

## FCC Test Report

**Report No.:** RF161004D09

**FCC ID:** HFS-C401U

**Test Model:** C401U

**Received Date:** Oct. 04, 2016

**Test Date:** Dec. 21, 2016 ~ Jan. 07, 2017

**Issued Date:** Jan. 19, 2017

**Applicant:** QUANTA COMPUTER INC.

**Address:** 188, WEN HUA 2ND RD., GUISHAN DIST., TAO YUAN CITY 33377,  
TAIWAN

**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,  
R.O.C.

**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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## Table of Contents

<b>Release Control Record</b> .....	<b>4</b>
<b>1 Certificate of Conformity</b> .....	<b>5</b>
<b>2 Summary of Test Results</b> .....	<b>6</b>
2.1 Measurement Uncertainty.....	6
2.2 Modification Record.....	6
<b>3 General Information</b> .....	<b>7</b>
3.1 General Description of EUT.....	7
3.2 Description of Test Modes.....	8
3.2.1 Test Mode Applicability and Tested Channel Detail.....	9
3.3 Duty Cycle of Test Signal.....	11
3.4 Description of Support Units.....	12
3.4.1 Configuration of System under Test.....	12
3.5 General Description of Applied Standards.....	12
<b>4 Test Types and Results</b> .....	<b>13</b>
4.1 Radiated Emission and Bandedge Measurement.....	13
4.1.1 Limits of Radiated Emission and Bandedge Measurement.....	13
4.1.2 Test Instruments.....	14
4.1.3 Test Procedures.....	15
4.1.4 Deviation from Test Standard.....	15
4.1.5 Test Set Up.....	16
4.1.6 EUT Operating Conditions.....	17
4.1.7 Test Results.....	18
4.2 Conducted Emission Measurement.....	28
4.2.1 Limits of Conducted Emission Measurement.....	28
4.2.2 Test Instruments.....	28
4.2.3 Test Procedures.....	29
4.2.4 Deviation from Test Standard.....	29
4.2.5 Test Setup.....	29
4.2.6 EUT Operating Conditions.....	29
4.2.7 Test Results.....	30
4.3 6dB Bandwidth Measurement.....	32
4.3.1 Limits of 6dB Bandwidth Measurement.....	32
4.3.2 Test Setup.....	32
4.3.3 Test Instruments.....	32
4.3.4 Test Procedure.....	32
4.3.5 Deviation from Test Standard.....	32
4.3.6 EUT Operating Conditions.....	32
4.3.7 Test Result.....	33
4.4 Conducted Output Power Measurement.....	35
4.4.1 Limits of Conducted Output Power Measurement.....	35
4.4.2 Test Setup.....	35
4.4.3 Test Instruments.....	35
4.4.4 Test Procedures.....	35
4.4.5 Deviation from Test Standard.....	35
4.4.6 EUT Operating Conditions.....	35
4.4.7 Test Results.....	36
4.5 Power Spectral Density Measurement.....	37
4.5.1 Limits of Power Spectral Density Measurement.....	37
4.5.2 Test Setup.....	37
4.5.3 Test Instruments.....	37
4.5.4 Test Procedure.....	37
4.5.5 Deviation from Test Standard.....	37
4.5.6 EUT Operating Condition.....	37

4.5.7 Test Results .....	38
4.6 Conducted Out of Band Emission Measurement.....	40
4.6.1 Limits of Conducted Out of Band Emission Measurement .....	40
4.6.2 Test Setup.....	40
4.6.3 Test Instruments .....	40
4.6.4 Test Procedure .....	40
4.6.5 Deviation from Test Standard .....	41
4.6.6 EUT Operating Condition .....	41
4.6.7 Test Results .....	41
<b>5 Pictures of Test Arrangements.....</b>	<b>45</b>
<b>Appendix – Information on the Testing Laboratories .....</b>	<b>46</b>

### Release Control Record

Issue No.	Description	Date Issued
RF161004D09	Original release	Jan. 19, 2017

## 1 Certificate of Conformity

**Product:** Clover Flex

**Brand:** clover

**Test Model:** C401U

**Sample Status:** Engineering sample


**Applicant:** QUANTA COMPUTER INC.

**Test Date:** Dec. 21, 2016 ~ Jan. 07, 2017

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.10:2013

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 :**  , **Date:** Jan. 19, 2017  
Pettie Chen / Senior Specialist

**Approved by :**  , **Date:** Jan. 19, 2017  
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 -22.70dB at 0.15391MHz
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 2483.50MHz.
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) ( $\pm$ )
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	Clover Flex
Brand	clover
Test Model	C401U
Sample Status	Engineering sample
Power Supply Rating	7.6 Vdc (Battery) 12Vdc (Adapter)
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	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 802.11n: up to 72.2Mbps
Operating Frequency	2412 ~ 2462MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20)
Output Power	83.946mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Charging Dock (Brand: Clover, Model: K400) Microhub (Brand: Clover, Model: H400)
Data Cable Supplied	0.8m shielded Type-C cable without core

Note:

1. The EUT provides one completed transmitter and one receiver.

Modulation Mode	TX Function
802.11b	1TX
802.11g	1TX
802.11n (HT20)	1TX

2. The EUT consumes power from the following battery and adapter.

<b>Battery</b>	
Brand	LG Chem, Ltd.
Model	MPPCLOYJ4
Rating	7.6Vdc, 2170mAh (Typ)

<b>Adapter</b>	
Brand	clover
Model	FSP040-RHBN2 A
Input Power	100-240Vac~, 1.5A, 50-60Hz
Output Power	12.0Vdc / 3.33A
Power Line	1.2m shielded DC cable with one core

3. The EUT uses following antennas.

Ant. Type	Connector	Antenna Gain (dBi)			
		Frequency (GHz)			
		2.4	5.150	5.470	5.850
PIFA	NA	-2.5	4.0	4.4	3.4

4. 2.4GHz and 5GHz technology cannot transmit at same time.

5. Spurious emission of the simultaneous operation (WLAN+WWAN+NFC or BT+WWAN+NFC) has been evaluated and no non-compliance was found.

### 3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

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		



### 3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE≥1G**: Radiated Emission above 1GHz & Bandedge Measurement  
**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 (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

#### 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)
-	802.11b	1 to 11	1	DSSS	DBPSK	1.0

#### 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)
-	802.11b	1 to 11	1	DSSS	DBPSK	1.0

**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 (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

**Test Condition:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE $\geq$ 1G	20deg. C, 66%RH	120Vac, 60Hz	James Yang Jones Chang
RE<1G	20deg. C, 66%RH	120Vac, 60Hz	Jones Chang
PLC	24deg. C, 65%RH	120Vac, 60Hz	Jones Chang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Antony Lee

### 3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98%, duty factor is required.

802.11b: Duty cycle =  $8.212/8.437 = 0.973$ , Duty factor =  $10 * \log(1/0.973) = 0.12$

802.11g: Duty cycle =  $1.359/1.579 = 0.861$ , Duty factor =  $10 * \log(1/0.861) = 0.65$

802.11n (HT20): Duty cycle =  $1.275/1.492 = 0.855$ , Duty factor =  $10 * \log(1/0.855) = 0.68$



### 3.4 Description of Support Units

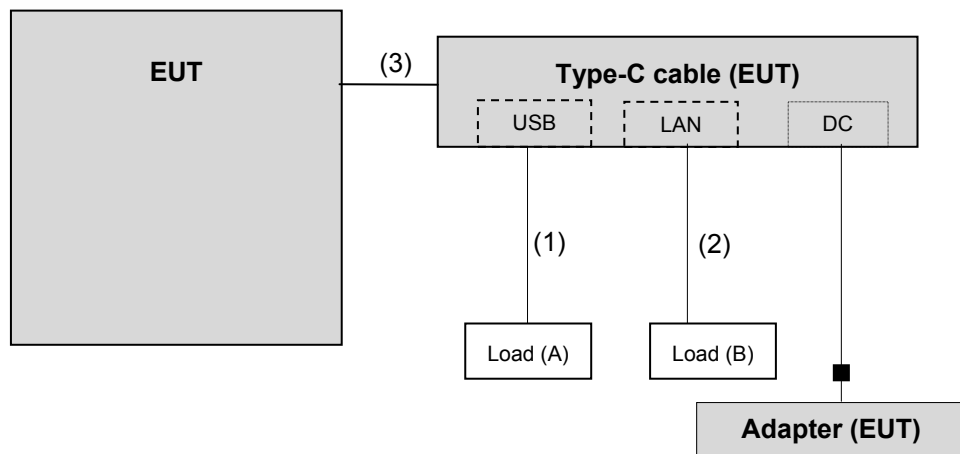
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Load	N/A	N/A	N/A	N/A	-
B.	Load	N/A	N/A	N/A	N/A	-

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	1.8	N	0	-
2.	LAN cable	1	1.8	N	0	-
3.	Type-C cable	1	0.8	Y	0	Accessory of EUT

#### 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)**

**KDB 558074 D01 DTS Meas Guidance v03r05**

ANSI C63.10-2013

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

Note: The EUT 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 30dB 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 30dB under any condition of modulation.

#### 4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	Apr. 18, 2016	Apr. 17, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Nov. 16, 2016	Nov. 15, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-151	Dec. 16, 2016	Dec. 15, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Dec. 12, 2016	Dec. 13, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 14, 2016	Dec. 13, 2017
Loop Antenna	EM-6879	269	Aug. 11, 2016	Aug. 10, 2017
Preamplifier Agilent	8447D	2944A10738	Aug. 22, 2016	Aug. 21, 2017
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2016	Aug. 21, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (214378)	Aug. 22, 2016	Aug. 21, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 106	Cable-CH3-03 (309224+12738)	Aug. 22, 2016	Aug. 21, 2017
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 BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
High Speed Peak Power Meter	ML2495A	0824012	Aug. 11, 2016	Aug. 10, 2017
Power Sensor	MA2411B	0738171	Aug. 11, 2016	Aug. 10, 2017

- 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 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

#### For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case 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.

#### Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

#### For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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:

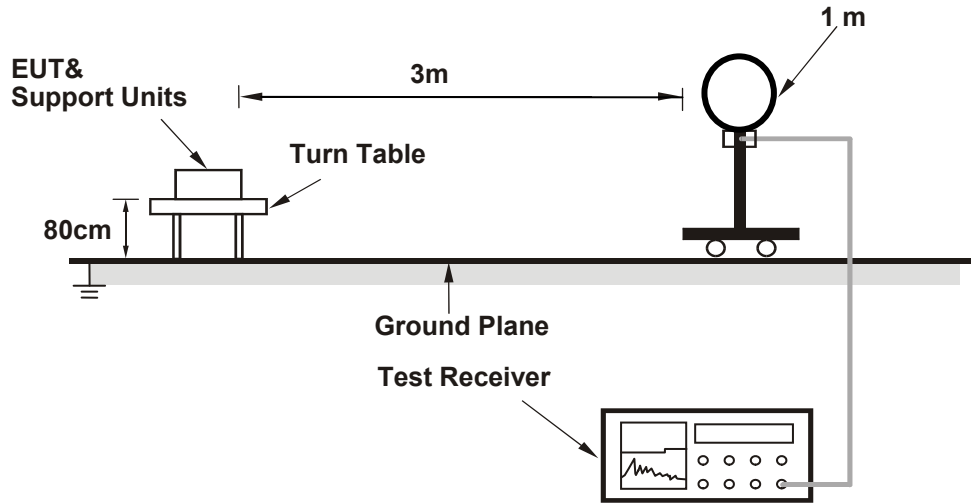
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz (Duty cycle  $\geq 98\%$ ) 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

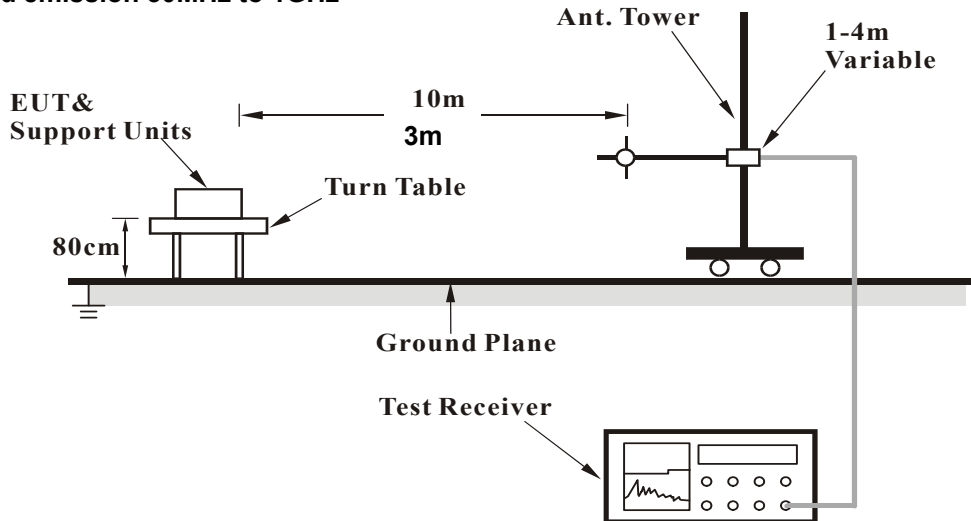
No deviation.

#### 4.1.5 Test Set Up

##### For Radiated emission below 30MHz

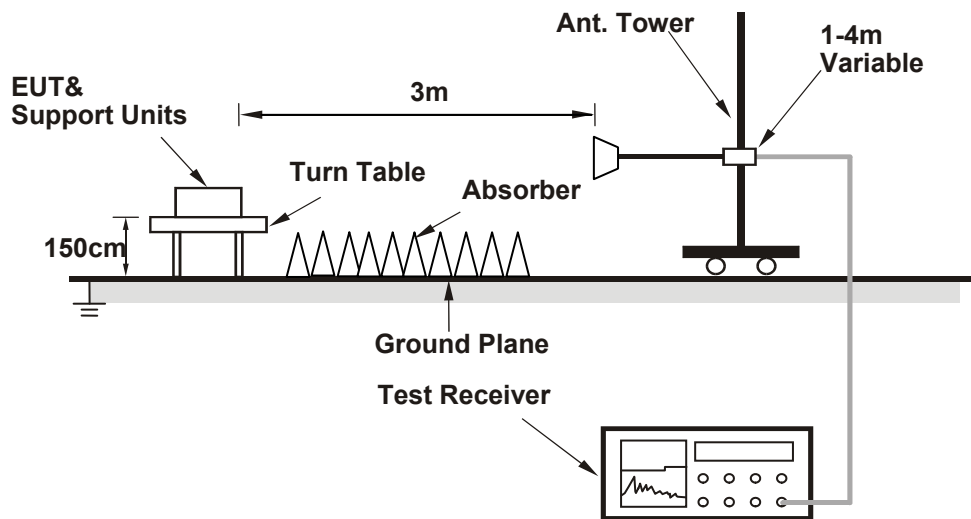


##### For Radiated emission 30MHz to 1GHz





### For Radiated emission above 1GHz



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

#### 4.1.6 EUT Operating Conditions

Set the EUT under transmission condition continuously at specific channel frequency.

#### 4.1.7 Test Results

Above 1GHz worst-Case data:

802.11b

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	65.8 PK	74.0	-8.2	1.57 H	27	34.9	30.9
2	2390.00	47.8 AV	54.0	-6.2	1.57 H	27	16.9	30.9
3	*2412.00	95.2 PK			1.76 H	36	64.1	31.1
4	*2412.00	91.2 AV			1.76 H	36	60.1	31.1
5	4824.00	45.5 PK	74.0	-28.5	1.93 H	325	41.0	4.5
6	4824.00	32.4 AV	54.0	-21.6	1.93 H	325	27.9	4.5

#### 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	57.5 PK	74.0	-16.5	1.85 V	47	26.6	30.9
2	2390.00	51.2 AV	54.0	-2.8	1.85 V	47	20.3	30.9
3	*2412.00	97.0 PK			1.74 V	151	65.9	31.1
4	*2412.00	93.1 AV			1.74 V	151	62.0	31.1
5	4824.00	45.4 PK	74.0	-28.6	1.66 V	85	40.9	4.5
6	4824.00	33.8 AV	54.0	-20.2	1.66 V	85	29.3	4.5

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	97.8 PK			2.05 H	138	66.7	31.1
2	*2437.00	93.7 AV			2.05 H	138	62.6	31.1
3	4874.00	48.6 PK	74.0	-25.4	1.74 H	145	44.0	4.6
4	4874.00	40.7 AV	54.0	-13.3	1.74 H	145	36.1	4.6

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	95.8 PK			1.60 V	133	64.7	31.1
2	*2437.00	91.9 AV			1.60 V	133	60.8	31.1
3	4874.00	45.7 PK	74.0	-28.3	1.35 V	288	41.1	4.6
4	4874.00	35.1 AV	54.0	-18.9	1.35 V	288	30.5	4.6

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	96.3 PK			2.01 H	140	65.1	31.2
2	*2462.00	92.2 AV			2.01 H	140	61.0	31.2
3	2483.50	57.6 PK	74.0	-16.4	1.83 H	138	26.3	31.3
4	2483.50	48.8 AV	54.0	-5.2	1.83 H	138	17.5	31.3
5	4924.00	46.0 PK	74.0	-28.0	1.81 H	132	41.5	4.5
6	4924.00	36.1 AV	54.0	-17.9	1.81 H	132	31.6	4.5

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	94.0 PK			1.45 V	90	62.8	31.2
2	*2462.00	90.5 AV			1.45 V	90	59.3	31.2
3	2483.50	58.1 PK	74.0	-15.9	1.23 V	132	26.8	31.3
4	2483.50	48.5 AV	54.0	-5.5	1.23 V	132	17.2	31.3
5	4924.00	46.3 PK	74.0	-27.7	1.45 V	291	41.8	4.5
6	4924.00	35.0 AV	54.0	-19.0	1.45 V	291	30.5	4.5

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 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	69.4 PK	74.0	-4.6	1.48 H	354	38.5	30.9
2	2390.00	52.3 AV	54.0	-1.7	1.48 H	354	21.4	30.9
3	*2412.00	99.2 PK			1.69 H	302	68.1	31.1
4	*2412.00	88.1 AV			1.69 H	302	57.0	31.1
5	4824.00	45.6 PK	74.0	-28.4	1.56 H	205	41.1	4.5
6	4824.00	32.7 AV	54.0	-21.3	1.56 H	205	28.2	4.5

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	65.0 PK	74.0	-9.0	1.95 V	49	34.1	30.9
2	2390.00	48.2 AV	54.0	-5.8	1.95 V	49	17.3	30.9
3	*2412.00	96.0 PK			1.97 V	292	64.9	31.1
4	*2412.00	85.7 AV			1.97 V	292	54.6	31.1
5	4824.00	45.8 PK	74.0	-28.2	1.68 V	333	41.3	4.5
6	4824.00	32.6 AV	54.0	-21.4	1.68 V	333	28.1	4.5

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	99.0 PK			1.75 H	298	67.9	31.1
2	*2437.00	88.3 AV			1.75 H	298	57.2	31.1
3	4874.00	45.7 PK	74.0	-28.3	1.82 H	166	41.1	4.6
4	4874.00	32.9 AV	54.0	-21.1	1.82 H	166	28.3	4.6

**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	95.9 PK			1.92 V	60	64.8	31.1
2	*2437.00	85.7 AV			1.92 V	60	54.6	31.1
3	4874.00	45.1 PK	74.0	-28.9	1.76 V	333	40.5	4.6
4	4874.00	32.7 AV	54.0	-21.3	1.76 V	333	28.1	4.6

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	98.1 PK			1.37 H	296	66.9	31.2
2	*2462.00	87.5 AV			1.37 H	296	56.3	31.2
3	2483.50	72.9 PK	74.0	-1.1	1.10 H	297	41.6	31.3
4	2483.50	52.4 AV	54.0	-1.6	1.10 H	297	21.1	31.3
5	4924.00	45.8 PK	74.0	-28.2	1.43 H	281	41.3	4.5
6	4924.00	32.4 AV	54.0	-21.6	1.43 H	281	27.9	4.5

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	96.6 PK			1.78 V	64	65.4	31.2
2	*2462.00	87.0 AV			1.78 V	64	55.8	31.2
3	2483.50	70.2 PK	74.0	-3.8	1.97 V	67	38.9	31.3
4	2483.50	51.5 AV	54.0	-2.5	1.97 V	67	20.2	31.3
5	4924.00	45.3 PK	74.0	-28.7	1.88 V	257	40.8	4.5
6	4924.00	32.8 AV	54.0	-21.2	1.88 V	257	28.3	4.5

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 (HT20)

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	66.6 PK	74.0	-7.4	1.50 H	13	35.7	30.9
2	2390.00	48.9 AV	54.0	-5.1	1.50 H	13	18.0	30.9
3	*2412.00	98.7 PK			1.94 H	129	67.6	31.1
4	*2412.00	88.3 AV			1.94 H	129	57.2	31.1
5	4824.00	49.5 PK	74.0	-24.5	1.68 H	211	45.0	4.5
6	4824.00	37.8 AV	54.0	-16.2	1.68 H	211	33.3	4.5

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	2.53 V	5	37.7	30.9
2	2390.00	50.0 AV	54.0	-4.0	2.53 V	5	19.1	30.9
3	*2412.00	96.8 PK			2.64 V	0	65.7	31.1
4	*2412.00	86.1 AV			2.64 V	0	55.0	31.1
5	4824.00	48.9 PK	74.0	-25.1	2.25 V	290	44.4	4.5
6	4824.00	37.9 AV	54.0	-16.1	2.25 V	290	33.4	4.5

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	98.4 PK			2.05 H	126	67.3	31.1
2	*2437.00	87.4 AV			2.05 H	126	56.3	31.1
3	4874.00	49.6 PK	74.0	-24.4	1.83 H	148	45.0	4.6
4	4874.00	38.6 AV	54.0	-15.4	1.83 H	148	34.0	4.6

**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	95.6 PK			2.92 V	46	64.5	31.1
2	*2437.00	86.3 AV			2.92 V	46	55.2	31.1
3	4874.00	48.7 PK	74.0	-25.3	2.33 V	303	44.1	4.6
4	4874.00	37.6 AV	54.0	-16.4	2.33 V	303	33.0	4.6

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	97.3 PK			2.04 H	128	66.1	31.2
2	*2462.00	86.9 AV			2.04 H	128	55.7	31.2
3	2483.50	72.2 PK	74.0	-1.8	2.40 H	124	40.9	31.3
<b>4</b>	<b>2483.50</b>	<b>53.0 AV</b>	<b>54.0</b>	<b>-1.0</b>	<b>2.40 H</b>	<b>124</b>	<b>21.7</b>	<b>31.3</b>
5	4924.00	46.2 PK	74.0	-27.8	1.50 H	190	41.7	4.5
6	4924.00	33.0 AV	54.0	-21.0	1.50 H	190	28.5	4.5

**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	96.1 PK			2.73 V	28	64.9	31.2
2	*2462.00	86.2 AV			2.73 V	28	55.0	31.2
3	2483.50	67.8 PK	74.0	-6.2	2.91 V	49	36.5	31.3
4	2483.50	51.4 AV	54.0	-2.6	2.91 V	49	20.1	31.3
5	4924.00	45.4 PK	74.0	-28.6	1.95 V	279	40.9	4.5
6	4924.00	32.6 AV	54.0	-21.4	1.95 V	279	28.1	4.5

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:

802.11b

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 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	22.3 QP	40.0	-17.7	2.00 H	37	36.8	-14.5
2	70.73	18.9 QP	40.0	-21.1	1.00 H	280	35.2	-16.3
3	109.62	16.9 QP	43.5	-26.6	1.00 H	188	34.2	-17.3
4	140.72	21.3 QP	43.5	-22.2	1.00 H	82	35.5	-14.2
5	249.60	17.8 QP	46.0	-28.2	1.50 H	174	31.7	-13.9
6	900.94	31.1 QP	46.0	-14.9	1.00 H	100	30.7	0.4
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	41.57	22.2 QP	40.0	-17.8	1.00 V	69	37.1	-14.9
2	80.45	28.4 QP	40.0	-11.6	1.00 V	178	46.9	-18.5
3	129.06	19.2 QP	43.5	-24.3	1.00 V	357	34.8	-15.6
4	162.11	19.7 QP	43.5	-23.8	1.00 V	79	33.3	-13.6
5	729.84	32.7 QP	46.0	-13.3	1.00 V	274	35.5	-2.8
6	899.00	33.7 QP	46.0	-12.3	1.00 V	118	33.4	0.3

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	100424	Oct. 24, 2016	Oct. 23, 2017
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Dec. 22, 2016	Dec. 21, 2017
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 26, 2016	Feb. 25, 2017
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 28, 2016	Jul. 27, 2017
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

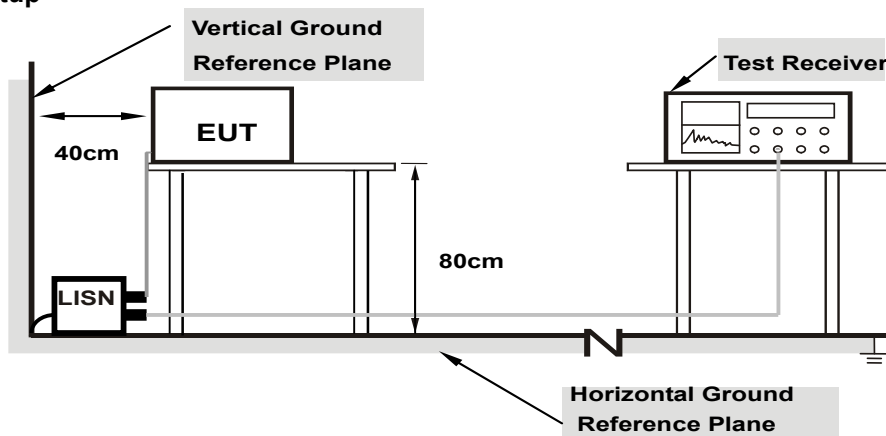
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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.

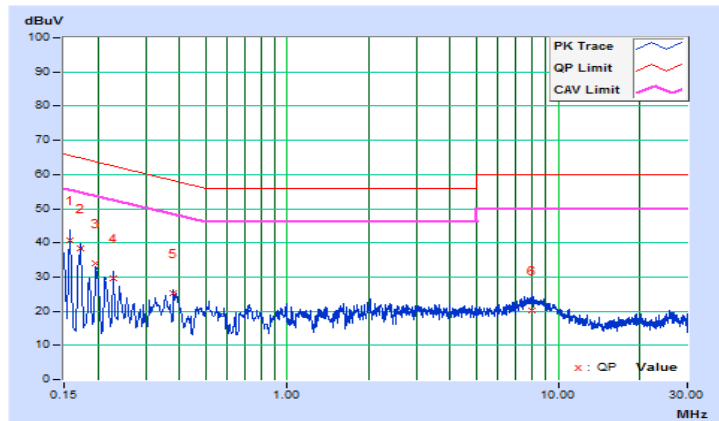
#### 4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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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	0.15782	10.18	30.59	12.87	40.77	23.05	65.58
2	0.17346	10.18	28.21	12.91	38.39	23.09	64.79	54.79	-26.40	-31.70
3	0.19692	10.19	23.91	8.31	34.10	18.50	63.74	53.74	-29.64	-35.24
4	0.22820	10.19	19.58	5.97	29.77	16.16	62.51	52.51	-32.74	-36.35
5	0.38069	10.22	15.15	8.09	25.37	18.31	58.26	48.26	-32.89	-29.95
6	7.95436	10.63	9.53	4.38	20.16	15.01	60.00	50.00	-39.84	-34.99

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.

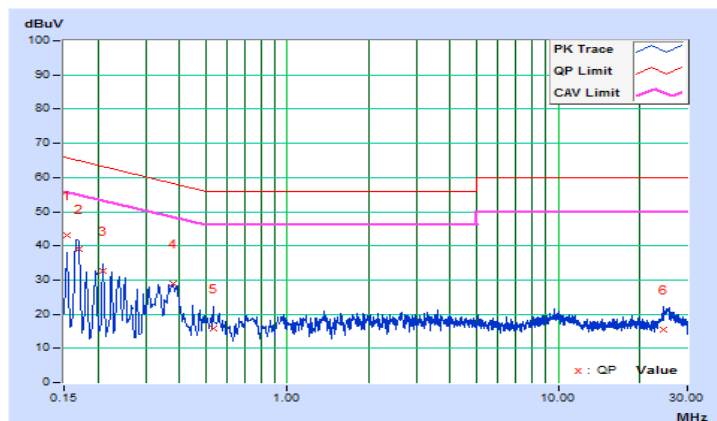


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
	<b>1</b>	<b>0.15391</b>	<b>10.19</b>	<b>32.90</b>	<b>17.52</b>	<b>43.09</b>	<b>27.71</b>	<b>65.79</b>	<b>55.79</b>	<b>-22.70</b>
2	0.16955	10.19	28.98	13.21	39.17	23.40	64.98	54.98	-25.81	-31.58
3	0.20865	10.19	22.36	7.93	32.55	18.12	63.26	53.26	-30.71	-35.14
4	0.38069	10.28	18.64	12.87	28.92	23.15	58.26	48.26	-29.34	-25.11
5	0.53318	10.29	5.57	0.94	15.86	11.23	56.00	46.00	-40.14	-34.77
6	24.44283	11.93	3.66	-1.14	15.59	10.79	60.00	50.00	-44.41	-39.21

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.

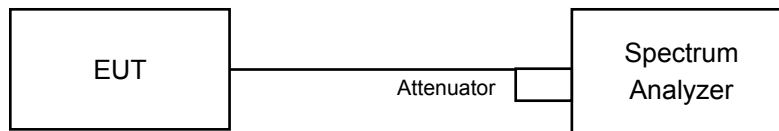


### 4.3 6dB Bandwidth Measurement

#### 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 = average.
- 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 Result

##### 802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	8.58	0.5	Pass
6	2437	9.08	0.5	Pass
11	2462	9.58	0.5	Pass

##### 802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	16.37	0.5	Pass
6	2437	16.40	0.5	Pass
11	2462	16.45	0.5	Pass

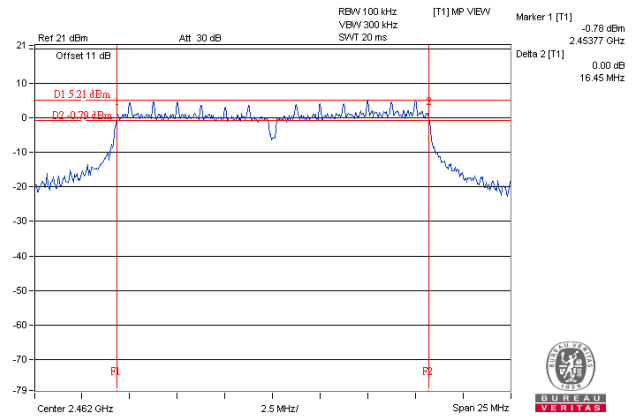
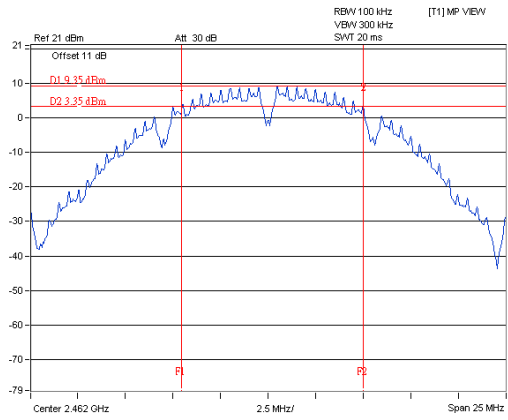
##### 802.11n (HT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	17.37	0.5	Pass
6	2437	17.62	0.5	Pass
11	2462	17.65	0.5	Pass

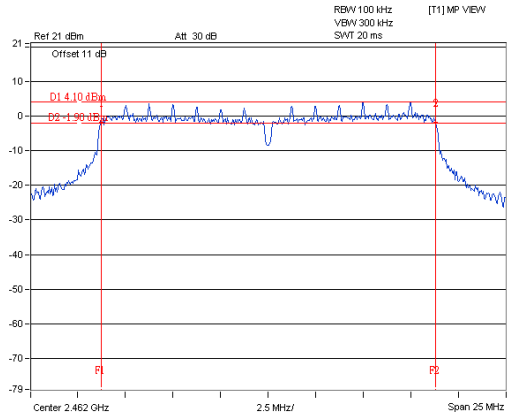
### Spectrum Plot of Worst Value

802.11b

802.11g



802.11n (HT20)



## 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,

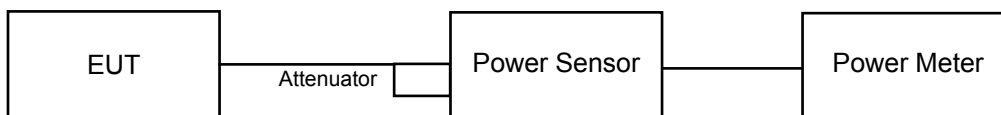
Array Gain = 0 dB (i.e., no array gain) for  $NANT \leq 4$ ;

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

An average power sensor was used on the output port of the EUT. A power meter was used to read the response of the 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

##### 802.11b

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	<b>83.946</b>	19.24	30	Pass
6	2437	81.283	19.10	30	Pass
11	2462	77.983	18.92	30	Pass

##### 802.11g

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	31.842	15.03	30	Pass
6	2437	46.881	16.71	30	Pass
11	2462	43.451	16.38	30	Pass

##### 802.11n (HT20)

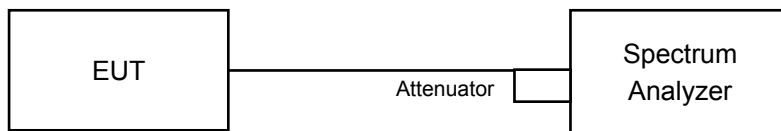
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	38.282	15.83	30	Pass
6	2437	49.317	16.93	30	Pass
11	2462	32.509	15.12	30	Pass

## 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

Duty cycle < 98%

- a. Measure the duty cycle (x).
- b. Set instrument center frequency to DTS channel center frequency.
- c. Set span to at least 1.5 times the OBW.
- d. Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- e. Set VBW  $\geq 3 \times \text{RBW}$ .
- f. Detector = power averaging (RMS) or sample detector (when RMS not available).
- g. Ensure that the number of measurement points in the sweep  $\geq 2 \times \text{span}/\text{RBW}$ .
- h. Sweep time = auto couple.
- i. Do not use sweep triggering. Allow sweep to “free run”.
- j. Employ trace averaging (RMS) mode over a minimum of 100 traces.
- k. Use the peak marker function to determine the maximum amplitude level.
- l. Add  $10 \log (1/x)$ , where x is the duty cycle measured in step (a), to the measured PSD to compute the average PSD during the actual transmission time.

### 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

Channel	Frequency (MHz)	PSD W/O Duty Factor (dBm/10kHz)	Duty Factor (dB)	TOTAL PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
1	2412	-9.70	0.12	-9.58	8.00	Pass
6	2437	-9.41	0.12	-9.29	8.00	Pass
11	2462	-10.56	0.12	-10.44	8.00	Pass

NOTE: Refer to section 3.3 for duty cycle spectrum plot.

##### 802.11g

Channel	Frequency (MHz)	PSD W/O Duty Factor (dBm/10kHz)	Duty Factor (dB)	TOTAL PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
1	2412	-16.73	0.65	-16.08	8.00	Pass
6	2437	-15.64	0.65	-14.99	8.00	Pass
11	2462	-15.91	0.65	-15.26	8.00	Pass

NOTE: Refer to section 3.3 for duty cycle spectrum plot.

##### 802.11n (HT20)

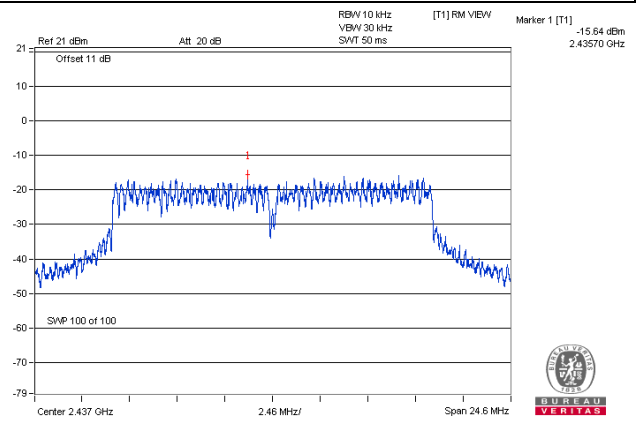
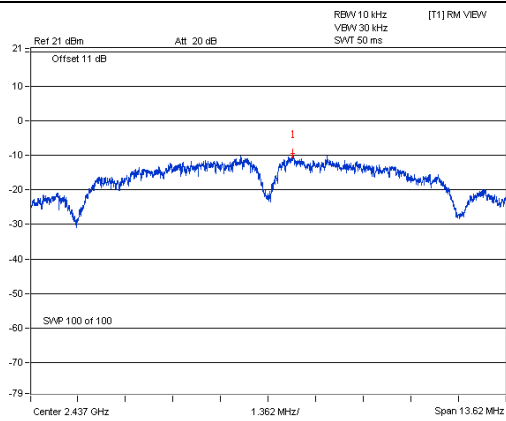
Channel	Frequency (MHz)	PSD W/O Duty Factor (dBm/10kHz)	Duty Factor (dB)	TOTAL PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
1	2412	-14.88	0.68	-14.20	8.00	Pass
6	2437	-15.80	0.68	-15.12	8.00	Pass
11	2462	-17.64	0.68	-16.96	8.00	Pass

NOTE: Refer to section 3.3 for duty cycle spectrum plot.

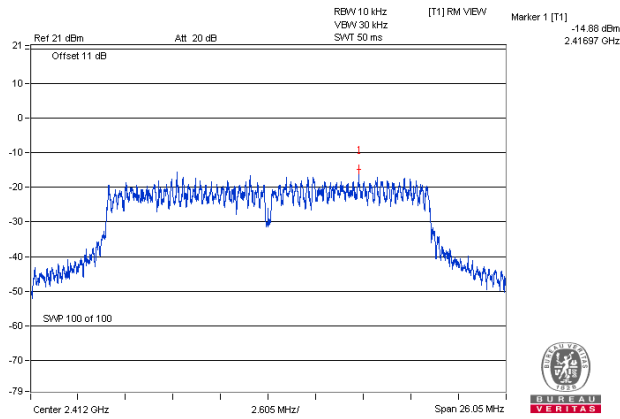
### Spectrum Plot of Worst Value

**802.11b**

**802.11g**



**802.11n (HT20)**

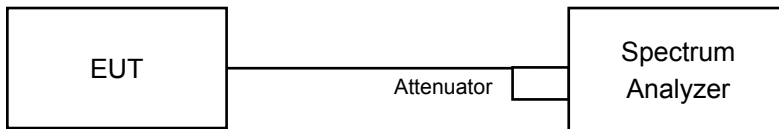


## 4.6 Conducted Out of Band Emission Measurement

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

Below 30dB 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

- Set the RBW = 100 kHz.
- Set the VBW  $\geq$  300 kHz.
- Detector = average.
- 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.

#### MEASUREMENT PROCEDURE OOBE

- Set RBW = 100 kHz.
- Set VBW  $\geq$  300 kHz.
- Ensure that the number of measurement points  $\geq$  span/RBW
- According to measurement points to set differ measurement span.
- Detector = average.
- Trace Mode = max hold.
- Sweep = auto couple.



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

No deviation.

#### **4.6.6 EUT Operating Condition**

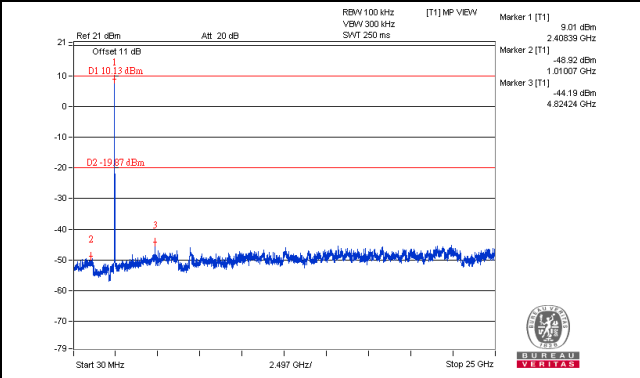
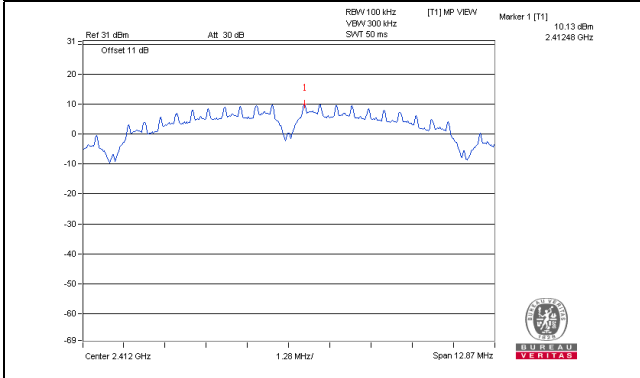
Same as Item 4.3.6

#### **4.6.7 Test Results**

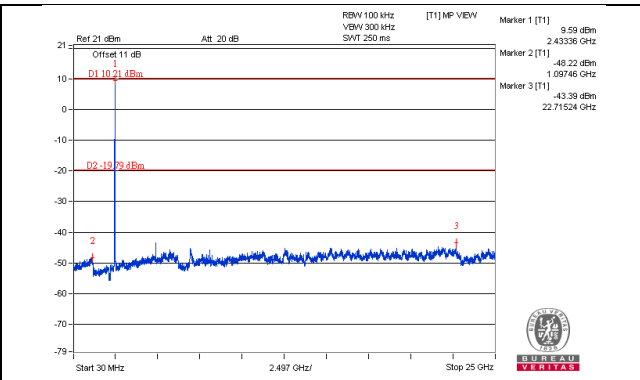
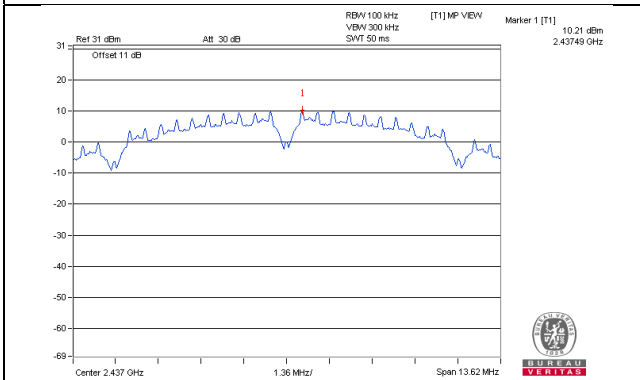
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

802.11b

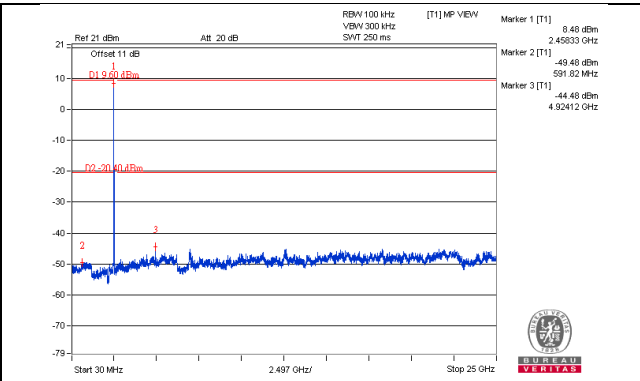
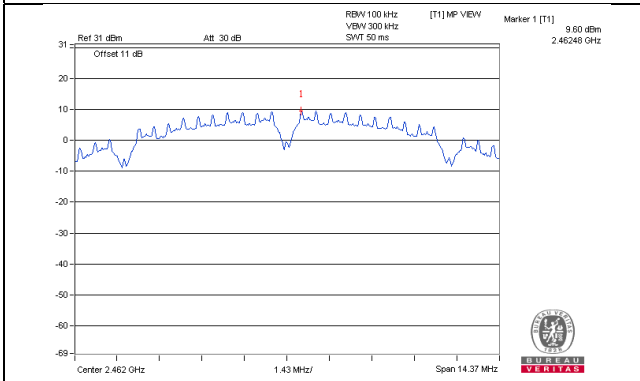
CH 1



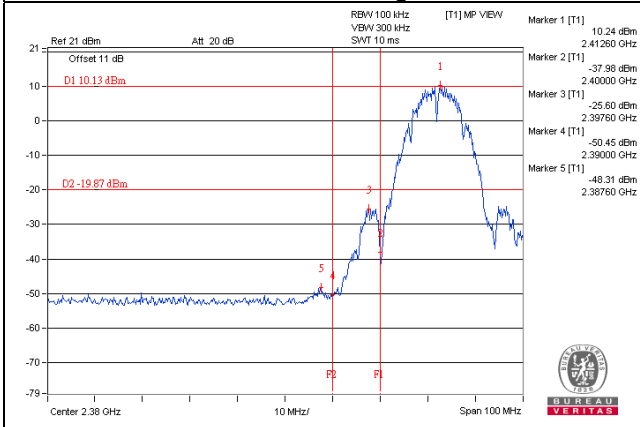
CH 6



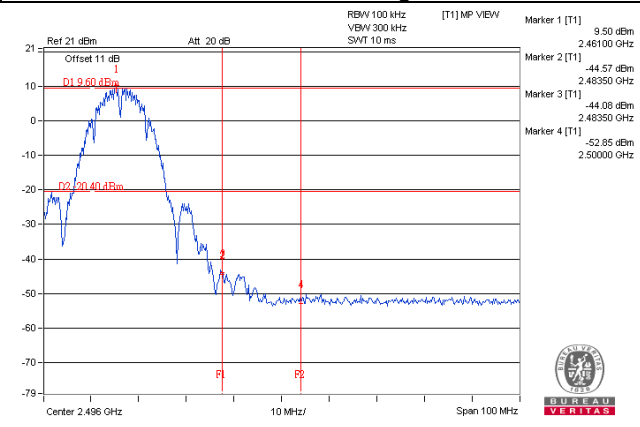
CH 11



CH 1 Band edge

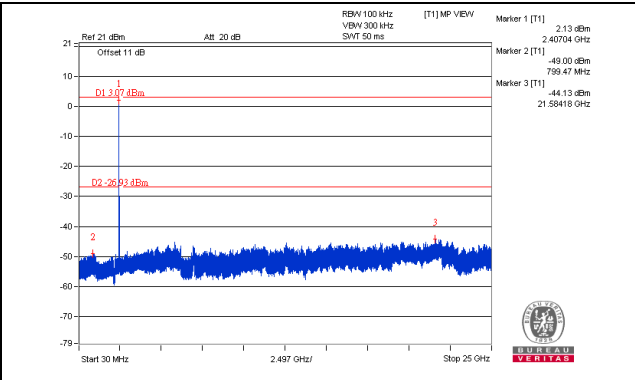
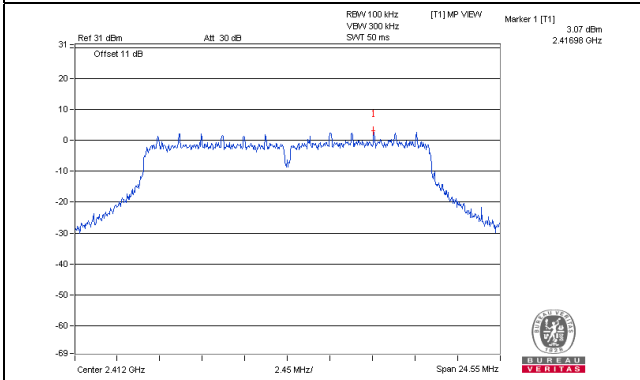


CH 11 Band edge

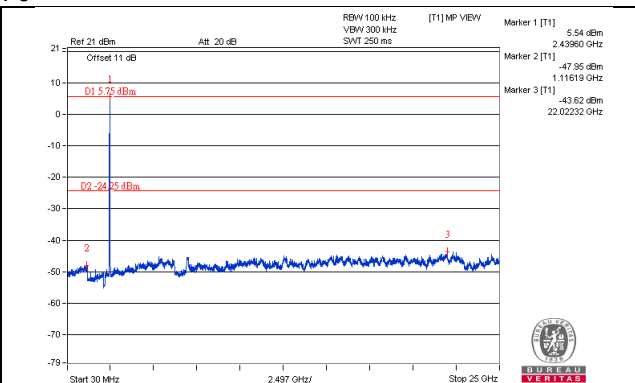
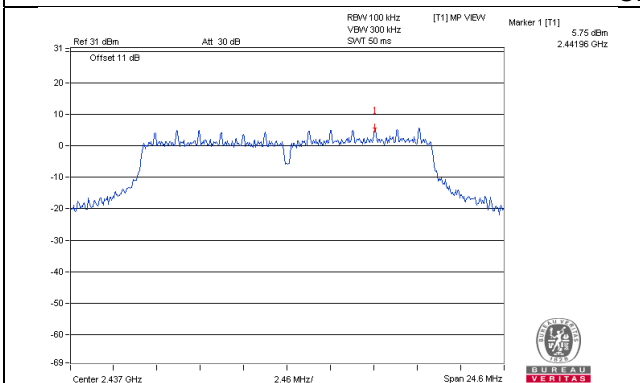


802.11g

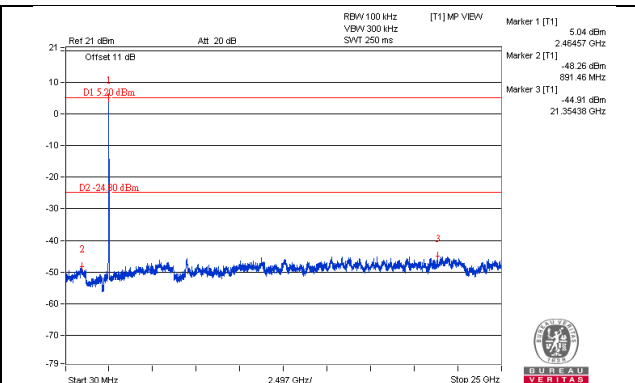
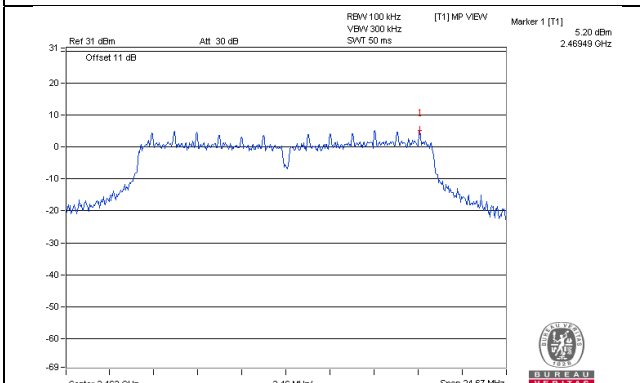
CH 1



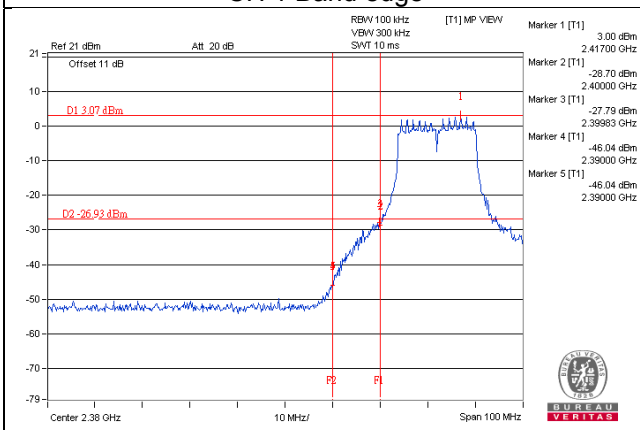
CH 6



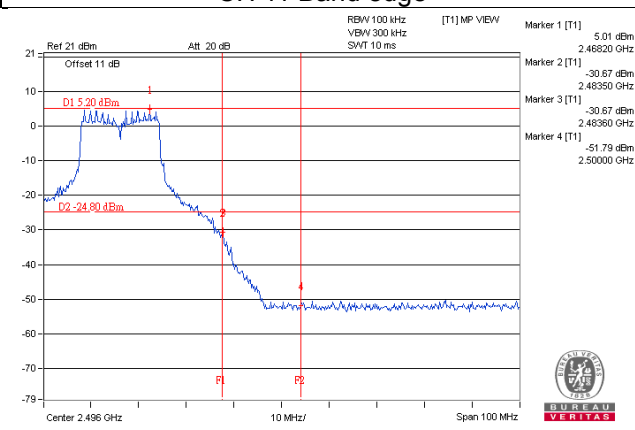
CH 11



CH 1 Band edge

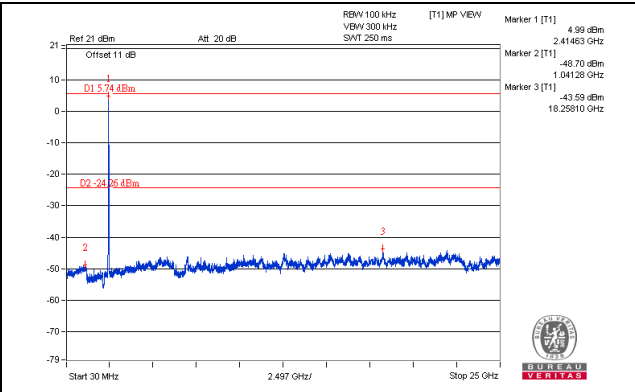
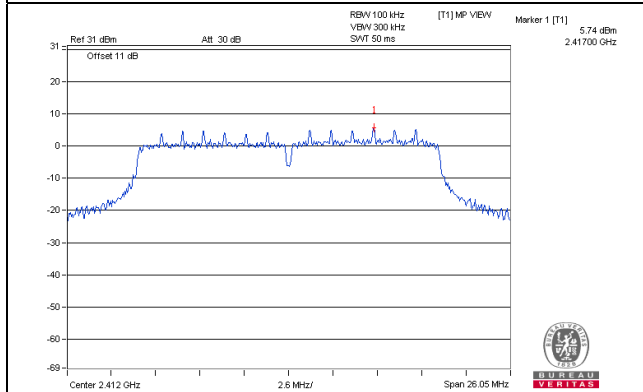


CH 11 Band edge

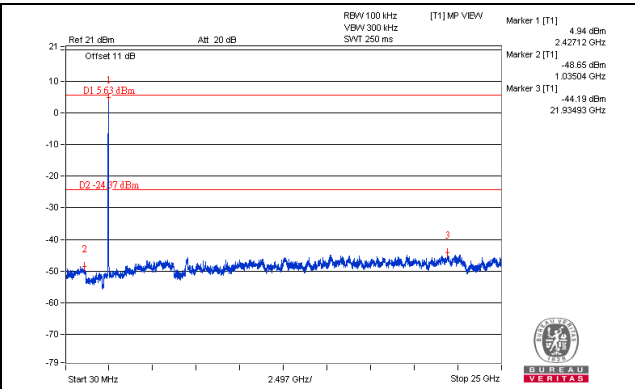
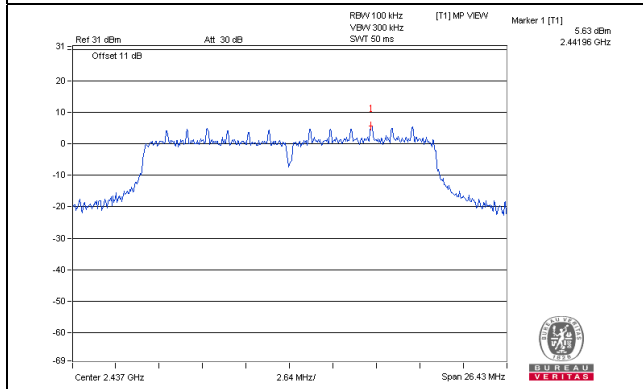


802.11n (HT20)

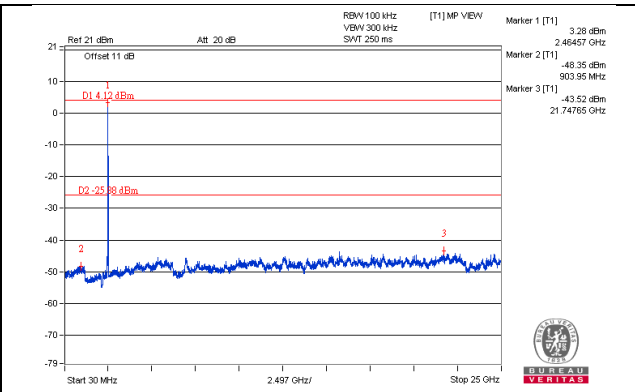
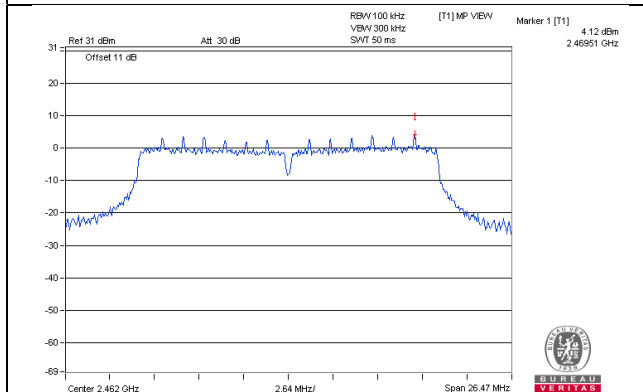
CH 1



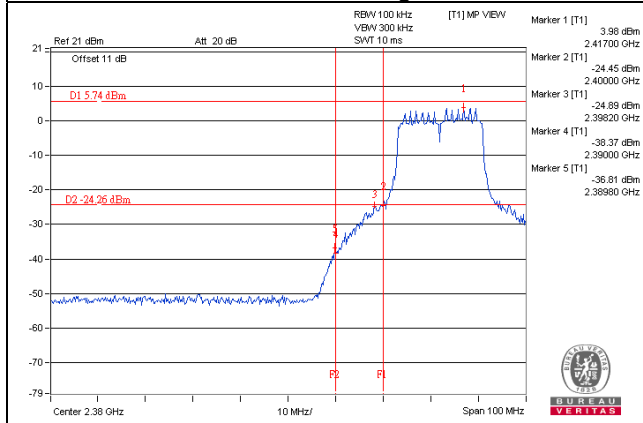
CH 6



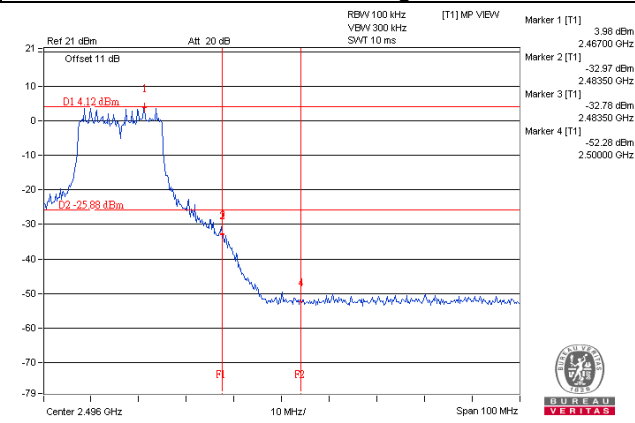
CH 11



CH 1 Band edge



CH 11 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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