

# FCC TEST REPORT (15.247)

**REPORT NO.:** RF150318C06-4  
**MODEL NO.:** S50c  
**FCC ID:** ZL5S50C  
**RECEIVED:** Mar. 18, 2015  
**TESTED:** Mar. 27, 2015 ~ Apr. 08, 2015  
**ISSUED:** Apr. 21, 2015

**APPLICANT:** Bullitt Group

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

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF150318C06-4	Original release	Apr. 21, 2015



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## 1. CERTIFICATION

**PRODUCT:** Rugged Smart Phone

**MODEL NO.:** S50c

**BRAND:** CAT

**APPLICANT:** Bullitt Group

**TESTED:** Mar. 27, 2015 ~ Apr. 08, 2015

**TEST SAMPLE:** Identical Prototype

**STANDARDS:** FCC Part 15, Subpart C (Section 15.247)

ANSI C63.10-2013

The above equipment (model: S50c) 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**

:

Ivonne Wu / Supervisor

, **DATE** :

Apr. 21, 2015

**APPROVED BY**

:

Sam Chen / Senior Project Engineer

, **DATE** :

Apr. 21, 2015

## 2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -13.19dB at 1.17833MHz.
15.205 & 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -3.42dB at 2484.00MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
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	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	2.93 dB
	200MHz ~1000MHz	2.95 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

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

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>EUT</b>	Rugged Smart Phone
<b>MODEL NO.</b>	S50c
<b>POWER SUPPLY</b>	5.0Vdc (adapter or host equipment) 3.75Vdc (Li-ion battery)
<b>MODULATION TYPE</b>	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
<b>MODULATION TECHNOLOGY</b>	DSSS, OFDM
<b>TRANSFER RATE</b>	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to MCS7
<b>OPERATING FREQUENCY</b>	2412 ~ 2462MHz
<b>NUMBER OF CHANNEL</b>	11 for 802.11b, 802.11g, 802.11n (20MHz) 7 for 802.11n (40MHz)
<b>OUTPUT POWER</b>	115.08mW
<b>ANTENNA TYPE</b>	PIFA antenna with 0.11dBi gain
<b>ANTENNA CONNECTOR</b>	NA
<b>DATA CABLE</b>	Refer to Note as below
<b>I/O PORTS</b>	Refer to user's manual
<b>ACCESSORY DEVICES</b>	Refer to Note as below

#### NOTE:

1. The EUT contains following accessory devices.

ITEM	BRAND	MODEL	SPECIFICATION
Adapter	Liteon	PA-1050-05L3	I/P: 100-240Vac, 0.3A O/P: 5Vdc, 1A
Battery	Simplo Technology	A09TA008H	3.75Vdc, 2680Ah
USB Cable	BING CHUANG	BC-1.1M-AMCR5P	1m cable
LCD Panel	Truly	BTFTSZ0192	--
Photo Camera	Chicony	CBAE821	--
Video Camera	Chicony	CIFDF31-1	--
Main Board	AT&S	14H08	--
eMMC	Hynix	H26M41103HPR	8GB
CPU	Qualcomm	MSM 8926	Pin: 784

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

## 3.2 DESCRIPTION OF TEST MODES

### FOR 2.4GHz:

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

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

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

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



### 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

#### WLAN 2.4GHz:

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 **Z-plane**.

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

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (20MHz)	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
-	802.11n (40MHz)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0

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

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11n (40MHz)	3 to 9	9	OFDM	BPSK	MCS0

#### POWER LINE CONDUCTED EMISSION TEST:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11n (40MHz)	3 to 9	9	OFDM	BPSK	MCS0

#### **BANDEDGE MEASUREMENT:**

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

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1, 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	MCS0
-	802.11n (40MHz)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0

#### **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	MCS0
-	802.11n (40MHz)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0

#### **TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE $\geq$ 1G	25deg. C, 65%RH	120Vac, 60Hz	Charles Hsiao
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Charles Hsiao
PLC	25deg. C, 65%RH	120Vac, 60Hz	Anson Lin
APCM	25deg. C, 65%RH	120Vac, 60Hz	Howard Kao

### 3.3 DESCRIPTION OF SUPPORT UNITS

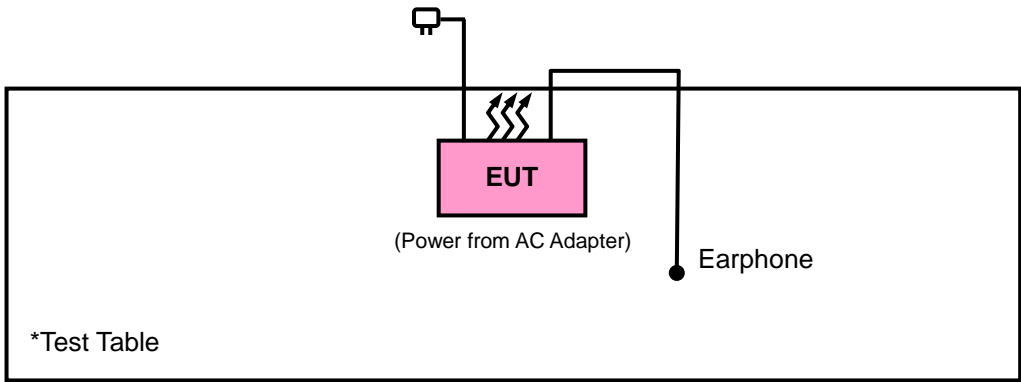
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Earphone	Funkey	N/A	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A

**NOTE:** 1. All power cords of the above support units are non shielded (1.8m).

#### 3.3.1 CONFIGURATION OF SYSTEM UNDER TEST



### 3.4 DUTY CYCLE TEST SIGNAL

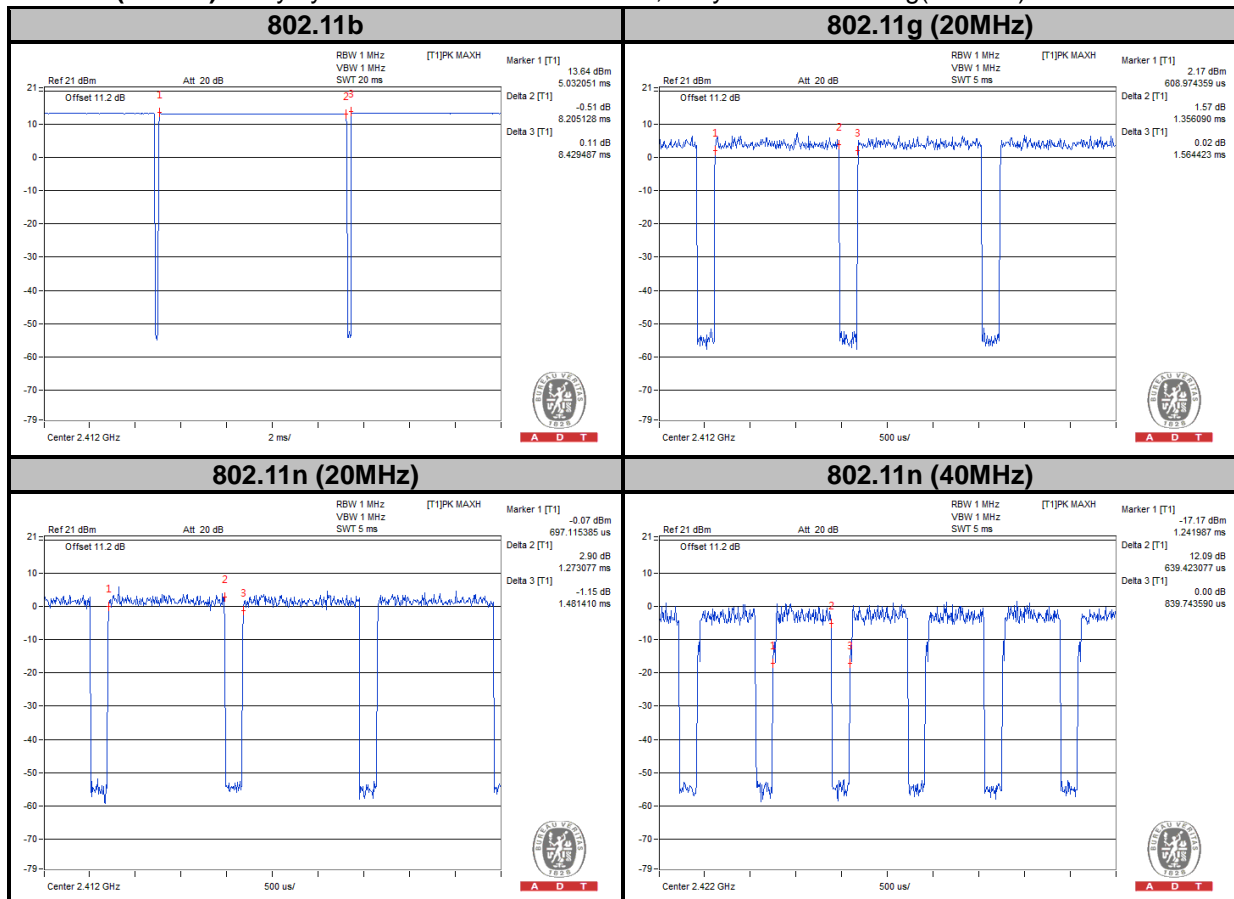
#### WLAN 2.4GHz

**802.11b:** Duty cycle =  $8.205/8.429 = 0.973$ , Duty factor =  $10 * \log(1/0.973) = 0.12$

**802.11g:** Duty cycle =  $1.356/1.564 = 0.867$ , Duty factor =  $10 * \log(1/0.867) = 0.23$

**802.11n (20MHz):** Duty cycle =  $1.273/1.481 = 0.860$ , Duty factor =  $10 * \log(1/0.860) = 0.66$

**802.11n (40MHz):** Duty cycle =  $639.42/839.74 = 0.761$ , Duty factor =  $10 * \log(1/0.761) = 1.19$



### 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**

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 (FOR 2.4GHz BAND)

### 4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

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

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

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

**NOTE:**

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

#### 4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver Agilent	N9038A	MY51210203	Jan. 21, 2015	Jan. 21, 2016
Spectrum Analyzer Agilent	N9010A	MY52220314	Sep. 03, 2014	Sep. 02, 2015
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 10, 2014	Dec. 09, 2015
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Feb. 04, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Feb. 09, 2015	Feb. 09, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Feb. 04, 2015	Feb. 04, 2016
Preamplifier EMCI	EMC 012645	980115	Dec. 12, 2014	Dec. 11, 2015
Preamplifier EMCI	EMC 184045	980116	Jan. 09, 2015	Jan. 08, 2016
Preamplifier EMCI	EMC 330H	980112	Dec. 27, 2014	Dec. 26, 2015
Power Meter Anritsu	ML2495A	1232002	Sep. 17, 2014	Sep. 16, 2015
Power Sensor Anritsu	MA2411B	1207325	Sep. 17, 2014	Sep. 16, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 18, 2014	Oct. 17, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 18, 2014	Oct. 17, 2015
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Nov. 07, 2014	Nov. 06, 2015
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA
Bluetooth Tester	CBT	100980	Apr. 18, 2013	Apr. 17, 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 10.
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 690701.
5. The IC Site Registration No. is IC 7450F-10.

#### 4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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. Height of receiving 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 1kHz (Duty cycle < 98%) or 10Hz (Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

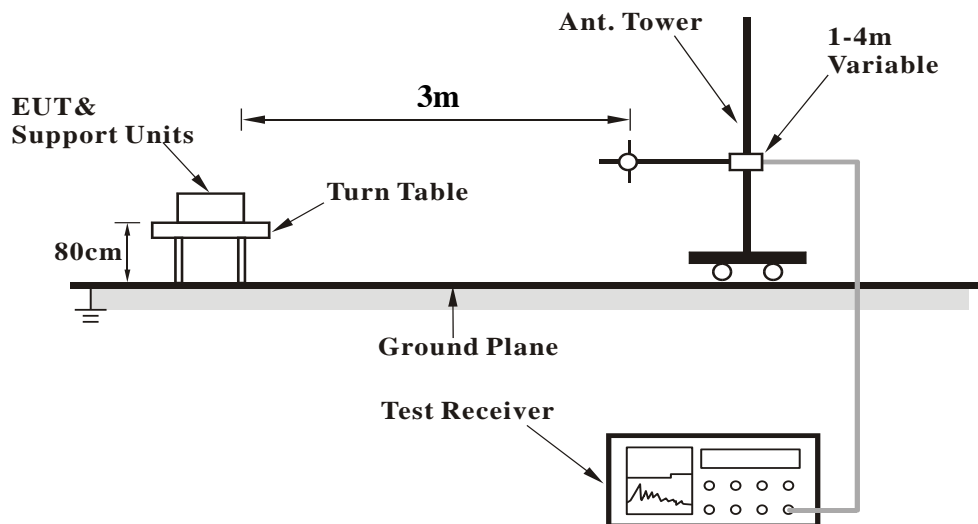
#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

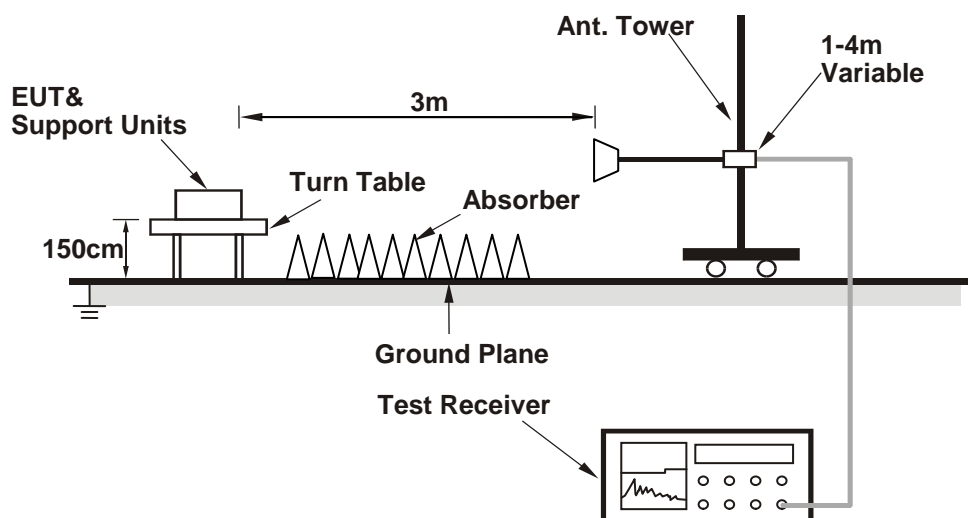


#### 4.1.5 TEST SETUP

<Frequency Range 30MHz ~ 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 a testing table.
- Use the software to control the EUT under transmission condition continuously at specific channel frequency.

#### 4.1.7 TEST RESULTS

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

802.11b

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2376	40.38	38.72	54	-13.62	31.78	5.37	35.49	148	155	Average
2376	54.92	53.26	74	-19.08	31.78	5.37	35.49	148	155	Peak
2412	105.47	103.7			31.81	5.43	35.47	148	155	Average
2412	108.19	106.42			31.81	5.43	35.47	148	155	Peak
2484	40.51	38.55	54	-13.49	31.88	5.5	35.42	148	155	Average
2484	55.2	53.24	74	-18.8	31.88	5.5	35.42	148	155	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2380	40.38	38.72	54	-13.62	31.78	5.37	35.49	101	168	Average
2380	55.57	53.91	74	-18.43	31.78	5.37	35.49	101	168	Peak
2412	107.48	105.71			31.81	5.43	35.47	101	168	Average
2412	110.07	108.3			31.81	5.43	35.47	101	168	Peak
2486	40.64	38.65	54	-13.36	31.88	5.53	35.42	101	168	Average
2486	55.49	53.5	74	-18.51	31.88	5.53	35.42	101	168	Peak

#### REMARKS:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2412MHz: Fundamental frequency.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2350	40.31	38.74	54	-13.69	31.74	5.33	35.5	145	154	Average
2350	54.94	53.37	74	-19.06	31.74	5.33	35.5	145	154	Peak
2437	105.73	103.88			31.85	5.46	35.46	145	154	Average
2437	108.29	106.44			31.85	5.46	35.46	145	154	Peak
2486	40.97	38.98	54	-13.03	31.88	5.53	35.42	145	154	Average
2486	55.76	53.77	74	-18.24	31.88	5.53	35.42	145	154	Peak
4874	45.19	37	54	-8.81	33.98	8.27	34.06	202	357	Average
4874	52.05	43.86	74	-21.95	33.98	8.27	34.06	202	357	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2388	40.43	38.72	54	-13.57	31.8	5.4	35.49	115	164	Average
2388	55.61	53.9	74	-18.39	31.8	5.4	35.49	115	164	Peak
2437	108.55	106.7			31.85	5.46	35.46	115	164	Average
2437	110.81	108.96			31.85	5.46	35.46	115	164	Peak
2496	40.67	38.65	54	-13.33	31.9	5.53	35.41	115	164	Average
2496	56.33	54.31	74	-17.67	31.9	5.53	35.41	115	164	Peak
4874	46.2	38.01	54	-7.8	33.98	8.27	34.06	106	193	Average
4874	52.78	44.59	74	-21.22	33.98	8.27	34.06	106	193	Peak

#### REMARKS:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2437MHz: Fundamental frequency.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2346	40.33	38.76	54	-13.67	31.74	5.33	35.5	115	153	Average
2346	55.6	54.03	74	-18.4	31.74	5.33	35.5	115	153	Peak
2462	105.6	103.67			31.87	5.5	35.44	115	153	Average
2462	108.19	106.26			31.87	5.5	35.44	115	153	Peak
2498	41.1	39.08	54	-12.9	31.9	5.53	35.41	115	153	Average
2498	54.93	52.91	74	-19.07	31.9	5.53	35.41	115	153	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2378	40.37	38.71	54	-13.63	31.78	5.37	35.49	113	167	Average
2378	55.13	53.47	74	-18.87	31.78	5.37	35.49	113	167	Peak
2462	107.6	105.67			31.87	5.5	35.44	113	167	Average
2462	110.07	108.14			31.87	5.5	35.44	113	167	Peak
2500	41.96	39.94	54	-12.04	31.9	5.53	35.41	113	167	Average
2500	54.93	52.91	74	-19.07	31.9	5.53	35.41	113	167	Peak

**REMARKS:**

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2462MHz: Fundamental frequency.

**802.11g**

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	42.72	40.99	54	-11.28	31.8	5.4	35.47	148	154	Average
2390	55.15	53.42	74	-18.85	31.8	5.4	35.47	148	154	Peak
2412	99.1	97.33			31.81	5.43	35.47	148	154	Average
2412	106.69	104.92			31.81	5.43	35.47	148	154	Peak
2496	40.67	38.65	54	-13.33	31.9	5.53	35.41	148	154	Average
2496	54.8	52.78	74	-19.2	31.9	5.53	35.41	148	154	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	44.43	42.7	54	-9.57	31.8	5.4	35.47	101	170	Average
2390	56.89	55.16	74	-17.11	31.8	5.4	35.47	101	170	Peak
2412	99.94	98.17			31.81	5.43	35.47	101	170	Average
2412	108.23	106.46			31.81	5.43	35.47	101	170	Peak
2490	42	39.99	54	-12	31.9	5.53	35.42	101	170	Average
2490	55.65	53.64	74	-18.35	31.9	5.53	35.42	101	170	Peak

**REMARKS:**

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2412MHz: Fundamental frequency.



A D T

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2386	40.43	38.72	54	-13.57	31.8	5.4	35.49	151	156	Average
2386	55.06	53.35	74	-18.94	31.8	5.4	35.49	151	156	Peak
2437	97.88	96.03			31.85	5.46	35.46	151	156	Average
2437	106.09	104.24			31.85	5.46	35.46	151	156	Peak
2486	40.97	38.98	54	-13.03	31.88	5.53	35.42	151	156	Average
2486	54.87	52.88	74	-19.13	31.88	5.53	35.42	151	156	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2380	39.71	38.05	54	-14.29	31.78	5.37	35.49	115	168	Average
2380	55.84	54.18	74	-18.16	31.78	5.37	35.49	115	168	Peak
2437	99.87	98.02			31.85	5.46	35.46	115	168	Average
2437	108.36	106.51			31.85	5.46	35.46	115	168	Peak
2492	40.67	38.65	54	-13.33	31.9	5.53	35.41	115	168	Average
2492	55.41	53.39	74	-18.59	31.9	5.53	35.41	115	168	Peak

**REMARKS:**

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2437MHz: Fundamental frequency.



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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2372	39.81	38.15	54	-14.19	31.78	5.37	35.49	147	151	Average
2372	55.09	53.43	74	-18.91	31.78	5.37	35.49	147	151	Peak
2462	98.6	96.67			31.87	5.5	35.44	147	151	Average
2462	106.69	104.76			31.87	5.5	35.44	147	151	Peak
2483.5	45.27	43.31	54	-8.73	31.88	5.5	35.42	147	151	Average
2483.5	59.64	57.68	74	-14.36	31.88	5.5	35.42	147	151	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2388	39.72	38.01	54	-14.28	31.8	5.4	35.49	112	168	Average
2388	55.1	53.39	74	-18.9	31.8	5.4	35.49	112	168	Peak
2462	100.75	98.82			31.87	5.5	35.44	112	168	Average
2462	108.24	106.31			31.87	5.5	35.44	112	168	Peak
2483.5	47.54	45.58	54	-6.46	31.88	5.5	35.42	112	168	Average
2483.5	63.04	61.08	74	-10.96	31.88	5.5	35.42	112	168	Peak

**REMARKS:**

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2462MHz: Fundamental frequency.

# 802.11n (20MHz)

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2378	40.38	38.72	54	-13.62	31.78	5.37	35.49	150	156	Average
2378	55.27	53.61	74	-18.73	31.78	5.37	35.49	150	156	Peak
2412	96.5	94.73			31.81	5.43	35.47	150	156	Average
2412	104.63	102.86			31.81	5.43	35.47	150	156	Peak
2490	40.67	38.66	54	-13.33	31.9	5.53	35.42	150	156	Average
2490	55.25	53.24	74	-18.75	31.9	5.53	35.42	150	156	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2374	42.01	40.35	54	-11.99	31.78	5.37	35.49	100	166	Average
2374	55	53.34	74	-19	31.78	5.37	35.49	100	166	Peak
2412	98.1	96.33			31.81	5.43	35.47	100	166	Average
2412	106.37	104.6			31.81	5.43	35.47	100	166	Peak
2492	40.99	38.97	54	-13.01	31.9	5.53	35.41	100	166	Average
2492	54.7	52.68	74	-19.3	31.9	5.53	35.41	100	166	Peak

## REMARKS:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2412MHz: Fundamental frequency.



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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2382	40.07	38.38	54	-13.93	31.78	5.4	35.49	151	153	Average
2382	56.03	54.34	74	-17.97	31.78	5.4	35.49	151	153	Peak
2437	95.88	94.03			31.85	5.46	35.46	151	153	Average
2437	103.95	102.1			31.85	5.46	35.46	151	153	Peak
2500	41	38.98	54	-13	31.9	5.53	35.41	151	153	Average
2500	55.94	53.92	74	-18.06	31.9	5.53	35.41	151	153	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2374	40.38	38.72	54	-13.62	31.78	5.37	35.49	115	167	Average
2374	56.05	54.39	74	-17.95	31.78	5.37	35.49	115	167	Peak
2437	98.17	96.32			31.85	5.46	35.46	115	167	Average
2437	106.1	104.25			31.85	5.46	35.46	115	167	Peak
2490	40.65	38.64	54	-13.35	31.9	5.53	35.42	115	167	Average
2490	55.84	53.83	74	-18.16	31.9	5.53	35.42	115	167	Peak

**REMARKS:**

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2437MHz: Fundamental frequency.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2376	40.38	38.72	54	-13.62	31.78	5.37	35.49	148	133	Average
2376	55.38	53.72	74	-18.62	31.78	5.37	35.49	148	133	Peak
2462	96.65	94.72			31.87	5.5	35.44	148	133	Average
2462	104.92	102.99			31.87	5.5	35.44	148	133	Peak
2483.5	44.91	42.95	54	-9.09	31.88	5.5	35.42	148	133	Average
2483.5	57.64	55.68	74	-16.36	31.88	5.5	35.42	148	133	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2382	40.38	38.69	54	-13.62	31.78	5.4	35.49	128	168	Average
2382	55.23	53.54	74	-18.77	31.78	5.4	35.49	128	168	Peak
2462	97.95	96.02			31.87	5.5	35.44	128	168	Average
2462	106.11	104.18			31.87	5.5	35.44	128	168	Peak
2483.5	45.24	43.28	54	-8.76	31.88	5.5	35.42	128	168	Average
2483.5	60.1	58.14	74	-13.9	31.88	5.5	35.42	128	168	Peak

**REMARKS:**

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2462MHz: Fundamental frequency.

**802.11n (40MHz)**

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	45.2	43.47	54	-8.8	31.8	5.4	35.47	153	344	Average
2390	58.47	56.74	74	-15.53	31.8	5.4	35.47	153	344	Peak
2422	96.47	94.67			31.83	5.43	35.46	153	344	Average
2422	104.58	102.78			31.83	5.43	35.46	153	344	Peak
2490	41.23	39.22	54	-12.77	31.9	5.53	35.42	153	344	Average
2490	55.47	53.46	74	-18.53	31.9	5.53	35.42	153	344	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	45.88	44.15	54	-8.12	31.8	5.4	35.47	101	201	Average
2390	58.86	57.13	74	-15.14	31.8	5.4	35.47	101	201	Peak
2422	98.06	96.26			31.83	5.43	35.46	101	201	Average
2422	106.02	104.22			31.83	5.43	35.46	101	201	Peak
2486	41.35	39.36	54	-12.65	31.88	5.53	35.42	101	201	Average
2486	55.33	53.34	74	-18.67	31.88	5.53	35.42	101	201	Peak

**REMARKS:**

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2422MHz: Fundamental frequency.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2342	41.08	39.51	54	-12.92	31.74	5.33	35.5	120	80	Average
2342	55.39	53.82	74	-18.61	31.74	5.33	35.5	120	80	Peak
2437	96.87	95.02			31.85	5.46	35.46	120	80	Average
2437	104.9	103.05			31.85	5.46	35.46	120	80	Peak
2488	43.43	41.42	54	-10.57	31.9	5.53	35.42	120	80	Average
2488	55.57	53.56	74	-18.43	31.9	5.53	35.42	120	80	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2326	41.13	39.62	54	-12.87	31.73	5.3	35.52	115	199	Average
2326	55.36	53.85	74	-18.64	31.73	5.3	35.52	115	199	Peak
2437	97.77	95.92			31.85	5.46	35.46	115	199	Average
2437	106.18	104.33			31.85	5.46	35.46	115	199	Peak
2484	44.18	42.22	54	-9.82	31.88	5.5	35.42	115	199	Average
2484	57.05	55.09	74	-16.95	31.88	5.5	35.42	115	199	Peak

**REMARKS:**

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2437MHz: Fundamental frequency.



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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2352	40.5	38.91	54	-13.5	31.76	5.33	35.5	152	157	Average
2352	55.38	53.79	74	-18.62	31.76	5.33	35.5	152	157	Peak
2452	96.61	94.74			31.85	5.46	35.44	152	157	Average
2452	104.4	102.53			31.85	5.46	35.44	152	157	Peak
2484	47.88	45.92	54	-6.12	31.88	5.5	35.42	152	157	Average
2484	61.91	59.95	74	-12.09	31.88	5.5	35.42	152	157	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2366	40.63	38.99	54	-13.37	31.76	5.37	35.49	129	195	Average
2366	55.44	53.8	74	-18.56	31.76	5.37	35.49	129	195	Peak
2452	98.31	96.44			31.85	5.46	35.44	129	195	Average
2452	106.27	104.4			31.85	5.46	35.44	129	195	Peak
2484	50.58	48.62	54	-3.42	31.88	5.5	35.42	129	195	Average
2484	64.94	62.98	74	-9.06	31.88	5.5	35.42	129	195	Peak

**REMARKS:**

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2452MHz: Fundamental frequency.

# **BELOW 1GHz WORST-CASE DATA:**

**802.11n (40MHz)**

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 9	FREQUENCY RANGE	30MHz ~ 1GHz
INPUT POWER	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Charles Hsiao

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
73.74	18.93	41.82	40	-21.07	8.22	1.11	32.22	144	98	Peak
139.35	26.1	47.69	43.5	-17.4	9.3	1.38	32.27	193	293	Peak
230.61	21.55	39.74	46	-24.45	12.13	1.85	32.17	142	154	Peak
326.6	25.41	40.11	46	-20.59	15.29	2.11	32.1	161	274	Peak
435.1	21.7	33.54	46	-24.3	17.84	2.49	32.17	188	59	Peak
916	28.99	30.87	46	-17.01	25.96	3.53	31.37	182	42	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
31.89	28.48	43.67	40	-11.52	16.33	0.74	32.26	157	146	Peak
48.09	27.46	50.38	40	-12.54	8.4	0.9	32.22	108	152	Peak
159.33	18.29	38.3	43.5	-25.21	10.74	1.52	32.27	199	263	Peak
326.6	23	37.7	46	-23	15.29	2.11	32.1	109	223	Peak
695.5	24.99	30.83	46	-21.01	23.14	3.11	32.09	165	76	Peak
937	28.2	29.59	46	-17.8	26.2	3.62	31.21	136	193	Peak

**REMARKS:** Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor

Margin value = Emission level – Limit value

## 4.2 CONDUCTED EMISSION MEASUREMENT

### 4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

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

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

### 4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
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

- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-2040.

#### **4.2.3 TEST PROCEDURES**

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

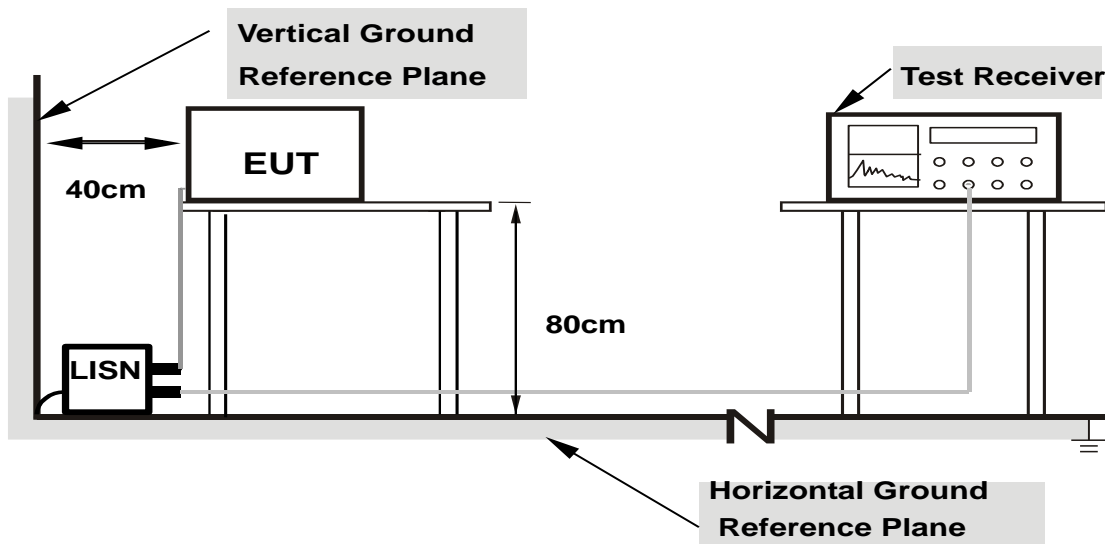
**NOTE:** All modes of operation were investigated and the worst-case emissions are reported.

#### **4.2.4 DEVIATION FROM TEST STANDARD**

No deviation.



#### 4.2.5 TEST SETUP



- Note:**
1. Support units were connected to second LISN.
  2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

#### 4.2.6 EUT OPERATING CONDITIONS

Same as section 4.1.6.

#### 4.2.7 TEST RESULTS

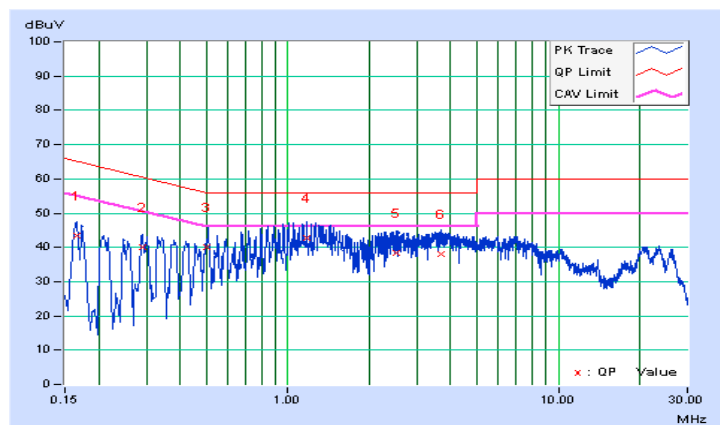
##### CONDUCTED WORST-CASE DATA :

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Anson Lin	Test Date	2015/3/27

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16526	0.05	43.35	27.08	43.40	27.13	65.20	55.20	-21.79	-28.06
2	0.28967	0.06	39.88	26.01	39.94	26.07	60.53	50.53	-20.59	-24.46
3	0.50000	0.06	39.92	22.75	39.98	22.81	56.00	46.00	-16.02	-23.19
4	1.17833	0.09	42.72	31.07	42.81	31.16	56.00	46.00	-13.19	-14.84
5	2.52337	0.14	38.29	27.90	38.43	28.04	56.00	46.00	-17.57	-17.96
6	3.70419	0.18	37.92	27.75	38.10	27.93	56.00	46.00	-17.90	-18.07

##### 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

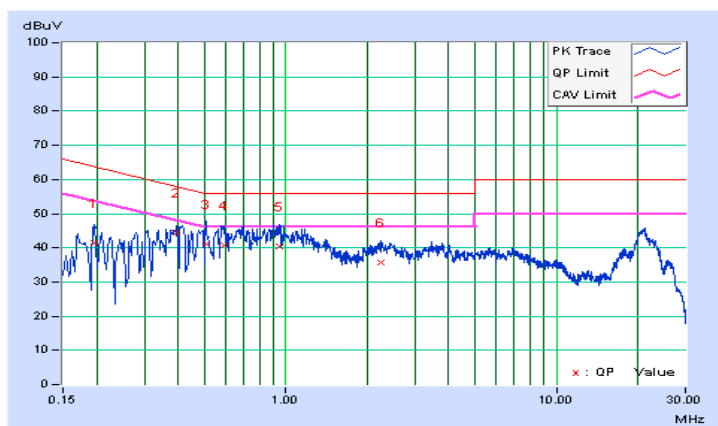


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Anson Lin	Test Date	2015/3/27

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.19692	0.05	41.37	23.48	41.42	23.53	63.74	53.74	-22.32	-30.21
2	0.39531	0.06	44.25	32.07	44.31	32.13	57.95	47.95	-13.64	-15.82
3	0.50581	0.06	40.94	23.64	41.00	23.70	56.00	46.00	-15.00	-22.30
4	0.59158	0.07	40.81	27.08	40.88	27.15	56.00	46.00	-15.12	-18.85
5	0.94373	0.08	40.44	26.40	40.52	26.48	56.00	46.00	-15.48	-19.52
6	2.24185	0.12	35.58	24.03	35.70	24.15	56.00	46.00	-20.30	-21.85

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

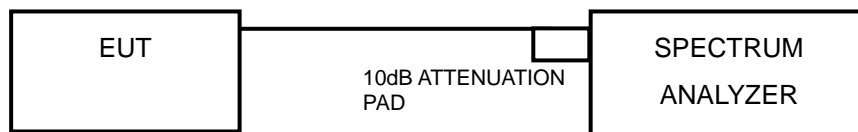


## 4.3 6dB BANDWIDTH MEASUREMENT

### 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
1	2412	9.54	0.5	PASS
6	2437	9.70	0.5	PASS
11	2462	8.60	0.5	PASS

##### 802.11g

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
1	2412	16.35	0.5	PASS
6	2437	16.40	0.5	PASS
11	2462	15.78	0.5	PASS

##### 802.11n (20MHz)

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
1	2412	17.32	0.5	PASS
6	2437	17.63	0.5	PASS
11	2462	16.38	0.5	PASS

##### 802.11n (40MHz)

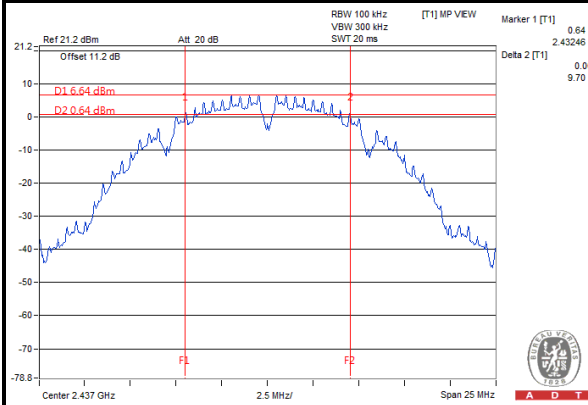
CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
3	2422	35.60	0.5	PASS
6	2437	35.52	0.5	PASS
9	2452	35.90	0.5	PASS



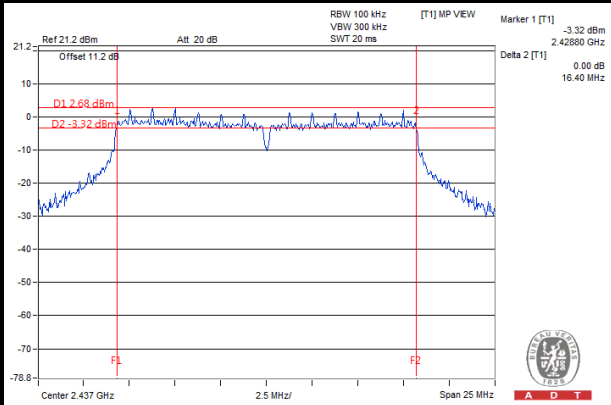
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## SPECTRUM PLOT OF WORST VALUE

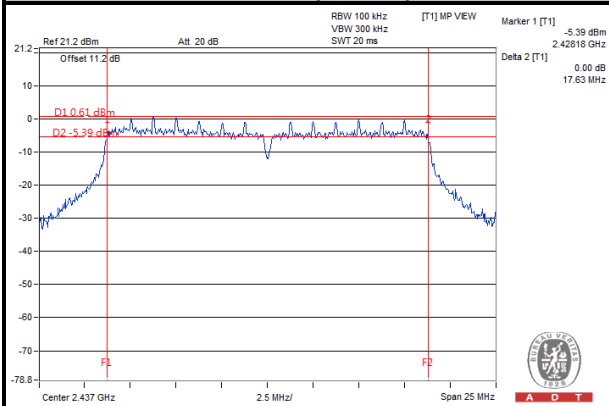
### 802.11b



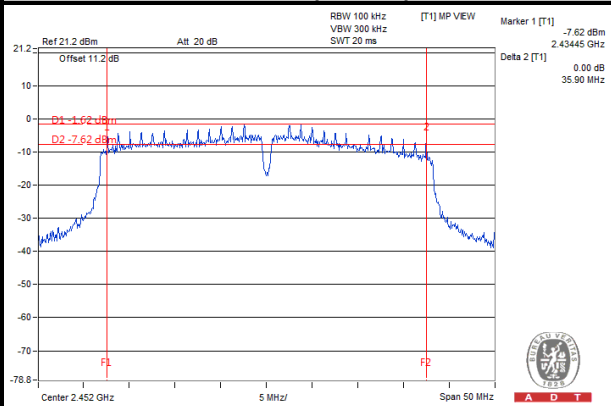
### 802.11g



### 802.11n (20MHz)



### 802.11n (40MHz)

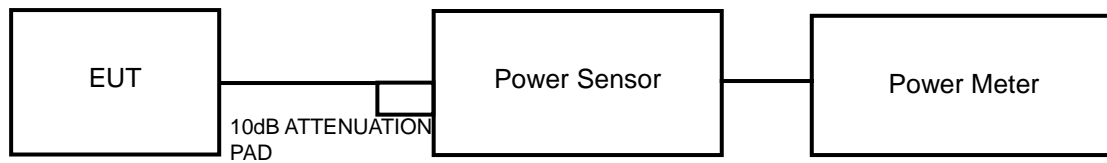


## 4.4 CONDUCTED OUTPUT POWER

### 4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

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

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

### 4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.4.6 EUT OPERATING CONDITIONS

Same as section 4.3.6.

#### 4.4.7 TEST RESULTS

##### 802.11b

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS / FAIL
1	2412	56.89	17.55	30	PASS
6	2437	57.54	17.60	30	PASS
11	2462	54.45	17.36	30	PASS

##### 802.11g

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS / FAIL
1	2412	113.50	20.55	30	PASS
6	2437	115.08	20.61	30	PASS
11	2462	113.24	20.54	30	PASS

##### 802.11n (20MHz)

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS / FAIL
1	2412	88.72	19.48	30	PASS
6	2437	89.33	19.51	30	PASS
11	2462	88.31	19.46	30	PASS

##### 802.11n (40MHz)

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS / FAIL
3	2422	83.56	19.22	30	PASS
6	2437	88.72	19.48	30	PASS
9	2452	88.10	19.45	30	PASS

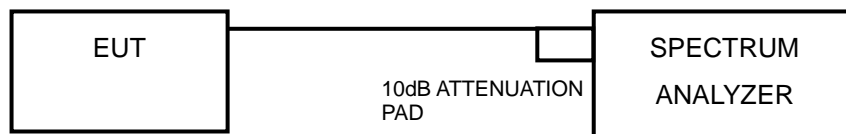


## 4.5 POWER SPECTRAL DENSITY MEASUREMENT

### 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

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

### 4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.5.6 EUT OPERATING CONDITION

Same as section 4.3.6.

#### 4.5.7 TEST RESULTS

##### 802.11b

CHANNEL	FREQUENCY (MHz)	PSD (dBm/3kHz)	LIMIT (dBm/3kHz)	PASS / FAIL
1	2412	-7.83	8	PASS
6	2437	-7.83	8	PASS
11	2462	-7.60	8	PASS

##### 802.11g

CHANNEL	FREQUENCY (MHz)	PSD (dBm/3kHz)	LIMIT (dBm/3kHz)	PASS / FAIL
1	2412	-11.74	8	PASS
6	2437	-10.68	8	PASS
11	2462	-11.15	8	PASS

##### 802.11n (20MHz)

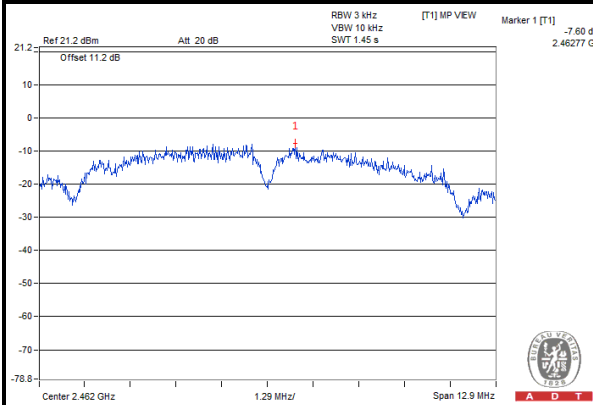
CHANNEL	FREQUENCY (MHz)	PSD (dBm/3kHz)	LIMIT (dBm/3kHz)	PASS / FAIL
1	2412	-12.53	8	PASS
6	2437	-14.98	8	PASS
11	2462	-12.91	8	PASS

##### 802.11n (40MHz)

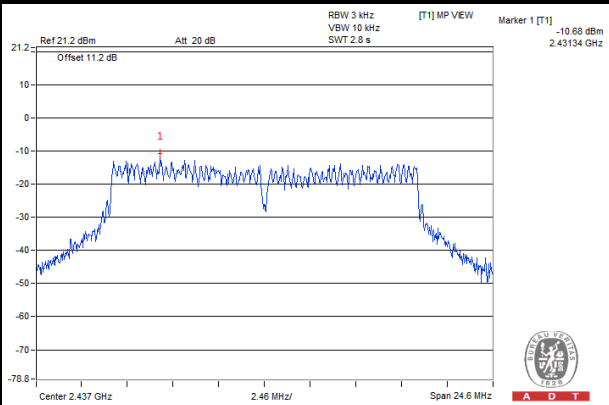
CHANNEL	FREQUENCY (MHz)	PSD (dBm/3kHz)	LIMIT (dBm/3kHz)	PASS / FAIL
3	2422	-16.63	8	PASS
6	2437	-17.43	8	PASS
9	2452	-16.50	8	PASS

## SPECTRUM PLOT OF WORST VALUE

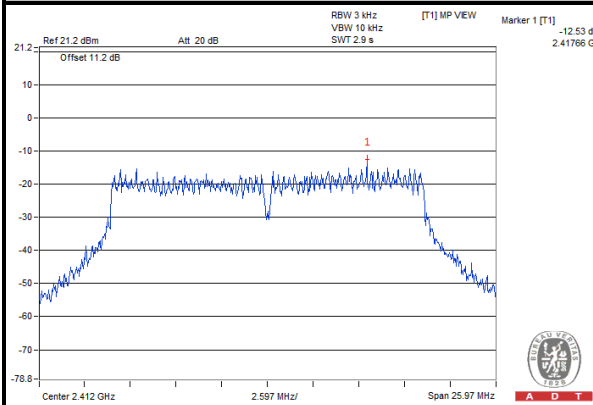
### 802.11b



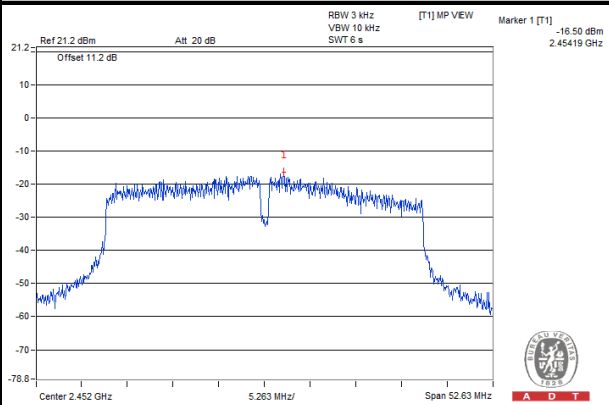
### 802.11g



### 802.11n (20MHz)



### 802.11n (40MHz)

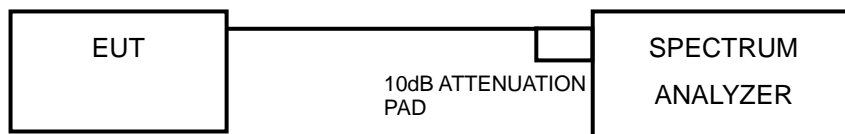


## 4.6 CONDUCTED OUT OF BAND EMISSION MEASUREMENT

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

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

### 4.6.2 TEST SETUP



### 4.6.3 TEST INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

### 4.6.4 TEST PROCEDURE

#### MEASUREMENT PROCEDURE REF

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

#### MEASUREMENT PROCEDURE OOB

1. Set RBW =  $100\text{ kHz}$ .
2. Set VBW  $\geq 300\text{ kHz}$ .
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.

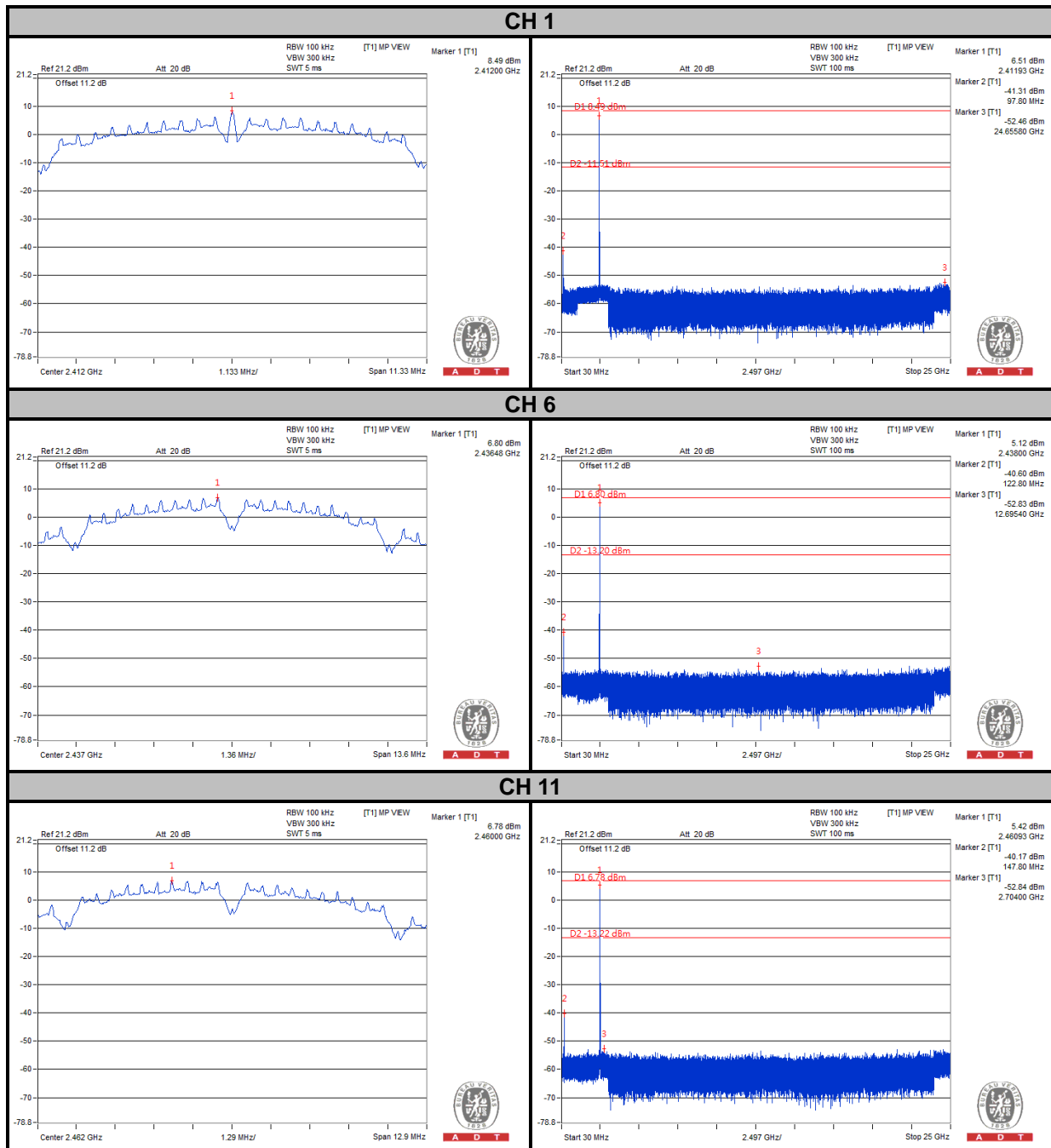
### 4.6.6 EUT OPERATING CONDITION

Same as section 4.3.6.

#### 4.6.7 TEST RESULTS

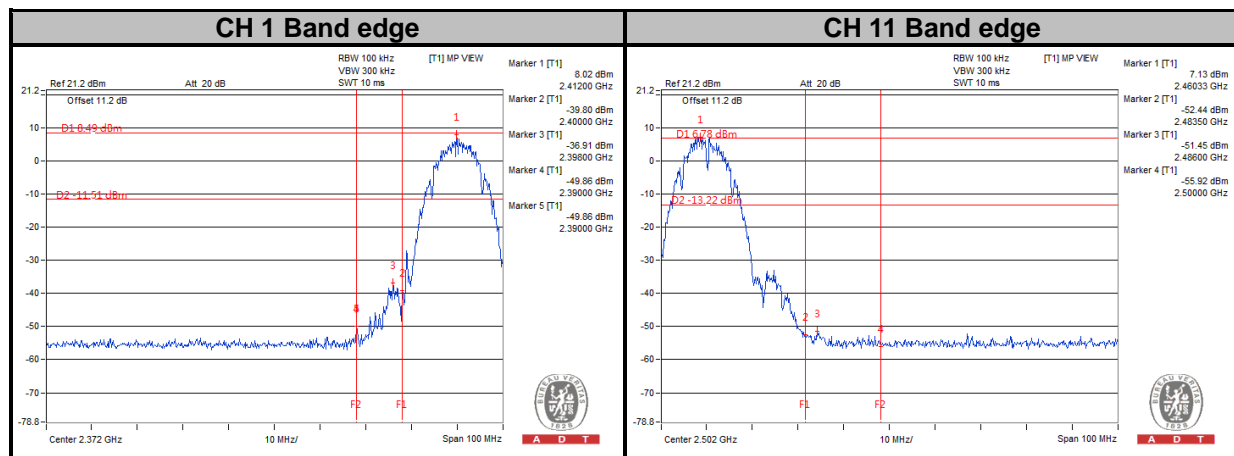
The spectrum plots are attached on the following images. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

#### 802.11b





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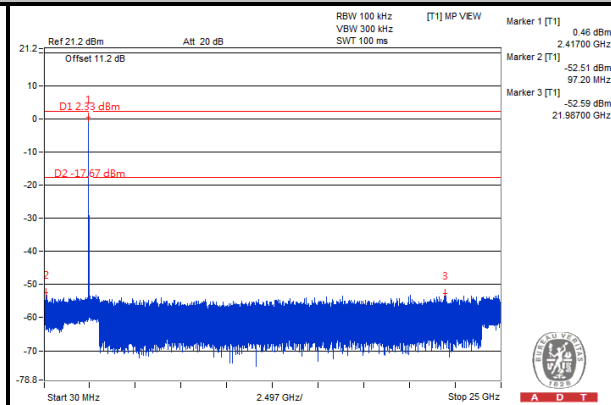
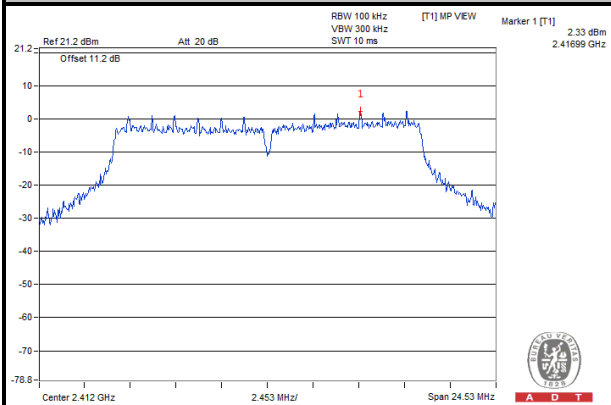




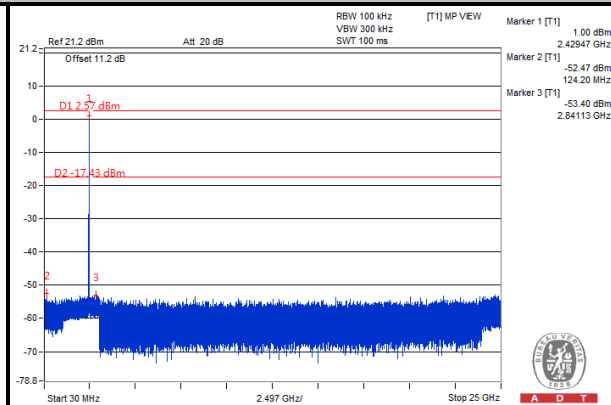
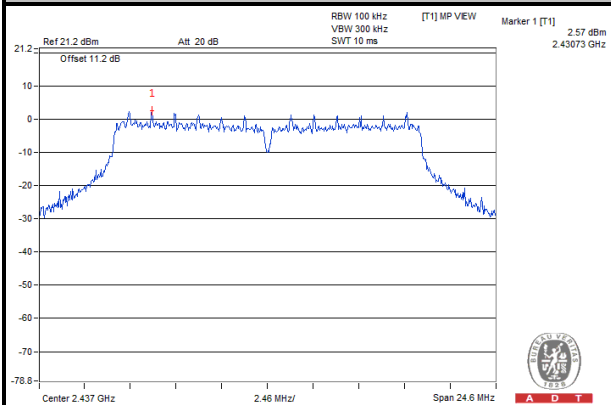
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802.11g

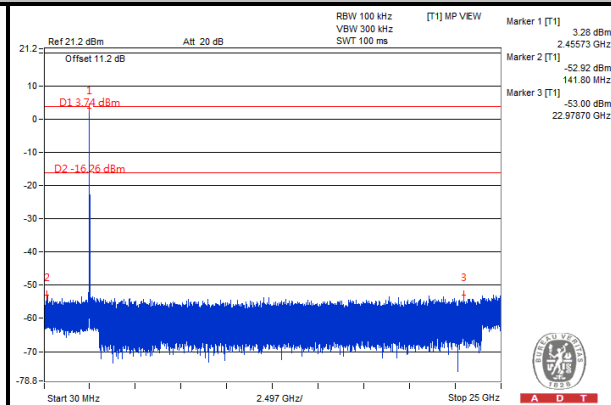
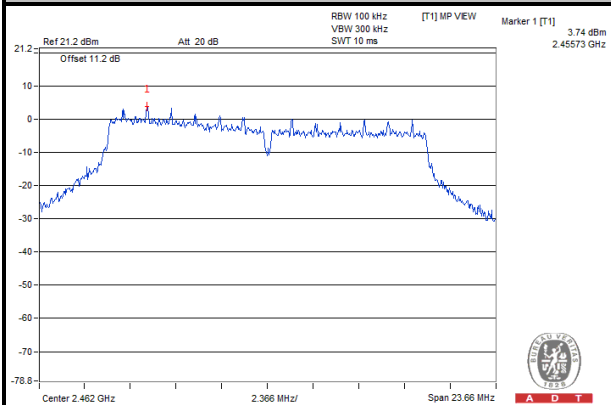
### CH 1



### CH 6

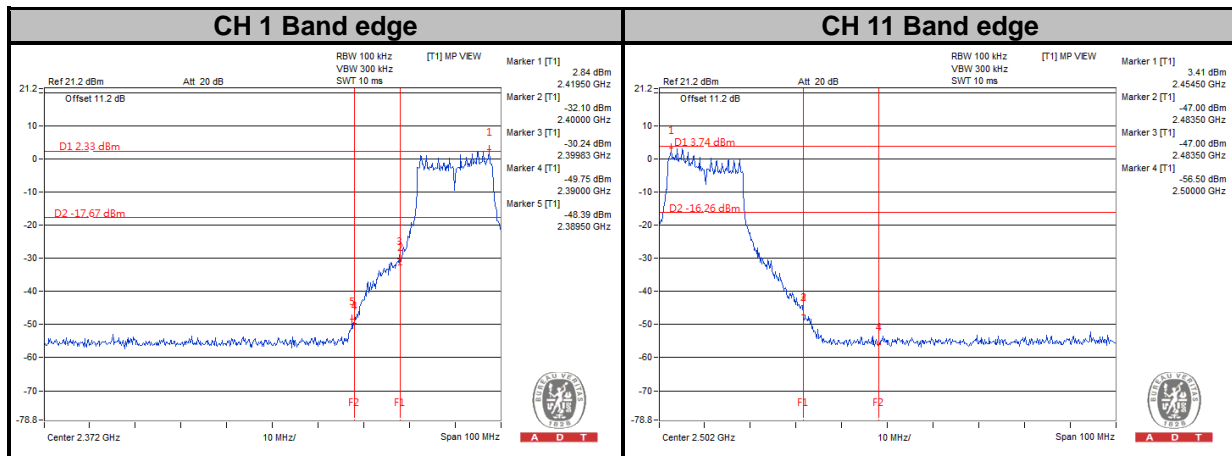


### CH 11





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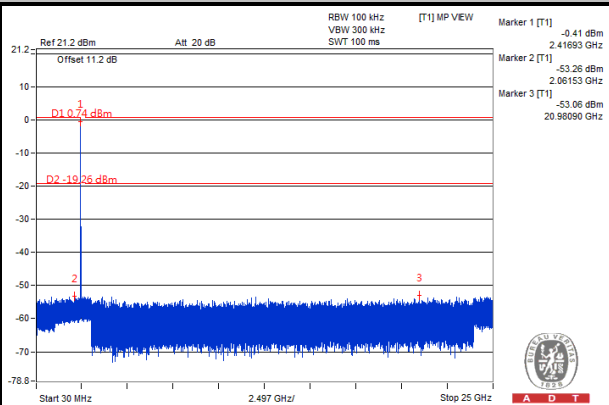
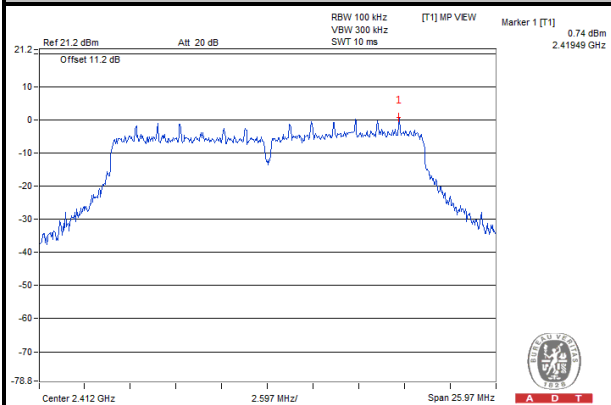




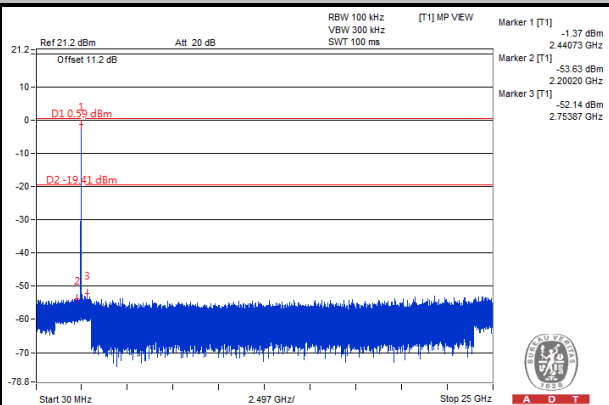
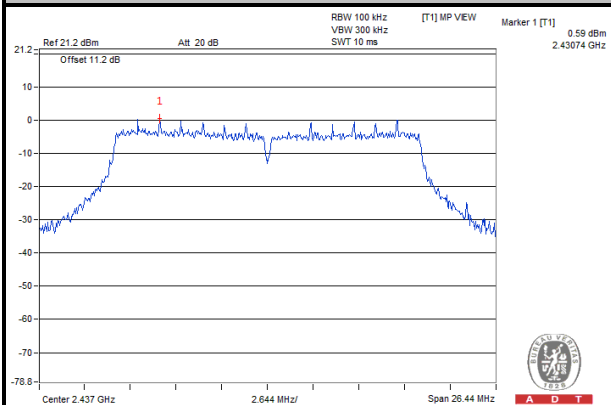
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## 802.11n (20MHz)

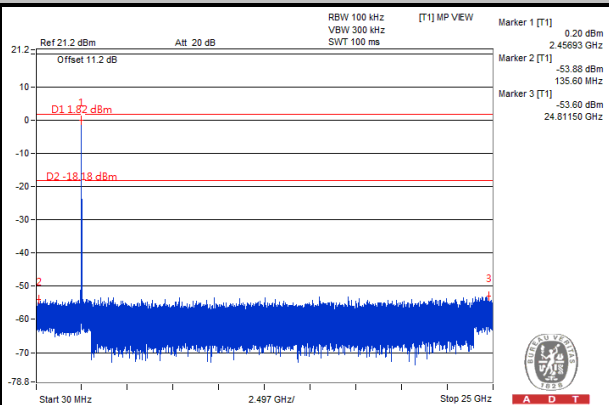
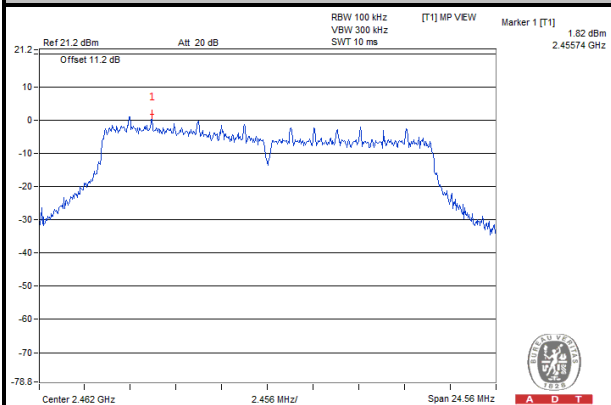
### CH 1



### CH 6

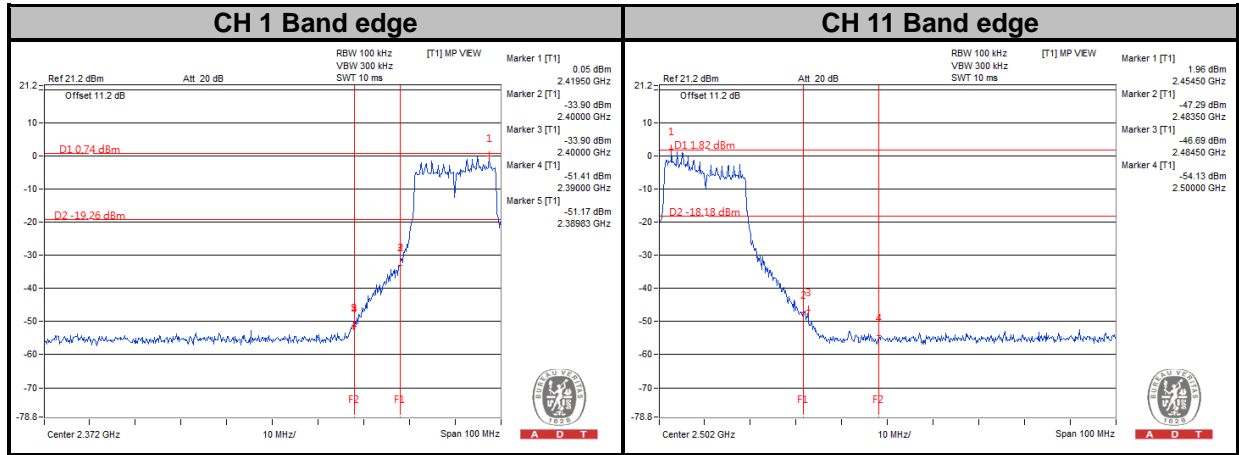


### CH 11





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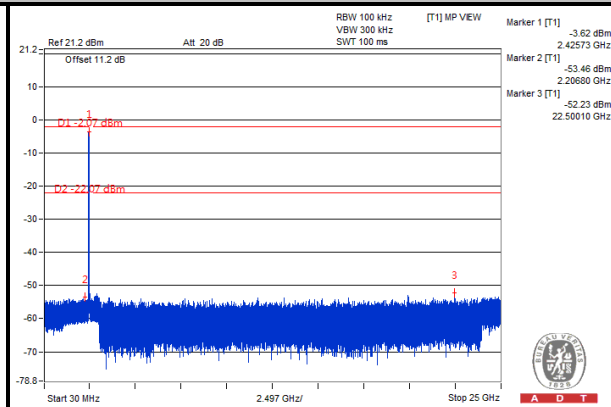
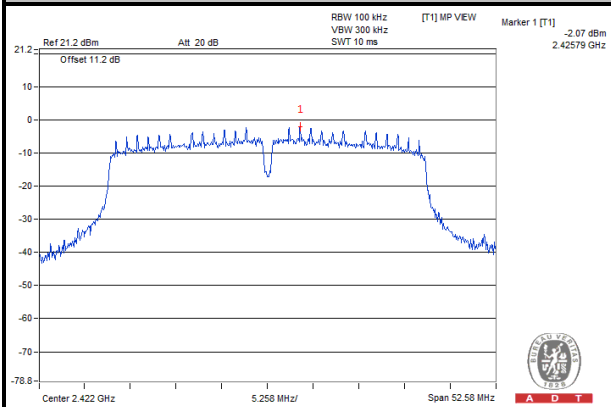




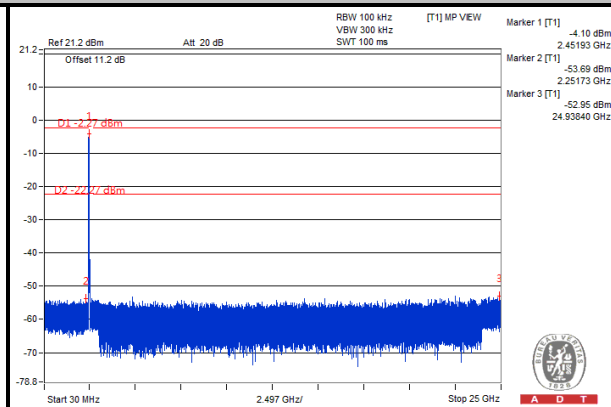
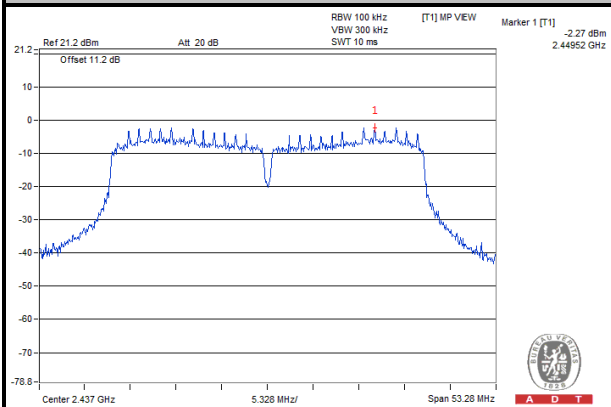
A D T

## 802.11n (40MHz)

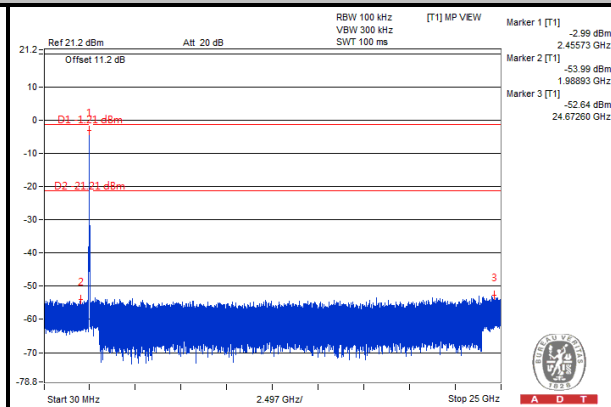
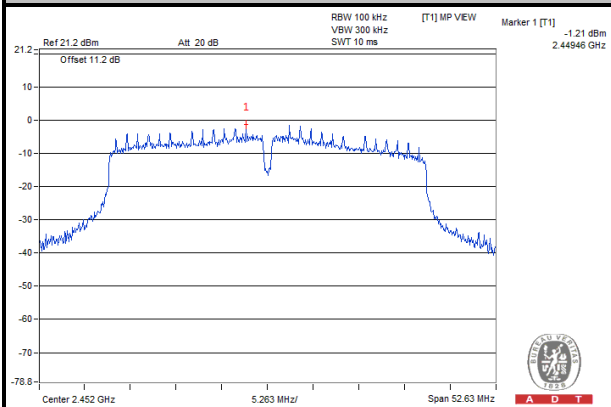
### CH 3



### CH 6

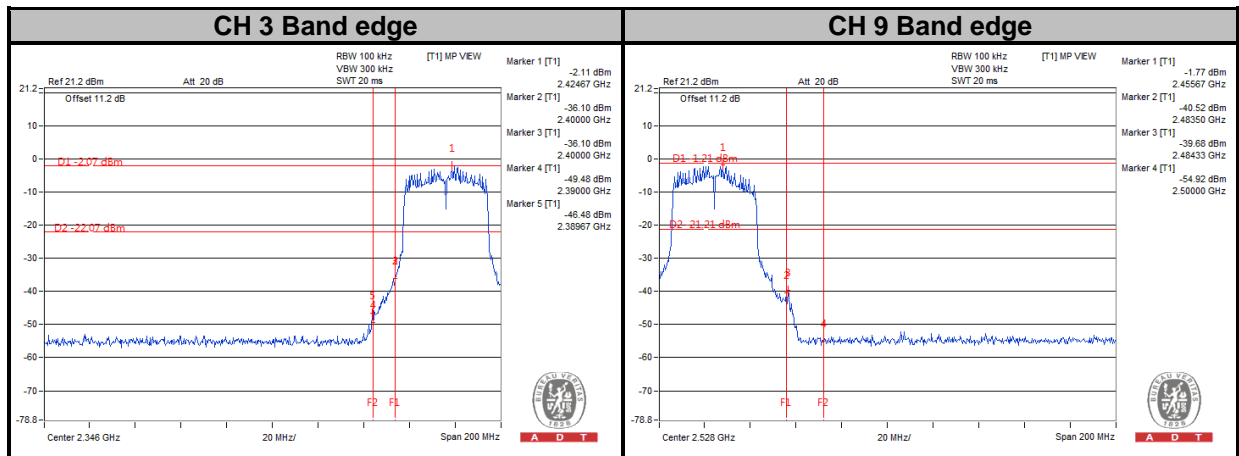


### CH 9





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## 5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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

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



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## **7. APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

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

---END---