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EMC Test Report

Application for Permissive Change/Re-assessment

Industry Canada RSS-Gen Issue 3 / RSS 210 Issue 8
FCC Part 15, Subpart E

Model: WS-AP3710e

FCC ID:	QQD10E
IC CERTIFICATION #:	5248S-10E
APPLICANT:	Flextronics 21 Richardson Side Road Kanata, ON K2K 2C1, Canada
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-4, 2845B-5, 2845B-7
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Testing Cert #0214.26

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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	05-06-2013	Initial release	

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SCOPE

An electromagnetic emissions test has been performed on the Flextronics model WS-AP3710e, pursuant to the following rules:

Industry Canada RSS-Gen Issue 3
RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15, Subpart E requirements for UNII Devices (using FCC KDB 789033)

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 National Technical Systems - Silicon Valley test procedures:

ANSI C63.4:2003
FCC UNII test procedure KDB 789033
FCC KDB 662911 "Emissions Testing of Transmitters with Multiple Outputs in the Same Band"

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.

7OBJECTIVE

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 Flextronics model WS-AP3710e complied with the requirements of the following regulations:

RSS 210 Issue 8 "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 Flextronics model WS-AP3710e and therefore apply only to the tested sample. The sample was selected and prepared by Georges Fares of Flextronics.

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)	A9.2(1)	Indoor operation only	Refer to user's manual	N/A	Complies
15.407(a) (2)		Min. 26dB Bandwidth			N/A
15.407 (a) (1)		Output Power	802.11a: 11.4 dBm n20: 11.8 dBm n40: 14.1 dBm (Max eirp: 0.147 W)[1]	a:12.7dBm[2] n20: 17.0 n40: 17.0	Complies
	A9.2(1)			a: 12.0dBm[3] n20: 16.6[3] n40: 17.0	Complies
15.407 (a) (1)	-	Power Spectral Density	a: -0.9 dBm/MHz n20: -0.9 dBm/MHz n40: -0.8 dBm/MHz	-0.3[4] dBm/MHz	Complies
-	A9.2 (1) A9.4(2)			-0.3[4] dBm/MHz	Complies

Note 1: EIRP calculated using antenna gain of 10.3 dBi (three 5.5 dBi antennas) for the highest EIRP system in legacy mode.
Note 2: Limit reduced to 12.7 dBm from 17 dBm as effective antenna gain exceeded 6 dBi by 4.3 dBi for highest output legacy mode.
Note 3: Limit reduced to 12.0/16.6 dBm from 17 dBm as effective antenna gain exceeded 6 dBi by 4.3 dBi for highest output legacy mode and the minimum 99% BW is 16.9/18.0 MHz for 20 MHz modes.
Note 4: Limit reduced to -0.3 dBm from 4 dBm as effective antenna gain exceeded 6 dBi by 4.3 dBi for the highest output.

Requirements for all U-NII/LELAN bands

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407	A9.4(1)	Modulation	System uses 802.11a/n techniques	Digital modulation is required	Complies
15.407(b) (5) / 15.209	A9.2(1) / RSS-GEN	Spurious Emissions above 1GHz	53.7 dBµV/m @ 5150.0 MHz (-0.3 dB)	Refer to page 21	Complies
15.407(a)(6)	-	Peak Excursion Ratio	No change from original filing		-
	A9.4(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)	A9.4(4)	Operation in the absence of information to transmit	No change from original filing		-
15.407 (g)		Frequency Stability	No change from original filing		-
15.407 (h2)	A9.3	Dynamic frequency Selection (device with radar detection)	Device does not operate in either 5470 – 5725 or 5250 – 5350 MHz bands.		N/A
	A9.4(6) & (7)	User Manual information	No change from original filing		-

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	No change from original filing		-
15.207	RSS GEN Table 2	AC Conducted Emissions	No change from original filing		-
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSP 100 RSS GEN 7.1.3	User Manual	No change from original filing		-
-	RSP 100 RSS GEN 7.1.2	User Manual	No change from original filing		-
-	RSP 100 RSS GEN 4.4.1 RSS-210 A9.2(1)	Max. 99% Bandwidth	No change from original filing		-

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 Flextronics model WS-AP3710e is a multiple radio access point, each radio operating in 3x3 MIMO and legacy modes. It incorporates both a 2.4 GHz band 802.11b/g/n and a 5.2 GHz band and 5.8 GHz band 802.11a/n radio in a single enclosure. Since the EUT could be placed in any position during operation, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 48 Volts DC, 0.8 Amps.

The sample was received on April 11, 2013 and tested on April 11, 16 and 17, 2013. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Flextronics	WS-AP3710e	Access Point	None	QQD10E

ANTENNA SYSTEM

The antenna system for this permissive change consists of a 6 element Sector antenna (gain of 12.5 dBi in the 2.4 GHz band and 11.5 dBi in the 5.8 GHz band). However, the antenna will be used with at least 6dB of attenuation in the feed line and thus the effective gains are 6.5 dBi and 5.5 dBi in the 2.4 and 5.8 GHz bands respectively.

Model	Application	Description	Gain (dBi)	Frequency (GHz)	Connector type
WS-AI-DX13025	Indoor	MIMO, Sector, dual-band	6.5 dBi 5.5 dBi	2.4 – 2.5 5.15 – 5.85	RSMA

ENCLOSURE

The EUT enclosure measures approximately 20 by 18.5 by 3 centimeters. It is constructed of uncoated plastic and cast metal.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at National Technical Systems - Silicon Valley.

SUPPORT EQUIPMENT

The following equipment was used as remote support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
PowerDsine	9001G-40/SP	POE adapter	N11456519001846A01	-
Dell	Latitude D610	Laptop Computer	26895386773	-

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Ethernet/POE	Remote POE adapter or switch	Cat 5	Unshielded	10
Remote POE Data or switch	Laptop	Cat 5	Unshielded	2

The console port was not connected during testing as this is used only during configuration of the radio.

EUT OPERATION

During testing, the EUT was configured to transmit a "continuous" modulated signal, 99% duty cycle at the selected frequency and power level on all three chains of both radios.

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 7	A2LA accreditation	2845B-7	41039 Boyce Road Fremont, CA 94538-2435

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.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

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.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

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.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

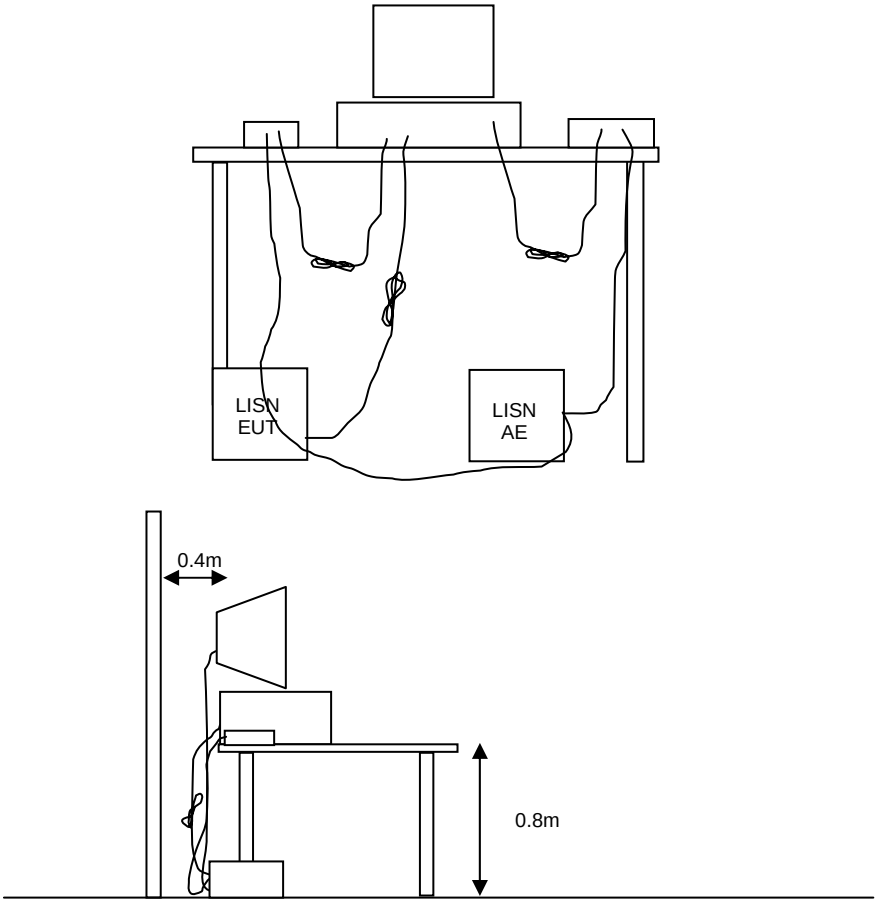


Figure 1 Typical Conducted Emissions Test Configuration

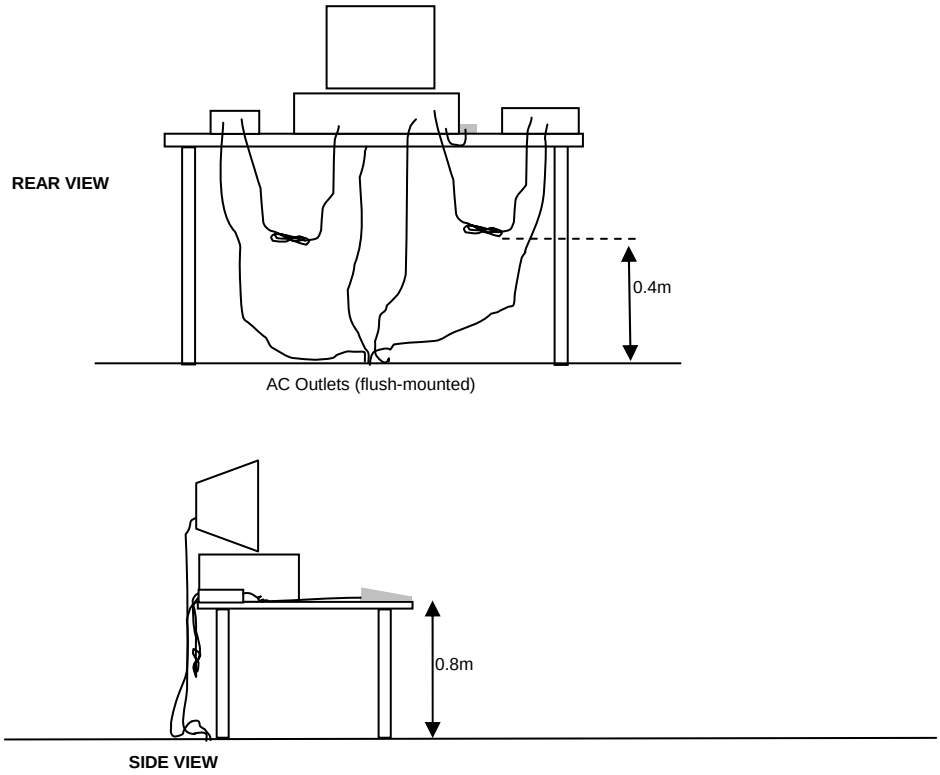
RADIATED EMISSIONS

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.

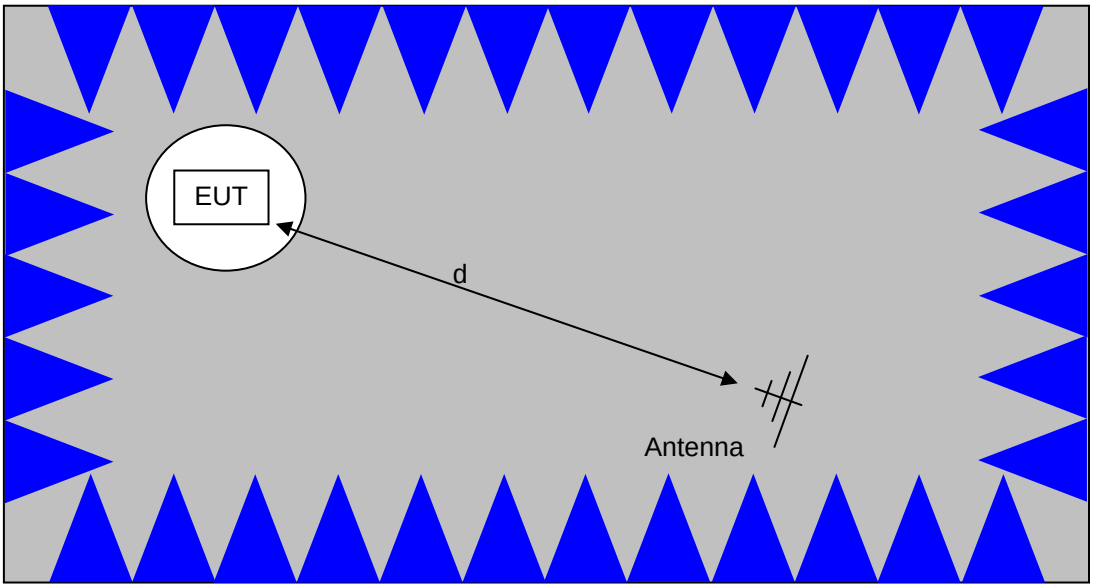
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

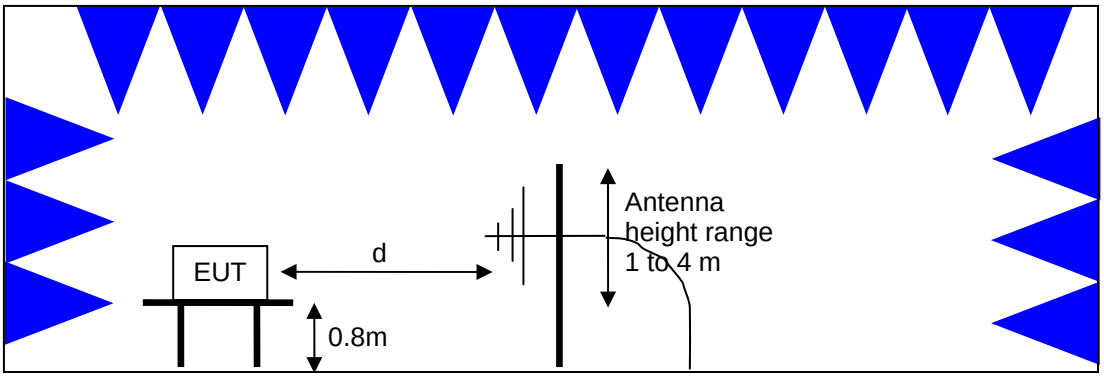


Typical Test Configuration for Radiated Field Strength Measurements



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.

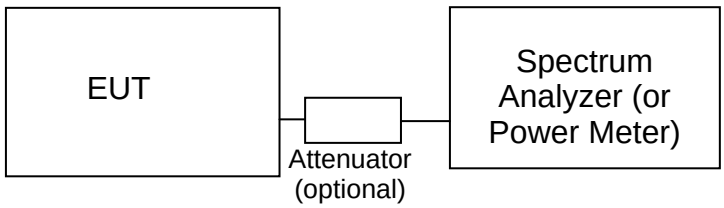
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.



Test Configuration for Antenna Port Measurements

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and National Technical Systems - Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN.

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:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

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

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

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

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.

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

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 (88.3dBuV/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.

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

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

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data

Radio Antenna Port (Power and Spurious Emissions), 11-Apr-13

Manufacturer	Description	Model	Asset #	Cal Due
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1422	1/3/2014
Rohde & Schwarz	Power Sensor 100 uW - 2 Watts use with 20dB attenuator sn:100059 only	NRV-Z32	1423	9/18/2013
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	1/28/2014

Radiated Emissions, 1000 - 40,000 MHz, 14-Apr-13 to 17-Apr-13

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	11/9/2013
Hewlett Packard	Head (Inc flex cable, 1143, 2198) Red	84125C	1145	7/5/2013
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	9/14/2013
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	7/12/2014
Hewlett Packard	High Pass filter, 8.2 GHz (Purple System)	P/N 84300-80039	1767	12/5/2013
A. H. Systems	Blue System Horn, 18-40GHz	SAS-574, p/n: 2581	2159	5/30/2013
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2249	10/11/2013
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2251	10/11/2013
Micro-Tronics	Band Reject Filter, 5725-5875 MHz	BRC50705-01	2738	11/6/2013
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	5/21/2013

Radio Antenna Port (Power and Spurious Emissions), 17-Apr-13

Manufacturer	Description	Model	Asset #	Cal Due
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1422	1/3/2014
Rohde & Schwarz	Power Sensor 100 uW - 2 Watts use with 20dB attenuator sn:100059 only	NRV-Z32	1423	9/18/2013
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	1/28/2014

Appendix B Test Data

T89830 Pages 25 - 49

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Emissions Standard(s):	15.247, 15.407, RSS-210	Class:	-
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

Flextronics

Model

WS-AP3710e

Date of Last Test: 4/22/2013

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

RSS-210 (LELAN) and FCC 15.407(UNII)
Antenna Port Measurements
Power, PSD, Peak Excursion, Bandwidth and 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: 4/11/2013
Test Engineer: Rafael Varelas
Test Location: FT Lab 4A

Config. Used: 1
Config Change: None
EUT Voltage: POE

General Test Configuration

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators and cables used.

Ambient Conditions:

Temperature: 20.4 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Power, 5150 - 5250MHz	15.407(a) (1), (2)	Pass	802.11a: 13.9 mW 802.11n20: 15.3 mW 802.11n40: 25.8 mW
1	PSD, 5150 - 5250MHz	15.407(a) (1), (2)	Pass	802.11a: -0.9 dBm/MHz 802.11n20: -0.9 dBm/MHz 802.11n40: -0.8 dBm/MHz
1	26dB Bandwidth	15.407 (Information only)	-	> 20MHz for all modes
1	99% Bandwidth	RSS 210 (Information only)	N/A	802.11a: 16.8 MHz 802.11n 20MHz: 18.1 MHz 802.11n n40MHz: 36.3 MHz

Antenna:

#	Model	Type	Freq. Band (GHz)	Gain (dBi)	Ind/Out	Xpol?	Pt to Pt?
4	Enterasys WS-AI-DX13025	Sector (6 element)	5.2	11.5	Indoor	2 Xpol / 2 Vert	No

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

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.

Notes

All measurements performed at the antenna port, Sample S/N 1245049259450000
Tested w/o 6dB attenuator w/ Low Power script, antenna gain is thus 5.5 dBi

ART GUI (Singleradio test) Or Command Line Script (multiple radio test)

ART GUI Used:	No
ART GUI Boot File:	-
	-
ART GUI Calibration file:	-
	-
Command Line Script:	3710e Pilot_295948 boot and initialize all 3 radios to NART Command Line Interface from 15T - LOW POWER

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run #1: Bandwidth, Output Power and Power Spectral Density - MIMO Systems

MIMO Device - 5150-5250 MHz Band

		Chain 1	Chain 2	Chain 3	Coherent	Effective[5]	EIRP (mW)	EIRP (dBm)
Legacy	Antenna Gain (dBi):	5.5	5.5	5.5	Yes	10.3	147.4	21.7
MIMO	Antenna Gain (dBi):	5.5	5.5	5.5	No	5.5	91.6	19.6

Power

Frequency (MHz)	Software Setting	26dB BW (MHz)	Measured Output Power[1] dBm			Total		Limit (dBm)	Max Power (W)	Pass or Fail
			Chain 1	Chain 2	Chain 3	mW	dBm			
20MHz a Mode										
5180	5.0	24.3	7.4	6.2	6.2	13.9	11.4	12.7	0.0139	PASS
5200	4.5	24.4	7.2	6.2	5.8	13.2	11.2	12.7		PASS
5240	4.5	24.0	7.0	6.6	6.2	13.8	11.4	12.7		PASS
20MHz n Mode										
5180	5.0	25.6	7.1	6.2	6.1	13.4	11.3	17.0	0.0153	PASS
5200	5.0	25.0	7.7	6.8	6.7	15.3	11.8	17.0		PASS
5240	5.0	25.5	7.5	6.8	6.4	14.8	11.7	17.0		PASS
40MHz n Mode										
5190	7.0	48.5	10.0	8.9	8.8	25.3	14.0	17.0	0.0258	PASS
5230	7.5	48.3	9.8	9.3	8.9	25.8	14.1	17.0		PASS

PSD

Frequency (MHz)	99%[4] BW	Total Power	PSD[2] dBm/MHz			Total PSD		Limit		Pass or Fail
			Chain 1	Chain 2	Chain 3	mW/MHz	dBm/MHz	FCC	RSS 210[3]	
20MHz a Mode										
5180	16.8	11.4	-5.2	-5.9	-5.2	0.9	-0.6	-0.3	-0.3	PASS
5200	16.8	11.2	-4.9	-6.0	-6.2	0.8	-0.9	-0.3	-0.3	PASS
5240	16.8	11.4	-5.2	-5.0	-5.4	0.9	-0.4	-0.3	-0.3	PASS
20MHz n Mode										
5180	18.0	11.3	-5.5	-5.6	-5.8	0.8	-0.9	-0.3	-0.3	PASS
5200	18.0	11.8	-5.0	-5.2	-5.2	0.9	-0.4	-0.3	-0.3	PASS
5240	18.1	11.7	-5.1	-5.4	-5.7	0.9	-0.6	-0.3	-0.3	PASS
40MHz n Mode										
5190	36.3	14.0	-5.4	-6.0	-6.0	0.8	-1.0	-0.3	-0.3	PASS
5230	36.3	14.1	-5.4	-5.7	-5.6	0.8	-0.8	-0.3	-0.3	PASS

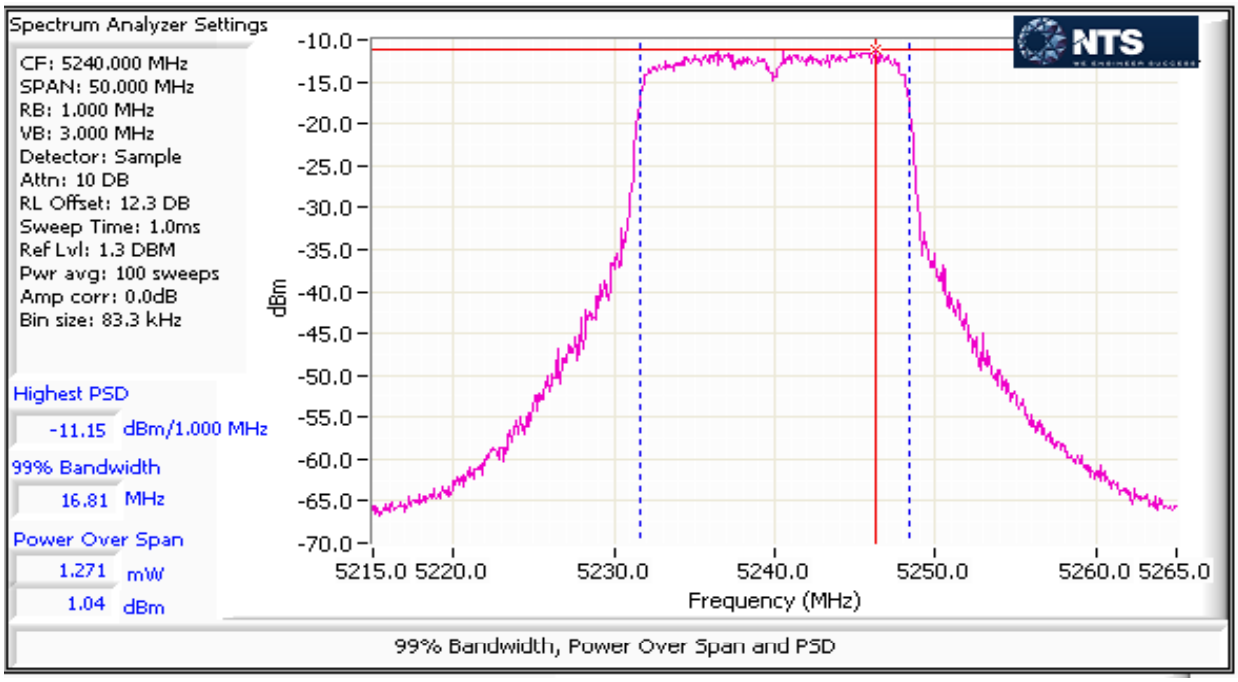
Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

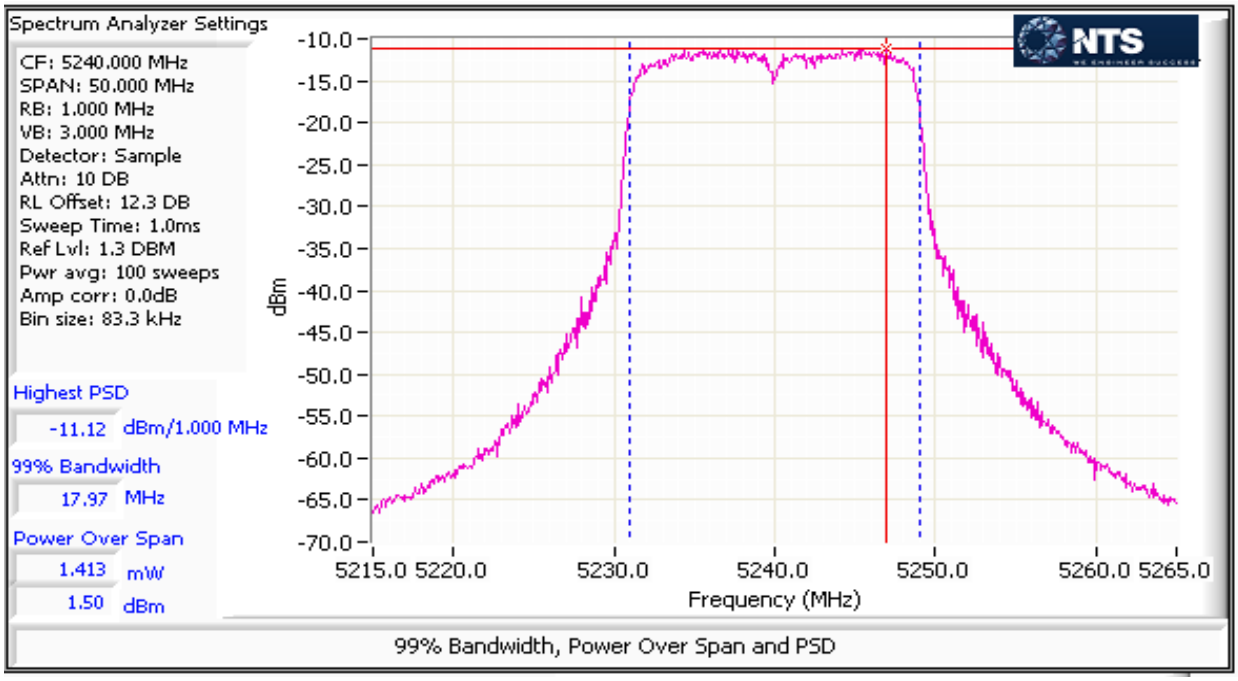
Power (RSS Limit)

Frequency (MHz)	Software Setting	99% BW (MHz)	Measured Output Power[1] dBm			Total		Limit (dBm)	Max Power (W)	Pass or Fail
			Chain 1	Chain 2	Chain 3	mW	dBm			
20MHz a Mode										
5180	5.0	16.8	7.4	6.2	6.2	13.9	11.4	12.0	0.014	PASS
5200	4.5	16.8	7.2	6.2	5.8	13.2	11.2	12.0		PASS
5240	4.5	16.8	7.0	6.6	6.2	13.8	11.4	12.0		PASS
20MHz n Mode										
5180	5.0	18.0	7.1	6.2	6.1	13.4	11.3	16.6	0.015	PASS
5200	5.0	18.0	7.7	6.8	6.7	15.3	11.8	16.6		PASS
5240	5.0	18.1	7.5	6.8	6.4	14.8	11.7	16.6		PASS
40MHz n Mode										
5190	7.0	36.3	10.0	8.9	8.8	25.3	14.0	17.0	0.026	PASS
5230	7.5	36.3	9.8	9.3	8.9	25.8	14.1	17.0		PASS

Note 1:	Output power measured using a spectrum analyzer (see plots below). RBW=1MHz, VB=3 MHz, # of points in sweep ≥ 2*span/RBW, sample detector, power averaging on (transmitted signal was continuous) and power integration over 50/80 MHz (method SA-1 of KDB 789033).
Note 2:	Measured using the same analyzer settings used for output power.
Note 3:	For RSS-210 the limit for the 5150 - 5250 MHz band accounts for the antenna gain as the maximum eirp allowed is 10dBm/MHz. The limits are also corrected for instances where the highest measured value of the PSD exceeds the average PSD (calculated from the measured power divided by the measured 99% bandwidth) by more than 3dB by the amount that the measured value exceeds the average by more than 3dB.
Note 4:	99% Bandwidth measured in accordance with RSS GEN - RB > 1% of span and VB >=3xRB
Note 5:	For MIMO systems the total output power and total PSD are calculated form the sum of the powers of the individual chains (in linear terms). The antenna gain used to determine the EIRP and limits for PSD/Output power depends on the operating mode of the MIMO device. If the signals on the non-coherent between the transmit chains then the gain used to determine the limits is the highest gain of the individual chains and the EIRP is the sum of the products of gain and power on each chain. If the signals are coherent then the effective antenna gain is the sum (in linear terms) of the gains for each chain and the EIRP is the product of the effective gain and total power.

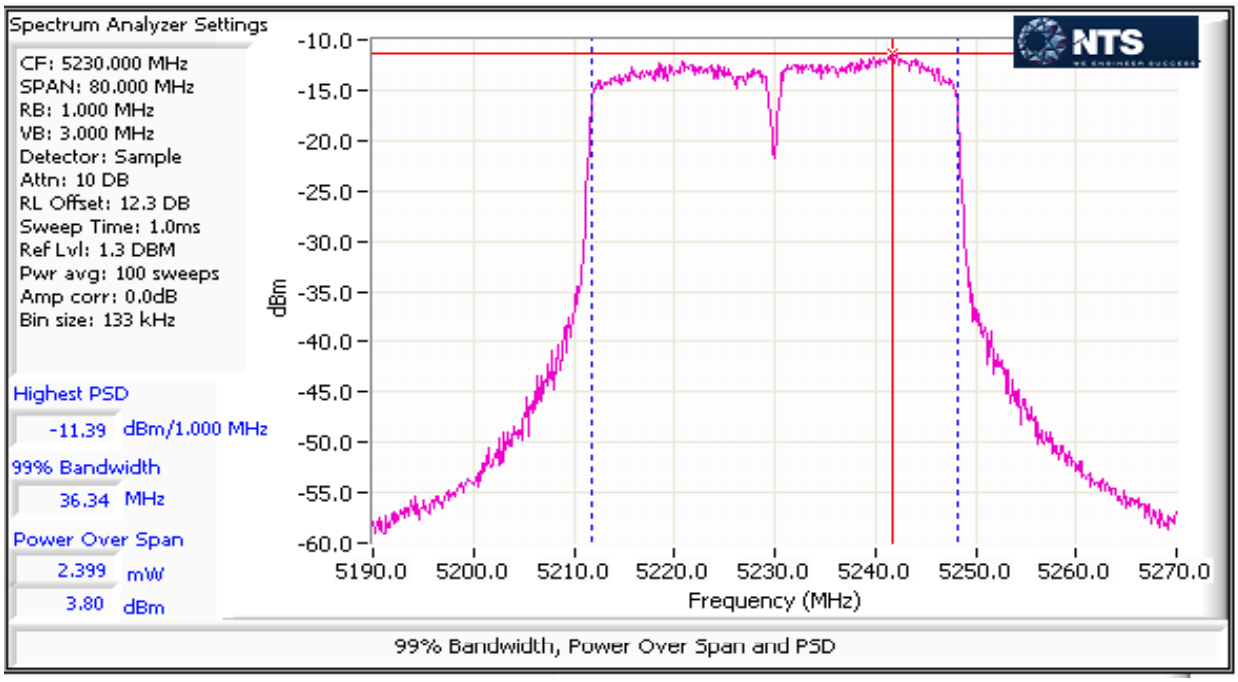
Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A





Note:	The 20dBc point is within the 5150-5250 MHz Band.

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A



Note: The 20dBc point is within the 5150-5250 MHz Band.

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

RSS 210 and FCC 15.407 (NII) 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.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 30 meters from the EUT.

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

Ambient Conditions:

Temperature: 20.8 °C
Rel. Humidity: 35 %

Summary of Results - Device Operating in the 5150-5250 MHz Band

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
Run # 1	802.11a Chain A+B+C	#36 5180MHz	16.0	-	Restricted Band Edge at 5150 MHz	15.209	52.9 dBµV/m @ 5149.5 MHz (-1.1 dB)
		#48 5240MHz	17.0	-	Restricted Band Edge at 5350 MHz	15.209	49.6 dBµV/m @ 5360.0 MHz (-4.4 dB)
Run # 2	802.11n20 Chain A+B+C	#36 5180MHz	15.5	-	Restricted Band Edge at 5150 MHz	15.209	53.7 dBµV/m @ 5150.0 MHz (-0.3 dB)
		#48 5240MHz	18.0	-	Restricted Band Edge at 5350 MHz	15.209	53.4 dBµV/m @ 5400.0 MHz (-0.6 dB)
Run # 3	802.11n40 Chain A+B+C	#38 5190MHz	9.5	-	Restricted Band Edge at 5150 MHz	15.209	53.2 dBµV/m @ 5150.0 MHz (-0.8 dB)
		#46 5230MHz	17.0	-	Restricted Band Edge at 5350 MHz	15.209	51.7 dBµV/m @ 5400.0 MHz (-2.3 dB)

Antenna:

#	Model	Type	Freq. Band (GHz)	Gain (dBi)	Ind/Out	Xpol?	Pt to Pt?
4	Enterasys WS-AI-DX13025	Sector (6 element)	5.2	11.5	Indoor	2 Xpol / 2 Vert	No

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

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.

Tested w/ 6dB Pad

Notes

ART GUI (Singleradio test) Or Command Line Script (multiple radio test)

ART GUI Used:	No
ART GUI Boot File:	-
	-
ART GUI Calibration file:	-
	-
Command Line Script:	3710e Pilot_295948 boot and initialize all 3 radios to NART Command Line Interface from 15T - HIGH POWER

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run # 1, Band Edge Field Strength - 802.11a, Chain A+B+C

Date of Test: 4/16/2013 Test Location: FT7

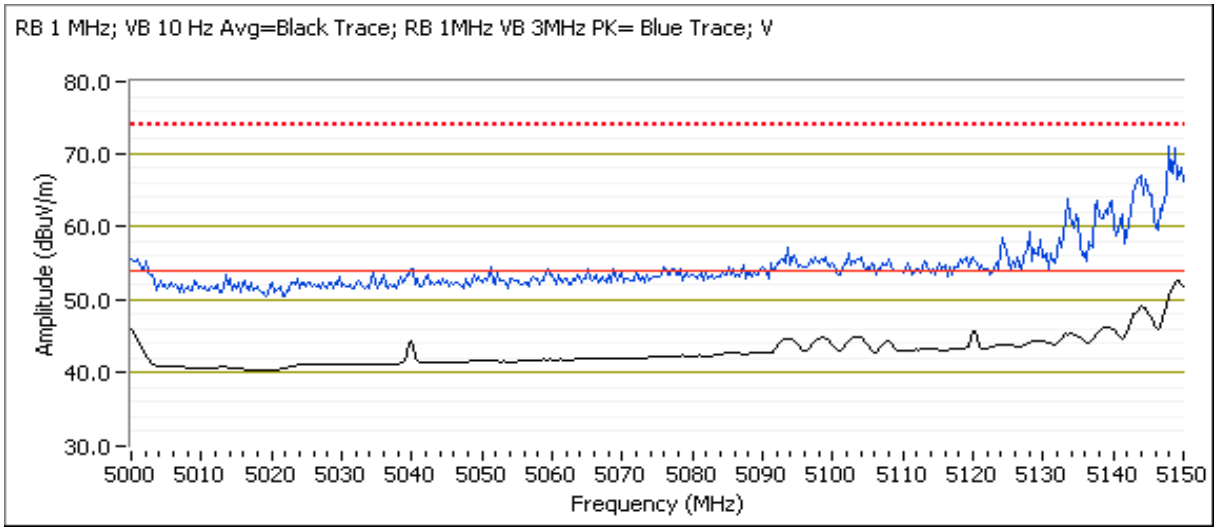
Test Engineer: Rafael Varelas Config Change: None

Run # 1a, EUT on Channel #36 5180MHz - 802.11a, Chain A+B+C

Radio	Freq	Power Setting
1	5180 MHz	16.0
2	2437 MHz	19.0

5150 MHz Band Edge 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	
5149.500	52.9	V	54.0	-1.1	AVG	2	1.0	POS; RB 1 MHz; VB: 10 Hz
5148.080	72.9	V	74.0	-1.1	PK	2	1.0	POS; RB 1 MHz; VB: 3 MHz
5150.000	47.0	H	54.0	-7.0	AVG	6	1.2	POS; RB 1 MHz; VB: 10 Hz
5144.070	60.3	H	74.0	-13.7	PK	6	1.2	POS; RB 1 MHz; VB: 3 MHz



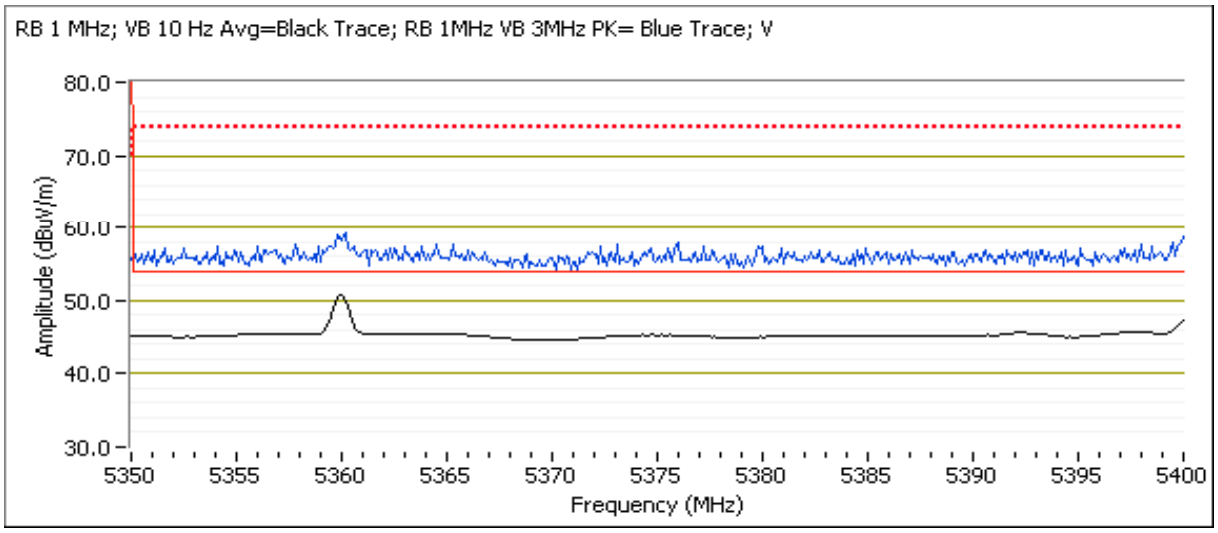
Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run # 1b, EUT on Channel #48 5240MHz - 802.11a, Chain A+B+C

Radio	Freq	Power Setting
1	5240 MHz	17.0
2	2437 MHz	19.0

5350 MHz Band Edge Signal Radiated 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	
5359.980	49.6	V	54.0	-4.4	AVG	0	1.0	POS; RB 1 MHz; VB: 10 Hz
5359.980	58.1	V	74.0	-15.9	PK	0	1.0	POS; RB 1 MHz; VB: 3 MHz
5360.020	47.3	H	54.0	-6.7	AVG	355	1.0	POS; RB 1 MHz; VB: 10 Hz
5392.180	56.4	H	74.0	-17.6	PK	355	1.0	POS; RB 1 MHz; VB: 3 MHz



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run # 2, Band Edge Field Strength - 802.11n20, Chain A+B+C

Date of Test: 4/16/2013 Test Location: FT7

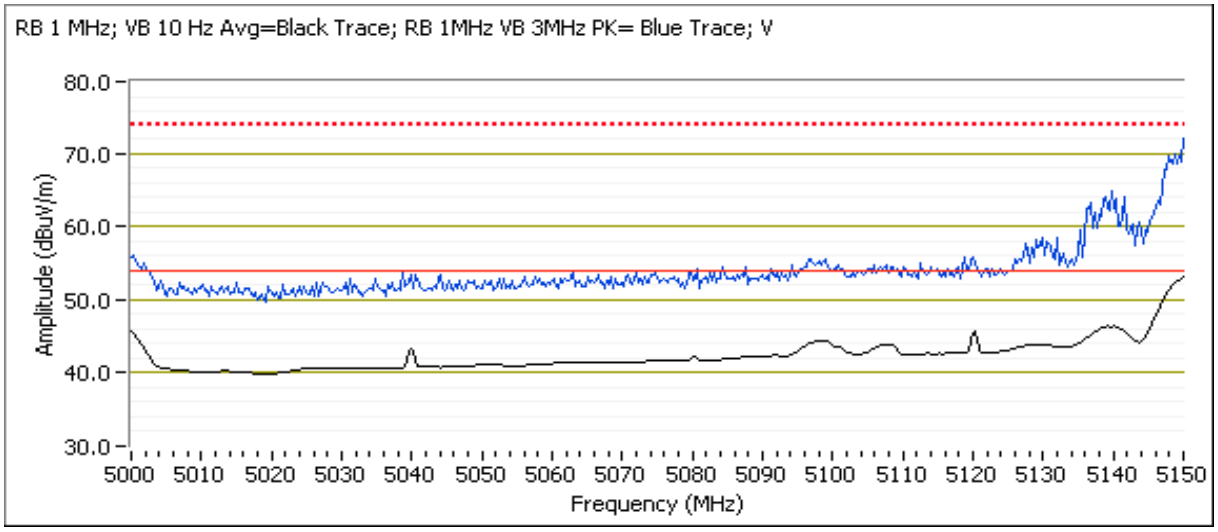
Test Engineer: Rafael Varelas Config Change: None

Run # 2a, EUT on Channel #36 5180MHz - 802.11n20, Chain A+B+C

Radio	Freq	Power Setting
1	5180 MHz	15.5
2	2437 MHz	19.0

5150 MHz Band Edge 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	
5149.950	53.7	V	54.0	-0.3	AVG	2	1.5	POS; RB 1 MHz; VB: 10 Hz
5149.950	73.2	V	74.0	-0.8	PK	2	1.5	POS; RB 1 MHz; VB: 3 MHz
5150.000	46.3	H	54.0	-7.7	AVG	0	1.0	POS; RB 1 MHz; VB: 10 Hz
5148.160	60.4	H	74.0	-13.6	PK	0	1.0	POS; RB 1 MHz; VB: 3 MHz



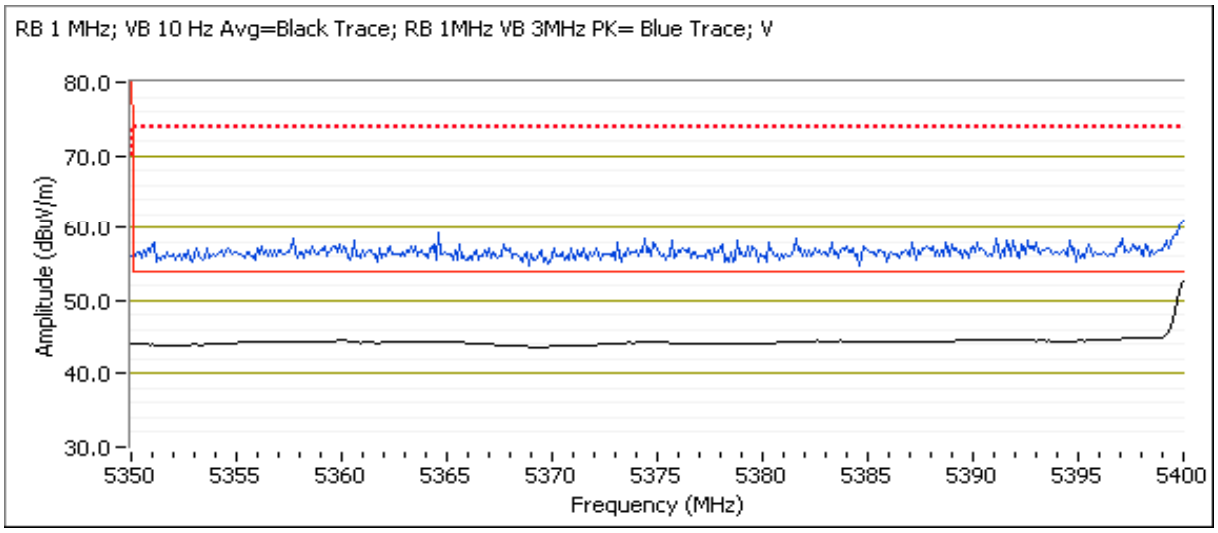
Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run # 2b, EUT on Channel #48 5240MHz - 802.11n20, Chain A+B+C

Radio	Freq	Power Setting
1	5240 MHz	18.0
2	2437 MHz	19.0

5350 MHz Band Edge Signal Radiated 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	
5400.000	53.4	V	54.0	-0.6	AVG	0	1.3	POS; RB 1 MHz; VB: 10 Hz
5399.900	59.3	V	74.0	-14.7	PK	0	1.3	POS; RB 1 MHz; VB: 3 MHz
5389.840	43.8	H	54.0	-10.2	AVG	358	1.0	POS; RB 1 MHz; VB: 10 Hz
5385.030	55.2	H	74.0	-18.8	PK	358	1.0	POS; RB 1 MHz; VB: 3 MHz



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run #3, Band Edge Field Strength - 802.11n40, Chain A+B+C

Date of Test: 4/16/2013 Test Location: FT7

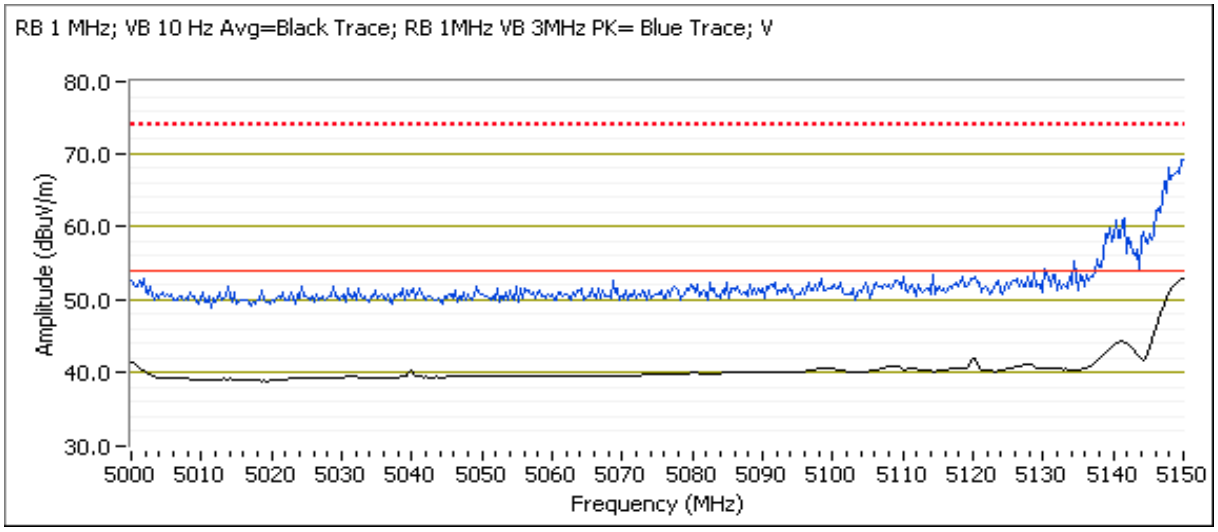
Test Engineer: Rafael Varelas Config Change: None

Run #3a, EUT on Channel #38 5190MHz - 802.11n40, Chain A+B+C

Radio	Freq	Power Setting
1	5190 MHz	9.5
2	2437 MHz	19.0

5150 MHz Band Edge 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	
5150.000	53.2	V	54.0	-0.8	AVG	0	1.5	POS; RB 1 MHz; VB: 10 Hz
5147.980	69.3	V	74.0	-4.7	PK	0	1.5	POS; RB 1 MHz; VB: 3 MHz
5150.000	46.6	H	54.0	-7.4	AVG	8	1.1	POS; RB 1 MHz; VB: 10 Hz
5149.040	60.5	H	74.0	-13.5	PK	8	1.1	POS; RB 1 MHz; VB: 3 MHz



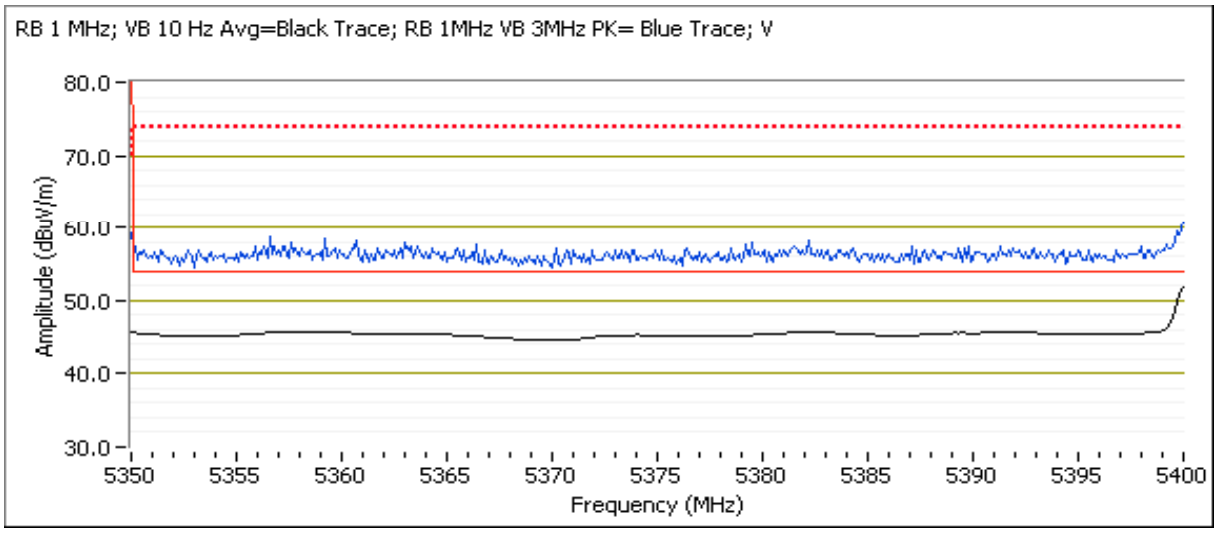
Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run #3b, EUT on Channel #46 5230MHz - 802.11n40, Chain A+B+C

Radio	Freq	Power Setting
1	5230 MHz	17.0
2	2437 MHz	19.0

5350 MHz Band Edge Signal Radiated 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	
5400.000	51.7	V	54.0	-2.3	AVG	0	1.2	POS; RB 1 MHz; VB: 10 Hz
5400.000	58.3	V	74.0	-15.7	PK	0	1.2	POS; RB 1 MHz; VB: 3 MHz
5400.000	45.0	H	54.0	-9.0	AVG	360	1.1	POS; RB 1 MHz; VB: 10 Hz
5398.700	55.2	H	74.0	-18.8	PK	360	1.1	POS; RB 1 MHz; VB: 3 MHz



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

RSS 210 and FCC 15.247 (DTS) 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.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 30 meters from the EUT.

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

Ambient Conditions:

Temperature: 20.8 °C
Rel. Humidity: 35 %

Summary of Results - Device Operating in the DTS Bands

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
Run #1	802.11b	2412 MHz	17	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15.247	51.0 dBµV/m @ 5440.1 MHz (-3.0 dB)
		5180 MHz	17				
	802.11a	2437 MHz	18	-			51.9 dBµV/m @ 5439.9 MHz (-2.1 dB)
		5200 MHz	17				
	Chain A+B+C	2462 MHz	18	-			51.3 dBµV/m @ 5440.1 MHz (-2.7 dB)
		5240 MHz	17				
Run # 2	802.11n20	2412 MHz	19	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15.247	51.4 dBµV/m @ 5439.9 MHz (-2.6 dB)
		5180 MHz	18				
	Chain A+B+C	2437 MHz	20	-			52.2 dBµV/m @ 5440.0 MHz (-1.8 dB)
		5200 MHz	18				
		2462 MHz	19	-			52.4 dBµV/m @ 5440.1 MHz (-1.6 dB)
		5240 MHz	18				

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
Run # 3	802.11n40	2422 MHz	17	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15.247	51.5 dBµV/m @ 5440.0 MHz (-2.5 dB)
		5190 MHz	17				
	Chain A+B+C	2452 MHz	18	-			50.2 dBµV/m @ 5440.1 MHz (-3.8 dB)
		5230 MHz	17				

Antenna:

#	Model	Type	Freq. Band (GHz)	Gain (dBi)	Ind/Out	Xpol?	Pt to Pt?
4	Enterasys WS-AI-DX13025	Sector (6 element)	5.2	11.5	Indoor	2 Xpol / 2 Vert	No

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.

Notes

Testing of 802.11g mode in combination with 802.11a were considered unnecessary as 802.11a mode was tested with 802.11b and 802.11n20 is very similar to 802.11g and was tested at higher power settings than 802.11g mode will use.

Antenna: antenna(s) connected

Duty Cycle: 99.0%

Tested w/ 6dB Pad

ART GUI (Singleradio test) Or Command Line Script (multiple radio test)

ART GUI Used: No

ART GUI Boot File: -

-

ART GUI Calibration file: -

-

Command Line Script: 3710e Pilot_295948 boot and initialize all 3 radios to NART Command Line Interface from 15T - HIGH POWER

Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run #1, Radiated Spurious Emissions, 1-40GHz, 802.11b/802.11a, Chain A+B+C

Run #1a, EUT on Channel #1 2412MHz - 802.11b and Channel #36 5180MHz - 802.11a - Chain A+B+C

Date of Test: 4/16/2013 Test Location: FT7

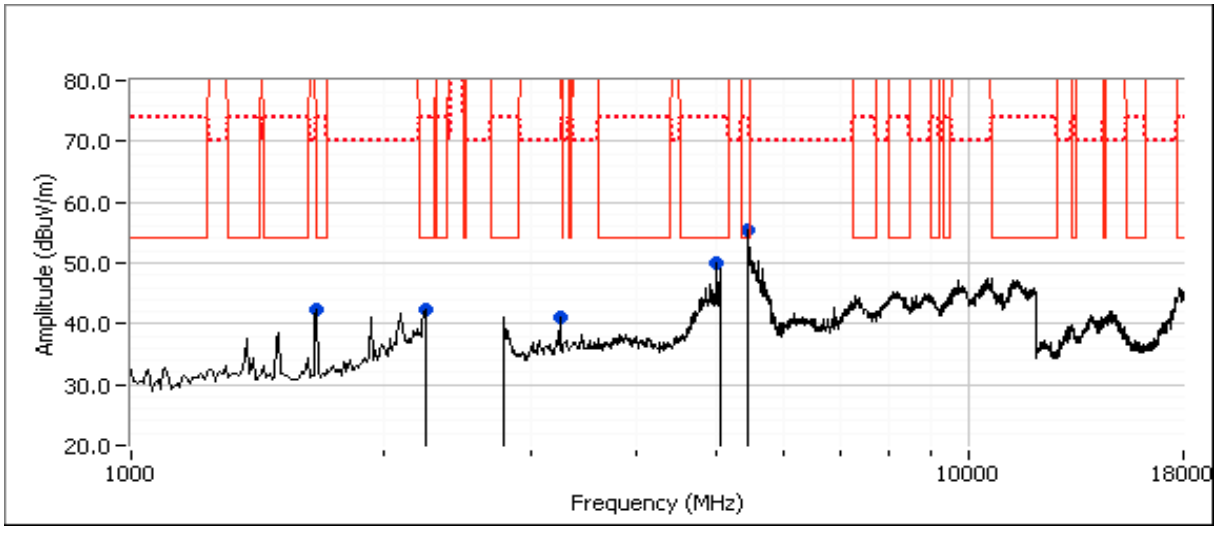
Test Engineer: Rafael Varelas Config Change: None

Radio	Freq	Power Setting
1	5180 MHz	17.0
2	2412 MHz	17.0

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.070	51.0	V	54.0	-3.0	AVG	0	1.1	RB 1 MHz;VB 10 Hz;Peak
5444.240	62.1	V	74.0	-11.9	PK	0	1.1	RB 1 MHz;VB 3 MHz;Peak
3249.340	40.6	V	54.0	-13.4	AVG	360	1.2	Note 2
3249.160	47.2	V	74.0	-26.8	PK	360	1.2	Note 2
2233.950	39.8	V	54.0	-14.2	AVG	356	1.0	RB 1 MHz;VB 10 Hz;Peak
2235.890	50.7	V	74.0	-23.3	PK	356	1.0	RB 1 MHz;VB 3 MHz;Peak
1666.570	40.4	V	54.0	-13.6	AVG	174	1.6	RB 1 MHz;VB 10 Hz;Peak
1666.730	45.1	V	74.0	-28.9	PK	174	1.6	RB 1 MHz;VB 3 MHz;Peak
4999.920	48.9	V	54.0	-5.1	AVG	3	1.0	RB 1 MHz;VB 10 Hz;Peak
5000.120	58.5	V	74.0	-15.5	PK	3	1.0	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -27dBm/MHz for peak measurements in a measurement bandwidth of 1MHz.
Note 2:	Restricted limit used for non-restricted emissions



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

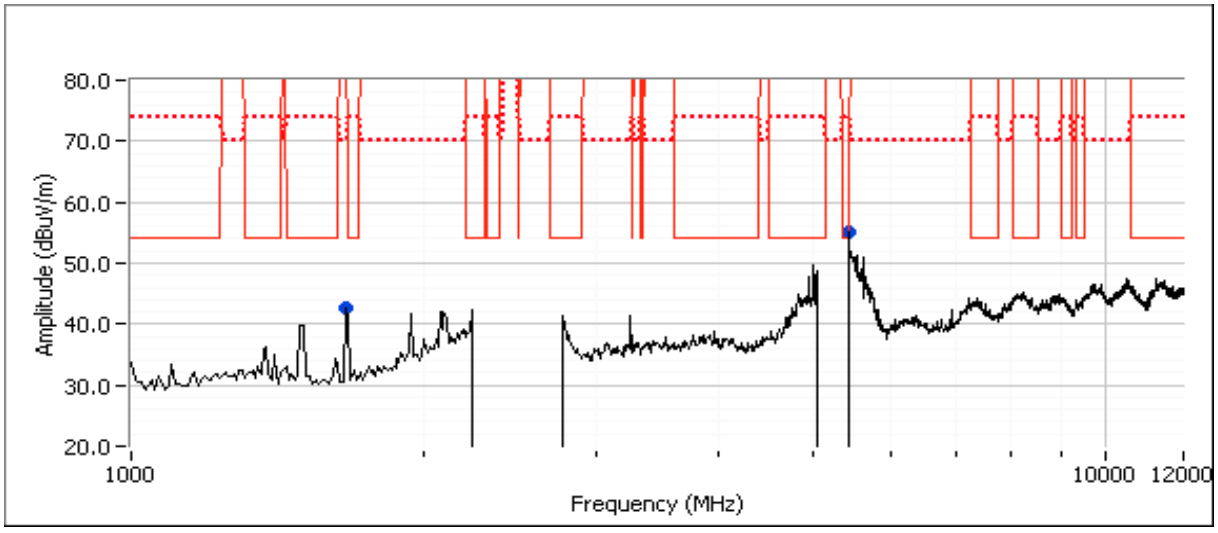
Run #1b, EUT on Channel #6 2437MHz - 802.11b and Channel #40 5200MHz - 802.11a, Chain A+B+C

Radio	Freq	Power Setting
1	5200 MHz	17.0
2	2437 MHz	18.0

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5439.900	51.9	V	54.0	-2.1	AVG	0	1.4	RB 1 MHz;VB 10 Hz;Peak
5439.740	61.5	V	74.0	-12.5	PK	0	1.4	RB 1 MHz;VB 3 MHz;Peak
1666.710	40.1	V	54.0	-13.9	AVG	169	1.7	RB 1 MHz;VB 10 Hz;Peak
1666.800	45.0	V	74.0	-29.0	PK	169	1.7	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -27dBm/MHz for peak measurements in a measurement bandwidth of 1MHz.
Note 2:	Scans made between 12 - 40GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

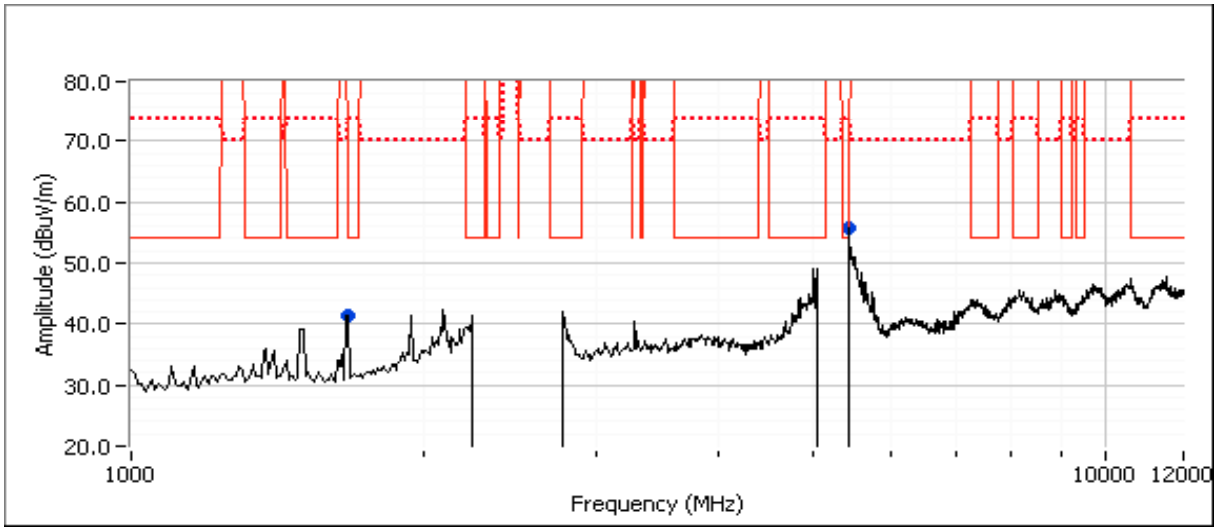
Run #1c, EUT on Channel #11 2462MHz - 802.11b and Channel #48 5240MHz - 802.11a, Chain A+B+C

Radio	Freq	Power Setting
1	5240 MHz	17.0
2	2462 MHz	18.0

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.130	51.3	V	54.0	-2.7	AVG	0	1.3	RB 1 MHz;VB 10 Hz;Peak
5440.910	62.3	V	74.0	-11.7	PK	0	1.3	RB 1 MHz;VB 3 MHz;Peak
1666.640	39.8	V	54.0	-14.2	AVG	169	1.6	RB 1 MHz;VB 10 Hz;Peak
1666.730	44.7	V	74.0	-29.3	PK	169	1.6	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -27dBm/MHz for peak measurements in a measurement bandwidth of 1MHz.



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run #2, Radiated Spurious Emissions, 1-40GHz, 802.11n20/802.11n20, Chain A+B+C
Run #2a, EUT on Channel #1 2412MHz - 802.11n20 and Channel #36 5180MHz - 802.11n20 - Chain A+B+C

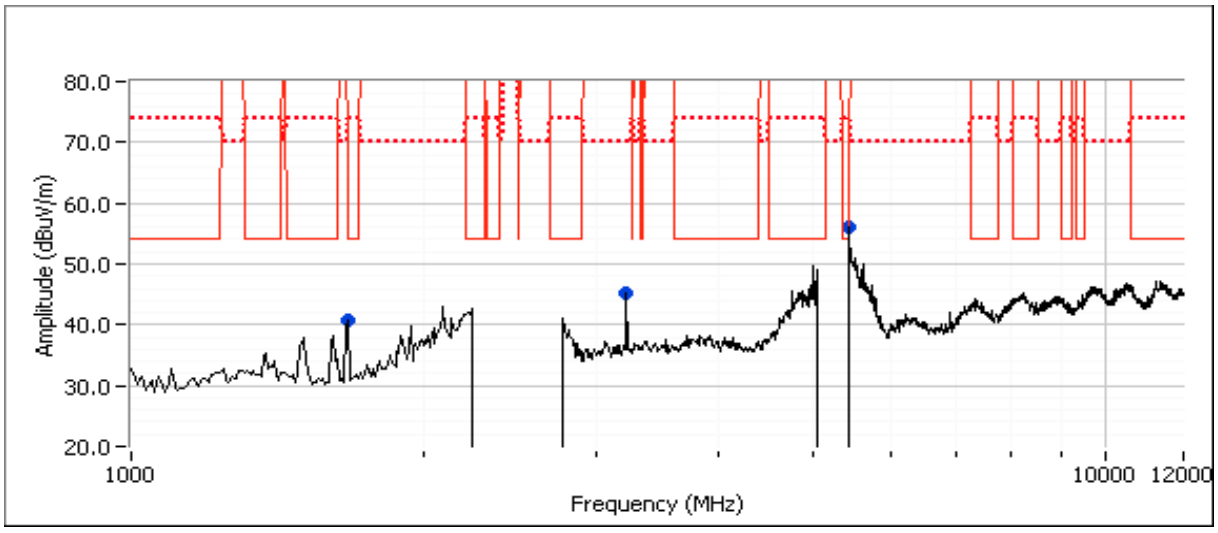
Date of Test: 4/16/2013 Test Location: FT7
Test Engineer: Mark Hill Config Change: None

Radio	Freq	Power Setting
1	5180 MHz	18.0
2	2412 MHz	19.0

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5439.880	51.4	V	54.0	-2.6	AVG	0	1.3	RB 1 MHz;VB 10 Hz;Peak
3216.000	45.4	V	54.0	-8.6	AVG	360	1.4	RB 1 MHz;VB 10 Hz;Peak, note 2
5442.810	61.8	V	74.0	-12.2	PK	0	1.3	RB 1 MHz;VB 3 MHz;Peak
1666.690	40.4	V	54.0	-13.6	AVG	169	1.7	RB 1 MHz;VB 10 Hz;Peak
3215.940	49.7	V	74.0	-24.3	PK	360	1.4	RB 1 MHz;VB 3 MHz;Peak, note 2
1666.620	44.8	V	74.0	-29.2	PK	169	1.7	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -27dBm/MHz for peak measurements in a measurement bandwidth of 1MHz.
Note 2:	Restricted limit used for non-restricted emissions



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

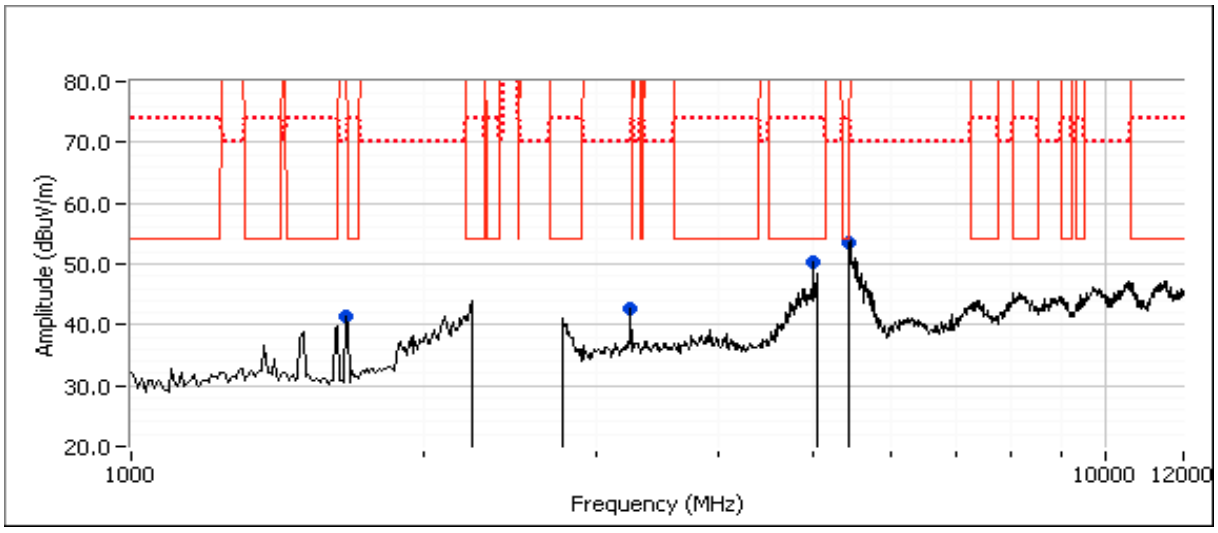
Run #2b, EUT on Channel #6 2437MHz - 802.11n20 and Channel #40 5200MHz - 802.11n20, Chain A+B+C

Radio	Freq	Power Setting
1	5200 MHz	18.0
2	2437 MHz	20.0

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.040	52.2	V	54.0	-1.8	AVG	360	1.4	RB 1 MHz;VB 10 Hz;Peak
4999.900	48.8	V	54.0	-5.2	AVG	1	1.0	RB 1 MHz;VB 10 Hz;Peak
3249.340	43.3	V	54.0	-10.7	AVG	0	1.6	RB 1 MHz;VB 10 Hz;Peak, note 2
5440.270	61.5	V	74.0	-12.5	PK	360	1.4	RB 1 MHz;VB 3 MHz;Peak
1666.750	39.7	V	54.0	-14.3	AVG	196	1.3	RB 1 MHz;VB 10 Hz;Peak
5000.100	58.3	V	74.0	-15.7	PK	1	1.0	RB 1 MHz;VB 3 MHz;Peak
3249.380	48.0	V	74.0	-26.0	PK	0	1.6	RB 1 MHz;VB 3 MHz;Peak, note 2
1666.680	44.1	V	74.0	-29.9	PK	196	1.3	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -27dBm/MHz for peak measurements in a measurement bandwidth of 1MHz.
Note 2:	Restricted limit used for non-restricted emissions
Note 3:	Scans made between 12 - 40GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

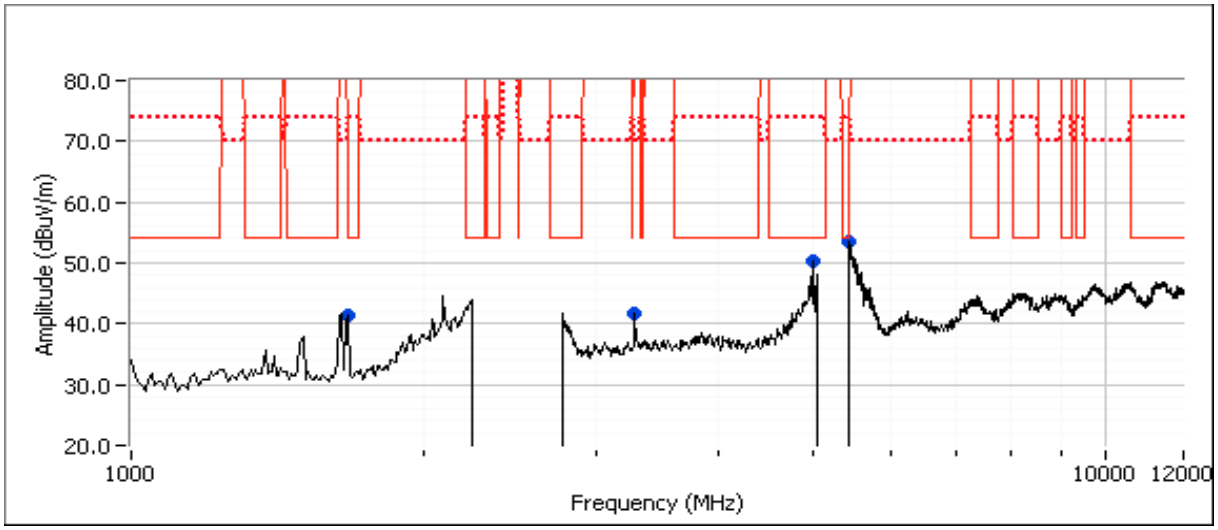
Run #2c, EUT on Channel #11 2462MHz - 802.11n20 and Channel #48 5240MHz - 802.11n20, Chain A+B+C

Radio	Freq	Power Setting
1	5240 MHz	18.0
2	2462 MHz	19.0

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.120	52.4	V	54.0	-1.6	AVG	360	1.2	RB 1 MHz;VB 10 Hz;Peak
5000.040	49.2	V	54.0	-4.8	AVG	0	1.6	RB 1 MHz;VB 10 Hz;Peak
3282.690	42.3	V	54.0	-11.7	AVG	360	1.6	RB 1 MHz;VB 10 Hz;Peak, note 2
5438.640	62.2	V	74.0	-11.8	PK	360	1.2	RB 1 MHz;VB 3 MHz;Peak
1666.720	39.6	V	54.0	-14.4	AVG	176	1.7	RB 1 MHz;VB 10 Hz;Peak
4999.910	58.6	V	74.0	-15.4	PK	0	1.6	RB 1 MHz;VB 3 MHz;Peak
3282.760	48.0	V	74.0	-26.0	PK	360	1.6	RB 1 MHz;VB 3 MHz;Peak, note 2
1666.500	44.3	V	74.0	-29.7	PK	176	1.7	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -27dBm/MHz for peak measurements in a measurement bandwidth of 1MHz.
Note 2:	Restricted limit used for non-restricted emissions



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

Run #3, Radiated Spurious Emissions, 1-40GHz, 802.11n40/802.11n40, Chain A+B+C
Run #3a, EUT on Channel #3 2422MHz - 802.11n40 and Channel #38 5190MHz - 802.11n40 - Chain A+B+C

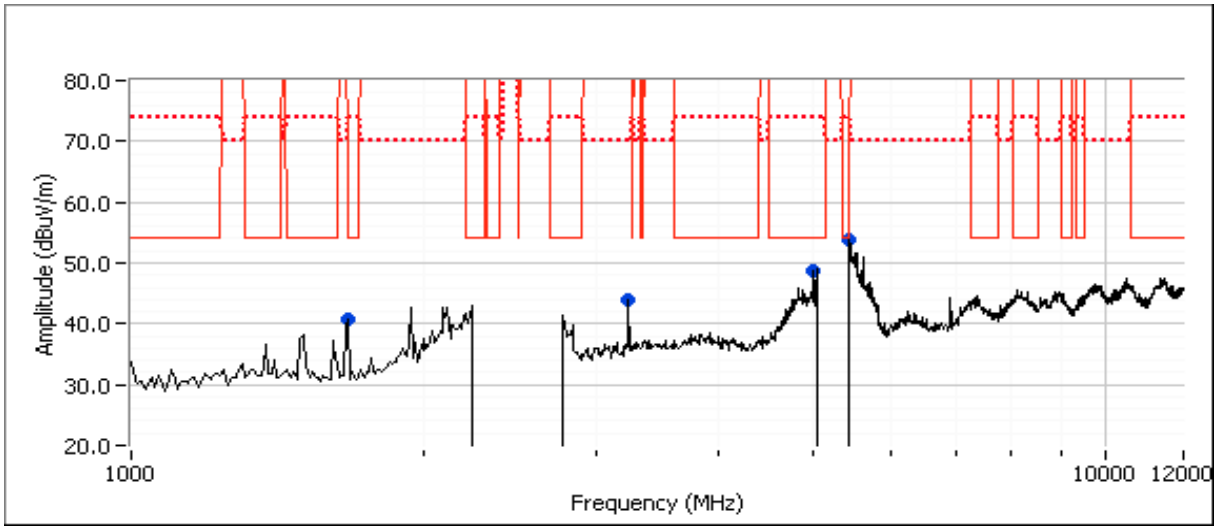
Date of Test: 4/17/2013 Test Location: FT#7
Test Engineer: Mark Hill Config Change: None

Radio	Freq	Power Setting
1	5190 MHz	17.0
2	2422 MHz	17.0

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.000	51.5	V	54.0	-2.5	AVG	0	1.1	RB 1 MHz;VB 10 Hz;Peak
4999.820	49.5	V	54.0	-4.5	AVG	360	1.6	RB 1 MHz;VB 10 Hz;Peak
3229.280	44.3	V	54.0	-9.7	AVG	360	1.4	RB 1 MHz;VB 10 Hz;Peak, note 2
5440.310	63.0	V	74.0	-11.0	PK	0	1.1	RB 1 MHz;VB 3 MHz;Peak
1666.760	40.5	V	54.0	-13.5	AVG	198	1.3	RB 1 MHz;VB 10 Hz;Peak
5000.550	58.9	V	74.0	-15.1	PK	360	1.6	RB 1 MHz;VB 3 MHz;Peak
3229.430	49.0	V	74.0	-25.0	PK	360	1.4	RB 1 MHz;VB 3 MHz;Peak, note 2
1666.670	44.2	V	74.0	-29.8	PK	198	1.3	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -27dBm/MHz for peak measurements in a measurement bandwidth of 1MHz.
Note 2:	Restricted limit used for non-restricted emissions



Client:	Flextronics	Job Number:	J89632
Model:	WS-AP3710e	T-Log Number:	T89830
		Account Manager:	Christine Krebill
Contact:	George Fares		
Standard:	15.247, 15.407, RSS-210	Class:	N/A

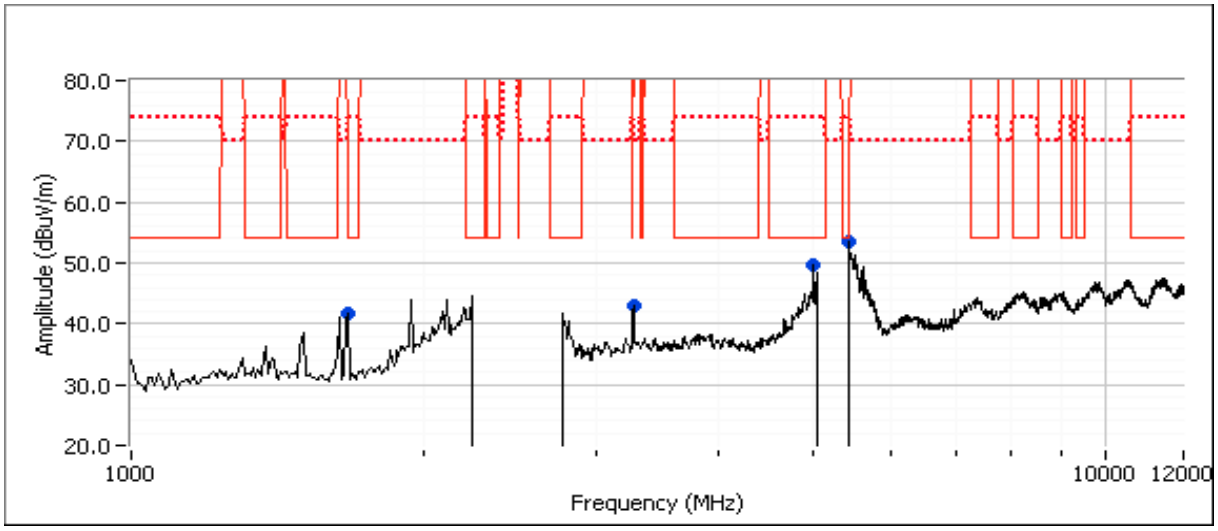
Run #3b, EUT on Channel #9 2452MHz - 802.11n40 and Channel #46 5230MHz - 802.11n40, Chain A+B+C

Radio	Freq	Power Setting
1	5230 MHz	17.0
2	2452 MHz	18.0

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.407		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.090	50.2	V	54.0	-3.8	AVG	0	1.1	RB 1 MHz;VB 10 Hz;Peak
4999.900	47.8	V	54.0	-6.2	AVG	0	1.6	RB 1 MHz;VB 10 Hz;Peak
3269.340	43.4	V	54.0	-10.6	AVG	360	1.6	RB 1 MHz;VB 10 Hz;Peak, note 2
5445.060	62.0	V	74.0	-12.0	PK	0	1.1	RB 1 MHz;VB 3 MHz;Peak
1666.790	40.2	V	54.0	-13.8	AVG	196	1.3	RB 1 MHz;VB 10 Hz;Peak
4999.600	57.5	V	74.0	-16.5	PK	0	1.6	RB 1 MHz;VB 3 MHz;Peak
3269.160	48.5	V	74.0	-25.5	PK	360	1.6	RB 1 MHz;VB 3 MHz;Peak, note 2
1666.650	44.8	V	74.0	-29.2	PK	196	1.3	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -27dBm/MHz for peak measurements in a measurement bandwidth of 1MHz.
Note 2:	Restricted limit used for non-restricted emissions
Note 3:	Scans made between 12 - 40GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range



End of Report

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