

FCC Test Report Test report no.: EMC_928FCC15.247_2005_rev1

FCC Part 15.247 for DSSS systems / CANADA RSS-210

EUT: WLAN

Model: RSVLD-0506

FCC ID: B94RSVLD0506 IC ID: 466F-RSVLD506





Bluetooth Qualification Test Facility (BQTF)



FCC listed # 101450

IC recognized # 3925

CETECOM Inc.

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- 1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

Issue date: 2005-06-07

TEST REPORT PREPARED BY: EMC Engineer: Harpreet Sidhu

1.2 Testing laboratory
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1.3 Details of applicant

Name	:		Hewlett Packard Company
Street	:		3000 Hanover Street
City / Zip Code	:		Palo Alto, CA 94304
Country	:		USA
Contact	:		Jim Henry (Regulatory Engineer)
Telephone	:		916 785 5417
Tele-fax	:		
e-mail	:		jhenry@hp.com
1.4 Application deta	ils		
Date of receipt test item		:	2005-05-17
Date of test		:	2005-05-17/18/20/24, 2005-06-07
1.5 Test item			
Manufacturer	:		Applicant
Model No. (EUT)	:		RSVLD-0506
Host	:		Dell Laptop
Description	:		802.11b/g radio module
FCC ID	:		B94RSVLD0506
IC ID	:		466F-RSVLD506
Additional information	1		
Frequency	:		2412MHz – 2472MHz for 2.4GHz band
Type of modulation	:		DSSS / OFDM (orthogonal frequency division multiplexing)
Number of channels	:		11
Antenna	:		PCB antenna
Power supply	:		5 VDC from Host
Output power	:		27.16dBm (519.99mW) conducted avg. power for 2.4GHz
			band
Extreme temp. Tolerance	e :		0° C to $+70^{\circ}$ C
1.6 Test standa	rds:		FCC Part 15 §15.247 / CANADA RSS-210



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PROJECT OVERVIEW:

This test report carries all measurements required as per FCC 15.247 on 802.11b/g radio module model# RSVLD-0506 tested as per DA001407 requirements for modular transmitter approval.

Radio module was tested for spurious emissions in both DSSS & OFDM modes at different data rates (1, 2, 5.5, 6, 11, and 54) to ensure compliance of the whole device. Test report shows only worst-case test results.



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2 **Technical test**

2.1 **Summary of test results**

No deviations from the technical specification(s) were ascertained in the course of the tests Performed				
Final Verdict: (Only "passed" if all single measurements are "passed")	Passed			

Technical responsibility for area of testing:

Section

Section	Name	Signature
EMC & Radio	Lothar Schmidt (Technical Manager)	ldunid

Signature

Responsible for test report and project leader:

Jor N.

Harpreet Sidhu (EMC Engineer) 2005-06-08 EMC & Radio

Date

2005-06-08

Date

Section

Name

Signature



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2.2 Test report

TEST REPORT

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2.3 Summary of test results

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2003 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2003 clause 4.2.

Antennas are conforming to ANSI C63.2-1996 item 15.

9 kHz - 30 MHz: Quasi Peak measurement, 9 kHz Bandwidth, loop antenna.

30 MHz – 1GHz: Quasi Peak measurement, 120 KHz Bandwidth, biconilog antenna

>1GHz: Average, RBW 1MHz, VBW 10 Hz, wave-guide horn

All measurement settings are according to FCC 15.35, 15.205, 15.209, 15.247 and the "Measurement guidelines for DSSS systems".



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§15.247(a) (2)

SPECTRUM BANDWIDTH OF DSSS SYSTEM 6 dB bandwidth (Data rate – 54Mbps)

 TEST CONDITIONS
 6 dB BANDWIDTH (MHz)

 Frequency (MHz)
 2412
 2437
 2462

 $T_{nom}(23)^{\circ}C$ $V_{nom}(5.0)$ VDC
 16.38
 16.43
 16.43

LIMIT

SUBCLAUSE §15.247(a) (2)

The minimum 6dB bandwidth shall be at least 500 KHz



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Issue date: 2005-06-07 Test report no.: EMC_928FCC15.247_2005_rev1 Page 12 (45) SPECTRUM BANDWIDTH OF DSSS SYSTEM §15.247(a) (2) 6 dB bandwidth (Data rate – 54Mbps) Ch-11: 2462MHz Delta 1 [T1] RBW 100 kHz RF Att 20 dB Ref Lvl -1.17 dB VBW 300 kHz 16.43286573 MHz 11.1 dBm SWT 6.5 ms Unit dBm 11.1 21.1 dB Offset A MAM MIL whe MAN Λ dBm 0 -10 -20 **1VIEW** 1MA -30 -40 -50 -60 -70 -80 -88.9 Center 2.462 GHz Span 25 MHz 2.5 MHz/ 07.JUN.2005 13:49:58 Date:



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MAXIMUM PEAK OUTPUT POWER (Conducted) (Data rate – 54Mbps)

§ 15.247 (b) (3)

TEST CONDITIONS		OUTPUT POWER (dBm)			
Frequency (MHz)		2412	2437	2462	
T _{nom} (23)°C	V _{nom} (3.3) VDC	26.96	27.06	27.16	
Measureme	ent uncertainty	y ±0.5dBm			

LIMIT

SUBCLAUSE § 15.247 (b) (3)

Frequency range	RF power output
2400-2483.5 MHz & 5725-5850 MHz	1.0 Watt / 30dBm



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§ 15.247 (b) (3)

MAXIMUM PEAK OUTPUT POWER (RADIATED) (Data rate – 54Mbps)

EIRP:

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)			
Frequency (MHz)		2412 2437		2462	
T _{nom} (23)°C	V _{nom} (3.3) VDC	25.77	25.63	25.58	
Measureme	ent uncertainty	y ±0.5dBm			

LIMIT

SUBCLAUSE § 15.247 (b) (3)

Frequency range	RF power output
2400-2483.5 MHz & 5725-5850 MHz	30dBm on Conducted



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§15.247 (e)

POWER SPECTRAL DENSITY (Data rate – 6Mbps b-mode)

 TEST CONDITIONS
 POWER SPECTRAL DENSITY (dBm)

 Frequery (MHz)
 2412
 2437
 2462

 $T_{nom}(23)^{\circ}C$ $V_{nom}(3.3)$ VDC
 6.39 4.11 4.69

LIMIT

SUBCLAUSE §15.247(e)

The peak power spectral density shall not be greater than 8dBm in any 3 kHz band

ANALYZER SETTINGS: RBW=3KHz, VBW=3KHz















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BAND E (Data rat Low freq (Peak me	DGE COMI te – 54Mbps uency sectio easurement)	PLIANCE g-mode) on (spurious	s in the res	stricted bar	nd 2310 – 2.	§15.247 (c) 390 MHz)
Antenna: EUT plane	:	Horizontal Horizontal v	with screen	vertical @ 90	·	
Operating SWEEP TA Limit Line	condition ABLE	: : :	Tx at 2412 "FCC15.24 74dBμV	2 MHz 47 LBE_Pk"		
Start	Stop	Detector	Meas.	RBW	VBW	Transducer
2.31 GHz	2.412 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)
Level [c	IBµV/m]			1		
110						
100						
90						
80						www.
70						
60					NA AM	M M M M
50 🐜	Mm	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	MMM	wwww	WWW V···	
40 2.3	1G	2.340	 G	2.36G	2	2.38G 2.412G
			Frequer	ncy [Hz]		



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BAND E Data ra High fre Averag	DGE COM te – 6Mbps quency secti e measurem	PLIANCE g-mode) ion (spurio ent)	ous in the re	estricted ba	nd 2483.5	§15.247 (d - 2500MHz)	2)
Antenna: EUT plan	e:	Horizonta Horizonta	l l with screen	vertical @ 90	•		
Operating SWEEP T. Limit Line	condition ABLE	: : :	Tx at 2462 "FCC15.24 54dBμV	2 MHz 47 HBE_AVG	"		
Start	Stop	Detector	Meas.	RBW	VBW	Transducer	
requency 2.462 GHz	2.5 GHz	11me MaxPeak	Bandw. Coupled	1 MHz	10Hz	#326 horn (dBi)	
Marker:		2.483931864	GHz		49.06 dBµV/	′m	
Level [dBµV/m]						
110 _							
100							
90		~					
80 -							
70							
60 —							
50				m			
					m	m	
40							
30							



Test repor	'est report no.: EMC_928FCC15.247_2005_rev1			Iss	sue date: 2005-	06-07 Page 22	2 (45)
BAND E (Data rat High free (Peak me	DGE COM e – 54Mbps quency secti easurement)	PLIANCE s g-mode) ion (spurio)	us in the re	estricted ba	and 2483.5 –	§15. 2500 MHz)	247 (c)
Antenna: EUT plane	:	Horizontal Horizontal	with screen	vertical @ 9	0•		
Operating SWEEP TA Limit Line	condition ABLE	: : :	Tx at 2462 "FCC15.24 74dBμV	2 MHz 47 HBE_PK"			
Start	Stop	Detector	Meas.	RBW	VBW	Transducer	
2.462 GHz	Frequency 2.5 GHz	1 ime MaxPeak	Bandw. Coupled	1 MHz	1MHz	#326 horn (dBi)	
Marker:		2.483551102 (GHz		68.92 dBµV/	m	
Level [d	lBµV/m]						
120							
110 🗸	munun	m					
100							
90							
80			M. M. M. M.	Ma more in			
70				han han	M		
60 —					·~~~~	Www.	
50						· · · · · · · · · · · · · · · · · · ·	mmmmmm
40 2.4	.62G	2.47G	2.475G	2.48G	2.485G	2.49G	2.5G
			Frequ	ency [Hz]			

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EMISSION LIMITATIONS Transmitter (Radiated)

§ 15.247 (c) (1)

LIMITS

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions, which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

NOTE:

1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 25 GHz very short cable connections to the antenna was used to minimize the noise level.

2. All measurements are done in peak mode unless specified with the plots.

Results for the radiated measurements below 30MHz according § 15.33

Frequency	Measured values	Remarks
9KHz – 30MHz	No emissions found, caused by the EUT	This is valid for all the tested channels





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EMISSION LIMITATIONS - Radiated (Transmitter)

§ 15.247 (c) (1)

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Transmit a	Transmit at Lowest channel Frequency 2412MHz								
Frequency (MHz)	Level (dBµV/m)								
	Peak Quasi-Peak Average								
	SEE PLOT	TS							
Transmit a	t Middle channel	Frequency 2437MHz	2						
Frequency (MHz)	Level (dBµV/m)								
	Peak	Quasi-Peak	Average						
	SEE PLOT	<u>S</u>							
Transmit at	t Highest channel	Frequency 2462MHz	Z						
Frequency (MHz)		Level (dBµV/m)							
	Peak	Quasi-Peak	Average						
	SEE PLOT	<u>S</u>							























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EMISSI(Channel- (Data rat (Average n	ON LIMITA -1 (2412MH te – 54Mbps neasurement)	ATIONS - H [z): 3GHz - 5)	Radiated (1 18GHz	Fransmitte	r)	§ 15.2	47 (c) (1)	
EUT plane	:	Horizontal	with screen	vertical @ 90)•			
SWEEP TA Start Frequency 3.0 GHz	ABLE: Stop Frequency 18.0 GHz	" WLAN Sj Detector Time MaxPeak	puri hi 3-18G Meas. Bandw. Coupled	" RBW 1 MHz	VBW 10Hz	Transdu #326 ho	ucer orn (dBi)	
Marker:		7.238476954 (GHz		49.76 dBµʻ	V/m		
Level [df	BμV/m]							
90								
80								
70								
60								
50			\rightarrow					
50								
40 30				m	h	·····	h	
20	man							
10								
5		 6G	8G	10G	12G	1.	 4G	16G 18G
			Frequ	iency [Hz]	.20			







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EMI Char (Dat (Aver Anter EUT	SSIO nnel-6 ta rato age Mo na: plane:	N LIMITA 5 (2437MH e – 54Mbps easurement)	ATIONS - 1 z): 3GHz - s) Horizontal Horizontal	Radiated (- 18GHz with screer	Transmit	ter) 90°	§ 15.2	247 (c) (1)		
SWEI Start Frequ 3.0 GI Mar	EP TAB ency Hz ker:	BLE: Stop Frequency 18.0 GHz 7	" WLAN S Detector Time MaxPeak	puri hi 3-180 Meas. Bandw. Coupled GHz	G" RBW 1 MHz	VBW 10Hz 47.43 dB	Transd #326 h 8µV/m	ucer orn (dBi)		
90										
80										
70										
60										
50				\rightarrow						
40								Λ	0.5	
30				lann	mhin		Am	m		
20	m	formallin								
10										
5	3G		6G	8G Freedu	10G	120	6 14	G 16	G 18G	
				riequ						







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EMI Char (Dat (Aver Anter EUT	SSIO nnel-1 a rate age M na: plane:	N LIMITA 11 (2462MI e – 54Mbps easurement)	ATIONS - 1 Hz): 3GHz) Horizontal Horizontal	Radiated (' – 18GHz with screen	Fransmitte vertical @ 9	er) 0 [.]	§ 15.2	247 (c) (1)		
SWEI Start Frequ 3.0 G	EP TAI ency Hz	BLE: Stop Frequency 18.0 GHz	" WLAN S Detector Time MaxPeak	puri hi 3-18G Meas. Bandw. Coupled	RBW 1 MHz	VBW 10Hz	Transd #326 h	ucer orn (dBi)		
Mar Le [,] 90	ker: vel [dB	7 µV/m]	.388777555 G	;Hz		43.32 dBµ\	V/m	1		
80										
70										
60										
50				\diamond						
40								mh		
30			m	Hunn	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					
20	J. March	m								
10 5	3G		6G	8G	10G	12G	14	G 1	6G 18G	
				Frequ	ency [Hz]					





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CONDUCTED EMISSIONS

30.0 MHz

150.0 kHz

Weasured with AC/DC power adapter and USB 1.1SWEEP TABLE: "55022 cond"Short Description:EN 55022 for 150KHz-30MHzStartStopDetectorMeasIFFrequencyTimeBandw.

MaxPeak

Technical specification:	15.107 / 15.207	(Revised as of	August 20,	2002)
Limit				

Coupled

Frequency of Emission (MHz)	Conducted Limit (dBµV)				
	Quasi-Peak	Average			
0.15 - 0.5	66 to 56*	56 to 46*			
0.5 – 5	56	46			
5 - 30	60	50			

10 kHz

* Decreases with logarithm of the frequency

ANALYZER SETTINGS: RBW = 10KHz VBW = 10KHz



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§ 15.107/207



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Transducer

None



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Measured with AC/DC power adapter and USB 2.0

SWEEP TABLE: ''55022 cond''										
Short Description: EN 55022 for 150KHz-30MHz										
Start	Stop	Detector	Meas	IF	Transducer					
Frequency	Frequency		Time	Bandw.						
150.0 kHz	30.0 MHz	MaxPeak	Coupled	10 kHz	None					

Technical specification: 15.107 / 15.207 (Revised as of August 20, 2002) Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)					
	Quasi-Peak	Average				
0.15 – 0.5	66 to 56*	56 to 46*				
0.5 – 5	56	46				
5 - 30	60	50				
* Decreases with logarithm of the frequency						

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RECEIVER SPURIOUS RADIATION

§ 15.209

Limits

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

NOTE:

The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 25 GHz very short cable connections to the antenna was used to minimize the noise level.







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RECEIVI 1GHz – 3 Peak Mea worst-cas Antenna: EUT plane:	ER SPURI(GHz surement e plot valid	OUS RADI for all ant Horizontal Horizontal	ATION ennas with screen	vertical @ 9	0°		§ 15.209
SWEEP TA Start Frequency 1.0 GHz	BLE: Stop Frequency 3.0 GHz	"WLAN Sp Detector Time MaxPeak	ouri hi 1-3G" Meas. Bandw. Coupled	RBW 1 MHz	VBW 1MHz	Transduo #326 hor	cer m (dBi)
Marker:	2	.098196393 G	HZ		48.58 dBµV/m		
Level [dl	BµV/m]						
120							
110							
100							
90							
80							
70							
60							
50							
40	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	www.wh	www.www.ww		mmmmmm	mpm	W. W
30 16		1.50		20		2 50	
.0			Frequer	ncy [Hz]		2.00	



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§ 15.209

RECEIVER SPURIOUS RADIATION 3GHz – 18GHz

Antenna EUT pla	a: ane:	Horizontal Horizontal v	with screen	vertical @	90 °		
SWEEP Start Frequen 3.0 GHz	TABLE: Stop cy Frequency z 18 GHz	"WLAN Spu Detector Time MaxPeak	ri hi 3-18G' Meas. Bandw. Coupled	RBW VBW 1 MHz	Tra #32	nsducer 26 horn (dBi)
Marke Leve	er: 15	7.182364729 G	iHz		47.02	2 dBµV/m	
130		1					
120							
100							
80							
60							A la more and and a second second
40	M		h	m			apprendent of the main
20							
10							100
	36 4	G 50	Freque	ency [Hz]	ðG	100	9 186







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TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Туре	Manufacturer	Serial No.	Calibration Due
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107	May 06
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	826880/ 010	May 06
03	Loop Antenna	6512	ETS Lindgren	1120	May 06
04	Biconilog Antenna	3141	EMCO	0005-	May 06
				1186	
05	Horn Antenna (700M-18GHz)	SAS-200/571	AH Systems	325	May 06
06	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240	May 06
07	2-3GHz Band reject filter	BRM50701	Microtronics	6	n/a
08	Power-Meter	NRVD	Rohde & Schwarz	0857.80	May 06
				08.02	
09	Pre-Amplifier	TS-ANA	Rohde & Schwarz		June 06
10	Pre-Amplifier	JS4-00102600	Miteq	00616	June 06



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BLOCK DIAGRAMS Conducted Testing



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Radiated Testing

