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EMC Test Report

Application for Grant of Equipment Authorization
Class II Permissive Change/Reassessment

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

Model: BCM943228HM4L

IC CERTIFICATION #:	4324A-BRCM1054
FCC ID:	QDS-BRCM1054
APPLICANT:	Broadcom Corporation 190 Mathilda Ave. Sunnyvale, CA 94086
TEST SITE(S):	NTS Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-4, 2845B-5
REPORT DATE:	October 31, 2012
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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	10-31-2012	First release	

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SCOPE

An electromagnetic emissions test has been performed on the Broadcom Corporation model BCM943228HM4L, 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 C

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 NTS Silicon Valley test procedures:

ANSI C63.4:2003
FCC DTS Measurement Procedure KDB558074

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 BCM943228HM4L complied with the requirements of the following regulations:

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 C

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 BCM943228HM4L and therefore apply only to the tested sample. The sample was selected and prepared by Anne Liang 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

DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 210 A8.2	Digital Modulation	N/A – change would not impact original filing (power verified to be within 0.5dB of original filing prior to evaluation of spurious emissions)		
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth			
15.247 (b) (3)	RSS 210 A8.2 (4)	Output Power (multipoint systems)			
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density			
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions 30MHz – 25 GHz			
15.247(c) / 15.209	RSS 210 A8.5	Radiated Spurious Emissions 30MHz – 25 GHz	52.9 dBµV/m @ 2382.1 MHz (-1.1 dB)	15.207 in restricted bands, all others <-20dBc Note 2	Complies
Note 2: Limit of -20dBc used because the power was measured peak during the original filing.					

DIGITAL TRANSMISSION SYSTEMS (5725 –5850 MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 210 A8.2	Digital Modulation	N/A – change would not impact original filing (power verified to be within 0.5dB of original filing prior to evaluation of spurious emissions)		
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth			
15.247 (b)	RSS 210 A8.2 (4)	Output Power (multipoint systems)			
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density			
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions – 30MHz – 40 GHz			
15.247(c) / 15.209	RSS 210 A8.5 Table 2, 3	Radiated Spurious Emissions 30MHz – 40 GHz	51.8 dBµV/m @ 11570.1 MHz (-2.2 dB)	15.207 in restricted bands, all others <-20dBc Note 2	Complies
Note 2: Limit of -20dBc used because the power was measured peak during the 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	N/A – change would not impact original filing		
15.207	RSS GEN Table 2	AC Conducted Emissions	N/A – change would not impact original filing		
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	N/A – Receiver tunes above 960MHz		
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	As the new antenna is lower gain than the original filing, the original RF Exposure Brief is applicable.		
-	RSP 100 RSS GEN 7.1.5	User Manual	N/A – change would not impact original filing		
-	RSP 100 RSS GEN 7.1.5	User Manual	N/A – change would not impact original filing		
-	RSP 100 RSS GEN 4.4.1	99% Bandwidth	N/A – change would not impact 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 Broadcom Corporation model BCM943228HM4L is a 2x2 WLAN PCI-E Minicard, that is designed to enable WLAN connections when installed in PCs. It supports abgn modes. 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 3.3Vdc, 800mA

The sample was received on August 28, 2012 and tested on August 28, September 4, 5, 11, 18 and 28 and October 18, 22 and 23, 2012. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Broadcom	BCM943228HM4L (C2PC)	802.11abgn WLAN PCI-E Mini Card	-	QDS-BRCM1054

OTHER EUT DETAILS

Testing limited to worse case modes from original filing using the lower gain/different type antenna.

ANTENNA SYSTEM

The EUT antenna is a 802.11abgn dipole antenna.

The antenna connects to the EUT via a non-standard hirose antenna connector, thereby meeting the requirements of FCC 15.203.

ENCLOSURE

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

MODIFICATIONS

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
IBM	Lenove G560	Laptop	-	-

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)
PCI adaptor	PCI slot (laptop)	Direct plug in	NA	NA
J1	External antenna	Coax	Shielded	0.2
J2	External antenna	Coax	Shielded	0.2
DC power (laptop)	External pwr supply	2 wire	Unshielded	2
AC Power (pwr supply)	AC Mains	3 wire	Unshielded	1

EUT OPERATION

Prior to testing, the sample was configured using a gated average power meter to be within 0.5dB of the power levels listed in the operational description of the original filing. The power levels listed in the operational description are equivalent to the power levels recorded in the original test reports.

During testing, the EUT was configured to continuously transmit at the noted channel at the maximum output power. For 802.11b mode testing, the data rate was set to 1Mb/s. For 802.11g mode, the data rate was set to 6Mb/s. For 802.11n20 and 802.11n40, the data rate was set to MCS0. These data rates represent worse case, as they resulted in the highest output power.

Bandedge testing was performed for all modes, on all appropriate channels. Spurious emissions were performed on the worse case mode 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 4	211948	2845B-4	41039 Boyce Road Fremont, CA 94538-2435
Chamber 5	211948	2845B-5	

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

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.

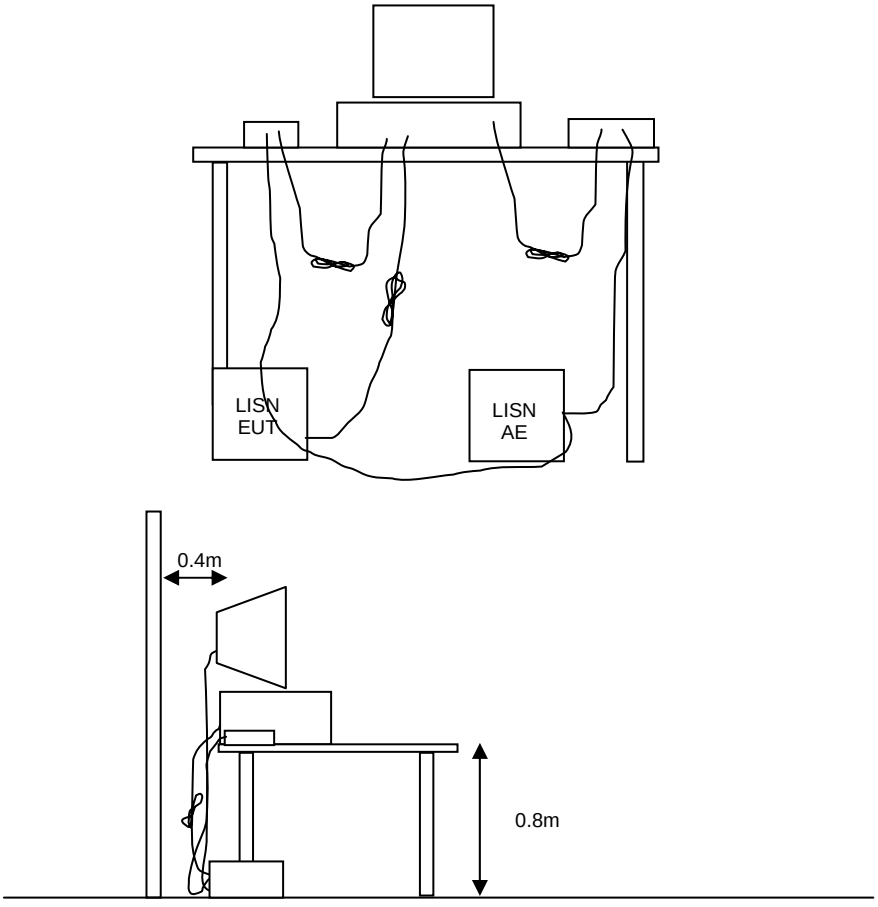


Figure 1 Typical Conducted Emissions Test Configuration

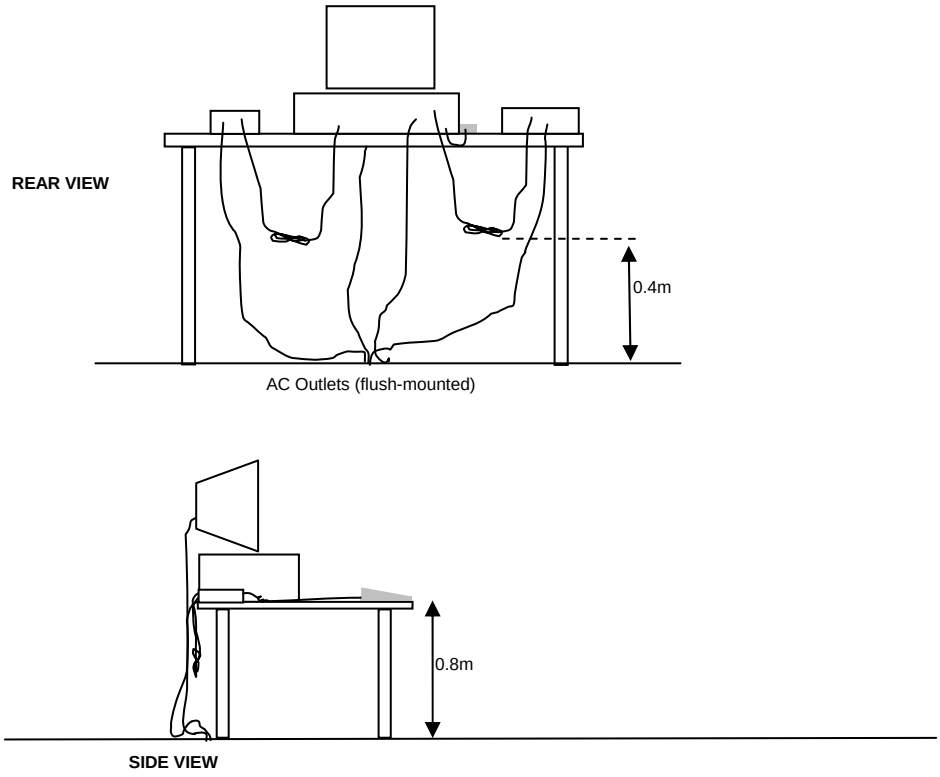
RADIATED EMISSIONS

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.

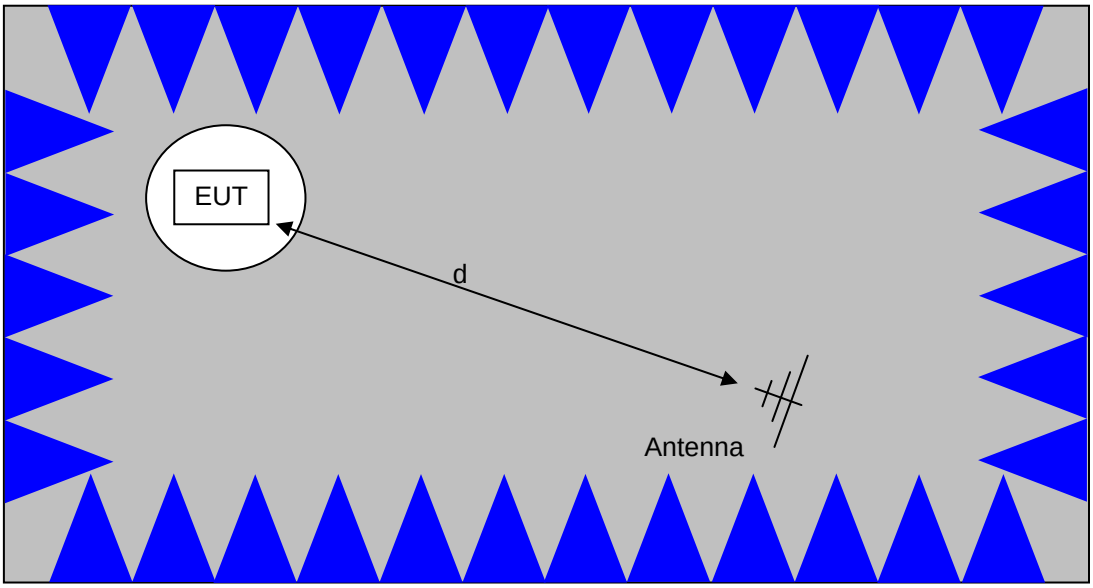
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

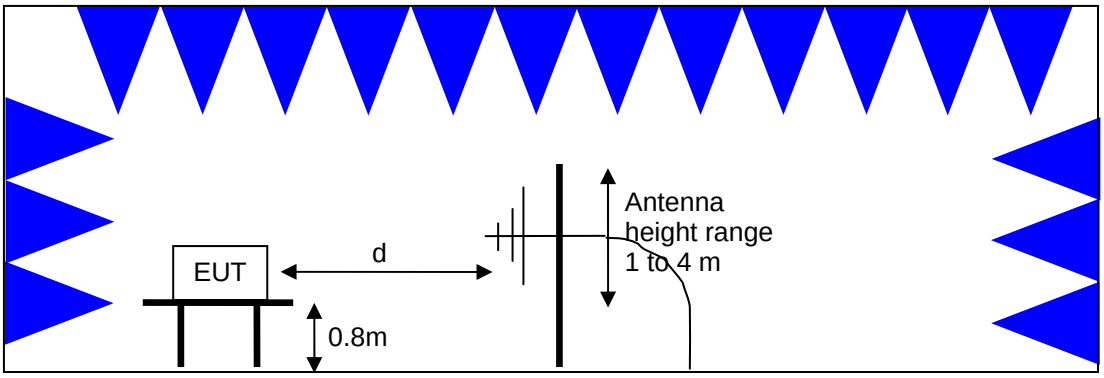


Typical Test Configuration for Radiated Field Strength Measurements



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.

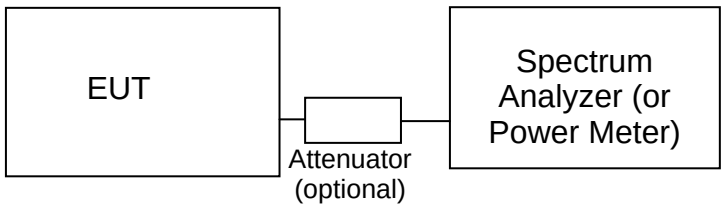
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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 NTS 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:

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

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

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
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

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

Manufacturer	Description	Model	Asset #	Cal Due
Radio Antenna Port (Power and Spurious Emissions), 28-Aug-12				
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/6/2012
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	7/12/2014
Radiated Emissions, 1000 - 40,000 MHz, 05-Sep-12				
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	1386	9/21/2012
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/6/2012
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	1681	8/31/2013
Hewlett Packard	Head (Inc W1-W4, 1742 , 1743)	84125C	1772	5/1/2013
A.H. Systems	Purple System Horn, 18-40GHz	SAS-574, p/n: 2581	2160	4/17/2013
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/23/2013
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2251	10/11/2012
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	8/10/2013
Radiated Emissions, 1,000 - 26,500 MHz, 06-Sep-12				
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	3/29/2013
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/1/2013
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	7/12/2014
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2238	10/4/2012
Radiated Emissions, 1000 - 6,500 MHz, 06-Sep-12				
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/6/2012
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	7/12/2014
Radiated Emissions, 1000 - 18,000 MHz, 06-Sep-12				
Hewlett Packard	SpecAn 9 KHz-26.5 GHz, Non-Program	8563E	284	1/13/2013
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/19/2014
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/23/2013
Micro-Tronics	Band Reject Filter, 5725-5875 MHz	BRC50705-02	1682	3/23/2013
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	8/2/2013
Radiated Emissions, 30 - 26,500 MHz, 11-Sep-12				
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	3/29/2013
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/19/2014
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/1/2013
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	5/31/2013
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2238	10/4/2012

Manufacturer	Description	Model	Asset #	Cal Due
Radiated Emissions, 1,000 - 6,500 MHz, 18-Sep-12				
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/19/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	5/31/2013
Band edge, 28-Sep-12				
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/19/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/6/2012
Radiated Spurious Emissions, 1000 - 6,000 MHz, 18-Oct-12				
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	8/23/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/6/2012
Radiated Spurious Emissions, 1000 - 6,500 MHz, 22-Oct-12				
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	8/23/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	5/31/2013
Radiated Emissions, 1000 - 6,500 MHz, 23-Oct-12				
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/19/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	12/9/2012

Appendix B Test Data

T88992 Pages 26 - 49

Client:	Broadcom Corporation	Job Number:	J88870
Product	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Emissions Standard(s):	15.247, 15.E, RSS-210, LP0002	Class:	-
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Broadcom Corporation

Product

BRCM943228HM4L (C2PC to add new antenna)

Date of Last Test: 10/23/2012

Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	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 with all I/O connections running on top of the groundplane or routed in overhead in the GR-1089 test configuration.

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

Ambient Conditions:

Temperature: 22.4 °C
Rel. Humidity: 36 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
Run # 1	802.11b Chain Main	#1 2412MHz	-		Restricted Band Edge at 2390 MHz	15.209	44.1 dBµV/m @ 2390.0 MHz (-9.9 dB)
		#11 2462MHz	-		Restricted Band Edge at 2483.5 MHz	15.209	42.7 dBµV/m @ 2483.6 MHz (-11.3 dB)
Run # 2	802.11g Chain Main	#1 2412MHz	-		Restricted Band Edge at 2390 MHz	15.209	51.3 dBµV/m @ 2390.0 MHz (-2.7 dB)
		#11 2462MHz	-		Restricted Band Edge at 2483.5 MHz	15.209	51.8 dBµV/m @ 2483.5 MHz (-2.2 dB)
Run # 3	HT20 Chain Main+Aux	#1 2412MHz	-		Restricted Band Edge at 2390 MHz	15.209	52.1 dBµV/m @ 2389.7 MHz (-1.9 dB)
		#11 2462MHz	-		Restricted Band Edge at 2483.5 MHz	15.209	52.2 dBµV/m @ 2483.6 MHz (-1.8 dB)
Run # 4	HT40 Chain Main+Aux	#3 2422MHz	-		Restricted Band Edge at 2390 MHz	15.209	52.9 dBµV/m @ 2382.1 MHz (-1.1 dB)
		#9 2452MHz	-		Restricted Band Edge at 2483.5 MHz	15.209	52.6 dBµV/m @ 2491.1 MHz (-1.4 dB)

Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, 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 Field Strength - 802.11b, Chain Main

Date of Test: 9/4/2012 Test Location: FT Chamber #4

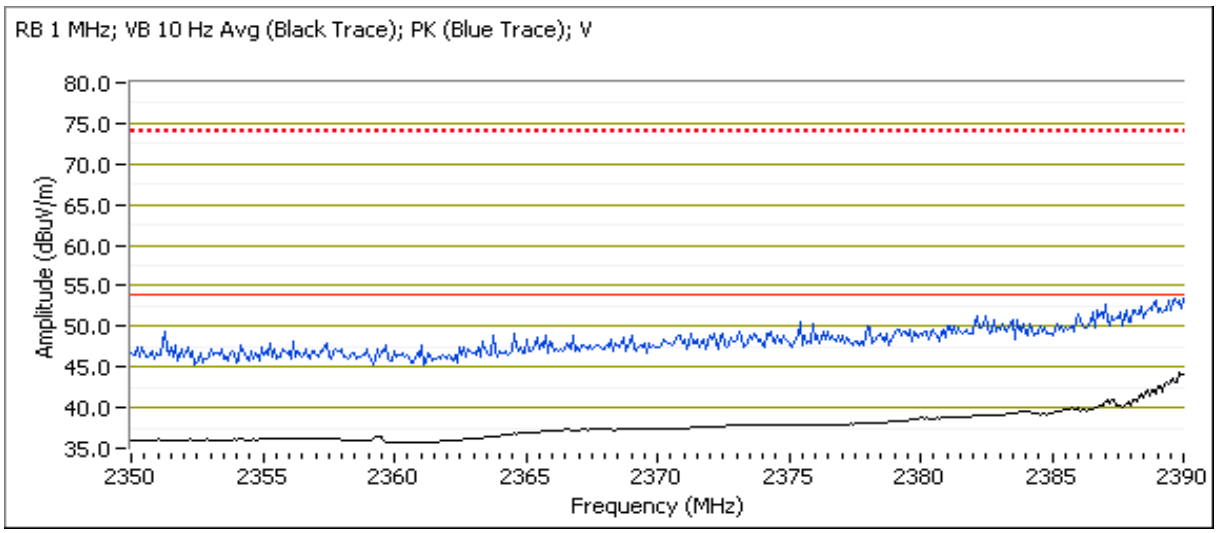
Test Engineer: Rafael Varelas Config Change: Nome

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

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain Main	-	-	-

2390 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	
2390.000	44.1	V	54.0	-9.9	AVG	237	1.1	POS; RB 1 MHz; VB: 10 Hz
2389.440	52.6	V	74.0	-21.4	PK	237	1.1	POS; RB 1 MHz; VB: 3 MHz
2389.600	35.6	H	54.0	-18.4	AVG	19	0.9	POS; RB 1 MHz; VB: 10 Hz
2379.660	45.5	H	74.0	-28.5	PK	19	0.9	POS; RB 1 MHz; VB: 3 MHz



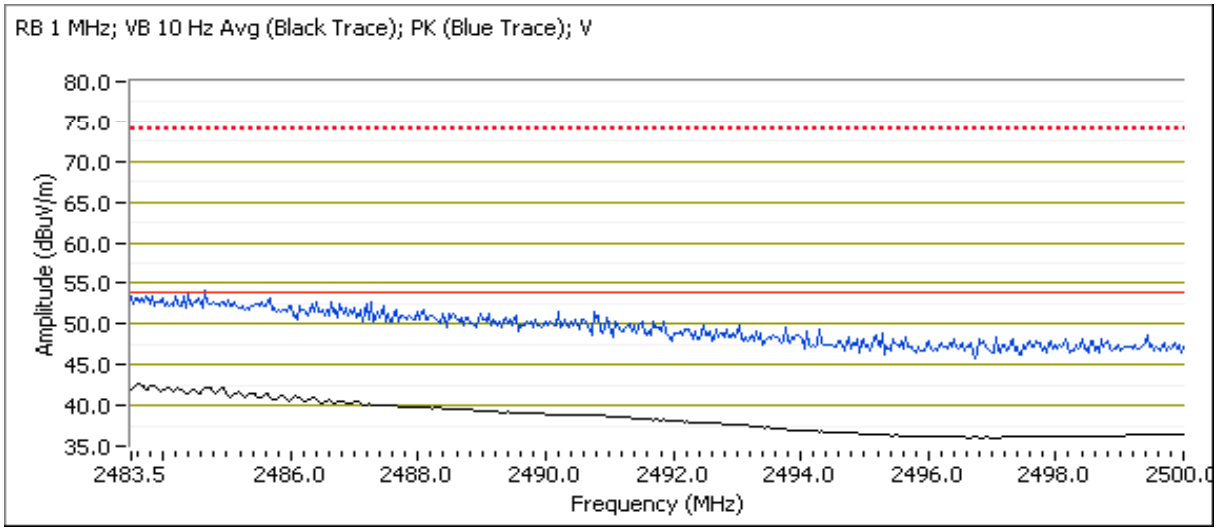
Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run # 1b, EUT on Channel #11 2462MHz - 802.11b, Chain Main

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain Main	-	-	-

2483.5 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	
2483.610	42.7	V	54.0	-11.3	AVG	227	1.6	POS; RB 1 MHz; VB: 10 Hz
2483.650	53.4	V	74.0	-20.6	PK	227	1.6	POS; RB 1 MHz; VB: 3 MHz
2483.880	36.9	H	54.0	-17.1	AVG	9	1.2	POS; RB 1 MHz; VB: 10 Hz
2489.670	49.2	H	74.0	-24.8	PK	9	1.2	POS; RB 1 MHz; VB: 3 MHz



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run # 2, Band Edge Field Strength - 802.11g, Chain Main

Date of Test: 9/4/2012 Test Location: FT Chamber #4

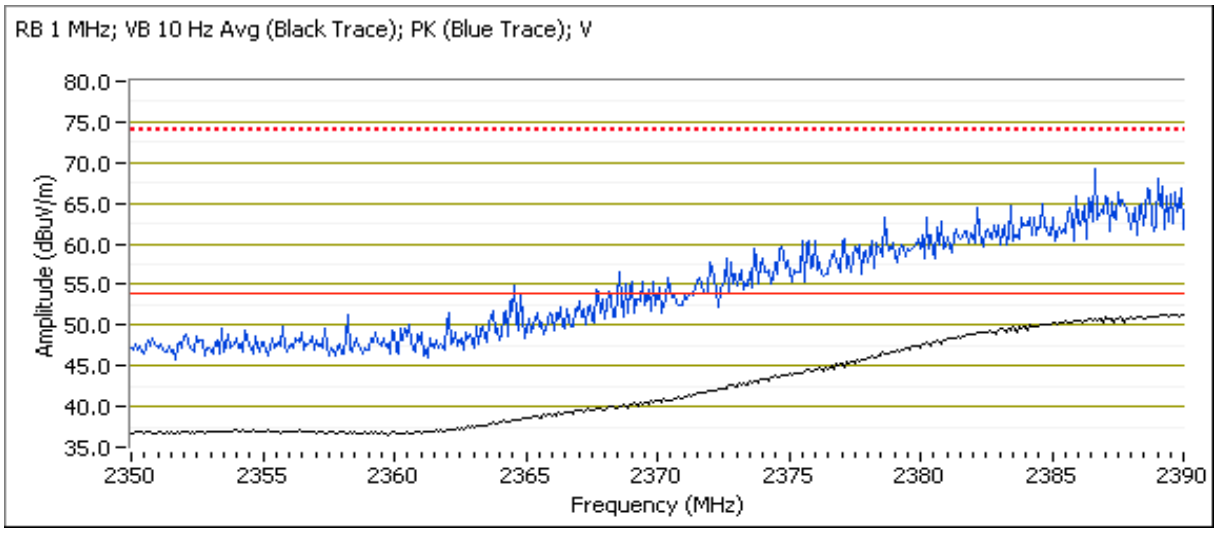
Test Engineer: Rafael Varelas Config Change: Nome

Run # 2a, EUT on Channel #1 2412MHz - 802.11g, Chain Main

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain Main	-	-	-

2390 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	
2390.000	51.3	V	54.0	-2.7	AVG	34	1.1	POS; RB 1 MHz; VB: 10 Hz
2389.360	67.3	V	74.0	-6.7	PK	34	1.1	POS; RB 1 MHz; VB: 3 MHz
2384.230	44.5	H	54.0	-9.5	AVG	10	0.9	POS; RB 1 MHz; VB: 10 Hz
2388.320	61.8	H	74.0	-12.2	PK	10	0.9	POS; RB 1 MHz; VB: 3 MHz



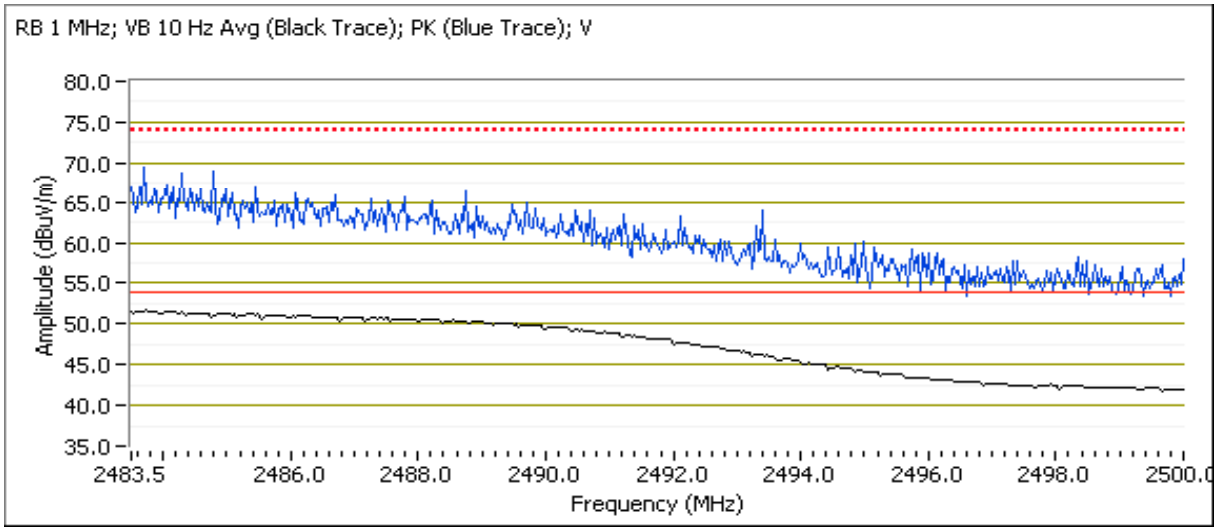
Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run # 2b, EUT on Channel #11 2462MHz - 802.11g, Chain Main

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain Main	-	-	-

2483.5 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	
2483.530	51.8	V	54.0	-2.2	AVG	231	1.0	POS; RB 1 MHz; VB: 10 Hz
2483.500	64.5	V	74.0	-9.5	PK	231	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.530	48.8	H	54.0	-5.2	AVG	231	1.0	POS; RB 1 MHz; VB: 10 Hz
2485.320	63.8	H	74.0	-10.2	PK	231	1.0	POS; RB 1 MHz; VB: 3 MHz



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run # 3, Band Edge Field Strength - HT20, Chain Main+Aux

Date of Test: 9/4/2012 Test Location: FT Chamber #4

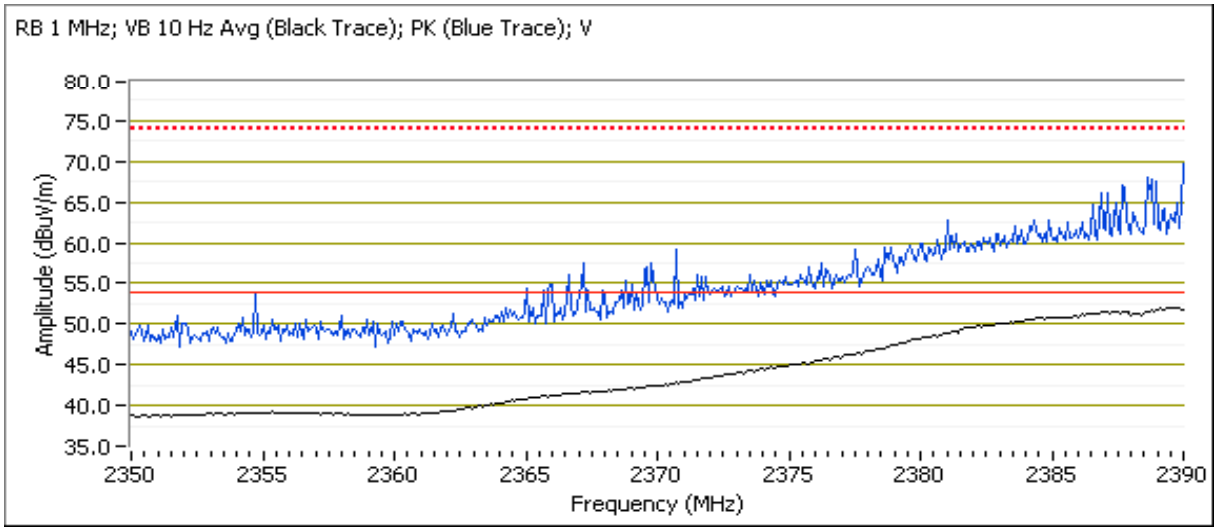
Test Engineer: Rafael Varelas Config Change: Nome

Run # 3a, EUT on Channel #1 2412MHz - HT20, Chain Main+Aux

	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

2390 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	
2389.680	52.1	V	54.0	-1.9	AVG	273	1.1	POS; RB 1 MHz; VB: 10 Hz
2387.600	65.4	V	74.0	-8.6	PK	273	1.1	POS; RB 1 MHz; VB: 3 MHz
2390.000	43.5	H	54.0	-10.5	AVG	312	1.2	POS; RB 1 MHz; VB: 10 Hz
2387.350	61.5	H	74.0	-12.5	PK	312	1.2	POS; RB 1 MHz; VB: 3 MHz



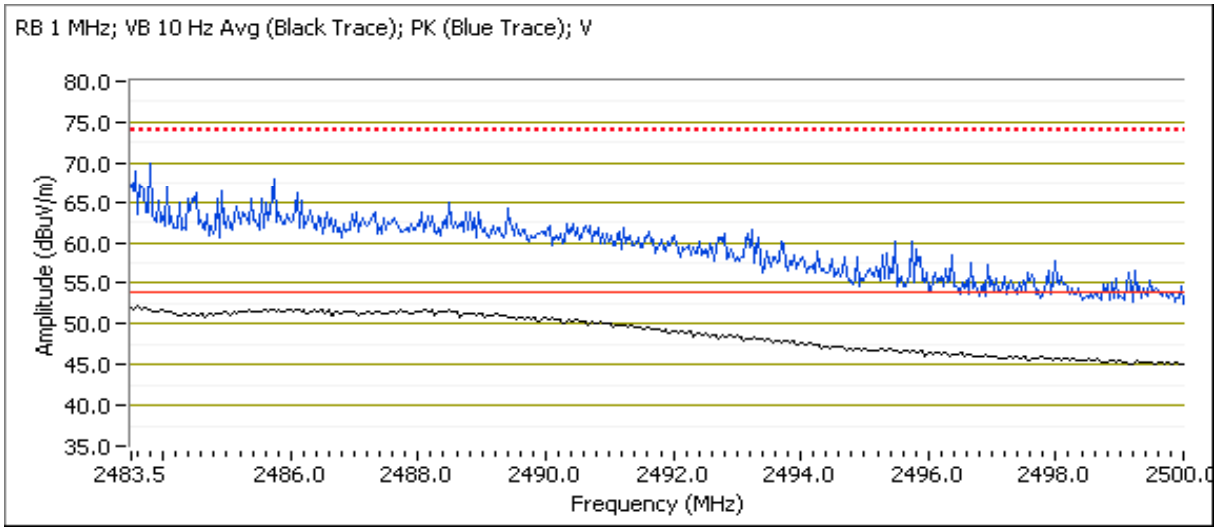
Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run # 3b, EUT on Channel #11 2462MHz - HT20, Chain Main+Aux

	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

2483.5 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	
2483.570	52.2	V	54.0	-1.8	AVG	360	1.2	POS; RB 1 MHz; VB: 10 Hz
2484.260	63.7	V	74.0	-10.3	PK	360	1.2	POS; RB 1 MHz; VB: 3 MHz
2483.760	44.3	H	54.0	-9.7	AVG	349	0.9	POS; RB 1 MHz; VB: 10 Hz
2483.960	55.7	H	74.0	-18.3	PK	349	0.9	POS; RB 1 MHz; VB: 3 MHz



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run # 4, Band Edge Field Strength - HT40, Chain Main+Aux

Date of Test: 9/4/2012 Test Location: FT Chamber #4

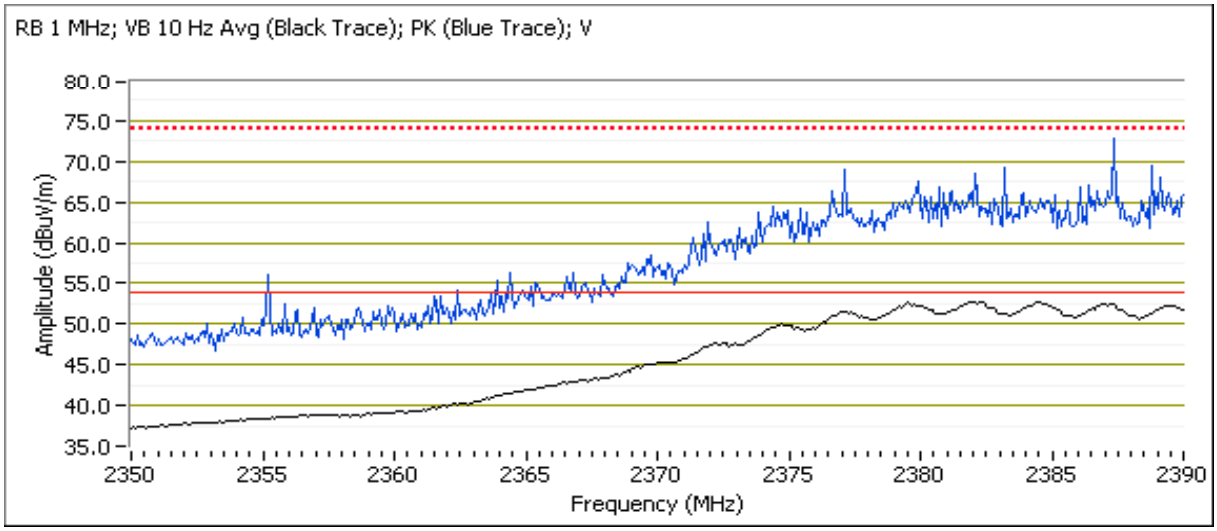
Test Engineer: Rafael Varelas Config Change: Nome

Run # 4a, EUT on Channel #3 2422MHz - HT40, Chain Main+Aux

	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

2390 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	
2382.060	52.9	V	54.0	-1.1	AVG	273	1.1	POS; RB 1 MHz; VB: 10 Hz
2387.840	71.1	V	74.0	-2.9	PK	273	1.1	POS; RB 1 MHz; VB: 3 MHz
2380.940	43.6	H	54.0	-10.4	AVG	315	1.2	POS; RB 1 MHz; VB: 10 Hz
2375.650	57.7	H	74.0	-16.3	PK	315	1.2	POS; RB 1 MHz; VB: 3 MHz



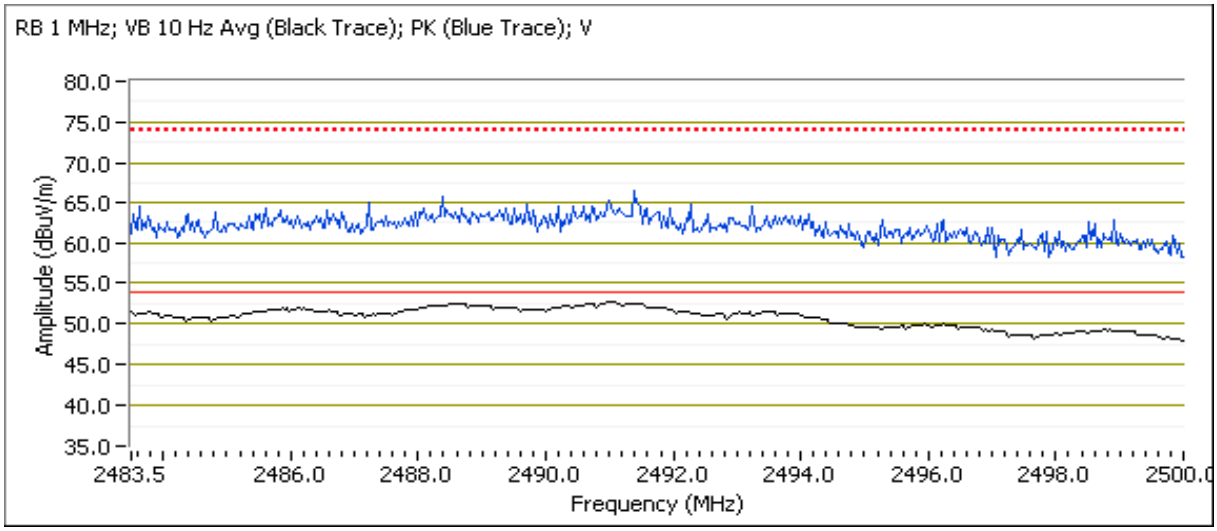
Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run # 4b, EUT on Channel #9 2452MHz - HT40, Chain Main+Aux

	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

2483.5 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	
2491.140	52.6	V	54.0	-1.4	AVG	16	1.0	POS; RB 1 MHz; VB: 10 Hz
2488.760	64.7	V	74.0	-9.3	PK	16	1.0	POS; RB 1 MHz; VB: 3 MHz
2489.220	44.0	H	54.0	-10.0	AVG	0	1.0	POS; RB 1 MHz; VB: 10 Hz
2491.200	55.6	H	74.0	-18.4	PK	0	1.0	POS; RB 1 MHz; VB: 3 MHz



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	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.

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

Ambient Conditions:

Temperature: 17-20 °C

Rel. Humidity: 35-40 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
Run #1	802.11b Chain Main	#1 2412MHz	-	-	Radiated Emissions 1 - 26 GHz	FCC 15.209 / 15.247	45.7 dBµV/m @ 4823.9 MHz (-8.3 dB)
		#6 2437MHz	-	-			45.7 dBµV/m @ 7310.2 MHz (-8.3 dB)
		#11 2462MHz	-	-			52.2 dBµV/m @ 7385.2 MHz (-1.8 dB)
Run # 2	HT20 Chain Main+Aux	#1 2412MHz	-	-	Radiated Emissions 1 - 26 GHz	FCC 15.209 / 15.247	35.1 dBµV/m @ 4820.3 MHz (-18.9 dB)
		#6 2437MHz	-	-			49.8 dBµV/m @ 7308.7 MHz (-4.2 dB)
		#11 2462MHz	-	-			40.4 dBµV/m @ 7386.7 MHz (-13.6 dB)

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 worse case modes from original filing only

Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

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

Date of Test: 9/5/2012 Test Location: FT chamber #4

Test Engineer: M. Birgani Config Change: -

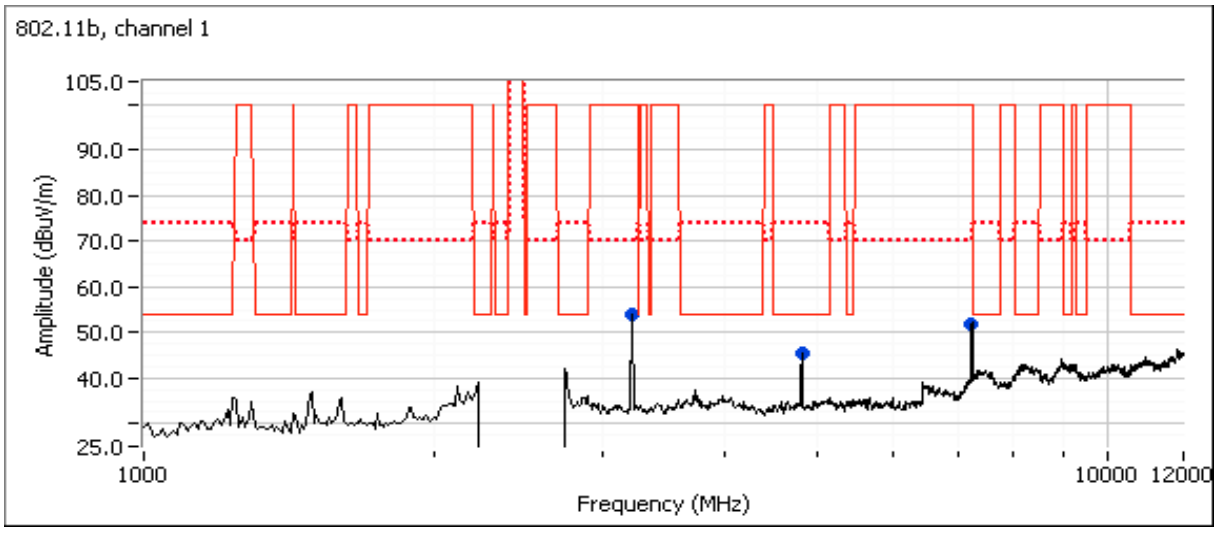
Run #1a, EUT on Channel #1 2412MHz - 802.11b, Chain Main

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain Main	-	-	-

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4823.940	45.7	H	54.0	-8.3	AVG	104	1.6	RB 1 MHz;VB 10 Hz;Peak
3216.030	53.9	V	-	-	Peak	82	1.0	Note 2
7236.990	51.9	H	-	-	Peak	38	1.9	Note 2
4824.080	48.3	H	74.0	-25.7	PK	104	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 -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Emission in non-restricted band. Covered by antenna port measurements in the original filing.



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

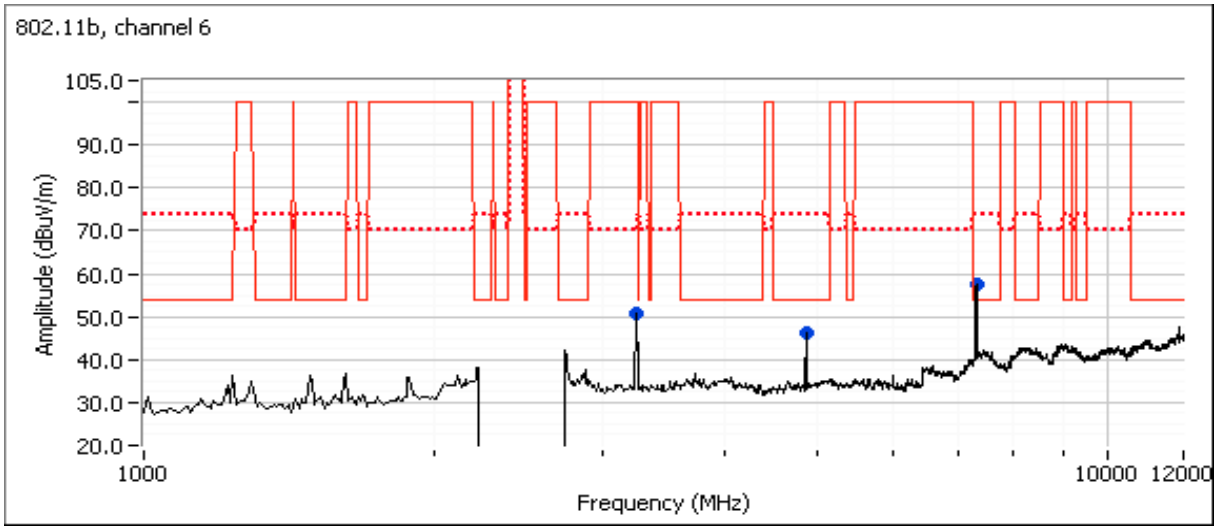
Run #1b: , EUT on Channel #6 2437MHz - 802.11b, Chain Main

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain Main	-	-	-

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7310.200	45.7	V	54.0	-8.3	AVG	22	1.7	RB 1 MHz;VB 10 Hz;Peak
4873.940	39.8	V	54.0	-14.2	AVG	180	1.3	RB 1 MHz;VB 10 Hz;Peak
7310.410	39.3	H	54.0	-14.7	AVG	101	1.0	RB 1 MHz;VB 10 Hz;Peak
3249.340	50.7	H	-	-	Peak	38	1.3	Note 3
7310.020	53.4	V	74.0	-20.6	PK	22	1.7	RB 1 MHz;VB 3 MHz;Peak
4873.940	30.9	H	54.0	-23.1	AVG	57	1.1	RB 1 MHz;VB 10 Hz;Peak
7310.010	50.7	H	74.0	-23.3	PK	101	1.0	RB 1 MHz;VB 3 MHz;Peak
4873.950	45.4	V	74.0	-28.6	PK	180	1.3	RB 1 MHz;VB 3 MHz;Peak
4873.730	41.7	H	74.0	-32.3	PK	57	1.1	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 -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Scans made between 18 - 25GHz 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
Note 3:	Emission in non-restricted band. Covered by antenna port measurements in the original filing.



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

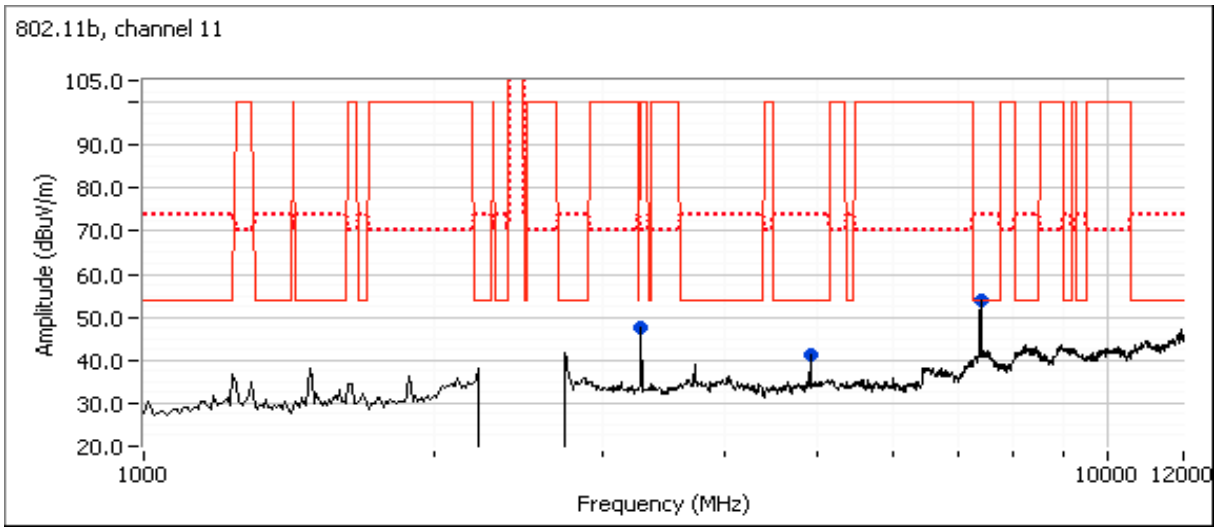
Run #1c: , EUT on Channel #11 2462MHz - 802.11b, Chain Main

	Power Settings		
	Target (dBm)	Measured (dBm)	Software Setting
Chain Main	-	-	-

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7385.190	52.2	H	54.0	-1.8	AVG	360	1.3	RB 1 MHz;VB 10 Hz;Peak
4923.940	39.8	H	54.0	-14.2	AVG	66	1.1	RB 1 MHz;VB 10 Hz;Peak
7386.710	57.1	H	74.0	-16.9	PK	360	1.3	RB 1 MHz;VB 3 MHz;Peak
3282.650	47.6	H	-	-	Peak	172	1.0	Note 2
4923.830	44.0	H	74.0	-30.0	PK	66	1.1	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 -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Emission in non-restricted band. Covered by antenna port measurements in the original filing.



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run # 2, Radiated Spurious Emissions, 1-26GHz, HT20, Chain Main+Aux

Date of Test: 9/5/2012 Test Location: FT chamber #4

Test Engineer: Joseph Cadigal Config Change: -

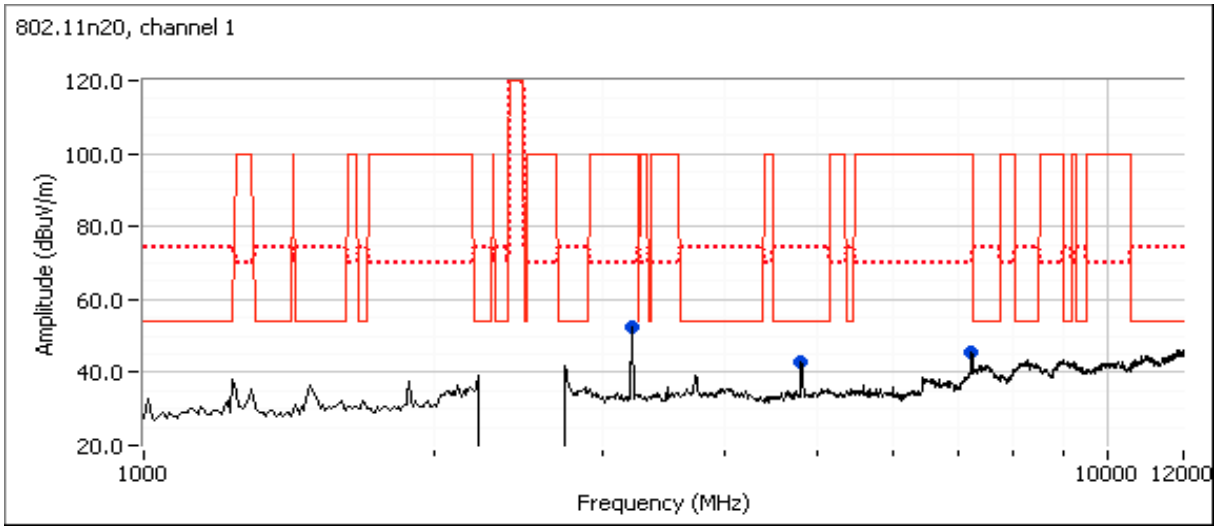
Run # 2a, EUT on Channel #1 2412MHz - HT20, Chain Main+Aux

	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
3216.040	53.7	H	-	-	PK	281	1.3	Note 2
7227.500	51.8	H	-	-	PK	109	1.6	Note 2
4820.350	35.1	H	54.0	-18.9	AVG	353	1.9	RB 1 MHz;VB 10 Hz;Peak
4820.420	48.3	H	74.0	-25.7	PK	353	1.9	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 -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Emission in non-restricted band. Covered by antenna port measurements in the original filing.



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

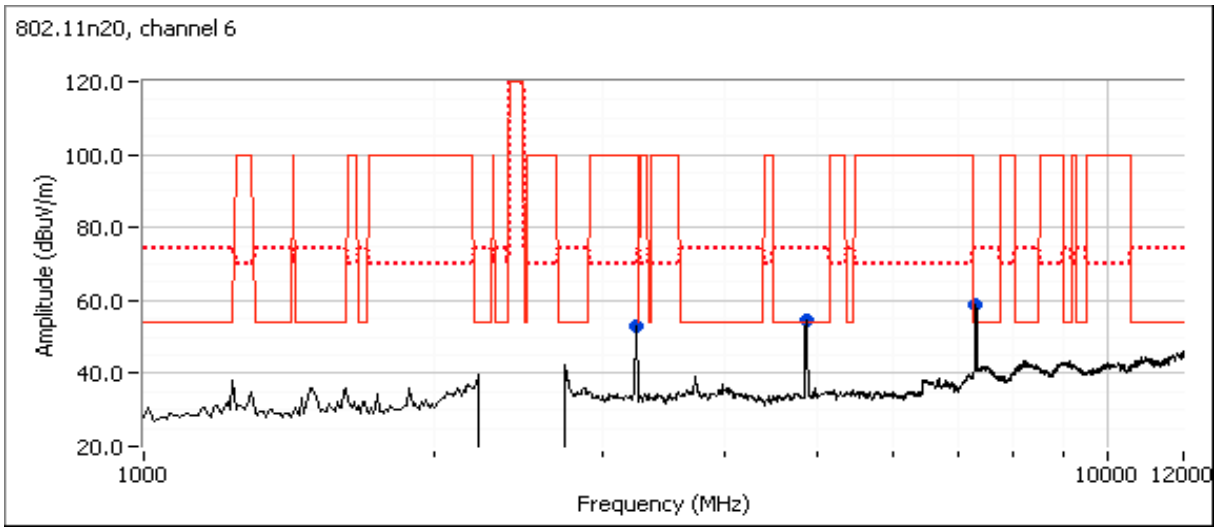
Run # 2b: , EUT on Channel #6 2437MHz - HT20, Chain Main+Aux

	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7308.670	49.8	V	54.0	-4.2	AVG	169	1.3	RB 1 MHz;VB 10 Hz;Peak
7313.400	43.8	H	54.0	-10.2	AVG	43	1.3	RB 1 MHz;VB 10 Hz;Peak
7306.400	62.7	V	74.0	-11.3	PK	169	1.3	RB 1 MHz;VB 3 MHz;Peak
4872.200	41.2	V	54.0	-12.8	AVG	212	1.5	RB 1 MHz;VB 10 Hz;Peak
3249.210	53.2	H	-	-	PK	278	1.3	Note 3
4870.270	55.7	V	74.0	-18.3	PK	212	1.5	RB 1 MHz;VB 3 MHz;Peak
7305.530	55.6	H	74.0	-18.4	PK	43	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 -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Scans made between 18 - 26GHz 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
Note 3:	Emission in non-restricted band. Covered by antenna port measurements in the original filing.



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

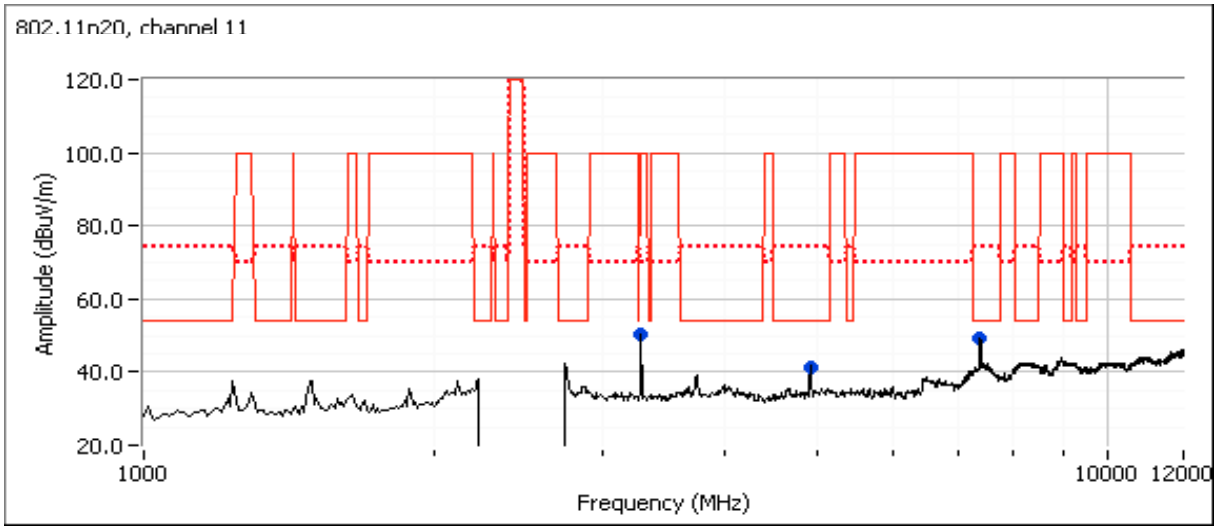
Run # 2c: , EUT on Channel #11 2462MHz - HT20, Chain Main+Aux

	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7386.650	40.4	H	54.0	-13.6	AVG	17	1.3	RB 1 MHz;VB 10 Hz;Peak
3282.730	52.1	H	-	-	PK	33	1.0	Note 2
4922.990	34.5	H	54.0	-19.5	AVG	17	2.2	RB 1 MHz;VB 10 Hz;Peak
7386.900	51.1	H	74.0	-22.9	PK	17	1.3	RB 1 MHz;VB 3 MHz;Peak
4922.790	47.4	H	74.0	-26.6	PK	17	2.2	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 -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Emission in non-restricted band. Covered by antenna port measurements in the original filing.



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	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.

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

Ambient Conditions:

Temperature: 21.4 °C
Rel. Humidity: 37 %

Summary of Results - Device Operating in the 5725 - 5850 MHz Band

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
Run #1	HT20 Chain Main+Aux	#149 5745MHz	-	-	Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15.247	47.9 dBµV/m @ 11490.0 MHz (-6.1 dB)
		#157 5785MHz	-	-			51.8 dBµV/m @ 11570.1 MHz (-2.2 dB)
		#165 5825MHz	-	-			50.7 dBµV/m @ 3883.3 MHz (-3.3 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run #1, Radiated Spurious Emissions, 1-40GHz, HT20, Chain Main+Aux

Date of Test: 9/6/2012 Test Location: Chamber 5
Test Engineer: John Caizzi/Vishal Config Change: none

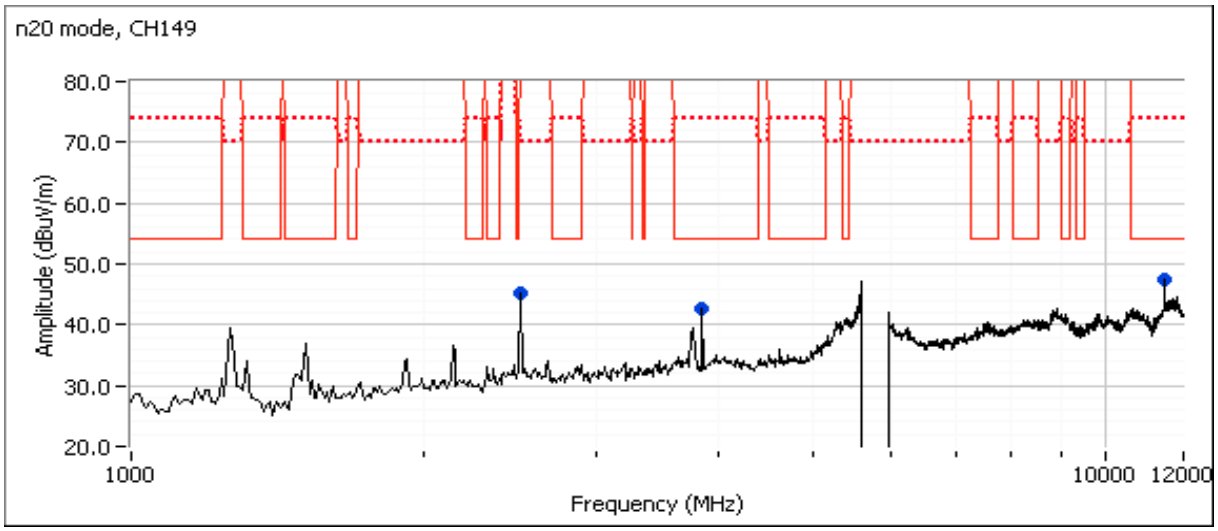
Run #1a, EUT on Channel #149 5745MHz - HT20, Chain Main+Aux

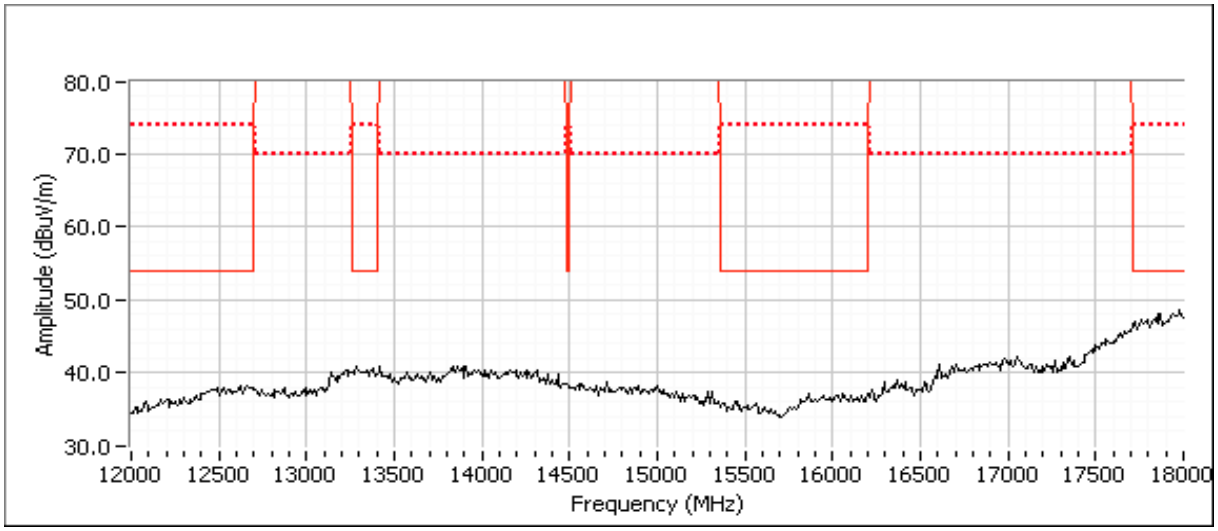
	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11490.000	47.9	V	54.0	-6.1	AVG	8	1.35	
11492.460	58.6	V	74.0	-15.4	PK	8	1.35	
3830.010	45.8	V	54.0	-8.2	AVG	162	1.41	
3830.100	48.8	V	74.0	-25.2	PK	162	1.41	
2497.670	36.1	V	54.0	-17.9	AVG	28	1.00	
2495.630	54.2	V	74.0	-19.8	PK	28	1.00	

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

Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A





Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

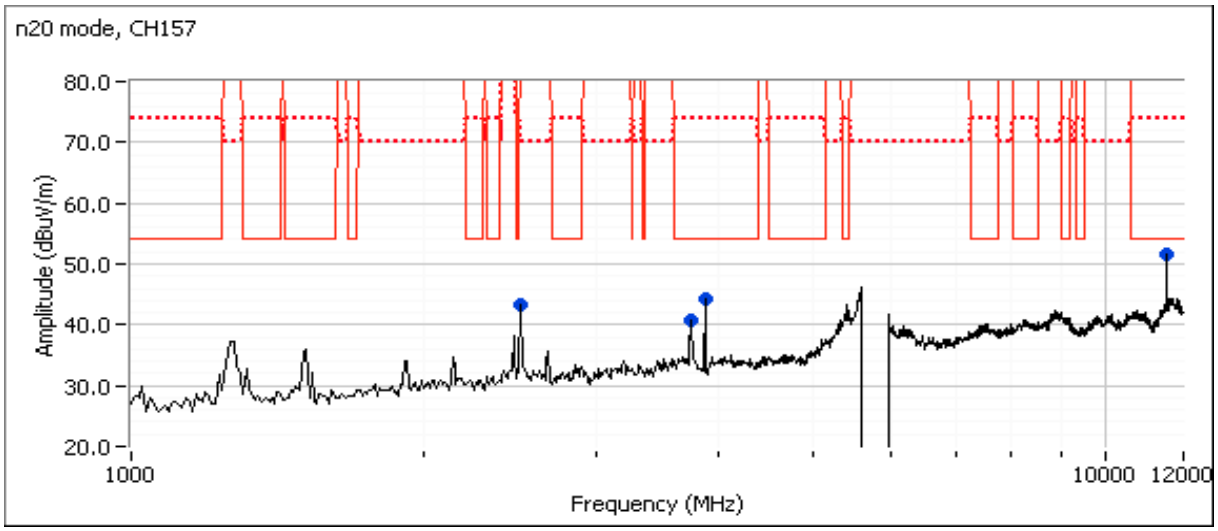
Run #1b: , EUT on Channel #157 5785MHz - HT20, Chain Main+Aux

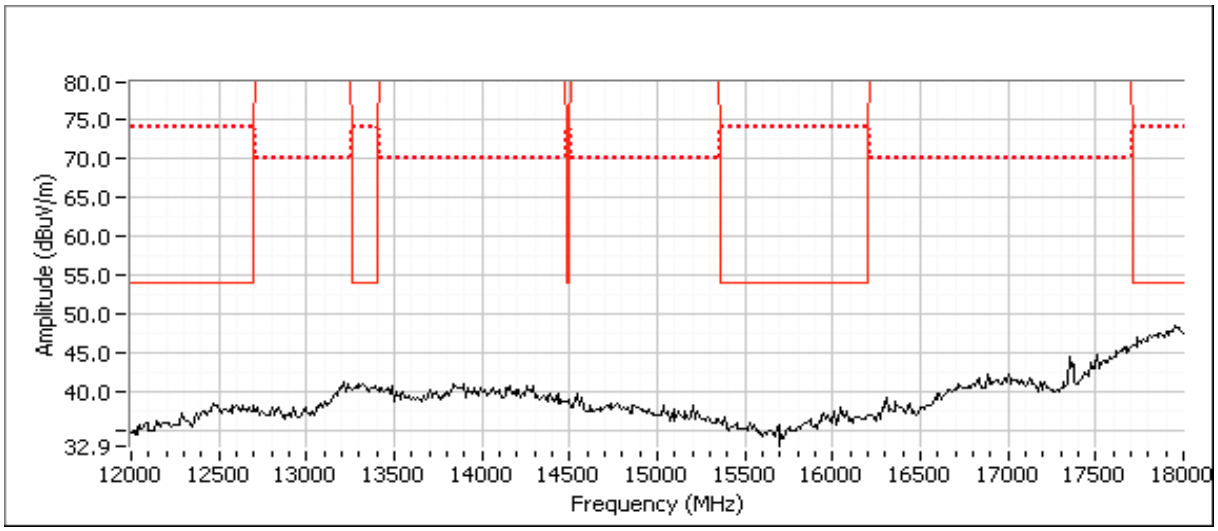
	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11570.140	51.8	V	54.0	-2.2	AVG	127	2.08	
11570.670	62.5	V	74.0	-11.5	PK	127	2.08	
2489.540	36.1	V	54.0	-17.9	AVG	161	1.00	
2498.700	53.8	V	74.0	-20.2	PK	161	1.00	
3856.600	46.4	V	54.0	-7.6	AVG	186	1.39	
3856.750	49.3	V	74.0	-24.7	PK	186	1.39	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit is -30dBc for peak measurements in a measurement bandwidth of 100kHz.
Note 2:	Scans made between 18 - 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:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A





Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A

Run #1c: , EUT on Channel #165 5825MHz - HT20, Chain Main+Aux

Date of Test: 9/6/2012 Test Location: Chamber 4

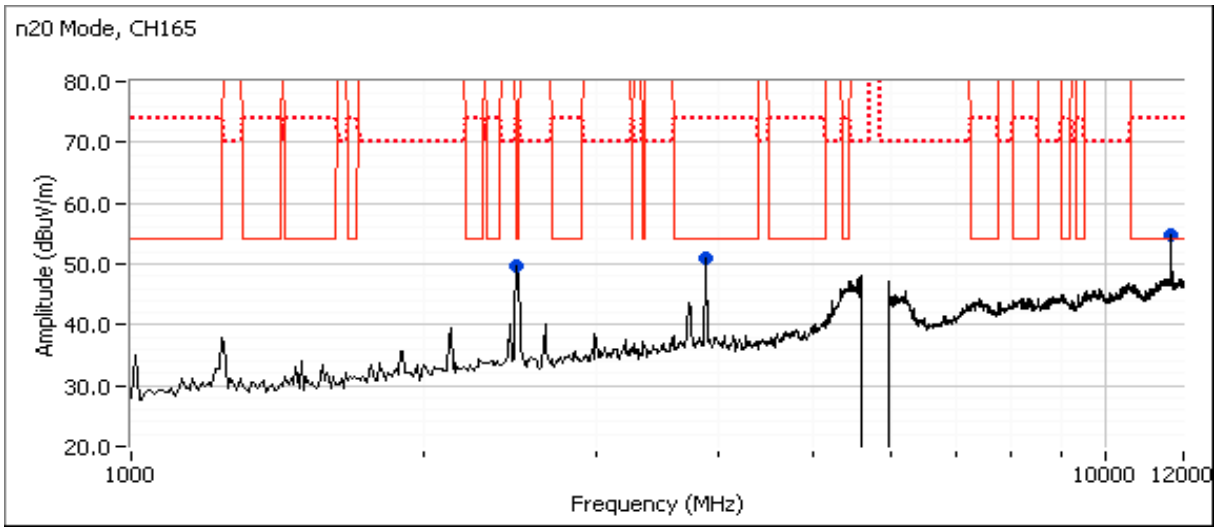
Test Engineer: Vishal Narayan Config Change: None

	Power Settings								
	Target (dBm)				Measured (dBm)				Software Setting
Chain	A	B	C	Total	A	B	C	Total	
	-	-	-	-	-	-	-	-	-

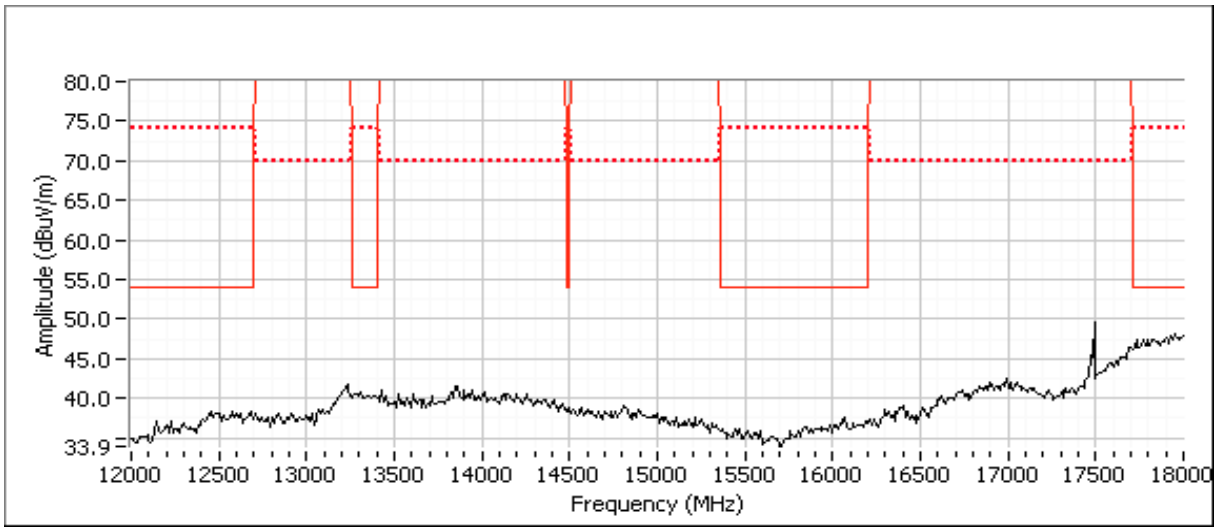
Spurious Radiated Emissions:

Frequency	Level	Pol	15.209/15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
3883.330	50.7	V	54.0	-3.3	AVG	65	1.6	RB 1 MHz;VB 10 Hz;Peak
3883.420	53.1	V	74.0	-20.9	PK	65	1.6	RB 1 MHz;VB 3 MHz;Peak
2497.380	39.3	V	54.0	-14.7	AVG	348	1.0	RB 1 MHz;VB 10 Hz;Peak
2488.660	59.0	V	74.0	-15.0	PK	348	1.0	RB 1 MHz;VB 3 MHz;Peak
11650.210	49.9	V	54.0	-4.1	AVG	226	1.6	RB 1 MHz;VB 10 Hz;Peak
11650.550	61.3	V	74.0	-12.7	PK	226	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 -30dBc for peak measurements in a measurement bandwidth of 100kHz.



Client:	Broadcom Corporation	Job Number:	J88870
Model:	BRCM943228HM4L (C2PC to add new antenna)	T-Log Number:	T88992
		Account Manager:	Sheareen Jacobs
Contact:	Anne Liang		
Standard:	15.247, 15.E, RSS-210, LP0002	Class:	N/A



End of Report

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