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# FCC TEST REPORT (15.247)

**REPORT NO.:** RF111005C22A  
**MODEL NO.:** EMP7618  
(Refer to item 3.1 for more details)  
**FCC ID:** TVE-0120201  
**RECEIVED:** Mar. 07, 2013  
**TESTED:** Mar. 11 ~ May 09, 2013  
**ISSUED:** May 13, 2013

**APPLICANT:** Fortinet, Inc.

**ADDRESS:** 1090 Kifer Road Sunnyvale, CA 94086, USA

**ISSUED BY:** Bureau Veritas Consumer Products Services  
(H.K.) Ltd., Taoyuan Branch

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**TEST LOCATION:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei  
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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF111005C22A	Original release	May 13, 2013



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## 1. CERTIFICATION

**PRODUCT:** 802.11 abgn RF Module Card  
**MODEL NO.:** EMP7618 (Refer to item 3.1 for more details)  
**BRAND:** Fortinet  
**APPLICANT:** Fortinet, Inc.  
**TESTED:** Mar. 11 ~ May 09, 2013  
**TEST SAMPLE:** ENGINEERING SAMPLE  
**STANDARDS:** **FCC Part 15, Subpart C (Section 15.247)**  
ANSI C63.10-2009

The above equipment (model: EMP7618) 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 :** Polly Chien , **DATE :** May 13, 2013  
Polly Chien / Specialist

**APPROVED BY :** Ken Liu , **DATE :** May 13, 2013  
Ken Liu / Senior Manager



## 2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -7.83dB at 0.49324MHz.
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -1.0dB at 11490.00MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is RSMA not a standard connector.

### 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:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	3.19 dB
	200MHz ~1000MHz	3.21 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

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



### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>EUT</b>	802.11 abgn RF Module Card
<b>MODEL NO.</b>	EMP7618 (Refer to Note for more details)
<b>NOMINAL VOLTAGE</b>	3.3Vdc (host equipment)
<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>	802.11b:11.0/ 5.5/ 2.0/ 1.0Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 300.0Mbps
<b>OPERATING FREQUENCY</b>	<b>2.4GHz:</b> 2412 ~ 2462MHz <b>5.0GHz:</b> 5745 ~ 5825MHz
<b>NUMBER OF CHANNEL</b>	<b>2.4GHz:</b> 11 for 802.11b, 802.11g, 802.11n (20MHz) 7 for 802.11n (40MHz) <b>5.0GHz:</b> 5 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz)
<b>OUTPUT POWER</b>	425.202mW for 2412 ~ 2462MHz 210.958mW for 5745 ~ 5825MHz
<b>ANTENNA TYPE</b>	Refer to note as below
<b>ANTENNA CONNECTOR</b>	RSMA
<b>DATA CABLE</b>	NA
<b>I/O PORTS</b>	Refer to user's manual
<b>ACCESSORY DEVICES</b>	NA

**NOTE:**

1. This report is issued as a supplementary report of original report no.: RF111005C22.
2. This report is prepared for FCC class II permissive change. The difference is adding new antenna. Therefore, all relevant items had been re-tested and recorded in this test report.
3. The following models are electrically identical, different model names are for marketing purpose.

BRAND	MODEL
Fortinet	EMP7618
Fortinet	EMP7618-FT

\* The model of the EMP7618 was chosen for final test.



4. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

MODULATION MODE	TX FUNCTION
802.11b	2TX
802.11g	2TX
802.11a	2TX
802.11n (20MHz)	2TX
802.11n (40MHz)	2TX

5. The following antennas are used in this EUT.

**Original antennas**

SET	TRANSMITTER CIRCUIT	TYPE	CONNECTOR	GAIN (dBi)	
				2.4GHz	5 GHz
1	Chain (0)	Dipole	RSMA	2	4.5
	Chain (1)			2	4.5
2	Chain (0)	Dipole		2	1
	Chain (1)			2	1
3	Chain (0)	Dipole		2	2
	Chain (1)			2	2

\* For original report, the set 1 was chosen for final test.

**New antennas**

SET	TRANSMITTER CIRCUIT	TYPE	CONNECTOR	GAIN (dBi)	
				2.4GHz	5 GHz
1	Chain (0)	Dipole	RSMA	3	6
	Chain (1)			3	6
2	Chain (0)	Dipole		2	1
	Chain (1)			2	1
3	Chain (0)	Dipole		2	3
	Chain (1)			2	3

\* For this test report, the set 1 was chosen for final test.

6. The above EUT information is declared by the manufacturer and for more detailed feature description, please refer to the manufacturer's specifications or User's Manual.



### 3.2 DESCRIPTION OF TEST MODES

#### FOR 2.4GHz:

11 channels are provided for 802.11b, 802.11g and 802.11n (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz		

7 channels are provided for 802.11n (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz		

#### FOR 5.0GHz (5745 ~ 5825MHz):

5 channels are provided for 802.11a, 802.11n (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz		

2 channels are provided for 802.11n (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
151	5755MHz	159	5795MHz



### 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

#### FOR 2.4GHz:

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

Where **RE≥1G**: Radiated Emission above 1GHz      **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission      **APCM**: Antenna Port Conducted Measurement

**NOTE:** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.

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

- 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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (20MHz)	1 to 11	1, 6, 11	OFDM	BPSK	7.2
-	802.11n (40MHz)	3 to 9	3, 6, 9	OFDM	BPSK	15.0

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

- 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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11g	1 to 11	6	OFDM	BPSK	6.0

#### 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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11g	1 to 11	6	OFDM	BPSK	6.0



**BANDEDGE 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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 11	OFDM	BPSK	6.0
-	802.11n (20MHz)	1 to 11	1, 11	OFDM	BPSK	7.2
-	802.11n (40MHz)	3 to 9	3, 9	OFDM	BPSK	15.0

**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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (20MHz)	1 to 11	1, 6, 11	OFDM	BPSK	7.2
-	802.11n (40MHz)	3 to 9	3, 6, 9	OFDM	BPSK	15.0

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Brad Wu
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Brad Wu
PLC	25deg. C, 65%RH	120Vac, 60Hz	Brad Wu
APCM	25deg. C, 60%RH	120Vac, 60Hz	Antony Lee



**FOR 5.0GHz (5745 ~ 5825MHz):**

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

Where **RE≥1G**: Radiated Emission above 1GHz      **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission      **APCM**: Antenna Port Conducted Measurement

**NOTE:** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Z-plane.

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

- 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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-	802.11n (20MHz)	149 to 165	149, 157, 165	OFDM	BPSK	7.2
-	802.11n (40MHz)	151 to 159	151, 159	OFDM	BPSK	15.0

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

- 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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11n (40MHz)	151 to 159	159	OFDM	BPSK	15.0

**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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11n (40MHz)	151 to 159	159	OFDM	BPSK	15.0



**BANDEDGE 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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	149 to 165	149, 165	OFDM	BPSK	6.0
-	802.11n (20MHz)	149 to 165	149, 165	OFDM	BPSK	7.2
-	802.11n (40MHz)	151 to 159	151, 159	OFDM	BPSK	15.0

**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.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-	802.11n (20MHz)	149 to 165	149, 157, 165	OFDM	BPSK	7.2
-	802.11n (40MHz)	151 to 159	151, 159	OFDM	BPSK	15.0

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Brad Wu
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Brad Wu
PLC	25deg. C, 65%RH	120Vac, 60Hz	Brad Wu
APCM	25deg. C, 60%RH	120Vac, 60Hz	Antony Lee

### 3.3 DESCRIPTION OF SUPPORT UNITS

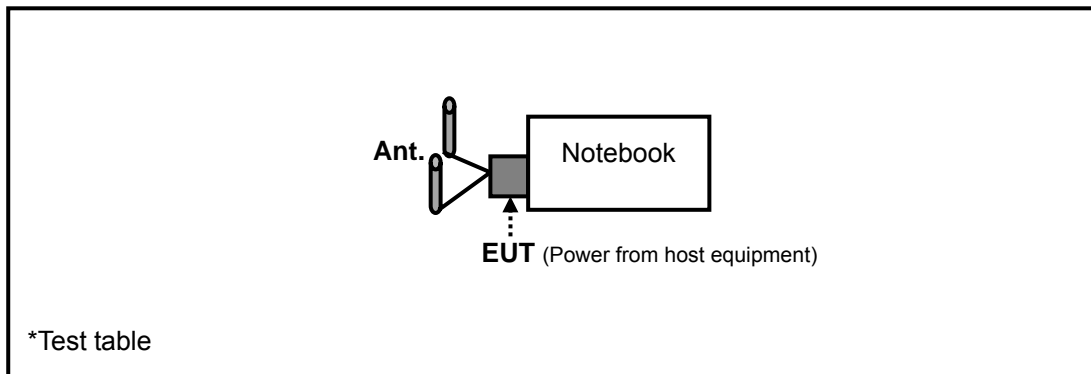
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK	DELL	E5420	33MLMQ1	FCC DoC Approved

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

**NOTE:** All power cords of the above support units are non-shielded (1.8 m).

#### 3.3.1 CONFIGURATION OF SYSTEM UNDER TEST





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### 3.4 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 C (15.247)**

**558074 D01 DTS Meas Guidance v02**

**662911 D01 Multiple Transmitter Output v01 r02**

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.





## 4. TEST TYPES AND RESULTS (FOR 2.4GHz BAND)

### 4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

#### 4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

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. 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.



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#### 4.1.2 TEST INSTRUMENTS

Tested date: Mar. 11 ~ Mar. 13, 2013

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESIB7	100212	Aug. 06, 2012	Aug. 05, 2013
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Jan. 31, 2013	Jan. 30, 2014
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Apr. 06, 2012	Apr. 05, 2013
HORN Antenna SCHWARZBECK	9120D	209	Sep. 03, 2012	Sep. 02, 2013
HORN Antenna SCHWARZBECK	BBHA 9170	148	Jul. 11, 2012	Jul. 10, 2013
Loop Antenna	HFH2-Z2	100070	Jan. 31, 2012	Jan. 30, 2014
Preamplifier Agilent	8447D	2944A10633	Oct. 25, 2012	Oct. 24, 2013
Preamplifier Agilent	8449B	3008A01964	Oct. 25, 2012	Oct. 24, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250723/4	Aug. 28, 2012	Aug. 27, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 106	12738/6+309224/ 4	Aug. 28, 2012	Aug. 27, 2013
Software ADT.	ADT_Radiated_ V7.6.15.9.2	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller inn-co GmbH	CO2000	017303	NA	NA
Turn Table ADT.	TT100	TT93021703	NA	NA
Turn Table Controller ADT.	SC100	SC93021703	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 25, 2012	Oct. 24, 2013
High Speed Peak Power Meter	ML2495A	0842014	Apr. 28, 2012	Apr. 27, 2013
Power Sensor	MA2411B	0738404	Apr. 28, 2012	Apr. 27, 2013

- 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 calibration interval of the loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. The test was performed in HwaYa Chamber 3.
  4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
  5. The FCC Site Registration No. is 988962.
  6. The IC Site Registration No. is IC 7450F-3.



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Tested date: May 09, 2013

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESIB7	100212	Aug. 06, 2012	Aug. 05, 2013
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Jan. 31, 2013	Jan. 30, 2014
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Mar. 20, 2013	Mar. 19, 2014
HORN Antenna SCHWARZBECK	9120D	209	Sep. 03, 2012	Sep. 02, 2013
HORN Antenna SCHWARZBECK	BBHA 9170	148	Jul. 11, 2012	Jul. 10, 2013
Loop Antenna	HFH2-Z2	100070	Jan. 31, 2012	Jan. 30, 2014
Preamplifier Agilent	8447D	2944A10633	Oct. 25, 2012	Oct. 24, 2013
Preamplifier Agilent	8449B	3008A01964	Oct. 25, 2012	Oct. 24, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250723/4	Aug. 28, 2012	Aug. 27, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 106	12738/6+309224/ 4	Aug. 28, 2012	Aug. 27, 2013
Software BV ADT	ADT_Radiated_ V7.6.15.9.2	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller inn-co GmbH	CO2000	017303	NA	NA
Turn Table BV ADT	TT100	TT93021703	NA	NA
Turn Table Controller BV ADT	SC100	SC93021703	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 25, 2012	Oct. 24, 2013
High Speed Peak Power Meter	ML2495A	0842014	Apr. 25, 2013	Apr. 24, 2014
Power Sensor	MA2411B	0738404	Apr. 24, 2013	Apr. 23, 2014

- 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 calibration interval of the loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. The test was performed in HwaYa Chamber 3.
  4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
  5. The FCC Site Registration No. is 988962.
  6. The IC Site Registration No. is IC 7450F-3.



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#### 4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters semi-anechoic chamber. 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 lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

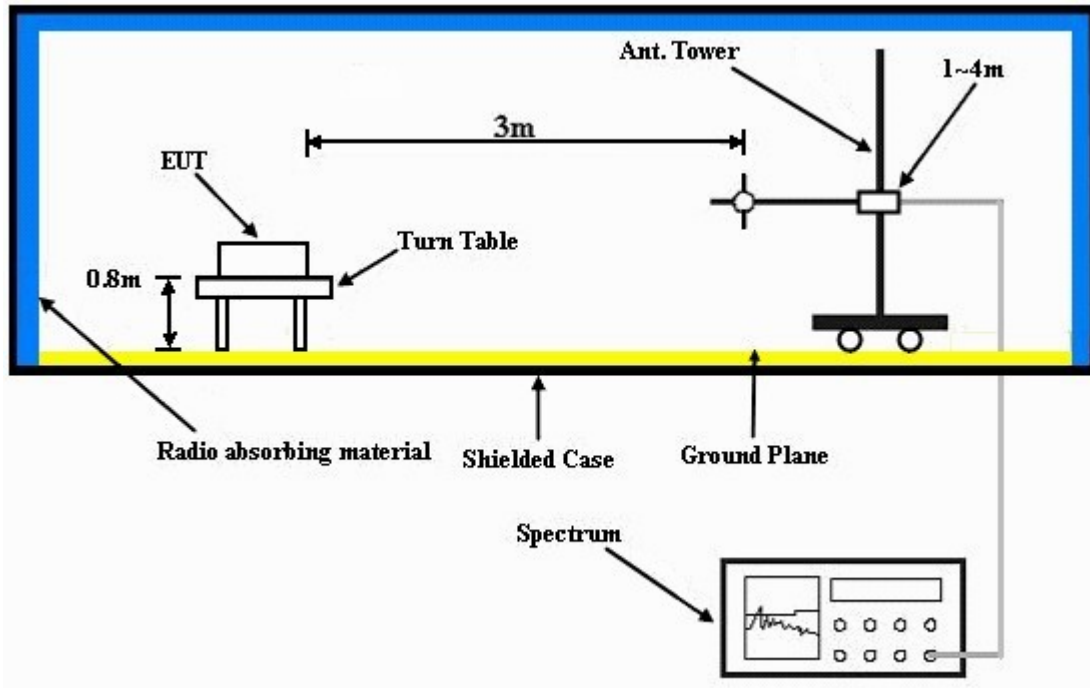
**NOTE:**

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 of test receiver/spectrum analyzer is 100kHz and video bandwidth is 300kHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 1kHz for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.1.5 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT OPERATING CONDITIONS

- Plugged the EUT into notebook and placed them on the testing table.
- The notebook system ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.



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### 4.1.7 TEST RESULTS

#### ABOVE 1GHz WORST-CASE DATA :

##### 802.11b

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 1	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	2390.00	53.5 PK	74.0	-20.5	1.00 H	330	22.70	30.80
2	2390.00	43.1 AV	54.0	-10.9	1.00 H	330	12.30	30.80
3	*2412.00	89.4 PK			1.02 H	329	58.50	30.90
4	*2412.00	85.7 AV			1.02 H	329	54.80	30.90
5	4824.00	49.1 PK	74.0	-24.9	1.18 H	132	12.10	37.00
6	4824.00	43.8 AV	54.0	-10.2	1.18 H	132	6.80	37.00

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	2390.00	59.1 PK	74.0	-14.9	1.05 V	57	28.30	30.80
2	2390.00	51.4 AV	54.0	-2.6	1.05 V	57	20.60	30.80
3	*2412.00	106.6 PK			1.05 V	57	75.70	30.90
4	*2412.00	102.9 AV			1.05 V	57	72.00	30.90
5	4824.00	53.4 PK	74.0	-20.6	1.54 V	94	16.40	37.00
6	4824.00	50.5 AV	54.0	-3.5	1.54 V	94	13.50	37.00

#### 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.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 6	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*2437.00	89.8 PK			1.04 H	311	58.80	31.00
2	*2437.00	85.7 AV			1.04 H	311	54.70	31.00
3	4874.00	49.7 PK	74.0	-24.3	1.22 H	120	12.60	37.10
4	4874.00	43.7 AV	54.0	-10.3	1.22 H	120	6.60	37.10
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	*2437.00	106.8 PK			1.03 V	78	75.80	31.00
2	*2437.00	103.2 AV			1.03 V	78	72.20	31.00
3	4874.00	53.5 PK	74.0	-20.5	1.48 V	94	16.40	37.10
4	4874.00	50.0 AV	54.0	-4.0	1.48 V	94	12.90	37.10

**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.
5. “ \* “: Fundamental frequency.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 11	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*2462.00	84.9 PK			1.00 H	228	53.80	31.10
2	*2462.00	81.1 AV			1.00 H	228	50.00	31.10
3	2483.50	55.3 PK	74.0	-18.7	1.00 H	228	24.10	31.20
4	2483.50	43.7 AV	54.0	-10.3	1.00 H	228	12.50	31.20
5	4924.00	48.2 PK	74.0	-25.8	1.02 H	129	11.00	37.20
6	4924.00	41.8 AV	54.0	-12.2	1.02 H	129	4.60	37.20
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	*2462.00	101.5 PK			1.03 V	74	70.40	31.10
2	*2462.00	98.0 AV			1.03 V	74	66.90	31.10
3	2483.50	55.9 PK	74.0	-18.1	1.03 V	74	24.70	31.20
4	2483.50	46.0 AV	54.0	-8.0	1.03 V	74	14.80	31.20
5	4924.00	48.3 PK	74.0	-25.7	1.37 V	82	11.10	37.20
6	4924.00	42.3 AV	54.0	-11.7	1.37 V	82	5.10	37.20

**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.





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802.11g

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 1	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	2390.00	56.2 PK	74.0	-17.8	1.00 H	264	25.40	30.80
2	2390.00	43.5 AV	54.0	-10.5	1.00 H	264	12.70	30.80
3	*2412.00	92.3 PK			1.00 H	264	61.40	30.90
4	*2412.00	83.1 AV			1.00 H	264	52.20	30.90
5	4824.00	49.5 PK	74.0	-24.5	1.26 H	24	12.50	37.00
6	4824.00	36.0 AV	54.0	-18.0	1.26 H	24	-1.00	37.00
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	2390.00	68.4 PK	74.0	-5.6	1.30 V	78	37.60	30.80
2	2390.00	52.5 AV	54.0	-1.5	1.30 V	78	21.70	30.80
3	*2412.00	108.3 PK			1.30 V	78	77.40	30.90
4	*2412.00	99.1 AV			1.30 V	78	68.20	30.90
5	4824.00	52.8 PK	74.0	-21.2	1.21 V	263	15.80	37.00
6	4824.00	38.7 AV	54.0	-15.3	1.21 V	263	1.70	37.00

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.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 6	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*2437.00	98.9 PK			1.71 H	270	67.90	31.00
2	*2437.00	89.6 AV			1.71 H	270	58.60	31.00
3	4874.00	55.7 PK	74.0	-18.3	1.52 H	23	18.60	37.10
4	4874.00	42.8 AV	54.0	-11.2	1.52 H	23	5.70	37.10
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	*2437.00	114.4 PK			1.30 V	76	83.40	31.00
2	*2437.00	104.9 AV			1.30 V	76	73.90	31.00
3	4874.00	59.0 PK	74.0	-15.0	1.00 V	306	21.90	37.10
4	4874.00	45.8 AV	54.0	-8.2	1.00 V	306	8.70	37.10
5	7311.00	59.6 PK	74.0	-14.4	1.09 V	268	16.00	43.60
6	7311.00	45.5 AV	54.0	-8.5	1.09 V	268	1.90	43.60

**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.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 11	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*2462.00	88.0 PK			1.00 H	227	56.90	31.10
2	*2462.00	78.3 AV			1.00 H	227	47.20	31.10
3	2483.50	56.6 PK	74.0	-17.4	1.00 H	227	25.40	31.20
4	2483.50	43.6 AV	54.0	-10.4	1.00 H	227	12.40	31.20
5	4924.00	48.7 PK	74.0	-25.3	1.24 H	30	11.50	37.20
6	4924.00	35.9 AV	54.0	-18.1	1.24 H	30	-1.30	37.20
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	*2462.00	105.0 PK			1.29 V	75	73.90	31.10
2	*2462.00	95.3 AV			1.29 V	75	64.20	31.10
3	2483.50	63.4 PK	74.0	-10.6	1.29 V	136	32.20	31.20
4	2483.50	49.4 AV	54.0	-4.6	1.29 V	136	18.20	31.20
5	4924.00	50.9 PK	74.0	-23.1	1.08 V	274	13.70	37.20
6	4924.00	37.2 AV	54.0	-16.8	1.08 V	274	0.00	37.20

**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.



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802.11n (20MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 1	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	2390.00	55.3 PK	74.0	-18.7	1.00 H	265	24.50	30.80
2	2390.00	43.1 AV	54.0	-10.9	1.00 H	265	12.30	30.80
3	*2412.00	91.5 PK			1.00 H	265	60.60	30.90
4	*2412.00	81.7 AV			1.00 H	265	50.80	30.90
5	4824.00	48.5 PK	74.0	-25.5	1.24 H	33	11.50	37.00
6	4824.00	35.4 AV	54.0	-18.6	1.24 H	33	-1.60	37.00
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	2390.00	68.6 PK	74.0	-5.4	1.37 V	79	37.80	30.80
2	2390.00	52.8 AV	54.0	-1.2	1.37 V	79	22.00	30.80
3	*2412.00	107.4 PK			1.37 V	79	76.50	30.90
4	*2412.00	98.0 AV			1.37 V	79	67.10	30.90
5	4824.00	48.9 PK	74.0	-25.1	1.26 V	133	11.90	37.00
6	4824.00	36.5 AV	54.0	-17.5	1.26 V	133	-0.50	37.00

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.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 6	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*2437.00	97.4 PK			1.65 H	277	66.40	31.00
2	*2437.00	88.5 AV			1.65 H	277	57.50	31.00
3	4874.00	55.4 PK	74.0	-18.6	1.45 H	30	18.30	37.10
4	4874.00	42.1 AV	54.0	-11.9	1.45 H	30	5.00	37.10
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	*2437.00	113.6 PK			1.34 V	80	82.60	31.00
2	*2437.00	103.4 AV			1.34 V	80	72.40	31.00
3	4874.00	58.1 PK	74.0	-15.9	1.00 V	297	21.00	37.10
4	4874.00	44.9 AV	54.0	-9.1	1.00 V	297	7.80	37.10

**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.
5. “ \* “: Fundamental frequency.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 11	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*2462.00	87.8 PK			1.00 H	280	56.70	31.10
2	*2462.00	77.8 AV			1.00 H	280	46.70	31.10
3	2483.50	56.0 PK	74.0	-18.0	1.00 H	280	24.80	31.20
4	2483.50	43.3 AV	54.0	-10.7	1.00 H	280	12.10	31.20
5	4924.00	48.5 PK	74.0	-25.5	1.19 H	45	11.30	37.20
6	4924.00	35.6 AV	54.0	-18.4	1.19 H	45	-1.60	37.20
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	*2462.00	104.9 PK			1.30 V	72	73.80	31.10
2	*2462.00	94.8 AV			1.30 V	72	63.70	31.10
3	2483.50	64.3 PK	74.0	-9.7	1.30 V	75	33.10	31.20
4	2483.50	49.1 AV	54.0	-4.9	1.30 V	75	17.90	31.20
5	4924.00	50.2 PK	74.0	-23.8	1.10 V	285	13.00	37.20
6	4924.00	37.1 AV	54.0	-16.9	1.10 V	285	-0.10	37.20

**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.



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### 802.11n (40MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 3	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	2390.00	54.4 PK	74.0	-19.6	1.80 H	270	23.60	30.80
2	2390.00	45.0 AV	54.0	-9.0	1.80 H	270	14.20	30.80
3	*2422.00	85.0 PK			1.80 H	270	54.10	30.90
4	*2422.00	76.9 AV			1.80 H	270	46.00	30.90
5	4844.00	46.8 PK	74.0	-27.2	1.29 H	41	9.80	37.00
6	4844.00	37.0 AV	54.0	-17.0	1.29 H	41	0.00	37.00

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	2390.00	63.4 PK	74.0	-10.6	1.38 V	269	32.60	30.80
2	2390.00	50.5 AV	54.0	-3.5	1.38 V	269	19.70	30.80
3	*2422.00	98.5 PK			1.38 V	269	67.60	30.90
4	*2422.00	90.0 AV			1.38 V	269	59.10	30.90
5	4844.00	48.4 PK	74.0	-25.6	1.30 V	22	11.40	37.00
6	4844.00	38.1 AV	54.0	-15.9	1.30 V	22	1.10	37.00

#### 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.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 6	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	2390.00	53.2 PK	74.0	-20.8	1.58 H	264	22.40	30.80
2	2390.00	43.2 AV	54.0	-10.8	1.58 H	264	12.40	30.80
3	*2437.00	88.9 PK			1.64 H	252	57.90	31.00
4	*2437.00	80.8 AV			1.64 H	252	49.80	31.00
5	2483.50	53.8 PK	74.0	-20.2	1.68 H	259	22.60	31.20
6	2483.50	43.9 AV	54.0	-10.1	1.68 H	259	12.70	31.20
7	4874.00	45.0 PK	74.0	-29.0	1.23 H	73	7.90	37.10
8	4874.00	34.2 AV	54.0	-19.8	1.23 H	73	-2.90	37.10
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	2390.00	64.3 PK	74.0	-9.7	1.40 V	269	33.50	30.80
2	2390.00	51.2 AV	54.0	-2.8	1.40 V	269	20.40	30.80
3	*2437.00	102.2 PK			1.41 V	267	71.20	31.00
4	*2437.00	93.3 AV			1.41 V	267	62.30	31.00
5	2483.50	63.3 PK	74.0	-10.7	1.00 V	296	32.10	31.20
6	2483.50	52.8 AV	54.0	-1.2	1.00 V	296	21.60	31.20
7	4874.00	47.7 PK	74.0	-26.3	1.18 V	264	10.60	37.10
8	4874.00	36.5 AV	54.0	-17.5	1.18 V	264	-0.60	37.10

**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.
5. “ \* “: Fundamental frequency.





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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 9	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*2452.00	85.2 PK			1.69 H	259	54.10	31.10
2	*2452.00	77.0 AV			1.69 H	259	45.90	31.10
3	2483.50	54.8 PK	74.0	-19.2	1.69 H	254	23.60	31.20
4	2483.50	44.8 AV	54.0	-9.2	1.69 H	254	13.60	31.20
5	4904.00	46.4 PK	74.0	-27.6	1.32 H	52	9.20	37.20
6	4904.00	36.2 AV	54.0	-17.8	1.32 H	52	-1.00	37.20
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	*2452.00	98.3 PK			1.20 V	281	67.20	31.10
2	*2452.00	89.0 AV			1.20 V	281	57.90	31.10
3	2483.50	63.3 PK	74.0	-10.7	1.20 V	282	32.10	31.20
4	2483.50	49.5 AV	54.0	-4.5	1.20 V	282	18.30	31.20
5	4904.00	47.0 PK	74.0	-27.0	1.22 V	215	9.80	37.20
6	4904.00	35.8 AV	54.0	-18.2	1.22 V	215	-1.40	37.20

**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.



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**BELOW 1GHz WORST-CASE DATA : 802.11g**

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 6	FREQUENCY RANGE	Below 1000MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	61.01	32.3 QP	40.0	-7.7	1.25 H	211	18.90	13.40
2	99.89	33.0 QP	43.5	-10.5	1.00 H	0	23.80	9.20
3	142.67	34.2 QP	43.5	-9.3	1.50 H	0	20.70	13.50
4	300.16	31.9 QP	46.0	-14.1	1.00 H	227	16.80	15.10
5	663.74	31.0 QP	46.0	-15.0	2.00 H	93	7.80	23.20
6	696.79	31.8 QP	46.0	-14.2	1.25 H	112	8.20	23.60

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	39.62	28.7 QP	40.0	-11.3	1.50 V	60	15.30	13.40
2	94.06	32.9 QP	43.5	-10.6	1.00 V	215	24.30	8.60
3	179.61	27.9 QP	43.5	-15.6	1.25 V	220	15.20	12.70
4	432.37	22.0 QP	46.0	-24.0	1.00 V	7	3.60	18.40
5	696.79	26.1 QP	46.0	-19.9	2.00 V	91	2.50	23.60
6	960.21	30.9 QP	54.0	-23.1	1.50 V	168	3.30	27.60

**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.



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## 4.2 CONDUCTED EMISSION MEASUREMENT

### 4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

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

- 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 0.50MHz.
  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.

### 4.2.2 TEST INSTRUMENTS

Tested date: Mar. 14, 2013

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Nov. 16, 2012	Nov. 15, 2013
RF signal cable Woken	5D-FB	Cable-HYC01-01	Dec. 28, 2012	Dec. 27, 2013
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 02, 2012	Jul. 01, 2013
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 04, 2013	Feb. 03, 2014
Software ADT	BV ADT_Cond_ V7.3.7.3	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 HwaYa Shielded Room 1.
  3. The VCCI Site Registration No. is C-2040.

#### 4.2.3 TEST PROCEDURES

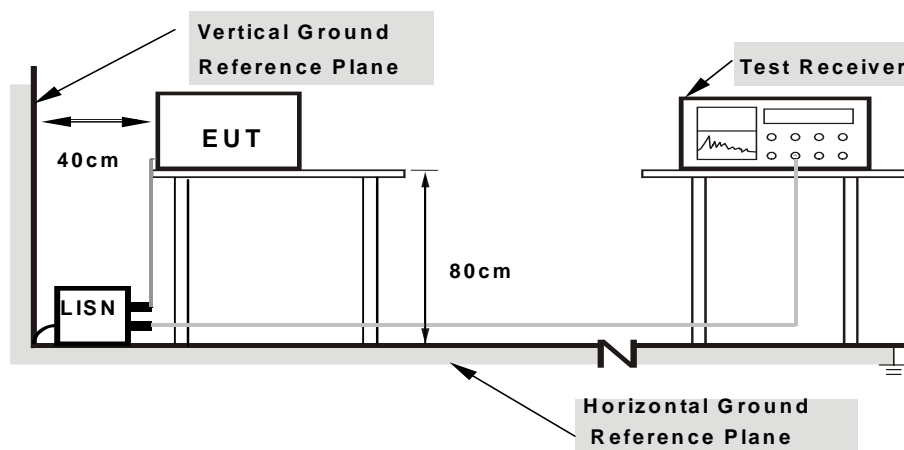
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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) was not recorded.

**NOTE:** All modes of operation were investigated and the worst-case emissions are reported.

#### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.2.5 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 cm from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6.

### 4.2.7 TEST RESULTS

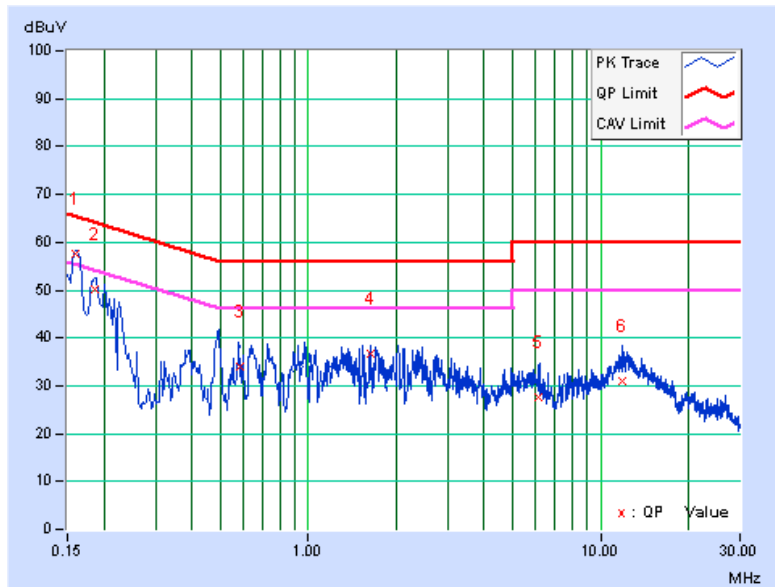
**CONDUCTED WORST-CASE DATA : 802.11g**

<b>PHASE</b>	Line 1	<b>6dB BANDWIDTH</b>	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15885	0.16	57.38	45.74	57.54	45.90	65.52	55.52	-7.98	-9.62
2	0.18508	0.20	49.90	35.05	50.10	35.25	64.25	54.25	-14.15	-19.00
3	0.58077	0.21	33.93	21.88	34.14	22.09	56.00	46.00	-21.86	-23.91
4	1.62717	0.25	36.36	32.36	36.61	32.61	56.00	46.00	-19.39	-13.39
5	6.09167	0.43	27.33	21.73	27.76	22.16	60.00	50.00	-32.24	-27.84
6	11.80571	0.64	30.40	24.83	31.04	25.47	60.00	50.00	-28.96	-24.53

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

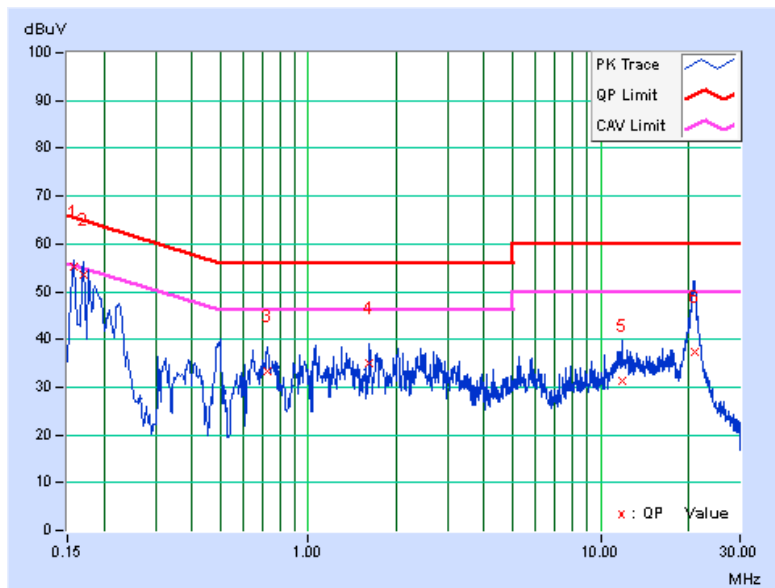


PHASE	Line 2	6dB BANDWIDTH	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.15719	0.25	54.99	39.97	55.24	40.22	65.61
2	0.16967	0.27	53.11	37.71	53.38	37.98	64.98	54.98	-11.60	-17.00
3	0.72084	0.31	32.92	23.41	33.23	23.72	56.00	46.00	-22.77	-22.28
4	1.62289	0.34	34.69	29.97	35.03	30.31	56.00	46.00	-20.97	-15.69
5	11.79789	0.72	30.69	25.12	31.41	25.84	60.00	50.00	-28.59	-24.16
6	20.91210	1.06	36.44	30.75	37.50	31.81	60.00	50.00	-22.50	-18.19

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

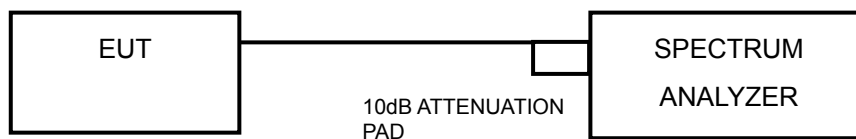


### 4.3 6dB BANDWIDTH MEASUREMENT

#### 4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

#### 4.3.2 TEST SETUP



#### 4.3.3 TEST INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.4 TEST PROCEDURE

- Set resolution bandwidth (RBW) = approximately 1% of the emission bandwidth
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

#### 4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



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### 4.3.7 TEST RESULTS

#### 802.11b

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
1	2412	10.08	10.06	0.5	PASS
6	2437	10.14	10.11	0.5	PASS
11	2462	10.12	10.15	0.5	PASS

#### 802.11g

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
1	2412	16.61	16.61	0.5	PASS
6	2437	16.67	16.61	0.5	PASS
11	2462	16.57	16.58	0.5	PASS

#### 802.11n (20MHz)

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
1	2412	17.82	17.85	0.5	PASS
6	2437	17.79	17.84	0.5	PASS
11	2462	17.83	17.86	0.5	PASS

#### 802.11n (40MHz)

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
3	2422	36.71	36.71	0.5	PASS
6	2437	36.69	36.72	0.5	PASS
9	2452	36.70	36.73	0.5	PASS



## 4.4 CONDUCTED OUTPUT POWER

### 4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

Per KDB 662911 D01 Multiple Transmitter Output v01r02 Method of conducted output power measurement on IEEE 802.11 devices,

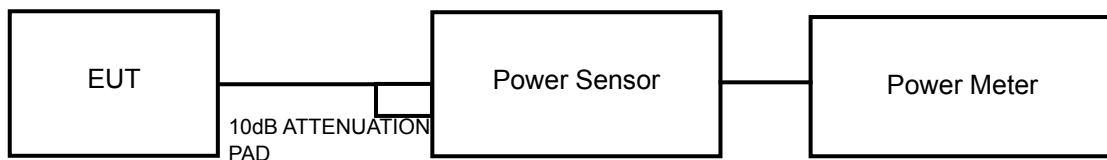
Array Gain = 0 dB (i.e., no array gain) for  $NANT \leq 4$ ;

Array Gain = 0 dB (i.e., no array gain) for channel widths  $\geq 40$  MHz for any NANT;

Array Gain =  $5 \log(NANT/NSS)$  dB or 3 dB, whichever is less for 20-MHz channel widths with  $NANT \geq 5$ .

For power measurements on all other devices: Array Gain =  $10 \log(NANT/NSS)$  dB.

### 4.4.2 TEST SETUP



### 4.4.3 TEST INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

### 4.4.4 TEST PROCEDURES

A peak / average power sensor were used on the output port of the EUT. A power meter was used to read the response of the peak / average power sensor. Record the peak power level.



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#### 4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.4.6 EUT OPERATING CONDITIONS

Same as Item 4.3.6.



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#### 4.4.7 TEST RESULTS

##### FOR PEAK POWER

##### 802.11b

CHAN.	FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
1	2412	12.71	12.53	36.570	15.63	30	PASS
6	2437	13.23	13.12	41.550	16.19	30	PASS
11	2462	8.32	8.84	14.448	11.60	30	PASS

##### 802.11g

CHAN.	FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
1	2412	18.71	19.42	161.800	22.09	30	PASS
6	2437	23.20	23.35	<b>425.202</b>	26.29	30	PASS
11	2462	15.01	14.91	62.670	17.97	30	PASS

##### 802.11n (20MHz)

CHAN.	FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
1	2412	16.90	18.34	117.212	20.69	30	PASS
6	2437	22.76	22.98	387.408	25.88	30	PASS
11	2462	15.54	16.55	80.996	19.08	30	PASS

##### 802.11n (40MHz)

CHAN.	FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
3	2422	14.00	14.42	52.788	17.23	30	PASS
6	2437	18.17	18.39	134.639	21.29	30	PASS
9	2452	13.11	13.57	43.215	16.36	30	PASS



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**FOR AVERAGE POWER**

**802.11b**

CHAN.	FREQUENCY (MHz)	AVG. POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
1	2412	10.51	10.22	21.766	12.96
6	2437	11.14	10.91	25.333	13.53
11	2462	6.01	6.51	8.467	8.78

**802.11g**

CHAN.	FREQUENCY (MHz)	AVG. POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
1	2412	10.57	10.15	21.753	12.44
6	2437	16.10	16.22	82.617	18.21
11	2462	7.33	6.97	10.385	9.18

**802.11n (20MHz)**

CHAN.	FREQUENCY (MHz)	AVG. POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
1	2412	9.17	9.54	17.255	11.43
6	2437	15.51	15.77	73.320	17.62
11	2462	7.14	7.23	10.460	9.18

**802.11n (40MHz)**

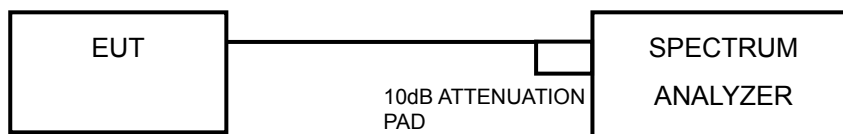
CHAN.	FREQUENCY (MHz)	AVG. POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
3	2422	5.18	5.54	6.877	7.33
6	2437	9.65	9.55	18.242	11.61
9	2452	4.94	5.11	6.362	7.04

## 4.5 POWER SPECTRAL DENSITY MEASUREMENT

### 4.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm.

### 4.5.2 TEST SETUP



### 4.5.3 TEST INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

### 4.5.4 TEST PROCEDURE

- Set the RBW = 3 kHz, VBW = 10 kHz, Detector = peak.
- Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

### 4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.5.6 EUT OPERATING CONDITION

Same as Item 4.3.6



## 4.5.7 TEST RESULTS

### 802.11b

TX chain	Channel	FREQ. (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	1	2412	-15.41	3.01	-12.40	7.99	PASS
	6	2437	-15.54	3.01	-12.53	7.99	PASS
	11	2462	-17.92	3.01	-14.91	7.99	PASS
1	1	2412	-13.23	3.01	-10.22	7.99	PASS
	6	2437	-14.05	3.01	-11.04	7.99	PASS
	11	2462	-19.36	3.01	-16.35	7.99	PASS

**NOTE:** Directional gain =  $3\text{dBi} + 10\log(2) = 6.01\text{dBi} > 6\text{dBi}$ , so the power density limit shall be reduced to  $8-(6.01-6) = 7.99\text{dBm}$ .

### 802.11g

TX chain	Channel	FREQ. (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	1	2412	-16.53	3.01	-13.52	7.99	PASS
	6	2437	-10.45	3.01	-7.44	7.99	PASS
	11	2462	-19.58	3.01	-16.57	7.99	PASS
1	1	2412	-17.20	3.01	-14.19	7.99	PASS
	6	2437	-10.18	3.01	-7.17	7.99	PASS
	11	2462	-19.00	3.01	-15.99	7.99	PASS

**NOTE:** Directional gain =  $3\text{dBi} + 10\log(2) = 6.01\text{dBi} > 6\text{dBi}$ , so the power density limit shall be reduced to  $8-(6.01-6) = 7.99\text{dBm}$ .

### 802.11n (20MHz)

TX chain	Channel	FREQ. (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	1	2412	-18.56	3.01	-15.55	7.99	PASS
	6	2437	-11.87	3.01	-8.86	7.99	PASS
	11	2462	-19.36	3.01	-16.35	7.99	PASS
1	1	2412	-16.85	3.01	-13.84	7.99	PASS
	6	2437	-10.70	3.01	-7.69	7.99	PASS
	11	2462	-19.62	3.01	-16.61	7.99	PASS

**NOTE:** Directional gain =  $3\text{dBi} + 10\log(2) = 6.01\text{dBi} > 6\text{dBi}$ , so the power density limit shall be reduced to  $8-(6.01-6) = 7.99\text{dBm}$ .



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### 802.11n (40MHz)

TX chain	Channel	FREQ. (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	3	2422	-25.33	3.01	-22.32	7.99	PASS
	6	2437	-21.23	3.01	-18.22	7.99	PASS
	9	2452	-25.81	3.01	-22.80	7.99	PASS
1	3	2422	-24.56	3.01	-21.55	7.99	PASS
	6	2437	-21.28	3.01	-18.27	7.99	PASS
	9	2452	-24.65	3.01	-21.64	7.99	PASS

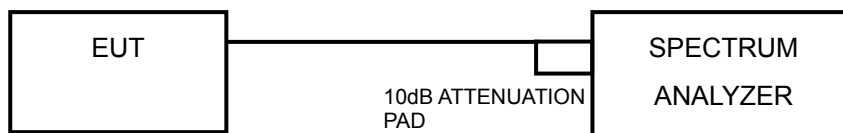
**NOTE:** Directional gain =  $3\text{dBi} + 10\log(2) = 6.01\text{dBi} > 6\text{dBi}$  , so the power density limit shall be reduced to  $8 - (6.01 - 6) = 7.99\text{dBm}$ .

## 4.6 CONDUCTED OUT OF BAND EMISSION MEASUREMENT

### 4.6.1 LIMITS OF CONDUCTED OUT OF BAND EMISSION MEASUREMENT

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### 4.6.2 TEST SETUP



### 4.6.3 TEST INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

### 4.6.4 TEST PROCEDURE

#### MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.





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## MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Set span to encompass the spectrum to be examined.
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

### 4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.6.6 EUT OPERATING CONDITION

Same as Item 4.3.6

### 4.6.7 TEST RESULTS

The conducted emission test is performed on each TX port of operating mode without summing or adding  $10\log(N)$  since the limit is relative emission limit. Only worst data of each operating mode is presented.

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



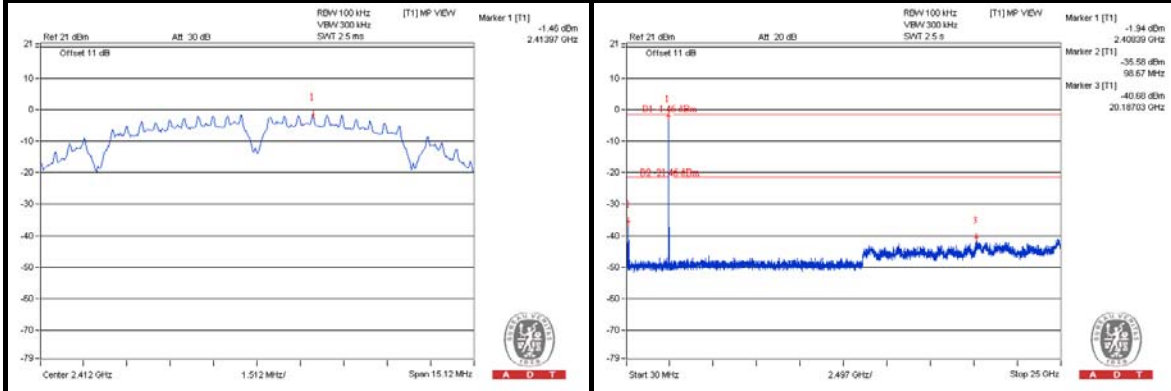
A D T

## 4.6.8 TEST RESULTS

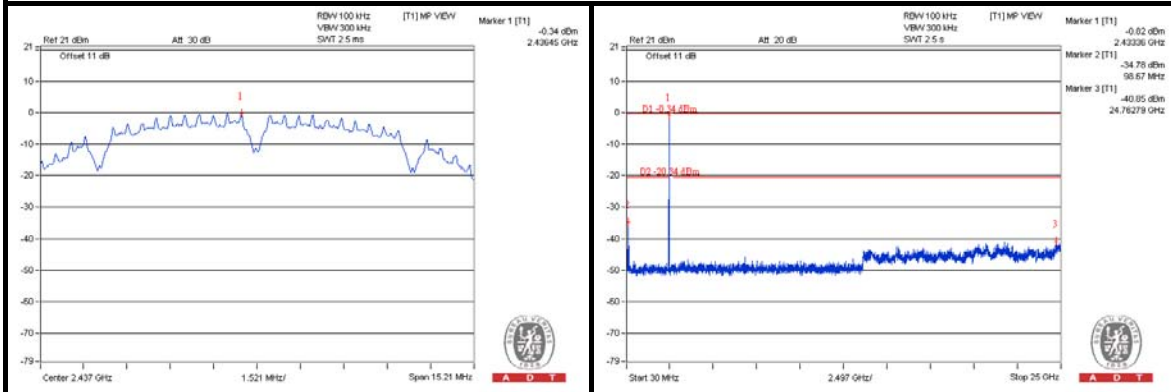
802.11b

CHAIN 0

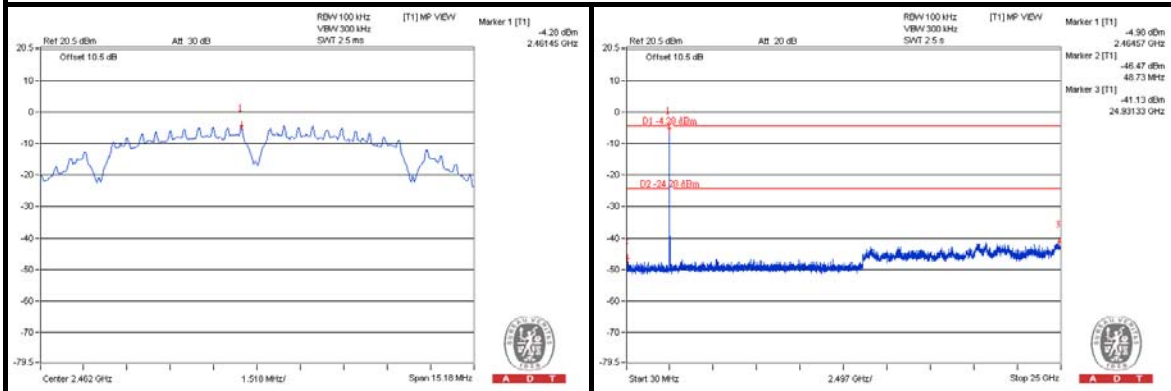
### CH 1



### CH 6



### CH 11

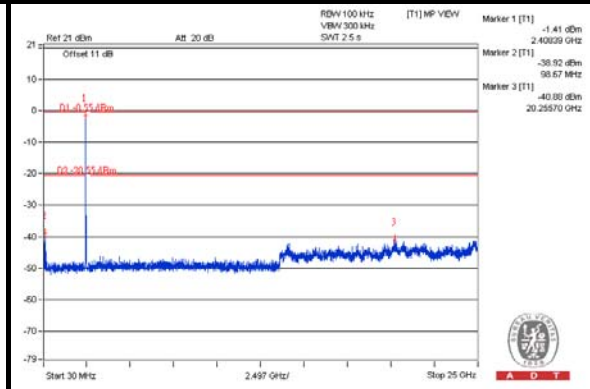
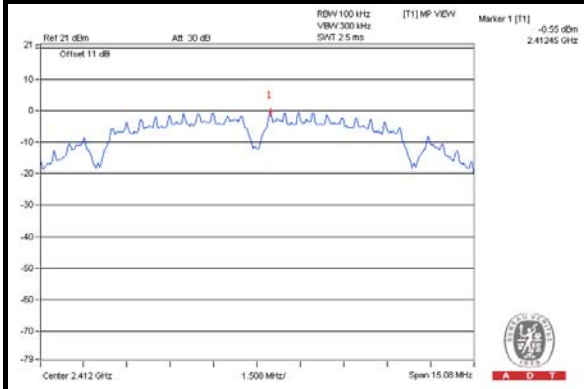




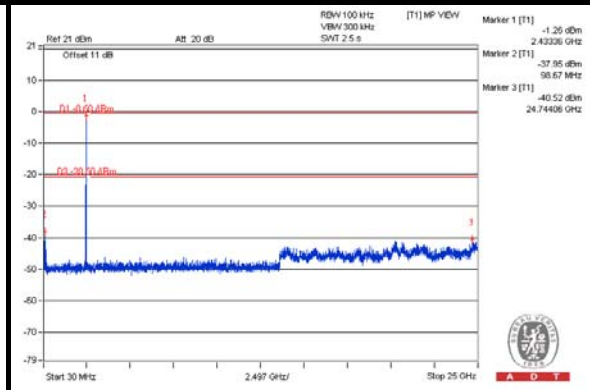
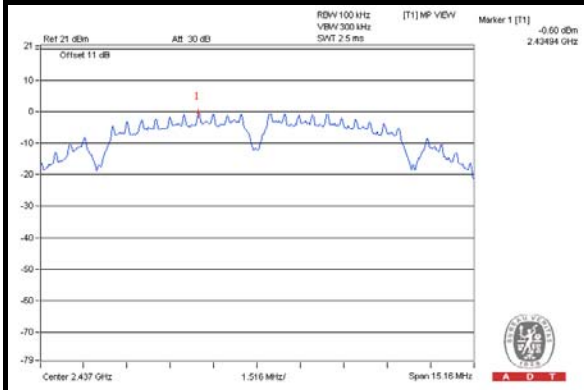
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### CHAIN 1

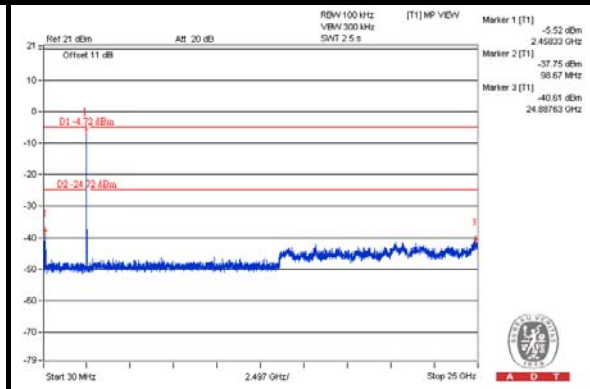
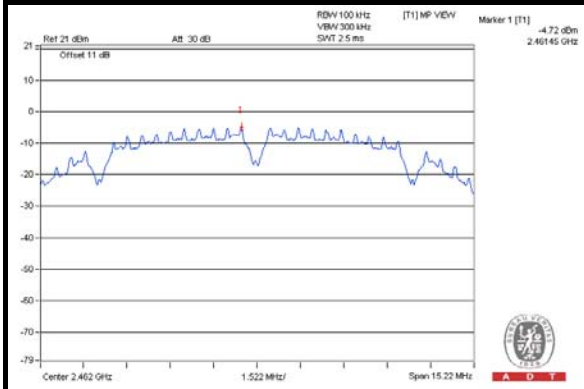
#### CH 1



#### CH 6



#### CH 11

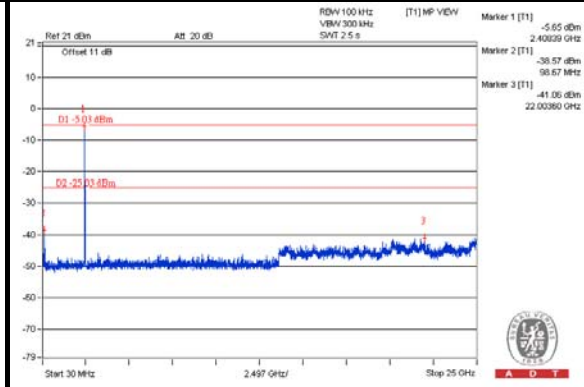
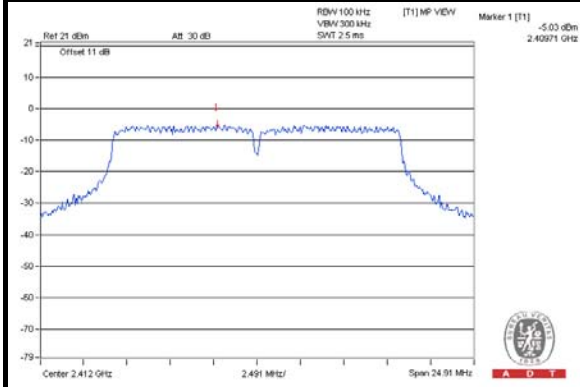




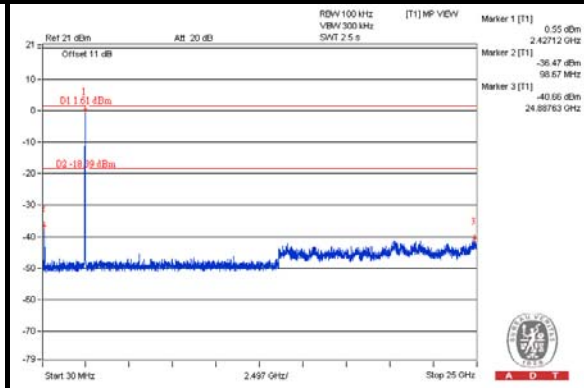
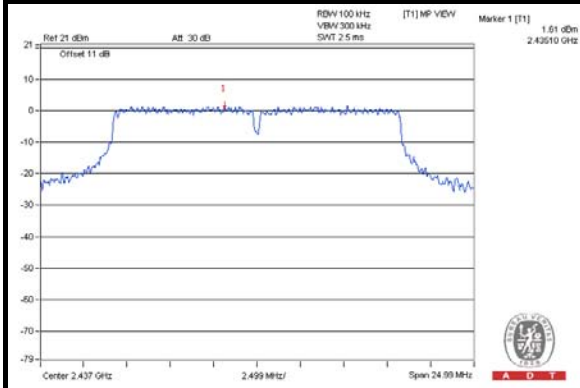
A D T

# 802.11g CHAIN 0

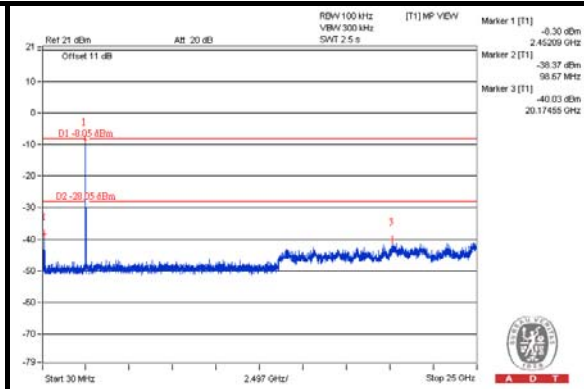
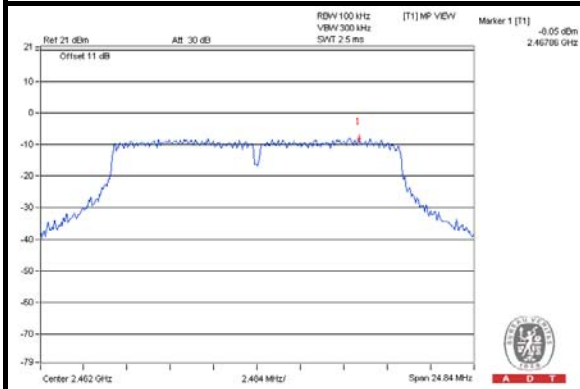
## CH 1



## CH 6



## CH 11

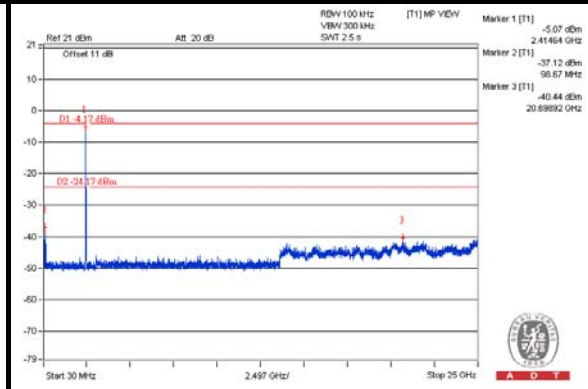
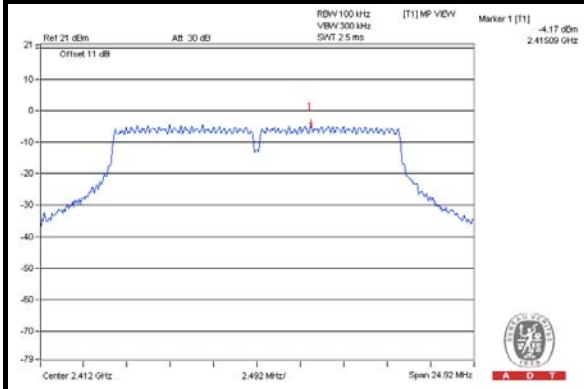




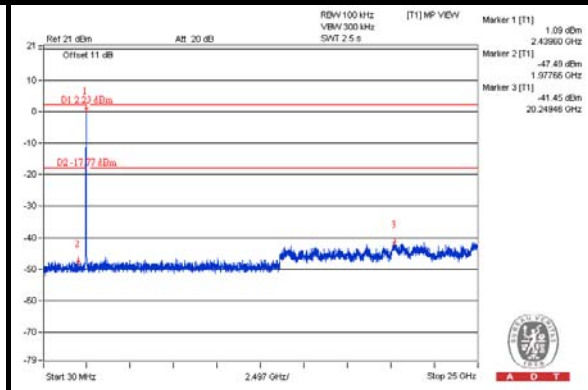
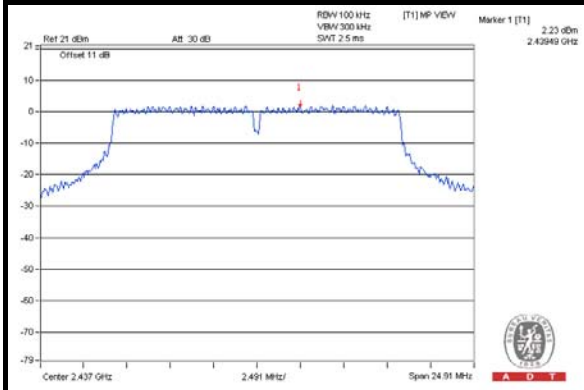
A D T

### CHAIN 1

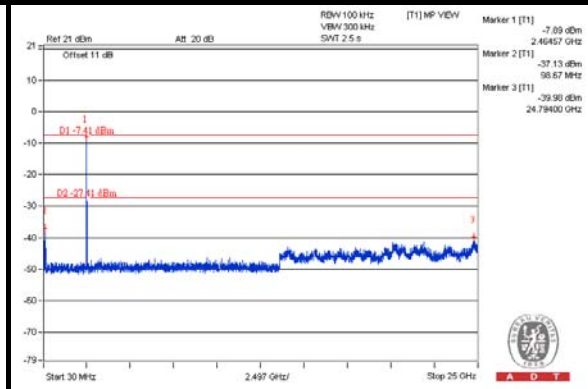
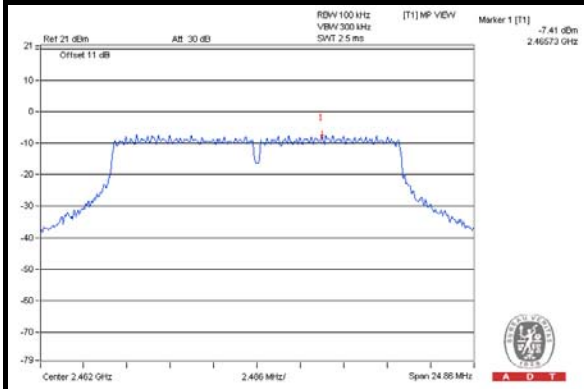
#### CH 1



#### CH 6



#### CH 11

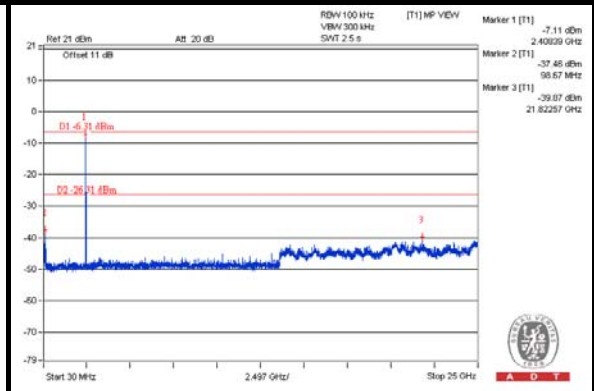
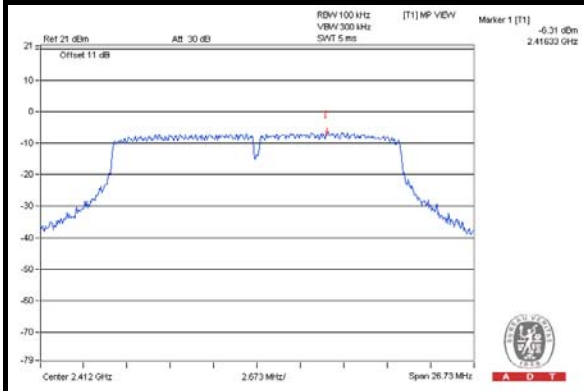




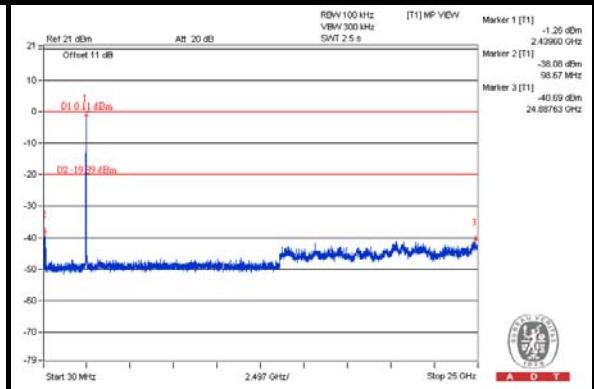
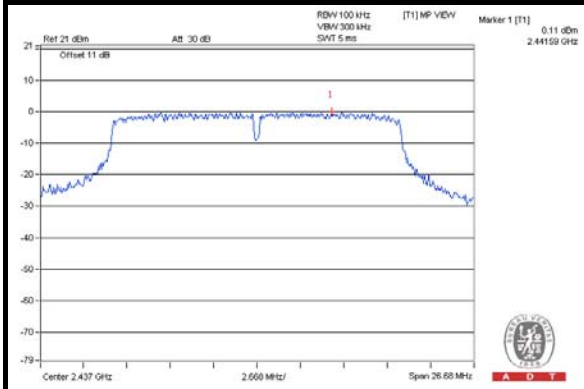
A D T

802.11n (20MHz)  
CHAIN 0

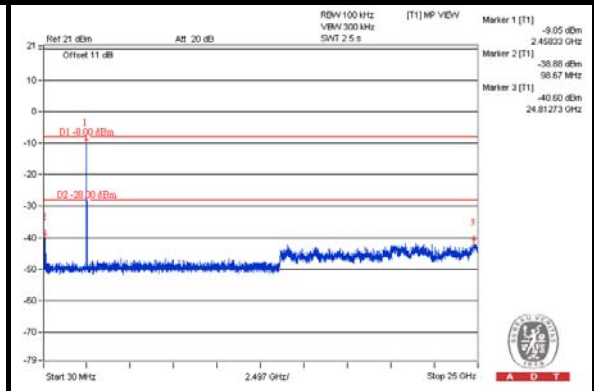
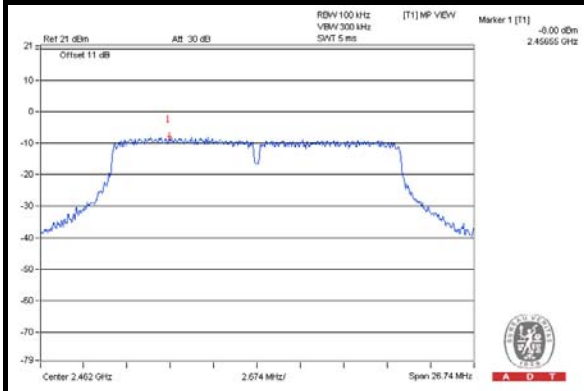
CH 1



CH 6



CH 11

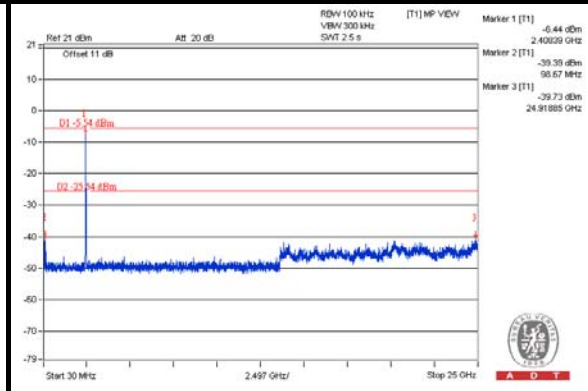
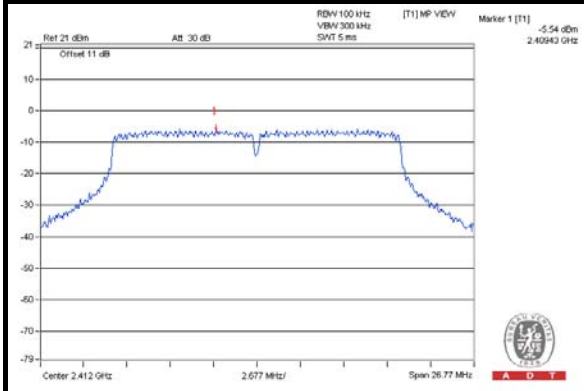




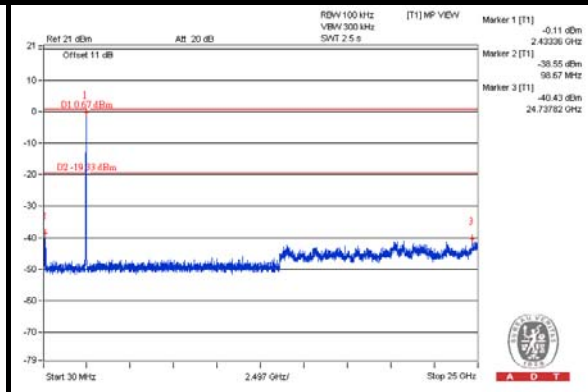
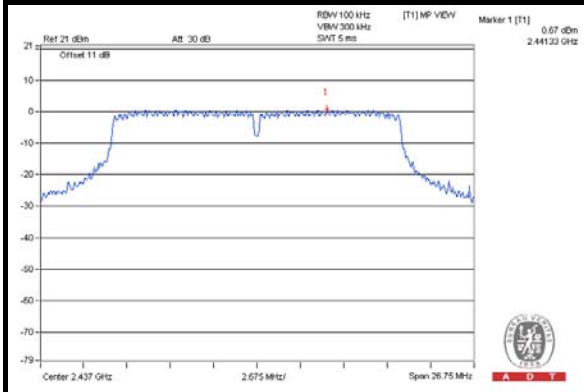
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### CHAIN 1

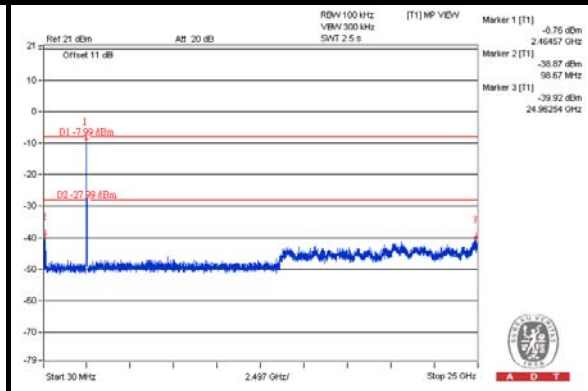
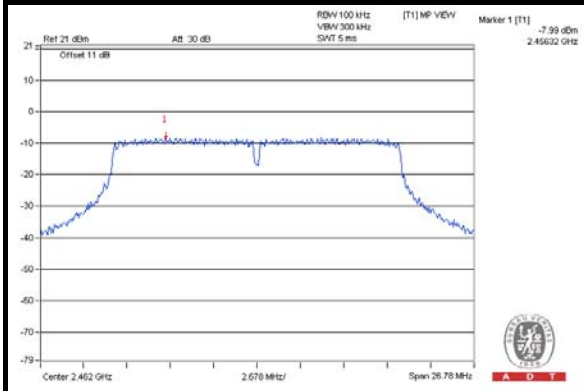
#### CH 1



#### CH 6



#### CH 11

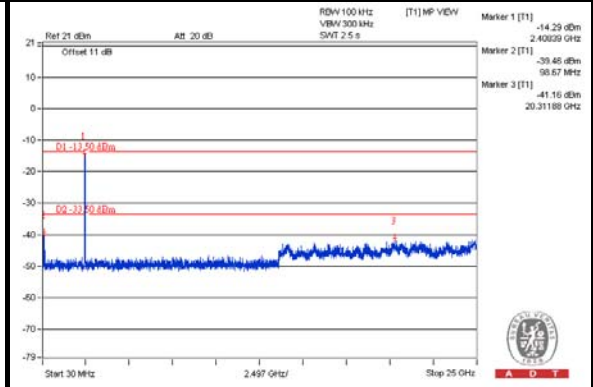
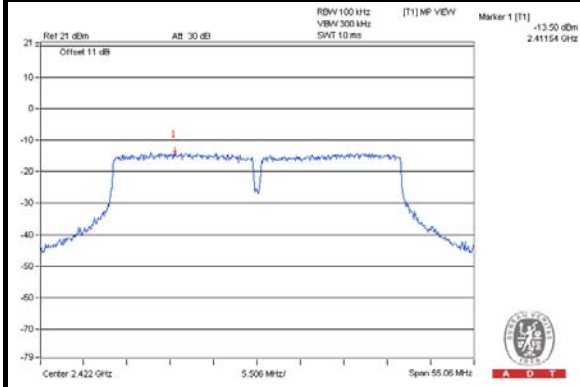




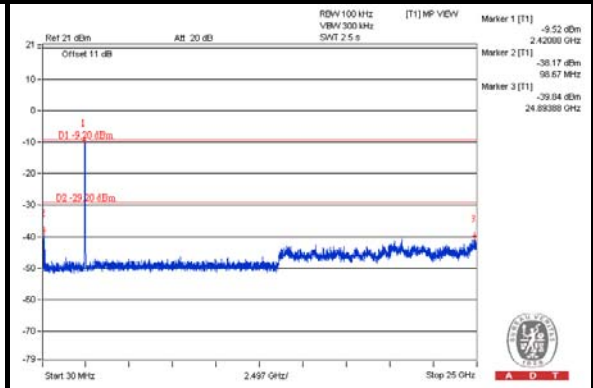
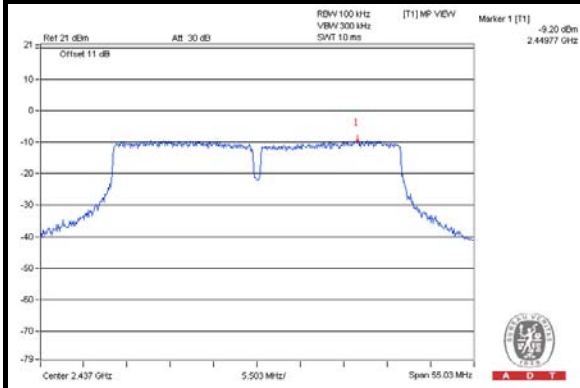
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# 802.11n (40MHz) CHAIN 0

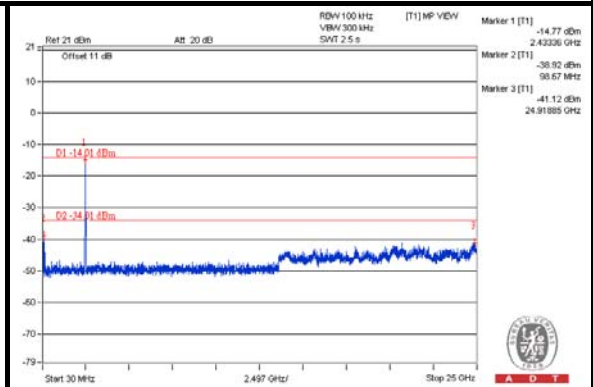
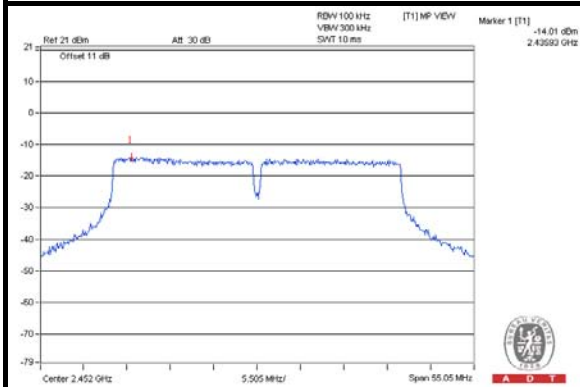
## CH 3



## CH 6



## CH 9



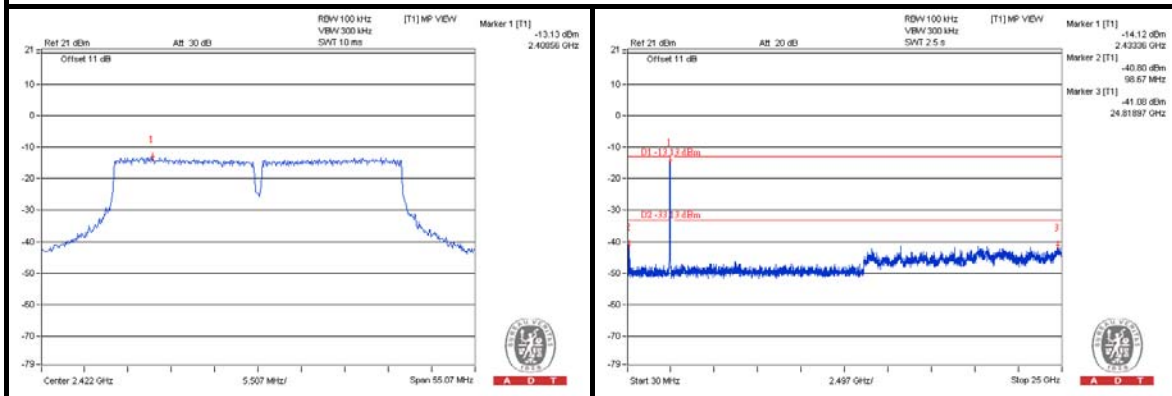




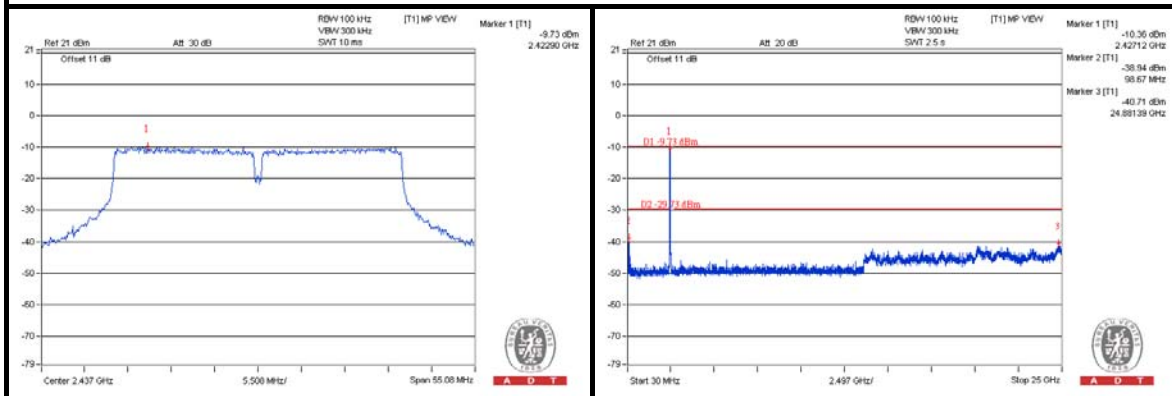
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### CHAIN 1

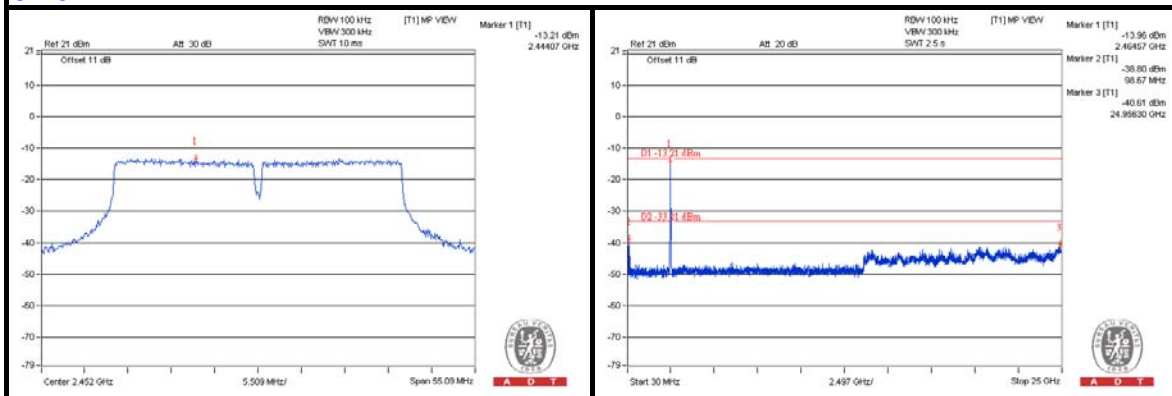
#### CH 3



#### CH 6



#### CH 9





## 5. TEST TYPES AND RESULTS (FOR 5.0GHz BAND)

### 5.1 RADIATED EMISSION MEASUREMENT

#### 5.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

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. 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.



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### 5.1.2 TEST INSTRUMENTS

Same as item 4.1.2.

### 5.1.3 TEST PROCEDURES

Same as item 4.1.3.

### 5.1.4 DEVIATION FROM TEST STANDARD

No deviation.

### 5.1.5 TEST SETUP

Same as item 4.1.5.

### 5.1.6 EUT OPERATING CONDITIONS

Same as 4.1.6.



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### 5.1.7 TEST RESULTS

#### ABOVE 1GHz WORST-CASE DATA :

##### 802.11a

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 149	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	#5725.00	63.1 PK	78.1	-15.0	1.00 H	0	24.40	38.70
2	#5725.00	52.9 AV	67.9	-15.0	1.00 H	0	14.20	38.70
3	*5745.00	98.1 PK			1.00 H	0	59.40	38.70
4	*5745.00	87.9 AV			1.00 H	0	49.20	38.70
5	11490.00	65.2 PK	74.0	-8.8	1.20 H	72	15.70	49.50
6	11490.00	52.8 AV	54.0	-1.2	1.20 H	72	3.30	49.50
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	#5725.00	77.8 PK	92.8	-15.0	1.00 V	116	39.10	38.70
2	#5725.00	68.3 AV	83.3	-15.0	1.00 V	116	29.60	38.70
3	*5745.00	112.8 PK			1.00 V	116	74.10	38.70
4	*5745.00	103.3 AV			1.00 V	116	64.60	38.70
5	11490.00	65.2 PK	74.0	-8.8	1.16 V	39	15.70	49.50
6	11490.00	53.0 AV	54.0	-1.0	1.16 V	39	3.50	49.50

#### 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 limit value is defined as per 15.247.
7. "#":The radiated frequency is out the restricted band.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 157	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*5785.00	97.7 PK			1.00 H	1	58.90	38.80
2	*5785.00	87.5 AV			1.00 H	1	48.70	38.80
3	11570.00	67.4 PK	74.0	-6.6	1.22 H	68	18.00	49.40
4	11570.00	51.4 AV	54.0	-2.6	1.22 H	68	2.00	49.40
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	*5785.00	113.4 PK			1.00 V	120	74.60	38.80
2	*5785.00	103.5 AV			1.00 V	120	64.70	38.80
3	11570.00	66.9 PK	74.0	-7.1	1.14 V	43	17.50	49.40
4	11570.00	52.1 AV	54.0	-1.9	1.14 V	43	2.70	49.40

**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 limit value is defined as per 15.247.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 165	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*5825.00	98.2 PK			1.00 H	3	59.30	38.90
2	*5825.00	88.6 AV			1.00 H	3	49.70	38.90
3	#5850.00	56.2 PK	78.2	-22.0	1.00 H	3	17.30	38.90
4	#5850.00	46.6 AV	68.6	-22.0	1.00 H	3	7.70	38.90
5	11650.00	66.5 PK	74.0	-7.5	1.28 H	51	17.20	49.30
6	11650.00	51.2 AV	54.0	-2.8	1.28 H	51	1.90	49.30
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	*5825.00	113.7 PK			1.00 V	128	74.80	38.90
2	*5825.00	93.7 AV			1.00 V	128	54.80	38.90
3	#5850.00	71.7 PK	93.7	-22.0	1.00 V	128	32.80	38.90
4	#5850.00	51.7 AV	73.7	-22.0	1.00 V	128	12.80	38.90
5	11650.00	66.7 PK	74.0	-7.3	1.15 V	30	17.40	49.30
6	11650.00	52.4 AV	54.0	-1.6	1.15 V	30	3.10	49.30

**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 limit value is defined as per 15.247.
7. "#":The radiated frequency is out the restricted band.



A D T

802.11n (20MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 149	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	#5725.00	65.5 PK	78.2	-12.7	1.48 H	277	26.80	38.70
2	#5725.00	55.7 AV	68.4	-12.7	1.48 H	277	17.00	38.70
3	*5745.00	98.2 PK			1.51 H	249	59.50	38.70
4	*5745.00	88.4 AV			1.51 H	249	49.70	38.70
5	11490.00	66.9 PK	74.0	-7.1	1.44 H	71	17.40	49.50
6	11490.00	52.2 AV	54.0	-1.8	1.44 H	71	2.70	49.50
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	#5725.00	81.5 PK	94.1	-12.6	1.17 V	77	42.80	38.70
2	#5725.00	72.1 AV	84.7	-12.6	1.17 V	77	33.40	38.70
3	*5745.00	114.1 PK			1.16 V	70	75.40	38.70
4	*5745.00	104.7 AV			1.16 V	70	66.00	38.70
5	11490.00	65.3 PK	74.0	-8.7	1.81 V	106	15.80	49.50
6	11490.00	52.7 AV	54.0	-1.3	1.81 V	106	3.20	49.50

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 limit value is defined as per 15.247.
7. "#":The radiated frequency is out the restricted band.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 157	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*5785.00	97.8 PK			1.48 H	252	59.00	38.80
2	*5785.00	87.8 AV			1.48 H	252	49.00	38.80
3	11570.00	67.2 PK	74.0	-6.8	1.43 H	75	17.80	49.40
4	11570.00	51.4 AV	54.0	-2.6	1.43 H	75	2.00	49.40
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	*5785.00	113.6 PK			1.12 V	67	74.80	38.80
2	*5785.00	93.7 AV			1.12 V	67	54.90	38.80
3	11570.00	66.7 PK	74.0	-7.3	1.73 V	68	17.30	49.40
4	11570.00	51.9 AV	54.0	-2.1	1.73 V	68	2.50	49.40

**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 limit value is defined as per 15.247.





A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 165	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*5825.00	98.5 PK			1.38 H	298	59.60	38.90
2	*5825.00	88.5 AV			1.38 H	298	49.60	38.90
3	#5850.00	53.7 PK	78.5	-24.8	1.38 H	304	14.80	38.90
4	#5850.00	43.7 AV	68.5	-24.8	1.38 H	304	4.80	38.90
5	11650.00	66.4 PK	74.0	-7.6	1.15 H	77	17.10	49.30
6	11650.00	50.9 AV	54.0	-3.1	1.15 H	77	1.60	49.30
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	*5825.00	114.2 PK			1.12 V	67	75.30	38.90
2	*5825.00	94.0 AV			1.12 V	67	55.10	38.90
3	#5850.00	70.7 PK	94.2	-23.5	1.13 V	70	31.80	38.90
4	#5850.00	50.5 AV	74.0	-23.5	1.13 V	70	11.60	38.90
5	11650.00	66.9 PK	74.0	-7.1	1.72 V	77	17.60	49.30
6	11650.00	52.0 AV	54.0	-2.0	1.72 V	77	2.70	49.30

**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 limit value is defined as per 15.247.
7. "#":The radiated frequency is out the restricted band.



A D T

802.11n (40MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 151	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	#5725.00	62.6 PK	71.5	-8.9	1.15 H	247	23.90	38.70
2	#5725.00	52.9 AV	61.8	-8.9	1.15 H	247	14.20	38.70
3	*5755.00	91.5 PK			1.15 H	247	52.80	38.70
4	*5755.00	81.8 AV			1.15 H	247	43.10	38.70
5	11510.00	56.5 PK	74.0	-17.5	1.29 H	296	7.00	49.50
6	11510.00	45.8 AV	54.0	-8.2	1.29 H	296	-3.70	49.50

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	#5725.00	83.5 PK	90.5	-7.0	1.32 V	46	44.80	38.70
2	#5725.00	74.5 AV	81.5	-7.0	1.32 V	46	35.80	38.70
3	*5755.00	110.5 PK			1.32 V	46	71.80	38.70
4	*5755.00	101.5 AV			1.32 V	46	62.80	38.70
5	11510.00	61.2 PK	74.0	-12.8	1.18 V	32	11.70	49.50
6	11510.00	48.7 AV	54.0	-5.3	1.18 V	32	-0.80	49.50

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 limit value is defined as per 15.247.
7. "#":The radiated frequency is out the restricted band.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 159	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	*5795.00	90.8 PK			1.21 H	232	52.00	38.80
2	*5795.00	81.2 AV			1.21 H	232	42.40	38.80
3	#5850.00	40.8 PK	70.8	-30.0	1.21 H	232	1.90	38.90
4	#5850.00	31.2 AV	61.2	-30.0	1.21 H	232	-7.70	38.90
5	11590.00	56.2 PK	74.0	-17.8	1.21 H	302	6.80	49.40
6	11590.00	45.6 AV	54.0	-8.4	1.21 H	302	-3.80	49.40
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	*5795.00	109.7 PK			1.16 V	84	70.90	38.80
2	*5795.00	101.1 AV			1.16 V	84	62.30	38.80
3	#5850.00	61.4 PK	89.7	-28.3	1.12 V	78	22.50	38.90
4	#5850.00	52.8 AV	81.1	-28.3	1.12 V	78	13.90	38.90
5	11590.00	58.2 PK	74.0	-15.8	1.29 V	65	8.80	49.40
6	11590.00	46.2 AV	54.0	-7.8	1.29 V	65	-3.20	49.40

**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 limit value is defined as per 15.247.
7. "#":The radiated frequency is out the restricted band.



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**BELOW 1GHz WORST-CASE DATA : 802.11n (40MHz)**

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 159	FREQUENCY RANGE	Below 1000MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Brad Wu

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	99.89	32.0 QP	43.5	-11.5	1.50 H	10	22.80	9.20
2	142.67	34.4 QP	43.5	-9.1	1.00 H	30	20.90	13.50
3	166.00	32.2 QP	43.5	-11.3	1.50 H	190	18.50	13.70
4	290.43	33.9 QP	46.0	-12.1	2.00 H	213	19.20	14.70
5	663.74	32.9 QP	46.0	-13.1	1.00 H	104	9.70	23.20
6	900.94	30.9 QP	46.0	-15.1	1.00 H	135	3.90	27.00
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	57.12	26.1 QP	40.0	-13.9	1.50 V	220	12.50	13.60
2	142.67	27.5 QP	43.5	-16.0	1.00 V	349	14.00	13.50
3	166.00	27.3 QP	43.5	-16.2	1.25 V	130	13.60	13.70
4	257.38	25.2 QP	46.0	-20.8	1.00 V	199	11.70	13.50
5	700.68	27.8 QP	46.0	-18.2	2.00 V	90	4.10	23.70
6	961.21	30.0 QP	54.0	-24.0	1.50 V	9	2.40	27.60

**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.

## 5.2 CONDUCTED EMISSION MEASUREMENT

### 5.2.1 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 0.50MHz.  
 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.

### 5.2.2 TEST INSTRUMENTS

Same as item 4.2.2.

### 5.2.3 TEST PROCEDURES

Same as item 4.2.3.

### 5.2.4 DEVIATION FROM TEST STANDARD

No deviation.

### 5.2.5 TEST SETUP

Same as item 4.2.5.

### 5.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6

### 5.2.7 TEST RESULTS

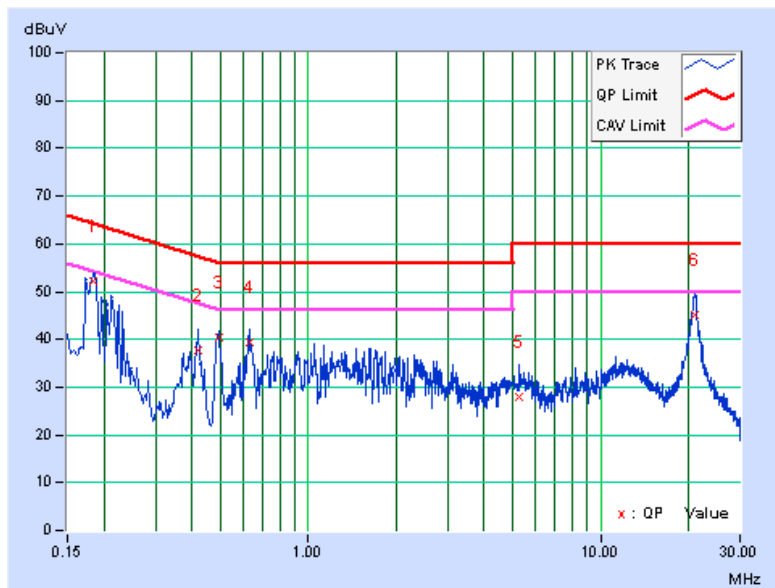
CONDUCTED WORST-CASE DATA : 802.11n (40MHz)

PHASE	Line 1	6dB BANDWIDTH	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18266	0.20	52.00	39.27	52.20	39.47	64.36	54.36	-12.16	-14.89
2	0.41780	0.21	37.38	28.31	37.59	28.52	57.49	47.49	-19.90	-18.97
<b>3</b>	<b>0.49324</b>	<b>0.21</b>	<b>40.10</b>	<b>38.07</b>	<b>40.31</b>	<b>38.28</b>	<b>56.11</b>	<b>46.11</b>	<b>-15.80</b>	<b>-7.83</b>
4	0.62689	0.21	39.02	31.73	39.23	31.94	56.00	46.00	-16.77	-14.06
5	5.24216	0.40	27.57	21.63	27.97	22.03	60.00	50.00	-32.03	-27.97
6	20.89255	0.95	44.31	38.96	45.26	39.91	60.00	50.00	-14.74	-10.09

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

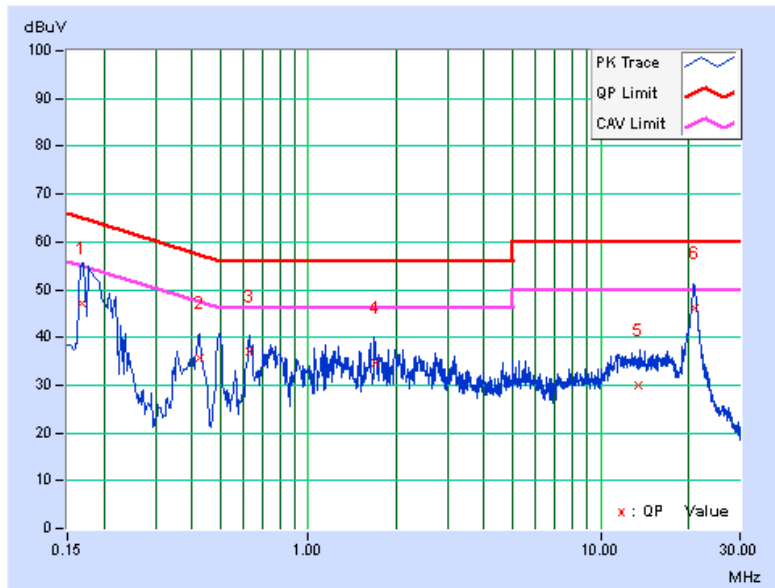


PHASE	Line 2	6dB BANDWIDTH	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.16745	0.27	46.82	29.30	47.09	29.57	65.09
2	0.42334	0.30	35.32	29.34	35.62	29.64	57.38	47.38	-21.76	-17.74
3	0.62689	0.30	36.81	30.04	37.11	30.34	56.00	46.00	-18.89	-15.66
4	1.68831	0.34	34.18	28.38	34.52	28.72	56.00	46.00	-21.48	-17.28
5	13.40490	0.78	29.29	23.75	30.07	24.53	60.00	50.00	-29.93	-25.47
6	20.92774	1.06	45.06	39.44	46.12	40.50	60.00	50.00	-13.88	-9.50

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.





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### **5.3 6dB BANDWIDTH MEASUREMENT**

#### **5.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT**

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

#### **5.3.2 TEST SETUP**

Same as item 4.3.2.

#### **5.3.3 TEST INSTRUMENTS**

Refer to section 4.1.2 to get information of above instrument.

#### **5.3.4 TEST PROCEDURE**

Same as item 4.3.4.

#### **5.3.5 DEVIATION FROM TEST STANDARD**

No deviation.

#### **5.3.6 EUT OPERATING CONDITIONS**

Same as item 4.3.6.





### 5.3.7 TEST RESULTS

#### 802.11a

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
149	5745	16.64	16.62	0.5	PASS
157	5785	16.63	16.61	0.5	PASS
165	5825	16.61	16.59	0.5	PASS

#### 802.11n (20MHz)

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
149	5745	17.82	17.87	0.5	PASS
157	5785	17.89	17.90	0.5	PASS
165	5825	17.86	17.88	0.5	PASS

#### 802.11n (40MHz)

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1		
151	5755	36.67	36.66	0.5	PASS
159	5795	36.66	36.64	0.5	PASS



## 5.4 CONDUCTED OUTPUT POWER

### 5.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 5725 –5850 MHz bands: 1 Watt (30dBm)

Per KDB 662911 D01 Multiple Transmitter Output v01r02 Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for  $NANT \leq 4$ ;

Array Gain = 0 dB (i.e., no array gain) for channel widths  $\geq 40$  MHz for any NANT;

Array Gain =  $5 \log(NANT/NSS)$  dB or 3 dB, whichever is less for 20-MHz channel widths with  $NANT \geq 5$ .

For power measurements on all other devices: Array Gain =  $10 \log(NANT/NSS)$  dB.

### 5.4.2 TEST SETUP

Same as Item 4.4.2.

### 5.4.3 INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

### 5.4.4 TEST PROCEDURES

Same as Item 4.4.4.

### 5.4.5 DEVIATION FROM TEST STANDARD

No deviation.

### 5.4.6 EUT OPERATING CONDITIONS

Same as Item 4.3.6.



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## 5.4.7 TEST RESULTS

### FOR PEAK POWER

#### 802.11a

CHAN.	FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
149	5745	20.12	19.75	197.208	22.95	30	PASS
157	5785	19.92	19.91	196.124	22.93	30	PASS
165	5825	19.24	19.24	167.892	22.25	30	PASS

#### 802.11n (20MHz)

CHAN.	FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
149	5745	19.99	19.72	193.526	22.87	30	PASS
157	5785	20.11	19.77	197.407	22.95	30	PASS
165	5825	19.64	19.88	189.320	22.77	30	PASS

#### 802.11n (40MHz)

CHAN.	FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
151	5755	20.22	19.49	194.116	22.88	30	PASS
159	5795	20.35	20.11	<b>210.958</b>	23.24	30	PASS



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### FOR AVERAGE POWER

#### 802.11a

CHANNEL	FREQUENCY (MHz)	AVG. POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
149	5745	13.35	12.84	40.858	15.18
157	5785	13.41	13.18	42.725	15.23
165	5825	12.64	12.53	36.271	14.50

#### 802.11n (20MHz)

CHANNEL	FREQUENCY (MHz)	AVG. POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
149	5745	13.42	12.81	41.078	15.09
157	5785	13.52	12.68	41.026	15.02
165	5825	12.34	12.45	34.719	14.38

#### 802.11n (40MHz)

CHANNEL	FREQUENCY (MHz)	AVG. POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
151	5755	13.52	13.11	42.955	15.26
159	5795	13.24	13.08	41.410	15.10



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## **5.5 POWER SPECTRAL DENSITY MEASUREMENT**

### **5.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT**

The Maximum of Power Spectral Density Measurement is 8dBm.

### **5.5.2 TEST SETUP**

Same as item 4.5.2.

### **5.5.3 TEST INSTRUMENTS**

Refer to section 4.1.2 to get information of above instrument.

### **5.5.4 TEST PROCEDURE.**

Same as item 4.5.4.

### **5.5.5 DEVIATION FROM TEST STANDARD**

No deviation.

### **5.5.6 EUT OPERATING CONDITION**

Same as item 4.3.6.



### 5.5.7 TEST RESULTS

#### 802.11a

TX chain	Channel	FREQ. (MHz)	PSD (dBm/3kHz)	10 log (N=3) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	149	5745	-11.90	3.01	-8.89	4.99	PASS
	157	5785	-12.40	3.01	-9.39	4.99	PASS
	165	5825	-14.14	3.01	-11.13	4.99	PASS
1	149	5745	-13.47	3.01	-10.46	4.99	PASS
	157	5785	-12.65	3.01	-9.64	4.99	PASS
	165	5825	-13.14	3.01	-10.13	4.99	PASS

**NOTE:** Directional gain = 6dBi + 10log(2) = 9.01dBi > 6dBi , so the power density limit shall be reduced to 8-(9.01-6) = 4.99dBm.

#### 802.11n (20MHz)

TX chain	Channel	FREQ. (MHz)	PSD (dBm/3kHz)	10 log (N=3) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	149	5745	-14.38	3.01	-11.37	4.99	PASS
	157	5785	-14.35	3.01	-11.34	4.99	PASS
	165	5825	-14.28	3.01	-11.27	4.99	PASS
1	149	5745	-13.61	3.01	-10.60	4.99	PASS
	157	5785	-14.10	3.01	-11.09	4.99	PASS
	165	5825	-11.87	3.01	-8.86	4.99	PASS

**NOTE:** Directional gain = 6dBi + 10log(2) = 9.01dBi > 6dBi , so the power density limit shall be reduced to 8-(9.01-6) = 4.99dBm.

#### 802.11n (40MHz)

TX chain	Channel	FREQ. (MHz)	PSD (dBm/3kHz)	10 log (N=3) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	151	5755	-14.98	3.01	-11.97	4.99	PASS
	159	5795	-15.75	3.01	-12.74	4.99	PASS
1	151	5755	-16.78	3.01	-13.77	4.99	PASS
	159	5795	-15.90	3.01	-12.89	4.99	PASS

**NOTE:** Directional gain = 6dBi + 10log(2) = 9.01dBi > 6dBi , so the power density limit shall be reduced to 8-(9.01-6) = 4.99dBm.



## 5.6 CONDUCTED OUT OF BAND EMISSION MEASUREMENT

### 5.6.1 LIMITS OF CONDUCTED OUT OF BAND EMISSION MEASUREMENT

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### 5.6.2 TEST SETUP

Same as Item 4.6.2

### 5.6.3 TEST INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

### 5.6.4 TEST PROCEDURE

Same as Item 4.6.4

### 5.6.5 DEVIATION FROM TEST STANDARD

No deviation.

### 5.6.6 EUT OPERATING CONDITION

Same as Item 4.3.6

### 5.6.7 TEST RESULTS

The conducted emission test is performed on each TX port of operating mode without summing or adding  $10\log(N)$  since the limit is relative emission limit. Only worst data of each operating mode is presented.

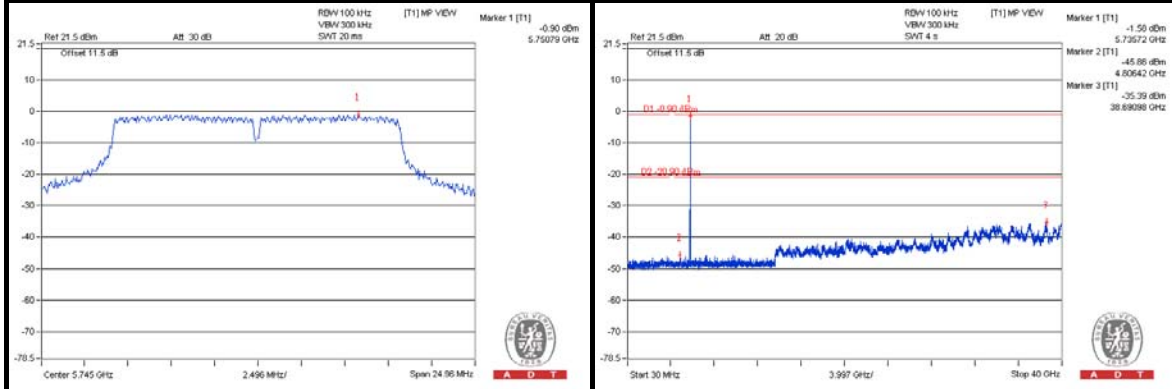
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



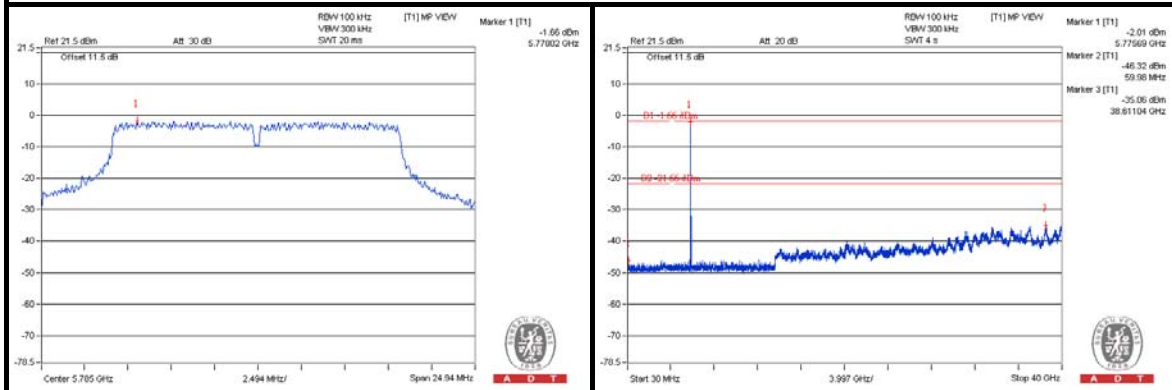
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802.11a  
CHAIN 0

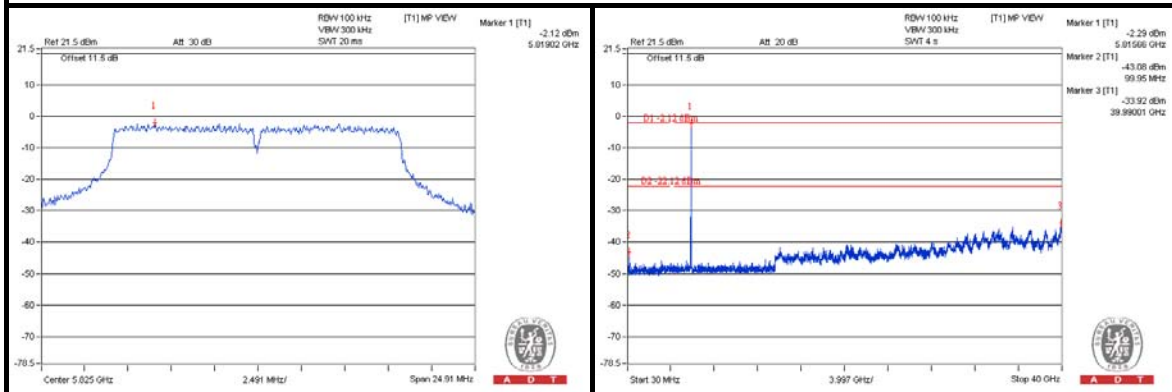
CH 149



CH 157



CH 165



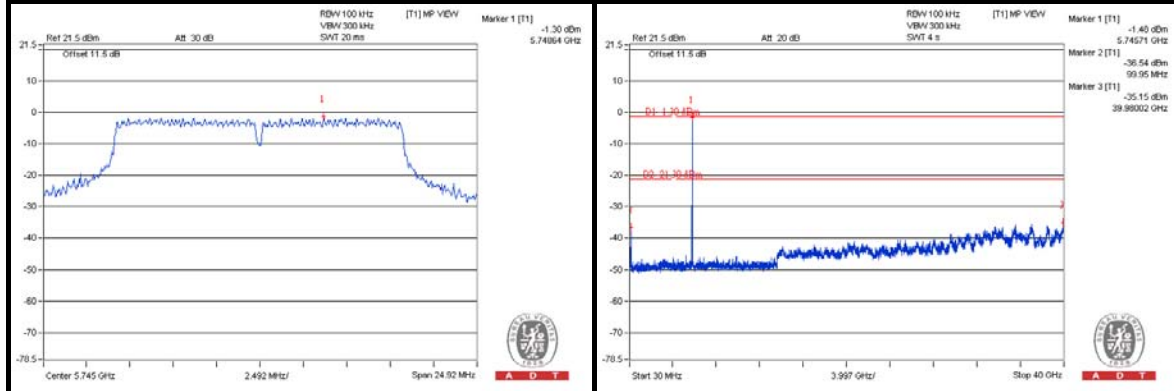




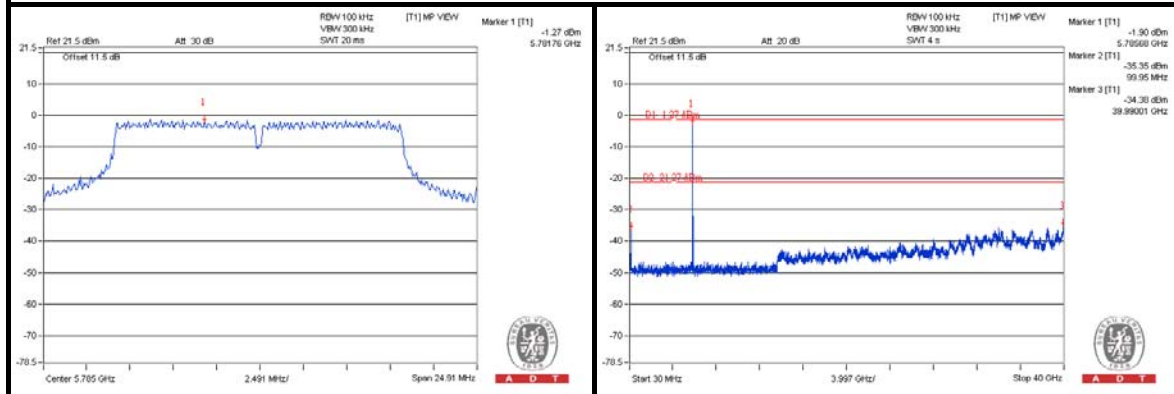
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### CHAIN 1

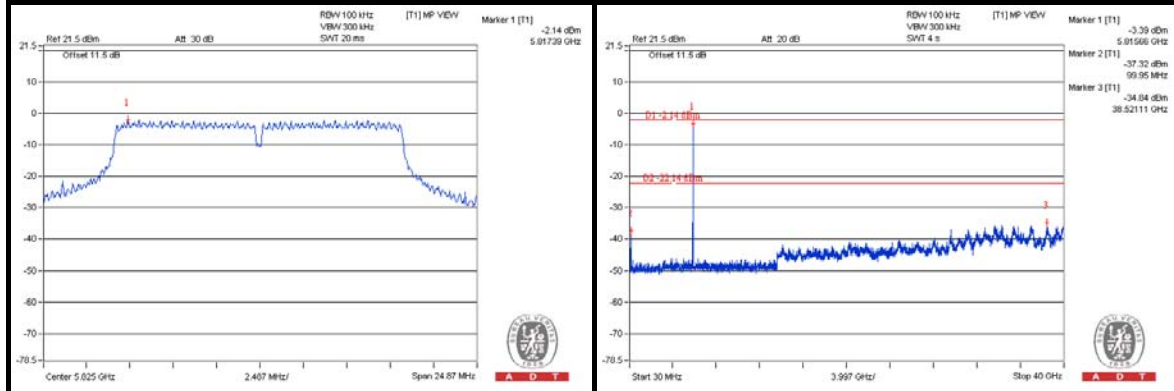
#### CH 149



#### CH 157



#### CH 165



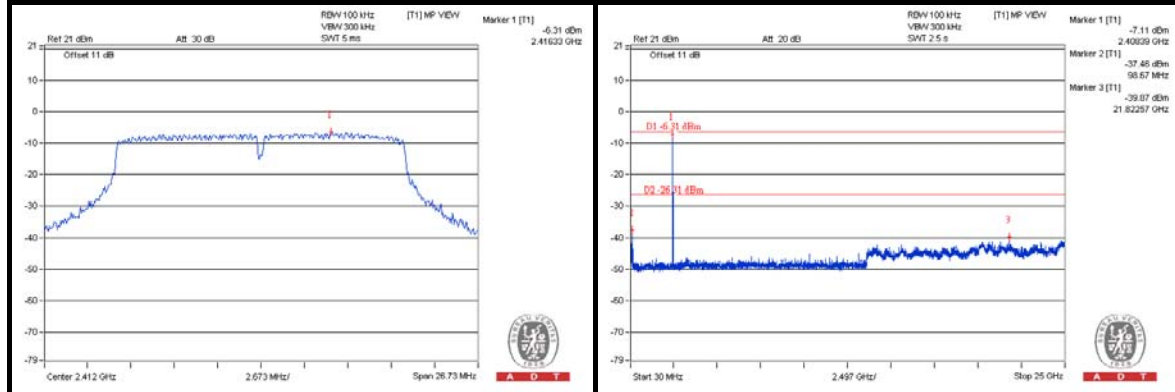


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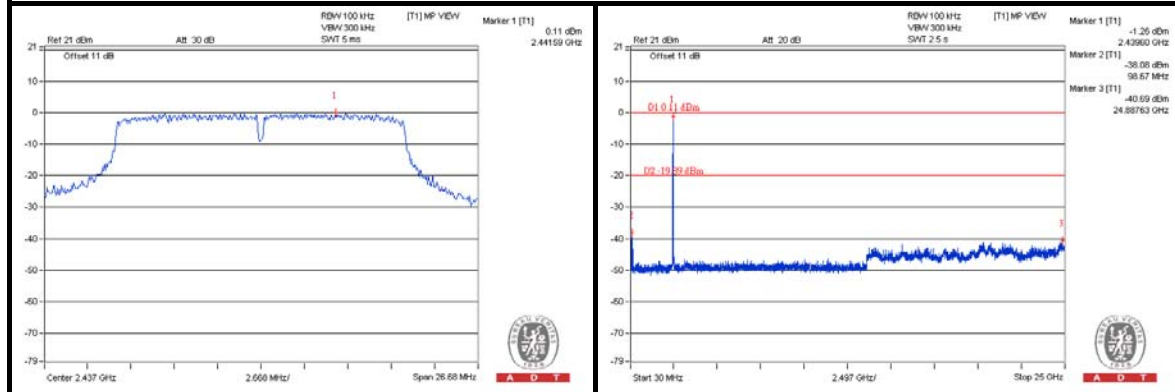
### 802.11n (20MHz)

### CHAIN 0

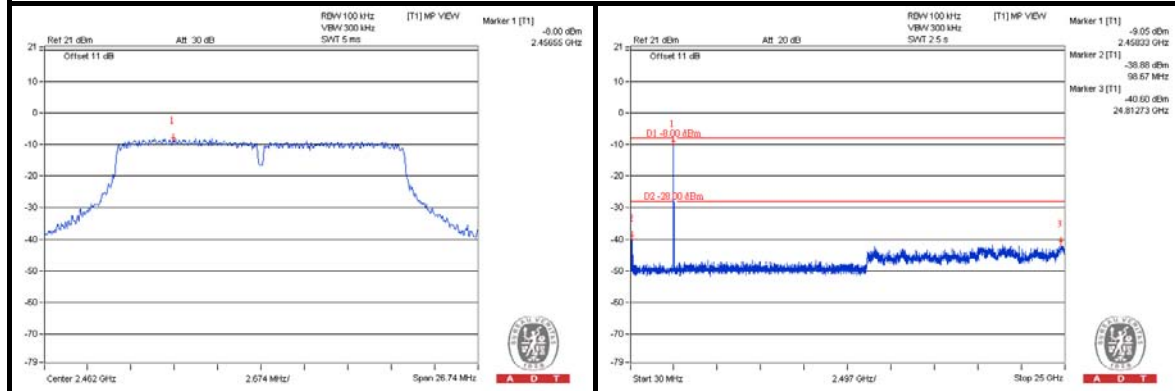
#### CH 149



#### CH 157



#### CH 165

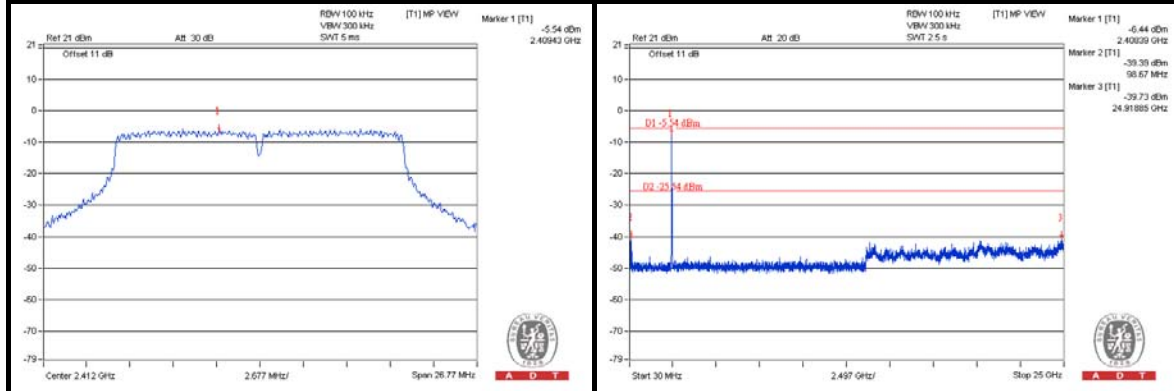




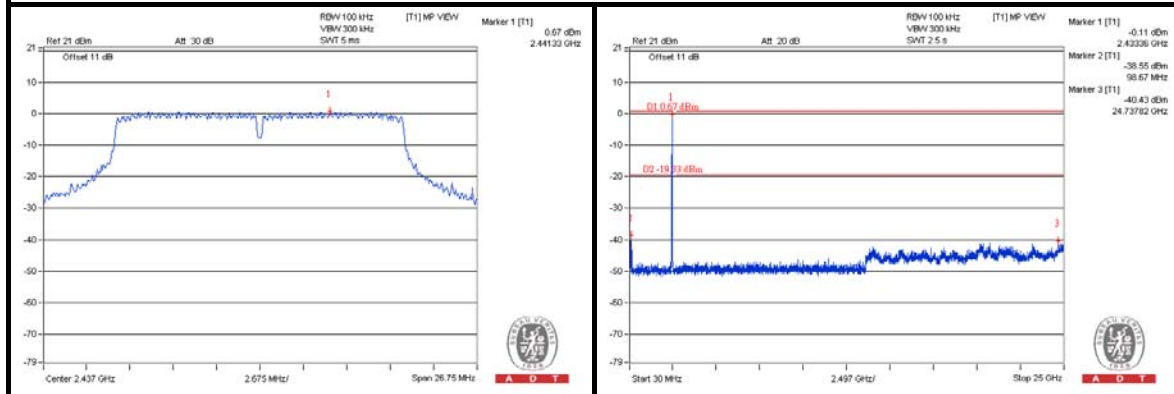
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### CHAIN 1

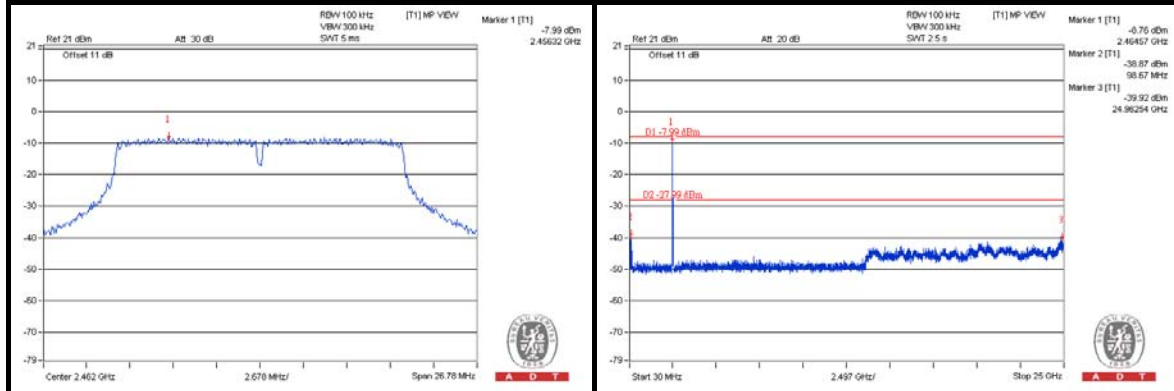
#### CH 149



#### CH 157



#### CH 165



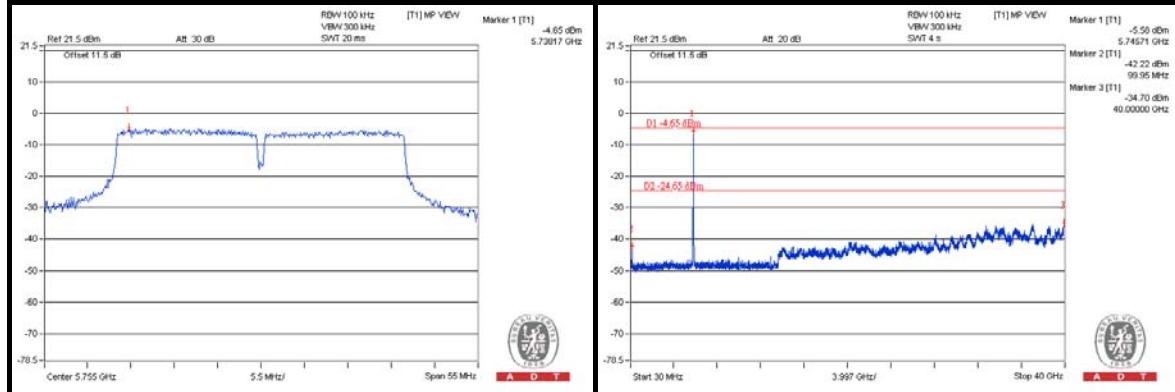


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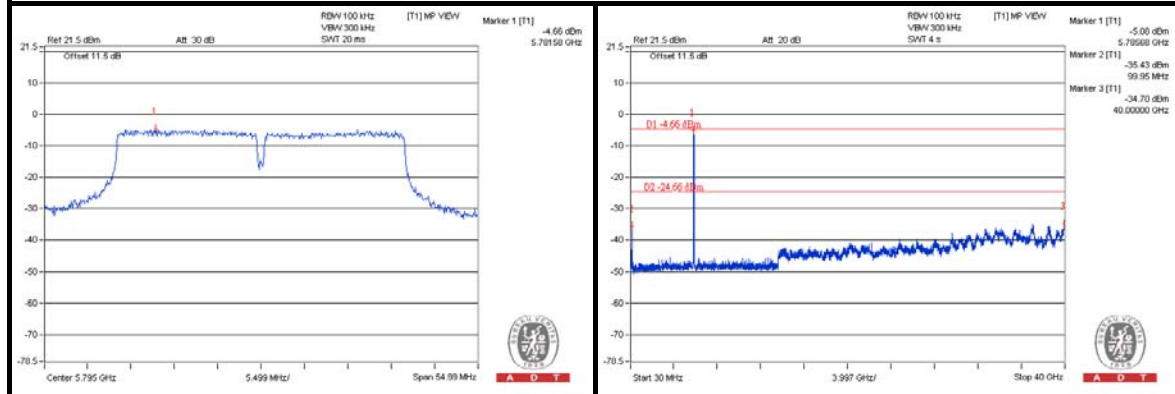
### 802.11n (40MHz)

### CHAIN 0

#### CH 151



#### CH 159

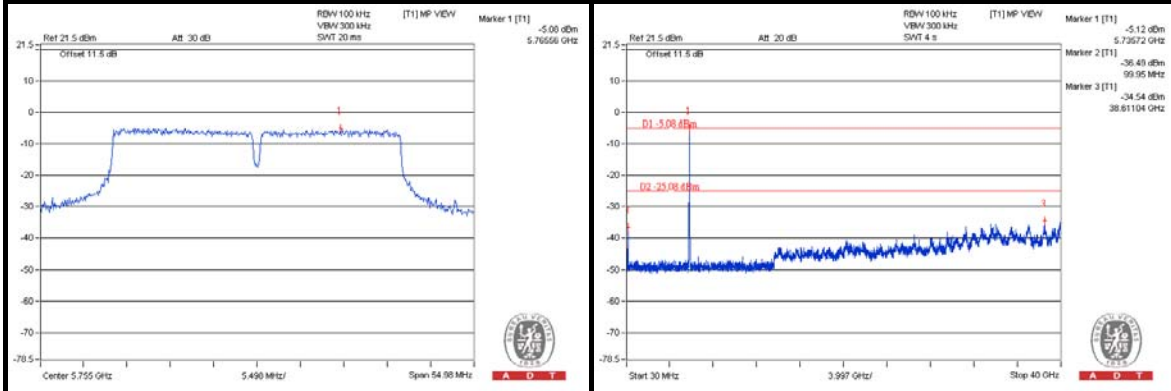




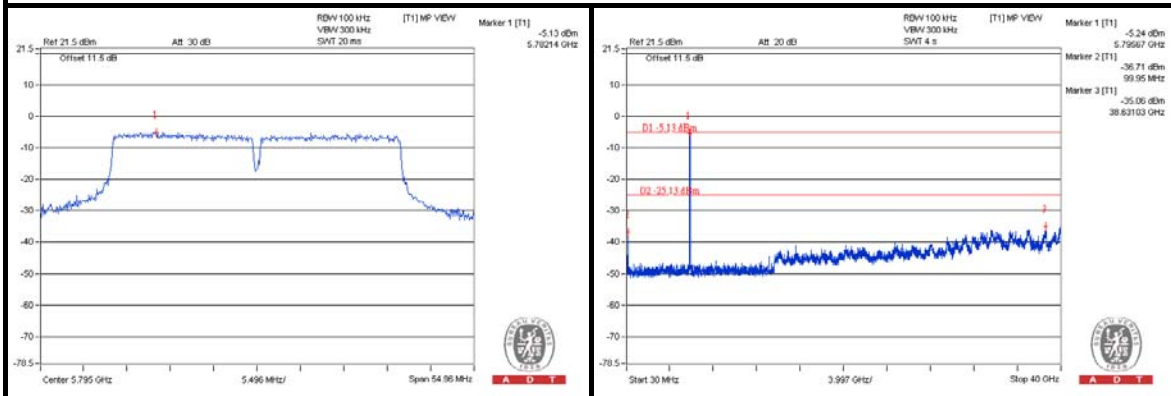
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### CHAIN 1

#### CH 151



#### CH 159





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## 6. PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



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## 7. 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.

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

**Linko EMC/RF Lab**

Tel: 886-2-26052180

Fax: 886-2-26051924

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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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



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

No modifications were made to the EUT by the lab during the test.

**---END---**