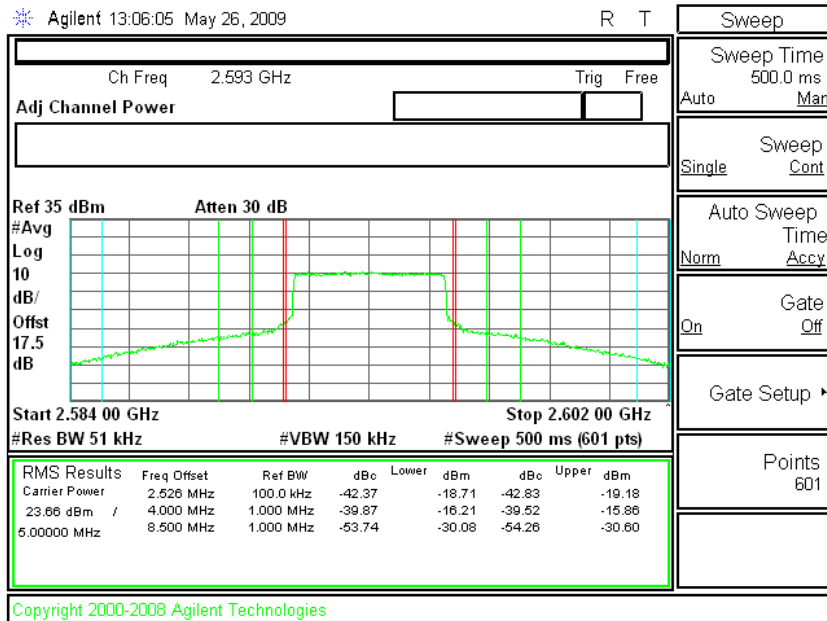
5MHz 16QAM High CH



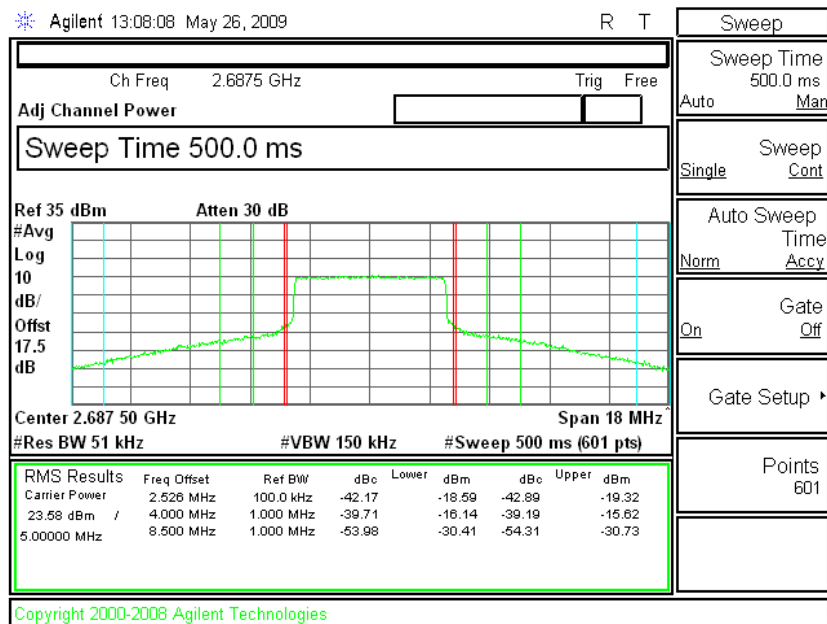
5MHz QPSK Low CH



5MHz QPSK Mid CH



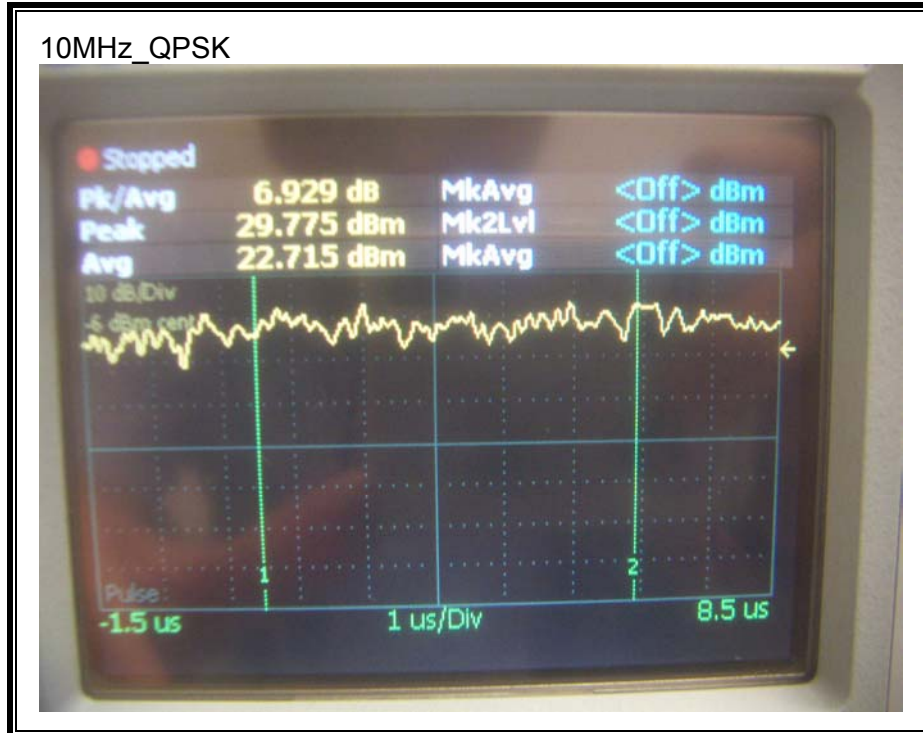
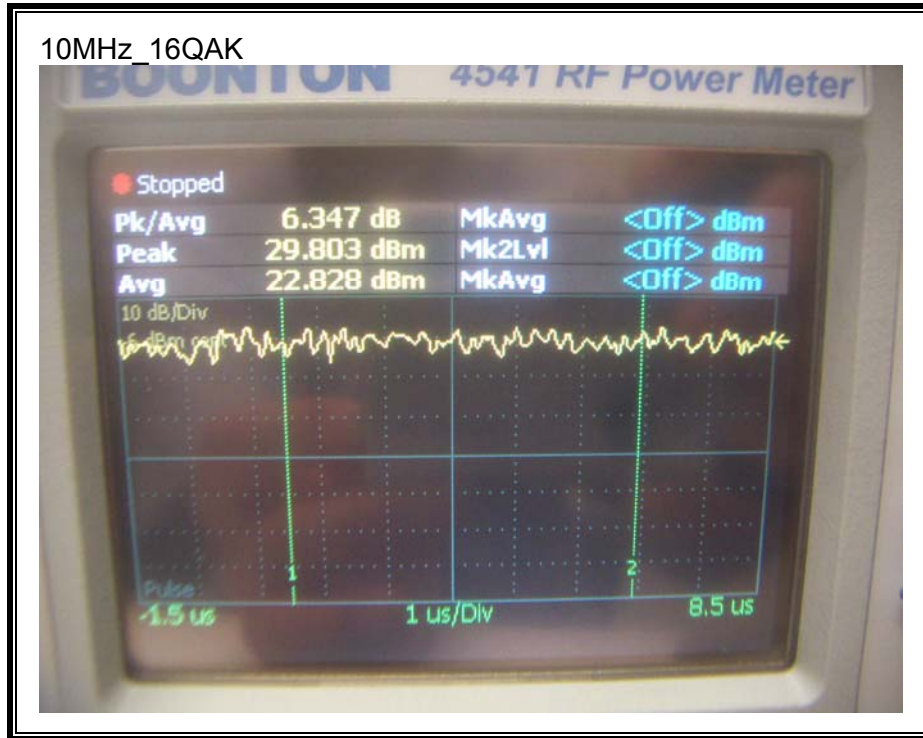
5MHz QPSK High CH

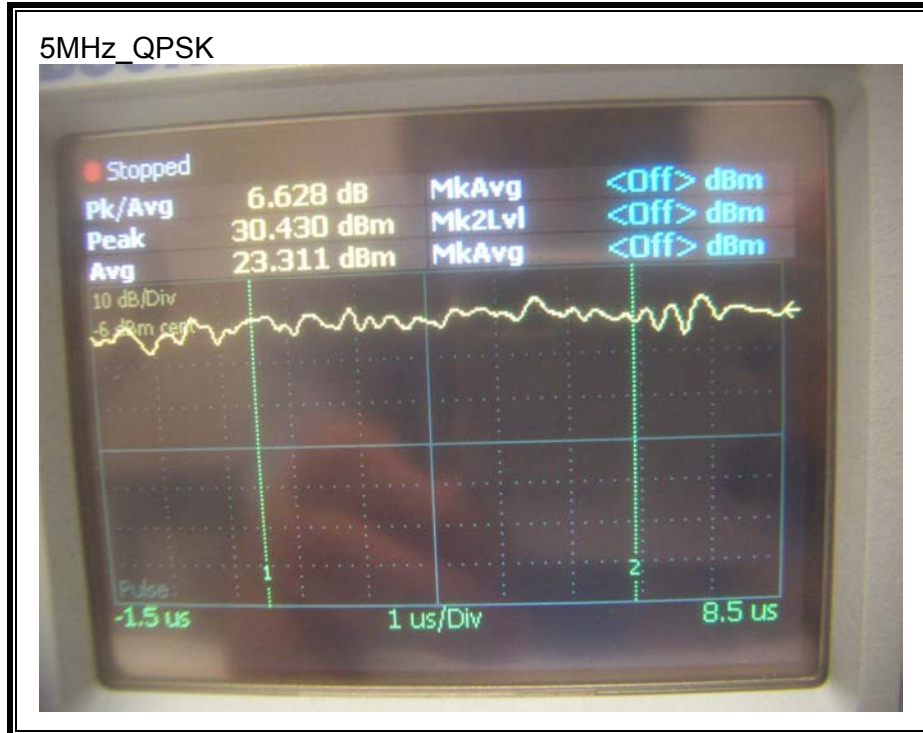
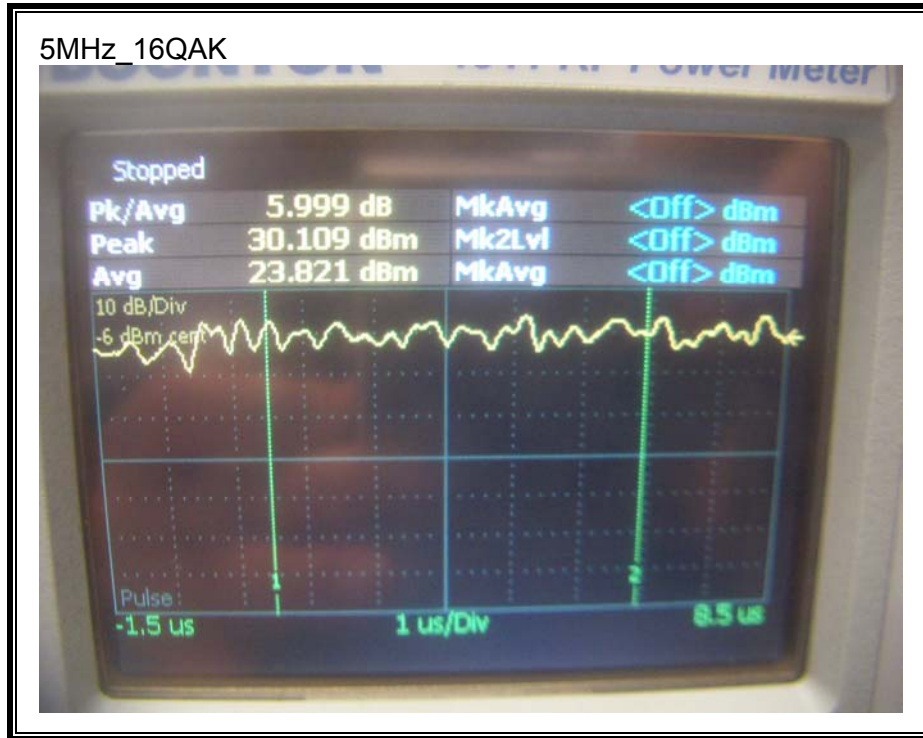


Offset: 1 (cable) + 10 (pad) + 6.5 (Splitter) = 17.5 dB

Peak and Average Output power readings were measured with Power Meter

Mode	Channel Band-width (MHZ)	Ch. No.	f (MHz)	Couducted Power (dBm)		Average Ratio (PAR)
				Peak	Average	
16QAM	10	368	2593	29.803	22.828	6.347
Mode	Channel Band-width	Ch. No.	f (MHz)	Couducted Power (dBm)		Peak-to-Average
				Peak	Average	
QPSK	10	368	2593	29.775	22.715	6.929
Mode	Channel Band-width	Ch. No.	f (MHz)	Couducted Power (dBm)		Peak-to-Average
				Peak	Average	
16QAM	5	378	2593	30.109	23.821	5.999
Mode	Channel Band-width	Ch. No.	f (MHz)	Couducted Power (dBm)		Peak-to-Average
				Peak	Average	
QPSK	5	378	2593	30.43	23.311	6.628





7.2. RADIATED OUTPUT POWER

LIMITS

27.50 (h)(2) Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.2.17& FCC 27

RESULTS

QPSK 10MHZ

Channel	Frequency (MHz)	EIRP Peak Power (dBm)	EIRP Peak Power (mW)
Low	2501	22.70	186.21
Middle	2593	22.50	177.83
High	2685	23.10	204.17

16QAM 5MHZ

Channel	Frequency (MHz)	EIRP Peak Power (dBm)	EIRP Peak Power (mW)
Low	2498.5	22.30	169.82
Middle	2593	22.40	173.78
High	2687.5	22.80	190.55

OUTPUT POWER (EIRP)

QPSK_10MHz

Compliance Certification Services
 Above 1GHz High Frequency Substitution Measurement

Company: Intel
 Project #: 09U12587
 Date: 6/02/2009
 Test Engineer: Chin Pang
 Configuration: EUT only
 Mode: QPSK_10MHz

Chamber

Pre-amplifier

Filter

Limit

5m Chamber B

Part 27

f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch										
2.501	-19.2	V	3.0	41.8			22.7	33.0	-10.3	
2.501	-22.2	H	3.0	39.8			17.6	33.0	-15.4	
Mid Ch										
2.593	-19.6	V	3.0	42.1			22.5	33.0	-10.5	
2.593	-22.9	H	3.0	40.4			17.5	33.0	-15.5	
High Ch										
2.685	-19.3	V	3.0	42.4			23.1	33.0	-9.9	
2.685	-23.0	H	3.0	41.0			18.0	33.0	-15.0	

Rev. 03.03.09

16QAM_5MHz

Compliance Certification Services
 Above 1GHz High Frequency Substitution Measurement

Company: Intel
 Project #: 09U12587
 Date: 6/02/2009
 Test Engineer: Chin Pang
 Configuration: EUT only
 Mode: 16QAM_5MHz

Chamber	Pre-amplifier	Filter	Limit
5m Chamber A			Part 27

f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch										
2.4985	-19.5	V	3.0	41.8			22.3	33.0	-10.7	
2.4985	-22.3	H	3.0	40.1			17.8	33.0	-15.2	
Mid Ch										
2.5930	-19.7	V	3.0	42.1			22.4	33.0	-10.6	
2.5930	-23.3	H	3.0	40.6			17.4	33.0	-15.6	
High Ch										
2.6875	-19.6	V	3.0	42.4			22.8	33.0	-10.2	
2.6875	-23.4	H	3.0	41.2			17.8	33.0	-15.2	

Rev. 03.03.09

7.3. FIELD STRENGTH OF SPURIOUS RADIATION

LIMIT

§27.53 (m)(4) For mobile digital stations, the attenuation factor shall be not less than $43 + 10 \log (P)$ dB at the channel edge and $55 + 10 \log (P)$ dB at 5.5 megahertz from the channel edges.

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 3.2.12 & FCC 27

RESULTS

SPURIOUS & HARMONIC
Below 1GHz (Worst Case)

Compliance Certification Services
 30 - 1000MHz Substitution Measurement

Company: Intel
 Project #: 09U12587
 Date: 5/23/2009
 Test Engineer: Chin Pang
 Configuration: EUT only
 Mode: Tx mode

Chamber

5m Chamber A

Pre-amplifier

T64 8447D

Filter

Limit

Part 27

f MHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
105.20	-63.5	V	3.0	22.6	28.3		-67.1	-25.0	-42.1	
262.65	-60.3	V	3.0	21.6	28.2		-64.8	-25.0	-39.8	
369.80	-57.5	V	3.0	24.4	28.0		-59.0	-25.0	-34.0	
748.80	-61.4	V	3.0	32.4	27.3		-54.2	-25.0	-29.2	
105.20	-65.1	H	3.0	18.3	28.3		-73.0	-25.0	-48.0	
262.65	-64.1	H	3.0	19.7	28.2		-70.4	-25.0	-45.4	
449.00	-65.0	H	3.0	23.8	27.9		-67.0	-25.0	-42.0	
748.80	-63.0	H	3.0	29.7	27.3		-58.5	-25.0	-33.5	

Rev. 03.03.09

Above 1GHz

Compliance Certification Services Above 1GHz High Frequency Substitution Measurement										
Company: Intel Project #: 09U12587 Date: 6/02/2009 Test Engineer: Chin Pang Configuration: EUT Only Mode: QPSK_10MHz										
Chamber			Pre-amplifier			Filter			Limit	
5m Chamber A			T144 8449B			Filter 1			Part 27	
f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
2501MHz										
5.002	-57.1	H	3.0	48.8	36.3	1.0	-43.6	-25.0	-18.6	
7.503	-53.2	H	3.0	53.0	36.6	1.0	-35.8	-25.0	-10.8	
5.002	-55.6	V	3.0	48.3	36.3	1.0	-42.6	-25.0	-17.6	
7.503	-51.3	V	3.0	52.0	36.6	1.0	-34.9	-25.0	-9.9	
2593MHz										
5.186	-56.3	H	3.0	49.3	36.3	1.0	-42.2	-25.0	-17.2	
7.779	-55.7	H	3.0	53.4	36.7	1.0	-38.0	-25.0	-13.0	
5.186	-55.1	V	3.0	48.7	36.3	1.0	-41.6	-25.0	-16.6	
7.779	-56.0	V	3.0	52.3	36.7	1.0	-39.3	-25.0	-14.3	
2685MHz										
5.370	-56.2	H	3.0	49.6	36.3	1.0	-41.8	-25.0	-16.8	
8.055	-56.3	H	3.0	53.7	36.7	1.0	-38.3	-25.0	-13.3	
5.370	-48.4	V	3.0	49.0	36.3	1.0	-34.6	-25.0	-9.6	
8.055	-55.5	V	3.0	52.7	36.7	1.0	-38.6	-25.0	-13.6	
Rev. 03.03.09										

16QAM_5MHz

Compliance Certification Services
 Above 1GHz High Frequency Substitution Measurement

Company: Intel
 Project #: 09U12587
 Date: 6/02/2009
 Test Engineer: Chin Pang
 Configuration: EUT
 Mode: 16QAM_5MHz

Chamber	Pre-amplifier	Filter	Limit
5m Chamber A	T144 8449B	Filter 1	Part 27

f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
2498.5MHz										
4.997	-51.6	H	3.0	48.8	36.3	1.0	-38.2	-25.0	-13.2	
7.496	-50.5	H	3.0	53.0	36.6	1.0	-33.1	-25.0	-8.1	
4.997	-48.2	V	3.0	48.2	36.3	1.0	-35.3	-25.0	-10.3	
7.496	-49.3	V	3.0	51.9	36.6	1.0	-32.9	-25.0	-7.9	
2593MHz										
5.186	-54.2	H	3.0	49.3	36.3	1.0	-40.1	-25.0	-15.1	
7.779	-55.3	H	3.0	53.4	36.7	1.0	-37.6	-25.0	-12.6	
5.186	-51.4	V	3.0	48.7	36.3	1.0	-37.9	-25.0	-12.9	
7.779	-52.2	V	3.0	52.3	36.7	1.0	-35.5	-25.0	-10.5	
2687.5MHz										
5.375	-47.1	H	3.0	49.6	36.3	1.0	-32.7	-25.0	-7.7	
8.062	-52.3	H	3.0	53.7	36.7	1.0	-34.3	-25.0	-9.3	
5.375	-45.1	V	3.0	49.0	36.3	1.0	-31.3	-25.0	-6.3	
8.062	-51.2	V	3.0	52.7	36.7	1.0	-34.2	-25.0	-9.2	

Rev. 03.03.09

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

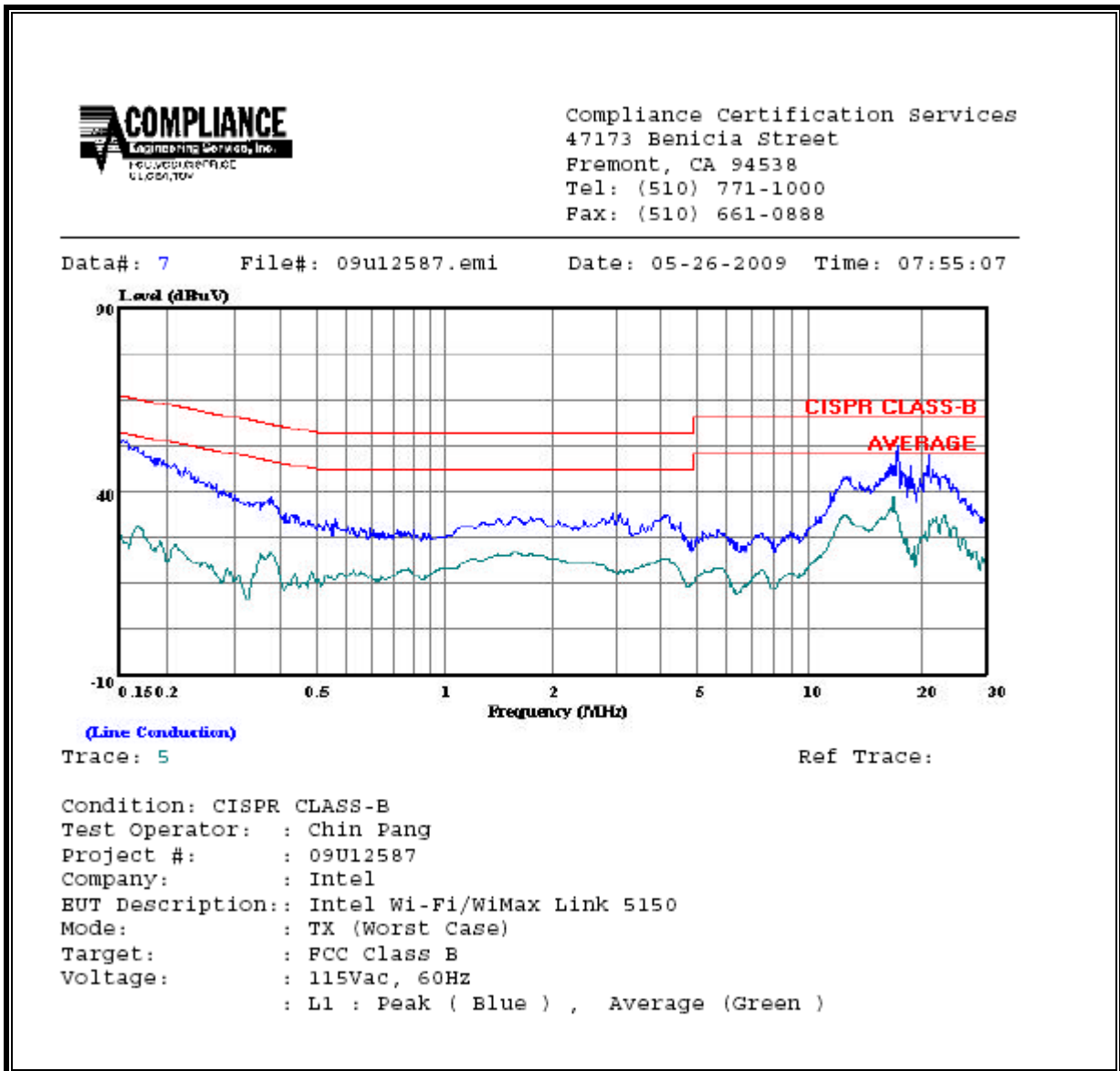
ANSI C63.4

RESULTS

6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq. (MHz)	Reading			Class (dB)	Limit QP	EN B AV	Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)				QP (dB)	AV (dB)	
0.16	53.01	--	30.47	0.00	65.73	55.73	-12.72	-25.26	L1
12.50	43.85	--	33.11	0.00	60.00	50.00	-16.15	-16.89	L1
17.29	38.62	--	38.62	0.00	60.00	50.00	-21.38	-11.38	L1
0.15	56.21	--	28.16	0.00	65.89	55.89	-9.68	-27.73	L2
12.58	43.21	--	33.09	0.00	60.00	50.00	-16.79	-16.91	L2
17.29	50.97	--	37.54	0.00	60.00	50.00	-9.03	-12.46	L2
6 Worst Data									

LINE 1 RESULTS

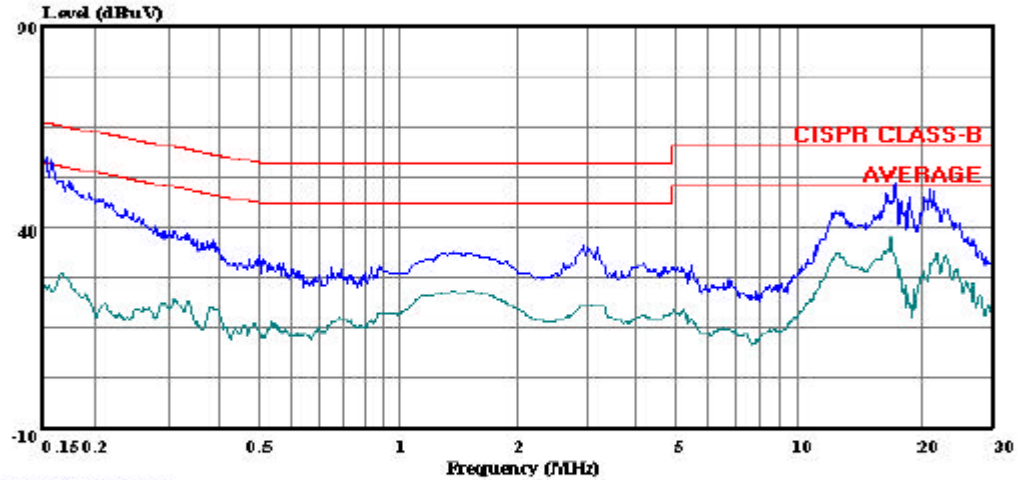


LINE 2 RESULTS



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

Data#: 14 File#: 09u12587.emi Date: 05-26-2009 Time: 08:02:03



(Line Conduction)

Trace: 12

Ref Trace:

Condition: CISPR CLASS-B
Test Operator: : Chin Pang
Project #: : 09U12587
Company: : Intel
EUT Description: : Intel Wi-Fi/WiMax Link 5150
Mode: : TX (Worst Case)
Target: : FCC Class B
Voltage: : 115Vac, 60Hz
: L2 : Peak (Blue) , Average (Green)