EMC Test Report

Class II Permissive Change/Reassessment
Industry Canada RSS-Gen Issue 2 / RSS 210 Issue 7
FCC Part 15, Subpart E

Model: 633ANHU

IC CERTIFICATION #:	1000M-633ANHU
FCC ID:	PD9633ANHU
APPLICANT:	Intel Corporation 2111 NE 25th Avenue Hillsboro, OR 97124
TEST SITE(S):	Elliott Laboratories 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-4, 2845B-5
REPORT DATE:	May 24, 2010
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Testing Cert #2016-01

REVISION HISTORY

Rev#	Date	Comments	Modified By
1		First release	

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SCOPE

An electromagnetic emissions test has been performed on the Intel Corporation model 633ANHU, pursuant to the following rules:

Industry Canada RSS-Gen Issue 2
RSS 210 Issue 7 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15, Subpart E requirements for UNII Devices (using FCC DA 02-2138, August 30, 2002)

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in Elliott Laboratories test procedures:

ANSI C63.4:2003
FCC UNII test procedure 2002-08 DA-02-2138, August 2002

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Intel Corporation model 633ANHU complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 2
RSS 210 Issue 7 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15, Subpart E requirements for UNII Devices

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Intel Corporation model 633ANHU and therefore apply only to the tested sample. The sample was selected and prepared by Steve Hackett of Intel Corporation.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY

UNII / LELAN DEVICES

Operation in the 5.15 – 5.25 GHz Band

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407(e)		Indoor operation only	Refer to user's manual	Device is limited to indoor use only.	Complies
15.407(a) (1)		26dB Bandwidth	Limits output power if < 20MHz		N/A
15.407 (a) (1)	A9.2(1)	Output Power	The proposed change to add a new antenna type does not affect the measurements reported in the test report filed with original application for equipment authorization.		
15.407 (a) (1)	-	Power Spectral Density			
-	A9.5 (2)				
15.407(b) (5) / 15.209	A9.3	Spurious Emissions below 1GHz			
15.407(b) (2)	A9.3	Spurious Emissions above 1GHz	52.1dBµV/m @ 5148.1MHz	Refer to page 17	Complies (- 1.9dB)

Operation in the 5.25 – 5.35 GHz Band

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(a) (2)		26dB Bandwidth	The proposed change to add a new antenna type does not affect the measurements reported in the test report filed with original application for equipment authorization.		
15.407(a) (2)	A9.2(2)	Output Power			
15.407(a) (2))	-	Power Spectral Density			
-	A9.2(2) / A9.5 (2)	Power Spectral Density			
-	A9.5 (2)	Peak Spectral Density			
15.407(b) (5) / 15.209	A9.3	Spurious Emissions below 1GHz			
15.407(b) (2)	A9.3	Spurious Emissions above 1GHz	53.7dBµV/m @ 5350.0MHz	Refer to page 17	Complies (- 0.3dB)

Requirements for all U-NII/LELAN bands

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407	A9.5a	Modulation	Digital Modulation is used	Digital modulation is required	Complies
	A9.5 (3)	Channel Selection	Spurious emissions tested at outermost channels in each band	Device was tested on the top, bottom and center channels in each band	N/A
15			Measurements on three channels in each band		
15.407 (c)	A9.5(4)	Operation in the absence of information to transmit	The proposed change to add a new antenna type does not affect the measurements/information filed in the original application for equipment authorization.		
15.407 (g)	A9.5 (5)	Frequency Stability			
15.407 (h1)	A9.4	Transmit Power Control			
15.407 (h2)	A9.4	Dynamic frequency Selection (device without radar detection)			
	A9.9g	User Manual information			

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	The proposed change to add a new antenna type does not affect the measurements/information filed in the original application for equipment authorization.		
15.207	RSS GEN Table 2	AC Conducted Emissions			
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in Exhibit 11, RSS 102 declaration	Refer to OET 65, FCC Part 1 and RSS 102	Complies
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	49.0dBµV/m @ 7713.4MHz	Refer to table on page 16	Complies (-5.0dB)

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted (power meter)	dBm	25 to 7000 MHz	± 0.52 dB
RF power, conducted (Spectrum analyzer)	dBm	25 to 7000 MHz	± 0.7 dB
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 26500 MHz	± 2.5 dB
Radiated emission (field strength)	dBµV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dBµV	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Intel Corporation model 633ANHU is an 802.11abgn (3x3) module designed for installation by OEMs into laptops and similar devices. The device has been certified and the scope of testing is to evaluate a new PIFA antenna that has a higher gain in some of the operating bands than the original PIFA antenna approved for use with the module.

The sample was received on May 13, 2010 and tested on May 14,15 and 17, 2010. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC/Canada ID
Intel Corporation	633ANHMW	802.11abgn 3x3 mini pCIe	MAC 0024D7012728	FCC: PD9633ANHU IC: 1000M-633ANHU

ANTENNA SYSTEM

The purpose of testing is to evaluate a new set of PIFA antennas with the module. As the module had been tested with a PIFA antenna during the original filing for device certification testing was limited to those bands where the new antennas had a higher gain than the tested antenna. Those bands are highlighted in orange in the table below.

Antenna Name and model	Chain	Type	Antenna Gain				Comments
			2.4GHz	5.2GHz	5.5GHz	5.7GHz	
Universe	A,B,C	PIFA	3.24	3.73	4.77	4.97	Original Antenna tested
Quanta Smart Approach							
SE-07200-EQQU8	A	PIFA	-0.88	1.58	0.21	-0.8	Proposed new antenna
SE-07200-EQQU8	B	PIFA	1.06	1.26	0.23	-0.01	Proposed new antenna
SE-07200-EQQU8	C	PIFA	-0.28	**4.66**	3.9	3.53	Proposed new antenna

The new Smart Approach antenna has lower gain than the universe antennas originally approved with the device on all chains and in all the operating bands with the exception of the 5150-5250 and 5250 to 5350 MHz bands on Chain C. Transmitter radiated spurious emissions were performed on the low, middle and high channels in these bands using the worst case operating mode(s) in each band. The original data indicated that the worst case mode for radiated spurious emissions away from the band edges was 802.11n 20MHz mode and at the band edges both 20- and 40-MHz channel bandwidths were evaluated.

Receiver spurious emissions were evaluated for all operating bands to verify that the signals related to the VCOs in all the bands were still below the receiver limit.

In addition, Chain C was evaluated for spurious emissions with the device operating on the worst case mode (802.11b mode) in the 2.4GHz band as the higher gain in the lower 5GHz band could extend down to the second harmonic of the 2.4GHz signal. As the emissions were not degraded the proposed change is considered a Class 1 permissive change for the DTS operation of the device.

ENCLOSURE

The EUT has no enclosure. It is designed to be installed within the enclosure of a host computer.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at Elliott.

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Dell	-	Laptop PC	Prototype	N/A
Intel	-	Extender Card	-	N/A
Topward	-	DC Power Supply	-	N/A

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded / Unshielded	Length(m)
Laptop Mini PCIe	Extender	Ribbon	Unshielded	0.8m
DC Supply DC	Extender	2-wire	Unshielded	1m
EUT antenna A	antenna A	Coaxial (integral to antenna)	-	~30cm
EUT antenna A	antenna A	Coaxial (integral to antenna)	-	~30cm
EUT antenna A	antenna A	Coaxial (integral to antenna)	-	~30cm

EUT OPERATION

During testing, the EUT was either transmitting continuously in the operating mode detailed or was in receive mode.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 4	211948	2845B-4	41039 Boyce Road Fremont, CA 94538-2435
Chamber 5	211948	2845B-5	

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

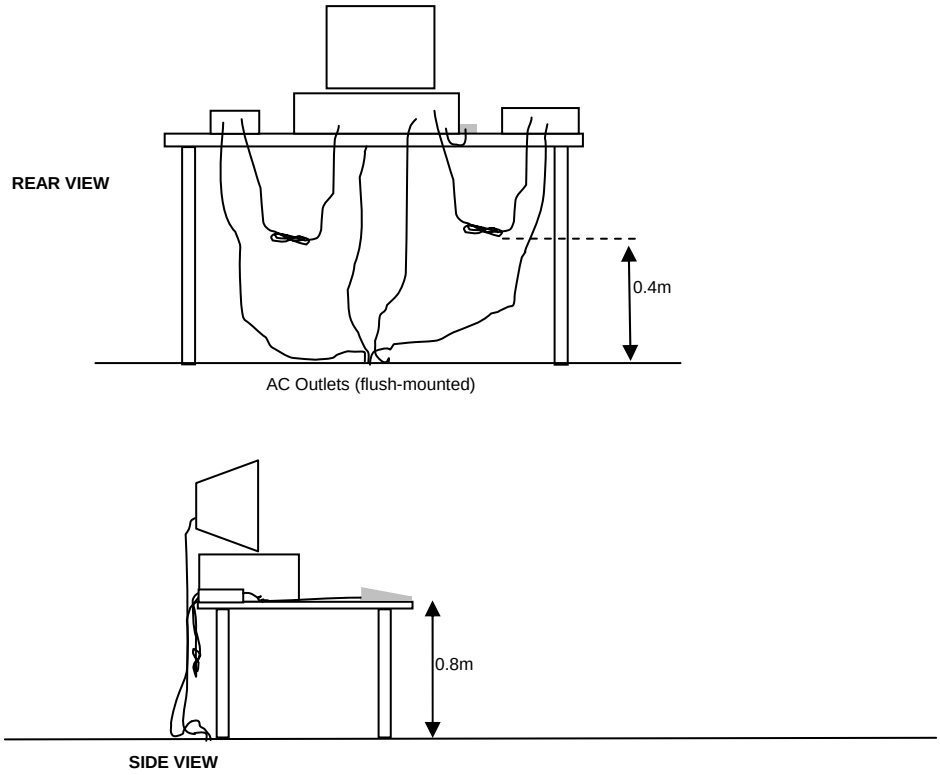
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

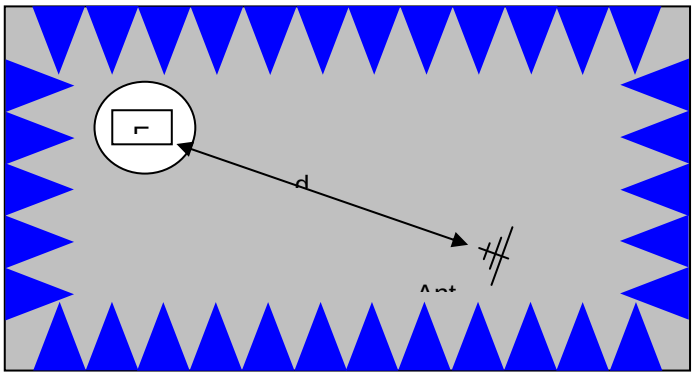
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

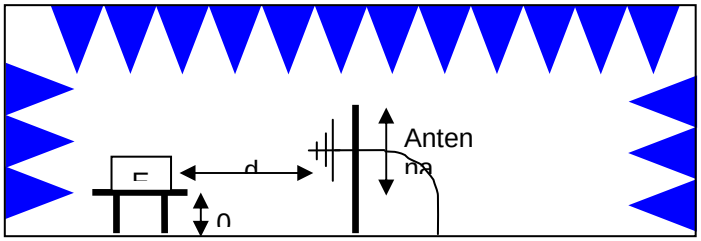
When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.



Typical Test Configuration for Radiated Field Strength Measurements



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

FCC 15.407 (a) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
5150 – 5250	50mW (17 dBm)	4 dBm/MHz
5250 – 5350	250 mW (24 dBm)	11 dBm/MHz
5725 – 5825	1 Watts (30 dBm)	17 dBm/MHz

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

The peak excursion envelope is limited to 13dB.

OUTPUT POWER LIMITS –LELAN DEVICES

The table below shows the limits for output power and output power density defined by RSS 210. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
5150 – 5250	200mW (23 dBm) eirp	10 dBm/MHz eirp
5250 – 5350	250 mW (24 dBm)[2] 1W (30dBm) eirp	11 dBm/MHz
5470 – 5725	250 mW (24 dBm)[3] 1W (30dBm) eirp	11 dBm/MHz
5725 – 5825	1 Watts (30 dBm) 4W eirp	17 dBm/MHz

In addition, the power spectral density limit shall be reduced by 1dB for every dB the highest power spectral density exceeds the "average" power spectral density) by more than 3dB. The "average" power spectral density is determined by dividing the output power by 10log(EBW) where EBW is the 99% power bandwidth.

Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

SPURIOUS EMISSIONS LIMITS –UNII and LELAN DEVICES

The spurious emissions limits for signals below 1GHz are the FCC/RSS-GEN general limits. For emissions above 1GHz, signals in restricted bands are subject to the FCC/RSS GEN general limits. All other signals have a limit of –27dBm/MHz, which is a field strength of 68.3dBuV/m/MHz at a distance of 3m. This is an average limit so the peak value of the emission may not exceed –7dBm/MHz (68.3dBuV/m/MHz at a distance of 3m). For devices operating in the 5725-5850Mhz bands under the LELAN/UNII rules, the limit within 10Mhz of the allocated band is increased to –17dBm/MHz.

[2] If EIRP exceeds 500mW the device must employ TPC
[3] If EIRP exceeds 500mW the device must employ TPC

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

Appendix A Test Equipment Calibration Data

Radio (BE & Fundamental), 14-May-10

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	6/3/2010
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	7/15/2010
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	6/12/2010

Radio (Spurious Emissions), 15-May-10

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	High Pass filter, 8.2 GHz (Red System)	P/N 84300-80039 (84125C)	1152	9/28/2010
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	4/14/2011
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/10/2010
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	1729	9/25/2010
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	1780	9/17/2010

Radio Spurious Emissions, 17-May-10

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	4/14/2011
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/10/2010
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/29/2010
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	1780	9/17/2010

Radiated Emissions, 1000 - 18,000 MHz, 17-May-10

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/10/2010
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	8/19/2010
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	6/12/2010

Appendix B Test Data

T79310 27 Pages

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		-
Emissions Standard(s):	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	-
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Intel

Model

633ANHMW with Smart Approach PIFA antenna

Date of Last Test: 5/17/2010

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

RSS 210 and FCC 15.407 (UNII) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Summary of Results

CRTU Tool Version 5.15.36.0 Driver version 13.0.0.91. MAC Address: 0024D7012728
Scope of testing is to evaluate a new PIFA antenna with higher gain in the 5150 - 5250/5250-5350 MHz than the PIFA antenna originally approved with the module. Testing was limited to evaluating the worst case modes (taken from the original testing) on the top, bottom and center channels in each band.

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
Band edge radiated field strength							
Run #1	n40 Chain C	#38 5190MHz	11.0	11.1	Restricted Band Edge at 5150 MHz	15.209	**52.1dBµV/m @ 5148.1MHz (-1.9dB)**
Run #1	n40 Chain C	#62 5310MHz	12.5	12.6	Restricted Band Edge at 5350 MHz	15.209	51.2dBµV/m @ 5351.0MHz (-2.8dB)
Run # 2	n20 Chain C	#36 5180MHz	14.5	14.5	Restricted Band Edge at 5150 MHz	15.209	52.6dBµV/m @ 5150.0MHz (-1.4dB)
Run # 2	n20 Chain C	#64 5320MHz	16.5	16.7	Restricted Band Edge at 5350 MHz	15.209	**53.7dBµV/m @ 5350.0MHz (-0.3dB)**
Spurious radiated emissions							
Run # 3	n20 Chain C	#36 5180MHz	16.5	16.5	Radiated Emissions, 1 - 18 GHz (Emissons above 18GHz more than 20dB below the limit)	FCC 15.209 / 15 E	47.3dBµV/m @ 15543.1MHz (-6.7dB)
		#40 5200MHz	16.5	16.6			46.3dBµV/m @ 15604.1MHz (-7.7dB)
		#48 5240MHz	16.5	16.7			40.3dBµV/m @ 1330.3MHz (-13.7dB)
Run # 3	n20 Chain C	#52 5260MHz	16.5	16.8		FCC 15.209 / 15 E	39.3dBµV/m @ 15773.4MHz (-14.7dB)
		#60 5300MHz	16.5	16.7			41.4dBµV/m @ 1331.8MHz (-12.6dB)
		#64 5320MHz	16.5	16.7			42.4dBµV/m @ 5416.3MHz (-11.6dB)

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Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

As the new antenna has higher gain in the 5GHz band we want to check that the 2.4GHz spurious at the second harmonic are not increased with this new antenna. Worst case mode is 802.11b.

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
Run # 4	802.11b Chain C	#1 2412MHz	16.5	16.8	Radiated Emissions, 1 - 26 GHz	FCC 15.209 / 15.247	47.5dBµV/m @ 3000.4MHz (-6.5dB)
		#6 2437MHz	16.5	16.7			41.2dBµV/m @ 4874.0MHz (-12.8dB)
		#11 2462MHz	16.5	16.5			45.5dBµV/m @ 3000.2MHz (-8.5dB)

Note - the target and measured power are average powers (measured with average power sensor) and are used for reference purposes only. Power is set using " **GAIN CONTROL**" mode in the CRTU tool.

General Test Configuration

The EUT ws installed into a test fixture such that the EUT was exposed (i.e. outside of a host PC).
For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Rel. Humidity:	15 - 55 %
Temperature:	18 - 25 °C

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Marker Delta Measurements

Three sets of marker deltas are measured using the following settings: RB=VB=100kHz; RB=1MHz,VB=1MHz; RB=1MHz, VB=10Hz.
Marker deltas are made conducted (analyzer connected to EUT rf port a 20dB pad) for single chain operation and radiated (at a distance of ~ 50cm) for MIMO modes.
The fundamental field strength is always measured at a 3m test distance.

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run #1, Band Edge Field Strength - n40, Chain C
Run #1a, EUT on Channel #38 5190MHz - n40, Chain C

Date of Test: 5/14/2010 Test Location: FT Chamber #5
Test Engineer: Rafael Varelas Config Change: none

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	11.0	11.1	20.5

Fundamental Signal Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5179.000	95.1	V	-	-	AVG	116	1.0	RB 1 MHz;VB 10 Hz;Pk
5179.930	103.1	V	-	-	PK	116	1.0	RB 1 MHz;VB 3 MHz;Pk
5178.930	91.2	H	-	-	AVG	296	1.0	RB 1 MHz;VB 10 Hz;Pk
5178.470	99.4	H	-	-	PK	296	1.0	RB 1 MHz;VB 3 MHz;Pk

5150 MHz Band Edge Signal Radiated Field Strength - Marker Delta

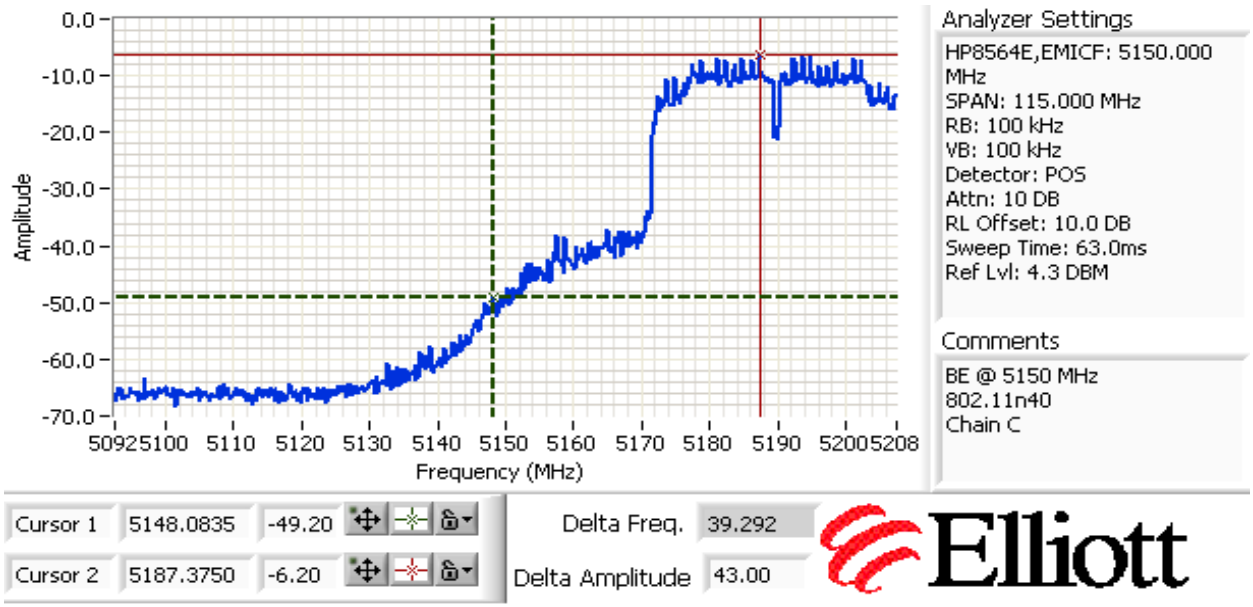
	H	V	
Fundamental emission level @ 3m in **1MHz RBW:**	99.4	103.1	Peak Measurement (RB=VB=1MHz)
Fundamental emission level @ 3m in **1MHz RBW:**	91.2	95.1	Average Measurement (RB=1MHz, VB=10Hz)
Delta Marker - 100kHz	**43.0** *dB*		<- this can only be used if band edge signal is highest within 2MHz of band edge.
Calculated Band-Edge Measurement (Peak):	60.1 dBuV/m		
Calculated Band-Edge Measurement (Avg):	52.1 dBuV/m		

	Margin	Level	Limit	Detector
Delta Marker - 1MHz/1MHz:	-1.9	52.1	54	Avg
Delta Marker - 1MHz/10Hz:	-13.9	60.1	74	Pk

Calculated Band-Edge Measurement (Peak):	65.3 dBuV/m	Using 100kHz delta value
Calculated Band-Edge Measurement (Avg):	53.8 dBuV/m	Using 100kHz delta value

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5148.084	52.1	-	54.0	**-1.9**	Avg	-	-	Using 100kHz delta value

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A



Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run #1b, EUT on Channel #62 5310MHz - n40, Chain C

Date of Test: 5/14/2010 Test Location: FT Chamber #5

Test Engineer: Rafael Varelas Config Change: none

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	12.5 (EEPROM +1.5)	12.6	22.5

Fundamental Signal Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5298.870	93.4	V	-	-	AVG	99	1.0	RB 1 MHz;VB 10 Hz;Pk
5320.400	101.7	V	-	-	PK	99	1.0	RB 1 MHz;VB 3 MHz;Pk
5320.800	91.4	H	-	-	AVG	298	1.0	RB 1 MHz;VB 10 Hz;Pk
5320.470	99.9	H	-	-	PK	298	1.0	RB 1 MHz;VB 3 MHz;Pk

5350 MHz Band Edge Signal Radiated Field Strength - Marker Delta

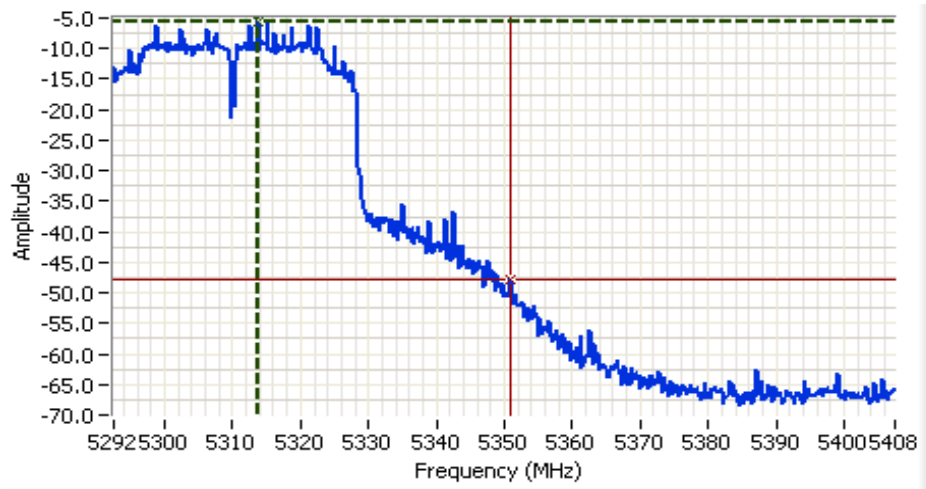
	H	V	
Fundamental emission level @ 3m in **1MHz RBW:**	99.9	101.7	Peak Measurement (RB=VB=1MHz)
Fundamental emission level @ 3m in **1MHz RBW:**	91.4	93.4	Average Measurement (RB=1MHz, VB=10Hz)
Delta Marker - 100kHz	**42.2** *dB*		<- this can only be used if band edge signal is highest within 2MHz of band edge.
Calculated Band-Edge Measurement (Peak):	59.5 dBuV/m		
Calculated Band-Edge Measurement (Avg):	51.2 dBuV/m		

Margin	Level	Limit	Detector
-2.8	51.2	54	Avg
-14.5	59.5	74	Pk

Delta Marker - 1MHz/1MHz:	*39.8 dB*	
Delta Marker - 1MHz/10Hz:	*42.0 dB*	
Calculated Band-Edge Measurement (Peak):	61.9 dBuV/m	Using 100kHz delta value
Calculated Band-Edge Measurement (Avg):	51.4 dBuV/m	Using 100kHz delta value

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5350.958	51.2	-	54.0	**-2.8**	Avg	-	-	Using 100kHz delta value

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A



Analyzer Settings

HP8564E,EMICF: 5350.000 MHz
SPAN: 115.000 MHz
RB: 100 kHz
VB: 100 kHz
Detector: POS
Attn: 10 DB
RL Offset: 10.0 DB
Sweep Time: 63.0ms
Ref Lvl: 4.3 DBM

Comments

BE @ 5350 MHz
802.11n40
Chain C

Cursor 1	5313.7749	-5.70	Delta Freq.	37.184	Elliott
Cursor 2	5350.9585	-47.87	Delta Amplitude	42.17	

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 2, Band Edge Field Strength - n20, Chain C
Run # 2a, EUT on Channel #36 5180MHz - n20, Chain C

Date of Test: 5/14/2010 Test Location: FT Chamber #5
Test Engineer: Rafael Varelas Config Change: none

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	14.5	14.5	23.0

Fundamental Signal Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5174.400	101.4	V	-	-	AVG	122	1.1	RB 1 MHz;VB 10 Hz;Pk
5173.230	109.6	V	-	-	PK	122	1.1	RB 1 MHz;VB 3 MHz;Pk
5176.730	96.5	H	-	-	AVG	53	1.1	RB 1 MHz;VB 10 Hz;Pk
5176.130	104.5	H	-	-	PK	53	1.1	RB 1 MHz;VB 3 MHz;Pk

5150 MHz Band Edge Signal Radiated Field Strength - Marker Delta

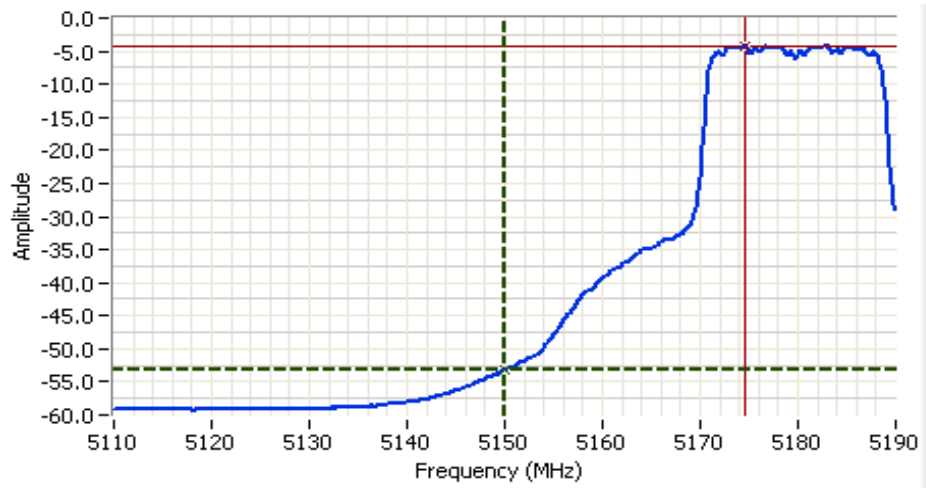
	H	V	
Fundamental emission level @ 3m in **1MHz RBW:**	104.5	109.6	Peak Measurement (RB=VB=1MHz)
Fundamental emission level @ 3m in **1MHz RBW:**	96.5	101.4	Average Measurement (RB=1MHz, VB=10Hz)
Delta Marker - 100kHz	*48.8 dB*		<- this can only be used if band edge signal is
Calculated Band-Edge Measurement (Peak):	60.8 dBuV/m		highest within 2MHz of band edge.
Calculated Band-Edge Measurement (Avg):	52.6 dBuV/m		

Margin	Level	Limit	Detector
-1.4	52.6	54	Avg
-13.2	60.8	74	Pk

Delta Marker - 1MHz/1MHz:	*42.5 dB*	
Delta Marker - 1MHz/10Hz:	*48.8 dB*	
Calculated Band-Edge Measurement (Peak):	67.1 dBuV/m	Using 100kHz delta value
Calculated Band-Edge Measurement (Avg):	52.6 dBuV/m	Using 1MHz delta value

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5150.000	52.6	-	54.0	**-1.4**	Avg	-	-	Using 1MHz delta value

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A



Analyzer Settings

HP8564E,EMICF: 5150.000 MHz
SPAN: 80.000 MHz
RB: 1.000 MHz
VB: 10 Hz
Detector: Sample
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 30.0s
Ref Lvl: 10.9 DBM

Comments

BE @ 5150 MHz
802.11n20
Chain C

Cursor 1	5150.0000	-53.10	Delta Freq.	24.533	
Cursor 2	5174.5332	-4.27	Delta Amplitude	48.83	

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 2b, EUT on Channel #64 5320MHz - n20, Chain C

Date of Test: 5/14/2010 Test Location: FT Chamber #5

Test Engineer: Rafael Varelas Config Change: none

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.7	27.5

Fundamental Signal Field Strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5314.700	102.7	V	-	-	AVG	127	1.0	RB 1 MHz;VB 10 Hz;Pk
5315.400	111.6	V	-	-	PK	127	1.0	RB 1 MHz;VB 3 MHz;Pk
5314.270	100.1	H	-	-	AVG	10	1.1	RB 1 MHz;VB 10 Hz;Pk
5313.370	108.7	H	-	-	PK	10	1.1	RB 1 MHz;VB 3 MHz;Pk

5350 MHz Band Edge Signal Radiated Field Strength - Marker Delta

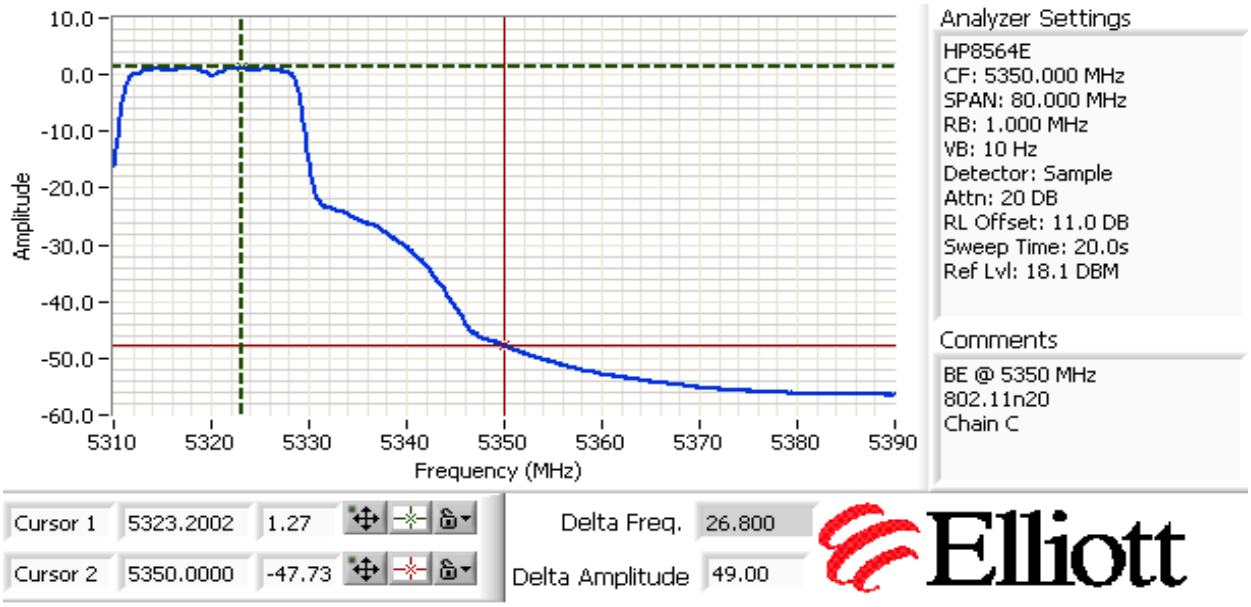
	H	V	
Fundamental emission level @ 3m in **1MHz RBW:**	108.7	111.6	Peak Measurement (RB=VB=1MHz)
Fundamental emission level @ 3m in **1MHz RBW:**	100.1	102.7	Average Measurement (RB=1MHz, VB=10Hz)
Delta Marker - 100kHz	*48.0 dB*		<- this can only be used if band edge signal is highest within 2MHz of band edge.
Calculated Band-Edge Measurement (Peak):	63.6 dBuV/m		
Calculated Band-Edge Measurement (Avg):	54.7 dBuV/m		

Margin	Level	Limit	Detector
-0.3	53.7	54	Avg
-10.4	63.6	74	Pk

Delta Marker - 1MHz/1MHz:	*40.2 dB*	
Delta Marker - 1MHz/10Hz:	**49.0** *dB*	
Calculated Band-Edge Measurement (Peak):	71.4 dBuV/m	Using 100kHz delta value
Calculated Band-Edge Measurement (Avg):	53.7 dBuV/m	Using 1MHz delta value

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5350.000	53.7	-	54.0	**-0.3**	Avg	-	-	Using 1MHz delta value

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A



Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 3, Radiated Spurious Emissions, 1-40GHz, n20, Chain C

Date of Test: 5/14/2010 Test Location: FT Chamber #4

Test Engineer: Rafael Varelas Config Change: none

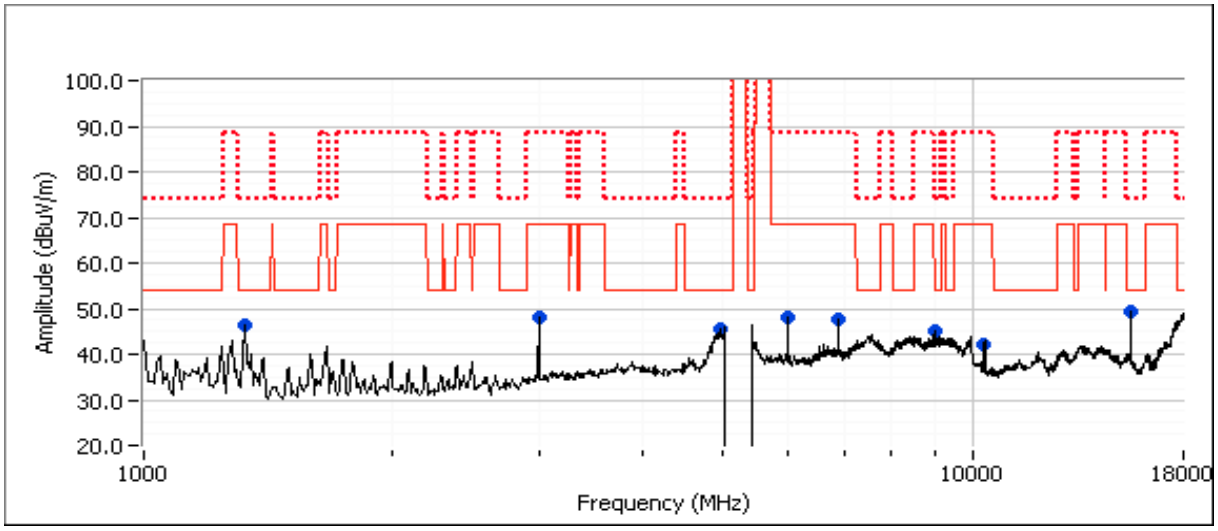
For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -27dBm eirp (68.3dBuV/m @3m). As the power measured is average power this is considered an average limit so the peak limit would be 88.3dBuV/m at 3m.

Run # 3a: EUT on Channel #36 5180MHz - n20, Chain C

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.5	26.5

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15543.090	47.3	H	54.0	-6.7	AVG	129	1.0	RB 1 MHz;VB 10 Hz;Pk
15541.160	59.9	H	74.0	-14.1	PK	129	1.0	RB 1 MHz;VB 3 MHz;Pk
4983.680	40.7	V	54.0	-13.3	AVG	82	1.0	RB 1 MHz;VB 10 Hz;Pk
4982.180	52.1	V	74.0	-21.9	PK	82	1.0	RB 1 MHz;VB 3 MHz;Pk
1328.590	36.2	V	54.0	-17.8	AVG	138	1.0	RB 1 MHz;VB 10 Hz;Pk
1327.690	51.7	V	74.0	-22.3	PK	138	1.0	RB 1 MHz;VB 3 MHz;Pk
9001.010	43.4	V	54.0	-10.6	AVG	180	1.0	RB 1 MHz;VB 10 Hz;Pk
9001.010	50.9	V	74.0	-23.1	PK	180	1.0	RB 1 MHz;VB 3 MHz;Pk
3000.150	48.0	V	68.3	-20.3	Peak	69	1.0	
6000.960	48.0	V	68.3	-20.3	Peak	263	1.0	
6906.630	47.8	H	68.3	-20.5	Peak	202	1.0	
10340.610	42.0	V	68.3	-26.3	Peak	258	1.0	
15544.190	49.4	H	54.0	-4.6	Peak	111	1.0	



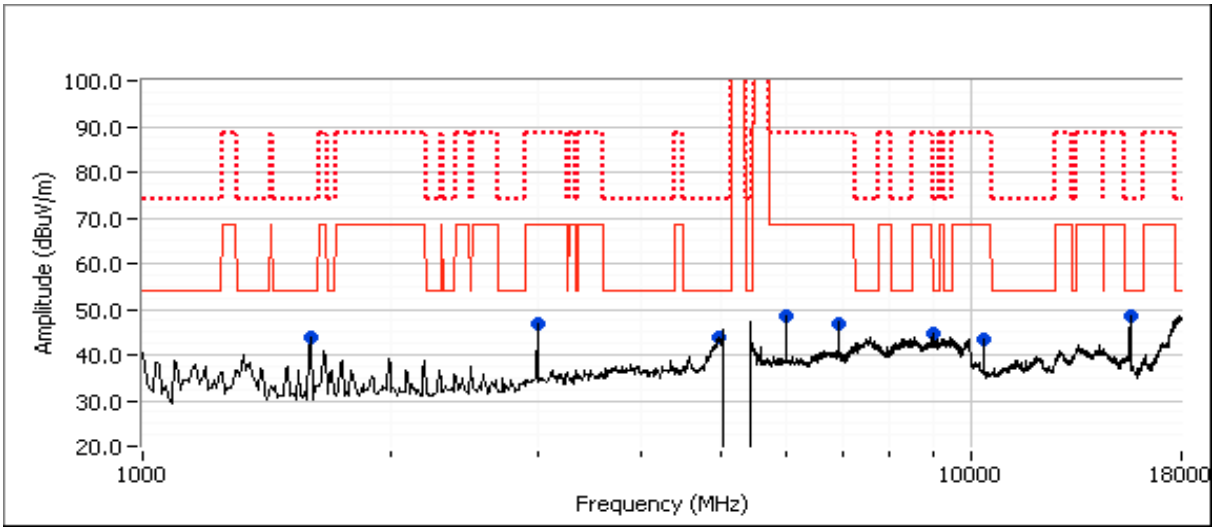
Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 3b: EUT on Channel #40 5200MHz - n20, Chain C

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.6	27.0

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15604.070	46.3	H	54.0	-7.7	AVG	124	1.0	MHz;VB 10 Hz;Pk
15606.370	59.1	H	74.0	-14.9	PK	124	1.0	MHz;VB 3 MHz;Pk
4961.980	38.7	V	54.0	-15.3	AVG	100	1.0	MHz;VB 10 Hz;Pk
4963.350	50.0	V	74.0	-24.0	PK	100	1.0	MHz;VB 3 MHz;Pk
9001.060	43.2	V	54.0	-10.8	AVG	179	1.0	MHz;VB 10 Hz;Pk
9001.190	50.3	V	74.0	-23.7	PK	179	1.0	MHz;VB 3 MHz;Pk
1593.620	29.6	H	54.0	-24.4	AVG	272	1.2	MHz;VB 10 Hz;Pk
1592.850	44.3	H	74.0	-29.7	PK	272	1.2	MHz;VB 3 MHz;Pk
3000.150	47.0	V	68.3	-21.3	Peak	200	1.0	
6000.960	48.5	V	68.3	-19.8	Peak	262	1.0	
6933.360	46.8	H	68.3	-21.5	Peak	195	1.0	
10400.470	43.5	V	68.3	-24.8	Peak	249	1.0	



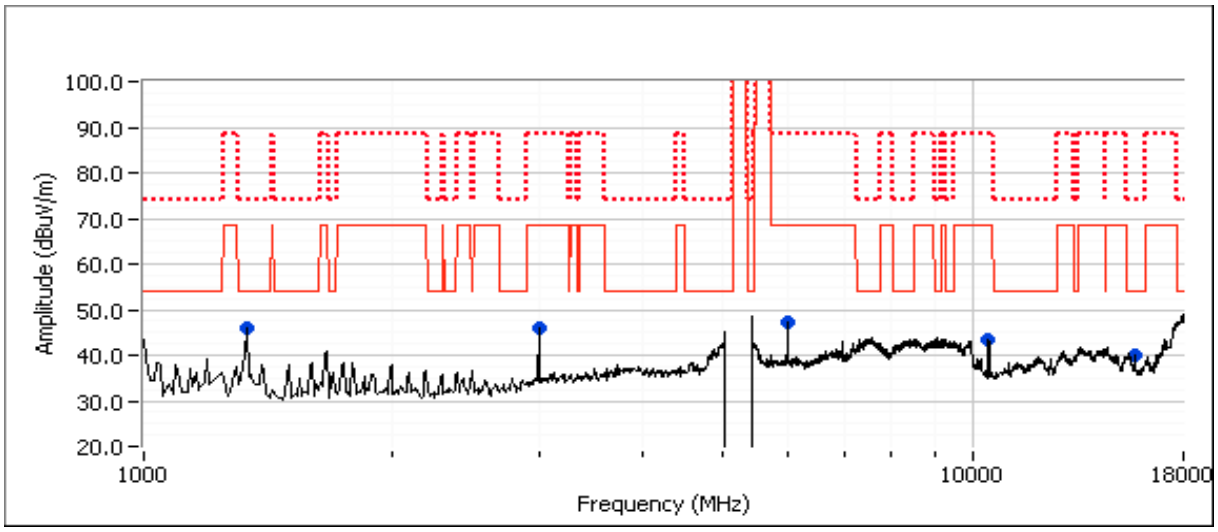
Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 3c: EUT on Channel #48 5240MHz - n20, Chain C

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.7	27.5

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1330.250	40.3	V	54.0	-13.7	AVG	131	1.0	RB 1 MHz;VB 10 Hz;Pk
1328.560	51.2	V	74.0	-22.8	PK	131	1.0	RB 1 MHz;VB 3 MHz;Pk
3000.150	46.1	V	68.3	-22.2	Peak	263	1.3	
6000.850	47.1	V	68.3	-21.2	Peak	263	1.3	
10466.670	43.6	V	68.3	-24.7	Peak	255	1.0	
15733.330	40.0	H	54.0	-14.0	Peak	115	1.0	



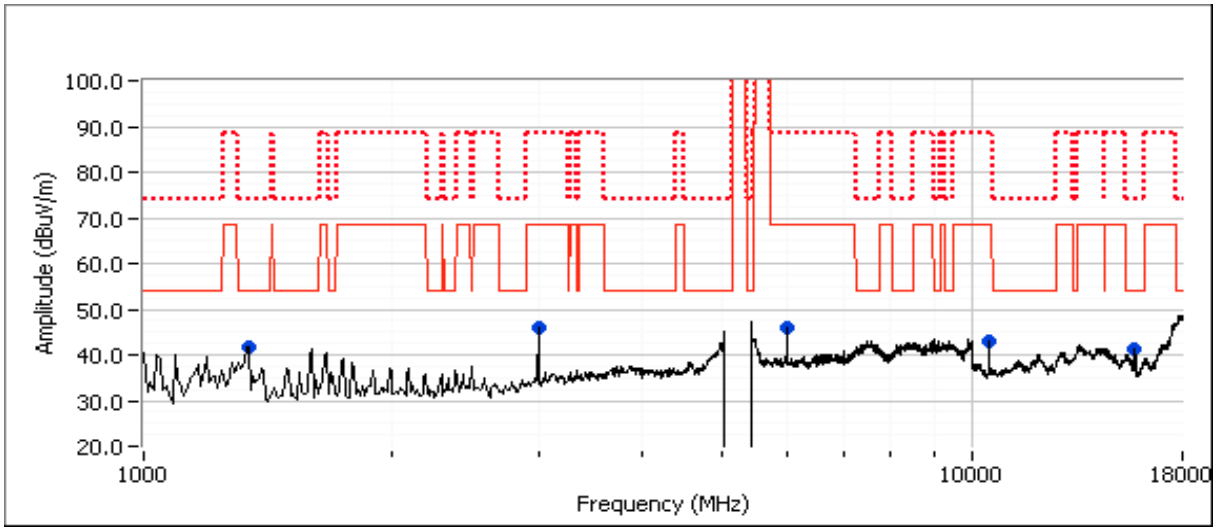
Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 3d: EUT on Channel #52 5260MHz - n20, Chain C

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.8	27.5

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15773.430	39.3	V	54.0	-14.7	AVG	266	1.2	RB 1 MHz;VB 10 Hz;Pk
15782.730	50.6	V	74.0	-23.4	PK	266	1.2	RB 1 MHz;VB 3 MHz;Pk
1330.010	39.2	V	54.0	-14.8	AVG	245	1.0	RB 1 MHz;VB 10 Hz;Pk
1332.190	51.2	V	74.0	-22.8	PK	245	1.0	RB 1 MHz;VB 3 MHz;Pk
10520.000	42.9	V	68.3	-25.4	Peak	263	1.3	
1330.950	41.8	V	54.0	-12.2	Peak	244	1.3	
3000.150	45.8	V	68.3	-22.5	Peak	251	1.3	
6000.850	46.0	V	68.3	-22.3	Peak	264	1.3	



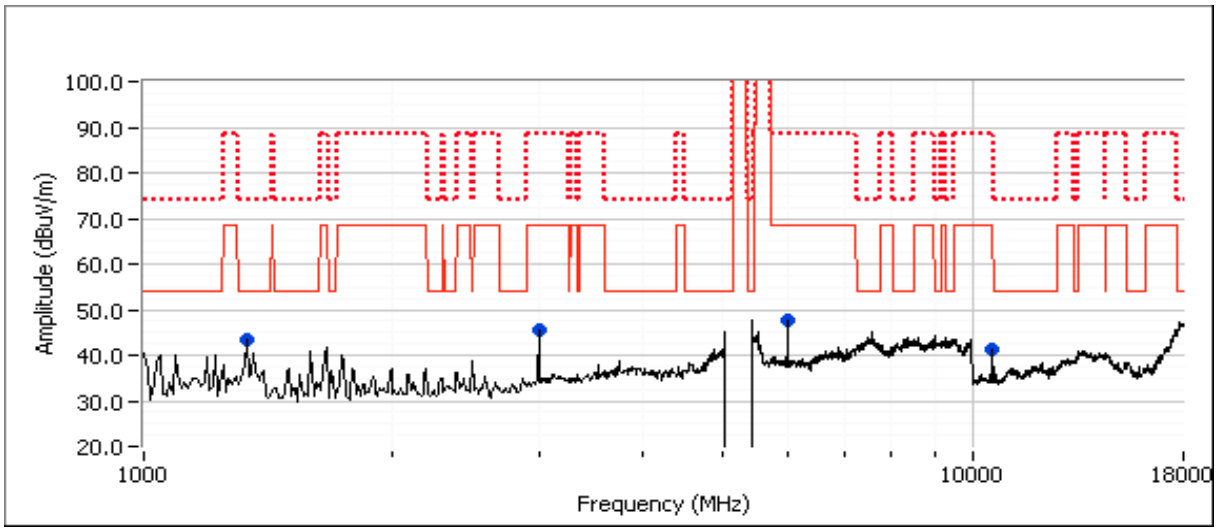
Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 3e: EUT on Channel #60 5300MHz - n20, Chain C

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.7	27.5

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1331.800	41.4	V	54.0	-12.6	AVG	242	1.0	RB 1 MHz;VB 10 Hz;Pk
1331.990	55.1	V	74.0	-18.9	PK	242	1.0	RB 1 MHz;VB 3 MHz;Pk
10600.130	35.6	V	54.0	-18.4	AVG	256	1.1	RB 1 MHz;VB 10 Hz;Pk
10592.100	47.3	V	74.0	-26.7	PK	256	1.1	RB 1 MHz;VB 3 MHz;Pk
3000.150	45.5	V	68.3	-22.8	Peak	250	1.3	
6000.850	47.8	V	68.3	-20.5	Peak	262	1.0	



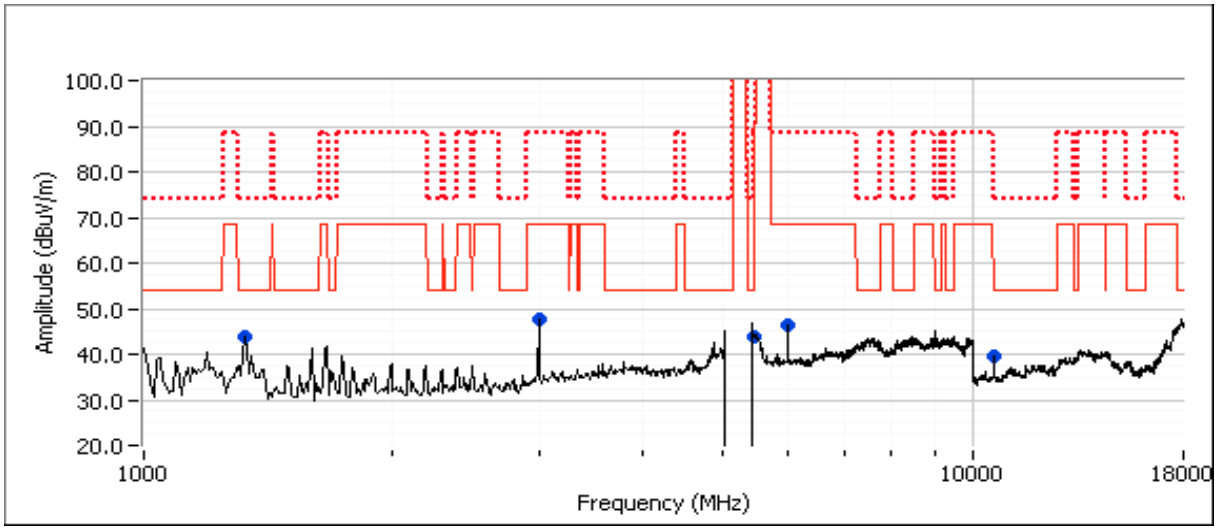
Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 3f: EUT on Channel #64 5320MHz - n20, Chain C

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.7	27.5

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5416.250	42.4	V	54.0	-11.6	AVG	129	1.3	RB 1 MHz;VB 10 Hz;Pk
5415.210	53.7	V	74.0	-20.3	PK	129	1.3	RB 1 MHz;VB 3 MHz;Pk
1331.700	34.0	V	54.0	-20.0	AVG	73	1.0	RB 1 MHz;VB 10 Hz;Pk
1331.330	49.7	V	74.0	-24.3	PK	73	1.0	RB 1 MHz;VB 3 MHz;Pk
10639.980	34.0	V	54.0	-20.0	AVG	256	1.0	RB 1 MHz;VB 10 Hz;Pk
10639.080	45.6	V	74.0	-28.4	PK	256	1.0	RB 1 MHz;VB 3 MHz;Pk
3000.150	47.6	V	68.3	-20.7	Peak	255	1.3	
6000.850	46.5	V	68.3	-21.8	Peak	106	1.0	



Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

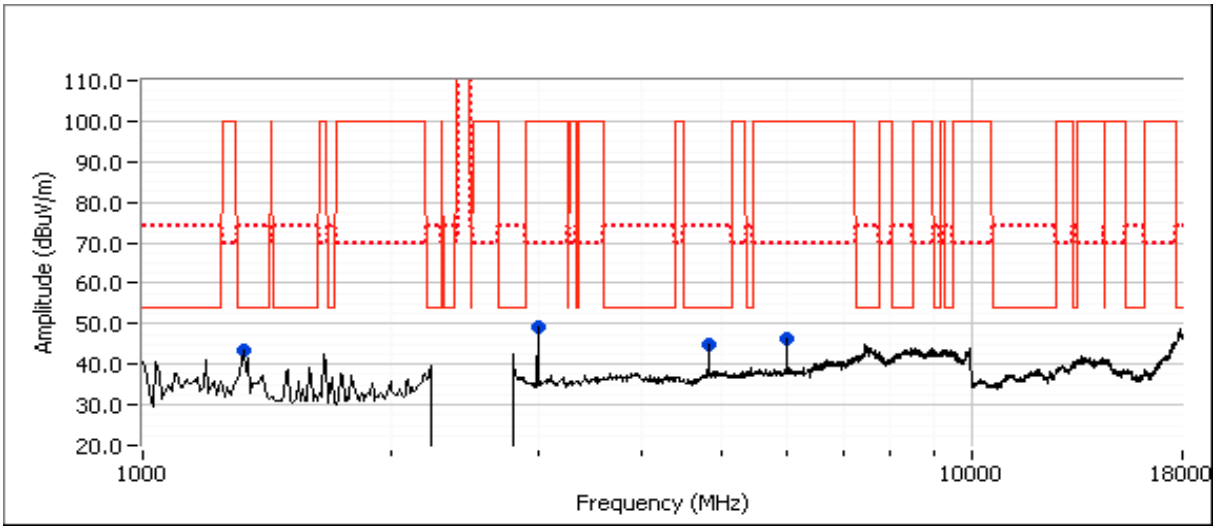
Run # 4, Radiated Spurious Emissions, 1-26GHz, 802.11b, Chain C

Date of Test: 5/17/2010 Test Location: Chamber #4

Test Engineer: Suhaila Khushzad Config Change: None

Run # 4a, EUT on Channel #1 2412MHz - 802.11b, Chain C

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.8	26.0



Spurious Radiated Emissions:

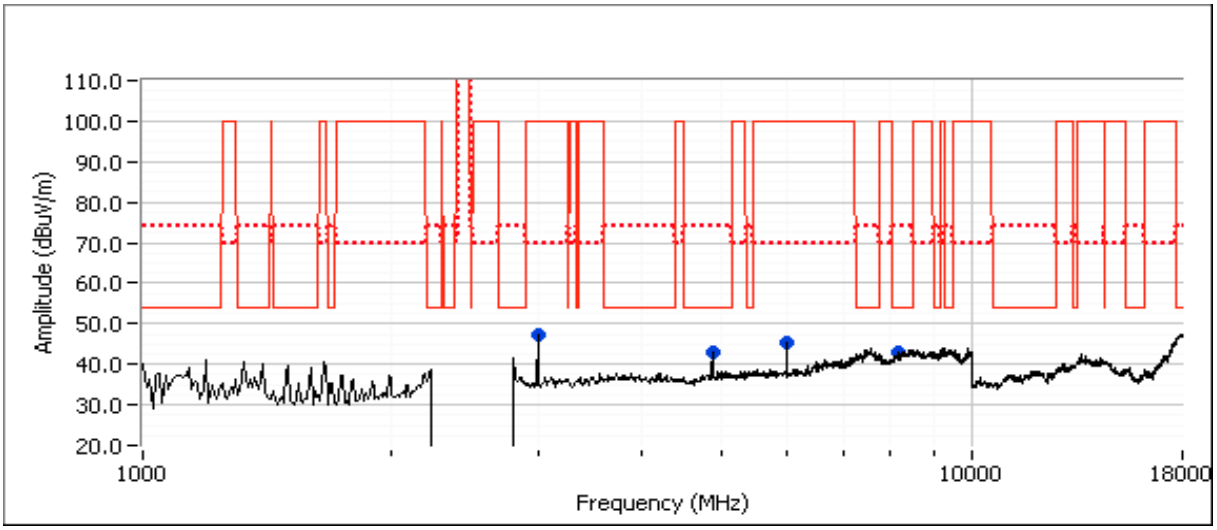
Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
3000.440	47.5	V	54.0	-6.5	AVG	198	1.0	RB 1 MHz; VB: 10 Hz	Note 2
3000.410	51.9	V	74.0	-22.1	PK	198	1.0	RB 1 MHz; VB: 1 MHz	Note 2
6000.790	40.7	V	54.0	-13.3	AVG	273	1.0	RB 1 MHz; VB: 10 Hz	Note 2
6000.530	47.5	V	74.0	-26.5	PK	273	1.0	RB 1 MHz; VB: 1 MHz	Note 2
4824.070	43.4	V	54.0	-10.6	AVG	189	1.3	RB 1 MHz; VB: 10 Hz	
4824.200	47.2	V	74.0	-26.8	PK	189	1.3	RB 1 MHz; VB: 1 MHz	
3000.010	49.1	V	70.0	-20.9	Peak	194	1.0		
6000.860	46.3	V	70.0	-23.7	Peak	263	1.3		
1328.680	27.2	H	54.0	-26.8	AVG	59	1.3	RB 1 MHz; VB: 10 Hz	
1333.210	40.9	H	74.0	-33.1	PK	59	1.3	RB 1 MHz; VB: 1 MHz	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 4b: , EUT on Channel #6 2437MHz - 802.11b, Chain C

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.7	26.0



Spurious Radiated Emissions:

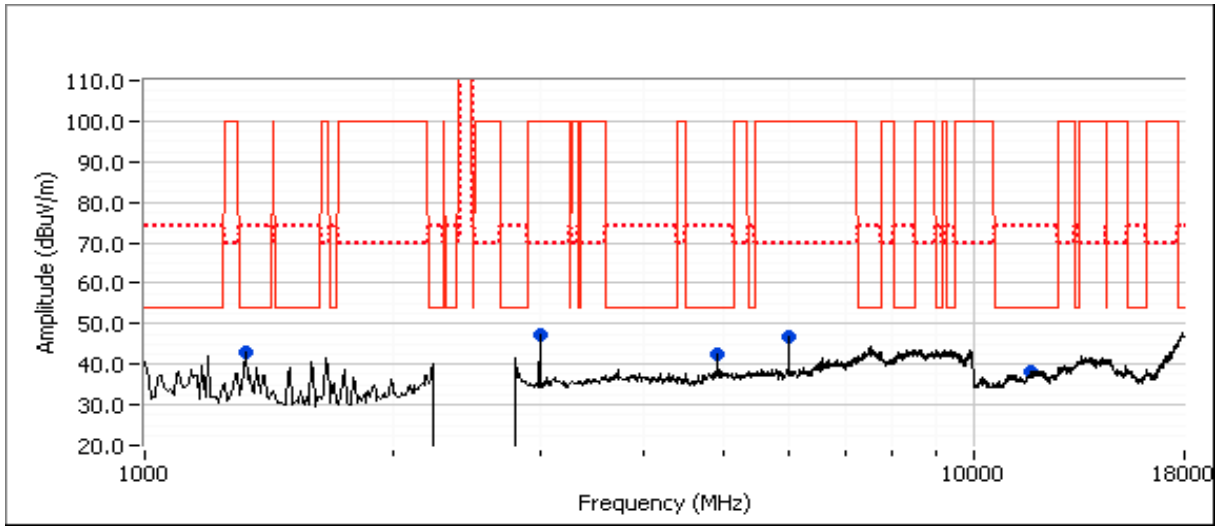
Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4874.020	41.2	V	54.0	-12.8	AVG	274	1.5	RB 1 MHz; VB: 10 Hz
4874.090	46.2	V	74.0	-27.8	PK	274	1.5	RB 1 MHz; VB: 1 MHz
8112.880	35.8	V	54.0	-18.2	AVG	250	1.9	RB 1 MHz; VB: 10 Hz
8138.880	46.8	V	74.0	-27.2	PK	250	1.9	RB 1 MHz; VB: 1 MHz
3000.010	47.5	V	70.0	-22.5	Peak	196	1.0	
6000.860	45.5	V	70.0	-24.5	Peak	94	1.0	

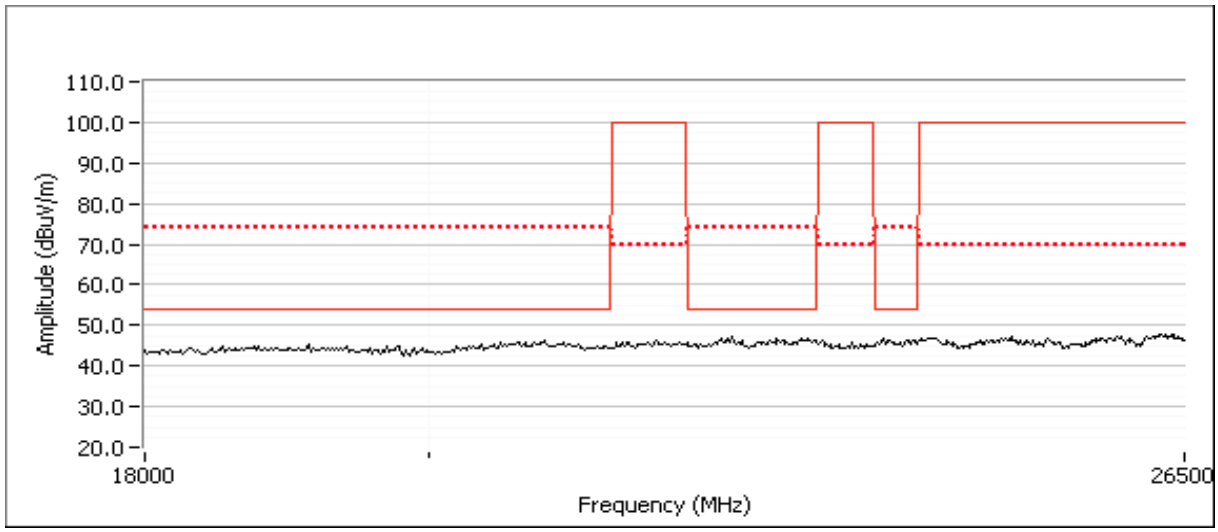
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run # 4c: , EUT on Channel #11 2462MHz - 802.11b, Chain C

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain C	16.5	16.5	26.0





Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
3000.210	45.5	V	54.0	-8.5	AVG	197	1.0	RB 1 MHz; VB: 10 Hz	Note 2
3000.140	50.1	V	74.0	-23.9	PK	197	1.0	RB 1 MHz; VB: 1 MHz	Note 2
6000.790	45.1	V	54.0	-8.9	AVG	259	1.2	RB 1 MHz; VB: 10 Hz	Note 2
6000.660	49.5	V	74.0	-24.5	PK	259	1.2	RB 1 MHz; VB: 1 MHz	Note 2
4924.050	40.3	V	54.0	-13.7	AVG	269	2.1	RB 1 MHz; VB: 10 Hz	
4923.980	45.4	V	74.0	-28.6	PK	269	2.1	RB 1 MHz; VB: 1 MHz	
1327.980	28.0	V	54.0	-26.0	AVG	237	1.0	RB 1 MHz; VB: 10 Hz	
1327.710	45.6	V	74.0	-28.4	PK	237	1.0	RB 1 MHz; VB: 1 MHz	
11744.230	38.0	H	54.0	-16.0	Peak	51	2.2		

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.

Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

RSS 210 Receiver Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/17/2010
Test Engineer: Rafael Varelas
Test Location: FT Chamber #5

Config. Used: 1
Config Change: none
Host Unit Voltage 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 19.4 °C
Rel. Humidity: 39 %

Summary of Results

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
1	Receive Mode, Chains A,B,C active	#6 2437MHz	-	-	Radiated Emissions, 1 - 7 GHz	RSS 210 RSS GEN	48.8dBµV/m @ 3000.4MHz (-5.2dB)
		#40 5200MHz	-	-	Radiated Emissions, 1 - 18 GHz		47.8dBµV/m @ 6000.8MHz (-6.2dB)
		#60 5300MHz	-	-			48.5dBµV/m @ 3000.4MHz (-5.5dB)
		#120 5600MHz	-	-			48.0dBµV/m @ 6000.8MHz (-6.0dB)
		#157 5785MHz	-	-			49.0dBµV/m @ 7713.4MHz (-5.0dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

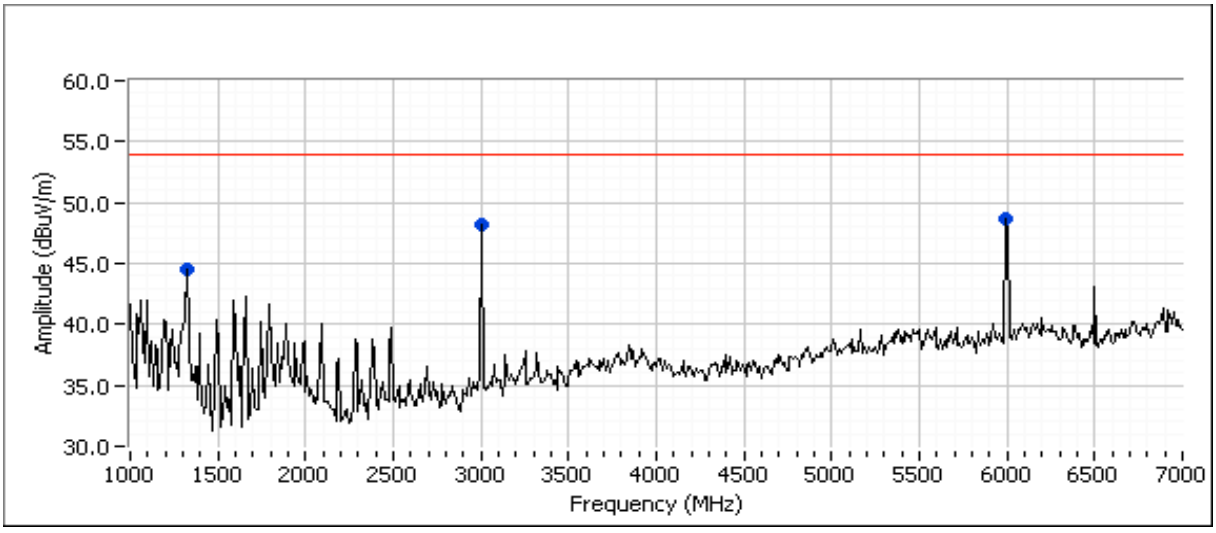
Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run #1, Radiated Spurious Emissions, Receive Mode, Chains A+B+C

Date of Test: 5/17/2010
Test Engineer: Rafael Varelas
Test Location: FT Chamber #5

Run #1a: Receiver tuned to 2437MHz, 1 - 7GHz

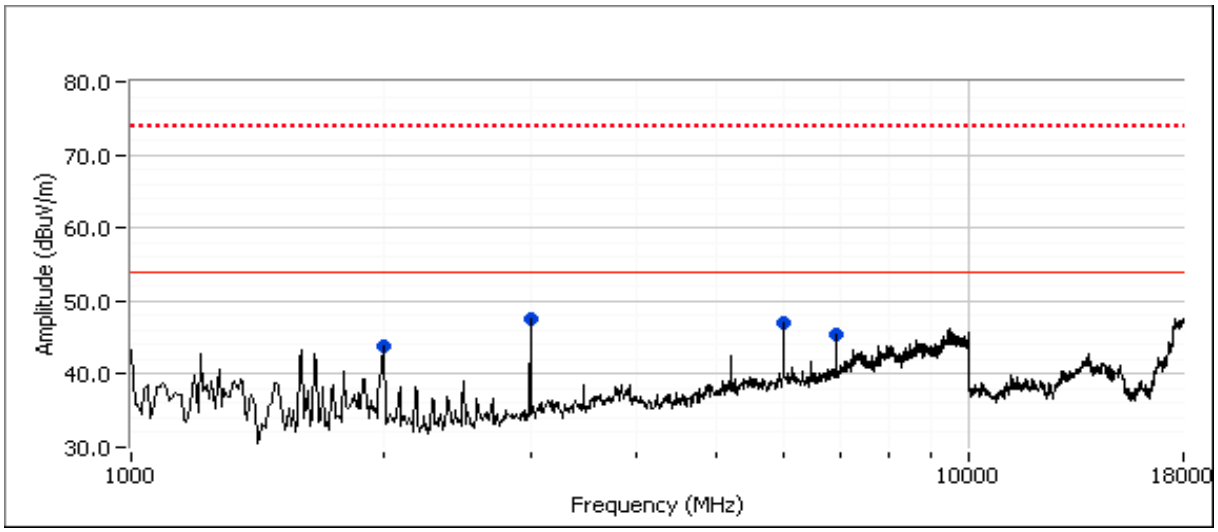
Frequency	Level	Pol	RSS 210 / RSS GEN		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
3000.400	48.8	V	54.0	-5.2	AVG	267	1.3	MHz; VB: 10 Hz
3000.190	52.9	V	74.0	-21.1	PK	267	1.3	MHz; VB: 1 MHz
6000.780	48.6	V	54.0	-5.4	AVG	261	1.0	MHz; VB: 10 Hz
6000.920	54.4	V	74.0	-19.6	PK	261	1.0	MHz; VB: 1 MHz
1331.110	31.5	V	54.0	-22.5	AVG	360	1.0	MHz; VB: 10 Hz
1326.890	50.1	V	74.0	-23.9	PK	360	1.0	MHz; VB: 1 MHz



Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run #1b: Receiver tuned to 5200MHz, 1 - 16GHz

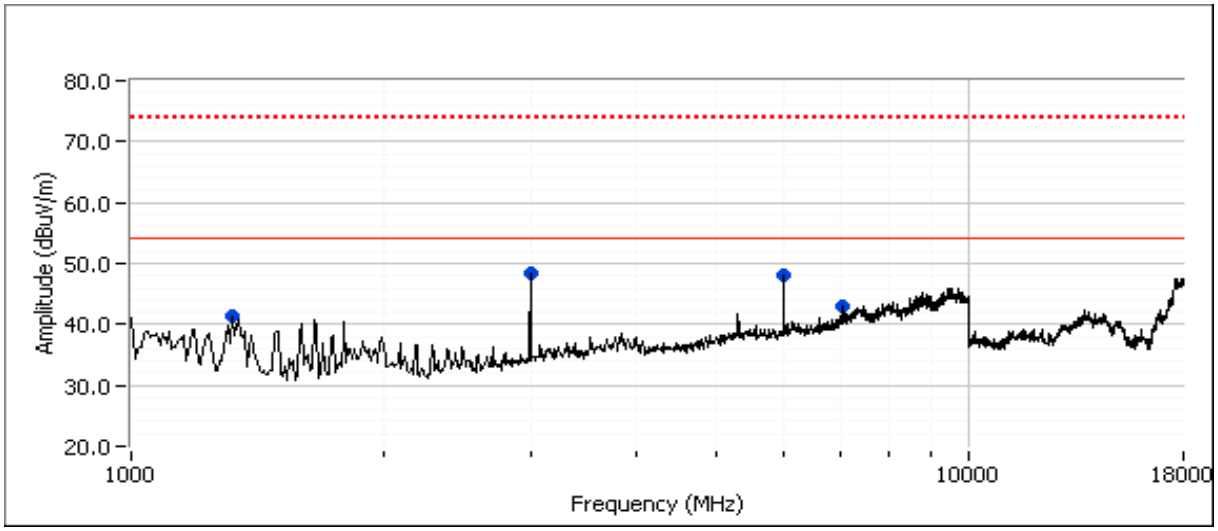
Frequency	Level	Pol	RSS 210 / RSS GEN		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
6000.770	47.8	V	54.0	-6.2	AVG	104	1.0	MHz; VB: 10 Hz
6000.930	52.2	V	74.0	-21.8	PK	104	1.0	MHz; VB: 1 MHz
6933.370	44.8	V	54.0	-9.2	AVG	277	1.8	MHz; VB: 10 Hz
6933.520	50.8	V	74.0	-23.2	PK	277	1.8	MHz; VB: 1 MHz
3000.350	45.5	V	54.0	-8.5	AVG	88	1.0	MHz; VB: 10 Hz
3000.330	50.6	V	74.0	-23.4	PK	88	1.0	MHz; VB: 1 MHz
1992.570	32.7	V	54.0	-21.3	AVG	3	1.0	MHz; VB: 10 Hz
1995.370	47.8	V	74.0	-26.2	PK	3	1.0	MHz; VB: 1 MHz



Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run #1c: Receiver tuned to 5300MHz, 1 - 16GHz

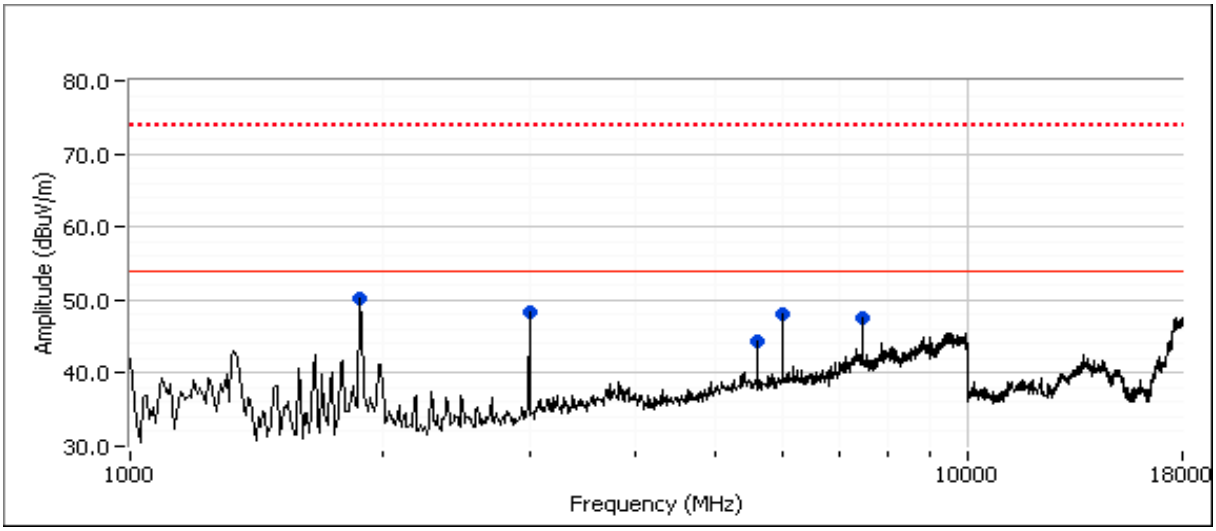
Frequency	Level	Pol	RSS 210 / RSS GEN		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
3000.380	48.5	V	54.0	-5.5	AVG	266	1.6	MHz; VB: 10 Hz
3000.340	52.4	V	74.0	-21.6	PK	266	1.6	MHz; VB: 1 MHz
1309.500	28.7	V	54.0	-25.3	AVG	61	1.0	MHz; VB: 10 Hz
1307.320	43.3	V	74.0	-30.7	PK	61	1.0	MHz; VB: 1 MHz
7066.740	40.9	V	54.0	-13.1	AVG	93	1.3	MHz; VB: 10 Hz
7066.900	49.6	V	74.0	-24.4	PK	93	1.3	MHz; VB: 1 MHz
6000.740	47.0	V	54.0	-7.0	AVG	221	1.0	MHz; VB: 10 Hz
6000.560	52.8	V	74.0	-21.2	PK	221	1.0	MHz; VB: 1 MHz



Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run #1d: Receiver tuned to 5600MHz, 1 - 17GHz

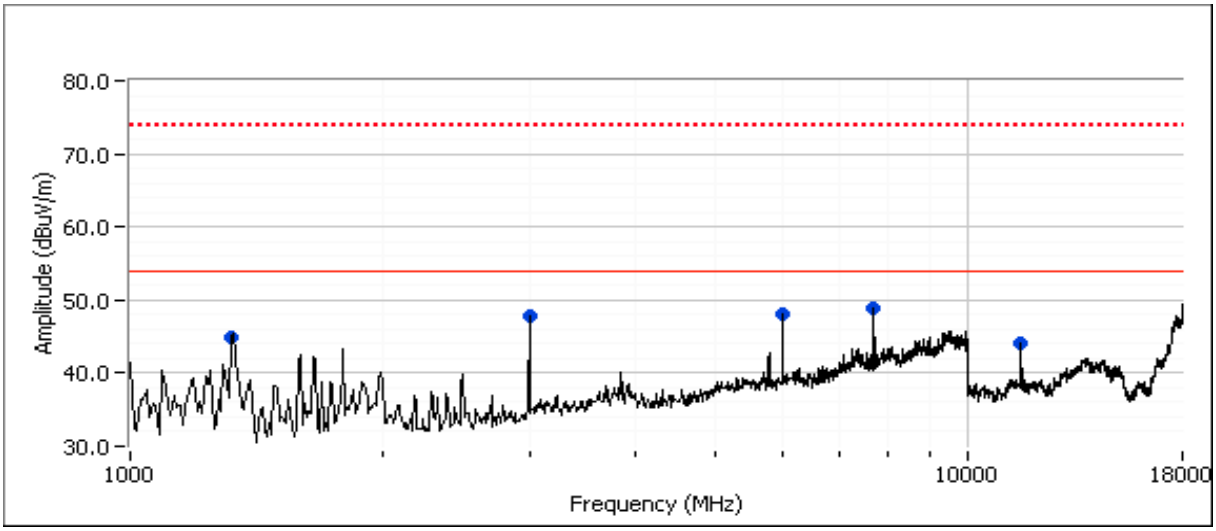
Frequency	Level	Pol	RSS 210 / RSS GEN		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
6000.790	48.0	V	54.0	-6.0	AVG	155	1.2	MHz; VB: 10 Hz
6000.820	52.6	V	74.0	-21.4	PK	155	1.2	MHz; VB: 1 MHz
3000.360	45.9	V	54.0	-8.1	AVG	270	1.5	MHz; VB: 10 Hz
3000.350	50.6	V	74.0	-23.4	PK	270	1.5	MHz; VB: 1 MHz
7466.680	47.7	V	54.0	-6.3	AVG	149	1.0	MHz; VB: 10 Hz
7466.570	53.3	V	74.0	-20.7	PK	149	1.0	MHz; VB: 1 MHz
5600.040	40.1	V	54.0	-13.9	AVG	41	1.1	MHz; VB: 10 Hz
5600.170	48.1	V	74.0	-25.9	PK	41	1.1	MHz; VB: 1 MHz
1893.030	34.4	V	54.0	-19.6	AVG	58	1.0	MHz; VB: 10 Hz
1894.430	50.1	V	74.0	-23.9	PK	58	1.0	MHz; VB: 1 MHz



Client:	Intel	Job Number:	J79218
Model:	633ANHMW with Smart Approach PIFA antenna	T-Log Number:	T79310
		Account Manager:	Christine Krebbil
Contact:	Steve Hackett		
Standard:	FCC Part 15.247 / FCC Part 15 E / RSS 210	Class:	N/A

Run #1e: Receiver tuned to 5785MHz, 1 - 18GHz

Frequency	Level	Pol	RSS 210 / RSS GEN		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7713.350	49.0	V	54.0	-5.0	AVG	27	1.1	MHz; VB: 10 Hz
7713.290	54.0	V	74.0	-20.0	PK	27	1.1	MHz; VB: 1 MHz
11570.170	41.4	V	54.0	-12.6	AVG	262	1.0	MHz; VB: 10 Hz
11569.900	47.0	V	74.0	-27.0	PK	262	1.0	MHz; VB: 1 MHz
6000.750	47.0	V	54.0	-7.0	AVG	90	1.0	MHz; VB: 10 Hz
6000.590	52.7	V	74.0	-21.3	PK	90	1.0	MHz; VB: 1 MHz
1328.690	28.8	V	54.0	-25.2	AVG	267	1.0	MHz; VB: 10 Hz
1327.710	47.0	V	74.0	-27.0	PK	267	1.0	MHz; VB: 1 MHz
3000.370	47.1	V	54.0	-6.9	AVG	269	1.4	MHz; VB: 10 Hz
3000.240	52.5	V	74.0	-21.5	PK	269	1.4	MHz; VB: 1 MHz



Appendix C Photographs of Test Configurations

Uploaded as a separate exhibit

Appendix D Theory of Operation

Uploaded as a separate exhibit – antenna specifications

Appendix E RF Exposure Information

Uploaded as a separate exhibit – MPE Calculation