

FCC Test Report

Report No.: RF150921C13

FCC ID: A8J-EMR3000

Test Model: EMR3000

Received Date: Sep. 10, 2015

Test Date: Oct. 08, ~ Oct. 17, 2015

Issued Date: Oct. 21, 2015

Applicant: EnGenius Technologies

Address: 1580 Scenic Avenue, Costa Mesa, CA92626

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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Table of Contents

Release Control Record	4
1 Certificate of Conformity	5
2 Summary of Test Results	6
2.1 Measurement Uncertainty	6
2.2 Modification Record	6
3 General Information	7
3.1 General Description of EUT	7
3.2 Description of Test Modes	8
3.2.1 Test Mode Applicability and Tested Channel Detail	9
3.3 Duty Cycle of Test Signal	11
3.4 Description of Support Units	12
3.4.1 Configuration of System under Test	12
3.5 General Description of Applied Standards	13
4 Test Types and Results	14
4.1 Radiated Emission and Bandedge Measurement	14
4.1.1 Limits of Radiated Emission and Bandedge Measurement	14
4.1.2 Test Instruments	15
4.1.3 Test Procedures	16
4.1.4 Deviation from Test Standard	16
4.1.5 Test Set Up	17
4.1.6 EUT Operating Conditions	17
4.1.7 Test Results	18
4.2 Conducted Emission Measurement	31
4.2.1 Limits of Conducted Emission Measurement	31
4.2.2 Test Instruments	31
4.2.3 Test Procedures	32
4.2.4 Deviation from Test Standard	32
4.2.5 Test Setup	32
4.2.6 EUT Operating Conditions	32
4.2.7 Test Results	33
4.3 6dB Bandwidth Measurement	35
4.3.1 Limits of 6dB Bandwidth Measurement	35
4.3.2 Test Setup	35
4.3.3 Test Instruments	35
4.3.4 Test Procedure	35
4.3.5 Deviation from Test Standard	35
4.3.6 EUT Operating Conditions	35
4.3.7 Test Result	36
4.4 Conducted Output Power Measurement	38
4.4.1 Limits of Conducted Output Power Measurement	38
4.4.2 Test Setup	38
4.4.3 Test Instruments	38
4.4.4 Test Procedures	38
4.4.5 Deviation from Test Standard	38
4.4.6 EUT Operating Conditions	38
4.4.7 Test Results	39
4.5 Power Spectral Density Measurement	40
4.5.1 Limits of Power Spectral Density Measurement	40
4.5.2 Test Setup	40
4.5.3 Test Instruments	40
4.5.4 Test Procedure	40
4.5.5 Deviation from Test Standard	41
4.5.6 EUT Operating Condition	41

4.5.7 Test Results	42
4.6 Conducted Out of Band Emission Measurement.....	45
4.6.1 Limits of Conducted Out of Band Emission Measurement	45
4.6.2 Test Setup.....	45
4.6.3 Test Instruments	45
4.6.4 Test Procedure	45
4.6.5 Deviation from Test Standard	46
4.6.6 EUT Operating Condition	46
4.6.7 Test Results	46
5 Pictures of Test Arrangements.....	55
Appendix – Information on the Testing Laboratories	56



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Release Control Record

Issue No.	Description	Date Issued
RF150921C13	Original release.	Oct. 21, 2015

1 Certificate of Conformity

Product: Mesh Router

Brand: EnGenius

Test Model: EMR3000

Sample Status: Engineering sample

Applicant: EnGenius Technologies

Test Date: Oct. 08, ~ Oct. 17, 2015

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 : Celine Chou , **Date:** Oct. 21, 2015
Celine Chou / Specialist

Approved by : Ken Liu , **Date:** Oct. 21, 2015
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 -9.25dB at 0.36094MHz
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -1.0dB at 7386.00MHz and 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) ($\pm$)
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	Mesh Router
Brand	EnGenius
Test Model	EMR3000
Sample Status	Engineering sample
Power Supply Rating	12Vdc from adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11.0/ 5.5/ 2.0/ 1.0Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 300Mbps
Operating Frequency	2412 ~ 2462MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Output Power	544.633mW
Antenna Type	PIFA antenna with 4dBi gain
Antenna Connector	IPEX
Accessory Device	Adapter
Data Cable Supplied	N/A

Note:

- The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

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

- The EUT consumes power from the following adapter.

Adapter	
Brand	Powertron Electronics Corp.
Model	PA1015-120DUB150
Input Power	100-240Vac, 50-60Hz, 0.4A
Output Power	12Vdc, 1.5A, 18W Max
Power Line	1.5m power cable without core attached on adapter

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 **Z-plane**.

Radiated Emission Test (Above 1GHz):

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

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

Power Line Conducted Emission Test:

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

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11b	1 to 11	1	DSSS	DBPSK	1.0

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	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	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 $\geq$ 1G	20deg. C, 66%RH	120Vac, 60Hz	Jones Chang
RE<1G	22deg. C, 70%RH	120Vac, 60Hz	Jones Chang
PLC	18deg. C, 70%RH	120Vac, 60Hz	Nick Hsu
APCM	25deg. C, 60%RH	120Vac, 60Hz	Ted Chang

3.3 Duty Cycle of Test Signal

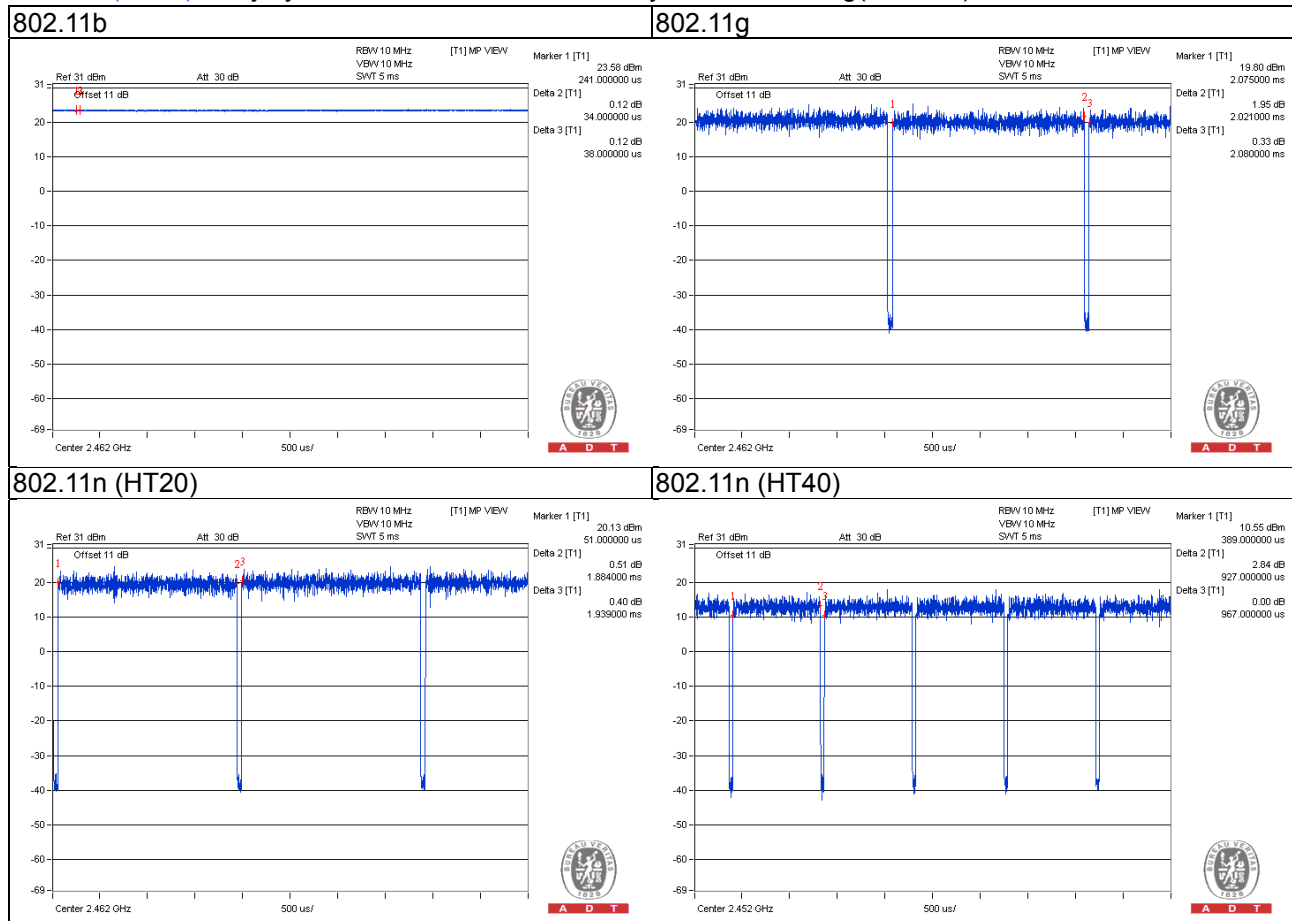
802.11b: Duty cycle of test signal is 100 %, duty factor is not required.

802.11g, 802.11n (HT20), 802.11n (HT40): Duty cycle of test signal is < 98 %, duty factor shall be considered.

802.11g: Duty cycle = $2.021/2.080 = 0.972$, Duty factor = $10 * \log(1/0.972) = 0.12$

802.11n (HT20): Duty cycle = $1.884/1.939 = 0.972$, Duty factor = $10 * \log(1/0.972) = 0.12$

802.11n (HT40): Duty cycle = $0.927/0.967 = 0.959$, Duty factor = $10 * \log(1/0.959) = 0.18$



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.

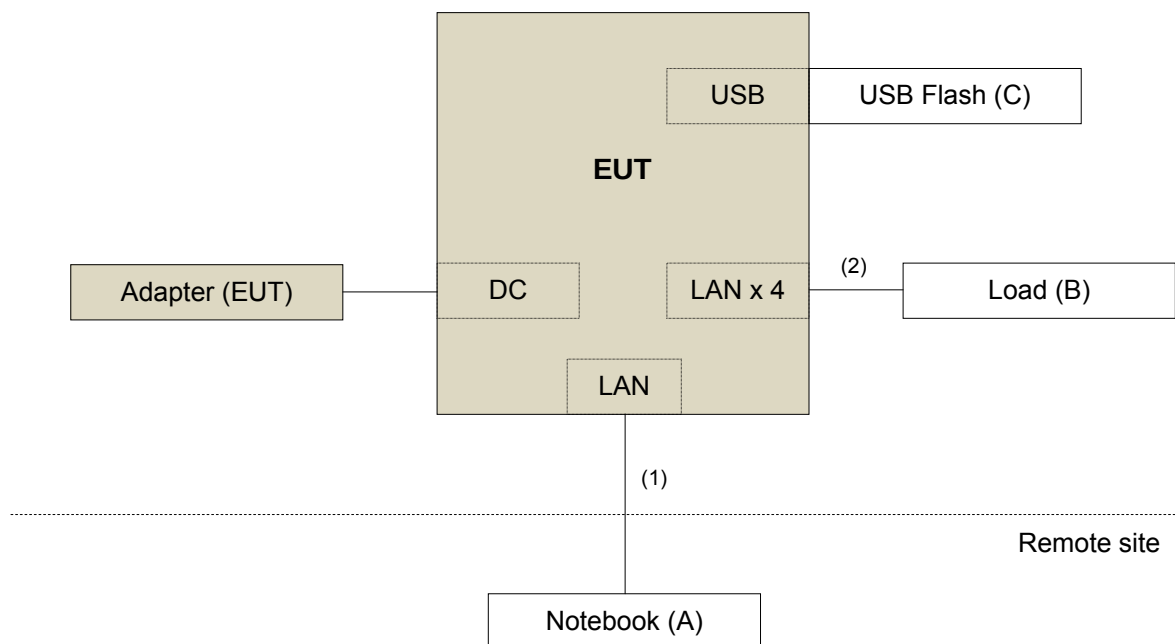
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	1HC2XM1	FCC DoC Approved	-
B.	Load	NA	NA	NA	NA	-
C.	USB Flash	Transcend	V85	538455 4489	FCC DoC Approved	-

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	LAN cable	1	3	N	0	-
2.	LAN cable	4	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 specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)

558074 D01 DTS Meas Guidance v03r03

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 is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It 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. 10, 2015	Apr. 09, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Sep. 02, 2015	Sep. 01, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Feb. 05, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	9120D	209	Feb. 09, 2015	Feb. 08, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2015	Feb. 08, 2016
Preamplifier Agilent	8447D	2944A10738	Oct. 18, 2014	Oct. 17, 2015
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2015	Aug. 21, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03(214378)	Aug. 22, 2015	Aug. 21, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 106	Cable-CH3-03(309224+12738)	Aug. 22, 2015	Aug. 21, 2016
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	0824011	Jul. 09, 2015	Jul. 08, 2016
Power Sensor	MA2411B	0738171	Jul. 09, 2015	Jul. 08, 2016

- 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:

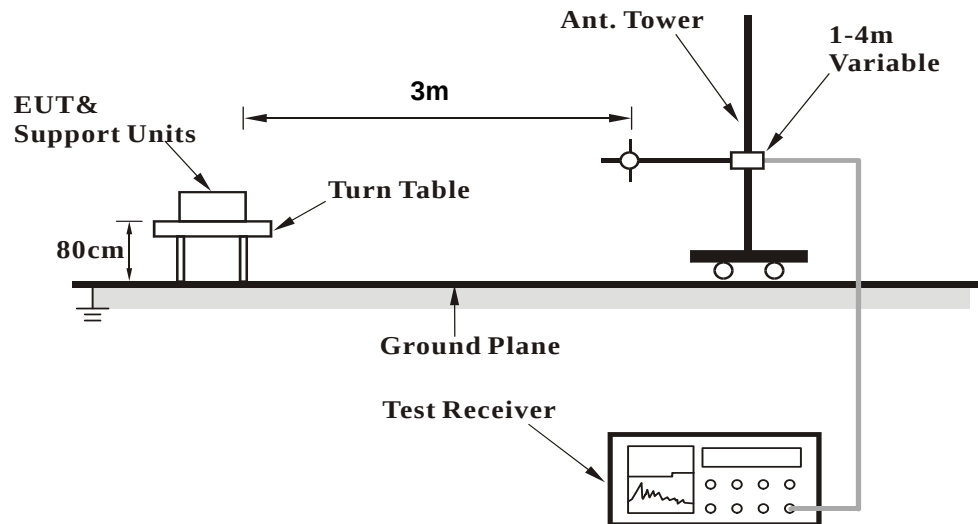
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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 ($10 \log(1/\text{duty cycle})$).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle $\geq 98\%$) 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

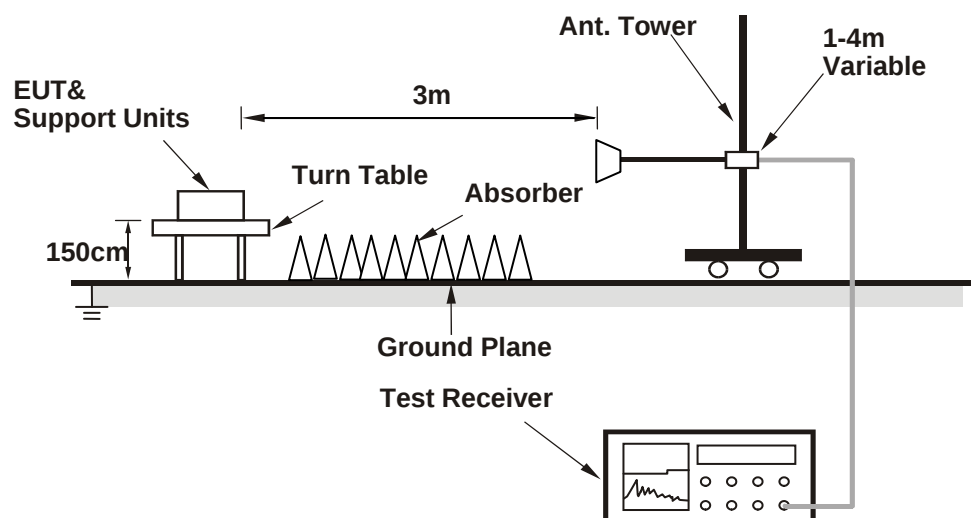
No deviation.

4.1.5 Test Set Up

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Prepared notebook to act as communication partner and placed it outside of testing area.
- 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.
- The communication partner sent data to EUT by command "PING".
- 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)
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	59.8 PK	74.0	-14.2	1.43 H	311	27.30	32.50
2	2390.00	49.5 AV	54.0	-4.5	1.43 H	311	17.00	32.50
3	*2412.00	115.1 PK			1.43 H	311	82.50	32.60
4	*2412.00	111.5 AV			1.43 H	311	78.90	32.60
5	4824.00	50.9 PK	74.0	-23.1	1.05 H	19	44.80	6.10
6	4824.00	46.1 AV	54.0	-7.9	1.05 H	19	40.00	6.10
7	#7236.00	58.4 PK	74.0	-15.6	1.37 H	295	45.70	12.70
8	#7236.00	49.0 AV	54.0	-5.0	1.37 H	295	36.30	12.70
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	61.5 PK	74.0	-12.5	1.38 V	353	29.00	32.50
2	2390.00	50.0 AV	54.0	-4.0	1.38 V	353	17.50	32.50
3	*2412.00	116.3 PK			1.37 V	349	83.70	32.60
4	*2412.00	112.8 AV			1.37 V	349	80.20	32.60
5	4824.00	52.8 PK	74.0	-21.2	1.52 V	10	46.70	6.10
6	4824.00	48.2 AV	54.0	-5.8	1.52 V	10	42.10	6.10
7	#7236.00	59.2 PK	74.0	-14.8	1.02 V	350	46.50	12.70
8	#7236.00	52.1 AV	54.0	-1.9	1.02 V	350	39.40	12.70

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)
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	*2437.00	85.9 PK			2.30 H	8	87.30	-1.40
2	*2437.00	82.1 AV			2.30 H	8	83.50	-1.40
3	2483.50	70.9 PK	74.0	-3.1	2.32 H	21	38.20	32.70
4	2483.50	49.0 AV	54.0	-5.0	2.32 H	21	16.30	32.70
5	4874.00	52.9 PK	74.0	-21.1	1.50 H	19	46.70	6.20
6	4874.00	48.1 AV	54.0	-5.9	1.50 H	19	41.90	6.20
7	7311.00	59.0 PK	74.0	-15.0	2.12 H	313	46.40	12.60
8	7311.00	51.2 AV	54.0	-2.8	2.12 H	313	38.60	12.60
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	118.8 PK			1.23 V	351	86.10	32.70
2	*2437.00	114.6 AV			1.23 V	351	81.90	32.70
3	4874.00	53.1 PK	74.0	-20.9	1.53 V	0	46.90	6.20
4	4874.00	46.9 AV	54.0	-7.1	1.53 V	0	40.70	6.20
5	7311.00	59.1 PK	74.0	-14.9	1.69 V	157	46.50	12.60
6	7311.00	52.6 AV	54.0	-1.4	1.69 V	157	40.00	12.60

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)
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	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	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	*2462.00	116.0 PK			1.44 H	311	83.40	32.60
2	*2462.00	112.1 AV			1.44 H	311	79.50	32.60
3	2500.00	59.5 PK	74.0	-14.5	1.44 H	311	26.70	32.80
4	2500.00	48.3 AV	54.0	-5.7	1.44 H	311	15.50	32.80
5	4924.00	51.3 PK	74.0	-22.7	1.02 H	19	45.00	6.30
6	4924.00	45.0 AV	54.0	-9.0	1.02 H	19	38.70	6.30
7	7386.00	60.0 PK	74.0	-14.0	1.30 H	302	47.60	12.40
8	7386.00	52.2 AV	54.0	-1.8	1.30 H	302	39.80	12.40
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	*2462.00	108.9 PK			1.37 V	281	76.30	32.60
2	*2462.00	104.9 AV			1.37 V	281	72.30	32.60
3	2483.50	57.3 PK	74.0	-16.7	1.34 V	282	24.60	32.70
4	2483.50	45.4 AV	54.0	-8.6	1.34 V	282	12.70	32.70
5	4924.00	49.9 PK	74.0	-24.1	1.33 V	2	43.60	6.30
6	4924.00	42.8 AV	54.0	-11.2	1.33 V	2	36.50	6.30
7	7386.00	59.9 PK	74.0	-14.1	1.00 V	351	47.50	12.40
8	7386.00	53.0 AV	54.0	-1.0	1.00 V	351	40.60	12.40

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)
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)
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	72.1 PK	74.0	-1.9	1.93 H	357	39.60	32.50
2	2390.00	51.4 AV	54.0	-2.6	1.93 H	357	18.90	32.50
3	*2412.00	114.1 PK			1.32 H	330	81.50	32.60
4	*2412.00	104.5 AV			1.32 H	330	71.90	32.60
5	4824.00	48.6 PK	74.0	-25.4	1.53 H	16	42.50	6.10
6	4824.00	35.6 AV	54.0	-18.4	1.53 H	16	29.50	6.10
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	72.0 PK	74.0	-2.0	1.55 V	4	39.50	32.50
2	2390.00	49.8 AV	54.0	-4.2	1.55 V	4	17.30	32.50
3	*2412.00	111.1 PK			1.21 V	151	78.50	32.60
4	*2412.00	101.3 AV			1.21 V	151	68.70	32.60
5	4824.00	48.3 PK	74.0	-25.7	1.80 V	121	42.20	6.10
6	4824.00	35.0 AV	54.0	-19.0	1.80 V	121	28.90	6.10

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)
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	65.4 PK	74.0	-8.6	2.08 H	19	32.90	32.50
2	2390.00	48.4 AV	54.0	-5.6	2.08 H	19	15.90	32.50
3	*2437.00	119.2 PK			1.63 H	317	86.50	32.70
4	*2437.00	109.1 AV			1.63 H	317	76.40	32.70
5	2483.50	72.8 PK	74.0	-1.2	1.62 H	14	40.10	32.70
6	2483.50	50.6 AV	54.0	-3.4	1.62 H	14	17.90	32.70
7	4874.00	49.6 PK	74.0	-24.4	1.53 H	333	43.40	6.20
8	4874.00	37.7 AV	54.0	-16.3	1.53 H	333	31.50	6.20
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	67.2 PK	74.0	-6.8	1.58 V	353	34.70	32.50
2	2390.00	47.3 AV	54.0	-6.7	1.58 V	353	14.80	32.50
3	*2437.00	115.8 PK			1.71 V	5	83.10	32.70
4	*2437.00	107.0 AV			1.71 V	5	74.30	32.70
5	2483.50	68.7 PK	74.0	-5.3	1.36 V	345	36.00	32.70
6	2483.50	49.5 AV	54.0	-4.5	1.36 V	345	16.80	32.70
7	4874.00	49.4 PK	74.0	-24.6	1.80 V	290	43.20	6.20
8	4874.00	36.7 AV	54.0	-17.3	1.80 V	290	30.50	6.20

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)
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	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	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	*2462.00	115.0 PK			1.43 H	331	82.40	32.60
2	*2462.00	105.4 AV			1.43 H	331	72.80	32.60
3	2483.50	71.5 PK	74.0	-2.5	2.08 H	0	38.80	32.70
4	2483.50	51.1 AV	54.0	-2.9	2.08 H	0	18.40	32.70
5	4924.00	48.8 PK	74.0	-25.2	1.00 H	356	42.50	6.30
6	4924.00	35.6 AV	54.0	-18.4	1.00 H	356	29.30	6.30
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	112.0 PK			1.20 V	341	79.40	32.60
2	*2462.00	102.7 AV			1.20 V	341	70.10	32.60
3	2483.50	73.0 PK	74.0	-1.0	1.34 V	339	40.30	32.70
4	2483.50	50.2 AV	54.0	-3.8	1.34 V	339	17.50	32.70
5	4924.00	48.3 PK	74.0	-25.7	1.56 V	121	42.00	6.30
6	4924.00	35.5 AV	54.0	-18.5	1.56 V	121	29.20	6.30

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)
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)
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	71.8 PK	74.0	-2.2	1.65 H	325	39.30	32.50
2	2390.00	52.5 AV	54.0	-1.5	1.65 H	325	20.00	32.50
3	*2412.00	114.0 PK			1.17 H	320	81.40	32.60
4	*2412.00	104.1 AV			1.17 H	320	71.50	32.60
5	4824.00	48.1 PK	74.0	-25.9	1.50 H	216	42.00	6.10
6	4824.00	35.2 AV	54.0	-18.8	1.50 H	216	29.10	6.10
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	66.0 PK	74.0	-8.0	1.40 V	20	33.50	32.50
2	2390.00	49.3 AV	54.0	-4.7	1.40 V	20	16.80	32.50
3	*2412.00	110.6 PK			1.40 V	350	78.00	32.60
4	*2412.00	101.7 AV			1.40 V	350	69.10	32.60
5	4824.00	47.9 PK	74.0	-26.1	1.34 V	256	41.80	6.10
6	4824.00	34.9 AV	54.0	-19.1	1.34 V	256	28.80	6.10

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)
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	65.8 PK	74.0	-8.2	2.10 H	19	33.30	32.50
2	2390.00	47.6 AV	54.0	-6.4	2.10 H	19	15.10	32.50
3	*2437.00	118.6 PK			1.63 H	318	85.90	32.70
4	*2437.00	109.3 AV			1.63 H	318	76.60	32.70
5	2483.50	72.1 PK	74.0	-1.9	1.73 H	5	39.40	32.70
6	2483.50	49.8 AV	54.0	-4.2	1.73 H	5	17.10	32.70
7	4874.00	50.2 PK	74.0	-23.8	1.54 H	321	44.00	6.20
8	4874.00	37.2 AV	54.0	-16.8	1.54 H	321	31.00	6.20
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	66.9 PK	74.0	-7.1	1.58 V	6	34.40	32.50
2	2390.00	47.6 AV	54.0	-6.4	1.58 V	6	15.10	32.50
3	*2437.00	116.1 PK			1.71 V	351	83.40	32.70
4	*2437.00	106.5 AV			1.71 V	351	73.80	32.70
5	2483.50	69.3 PK	74.0	-4.7	1.36 V	346	36.60	32.70
6	2483.50	49.5 AV	54.0	-4.5	1.36 V	346	16.80	32.70
7	4874.00	49.3 PK	74.0	-24.7	1.67 V	22	43.10	6.20
8	4874.00	36.5 AV	54.0	-17.5	1.67 V	22	30.30	6.20

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)
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	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	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	*2462.00	115.2 PK			1.44 H	314	82.60	32.60
2	*2462.00	105.5 AV			1.44 H	314	72.90	32.60
3	2483.50	72.5 PK	74.0	-1.5	1.58 H	314	39.80	32.70
4	2483.50	52.2 AV	54.0	-1.8	1.58 H	314	19.50	32.70
5	4924.00	48.7 PK	74.0	-25.3	1.50 H	264	42.40	6.30
6	4924.00	35.5 AV	54.0	-18.5	1.50 H	264	29.20	6.30
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	112.0 PK			1.37 V	346	79.40	32.60
2	*2462.00	102.6 AV			1.37 V	346	70.00	32.60
3	2483.50	72.2 PK	74.0	-1.8	1.35 V	347	39.50	32.70
4	2483.50	51.2 AV	54.0	-2.8	1.35 V	347	18.50	32.70
5	4924.00	49.0 PK	74.0	-25.0	1.40 V	313	42.70	6.30
6	4924.00	35.9 AV	54.0	-18.1	1.40 V	313	29.60	6.30

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)
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)
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	68.8 PK	74.0	-5.2	1.92 H	359	36.30	32.50
2	2390.00	52.5 AV	54.0	-1.5	1.92 H	359	20.00	32.50
3	*2422.00	108.5 PK			1.30 H	336	75.90	32.60
4	*2422.00	98.5 AV			1.30 H	336	65.90	32.60
5	4844.00	48.1 PK	74.0	-25.9	1.31 H	19	42.00	6.10
6	4844.00	35.1 AV	54.0	-18.9	1.31 H	19	29.00	6.10
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	67.7 PK	74.0	-6.3	1.22 V	3	35.20	32.50
2	2390.00	50.5 AV	54.0	-3.5	1.22 V	3	18.00	32.50
3	*2422.00	104.1 PK			1.37 V	352	71.50	32.60
4	*2422.00	94.5 AV			1.37 V	352	61.90	32.60
5	4844.00	48.0 PK	74.0	-26.0	1.46 V	83	41.90	6.10
6	4844.00	35.0 AV	54.0	-19.0	1.46 V	83	28.90	6.10

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)
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	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	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	70.8 PK	74.0	-3.2	1.66 H	334	38.30	32.50
2	2390.00	52.1 AV	54.0	-1.9	1.66 H	334	19.60	32.50
3	*2437.00	113.0 PK			1.46 H	321	80.30	32.70
4	*2437.00	102.5 AV			1.46 H	321	69.80	32.70
5	4874.00	48.9 PK	74.0	-25.1	1.63 H	219	42.70	6.20
6	4874.00	35.9 AV	54.0	-18.1	1.63 H	219	29.70	6.20
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	58.1 PK	74.0	-15.9	1.39 V	353	25.60	32.50
2	2390.00	46.7 AV	54.0	-7.3	1.39 V	353	14.20	32.50
3	*2437.00	109.2 PK			1.39 V	353	76.50	32.70
4	*2437.00	99.7 AV			1.39 V	353	67.00	32.70
5	2483.50	63.9 PK	74.0	-10.1	1.35 V	342	31.20	32.70
6	2483.50	47.7 AV	54.0	-6.3	1.35 V	342	15.00	32.70
7	4874.00	48.3 PK	74.0	-25.7	1.44 V	345	42.10	6.20
8	4874.00	35.7 AV	54.0	-18.3	1.44 V	345	29.50	6.20

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)
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	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	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	*2452.00	108.9 PK			1.43 H	337	76.30	32.60
2	*2452.00	99.3 AV			1.43 H	337	66.70	32.60
3	2483.50	72.8 PK	74.0	-1.2	1.00 H	320	40.10	32.70
4	2483.50	52.9 AV	54.0	-1.1	1.00 H	320	20.20	32.70
5	4904.00	48.0 PK	74.0	-26.0	1.23 H	280	41.90	6.10
6	4904.00	35.1 AV	54.0	-18.9	1.23 H	280	29.00	6.10
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	*2452.00	104.5 PK			1.21 V	336	71.80	32.70
2	*2452.00	94.4 AV			1.21 V	336	61.70	32.70
3	2483.50	67.2 PK	74.0	-6.8	1.36 V	335	34.50	32.70
4	2483.50	48.7 AV	54.0	-5.3	1.36 V	335	16.00	32.70
5	4904.00	48.1 PK	74.0	-25.9	1.44 V	296	42.00	6.10
6	4904.00	35.3 AV	54.0	-18.7	1.44 V	296	29.20	6.10

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)
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: 802.11b

CHANNEL	TX Channel 1	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	86.28	33.5 QP	40.0	-6.5	2.00 H	279	53.20	-19.70
2	195.16	38.5 QP	43.5	-5.0	1.51 H	105	55.00	-16.50
3	280.71	39.2 QP	46.0	-6.8	1.01 H	99	52.10	-12.90
4	374.04	32.9 QP	46.0	-13.1	1.01 H	132	43.90	-11.00
5	624.85	35.2 QP	46.0	-10.8	1.51 H	129	40.60	-5.40
6	960.00	42.7 QP	46.0	-3.3	2.00 H	328	42.10	0.60
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	39.62	36.7 QP	40.0	-3.3	1.49 V	16	51.90	-15.20
2	88.23	33.1 QP	43.5	-10.4	1.00 V	208	52.90	-19.80
3	193.22	35.6 QP	43.5	-7.9	1.49 V	16	51.90	-16.30
4	624.85	37.2 QP	46.0	-8.8	1.00 V	234	42.60	-5.40
5	838.72	37.0 QP	46.0	-9.0	1.00 V	84	38.70	-1.70
6	961.21	38.7 QP	54.0	-15.3	1.49 V	274	38.10	0.60

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)
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	ESCS 30	100288	Apr. 27, 2015	Apr. 26, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Dec. 30, 2014	Dec. 29, 2015
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 21, 2015	Jul. 20, 2016
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

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

4.2.3 Test Procedures

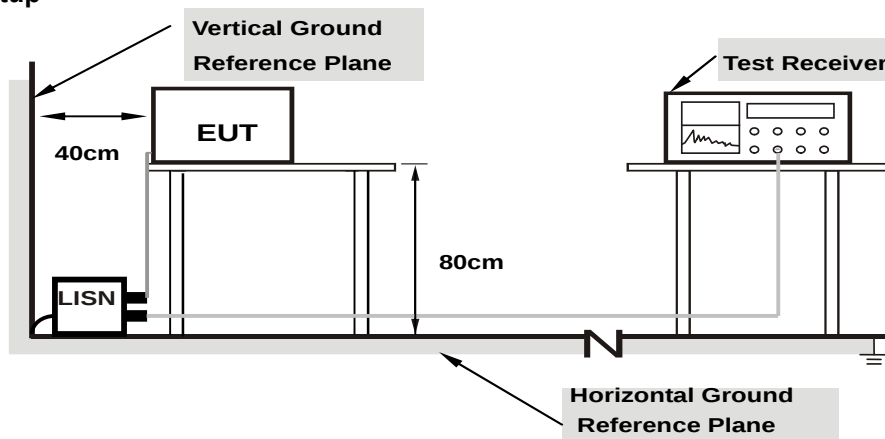
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

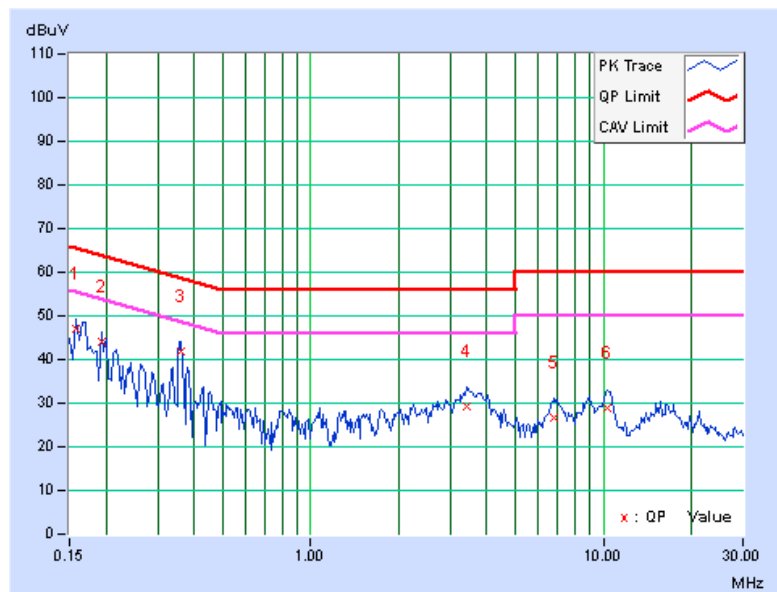
Worst-case data: 802.11b

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	9.94	37.02	21.15	46.96	31.09	65.58	55.58	-18.62	-24.49
2	0.19297	9.95	34.07	20.81	44.02	30.76	63.91	53.91	-19.89	-23.15
3	0.36094	9.95	32.08	29.30	42.03	39.25	58.71	48.71	-16.68	-9.46
4	3.43359	10.24	19.16	10.96	29.40	21.20	56.00	46.00	-26.60	-24.80
5	6.81641	10.34	16.24	6.26	26.58	16.60	60.00	50.00	-33.42	-33.40
6	10.32031	10.43	18.36	8.53	28.79	18.96	60.00	50.00	-31.21	-31.04

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.

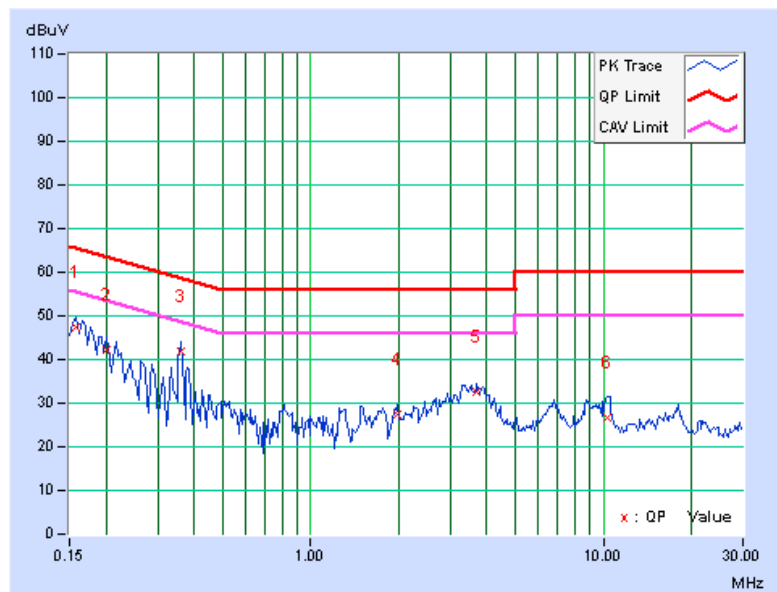


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	9.95	37.34	19.83	47.29	29.78	65.58	55.58	-18.29	-25.80
2	0.20078	9.97	32.40	16.83	42.37	26.80	63.58	53.58	-21.21	-26.78
3	0.36094	9.99	31.85	29.46	41.84	39.45	58.71	48.71	-16.86	-9.25
4	1.98828	10.19	17.05	12.74	27.24	22.93	56.00	46.00	-28.76	-23.07
5	3.70703	10.29	22.24	13.47	32.53	23.76	56.00	46.00	-23.47	-22.24
6	10.28906	10.51	16.11	7.93	26.62	18.44	60.00	50.00	-33.38	-31.56

Remarks:

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

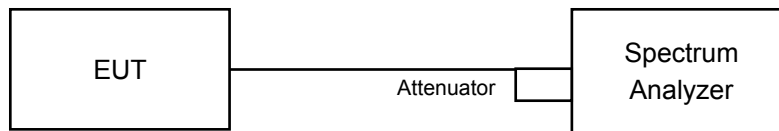


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	7.11	7.57	0.5	Pass
6	2437	7.09	7.09	0.5	Pass
11	2462	7.09	7.10	0.5	Pass

802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.44	16.37	0.5	Pass
6	2437	16.38	16.35	0.5	Pass
11	2462	16.39	16.38	0.5	Pass

802.11n (HT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	17.63	17.63	0.5	Pass
6	2437	17.61	16.73	0.5	Pass
11	2462	17.61	17.62	0.5	Pass

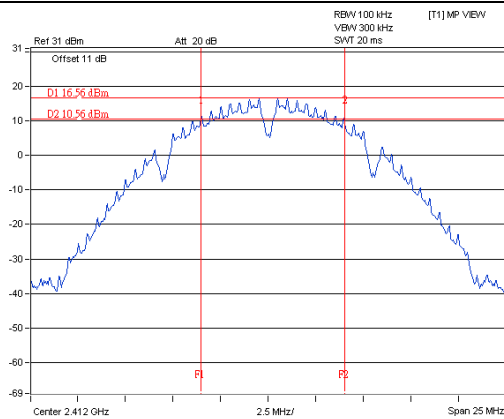
802.11n (HT40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	36.29	36.09	0.5	Pass
6	2437	36.14	36.35	0.5	Pass
9	2452	36.36	36.12	0.5	Pass

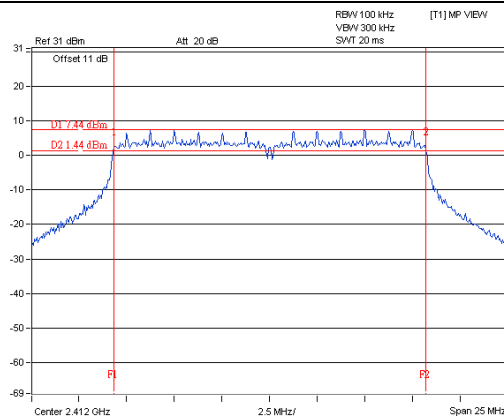
Spectrum Plot of Worst Value

802.11b

802.11g



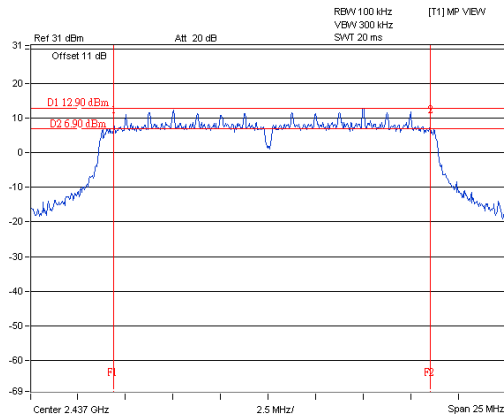
A D T



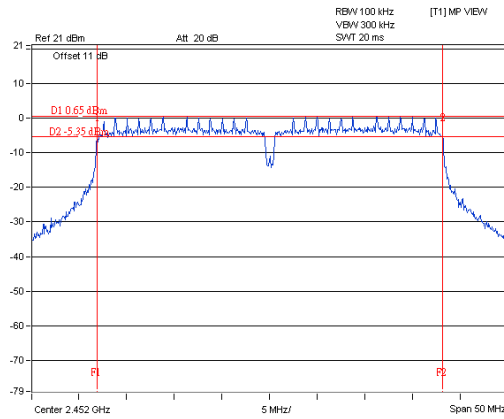
A D T

802.11n (HT20)

802.11n (HT40)



A D T



A D T

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,

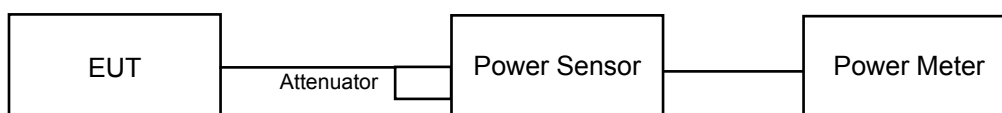
Array Gain = 0 dB (i.e., no array gain) for $NANT \leq 4$;

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 $NANT \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(NANT/NSS)$ dB.

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

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 Item 4.3.6.

4.4.7 Test Results

802.11b

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	24.43	24.27	544.633	27.36	30	Pass
6	2437	23.14	24.01	457.831	26.61	30	Pass
11	2462	20.74	21.44	257.893	24.11	30	Pass

802.11g

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	18.73	18.66	148.096	21.71	30	Pass
6	2437	22.25	22.72	354.948	25.50	30	Pass
11	2462	18.14	18.95	143.687	21.57	30	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	18.11	18.28	132.012	21.21	30	Pass
6	2437	22.14	22.89	358.218	25.54	30	Pass
11	2462	17.91	18.41	131.145	21.18	30	Pass

802.11n (HT40)

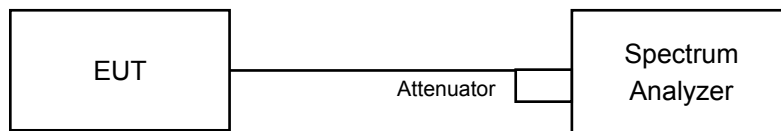
Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	16.05	15.51	75.835	18.80	30	Pass
6	2437	18.38	19.23	152.618	21.84	30	Pass
9	2452	14.99	15.16	64.360	18.09	30	Pass

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

For duty cycle $\geq 98\%$

- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
- Sweep time = auto couple.
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.

For duty cycle $< 98\%$

- Measure the duty cycle (x).
- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
- Sweep time = auto couple.
- Do not use sweep triggering. Allow sweep to "free run".
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.
- 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 Item 4.3.6

4.5.7 Test Results

802.11b

TX chain	Channel	Frequency (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass / Fail
0	1	2412	-3.57	3.01	-0.56	6.99	Pass
	6	2437	-3.34	3.01	-0.33	6.99	Pass
	11	2462	-6.36	3.01	-3.35	6.99	Pass
1	1	2412	-2.42	3.01	0.59	6.99	Pass
	6	2437	-2.62	3.01	0.39	6.99	Pass
	11	2462	-5.02	3.01	-2.01	6.99	Pass

Note:

- 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.
- Directional gain = $4\text{dBi} + 10\log(2) = 7.01\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8-(7.01-6) = 6.99\text{dBm}$.

802.11g

TX chain	Channel	Frequency (MHz)	PSD (dBm)	10 log (N=2) dB	Duty Factor	Total PSD with Duty Factor (dBm)	Limit (dBm)	Pass / Fail
0	1	2412	-3.13	3.01	0.12	0.00	6.99	Pass
	6	2437	-5.62	3.01	0.12	-2.49	6.99	Pass
	11	2462	-6.75	3.01	0.12	-3.62	6.99	Pass
1	1	2412	-11.11	3.01	0.12	-7.98	6.99	Pass
	6	2437	-7.17	3.01	0.12	-4.04	6.99	Pass
	11	2462	-11.27	3.01	0.12	-8.14	6.99	Pass

Note:

- 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.
- Directional gain = $4\text{dBi} + 10\log(2) = 7.01\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8-(7.01-6) = 6.99\text{dBm}$.
- Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

TX chain	Channel	Frequency (MHz)	PSD (dBm)	10 log (N=2) dB	Duty Factor	Total PSD with Duty Factor (dBm)	Limit (dBm)	Pass / Fail
0	1	2412	-12.49	3.01	0.12	-9.36	6.99	Pass
	6	2437	-7.92	3.01	0.12	-4.79	6.99	Pass
	11	2462	-12.71	3.01	0.12	-9.58	6.99	Pass
1	1	2412	-12.16	3.01	0.12	-9.03	6.99	Pass
	6	2437	-7.49	3.01	0.12	-4.36	6.99	Pass
	11	2462	-11.78	3.01	0.12	-8.65	6.99	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 = $4\text{dBi} + 10\log(2) = 7.01\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8-(7.01-6) = 6.99\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

TX chain	Channel	Frequency (MHz)	PSD (dBm)	10 log (N=2) dB	Duty Factor	Total PSD with Duty Factor (dBm)	Limit (dBm)	Pass / Fail
0	3	2422	-9.65	3.01	0.18	-6.46	6.99	Pass
	6	2437	-4.60	3.01	0.18	-1.41	6.99	Pass
	9	2452	-17.91	3.01	0.18	-14.72	6.99	Pass
1	3	2422	-17.78	3.01	0.18	-14.59	6.99	Pass
	6	2437	-13.03	3.01	0.18	-9.84	6.99	Pass
	9	2452	-15.93	3.01	0.18	-12.74	6.99	Pass

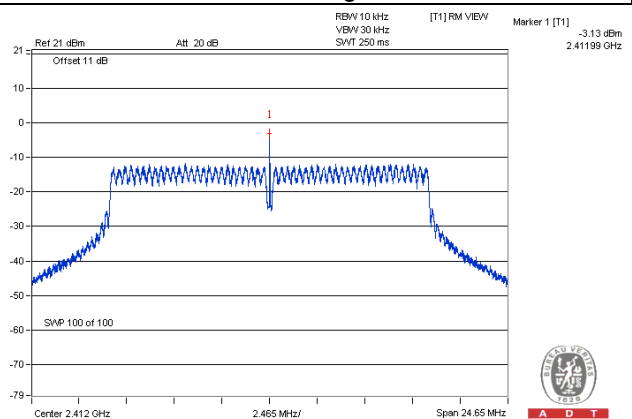
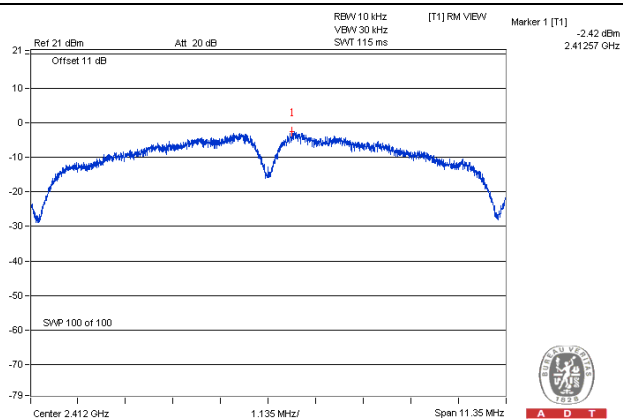
Note:

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 = $4\text{dBi} + 10\log(2) = 7.01\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8-(7.01-6) = 6.99\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

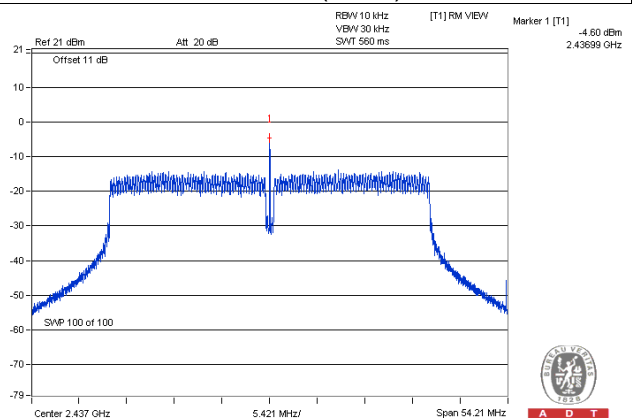
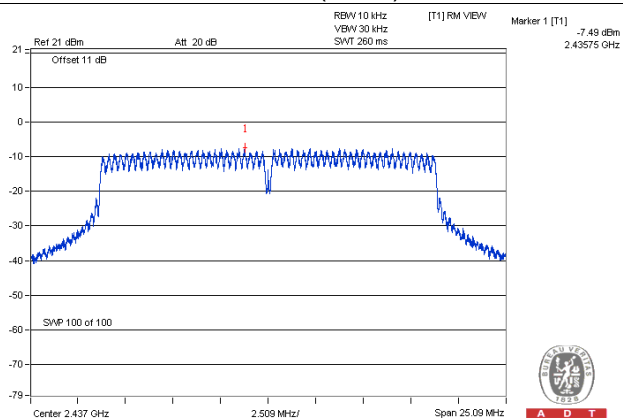
802.11b

802.11g



802.11n (HT20)

802.11n (HT40)

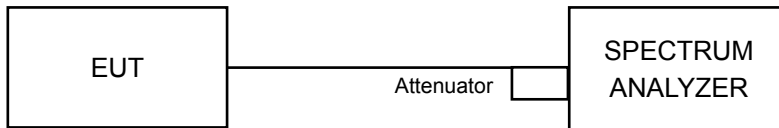


4.6 Conducted Out of Band Emission Measurement

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

- Set the RBW = 100 kHz.
- Set the VBW $\geq$ 300 kHz.
- Detector = average.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW $\geq$ 300 kHz.
- Ensure that the number of measurement points $\geq$ span/RBW
- According to measurement points to set differ measurement span.
- Detector = peak.
- Trace Mode = max hold.
- Sweep = auto couple.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

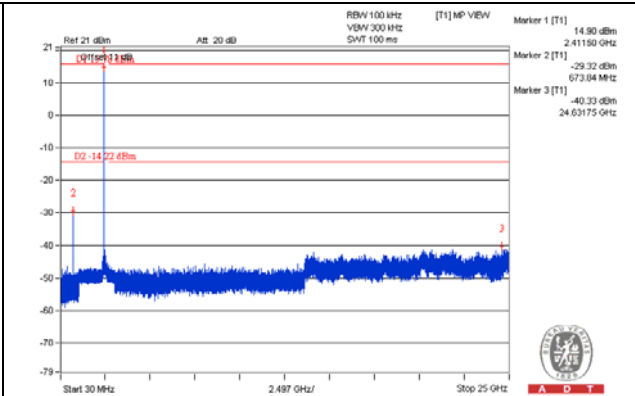
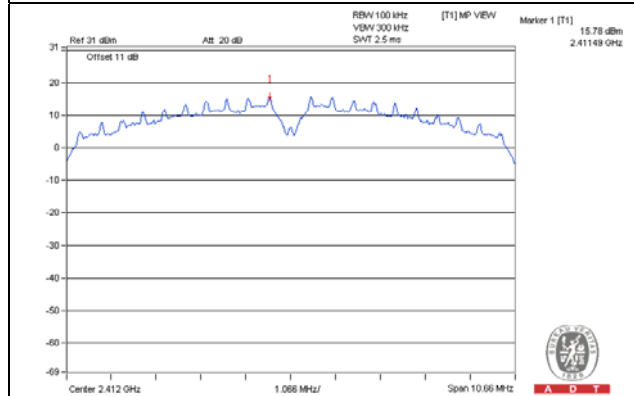
Same as Item 4.3.6

4.6.7 Test Results

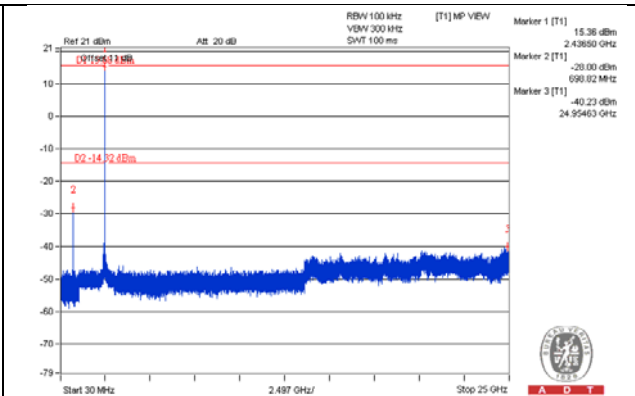
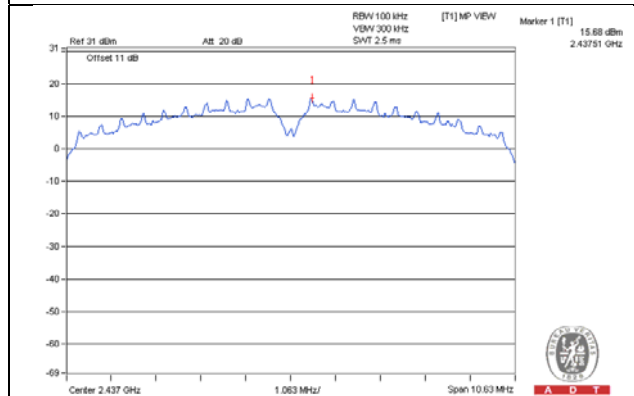
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

802.11b_Chain 0

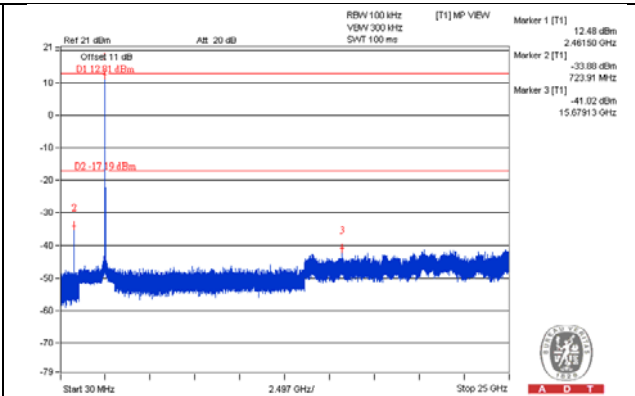
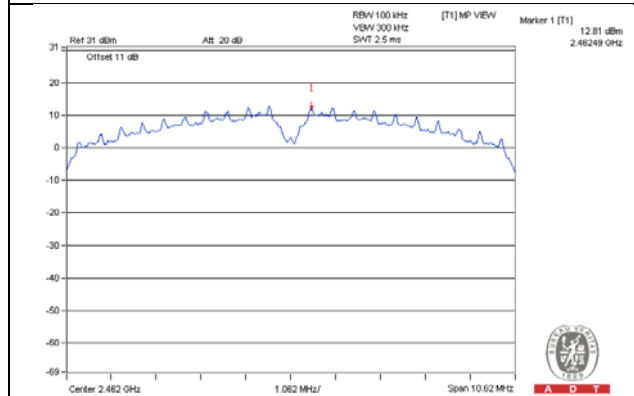
CH 1



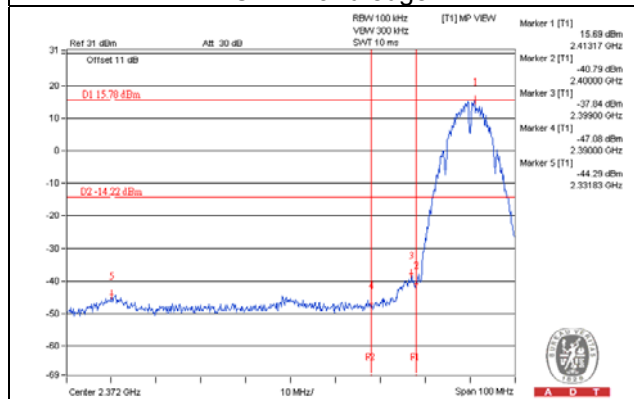
CH 6



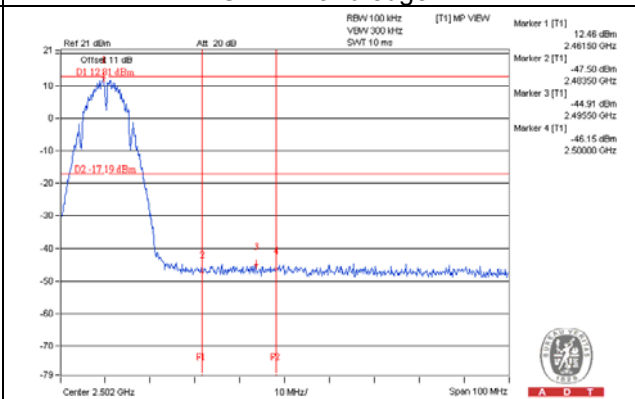
CH 11



CH 1 Band edge

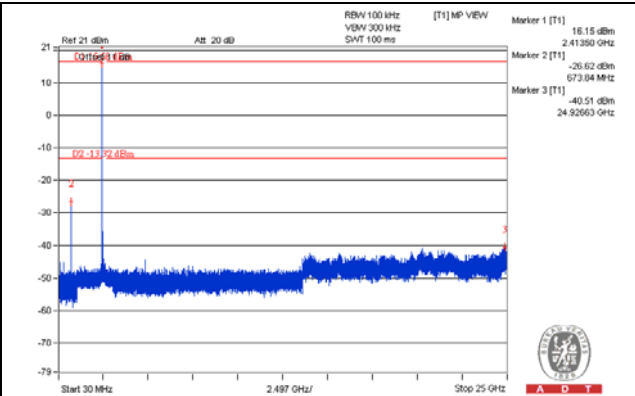
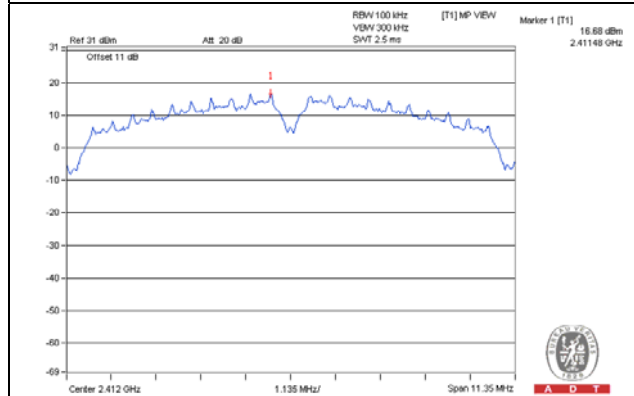


CH 11 Band edge

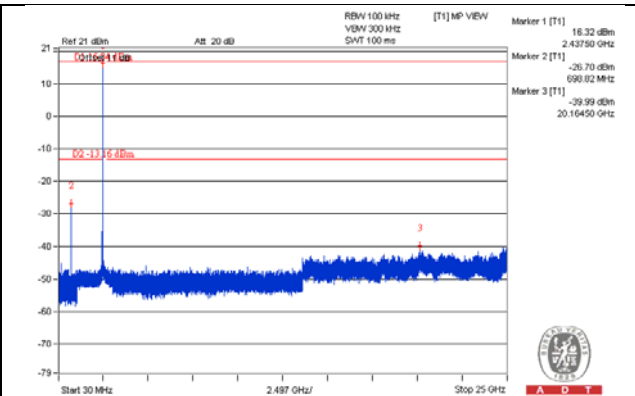
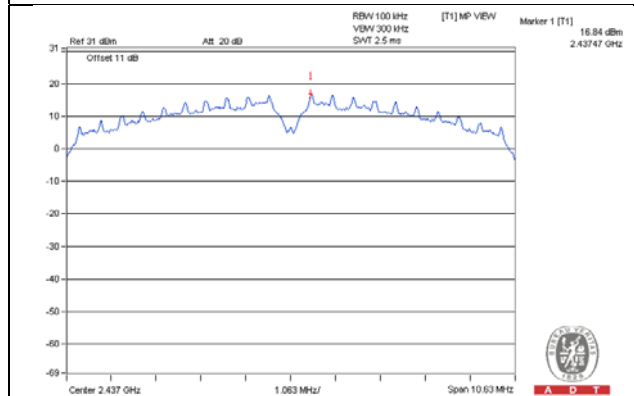


802.11b_Chain 1

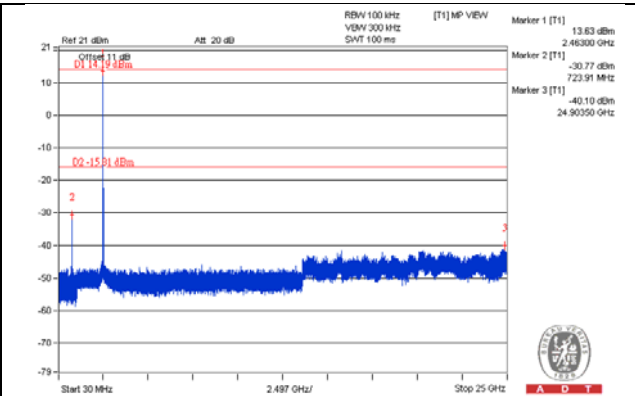
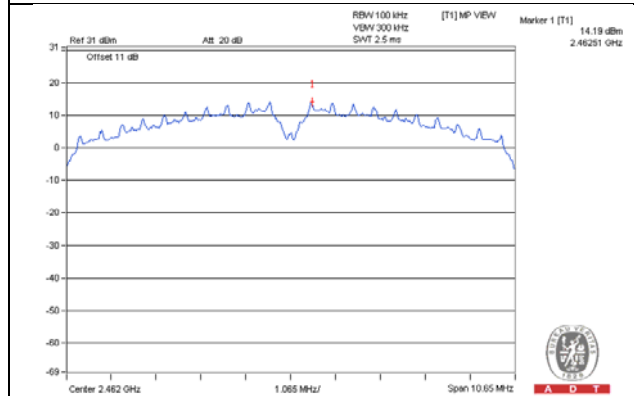
CH 1



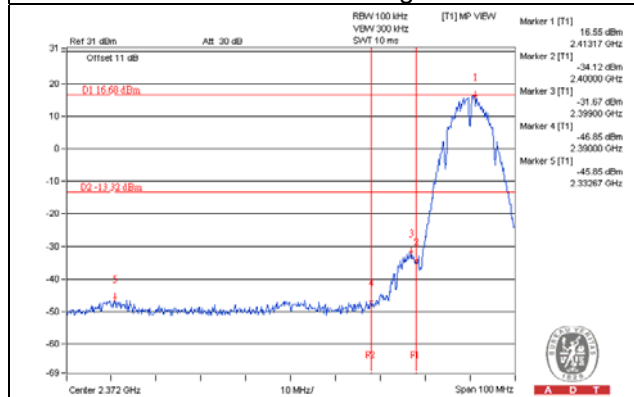
CH 6



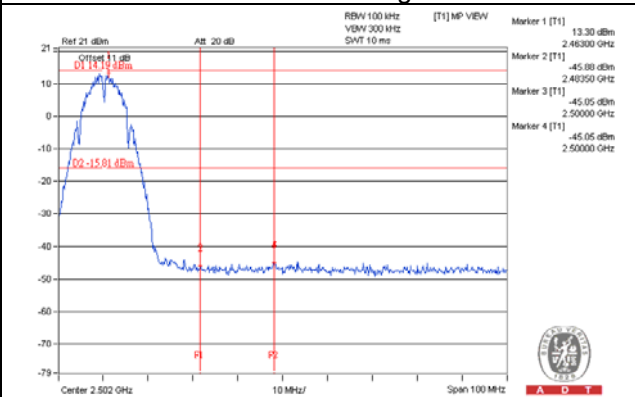
CH 11



CH 1 Band edge

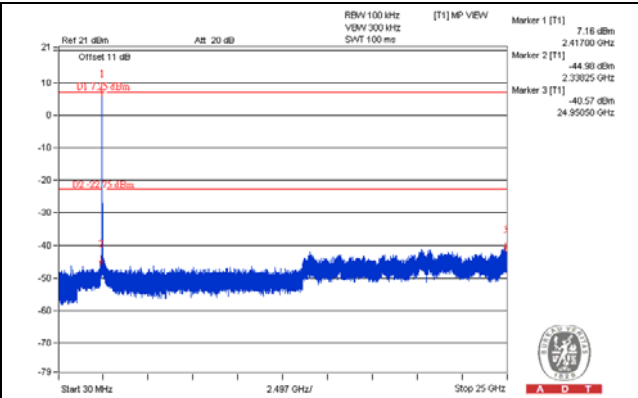
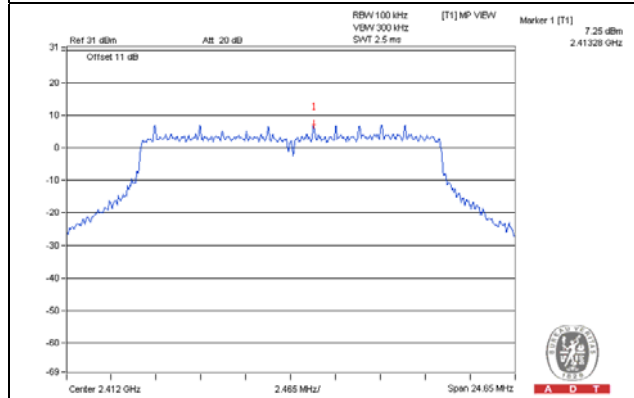


CH 11 Band edge

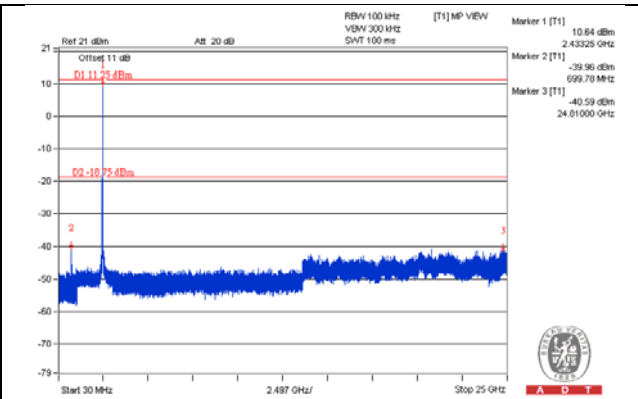
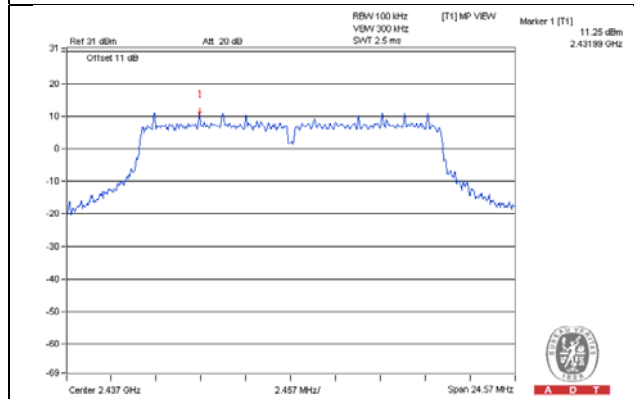


802.11g_Chain 0

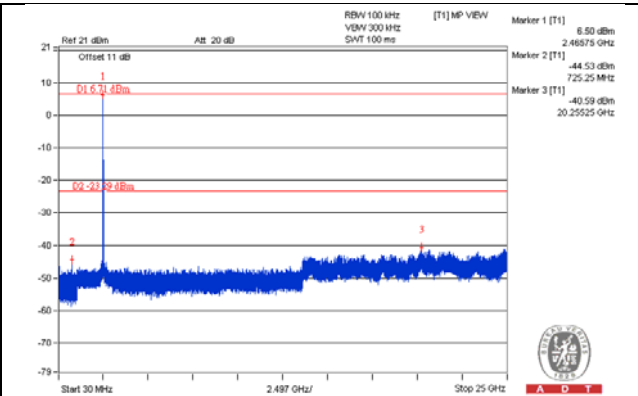
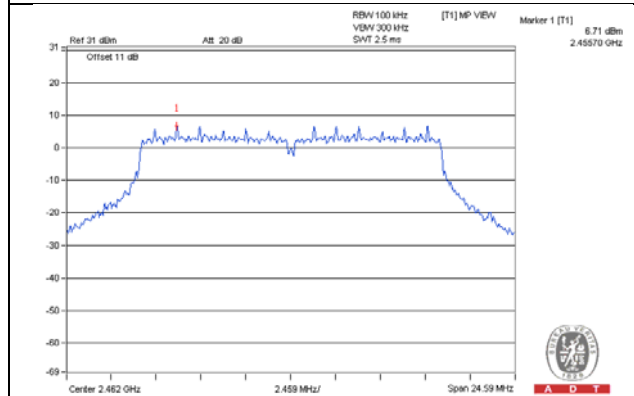
CH 1



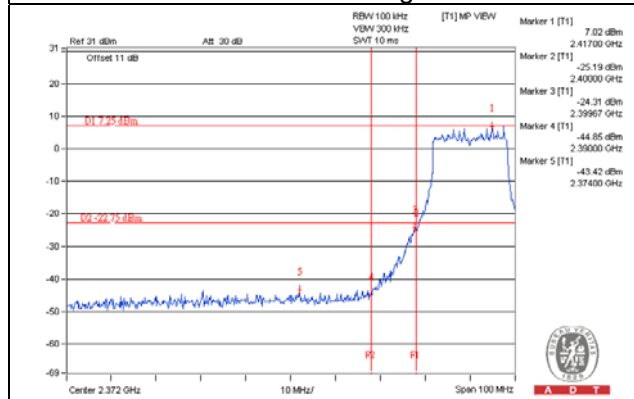
CH 6



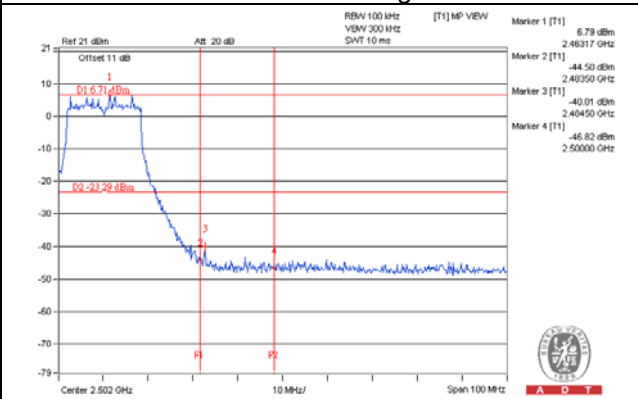
CH 11



CH 1 Band edge

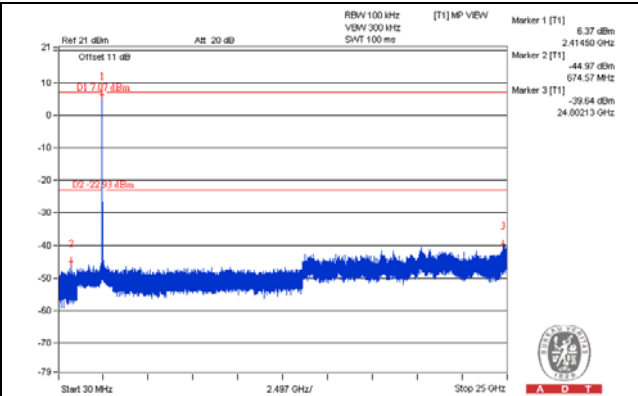
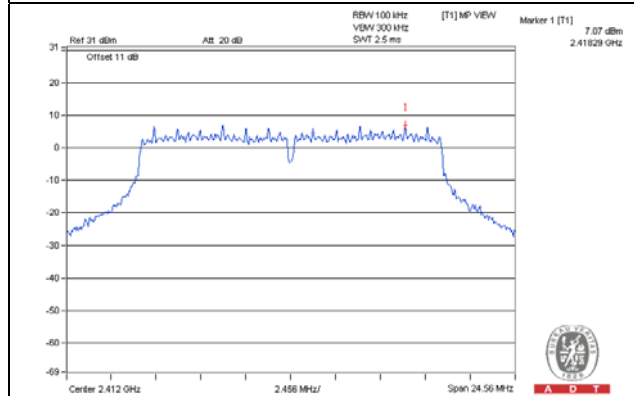


CH 11 Band edge

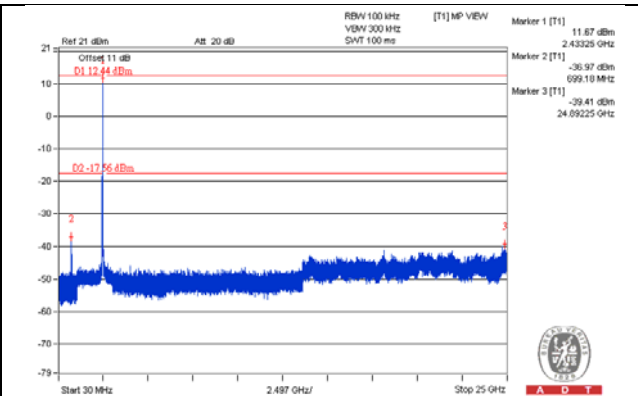
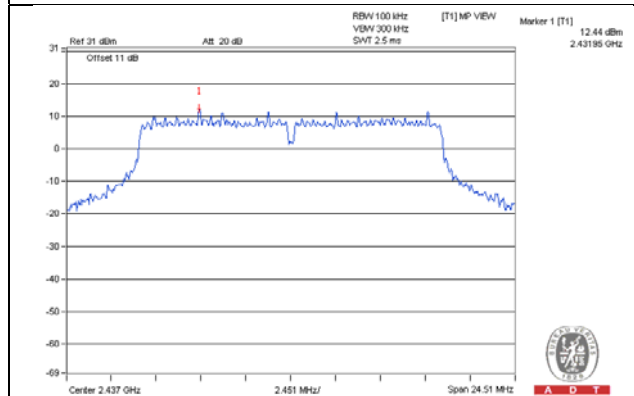


802.11g_Chain 1

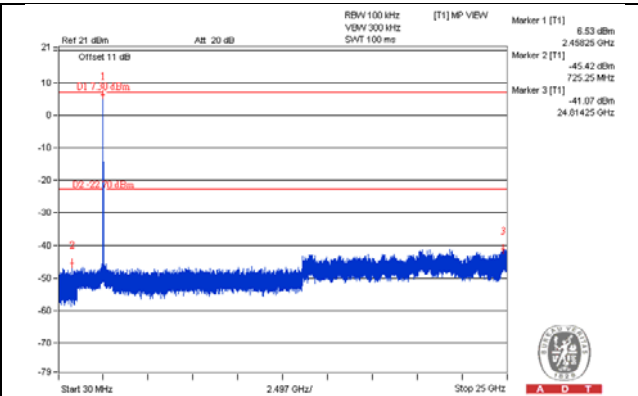
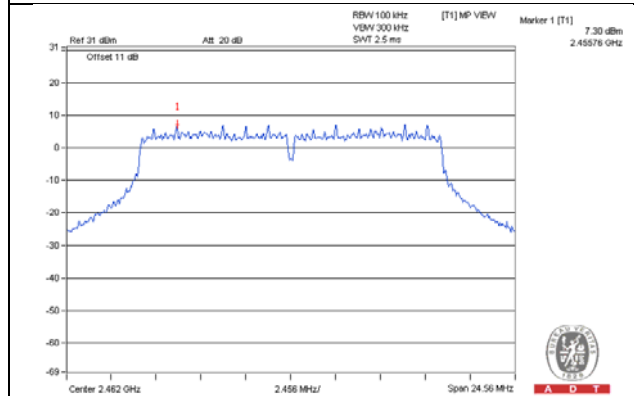
CH 1



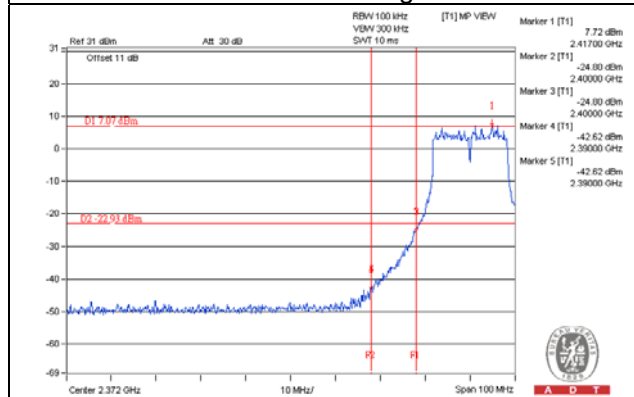
CH 6



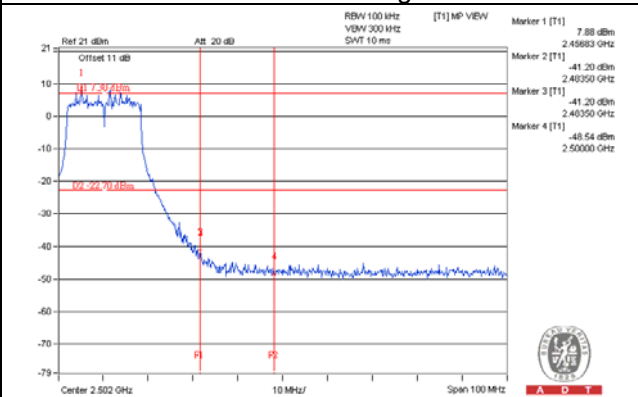
CH 11



CH 1 Band edge

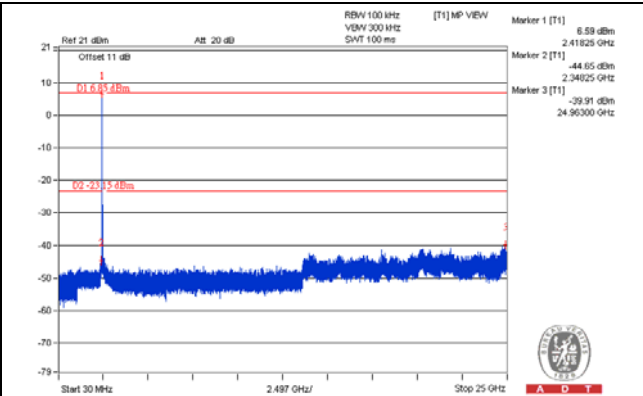
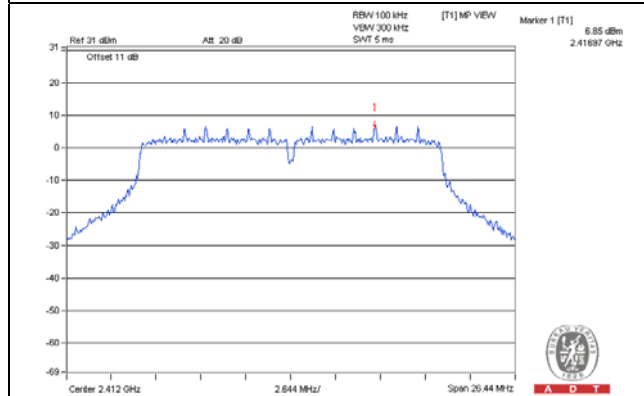


CH 11 Band edge

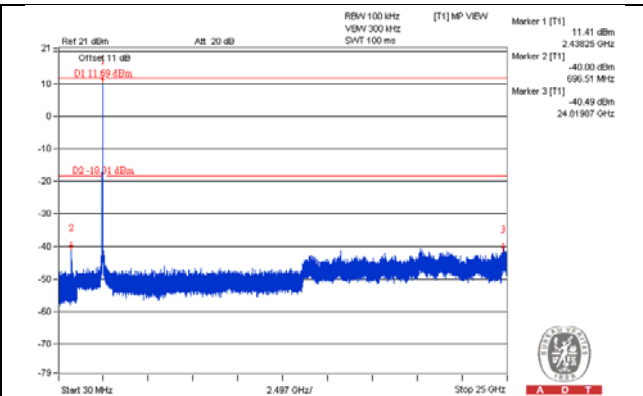
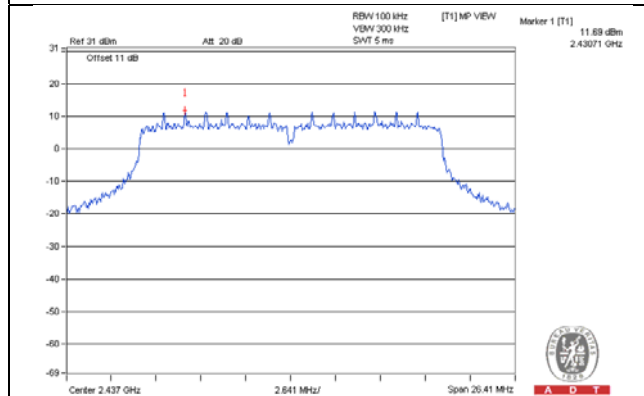


802.11n (HT20)_Chain 0

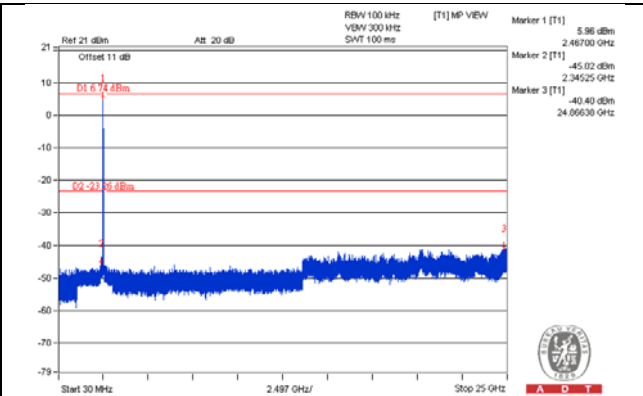
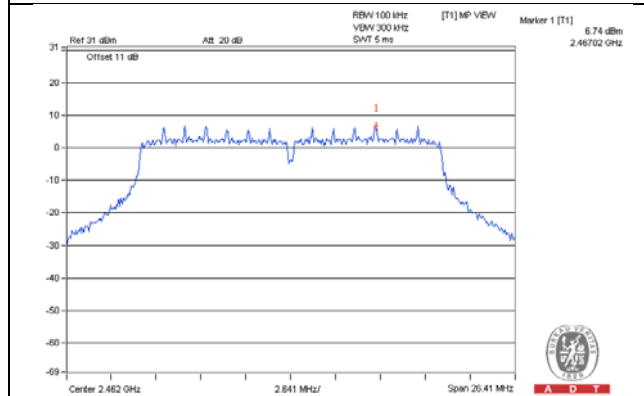
CH 1



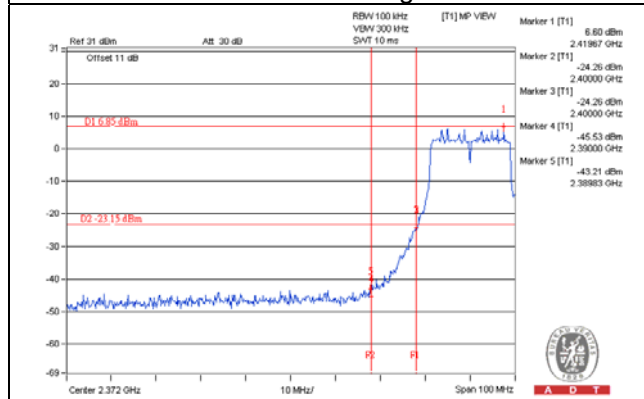
CH 6



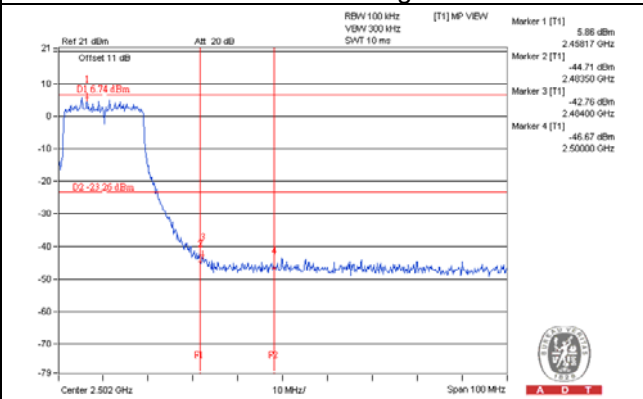
CH 11



CH 1 Band edge

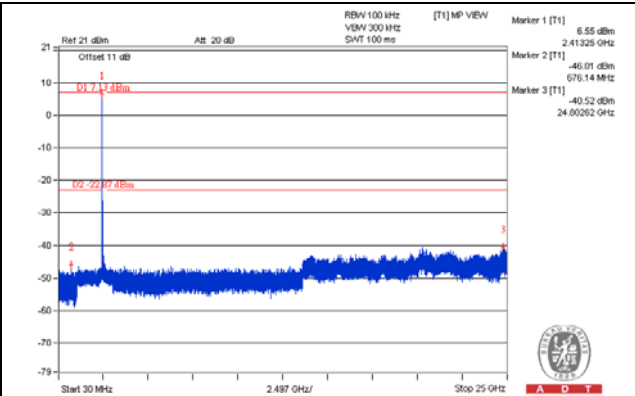
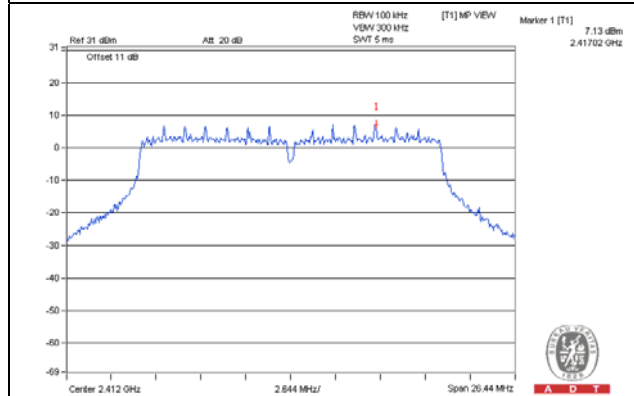


CH 11 Band edge

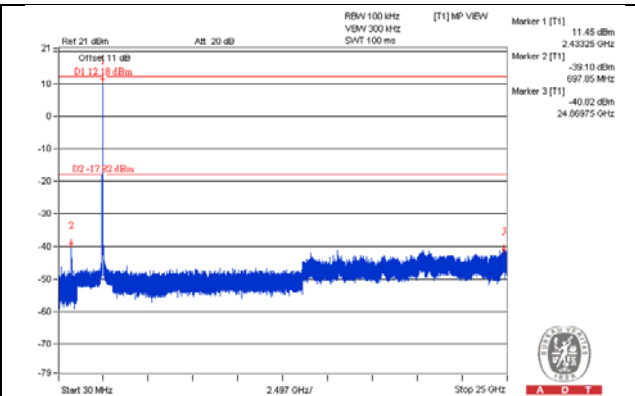
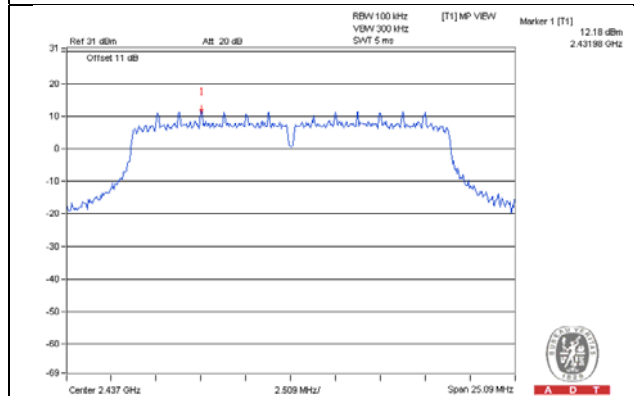


802.11n (HT20)_Chain 1

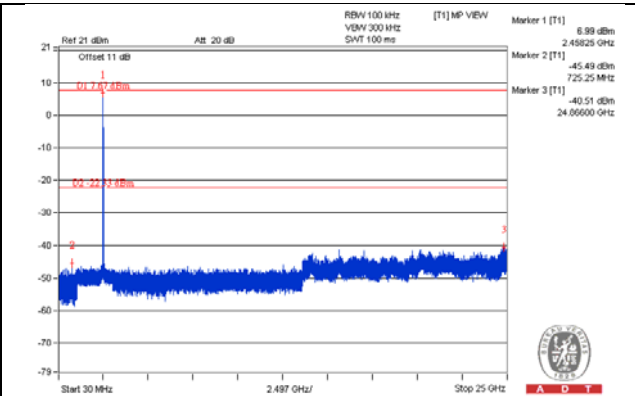
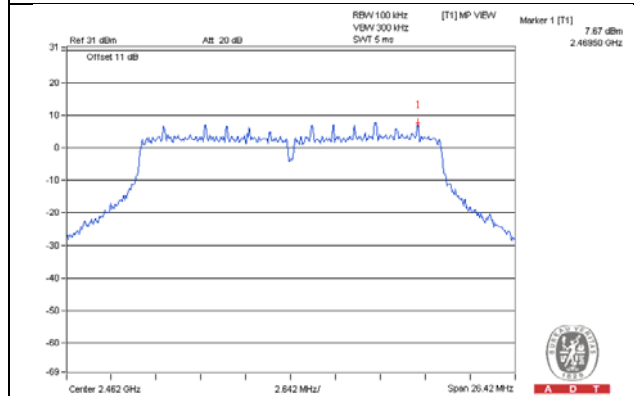
CH 1



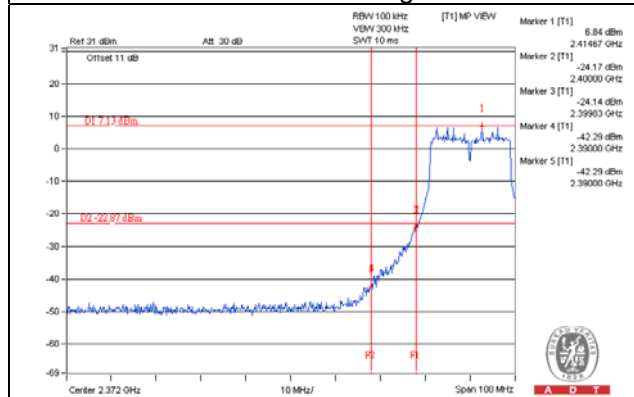
CH 6



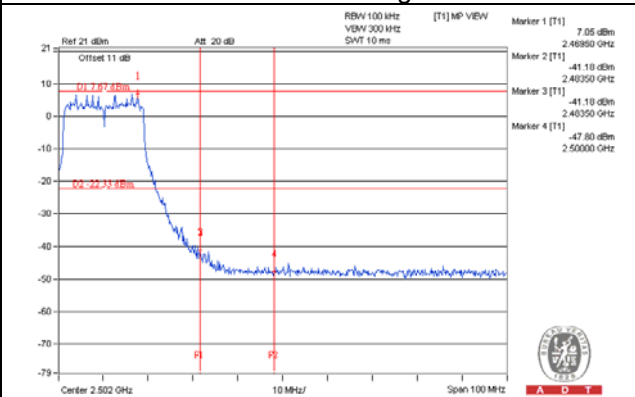
CH 11



CH 1 Band edge

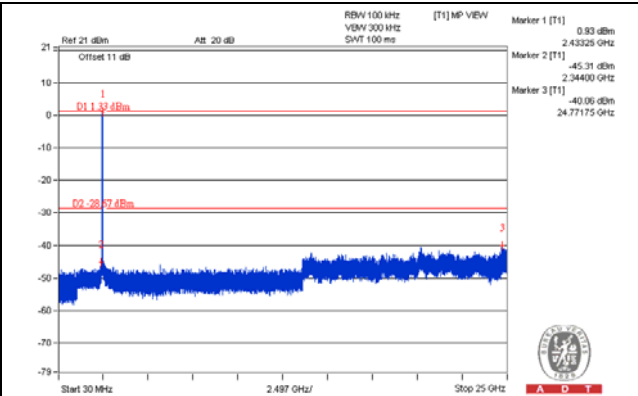
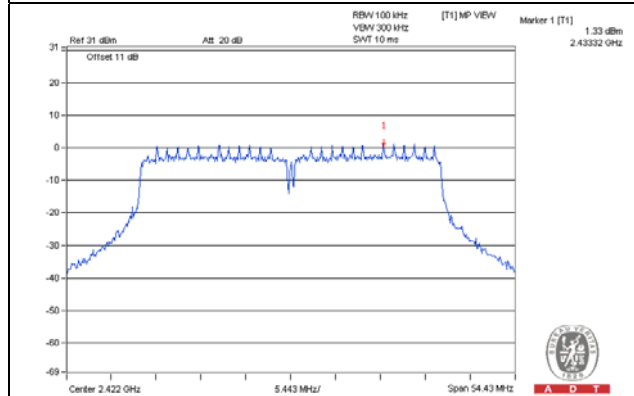


CH 11 Band edge

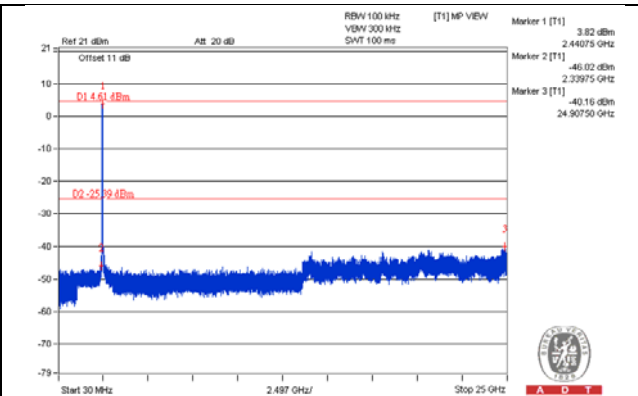
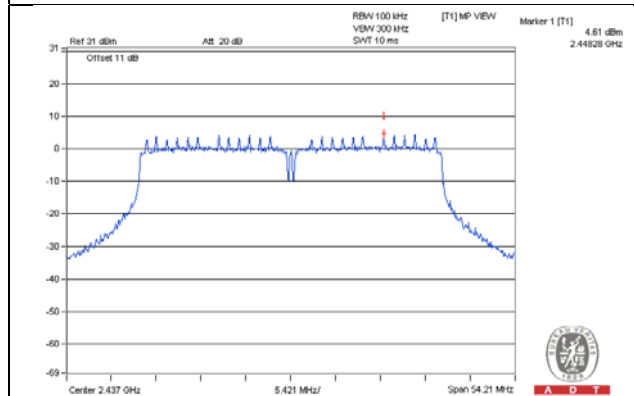


802.11n (HT40)_Chain 0

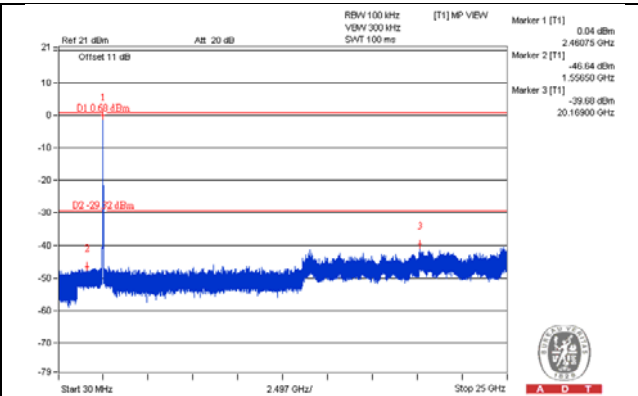
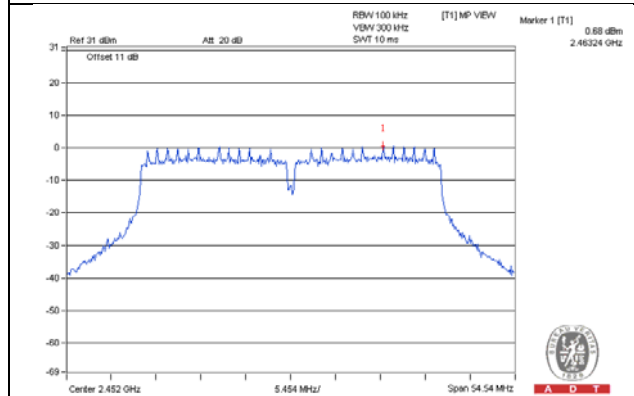
CH 3



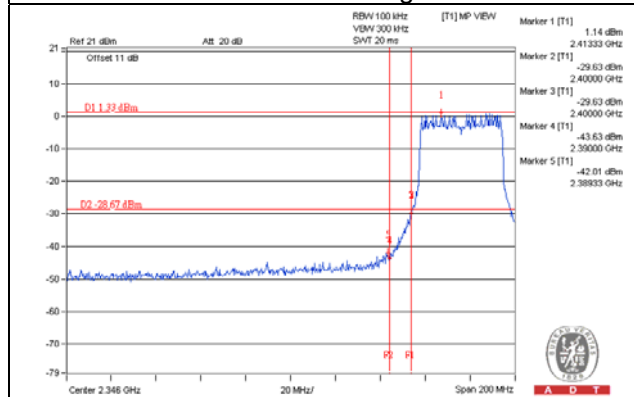
CH 6



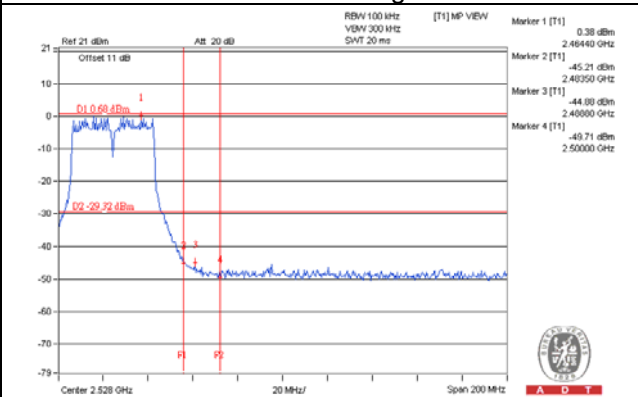
CH 9



CH 3 Band edge

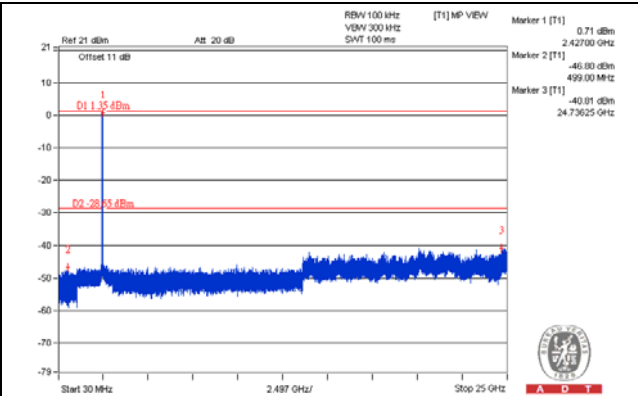
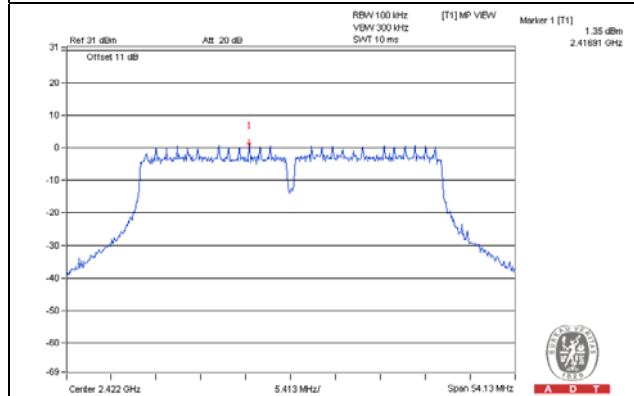


CH 9 Band edge

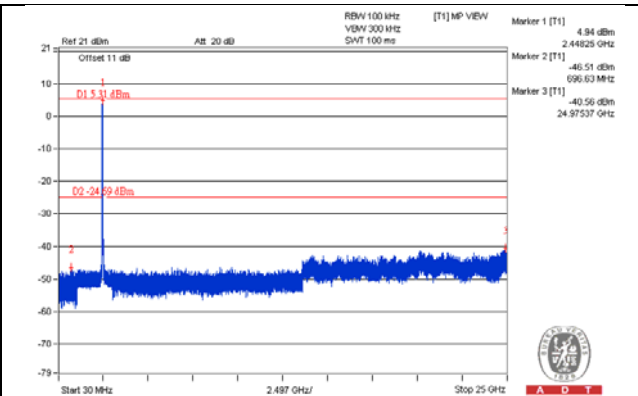
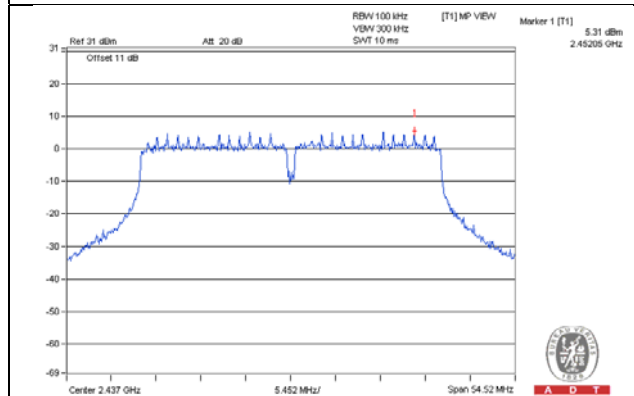


802.11n (HT40)_Chain 1

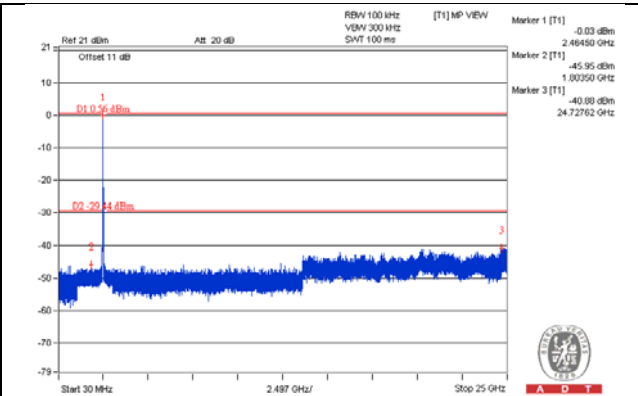
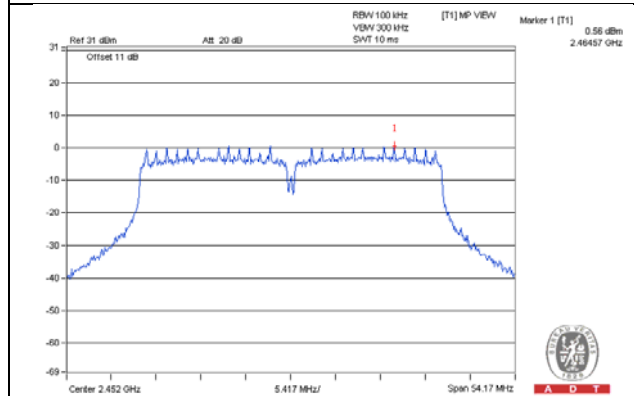
CH 3



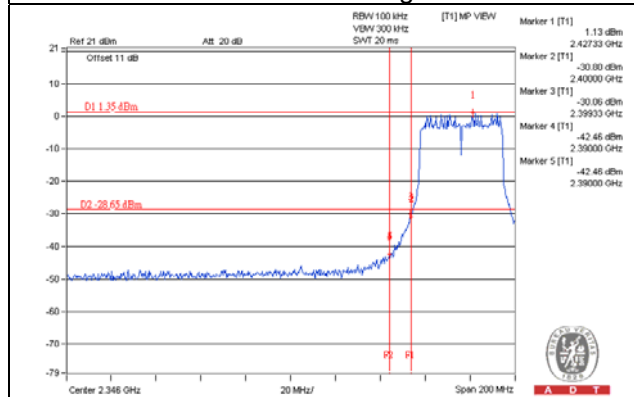
CH 6



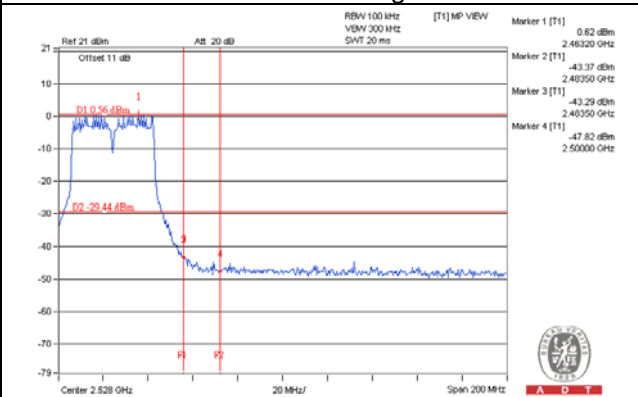
CH 9



CH 3 Band edge



CH 9 Band edge



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:

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

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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