



Test report No. : 4789804204-US-R0-V0
Page : 1 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT

RADIO TEST REPORT

Product : 802.11ac/a/b/g/n 2T2R Wifi + Bluetooth 4.2 USB Module

Model Name : WUBT-236ACN(BT)[MN]

FCC ID : ZZ6-WUBT236ACNBT

Test Regulation : FCC 47 CFR Part 15 Subpart E (Section 15.407)

Received Date : 2021/10/8

Test Date : 2021/10/18 ~ 2021/11/25

Issued Date : 2021/12/20

Applicant : Varex Imaging Corporation
1678 South Pioneer Road, Salt Lake City, Utah 84104, USA

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan



The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report are responsible of the test sample(s) provided by the client only and are not to be used to indicate applicability to other similar products.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test report No. : 4789804204-US-R0-V0
Page : 2 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT

REVISION HISTORY

Original Test Report No.: 4789804204-US-R0-V0

[illegible]

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Table of Contents

1. Attestation of Test Results	4
2. Summary of Test Results	5
3. Test Methodology and Reference Procedures.....	6
4. Facilities and Accreditation	6
5. Measurement Uncertainty	7
6. Equipment under Test	8
6.1. Description of EUT	8
6.2. Channel List	10
6.3. Test Condition	11
6.4. Description of Available Antennas	11
6.5. Test Mode Applicability and Tested Channel Detail	12
6.6. Duty cycle	13
7. Test Equipment.....	14
8. Description of Test Setup.....	16
9. Test Results.....	18
9.1. 6dB Bandwidth	18
9.2. 26dB Bandwidth	21
9.3. Occupied Bandwidth.....	24
9.4. Conducted output power	29
9.5. Power Spectral Density	34
9.6. Frequency Stability	42
9.7. Radiated Spurious Emission	44
9.8. AC Power Line Conducted Emission	88



Test report No. : 4789804204-US-R0-V0
Page : 4 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT

1. Attestation of Test Results

APPLICANT: Varex Imaging Corporation
1678 South Pioneer Road, Salt Lake City, Utah 84104, USA

MANUFACTURER: Varex Imaging Corporation
1678 South Pioneer Road, Salt Lake City, Utah 84104, USA

EUT DESCRIPTION: 802.11ac/a/b/g/n 2T2R Wifi + Bluetooth 4.2 USB Module

BRAND: Varex Imaging Corporation

MODEL: WUBT-236ACN(BT)[MN]

SAMPLE STAGE: Mass-Production

DATE of TESTED: 2021/10/18 ~ 2021/11/25

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart E (Section 15.407)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Sally Lu
Project Handler

Date : 2021/12/20

Approved and Authorized By:

Waternil Guan
Engineer

Date : 2021/12/20

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.407(e)	6dB Bandwidth	PASS
15.403(i)	26dB Bandwidth	PASS
2.1049	Occupied Bandwidth	See Note1
15.407(a)(1/3)	Conducted Output Power	PASS
15.407(a)(1/3)	Power Spectral Density	PASS
15.407(g)	Frequency Stability	PASS
15.407(b) (1/4(i/ii)/9)	Radiated Emissions and Band Edge Measurement	PASS
15.407(b)(9)	AC Power Conducted Emission	PASS
15.203	Antenna Requirement	PASS
15.407(h)	Dynamic Frequency Selection	N/A

Note:

1. The Occupied Bandwidth was reference only.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB 789033 D02 General UNII Test Procedure New Rules v02r01, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013 and KDB 662911 D01 Multiple Transmitter Output v02r01.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Measurement	Frequency	Uncertainty
Conducted disturbance at mains terminals ports	150kHz ~ 30MHz	± 3.1 dB
RF Conducted	9 kHz - 40GHz	± 1.9 dB
Radiated disturbance below 30MHz	9 kHz - 30 MHz	± 1.9 dB
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	± 5.4 dB
Radiated disturbance above 1 GHz	1GHz ~ 40GHz	± 4.7 dB

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



6. Equipment under Test

6.1. Description of EUT

Product	802.11ac/a/b/g/n 2T2R Wifi + Bluetooth 4.2 USB Module	
Brand Name	Varex Imaging Corporation	
Model Name	WUBT-236ACN(BT)[MN]	
Operating Frequency	5180 ~ 5240 MHz 5745 ~ 5825 MHz	
Modulation	256QAM, 64QAM, 16QAM, QPSK, BPSK	
Transfer Rate	802.11a: up to 54 Mbps 802.11n: up to MCS15 802.11ac: up to MCS9	
Number of Channel	5180 ~ 5240 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		2 for 802.11n (HT40), 802.11ac (VHT40)
		1 for 802.11ac (VHT80)
	5745 ~ 5825 MHz	5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)
		2 for 802.11n (HT40), 802.11ac (VHT40)
		1 for 802.11ac (VHT80)
Maximum Output Power	5180 ~ 5240 MHz: 12.85 dBm 5745 ~ 5825 MHz: 12.75 dBm	
Normal Voltage	Host: 19Vdc from adapter EUT: 15.4Vdc from battery	
Sample ID	Conducted Test: 4286533 Radiated Test: 4286527	

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx,Rx Function
802.11a	1TX,1RX
802.11n (HT20)	2TX,2RX
802.11n (HT40)	2TX,2RX
802.11ac (VHT20)	2TX,2RX
802.11ac (VHT40)	2TX,2RX
802.11ac (VHT80)	2TX,2RX

* The modulation and bandwidth are similar for 802.11n mode for HT20 / HT40 and 802.11ac mode for VHT20 / VHT40, therefore investigated the worst case to representative mode in test report.

2. The EUT is WLAN module inside the X-ray Detector, Host information as below:

Product	Brand	Model	Description
Digital Image Receptor	Varex Imaging Corporation	2530W-G5	S/N: D03507-0305 Size: 330 x 280 x 10 mm

3. The EUT contains following accessory devices.

Product	Brand	Model	Description
Tether Cable (USB Type C to RJ45 and DC jack cable (Y cable))	BizLink	117G0-073100-R1	Shielded, 2m
Battery	Accutronics	VB-200	15.4Vdc/ 3.43Ah
3-Bay Battery Charger	Great Batch	35205 REV G	Input:19Vdc, 4.5A Output: 16.8Vdc, 1.4A
Adapter for battery charger	XP Power	AHM85PS19	Input: 100-240Vac ~1.0A 50/60Hz, Output: 19Vdc, 4.47A
Adapter	XP power	AHM85PS19-XG1714	Input: 100-240Vac ~1.0A 50/60Hz, Output: 19Vdc, 4.47A

4. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



6.2. Channel List

FOR 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz	-	-

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	21~26°C/ 51~59%RH	120Vac/ 60Hz	2021/10/25~ 2021/11/25	Mike Cai
Radiated Spurious Emission	966-2	21~26°C/ 51~59%RH	120Vac/ 60Hz	2021/10/18~ 2021/11/25	Mike Cai
AC power Line Conducted Emission	SR1	21~26°C/ 51~59%RH	120Vac/ 60Hz	2021/10/25~ 2021/11/05	Mike Cai

FCC Test Firm Registration Number: 498077

6.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Frequency (MHz)	Maximum Gain (dBi)
1	Chain (0)+(1)	Perkin Elmer	XRpad CBSA	PCB	5180 ~ 5240	5.6
					5745 ~ 5825	5.9
2	Chain (0)+(1)	Perkin Elmer	XRpad CBSA	PCB	5180 ~ 5240	5.6
					5745 ~ 5825	5.9

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



6.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that X-Y plane was worst-case. Therefore, all final radiated testing was performed with the EUT in X-Y plane.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- For below 1 GHz radiated emission and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.
- 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).

Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions (Above 1GHz)	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11ac20		OFDM	36 to 48	36, 44, 48	MCS0
	802.11ac40			38 to 46	38, 46	MCS0
	802.11ac80			42	42	MCS0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11ac20		OFDM	149 to 165	149, 157, 165	MCS0
	802.11ac40			151 to 159	151, 159	MCS0
	802.11ac80			155	155	MCS0
Radiated Emissions (Below 1GHz)	802.11ac40	5180-5240	OFDM	36 to 48	38	MCS0
AC Power Line Conducted Emission	802.11ac40	5180-5240	OFDM	36 to 48	38	MCS0
Antenna Port Conducted Measurement	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11ac20		OFDM	36 to 48	36, 44, 48	MCS0
	802.11ac40			38 to 46	38, 46	MCS0
	802.11ac80			42	42	MCS0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11ac20		OFDM	149 to 165	149, 157, 165	MCS0
	802.11ac40			151 to 159	151, 159	MCS0
	802.11ac80			155	155	MCS0

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



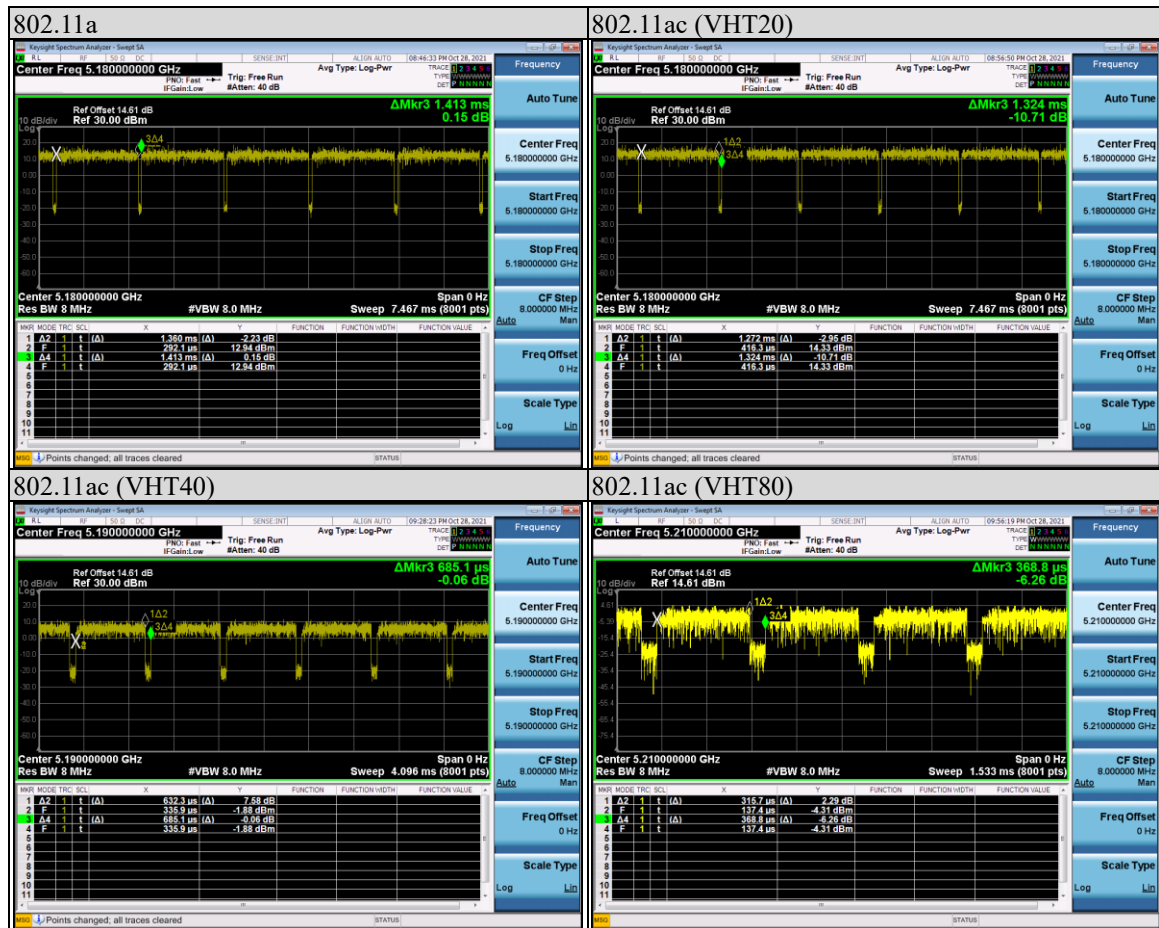
6.6. Duty cycle

802.11a: Duty cycle = $1.36/1.413 = 0.962\%$, Duty factor(dB) = $10 * \log(1/0.962) = 0.17$

802.11ac (VHT20): Duty cycle = $1.272/1.324 = 0.961\%$, Duty factor(dB) = $10 * \log(1/0.961) = 0.18$

802.11ac (VHT40): Duty cycle = $0.6323/0.6851 = 0.923\%$, Duty factor(dB) = $10 * \log(1/0.923) = 0.35$

802.11ac (VHT80): Duty cycle = $0.3157/0.3688 = 0.856\%$, Duty factor(dB) = $10 * \log(1/0.856) = 0.68$





7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2020/11/11	2021/11/10
				2021/11/9	2022/11/8
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2020/12/11	2021/12/10
Loop Antenna	ETS lindgren	6502	00213440	2020/12/25	2021/12/24
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	2021/1/13	2022/1/12
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2020/12/30	2021/12/29
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2020/12/30	2021/12/29
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2021/6/8	2022/6/7
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2021/2/3	2022/2/2
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2021/5/19	2022/5/18
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2021/1/22	2022/1/21
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	2021/1/22	2022/1/21

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test report No. : 4789804204-US-R0-V0
Page : 15 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	2020/11/6	2021/11/5
				2021/10/29	2022/10/28
Pulse Power Sensor	Anritsu	MA2411B	1531202	2020/12/21	2021/12/20
Power Meter	Anritsu	ML2495A	1645002	2020/12/21	2021/12/20
Temperature & Humidity Test Chamber	GIANT FORCE	GTH-150-40-CP-AR	MAA1701-010	2021/3/22	2022/3/21
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2020/11/17	2021/11/16
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	2021/8/30	2022/8/29
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2021/8/26	2022/8/25
Cables	TITAN	CFD200	T0732ACFD20 020A300-1	2021/3/2	2022/3/1

UL Software		
Description	Name	Version
Radiated measurement	e3	6.191211 (V6)
Conducted measurement	RF Conducted Test Tools	ver 2.4.0.620b
AC power Line Conducted Emission	EZ EMC	UL-3A1.2

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



8. Description of Test Setup

Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	Laptop	Lenovo	T430	PBE38AK	Provided by Lab
B	RJ-45 connector	N/A	N/A	N/A	Provided by Client

I/O Cables

ID	Equipment	Brand Name	Model Name	Length (m)	Remark
1	USB Cable	AWM	20276	1.6	Provided by Lab
2	2 meter Tether cable	Bizlink	117G0-073100-R1	2	with three core Provided by Client
3	Power cord	Baohing	C1	1.8	Provided by Lab

Test Setup

Controlled using a bespoke application (Mptool_1.2.0.5) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

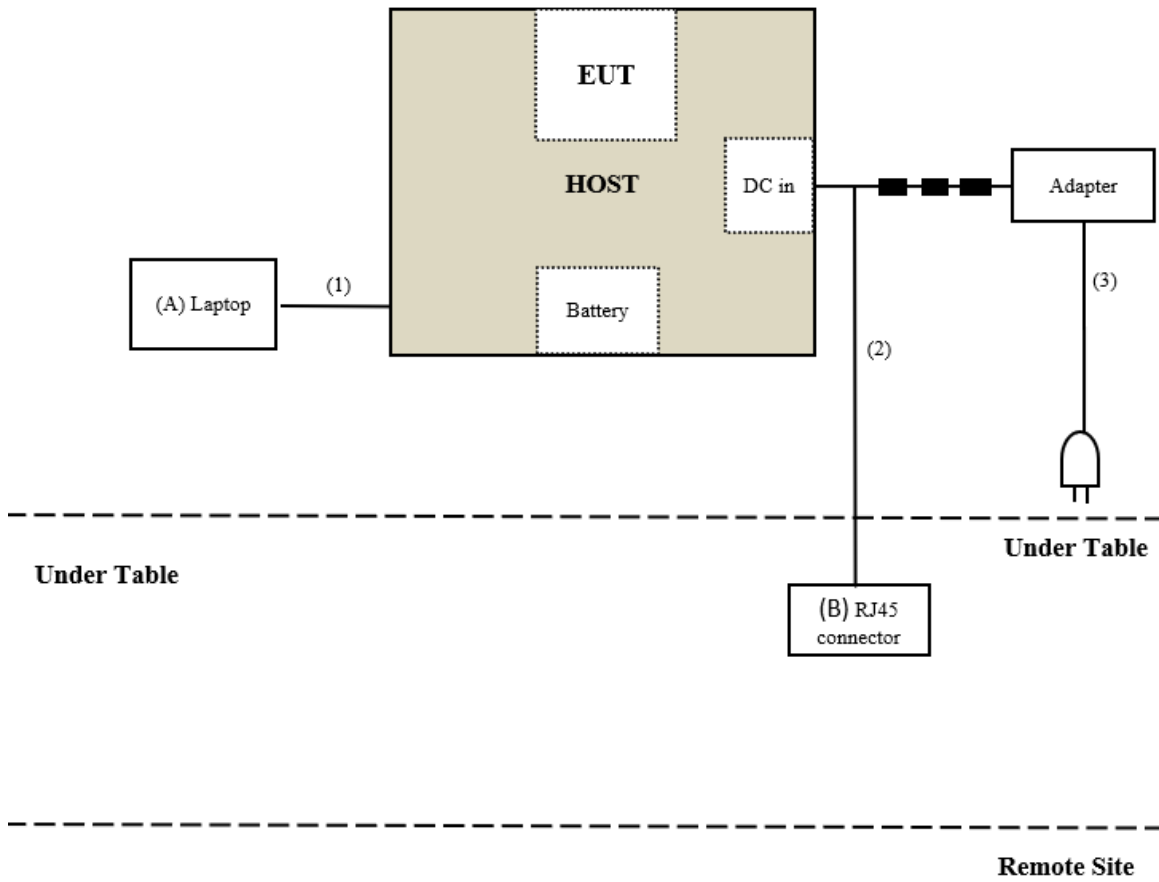
Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Setup Diagram for Test



Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



9. Test Results

9.1. 6dB Bandwidth

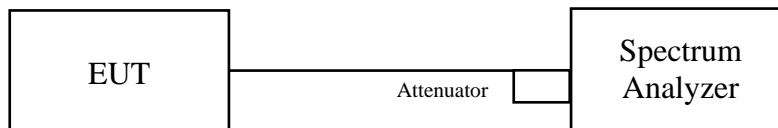
Requirements

The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.



Test Data

802.11a

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
149	5745	16.31	0.5	PASS
157	5785	16.33	0.5	PASS
165	5825	16.32	0.5	PASS

802.11ac (VHT20)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
149	5745	17.16	17.06	0.5	PASS
157	5785	17.11	17.03	0.5	PASS
165	5825	17.39	16.91	0.5	PASS

802.11ac (VHT40)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
151	5755	35.99	35.81	0.5	PASS
159	5795	36.26	35.79	0.5	PASS

802.11ac (VHT80)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
155	5775	73.92	75.08	0.5	PASS

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

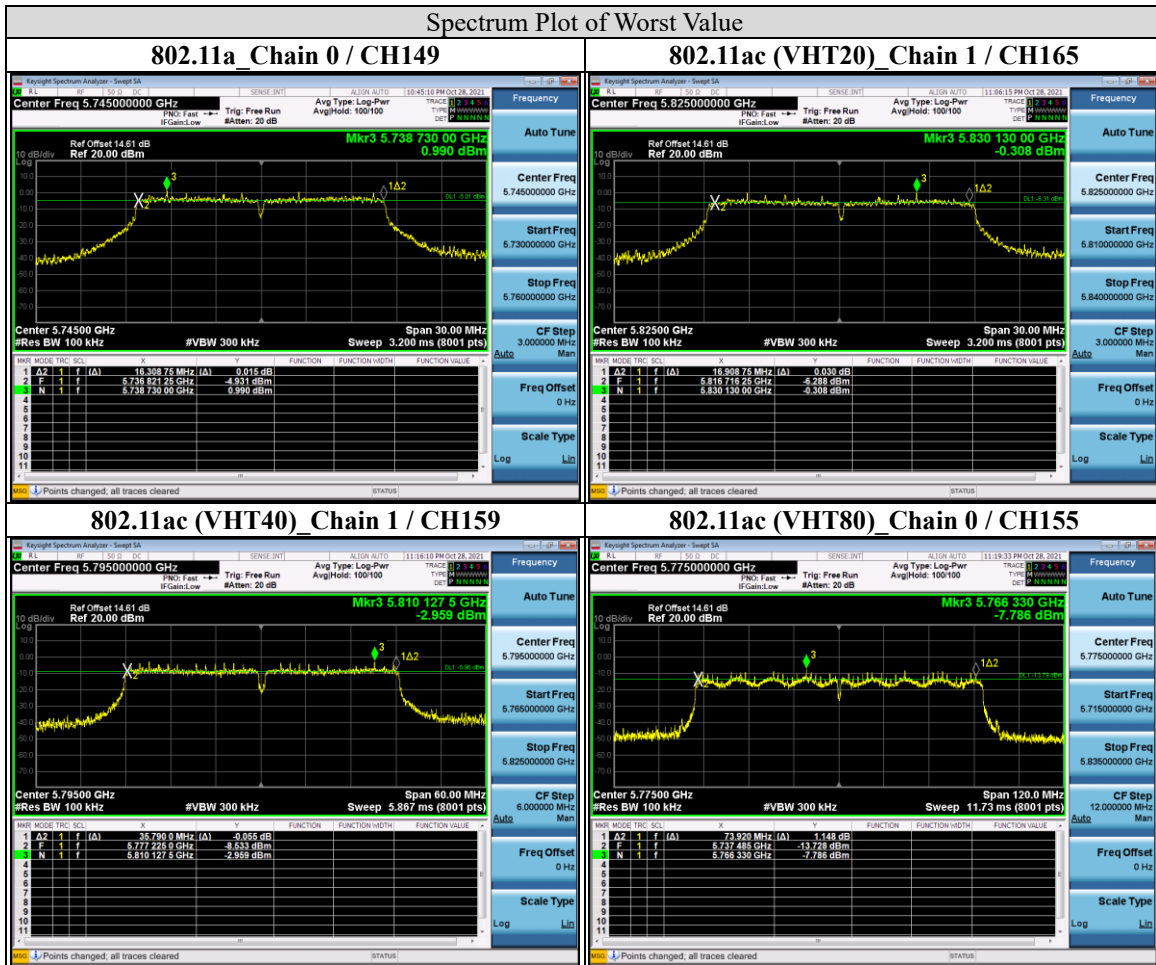
Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test report No. : 4789804204-US-R0-V0
Page : 20 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT



Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0

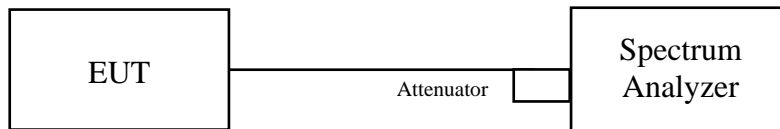


9.2. 26dB Bandwidth

Test procedure

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test Data

802.11a

Channel	Channel Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	21.61
44	5220	21.51
48	5240	21.39

802.11ac (VHT20)

Channel	Channel Frequency (MHz)	26 dB Bandwidth (MHz)	
		Chain 0	Chain 1
36	5180	21.59	21.86
44	5220	21.55	21.65
48	5240	21.61	21.43

802.11ac (VHT40)

Channel	Channel Frequency (MHz)	26 dB Bandwidth (MHz)	
		Chain 0	Chain 1
38	5190	44.64	44.11
46	5230	44.87	44.15

802.11ac (VHT80)

Channel	Channel Frequency (MHz)	26 dB Bandwidth (MHz)	
		Chain 0	Chain 1
42	5210	83.69	81.99

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

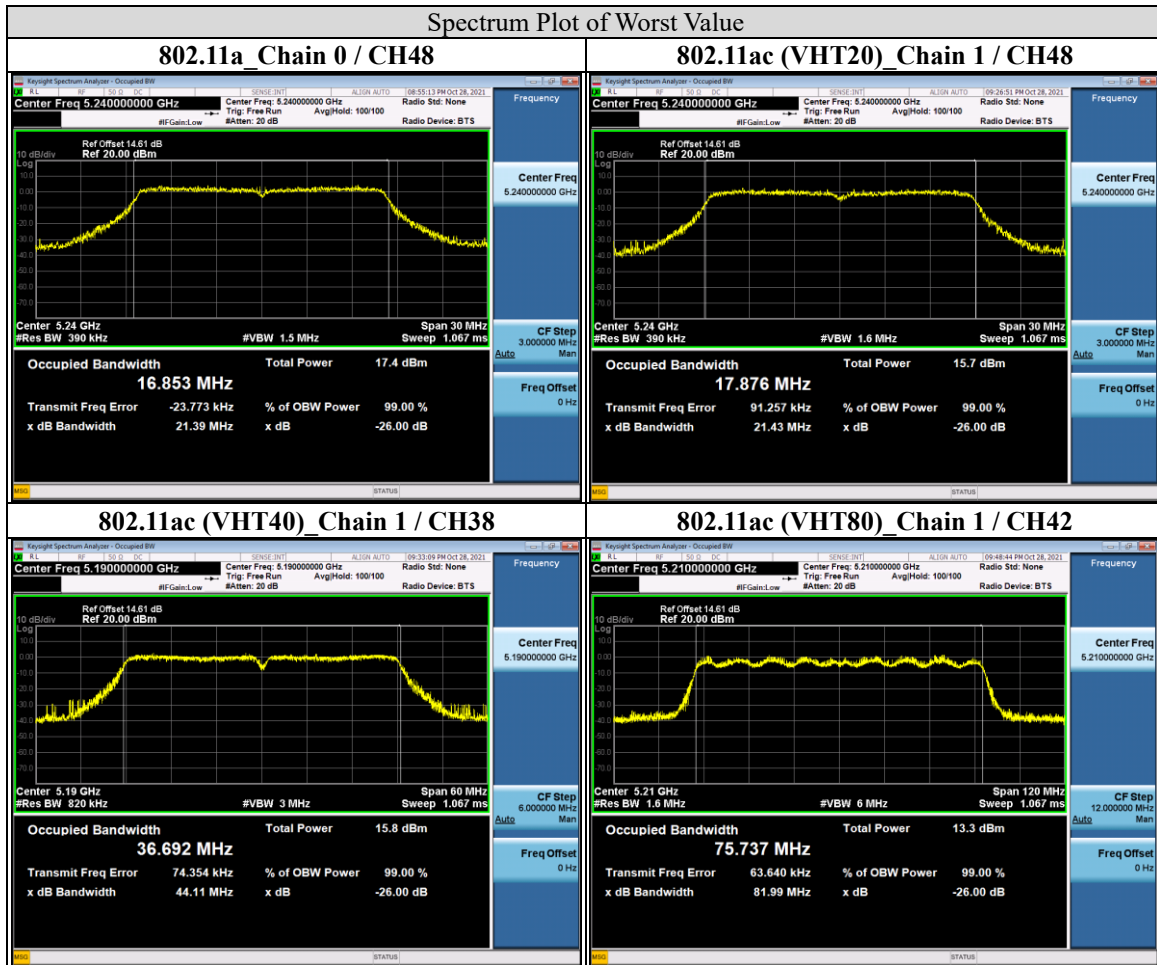
Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test report No. : 4789804204-US-R0-V0
Page : 23 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT



Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0

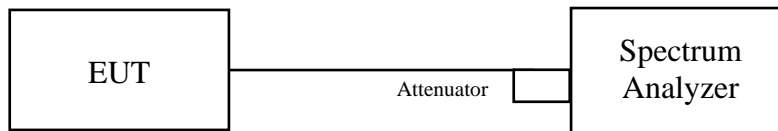


9.3. Occupied Bandwidth

Test procedure

- Set center frequency to the nominal EUT channel center frequency.
- Set span = 1.5 times to 5.0 times the OBW.
- Set RBW = 1% to 5% of the OBW
- Set VBW $\geq 3 \times$ RBW
- Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- Use the 99% power bandwidth function of the instrument (if available).
- If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.



Test Data

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	16.78
44	5220	16.76
48	5240	16.75
149	5745	16.77
157	5785	16.76
165	5825	16.76

802.11ac (VHT20)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
36	5180	17.85	17.76
44	5220	17.83	17.82
48	5240	17.83	17.79
149	5745	17.79	17.87
157	5785	17.82	17.86
165	5825	17.79	17.83

802.11ac (VHT40)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
38	5190	36.60	36.61
46	5230	36.62	36.64
151	5755	36.68	36.66
159	5795	36.70	36.74

802.11ac (VHT80)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		Chain 0	Chain 1
42	5210	75.85	75.71
155	5775	75.78	75.74

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

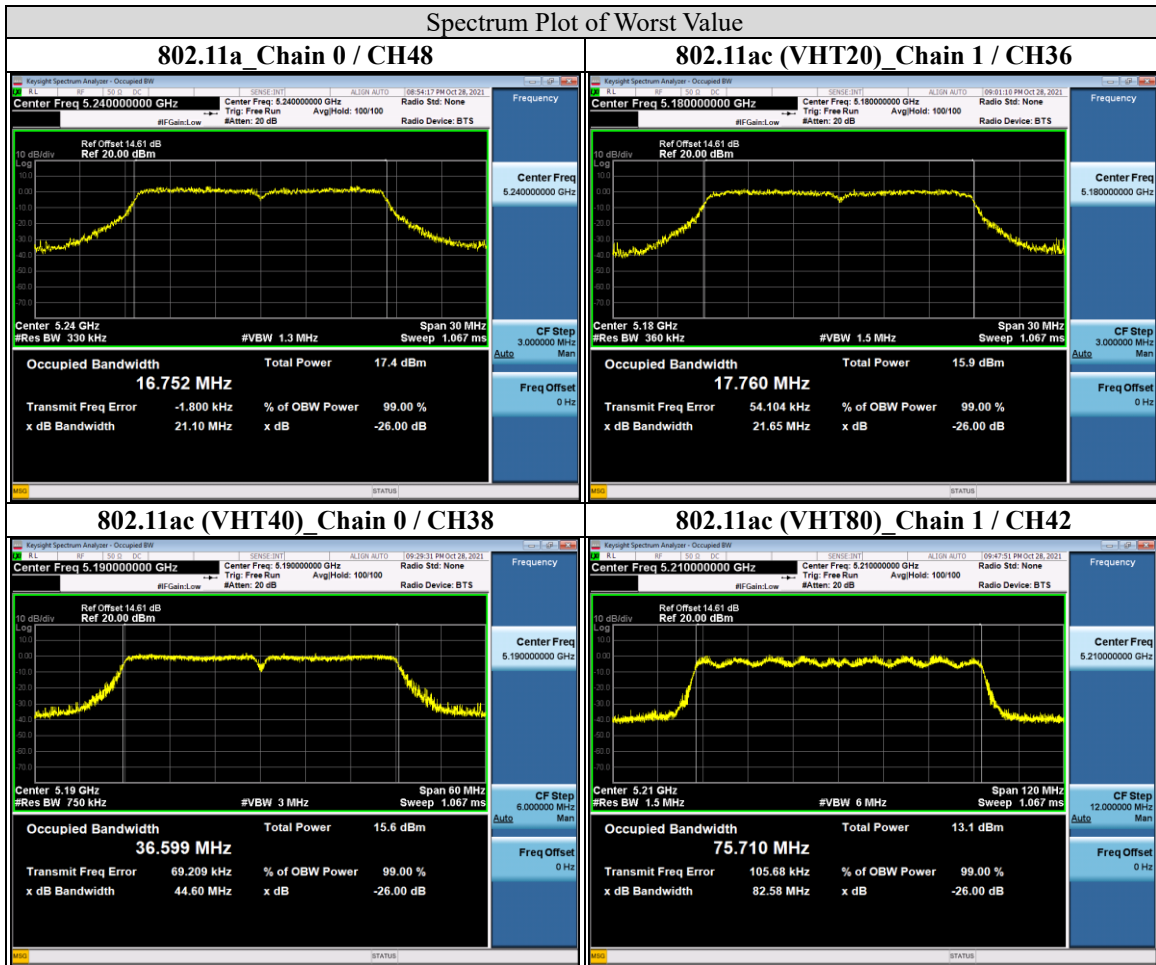
Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test report No. : 4789804204-US-R0-V0
Page : 26 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT



Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

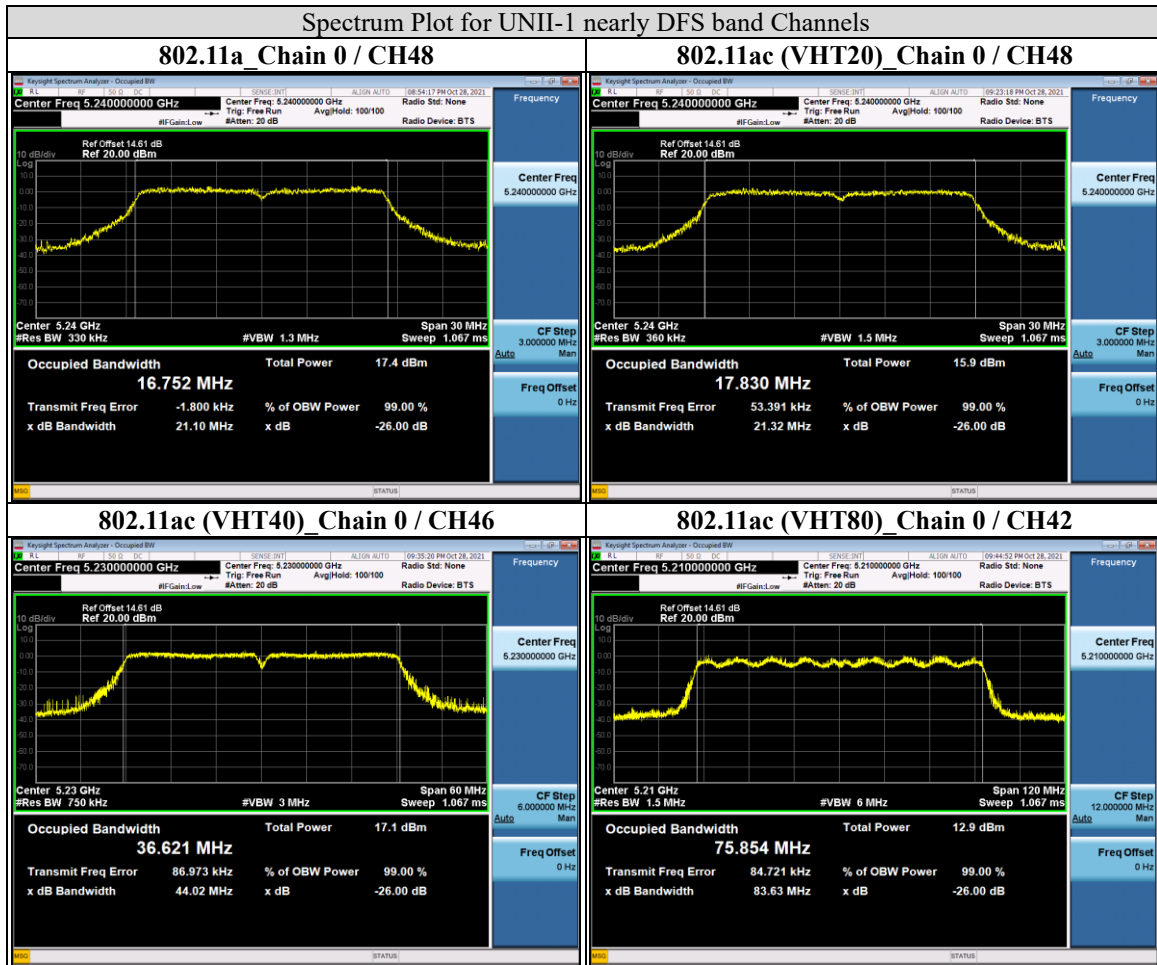
Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test report No. : 4789804204-US-R0-V0
Page : 27 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT



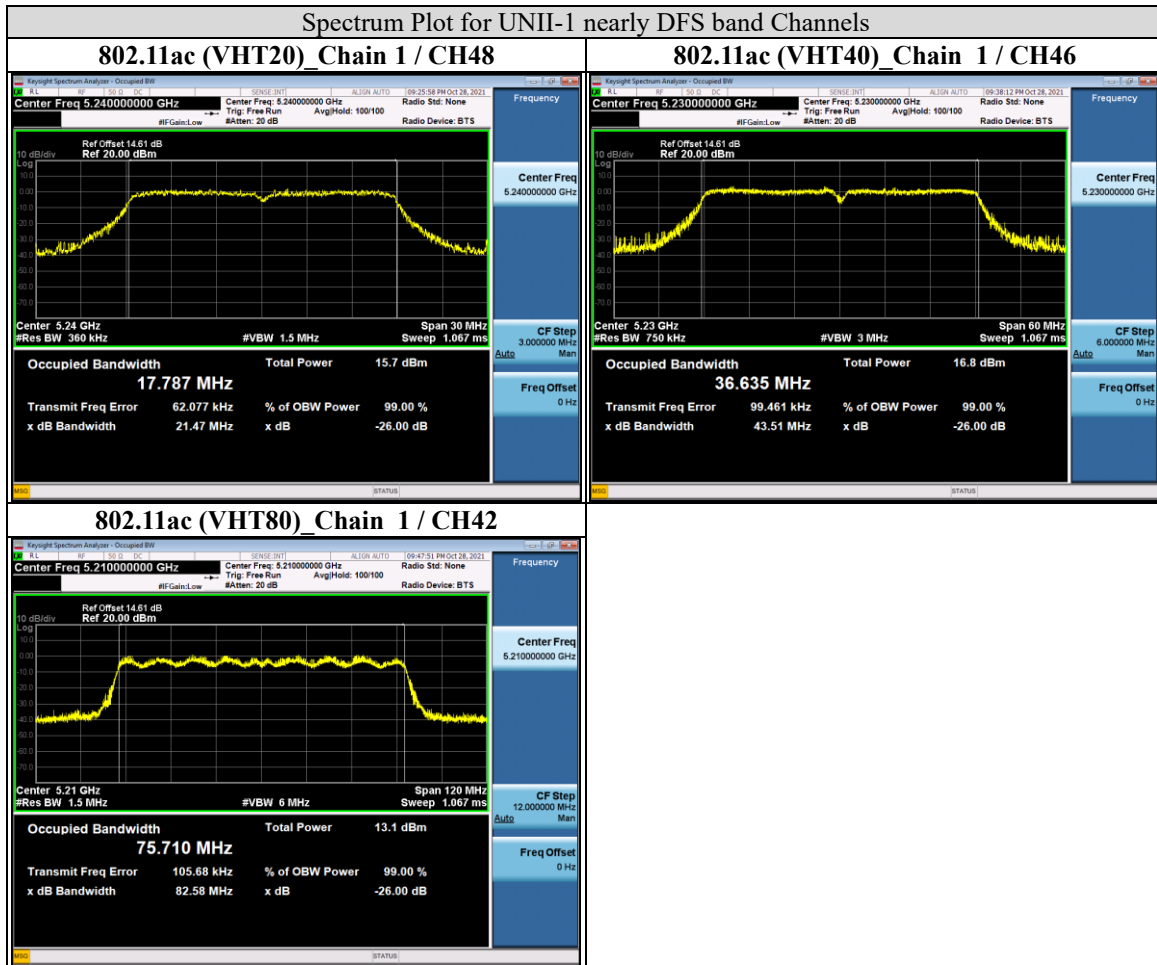
Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Note: The observed T2 is all <5250 MHz, so UNII-1 band channels which in nearly DFS band no need for DFS function.

Modulation	Channel	Channel Frequency (MHz)	Highest Occupied Channel Edge (MHz)
			Chain 0
802.11a	CH48	5240	5248.376
802.11ac (VHT20)	CH48	5240	5248.915
802.11ac (VHT40)	CH46	5230	5248.3175
802.11ac (VHT80)	CH42	5210	5247.927

Note:

1. The Highest Occupied Channel Edge is all <5250 MHz, so in nearby DFS band channels no need for DFS function
2. Highest Occupied Channel Edge frequency calculation = Center Frequency + (1/2*Occupied Bandwidth)

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



9.4. Conducted output power

Requirements

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) Max. e.i.r.p $\leq 125\text{mW}$ (21 dBm) at any elevation angle above 30 degrees as measured from the horizon If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 30 - (G_{\text{TX}} - 6)$
		Fixed point-to-point Access Point	1 Watt (30 dBm) If $G_{\text{TX}} > 23 \text{ dBi}$, then $P_{\text{Out}} = 30 - (G_{\text{TX}} - 23)$
		Indoor Access Point	1 Watt (30 dBm) If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 30 - (G_{\text{TX}} - 6)$
	√	Client device	250mW (24 dBm) If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 23.98 - (G_{\text{TX}} - 6)$
U-NII-2A	---		250mW (24 dBm) or $11 \text{ dBm} + 10 \log B^*$ If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 23.98 - (G_{\text{TX}} - 6)$
U-NII-2C	---		250mW (24 dBm) or $11 \text{ dBm} + 10 \log B^*$ If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 23.98 - (G_{\text{TX}} - 6)$
U-NII-3	√		For Point-to-multipoint systems (P2M): 1 Watt (30 dBm). If $G_{\text{TX}} > 6 \text{ dBi}$, then $P_{\text{Out}} = 30 - (G_{\text{TX}} - 6)$ For Point-to-point systems (P2P): 1 Watt (30 dBm)

Note:

- P_{Out} = maximum conducted output power in dBm,
- G_{TX} = the maximum transmitting antenna directional gain in dBi.
- B is the 26 dB emission bandwidth in megahertz
- Directional Gain = $G_{\text{ant}} + 10 \log (N_{\text{ant}})$ dBi.

N_{ant} : Number of Transmit Antennas

G_1, G_2, \dots, G_n : Gain of Individual Antennas (Same for Each Antenna)

- Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

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

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

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

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test Procedure

For Average Power Measurement

Test method PM-G

For 802.11a, 802.11ac (VHT20), 802.11ac (VHT40)

Method PM is 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 and set the detector to AVERAGE. Duty factor is not added to measured value.

Test method SA-1

For 802.11ac (VHT80)

- a. Set span to encompass the entire 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- b. Set sweep trigger*.
- c. Set RBW = 1 MHz.
- d. Set VBW \geq 3 MHz
- e. Number of points in sweep \geq 2 Span / RBW.
- f. Sweep time \leq (number of points in sweep) * T
- g. Using emission bandwidth to determine the frequency span for integration the channel bandwidth.
- h. Detector = RMS.
- i. Trace mode = max hold.
- j. Allow max hold to run for at least 60 seconds, or longer as needed to allow the trace to stabilize.

* If transmit duty cycle $< 98\%$, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle $\geq 98\%$, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

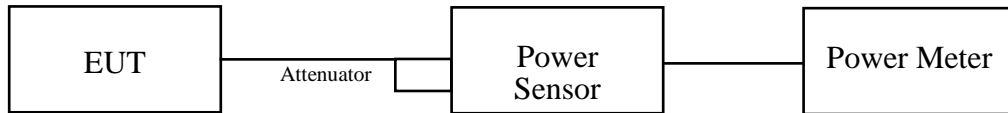
Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0

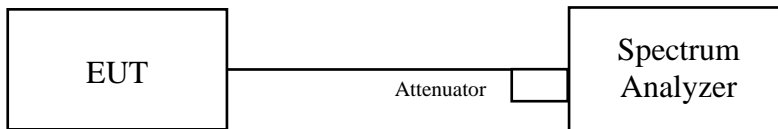


Test Setup

For Average Power Measurement



The loss between RF output port of the EUT and the input port of the Power Meter has been taken into consideration.



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test Data

802.11a

Channel	Channel Frequency (MHz)	Maximum Conducted Power (mW)	Maximum Conducted Power (dBm)	Power Limit (dBm)	Pass/Fail
36	5180	17.539	12.44	23.98	PASS
44	5220	18.923	12.77	23.98	PASS
48	5240	19.275	12.85	23.98	PASS
149	5745	17.539	12.44	30	PASS
157	5785	18.535	12.68	30	PASS
165	5825	18.836	12.75	30	PASS

802.11ac (VHT20)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
36	5180	9.36	9.73	18.03	12.56	23.98	PASS
44	5220	9.25	9.74	17.824	12.51	23.98	PASS
48	5240	9.35	9.39	17.298	12.38	23.98	PASS
149	5745	9.31	9.37	17.179	12.35	30	PASS
157	5785	9.46	9.57	17.906	12.53	30	PASS
165	5825	9.44	9.50	17.701	12.48	30	PASS

Note:

For U-NII-1 Band: The directional gain = 5.6 dBi < 6 dBi, so the power limit shall not be reduced.

For U-NII-3 Band: The directional gain = 5.9 dBi < 6 dBi, so the power limit shall not be reduced.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



802.11ac (VHT40)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
38	5190	9.63	9.75	18.621	12.70	23.98	PASS
46	5230	9.56	9.52	17.989	12.55	23.98	PASS
151	5755	9.51	9.49	17.824	12.51	30	PASS
159	5795	9.45	9.44	17.62	12.46	30	PASS

Note:

For U-NII-1 Band: The directional gain = 5.6 dBi < 6 dBi, so the power limit shall not be reduced.

For U-NII-3 Band: The directional gain = 5.9 dBi < 6 dBi, so the power limit shall not be reduced.

802.11ac (VHT80)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
42	5210	8.54	8.75	14.655	11.66	23.98	PASS
155	5775	8.43	8.46	13.996	11.46	30	PASS

Note:

For U-NII-1 Band: The directional gain = 5.6 dBi < 6 dBi, so the power limit shall not be reduced.

For U-NII-3 Band: The directional gain = 5.9 dBi < 6 dBi, so the power limit shall not be reduced.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



9.5. Power Spectral Density

Requirements

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	17dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 17 - (G_{TX} - 6)$
		Fixed point-to-point Access Point	17dBm/ MHz If $G_{TX} > 23$ dBi, then $PSD = 17 - (G_{TX} - 23)$
		Indoor Access Point	17dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 17 - (G_{TX} - 6)$
	√	Client device	11dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 11 - (G_{TX} - 6)$
U-NII-2A	---		11dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 11 - (G_{TX} - 6)$
U-NII-2C	---		11dBm/ MHz If $G_{TX} > 6$ dBi, then $PSD = 11 - (G_{TX} - 6)$
U-NII-3	√		For Point-to-multipoint systems (P2M): 30dBm/ 500kHz. If $G_{TX} > 6$ dBi, then $PSD = 30 - (G_{TX} - 6)$ For Point-to-point systems (P2P): 30dBm/ 500kHz

Note:

- PSD = power spectral density that the same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz
- G_{TX} = the maximum transmitting antenna directional gain in dBi.
- Directional Gain = $G_{ant} + 10 \log (N_{ant})$ dBi.
Nant: Number of Transmit Antennas
 G_1, G_2, \dots, G_n : Gain of Individual Antennas (Same for Each Antenna)
- Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test procedure

For U-NII-1 band:

Using method as below:

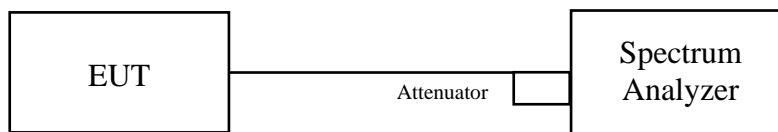
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 1 MHz, Set VBW \geq 3 RBW, Detector = RMS
- Sweep time = auto, trigger set to “free run”.
- Trace average at least 100 traces in power averaging mode.
- Record the max value. (if Duty cycle $< 98\%$, add $10 \log (1/\text{duty cycle})$)

For U-NII-3 band:

Using method as below:

- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz, Set VBW \geq 1 MHz, Detector = RMS
- Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
- Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $\text{BWCF} = 10 \log (500 \text{ kHz}/300 \text{ kHz})$
- Sweep time = auto, trigger set to “free run”.
- Trace average at least 100 traces in power averaging mode.
- Record the max value. (if Duty cycle $< 98\%$, add $10 \log (1/\text{duty cycle})$)

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test Data

For U-NII-1 band

802.11a

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/MHz)	Total PSD with duty factor (dBm/MHz)	PSD Maximum Limit (dBm/MHz)	Pass/Fail
36	5180	-1.84	-1.67	11.00	PASS
44	5220	-0.43	-0.26	11.00	PASS
48	5240	-1.92	-1.75	11.00	PASS

Note: Refer to section 6.6 for duty cycle spectrum plot.

802.11ac (VHT20)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/MHz)		Total PSD with duty factor (dBm/MHz)	PSD Maximum Limit (dBm/MHz)	Pass/Fail
		Chain 0	Chain 1			
36	5180	-3.71	-4.47	-0.88	8.39	PASS
44	5220	-4.33	-4.71	-1.32	8.39	PASS
48	5240	-4.09	-3.36	-0.52	8.39	PASS

Note:

1. Directional gain = 8.61 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



802.11ac (VHT40)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/MHz)		Total PSD with duty factor (dBm/MHz)	PSD Maximum Limit (dBm/MHz)	Pass/Fail
		Chain 0	Chain 1			
38	5190	-8.98	-7.93	-5.06	8.39	PASS
46	5230	-9.37	-8.07	-5.31	8.39	PASS

Note:

1. Directional gain = 8.61 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ac (VHT80)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/MHz)		Total PSD with duty factor (dBm/MHz)	PSD Maximum Limit (dBm/MHz)	Pass/Fail
		Chain 0	Chain 1			
42	5210	-14.71	-14.74	-11.03	8.39	PASS

Note:

1. Directional gain = 8.61 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

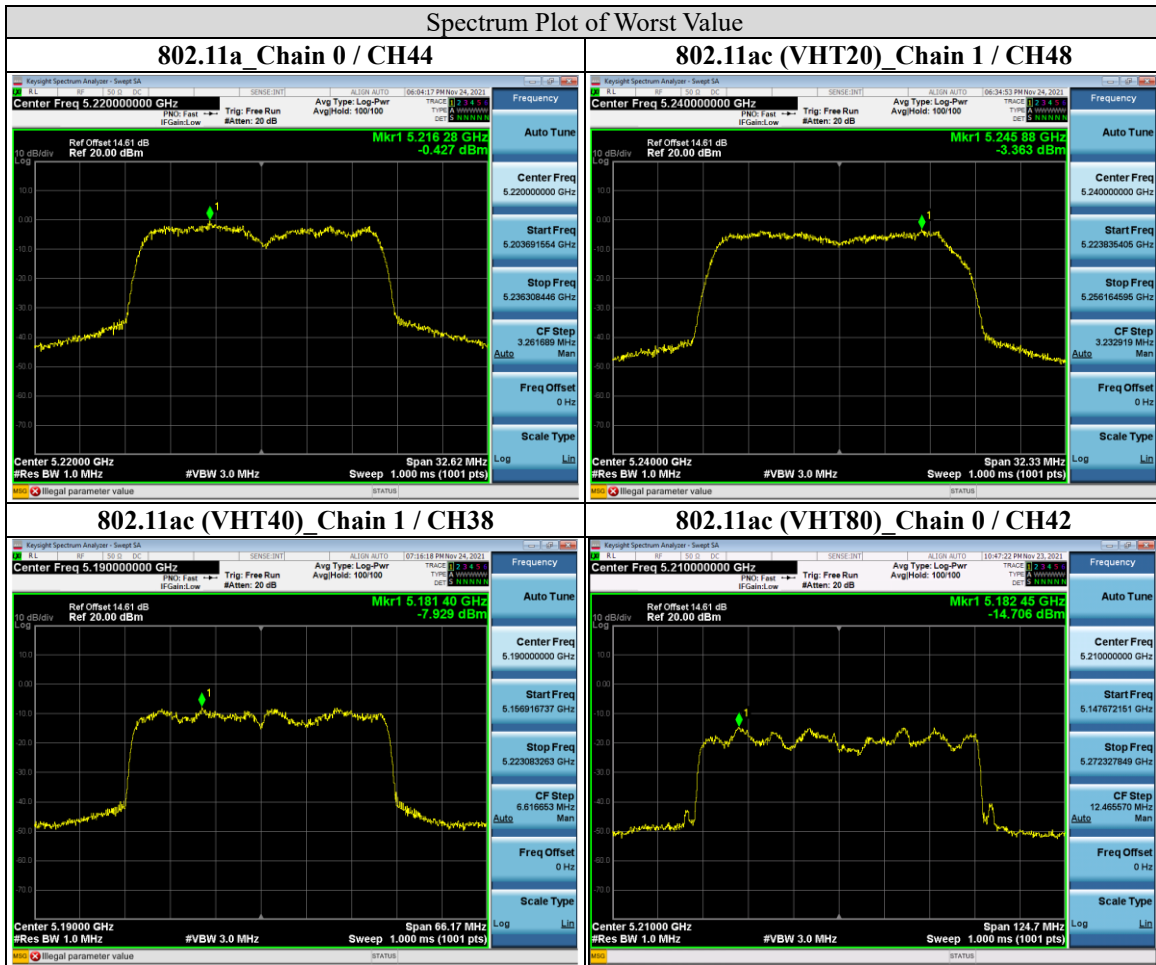
Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test report No. : 4789804204-US-R0-V0
Page : 38 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT



Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



For U-NII-3 Band

802.11a

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/300 kHz)	Total PSD with BWCF (dBm/500 kHz)	Total PSD with duty factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
149	5745	-6.29	-4.07	-3.9	30	PASS
157	5785	-5.61	-3.39	-3.22	30	PASS
165	5825	-6.43	-4.21	-4.04	30	PASS

Note:

1. Refer to section 6.6 for duty cycle spectrum plot.
2. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$.

802.11ac (VHT20)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/300 kHz)		Total PSD w/o BWCF (dBm/300 kHz)	Total PSD with BWCF (dBm/500 kHz)	Total PSD with duty factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		Chain 0	Chain 1					
149	5745	-10.63	-9.10	-6.79	-4.57	-4.39	27.09	PASS
157	5785	-11.20	-10.46	-7.81	-5.59	-5.41	27.09	PASS
165	5825	-10.83	-10.34	-7.57	-5.35	-5.17	27.09	PASS

Note:

1. Directional gain = 8.91 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.
3. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



802.11ac (VHT40)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/300 kHz)		Total PSD w/o BWCF (dBm/300 kHz)	Total PSD with BWCF (dBm/500 kHz)	Total PSD with duty factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		Chain 0	Chain 1					
151	5755	-13.59	-12.72	-10.12	-7.90	-7.55	27.09	PASS
159	5795	-14.30	-13.51	-10.88	-8.66	-8.31	27.09	PASS

Note:

1. Directional gain = 8.91 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.
3. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$.

802.11ac (VHT80)

Channel	Frequency (MHz)	PSD w/o duty factor (dBm/300 kHz)		Total PSD w/o BWCF (dBm/300 kHz)	Total PSD with BWCF (dBm/500 kHz)	Total PSD with duty factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
		Chain 0	Chain 1					
155	5775	-18.86	-18.19	-15.5	-13.28	-12.6	27.09	PASS

Note:

1. Directional gain = 8.91 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.
3. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(500 \text{ kHz}/300\text{kHz})$.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

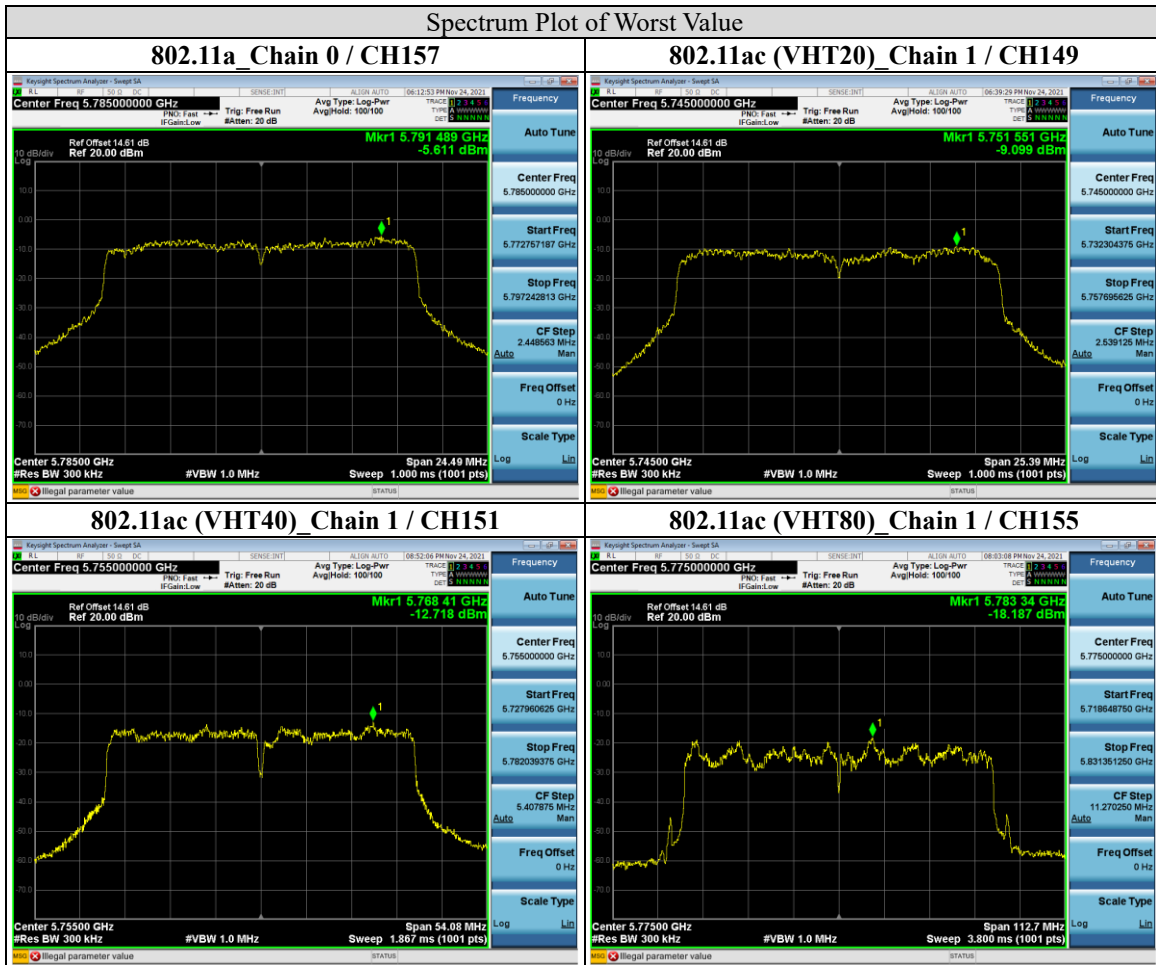
Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test report No. : 4789804204-US-R0-V0
Page : 41 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT



Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



9.6. Frequency Stability

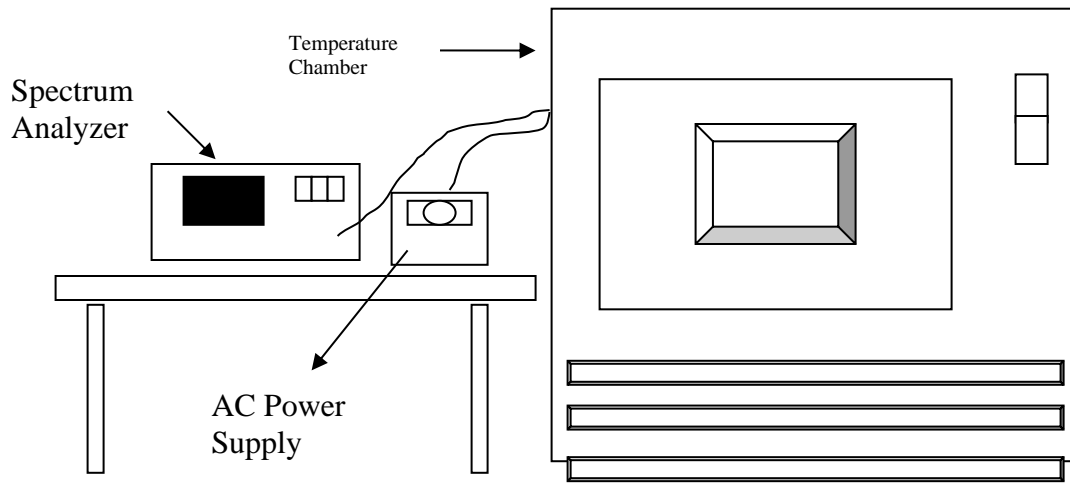
Requirements

The frequency of the carrier signal shall be maintained within band of operation.

Test procedure

- The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- Turn the EUT on and couple its output to a spectrum analyzer.
- Turn the EUT off and set the chamber to the highest temperature specified.
- Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 Minutes.
- Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
- The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 Minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

Test Setup





Test Data

Frequency Stability Versus Temp.									
Operating Frequency: 5180 MHz									
TEMP. (°C)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
50	120	5179.9907	-1.80	5179.9919	-1.56	5179.9911	-1.72	5179.994	-1.16
40	120	5180.0245	4.73	5180.0215	4.15	5180.0215	4.15	5180.0226	4.36
30	120	5179.9913	-1.68	5179.9887	-2.18	5179.9886	-2.20	5179.988	-2.32
20	120	5180.0078	1.51	5180.0114	2.20	5180.0105	2.03	5180.0121	2.34
10	120	5179.9919	-1.56	5179.9939	-1.18	5179.9934	-1.27	5179.992	-1.54
0	120	5180.0022	0.42	5180.002	0.39	5180.0007	0.14	5180.0048	0.93
-10	120	5180.0086	1.66	5180.0065	1.25	5180.0069	1.33	5180.0035	0.68
-20	120	5180.0137	2.64	5180.0102	1.97	5180.0131	2.53	5180.0136	2.63
-30	120	5180.0249	4.81	5180.0255	4.92	5180.0238	4.59	5180.0266	5.14
TEMP. (°C)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
20	138	5180.0081	1.56	5180.0118	2.28	5180.0103	1.99	5180.0112	2.16
20	120	5180.0078	1.51	5180.0114	2.20	5180.0105	2.03	5180.0121	2.34
20	102	5180.0074	1.43	5180.0105	2.03	5180.0101	1.95	5180.013	2.51

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



9.7. Radiated Spurious Emission

Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequency(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.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Limits of unwanted emission out of the restricted bands

Applicable To		Limit	
789033 D02 General UNII Test Procedure New Rules v02r01		Field Strength at 3m	
		PK:74 (dBμV/m)	AV:54 (dBμV/m)
Frequency Band	Applicable To	EIRP Limit	Equivalent Field Strength at 3m
5150~5250 MHz	15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBμV/m)
5250~5350 MHz	15.407(b)(2)		
5470~5725 MHz	15.407(b)(3)		
5725~5850 MHz	15.407(b)(4)(i)	PK:-27 (dBm/MHz) ^{*1} PK:10 (dBm/MHz) ^{*2} PK:15.6 (dBm/MHz) ^{*3} PK:27 (dBm/MHz) ^{*4}	PK: 68.2(dBμV/m) ^{*1} PK:105.2 (dBμV/m) ^{*2} PK: 110.8(dBμV/m) ^{*3} PK:122.2 (dBμV/m) ^{*4}
<p>*1 beyond 75 MHz or more above of the band edge. *2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above. *3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above. *4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.</p>			

Note:

The following formula is used to convert the effective isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts).}$$

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Test Procedures

[For 9 kHz ~ 30 MHz]

- 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. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

- 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. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- 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.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



Note:

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

Configuration	Average	
	RBW	VBW
802.11a	1MHz	1kHz
802.11ac (VHT20)		1kHz
802.11ac (VHT40)		2kHz
802.11ac (VHT80)		5.1kHz

Note: Refer to section 6.6 for duty cycle.

- All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
- Test data of Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
- Test data of Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
- Test data of Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
- Test data of Notation "@" = Fundamental Frequency
- Test data of Notation "*" = Only required peak limit or the peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

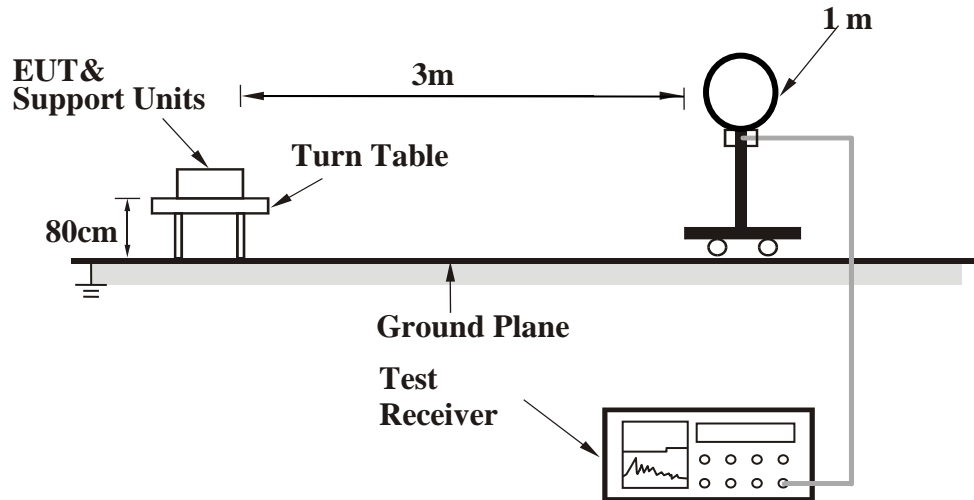
Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

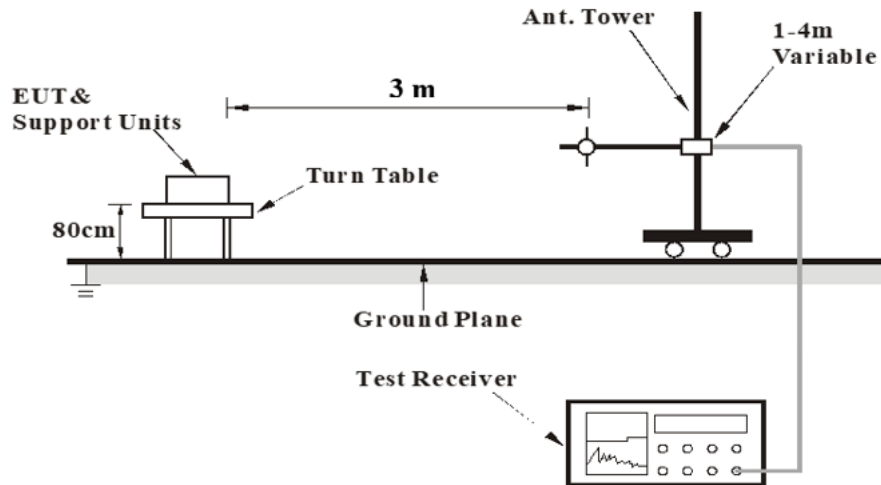
Doc No: 17-EM-F0878 / 6.0

Test Setup

<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >



Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

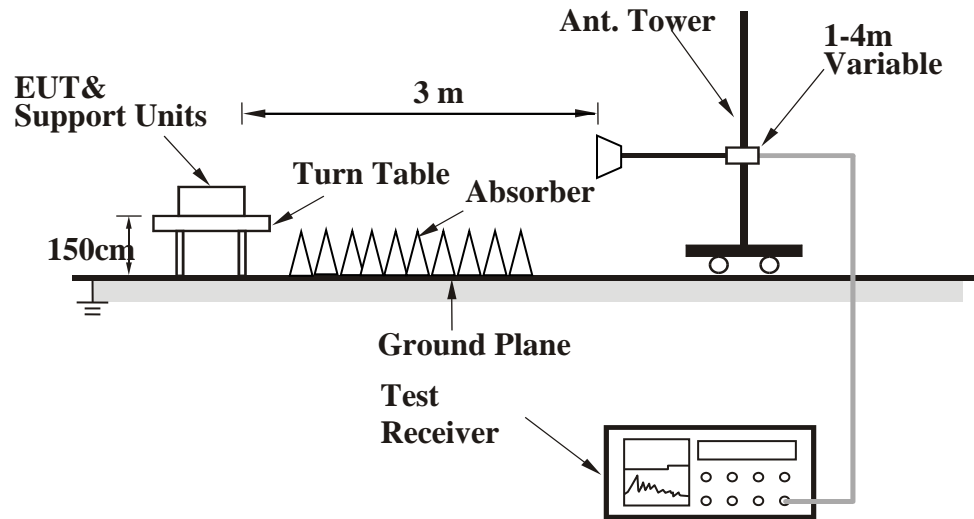
Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0878 / 6.0



<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.



Test report No. : 4789804204-US-R0-V0
Page : 50 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT

Test Data

Above 1 GHz

Mode	802.11a	Channel	36
------	---------	---------	----

Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		5074.9	41.95	19.38	61.33	74	-12.67	PK
		5101.5	30.1	19.46	49.56	54	-4.44	AVG
	@	5180	78.48	19.4	97.88	N/A	N/A	PK
	@	5180	70.24	19.4	89.64	N/A	N/A	AVG
		10360	30.36	17.39	47.75	68.2	-20.45	PK
Vertical		5077.35	42.87	19.39	62.26	74	-11.74	PK
		5149.8	31.51	19.43	50.94	54	-3.06	AVG
	@	5180	88.19	19.4	107.59	N/A	N/A	PK
	@	5180	78.49	19.4	97.89	N/A	N/A	AVG
		10360	30.54	17.39	47.93	68.2	-20.27	PK

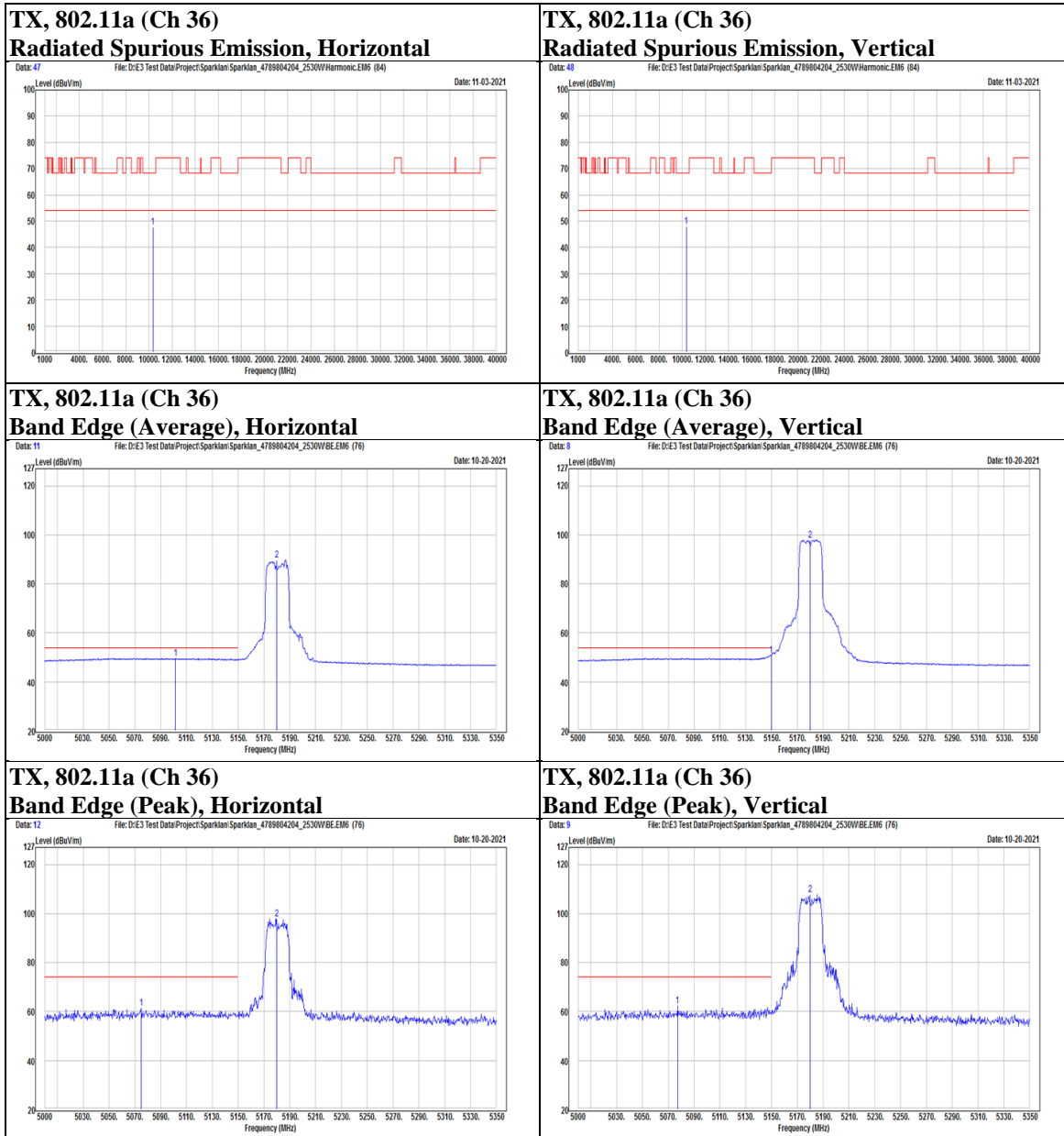
Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0





Test report No. : 4789804204-US-R0-V0
Page : 52 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT

Mode	802.11a	Channel	44
------	---------	---------	----

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		5081.55	30.21	19.4	49.61	54	-4.39	AVG
		5115.85	41.8	19.46	61.26	74	-12.74	PK
	@	5220	77.01	19.33	96.34	N/A	N/A	PK
	@	5220	68.3	19.33	87.63	N/A	N/A	AVG
		10440	30.37	17.63	48	68.2	-20.2	PK
Vertical		5045.5	42.72	19.25	61.97	74	-12.03	PK
		5061.95	30.24	19.33	49.57	54	-4.43	AVG
	@	5220	90.53	19.33	109.86	N/A	N/A	PK
	@	5220	80.64	19.33	99.97	N/A	N/A	AVG
		10440	30.29	17.63	47.92	68.2	-20.28	PK

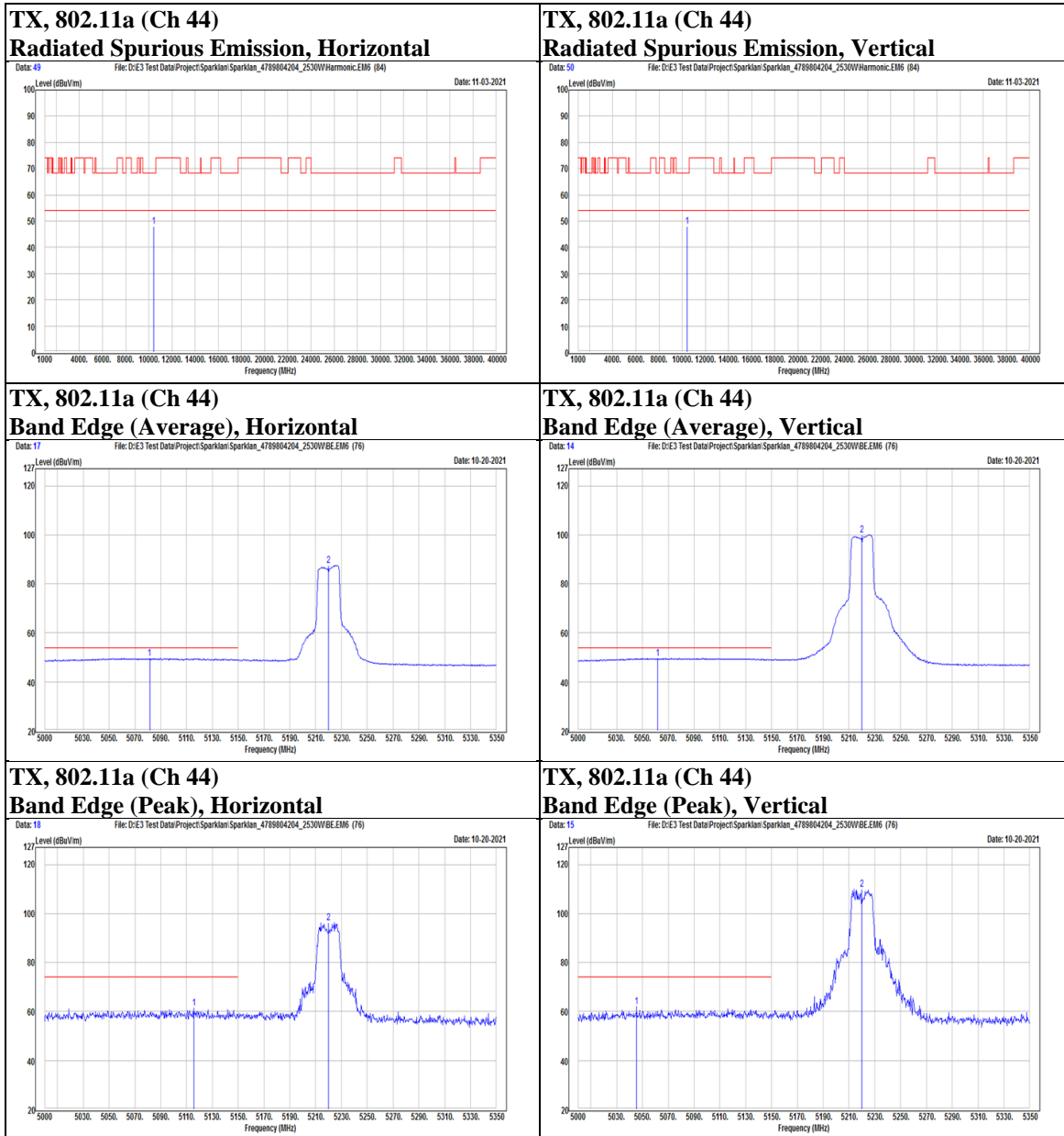
Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0





Test report No. : 4789804204-US-R0-V0
Page : 54 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT

Mode	802.11a	Channel	48
------	---------	---------	----

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		5046.9	43.25	19.27	62.52	74	-11.48	PK
		5094.5	30.04	19.44	49.48	54	-4.52	AVG
	@	5240	77.9	19.27	97.17	N/A	N/A	PK
	@	5240	67.71	19.27	86.98	N/A	N/A	AVG
		10480	31.13	17.69	48.82	68.2	-19.38	PK
Vertical		5074.55	37.41	19.38	56.79	74	-17.21	PK
		5096.25	30.24	19.45	49.69	54	-4.31	AVG
	@	5240	86.4	19.27	105.67	N/A	N/A	PK
	@	5240	82.1	19.27	101.37	N/A	N/A	AVG
		10480	31.2	17.69	48.89	68.2	-19.31	PK

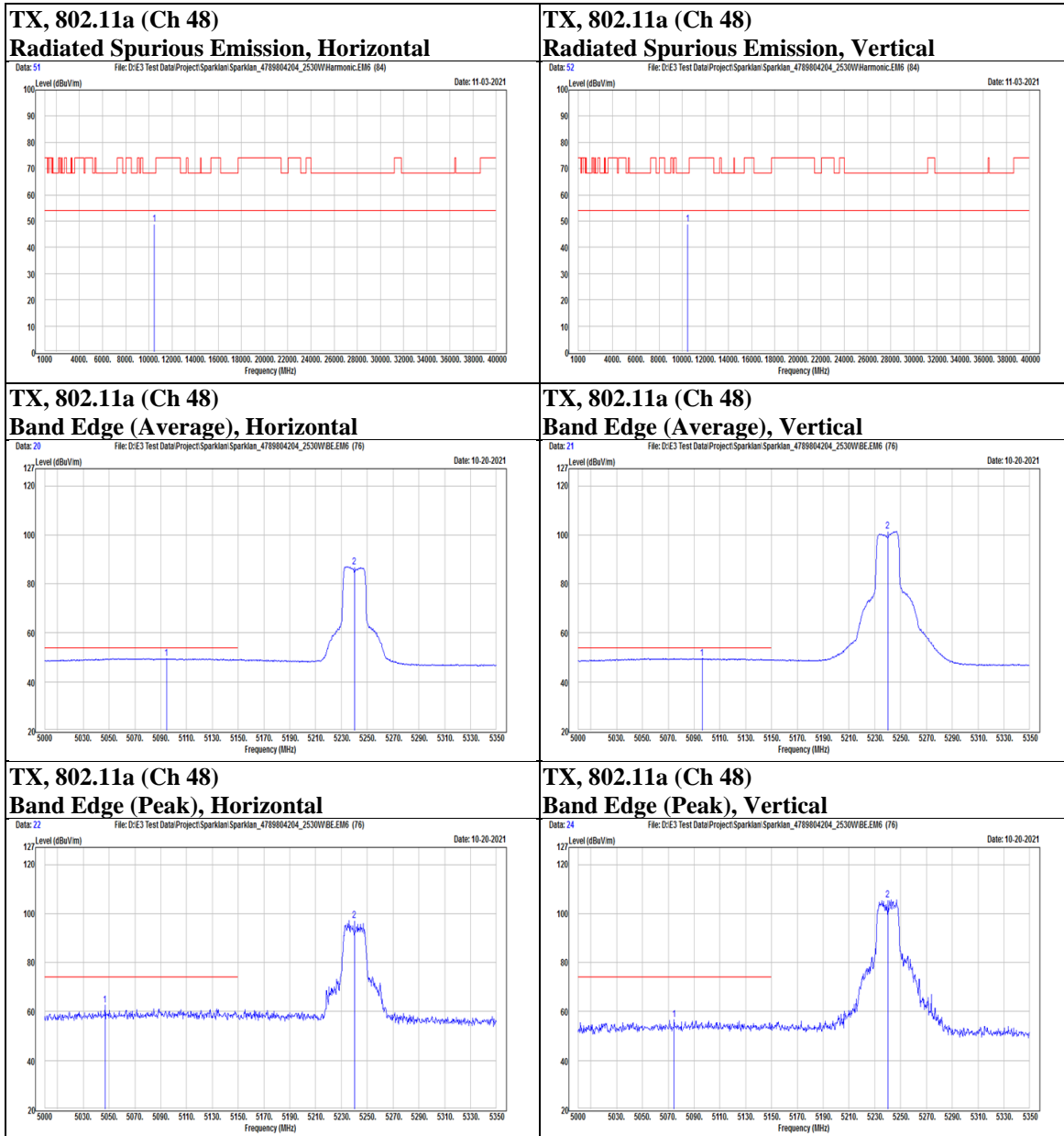
Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0





Test report No. : 4789804204-US-R0-V0
Page : 56 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT

Mode	802.11a	Channel	149
------	---------	---------	-----

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		5637	41.19	20.02	61.21	68.2	-6.99	PK
		5687	40.81	20.04	60.85	95.61	-34.76	PK
	@	5745	77.44	20.28	97.72	N/A	N/A	PK
	*	11490	30.14	19.02	49.16	74	-24.84	PK
Vertical		5578.5	40.91	19.98	60.89	68.2	-7.31	PK
		5696	42.89	20.05	62.94	102.25	-39.31	PK
	@	5745	94.89	20.28	115.17	N/A	N/A	PK
	*	11490	30.05	19.02	49.07	74	-24.93	PK

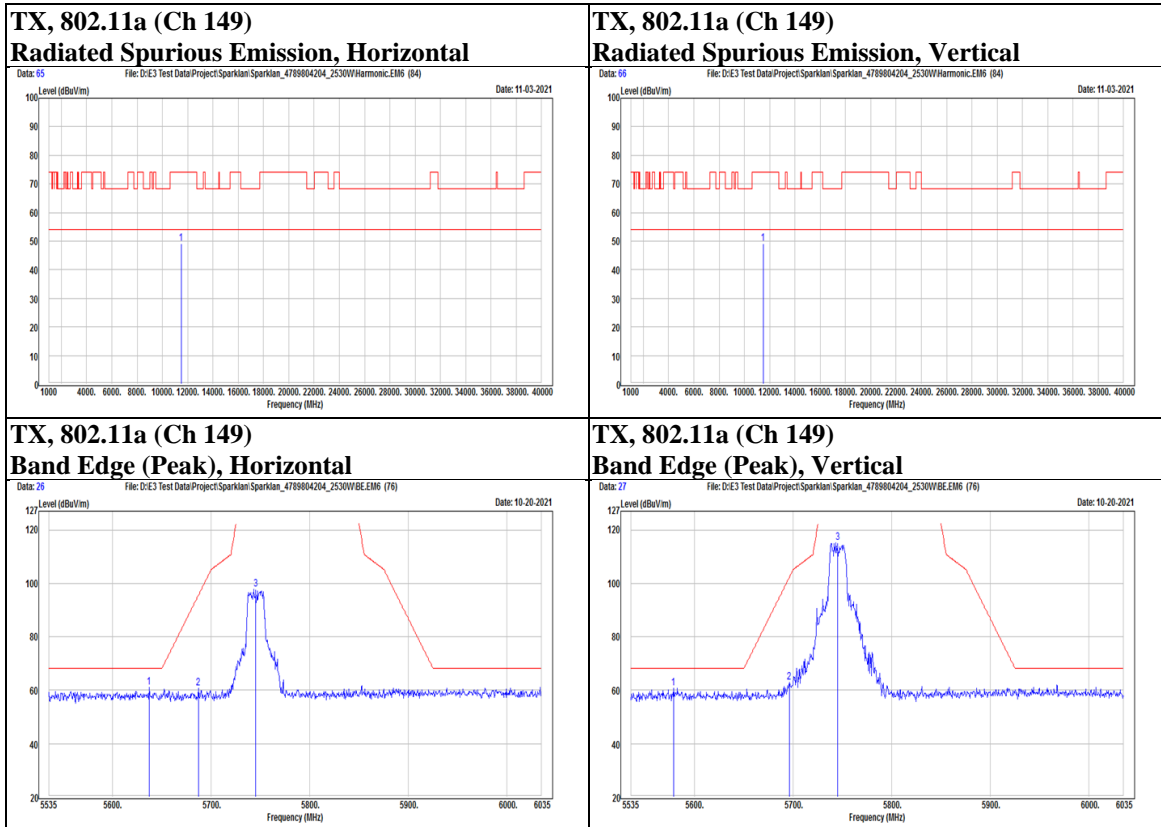
Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0





Test report No. : 4789804204-US-R0-V0
Page : 58 of 91
Issued date : 2021/12/20
FCC ID : ZZ6-WUBT236ACNBT

Mode	802.11a	Channel	157
------	---------	---------	-----

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		5629.5	41.14	20.02	61.16	68.2	-7.04	PK
		5657.5	39.79	20	59.79	73.77	-13.98	PK
	@	5785	76.29	20.48	96.77	N/A	N/A	PK
		5899	40.24	20.97	61.21	87.4	-26.19	PK
		5955	40.7	21.04	61.74	68.2	-6.46	PK
	*	11570	30.05	18.88	48.93	74	-25.07	PK
Vertical		5635	40.56	20.01	60.57	68.2	-7.63	PK
		5660.5	39.96	20	59.96	76	-16.04	PK
	@	5785	93.78	20.48	114.26	N/A	N/A	PK
		5883	40.24	20.92	61.16	99.26	-38.1	PK
		6028.5	40.76	21.21	61.97	68.2	-6.23	PK
	*	11570	31.45	18.88	50.33	74	-23.67	PK

Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0878 / 6.0