FCC Test Report

Report No.:	RF160817C08
FCC ID:	2AJRV-TORCH1
Test Model:	Torch Router
Received Date:	Aug. 17, 2016
Test Date:	Aug. 29 ~ Sep. 14, 2016
Issued Date:	Sep. 20, 2016
Applicant:	Vesta Technologies Inc.
Address:	800 Market St, Suite 200, Chattanooga, Tennessee, 37402, USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

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Release Control Record

Issue No.	Description	Date Issued
RF160817C08	Original release.	Sep. 20, 2016

1 Certificate of Conformity

Product:	Wireless Device
Brand:	Torch
Test Model:	Torch Router
Sample Status:	Engineering sample
Applicant:	Vesta Technologies Inc.
Test Date:	Aug. 29 ~ Sep. 14, 2016
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** Sep. 20, 2016

Polly Chien / Specialist

Approved by : _____ , **Date:** Sep. 20, 2016

Ken Liu / Senior Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -8.81dB at 0.15391MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -1.2dB at 2390.00MHz, 2483.50MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is IPEX not a standard connector.

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	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.86 dB
	200MHz ~1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wireless Device
Brand	Torch
Test Model	Torch Router
Sample Status	Engineering sample
Power Supply Rating	12Vdc (adapter)
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11/5.5/2/1Mbps 802.11g: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 450Mbps
Operating Frequency	2412~2462MHz
Number of Channel	802.11b, 802.11g, 802.11n (HT20): 11 802.11n (HT40): 7
Output Power	664.807mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter
Cable Supplied	1m shielded LAN cable without core

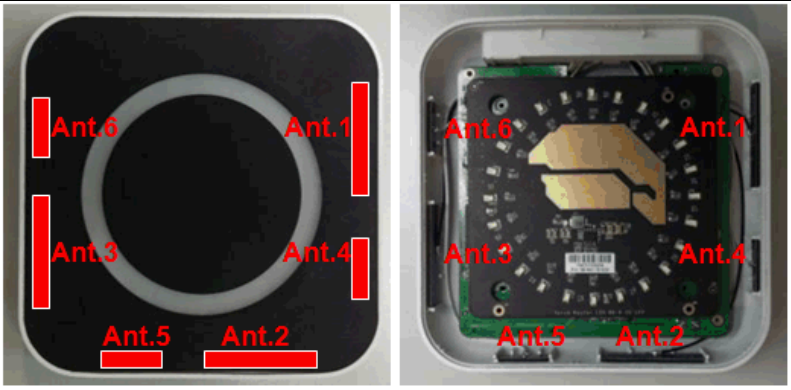
Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides 3 completed transmitters and 3 receivers.

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

2. The EUT uses following antennas.

Ant. No.	1	2	3	4	5	6
Ant. Type	PCB					
Frequency (MHz)	2400-2500			5150-5850		
Gain (dBi)	4.0	2.8	3.6	5.8	4.3	5.9
Connector	IPEX					



3. The EUT consumes power from the following adapter.

Adapter	
Brand	THXIN
Model	THX-120200KD
Input Power	100-240Vac, 50/60Hz, 0.65A MAX
Output Power	12Vdc, 2A
Power Line	1.45m cable without core attached on adapter

4. WLAN 2.4GHz and WLAN 5GHz technologies can transmit at same time.
5. Spurious emission of the simultaneous operation (WLAN 2.4GHz and WLAN 5GHz) has been evaluated and no non-compliance was found.

3.2 Description of Test Modes

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

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

7 channels are provided for 802.11n (HT40):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission APCM: Antenna Port Conducted Measurement

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on X-plane.

Radiated Emission Test (Above 1GHz):

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

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Date 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	7.2
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	15.0

Radiated Emission Test (Below 1GHz):

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

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Date Rate (Mbps)
-	802.11g	1 to 11	6	OFDM	BPSK	6.0

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	Date Rate (Mbps)
-	802.11g	1 to 11	6	OFDM	BPSK	6.0

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

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

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Date 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	7.2
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	15.0

Test Condition:

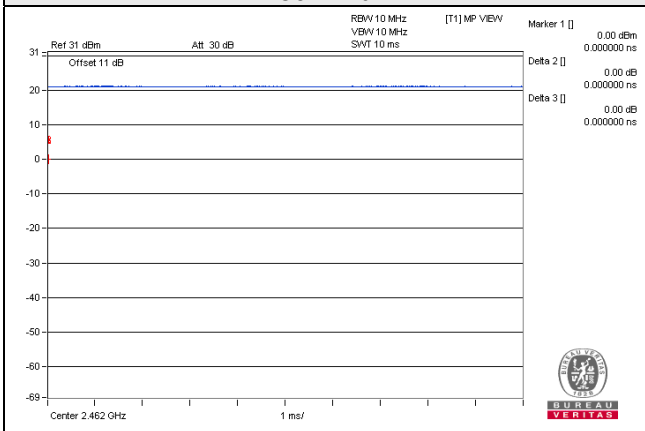
Applicable to	Environmental Conditions	Input Power	Tested by
RE≥1G	19 deg. C, 70% RH	120Vac, 60Hz	James Yang
RE<1G	19 deg. C, 70% RH	120Vac, 60Hz	Jones Chang
PLC	25 deg. C, 66% RH	120Vac, 60Hz	James Yang
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Antony Lee

3.3 Duty Cycle of Test Signal

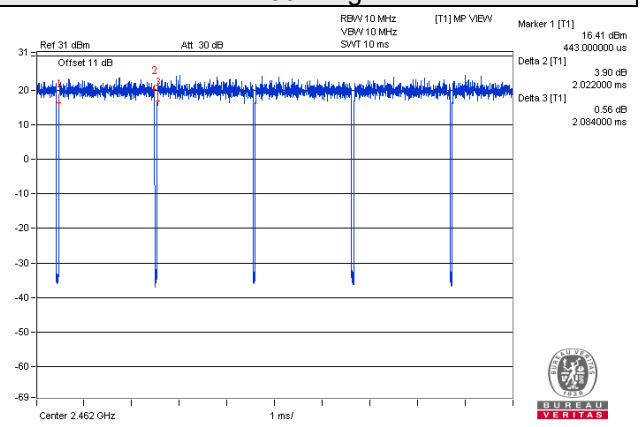
Duty cycle of test signal is ≥ 98%, duty factor is not required.
Duty cycle of test signal is < 98%, duty factor shall be considered.

802.11b: Duty cycle of test signal is 100 %, duty factor is not required.
802.11g: Duty cycle = 2.022/2.084 = 0.970, Duty factor = 10 * log(1/0.970) = 0.13
802.11n (HT20): Duty cycle = 1.879/1.954 = 0.962, Duty factor = 10 * log(1/0.962) = 0.17
802.11n (HT40): Duty cycle = 0.922/0.972 = 0.949, Duty factor = 10 * log(1/0.949) = 0.23

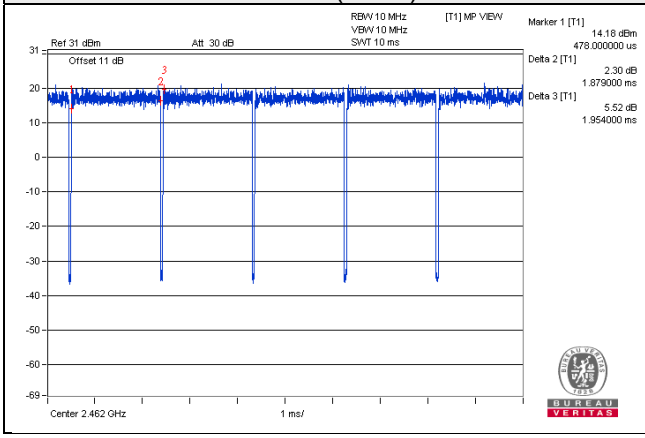
802.11b



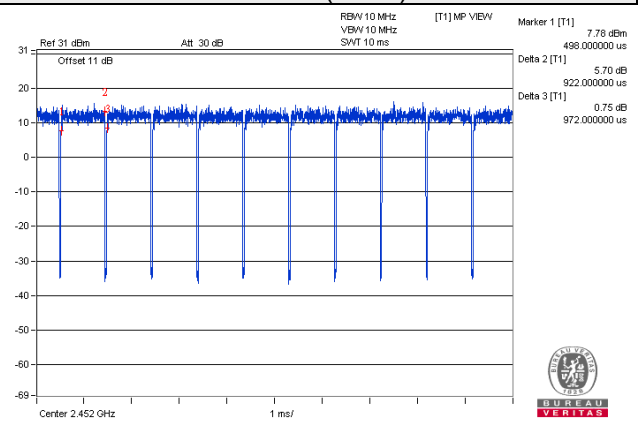
802.11g



802.11n (HT20)



802.11n (HT40)



3.4 Description of Support Units

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

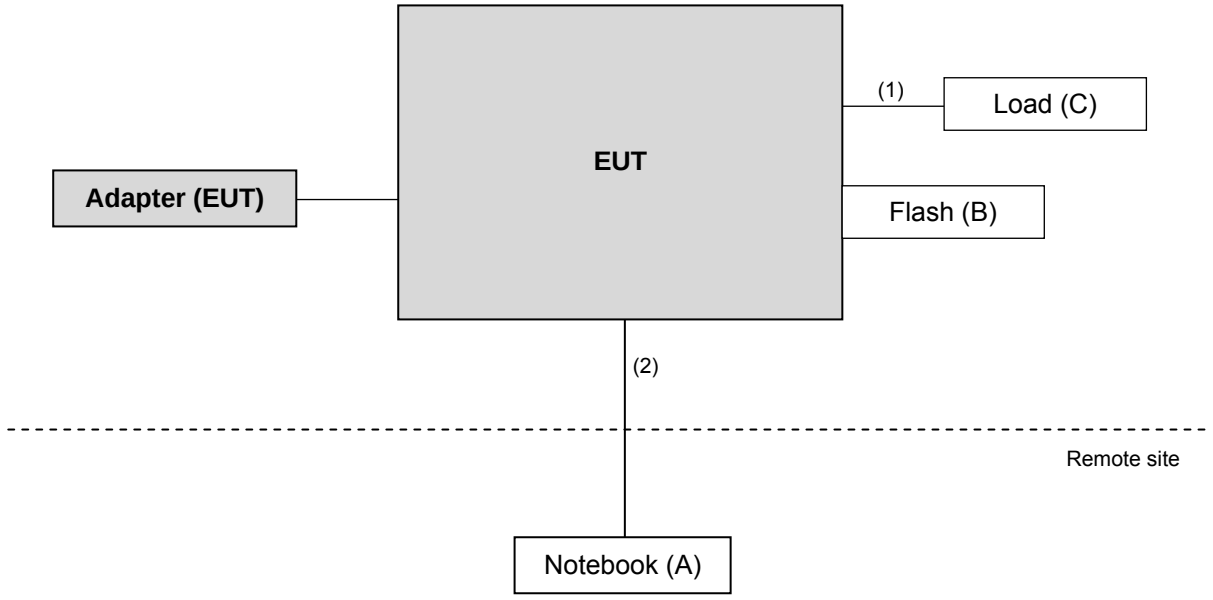
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	1HC2XM1	FCC DoC Approved	-
B.	USB Flash	HP	v250w	01	FCC DoC Approved	-
C.	Load	NA	NA	NA	NA	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45	1	1.8	N	0	-
2.	RJ45	1	5	N	0	-

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)
558074 D01 DTS Meas Guidance v03r05
662911 D01 Multiple Transmitter Output v02r01
ANSI C63.10-2013

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

Note: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 30dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 30dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	Apr. 18, 2016	Apr. 17, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Aug. 16, 2016	Aug. 15, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Jan. 07, 2016	Jan. 06, 2017
HORN Antenna SCHWARZBECK	9120D	209	Jan. 20, 2016	Jan. 19, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Jan. 18, 2016	Jan. 17, 2017
Preamplifier Agilent	8447D	2944A10738	Aug. 22, 2016	Aug. 21, 2017
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2016	Aug. 21, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (214378)	Aug. 22, 2016	Aug. 21, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 106	Cable-CH3-03 (309224+12738)	Aug. 22, 2016	Aug. 21, 2017
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
High Speed Peak Power Meter	ML2495A	0824012	Aug. 21, 2016	Aug. 20, 2017
Power Sensor	MA2411B	0738171	Aug. 11, 2016	Aug. 10, 2017

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 3.
3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 988962.
5. The IC Site Registration No. is IC 7450F-3.

4.1.3 Test Procedures

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

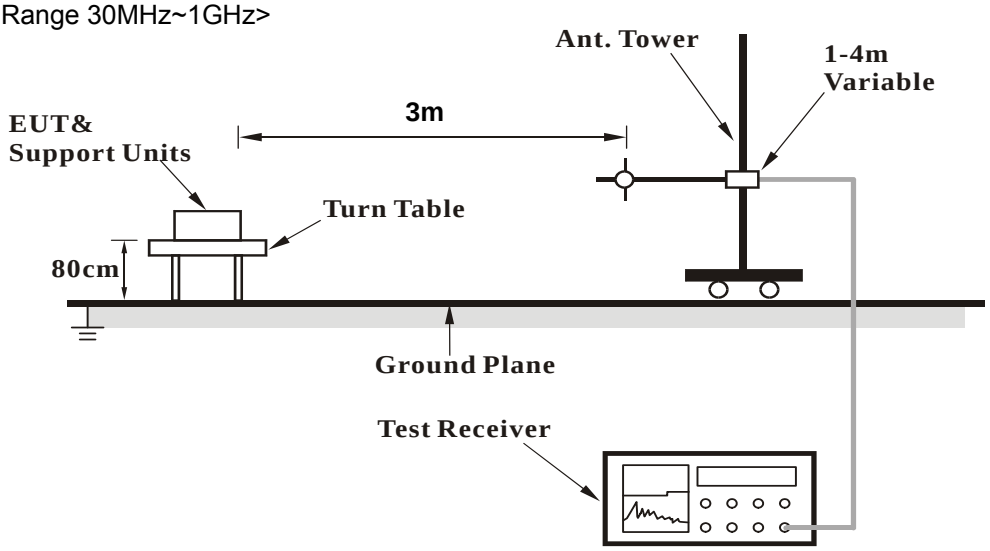
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

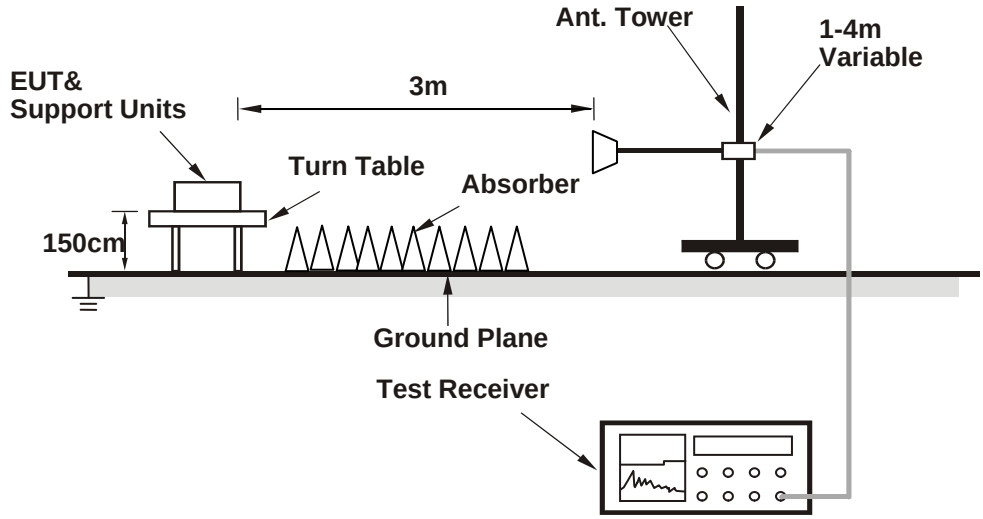
No deviation.

4.1.5 Test Setup

<Frequency Range 30MHz~1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Prepared a notebook to act as a communication partner and placed it outside of testing area.
c. The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
d. The communication partner sent data to EUT by command "PING".
e. The necessary accessories enable the system in full functions.

4.1.7 Test Results

Above 1GHz Worst-case Data:

802.11b

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.0 PK	74.0	-17.0	1.42 H	64	26.10	30.90
2	2390.00	45.2 AV	54.0	-8.8	1.42 H	64	14.30	30.90
3	*2412.00	110.9 PK			1.74 H	70	79.80	31.10
4	*2412.00	107.2 AV			1.74 H	70	76.10	31.10
5	4824.00	55.0 PK	74.0	-19.0	1.22 H	250	50.50	4.50
6	4824.00	52.4 AV	54.0	-1.6	1.22 H	250	47.90	4.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	55.6 PK	74.0	-18.4	3.75 V	323	24.70	30.90
2	2390.00	43.4 AV	54.0	-10.6	3.75 V	323	12.50	30.90
3	*2412.00	103.7 PK			3.80 V	313	72.60	31.10
4	*2412.00	99.9 AV			3.80 V	313	68.80	31.10
5	4824.00	53.6 PK	74.0	-20.4	3.75 V	321	49.10	4.50
6	4824.00	50.7 AV	54.0	-3.3	3.75 V	321	46.20	4.50

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	109.1 PK			1.75 H	41	78.00	31.10
2	*2437.00	105.3 AV			1.75 H	41	74.20	31.10
3	4874.00	54.8 PK	74.0	-19.2	1.41 H	251	50.20	4.60
4	4874.00	52.4 AV	54.0	-1.6	1.41 H	251	47.80	4.60
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	104.9 PK			3.70 V	178	73.80	31.10
2	*2437.00	101.1 AV			3.70 V	178	70.00	31.10
3	4874.00	51.0 PK	74.0	-23.0	3.73 V	0	46.40	4.60
4	4874.00	45.8 AV	54.0	-8.2	3.73 V	0	41.20	4.60

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	111.8 PK			1.97 H	241	80.60	31.20
2	*2462.00	108.0 AV			1.97 H	241	76.80	31.20
3	2483.50	59.3 PK	74.0	-14.7	1.69 H	245	28.00	31.30
4	2483.50	47.5 AV	54.0	-6.5	1.69 H	245	16.20	31.30
5	4924.00	54.2 PK	74.0	-19.8	1.18 H	250	49.70	4.50
6	4924.00	52.5 AV	54.0	-1.5	1.18 H	250	48.00	4.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	107.1 PK			3.60 V	124	75.90	31.20
2	*2462.00	103.3 AV			3.60 V	124	72.10	31.20
3	2483.50	57.0 PK	74.0	-17.0	3.52 V	134	25.70	31.30
4	2483.50	45.5 AV	54.0	-8.5	3.52 V	134	14.20	31.30
5	4924.00	51.0 PK	74.0	-23.0	3.76 V	153	46.50	4.50
6	4924.00	46.7 AV	54.0	-7.3	3.76 V	153	42.20	4.50

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11g

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	69.4 PK	74.0	-4.6	2.32 H	255	38.50	30.90
2	2390.00	52.5 AV	54.0	-1.5	2.32 H	255	21.60	30.90
3	*2412.00	110.0 PK			1.79 H	73	78.90	31.10
4	*2412.00	100.4 AV			1.79 H	73	69.30	31.10
5	4824.00	53.7 PK	74.0	-20.3	1.23 H	251	49.20	4.50
6	4824.00	39.5 AV	54.0	-14.5	1.23 H	251	35.00	4.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	62.4 PK	74.0	-11.6	3.39 V	318	31.50	30.90
2	2390.00	46.4 AV	54.0	-7.6	3.39 V	318	15.50	30.90
3	*2412.00	104.9 PK			3.29 V	122	73.80	31.10
4	*2412.00	95.5 AV			3.29 V	122	64.40	31.10
5	4824.00	47.7 PK	74.0	-26.3	3.33 V	163	43.20	4.50
6	4824.00	34.9 AV	54.0	-19.1	3.33 V	163	30.40	4.50

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	67.1 PK	74.0	-6.9	1.21 H	64	36.20	30.90
2	2390.00	50.2 AV	54.0	-3.8	1.21 H	64	19.30	30.90
3	*2437.00	117.7 PK			2.61 H	248	86.60	31.10
4	*2437.00	108.3 AV			2.61 H	248	77.20	31.10
5	2483.50	68.8 PK	74.0	-5.2	1.11 H	245	37.50	31.30
6	2483.50	50.8 AV	54.0	-3.2	1.11 H	245	19.50	31.30
7	4874.00	61.8 PK	74.0	-12.2	3.06 H	249	57.20	4.60
8	4874.00	46.3 AV	54.0	-7.7	3.06 H	249	41.70	4.60
9	7311.00	65.3 PK	74.0	-8.7	3.16 H	66	53.20	12.10
10	7311.00	52.3 AV	54.0	-1.7	3.16 H	66	40.20	12.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.8 PK	74.0	-16.2	3.05 V	198	26.90	30.90
2	2390.00	44.8 AV	54.0	-9.2	3.05 V	198	13.90	30.90
3	*2437.00	114.0 PK			3.11 V	188	82.90	31.10
4	*2437.00	104.5 AV			3.11 V	188	73.40	31.10
5	2483.50	63.4 PK	74.0	-10.6	2.72 V	215	32.10	31.30
6	2483.50	46.1 AV	54.0	-7.9	2.72 V	215	14.80	31.30
7	4874.00	51.7 PK	74.0	-22.3	2.11 V	311	47.10	4.60
8	4874.00	36.6 AV	54.0	-17.4	2.11 V	311	32.00	4.60
9	7311.00	64.7 PK	74.0	-9.3	1.71 V	340	52.60	12.10
10	7311.00	52.6 AV	54.0	-1.4	1.71 V	340	40.50	12.10

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	109.6 PK			3.00 H	239	78.40	31.20
2	*2462.00	100.4 AV			3.00 H	239	69.20	31.20
3	2483.50	70.2 PK	74.0	-3.8	2.58 H	273	38.90	31.30
4	**2483.50**	**52.8 AV**	**54.0**	**-1.2**	**2.58 H**	**273**	**21.50**	**31.30**
5	4924.00	49.5 PK	74.0	-24.5	3.05 H	261	45.00	4.50
6	4924.00	36.2 AV	54.0	-17.8	3.05 H	261	31.70	4.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	105.4 PK			2.81 V	194	74.20	31.20
2	*2462.00	96.0 AV			2.81 V	194	64.80	31.20
3	2483.50	64.1 PK	74.0	-9.9	2.74 V	225	32.80	31.30
4	2483.50	48.0 AV	54.0	-6.0	2.74 V	225	16.70	31.30
5	4874.00	45.2 PK	74.0	-28.8	2.41 V	139	40.60	4.60
6	4874.00	32.7 AV	54.0	-21.3	2.41 V	139	28.10	4.60

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11n (HT20)

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	71.1 PK	74.0	-2.9	2.32 H	244	40.20	30.90
2	2390.00	52.6 AV	54.0	-1.4	2.32 H	244	21.70	30.90
3	*2412.00	110.6 PK			1.36 H	74	79.50	31.10
4	*2412.00	101.0 AV			1.36 H	74	69.90	31.10
5	4824.00	51.3 PK	74.0	-22.7	1.53 H	250	46.80	4.50
6	4824.00	37.7 AV	54.0	-16.3	1.53 H	250	33.20	4.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	67.7 PK	74.0	-6.3	2.97 V	105	36.80	30.90
2	2390.00	50.2 AV	54.0	-3.8	2.97 V	105	19.30	30.90
3	*2412.00	104.7 PK			3.22 V	109	73.60	31.10
4	*2412.00	95.2 AV			3.22 V	109	64.10	31.10
5	4824.00	45.6 PK	74.0	-28.4	2.50 V	166	41.10	4.50
6	4824.00	33.2 AV	54.0	-20.8	2.50 V	166	28.70	4.50

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	68.2 PK	74.0	-5.8	1.20 H	73	37.30	30.90
2	2390.00	51.5 AV	54.0	-2.5	1.20 H	73	20.60	30.90
3	*2437.00	118.1 PK			1.73 H	57	87.00	31.10
4	*2437.00	108.5 AV			1.73 H	57	77.40	31.10
5	2483.50	69.0 PK	74.0	-5.0	1.45 H	244	37.70	31.30
6	2483.50	51.5 AV	54.0	-2.5	1.45 H	244	20.20	31.30
7	4874.00	58.7 PK	74.0	-15.3	1.26 H	252	54.10	4.60
8	4874.00	44.1 AV	54.0	-9.9	1.26 H	252	39.50	4.60
9	7311.00	64.5 PK	74.0	-9.5	1.35 H	345	52.40	12.10
10	7311.00	50.9 AV	54.0	-3.1	1.35 H	345	38.80	12.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.9 PK	74.0	-16.1	2.36 V	317	27.00	30.90
2	2390.00	44.3 AV	54.0	-9.7	2.36 V	317	13.40	30.90
3	*2437.00	109.9 PK			2.43 V	331	78.80	31.10
4	*2437.00	100.3 AV			2.43 V	331	69.20	31.10
5	2483.50	58.6 PK	74.0	-15.4	2.48 V	299	27.30	31.30
6	2483.50	45.3 AV	54.0	-8.7	2.48 V	299	14.00	31.30
7	4874.00	51.6 PK	74.0	-22.4	1.35 V	201	47.00	4.60
8	4874.00	37.8 AV	54.0	-16.2	1.35 V	201	33.20	4.60
9	7311.00	65.7 PK	74.0	-8.3	1.19 V	337	53.60	12.10
10	7311.00	52.1 AV	54.0	-1.9	1.19 V	337	40.00	12.10

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	109.2 PK			2.19 H	253	78.00	31.20
2	*2462.00	99.5 AV			2.19 H	253	68.30	31.20
3	2483.50	69.6 PK	74.0	-4.4	2.22 H	228	38.30	31.30
4	2483.50	52.7 AV	54.0	-1.3	2.22 H	228	21.40	31.30
5	4924.00	47.6 PK	74.0	-26.4	1.98 H	256	43.10	4.50
6	4924.00	34.7 AV	54.0	-19.3	1.98 H	256	30.20	4.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	102.5 PK			2.73 V	193	71.30	31.20
2	*2462.00	92.8 AV			2.73 V	193	61.60	31.20
3	2483.50	59.2 PK	74.0	-14.8	2.72 V	217	27.90	31.30
4	2483.50	45.3 AV	54.0	-8.7	2.72 V	217	14.00	31.30
5	4924.00	46.6 PK	74.0	-27.4	2.24 V	300	42.10	4.50
6	4924.00	33.1 AV	54.0	-20.9	2.24 V	300	28.60	4.50

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11n (HT40)

CHANNEL	TX Channel 3	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	69.0 PK	74.0	-5.0	1.19 H	73	38.10	30.90
2	**2390.00**	**52.8 AV**	**54.0**	**-1.2**	**1.19 H**	**73**	**21.90**	**30.90**
3	*2422.00	102.9 PK			3.34 H	246	71.80	31.10
4	*2422.00	93.5 AV			3.34 H	246	62.40	31.10
5	4844.00	45.9 PK	74.0	-28.1	2.93 H	115	41.50	4.40
6	4844.00	33.2 AV	54.0	-20.8	2.93 H	115	28.80	4.40
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	62.1 PK	74.0	-11.9	3.57 V	201	31.20	30.90
2	2390.00	47.3 AV	54.0	-6.7	3.57 V	201	16.40	30.90
3	*2422.00	98.7 PK			3.54 V	221	67.60	31.10
4	*2422.00	89.2 AV			3.54 V	221	58.10	31.10
5	4844.00	46.0 PK	74.0	-28.0	2.74 V	158	41.60	4.40
6	4844.00	32.8 AV	54.0	-21.2	2.74 V	158	28.40	4.40

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	65.8 PK	74.0	-8.2	1.16 H	47	34.90	30.90
2	2390.00	50.2 AV	54.0	-3.8	1.16 H	47	19.30	30.90
3	*2437.00	107.8 PK			1.28 H	72	76.70	31.10
4	*2437.00	98.2 AV			1.28 H	72	67.10	31.10
5	2483.50	68.7 PK	74.0	-5.3	3.32 H	254	37.40	31.30
6	**2483.50**	**52.8 AV**	**54.0**	**-1.2**	**3.32 H**	**254**	**21.50**	**31.30**
7	4874.00	46.1 PK	74.0	-27.9	2.54 H	320	41.50	4.60
8	4874.00	33.5 AV	54.0	-20.5	2.54 H	320	28.90	4.60
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	61.6 PK	74.0	-12.4	3.36 V	190	30.70	30.90
2	2390.00	47.6 AV	54.0	-6.4	3.36 V	190	16.70	30.90
3	*2437.00	101.7 PK			3.59 V	180	70.60	31.10
4	*2437.00	92.1 AV			3.59 V	180	61.00	31.10
5	2483.50	57.8 PK	74.0	-16.2	3.35 V	181	26.50	31.30
6	2483.50	46.4 AV	54.0	-7.6	3.35 V	181	15.10	31.30
7	4874.00	46.4 PK	74.0	-27.6	2.74 V	185	41.80	4.60
8	4874.00	33.0 AV	54.0	-21.0	2.74 V	185	28.40	4.60

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 9	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2452.00	103.3 PK			2.90 H	249	72.10	31.20
2	*2452.00	93.9 AV			2.90 H	249	62.70	31.20
3	2483.50	66.9 PK	74.0	-7.1	2.60 H	241	35.60	31.30
4	2483.50	52.6 AV	54.0	-1.4	2.60 H	241	21.30	31.30
5	4904.00	46.3 PK	74.0	-27.7	2.78 H	284	41.80	4.50
6	4904.00	33.5 AV	54.0	-20.5	2.78 H	284	29.00	4.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2452.00	98.8 PK			3.31 V	135	67.60	31.20
2	*2452.00	88.0 AV			3.31 V	135	56.80	31.20
3	2483.50	59.9 PK	74.0	-14.1	3.40 V	181	28.60	31.30
4	2483.50	47.3 AV	54.0	-6.7	3.40 V	181	16.00	31.30
5	4904.00	46.2 PK	74.0	-27.8	2.73 V	265	41.70	4.50
6	4904.00	33.2 AV	54.0	-20.8	2.73 V	265	28.70	4.50

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

Below 1GHz Worst-Case Data: 802.11g

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	374.04	42.1 QP	46.0	-3.9	1.00 H	29	52.60	-10.50
2	562.64	42.0 QP	46.0	-4.0	1.49 H	172	48.70	-6.70
3	624.85	38.7 QP	46.0	-7.3	1.49 H	193	43.40	-4.70
4	751.23	39.7 QP	46.0	-6.3	1.00 H	202	41.90	-2.20
5	875.67	41.6 QP	46.0	-4.4	1.00 H	181	41.70	-0.10
6	899.98	43.1 QP	46.0	-2.9	1.55 H	248	42.30	0.80
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	43.51	37.3 QP	40.0	-2.7	1.00 V	158	52.10	-14.80
2	374.04	35.1 QP	46.0	-10.9	1.49 V	288	45.60	-10.50
3	564.58	40.5 QP	46.0	-5.5	1.00 V	261	47.10	-6.60
4	624.85	39.5 QP	46.0	-6.5	1.00 V	100	44.20	-4.70
5	751.23	35.0 QP	46.0	-11.0	1.49 V	144	37.20	-2.20
6	900.94	41.0 QP	46.0	-5.0	1.00 V	280	40.20	0.80

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Dec. 23, 2015	Dec. 22, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Dec. 26, 2015	Dec. 25, 2016
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Jan. 11, 2016	Jan. 10, 2017
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 26, 2016	Jul. 25, 2017
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 2.
3. The VCCI Site Registration No. is C-2047.

4.2.3 Test Procedures

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

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

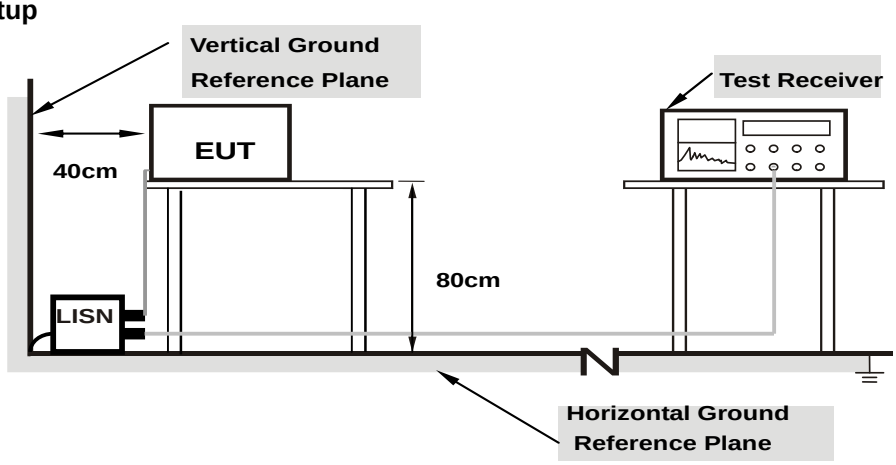
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

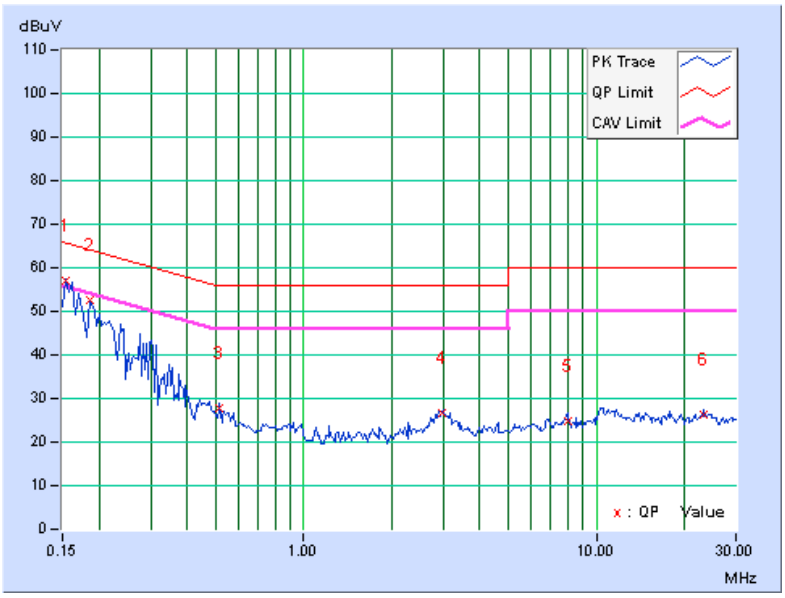
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.15391**	**10.12**	**46.86**	**26.43**	**56.98**	**36.55**	**65.79**	**55.79**	**-8.81**	**-19.24**
2	0.18516	10.15	42.44	25.94	52.59	36.09	64.25	54.25	-11.66	-18.16
3	0.51328	10.20	17.45	0.06	27.65	10.26	56.00	46.00	-28.35	-35.74
4	2.98438	10.31	16.31	8.75	26.62	19.06	56.00	46.00	-29.38	-26.94
5	7.95703	10.44	14.41	-1.45	24.85	8.99	60.00	50.00	-35.15	-41.01
6	23.28516	10.55	15.92	0.17	26.47	10.72	60.00	50.00	-33.53	-39.28

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

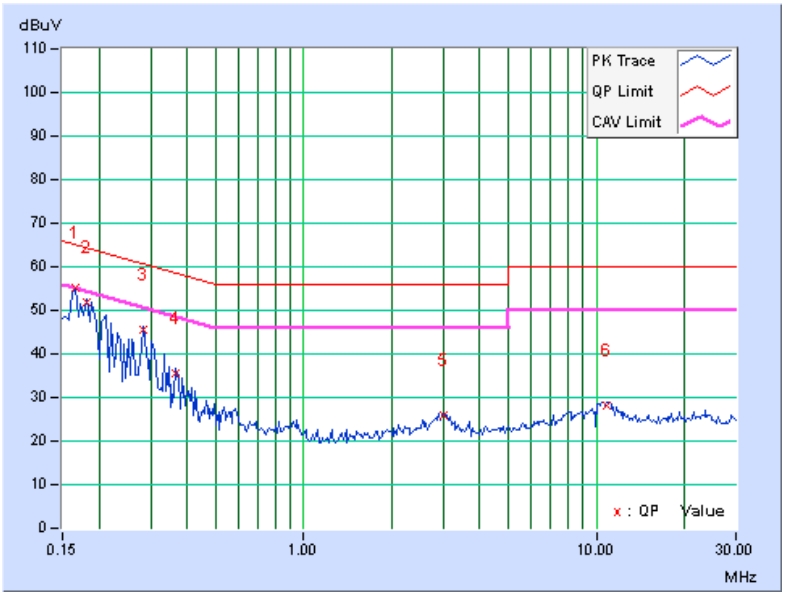


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	10.14	45.06	28.29	55.20	38.43	65.18	55.18	-9.98	-16.75
2	0.18125	10.15	41.54	25.76	51.69	35.91	64.43	54.43	-12.74	-18.52
3	0.28281	10.17	35.22	23.85	45.39	34.02	60.73	50.73	-15.34	-16.71
4	0.36484	10.18	25.55	9.32	35.73	19.50	58.62	48.62	-22.89	-29.12
5	2.99609	10.34	15.54	7.17	25.88	17.51	56.00	46.00	-30.12	-28.49
6	10.82813	10.57	17.61	8.45	28.18	19.02	60.00	50.00	-31.82	-30.98

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

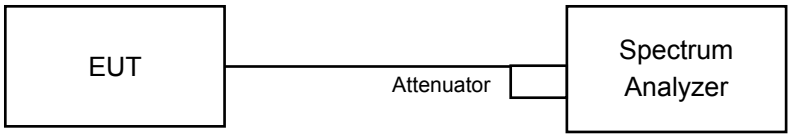


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

a. Set resolution bandwidth (RBW) = 100kHz
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 Result

802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
1	2412	10.10	10.09	10.12	0.5	Pass
6	2437	10.10	10.12	10.11	0.5	Pass
11	2462	10.10	10.13	10.12	0.5	Pass

802.11g

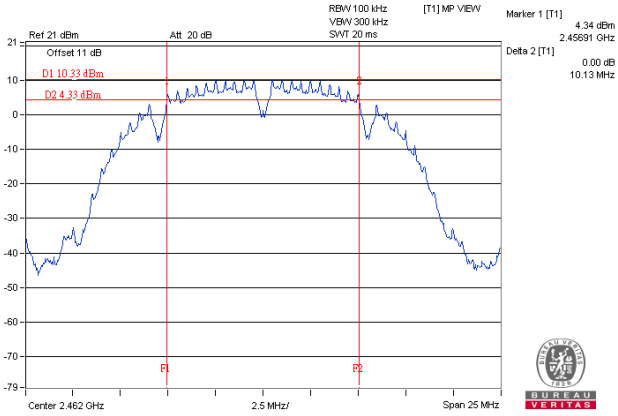
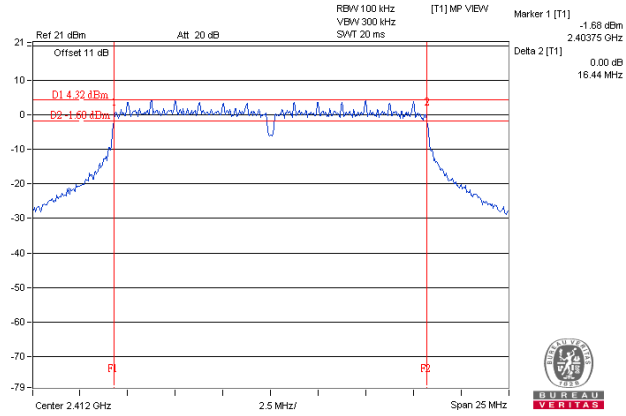
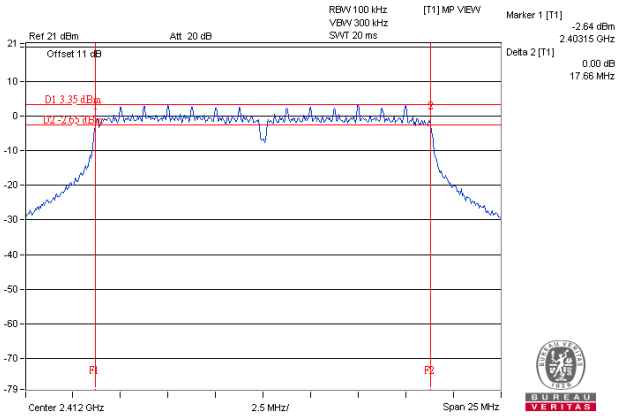
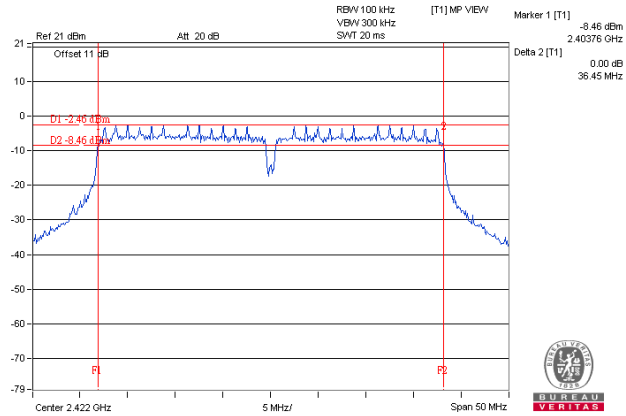
Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
1	2412	16.42	16.44	16.43	0.5	Pass
6	2437	16.40	16.38	16.39	0.5	Pass
11	2462	16.42	16.41	16.41	0.5	Pass

802.11n (HT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
1	2412	17.64	17.65	17.66	0.5	Pass
6	2437	17.61	17.60	17.61	0.5	Pass
11	2462	17.63	17.64	17.63	0.5	Pass

802.11n (HT40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
3	2422	36.45	36.12	36.41	0.5	Pass
6	2437	36.40	36.40	36.41	0.5	Pass
9	2452	36.39	36.43	36.40	0.5	Pass

Spectrum Plot of Worst Value	
802.11b	802.11g
	
802.11n (HT20)	802.11n (HT40)
	

4.4 Conducted Output Power Measurement

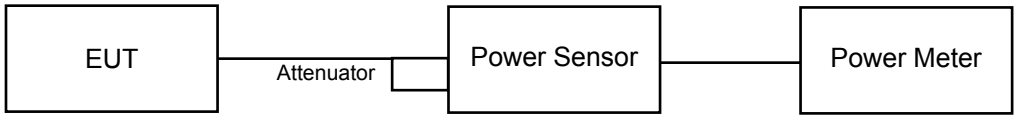
4.4.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)
Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

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

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as 4.3.6.

4.4.7 Test Results

Average Power:

802.11b

Chan.	Freq. (MHz)	Avg. Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
1	2412	18.38	17.77	17.49	184.811	22.67	30.00	Pass
6	2437	17.42	17.49	17.47	167.160	22.23	30.00	Pass
11	2462	19.09	19.48	19.01	249.428	23.97	30.00	Pass

802.11g

Chan.	Freq. (MHz)	Avg. Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
1	2412	15.66	15.32	15.74	108.351	20.35	30.00	Pass
6	2437	23.25	23.53	23.58	**664.807**	28.23	30.00	Pass
11	2462	15.14	16.42	16.08	117.063	20.68	30.00	Pass

802.11n (HT20)

Chan.	Freq. (MHz)	Avg. Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
1	2412	15.11	14.44	14.11	85.994	19.34	30.00	Pass
6	2437	23.32	23.60	23.32	658.653	28.19	30.00	Pass
11	2462	12.74	13.71	13.66	65.516	18.16	30.00	Pass

802.11n (HT40)

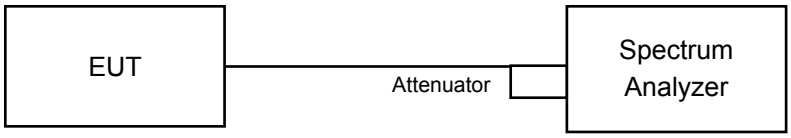
Chan.	Freq. (MHz)	Avg. Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
3	2422	11.46	11.43	11.26	41.262	16.16	30.00	Pass
6	2437	15.00	14.93	15.16	95.550	19.80	30.00	Pass
9	2452	10.93	11.15	11.00	38.009	15.80	30.00	Pass

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

For AVG. power (duty cycle ≥ 98%)
a) Set instrument center frequency to DTS channel center frequency.
b) Set span to at least 1.5 times the OBW.
c) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set VBW ≥3 x RBW.
e) Detector = power averaging (RMS) or sample detector (when RMS not available).
f) Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
g) Sweep time = auto couple.
h) Employ trace averaging (RMS) mode over a minimum of 100 traces.
i) Use the peak marker function to determine the maximum amplitude level.

For AVG. power (duty cycle < 98%)
a) Measure the duty cycle (x).
b) Set instrument center frequency to DTS channel center frequency.
c) Set span to at least 1.5 times the OBW.
d) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
e) Set VBW ≥3 x RBW.
f) Detector = power averaging (RMS) or sample detector (when RMS not available).
g) Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
h) Sweep time = auto couple.
i) Do not use sweep triggering. Allow sweep to “free run”.
j) Employ trace averaging (RMS) mode over a minimum of 100 traces.
k) Use the peak marker function to determine the maximum amplitude level.
l) Add 10 log (1/x), where x is the duty cycle measured in step (a, to the measured PSD to compute the average PSD during the actual transmission time.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

Same as 4.3.6

4.5.7 Test Results

802.11b

TX chain	Chan.	Freq. (MHz)	PSD (dBm/3kHz)	10 log (N=3) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
0	1	2412	-19.47	4.77	-14.70	5.23	Pass
	6	2437	-16.80	4.77	-12.03	5.23	Pass
	11	2462	-15.37	4.77	-10.60	5.23	Pass
1	1	2412	-19.58	4.77	-14.81	5.23	Pass
	6	2437	-16.07	4.77	-11.30	5.23	Pass
	11	2462	-14.46	4.77	-9.69	5.23	Pass
2	1	2412	-19.20	4.77	-14.43	5.23	Pass
	6	2437	-16.09	4.77	-11.32	5.23	Pass
	11	2462	-14.91	4.77	-10.14	5.23	Pass

Note:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 4dBi + 10log(3) = 8.77dBi > 6dBi, so the power density limit shall be reduced to 8-(8.77-6) = 5.23dBm.

802.11g

TX chain	Chan.	Freq. (MHz)	PSD (dBm/3kHz)	10 log (N=3) dB	Duty Factor	Total PSD with Duty Factor (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
0	1	2412	-20.22	4.77	0.13	-15.32	5.23	Pass
	6	2437	-12.76	4.77	0.13	-7.86	5.23	Pass
	11	2462	-20.82	4.77	0.13	-15.92	5.23	Pass
1	1	2412	-20.60	4.77	0.13	-15.70	5.23	Pass
	6	2437	-12.78	4.77	0.13	-7.88	5.23	Pass
	11	2462	-19.25	4.77	0.13	-14.35	5.23	Pass
2	1	2412	-20.51	4.77	0.13	-15.61	5.23	Pass
	6	2437	-12.46	4.77	0.13	-7.56	5.23	Pass
	11	2462	-19.64	4.77	0.13	-14.74	5.23	Pass

Note:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 4dBi + 10log(3) = 8.77dBi > 6dBi, so the power density limit shall be reduced to 8-(8.77-6) = 5.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

TX chain	Chan.	Freq. (MHz)	PSD (dBm/3kHz)	10 log (N=3) dB	Duty Factor	Total PSD with Duty Factor (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
0	1	2412	-21.18	4.77	0.17	-16.24	5.23	Pass
	6	2437	-13.35	4.77	0.17	-8.41	5.23	Pass
	11	2462	-23.45	4.77	0.17	-18.51	5.23	Pass
1	1	2412	-21.95	4.77	0.17	-17.01	5.23	Pass
	6	2437	-13.22	4.77	0.17	-8.28	5.23	Pass
	11	2462	-22.57	4.77	0.17	-17.63	5.23	Pass
2	1	2412	-21.90	4.77	0.17	-16.96	5.23	Pass
	6	2437	-13.37	4.77	0.17	-8.43	5.23	Pass
	11	2462	-22.89	4.77	0.17	-17.95	5.23	Pass

Note:

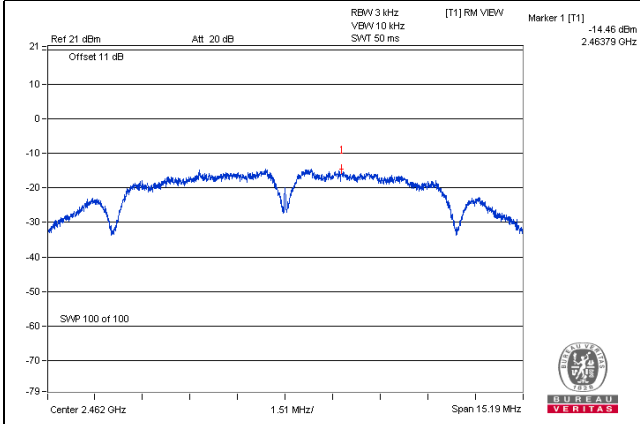
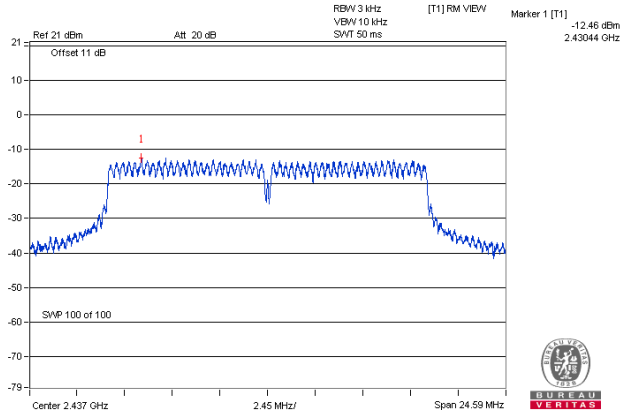
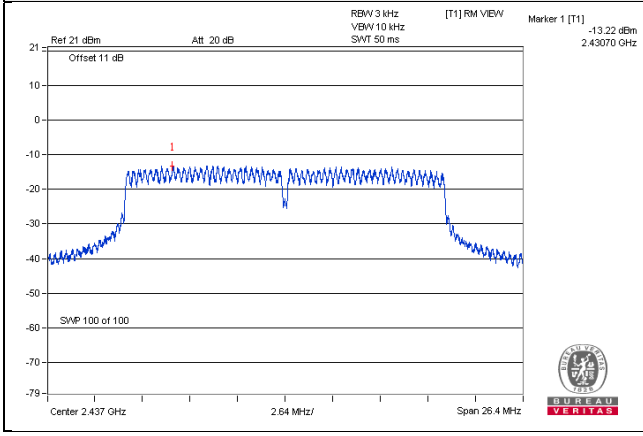
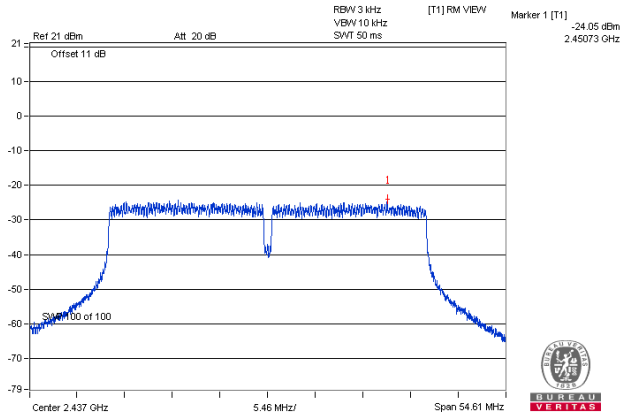
1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 2dBi + 10log(3) = 6.77dBi > 6dBi, so the power density limit shall be reduced to 8-(6.77-6) = 7.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

TX chain	Chan.	Freq. (MHz)	PSD (dBm/3kHz)	10 log (N=3) dB	Duty Factor	Total PSD with Duty Factor (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
0	3	2422	-28.00	4.77	0.23	-23.00	5.23	Pass
	6	2437	-24.96	4.77	0.23	-19.96	5.23	Pass
	9	2452	-27.96	4.77	0.23	-22.96	5.23	Pass
1	3	2422	-28.59	4.77	0.23	-23.59	5.23	Pass
	6	2437	-24.78	4.77	0.23	-19.78	5.23	Pass
	9	2452	-28.91	4.77	0.23	-23.91	5.23	Pass
2	3	2422	-28.36	4.77	0.23	-23.36	5.23	Pass
	6	2437	-24.05	4.77	0.23	-19.05	5.23	Pass
	9	2452	-28.37	4.77	0.23	-23.37	5.23	Pass

Note:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 4dBi + 10log(3) = 8.77dBi > 6dBi, so the power density limit shall be reduced to 8-(8.77-6) = 5.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

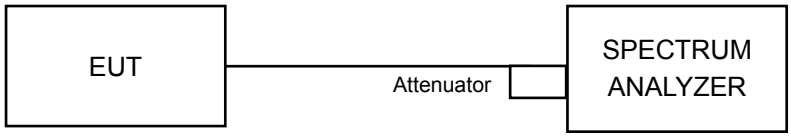
Spectrum Plot of Worst Value	
802.11b	802.11g
	
802.11n (HT20)	802.11n (HT40)
	

4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below 30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

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.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

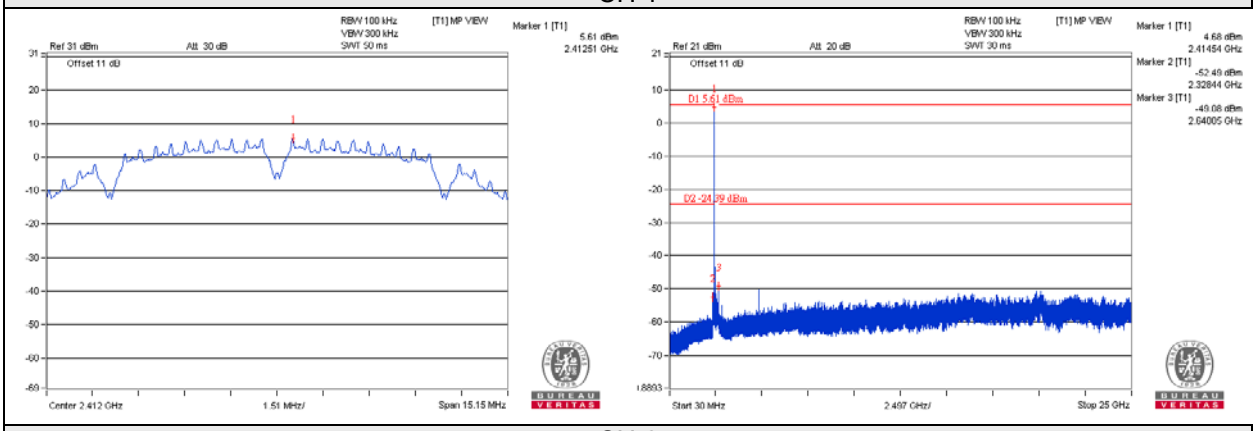
Same as 4.3.6

4.6.7 Test Results

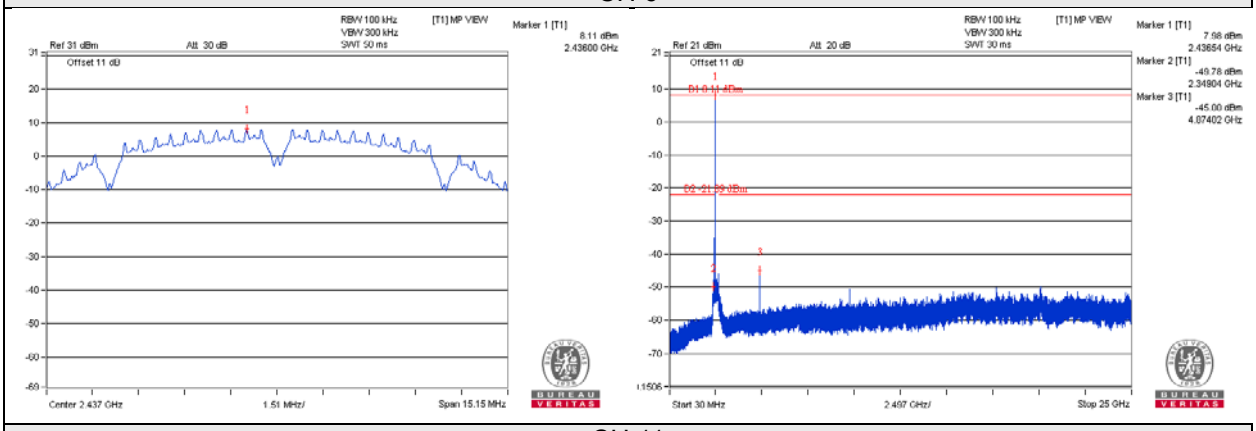
The conducted emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

802.11b_Chain 0

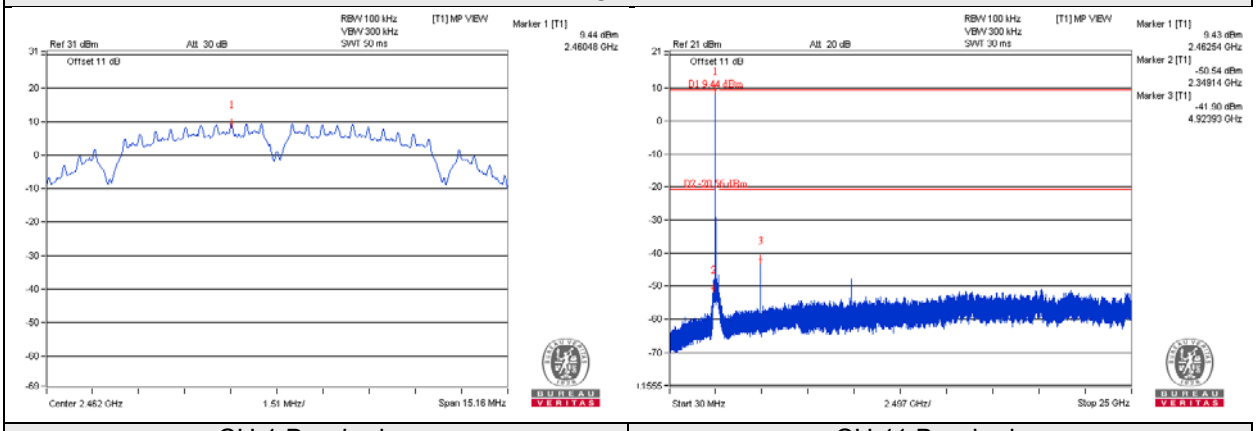
CH 1



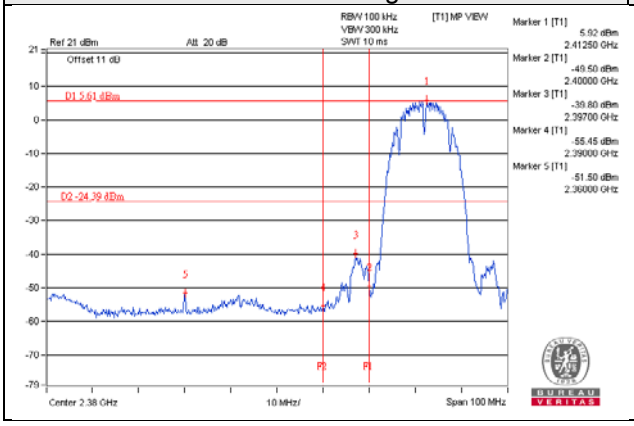
CH 6



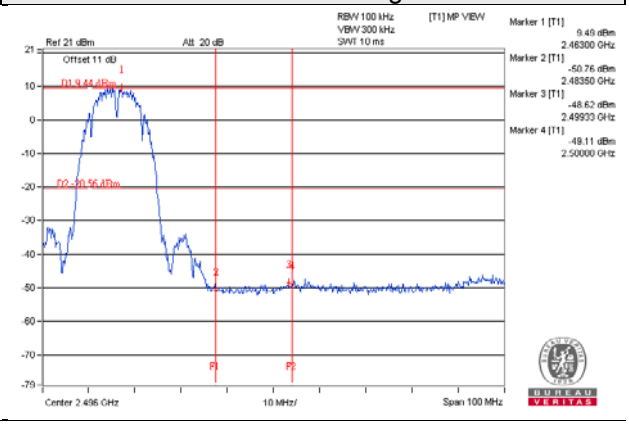
CH 11



CH 1 Band edge

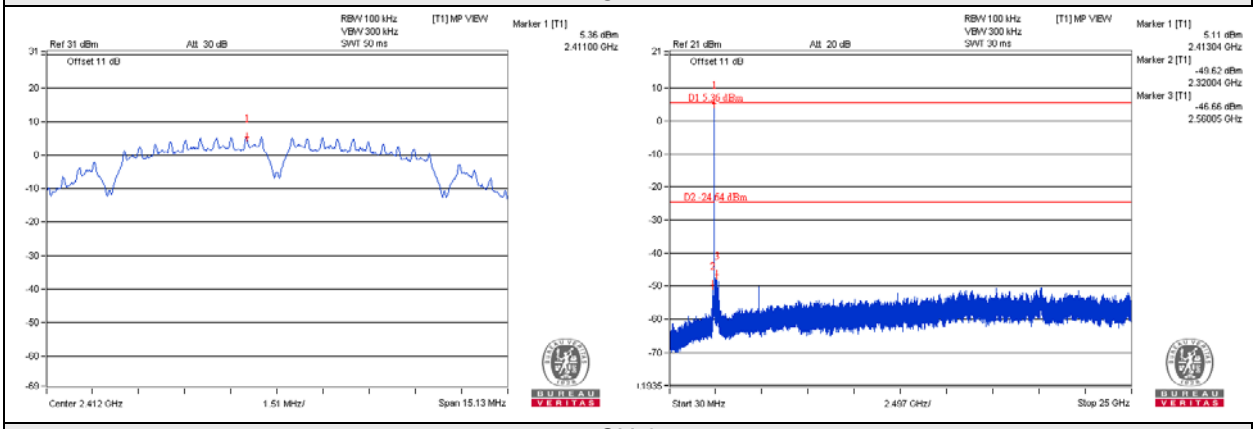


CH 11 Band edge

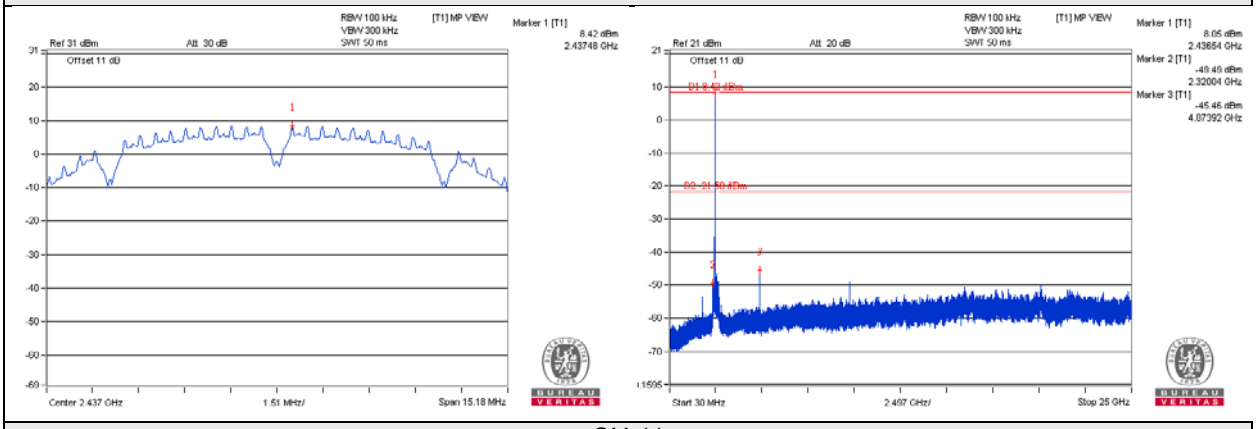


802.11b_Chain 1

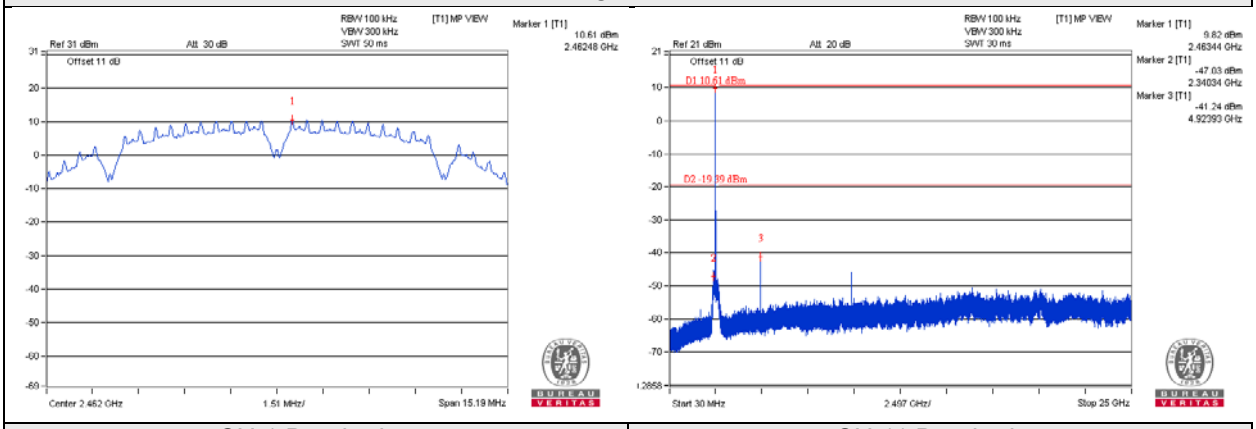
CH 1



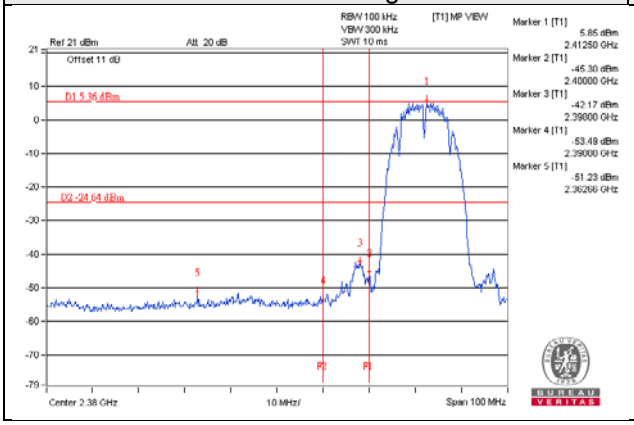
CH 6



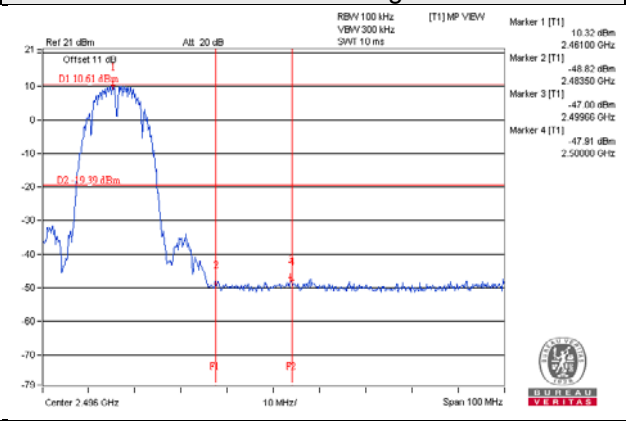
CH 11



CH 1 Band edge

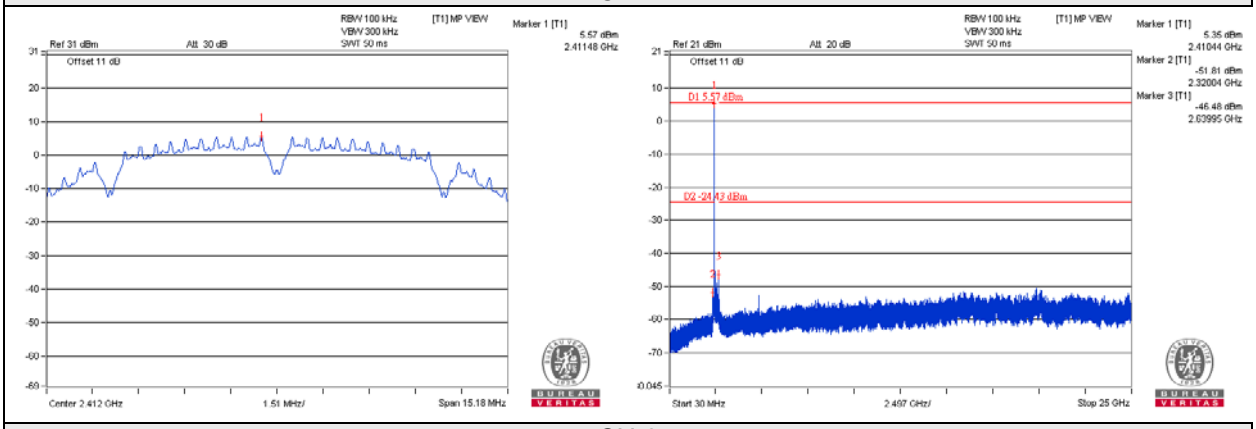


CH 11 Band edge

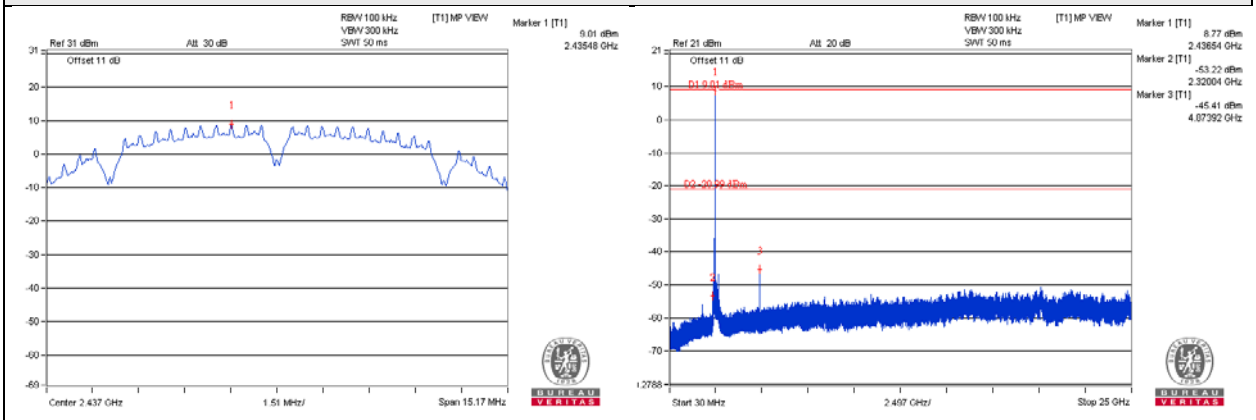


802.11b_Chain 2

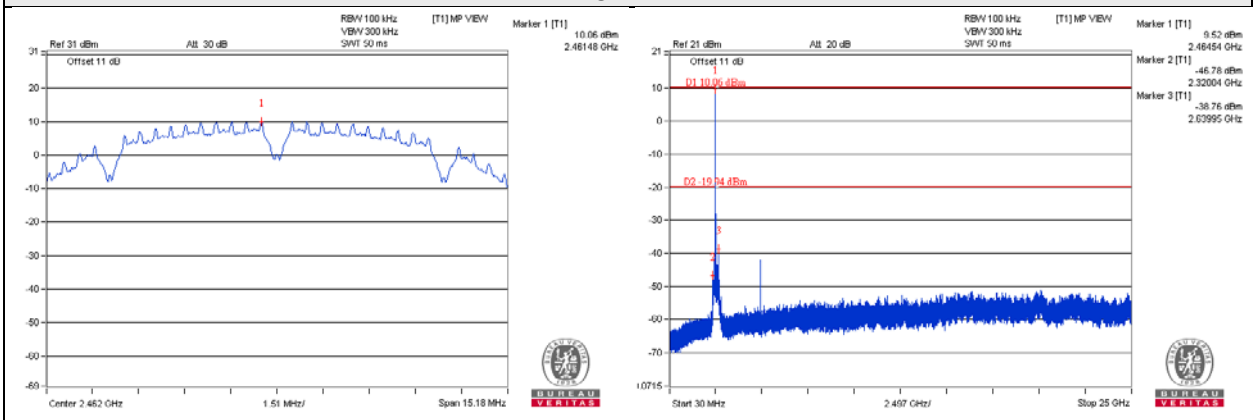
CH 1



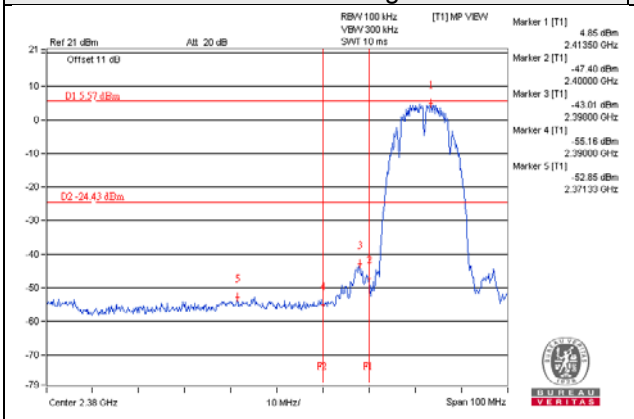
CH 6



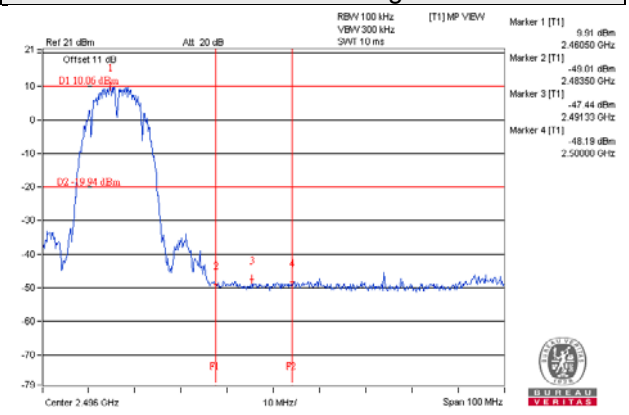
CH 11



CH 1 Band edge

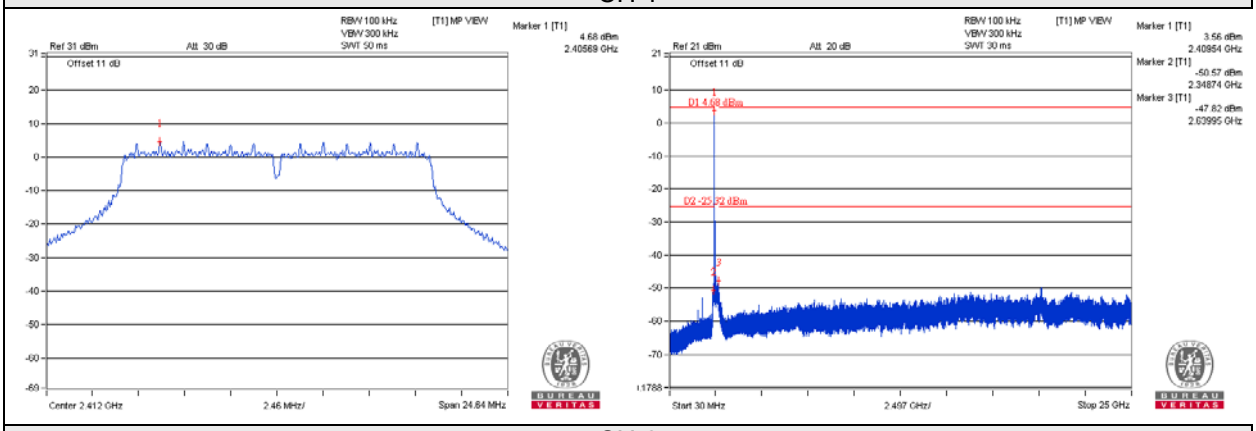


CH 11 Band edge

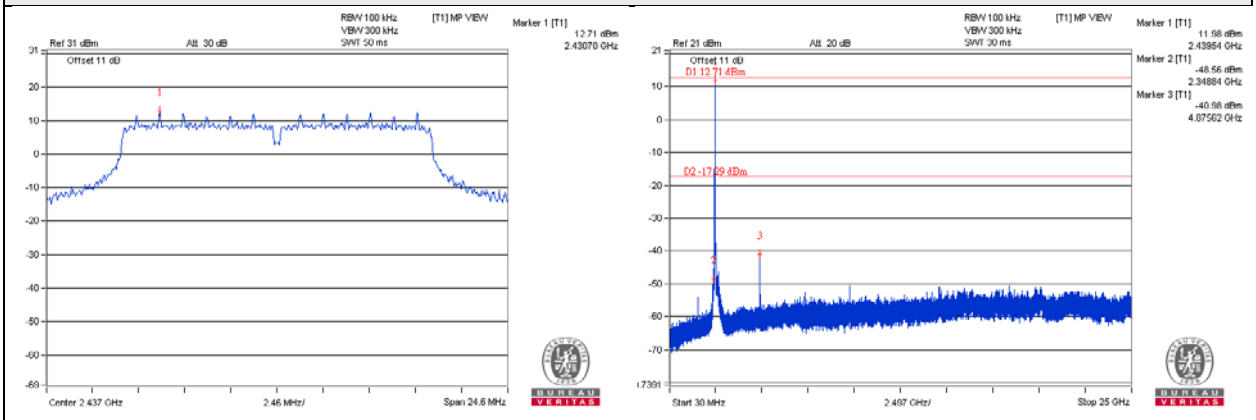


802.11g_Chain 0

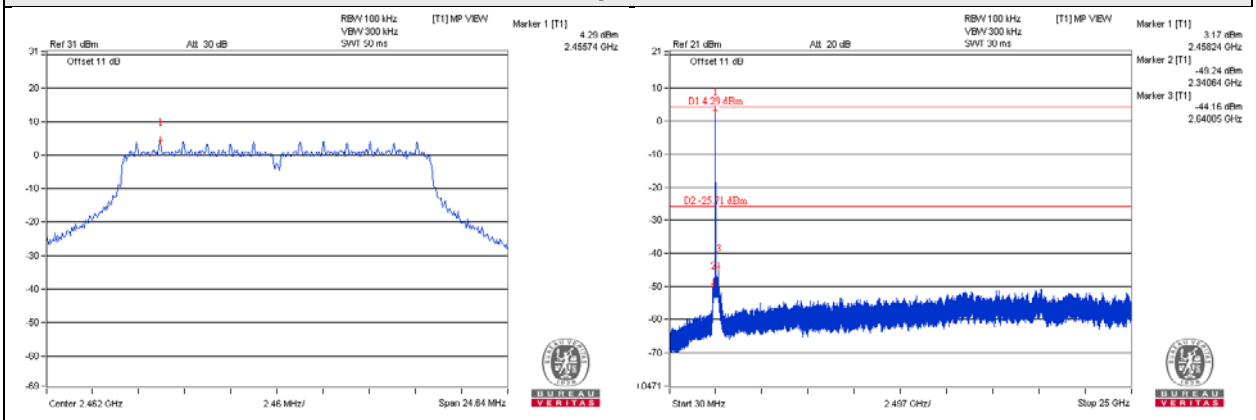
CH 1



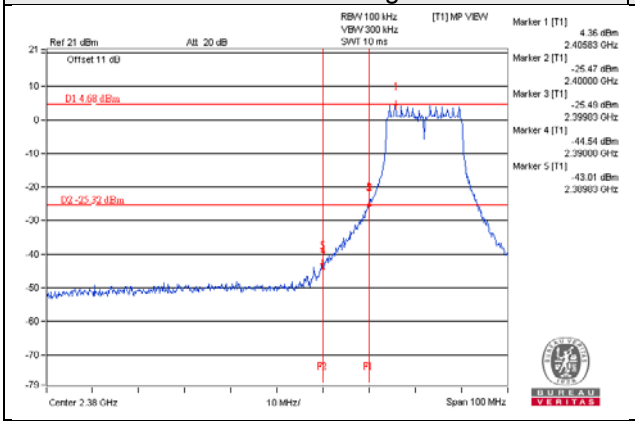
CH 6



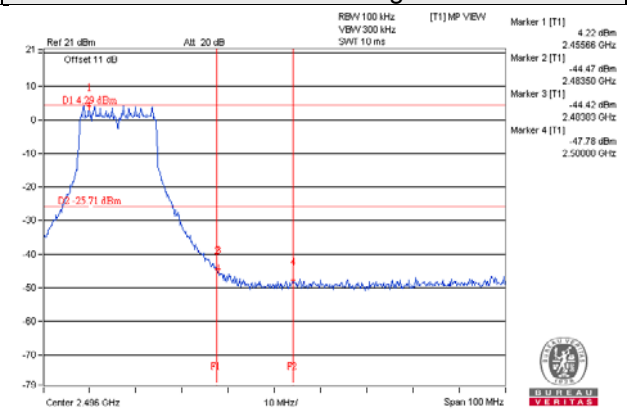
CH 11



CH 1 Band edge

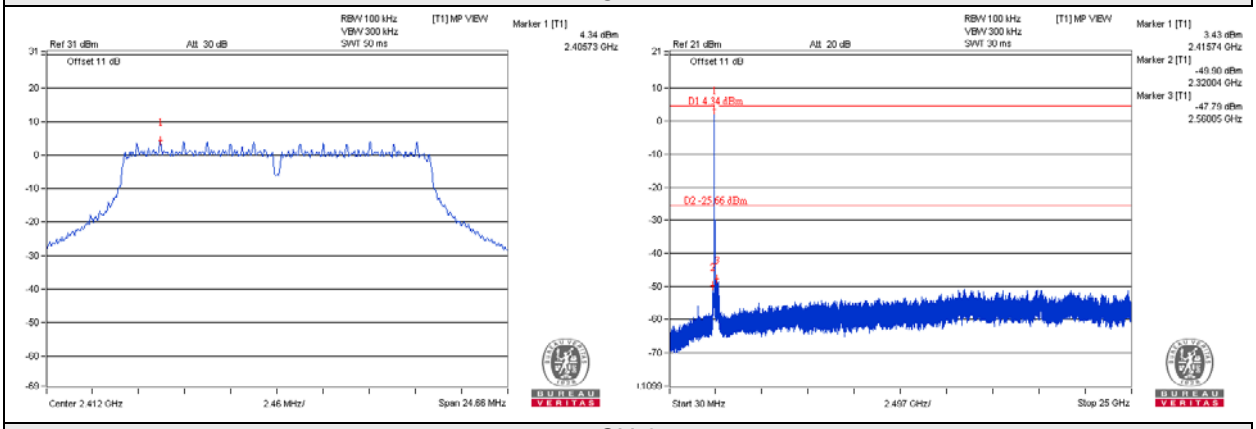


CH 11 Band edge

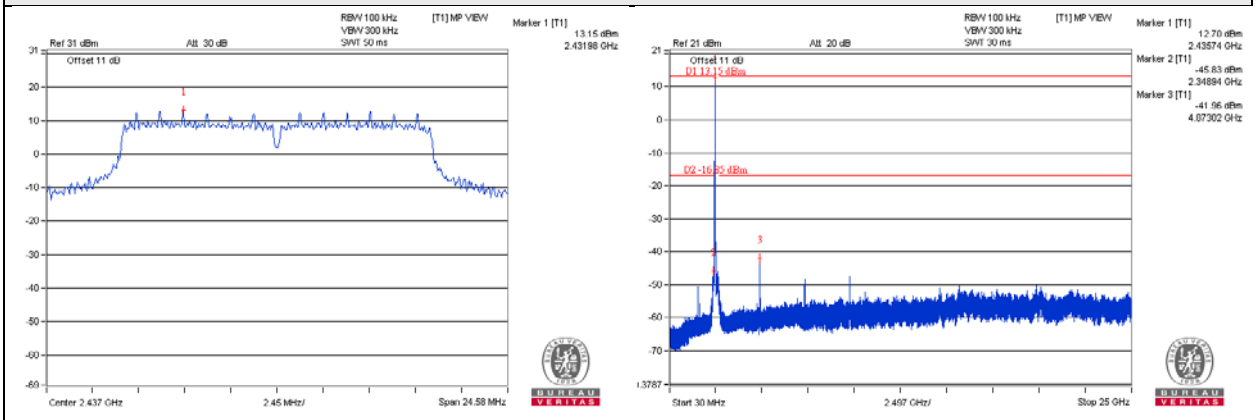


802.11g_Chain 1

CH 1



CH 6



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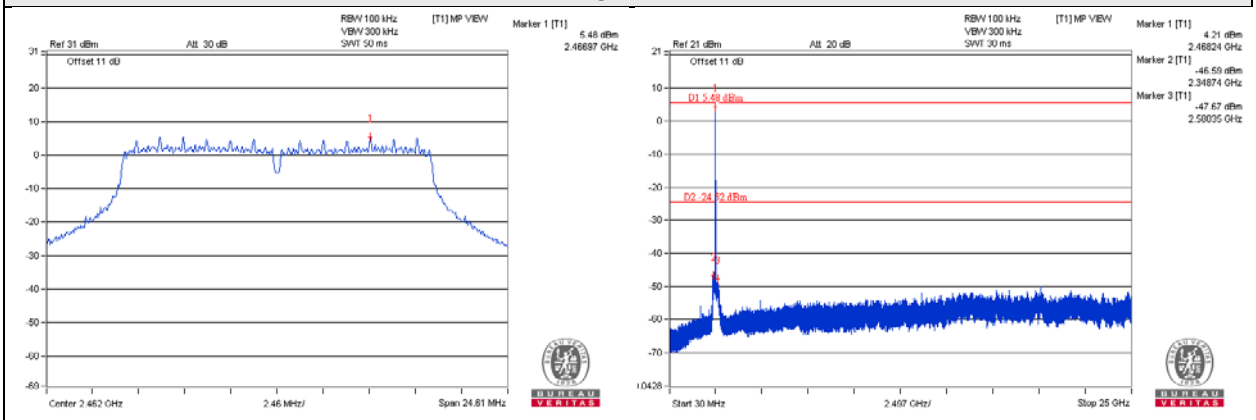
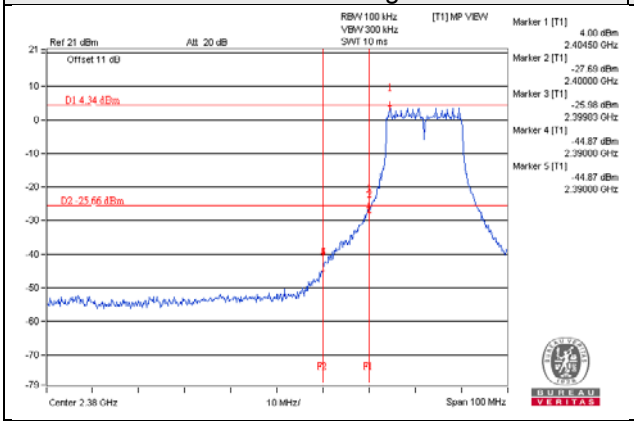
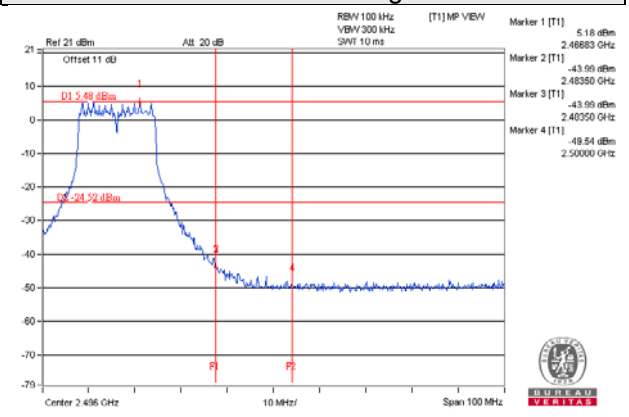


CH 1 Band edge

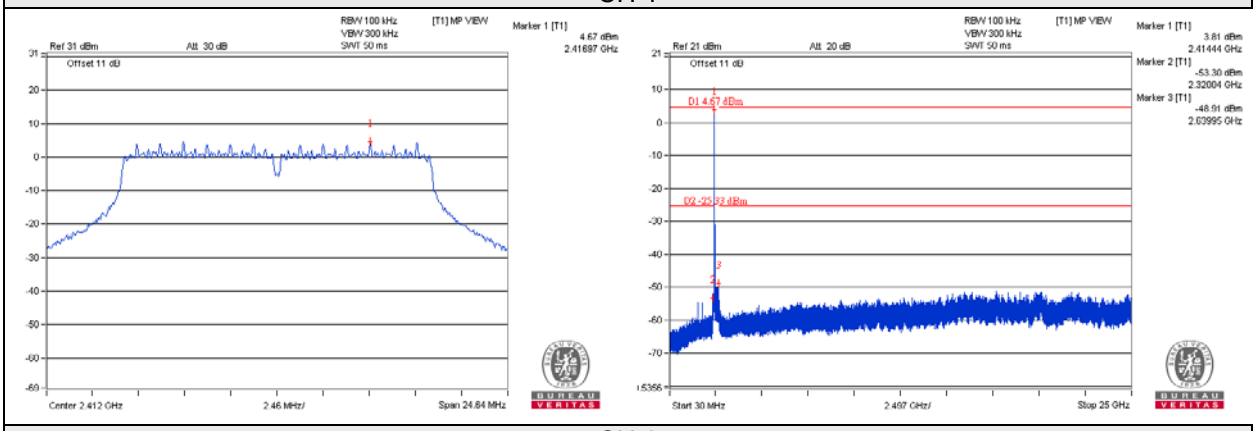


CH 11 Band edge

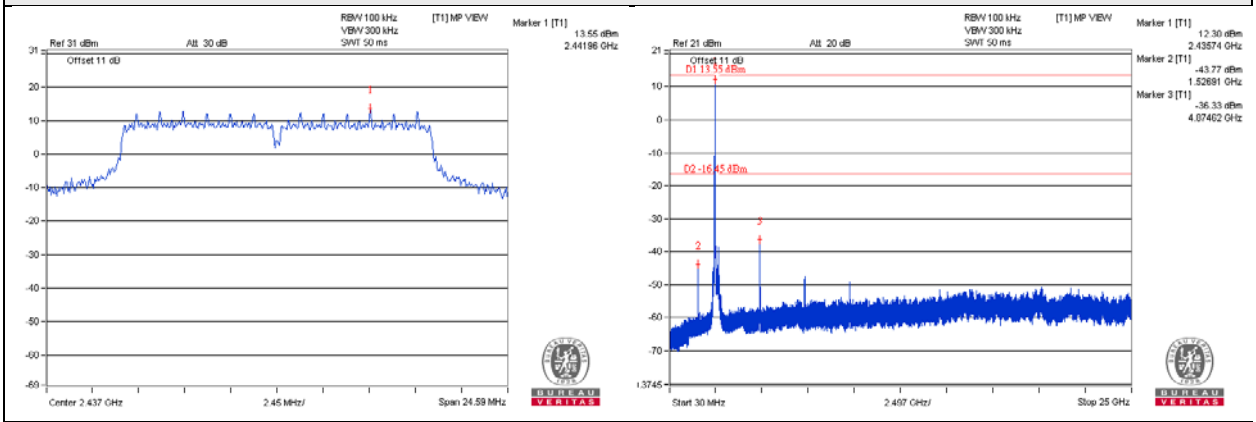


802.11g_Chain 2

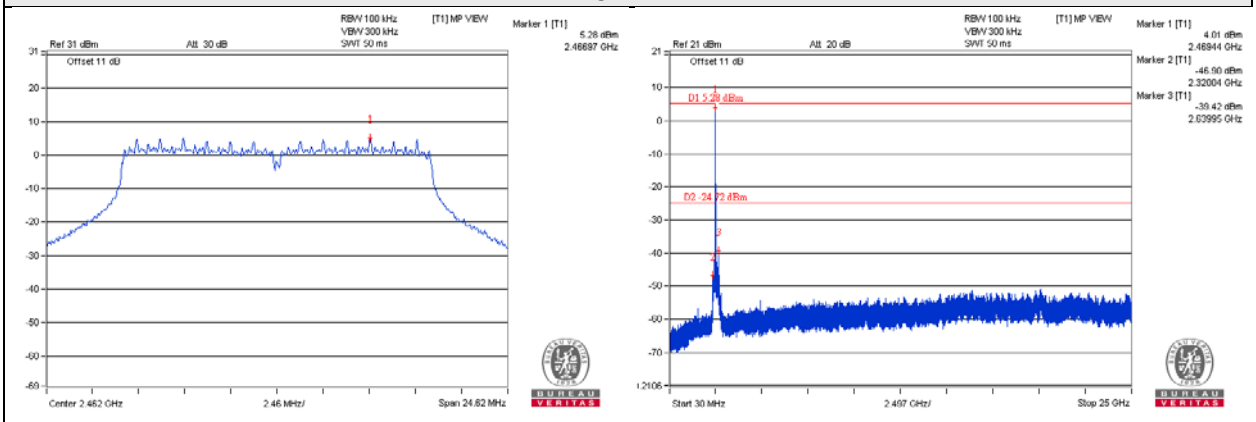
CH 1



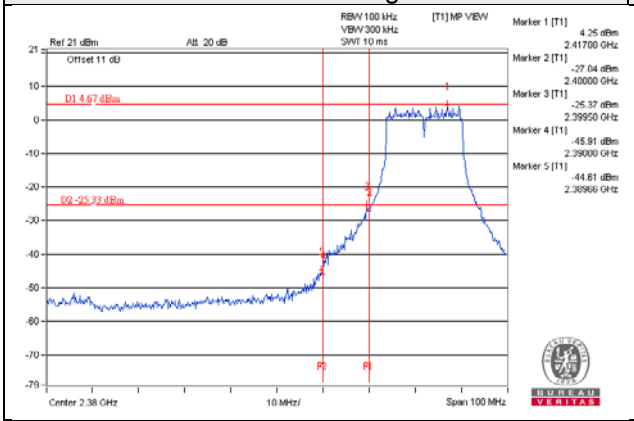
CH 6



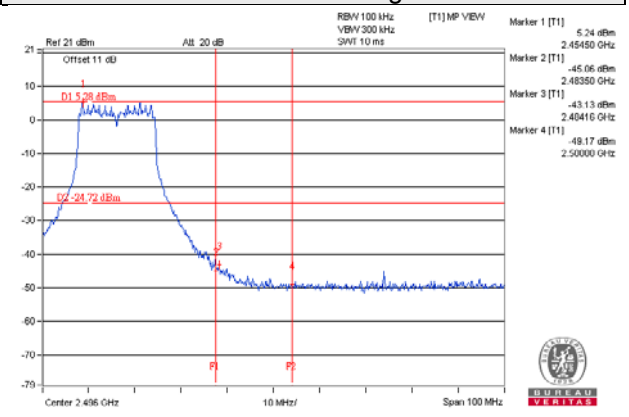
CH 11



CH 1 Band edge

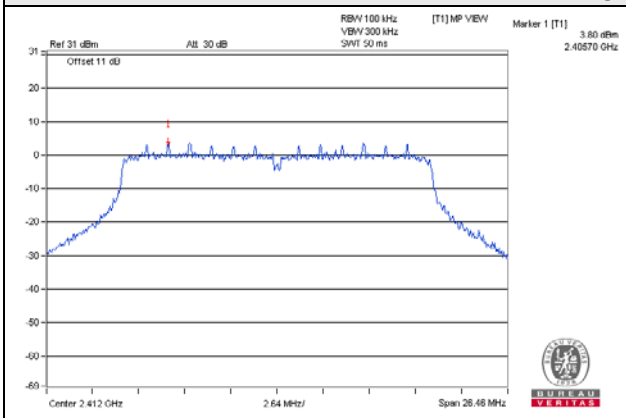


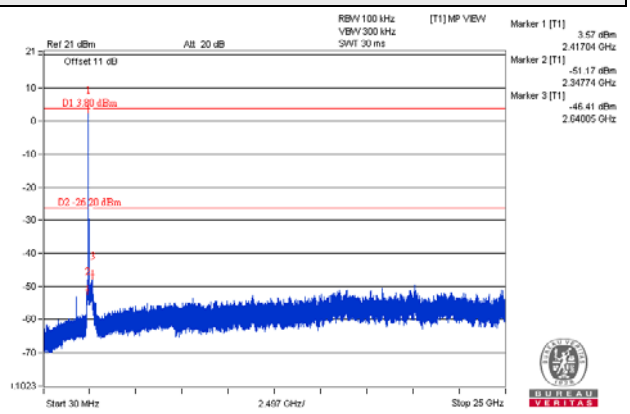
CH 11 Band edge



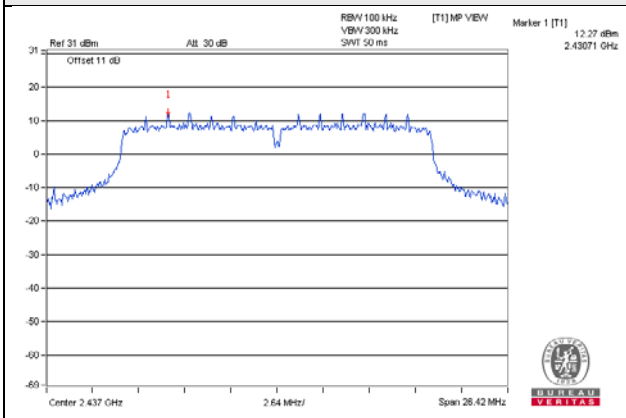
802.11n (HT20)_Chain 0

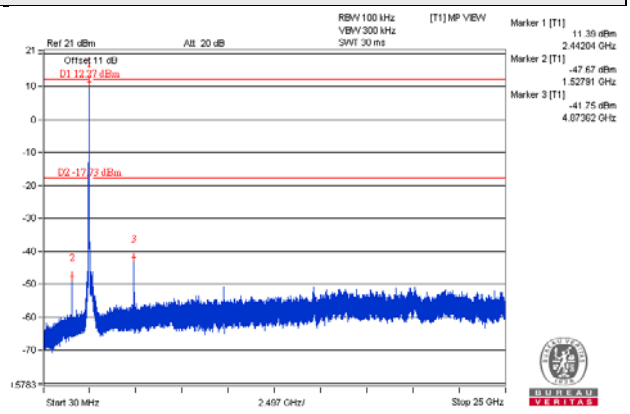
CH 1



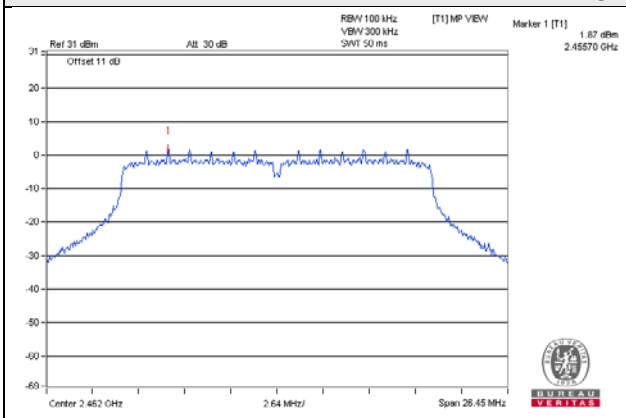


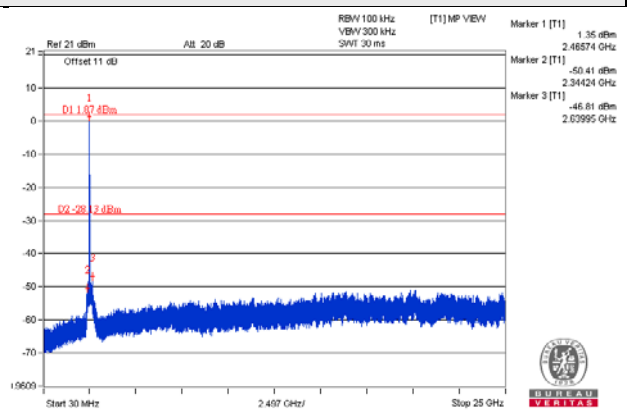
CH 6



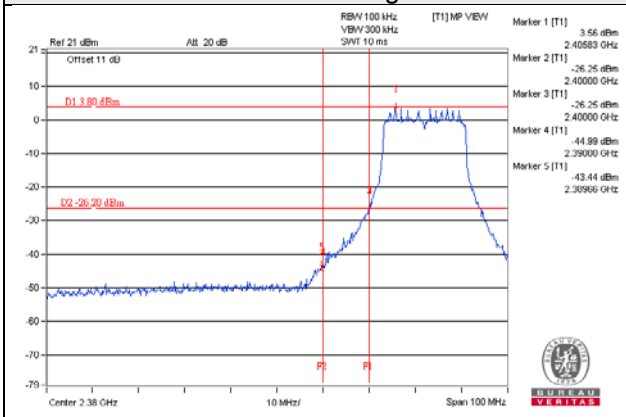


CH 11

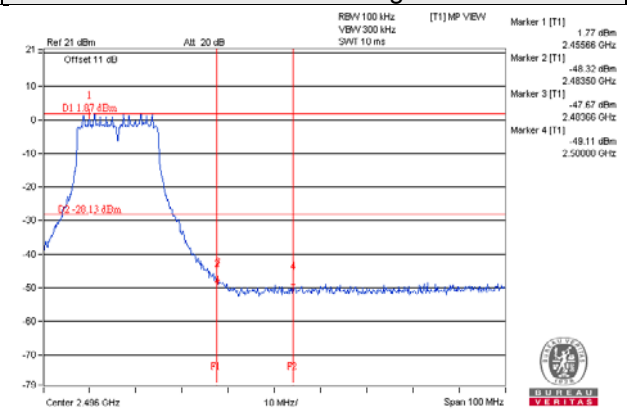




CH 1 Band edge

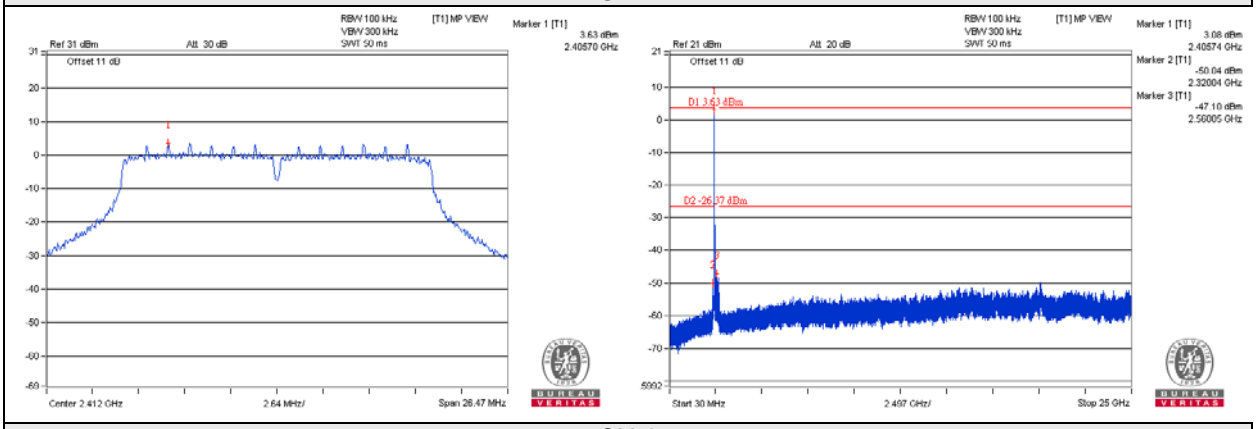


CH 11 Band edge

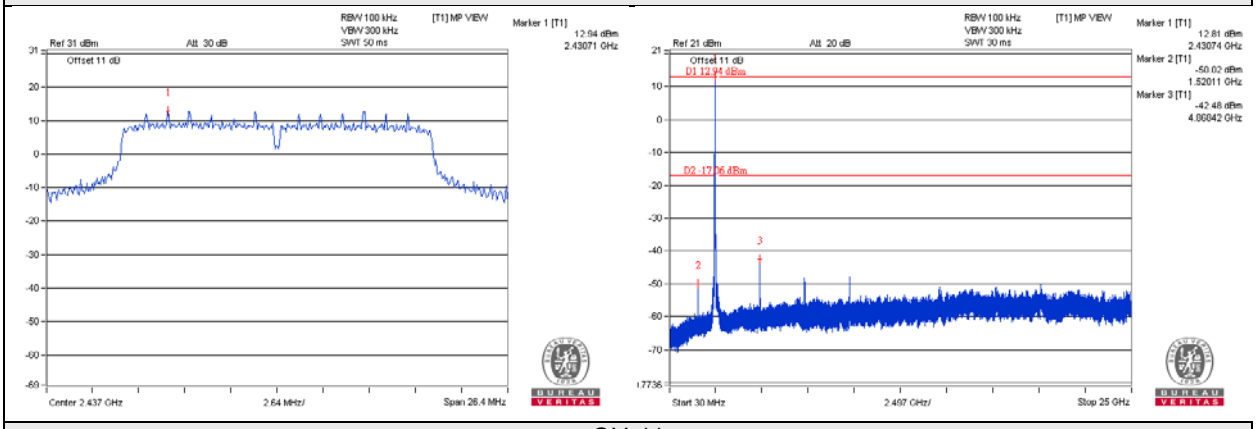


802.11n (HT20)_Chain 1

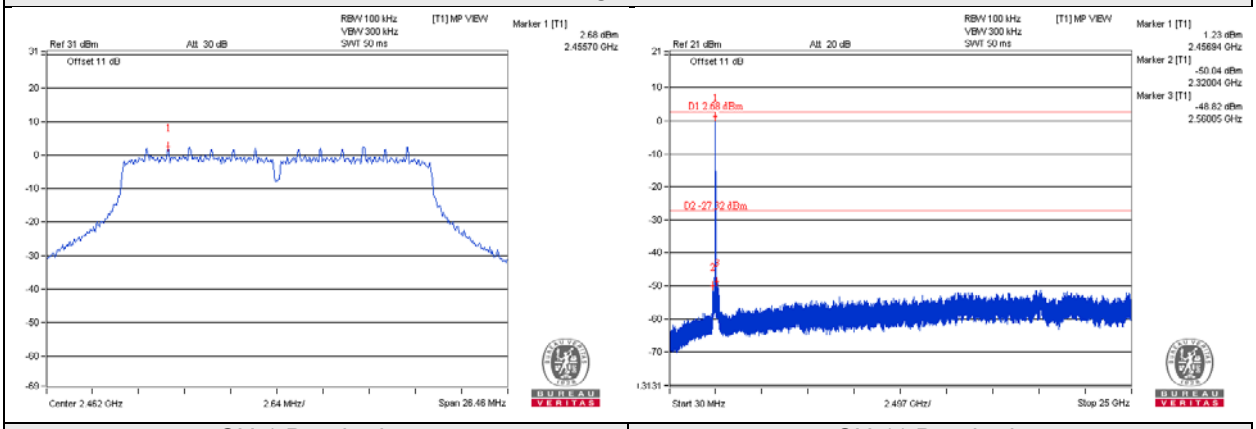
CH 1



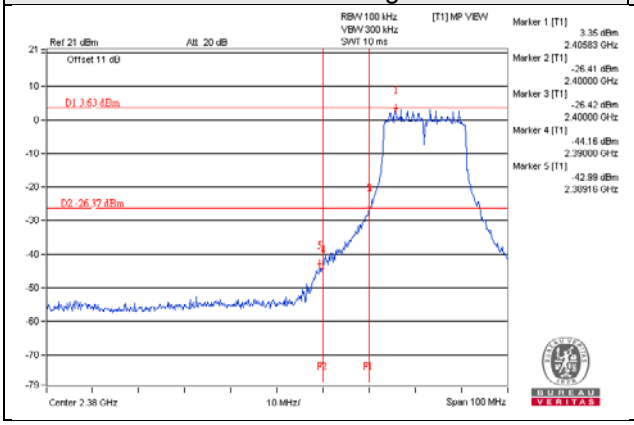
CH 6



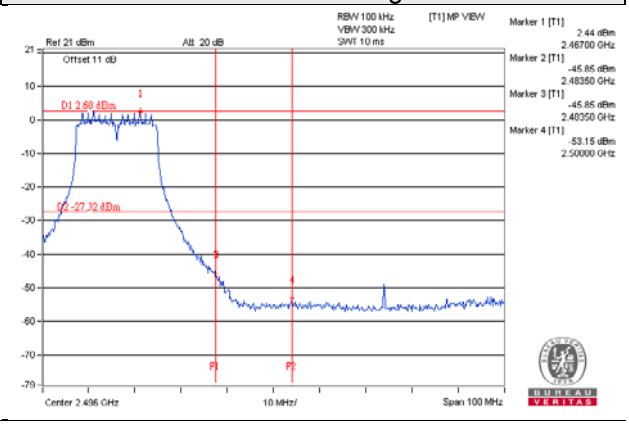
CH 11



CH 1 Band edge

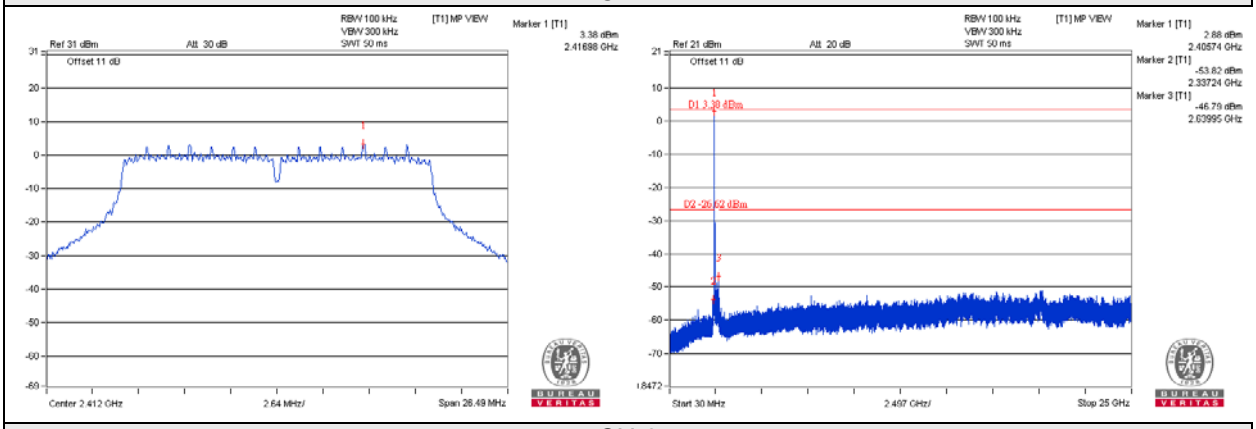


CH 11 Band edge

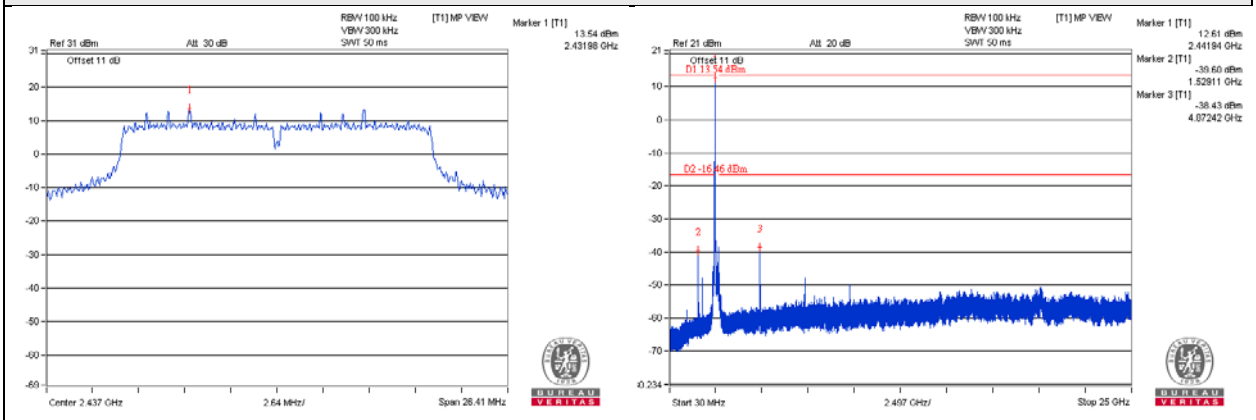


802.11n (HT20)_Chain 2

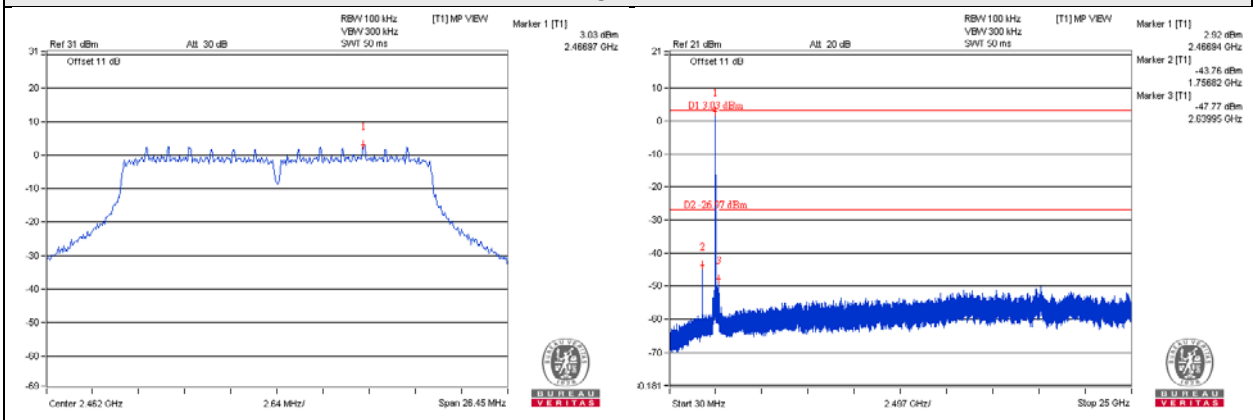
CH 1



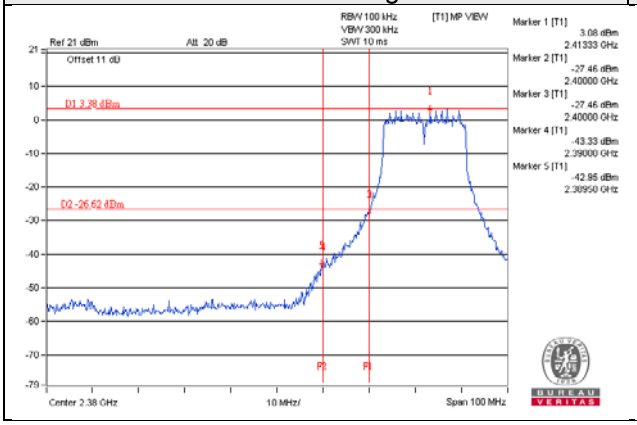
CH 6



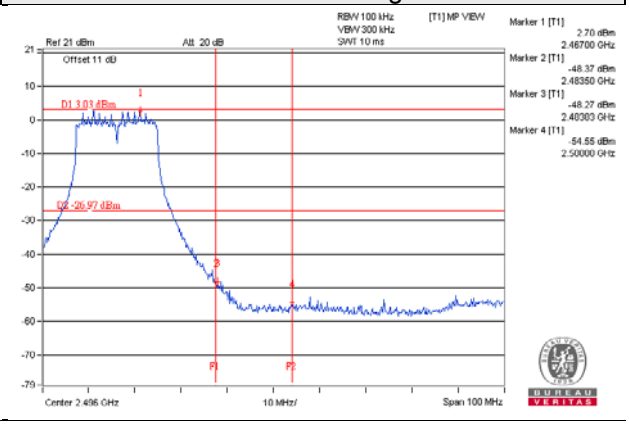
CH 11



CH 1 Band edge

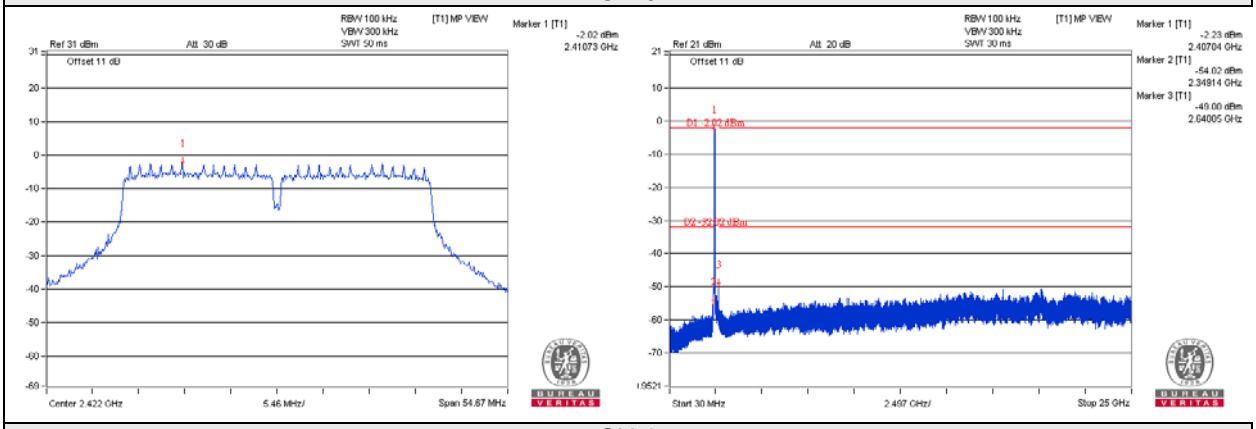


CH 11 Band edge

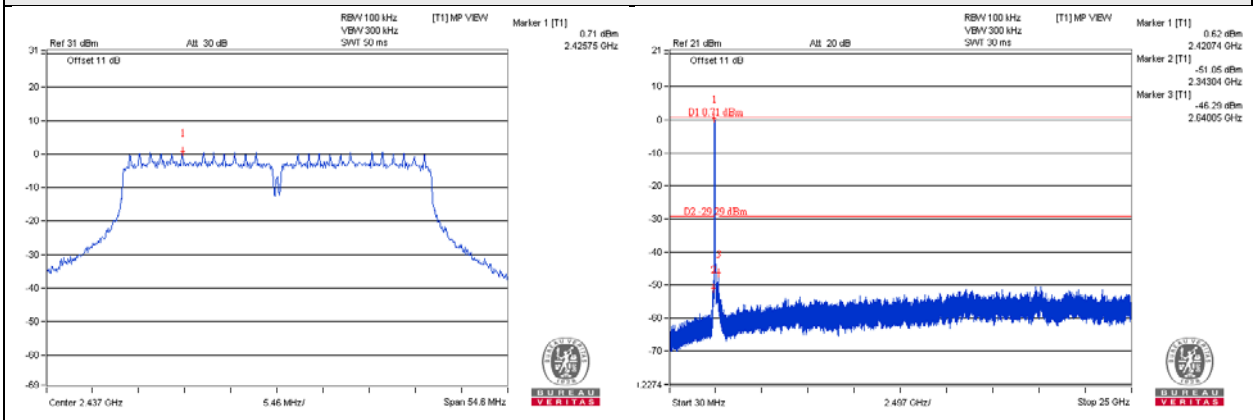


802.11n (HT40)_Chain 0

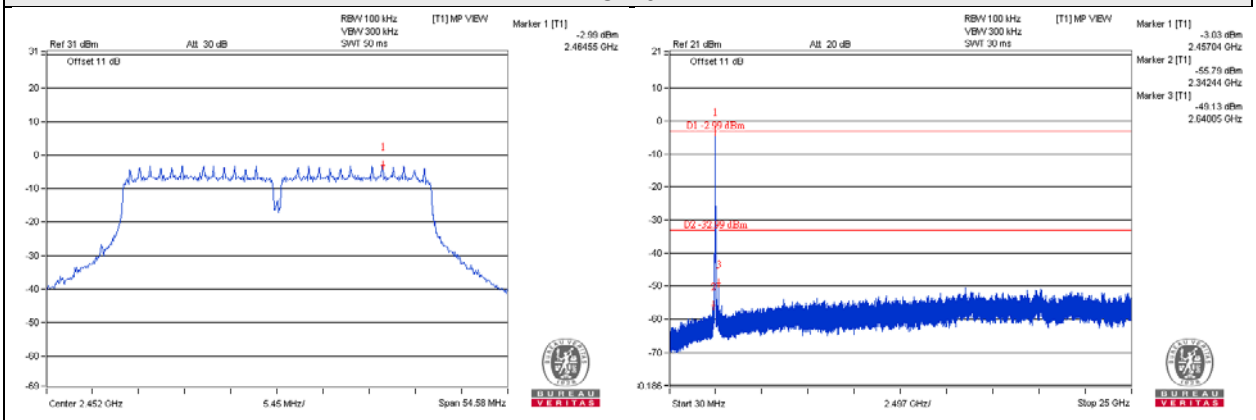
CH 3



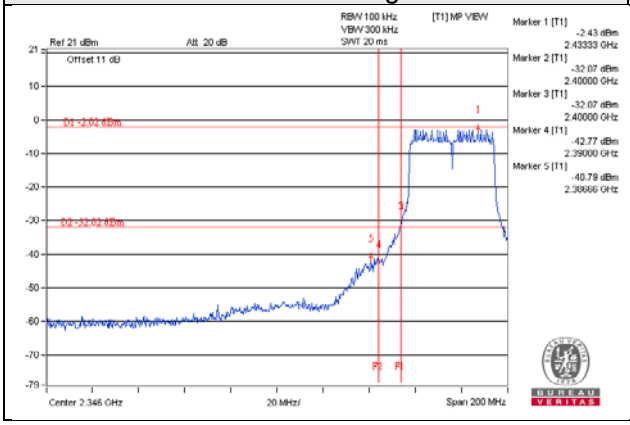
CH 6



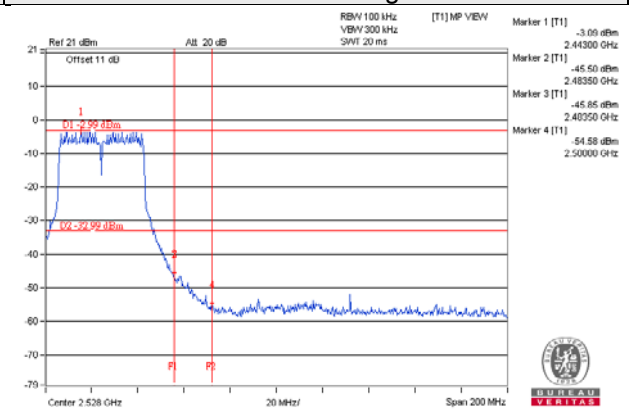
CH 9



CH 3 Band edge

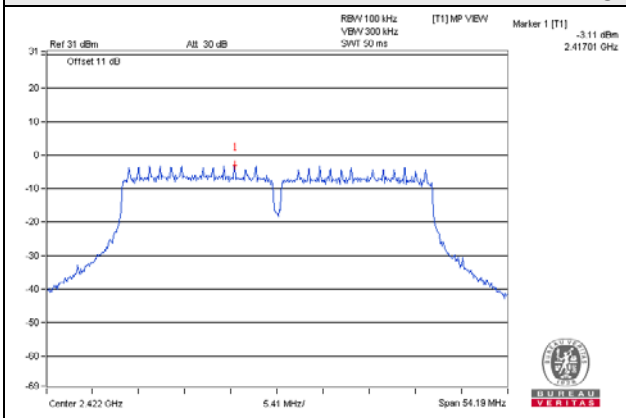


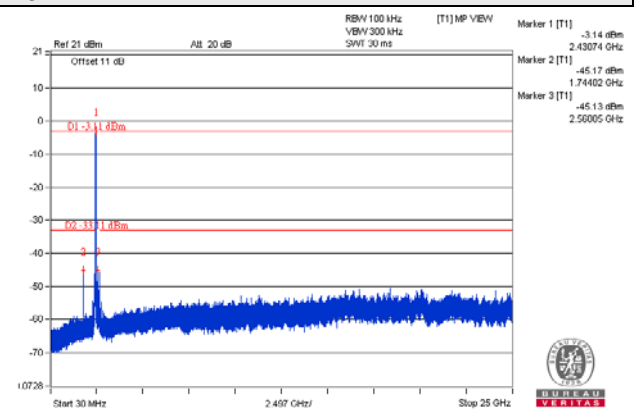
CH 9 Band edge



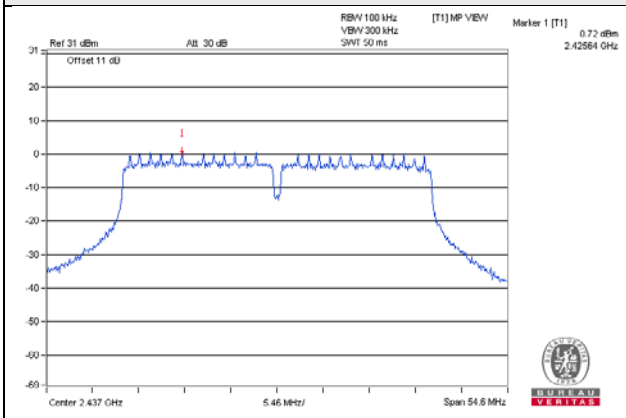
802.11n (HT40)_Chain 1

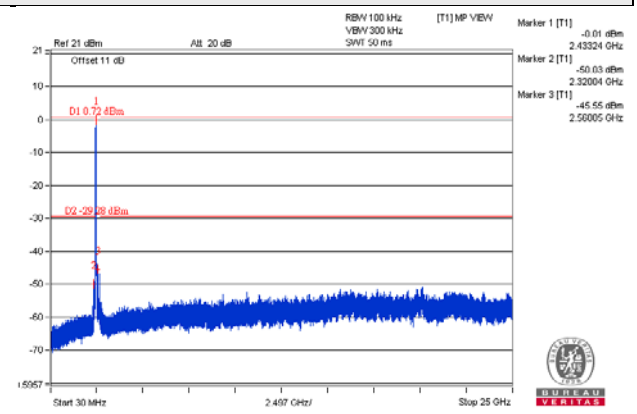
CH 3



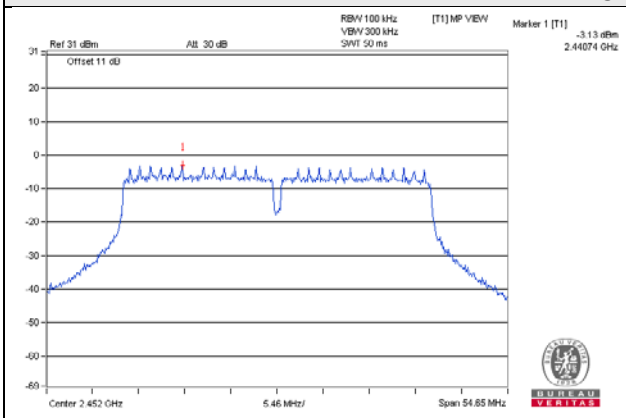


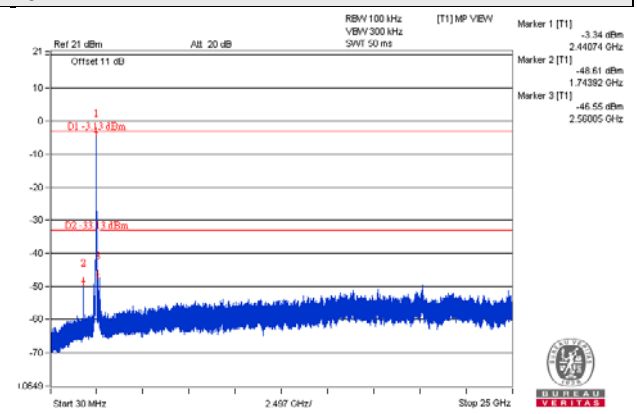
CH 6



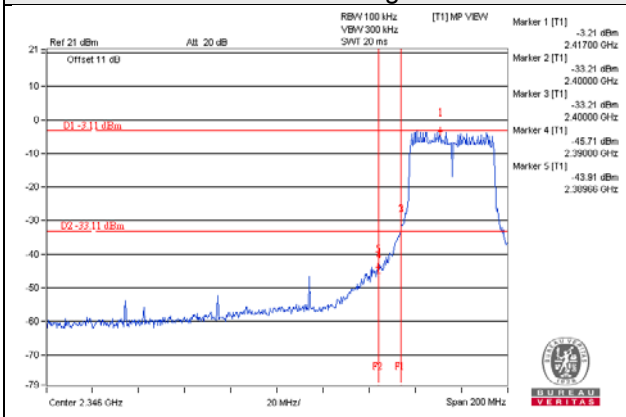


CH 9

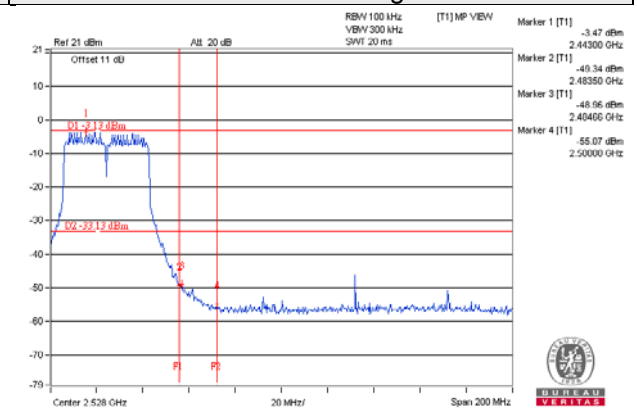




CH 3 Band edge

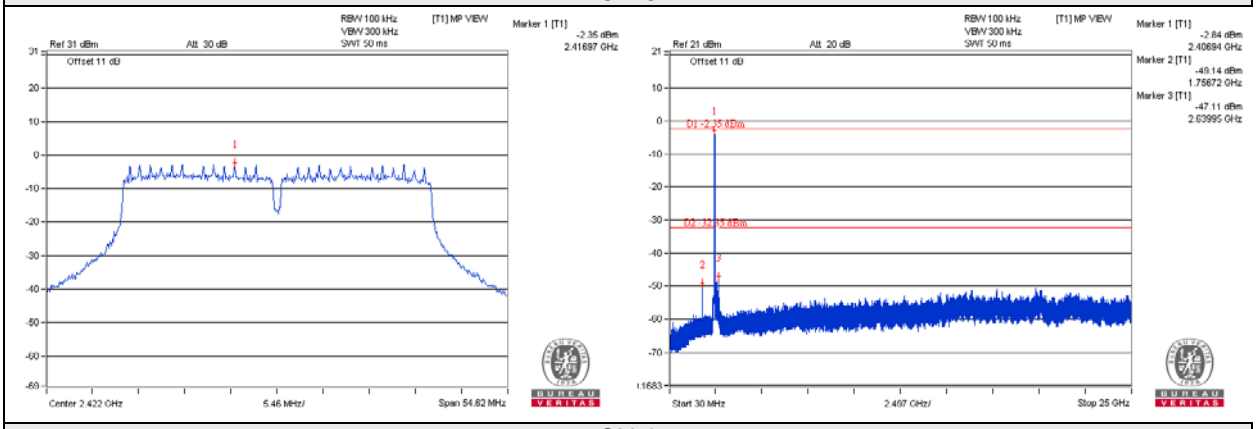


CH 9 Band edge

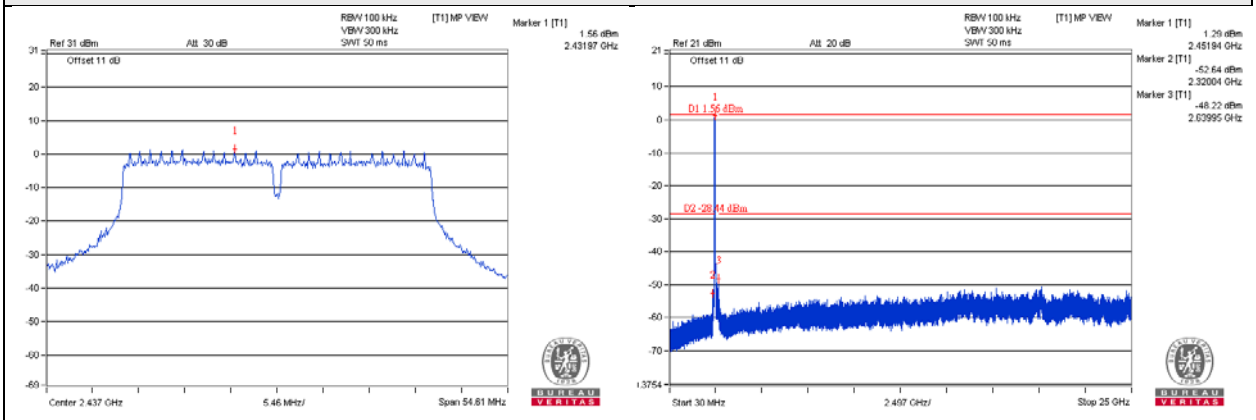


802.11n (HT40)_Chain 2

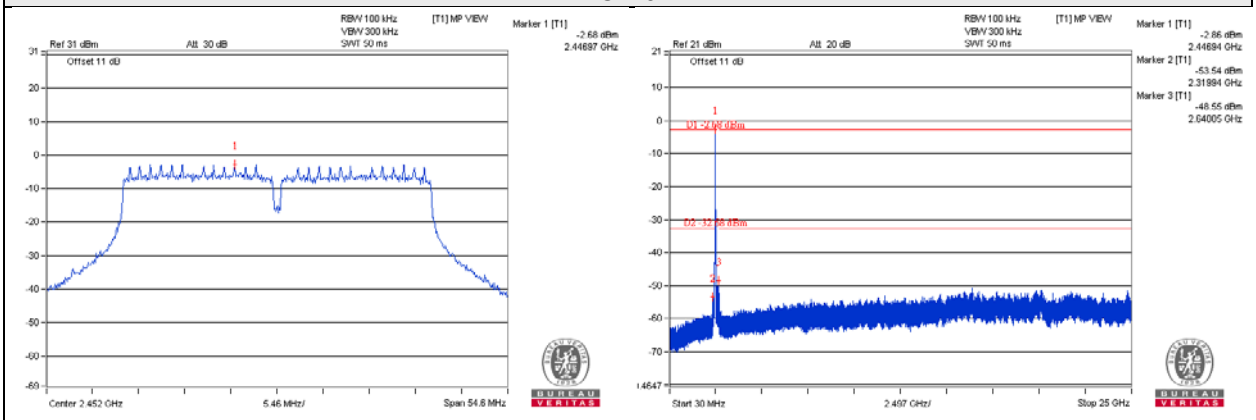
CH 3



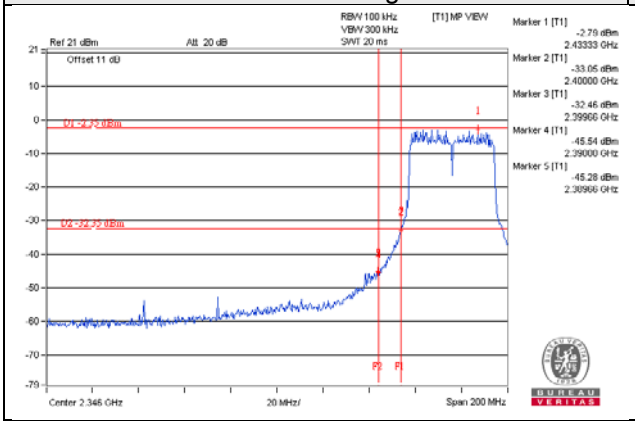
CH 6



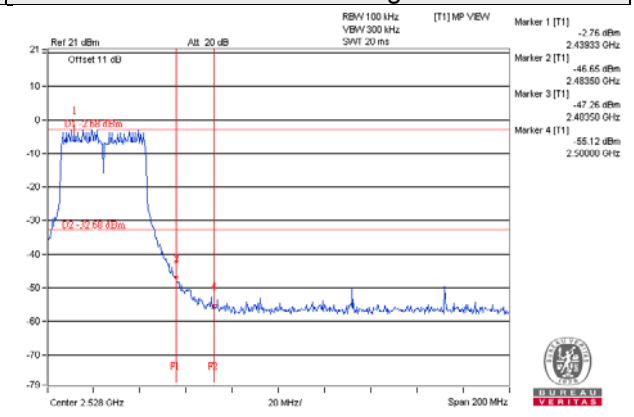
CH 9



CH 3 Band edge



CH 9 Band edge



5 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

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

If you have any comments, please feel free to contact us at the following:

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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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