

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

Equipment Under Test (EUT)

Trade Mark: Insta360

FCC ID: 2AWWH-ING2

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

Date of sample receipt: September 25, 2020

Date of Test: September 25, 2020-October 22, 2020

Date of report issued: October 23, 2020

Test Result : PASS *

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

Authorized Signature:



Robinson Luo

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	October 23, 2020	Original

Prepared By:

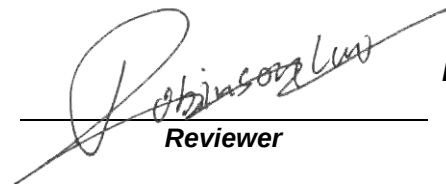


Project Engineer

Date:

October 23, 2020

Check By:



Reviewer

Date:

October 23, 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.:	CING2XX/A
Serial No.:	IG2KM2011Q5659
Hardware Version:	V1.1.2
Software Version:	V1.1.1
Test sample(s) ID:	GTS202009000264-1
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:	-2.58dBi(declare by applicant)
Power supply:	Rechargeable Li-ion Battery: DC 3.8V, 215mAh, 0.82Wh

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
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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
Lenovo	Notebook PC	E40	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. 18 2020	Oct. 17 2021
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 18 2020	Oct. 17 2021
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 18 2020	Oct. 17 2021
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 -2.58dBi, reference to the appendix II for details</i>	

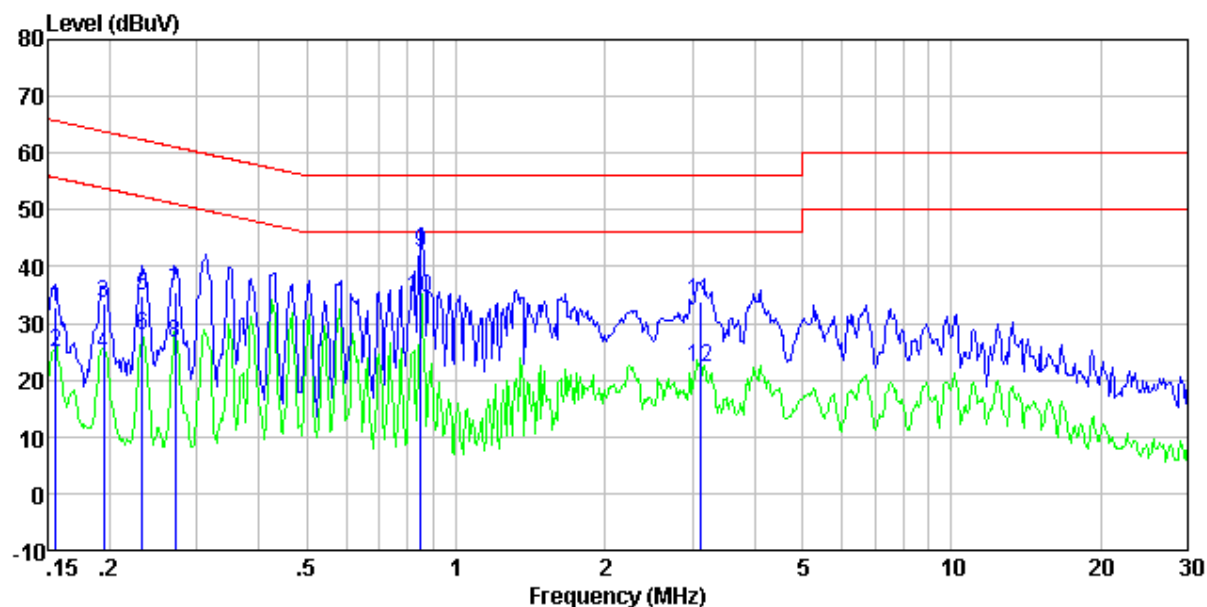
7.2 Conducted Emissions

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:</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m					
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.

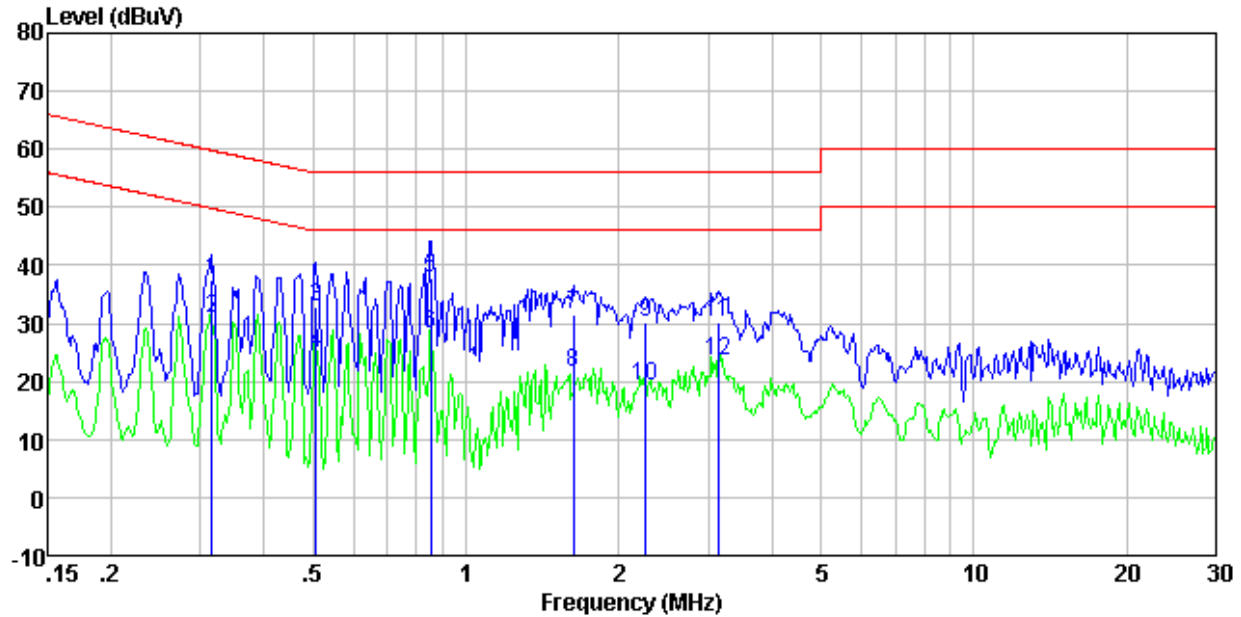
Measurement data

Line:



Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.16	12.46	20.40	0.07	32.93	65.69	-32.76	QP
0.16	4.56	20.40	0.07	25.03	55.69	-30.66	Average
0.19	12.93	20.40	0.11	33.44	63.84	-30.40	QP
0.19	4.00	20.40	0.11	24.51	53.84	-29.33	Average
0.23	14.46	20.40	0.11	34.97	62.35	-27.38	QP
0.23	7.27	20.40	0.11	27.78	52.35	-24.57	Average
0.27	14.89	20.40	0.10	35.39	61.07	-25.68	QP
0.27	6.04	20.40	0.10	26.54	51.07	-24.53	Average
0.85	22.06	20.23	0.14	42.43	56.00	-13.57	QP
0.85	13.99	20.23	0.14	34.36	46.00	-11.64	Average
3.11	13.29	20.20	0.19	33.68	56.00	-22.32	QP
3.11	1.98	20.20	0.19	22.37	46.00	-23.63	Average

Neutral:

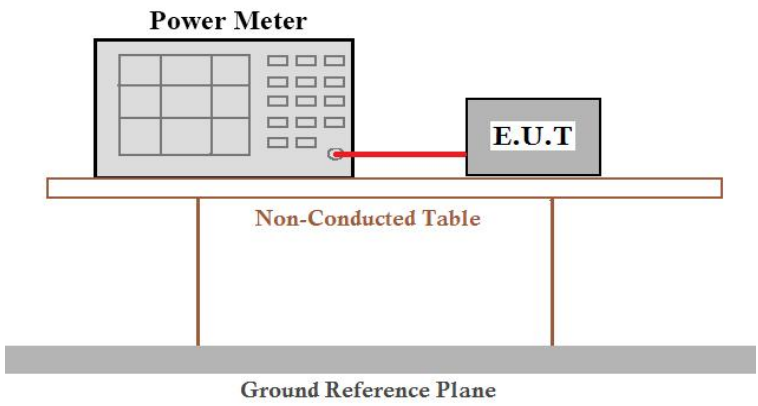


Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.32	17.06	20.39	0.10	37.55	59.80	-22.25	QP
0.32	10.24	20.39	0.10	30.73	49.80	-19.07	Average
0.51	12.59	20.31	0.11	33.01	56.00	-22.99	QP
0.51	4.59	20.31	0.11	25.01	46.00	-20.99	Average
0.85	17.52	20.23	0.14	37.89	56.00	-18.11	QP
0.85	7.89	20.23	0.14	28.26	46.00	-17.74	Average
1.63	11.14	20.20	0.17	31.51	56.00	-24.49	QP
1.63	1.28	20.20	0.17	21.65	46.00	-24.35	Average
2.26	9.88	20.20	0.18	30.26	56.00	-25.74	QP
2.26	-1.06	20.20	0.18	19.32	46.00	-26.68	Average
3.14	9.83	20.20	0.19	30.22	56.00	-25.78	QP
3.14	3.32	20.20	0.19	23.71	46.00	-22.29	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

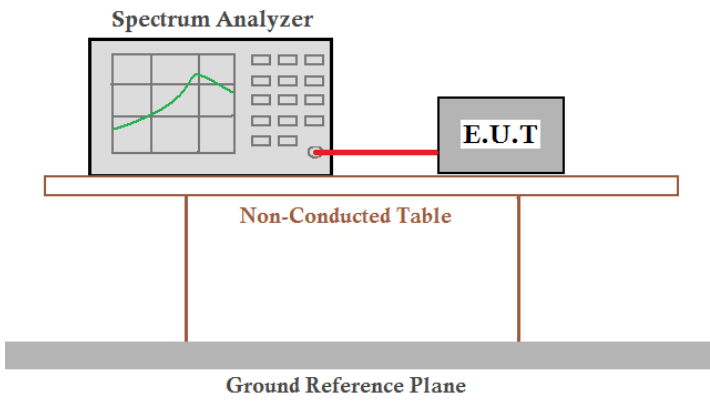
Test Requirement:	FCC Part15 E Section 15.407(a)(3)
Test Method:	ANSI C63.10:2013 and KDB 789033 D02 General U-NII Test Procedures New Rules v02r01
Limit:	30dBm
Test setup:	 The diagram illustrates the test setup. A Power Meter is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which 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	-0.09	-0.72	---	30.00	Pass
Middle	-0.86	---	-1.73		
Highest	-1.22	-0.77	---		

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

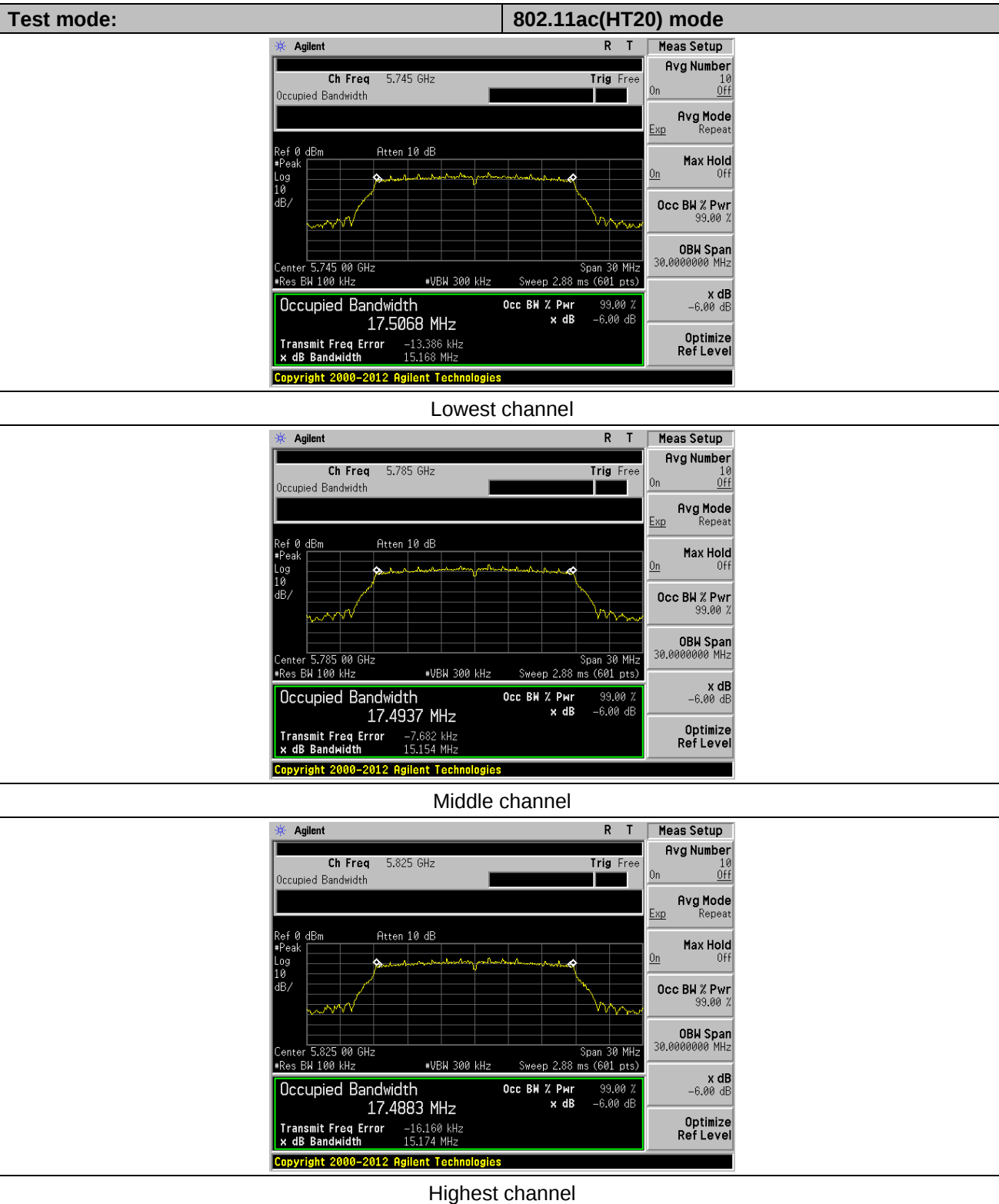
Test CH	Channel Bandwidth (MHz)			Limit (KHz)	Result
	802.11ac(HT20)	802.11ac(HT40)	802.11ac(HT80)		
Lowest	15.168	35.153	---	>500	Pass
Middle	15.154	---	75.413		
Highest	15.174	35.210	---		

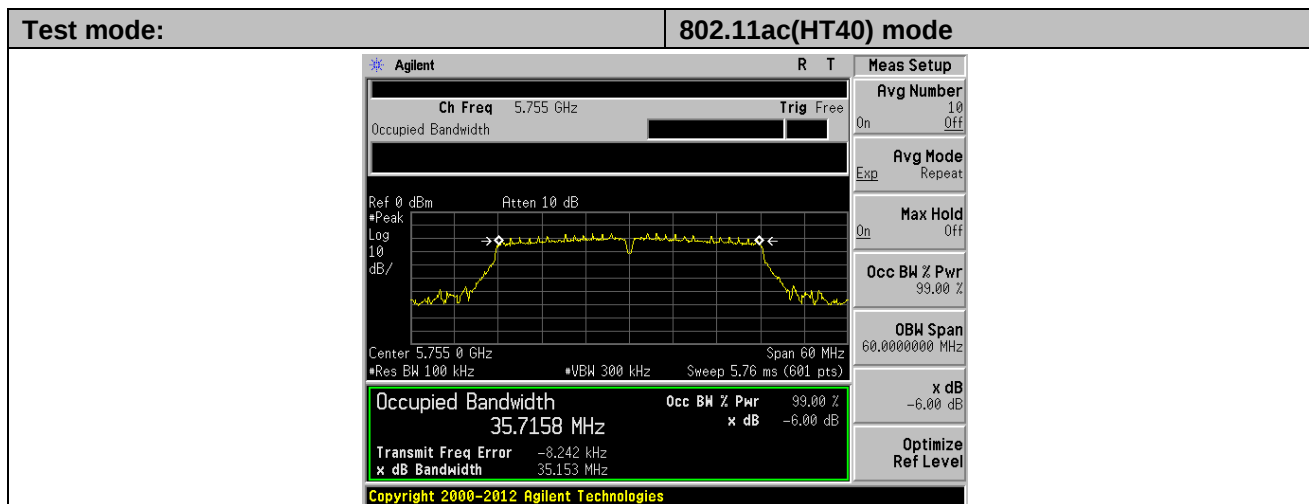
Test CH	99% Occupied Bandwidth (MHz)			Limit (KHz)	Result
	802.11ac(HT20)	802.11ac(HT40)	802.11ac(HT80)		
Lowest	17.5301	35.9476	---	>500	Pass
Middle	17.5304	---	75.1271		
Highest	17.5581	35.8977	---		

Remark: “---“is not applicable

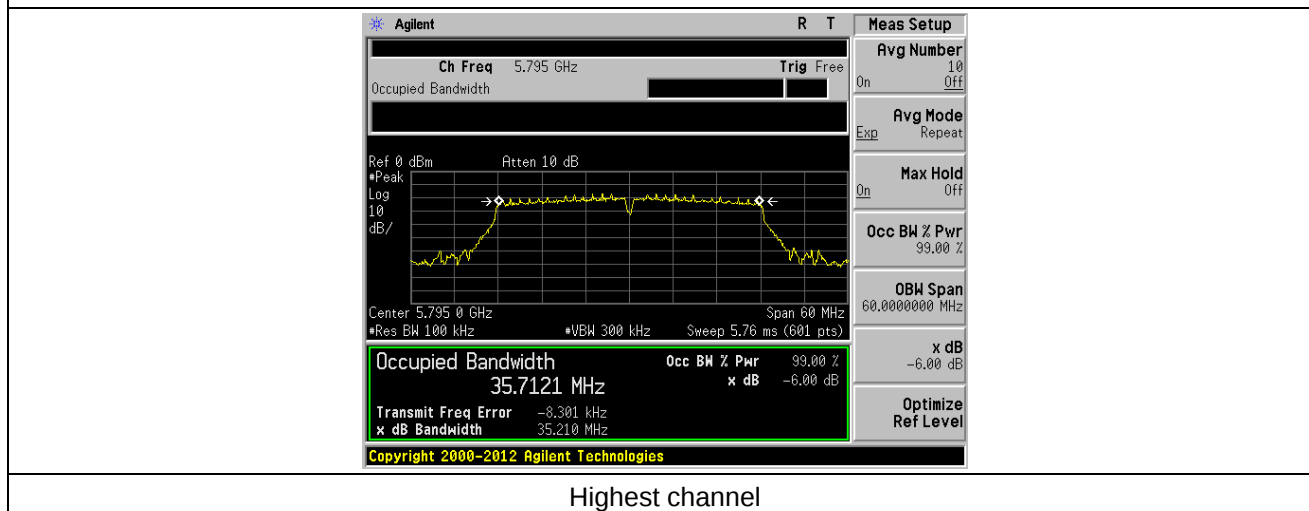
Test plot as follows:

-6dB:

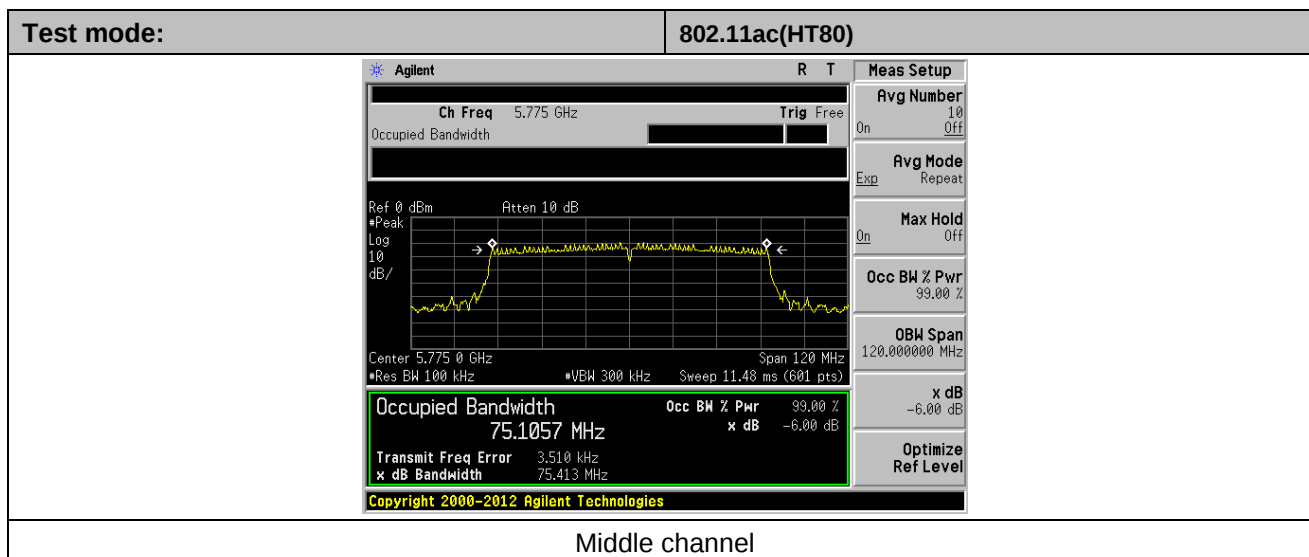




Lowest channel

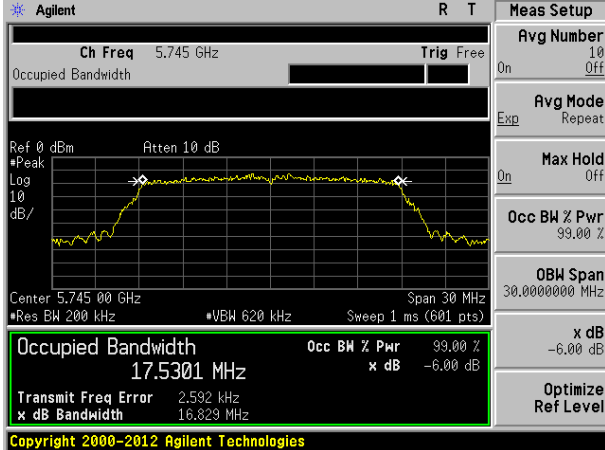
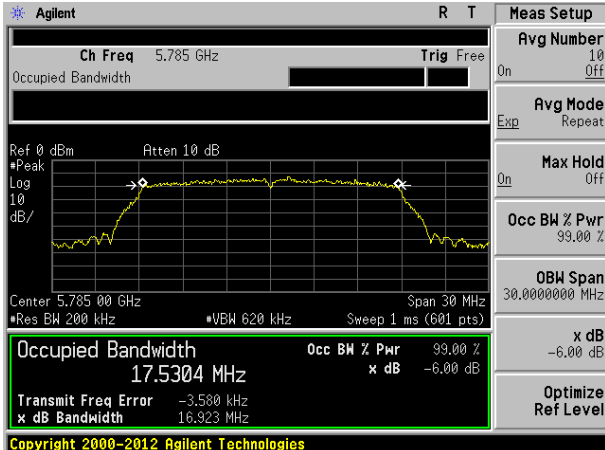
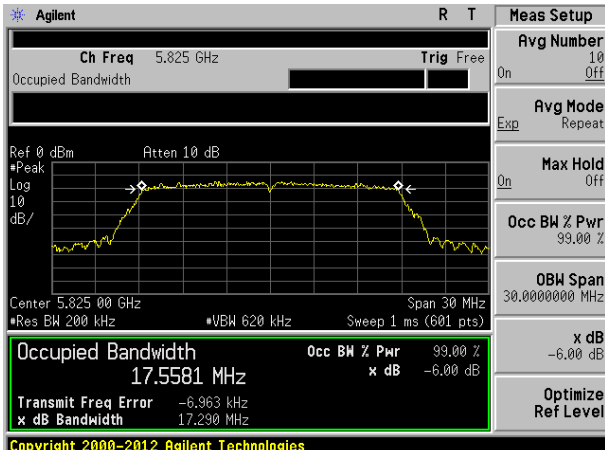


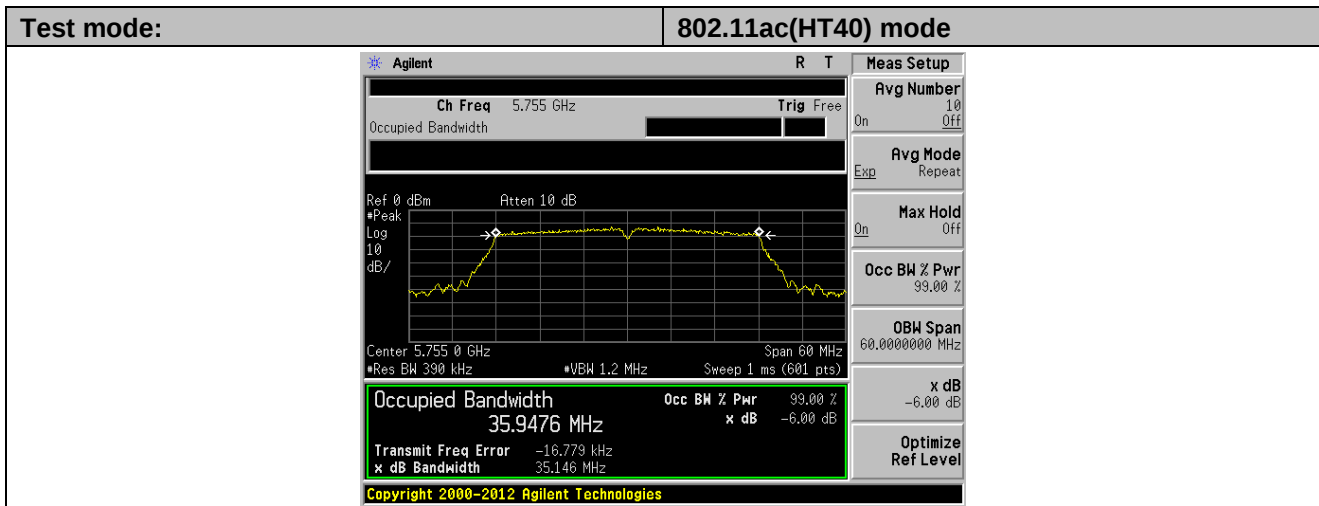
Highest channel



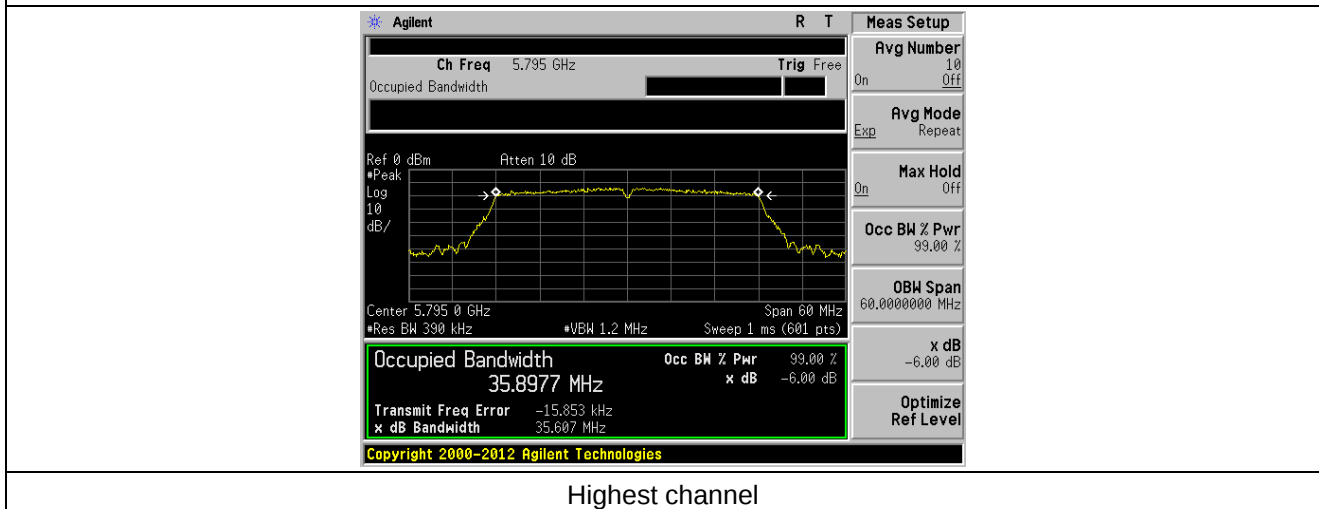
Middle channel

99%:

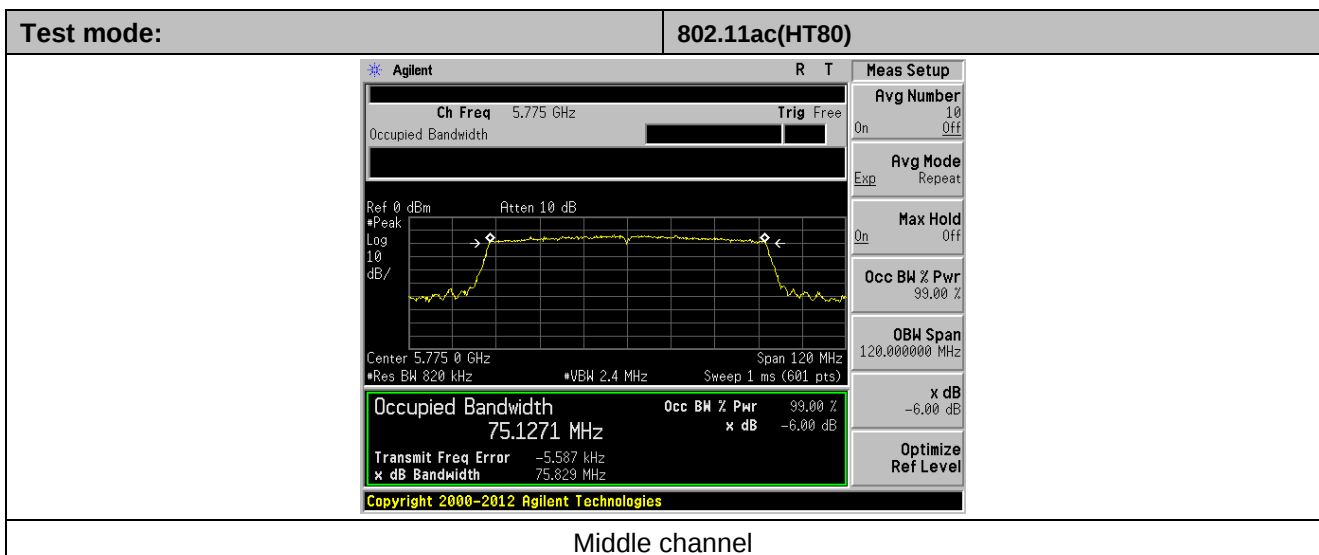
Test mode:	802.11ac(HT20) mode
 Agilent R T Meas Setup Ch Freq 5.745 GHz Trig Free Occupied Bandwidth Ref 0 dBm Atten 10 dB Peak Log 10 dB/ Center 5.745 00 GHz Span 30 MHz Res BW 200 kHz VBW 620 kHz Sweep 1 ms (601 pts) Occupied Bandwidth 17.5301 MHz Occ BW % Pwr 99.00 % Transmit Freq Error 2.592 kHz x dB -6.00 dB Copyright 2000-2012 Agilent Technologies Avg Number 10 Off Avg Mode Repeat Max Hold On Off Occ BW % Pwr 99.00 % OBW Span 30.0000000 MHz x dB -6.00 dB Optimize Ref Level	
Lowest channel	
 Agilent R T Meas Setup Ch Freq 5.785 GHz Trig Free Occupied Bandwidth Ref 0 dBm Atten 10 dB Peak Log 10 dB/ Center 5.785 00 GHz Span 30 MHz Res BW 200 kHz VBW 620 kHz Sweep 1 ms (601 pts) Occupied Bandwidth 17.5304 MHz Occ BW % Pwr 99.00 % Transmit Freq Error -3.580 kHz x dB -6.00 dB Copyright 2000-2012 Agilent Technologies Avg Number 10 Off Avg Mode Repeat Max Hold On Off Occ BW % Pwr 99.00 % OBW Span 30.0000000 MHz x dB -6.00 dB Optimize Ref Level	
Middle channel	
 Agilent R T Meas Setup Ch Freq 5.825 GHz Trig Free Occupied Bandwidth Ref 0 dBm Atten 10 dB Peak Log 10 dB/ Center 5.825 00 GHz Span 30 MHz Res BW 200 kHz VBW 620 kHz Sweep 1 ms (601 pts) Occupied Bandwidth 17.5581 MHz Occ BW % Pwr 99.00 % Transmit Freq Error -6.963 kHz x dB -6.00 dB Copyright 2000-2012 Agilent Technologies Avg Number 10 Off Avg Mode Repeat Max Hold On Off Occ BW % Pwr 99.00 % OBW Span 30.0000000 MHz x dB -6.00 dB Optimize Ref Level	
Highest channel	



Lowest channel

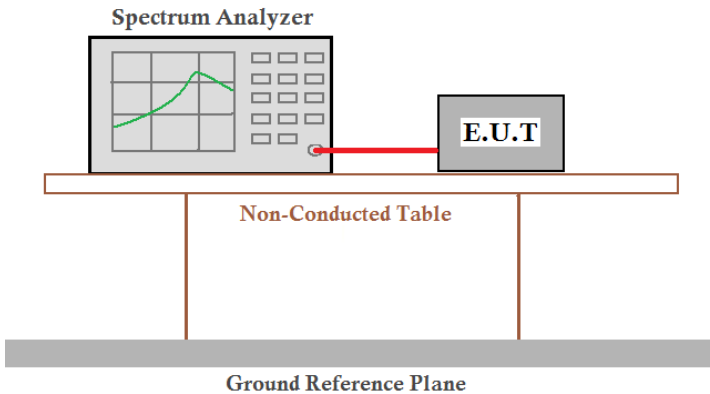


Highest channel



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

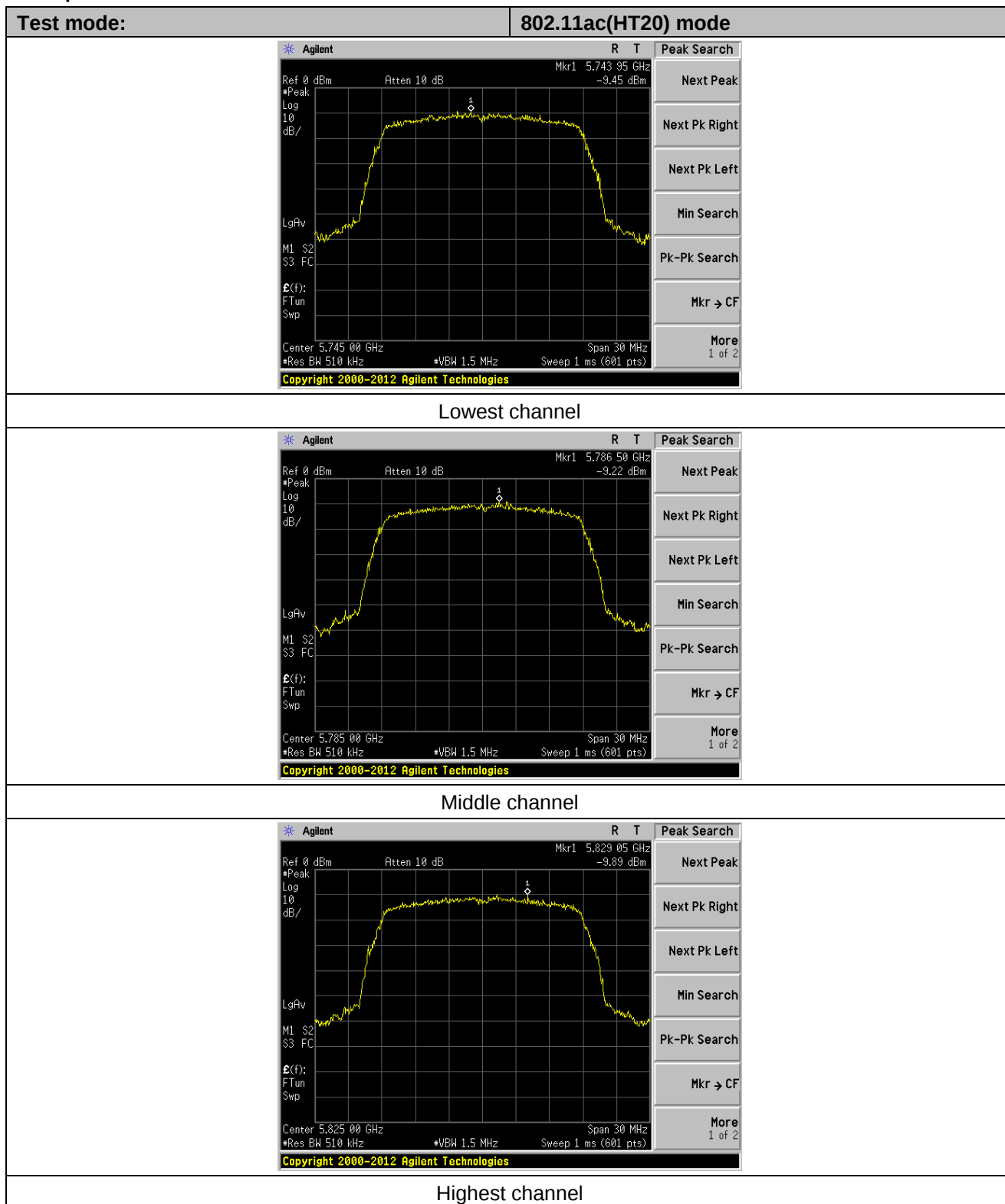
Measurement Data

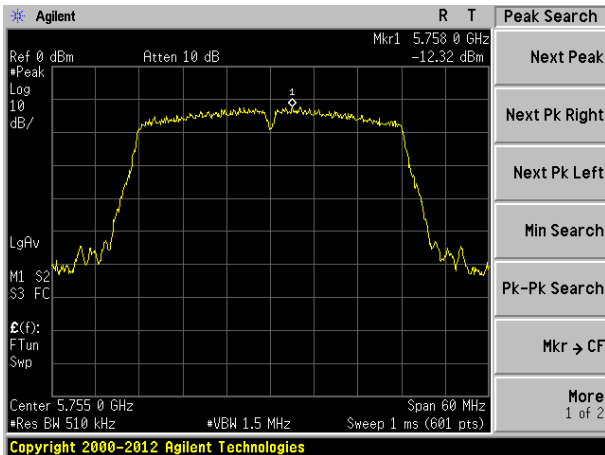
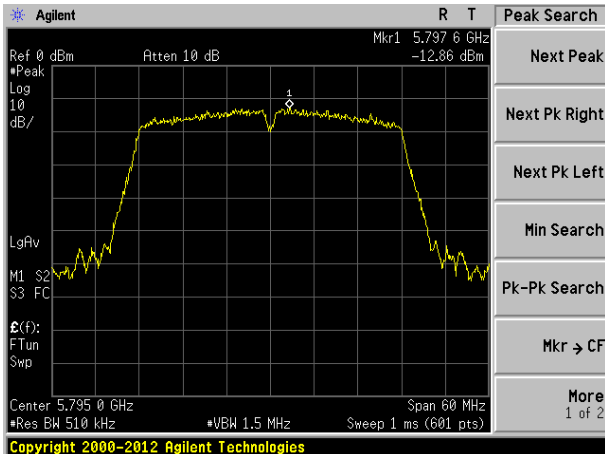
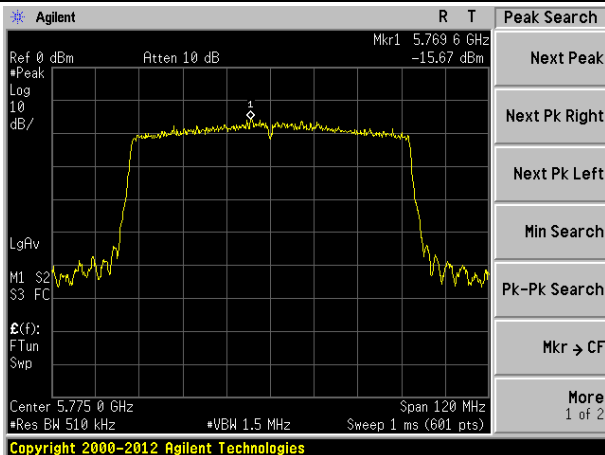
Test CH	Power Spectral Density (dBm/500kHz)			Limit (dBm/500k Hz)	Result
	802.11ac(HT20)	802.11ac(HT40)	802.11ac(HT80)		
Lowest	-9.45	-12.32	---	30.00	Pass
Middle	-9.22	---	-15.67		
Highest	-9.89	-12.86	---		

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:



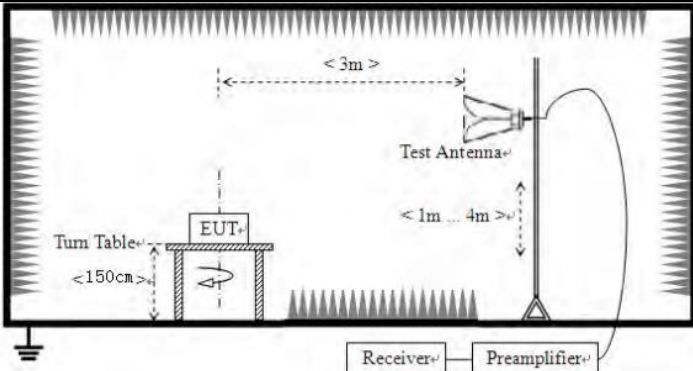
Test mode:		802.11ac(HT40) mode
		
Lowest channel		
		
Highest channel		
Test mode:		802.11ac(HT80)
		
Middle channel		

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:

IEEE 802.11ac HT20								
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	29.39	32.36	9.72	23.83	47.64	68.2	-20.56	Horizontal
5700.00	25.65	32.5	9.79	23.84	44.1	105.2	-61.1	Horizontal
5720.00	28.41	32.53	9.81	23.85	46.9	110.8	-63.9	Horizontal
5725.00	27.11	32.53	9.83	23.86	45.61	122.2	-76.59	Horizontal
5850.00	27.04	32.7	9.99	23.87	45.86	122.2	-76.34	Horizontal
5855.00	27.99	32.72	9.99	23.88	46.82	110.8	-63.98	Horizontal
5875.00	25.97	32.74	10.04	23.89	44.86	105.2	-60.34	Horizontal
5925.00	28.38	32.8	10.11	23.9	47.39	68.2	-20.81	Horizontal
5650.00	28.14	32.36	9.72	23.83	46.39	68.2	-21.81	Vertical
5700.00	29.56	32.5	9.79	23.84	48.01	105.2	-57.19	Vertical
5720.00	26.75	32.53	9.81	23.85	45.24	110.8	-65.56	Vertical
5725.00	25.10	32.53	9.83	23.86	43.6	122.2	-78.6	Vertical
5850.00	29.21	32.7	9.99	23.87	48.03	122.2	-74.17	Vertical
5855.00	25.73	32.72	9.99	23.88	44.56	110.8	-66.24	Vertical
5875.00	25.90	32.74	10.04	23.89	44.79	105.2	-60.41	Vertical
5925.00	25.47	32.8	10.11	23.9	44.48	68.2	-23.72	Vertical

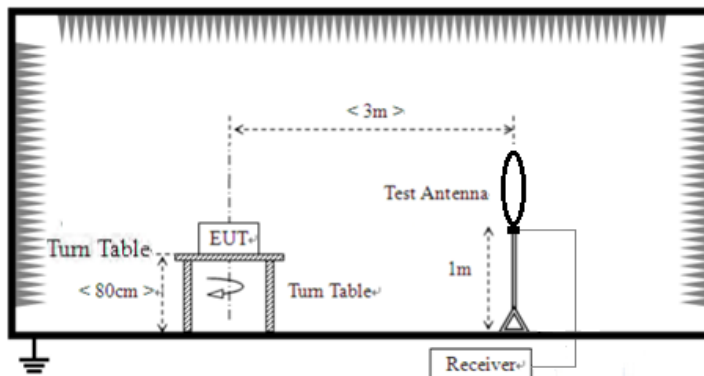
IEEE 802.11ac HT40								
Peak value:								
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
5650.00	26.15	32.36	9.72	23.83	44.4	68.2	-23.8	Horizontal
5700.00	29.45	32.5	9.79	23.84	47.9	105.2	-57.3	Horizontal
5720.00	27.93	32.53	9.81	23.85	46.42	110.8	-64.38	Horizontal
5725.00	28.41	32.53	9.83	23.86	46.91	122.2	-75.29	Horizontal
5850.00	25.02	32.7	9.99	23.87	43.84	122.2	-78.36	Horizontal
5855.00	28.90	32.72	9.99	23.88	47.73	110.8	-63.07	Horizontal
5875.00	28.34	32.74	10.04	23.89	47.23	105.2	-57.97	Horizontal
5925.00	28.56	32.8	10.11	23.9	47.57	68.2	-20.63	Horizontal
5650.00	27.42	32.36	9.72	23.83	45.67	68.2	-22.53	Vertical
5700.00	25.59	32.5	9.79	23.84	44.04	105.2	-61.16	Vertical
5720.00	26.52	32.53	9.81	23.85	45.01	110.8	-65.79	Vertical
5725.00	26.25	32.53	9.83	23.86	44.75	122.2	-77.45	Vertical
5850.00	25.49	32.7	9.99	23.87	44.31	122.2	-77.89	Vertical
5855.00	28.02	32.72	9.99	23.88	46.85	110.8	-63.95	Vertical
5875.00	29.09	32.74	10.04	23.89	47.98	105.2	-57.22	Vertical
5925.00	25.66	32.8	10.11	23.9	44.67	68.2	-23.53	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	28.73	32.36	9.72	23.83	46.98	68.2	-21.22	Horizontal
5700.00	25.44	32.5	9.79	23.84	43.89	105.2	-61.31	Horizontal
5720.00	25.34	32.53	9.81	23.85	43.83	110.8	-66.97	Horizontal
5725.00	27.28	32.53	9.83	23.86	45.78	122.2	-76.42	Horizontal
5850.00	25.22	32.7	9.99	23.87	44.04	122.2	-78.16	Horizontal
5855.00	28.48	32.72	9.99	23.88	47.31	110.8	-63.49	Horizontal
5875.00	28.40	32.74	10.04	23.89	47.29	105.2	-57.91	Horizontal
5925.00	28.83	32.8	10.11	23.9	47.84	68.2	-20.36	Horizontal
5650.00	29.76	32.36	9.72	23.83	48.01	68.2	-20.19	Vertical
5700.00	28.50	32.5	9.79	23.84	46.95	105.2	-58.25	Vertical
5720.00	29.97	32.53	9.81	23.85	48.46	110.8	-62.34	Vertical
5725.00	29.60	32.53	9.83	23.86	48.1	122.2	-74.1	Vertical
5850.00	25.19	32.7	9.99	23.87	44.01	122.2	-78.19	Vertical
5855.00	28.00	32.72	9.99	23.88	46.83	110.8	-63.97	Vertical
5875.00	28.28	32.74	10.04	23.89	47.17	105.2	-58.03	Vertical
5925.00	25.55	32.8	10.11	23.9	44.56	68.2	-23.64	Vertical

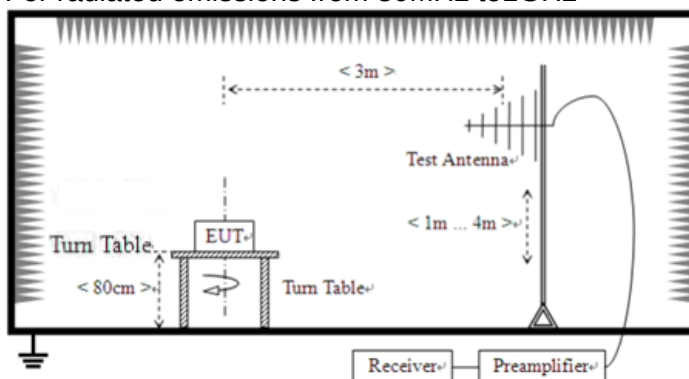
7.7 Spurious Emission

7.7.1 Radiated Emission Method

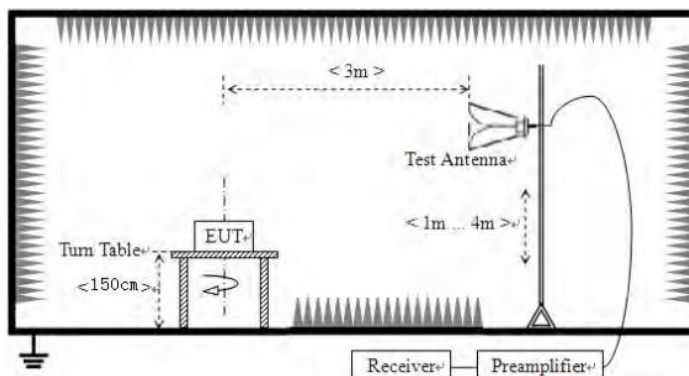
Test Requirement:	FCC Part15 C Section 15.209, Part 15E Section 15.407(b)(4)				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 40GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9kHz-150KHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
	150kHz-30MHz	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:					
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				
Table 6 – General field strength limits at frequencies below 30 MHz					
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. 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:

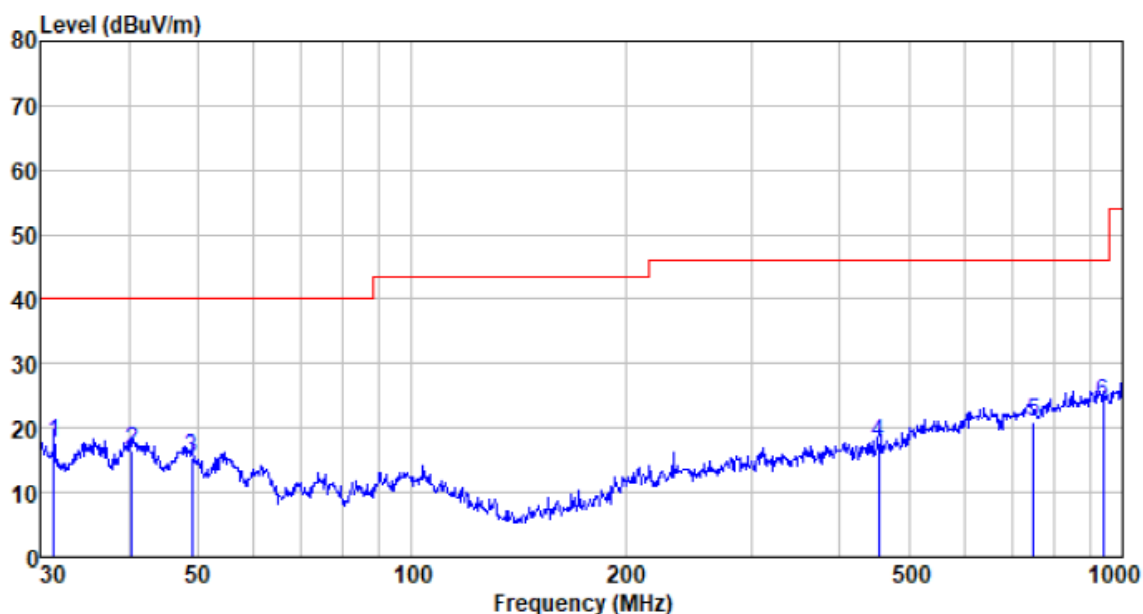
9 kHz ~ 30 MHz

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

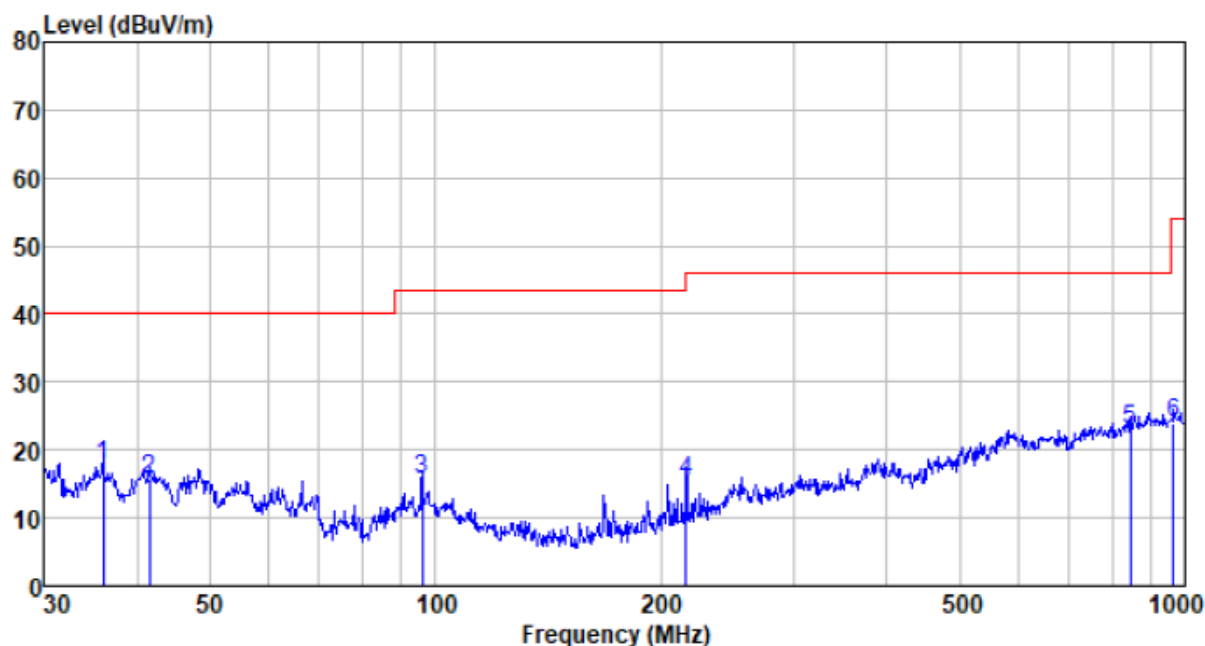
Pre-scan all test modes, found worst case at 802.11ac(HT80) 5775MHz, and so only show the test result of 802.11ac(HT80) 5775MHz

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
31.399	41.01	11.23	0.57	35.11	17.70	40.00	-22.30	QP
40.417	39.41	12.21	0.66	35.69	16.59	40.00	-23.41	QP
49.014	38.57	12.29	0.76	36.13	15.49	40.00	-24.51	QP
454.310	35.75	16.44	3.11	37.51	17.79	46.00	-28.21	QP
750.108	33.65	20.53	4.28	37.62	20.84	46.00	-25.16	QP
938.833	33.92	22.46	4.99	37.56	23.81	46.00	-22.19	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
36.001	40.88	11.52	0.62	35.42	17.60	40.00	-22.40	QP
41.567	38.36	12.22	0.68	35.75	15.51	40.00	-24.49	QP
96.099	39.45	11.65	1.16	36.69	15.57	43.50	-27.93	QP
216.024	39.75	11.02	1.93	37.35	15.35	46.00	-30.65	QP
845.088	34.08	21.82	4.63	37.61	22.92	46.00	-23.08	QP
965.542	33.82	22.57	5.09	37.54	23.94	54.00	-30.06	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	22.46	21.64	44.1	74	-29.9	PK
V	17235	20.53	21.8	42.33	74	-31.67	PK
H	11490	22.43	21.83	44.26	74	-29.74	PK
H	17235	22.27	21.67	43.94	74	-30.06	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	22.76	21.64	44.4	74	-29.6	PK
V	17355	21.01	21.8	42.81	74	-31.19	PK
H	11570	22.59	21.83	44.42	74	-29.58	PK
H	17355	20.08	21.67	41.75	74	-32.25	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	22.41	21.64	44.05	74	-29.95	PK
V	17475	22.21	21.8	44.01	74	-29.99	PK
H	11650	20.27	21.83	42.1	74	-31.9	PK
H	17475	22.98	21.67	44.65	74	-29.35	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	22.41	21.67	44.08	74	-29.92	PK
V	17265	20.05	21.83	41.88	74	-32.12	PK
H	11510	20.96	21.67	42.63	74	-31.37	PK
H	17265	20.64	21.83	42.47	74	-31.53	PK

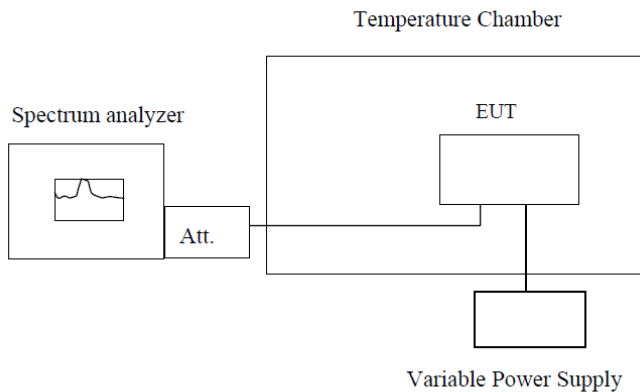
Test mode:		802.11ac(HT40)		Test channel:		Highest	
Antenna Pol.	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dBuV/m)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over limit(dB)	Detector
V	11590	22.32	21.67	43.99	74	-30.01	PK
V	17385	20.94	21.83	42.77	74	-31.23	PK
H	11590	21.57	21.67	43.24	74	-30.76	PK
H	17385	22.74	21.83	44.57	74	-29.43	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	21.97	21.67	43.64	74	-30.36	PK
V	17325	20.38	21.83	42.21	74	-31.79	PK
H	11550	20.68	21.67	42.35	74	-31.65	PK
H	17325	20.31	21.83	42.14	74	-31.86	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	5745.706	5745.614	5745.427	5745.568
	5755	5755.550	5755.344	5755.817	5755.797
	5775	5775.633	5775.811	5775.134	5775.243
	5785	5785.511	5785.250	5785.426	5785.963
	5795	5795.504	5795.100	5795.532	5795.075
	5825	5825.464	5825.335	5825.525	5825.623
-20	5745	5745.150	5745.679	5745.277	5745.364
	5755	5755.514	5755.979	5755.291	5755.908
	5775	5775.697	5775.024	5775.895	5775.051
	5785	5785.560	5785.551	5785.856	5785.434
	5795	5795.665	5795.297	5795.828	5795.158
	5825	5825.454	5825.799	5825.875	5825.491
-10	5745	5745.865	5745.659	5745.684	5745.328
	5755	5755.301	5755.458	5755.590	5755.292
	5775	5775.763	5775.846	5775.658	5775.266
	5785	5785.675	5785.369	5785.874	5785.089
	5795	5795.607	5795.383	5795.043	5795.004
	5825	5825.700	5825.017	5825.967	5825.261
0	5745	5745.099	5745.805	5745.058	5745.456
	5755	5755.519	5755.869	5755.104	5755.259
	5775	5775.595	5775.940	5775.155	5775.111
	5785	5785.845	5785.575	5785.798	5785.499
	5795	5795.962	5795.505	5795.658	5795.644
	5825	5825.773	5825.586	5825.661	5825.837
10	5745	5745.675	5745.685	5745.413	5745.228
	5755	5755.265	5755.366	5755.459	5755.644
	5775	5775.525	5775.125	5775.597	5775.865
	5785	5785.394	5785.826	5785.552	5785.196
	5795	5795.215	5795.500	5795.264	5795.532
	5825	5825.827	5825.747	5825.701	5825.247
20	5745	5745.321	5745.233	5745.983	5745.217
	5755	5755.506	5755.345	5755.606	5755.712
	5775	5775.502	5775.909	5775.691	5775.757
	5785	5785.891	5785.288	5785.520	5785.903
	5795	5795.309	5795.419	5795.029	5795.364
	5825	5825.765	5825.361	5825.583	5825.103
30	5745	5745.724	5745.502	5745.281	5745.808
	5755	5755.198	5755.184	5755.958	5755.599
	5775	5775.901	5775.480	5775.078	5775.086
	5785	5785.992	5785.014	5785.772	5785.432
	5795	5795.194	5795.242	5795.641	5795.634
	5825	5825.320	5825.256	5825.876	5825.813
40	5745	5745.959	5745.322	5745.440	5745.431
	5755	5755.926	5755.780	5755.354	5755.356
	5775	5775.282	5775.996	5775.734	5775.646
	5785	5785.589	5785.920	5785.179	5785.211

	5795	5795.954	5795.442	5795.099	5795.087
	5825	5825.463	5825.655	5825.192	5825.080
50	5745	5745.451	5745.462	5745.588	5745.425
	5755	5755.874	5755.120	5755.828	5755.587
	5775	5775.814	5775.179	5775.004	5775.953
	5785	5785.623	5785.073	5785.407	5785.345
	5795	5795.071	5795.465	5795.324	5795.491
	5825	5825.583	5825.448	5825.823	5825.483

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	5745.760	5745.037	5745.838	5745.689
	5755	5755.473	5755.329	5755.866	5755.688
	5775	5775.179	5775.588	5775.850	5775.162
	5785	5785.886	5785.365	5785.484	5785.793
	5795	5795.445	5795.994	5795.974	5795.198
	5825	5825.278	5825.831	5825.239	5825.104
4.4	5745	5745.916	5745.404	5745.730	5745.093
	5755	5755.514	5755.289	5755.441	5755.590
	5775	5775.399	5775.740	5775.909	5775.356
	5785	5785.004	5785.661	5785.191	5785.544
	5795	5795.054	5795.281	5795.650	5795.430
	5825	5825.966	5825.881	5825.260	5825.550

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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