

TEST REPORT

Applicant: Arashi Vision Inc.

Address of Applicant: Floor 6, Block A, Logan Century, Baoan District, Shenzhen 518000, China

Manufacturer/Factory: Arashi Vision Inc.

Address of Manufacturer/Factory: Floor 6, Block A, Logan Century, Baoan District, Shenzhen 518000, China

Trade Mark: Insta360

FCC ID: 2AWWH-CINOSXX-A

Applicable standards: FCC CFR Title 47 Part 15 Subpart E Section 15.407

Date of sample receipt: July 10, 2020

Date of Test: July 10-30, 2020

Date of report issued: July 30, 2020

Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

A circular blue stamp with the text "GLOBAL UNITED TECHNOLOGY SERVICES" around the perimeter and "GTS" in the center. Overlaid on the stamp is a handwritten signature in black ink that appears to read "Robinson Lo".

Robinson Lo

Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	July 30, 2020	Original

Prepared By:



Date:

July 30, 2020

Project Engineer

Check By:


Reviewer

Date:

July 30, 2020

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4 Test Summary

Test Item	Section	Result
Antenna requirement	FCC part 15.203	Pass
AC Power Line Conducted Emission	FCC part 15.207	Pass
Conducted Peak Output Power	FCC part 15.407(a)(3)	Pass
Channel Bandwidth and 99% Occupied Bandwidth	FCC part 15.407(e)	Pass
Power Spectral Density	FCC part 15.407(a)(3)	Pass
Band Edge	FCC part 15.407(b)(4)	Pass
Spurious Emission	FCC part 15.205/15.209/15.407(b)(4)	Pass
Frequency Stability	FCC part 15.407(g)	Pass

Remarks:

1. Pass: The EUT complies with the essential requirements in the standard.
2. Test according to ANSI C63.10:2013.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	30MHz-200MHz	3.8039dB	(1)
Radiated Emission	200MHz-1GHz	3.9679dB	(1)
Radiated Emission	1GHz-18GHz	4.29dB	(1)
Radiated Emission	18GHz-40GHz	3.30dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	3.44dB	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 General Description of EUT

Product Type:	Camera
Model No.:	CINOSXX/A
Serial No.:	IXSE31BN48XSEQ
Hardware Version:	V0.6
Software Version:	v0.0.4.1_build1
Test sample(s) ID:	GTS202007000101-1
Sample(s) Status:	Engineer sample
Operation Frequency:	802.11ac(HT20): 5745MHz ~ 5825MHz 802.11ac(HT40): 5755MHz ~ 5795MHz 802.11ac(HT80): 5775MHz
Channel numbers:	802.11ac(HT20): 5 802.11ac(HT40): 2 802.11ac(HT80): 1
Channel bandwidth:	802.11ac(HT20) : 20MHz 802.11ac(HT40) : 40MHz 802.11ac(HT80): 80MHz
Modulation technology:	Orthogonal Frequency Division Multiplexing (OFDM)
Antenna Type:	FPC Antenna
Antenna gain:	2.93dBi(declare by applicant)
Power supply:	DC 3.85V by Li-ion polymer battery

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
149	5745MHz	151	5755MHz	153	5765MHz	155	5775MHz
157	5785MHz	159	5795MHz	161	5805MHz	163	5815MHz
165	5825MHz						

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Test channel	Frequency (MHz)		
	802.11ac(HT20)	802.11ac(HT40)	802.11ac(HT80)
Lowest channel	5745	5755	
Middle channel	5785		5775
Highest channel	5825	5795	

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode
<i>Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i>	

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	Data rate
802.11ac(HT20)	6.5Mbps
802.11ac(HT40)	13Mbps
802.11ac(HT80)	29.3Mbps

5.3 Description of Support Units

Manufacturer	Description	Model	Serial Number
DELTA	ADAPTER	ADP-60ADT	N/A

5.4 Test Facility

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

• FCC —Registration No.: 381383

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383.

• IC —Registration No.: 9079A

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A.

• CNAS (No. CNAS L5775)

CNAS has accredited Global United Technology Services Co., Ltd., to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

Fax: 0755-27798960

5.6 Additional Instructions

Test Software	Special test command provided by manufacturer
Power level setup	Default

6 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 02 2020	July. 01 2025
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 25 2020	June. 24 2021
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 25 2020	June. 24 2021
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 25 2020	June. 24 2021
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 25 2020	June. 24 2021
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 25 2020	June. 24 2021
9	Coaxial Cable	GTS	N/A	GTS211	June. 25 2020	June. 24 2021
10	Coaxial cable	GTS	N/A	GTS210	June. 25 2020	June. 24 2021
11	Coaxial Cable	GTS	N/A	GTS212	June. 25 2020	June. 24 2021
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 25 2020	June. 24 2021
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 25 2020	June. 24 2021
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 25 2020	June. 24 2021
15	Band filter	Amindeon	82346	GTS219	June. 25 2020	June. 24 2021
16	Power Meter	Anritsu	ML2495A	GTS540	June. 25 2020	June. 24 2021
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 25 2020	June. 24 2021
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 25 2020	June. 24 2021
19	Splitter	Agilent	11636B	GTS237	June. 25 2020	June. 24 2021
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 25 2020	June. 24 2021
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 19 2019	Oct. 18 2020
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 19 2019	Oct. 18 2020
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 19 2019	Oct. 18 2020
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 25 2020	June. 24 2021

Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 25 2020	June. 24 2021
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 25 2020	June. 24 2021
4	ENV216 2-L-V-NETZNACHB.DE	ROHDE&SCHWARZ	ENV216	GTS226	June. 25 2020	June. 24 2021
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 25 2020	June. 24 2021
8	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	June. 25 2020	June. 24 2021
9	ISN	SCHWARZBECK	NTFM 8158	GTD565	June. 25 2020	June. 24 2021

RF Conducted Test:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	June. 25 2020	June. 24 2021
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 25 2020	June. 24 2021
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June. 25 2020	June. 24 2021
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	June. 25 2020	June. 24 2021
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	June. 25 2020	June. 24 2021
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	June. 25 2020	June. 24 2021
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	June. 25 2020	June. 24 2021
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	June. 25 2020	June. 24 2021

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 25 2020	June. 24 2021
2	Barometer	ChangChun	DYM3	GTS255	June. 25 2020	June. 24 2021

7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203
<i>15.203 requirement:</i> 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.	
E.U.T Antenna:	
<i>The antenna is FPC antenna, the best case gain of the antenna is 2.93dBi, reference to the appendix II for details</i>	

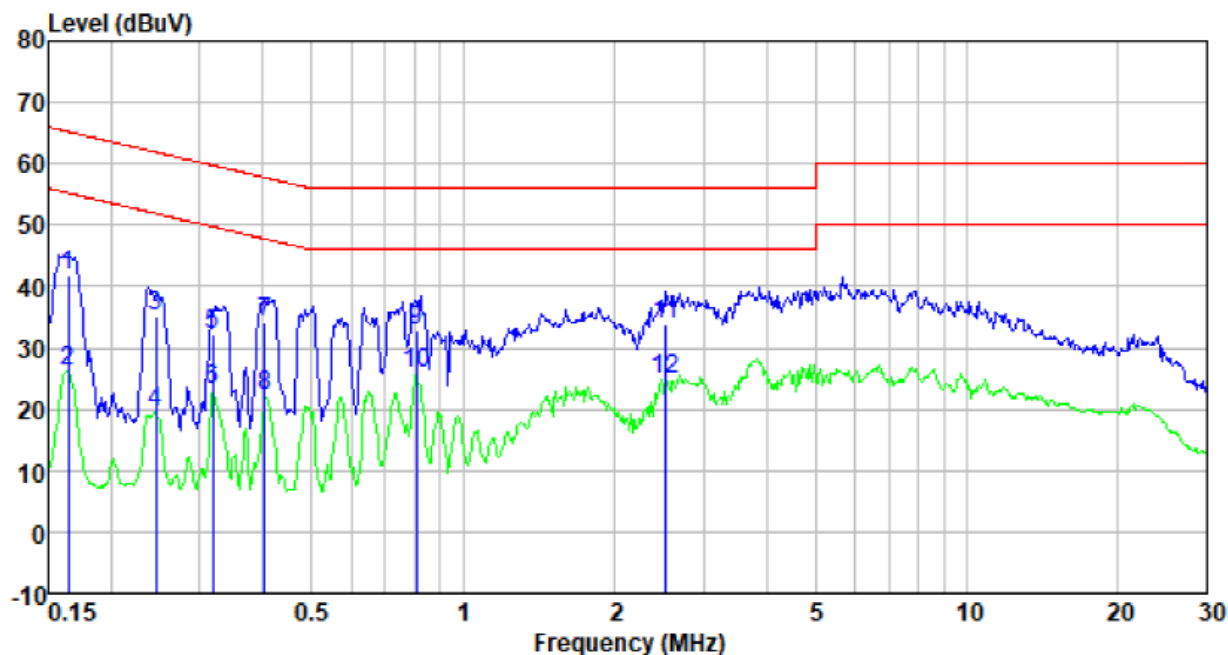
7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207					
Test Method:	ANSI C63.10:2013					
Test Frequency Range:	150KHz to 30MHz					
Class / Severity:	Class B					
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto					
Limit:	Frequency range (MHz)		Limit (dBuV)			
			Quasi-peak		Average	
	0.15-0.5		66 to 56*		56 to 46*	
	0.5-5		56		46	
	5-30		60		50	
* Decreases with the logarithm of the frequency.						
Test setup:	Reference Plane <i>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</i>					
Test procedure:	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.					
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Remark: Both high and low voltages have been tested to show only the worst low voltage test data.

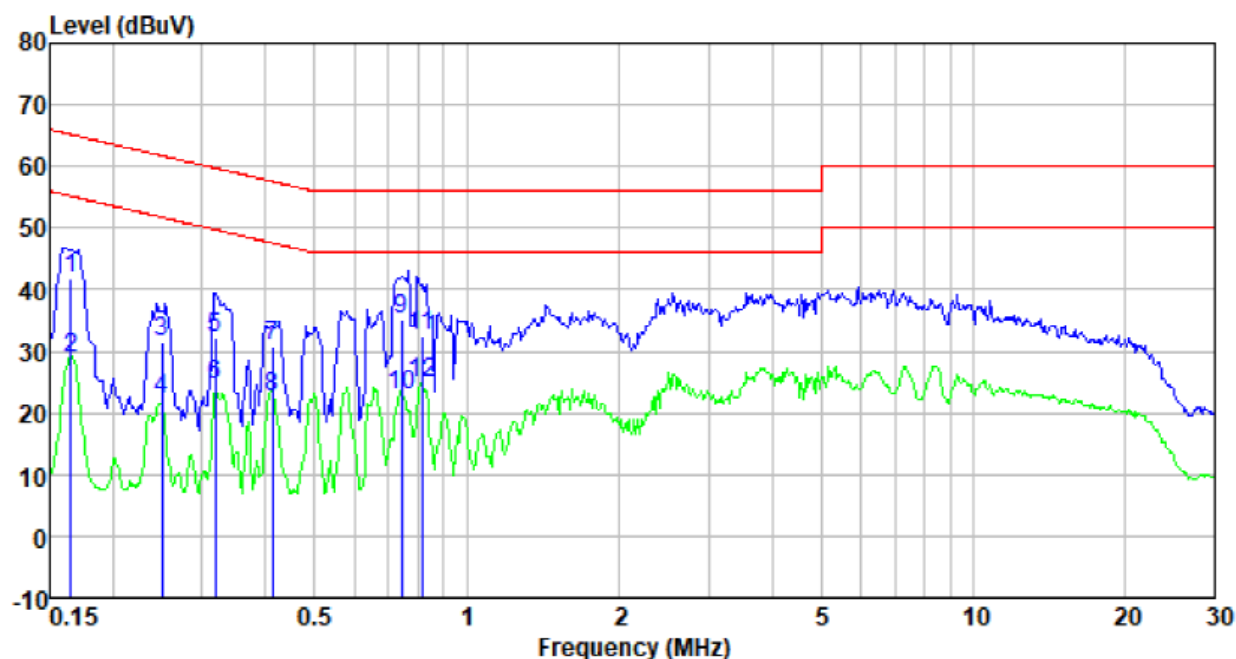
Measurement data

Line:



Freq MHz	Reading level dBpW	LISN/ISN factor dB	Cable loss dB	Level dBpW	Limit level dBpW	Over limit dB	Remark
0.16	21.48	20.40	0.08	41.96	65.25	-23.29	QP
0.16	5.83	20.40	0.08	26.31	55.25	-28.94	Average
0.25	14.65	20.40	0.10	35.15	61.91	-26.76	QP
0.25	-0.95	20.40	0.10	19.55	51.91	-32.36	Average
0.32	11.79	20.39	0.10	32.28	59.75	-27.47	QP
0.32	2.58	20.39	0.10	23.07	49.75	-26.68	Average
0.40	13.58	20.35	0.11	34.04	57.77	-23.73	QP
0.40	1.91	20.35	0.11	22.37	47.77	-25.40	Average
0.81	12.41	20.24	0.14	32.79	56.00	-23.21	QP
0.81	5.44	20.24	0.14	25.82	46.00	-20.18	Average
2.53	13.31	20.20	0.18	33.69	56.00	-22.31	QP
2.53	4.35	20.20	0.18	24.73	46.00	-21.27	Average

Neutral:

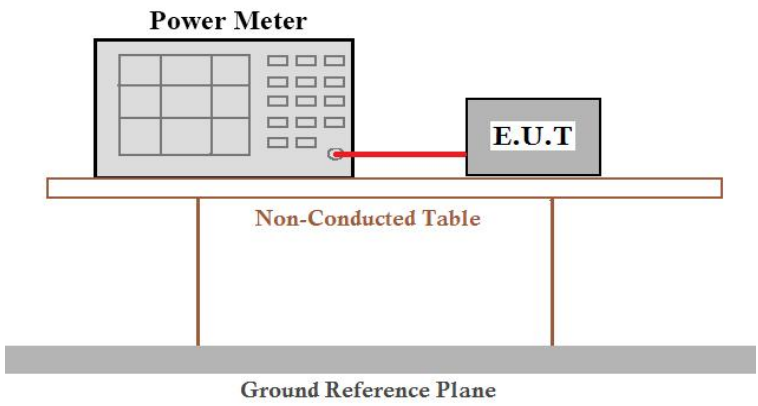


Freq MHz	Reading level dBpW	LISN/ISN factor dB	Cable loss dB	Level dBpW	Limit level dBpW	Over limit dB	Remark
0.17	21.19	20.40	0.08	41.67	65.21	-23.54	QP
0.17	8.44	20.40	0.08	28.92	55.21	-26.29	Average
0.25	11.05	20.40	0.10	31.55	61.78	-30.23	QP
0.25	1.71	20.40	0.10	22.21	51.78	-29.57	Average
0.32	11.60	20.39	0.10	32.09	59.75	-27.66	QP
0.32	3.88	20.39	0.10	24.37	49.75	-25.38	Average
0.41	10.54	20.35	0.11	31.00	57.59	-26.59	QP
0.41	2.21	20.35	0.11	22.67	47.59	-24.92	Average
0.74	14.77	20.25	0.13	35.15	56.00	-20.85	QP
0.74	2.35	20.25	0.13	22.73	46.00	-23.27	Average
0.81	12.30	20.23	0.14	32.67	56.00	-23.33	QP
0.81	4.46	20.23	0.14	24.83	46.00	-21.17	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both *limits and measurement with the average detector receiver is unnecessary*.

7.3 Conducted Peak Output Power

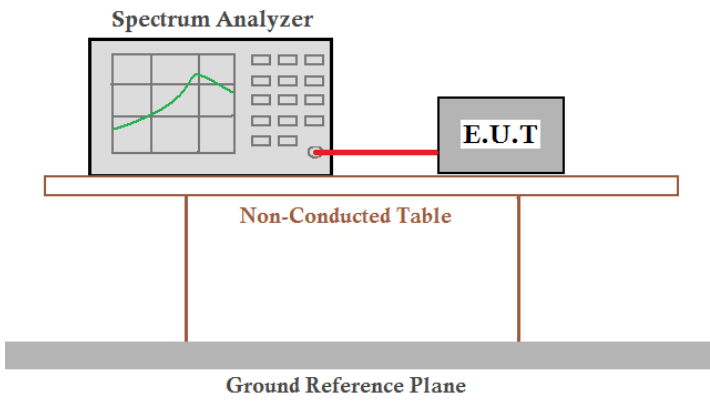
Test Requirement:	FCC Part15 E Section 15.407(a)(3)
Test Method:	ANSI C63.10:2013 and KDB 789033 D02 General U-NII Test Procedures New Rules v02r01
Limit:	30dBm
Test setup:	 The diagram illustrates the test setup. A Power Meter is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Power Meter and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Test CH	Peak Output Power (dBm)			Limit(dBm)	Result
	802.11ac(HT20)	802.11ac(HT40)	802.11ac(HT80)		
Lowest	10.85	10.58	---	30.00	Pass
Middle	11.09	---	10.73		
Highest	11.10	10.24	---		

Remark: "---"is not applicable

7.4 Channel Bandwidth and 99% Occupied Bandwidth

Test Requirement:	FCC Part15 E Section 15.407(e)
Test Method:	ANSI C63.10:2013 and KDB 789033 D02 General U-NII Test Procedures New Rules v02r01
Limit:	>500KHz
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

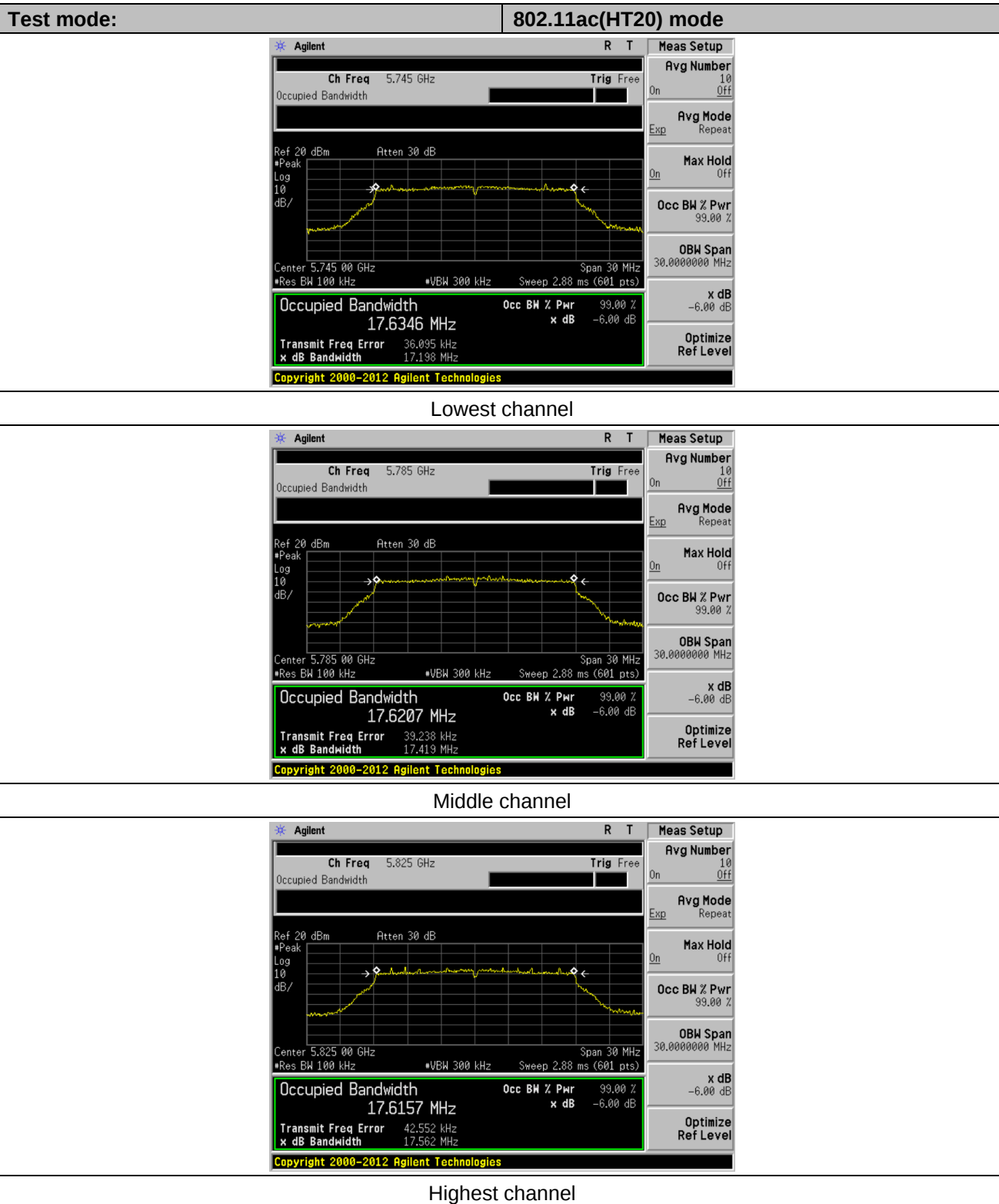
Test CH	Channel Bandwidth (MHz)			Limit (KHz)	Result
	802.11ac(HT20)	802.11ac(HT40)	802.11ac(HT80)		
Lowest	17.198	35.423	---	>500	Pass
Middle	17.419	---	75.380		
Highest	17.562	35.409	---		

Test CH	99% Occupied Bandwidth (MHz)			Limit (KHz)	Result
	802.11ac(HT20)	802.11ac(HT40)	802.11ac(HT80)		
Lowest	17.7263	36.1361	---	>500	Pass
Middle	17.7389	---	75.4924		
Highest	17.7483	36.1295	---		

Remark: “---“is not applicable

Test plot as follows:

-6dB:



The screenshot shows the Agilent spectrum analyzer interface. The main display area shows a signal centered at 5.755 GHz with a span of 60 MHz. The signal is labeled '802.11ac(HT40) mode'. The occupied bandwidth is 36.0175 MHz. The power level is 27.353 kHz. The signal is labeled '802.11ac(HT40) mode'.

Meas Setup	
Avg Number	10
On	Off
Avg Mode	Repeat
Exp	Repeat
Max Hold	Off
On	Off
Occ BW % Pwr	99.00 %
OBW Span	60.00000000 MHz
x dB	-6.00 dB
Optimize	Ref Level

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Lowest channel

The screenshot shows the Agilent Spectrum Analyzer interface. The main display shows a signal at 5.795 GHz. The occupied bandwidth is 36.0151 MHz. The signal level is 99.00% and the noise floor is -6.00 dB. The center frequency is 5.795 GHz, the resolution bandwidth is 100 kHz, and the span is 60 MHz. The sweep rate is 5.76 ms. The reference level is 20 dBm and the attenuation is 30 dB. The display is in log mode. The occupied bandwidth is highlighted in green.

Meas Setup	
Avg Number	10
On	Off
Avg Mode	Repeat
Exp	
Max Hold	Off
On	
Occ BW % Pwr	99.00 %
OBW Span	60.0000000 MHz
x dB	-6.00 dB
Optimize	
Ref Level	

Highest channel

Test mode:	802.11ac(HT80)
-------------------	-----------------------

Agilent
R T

Ch Freq 5.775 GHz
 Occupied Bandwidth

Trig Free

Ref 20 dBm
 *Peak
 Log
 10
 dB/

Atten 30 dB

Center 5.775 0 GHz
*VBW 300 kHz
Sweep 11.48 ms (601 pts)
Span 120 MHz

Occupied Bandwidth
 75.2877 MHz

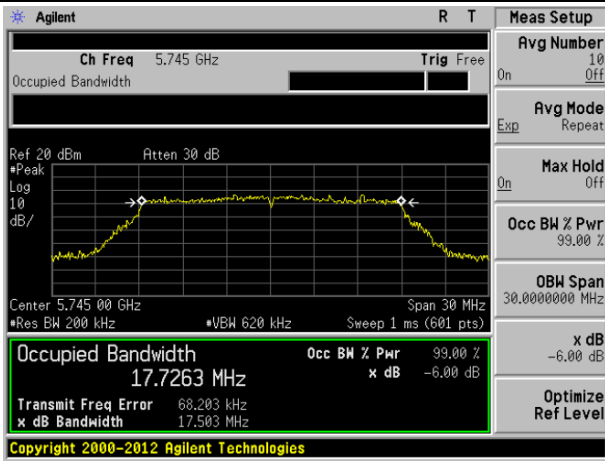
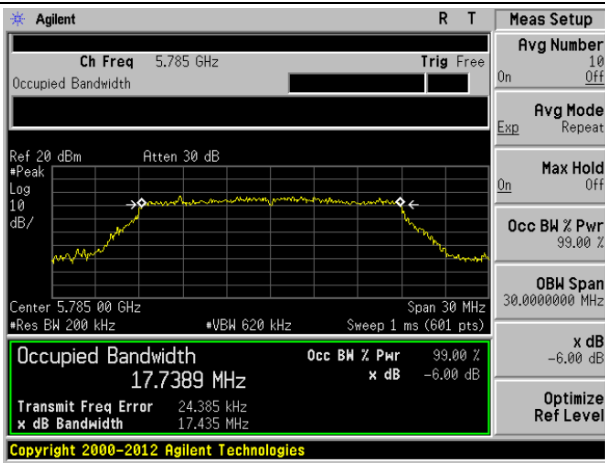
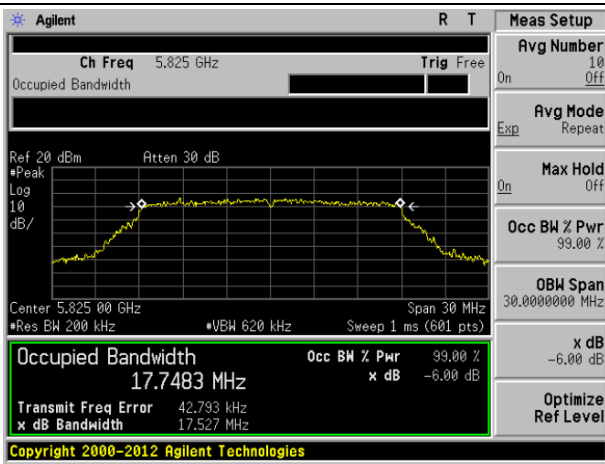
Occ BW % Pwr 99.00 %
x dB -6.00 dB

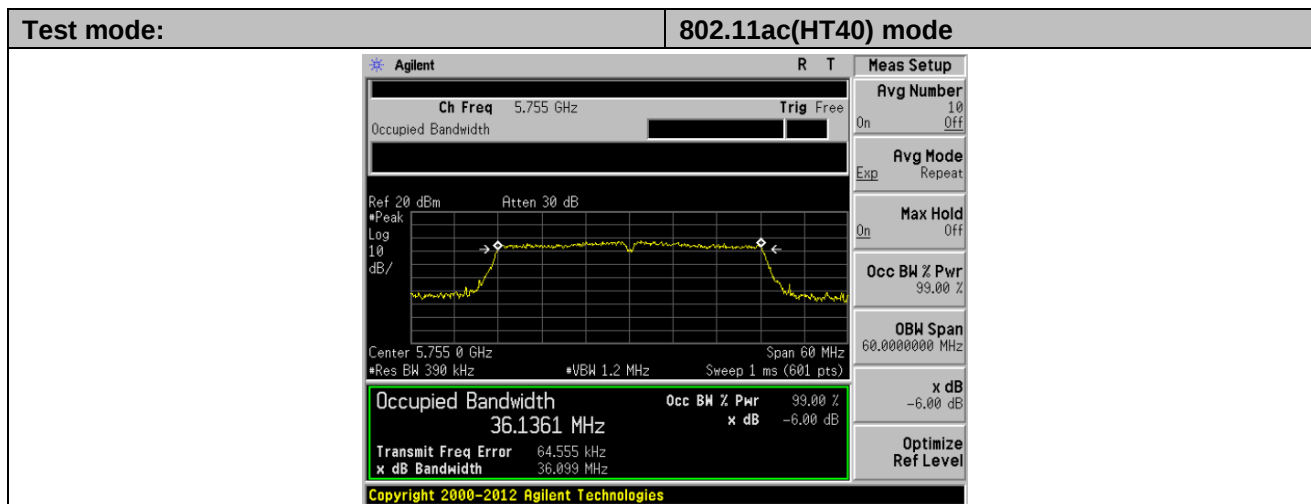
Transmit Freq Error 60.692 kHz
x dB Bandwidth 75.380 MHz

Meas Setup	
Avg Number	10 On Off
Avg Mode	Exp Repeat
Max Hold	On Off
Occ BW % Pwr	99.00 %
OBW Span	120.000000 MHz
x dB	-6.00 dB
Optimize	Ref Level

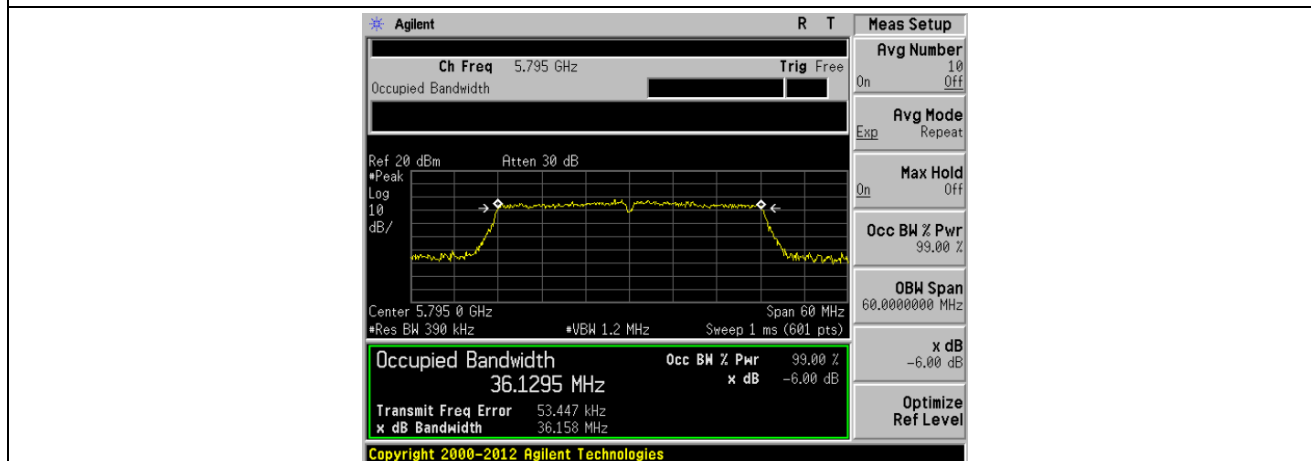
Middle channel

99%:

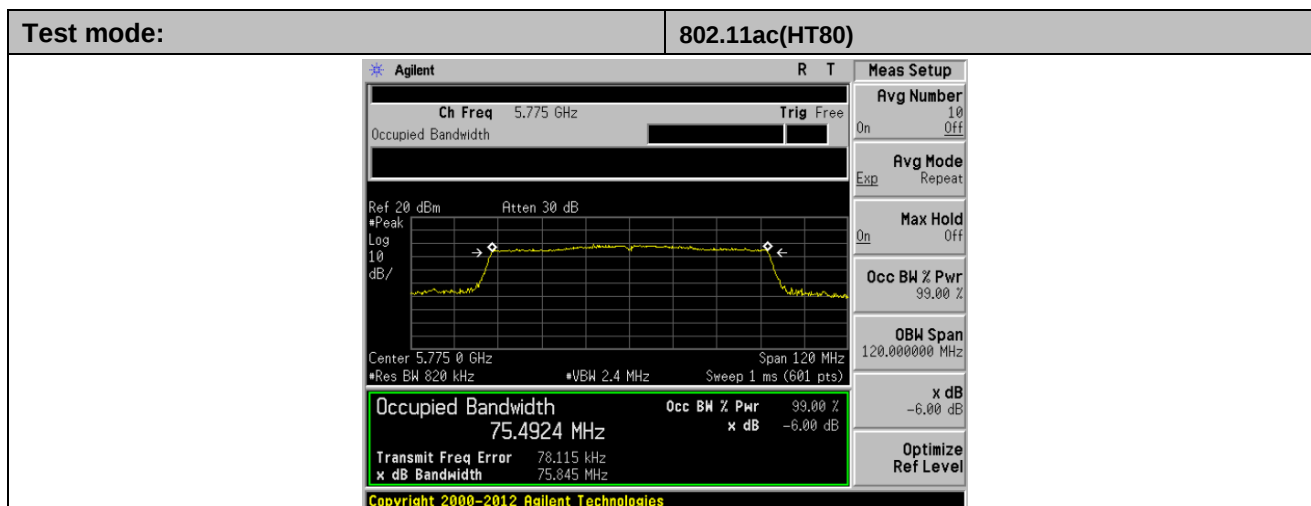
Test mode:	802.11ac(HT20) mode
	
Lowest channel	
	
Middle channel	
	
Highest channel	



Lowest channel

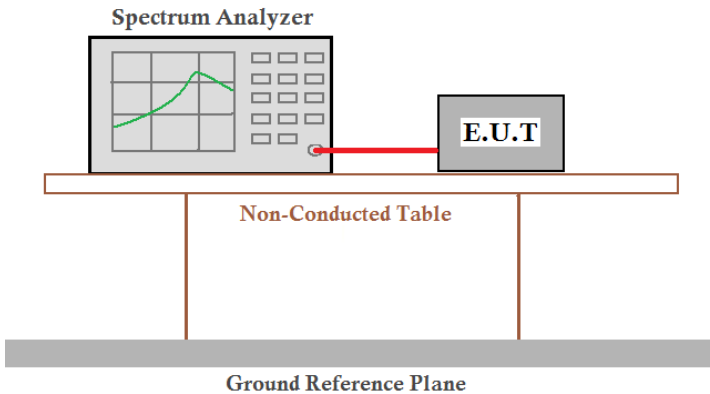


Highest channel



Middle channel

7.5 Power Spectral Density

Test Requirement:	FCC Part15 E Section 15.407(a)(3)
Test Method:	ANSI C63.10:2013 and KDB 789033 D02 General U-NII Test Procedures New Rules v02r01
Limit:	30dBm/500kHz
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

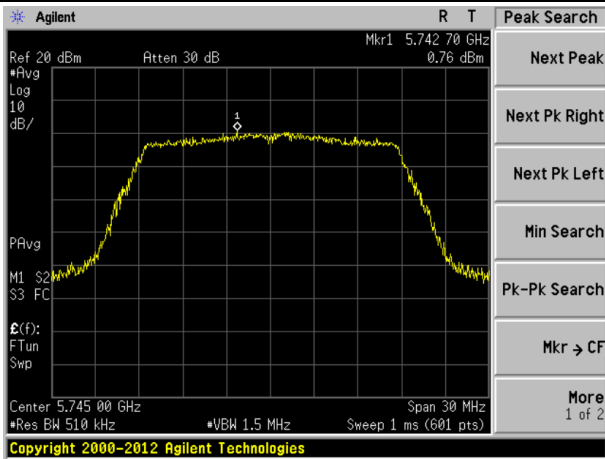
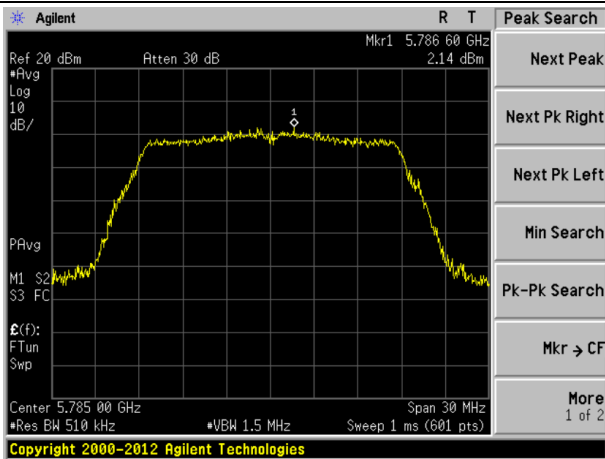
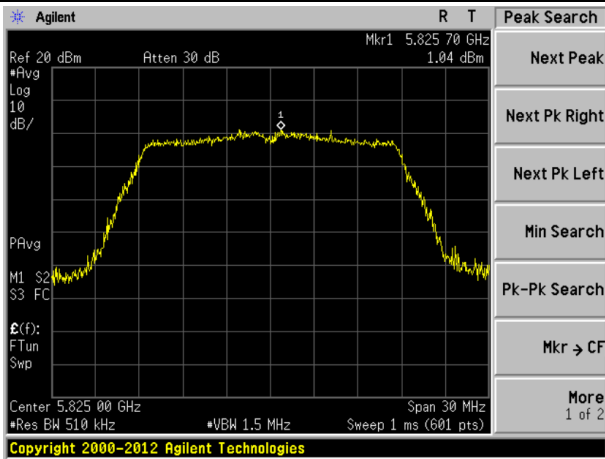
Measurement Data

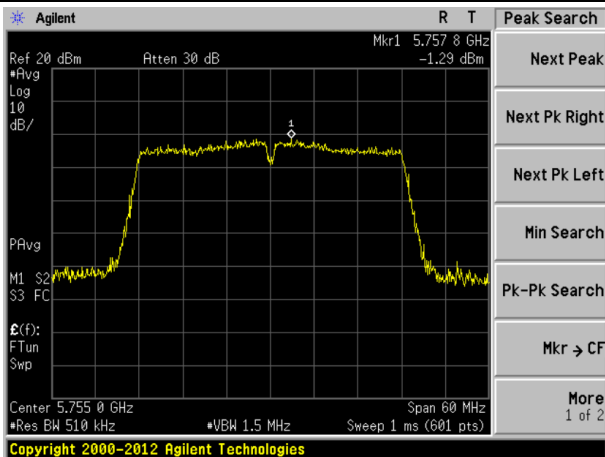
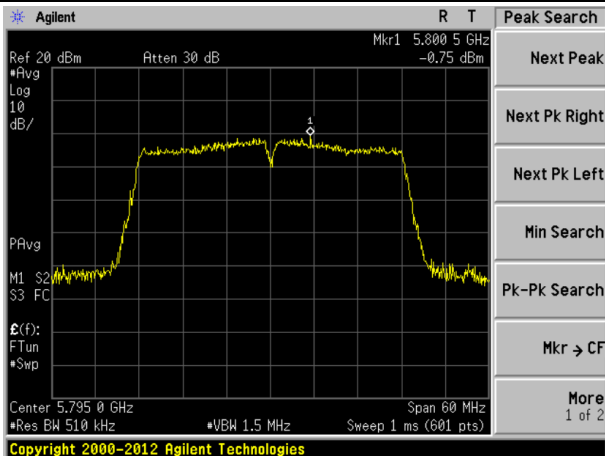
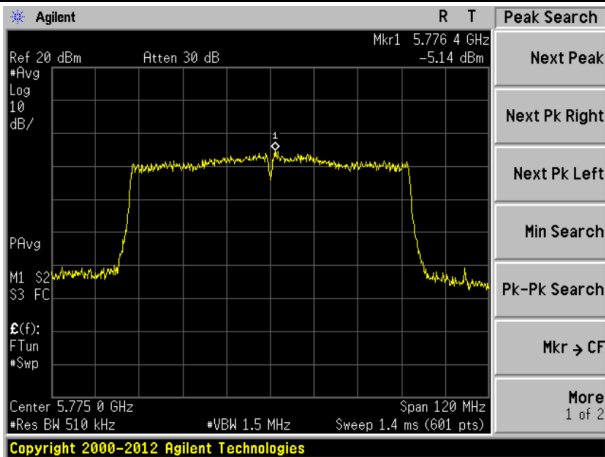
Test CH	Power Spectral Density (dBm/500kHz)			Limit (dBm/500k Hz)	Result
	802.11ac(HT20)	802.11ac(HT40)	802.11ac(HT80)		
Lowest	0.76	-1.29	---	30.00	Pass
Middle	2.14	---	-5.14		
Highest	1.04	-0.75	---		

Remark: “---“is not applicable

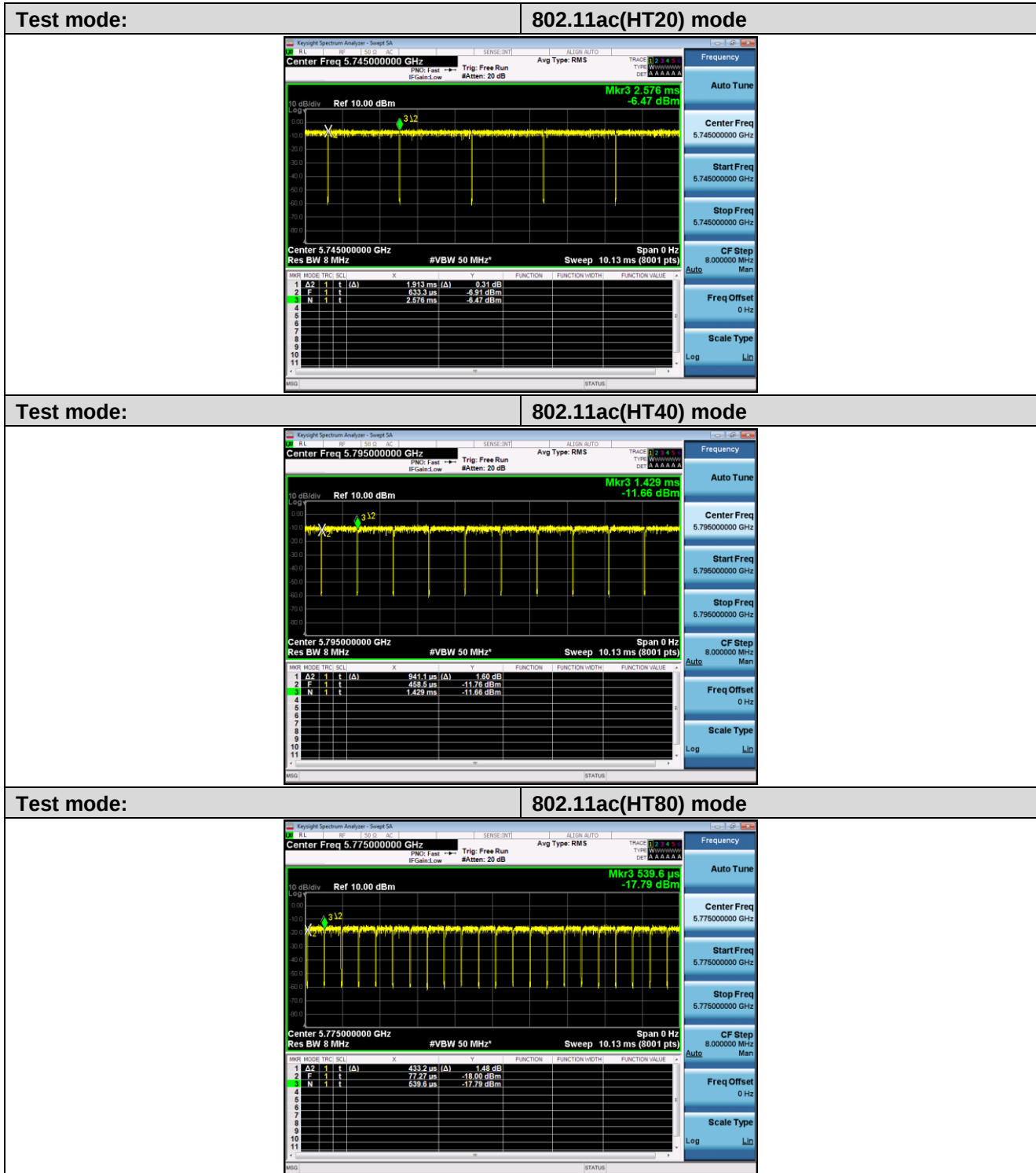
Modulation	Duty cycle	Duty Factor
802.11ac(HT20)	98.44%	0.07
802.11ac(HT40)	97.0%	0.13
802.11ac(HT80)	93.7%	0.28

Test plot as follows:

Test mode:	802.11ac(HT20) mode
	
Lowest channel	
	
Middle channel	
	
Highest channel	

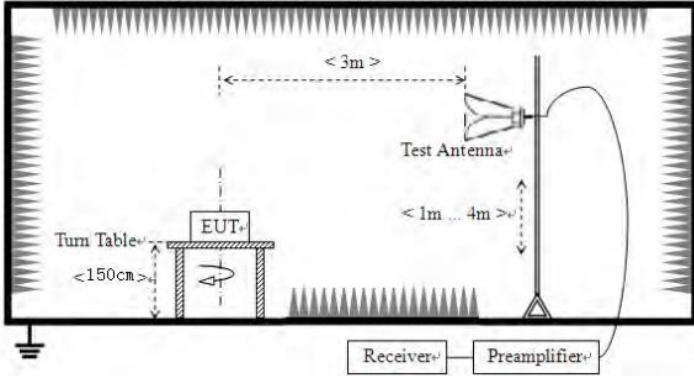
Test mode:		802.11ac(HT40) mode
		
Lowest channel		
		
Highest channel		
Test mode:		802.11ac(HT80)
		
Middle channel		

Duty cycle Plot:



7.6 Band edge

7.6.1 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10: 2013				
Test Frequency Range:	9kHz to 40GHz, only worse case is reported				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	Above 1GHz	Peak	1MHz	3MHz	Peak
		RMS	1MHz	3MHz	RMS
Limit:	All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.				
Test setup:					
Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. 7. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test				

	worst case mode is recorded in the report.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Remarks:

1. Only the worst case Main Antenna test data..
2. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.
5. According to KDB 789033 D02v02r01 section G) 1) d), for measurements above 1000 MHz @3m distance, the limit of field strength is computed as follows:
 $E[\text{dBuV/m}] = \text{EIRP}[\text{dBm}] + 95.2;$
 $E[\text{dBuV/m}] = -27 + 95.2 = 68.2\text{dBuV/m}.$
 $E[\text{dBuV/m}] = 10 + 95.2 = 105.2\text{dBuV/m}.$
 $E[\text{dBuV/m}] = 15.6 + 95.2 = 110.8\text{dBuV/m}.$
 $E[\text{dBuV/m}] = 27 + 95.2 = 122.2\text{dBuV/m}$

Measurement data:

<i>IEEE 802.11ac HT20</i>								
Peak value:								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5650.00	26.79	32.36	9.72	23.83	45.04	68.2	-23.16	Horizontal
5700.00	28.59	32.5	9.79	23.84	47.04	105.2	-58.16	Horizontal
5720.00	27.46	32.53	9.81	23.85	45.95	110.8	-64.85	Horizontal
5725.00	27.65	32.53	9.83	23.86	46.15	122.2	-76.05	Horizontal
5850.00	26.27	32.7	9.99	23.87	45.09	122.2	-77.11	Horizontal
5855.00	26.90	32.72	9.99	23.88	45.73	110.8	-65.07	Horizontal
5875.00	25.33	32.74	10.04	23.89	44.22	105.2	-60.98	Horizontal
5925.00	25.93	32.8	10.11	23.9	44.94	68.2	-23.26	Horizontal
5650.00	25.13	32.36	9.72	23.83	43.38	68.2	-24.82	Vertical
5700.00	28.51	32.5	9.79	23.84	46.96	105.2	-58.24	Vertical
5720.00	29.10	32.53	9.81	23.85	47.59	110.8	-63.21	Vertical
5725.00	27.66	32.53	9.83	23.86	46.16	122.2	-76.04	Vertical
5850.00	29.52	32.7	9.99	23.87	48.34	122.2	-73.86	Vertical
5855.00	27.83	32.72	9.99	23.88	46.66	110.8	-64.14	Vertical
5875.00	27.97	32.74	10.04	23.89	46.86	105.2	-58.34	Vertical
5925.00	28.59	32.8	10.11	23.9	47.6	68.2	-20.6	Vertical

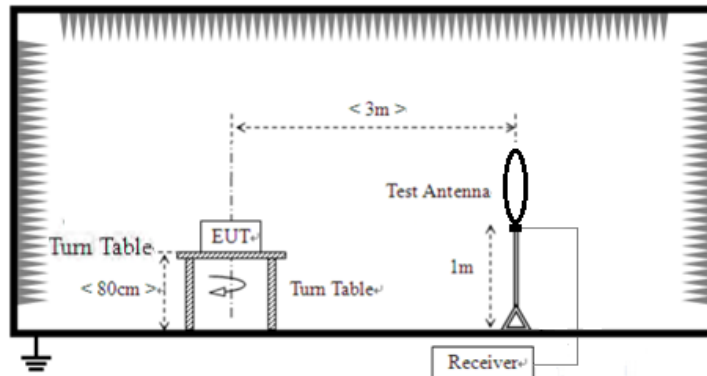
IEEE 802.11ac HT40								
Peak value:								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5650.00	26.08	32.36	9.72	23.83	44.33	68.2	-23.87	Horizontal
5700.00	25.94	32.5	9.79	23.84	44.39	105.2	-60.81	Horizontal
5720.00	27.42	32.53	9.81	23.85	45.91	110.8	-64.89	Horizontal
5725.00	27.30	32.53	9.83	23.86	45.8	122.2	-76.4	Horizontal
5850.00	25.87	32.7	9.99	23.87	44.69	122.2	-77.51	Horizontal
5855.00	29.92	32.72	9.99	23.88	48.75	110.8	-62.05	Horizontal
5875.00	25.29	32.74	10.04	23.89	44.18	105.2	-61.02	Horizontal
5925.00	29.59	32.8	10.11	23.9	48.6	68.2	-19.6	Horizontal
5650.00	28.62	32.36	9.72	23.83	46.87	68.2	-21.33	Vertical
5700.00	28.05	32.5	9.79	23.84	46.5	105.2	-58.7	Vertical
5720.00	25.08	32.53	9.81	23.85	43.57	110.8	-67.23	Vertical
5725.00	25.07	32.53	9.83	23.86	43.57	122.2	-78.63	Vertical
5850.00	28.08	32.7	9.99	23.87	46.9	122.2	-75.3	Vertical
5855.00	25.13	32.72	9.99	23.88	43.96	110.8	-66.84	Vertical
5875.00	27.85	32.74	10.04	23.89	46.74	105.2	-58.46	Vertical
5925.00	25.77	32.8	10.11	23.9	44.78	68.2	-23.42	Vertical

IEEE 802.11ac HT80								
Peak value:								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5650.00	26.22	32.36	9.72	23.83	44.47	68.2	-23.73	Horizontal
5700.00	28.88	32.5	9.79	23.84	47.33	105.2	-57.87	Horizontal
5720.00	28.68	32.53	9.81	23.85	47.17	110.8	-63.63	Horizontal
5725.00	26.48	32.53	9.83	23.86	44.98	122.2	-77.22	Horizontal
5850.00	26.12	32.7	9.99	23.87	44.94	122.2	-77.26	Horizontal
5855.00	27.69	32.72	9.99	23.88	46.52	110.8	-64.28	Horizontal
5875.00	29.65	32.74	10.04	23.89	48.54	105.2	-56.66	Horizontal
5925.00	29.74	32.8	10.11	23.9	48.75	68.2	-19.45	Horizontal
5650.00	29.27	32.36	9.72	23.83	47.52	68.2	-20.68	Vertical
5700.00	29.25	32.5	9.79	23.84	47.7	105.2	-57.5	Vertical
5720.00	27.95	32.53	9.81	23.85	46.44	110.8	-64.36	Vertical
5725.00	26.66	32.53	9.83	23.86	45.16	122.2	-77.04	Vertical
5850.00	28.33	32.7	9.99	23.87	47.15	122.2	-75.05	Vertical
5855.00	28.15	32.72	9.99	23.88	46.98	110.8	-63.82	Vertical
5875.00	26.64	32.74	10.04	23.89	45.53	105.2	-59.67	Vertical
5925.00	26.47	32.8	10.11	23.9	45.48	68.2	-22.72	Vertical

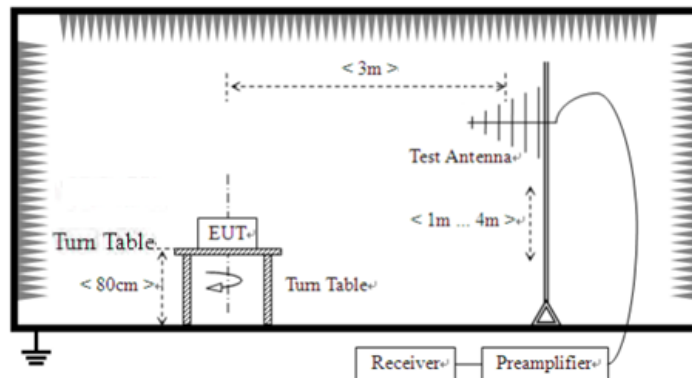
7.7 Spurious Emission

7.7.1 Radiated Emission Method

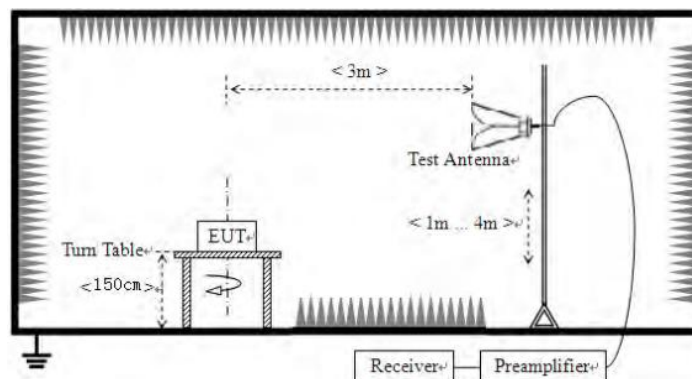
Test Requirement:	FCC Part15 C Section 15.209, Part 15E Section 15.407(b)(4)				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 40GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9kHz-150KHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
	150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
AV		1MHz	3MHz	Average Value	
FCC Limit:					
	Frequency (MHz)	Field strength (microvolts/meter)		Measurement distance (meters)	
	0.009-0.490	2400/F(kHz)		300	
	0.490-1.705	24000/F(kHz)		30	
	1.705-30.0	30		30	
	30-88	100**		3	
	88-216	150**		3	
	216-960	200**		3	
	Above 960	500		3	
	The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.				
IC Limit:	Table 5 – General field strength limits at frequencies above 30 MHz				
	Frequency (MHz)		Field strength (µV/m at 3 m)		
	30 – 88		100		
	88 – 216		150		
	216 – 960		200		
	Above 960		500		
	Table 6 – General field strength limits at frequencies below 30 MHz				
	Frequency	Magnetic field strength (H-Field) (µA/m)		Measurement distance (m)	
	9 - 490 kHz ¹	6.37/F (F in kHz)		300	
	490 - 1705 kHz	63.7/F (F in kHz)		30	
1.705 - 30 MHz	0.08		30		
Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.					
Test setup:	For radiated emissions from 9kHz to 30MHz				



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



Test Procedure:

1. The EUT was placed on the top of a rotating table (0.8m for below 1GHz and 1.5 meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case

	and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. 7. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.					
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Remarks:

1. Only the worst case Main Antenna test data.
2. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

Measurement Data:

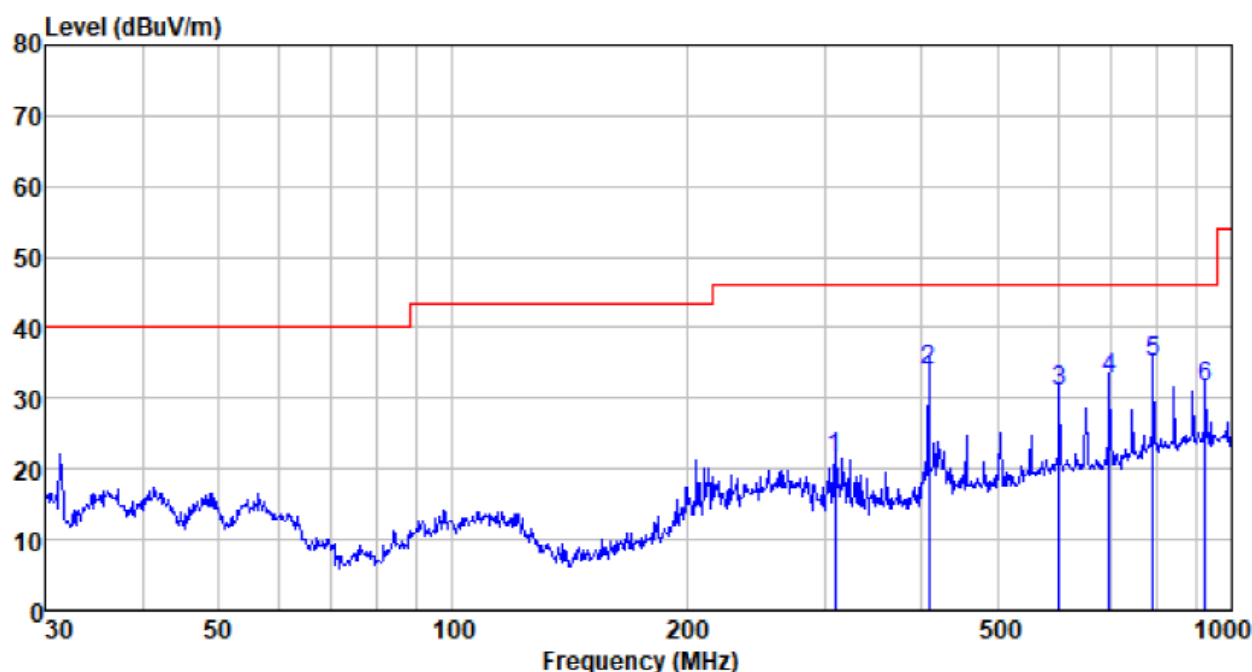
9 kHz ~ 30 MHz

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Below 1GHz

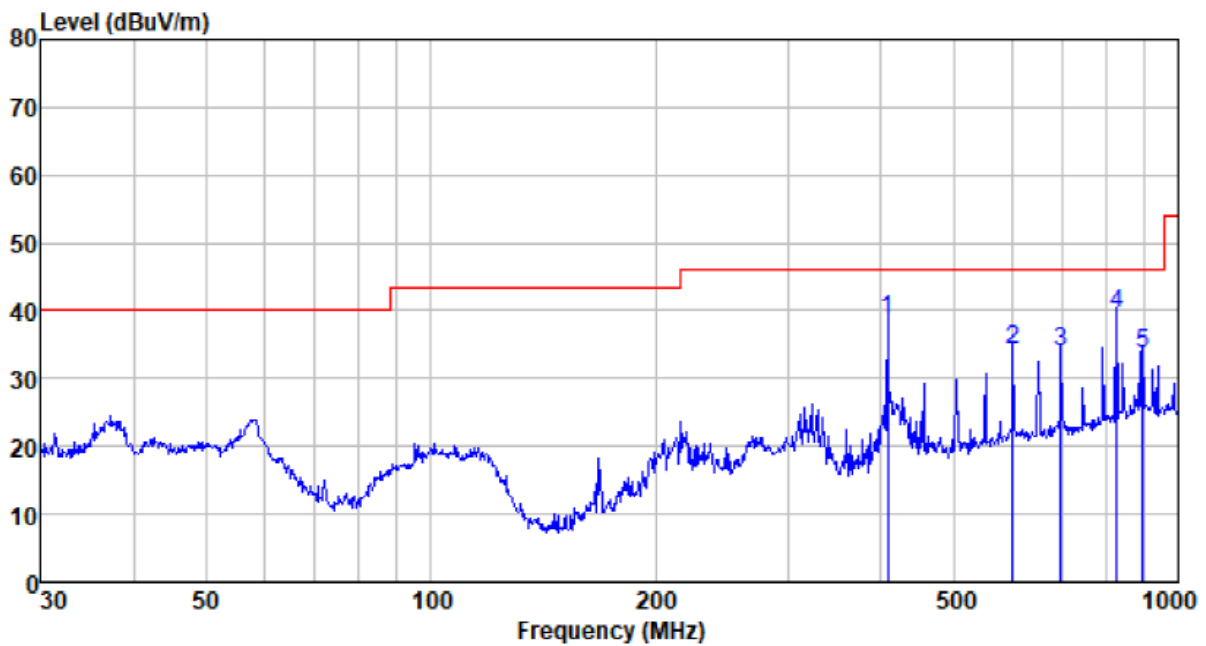
Pre-scan all test modes, found worst case at 802.11ac(HT80) 5775MHz, and so only show the test result of 802.11ac(HT80) 5775MHz

Horizontal:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
309.998	42.87	13.79	2.42	37.43	21.65	46.00	-24.35	QP
408.946	53.21	15.50	2.90	37.52	34.09	46.00	-11.91	QP
601.427	45.31	19.50	3.73	37.54	31.00	46.00	-15.00	QP
696.857	46.74	19.60	4.08	37.63	32.79	46.00	-13.21	QP
793.396	46.96	21.28	4.43	37.62	35.05	46.00	-10.95	QP
925.756	41.77	22.41	4.95	37.58	31.55	46.00	-14.45	QP

Vertical:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
408.946	57.71	15.50	2.90	37.52	38.59	46.00	-7.41	QP
601.427	48.58	19.50	3.73	37.54	34.27	46.00	-11.73	QP
696.857	47.90	19.60	4.08	37.63	33.95	46.00	-12.05	QP
827.493	50.94	21.64	4.57	37.61	39.54	46.00	-6.46	QP
896.997	44.30	22.27	4.83	37.60	33.80	46.00	-12.20	QP

Above 1GHz:

Test mode:		802.11ac		Test channel:		lowest	
Antenna Pol.	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dBuV/m)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	Detector
V	11490	21.96	21.64	43.60	54	-10.40	PK
V	17235	23.49	21.8	45.29	54	-8.71	PK
H	11490	21.00	21.83	42.83	54	-11.17	PK
H	17235	22.57	21.67	44.24	54	-9.76	PK

Test mode:		802.11ac		Test channel:		Middle	
Antenna Pol.	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dBuV/m)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	Detector
V	11570	21.55	21.64	43.19	54	-10.81	PK
V	17355	23.43	21.8	45.23	54	-8.77	PK
H	11570	23.34	21.83	45.17	54	-8.83	PK
H	17355	21.05	21.67	42.72	54	-11.28	PK

Test mode:		802.11ac		Test channel:		Highest	
Antenna Pol.	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dBuV/m)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	Detector
V	11650	23.82	21.64	45.46	54	-8.54	PK
V	17475	23.49	21.8	45.29	54	-8.71	PK
H	11650	21.84	21.83	43.67	54	-10.33	PK
H	17475	21.43	21.67	43.10	54	-10.90	PK

Test mode:		802.11ac(HT40)		Test channel:		Lowest	
Antenna Pol.	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dBuV/m)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	Detector
V	11510	21.27	21.67	42.94	54	-11.06	PK
V	17265	23.97	21.83	45.80	54	-8.20	PK
H	11510	21.93	21.67	43.60	54	-10.40	PK
H	17265	21.48	21.83	43.31	54	-10.69	PK

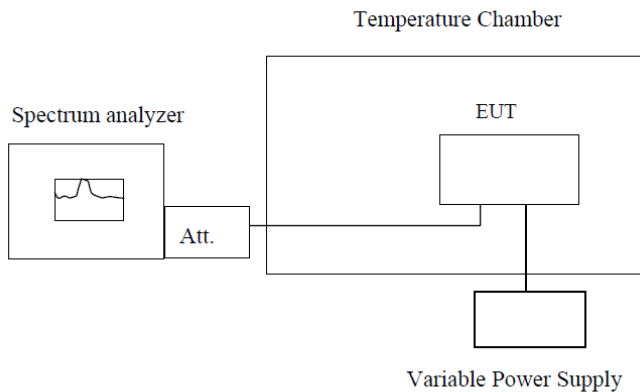
Test mode:		802.11ac(HT40)		Test channel:		Highest	
Antenna Pol.	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dBuV/m)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	Detector
V	11590	21.35	21.67	43.02	54	-10.98	PK
V	17385	23.52	21.83	45.35	54	-8.65	PK
H	11590	21.31	21.67	42.98	54	-11.02	PK
H	17385	22.48	21.83	44.31	54	-9.69	PK

Test mode:		802.11ac(HT80)		Test channel:		Middle	
Antenna Pol.	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dBuV/m)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	Detector
V	11550	21.92	21.65	43.57	54	-10.43	PK
V	17325	22.46	21.81	44.27	54	-9.73	PK
H	11550	23.51	21.65	45.16	54	-8.84	PK
H	17325	21.79	21.81	43.60	54	-10.40	PK

Notes:

1. Measure Level = Reading Level + Factor.
2. The test trace is same as the ambient noise (the test frequency range: 18GHz~40GHz), therefore no data appear in the report.
3. The test result on peak is lower than average limit, then average measurement needn't be performed.

7.8 Frequency stability

Test Requirement:	FCC Part15 C Section 15.407(g)
Test Method:	ANSI C63.10:2013, FCC Part 2.1055
Limit:	Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified
Test Procedure:	The EUT was setup to ANSI C63.4, 2003; tested to 2.1055 for compliance to FCC Part 15.407(g) requirements.
Test setup:	 Note : Measurement setup for testing on Antenna connector
Test Instruments:	Refer to section 6 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement data:

Frequency stability versus Temp.					
Power Supply: DC 3.85V					
Temp. (°C)	Operating Frequency (MHz)	0 minute Measured Frequency (MHz)	2 minute Measured Frequency (MHz)	5 minute Measured Frequency (MHz)	10 minute Measured Frequency (MHz)
-30	5745	5745.817	5745.664	5745.802	5745.341
	5755	5755.688	5755.408	5755.794	5755.126
	5755	5755.958	5755.970	5755.501	5755.547
	5785	5785.476	5785.189	5785.348	5785.274
	5795	5795.418	5795.894	5795.255	5795.187
	5825	5825.658	5825.520	5825.617	5825.004
-20	5745	5745.609	5745.865	5745.348	5745.671
	5755	5755.735	5755.325	5755.114	5755.701
	5755	5755.105	5755.765	5755.593	5755.860
	5785	5785.724	5785.242	5785.931	5785.579
	5795	5795.743	5795.030	5795.626	5795.504
	5825	5825.404	5825.403	5825.976	5825.591
-10	5745	5745.003	5745.498	5745.543	5745.745
	5755	5755.545	5755.085	5755.704	5755.501
	5755	5755.925	5755.179	5755.124	5755.786
	5785	5785.200	5785.992	5785.770	5785.086
	5795	5795.731	5795.470	5795.057	5795.057
	5825	5825.886	5825.796	5825.998	5825.392
0	5745	5745.715	5745.049	5745.327	5745.764
	5755	5755.948	5755.030	5755.986	5755.455
	5755	5755.798	5755.700	5755.354	5755.275
	5785	5785.838	5785.349	5785.846	5785.335
	5795	5795.353	5795.592	5795.083	5795.696
	5825	5825.317	5825.833	5825.110	5825.865
10	5745	5745.101	5745.107	5745.705	5745.166
	5755	5755.308	5755.789	5755.141	5755.282
	5755	5755.711	5755.182	5755.370	5755.976
	5785	5785.693	5785.746	5785.012	5785.507
	5795	5795.732	5795.631	5795.051	5795.113
	5825	5825.673	5825.029	5825.363	5825.086
20	5745	5745.376	5745.224	5745.569	5745.721
	5755	5755.426	5755.707	5755.760	5755.113
	5755	5755.605	5755.435	5755.909	5755.489
	5785	5785.947	5785.608	5785.440	5785.476
	5795	5795.040	5795.087	5795.761	5795.723
	5825	5825.061	5825.196	5825.888	5825.777
30	5745	5745.662	5745.339	5745.405	5745.865
	5755	5755.738	5755.192	5755.944	5755.133
	5755	5755.731	5755.696	5755.593	5755.199
	5785	5785.770	5785.064	5785.318	5785.575
	5795	5795.140	5795.508	5795.120	5795.702
	5825	5825.864	5825.024	5825.240	5825.566
40	5745	5745.143	5745.665	5745.049	5745.805
	5755	5755.875	5755.518	5755.065	5755.217
	5755	5755.363	5755.286	5755.911	5755.909
	5785	5785.136	5785.065	5785.138	5785.999

	5795	5795.287	5795.513	5795.404	5795.105
	5825	5825.371	5825.045	5825.446	5825.926
50	5745	5745.196	5745.707	5745.575	5745.851
	5755	5755.195	5755.453	5755.890	5755.174
	5755	5755.508	5755.429	5755.296	5755.157
	5785	5785.743	5785.741	5785.046	5785.672
	5795	5795.333	5795.266	5795.283	5795.632
	5825	5825.041	5825.353	5825.706	5825.122

Frequency stability versus Voltage					
Temperature: 25°C					
Power Supply (VDC)	Operating Frequency (MHz)	0 minute Measured Frequency (MHz)	2 minute Measured Frequency (MHz)	5 minute Measured Frequency (MHz)	10 minute Measured Frequency (MHz)
3.6	5745	5745.902	5745.010	5745.474	5745.440
	5755	5755.204	5755.609	5755.448	5755.761
	5755	5755.417	5755.651	5755.025	5755.583
	5785	5785.862	5785.272	5785.674	5785.373
	5795	5795.581	5795.798	5795.662	5795.498
	5825	5825.718	5825.886	5825.537	5825.158
4.4	5745	5745.796	5745.376	5745.155	5745.453
	5755	5755.769	5755.088	5755.314	5755.298
	5755	5755.954	5755.156	5755.242	5755.686
	5785	5785.432	5785.125	5785.460	5785.601
	5795	5795.164	5795.232	5795.796	5795.294
	5825	5825.230	5825.235	5825.678	5825.600

8 Test Setup Photo

Reference to the **appendix I** for details.

9 EUT Constructional Details

Reference to the **appendix II** for details.

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