

# **FCC Test Report**

Report No.: AGC13776220101FE05

FCC ID : 2A4KW-MP1PRO

**APPLICATION PURPOSE** : Original Equipment

**PRODUCT DESIGNATION**: Mushi Pad Pro

BRAND NAME : mushi.ai

**MODEL NAME** : MP1 Pro

**APPLICANT**: Nanjing Mushi Technology Co., Ltd.

**DATE OF ISSUE** : Mar. 25, 2022

STANDARD(S)

**TEST PROCEDURE(S)** 

: FCC Part 15.247

**REPORT VERSION**: V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd





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## **REPORT REVISE RECORD**

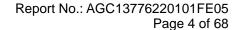
Report Version	Revise Time	Issued Date	Valid Version	Notes	
V1.0	/	Mar. 25, 2022	Valid	Initial Release	



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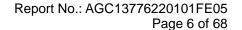
# 1. VERIFICATION OF CONFORMITY

Applicant	Nanjing Mushi Technology Co., Ltd.		
Address	320 Pubin Road, Jiangpu Street, Pukou District, Nanjing		
manufacturer	Nanjing Mushi Technology Co., Ltd.		
Address	320 Pubin Road, Jiangpu Street, Pukou District, Nanjing		
Factory	ShenZhen WeiHejia Electronics Technology CO., LTD		
Address	Block 102, Building 9, Xihu Industrial park, Xikeng community, Yuanshan street, Longgang district, Shenzhen		
Product Designation	Mushi Pad Pro		
Brand Name	mushi.ai		
Test Model	MP1 Pro		
Date of test	Feb. 11, 2022~Mar. 25, 2022		
Deviation	No any deviation from the test method		
Condition of Test Sample	Normal		
Test Result	Pass		
Report Template	AGCRT-US-BGN/RF		

# We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) 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 radiated emission limits of FCC Rules Part 15.247.

Prepared By	Foler zhan			
	Eder Zhan (Project Engineer)	Mar. 25, 2022		
Reviewed By	Calin	Lin		
	Calvin Liu (Reviewer)	Mar. 25, 2022		
Approved By	Max Zha	ng		
_	Max Zhang Authorized Officer	Mar. 25, 2022		





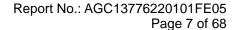
# 2. GENERAL INFORMATION

# 2.1. PRODUCT DESCRIPTION

The EUT is designed as "Mushi Pad Pro". It is designed by way of utilizing the DSSS and OFDM technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.412 GHz ~ 2.462GHz		
Output Power (Average)	IEEE 802.11b:17.22dBm; IEEE 802.11g:9.91dBm;IEEE 802.11n(20):8.39dBm		
Output Power (Peak)	IEEE 802.11b:19.84dBm; IEEE 802.11g:17.70dBm;IEEE 802.11n(20):16.36dBm		
Modulation	802.11b: (DQPSK, DBPSK, CCK) DSSS 802.11g/n: (64-QAM, 16-QAM, QPSK, BPSK) OFDM		
Data Rate	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps		
Number of channels	802.11b/g/n-HT20:11channels		
Hardware Version	B000RK12_IO_V103		
Software Version	RK12_wh_20211126_update		
Antenna Designation	PIFA Antenna (Comply with requirements of the FCC part 15.203)		
Antenna Gain	1.42dBi		
Power Supply	DC 12V by adapter		





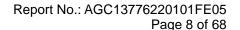
## 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
	1	2412 MHZ
	2	2417 MHZ
	3	2422 MHZ
	4	2427 MHZ
	5	2432 MHZ
2400~2483.5MHZ	6	2437 MHZ
	7	2442 MHZ
	8	2447 MHZ
	9	2452 MHZ
	10	2457 MHZ
	11	2462 MHZ

Note: For 20MHZ bandwidth system use Channel 1 to Channel 11.

# 2.3. IEEE 802.11N MODULATION SCHEME

MCS Index	Nss	Modulation	R	NBPSC NCBI		BPS	NDBPS		rate(I	ata Mbps) nsGl
					20MHz	40MHz	20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0
6	1	64-QAM	3/4	6	312	648	234	489	58.5	121.5
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0





Symbol	Explanation	
NSS	Number of spatial streams	
R	Code rate	
NBPSC	Number of coded bits per single carrier	
NCBPS	Number of coded bits per symbol	
NDBPS	Number of data bits per symbol	
GI	Guard interval	

# 2.4. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID**: **2A4KW-MP1PRO** filing to comply with the FCC Part 15 requirements.

## 2.5. TEST METHODOLOGY

KDB 558074 D01 15.247 Meas Guidance v05: Guidance for compliance measurements on Digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules

ANSI C63.10:2013: American National Standard for Testing Unlicensed Wireless Devices

# 2.6. SPECIAL ACCESSORIES

Refer to section 5.2.

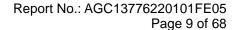
# 2.7. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

# 2.8. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.





# 3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Item	Measurement Uncertainty
Uncertainty of Conducted Emission for AC Port	$U_c = \pm 3.1 \text{ dB}$
Uncertainty of Radiated Emission below 1GHz	$U_c = \pm 4.0 \text{ dB}$
Uncertainty of Radiated Emission above 1GHz	$U_c = \pm 4.8 \text{ dB}$
Uncertainty of total RF power, conducted	$U_c = \pm 0.8 \text{ dB}$
Uncertainty of RF power density, conducted	$U_c = \pm 2.6 \text{ dB}$
Uncertainty of spurious emissions, conducted	$U_c = \pm 2 \%$
Uncertainty of Occupied Channel Bandwidth	$U_c = \pm 2 \%$



# 4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel transmitting (TX)
2	Middle channel transmitting (TX)
3	High channel transmitting (TX)

#### Note:

Transmit by 802.11b with Date rate (1/2/5.5/11)

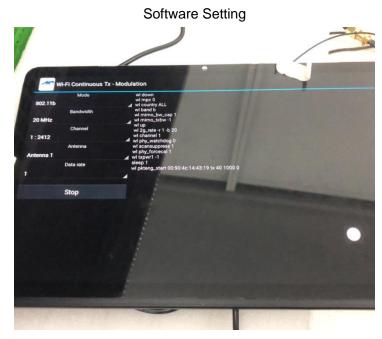
Transmit by 802.11g with Date rate (6/9/12/18/24/36/48/54)

Transmit by 802.11n (20MHz) with Date rate (6.5/13/19.5/26/39/52/58.5/65)

The test channel for 20MHZ bandwidth system is channel 1, 6 and 11.

#### Note:

- 1. The EUT has been set to operate continuously on the lowest, middle and highest operation frequency Individually, and the EUT is operating at its maximum duty cycle>or equal 98%
- 2. All modes under which configure applicable have been tested and the worst mode test data recording in the test report, if no other mode data.





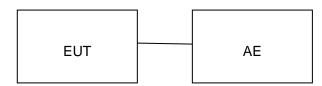
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# 5. SYSTEM TEST CONFIGURATION

# **5.1. CONFIGURATION OF EUT SYSTEM**

Configure:

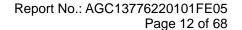


## **5.2. EQUIPMENT USED IN EUT SYSTEM**

Item	Equipment	Model No.	ID or Specification	Remark
1	Mushi Pad Pro	MP1 Pro	2A4KW-MP1PRO	EUT
2	Adapter	HTY-1201500	Input: AC 100-240V 50/60Hz, 0.5A Output: DC 12V 1.5A	AE
3	USB Cable	N/A	N/A	AE

## **5.3. SUMMARY OF TEST RESULTS**

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247	Output Power	Compliant
§15.247	6 dB Bandwidth	Compliant
§15.247	Conducted Spurious Emission	Compliant
§15.247	Maximum Conducted Output Power Spectral Density	Compliant
§15.209	Radiated Emission	Compliant
§15.247	Band Edges	Compliant
§15.207	Line Conduction Emission	Compliant





# 6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

# TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	May 11, 2021	May 10, 2022
LISN	R&S	ESH2-Z5	100086	Jun. 09, 2021	Jun. 08, 2022
Test software	R&S	ES-K1(Ver.V1.71)	N/A	N/A	N/A

#### **TEST EQUIPMENT OF RADIATED EMISSION TEST**

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Apr. 14, 2021	Apr. 13, 2022
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Nov. 17, 2021	Nov. 16, 2022
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 23, 2020	Mar. 22, 2022
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 21, 2022	Mar. 20, 2023
Attenuator	ZHINAN	E-002	N/A	Sep. 03, 2020	Sep. 02, 2022
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 19, 2021	Sep. 18, 2023
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 08, 2021	Jan. 07, 2023
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A



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# 7. OUTPUT POWER

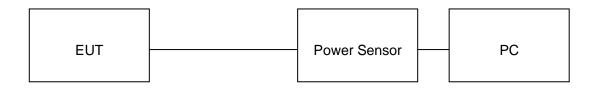
# 7.1. MEASUREMENT PROCEDURE

For average power test:

- 1. Connect EUT RF output port to power sensor through an RF attenuator.
- 2. Connect the power sensor to the PC.
- 3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 4. Record the maximum power from the software.

**Note**: The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements.

# 7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



#### 7.3. LIMITS AND MEASUREMENT RESULT

Test Data of Conducted Output Power					
Test Mode	Test Channel (MHz)	Average Power (dBm)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
	2412	17.05	19.77	≤30	Pass
802.11b	2437	17.22	19.84	≤30	Pass
	2462	17.01	19.71	≤30	Pass
	2412	9.91	17.70	≤30	Pass
802.11g	2437	8.95	16.84	≤30	Pass
	2462	9.83	17.69	≤30	Pass
	2412	8.39	16.36	≤30	Pass
802.11n20	2437	7.57	15.52	≤30	Pass
	2462	8.32	16.12	≤30	Pass



## 8. BANDWIDTH

#### **8.1. MEASUREMENT PROCEDURE**

#### 6dB bandwidth:

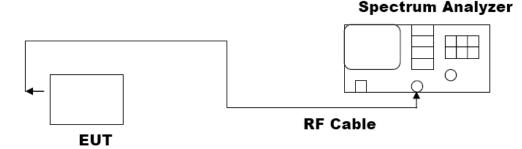
- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 kHz, VBW≥3×RBW.
- 4. Set SPA Trace 1 Max hold, then View.

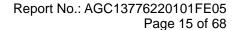
## Occupied bandwidth:

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel
  The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video
  bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
- 4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

# 8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)





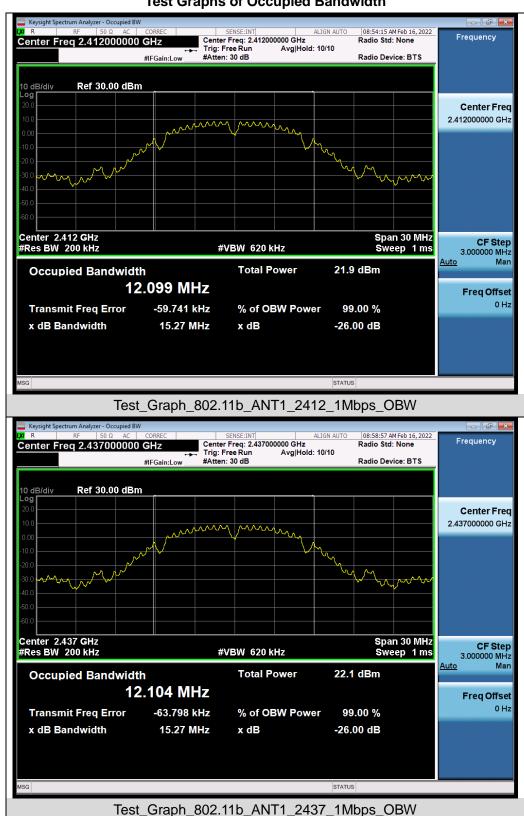


## 8.3. LIMITS AND MEASUREMENT RESULTS

Test Data of Occupied Bandwidth and DTS Bandwidth						
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-6dB Bandwidth (MHz)	Limits (MHz)	Pass or Fail	
	2412	12.099	9.042	≥0.5	Pass	
802.11b	2437	12.104	8.563	≥0.5	Pass	
	2462	12.130	9.040	≥0.5	Pass	
802.11g	2412	16.618	16.071	≥0.5	Pass	
	2437	16.781	16.328	≥0.5	Pass	
	2462	16.527	16.039	≥0.5	Pass	
802.11n20	2412	17.726	17.149	≥0.5	Pass	
	2437	17.833	17.543	≥0.5	Pass	
	2462	17.666	16.088	≥0.5	Pass	



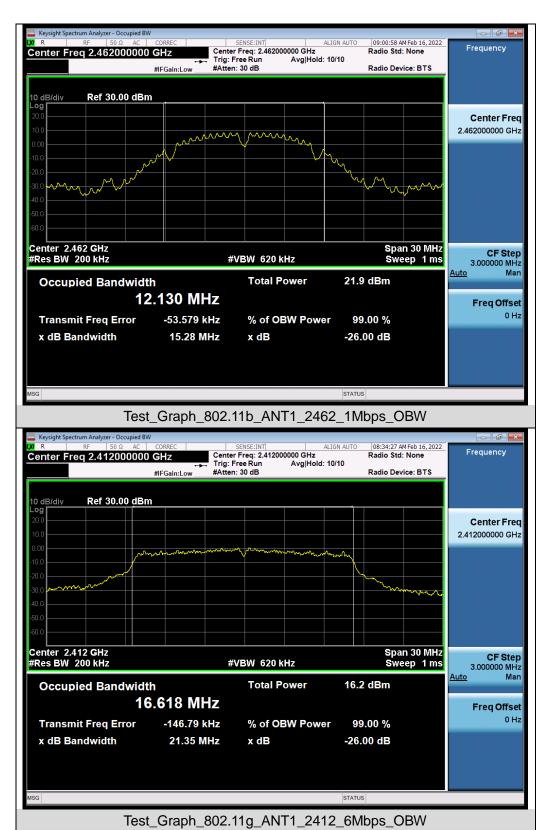
# Test Graphs of Occupied Bandwidth



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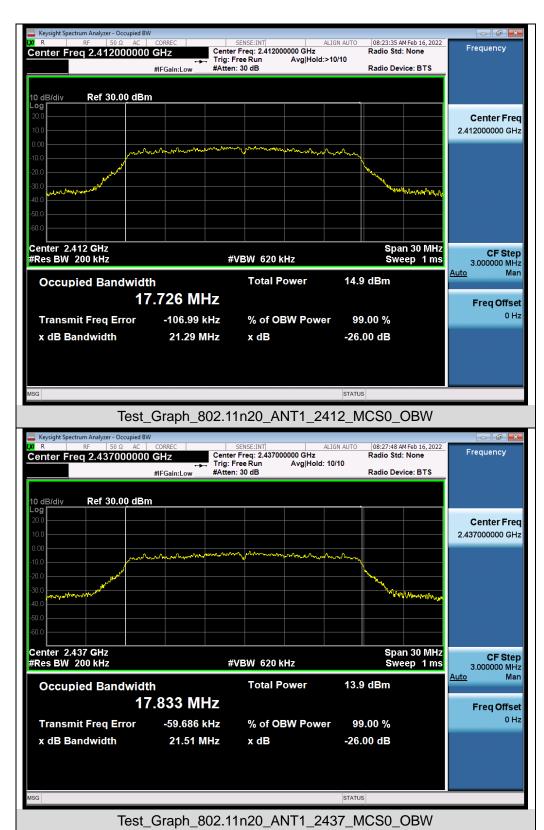




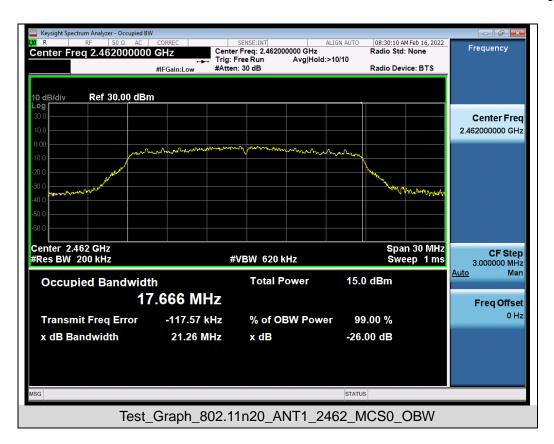






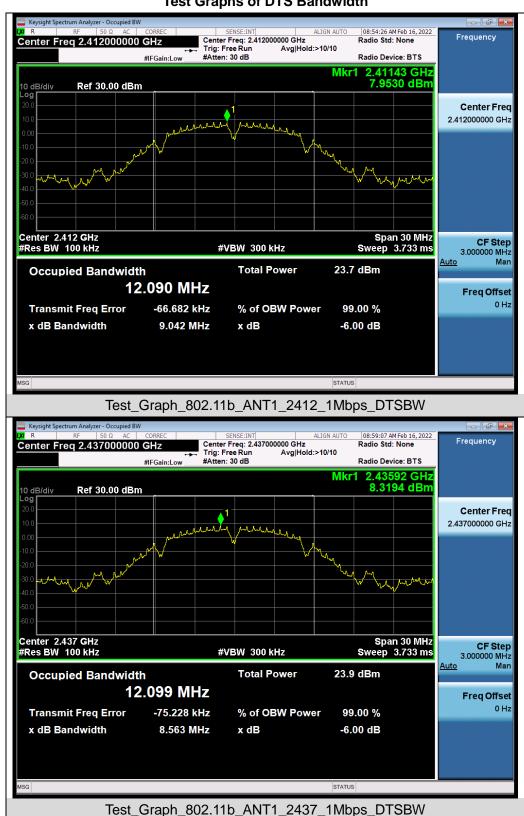




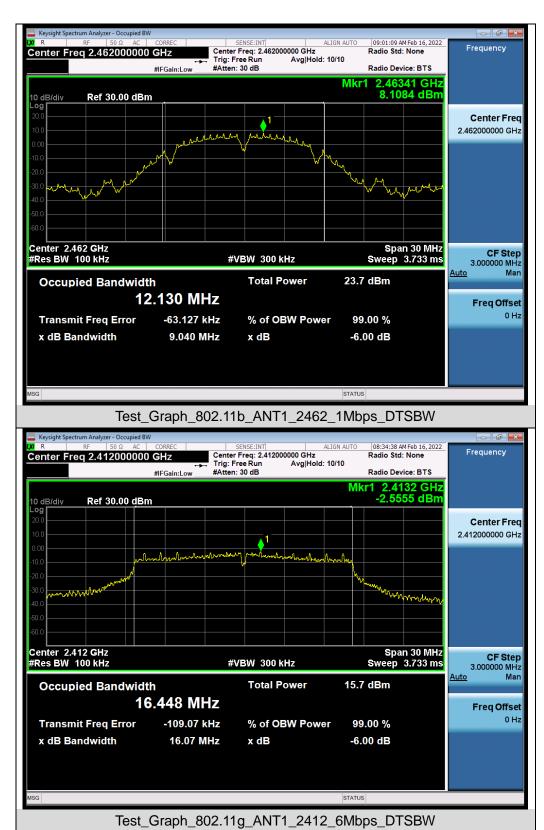




## Test Graphs of DTS Bandwidth







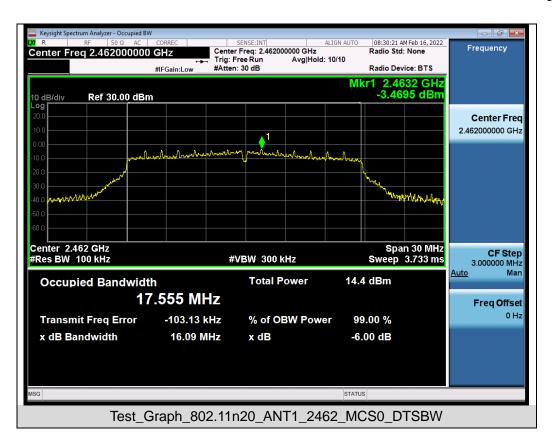














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## 9. CONDUCTED SPURIOUS EMISSION

#### 9.1. MEASUREMENT PROCEDURE

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements. Owing to satisfy the requirements of the number of measurement points, we set the RBW=1MHz, VBW>RBW, scan up through 10th harmonic, and consider the tested results as the worst case, if the tested results conform to the requirement, we can deem that the real tested results(set the RBW=100KHz, VBW>RBW) are conform to the requirement.

# 9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2.

#### 9.3. MEASUREMENT EQUIPMENT USEDJN

The same as described in section 6.

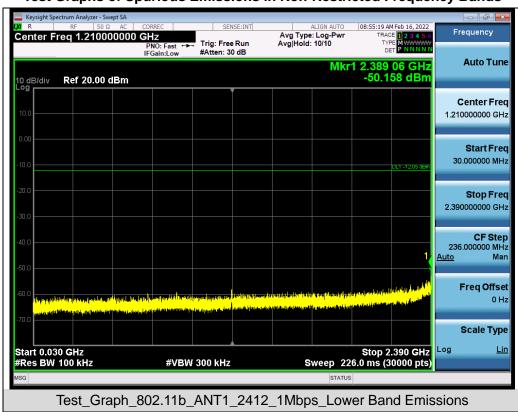
#### 9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT					
Applicable Limite	Measurement Result				
Applicable Limits	Test Data	Criteria			
In any 100 KHz Bandwidth Outside the	At least -20dBc than the limit				
frequency band in which the spread spectrum	Specified on the BOTTOM	PASS			
intentional radiator is operating, the radio frequency	Channel				
power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth					
within the band that contains the highest level of the					
desired power.	At least -20dBc than the limit	PASS			
In addition, radiation emissions which fall in the	Specified on the TOP Channel	FASS			
restricted bands, as defined in §15.205(a), must also					
comply with the radiated emission limits specified					
in§15.209(a))					

Note: The limits reference level is according to the test plot of -6dB bandwidth.



# Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands





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Freq Offset 0 Hz

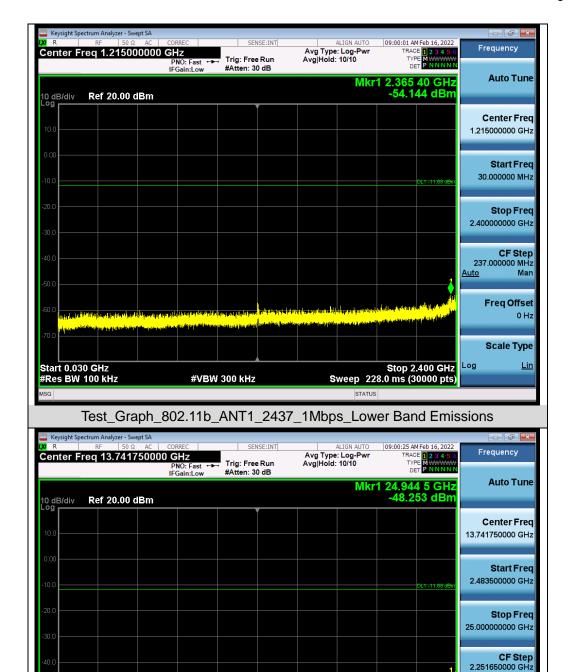
Scale Type

<u>Lin</u>

Log

Stop 25.00 GHz Sweep 2.152 s (30000 pts)





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Test\_Graph\_802.11b\_ANT1\_2437\_1Mbps\_Higher Band Emissions

**#VBW** 300 kHz

Start 2.48 GHz #Res BW 100 kHz

CF Step 2.250000000 GHz

> Freq Offset 0 Hz

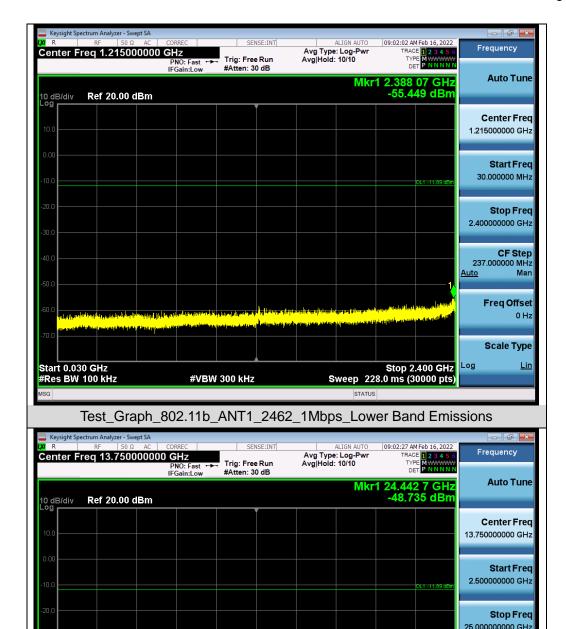
Scale Type

<u>Lin</u>

Log

Stop 25.00 GHz Sweep 2.152 s (30000 pts)





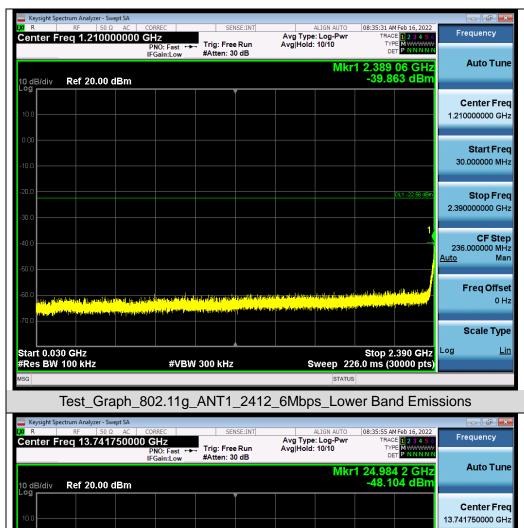
Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.

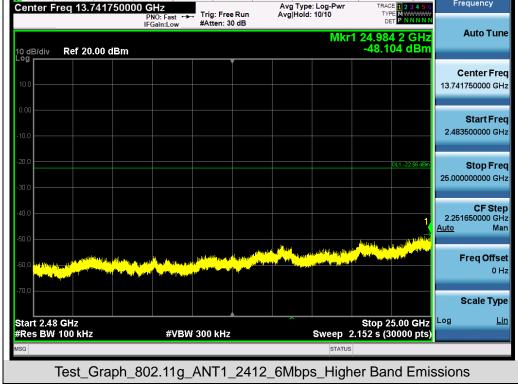
Test\_Graph\_802.11b\_ANT1\_2462\_1Mbps\_Higher Band Emissions

**#VBW** 300 kHz

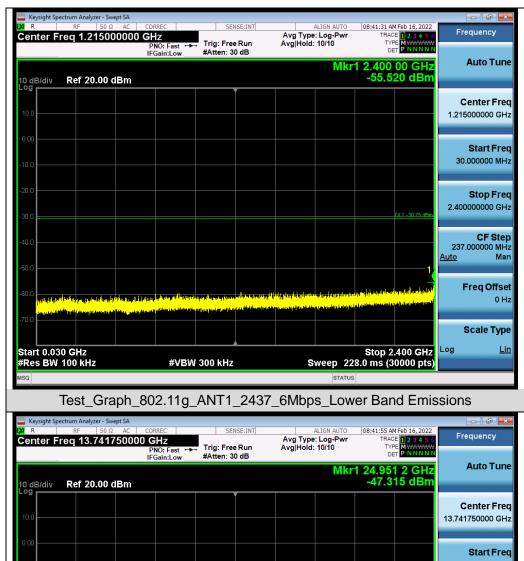
Start 2.50 GHz #Res BW 100 kHz











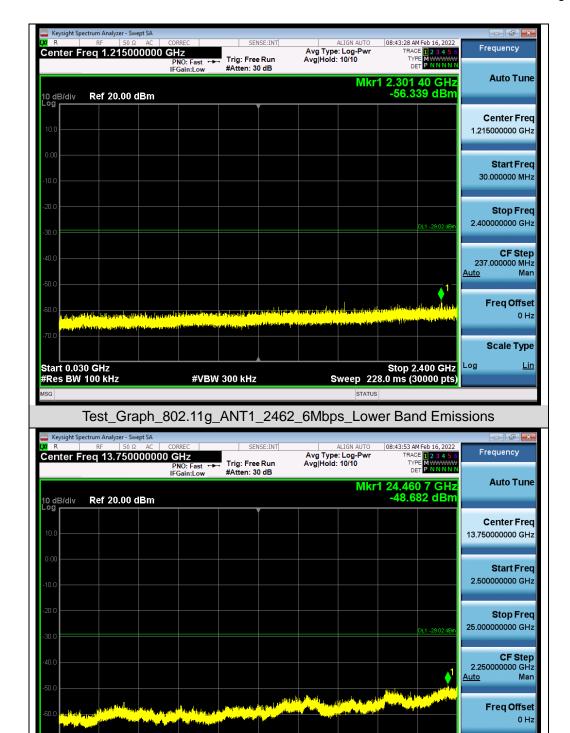
Scale Type

<u>Lin</u>

Log

Stop 25.00 GHz Sweep 2.152 s (30000 pts)





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Test\_Graph\_802.11g\_ANT1\_2462\_6Mbps\_Higher Band Emissions

**#VBW** 300 kHz

Start 2.50 GHz #Res BW 100 kHz

**CF Step** 2.251650000 GHz

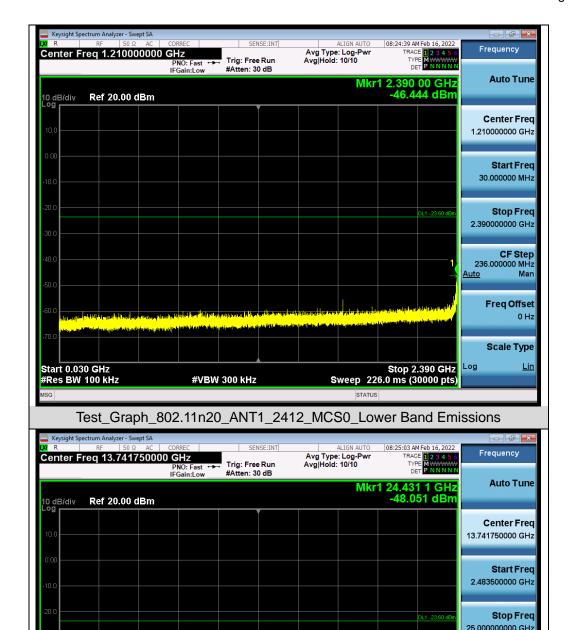
Freq Offset 0 Hz

Scale Type

<u>Lin</u>

Stop 25.00 GHz Sweep 2.152 s (30000 pts)





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Test\_Graph\_802.11n20\_ANT1\_2412\_MCS0\_Higher Band Emissions

**#VBW** 300 kHz

Start 2.48 GHz #Res BW 100 kHz

<u>Auto</u>

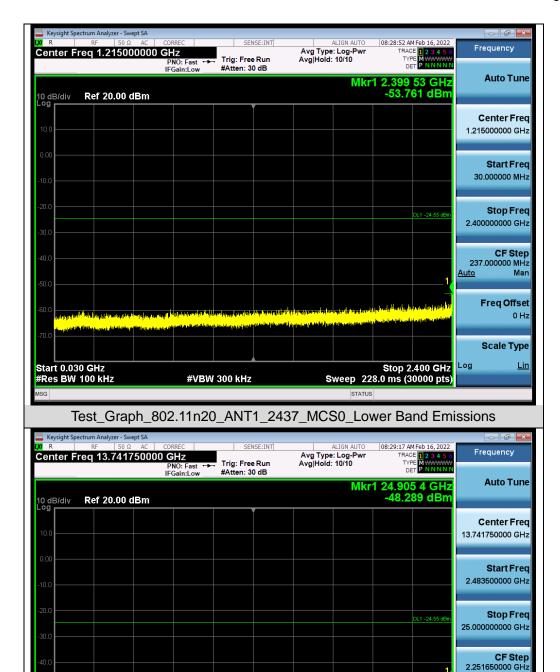
Log

Stop 25.00 GHz Sweep 2.152 s (30000 pts) Freq Offset 0 Hz

Scale Type

<u>Lin</u>





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Test\_Graph\_802.11n20\_ANT1\_2437\_MCS0\_Higher Band Emissions

**#VBW** 300 kHz

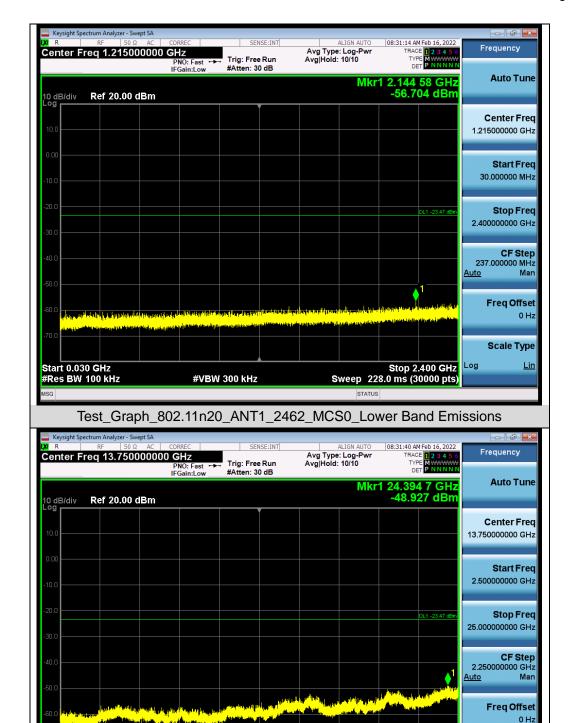
Start 2.48 GHz #Res BW 100 kHz

Scale Type

<u>Lin</u>

Stop 25.00 GHz Sweep 2.152 s (30000 pts)





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Test\_Graph\_802.11n20\_ANT1\_2462\_MCS0\_Higher Band Emissions

**#VBW** 300 kHz

Start 2.50 GHz #Res BW 100 kHz

0 Hz

Scale Type <u>Lin</u>



# Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands



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Test\_Graph\_802.11g\_ANT1\_2412\_6Mbps\_Lower Band Edge Emissions





Note: Emissions from 2483.5-2500MHz which fall in the restricted bands had been considered with the radiated emission limits specified.



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# 10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

## **10.1 MEASUREMENT PROCEDURE**

- (1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- (2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- (3). Set SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the ANSI C63.10 (2013) item 11.10 was used in this testing.

# 10.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer to Section 8.2.

# **10.3 MEASUREMENT EQUIPMENT USED**

Refer to Section 6.

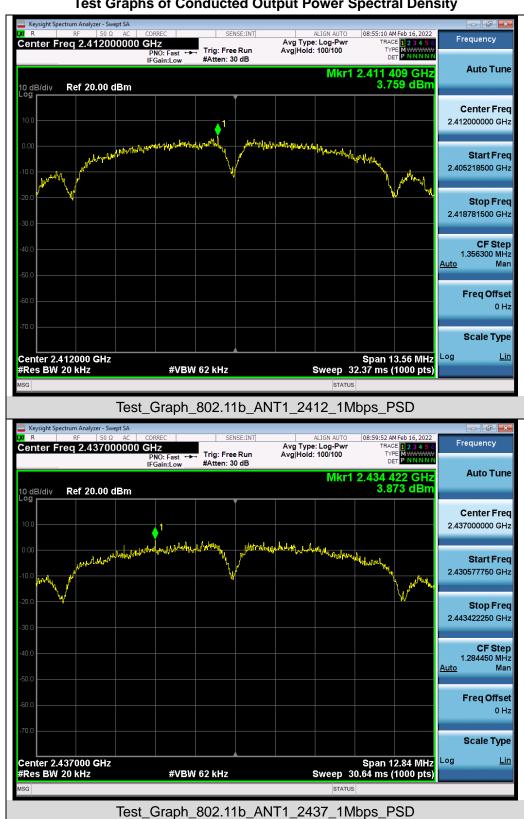
# **10.4 LIMITS AND MEASUREMENT RESULT**

Test Data of Conducted Output Power Spectral Density						
Test Mode	Test Channel (MHz)	Power density (dBm/20kHz)	Power density (dBm/3kHz)	Limit (dBm/3kHz)	Pass or Fail	
	2412	3.759	-4.48	≪8	Pass	
802.11b	2437	3.873	-4.366	≪8	Pass	
	2462	3.107	-5.132	≪8	Pass	
802.11g	2412	-6.367	-14.606	≪8	Pass	
	2437	-7.259	-15.498	≤8	Pass	
	2462	-6.405	-14.644	≪8	Pass	
802.11n20	2412	-6.808	-15.047	≪8	Pass	
	2437	-8.744	-16.983	≪8	Pass	
	2462	-7.389	-15.628	≤8	Pass	

Note: Power density(dBm/3kHz) = Power density(dBm/20kHz) - 10\*log(20/3).



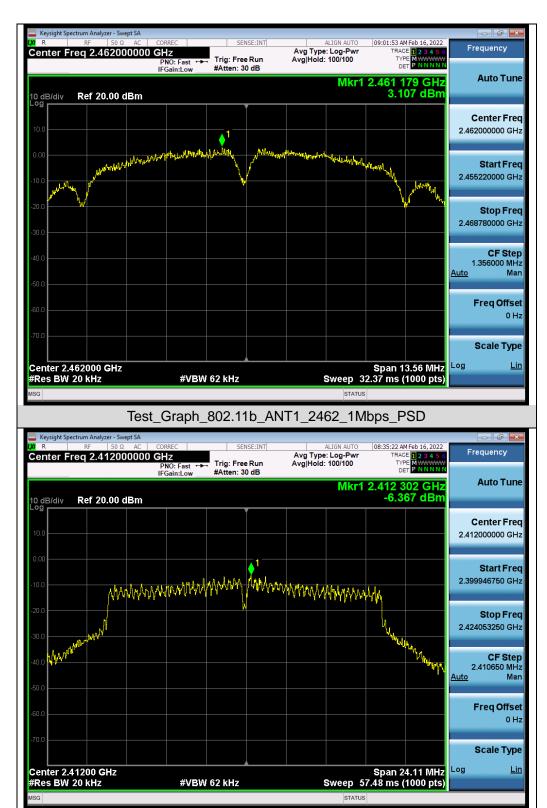
# **Test Graphs of Conducted Output Power Spectral Density**



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Test\_Graph\_802.11g\_ANT1\_2412\_6Mbps\_PSD



