

FCC Test Report (BT-EDR)

Report No.: RF160819E01D-1

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 16, 2018

Issued Date: May 23, 2018

Applicant: UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

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

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Taiwan R.O.C.

Test Location : E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
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**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RF160819E01D-1	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.

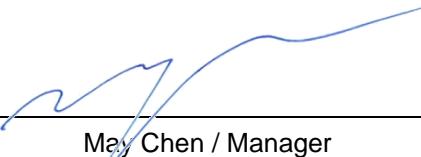
Test Date: May 10 to 16, 2018

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
15.247(b)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.205 & 209 & 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -11.3dB at 944.37MHz.

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 (BT-EDR)

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	GFSK, π/4-DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	Up to 3Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	79
Output Power	5.929mW
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-1 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 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

79 channels are provided for BT-EDR mode:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

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 **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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	0, 39, 78	FHSS	GFSK	DH5
0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	78	FHSS	GFSK	DH5

Antenna Port Conducted Measurement:

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

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	0, 39, 78	FHSS	GFSK	DH5
0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥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 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.

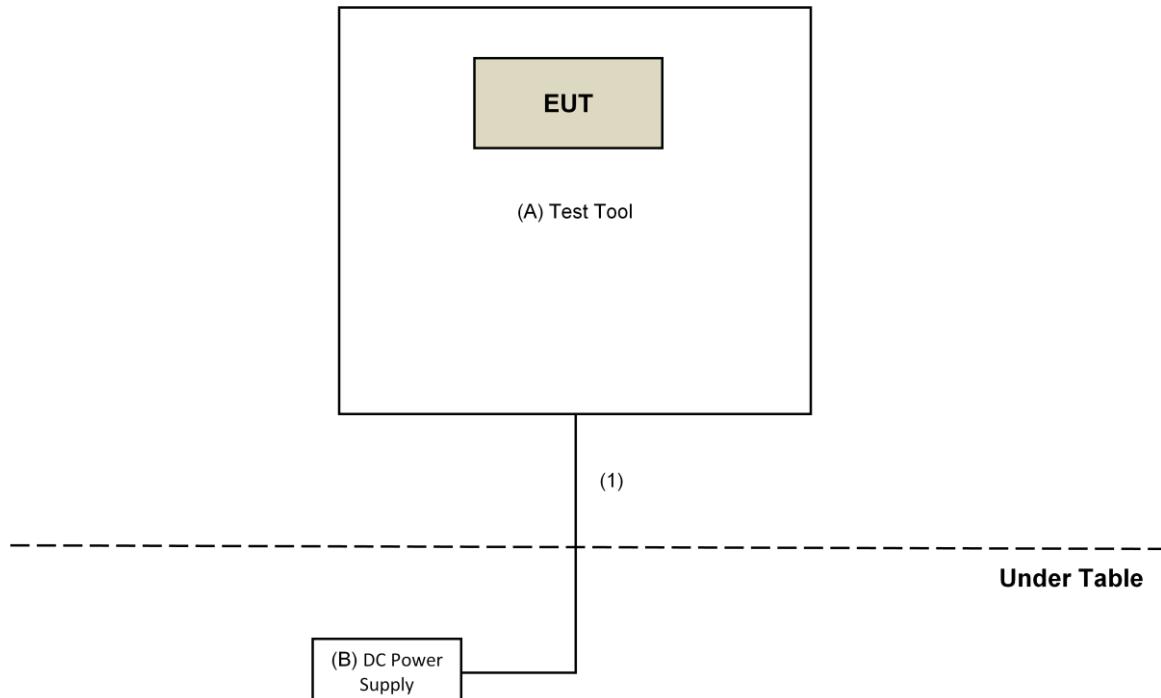
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Test Tool	NA	NA	NA	NA	Supplied by client
B.	DC Power Supply	GOOD WILL INSTRUMENT CO., LTD.	GPC-3030D	7700087	NA	Provided by Lab

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

3.3.1 Configuration of System under Test



3.4 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)

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 16, 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:

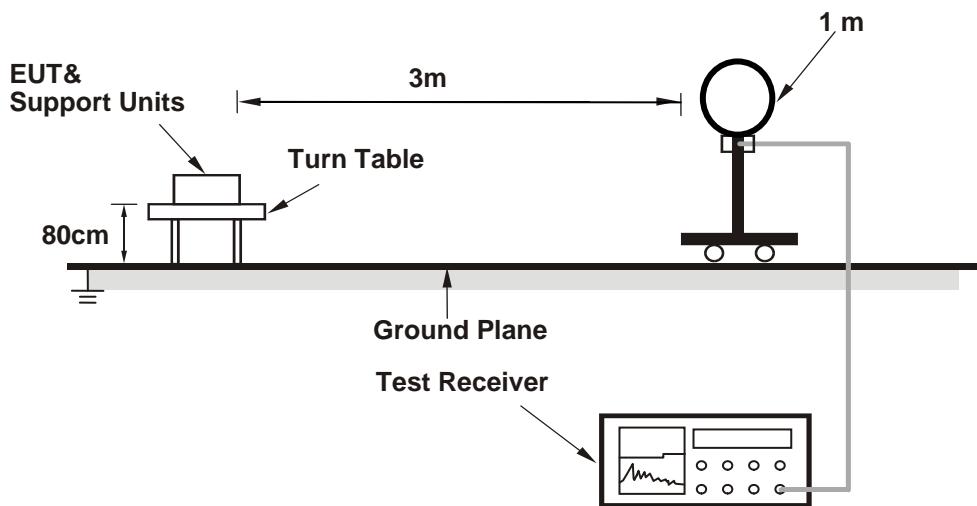
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

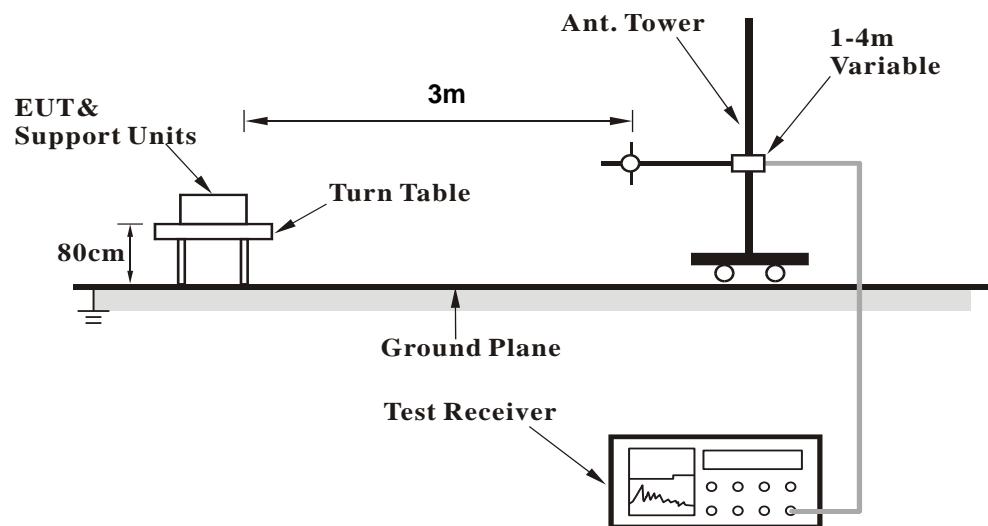
No deviation.

4.1.5 Test Setup

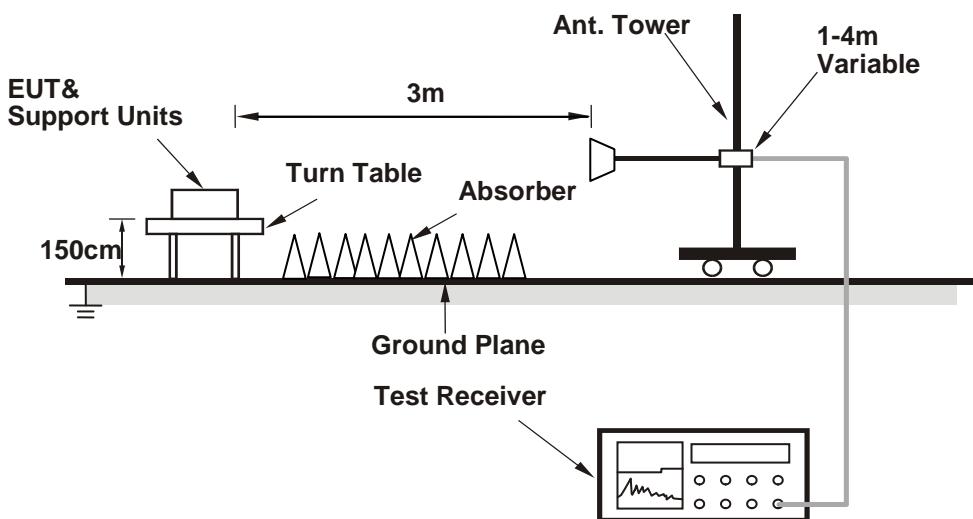
For Radiated emission below 30MHz



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

- Connected the EUT with the Laptop.
- 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:

BT_GFSK

CHANNEL	TX Channel 0	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	54.8 PK	74.0	-19.2	1.02 H	89	57.0	-2.2
2	2390.00	42.2 AV	54.0	-11.8	1.02 H	89	44.4	-2.2
3	*2402.00	103.8 PK			1.02 H	89	106.1	-2.3
4	*2402.00	73.7 AV			1.02 H	89	76.0	-2.3
5	4804.00	42.1 PK	74.0	-31.9	1.46 H	315	40.3	1.8
6	4804.00	12.0 AV	54.0	-42.0	1.46 H	315	10.2	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	53.9 PK	74.0	-20.1	2.01 V	263	56.1	-2.2
2	2390.00	42.0 AV	54.0	-12.0	2.01 V	263	44.2	-2.2
3	*2402.00	92.3 PK			2.01 V	263	94.6	-2.3
4	*2402.00	62.2 AV			2.01 V	263	64.5	-2.3
5	4804.00	41.6 PK	74.0	-32.4	1.58 V	221	39.8	1.8
6	4804.00	11.5 AV	54.0	-42.5	1.58 V	221	9.7	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.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on $0.625 * 5$ per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: $20\log(3.125 / 100) = -30.1$ dB
7. The average value of fundamental and harmonic frequency is: Average = Peak value + $20 \log(\text{Duty cycle})$

CHANNEL	TX Channel 39	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	*2441.00	103.2 PK			1.01 H	87	105.8	-2.6
2	*2441.00	73.1 AV			1.01 H	87	75.7	-2.6
3	4882.00	41.5 PK	74.0	-32.5	1.96 H	257	39.5	2.0
4	4882.00	11.4 AV	54.0	-42.6	1.96 H	257	9.4	2.0
5	7323.00	47.8 PK	74.0	-26.2	1.63 H	219	39.4	8.4
6	7323.00	17.7 AV	54.0	-36.3	1.63 H	219	9.3	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	*2441.00	91.9 PK			2.05 V	264	94.5	-2.6
2	*2441.00	61.8 AV			2.05 V	264	64.4	-2.6
3	4882.00	42.3 PK	74.0	-31.7	1.96 V	259	40.3	2.0
4	4882.00	12.2 AV	54.0	-41.8	1.96 V	259	10.2	2.0
5	7323.00	46.9 PK	74.0	-27.1	1.53 V	206	38.5	8.4
6	7323.00	16.8 AV	54.0	-37.2	1.53 V	206	8.4	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.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: $20\log(3.125 / 100) = -30.1$ dB
7. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle)

CHANNEL	TX Channel 78	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	*2480.00	103.3 PK			1.00 H	107	105.9	-2.6
2	*2480.00	73.2 AV			1.00 H	107	75.8	-2.6
3	2483.50	54.3 PK	74.0	-19.7	1.00 H	107	56.7	-2.4
4	2483.50	24.2 AV	54.0	-29.8	1.00 H	107	26.6	-2.4
5	4960.00	39.5 PK	74.0	-34.5	1.48 H	221	37.4	2.1
6	4960.00	9.4 AV	54.0	-44.6	1.48 H	221	7.3	2.1
7	7440.00	44.7 PK	74.0	-29.3	1.25 H	351	35.9	8.8
8	7440.00	14.6 AV	54.0	-39.4	1.25 H	351	5.8	8.8

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	*2480.00	92.0 PK			1.98 V	265	94.6	-2.6
2	*2480.00	61.9 AV			1.98 V	265	64.5	-2.6
3	2483.50	54.0 PK	74.0	-20.0	1.98 V	265	56.4	-2.4
4	2483.50	23.9 AV	54.0	-30.1	1.98 V	265	26.3	-2.4
5	4960.00	39.9 PK	74.0	-34.1	1.36 V	152	37.8	2.1
6	4960.00	9.8 AV	54.0	-44.2	1.36 V	152	7.7	2.1
7	7440.00	45.6 PK	74.0	-28.4	2.51 V	89	36.8	8.8
8	7440.00	15.5 AV	54.0	-38.5	2.51 V	89	6.7	8.8

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.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: $20\log(3.125 / 100) = -30.1$ dB
7. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle)

BT_8DPSK

CHANNEL	TX Channel 0	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	54.9 PK	74.0	-19.1	1.02 H	85	57.1	-2.2
2	2390.00	42.2 AV	54.0	-11.8	1.02 H	85	44.4	-2.2
3	*2402.00	108.0 PK			1.02 H	85	110.3	-2.3
4	*2402.00	77.9 AV			1.02 H	85	80.2	-2.3
5	4804.00	41.2 PK	74.0	-32.8	2.15 H	89	39.4	1.8
6	4804.00	11.1 AV	54.0	-42.9	2.15 H	89	9.3	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	49.6 PK	74.0	-24.4	2.00 V	262	51.8	-2.2
2	2390.00	42.1 AV	54.0	-11.9	2.00 V	262	44.3	-2.2
3	*2402.00	95.3 PK			2.00 V	262	97.6	-2.3
4	*2402.00	65.2 AV			2.00 V	262	67.5	-2.3
5	4804.00	41.6 PK	74.0	-32.4	2.05 V	226	39.8	1.8
6	4804.00	11.5 AV	54.0	-42.5	2.05 V	226	9.7	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.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: $20\log(3.125 / 100) = -30.1$ dB
7. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle)

CHANNEL	TX Channel 39	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	*2441.00	107.6 PK			1.00 H	84	110.2	-2.6
2	*2441.00	77.5 AV			1.00 H	84	80.1	-2.6
3	4882.00	39.3 PK	74.0	-34.7	1.03 H	116	37.3	2.0
4	4882.00	9.2 AV	54.0	-44.8	1.03 H	116	7.2	2.0
5	7323.00	44.9 PK	74.0	-29.1	1.46 H	225	36.5	8.4
6	7323.00	14.8 AV	54.0	-39.2	1.46 H	225	6.4	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	*2441.00	95.2 PK			1.98 V	277	97.8	-2.6
2	*2441.00	65.1 AV			1.98 V	277	67.7	-2.6
3	4882.00	39.3 PK	74.0	-34.7	1.00 V	100	37.3	2.0
4	4882.00	9.2 AV	54.0	-44.8	1.00 V	100	7.2	2.0
5	7323.00	44.6 PK	74.0	-29.4	1.43 V	230	36.2	8.4
6	7323.00	14.5 AV	54.0	-39.5	1.43 V	230	6.1	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.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: $20\log(3.125 / 100) = -30.1$ dB
7. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle)

CHANNEL	TX Channel 78	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	*2480.00	107.5 PK			1.03 H	76	110.1	-2.6
2	*2480.00	77.4 AV			1.03 H	76	80.0	-2.6
3	2483.50	54.5 PK	74.0	-19.5	1.03 H	76	56.9	-2.4
4	2483.50	24.4 AV	54.0	-29.6	1.03 H	76	26.8	-2.4
5	4960.00	39.8 PK	74.0	-34.2	2.63 H	212	37.7	2.1
6	4960.00	9.7 AV	54.0	-44.3	2.63 H	212	7.6	2.1
7	7440.00	45.5 PK	74.0	-28.5	1.03 H	122	36.7	8.8
8	7440.00	15.4 AV	54.0	-38.6	1.03 H	122	6.6	8.8

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	*2480.00	95.3 PK			2.01 V	253	97.9	-2.6
2	*2480.00	65.2 AV			2.01 V	253	67.8	-2.6
3	2483.50	54.3 PK	74.0	-19.7	2.01 V	253	56.7	-2.4
4	2483.50	24.2 AV	54.0	-29.8	2.01 V	253	26.6	-2.4
5	4960.00	39.6 PK	74.0	-34.4	1.94 V	68	37.5	2.1
6	4960.00	9.5 AV	54.0	-44.5	1.94 V	68	7.4	2.1
7	7440.00	45.2 PK	74.0	-28.8	2.68 V	199	36.4	8.8
8	7440.00	15.1 AV	54.0	-38.9	2.68 V	199	6.3	8.8

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.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on $0.625 * 5$ per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: $20\log(3.125 / 100) = -30.1$ dB
7. The average value of fundamental and harmonic frequency is: Average = Peak value + $20 \log(\text{Duty cycle})$

Below 1GHz Worst-Case Data
BT_GFSK

CHANNEL	TX Channel 78	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	105.88	30.0 QP	43.5	-13.5	1.50 H	299	41.4	-11.4
2	157.51	25.5 QP	43.5	-18.0	1.00 H	84	33.1	-7.6
3	214.81	28.8 QP	43.5	-14.7	1.00 H	151	40.0	-11.2
4	529.82	28.6 QP	46.0	-17.4	1.00 H	200	29.9	-1.3
5	558.48	29.1 QP	46.0	-16.9	1.50 H	97	29.8	-0.7
6	701.68	31.6 QP	46.0	-14.4	2.00 H	237	29.7	1.9
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	106.98	27.9 QP	43.5	-15.6	1.00 V	341	39.1	-11.2
2	157.30	25.7 QP	43.5	-17.8	1.50 V	100	33.3	-7.6
3	186.15	23.8 QP	43.5	-19.7	1.50 V	279	34.0	-10.2
4	420.01	23.7 QP	46.0	-22.3	1.50 V	126	27.3	-3.6
5	880.79	32.8 QP	46.0	-13.2	1.50 V	286	27.8	5.0
6	944.37	34.7 QP	46.0	-11.3	1.00 V	259	28.5	6.2

REMARKS:

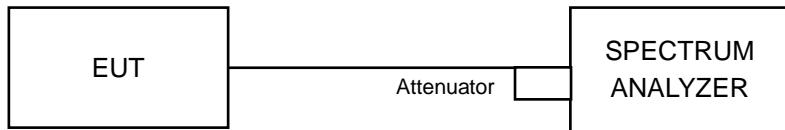
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.2 Maximum Output Power

4.2.1 Limits of Maximum Output Power Measurement

The Maximum Output Power Measurement is 125mW.

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 Procedure

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10 MHz VBW.
- d. Detector = peak.
- e. Measure the captured power within the band and recording the plot.
- f. Repeat above procedures until all frequencies required were complete.

4.2.5 Deviation from Test Standard

No deviation.

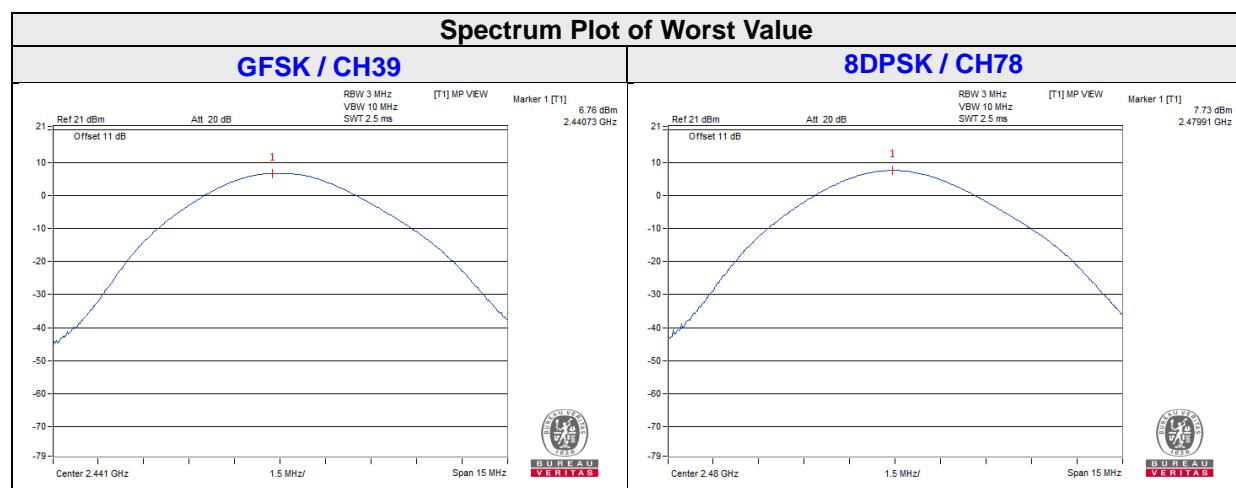
4.2.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.2.7 Test Results

FOR PEAK POWER

Channel	Frequency (MHz)	Output Power (mW)		Output Power (dBm)		Power Limit (mW)	Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	4.498	4.498	6.53	6.53	125	Pass
39	2441	4.742	5.47	6.76	7.38	125	Pass
78	2480	4.656	5.929	6.68	7.73	125	Pass



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:

Linko EMC/RF Lab

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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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