TCT 通测检测
TESTING CENTRE TECHNOLOGY

TEST REPORT

FCC ID: 2AI5MN1405A-E

Product: Ultrabook

Model No.: HN4C401

Additional Model No.: N1405A-E

Trade Mark: N/A

Report No.: TCT171018E016

Issued Date: November 26, 2017

Issued for:

CHUNGHSIN INTERNATIONAL ELECTRONICS CO.,LTD
618 GONGREN WEST ROAD,JIAOJIANG AREA, TAIZHOU, China

Issued By:

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1. Test Certification

Product:	**Ultrabook**
Model No.:	**HN4C401**
Additional Model No.:	**N1405A-E**
Trade Mark:	**N/A**
Applicant:	**CHUNGHSIN INTERNATIONAL ELECTRONICS CO.,LTD**
Address:	**618 GONGREN WEST ROAD,JIAOJIANG AREA, TAIZHOU, China**
Manufacturer:	**CHUNGHSIN INTERNATIONAL ELECTRONICS CO.,LTD**
Address:	**618 GONGREN WEST ROAD,JIAOJIANG AREA, TAIZHOU, China**
Date of Test:	**November 10, 2017 to November 25, 2017**
Applicable Standards:	**FCC CFR Title 47 Part 15 Subpart E Section 15.407: 2016 KDB789033 D02 General U-NII Test Procedures New Rules v01r04**

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By: Brews Xu **Date:** ***November 25, 2017***

Brews Xu

Reviewed By: Joe Zhou **Date:** ***November 26, 2017***

Joe Zhou

Approved By: Tomsin ***November 26, 2017***

Tomsin

SHENZHEN TONGCE TESTING LAB TCT

2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203	PASS
AC Power Line Conducted Emission	§15.207	PASS
Maximum Conducted Output Power	§15.407(a) §2.1046	PASS
6dB Emission Bandwidth	§15.407(a) §2.1049	PASS
26dB Emission Bandwidth& 99% Occupied Bandwidth	§15.407(a) §2.1049	PASS
Power Spectral Density	§15.407(a)	PASS
Band edge	§15.407(a)	PASS
Radiated Emission	§15.407(a) §2.1053	PASS
Frequency Stability	§15.407(g) §2.1055	PASS

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

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3. EUT Description

Product:	Ultrabook
Model No.:	HN4C401
Additional Model No.:	N1405A-E
Trade Mark:	N/A
Operation Frequency:	Band I:5180-5240MHz；5190-5230MHz；5210MHz Band IV:5745-5825MHz；5755-5795MHz；5775MHz
Channel Bandwidth:	802.11a/11n (HT20)/11ac(VHT20) : 20MHz （5180-5240MHz；5745-5825MHz） 802.11n (HT40) /11ac(VHT40) : 40MHz （5190-5230MHz；5755-5795MHz） 802.11ac(VHT80) : 80MHz （5210MHz；5775MHz）
Modulation Technology:	OFDM
Modulation Type	CCK, DQPSK, DBPSK for 802.11a 64-QAM,16-QAM, QPSK, BPSK for 802.11n 256-QAM,64-QAM,16-QAM, QPSK BPSK for 802.11ac
Antenna Type:	Integral Antenna
Antenna Gain:	1.83 dBi
Power Supply:	1. DC 12V 2.0A 24W 2. DC 7.6V Built-in Li-ion battery
Adapter:	Manufacturer :BSY M/N: BSYF120200U W Input: AC 100-240V 50/60Hz 1A Output: DC 12V 2A
Remark:	Both of models have the same circuitry, electrical mechanical, PCB Layout and physical construction. Their difference in model number due to trading purpose.

Operation Frequency each of channel

20MHz		40MHz		80MHz	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230	155	5775
44	5220	151	5755		
48	5240	159	5790		
149	5745				
153	5765				
157	5785				
161	5805				
165	5825				

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:

For 802.11a/n (HT20)/ac(VHT20)

Band I (5150 - 5250 MHz)			Band IV (5725 - 5850 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
36	Low	5180	149	Low	5745
40	Mid	5200	157	Mid	5785
48	High	5240	165	High	5825

For 802.11n (HT40)/ac(VHT40)

Band I (5150 - 5250 MHz)			Band IV (5725 - 5850 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
38	Low	5190	151	Low	5755
46	High	5230	159	High	5795

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For 802.11ac (VHT80)

Band I (5150 - 5250 MHz)			Band IV (5725 - 5850 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
42	/	5210	155	/	5775

4. Genera Information

4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 100%)
The sample was placed 0.8m/1.5m for blow/above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

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
802.11a	6 Mbps
802.11n(HT20)/ac(VHT20)	MCS0
802.11n(HT40)/ac(VHT40)	MCS0
802.11ac(VHT80)	MCS0
Final Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation

4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3. For conducted measurements (Output Power, Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

5. Facilities and Accreditations

5.1. Facilities

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

- FCC - Registration No.: 645098
  Shenzhen Tongce Testing Lab
  The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.
- IC - Registration No.: 10668A-1
  The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

5.2. Location

Shenzhen Tongce Testing Lab
Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China
TEL: +86-755-27673339

5.3. Measurement Uncertainty

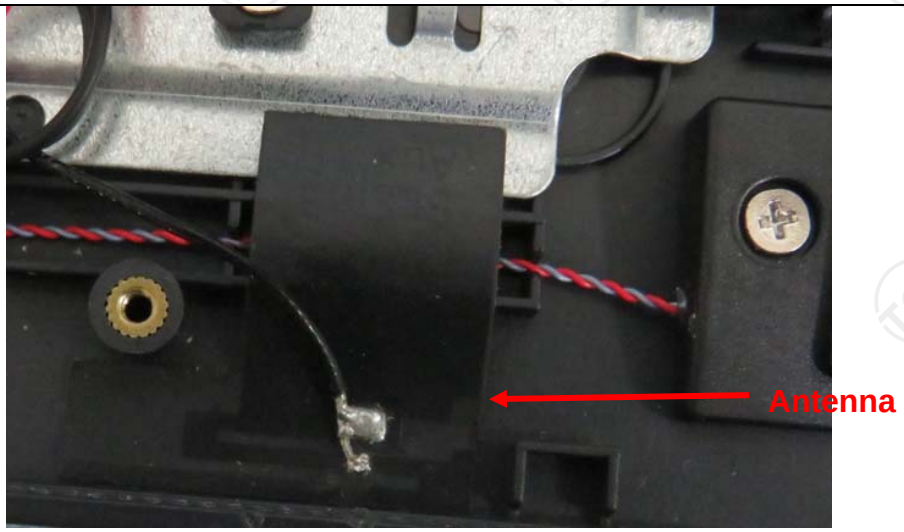
The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	±2.56dB
2	RF power, conducted	±0.12dB
3	Spurious emissions, conducted	±0.11dB
4	All emissions, radiated(<1G)	±3.92dB
5	All emissions, radiated(>1G)	±4.28dB
6	Temperature	±0.1°C
7	Humidity	±1.0%

6. Test Results and Measurement Data

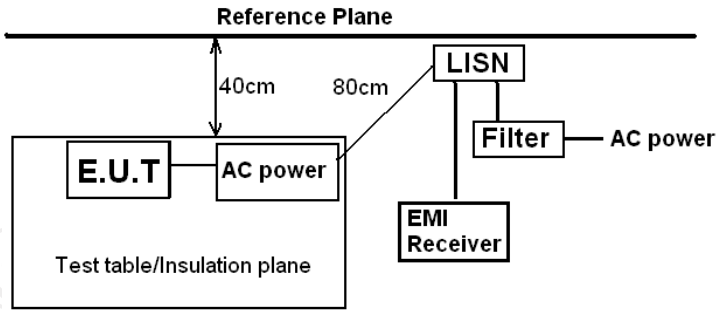
6.1. Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
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.	
E.U.T Antenna:	
The WIFI antenna is an internal antenna which permanently attached, and the best case gain of the antenna is 1.83dBi .	



6.2. Conducted Emission

6.2.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Frequency Range:</td><td>150 kHz to 30 MHz</td></tr>
<tr><td>Receiver setup:</td><td>RBW=9 kHz, VBW=30 kHz, Sweep time=auto</td></tr>
<tr><td>Limits:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
</td></tr>
<tr><td>Test Setup:</td><td>


Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m
</td></tr>
<tr><td>Test Mode:</td><td>Tx Mode</td></tr>
<tr><td>Test Procedure:</td><td>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.</td></tr>
<tr><td>Test Result:</td><td>PASS</td></tr>
</table>

6.2.2. Test Instruments

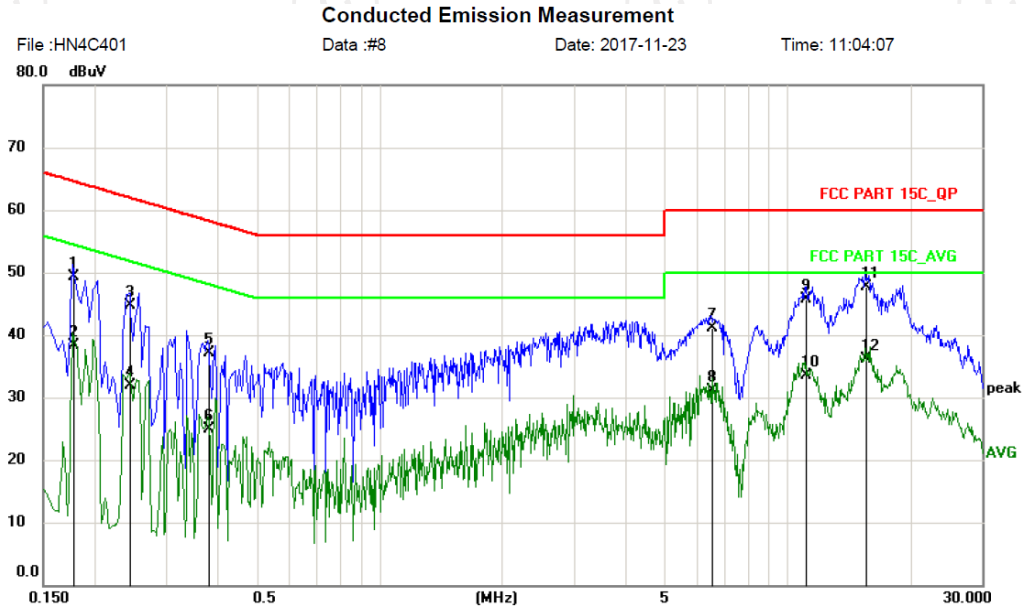
Conducted Emission Shielding Room Test Site (843)				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Test Receiver	R&S	ESPI	101401	Jun. 12, 2018
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 27, 2018
Coax cable (9KHz-30MHz)	TCT	CE-05	N/A	Sep. 27, 2018
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.2.3. Test data

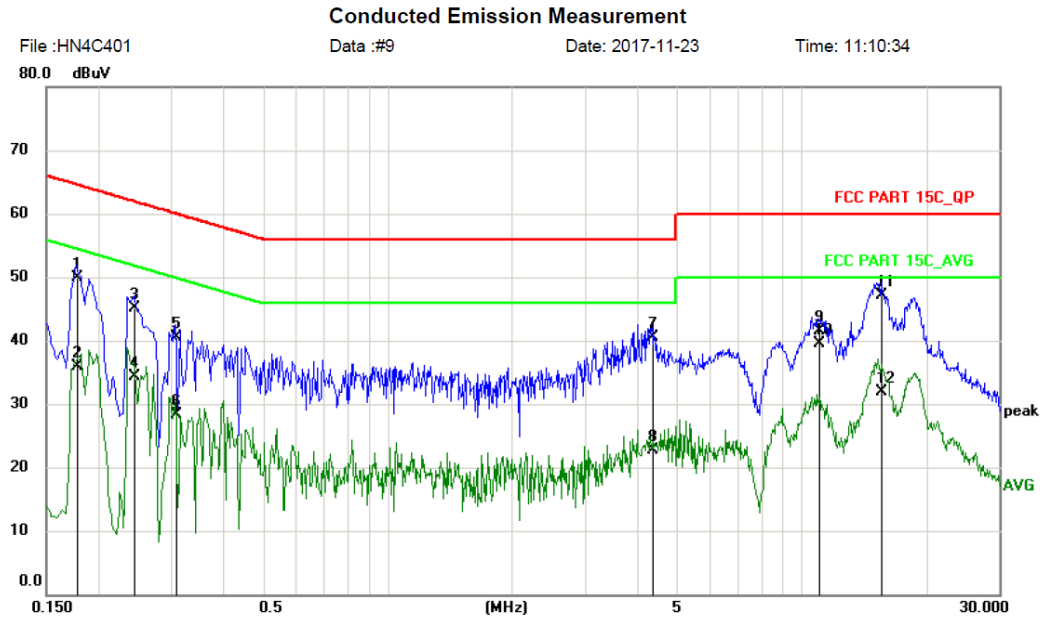
Please refer to following diagram for individual

Conducted Emission on Line Terminal of the power line



Site		Phase:	*L1*	Temperature:	26
Limit:	FCC PART 15C_QP	Power:	AC120V/60Hz	Humidity:	53 %
EUT:	Ultrabook				
M/N:	HN4C401				
Mode:	Charging +WIFI Mode (5G WLAN)				

Conducted Emission on Neutral Terminal of the power line

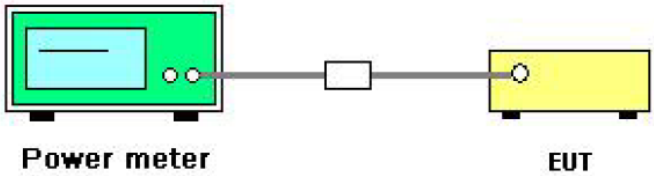


Site		Phase:	*N*	Temperature:	26
Limit:	FCC PART 15C_QP	Power:	AC120V/60Hz	Humidity:	53 %
EUT:	Ultrabook				
M/N:	HN4C401				
Mode:	Charging +WIFI Mode (5G WLAN)				

Remark:
Factor = Cable lose+ PULSE LIMITER factor + ARTIFICIAL MAINS factor; Margin= Limit - Level

6.3. Maximum Conducted Output Power

6.3.1. Test Specification

Test Requirement:	FCC Part15 E Section 15.407(a)& Part 2 J Section 2.1046
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section E
Limit:	Frequency Band (MHz) / Limit 5150-5250 / 250mW for client devices 5725-5850 / 1 W
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows the Measurement Procedure of KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section E, 3, a 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 5. Measure the conducted output power and record the results in the test report.
Test Result:	PASS
Remark:	Conducted output power= measurement power +10log(1/x) X is duty cycle=1, so 10log(1/1)=0 Conducted output power= measurement power

6.3.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
Power Meter	Agilent	N1911A	MY45101557	Sep. 27, 2018
Power Sensor	Agilent	N1922A	MY44124432	Sep. 27, 2018
RF Cable (9KHz-40GHz)	TCT	RE-03	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-03	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

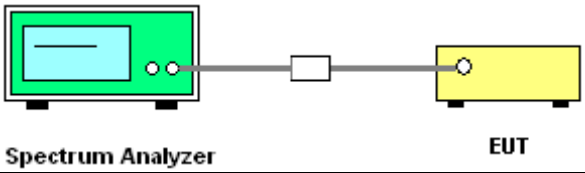
6.3.3. Test Data

Configuration Band I (5150 - 5250 MHz)				
Mode	Test channel	Maximum Conducted Output Power (dBm)	FCC Limit (dBm)	Result
11a	CH36	4.60	24	PASS
11a	CH40	4.41	24	PASS
11a	CH48	4.40	24	PASS
11n(HT20)	CH36	3.90	24	PASS
11n(HT20)	CH40	4.89	24	PASS
11n(HT20)	CH48	4.32	24	PASS
11n(HT40)	CH38	4.52	24	PASS
11n(HT40)	CH46	5.85	24	PASS
11ac(VHT20)	CH36	3.92	24	PASS
11ac(VHT20)	CH40	4.40	24	PASS
11ac(VHT20)	CH48	4.27	24	PASS
11ac(VHT40)	CH38	4.49	24	PASS
11ac(VHT40)	CH46	5.94	24	PASS
11ac(VHT80)	CH42	3.55	24	PASS

Configuration Band IV (5725 - 5850 MHz)				
Mode	Test channel	Maximum Conducted Output Power (dBm)	FCC Limit (dBm)	Result
11a	CH149	5.22	30	PASS
11a	CH157	6.12	30	PASS
11a	CH165	6.06	30	PASS
11n (HT20)	CH149	3.49	30	PASS
11n (HT20)	CH157	4.59	30	PASS
11n (HT20)	CH165	5.98	30	PASS
11n (HT40)	CH151	4.04	30	PASS
11n (HT40)	CH159	5.66	30	PASS
11ac(VHT20)	CH149	3.58	30	PASS
11ac(VHT20)	CH157	5.10	30	PASS
11ac(VHT20)	CH165	5.98	30	PASS
11ac(VHT40)	CH151	4.30	30	PASS
11ac(VHT40)	CH159	5.60	30	PASS
11ac(VHT80)	CH155	4.53	30	PASS

6.4. 6dB Emission Bandwidth

6.4.1. Test Specification

Test Requirement:	FCC CFR47 Part 15 Section 15.407(e)& Part 2 J Section 2.1049
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section C
Limit:	>500kHz
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section C 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz. 4. Measure and record the results in the test report.
Test Result:	PASS

6.4.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	ROHDE&SCHWARZ	FSQ	200061	Sep. 27, 2018
RF Cable (9KHz-40GHz)	TCT	RE-03	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-03	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

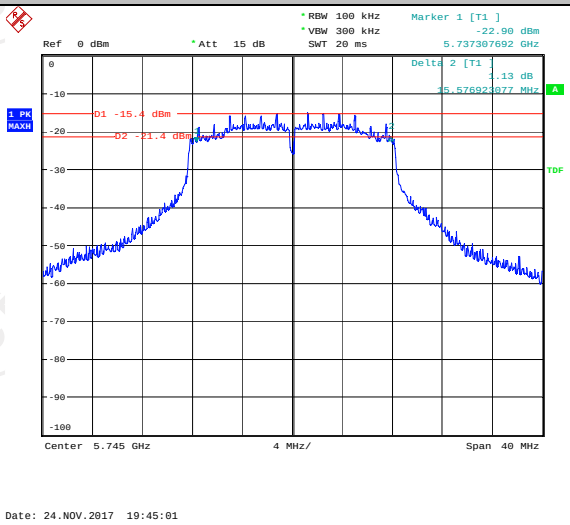
6.4.3. Test data

Band IV (5725 - 5850 MHz)					
Mode	Test channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)	Result
11a	CH149	5745	15.58	0.5	PASS
11a	CH157	5785	15.77	0.5	PASS
11a	CH161	5825	15.32	0.5	PASS
11n(HT20)	CH149	5745	15.26	0.5	PASS
11n(HT20)	CH157	5785	15.26	0.5	PASS
11n(HT20)	CH161	5825	15.26	0.5	PASS
11n(HT40)	CH151	5755	35.51	0.5	PASS
11n(HT40)	CH159	5795	35.51	0.5	PASS
11ac(VHT20)	CH149	5745	16.15	0.5	PASS
11ac(VHT20)	CH157	5785	15.26	0.5	PASS
11ac(VHT20)	CH165	5825	16.15	0.5	PASS
11ac(VHT40)	CH151	5755	35.38	0.5	PASS
11ac(VHT40)	CH159	5795	35.51	0.5	PASS
11ac(VHT80)	CH155	5775	76.03	0.5	PASS

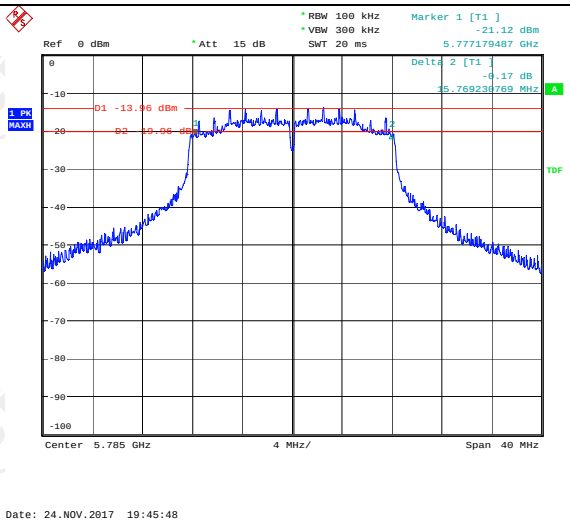
Test plots as follows:

Band IV (5725 – 5850 MHz)

802.11a



Low



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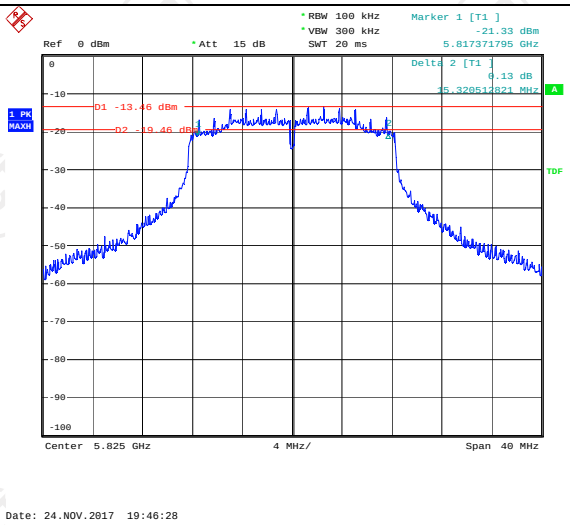
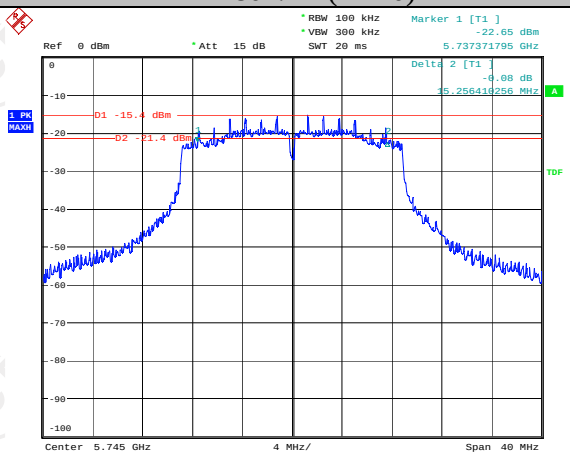


High

802.11n(HT20)



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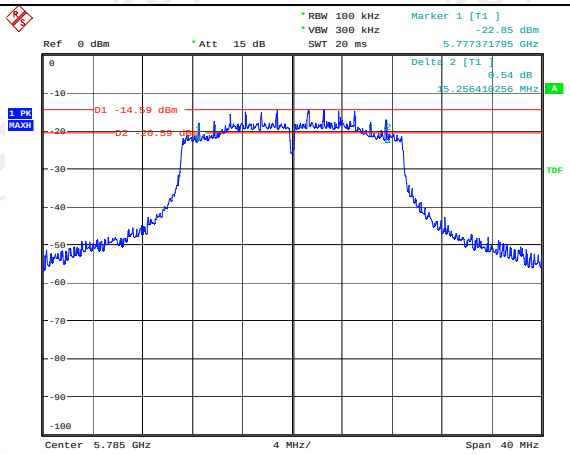

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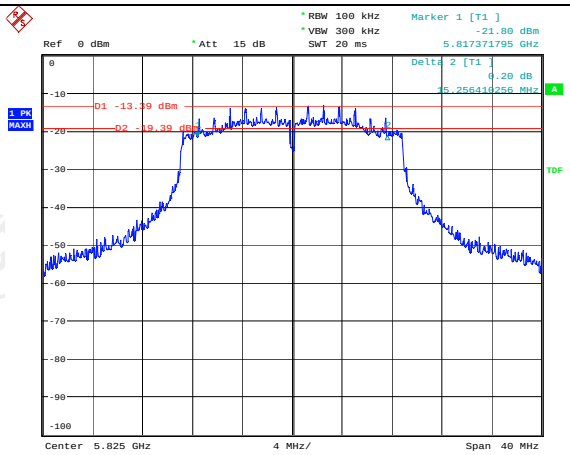

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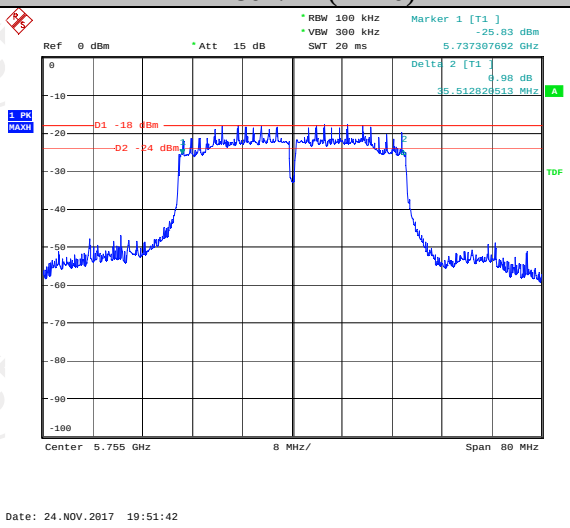
High

802.11n(HT40)



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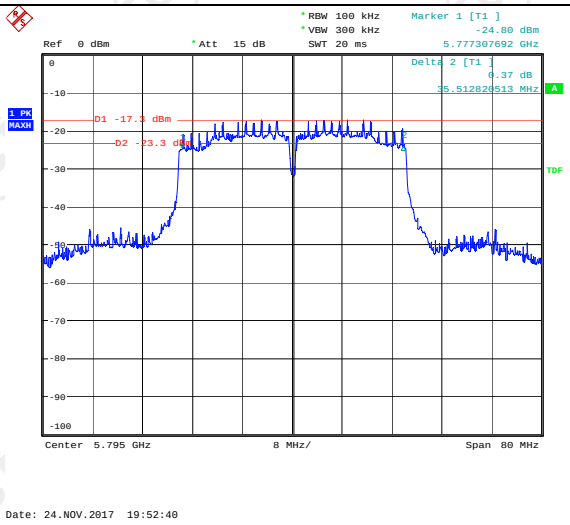

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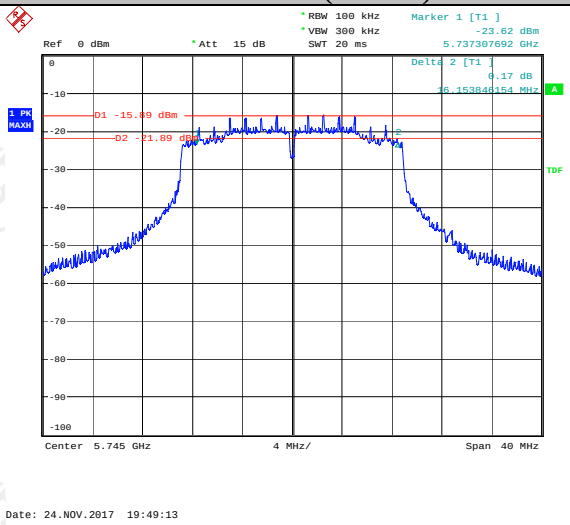
802.11ac(VHT20)



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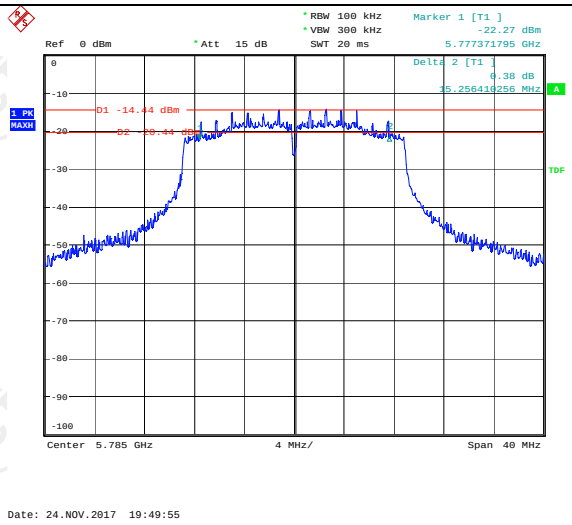

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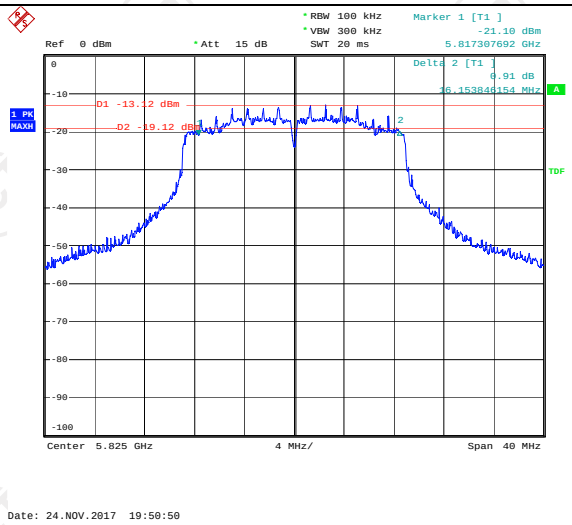

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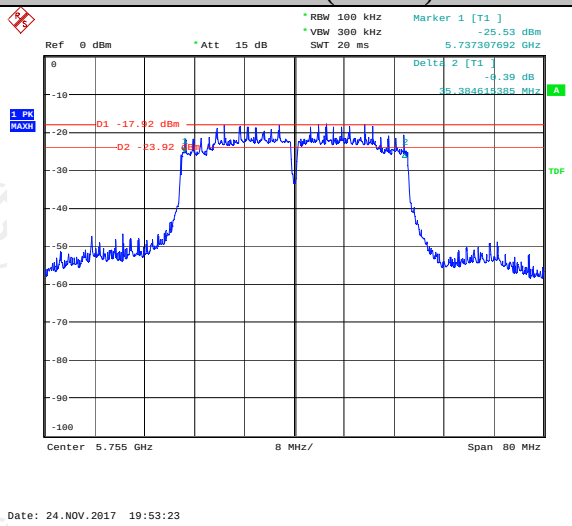

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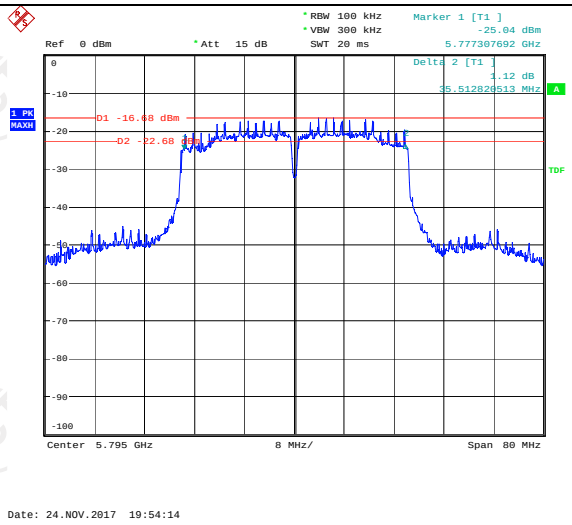

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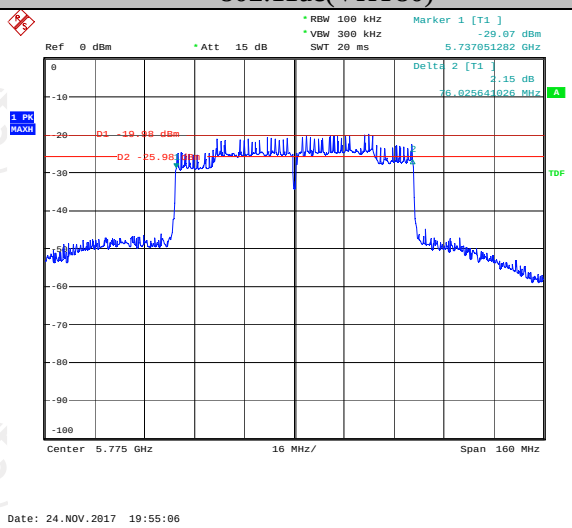
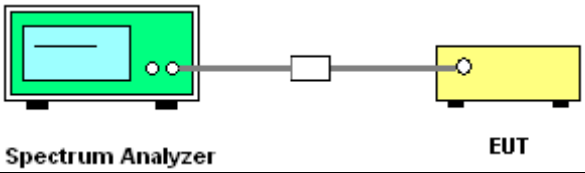
802.11ac(VHT80)



6.5. 26dB Bandwidth and 99% Occupied Bandwidth

6.5.1. Test Specification

Test Requirement:	47 CFR Part 15C Section 15.407 (a)& Part 2 J Section 2.1049
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section D
Limit:	No restriction limits
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section D 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. 4. Measure and record the results in the test report.
Test Result:	PASS

6.5.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	ROHDE&SCHWARZ	FSQ	200061	Sep. 27, 2018
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-01	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.5.3. Test data

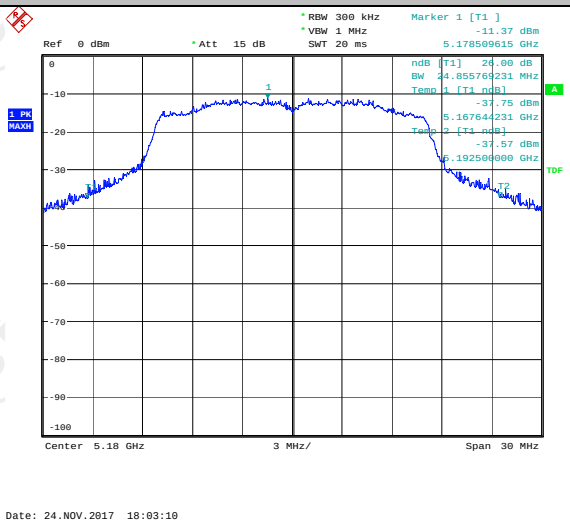
Band I

Mode	Test channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH36	5180	24.86	17.02
11a	CH40	5200	26.06	17.07
11a	CH48	5240	25.77	17.07
11n(HT20)	CH36	5180	26.54	18.08
11n(HT20)	CH40	5200	25.53	18.17
11n(HT20)	CH48	5240	25.29	18.08
11n(HT40)	CH38	5190	43.75	36.63
11n(HT40)	CH46	5230	48.65	36.83
11ac(VHT20)	CH36	5180	25.58	18.03
11ac(VHT20)	CH40	5200	26.30	18.17
11ac(VHT20)	CH48	5240	25.91	18.17
11ac(VHT40)	CH38	5190	43.56	36.63
11ac(VHT40)	CH46	5230	47.69	36.83
11ac(VHT80)	CH42	5210	82.50	75.38

Test plots as follows:

Band I （5150 – 5250 MHz）26dB Bandwidth

802.11a



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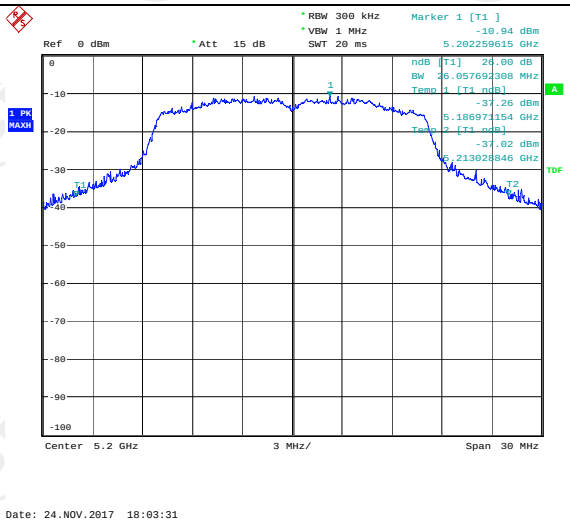

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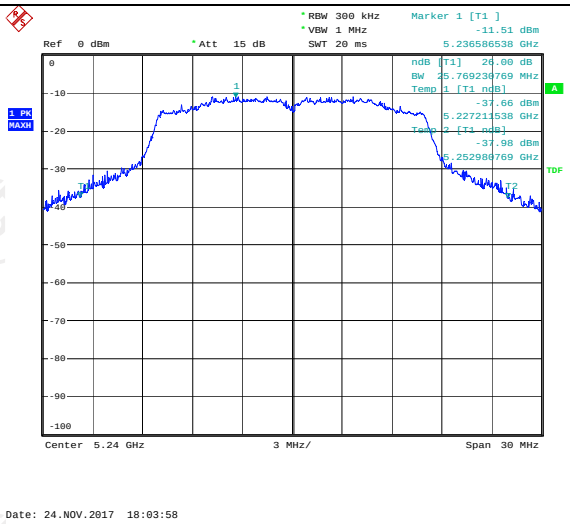

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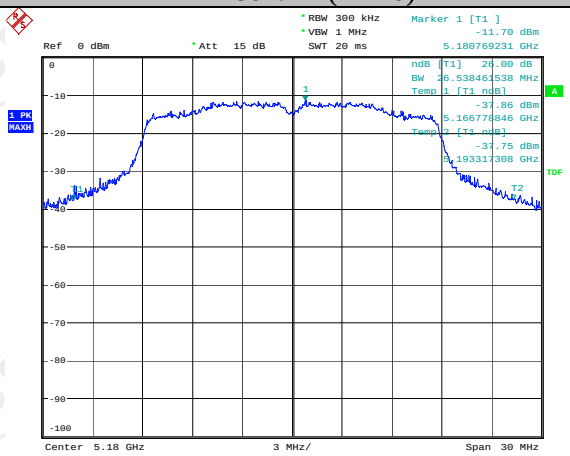
802.11n(HT20)



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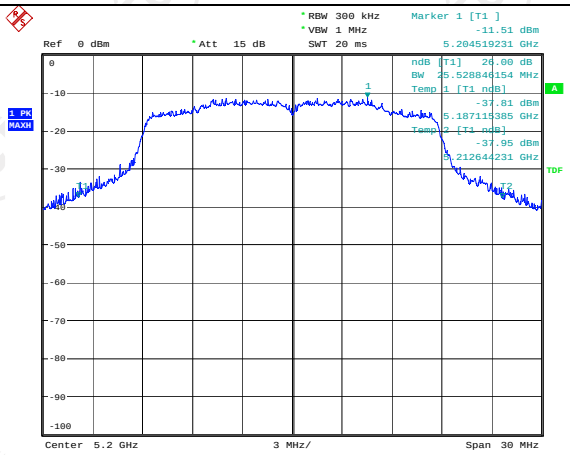

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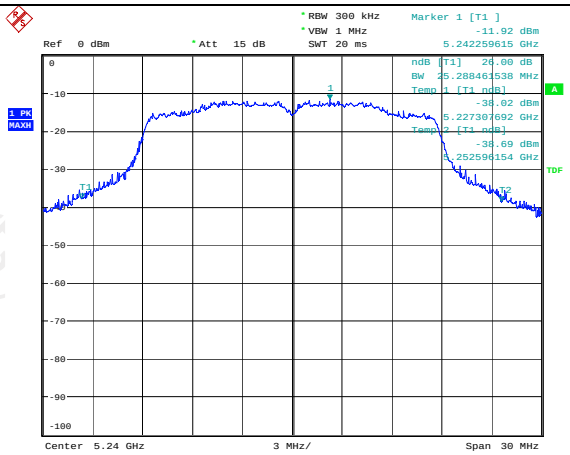

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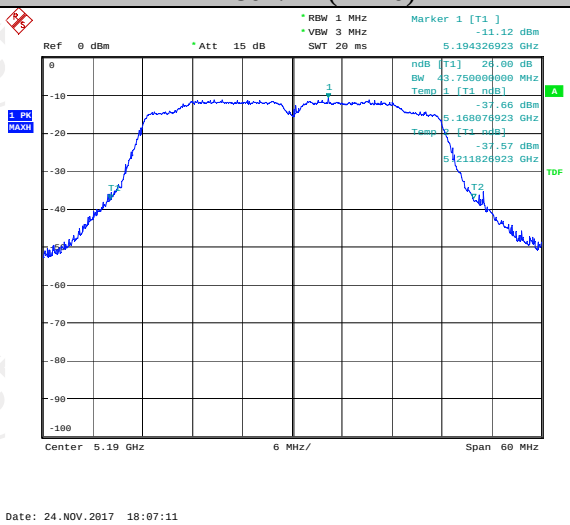
802.11n(HT40)



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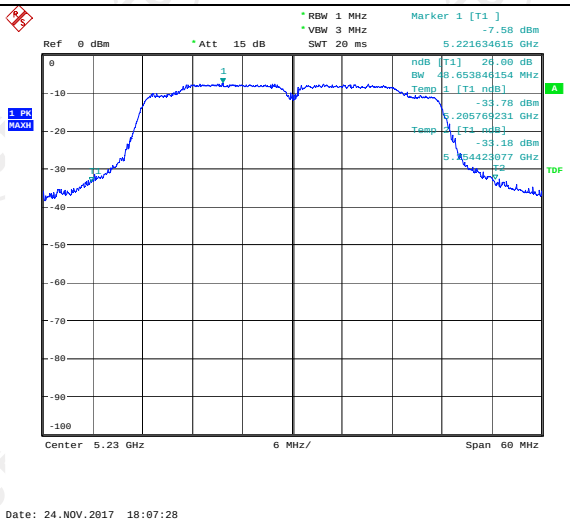

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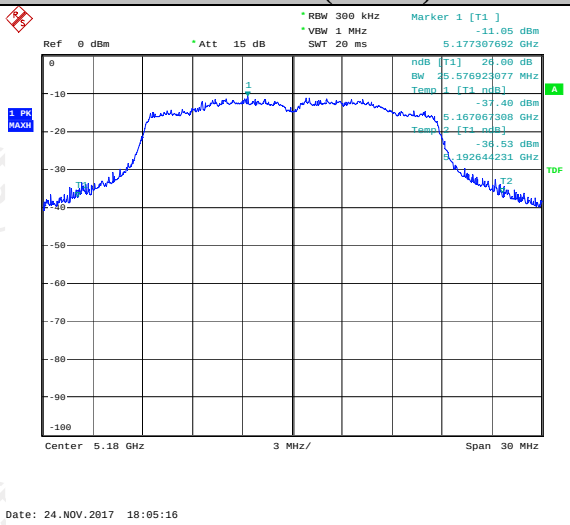

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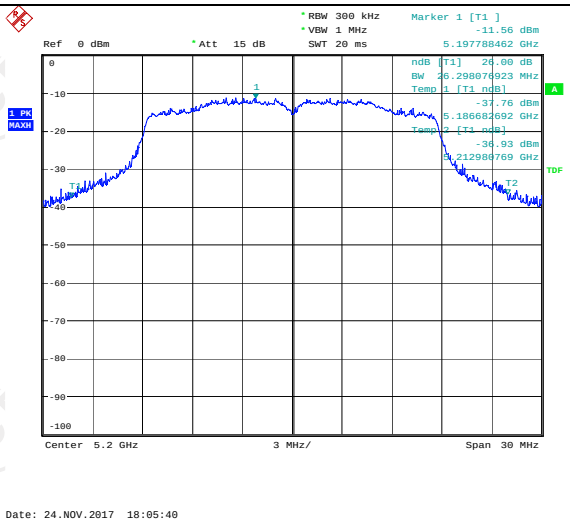
Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com



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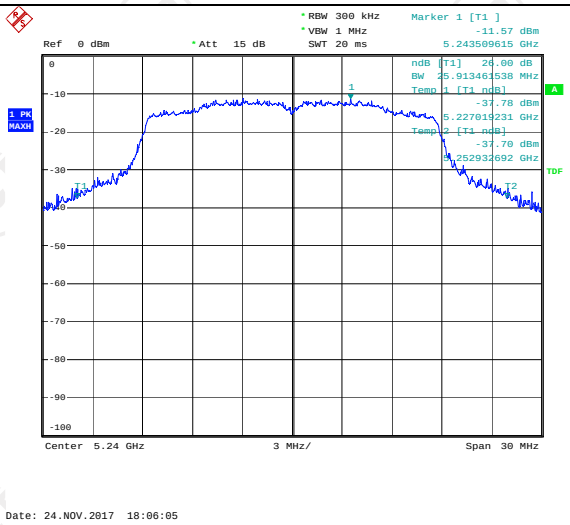

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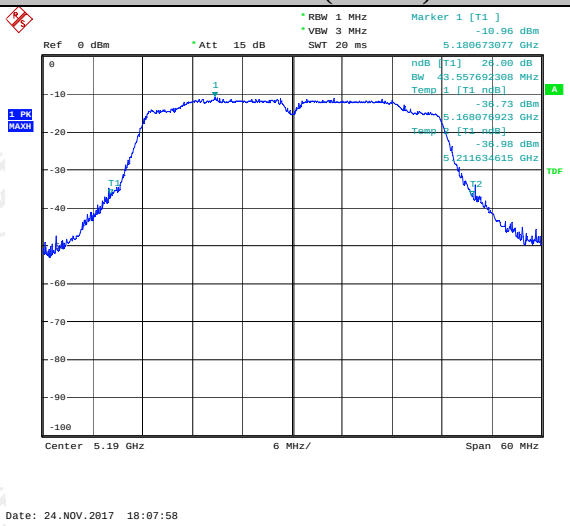
802.11ac(VHT40)



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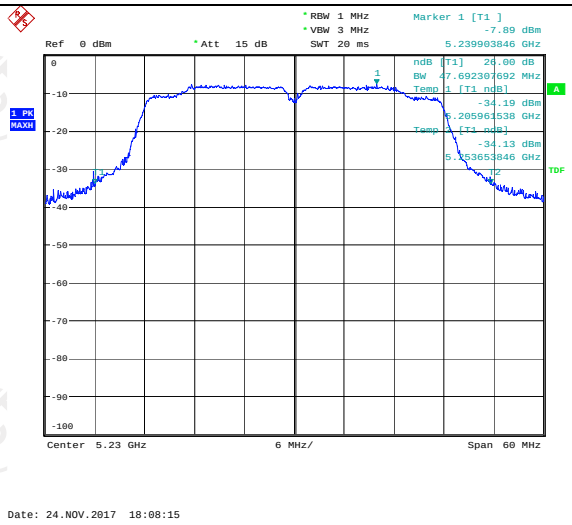
Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com



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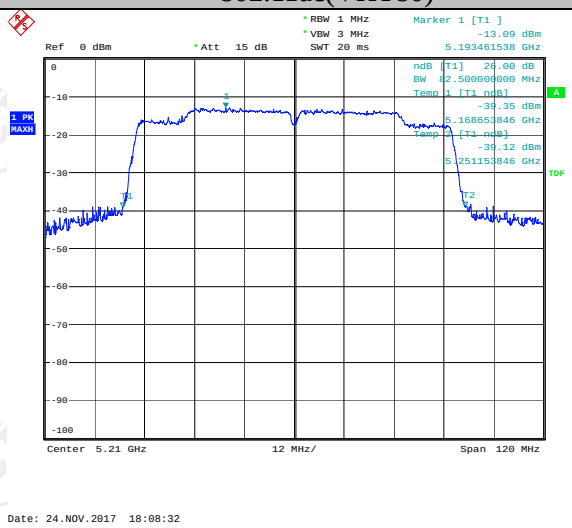
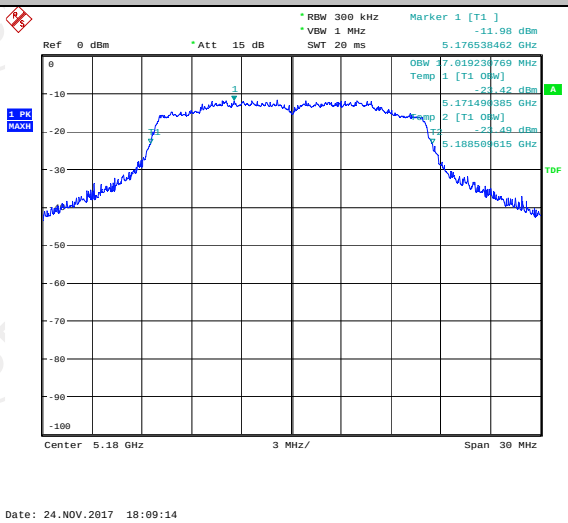


Band I （5150 – 5250 MHz）99% Bandwidth

802.11a



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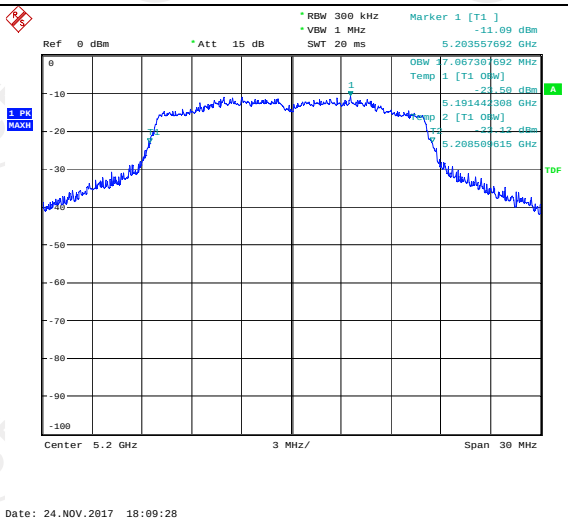

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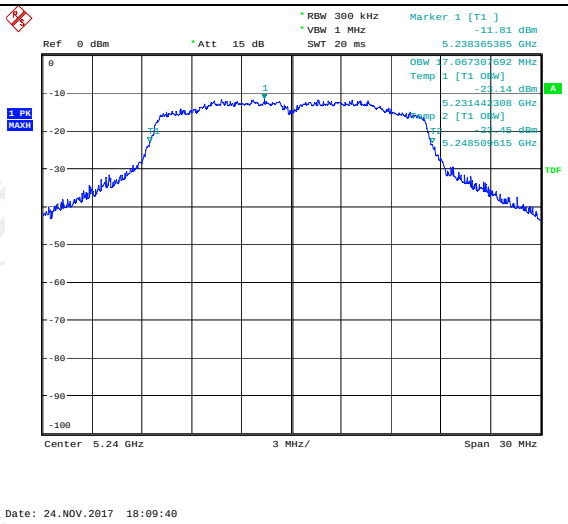

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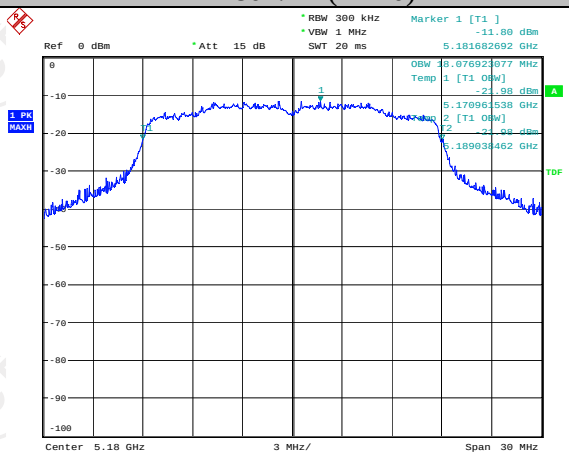

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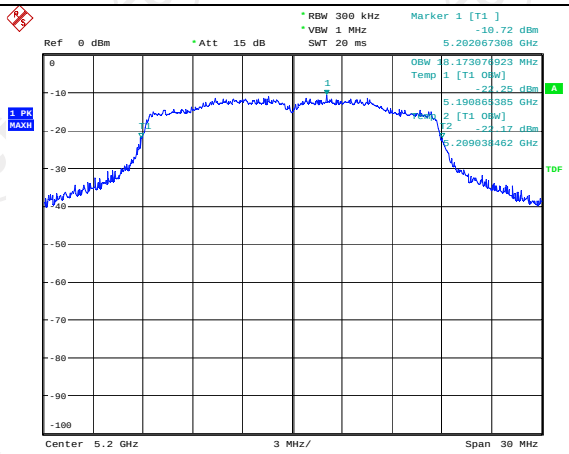

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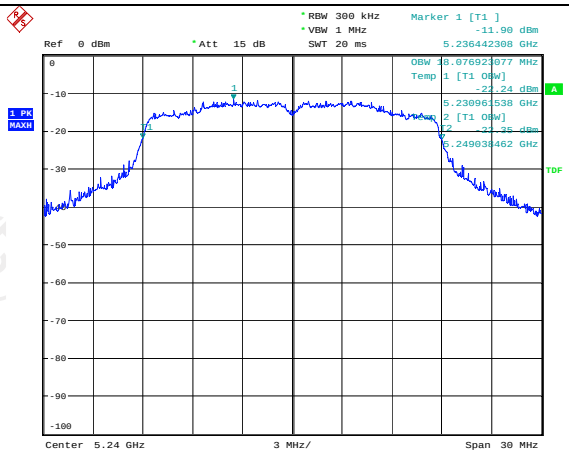

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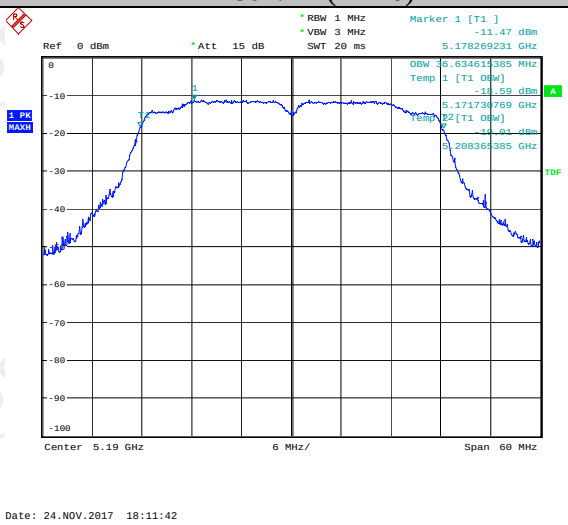
802.11n(HT40)



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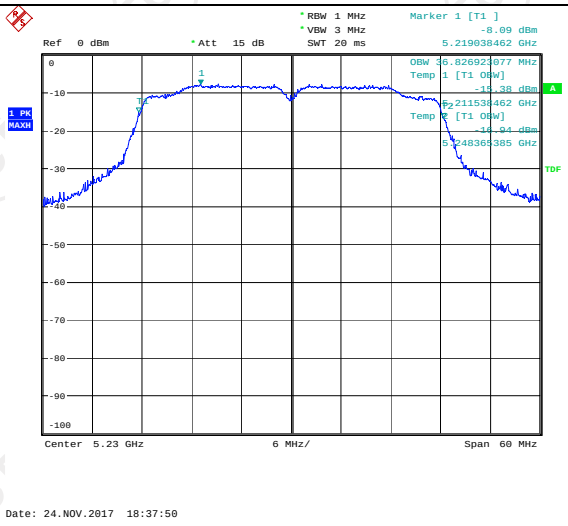

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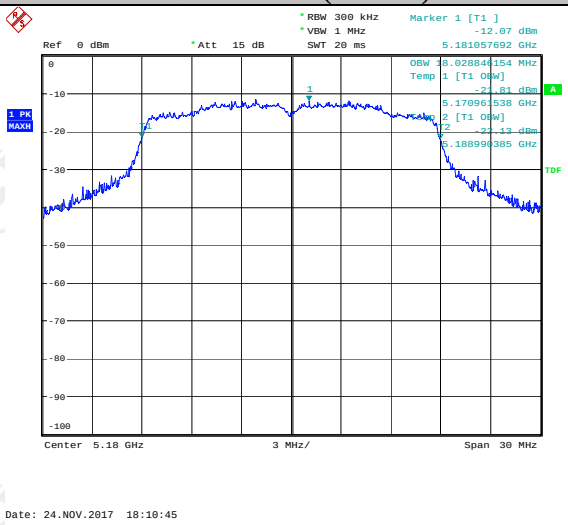
802.11ac(VHT20)



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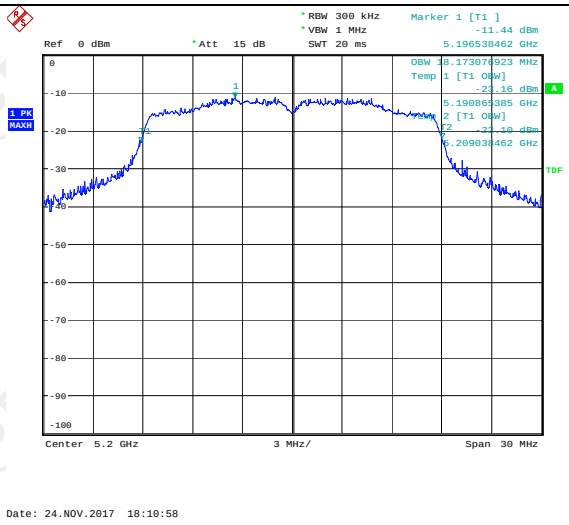

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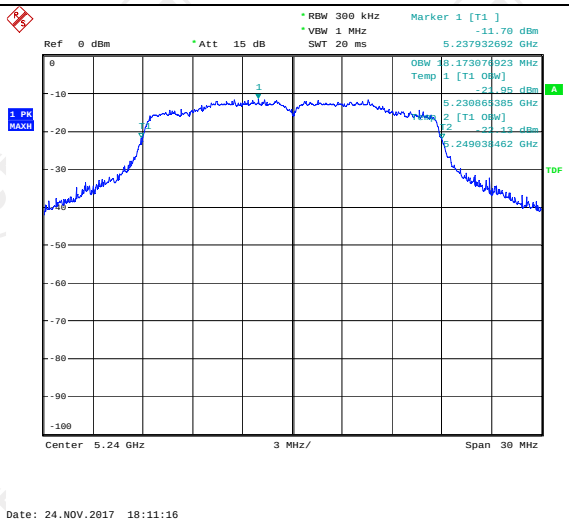

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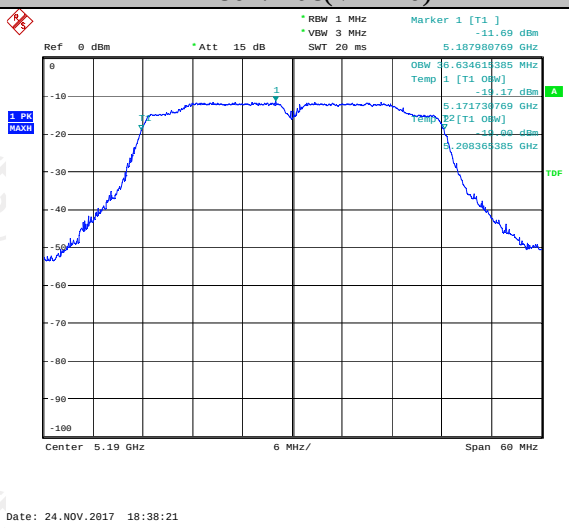
802.11ac(VHT40)



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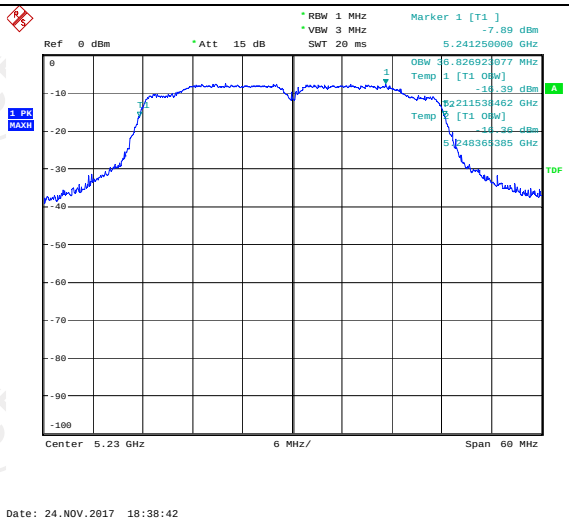

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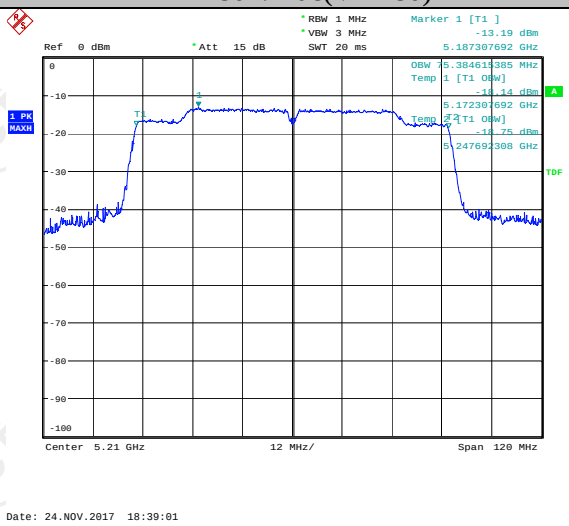
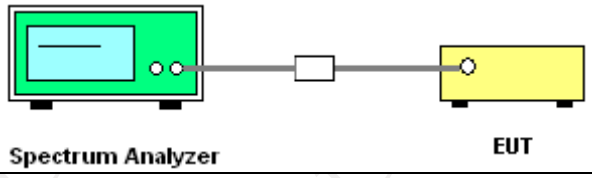
802.11ac(VHT80)



6.6. Power Spectral Density

6.6.1. Test Specification

Test Requirement:	FCC Part15 E Section 15.407 (a)
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section F
Limit:	≤11.00dBm/MHz for Band I 5150MHz-5250MHz ≤30.00dBm/500KHz for Band IV 5725MHz-5850MHz The e.i,r,p spectral density for Band I 5150MHz – 5250 MHz should not exceed 10dBm/MHz
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. Set the spectrum analyzer or EMI receiver span to view the entire emission bandwidth. 1. Set RBW = 510 kHz/1 MHz, VBW ≥ 3*RBW, Sweep time = Auto, Detector = RMS. 2. Allow the sweeps to continue until the trace stabilizes. 3. Use the peak marker function to determine the maximum amplitude level. 4. The E.I.R.P spectral density used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment.
Test Result:	PASS

6.6.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	ROHDE&SCHWARZ	FSQ	200061	Sep. 27, 2018
RF Cable (9KHz-40GHz)	TCT	RE-03	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-03	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.6.3. Test data

Configuration Band I (5150 - 5250 MHz)				
Mode	Test channel	Power Spectral Density	Limit (dBm/MHz)	Result
11a	CH36	-13.68	11	PASS
11a	CH40	-12.74	11	PASS
11a	CH48	-13.79	11	PASS
11n(HT20)	CH36	-14.02	11	PASS
11n(HT20)	CH40	-12.73	11	PASS
11n(HT20)	CH48	-13.84	11	PASS
11n(HT40)	CH38	-18.91	11	PASS
11n(HT40)	CH46	-15.58	11	PASS
11ac(VHT20)	CH36	-13.89	11	PASS
11ac(VHT20)	CH40	-13.49	11	PASS
11ac(VHT20)	CH48	-13.70	11	PASS
11ac(VHT40)	CH38	-19.60	11	PASS
11ac(VHT40)	CH46	-15.78	11	PASS
11ac(VHT80)	CH42	-20.35	11	PASS

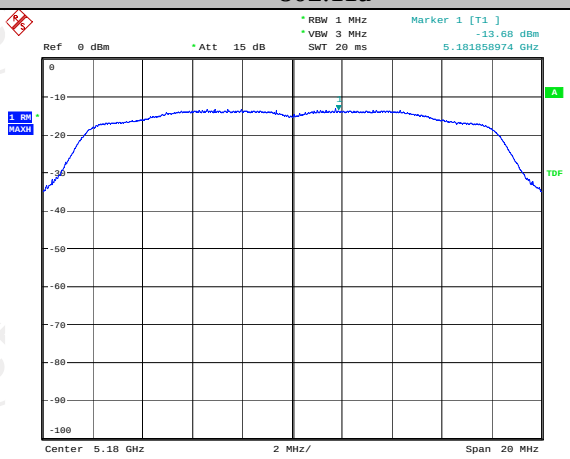
Configuration Band IV (5725 - 5850 MHz)				
Mode	Test channel	Power Spectral Density	Limit (dBm/500kHz)	Result
11a	CH149	-17.62	30	PASS
11a	CH157	-16.07	30	PASS
11a	CH161	-14.95	30	PASS
11n(HT20)	CH149	-17.69	30	PASS
11n(HT20)	CH157	-16.38	30	PASS
11n(HT20)	CH161	-15.12	30	PASS
11n(HT40)	CH151	-20.29	30	PASS
11n(HT40)	CH159	-19.08	30	PASS
11ac(VHT20)	CH149	-16.77	30	PASS
11ac(VHT20)	CH157	-16.18	30	PASS
11ac(VHT20)	CH161	-15.25	30	PASS
11ac(VHT40)	CH151	-20.46	30	PASS
11ac(VHT40)	CH159	-19.07	30	PASS
11ac(VHT80)	CH155	-21.97	30	PASS

Remark: 10log(500kHz/RBW) Factor = -3.01dB

Test plots as follows:

Band I （5150 – 5250 MHz）

802.11a



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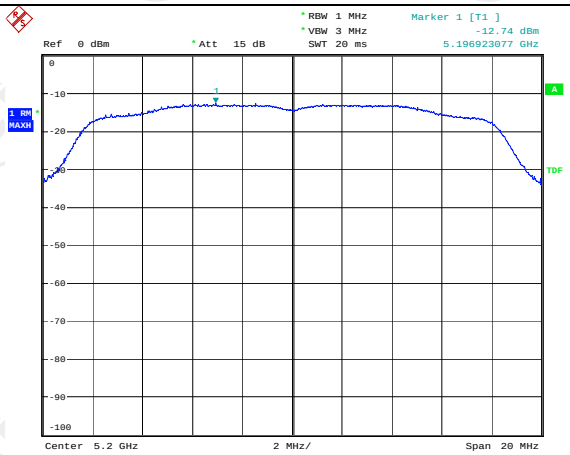

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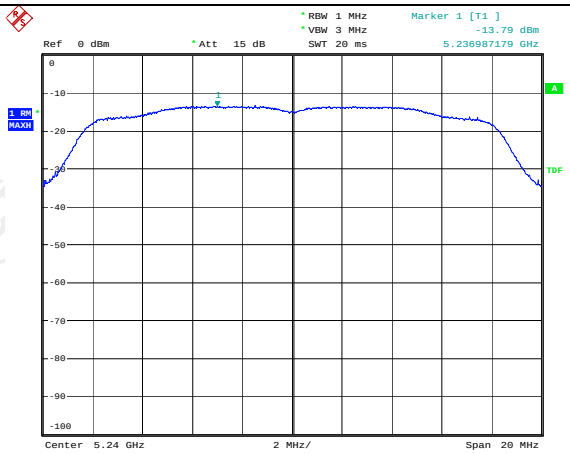

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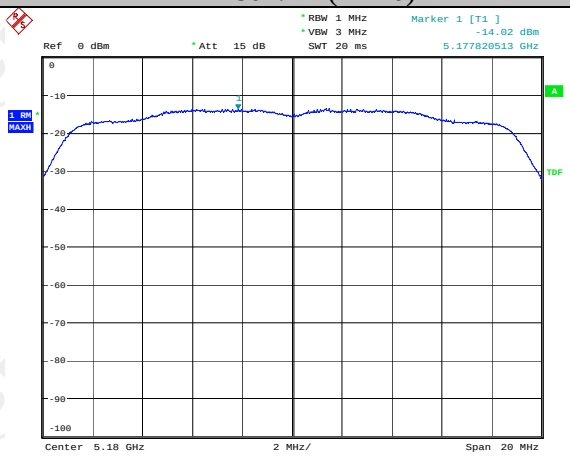
High

802.11n(HT20)



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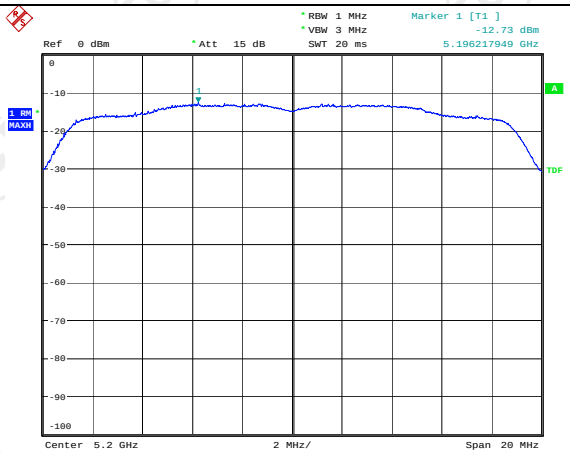

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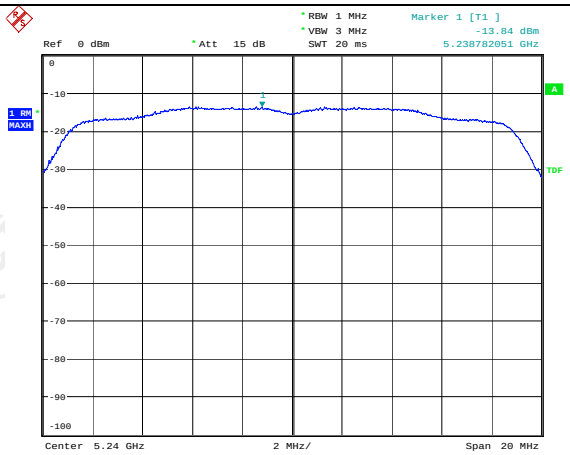

Date: 24.NOV.2017 18:41:14

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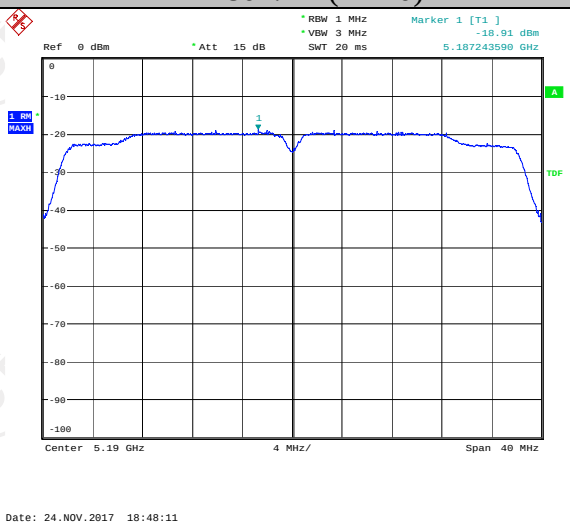
Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

802.11n(HT40)



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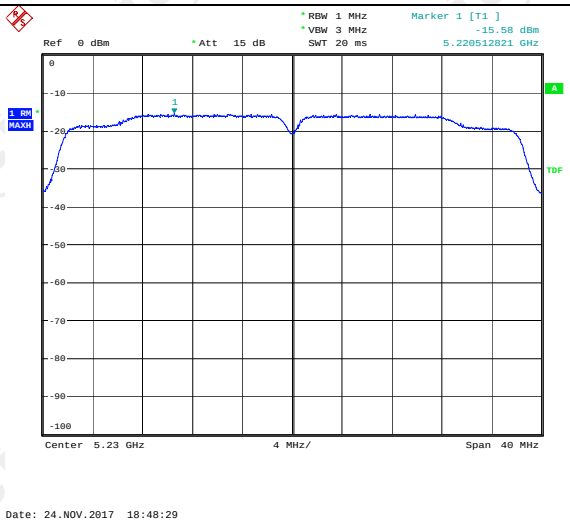

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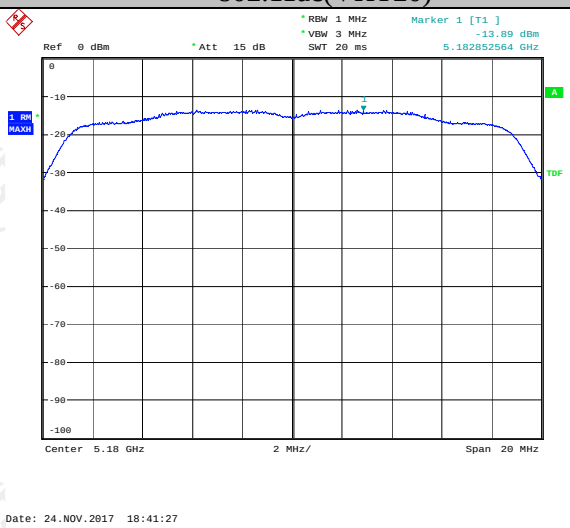
802.11ac(VHT20)



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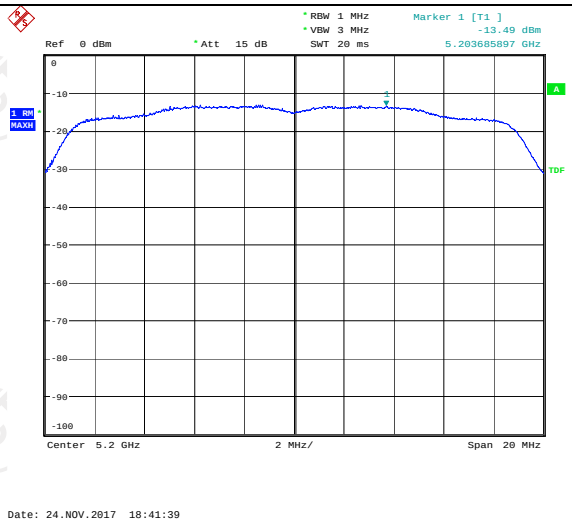
Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com



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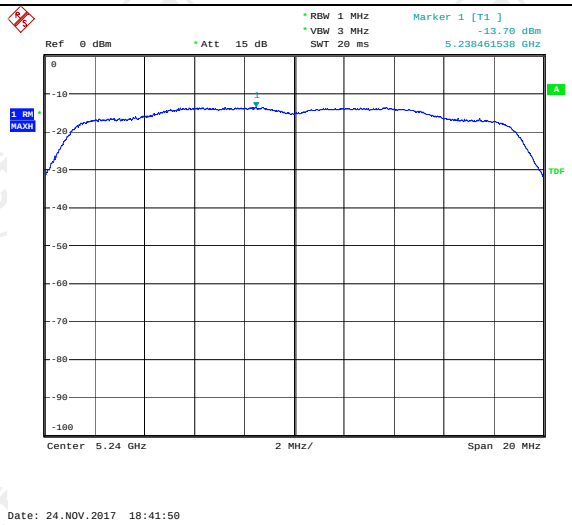

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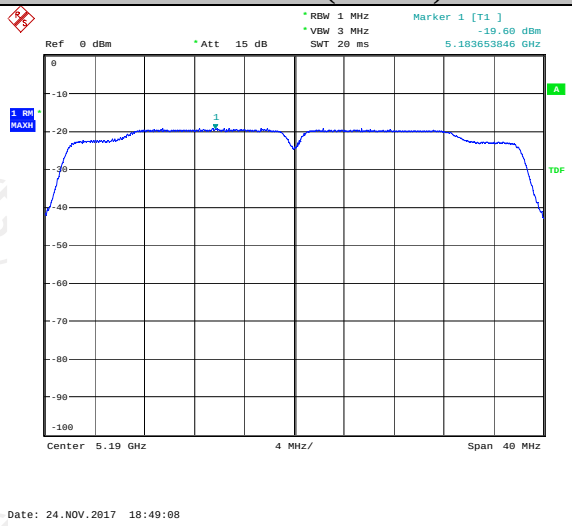
802.11ac(VHT40)



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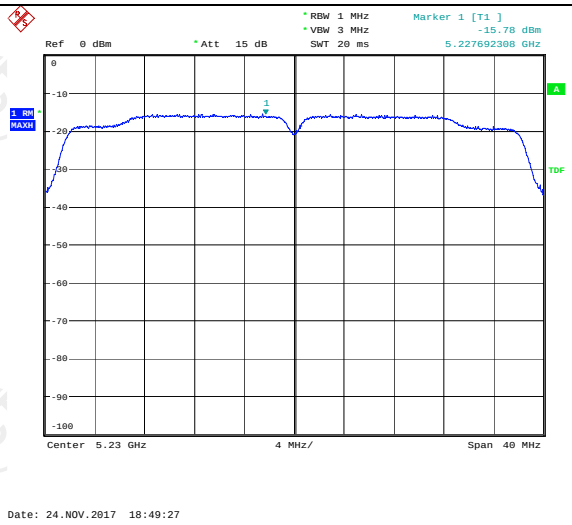
Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com



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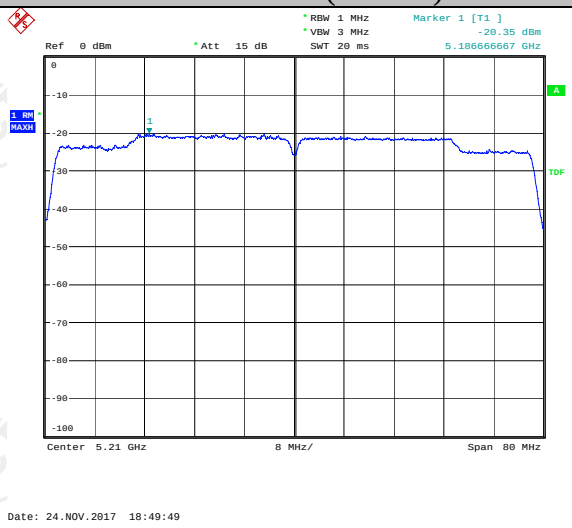
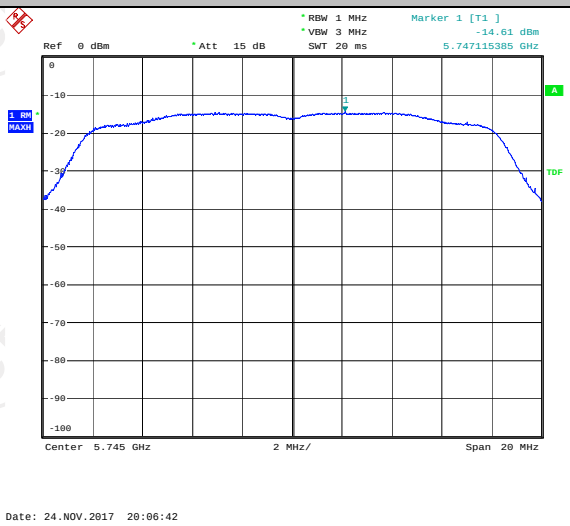
802.11ac(VHT80)



Band IV (5725 – 5850 MHz)

802.11a



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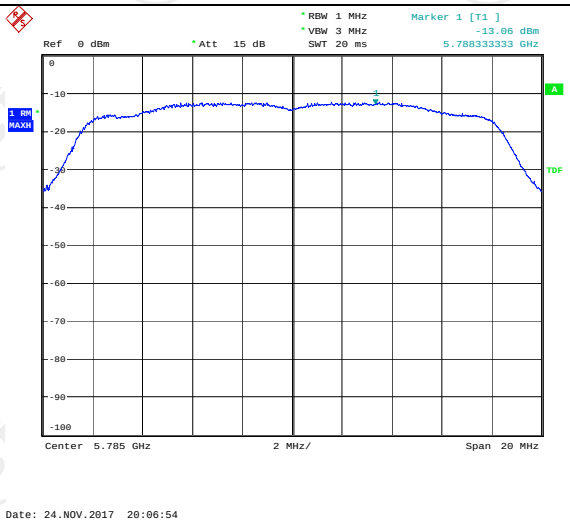

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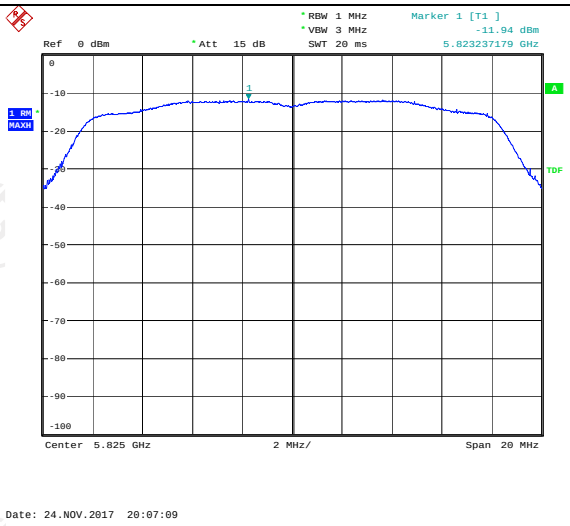
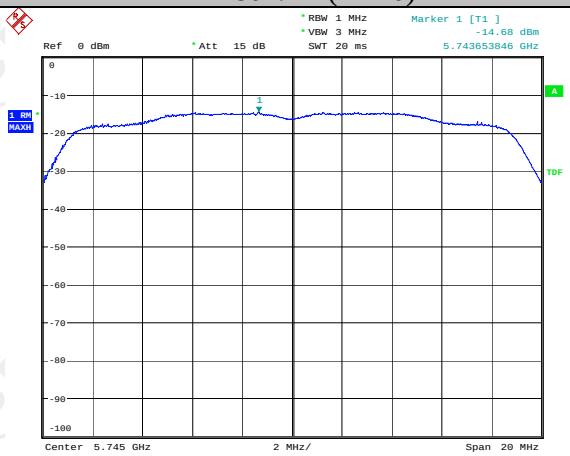


High

802.11n(HT20)



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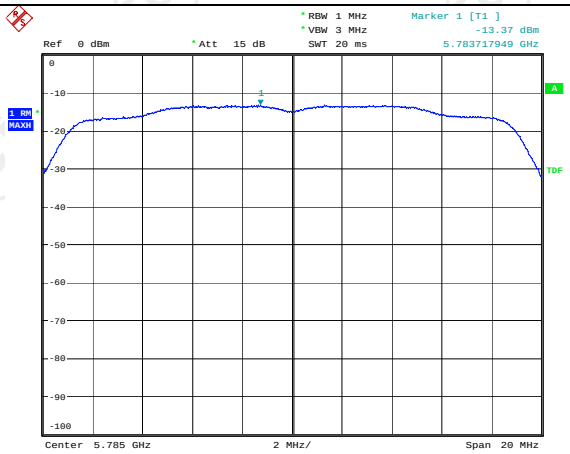

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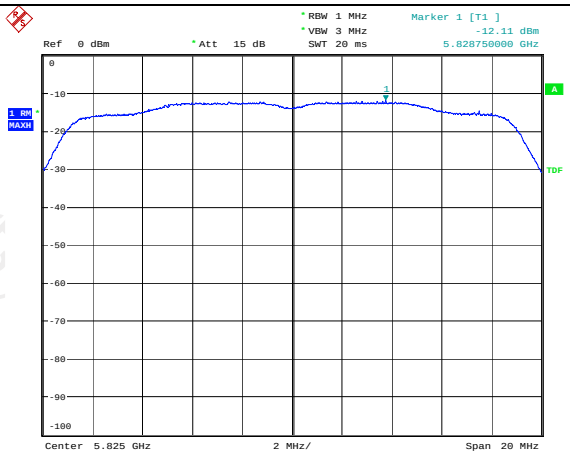

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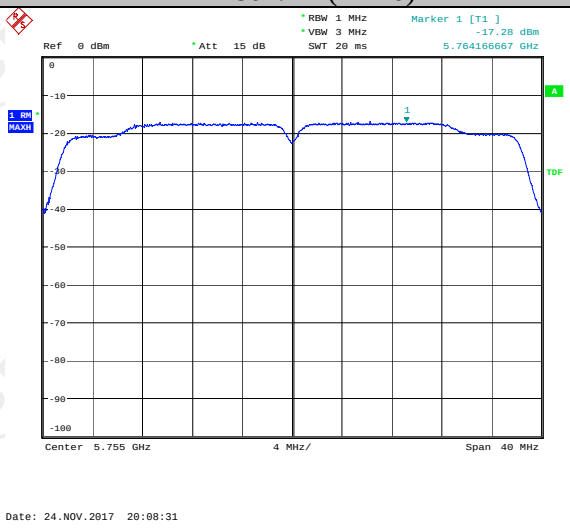
802.11n(HT40)



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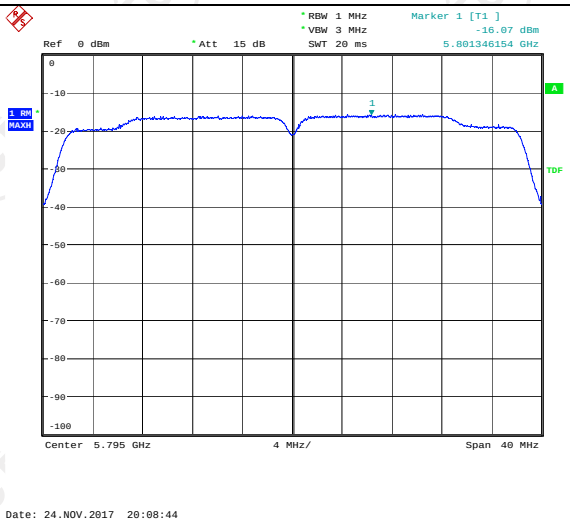

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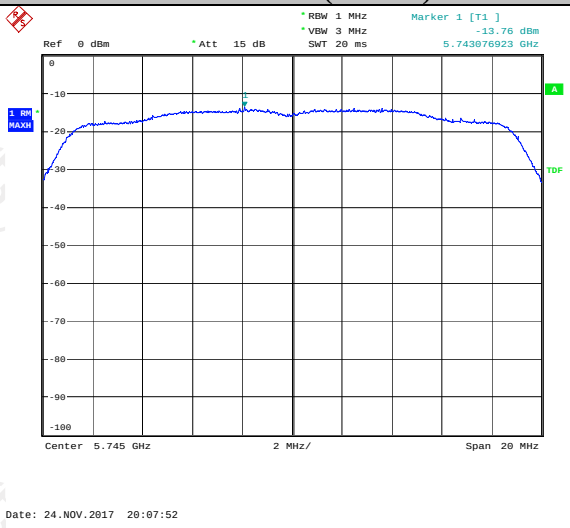
802.11ac(VHT20)



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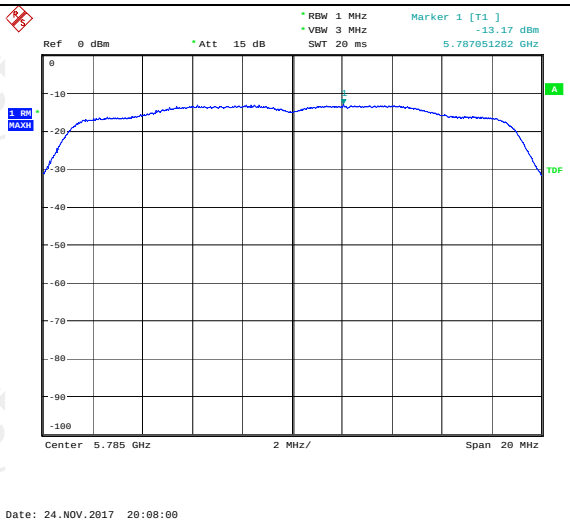

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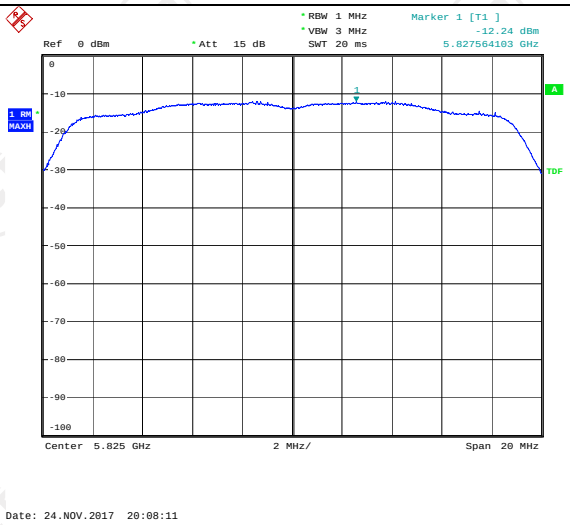
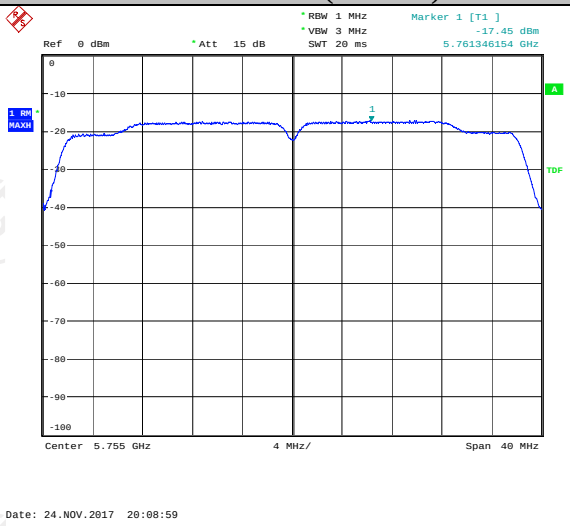


High

802.11ac(VHT40)



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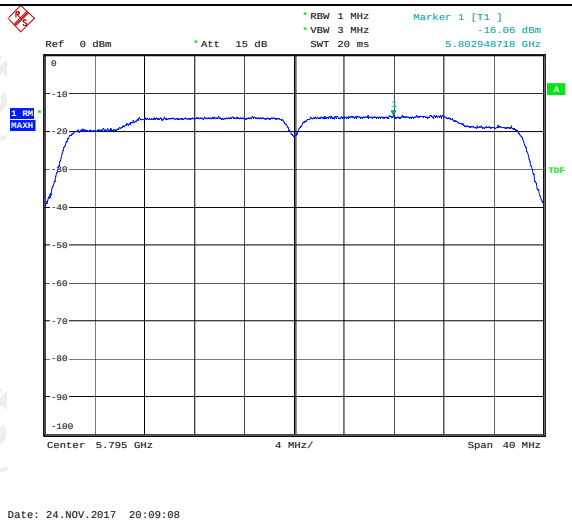
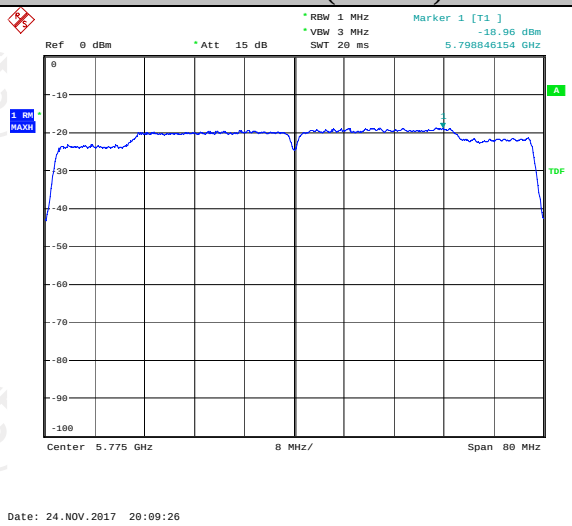


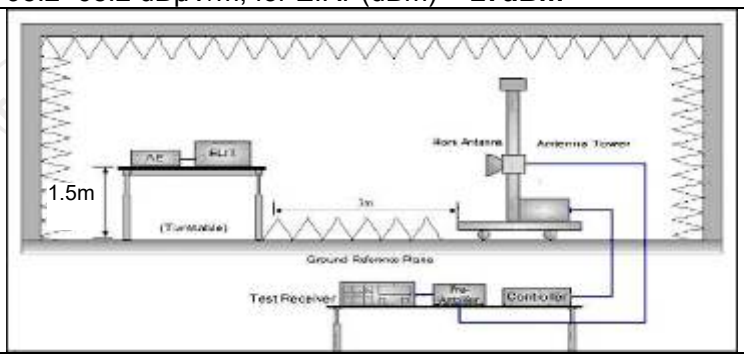
High

802.11ac(VHT80)



6.7. Band edge

6.7.1. Test Specification

Test Requirement:	FCC CFR47 Part 15E Section 15.407
Test Method:	ANSI C63.10 2013
Limit:	For band I&II&III: E[dBμV/m] = EIRP[dBm] + 95.2=68.2 dBμV/m, for EIRP(dBm)= **-27dBm** For band IV(5715-5725MHz&5850-5860MHz): E[dBμV/m] = EIRP[dBm] + 95.2=78.2 dBμV/m, for EIRP(dBm)= **-17dBm;** For band IV(other un-restricted band):E[dBμV/m] = EIRP[dBm] + 95.2=68.2 dBμV/m, for EIRP(dBm)= **-27dBm**
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8 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, quasipeak or average method as specified and then reported in a data sheet.
Test Result:	PASS

6.7.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Test Receiver	ROHDE&SCHWARZ	ESVD	100008	Sep. 27, 2018
Spectrum Analyzer	ROHDE&SCHWARZ	FSQ	200061	Sep. 27, 2018
Spectrum Analyzer	ROHDE&SCHWARZ	FSP40	100056	Sep. 27, 2018
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 27, 2018
Pre-amplifier	HP	8447D	2727A05017	Sep. 27, 2018
Loop antenna	ZHINAN	ZN30900A	12024	Sep. 27, 2018
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 27, 2018
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 27, 2018
Horn Antenna	Schwarzbeck	BBH 9170	582	Jun. 07, 2018
Coax cable (9KHz-1GHz)	TCT	RE-low-01	N/A	Sep. 27, 2018
Coax cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Sep. 27, 2018
Coax cable (9KHz-1GHz)	TCT	RE-low-03	N/A	Sep. 27, 2018
Coax cable (9KHz-40GHz)	TCT	RE-high-04	N/A	Sep. 27, 2018
Antenna Mast	Keleto	CC-A-4M	N/A	N/A
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.7.3. Test Data

Band edge emission										
Frequency (MHz)	Ant.Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
					Peak (dBuV/m)	AV (dBuV/m)			Peak	AV
5150	V	51.65	40.57	6.89	58.54	47.46	68.20	54.00	-9.66	-6.54
5150	H	52.34	41.02	6.89	59.23	47.91	68.20	54.00	-8.97	-6.09

5350	V	50.25	39.08	6.95	57.20	46.03	68.20	54.00	-11.00	-7.97
5350	H	51.99	40.73	6.95	58.94	47.68	68.20	54.00	-9.26	-6.32

Band edge emission										
Frequency (MHz)	Ant.Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
					Peak (dBuV/m)	AV (dBuV/m)			Peak	AV
5725	V	54.12	42.41	7.63	61.75	50.04	68.20	54.00	-6.45	-3.96
5725	H	55.30	43.29	7.63	62.93	50.92	68.20	54.00	-5.27	-3.08

5850	V	55.32	43.86	7.82	63.14	51.68	68.20	54.00	-5.06	-2.32
5850	H	56.41	44.48	7.82	64.23	52.30	68.20	54.00	-3.97	-1.70

Remark:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor=Antenna Factor + Cable loss - Pre-amplifier.
2. Margin (dB)= Emission Level - Peak Limit / AV Limit
3. Data of measurement shown "---" in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

Note: 802.11a/11n(HT20)/11ac(VHT20)/802.11n(HT40)/11ac(VHT40)/802.11ac(VHT80) modes of band I and band IV all have been tested ,only worse case is reported

6.8. Spurious Emission

6.8.1.1. Test Specification

Test Requirement:	FCC CFR47 Part 15 Section 15.407 & 15.209 & 15.205
Test Method:	KDB 789033 D02 v01r04
Frequency Range:	9kHz to 40GHz
Measurement Distance:	3 m
Antenna Polarization:	Horizontal & Vertical
Operation mode:	Transmitting mode with modulation
Receiver Setup:	

Frequency	Detector	RBW	VBW	Remark
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
	RMS	1MHz	3MHz	Average Value

Limit:

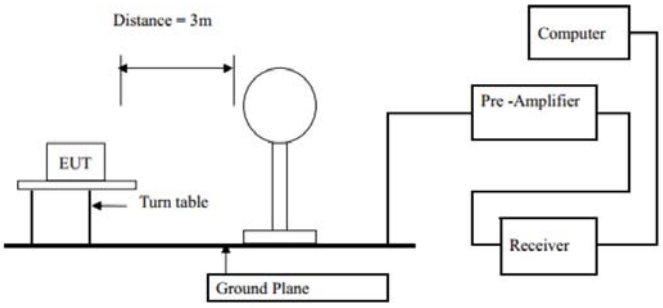
Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table,

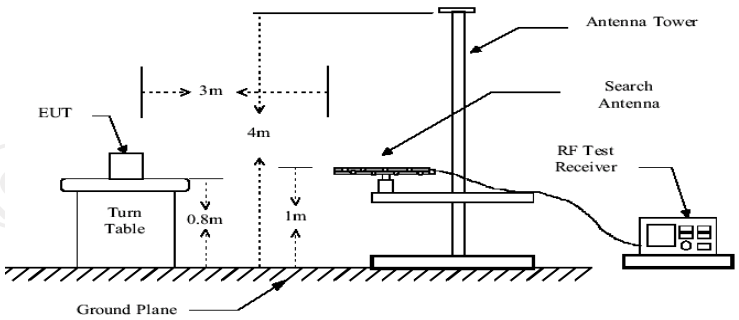
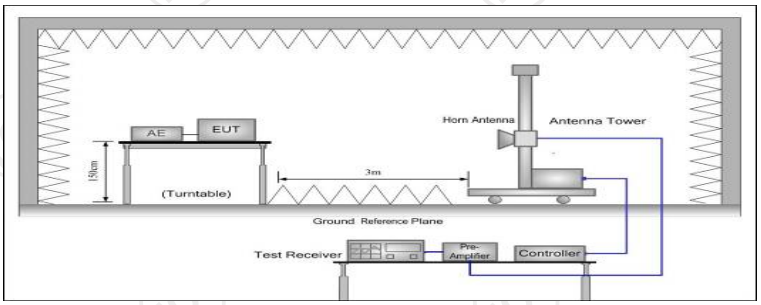
Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(KHz)	300
0.490-1.705	24000/F(KHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Frequency	Limit (dBuV/m @3m)	Detector
Above 1G	74.0	Peak
	54.0	Average

Test setup:

For radiated emissions below 30MHz



	30MHz to 1GHz  Above 1GHz 
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8 meters above the groundat a 3 meter camber. The table was rotated 360 degrees todetermine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, whichwas 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 thenthe antenna was tuned to heights from 1 meter to 4 meters and the rotatablewas turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and SpecifiedBandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limitspecified, then testing could be stopped and the peak values of the EUT wouldbe reported. Otherwise the emissions that did not have 10dB margin would bere-tested one by one using peak, quasi-peak or average method as specified andthen reported in a data sheet.
Test results:	PASS

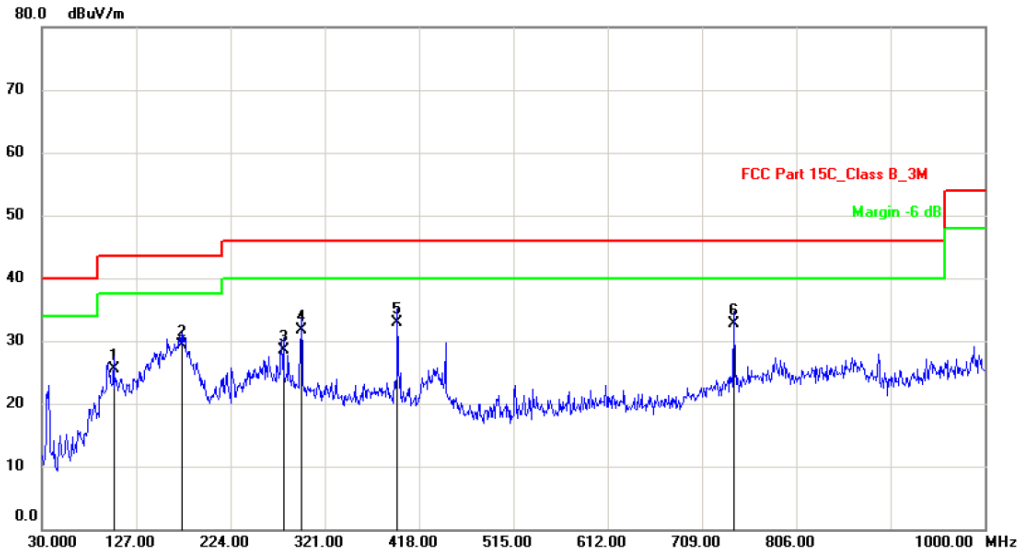
6.8.2. Test Data

Please refer to following diagram for individual

Below 1GHz

Radiated Emission Measurement

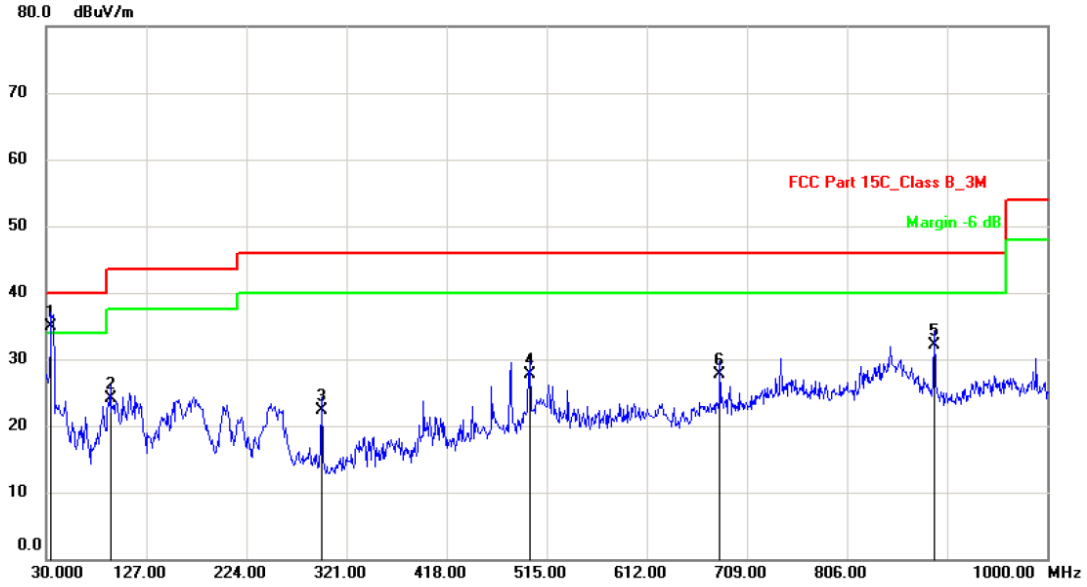
File :HN4C401 Data :#27 Date: 2017-11-22 Time: 19:45:16



Site	Polarization: *Horizontal*	Temperature: 24
Limit: FCC Part 15C_Class B_3M	Power: AC 120V/60Hz	Humidity: 47 %
EUT: Ultrabook	Distance: 3m	
M/N: HN4C401		
Mode: Charging + WIFI Mode(5G WLAN)		

Radiated Emission Measurement

File :HN4C401 Data :#28 Date: 2017-11-22 Time: 19:52:56



Site	Polarization: *Vertical*	Temperature: 24
Limit: FCC Part 15C_Class B_3M	Power: AC 120V/60Hz	Humidity: 47 %
EUT: Ultrabook	Distance: 3m	
M/N: HN4C401		
Mode: Charging + WIFI Mode(5G WLAN)		

Remark: 1. Transd = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

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

Above 1GHz

Band I										
The worst case: 802.11a, CH36, 5180MHz										
Frequency (MHz)	Ant.Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
					Peak (dBuV/m)	AV (dBuV/m)			Peak	AV
10360	V	37.51	25.25	14.04	51.55	39.29	74.00	54.00	-22.45	-14.71
15540	V	38.88	26.43	19.00	57.88	45.43	74.00	54.00	-16.12	-8.57

10360	H	38.19	26.47	14.04	52.23	40.51	74.00	54.00	-21.77	-13.49
15540	H	36.33	24.58	19.00	55.33	43.58	74.00	54.00	-18.67	-10.42

Band I										
The worst case: 802.11a, CH40, 5200MHz										
Frequency (MHz)	Ant.Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
					Peak (dBuV/m)	AV (dBuV/m)			Peak	AV
10400	V	39.37	27.24	14.12	53.49	41.36	74.00	54.00	-20.51	-12.64
15600	V	38.48	25.92	20.20	58.68	46.12	74.00	54.00	-15.32	-7.88

10400	H	38.22	26.15	14.12	52.34	40.27	74.00	54.00	-21.66	-13.73
15600	H	36.25	24.61	20.20	56.45	44.81	74.00	54.00	-17.55	-9.19

Band I										
The worst case: 802.11a, CH48, 5240MHz										
Frequency (MHz)	Ant.Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
					Peak (dBuV/m)	AV (dBuV/m)			Peak	AV
10480	V	32.79	20.47	14.29	47.08	34.76	74.00	54.00	-26.92	-19.24
15720	V	32.45	20.67	20.82	53.27	41.49	74.00	54.00	-20.73	-12.51

10480	H	32.64	20.23	14.29	46.93	34.52	74.00	54.00	-27.07	-19.48
15720	H	31.81	19.89	20.82	52.63	40.71	74.00	54.00	-21.37	-13.29

Band IV										
The worst case: 802.11a, CH149, 5745MHz										
Frequency (MHz)	Ant.Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
					Peak (dBuV/m)	AV (dBuV/m)			Peak	AV
11490	V	35.85	23.52	16.86	52.71	40.38	74.00	54.00	-21.29	-13.62
17235	V	35.29	23.26	22.23	57.52	45.49	74.00	54.00	-16.48	-8.51

11490	H	35.75	24.18	16.86	52.61	41.04	74.00	54.00	-21.39	-12.96
17235	H	33.89	22.16	22.23	56.12	44.39	74.00	54.00	-17.88	-9.61

Band IV										
The worst case: 802.11a, CH157, 5785MHz										
Frequency (MHz)	Ant.Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
					Peak (dBuV/m)	AV (dBuV/m)			Peak	AV
11570	V	36.76	24.38	17.01	53.77	41.39	74.00	54.00	-20.23	-12.61
17355	V	35.87	23.56	22.62	58.49	46.18	74.00	54.00	-15.51	-7.82

11570	H	35.15	22.96	17.01	52.16	39.97	74.00	54.00	-21.84	-14.03
17355	H	33.65	21.81	22.62	56.27	44.43	74.00	54.00	-17.73	-9.57

Band IV										
The worst case: 802.11a, CH165, 5825MHz										
Frequency (MHz)	Ant.Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	
					Peak (dBuV/m)	AV (dBuV/m)			Peak	AV
11650	V	35.33	23.01	17.16	52.49	40.17	74.00	54.00	-21.51	-13.83
17475	V	34.32	22.33	23.01	57.33	45.34	74.00	54.00	-16.67	-8.66

11650	H	36.3	24.03	17.16	53.46	41.19	74.00	54.00	-20.54	-12.81
17475	H	33.22	21.38	23.01	56.23	44.39	74.00	54.00	-17.77	-9.61

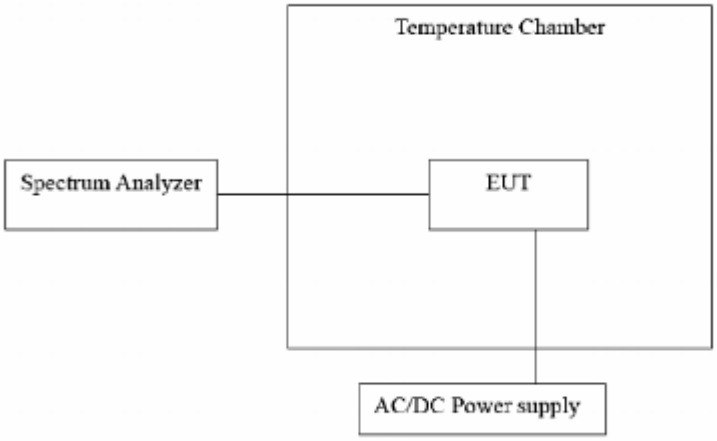
Remark:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor=Antenna Factor + Cable loss - Pre-amplifier.
2. Margin (dB)= Emission Level - Limit
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measuring frequencies from 1 GHz to 40GHz of highest fundamental frequency.
5. Data of measurement shown "---" in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

Note: 802.11a/11n(HT20)/11ac(VHT20)/802.11n(HT40)/11ac(VHT40)/802.11ac(VHT80) modes of band I and band IV all have been tested ,only worse case is reported

6.9. Frequency Stability Measurement

6.9.1. Test Specification

Test Requirement:	FCC Part15 Section 15.407(g) &Part2 J Section 2.1055
Test Method:	ANSI C63.10: 2013
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.
Test Setup:	
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.
Test Result:	PASS
Remark:	Pre-scan was performed at Antenna 0 and Antenna 1, the worst case was found. Only the test data of Antenna 0 was shown in this report.

Test plots as follows:

Band I for 802.11a Low (5180MHz)				
Temperature(°C)	Voltage (DC)	Measurement Frequency(MHz)	Delta Frequency(Hz)	Result
0	7.6	5180.0135	1350	PASS
10		5180.0170	1700	PASS
20		5180.0172	1720	PASS
30		5180.0110	1100	PASS
45		5180.0155	1550	PASS
20	6.46	5180.0143	1430	PASS
	8.74	5180.0136	1360	PASS

Band I for 802.11a High (5240MHz)				
Temperature(°C)	Voltage (DC)	Measurement Frequency(MHz)	Delta Frequency(Hz)	Result
0	7.6	5240.0259	2590	PASS
10		5240.0191	1910	PASS
20		5240.0140	1400	PASS
30		5240.0115	1150	PASS
45		5240.0135	1350	PASS
20	6.46	5240.0122	1220	PASS
	8.74	5240.0136	1360	PASS

Remark:
1. EUT temperature working range is 0 to 45.

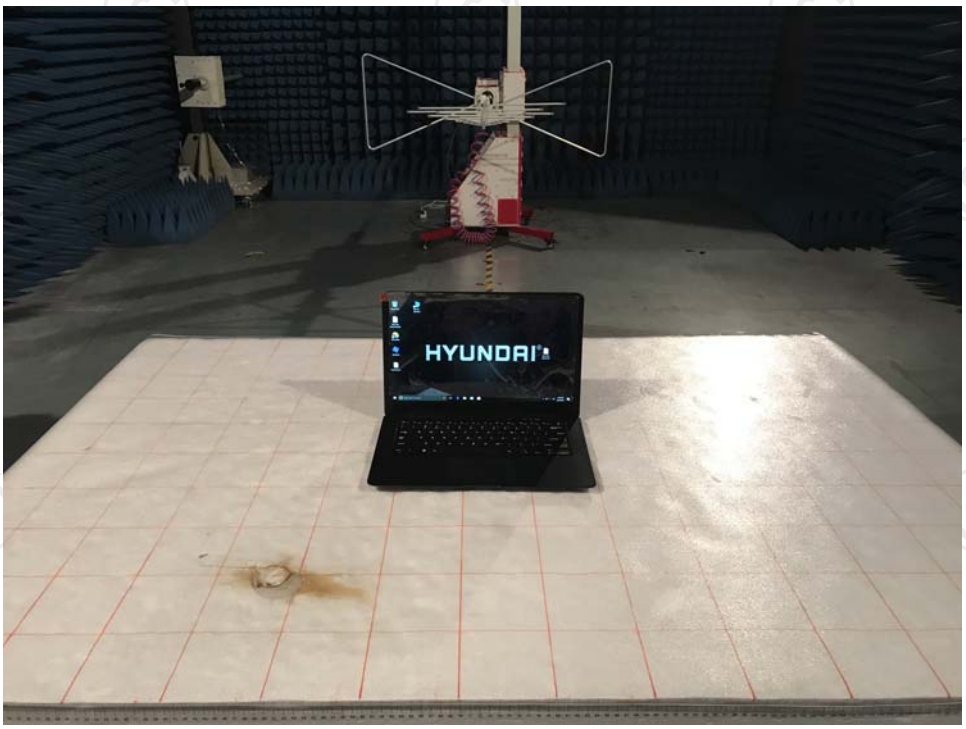
Band IV for 802.11a Low (5745MHz)				
Temperature(°C)	Voltage (DC)	Measurement Frequency(MHz)	Delta Frequency(Hz)	Result
0	7.6	5745.0153	1530	PASS
10		5745.0155	1550	PASS
20		5745.0182	1820	PASS
30		5745.0112	1120	PASS
45		5745.0125	1250	PASS
20	6.46	5745.0166	1660	PASS
	8.74	5745.0167	1670	PASS

Band IV for 802.11a High (5825MHz)				
Temperature(°C)	Voltage (DC)	Measurement Frequency(MHz)	Delta Frequency(Hz)	Result
0	7.6	5825.0145	1450	PASS
10		5825.0163	1630	PASS
20		5825.0123	1230	PASS
30		5825.0157	1570	PASS
45		5825.0162	1620	PASS
20	6.46	5825.0135	1350	PASS
	8.74	5825.0158	1580	PASS

Remark:
1. EUT temperature working range is 0 to 45.

Appendix A: Photographs of Test Setup

Radiated Emission



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Appendix B: Photographs of EUT

Refer to the test report No.: TRE171XXX

********END OF REPORT********