FCC Test Report

Report No.: RF191111C27-2

FCC ID: QYLWCN3990Z

Test Model: ZX70

Received Date: Nov. 11, 2019

Test Date: Nov. 24, 2019 ~ Jan. 21, 2020

Issued Date: Feb. 05, 2020

Applicant: Getac Technology Corporation

Address: 5F., Building A, No. 209, Sec.1, Nangang Rd.,Nangang Dist., Taipei City 11568, Taiwan, R.O.C.

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

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

Test Location (1): No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan

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

FCC Registration / Designation Number: 788550 / TW0003
427177 / TW0011

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Release Control Record

Issue No.	Description	Date Issued
RF191111C27-2	Original Release	Feb. 05, 2020

1 Certificate of Conformity

Product: Tablet

Brand: Getac

Test Model: ZX70

Sample Status: Mass product

Applicant: Getac Technology Corporation

Test Date: Nov. 24, 2019 ~ Jan. 21, 2020

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 RF characteristics under the conditions specified in this report.

Prepared by : Lena Wang , **Date:** Feb. 05, 2020

Lena Wang / Specialist

Approved by : Dylan Chiou , **Date:** Feb. 05, 2020

Dylan Chiou / Senior 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 -9.40 dB at 0.59000 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 2483.56 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	Antenna connector is i-pex (MHF).

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	2.79 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	Tablet
Brand	Getac
Test Model	ZX70
Status of EUT	Mass product
Power Supply Rating	3.8 Vdc (Battery) 12.0 Vdc (Adapter)
Modulation Type	CCK, DQPSK, DBPSK for DSSS 256QAM, 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 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	111.543 mW
Antenna Type	Refer to Note as below
Antenna Connector	Refer to Note as below
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

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

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

2. The antenna information is listed as below.

Antenna Type	Manufacturer	Model	Antenna Connector	Antenna Gain				
				WLAN 2.4 GHz	WLAN 5.15~5.25 GHz	WLAN 5.25~5.35 GHz	WLAN 5.47~5.725 GHz	WLAN 5.725~5.875 GHz
PIFA	SINBON	Main Ant/Ant0 :ZX70 WIFI	POGO pin	1.18	3.91	4.78	3.98	2.01
Dipole	Pulse	Aux Ant /Ant1 :422144300002	i-pex(MHF)	3.75	6.28	6.31	5.07	4.1

3. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter + Plugs	FSP	FSP025-DHAN3	I/P: 100-240 Vac, 50-60 Hz, 1.0 A O/P: 12 Vdc, Max. 25 W
Battery	Getac	BP1S2P4240L	3.8 Vdc, 8220 mAh
CPU	Qualcomm	SDA660	692 PIN
Storage	Samsung	KMDH6001DA-B422	64GB
WWAN Module	Sierra	EM7455	--
WiFi/BT Chip on board	Qualcomm	WCN3990	802.11 ac/ BT5.0 2x2 support
Front Camera	Truly	COD865-B8BF-E	8 MP, Fix Focus
Rear Camera	Truly	COD898-B12BA-E	12 MP, Auto focus
GPS	Locosys	MC-1010G	--
LCD	Truly	TDO-HD0698K61701	7" HD 720 x 1280
Barcode Reader	Honeywell	N6603	--
HF RFID Module	NXP	NQ310	--

4. 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≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥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)
-	802.11n (HT20)	1 to 11	11	OFDM	BPSK	6.5

Power Line Conducted Emission Test:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11n (HT20)	1 to 11	11	OFDM	BPSK	6.5

Bandedge Measurement:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5
-	802.11n (HT40)	3 to 9	3, 6, 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	3.8 Vdc	Gavin Wu

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is ≥ 98 %, duty factor is not required.

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

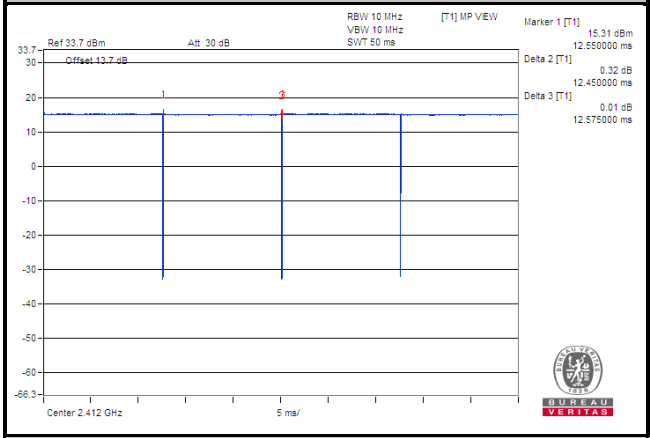
802.11b: Duty cycle = 12.45/12.57 = 0.99, Duty factor = 10 * log(1/0.99) = 0.04

802.11g: Duty cycle = 2.06/2.157 = 0.955, Duty factor = 10 * log(1/0.955) = 0.2

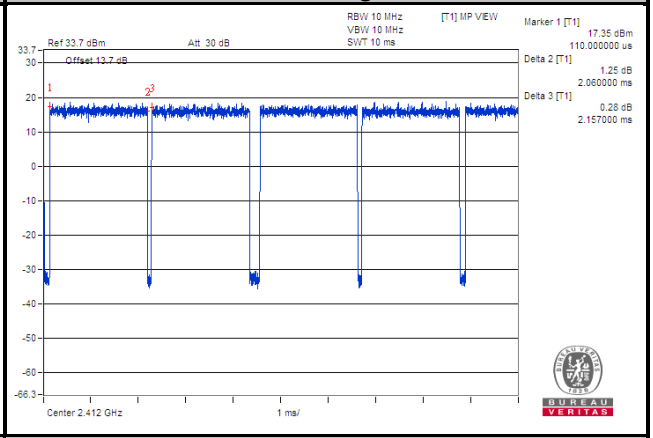
802.11n (HT20): Duty cycle = 0.981/1.079 = 0.909, Duty factor = 10 * log(1/0.909) = 0.41

802.11n (HT40): Duty cycle = 0.493/0.602 = 0.819, Duty factor = 10 * log(1/0.819) = 0.87

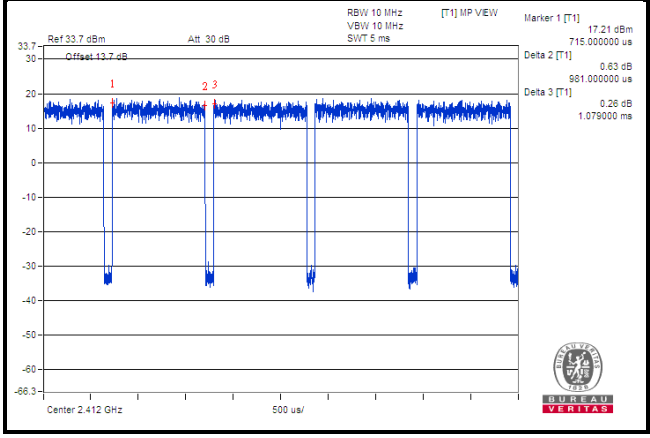
802.11b



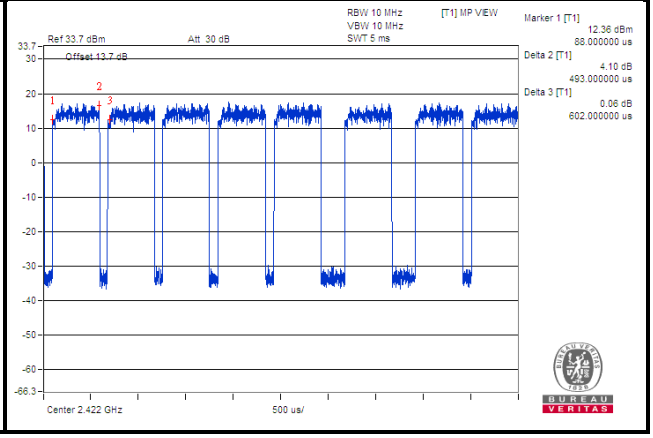
802.11g



802.11n (HT20)

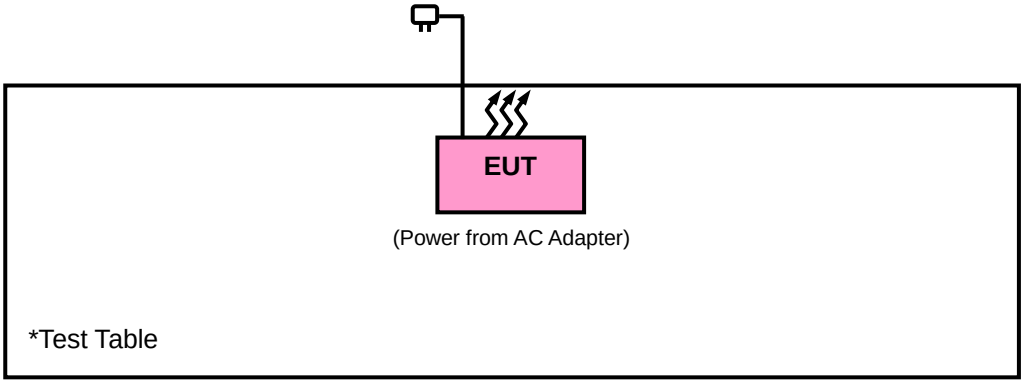


802.11n (HT40)



3.4 Description of Support Units

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and References

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

Test Standard:

FCC Part 15, Subpart C (15.247)
ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 Meas Guidance v05r02
KDB 662911 D01 Multiple Transmitter Output v02r01

All test items have been performed as a reference to the above KDB test guidance.

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	MY52260177	Aug. 26, 2019	Aug. 25, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 15, 2019	Apr. 14, 2020
HORN Antenna ETS-Lindgren	3117	00143293	Nov. 24, 2019	Nov. 23, 2020
BILOG Antenna SCHWARZBECK	VULB 9168	9168-616	Nov. 12, 2019	Nov. 11, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Nov. 24, 2019	Nov. 23, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020
Loop Antenna	EM-6879	269	Sep. 16, 2019	Sep. 15, 2020
Preamplifier Agilent	310N	187226	Jun. 18, 2019	Jun. 17, 2020
Preamplifier Agilent	83017A	MY39501357	Jun. 18, 2019	Jun. 17, 2020
Power Meter Anritsu	ML2495A	1012010	Sep. 04, 2019	Sep. 03, 2020
Power Sensor Anritsu	MA2411B	1315050	Sep. 04, 2019	Sep. 03, 2020
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(RFC-SMS-100-SMS-120+RFC-SMS-100-SMS-400)	Jun. 18, 2019	Jun. 17, 2020
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(RFC-SMS-100-SMS-24)	Jun. 18, 2019	Jun. 17, 2020
Preamplifier Agilent	310N	187226	Jun. 18, 2019	Jun. 17, 2020
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.

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:

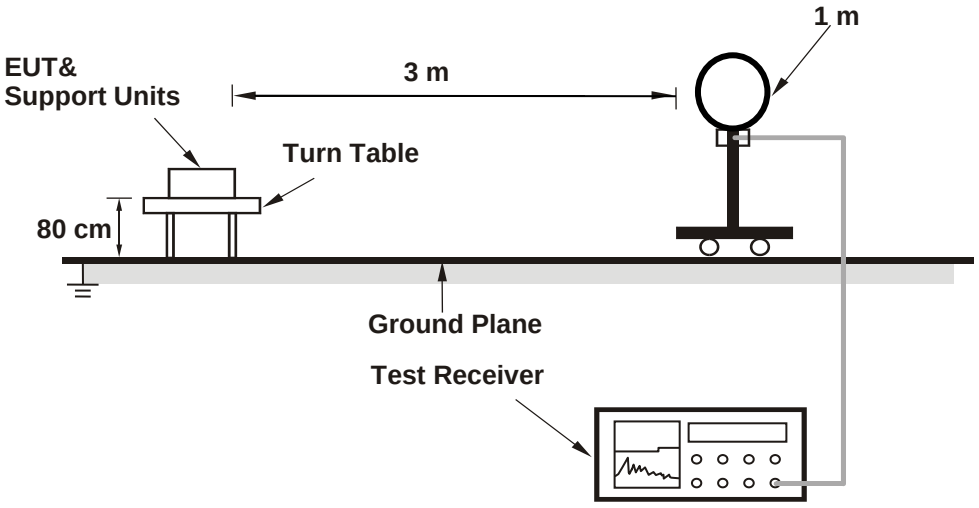
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 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>



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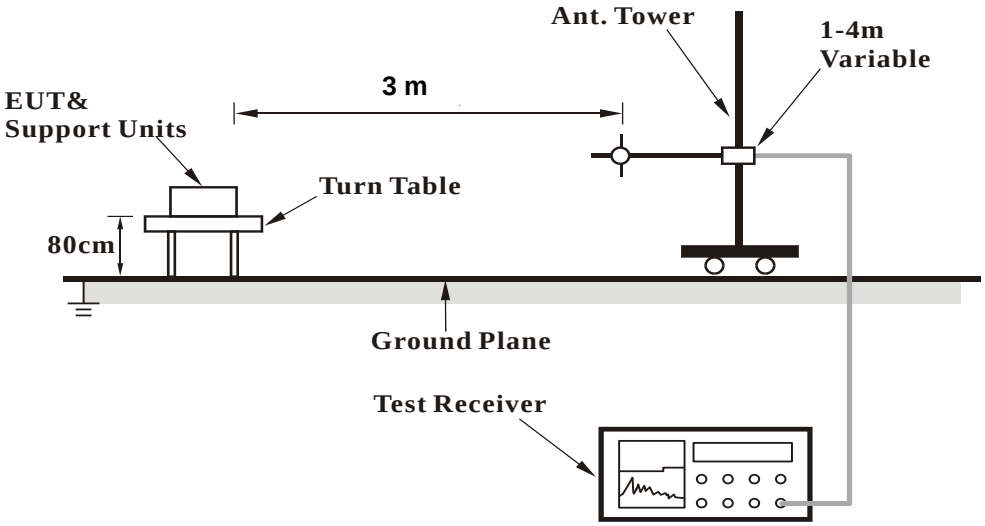

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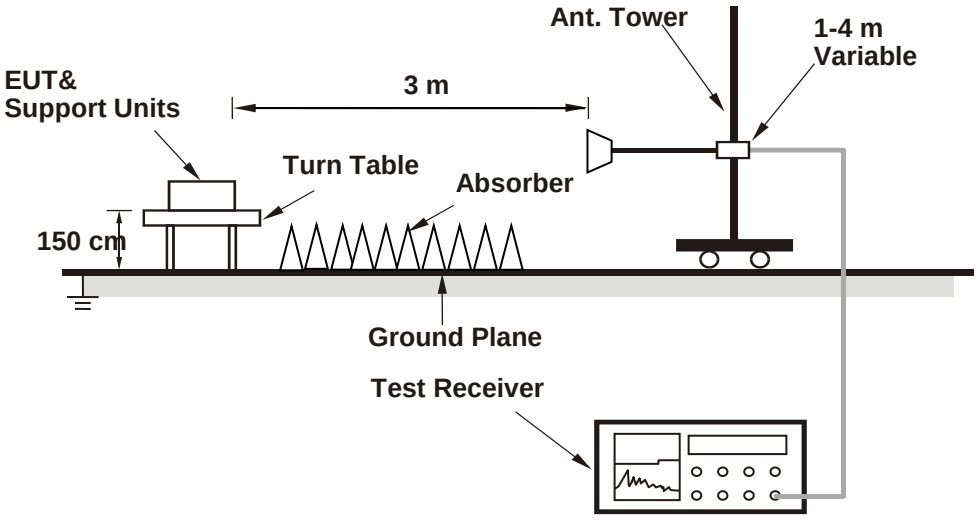


For the actual test configuration, please refer to the attached file (Test Setup Photo).

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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2388.84	42.06	37.57	4.49	54	-11.94	335	300	Average
2388.84	51.01	46.52	4.49	74	-22.99	335	300	Peak
2412	107.13	102.58	4.55			335	300	Average
2412	109.46	104.91	4.55			335	300	Peak
4824	48.01	37.72	10.29	54	-5.99	152	194	Average
4824	53.21	42.92	10.29	74	-20.79	152	194	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2388.66	47.64	43.15	4.49	54	-6.36	100	29	Average
2388.66	53.97	49.48	4.49	74	-20.03	100	29	Peak
2412	113.4	108.85	4.55			130	262	Average
2412	115.89	111.34	4.55			130	262	Peak
4824	52.76	42.47	10.29	54	-1.24	192	218	Average
4824	56.35	46.06	10.29	74	-17.65	192	218	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 2412 MHz: Fundamental frequency.
3. 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2386.05	41.56	37.07	4.49	54	-12.44	335	304	Average
2386.05	51.85	47.36	4.49	74	-22.15	335	304	Peak
2437	108.63	104.04	4.59			335	304	Average
2437	110.72	106.13	4.59			335	304	Peak
2484.04	42.08	37.42	4.66	54	-11.92	335	304	Average
2484.04	52.46	47.8	4.66	74	-21.54	335	304	Peak
4874	43.43	33.22	10.21	54	-10.57	123	48	Average
4874	49.86	39.65	10.21	74	-24.14	123	48	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.74	42.93	38.44	4.49	54	-11.07	126	263	Average
2389.74	54.74	50.25	4.49	74	-19.26	126	263	Peak
2437	115.06	110.47	4.59			126	263	Average
2437	117.23	112.64	4.59			126	263	Peak
2487.24	43.83	39.17	4.66	54	-10.17	126	263	Average
2487.24	60.41	55.75	4.66	74	-13.59	126	263	Peak
4874	45.38	35.17	10.21	54	-8.62	192	220	Average
4874	51.25	41.04	10.21	74	-22.75	192	220	Peak

Remarks:

1. Emission Level = Read Level + 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	104.59	99.97	4.62			335	304	Average
2462	107.18	102.56	4.62			335	304	Peak
2486.52	42.84	38.18	4.66	54	-11.16	335	304	Average
2486.52	52.62	47.96	4.66	74	-21.38	335	304	Peak
4924	42.11	31.86	10.25	54	-11.89	112	49	Average
4924	48.33	38.08	10.25	74	-25.67	112	49	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	110.82	106.2	4.62			125	252	Average
2462	113.5	108.88	4.62			125	252	Peak
2486.76	52.82	48.16	4.66	54	-1.18	121	252	Average
2486.76	58.09	53.43	4.66	74	-15.91	121	252	Peak
4924	42.63	32.38	10.25	54	-11.37	194	201	Average
4924	48.96	38.71	10.25	74	-25.04	194	201	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 2462 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

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**	Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.92	45.83	41.33	4.5	54	-8.17	335	304	Average
2389.92	56.29	51.79	4.5	74	-17.71	335	304	Peak
2412	98.7	94.15	4.55			335	304	Average
2412	105.83	101.28	4.55			335	304	Peak
4824	42.51	32.22	10.29	54	-11.49	132	97	Average
4824	48.79	38.5	10.29	74	-25.21	132	97	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.92	52.51	48.01	4.5	54	-1.49	108	262	Average
2389.92	63.15	58.65	4.5	74	-10.85	108	262	Peak
2412	105.18	100.63	4.55			130	262	Average
2412	112.18	107.63	4.55			130	262	Peak
4824	41.82	31.53	10.29	54	-12.18	169	235	Average
4824	48.1	37.81	10.29	74	-25.9	169	235	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 2412 MHz: Fundamental frequency.
3. 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2386.23	41.5	37.01	4.49	54	-12.5	335	304	Average
2386.23	51.12	46.63	4.49	74	-22.88	335	304	Peak
2437	100.42	95.83	4.59			335	304	Average
2437	107.86	103.27	4.59			335	304	Peak
2487	41.9	37.24	4.66	54	-12.1	335	304	Average
2487	52.47	47.81	4.66	74	-21.53	335	304	Peak
4874	41.16	30.95	10.21	54	-12.84	105	217	Average
4874	47.29	37.08	10.21	74	-26.71	105	217	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.29	43.64	39.15	4.49	54	-10.36	126	263	Average
2389.29	54.32	49.83	4.49	74	-19.68	126	263	Peak
2437	107.11	102.52	4.59			126	263	Average
2437	114.35	109.76	4.59			126	263	Peak
2483.8	44.16	39.5	4.66	54	-9.84	126	263	Average
2483.8	53.96	49.3	4.66	74	-20.04	126	263	Peak
4874	41.89	31.68	10.21	54	-12.11	154	113	Average
4874	48.12	37.91	10.21	74	-25.88	154	113	Peak

Remarks:

1. Emission Level = Read Level + 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	99.51	94.89	4.62			335	304	Average
2462	106.33	101.71	4.62			335	304	Peak
2483.56	46.31	41.65	4.66	54	-7.69	335	304	Average
2483.56	56.73	52.07	4.66	74	-17.27	335	304	Peak
4924	42.18	31.93	10.25	54	-11.82	103	112	Average
4924	48.5	38.25	10.25	74	-25.5	103	112	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	105.47	100.85	4.62			125	252	Average
2462	112.85	108.23	4.62			125	252	Peak
2484.08	52.5	47.84	4.66	54	-1.5	125	252	Average
2484.08	64.95	60.29	4.66	74	-9.05	125	252	Peak
4924	42.74	32.49	10.25	54	-11.26	130	56	Average
4924	49.16	38.91	10.25	74	-24.84	130	56	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 2462 MHz: Fundamental frequency.
3. 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.92	45.23	40.73	4.5	54	-8.77	335	304	Average
2389.92	57.07	52.57	4.5	74	-16.93	335	304	Peak
2412	94.16	89.61	4.55			335	304	Average
2412	101.59	97.04	4.55			335	304	Peak
4824	41.75	31.46	10.29	54	-12.25	175	225	Average
4824	47.3	37.01	10.29	74	-26.7	175	225	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.92	52.32	47.82	4.5	54	-1.68	108	332	Average
2389.92	63.58	59.08	4.5	74	-10.42	108	332	Peak
2412	100.12	95.57	4.55			130	332	Average
2412	107.92	103.37	4.55			130	332	Peak
4824	41.68	31.39	10.29	54	-12.32	148	173	Average
4824	48.69	38.4	10.29	74	-25.31	148	173	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 2412 MHz: Fundamental frequency.
3. 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2387.13	41.52	37.03	4.49	54	-12.48	335	304	Average
2387.13	51.92	47.43	4.49	74	-22.08	335	304	Peak
2437	99.31	94.72	4.59			335	304	Average
2437	106.79	102.2	4.59			335	304	Peak
2493.36	41.84	37.17	4.67	54	-12.16	335	304	Average
2493.36	52.25	47.58	4.67	74	-21.75	335	304	Peak
4874	41.9	31.69	10.21	54	-12.1	199	198	Average
4874	47.88	37.67	10.21	74	-26.12	199	198	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.92	43.32	38.82	4.5	54	-10.68	126	263	Average
2389.92	53.58	49.08	4.5	74	-20.42	126	263	Peak
2437	105.85	101.26	4.59			126	263	Average
2437	113.26	108.67	4.59			126	263	Peak
2484.08	44.26	39.6	4.66	54	-9.74	126	263	Average
2484.08	53.73	49.07	4.66	74	-20.27	126	263	Peak
4874	41.58	31.37	10.21	54	-12.42	174	188	Average
4874	48.87	38.66	10.21	74	-25.13	174	188	Peak

Remarks:

1. Emission Level = Read Level + 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	98.14	93.52	4.62			335	304	Average
2462	105.16	100.54	4.62			335	304	Peak
2484.12	46.09	41.43	4.66	54	-7.91	335	304	Average
2484.12	56.15	51.49	4.66	74	-17.85	335	304	Peak
4924	41.64	31.39	10.25	54	-12.36	186	347	Average
4924	48.05	37.8	10.25	74	-25.95	186	347	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2462	104.98	100.36	4.62			125	252	Average
2462	111.76	107.14	4.62			125	252	Peak
2483.56	**52.98**	**48.32**	**4.66**	**54**	**-1.02**	**125**	**252**	**Average**
2483.56	63.6	58.94	4.66	74	-10.4	125	252	Peak
4924	41.72	31.47	10.25	54	-12.28	110	145	Average
4924	47.7	37.45	10.25	74	-26.3	110	145	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 2462 MHz: Fundamental frequency.
3. 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2388.93	45.87	41.38	4.49	54	-8.13	335	304	Average
2388.93	55.54	51.05	4.49	74	-18.46	335	304	Peak
2422	88.51	83.95	4.56			335	304	Average
2422	95.99	91.43	4.56			335	304	Peak
2488	42.01	37.33	4.68	54	-11.99	335	304	Average
2488	52.01	47.33	4.68	74	-21.99	335	304	Peak
4844	41.68	31.45	10.23	54	-12.32	193	145	Average
4844	48.1	37.87	10.23	74	-25.9	193	145	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.47	52.47	47.98	4.49	54	-1.53	107	262	Average
2389.47	61.01	56.52	4.49	74	-12.99	107	262	Peak
2422	97.54	92.98	4.56			130	262	Average
2422	104.77	100.21	4.56			130	262	Peak
2487.88	42.95	38.27	4.68	54	-11.05	107	262	Average
2487.88	52.51	47.83	4.68	74	-21.49	107	262	Peak
4844	41.86	31.63	10.23	54	-12.14	146	286	Average
4844	48.15	37.92	10.23	74	-25.85	146	286	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 2422 MHz: Fundamental frequency.
3. 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.65	46.06	41.57	4.49	54	-7.94	335	304	Average
2389.65	56.61	52.12	4.49	74	-17.39	335	304	Peak
2437	93.04	88.45	4.59			335	304	Average
2437	100.21	95.62	4.59			335	304	Peak
2491.4	41.89	37.21	4.68	54	-12.11	335	304	Average
2491.4	52.07	47.39	4.68	74	-21.93	335	304	Peak
4874	41.99	31.78	10.21	54	-12.01	137	208	Average
4874	47.85	37.64	10.21	74	-26.15	137	208	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.83	52.12	47.62	4.5	54	-1.88	153	252	Average
2389.83	63.41	58.91	4.5	74	-10.59	153	252	Peak
2437	99.6	95.01	4.59			126	263	Average
2437	106.74	102.15	4.59			126	263	Peak
2483.64	45.46	40.8	4.66	54	-8.54	126	263	Average
2483.64	54.53	49.87	4.66	74	-19.47	126	263	Peak
4874	41.95	31.74	10.21	54	-12.05	165	295	Average
4874	48.6	38.39	10.21	74	-25.4	165	295	Peak

Remarks:

1. Emission Level = Read Level + 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 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

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.65	41.59	37.1	4.49	54	-12.41	335	304	Average
2389.65	51.69	47.2	4.49	74	-22.31	335	304	Peak
2452	94.22	89.62	4.6			335	304	Average
2452	102.14	97.54	4.6			335	304	Peak
2483.52	43.33	38.67	4.66	54	-10.67	335	304	Average
2483.52	52.43	47.77	4.66	74	-21.57	335	304	Peak
4904	41.79	31.65	10.14	54	-12.21	147	174	Average
4904	49.29	39.15	10.14	74	-24.71	147	174	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
2389.47	45.21	40.72	4.49	54	-8.79	125	252	Average
2389.47	55.64	51.15	4.49	74	-18.36	125	252	Peak
2452	100.62	96.02	4.6			125	252	Average
2452	108.78	104.18	4.6			125	252	Peak
2487.76	52.56	47.88	4.68	54	-1.44	164	252	Average
2487.76	64.13	59.45	4.68	74	-9.87	164	252	Peak
4904	42.03	31.89	10.14	54	-11.97	125	208	Average
4904	47.86	37.72	10.14	74	-26.14	125	208	Peak

Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value
2. 2452 MHz: Fundamental frequency.
3. 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:

802.11n (HT20)

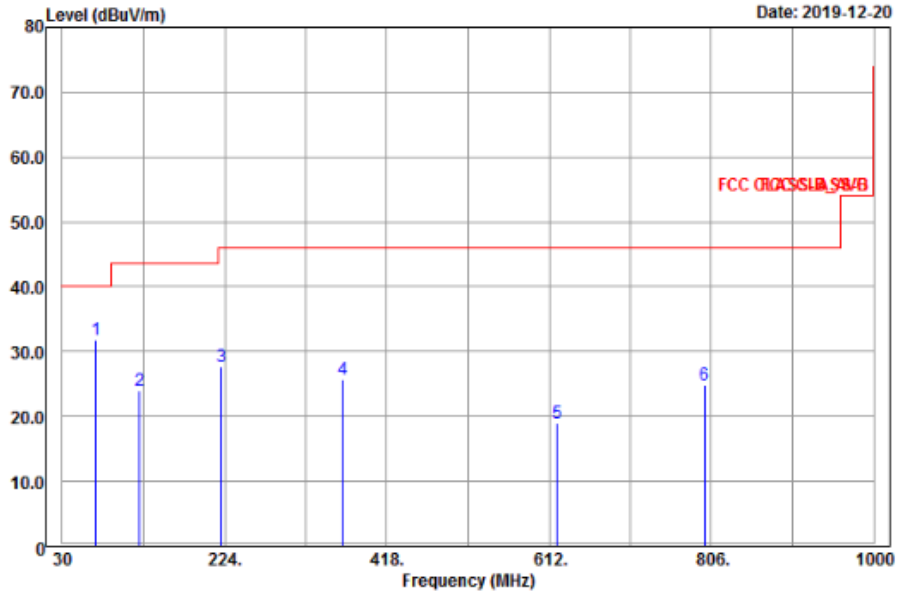
EUT Test Condition		Measurement Detail	
Channel	Channel 11	**Frequency Range**	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	**Detector Function**	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	**Tested By**	Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
69.96	31.93	51.48	-19.55	40	-8.07	173	214	Peak
122.07	23.99	43.64	-19.65	43.5	-19.51	190	124	Peak
220.62	27.75	45.56	-17.81	46	-18.25	143	243	Peak
365.1	25.78	40.26	-14.48	46	-20.22	120	34	Peak
621.3	18.99	29.31	-10.32	46	-27.01	195	164	Peak
798.4	24.93	32.56	-7.63	46	-21.07	121	77	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	**Emission Level (dBuV/m)**	**Read Level (dBuV)**	**Factor (dB/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (cm)**	**Table Angle (Degree)**	**Remark**
45.39	31.9	47.2	-15.3	40	-8.1	183	48	Peak
122.07	19.66	39.31	-19.65	43.5	-23.84	195	281	Peak
222.51	27.03	44.79	-17.76	46	-18.97	134	167	Peak
366.5	27.28	41.73	-14.45	46	-18.72	120	124	Peak
520.5	34.44	46.51	-12.07	46	-11.56	181	43	Peak
722.1	32.4	41.14	-8.74	46	-13.6	195	131	Peak

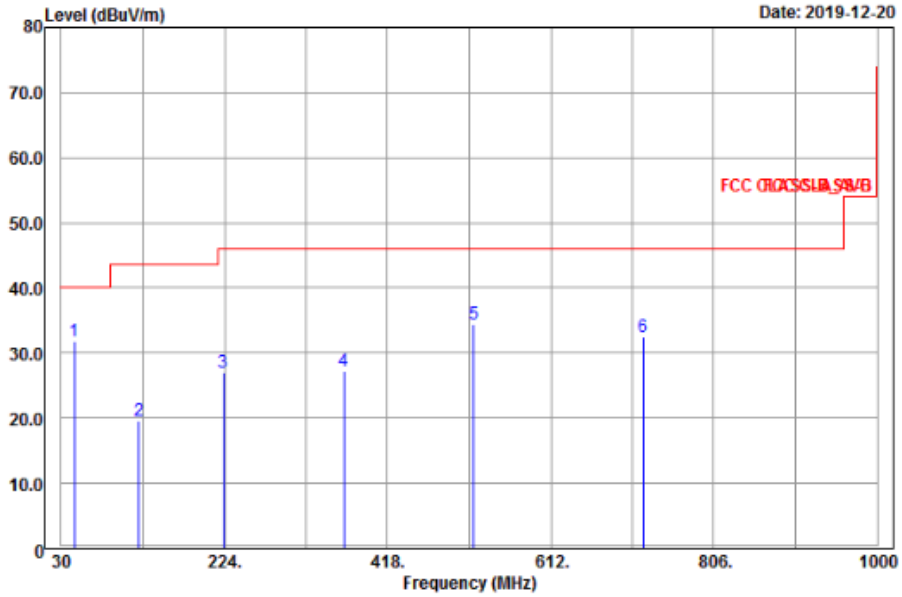
Remarks:

1. Emission Level = Read Level + Factor
   Margin value = Emission level – Limit value.
2. The emission levels of other frequencies were very low against the limit.

Horizontal



Vertical



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. 14, 2018	Dec. 13, 2019
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2019	Sep. 04, 2020
LISN/AMN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 21, 2019	Feb. 20, 2020
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 22, 2019	Aug. 21, 2020
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

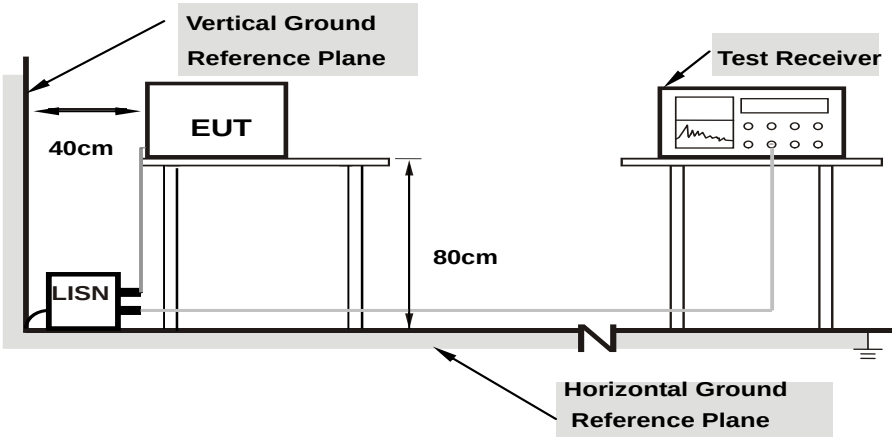
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling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

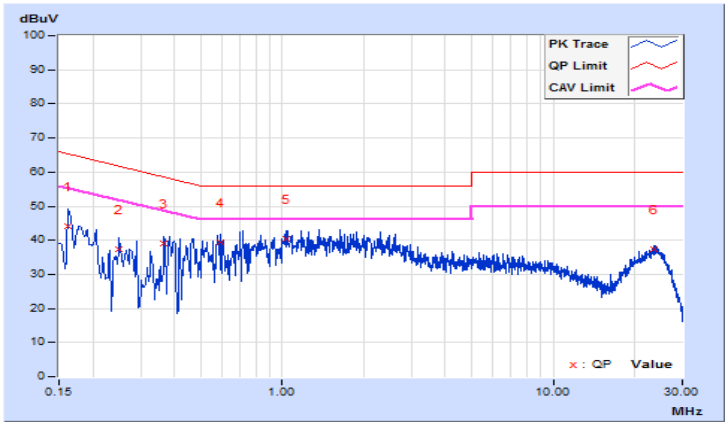
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25℃, 65%RH
Tested by	Jisyong Wang	Test Date	2019/11/24

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	0.16200	9.67	34.48	30.96	44.15	40.63	65.36	55.36	-21.21	-14.73
2	0.25000	9.67	27.85	24.60	37.52	34.27	61.76	51.76	-24.24	-17.49
3	0.36600	9.68	29.44	26.15	39.12	35.83	58.59	48.59	-19.47	-12.76
4	**0.59000**	**9.70**	**29.66**	**26.90**	**39.36**	**36.60**	**56.00**	**46.00**	**-16.64**	**-9.40**
5	1.03000	9.73	30.51	25.86	40.24	35.59	56.00	46.00	-15.76	-10.41
6	23.68600	10.00	27.50	21.57	37.50	31.57	60.00	50.00	-22.50	-18.43

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

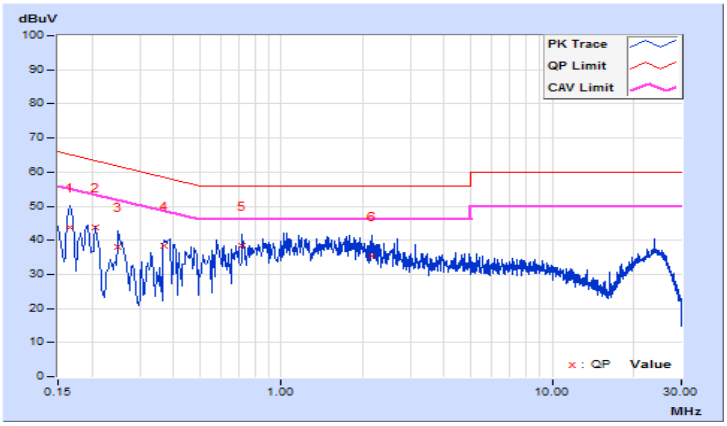


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25℃, 65%RH
Tested by	Jisyong Wang	Test Date	2019/11/24

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	0.16600	9.64	34.12	30.81	43.76	40.45	65.16	55.16	-21.40	-14.71
2	0.20600	9.64	34.09	30.62	43.73	40.26	63.37	53.37	-19.64	-13.11
3	0.25000	9.65	28.29	25.77	37.94	35.42	61.76	51.76	-23.82	-16.34
4	0.37000	9.66	28.66	25.56	38.32	35.22	58.50	48.50	-20.18	-13.28
5	0.71800	9.68	28.58	25.10	38.26	34.78	56.00	46.00	-17.74	-11.22
6	2.16200	9.75	25.77	21.03	35.52	30.78	56.00	46.00	-20.48	-15.22

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

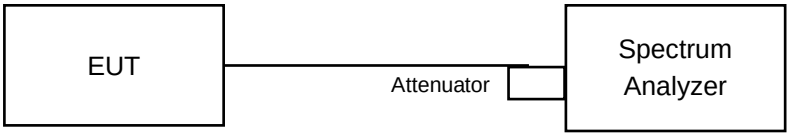


4.3 6 dB Bandwidth Measurement

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) ≥ 3 x 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
		Chain 0	Chain 1		
1	2412	7.11	7.57	0.5	Pass
6	2437	9.10	7.58	0.5	Pass
11	2462	7.11	7.11	0.5	Pass

802.11g

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	15.72	15.48	0.5	Pass
6	2437	15.70	16.04	0.5	Pass
11	2462	15.46	15.77	0.5	Pass

802.11n (HT20)

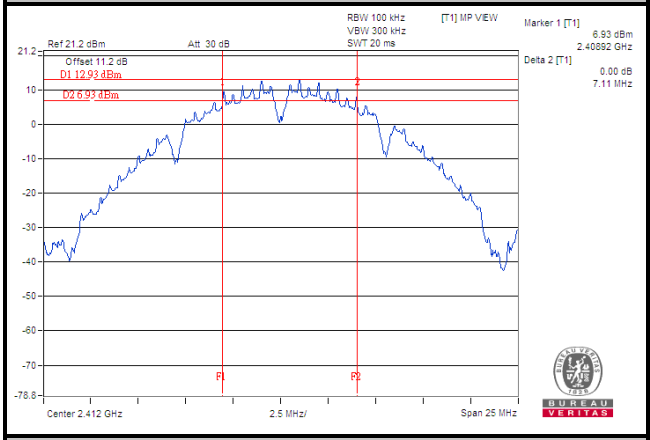
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.34	16.57	0.5	Pass
6	2437	16.34	16.86	0.5	Pass
11	2462	15.78	16.38	0.5	Pass

802.11n (HT40)

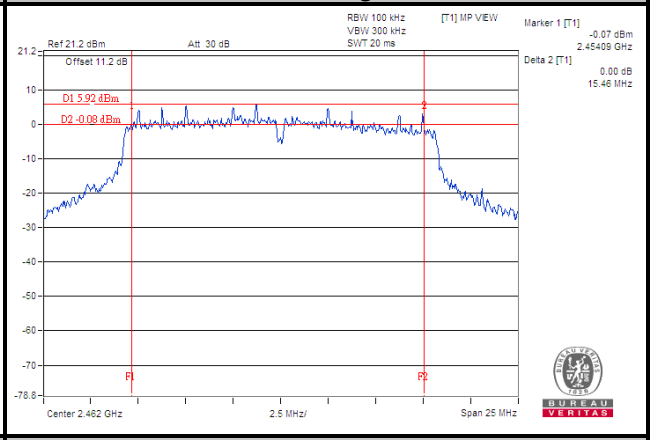
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	35.14	35.17	0.5	Pass
6	2437	35.55	35.79	0.5	Pass
9	2452	35.39	35.20	0.5	Pass

Spectrum Plot of Worst Value

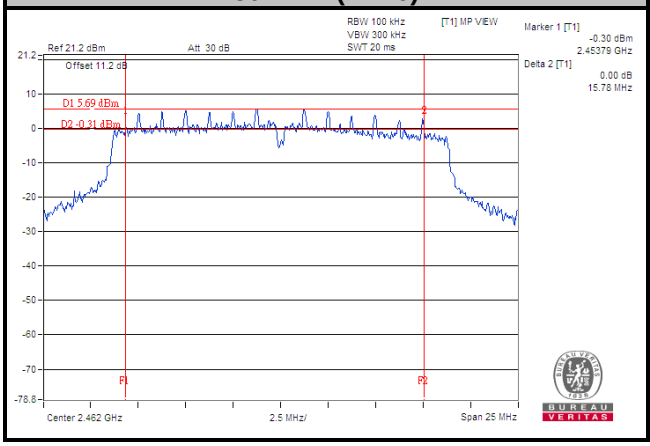
802.11b



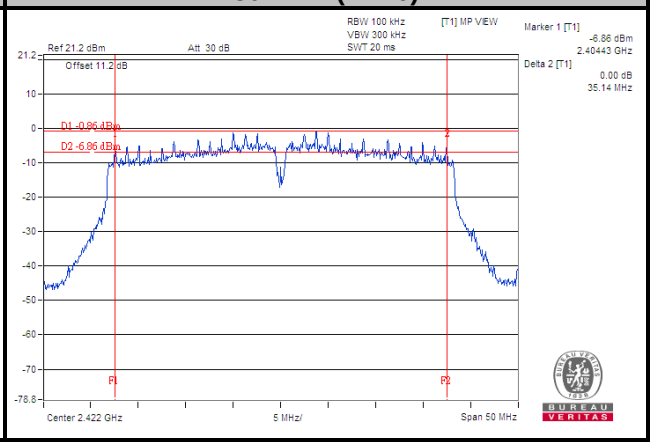
802.11g



802.11n (HT20)

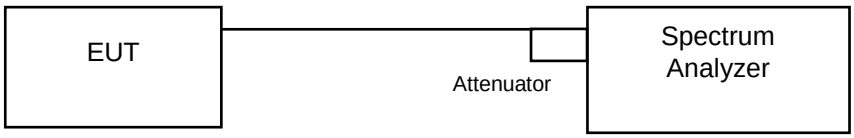


802.11n (HT40)



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 sampling. 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
		Chain 0	Chain 1	
1	2412	13.27	13.37	Pass
6	2437	13.56	13.08	Pass
11	2462	12.88	12.69	Pass

802.11g

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	16.73	16.64	Pass
6	2437	16.73	16.74	Pass
11	2462	16.73	16.73	Pass

802.11n (HT20)

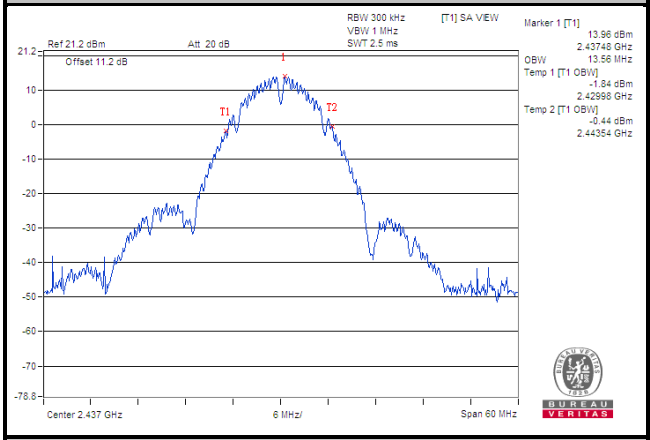
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	17.89	17.79	Pass
6	2437	17.89	17.88	Pass
11	2462	17.89	17.89	Pass

802.11n (HT40)

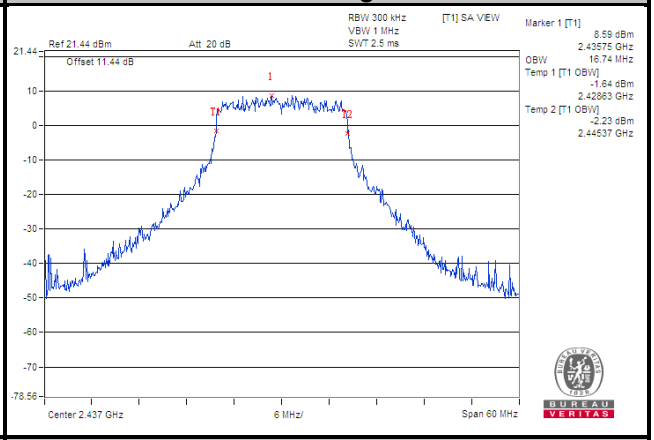
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
3	2422	36.25	36.34	Pass
6	2437	36.63	36.63	Pass
9	2452	36.54	36.45	Pass

Spectrum Plot of Worst Value

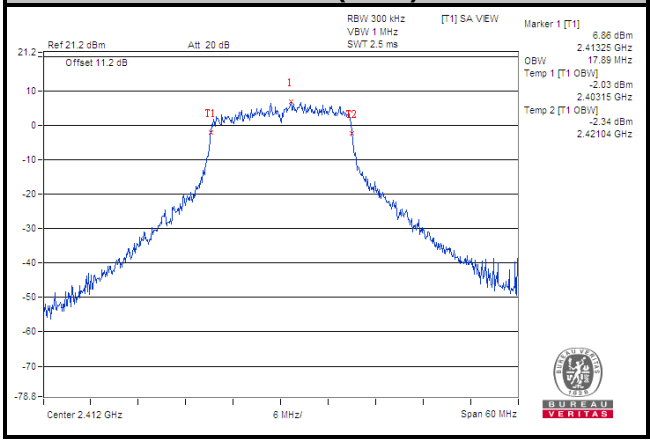
802.11b



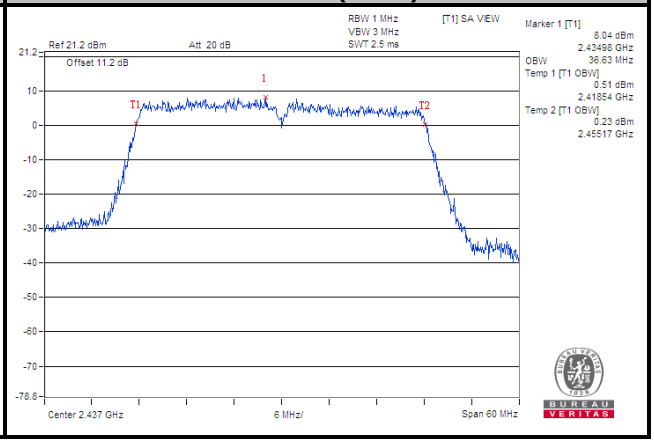
802.11g



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,

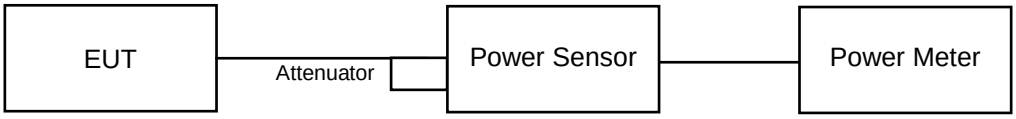
Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 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 ≥ 5.

For power measurements on all other devices: Array Gain = 10 log(NANT/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 (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	17.57	17.25	110.236	20.42	30	Pass
6	2437	17.65	17.27	111.543	20.47	30	Pass
11	2462	17.52	17.22	109.217	20.38	30	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	15.61	14.88	67.153	18.27	30	Pass
6	2437	15.23	14.95	64.604	18.10	30	Pass
11	2462	15.60	15.08	68.519	18.36	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	15.56	14.82	66.314	18.22	30	Pass
6	2437	15.40	14.91	65.648	18.17	30	Pass
11	2462	15.83	15.20	71.395	18.54	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	16.56	16.32	88.145	19.45	30	Pass
6	2437	16.65	16.10	86.976	19.39	30	Pass
9	2452	16.61	15.97	85.351	19.31	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 in any 3 kHz band during any time interval of continuous transmission.

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 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × 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

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	-3.38	3.01	-0.37	8	Pass
	6	2437	-2.05	3.01	0.96	8	Pass
	11	2462	-5.34	3.01	-2.33	8	Pass
1	1	2412	-3.21	3.01	-0.20	8	Pass
	6	2437	-2.18	3.01	0.83	8	Pass
	11	2462	-4.81	3.01	-1.80	8	Pass

NOTE:

1. Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ = 5.57 dBi < 6 dBi, so the limit no need to be reduced.
2. Method 2) C) of power density measurement of KDB 662911 is using for calculating total power density.

802.11g

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	-9.75	3.01	-6.74	8	Pass
	6	2437	-8.04	3.01	-5.03	8	Pass
	11	2462	-9.74	3.01	-6.73	8	Pass
1	1	2412	-9.65	3.01	-6.64	8	Pass
	6	2437	-8.83	3.01	-5.82	8	Pass
	11	2462	-9.28	3.01	-6.27	8	Pass

NOTE:

1. Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ = 5.57 dBi < 6 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 (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	-11.14	3.01	-8.13	8	Pass
	6	2437	-8.96	3.01	-5.95	8	Pass
	11	2462	-9.40	3.01	-6.39	8	Pass
1	1	2412	-10.16	3.01	-7.15	8	Pass
	6	2437	-8.62	3.01	-5.61	8	Pass
	11	2462	-9.42	3.01	-6.41	8	Pass

NOTE:

1. Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ = 5.57 dBi < 6 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)

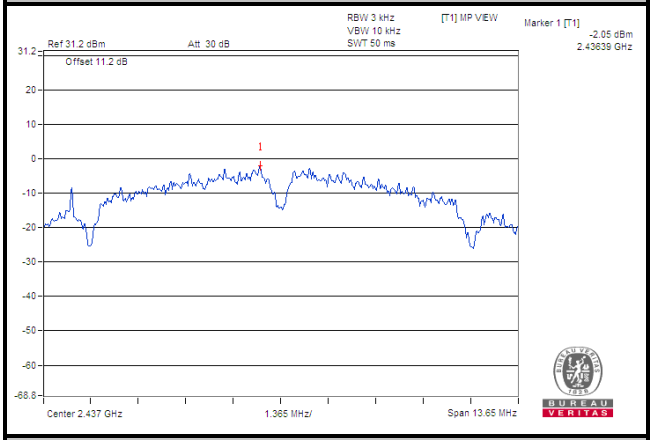
TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	3	2422	-15.67	3.01	-12.66	8	Pass
	6	2437	-13.42	3.01	-10.41	8	Pass
	9	2452	-12.07	3.01	-9.06	8	Pass
1	3	2422	-14.78	3.01	-11.77	8	Pass
	6	2437	-13.44	3.01	-10.43	8	Pass
	9	2452	-11.74	3.01	-8.73	8	Pass

NOTE:

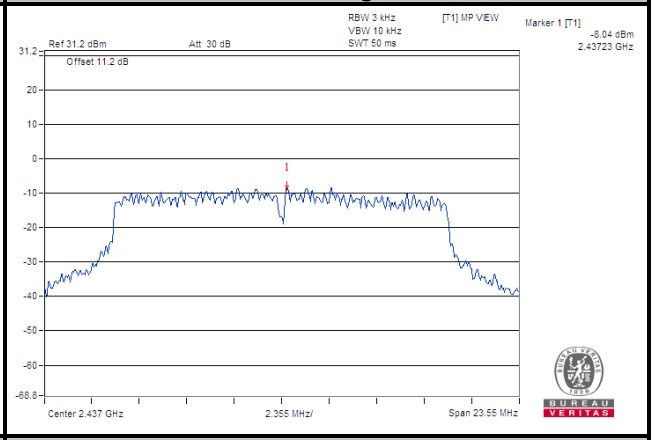
1. Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ = 5.57 dBi < 6 dBi, so the limit no need to be reduced.
2. Method E) 2) c) of power density measurement of KDB 662911 is using for calculating total power density.

Spectrum Plot of Worst Value

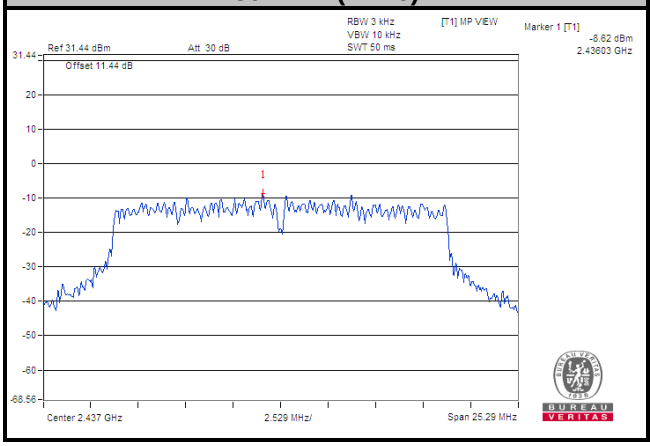
802.11b



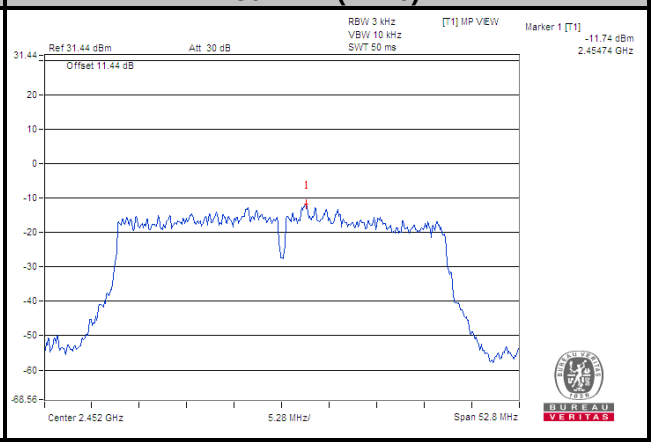
802.11g



802.11n (HT20)



802.11n (HT40)

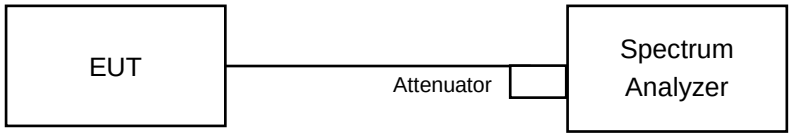


4.7 Conducted Out of Band Emission Measurement

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 ≥ 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 OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 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

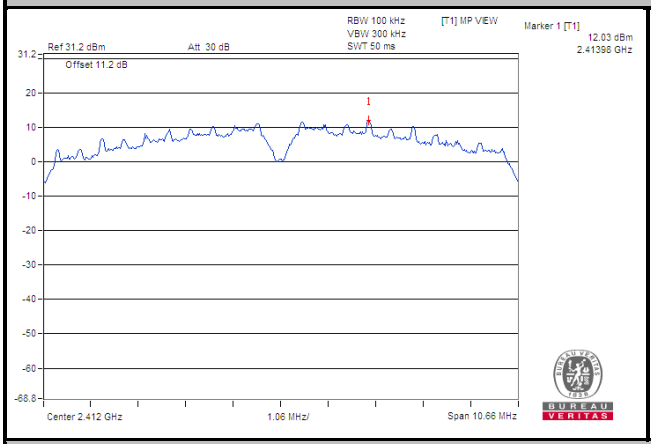
The conducted emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.

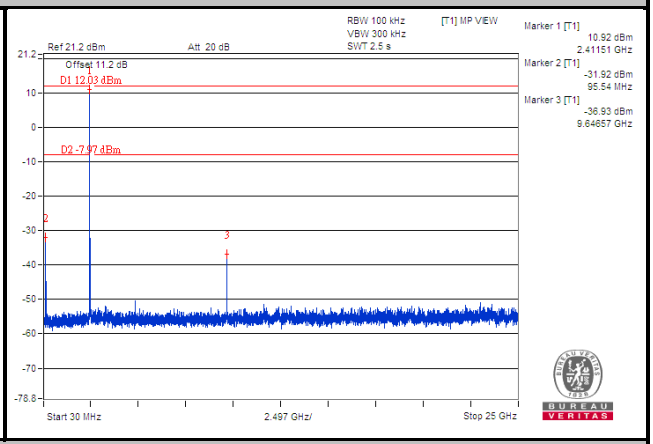
The spectrum plots are attached on the following images. D1 line indicates the highest level, and D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement.

802.11b

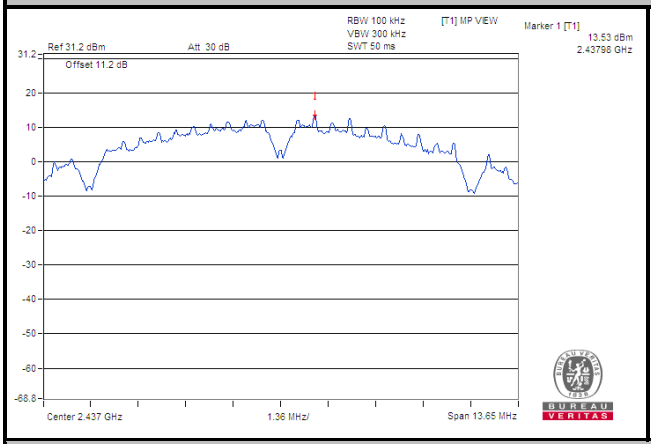
CHAIN 0

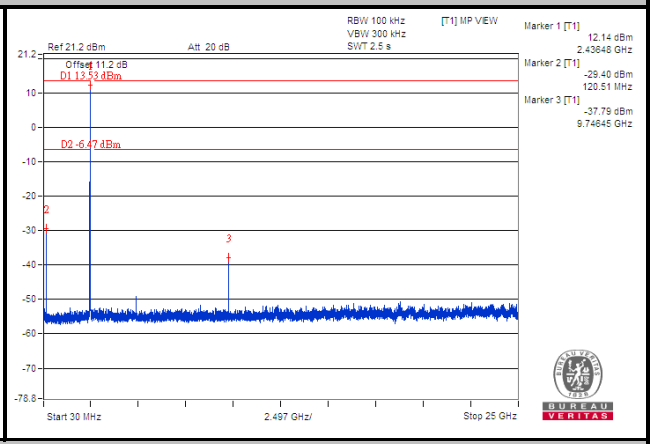
Ch 1



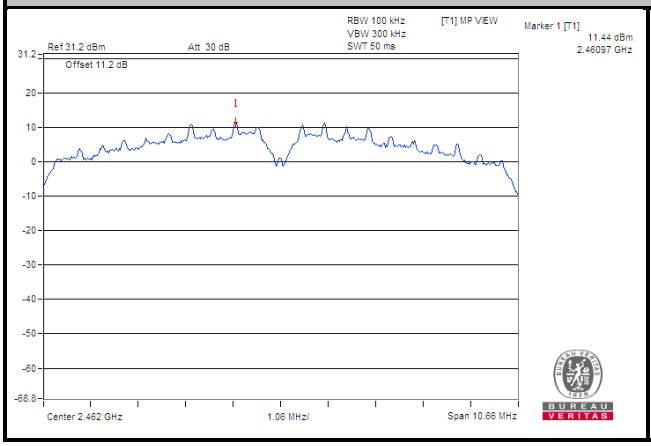


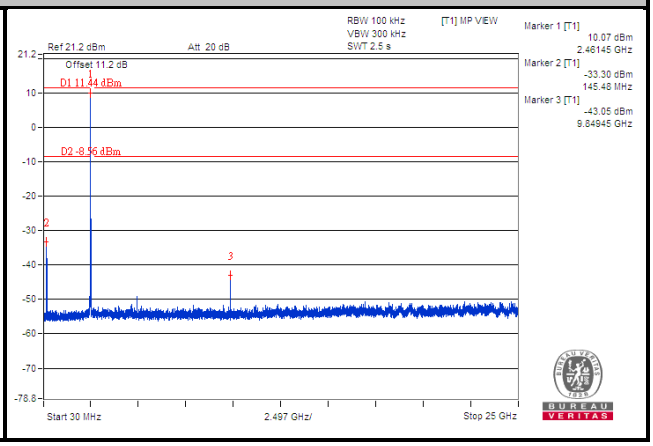
Ch 6

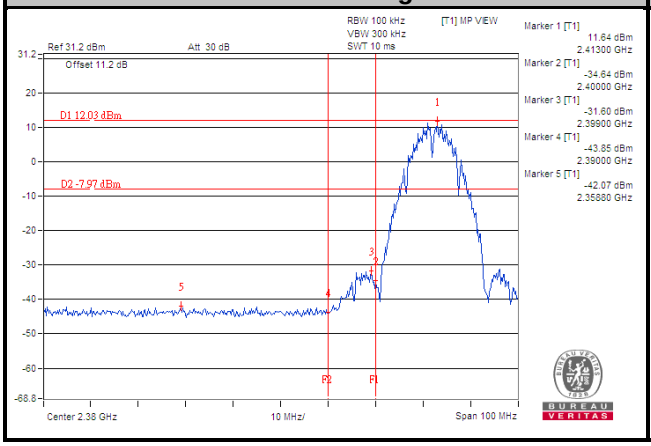
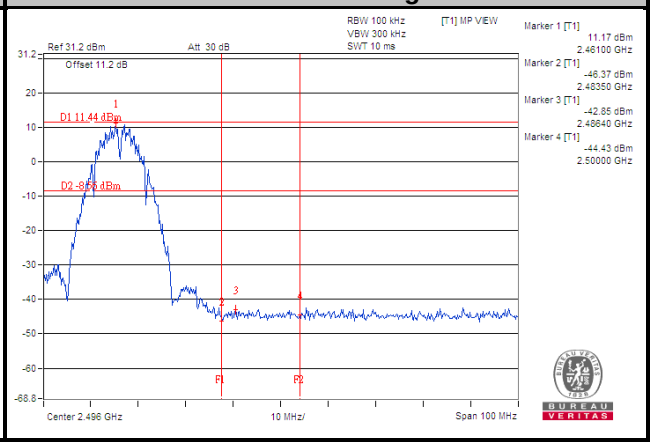




Ch 11

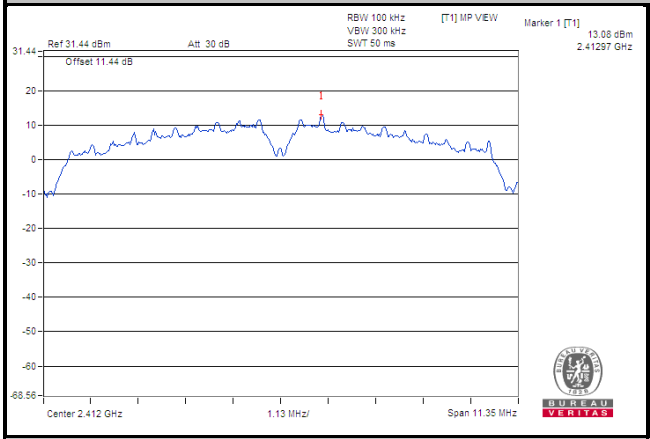


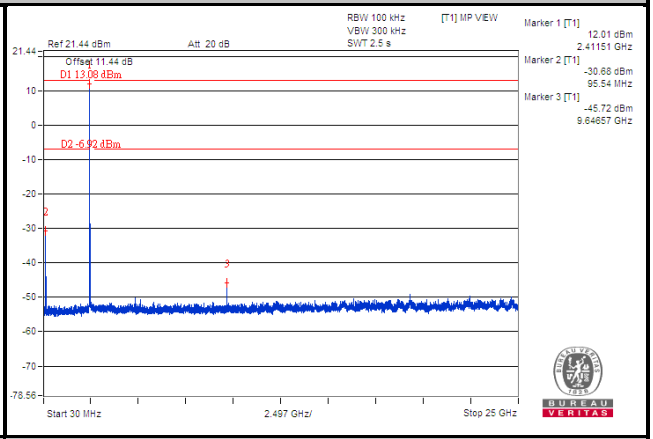


Ch 1 Band Edge	Ch 11 Band Edge
	

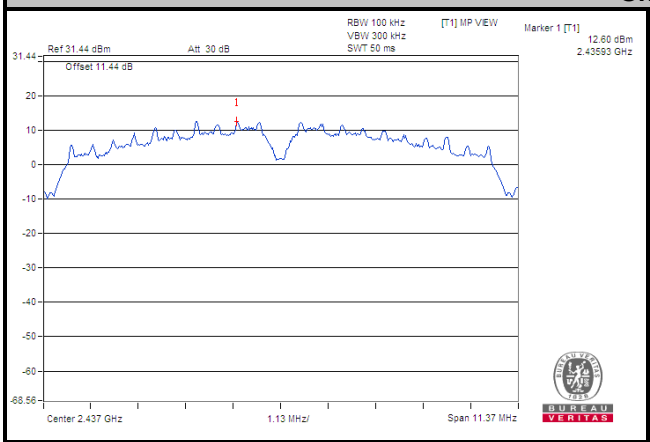
CHAIN 1

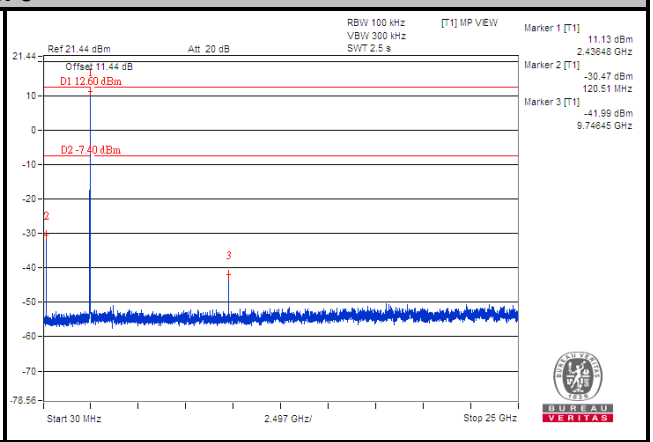
Ch 1



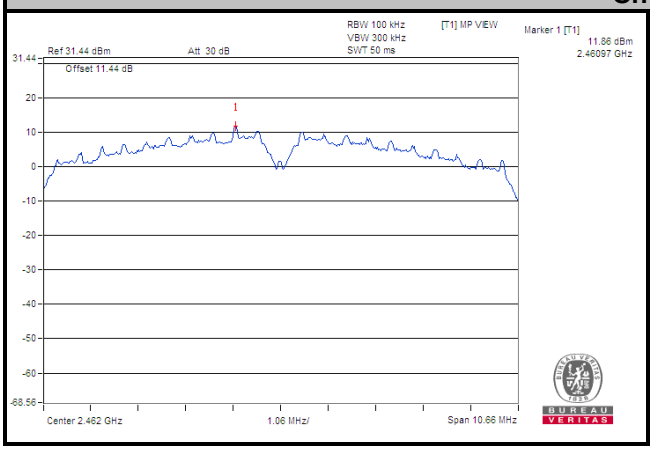


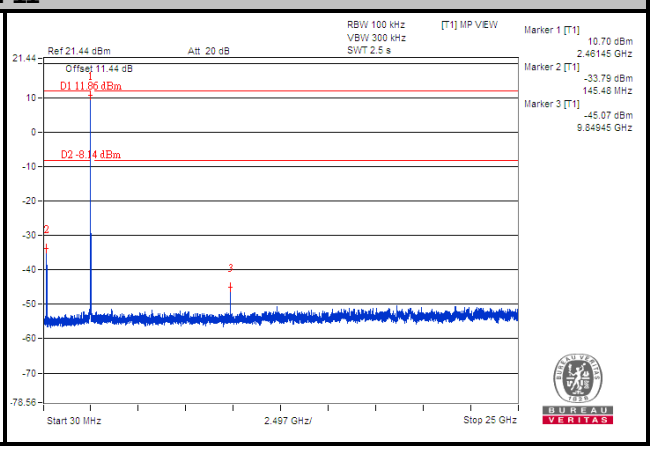
Ch 6

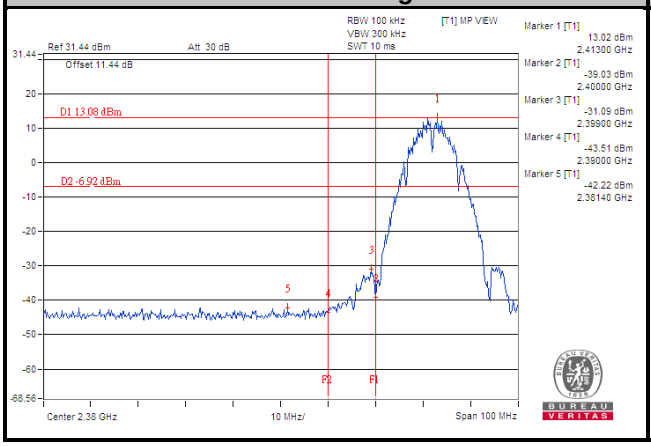
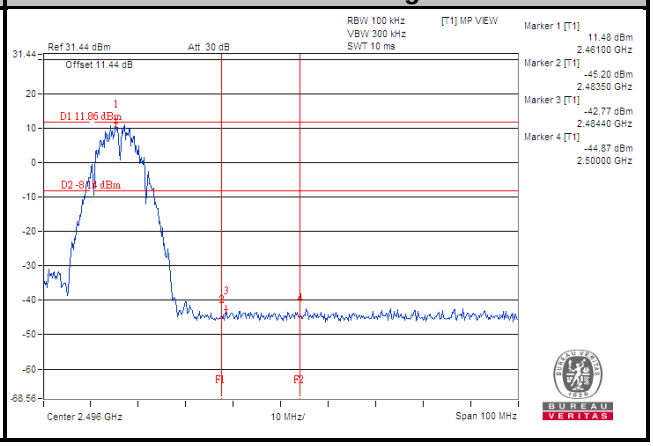




Ch 11



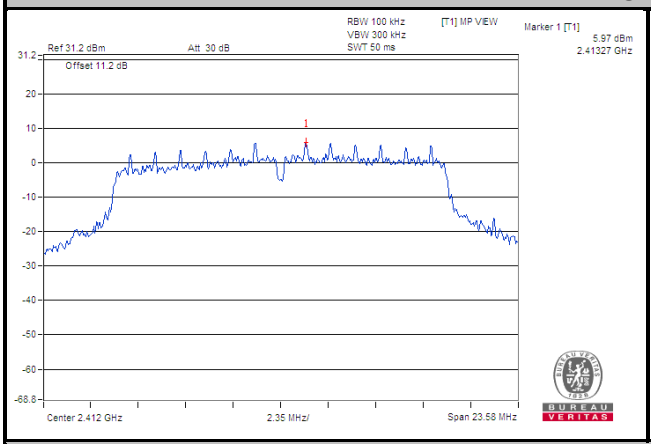


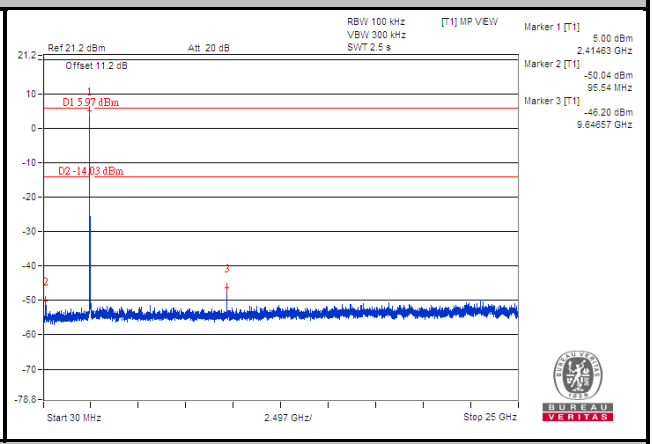
Ch 1 Band Edge	Ch 11 Band Edge
	

802.11g

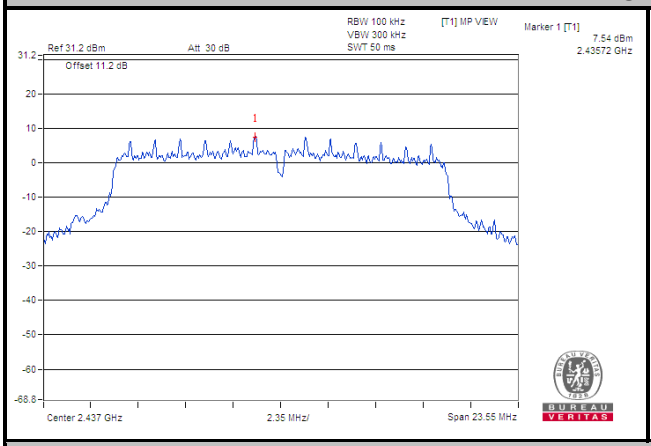
CHAIN 0

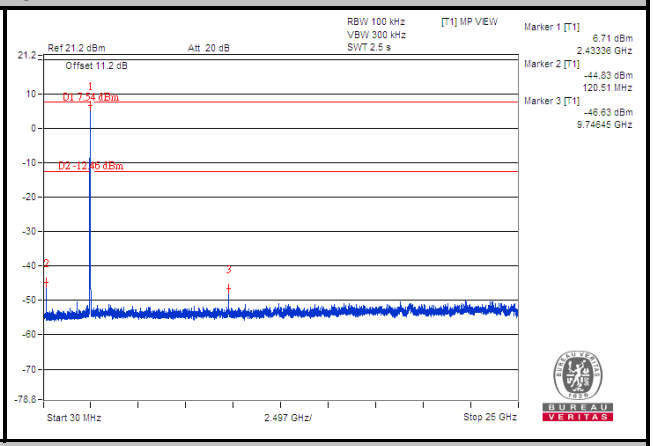
Ch 1



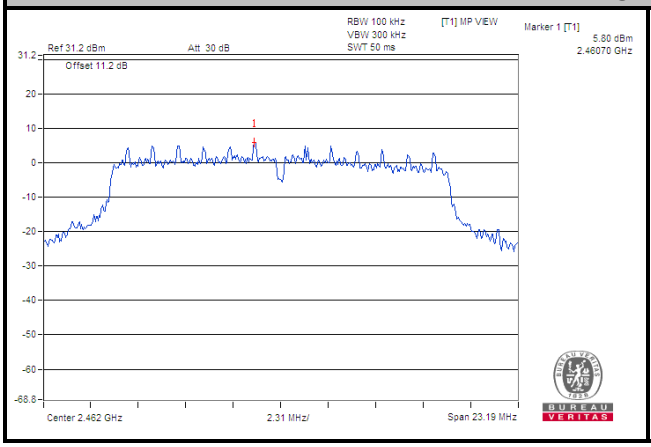


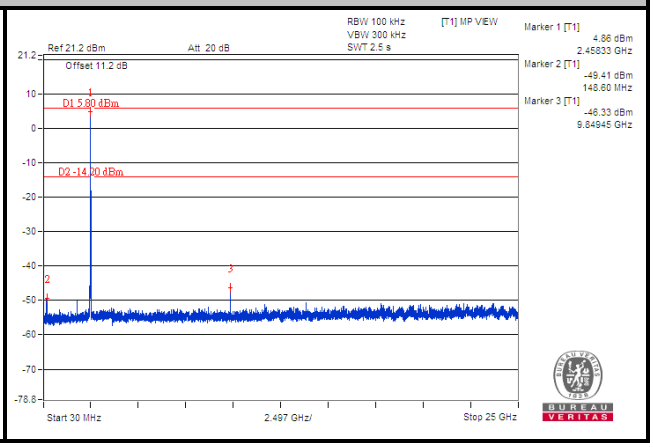
Ch 6

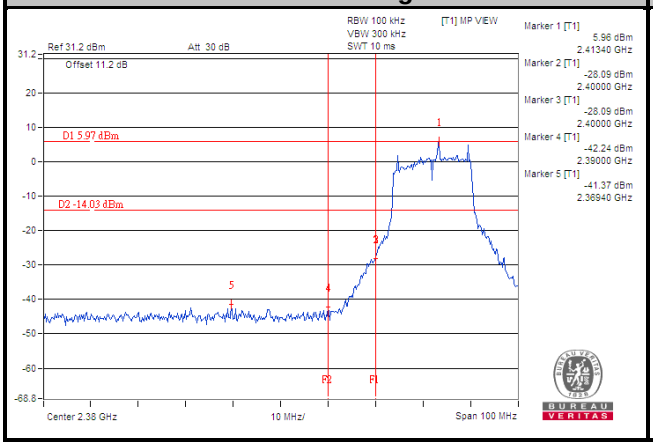
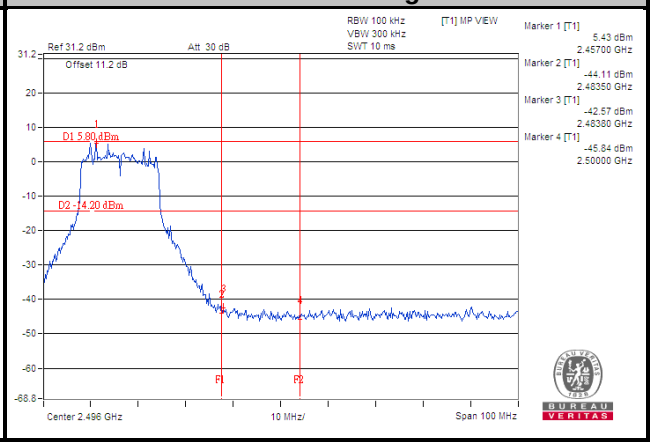




Ch 11

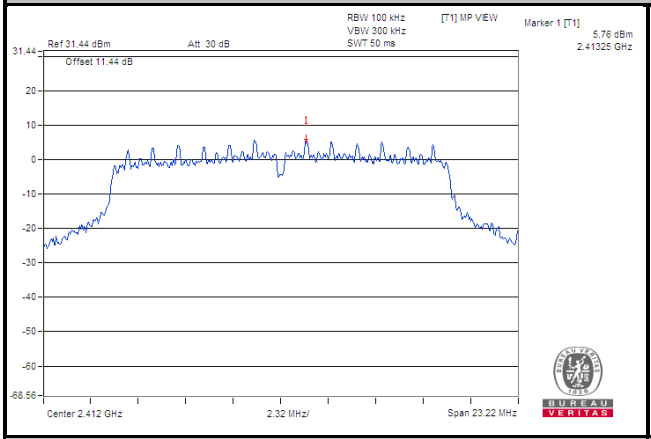


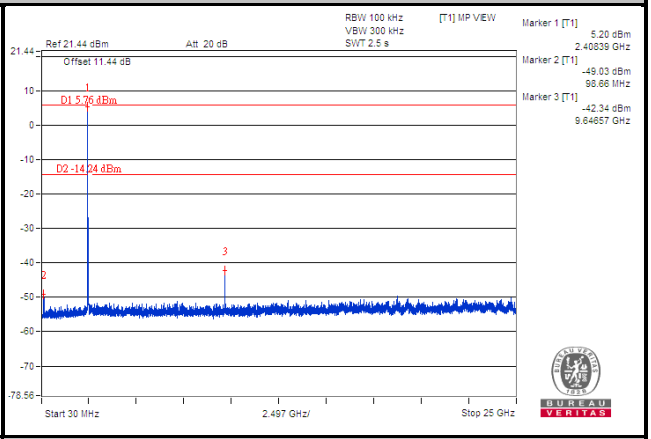


Ch 1 Band Edge	Ch 11 Band Edge
	

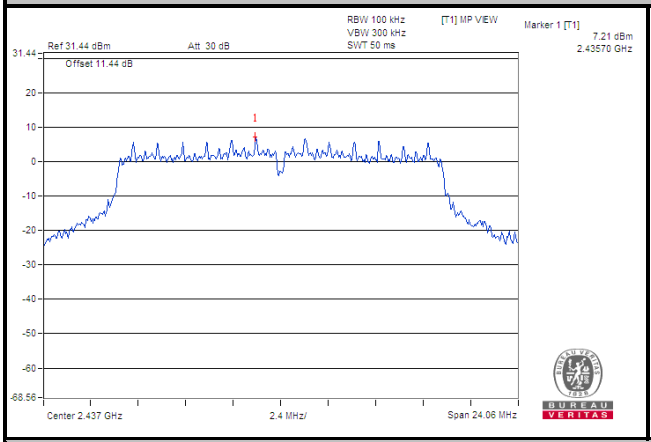
CHAIN 1

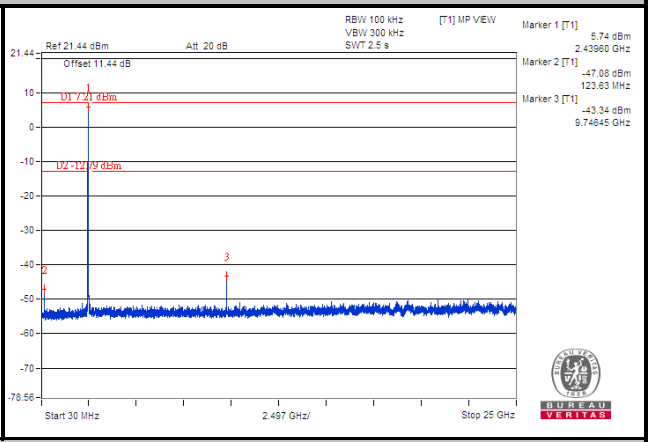
Ch 1



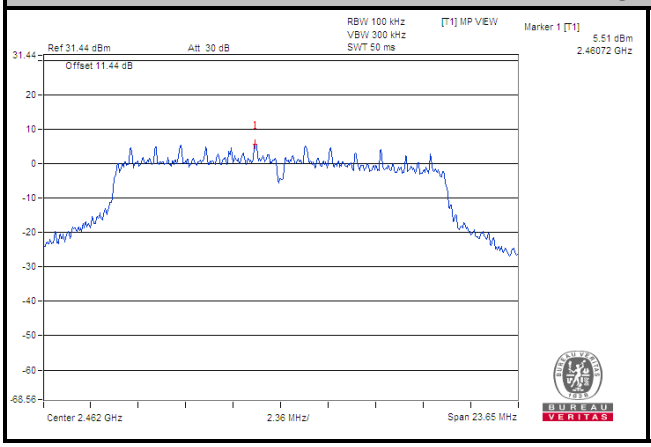


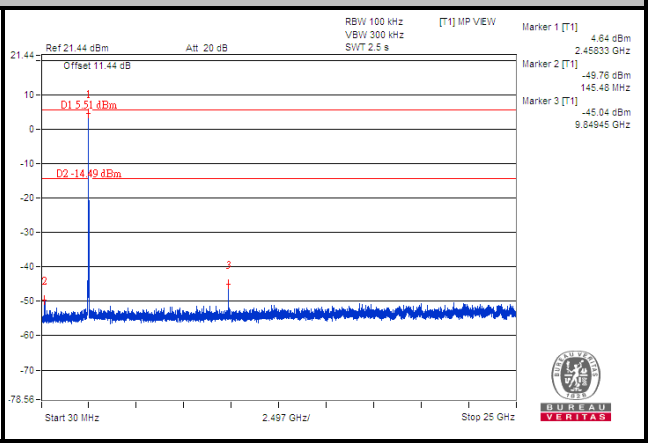
Ch 6

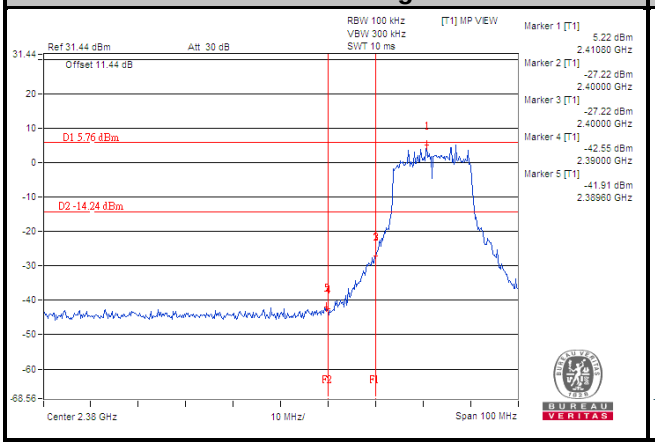
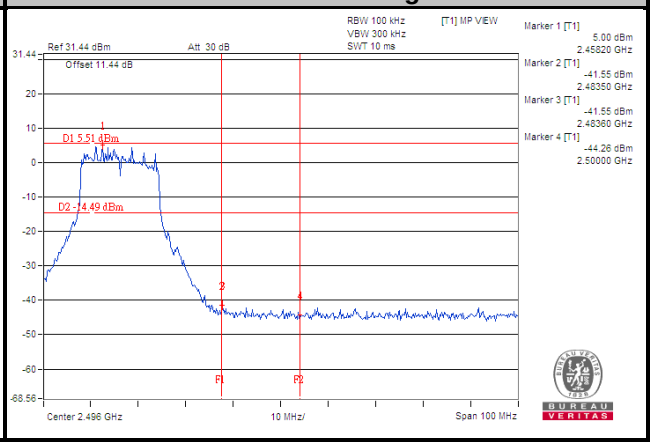




Ch 11





Ch 1 Band Edge	Ch 11 Band Edge
	

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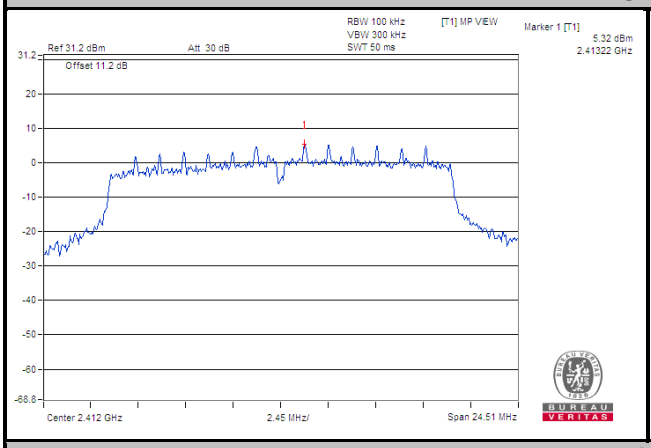
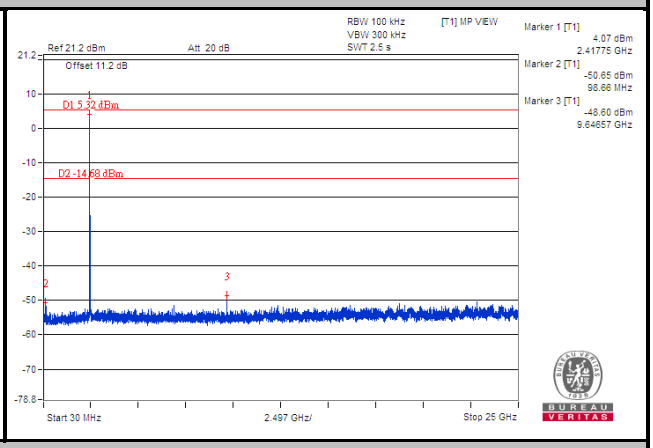
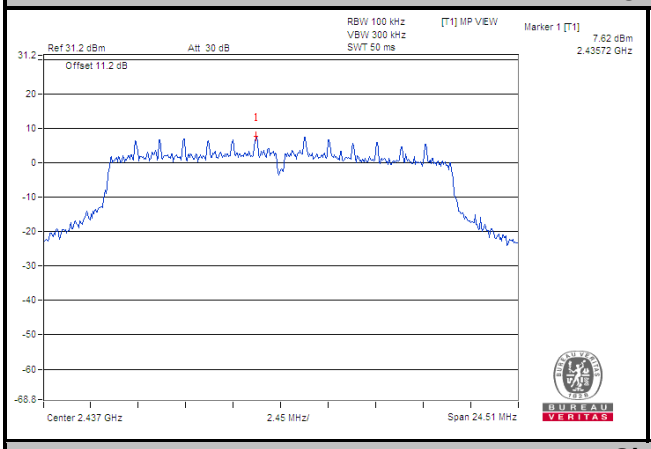
CHAIN 0

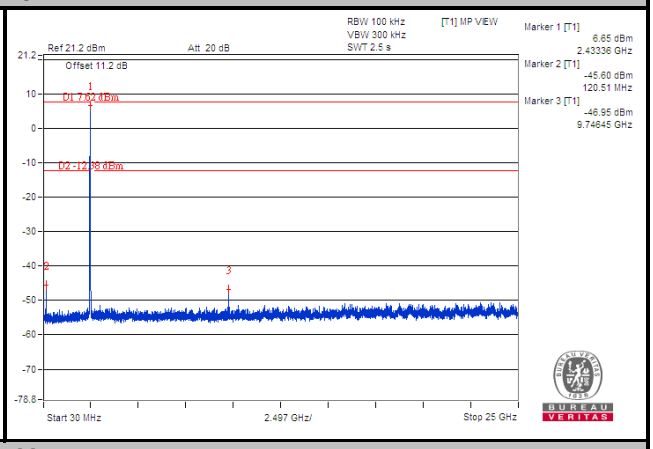
Ch 1



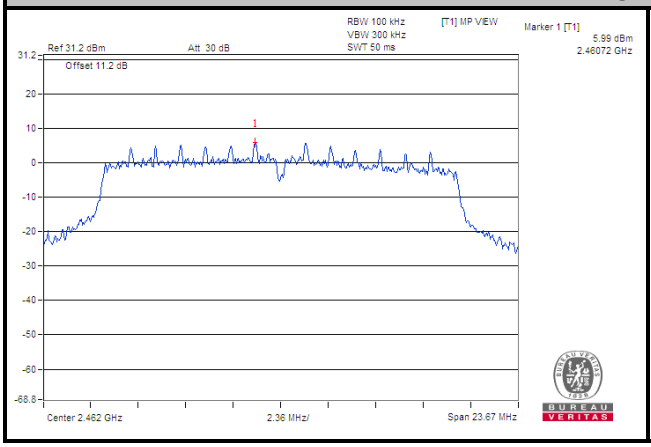


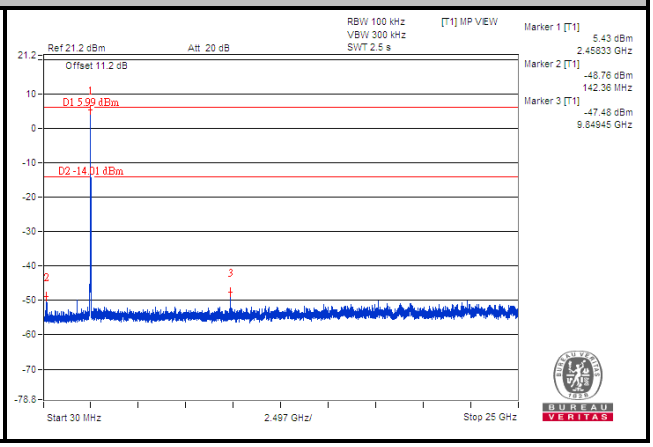
Ch 6

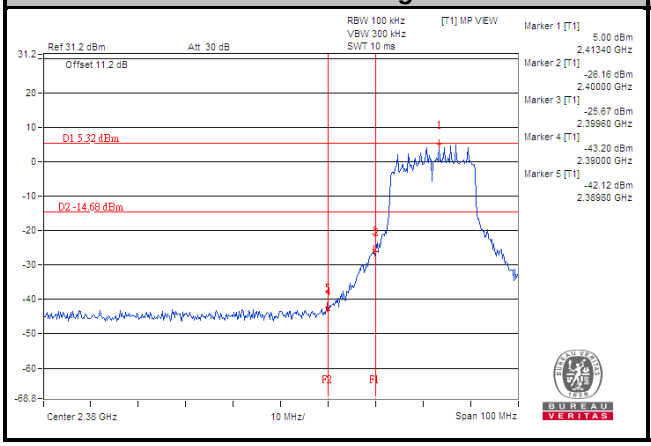
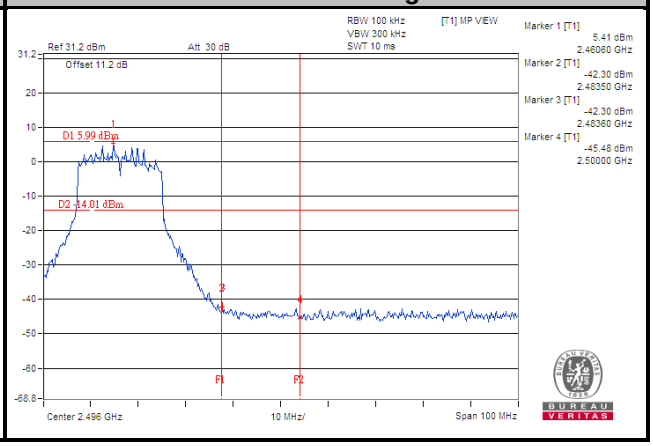




Ch 11

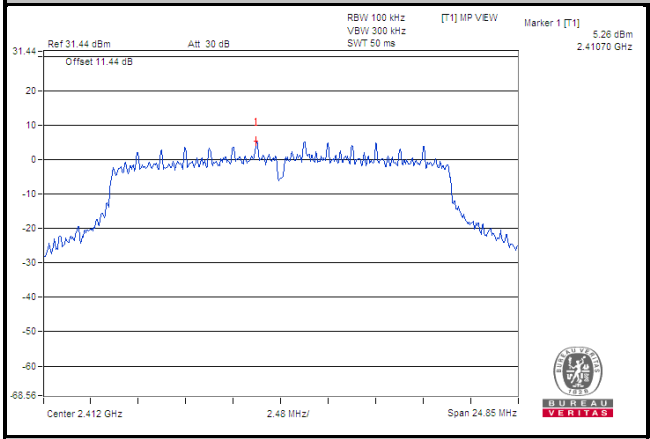


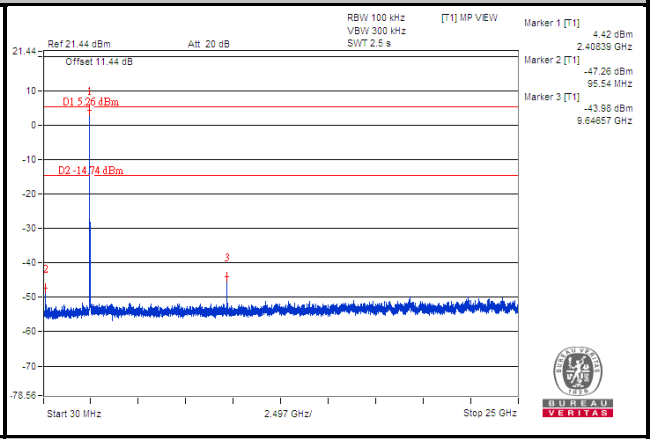


Ch 1 Band Edge	Ch 11 Band Edge
	

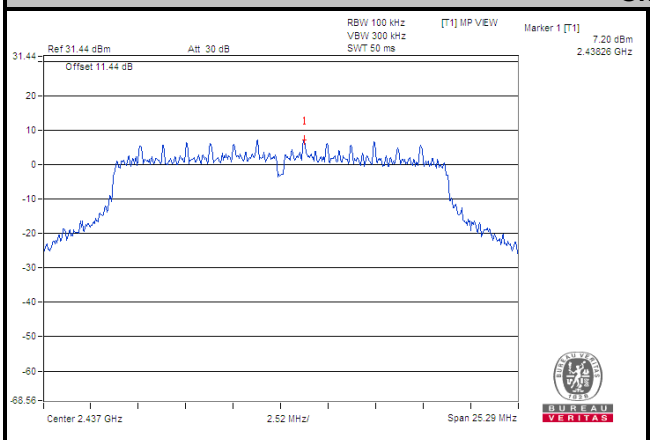
CHAIN 1

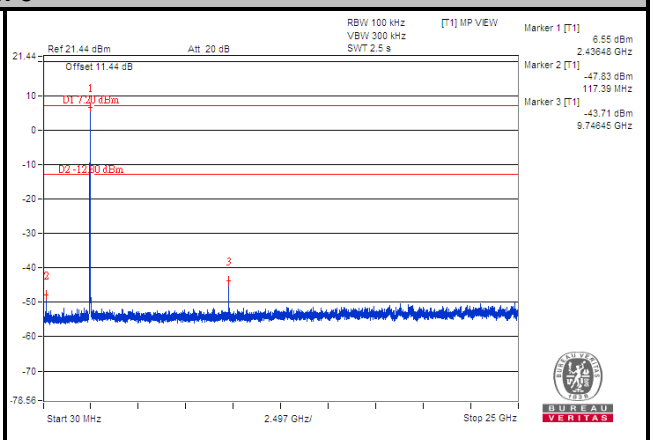
Ch 1



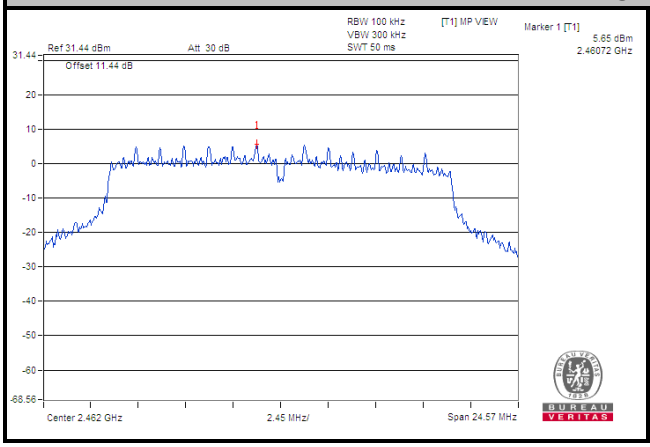


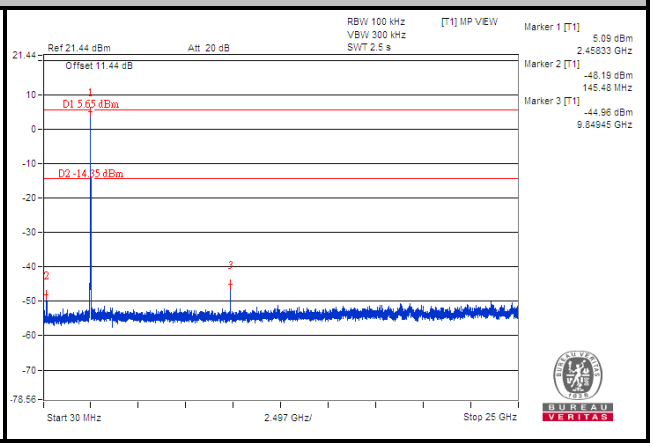
Ch 6

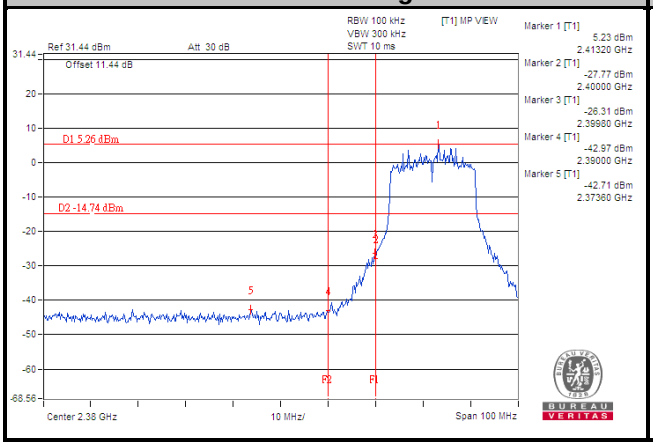
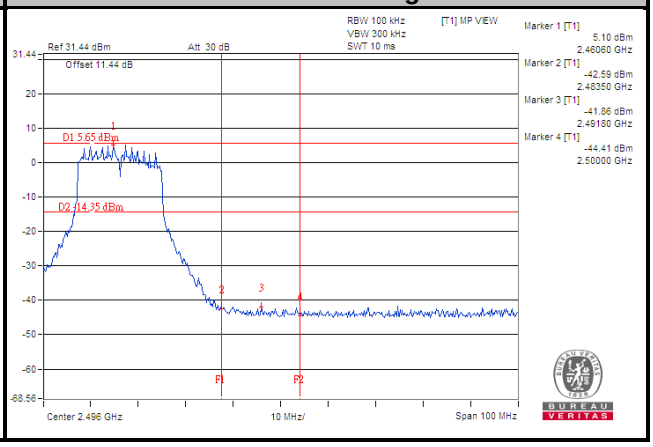




Ch 11



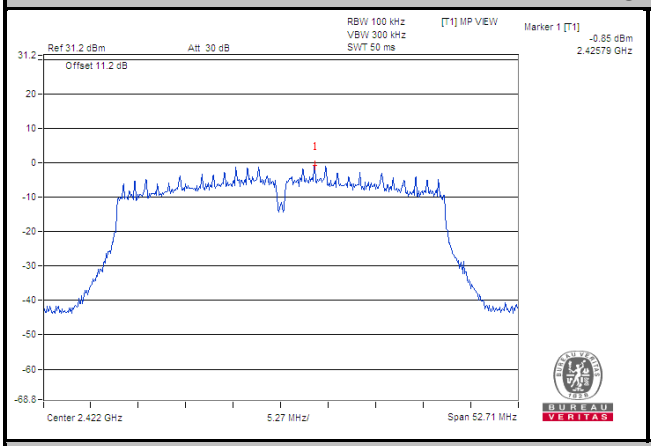


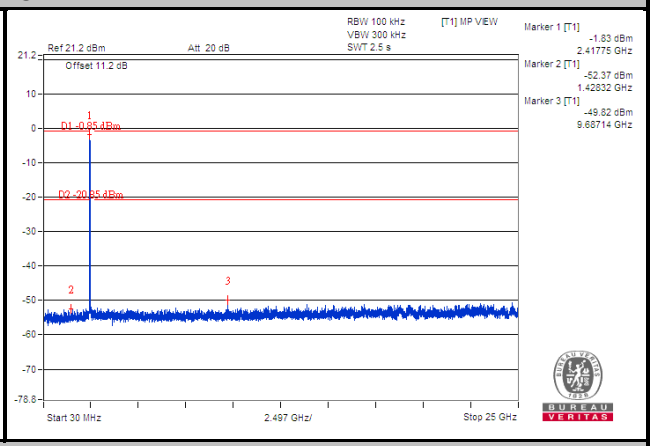
Ch 1 Band Edge	Ch 11 Band Edge
	

802.11n (HT40)

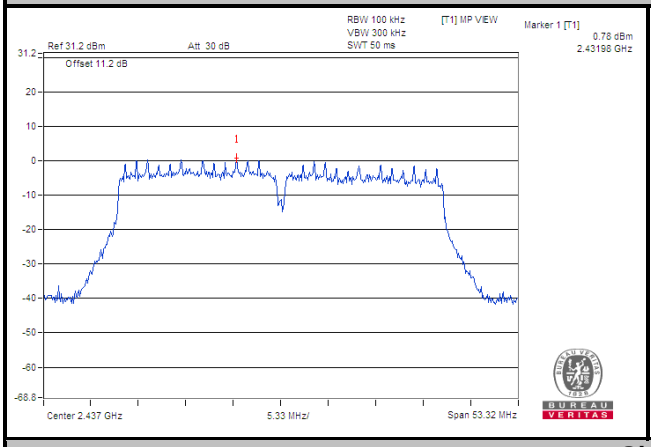
CHAIN 0

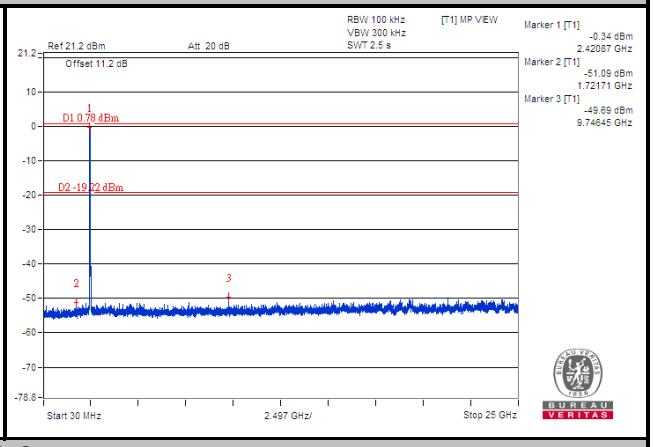
Ch 3



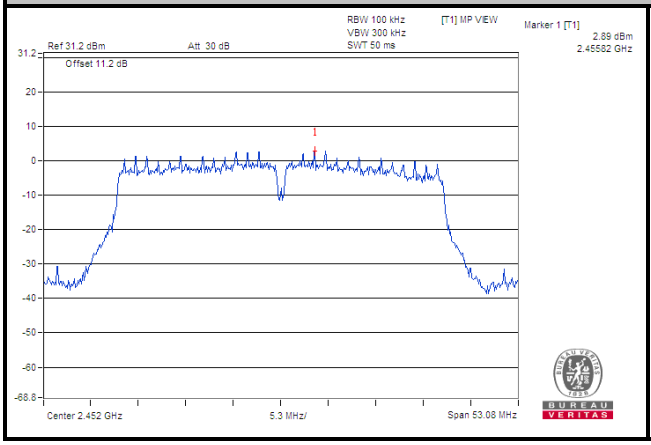


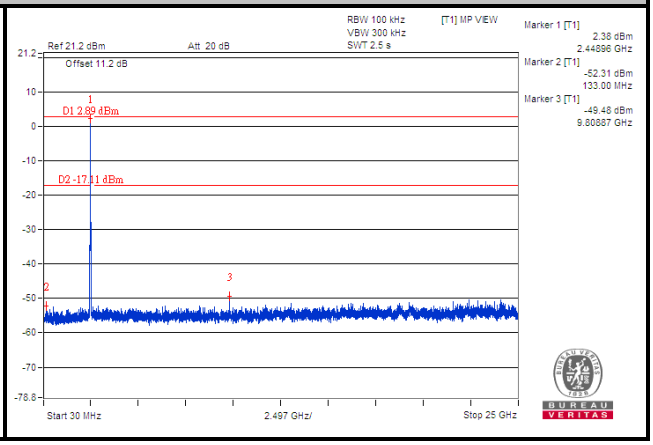
Ch 6

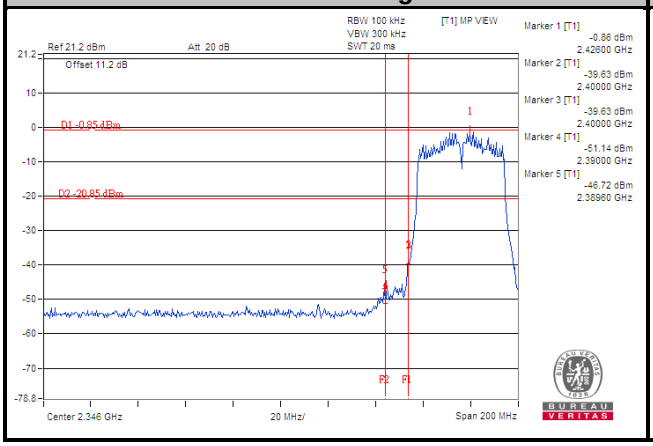
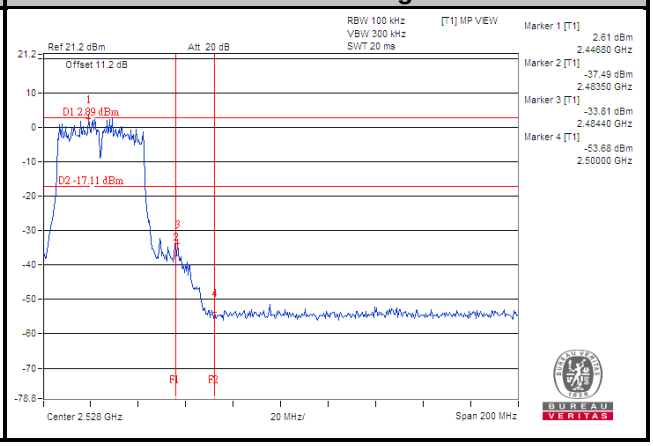




Ch 9

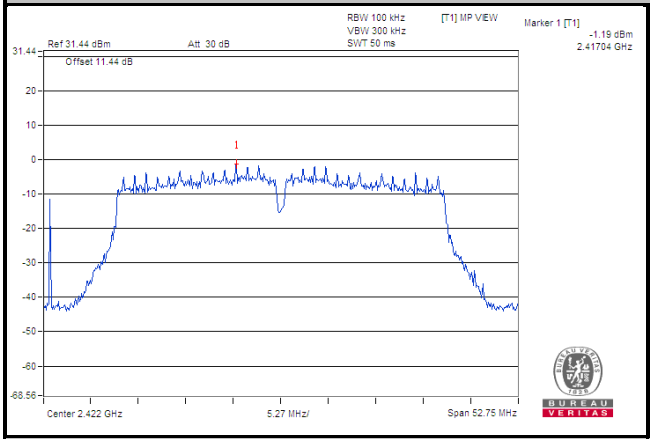


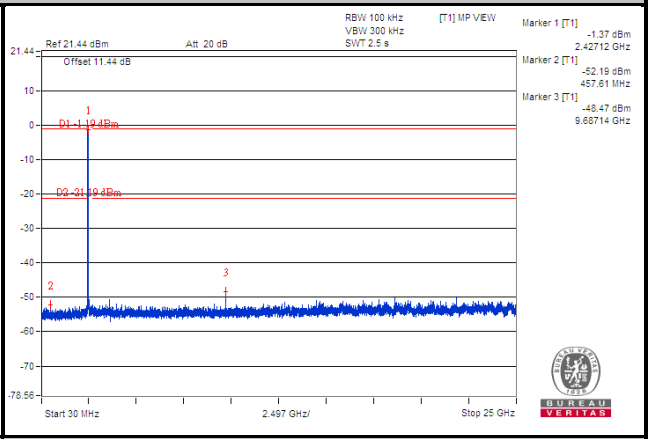


Ch 3 Band Edge	Ch 9 Band Edge
	

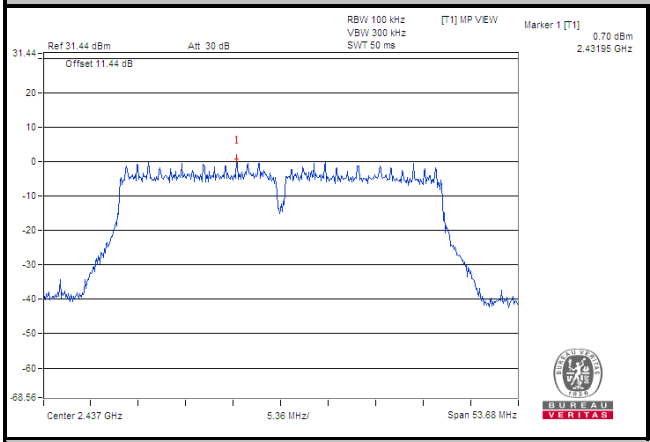
CHAIN 1

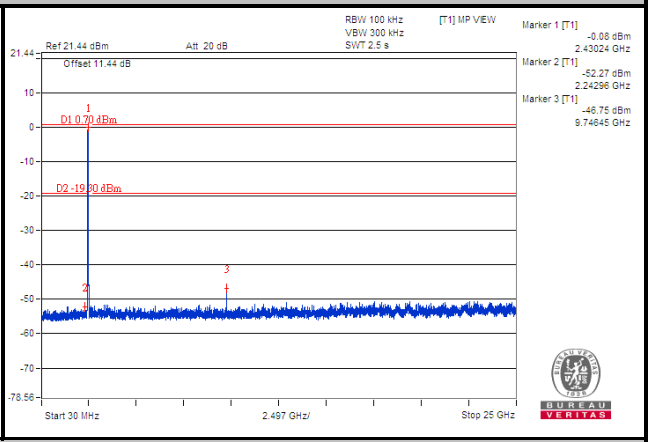
Ch 3



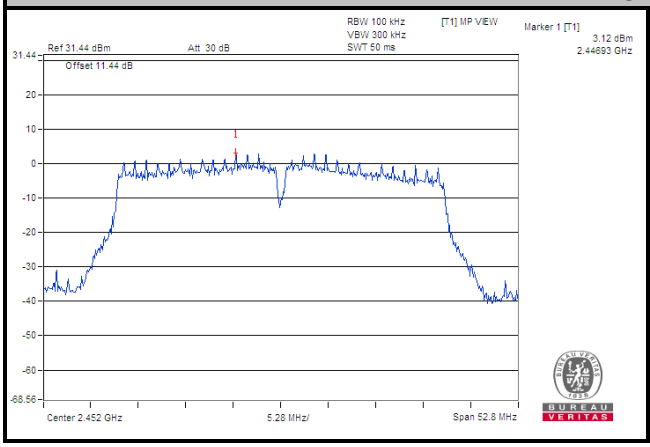


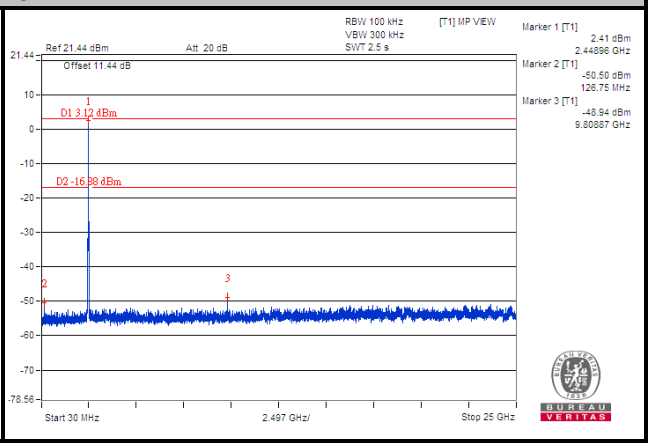
Ch 6

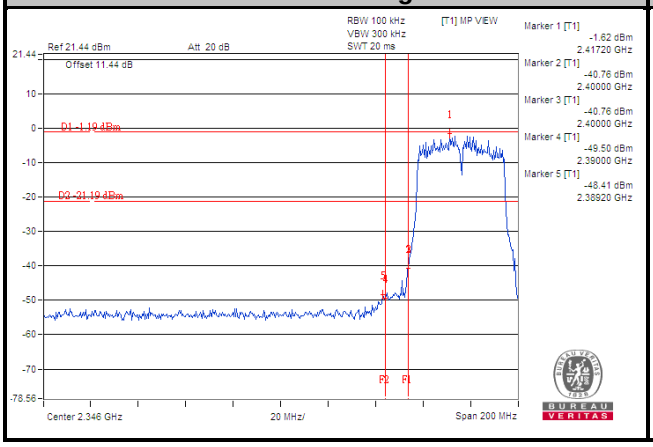
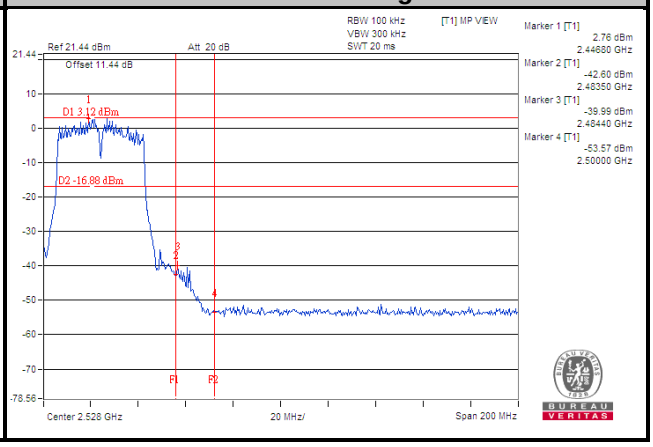




Ch 9





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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Web Site: 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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