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# FCC TEST REPORT (15.407)

**REPORT NO.:** RF110128E05C-1

**MODEL NO.:** WA4271, NA4271, WA4271-R, NA4271-R,  
WA4281, NA4281, WA4281-R, NA4281-R

**FCC ID:** ZLP-WA4200

**RECEIVED:** Jan. 31, 2011

**TESTED:** Apr. 14 to May 03, 2011

**ISSUED:** July 12, 2011

**APPLICANT:** EtherWAN Systems

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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
RF110128E05C-1	Original release	July 12, 2011

## 1. CERTIFICATION

**PRODUCT:** Industrial Dual Radio Multi-function Wireless Device,  
Hardened Dual Radio Multi-function Wireless Device

**BRAND NAME:** EtherWAN Systems

**MODEL NO.:** WA4271, NA4271, WA4271-R, NA4271-R, WA4281,  
NA4281, WA4281-R, NA4281-R

**TEST SAMPLE:** MASS-PRODUCTION

**APPLICANT:** EtherWAN Systems

**TESTED:** Apr. 14 to May 03, 2011

**STANDARDS:** FCC Part 15, Subpart E (Section 15.407)  
ANSI C63.4-2003  
ANSI C63.10-2009

The above equipment (Model: WA4281) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY :** Midoli Peng, **DATE:** July 12, 2011  
( Midoli Peng, Specialist )

**APPROVED BY :** May Chen, **DATE:** July 12, 2011  
( May Chen, Deputy Manager )

## 2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

[For 802.11a](#)

APPLIED STANDARD: FCC Part 15, Subpart E (Section 15.407)			
Standard Section	Test Type	Result	Remark
15.407(b)(5)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -0.66dB at 0.554MHz
15.407(b)(1/2/3) (b)(5)	Electric Field Strength Spurious Emissions, 30MHz ~ 40000MHz	PASS	Meet the requirement of limit. Minimum passing margin is -1.2dB at 133.26MHz
15.407(a)(1/2/3)	Output Transmit Power	PASS	Meet the requirement of limit.
15.407(a)(6)	Peak Power Excursion	PASS	Meet the requirement of limit.
15.407(a)(1/2/3)	Peak Power Spectral Density	PASS	Meet the requirement of limit.
15.407(g)	Frequency Stability	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is N PLUG for professional Install device.

### NOTE:

1. The EUT was operating in 2400 ~ 2483.5MHz, 5.15~5.25GHz and 5.725~5.850GHz frequencies band. This report was recorded the RF parameters including 5.15~5.25GHz. For the 2400 ~ 2483.5MHz and 5.725~5.850GHz RF parameters was recorded in another test report.

## 2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

Measurement	Value
Conducted emissions	2.45 dB
Radiated emissions (30MHz-1GHz)	3.3 dB
Radiated emissions (1GHz -18GHz)	2.19 dB
Radiated emissions (18GHz -40GHz)	2.55 dB

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	Industrial Dual Radio Multi-function Wireless Device, Hardened Dual Radio Multi-function Wireless Device
<b>MODEL NO.</b>	WA4271, NA4271, WA4271-R, NA4271-R, WA4281, NA4281, WA4281-R, NA4281-R
<b>FCC ID</b>	ZLP-WA4200
<b>POWER SUPPLY</b>	DC 48V from POE
<b>MODULATION TYPE</b>	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
<b>MODULATION TECHNOLOGY</b>	DSSS, OFDM
<b>TRANSFER RATE</b>	802.11g: 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6Mbps 802.11b: 11 / 5.5 / 2 / 1Mbps 802.11a: 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6Mbps
<b>OPERATING FREQUENCY</b>	<b>For 15.407</b> 802.11a: 5.18 ~ 5.24GHz
	<b>For 15.247</b> 802.11b & 802.11g: 2.412 ~ 2.462GHz 802.11a: 5.745 ~ 5.825GHz
<b>NUMBER OF CHANNEL</b>	<b>For 15.407</b> 4 for 802.11a
	<b>For 15.247(2.4GHz)</b> 11 for 802.11b, 802.11g
	<b>For 15.247(5GHz)</b> 5 for 802.11a
<b>MAXIMUM OUTPUT POWER</b>	<b>For 15.407</b> 802.11a: 24.5mW <b>For 15.247(2.4GHz)</b> 802.11b: 109.6mW 802.11g: 371.5mW <b>For 15.247(5GHz)</b> 802.11a: 537.0mW
<b>ANTENNA TYPE</b>	Please see note
<b>DATA CABLE</b>	NA
<b>I/O PORTS</b>	RJ-45(POE) port x 2
<b>ASSOCIATED DEVICES</b>	NA



**NOTE:**

1. The EUT has two product names, brand names and eight model names which are identical to each other in all aspects except for the following table:

Product	Brand	Model No.	Description	Material
Industrial Dual Radio Multi-function Wireless Device	EtherWANSystems	WA4271	for different marketing	Plastics
	NA	NA4271		
	EtherWANSystems	WA4271-R		
	NA	NA4271-R		
Hardened Dual Radio Multi-function Wireless Device	EtherWANSystems	WA4281	for different marketing	Aluminum
	NA	NA4281		
	EtherWANSystems	WA4281-R		
	NA	NA4281-R		

Above modes were pre-tested in chamber, the worst case was found in **WA4281**. Therefore only the test data of the model was recorded in this report.

2. There are two antennas provided to this EUT, please refer to the following table:

Manufacturer	Model No.	Antenna Type	Gain (dBi)	Frequency range (MHz)	Antenna Connector
ARISTOTLE	RFA-25-T27	Onmi	4.95	2400~2500	N PLUG
ARISTOTLE	RFA-25-T27	Onmi	7.14	5150~5850	

3. The EUT must be supplied with a power adapter as following table:

POE 1(Only for test, not for sale) – for conduct test item	
BRAND	symbol
MODEL	AP-PSBISA-T-1P-AF
INPUT POWER	100-240V 50-60Hz 0.34-0.17A
OUTPUT POWER	48V 1.0A
POE 2(Only for test, not for sale) – for radiated test item	
BRAND	NA
MODEL	F919I-48 10
INPUT POWER	100-240V 50-60Hz 2A
OUTPUT POWER	48V 1.0A
POE 3(Only for test, not for sale) – for other test items	
BRAND	UMEC
MODEL	UP0181B-48PA
INPUT POWER	100-240V~ 50/60Hz 0.4A MAX
OUTPUT POWER	+48V~ 0.38A 18W MAX

4. The EUT has two same modules inside, the detail information as below table:

No.	Brand Name	Model Name
1	WNC	DCMA-83
2	WNC	DCMA-83

5. The EUT operates in both the 5GHz and 2.4GHz Bands and compatibility with 802.11a and 802.11b, 802.11g technology.
6. Spurious emission of the simultaneous operation has been evaluated and no non-compliance found.
7. The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

### 3.2 DESCRIPTION OF TEST MODES

#### Operated in 5150MHz ~ 5250MHz bands:

Four channels are provided for 802.11a:

CHANNEL	FREQUENCY
36	5180 MHz
40	5200 MHz
44	5220 MHz
48	5240 MHz

### 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL:

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	PLC	RE < 1G	RE ≥ 1G	APCM	
-	√	√	√	√	-

Where **PLC**: Power Line Conducted Emission

**RE < 1G**: Radiated Emission below 1GHz

**RE ≥ 1G**: Radiated Emission above 1GHz

**APCM**: Antenna Port Conducted Measurement

#### POWER LINE CONDUCTED EMISSION TEST:

- ☒ 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)
802.11a	36 to 48	48	OFDM	BPSK	6

#### RADIATED EMISSION TEST (BELOW 1 GHz):

- ☒ 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)
802.11a	36 to 48	48	OFDM	BPSK	6

#### **RADIATED EMISSION TEST (ABOVE 1 GHz):**

- ☒ 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)
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6

#### **CONDUCTED OUT-BAND EMISSION MEASUREMENT:**

- ☒ 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)
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6

#### **ANTENNA PORT CONDUCTED MEASUREMENT:**

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ 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)
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6

#### **TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE <sup>3</sup> 1G	15deg. C, 66%RH, 1024 hPa	120Vac, 60Hz	Frank Liu
RE<1G	16deg. C, 70%RH, 1024 hPa	120Vac, 60Hz	Kent Liu
PLC	21deg. C, 60%RH, 1024 hPa	120Vac, 60Hz	Kyle Huang
APCM	25deg. C, 60%RH, 1024 hPa	120Vac, 60Hz	Rex Huang

### 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart E (15.407)**

**ANSI C63.4-2003**

**ANSI C63.10-2009**

All test items have been performed and recorded as per the above standards.

**NOTE:** The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.



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### 3.4 DESCRIPTION OF SUPPORT UNITS

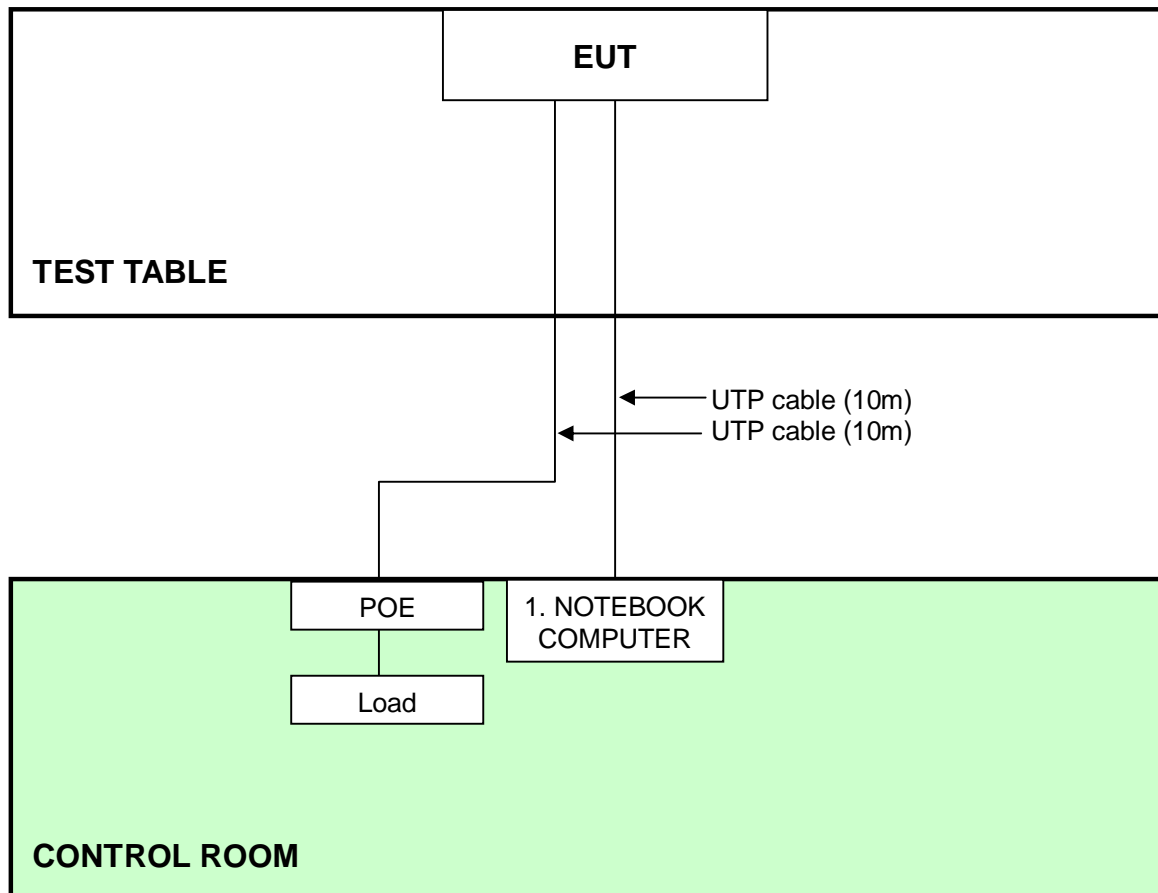
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID
1	NOTEBOOK COMPUTER	DELL	PP32LA	FSLB32S	FCC DoC

No.	Signal cable description
1	UTP Cable (10m)

Note: The power cords of the above support units were unshielded (1.8m).

### 3.5 CONFIGURATION OF SYSTEM UNDER TEST





## 4. TEST TYPES AND RESULTS

### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ 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.

#### 4.1.2 TEST INSTRUMENTS

Test date: May 03, 2011

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver	ESCS 30	100375	Mar. 09, 2011	Mar. 08, 2012
Line-Impedance Stabilization Network (for EUT)	NSLK 8127	8127-522	Sep. 08, 2010	Sep. 07, 2011
Line-Impedance Stabilization Network (for Peripheral)	ESH3-Z5	848773/004	Nov. 03, 2010	Nov. 02, 2011
RF Cable (JYEBAO)	5DFB	COCCAB-002	Aug. 30, 2010	Aug. 29, 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. C.
3. The VCCI Con C Registration No. is C-3611.

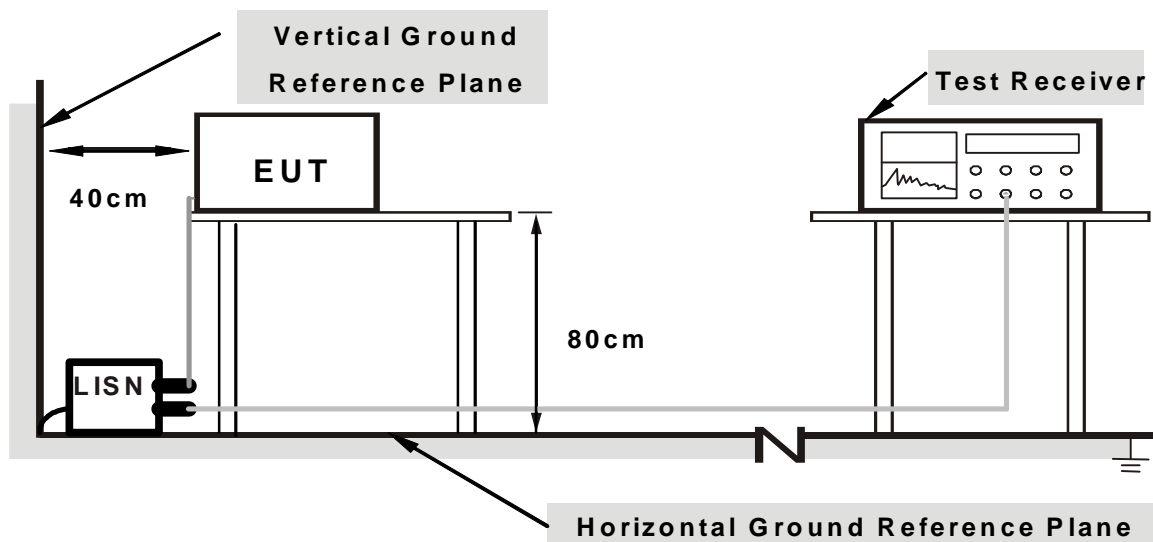
#### 4.1.3 TEST PROCEDURES

- 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
- b. provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- c. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- d. The frequency range from 150kHz to 30MHz was searched. Emission level under (Limit – 20dB) was not recorded.

#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.1.5 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.

#### 4.1.6 EUT OPERATING CONDITIONS

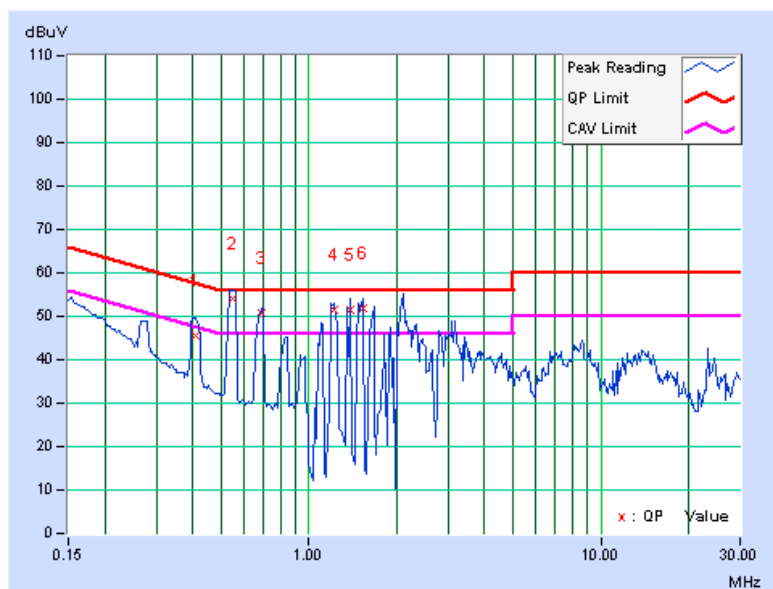
1. Placed the EUT on testing table.
2. Prepared other computer system (support unit 1) to act as communication partner and placed it outside of testing area.
3. The communication partner ran test program “HyperTerminal Command” to enable EUT under transmission/receiving condition continuously via one UTP cable.

## 4.1.7 TEST RESULTS

PHASE	Line (L)	6dB BANDWIDTH	9 kHz
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.408	0.06	45.34	-	45.40	-	57.69	47.69	-12.29	-
2	0.551	0.07	53.89	44.56	53.96	44.63	56.00	46.00	-2.04	-1.37
3	0.689	0.07	50.73	39.24	50.80	39.31	56.00	46.00	-5.20	-6.69
4	1.227	0.10	51.23	36.44	51.33	36.54	56.00	46.00	-4.67	-9.46
5	1.395	0.11	51.24	36.88	51.35	36.99	56.00	46.00	-4.65	-9.01
6	1.527	0.11	51.58	35.56	51.69	35.67	56.00	46.00	-4.31	-10.33

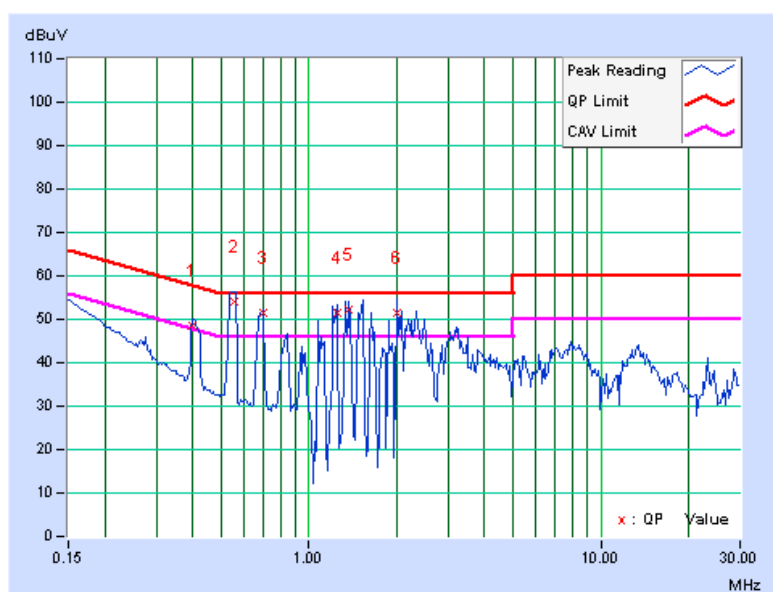
- REMARKS:** 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.  
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.  
3. The emission levels of other frequencies were very low against the limit.  
4. Margin value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



PHASE	Neutral (N)	6dB BANDWIDTH	9 kHz
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	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
No		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.400	0.07	48.34	38.24	48.41	38.31	57.85	47.85	-9.44	-9.54
2	0.554	0.08	54.13	45.26	54.21	45.34	56.00	46.00	-1.79	-0.66
3	0.697	0.08	51.24	39.27	51.32	39.35	56.00	46.00	-4.68	-6.65
4	1.246	0.11	51.33	37.24	51.44	37.35	56.00	46.00	-4.56	-8.65
5	1.371	0.11	52.22	36.13	52.33	36.24	56.00	46.00	-3.67	-9.76
6	2.016	0.14	51.33	32.44	51.47	32.58	56.00	46.00	-4.53	-13.42

- 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.



## 4.2 RADIATED EMISSION MEASUREMENT

### 4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

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.
4. Section 15.205 restricted bands of operation shall compliance with the limits in Section 15.209.

#### 4.2.2 LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

Frequencies (MHz)	EIRP Limit (dBm)	Equivalent Field Strength at 3m (dBμV/m) *note 3
5150~5250	-27	68.3
5250~5350	-27	68.3
5470~5725	-27	68.3
5725~5825	-27 *note 1	68.3
	-17 *note 2	78.3

**NOTE:**

1. For frequencies 10MHz or greater above or below the band edge.
2. All emissions within the frequency range from the band edge to 10MHz above or below the band edge.
3. The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts)}$$



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#### 4.2.3 TEST INSTRUMENTS

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. 14, 2011	Apr. 13, 2012
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. 27, 2010	Dec. 26, 2011
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.



#### 4.2.4 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter 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 height of antenna 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 quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

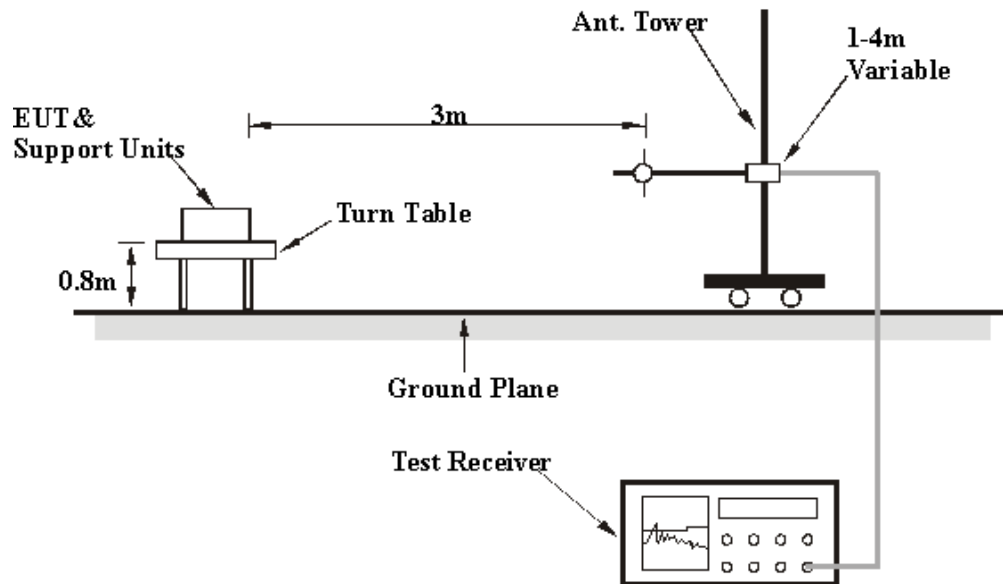
**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 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 10 Hz for Average detection (AV) at frequency above 1GHz.

#### 4.2.5 DEVIATION FROM TEST STANDARD

No deviation

#### 4.2.6 TEST SETUP



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

#### 4.2.7 EUT OPERATING CONDITION

Same as 4.1.6

## 4.2.8 TEST RESULTS

### BELOW 1GHz WORST-CASE DATA : 802.11a OFDM MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 48	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	16deg. C, 70%RH 1024 hPa	TESTED BY	Kent Liu

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	132.11	37.3 QP	43.5	-6.2	1.50 H	123	23.84	13.48
2	153.65	42.2 QP	43.5	-1.3	1.75 H	264	27.97	14.26
3	230.02	36.5 QP	46.0	-9.5	1.50 H	27	24.15	12.38
4	250.03	42.1 QP	46.0	-3.9	1.00 H	289	28.64	13.42
5	294.44	36.6 QP	46.0	-9.4	1.00 H	326	21.33	15.23
6	660.01	34.3 QP	46.0	-11.7	1.00 H	12	11.15	23.17
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	30.62	38.7 QP	40.0	-1.3	1.00 V	124	26.07	12.63
2	47.76	36.4 QP	40.0	-3.6	1.00 V	133	22.21	14.17
3	124.97	38.7 QP	43.5	-4.9	1.00 V	319	25.65	13.00
4	133.26	42.3 QP	43.5	-1.2	1.00 V	300	28.71	13.56
5	250.03	38.4 QP	46.0	-7.7	1.00 V	153	24.93	13.42
6	324.99	43.4 QP	46.0	-2.6	1.50 V	132	27.36	16.01
7	500.02	34.2 QP	46.0	-11.8	1.00 V	244	14.13	20.10

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

## ABOVE 1GHz WORST-CASE DATA

### 802.11a OFDM MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 36	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	15deg. C, 66%RH 1024 hPa	TESTED BY	Frank Liu

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	5150.00	58.0 PK	74.0	-16.0	1.17 H	8	18.06	39.94
2	5150.00	47.1 AV	54.0	-6.9	1.17 H	8	7.16	39.94
3	*5180.00	100.2 PK			1.17 H	8	60.18	40.02
4	*5180.00	91.4 AV			1.17 H	8	51.38	40.02
5	#10360.00	56.2 PK	68.3	-12.1	1.00 H	24	9.67	46.53
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	5150.00	66.7 PK	74.0	-7.3	1.00 V	152	26.76	39.94
2	5150.00	52.3 AV	54.0	-1.7	1.00 V	152	12.36	39.94
3	*5180.00	110.3 PK			1.00 V	146	70.28	40.02
4	*5180.00	100.1 AV			1.00 V	146	60.08	40.02
5	#10360.00	56.7 PK	68.3	-11.6	1.00 V	36	10.17	46.53

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. " \* ": Fundamental frequency.
  6. "#":The radiated frequency is out the restricted band.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 40	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	15deg. C, 66%RH 1024 hPa	TESTED BY	Frank Liu

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	*5200.00	100.1 PK			1.17 H	16	60.03	40.07
2	*5200.00	91.1 AV			1.17 H	16	51.03	40.07
3	#10400.00	56.1 PK	68.3	-12.2	1.00 H	12	9.53	46.57
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	*5200.00	109.9 PK			1.00 V	124	69.83	40.07
2	*5200.00	99.8 AV			1.00 V	124	59.73	40.07
3	#10400.00	56.4 PK	68.3	-11.9	1.00 V	57	9.83	46.57

**REMARKS:** 1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).  
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).  
3. The other emission levels were very low against the limit.  
4. Margin value = Emission level – Limit value.  
5. “ \* “: Fundamental frequency.  
6. “#”:The radiated frequency is out the restricted band.



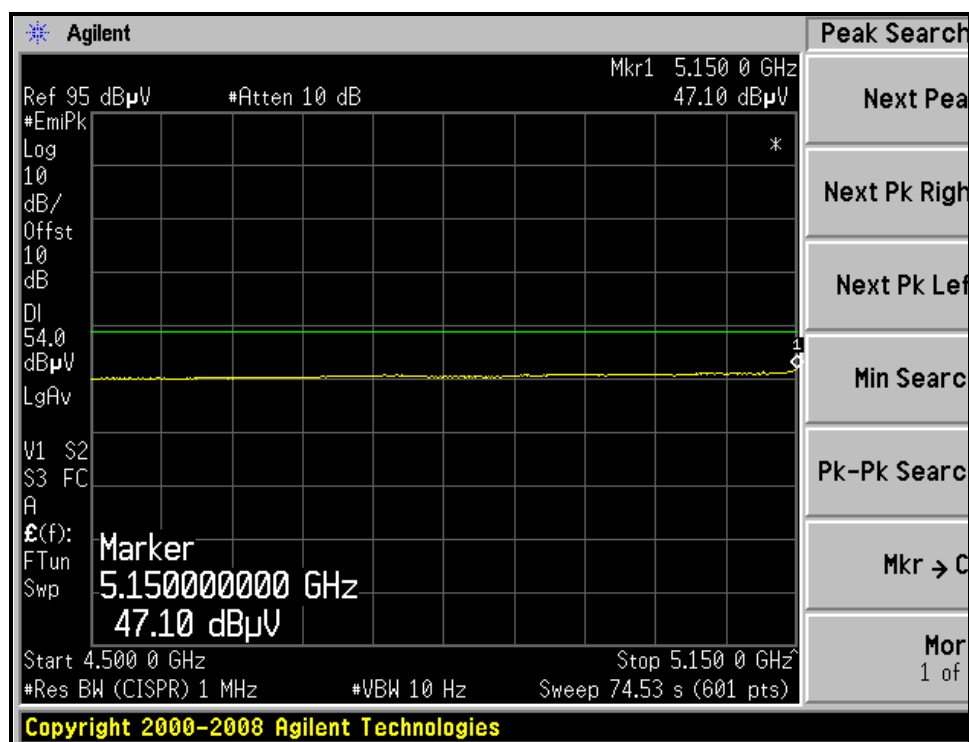
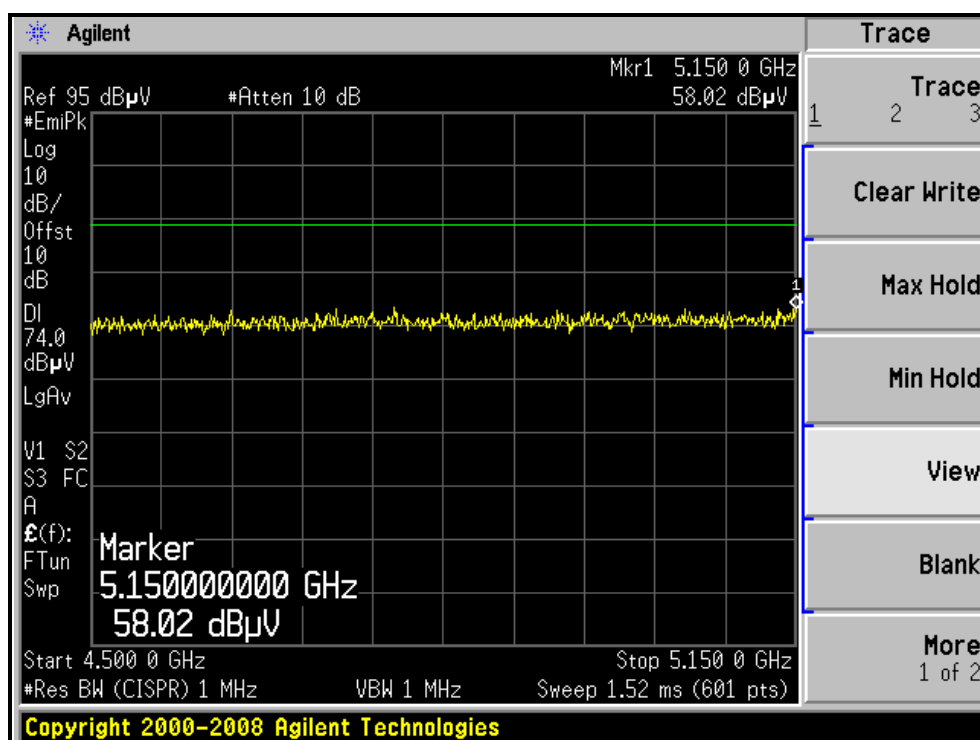
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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 48	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	15deg. C, 66%RH 1024 hPa	TESTED BY	Frank Liu

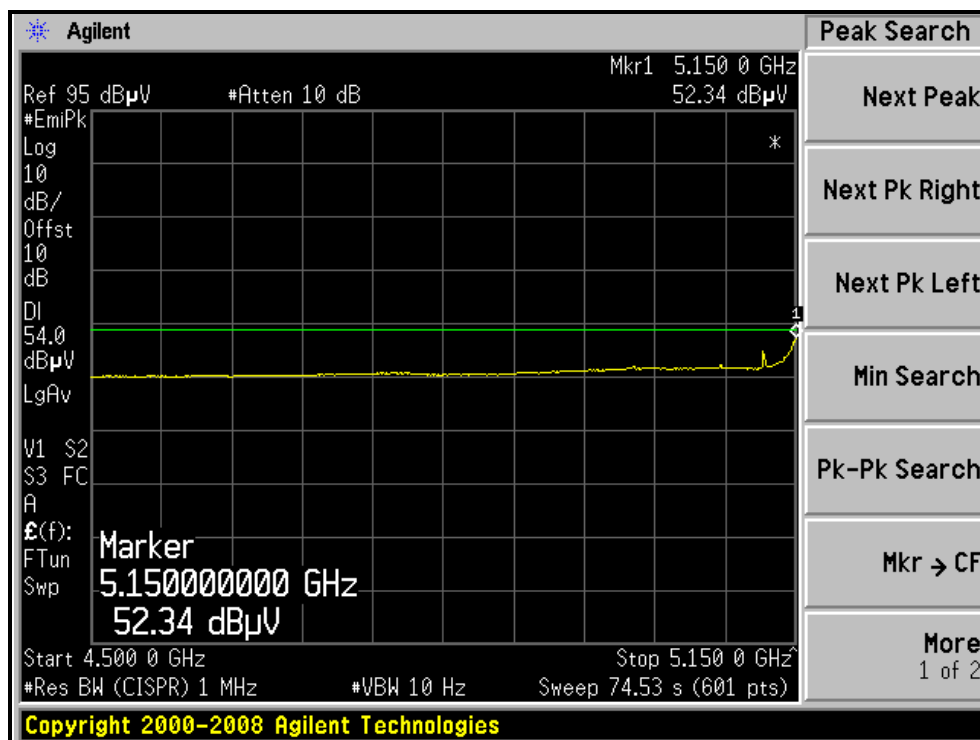
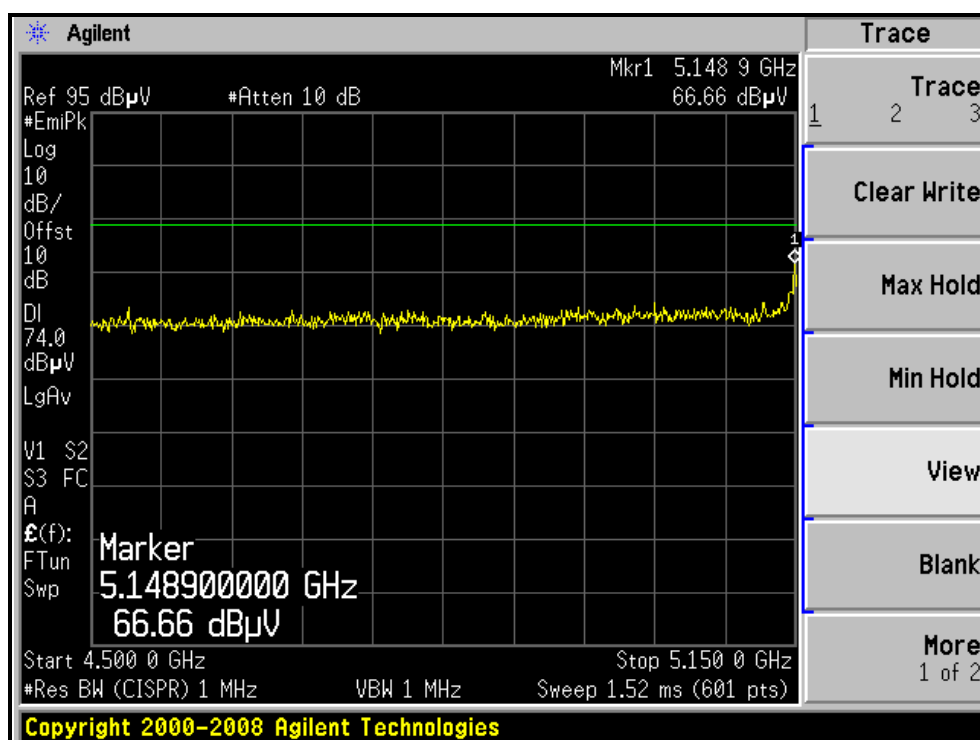
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	99.9 PK			1.16 H	0	59.73	40.17
2	*5240.00	90.7 AV			1.16 H	0	50.53	40.17
3	5350.00	56.6 PK	74.0	-17.4	1.16 H	0	16.13	40.47
4	5350.00	46.2 AV	54.0	-7.8	1.16 H	0	5.73	40.47
5	#10480.00	56.3 PK	68.3	-12.0	1.00 H	54	9.63	46.67
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	*5240.00	109.3 PK			1.00 V	129	69.13	40.17
2	*5240.00	99.4 AV			1.00 V	129	59.23	40.17
3	5440.00	60.2 PK	74.0	-13.8	1.00 V	129	19.49	40.71
4	5440.00	52.3 AV	54.0	-1.7	1.00 V	129	11.59	40.71
5	#10480.00	56.3 PK	68.3	-12.0	1.00 V	24	9.63	46.67

- REMARKS:** 1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).  
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).  
3. The other emission levels were very low against the limit.  
4. Margin value = Emission level – Limit value.  
5. “ \* “: Fundamental frequency.  
6. “#”:The radiated frequency is out the restricted band.

# RESTRICTED BANDEDGE (802.11a MODE, CH36, HORIZONTAL)

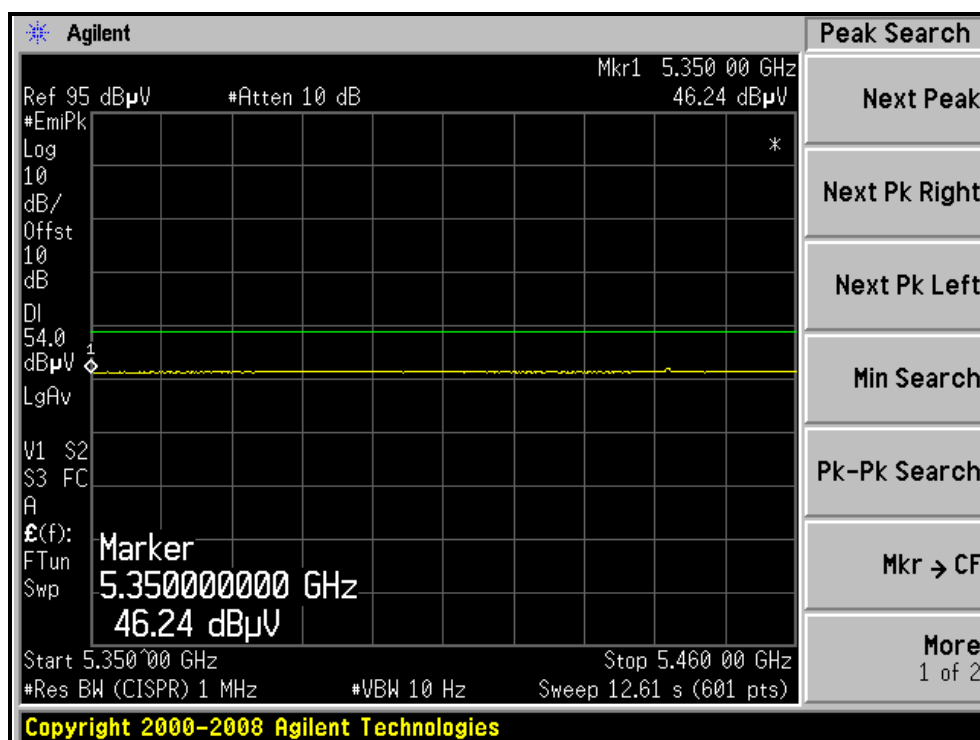
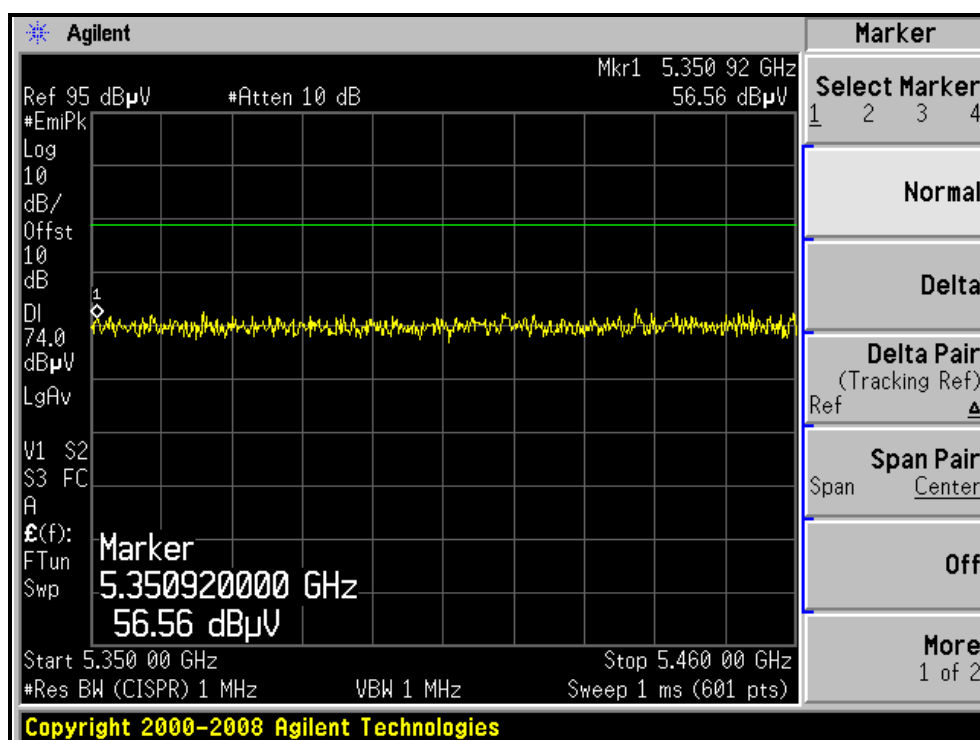


# RESTRICTED BANDEDGE (802.11a MODE, CH36, VERTICAL)

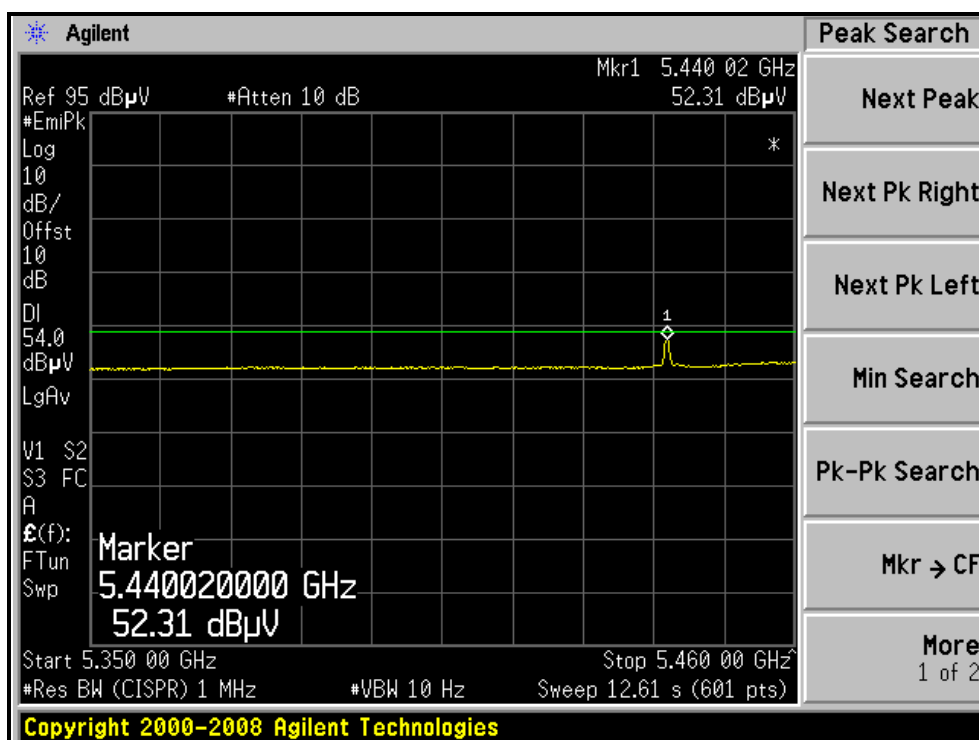
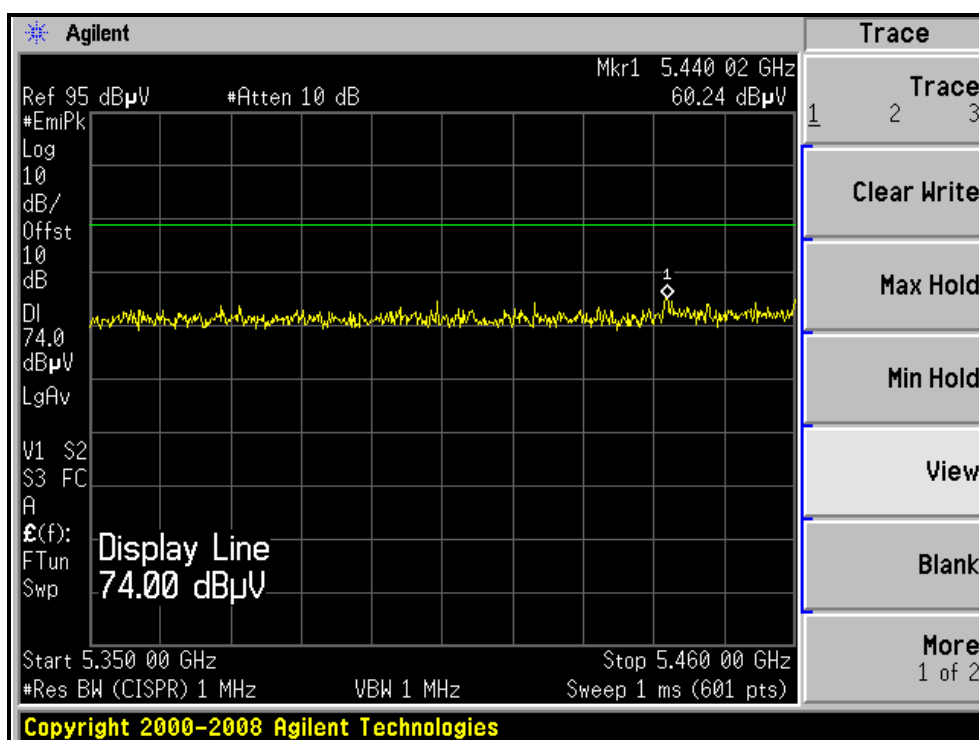




# RESTRICTED BANDEDGE (802.11a MODE, CH48, HORIZONTAL)



# RESTRICTED BANDEDGE (802.11a MODE, CH48, VERTICAL)





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### 4.3 OUTPUT TRANSMIT POWER MEASUREMENT

#### 4.3.1 LIMITS OF Output TRANSMIT POWER MEASUREMENT

Frequency Band	Limit
5.15 – 5.25GHz	The lesser of 50mW (17dBm) or 4dBm + 10logB
5.25 – 5.35GHz	The lesser of 250mW (24dBm) or 11dBm + 10logB
5.47 – 5.725GHz	The lesser of 250mW (24dBm) or 11dBm + 10logB
5.725 – 5.825GHz	The lesser of 1W (30dBm) or 17dBm + 10logB

**NOTE:** Where B is the 26dB emission bandwidth in MHz.

#### 4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	E4446A	MY48250254	July 14, 2010	July 13, 2011

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

#### 4.3.3 TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer.
2. Set span to encompass the entire emission bandwidth of the signal.
3. Set RBW to 1MHz, VBW to 3MHz.
4. Using the spectrum analyzer's channel power measurement function to measure the output power.

**NOTE:**

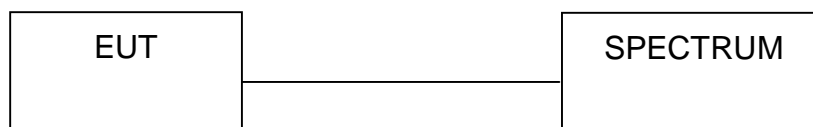
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

#### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.3.5 TEST SETUP



#### 4.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

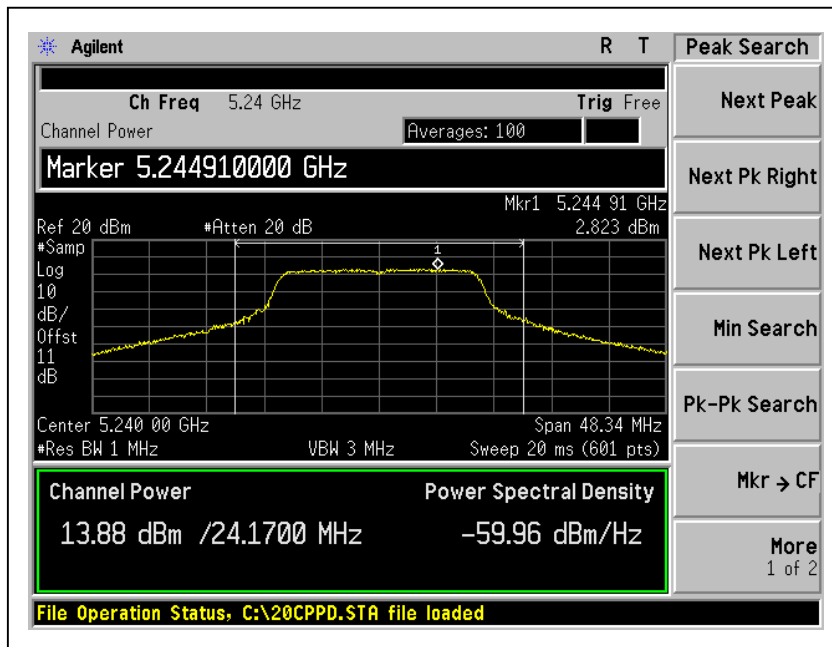
#### 4.3.7 TEST RESULTS

##### 802.11a OFDM MODULATION:

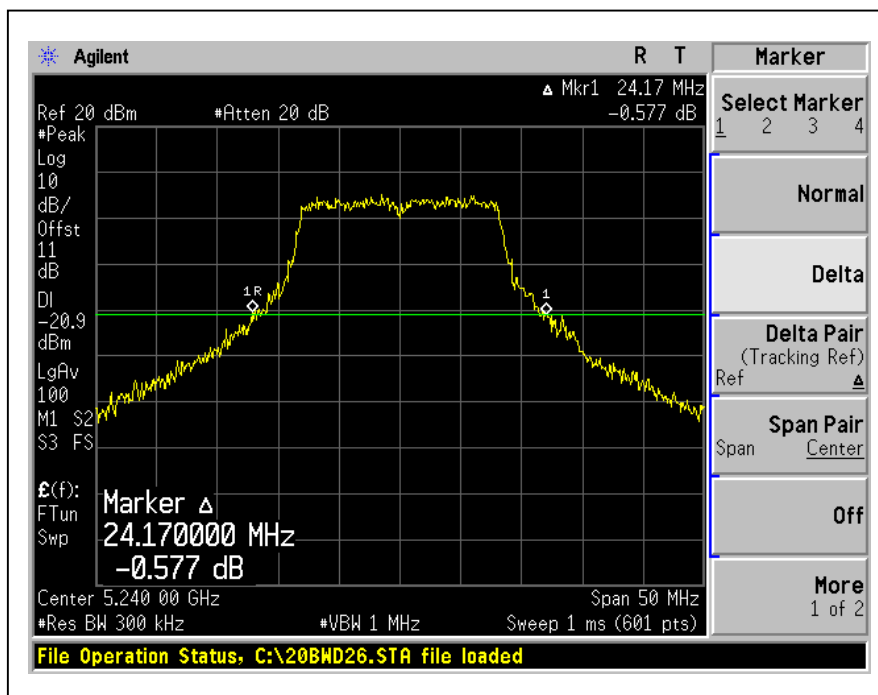
CHANNEL	CHANNEL FREQUENCY (MHz)	TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	PEAK POWER LIMIT (dBm)	26dBc Occupied Bandwidth (MHz)	PASS / FAIL
36	5180	24.0	13.8	15.9	24.0	PASS
40	5200	20.4	13.1	15.9	23.58	PASS
48	5240	24.5	13.9	15.9	24.17	PASS

**NOTE:** The 26dBc Occupied Bandwidth plot, please refer to the following pages.

## Power Output: CH48



## 26dB Occupied Bandwidth: CH48



## 4.4 PEAK POWER EXCURSION MEASUREMENT

### 4.4.1 LIMITS OF PEAK POWER EXCURSION MEASUREMENT

Frequency Band	Limit
5.15 – 5.25 GHz	13dB
5.25 – 5.35 GHz	13dB
5.47 – 5.725GHz	13dB
5.725 – 5.825 GHz	13dB

### 4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	E4446A	MY48250254	July 14, 2010	July 13, 2011

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

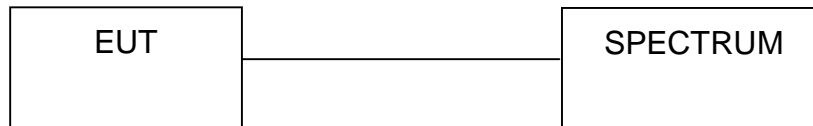
### 4.4.3 TEST PROCEDURE

1. Connect the cable from the spectrum analyzer to the EUT antenna port using an appropriate RF attenuator.
2. Verify the antenna port selected is the active one if the system has more than one antenna.
3. Verify the unlicensed wireless device is set to operate at 100 % duty cycle at the maximum allowed power for operation.
4. Testing shall be done on the center frequency of each U-NII band.
5. Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be 13 dB for all frequencies across the emission bandwidth.
  - a. First trace: set RBW = 1 MHz, VBW = 3 MHz with peak detector and max hold settings.
  - b. Second trace: set RBW = 1 MHz, VBW = 3 MHz with sample detector and trace average across 100 traces in power averaging mode.

### 4.4.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.4.5 TEST SETUP



#### 4.4.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

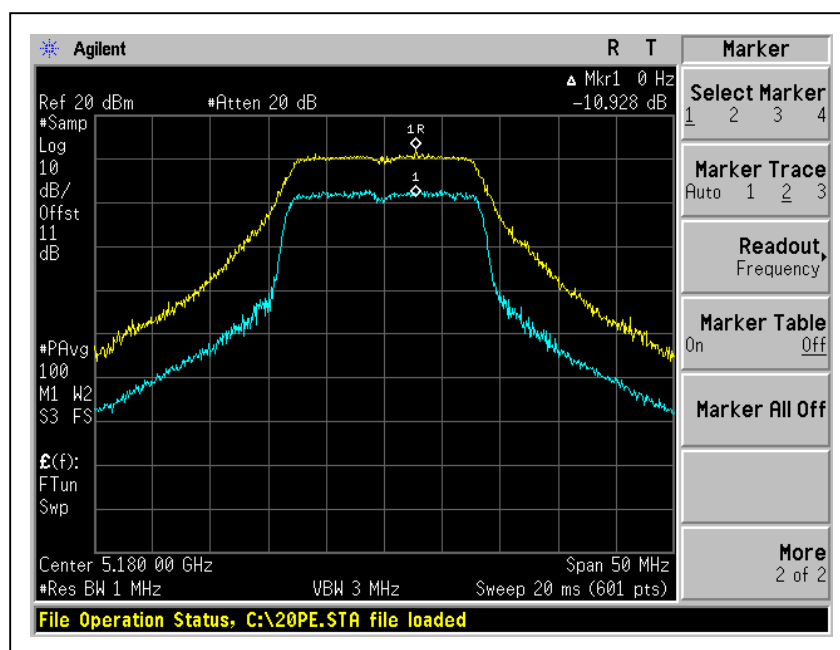


#### 4.4.7 TEST RESULTS

##### 802.11a OFDM MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER EXCURSION (dB)	PEAK to AVERAGE EXCURSION LIMIT (dB)	PASS/FAIL
36	5180	10.9	13	PASS
40	5200	10.1	13	PASS
48	5240	9.7	13	PASS

#### CH36



## 4.5 PEAK POWER SPECTRAL DENSITY MEASUREMENT

### 4.5.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT

Frequency Band	Limit
5.15 ~ 5.25GHz	4dBm
5.25 ~ 5.35GHz	11dBm
5.47 ~ 5.725GHz	11dBm
5.725 ~ 5.825GHz	17dBm

### 4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	E4446A	MY48250254	July 14, 2010	July 13, 2011

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

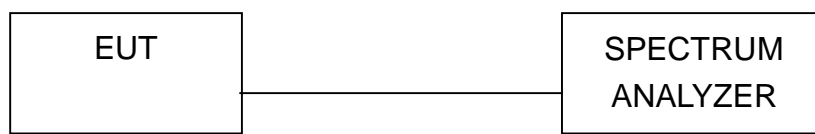
#### 4.5.3 TEST PROCEDURES

1. The transmitter output was connected to the spectrum analyzer.
2. Set RBW=1MHz, VBW=3MHz. The PPSD is the highest level found across the emission in any 1MHz band.

#### 4.5.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.5.5 TEST SETUP



#### 4.5.6 EUT OPERATING CONDITIONS

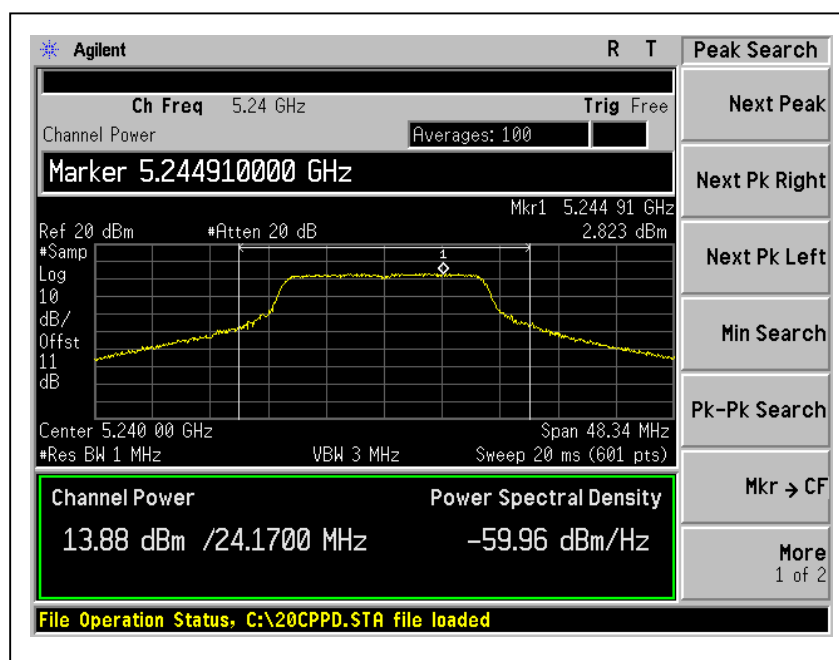
Same as 4.3.6

## 4.5.7 TEST RESULTS

### 802.11a OFDM MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	TOTAL POWER DENSITY (dBm)	MAXIMUM LIMIT (dBm)	PASS / FAIL
36	5180	2.8	4	PASS
40	5200	2.4	4	PASS
48	5240	2.8	4	PASS

### CH48



## 4.6 FREQUENCY STABILITY

### 4.6.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within the band of the operating frequency over a temperature variation of –30 degrees to 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

### 4.6.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	FSP 40	100060	May 17, 2010	May 16, 2011

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

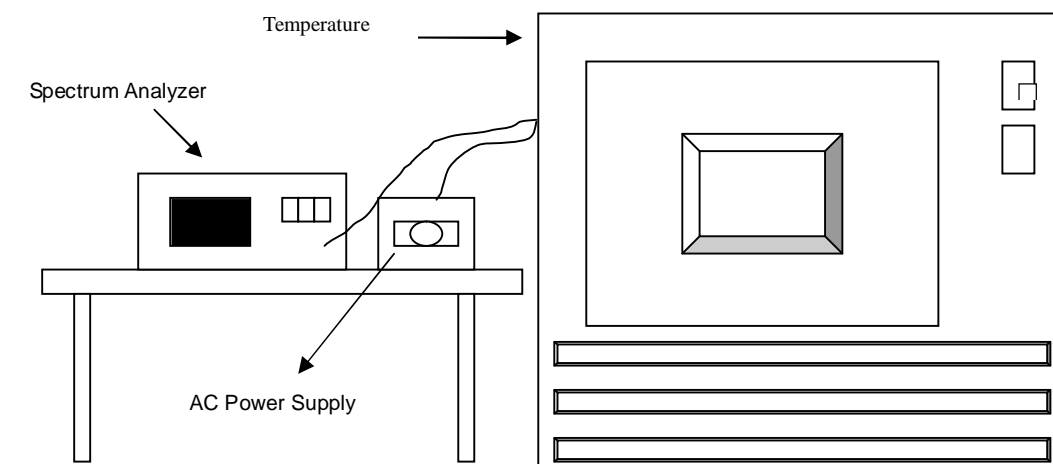
### 4.6.3 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

#### 4.6.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.6.5 TEST SETUP



#### 4.6.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

#### 4.6.7 TEST RESULTS

Operating frequency: 5180MHz									
Temp. (°C)	Power supply (VAC)	0 minute		2 minute		5 minute		10 minute	
		(MHz)	(%)	(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
50	138	5179.9949	-0.9846	5179.9984	-0.3089	5179.995	-0.9653	5179.9927	-1.4093
	120	5179.9952	-0.9266	5179.999	-0.1931	5179.9958	-0.8108	5179.992	-1.5444
	102	5179.9943	-1.1004	5179.9974	-0.5019	5179.9961	-0.7529	5179.993	-1.3514
40	138	5180.0182	3.5135	5180.0164	3.1660	5180.0166	3.2046	5180.0186	3.5907
	120	5180.0165	3.1853	5180.0163	3.1467	5180.0163	3.1467	5180.0174	3.3591
	102	5180.0165	3.1853	5180.0167	3.2239	5180.0161	3.1081	5180.0174	3.3591
30	138	5180.0033	0.6371	5180.0048	0.9266	5180.0087	1.6795	5180.0055	1.0618
	120	5180.0035	0.6757	5180.004	0.7722	5180.0089	1.7181	5180.0063	1.2162
	102	5180.0037	0.7143	5180.0056	1.0811	5180.0082	1.5830	5180.0057	1.1004
20	138	5180.0062	1.1969	5180.001	0.1931	5179.9974	-0.5019	5180.0008	0.1544
	120	5180.0061	1.1776	5180.0015	0.2896	5179.9976	-0.4633	5180.002	0.3861
	102	5180.0057	1.1004	5180.001	0.1931	5179.9963	-0.7143	5180.001	0.1931
10	138	5180.0039	0.7529	5180.0082	1.5830	5180.0135	2.6062	5180.013	2.5097
	120	5180.0036	0.6950	5180.0078	1.5058	5180.0119	2.2973	5180.012	2.3166
	102	5180.0035	0.6757	5180.0078	1.5058	5180.0135	2.6062	5180.0124	2.3938
0	138	5180.0053	1.0232	5180.0024	0.4633	5179.9977	-0.4440	5180.0009	0.1737
	120	5180.0065	1.2548	5180.0018	0.3475	5179.999	-0.1931	5180.0002	0.0386
	102	5180.0069	1.3320	5180.0022	0.4247	5179.9987	-0.2510	5180.0016	0.3089
-10	138	5179.9853	-2.8378	5179.9866	-2.5869	5179.9899	-1.9498	5179.9898	-1.9691
	120	5179.9855	-2.7992	5179.9877	-2.3745	5179.9895	-2.0270	5179.99	-1.9305
	102	5179.9856	-2.7799	5179.987	-2.5097	5179.9906	-1.8147	5179.9896	-2.0077
-20	138	5179.9827	-3.3398	5179.9845	-2.9923	5179.9854	-2.8185	5179.9835	-3.1853
	120	5179.9835	-3.1853	5179.9827	-3.3398	5179.9859	-2.7220	5179.983	-3.2819
	102	5179.982	-3.4749	5179.9828	-3.3205	5179.9862	-2.6641	5179.9828	-3.3205
-30	138	5179.9845	-2.9923	5179.9866	-2.5869	5179.9904	-1.8533	5179.995	-0.9653
	120	5179.9844	-3.0116	5179.9878	-2.3552	5179.9901	-1.9112	5179.994	-1.1583
	102	5179.9854	-2.8185	5179.9865	-2.6062	5179.9898	-1.9691	5179.9947	-1.0232



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## 4.7 CONDUCTED OUT-BAND EMISSION MEASUREMENT

### 4.7.1 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer	FSP 40	100060	May 17, 2010	May 16, 2011

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

### 4.7.2 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low loss cable. Set RBW of spectrum analyzer to 1MHz with suitable frequency span including 100MHz or 200MHz bandwidth from band edge. The band edges was measured and recorded.

### 4.7.3 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

### 4.7.4 TEST RESULTS

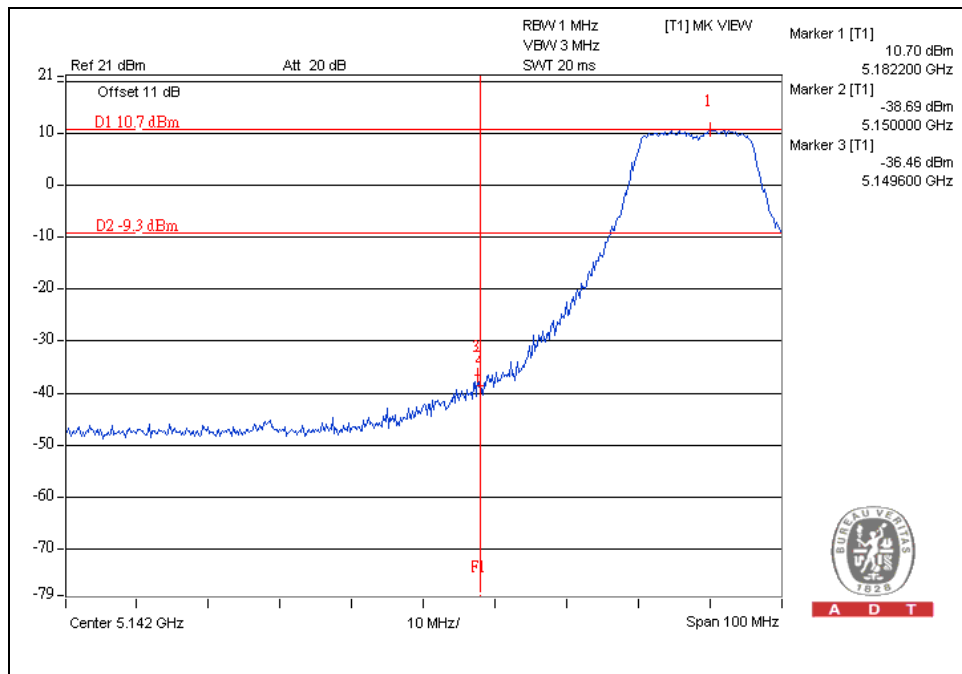
For 5.15 to 5.25GHz band:

The spectrum plots (Peak RBW=1MHz, VBW=3MHz) are attached on the following pages.

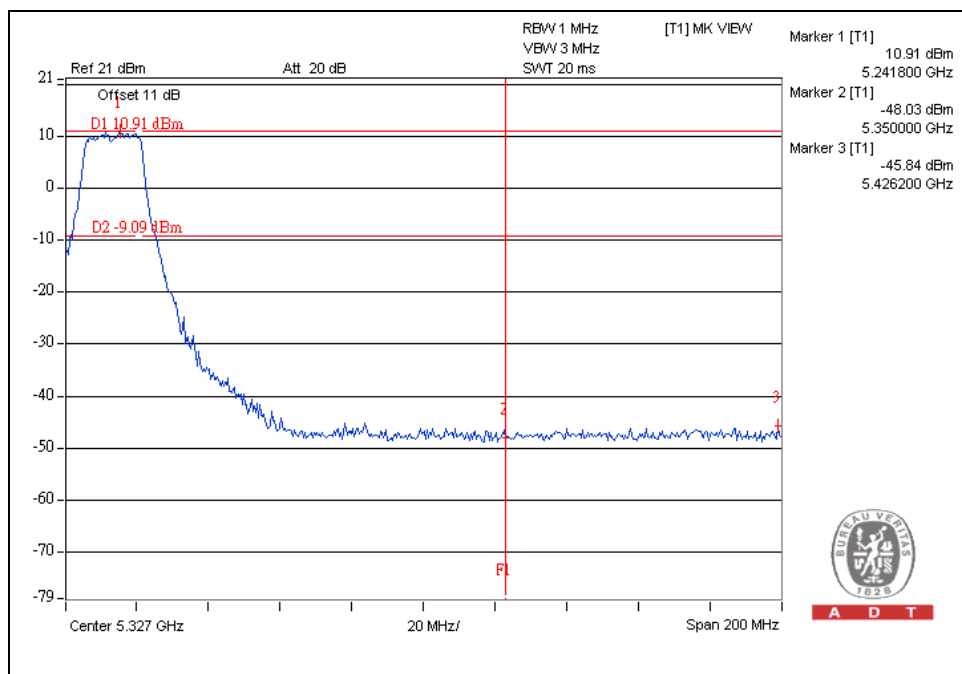


## 802.11a OFDM MODULATION

### CH 36



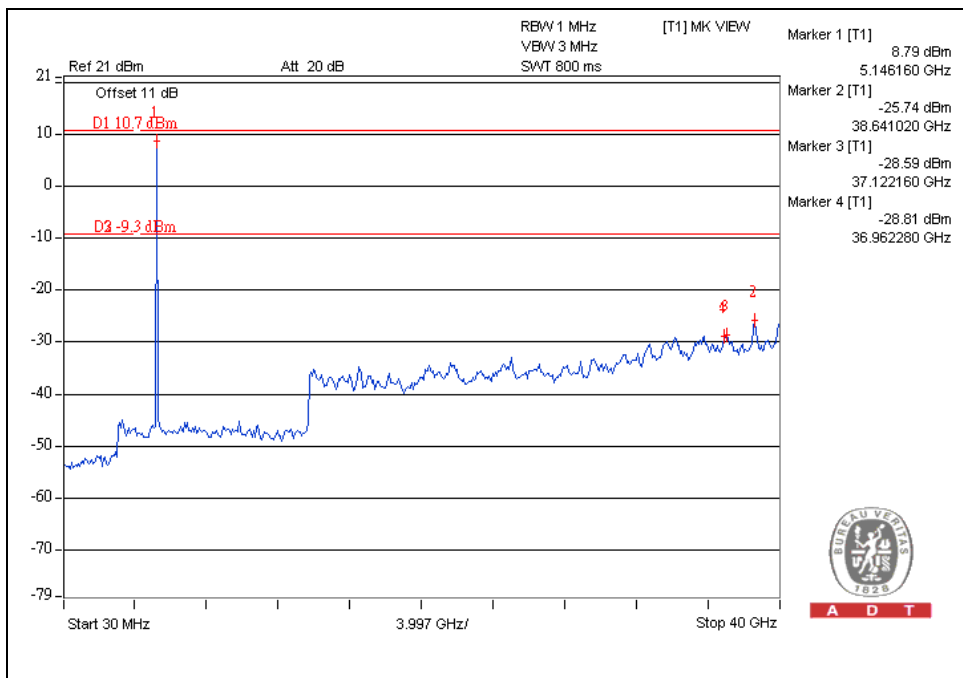
### CH 48





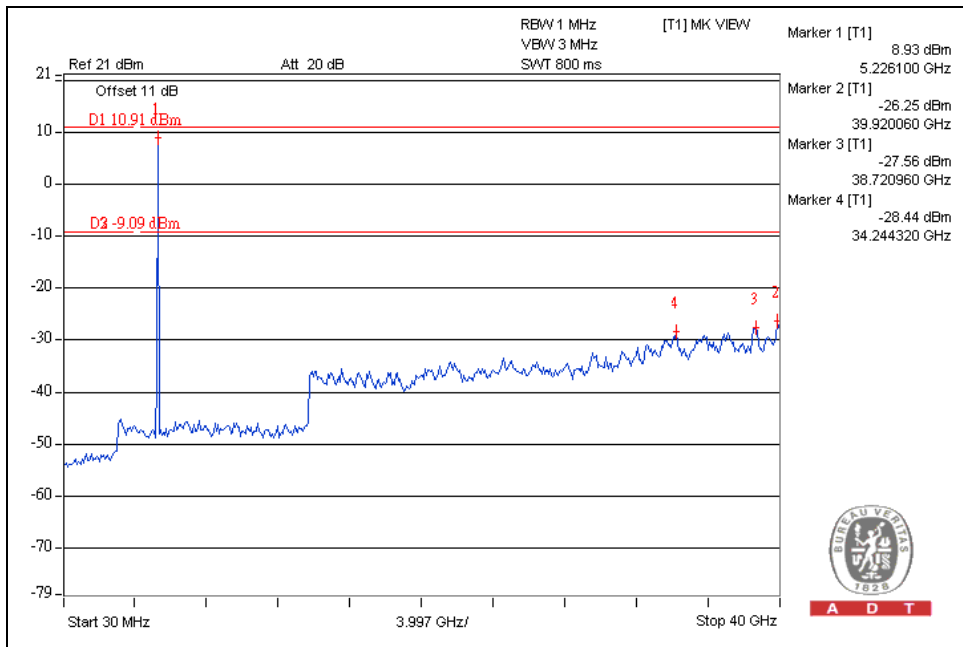
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## CH 36



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## CH 48



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## 5. 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](http://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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**Web Site:** [www.adt.com.tw](http://www.adt.com.tw)

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



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## **6.APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications are made to the EUT by the lab during the test.