

## FCC Test Report

**Report No.:** RF150211C07

**FCC ID:** KA2CHS160A1

**Test Model:** DCH-S160

**Received Date:** Feb. 11, 2015

**Test Date:** Mar. 12 ~ Mar. 18, 2015

**Issued Date:** Mar. 24, 2015

**Applicant:** D-LINK CORPORATION

**Address:** 17595 Mt. Hermann, Fountain Valley, CA 92708, U.S.A.

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

**Lab Address:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

**Test Location:** No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City  
33383, TAIWAN (R.O.C.)



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### Release Control Record

Issue No.	Description	Date Issued
RF150211C07	Original release.	Mar. 24, 2015



## 1 Certificate of Conformity

**Product:** mydlink™ Wi-Fi Water Sensor

**Brand:** D-Link

**Test Model:** DCH-S160

**Sample Status:** Engineering sample

**Applicant:** D-LINK CORPORATION

**Test Date:** Mar. 12 ~ Mar. 18, 2015

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.10:2009

The above equipment 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 :**                     *Suntee Liu*                     , **Date:**                     Mar. 24, 2015                      
Suntee Liu / Specialist

**Approved by :**                     *Ken Liu*                     , **Date:**                     Mar. 24, 2015                      
Ken Liu / Senior Manager

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -17.74dB at 0.49017MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -1.0dB at 2483.50 & 4874.00 & 4924.00 & 2390.00MHz.
15.247(d)	Antenna Port Emission	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	No antenna connector is used.

### 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	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.86 dB
	200MHz ~ 1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	mydlink™ Wi-Fi Water Sensor
Brand	D-Link
Test Model	DCH-S160
Status of EUT	Engineering sample
Power Supply Rating	100-240Vac
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11/5.5/2/1Mbps 802.11g: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 300Mbps
Operating Frequency	2412 ~ 2462MHz
Number of Channel	802.11b, 802.11g, 802.11n (20MHz): 11 802.11n (40MHz): 7
Output Power	561.707mW
Antenna Type	PCB antenna with 0dBi gain
Antenna Connector	NA
Accessory Device	NA
Data Cable Supplied	1m non-shielded RJ11 cable 0.5m non-shielded RJ11 cable

Note:

- 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
802.11n (20MHz)	2TX
802.11n (40MHz)	2TX

### 3.2 Description of Test Modes

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		

### 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where RE $\geq$ 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 X-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

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	TESTED BY
RE $\geq$ 1G	18 deg. C, 70% RH	120Vac, 60Hz	Jones Chang
RE<1G	19 deg. C, 70% RH	120Vac, 60Hz	Jones Chang
PLC	25 deg. C, 65% RH	120Vac, 60Hz	Chris Lin
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Leo Tsai

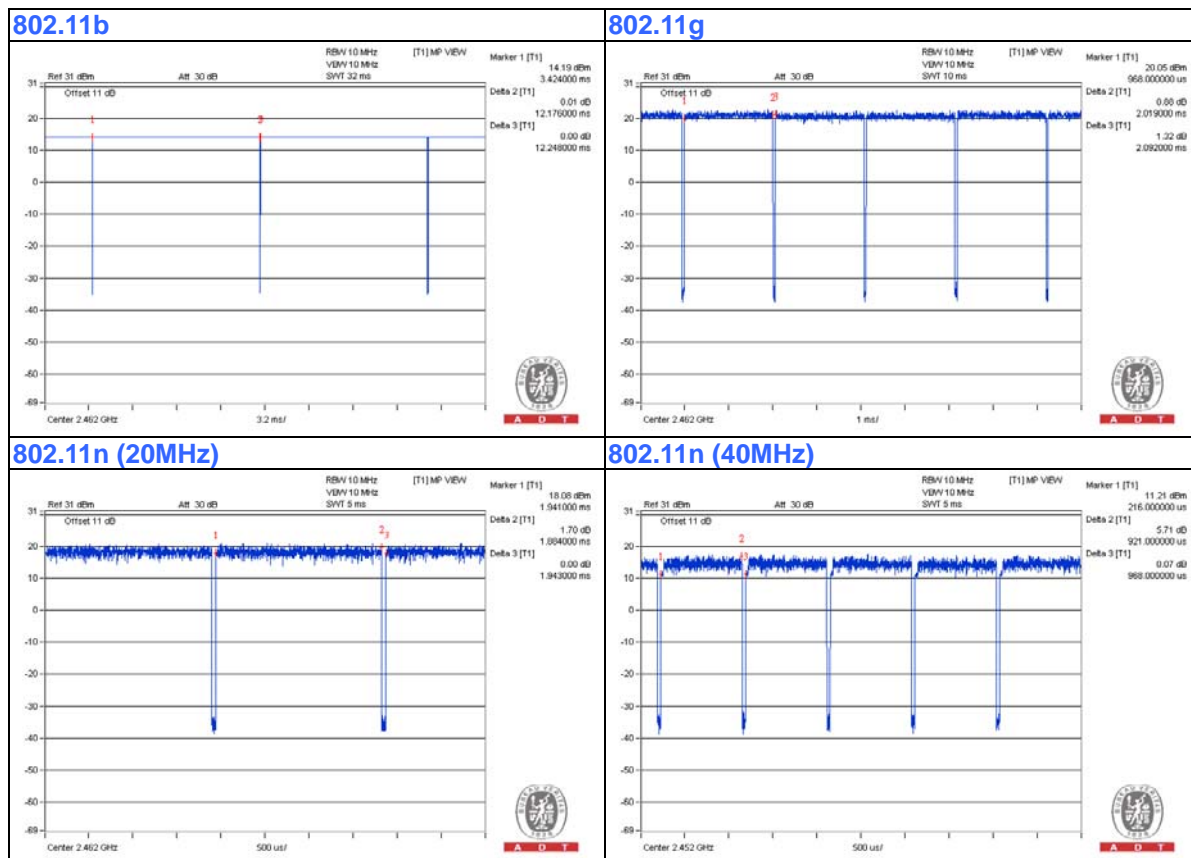
### 3.3 Duty Cycle of Test Signal

**802.11b:** Duty cycle =  $12.176/12.248 = 0.994$

**802.11g:** Duty cycle =  $2.019/2.092 = 0.965$ , Duty factor =  $10 * \log(1/0.965) = 0.15$

**802.11n (20MHz):** Duty cycle =  $1.884/1.943 = 0.970$ , Duty factor =  $10 * \log(1/0.970) = 0.13$

**802.11n (40MHz):** Duty cycle =  $0.921/0.968 = 0.951$ , Duty factor =  $10 * \log(1/0.951) = 0.22$



### 3.4 Description of Support Units

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

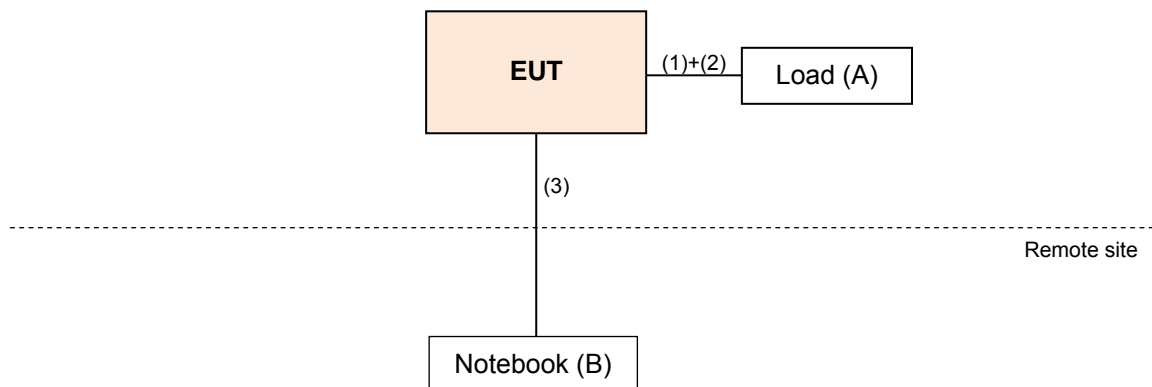
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Load	NA	NA	NA	NA	-
B.	Notebook	Dell	E5420	CN-0H5TG2-75900-1B 3-01TV-A01	FCC DoC Approved	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item B acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ11	1	1	N	0	Accessory of EUT
2.	RJ11	1	0.5	N	0	Accessory of EUT
3.	RJ45	1	3	N	0	-

#### 3.4.1 Configuration of System under Test



### 3.5 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 v03r02**

**662911 D01 Multiple Transmitter Output v02r01**

ANSI C63.10-2013

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

### 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.

#### 4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Oct. 06, 2014	Oct. 05, 2015
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Mar. 03, 2015	Mar. 02, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Feb. 05, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	9120D	209	Feb. 09, 2015	Feb. 08, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2015	Feb. 08, 2016
Preamplifier Agilent	8447D	2944A10738	Oct. 18, 2014	Oct. 17, 2015
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2014	Aug. 21, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	214378/4	Aug. 22, 2014	Aug. 21, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 106	12738/6 +309224/4	Aug. 22, 2014	Aug. 21, 2015
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	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
High Speed Peak Power Meter	ML2495A	0824011	Jul. 26, 2014	Jul. 25, 2015
Power Sensor	MA2411B	0738171	Jul. 26, 2014	Jul. 25, 2015

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 Chamber 3.

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

4. The FCC Site Registration No. is 988962.

5. The IC Site Registration No. is IC 7450F-3.

#### 4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

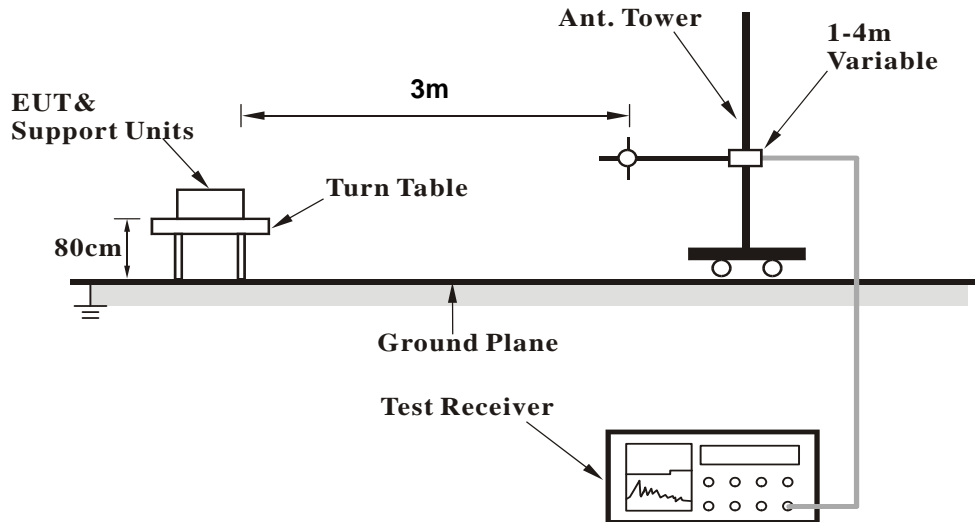
1. For emission measurements above 1 GHz, the EUT shall be placed at a height of 1.5 m above the ground at 3 meter chamber room for test
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ( $10 \log(1/\text{duty cycle})$ ).
5. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle  $\geq$  98%) for Average detection (AV) at frequency above 1GHz.
6. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

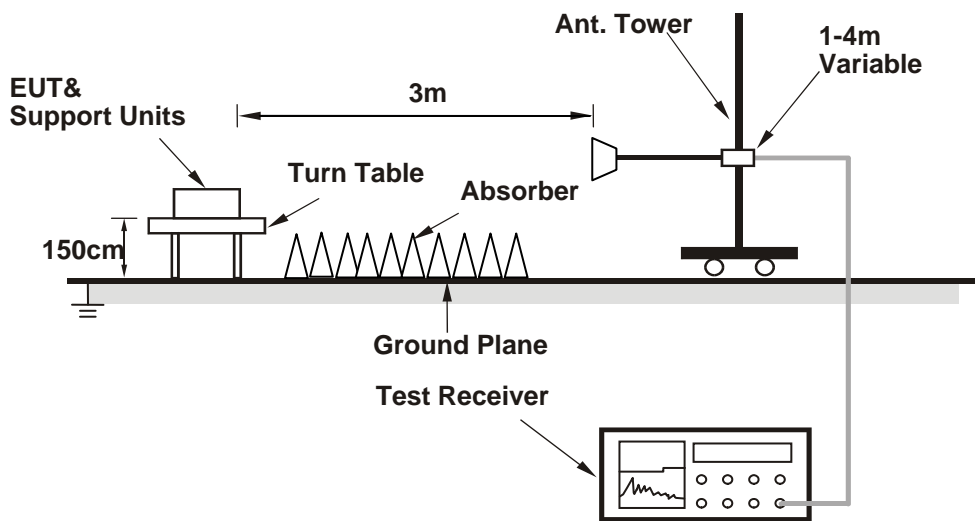
No deviation.

#### 4.1.5 Test Setup

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

#### 4.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Prepared a notebook to act as a communication partner and placed it outside of testing area.
- The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- The communication partner sent data to EUT by command "PING".

#### 4.1.7 Test Results

##### Above 1GHz Data

##### 802.11b

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	56.5 PK	74.0	-17.5	1.20 H	301	24.00	32.50
2	2390.00	46.6 AV	54.0	-7.4	1.20 H	301	14.10	32.50
3	*2412.00	101.9 PK			1.02 H	299	69.30	32.60
4	*2412.00	98.3 AV			1.02 H	299	65.70	32.60
5	4824.00	54.2 PK	74.0	-19.8	1.77 H	333	48.30	5.90
6	4824.00	49.9 AV	54.0	-4.1	1.77 H	333	44.00	5.90
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	58.1 PK	74.0	-15.9	1.51 V	77	25.60	32.50
2	2390.00	47.8 AV	54.0	-6.2	1.51 V	77	15.30	32.50
3	*2412.00	96.2 PK			1.47 V	65	63.60	32.60
4	*2412.00	92.5 AV			1.47 V	65	59.90	32.60
5	4824.00	55.9 PK	74.0	-18.1	1.76 V	304	50.00	5.90
6	4824.00	52.5 AV	54.0	-1.5	1.76 V	304	46.60	5.90

#### 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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.



CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

**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	103.5 PK			1.16 H	214	70.80	32.70
2	*2437.00	99.8 AV			1.16 H	214	67.10	32.70
3	4874.00	56.5 PK	74.0	-17.5	1.82 H	334	50.60	5.90
4	4874.00	52.5 AV	54.0	-1.5	1.82 H	334	46.60	5.90

**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	96.5 PK			1.88 V	140	63.80	32.70
2	*2437.00	93.6 AV			1.88 V	140	60.90	32.70
3	4874.00	56.7 PK	74.0	-17.3	1.74 V	306	50.80	5.90
<b>4</b>	<b>4874.00</b>	<b>53.0 AV</b>	<b>54.0</b>	<b>-1.0</b>	<b>1.74 V</b>	<b>306</b>	<b>47.10</b>	<b>5.90</b>

**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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

**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	103.5 PK			1.02 H	215	70.90	32.60
2	*2462.00	99.8 AV			1.02 H	215	67.20	32.60
3	2483.50	57.7 PK	74.0	-16.3	1.02 H	215	25.00	32.70
4	2483.50	47.2 AV	54.0	-6.8	1.02 H	215	14.50	32.70
5	4924.00	54.2 PK	74.0	-19.8	1.78 H	327	48.20	6.00
6	4924.00	49.9 AV	54.0	-4.1	1.78 H	327	43.90	6.00

**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	*2462.00	98.5 PK			1.58 V	122	65.90	32.60
2	*2462.00	95.2 AV			1.58 V	122	62.60	32.60
3	2483.50	57.4 PK	74.0	-16.6	1.61 V	123	24.70	32.70
4	2483.50	46.3 AV	54.0	-7.7	1.61 V	123	13.60	32.70
5	4924.00	56.8 PK	74.0	-17.2	1.80 V	309	50.80	6.00
<b>6</b>	<b>4924.00</b>	<b>53.0 AV</b>	<b>54.0</b>	<b>-1.0</b>	<b>1.80 V</b>	<b>309</b>	<b>47.00</b>	<b>6.00</b>

**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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* " : Fundamental frequency.

802.11g

CHANNEL	TX Channel 1	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

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	67.8 PK	74.0	-6.2	1.19 H	301	35.30	32.50
2	<b>2390.00</b>	<b>53.0 AV</b>	<b>54.0</b>	<b>-1.0</b>	<b>1.19 H</b>	<b>301</b>	<b>20.50</b>	<b>32.50</b>
3	*2412.00	110.6 PK			1.02 H	298	78.00	32.60
4	*2412.00	99.9 AV			1.02 H	298	67.30	32.60
5	4824.00	56.7 PK	74.0	-17.3	1.72 H	333	50.80	5.90
6	4824.00	43.4 AV	54.0	-10.6	1.72 H	333	37.50	5.90

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	61.2 PK	74.0	-12.8	1.69 V	66	28.70	32.50
2	2390.00	49.2 AV	54.0	-4.8	1.69 V	66	16.70	32.50
3	*2412.00	105.7 PK			1.67 V	123	73.10	32.60
4	*2412.00	95.3 AV			1.67 V	123	62.70	32.60
5	4824.00	60.8 PK	74.0	-13.2	2.05 V	307	54.90	5.90
6	4824.00	46.6 AV	54.0	-7.4	2.05 V	307	40.70	5.90

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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

**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	112.0 PK			1.17 H	316	79.30	32.70
2	*2437.00	102.6 AV			1.17 H	316	69.90	32.70
3	4874.00	58.9 PK	74.0	-15.1	1.84 H	336	53.00	5.90
4	4874.00	45.8 AV	54.0	-8.2	1.84 H	336	39.90	5.90
5	7311.00	55.2 PK	74.0	-18.8	1.83 H	243	43.50	11.70
6	7311.00	42.2 AV	54.0	-11.8	1.83 H	243	30.50	11.70

**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	108.4 PK			1.63 V	130	75.70	32.70
2	*2437.00	98.1 AV			1.63 V	130	65.40	32.70
3	4874.00	62.5 PK	74.0	-11.5	1.50 V	309	56.60	5.90
4	4874.00	49.8 AV	54.0	-4.2	1.50 V	309	43.90	5.90
5	7311.00	61.7 PK	74.0	-12.3	1.99 V	272	50.00	11.70
6	7311.00	47.0 AV	54.0	-7.0	1.99 V	272	35.30	11.70

**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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

**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	111.5 PK			1.17 H	171	78.90	32.60
2	*2462.00	101.5 AV			1.17 H	171	68.90	32.60
3	2483.50	68.4 PK	74.0	-5.6	1.15 H	316	35.70	32.70
<b>4</b>	<b>2483.50</b>	<b>53.0 AV</b>	<b>54.0</b>	<b>-1.0</b>	<b>1.15 H</b>	<b>316</b>	<b>20.30</b>	<b>32.70</b>
5	4924.00	55.9 PK	74.0	-18.1	1.78 H	193	49.90	6.00
6	4924.00	42.0 AV	54.0	-12.0	1.78 H	193	36.00	6.00

**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	*2462.00	106.9 PK			1.61 V	124	74.30	32.60
2	*2462.00	97.1 AV			1.61 V	124	64.50	32.60
3	2483.50	61.0 PK	74.0	-13.0	1.68 V	220	28.30	32.70
4	2483.50	50.0 AV	54.0	-4.0	1.68 V	220	17.30	32.70
5	4924.00	59.5 PK	74.0	-14.5	2.06 V	308	53.50	6.00
6	4924.00	45.8 AV	54.0	-8.2	2.06 V	308	39.80	6.00

**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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

**802.11n (20MHz)**

CHANNEL	TX Channel 1	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

**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	64.0 PK	74.0	-10.0	1.34 H	275	31.50	32.50
2	2390.00	52.8 AV	54.0	-1.2	1.34 H	275	20.30	32.50
3	*2412.00	109.5 PK			1.03 H	263	76.90	32.60
4	*2412.00	99.9 AV			1.03 H	263	67.30	32.60
5	4824.00	57.6 PK	74.0	-16.4	1.05 H	60	51.70	5.90
6	4824.00	42.6 AV	54.0	-11.4	1.05 H	60	36.70	5.90

**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	61.3 PK	74.0	-12.7	1.66 V	61	28.80	32.50
2	2390.00	49.9 AV	54.0	-4.1	1.66 V	61	17.40	32.50
3	*2412.00	101.2 PK			1.70 V	120	68.60	32.60
4	*2412.00	92.0 AV			1.70 V	120	59.40	32.60
5	4824.00	62.2 PK	74.0	-11.8	2.03 V	301	56.30	5.90
6	4824.00	46.1 AV	54.0	-7.9	2.03 V	301	40.20	5.90

**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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.



CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

**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	112.0 PK			1.33 H	204	79.30	32.70
2	*2437.00	102.6 AV			1.33 H	204	69.90	32.70
3	4874.00	59.2 PK	74.0	-14.8	1.00 H	240	53.30	5.90
4	4874.00	45.2 AV	54.0	-8.8	1.00 H	240	39.30	5.90

**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	105.3 PK			1.69 V	120	72.60	32.70
2	*2437.00	95.4 AV			1.69 V	120	62.70	32.70
3	4874.00	62.0 PK	74.0	-12.0	2.01 V	301	56.10	5.90
4	4874.00	48.9 AV	54.0	-5.1	2.01 V	301	43.00	5.90

**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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

**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	110.5 PK			1.16 H	208	77.90	32.60
2	*2462.00	100.5 AV			1.16 H	208	67.90	32.60
3	2483.50	69.6 PK	74.0	-4.4	1.79 H	203	36.90	32.70
4	2483.50	52.1 AV	54.0	-1.9	1.79 H	203	19.40	32.70
5	4924.00	53.3 PK	74.0	-20.7	1.76 H	336	47.30	6.00
6	4924.00	39.3 AV	54.0	-14.7	1.76 H	336	33.30	6.00

**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	*2462.00	103.9 PK			2.00 V	123	71.30	32.60
2	*2462.00	93.8 AV			2.00 V	123	61.20	32.60
3	2483.50	63.2 PK	74.0	-10.8	1.87 V	133	30.50	32.70
4	2483.50	51.2 AV	54.0	-2.8	1.87 V	133	18.50	32.70
5	4924.00	56.5 PK	74.0	-17.5	2.04 V	186	50.50	6.00
6	4924.00	42.4 AV	54.0	-11.6	2.04 V	186	36.40	6.00

**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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

**802.11n (40MHz)**

CHANNEL	TX Channel 3	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

**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	68.0 PK	74.0	-6.0	1.67 H	276	35.50	32.50
2	2390.00	52.8 AV	54.0	-1.2	1.67 H	276	20.30	32.50
3	*2422.00	102.1 PK			1.66 H	273	69.50	32.60
4	*2422.00	91.7 AV			1.66 H	273	59.10	32.60
5	4844.00	49.7 PK	74.0	-24.3	1.53 H	100	43.80	5.90
6	4844.00	36.5 AV	54.0	-17.5	1.53 H	100	30.60	5.90

**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	2.00 V	93	26.60	32.50
2	2390.00	48.2 AV	54.0	-5.8	2.00 V	93	15.70	32.50
3	*2422.00	96.4 PK			2.05 V	116	63.80	32.60
4	*2422.00	86.1 AV			2.05 V	116	53.50	32.60
5	4844.00	32.8 PK	74.0	-41.2	1.98 V	300	26.90	5.90
6	4844.00	22.1 AV	54.0	-31.9	1.98 V	300	16.20	5.90

**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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* " : Fundamental frequency.



CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

**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	67.8 PK	74.0	-6.2	1.67 H	273	35.30	32.50
2	2390.00	52.8 AV	54.0	-1.2	1.67 H	273	20.30	32.50
3	*2437.00	105.5 PK			1.63 H	274	72.80	32.70
4	*2437.00	96.0 AV			1.63 H	274	63.30	32.70
5	2483.50	59.8 PK	74.0	-14.2	1.70 H	266	27.10	32.70
6	2483.50	48.3 AV	54.0	-5.7	1.70 H	266	15.60	32.70
7	4874.00	53.4 PK	74.0	-20.6	1.46 H	58	47.50	5.90
8	4874.00	39.2 AV	54.0	-14.8	1.46 H	58	33.30	5.90

**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	61.5 PK	74.0	-12.5	2.03 V	125	29.00	32.50
2	2390.00	50.0 AV	54.0	-4.0	2.03 V	125	17.50	32.50
3	*2437.00	100.7 PK			2.06 V	123	68.00	32.70
4	*2437.00	91.0 AV			2.06 V	123	58.30	32.70
5	2483.50	59.1 PK	74.0	-14.9	1.89 V	201	26.40	32.70
6	2483.50	47.7 AV	54.0	-6.3	1.89 V	201	15.00	32.70
7	4874.00	55.1 PK	74.0	-18.9	2.06 V	308	49.20	5.90
8	4874.00	41.7 AV	54.0	-12.3	2.06 V	308	35.80	5.90

**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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.



CHANNEL	TX Channel 9	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

## ANTENNA POLARITY &amp; 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	105.5 PK			1.00 H	264	72.80	32.70
2	*2452.00	95.6 AV			1.00 H	264	62.90	32.70
3	2483.50	67.0 PK	74.0	-7.0	1.32 H	202	34.30	32.70
<b>4</b>	<b>2483.50</b>	<b>53.0 AV</b>	<b>54.0</b>	<b>-1.0</b>	<b>1.32 H</b>	<b>202</b>	<b>20.30</b>	<b>32.70</b>
5	4904.00	50.4 PK	74.0	-23.6	1.09 H	70	44.60	5.80
6	4904.00	37.1 AV	54.0	-16.9	1.09 H	70	31.30	5.80

## ANTENNA POLARITY &amp; 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	96.7 PK			1.88 V	287	64.00	32.70
2	*2452.00	87.0 AV			1.88 V	287	54.30	32.70
3	2483.50	59.7 PK	74.0	-14.3	1.93 V	264	27.00	32.70
4	2483.50	48.3 AV	54.0	-5.7	1.93 V	264	15.60	32.70
5	4904.00	52.3 PK	74.0	-21.7	1.90 V	302	46.50	5.80
6	4904.00	39.4 AV	54.0	-14.6	1.90 V	302	33.60	5.80

## 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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.

**Below 1GHz Worst-Case Data**
**802.11g**

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

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	57.12	32.3 QP	40.0	-7.7	2.00 H	35	46.90	-14.60
2	134.89	26.3 QP	43.5	-17.2	2.00 H	78	41.50	-15.20
3	195.16	34.5 QP	43.5	-9.0	1.50 H	79	51.30	-16.80
4	393.48	38.6 QP	46.0	-7.4	1.01 H	10	49.30	-10.70
5	784.28	37.1 QP	46.0	-8.9	1.01 H	54	39.40	-2.30
6	980.66	36.2 QP	54.0	-17.8	1.50 H	279	35.40	0.80
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	29.0 QP	40.0	-11.0	1.49 V	16	43.60	-14.60
2	132.95	22.1 QP	43.5	-21.4	1.00 V	200	37.40	-15.30
3	230.16	26.2 QP	46.0	-19.8	1.00 V	262	42.50	-16.30
4	391.54	38.3 QP	46.0	-7.7	1.00 V	267	48.90	-10.60
5	587.91	28.8 QP	46.0	-17.2	1.00 V	225	35.40	-6.60
6	788.17	40.2 QP	46.0	-5.8	1.00 V	179	42.50	-2.30

**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)  
– Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

## 4.2 Conducted Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	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.

### 4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 11, 2014	Nov. 10, 2015
RF signal cable Woken	5D-FB	Cable-HYC01-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 02, 2015	Mar. 01, 2016
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 21, 2014	Jul. 20, 2015
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

Notes: 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

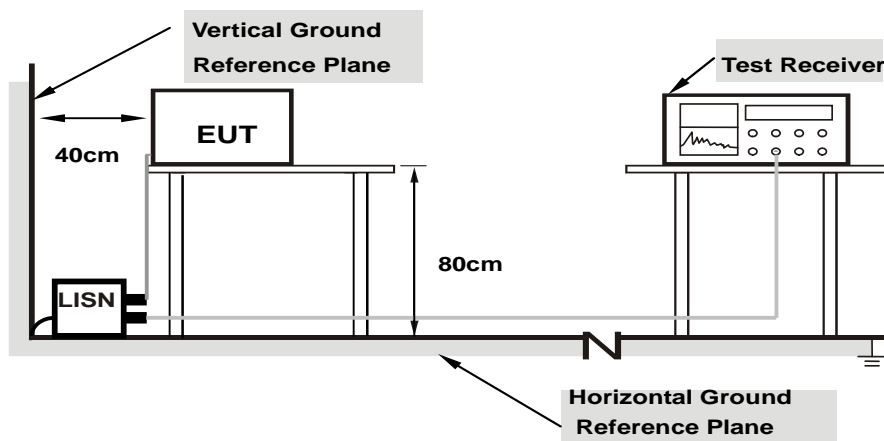
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

**NOTE:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

#### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



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

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.

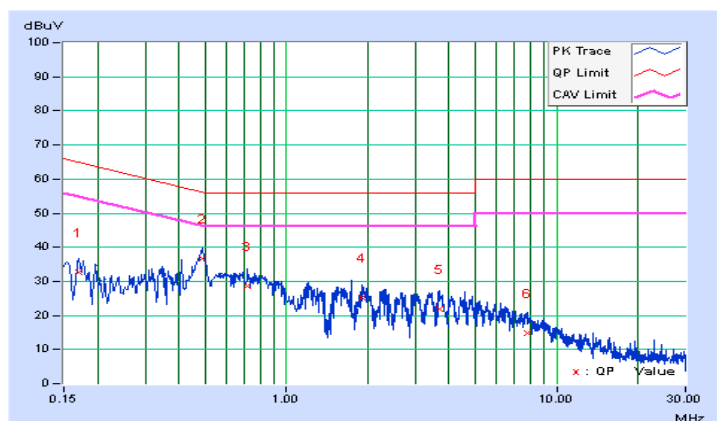
### 4.2.7 Test Results

PHASE	Line (L)	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	0.16955	0.11	32.53	19.75	32.64	19.86	64.98
<b>2</b>	<b>0.49017</b>	<b>0.09</b>	<b>36.46</b>	<b>28.33</b>	<b>36.55</b>	<b>28.42</b>	<b>56.16</b>	<b>46.16</b>	<b>-19.61</b>	<b>-17.74</b>
3	0.71304	0.08	28.61	17.26	28.69	17.34	56.00	46.00	-27.31	-28.66
4	1.90950	0.12	25.07	15.47	25.19	15.59	56.00	46.00	-30.81	-30.41
5	3.66509	0.25	21.69	11.06	21.94	11.31	56.00	46.00	-34.06	-34.69
6	7.77059	0.41	14.43	6.60	14.84	7.01	60.00	50.00	-45.16	-42.99

#### 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.

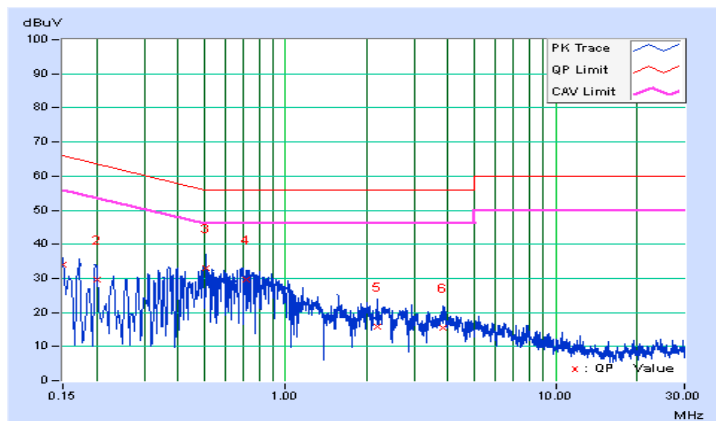


PHASE	Neutral (N)	6dB BANDWIDTH	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
	1	0.15000	0.12	33.73	24.07	33.85	24.19	66.00	56.00	-32.15
2	0.20083	0.13	29.66	14.61	29.79	14.74	63.58	53.58	-33.79	-38.84
3	0.50972	0.14	32.83	20.33	32.97	20.47	56.00	46.00	-23.03	-25.53
4	0.71705	0.16	29.45	16.45	29.61	16.61	56.00	46.00	-26.39	-29.39
5	2.18711	0.24	15.56	6.17	15.80	6.41	56.00	46.00	-40.20	-39.59
6	3.81758	0.27	15.25	7.23	15.52	7.50	56.00	46.00	-40.48	-38.50

**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.

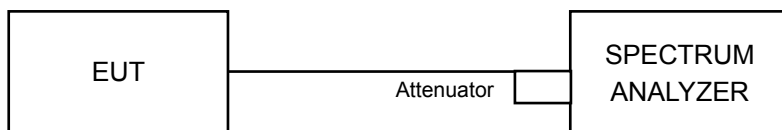


### 4.3 6dB Bandwidth Measurement

#### 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) = 100kHz
- 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.

### 4.3.7 Test Results

#### 802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		CHAIN 0	CHAIN 1		
1	2412	10.06	10.07	0.5	PASS
6	2437	10.06	9.60	0.5	PASS
11	2462	9.13	10.04	0.5	PASS

#### 802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		CHAIN 0	CHAIN 1		
1	2412	15.16	15.15	0.5	PASS
6	2437	15.16	15.15	0.5	PASS
11	2462	15.15	15.13	0.5	PASS

#### 802.11n (20MHz)

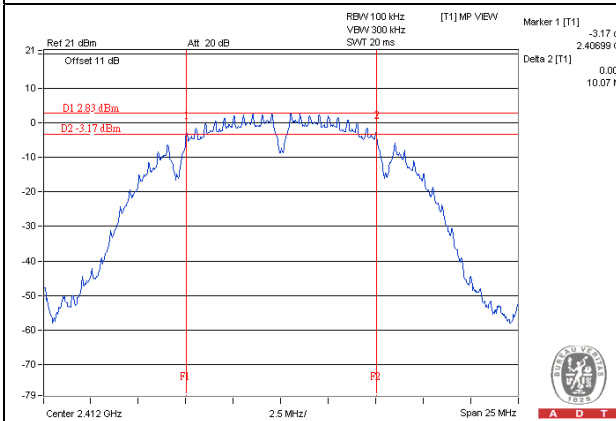
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		CHAIN 0	CHAIN 1		
1	2412	15.17	15.17	0.5	PASS
6	2437	15.15	15.32	0.5	PASS
11	2462	15.13	15.15	0.5	PASS

#### 802.11n (40MHz)

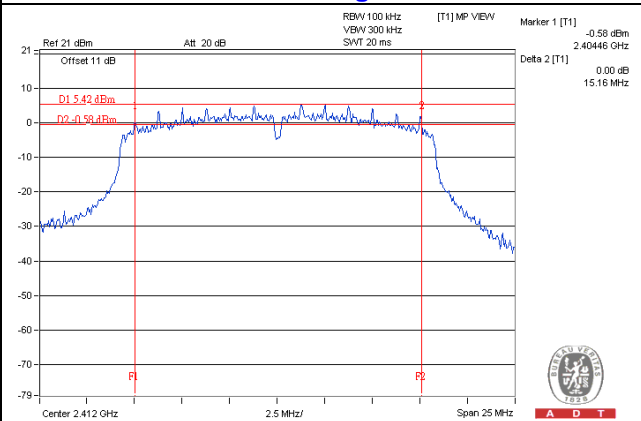
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		CHAIN 0	CHAIN 1		
3	2422	33.94	33.93	0.5	PASS
6	2437	35.10	32.70	0.5	PASS
9	2452	35.10	32.65	0.5	PASS

## Spectrum Plot of Worst Value

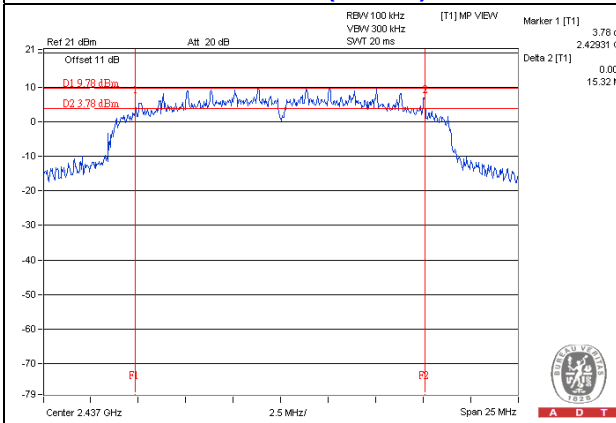
## 802.11b



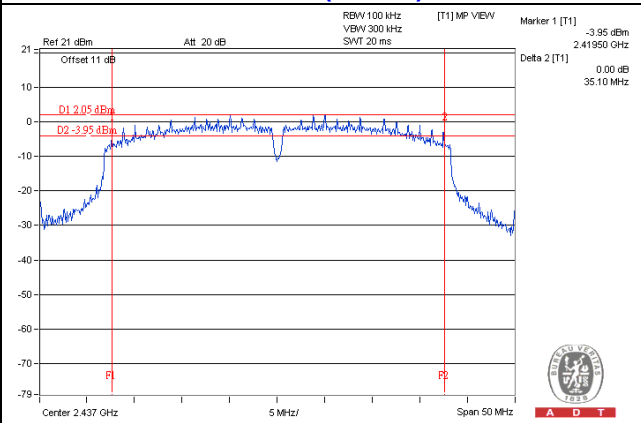
## 802.11g



## 802.11n (20MHz)



## 802.11n (40MHz)



## 4.4 Conducted Output Power Measurement

### 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 Method of conducted output power measurement on IEEE 802.11 devices,

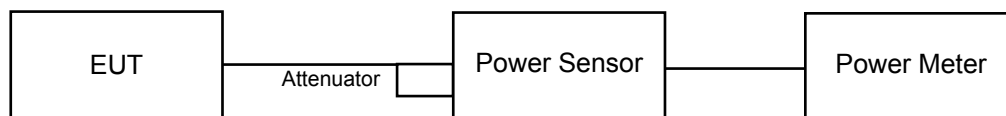
Array Gain = 0 dB (i.e., no array gain) for  $N_{ANT} \leq 4$ ;

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

Array Gain =  $5 \log(N_{ANT}/N_{SS})$  dB or 3 dB, whichever is less for 20-MHz channel widths with  $N_{ANT} \geq 5$ .

For power measurements on all other devices: Array Gain =  $10 \log(N_{ANT}/N_{SS})$  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 was 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 power level.

### 4.4.5 Deviation from Test Standard

No deviation.

### 4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

#### 4.4.7 Test Results

##### FOR PEAK POWER

##### 802.11b

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
1	2412	13.21	14.08	46.527	16.68	30	Pass
6	2437	14.55	15.05	60.499	17.82	30	Pass
11	2462	15.91	15.44	73.989	18.69	30	Pass

##### 802.11g

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
1	2412	21.93	22.14	319.637	25.05	30	Pass
6	2437	24.88	24.05	<b>561.707</b>	27.50	30	Pass
11	2462	24.00	23.22	461.083	26.64	30	Pass

##### 802.11n (20MHz)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
1	2412	21.84	22.19	318.334	25.03	30	Pass
6	2437	24.62	24.05	543.831	27.35	30	Pass
11	2462	22.72	22.30	356.892	25.53	30	Pass

##### 802.11n (40MHz)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
3	2422	16.22	16.81	89.852	19.54	30	Pass
6	2437	20.96	21.45	264.375	24.22	30	Pass
9	2452	19.76	19.77	189.466	22.78	30	Pass

**FOR AVERAGE POWER**
**802.11b**

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	10.92	11.72	27.218	14.35
6	2437	12.24	12.68	35.284	15.48
11	2462	13.65	13.16	43.875	16.42

**802.11g**

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	16.31	16.28	85.218	19.31
6	2437	20.18	19.86	201.060	23.03
11	2462	19.15	18.42	151.726	21.81

**802.11n (20MHz)**

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	15.87	16.21	80.420	19.05
6	2437	20.11	20.34	210.708	23.24
11	2462	17.11	17.03	101.870	20.08

**802.11n (40MHz)**

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
3	2422	11.62	12.16	30.965	14.91
6	2437	16.28	17.03	92.928	19.68
9	2452	15.38	15.34	68.712	18.37

## **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**

Same as item 4.3.2

### **4.5.3 Test Instruments**

Refer to section 4.1.2 to get information of above instrument.

### **4.5.4 Test Procedure**

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d. Set the VBW  $\geq 3 \times \text{RBW}$ .
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

### **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	Chan.	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass / Fail
0	1	2412	-12.13	3.01	-9.12	8	PASS
	6	2437	-10.93	3.01	-7.92	8	PASS
	11	2462	-9.39	3.01	-6.38	8	PASS
1	1	2412	-11.12	3.01	-8.11	8	PASS
	6	2437	-9.47	3.01	-6.46	8	PASS
	11	2462	-9.14	3.01	-6.13	8	PASS

**NOTE:**

- Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
- Directional gain = 0dBi + 10log(2) = 3.01dBi < 6dBi, so the limit no need to reduced.

##### 802.11g

TX Chain	Chan.	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass / Fail
0	1	2412	-9.09	3.01	-6.08	8	PASS
	6	2437	-5.18	3.01	-2.17	8	PASS
	11	2462	-7.21	3.01	-4.20	8	PASS
1	1	2412	-8.47	3.01	-5.46	8	PASS
	6	2437	-5.17	3.01	-2.16	8	PASS
	11	2462	-6.42	3.01	-3.41	8	PASS

**NOTE:**

- Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
- Directional gain = 0dBi + 10log(2) = 3.01dBi < 6dBi, so the limit no need to reduced.

### 802.11n (20MHz)

TX Chain	Chan.	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass / Fail
0	1	2412	-9.46	3.01	-6.45	8	PASS
	6	2437	-5.73	3.01	-2.72	8	PASS
	11	2462	-8.89	3.01	-5.88	8	PASS
1	1	2412	-8.49	3.01	-5.48	8	PASS
	6	2437	-4.37	3.01	-1.36	8	PASS
	11	2462	-8.05	3.01	-5.04	8	PASS

**NOTE:**

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain =  $0\text{dBi} + 10\log(2) = 3.01\text{dBi} < 6\text{dBi}$ , so the limit no need to reduced.

### 802.11n (40MHz)

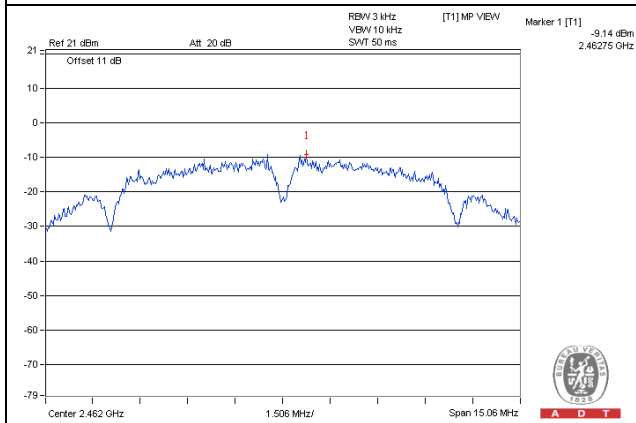
TX Chain	Chan.	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass / Fail
0	3	2422	-17.42	3.01	-14.41	8	PASS
	6	2437	-13.95	3.01	-10.94	8	PASS
	9	2452	-13.97	3.01	-10.96	8	PASS
1	3	2422	-16.17	3.01	-13.16	8	PASS
	6	2437	-12.28	3.01	-9.27	8	PASS
	9	2452	-13.42	3.01	-10.41	8	PASS

**NOTE:**

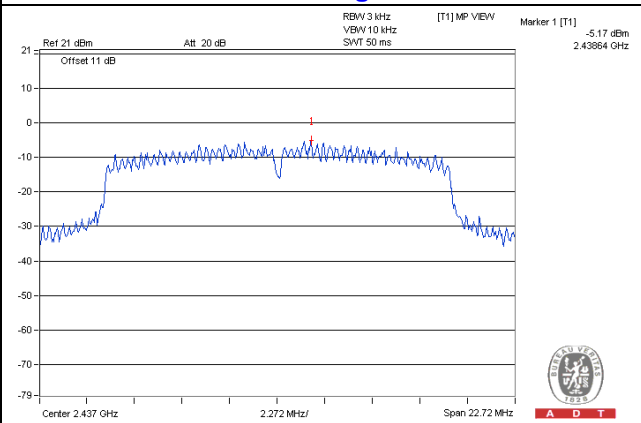
1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain =  $0\text{dBi} + 10\log(2) = 3.01\text{dBi} < 6\text{dBi}$ , so the limit no need to reduced.

## Spectrum Plot of Worst Value

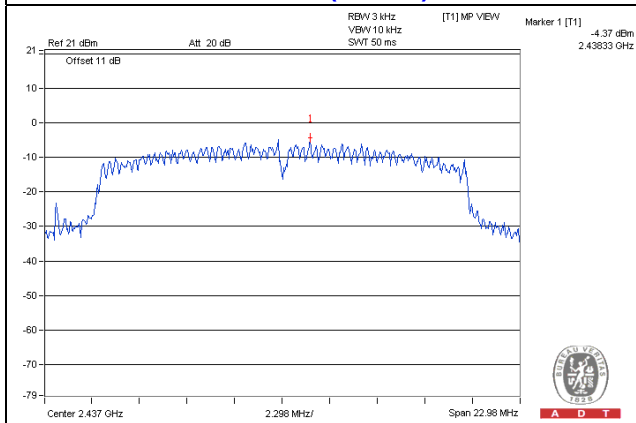
## 802.11b



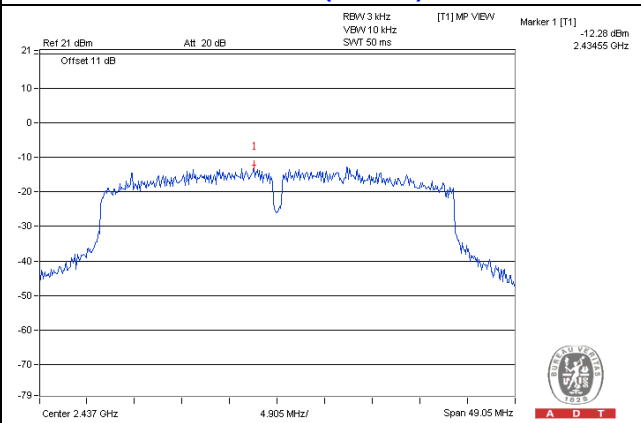
## 802.11g



## 802.11n (20MHz)



## 802.11n (40MHz)



## **4.6 Conducted Out of Band Emission Measurement**

### **4.6.1 Limits of Conducted Out of Band Emission Measurement**

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### **4.6.2 Test Setup**

Same as item 4.3.2

### **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 = average.
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.

#### **Measurement Procedure OOB**

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

### **4.6.5 Deviation from Test Standard**

No deviation.

### **4.6.6 EUT Operating Condition**

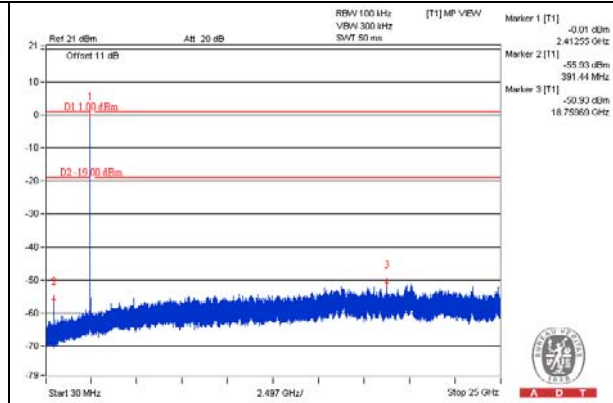
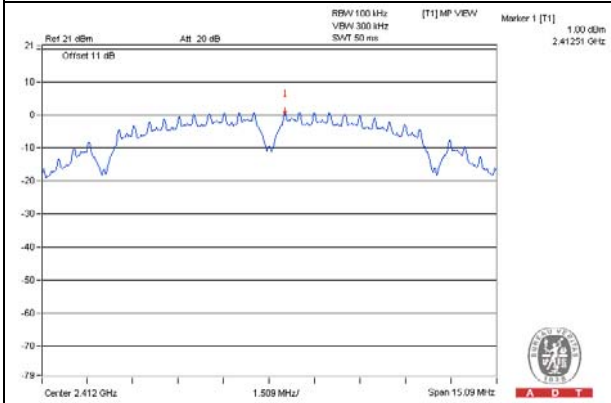
Same as Item 4.3.6

### **4.6.7 Test Results**

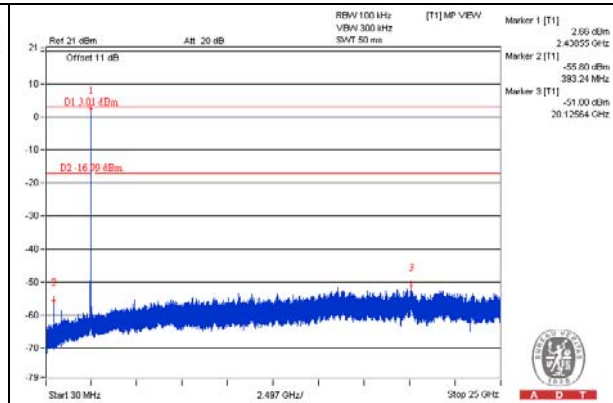
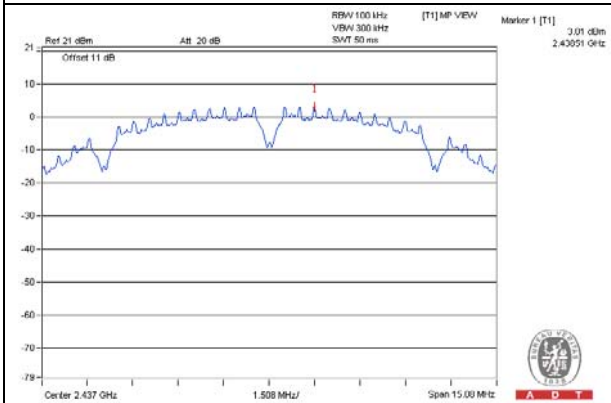
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

802.11b  
CHAIN 0

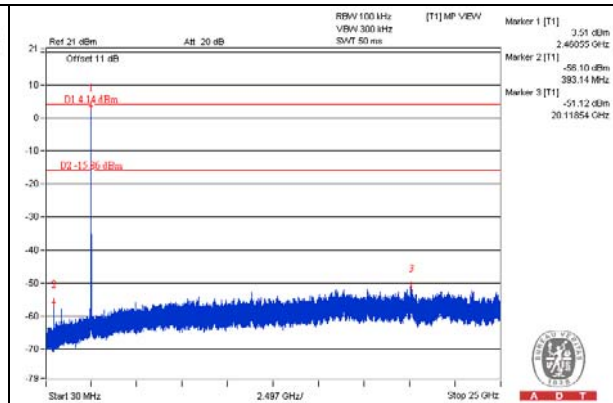
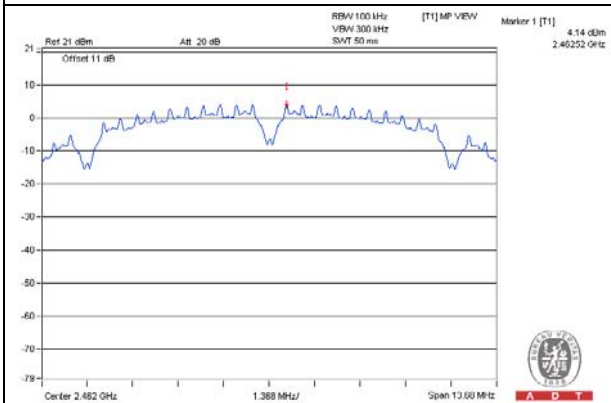
CH 1



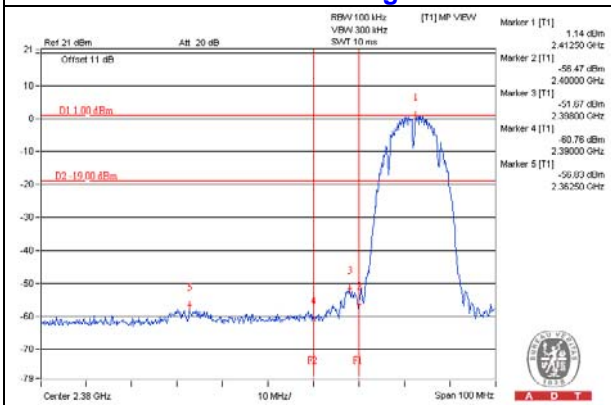
CH 6



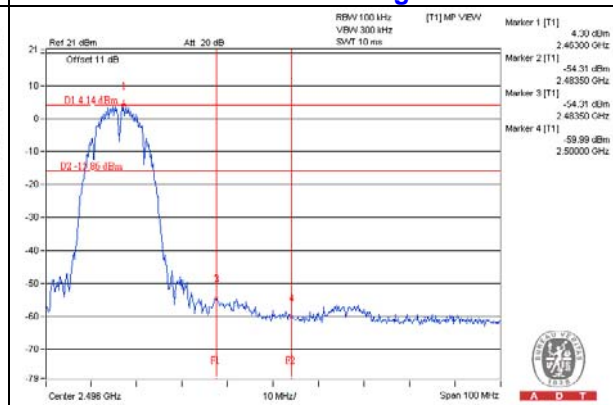
CH 11



CH 1 Band edge

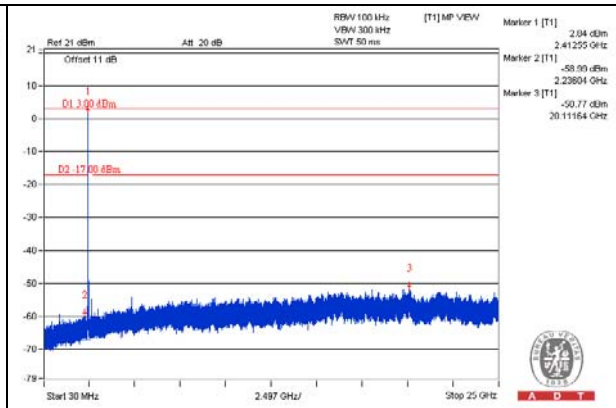
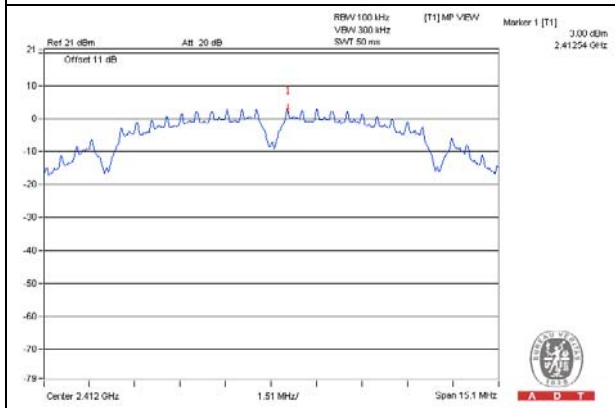


CH 11 Band edge

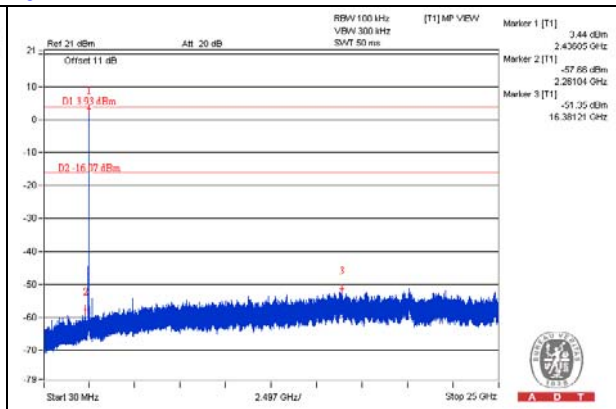
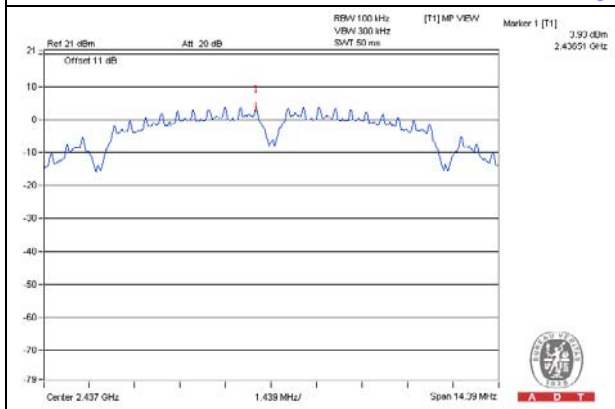


CHAIN 1

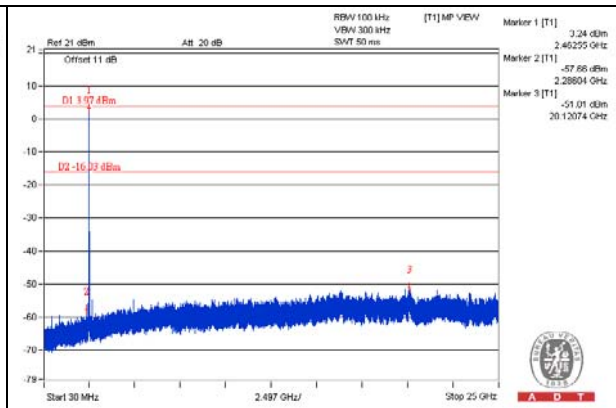
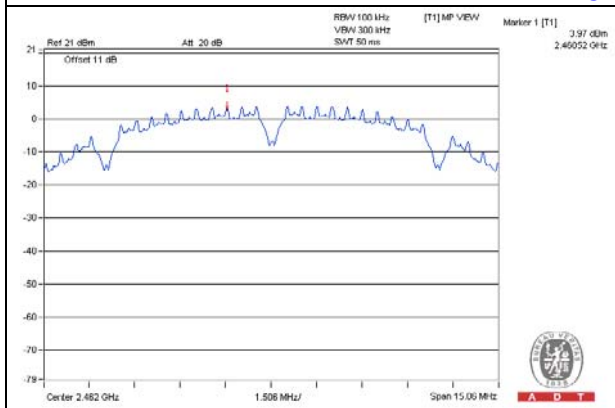
CH 1



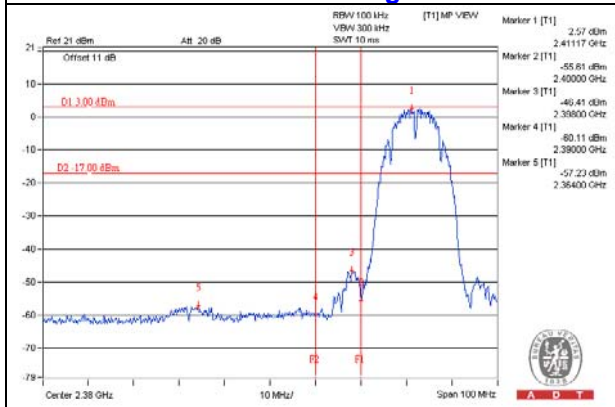
CH 6



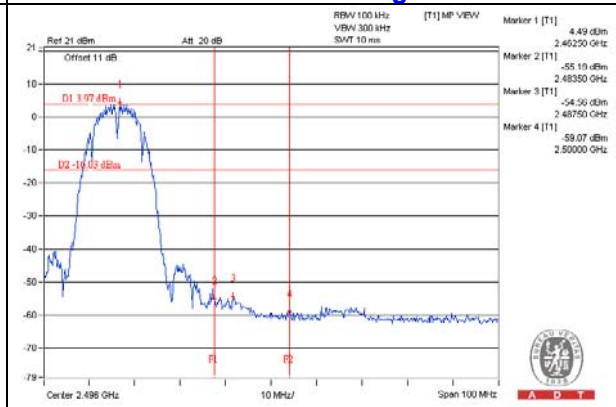
CH 11



CH 11 Band edge

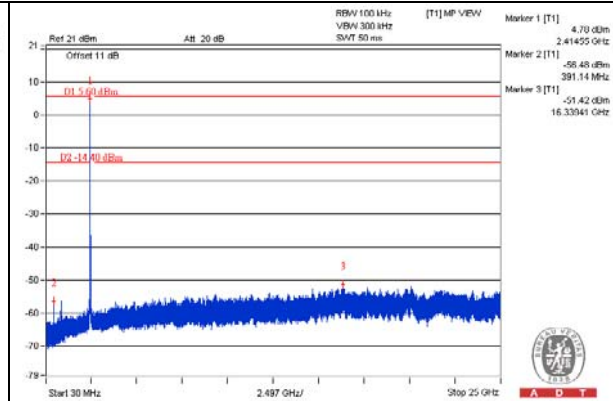
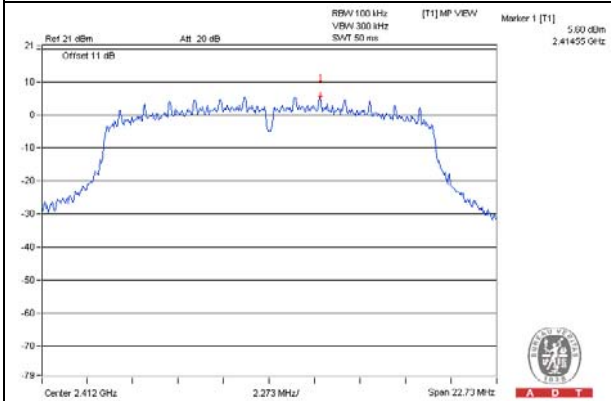


CH 11 Band edge

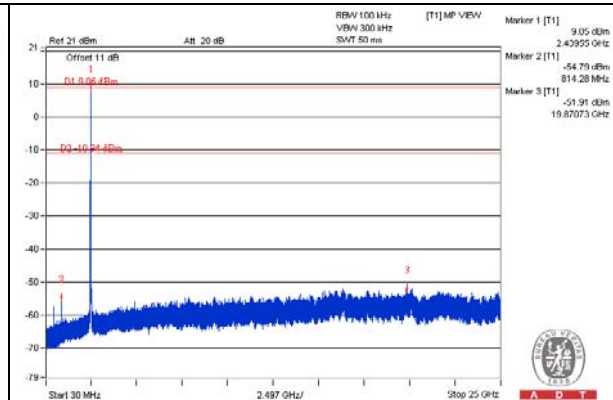
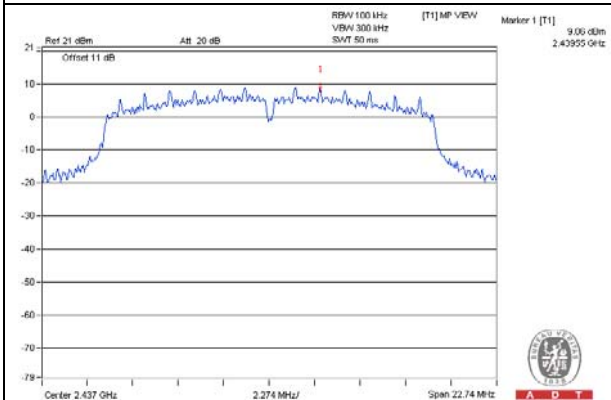


802.11g  
CHAIN 0

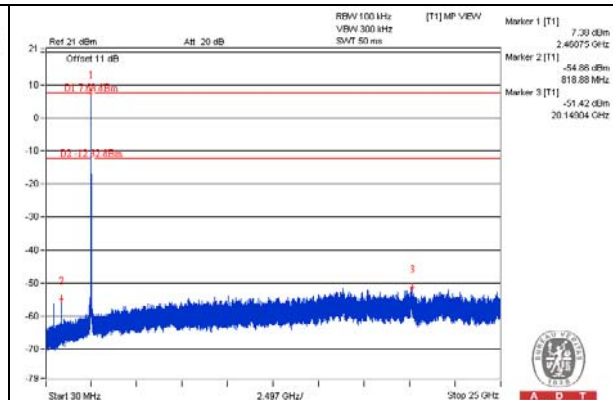
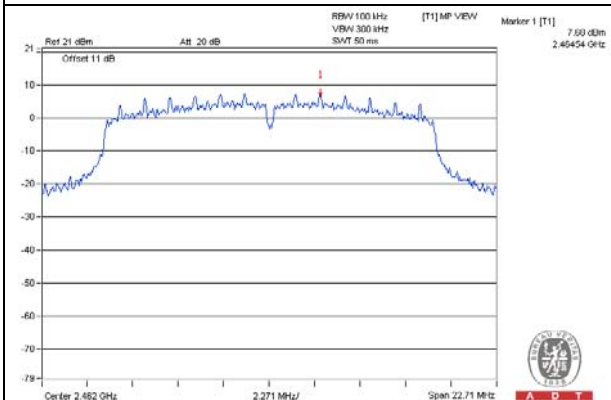
CH 1



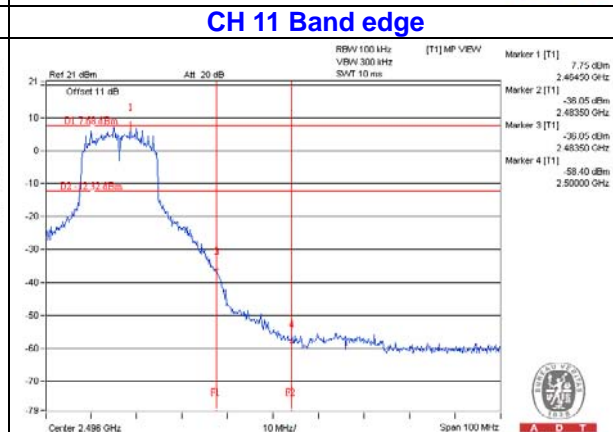
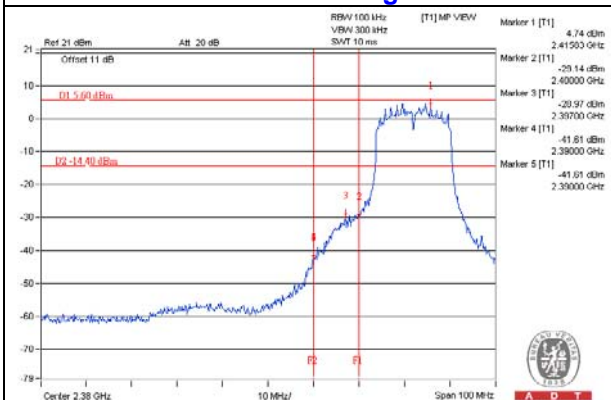
CH 6



CH 11

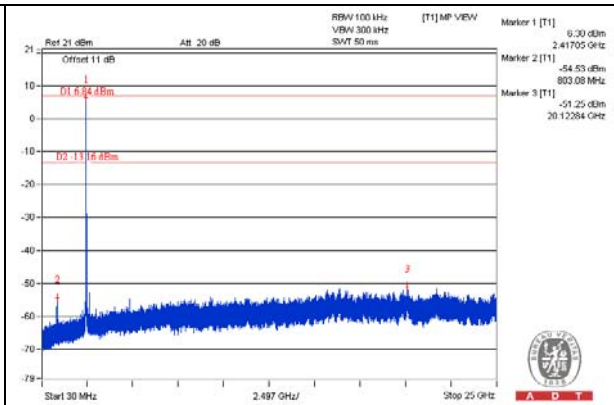
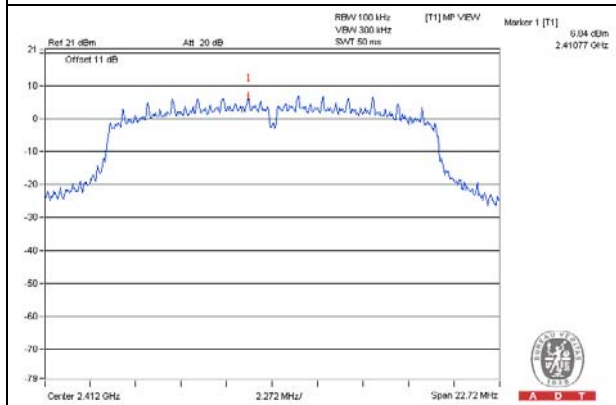


CH 11 Band edge

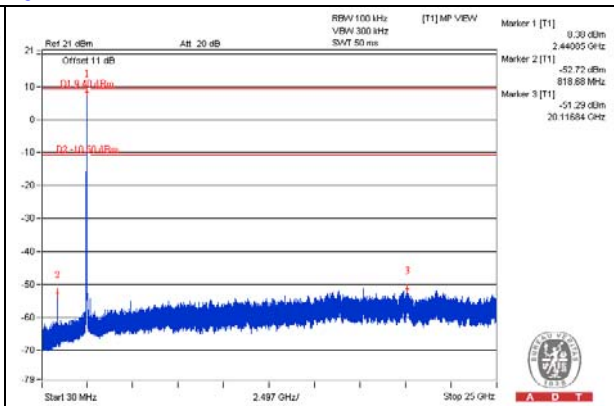
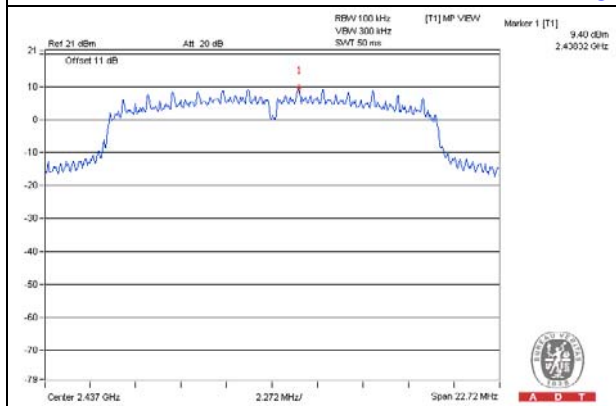


CHAIN 1

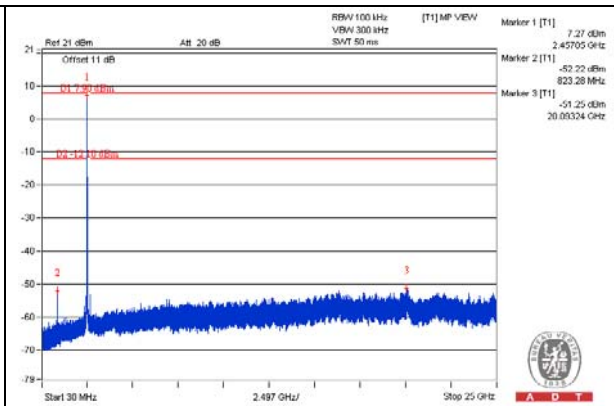
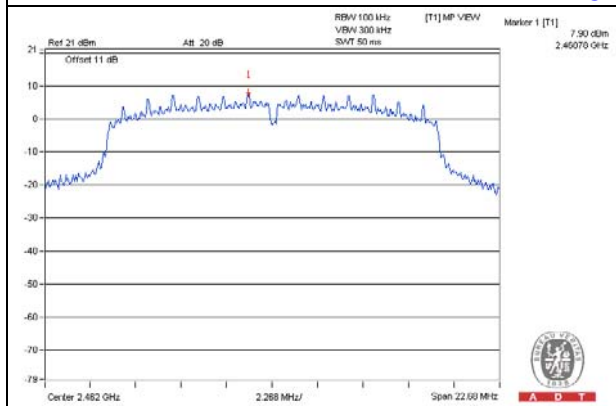
CH 1



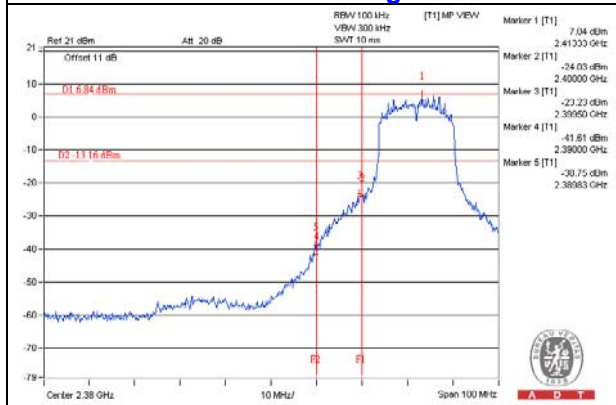
CH 6



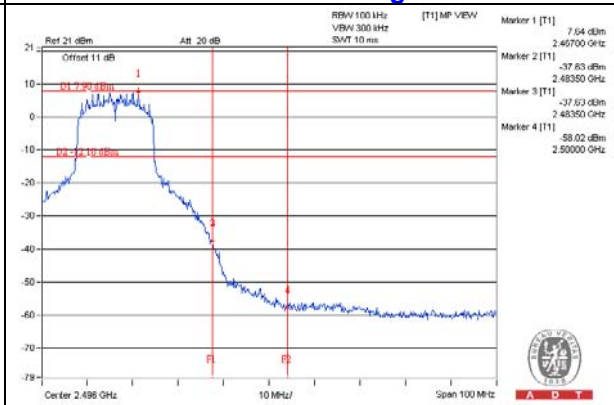
CH 11



CH 11 Band edge

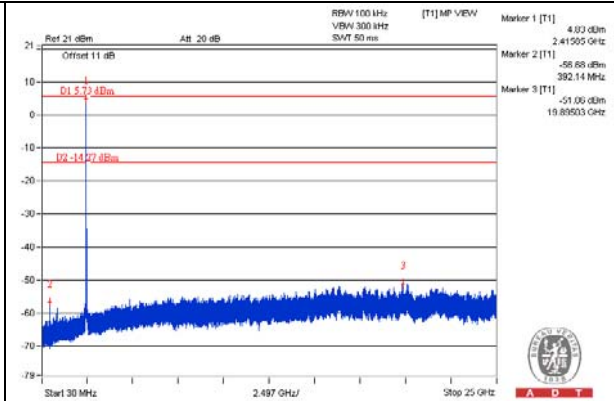
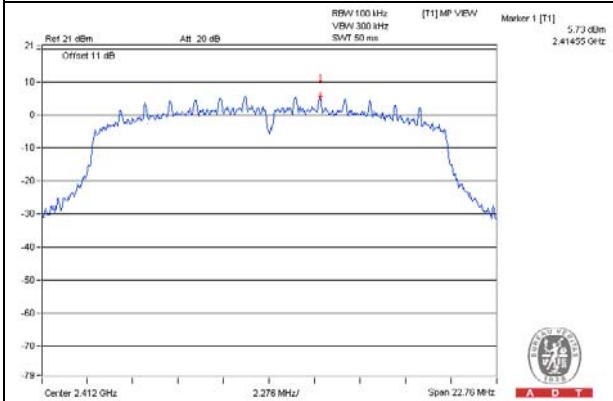


CH 11 Band edge

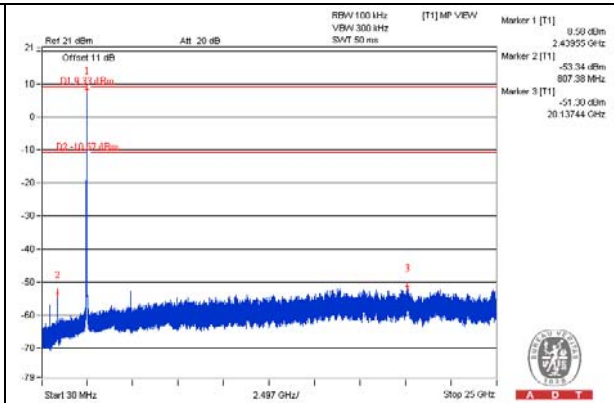


802.11n (20MHz)  
CHAIN 0

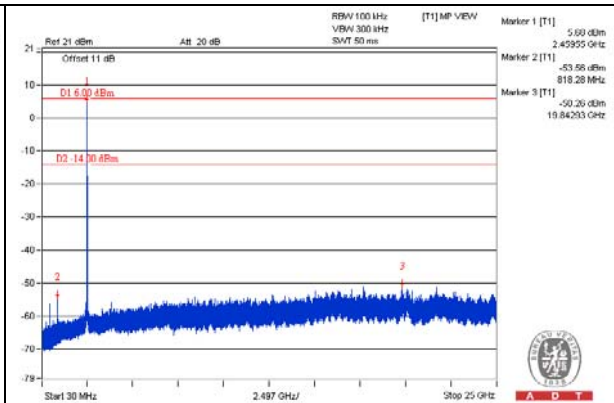
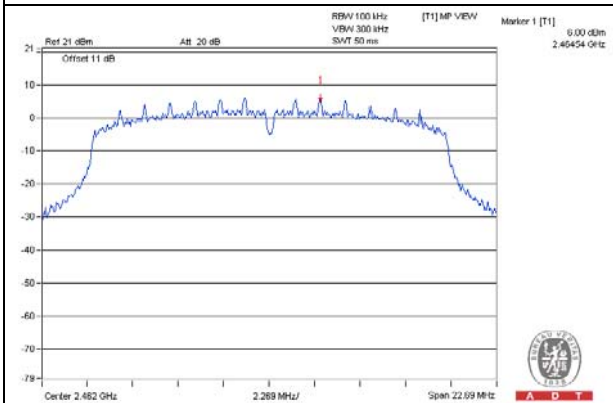
CH 1



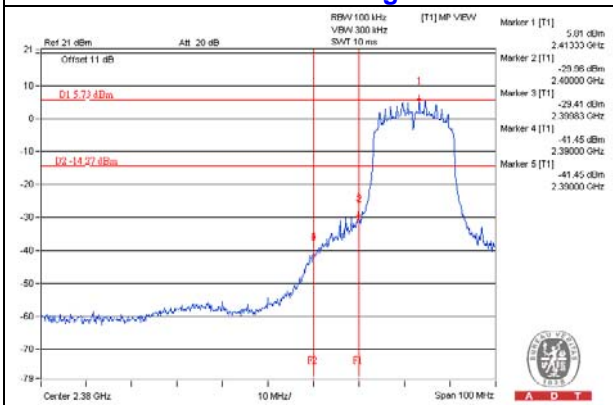
CH 6



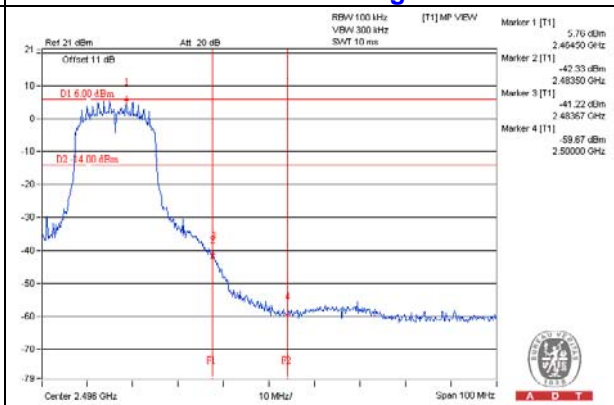
CH 11



CH 1 Band edge

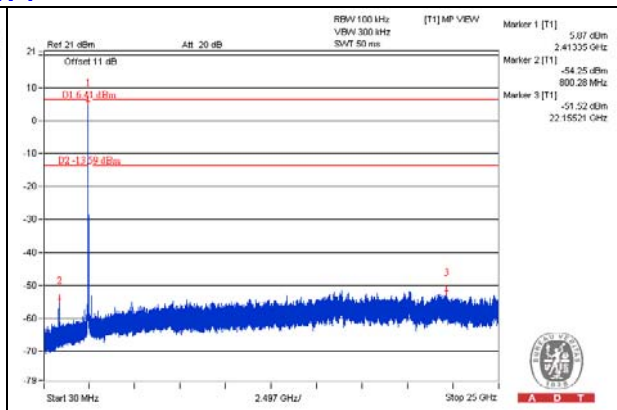
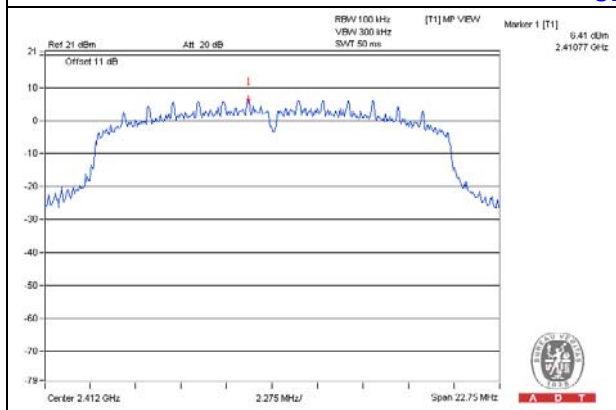


CH 11 Band edge

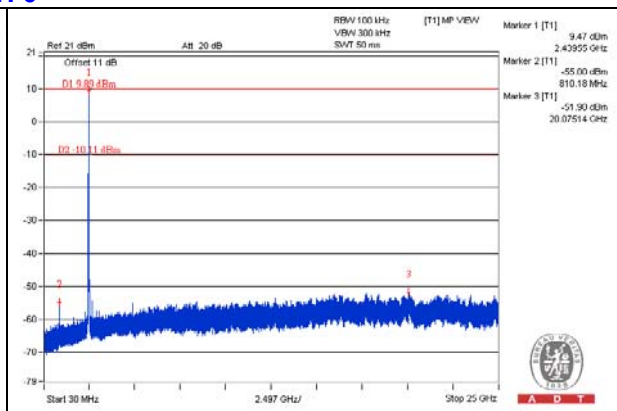
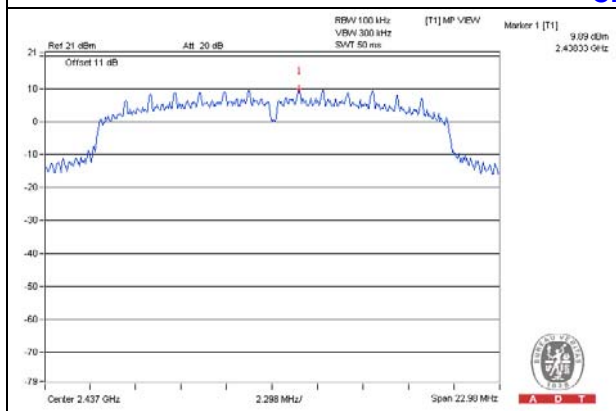


CHAIN 1

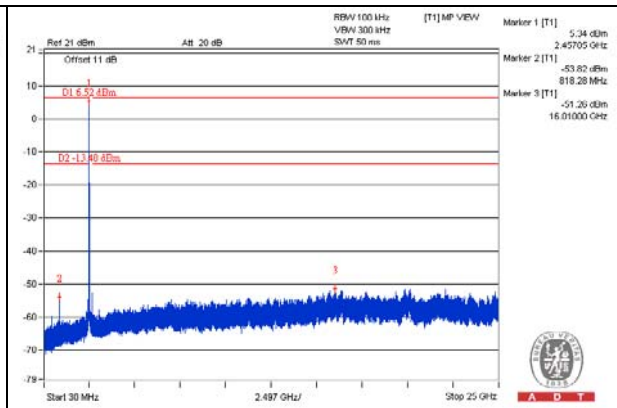
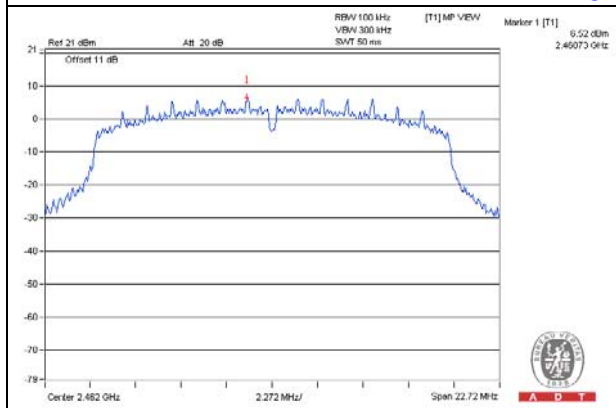
CH 1



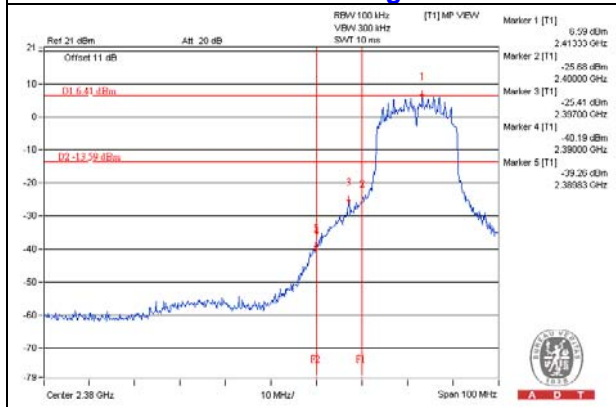
CH 6



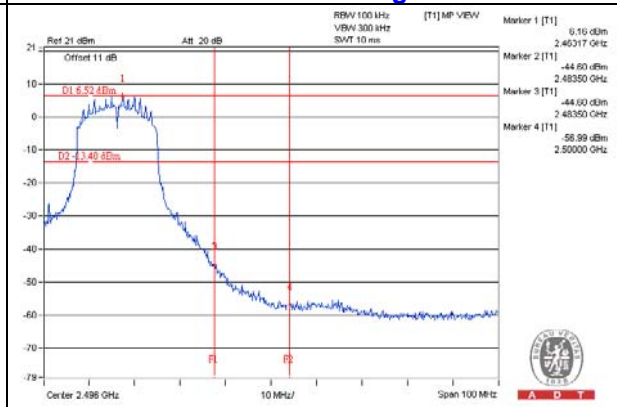
CH 11



CH 11 Band edge

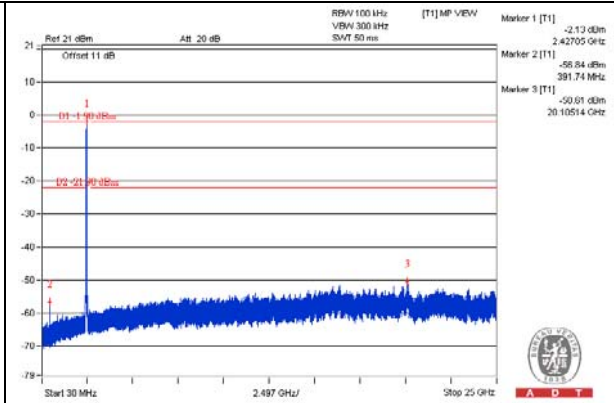
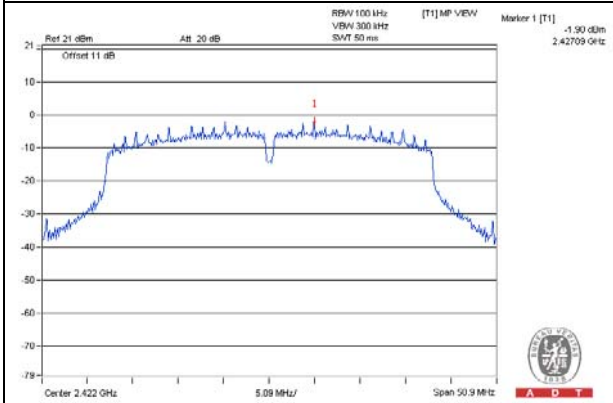


CH 11 Band edge

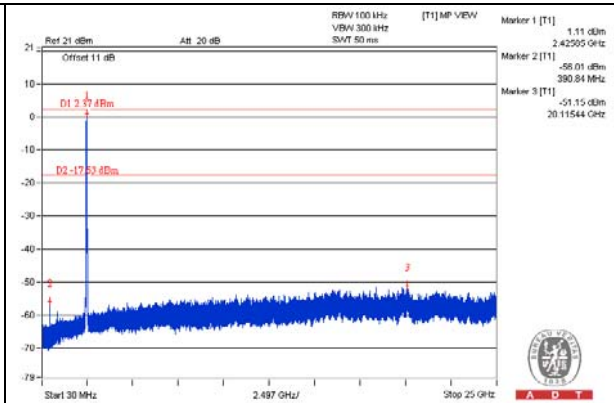
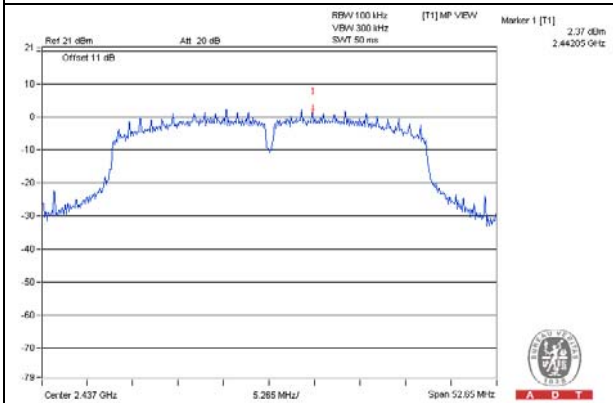


802.11n (40MHz)  
CHAIN 0

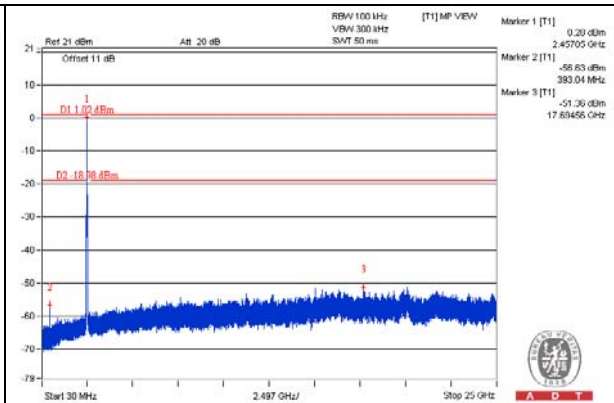
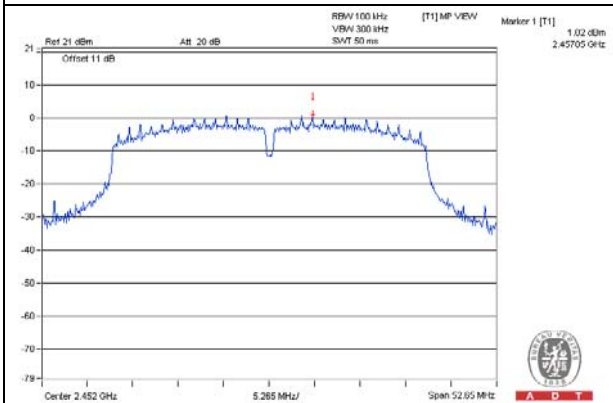
CH 3



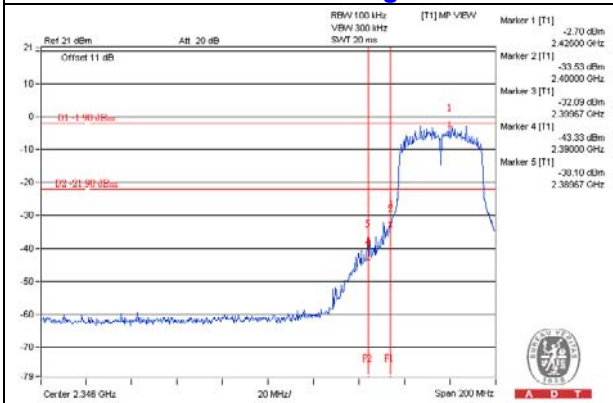
CH 6



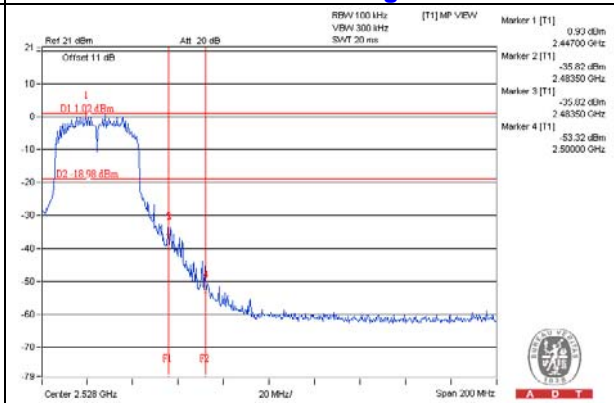
CH 9



CH 3 Band edge

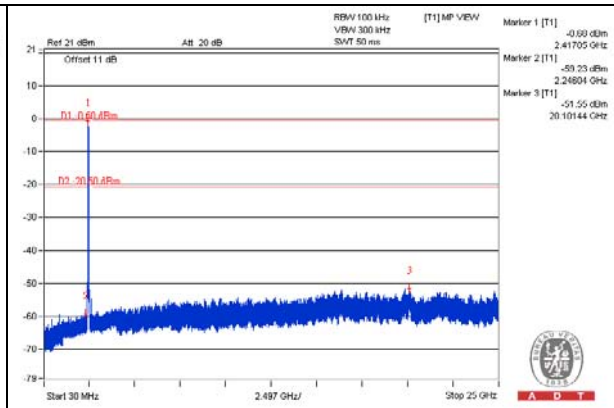
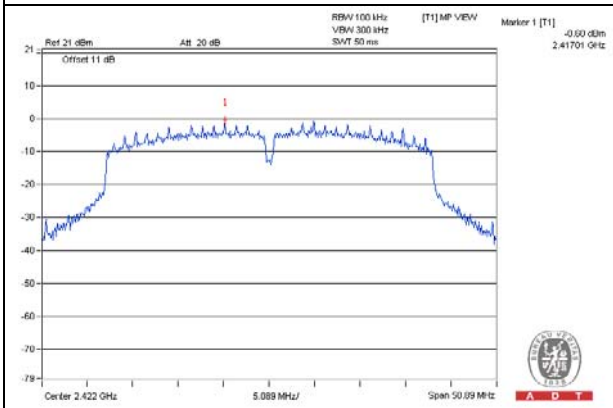


CH 9 Band edge

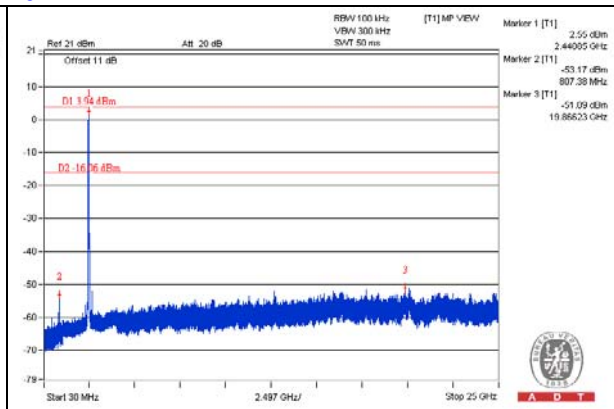
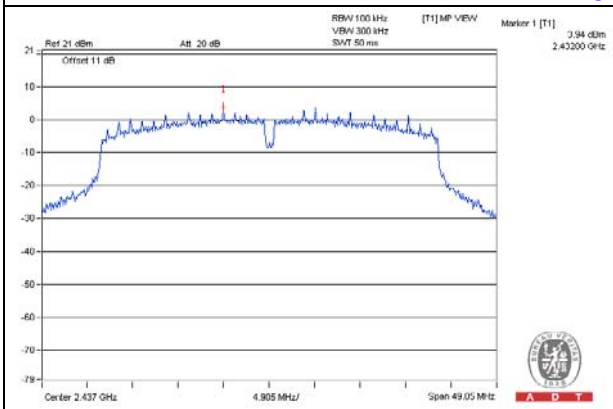


CHAIN 1

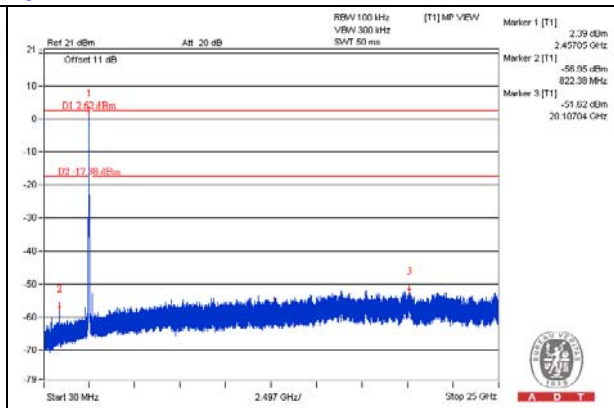
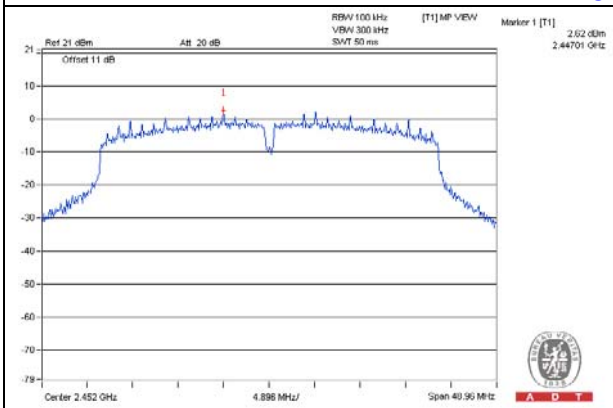
CH 3



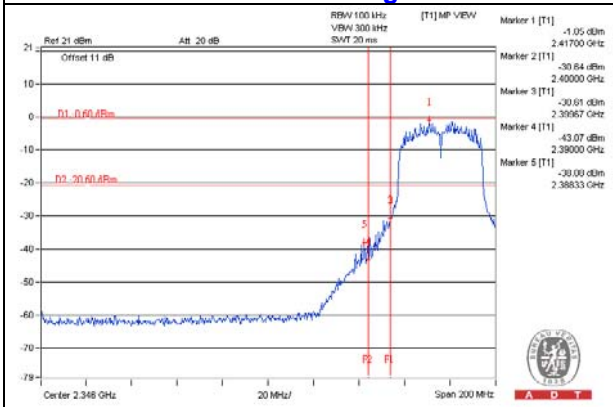
CH 6



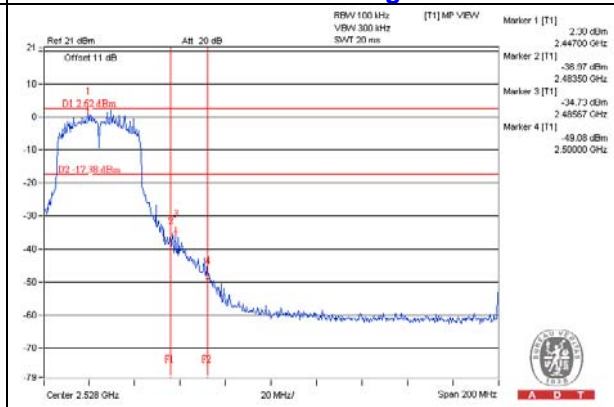
CH 9



CH 3 Band edge



CH 9 Band edge



## 5 Pictures of Test Arrangements

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



## Appendix – 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:

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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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