FCC Test Report

Client Name	:	Benro Image Technology Industrial Co., Ltd.
Address	:	No.59 Huoju Road, The 3rd Industrial Park, Tanzhou, Zhongshan, China
Product Name	:	Polaris
Date	:	Apr. 21, 2022

Shenzhen Anbotek Compliance Laboratory Limited

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Address: 1/F., Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86) 755-26066440 Fax: (86) 755-26014772 Email: service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

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TEST REPORT

Applicant	:	Benro Image Technology Industrial Co., Ltd.
Manufacturer	:	Benro Image Technology Industrial Co., Ltd.
Product Name	:	Polaris
Model No.	:	BR203, BR209
Trade Mark	:	BENRO®
Rating(s)	:	Input: DC 5/9V, 2A (with DC 11.1V, 2500mAh Battery inside
Test Standard(s)	):	**FCC Part15 Subpart E, Paragraph 15.407**
Test Method(s)	:	**ANSI C63.10: 2020,** **KDB 789033 D02 General UNII Test Procedures New Rules v02r01**

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart E requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Receipt	Apr. 01, 2022
Date of Test	Apr. 01~15, 2022
Prepared By	Nian xiu Chen (Nianxiu Chen)
Approved & Authorized Signer	Kingkong Jin (Kingkong Jin)

1. General Information

1.1. Client Information

Applicant	:	Benro Image Technology Industrial Co., Ltd.
Address	:	No.59 Huoju Road, The 3rd Industrial Park, Tanzhou, Zhongshan, China
Manufacturer	:	Benro Image Technology Industrial Co., Ltd.
Address	:	No.59 Huoju Road, The 3rd Industrial Park, Tanzhou, Zhongshan, China
Factory	:	Benro Image Technology Industrial Co., Ltd.
Address	:	No.59 Huoju Road, The 3rd Industrial Park, Tanzhou, Zhongshan, China

1.2. Description of Device (EUT)

Product Name	:	Polaris	
Model No.	:	BR2039, BR209 (Note: All samples are the same except the model number, so we prepare "BR203" for test only.)	
Trade Mark	:	BENRO®	
Test Power Supply	:	AC 120V, 60Hz for adapter/ DC 11.1V Battery inside	
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)	
Product Description	:	Operation Frequency:	BLE: 2402~2480MHz WiFi 2.4G: 2412~2462MHz for 802.11n(HT20) WiFi 5.2G: 5180~5240MHz for 802.11n(HT20)
		Number of Channel:	BLE: 40 Channels WiFi 2.4G 802.11n(HT20): 11 Channels WiFi 5.2G 802.11n(HT20): 4 Channels
		Modulation Type:	BLE: GFSK WiFi 2.4G: 64QAM, 16QAM, QPSK, BPSK for OFDM WiFi 5.2G: OFDM with BPSK, QPSK, 16QAM, 64QAM, 256QAM
		Antenna Type:	BLE: FPC Antenna WiFi 2.4G: FPC Antenna WiFi 5.2G: FPC Antenna
		Antenna Gain(Peak):	BLE: 7.55dBi (Provided by customer) WiFi 2.4G: 7.55dBi (Provided by customer) WiFi 5.2G: 6.48dBi (Provided by customer)
		Adapter:	N/A
Remark: 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual. 2) This report is for WiFi 5.2G module.			

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Hotline 400-003-0500
www.anbotek.com

1.3. Auxiliary Equipment Used During Test

Adapter	:	M/N: A2613 Input: AC 100-240V, 1.8A, 50-60Hz Output: 5V⎓2.4A/ 9V⎓3A/ 15V⎓3A/ 20V⎓3A

1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Frequency Band	Mode	Test channel	Frequency (MHz)
5.2GHz	OFDM(802.11n20)	CH 36	5180MHz
		CH 40	5200MHz
		CH 48	5240MHz

Note:

1. The measurements are performed at the highest, middle, lowest available channels.
2. The EUT has been tested as an independent unit. And Continual Transmitting in maximum power.
3. For the relevant Conducted Measurement, the temporary antenna connector is used during the measurement. Antenna Connector Impedance: 50Ω, Cable Loss: 1.0 dB
4. The EUT was programmed to be in continuously transmitting mode

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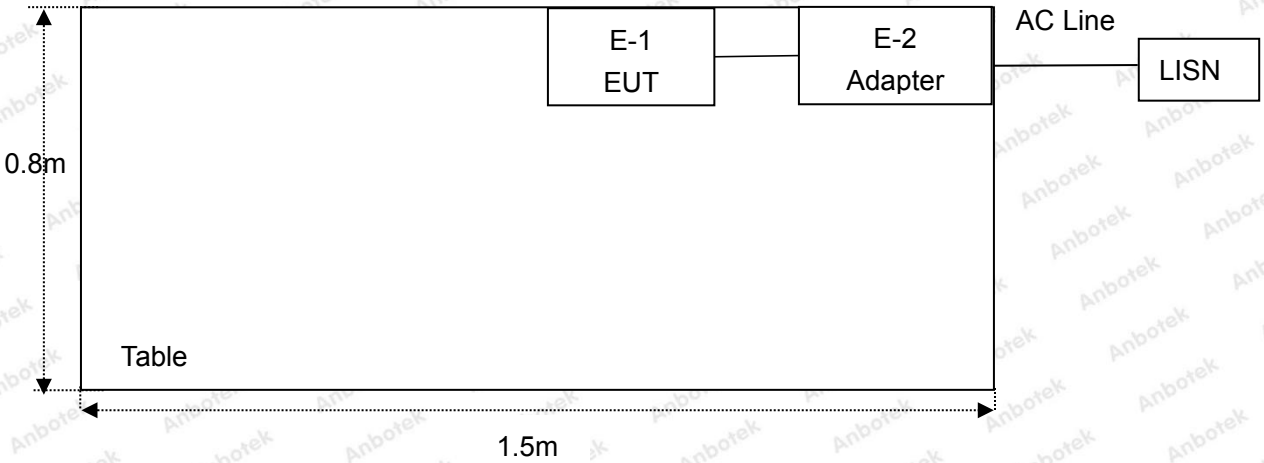
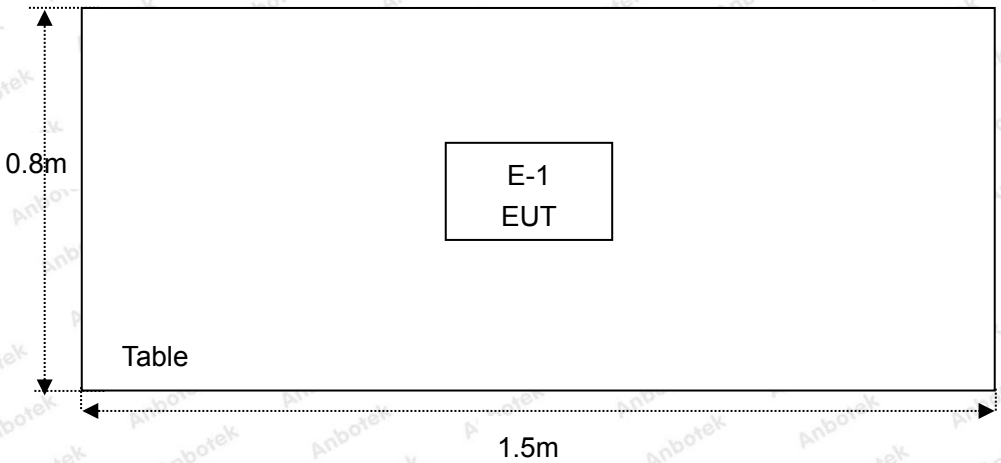
1.5. Description Of Test Setup

CE



RE



1.6. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jul 05, 2021	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 22, 2021	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 22, 2021	1 Year
4.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Oct. 22, 2021	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 22, 2021	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Oct. 22, 2021	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Oct. 22, 2021	2 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Oct. 22, 2021	2 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 22, 2021	2 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Oct. 22, 2021	2 Year
11.	Pre-amplifier	SONOMA	310N	186860	Oct. 22, 2021	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	RF Test Control System	YIHENG	YH3000	2017430	Oct. 22, 2021	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Oct. 22, 2021	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Oct. 22, 2021	1 Year
16.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 22, 2021	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 22, 2021	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 22, 2021	1 Year
19.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 22, 2021	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Oct. 22, 2021	1 Year

1.7. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
		Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4 dB

1.8. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111.

ISED-Registration No.: 8058A

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotek Compliance Laboratory Limited.
1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102

2. Summary of Test Results

Standard	Test Type	Result
15.207 & 15.407	Conducted Emission	PASS
15.205/15.209	Spurious Emission	PASS
15.407(b)	Band Edge	PASS
15.407(a)(5)	Occupy Bandwidth	PASS
15.407(a)(1)(ii)	Maximum Conducted Output Power	PASS
15.407(a)(1)	Peak Power Spectral Density	PASS
15.203	Antenna Requirement	PASS
15.407(g)	Frequency Stability	PASS

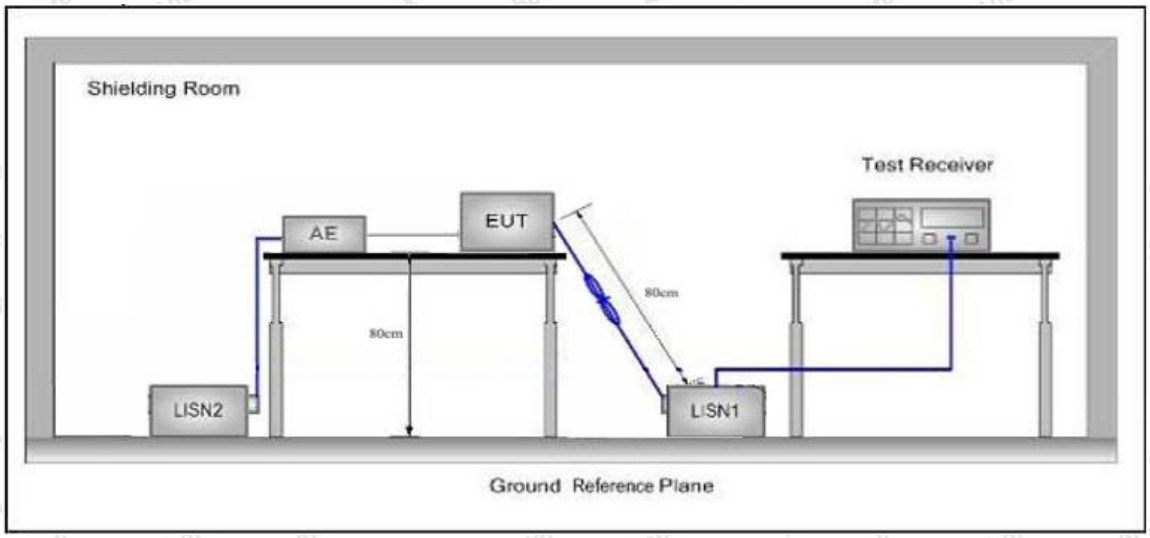
Remark: “N/A” is an abbreviation for Not Applicable.

3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207&15.407		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50
Remark: (1) *Decreasing linearly with logarithm of the frequency. (2) The lower limit shall apply at the transition frequency.			

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10: 2020 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

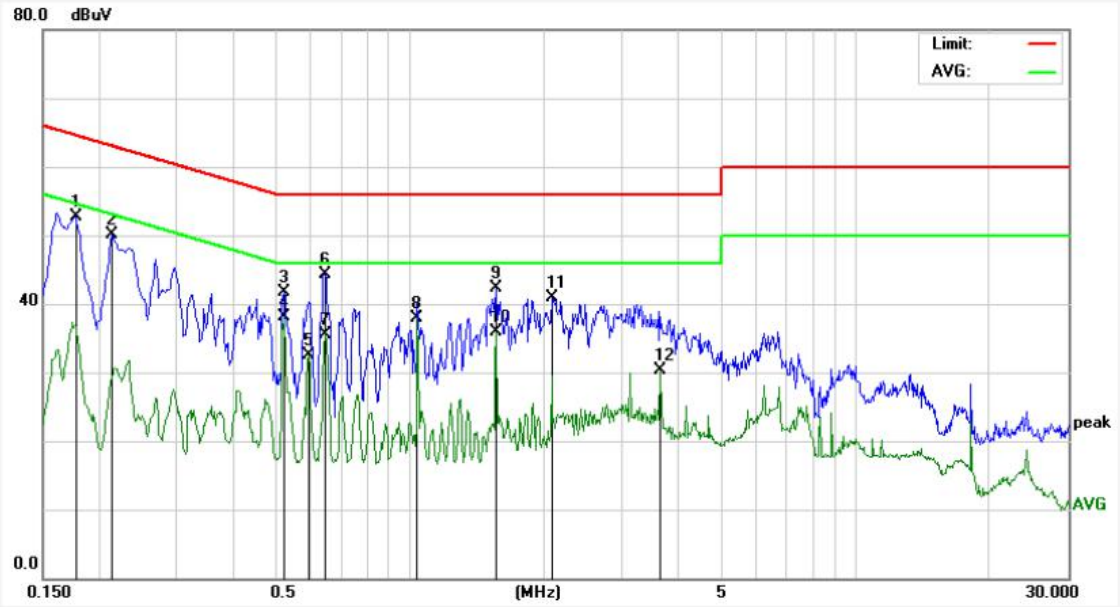
The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

During the test, pre-scan all modes, and found the 802.11n20 CH40 which is the worst case, only the worst case is recorded in the report.

Conducted Emission Test Data

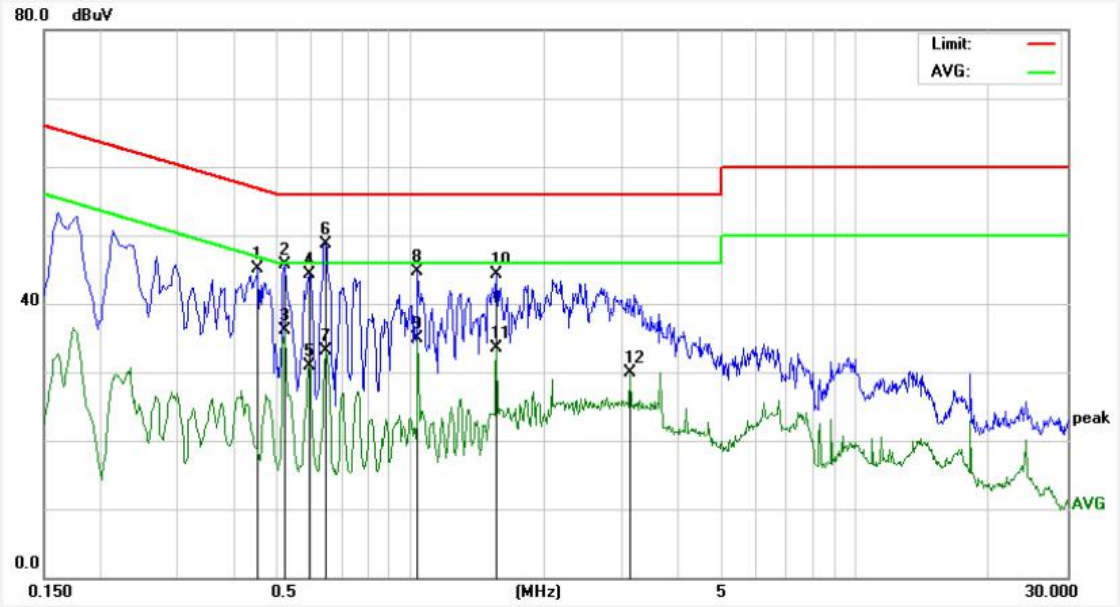
Test Site: 1# Shielded Room
Operating Condition: 802.11n20 CH40
Test Specification: AC 120V, 60Hz for Adapter
Comment: Live Line
Tem.: 22.8℃ Hum.: 48%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1780	52.65	0.12	52.77	64.57	-11.80	QP	
2	0.2140	50.01	0.12	50.13	63.04	-12.91	QP	
3	0.5220	41.61	0.15	41.76	56.00	-14.24	QP	
4	0.5220	37.89	0.15	38.04	46.00	-7.96	AVG	
5	0.5940	32.32	0.15	32.47	46.00	-13.53	AVG	
6	0.6460	44.08	0.15	44.23	56.00	-11.77	QP	
7	0.6460	35.45	0.15	35.60	46.00	-10.40	AVG	
8	1.0420	37.81	0.15	37.96	46.00	-8.04	AVG	
9	1.5620	42.27	0.13	42.40	56.00	-13.60	QP	
10	1.5620	35.81	0.13	35.94	46.00	-10.06	AVG	
11	2.0820	40.86	0.12	40.98	56.00	-15.02	QP	
12	3.6420	30.18	0.12	30.30	46.00	-15.70	AVG	

Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: 802.11n20 CH40
Test Specification: AC 120V, 60Hz for Adapter
Comment: Neutral Line
Tem.: 22.8℃ Hum.: 48%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.4540	45.01	0.13	45.14	56.80	-11.66	QP	
2	0.5220	45.61	0.15	45.76	56.00	-10.24	QP	
3	0.5220	35.89	0.15	36.04	46.00	-9.96	AVG	
4	0.5940	44.25	0.15	44.40	56.00	-11.60	QP	
5	0.5940	30.82	0.15	30.97	46.00	-15.03	AVG	
6	0.6460	48.58	0.15	48.73	56.00	-7.27	QP	
7	0.6460	32.95	0.15	33.10	46.00	-12.90	AVG	
8	1.0420	44.65	0.15	44.80	56.00	-11.20	QP	
9	1.0420	34.81	0.15	34.96	46.00	-11.04	AVG	
10	1.5620	44.27	0.13	44.40	56.00	-11.60	QP	
11	1.5620	33.31	0.13	33.44	46.00	-12.56	AVG	
12	3.1220	29.74	0.12	29.86	46.00	-16.14	AVG	

4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

Radiated Spurious Emission					
Test Standard	FCC Part15 C Section 15.209, 15.205 and 15.407				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	68.2	Peak	3

Band Edge				
Test Standard	15.407(b)			
Test Limit	Operating Band	Frequency	EIRP Limit	Remark
	5150-5250MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
	5250-5350MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
	5470-5725MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
	5725-5850 MHz	Above 1GHz	-27dBm/MHz(68.2dBuV/m)@3m	Peak
		1GHz-5.65GHz	-27*dBm/MHz to 10dBm/MHz (68.2* dBuV/m to 105.6dBuV/m)	Peak
		5.65GHz-5.7GHz	10*dBm/MHz to 15.6dBm/MHz (105.6*dBuV/m to 110.8dBuV/m)	Peak
		5.7GHz-5.72GHz	15.6*dBm/MHz to 27dBm/MHz (110.8dBuV/m to* 122.2dBuV/m)	Peak
		5.72GHz-5.725GHz	27dBm/MHz to 15.6*dBm/MHz (122.2dBuV/m to110.8* dBuV/m)	Peak

		5.85GHz-5.855GHz	15.6dBm/MHz to 10*dBm/MHz (110.8dBuV/m to 105.6* dBuV/m	Peak
		5.855GHz-5.875GHz	10dBm/MHz to -27*dBm/MHz (105.6dBuV/m to 68.2* dBuV/m)	Peak
		5.875GHz-5.925GHz	-27 dBm/MHz(68.2dBuV/m)@3m	Peak

Remark:

(1)The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

(3)Above 1GHz limit:E[dBμV/m] = EIRP[dBm] + 95.2=68.2 dBuV/m, for EIPR[dBm]=-27dBm.

4.2. Test Setup

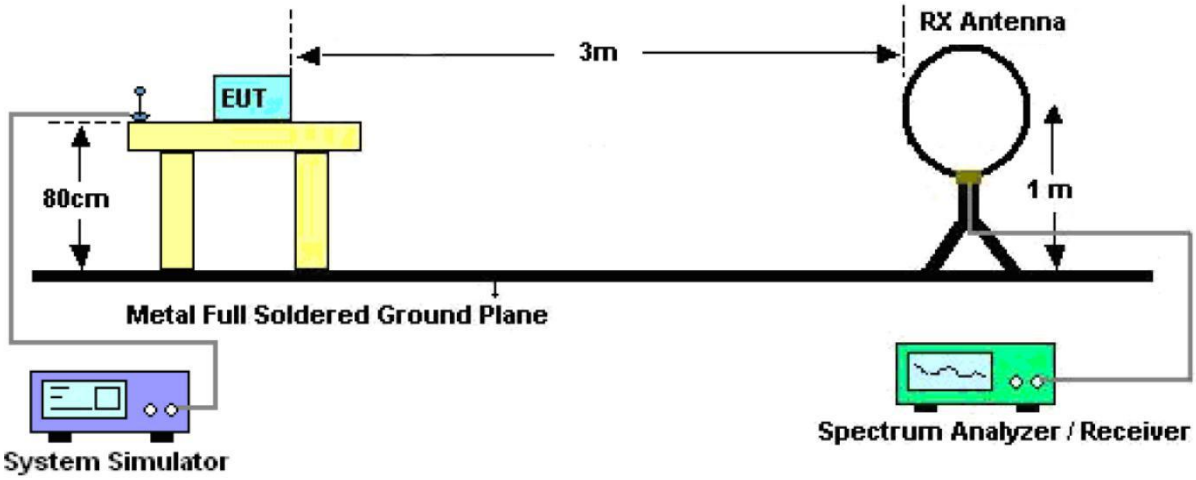


Figure 1. Below 30MHz

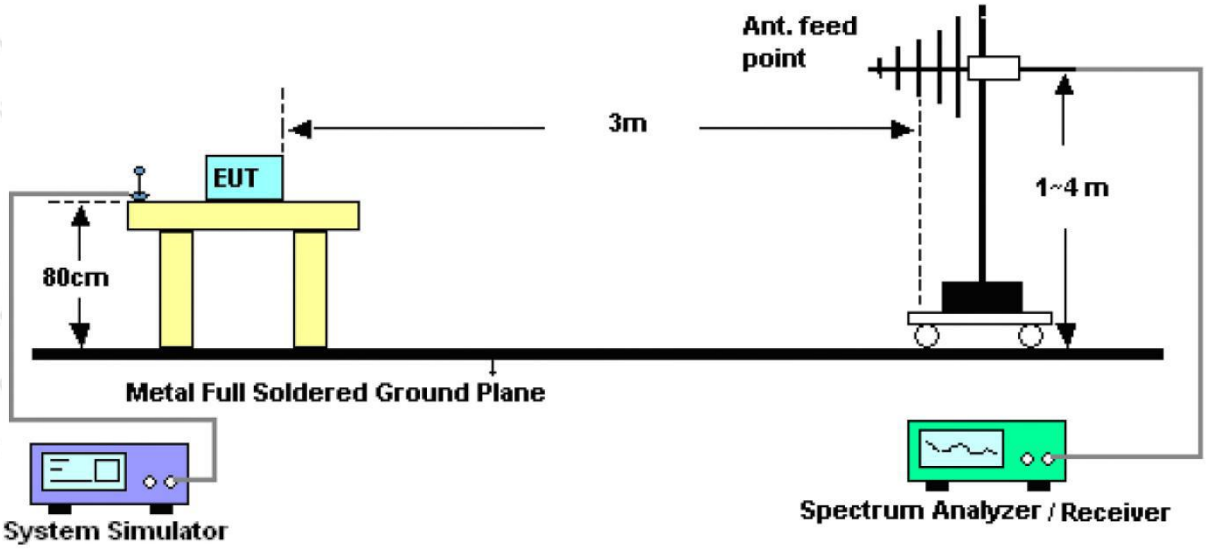


Figure 2. 30MHz to 1GHz

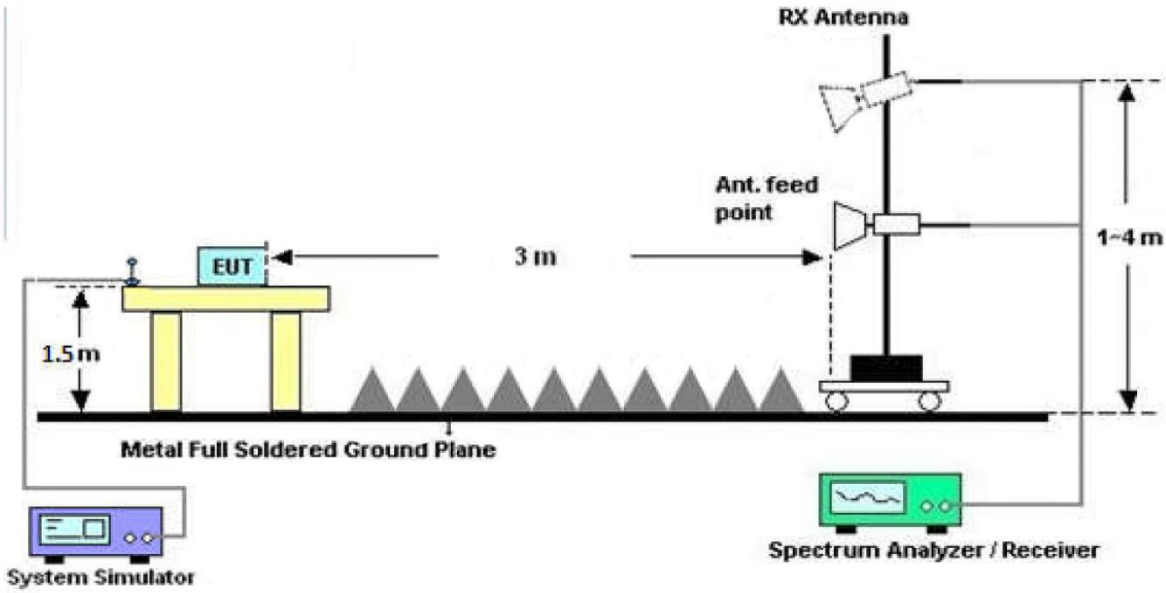


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.
For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.
The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

For 9kHz to 150kHz, Set the spectrum analyzer as:
RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:
RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:
RBW = 100kHz, VBW =300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.
.
For above 1GHz, Set the spectrum analyzer as:
RBW =1MHz, VBW =1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.
RBW =1MHz, VBW =10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

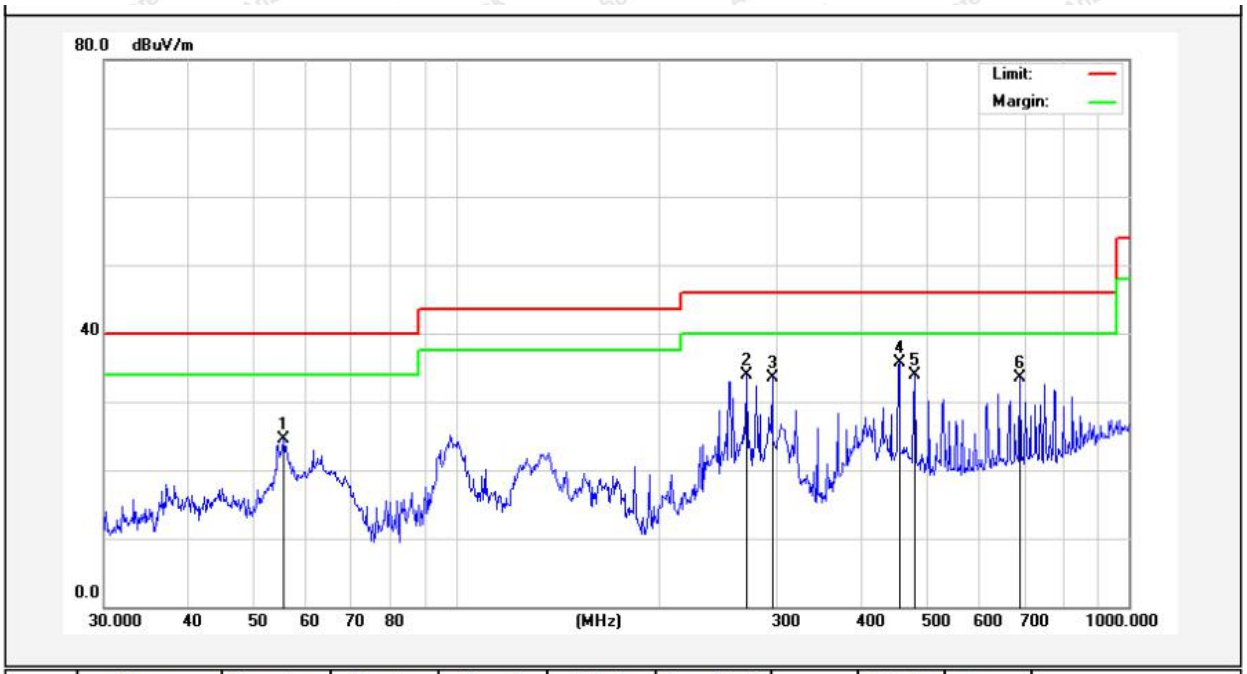
PASS

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Note: During the test, pre-scan all modes, and found the 802.11n20 CH40 which is the worst case, only the worst case is recorded in the report.

Test Results (30~1000MHz)

Test Mode:	802.11n20 CH40
Power Source:	DC 11.1V Battery inside
Polarization:	Horizontal
Temp.(℃)/Hum.(%RH):	23.1℃/46%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	55.4147	42.03	-17.62	24.41	40.00	-15.59	QP			
2	270.3748	53.60	-19.72	33.88	46.00	-12.12	QP			
3	295.1469	51.19	-17.59	33.60	46.00	-12.40	QP			
4	455.9058	50.98	-15.28	35.70	46.00	-10.30	QP			
5	480.5276	48.28	-14.43	33.85	46.00	-12.15	QP			
6	689.5644	43.51	-10.07	33.44	46.00	-12.56	QP			

Test Results (30~1000MHz)

Test Mode:	802.11n20 CH40
Power Source:	DC 11.1V Battery inside
Polarization:	Vertical
Temp.(℃)/Hum.(%RH):	23.1℃/46%RH

No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	54.2610	45.41	-17.35	28.06	40.00	-11.94	QP			
2	61.3462	46.72	-17.98	28.74	40.00	-11.26	QP			
3	98.1419	44.64	-16.81	27.83	43.50	-15.67	QP			
4	455.9057	50.58	-13.51	37.07	46.00	-8.93	QP			
5	614.2142	45.95	-10.56	35.39	46.00	-10.61	QP			
6	890.7278	43.96	-6.46	37.50	46.00	-8.50	QP			

Test Results (Above 1000MHz)

Test Mode: IEEE 802.11n20				Test channel: Low CH		
Peak value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10360.00	31.27	23.81	55.08	68.20	-13.12	V
15540.00	32.44	28.68	61.12	68.20	-7.08	V
10360.00	31.42	23.81	55.23	68.20	-12.97	H
15540.00	32.61	28.68	61.29	68.20	-6.91	H
Average value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	polarization
10360.00	20.491	23.81	44.30	54.00	-9.70	V
15540.00	21.410	28.68	50.09	54.00	-3.91	V
10360.00	20.605	23.81	44.42	54.00	-9.58	H
15540.00	21.372	28.68	50.05	54.00	-3.95	H

Test Mode: IEEE 802.11n20				Test channel: Middle CH		
Peak value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10400.00	30.63	23.81	54.44	68.20	-13.76	V
15600.00	31.97	29.13	61.10	68.20	-7.10	V
10400.00	30.91	23.81	54.72	68.20	-13.48	H
15600.00	32.13	29.13	61.26	68.20	-6.94	H
Average value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	polarization
10400.00	20.761	23.81	44.57	54.00	-9.43	V
15600.00	21.530	29.13	50.66	54.00	-3.34	V
10400.00	20.595	23.81	44.41	54.00	-9.59	H
15600.00	21.452	29.13	50.58	54.00	-3.42	H

Test Mode: IEEE 802.11n20				Test channel: High CH		
Peak value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10480.00	30.20	23.80	54.00	68.20	-14.20	V
15720.00	31.45	30.03	61.48	68.20	-6.72	V
10480.00	30.55	23.80	54.35	68.20	-13.85	H
15720.00	31.04	30.03	61.07	68.20	-7.13	H
Average value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	polarization
10480.00	19.43	23.80	43.23	54.00	-10.77	V
15720.00	20.29	30.03	50.32	54.00	-3.68	V
10480.00	19.81	23.80	43.61	54.00	-10.39	H
15720.00	20.24	30.03	50.27	54.00	-3.73	H

Remark:

1. Result =Reading + Factor

Address: 1/F., Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86) 755-26066440 Fax: (86) 755-26014772 Email: service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

Radiated Band Edge:

Test Mode: 802.11n20				Test channel: Lowest		
Peak value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5150.00	35.66	15.99	51.65	68.20	-16.55	Horizontal
5150.00	36.94	15.99	52.93	68.20	-15.27	Vertical
Average value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Polarization
5150.00	26.38	15.99	42.37	54.00	-11.63	Horizontal
5150.00	27.41	15.99	43.40	54.00	-10.60	Vertical

Test Mode: 802.11n20				Test channel: Highest		
Peak value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5250.00	37.41	16.43	53.84	68.20	-14.36	Horizontal
5250.00	38.52	16.43	54.95	68.20	-13.25	Vertical
Average value:						
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Polarization
5250.00	27.40	16.43	43.83	54.00	-10.17	Horizontal
5250.00	28.74	16.43	45.17	54.00	-8.83	Vertical

Remark: 1. Result =Reading + Factor

Conducted Measurement:

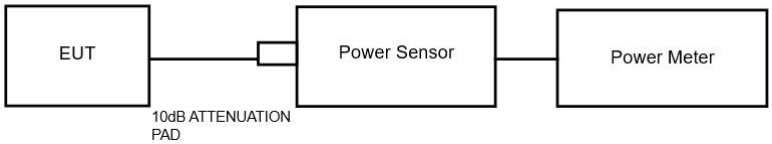
Please refer to Appendix D of the Appendix Test Data.

5. Maximum conducted output power Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.407(a)	
Test Limit	5.15 - 5.25GHz	1) Outdoor AP The maximum conducted output power (Pout) shall not exceed the lesser of 1W (30dBm). if GTx>6dBi, then Pout =30-(GTx-6). e.i.r.p. at any elevation angle above 30 degrees≤125mW (21dBm) 2) Indoor AP The maximum conducted output power (Pout) shall not exceed the lesser of 1W (30dBm). if GTx>6dBi, then Pout =30-(GTx-6). 3) Point-to-point AP The maximum conducted output power (Pout) shall not exceed the lesser of 1W (30dBm). if GTx>23dBi, then Pout =30-(GTx-23). 4) Client devices The maximum conducted output power (Pout) shall not exceed the lesser of 250W (24dBm). if GTx>6dBi, then Pout =24-(GTx-6).

5.2. Test Setup



5.3. Test Procedure

1. The Transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the power value.
3. Repeat above procedures on all channels needed to be tested.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

5.4. Test Data

Pass

Please refer to Appendix B of the Appendix Test Data.

Additional test for duty cycle.

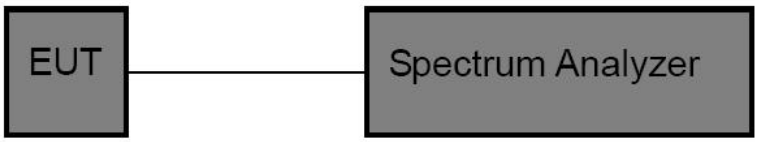
Please refer to Appendix E of the Appendix Test Data.

6. Occupy Bandwidth Test

6.1. Test Standard

Test Standard	FCC Part15 C Section 15.407 (a)(5)

6.2. Test Setup



6.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:

26 dB &99%bandwidth

RBW = approximately 1% of the emission bandwidth;
Set the VBW＞RBW;
Detector= Peak
Trace mode= Max hold.
Sweep- auto couple.

6 dB bandwidth

RBW = approximately 1% of the emission bandwidth;
Set the VBW＞RBW;
Detector= Peak
Trace mode= Max hold.
Sweep- auto couple.

4. Measure the maximum width of the emission that is 26dB /6dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer.

5. Repeat until all the rest channels are investigated.

6.4. Test Data

Pass

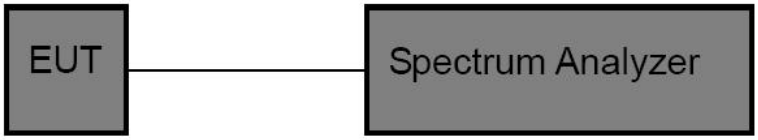
Please refer to Appendix A1&A2 of the Appendix Test Data.

7. Power Spectral Density Test

7.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.407(a)	
Test Limit	5.15 - 5.25GHz	1) Outdoor AP The peak power spectral density (PSD) shall not exceed the lesser of 17dBm/MHz. if GTx>6dBi, then PSD =17-(GTx-6). 2) Indoor AP The peak power spectral density (PSD) shall not exceed the lesser of 17dBm/MHz. if GTx>6dBi, then PSD =17-(GTx-6). 3) Point-to-point AP The peak power spectral density (PSD) shall not exceed the lesser of 17dBm/MHz. if GTx>23dBi, then PSD =17-(GTx-23). 4) Client devices The peak power spectral density (PSD) shall not exceed the lesser of 11dBm/MHz. if GTx>6dBi, then PSD =11-(GTx-6).

7.2. Test Setup



7.3. Test Procedure

For devices operating in the bands 5.15-5.25 GHz the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz).

1. The EUT is directly connected to the spectrum analyzer;
2. Set RBW =1MHz(for WIFI 5.2G);
3. Set VBW ≥ 3 RBW=3MHz(for WIFI 5.2G);
3. Set the span to encompass the entire emissions bandwidth (EBW) of the signal;
5. Detector=RMS;
6. Sweep time= auto couple;
7. Trace mode=max. hold;

7.4. Test Data

Pass

Please refer to Appendix C of the Appendix Test Data.

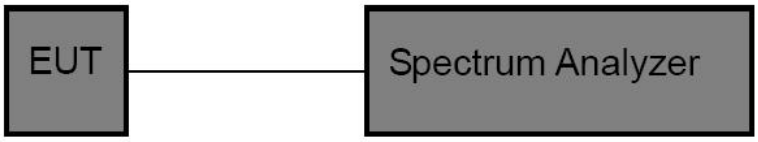
Address: 1/F., Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86) 755-26066440 Fax: (86) 755-26014772 Email: service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

8. Frequency Stability

8.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.407(g) &Part2 J Section 2.1055
Test Limit	The frequency tolerance shall be maintained within the band of operation frequency over a temperature variation of 0 degrees to 35 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

8.2. Test Setup



8.3. Test Procedure

The EUT was placed inside the environmental test chamber and powered by nominal AC/DC voltage. b. Turn the EUT on and couple its output to a spectrum analyzer. c. Turn the EUT off and set the chamber to the highest temperature specified. d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature. f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

8.4. Test Data

Pass

Please to see the following pages.

Test Mode: 5.2G							
Mode	TX Type	Frequency (MHz)	Temperature (°C)	Voltage (VDC)	Measured Frequency (MHz)	Limit	Verdict
802.11n (HT20)	SISO	5180	20	9.44	5180.02	5172 to 5188	Pass
				11.10	5180.08	5172 to 5188	Pass
				12.77	5180.06	5172 to 5188	Pass
			-30	11.10	5180.13	5172 to 5188	Pass
			-20	11.10	5180.02	5150 to 5250	Pass
			-10	11.10	5180.12	5150 to 5250	Pass
			0	11.10	5180.09	5150 to 5250	Pass
			10	11.10	5180.08	5150 to 5250	Pass
			30	11.10	5180.12	5150 to 5250	Pass
			40	11.10	5180.03	5150 to 5250	Pass
			50	11.10	5180.11	5172 to 5188	Pass
		5200	20	9.44	5200.04	5192 to 5208	Pass
				11.10	5200.06	5192 to 5208	Pass
				12.77	5200.06	5192 to 5208	Pass
			-30	11.10	5200.00	5192 to 5208	Pass
			-20	11.10	5200.02	5150 to 5250	Pass
			-10	11.10	5200.02	5150 to 5250	Pass
			0	11.10	5200.01	5150 to 5250	Pass
			10	11.10	5200.10	5150 to 5250	Pass
			30	11.10	5200.11	5150 to 5250	Pass
			40	11.10	5200.01	5150 to 5250	Pass
			50	11.10	5200.12	5192 to 5208	Pass
		5240	20	9.44	5240.05	5232 to 5248	Pass
				11.10	5240.02	5232 to 5248	Pass
				12.77	5240.00	5232 to 5248	Pass
			-30	11.10	5240.11	5232 to 5248	Pass
			-20	11.10	5240.10	5150 to 5250	Pass
			-10	11.10	5240.12	5150 to 5250	Pass
			0	11.10	5240.05	5150 to 5250	Pass
			10	11.10	5240.03	5150 to 5250	Pass
			30	11.10	5240.02	5150 to 5250	Pass
			40	11.10	5240.02	5150 to 5250	Pass
			50	11.10	5240.06	5232 to 5248	Pass

9. Antenna Requirement

9.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203 /15.407
Requirement	1) 15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 2) 15.407 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

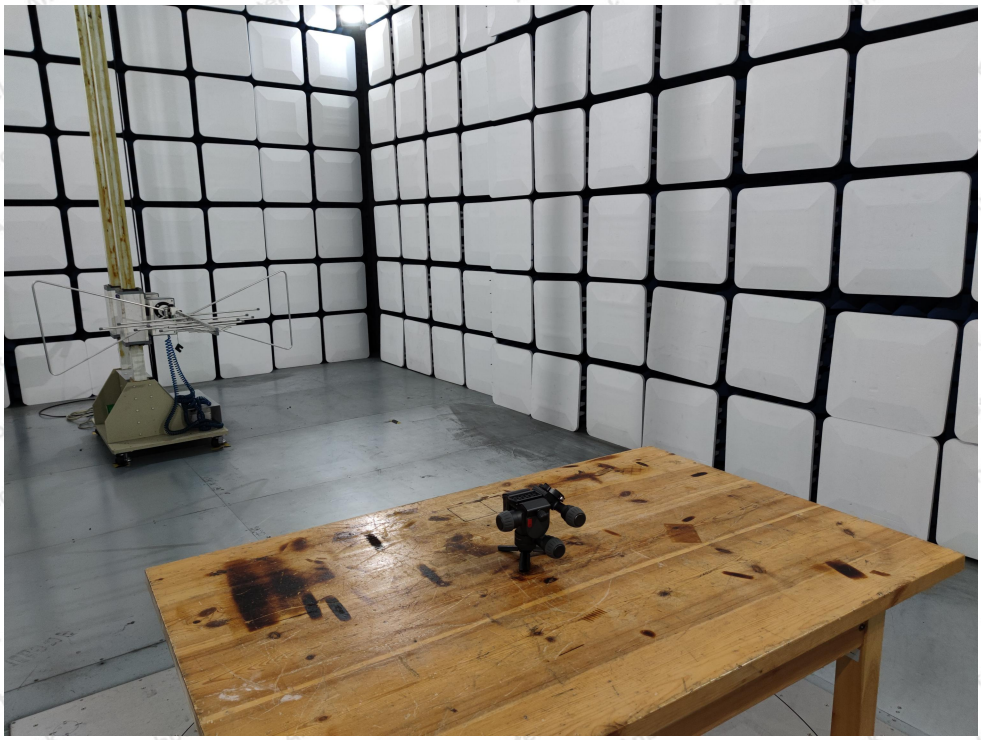
9.2. Antenna Connected Construction

The antenna is a FPC antenna which permanently attached, and the best case gain of the antenna is 6.48dBi It complies with the standard requirement.

APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Conducted Emission Measurement

Photo of Radiation Emission Test



APPENDIX II -- EXTERNAL PHOTOGRAPH

Reference to the test report 18220WC20066901.

APPENDIX III -- INTERNAL PHOTOGRAPH

Reference to the test report 18220WC20066901.

APPENDIX IV – Appendix Test Data