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Supplemental “Dual Xmit” Test Report

REPORT NO.: RF991126E02-2

MODEL NO.: AR5B225

FCC ID: PPD-AR5B225

RECEIVED: Nov. 25, 2010

TESTED: Dec. 22, 2010 to Jan. 03, 2011

ISSUED: Jan. 26, 2011

APPLICANT: Atheros Communications, Inc.

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ISSUED BY: Bureau Veritas Consumer Products Services (H.K.)
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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	NA	Jan. 26, 2011



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1. CERTIFICATION

PRODUCT : 1X1 802.11b/g/n - BT Combo PCIe minicard
BRAND NAME : Atheros
MODEL NO. : AR5B225
TESTED: Dec. 22, 2010 to Jan. 03, 2011
APPLICANT : Atheros Communications, Inc.
TEST ITEM: R&D SAMPLE
STANDARDS : FCC Part 15, Subpart C (Section 15.247),
ANSI C63.4-2003
ANSI C63.10-2009

PREPARED BY : Carol Liao , **DATE:** Jan. 26, 2011
(Carol Liao, Specialist)

APPROVED BY : May Chen , **DATE:** Jan. 26, 2011
(May Chen, Deputy Manager)

Note:

Per a request of the FCC, the 1X1 802.11b/g/n - BT Combo PCIe minicard was tested for conducted and radiated emissions in restricted bands while transmitting on both WLAN and bluetooth at simultaneously.

2. DUAL XMIT, CONDUCTED EMISSION MEASUREMENT

2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
ROHDE & SCHWARZ Test Receiver	ESCS 30	100287	Mar. 01, 2010	Feb. 28, 2011
Line-Impedance Stabilization Network (for EUT)	NSLK 8127	8127-523	Sep. 17, 2010	Sep. 16, 2011
Line-Impedance Stabilization Network (for Peripheral)	ENV-216	100072	June 11, 2010	June 10, 2011
RF Cable (JYEBAO)	5DFB	CONCAB-003	Aug. 06, 2010	Aug. 05, 2011
50 ohms Terminator	50	3	Nov. 03, 2010	Nov. 02, 2011
Software	BV ADT_Cond_V7.3.7	NA	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. A.
3. The VCCI Con A Registration No. is C-817.

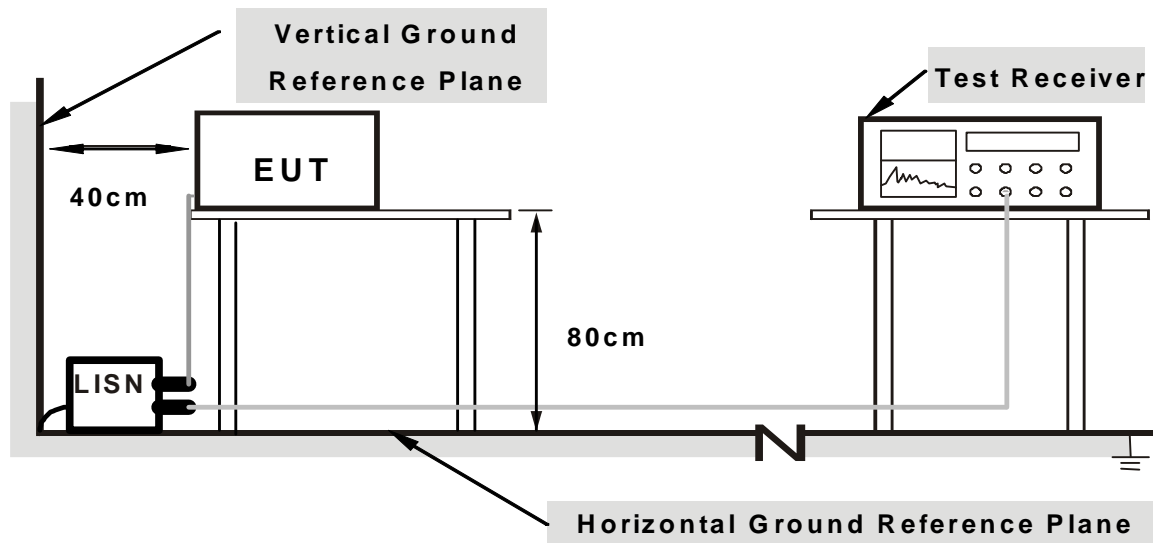
2.3 TEST PROCEDURES

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

2.4 DEVIATION FROM TEST STANDARD

No deviation

2.5 TEST SETUP



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

2.5 EUT OPERATING CONDITIONS

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
WLAN + Bluetooth	1 to 11	6	OFDM	BPSK	6
	0 to 78	39	FHSS	8DPSK	DH5

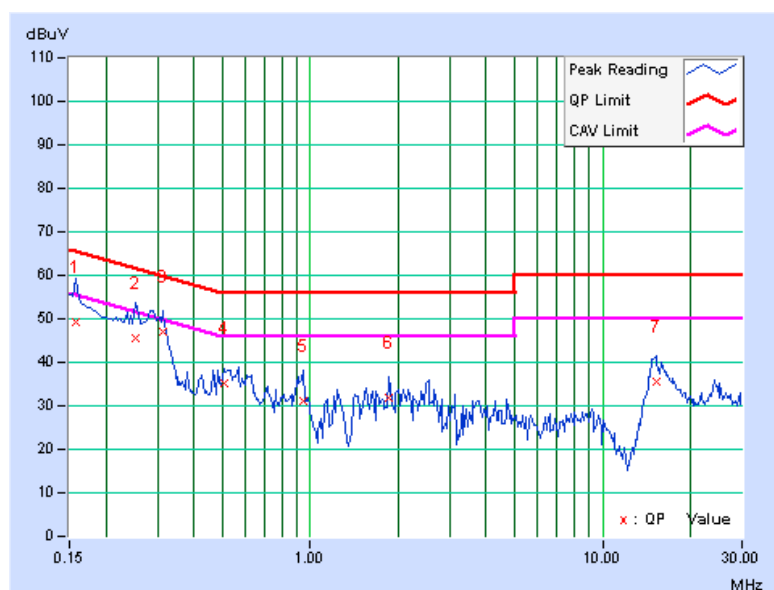
1. Connect the EUT with the support unit 1 (Notebook Computer) which is placed on a testing table via support unit 2 (Test Tool).
2. The support unit 1 (Notebook Computer) runs test program “ArcMfgTool 2.0.0.9” and “BtUSB Tool V1.0 B18” to enable EUT under transmission/receiving condition continuously.

2.6 TEST RESULTS

TEST MODE	Dual transmission 802.11g, 2437MHz Bluetooth, 2441MHz	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	PHASE	Line (L)
ENVIRONMENTAL CONDITIONS	28deg. C, 67%RH, 1011hPa	TESTED BY	Wen Yu

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.158	0.36	48.79	-	49.15	-	65.58	55.58	-16.42	-
2	0.252	0.36	45.20	-	45.56	-	61.71	51.71	-16.15	-
3	0.314	0.36	46.80	-	47.16	-	59.86	49.86	-12.70	-
4	0.505	0.37	34.88	-	35.25	-	56.00	46.00	-20.75	-
5	0.951	0.41	30.86	-	31.27	-	56.00	46.00	-24.73	-
6	1.855	0.45	31.22	-	31.67	-	56.00	46.00	-24.33	-
7	15.207	1.00	34.53	-	35.53	-	60.00	50.00	-24.47	-

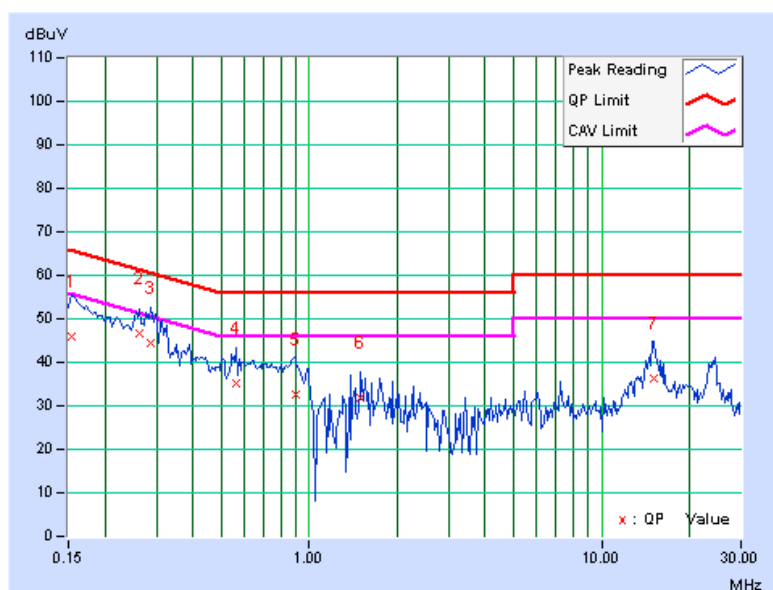
- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.



TEST MODE	Dual transmission 802.11g, 2437MHz Bluetooth, 2441MHz	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	PHASE	Neutral (N)
ENVIRONMENTAL CONDITIONS	28deg. C, 67%RH, 1011hPa	TESTED BY	Wen Yu

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.154	0.10	45.91	-	46.01	-	65.78	55.78	-19.78	-
2	0.263	0.10	46.71	-	46.81	-	61.33	51.33	-14.51	-
3	0.287	0.10	44.36	-	44.46	-	60.62	50.62	-16.15	-
4	0.560	0.12	35.17	-	35.29	-	56.00	46.00	-20.71	-
5	0.896	0.15	32.34	-	32.49	-	56.00	46.00	-23.51	-
6	1.504	0.18	31.76	-	31.94	-	56.00	46.00	-24.06	-
7	15.168	0.95	35.38	-	36.33	-	60.00	50.00	-23.67	-

- REMARKS:** 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



3. DUAL XMIT, RADIATED EMISSION MEASUREMENT

3.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Field strength limits are at the distance of 3 meters, emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
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:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



3.2 TEST INSTRUMENTS

For Below 1GHz: Test date: Dec. 22, 2010

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Agilent Spectrum Analyzer	E4446A	MY48250253	Aug. 23, 2010	Aug. 22, 2011
Agilent Pre-Selector	N9039A	MY46520310	Aug. 23, 2010	Aug. 22, 2011
Agilent Signal Generator	N5181A	MY49060347	July 30, 2010	July 29, 2011
LIG NEX1 Test Receiver	ER-265	L09068005	Oct. 25, 2010	Oct. 24, 2011
Mini-Circuits Pre-Amplifier	ZFL-1000VH2B	AMP-ZFL-04	Nov. 16, 2010	Nov. 15, 2011
Agilent Pre-Amplifier	8449B	3008A02465	Mar. 01, 2010	Feb. 28, 2011
Miteq Pre-Amplifier	AFS33-1800265 0-30-8P-44	881786	NA	NA
SCHWARZBECK Trilog Broadband Antenna	VULB 9168	9168-361	Apr. 28, 2010	Apr. 27, 2011
AISI Horn_Antenna	AIH.8018	0000220091110	Nov. 22, 2010	Nov. 21, 2011
SCHWARZBECK Horn_Antenna	BBHA 9170	9170-424	Oct. 08, 2010	Oct. 07, 2011
RF CABLE	NA	RF104-205 RF104-207 RF104-208	Dec. 24, 2009	Dec. 23, 2010
RF Cable	NA	CHHCAB_001	NA	NA
Software	ADT_Radiated_V8.7.05	NA	NA	NA
CT Antenna Tower & Turn Table	NA	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

3. The test was performed in 966 Chamber No. H.

4. The FCC Site Registration No. is 797305.

5. The CANADA Site Registration No. is IC 7450H-3.



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For Above 1GHz: Test date: Dec. 22, 2010

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Agilent Spectrum Analyzer	E4446A	MY48250254	July 14, 2010	July 13, 2011
Agilent Pre-Selector	N9039A	MY46520311	July 14, 2010	July 13, 2011
Agilent Signal Generator	N5181A	MY49060517	July 14, 2010	July 13, 2011
Mini-Circuits Pre-Amplifier	ZFL-1000VH2B	AMP-ZFL-03	Nov. 16, 2010	Nov. 15, 2011
Agilent Pre-Amplifier	8449B	3008A02578	July 05, 2010	July 04, 2011
Miteq Pre-Amplifier	AFS33-1800265 0-30-8P-44	881786	NA	NA
SCHWARZBECK Trilog Broadband Antenna	VULB 9168	9168-360	Apr. 29, 2010	Apr. 28, 2011
AISI Horn_Antenna	AIH.8018	0000320091110	Nov. 12, 2010	Nov. 11, 2011
SCHWARZBECK Horn_Antenna	BBHA 9170	9170-424	Oct. 08, 2010	Oct. 07, 2011
RF CABLE	NA	RF104-201 RF104-203 RF104-204	Dec. 24, 2009	Dec. 23, 2010
RF Cable	NA	CHGCAB_001	NA	NA
Software	ADT_Radiated_ V8.7.05	NA	NA	NA
CT Antenna Tower & Turn Table	NA	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

3. The test was performed in 966 Chamber No. G.

4. The FCC Site Registration No. is 966073.

5. The VCCI Site Registration No. is G-137.

6. The CANADA Site Registration No. is IC 7450H-2.

3.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using the quasi-peak method or average method as specified and then reported in Data sheet peak mode and QP mode.
- g. The emissions up to 40 GHz were examined. Those emission falling within a restricted band were evaluated against the "restricted band emission limit" (54 dB μ V / 74 dB μ V).

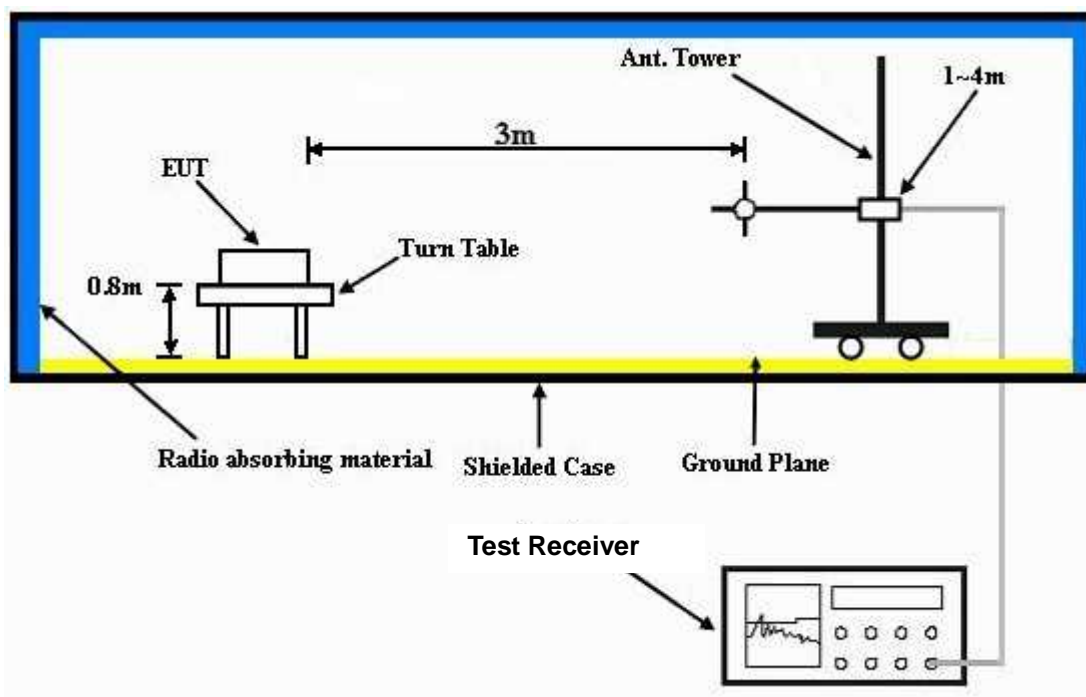
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 300 Hz for Average detection (AV) at frequency above 1GHz.

3.4 DEVIATION FROM TEST STANDARD

No deviation

3.5 TEST SETUP



3.6 EUT OPERATING CONDITIONS

The EUT was tested with the following test mode:

Test Mode	Description
Mode 1	With PIFA Antenna

Note:

The EUT was tested for out of band radiated emissions with the unit transmitting on 802.11g, 2437 MHz with Bluetooth, 2441MHz. These frequencies and power levels were chosen because these frequencies produced the worst case radiated emissions during the radiated emissions in restricted bands test performed previously. The unit was set to transmit at the same power level as was used in the initial radiated emissions tests and was transmitting at the same data rate.

(Please refer to RF991126E02 and RF991126E02-1 test report)

The harmonic of the fundamental signals were recorded in this report.

There are five sets of antennas provided to this EUT, please refer to the following table:

No.	Brand	Model	Gain(dBi) (included cable loss)	Antenna Type	Connector	Cable Loss(dB)	Cable Length
1	WNC	81-EBJ15.005	3.62	PIFA	IPEX	1.15	300mm
2	INPAQ	DAMA1BM30000402	3.2	Dipole	SMA Reverse	0.5	N.A.
3	Tyco	TBN009	2.06	PIFA	U.FL	0.96	300mm
4	Tyco	TBN010	2.64	PIFA	U.FL	0.95	300mm
5	Hitachi Cable	HBV17	1.97	PIFA	IPEX	0.99	306mm

Note: 1. Main – Wireless / Aux – BT

2. Antenna (model: 81-EBJ15.005) was chosen for final test.

1. Connect the EUT with the support unit 1 (Notebook Computer) which is placed on a testing table via support unit 2 (Test Tool).
2. The support unit 1 (Notebook Computer) runs test program “ArcMfgTool 2.0.0.9” and “BtUSB Tool V1.0 B18” to enable EUT under transmission/ receiving condition continuously.

3.7 TEST RESULTS

TEST MODE	Dual transmission 11g, 2437MHz Bluetooth, 2441MHz	FREQUENCY RANGE	30MHz~1000MHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	DETECTOR FUNCTION & BANDWIDTH	Peak (PK) Average (AV) 1 MHz
ENVIRONMENTAL CONDITIONS	20deg. C, 70%RH, 1011hPa	TESTED BY	Eric Lee

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	138.12	36.8 QP	43.5	-6.7	1.25 H	328	22.83	13.98
2	148.42	41.9 QP	43.5	-1.6	1.50 H	0	27.68	14.24
3	166.42	42.6 QP	43.5	-0.9	1.50 H	0	28.61	13.99
4	199.23	41.3 QP	43.5	-2.3	1.50 H	0	30.01	11.24
5	593.81	36.1 QP	46.0	-9.9	1.50 H	318	13.91	22.22
6	896.38	37.9 QP	46.0	-8.2	1.00 H	253	11.35	26.50

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	147.95	32.4 QP	43.5	-11.1	1.00 V	333	18.20	14.23
2	165.95	35.7 QP	43.5	-7.9	1.00 V	199	21.64	14.01
3	184.66	31.1 QP	43.5	-12.4	1.00 V	0	18.75	12.32
4	199.70	31.8 QP	43.5	-11.7	1.25 V	301	20.56	11.20
5	499.55	35.5 QP	46.0	-10.5	1.00 V	320	15.52	19.95
6	890.81	32.8 QP	46.0	-13.2	1.25 V	260	6.43	26.41

NOTE:

1. Emission level = Raw value + Correction Factor
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. Margin value = Emission level - Limit value
4. The other emission levels were very low against the limit.



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TEST MODE	Dual transmission 11g, 2437MHz Bluetooth, 2441MHz	FREQUENCY RANGE	1000MHz~25000MHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	DETECTOR FUNCTION & BANDWIDTH	Peak (PK) Average (AV) 1 MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 64%RH, 1011hPa	TESTED BY	Eric Lee

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4882.00	55.2 PK	74.0	-18.8	1.20 H	23	16.00	39.20
2	4882.00	47.8 AV	54.0	-6.2	1.20 H	23	8.60	39.20
3	4874.00	49.8 PK	74.0	-24.2	1.40 H	258	10.36	39.44
4	4874.00	37.8 AV	54.0	-16.2	1.40 H	258	-1.64	39.44
5	7323.00	53.2 PK	74.0	-20.8	1.54 H	213	6.33	46.87
6	7323.00	38.2 AV	54.0	-15.8	1.54 H	213	-8.67	46.87
7	7311.00	52.3 PK	74.0	-21.7	1.00 H	123	5.53	46.77
8	7311.00	38.5 AV	54.0	-15.5	1.00 H	123	-8.27	46.77

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4882.00	57.9 PK	74.0	-16.1	1.24 V	236	18.70	39.20
2	4882.00	50.2 AV	54.0	-3.8	1.24 V	236	11.00	39.20
3	4874.00	47.3 PK	74.0	-26.7	1.19 V	155	7.86	39.44
4	4874.00	36.9 AV	54.0	-17.1	1.19 V	157	-2.54	39.44
5	7323.00	54.3 PK	74.0	-19.7	1.11 V	108	7.43	46.87
6	7323.00	39.6 AV	54.0	-14.4	1.11 V	108	-7.27	46.87
7	7311.00	54.2 PK	74.0	-19.8	1.15 V	151	7.43	46.77
8	7311.00	40.4 AV	54.0	-13.6	1.15 V	151	-6.37	46.77

NOTE:

1. Emission level = Raw value + Correction Factor
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. Margin value = Emission level - Limit value
4. The other emission levels were very low against the limit.



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4. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5.phtml.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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