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Electromagnetic Emissions Test Report and Request for Class II Permissive Change pursuant to FCC Part 15, Subpart E (UNII Devices) and Industry Canada RSS 210 Issue 5 (LELEAN Devices) Specifications for an Intentional Radiator on the Broadcom Corporation Model: BCM94309MP in PP07L laptop

FCC ID:	QDS-BRCM1007
GRANTEE:	Broadcom Corporation 190 Mathilda Ave. Sunnyvale, CA 94086
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	March 26, 2003
FINAL TEST DATE:	February 10 and February 11, 2003
AUTHORIZED SIGNATORY:	Juan Martinez Sr. EMC Engineer

ACCREDITED

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SCOPE

An electromagnetic emissions test has been performed on the Broadcom Corporation model BCM94309MP in PP07L laptop pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC 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.

The test results recorded herein are based on a single type test of the Broadcom Corporation model BCM94309MP in PP07L laptop and therefore apply only to the tested sample. The sample was selected and prepared by David Boldyof Broadcom Corporation

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units subsequently manufactured.

STATEMENT OF COMPLIANCE

The tested sample of Broadcom Corporation model BCM94309MP in PP07L laptop complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC 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.).

SUMMARY OF RESULTS

FCC Part 15 Section	RSS 210 Section	Description	Comments	Result
Operation in the 5.15 – 5.25 GHz Band				
15.407 (d)		As the device operates in the 5.15 – 5.25 GHz band the antenna must be integral to the device.	Antenna Gain = 5.6 dBi The antenna is integral to the laptop computer	COMPLIES
15.407(a) (1)	6.2.2(q1)(i)	Output Power	15.0 dBm @ 5180 MHz	COMPLIES
15.407(b) (5) / 15.209	6.2.2(q1)(ii)	Spurious Emissions below 1GHz	-5.4dB @ 663.24 MHz	COMPLIES
15.407(b) (2)	6.2.2(q1)(ii)	Spurious Emissions above 1GHz	-6.1 dB @ 15541.77 MHz	COMPLIES
Operation in the 5.25 – 5.35 GHz Band Note: The device is restricted to indoor use only, therefore the spectral density of spurious emissions in the 5.15 – 5.25 GHz band were limited to the power spectral limits for intentional signals detailed in FCC 15.407(a)(1) and RSS 210 6.2.2(q1) (i)				
		Maximum Antenna Gain /Integral Antenna	Antenna Gain = 5.6 dBi	COMPLIES
15.407(a) (2)	6.2.2(q1)(ii)	Output Power	21.8 dBm @ 5320 MHz	COMPLIES
15.407(b) (5) / 15.209	6.2.2(q1)(ii)	Spurious Emissions below 1GHz	-5.4dB @ 663.24 MHz	COMPLIES
15.407(b) (2)	6.2.2(q1)(ii)	Spurious Emissions above 1GHz	-2.3 dB @ 10638.61 MHz	COMPLIES

General requirements for all bands				
FCC Part 15 Section	RSS 210 Section	Description	Comments	Result
	6.2.2(q1)(iv)(a)	Digital Modulation	Digital Modulation is used, refer to the "Theory of Operations" (Exhibit 9) for a detailed explanation.	COMPLIES
	6.2.2(q1)(iv)(c)	Channel Selection	The device was tested on the following channels: 36, 52 and 64. These channels represent the highest, lowest and center channels available.	N/A
15.407 (c)	6.2.2(q1)(iv)(d)	Automatic Discontinuation of Operation in the absence of information to transmit	Operation is discontinued in the absence of information to transmit, refer to the "Theory of Operations" in Exhibit 9 for a detailed explanation.	COMPLIES
15.407 (g)	6.2.2(q1)(iv)(e)	Frequency Stability	Frequency stability is 20 ppm, refer to the "Theory of Operations" in Exhibit 9 for a detailed analysis.	COMPLIES
	6.2.2(q1)(iv)(g)	User Manual information	All relevant statements have been included in the user's manuals. Refer to Exhibit 6 for details	COMPLIES
15.407(b) / 15.207	6.6	AC Conducted Emissions	This was tested previously on PP50L and the only change was antenna, so no test was performed.	N/A

CLASS II PERMISSIVE CHANGES

All other radio parameters are the same the only change on the device is the antenna.

MEASUREMENT UNCERTAINTIES

ISO Guide 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 NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Broadcom Corporation model BCM94309MP in PP07L laptop is a 802.11a/g/b mini PC card which is designed for wireless internet access for the laptop. Normally, the EUT would be table-top during operation. The EUT was treated as table-top equipment during testing to simulate the end user environment.

The sample was received on February 10, 2003 and tested on February 10 and February 11, 2003. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
Dell PP07L Laptop	22500
Dell PP05L Laptop	231905
Broadcom BCM94309MP Mini PCI Transceiver	-

ANTENNA

The EUT uses the antenna an antenna integral to the laptop with a gain of 4.5 dBi in the 5150 - 5350 MHz band and 2.55 dBi in the 2400 - 2483.5 MHz band.
The antenna connector used is non-standard antenna (Hirose U.FL series) to meet the requirements of FCC Part 15.203 and RSS-210

ENCLOSURE

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

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

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

Manufacturer/Model/Description	Serial Number	FCC ID Number
Dell PP07L Laptop	22500	DoC
Dell PP05L Laptop	231905	DoC
Dell pa-190-05D power supply	Cn-06g356-48010-28v-00a3	N/A

No remote support equipment was used during emissions testing.

EUT INTERFACE PORTS

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

Cable Description	Length (m)	From Unit/Port	To Unit/Port
None	-	-	-

Note: Serial and Parrallel printer were not connected as there were no ports available. Manufacture was notified and are aware that a deviation from the standard had been made.

EUT OPERATION

The radio was transmitting at full power on the specified channels with a 100 % duty cycle and at a data rates from 1 to 54 Mb/s. The channels were selected since they are at the top, near the center and at the bottom of the allocated bands. The radio uses 8-chip complementary code keying (CCK), 11-chip differential quadrature phase shift keying (DQPSK) modulation for 802.11b operation and Orthogonal Frequency Division Multiplexing (OFDM) for 802.11a and 802.11g operation.

Note: During digital device tests, scrolling H characters were displayed in a window on the laptop display and the radio was set to the channel and data rate that produced the highest output power.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on February 10 and February 11, 2003 at the Elliott Laboratories Open Area Test Site #4 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal standardized RF impedance, 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. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 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.

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.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and 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.

POWER METER

A power meter and thermister mount are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

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 biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors, which are programmed into the test receivers.

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.

ANSI C63.4 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 FCC requires 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, 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.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these are with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

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. 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. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

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

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

CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207

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

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level- Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

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, 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

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

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 1 - 40GHz, 10-Feb-03
Engineer: Chris

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	868	12	3/11/2002	3/11/2003
Hewlett Packard	Spectrum Analyzer 30Hz - 40 GHz	8564E (84125C)	1148	12	4/2/2002	4/2/2003
Hewlett Packard	Spectrum Analyzer 9KHz - 26.5GHz, non programable	8563E	284	12	3/21/2002	3/21/2003
Miteq	Preamplifier, 1-18GHz	AFS44	1346	12	1/6/2003	1/6/2004
Narda West	High Pass Filter 4.0 GHz,	60583 HXF370	247	12	3/14/2002	3/14/2003
Hewlett Packard	High Pass filter, 8.2GHz	P/N 84300-80039	1156	12	3/25/2002	2/25/2003

Radiated Emissions, 30 - 1000 MHz, 24-Feb-03
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	12	4/23/2002	4/23/2003
Rohde & Schwarz	Test Receiver, 20-1300MHz	ESVP	273	12	2/13/2003	2/13/2004

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T 50149_5Radio 8 Pages

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EMC Test Data

Client:	Broadcom	Job Number:	T50066
Model:	PP07L Laptop with NeWeb Antenna	T-Log Number:	T50149
		Proj Eng:	Juan Martinez
Contact:	Dave Boldy		
Emissions Spec:	FCC 15.247, 15.401	Class:	DSSS / UNII
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Broadcom

Model

PP07L Laptop with NeWeb Antenna

Client:	Broadcom	Job Number:	T50066
Model:	PP07L Laptop with NeWeb Antenna	T-Log Number:	T50149
		Proj Eng:	Juan Martinez
Contact:	Dave Boldy		
Emissions Spec:	FCC 15.247, 15.401	Class:	DSSS / UNII
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is a 802.11a/g/b mini PC card which is designed for wireless internet access for the laptop. Normally, the EUT would be table-top during operation. The EUT was treated as table-top equipment during testing to simulate the end user environment.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PPO7L	Laptop	22500	DoC
Dell	PPO5L	Laptop	231905	DoC
Broadcom	BCM94309MP	Mini PCI Transceiver	-	TBD

Antenna

The EUT uses the antenna an antenna integral to the laptop with a gain of 4.5 dBi in the 5150 - 5350 MHz band and 2.55 dBi in the 2400 - 2483.5 MHz band.

The antenna connector used is non-standard antenna (Hirose U.FL series) to meet the requirements of FCC Part 15.203 and RSS-210

EUT Enclosure

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

Modification History

Mod. #	Test	Date	Modification
1			

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.

Client:	Broadcom	Job Number:	T50066
Model:	PP07L Laptop with NeWeb Antenna	T-Log Number:	T50149
		Proj Eng:	Juan Martinez
Contact:	Dave Boldy		
Emissions Spec:	FCC 15.247, 15.401	Class:	DSSS / UNII
Immunity Spec:	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	PPO7L	Laptop	22500	DoC
Dell	PPO5L	Laptop	231905	DoC
dell	pa-190-05D	power supply	cn-06g356-48010-28v-00a3	N/A

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
None				

Note: Serial and Parrallel printer were not connected as there were no ports available. Manufacture was notified and are aware that a deviation from the standard had been made.

EUT Operation During Radio Emissions

The radio was transmitting at full power on the specified channels with a 100 % duty cycle and at a data rates from 1 to 54 Mb/s. The channels were selected since they are at the top, near the center and at the bottom of the allocated bands. The radio uses 8-chip complementary code keying (CCK), 11-chip differential quadrature phase shift keying (DQPSK) modulation for 802.11b operation and Orthogonal Frequency Division Multiplexing (OFDM) for 802.11a and 802.11g operation.

Note: During digital device tests, scrolling H characters were displayed in a window on the laptop display and the radio was set to the channel and data rate that produced the highest output power.

Client:	Broadcom	Job Number:	T50066
Model:	PP07L Laptop with NeWeb Antenna	T-Log Number:	T50149
		Proj Eng:	Juan Martinez
Contact:	Dave Boldy		
Spec:	FCC 15.247, 15.401	Class:	DSSS / UNII

Radiated Emissions

Test Specifics

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: 2/11/2003
Test Engineer: jmartinez
Test Location: SVOATS #4

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.
On the OATS, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz.
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: 16°C
Rel. Humidity: 44%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, Preliminary Scan 30 - 1000 MHz	FCC B	Pass	Refer to individual runs
2	RE, 30 - 1000MHz - Maximized Emissions	FCC B	Pass	-5.4dB @ 663.24 MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

Serial and Parrallel printer were not connected as there were no ports available. Manufacture was notified and are aware that a deviation from the standard had been made.

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EMC Test Data

Client:	Broadcom	Job Number:	T50066
Model:	PP07L Laptop with NeWeb Antenna	T-Log Number:	T50149
		Proj Eng:	Juan Martinez
Contact:	Dave Boldy		
Spec:	FCC 15.247, 15.401	Class:	DSSS / UNII

Run #1: Preliminary Radiated Emissions, 30-1000 MHz

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
663.242	40.6	h	46.0	-5.4	QP	0	1.5	
407.300	40.1	h	46.0	-5.9	QP	136	2.0	
407.552	39.4	h	46.0	-6.6	QP	0	1.0	
414.249	39.1	h	46.0	-6.9	QP	126	1.5	
240.000	28.3	h	46.0	-17.7	QP	7	1.4	
243.000	26.5	h	46.0	-19.5	QP	0	1.3	

Run #2: Maximized Readings From Run #1

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
663.242	40.6	h	46.0	-5.4	QP	0	1.5	
407.300	40.1	h	46.0	-5.9	QP	136	2.0	
407.552	39.4	h	46.0	-6.6	QP	0	1.0	
414.249	39.1	h	46.0	-6.9	QP	126	1.5	
240.000	28.3	h	46.0	-17.7	QP	7	1.4	
243.000	26.5	h	46.0	-19.5	QP	0	1.3	

Client:	Broadcom	Job Number:	T50066
Model:	PP07L Laptop with NeWeb Antenna	T-Log Number:	T50149
		Proj Eng:	Juan Martinez
Contact:	Dave Boldy		
Spec:	FCC 15.247, 15.401	Class:	N/A

UNII 15.401 Radiated Emissions

Test Specifics

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: 2/10/2003
Test Engineer: Chris Byleckie
Test Location: SVOATS #4
Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT.
When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 16°C
Rel. Humidity: 44%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Output Power	15.401(a)	Pass	21.8 dBm
2a - 2c	RE, 30 - 40,000 MHz - Spurious Emissions In Restricted Bands	15.401(b)	Pass	-2.3dB @ 10638 MHz

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	Job Number:	T50066
Model:	PP07L Laptop with NeWeb Antenna	T-Log Number:	T50149
		Proj Eng:	Juan Martinez
Contact:	Dave Boldy		
Spec:	FCC 15.247, 15.401	Class:	N/A

Run #1: Output Power Data Rate 54Mb/s

The minimum VBW required for power measurements using a spectrum analyzer is 1/T, where T is the pulse transmission rate.

Pulse Transmission Rate: 4.0 uS
Minimum VBW: 250 kHz
VBW Used: 300 kHz

Antenna Gain: 4.5 dBi

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm) (note 3)	Comments
36	5180	15.0	17.0	
52	5260	21.5	24.0	
64	5320	21.8	24.0	

Elliott

EMC Test Data

Client:	Broadcom	Job Number:	T50066
Model:	PP07L Laptop with NeWeb Antenna	T-Log Number:	T50149
		Proj Eng:	Juan Martinez
Contact:	Dave Boldy		
Spec:	FCC 15.247, 15.401	Class:	N/A

Data rate 54 M/bs
Antenna - NeWeb, Aux

Run #2a: Radiated Spurious Emissions, 30-40000 MHz. Low Channel @ 5180 MHz

Frequency	Level	Pol	15.205 / 15.401		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15541.77	47.9	V	54.0	-6.1	Avg	172	1.3	
15542.57	47.1	H	54.0	-6.9	Avg	216	1.4	
15541.83	62.4	V	74.0	-11.6	Pk	172	1.3	
15542.52	60.9	H	74.0	-13.1	Pk	216	1.4	
10363.23	51.4	V	68.3	-16.9	Note 3	152	1.6	
10363.17	49.1	H	68.3	-19.2	Note 3	211	1.5	

Run #2b: Radiated Spurious Emissions, 30-40000 MHz. middle Channel @ 5260 MHz

Frequency	Level	Pol	15.205 / 15.401		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
15780.56	46.4	V	54.0	-7.6	Avg	174	1.7	
15780.73	44.3	H	54.0	-9.7	Avg	0	0.0	
10522.05	56.1	V	68.3	-12.2	Note 3	187	1.6	
15779.89	60.3	V	74.0	-13.7	Pk	174	1.7	
15781.30	57.1	H	74.0	-16.9	Pk	0	0.0	
10521.82	51.0	H	68.3	-17.3	Note 3	215	1.4	

Run #2c: Radiated Spurious Emissions, 30-40000 MHz. High Channel @ 5320 MHz

Frequency	Level	Pol	15.205 / 15.401		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
10638.61	51.7	V	54.0	-2.3	Avg	234	1.3	
10636.30	47.5	H	54.0	-6.5	Avg	200	1.3	
15958.14	47.1	H	54.0	-6.9	Avg	220	1.5	
10638.16	66.8	V	74.0	-7.2	Pk	234	1.3	
15957.84	46.0	V	54.0	-8.0	Avg	213	1.3	
10636.61	61.8	H	74.0	-12.2	Pk	200	1.3	
15959.09	61.3	H	74.0	-12.7	Pk	220	1.5	
15958.61	59.2	V	74.0	-14.8	Pk	213	1.3	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.
Note 2:	No emissions visible above the noise floor beyond 16 GHz

EXHIBIT 3: Radiated Emissions Above 1 GHz Configuration

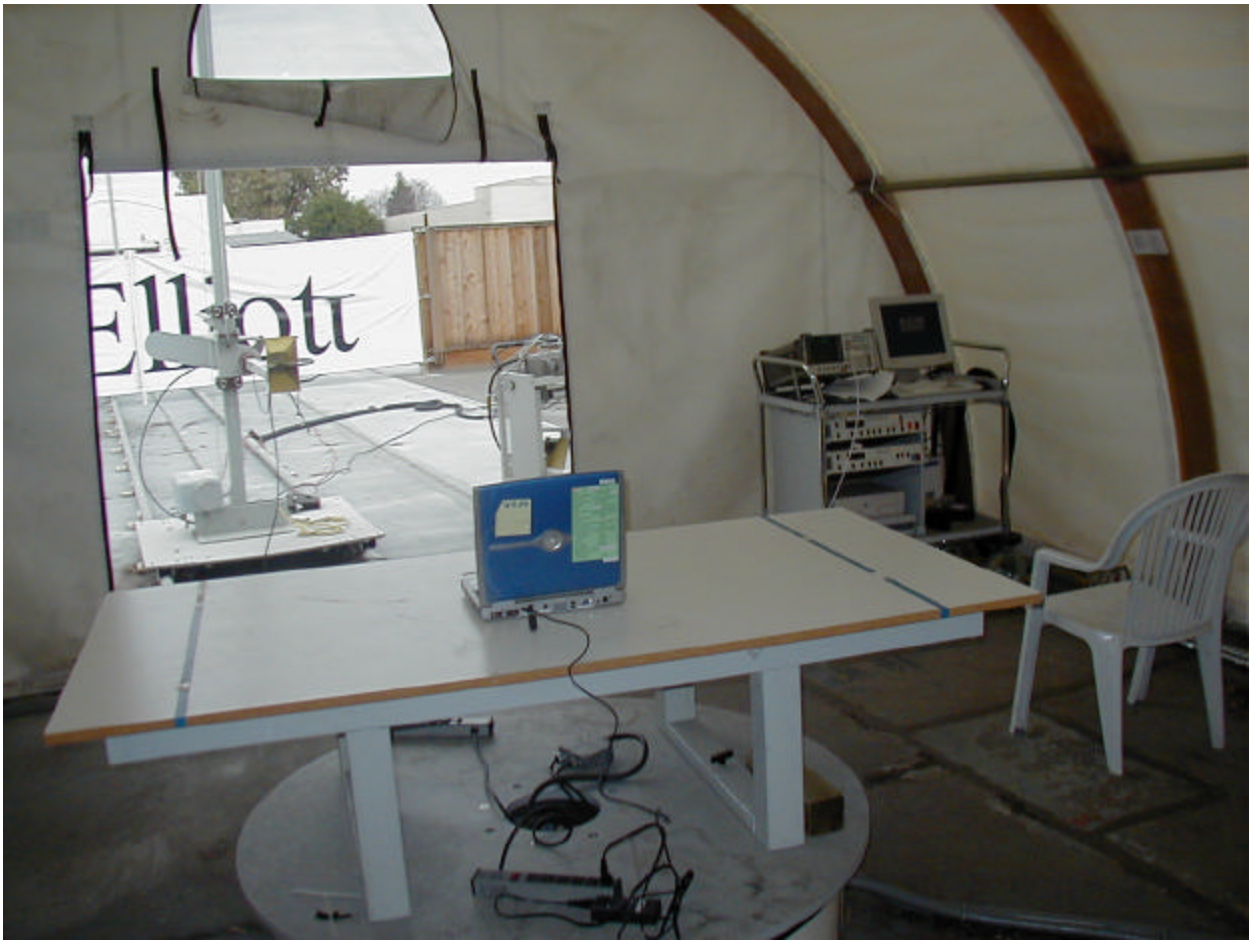

EXHIBIT 3: Radiated Emissions Below 1 GHz Configuration