

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)
Report No.: RFBBUI-WTW-P22100653B
FCC ID: TX2-RTL8851BE
Product: 11ax RTL8851BE Combo module
Brand: REALTEK
Model No.: RTL8851BE
Received Date: 2023/7/4
Test Date: 2023/7/5
Issued Date: 2023/7/10
Applicant: Realtek Semiconductor Corp.
Address: No. 2, Innovation Road II, Hsinchu Science Park, Hsinchu 300, 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 / 723255 / TW2022
Designation Number:

Approved by: _____

May Chen / Manager

, Date: _____

2023/7/10

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Prepared by : Claire Kuan / Specialist



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Release Control Record

Issue No.	Description	Date Issued
RFBBUI-WTW-P22100653B	Original release.	2023/7/10

1 Certificate

Product: 11ax RTL8851BE Combo module

Brand: REALTEK

Test Model: RTL8851BE

Sample Status: Engineering sample

Applicant: Realtek Semiconductor Corp.

Test Date: 2023/7/5

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

Measurement ANSI C63.10-2013

procedure: KDB 558074 D01 15.247 Meas Guidance v05r02

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	NA	Refer to Note 1
15.247(a)(2)	6 dB Bandwidth	NA	Refer to Note 1
15.247(d)	Conducted Out of Band Emissions	Pass	Meet the requirement of limit.
15.207	AC Power Conducted Emissions	NA	Refer to Note 1
15.205 / 15.209 / 15.247(d)	Unwanted Emissions below 1 GHz	NA	Refer to Note 1
15.205 / 15.209 / 15.247(d)	Unwanted Emissions above 1 GHz	NA	Refer to Note 1
15.203	Antenna Requirement	Pass	Antenna connector is IPEX4 not a standard connector.

Notes:

1. RF Output Power and Conducted Out of Band Emissions was performed for this addendum. The other testing data refer to original test report.
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) (±)
Conducted Out of Band Emissions	9 kHz ~ 40 GHz	2.5 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	11ax RTL8851BE Combo module
Brand	REALTEK
Test Model	RTL8851BE
Status of EUT	Engineering sample
Power Supply Rating	3.3Vdc from host equipment
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in VHT mode 1024QAM for OFDMA in 11ax mode
Modulation Technology	DSSS, OFDM, OFDMA
Transfer Rate	802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to 150 Mbps VHT: up to 200 Mbps 802.11ax: up to 286.8 Mbps
Operating Frequency	2.412 GHz ~ 2.472 GHz
Number of Channel	802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20): 13 802.11n (HT40), VHT40, 802.11ax (HE40): 9
Resource Unit (RU)	Single RU: 26-tone, 52-tone, 106-tone, 242-tone, 484-tone
Output Power	251.189 mW (24.00 dBm)

Note:

- This is a supplementary report of Report No.: RFBBUI-WTW-P22100653. The differences between them are as below information:
 - ◆ There is no change in H/W, and the output power is lowered by S/W to meet the situation of using this module in portable
- According to above condition, there is RF Output Power and Conducted Out of Band Emissions test item needs to be performed. And all data are verified to meet the requirements.
- The EUT has below HW SKU configuration, as below table:

SKU No.	Product name	HW Configuration
1	11ax RTL8851BE Combo module	PCIe + USB interface + Dual antenna port

- There are Bluetooth and WLAN (2.4 GHz & 5 GHz) technology used for the EUT.
- Simultaneously transmission condition.

Condition	Technology	
1	WLAN (5 GHz)	Bluetooth
2	WLAN (2.4 GHz)	Bluetooth

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

- The EUT support OFDMA and Partial RU mode, therefore partial RU combination were investigated and the worst case scenario was identified.
- 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.	RF Chain NO.	Brand	Model	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length (mm)
1	Chain 1	REALTEK	RTK-ANT-0022	3.4	2.4~2.4835GHz	PIFA	IPEX4	300
				5	5.15~5.895GHz			
	Chain 2	REALTEK	RTK-ANT-0022	3.4	2.4~2.4835GHz	PIFA	IPEX4	300
				5	5.15~5.895GHz			
2	Chain 1	Aristotle	RFA-27-C38H1-MHF4300	3	2.4~2.4835GHz	Dipole	IPEX4	300
				5	5.15~5.895GHz			
	Chain 2	Aristotle	RFA-27-C38H1-MHF4300	3	2.4~2.4835GHz	Dipole	IPEX4	300
				5	5.15~5.895GHz			
3	Chain 1	LYNwave	ALX22F-120AA0-00	3.2	2.4~2.4835GHz	Monopole	IPEX4	200
				4	5.15~5.895GHz			
	Chain 2	LYNwave	ALX22F-120AA0-00	3.2	2.4~2.4835GHz	Monopole	IPEX4	200
				4	5.15~5.895GHz			

Note:

1. Max. gain was selected for the final test, except for Unwanted Emissions.

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

2. The EUT incorporates a SISO function:

2.4 GHz Band		
Modulation Mode	TX & RX Configuration	
802.11b	1TX Diversity	1RX
802.11g	1TX Diversity	1RX
802.11n (HT20)	1TX Diversity	1RX
802.11n (HT40)	1TX Diversity	1RX
VHT20	1TX Diversity	1RX
VHT40	1TX Diversity	1RX
802.11ax (HE20)	1TX Diversity	1RX
802.11ax (HE40)	1TX Diversity	1RX
802.11ax (RU26/52/106/242/484)	1TX Diversity	1RX

Note:

1. The modulation and bandwidth are similar for 802.11n mode for 20 MHz (40 MHz) and VHT mode for 20 MHz (40 MHz), therefore the manufacturer will control the power for 802.11n/VHT mode is the same as the 802.11ax or more lower than it and investigated worst case to representative mode in test report.

3.3 Channel List

13 channels are provided for 802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
1	2412 MHz	8	2447 MHz
2	2417 MHz	9	2452 MHz
3	2422 MHz	10	2457 MHz
4	2427 MHz	11	2462 MHz
5	2432 MHz	12	2467 MHz
6	2437 MHz	13	2472 MHz
7	2442 MHz		

9 channels are provided for 802.11n (HT40), VHT40, 802.11ax (HE40):

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

3.4 Test Mode Applicability and Tested Channel Detail

Pre-Scan:	1. EUT has two antennas, but only single antenna diversity function: Chain1/Chain2. Pre-scan in these ways to find the worst case as a representative test condition. 4. 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).
Worst Case:	1. Chain1/Chain2 single-antenna transmission Worst Condition: Chain1

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

Test Item	Mode	Tested Channel	Modulation	Data Rate Parameter	RU Configuration
RF Output Power	802.11b	1, 11	DBPSK	1Mb/s	-
	802.11ax (HE20)	1, 6	BPSK	MCS0	-
	802.11ax (HE40)	9, 11	BPSK	MCS0	-
Conducted Out of Band Emissions	802.11b	1, 11	DBPSK	1Mb/s	-
	802.11ax (HE20)	1, 6	BPSK	MCS0	-
	802.11ax (HE40)	9, 11	BPSK	MCS0	-

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
Power Meter Anritsu	ML2495A	1529002	2023/6/17	2024/6/16
Pulse Power Sensor Anritsu	MA2411B	1726434	2023/6/19	2024/6/18

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2023/7/5

4.2 Conducted Out of Band Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Fixed Attenuator Woken	MDCS18N-10	MDCS18N-10-01	2023/3/27	2024/3/26
MXA Signal Analyzer Keysight	N9020B	MY60112409	2023/2/18	2024/2/17
Software	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2023/7/5

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)

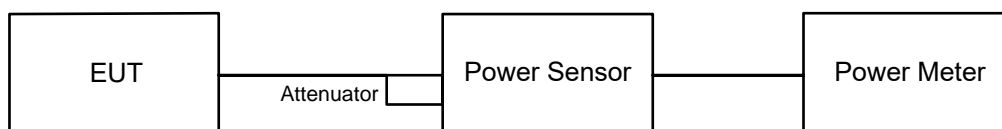
5.2 Conducted Out of Band Emissions

Below 30 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

6 Test Arrangements

6.1 RF Output Power

6.1.1 Test Setup



6.1.2 Test Procedure

Peak Power:

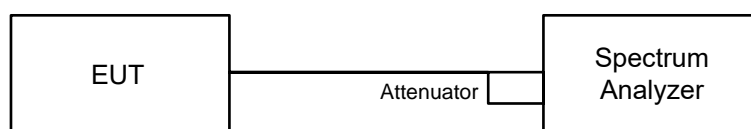
A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average Power:

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 Conducted Out of Band Emissions

6.2.1 Test Setup



6.2.2 Test Procedure

MEASUREMENT PROCEDURE REF

- Set the RBW = 100 kHz.
- Set the VBW \geq 300 kHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW \geq 300 kHz.
- Detector = peak.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

7 Test Results of Test Item

7.1 RF Output Power

Input Power:	3.3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Katina Lu
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For Peak Power

802.11b

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
1	2412	57.943	17.63	30	Pass
11	2462	57.016	17.56	30	Pass

Note: The antenna gain is 3.4 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
1	2412	246.037	23.91	30	Pass
6	2437	251.189	24.00	30	Pass

Note: The antenna gain is 3.4 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
9	2452	171.002	22.33	30	Pass
11	2462	163.305	22.13	30	Pass

Note: The antenna gain is 3.4 dBi < 6 dBi, so the output power limit shall not be reduced.

For Average Power

802.11b

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	33.574	15.26
11	2462	33.497	15.25

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	32.434	15.11
6	2437	32.584	15.13

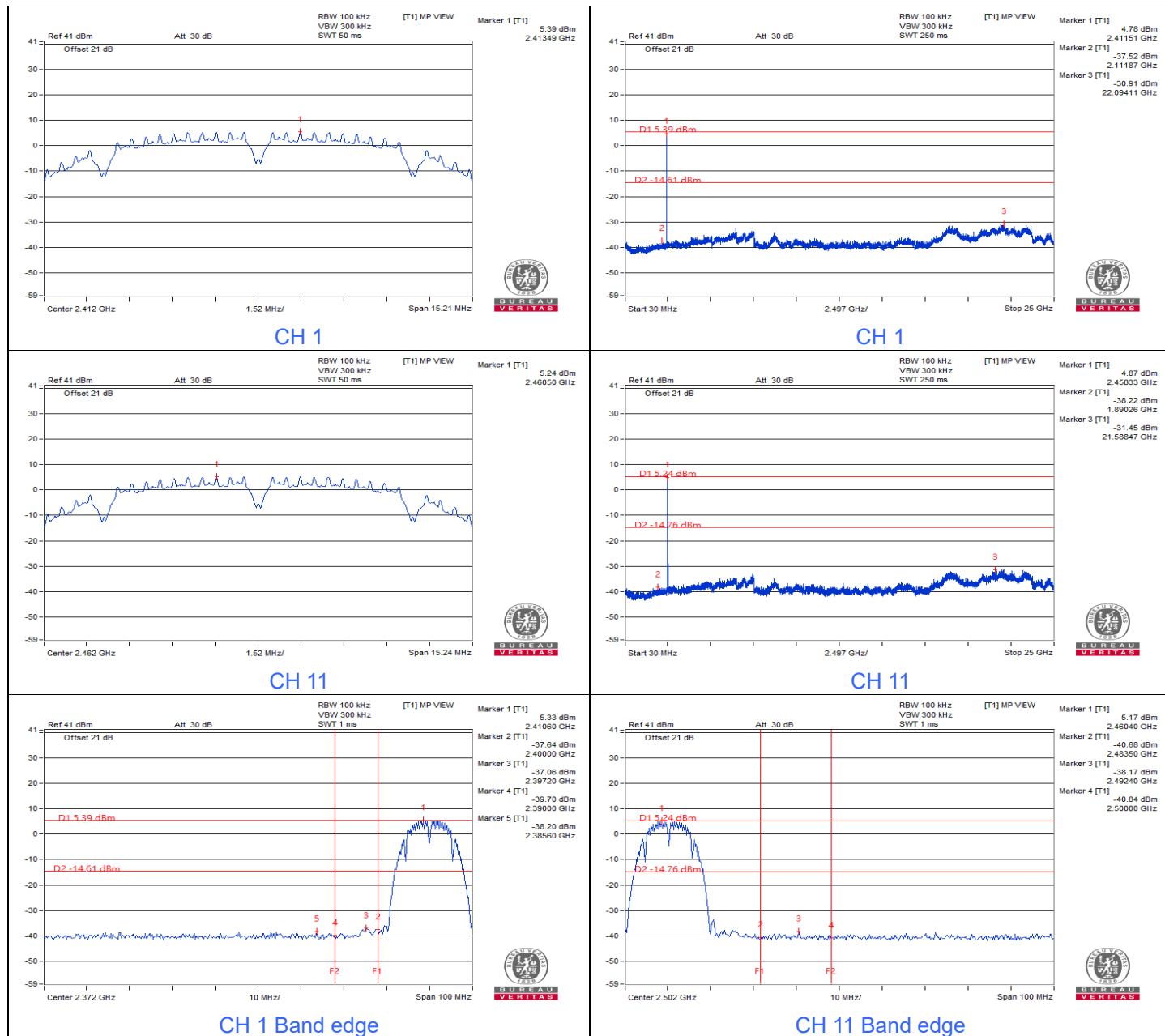
802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
9	2452	32.885	15.17
11	2462	32.584	15.13

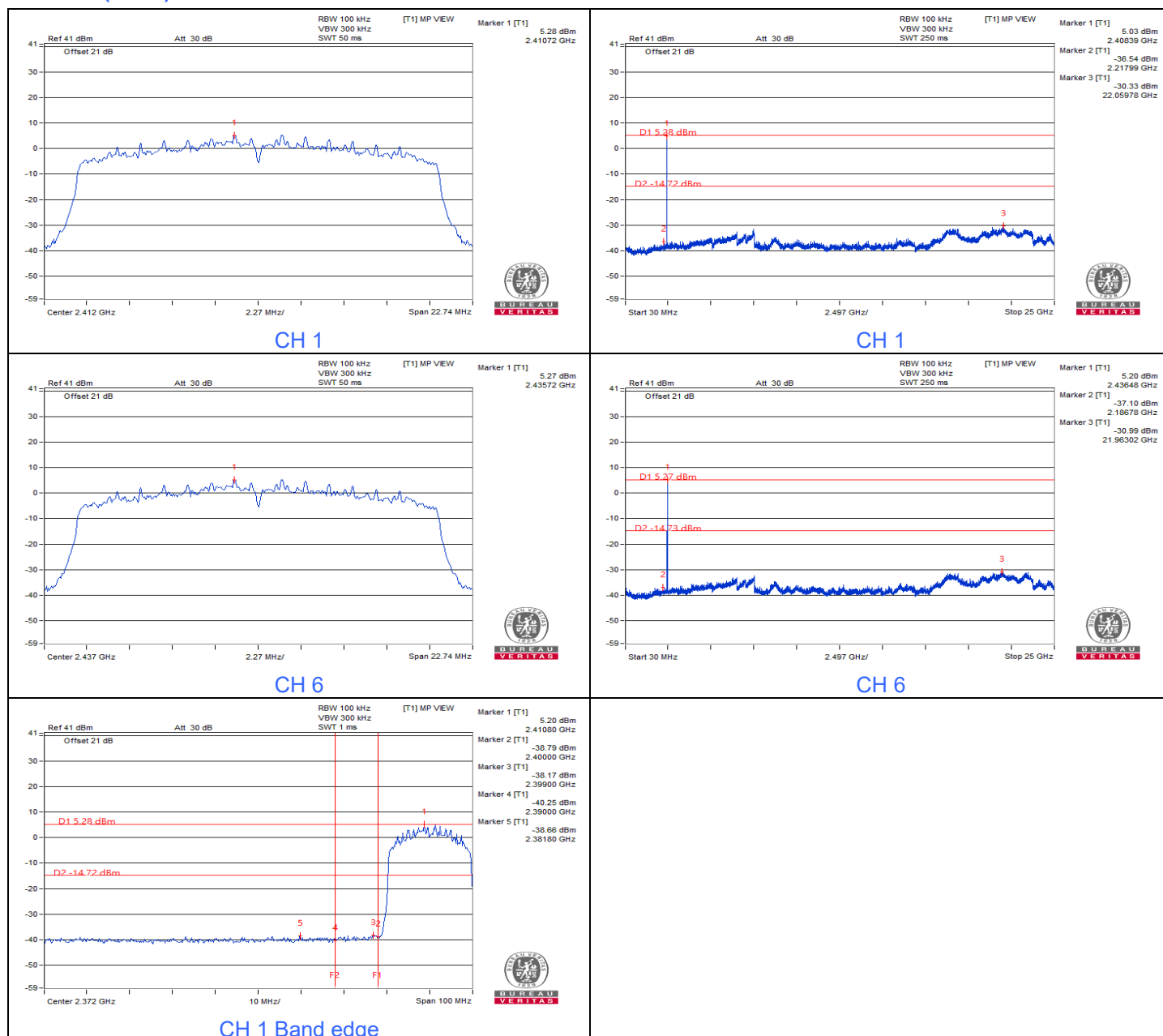
7.2 Conducted Out of Band Emissions

Input Power:	3.3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Katina Lu
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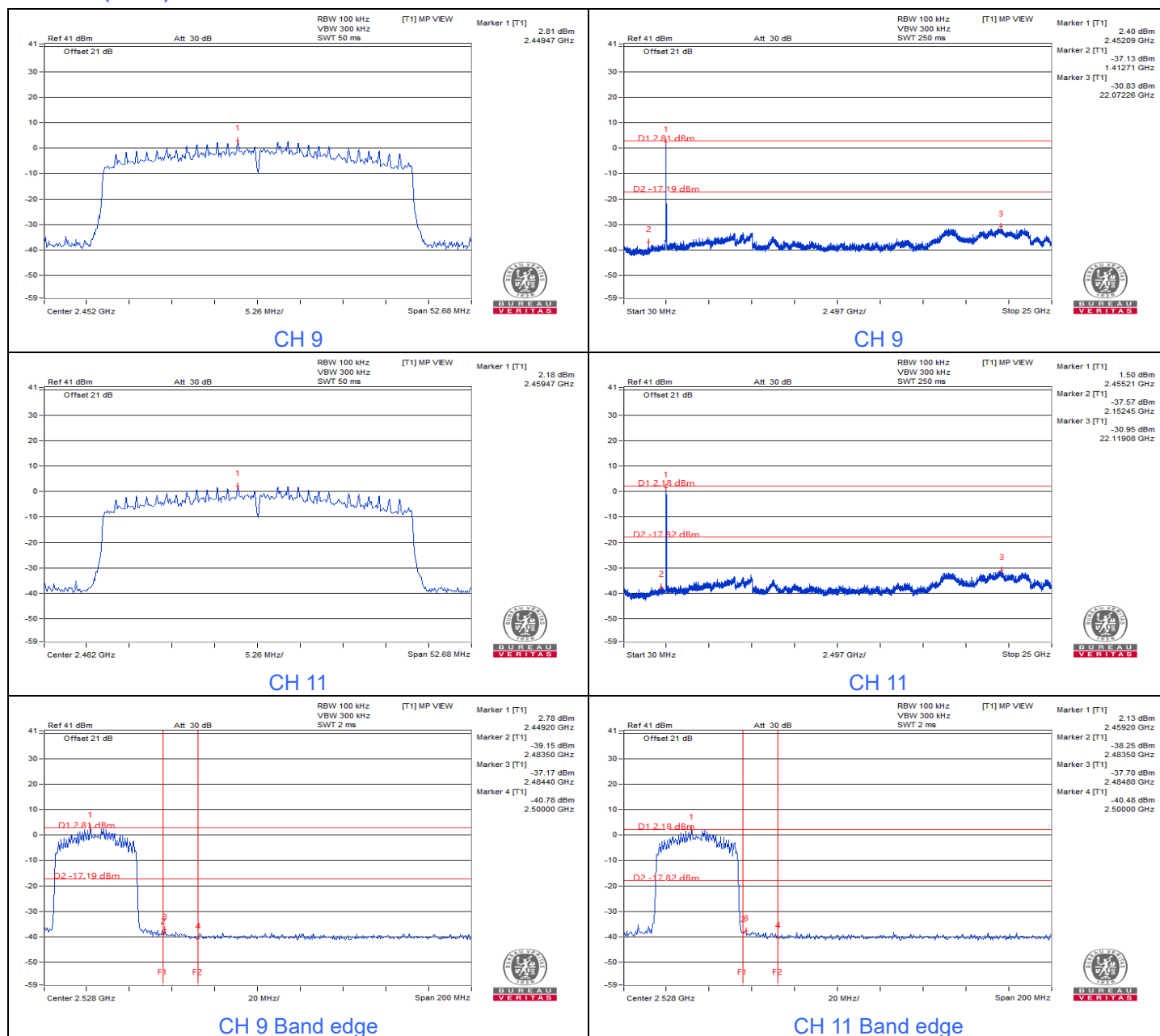
802.11b



802.11ax (HE20)



802.11ax (HE40)



8 Information of the Testing Laboratories

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

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

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

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