

FCC Test Report

Report No.: RF190320C04-3

FCC ID: HV4DTHW1321

Test Model: DTH-W1321

Series Model: DTH-W1321*****; DTHW1321***** (* may be alphanumeric/symbol or blank)

(refer to item 3.1 for more details)

Received Date: Mar. 20, 2019

Test Date: Apr. 11 ~ Apr. 29, 2019

Issued Date: May 07, 2019

Applicant: Wacom Co., Ltd.

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

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Test Location (2): B2F., No.215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan, R.O.C

**FCC Registration /
Designation Number:** 427177 / TW0011



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Release Control Record

Issue No.	Description	Date Issued
RF190320C04-3	Original Release	May 07, 2019

1 Certificate of Conformity

Product: GRAPHICS TABLET COMPUTER

Brand: Wacom

Test Model: DTH-W1321

Series Model: DTH-W1321*****; DTHW1321***** (* may be alphanumeric/symbol or blank)
(refer to item 3.1 for more details)

Sample Status: Production Unit


Applicant: Wacom Co., Ltd.


Test Date: Apr. 11 ~ Apr. 29, 2019

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

The above equipment has 46

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 RF characteristics under the conditions specified in this report.

Prepared by : , **Date:** May 07, 2019
Ivonne Wu / Supervisor

Approved by : , **Date:** May 07, 2019
Dylan Chiou / Project Engineer

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 -21.18 dB at 0.17698 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -1.02 dB at 2488.04 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.
---	Occupied Bandwidth Measurement	Pass	Reference only
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.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.44 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~ 1000 MHz	2.0224 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.1508 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	GRAPHICS TABLET COMPUTER
Brand	Wacom
Test Model	DTH-W1321
Series Model	DTH-W1321*****; DTHW1321***** (* may be alphanumeric/symbol or blank)
Status of EUT	Production Unit
Power Supply Rating	20 Vdc (adapter)
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to 300.0 Mbps
Operating Frequency	2412 ~ 2462 MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Output Power	413.574 mW
Antenna Type	PIFA antenna with 0.38 dBi gain
Antenna Connector	N/A
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

- All models are listed as below.

Brand	Model	Description
Wacom	DTH-W1321	Main test
	DTH-W1321***** (* may be alphanumeric/symbol or blank)	For marketing purpose
	DTHW1321***** (* may be alphanumeric/symbol or blank)	

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

Modulation Mode	Tx Function
802.11b	1TX
802.11g	1TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX

- The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter	WACOM	ADP-100PB B	I/P: 100-240 Vac, 50-60 Hz, 1.5 A O/P: 5 Vdc, 3 A or 20 Vdc, 5 A 1.8m / 1 core
WLAN/BT Module	Intel	9260NGW	--
GPS Module	U-Blox	EVA-8M	--

- The above EUT information is declared by manufacturer and for more detailed features description, please refers 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	
-	√	√	√	√	-

Where **RE \geq 1G**: Radiated Emission above 1 GHz **RE<1G**: Radiated Emission below 1 GHz
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**.
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)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	13.5

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)
-	802.11b	1 to 11	11	DSSS	DBPSK	1.0

Power Line Conducted Emission Test:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	11	DSSS	DBPSK	1.0

Bandedge Measurement:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 11	OFDM	BPSK	6.5
-	802.11n (HT40)	3 to 9	3, 9	OFDM	BPSK	13.5

Antenna Port Conducted Measurement:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	13.5

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE≥1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Karl Lee
RE<1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Karl Lee
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	Jisyong Wang
APCM	25 deg. C, 65 % RH	120 Vac, 60 Hz	Vincent Huang

3.3 Duty Cycle of Test Signal

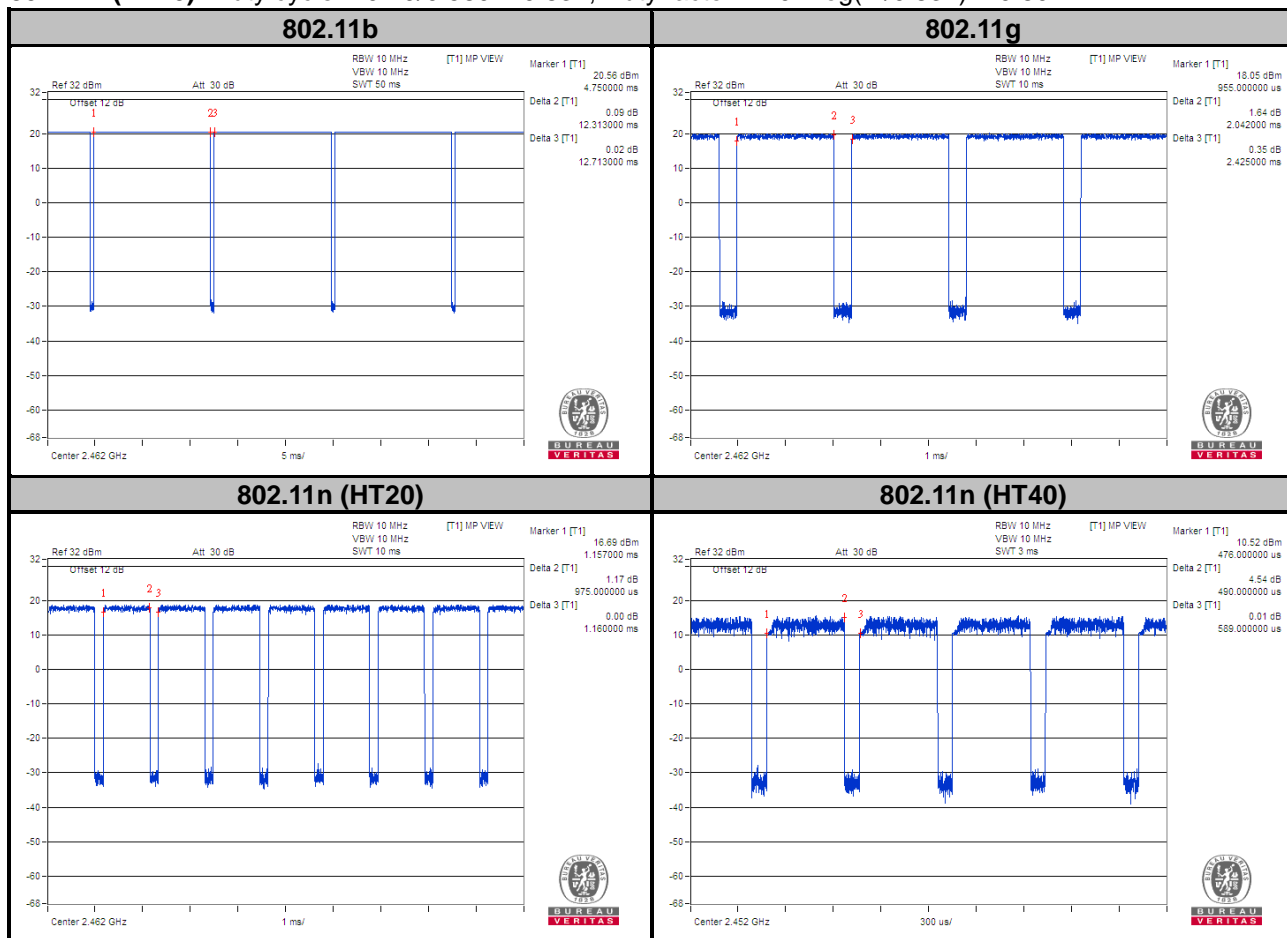
Duty cycle of test signal is < 98 %, duty factor shall be considered.

802.11b: Duty cycle = $12.313/12.713 = 0.969$, Duty factor = $10 * \log(1/0.969) = 0.14$

802.11g: Duty cycle = $2.042/2.425 = 0.842$, Duty factor = $10 * \log(1/0.842) = 0.75$

802.11n (HT20): Duty cycle = $0.975/1.16 = 0.841$, Duty factor = $10 * \log(1/0.841) = 0.75$

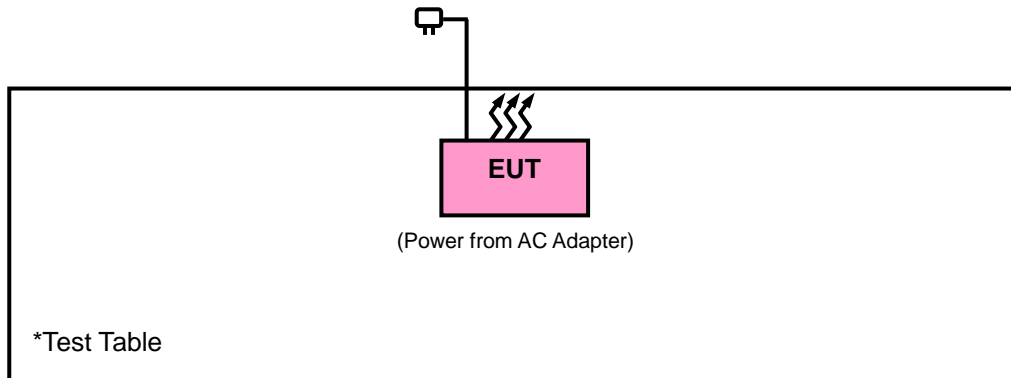
802.11n (HT40): Duty cycle = $0.49/0.589 = 0.832$, Duty factor = $10 * \log(1/0.832) = 0.80$



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)

KDB 558074 D01 15.247 Meas Guidance v05r02

KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10-2013

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

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 Technologies	N9038A	MY51210203	Mar. 18, 2019	Mar. 17, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	100115	Jan. 21, 2019	Jan. 20, 2020
HORN Antenna ETS-Lindgren	3117	00143293	Nov. 25, 2018	Nov. 24, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-616	Nov. 27, 2018	Nov. 26, 2019
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Nov. 25, 2018	Nov. 24, 2019
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 16, 2018	Apr. 15, 2019
			Apr. 15, 2019	Apr. 14, 2020
Loop Antenna	EM-6879	269	Sep. 07, 2018	Sep. 06, 2019
Pre-amplifier Agilent	310N	187226	Jun. 19, 2018	Jun. 18, 2019
Pre-amplifier Agilent	83017A	MY39501357	Jun. 19, 2018	Jun. 18, 2019
Power Meter Anritsu	ML2495A	1012010	Sep. 05, 2018	Sep. 04, 2019
Power Sensor Anritsu	MA2411B	1315050	Sep. 04, 2018	Sep. 03, 2019
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC -SMS-100-SMS-12 0+RFC-SMS-100-S MS-400)	Jun. 19, 2018	Jun. 18, 2019
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(RFC -SMS-100-SMS-24)	Jun. 19, 2018	Jun. 18, 2019
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 8.130425b	NA	NA	NA
Antenna Tower MF	NA	NA	NA	NA
Turn Table MF	NA	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 HsinTien Chamber 1.
3. The horn antenna and pre-amplifier (model: 83017A) are used only for the measurement of emission frequency above 1 GHz if tested.
4. The IC Site Registration No. is 7450I-1.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

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

For Radiated Emission above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 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:

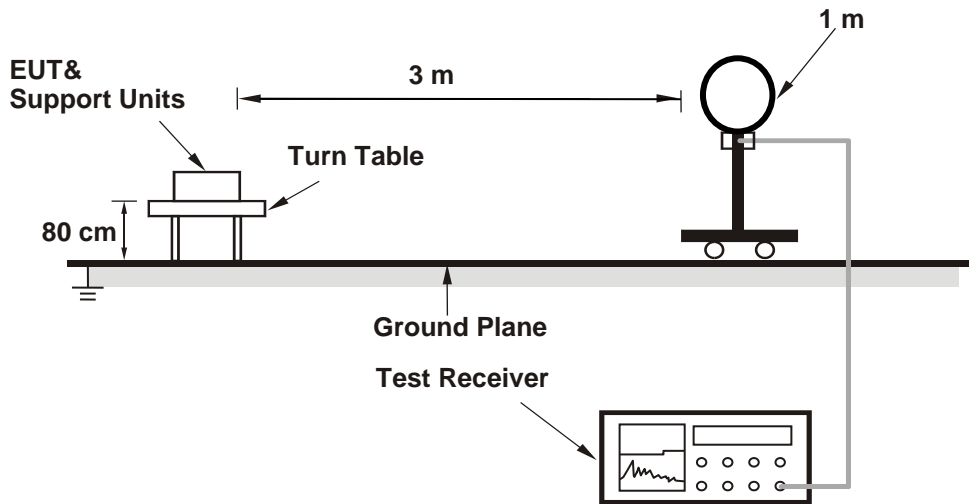
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
(11b: RBW = 1 MHz, VBW = 100 Hz ; 11g: RBW = 1 MHz, VBW = 1 kHz ;
11n (HT20): RBW = 1 MHz, VBW = 3 kHz ; 11n (HT40): RBW = 1 MHz, VBW = 3 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

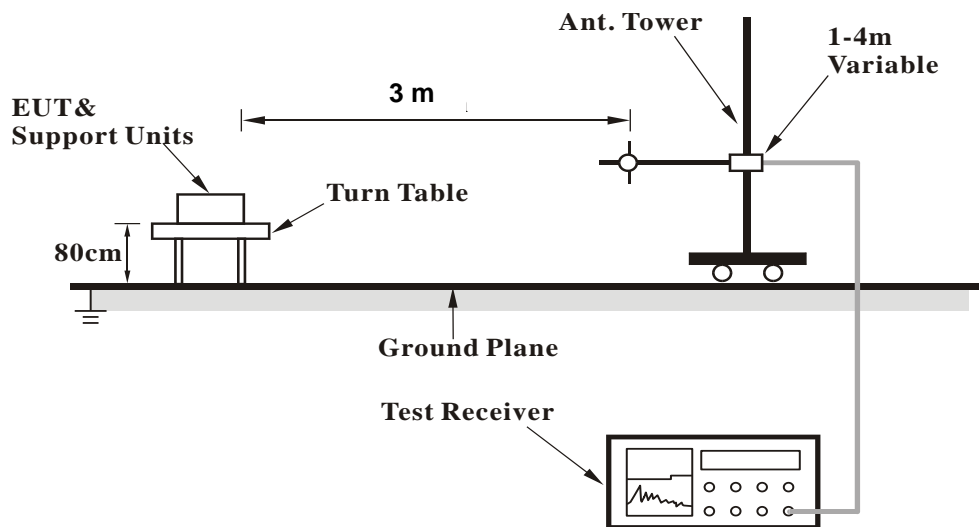
No deviation.

4.1.5 Test Set Up

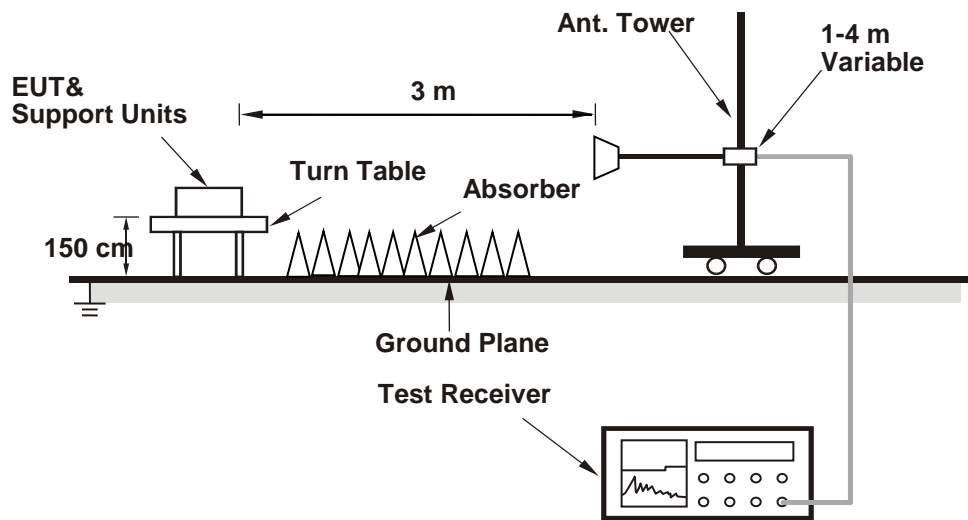
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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

4.1.6 EUT Operating Conditions

- a. Placed the EUT on a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz Data :
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	Karl Lee

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
2389.47	51.26	49.55	54	-2.74	31.8	5.4	35.49	180	63	Average
2389.47	66.01	64.3	74	-7.99	31.8	5.4	35.49	180	63	Peak
2412	101.87	100.1			31.81	5.43	35.47	179	63	Average
2412	105.07	103.3			31.81	5.43	35.47	179	63	Peak
4824	48.28	40.15	54	-5.72	33.97	8.26	34.1	196	14	Average
4824	51.35	43.22	74	-22.65	33.97	8.26	34.1	196	14	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
2389.83	43.6	41.87	54	-10.4	31.8	5.4	35.47	182	82	Average
2389.83	56.6	54.87	74	-17.4	31.8	5.4	35.47	182	82	Peak
2412	92.84	91.07			31.81	5.43	35.47	182	82	Average
2412	96.26	94.49			31.81	5.43	35.47	182	82	Peak
4824	44.55	36.42	54	-9.45	33.97	8.26	34.1	124	111	Average
4824	47.82	39.69	74	-26.18	33.97	8.26	34.1	124	111	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2412 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2384.88	50.11	48.42	54	-3.89	31.78	5.4	35.49	179	63	Average
2384.88	56.89	55.2	74	-17.11	31.78	5.4	35.49	179	63	Peak
2437	105.15	103.3			31.85	5.46	35.46	179	63	Average
2437	108.6	106.75			31.85	5.46	35.46	179	63	Peak
2484.68	52.96	50.97	54	-1.04	31.88	5.53	35.42	179	63	Average
2484.68	59.9	57.91	74	-14.1	31.88	5.53	35.42	179	63	Peak
4874	47.3	39.11	54	-6.7	33.98	8.27	34.06	196	14	Average
4874	50.85	42.66	74	-23.15	33.98	8.27	34.06	196	14	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
2386.68	42.85	41.14	54	-11.15	31.8	5.4	35.49	182	82	Average
2386.68	52.5	50.79	74	-21.5	31.8	5.4	35.49	182	82	Peak
2437	96	94.15			31.85	5.46	35.46	182	82	Average
2437	98.83	96.98			31.85	5.46	35.46	182	82	Peak
2484.72	44.58	42.59	54	-9.42	31.88	5.53	35.42	182	82	Average
2484.72	53.77	51.78	74	-20.23	31.88	5.53	35.42	182	82	Peak
4874	40.55	32.36	54	-13.45	33.98	8.27	34.06	105	326	Average
4874	45.7	37.51	74	-28.3	33.98	8.27	34.06	105	326	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2437 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2462	104.58	102.65			31.87	5.5	35.44	179	63	Average
2462	108.5	106.57			31.87	5.5	35.44	179	63	Peak
2488.04	52.98	50.97	54	-1.02	31.9	5.53	35.42	179	63	Average
2488.04	70.98	68.97	74	-3.02	31.9	5.53	35.42	179	63	Peak
4924	40.5	32.25	54	-13.5	33.99	8.28	34.02	145	188	Average
4924	45.08	36.83	74	-28.92	33.99	8.28	34.02	145	188	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
2462	95.71	58.34			31.87	5.5	0	182	82	Average
2462	99.05	61.68			31.87	5.5	0	182	82	Peak
2483.72	44.81	42.85	54	-9.19	31.88	5.5	35.42	182	82	Average
2483.72	60.96	59	74	-13.04	31.88	5.5	35.42	182	82	Peak
4924	40.4	32.15	54	-13.6	33.99	8.28	34.02	147	77	Average
4924	46.03	37.78	74	-27.97	33.99	8.28	34.02	147	77	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2462 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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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	Karl Lee

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
2389.92	51.44	49.71	54	-2.56	31.8	5.4	35.47	179	63	Average
2389.92	66.75	65.02	74	-7.25	31.8	5.4	35.47	179	63	Peak
2412	99.29	97.52			31.81	5.43	35.47	179	63	Average
2412	107.68	105.91			31.81	5.43	35.47	179	63	Peak
4824	40.43	32.3	54	-13.57	33.97	8.26	34.1	105	2	Average
4824	45.33	37.2	74	-28.67	33.97	8.26	34.1	105	2	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
2389.92	43.34	41.61	54	-10.66	31.8	5.4	35.47	182	82	Average
2389.92	57.92	56.19	74	-16.08	31.8	5.4	35.47	182	82	Peak
2412	90	88.23			31.81	5.43	35.47	182	82	Average
2412	98.12	96.35			31.81	5.43	35.47	182	82	Peak
4824	40.58	32.45	54	-13.42	33.97	8.26	34.1	195	55	Average
4824	45.36	37.23	74	-28.64	33.97	8.26	34.1	195	55	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2412 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2389.2	48.83	47.12	54	-5.17	31.8	5.4	35.49	179	63	Average
2389.2	62.45	60.74	74	-11.55	31.8	5.4	35.49	179	63	Peak
2437	101.93	100.08			31.85	5.46	35.46	179	63	Average
2437	110.52	108.67			31.85	5.46	35.46	179	63	Peak
2483.56	52.84	50.88	54	-1.16	31.88	5.5	35.42	179	63	Average
2483.56	69.76	67.8	74	-4.24	31.88	5.5	35.42	179	63	Peak
4874	40.65	32.46	54	-13.35	33.98	8.27	34.06	147	77	Average
4874	46.06	37.87	74	-27.94	33.98	8.27	34.06	147	77	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
2385.51	42.27	40.56	54	-11.73	31.8	5.4	35.49	182	82	Average
2385.51	54.04	52.33	74	-19.96	31.8	5.4	35.49	182	82	Peak
2437	91.63	89.78			31.85	5.46	35.46	182	82	Average
2437	99.73	97.88			31.85	5.46	35.46	182	82	Peak
2483.72	44.6	42.64	54	-9.4	31.88	5.5	35.42	182	82	Average
2483.72	57.68	55.72	74	-16.32	31.88	5.5	35.42	182	82	Peak
4874	40.77	32.58	54	-13.23	33.98	8.27	34.06	156	195	Average
4874	45.58	37.39	74	-28.42	33.98	8.27	34.06	156	195	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2437 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2462	99.08	97.15			31.87	5.5	35.44	179	63	Average
2462	107.74	105.81			31.87	5.5	35.44	179	63	Peak
2483.52	52.56	50.6	54	-1.44	31.88	5.5	35.42	179	63	Average
2483.52	67.39	65.43	74	-6.61	31.88	5.5	35.42	179	63	Peak
4924	40.78	32.53	54	-13.22	33.99	8.28	34.02	108	145	Average
4924	45.08	36.83	74	-28.92	33.99	8.28	34.02	108	145	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
2462	90.41	88.48			31.87	5.5	35.44	182	82	Average
2462	98.85	96.92			31.87	5.5	35.44	182	82	Peak
2483.52	44.29	42.33	54	-9.71	31.88	5.5	35.42	182	82	Average
2483.52	57.93	55.97	74	-16.07	31.88	5.5	35.42	182	82	Peak
4924	40.77	32.52	54	-13.23	33.99	8.28	34.02	124	177	Average
4924	46.03	37.78	74	-27.97	33.99	8.28	34.02	124	177	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2462 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2389.92	52.66	50.93	54	-1.34	31.8	5.4	35.47	286	316	Average
2389.92	68.26	66.53	74	-5.74	31.8	5.4	35.47	286	316	Peak
2412	101.65	99.88			31.81	5.43	35.47	257	316	Average
2412	110.35	108.58			31.81	5.43	35.47	257	316	Peak
4824	40.43	32.3	54	-13.57	33.97	8.26	34.1	118	14	Average
4824	46.12	37.99	74	-27.88	33.97	8.26	34.1	118	14	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
2389.92	42.28	40.55	54	-11.72	31.8	5.4	35.47	274	68	Average
2389.92	54.5	52.77	74	-19.5	31.8	5.4	35.47	274	68	Peak
2412	93.41	91.64			31.81	5.43	35.47	289	74	Average
2412	101.08	99.31			31.81	5.43	35.47	289	74	Peak
4824	40.65	32.52	54	-13.35	33.97	8.26	34.1	145	199	Average
4824	46.91	38.78	74	-27.09	33.97	8.26	34.1	145	199	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2412 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2389.83	49.16	47.43	54	-4.84	31.8	5.4	35.47	236	324	Average
2389.83	63.03	61.3	74	-10.97	31.8	5.4	35.47	236	324	Peak
2437	105.84	103.99			31.85	5.46	35.46	265	313	Average
2437	113.84	111.99			31.85	5.46	35.46	265	313	Peak
2483.6	52.25	50.29	54	-1.75	31.88	5.5	35.42	257	313	Average
2483.6	70.28	68.32	74	-3.72	31.88	5.5	35.42	257	313	Peak
4874	40.38	32.19	54	-13.62	33.98	8.27	34.06	105	297	Average
4874	44.87	36.68	74	-29.13	33.98	8.27	34.06	105	297	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
2389.47	41.85	40.14	54	-12.15	31.8	5.4	35.49	289	74	Average
2389.47	52.49	50.78	74	-21.51	31.8	5.4	35.49	289	74	Peak
2437	96.19	94.34			31.85	5.46	35.46	289	74	Average
2437	105	103.15			31.85	5.46	35.46	289	74	Peak
2484	42.5	40.54	54	-11.5	31.88	5.5	35.42	289	74	Average
2484	53.87	51.91	74	-20.13	31.88	5.5	35.42	289	74	Peak
4874	40.71	32.52	54	-13.29	33.98	8.27	34.06	145	175	Average
4874	45.29	37.1	74	-28.71	33.98	8.27	34.06	145	175	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
2. 2437 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2462	100.79	98.86			31.87	5.5	35.44	275	316	Average
2462	108.72	106.79			31.87	5.5	35.44	275	316	Peak
2483.56	52.15	50.19	54	-1.85	31.88	5.5	35.42	269	316	Average
2483.56	64.52	62.56	74	-9.48	31.88	5.5	35.42	269	316	Peak
4924	40.59	32.34	54	-13.41	33.99	8.28	34.02	145	277	Average
4924	46.66	38.41	74	-27.34	33.99	8.28	34.02	145	277	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
2462	91.91	89.98			31.87	5.5	35.44	289	131	Average
2462	99.95	98.02			31.87	5.5	35.44	289	131	Peak
2483.6	45.52	43.56	54	-8.48	31.88	5.5	35.42	276	126	Average
2483.6	57.59	55.63	74	-16.41	31.88	5.5	35.42	276	126	Peak
4924	40.7	32.45	54	-13.3	33.99	8.28	34.02	118	214	Average
4924	45.86	37.61	74	-28.14	33.99	8.28	34.02	118	214	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2462 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2389.47	52.77	51.06	54	-1.23	31.8	5.4	35.49	279	314	Average
2389.47	63.7	61.99	74	-10.3	31.8	5.4	35.49	279	314	Peak
2422	96.23	94.43			31.83	5.43	35.46	265	316	Average
2422	105.3	103.5			31.83	5.43	35.46	265	316	Peak
2483.72	43.54	41.58	54	-10.46	31.88	5.5	35.42	265	316	Average
2483.72	55.64	53.68	74	-18.36	31.88	5.5	35.42	265	316	Peak
4844	40.7	32.55	54	-13.3	33.97	8.26	34.08	146	338	Average
4844	46	37.85	74	-28	33.97	8.26	34.08	146	338	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
2388.39	43.83	42.12	54	-10.17	31.8	5.4	35.49	289	74	Average
2388.39	56.74	55.03	74	-17.26	31.8	5.4	35.49	289	74	Peak
2422	88.26	86.46			31.83	5.43	35.46	289	74	Average
2422	96.13	94.33			31.83	5.43	35.46	289	74	Peak
2487.56	41.6	39.59	54	-12.4	31.9	5.53	35.42	289	74	Average
2487.56	52.5	50.49	74	-21.5	31.9	5.53	35.42	289	74	Peak
4844	40.91	32.76	54	-13.09	33.97	8.26	34.08	144	246	Average
4844	45.76	37.61	74	-28.24	33.97	8.26	34.08	144	246	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2422 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2389.56	52.72	51.01	54	-1.28	31.8	5.4	35.49	259	313	Average
2389.56	65.84	64.13	74	-8.16	31.8	5.4	35.49	259	313	Peak
2437	98.65	96.8			31.85	5.46	35.46	265	313	Average
2437	107.82	105.97			31.85	5.46	35.46	265	313	Peak
2483.56	52.67	50.71	54	-1.33	31.88	5.5	35.42	268	316	Average
2483.56	65.7	63.74	74	-8.3	31.88	5.5	35.42	268	316	Peak
4874	40.88	32.69	54	-13.12	33.98	8.27	34.06	195	199	Average
4874	45.14	36.95	74	-28.86	33.98	8.27	34.06	195	199	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
2389.74	44.67	42.96	54	-9.33	31.8	5.4	35.49	289	81	Average
2389.74	54.83	53.12	74	-19.17	31.8	5.4	35.49	289	81	Peak
2437	89.88	88.03			31.85	5.46	35.46	289	74	Average
2437	97.74	95.89			31.85	5.46	35.46	289	74	Peak
2484.72	43.7	41.71	54	-10.3	31.88	5.53	35.42	276	75	Average
2484.72	54.3	52.31	74	-19.7	31.88	5.53	35.42	276	75	Peak
4874	40.85	32.66	54	-13.15	33.98	8.27	34.06	145	175	Average
4874	45.35	37.16	74	-28.65	33.98	8.27	34.06	145	175	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2437 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

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	Karl Lee

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
2389.5	48.26	46.55	54	-5.74	31.8	5.4	35.49	271	305	Average
2389.5	62.13	60.42	74	-11.87	31.8	5.4	35.49	271	305	Peak
2452	97.13	95.26			31.85	5.46	35.44	275	316	Average
2452	105.08	103.21			31.85	5.46	35.44	275	316	Peak
2483.92	52.96	51	54	-1.04	31.88	5.5	35.42	271	305	Average
2483.92	65.84	63.88	74	-8.16	31.88	5.5	35.42	271	305	Peak
4904	40.81	32.59	54	-13.19	33.98	8.28	34.04	151	2	Average
4904	45.73	37.51	74	-28.27	33.98	8.28	34.04	151	2	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
2384.23	41.37	39.68	54	-12.63	31.78	5.4	35.49	294	133	Average
2384.23	52.36	50.67	74	-21.64	31.78	5.4	35.49	294	133	Peak
2452	88.09	86.22			31.85	5.46	35.44	291	131	Average
2452	96.16	94.29			31.85	5.46	35.44	291	131	Peak
2485.12	46.12	44.13	54	-7.88	31.88	5.53	35.42	293	145	Average
2485.12	57.65	55.66	74	-16.35	31.88	5.53	35.42	293	145	Peak
4904	40.71	32.49	54	-13.29	33.98	8.28	34.04	164	166	Average
4904	48.16	39.94	74	-25.84	33.98	8.28	34.04	164	166	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2452 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

9 kHz ~ 30 MHz Data:

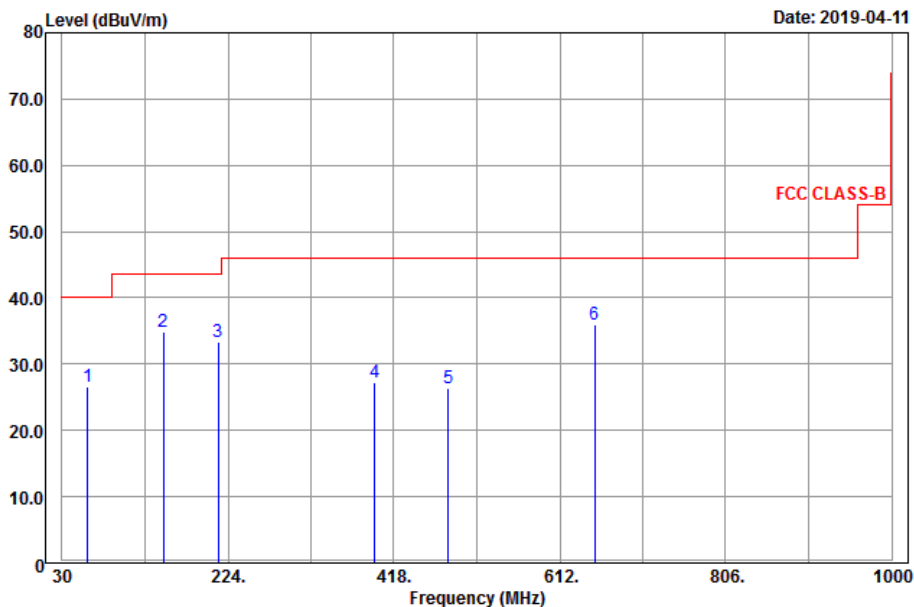
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Worst-Case Data:

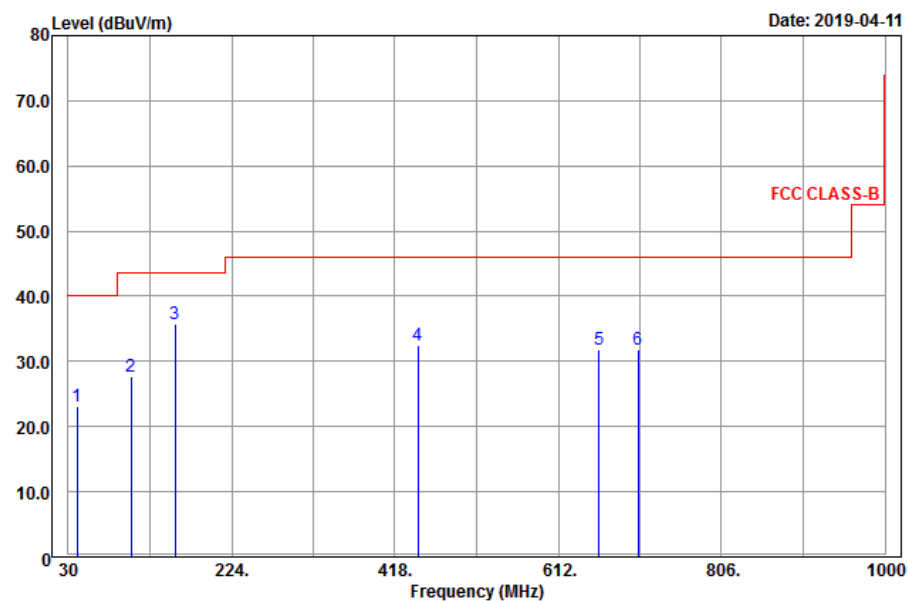
802.11b

EUT Test Condition		Measurement Detail	
Channel	Channel 11	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	Karl Lee

Horizontal



Vertical



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
60.24	26.55	51.08	40	-13.45	6.8	0.9	32.23	162	154	Peak
148.26	34.77	55.54	43.5	-8.73	9.98	1.52	32.27	142	157	Peak
212.79	33.37	52.57	43.5	-10.13	11.4	1.65	32.25	133	162	Peak
395.9	27.32	39.39	46	-18.68	17.8	2.34	32.21	102	155	Peak
481.3	26.41	37.04	46	-19.59	18.92	2.56	32.11	195	146	Peak
652.8	36.07	43.13	46	-9.93	22.1	2.99	32.15	155	175	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
40.53	23.05	43.5	40	-16.95	11.04	0.74	32.23	144	155	Peak
104.79	27.61	49.03	43.5	-15.89	9.56	1.28	32.26	104	152	Peak
157.17	35.84	55.97	43.5	-7.66	10.62	1.52	32.27	122	164	Peak
445.6	32.43	44.14	46	-13.57	17.95	2.49	32.15	157	142	Peak
660.5	31.92	38.54	46	-14.08	22.53	2.99	32.14	192	163	Peak
706.7	31.87	37.67	46	-14.13	23.19	3.11	32.1	182	169	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value.
- The emission levels of other frequencies were very low against the limit.

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	Dec. 10, 2018	Dec. 09, 2019
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2018	Sep. 04, 2019
LISN/AMN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 21, 2019	Feb. 20, 2020
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 19, 2018	Aug. 18, 2019
Software ADT	BV ADT_Cond_ V7.3.7.4	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-12040.

4.2.3 Test Procedures

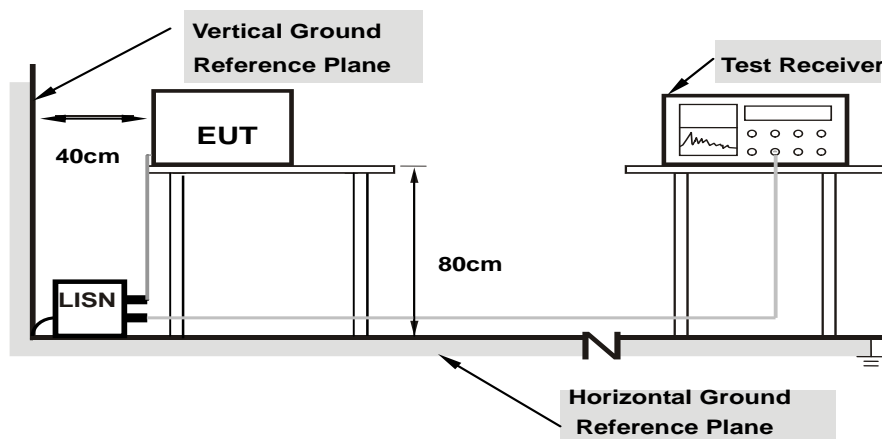
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling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

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

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

- a. Placed the EUT on a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.2.7 Test Results

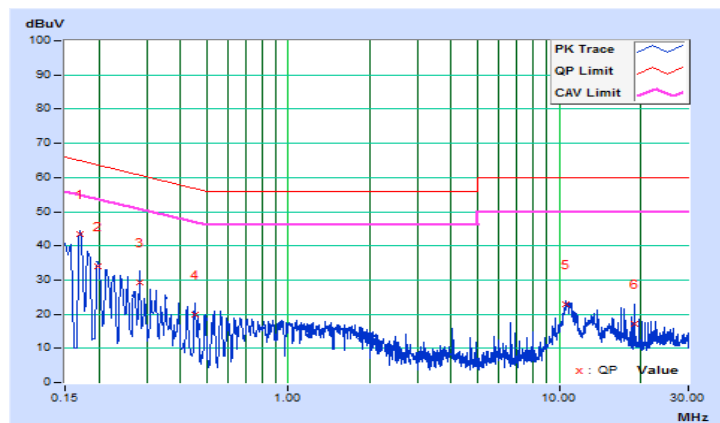
LISN

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	Jisyong Wang	Test Date	2019/4/29

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	0.16967	0.26	43.18	29.94	43.44	30.20	64.98	54.98	-21.54	-24.78
2	0.19717	0.24	33.60	18.04	33.84	18.28	63.73	53.73	-29.89	-35.45
3	0.28294	0.24	29.10	16.44	29.34	16.68	60.73	50.73	-31.39	-34.05
4	0.45097	0.23	19.71	4.86	19.94	5.09	56.86	46.86	-36.92	-41.77
5	10.62489	4.01	18.83	1.15	22.84	5.16	60.00	50.00	-37.16	-44.84
6	18.87499	6.27	11.00	1.88	17.27	8.15	60.00	50.00	-42.73	-41.85

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

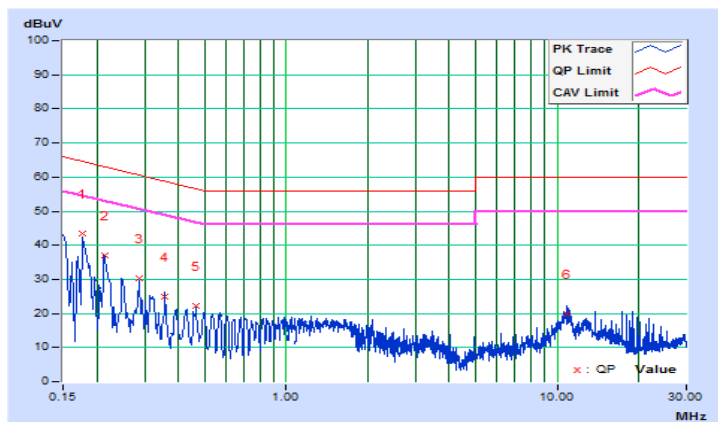


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Jisyong Wang	Test Date	2019/4/29

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	0.17698	0.26	43.19	15.05	43.45	15.31	64.63	54.63	-21.18	-39.32
2	0.21282	0.24	36.78	15.22	37.02	15.46	63.09	53.09	-26.07	-37.63
3	0.28685	0.24	30.15	11.38	30.39	11.62	60.62	50.62	-30.23	-39.00
4	0.35723	0.24	24.67	11.61	24.91	11.85	58.79	48.79	-33.88	-36.94
5	0.46280	0.24	21.84	5.23	22.08	5.47	56.64	46.64	-34.56	-41.17
6	10.81648	3.44	16.48	1.27	19.92	4.71	60.00	50.00	-40.08	-45.29

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

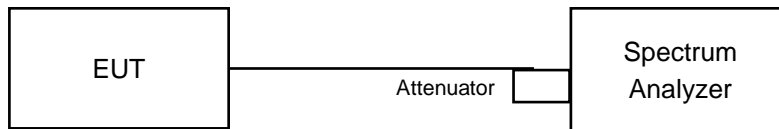


4.3 6 dB Bandwidth Measurement

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

- a. Set resolution bandwidth (RBW) = 100 kHz
- b. Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. 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)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	10.10	0.5	Pass
6	2437	10.03	0.5	Pass
11	2462	10.03	0.5	Pass

802.11g

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	16.34	0.5	Pass
6	2437	16.36	0.5	Pass
11	2462	16.36	0.5	Pass

802.11n (HT20)

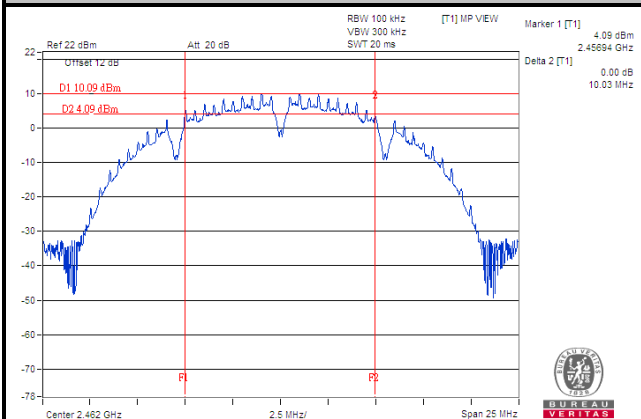
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	17.59	17.62	0.5	Pass
6	2437	17.60	17.62	0.5	Pass
11	2462	17.60	17.62	0.5	Pass

802.11n (HT40)

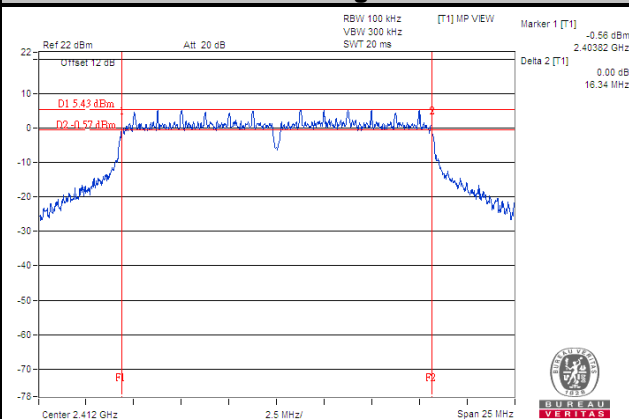
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	36.38	36.40	0.5	Pass
6	2437	36.34	36.39	0.5	Pass
9	2452	36.36	36.40	0.5	Pass

Spectrum Plot of Worst Value

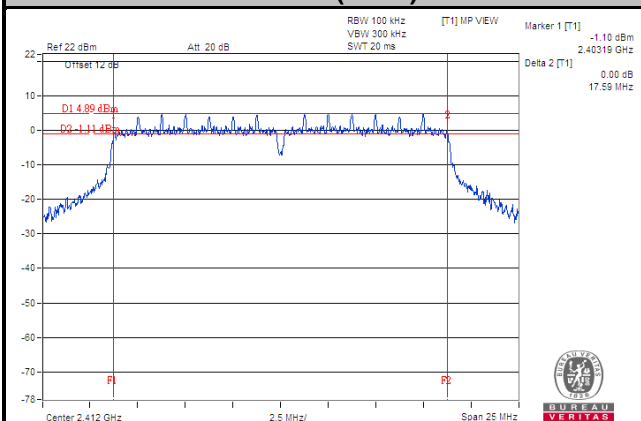
802.11b



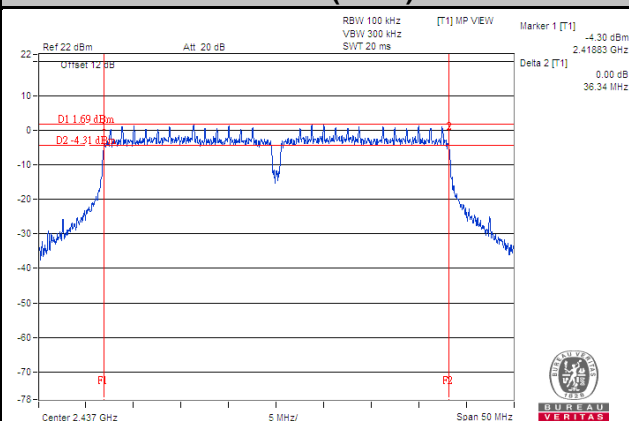
802.11g



802.11n (HT20)

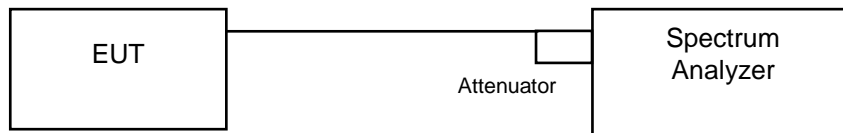


802.11n (HT40)



4.4 Occupied Bandwidth Measurement

4.4.1 Test Setup



4.4.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

4.4.4 Deviation from Test Standard

No deviation.

4.4.5 EUT Operating Conditions

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

4.4.6 Test Results

802.11b

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	Pass / Fail
1	2412	15.18	Pass
6	2437	15.00	Pass
11	2462	15.00	Pass

802.11g

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	Pass / Fail
1	2412	16.98	Pass
6	2437	17.64	Pass
11	2462	17.04	Pass

802.11n (HT20)

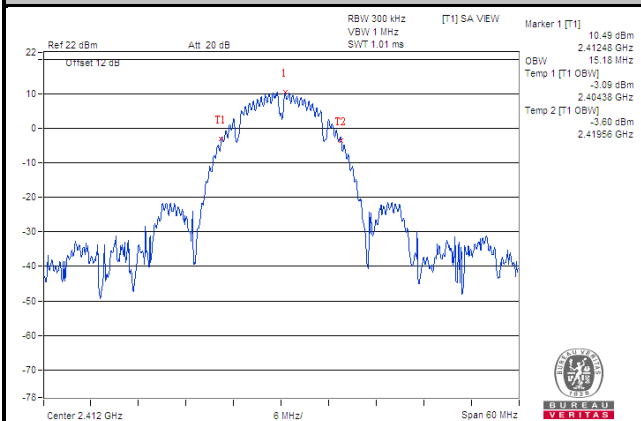
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	18.06	17.88	Pass
6	2437	18.48	18.12	Pass
11	2462	18.06	18.00	Pass

802.11n (HT40)

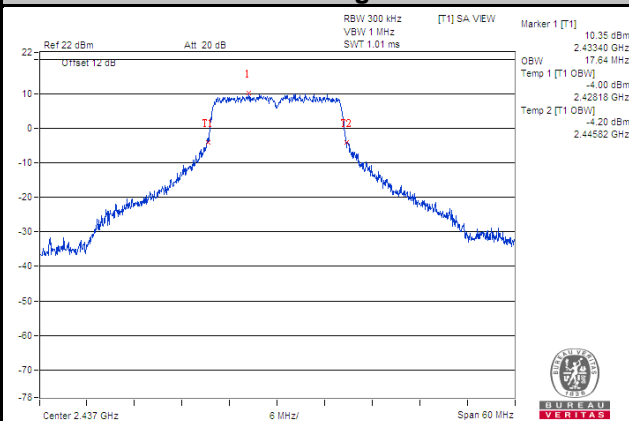
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
3	2422	36.78	36.60	Pass
6	2437	36.72	36.66	Pass
9	2452	36.78	36.66	Pass

Spectrum Plot of Worst Value

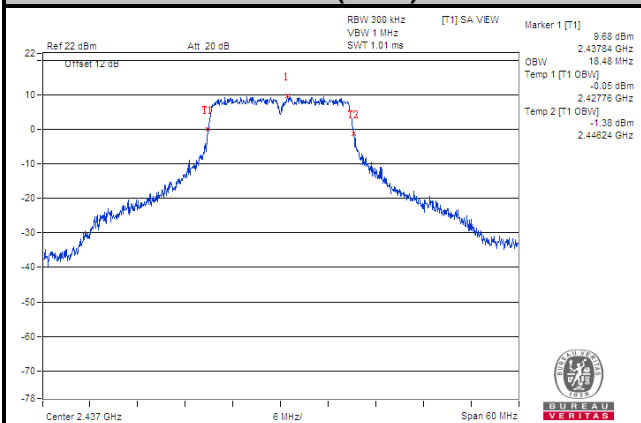
802.11b



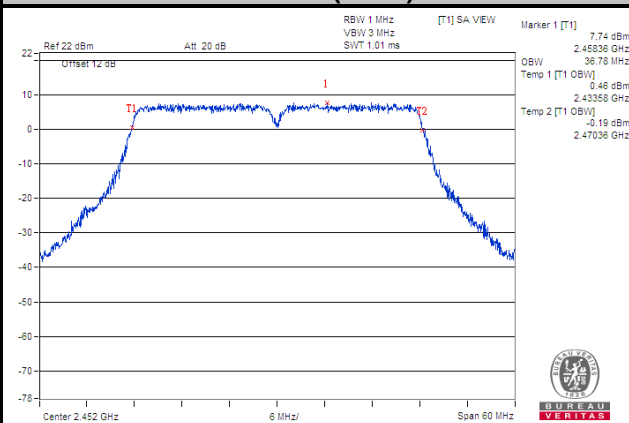
802.11g



802.11n (HT20)



802.11n (HT40)



4.5 Conducted Output Power Measurement

4.5.1 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,

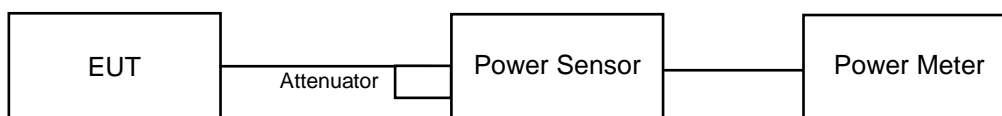
Array Gain = 0 dB (i.e., no array gain) for NANT \leq 4;

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

Array Gain = $5 \log(\text{NANT}/\text{NSS})$ 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 = $10 \log(\text{NANT}/\text{NSS})$ dB.

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 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.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

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

4.5.7 Test Results

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	109.901	20.41	30	Pass
6	2437	110.662	20.44	30	Pass
11	2462	108.893	20.37	30	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	118.032	20.72	30	Pass
6	2437	247.742	23.94	30	Pass
11	2462	153.109	21.85	30	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.32	20.26	213.817	23.30	30	Pass
6	2437	23.11	23.20	413.574	26.17	30	Pass
11	2462	20.40	20.32	217.295	23.37	30	Pass

802.11n (HT40)

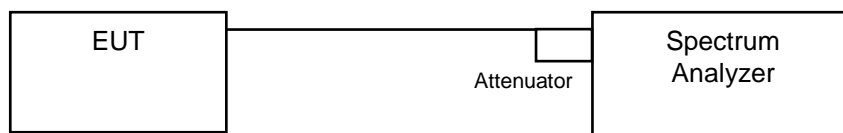
Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	17.85	17.75	120.52	20.81	30	Pass
6	2437	20.78	20.76	238.798	23.78	30	Pass
9	2452	18.41	18.35	137.734	21.39	30	Pass

4.6 Power Spectral Density Measurement

4.6.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8 dBm.

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

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

4.6.5 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

802.11b

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
1	2412	-3.37	8	Pass
6	2437	-3.42	8	Pass
11	2462	-3.42	8	Pass

802.11g

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
1	2412	-8.70	8	Pass
6	2437	-5.79	8	Pass
11	2462	-7.65	8	Pass

802.11n (HT20)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-9.48	3.01	-6.47	8	Pass
	6	2437	-6.17	3.01	-3.16	8	Pass
	11	2462	-9.74	3.01	-6.73	8	Pass
1	1	2412	-8.99	3.01	-5.98	8	Pass
	6	2437	-6.03	3.01	-3.02	8	Pass
	11	2462	-9.10	3.01	-6.09	8	Pass

NOTE:

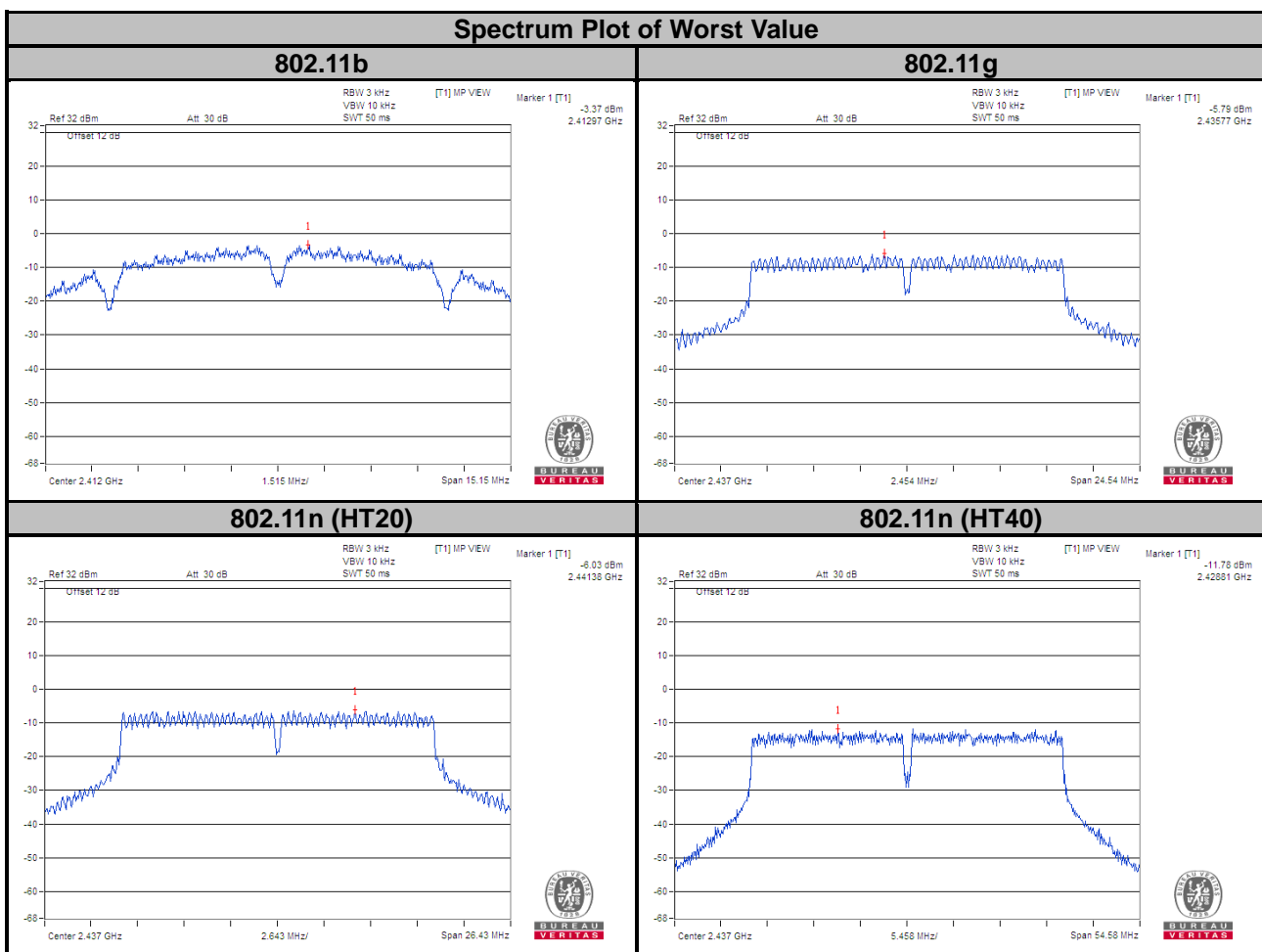
1. Directional gain = $0.38 \text{ dBi} + 10\log(2) = 3.39 \text{ dBi} < 6 \text{ dBi}$, so the limit no need to be reduced.
2. Method E) 2) c) of power density measurement of KDB 662911 is using for calculating total power density.

802.11n (HT40)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	3	2422	-15.08	3.01	-12.07	8	Pass
	6	2437	-12.23	3.01	-9.22	8	Pass
	9	2452	-13.83	3.01	-10.82	8	Pass
1	3	2422	-14.71	3.01	-11.70	8	Pass
	6	2437	-11.78	3.01	-8.77	8	Pass
	9	2452	-13.55	3.01	-10.54	8	Pass

NOTE:

1. Directional gain = $0.38 \text{ dBi} + 10\log(2) = 3.39 \text{ dBi} < 6 \text{ dBi}$, so the limit no need to be reduced.
2. Method E) 2) c) of power density measurement of KDB 662911 is using for calculating total power density.

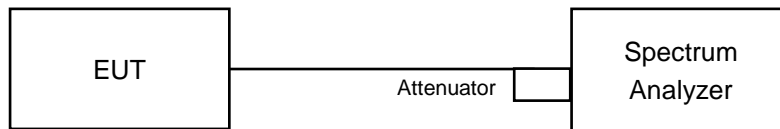


4.7 Conducted Out of Band Emission Measurement

4.7.1 Limits of Conducted Out of Band Emission Measurement

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

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 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.

4.7.5 Deviation from Test Standard

No deviation.

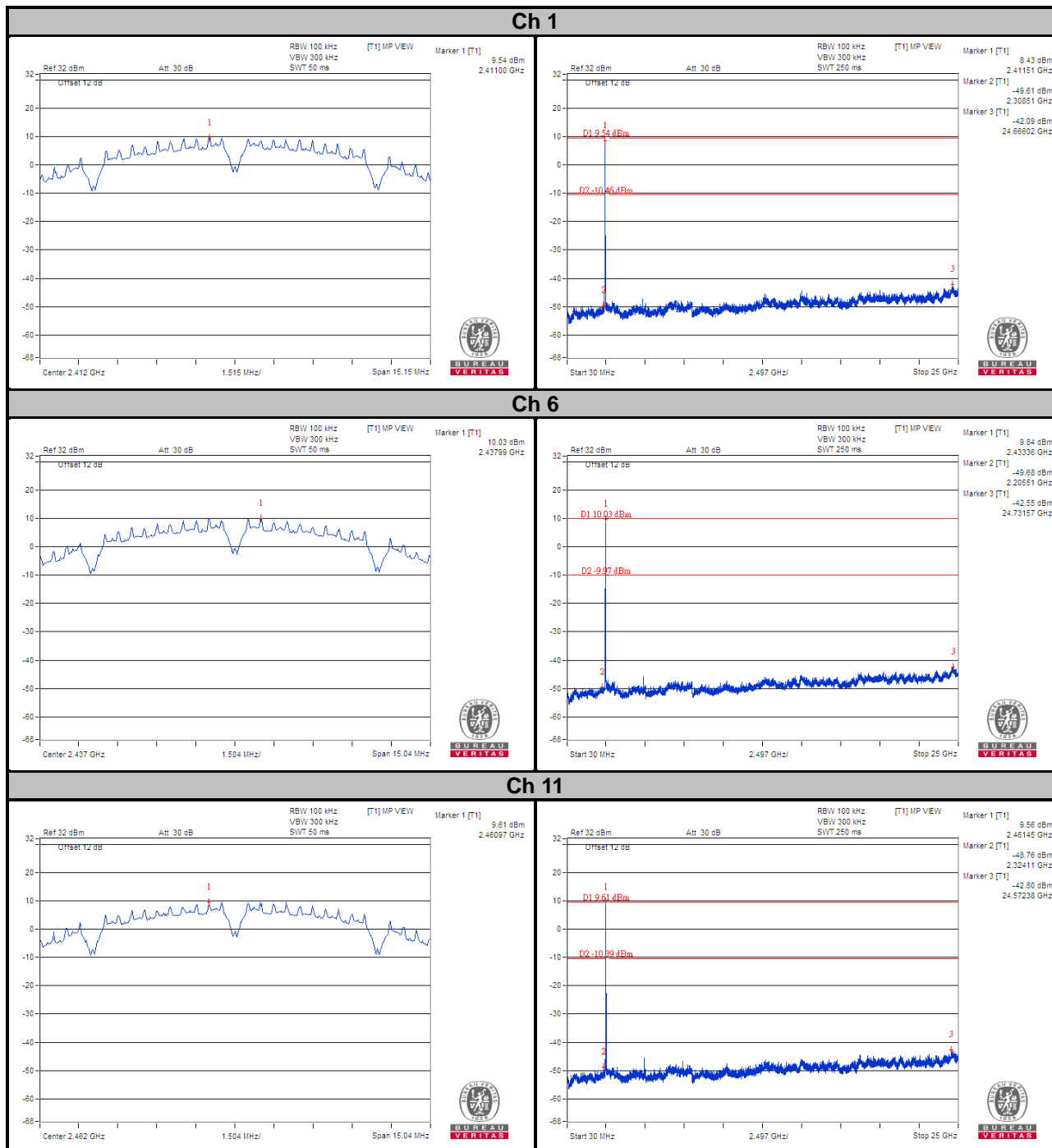
4.7.6 EUT Operating Condition

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

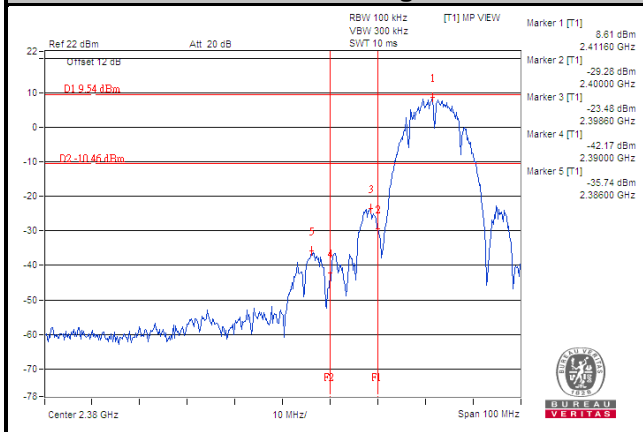
4.7.7 Test Results

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.

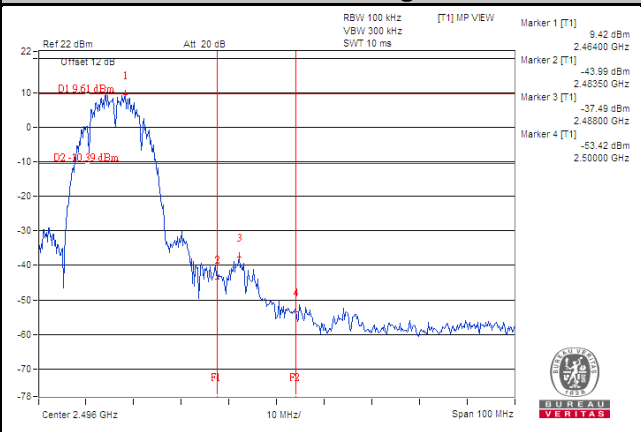
802.11b



Ch 1 Band Edge

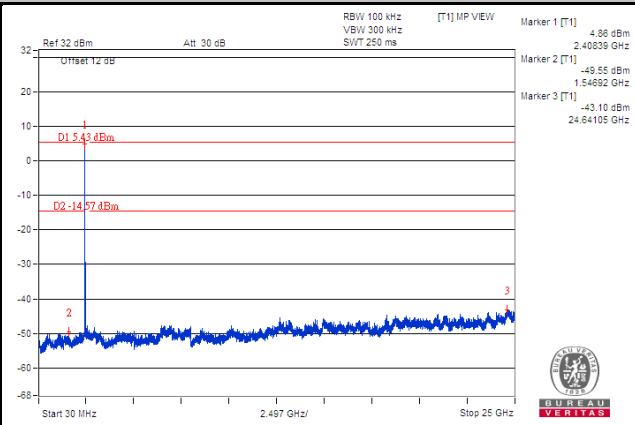
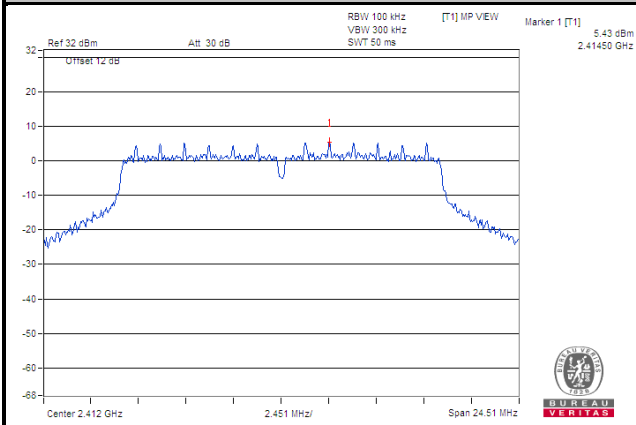


Ch 11 Band Edge

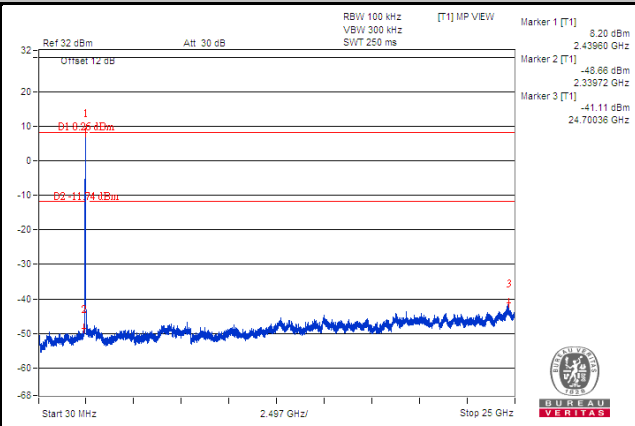
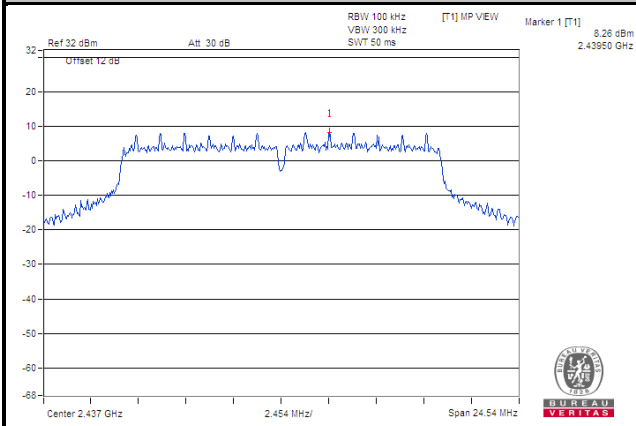


802.11g

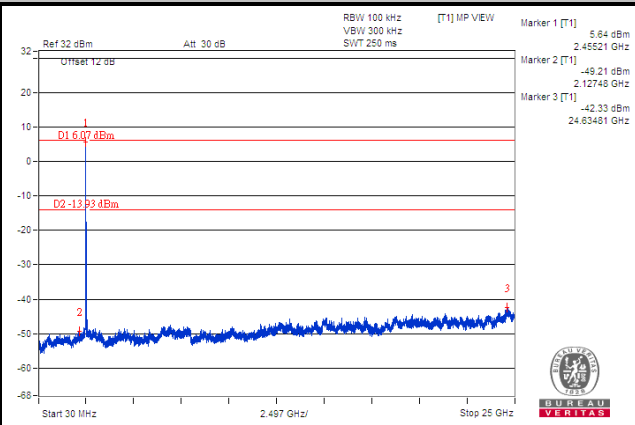
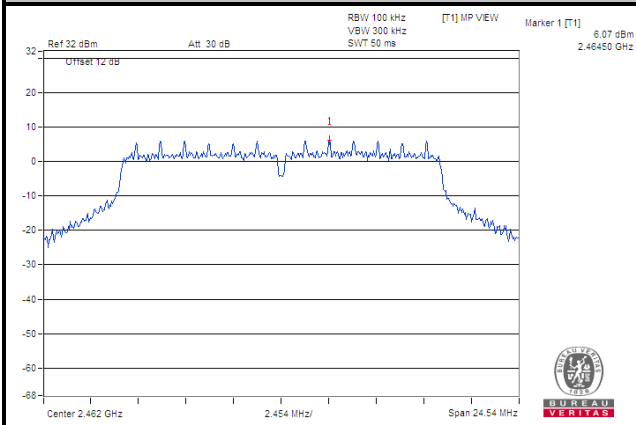
Ch 1



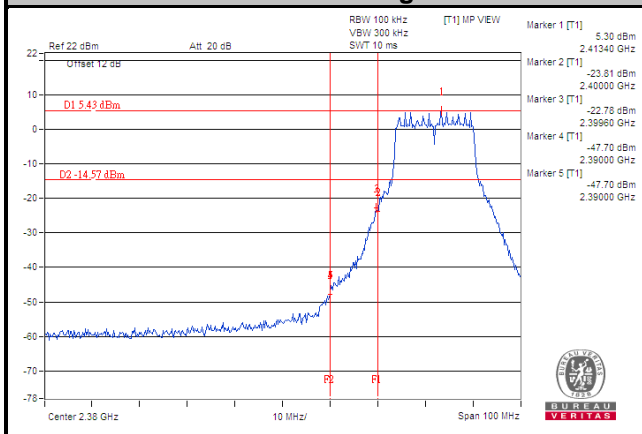
Ch 6



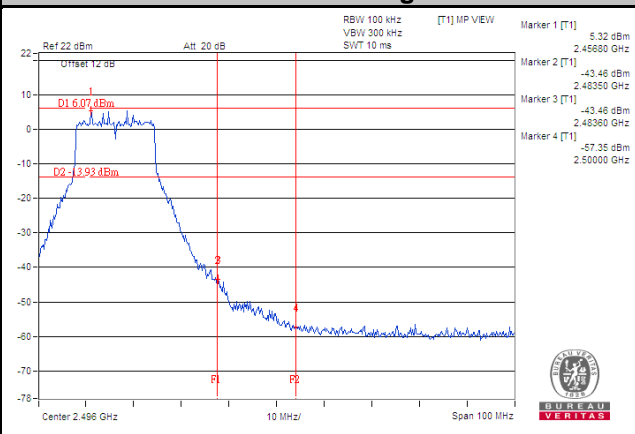
Ch 11



Ch 1 Band Edge

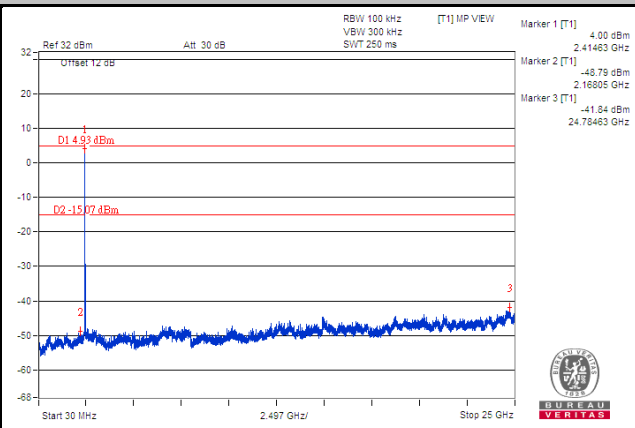
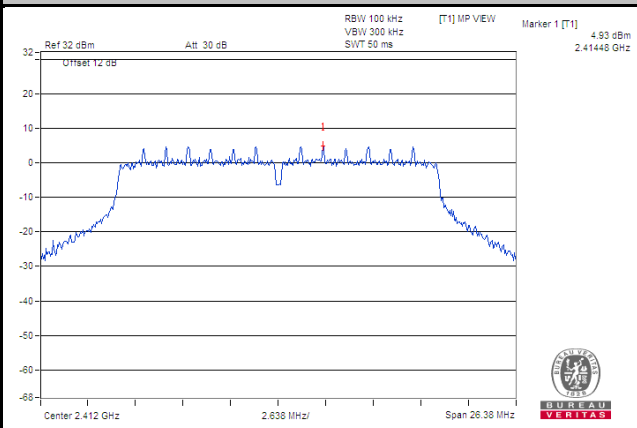


Ch 11 Band Edge

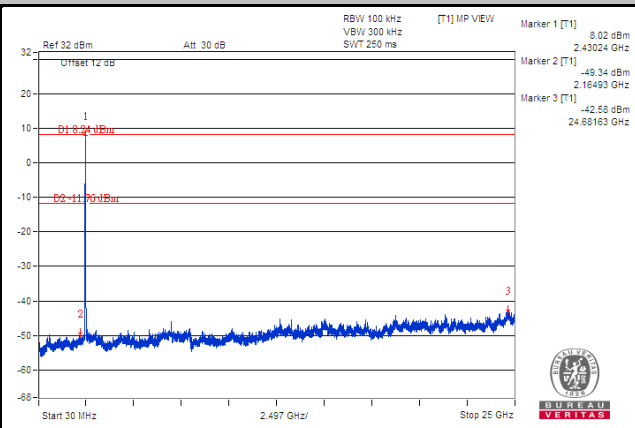
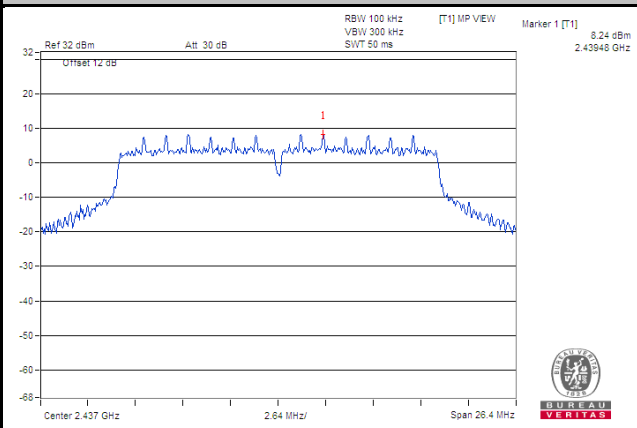


802.11n (HT20)
CHAIN 0

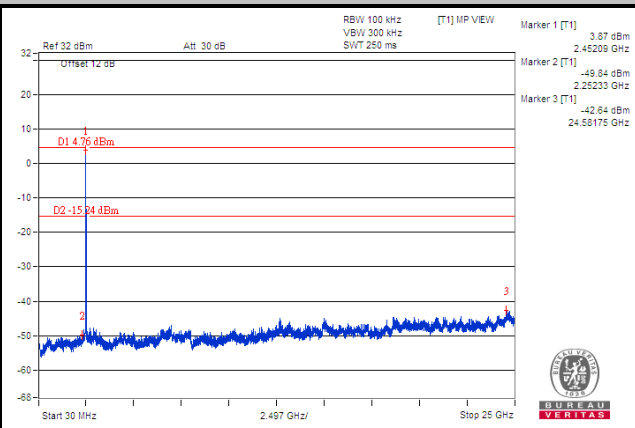
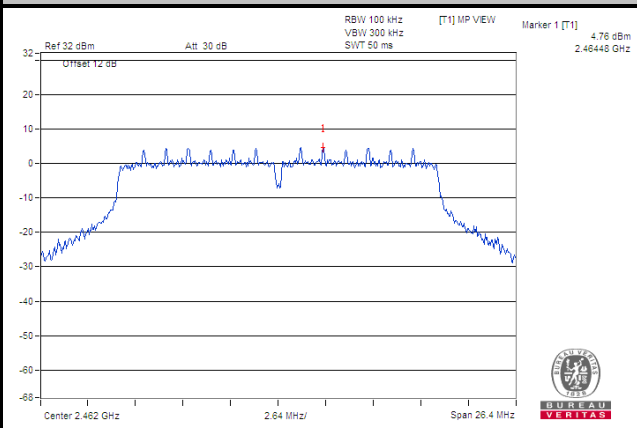
Ch 1



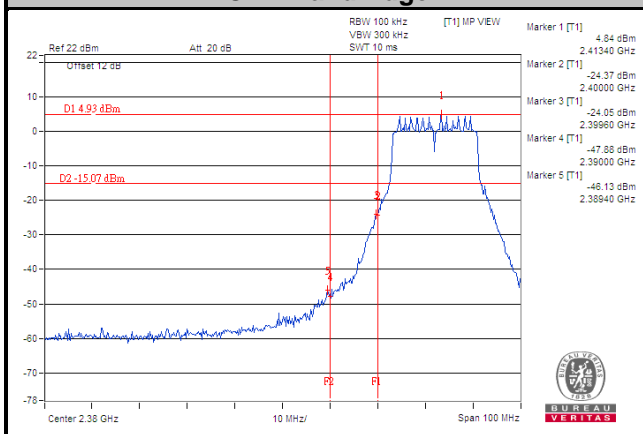
Ch 6



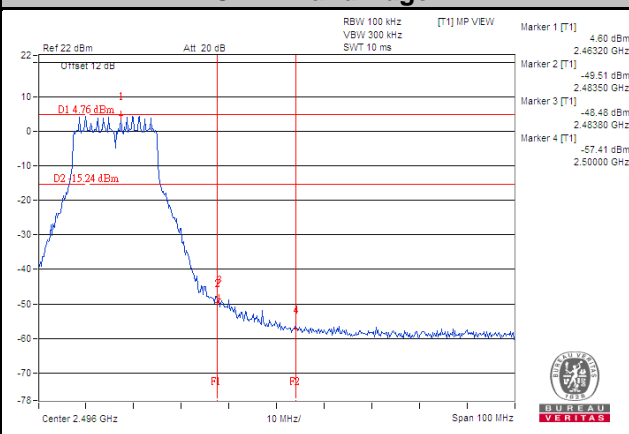
Ch 11



Ch 1 Band Edge

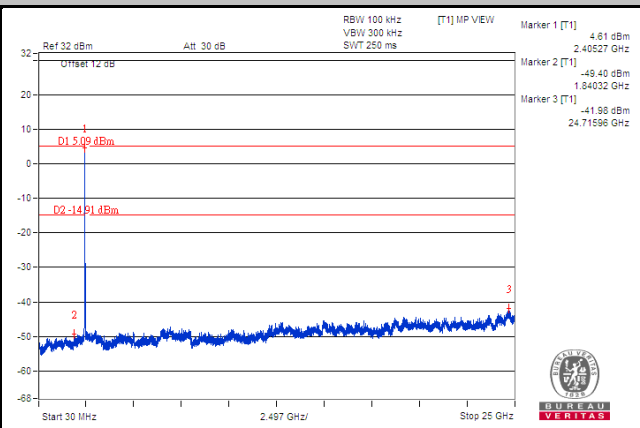
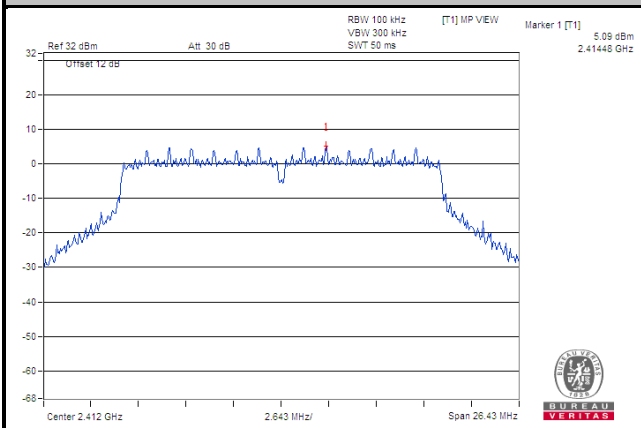


Ch 11 Band Edge

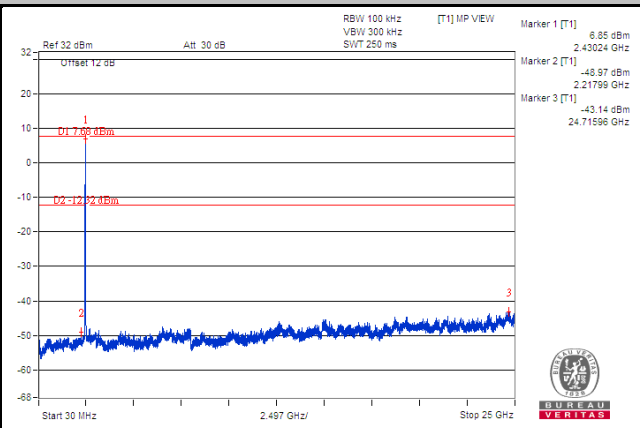
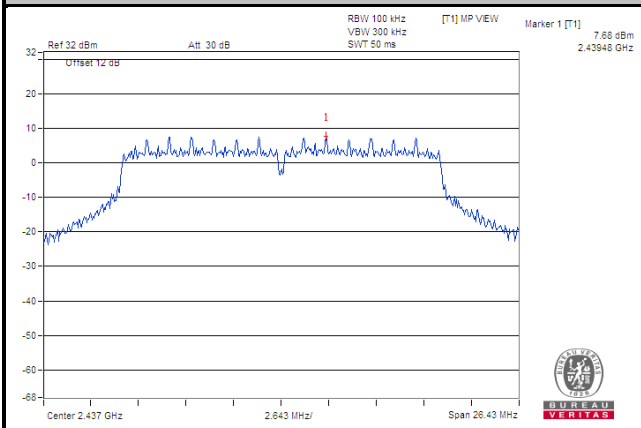


CHAIN 1

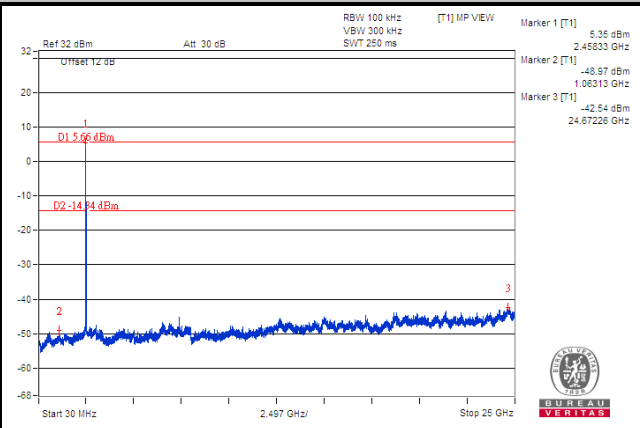
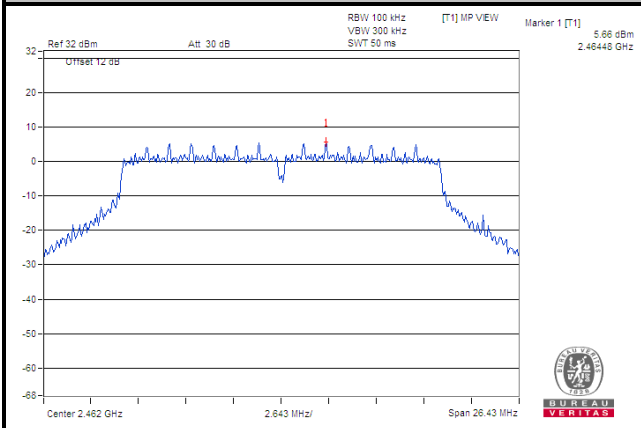
Ch 1



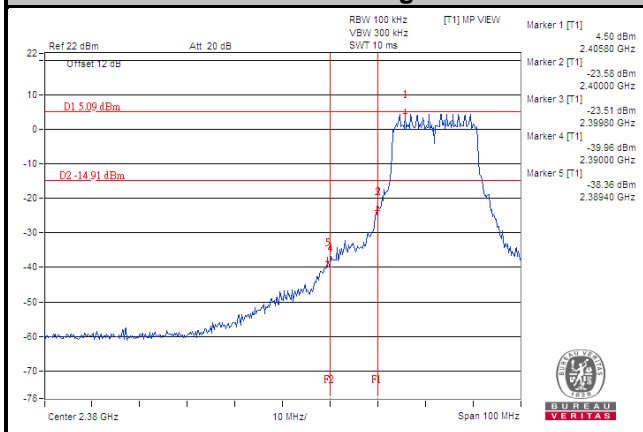
Ch 6



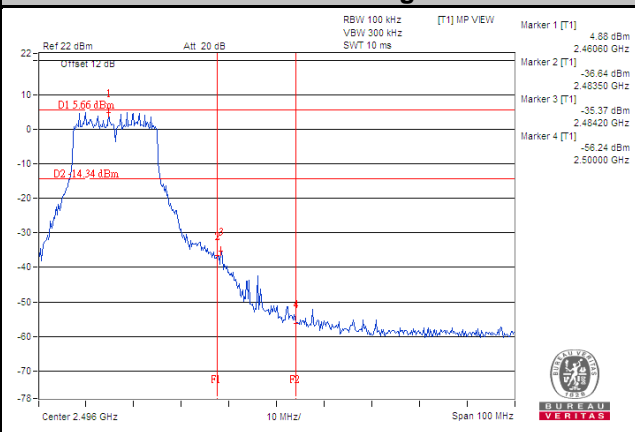
Ch 11



Ch 1 Band Edge

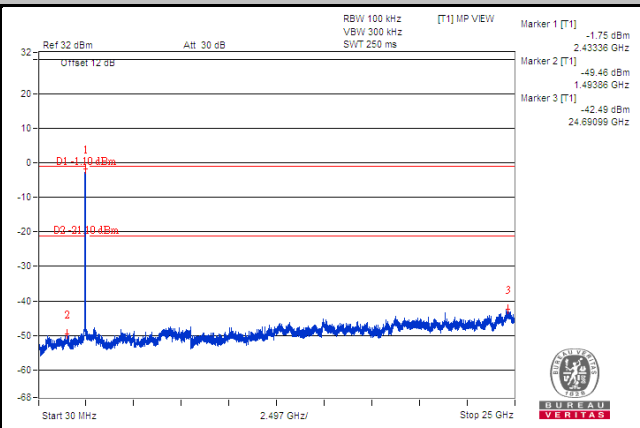
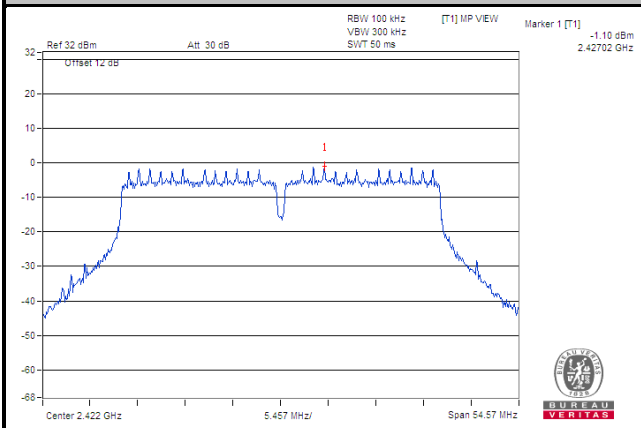


Ch 11 Band Edge

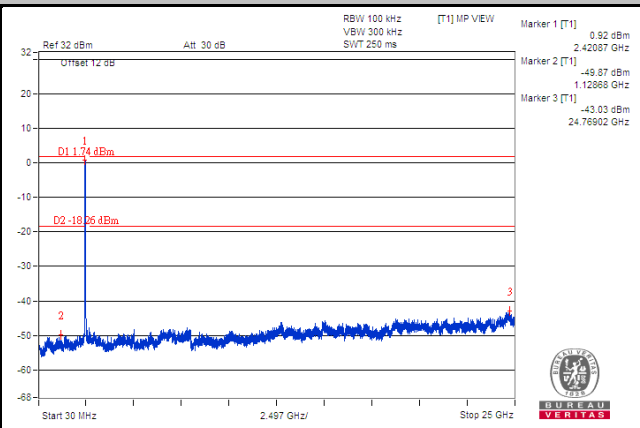
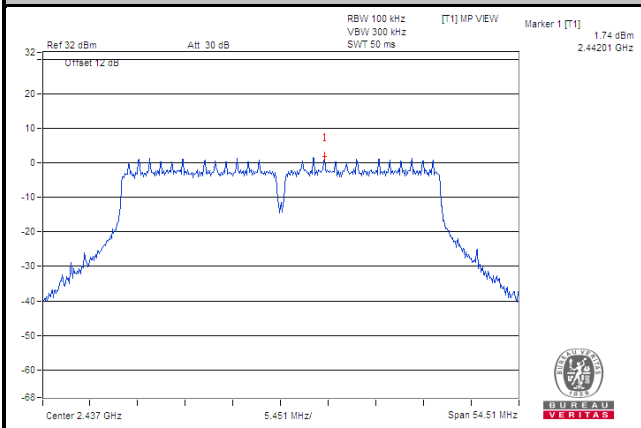


802.11n (HT40)
CHAIN 0

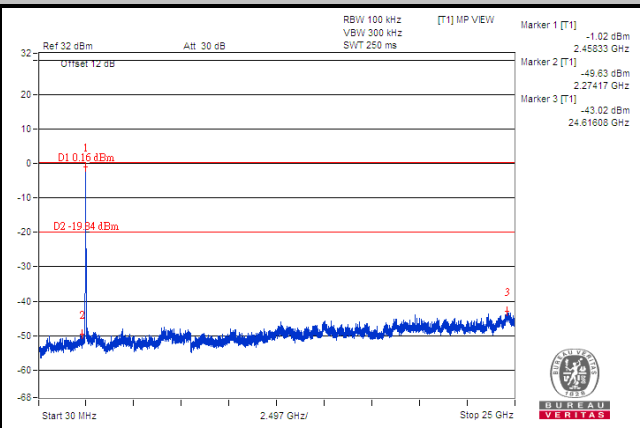
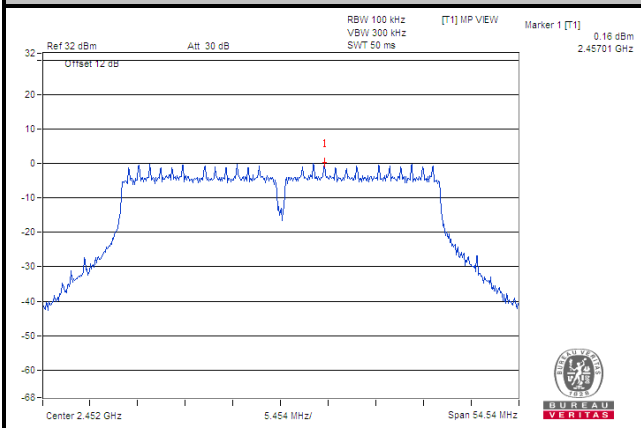
Ch 3



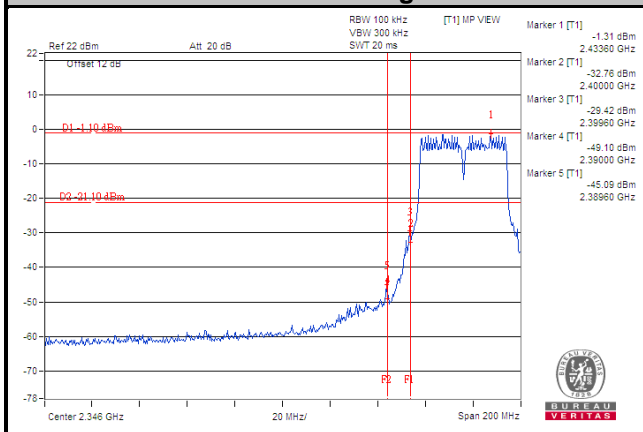
Ch 6



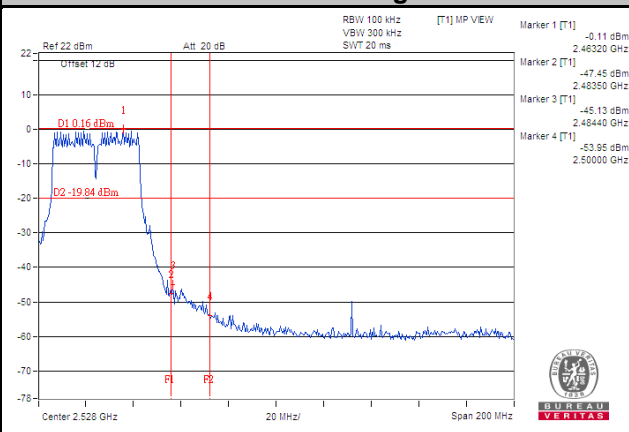
Ch 9



Ch 3 Band Edge

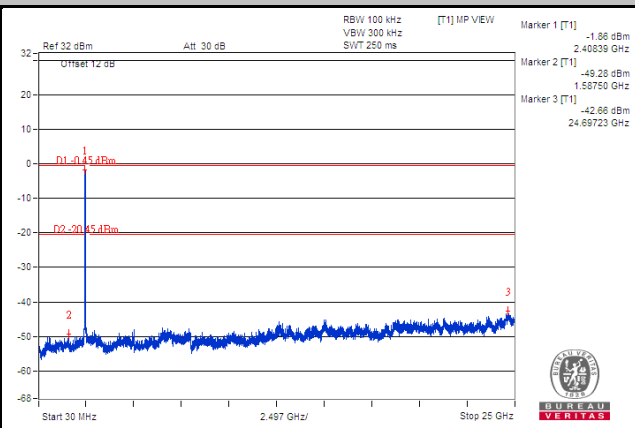
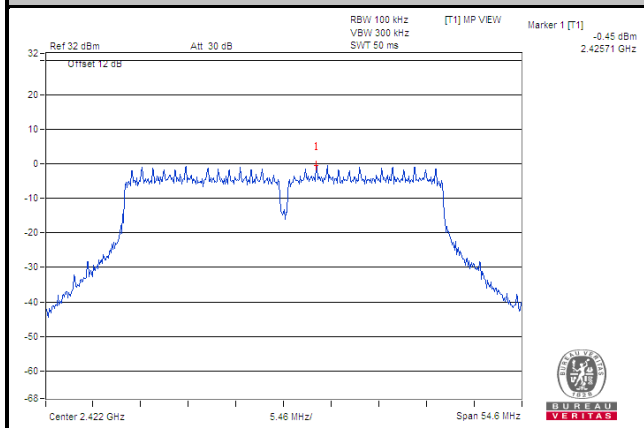


Ch 9 Band Edge

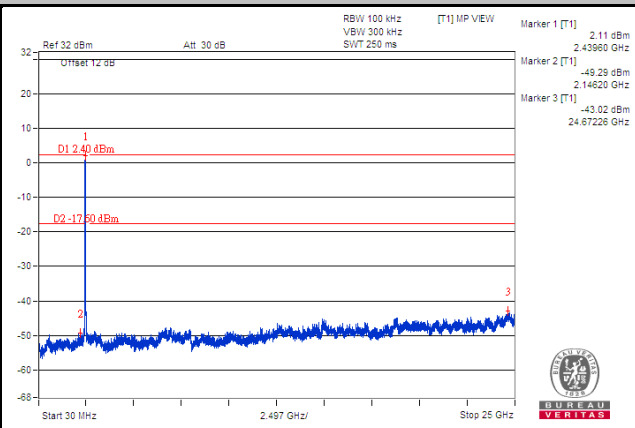
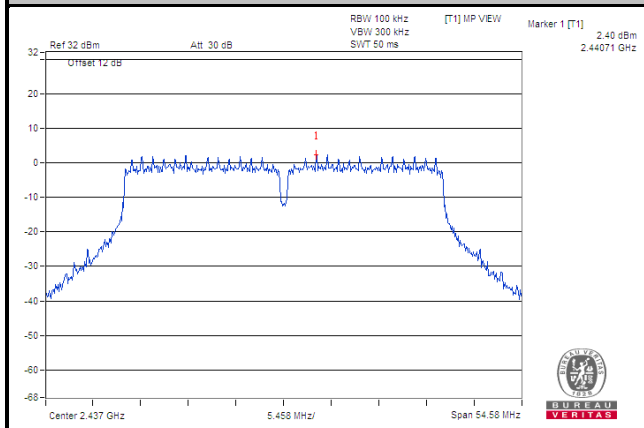


CHAIN 1

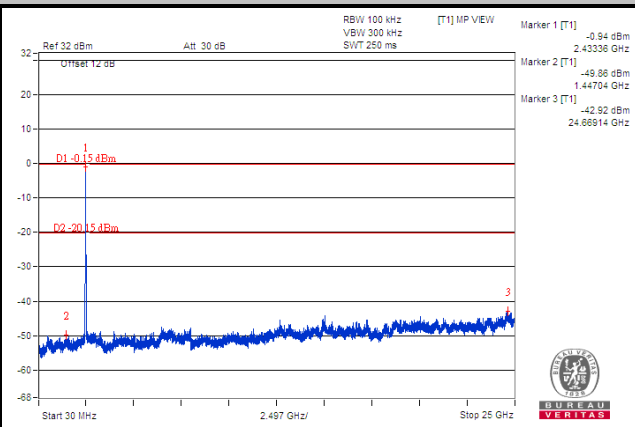
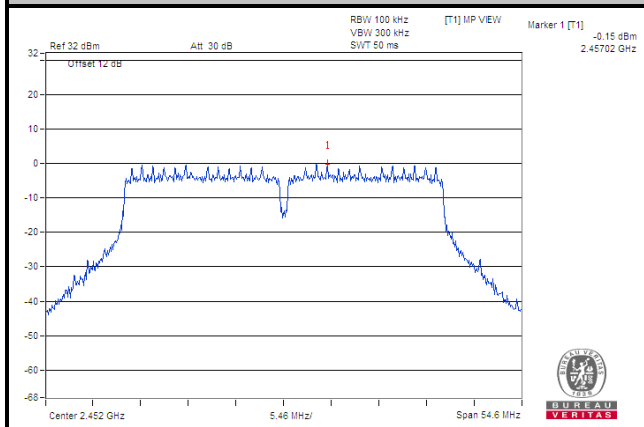
Ch 3



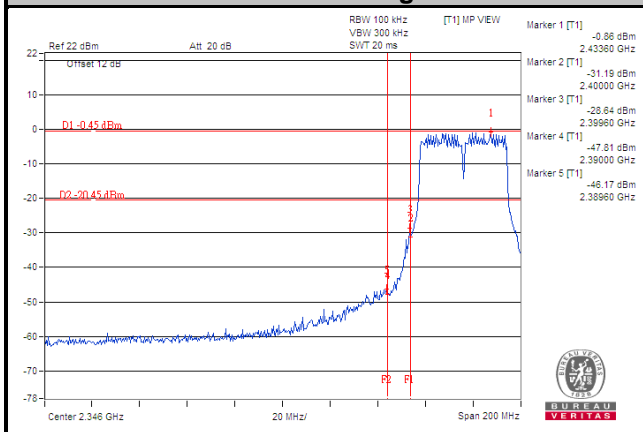
Ch 6



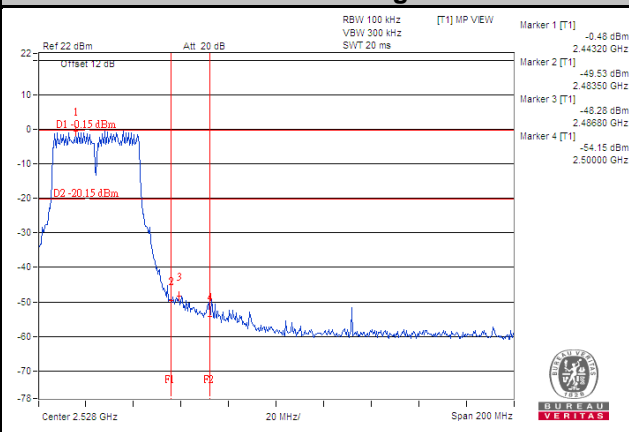
Ch 9



Ch 3 Band Edge



Ch 9 Band Edge



5 Pictures of Test Arrangements

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

Appendix – Information of 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 FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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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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