

# FCC CFR47 PART 15 SUBPART E CLASS II PERMISSIVE CHANGE

#### **CERTIFICATION TEST REPORT**

**FOR** 

**INTEL WIMAX/WIFI LINK 5350 SERIES** 

FCC MODEL NUMBER: 533ANXMMW

FCC ID: PD9533ANXMU

**REPORT NUMBER: 08U12161-2** 

**ISSUE DATE: NOVEMBER 10, 2008** 

Prepared for

INTEL CORPORATION 2111 N.E. 25th AVE HILLSBORO, OR 97124-5961, U.S.A.

Prepared by

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REPORT NO: 08U12161-2 EUT: INTEL WIMAX/WIFI LINK 5350 SERIES DATE: NOVEMBER 10, 2008 FCC ID: PD9533ANXMU

#### **Revision History**

Rev.	Issue Date	Revisions	Revised By
	11/10/08	Initial Issue	T. Chan

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#### 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** INTEL CORPORATION

2111 NE 25TH AVENUE

HILLSBORO, OREGON 97124, USA

**EUT DESCRIPTION:** INTEL WIMAX/WIFI LINK 5350 SERIES

FCC MODEL NUMBER: 533ANXMMW

SERIAL NUMBER: 0016EB041B3C

**DATE TESTED:** OCTOBER 02-07, 2008

#### APPLICABLE STANDARDS

STANDARD TEST RESULTS

CFR 47 Part 15 Subpart E 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. 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 SUPERVISOR

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CHIN PANG EMC ENGINEER

Chin Pany

COMPLIANCE CERTIFICATION SERVICES

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#### 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, RSS-GEN Issue 2, and RSS-210 Issue 7.

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#### 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. 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 802.11a/b/g/n transceiver Intel WiMAX/WiFi Link 5350 Series The radio module is manufactured by Intel.

#### 5.2. MAXIMUM OUTPUT POWER

The measured target power of this device is within ± 0.5dB of the original output power.

For 5GHz Band, 802.11n HT40 single chain, in order to pass the band edges, output power is reduced to 14.50dBm on low channel at 5.2GHz band and 14.54dBm on high channel at 5.3GHz band, no change on mid-band. The manufacturer states that this change will be incorporated in the EEPROM.

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#### 5.3. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding portable tablet LENOVO THINKPAD X200 TABLET SERIES.

#### 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of 0.64 dBi for 2.4GHZ Band, 1.45 dBi for 5150-5350MHz band, 1.47 dBi for 5470-5725MHz band, and 0.92 dBi for 5.725 – 5850MHz band.

#### 5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was CRTU, version 5.0.76.0

#### 5.6. WORST-CASE CONFIGURATION AND MODE

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

The worst-position was the EUT with highest emissions. To determine the worst-case, the EUT was investigated for X, Y, Z, and mobile Positions, after the investigations, the worst-position were turned out to be a mobile position for all bands.

### 5.7. DESCRIPTION OF TEST SETUP

#### **SUPPORT EQUIPMENT**

PERIPHERAL SUPPORT EQUIPMENT LIST									
Description	Description Manufacturer Model Serial Number FCC ID								
Laptop	Lenovo	12MY	LV-002MY	DoC					
AC Adapter	Lenovo	PA-1650-171	11S92P1160Z1ZBQH84K95K	DoC					

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

	I/O CABLE LIST								
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks			
1	AC	1	US 115V	Un-shielded	0.8m	NA			
2	DC	1	DC	Un-shielded	1.8m	Ferrite at laptop's end			

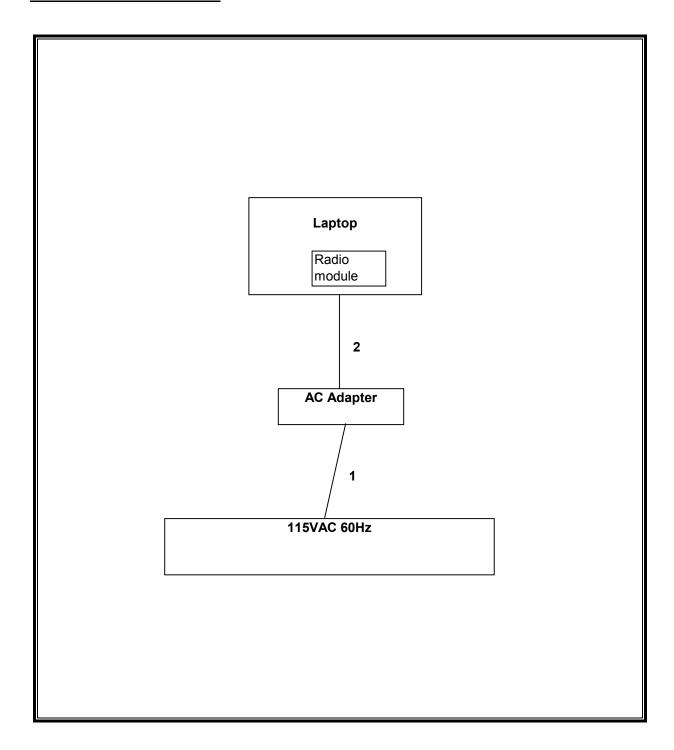
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#### **TEST SETUP**

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:

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	TEST	EQUIPMENT LIST		
Description	Manufacturer	Model	Asset	Cal Due
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	12/27/08
Antenna, Horn, 18 GHz	EMCO	3115	C00872	04/22/09
Preamp, 1000MHz	Sonoma	310N	N02891	03/31/09
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	02/11/09
EMI Receiver, 2.9 GHz	Agilent / HP	8542E	C00957	09/19/09
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	C00958	09/19/09
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/25/08
EMI Test Receiver, 30 MHz	R&S	ESHS 20	N02396	08/06/09
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	12/28/08
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	03/03/09
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02681	CNR
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	12/11/08
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	04/29/09

#### 7. ANTENNA PORT TEST RESULTS

#### 7.1.1. 26 dB 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.

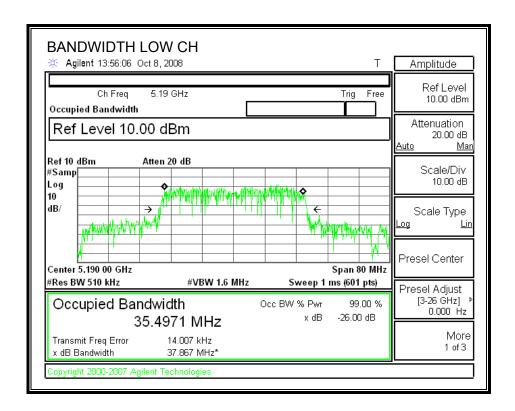
DATE: NOVEMBER 10, 2008

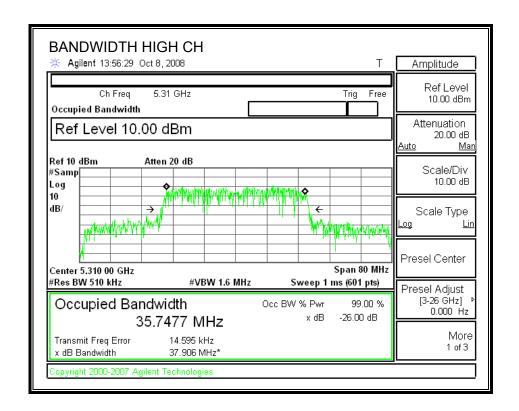
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#### **RESULTS**

Channel	Frequency	26 dB Bandwidth
	(MHz)	(MHz)
Low	5190	37.867
High	5310	37.906

#### 26 dB and 99% BANDWIDTH





#### 7.1.2. OUTPUT POWER

#### **LIMITS**

FCC §15.407 (a) (1 & 2)

IC RSS-210 A9.2 (1 & 2)

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.

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For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 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.

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#### **RESULTS**

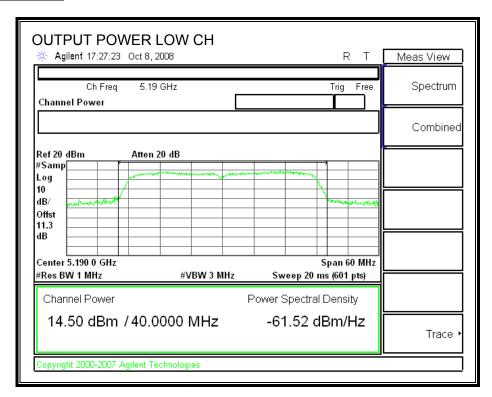
#### Limit

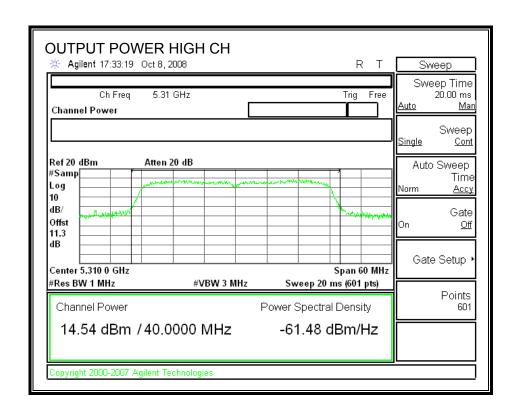
Channel	Frequency	Fixed	В	4 + 10 Log B	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5190	17	37.867	19.78	1.47	17.00
High	5310	17	37.867	19.78	1.47	17.00

#### Results

Itoouito						
Channel	Frequency	Power	Limit	Margin		
	(MHz)	(dBm)	(dBm)	(dB)		
Low	5190	14.50	17.00	-2.50		
High	5310	14.54	17.00	-2.46		

#### **OUTPUT POWER**





#### 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.

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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.

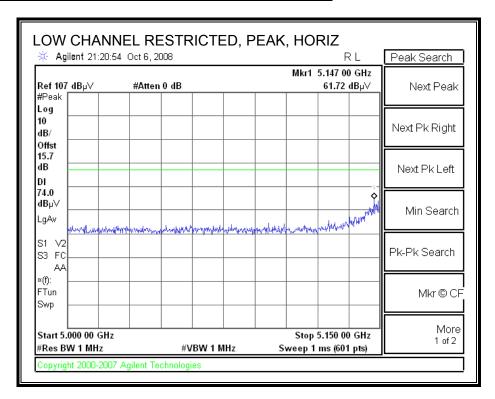
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

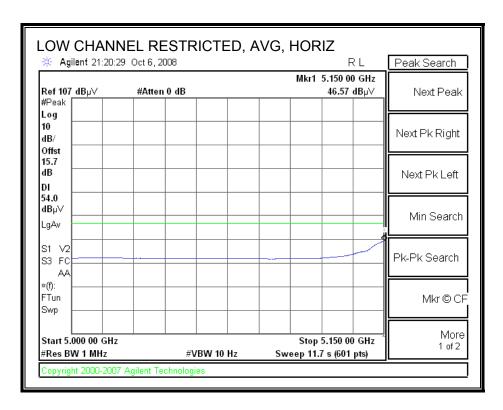
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

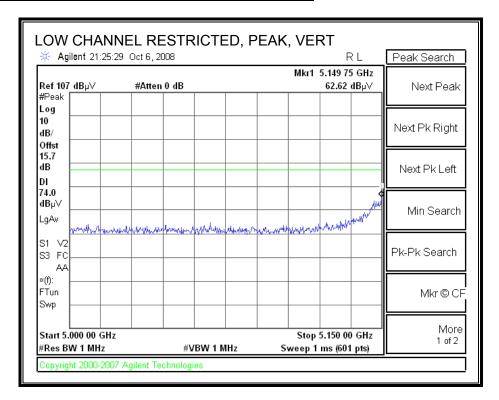
#### 8.2. TRANSMITTER ABOVE 1 GHz

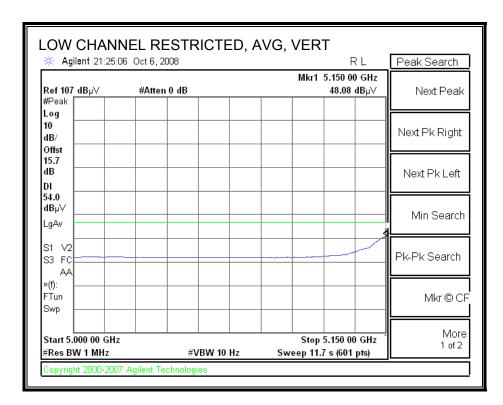
# 8.2.1. FOR 802.11n HT40 MODE CHAIN A IN THE 5.2 GHz RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



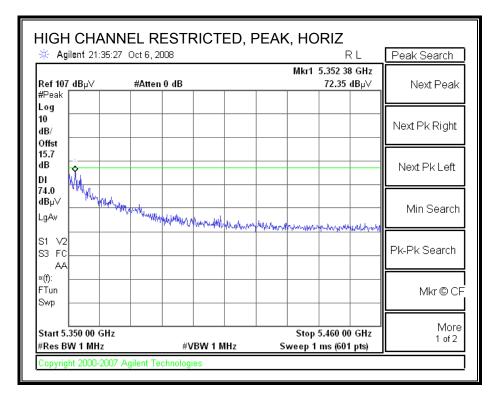


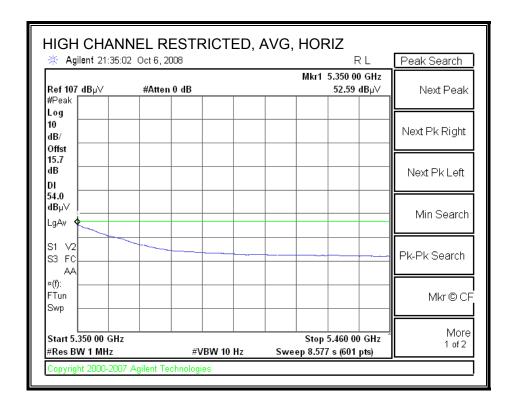
#### RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



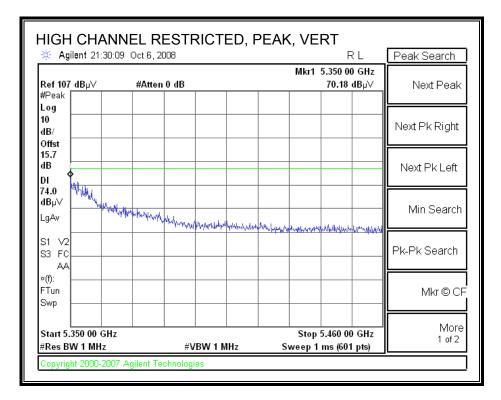


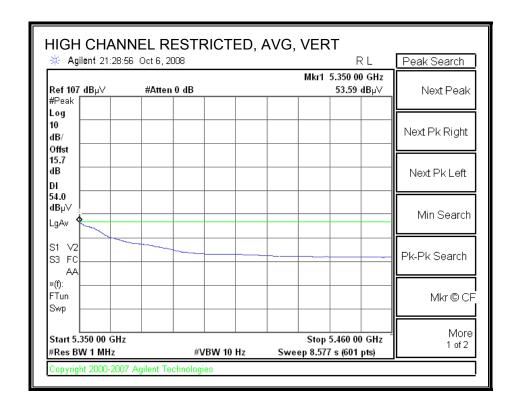
### 8.2.2. FOR 802.11n HT40 MODECHAIN A IN THE 5.3 GHz RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





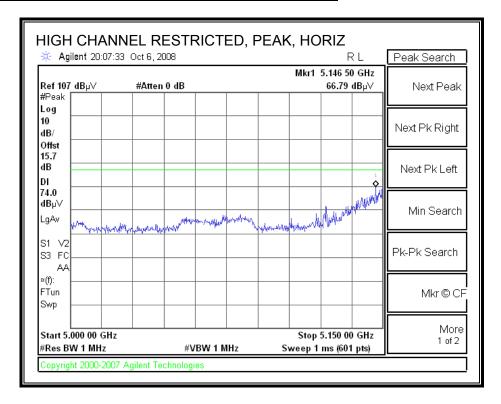
#### RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

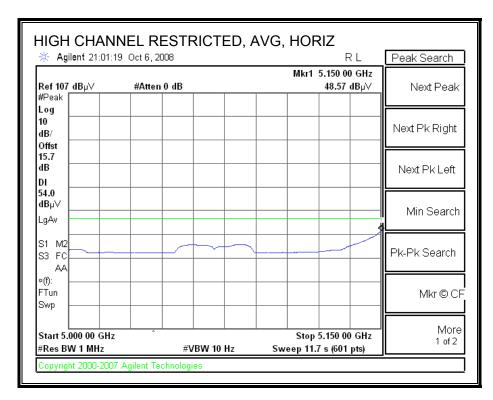




#### 8.2.3. FOR 802.11n HT40 MODE CHAIN B IN THE 5.2 GHz

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

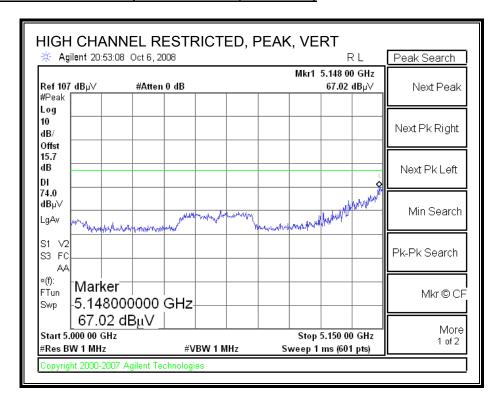


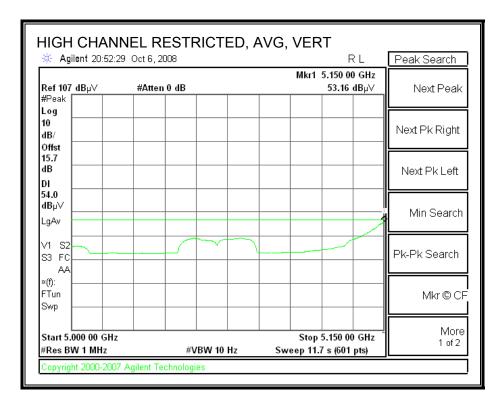


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#### RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



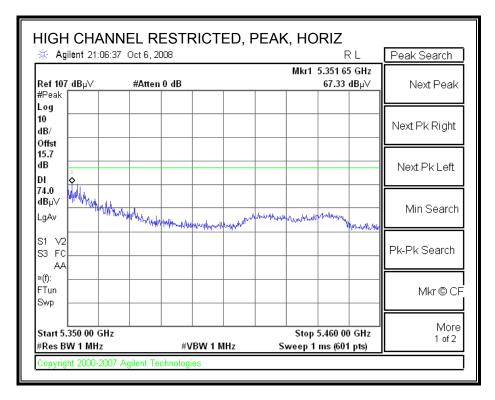


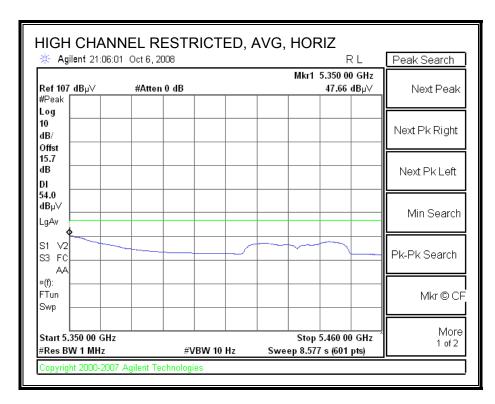
#### 8.2.4. FOR 802.11n HT40 MODE CHAIN B IN THE 5.3 GHz

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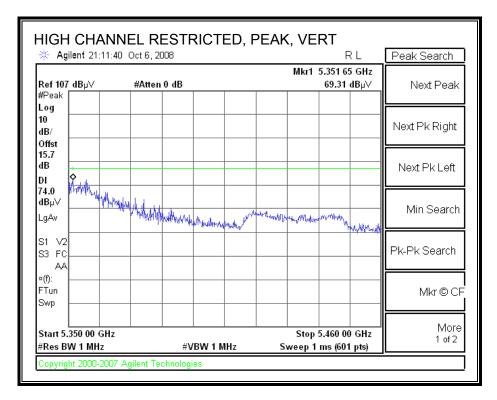
FCC ID: PD9533ANXMU

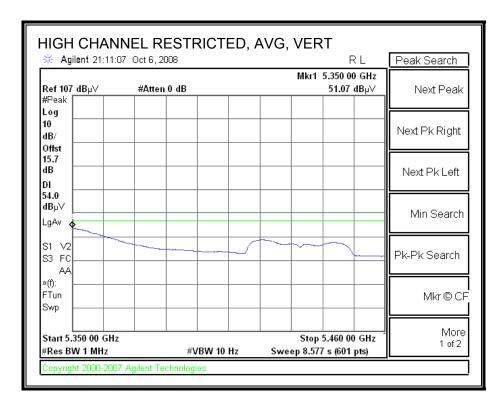
#### RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





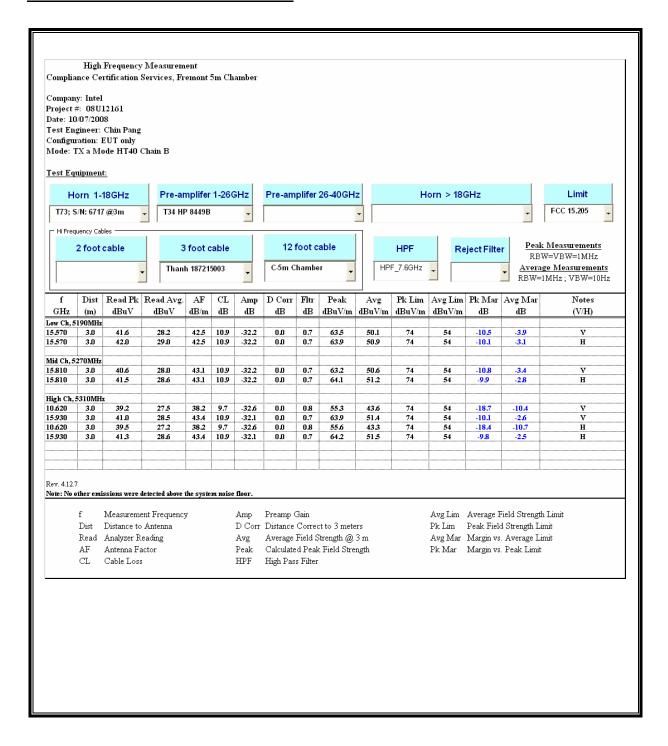
#### RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





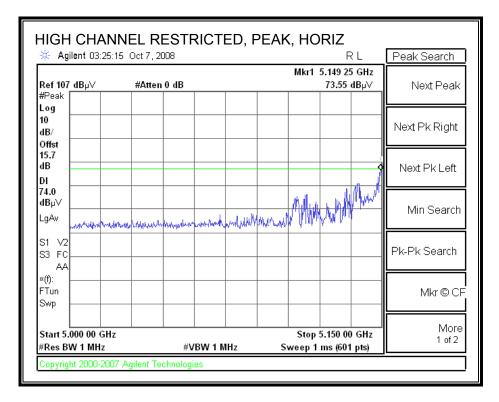
# DATE: NOVEMBER 10, 2008 FCC ID: PD9533ANXMU

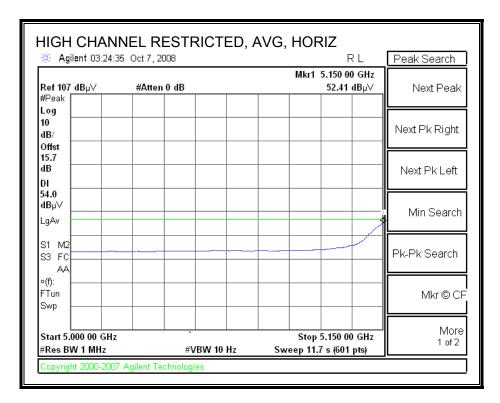
#### **HARMONICS AND SPURIOUS EMISSIONS**



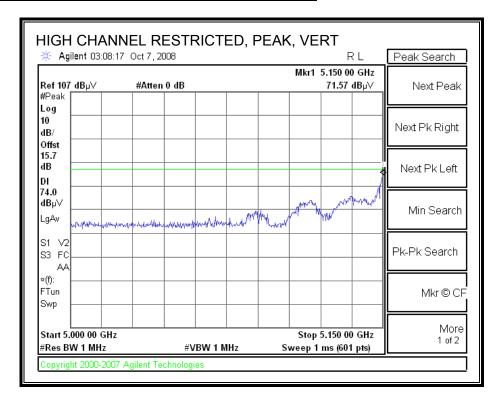
#### 8.2.5. FOR 802.11n HT40 MODE IN THE 5.2 GHz-3TX

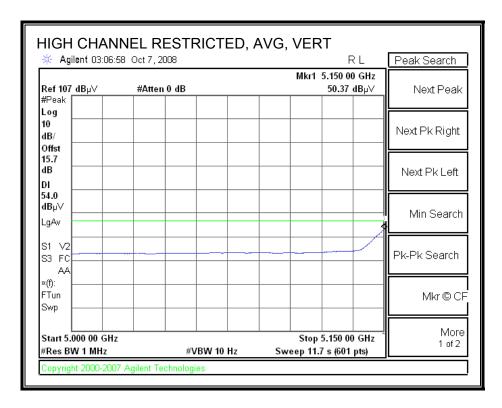
#### RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





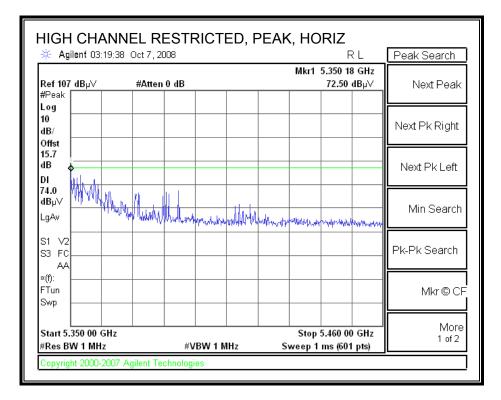
#### RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

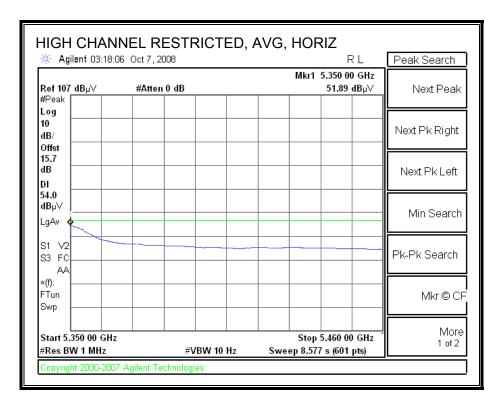




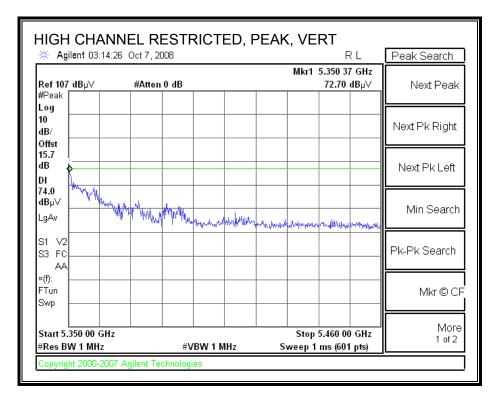
#### 8.2.6. FOR 802.11n HT40 MODE IN THE 5.3 GHz-3TX

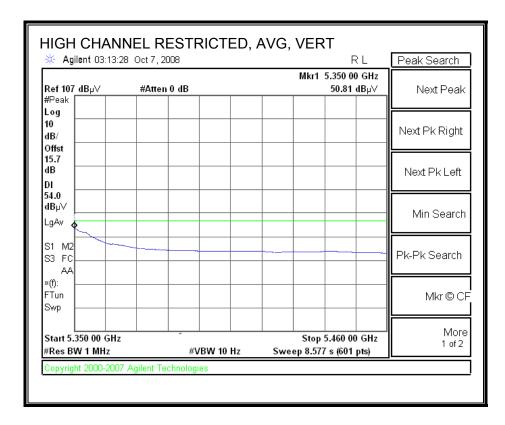
#### RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





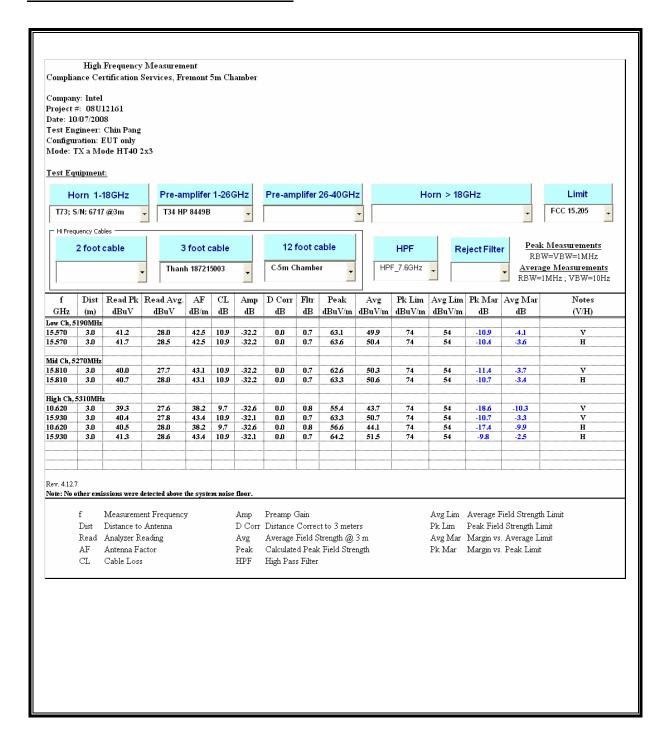
#### RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





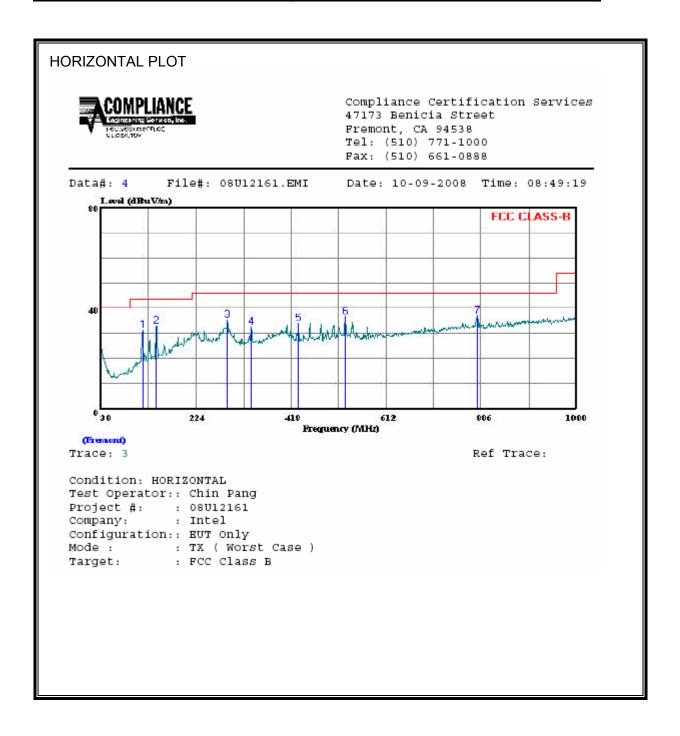
# DATE: NOVEMBER 10, 2008 FCC ID: PD9533ANXMU

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



#### 8.3. WORST-CASE BELOW 1 GHz

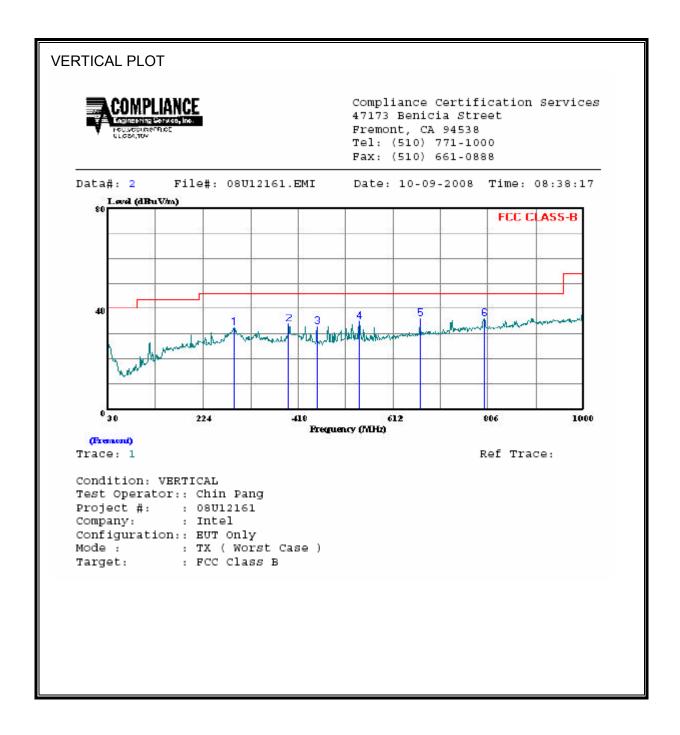
#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



HORIZ	ONTAL DAT	A						
	Freq	Read Level	Factor	Level	Limit Line		Remark	
	MHZ	₫BuV	dB	$\overline{\mathtt{dBuV/m}}$	$\overline{\mathtt{dBuV/m}}$	dв		
1	115.360							
2	142.520 288.020							
4	336.520							
5	432.550	39.67	-5.84	33.83	46.00	-12.17	Peak	
6	529.550					-9.31		
7	799.210	35.83	1.22	37.05	46.00	-8.95	Peak	

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



VERTI	CAL DATA						
	Freq	Read Level	Factor	Level		Over Limit	Remark
	MHZ	₫BuV	dВ	dBu√/m	$\overline{\mathtt{dBuV/m}}$	dB	
1	288.020	41.83		32.39			
2		40.67		33.90			
3 4	456.800 544.100	38.50		33.05 35.14			
5	666.320			36.17			
6	799.210	34.83	1.22	36.05	46.00	-9.95	Peak

### 9. AC POWER LINE CONDUCTED EMISSIONS

#### **LIMITS**

FCC §15.207 (a)

RSS-Gen 7.2.2

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

Decreases with the logarithm of the frequency.

#### **TEST PROCEDURE**

ANSI C63.4

#### **RESULTS**

#### **6 WORST EMISSIONS**

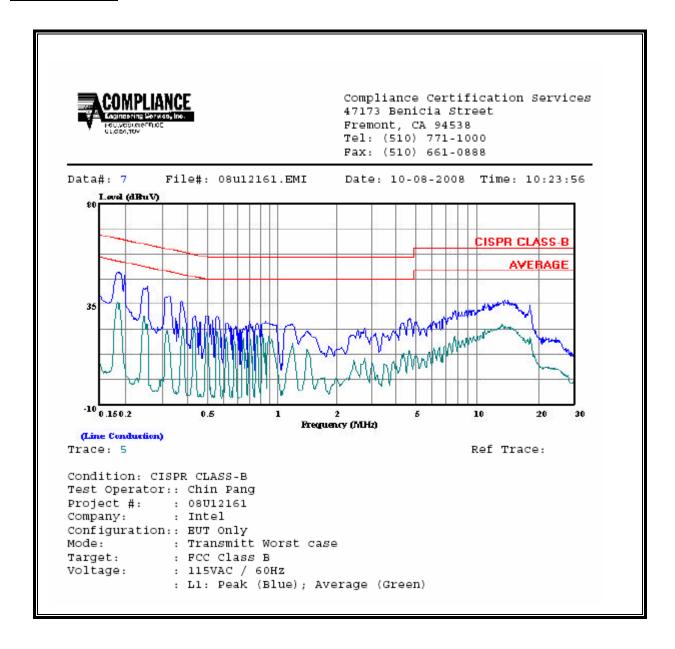
CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.18	49.12		36.24	0.00	64.35	54.35	-15.23	-18.11	L1
0.26	40.97		30.25	0.00	61.56	51.56	-20.59	-21.31	L1
13.84	36.82		25.31	0.00	60.00	50.00	-23.18	-24.69	L1
0.19	49.42		36.65	0.00	64.21	54.21	-14.79	-17.56	L2
0.25	43.09		30.60	0.00	61.89	51.89	-18.80	-21.29	L2
13.27	36.76		25.09	0.00	60.00	50.00	-23.24	-24.91	L2
6 Worst I	Data								

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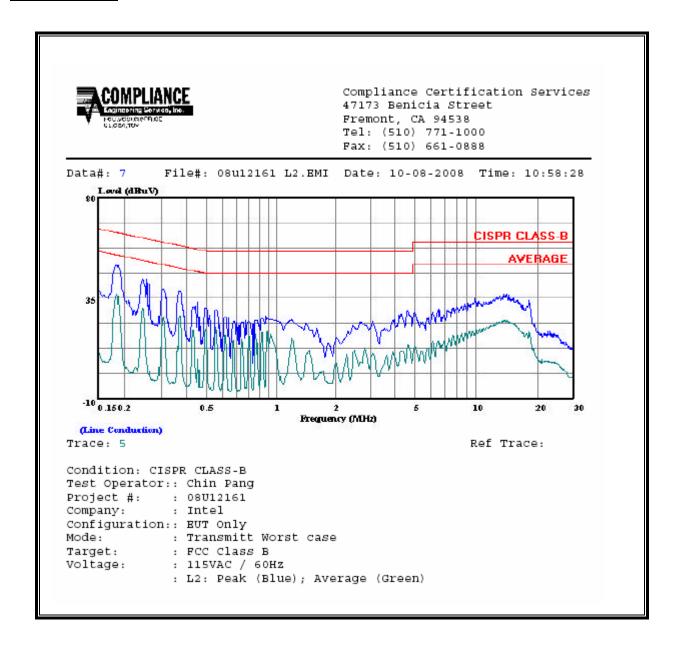
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#### **LINE 1 RESULTS**



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#### **LINE 2 RESULTS**



#### 10. SETUP PHOTOS

#### RADIATED RF MEASUREMENT SETUP FOR MOBILE CONFIGURATION

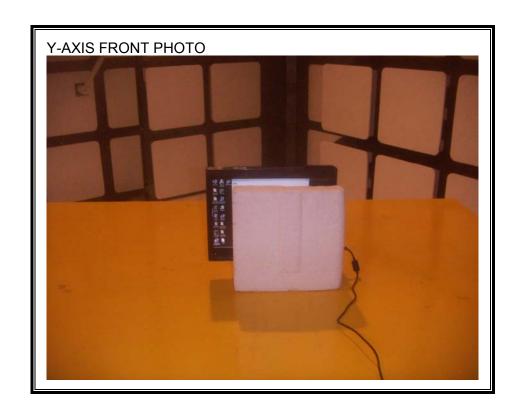


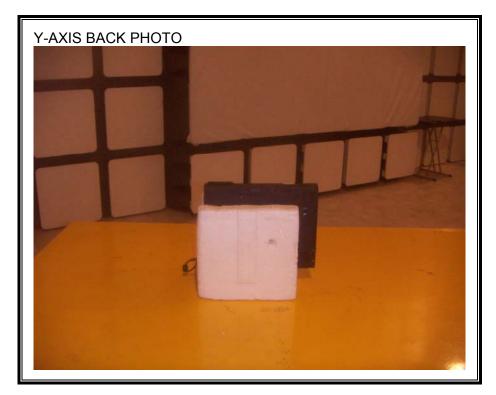


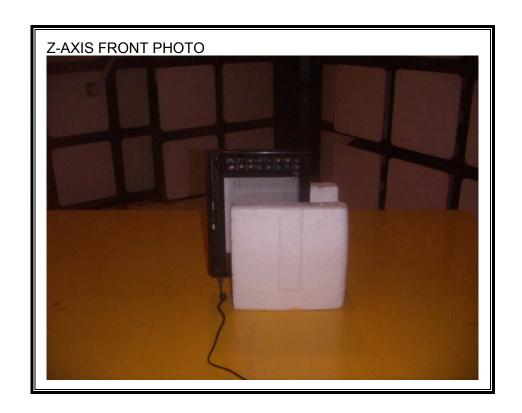
#### RADIATED RF MEASUREMENT SETUP FOR PORTABLE CONFIGURATION

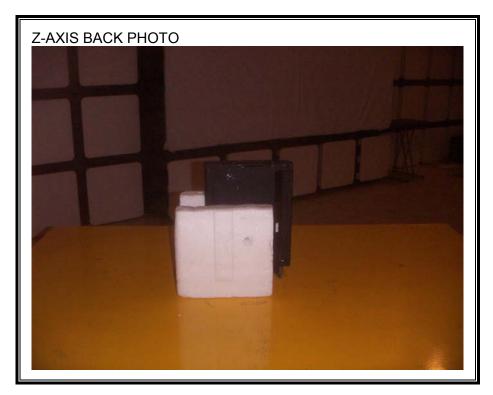




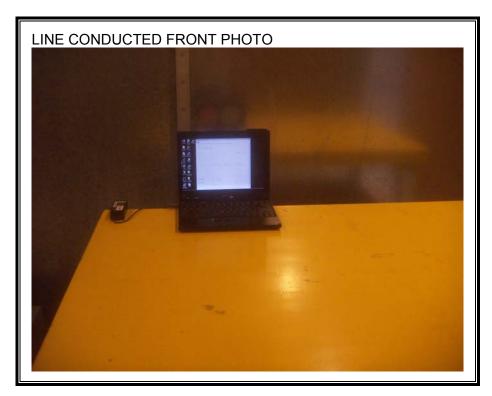


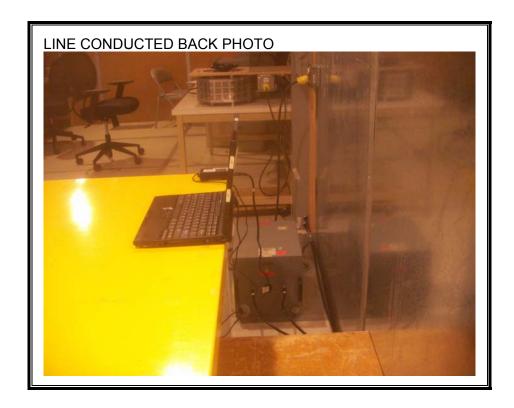






#### POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP





**END OF REPORT** 

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