

FCC Test Report (WLAN)

Report No.: RF160819E01G

FCC ID: COF-WMBNBM26A

Test Model: WM-BN-BM-26_A_FF4

Series Model: Refer to section 3.1 for more details

Received Date: Aug. 26, 2019

Test Date: Aug. 31 to Sep. 11, 2019

Issued Date: Sep. 23, 2019

Applicant: UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

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Hsin Chu Laboratory

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Test Location : E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan.

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



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Release Control Record

Issue No.	Description	Date Issued
RF160819E01G	Original release.	Sep. 23, 2019

1 Certificate of Conformity

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

Brand: USI

Test Model: WM-BN-BM-26_A_FF4

Series Model: Refer to section 3.1 for more details

Sample Status: ENGINEERING SAMPLE

Applicant: UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

Test Date: Aug. 31 to Sep. 11, 2019

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 : Wendy Wu , **Date:** Sep. 23, 2019
Wendy Wu / Specialist

Approved by : May Chen , **Date:** Sep. 23, 2019
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 -2.4dB at 2483.50MHz.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. 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) ($\pm$)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.0 dB
	30MHz ~ 1GHz	5.1 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.1 dB
	6GHz ~ 18GHz	5.0 dB
	18GHz ~ 40GHz	5.2 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	802.11b/g/n + BT Wireless LAN Module
Brand	USI
Test Model	WM-BN-BM-26_A_FF4
Series Model	Refer to Note
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
Output Power	283.792mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

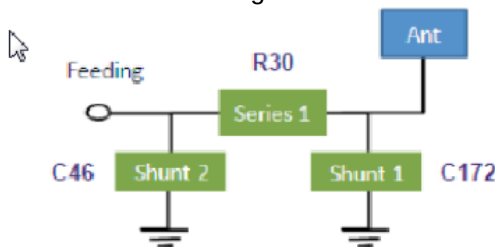
Note:

1. This report is prepared for FCC class II permissive change. The difference compared with the Report No.: RF160819E01D as the following:

◆ Added the one new model name to change the RF matching and layout is same as following table:

Original		
Brand	Model	Diffenence
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
	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

Newly

Brand	Model	Diffenence																
USI	WM-BN-BM-26_A_FF4	1. C172 change to Open 2. R30's Capacitor change to 2.2pf 3. C46's Inductor change to 1.0nH  <table><thead><tr><th>Name</th><th>Component</th><th>Supplier</th><th>Value</th></tr></thead><tbody><tr><td>C172</td><td>Shunt 1</td><td>Open</td><td></td></tr><tr><td>R30</td><td>Series 1</td><td>Capacitor Yageo</td><td>2.2pF</td></tr><tr><td>C46</td><td>Shunt 2</td><td>Inductor Chillisin</td><td>1.0nH</td></tr></tbody></table>	Name	Component	Supplier	Value	C172	Shunt 1	Open		R30	Series 1	Capacitor Yageo	2.2pF	C46	Shunt 2	Inductor Chillisin	1.0nH
Name	Component	Supplier	Value															
C172	Shunt 1	Open																
R30	Series 1	Capacitor Yageo	2.2pF															
C46	Shunt 2	Inductor Chillisin	1.0nH															

From the above models, new model: WM-BN-BM-26_A_FF4 was selected as representative model for the test and its data was recorded in this report.

2. According to above conditions, only Conducted power and Radiated Emissions need to be performed. And all data were 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 $\geq$ 1G	RE<1G	APCM	
-	√	√	√	-

Where RE $\geq$ 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	22deg. C, 67%RH	120Vac, 60Hz	Ryan Du
RE<1G	23deg. C, 67%RH	120Vac, 60Hz	Ryan Du
APCM	25deg. C, 60%RH	120Vac, 60Hz	Ryan Du

3.3 Duty Cycle of Test Signal

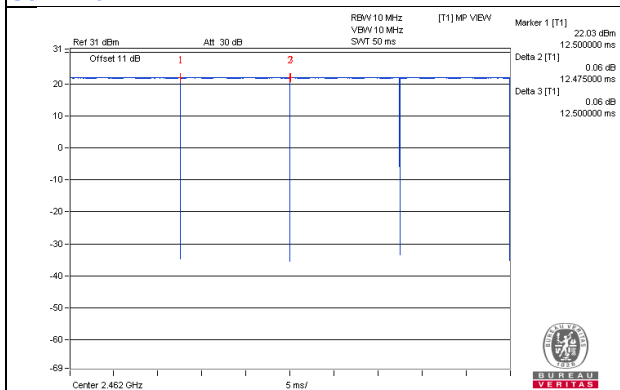
If duty cycle of test signal is $\geq 98\%$, duty factor is not required.

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

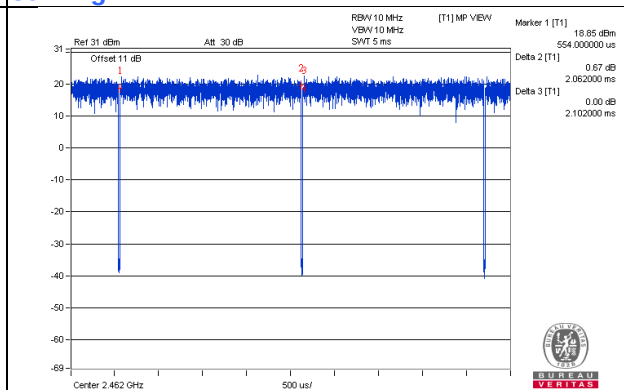
802.11g: Duty cycle = $2.062/2.102 = 0.981$

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

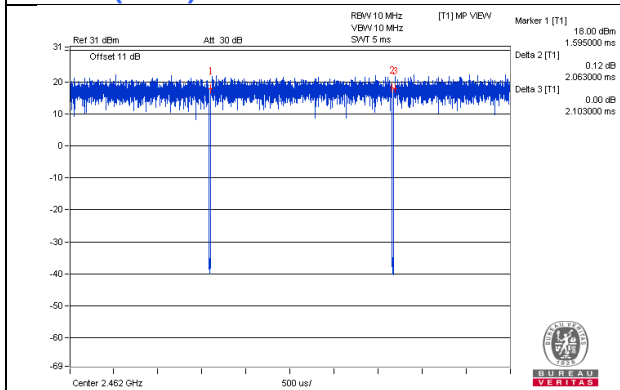
802.11b



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.

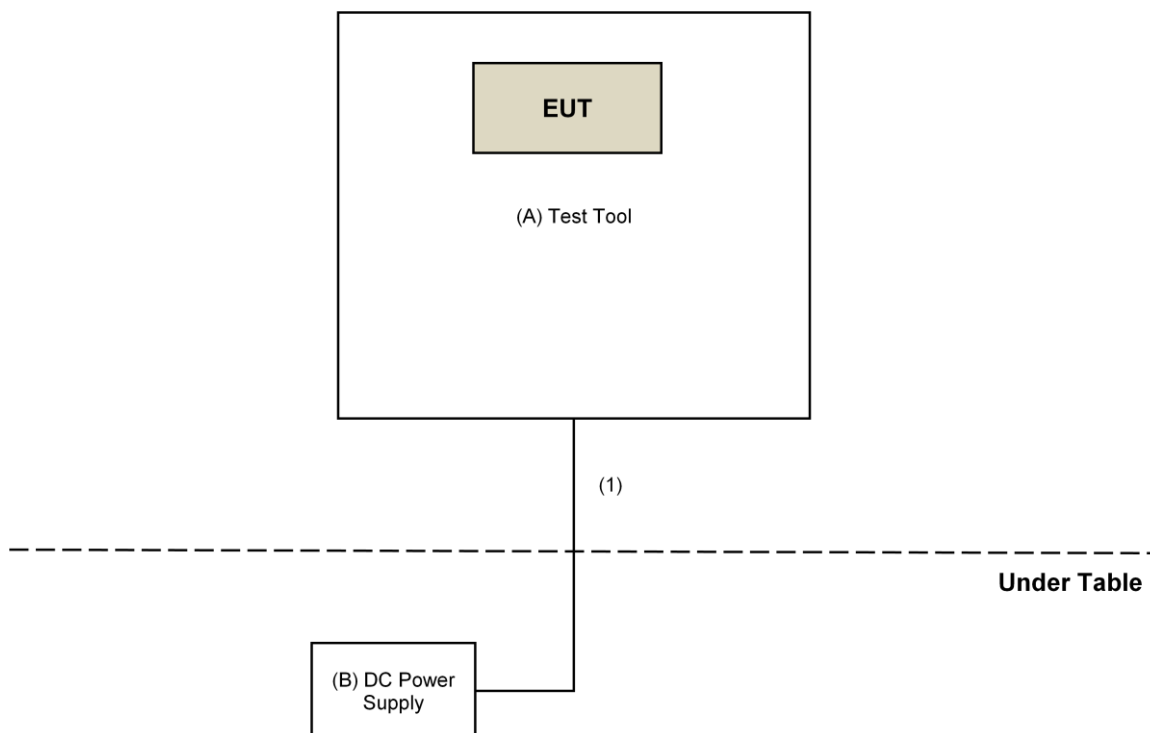
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Test Tool	NA	NA	NA	NA	Supplied by client
B.	DC Power Supply	Topward	6603D	795558	NA	Provided by Lab

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	1.8	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 15.247 Meas Guidance v05r02

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 Agilent	N9038A	MY50010156	July 17, 2019	July 16, 2020
Pre-Amplifier EMCI	EMC001340	980142	May 30, 2019	May 29, 2020
Loop Antenna Electro-Metrics	EM-6879	264	Jan. 22, 2019	Jan. 21, 2020
RF Cable	NA	LOOPCAB-001	Jan. 14, 2019	Jan. 13, 2020
RF Cable	NA	LOOPCAB-002	Jan. 14, 2019	Jan. 13, 2020
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	Apr. 30, 2019	Apr. 29, 2020
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 22, 2018	Nov. 21, 2019
RF Cable	8D	966-3-1	Mar. 18, 2019	Mar. 17, 2020
RF Cable	8D	966-3-2	Mar. 18, 2019	Mar. 17, 2020
RF Cable	8D	966-3-3	Mar. 18, 2019	Mar. 17, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 27, 2018	Sep. 26, 2019
Horn Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC104-SM-SM-1200	160922	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC104-SM-SM-2000	180601	June 10, 2019	June 09, 2020
RF Cable	EMC104-SM-SM-6000	180602	June 10, 2019	June 09, 2020
Spectrum Analyzer Keysight	N9030A	MY54490679	July 17, 2019	July 16, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 28, 2019	Jan. 27, 2020
Horn Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 25, 2018	Nov. 24, 2019
RF Cable	EMC102-KM-KM-1200	160924	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC102-KM-KM-1200	160925	Jan. 28, 2019	Jan. 27, 2020
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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 966 Chamber No. 3.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: Aug. 31 to Sep. 11, 2019

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 detects 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:

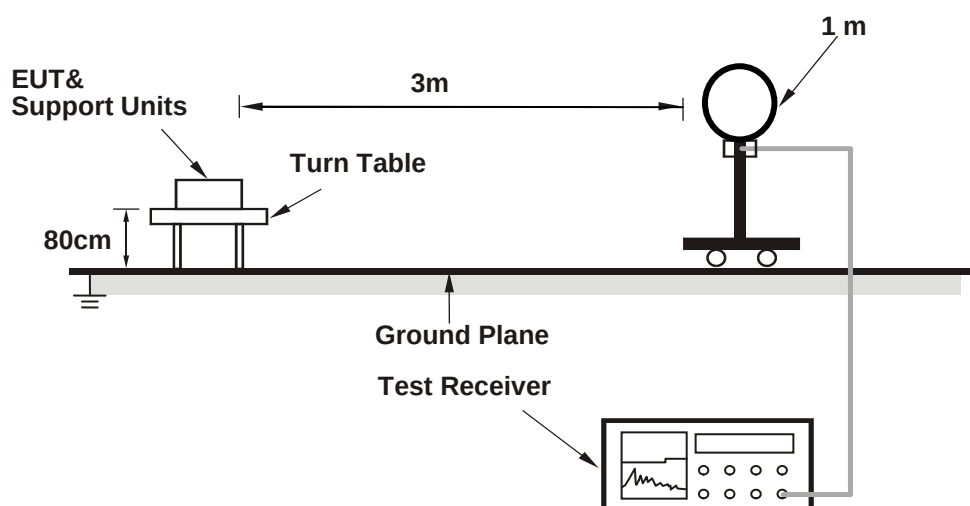
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

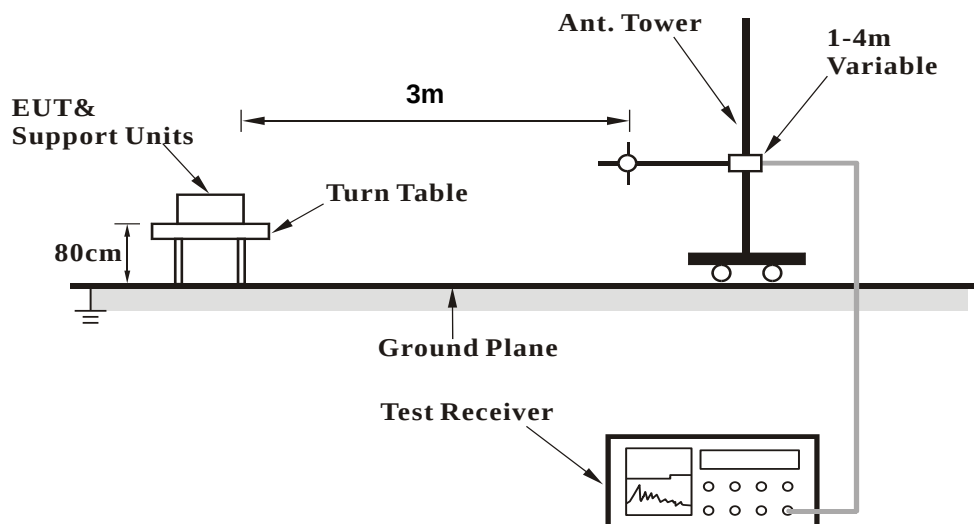
No deviation.

4.1.5 Test Setup

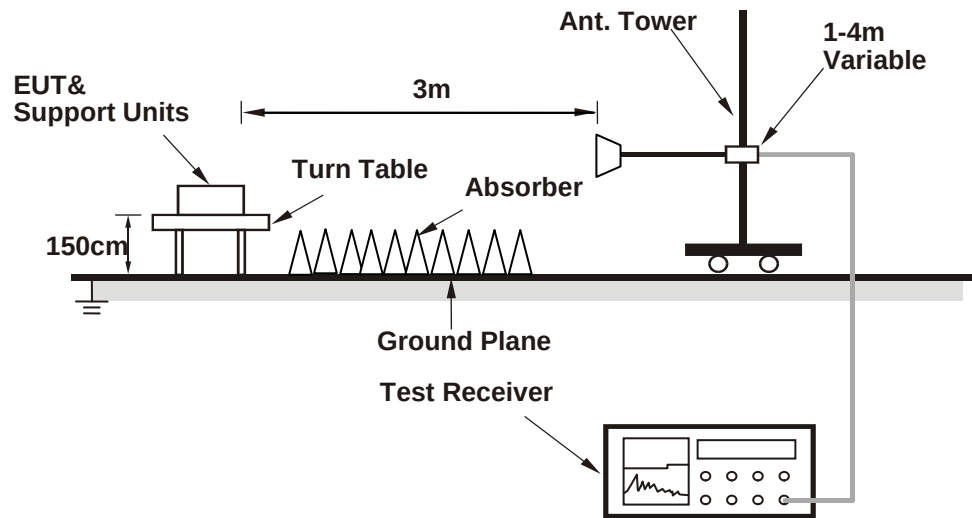
For Radiated emission below 30MHz



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

- a. Placed the EUT on the testing table.
- b. Controlling software (sh use Test scripts.sh) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

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	58.3 PK	74.0	-15.7	1.50 H	188	60.3	-2.0
2	2390.00	49.0 AV	54.0	-5.0	1.50 H	188	51.0	-2.0
3	*2412.00	106.2 PK			1.50 H	188	108.2	-2.0
4	*2412.00	103.9 AV			1.50 H	188	105.9	-2.0
5	4824.00	39.4 PK	74.0	-34.6	1.82 H	192	37.1	2.3
6	4824.00	28.1 AV	54.0	-25.9	1.82 H	192	25.8	2.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	55.4 PK	74.0	-18.6	3.38 V	281	57.4	-2.0
2	2390.00	42.3 AV	54.0	-11.7	3.38 V	281	44.3	-2.0
3	*2412.00	96.6 PK			3.38 V	281	98.6	-2.0
4	*2412.00	94.2 AV			3.38 V	281	96.2	-2.0
5	4824.00	39.7 PK	74.0	-34.3	2.49 V	193	37.4	2.3
6	4824.00	28.2 AV	54.0	-25.8	2.49 V	193	25.9	2.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	55.5 PK	74.0	-18.5	1.46 H	195	57.5	-2.0
2	2390.00	43.6 AV	54.0	-10.4	1.46 H	195	45.6	-2.0
3	*2437.00	107.5 PK			1.46 H	195	109.6	-2.1
4	*2437.00	104.2 AV			1.46 H	195	106.3	-2.1
5	2483.50	55.8 PK	74.0	-18.2	1.46 H	195	58.0	-2.2
6	2483.50	43.1 AV	54.0	-10.9	1.46 H	195	45.3	-2.2
7	4874.00	38.8 PK	74.0	-35.2	1.88 H	199	36.5	2.3
8	4874.00	27.6 AV	54.0	-26.4	1.88 H	199	25.3	2.3
9	7311.00	47.9 PK	74.0	-26.1	3.27 H	248	39.6	8.3
10	7311.00	39.2 AV	54.0	-14.8	3.27 H	248	30.9	8.3

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	55.5 PK	74.0	-18.5	3.43 V	273	57.5	-2.0
2	2390.00	43.4 AV	54.0	-10.6	3.43 V	273	45.4	-2.0
3	*2437.00	98.0 PK			3.43 V	273	100.1	-2.1
4	*2437.00	95.6 AV			3.43 V	273	97.7	-2.1
5	2483.50	55.5 PK	74.0	-18.5	3.43 V	273	57.7	-2.2
6	2483.50	42.8 AV	54.0	-11.2	3.43 V	273	45.0	-2.2
7	4874.00	39.3 PK	74.0	-34.7	2.55 V	189	37.0	2.3
8	4874.00	28.0 AV	54.0	-26.0	2.55 V	189	25.7	2.3
9	7311.00	51.5 PK	74.0	-22.5	2.88 V	219	43.2	8.3
10	7311.00	47.3 AV	54.0	-6.7	2.88 V	219	39.0	8.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	105.9 PK			1.50 H	197	108.1	-2.2
2	*2462.00	103.5 AV			1.50 H	197	105.7	-2.2
3	2483.50	60.3 PK	74.0	-13.7	1.50 H	197	62.5	-2.2
4	2483.50	50.6 AV	54.0	-3.4	1.50 H	197	52.8	-2.2
5	4924.00	38.5 PK	74.0	-35.5	1.83 H	212	36.0	2.5
6	4924.00	27.6 AV	54.0	-26.4	1.83 H	212	25.1	2.5
7	7386.00	47.2 PK	74.0	-26.8	3.23 H	257	38.9	8.3
8	7386.00	38.7 AV	54.0	-15.3	3.23 H	257	30.4	8.3
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	96.3 PK			3.45 V	282	98.5	-2.2
2	*2462.00	94.0 AV			3.45 V	282	96.2	-2.2
3	2483.50	57.8 PK	74.0	-16.2	3.45 V	282	60.0	-2.2
4	2483.50	44.3 AV	54.0	-9.7	3.45 V	282	46.5	-2.2
5	4924.00	39.6 PK	74.0	-34.4	2.54 V	185	37.1	2.5
6	4924.00	28.3 AV	54.0	-25.7	2.54 V	185	25.8	2.5
7	7386.00	50.7 PK	74.0	-23.3	2.86 V	214	42.4	8.3
8	7386.00	46.6 AV	54.0	-7.4	2.86 V	214	38.3	8.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	66.8 PK	74.0	-7.2	1.51 H	178	68.8	-2.0
2	2390.00	51.0 AV	54.0	-3.0	1.51 H	178	53.0	-2.0
3	*2412.00	109.3 PK			1.51 H	178	111.3	-2.0
4	*2412.00	99.1 AV			1.51 H	178	101.1	-2.0
5	4824.00	39.3 PK	74.0	-34.7	1.86 H	241	37.0	2.3
6	4824.00	28.3 AV	54.0	-25.7	1.86 H	241	26.0	2.3
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	61.9 PK	74.0	-12.1	3.43 V	281	63.9	-2.0
2	2390.00	44.3 AV	54.0	-9.7	3.43 V	281	46.3	-2.0
3	*2412.00	100.6 PK			3.43 V	281	102.6	-2.0
4	*2412.00	90.3 AV			3.43 V	281	92.3	-2.0
5	4824.00	39.2 PK	74.0	-34.8	2.57 V	185	36.9	2.3
6	4824.00	28.0 AV	54.0	-26.0	2.57 V	185	25.7	2.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	55.3 PK	74.0	-18.7	1.51 H	176	57.3	-2.0
2	2390.00	43.6 AV	54.0	-10.4	1.51 H	176	45.6	-2.0
3	*2437.00	113.6 PK			1.51 H	176	115.7	-2.1
4	*2437.00	103.4 AV			1.51 H	176	105.5	-2.1
5	2483.50	56.0 PK	74.0	-18.0	1.51 H	176	58.2	-2.2
6	2483.50	43.1 AV	54.0	-10.9	1.51 H	176	45.3	-2.2
7	4874.00	39.1 PK	74.0	-34.9	1.82 H	228	36.8	2.3
8	4874.00	27.9 AV	54.0	-26.1	1.82 H	228	25.6	2.3
9	7311.00	46.7 PK	74.0	-27.3	3.25 H	273	38.4	8.3
10	7311.00	38.5 AV	54.0	-15.5	3.25 H	273	30.2	8.3

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	55.0 PK	74.0	-19.0	3.40 V	279	57.0	-2.0
2	2390.00	43.3 AV	54.0	-10.7	3.40 V	279	45.3	-2.0
3	*2437.00	106.2 PK			3.40 V	279	108.3	-2.1
4	*2437.00	95.8 AV			3.40 V	279	97.9	-2.1
5	2483.50	56.3 PK	74.0	-17.7	3.40 V	279	58.5	-2.2
6	2483.50	43.4 AV	54.0	-10.6	3.40 V	279	45.6	-2.2
7	4874.00	39.7 PK	74.0	-34.3	2.58 V	178	37.4	2.3
8	4874.00	28.4 AV	54.0	-25.6	2.58 V	178	26.1	2.3
9	7311.00	50.4 PK	74.0	-23.6	2.91 V	218	42.1	8.3
10	7311.00	46.2 AV	54.0	-7.8	2.91 V	218	37.9	8.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	108.7 PK			1.45 H	186	110.9	-2.2
2	*2462.00	98.8 AV			1.45 H	186	101.0	-2.2
3	2483.50	67.1 PK	74.0	-6.9	1.45 H	186	69.3	-2.2
4	2483.50	51.1 AV	54.0	-2.9	1.45 H	186	53.3	-2.2
5	4924.00	39.0 PK	74.0	-35.0	1.83 H	229	36.5	2.5
6	4924.00	27.5 AV	54.0	-26.5	1.83 H	229	25.0	2.5
7	7386.00	46.5 PK	74.0	-27.5	3.29 H	279	38.2	8.3
8	7386.00	38.5 AV	54.0	-15.5	3.29 H	279	30.2	8.3
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	100.4 PK			3.36 V	291	102.6	-2.2
2	*2462.00	90.2 AV			3.36 V	291	92.4	-2.2
3	2483.50	61.2 PK	74.0	-12.8	3.36 V	291	63.4	-2.2
4	2483.50	43.9 AV	54.0	-10.1	3.36 V	291	46.1	-2.2
5	4924.00	40.2 PK	74.0	-33.8	2.63 V	192	37.7	2.5
6	4924.00	28.6 AV	54.0	-25.4	2.63 V	192	26.1	2.5
7	7386.00	50.4 PK	74.0	-23.6	2.97 V	209	42.1	8.3
8	7386.00	46.3 AV	54.0	-7.7	2.97 V	209	38.0	8.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	64.3 PK	74.0	-9.7	1.51 H	194	66.3	-2.0
2	2390.00	50.3 AV	54.0	-3.7	1.51 H	194	52.3	-2.0
3	*2412.00	108.3 PK			1.51 H	194	110.3	-2.0
4	*2412.00	98.0 AV			1.51 H	194	100.0	-2.0
5	4824.00	38.5 PK	74.0	-35.5	1.88 H	224	36.2	2.3
6	4824.00	27.3 AV	54.0	-26.7	1.88 H	224	25.0	2.3
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	3.33 V	286	62.1	-2.0
2	2390.00	44.7 AV	54.0	-9.3	3.33 V	286	46.7	-2.0
3	*2412.00	100.1 PK			3.33 V	286	102.1	-2.0
4	*2412.00	89.8 AV			3.33 V	286	91.8	-2.0
5	4824.00	40.0 PK	74.0	-34.0	2.45 V	221	37.7	2.3
6	4824.00	29.1 AV	54.0	-24.9	2.45 V	221	26.8	2.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	55.1 PK	74.0	-18.9	1.47 H	189	57.1	-2.0
2	2390.00	42.9 AV	54.0	-11.1	1.47 H	189	44.9	-2.0
3	*2437.00	112.7 PK			1.47 H	189	114.8	-2.1
4	*2437.00	102.4 AV			1.47 H	189	104.5	-2.1
5	2483.50	55.6 PK	74.0	-18.4	1.47 H	189	57.8	-2.2
6	2483.50	43.0 AV	54.0	-11.0	1.47 H	189	45.2	-2.2
7	4874.00	38.6 PK	74.0	-35.4	1.88 H	209	36.3	2.3
8	4874.00	27.5 AV	54.0	-26.5	1.88 H	209	25.2	2.3
9	7311.00	48.1 PK	74.0	-25.9	3.29 H	264	39.8	8.3
10	7311.00	39.2 AV	54.0	-14.8	3.29 H	264	30.9	8.3

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	55.6 PK	74.0	-18.4	3.37 V	289	57.6	-2.0
2	2390.00	43.7 AV	54.0	-10.3	3.37 V	289	45.7	-2.0
3	*2437.00	106.1 PK			3.37 V	289	108.2	-2.1
4	*2437.00	95.4 AV			3.37 V	289	97.5	-2.1
5	2483.50	56.3 PK	74.0	-17.7	3.37 V	289	58.5	-2.2
6	2483.50	43.5 AV	54.0	-10.5	3.37 V	289	45.7	-2.2
7	4874.00	40.0 PK	74.0	-34.0	2.50 V	205	37.7	2.3
8	4874.00	28.8 AV	54.0	-25.2	2.50 V	205	26.5	2.3
9	7311.00	51.3 PK	74.0	-22.7	2.84 V	220	43.0	8.3
10	7311.00	46.9 AV	54.0	-7.1	2.84 V	220	38.6	8.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
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	108.5 PK			1.49 H	197	110.7	-2.2
2	*2462.00	98.2 AV			1.49 H	197	100.4	-2.2
3	2483.50	65.8 PK	74.0	-8.2	1.49 H	197	68.0	-2.2
4	2483.50	51.6 AV	54.0	-2.4	1.49 H	197	53.8	-2.2
5	4924.00	38.6 PK	74.0	-35.4	1.91 H	205	36.1	2.5
6	4924.00	27.4 AV	54.0	-26.6	1.91 H	205	24.9	2.5
7	7386.00	47.7 PK	74.0	-26.3	3.32 H	258	39.4	8.3
8	7386.00	38.9 AV	54.0	-15.1	3.32 H	258	30.6	8.3
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	99.9 PK			3.35 V	273	102.1	-2.2
2	*2462.00	89.4 AV			3.35 V	273	91.6	-2.2
3	2483.50	60.3 PK	74.0	-13.7	3.35 V	273	62.5	-2.2
4	2483.50	45.0 AV	54.0	-9.0	3.35 V	273	47.2	-2.2
5	4924.00	40.0 PK	74.0	-34.0	2.55 V	200	37.5	2.5
6	4924.00	28.6 AV	54.0	-25.4	2.55 V	200	26.1	2.5
7	7386.00	51.0 PK	74.0	-23.0	2.81 V	207	42.7	8.3
8	7386.00	46.9 AV	54.0	-7.1	2.81 V	207	38.6	8.3

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

Below 1GHz Data:

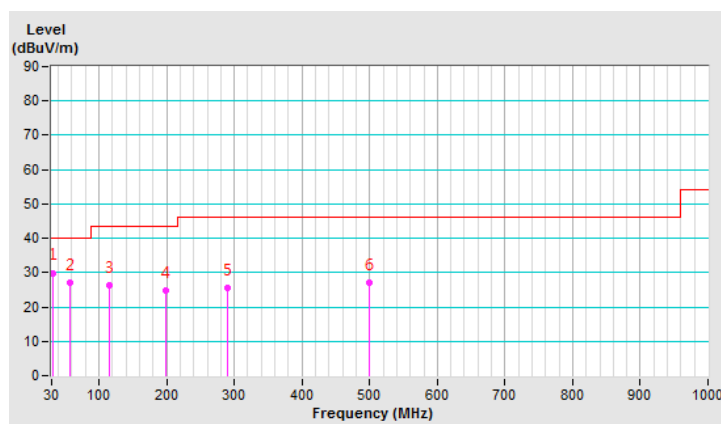
802.11n (HT20)

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	31.87	29.9 QP	40.0	-10.1	2.00 H	112	39.3	-9.4
2	56.23	27.0 QP	40.0	-13.0	2.00 H	77	35.6	-8.6
3	116.24	26.4 QP	43.5	-17.1	1.50 H	43	36.5	-10.1
4	198.10	24.8 QP	43.5	-18.7	1.00 H	326	34.9	-10.1
5	289.32	25.5 QP	46.0	-20.5	2.00 H	113	32.4	-6.9
6	499.38	26.9 QP	46.0	-19.1	1.50 H	144	28.3	-1.4

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

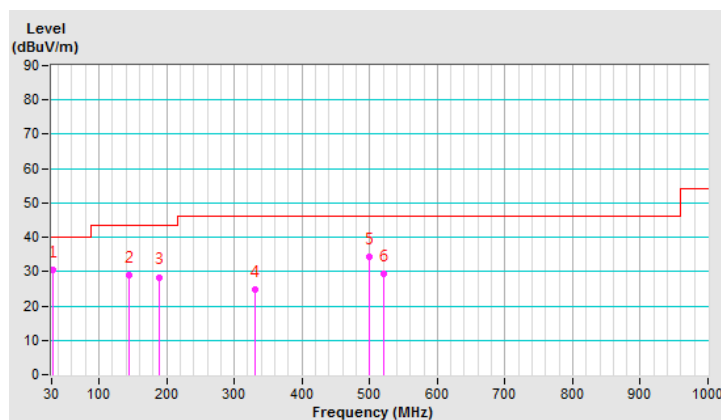


CHANNEL	TX Channel 6	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	31.29	30.5 QP	40.0	-9.5	1.50 V	211	40.0	-9.5
2	145.32	28.9 QP	43.5	-14.6	2.00 V	187	36.7	-7.8
3	188.42	28.4 QP	43.5	-15.1	1.00 V	163	38.1	-9.7
4	330.02	24.6 QP	46.0	-21.4	1.00 V	66	30.1	-5.5
5	499.95	34.3 QP	46.0	-11.7	1.00 V	44	35.7	-1.4
6	520.84	29.3 QP	46.0	-16.7	1.50 V	65	30.4	-1.1

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

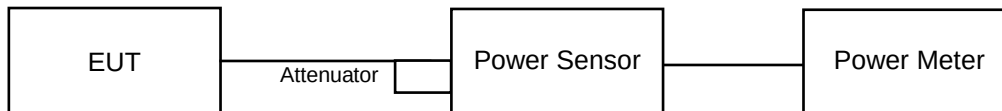


4.2 Conducted Output Power Measurement

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

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

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	115.611	20.63	30.00	Pass
6	2437	161.065	22.07	30.00	Pass
11	2462	114.288	20.58	30.00	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	175.792	22.45	30.00	Pass
6	2437	280.543	24.48	30.00	Pass
11	2462	168.267	22.26	30.00	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	185.353	22.68	30.00	Pass
6	2437	283.792	24.53	30.00	Pass
11	2462	187.499	22.73	30.00	Pass

FOR AVERAGE POWER

802.11b

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	71.45	18.54
6	2437	100.693	20.03
11	2462	69.663	18.43

802.11g

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	44.055	16.44
6	2437	89.95	19.54
11	2462	37.844	15.78

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	31.333	14.96
6	2437	76.033	18.81
11	2462	31.477	14.98

5 Pictures of Test Arrangements

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

Appendix – Information of the Testing Laboratories

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

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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