

FCC Test Report (WLAN)

Report No.: RF160819E01D

FCC ID: COF-WMBNBM26A

Test Model: WM-BN-BM-26_A_FF3

Series Model: WM-BN-BM-26_A

Received Date: Apr. 30, 2018

Test Date: May 10 to 15, 2018

Issued Date: May 23, 2018

Applicant: UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

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**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RF160819E01D	Original release.	May 23, 2018

1 Certificate of Conformity

Product: 802.11b/g/n + BT Wireless LAN Module

Brand: USI

Test Model: WM-BN-BM-26_A_FF3

Series Model: WM-BN-BM-26_A

Sample Status: ENGINEERING SAMPLE

Applicant: UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

Test Date: May 10 to 15, 2018

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

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

Prepared by :  , **Date:** May 23, 2018
Claire Kuan / Specialist

Approved by :  , **Date:** May 23, 2018
May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
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 2390.00MHz.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.

Note: This report is supplementary report.

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.33 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.10 dB
	6GHz ~ 18GHz	4.85 dB
	18GHz ~ 40GHz	5.24 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (WLAN)

Product	802.11b/g/n + BT Wireless LAN Module
Brand	USI
Test Model	WM-BN-BM-26_A_FF3
Series Model	WM-BN-BM-26_A
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	3.6Vdc from host equipment
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11g: up to 54Mbps 802.11n: up to 72Mbps
Operating Frequency	2412 ~ 2462MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20)
Output Power	293.765mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. This report is prepared for FCC Class II change. The difference compared with the Report No.: RF160819E01C design is as the following:

- ◆ Changed the component for improve radio throughput.
- ◆ Added one new model name as following table:

Original		
Brand	Model	Difference
USI	WM-BN-BM-26_A	-
	WM-BN-BM-26_A_FF2	1. R30 capacitor 1.8pF change to 2.7pF belongs to part of antenna matching circuit. 2. C46 inductor remove
Newly		
Brand	Model	Difference
USI	WM-BN-BM-26_A_FF3	1. R30 resistor 0 Ohm change to 3.3nH inductor belongs to part of antenna matching circuit 2. Add 27pF capacitor on C172

From the above models, model: WM-BN-BM-26_A_FF3 was selected as representative model for the test and its data was recorded in this report.

2. According to above conditions only Output Power and Radiated Emissions test items need to be performed. And all data was verified to meet the requirements.
3. There are WLAN, BT technology used for the EUT.
4. The antenna provided to the EUT, please refer to the following table:

Brand	Model	Antenna Net Gain(dBi)	Frequency range (GHz to GHz)	Antenna Type	Connector Type
YAGEO	ANT3216LL11R2400A	3.68	2.4~2.4835	Chip	NA

5. WLAN and BT technology cannot transmit at same time.

6. The EUT incorporates a SISO function.

MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	1TX	1RX
802.11g	6 ~ 54Mbps	1TX	1RX
802.11n (HT20)	MCS 0~7	1TX	1RX

7. The above EUT information is 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 (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		

3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE≥1G**: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
APCM: Antenna Port Conducted Measurement

NOTE: 1. In the original report, the EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

Radiated Emission Test (Above 1GHz):

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6
802.11n (HT20)	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)
802.11n (HT20)	1 to 11	6	OFDM	BPSK	6.5

Antenna Port Conducted 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
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE $\geq$ 1G	23deg. C, 68%RH	120Vac, 60Hz	Frank Chuang
RE<1G	23deg. C, 67%RH	120Vac, 60Hz	Frank Chuang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Anderson Chen

3.3 Duty Cycle of Test Signal

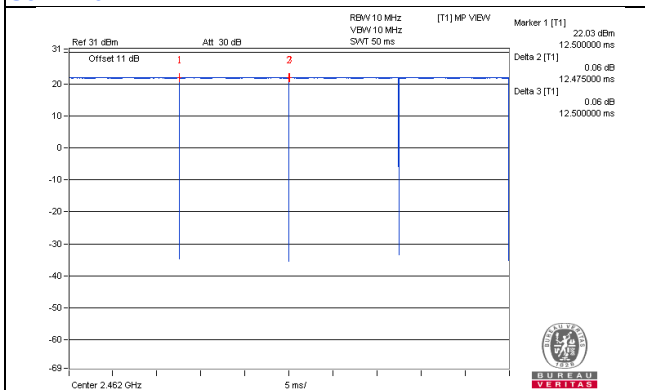
If duty cycle of test signal is $\geq 98\%$, duty factor is not required.

802.11b: Duty cycle = $12.475/12.5 = 0.998$

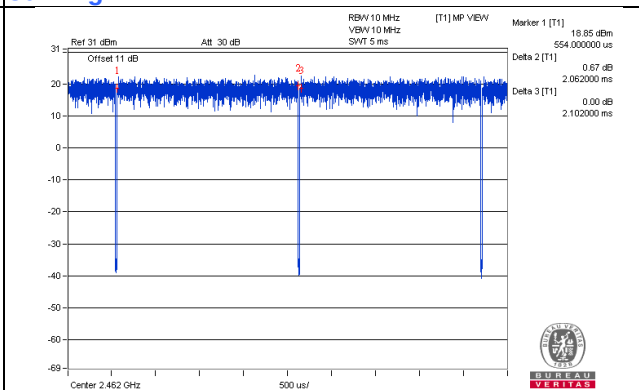
802.11g: Duty cycle = $2.062/2.102 = 0.981$

802.11n (HT20): Duty cycle = $2.063/2.103 = 0.981$

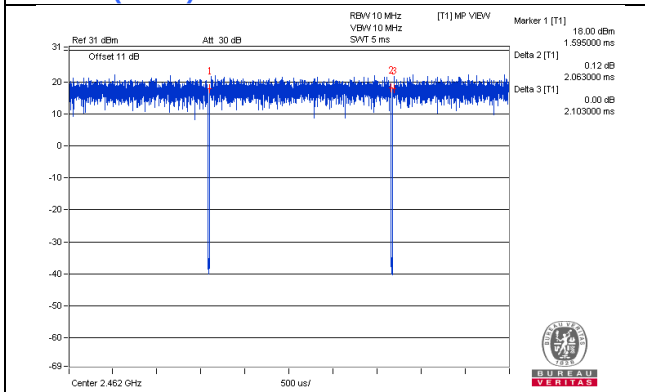
802.11b



802.11g



802.11n (HT20)



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.

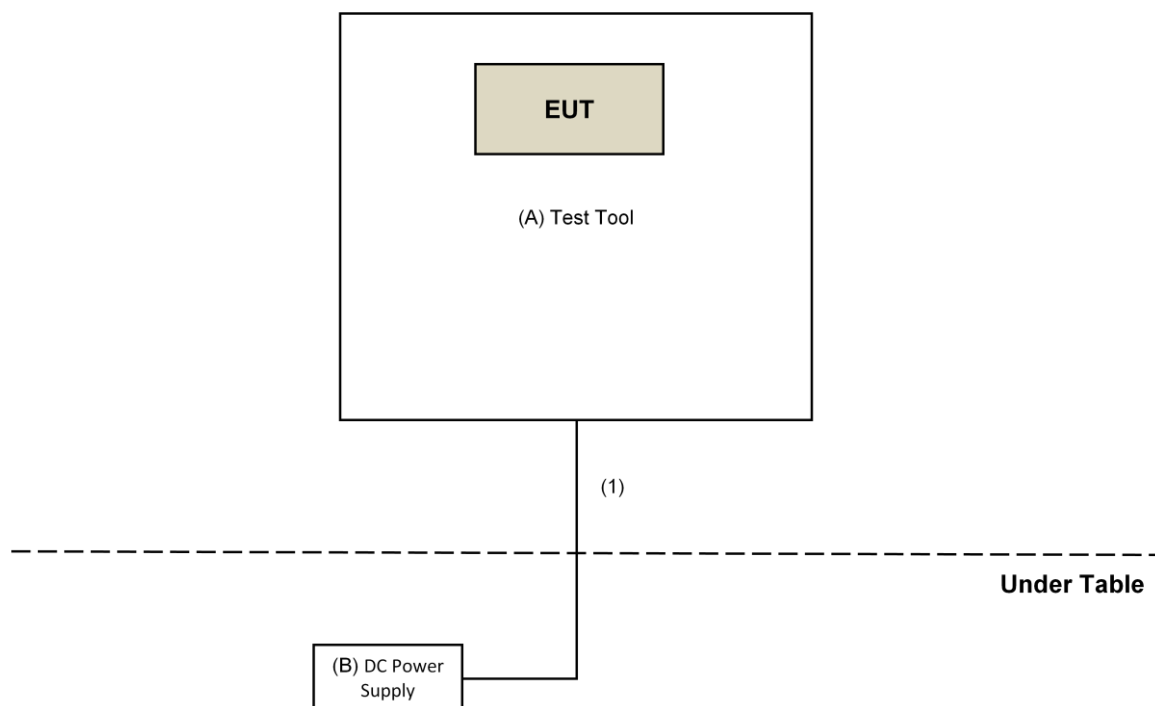
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Test Tool	NA	NA	NA	NA	Supplied by client
B.	DC Power Supply	GOOD WILL INSTRUMENT CO., LTD.	GPC-3030D	7700087	NA	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	2	No	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)
KDB 558074 D01 DTS Meas Guidance v04
ANSI C63.10-2013

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 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.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 08, 2017	July 07, 2018
Pre-Amplifier EMCi	EMC001340	980142	Feb. 09, 2018	Feb. 08, 2019
Loop Antenna ^(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 15, 2018	Jan. 14, 2019
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 09, 2017	Nov. 08, 2018
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 29, 2017	Nov. 28, 2018
RF Cable	8D	966-4-1 966-4-2 966-4-3	Mar. 21, 2018	Mar. 20, 2019
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Oct. 03, 2017	Oct. 02, 2018
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Dec. 12, 2017	Dec. 11, 2018
Pre-Amplifier EMCi	EMC12630SE	980385	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000	160923 150318 150321	Jan. 29, 2018	Jan. 28, 2019
Pre-Amplifier EMCi	EMC184045SE	980387	Jan. 29, 2018	Jan. 28, 2019
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 14, 2017	Dec. 13, 2018
RF Cable	EMC102-KM-KM-1200	160925	Jan. 29, 2018	Jan. 28, 2019
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP02	NA	NA
Spectrum Analyzer R&S	FSv40	100964	July 1, 2017	June 30, 2018
Power meter Anritsu	ML2495A	1014008	May 09, 2018	May 08, 2019
Power sensor Anritsu	MA2411B	0917122	May 09, 2018	May 08, 2019

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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 4.
4. The CANADA Site Registration No. is 20331-2
5. Loop antenna was used for all emissions below 30 MHz.
6. Tested Date: May 10 to 15, 2018

4.1.3 Test Procedures

For Radiated emission below 30MHz

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

NOTE:

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

For Radiated emission above 30MHz

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

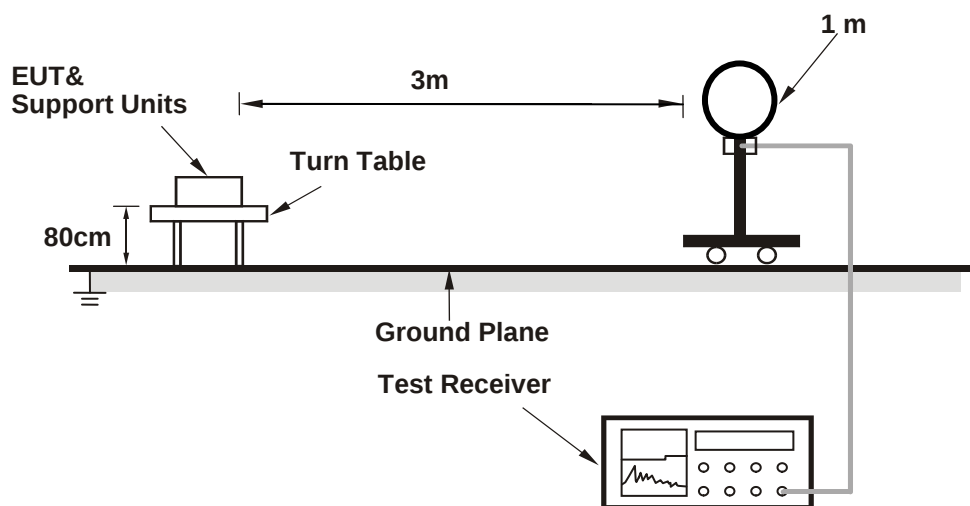
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

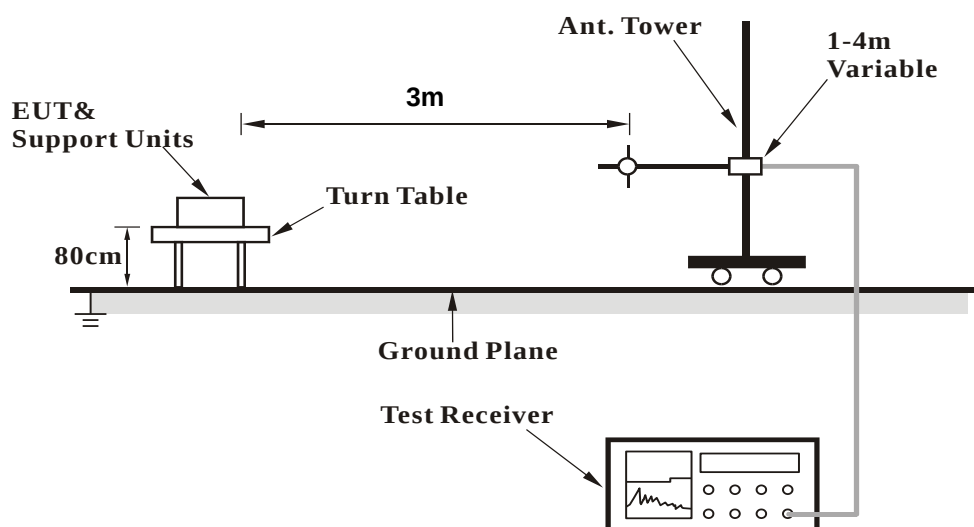
No deviation.

4.1.5 Test Setup

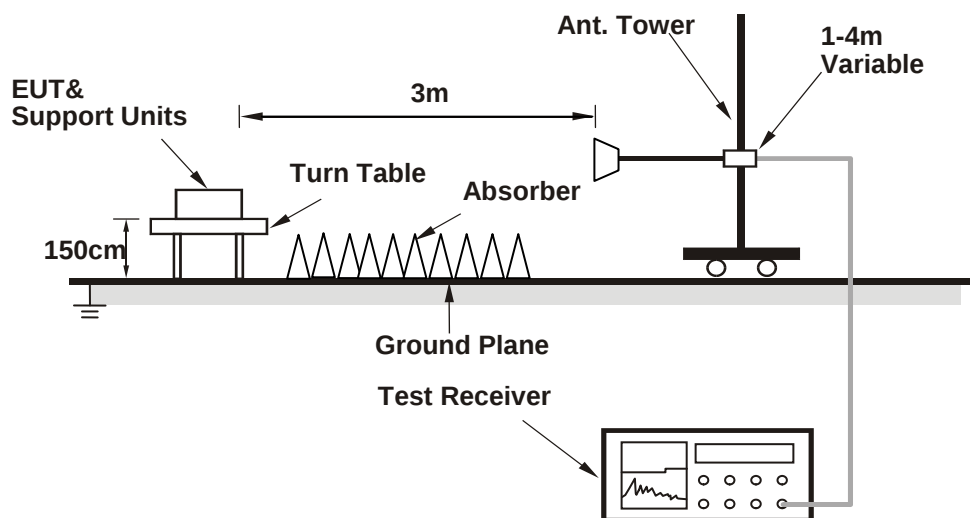
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission 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.
- Controlling software (USI Broadcom Wireless Labtool 2.0) has been activated to set the EUT on specific status.

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	59.8 PK	74.0	-14.2	1.00 H	104	62.0	-2.2
2	2390.00	53.0 AV	54.0	-1.0	1.00 H	104	55.2	-2.2
3	*2412.00	109.5 PK			1.00 H	104	111.9	-2.4
4	*2412.00	106.9 AV			1.00 H	104	109.3	-2.4
5	4824.00	41.3 PK	74.0	-32.7	1.46 H	179	39.5	1.8
6	4824.00	33.7 AV	54.0	-20.3	1.46 H	179	31.9	1.8
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	54.3 PK	74.0	-19.7	2.45 V	323	56.5	-2.2
2	2390.00	43.3 AV	54.0	-10.7	2.45 V	323	45.5	-2.2
3	*2412.00	97.2 PK			2.45 V	323	99.6	-2.4
4	*2412.00	94.1 AV			2.45 V	323	96.5	-2.4
5	4824.00	42.0 PK	74.0	-32.0	1.46 V	177	40.2	1.8
6	4824.00	34.1 AV	54.0	-19.9	1.46 V	177	32.3	1.8

REMARKS:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.8 PK	74.0	-17.2	1.00 H	93	59.0	-2.2
2	2390.00	46.2 AV	54.0	-7.8	1.00 H	93	48.4	-2.2
3	*2437.00	110.2 PK			1.00 H	93	112.8	-2.6
4	*2437.00	107.9 AV			1.00 H	93	110.5	-2.6
5	2483.50	54.7 PK	74.0	-19.3	1.00 H	93	57.1	-2.4
6	2483.50	42.5 AV	54.0	-11.5	1.00 H	93	44.9	-2.4
7	4874.00	41.4 PK	74.0	-32.6	1.50 H	178	39.4	2.0
8	4874.00	33.9 AV	54.0	-20.1	1.50 H	178	31.9	2.0
9	7311.00	44.8 PK	74.0	-29.2	2.22 H	207	36.4	8.4
10	7311.00	35.8 AV	54.0	-18.2	2.22 H	207	27.4	8.4

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	54.1 PK	74.0	-19.9	2.41 V	330	56.3	-2.2
2	2390.00	41.6 AV	54.0	-12.4	2.41 V	330	43.8	-2.2
3	*2437.00	98.6 PK			2.41 V	330	101.2	-2.6
4	*2437.00	95.2 AV			2.41 V	330	97.8	-2.6
5	2483.50	53.9 PK	74.0	-20.1	2.41 V	330	56.3	-2.4
6	2483.50	41.1 AV	54.0	-12.9	2.41 V	330	43.5	-2.4
7	4874.00	41.2 PK	74.0	-32.8	1.49 V	315	39.2	2.0
8	4874.00	34.5 AV	54.0	-19.5	1.49 V	315	32.5	2.0
9	7311.00	45.4 PK	74.0	-28.6	1.03 V	205	37.0	8.4
10	7311.00	36.2 AV	54.0	-17.8	1.03 V	205	27.8	8.4

REMARKS:

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

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK)
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			1.00 H	97	110.5	-2.6
2	*2462.00	105.4 AV			1.00 H	97	108.0	-2.6
3	2483.50	58.8 PK	74.0	-15.2	1.00 H	97	61.2	-2.4
4	2483.50	50.2 AV	54.0	-3.8	1.00 H	97	52.6	-2.4
5	2487.00	59.6 PK	74.0	-14.4	1.00 H	97	62.0	-2.4
6	2487.00	51.5 AV	54.0	-2.5	1.00 H	97	53.9	-2.4
7	4924.00	38.9 PK	74.0	-35.1	1.52 H	56	36.9	2.0
8	4924.00	31.2 AV	54.0	-22.8	1.52 H	56	29.2	2.0
9	7386.00	44.8 PK	74.0	-29.2	1.39 H	209	36.2	8.6
10	7386.00	35.6 AV	54.0	-18.4	1.39 H	209	27.0	8.6

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	97.2 PK			2.42 V	326	99.8	-2.6
2	*2462.00	93.6 AV			2.42 V	326	96.2	-2.6
3	2483.50	54.6 PK	74.0	-19.4	2.42 V	326	57.0	-2.4
4	2483.50	41.5 AV	54.0	-12.5	2.42 V	326	43.9	-2.4
5	2487.00	54.8 PK	74.0	-19.2	2.42 V	326	57.2	-2.4
6	2487.00	42.0 AV	54.0	-12.0	2.42 V	326	44.4	-2.4
7	4924.00	40.2 PK	74.0	-33.8	1.46 V	70	38.2	2.0
8	4924.00	33.2 AV	54.0	-20.8	1.46 V	70	31.2	2.0
9	7386.00	44.9 PK	74.0	-29.1	1.44 V	197	36.3	8.6
10	7386.00	35.7 AV	54.0	-18.3	1.44 V	197	27.1	8.6

REMARKS:

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

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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	68.9 PK	74.0	-5.1	1.01 H	94	71.1	-2.2
2	2390.00	52.6 AV	54.0	-1.4	1.01 H	94	54.8	-2.2
3	*2412.00	110.8 PK			1.01 H	94	113.2	-2.4
4	*2412.00	100.7 AV			1.01 H	94	103.1	-2.4
5	4824.00	39.6 PK	74.0	-34.4	1.61 H	72	37.8	1.8
6	4824.00	32.8 AV	54.0	-21.2	1.61 H	72	31.0	1.8
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	56.6 PK	74.0	-17.4	2.33 V	310	58.8	-2.2
2	2390.00	44.2 AV	54.0	-9.8	2.33 V	310	46.4	-2.2
3	*2412.00	99.7 PK			2.33 V	310	102.1	-2.4
4	*2412.00	91.2 AV			2.33 V	310	93.6	-2.4
5	4824.00	39.9 PK	74.0	-34.1	1.56 V	84	38.1	1.8
6	4824.00	32.9 AV	54.0	-21.1	1.56 V	84	31.1	1.8

REMARKS:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.3 PK	74.0	-17.7	1.02 H	97	58.5	-2.2
2	2390.00	44.1 AV	54.0	-9.9	1.02 H	97	46.3	-2.2
3	*2437.00	111.3 PK			1.02 H	97	113.9	-2.6
4	*2437.00	101.2 AV			1.02 H	97	103.8	-2.6
5	2483.50	56.1 PK	74.0	-17.9	1.02 H	97	58.5	-2.4
6	2483.50	42.2 AV	54.0	-11.8	1.02 H	97	44.6	-2.4
7	4874.00	41.3 PK	74.0	-32.7	1.00 H	189	39.3	2.0
8	4874.00	34.4 AV	54.0	-19.6	1.00 H	189	32.4	2.0
9	7311.00	46.0 PK	74.0	-28.0	2.41 H	333	37.6	8.4
10	7311.00	36.6 AV	54.0	-17.4	2.41 H	333	28.2	8.4

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	54.2 PK	74.0	-19.8	2.44 V	345	56.4	-2.2
2	2390.00	41.5 AV	54.0	-12.5	2.44 V	345	43.7	-2.2
3	*2437.00	100.3 PK			2.44 V	345	102.9	-2.6
4	*2437.00	91.9 AV			2.44 V	345	94.5	-2.6
5	2483.50	54.3 PK	74.0	-19.7	2.44 V	345	56.7	-2.4
6	2483.50	41.3 AV	54.0	-12.7	2.44 V	345	43.7	-2.4
7	4874.00	40.9 PK	74.0	-33.1	1.55 V	328	38.9	2.0
8	4874.00	34.4 AV	54.0	-19.6	1.55 V	328	32.4	2.0
9	7311.00	45.2 PK	74.0	-28.8	1.00 V	191	36.8	8.4
10	7311.00	36.2 AV	54.0	-17.8	1.00 V	191	27.8	8.4

REMARKS:

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

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK)
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	107.5 PK			1.02 H	99	110.1	-2.6
2	*2462.00	98.2 AV			1.02 H	99	100.8	-2.6
3	2483.50	67.1 PK	74.0	-6.9	1.02 H	99	69.5	-2.4
4	2483.50	51.3 AV	54.0	-2.7	1.02 H	99	53.7	-2.4
5	4924.00	39.3 PK	74.0	-34.7	1.48 H	47	37.3	2.0
6	4924.00	31.3 AV	54.0	-22.7	1.48 H	47	29.3	2.0
7	7386.00	44.7 PK	74.0	-29.3	1.41 H	213	36.1	8.6
8	7386.00	35.6 AV	54.0	-18.4	1.41 H	213	27.0	8.6
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	97.8 PK			2.38 V	316	100.4	-2.6
2	*2462.00	89.2 AV			2.38 V	316	91.8	-2.6
3	2483.50	56.4 PK	74.0	-17.6	2.38 V	316	58.8	-2.4
4	2483.50	43.9 AV	54.0	-10.1	2.38 V	316	46.3	-2.4
5	4924.00	40.0 PK	74.0	-34.0	1.51 V	75	38.0	2.0
6	4924.00	33.0 AV	54.0	-21.0	1.51 V	75	31.0	2.0
7	7386.00	44.9 PK	74.0	-29.1	1.49 V	193	36.3	8.6
8	7386.00	35.6 AV	54.0	-18.4	1.49 V	193	27.0	8.6

REMARKS:

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

802.11n (HT20)

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK)
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	68.9 PK	74.0	-5.1	1.03 H	96	71.1	-2.2
2	2390.00	52.1 AV	54.0	-1.9	1.03 H	96	54.3	-2.2
3	*2412.00	110.9 PK			1.03 H	96	113.3	-2.4
4	*2412.00	100.5 AV			1.03 H	96	102.9	-2.4
5	4824.00	40.1 PK	74.0	-33.9	1.59 H	76	38.3	1.8
6	4824.00	32.8 AV	54.0	-21.2	1.59 H	76	31.0	1.8
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	56.4 PK	74.0	-17.6	2.32 V	303	58.6	-2.2
2	2390.00	43.9 AV	54.0	-10.1	2.32 V	303	46.1	-2.2
3	*2412.00	99.4 PK			2.32 V	303	101.8	-2.4
4	*2412.00	91.1 AV			2.32 V	303	93.5	-2.4
5	4824.00	39.5 PK	74.0	-34.5	1.58 V	69	37.7	1.8
6	4824.00	32.4 AV	54.0	-21.6	1.58 V	69	30.6	1.8

REMARKS:

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

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	58.2 PK	74.0	-15.8	1.01 H	98	60.4	-2.2
2	2390.00	45.7 AV	54.0	-8.3	1.01 H	98	47.9	-2.2
3	*2437.00	112.5 PK			1.01 H	98	115.1	-2.6
4	*2437.00	102.3 AV			1.01 H	98	104.9	-2.6
5	2483.50	56.5 PK	74.0	-17.5	1.01 H	98	58.9	-2.4
6	2483.50	44.0 AV	54.0	-10.0	1.01 H	98	46.4	-2.4
7	4874.00	41.7 PK	74.0	-32.3	1.00 H	179	39.7	2.0
8	4874.00	34.9 AV	54.0	-19.1	1.00 H	179	32.9	2.0
9	7311.00	46.1 PK	74.0	-27.9	2.44 H	333	37.7	8.4
10	7311.00	36.7 AV	54.0	-17.3	2.44 H	333	28.3	8.4

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	54.1 PK	74.0	-19.9	2.38 V	347	56.3	-2.2
2	2390.00	41.3 AV	54.0	-12.7	2.38 V	347	43.5	-2.2
3	*2437.00	100.1 PK			2.38 V	347	102.7	-2.6
4	*2437.00	91.7 AV			2.38 V	347	94.3	-2.6
5	2483.50	54.1 PK	74.0	-19.9	2.38 V	347	56.5	-2.4
6	2483.50	41.2 AV	54.0	-12.8	2.38 V	347	43.6	-2.4
7	4874.00	41.3 PK	74.0	-32.7	1.52 V	339	39.3	2.0
8	4874.00	34.8 AV	54.0	-19.2	1.52 V	339	32.8	2.0
9	7311.00	45.1 PK	74.0	-28.9	1.00 V	204	36.7	8.4
10	7311.00	36.0 AV	54.0	-18.0	1.00 V	204	27.6	8.4

REMARKS:

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

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK)
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	108.9 PK			1.00 H	98	111.5	-2.6
2	*2462.00	98.8 AV			1.00 H	98	101.4	-2.6
3	2483.50	68.2 PK	74.0	-5.8	1.00 H	98	70.6	-2.4
4	2483.50	52.0 AV	54.0	-2.0	1.00 H	98	54.4	-2.4
5	4924.00	39.9 PK	74.0	-34.1	1.46 H	53	37.9	2.0
6	4924.00	31.6 AV	54.0	-22.4	1.46 H	53	29.6	2.0
7	7386.00	45.1 PK	74.0	-28.9	1.42 H	213	36.5	8.6
8	7386.00	36.1 AV	54.0	-17.9	1.42 H	213	27.5	8.6
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	97.6 PK			2.35 V	307	100.2	-2.6
2	*2462.00	89.3 AV			2.35 V	307	91.9	-2.6
3	2483.50	56.5 PK	74.0	-17.5	2.35 V	307	58.9	-2.4
4	2483.50	44.0 AV	54.0	-10.0	2.35 V	307	46.4	-2.4
5	4924.00	40.6 PK	74.0	-33.4	1.54 V	71	38.6	2.0
6	4924.00	33.4 AV	54.0	-20.6	1.54 V	71	31.4	2.0
7	7386.00	44.9 PK	74.0	-29.1	1.44 V	196	36.3	8.6
8	7386.00	35.6 AV	54.0	-18.4	1.44 V	196	27.0	8.6

REMARKS:

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

Below 1GHz Data:

802.11n (HT20)

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz~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	105.68	30.5 QP	43.5	-13.0	1.50 H	281	41.9	-11.4
2	143.93	23.9 QP	43.5	-19.6	1.00 H	87	31.9	-8.0
3	215.10	29.5 QP	43.5	-14.0	1.00 H	161	40.7	-11.2
4	415.31	24.9 QP	46.0	-21.1	1.00 H	1	28.7	-3.8
5	639.26	28.5 QP	46.0	-17.5	1.50 H	241	27.1	1.4
6	931.06	34.1 QP	46.0	-11.9	2.00 H	323	28.1	6.0
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	106.73	27.3 QP	43.5	-16.2	1.00 V	101	38.6	-11.3
2	157.51	25.4 QP	43.5	-18.1	1.50 V	0	33.0	-7.6
3	186.17	23.6 QP	43.5	-19.9	1.00 V	360	33.8	-10.2
4	510.20	26.6 QP	46.0	-19.4	1.00 V	313	28.1	-1.5
5	638.60	30.0 QP	46.0	-16.0	2.00 V	297	28.6	1.4
6	743.07	31.5 QP	46.0	-14.5	1.50 V	183	28.4	3.1

REMARKS:

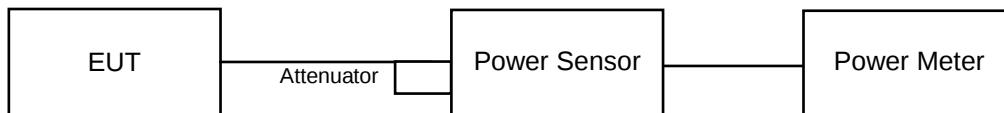
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.2 Conducted Output Power Measurement

4.2.1 Limits of Conducted Output Power Measurement

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

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedures

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

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Conditions

Same as Item 4.1.6.

4.2.7 Test Results

FOR PEAK POWER

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	108.393	20.35	30.00	Pass
6	2437	148.936	21.73	30.00	Pass
11	2462	121.339	20.84	30.00	Pass

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Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	209.894	23.22	30.00	Pass
6	2437	293.089	24.67	30.00	Pass
11	2462	221.309	23.45	30.00	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	161.065	22.07	30.00	Pass
6	2437	293.765	24.68	30.00	Pass
11	2462	179.473	22.54	30.00	Pass

FOR AVERAGE POWER

802.11b

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	69.343	18.41
6	2437	93.325	19.70
11	2462	93.756	19.72

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Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	45.499	16.58
6	2437	83.176	19.20
11	2462	39.902	16.01

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	33.037	15.19
6	2437	75.336	18.77
11	2462	31.696	15.01

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 FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

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Hsin Chu EMC/RF/Telecom Lab

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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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