

FCC Test Report (WLAN)

Report No.: RF160819E01H

FCC ID: COF-WMBNBM26A

Test Model: WM-BN-BM-26_A_FF5

Series Model: WM-BN-BM-26_A, WM-BN-BM-26_A_FF2, WM-BN-BM-26_A_FF3,
WM-BN-BM-26_A_FF4

Received Date: Nov. 21, 2019

Test Date: Nov. 30, 2019

Issued Date: Dec. 20, 2019

Applicant: UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

Address: 141, Lane 351, Sec. 1, Taiping Road., Tsautuen, Nantou 54261, Taiwan

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

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

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
RF160819E01H	Original release.	Dec. 20, 2019

1 Certificate of Conformity

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

Brand: USI

Test Model: WM-BN-BM-26_A_FF5

Series Model: WM-BN-BM-26_A, WM-BN-BM-26_A_FF2, WM-BN-BM-26_A_FF3,
WM-BN-BM-26_A_FF4

Sample Status: ENGINEERING SAMPLE

Applicant: UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

Test Date: Nov. 30, 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 : Phoenix Huang, **Date:** Dec. 20, 2019
Phoenix Huang / Specialist

Approved by : Clark Lin, **Date:** Dec. 20, 2019
Clark Lin / Technical 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 -2.5 dB at 2390.00 MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

Note:

Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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	4.9 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.1 dB
	6GHz ~ 18GHz	4.9 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 (WLAN)

Product	802.11b/g/n + BT Wireless LAN Module
Brand	USI
Test Model	WM-BN-BM-26_A_FF5
Series Model	WM-BN-BM-26_A, WM-BN-BM-26_A_FF2, WM-BN-BM-26_A_FF3, WM-BN-BM-26_A_FF4
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	2.412 ~ 2.462 GHz
Number of Channel	802.11b, 802.11g, 802.11n (HT20): 11
Output Power	281.19 mW
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.: RF160819E01G as the following:

◆ Added the one new model name to changed the RF matching and layout is same 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.
	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.
	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.
Newly		
Brand	Model	Difference
USI	WM-BN-BM-26_A_FF5	1. R30's Capacitor change to 3.3pF. 2. C46's Inductor change to 1.5nH.

From the above models, new model: WM-BN-BM-26_A_FF5 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	TX & RX CONFIGURATION	
802.11b	1TX	1RX
802.11g	1TX	1RX
802.11n (HT20)	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 (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

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: 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	25deg. C, 65%RH	120Vac, 60Hz	Jeff Lee
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Jeff Lee
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jeff Lee

3.3 Duty Cycle of Test Signal

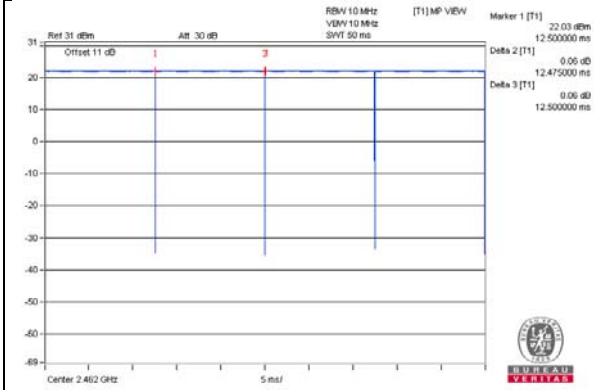
If duty cycle of test signal is $\geq 98\%$, duty factor is not required.

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

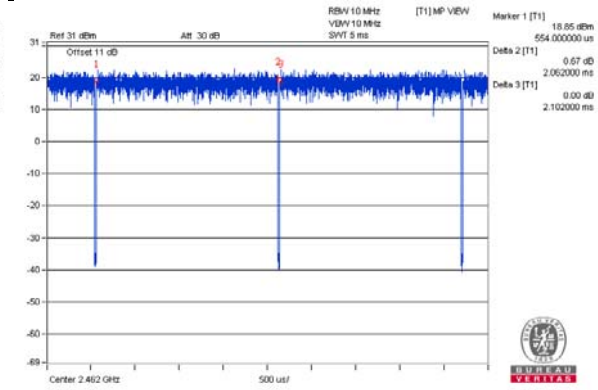
802.11g: Duty cycle = $2.062/2.102 = 0.981$

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

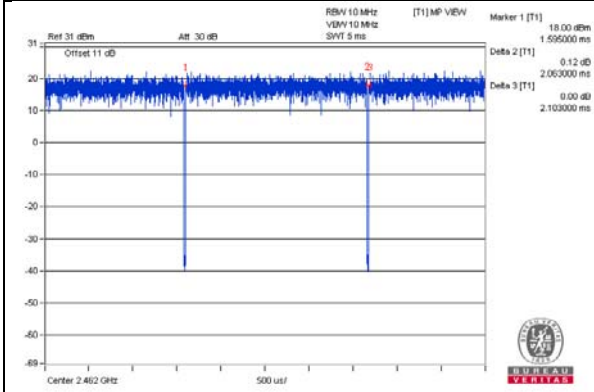
802.11b



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.

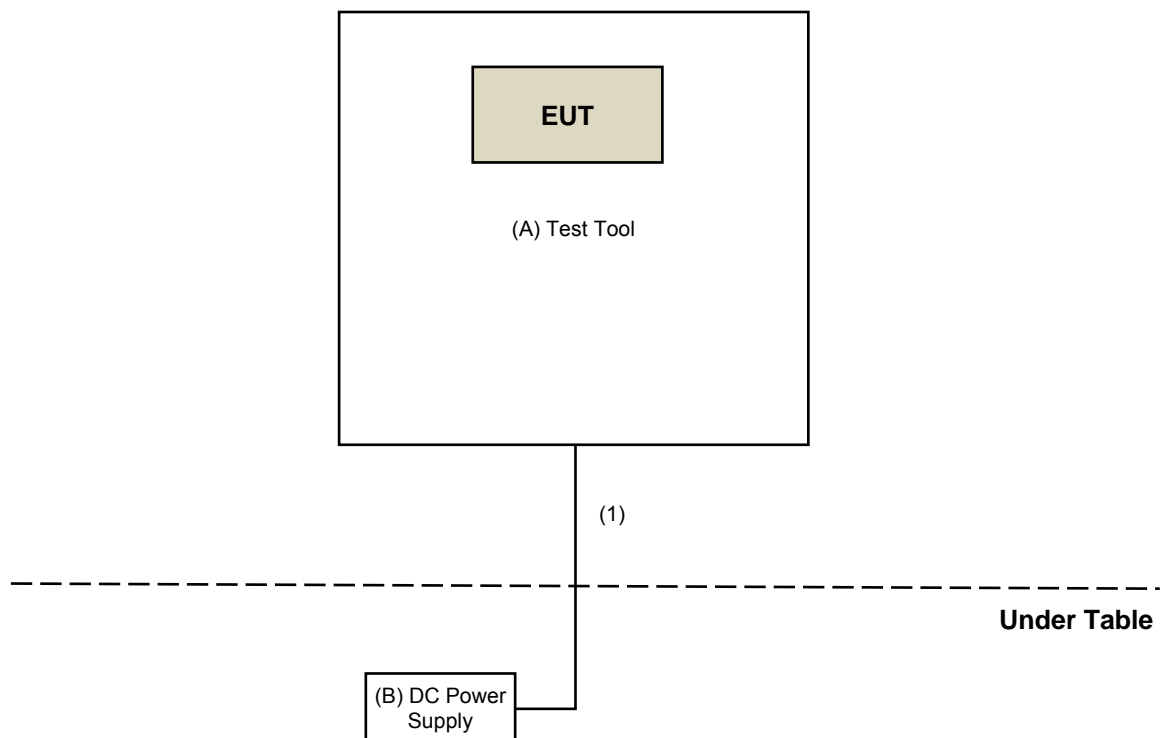
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Test Tool	USI	WM-BN-BM-26_A _EV B TDK V1.1	NA	NA	Supplied by client
B.	DC Power Supply	Topward	6603D	795558	NA	Provided by Lab

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	2.5	No	0	Supplied by client

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and References

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

Test Standard:

FCC Part 15, Subpart C (15.247)

ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 15.247 Meas Guidance v05r02

All test items have been performed as a reference to the above KDB test guidance.

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 ESR7 R&S	ESR7	102026	Apr. 24, 2019	Apr. 23, 2020
Spectrum Analyzer Keysight	N9030B	MY57141948	May 25, 2019	May 24, 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 EMCI	EMC330N	980538	Apr. 30, 2019	Apr. 29, 2020
Trilog Broadband Antenna SCHWARZBECK	VULB9168	9168-0842	Nov. 08, 2019	Nov. 07, 2020
RF Cable	8D	966-5-1	May 03, 2019	May 02, 2020
RF Cable	8D	966-5-2	May 03, 2019	May 02, 2020
RF Cable	8D	966-5-3	May 03, 2019	May 02, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-02	Jan. 28, 2019	Jan. 27, 2020
Horn Antenna SCHWARZBECK	BBHA 9120D	9120D-1819	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier EMCI	EMC12630SE	980509	May 03, 2019	May 02, 2020
RF Cable EMCI	EMC104-SM-SM-1500	180503	May 03, 2019	May 02, 2020
RF Cable EMCI	EMC104-SM-SM-2000	180501	May 03, 2019	May 02, 2020
RF Cable EMCI	EMC104-SM-SM-6000	180505	May 03, 2019	May 02, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 28, 2019	Jan. 27, 2020
Horn Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 24, 2019	Nov. 23, 2020
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
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA
Spectrum Analyzer R&S	FSV40	100964	June 04, 2019	June 03, 2020
Power meter Anritsu	ML2495A	1014008	May 13, 2019	May 12, 2020
Power sensor Anritsu	MA2411B	0917122	May 13, 2019	May 12, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020

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. 5.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: Nov. 30, 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:

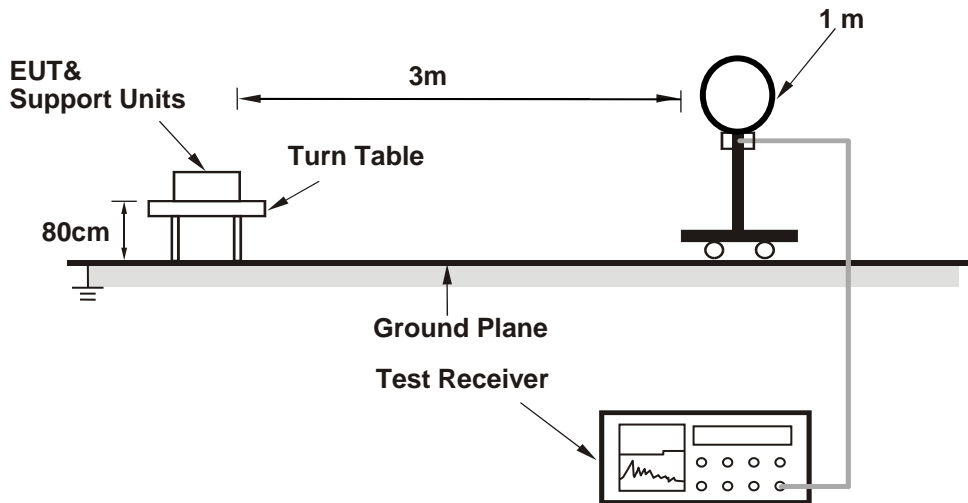
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

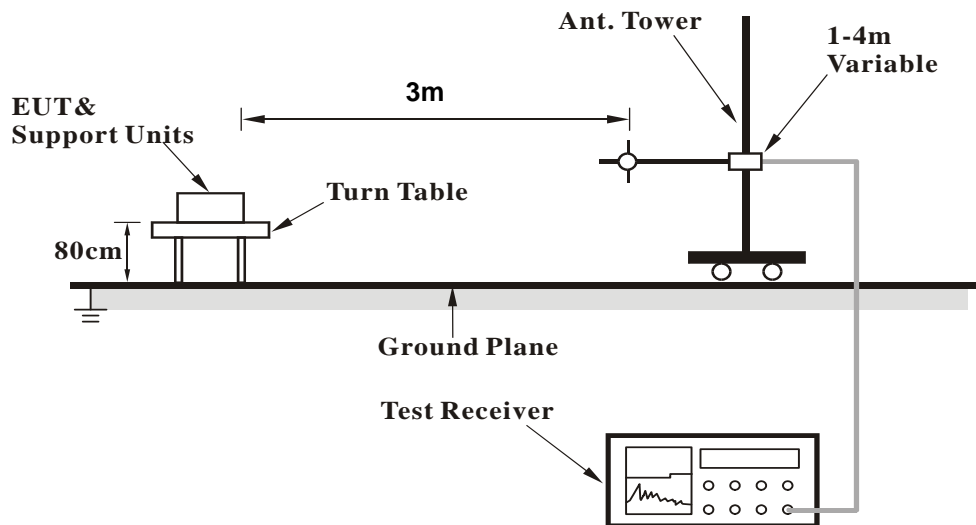
No deviation.

4.1.5 Test Setup

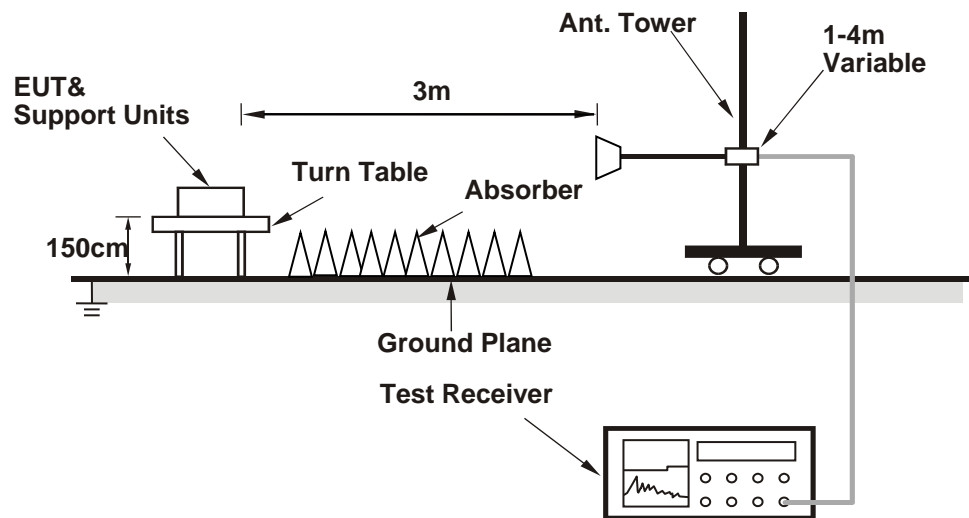
For Radiated emission below 30MHz



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	59.2 PK	74.0	-14.8	2.30 H	2	62.3	-3.1
2	2390.00	51.5 AV	54.0	-2.5	2.30 H	2	54.6	-3.1
3	*2412.00	104.8 PK			2.30 H	2	107.9	-3.1
4	*2412.00	102.5 AV			2.30 H	2	105.6	-3.1
5	4824.00	39.4 PK	74.0	-34.6	1.66 H	165	38.2	1.2
6	4824.00	31.5 AV	54.0	-22.5	1.66 H	165	30.3	1.2

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.0 PK	74.0	-17.0	2.37 V	31	60.1	-3.1
2	2390.00	45.9 AV	54.0	-8.1	2.37 V	31	49.0	-3.1
3	*2412.00	95.7 PK			2.37 V	31	98.8	-3.1
4	*2412.00	93.3 AV			2.37 V	31	96.4	-3.1
5	4824.00	44.7 PK	74.0	-29.3	1.45 V	179	43.5	1.2
6	4824.00	38.0 AV	54.0	-16.0	1.45 V	179	36.8	1.2

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	56.9 PK	74.0	-17.1	2.26 H	10	60.0	-3.1
2	2390.00	43.4 AV	54.0	-10.6	2.26 H	10	46.5	-3.1
3	*2437.00	107.2 PK			2.26 H	10	110.3	-3.1
4	*2437.00	105.0 AV			2.26 H	10	108.1	-3.1
5	2483.50	57.5 PK	74.0	-16.5	2.26 H	10	60.6	-3.1
6	2483.50	44.5 AV	54.0	-9.5	2.26 H	10	47.6	-3.1
7	4874.00	39.6 PK	74.0	-34.4	1.67 H	176	38.5	1.1
8	4874.00	32.0 AV	54.0	-22.0	1.67 H	176	30.9	1.1
9	7311.00	43.0 PK	74.0	-31.0	1.73 H	175	35.7	7.3
10	7311.00	34.8 AV	54.0	-19.2	1.73 H	175	27.5	7.3

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	57.6 PK	74.0	-16.4	2.31 V	26	60.7	-3.1
2	2390.00	46.3 AV	54.0	-7.7	2.31 V	26	49.4	-3.1
3	*2437.00	98.3 PK			2.31 V	26	101.4	-3.1
4	*2437.00	96.0 AV			2.31 V	26	99.1	-3.1
5	2483.50	57.0 PK	74.0	-17.0	2.31 V	26	60.1	-3.1
6	2483.50	46.1 AV	54.0	-7.9	2.31 V	26	49.2	-3.1
7	4874.00	44.9 PK	74.0	-29.1	1.45 V	183	43.8	1.1
8	4874.00	38.0 AV	54.0	-16.0	1.45 V	183	36.9	1.1
9	7311.00	45.8 PK	74.0	-28.2	1.70 V	359	38.5	7.3
10	7311.00	37.0 AV	54.0	-17.0	1.70 V	359	29.7	7.3

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	106.3 PK			2.20 H	7	109.4	-3.1
2	*2462.00	104.1 AV			2.20 H	7	107.2	-3.1
3	2483.50	58.5 PK	74.0	-15.5	1.50 H	197	61.6	-3.1
4	2483.50	46.7 AV	54.0	-7.3	1.50 H	197	49.8	-3.1
5	4924.00	39.5 PK	74.0	-34.5	1.65 H	181	38.3	1.2
6	4924.00	32.1 AV	54.0	-21.9	1.65 H	181	30.9	1.2
7	7386.00	43.1 PK	74.0	-30.9	1.70 H	175	35.7	7.4
8	7386.00	34.9 AV	54.0	-19.1	1.70 H	175	27.5	7.4

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	*2462.00	97.6 PK			2.39 V	27	100.7	-3.1
2	*2462.00	95.1 AV			2.39 V	27	98.2	-3.1
3	2483.50	56.8 PK	74.0	-17.2	2.37 V	31	59.9	-3.1
4	2483.50	45.8 AV	54.0	-8.2	2.37 V	31	48.9	-3.1
5	4924.00	44.6 PK	74.0	-29.4	1.41 V	191	43.4	1.2
6	4924.00	37.9 AV	54.0	-16.1	1.41 V	191	36.7	1.2
7	7386.00	45.7 PK	74.0	-28.3	1.71 V	360	38.3	7.4
8	7386.00	36.9 AV	54.0	-17.1	1.71 V	360	29.5	7.4

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.
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	62.8 PK	74.0	-11.2	2.28 H	0	65.9	-3.1
2	2390.00	49.1 AV	54.0	-4.9	2.28 H	0	52.2	-3.1
3	*2412.00	105.1 PK			2.28 H	0	108.2	-3.1
4	*2412.00	96.3 AV			2.28 H	0	99.4	-3.1
5	4824.00	39.7 PK	74.0	-34.3	1.69 H	185	38.5	1.2
6	4824.00	32.1 AV	54.0	-21.9	1.69 H	185	30.9	1.2

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	2.41 V	20	59.7	-3.1
2	2390.00	45.4 AV	54.0	-8.6	2.41 V	20	48.5	-3.1
3	*2412.00	95.7 PK			2.41 V	20	98.8	-3.1
4	*2412.00	86.9 AV			2.41 V	20	90.0	-3.1
5	4824.00	44.2 PK	74.0	-29.8	1.48 V	177	43.0	1.2
6	4824.00	37.8 AV	54.0	-16.2	1.48 V	177	36.6	1.2

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	55.6 PK	74.0	-18.4	2.25 H	13	58.7	-3.1
2	2390.00	44.1 AV	54.0	-9.9	2.25 H	13	47.2	-3.1
3	*2437.00	113.1 PK			2.25 H	13	116.2	-3.1
4	*2437.00	102.9 AV			2.25 H	13	106.0	-3.1
5	2483.50	56.5 PK	74.0	-17.5	2.25 H	13	59.6	-3.1
6	2483.50	43.6 AV	54.0	-10.4	2.25 H	13	46.7	-3.1
7	4874.00	40.0 PK	74.0	-34.0	1.69 H	170	38.9	1.1
8	4874.00	32.2 AV	54.0	-21.8	1.69 H	170	31.1	1.1
9	7311.00	42.8 PK	74.0	-31.2	1.78 H	165	35.5	7.3
10	7311.00	34.6 AV	54.0	-19.4	1.78 H	165	27.3	7.3

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	56.7 PK	74.0	-17.3	2.40 V	28	59.8	-3.1
2	2390.00	45.8 AV	54.0	-8.2	2.40 V	28	48.9	-3.1
3	*2437.00	103.7 PK			2.40 V	28	106.8	-3.1
4	*2437.00	93.5 AV			2.40 V	28	96.6	-3.1
5	2483.50	57.4 PK	74.0	-16.6	2.40 V	28	60.5	-3.1
6	2483.50	46.3 AV	54.0	-7.7	2.40 V	28	49.4	-3.1
7	4874.00	40.0 PK	74.0	-34.0	1.45 V	177	38.9	1.1
8	4874.00	32.9 AV	54.0	-21.1	1.45 V	177	31.8	1.1
9	7311.00	45.5 PK	74.0	-28.5	1.72 V	353	38.2	7.3
10	7311.00	35.0 AV	54.0	-19.0	1.72 V	353	27.7	7.3

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	108.9 PK			2.25 H	12	112.0	-3.1
2	*2462.00	98.1 AV			2.25 H	12	101.2	-3.1
3	2483.50	66.7 PK	74.0	-7.3	2.25 H	12	69.8	-3.1
4	2483.50	50.8 AV	54.0	-3.2	2.25 H	12	53.9	-3.1
5	4924.00	39.3 PK	74.0	-34.7	1.68 H	190	38.1	1.2
6	4924.00	31.8 AV	54.0	-22.2	1.68 H	190	30.6	1.2
7	7386.00	42.8 PK	74.0	-31.2	1.65 H	175	35.4	7.4
8	7386.00	34.5 AV	54.0	-19.5	1.65 H	175	27.1	7.4

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	*2462.00	99.5 PK			2.43 V	29	102.6	-3.1
2	*2462.00	88.6 AV			2.43 V	29	91.7	-3.1
3	2483.50	57.0 PK	74.0	-17.0	2.43 V	29	60.1	-3.1
4	2483.50	46.0 AV	54.0	-8.0	2.43 V	29	49.1	-3.1
5	4924.00	44.3 PK	74.0	-29.7	1.41 V	201	43.1	1.2
6	4924.00	37.8 AV	54.0	-16.2	1.41 V	201	36.6	1.2
7	7386.00	45.6 PK	74.0	-28.4	1.66 V	346	38.2	7.4
8	7386.00	37.0 AV	54.0	-17.0	1.66 V	346	29.6	7.4

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.
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	64.2 PK	74.0	-9.8	2.30 H	25	67.3	-3.1
2	2390.00	50.4 AV	54.0	-3.6	2.30 H	25	53.5	-3.1
3	*2412.00	107.8 PK			2.30 H	25	110.9	-3.1
4	*2412.00	97.7 AV			2.30 H	25	100.8	-3.1
5	4824.00	39.1 PK	74.0	-34.9	1.77 H	157	37.9	1.2
6	4824.00	31.3 AV	54.0	-22.7	1.77 H	157	30.1	1.2

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	56.8 PK	74.0	-17.2	2.36 V	14	59.9	-3.1
2	2390.00	45.3 AV	54.0	-8.7	2.36 V	14	48.4	-3.1
3	*2412.00	95.0 PK			2.36 V	14	98.1	-3.1
4	*2412.00	86.4 AV			2.36 V	14	89.5	-3.1
5	4824.00	43.5 PK	74.0	-30.5	1.43 V	200	42.3	1.2
6	4824.00	37.0 AV	54.0	-17.0	1.43 V	200	35.8	1.2

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	2.22 H	14	58.6	-3.1
2	2390.00	43.2 AV	54.0	-10.8	2.22 H	14	46.3	-3.1
3	*2437.00	112.5 PK			2.22 H	14	115.6	-3.1
4	*2437.00	102.5 AV			2.22 H	14	105.6	-3.1
5	2483.50	55.4 PK	74.0	-18.6	2.22 H	14	58.5	-3.1
6	2483.50	42.6 AV	54.0	-11.4	2.22 H	14	45.7	-3.1
7	4874.00	39.1 PK	74.0	-34.9	1.70 H	186	38.0	1.1
8	4874.00	31.6 AV	54.0	-22.4	1.70 H	186	30.5	1.1
9	7311.00	43.2 PK	74.0	-30.8	1.68 H	183	35.9	7.3
10	7311.00	34.9 AV	54.0	-19.1	1.68 H	183	27.6	7.3

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	57.4 PK	74.0	-16.6	2.35 V	16	60.5	-3.1
2	2390.00	46.2 AV	54.0	-7.8	2.35 V	16	49.3	-3.1
3	*2437.00	104.1 PK			2.35 V	16	107.2	-3.1
4	*2437.00	93.9 AV			2.35 V	16	97.0	-3.1
5	2483.50	58.0 PK	74.0	-16.0	2.35 V	16	61.1	-3.1
6	2483.50	46.8 AV	54.0	-7.2	2.35 V	16	49.9	-3.1
7	4874.00	44.3 PK	74.0	-29.7	1.46 V	194	43.2	1.1
8	4874.00	37.8 AV	54.0	-16.2	1.46 V	194	36.7	1.1
9	7311.00	45.3 PK	74.0	-28.7	1.71 V	360	38.0	7.3
10	7311.00	36.7 AV	54.0	-17.3	1.71 V	360	29.4	7.3

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	106.7 PK			2.20 H	360	109.8	-3.1
2	*2462.00	97.3 AV			2.20 H	360	100.4	-3.1
3	2483.50	66.5 PK	74.0	-7.5	2.20 H	360	69.6	-3.1
4	2483.50	48.4 AV	54.0	-5.6	2.20 H	360	51.5	-3.1
5	4924.00	39.6 PK	74.0	-34.4	1.71 H	169	38.4	1.2
6	4924.00	31.7 AV	54.0	-22.3	1.71 H	169	30.5	1.2
7	7386.00	43.3 PK	74.0	-30.7	1.70 H	171	35.9	7.4
8	7386.00	35.3 AV	54.0	-18.7	1.70 H	171	27.9	7.4

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	*2462.00	96.0 PK			2.40 V	32	99.1	-3.1
2	*2462.00	87.2 AV			2.40 V	32	90.3	-3.1
3	2483.50	56.7 PK	74.0	-17.3	2.40 V	32	59.8	-3.1
4	2483.50	45.8 AV	54.0	-8.2	2.40 V	32	48.9	-3.1
5	4924.00	44.0 PK	74.0	-30.0	1.46 V	184	42.8	1.2
6	4924.00	37.5 AV	54.0	-16.5	1.46 V	184	36.3	1.2
7	7386.00	46.1 PK	74.0	-27.9	1.76 V	353	38.7	7.4
8	7386.00	37.0 AV	54.0	-17.0	1.76 V	353	29.6	7.4

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.
5. " * ": Fundamental frequency.

Below 1GHz Data:

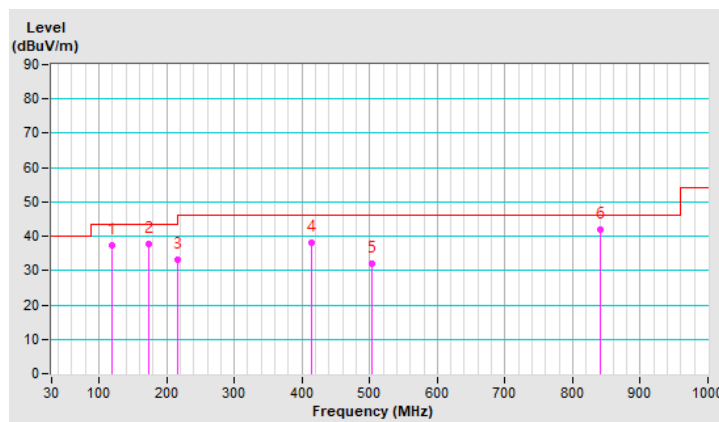
802.11n (HT20)

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	120.10	37.5 QP	43.5	-6.0	2.25 H	248	52.4	-14.9
2	174.14	37.8 QP	43.5	-5.7	1.75 H	282	51.3	-13.5
3	216.13	33.3 QP	46.0	-12.7	1.25 H	0	49.2	-15.9
4	414.14	38.2 QP	46.0	-7.8	1.50 H	318	47.6	-9.4
5	504.07	32.1 QP	46.0	-13.9	2.50 H	116	39.4	-7.3
6	840.24	41.9 QP	46.0	-4.1	1.75 H	332	43.8	-1.9

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.

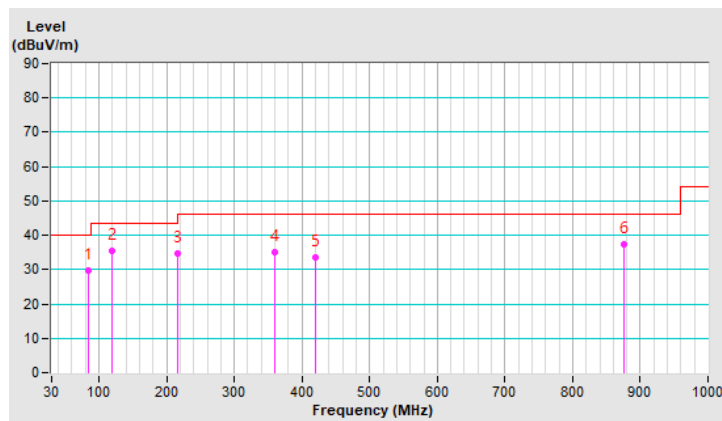


CHANNEL	TX Channel 6	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	84.30	29.7 QP	40.0	-10.3	1.75 V	312	47.9	-18.2
2	120.09	35.6 QP	43.5	-7.9	2.50 V	313	50.5	-14.9
3	216.21	34.8 QP	46.0	-11.2	1.50 V	209	50.7	-15.9
4	359.72	35.2 QP	46.0	-10.8	2.00 V	349	45.9	-10.7
5	420.24	33.7 QP	46.0	-12.3	1.50 V	314	42.9	-9.2
6	876.23	37.2 QP	46.0	-8.8	1.50 V	253	38.8	-1.6

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. 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.

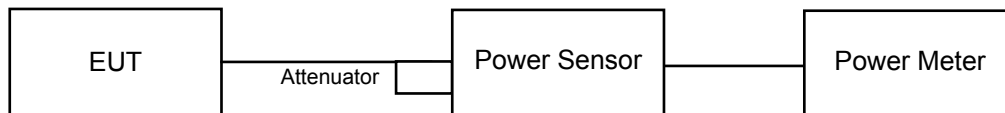


4.2 Conducted Output Power Measurement

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	145.546	21.63	30.00	Pass
11	2462	102.802	20.12	30.00	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	174.181	22.41	30.00	Pass
6	2437	277.971	24.44	30.00	Pass
11	2462	154.17	21.88	30.00	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	165.196	22.18	30.00	Pass
6	2437	281.19	24.49	30.00	Pass
11	2462	157.761	21.98	30.00	Pass

FOR AVERAGE POWER

802.11b

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	63.973	18.06
6	2437	90.573	19.57
11	2462	62.517	17.96

802.11g

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	40.179	16.04
6	2437	80.538	19.06
11	2462	34.435	15.37

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	34.435	15.37
6	2437	68.234	18.34
11	2462	31.405	14.97

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:

Lin Kou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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