

FCC REPORT

Product Name : Wifi Module
Trade mark : N/A
Model No. : F12ASUM13
FCC ID : 2AATL-F12ASUM13
Report Number : BLA-EMC-201911-A53-02
Date of sample receipt : November 26, 2019
Date of Test : November 26, 2019–December 16, 2019
Date of Issue : December 27, 2019
Test standard : FCC CFR Title 47 Part 15 Subpart E
Section 15.407
Test result : PASS

Prepared for:

HUNAN FN-LINK TECHNOLOGY LIMITED
No. 8, Litong Road, Liuyang Economic Development Zone, Liuyang,
China

Prepared by:

BlueAsia of Technical Services(Shenzhen) Co., Ltd.
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Compiled by: *Bason*

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Approved by: *Emen-li*

Date: December 27, 2019



2 Version

Version No.	Date	Description
00	December 27, 2019	Original

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203/15.407 (g)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.407 (a)	Pass
26dB Occupied Bandwidth	15.407 (a)	Pass
6dB Emission Bandwidth	15.407(e)	Pass
Power Spectral Density	15.407 (a)	Pass
Band Edge	15.407(b)	Pass
Spurious Emission	15.205/15.209	Pass
Frequency Stability	15.407(g)	Pass

Pass: The EUT complies with the essential requirements in the standard.

5 General Information

5.1 Client Information

Applicant:	HUNAN FN-LINK TECHNOLOGY LIMITED
Address of Applicant:	No. 8, Litong Road,Liuyang Economic Development Zone, Liuyang, China
Manufacturer:	HUNAN FN-LINK TECHNOLOGY LIMITED
Address of Manufacturer:	No. 8, Litong Road, Liuyang Economic Development Zone, Liuyang, China

5.2 General Description of E.U.T.

Product Name:	Wifi Module
Model No.:	F12ASUM13
Operation Frequency:	Band 1: 5180MHz-5240MHz Band 4: 5745MHz-5825MHz
Operation mode:	Indoor used
Channel numbers:	Band 1: 802.11a/802.11n(HT20)/802.11ac(HT20): 4, 802.11n(HT40)/802.11ac(HT40):2, 802.11ac(HT80): 1 Band 4: 802.11a/802.11(HT20)/802.11ac(HT20): 5, 802.11n(HT40)/802.11ac(HT40): 2, 802.11ac(HT80): 1
Channel separation:	802.11a/n/ac(HT20): 20MHz, 802.11n/ac(HT40): 40MHz, 802.11ac(HT80): 80MHz
Modulation technology: (IEEE 802.11a/n/ac)	BPSK, QPSK,16-QAM, 64-QAM, 256QAM
Data speed(IEEE 802.11a)	6Mbps, 9Mbps,12Mbps,18Mbps, 24Mbps,36Mbps,48Mbps, 54Mbps
Data speed (IEEE 802.11n/ac):	Up to 866.7Mbps
Antenna Type:	External antenna
Antenna gain:	2dBi antenna gain per antenna
Power supply:	DC3.3V
Note:	Antenna number : 2 SISO mode: 802.11a MIMO mode: 802.11n(HT20)/ 802.11n(HT40)/ 802.11ac(HT20)/ 802.11ac(HT40)/ 802.11ac(HT80) Directional gain of MIMO mode: $2+10\log 2=5.01\text{dBi}$

Operation Frequency each of channel

Band 1					
802.11a/802.11nH20/802.11ac(HT20)		802.11nH40/802.11ac(HT40)		802.11ac(HT80)	
Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180MHz	39	5190MHz	42	5210MHz
40	5200MHz	45	5230MHz		
44	5220MHz				
48	5240MHz				
Band 4					
802.11a/802.11nH20/802.11ac(HT20)		802.11nH40/802.11ac(HT40)		802.11ac(HT80)	
Channel	Frequency	Channel	Frequency	Channel	Frequency
149	5745MHz	151	5755MHz	155	5775MHz
153	5765MHz	159	5795MHz		
157	5785MHz				
161	5805MHz				
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:

Band 1					
802.11a/802.11nH20/802.11ac(HT20)		802.11nH40/802.11ac(HT40)		802.11ac(HT80)	
Channel	Frequency	Channel	Frequency	Channel	Frequency
The lowest channel	5180MHz	The lowest channel	5190MHz	The middle channel	5210MHz
The middle channel	5200MHz	The highest channel	5230MHz		
The highest channel	5240MHz				
Band 4					
802.11a/802.11nH20/802.11ac(HT20)		802.11nH40/802.11ac(HT40)		802.11ac(HT80)	
Channel	Frequency	Channel	Frequency	Channel	Frequency
The lowest channel	5745MHz	The lowest channel	5755MHz	The middle channel	5775MHz
The middle channel	5785MHz	The highest channel	5795MHz		
The highest channel	5825MHz				

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5.3 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test mode:	
Continuously transmitting mode	Keep the EUT in 100% duty cycle transmitting with modulation.

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	6Mbps
802.11n(HT20)	6.5Mbps
802.11n(HT40)	13Mbps
802.11ac(HT20)	6.5Mbps
802.11ac(HT40)	13.5Mbps
802.11ac(HT80)	29.3Mbps

Final Test Mode:

According to ANSI C63.4 standards, the test results are both the “worst case” and “worst setup” 6 Mbps for 802.11a, 6.5 Mbps for 802.11n20 and 13 Mbps for 802.11n40. All test items for 802.11a and 802.11n were performed with duty cycle above 98%, meet the requirements of KDB789033.

5.4 Description of Support Units

Manufacturer	Description	Model	Serial Number
DELL	MONITOR	S2817Q	N/A
DELL	KEYBOARD	KB216d	05HDWJ
Lenovo	MOUSE	SM-8823	SM50L24506
DELL	PC	Vostro3668	B070NR2
Lenovo	Notebook computer	E470C	PF-10FB5C

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5.5 Test Facility

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

- FCC — Designation No.: CN1252

BlueAsia of Technical Services(Shenzhen) Co., Ltd 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. Designation CN1252.

- ISED — CAB identifier No.: CN0028

BlueAsia of Technical Services(Shenzhen) Co., Ltd has been registered by Certification and Engineering Bureau of ISED for radio equipment testing with CAB identifier CN0028

5.6 Laboratory Location

All tests were performed at:

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No tests were sub-contracted.

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5.7 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
1	3m SAC	SKET	9m*6m*6m	966	06-10-2018	06-09-2023
2	Broadband Antenna	SCHWARZBECK	VULB9168	00836 P:00227	07-14-2019	07-13-2020
3	Horn Antenna	SCHWARZBECK	9120D	01892 P:00331	07-14-2019	07-13-2020
4	EMI Test Software	EZ	EZ	N/A	N/A	N/A
5	Pre-amplifier	SKET	N/A	N/A	07-19-2019	07-18-2020
6	Spectrum analyzer	Rohde & Schwarz	FSP40	100817	05-24-2019	05-23-2020
7	EMI Test Receiver	Rohde & Schwarz	ESR7	101199	03-21-2019	03-20-2020
8	Controller	SKET	N/A	N/A	N/A	N/A
9	Vector Signal Generator	Agilent	E4438C	MY45092582	05-24-2019	05-23-2020
10	Signal Generator	Agilent	E8257D	MY44320250	05-24-2019	05-23-2020
11	Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
12	Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
13	Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
1	EMI Test Receiver	Rohde & Schwarz	ESPI3	101082	06-10-2019	06-09-2020
2	LISN	CHASE	MN2050D	1447	12-18-2019	12-17-2020
3	LISN	Rohde & Schwarz	ENV216	3560.6550.15	07-19-2019	07-18-2020
4	EMI Test Software	EZ	EZ	N/A	N/A	N/A
5	Temperature Humidity Chamber	Mingle	TH101B	N/A	07-19-2019	07-18-2020
6	Coaxial Cable	BlueAsia	BLA-XC-05	N/A	N/A	N/A

RF Conducted Test:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Spectrum Analyzer	Agilent	N9030A	MY50510123	05-24-2019	05-23-2020
2	Spectrum analyzer	Rohde & Schwarz	FSP40	100817	05-24-2019	05-23-2020
3	Vector Signal Generator	Agilent	E4438C	MY45092582	05-24-2019	05-23-2020
4	Signal Generator	Agilent	E8257D	MY44320250	05-24-2019	05-23-2020

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5	Power Sensor	D.A.R.E	RPR3006W	17I00015SNO27	05-24-2019	05-23-2020
6	Power Sensor	D.A.R.E	RPR3006W	17I00015SNO28	05-24-2019	05-23-2020
7	DC Power Supply	LODESTAR	LP305DE	N/A	07-19-2019	07-18-2020
8	Temperature Humidity Chamber	Mingle	TH101B	N/A	07-19-2019	07-18-2020

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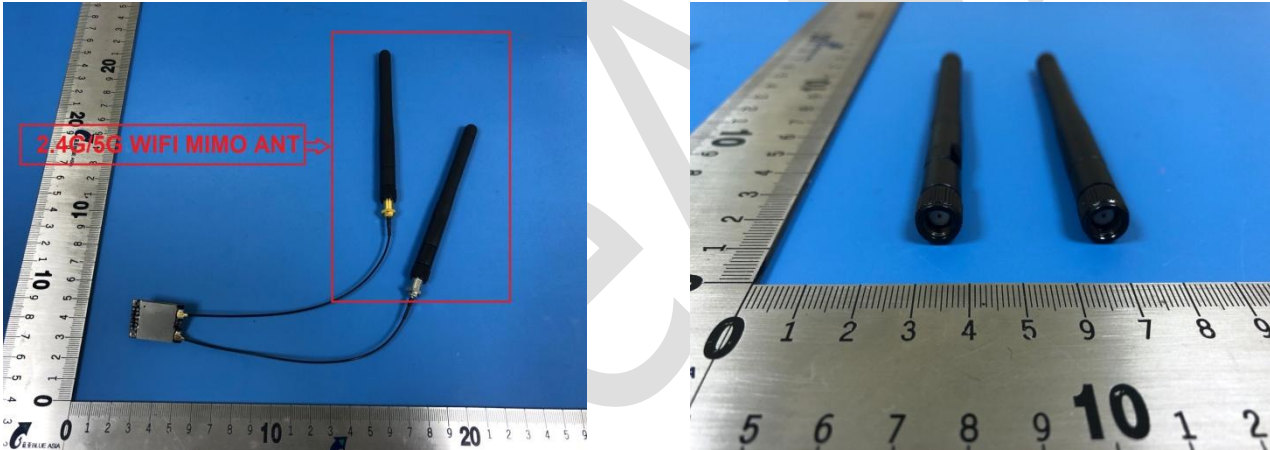
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6 Test results and Measurement Data

6.1 Antenna requirement

Standard requirement:	FCC Part15 E Section 15.203 /407(a)
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.</i> <i>This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.</i>	
E.U.T Antenna:	The antenna is External Antenna, Directional gain of the antenna is 5.0dBi 

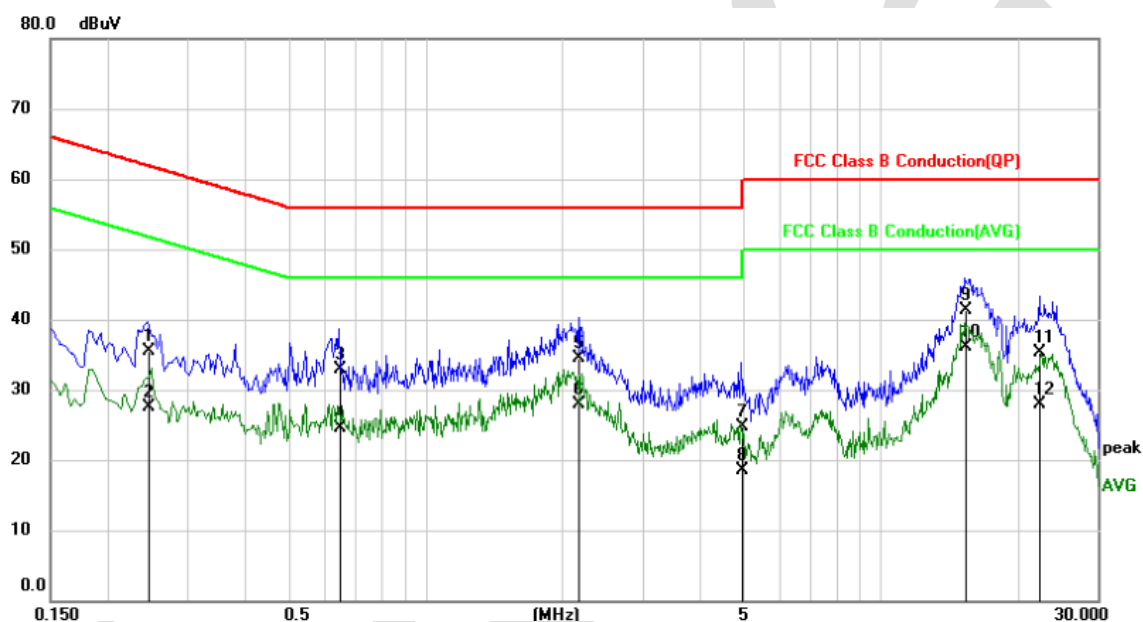
6.2 Conducted Emission

Test Requirement:	FCC Part15 C Section 15.207			
Test Method:	ANSI C63.10: 2013			
Test Frequency Range:	150 kHz to 30 MHz			
Class / Severity:	Class B			
Receiver setup:	RBW=9 kHz, VBW=30 kHz			
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 procedure	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). It 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 setup:	Reference Plane LISN AUX Equipment E.U.T Test table/Insulation plane 40cm 80cm LISN Filter AC power EMI Receiver Remark E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m			
Test Instruments:	Refer to section 5.7 for details			
Test mode:	Refer to section 5.3 for details.			
Test results:	Pass			

Measurement data

Line:

EUT:	Wifi Module	Probe:	L1
Model:	F12ASUM13	Power Source:	AC120V/60Hz
Mode:	Wifi mode	Test by:	Eason
Temp./Hum.(%RH):	26°C/60%RH		



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.2460	25.50	9.94	35.44	61.89	-26.45	QP
2		0.2460	17.51	9.94	27.45	51.89	-24.44	AVG
3		0.6460	23.19	9.70	32.89	56.00	-23.11	QP
4		0.6460	14.74	9.70	24.44	46.00	-21.56	AVG
5		2.1740	24.63	9.82	34.45	56.00	-21.55	QP
6		2.1740	18.15	9.82	27.97	46.00	-18.03	AVG
7		4.9420	14.92	9.88	24.80	56.00	-31.20	QP
8		4.9420	8.69	9.88	18.57	46.00	-27.43	AVG
9		15.3340	31.37	9.97	41.34	60.00	-18.66	QP
10	*	15.3340	26.07	9.97	36.04	50.00	-13.96	AVG
11		22.3260	25.22	10.02	35.24	60.00	-24.76	QP
12		22.3260	17.86	10.02	27.88	50.00	-22.12	AVG

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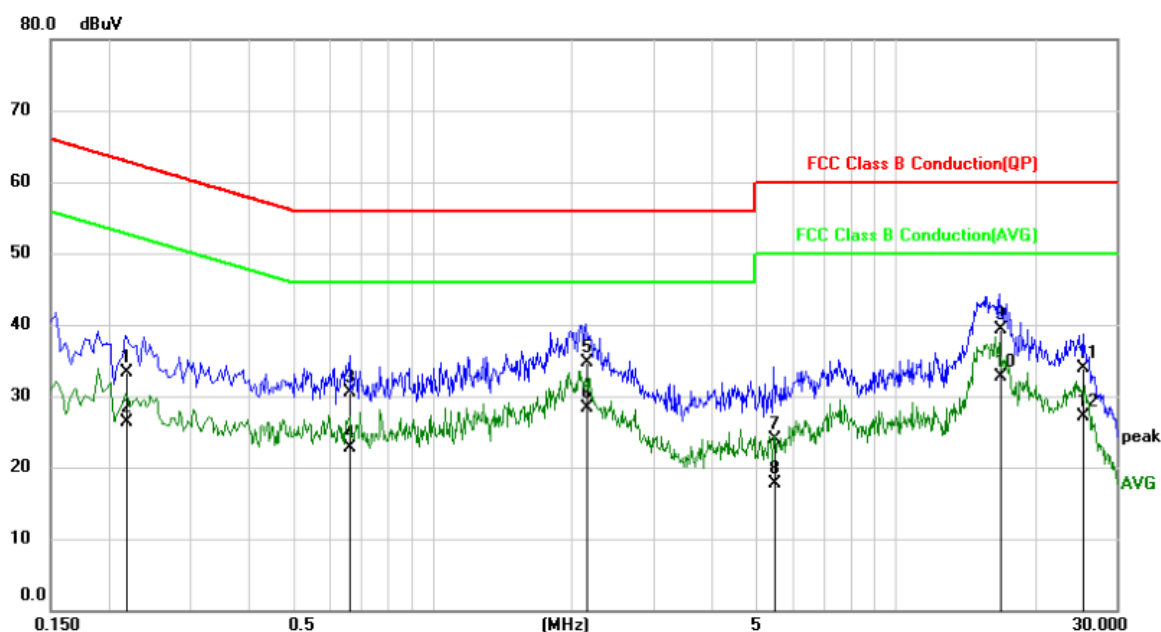
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Neutral:

EUT:	Wifi Module	Probe:	N
Model:	F12ASUM13	Power Source:	AC120V/60Hz
Mode:	Wifi mode	Test by:	Eason
Temp./Hum.(%RH):	26°C/60%RH		



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.2180	23.34	9.87	33.21	62.89	-29.68	QP
2		0.2180	16.48	9.87	26.35	52.89	-26.54	AVG
3		0.6620	20.71	9.73	30.44	56.00	-25.56	QP
4		0.6620	12.93	9.73	22.66	46.00	-23.34	AVG
5		2.1500	24.81	9.86	34.67	56.00	-21.33	QP
6		2.1500	18.36	9.86	28.22	46.00	-17.78	AVG
7		5.4540	14.11	9.89	24.00	60.00	-36.00	QP
8		5.4540	7.78	9.89	17.67	50.00	-32.33	AVG
9		16.7700	29.23	10.03	39.26	60.00	-20.74	QP
10	*	16.7700	22.65	10.03	32.68	50.00	-17.32	AVG
11		25.3620	23.87	10.04	33.91	60.00	-26.09	QP
12		25.3620	17.04	10.04	27.08	50.00	-22.92	AVG

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.

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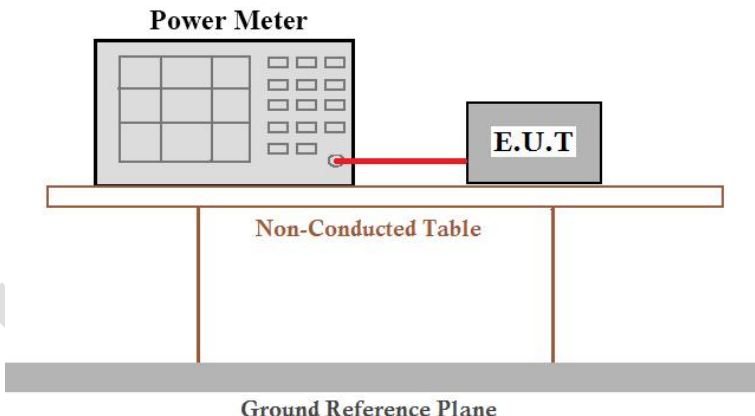
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2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. *Final Level = Receiver Read level + Correct factor*
4. *Correct factor = LISN Factor + Cable Loss*

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.

6.3 Conducted Output Power

Test Requirement:	FCC Part15 E Section 15.407 (a) (1) (ii) & (a) (3)
Test Method:	ANSI C63.10: 2013, KDB 789033
Limit:	Band 1: 1 W (For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.); Band 4: 1W.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data

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Band 1

Mode	Test CH	Conducted Output power(dBm)		Total Power dBm	Limit (dBm)	Result
		ANT1	ANT2			
802.11a	Lowest	13.51	11.36	/	30.00	Pass
	Middle	14.42	11.89	/	30.00	Pass
	Highest	15.57	12.43	/	30.00	Pass
802.11n(HT20) MIMO	Lowest	13.85	10.96	15.65	30.00	Pass
	Middle	14.28	10.42	15.78	30.00	Pass
	Highest	15.23	11.45	16.75	30.00	Pass
802.11n(HT40) MIMO	Lowest	13.51	13.90	16.72	30.00	Pass
	Highest	13.91	14.59	17.27	30.00	Pass
802.11ac(HT20) MIMO	Lowest	11.34	9.34	13.46	30.00	Pass
	Middle	12.20	5.49	13.04	30.00	Pass
	Highest	12.53	6.15	13.43	30.00	Pass
802.11ac(HT40) MIMO	Lowest	11.50	11.14	14.33	30.00	Pass
	Highest	11.64	14.13	16.07	30.00	Pass
802.11ac(HT80) MIMO	Lowest	13.34	12.39	15.90	30.00	Pass

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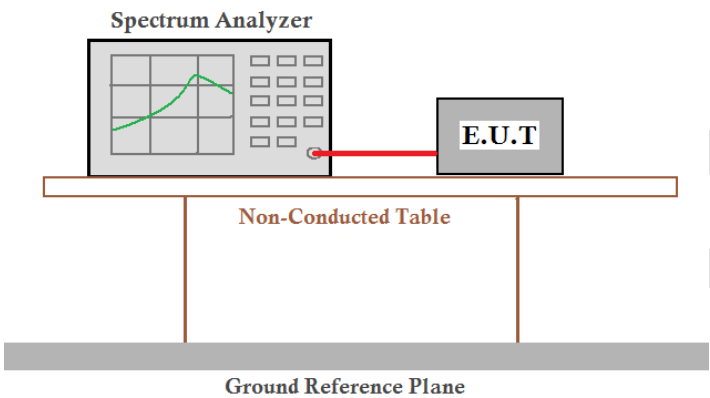
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Band 4

Mode	Test CH	Conducted Output power(dBm)		Total Power (dBm)	Limit (dBm)	Result
		ANT1	ANT2			
802.11a	Lowest	12.26	14.08	/	30.00	Pass
	Middle	13.28	13.34	/	30.00	Pass
	Highest	13.07	12.36	/	30.00	Pass
802.11n(HT20) MIMO	Lowest	13.02	14.41	16.78	30.00	Pass
	Middle	13.53	13.51	16.53	30.00	Pass
	Highest	13.22	12.79	16.02	30.00	Pass
802.11n(HT40) MIMO	Lowest	11.78	13.50	15.73	30.00	Pass
	Highest	12.90	12.54	15.73	30.00	Pass
802.11ac(HT20) MIMO	Lowest	10.73	11.15	13.96	30.00	Pass
	Middle	10.77	12.81	14.92	30.00	Pass
	Highest	10.12	10.21	13.18	30.00	Pass
802.11ac(HT40) MIMO	Lowest	9.41	11.25	13.44	30.00	Pass
	Highest	11.90	12.18	15.05	30.00	Pass
802.11ac(HT80) MIMO	Lowest	12.29	11.53	14.94	30.00	Pass

6.4 Occupy Bandwidth

Test Requirement:	FCC Part15 E Section 15.407 (a) (5) and Section 15.407 (e)
Test Method:	ANSI C63.10:2013 and KDB 789033
Limit:	Band 1: N/A(26dB Emission Bandwidth and 99% Occupy Bandwidth) Band 4: >500kHz(6dB Bandwidth)
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data

During the test, found the ANT2 port, which it is worse case.

Band 1:

CH. No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)			26dB Emission Bandwidth (MHz)		
		802.11a	802.11n(HT 20)	802.11ac(H T20)	802.11a	802.11n(HT 20)	802.11ac(H T20)
36	5180.00	17.20	18.16	18.08	21.60	22.32	22.16
40	5200.00	17.20	18.08	18.08	21.60	22.32	22.08
48	5240.00	17.12	18.08	18.16	21.52	22.24	22.08

CH. No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)		26dB Emission Bandwidth (MHz)	
		802.11n(HT40)	802.11ac(HT40)	802.11n(HT40)	802.11ac(HT40)
38	5190.00	36.48	36.48	43.04	42.88
46	5230.00	36.48	36.32	42.88	42.88

CH. No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26dB Emission Bandwidth (MHz)
		802.11ac(HT80)	802.11ac(HT80)
42	5210.00	75.52	79.68

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Band 4:

Test CH	6dB Emission Bandwidth (MHz)						Limit (KHz)	Result
	802.11a	802.11n(H T20)	802.11ac(HT20)	802.11n(H T40)	802.11ac(HT40)	802.11ac(HT80)		
Lowest	16.64	17.84	17.84	36.64	36.80	---	>500	Pass
Middle	16.64	17.84	17.84	---	---	76.16		
Highest	16.72	17.84	17.84	36.80	36.80	---		

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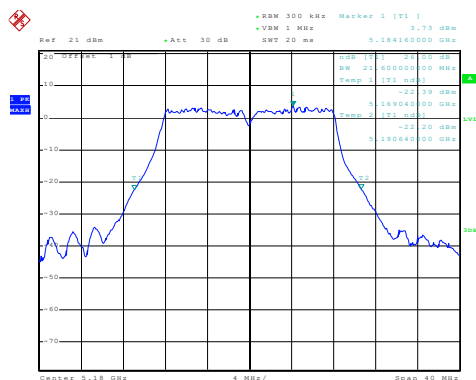
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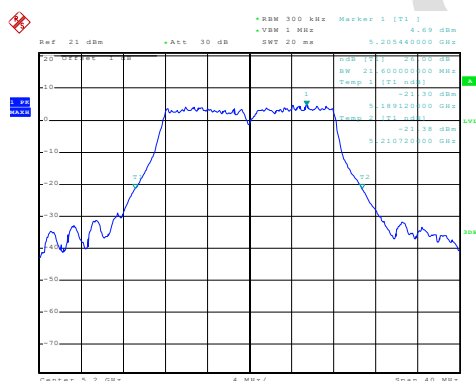
Band 1:

26 dB EBW - 802.11a



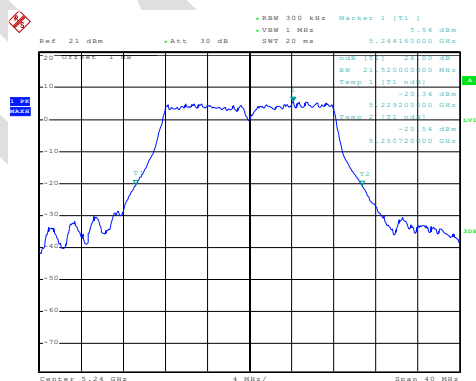
Date: 6.DEC.2019 17:23:19

Lowest channel



Date: 6.DEC.2019 17:24:22

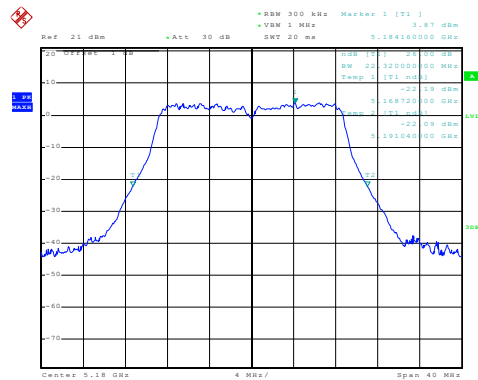
Middle channel



Date: 6.DEC.2019 17:25:00

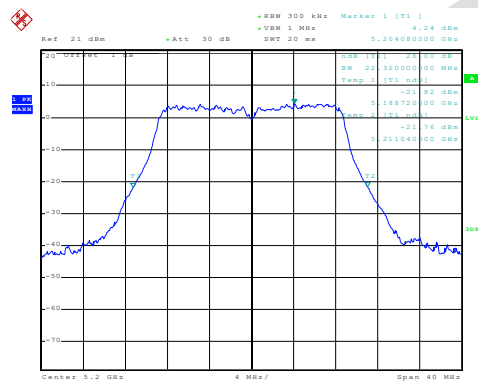
Highest channel

802.11n(HT20)



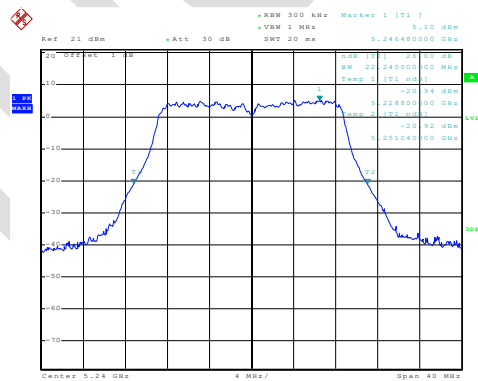
Date: 6.DEC.2019 17:25:55

Lowest channel



Date: 6.DEC.2019 17:26:31

Middle channel



Date: 6.DEC.2019 17:27:17

Highest channel

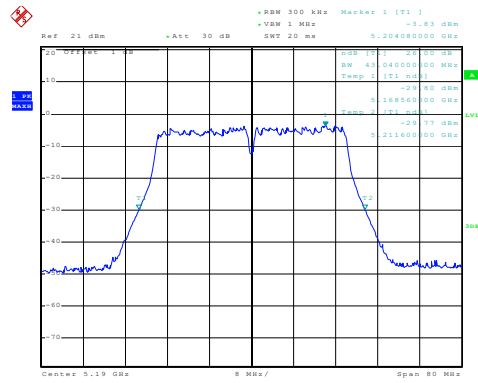
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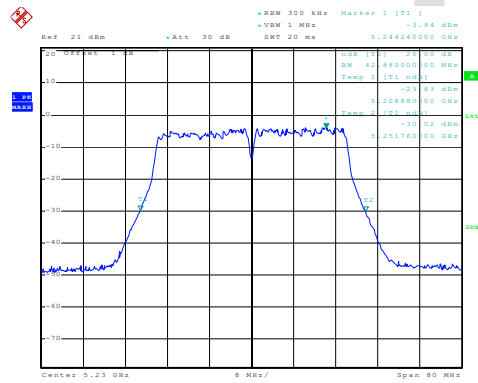
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802.11n(HT40)



Date: 6.DEC.2019 17:31:49

Lowest channel



Date: 6.DEC.2019 17:32:20

Highest channel

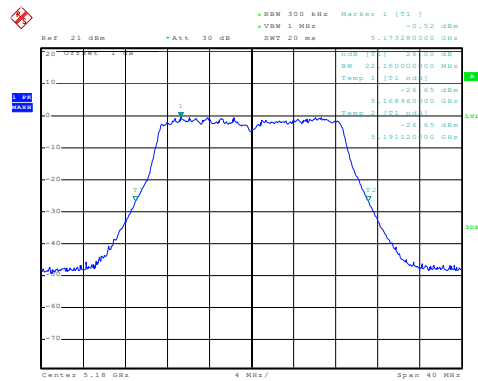
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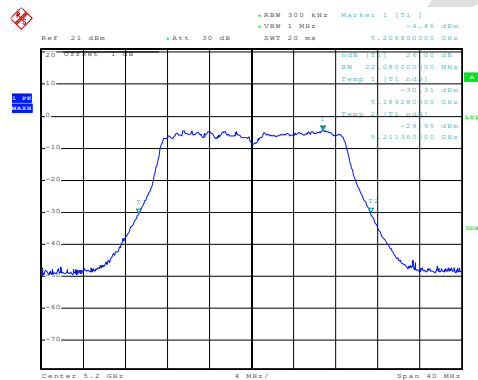
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802.11ac(HT20)



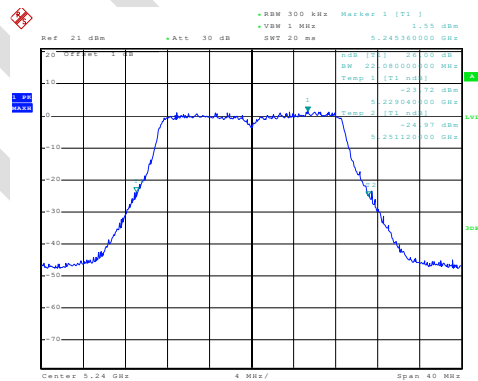
Date: 6.DEC.2019 17:28:26

Lowest channel



Date: 6.DEC.2019 17:28:56

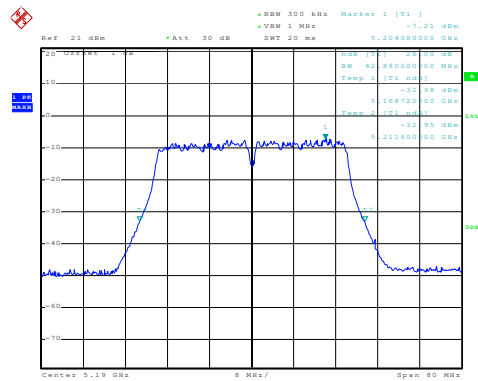
Middle channel



Date: 6.DEC.2019 17:30:56

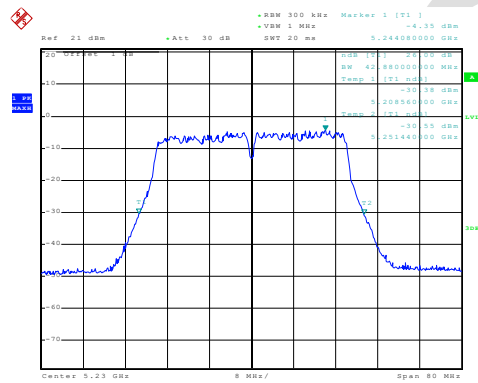
Highest channel

802.11ac(HT40)



Date: 6.DEC.2019 17:33:46

Lowest channel



Date: 6.DEC.2019 17:33:07

Highest channel

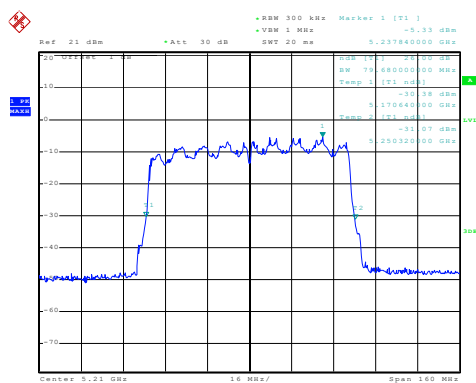
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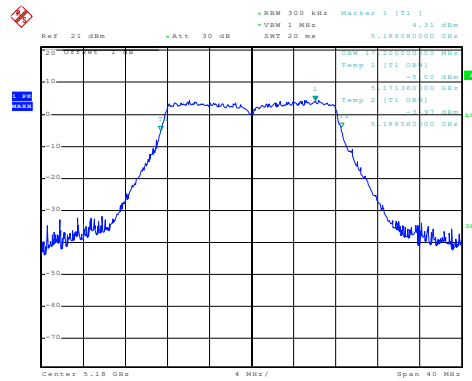
802.11ac(HT80)



Date: 6.DEC.2019 17:35:25

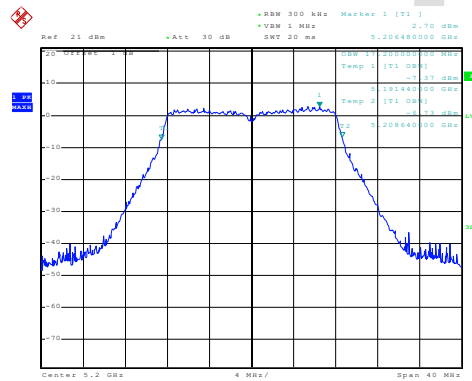
Middle channel

99% OBW - 802.11a



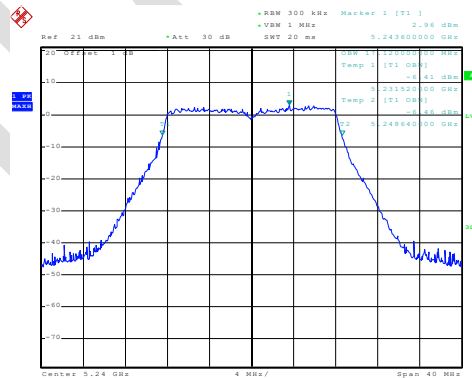
Date: 6.DEC.2019 18:12:46

Lowest channel



Date: 6.DEC.2019 18:13:10

Middle channel



Date: 6.DEC.2019 18:13:47

Highest channel

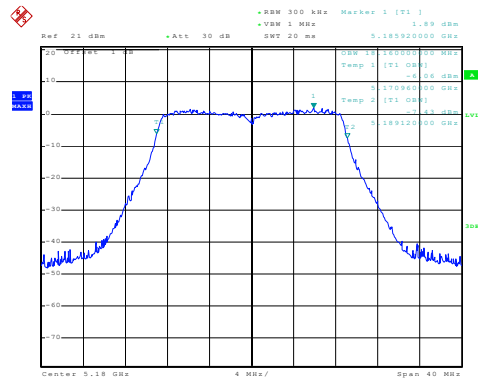
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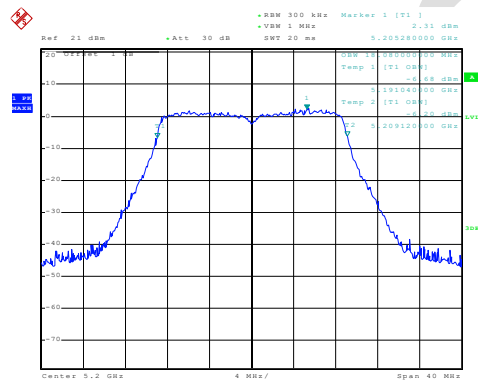
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802.11n(HT20)



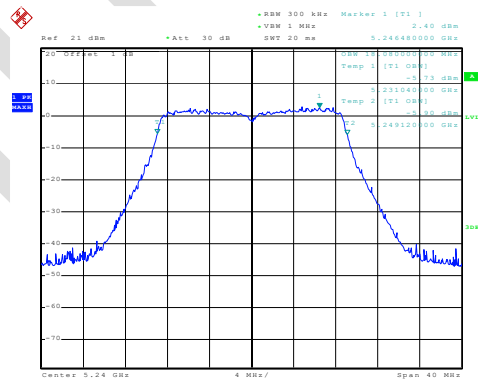
Date: 6.DEC.2019 18:15:36

Lowest channel



Date: 6.DEC.2019 18:16:05

Middle channel



Date: 6.DEC.2019 18:16:31

Highest channel

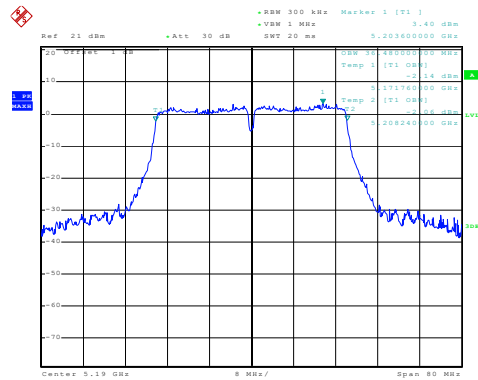
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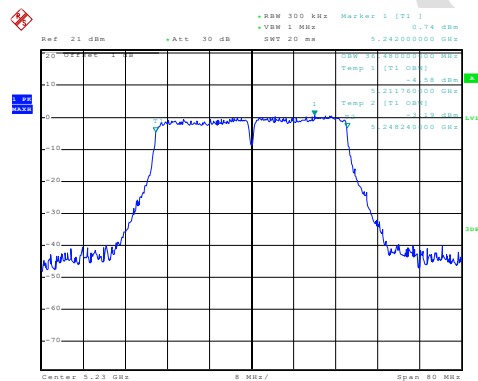
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802.11n(HT40)



Date: 6.DEC.2019 18:23:35

Lowest channel



Date: 6.DEC.2019 18:24:28

Highest channel

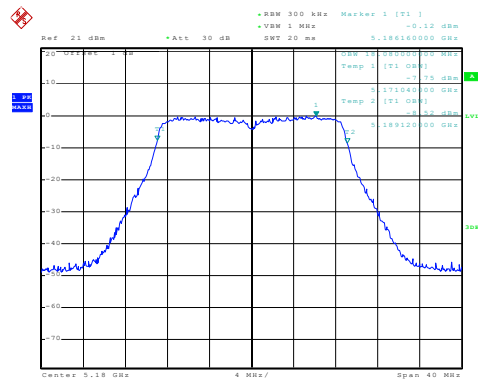
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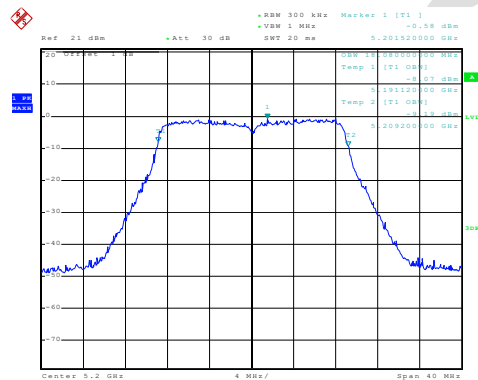
Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673

802.11ac(HT20)



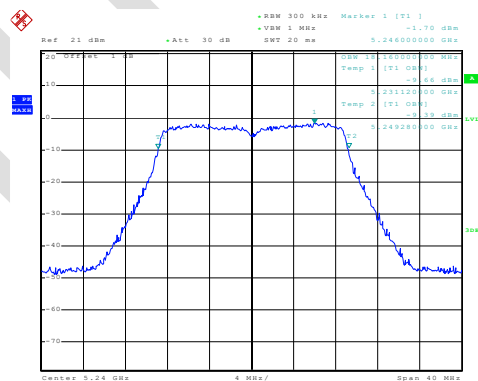
Date: 6.DEC.2019 18:19:04

Lowest channel



Date: 6.DEC.2019 18:19:25

Middle channel



Date: 6.DEC.2019 18:19:50

Highest channel

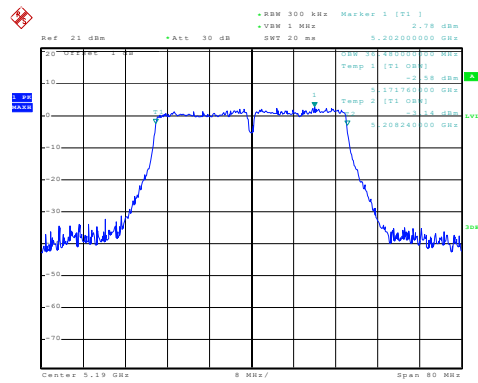
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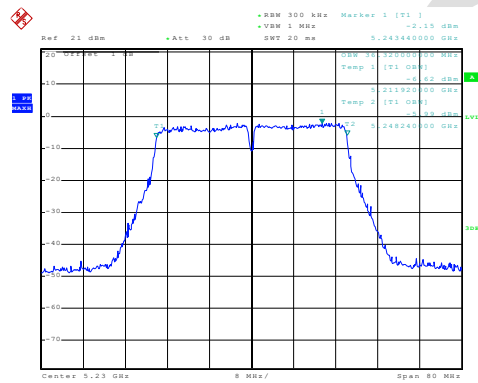
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802.11ac(HT40)



Date: 6.DEC.2019 18:27:43

Lowest channel



Date: 6.DEC.2019 18:28:27

Highest channel

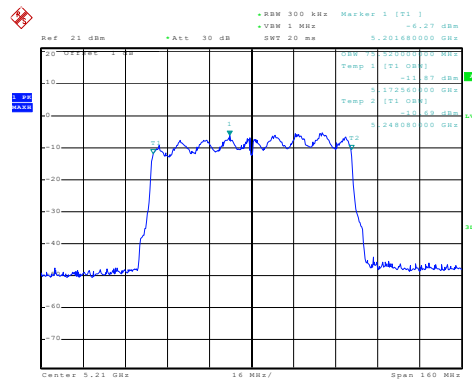
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802.11ac(HT80)



Date: 6.DEC.2019 18:30:35

Middle channel

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