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FCC TEST REPORT

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MODEL NO.: WM-N-BM-02_D
FCC ID: W2Z-02100003
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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF130102C16	Original release	Feb. 21, 2013



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1. CERTIFICATION

PRODUCT: IEEE802.11 b/g/n Wireless LAN module
MODEL NO.: WM-N-BM-02_D
BRAND: FUJIFILM
APPLICANT: FUJIFILM Corporation
TESTED: Jan. 4 ~ 7, 2013
TEST SAMPLE: ENGINEERING SAMPLE
STANDARDS: FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10-2009

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 : Annie Chang , **DATE:** Feb. 21, 2013
(Annie Chang / Supervisor)

APPROVED BY : Ken Liu , **DATE:** Feb. 21, 2013
(Ken Liu / Manager)



2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.207	AC Power Conducted Emission	N/A	Power supply is 6.0Vdc from batteries
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -1.1dB at 2390.00MHz.
15.247(d)	Band Edge Measurement	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	No antenna connector is used.

2.1 MEASUREMENT UNCERTAINTY

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

MEASUREMENT	FREQUENCY	UNCERTAINTY
Radiated emissions	30MHz ~ 1GHz	3.78 dB
	Above 1GHz	3.36 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

EUT	IEEE802.11 b/g/n Wireless LAN module
MODEL NO.	WM-N-BM-02_D
POWER SUPPLY	6.0Vdc from batteries
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 72Mbps
OPERATING FREQUENCY	2412 ~ 2462MHz
NUMBER OF CHANNEL	11
OUTPUT POWER	158.5mW
ANTENNA TYPE	Chip antenna with -0.13dBi gain
ANTENNA CONNECTOR	N/A
DATA CABLE	Refer to user's manual
I/O PORTS	Refer to user's manual
ACCESSORY DEVICES	Refer to user's manual

Note:

1. The EUT incorporates a SISO function. Physically, the EUT provides one completed transmitter and one receiver.

Modulation Mode	Tx Function
802.11b	1TX
802.11g	1TX
802.11n (20MHz)	1TX

2. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.



3.2 DESCRIPTION OF TEST MODES

11 channels are provided for 802.11b, 802.11g and 802.11n (20MHz):

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		

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	OB	
-	√	√	Note 1	√	√	-

Where **RE≥1G**: Radiated Emission above 1GHz **RE<1G**: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement
OB: Conducted Out-Band Emission Measurement

NOTE 1: No need to concern of Conducted Emission due to the EUT is powered by batteries.

NOTE 2: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-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.

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 (20MHz)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

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.

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



CONDUCTED OUT-BAND EMISSION MEASUREMENT:

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

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 (20MHz)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

ANTENNA PORT CONDUCTED MEASUREMENT:

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

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 (20MHz)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

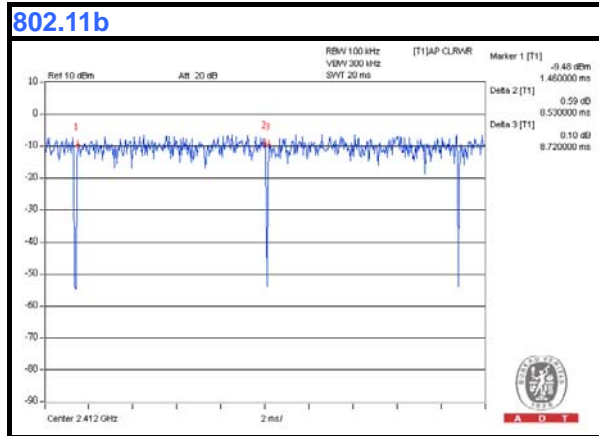
TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	18deg. C, 78%RH	6.0Vdc	Dalen Dai
RE<1G	18deg. C, 78%RH	6.0Vdc	Dalen Dai
OB	18deg. C, 78%RH	6.0Vdc	Dalen Dai
APCM	18deg. C, 78%RH	6.0Vdc	Chad Lee

3.3 DUTY CYCLE OF TEST SIGNAL

For 802.11b:

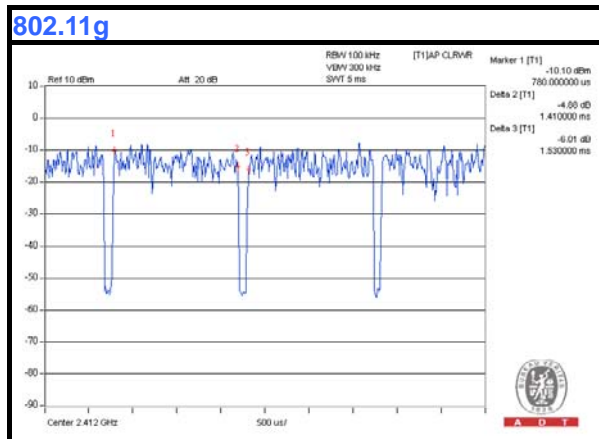
Duty cycle of test signal is > 98 %



802.11g:

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

Duty cycle = $1.41/1.53 = 0.92$, Duty factor = $10 * \log(1/0.92) = 0.36$



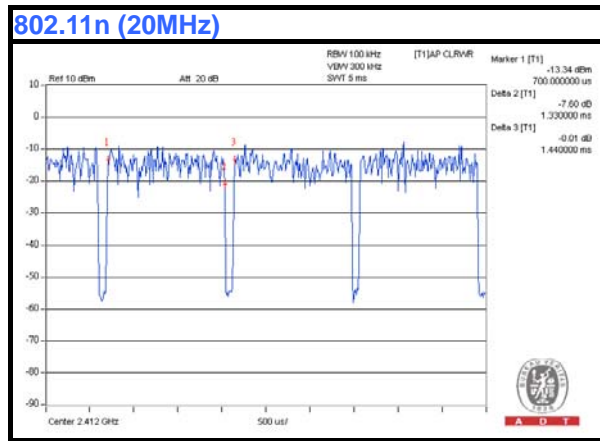


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802.11n (20MHz):

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

Duty cycle = $1.33/1.44 = 0.92$, Duty factor = $10 * \log(1/0.92) = 0.36$



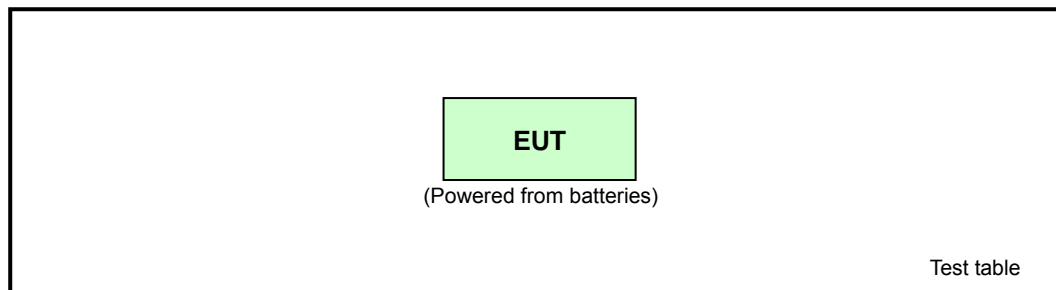


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3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together without any necessary accessory or support unit.

3.4.1 CONFIGURATION OF SYSTEM UNDER TEST





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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 v02

ANSI C63.10-2009

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



4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB 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 20dB under any condition of modulation.



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4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Feb. 29, 2012	Feb. 28, 2013
HP Preamplifier	8449B	3008A01201	Feb. 29, 2012	Feb. 28, 2013
Agilent Spectrum Analyzer	E4446A	MY46180403	Jun. 13, 2012	Jun. 12, 2013
ROHDE & SCHWARZ Test Receiver	ESCS 30	838251/021	Oct. 11, 2012	Oct. 10, 2013
Schwarzbeck Antenna	VULB 9168	137	Apr. 03, 2012	Apr. 02, 2013
Schwarzbeck Antenna	VHBA 9123	480	May 22, 2012	May 21, 2013
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	ADT_Radiated_V 7.6.15.9.2	NA	NA	NA
SUHNER RF cable	SF102	CABLE-CH6	Aug. 19, 2012	Aug. 18, 2013
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	May 18, 2012	May 17, 2013
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSP 40	100036	May 09, 2012	May 08, 2013
Anritsu Power Sensor	MA2411B	0738404	Apr. 28, 2012	Apr. 27, 2013
Anritsu Power Meter	ML2495A	0842014	Apr. 28, 2012	Apr. 27, 2013

- 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 horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.
4. The Industry Canada Reference No. IC 7450E-6.
5. The FCC Site Registration No. is 447212.



4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters semi-anechoic chamber. 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

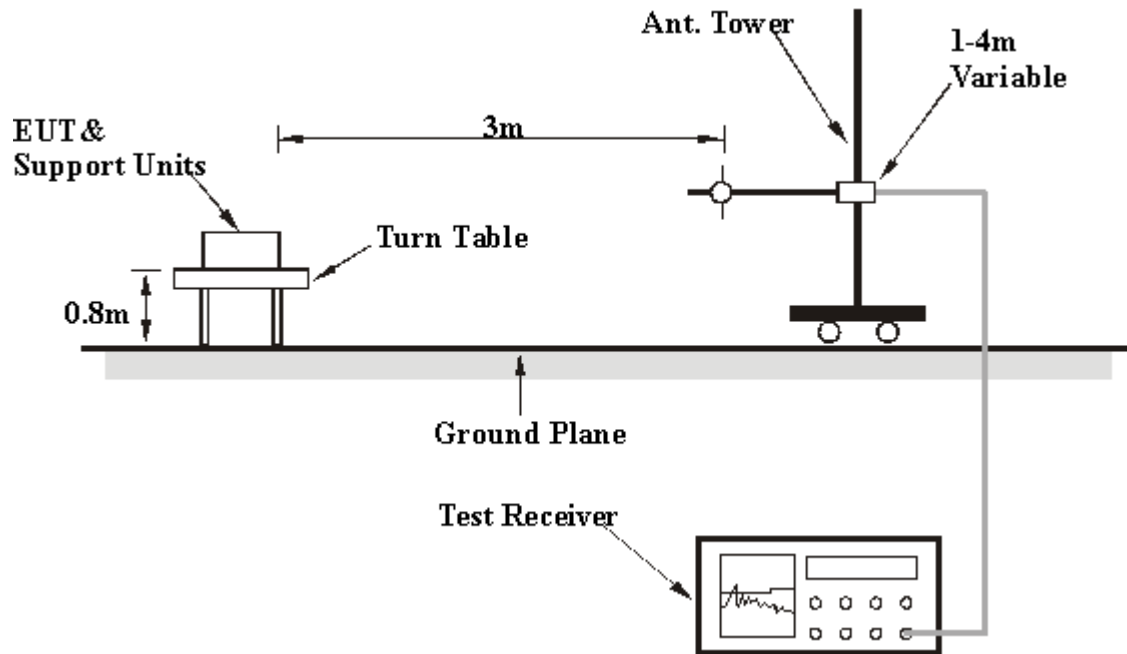
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 100kHz and video bandwidth is 300kHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 1kHz for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 TEST SETUP



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

4.1.6 EUT OPERATING CONDITIONS

Set the EUT under transmission/receiving condition continuously at specific channel frequency.



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4.1.7 TEST RESULTS

ABOVE 1GHz 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	57.5 PK	74.0	-16.5	1.00 H	20	24.62	32.85
2	2390.00	46.1 AV	54.0	-7.9	1.00 H	20	13.25	32.85
3	*2412.00	101.4 PK			1.00 H	20	68.49	32.93
4	*2412.00	97.1 AV			1.00 H	20	64.15	32.93
5	4824.00	49.7 PK	74.0	-24.3	1.00 H	86	9.86	39.84
6	4824.00	38.8 AV	54.0	-15.2	1.00 H	86	-1.00	39.84
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	60.1 PK	74.0	-13.9	1.00 V	278	27.25	32.85
2	2390.00	45.6 AV	54.0	-8.4	1.00 V	278	12.77	32.85
3	*2412.00	103.0 PK			1.00 V	278	70.06	32.93
4	*2412.00	98.8 AV			1.00 V	278	65.82	32.93
5	4824.00	46.9 PK	74.0	-27.1	1.08 V	313	7.03	39.84
6	4824.00	35.2 AV	54.0	-18.8	1.08 V	313	-4.68	39.84

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.



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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	101.6 PK			1.06 H	59	68.64	33.00
2	*2437.00	98.3 AV			1.06 H	59	65.27	33.00
3	4874.00	51.5 PK	74.0	-22.5	1.15 H	227	11.61	39.91
4	4874.00	41.9 AV	54.0	-12.2	1.15 H	227	1.94	39.91
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	103.3 PK			1.03 V	83	70.31	33.00
2	*2437.00	99.9 AV			1.03 V	83	66.92	33.00
3	4874.00	50.4 PK	74.0	-23.6	1.04 V	324	10.52	39.91
4	4874.00	39.9 AV	54.0	-14.1	1.04 V	324	0.01	39.91

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.



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CHANNEL	TX Channel 11	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	*2462.00	103.4 PK			1.03 H	61	70.34	33.08
2	*2462.00	99.7 AV			1.03 H	61	66.64	33.08
3	2483.50	59.4 PK	74.0	-14.6	1.03 H	61	26.27	33.15
4	2483.50	46.8 AV	54.0	-7.2	1.03 H	61	13.64	33.15
5	4924.00	49.2 PK	74.0	-24.8	1.00 H	313	9.19	40.02
6	4924.00	36.8 AV	54.0	-17.2	1.00 H	313	-3.20	40.02
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	103.7 PK			1.03 V	84	70.57	33.08
2	*2462.00	100.1 AV			1.03 V	84	67.01	33.08
3	2483.50	59.8 PK	74.0	-14.2	1.03 V	84	26.64	33.15
4	2483.50	46.6 AV	54.0	-7.4	1.03 V	84	13.47	33.15
5	4924.00	50.4 PK	74.0	-23.6	1.04 V	349	10.42	40.02
6	4924.00	40.1 AV	54.0	-13.9	1.04 V	349	0.04	40.02

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.



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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	66.3 PK	74.0	-7.7	1.06 H	58	33.49	32.85
2	2390.00	52.2 AV	54.0	-1.8	1.06 H	58	19.33	32.85
3	*2412.00	106.2 PK			1.06 H	58	73.31	32.93
4	*2412.00	94.4 AV			1.06 H	58	61.48	32.93
5	4824.00	48.7 PK	74.0	-25.3	1.00 H	313	8.85	39.84
6	4824.00	36.5 AV	54.0	-17.5	1.00 H	313	-3.37	39.84
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	67.5 PK	74.0	-6.5	1.00 V	85	34.62	32.85
2	2390.00	52.5 AV	54.0	-1.5	1.00 V	85	19.62	32.85
3	*2412.00	107.1 PK			1.00 V	85	74.14	32.93
4	*2412.00	95.2 AV			1.00 V	85	62.25	32.93
5	4824.00	50.4 PK	74.0	-23.6	1.08 V	229	10.57	39.84
6	4824.00	40.2 AV	54.0	-13.8	1.08 V	229	0.32	39.84

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.



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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	106.3 PK			1.04 H	59	73.25	33.00
2	*2437.00	95.4 AV			1.04 H	59	62.36	33.00
3	4874.00	49.4 PK	74.0	-24.6	1.00 H	194	9.45	39.91
4	4874.00	35.9 AV	54.0	-18.1	1.00 H	194	-4.05	39.91
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	108.2 PK			1.00 V	82	75.16	33.00
2	*2437.00	96.2 AV			1.00 V	82	63.17	33.00
3	4874.00	50.6 PK	74.0	-23.4	1.09 V	313	10.68	39.91
4	4874.00	39.6 AV	54.0	-14.4	1.09 V	313	-0.30	39.91

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.



A D T

CHANNEL	TX Channel 11	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	*2462.00	108.5 PK			1.02 H	62	75.40	33.08
2	*2462.00	96.4 AV			1.02 H	62	63.28	33.08
3	2483.50	61.1 PK	74.0	-12.9	1.02 H	62	27.91	33.15
4	2483.50	47.2 AV	54.0	-6.8	1.02 H	62	14.07	33.15
5	4924.00	49.0 PK	74.0	-25.0	1.00 H	127	8.98	40.02
6	4924.00	37.1 AV	54.0	-16.9	1.00 H	127	-2.90	40.02
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	108.2 PK			1.05 V	83	75.08	33.08
2	*2462.00	96.4 AV			1.05 V	83	63.31	33.08
3	2483.50	63.2 PK	74.0	-10.8	1.05 V	83	30.02	33.15
4	2483.50	50.7 AV	54.0	-3.3	1.05 V	83	17.59	33.15
5	4924.00	51.7 PK	74.0	-22.3	1.13 V	281	11.66	40.02
6	4924.00	41.5 AV	54.0	-12.5	1.13 V	281	1.46	40.02

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.



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802.11n (20MHz)

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	66.4 PK	74.0	-7.6	1.05 H	58	33.58	32.85
2	2390.00	52.0 AV	54.0	-2.0	1.05 H	58	19.15	32.85
3	*2412.00	105.4 PK			1.05 H	58	72.51	32.93
4	*2412.00	94.8 AV			1.05 H	58	61.83	32.93
5	4824.00	48.8 PK	74.0	-25.2	1.00 H	274	8.97	39.84
6	4824.00	36.8 AV	54.0	-17.3	1.00 H	274	-3.09	39.84
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	67.6 PK	74.0	-6.4	1.03 V	87	34.77	32.85
2	2390.00	52.9 AV	54.0	-1.1	1.03 V	87	20.02	32.85
3	*2412.00	106.7 PK			1.03 V	87	73.76	32.93
4	*2412.00	96.1 AV			1.03 V	87	63.21	32.93
5	4824.00	51.4 PK	74.0	-22.6	1.00 V	191	11.59	39.84
6	4824.00	40.5 AV	54.0	-13.5	1.00 V	191	0.66	39.84

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.



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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	105.7 PK			1.06 H	59	72.73	33.00
2	*2437.00	95.5 AV			1.06 H	59	62.53	33.00
3	4874.00	49.5 PK	74.0	-24.5	1.00 H	225	9.60	39.91
4	4874.00	36.9 AV	54.0	-17.2	1.00 H	225	-3.06	39.91

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	107.5 PK			1.00 V	86	74.46	33.00
2	*2437.00	96.7 AV			1.00 V	86	63.70	33.00
3	4874.00	50.8 PK	74.0	-23.2	1.00 V	76	10.90	39.91
4	4874.00	40.2 AV	54.0	-13.8	1.00 V	76	0.31	39.91

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.



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CHANNEL	TX Channel 11	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	*2462.00	107.9 PK			1.04 H	60	74.86	33.08
2	*2462.00	96.8 AV			1.04 H	60	63.73	33.08
3	2483.50	67.5 PK	74.0	-6.5	1.04 H	60	34.35	33.15
4	2483.50	52.2 AV	54.0	-1.8	1.04 H	60	19.02	33.15
5	4924.00	48.9 PK	74.0	-25.1	1.27 H	336	8.92	40.02
6	4924.00	37.7 AV	54.0	-16.3	1.27 H	336	-2.32	40.02
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	107.7 PK			1.02 V	86	74.61	33.08
2	*2462.00	96.9 AV			1.02 V	86	63.78	33.08
3	2483.50	66.9 PK	74.0	-7.1	1.02 V	86	33.76	33.15
4	2483.50	51.3 AV	54.0	-2.7	1.02 V	86	18.19	33.15
5	4924.00	51.7 PK	74.0	-22.3	1.00 V	177	11.70	40.02
6	4924.00	39.8 AV	54.0	-14.2	1.00 V	177	-0.22	40.02

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.



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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	41.32	18.1 QP	40.0	-21.9	1.27 H	210	4.45	13.66
2	138.32	15.4 QP	43.5	-28.1	1.96 H	256	1.72	13.72
3	181.97	20.3 QP	43.5	-23.2	1.58 H	173	7.63	12.63
4	649.18	24.1 QP	46.0	-21.9	1.19 H	14	0.10	23.98
5	780.13	25.8 QP	46.0	-20.2	1.31 H	11	-0.26	26.10
6	904.62	27.0 QP	46.0	-19.0	1.00 H	148	-0.97	27.98

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	44.55	22.5 QP	40.0	-17.5	1.91 V	279	8.21	14.26
2	73.65	21.7 QP	40.0	-18.3	1.34 V	84	10.21	11.48
3	102.75	20.9 QP	43.5	-22.6	1.56 V	124	11.09	9.77
4	128.62	21.5 QP	43.5	-22.0	1.00 V	41	8.74	12.74
5	149.63	16.8 QP	43.5	-26.7	1.74 V	24	2.67	14.16
6	177.12	17.6 QP	43.5	-25.9	1.08 V	10	4.67	12.96

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

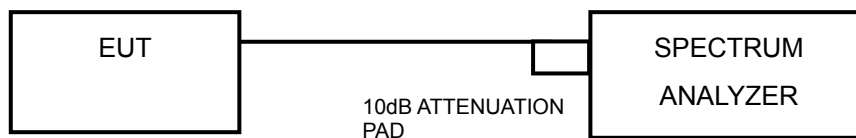
N/A

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) = approximately 1% of the emission bandwidth
- b. Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

4.3.6 EUT OPERATING CONDITIONS

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



4.3.7 TEST RESULTS

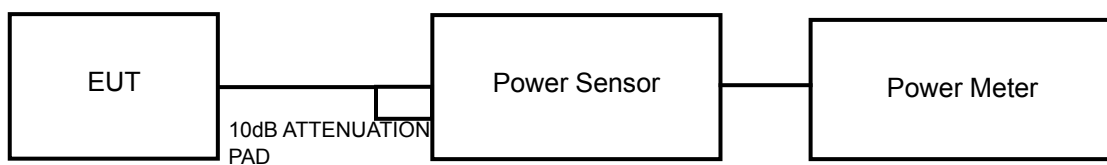
CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
802.11b				
1	2412	8.12	0.5	PASS
6	2437	9.10	0.5	PASS
11	2462	7.16	0.5	PASS
802.11g				
1	2412	14.51	0.5	PASS
6	2437	15.11	0.5	PASS
11	2462	15.16	0.5	PASS
802.11n (20MHz)				
1	2412	15.16	0.5	PASS
6	2437	16.06	0.5	PASS
11	2462	15.17	0.5	PASS

4.4 CONDUCTED OUTPUT POWER

4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

4.4.2 TEST SETUP



4.4.3 TEST INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

4.4.4 TEST PROCEDURES

A peak / average power sensor were used on the output port of the EUT. A power meter was used to read the response of the peak / average power sensor. Record the peak 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

FOR PEAK POWER

CHAN.	CHAN. FREQ. (MHz)	POWER OUTPUT (dBm)	POWER OUTPUT (mW)	POWER LIMIT (dBm)	PASS / FAIL
802.11b					
1	2412	15.7	37.2	30	PASS
6	2437	15.6	36.3	30	PASS
11	2462	15.7	37.2	30	PASS
802.11g					
1	2412	22.0	158.5	30	PASS
6	2437	21.8	151.4	30	PASS
11	2462	21.8	151.4	30	PASS
802.11n (20MHz)					
1	2412	20.7	117.5	30	PASS
6	2437	20.5	112.2	30	PASS
11	2462	21.1	128.8	30	PASS

FOR AVERAGE POWER

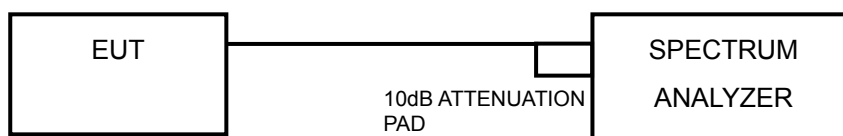
CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)	AVERAGE POWER (mW)
802.11b			
1	2412	12.6	18.2
6	2437	12.5	17.8
11	2462	12.6	18.2
802.11g			
1	2412	12.9	19.5
6	2437	12.7	18.6
11	2462	12.8	19.1
802.11n (20MHz)			
1	2412	12.1	16.2
6	2437	12.4	17.4
11	2462	12.6	18.2

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

- Set the RBW = 3 kHz, VBW = 10 kHz, Detector = peak.
- 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.
- Record the max value and add 10 log (1/duty cycle)

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

CHAN.	CHAN. FREQ. (MHz)	TOTAL PSD W/O DUTY FACTOR (dBm)	DUTY FACTOR	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
802.11b						
1	2412	-12.23	0	-12.23	8	PASS
6	2437	-10.79	0	-10.79	8	PASS
11	2462	-11.12	0	-11.12	8	PASS
802.11g						
1	2412	-13.58	0.36	-13.22	8	PASS
6	2437	-12.68	0.36	-12.32	8	PASS
11	2462	-12.89	0.36	-12.53	8	PASS
802.11n (20MHz)						
1	2412	-13.61	0.36	-13.25	8	PASS
6	2437	-13.11	0.36	-12.75	8	PASS
11	2462	-12.49	0.36	-12.13	8	PASS

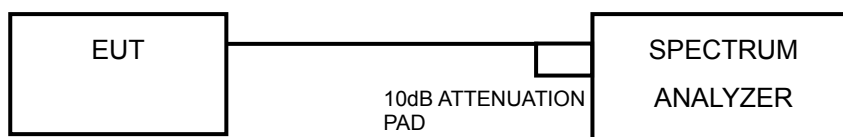
NOTE: Refer to section 3.3 for duty cycle spectrum plot.

4.6 CONDUCTED OUT OF BAND EMISSION MEASUREMENT

4.6.1 LIMITS OF CONDUCTED OUT OF BAND EMISSION MEASUREMENT

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



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MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW \geq 300 kHz.
3. Set span to encompass the spectrum to be examined.
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

Same as Item 4.3.6

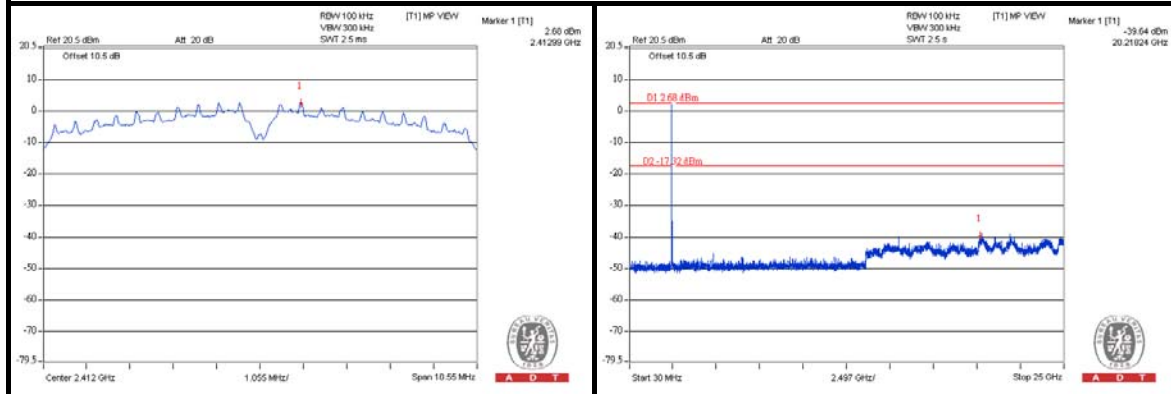
4.6.7 TEST RESULTS

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

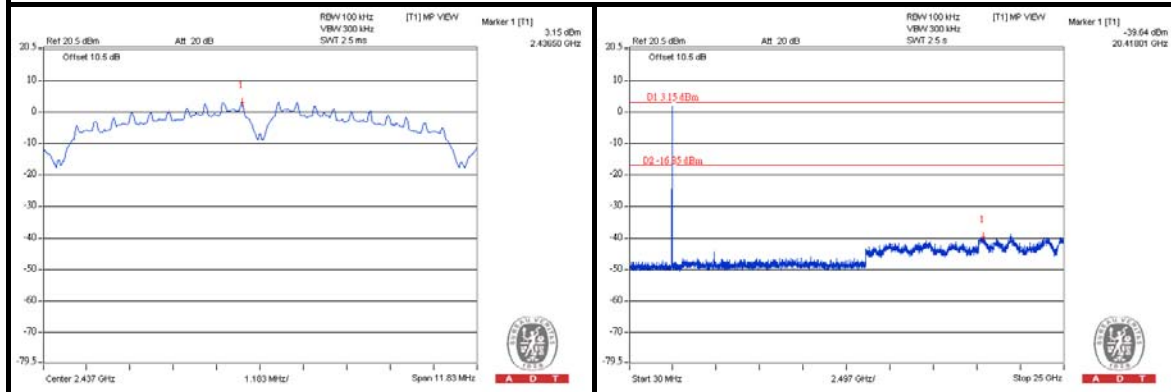
4.6.8 TEST RESULTS

802.11b

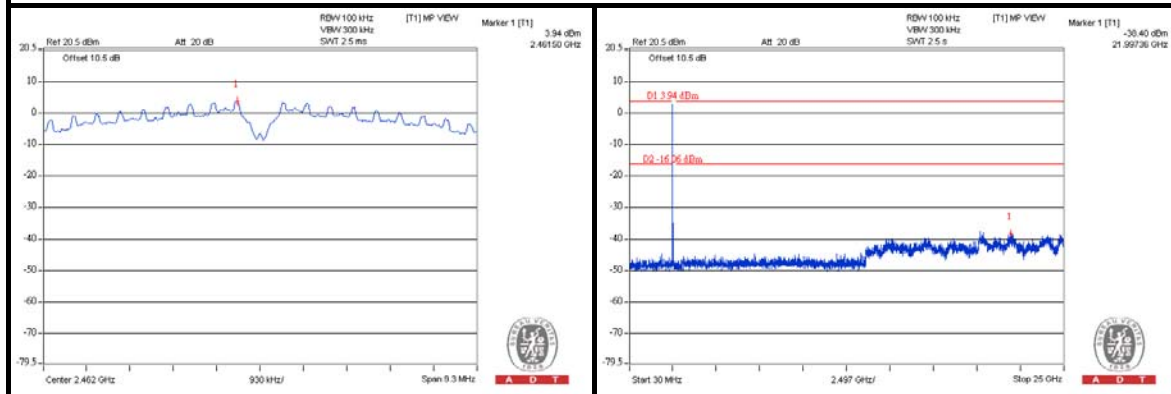
CH 1

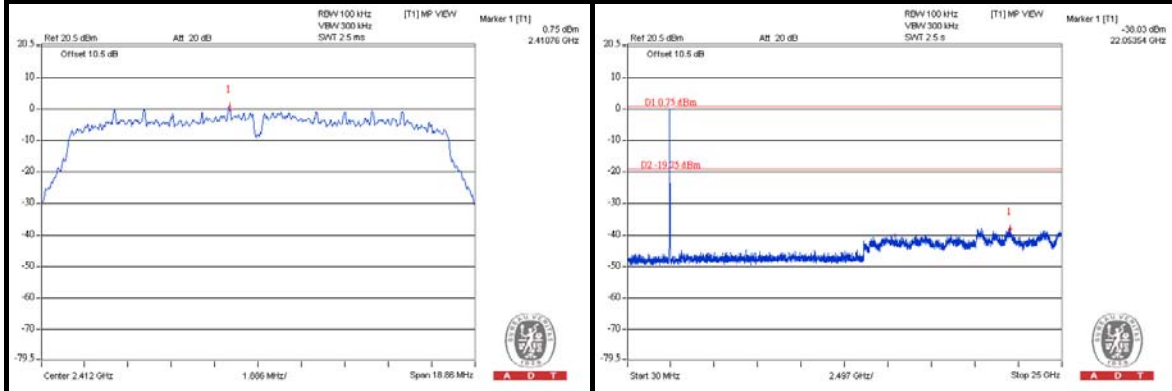
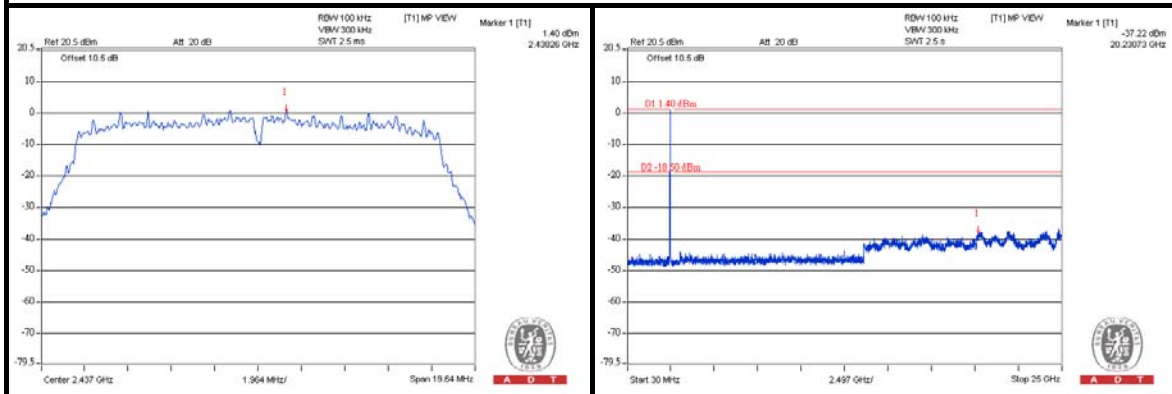
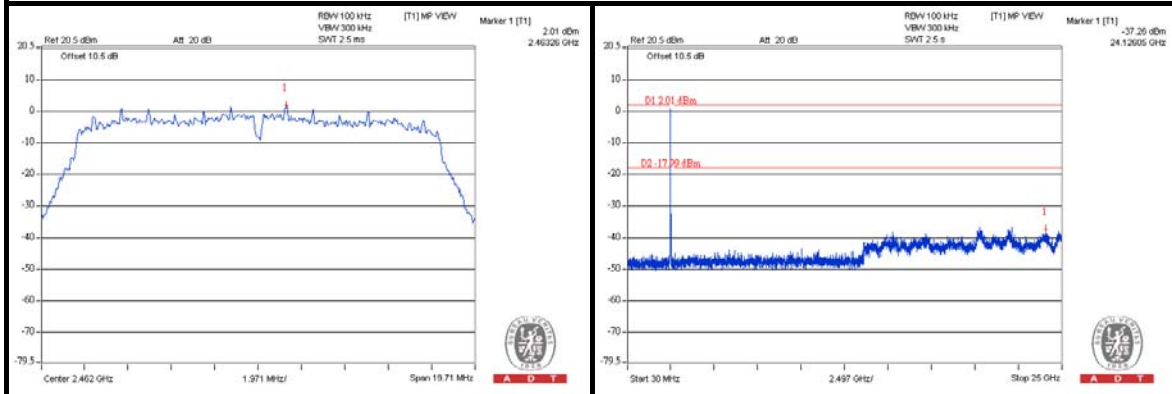


CH 6



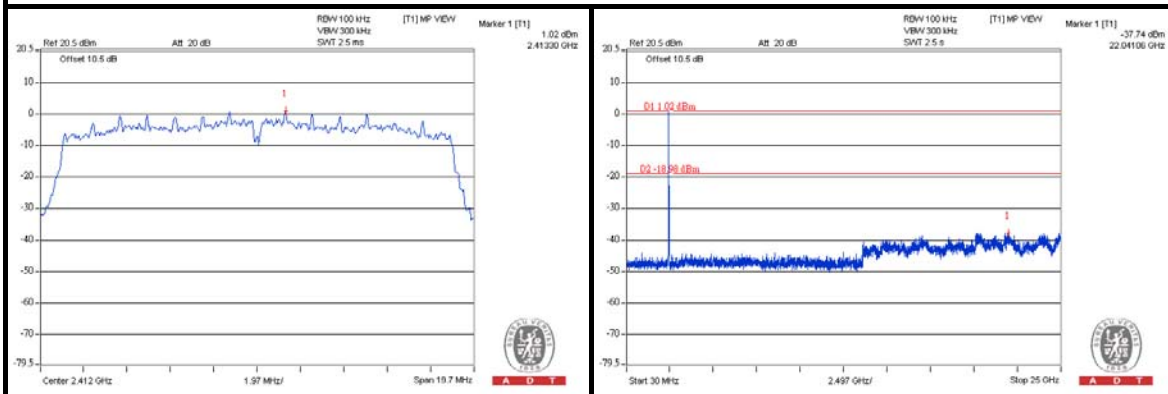
CH 11



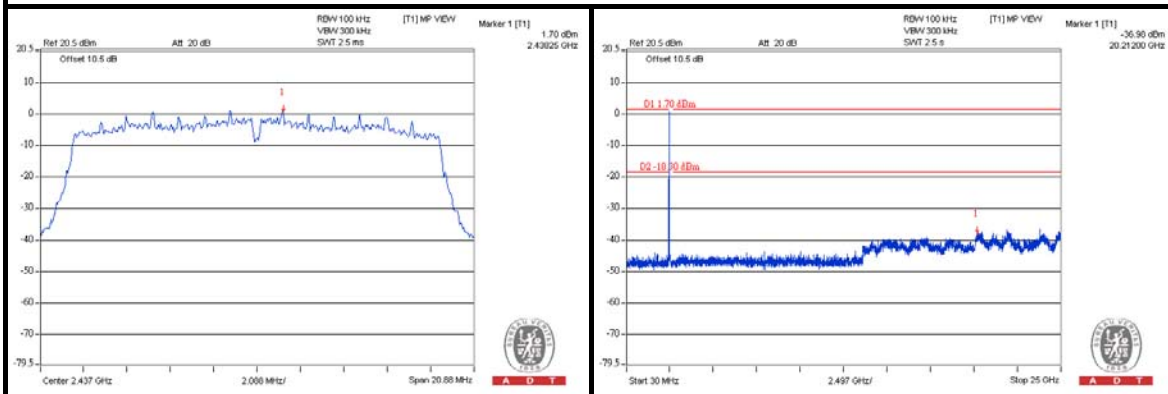
802.11g**CH 1****CH 6****CH 11**

802.11n (20MHz)

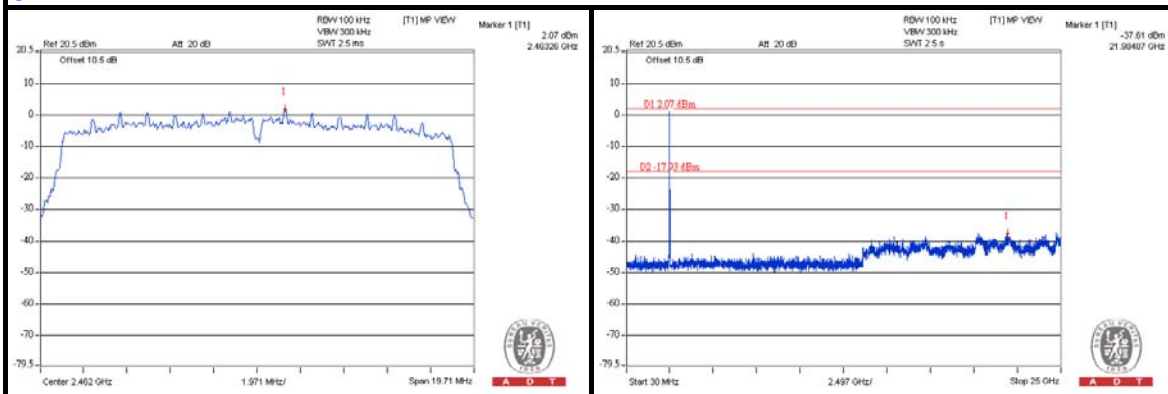
CH 1



CH 6



CH 11





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5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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6. 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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The address and road map of all our labs can be found in our web site also.



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7. APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

---END---