

TEST REPORT

	Nι	Name : Embedded Wi-Fi Module Imber : EMW3090V2-P, EMW3090V2-E : P53-EMW3090V2
Prepared for Address	:	Shanghai MXCHIP Information Technology Co., Ltd. 9F, Building B, Lane 2145, Jinshajiang Road, Putuo District, Shanghai, China
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Report Number Date(s) of Tests Date of Issue		EDG2304070116E00301R March 07, 2023 to March 28, 2023 April 27, 2023

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1 TEST RESULT CERTIFICATION

Applicant	:	Shanghai MXCHIP Information Technology Co., Ltd.
Address	:	9F, Building B, Lane 2145, Jinshajiang Road, Putuo District, Shanghai, China
Manufacturer	:	Shanghai MXCHIP Information Technology Co., Ltd.
Address	:	9F, Building B, Lane 2145, Jinshajiang Road, Putuo District, Shanghai, China
EUT	:	Embedded Wi-Fi Module
Model Name	:	EMW3090V2-P, EMW3090V2-E
Trademark	:	MXCHIP [®]

Measurement Procedure Used:

APPLICABLE STANDARDS					
STANDARD	TEST RESULT				
FCC 47 CFR Part 2, Subpart J FCC 47 CFR Part 15, Subpart C	PASS				

The above equipment was tested by EMTEK (DONGGUAN) CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.247

The test results of this report relate only to the tested sample identified in this report.

Date of Test :	March 07, 2023 to March 28, 2023				
Prepared by :	Warren Deng				
	Warren deng /Engineer 7 im DoM				
Reviewer :	Tim Dong /Supervisor				
Approved & Authorized Signer :	Sam Lv /Manager				

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EUT TECHNICAL DESCRIPTION 2

Characteristics	Description				
Product	Embedded Wi-Fi Module				
Model Number	EMW3090V2-P, EMW3090V2-E Note: EMW3090V2-P is the PCB antenna, and EMW3090V2-E is the IPEX antenna. These two models belong to the same series of products, the only difference is the antenna type. We chose EMW3090V2-P for testing, and conducted the difference test of radiation spurious between the two models.				
Sample Number	1#				
IEEE 802.11 WLAN Mode Supported	⊠802.11b ⊠802.11g ⊠802.11n(20MHz channel bandwidth)				
Data Rate	802.11 b:1,2,5.5,11Mbps; 802.11 g:6,9,12,18,24,36,48,54Mbps; 802.11 n: MCS0~7,up to 150Mbps;				
Modulation	DSSS with DBPSK/DQPSK/CCK for 802.11b; OFDM with BPSK/ CCK /16QAM/64QAM for 802.11g/n20;				
Operating Frequency Range	⊠2412-2462MHz for 802.11b/g/n(HT20);				
Number of Channels	⊠11 channels for 802.11b/g n(HT20);				
Transmit Power Max	17.00 dBm				
Smart system	SISO for802.11 b/g/n(HT20) □MIMO for802.11n(HT20);				
Antenna Type	EMW3090V2-P: PCB Antenna EMW3090V2-E: IPEX Antenna				
Antenna Gain	EMW3090V2-P: -1.0 dBi EMW3090V2-E: 2.0 dBi				
Power supply	DC 3.3V				
Temperature Range	-20℃~+85℃				
Date of Received	March 07, 2023				

Note: for more details, please refer to the User's manual of the EUT.

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FCC Part Clause	Test Parameter	Verdict	Remark			
15.247(a)(2)	DTS (6dB) Bandwidth	PASS				
15.247(b)(3)	Maximum Peak Conducted Output Power	PASS				
15.247(e)	Maximum Power Spectral Density Level	PASS				
15.247(d)	Unwanted Emission Into Non-Restricted	PASS				
	Frequency Bands					
15.247(d)	Unwanted Emission Into Restricted Frequency	PASS				
15.209	Bands (conducted)					
15.247(d)	Radiated Spurious Emission	PASS				
15.209						
15.207	Conducted Emission Test	PASS				
15.247(b)	Antenna Application PASS					
	NOTE1:N/A (Not Applicable)	•				
	NOTE2: According to FCC OET KDB 558074, the report use radiated					
	measurements in the restricted frequency bands. In addition, the radiated					
	test is also performed to ensure the emissions emanating from the device					
	cabinet also comply with the applicable limits.					

3 SUMMARY OF TEST RESULT

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: P53-EMW3090V2 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

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TEST METHODOLOGY 4

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards: FCC 47 CFR Part 2, Subpart J FCC 47 CFR Part 15, Subpart C FCC KDB 558074 D01 15.247 Meas Guidance v05r02

4.2 MEASUREMENT EQUIPMENT USED

4.2.1 **Conducted Emission Test Equipment**

Equipment Manufacture		Model No.	Serial No.	Last Cal.	Cal. Interval
Test Receiver	Rohde& Schwarz	ESCI	100137	2022/05/19	1Year
L.I.S.N.	Rohde& Schwarz	ENV216	101209	2022/05/19	1Year
RF Switching Unit	CDS	RSU-M2	38401	2022/05/19	1Year

4.2.2 Radiated Emission Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EMI Test Receiver	Rohde & Schwarz	ESCI	101415	2022/05/19	1Year
Power Amplifier	HP	8447F	OPTH64	2022/05/19	1Year
Bilog Antenna	Schwarzbeck	VULB9163	141	2022/05/22	1Year
Horn antenna	Schwarzbeck	BBHA9120D	1272	2022/05/22	1Year
Power Amplifier	LUNAR EM	LNA1G18-40	J1010000081	2022/05/19	1Year
Loop Antenna	Schwarzbeck	FMZB1513	1513-60	2022/05/22	2 Year
Signal Analyzer	R&S	FSV30	103039	2022/05/19	1Year
Bilog Antenna	Schwarzbeck	VULB9163	141	2022/05/22	1Year
Band reject Filter(50dB)	WI/DE	WRCGV-2400(2400- 2485MHz)	2	2022/05/20	1 Year

4.2.3 Radio Frequency Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Wireless Connectivity Tester	R&S	CMW270	102543	2022/06/21	1Year
Automatic Control Unit	Tonscend	JS0806-2	2118060480	2022/06/21	1Year
Signal Analyzer	KEYSIGHT	N9010B	MY60242456	2022/06/21	1Year
Analog Signal Generator	KEYSIGHT	N5173B	MY61252625	2022/06/21	1Year
UP/DOWN-Converter	R&S	CMW-Z800A	100274	2022/06/21	1Year
Vector Signal Generator	KEYSIGHT	N5182B	MY61252674	2022/06/21	1Year
Frequency Extender	KEYSIGHT	N5182BX07	MY59362541	2022/06/21	1Year
Temperature&Humidity test chamber	ESPEC	EL-02KA	12107166	2022/06/21	1 Year

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4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (🛛 802.11b:1 Mbps; 🖾 802.11g: 6 Mbps; 🖾 802.11n(HT20): MCS0; 🗌 802.11n(HT40): MCS0) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

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

Frequency and Channel list for 802.11b/g/n (HT20):

Frequency and Channel list for 802.11n (HT40):

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

Test Frequency and Channel for 802.11b/g/n (HT20):

Lowest Frequency		Middle F	requency	Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	6	2437	11	2462

Test Frequency and Channel for 802.11n (HT40):

Lowest Frequency		Middle F	Frequency	Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	6	2437	9	2452

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4.4 TEST SOFTWARE

Item	Software
Radiated Emission: AmebaD_mptool (Ver. 2.0)	
Conducted Emission	AmebaD_mptool (Ver. 2.0)



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FACILITIES AND ACCREDITATIONS 5

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

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-1&2F., Building 2, Zone A, Zhongda Marine Biotechnology Research and Development Base, No. 9, Xincheng Avenue, Songshanhu High-technology Industrial Development Zone, Dongguan, Guangdong, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 32.

5.2 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description	
EMC Lab.	: Accredited by CNAS, 2020.08.27 The certificate is valid until 2024.07.05 The Laboratory has been assessed and proved to be in compliance with CNAS/CL01:2018 The Certificate Registration Number is L3150
	Designation by FCC Designation Number: CN1300 Test Firm Registration Number: 945551
	Accredited by A2LA, April 05, 2021 The Certificate Registration Number is 4321.02
	Designation by Industry Canada The Certificate Registration Number is CN0113
Name of Firm Site Location	 EMTEK (Dongguan) Co., Ltd. -1&2/F.,Buiding 2,Zone A,Zhongda Marine Biotechnology Research and Development Base,N.9,Xincheng Avenue,Songshanhu High-technology Industrial Development Zone, Dongguan, Guangdong, China

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6 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	± 1x10^-5
Maximum Peak Output Power Test	± 1.0 dB
Conducted Emissions Test	± 2.0 dB
Radiated Emission Test	± 2.0 dB
Power Density	± 2.0 dB
Occupied Bandwidth Test	± 1.0 dB
Band Edge Test	± 3 dB
All emission, radiated	± 3 dB
Antenna Port Emission	± 3 dB
Temperature	± 0.5 °C
Humidity	± 3 %

Measurement Uncertainty for a level of Confidence of 95%

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7 SETUP OF EQUIPMENT UNDER TEST

7.1 RADIO FREQUENCY TEST SETUP 1

The WLAN component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



7.2 RADIO FREQUENCY TEST SETUP 2

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.

Below 30MHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT androtated about its vertical axis formaximum response at each azimuth about the EUT. The center of the loopshall be 1 m above the ground. For certain applications, the loop antennaplane may also need to be positioned horizontally at the specified distance from the EUT.

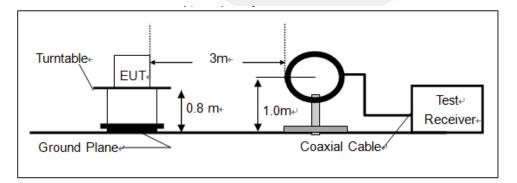
30MHz-1GHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

Above 1GHz:

The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

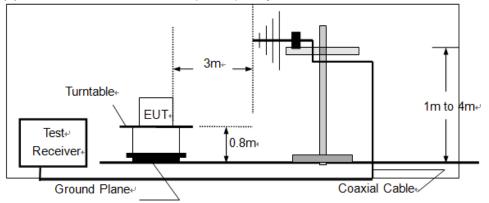
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



K (Dongguan) Co., Ltd.

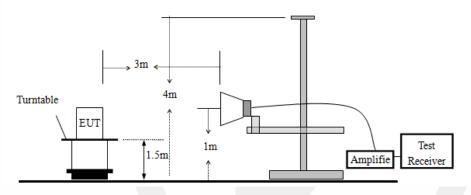
东莞市信测科技有限公司 地址:广东省东莞市松山湖高新技术产业开发区新城大道9号中大海洋生物科技研发基地A区2号办公楼负一层. 第二层 网址:Http://www.emtek.com.cn 邮箱:E-mail: project@emtek.com.cn Add: -1&2/F ...Building 2,Zone A,Zhongda Marine Biotechnology Research and Development Base ,No.9, Xincheng Avenue,Songshanhu High-technology Industrial Development Zone, Dongguan, Guangdong, China Http://www.emtek.com.cn E-mail: project@emtek.com.cn





(b)Radiated Emission Test Set-Up, Frequency Below 1000MHz

(c) Radiated Emission Test Set-Up, Frequency above 1000MHz

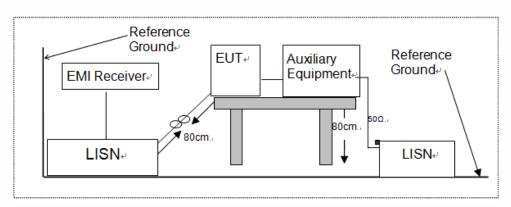


7.3 CONDUCTED EMISSION TEST SETUP

The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.1 m.

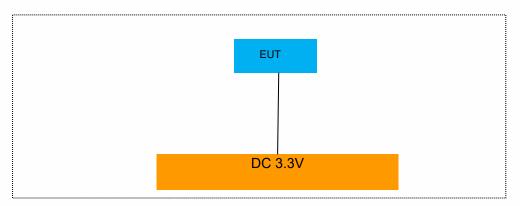
According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



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7.4 BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM



7.5 SUPPORT EQUIPMENT

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
1	/	1	/

	Auxiliary Cable List and Details						
Cable Description		Length (m) Shielded/Unshielded		With / Without Ferrite			
	1	1	1	1			

Auxiliary Equipment List and Details						
Description	Manufacturer	Model	Serial Number			
1	1	1	/			

Notes:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
- 3. Unless otherwise denoted as EUT in *[Remark]* column , device(s) used in tested system is a support equipment

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8 **TEST REQUIREMENTS**

8.1 DTS (6DB) BANDWIDTH

8.1.1 Applicable Standard

According to FCC Part15.247 (a)(2) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.1.2 **Conformance Limit**

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

8.1.3 **Test Configuration**

Test according to clause 7.1 radio frequency test setup 1

8.1.4 **Test Procedure**

The EUT was operating in IEEE 802.11b/g/n mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously

Set RBW = 100 kHz.

Set the video bandwidth (VBW) =300kHz.

Set Span=2 times OBW

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Measure and record the results in the test report.

8.1.5 **Test Results**

Temperature:	18 ℃
Relative Humidity:	58%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (MHz)	Limit (kHz)	Verdict
	1	2412	10.090	>500	PASS
802.11b	6	2437	10.080	>500	PASS
	11	2462	10.070	>500	PASS
	1	2412	16.360	>500	PASS
802.11g	6	2437	16.350	>500	PASS
	11	2462	16.350	>500	PASS
900 11 m	1	2412	17.320	>500	PASS
802.11n (HT20)	6	2437	17.300	>500	PASS
	11	2462	17.350	>500	PASS

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		DTS (6	dB) Bandwidth	
Fest Model			302.11g el 6: 2437MHz	
Spectrum Analyzer 1	+	Channe	51 0. 243710112	Frequency v
KEYSIGHT Input: RF	Input Z: 50 Ω Atten: 30 dB		Center Freq: 2.437000000 GHz	
Align: Auto	Corr CCorr µW Path: Stan Freq Ref: Int (S)		Avg Hold:>10/10 Radio Std: None	2.437000000 GHz
Dar 1 Graph v	Ref LvI Offset *	11 00 dB		Span 30.000 MHz
Scale/Div 10.0 dB	Ref Value 20.00			CF Step
10.0 0.00 -10.0 -20.0	and and the strengt of the second sec	for and the second s	hunsen hanne	3.000000 MHz Auto
-30.0 -40.0 -50.0 -60.0				Freq Offset 0 Hz
-70.0 Center 2.43700 GHz #Res BW 100.00 kHz	#Video BW 300	0.00 kHz	Span 30 M Sweep 2.93 ms (1001 j	
2 Metrics				
Occupied Bandwidth		Measure Trace	Trace 1	
16.48	88 MHz	Total Power	19.8 dBm	
Transmit Freq Error x dB Bandwidth	-24.595 kHz 16.35 MHz	% of OBW Power x dB	99.00 % -6.00 dB	
	Apr 10, 2023 9:06:19 AM			
		DTS (6	6dB) Bandwidth	
Test Model		Chann	802.11g el 11: 2462MHz	
Spectrum Analyzer 1	+	Channe		
Occupied BW	Input Z: 50 Ω Atten: 30 dB	Trig: Free Run 0	Center Freq: 2.462000000 GHz	Frequency V
Coupling: DC Align: Auto		idard Gate: Off	Avg Hold:>10/10 Radio Std: None	Center Frequency 2.46200000 GHz Span
1 Graph ▼ Scale/Div 10.0 dB	Ref LvI Offset [/] Ref Value 20.00			30.000 MHz
				CF Step 3.000000 MHz
0.00	mmahantonantonantonantonantonanto	mohennannon	menting	Auto Man
-20.0				Freq Offset
-40.0 -50.0 -60.0				
-70.0 Center 2.46200 GHz #Res BW 100.00 kHz	#Video BW 300	0.00 kHz	Span 30 M Sweep 2.93 ms (1001)	
2 Metrics				
Occupied Bandwidth		Measure Trace	Trace 1	
	94 MHz	Total Power	19.2 dBm	
Transmit Freq Error x dB Bandwidth	-28.832 kHz 16.35 MHz	% of OBW Power x dB	99.00 % -6.00 dB	
	Apr 10, 2023 9:06:42 AM			

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est Model		802.	dB) Bandwidth 11n (HT20) el 1: 2412MHz	
Spectrum Analyzer 1	F			Frequency v
KEYSIGHT Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Atten: 30 dB Corr CCorr μW Path: Sta Freq Ref: Int (S)	ndard Gate: Off A	Senter Freq: 2.412000000 GHz vg[Hold:>1010 tadio Std: None	Center Frequency 2.412000000 GHz Span
1 Graph v	Ref LvI Offset			30.000 MHz
Scale/Div 10.0 dB Log 10.0 0.00 -00 -20.0 -30.0 -30.0 -50.0 -50.0	Ref Value 20.0		northered the second	CF Step 3.000000 MHz Auto Man Freq Offset 0 Hz
-00.0 -70.0 Center 2.41200 GHz #Res BW 100.00 kHz	#Video BW 30	0.00 kHz	Span 30 Mi Sweep 2.93 ms (1001 pt	
2 Metrics Occupied Bandwidth 17.62 ⁻ Transmit Freq Error	1 MHz -13.287 kHz	Measure Trace Total Power % of OBW Power	Trace 1 19.7 dBm 99.00 %	
	17.32 MHz Apr 10, 2023 9:07:11 AM	x dB	-6.00 dB	
est Model		802	dB) Bandwidth .11n (HT20) el 6: 2437MHz	
Spectrum Analyzer 1	F	Ondini		Frequency 🔹
KEYSIGHT Coupling: DC Align: Auto	Input Z: 50 Ω Atten: 30 dB	ndard Gate: Off A	center Freq: 2.437000000 GHz vg Hold:>10/10 tadio Std: None	Center Frequency 2.437000000 GHz
1 Graph v Scale/Div 10.0 dB	Ref Lvi Offset Ref Value 20.0			Span 30.000 MHz CF Step
10.0 -10.0 -20.0 -30.0 -40.0 -20.0 -30.0 -30.0 -40.0 	and mention and and and and and and and and and an	pmahanhannahanah	northern the second sec	3.000000 MHz → Auto Man Freq Offset → 0 Hz
-50.0 -60.0 -70.0				
Center 2.43700 GHz #Res BW 100.00 kHz	#Video BW 30	0.00 kHz	Span 30 Mi Sweep 2.93 ms (1001 pt	
2 Metrics v		Measure Trace	Trace 1	
Occupied Bandwidth 17.610) MHz	Total Power	20.1 dBm	
Transmit Freq Error x dB Bandwidth	-21.978 kHz 17.30 MHz	% of OBW Power x dB	99.00 % -6.00 dB	
	Apr 10, 2023 9:07:45 AM			

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est Model			dB) Bandwidth .11n (HT20)		
—			el 11: 2462MHz		
Spectrum Analyzer 1 Occupied BW				Frequenc	y v 🔆
Coupling: DC Align: Auto	nput Z: 50 Ω Atten: 30 dB corr CCorr μW Path: Stan req Ref: Int (S)	dard Gate: Off	Center Freq: 2.462000000 GHz Avg Hold.>10/10 Radio Std: None	Center Frequency 2.462000000 GHz	Settings
1 Graph T	Ref LvI Offset 1			Span 30.000 MHz	
Scale/Div 10.0 dB	Ref Value 20.00) dBm		CF Step 3.000000 MHz	
0.00 -10.0 -20.0	muntimenter and many	nen han Amerikanan Amerikanan di kana d	Annon hu	Auto Man	
-20.0 -30.0 -40.0				Freq Offset 0 Hz	
-50.0					
-70.0 Center 2.46200 GHz #Res BW 100.00 kHz	#Video BW 300	0.00 kHz	Span 30 M Sweep 2.93 ms (1001)		
2 Metrics			Sweep 2.95 ms (1001)		
Occupied Bandwidth		Measure Trace	Trace 1		
17.616 M	Hz	Total Power	19.4 dBm		
Transmit Freq Error x dB Bandwidth	-23.052 kHz 17.35 MHz	% of OBW Power x dB	99.00 % -6.00 dB		
	Apr 10, 2023 9:08:08 AM				



8.2 MAXIMUM CONDUCTED (AVERAGE) OUTPUT POWER

8.2.1 Applicable Standard

According to FCC Part15.247 (b)(3) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.2.2 **Conformance Limit**

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 2400 - 2483.5 MHz bands shall not exceed: 1 Watt (30dBm).

8.2.3 **Test Configuration**

Test according to clause 7.1 radio frequency test setup 1

8.2.4 **Test Procedure**

a) Set span to at least 1.5 times the OBW.

b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.

c) Set VBW \geq 3 x RBW.

d) Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$. (This gives bin-to-bin spacing $\leq \text{RBW}/2$, so that narrowband signals are not lost between frequency bins.)

e) Sweep time = auto.

8.2.5

f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

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

h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.

i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Temperature:	18 ℃
Relative Humidity:	58%
ATM Pressure:	1011 mbar

Test Results

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm)	Limit (dBm)	Verdict
	1	2412	16.11	30	PASS
802.11b	6	2437	17.00	30	PASS
	11	2462	16.54	30	PASS
	1	2412	12.29	30	PASS
802.11g	6	2437	13.03	30	PASS
	11	2462	12.60	30	PASS
900 11 m	1	2412	12.93	30	PASS
802.11n	6	2437	13.15	30	PASS
(HT20)	11	2462	12.39	30	PASS

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Test Model		Duty cycle 802.11b Channel 1: 2412MHz					
Spectrum Analyzer 1 Swept SA	• +				Frequency 🔻 🔆		
KEYSIGHT Input: RF Coupling: C Align: Auto	C Input Ζ: 50 Ω Corr CCorr Freq Ref: Int (S)	#Atten: 30 dB PNO: Fast µW Path: Standard Gate: Off IF Gain: Low Sig Track: Off	Avg Type: Log-Power Trig: Free Run	123456 WWWWWW NNNNN	Center Frequency 2.412000000 GHz		
Spectrum v Scale/Div 10 dB		Ref Lvi Offset 11.00 dB Ref Level 30.00 dBm			Span 0.00000000 Hz Swept Span Zero Span		
20.0					Full Span		
10.0					Start Freq 2.412000000 GHz		
10.0					Stop Freq 2.412000000 GHz		
20.0					AUTO TUNE		
40.0					CF Step 1.000000 MHz		
50.0					Auto Man		
60.0					Freq Offset 0 Hz		
enter 2.412000000 GHz es BW 1.0 MHz		#Video BW 3.0 MHz	Sweep 8.33	Span 0 Hz ms (1001 pts)	X Axis Scale Log Lin		
100	Apr 10, 2023 9:18:34 AM	\Box			Signal Track (Span Zoom)		

Duty cycle 802.11g annel 1: 2412MHz

Spectrum Swept SA		zer 1	+						y v 🗦
		Input: RF Coupling: DC Align: Auto	Input Ζ: 50 Ω Corr CCorr Freq Ref: Int (S)	#Atten: 30 dB µW Path: Standard	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	Avg Type: Log-Power Trig: Free Run	123456 WWWWWW NNNNN	Center Frequency 2.412000000 GHz Span	Settings
1 Spectru	m	٧		Ref LvI Offset 11.0) dB			0.00000000 Hz	
cale/Div	v 10 d	В		Ref Level 30.00 dB				Swept Span	
_og								Zero Span	
20.0								Full Span	
10.0								Start Freq	
								2.412000000 GHz	
0.00								Stop Freg	
								2.412000000 GHz	
20.0								AUTO TUNE	
30.0								CF Step 1.000000 MHz	
40.0								Auto	
50.0								Man	
30.0								Freq Offset	
60.0								0 Hz	
								X Axis Scale	
enter 2. es BW		10000 GHz Hz		#Video BW 3.0 M	HZ	Sweep 8.33	Span 0 Hz ms (1001 pts)	Log Lin	
			Apr 10, 2023						
		الالك	9:18:46 AM	\mathbb{D}				Signal Track (Span Zoom)	

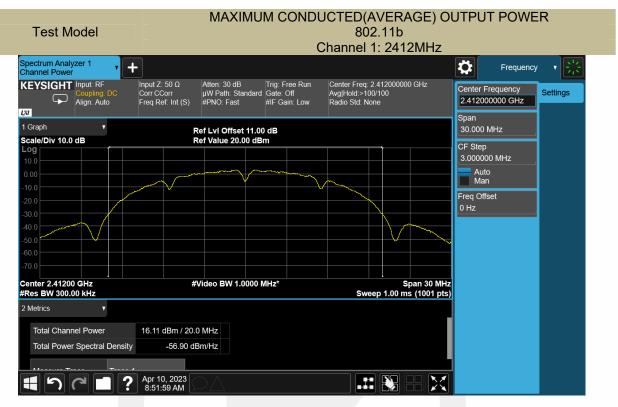
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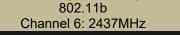


Test Model			Duty cycle 802.11n(HT20) Channel 1: 2412MHz					
Spectrum Analyzer Swept SA	1 -	F					Frequenc	y v 👫
	ut: RF upling: DC gn: Auto	Input Ζ: 50 Ω Corr CCorr Freq Ref: Int (S)	#Atten: 30 dB µW Path: Standard	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	Avg Type: Log-P Trig: Free Run	ower 123456 WWWWWW NNNNN	Center Frequency 2.412000000 GHz	Settings
Spectrum cale/Div 10 dB	T		ef LvI Offset 11.0 ef Level 30.00 dB				Span 0.00000000 Hz Swept Span Zero Span	
20.0							Full Span	
0.00							Start Freq 2.412000000 GHz	
10.0							Stop Freq 2.412000000 GHz	
20.0							AUTO TUNE	
40.0							CF Step 1.000000 MHz	
50.0							Auto Man	
60.0							Freq Offset 0 Hz	
Center 2.4120000 Res BW 1.0 MHz	00 GHz		#Video BW 3.0 M	Hz	Sweep	Span 0 Hz 8.33 ms (1001 pts)	X Axis Scale Log Lin	
100	?	Apr 10, 2023 9:19:24 AM					Signal Track (Span Zoom)	1





MAXIMUM CONDUCTED(AVERAGE) OUTPUT POWER

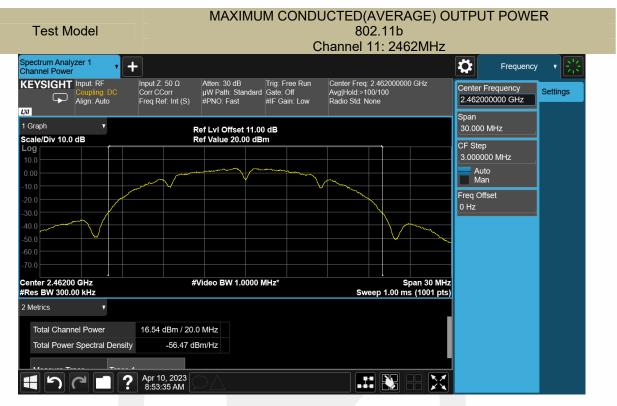




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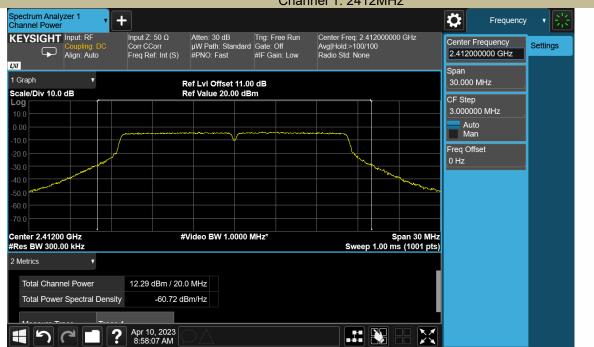
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MAXIMUM CONDUCTED(AVERAGE) OUTPUT POWER 802.11q

Channel 1: 2412MHz



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Test Model	MAXIMU	IM CONDU	JCTED(AVERA 802.11g	GE) OUTPUT POWER			
1 CSt Model		C	Channel 6: 2437MHz				
Spectrum Analyzer 1 Channel Power				Frequency 🔻 🔆			
Coupling: DC Align: Auto	Input Z: 50 Ω Atten: 30 dB Corr CCorr μW Path: Standard Freq Ref: Int (S) #PNO: Fast	Trig: Free Run Gate: Off #IF Gain: Low	Center Freq: 2.437000000 (Avg Hold:>100/100 Radio Std: None	GHz Center Frequency 2:437000000 GHz Settings			
1 Graph v Scale/Div 10.0 dB	Ref LvI Offset 11.0 Ref Value 20.00 dE			30.000 MHz			
Log 10.0 0.00				CF Step 3.000000 MHz			
-10.0				Man Freq Offset 0 Hz			
-30.0							
-50.0 -60.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -70.0 -							
Center 2.43700 GHz #Res BW 300.00 kHz	#Video BW 1.0000	MHz*	Spa Sweep 1.00 ms	an 30 MHz (1001 pts)			
2 Metrics							
Total Channel Power	13.03 dBm / 20.0 MHz						
Total Power Spectral Density	-59.98 dBm/Hz						
∎ n c ∎ ?	Apr 10, 2023 8:58:35 AM						

MAXIMUM CONDUCTED(AVERAGE) OUTPUT POWER



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Test Model	MAXIMUM CONDUCTED(AVERAGE) OUTPUT POWER 802.11n(HT20) Channel 1: 2412MHz					
Coupling: DC	nput Z: 50 Ω Atten: 30 dB Corr CCorr μW Path: Standar Freq Ref: Int (S) #PNO: Fast	#IF Gain: Low	Center Freq: 2.412000000 GHz Avg Hold.>100/100 Radio Std. None	Frequency Settings Center Frequency 2.41200000 GHz Span Span		
Scale/Div 10.0 dB Log 10.0 -10.0 -20.0 -30.0 -40.0 -50.0 -70.0	Ref Lvi Offset 11. Ref Value 20.00 d			30.000 MHz CF Step 3.000000 MHz Auto Man Freq Offset 0 Hz		
Total Power Spectral Density	#Video BW 1.0000	MHz*	Span 30 M Sweep 1.00 ms (1001 p			

MAXIMUM CONDUCTED(AVERAGE) OUTPUT POWER 802.11n(HT20)



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Test Model		JCTED(AVERAGE) OI 802.11n(HT20) Channel 11: 2462MHz	JTPUT POWER
Spectrum Analyzer 1 Channel Power KEYSIGHT Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Atten: 30 dB Trig: Free Run W Path: Standard Trig: Free Run Gate: Off Freq Ref: Int (S) #PNO: Fast #IF Gain: Low	Center Freq: 2 462000000 GHz Avg Hold:>100/100 Radio Std: None	Frequency V Center Frequency 2.462000000 GHz Span
1 Graph v Scale/Div 10.0 dB Log 10.0 0.00 -10.0 -20.0 -30.0 -40.0 -50.0 -70.0 -70.0 -70.0	Ref LvI Offset 11.00 dB Ref Value 20.00 dBm		30.000 MHz CF Step 3.00000 MHz Auto Man Freq Offset 0 Hz
Center 2.46200 GHz #Res BW 300.00 kHz 2 Metrics Total Channel Power Total Power Spectral Density	#Video BW 1.0000 MHz* 12.39 dBm / 20.0 MHz -60.62 dBm/Hz Apr 10, 2023 9:00:06 AM	Span 30 MHz Sweep 1.00 ms (1001 pts)	

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8.3 MAXIMUM POWER SPECTRAL DENSITY

8.3.1 **Applicable Standard**

According to FCC Part15.247(e) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.3.2 **Conformance Limit**

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.3.3 **Test Configuration**

Test according to clause 7.1 radio frequency test setup 1

8.3.4 **Test Procedure**

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance

The transmitter output (antenna port) was connected to the spectrum analyzer Set analyzer center frequency to DTS channel center frequency. Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz

Set the VBW to:10 kHz.

Set Detector = peak.

Set Sweep time = auto couple.

Set Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW. Note: If antenna Gain exceeds 6 dBi, then PSD Limit=8-(Gain- 6)

8.3.5 **Test Results**

Temperature:	18 ℃
Relative Humidity:	68%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
	1	2412	2.68	8	PASS
802.11b	6	2437	3.23	8	PASS
	11	2462	2.77	8	PASS
	1	2412	-13.90	8	PASS
802.11g	6	2437	-13.47	8	PASS
	11	2462	-13.97	8	PASS
902 11p	1	2412	-13.26	8	PASS
802.11n (HT20)	6	2437	-12.88	8	PASS
(1120)	11	2462	-13.35	8	PASS

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Power Spectral Density 802.11b



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Power Spectral Density 802.11q

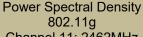


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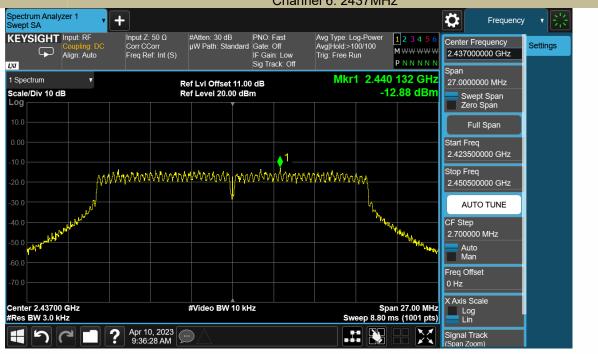
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Power Spectral Density 802.11n (HT20) Channel 6: 2437MHz



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8.4 UNWANTED EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS

8.4.1 Applicable Standard

According to FCC Part15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.4.2 Conformance Limit

According to FCC Part 15.247(d):

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.

8.4.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

8.4.4 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to \geq 1.5 times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW \ge 3 x RBW.

Set Detector = peak.

Set Sweep time = auto couple.

Set Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Emission level measurement

Set the center frequency and span to encompass frequency range to be measured.

Set the RBW = 100 kHz.

Set the VBW =300 kHz.

Set Detector = peak

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

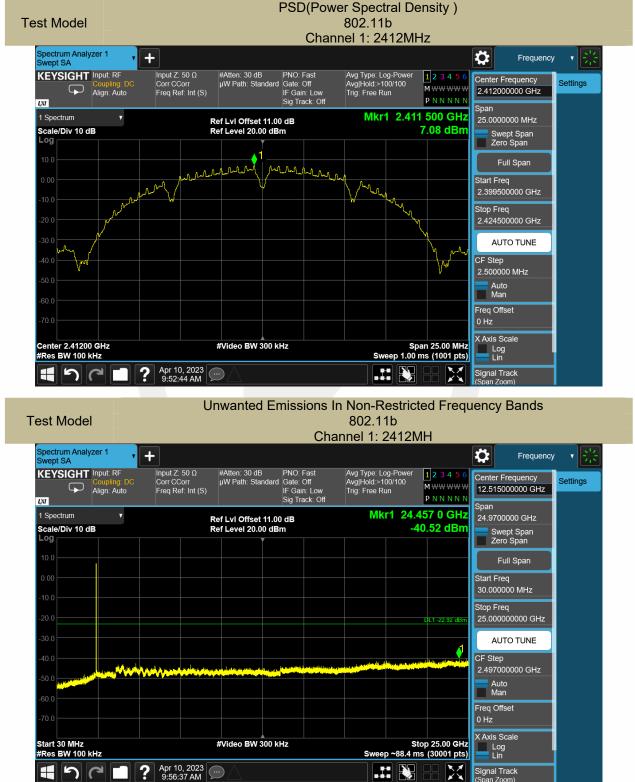
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements. Report the three highest emissions relative to the limit.

8.4.5 Test Results

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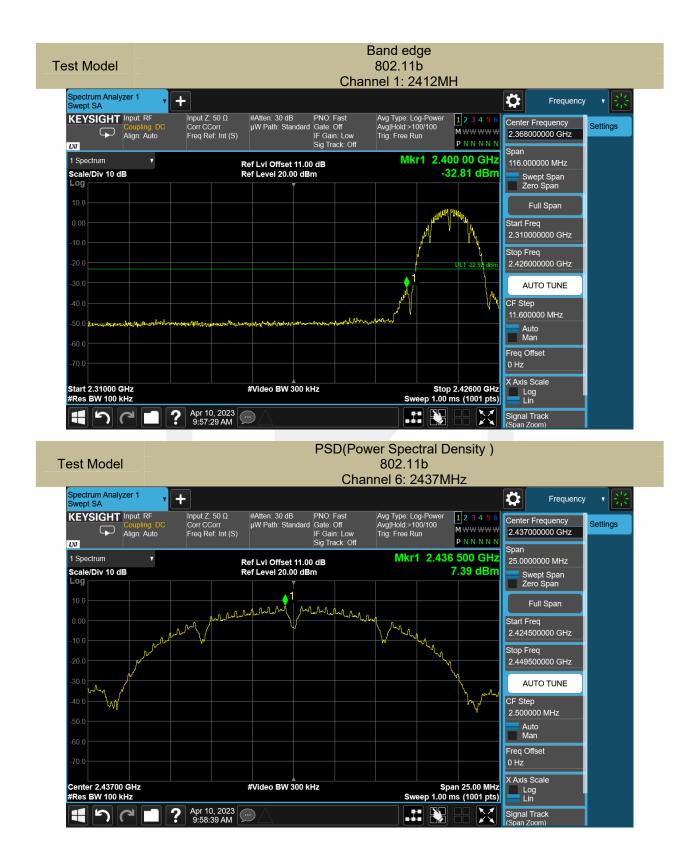
All modes 2.4G 802.11b/g/n have been tested, and the worst result 802.11b recorded was report as below:



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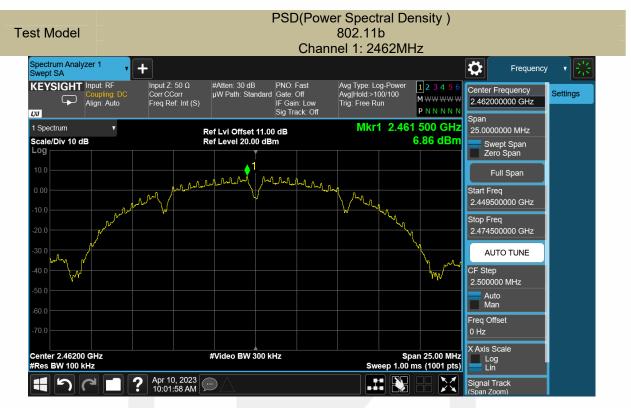
	Unv	wanted Emissions		ed Frequ	ency Bands	
est Model		Cha	802.11b	1		
Creature Analyzar 1		Cna	nnel 11: 2437M	/IH		
Spectrum Analyzer 1 Swept SA	▼ +				Frequency	/ 「迷
KEYSIGHT Coupling: D Align: Auto	Input Z: 50 Ω Corr CCorr Freq Ref: Int (S)	#Atten: 30 dB PNO: Fast µW Path: Standard Gate: Off IF Gain: Low Sig Track: Off	Avg Type: Log-Power Avg Hold:>100/100 Trig: Free Run	123456 MWWWWW PNNNNN	Center Frequency 12.515000000 GHz	Settings
1 Spectrum	R	ef Lvi Offset 11.00 dB	Mkr1 23.	736 2 GHz	Span 24.9700000 GHz	
Scale/Div 10 dB Log		ef Level 20.00 dBm	-4	12.38 dBm	Swept Span Zero Span	
10.0					Full Span	
0.00					Start Freq 30.000000 MHz	
-10.0				DL1 -22.61 dBm	Stop Freq 25.00000000 GHz	
-30.0					AUTO TUNE	
-40.0					CF Step 2.497000000 GHz	
-50.0					Auto Man	
-70.0					Freq Offset 0 Hz	
Start 30 MHz #Res BW 100 kHz		#Video BW 300 kHz	Si Sweep ~88.4 n	top 25.00 GHz ns (30001 pts)		
	Apr 10, 2023 10:00:25 AM				Signal Track (Span Zoom)	1

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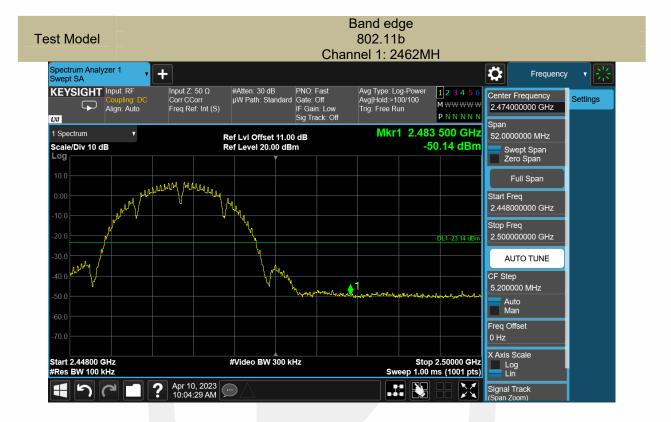
Unwanted Emissions In Non-Restricted Frequency Bands 802.11b



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