

## FCC Test Report

**Report No.:** RF160113C23

**FCC ID:** W23-JWX5253

**Test Model:** JWX6052, JWX6053

**Received Date:** Jan. 13, 2016

**Test Date:** Apr. 22, 2016 ~ Apr. 30, 2016

**Issued Date:** May 16, 2016

**Applicant:** jjPlus CORP.

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

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( R.O.C )

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Hsien 333, Taiwan, R.O.C.



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### Release Control Record

Issue No.	Description	Date Issued
RF160113C23	Original Release	May 16, 2016

## 1 Certificate of Conformity

**Product:** 802.11a/b/g/n/ac 3T3R Mini-PCI-Express Module

**Brand:** jjPlus

**Test Model:** JWX6052, JWX6053

**Sample Status:** Identical Prototype

**Applicant:** jjPlus CORP.

**Test Date:** Apr. 22, 2016 ~ Apr. 30, 2016

**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 :** Evonne Liu, **Date:** May 16, 2016  
Evonne Liu / Specialist

**Approved by :** Stanley Wu, **Date:** May 16, 2016  
Stanley Wu / Assistant 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 -12.40 dB at 0.17801 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -1 dB at 2384 MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB 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:

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.44 dB
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

<b>Product</b>	802.11a/b/g/n/ac 3T3R Mini-PCI-Express Module
<b>Brand</b>	jjPlus
<b>Test Model</b>	JWX6052, JWX6053
<b>Status of EUT</b>	Identical Prototype
<b>Power Supply Rating</b>	3.3 Vdc (host equipment)
<b>Modulation Type</b>	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
<b>Modulation Technology</b>	DSSS, OFDM
<b>Transfer Rate</b>	802.11b: 11.0 / 5.5 / 2.0 / 1.0 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 ~ 2462 MHz
<b>Number of Channel</b>	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
<b>Output Power</b>	499.713 mW
<b>Antenna Type</b>	Omni antenna with 5 dBi gain
<b>Antenna Connector</b>	N/A
<b>Accessory Device</b>	Refer to Note as below
<b>Data Cable Supplied</b>	Refer to Note as below

Note:

- The EUT incorporates a MIMO function. Physically, the EUT provides three completed transmitters and three receivers.

Modulation Mode	TX Function
802.11b	1TX
802.11g	1TX
802.11n (HT20)	3TX
802.11n (HT40)	3TX

- All models are listed as below.

Brand	Model	Difference
jjPlus	JWX6052	The difference between two model names is temperature operating range only. Other specification is the same.
	JWX6053	

\*Model of 'JWX6053' was chosen for final test.

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

### 3.2 Description of Test Modes

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

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

7 channels are provided for 802.11n (HT40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	7	2442
4	2427	8	2447
5	2432	9	2452
6	2437		



### 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
A	√	-	-	√	1TX
B	√	√	√	√	3TX

Where **RE $\geq$ 1G**: Radiated Emission above 1 GHz  
**PLC**: Power Line Conducted Emission

**RE<1G**: Radiated Emission below 1 GHz  
**APCM**: Antenna Port Conducted Measurement

**NOTE**: “-” means no effect.

#### **Radiated Emission Test (Above 1 GHz):**

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
A	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
B	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0

#### **Radiated Emission Test (Below 1 GHz):**

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
B	802.11n (HT40)	1 to 11	3	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)
B	802.11n (HT40)	1 to 11	3	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)
A	802.11b	1 to 11	1, 11	DSSS	DBPSK	1.0
	802.11g	1 to 11	1, 11	OFDM	BPSK	6.0
B	802.11n (HT20)	1 to 11	1, 11	OFDM	BPSK	MCS0
	802.11n (HT40)	3 to 9	3, 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)
A	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
B	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0

### **Test Condition:**

Applicable To	Environmental Conditions	Input Power	Tested by
RE $\geq$ 1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Gavin Wu
RE<1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Gavin Wu
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	Toby Tian
APCM	25 deg. C, 65 % RH	3.3 Vdc	Taylor Liu

### 3.3 Duty Cycle of Test Signal

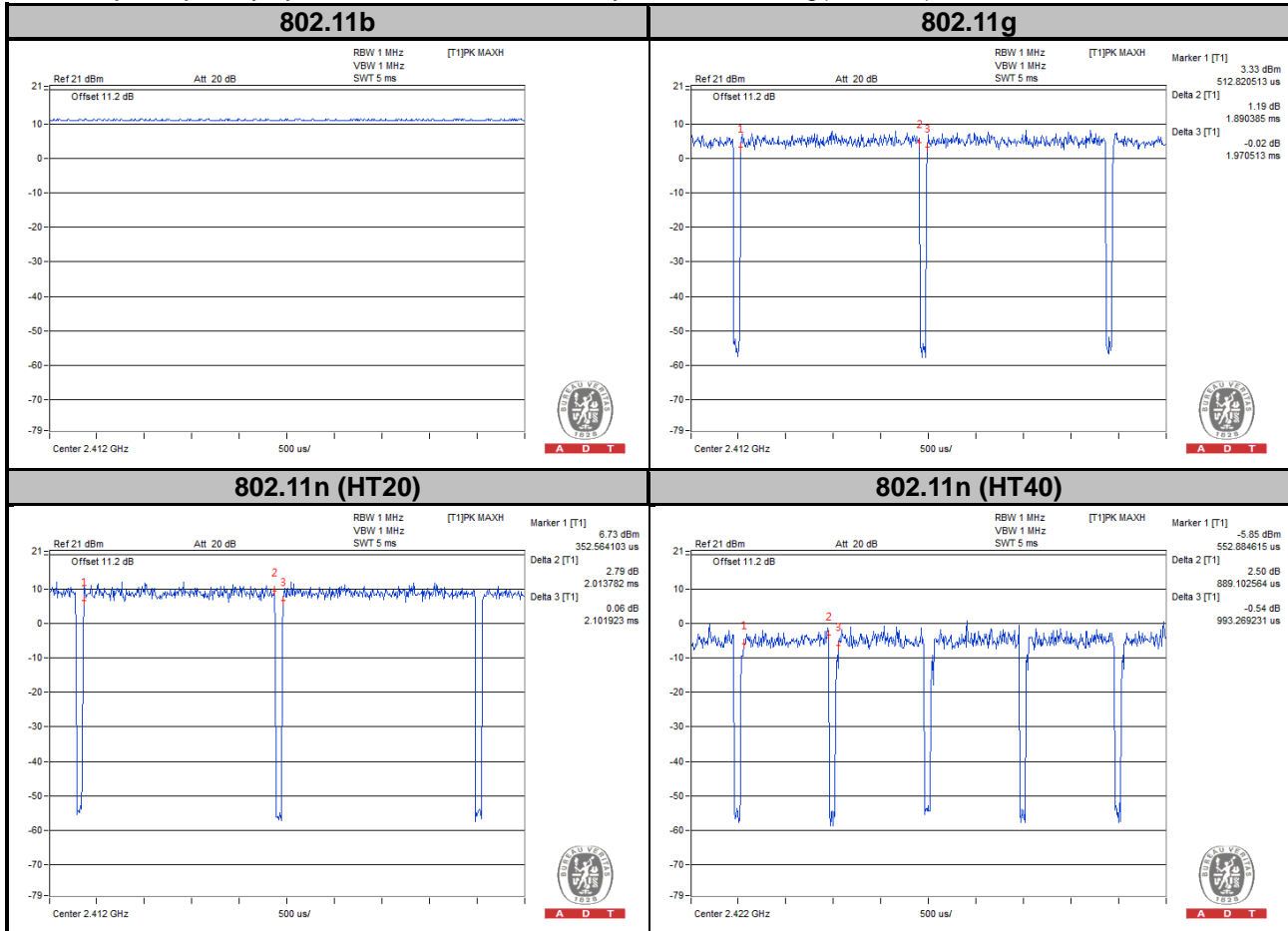
**802.11b:** Duty cycle of test signal is 100 %

Duty cycle of test signal is < 98 %

**802.11g:** Duty cycle =  $1.890/1.970 = 0.959$ , Duty factor =  $10 * \log(1/0.959) = 0.18$

**802.11n (HT20):** Duty cycle =  $2.0137/2.1019 = 0.958$ , Duty factor =  $10 * \log(1/0.958) = 0.19$

**802.11n (HT40):** Duty cycle =  $889/993 = 0.895$ , Duty factor =  $10 * \log(1/0.895) = 0.48$



### 3.4 Description of Support Units

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

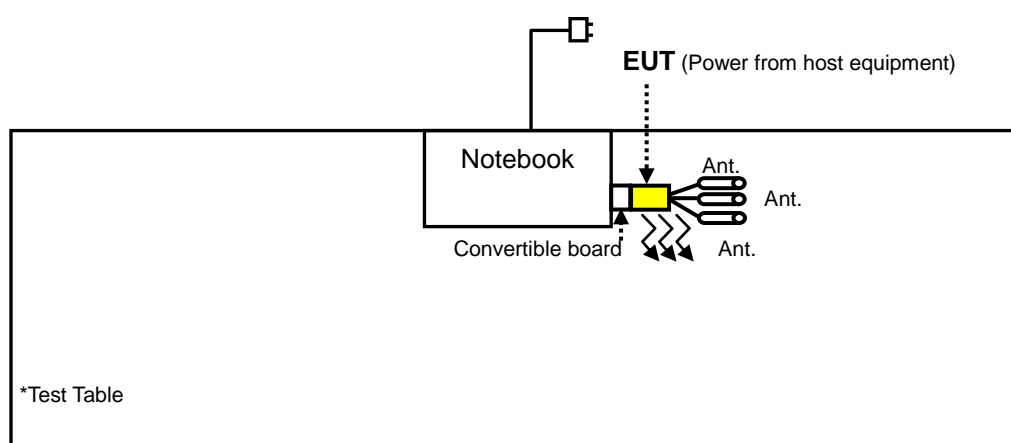
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook	DELL	E5420	8BHF5S1	N/A
2.	Ant* 3	N/A	N/A	N/A	N/A

No.	Signal Cable Description Of The Above Support Units
1.	N/A
2.	N/A

Note:

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

#### 3.4.1 Configuration of System under Test



### 3.5 General Description of Applied Standards

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

**FCC Part 15, Subpart C (15.247)**

**558074 D01 DTS Meas Guidance v03r05**

**662911 D01 Multiple Transmitter Output v02r01**

**ANSI C63.10-2013**

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

**NOTE:** The EUT 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 20 dB 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 1000 MHz, 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 20 dB 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, 2016	Jan. 20, 2017
Spectrum Analyzer Agilent	N9010A	MY52220314	Sep. 03, 2015	Sep. 02, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 17, 2015	Dec. 16, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Jan. 07, 2016	Jan. 06, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Jan. 04, 2016	Jan. 03, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Jan. 08, 2016	Jan. 07, 2017
Loop Antenna	EM-6879	269	Jul. 31, 2015	Jul. 30, 2016
Preamplifier EMCI	EMC 012645	980115	Dec. 21, 2015	Dec. 20, 2016
Preamplifier EMCI	EMC 184045	980116	Dec. 21, 2015	Dec. 20, 2016
Preamplifier EMCI	EMC 330H	980112	Dec. 28, 2015	Dec. 27, 2016
Power Meter Anritsu	ML2495A	1232002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor Anritsu	MA2411B	1207325	Sep. 21, 2015	Sep. 20, 2016
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 12, 2015	Oct. 11, 2016
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 12, 2015	Oct. 11, 2016
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Oct. 12, 2015	Oct. 11, 2016
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

- 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 preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1 GHz if tested.
4. The FCC Site Registration No. is 690701.
5. The IC Site Registration No. is IC7450F-10.

#### 4.1.3 Test Procedures

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

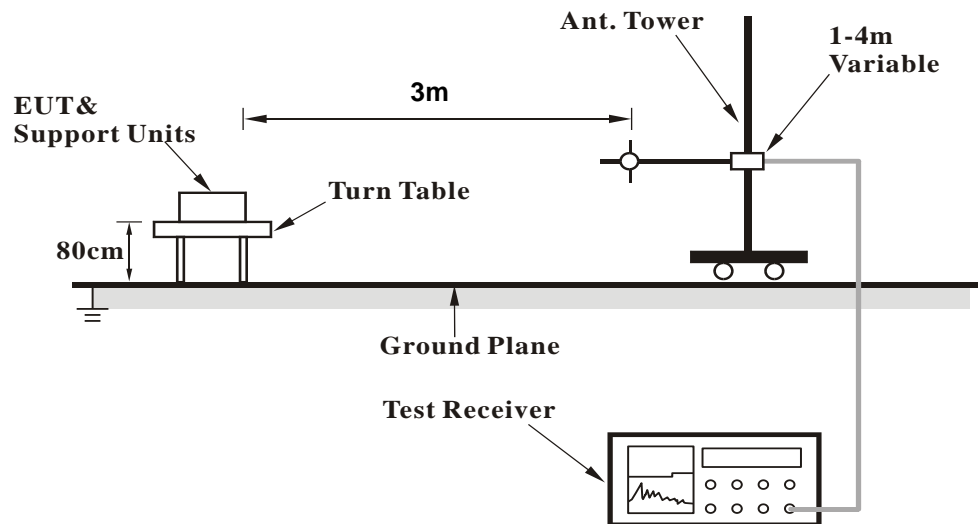
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.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

#### 4.1.4 Deviation from Test Standard

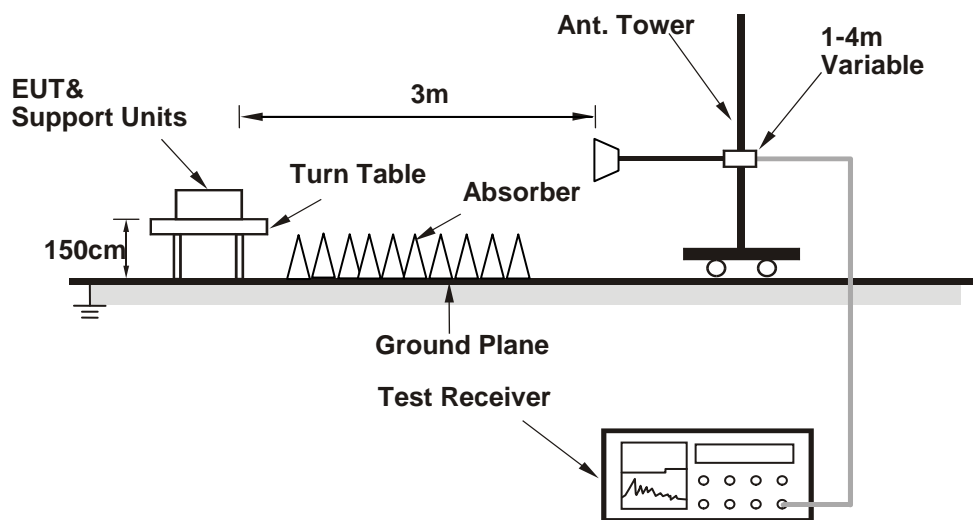
No deviation.

#### 4.1.5 Test Set Up

##### <Frequency Range below 1 GHz>



##### <Frequency Range above 1 GHz>



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 1 GHz Data :

MODE A (1TX)

802.11b

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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
2384	35.54	42.1	54	-18.46	26.86	4.08	37.5	109	163	Average
2384	58.36	64.92	74	-15.64	26.86	4.08	37.5	109	163	Peak
2412	102.14	108.61			26.96	4.09	37.52	109	163	Average
2412	105.86	112.33			26.96	4.09	37.52	109	163	Peak
2496	36.6	42.49	54	-17.4	27.2	4.16	37.25	109	163	Average
2496	56.49	62.38	74	-17.51	27.2	4.16	37.25	109	163	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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
2354	39.39	46.02	54	-14.61	26.81	4.05	37.49	217	274	Average
2354	56.61	63.24	74	-17.39	26.81	4.05	37.49	217	274	Peak
2412	107.23	113.7			26.96	4.09	37.52	217	274	Average
2412	111.03	117.5			26.96	4.09	37.52	217	274	Peak
2488	38.66	44.62	54	-15.34	27.2	4.16	37.32	217	274	Average
2488	58.63	64.59	74	-15.37	27.2	4.16	37.32	217	274	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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	34.61	41.12	54	-19.39	26.91	4.08	37.5	109	164	Average
2386	56.85	63.36	74	-17.15	26.91	4.08	37.5	109	164	Peak
2437	102.49	108.77			27.06	4.12	37.46	109	164	Average
2437	106.17	112.45			27.06	4.12	37.46	109	164	Peak
2486	36.62	42.64	54	-17.38	27.15	4.15	37.32	109	164	Average
2486	57.15	63.17	74	-16.85	27.15	4.15	37.32	109	164	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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
2318	36.34	43.06	54	-17.66	26.72	4.03	37.47	217	274	Average
2318	57.61	64.33	74	-16.39	26.72	4.03	37.47	217	274	Peak
2437	107.52	113.8			27.06	4.12	37.46	217	274	Average
2437	111.19	117.47			27.06	4.12	37.46	217	274	Peak
2492	38.72	44.61	54	-15.28	27.2	4.16	37.25	217	274	Average
2492	57.16	63.05	74	-16.84	27.2	4.16	37.25	217	274	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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
2336	34.22	40.88	54	-19.78	26.77	4.04	37.47	107	164	Average
2336	56.66	63.32	74	-17.34	26.77	4.04	37.47	107	164	Peak
2462	102.64	108.8			27.1	4.13	37.39	107	164	Average
2462	106.5	112.66			27.1	4.13	37.39	107	164	Peak
2488	37.77	43.73	54	-16.23	27.2	4.16	37.32	107	164	Average
2488	56.29	62.25	74	-17.71	27.2	4.16	37.32	107	164	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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	36.16	42.73	54	-17.84	26.86	4.07	37.5	232	273	Average
2378	56.8	63.37	74	-17.2	26.86	4.07	37.5	232	273	Peak
2462	107.34	113.5			27.1	4.13	37.39	232	273	Average
2462	111.17	117.33			27.1	4.13	37.39	232	273	Peak
2494	40.54	46.43	54	-13.46	27.2	4.16	37.25	232	273	Average
2494	58.9	64.79	74	-15.1	27.2	4.16	37.25	232	273	Peak

Remarks:

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

# 802.11g

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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	46.98	53.51	54	-7.02	26.91	4.08	37.52	109	162	Average
2390	62.58	69.11	74	-11.42	26.91	4.08	37.52	109	162	Peak
2412	95.06	101.53			26.96	4.09	37.52	109	162	Average
2412	105.49	111.96			26.96	4.09	37.52	109	162	Peak
2488	36.7	42.66	54	-17.3	27.2	4.16	37.32	109	162	Average
2488	56.85	62.81	74	-17.15	27.2	4.16	37.32	109	162	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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	52.92	59.45	54	-1.08	26.91	4.08	37.52	237	274	Average
2390	70.08	76.61	74	-3.92	26.91	4.08	37.52	237	274	Peak
2412	101.42	107.89			26.96	4.09	37.52	237	274	Average
2412	111.68	118.15			26.96	4.09	37.52	237	274	Peak
2492	38.87	44.76	54	-15.13	27.2	4.16	37.25	237	274	Average
2492	57.82	63.71	74	-16.18	27.2	4.16	37.25	237	274	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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	34.79	41.41	54	-19.21	26.81	4.07	37.5	107	161	Average
2366	56.82	63.44	74	-17.18	26.81	4.07	37.5	107	161	Peak
2437	96.52	102.8			27.06	4.12	37.46	107	161	Average
2437	106.39	112.67			27.06	4.12	37.46	107	161	Peak
2500	37.41	43.3	54	-16.59	27.2	4.16	37.25	107	161	Average
2500	56.97	62.86	74	-17.03	27.2	4.16	37.25	107	161	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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
2358	36.67	43.3	54	-17.33	26.81	4.05	37.49	207	274	Average
2358	57.08	63.71	74	-16.92	26.81	4.05	37.49	207	274	Peak
2437	102.3	108.58			27.06	4.12	37.46	207	274	Average
2437	112.08	118.36			27.06	4.12	37.46	207	274	Peak
2498	40.28	46.17	54	-13.72	27.2	4.16	37.25	207	274	Average
2498	57.27	63.16	74	-16.73	27.2	4.16	37.25	207	274	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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	34.34	40.85	54	-19.66	26.91	4.08	37.5	107	165	Average
2386	56.49	63	74	-17.51	26.91	4.08	37.5	107	165	Peak
2462	96.56	102.72			27.1	4.13	37.39	107	165	Average
2462	106.45	112.61			27.1	4.13	37.39	107	165	Peak
2484	48.31	54.33	54	-5.69	27.15	4.15	37.32	107	165	Average
2484	64.29	70.31	74	-9.71	27.15	4.15	37.32	107	165	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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
2384	35.53	42.09	54	-18.47	26.86	4.08	37.5	207	275	Average
2384	56.4	62.96	74	-17.6	26.86	4.08	37.5	207	275	Peak
2462	101.89	108.05			27.1	4.13	37.39	207	275	Average
2462	111.63	117.79			27.1	4.13	37.39	207	275	Peak
2484	52.62	58.64	54	-1.38	27.15	4.15	37.32	207	275	Average
2484	67.28	73.3	74	-6.72	27.15	4.15	37.32	207	275	Peak

Remarks:

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

**MODE B (3TX)**  
**802.11n (HT20)**

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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	48.88	55.41	54	-5.12	26.91	4.08	37.52	127	355	Average
2390	65.84	72.37	74	-8.16	26.91	4.08	37.52	127	355	Peak
2412	98.79	105.18			26.96	4.11	37.46	127	355	Average
2412	108.02	114.41			26.96	4.11	37.46	127	355	Peak
2498	36.04	41.93	54	-17.96	27.2	4.16	37.25	127	355	Average
2498	56.3	62.19	74	-17.7	27.2	4.16	37.25	127	355	Peak
4824	33.24	48.54	54	-20.76	30.99	6.79	53.08	100	56	Average
4824	45.14	60.44	74	-28.86	30.99	6.79	53.08	100	56	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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	52.79	59.32	54	-1.21	26.91	4.08	37.52	239	8	Average
2390	67.24	73.77	74	-6.76	26.91	4.08	37.52	239	8	Peak
2412	104.89	111.36			26.96	4.09	37.52	239	8	Average
2412	114.36	120.83			26.96	4.09	37.52	239	8	Peak
2490	40.16	46.12	54	-13.84	27.2	4.16	37.32	239	8	Average
2490	57.42	63.38	74	-16.58	27.2	4.16	37.32	239	8	Peak
4824	39.82	55.12	54	-14.18	30.99	6.79	53.08	199	116	Average
4824	49.83	65.13	74	-24.17	30.99	6.79	53.08	199	116	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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	35.49	42	54	-18.51	26.91	4.08	37.5	124	358	Average
2386	57.73	64.24	74	-16.27	26.91	4.08	37.5	124	358	Peak
2437	96.88	103.16			27.06	4.12	37.46	124	358	Average
2437	106.42	112.7			27.06	4.12	37.46	124	358	Peak
2486	36.5	42.52	54	-17.5	27.15	4.15	37.32	124	358	Average
2486	57.52	63.54	74	-16.48	27.15	4.15	37.32	124	358	Peak
4874	33.63	48.77	54	-20.37	31.06	6.85	53.05	100	68	Average
4874	44.58	59.72	74	-29.42	31.06	6.85	53.05	100	68	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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	35.43	42	54	-18.57	26.86	4.07	37.5	216	8	Average
2372	57.21	63.78	74	-16.79	26.86	4.07	37.5	216	8	Peak
2437	96.88	103.16			27.06	4.12	37.46	216	8	Average
2437	111.93	118.21			27.06	4.12	37.46	216	8	Peak
2490	36.56	42.52	54	-17.44	27.2	4.16	37.32	216	8	Average
2490	56.52	62.48	74	-17.48	27.2	4.16	37.32	216	8	Peak
4874	41.15	56.29	54	-12.85	31.06	6.85	53.05	194	118	Average
4874	51.83	66.97	74	-22.17	31.06	6.85	53.05	194	118	Peak

Remarks:

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



EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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
2384	34.97	41.53	54	-19.03	26.86	4.08	37.5	124	358	Average
2384	56.12	62.68	74	-17.88	26.86	4.08	37.5	124	358	Peak
2462	96.44	102.6			27.1	4.13	37.39	124	358	Average
2462	105.85	112.01			27.1	4.13	37.39	124	358	Peak
2484	43.07	49.09	54	-10.93	27.15	4.15	37.32	124	358	Average
2484	58.86	64.88	74	-15.14	27.15	4.15	37.32	124	358	Peak
4924	39.87	54.9	54	-14.13	31.12	6.88	53.03	195	122	Average
4924	50.03	65.06	74	-23.97	31.12	6.88	53.03	195	122	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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
2370	38.98	45.55	54	-15.02	26.86	4.07	37.5	211	10	Average
2370	57.01	63.58	74	-16.99	26.86	4.07	37.5	211	10	Peak
2462	102.88	109.04			27.1	4.13	37.39	211	10	Average
2462	112.74	118.9			27.1	4.13	37.39	211	10	Peak
2484	52.59	58.61	54	-1.41	27.15	4.15	37.32	211	10	Average
2484	66.03	72.05	74	-7.97	27.15	4.15	37.32	211	10	Peak
4920	43.33	58.36	74	-30.67	31.12	6.88	53.03	109	41	Peak
4924	33.3	48.33	54	-20.7	31.12	6.88	53.03	109	41	Average

Remarks:

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

# 802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 3	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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
2384	45.93	52.49	54	-8.07	26.86	4.08	37.5	126	357	Average
2384	61.1	67.66	74	-12.9	26.86	4.08	37.5	126	357	Peak
2422	91.28	97.62			27.01	4.11	37.46	126	357	Average
2422	101.37	107.71			27.01	4.11	37.46	126	357	Peak
2498	35.91	41.8	54	-18.09	27.2	4.16	37.25	126	357	Average
2498	57.83	63.72	74	-16.17	27.2	4.16	37.25	126	357	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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
2384	53	59.56	54	-1	26.86	4.08	37.5	219	7	Average
2384	65.49	72.05	74	-8.51	26.86	4.08	37.5	219	7	Peak
2422	98.78	105.12			27.01	4.11	37.46	219	7	Average
2422	108.35	114.69			27.01	4.11	37.46	219	7	Peak
2492	38.52	44.41	54	-15.48	27.2	4.16	37.25	219	7	Average
2492	57.85	63.74	74	-16.15	27.2	4.16	37.25	219	7	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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	43.48	50.01	54	-10.52	26.91	4.08	37.52	126	21	Average
2390	58.6	65.13	74	-15.4	26.91	4.08	37.52	126	21	Peak
2437	94.51	100.79			27.06	4.12	37.46	126	21	Average
2437	104.04	110.32			27.06	4.12	37.46	126	21	Peak
2492	40.73	46.62	54	-13.27	27.2	4.16	37.25	126	21	Average
2492	57.65	63.54	74	-16.35	27.2	4.16	37.25	126	21	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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	52.46	58.99	54	-1.54	26.91	4.08	37.52	216	357	Average
2390	66.84	73.37	74	-7.16	26.91	4.08	37.52	216	357	Peak
2437	100.26	106.54			27.06	4.12	37.46	216	357	Average
2437	109.32	115.6			27.06	4.12	37.46	216	357	Peak
2486	47.71	53.73	54	-6.29	27.15	4.15	37.32	216	357	Average
2486	61.75	67.77	74	-12.25	27.15	4.15	37.32	216	357	Peak

Remarks:

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

EUT Test Condition		Measurement Detail	
Channel	Channel 9	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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	34.93	41.44	54	-19.07	26.91	4.08	37.5	124	349	Average
2388	56.72	63.23	74	-17.28	26.91	4.08	37.5	124	349	Peak
2452	91.03	97.23			27.06	4.13	37.39	124	349	Average
2452	100.78	106.98			27.06	4.13	37.39	124	349	Peak
2486	46.47	52.49	54	-7.53	27.15	4.15	37.32	124	349	Average
2486	61.38	67.4	74	-12.62	27.15	4.15	37.32	124	349	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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
2368	36.54	43.16	54	-17.46	26.81	4.07	37.5	218	29	Average
2368	57.47	64.09	74	-16.53	26.81	4.07	37.5	218	29	Peak
2452	96.6	102.8			27.06	4.13	37.39	218	29	Average
2452	106.01	112.21			27.06	4.13	37.39	218	29	Peak
2486	52.74	58.76	54	-1.26	27.15	4.15	37.32	218	29	Average
2486	66.57	72.59	74	-7.43	27.15	4.15	37.32	218	29	Peak

Remarks:

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

### 9 kHz ~ 30 MHz DATA:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

### 30 MHz ~ 1 GHz WORST-CASE DATA:

#### 802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 3	Frequency Range	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (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
107.6	32.97	53.93	43.5	-10.53	9.81	1.09	31.86	129	284	Peak
198.78	40.19	61.23	43.5	-3.31	9.43	1.29	31.76	102	142	Peak
298.69	44	61.28	46	-2	12.91	1.63	31.82	123	194	QP
666.32	35.97	45.03	46	-10.03	20.41	2.39	31.86	133	9	Peak
699.3	43.89	52.42	46	-2.11	20.81	2.45	31.79	137	152	QP
896.21	35.48	41.28	46	-10.52	23.46	2.74	32	101	40	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (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
99.84	34.82	56.68	43.5	-8.68	9.06	1.04	31.96	121	197	Peak
299.66	40.58	57.85	46	-5.42	12.94	1.63	31.84	119	205	Peak
431.58	26.87	40.96	46	-19.13	15.96	1.96	32.01	114	20	Peak
664.38	34.33	43.44	46	-11.67	20.39	2.39	31.89	107	35	Peak
697.36	43.08	51.65	46	-2.92	20.78	2.45	31.8	130	93	QP
896.21	36.5	42.3	46	-9.5	23.46	2.74	32	114	314	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 (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 0.50 MHz.

### 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. 16, 2015	Nov. 15, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Dec. 26, 2015	Dec. 25, 2016
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 26, 2016	Feb. 25, 2017
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 24, 2015	Jul. 23, 2016
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

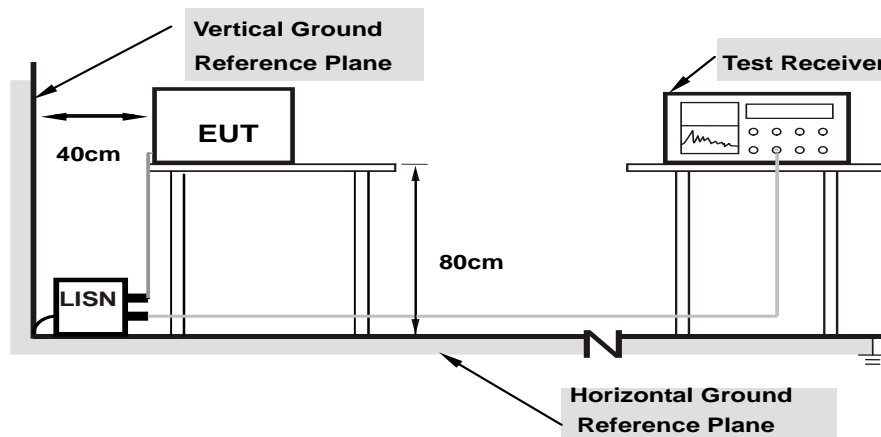
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) 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.

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

#### 4.2.6 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.

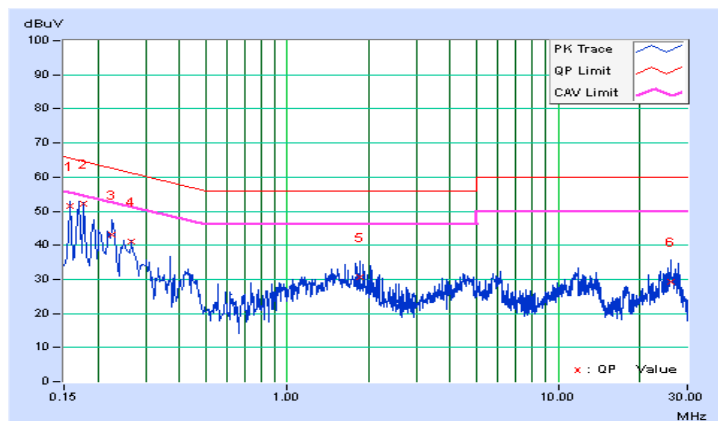
#### 4.2.7 Test Results

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	Toby Tian	Test Date	2016/4/24

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	0.15800	10.02	41.62	19.59	51.64	29.61	65.57	55.57	-13.93	-25.96
<b>2</b>	<b>0.17801</b>	<b>10.02</b>	<b>42.15</b>	<b>21.34</b>	<b>52.17</b>	<b>31.36</b>	<b>64.58</b>	<b>54.58</b>	<b>-12.40</b>	<b>-23.21</b>
3	0.22624	10.04	33.11	17.16	43.15	27.20	62.59	52.59	-19.43	-25.38
4	0.26600	10.06	31.08	16.31	41.14	26.37	61.24	51.24	-20.10	-24.87
5	1.85000	10.26	20.38	10.98	30.64	21.24	56.00	46.00	-25.36	-24.76
6	26.11400	11.74	17.41	11.67	29.15	23.41	60.00	50.00	-30.85	-26.59

#### 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



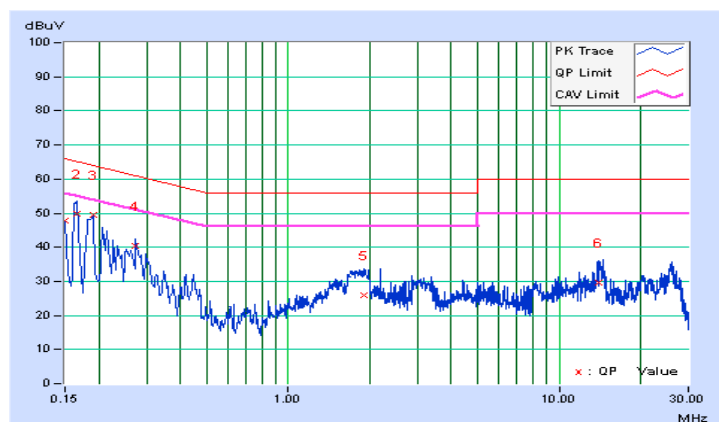


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Toby Tian	Test Date	2016/4/24

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	0.15000	10.03	37.90	20.02	47.93	30.05	66.00	56.00	-18.07	-25.95
2	0.16535	10.03	39.72	20.57	49.75	30.60	65.19	55.19	-15.44	-24.59
3	0.19000	10.04	39.39	19.05	49.43	29.09	64.04	54.04	-14.61	-24.95
4	0.27422	10.07	30.45	15.69	40.52	25.76	60.99	50.99	-20.47	-25.23
5	1.91000	10.27	15.54	7.90	25.81	18.17	56.00	46.00	-30.19	-27.83
6	14.00200	11.05	18.61	11.01	29.66	22.06	60.00	50.00	-30.34	-27.94

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

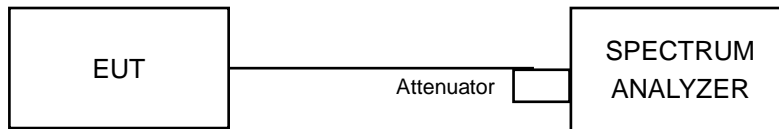


### 4.3 6 dB Bandwidth Measurement

#### 4.3.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB 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) = 100 kHz
- 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 Result

##### MODE A (1TX)

###### 802.11b

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	10.10	0.5	Pass
6	2437	10.10	0.5	Pass
11	2462	10.09	0.5	Pass

###### 802.11g

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	16.31	0.5	Pass
6	2437	16.09	0.5	Pass
11	2462	16.37	0.5	Pass

##### MODE B (3TX)

###### 802.11n (HT20)

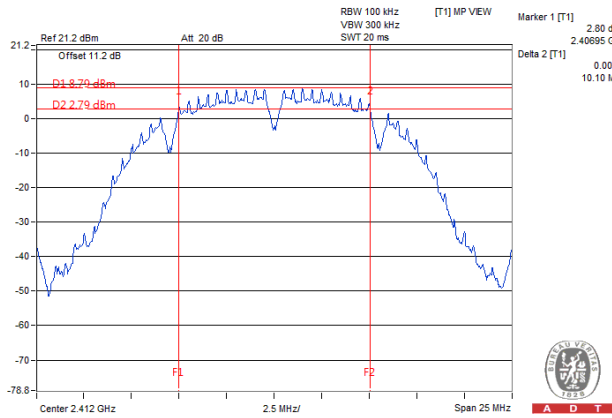
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
1	2412	17.32	16.91	16.95	0.5	Pass
6	2437	17.34	16.94	16.95	0.5	Pass
11	2462	17.36	17.28	16.94	0.5	Pass

###### 802.11n (HT40)

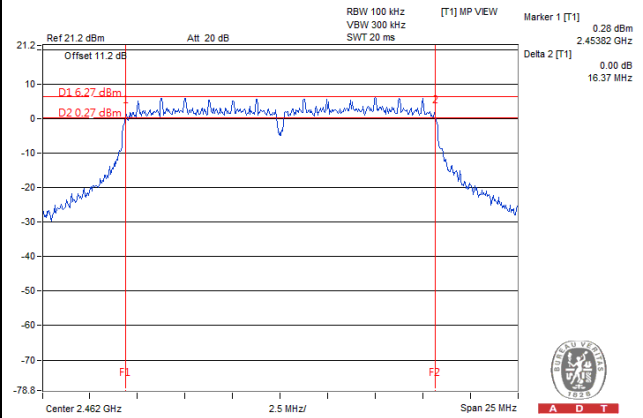
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
3	2422	35.80	35.79	35.81	0.5	Pass
6	2437	35.82	35.81	35.59	0.5	Pass
9	2452	35.95	35.81	35.74	0.5	Pass

## Spectrum Plot of Worst Value

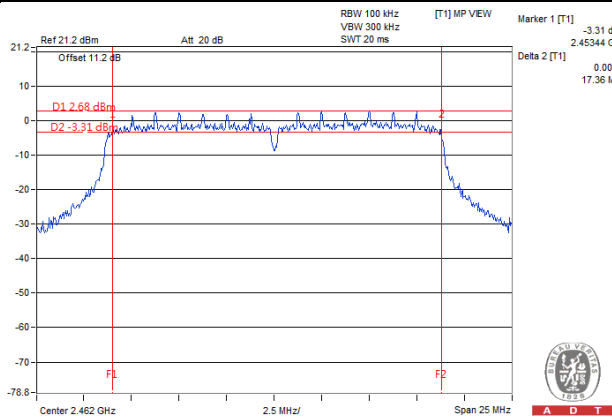
### 802.11b



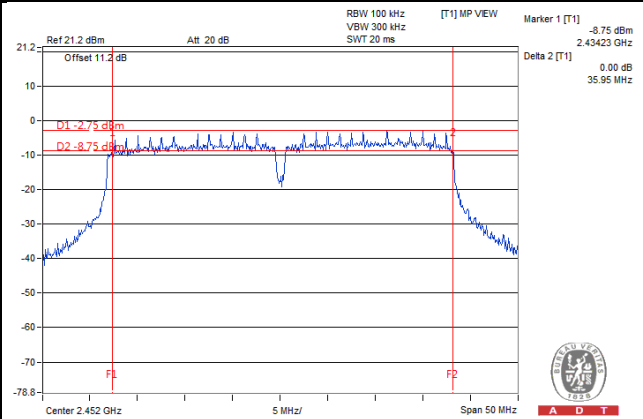
### 802.11g



### 802.11n (HT20)



### 802.11n (HT40)



#### 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 (30 dBm)

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

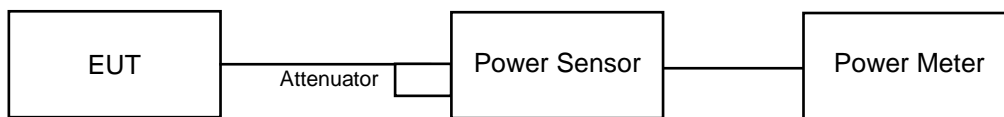
Array Gain = 0 dB (i.e., no array gain) for  $NANT \leq 4$ ;

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

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 power level.

##### 4.4.5 Deviation from Test Standard

No deviation.

##### 4.4.6 EUT Operating Conditions

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

#### 4.4.7 Test Results

##### MODE A (1TX)

###### 802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	101.39	20.06	30	Pass
6	2437	105.93	20.25	30	Pass
11	2462	100.46	20.02	30	Pass

###### 802.11g

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	194.54	22.89	30	Pass
6	2437	217.27	23.37	30	Pass
11	2462	198.61	22.98	30	Pass

##### MODE B (3TX)

###### 802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
1	2412	19.92	20.51	20.31	318.034	25.02	30	Pass
6	2437	22.03	22.53	22.07	499.713	26.99	30	Pass
11	2462	20.06	20.47	20.20	317.533	25.02	30	Pass

###### 802.11n (HT40)

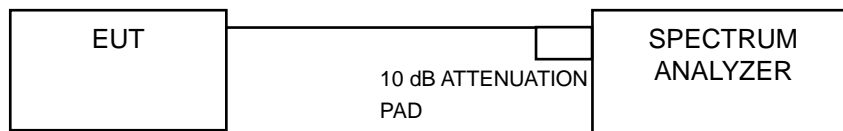
Channel	Frequency (MHz)	Peak Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
3	2422	16.79	17.29	17.17	153.452	21.86	30	Pass
6	2437	19.78	20.08	19.78	291.980	24.65	30	Pass
9	2452	17.11	18.01	17.71	173.666	22.40	30	Pass

## 4.5 Power Spectral Density Measurement

### 4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8 dBm.

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

### 4.5.5 Deviation from Test Standard

No deviation.

### 4.5.6 EUT Operating Condition

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

#### 4.5.7 Test Results

##### MODE A (1TX)

###### 802.11b

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Pass / Fail
1	2412	-5.15	8	Pass
6	2437	-5.99	8	Pass
11	2462	-5.69	8	Pass

###### 802.11g

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Pass / Fail
1	2412	-7.98	8	Pass
6	2437	-7.86	8	Pass
11	2462	-8.65	8	Pass

##### MODE B (3TX)

###### 802.11n (HT20)

TX Chain	Channel	Freq. (MHz)	PSD (dBm)	10 log (N=3) dB	Total PSD (dBm)	Limit (dBm)	Pass / Fail
0	1	2412	-11.16	4.77	-6.39	4.23	Pass
	6	2437	-10.99	4.77	-6.22	4.23	Pass
	11	2462	-11.42	4.77	-6.65	4.23	Pass
1	1	2412	-11.34	4.77	-6.57	4.23	Pass
	6	2437	-10.14	4.77	-5.37	4.23	Pass
	11	2462	-12.12	4.77	-7.35	4.23	Pass
2	1	2412	-15.01	4.77	-10.24	4.23	Pass
	6	2437	-13.94	4.77	-9.17	4.23	Pass
	11	2462	-15.31	4.77	-10.54	4.23	Pass

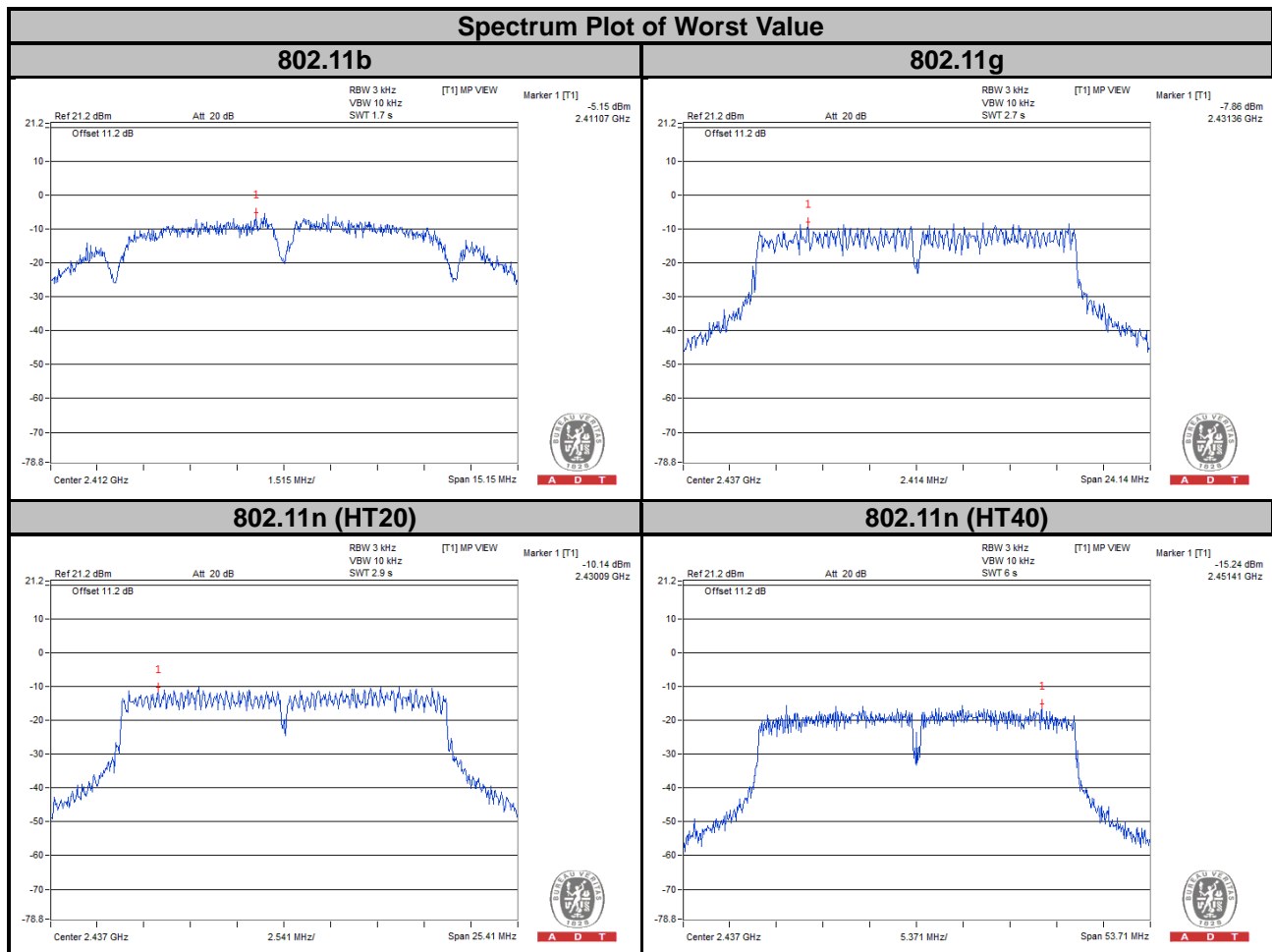
**NOTE:** Directional gain = 5 dBi + 10log(3) = 9.77 dBi > 6 dBi , so the power density limit shall be reduced to 8-(9.77-6) = 4.23 dBm.



### 802.11n (HT40)

TX Chain	Channel	Freq. (MHz)	PSD (dBm)	10 log (N=3) dB	Total PSD (dBm)	Limit (dBm)	Pass / Fail
0	3	2422	-17.56	4.77	-12.79	4.23	Pass
	6	2437	-15.54	4.77	-10.77	4.23	Pass
	9	2452	-18.00	4.77	-13.23	4.23	Pass
1	3	2422	-18.07	4.77	-13.30	4.23	Pass
	6	2437	-15.24	4.77	-10.47	4.23	Pass
	9	2452	-17.42	4.77	-12.65	4.23	Pass
2	3	2422	-21.83	4.77	-17.06	4.23	Pass
	6	2437	-18.94	4.77	-14.17	4.23	Pass
	9	2452	-20.60	4.77	-15.83	4.23	Pass

**NOTE:** Directional gain = 5 dBi + 10log(3) = 9.77 dBi > 6 dBi , so the power density limit shall be reduced to 8-(9.77-6) = 4.23 dBm.

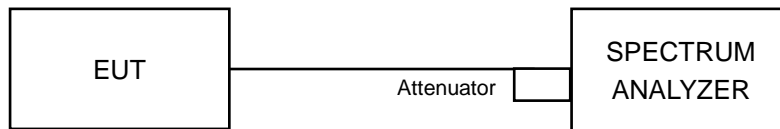


## 4.6 Conducted Out of Band Emission Measurement

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

Below 20 dB of the highest emission level of operating band (in 100 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 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

#### MEASUREMENT PROCEDURE OOB

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

### 4.6.5 Deviation from Test Standard

No deviation.

### 4.6.6 EUT Operating Condition

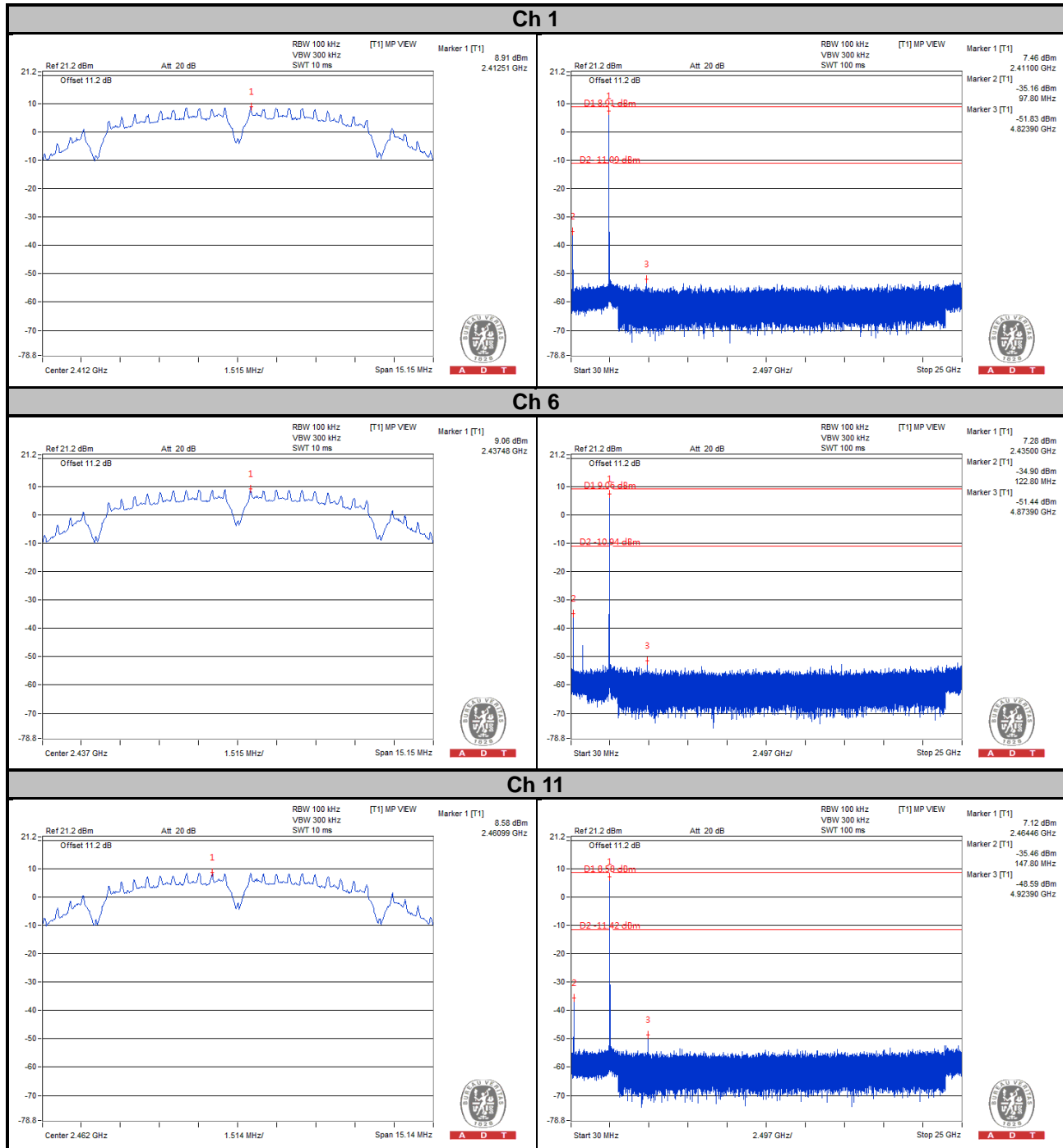
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

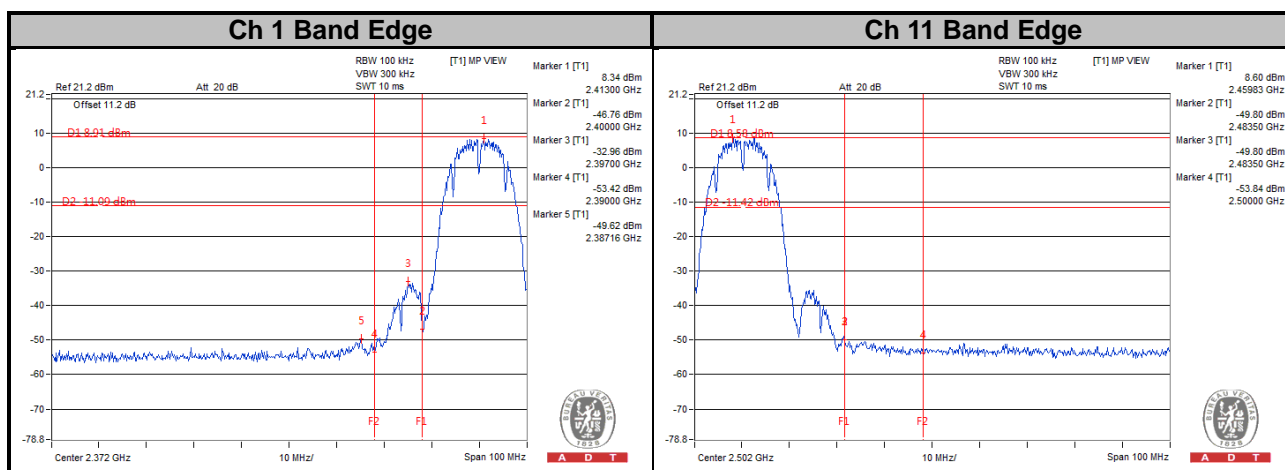
## 4.6.7 Test Results

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

### MODE A (1TX)

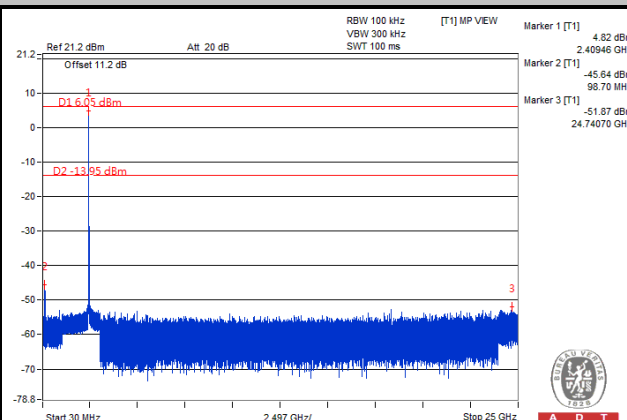
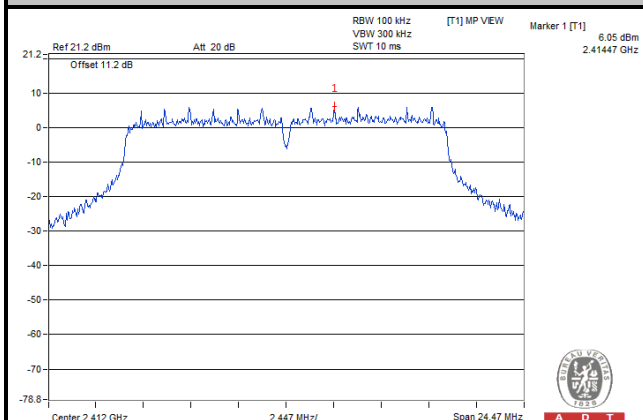
#### 802.11b



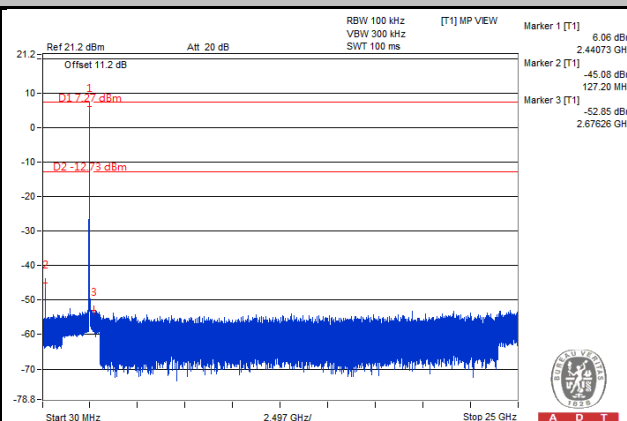
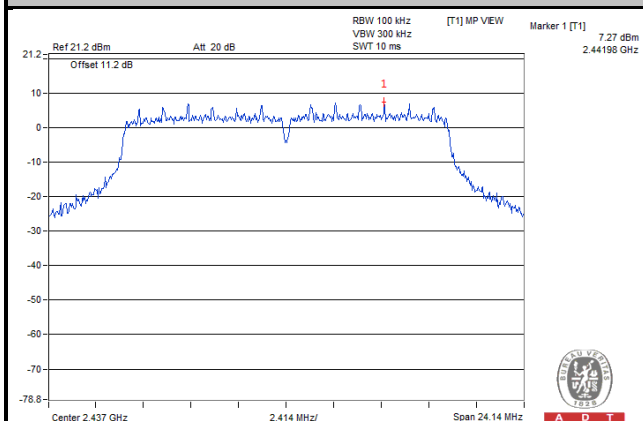


802.11g

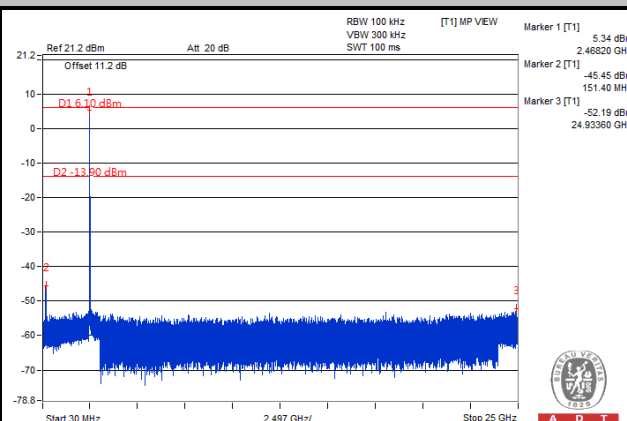
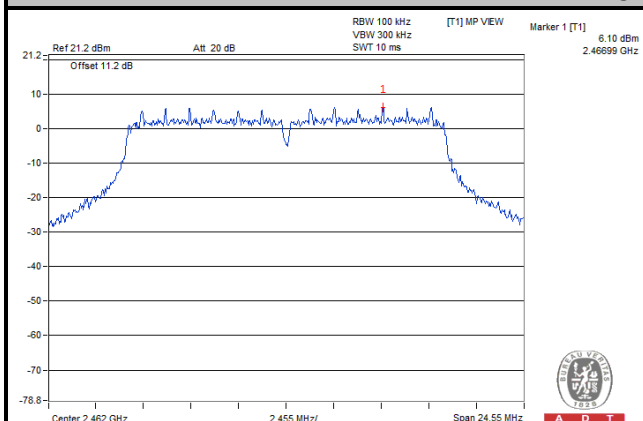
### Ch 1

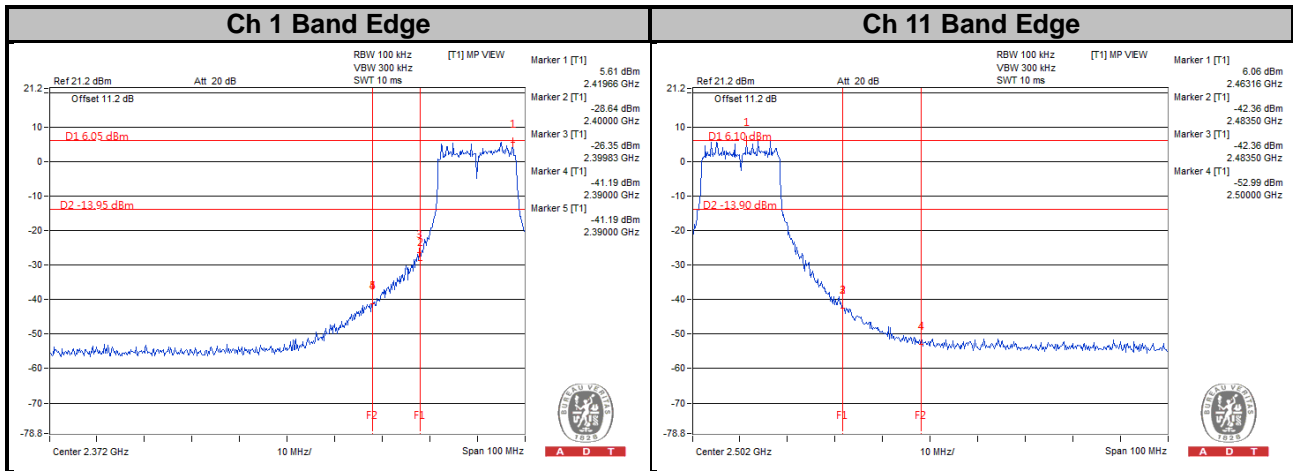


### Ch 6



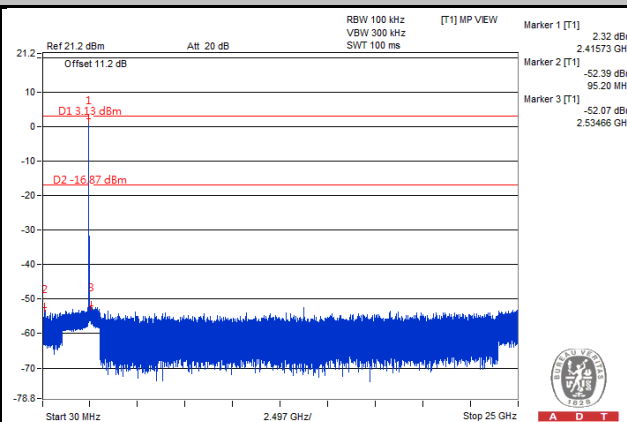
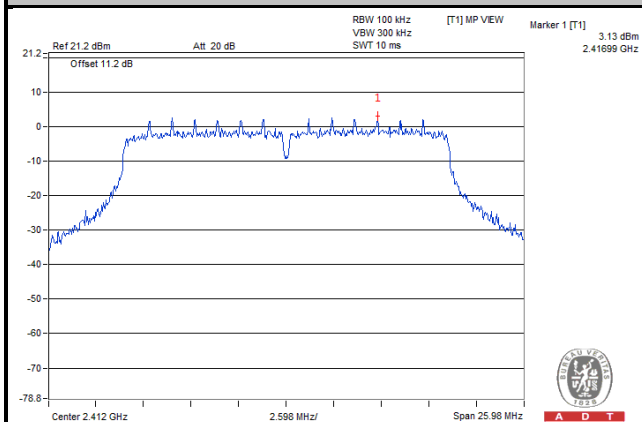
### Ch 11



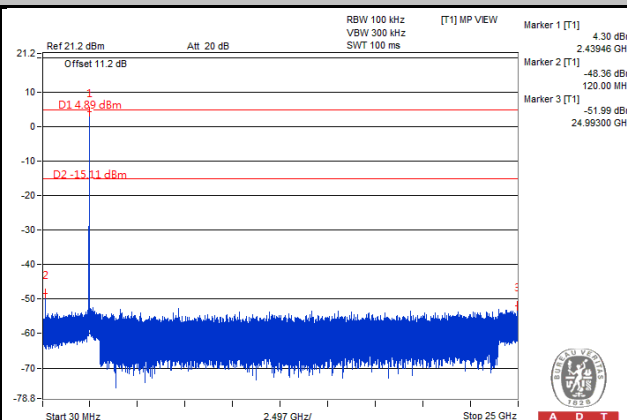
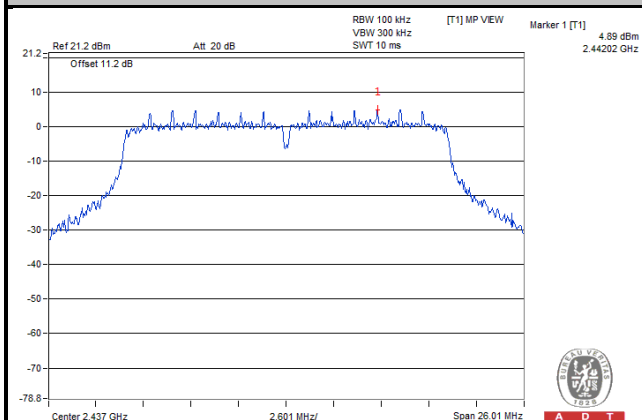


**MODE B (3TX)**  
**802.11n (HT20)**  
**CHAIN 0**

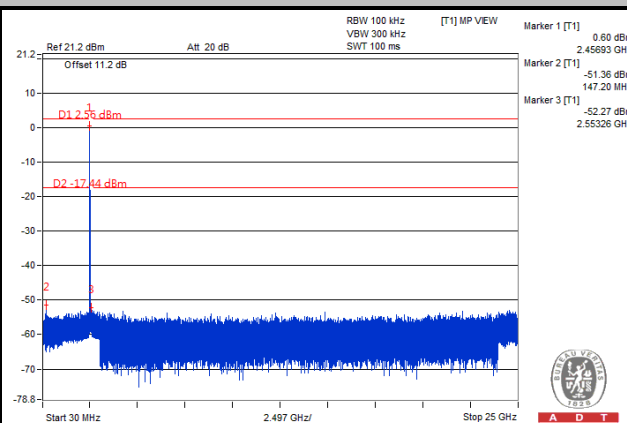
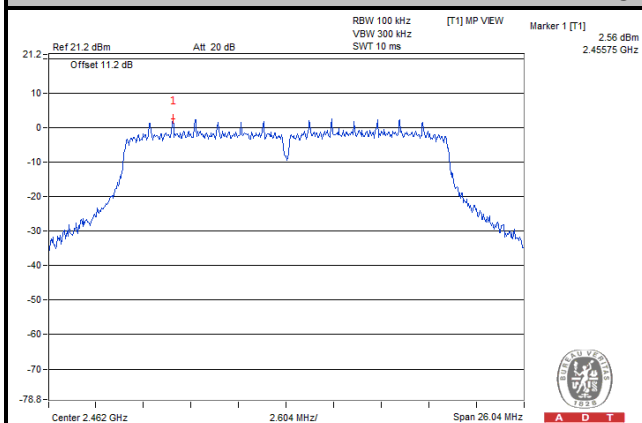
**Ch 1**

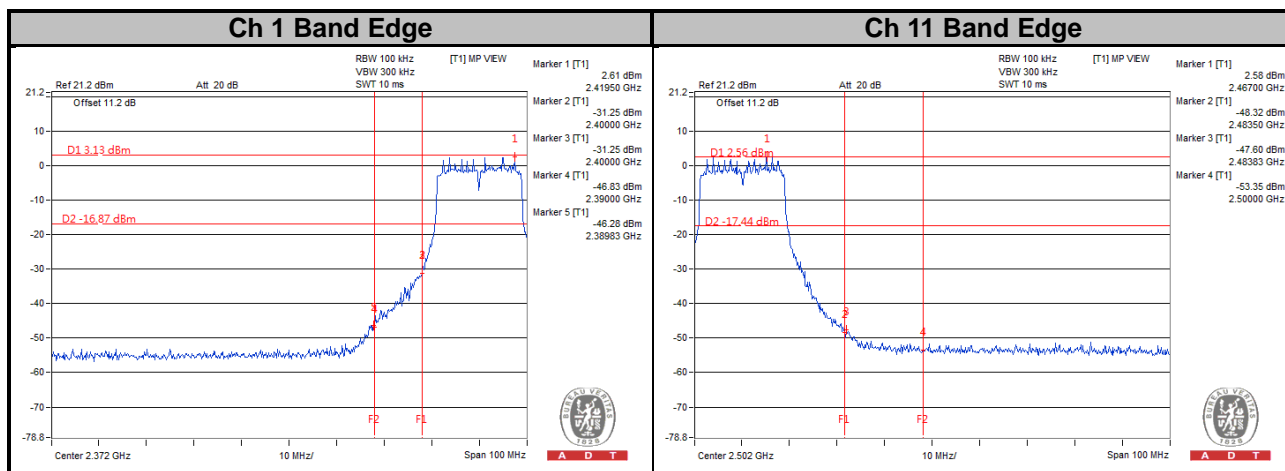


**Ch 6**



**Ch 11**

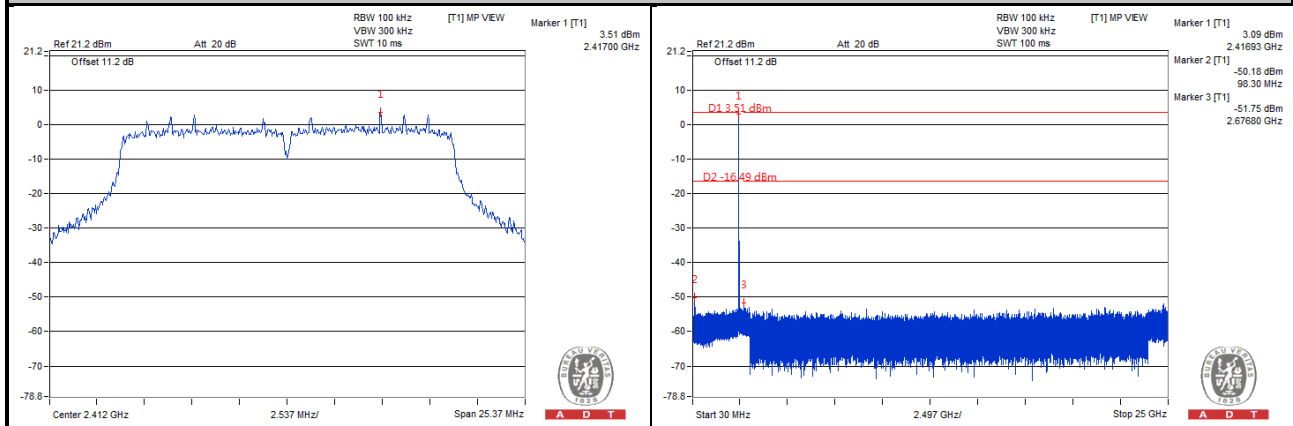




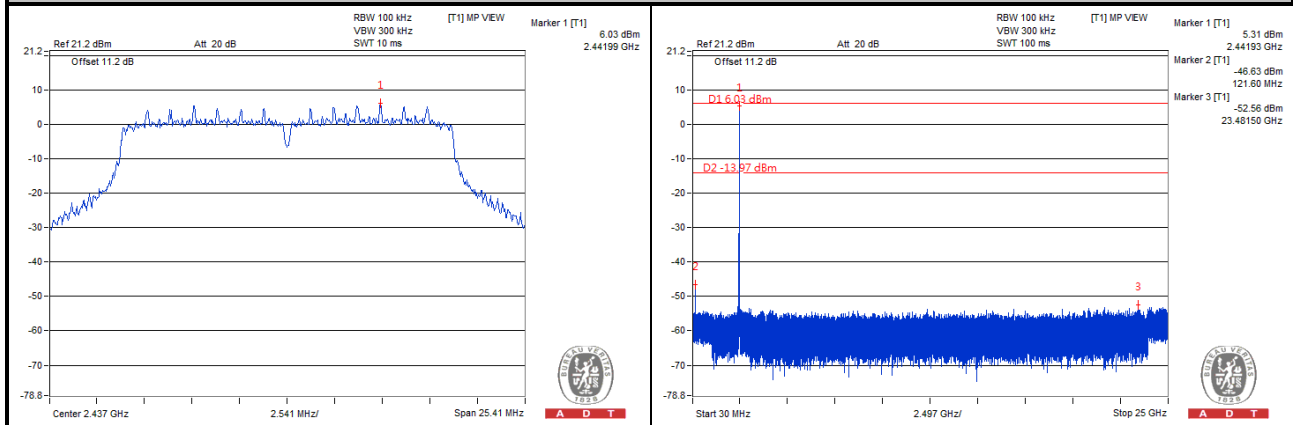


## CHAIN 1

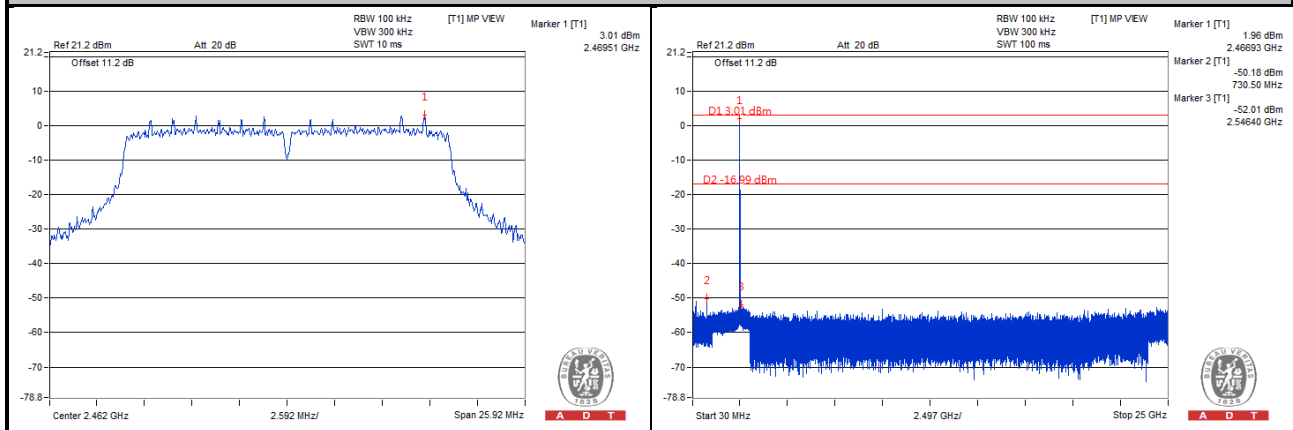
### Ch 1

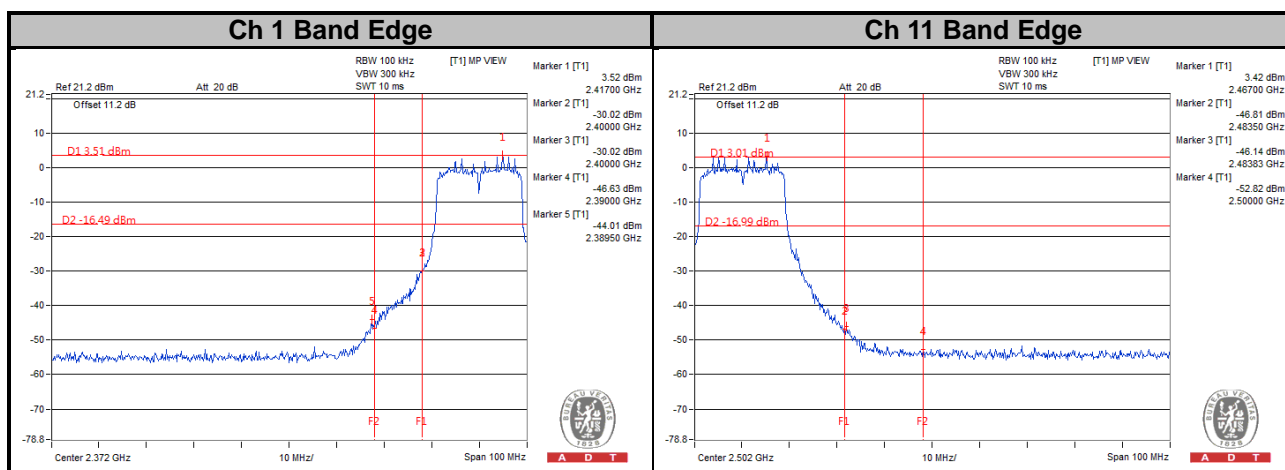


### Ch 6



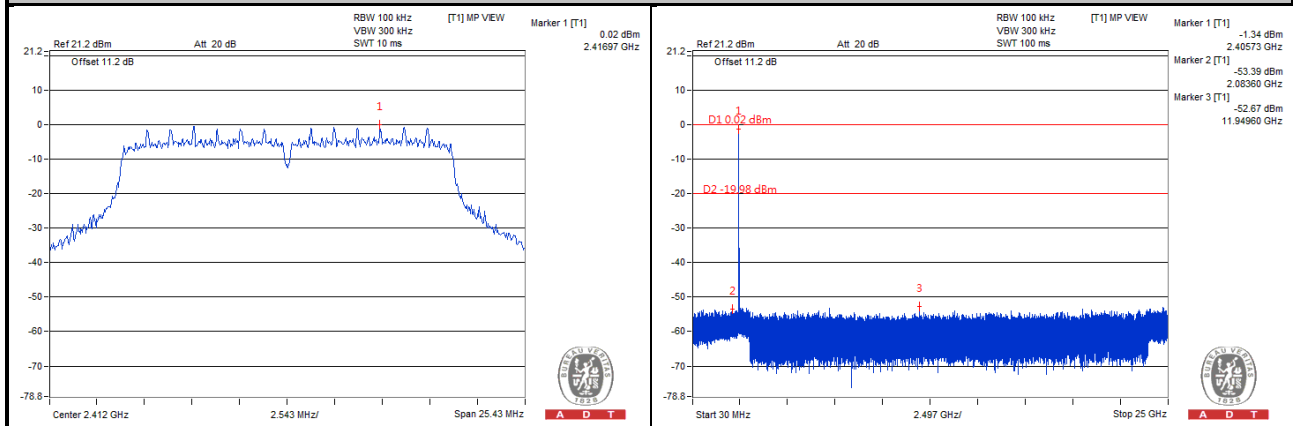
### Ch 11



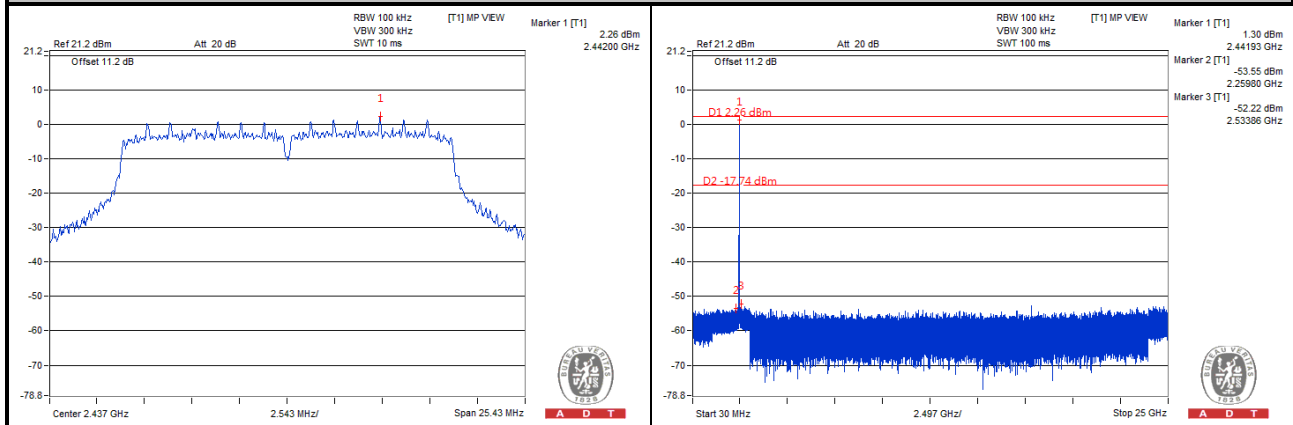


## CHAIN 2

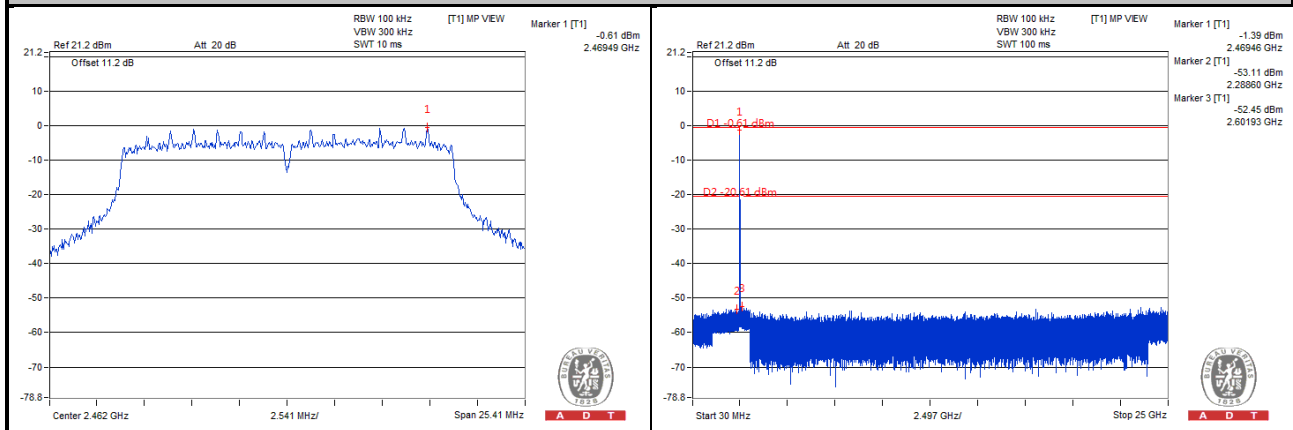
### Ch 1

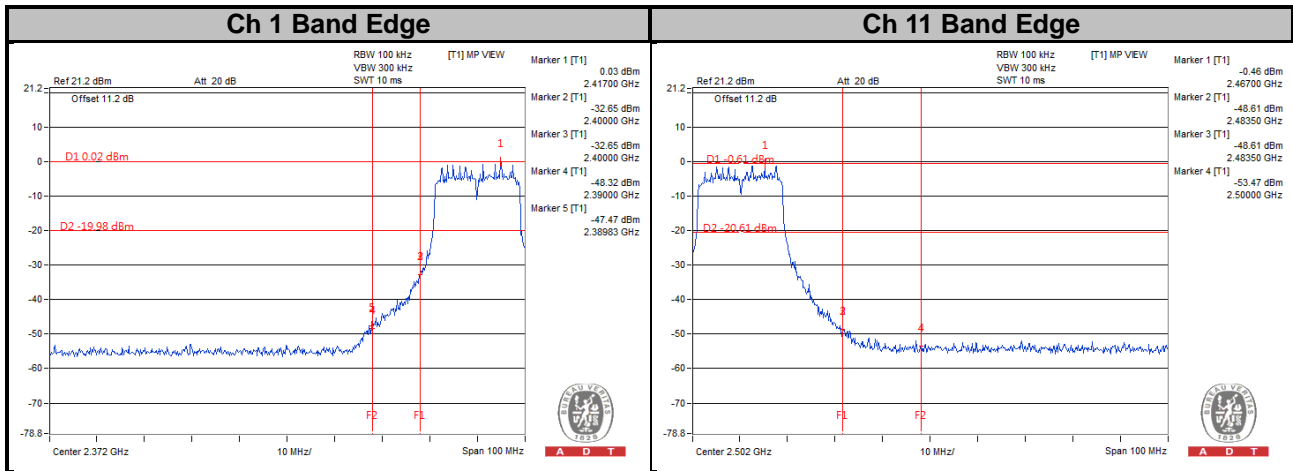


### Ch 6



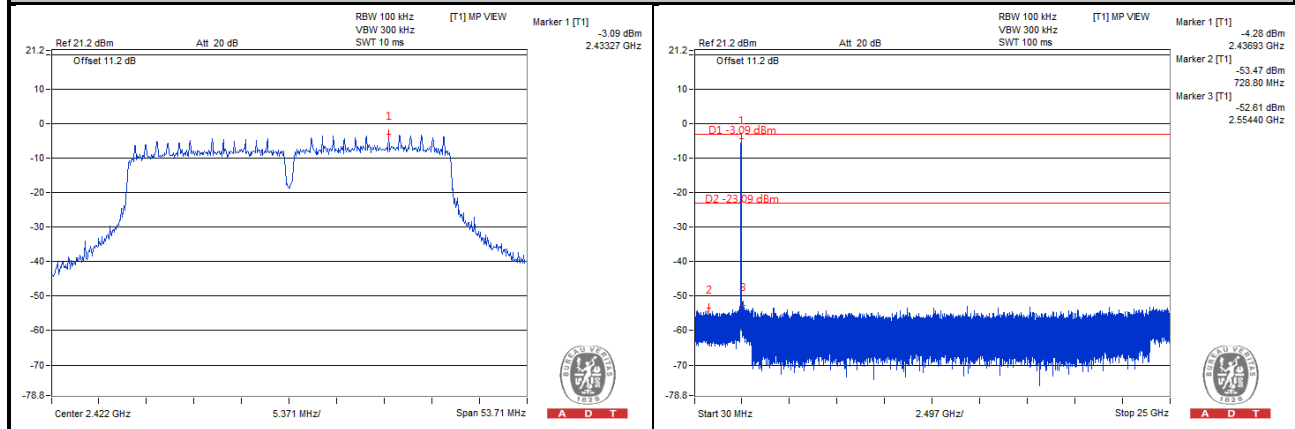
### Ch 11



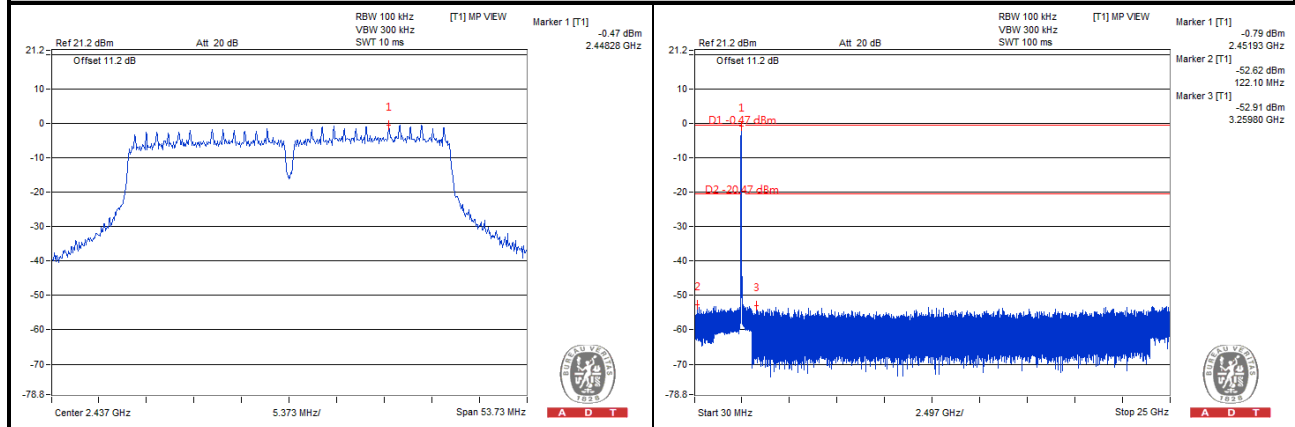


## 802.11n (HT40) CHAIN 0

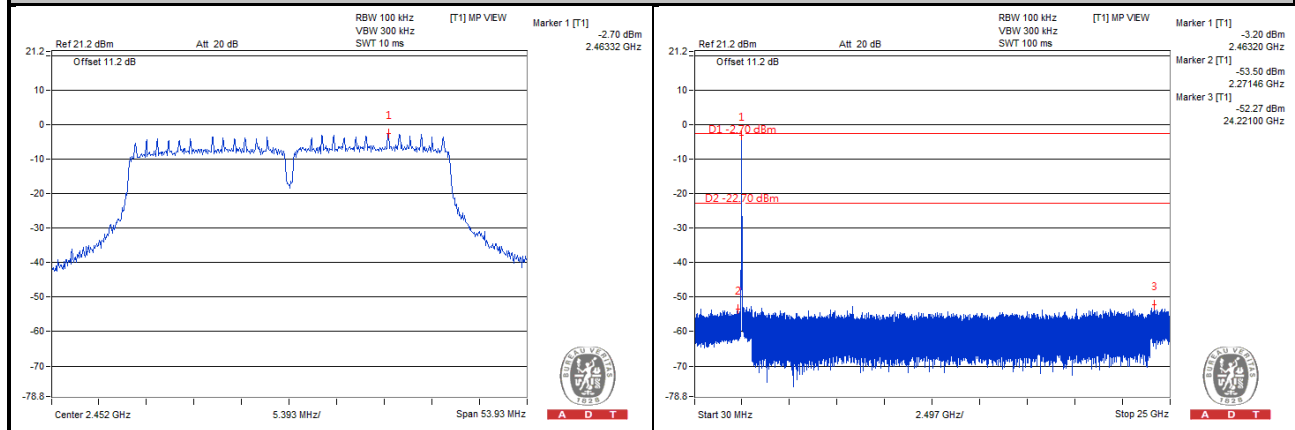
### Ch 3

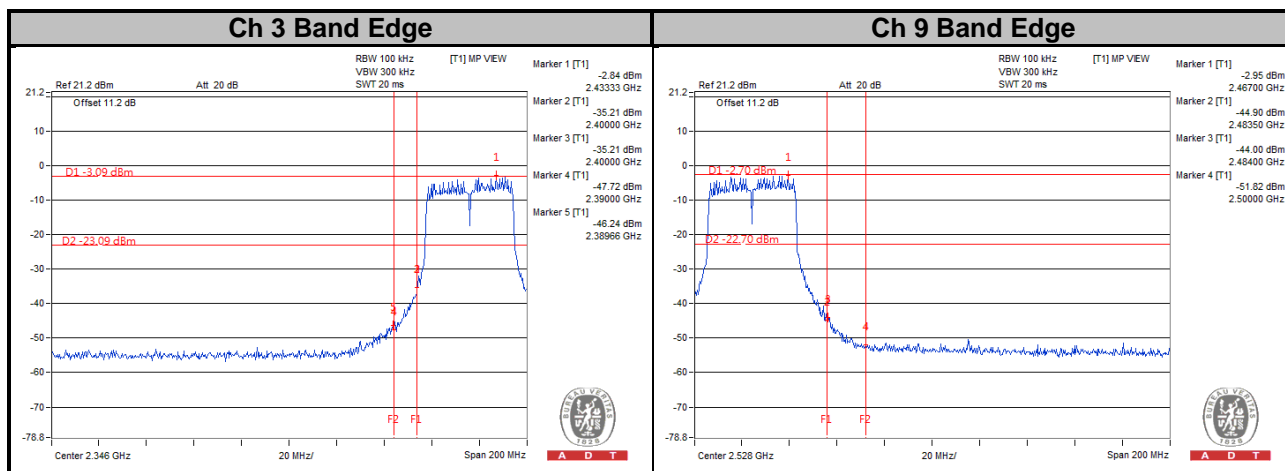


### Ch 6



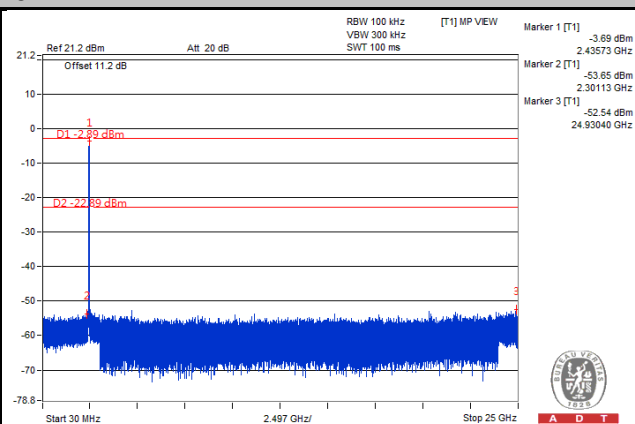
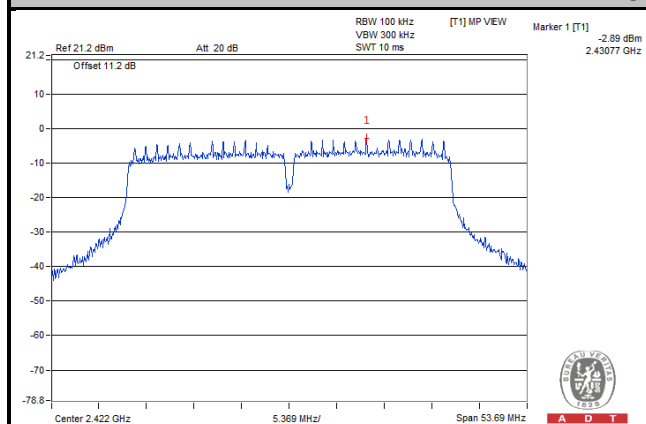
### Ch 9



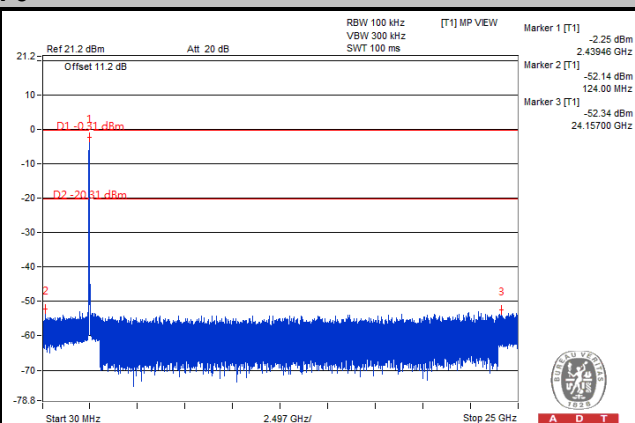
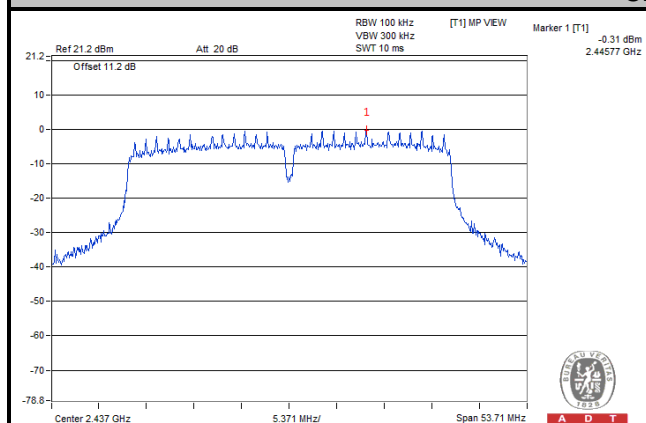


## CHAIN 1

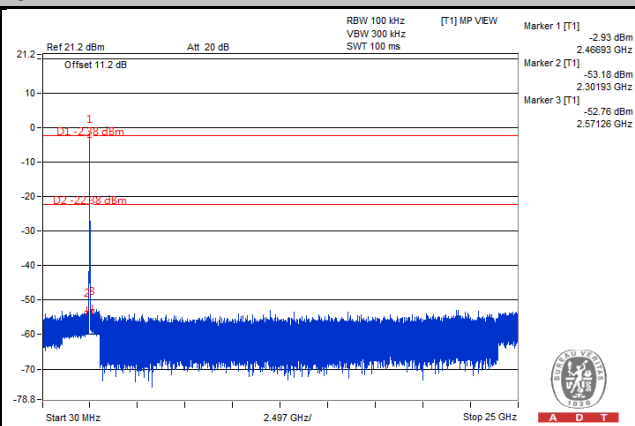
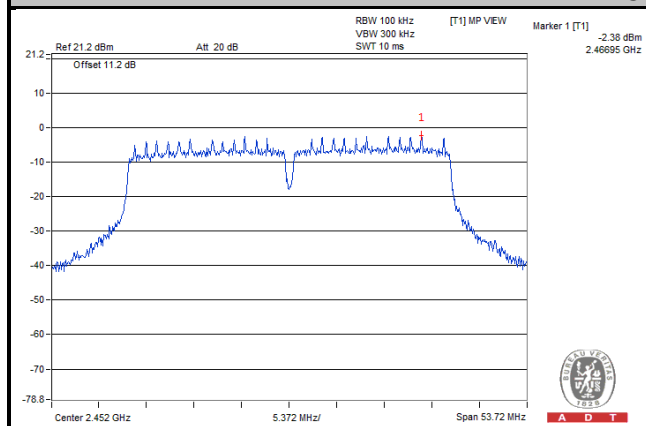
### Ch 3

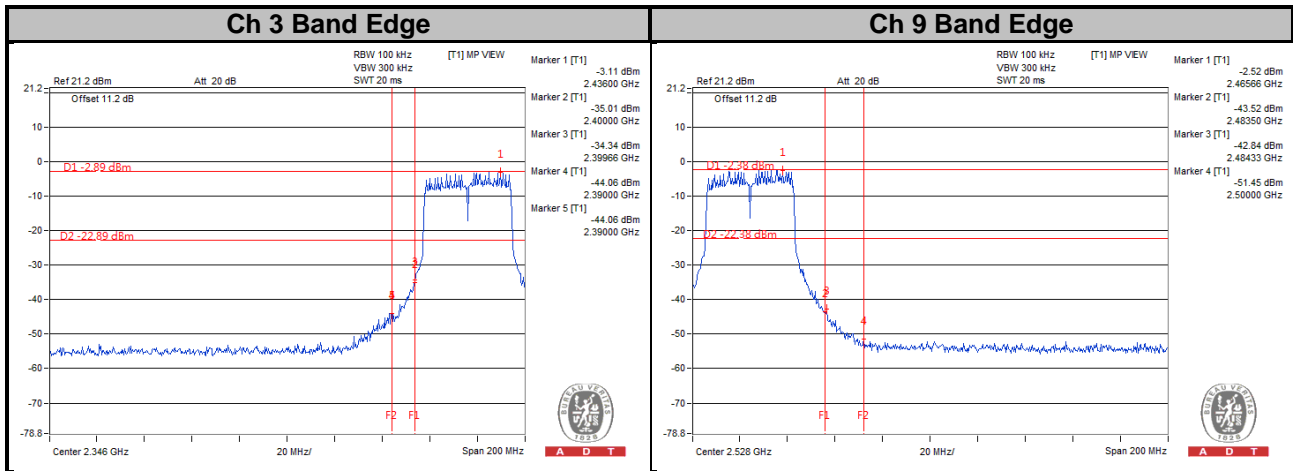


### Ch 6



### Ch 9

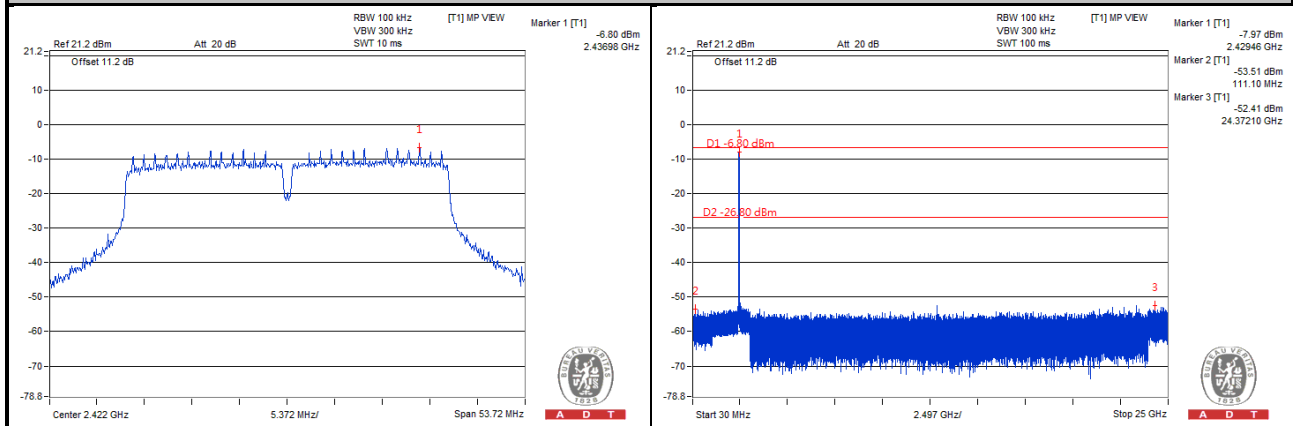




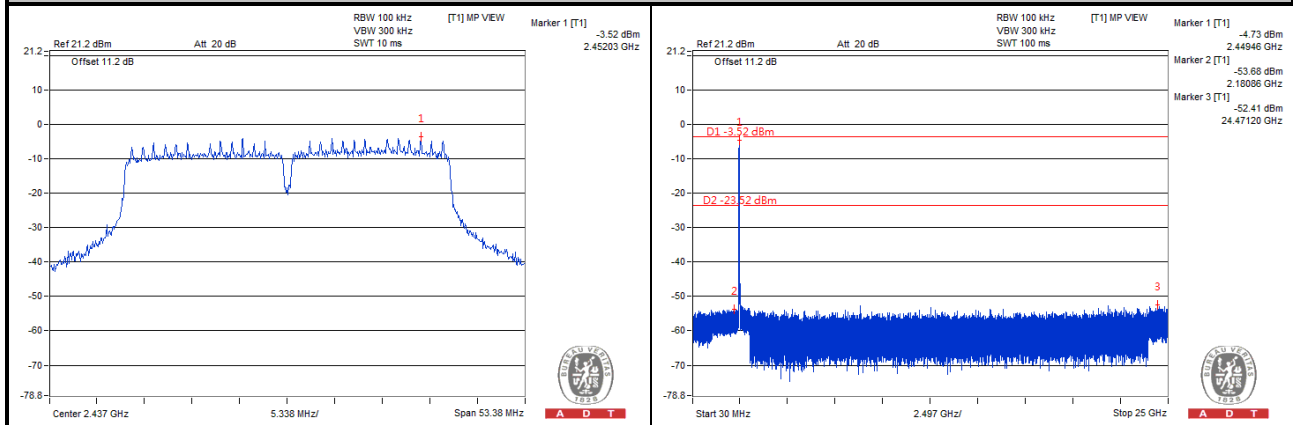


## CHAIN 2

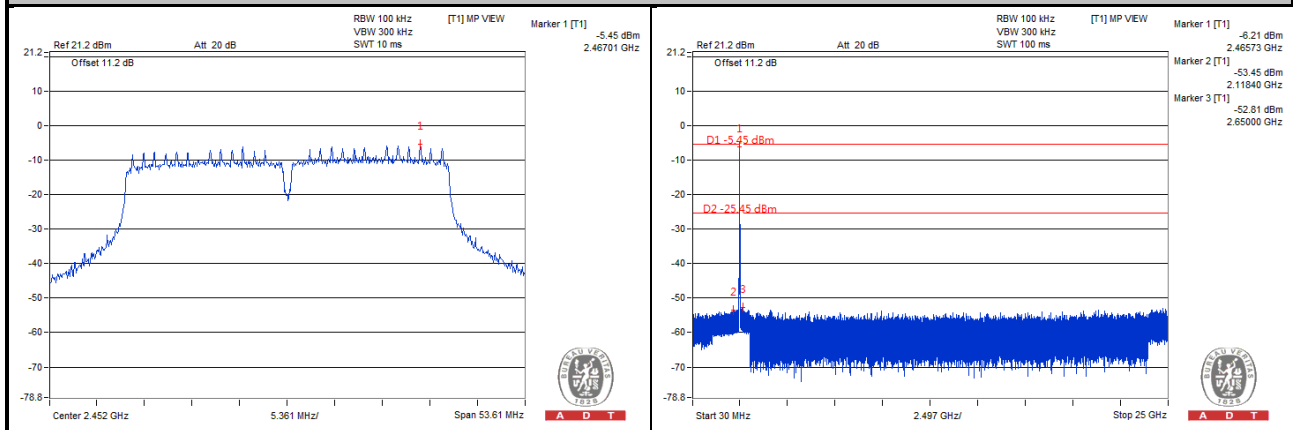
### Ch 3



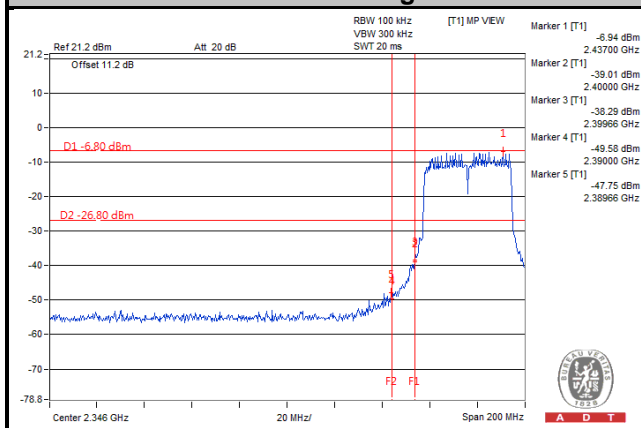
### Ch 6



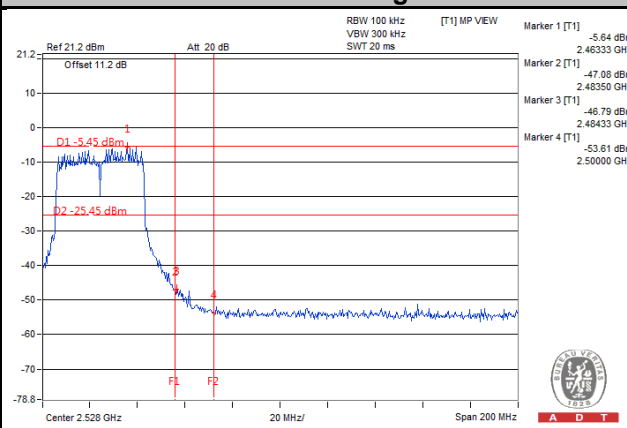
### Ch 9



### Ch 3 Band Edge



### Ch 9 Band Edge



## 5 Pictures of Test Arrangements

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

## Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

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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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