



Test report No. : 4790224862-US-R0-V0  
Page : 1 of 254  
Issued date : 2022/9/30  
FCC ID : 2AE3B-AEX-QCA98X

# RADIO TEST REPORT

**Product** : PCIE 802.11a/b/g/n/ac 2.4GHz/5GHz DB module

**Model Name** : AEX-QCA98x0

**Series Model** : AEX-QCA98X, AEX-QCA9880-NX, AEX-QCA9890-NX,  
AEX-QCA9890-NI

**FCC ID** : 2AE3B-AEX-QCA98X

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

**Received Date** : 2021/12/14

**Test Date** : 2022/8/15 ~ 2022/8/30

**Issued Date** : 2022/9/30

**Applicant** : VOXMICRO LTD  
20955 Pathfinder Rd., STE 100, Diamond Bar, California  
91765, 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



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Doc No: 17-EM-F0876 / 6.0





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## 1. Attestation of Test Results

**APPLICANT:** VOXMICRO LTD  
 20955 Pathfinder Rd., STE 100, Diamond Bar, California 91765, USA

**MANUFACTURER:** VOXMICRO LTD  
 8F.-3, No.5, Aly. 22, Ln. 513, Rueiguang Rd., Neihsu Dist., Taipei City  
 114, Taiwan

**EUT DESCRIPTION:** PCIE 802.11a/b/g/n/ac 2.4GHz/5GHz DB module

**BRAND:** AIRETOS

**MODEL:** AEX-QCA98x0

**SERIES MODEL:** AEX-QCA98X, AEX-QCA9880-NX, AEX-QCA9890-NX,  
 AEX-QCA9890-NI

**SAMPLE STAGE:** Engineering Verification Test sample

**DATE of TESTED:** 2022/8/15 ~ 2022/8/30

<b>APPLICABLE STANDARDS</b>	
<b>STANDARD</b>	<b>Test Results</b>
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 : 2022/9/30

Approved and Authorized By:

Kent Liu  
 Senior Laboratory Engineer

Date : 2022/9/30

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## 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

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### 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 KDB 662911 D01 Multiple Transmitter Output v02r01.

### 4. Facilities and Accreditation

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

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## 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	$\pm 2.9$ dB
RF Conducted	9 kHz - 40GHz	$\pm 2.4$ dB
Radiated disturbance below 30MHz	9 kHz - 30 MHz	$\pm 1.9$ dB
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	$\pm 5.8$ dB
Radiated disturbance above 1 GHz	1GHz ~ 40GHz	$\pm 4.8$ dB

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## 6. Equipment under Test

### 6.1. Description of EUT

<b>Product</b>	PCIE 802.11a/b/g/n/ac 2.4GHz/5GHz DB module
<b>Brand Name</b>	AIRETOS
<b>Model Name</b>	AEX-QCA98x0
<b>Series Model</b>	AEX-QCA98X, AEX-QCA9880-NX, AEX-QCA9890-NX, AEX-QCA9890-NI
<b>Operating Frequency</b>	2412MHz ~ 2462MHz
<b>Modulation</b>	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
<b>Transfer Rate</b>	802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to MCS23 TurboQAM: up to MCS9
<b>Number of Channel</b>	11 for 802.11b, 802.11g, 802.11n (HT20), TurboQAM (VHT20) 7 for 802.11n (HT40), TurboQAM (VHT40)
<b>Maximum Output Power</b>	<b>Non-Beamforming mode:</b> 802.11b: 21.62 dBm 802.11g: 29.94 dBm TurboQAM (VHT20): 29.94 dBm TurboQAM (VHT40): 26.69 dBm <b>Beamforming mode:</b> TurboQAM (VHT20): 28.10 dBm TurboQAM (VHT40): 26.57 dBm
<b>Normal Voltage</b>	3.3Vdc
<b>S/N</b>	E98X
<b>Sample ID</b>	5189932

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Note:

1. The models difference table as below:

Model	Difference
AEX-QCA98x0	Market assignment classification for application and grade finish
AEX-QCA98X	
AEX-QCA9880-NX	
AEX-QCA9890-NX	
AEX-QCA9890-NI	

2. The EUT incorporates a MIMO function. Physically, the EUT provides three completed transmitters and three receivers.

Modulation Mode	Tx,Rx Function
802.11b	3TX,3RX
802.11g	3TX,3RX
802.11n (HT20)	3TX,3RX
802.11n (HT40)	3TX,3RX
TurboQAM (VHT20)	3TX,3RX
TurboQAM (VHT40)	3TX,3RX

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

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

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## 6.2. Channel List

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20),  
TurboQAM (VHT20):

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	-	-

7 channels are provided for 802.11n (HT40), TurboQAM (VHT40):

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

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### 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/ 51~65%RH	3.3Vdc	2022/08/15~ 2022/08/30	WaterNil Guan/ Rex Chen
Radiated Spurious Emission	966-2	21~26°C/ 51~65%RH	3.3Vdc	2022/08/15~ 2022/08/30	WaterNil Guan/ Rex Chen
AC power Line Conducted Emission	SR1	21~26°C/ 51~65%RH	3.3Vdc	2022/08/15~ 2022/08/30	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)	Remark
1	Chain (0)+(1) +(2)	ethertronics	M830520	Chip	2.4GHz: 1 5GHz: 2.6	MHF4
2	Chain (0)+(1) +(2)	OXFORDTEC	WAFH-2DBI-15	FPC	2.4GHz: 2.7 5GHz: 2.6	UFL
3	Chain (0)+(1) +(2)	OXFORDTEC	WAND2DBI-SMA	Dipole	2.4GHz: 2 5GHz: 3	RP-SMA
4	Chain (0)+(1) +(2)	OXFORDTEC	WAND5DBI-SMA	Dipole	2.4GHz: 3 5GHz: 5	RP-SMA
5	Chain (0)+(1) +(2)	OXFORDTEC	WAPH2DB4-15	PCB	2.4GHz:2.18 5GHz: 2.69	MHF4

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.

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## 6.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the dipole antenna was investigated in two orthogonal (lay and stand), it was determined that stand mode was worst-case. Therefore, all final radiated testing was performed with the dipole antenna in stand mode.
- The fundamental of the Chip antenna 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 antenna in X-Y plane.
- The fundamental of the FPC antenna 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 antenna in X-Y plane.
- The fundamental of the PCB antenna was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that Y-Z plane was worst-case. Therefore, all final radiated testing was performed with the antenna in Y-Z 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).

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**Non-Beamforming mode:**

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
	TurboQAM (VHT20)	OFDM	BPSK	1 to 11	1,2,6,10,11	MCS0 Nss1
	TurboQAM (VHT40)	OFDM	BPSK	3 to 9	3,4,6,8,9	MCS0 Nss1
Radiated Emissions (Below 1GHz)	802.11g	OFDM	BPSK	1 to 11	6	6 Mbps
AC Power Line Conducted Emission	802.11g	OFDM	BPSK	1 to 11	6	6 Mbps
*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
	TurboQAM (VHT20)	OFDM	BPSK	1 to 11	1,2,6,10,11	MCS0 Nss1
	TurboQAM (VHT40)	OFDM	BPSK	3 to 9	3,4,6,8,9	MCS0 Nss1

\*Note : For Antenna Port Conducted Measurement item, Inner channels only test Power and Conducted Out of Band Emission.

**Beamforming mode:**

Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
*Antenna Port Conducted Measurement	TurboQAM (VHT20)	OFDM	BPSK	1 to 11	1,2,6,10,11	MCS0 Nss1
	TurboQAM (VHT40)	OFDM	BPSK	3 to 9	3,4,6,8,9	MCS0 Nss1

\*Note : For Antenna Port Conducted Measurement item, Inner channels only test Power and Conducted Out of Band Emission.

\*Note : The worse spurious emissions test and maximum output power was found in Non-Beamforming mode. Therefore, Beamforming mode only the test data of the RF output power were recorded in this report.

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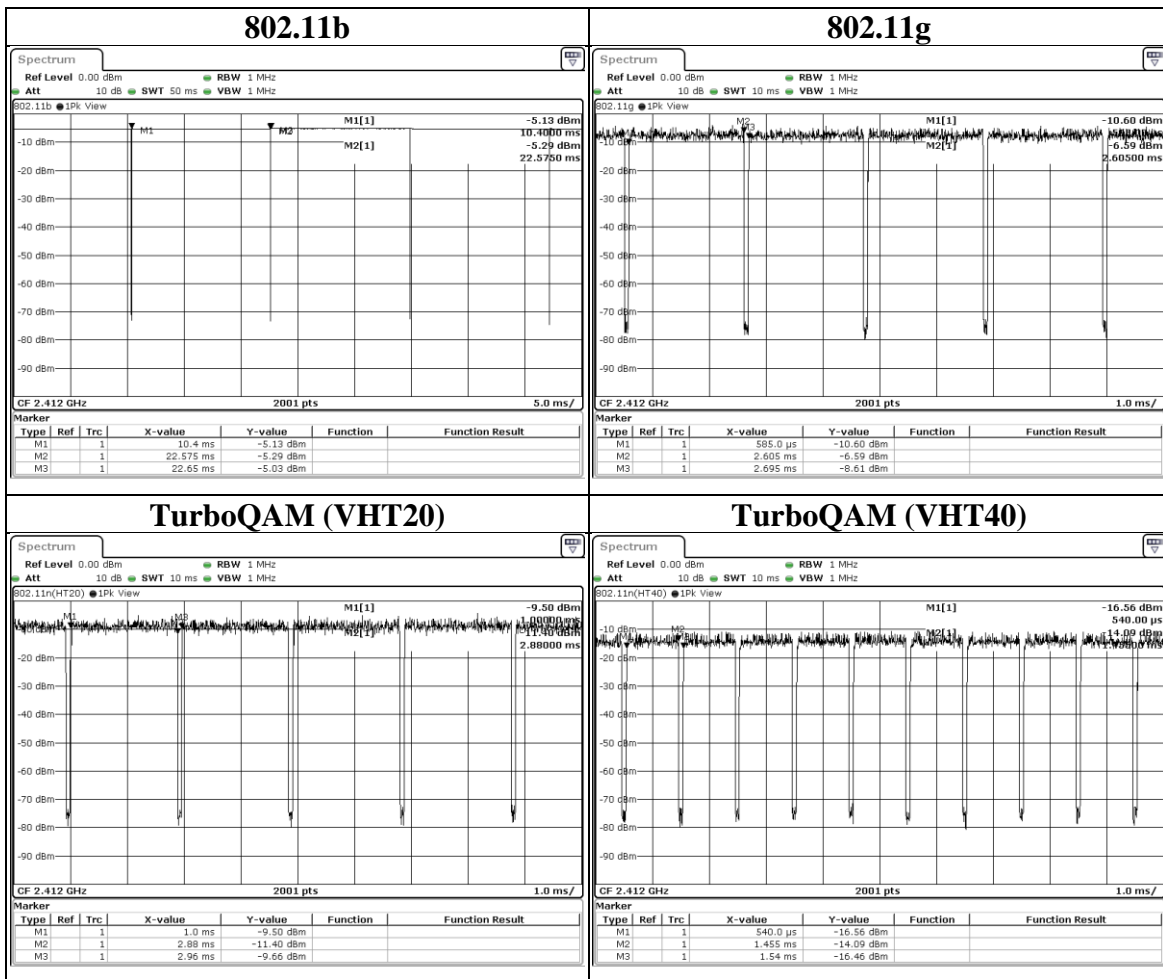
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### 6.6. Duty cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle	Duty Factor (dB)	VBW Set (above 1GHz)
802.11b	12.175	12.250	0.99	N/A	10Hz
802.11g	2.020	2.110	0.96	0.19	510Hz
TurboQAM (VHT20)	1.880	1.960	0.96	0.18	1kHz
TurboQAM (VHT40)	0.915	1.000	0.92	0.39	2kHz





## 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	2022/6/7	2023/6/6
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2022/2/16	2023/2/15
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2022/5/17	2023/5/16
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

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Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
<b>Antenna Port Conducted Measurement</b>					
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
<b>AC power Line Conducted Emission</b>					
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
				2022/8/29	2023/8/28
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2021/8/26	2022/8/25
				2022/8/30	2023/8/29
Cables	TITAN	CFD200	T0732ACFD20 020A300-2	2022/4/9	2023/4/8

UL Software		
Description	Name	Version
Radiated measurement	e3	6.191211 (V6)
Conducted measurement	RF-Conducted-FCC 15247	ver 1.0
AC power Line Conducted Emission	EZ_EMCC	UL-3A1.2

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## 8. Description of Test Setup

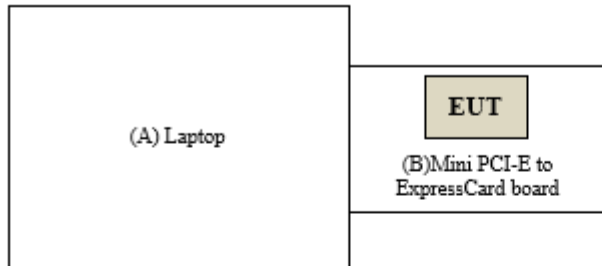
### Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	Laptop	Lenovo	T460	PC0FWU5Y	Provide by lab
B	Mini PCI-E to ExpressCard board	PHIYO TECH	ExpressCard Extender	19	Provide by lab

### Test Setup

Controlled using a bespoke application (ART2-GUI / Version 2.3) 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**

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## 9. Test Results

### 9.1. 6dB Bandwidth

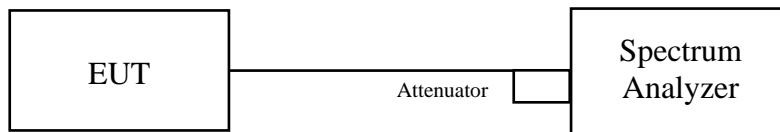
#### Requirements

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.

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**Test Data**

Mode	CH	Freq (MHz)	6dB BW (MHz)			Limit (MHz)	Result
			Chain 0	Chain 1	Chain 2		
802.11b	1	2412	7.195	7.210	7.187	0.5	Pass
	6	2437	7.218	7.194	7.209	0.5	Pass
	11	2462	7.202	7.188	7.215	0.5	Pass

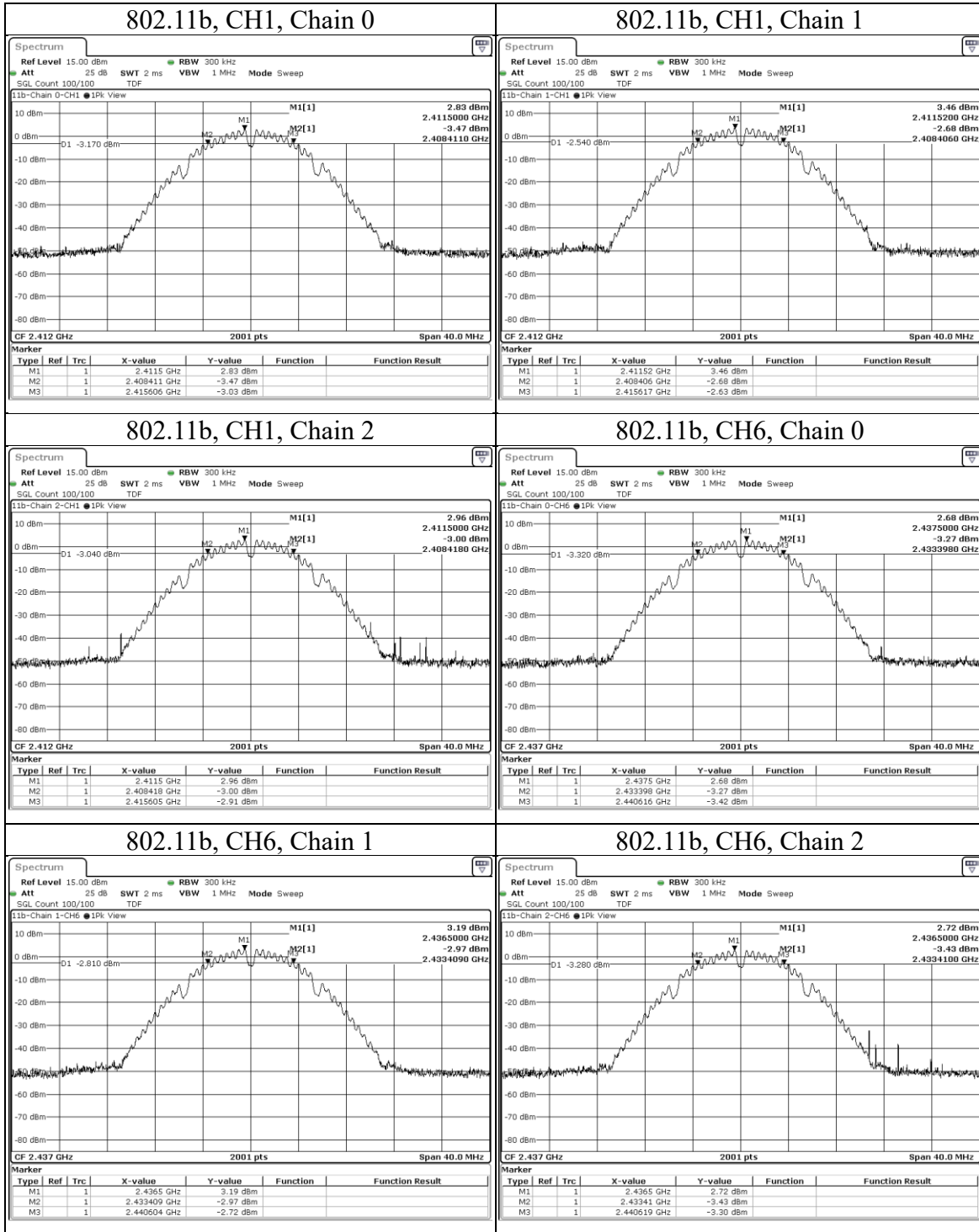
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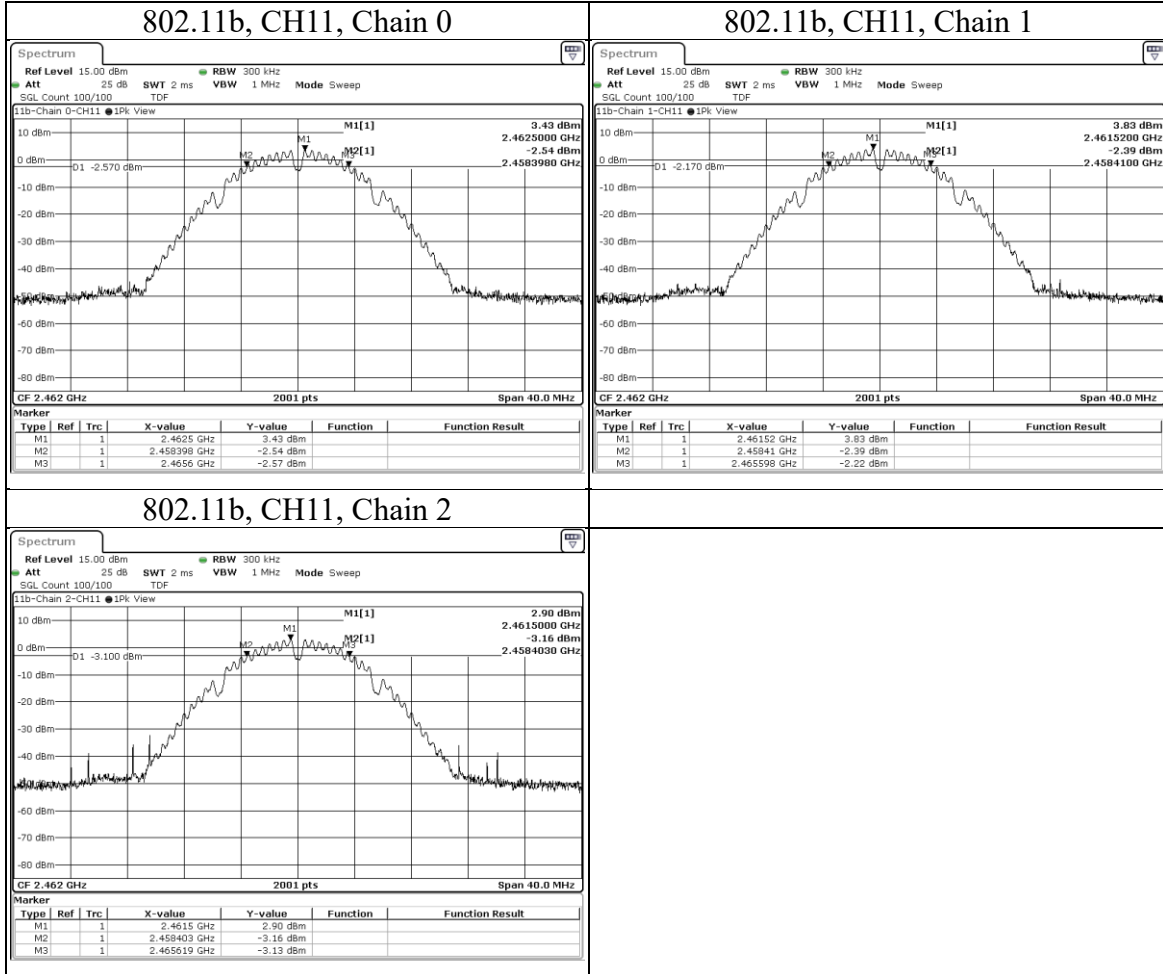


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Mode	CH	Freq (MHz)	6dB BW (MHz)			Limit (MHz)	Result
			Chain 0	Chain 1	Chain 2		
802.11g	1	2412	16.442	16.482	16.403	0.5	Pass
	6	2437	16.424	16.532	16.412	0.5	Pass
	11	2462	16.455	16.388	16.478	0.5	Pass

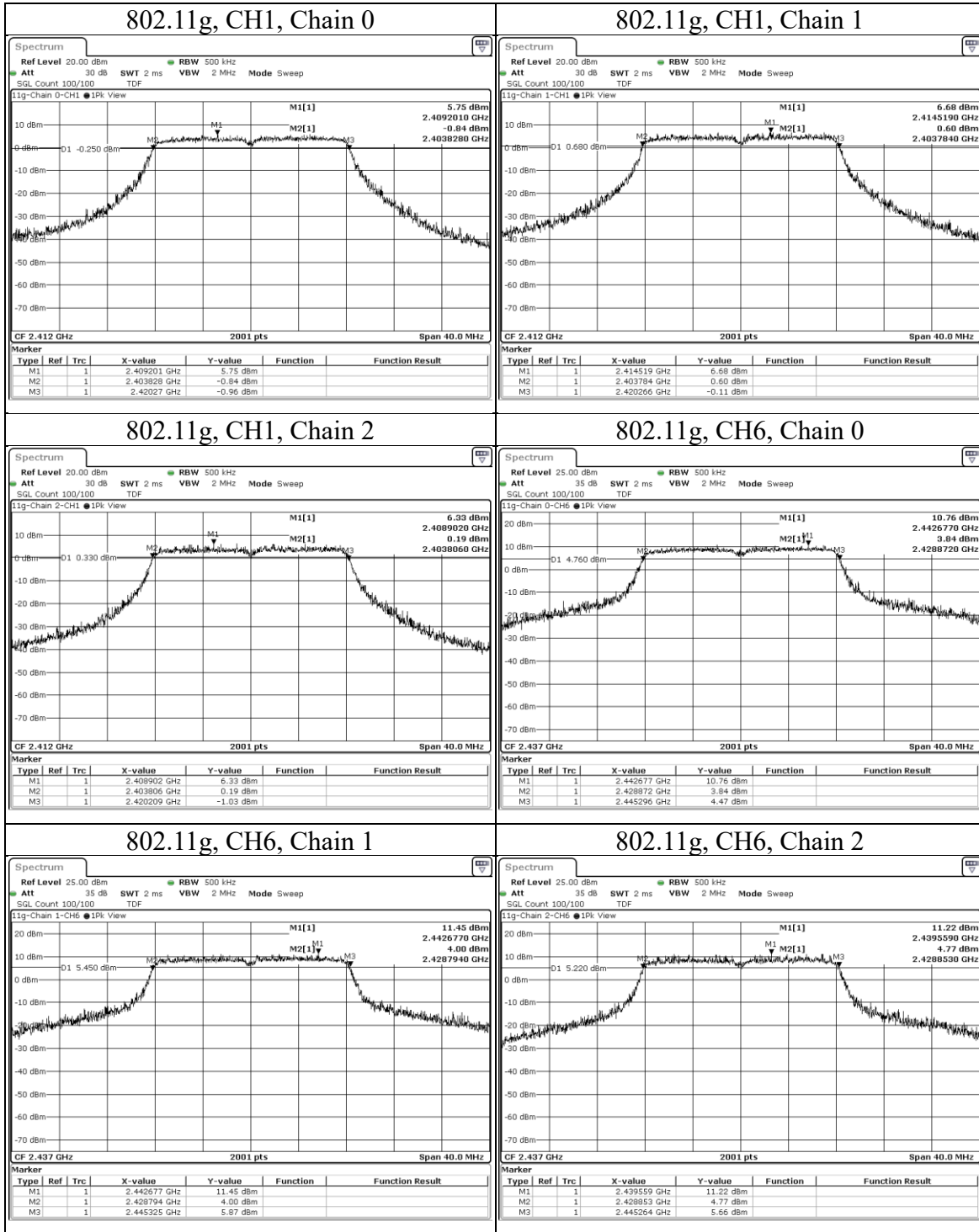
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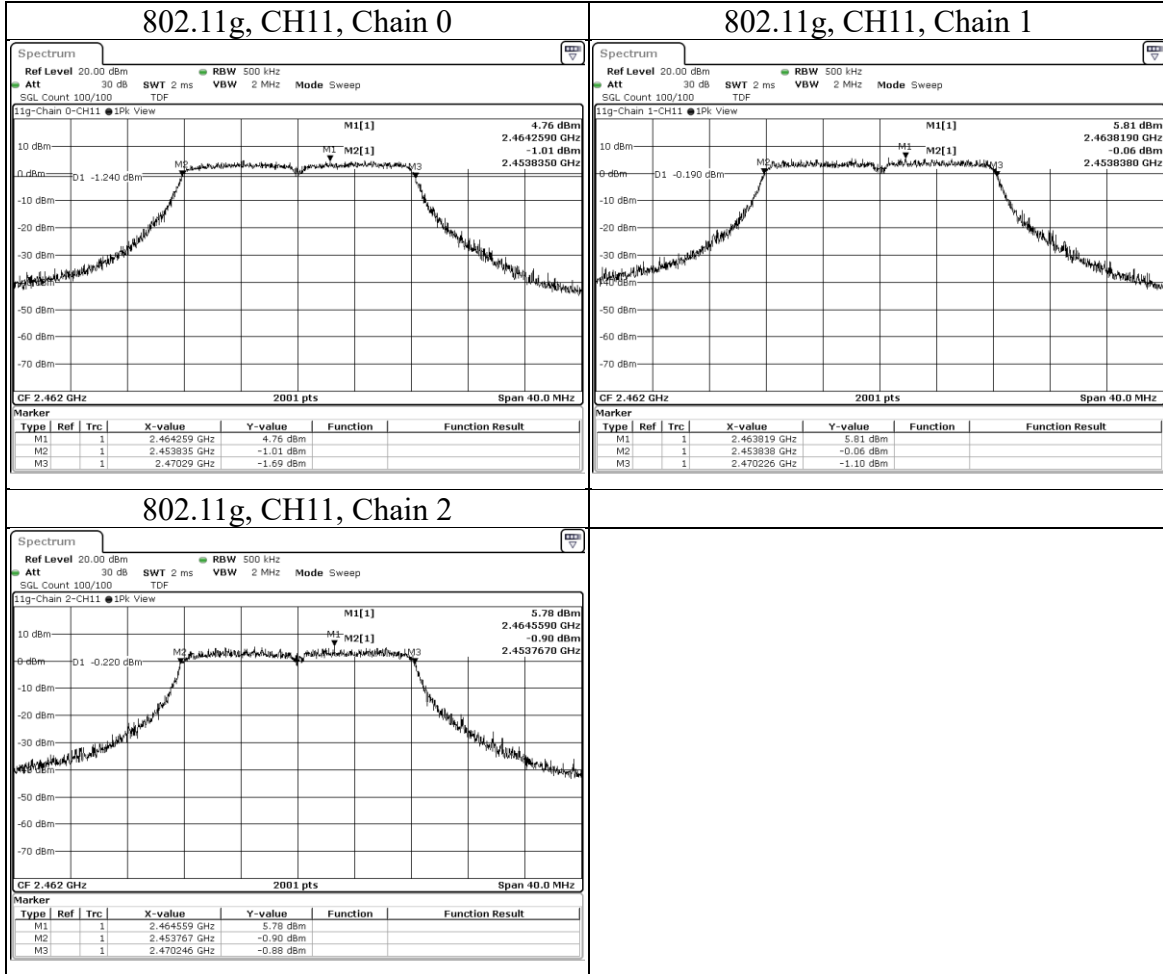


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Mode	CH	Freq (MHz)	6dB BW (MHz)			Limit (MHz)	Result
			Chain 0	Chain 1	Chain 2		
TurboQAM (VHT20)	1	2412	17.657	17.619	17.649	0.5	Pass
	6	2437	17.537	17.614	17.603	0.5	Pass
	11	2462	17.723	17.727	17.576	0.5	Pass

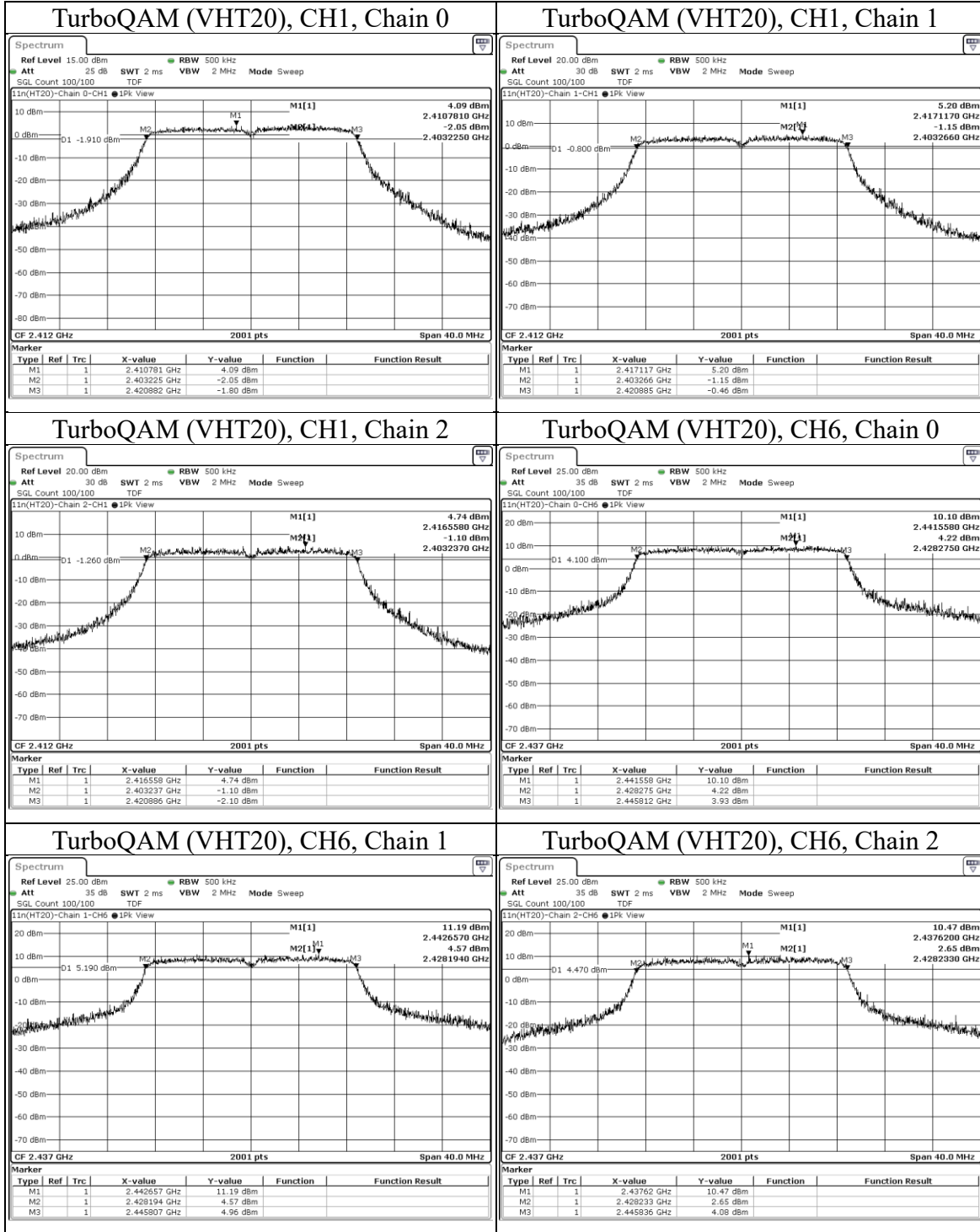
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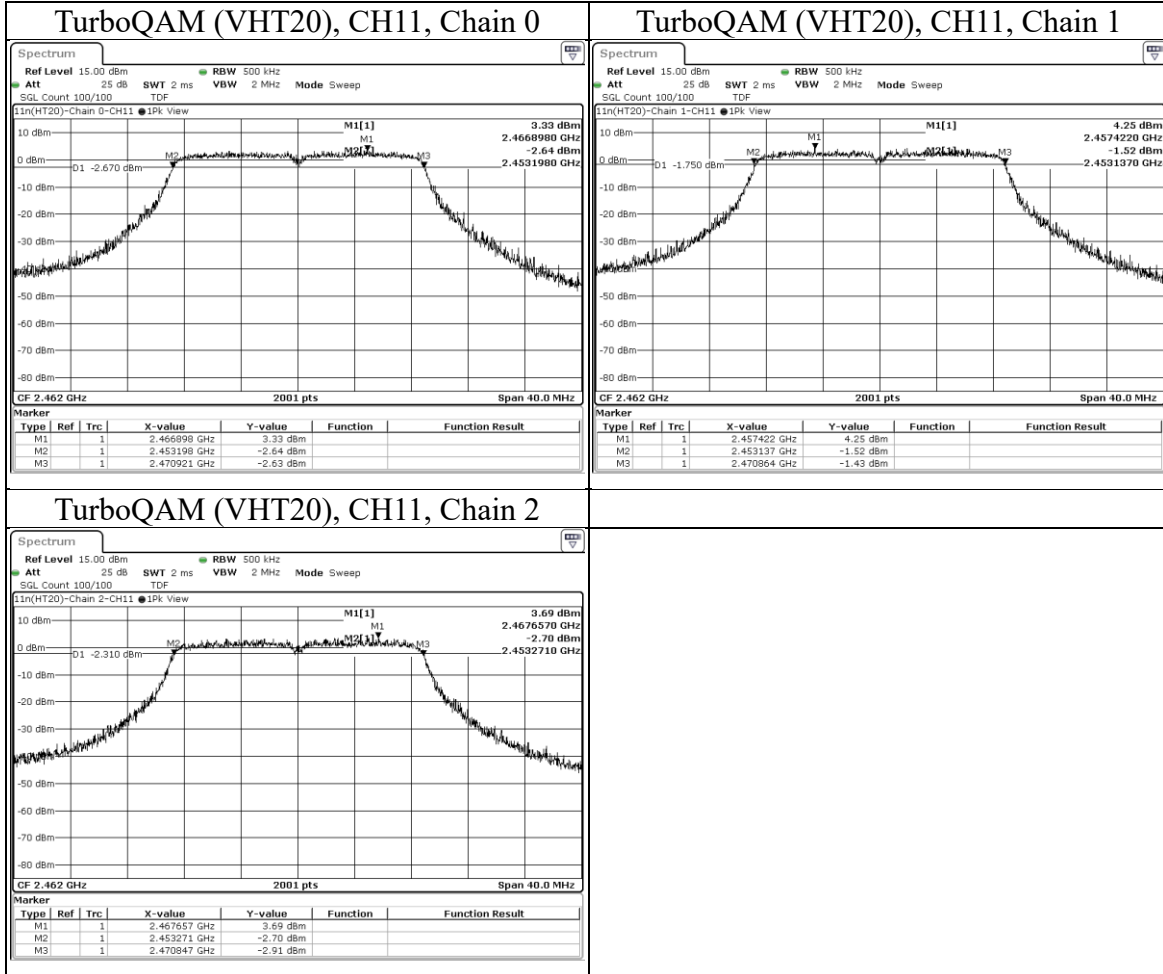
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Mode	CH	Freq (MHz)	6dB BW (MHz)			Limit (MHz)	Result
			Chain 0	Chain 1	Chain 2		
TurboQAM (VHT40)	3	2422	36.168	36.166	36.380	0.5	Pass
	6	2437	36.063	36.193	36.340	0.5	Pass
	9	2452	36.096	36.030	36.109	0.5	Pass

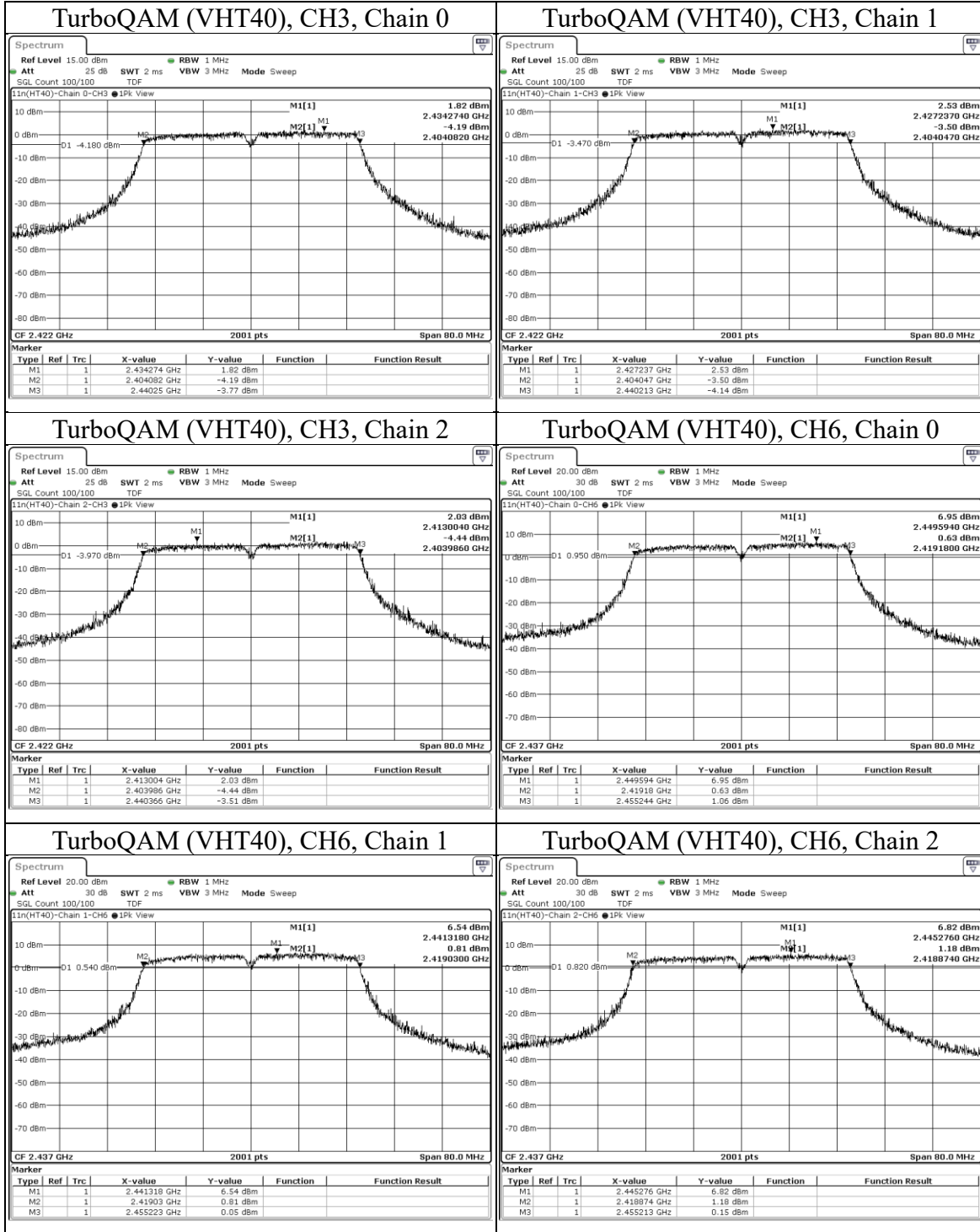
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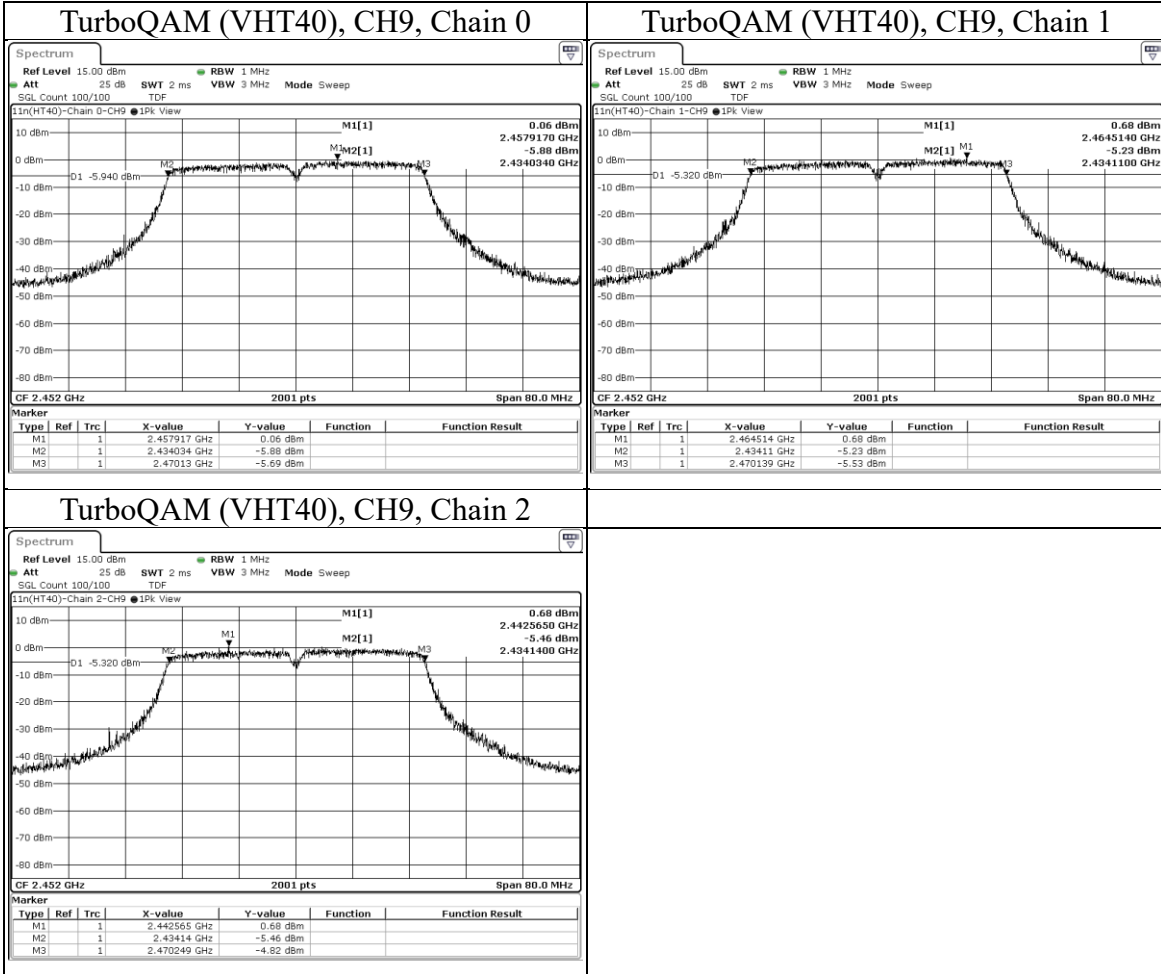


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## 9.2. Conducted Output Power

### Requirements

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

Note:

1. Directional Gain =  $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / N_{ANT}]$  dBi.

Nant: Number of Transmit Antennas

G1, G2,..., Gn: Gain of Individual Antennas

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

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

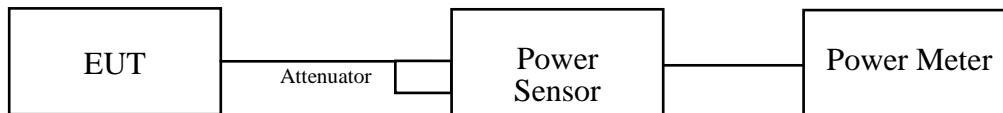
Array Gain = 0 dB (i.e., no array gain) for channel widths  $\geq 40$  MHz for any  $N_{ANT}$ ;

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

### 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.

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## Test Data

### Non-Beamforming mode

#### Peak Power

##### 802.11b

Channel	Frequency (MHz)	Peak Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
1	2412	16.62	16.74	16.79	140.929	21.49	30	PASS
6	2437	17.10	16.96	16.45	145.211	21.62	30	PASS
11	2462	16.99	17.05	16.82	148.936	21.73	30	PASS

##### 802.11g

Channel	Frequency (MHz)	Peak Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
1	2412	21.61	21.74	21.51	435.512	26.39	30	PASS
2	2417	22.96	23.01	22.92	592.925	27.73	30	PASS
6	2437	25.36	25.21	24.91	986.279	29.94	30	PASS
10	2457	23.11	23.12	22.46	586.138	27.68	30	PASS
11	2462	21.07	21.39	20.37	374.973	25.74	30	PASS

##### TurboQAM (VHT20)

Channel	Frequency (MHz)	Peak Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
1	2412	20.79	21.17	20.37	359.749	25.56	30	PASS
2	2417	23.14	23.24	22.60	598.412	27.77	30	PASS
6	2437	25.21	25.28	25.01	986.279	29.94	30	PASS
10	2457	23.03	23.40	22.80	609.537	27.85	30	PASS
11	2462	19.98	20.21	19.60	295.801	24.71	30	PASS

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**TurboQAM (VHT40)**

Channel	Frequency (MHz)	Peak Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
3	2422	17.52	17.82	17.08	168.267	22.26	30	PASS
4	2427	18.50	18.66	18.05	207.97	23.18	30	PASS
6	2437	22.00	22.24	21.48	466.659	26.69	30	PASS
8	2447	18.80	18.79	18.25	218.273	23.39	30	PASS
9	2452	15.41	15.91	15.25	107.152	20.30	30	PASS

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### Average Power (Reference Only)

#### 802.11b

Channel	Frequency (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1	Chain 2		
1	2412	13.51	13.76	13.86	70.469	18.48
6	2437	13.94	13.96	13.55	72.277	18.59
11	2462	13.99	14.14	13.91	75.683	18.79

#### 802.11g

Channel	Frequency (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1	Chain 2		
1	2412	15.51	15.87	15.60	110.408	20.43
2	2417	17.11	17.22	17.04	154.882	21.90
6	2437	20.64	20.73	19.94	332.66	25.22
10	2457	17.04	17.45	16.52	151.008	21.79
11	2462	15.05	15.41	14.39	94.189	19.74

#### TurboQAM (VHT20)

Channel	Frequency (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1	Chain 2		
1	2412	14.54	15.23	14.33	88.92	19.49
2	2417	17.03	17.36	16.63	151.008	21.79
6	2437	20.33	20.37	19.84	313.329	24.96
10	2457	17.24	17.63	16.73	158.125	21.99
11	2462	13.79	14.10	13.45	71.779	18.56

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**TurboQAM (VHT40)**

Channel	Frequency (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1	Chain 2		
3	2422	11.03	11.43	10.75	38.459	15.85
4	2427	12.03	12.36	11.63	47.753	16.79
6	2437	15.54	15.82	15.05	105.925	20.25
8	2447	12.42	12.41	11.76	49.888	16.98
9	2452	9.17	9.40	8.84	24.604	13.91

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### Beamforming mode

#### TurboQAM (VHT20)

Channel	Frequency (MHz)	Peak Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
1	2412	20.57	20.94	20.12	341.193	25.33	28.23	PASS
2	2417	22.92	23.07	22.38	571.479	27.57	28.23	PASS
6	2437	23.32	23.46	23.19	645.654	28.10	28.23	PASS
10	2457	22.90	23.19	22.57	584.79	27.67	28.23	PASS
11	2462	19.74	20.09	19.50	285.102	24.55	28.23	PASS

#### TurboQAM (VHT40)

Channel	Frequency (MHz)	Peak Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
3	2422	17.36	17.63	16.91	161.436	22.08	28.23	PASS
4	2427	18.36	18.45	17.87	199.986	23.01	28.23	PASS
6	2437	21.90	22.08	21.38	453.942	26.57	28.23	PASS
8	2447	18.62	18.54	18.07	208.449	23.19	28.23	PASS
9	2452	15.25	15.68	15.10	102.802	20.12	28.23	PASS

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### 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 =  $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / Nant]$  dBi.

Nant: Number of Transmit Antennas

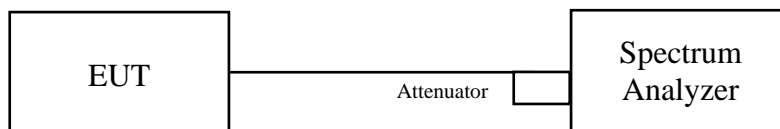
G1, G2, ..., Gn: Gain of Individual Antennas

4. "PSD per chain" of the report shown is maximum value for each chain, at the "Total PSD" is summing entire spectra across corresponding frequency bins on the various outputs by computer, refer KDB 662911 Method a) for calculating total power density.

#### 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.

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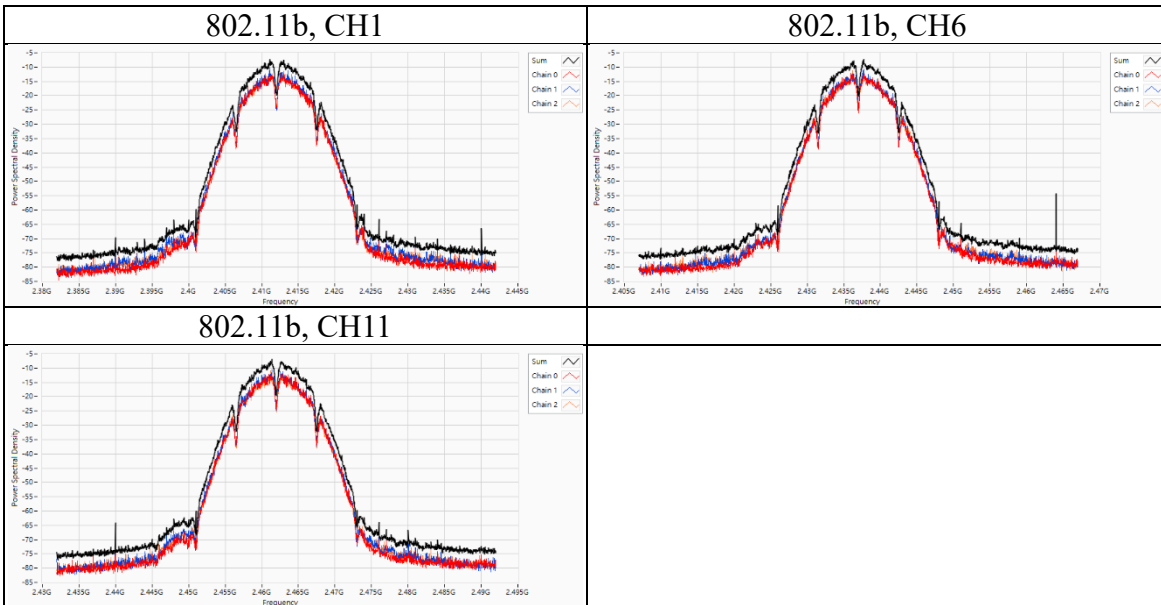
Doc No: 17-EM-F0876 / 6.0



**Test Data**

Mode	CH	Freq (MHz)	Directional Gain (dBi)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Result
802.11b	1	2412	7.77	0.48	6.23	Pass
	6	2437	7.77	0.408	6.23	Pass
	11	2462	7.77	0.88	6.23	Pass

Mode	CH	Freq (MHz)	PSD per Chain (dBm/MHz)		
			Chain 0	Chain 1	Chain 2
802.11b	1	2412	-12.259	-10.316	-11.481
	6	2437	-12.093	-10.634	-11.197
	11	2462	-12.032	-10.436	-11.062



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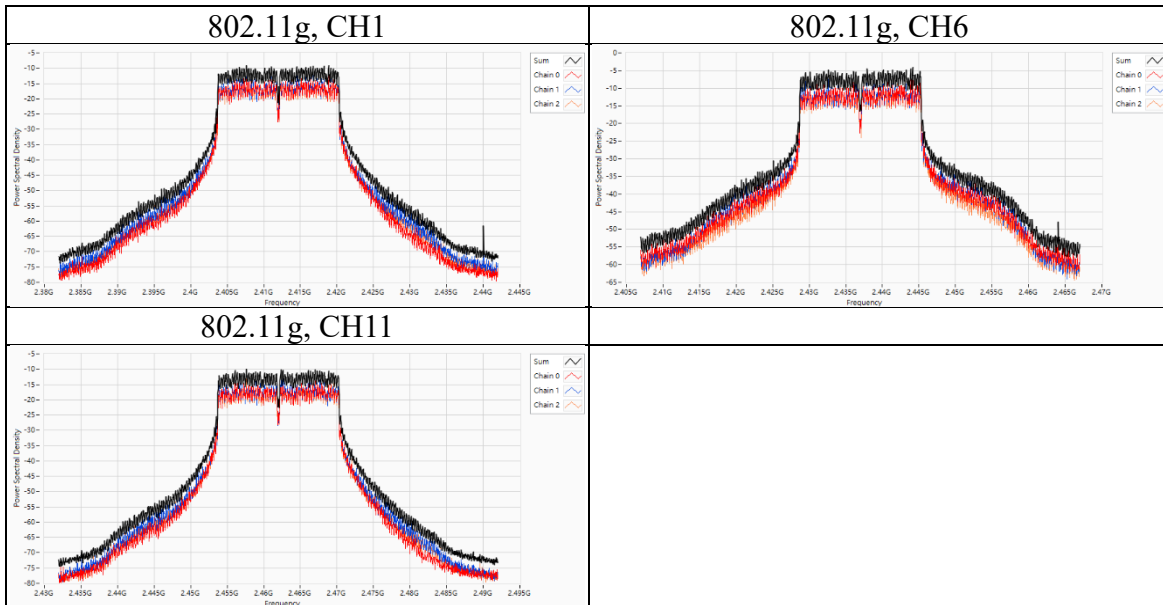
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Mode	CH	Freq (MHz)	Directional Gain (dBi)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Result
802.11g	1	2412	7.77	-1.395	6.23	Pass
	6	2437	7.77	3.618	6.23	Pass
	11	2462	7.77	-2.191	6.23	Pass

Mode	CH	Freq (MHz)	PSD per Chain (dBm/MHz)		
			Chain 0	Chain 1	Chain 2
802.11g	1	2412	-12.17	-12.216	-13.748
	6	2437	-7.548	-7.506	-8.797
	11	2462	-13.71	-12.684	-13.186



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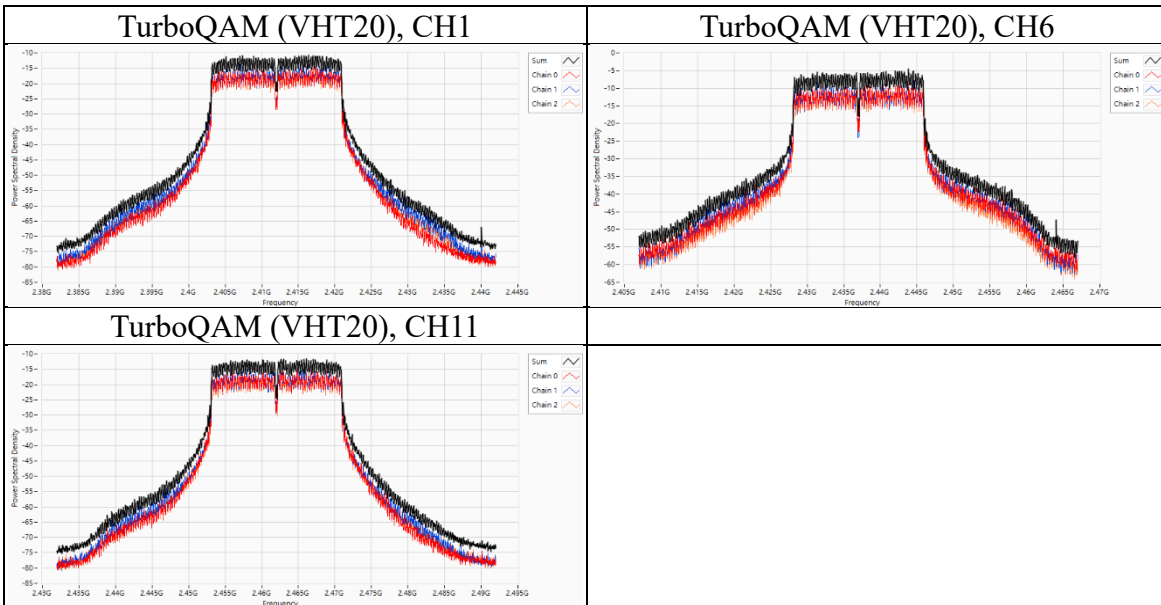
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Mode	CH	Freq (MHz)	Directional Gain (dBi)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Result
TurboQAM (VHT20)	1	2412	7.77	-2.974	6.23	Pass
	6	2437	7.77	3.212	6.23	Pass
	11	2462	7.77	-3.839	6.23	Pass

Mode	CH	Freq (MHz)	PSD per Chain (dBm/MHz)		
			Chain 0	Chain 1	Chain 2
TurboQAM (VHT20)	1	2412	-14.483	-13.618	-14.767
	6	2437	-8.568	-7.715	-9.282
	11	2462	-15.423	-14.96	-15.6



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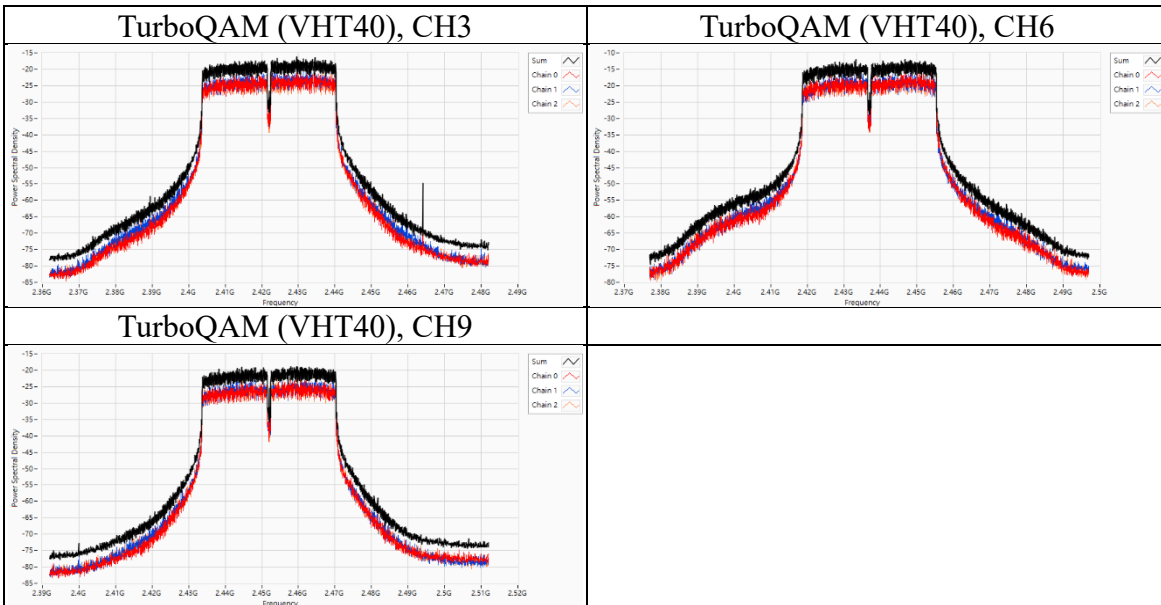
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Mode	CH	Freq (MHz)	Directional Gain (dBi)	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Result
TurboQAM (VHT40)	3	2422	7.77	-8.448	6.23	Pass
	6	2437	7.77	-4.255	6.23	Pass
	9	2452	7.77	-11.01	6.23	Pass

Mode	CH	Freq (MHz)	PSD per Chain (dBm/MHz)		
			Chain 0	Chain 1	Chain 2
TurboQAM (VHT40)	3	2422	-20.83	-20.395	-20.695
	6	2437	-15.715	-14.871	-15.828
	9	2452	-22.683	-22.088	-22.244



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## 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

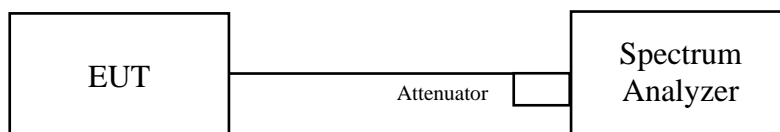
Measurement Procedure REF

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



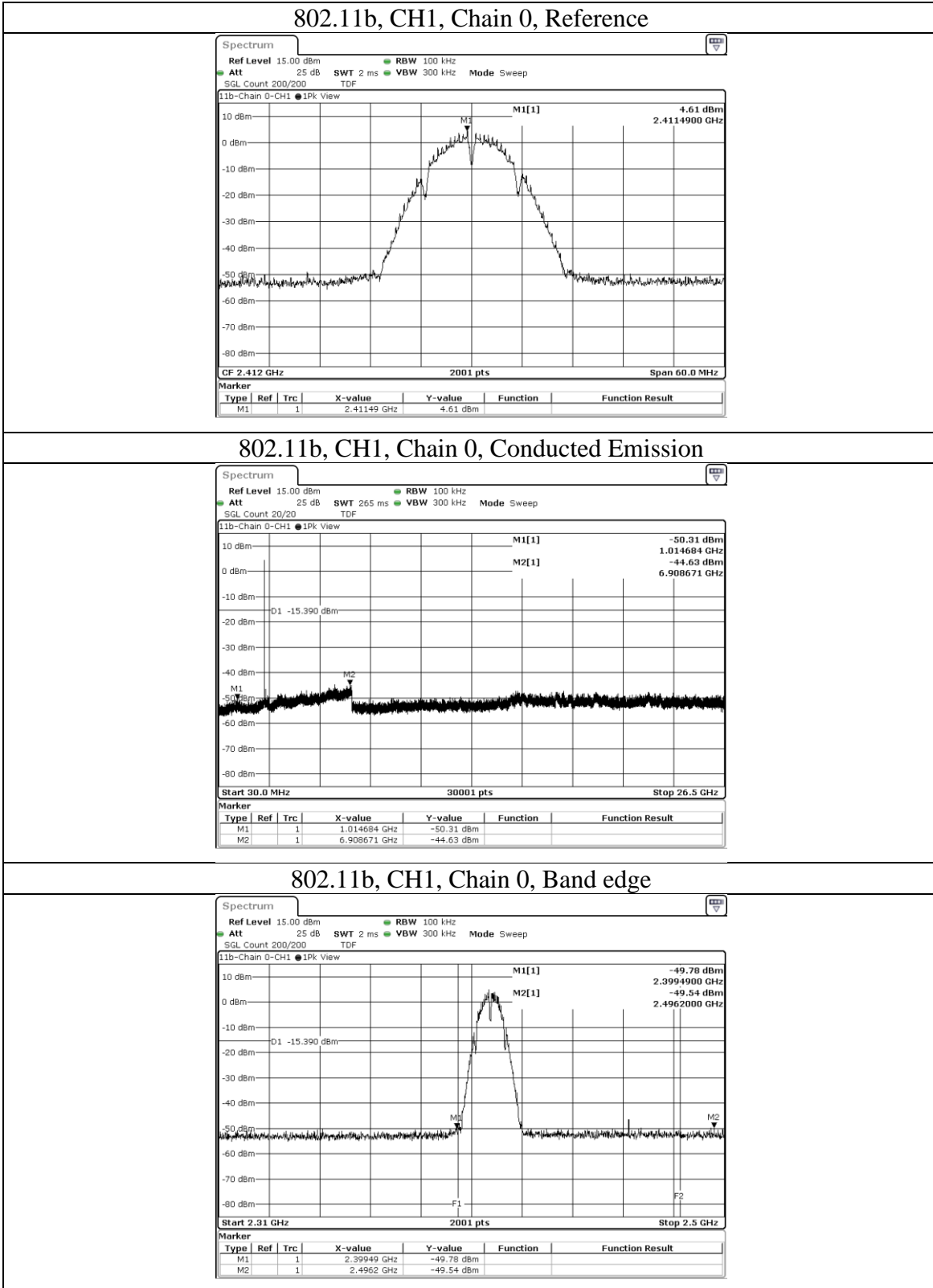
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**Test Data**



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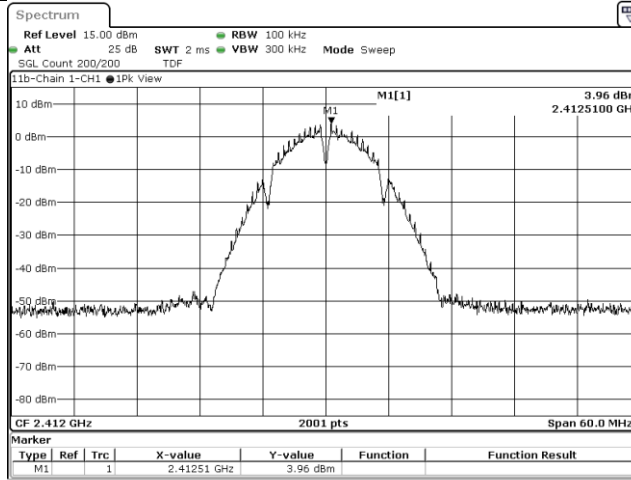
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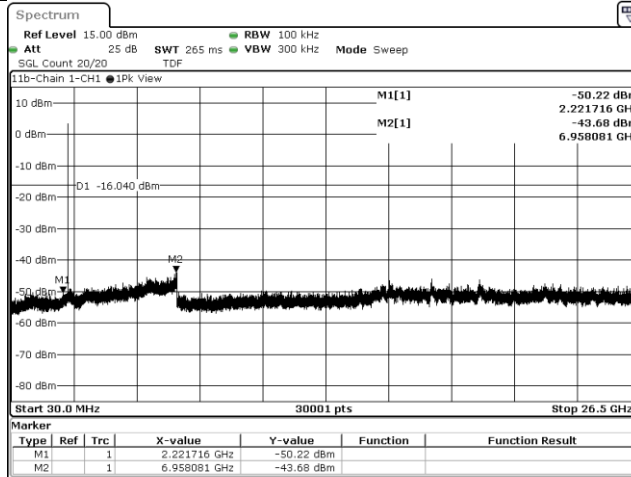
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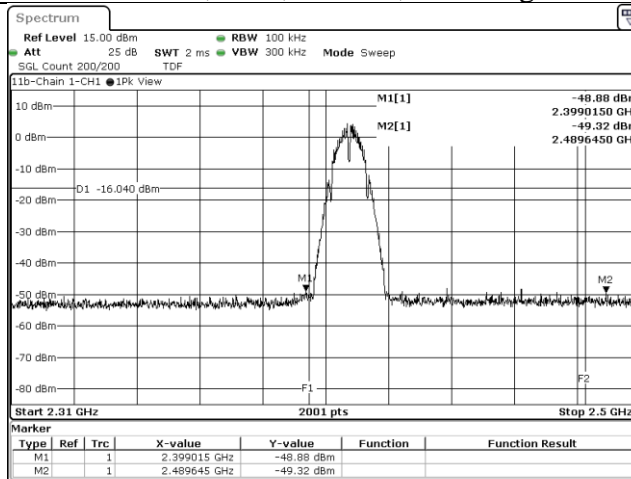
### 802.11b, CH1, Chain 1, Reference



### 802.11b, CH1, Chain 1, Conducted Emission



### 802.11b, CH1, Chain 1, Band edge



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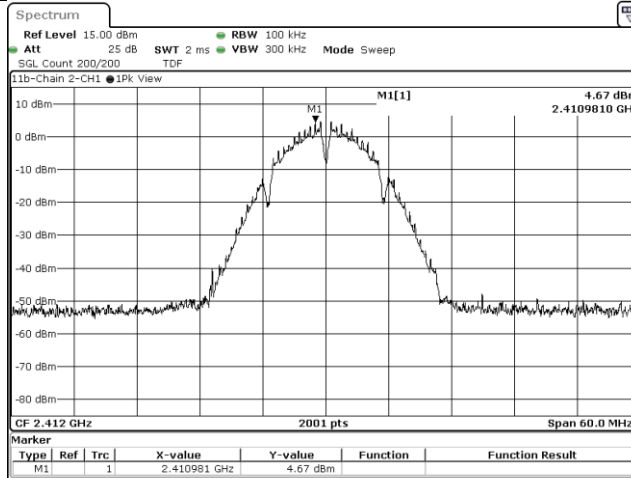
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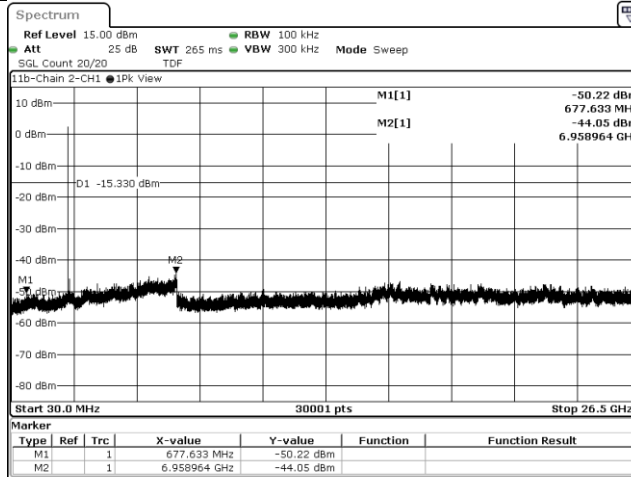
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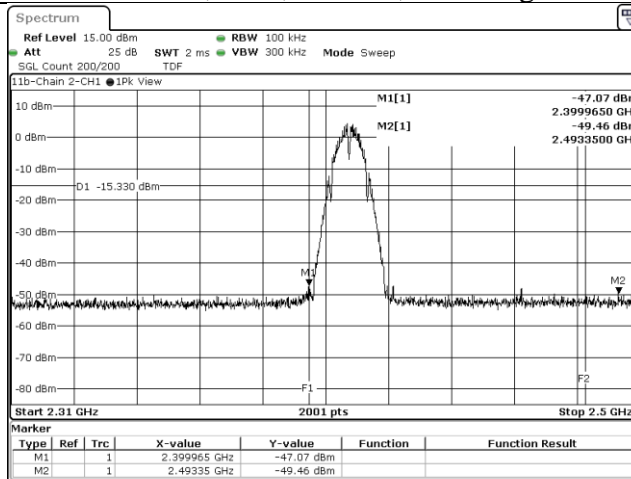
### 802.11b, CH1, Chain 2, Reference



### 802.11b, CH1, Chain 2, Conducted Emission



### 802.11b, CH1, Chain 2, Band edge



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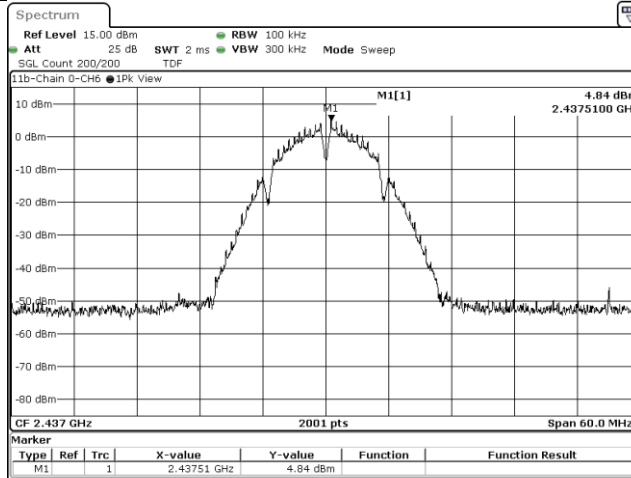
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

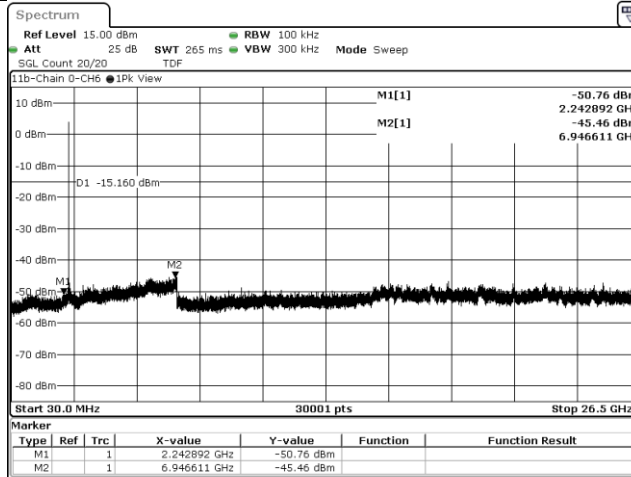
Facsimile (FAX) : +886-3-583-7948



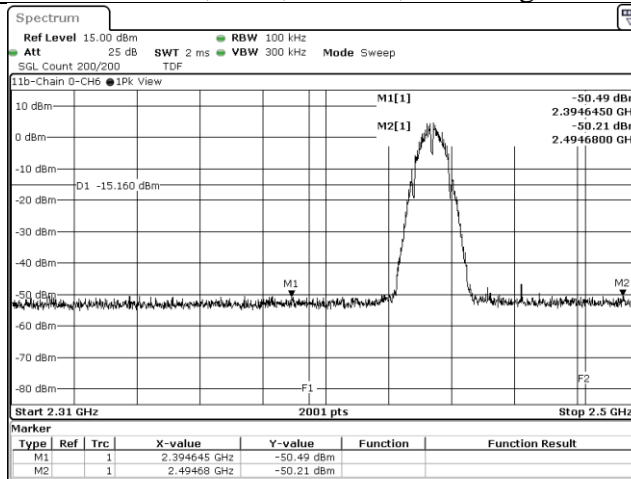
### 802.11b, CH6, Chain 0, Reference



### 802.11b, CH6, Chain 0, Conducted Emission



### 802.11b, CH6, Chain 0, Band edge



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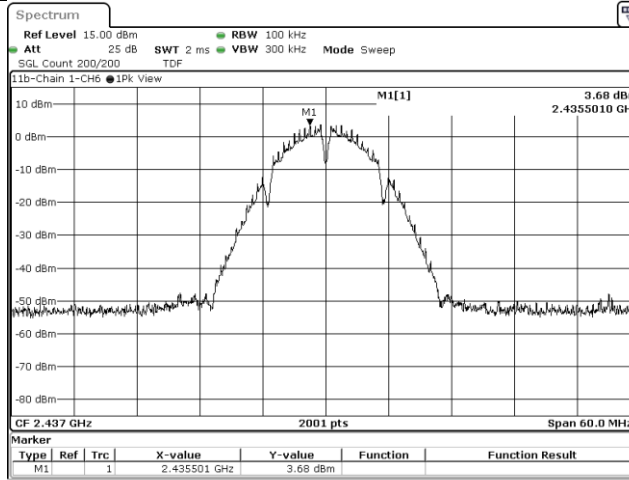
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

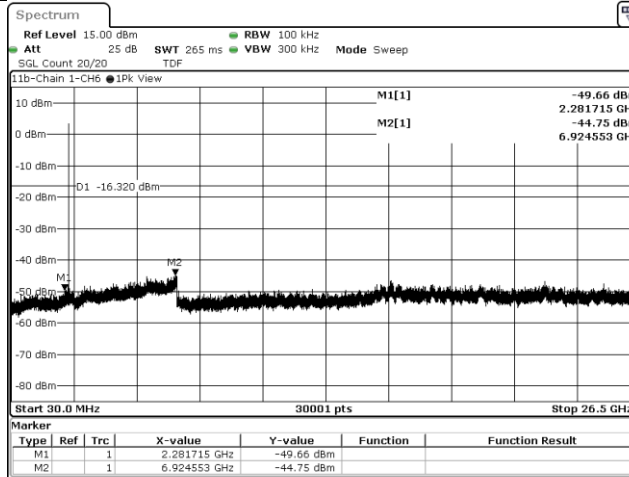
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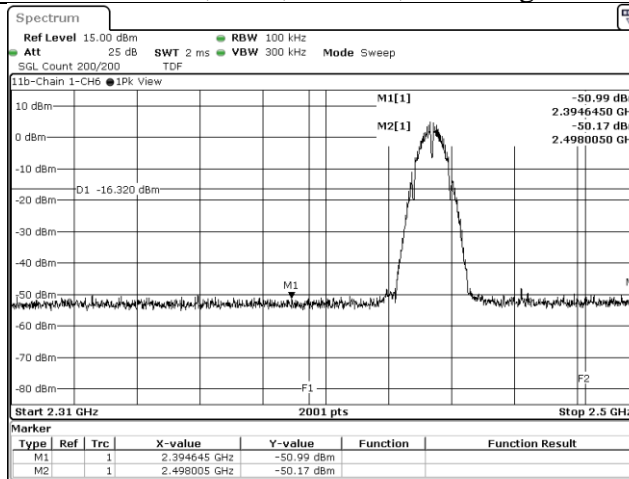
### 802.11b, CH6, Chain 1, Reference



### 802.11b, CH6, Chain 1, Conducted Emission



### 802.11b, CH6, Chain 1, Band edge



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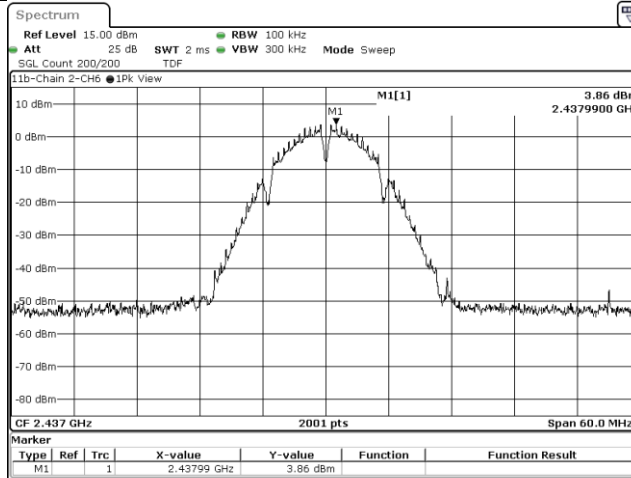
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

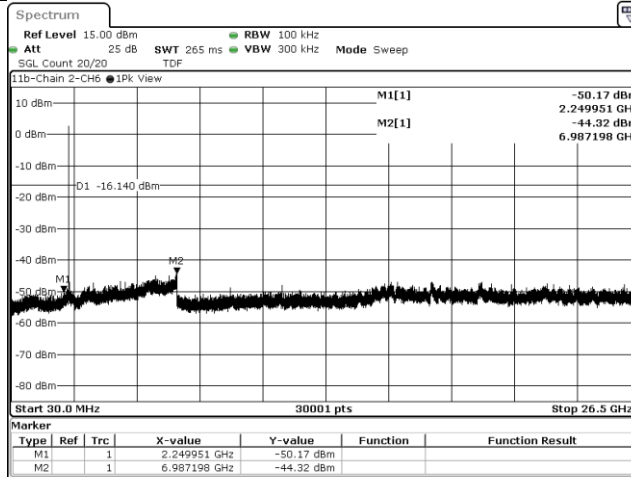
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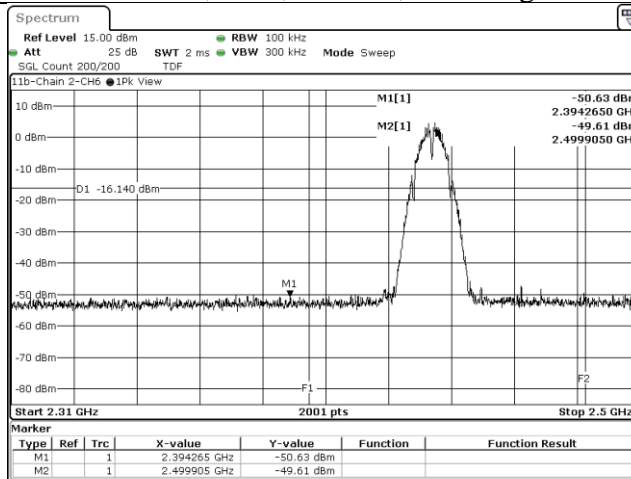
### 802.11b, CH6, Chain 2, Reference



### 802.11b, CH6, Chain 2, Conducted Emission



### 802.11b, CH6, Chain 2, Band edge



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

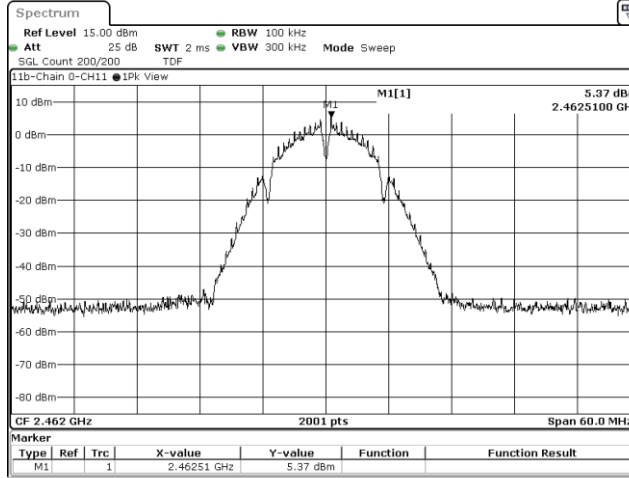
Telephone : +886-2-7737-3000

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

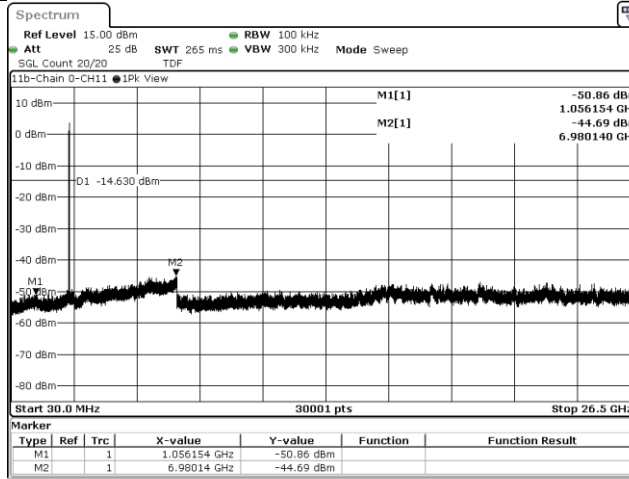




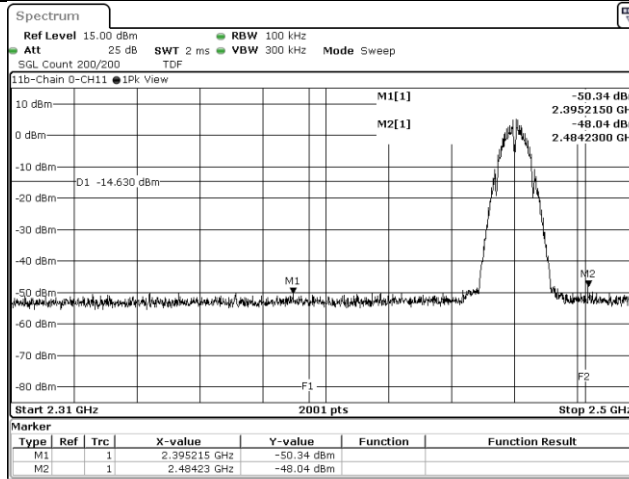
### 802.11b, CH11, Chain 0, Reference



### 802.11b, CH11, Chain 0, Conducted Emission



### 802.11b, CH11, Chain 0, Band edge



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

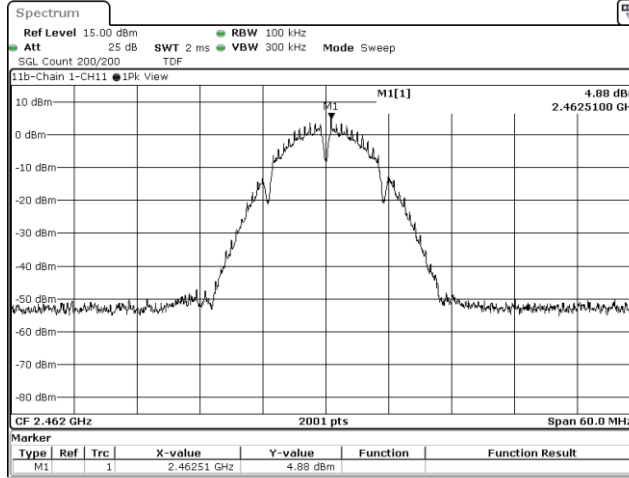
Telephone : +886-2-7737-3000

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

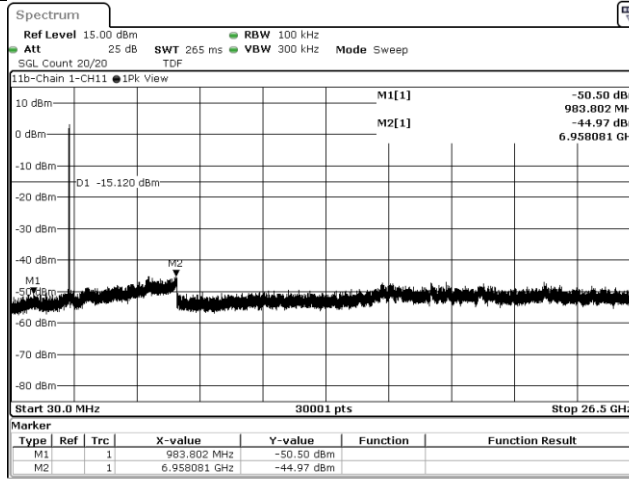
Doc No: 17-EM-F0876 / 6.0



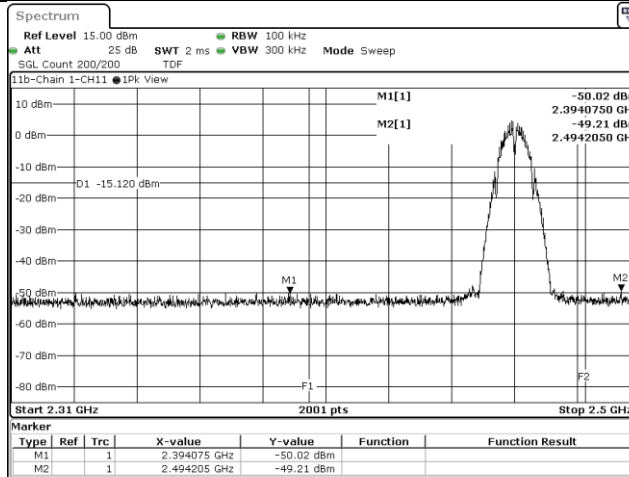
### 802.11b, CH11, Chain 1, Reference



### 802.11b, CH11, Chain 1, Conducted Emission



### 802.11b, CH11, Chain 1, Band edge



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

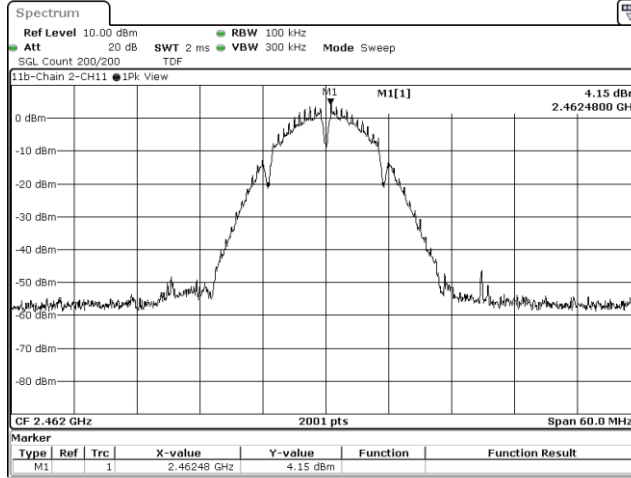
Telephone : +886-2-7737-3000

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

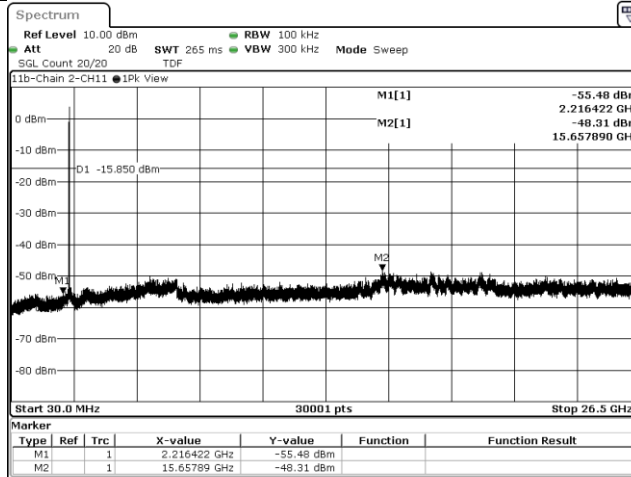
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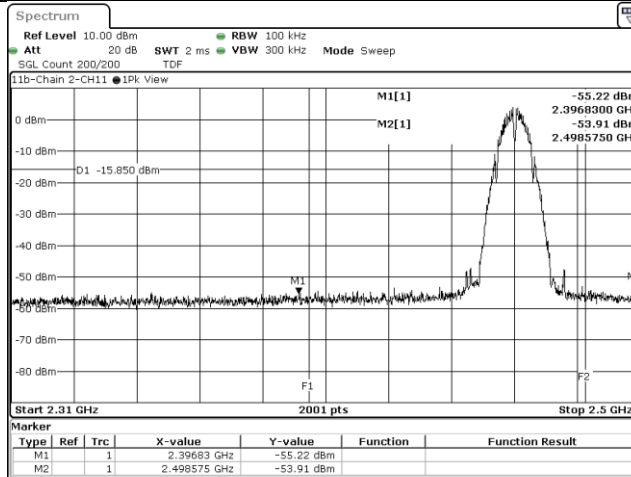
### 802.11b, CH11, Chain 2, Reference



### 802.11b, CH11, Chain 2, Conducted Emission



### 802.11b, CH11, Chain 2, Band edge



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

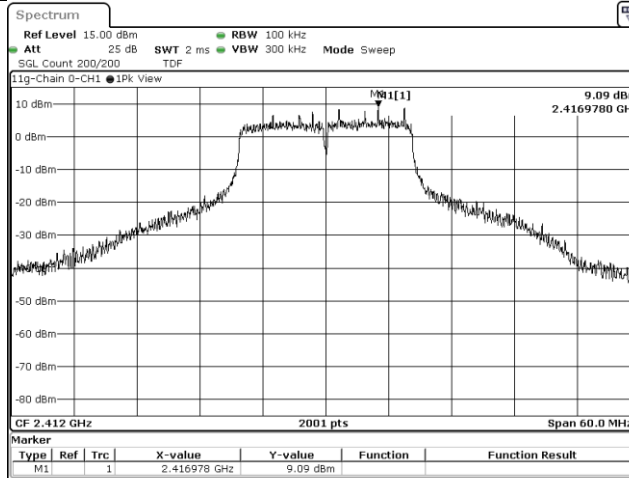
Telephone : +886-2-7737-3000

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

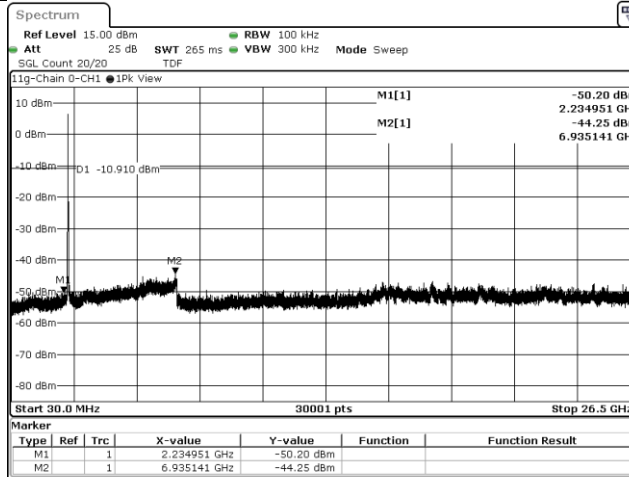
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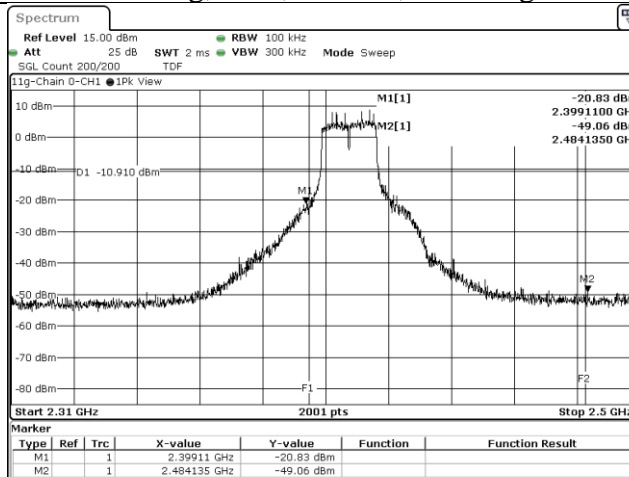
### 802.11g, CH1, Chain 0, Reference



### 802.11g, CH1, Chain 0, Conducted Emission



### 802.11g, CH1, Chain 0, Band edge



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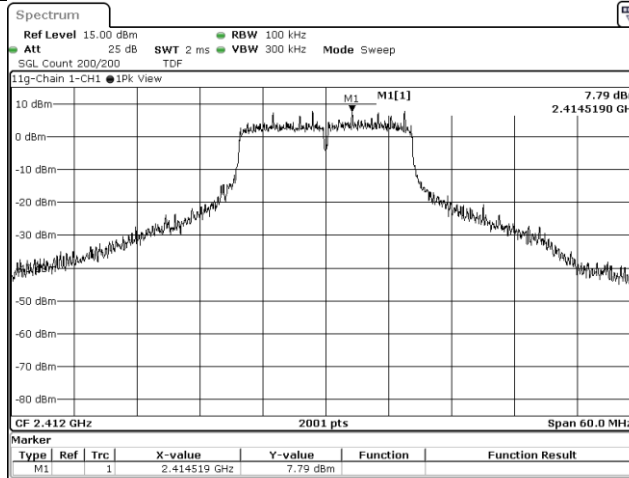
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

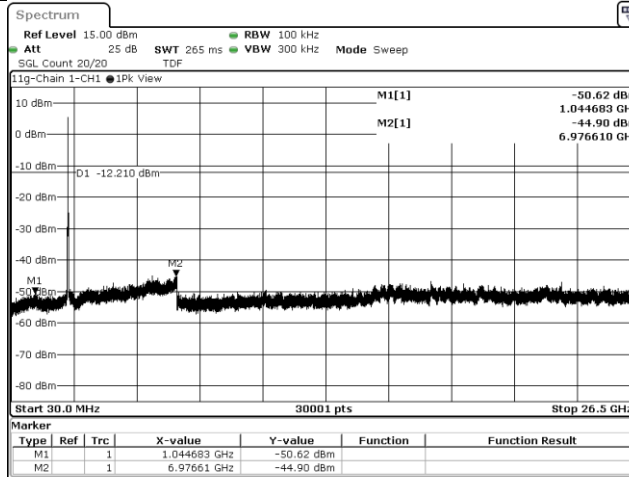
Facsimile (FAX) : +886-3-583-7948



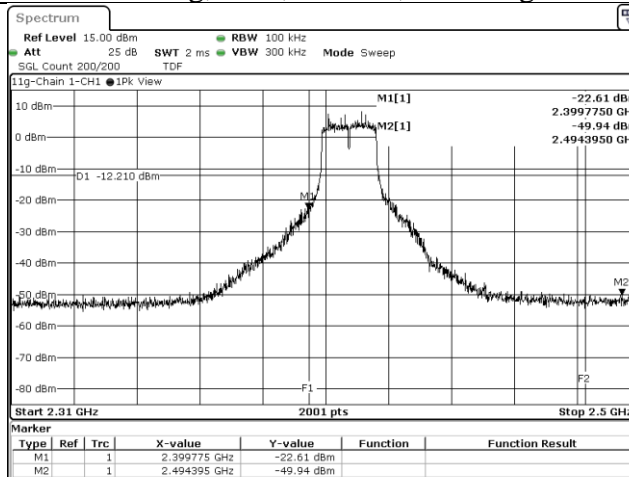
### 802.11g, CH1, Chain 1, Reference



### 802.11g, CH1, Chain 1, Conducted Emission



### 802.11g, CH1, Chain 1, Band edge



## Underwriters Laboratories Taiwan Co., Ltd.

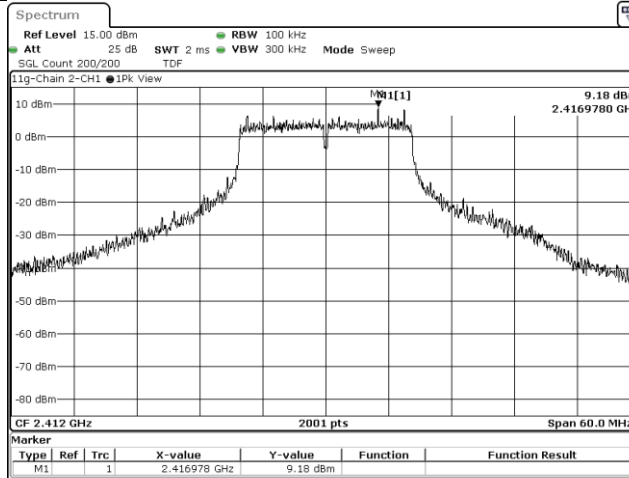
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

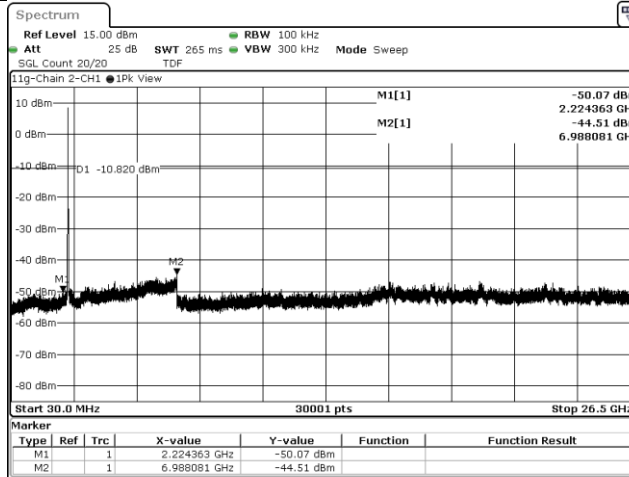
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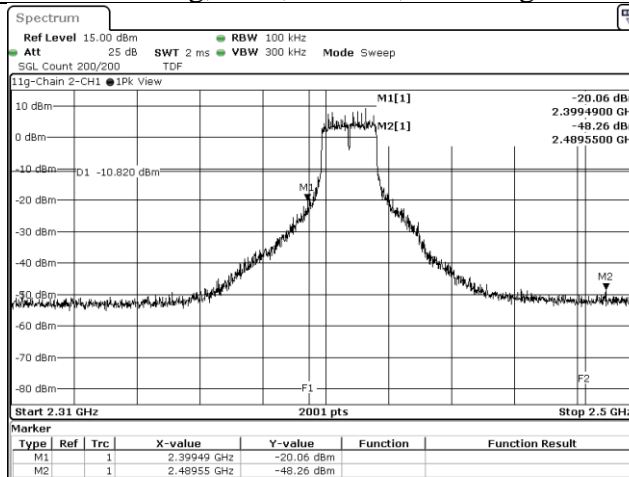
### 802.11g, CH1, Chain 2, Reference



### 802.11g, CH1, Chain 2, Conducted Emission



### 802.11g, CH1, Chain 2, Band edge



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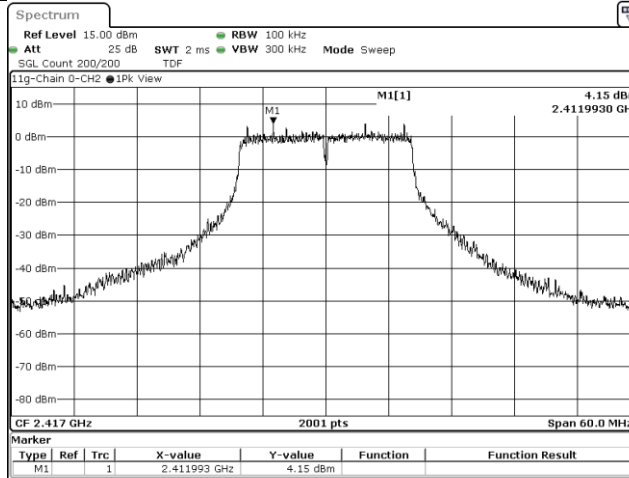
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

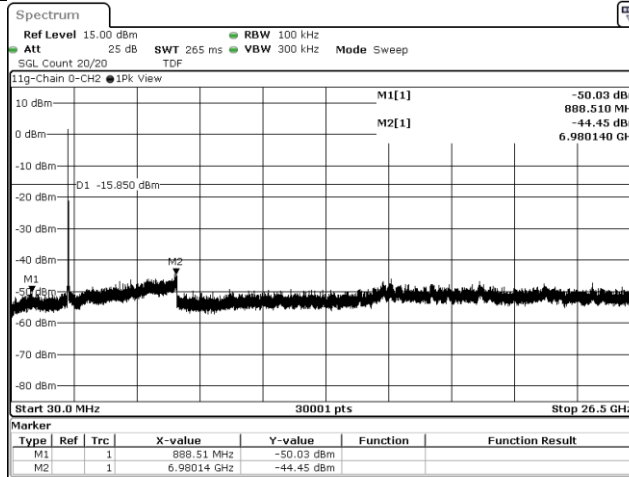
Facsimile (FAX) : +886-3-583-7948



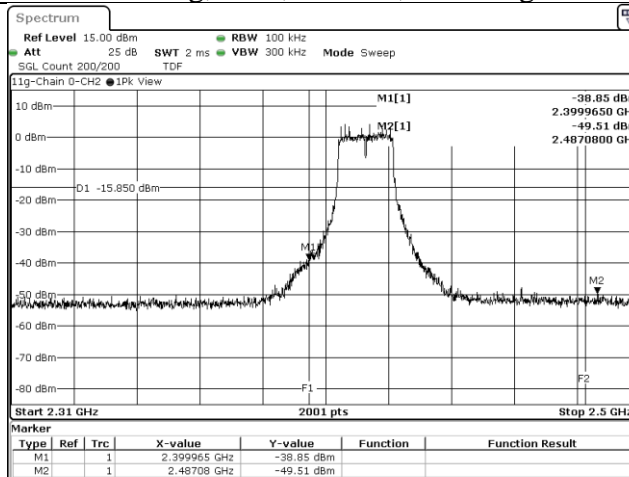
### 802.11g, CH2, Chain 0, Reference



### 802.11g, CH2, Chain 0, Conducted Emission



### 802.11g, CH2, Chain 0, Band edge



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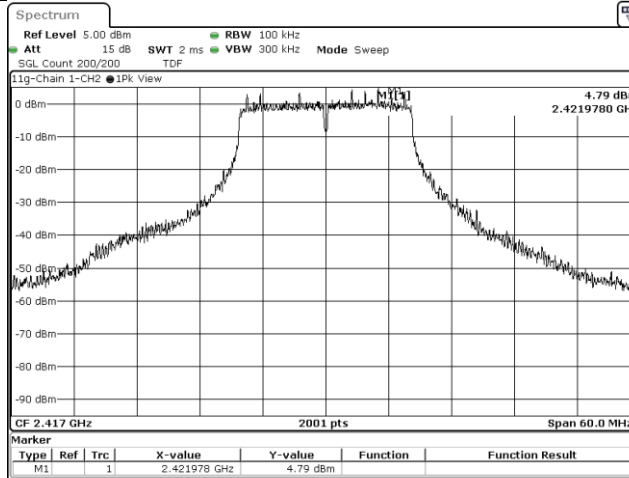
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone : +886-2-7737-3000

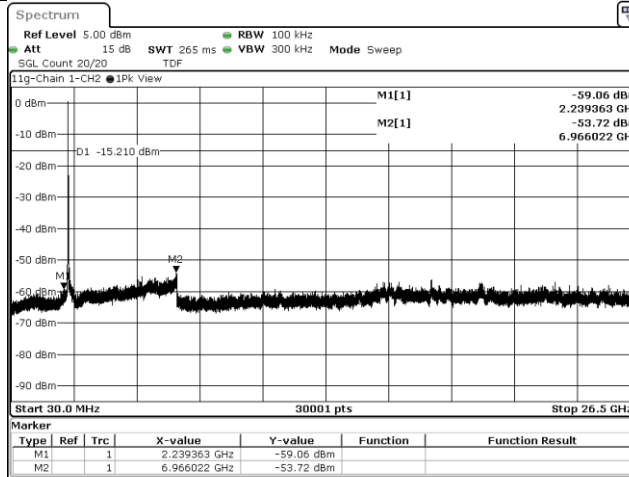
Facsimile (FAX) : +886-3-583-7948



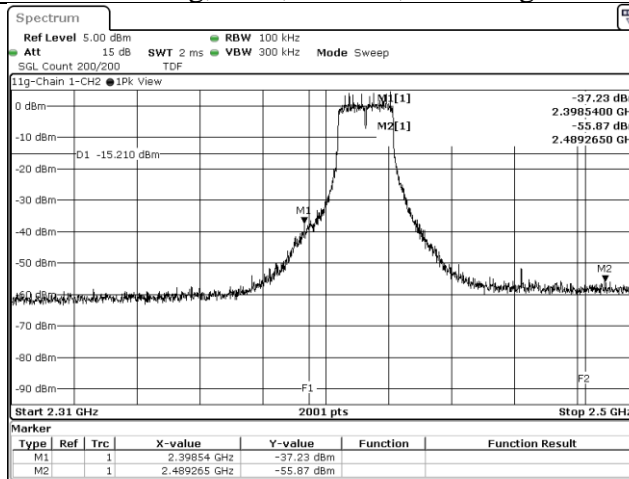
### 802.11g, CH2, Chain 1, Reference



### 802.11g, CH2, Chain 1, Conducted Emission



### 802.11g, CH2, Chain 1, Band edge



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

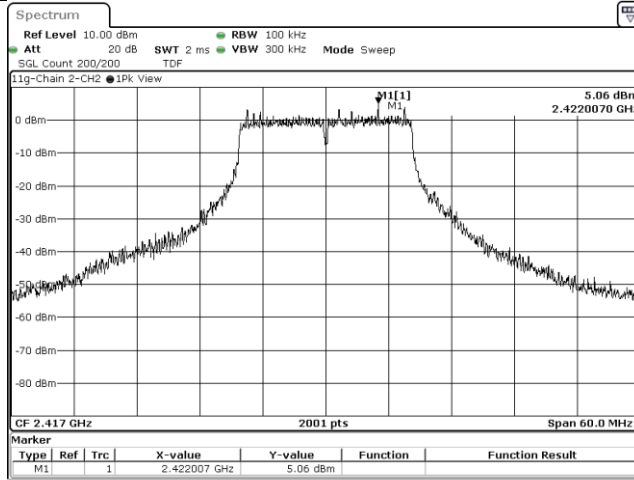
Telephone : +886-2-7737-3000

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

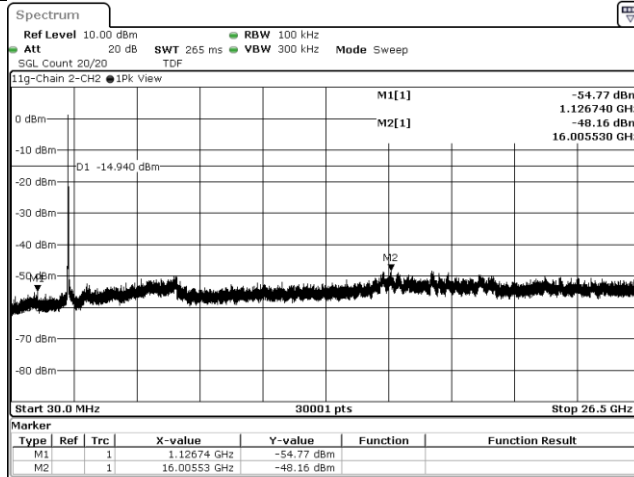




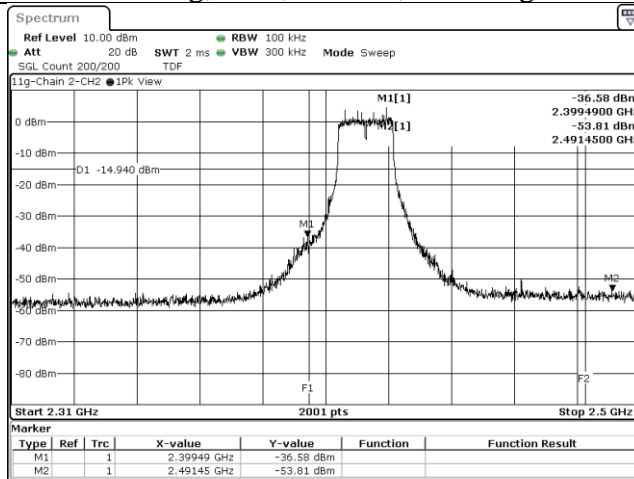
### 802.11g, CH2, Chain 2, Reference



### 802.11g, CH2, Chain 2, Conducted Emission



### 802.11g, CH2, Chain 2, Band edge



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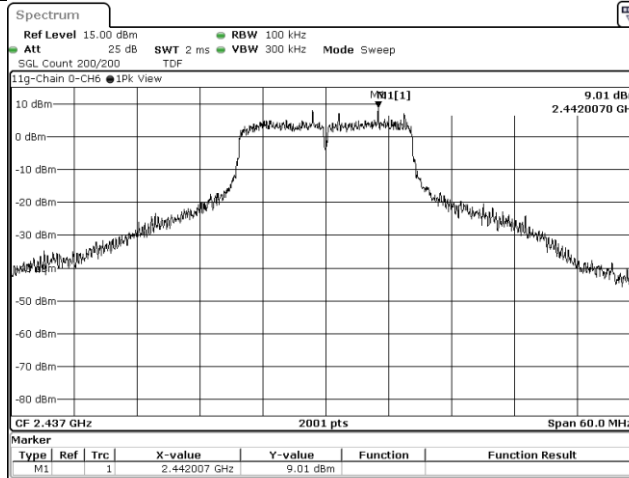
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Telephone :+886-2-7737-3000

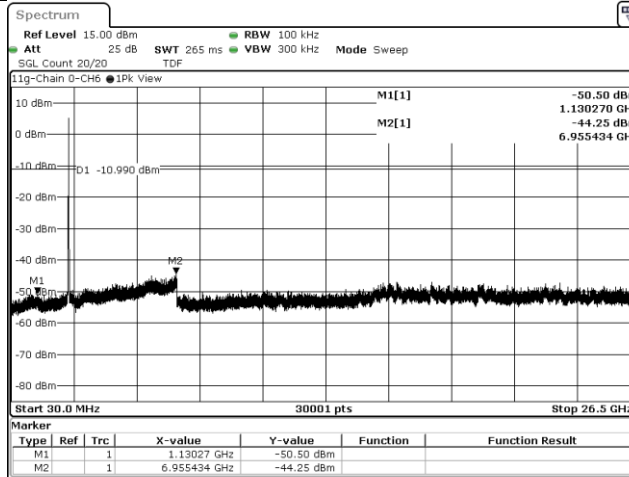
Facsimile (FAX) :+886-3-583-7948



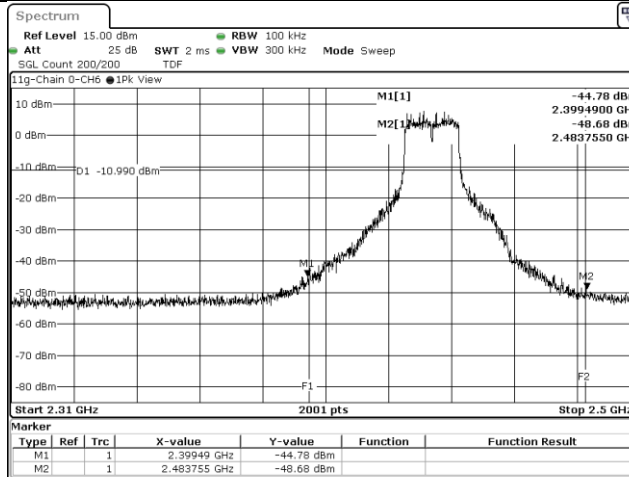
### 802.11g, CH6, Chain 0, Reference



### 802.11g, CH6, Chain 0, Conducted Emission



### 802.11g, CH6, Chain 0, Band edge



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