



Test report No. : 4790218754-US-R0-V0
Page : 1 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

RADIO TEST REPORT

Product : Security Hub

Model Name : SH1001

FCC ID : 2APLE18300417

Test Regulation : FCC 47 CFR Part 15 Subpart C (Section 15.247)

Received Date : 2022/3/31

Test Date : 2022/3/31 ~ 2022/5/25

Issued Date : 2022/6/27

Applicant : Arlo Technologies Inc
2200 Faraday Avenue, Suite 150, Carlsbad, CA 92008, 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-F0876 / 6.0



Test report No. : 4790218754-US-R0-V0
Page : 2 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

REVISION HISTORY

Original Test Report No.: 4790218754-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-F0876 / 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. Conducted Output Power	24
9.3. Power Spectral Density	27
9.4. Conducted Out of Band Emission.....	31
9.5. Radiated Spurious Emission	45
9.6. AC Power Line Conducted Emission	78



1. Attestation of Test Results

APPLICANT: Arlo Technologies Inc
2200 Faraday Avenue, Suite 150, Carlsbad, CA 92008, USA

MANUFACTURER: Funing Precision Component co., Ltd
Lot B, Que vo Industrial Zone.Nam Son Ward, Bac Ninh city, Bac
Ninh province, Viet Nam

EUT DESCRIPTION: Security Hub

BRAND: Arlo

MODEL: SH1001

SAMPLE STAGE: Engineering Verification Test sample

DATE of TESTED: 2022/3/31 ~ 2022/5/25

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart C (Section 15.247)	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:

Cindy Hsin
Project Handler

Date : 2022/6/27

Approved and Authorized By:

Eric Lee
Senior Laboratory Engineer

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



2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.247(a)(2)	6dB Bandwidth	PASS
15.247(b)	Conducted Output Power	PASS
15.247(e)	Power Spectral Density	PASS
15.247(d)	Antenna Port Emission	PASS
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS
15.207	AC Power Conducted Emission	PASS
15.203	Antenna Requirement	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-F0876 / 6.0



3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB558074 D01 Meas Guidance v05r02, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013 and.

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-F0876 / 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-F0876 / 6.0



6. Equipment under Test

6.1. Description of EUT

Product	Security Hub
Brand Name	Arlo
Model Name	SH1001
Operating Frequency	2412MHz ~ 2462MHz
Modulation	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Transfer Rate	802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to MCS7
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20)
Maximum Output Power	802.11b: 24.73 dBm 802.11g: 27.26 dBm 802.11n (HT20): 27.55 dBm
Normal Voltage	5Vdc from Adapter / 3.6Vdc from Battery
S/N	AB5U217LA00D0
Sample ID	Conducted Test: 4835381 Radiated Test: 4835380

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-F0876 / 6.0



Note:

1. The EUT incorporates a SISO function. Physically, the EUT provides one completed transmitters and one receivers.

Modulation Mode	Tx,Rx Function
802.11b	1TX,1RX
802.11g	1TX,1RX
802.11n (HT20)	1TX,1RX

2. The EUT contains following accessory devices:

Product	Brand	Model	Description
AC Adapter	PIE	AD2158	Input: 100-240V, 50/60Hz, 0.3A Output: 5.0V, 2A
AC Adapter	CWT	2AEA010	Input: 100-240V, 50/60Hz, 0.3A Output: 5.0V, 2A
USB Cable	Nienyi	322-50018-01	Length: 2.5 m

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer or user 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-F0876 / 6.0



6.2. Channel List

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

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

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-F0876 / 6.0



6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	20~26°C/ 50~70%RH	120Vac/ 60Hz	2022/03/31~ 2022/04/08	Rex Chen
Radiated Spurious Emission	966-2	20~26°C/ 50~70%RH	120Vac/ 60Hz	2022/03/31~ 2022/04/08	Rex Chen
AC power Line Conducted Emission	SR1	20~26°C/ 50~70%RH	120Vac/ 60Hz	2022/05/25~ 2022/05/25	Rex Chen

FCC Test Firm Registration Number: 498077

6.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Maximum Gain (dBi)
1	Chain (0)	N/A	N/A	PCB	2.8

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer specification or user 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-F0876 / 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-Z plane was worst-case. Therefore, all final radiated testing was performed with the EUT in X-Z plane.
- For all items, investigation was done on two power adapters (AD2185 and 2AEA010BA3B). The AD2185 is the worst case, therefore testing was performed on this model only.
- 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)	802.11b	DSSS	DBPSK	1 to 11	1,6,11	1 Mbps
	802.11g	OFDM	BPSK	1 to 11	1,2,6,10,11	6 Mbps
	802.11n20	OFDM	BPSK	1 to 11	1,2,6,10,11	MCS0
Radiated Emissions (Below 1GHz)	802.11n20	OFDM	BPSK	1 to 11	6	MCS
AC Power Line Conducted Emission	802.11n20	OFDM	BPSK	1 to 11	6	MCS
Antenna Port Conducted Measurement	802.11b	DSSS	DBPSK	1 to 11	1,6,11	1 Mbps
	802.11g	OFDM	BPSK	1 to 11	1,2,6,10,11	6 Mbps
	802.11n20	OFDM	BPSK	1 to 11	1,2,6,10,11	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

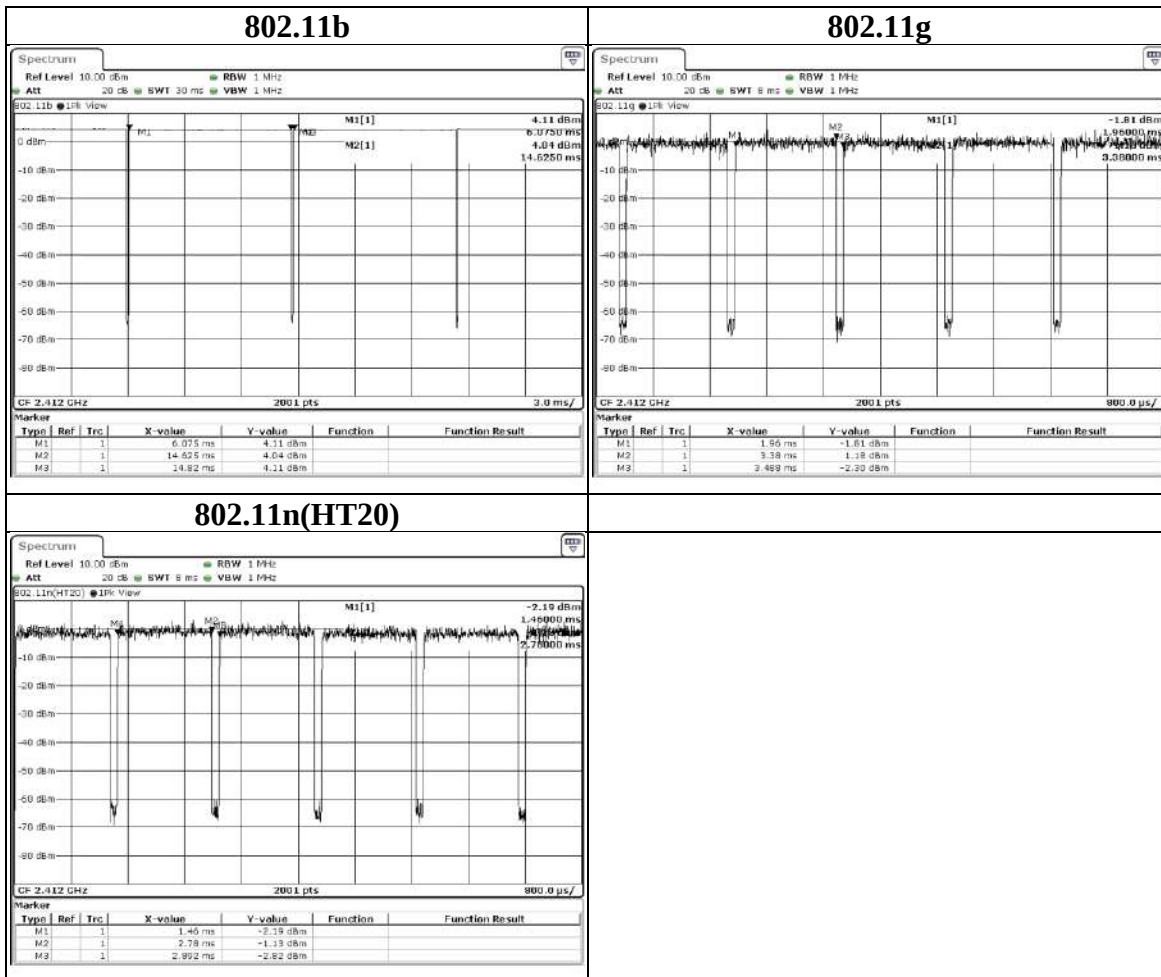
Facsimile (FAX) :+886-3-583-7948

Doc No: 17-EM-F0876 / 6.0



6.6. Duty cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle	Duty Factor (dB)	VBW Set (above 1GHz)
802.11b	8.550	8.745	0.98	N/A	200Hz
802.11g	1.420	1.528	0.93	0.32	1kHz
802.11n(HT20)	1.320	1.432	0.92	0.35	1kHz





7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2021/11/9	2022/11/8
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2021/12/10	2022/12/9
Loop Antenna	ETS lindgren	6502	00213440	2021/12/23	2022/12/22
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	2022/2/8	2023/2/7
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2021/12/13	2022/12/12
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2021/12/17	2022/12/16
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2021/6/8	2022/6/7
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2022/2/16	2023/2/15
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2021/5/19	2022/5/18
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2021/12/3	2022/12/2
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	2021/12/3	2022/12/2

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-F0876 / 6.0



Test report No. : 4790218754-US-R0-V0
Page : 15 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	2021/10/29	2022/10/28
Pulse Power Sensor	Anritsu	MA2411B	1531202	2021/12/22	2022/12/21
Power Meter	Anritsu	ML2495A	1645002	2021/12/22	2022/12/21
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2021/11/15	2022/11/14
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	2022/3/16	2023/3/15

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-F0876 / 6.0



8. Description of Test Setup

Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	USB Adapter	PIE	AD2158	NA	Supplied by client
B	Test Tool	NA	NA	NA	Supplied by client
C	Laptop	DELL	Latitude E5470	3JFKWF2	Provided by Lab

I/O Cables

ID	Equipment	Brand Name	Model Name	Length (m)	Remark
1	FPC Cable	NA	NA	0.2	Supplied by client
2	Micro USB Cable	WONDER	WA-W07UA	1.44	Provided by Lab

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

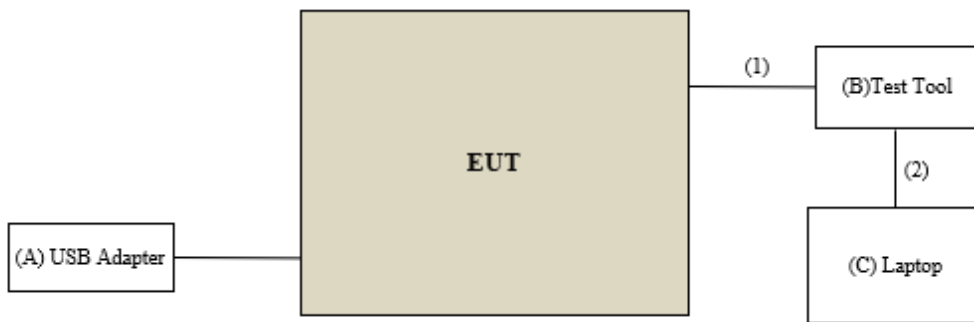
Doc No: 17-EM-F0876 / 6.0



Test Setup

Controlled using a bespoke application -Typing RF command by terminal tool(Tera Term_Version 4.92) 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.

Setup Diagram for Test



Under Table

Remote Site

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-F0876 / 6.0



9. Test Results

9.1. 6dB Bandwidth

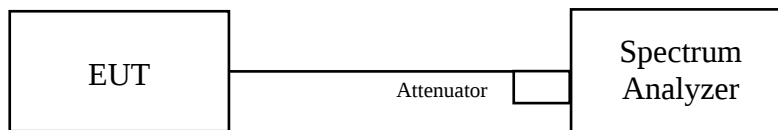
Requirements

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.

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

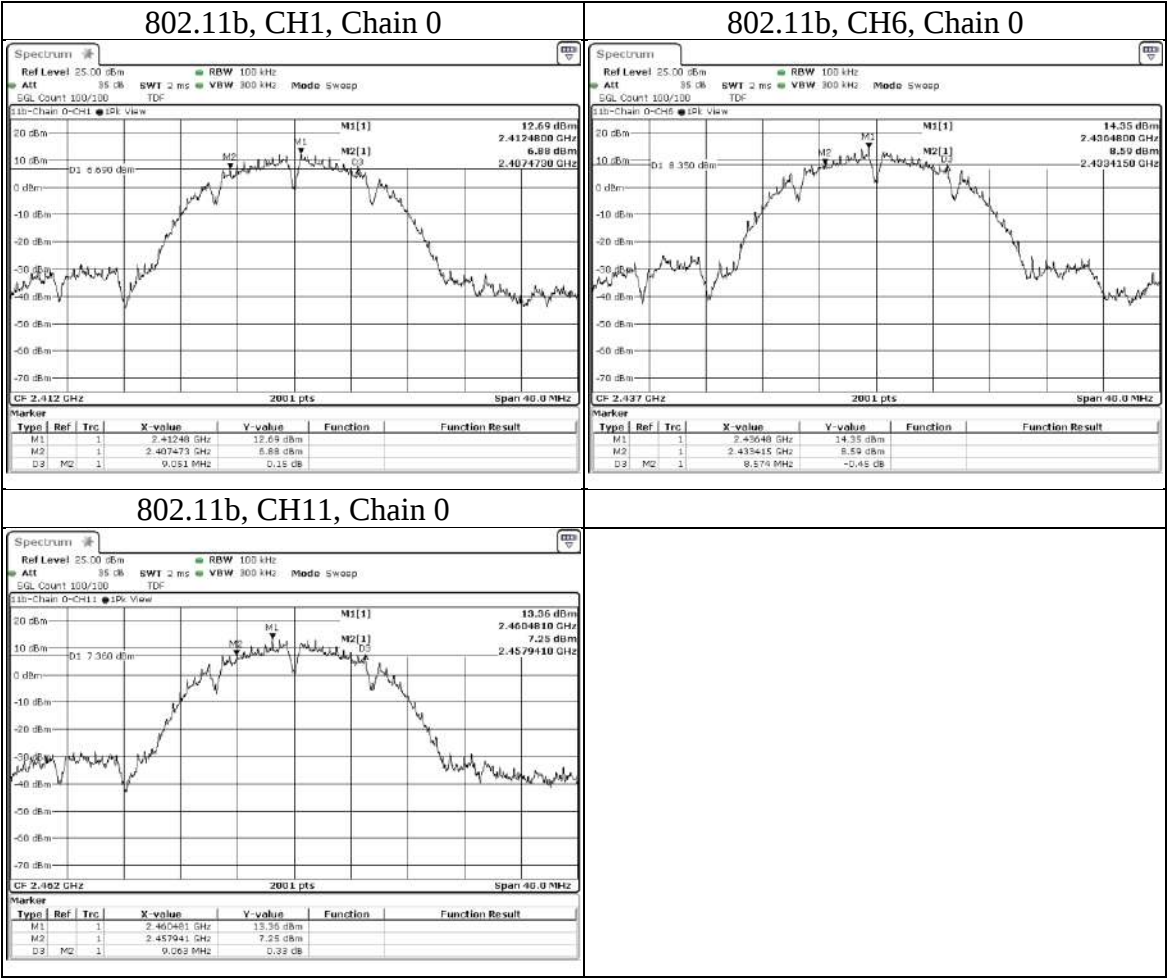
Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0876 / 6.0



Test Data

Mode	CH	Freq (MHz)	6dB BW (MHz)	Limit (MHz)	Result
			Chain 0		
802.11b	1	2412	9.051	0.5	Pass
	6	2437	8.574	0.5	Pass
	11	2462	9.063	0.5	Pass





Test report No. : 4790218754-US-R0-V0
Page : 20 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Mode	CH	Freq (MHz)	6dB BW (MHz)	Limit (MHz)	Result
			Chain 0		
802.11g	1	2412	15.041	0.5	Pass
	2	2417	15.080	0.5	Pass
	6	2437	14.072	0.5	Pass
	10	2457	14.053	0.5	Pass
	11	2462	15.061	0.5	Pass

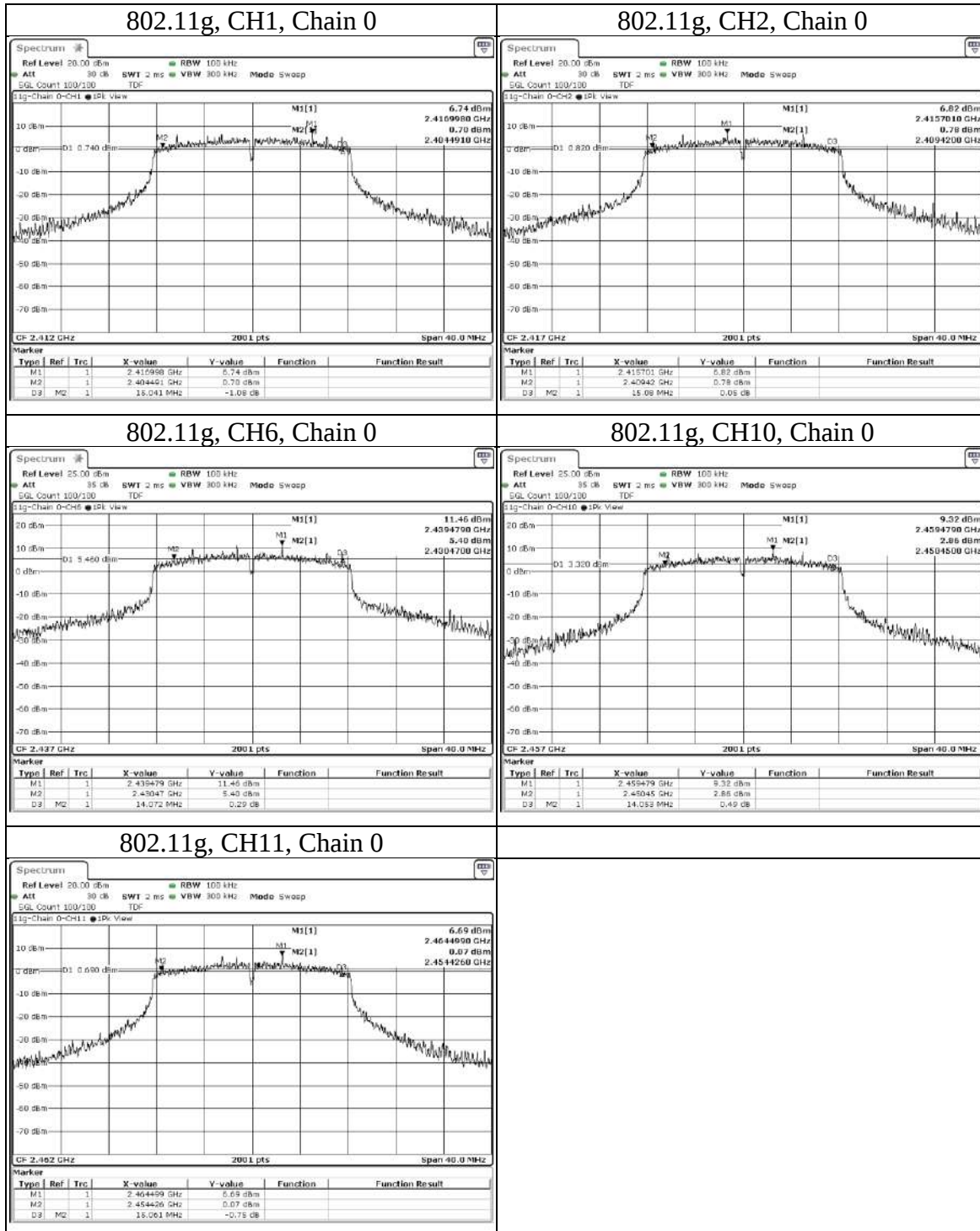
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0



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-F0876 / 6.0



Test report No. : 4790218754-US-R0-V0
Page : 22 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Mode	CH	Freq (MHz)	6dB BW (MHz)	Limit (MHz)	Result
			Chain 0		
802.11n(HT20)	1	2412	15.099	0.5	Pass
	2	2417	15.084	0.5	Pass
	6	2437	14.497	0.5	Pass
	10	2457	15.522	0.5	Pass
	11	2462	14.231	0.5	Pass

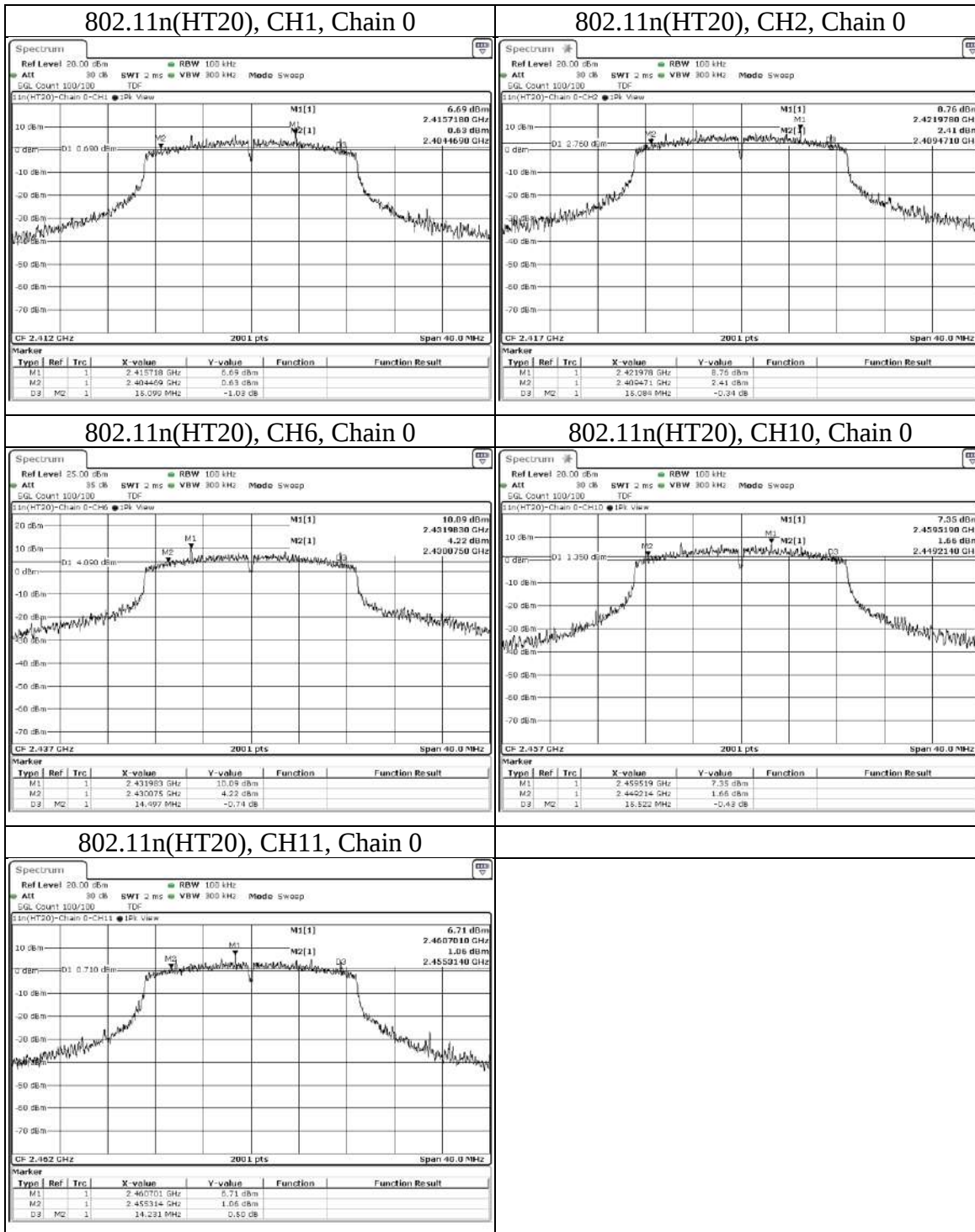
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





9.2. Conducted Output Power

Requirements

For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.

Note:

1. Directional Gain = $G_{ant} + 10 \log (N_{ant})$ dBi.

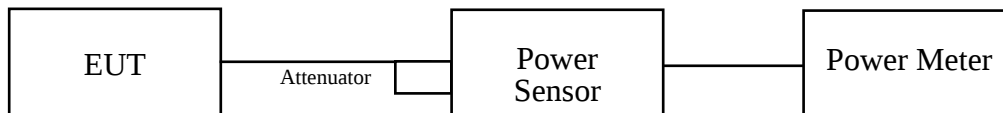
Nant: Number of Transmit Antennas

G1, G2,..., Gn: Gain of Individual Antennas (Same for Each Antenna)

Test Procedure

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.

Test Setup



The loss between RF output port of the EUT and the input port of the Power Meter 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-F0876 / 6.0



Test Data

Peak Power

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	266.073	24.25	30	PASS
6	2437	297.167	24.73	30	PASS
11	2462	257.632	24.11	30	PASS

802.11g

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	477.529	26.79	30	PASS
2	2417	532.108	27.26	30	PASS
6	2437	516.416	27.13	30	PASS
10	2457	468.813	26.71	30	PASS
11	2462	436.516	26.40	30	PASS

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	458.142	26.61	30	PASS
2	2417	489.779	26.90	30	PASS
6	2437	568.853	27.55	30	PASS
10	2457	466.659	26.69	30	PASS
11	2462	459.198	26.62	30	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-F0876 / 6.0



Average Power (Reference Only)

802.11b

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	157.761	21.98
6	2437	175.792	22.45
11	2462	153.109	21.85

802.11g

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	94.406	19.75
2	2417	87.902	19.44
6	2437	150.661	21.78
10	2457	74.645	18.73
11	2462	67.298	18.28

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	76.384	18.83
2	2417	83.56	19.22
6	2437	152.757	21.84
10	2457	74.989	18.75
11	2462	69.343	18.41

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-F0876 / 6.0



9.3. Power Spectral Density

Requirements

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz (If $G_{TX} > 6$ dBi, then $PSD = 8 - (G_{TX} - 6)$).

Note:

1. PSD = power spectral density that he 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.
2. G_{TX} = the maximum transmitting antenna directional gain in dBi.
3. Directional Gain = $G_{ant} + 10 \log (N_{ant})$ dBi.

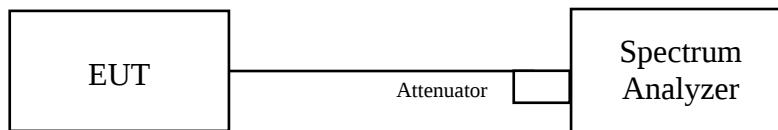
N_{ant} : Number of Transmit Antennas

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

Test procedure

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d. Set the VBW $\geq 3 \times \text{RBW}$.
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

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

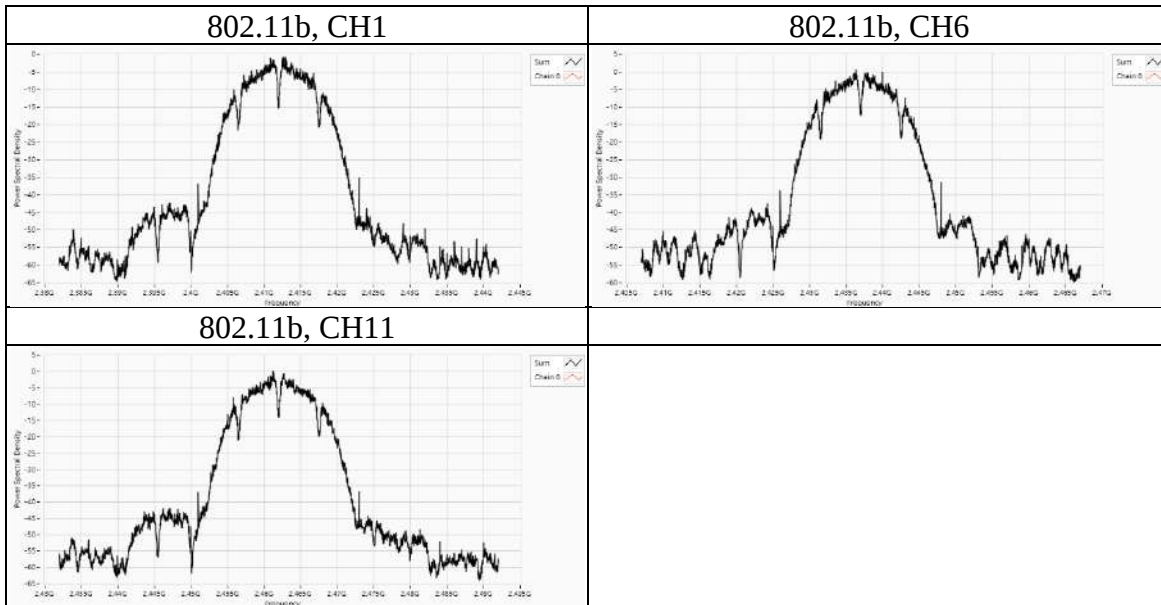
Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0876 / 6.0



Test Data

Mode	CH	Freq (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Directional Gain (dBi)	Result
802.11b	1	2412	-0.77	8	2.8	Pass
	6	2437	0.69	8	2.8	Pass
	11	2462	0.24	8	2.8	Pass



Underwriters Laboratories Taiwan Co., Ltd.

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

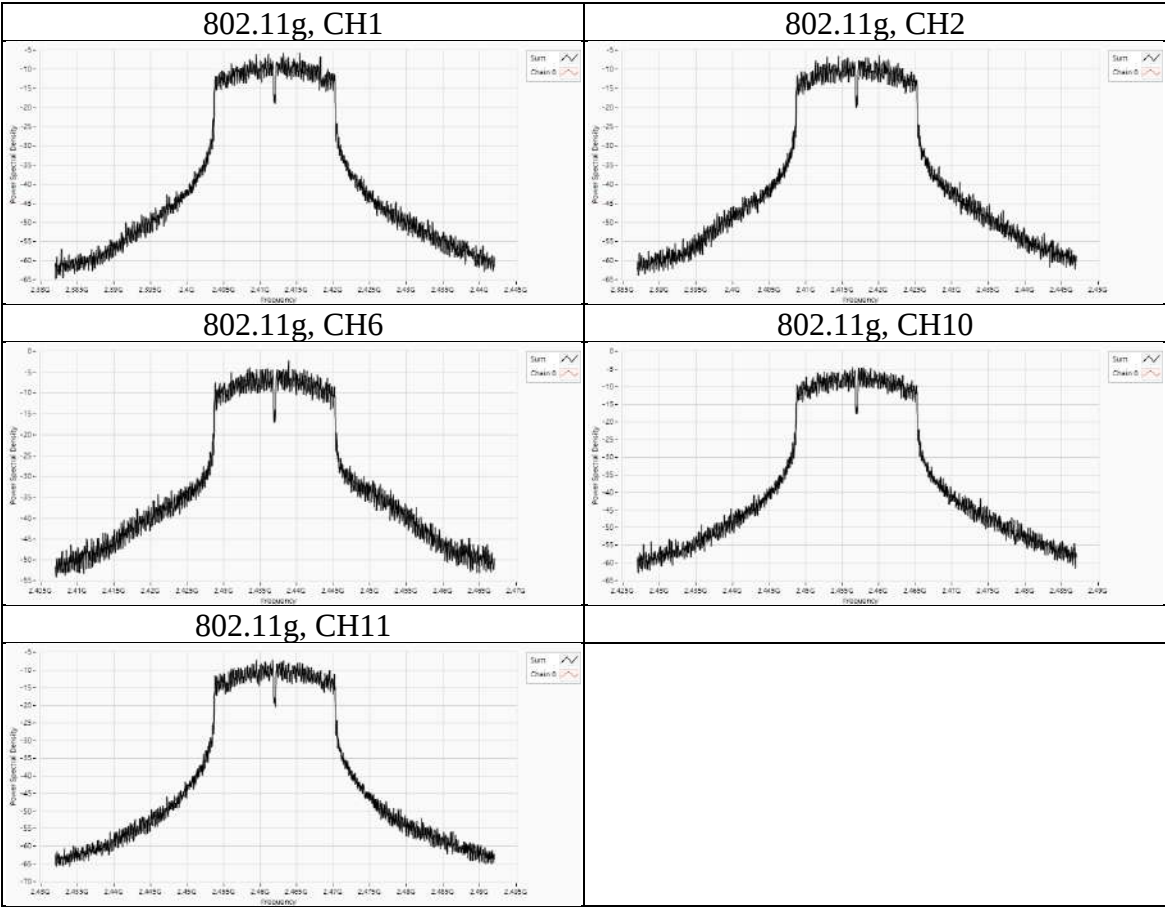
Telephone :+886-2-7737-3000

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

Doc No: 17-EM-F0876 / 6.0

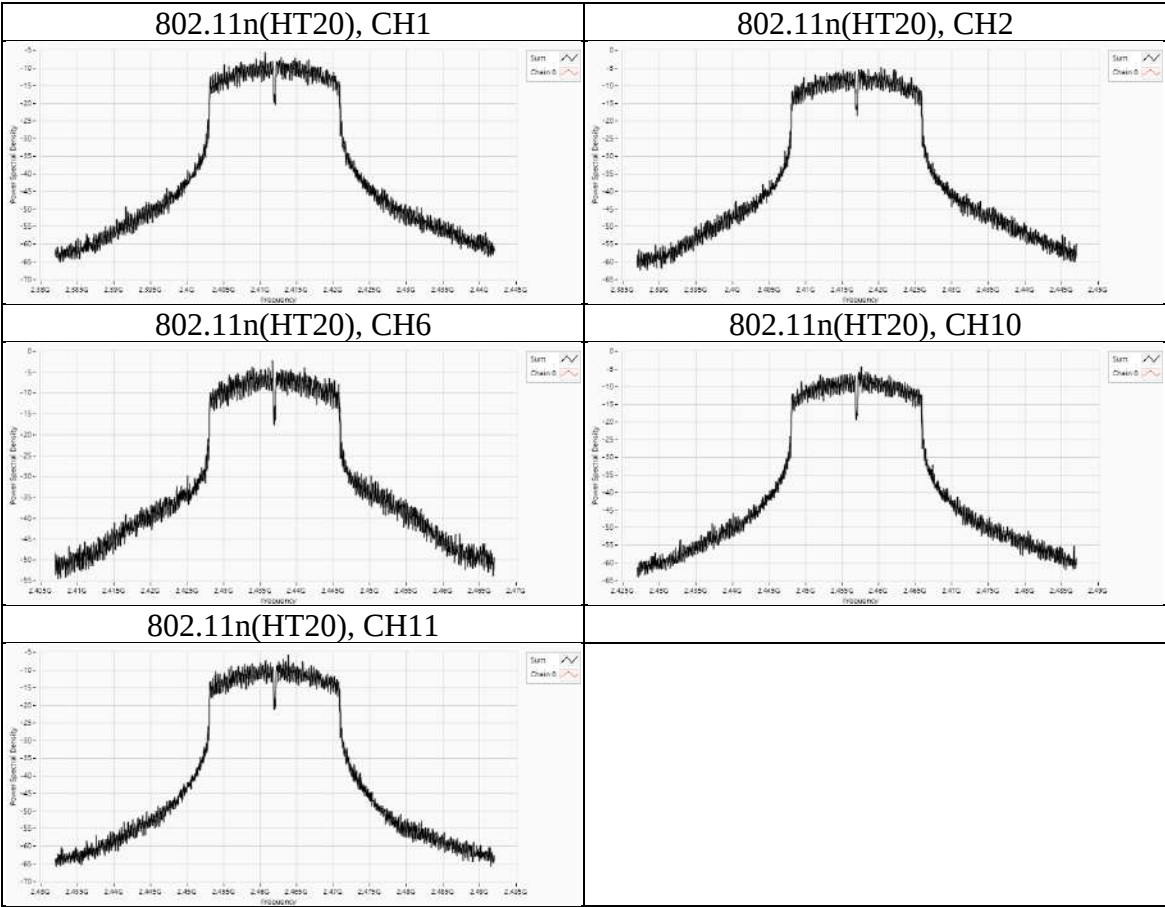


Mode	CH	Freq (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Directional Gain (dBi)	Result
802.11g	1	2412	-5.73	8	2.8	Pass
	2	2417	-6.38	8	2.8	Pass
	6	2437	-2.14	8	2.8	Pass
	10	2457	-4.44	8	2.8	Pass
	11	2462	-7.15	8	2.8	Pass





Mode	CH	Freq (MHz)	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	Directional Gain (dBi)	Result
802.11n(HT20)	1	2412	-5.65	8	2.8	Pass
	2	2417	-4.76	8	2.8	Pass
	6	2437	-2.23	8	2.8	Pass
	10	2457	-4.35	8	2.8	Pass
	11	2462	-5.77	8	2.8	Pass





9.4. Conducted Out of Band Emission

Requirements

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b) (3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209 (a) is not required.

Test procedure

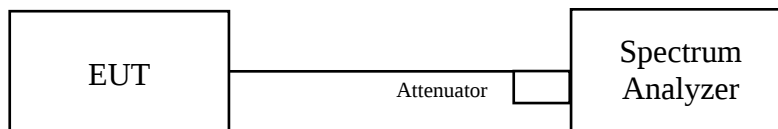
Measurement Procedure REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement Procedure OOBE

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

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

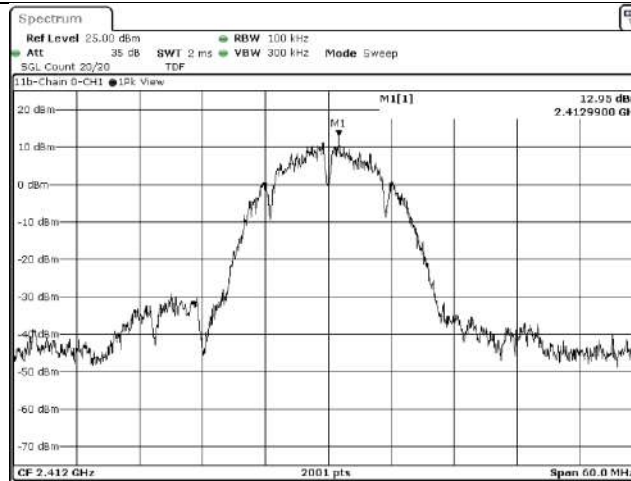
Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0876 / 6.0

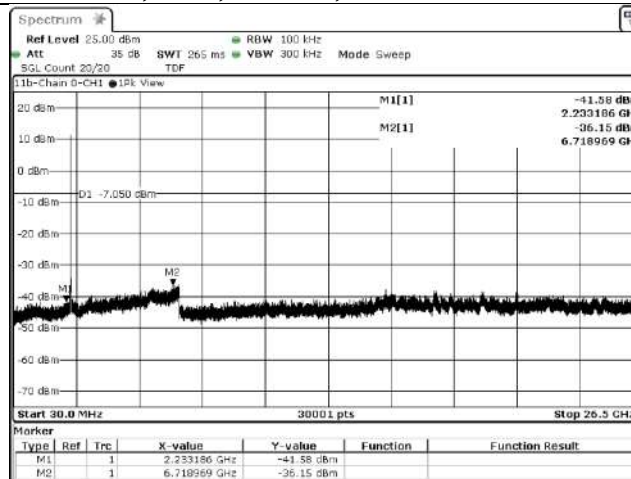


Test Data

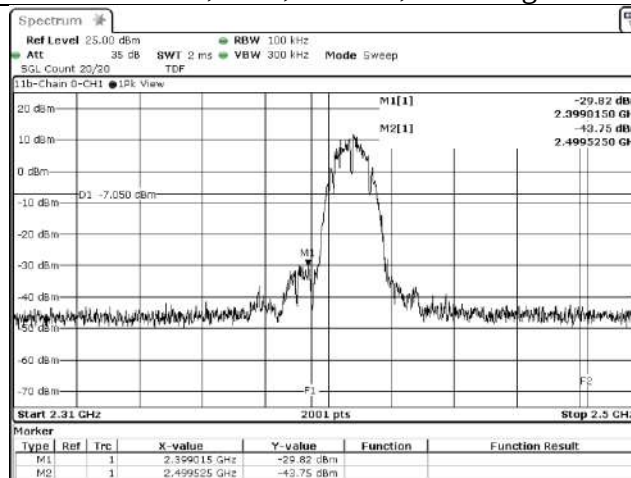
802.11b, CH1, Chain 0, Reference



802.11b, CH1, Chain 0, Conducted Emission



802.11b, CH1, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

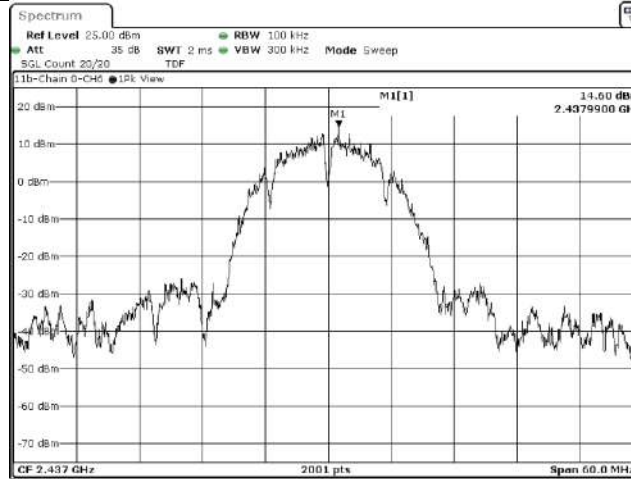
Telephone : +886-2-7737-3000

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

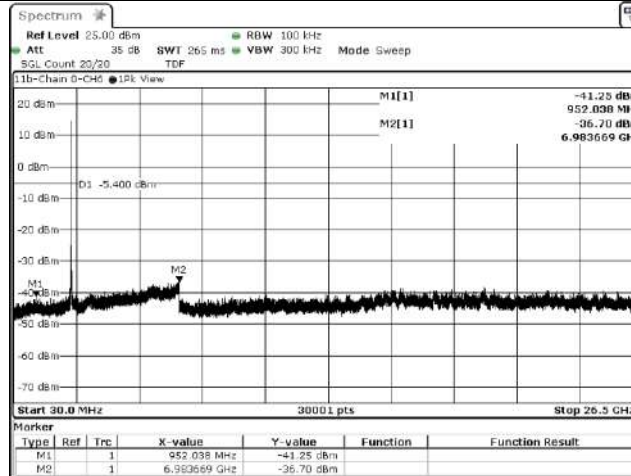
Doc No: 17-EM-F0876 / 6.0



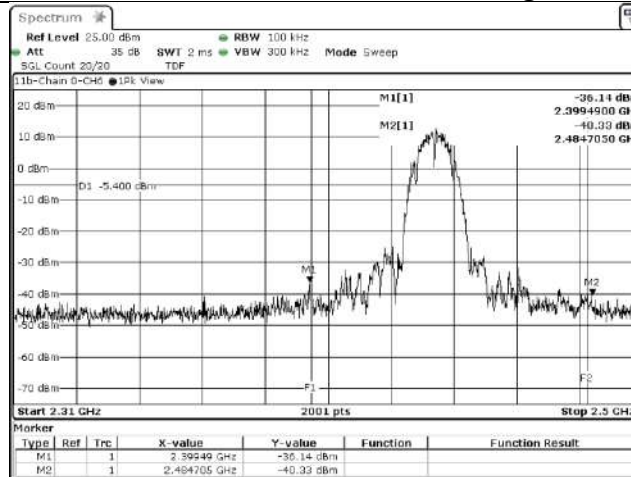
802.11b, CH6, Chain 0, Reference



802.11b, CH6, Chain 0, Conducted Emission



802.11b, CH6, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

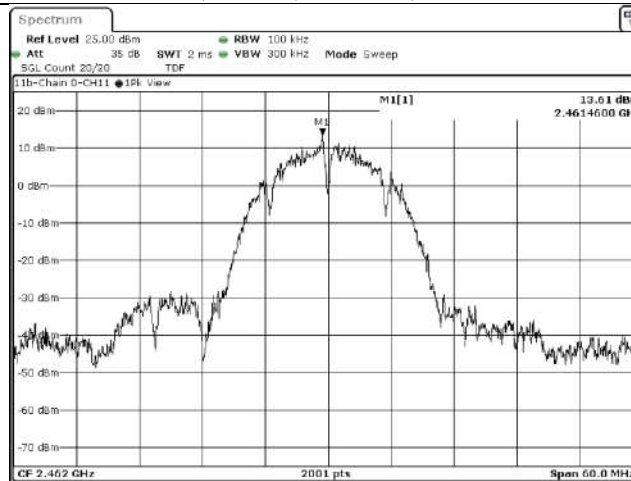
Telephone : +886-2-7737-3000

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

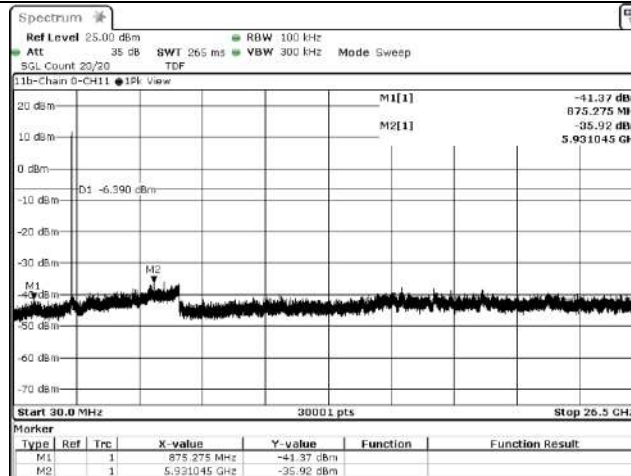
Doc No: 17-EM-F0876 / 6.0



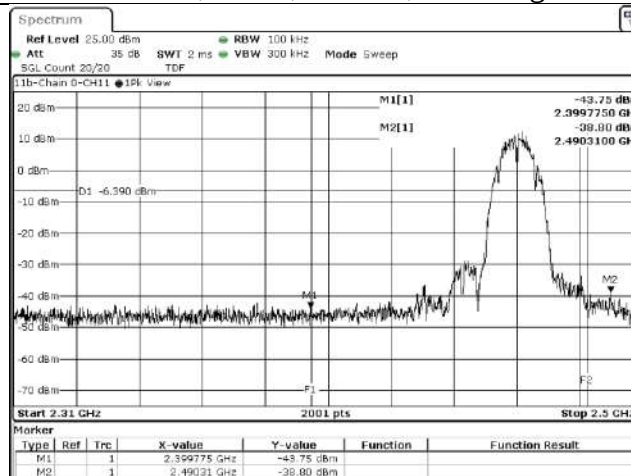
802.11b, CH11, Chain 0, Reference



802.11b, CH11, Chain 0, Conducted Emission



802.11b, CH11, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

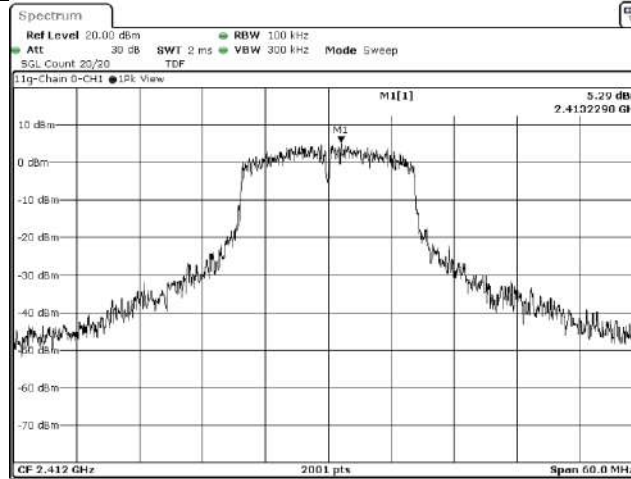
Telephone : +886-2-7737-3000

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

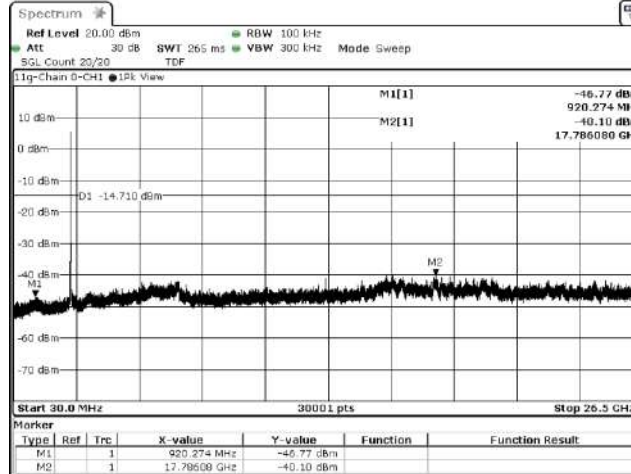
Doc No: 17-EM-F0876 / 6.0



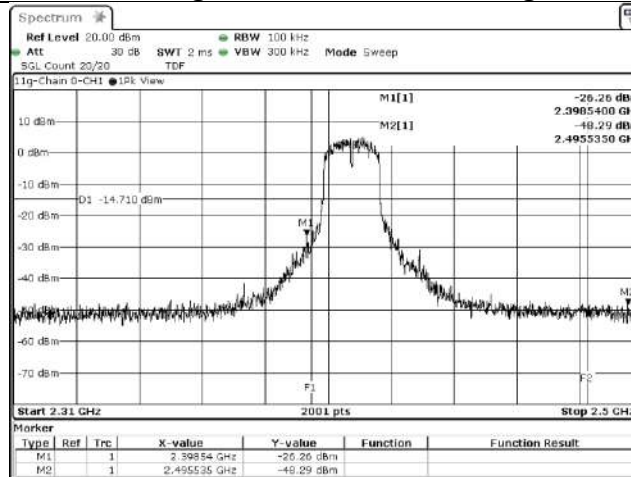
802.11g, CH1, Chain 0, Reference



802.11g, CH1, Chain 0, Conducted Emission



802.11g, CH1, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

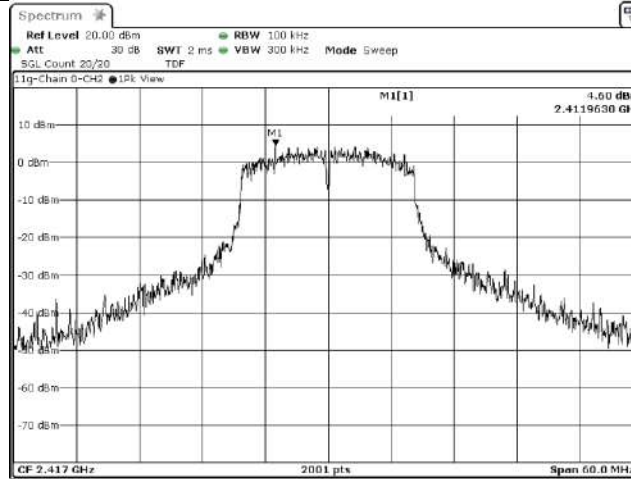
Telephone : +886-2-7737-3000

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

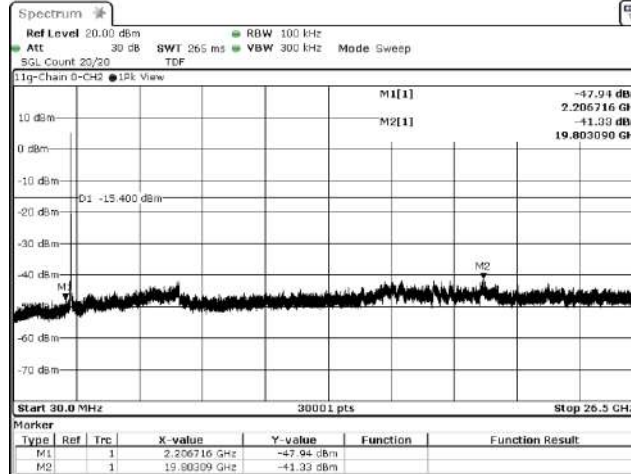
Doc No: 17-EM-F0876 / 6.0



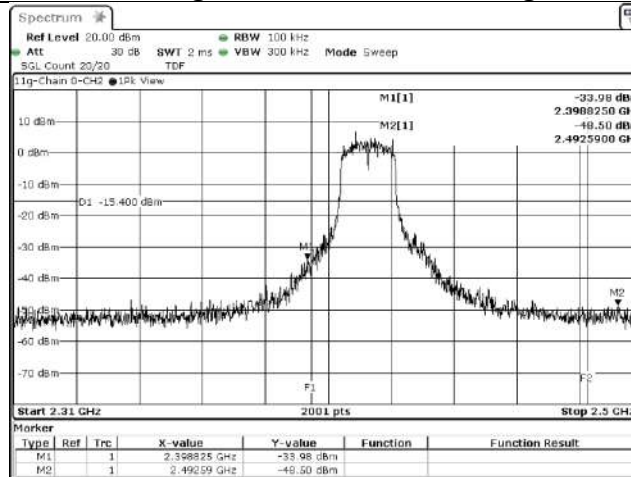
802.11g, CH2, Chain 0, Reference



802.11g, CH2, Chain 0, Conducted Emission



802.11g, CH2, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

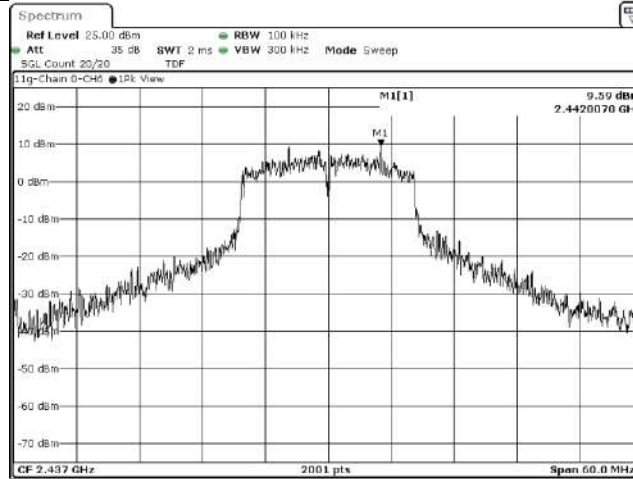
Telephone : +886-2-7737-3000

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

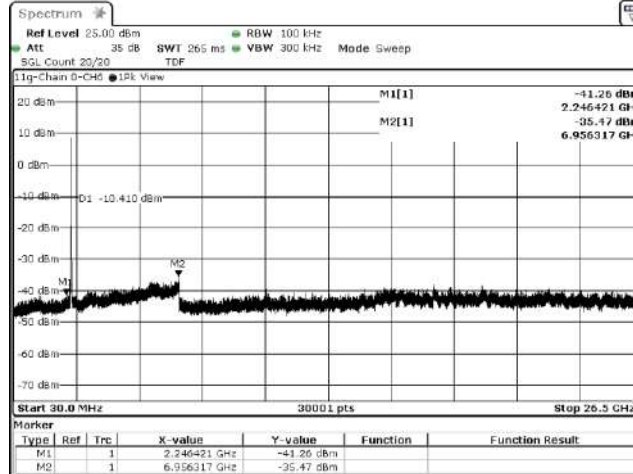
Doc No: 17-EM-F0876 / 6.0



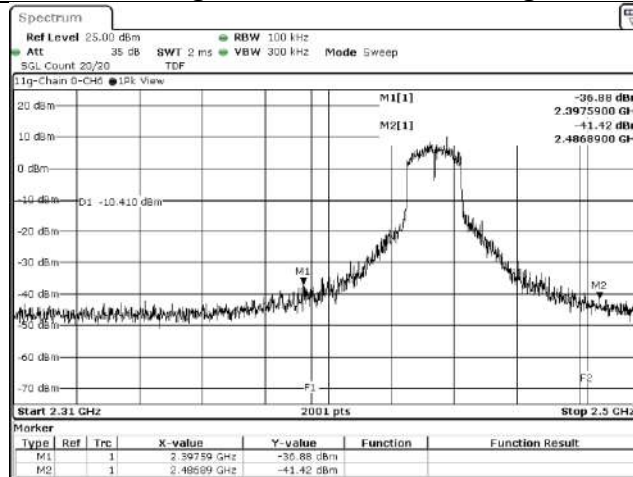
802.11g, CH6, Chain 0, Reference



802.11g, CH6, Chain 0, Conducted Emission



802.11g, CH6, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

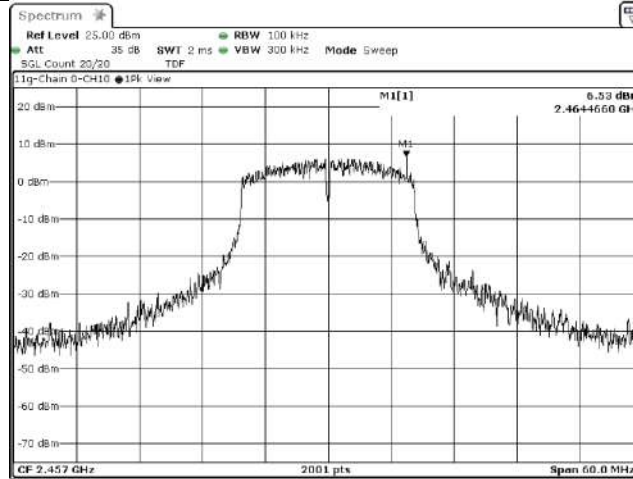
Telephone : +886-2-7737-3000

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

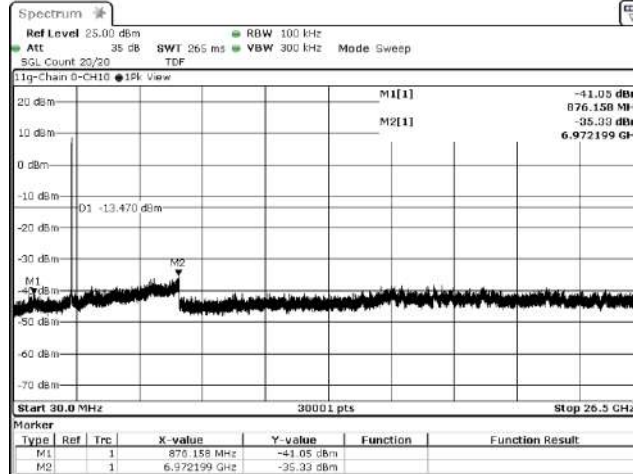
Doc No: 17-EM-F0876 / 6.0



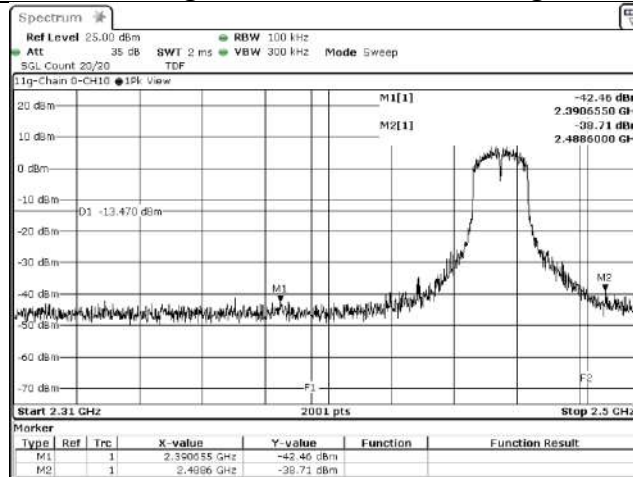
802.11g, CH10, Chain 0, Reference



802.11g, CH10, Chain 0, Conducted Emission



802.11g, CH10, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

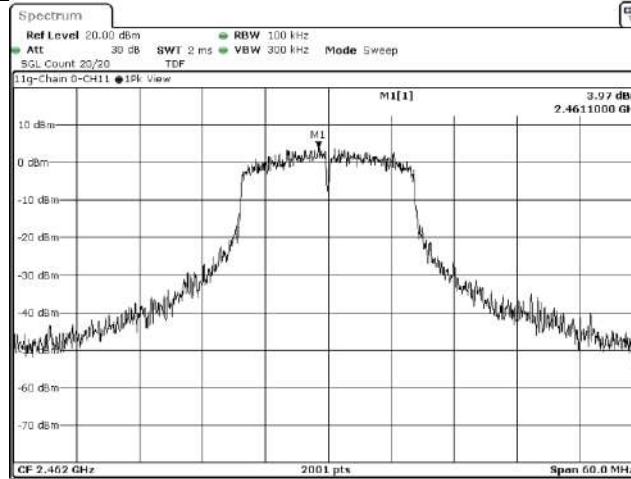
Telephone : +886-2-7737-3000

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

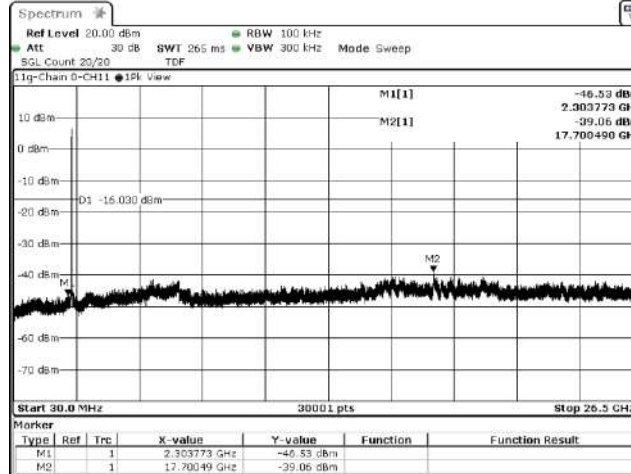
Doc No: 17-EM-F0876 / 6.0



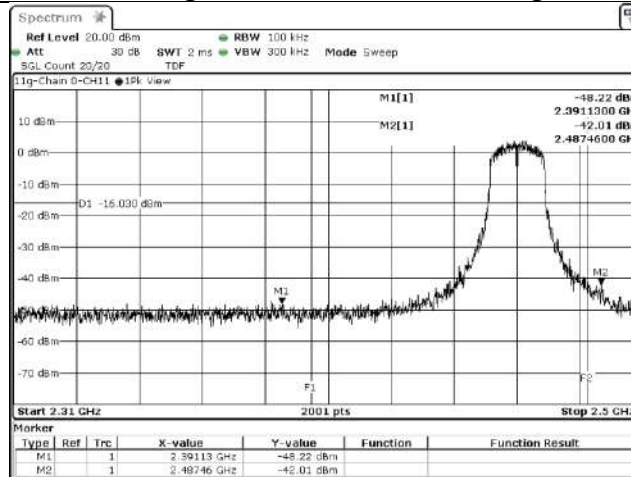
802.11g, CH11, Chain 0, Reference



802.11g, CH11, Chain 0, Conducted Emission



802.11g, CH11, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

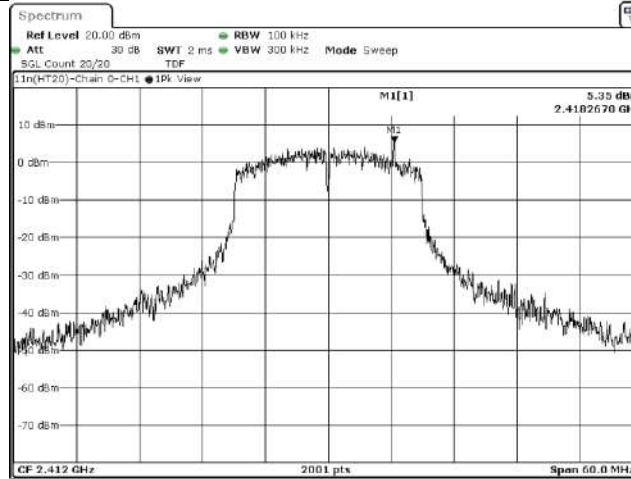
Telephone : +886-2-7737-3000

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

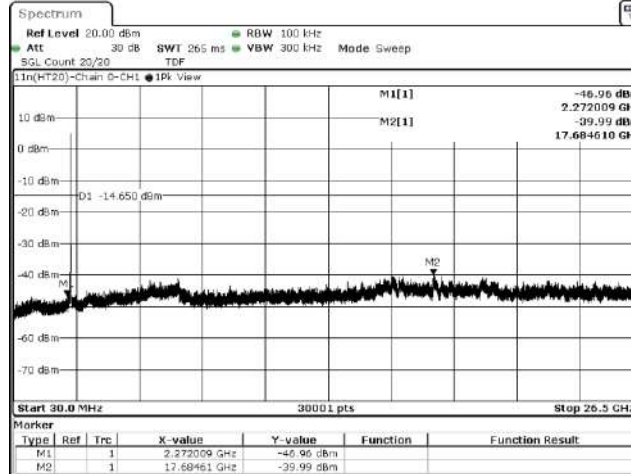
Doc No: 17-EM-F0876 / 6.0



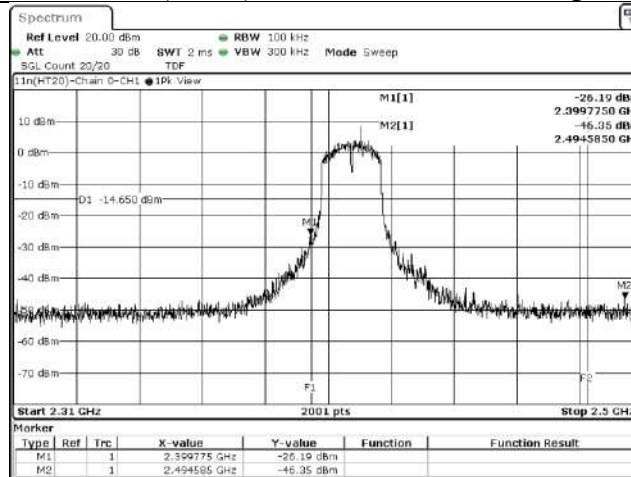
802.11n(HT20), CH1, Chain 0, Reference



802.11n(HT20), CH1, Chain 0, Conducted Emission



802.11n(HT20), CH1, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

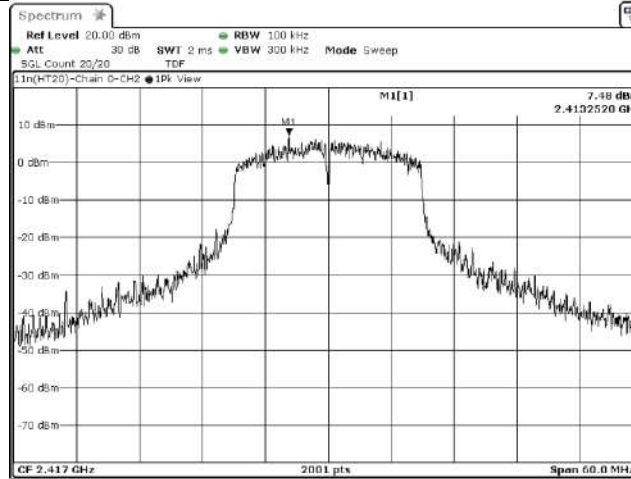
Telephone : +886-2-7737-3000

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

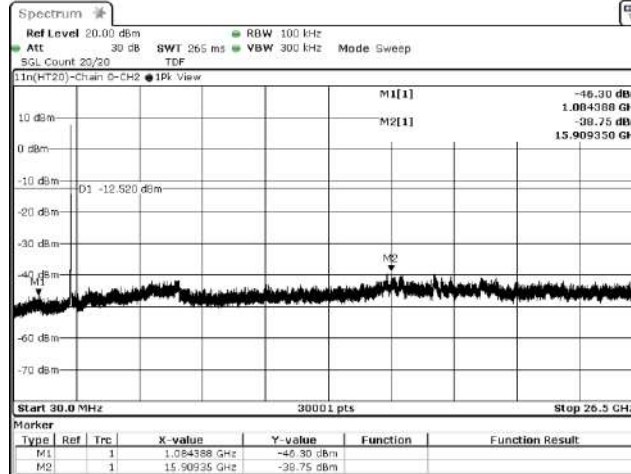
Doc No: 17-EM-F0876 / 6.0



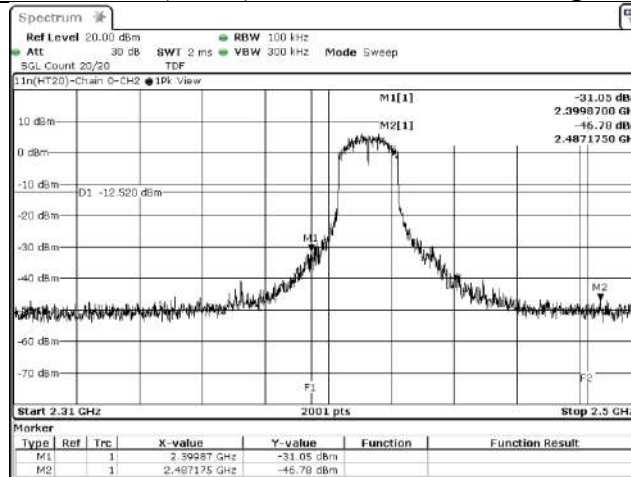
802.11n(HT20), CH2, Chain 0, Reference



802.11n(HT20), CH2, Chain 0, Conducted Emission



802.11n(HT20), CH2, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

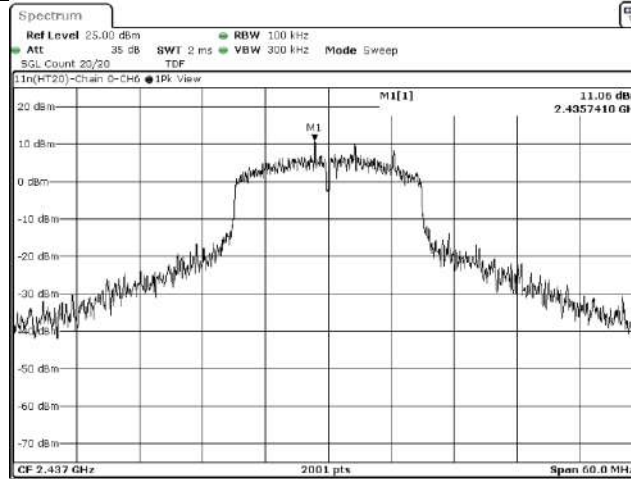
Telephone : +886-2-7737-3000

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

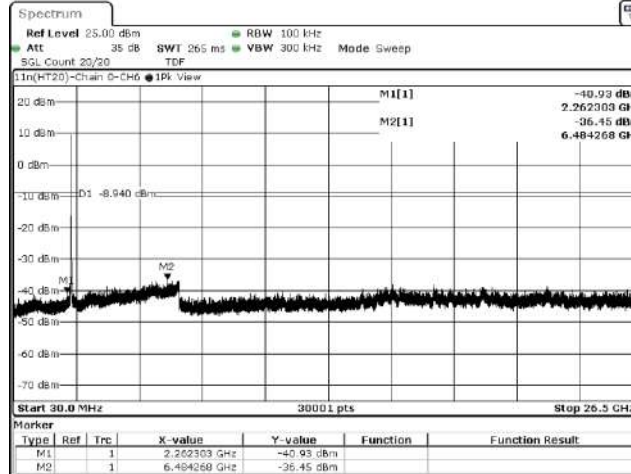
Doc No: 17-EM-F0876 / 6.0



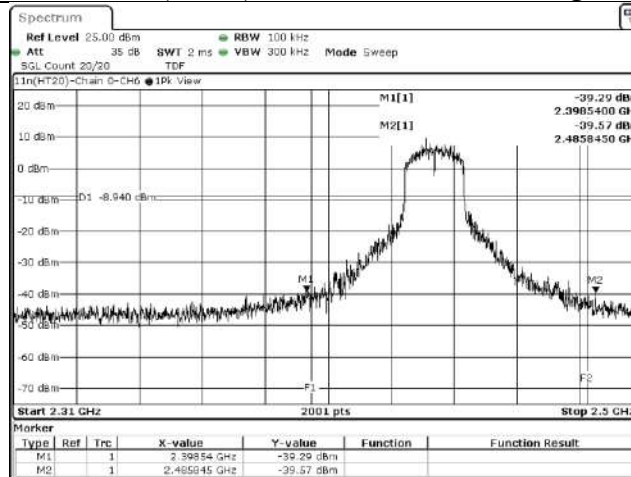
802.11n(HT20), CH6, Chain 0, Reference



802.11n(HT20), CH6, Chain 0, Conducted Emission



802.11n(HT20), CH6, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

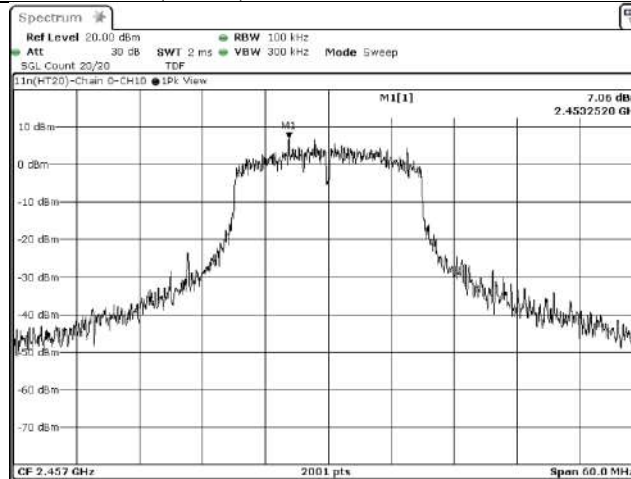
Telephone : +886-2-7737-3000

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

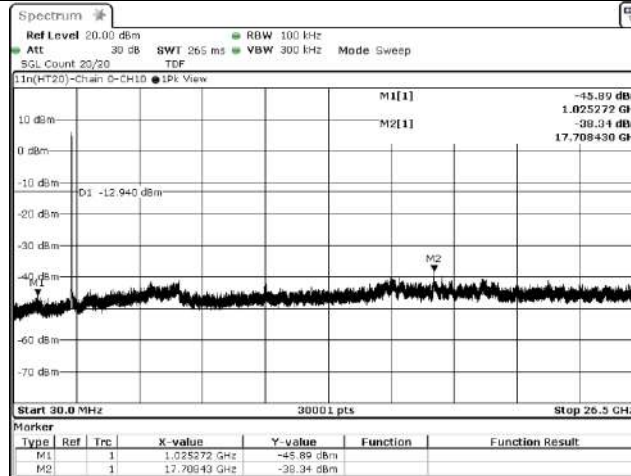
Doc No: 17-EM-F0876 / 6.0



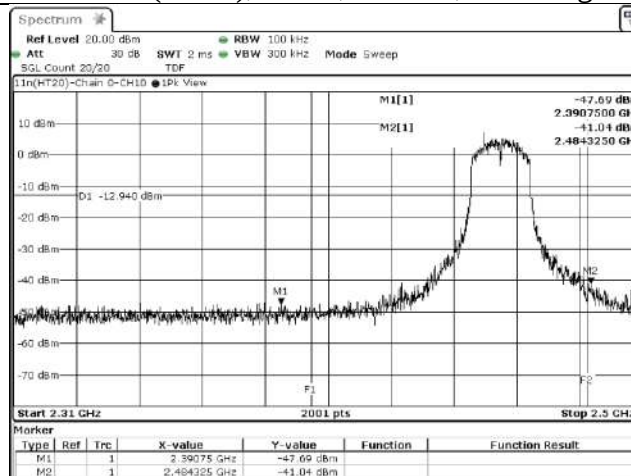
802.11n(HT20), CH10, Chain 0, Reference



802.11n(HT20), CH10, Chain 0, Conducted Emission



802.11n(HT20), CH10, Chain 0, Band edge



Underwriters Laboratories Taiwan Co., Ltd.

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

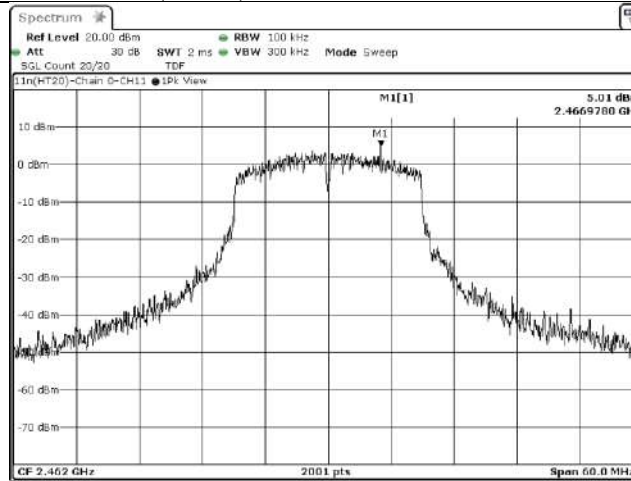
Telephone : +886-2-7737-3000

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

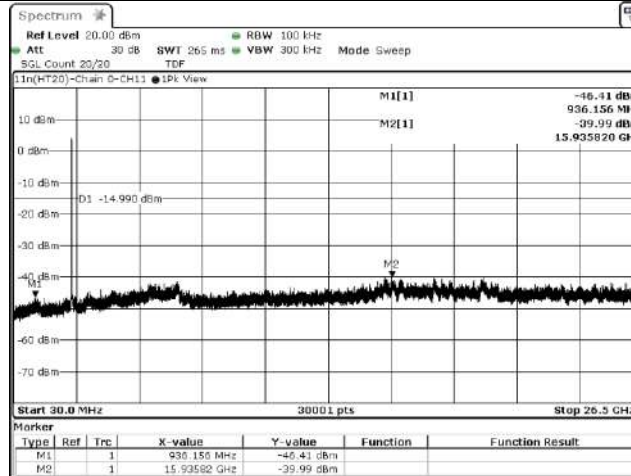
Doc No: 17-EM-F0876 / 6.0



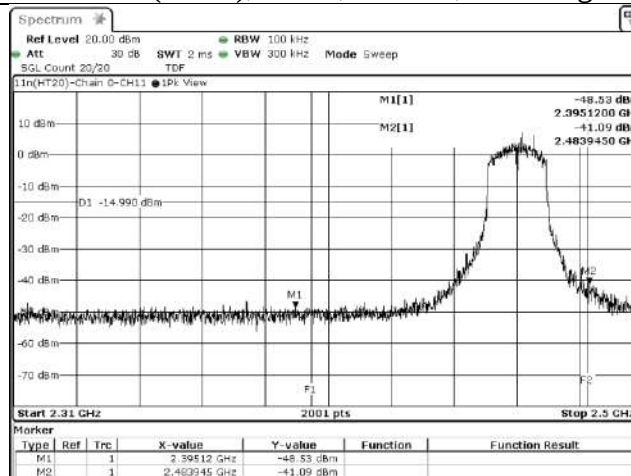
802.11n(HT20), CH11, Chain 0, Reference



802.11n(HT20), CH11, Chain 0, Conducted Emission



802.11n(HT20), CH11, Chain 0, Band edge



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-F0876 / 6.0



9.5. Radiated Spurious Emission

Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

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-F0876 / 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-F0876 / 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
802.11b	1MHz	200Hz
802.11g		1kHz
802.11n (HT20)		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 (dB/m) + Cable Loss (dB) - Preamp Factor (dB).
- Test data of Notation "@" = Fundamental Frequency
- Test data of Notation "*" = 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

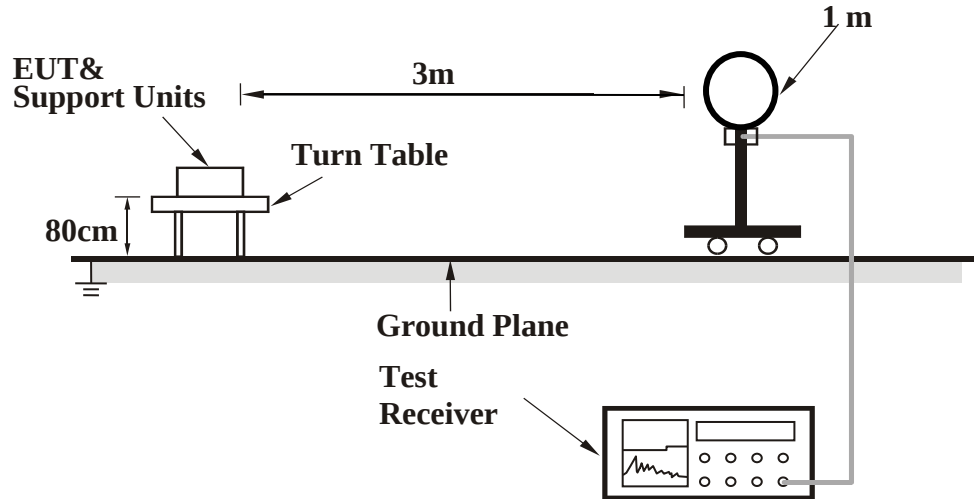
Telephone :+886-2-7737-3000

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

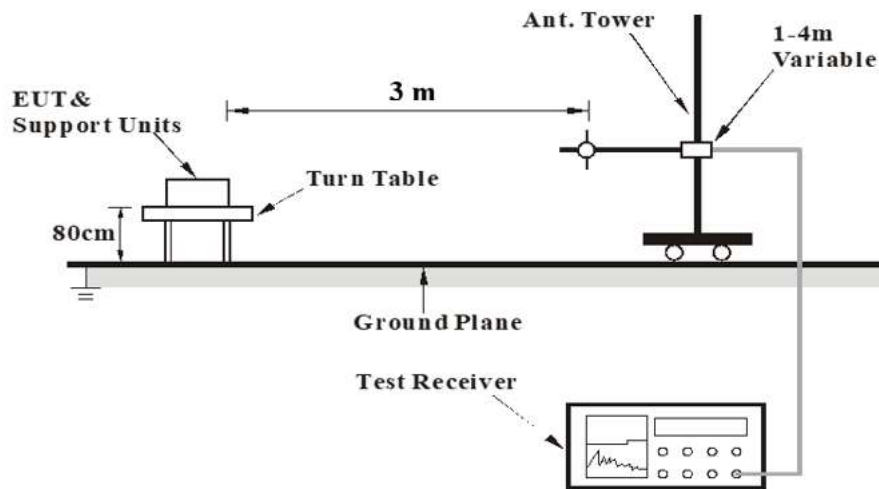
Doc No: 17-EM-F0876 / 6.0

Test Setup

<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >



Underwriters Laboratories Taiwan Co., Ltd.

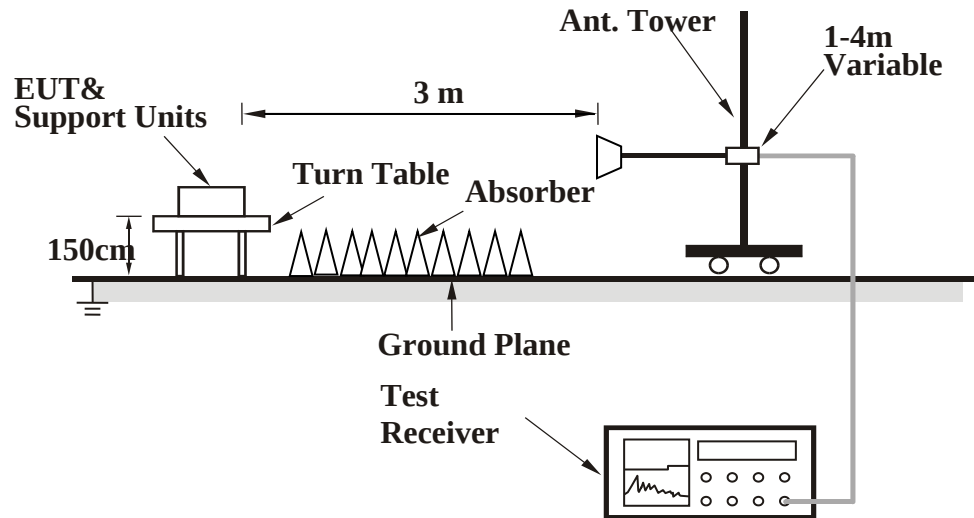
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

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

Doc No: 17-EM-F0876 / 6.0

<Frequency Range above 1 GHz>



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



Test Data

Above 1 GHz

Mode	802.11b	Channel	1
------	---------	---------	---

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		2389.23	47.74	11.82	59.56	74	-14.44	PK
		2389.61	42.07	11.82	53.89	54	-0.11	AVG
	@	2412	96.37	11.83	108.2	N/A	N/A	PK
	@	2412	94.51	11.83	106.34	N/A	N/A	AVG
	*	4824	36.43	2.35	38.78	74	-35.22	PK
Vertical		2389.04	49.22	11.81	61.03	74	-12.97	PK
		2389.61	41.84	11.82	53.66	54	-0.34	AVG
	@	2412	98.66	11.83	110.49	N/A	N/A	PK
	@	2412	94.99	11.83	106.82	N/A	N/A	AVG
	*	4824	36.14	2.35	38.49	74	-35.51	PK

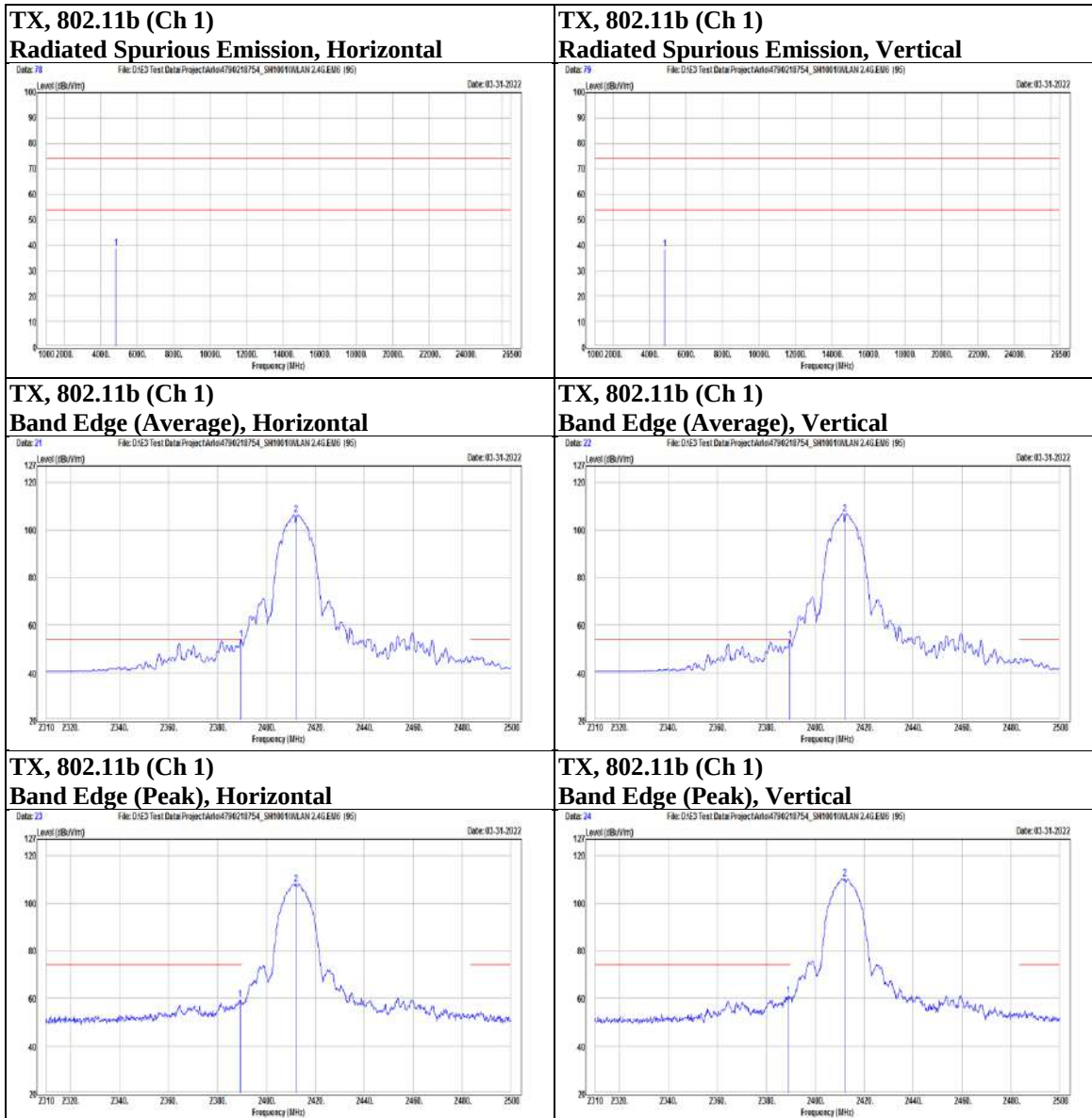
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Test report No. : 4790218754-US-R0-V0
Page : 52 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Mode	802.11b	Channel	6
------	---------	---------	---

Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		2389.42	36.84	11.82	48.66	54	-5.34	AVG
		2389.61	44	11.82	55.82	74	-18.18	PK
	@	2437	98.2	11.92	110.12	N/A	N/A	PK
	@	2437	94.64	11.92	106.56	N/A	N/A	AVG
		2485.18	36.86	11.67	48.53	54	-5.47	AVG
		2485.37	46.25	11.67	57.92	74	-16.08	PK
	*	4874	37.67	2.4	40.07	74	-33.93	PK
Vertical		2389.42	45.78	11.82	57.6	74	-16.4	PK
		2389.42	38.29	11.82	50.11	54	-3.89	AVG
	@	2437	100.57	11.92	112.49	N/A	N/A	PK
	@	2437	96.96	11.92	108.88	N/A	N/A	AVG
		2485.18	39.68	11.67	51.35	54	-2.65	AVG
		2485.56	46.58	11.67	58.25	74	-15.75	PK
	*	4874	37.61	2.4	40.01	74	-33.99	PK

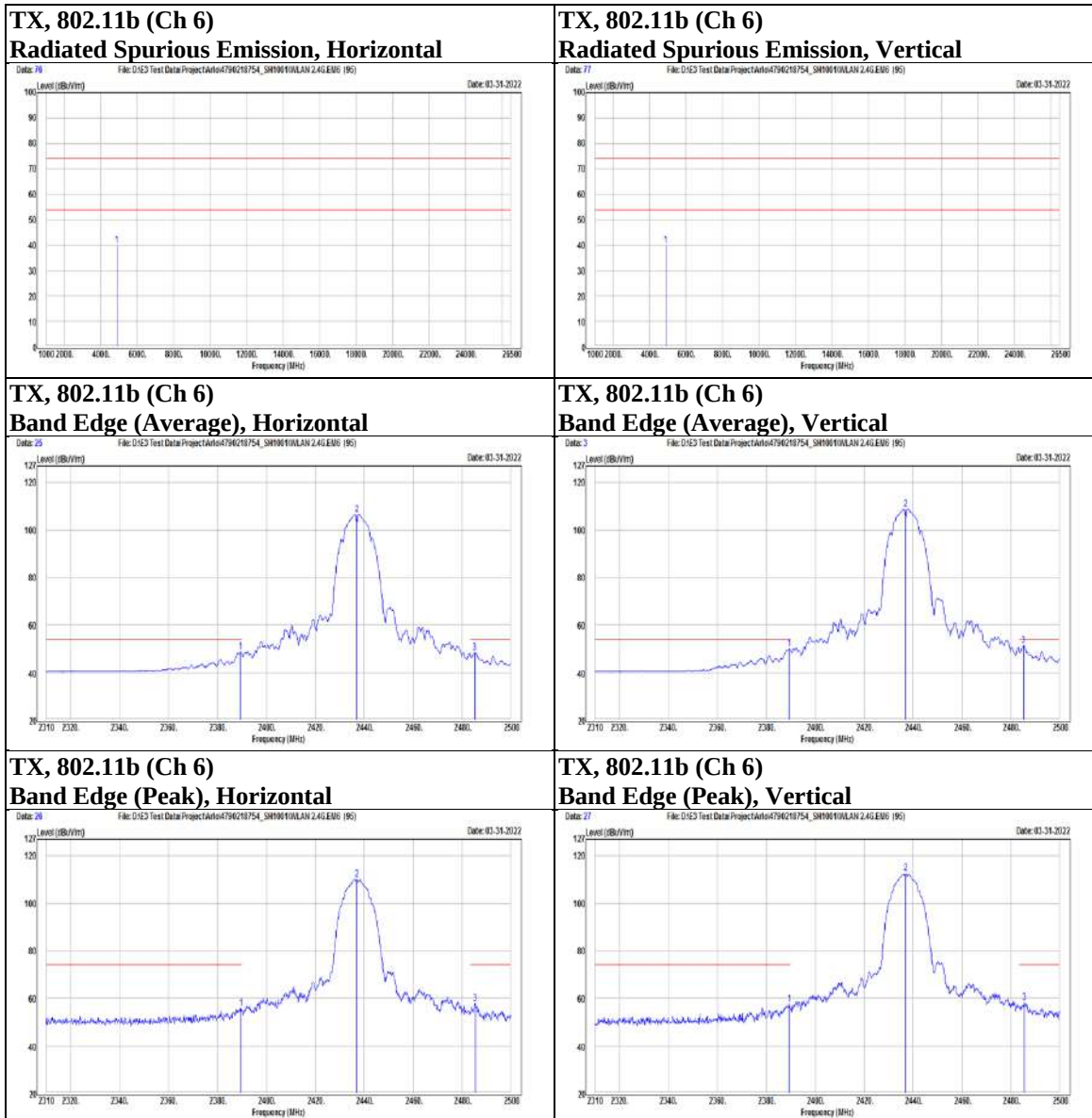
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Mode	802.11b	Channel	11
------	---------	---------	----

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal	@	2462	96.22	11.87	108.09	N/A	N/A	PK
	@	2462	92.5	11.87	104.37	N/A	N/A	AVG
		2484.42	37.71	11.68	49.39	54	-4.61	AVG
		2486.51	46.17	11.66	57.83	74	-16.17	PK
	*	4924	36.07	2.4	38.47	74	-35.53	PK
Vertical	@	2462	98.98	11.87	110.85	N/A	N/A	PK
	@	2462	95.4	11.87	107.27	N/A	N/A	AVG
		2484.04	47.31	11.68	58.99	74	-15.01	PK
		2484.42	40.34	11.68	52.02	54	-1.98	AVG
	*	4924	36.92	2.4	39.32	74	-34.68	PK

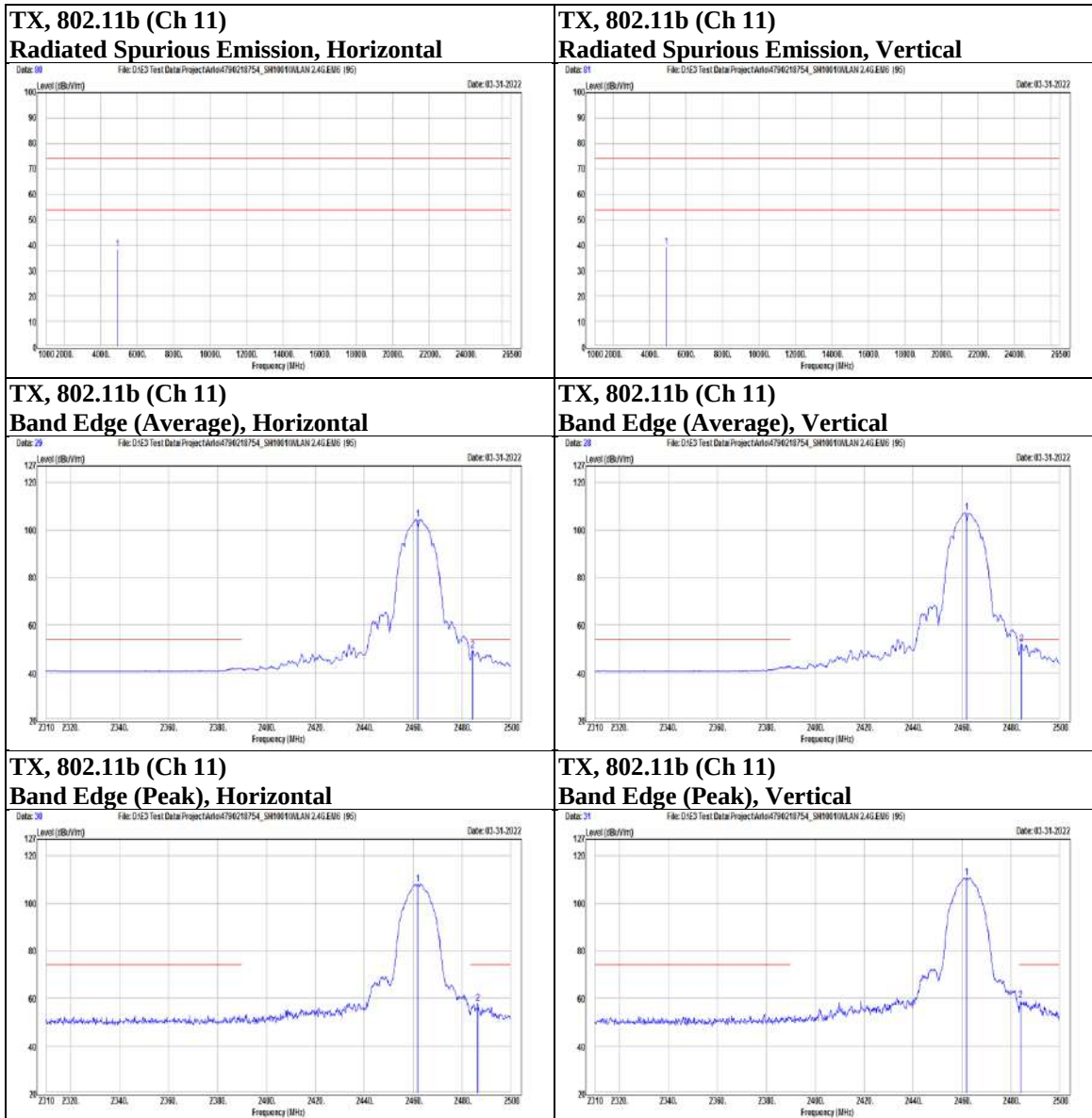
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Test report No. : 4790218754-US-R0-V0
Page : 56 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Mode	802.11g	Channel	1
------	---------	---------	---

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		2389.8	40.28	11.82	52.1	54	-1.9	AVG
		2389.99	59.97	11.82	71.79	74	-2.21	PK
	@	2412	95.51	11.83	107.34	N/A	N/A	PK
	@	2412	86.75	11.83	98.58	N/A	N/A	AVG
	*	4824	35.57	2.35	37.92	74	-36.08	PK
Vertical		2385.62	58.8	11.83	70.63	74	-3.37	PK
		2389.99	41.97	11.82	53.79	54	-0.21	AVG
	@	2412	97.39	11.83	109.22	N/A	N/A	PK
	@	2412	89.09	11.83	100.92	N/A	N/A	AVG
	*	4824	37.77	2.35	40.12	74	-33.88	PK

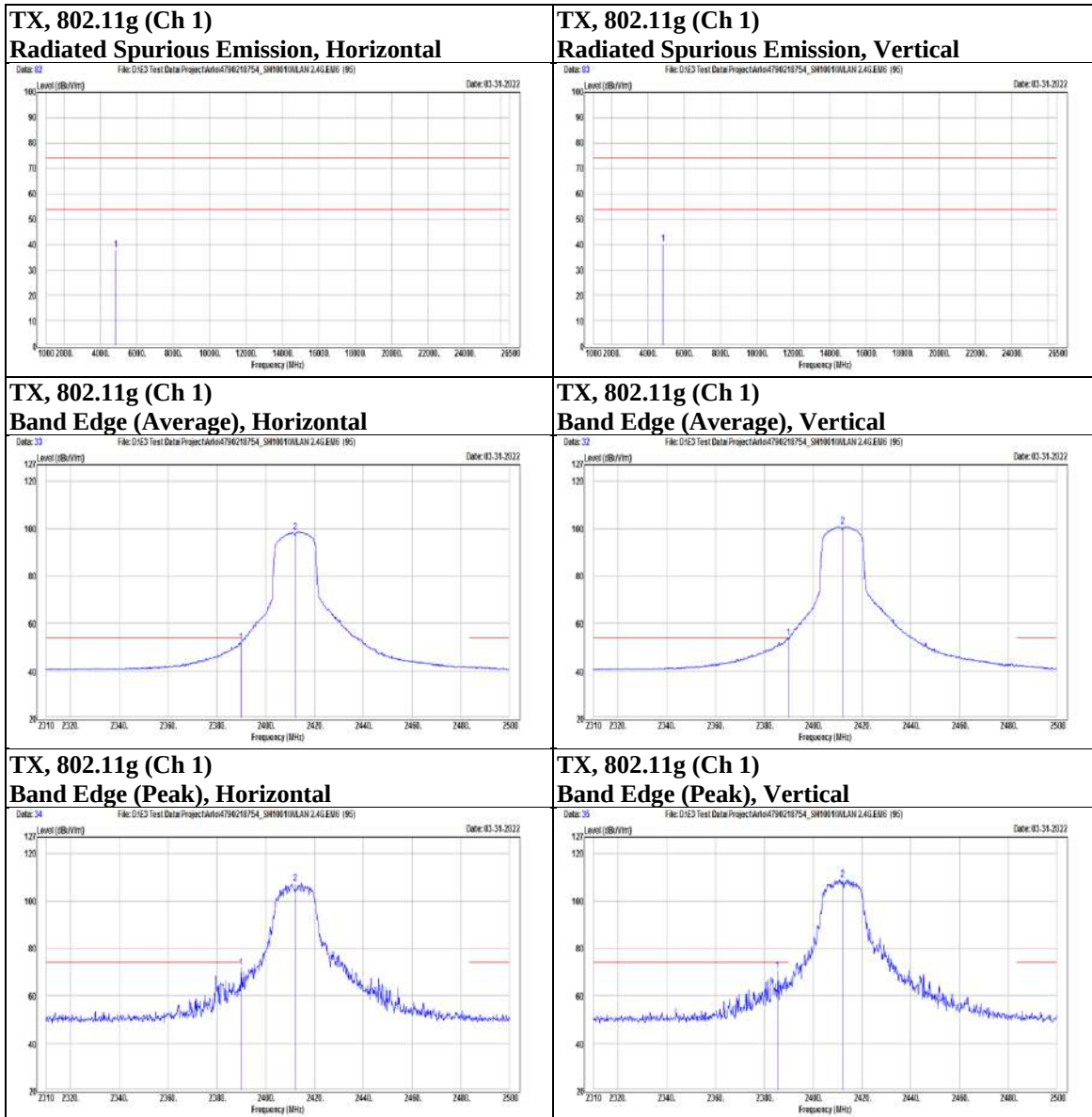
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0



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-F0876 / 6.0



Test report No. : 4790218754-US-R0-V0
Page : 58 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Mode	802.11g	Channel	2
------	---------	---------	---

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		2389.42	37.19	15.82	53.01	54	-0.99	AVG
		2389.61	36.03	15.82	51.85	54	-2.15	AVG
	@	2417	83.88	15.84	99.72	N/A	N/A	AVG
	@	2417	84.05	15.84	99.89	N/A	N/A	AVG
	*	4834	36.81	2.36	39.17	74	-34.83	PK
Vertical		2389.23	36.74	15.82	52.56	54	-1.44	AVG
		2389.42	54.49	15.82	70.31	74	-3.69	PK
	@	2417	93.06	15.84	108.9	N/A	N/A	PK
	@	2417	84.11	15.84	99.95	N/A	N/A	AVG
	*	4834	36	2.36	38.36	74	-35.64	PK

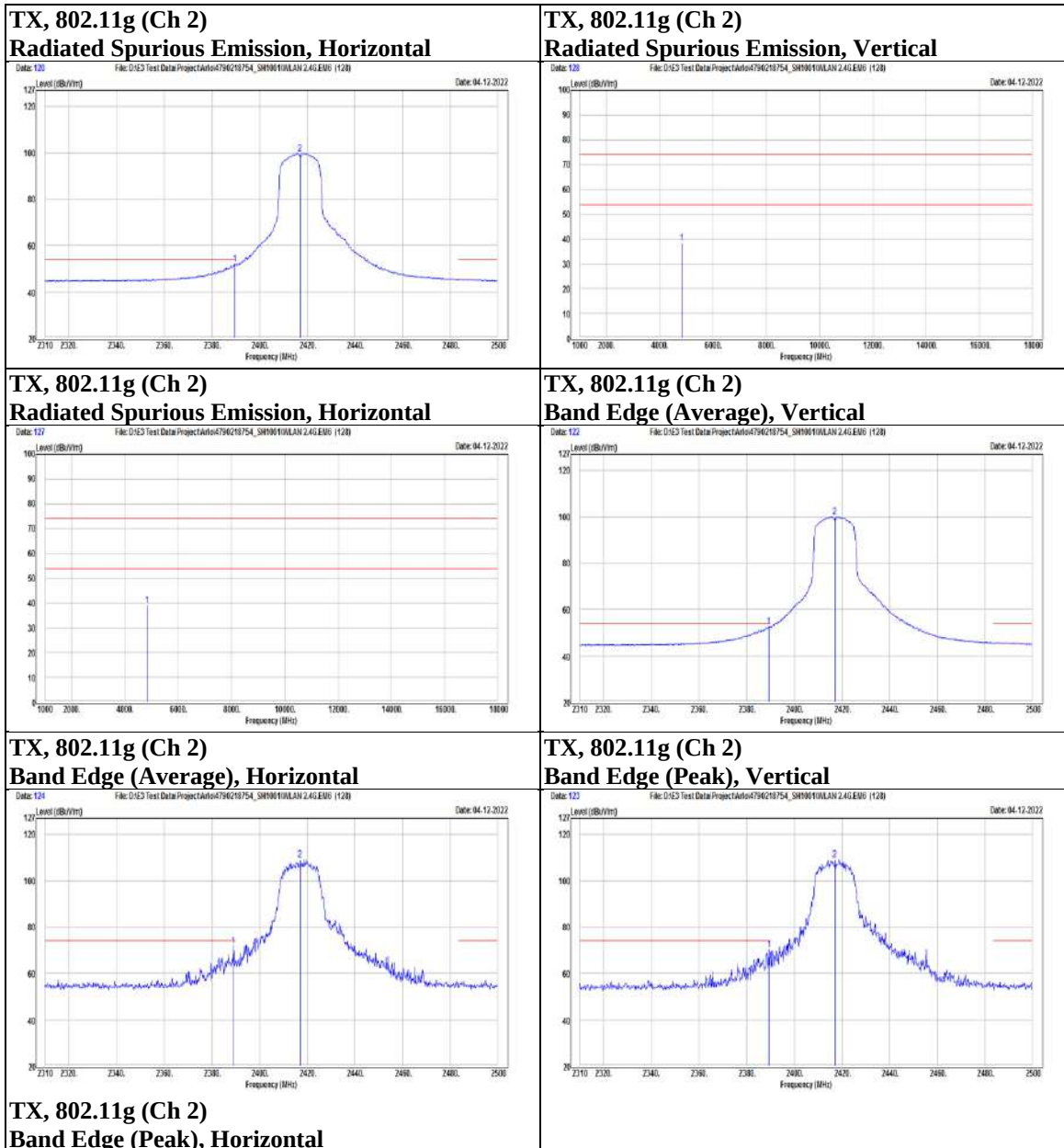
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Mode	802.11g	Channel	6
------	---------	---------	---

Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		2388.47	52.91	11.82	64.73	74	-9.27	PK
		2389.8	39.91	11.82	51.73	54	-2.27	AVG
	@	2437	98.89	11.92	110.81	N/A	N/A	PK
	@	2437	90.06	11.92	101.98	N/A	N/A	AVG
		2484.23	38.73	11.68	50.41	54	-3.59	AVG
		2489.74	54.1	11.63	65.73	74	-8.27	PK
	*	4874	36.31	2.4	38.71	74	-35.29	PK
Vertical		2385.81	55.56	11.83	67.39	74	-6.61	PK
		2389.99	41.34	11.82	53.16	54	-0.84	AVG
	@	2437	101.73	11.92	113.65	N/A	N/A	PK
	@	2437	92.54	11.92	104.46	N/A	N/A	AVG
		2483.66	41.4	11.68	53.08	54	-0.92	AVG
		2484.23	57.91	11.68	69.59	74	-4.41	PK
	*	4874	35.81	2.4	38.21	74	-35.79	PK

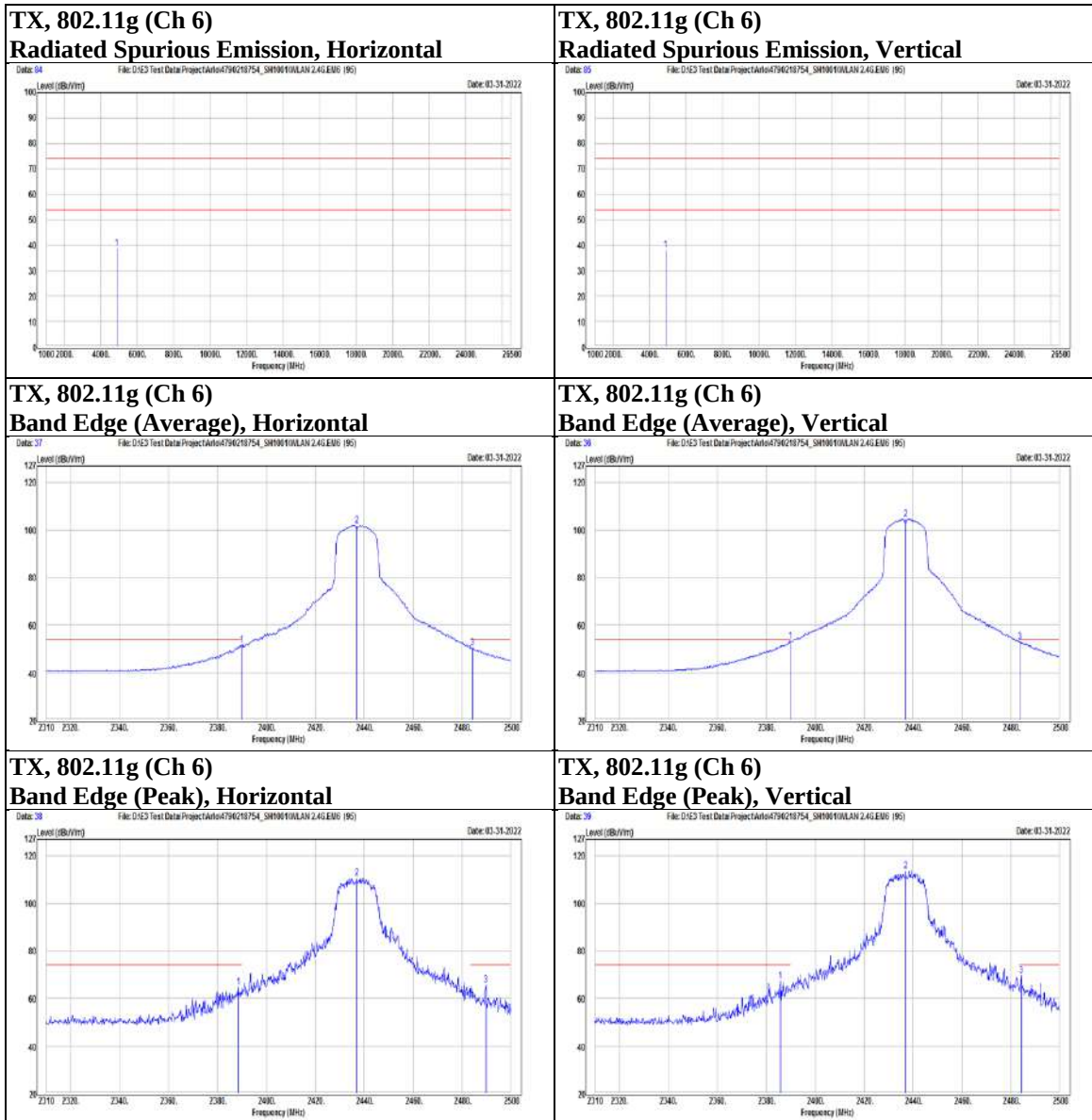
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Test report No. : 4790218754-US-R0-V0
Page : 62 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Mode	802.11g	Channel	10
------	---------	---------	----

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal	@	2457	95.14	15.92	111.06	N/A	N/A	PK
	@	2457	85.84	15.92	101.76	N/A	N/A	AVG
		2483.66	38.11	15.68	53.79	54	-0.21	AVG
		2485.37	54.73	15.67	70.4	74	-3.6	PK
	*	4914	38.2	2.42	40.62	74	-33.38	PK
Vertical	@	2457	93.22	15.92	109.14	N/A	N/A	PK
	@	2457	84.03	15.92	99.95	N/A	N/A	AVG
		2483.85	37.83	15.68	53.51	54	-0.49	AVG
		2485.75	55.49	15.67	71.16	74	-2.84	PK
	*	4914	37.23	2.42	39.65	74	-34.35	PK

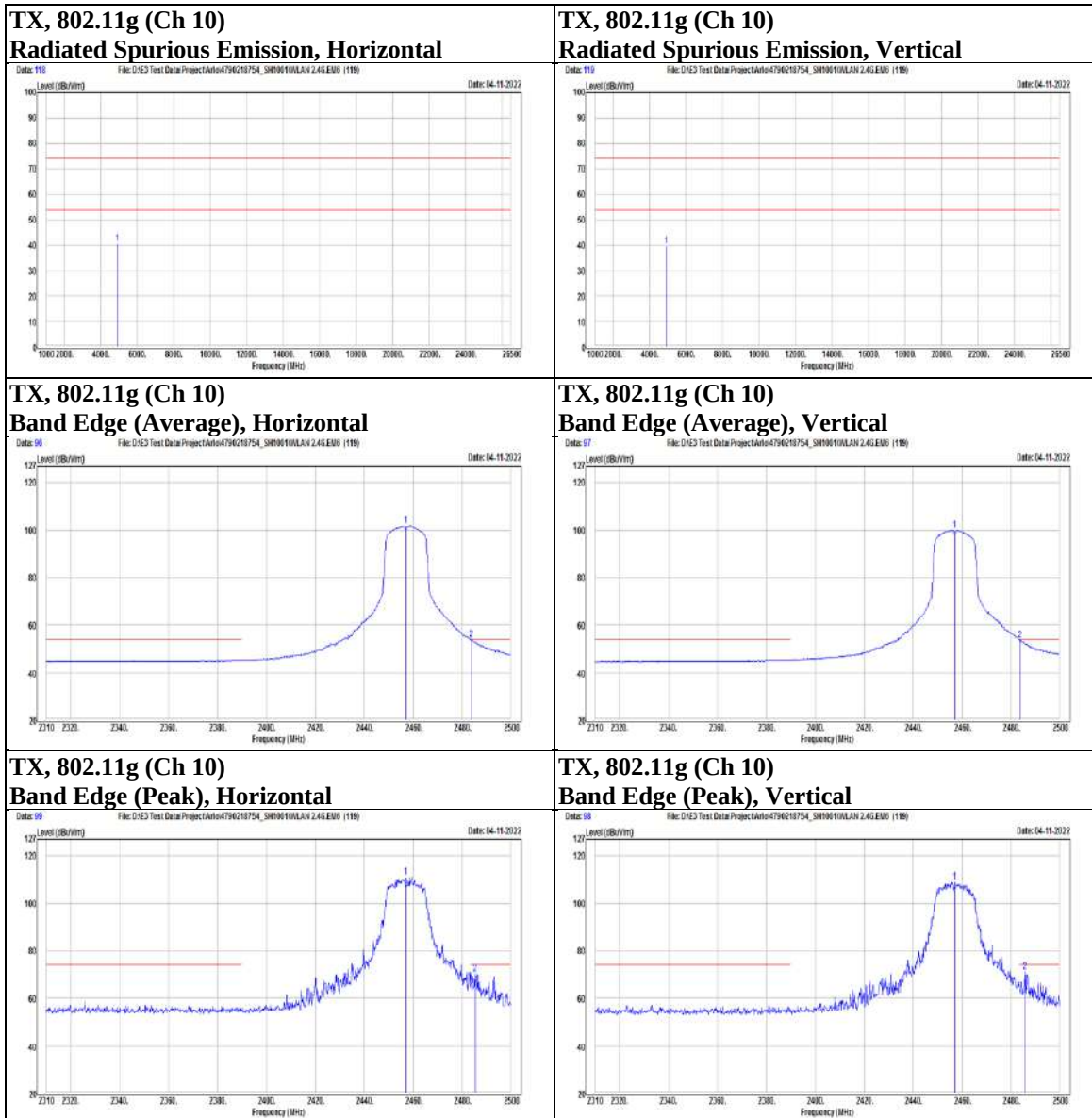
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Test report No. : 4790218754-US-R0-V0
Page : 64 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Mode	802.11g	Channel	11
------	---------	---------	----

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal	@	2462	94.47	11.87	106.34	N/A	N/A	PK
	@	2462	85.97	11.87	97.84	N/A	N/A	AVG
		2484.04	38.17	11.68	49.85	54	-4.15	AVG
			51.53	11.67	63.2	74	-10.8	PK
	*	4924	36.36	2.4	38.76	74	-35.24	PK
Vertical	@	2462	96.92	11.87	108.79	N/A	N/A	PK
	@	2462	88.82	11.87	100.69	N/A	N/A	AVG
		2483.66	56.09	11.68	67.77	74	-6.23	PK
		2483.66	41.07	11.68	52.75	54	-1.25	AVG
	*	4924	36.93	2.4	39.33	74	-34.67	PK

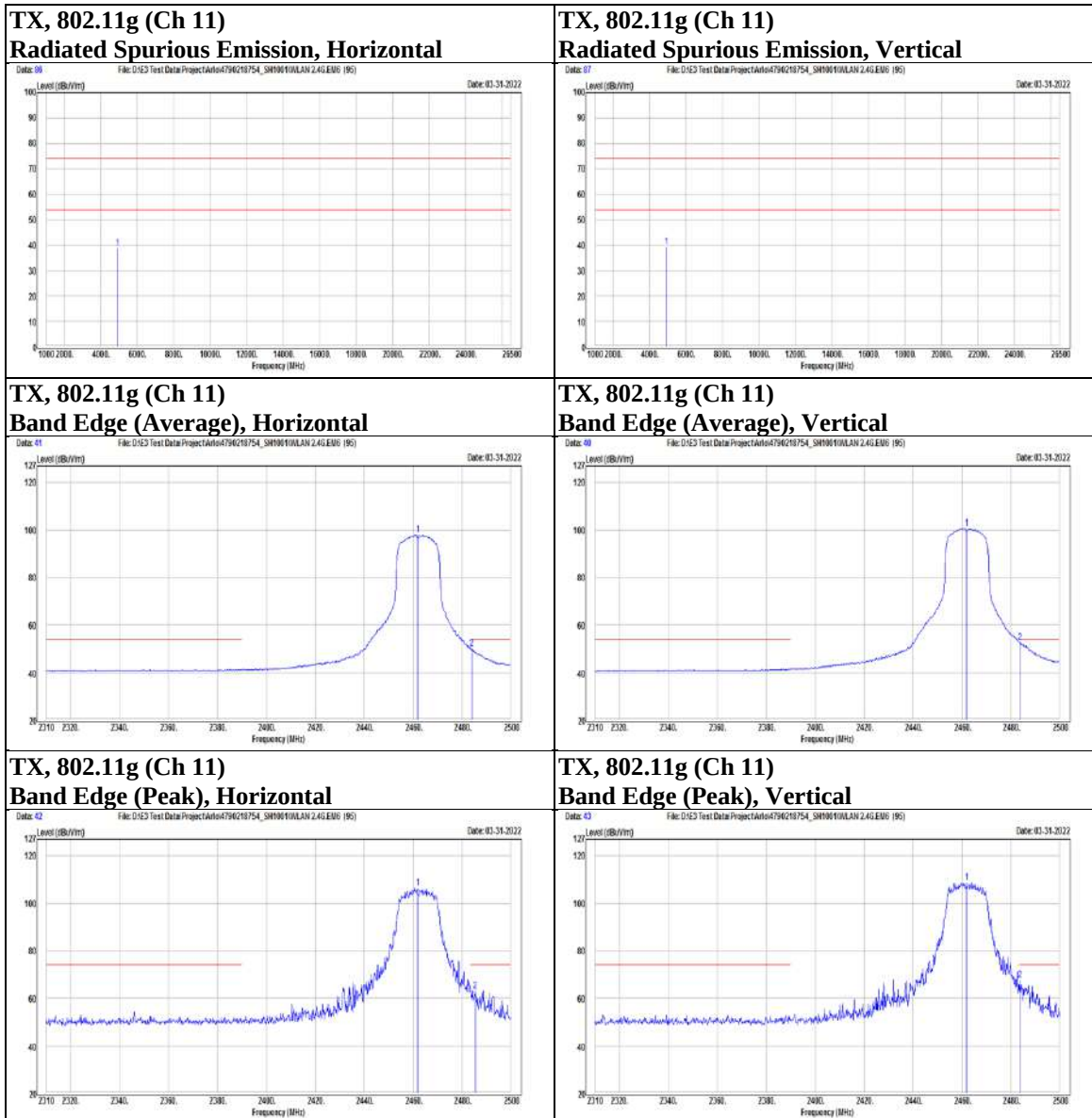
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Mode	802.11n(HT20)	Channel	1
------	---------------	---------	---

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		2386	56.6	11.83	68.43	74	-5.57	PK
		2389.8	39.77	11.82	51.59	54	-2.41	AVG
	@	2412	94.32	11.83	106.15	N/A	N/A	PK
	@	2412	85.8	11.83	97.63	N/A	N/A	AVG
	*	4824	35.99	2.35	38.34	74	-35.66	PK
Vertical		2384.67	57.22	11.83	69.05	74	-4.95	PK
		2389.99	41.71	11.82	53.53	54	-0.47	AVG
	@	2412	97.14	11.83	108.97	N/A	N/A	PK
	@	2412	88.24	11.83	100.07	N/A	N/A	AVG
	*	4824	37.21	2.35	39.56	74	-34.44	PK

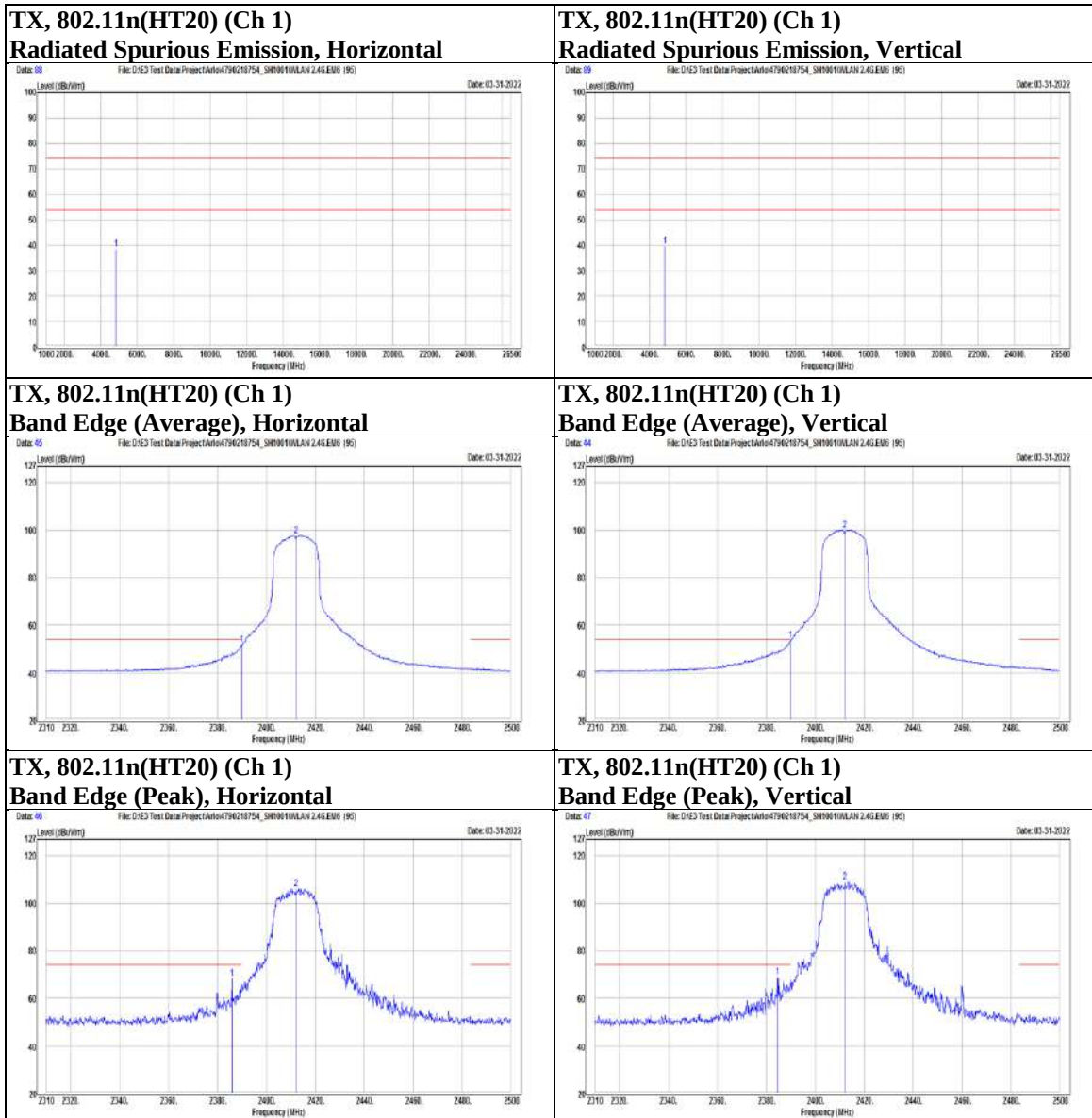
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Mode	802.11n(HT20)	Channel	2
------	---------------	---------	---

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		2388.09	51.21	15.82	67.03	74	-6.97	PK
		2389.99	37.36	15.82	53.18	54	-0.82	AVG
	@	2417	94.17	15.84	110.01	N/A	N/A	PK
	@	2417	85.6	15.84	101.44	N/A	N/A	AVG
	*	4834	37.22	2.36	39.58	74	-34.42	PK
Vertical		2385.81	55.2	15.83	71.03	74	-2.97	PK
		2389.61	37.73	15.82	53.55	54	-0.45	AVG
	@	2417	94.25	15.84	110.09	N/A	N/A	PK
	@	2417	84.44	15.84	100.28	N/A	N/A	AVG
	*	4834	36.96	2.36	39.32	74	-34.68	PK

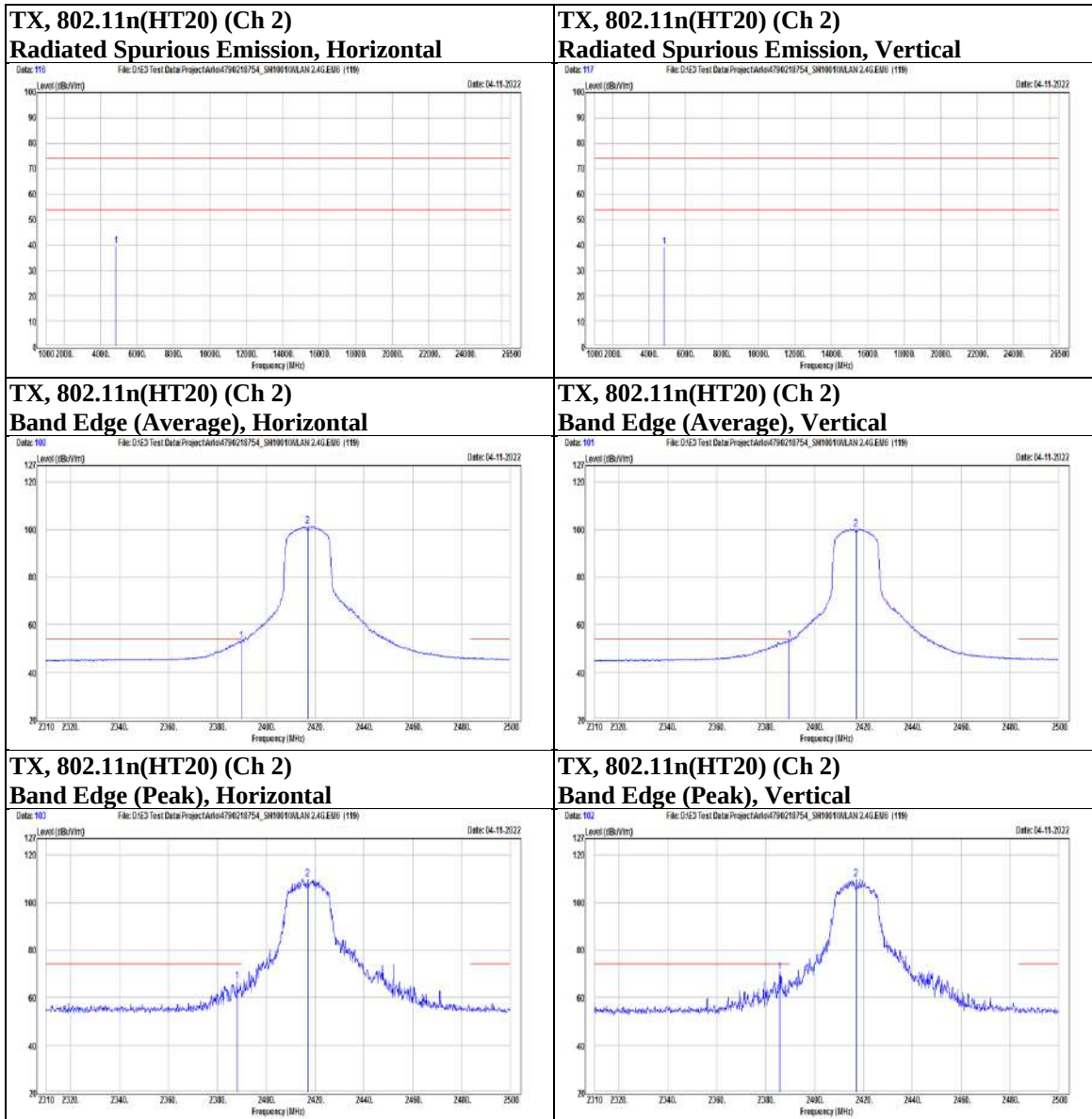
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Mode	802.11n(HT20)	Channel	6
------	---------------	---------	---

Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		2389.99	54.67	11.82	66.49	74	-7.51	PK
		2389.99	39.61	11.82	51.43	54	-2.57	AVG
	@	2437	98.63	11.92	110.55	N/A	N/A	PK
	@	2437	89.91	11.92	101.83	N/A	N/A	AVG
		2484.04	39.6	11.68	51.28	54	-2.72	AVG
		2485.18	55.28	11.67	66.95	74	-7.05	PK
	*	4874	36.03	2.4	38.43	74	-35.57	PK
Vertical		2389.23	55.89	11.82	67.71	74	-6.29	PK
		2389.8	40.37	11.82	52.19	54	-1.81	AVG
	@	2437	101.02	11.92	112.94	N/A	N/A	PK
	@	2437	92.16	11.92	104.08	N/A	N/A	AVG
		2484.23	40.86	11.68	52.54	54	-1.46	AVG
		2489.74	54.98	11.63	66.61	74	-7.39	PK
	*	4874	37.34	2.4	39.74	74	-34.26	PK

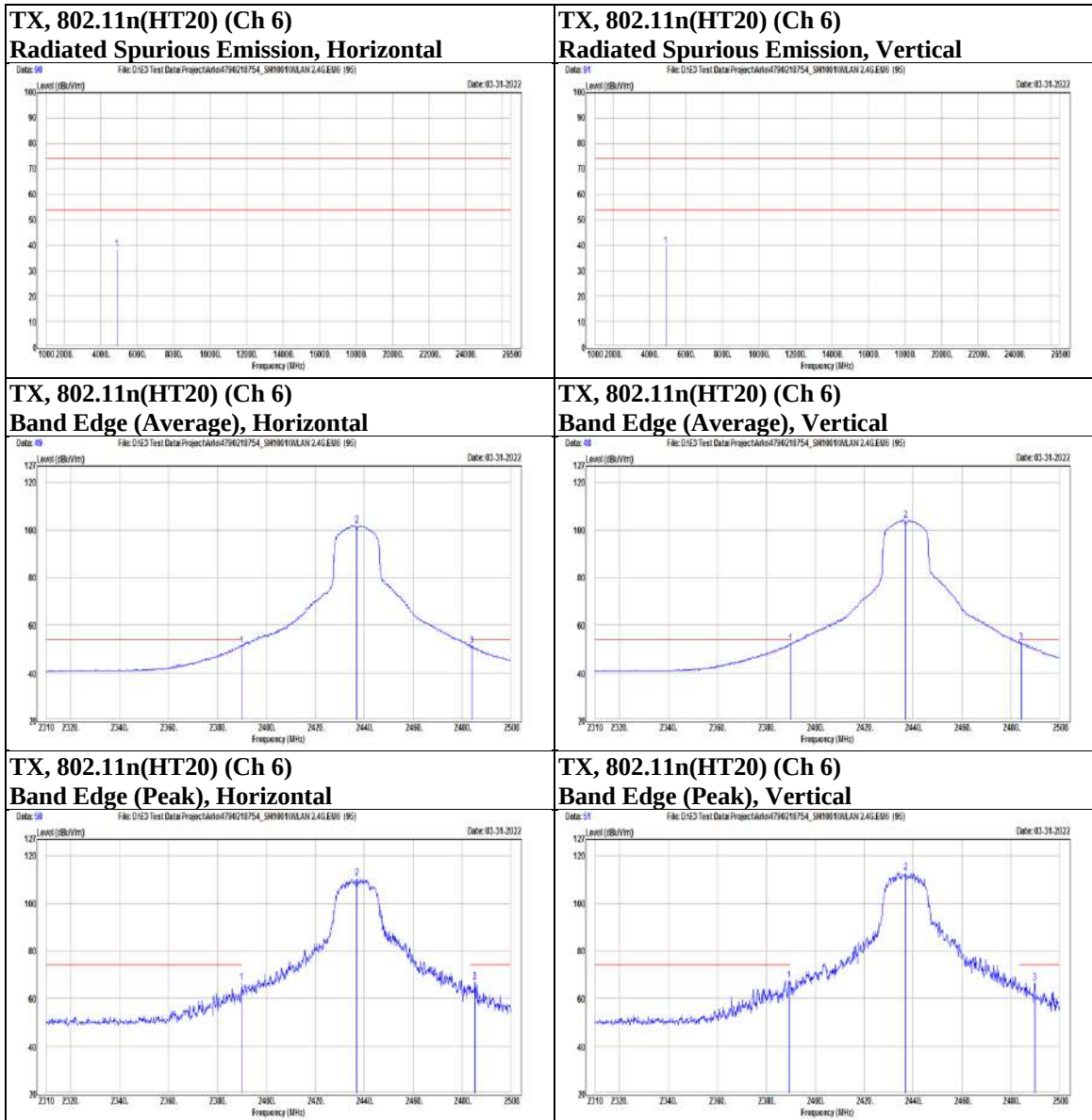
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Test report No. : 4790218754-US-R0-V0
Page : 72 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Mode	802.11n(HT20)	Channel	10
------	---------------	---------	----

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal	@	2457	93.68	15.92	109.6	N/A	N/A	PK
	@	2457	85.16	15.92	101.08	N/A	N/A	AVG
		2484.23	37.93	15.68	53.61	54	-0.39	AVG
		2488.03	55.58	15.65	71.23	74	-2.77	PK
	*	4914	37.28	2.42	39.7	74	-34.3	PK
Vertical	@	2457	92.77	15.92	108.69	N/A	N/A	PK
	@	2457	83.4	15.92	99.32	N/A	N/A	AVG
		2484.04	36.95	15.68	52.63	54	-1.37	AVG
		2486.32	54.55	15.67	70.22	74	-3.78	PK
	*	4914	37.46	2.42	39.88	74	-34.12	PK

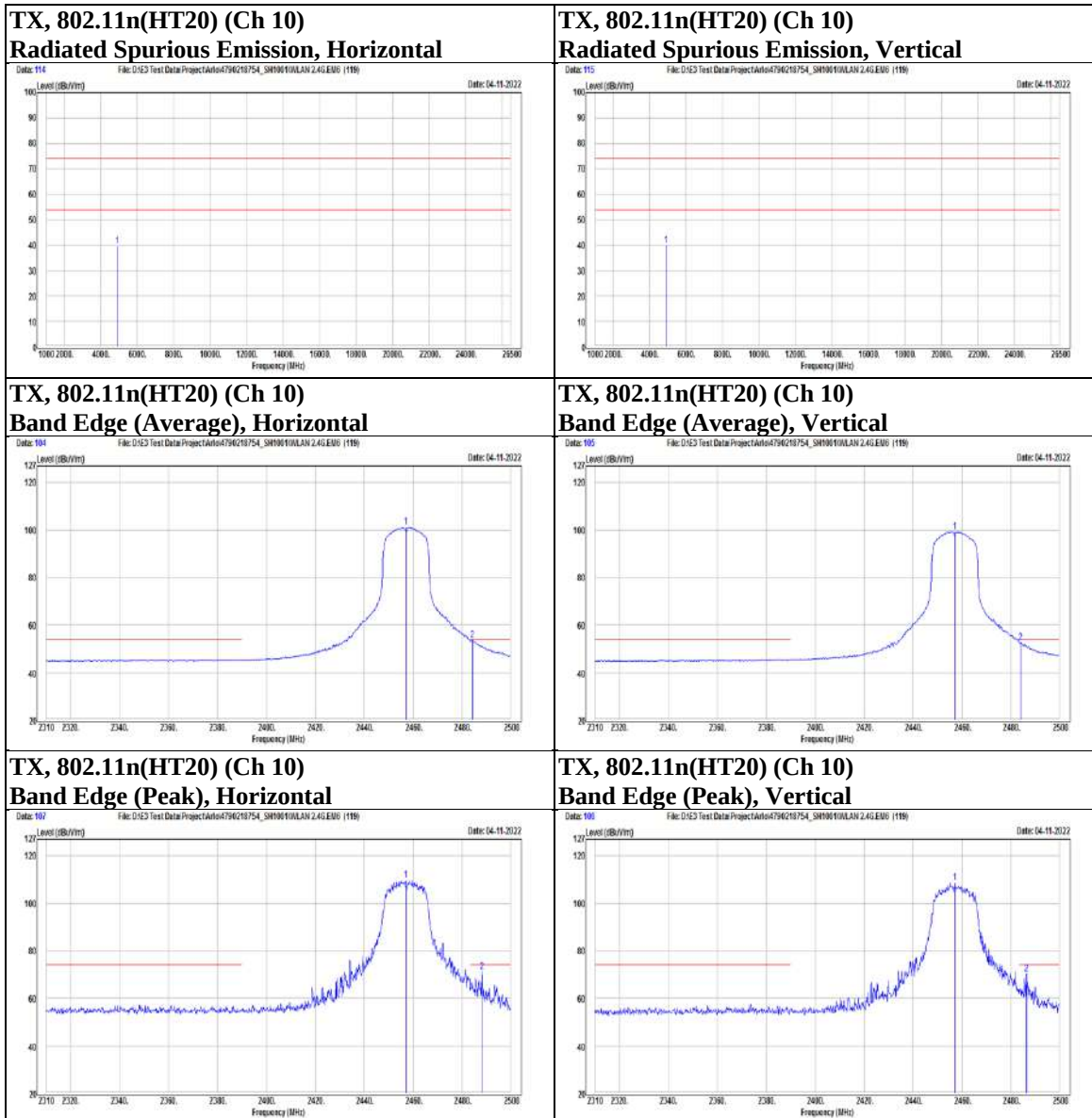
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





Test report No. : 4790218754-US-R0-V0
Page : 74 of 81
Issued date : 2022/6/27
FCC ID : 2APLE18300417

Mode	802.11n(HT20)	Channel	11
------	---------------	---------	----

Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal	@	2462	94.61	11.87	106.48	N/A	N/A	PK
	@	2462	85.59	11.87	97.46	N/A	N/A	AVG
		2483.85	38.68	11.68	50.36	54	-3.64	AVG
		2484.8	54.2	11.67	65.87	74	-8.13	PK
	*	4924	36.26	2.4	38.66	74	-35.34	PK
Vertical	@	2462	96.6	11.87	108.47	N/A	N/A	PK
	@	2462	88.44	11.87	100.31	N/A	N/A	AVG
		2483.66	41.68	11.68	53.36	54	-0.64	AVG
		2485.94	55.82	11.67	67.49	74	-6.51	PK
	*	4924	36.54	2.4	38.94	74	-35.06	PK

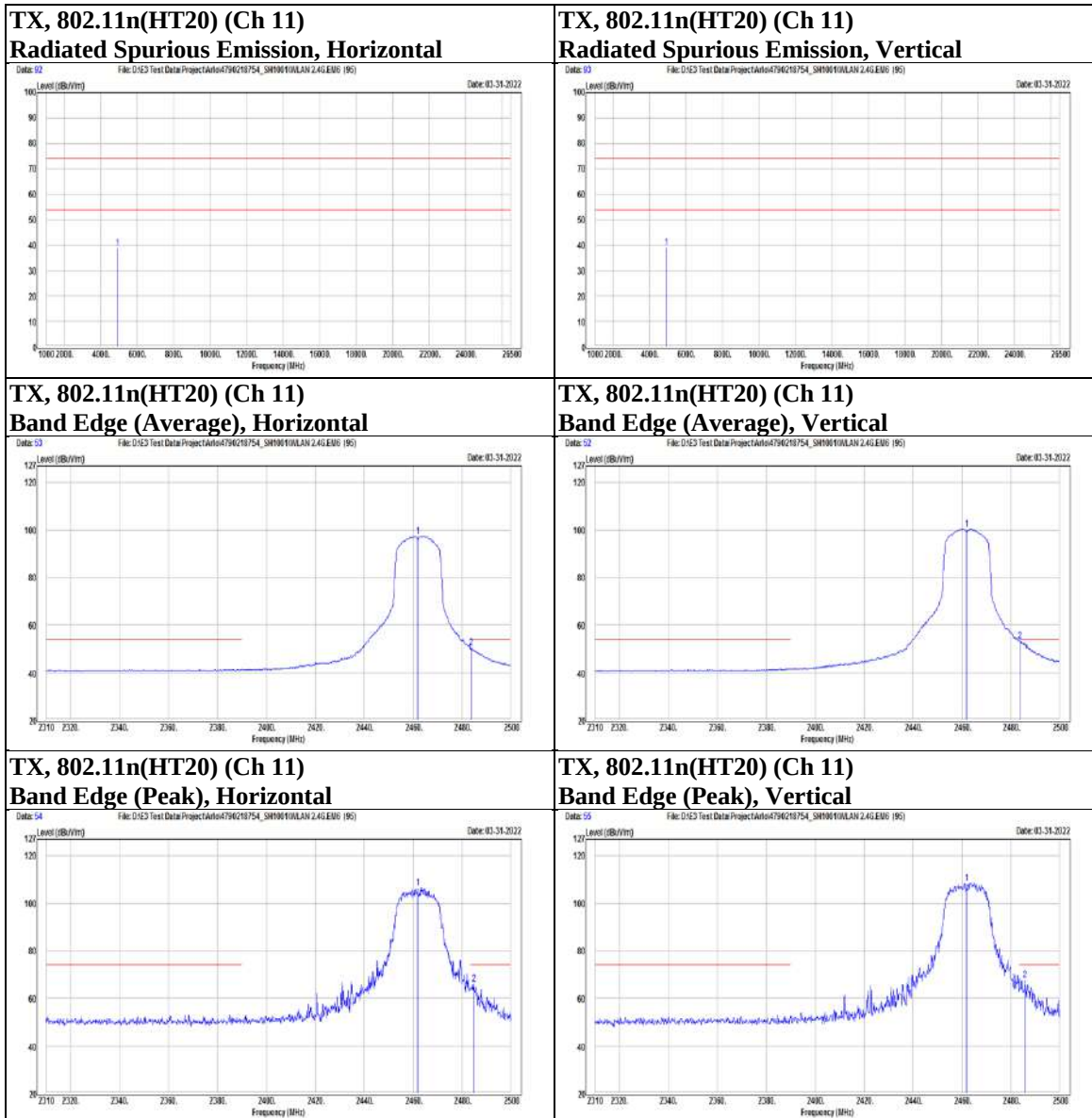
Underwriters Laboratories Taiwan Co., Ltd.

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-F0876 / 6.0





9 kHz ~ 30 MHz Data:

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

KDB 414788 D01 OATS and Chamber Correlation Justification

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

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

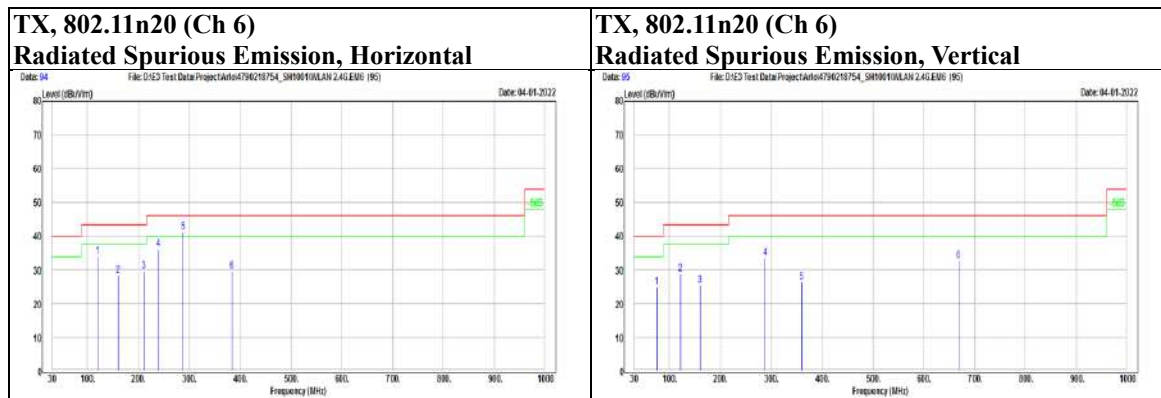
Doc No: 17-EM-F0876 / 6.0



Below 1 GHz

Mode	802.11n20	Channel	6
------	-----------	---------	---

Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		120.21	48.23	-14.32	33.91	43.5	-9.59	PK
		159.98	39.35	-11.11	28.24	43.5	-15.26	PK
		211.39	43.07	-13.64	29.43	43.5	-14.07	PK
		239.52	48.38	-12.16	36.22	46	-9.78	PK
		288.02	51.58	-10.39	41.19	46	-4.81	PK
		384.05	37.08	-7.48	29.6	46	-16.4	PK
Vertical		74.62	39.78	-15.02	24.76	40	-15.24	PK
		121.18	43.12	-14.23	28.89	43.5	-14.61	PK
		159.98	36.43	-11.11	25.32	43.5	-18.18	PK
		288.02	43.74	-10.39	33.35	46	-12.65	PK
		359.8	34.74	-8.3	26.44	46	-19.56	PK
		668.26	33.92	-1.26	32.66	46	-13.34	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-F0876 / 6.0



9.6. AC Power Line Conducted Emission

Requirements

Frequency (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.
2. 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.
3. Test data of Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB).
4. Test data of Margin(dB) = Result value (dBuV) - Limit value (dBuV).
5. Test data of Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).

Underwriters Laboratories Taiwan Co., Ltd.

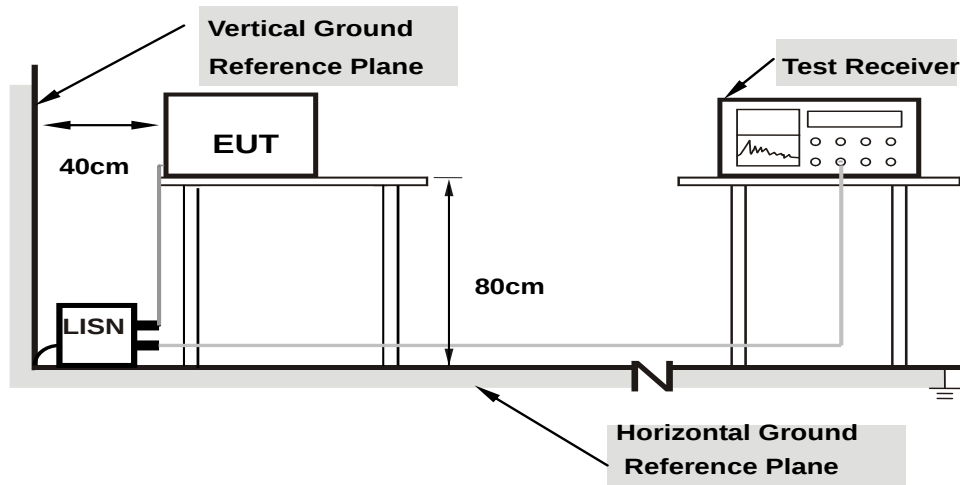
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

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

Doc No: 17-EM-F0876 / 6.0

Test Setup



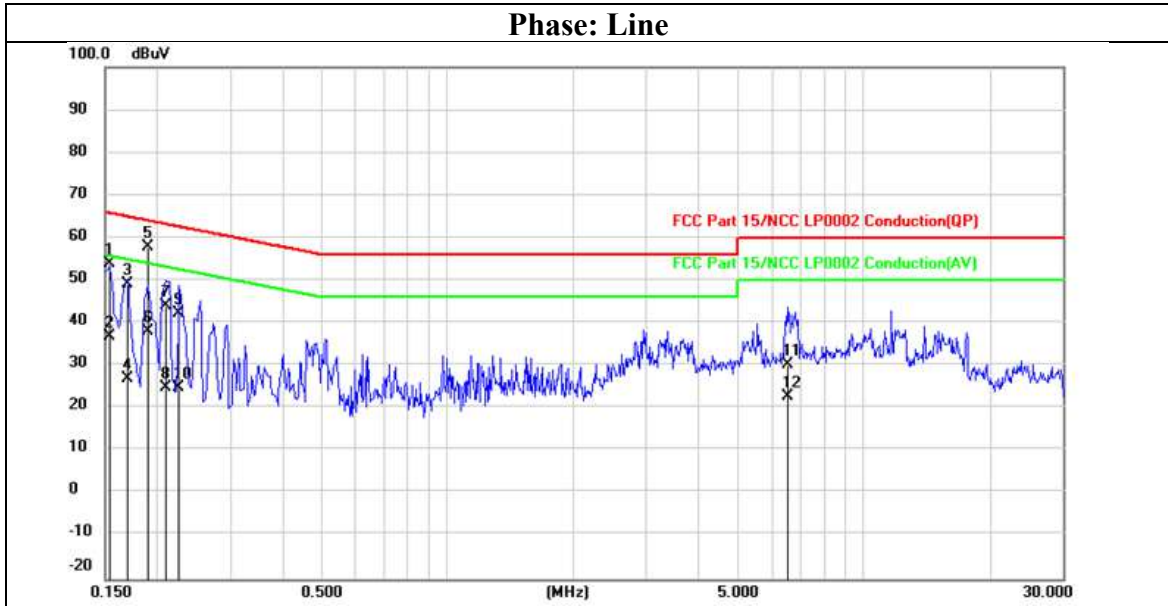
Note: 1.Support units were connected to second LISN.

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



Test Data

Mode	11n20_TX2437	Channel	6
------	--------------	---------	---



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1539	34.38	19.51	53.89	65.79	-11.90	QP
2	0.1539	17.38	19.51	36.89	55.79	-18.90	AVG
3	0.1700	29.79	19.51	49.30	64.96	-15.66	QP
4	0.1700	7.34	19.51	26.85	54.96	-28.11	AVG
5	0.1900	38.32	19.51	57.83	64.04	-6.21	QP
6	0.1900	18.47	19.51	37.98	54.04	-16.06	AVG
7	0.2100	24.58	19.51	44.09	63.21	-19.12	QP
8	0.2100	5.46	19.51	24.97	53.21	-28.24	AVG
9	0.2260	22.88	19.51	42.39	62.60	-20.21	QP
10	0.2260	5.32	19.51	24.83	52.60	-27.77	AVG
11	6.5340	10.56	19.64	30.20	60.00	-29.80	QP
12	6.5340	3.21	19.64	22.85	50.00	-27.15	AVG

Underwriters Laboratories Taiwan Co., Ltd.

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

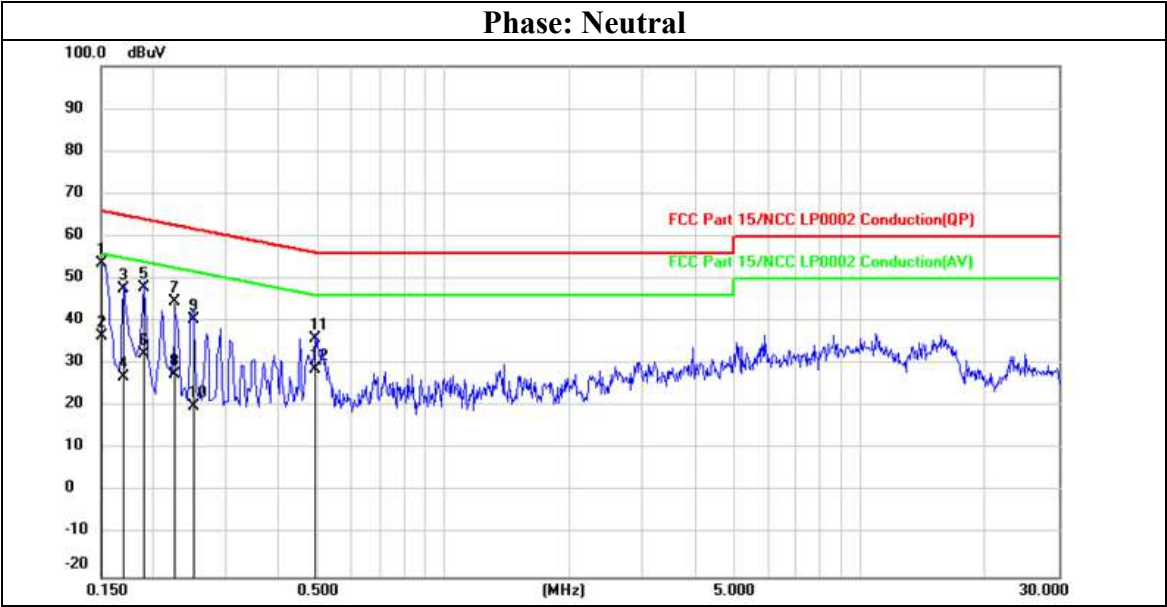
Telephone :+886-2-7737-3000

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

Doc No: 17-EM-F0876 / 6.0



Mode	11n20_TX2437	Channel	6
------	--------------	---------	---



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1500	34.27	19.51	53.78	66.00	-12.22	QP
2	0.1500	17.04	19.51	36.55	56.00	-19.45	AVG
3	0.1700	28.23	19.51	47.74	64.96	-17.22	QP
4	0.1700	7.40	19.51	26.91	54.96	-28.05	AVG
5	0.1900	28.53	19.51	48.04	64.04	-16.00	QP
6	0.1900	12.79	19.51	32.30	54.04	-21.74	AVG
7	0.2260	25.14	19.51	44.65	62.60	-17.95	QP
8	0.2260	8.07	19.51	27.58	52.60	-25.02	AVG
9	0.2500	21.01	19.51	40.52	61.76	-21.24	QP
10	0.2500	0.63	19.51	20.14	51.76	-31.62	AVG
11	0.4900	16.35	19.51	35.86	56.17	-20.31	QP
12	0.4900	9.14	19.51	28.65	46.17	-17.52	AVG

END OF REPORT

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-F0876 / 6.0