FCC Test Report

Applicant	:	**Anker Innovations Limited**
Address	:	**Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong**
Product Name	:	**Nebula Mars 3 Air**
Report Date	:	**Oct. 31, 2023**

Shenzhen Anbotek Compliance Laboratory Limited

Contents

1. General Information 6
1.1. Client Information 6
1.2. Description of Device (EUT) 6
1.3. Auxiliary Equipment Used During Test 7
1.4. Description of Test Modes 8
1.5. Description Of Test Setup 9
1.6. Test Equipment List 10
1.7. Measurement Uncertainty 11
1.8. Description of Test Facility 11
1.9. Disclaimer 12
2. Summary of Test Results 13
3. Conducted Emission Test 14
3.1. Test Standard and Limit 14
3.2. Test Setup 14
3.3. Test Procedure 14
3.4. Test Data 14
4. Radiation Spurious Emission and Band Edge 17
4.1. Test Standard and Limit 17
4.2. Test Setup 18
4.3. Test Procedure 19
4.4. Test Data 20
5. Maximum conducted output power Test 25
5.1. Test Standard and Limit 25
5.2. Test Setup 25
5.3. Test Procedure 25
5.4. Test Data 26
6. 26dB Bandwidth & 99% Occupied Bandwidth Test 27
6.1. Test Standard 27
6.2. Test Setup 27
6.3. Test Procedure 27
6.4. Test Data 27
7. Minimum 6dB bandwidth Test 28
7.1. Test Standard 28
7.2. Test Setup 28
7.3. Test Procedure 28
7.4. Test Data 28
8. Power Spectral Density Test 29
8.1. Test Standard and Limit 29
8.2. Test Setup 29

8.3. Test Procedure 29
8.4. Test Data 30
9. Frequency Stability 31
9.1. Test Standard and Limit 31
9.2. Test Setup 31
9.3. Test Procedure 31
9.4. Test Data 31
10. Dynamic Frequency Selection 32
10.1. Requirement 32
10.2. Test Description 35
10.3. Information of Companion Device 37
10.4. Test Data 37
11. Antenna Requirement 38
11.1. Test Standard and Requirement 38
11.2. Antenna Connected Construction 38
APPENDIX I -- TEST SETUP PHOTOGRAPH 39
APPENDIX II -- EXTERNAL PHOTOGRAPH 39
APPENDIX III -- INTERNAL PHOTOGRAPH 39

TEST REPORT

Applicant	:	Anker Innovations Limited
Manufacturer	:	Anker Innovations Limited
Product Name	:	Nebula Mars 3 Air
Test Model No.	:	D2325
Reference Model No.	:	N/A
Trade Mark	:	NEBULA
Rating(s)	:	Input: 19V⎓4.74A (with DC 10.8V, 6000mAh battery inside)
Test Standard(s)	:	**FCC Part15 Subpart E, Paragraph 15.407** **ANSI C63.10: 2020**
Test Method(s)	:	**789033 D02 General UNII Test Procedures New Rules v02r01** **662911 D01 Multiple Transmitter Output 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	Aug. 16, 2023
Date of Test	Aug. 16 ~ Oct. 31, 2023
Prepared By	Nian xiu Chen (Nianxiu Chen)
Approved & Authorized Signer	Edward pan (Edward Pan)

Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Oct. 31, 2023

1. General Information

1.1. Client Information

Applicant	:	Anker Innovations Limited
Address	:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong
Manufacturer	:	Anker Innovations Limited
Address	:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong

1.2. Description of Device (EUT)

Product Name	:	Nebula Mars 3 Air
Test Model No.	:	D2325
Reference Model No.	:	N/A
Trade Mark	:	NEBULA
Test Power Supply	:	AC 120V, 60Hz for Adapter
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Hardware Version	:	B145C
Software Version	:	V11.0.19
Adapter	:	Model: NSA90ED-19047401 Input: 100-240V~50/60Hz 2.0A Output: 19V⎓4.74A 90.0W
RF Specification		
Operation Mode	:	☒ a ☒ n(HT20) ☒ n(HT40) ☒ ac(VHT20) ☒ ac(VHT40) ☒ ac(VHT80) ☐ ac(VHT160) ☐ ax(HEW20) ☐ ax(HEW40) ☐ ax(HEW80) ☐ ax(HEW160)
Device Type	:	☐ Outdoor AP ☐ Indoor AP ☐ Point-to-point AP ☒ Client
TPC Function	:	☐ With TPC ☒ Without TPC
DFS Type	:	☒ Slave without radar detection ☐ Slave with radar detection ☐ Master
Operation Frequency	:	☒ Wi-Fi 5.2G: 5150~5250MHz ☒ Wi-Fi 5.3G: 5250~5350MHz ☒ Wi-Fi 5.6G: 5470~5725MHz ☒ Wi-Fi 5.8G: 5725~5850MHz

Number of Channel	:	Wi-Fi 5.2G: ☒4 Channels for 20MHz bandwidth (5180-5240MHz) ☒2 Channels for 40MHz bandwidth (5190-5230MHz) ☒1 Channels for 80MHz bandwidth (5210MHz) Wi-Fi 5.3G: ☒4 Channels for 20MHz bandwidth (5260-5320MHz) ☒2 Channels for 40MHz bandwidth (5270-5310MHz) ☒1 Channels for 80MHz bandwidth (5290MHz) Wi-Fi 5.6G: ☒12 Channels for 20MHz bandwidth (5500-5720MHz) ☒6 Channels for 40MHz bandwidth (5510-5710MHz) ☒3 Channels for 80MHz bandwidth (5530~5690MHz) Wi-Fi 5.8G: ☒5 Channels for 20MHz bandwidth (5745MHz ~ 5825MHz) ☒2 Channels for 40MHz bandwidth (5755MHz ~ 5795MHz) ☒1 Channels for 80MHz bandwidth (5775MHz)
Modulation Type	:	☒802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) ☒802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) ☒802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) ☐802.11ax: OFDMA(BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Antenna Type	:	Dipole Antenna
Antenna Gain(Peak)	:	ANT 0: 4.99dBi ANT 1: 5.36dBi
Directional antenna gain	:	8.19dBi
Remark: 1) All of the RF specification are provided by customer. 2) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual. 3) Only 802.11n(HT20), 802.11n(HT40), 802.11ac(HT20), 802.11ac(HT40), 802.11ac(HT80) support MIMO.		

1.3. Auxiliary Equipment Used During Test

Description	Rating(s)
Master device	Equipment: AX3000 Dual-Band Gigabit Wi-Fi 6 Router Model: RX9 Pro FCC-ID: V7TRX9P

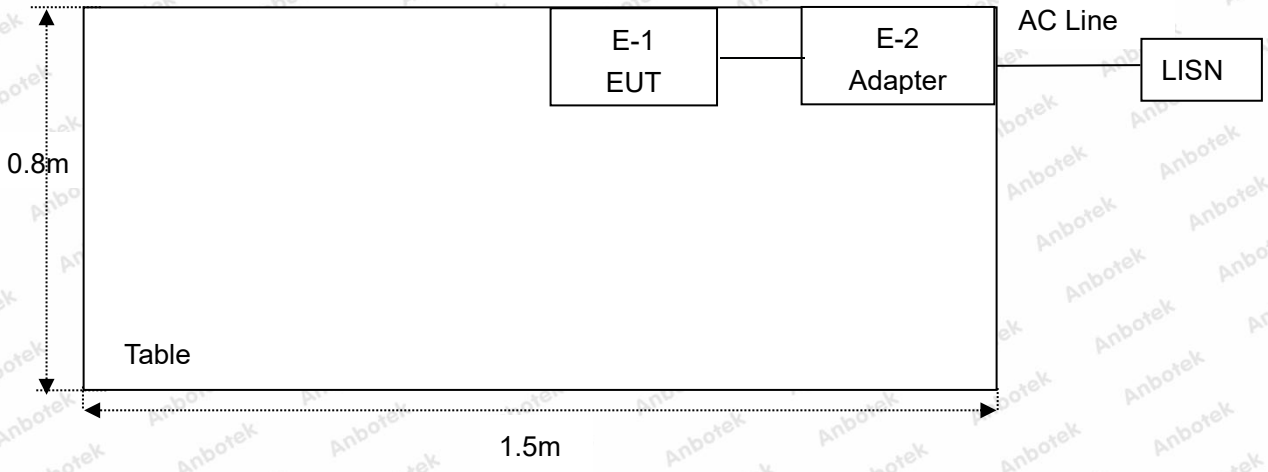
1.4. Description of Test Modes

(U-NII-1) 5180MHz-5240MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**36**	**5180**	40	5200
	44	**5220**	**48**	**5240**
40MHz	**38**	**5190**	**46**	**5230**
80MHz	**42**	**5210**		
(U-NII-2A) 5260MHz-5320MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**52**	**5260**	56	5280
	60	**5300**	**64**	**5320**
40MHz	**54**	**5270**	**62**	**5310**
80MHz	**58**	**5290**		
(U-NII-2C) 5500MHz-5720MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**100**	**5500**	105	5520
	108	5540	112	5560
	116	5580	**120**	**5600**
	124	5620	128	5640
	132	5660	136	5680
	140	5700	**144**	**5720**
40MHz	**102**	**5510**	110	5550
	118	5590	**126**	**5630**
	134	5670	**142**	**5710**
80MHz	**106**	**5530**	**122**	**5610**
	138	**5690**		
(U-NII-3) 5745MHz-5825MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**149**	**5745**	153	5765
	157	**5785**	161	5805
	165	**5825**		
40MHz	**151**	**5775**	**159**	**5795**
80MHz	**155**	**5775**		

Note 1: The black bold channels were selected for test.

1.5. Description Of Test Setup

CE



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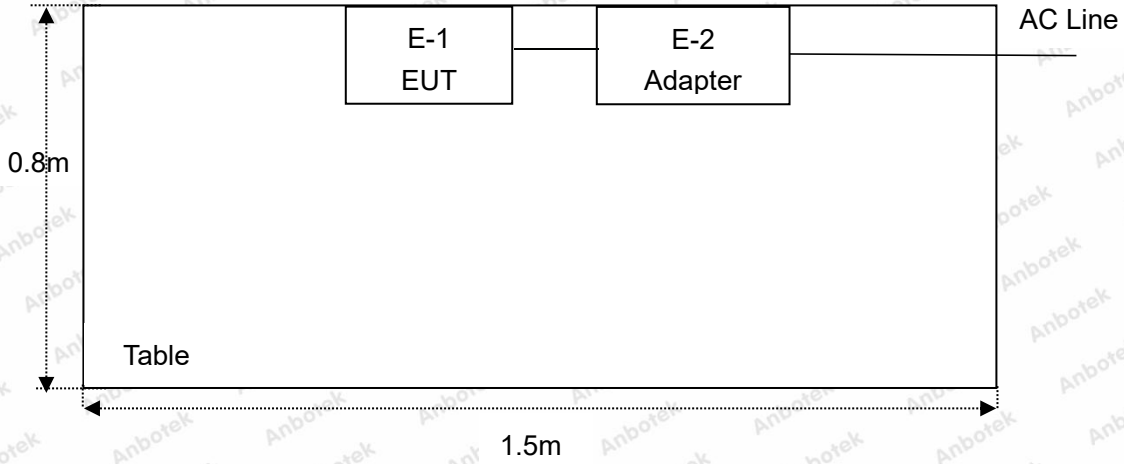


1.6. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Oct. 12, 2023	1 Year
2.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jul. 05, 2023	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 12, 2023	1 Year
4.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 12, 2023	1 Year
5.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 12, 2023	1 Year
6.	EMI Preamplifier	SKET Electronic	LNPA-0118G-45	SKET-PA-002	Oct. 12, 2023	1 Year
7.	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D	02555	Oct. 16, 2022	3 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	345	Oct. 23, 2022	3 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 12, 2023	1 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Oct. 12, 2023	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Oct. 12, 2023	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 12, 2023	1 Year
14.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 12, 2023	1 Year
15.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 12, 2023	1 Year
16.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 20, 2023	1 Year
17.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Oct. 16, 2023	1 Year
18.	Power Meter	Agilent	N1914A	MY50001102	Oct. 20, 2023	1 Year

1.7. Measurement Uncertainty

Parameter	Uncertainty
Conducted emissions (AMN 150kHz~30MHz)	3.8dB
Occupied Bandwidth	925Hz
Conducted Output Power	0.76dB
Conducted Spurious Emission	1.24dB
Radiated spurious emissions (Below 30MHz)	3.53dB
Radiated spurious emissions (30MHz~1GHz)	Horizontal: 3.92dB; Vertical: 4.52dB
Radiated spurious emissions (above 1GHz)	1G-6GHz: 4.78dB; 6G-18GHz: 4.88dB 18G-40GHz: 5.68dB
The measurement uncertainty and decision risk evaluated according to AB/WI-RF-F-032. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

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

1.9. Disclaimer

1. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
2. The test report is invalid if there is any evidence and/or falsification.
3. The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
4. This document may not be altered or revised in any way unless done so by Anbotek and all revisions are duly noted in the revisions section.
5. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
6. The authenticity of the information provided by the customer is the responsibility of the customer and the laboratory is not responsible for its authenticity.

The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

2. Summary of Test Results

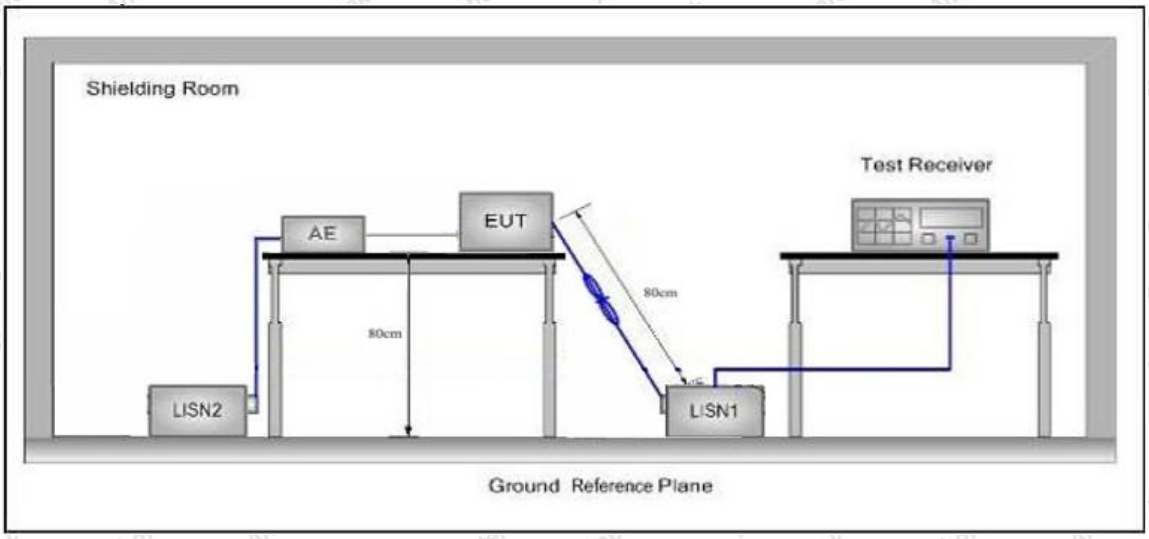
Standard	Test Type	Result
15.207 & 15.407(b)	Conducted Emission	PASS
15.205 & 15.209	Spurious Emission	PASS
15.407(b)	Band Edge	PASS
15.407(a) & 2.1049	26dB Bandwidth & 99% Occupied Bandwidth	PASS
15.407(e)	Minimum 6dB bandwidth (5.725-5.85GHz band)	PASS
15.407(a)	Maximum Conducted Output Power	PASS
15.407(a)	Peak Power Spectral Density	PASS
15.407(g)	Frequency Stability	PASS
15.407(h)	Dynamic Frequency Selection (DFS)	PASS
15.203	Antenna Requirement	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(b)		
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.

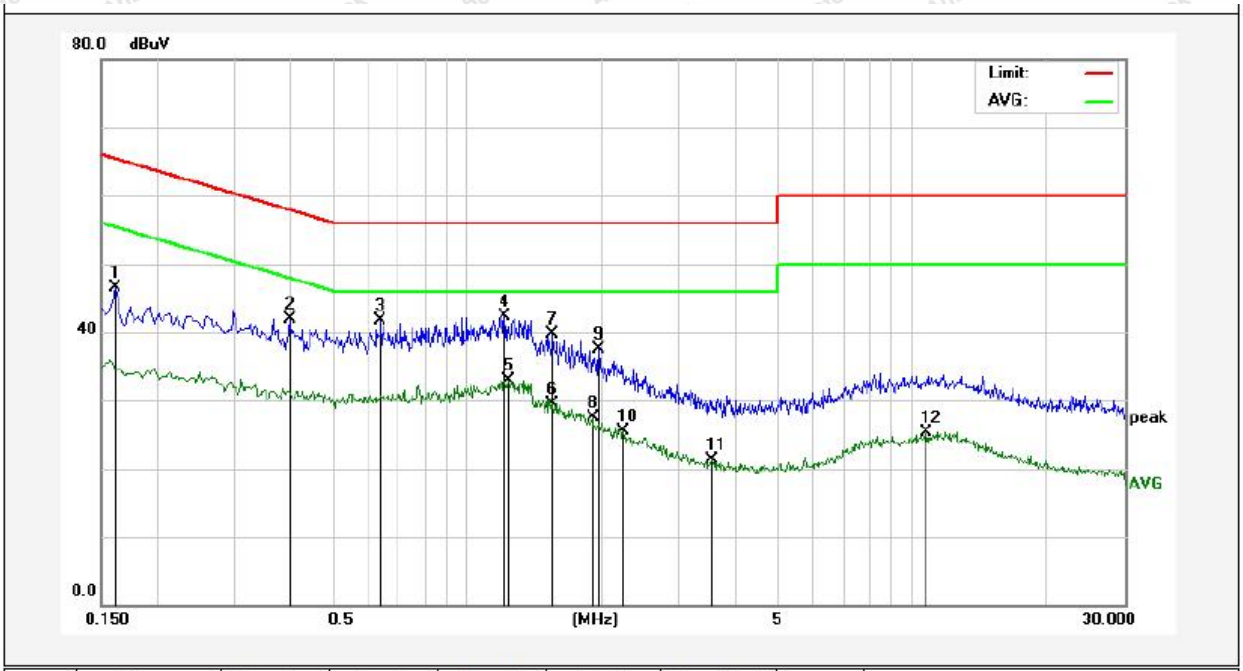
3.4. Test Data

During the test, pre-scan all modes, only the worst case is recorded in the report.

AC conducted emission pre-test at both at AC 120V/60Hz and AC 240V/60Hz modes, recorded worst case AC 120V/60Hz.

Conducted Emission Test Data

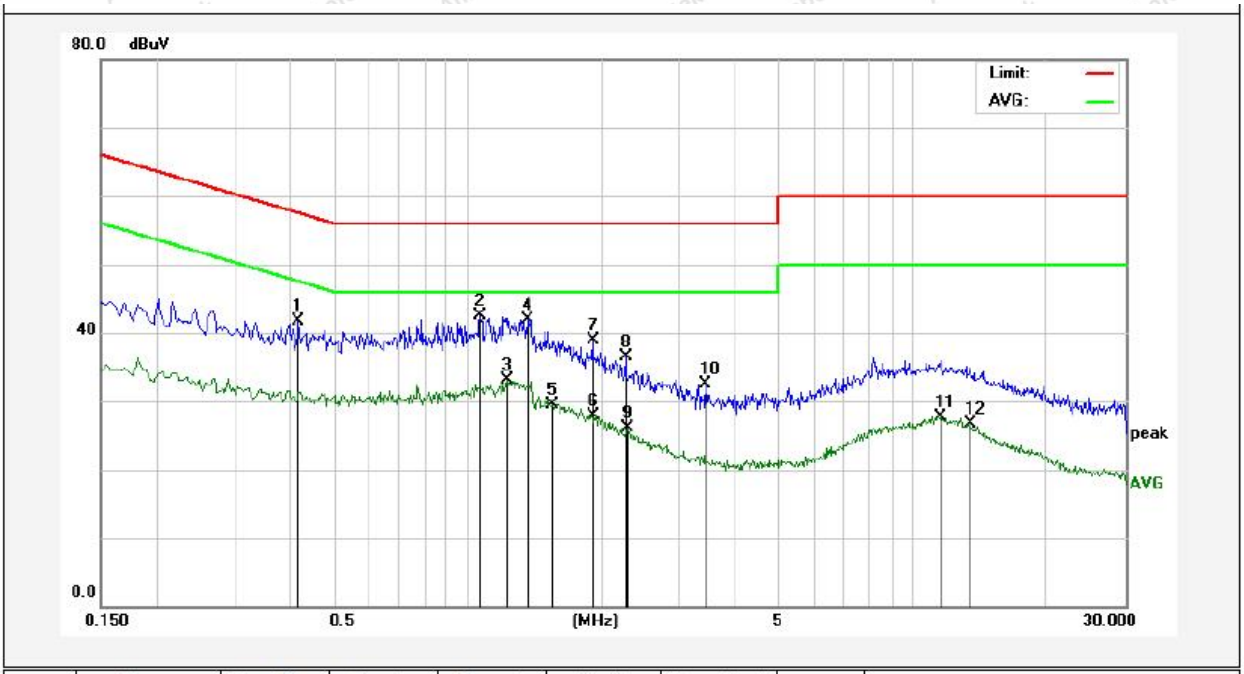
Test Site:	1# Shielded Room
Operating Condition:	802.11n(HT20) 5300MHz (MIMO)
Test Specification:	AC 120V, 60Hz for Adapter
Comment:	Live Line
Temp.(℃)/Hum.(%RH):	24.2℃/49%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1620	26.66	19.83	46.49	65.36	-18.87	QP	
2	0.3980	22.10	19.81	41.91	57.89	-15.98	QP	
3	0.6380	21.94	19.86	41.80	56.00	-14.20	QP	
4	1.2140	22.54	19.84	42.38	56.00	-13.62	QP	
5	1.2379	13.11	19.84	32.95	46.00	-13.05	AVG	
6	1.5460	9.69	19.84	29.53	46.00	-16.47	AVG	
7	1.5580	19.79	19.84	39.63	56.00	-16.37	QP	
8	1.9139	7.70	19.83	27.53	46.00	-18.47	AVG	
9	1.9740	17.75	19.83	37.58	56.00	-18.42	QP	
10	2.2379	5.65	19.83	25.48	46.00	-20.52	AVG	
11	3.5619	1.44	19.85	21.29	46.00	-24.71	AVG	
12	10.7858	5.35	20.01	25.36	50.00	-24.64	AVG	

Conducted Emission Test Data

Test Site:	1# Shielded Room
Operating Condition:	802.11n(HT20) 5300MHz (MIMO)
Test Specification:	AC 120V, 60Hz for Adapter
Comment:	Neutral Line
Temp.(℃)/Hum.(%RH):	24.2℃/49%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.4180	21.83	19.82	41.65	57.49	-15.84	QP	
2	1.0700	22.65	19.85	42.50	56.00	-13.50	QP	
3	1.2260	13.26	19.84	33.10	46.00	-12.90	AVG	
4	1.3700	22.16	19.84	42.00	56.00	-14.00	QP	
5	1.5580	9.76	19.84	29.60	46.00	-16.40	AVG	
6	1.9060	8.02	19.83	27.85	46.00	-18.15	AVG	
7	1.9100	19.04	19.83	38.87	56.00	-17.13	QP	
8	2.2700	16.65	19.83	36.48	56.00	-19.52	QP	
9	2.2900	6.19	19.83	26.02	46.00	-19.98	AVG	
10	3.4300	12.76	19.84	32.60	56.00	-23.40	QP	
11	11.5020	7.76	20.03	27.79	50.00	-22.21	AVG	
12	13.5100	6.58	20.13	26.71	50.00	-23.29	AVG	

4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

Radiated Spurious Emission					
Test Standard	FCC Part15 C Section 15.205 & 15.209				
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

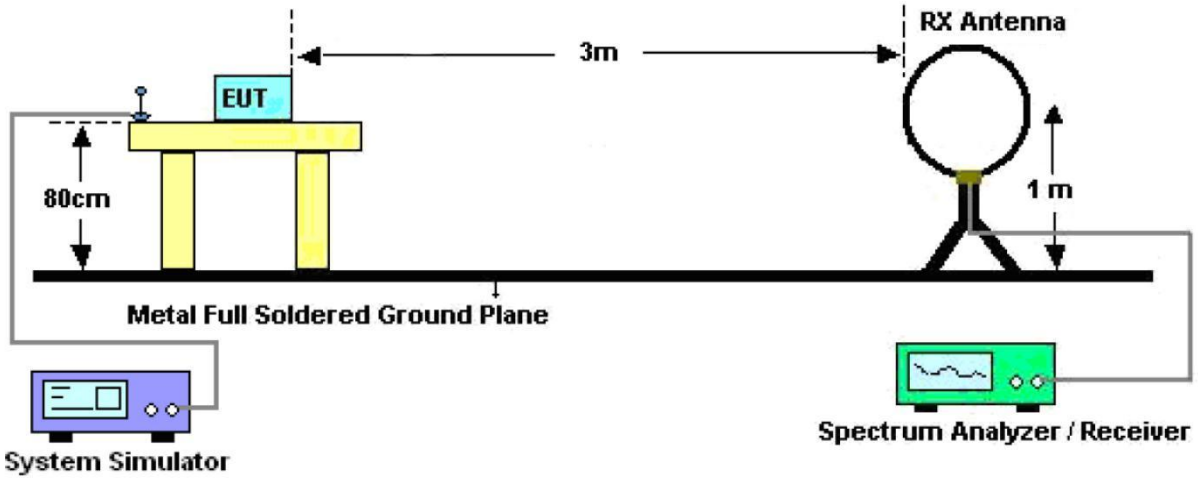


Figure 1. Below 30MHz

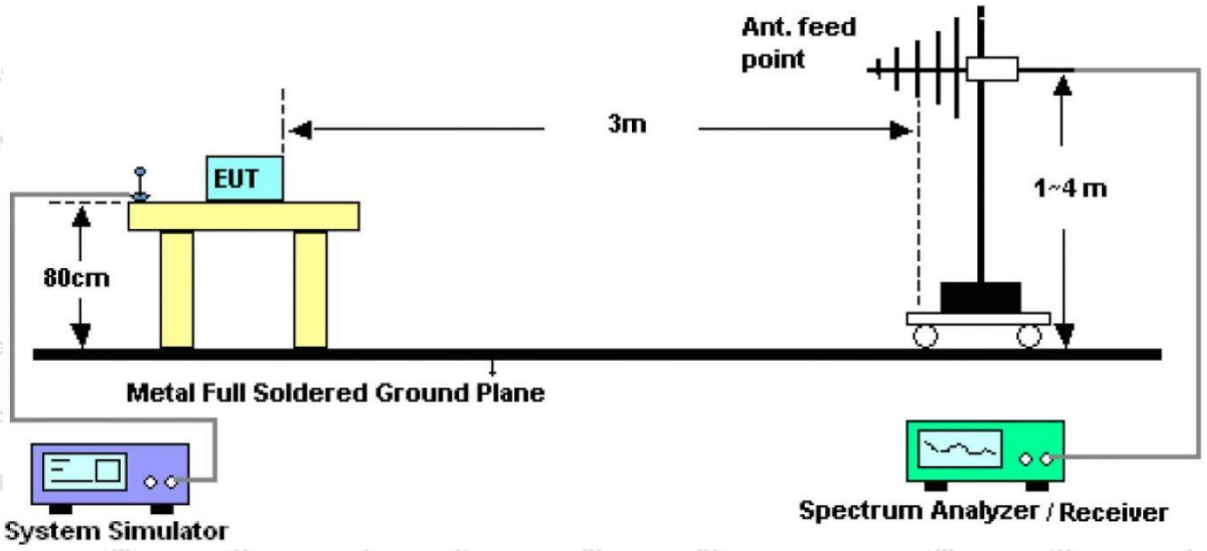


Figure 2. 30MHz to 1GHz

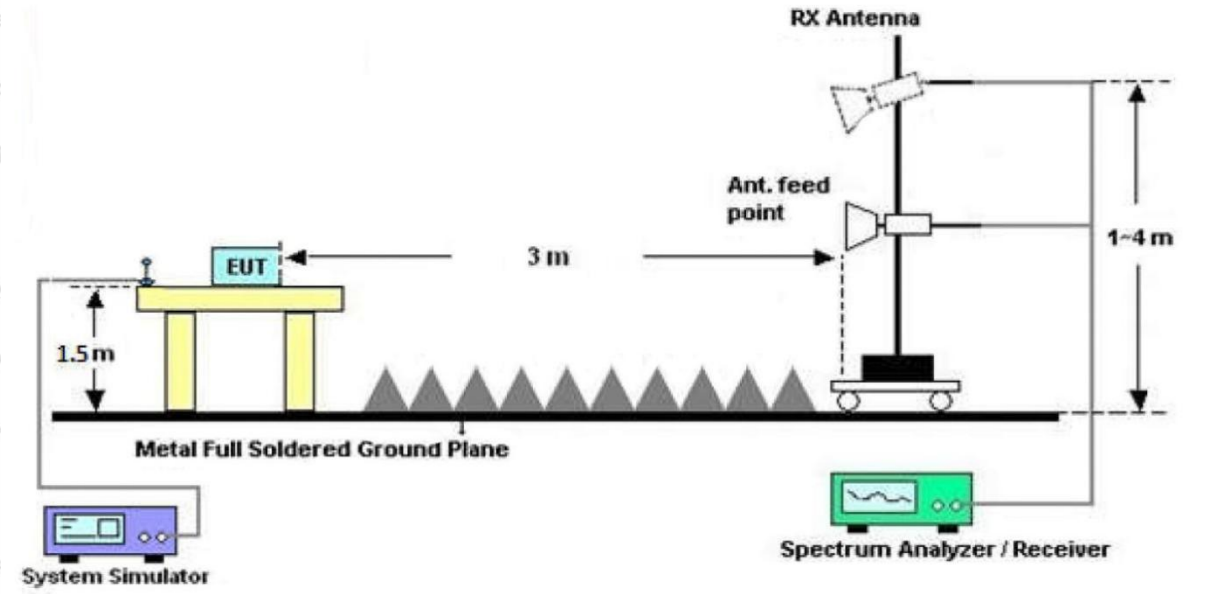


Figure 3. Above 1 GHz

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

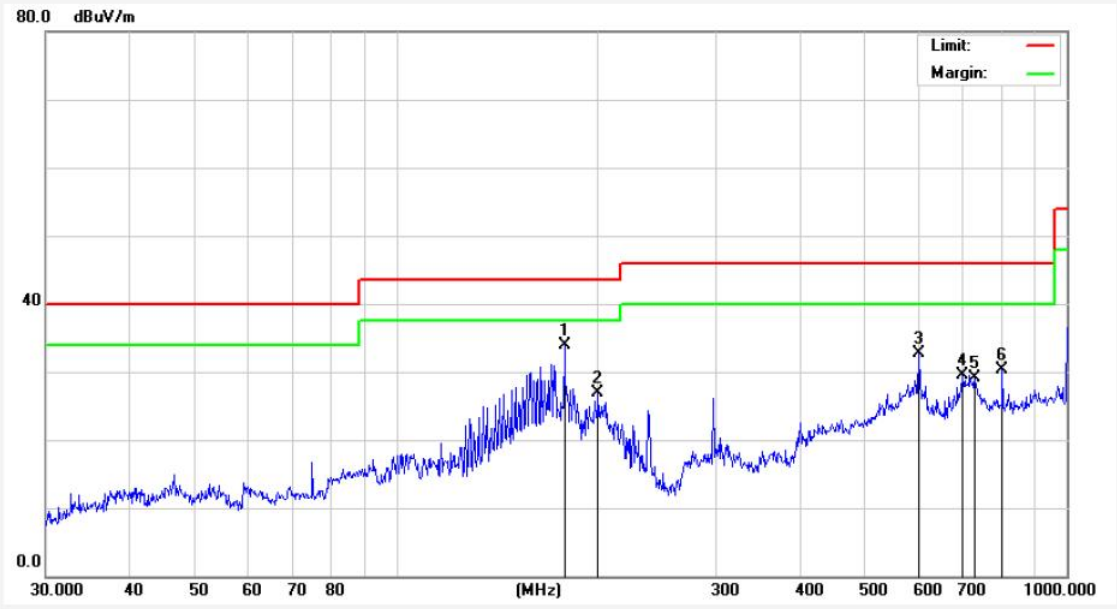
During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

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

During the test, pre-scan all the modes(pre-scan the Wi-Fi 5.2G, Wi-Fi 5.3G, Wi-Fi 5.6G, Wi-Fi 5.8G with the802.11a, 802.11n(HT20), ac(HT20), n(HT40), ac(HT40), ac(HT80) mode, and found the 802.11n(HT20) MIMO mode is worse case ,), only the worst case is recorded in the report.

Test Results (30~1000MHz)

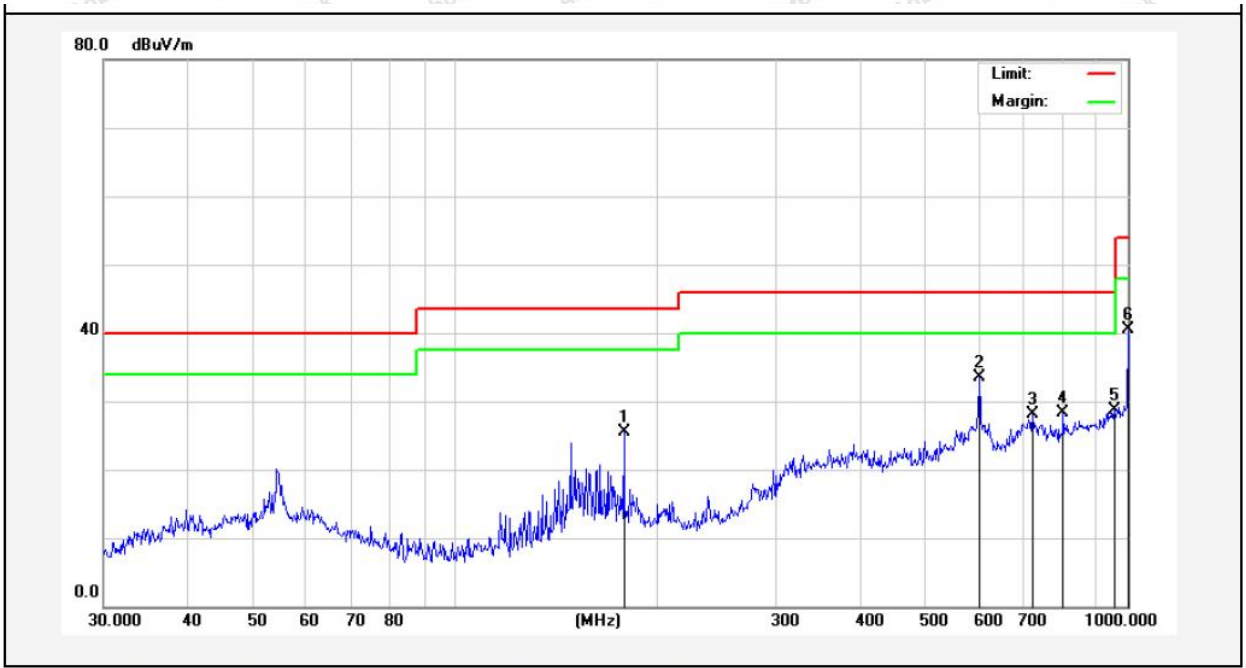
Test Mode:	802.11n(HT20) 5300MHz (MIMO)
Power Source:	AC 120V, 60Hz for Adapter
Polarization:	Horizontal
Temp.(℃)/Hum.(%RH):	23.5℃/49%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	178.1322	57.07	-23.26	33.81	43.50	-9.69	QP			
2	199.9856	49.31	-22.33	26.98	43.50	-16.52	QP			
3	601.4265	43.29	-10.53	32.76	46.00	-13.24	QP			
4	699.3046	39.45	-9.92	29.53	46.00	-16.47	QP			
5	729.3582	38.58	-9.52	29.06	46.00	-16.94	QP			
6	801.7862	38.51	-8.24	30.27	46.00	-15.73	QP			

Test Results (30~1000MHz)

Test Mode:	802.11n(HT20) 5300MHz (MIMO)
Power Source:	AC 120V, 60Hz for Adapter
Polarization:	Vertical
Temp.(℃)/Hum.(%RH):	23.5℃/49%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	178.1322	46.15	-20.70	25.45	43.50	-18.05	QP			
2	601.4265	44.06	-10.53	33.53	46.00	-12.47	QP			
3	721.7259	37.81	-9.62	28.19	46.00	-17.81	QP			
4	801.7862	36.50	-8.24	28.26	46.00	-17.74	QP			
5	955.4379	34.17	-5.55	28.62	46.00	-17.38	QP			
6	1000.0000	45.26	-4.77	40.49	54.00	-13.51	QP			

Test Results (Above 1000MHz)

Test Mode: IEEE 802.11n(HT20)MIMO for WiFi 5.3G							
Test channel: Low CH							
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over limit (dB)	Antenna Pol.	Detector
10520.00	27.72	23.81	51.53	68.20	-16.67	V	Peak
15780.00	29.07	30.48	59.55	68.20	-8.65	V	Peak
10520.00	28.65	23.81	52.46	68.20	-15.74	H	Peak
15780.00	27.75	30.48	58.23	68.20	-9.97	H	Peak
10520.00	17.587	23.81	41.40	54.00	-12.60	V	AVG
15780.00	19.268	30.48	49.75	54.00	-4.25	V	AVG
10520.00	19.024	23.81	42.83	54.00	-11.17	H	AVG
15780.00	18.475	30.48	48.95	54.00	-5.05	H	AVG
Test channel: Middle CH							
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over limit (dB)	Antenna Pol.	Detector
10600.00	28.91	23.87	52.78	68.20	-15.42	V	Peak
15900.00	28.12	31.38	59.50	68.20	-8.70	V	Peak
10600.00	27.95	23.87	51.82	68.20	-16.38	H	Peak
15900.00	28.17	31.38	59.55	68.20	-8.65	H	Peak
10600.00	18.257	23.87	42.13	54.00	-11.87	V	AVG
15900.00	19.018	31.38	50.40	54.00	-3.60	V	AVG
10600.00	18.304	23.87	42.17	54.00	-11.83	H	AVG
15900.00	18.625	31.38	50.00	54.00	-4.00	H	AVG
Test channel: High CH							
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over limit (dB)	Antenna Pol.	Detector
10640.00	28.25	23.90	52.15	68.20	-16.05	V	Peak
15960.00	27.62	31.83	59.45	68.20	-8.75	V	Peak
10640.00	28.32	23.90	52.22	68.20	-15.98	H	Peak
15960.00	27.73	31.83	59.56	68.20	-8.64	H	Peak
10640.00	17.00	23.90	40.90	54.00	-13.10	V	AVG
15960.00	17.98	31.83	49.81	54.00	-4.19	V	AVG
10640.00	17.47	23.90	41.37	54.00	-12.63	H	AVG
15960.00	18.94	31.83	50.77	54.00	-3.23	H	AVG

Remark:

1. During the test, pre-scan the Wi-Fi 5.2G, Wi-Fi 5.3G, Wi-Fi 5.6G, Wi-Fi 5.8G with the802.11a, 802.11n(HT20), ac(HT20), n(HT40), ac(HT40), ac(HT80) mode, and found the 802.11n(HT20) MIMO mode is worse case , the report only record this mode.

2. Result =Reading + Factor

3. For the frequency, which started from 18GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Radiated Band Edge & Conducted Measurement:

PASS

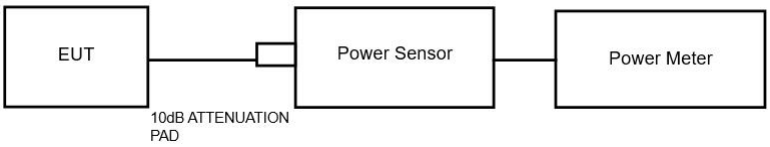
Please Refer to Appendix for Details.

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 (23.98dBm). if GTx>6dBi, then Pout =24-(GTx-6).
	5.25 - 5.35GHz	The maximum conducted output power (Pout) shall not exceed the lesser of 250mW (24dBm) or 11dBm+10 log B, where B is the 26dB emission bandwith in MHz. if GTx>6dBi, then Pout =24-(GTx-6).
	5.47- 5.725GHz	The maximum conducted output power (Pout) shall not exceed the lesser of 250mW (23.98dBm) or 11dBm+10 log B, where B is the 26dB emission bandwith in MHz. if GTx>6dBi, then Pout =24-(GTx-6).
	5.725 - 5.85GHz	1) Point-to-multipoint systems (P2M) The maximum conducted output power (Pout) shall not exceed the lesser of 1W (30dBm). if GTx>6dBi, then Pout =30-(GTx-6). 2) Point-to-point systems (P2P) The maximum conducted output power (Pout) shall not exceed the lesser of 1W (30dBm).

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 for Details.

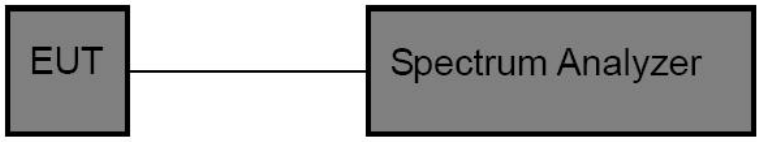
Additional test for duty cycle.
Please Refer to Appendix for Details.

6. 26dB Bandwidth & 99% Occupied Bandwidth Test

6.1. Test Standard

Test Standard	FCC Part15 C Section 15.407(a) & 2.1049
Test Limit	N/A

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.
4. Measure the maximum width of the emission that is 26dB 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

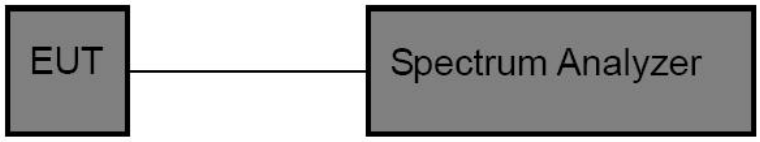
Please Refer to Appendix for Details.

7. Minimum 6dB bandwidth Test

7.1. Test Standard

Test Standard	FCC Part15 C Section 15.407(e)
Test Limit	≥500 kHz

7.2. Test Setup



7.3. 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.

4. Set the spectrum analyzer as:

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 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.

7.4. Test Data

Pass

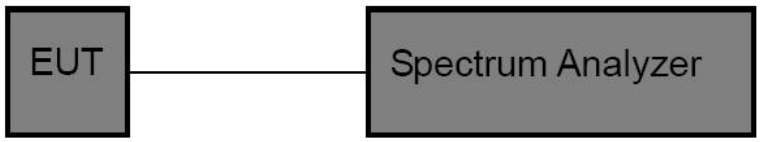
Please Refer to Appendix for Details.

8. Power Spectral Density Test

8.1. 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).
	5.25 - 5.35GHz	The peak power spectral density (PSD) shall not exceed the lesser of 11dBm/MHz. if GTx>6dBi, then PSD =11-(GTx-6).
	5.47- 5.725GHz	The peak power spectral density (PSD) shall not exceed the lesser of 11dBm/MHz. if GTx>6dBi, then PSD =11-(GTx-6).
	5.725 - 5.85GHz	1) Point-to-multipoint systems (P2M) The peak power spectral density (PSD) shall not exceed the lesser of 30dBm/500kHz. if GTx>6dBi, then PSD =30-(GTx-6). 2) Point-to-point systems (P2P) The peak power spectral density (PSD) shall not exceed the lesser of 30dBm/500kHz.

8.2. Test Setup



8.3. Test Procedure

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. 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;

3. Set VBW ≥ 3 RBW=3MHz;

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;

8.4. Test Data

Pass

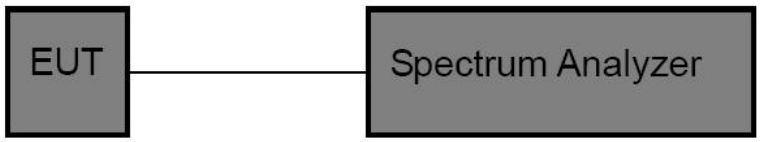
Please Refer to Appendix for Details.

9. Frequency Stability

9.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.407(g)
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.

9.2. Test Setup



9.3. 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.

9.4. Test Data

Pass

Please Refer to Appendix for Details.

10. Dynamic Frequency Selection

10.1. Requirement

According to FCC section 15.407(h), (1) Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW. (2) Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. Operators shall only use equipment with a DFS mechanism that is turned on when operating in these bands. The device must sense for radar signals at 100 percent of its emission bandwidth. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200 mW to 1 W is −64 dBm. For devices that operate with less than 200 mW e.i.r.p. and a power spectral density of less than 10 dBm in a 1 MHz band, the minimum detection threshold is −62 dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. For the initial channel setting, the manufacturers shall be permitted to provide for either random channel selection or manual channel selection.

A U-NII network will employ a DFS function to detect signals from radar systems and to avoid co-channel operation with these systems. This applies to the 5250-5350 MHz and/or 5470-5725 MHz bands.1

Within the context of the operation of the DFS function, a U-NII device will operate in either Master Mode or Client Mode. U-NII devices operating in Client Mode can only operate in a network controlled by a U-NII device operating in Master Mode.2

Tables 1 and 2 shown below summarize the information contained in sections 5.1.1 and 5.1.2.

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operational Mode		
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode	
	Master	Client Without Radar Detection
DFS Detection Threshold	Yes	Not required
Channel Closing Transmission Time	Yes	Yes
Channel Move Time	Yes	Yes

Address:1/F.,Building D,Sogood Science and Technology Park, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86) 0755-26066440 Fax:(86) 0755-26014772 Email:service@anbotek.com
Hotline 400-003-0500 www.anbotek.com.cn

U-NII Detection Bandwidth	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

The operational behavior and individual DFS requirements that are associated with these modes are as follows:

Master Devices

a) The Master Device will use DFS in order to detect Radar Waveforms with received signal strength above the DFS Detection Threshold in the 5250 − 5350 MHz and 5470 − 5725 MHz bands. DFS is not required in the 5150 − 5250 MHz or 5725 − 5825 MHz bands.

b) Before initiating a network on a Channel, the Master Device will perform a Channel Availability Check for specified time duration (Channel Availability Check Time) to ensure that there is no radar system operating on the Channel, using DFS described under subsection a) above.

c) The Master Device initiates a U-NII network by transmitting control signals that will enable other U-NII devices to Associate with the Master Device.

d) During normal operation, the Master Device will monitor the Channel (In-Service Monitoring) to ensure that there is no radar system operating on the Channel, using DFS described under a).

e) If the Master Device has detected a Radar Waveform during In-Service Monitoring as described under d), the Operating Channel of the U-NII network is no longer an Available Channel. The Master Device will instruct all associated Client Device(s) to stop transmitting on this Channel within the Channel Move Time. The transmissions during the Channel Move Time will be limited to the Channel Closing Transmission Time.

f) Once the Master Device has detected a Radar Waveform it will not utilize the Channel for the duration of the Non-Occupancy Period. 3.

g) If the Master Device delegates the In-Service Monitoring to a Client Device, then the combination will be tested to the requirements described under d) through f) above.

Client Devices

a) A Client Device will not transmit before having received appropriate control signals from a Master Device.

b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is

associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.

c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.

d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.

e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shut down (rather than moving channels), no beacons should appear.

DFS Detection Thresholds

Table 3 below provides the DFS Detection Thresholds for Master Devices as well as Client Devices incorporating In-Service Monitoring.

Table 3: DFS Detection Thresholds for Master Devices and Client Devices with Radar Detection

Maximum Transmit Power	Value (See Notes 1, 2, and 3)
EIRP ≥ 200 mill watt	-64 dBm
EIRP < 200 mill watt and power spectral density < 10 dBm/MHz	-62 dBm
EIRP < 200 mill watt that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

Response Requirements

Table 4 provides the response requirements for Master and Client Devices incorporating DFS.

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power

	bandwidth. See Note 3.

Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.

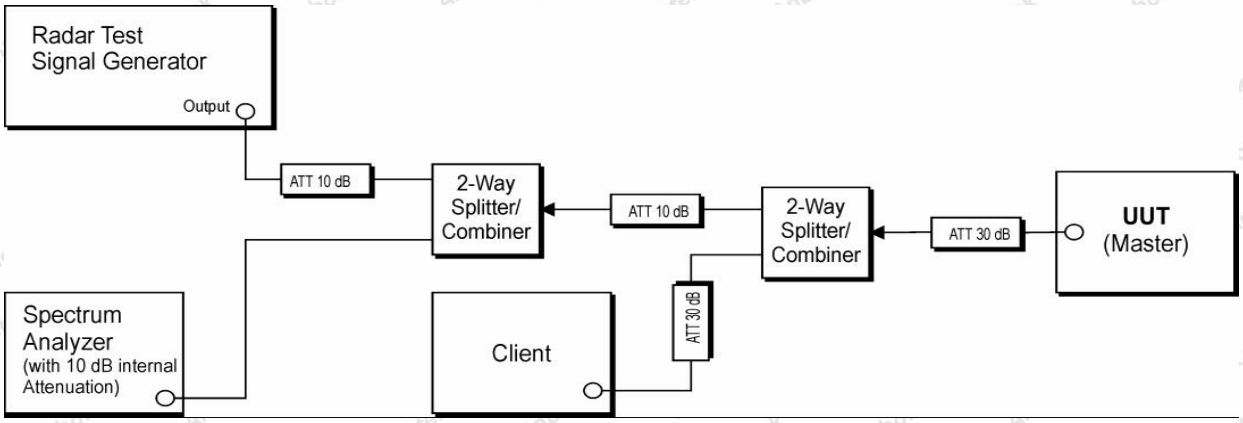
Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

10.2. Test Description

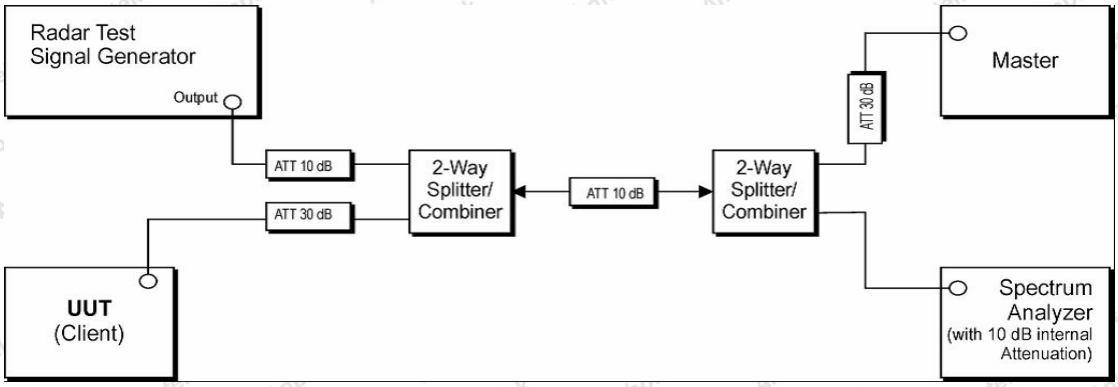
According to Section 7.2 of KDB 905462 D02 V01R01

1. Setup for Master with injection at the Master



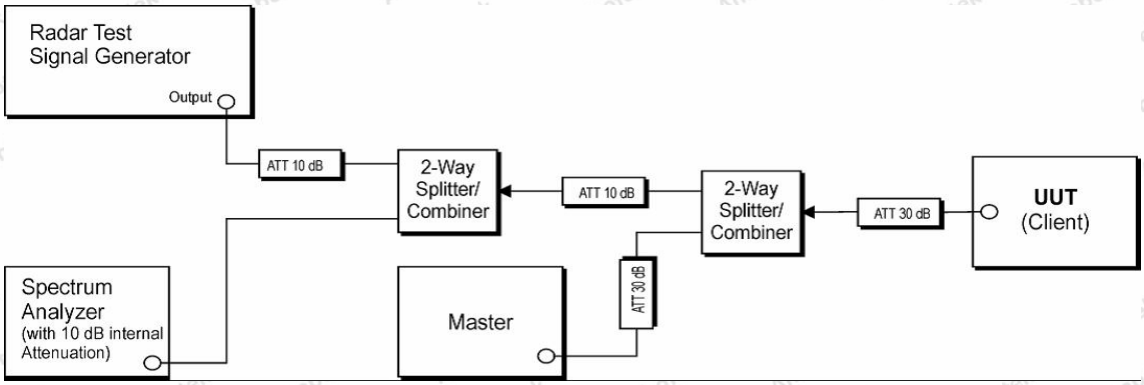
(Example Conducted Setup where UUT is a Master and Radar Test Waveforms are injected into the Master)

2. Setup for Client with injection at the Master



(Example Conducted Setup where UUT is a Client and Radar Test Waveforms are injected into the Master)

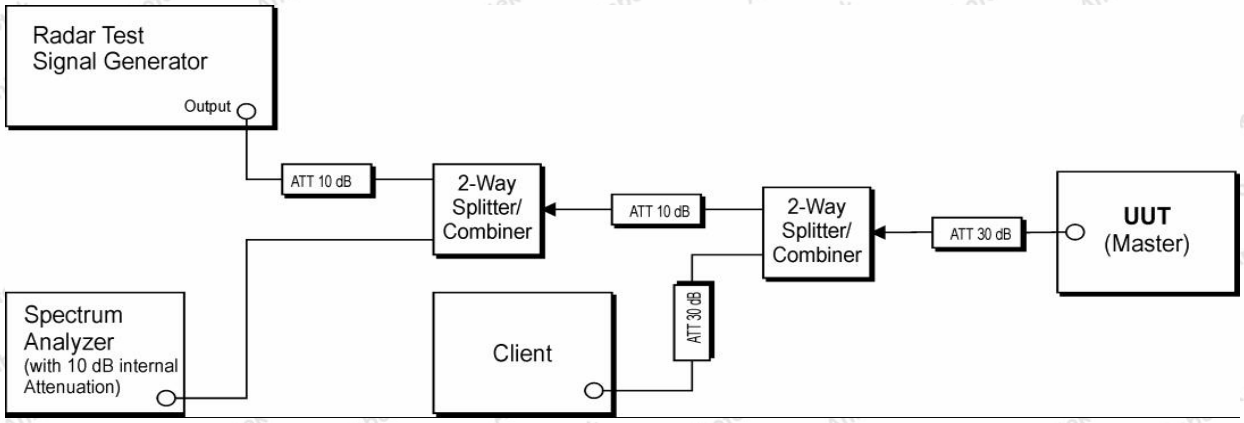
3. Setup for Client with injection at the Client



(Example Conducted Setup where UUT is a Client and Radar Test Waveforms are injected into the Client)

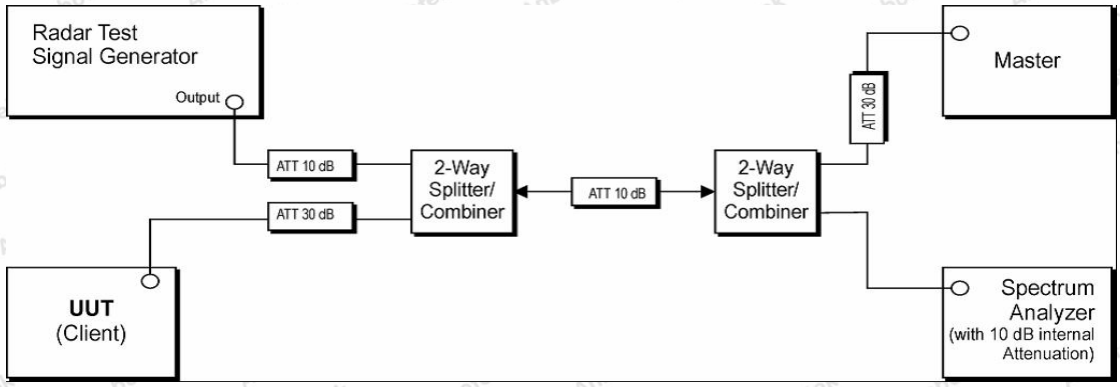
According to Section 7.2 of KDB 905462 D02 V01R01

1. Setup for Master with injection at the Master



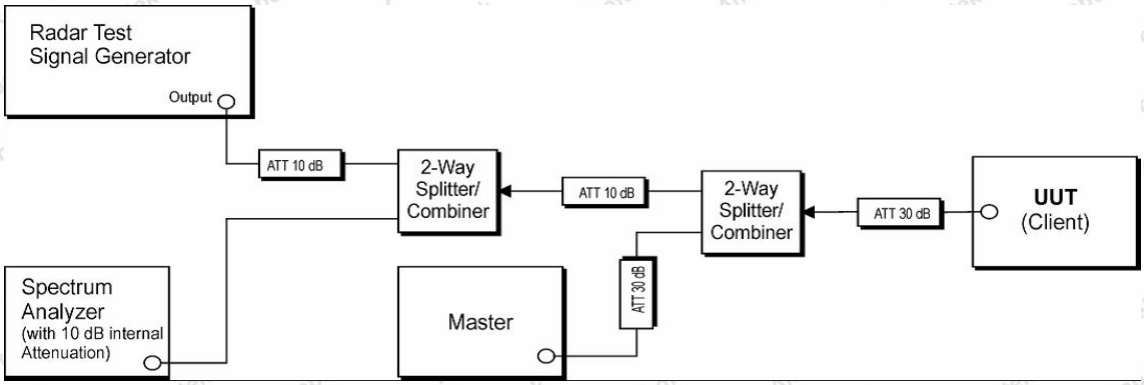
(Example Conducted Setup where UUT is a Master and Radar Test Waveforms are injected into the Master)

2. Setup for Client with injection at the Master



(Example Conducted Setup where UUT is a Client and Radar Test Waveforms are injected into the Master)

3. Setup for Client with injection at the Client



(Example Conducted Setup where UUT is a Client and Radar Test Waveforms are injected into the Client)

10.3. Information of Companion Device

Product Name:	Router
Manufacturer:	ASUS
FCC ID:	MSQ-RTAXJF00
Device Type:	Master Device
Operating Mode:	Master Mode
Serial No:	M3IAJF201046
Antenna Gain:	2.0dBi

10.4. Test Data

Please Refer to Appendix for Details.

11. Antenna Requirement

11.1. 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: if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Antenna Connected Construction

The antenna is a Dipole Antenna for ANT0/ANT1 which permanently attached, and the best case gain of the ANT 0: 4.99dBi; ANT 1: 5.36dBi. It complies with the standard requirement.

APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files Appendix I -- Test Setup Photograph

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files Appendix II -- External Photograph

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files Appendix III -- Internal Photograph

---------- End of Report ----------