

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)

Report No.: RFBICM-WTW-P22110528B-1

FCC ID: S9E-125500

Product: Rugged Handheld Computer

Brand: 

Model No.: 125500

Received Date: 2023/11/13

Test Date: 2024/1/5 ~ 2024/2/5

Issued Date: 2024/2/7

Applicant: Trimble Inc.

Address: 5475 Kellenburger Road, Dayton, Ohio, 45424

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

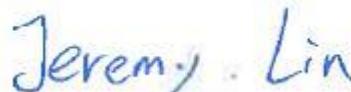
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FCC Registration / 788550 / TW0003

Designation Number:

Approved by: _____



, **Date:** _____

2024/2/7

Jeremy Lin / Project Engineer

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Prepared by : Gina Liu / Specialist



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Release Control Record

Issue No.	Description	Date Issued
RFBICM-WTW-P22110528B-1	Original release.	2024/2/7

1 Certificate

Product: Rugged Handheld Computer

Brand: 

Test Model: 125500

Sample Status: Engineering sample

Applicant: Trimble Inc.

Test Date: 2024/1/5 ~ 2024/2/5

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)

Measurement
procedure: ANSI C63.10-2013

KDB 558074 D01 15.247 Meas Guidance v05r02

KDB 662911 D01 Multiple Transmitter Output v02r01

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 RF characteristics under the conditions specified in this report.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
Standard / Clause	Test Item	Result	Remark
15.247(b)	RF Output Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	N/A	Refer to Note 1
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to Note 1
15.247(d)	Conducted Out of Band Emissions	N/A	Refer to Note 1
15.207	AC Power Conducted Emissions	N/A	Refer to Note 1
15.205 / 15.209 / 15.247(d)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -11.1 dB at 77.53 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -1.4 dB at 2483.50 MHz
15.203	Antenna Requirement	Pass	Antenna connector is shrapnel not a standard connector.

Note:

1. Only RF Output Power and Unwanted Emissions tests were performed for this addendum. Refer to original report for other test data.
2. 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	Specification	Expanded Uncertainty (k=2) (\pm)
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	3.59 dB
	30 MHz ~ 1 GHz	3.6 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 18 GHz	2.29 dB
	18 GHz ~ 40 GHz	2.29 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description

Product	Rugged Handheld Computer
Brand	Trimble SPECTRA
Test Model	125500
Status of EUT	Engineering sample
Power Supply Rating	Refer to note
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDMA
Modulation Technology	DSSS, OFDM, OFDMA
Transfer Rate	802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to 300 Mbps 802.11ax: up to 573.5 Mbps
Operating Frequency	2.412 GHz ~ 2.462 GHz
Number of Channel	802.11b, 802.11g, 802.11n (HT20), 802.11ax (HE20): 11 802.11n (HT40), 802.11ax (HE40): 7
Output Power	38.905 mW (15.90 dBm)

Note:

1. This report is prepared for FCC class II permissive change. This report is issued as a supplementary report to BV CPS report no.: RFBICM-WTW-P22110528-3. The difference compared with original report are disable 802.11b/g/a MIMO and reducing the power. Therefore, only test item of RF Output Power and Unwanted Emissions tests were performed for this report. For unwanted emission test items, select the worst radiated emission mode based on the original report. Other testing data please refer to original report.

2. The EUT uses following accessories.

Battery		
Brand	Model	Specification
LIFUN	1400-900069G	Manufacturer : LIFUN TECHNOLOGY CO.,LTD. Power Rating : 3.85 Vdc 4950mAh
USB Cable		
Brand	Model	Specification
Trimble	121920	Signal Line : 2 meters, shielded cable. w/o ferrite core

3. 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 Antenna Description of EUT

1. The antenna information is listed as below.

Antenna No.	Gain (dBi)	Antenna Type	Connector Type
	2400~2483.5 MHz		
3 (Chain0)	0.02	LDS	shrapnel
2 (Chain1)	-2.1	LDS	shrapnel

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

2. The EUT incorporates a MIMO function:

2.4 GHz Band		
Modulation Mode	TX & RX Configuration	
802.11b	1Tx Fixed Chain 0	1Rx
802.11g	1Tx Fixed Chain 0	1Rx
802.11n (HT20)	2TX	2RX
802.11n (HT40)	2TX	2RX
802.11ax (HE20)	2TX	2RX
802.11ax (HE40)	2TX	2RX

Note:

1. All of modulation mode support beamforming function except 802.11b modulation mode.
2. The EUT support Beamforming and CDD mode, therefore both mode were investigated and the worst case scenario was identified. The worst case data were presented in test report.
3. The modulation and bandwidth are similar for 802.11n mode for 20 MHz (40 MHz) and 802.11ax mode for 20 MHz (40 MHz), therefore the investigated worst case to representative mode in test report.
4. Partial RU (resource units) and channel puncturing/bandwidth reduction configurations are not supported.

3.3 Channel List

11 channels are provided for 802.11b, 802.11g, 802.11n (HT20), 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
1	2412 MHz	7	2442 MHz
2	2417 MHz	8	2447 MHz
3	2422 MHz	9	2452 MHz
4	2427 MHz	10	2457 MHz
5	2432 MHz	11	2462 MHz
6	2437 MHz		

7 channels are provided for 802.11n (HT40), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
3	2422 MHz	7	2442 MHz
4	2427 MHz	8	2447 MHz
5	2432 MHz	9	2452 MHz
6	2437 MHz		

3.4 Test Mode Applicability and Tested Channel Detail

Pre-Scan:	1. EUT can be used in the following ways: X-axis/ Y-axis/ Z-axis. Pre-scan these ways and find the worst case as a representative test condition.					
Worst Case:	1. X-axis/ Y-axis/ Z-axis Worst Condition: Y-axis					

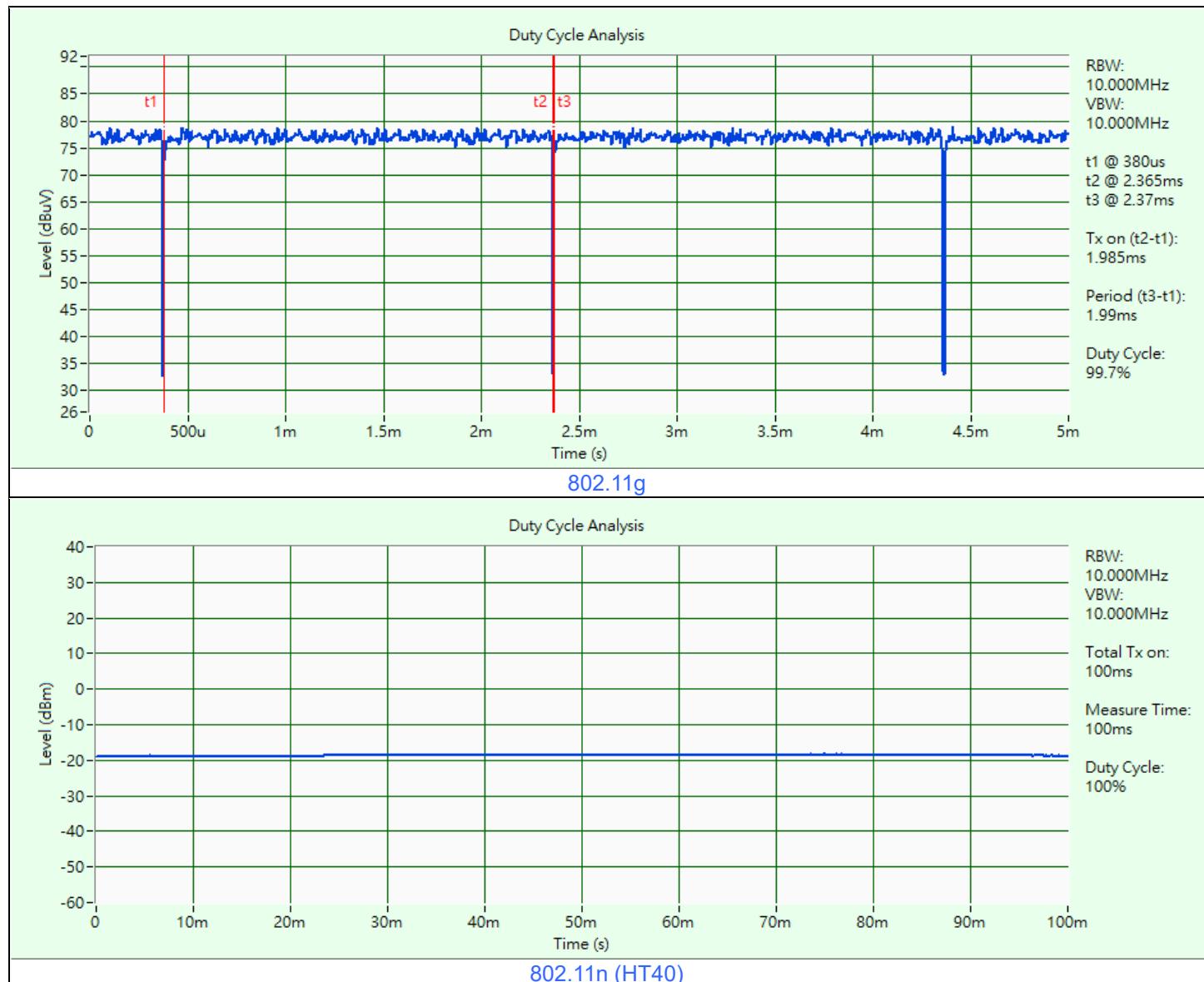
Following channel(s) was (were) selected for the final test as listed below:

Test Item	EUT Configure Mode	Mode	Signal Mode	Tested Channel	Modulation	Data Rate Parameter
RF Output Power	A	802.11b	CDD	1, 6, 11	DBPSK	1Mb/s
		802.11g	CDD	1, 6, 11	BPSK	6Mb/s
	A, B, C	802.11n (HT20)	CDD & Beamforming	1, 6, 11	BPSK	MCS0
		802.11n (HT40)	CDD & Beamforming	3, 6, 9	BPSK	MCS0
		802.11ax (HE20)	CDD & Beamforming	1, 6, 11	BPSK	MCS0
		802.11ax (HE40)	CDD & Beamforming	3, 6, 9	BPSK	MCS0
Unwanted Emissions below 1 GHz	B	802.11n (HT40)	CDD	9	DBPSK	1Mb/s
Unwanted Emissions above 1 GHz	A	802.11g	CDD	1	BPSK	6Mb/s
	B	802.11n (HT40)	CDD	9	BPSK	MCS0
EUT Configure Mode:	A	Antenna Chain 0				
	B	Antenna Chain 1				
	C	Antenna Chain 0+1				

3.5 Duty Cycle of Test Signal

802.11g: Duty cycle = $1.985 \text{ ms} / 1.99 \text{ ms} \times 100\% = 99.7\%$

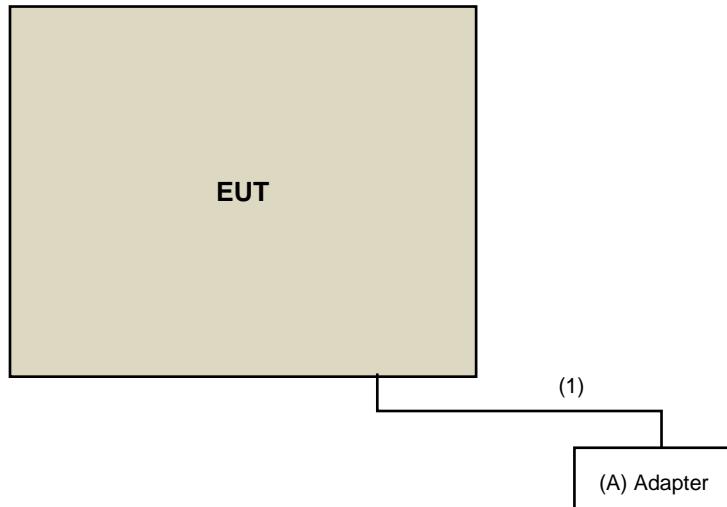
802.11n (HT20): Duty cycle = $100 \text{ ms} / 100 \text{ ms} \times 100\% = 100.0\%$



3.6 Test Program Used and Operation Descriptions

Controlling software QRCT 4.0 Version 4.0.00166.0 has been activated to set the EUT under transmission condition continuously at specific channel frequency.

3.7 Connection Diagram of EUT and Peripheral Devices



Under Table

Remote Site

3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Adapter	FULLPOWER	TYPE-C45IC	N/A	N/A	Supplied by applicant

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	Type-C Cable	1	2	Yes	0	Supplied by applicant

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 RF Output Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Peak Power Analyzer Keysight	8990B	MY51000485	2023/1/19	2024/1/18
Wideband Power Sensor Keysight	N1923A	MY58020002	2023/1/18	2024/1/17
		MY58140009	2023/1/18	2024/1/17

Notes:

1. The test was performed in Oven room.
2. Tested Date: 2024/1/10

4.2 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn BV ADT	AT100	AT93021705	N/A	N/A
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Spectrum Analyzer R&S	FSW43	101867	2023/12/29	2024/12/28
Test Receiver KEYSIGHT	N9038A	MY55420137	2023/5/3	2024/5/2
Turn Table BV ADT	TT100	TT93021705	N/A	N/A
Turn Table Controller BV ADT	SC100	SC93021705	N/A	N/A
Preamplifier Agilent	8447D	2944A10638	2023/5/7	2024/5/6
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-160	2023/10/17	2024/10/16
RF Coaxial Cable Woken	8D-FB	Cable-CH9-01	2023/5/7	2024/5/6

Notes:

1. The test was performed in HY - 966 chamber 4.
2. Tested Date: 2024/1/23

4.3 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn BV ADT	AT100	AT93021705	N/A	N/A
Boresight antenna tower fixture BV	BAF-02	5	N/A	N/A
Horn Antenna Schwarzbeck	9120D	9120D-1169	2023/11/12	2024/11/11
	BBHA 9170	9170-480	2023/11/12	2024/11/11
		BBHA9170243	2023/11/12	2024/11/11
Pre-Ammlifier EMCI	EMC 184045	980116	2023/9/27	2024/9/26
Preamplifier Agilent	8449B	3008A02367	2023/2/15	2024/2/14
RF Coaxial Cable EMCI	EMC102-KM-KM-600	150928	2023/7/8	2024/7/7
	EMC102-KM-KM-3000	150929	2023/7/8	2024/7/7
RF Coaxial Cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	2024/1/6	2025/1/5
RF Coaxial Cable HUBER+SUHNER&EMCI	SUCOFLEX 104& EMC104-SM-SM8000	CABLE-CH9-02 (248780+171006)	2024/1/6	2025/1/5
RF FLITER MICRO-TRONICS	BRM17690	004	2024/1/23	2025/1/22
		011	2023/5/7	2024/5/6
	BRM50716	060	2023/12/25	2024/12/24
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Spectrum Analyzer R&S	FSW43	101867	2023/12/29	2024/12/28
Test Receiver KEYSIGHT	N9038A	MY55420137	2023/5/3	2024/5/2
Turn Table BV ADT	TT100	TT93021705	N/A	N/A
Turn Table Controller BV ADT	SC100	SC93021705	N/A	N/A

Notes:

1. The test was performed in HY - 966 chamber 4.
2. Tested Date: 2024/2/5

5 Limits of Test Items

5.1 RF Output Power

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

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less, for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

5.2 Unwanted Emissions below 1 GHz

Radiated emissions up to 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 30 dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	$2400/F(\text{kHz})$	300
0.490 ~ 1.705	$24000/F(\text{kHz})$	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = $20 \log$ Emission level (uV/m).

5.3 Unwanted Emissions above 1 GHz

Radiated emissions above 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 30 dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
Above 960	500	3

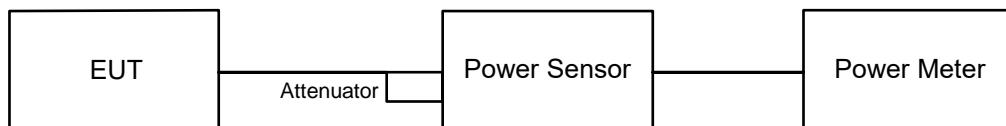
Notes:

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 1000 MHz, 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 20 dB under any condition of modulation.

6 Test Arrangements

6.1 RF Output Power

6.1.1 Test Setup



6.1.2 Test Procedure

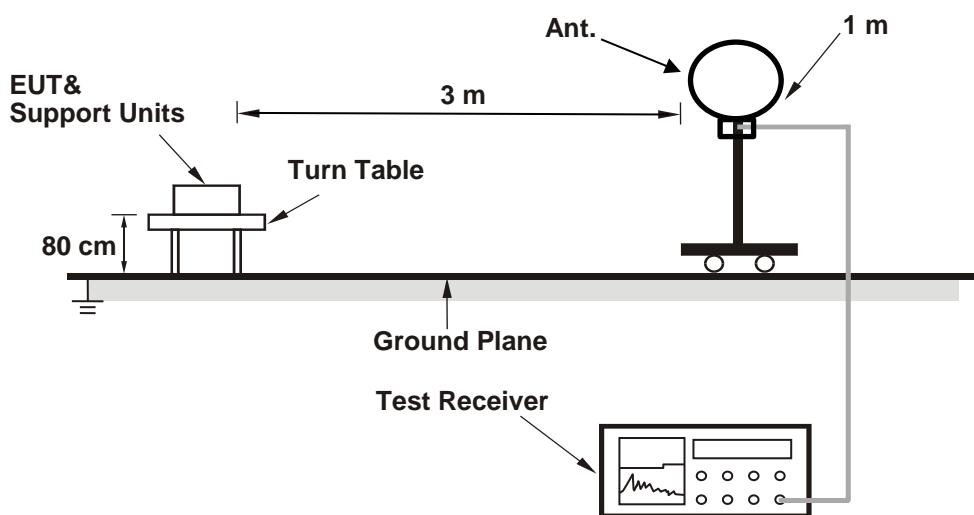
Average Power:

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.

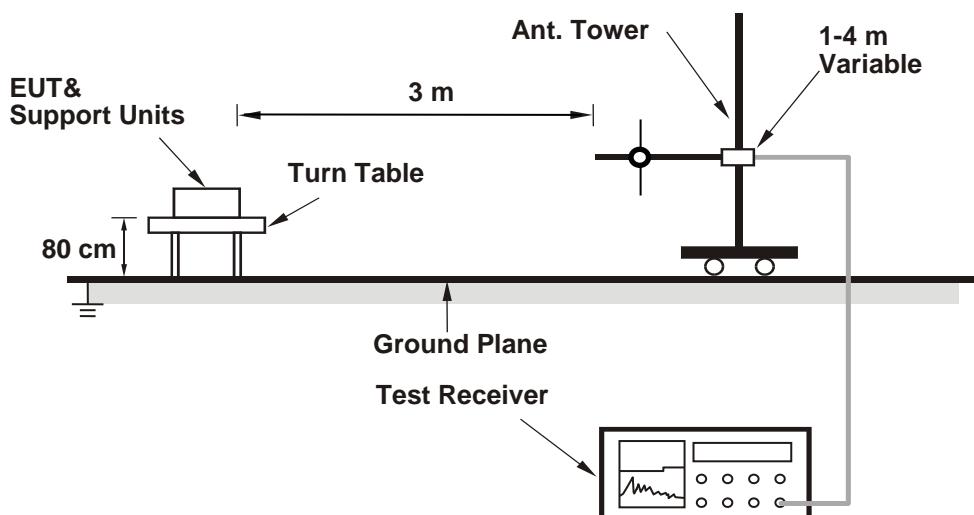
6.2 Unwanted Emissions below 1 GHz

6.2.1 Test Setup

For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



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

6.2.2 Test Procedure

For Radiated emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters 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. 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, except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
3. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission above 30 MHz

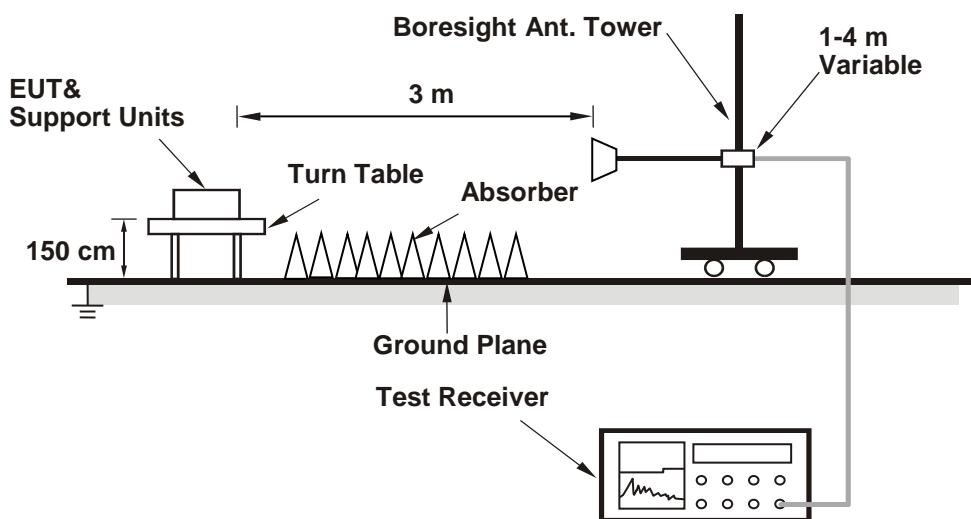
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the 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.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

6.3 Unwanted Emissions above 1 GHz

6.3.1 Test Setup



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

6.3.2 Test Procedure

- a. The EUT was placed on the top of a rotating table 1.5 meters 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 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.

Notes:

1. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz.
2. For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10 Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1 GHz.
3. All modes of operation were investigated and the worst-case emissions are reported.

7 Test Results of Test Item

7.1 RF Output Power

Input Power:	3.85 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Chris Lin
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Mode A

802.11b

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
1	2412	9.840	9.93	30	Pass
6	2437	9.683	9.86	30	Pass
11	2462	9.954	9.98	30	Pass

802.11g

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
1	2412	9.772	9.90	30	Pass
6	2437	9.594	9.82	30	Pass
11	2462	9.840	9.93	30	Pass

802.11n (HT20)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
1	2412	9.572	9.81	30	Pass
6	2437	9.817	9.92	30	Pass
11	2462	9.397	9.73	30	Pass

802.11n (HT40)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
3	2422	9.506	9.78	30	Pass
6	2437	9.750	9.89	30	Pass
9	2452	9.311	9.69	30	Pass

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
1	2412	9.506	9.78	30	Pass
6	2437	9.750	9.89	30	Pass
11	2462	9.311	9.69	30	Pass

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
3	2422	9.354	9.71	30	Pass
6	2437	9.550	9.80	30	Pass
9	2452	9.397	9.73	30	Pass

Mode B
802.11n (HT20)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
1	2412	38.815	15.89	30	Pass
6	2437	38.459	15.85	30	Pass
11	2462	38.019	15.80	30	Pass

802.11n (HT40)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
3	2422	38.726	15.88	30	Pass
6	2437	38.282	15.83	30	Pass
9	2452	38.905	15.90	30	Pass

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
1	2412	38.726	15.88	30	Pass
6	2437	38.726	15.88	30	Pass
11	2462	38.282	15.83	30	Pass

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
3	2422	38.815	15.89	30	Pass
6	2437	38.459	15.85	30	Pass
9	2452	38.548	15.86	30	Pass

Mode C
802.11n (HT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
1	2412	6.93	6.72	9.638	9.84	30	Pass
6	2437	6.70	6.83	9.506	9.78	30	Pass
11	2462	6.66	6.79	9.419	9.74	30	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. The maximum gain is 0.02 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11n (HT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
3	2422	6.74	6.87	9.594	9.82	30	Pass
6	2437	6.60	6.89	9.462	9.76	30	Pass
9	2452	6.91	6.70	9.594	9.82	30	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. The maximum gain is 0.02 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
1	2412	6.90	6.90	9.795	9.91	30	Pass
6	2437	6.67	6.68	9.311	9.69	30	Pass
11	2462	6.62	6.82	9.397	9.73	30	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. The maximum gain is 0.02 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
3	2422	6.77	6.90	9.661	9.85	30	Pass
6	2437	6.63	6.83	9.419	9.74	30	Pass
9	2452	6.79	6.79	9.550	9.80	30	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. The maximum gain is 0.02 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11n (HT20) Beamforming

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
1	2412	3.92	3.71	4.819	6.83	30	Pass
6	2437	3.69	3.82	4.753	6.77	30	Pass
11	2462	3.65	3.78	4.710	6.73	30	Pass

Notes:

1. Directional gain = $10 \log[(10^{\text{Chain0/20}} + 10^{\text{Chain1/20}})^2 / 2]$
2. The directional gain is 2.03 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11n (HT40) Beamforming

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
3	2422	3.73	3.86	4.797	6.81	30	Pass
6	2437	3.59	3.88	4.732	6.75	30	Pass
9	2452	3.90	3.69	4.797	6.81	30	Pass

Notes:

1. Directional gain = $10 \log[(10^{\text{Chain0/20}} + 10^{\text{Chain1/20}})^2 / 2]$
2. The directional gain is 2.03 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE20) Beamforming

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
1	2412	3.89	3.89	4.898	6.90	30	Pass
6	2437	3.66	3.67	4.656	6.68	30	Pass
11	2462	3.61	3.81	4.699	6.72	30	Pass

Notes:

1. Directional gain = $10 \log[(10^{\text{Chain0/20}} + 10^{\text{Chain1/20}})^2 / 2]$
2. The directional gain is 2.03 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE40) Beamforming

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
3	2422	3.76	3.89	4.831	6.84	30	Pass
6	2437	3.62	3.82	4.710	6.73	30	Pass
9	2452	3.78	3.78	4.775	6.79	30	Pass

Notes:

1. Directional gain = $10 \log[(10^{\text{Chain0/20}} + 10^{\text{Chain1/20}})^2 / 2]$
2. The directional gain is 2.03 dBi < 6 dBi, so the output power limit shall not be reduced.

7.2 Unwanted Emissions below 1 GHz

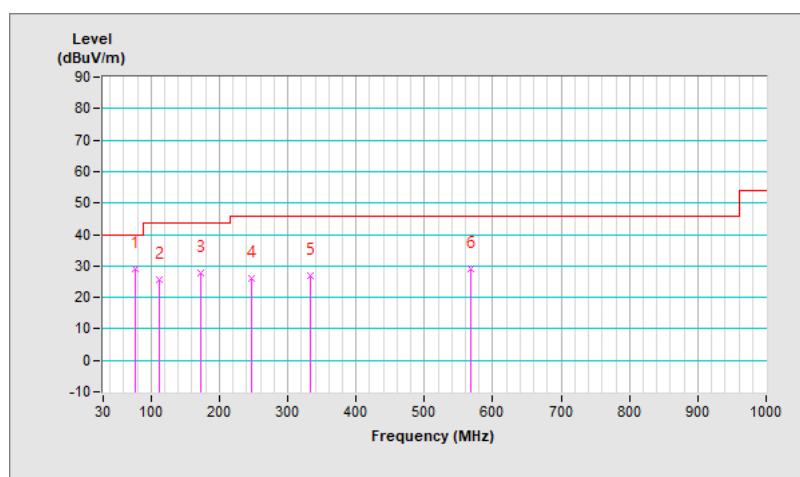
Mode B

RF Mode	802.11n (HT40)	Channel	CH 9 : 2452 MHz
Frequency Range	30 MHz ~1000 MHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	20.6°C, 78.3% RH
Tested By	Rex Wang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	77.53	28.9 QP	40.0	-11.1	1.00 H	60	42.0	-13.1
2	111.48	25.8 QP	43.5	-17.7	1.49 H	340	37.9	-12.1
3	173.56	27.9 QP	43.5	-15.6	1.49 H	266	37.4	-9.5
4	246.31	26.2 QP	46.0	-19.8	1.00 H	107	35.8	-9.6
5	332.64	26.9 QP	46.0	-19.1	1.00 H	224	33.9	-7.0
6	568.35	28.9 QP	46.0	-17.1	1.99 H	160	31.5	-2.6

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 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

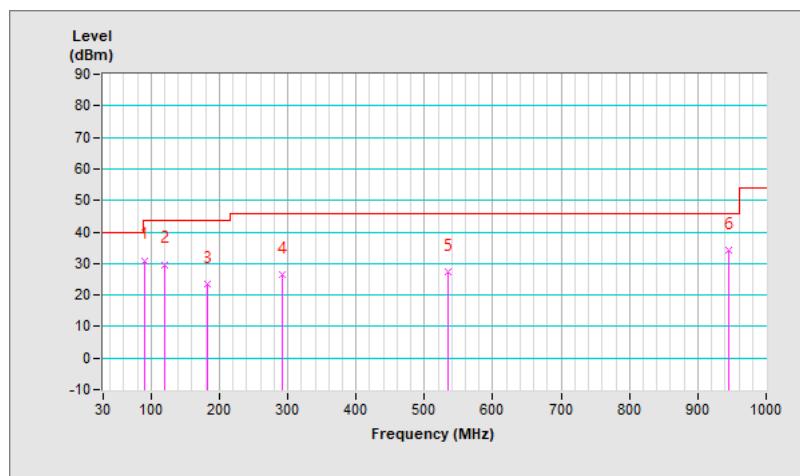


RF Mode	802.11n (HT40)	Channel	CH 9 : 2452 MHz
Frequency Range	30 MHz ~1000 MHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	20.6°C, 78.3% RH
Tested By	Rex Wang		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	90.14	31.0 QP	43.5	-12.5	1.99 V	19	45.8	-14.8
2	119.24	29.7 QP	43.5	-13.8	1.00 V	81	41.1	-11.4
3	183.26	23.6 QP	43.5	-19.9	1.00 V	17	34.3	-10.7
4	291.90	26.4 QP	46.0	-19.6	1.49 V	82	34.3	-7.9
5	534.40	27.5 QP	46.0	-18.5	1.99 V	321	30.8	-3.3
6	945.68	34.4 QP	46.0	-11.6	1.99 V	185	29.1	5.3

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 of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



7.3 Unwanted Emissions above 1 GHz

Mode A

RF Mode	802.11g	Channel	CH 1 : 2412 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23°C, 67% RH
Tested By	Adair Peng		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (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	1.74 H	235	24.9	33.4
2	2390.00	45.7 AV	54.0	-8.3	1.74 H	235	12.3	33.4
3	*2412.00	99.7 PK			1.74 H	235	66.2	33.5
4	*2412.00	90.6 AV			1.74 H	235	57.1	33.5
5	4824.00	49.3 PK	74.0	-24.7	1.79 H	197	39.5	9.8
6	4824.00	36.3 AV	54.0	-17.7	1.79 H	197	26.5	9.8
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (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	58.1 PK	74.0	-15.9	2.61 V	119	24.7	33.4
2	2390.00	45.4 AV	54.0	-8.6	2.61 V	119	12.0	33.4
3	*2412.00	97.8 PK			2.61 V	119	64.3	33.5
4	*2412.00	88.4 AV			2.61 V	119	54.9	33.5
5	4824.00	49.0 PK	74.0	-25.0	2.66 V	139	39.2	9.8
6	4824.00	36.0 AV	54.0	-18.0	2.66 V	139	26.2	9.8

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.



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Mode B

RF Mode	802.11n (HT40)	Channel	CH 9 : 2452 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	23°C, 67% RH
Tested By	Adair Peng		

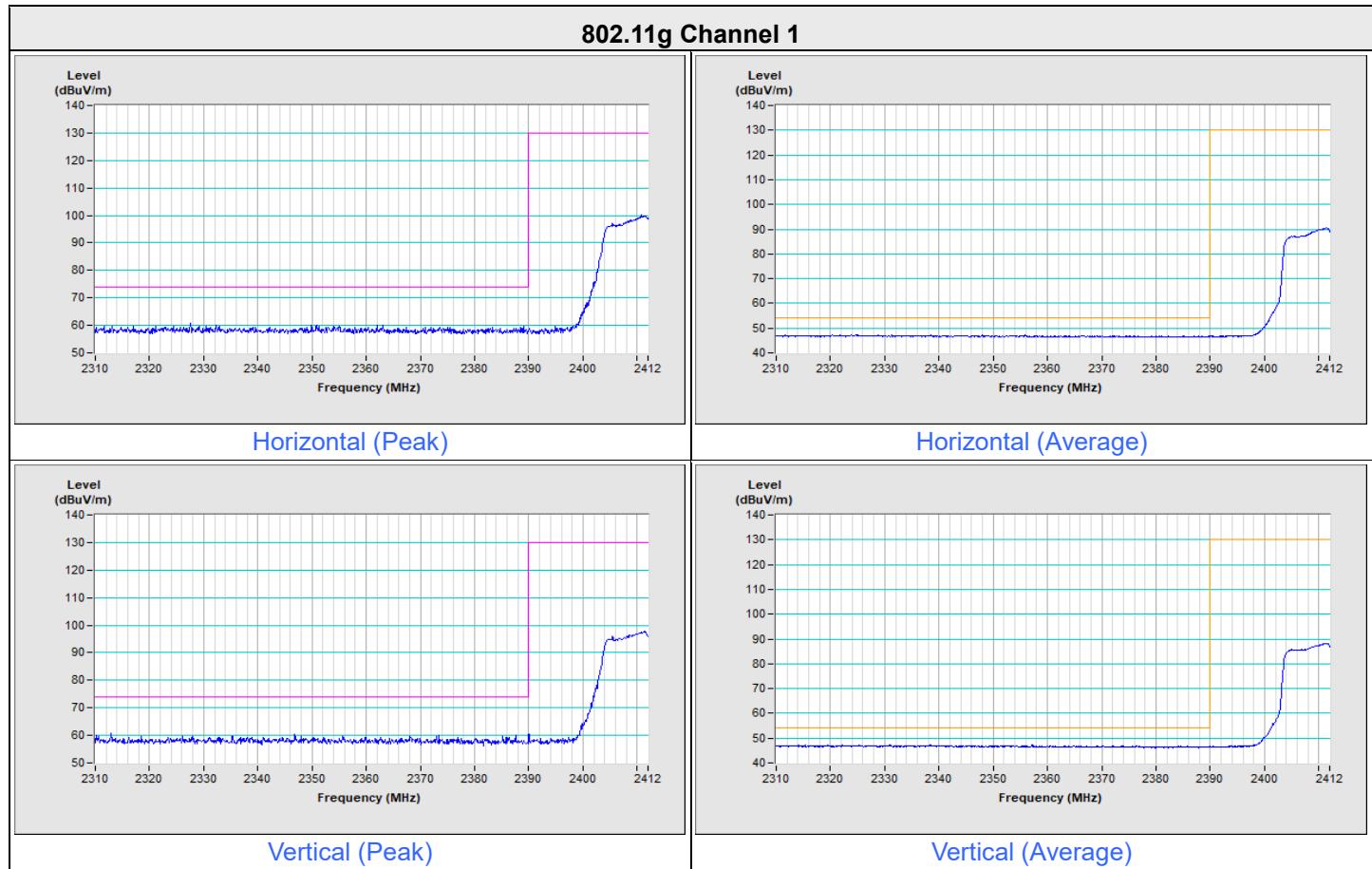
Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2452.00	106.8 PK			1.87 H	212	73.2	33.6
2	*2452.00	96.6 AV			1.87 H	212	63.0	33.6
3	2483.50	69.8 PK	74.0	-4.2	1.87 H	212	36.2	33.6
4	2483.50	52.6 AV	54.0	-1.4	1.87 H	212	19.0	33.6
5	4904.00	49.4 PK	74.0	-24.6	1.65 H	209	39.7	9.7
6	4904.00	36.7 AV	54.0	-17.3	1.65 H	209	27.0	9.7
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2452.00	105.2 PK			2.49 V	136	71.6	33.6
2	*2452.00	94.5 AV			2.49 V	136	60.9	33.6
3	2483.50	68.8 PK	74.0	-5.2	2.49 V	136	35.2	33.6
4	2483.50	52.2 AV	54.0	-1.8	2.49 V	136	18.6	33.6
5	4904.00	49.0 PK	74.0	-25.0	2.52 V	146	39.3	9.7
6	4904.00	36.3 AV	54.0	-17.7	2.52 V	146	26.6	9.7

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, the limit was restricted at the RF Output Power.

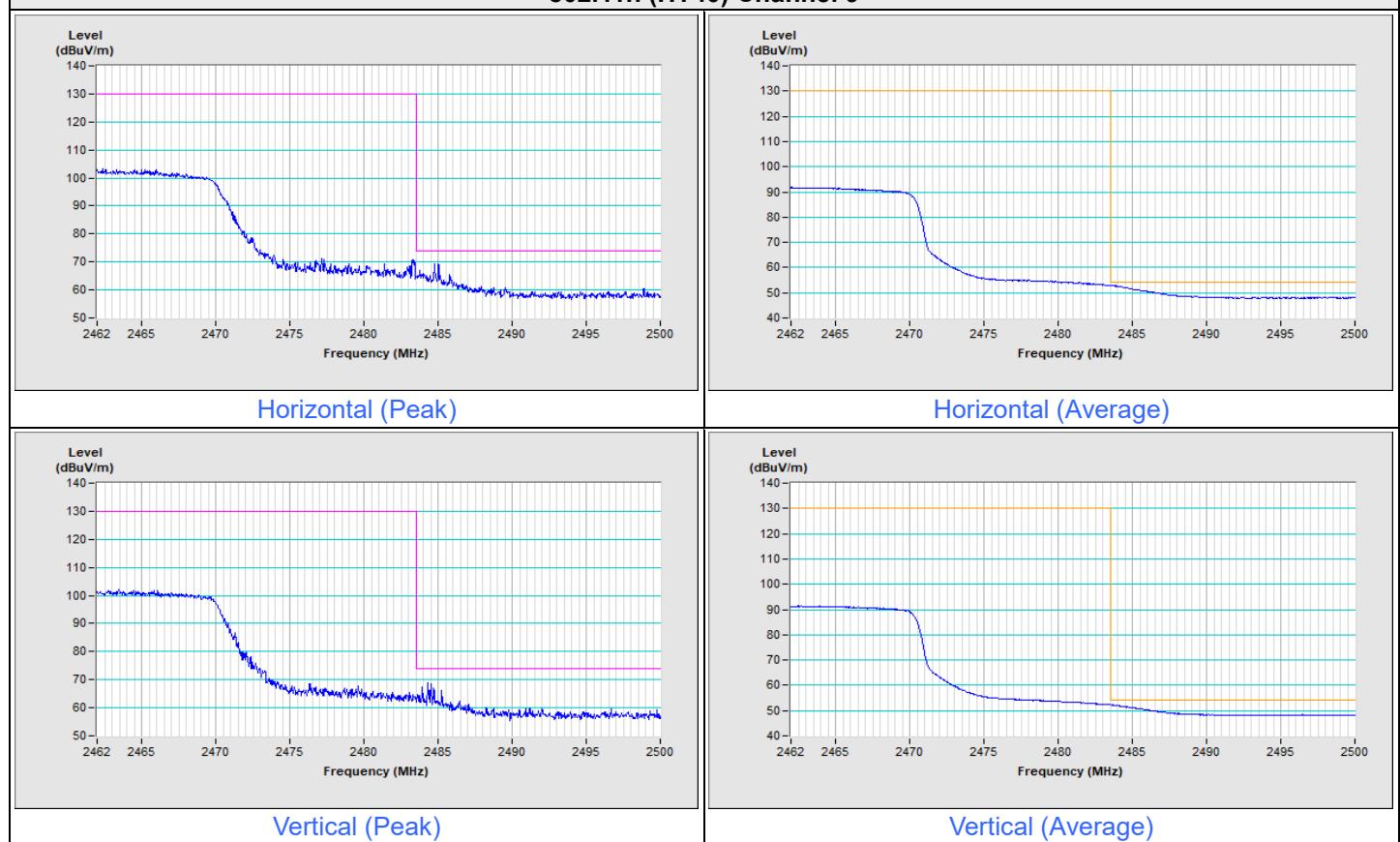
Plot of Band Edge

Frequency Range	2.31 GHz ~ 2.412 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
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Frequency Range	2.462 GHz ~ 2.5 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
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802.11n (HT40) Channel 9



8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

9 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.

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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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