EMC Test Report
Application for Grant of Equipment Authorization
Class II Permissive Change/Reassessment
Industry Canada RSS-Gen Issue 2 / RSS 210 Issue 7
FCC Part 15, Subpart E

Model: BCM943224HMS

IC CERTIFICATION #:	4324A-BRCM1041
FCC ID:	QDS-BRCM1041
APPLICANT:	Broadcom Corporation 190 Mathilda Ave Sunnyvale, CA 94086
TEST SITE(S):	Elliott Laboratories 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-4
REPORT DATE:	December 3, 2010
FINAL TEST DATES:	November 23 and 24, 2010

AUTHORIZED SIGNATORY:

Mark E. Hill
Staff Engineer
Elliott Laboratories

Testing Cert #2016.01

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	12/3/2010	First release	

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SCOPE

An electromagnetic emissions test has been performed on the Broadcom Corporation model BCM943224HMS, 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 Broadcom Corporation model BCM943224HMS complied with the requirements of the following regulations:

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 Broadcom Corporation model BCM943224HMS and therefore apply only to the tested sample. The sample was selected and prepared by Pin Wen of Broadcom Corporation.

DEVIATIONS FROM THE STANDARDS

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

TEST RESULTS SUMMARY

As the permissive change involves a new antenna with a higher gain in the 5470-5725 MHz band, only those results applicable are presented below.

UNII / LELAN DEVICES

Operation in the 5.47 – 5.725 GHz Band

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(a) (2)		26dB Bandwidth	Unchanged from original filing.		N/A
15.407(a) (2)	A9.2(2)	Output Power	Prior to testing, output power was confirmed to be within 0.5dB of original filing. Maximum EIRP does not exceed 1W requirement.		N/A
15.407(a) (2))		Power Spectral Density	Unchanged from original filing.		N/A
	A9.2(2) / A9.5 (2)	Power Spectral Density			
KDB 443999	A9	Non-operation in 5600 – 5650 MHz sub band	Unchanged from the original filing.		N/A

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	Unchanged from original filing.		N/A
15.407(b) (5) / 15.209	A9.3	Spurious Emissions	48.3dBµV/m @ 5460.1MHz	Refer to page 19	Complies (- 5.7dB)
15.407(a)(6)	-	Peak Excursion Ratio	Unchanged from original filing.		N/A
	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		Complies
15.407 (c)	A9.5(4)	Operation in the absence of information to transmit	Unchanged from original filing.		N/A
15.407 (g)	A9.5 (5)	Frequency Stability	Unchanged from original filing.		N/A
15.407 (h1)	A9.4	Transmit Power Control	The system is compliant with 802.11h, which allows for a reduction of up to 6dB depending on the link conditions.		Pass
15.407 (h2)	A9.4	Dynamic frequency Selection (device without radar detection)	As the device does not have radar detection, no testing was performed. Original results are still applicable.		N/A
	A9.9g	User Manual information	Unchanged from original filing.		N/A

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Unchanged from original filing.		N/A
15.207	RSS GEN Table 2	AC Conducted Emissions	Unchanged from original filing.		N/A
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	41.0dBµV/m @ 2496.1MHz	Refer to page 18	Complies (-13.0dB)
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in Exhibit 11 and RSS 102 declaration	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSP 100 RSS GEN 7.1.5	User Manual	Unchanged from original filing.		N/A
-	RSP 100 RSS GEN 7.1.5	User Manual	Unchanged from original filing.		N/A
-	RSP 100 RSS GEN 4.4.1	99% Bandwidth	Unchanged from original filing.		N/A

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 Broadcom Corporation model BCM943224HMS is a WLAN card designed to be installed in laptop computers. Since the EUT would be placed on a table top 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 3.3 VDC.

The sample was received on November 23, 2010 and tested on November 23 and 24, 2010. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Broadcom	BCM943224HMS	802.11ag/Draft 802.11n WLAN PCI-E Mini Card		QDS-BRCM1041 4324A-BRCM1041

ANTENNA SYSTEM

The EUT antenna connects to the EUT via a U.FL antenna connector, thereby meeting the requirements of FCC 15.203.

The antenna of the original filing had the following gain: 3.9dBi/2.4GHz, 5.6dBi/5.2GHz, 4.2dBi/5.5GHz and 5.8dBi/5.7GHz.

The new antenna has the following gains: 3.8dBi/2.4GHz, 5.6dBi/5.2GHz, 5.7dBi/5.5GHz and 5.7dBi/5.7GHz.

ENCLOSURE

The EUT does not have an enclosure as it is designed to be installed within the enclosure of a host computer or system.

During testing, the EUT was mounted on a test fixture located outside of the 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
Lenovo	4446-38U	Laptop	R8-CAC56 09/08	

No remote support equipment was used during testing.

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Laptop DC Power	AC/DC Adapter	Multiconductor	Shielded	1.5m
AC/DC Adapter	AC Mains	2Wire	Unshielded	1.0

EUT OPERATION

During testing, the EUT was configured to transmit continuously at the desired channel. For 802.11a, testing was performed at 6MB/s, and MCS0 for n20 and n40 operation, as these were the worse case from the original filing.

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 3	769238	2845B-3	41039 Boyce Road Fremont, CA 94538-2435
Chamber 4	211948	2845B-4	

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.

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.

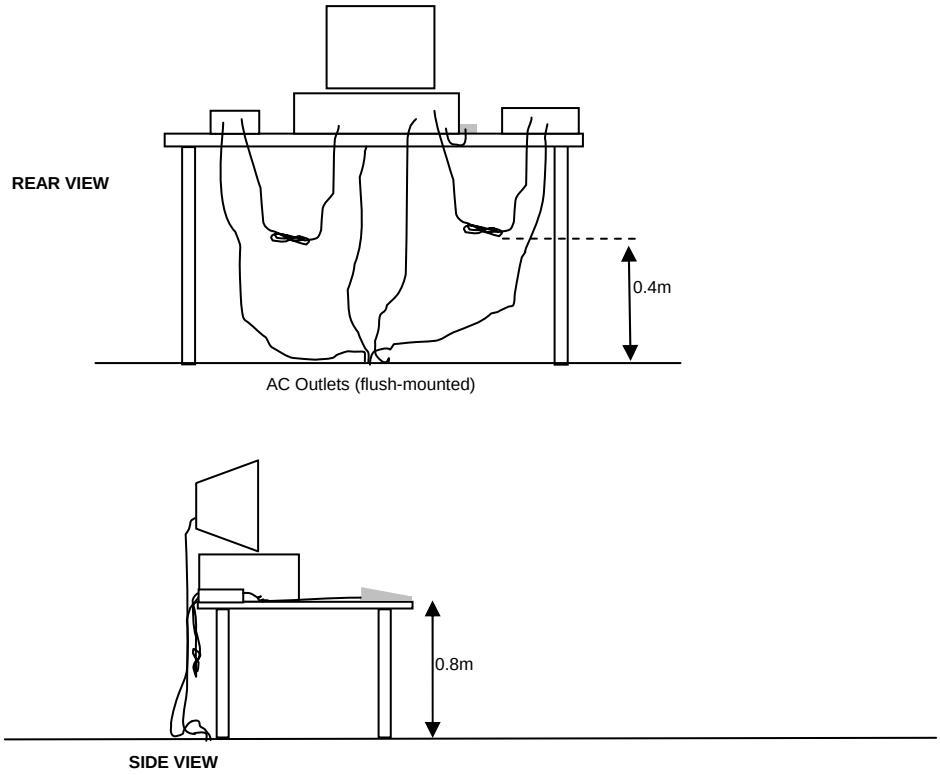
RADIATED EMISSIONS

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.

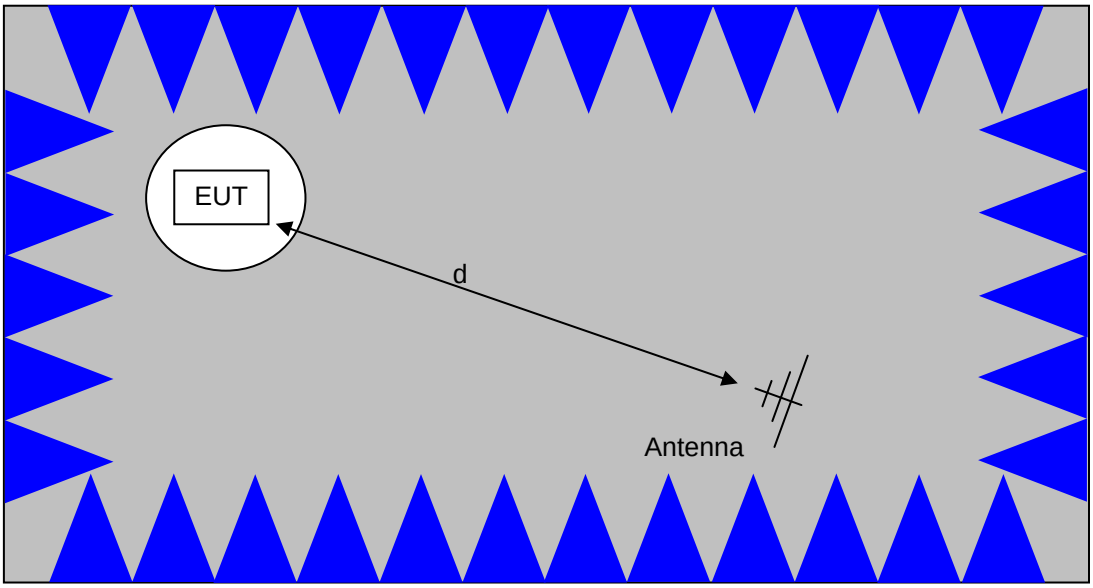
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

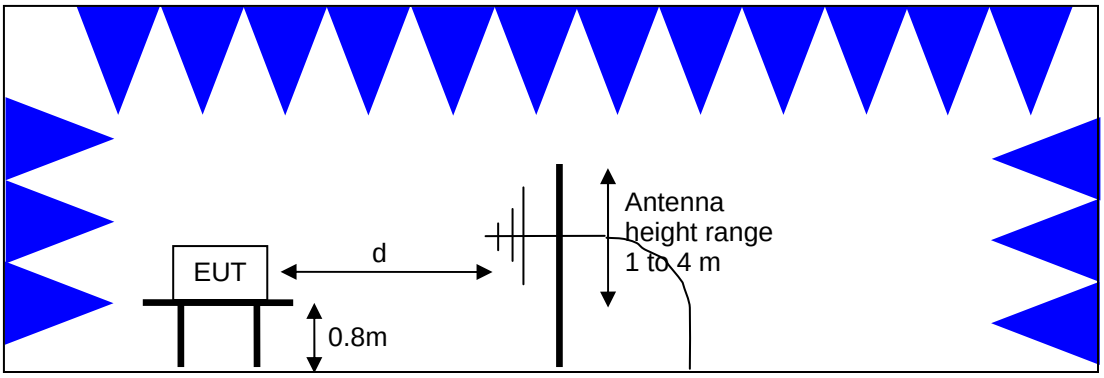


Typical Test Configuration for Radiated Field Strength Measurements



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.

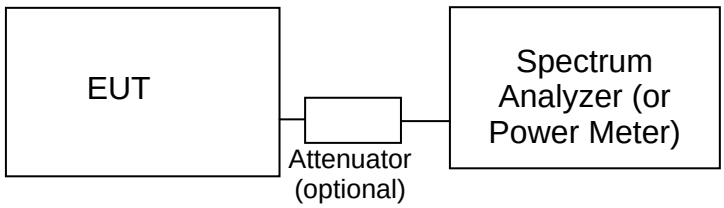
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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 Elliott'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

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

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 - 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

TX Radiated Spurious, 23-Nov-10

Manufacturer	Description	Model	Asset #	Cal Due
Trend	Isolation Transformer	N-59MG	197	N/A
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12/15/2010
Hewlett Packard	High Pass filter, 8.2 GHz (Red System)	P/N 84300-80039 (84125C)	1152	9/3/2011
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	1386	9/21/2012
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	4/14/2011
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	3/31/2011
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	1730	9/3/2011

Radiated Emissions, 1 - 40 GHz, 24-Nov-10

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	12/15/2010
Hewlett Packard	High Pass filter, 8.2 GHz (Red System)	P/N 84300-80039 (84125C)	1152	9/3/2011
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	1386	9/21/2012
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	4/14/2011
Hewlett Packard	Head (Inc W1-W4, 1742 , 1743) Blue	84125C	1620	5/4/2011
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	1730	9/3/2011
A.H. Systems	Red System Horn, 18-40GHz	SAS-574, p/n: 2581	2161	3/5/2011

Radio Antenna Port , 24-Nov-10

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	7/12/2011
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	11/2/2011

Radiated Emissions, 1000 - 18,000 MHz, 24-Nov-10

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	6/25/2011
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/22/2012
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	1771	8/26/2011

Appendix B Test Data

T81298 23 Pages

Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Emissions Standard(s):	FCC 15E, RSS 210, LP0002	Class:	-
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Broadcom

Model

BCM943224HMS

Date of Last Test: 11/30/2010

Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	-

Radiated Emissions

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

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: 11/24/2010
Test Engineer: Suresh Kondapalli
Test Location: Ch#4

Config. Used: 1
Config Change: No
Host Unit Voltage 120V/60Hz

General Test Configuration

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

The test distance and extrapolation factor (if applicable) are detailed under each run description.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1 Rx at 5580MHz, Aux and Main	RE, 1000 - 18,000 MHz, Maximized Emissions	RSS 210, LP0002	Pass	41.0dBµV/m @ 2496.1MHz (-13.0dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

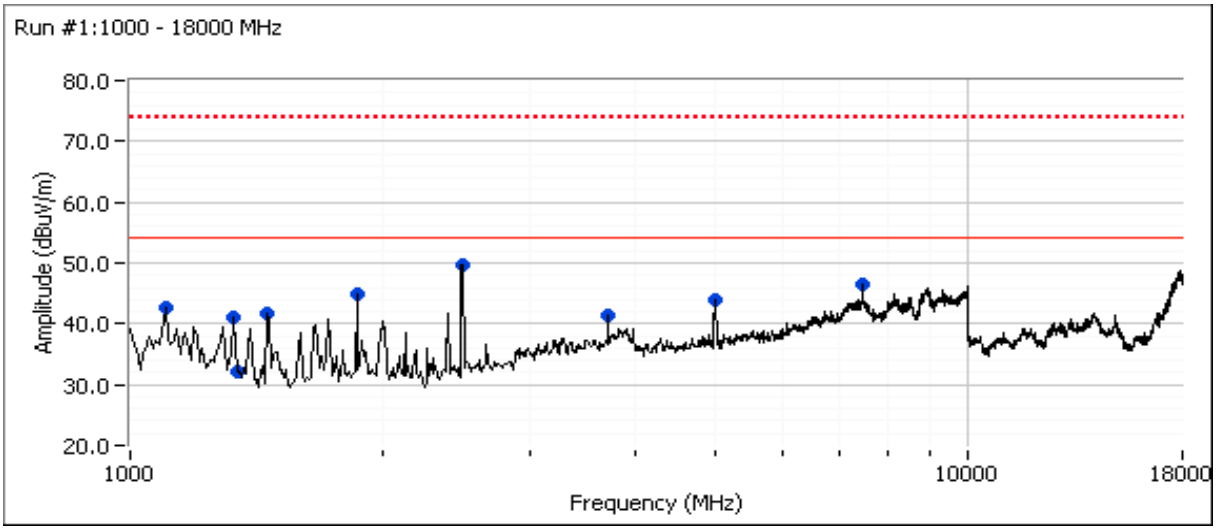
No deviations were made from the requirements of the standard.

Note: No emissions were observed below 1 GHz

Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	-

Run #1: Radiated Emissions, 1000 - 18000 MHz (Receive mode, 5580 MHz, main+aux)

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
1000-10000	3	3	0.0
10000-18000	1	3	-9.5



Maximized Radiated Emissions

Frequency	Level	Pol	RSS GEN \ LP0002		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2496.100	41.0	H	54.0	-13.0	AVG	267	1.3	RB 1 MHz;VB 10 Hz;Pk
2492.700	58.5	H	74.0	-15.5	PK	267	1.3	RB 1 MHz;VB 3 MHz;Pk
7467.910	39.1	V	54.0	-14.9	AVG	258	1.6	RB 1 MHz;VB 10 Hz;Pk
7466.950	53.8	V	74.0	-20.2	PK	258	1.6	RB 1 MHz;VB 3 MHz;Pk
1098.900	36.9	V	54.0	-17.1	AVG	24	1.0	RB 1 MHz;VB 10 Hz;Pk
1096.160	49.8	V	74.0	-24.2	PK	24	1.0	RB 1 MHz;VB 3 MHz;Pk
1329.180	29.0	V	54.0	-25.0	AVG	276	1.0	RB 1 MHz;VB 10 Hz;Pk
1330.780	40.2	V	74.0	-33.8	PK	276	1.0	RB 1 MHz;VB 3 MHz;Pk
1459.670	25.2	V	54.0	-28.8	AVG	261	1.1	RB 1 MHz;VB 10 Hz;Pk
1458.070	36.2	V	74.0	-37.8	PK	261	1.1	RB 1 MHz;VB 3 MHz;Pk
1860.360	26.2	V	54.0	-27.8	AVG	351	1.1	RB 1 MHz;VB 10 Hz;Pk
1863.020	37.7	V	74.0	-36.3	PK	351	1.1	RB 1 MHz;VB 3 MHz;Pk
3713.440	31.8	H	54.0	-22.2	AVG	221	1.9	RB 1 MHz;VB 10 Hz;Pk
3712.640	43.7	H	74.0	-30.3	PK	221	1.9	RB 1 MHz;VB 3 MHz;Pk
4995.230	35.6	V	54.0	-18.4	AVG	313	1.6	RB 1 MHz;VB 10 Hz;Pk
4997.770	53.2	V	74.0	-20.8	PK	313	1.6	RB 1 MHz;VB 3 MHz;Pk

Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

RSS 210 and FCC 15.407 (UNII) Band Edge Field Strength

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: Refer to individual run
Test Engineer: Refer to individual run
Test Location: Refer to individual run

Config. Used: -
Config Change: -
Host Unit Voltage 120V/60Hz

General Test Configuration

The EUT was located on the turntable for radiated spurious emissions testing. Any remote support equipment was located approximately 30 meters from the EUT with all I/O connections running beneath the groundplane.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 15 - 25 °C
Rel. Humidity: 35 - 65 %

Summary of Results

Run #	Mode	Channel	Chain/ Antenna	Power Setting	Test Performed	Limit	Result / Margin
1	802.11a (SISO)	#100 5500MHz	Main	-	Restricted Band Edge at 5460 MHz	15.209	45.6dBµV/m @ 5460.1MHz (-8.4dB)
				-	Band Edge 5460 - 5470 MHz	15E	51.4dBµV/m @ 5470.1MHz (-16.6dB)
2	CDD 20MHz (MIMO)	#100 5500MHz	Main + Aux	-	Restricted Band Edge at 5460 MHz	15.209	47.1dBµV/m @ 5459.5MHz (-6.9dB)
				-	Band Edge 5460 - 5470 MHz	15E	55.6dBµV/m @ 5469.7MHz (-12.4dB)
3	CDD 40MHz (MIMO)	#102 5510MHz	Main + Aux	-	Restricted Band Edge at 5460 MHz	15.209	48.3dBµV/m @ 5460.1MHz (-5.7dB)
				-	Band Edge 5460 - 5470 MHz	15E	56.5dBµV/m @ 5470.12MHz (-11.5dB)

Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	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.

Run #1, Band Edge Radiated Spurious Emissions, 802.11a SISO Mode

Date of Test: 11/23/2010 Test Engineer: Mark Hill

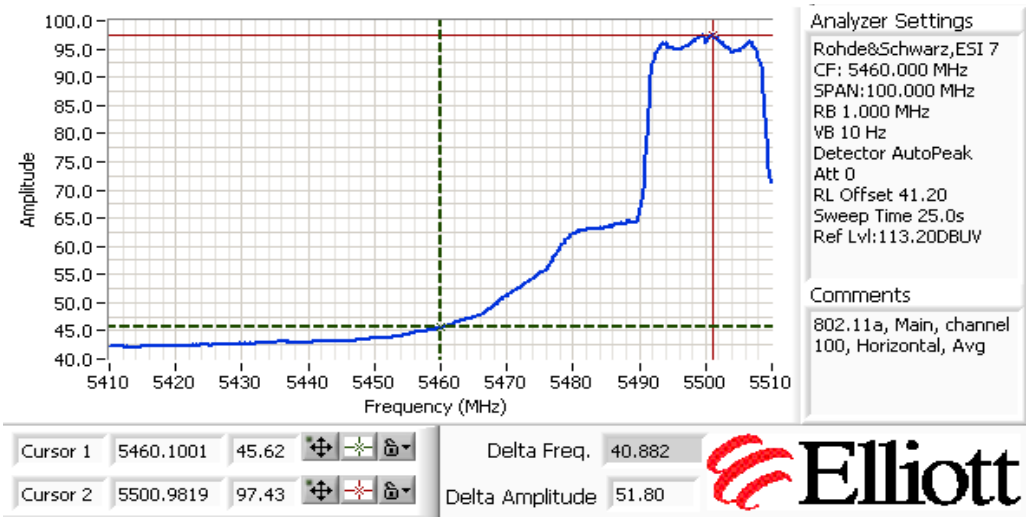
Test Location: FT#3 Comments:

Run #1a: Channel 100 (5500MHz), 802.11a SISO, 5460MHz & 5470MHz Band Edges

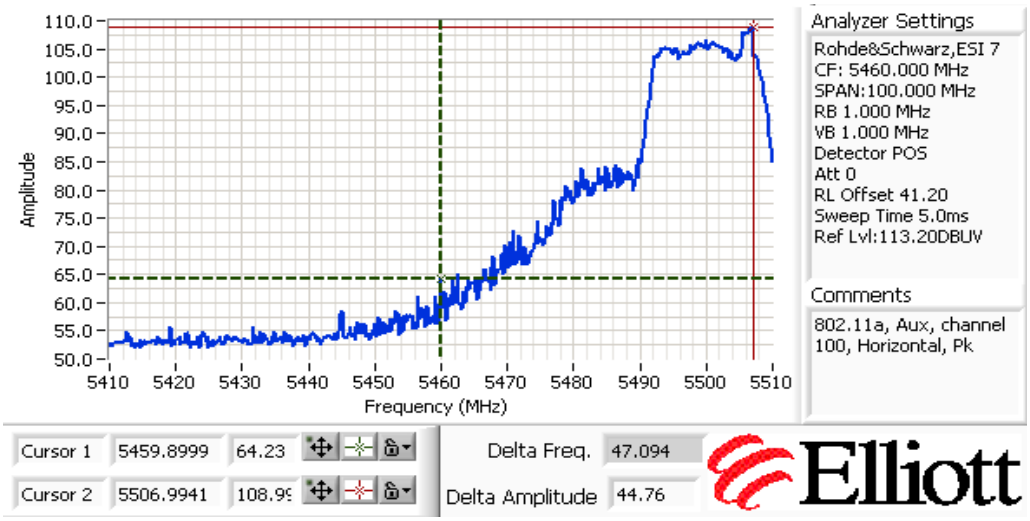
Target Power: - Power Setting: -

5350-5460 MHz Restricted Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5460.100	44.1	V	54.0	-10.0	Avg	234	1.2	Main
5459.098	59.5	V	74.0	-14.5	Pk	234	1.2	Main
5460.100	45.6	H	54.0	-8.4	Avg	43	1.0	Main
5457.896	63.5	H	74.0	-10.5	Pk	43	1.0	Main
5460.100	44.4	V	54.0	-9.6	Avg	244	1.4	Aux
5459.499	62.4	V	74.0	-11.6	Pk	244	1.4	Aux
5460.100	44.4	H	54.0	-9.6	Avg	118	1.1	Aux
5459.899	64.2	H	74.0	-9.8	Pk	118	1.1	Aux



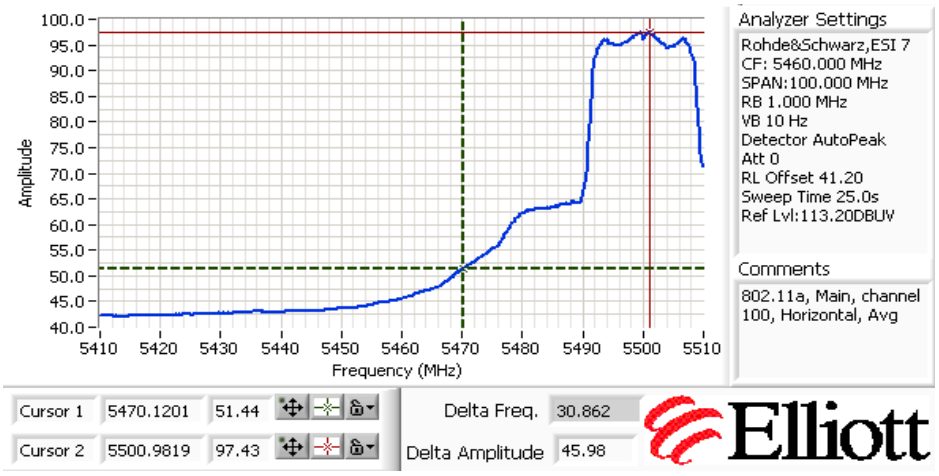
Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

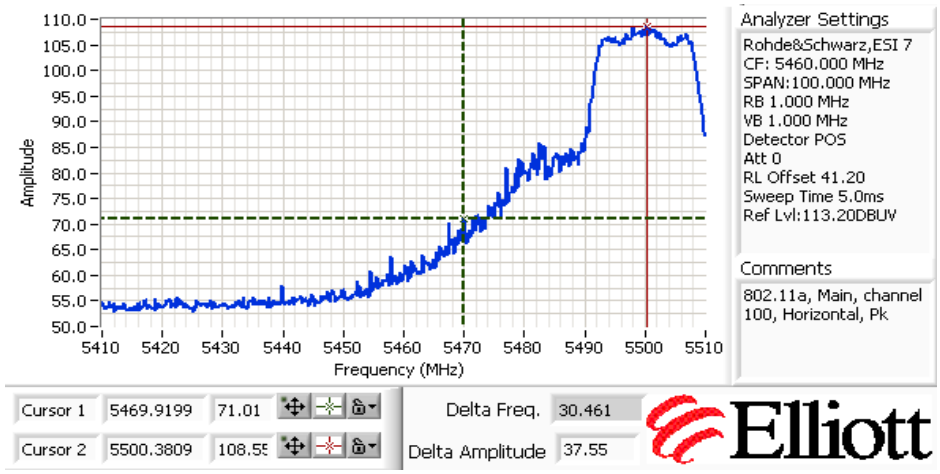


Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

5460 - 5470 MHz Band Edge Radiated Field Strength

Frequency	Level	Pol	15 E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5470.120	48.8	V	68.0	-19.3	Avg	234	1.2	Main
5470.120	69.5	V	88.0	-18.5	Pk	234	1.2	Main
5470.120	51.4	H	68.0	-16.6	Avg	43	1.0	Main
5470.919	71.0	H	88.0	-17.0	Pk	43	1.0	Main
5470.120	49.9	V	68.0	-18.1	Avg	244	1.4	Aux
5466.112	69.7	V	88.0	-18.3	Pk	244	1.4	Aux
5470.120	49.8	H	68.0	-18.2	Avg	118	1.1	Aux
5469.719	70.3	H	88.0	-17.7	Pk	118	1.1	Aux





Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #2, Band Edge Radiated Spurious Emissions, CDD 20MHz MIMO Mode

Date of Test: 11/23/2010 Test Engineer: Mark Hill

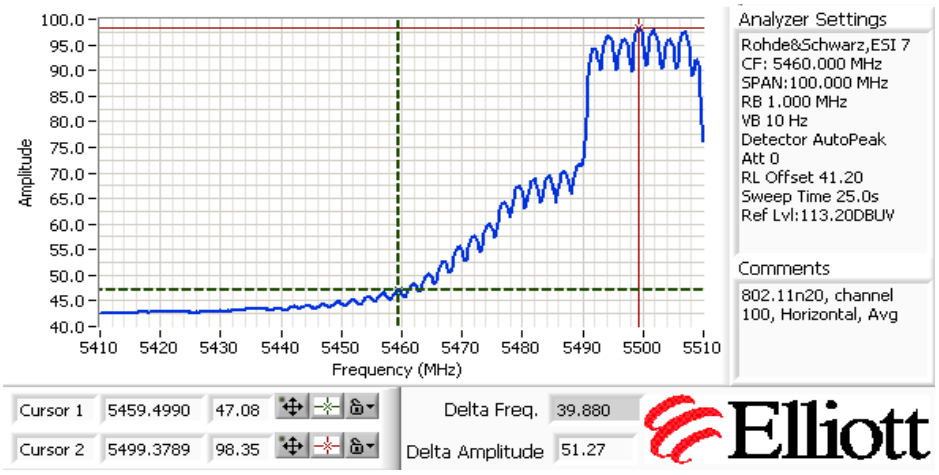
Test Location: FT#3 Comments:

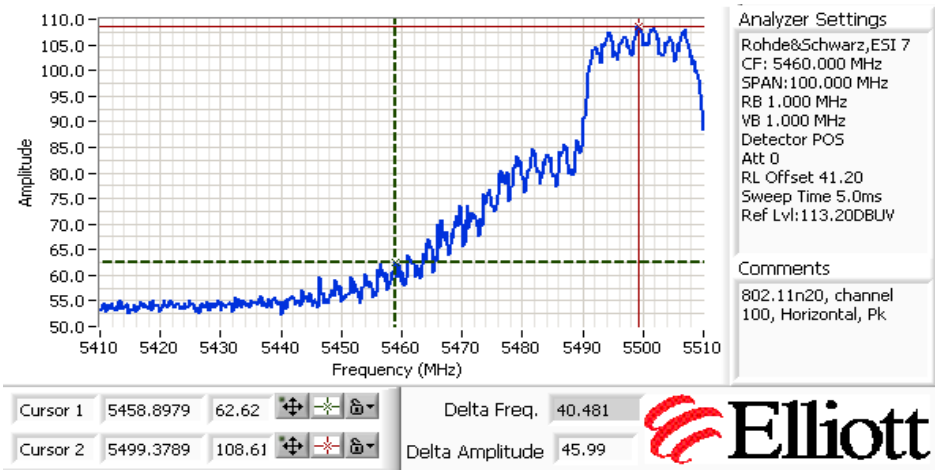
Run #2a: Channel 100 (5500MHz), CDD 20MHz MIMO, 5460MHz & 5470MHz Band Edges

Target Power: - Power Setting: -

5350-5460 MHz Restricted Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5460.100	46.7	V	54.0	-7.3	Avg	232	1.4	
5459.890	61.6	V	74.0	-12.4	Pk	232	1.4	
5459.499	47.1	H	54.0	-6.9	Avg	75	1.0	
5458.898	62.6	H	74.0	-11.4	Pk	75	1.0	

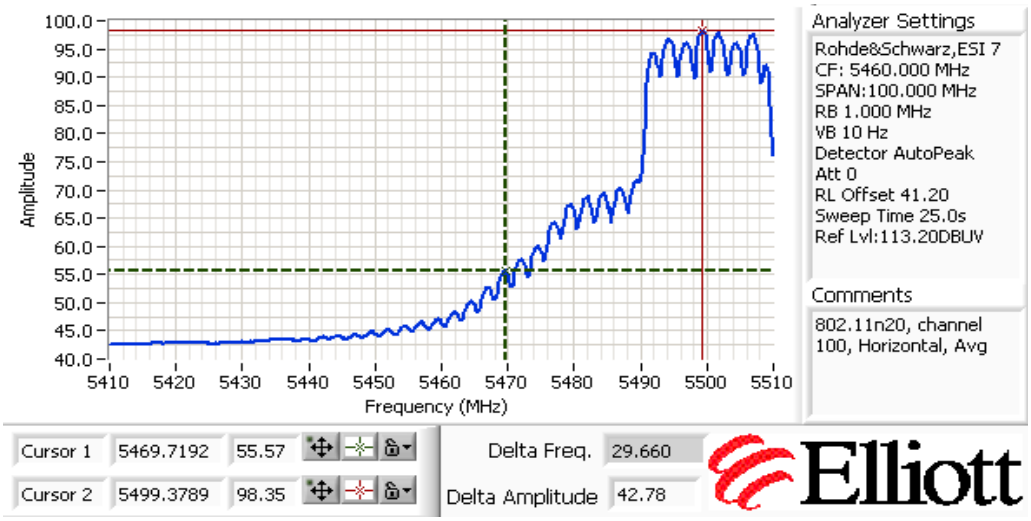


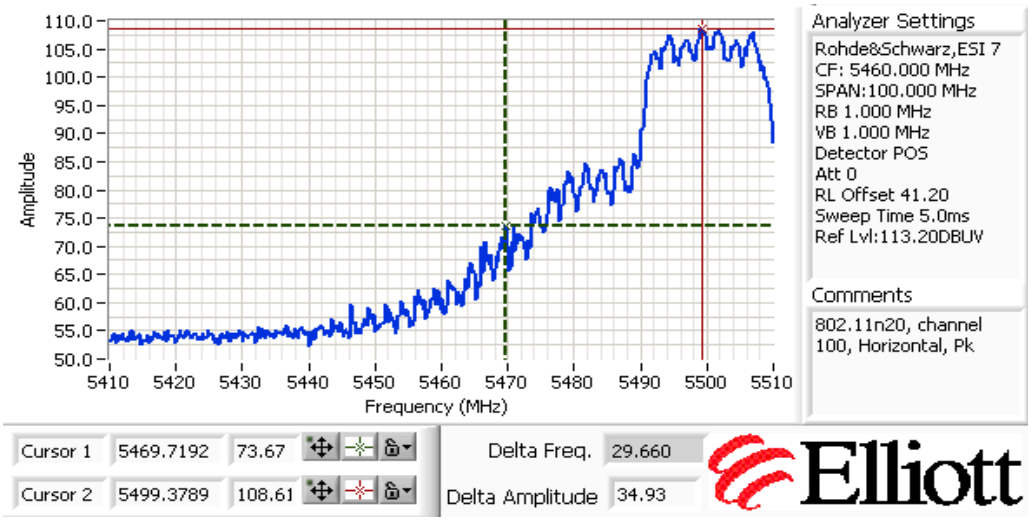


Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

5460 - 5470 MHz Band Edge Radiated Field Strength

Frequency	Level	Pol	15 E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5470.120	55.2	V	68.0	-12.8	Avg	232	1.4	
5467.715	71.2	V	88.0	-16.8	Pk	232	1.4	
5469.719	55.6	H	68.0	-12.4	Avg	75	1.0	
5469.719	73.7	H	88.0	-14.3	Pk	75	1.0	





Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #3, Band Edge Radiated Spurious Emissions, CDD 40MHz MIMO Mode

Date of Test: 11/23/2010 Test Engineer: Mark Hill

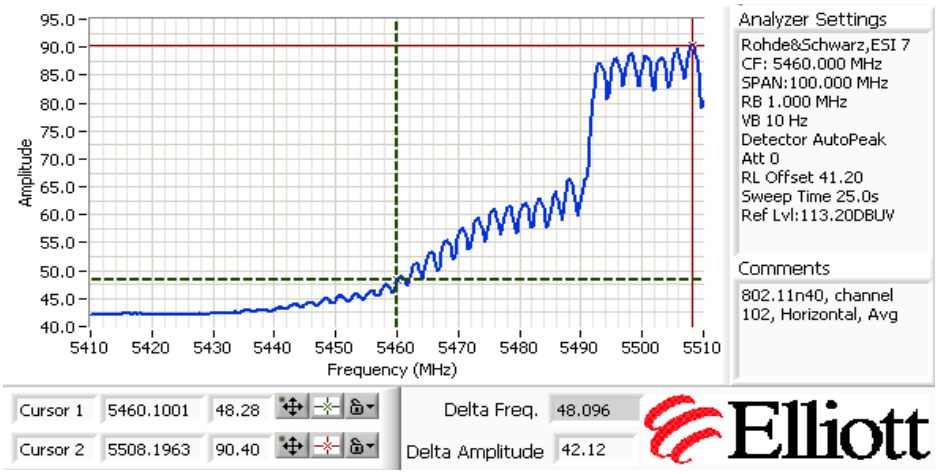
Test Location: FT#3 Comments:

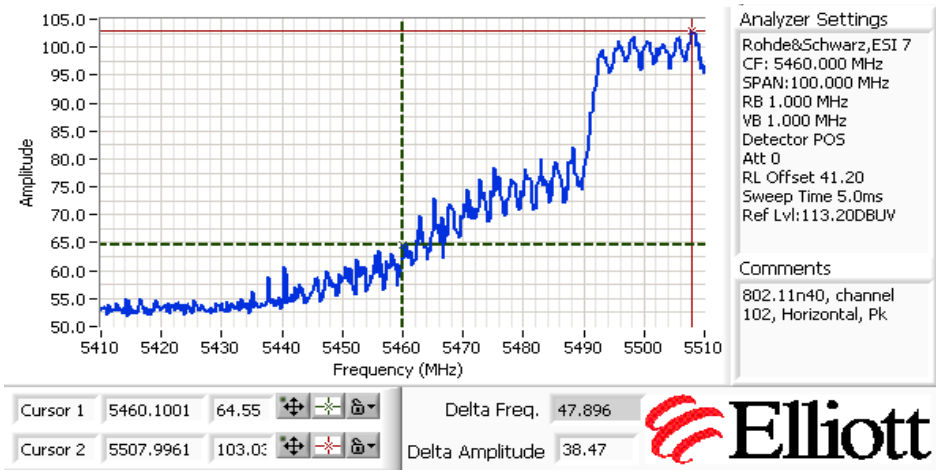
Run #3a: Channel 102 (5510MHz), CDD 40MHz MIMO, 5460MHz & 5470MHz Band Edges

Target Power: - Power Setting: -

5350-5460 MHz Restricted Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5459.899	46.4	V	54.0	-7.6	Avg	357	1.0	
5459.699	63.3	V	74.0	-10.7	Pk	357	1.0	
5460.100	48.3	H	54.0	-5.7	Avg	64	1.0	
5460.100	64.6	H	74.0	-9.5	Pk	64	1.0	

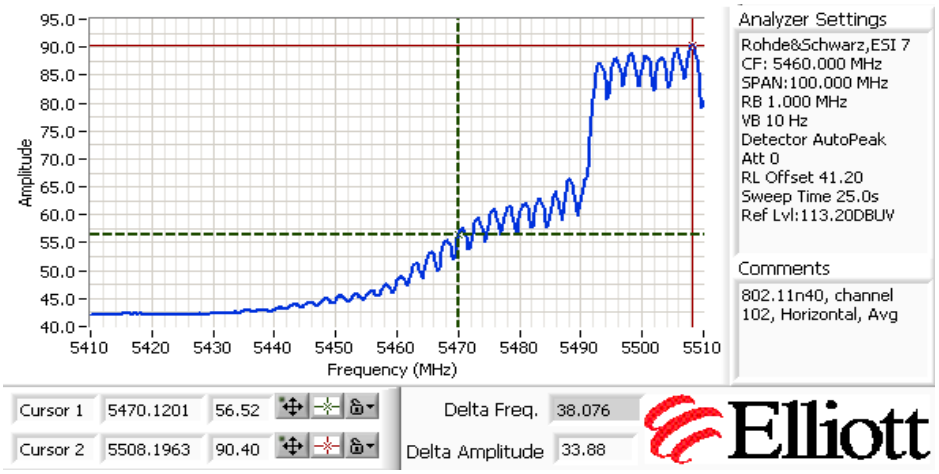


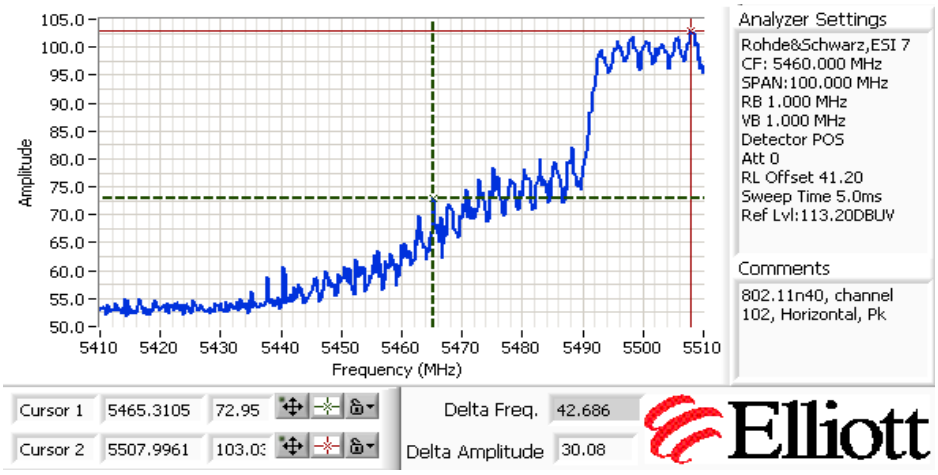


Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

5460 - 5470 MHz Band Edge Radiated Field Strength

Frequency	Level	Pol	15 E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5469.920	53.7	V	68.0	-14.3	Avg	357	1.0	
5469.920	72.8	V	88.0	-15.2	Pk	357	1.0	
5470.120	56.5	H	68.0	-11.5	Avg	64	1.0	
5465.310	73.0	H	88.0	-15.1	Pk	64	1.0	





Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	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.

Date of Test: 11/23/2010
Test Engineer: Rafael Varelas
Test Location: FT Ch#3

Config. Used: -
Config Change: -
Host Unit Voltage 120V/60Hz

General Test Configuration

The EUT was located on the turntable for radiated spurious emissions testing. Any remote support equipment was located approximately 30 meters from the EUT with all I/O connections running beneath the groundplane.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 18.7 °C
Rel. Humidity: 34 %

Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Summary of Results

Run #	Mode	Channel	Chain/ Antenna	Power Setting	Test Performed	Limit	Result / Margin
1	802.11 SISO	#100 5500MHz	Aux	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 210	43.1dBµV/m @ 2489.7MHz (-10.9dB)
		#116 5580MHz	Main	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 210	42.8dBµV/m @ 2491.1MHz (-11.2dB)
			Aux	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 210	42.8dBµV/m @ 2491.7MHz (-11.2dB)
		#140 5700MHz	Aux	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 210	45.3dBµV/m @ 11488.8MHz (-8.7dB)
2	CDD 20MHz	#100 5500MHz	Main + Aux	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 213	42.9dBµV/m @ 2490.1MHz (-11.1dB)
		#116 5580MHz	Main + Aux	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 210	43.4dBµV/m @ 2490.4MHz (-10.6dB)
		#140 5700MHz	Main + Aux	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 210	46.1dBµV/m @ 11400.4MHz (-7.9dB)
3	CDD 40MHz	#102 5510MHz	Main + Aux	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 213	43.2dBµV/m @ 2490.5MHz (-10.8dB)
		#110 5550MHz	Main + Aux	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 210	42.6dBµV/m @ 2493.2MHz (-11.4dB)
		#134 5670MHz	Main + Aux	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E / LP0002 / RSS 210	43.1dBµV/m @ 11333.3MHz (-10.9dB)

Note: No significant signals were observed between 18-40GHz when scanned at 20cm.

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.

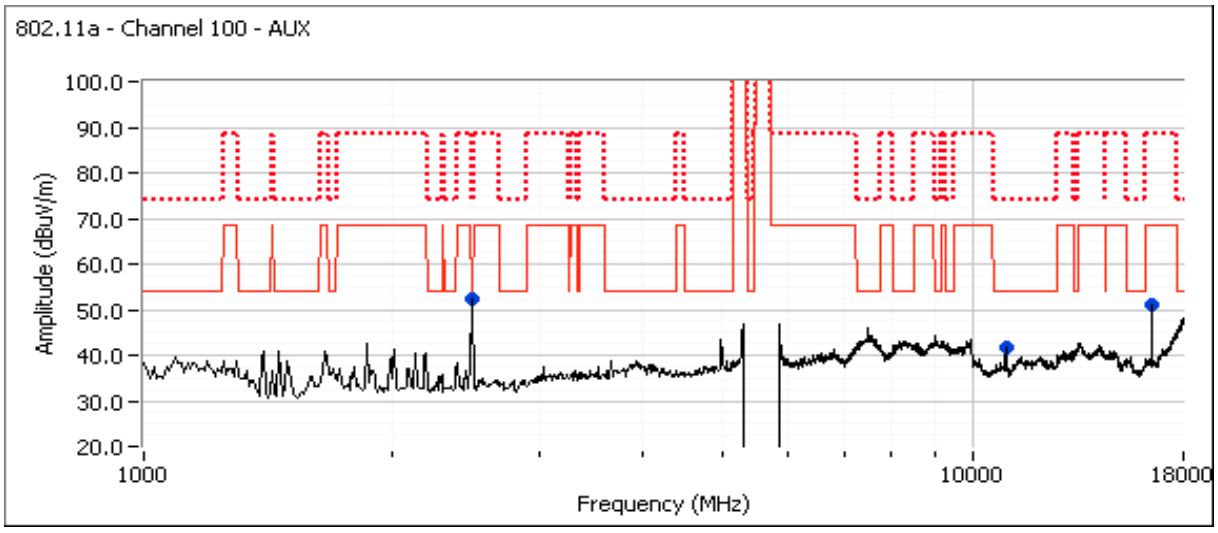
Note: No emissions were observed below 1 GHz or above 18GHz

Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #1, Radiated Spurious Emissions, 30 - 40,000 MHz. 5470-5725 MHz Bands - 802.11a SISO Mode
Run #1a: Channel 100 (5500 MHz), 802.11a SISO
Spurious Radiated Emissions - AUX Antenna *(antenna with highest emissions at 5600 MHz)*

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2489.680	43.1	V	54.0	-10.9	AVG	103	1.0	MHz;VB 10 Hz;Pk
2488.590	60.3	V	74.0	-13.7	PK	103	1.0	MHz;VB 3 MHz;Pk
10996.220	37.7	V	54.0	-16.3	AVG	14	1.0	MHz;VB 10 Hz;Pk
16499.620	46.5	H	68.3	-21.8	AVG	195	1.0	MHz;VB 10 Hz;Pk
10995.110	51.3	V	74.0	-22.7	PK	14	1.0	MHz;VB 3 MHz;Pk
16499.570	60.0	H	88.3	-28.3	PK	195	1.0	MHz;VB 3 MHz;Pk

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the **average** limit was set to -27dBm/MHz (~68dBuV/m).

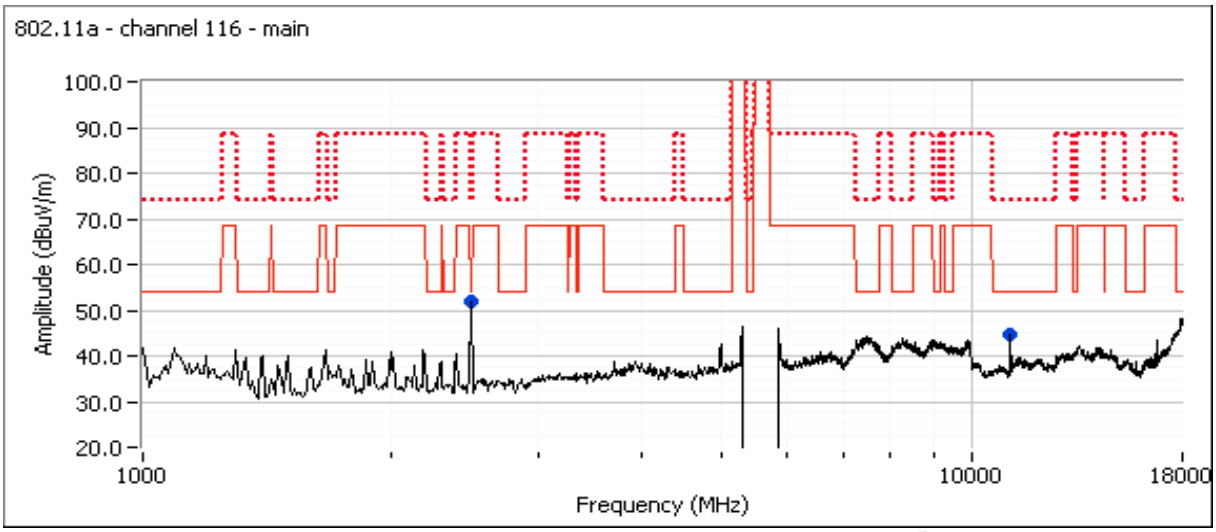


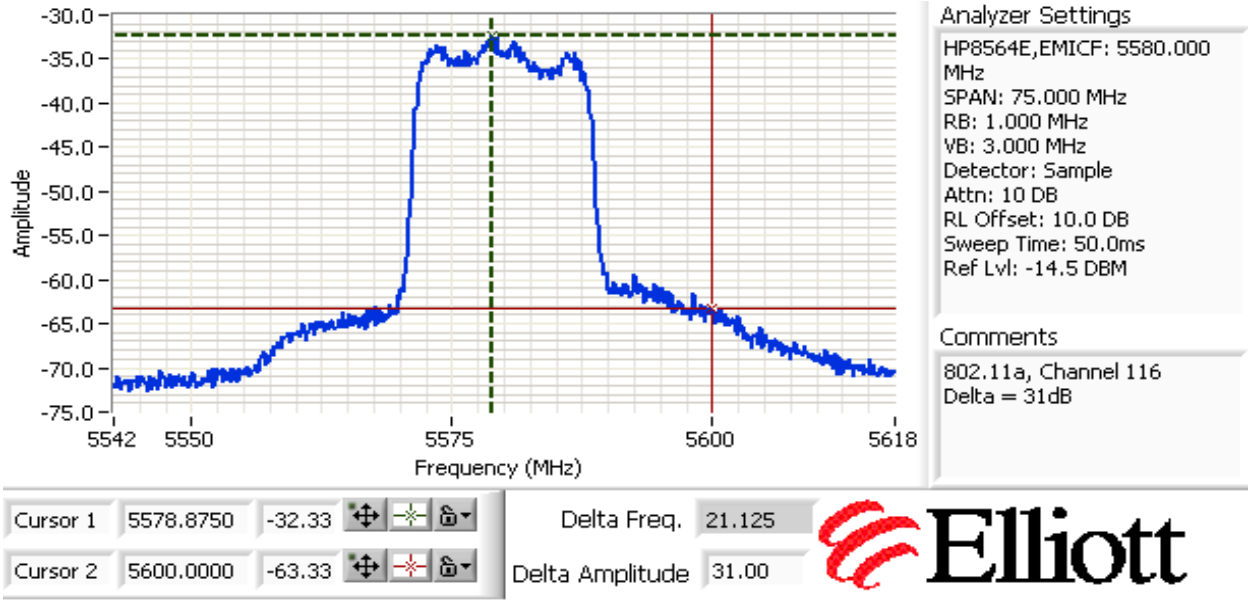
Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #1b: Channel 116 (5580 MHz), 802.11a SISO

Spurious Radiated Emissions - Main antenna

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2491.070	42.8	V	54.0	-11.2	AVG	192	1.0	RB 1 MHz;VB 10 Hz;Pk
11160.470	40.2	H	54.0	-13.8	AVG	0	1.0	RB 1 MHz;VB 10 Hz;Pk
2488.840	59.5	V	74.0	-14.5	PK	192	1.0	RB 1 MHz;VB 3 MHz;Pk
11159.410	51.6	H	74.0	-22.4	PK	0	1.0	RB 1 MHz;VB 3 MHz;Pk



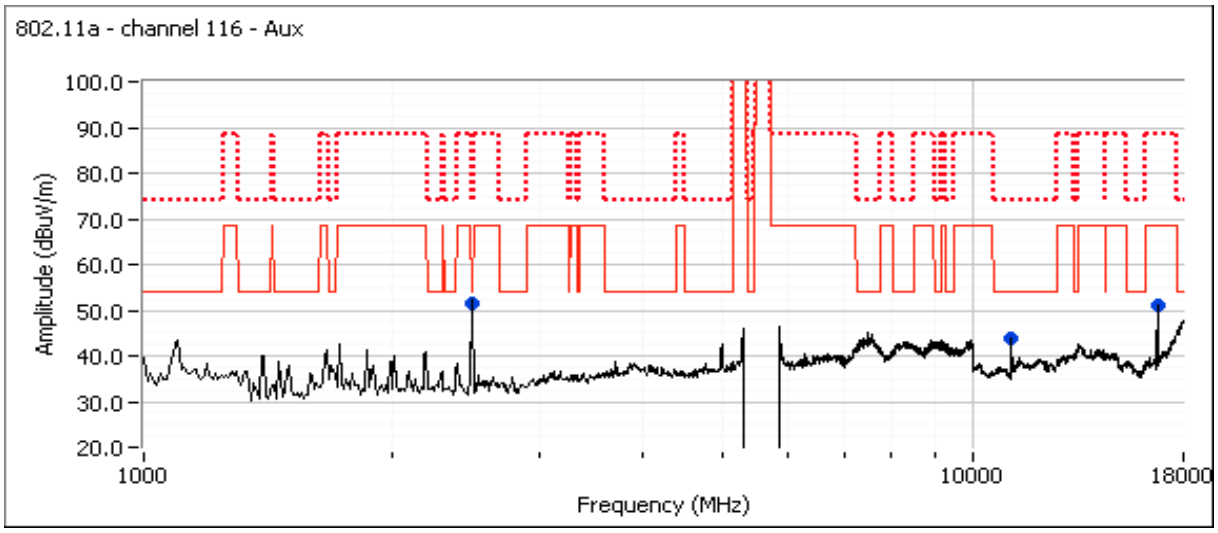


Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Spurious Radiated Emissions - Aux antenna

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2491.740	42.8	V	54.0	-11.2	AVG	188	1.4	RB 1 MHz;VB 10 Hz;Pk
11160.550	42.4	V	54.0	-11.6	AVG	178	1.0	RB 1 MHz;VB 10 Hz;Pk
2489.280	60.5	V	74.0	-13.5	PK	188	1.4	RB 1 MHz;VB 3 MHz;Pk
11161.550	52.6	V	74.0	-21.4	PK	178	1.0	RB 1 MHz;VB 3 MHz;Pk
16740.570	46.8	V	68.3	-21.5	AVG	175	1.0	RB 1 MHz;VB 10 Hz;Pk
16740.510	58.6	V	88.3	-29.7	PK	175	1.0	RB 1 MHz;VB 3 MHz;Pk

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the average limit was set to -27dBm/MHz (~68dBuV/m).



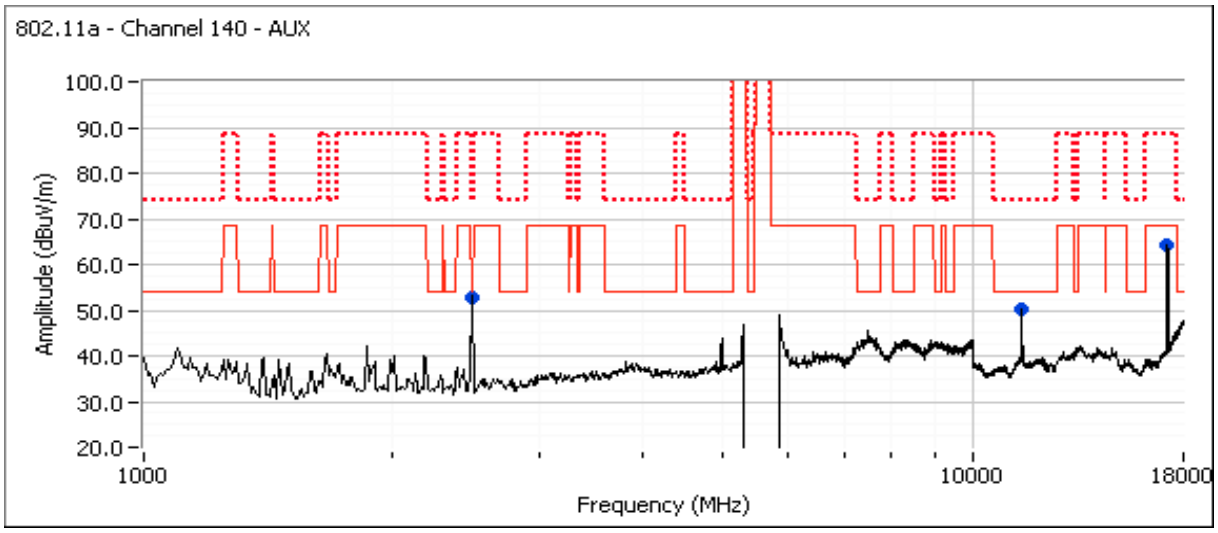
Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #1c: Channel 140 (5700 MHz), 802.11a SISO

Spurious Radiated Emissions - AUX Antenna (antenna with highest emissions at 5600 MHz)

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11488.830	45.3	V	54.0	-8.7	AVG	183	1.0	MHz;VB 10 Hz;Pk
17230.110	58.4	H	68.3	-9.9	AVG	159	1.0	MHz;VB 10 Hz;Pk
2489.720	42.7	V	54.0	-11.3	AVG	100	1.0	MHz;VB 10 Hz;Pk
2488.970	60.7	V	74.0	-13.3	PK	100	1.0	MHz;VB 3 MHz;Pk
11490.870	58.7	V	74.0	-15.3	PK	183	1.0	MHz;VB 3 MHz;Pk
17232.100	70.8	H	88.3	-17.5	PK	159	1.0	MHz;VB 3 MHz;Pk

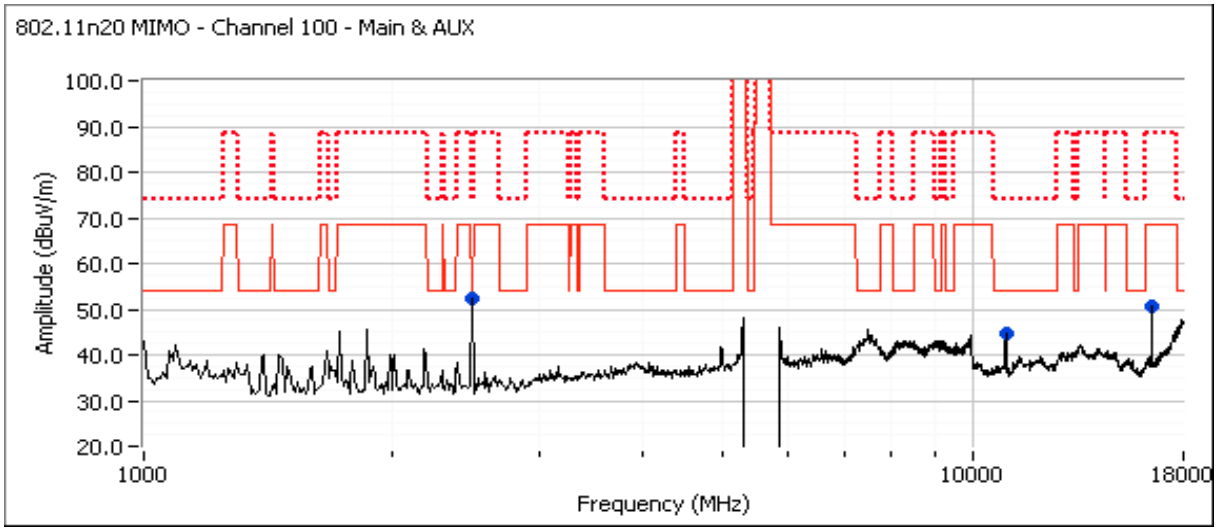
Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the average limit was set to -27dBm/MHz (~68dBuV/m).



Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #2, Radiated Spurious Emissions, 30 - 40,000 MHz. 5470-5725 MHz Band - 802.11n20 mode
Run #2a: Channel 100 (5500 MHz), 802.11n20 MIMO
Spurious Radiated Emissions - Main & Aux Antennas

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2490.140	42.9	V	54.0	-11.1	AVG	96	1.0	RB 1 MHz;VB 10 Hz;Pk
11000.130	40.7	V	54.0	-13.3	AVG	65	1.0	RB 1 MHz;VB 10 Hz;Pk
2489.320	60.0	V	74.0	-14.0	PK	96	1.0	RB 1 MHz;VB 3 MHz;Pk
11000.110	53.8	V	74.0	-20.2	PK	65	1.0	RB 1 MHz;VB 3 MHz;Pk
16500.920	46.9	H	68.3	-21.4	AVG	47	1.0	RB 1 MHz;VB 10 Hz;Pk
16500.730	59.7	H	88.3	-28.6	PK	47	1.0	RB 1 MHz;VB 3 MHz;Pk

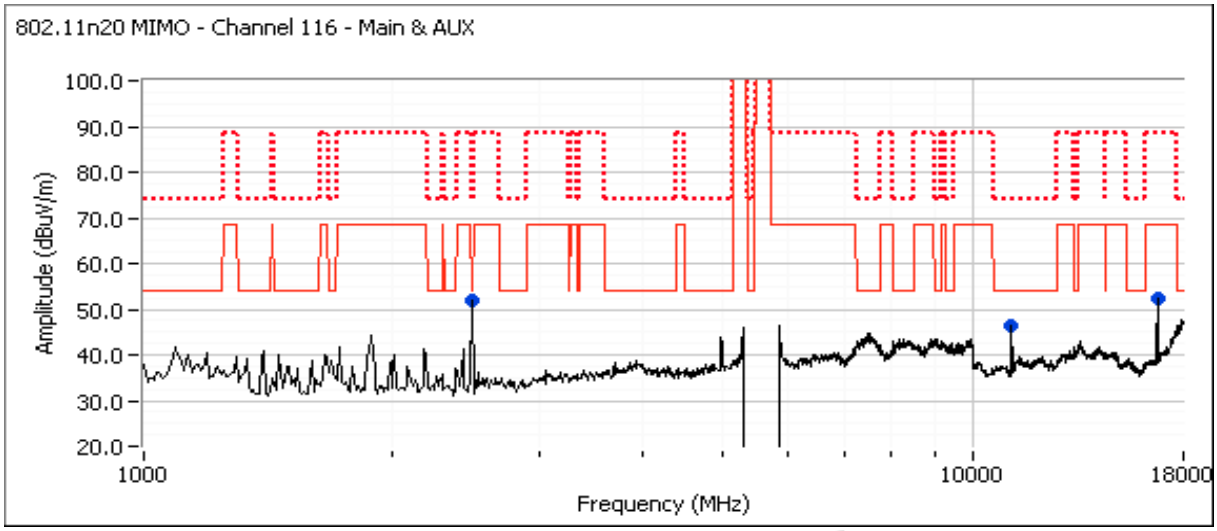


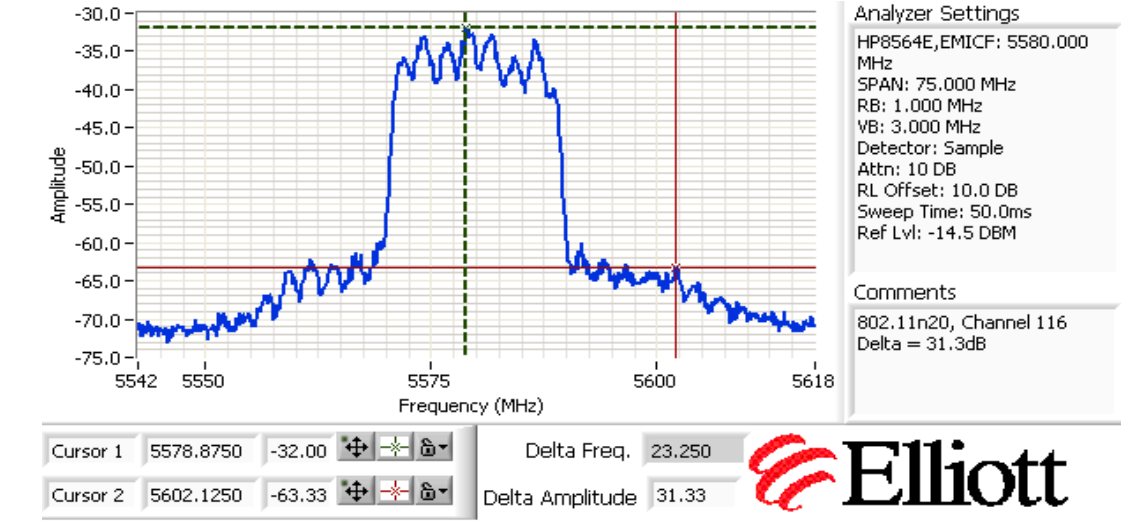
Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #2b: Channel 116 (5580 MHz), 802.11n20 MIMO

Spurious Radiated Emissions - Main & Aux Antennas

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2490.410	43.4	V	54.0	-10.6	AVG	100	1.0	MHz;VB 10 Hz;Pk
11160.410	43.2	V	54.0	-10.8	AVG	173	1.0	MHz;VB 10 Hz;Pk
2489.010	60.3	V	74.0	-13.7	PK	100	1.0	MHz;VB 3 MHz;Pk
11162.640	55.0	V	74.0	-19.0	PK	173	1.0	MHz;VB 3 MHz;Pk
16740.350	48.3	H	68.3	-20.0	AVG	69	1.0	MHz;VB 10 Hz;Pk
16745.880	59.6	H	88.3	-28.7	PK	69	1.0	MHz;VB 3 MHz;Pk



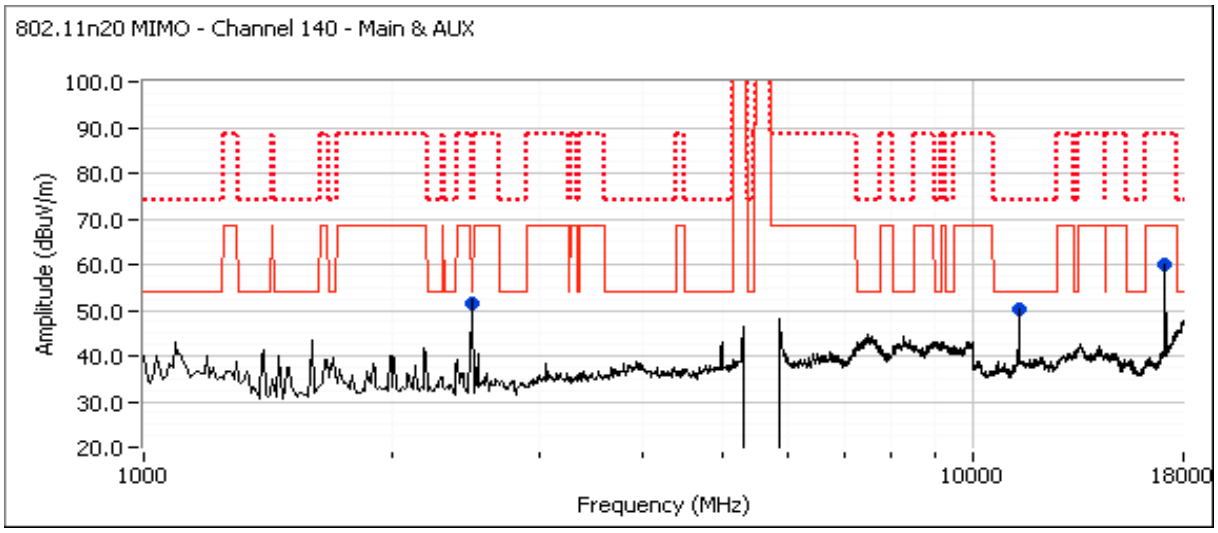


Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #2c: Channel 140 (5700 MHz), 802.11n20 MIMO

Spurious Radiated Emissions - Main & Aux Antennas

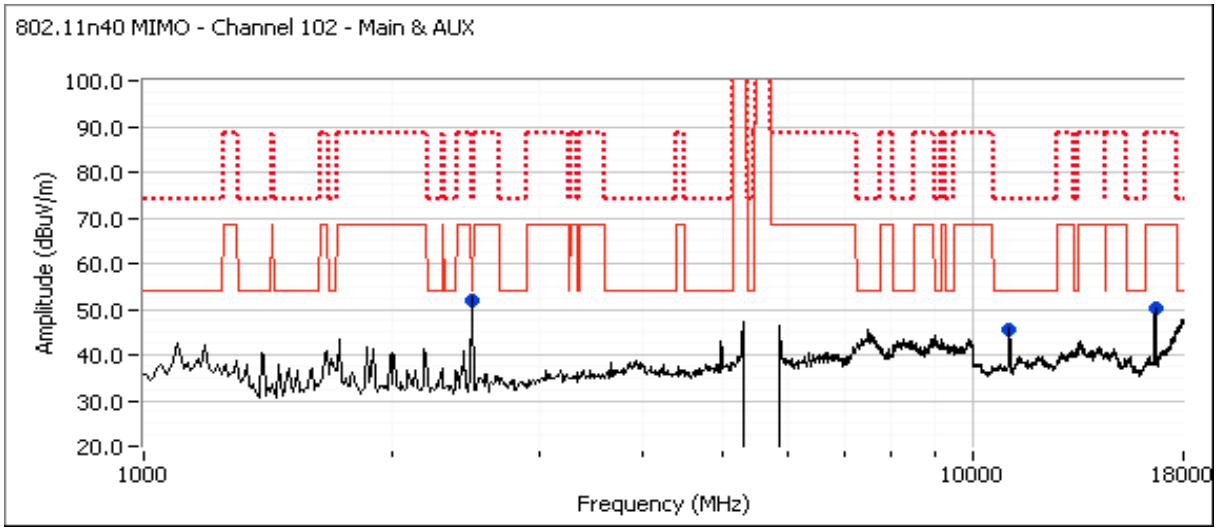
Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11400.400	46.1	V	54.0	-7.9	AVG	197	1.3	MHz;VB 10 Hz;Pk
2492.700	42.5	V	54.0	-11.5	AVG	186	1.0	MHz;VB 10 Hz;Pk
17098.450	55.4	H	68.3	-12.9	AVG	77	1.0	MHz;VB 10 Hz;Pk
2494.910	59.3	V	74.0	-14.7	PK	186	1.0	MHz;VB 3 MHz;Pk
11397.540	56.8	V	74.0	-17.2	PK	197	1.3	MHz;VB 3 MHz;Pk
17102.520	68.5	H	88.3	-19.8	PK	77	1.0	MHz;VB 3 MHz;Pk



Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #3, Radiated Spurious Emissions, 30 - 40,000 MHz. 5470-5725 MHz Band - 802.11n40 mode
Run #3a: Channel 102 (5510 MHz), 802.11n40 MIMO
Spurious Radiated Emissions - Main & Aux Antennas

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2490.470	43.2	V	54.0	-10.8	AVG	195	1.0	MHz;VB 10 Hz;Pk
2488.770	59.3	V	74.0	-14.7	PK	195	1.0	MHz;VB 3 MHz;Pk
11020.220	36.6	V	54.0	-17.4	AVG	87	1.3	MHz;VB 10 Hz;Pk
11020.250	48.3	V	74.0	-25.7	PK	87	1.3	MHz;VB 3 MHz;Pk
16528.700	41.9	H	68.3	-26.4	AVG	44	1.0	MHz;VB 10 Hz;Pk
16535.870	54.1	H	88.3	-34.2	PK	44	1.0	MHz;VB 3 MHz;Pk

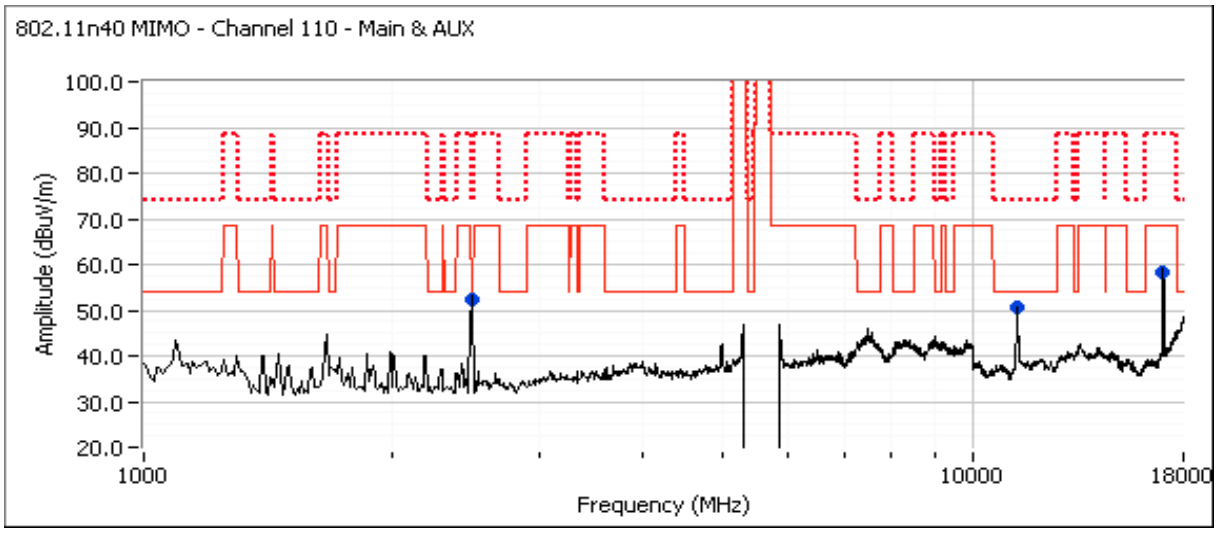


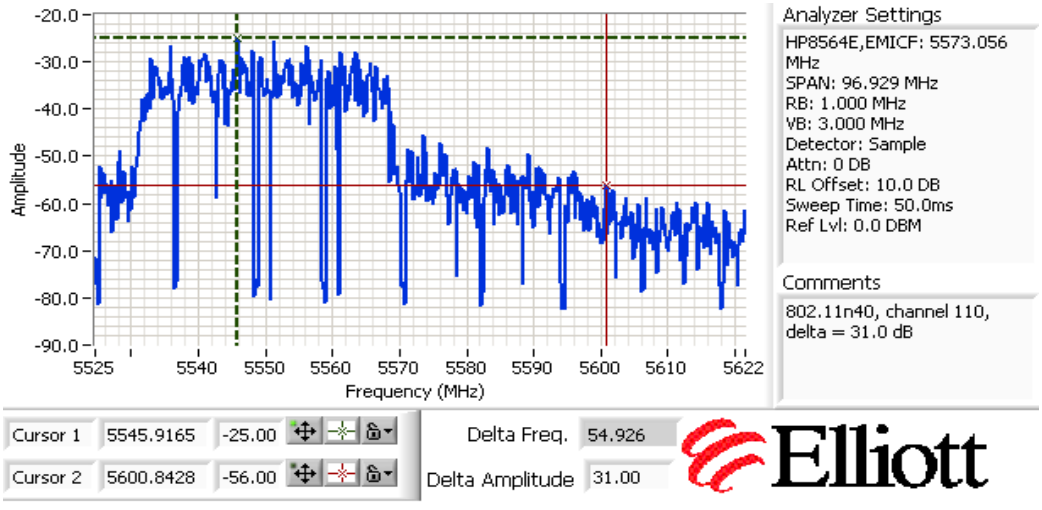
Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #3b: Channel 110 (5550 MHz), 802.11n40 MIMO

Spurious Radiated Emissions - Main & Aux Antennas

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2493.190	42.6	V	54.0	-11.4	AVG	194	1.3	MHz;VB 10 Hz;Pk
11100.390	41.4	V	54.0	-12.6	AVG	191	1.0	MHz;VB 10 Hz;Pk
2490.390	58.9	V	74.0	-15.1	PK	194	1.3	MHz;VB 3 MHz;Pk
11099.860	53.0	V	74.0	-21.0	PK	191	1.0	MHz;VB 3 MHz;Pk
16655.930	46.1	H	68.3	-22.2	AVG	194	1.0	MHz;VB 10 Hz;Pk
16645.900	56.6	H	88.3	-31.7	PK	194	1.0	MHz;VB 3 MHz;Pk





Client:	Broadcom	Job Number:	J81286
Model:	BCM943224HMS	T-Log Number:	T81298
		Account Manager:	Eriksen / Washington
Contact:	Pin Wen		
Standard:	FCC 15E, RSS 210, LP0002	Class:	N/A

Run #3c: Channel 134 (5670 MHz), 802.11n40 MIMO

Spurious Radiated Emissions - Main & Aux Antennas

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11333.250	43.1	V	54.0	-10.9	AVG	84	1.0	MHz;VB 10 Hz;Pk
2492.060	42.2	V	54.0	-11.8	AVG	172	1.0	MHz;VB 10 Hz;Pk
17003.520	54.4	H	68.3	-13.9	AVG	162	1.0	MHz;VB 10 Hz;Pk
2493.390	58.4	V	74.0	-15.6	PK	172	1.0	MHz;VB 3 MHz;Pk
11338.350	54.6	V	74.0	-19.4	PK	84	1.0	MHz;VB 3 MHz;Pk
17008.280	65.8	H	88.3	-22.5	PK	162	1.0	MHz;VB 3 MHz;Pk