





# FCC PART 15 TEST REPORT No.I20Z61602-IOT09

for

## Wingtech Group (Hong Kong) Limited

## 4G Mobile Broadband Router

## TMOHS1

### With

## FCC ID: 2APXW-TMOHS1

## Hardware Version: 89527\_1\_11

### Software Version: TMOHS1\_0.01.16

### Issued Date: 2020-11-12

#### Note:

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The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S.Government.

Test Laboratory:

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## **REPORT HISTORY**

Report Number	Revision	Description	Issue Date
I20Z61602-IOT09	Rev.0	1st edition	2020-11-12





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## 1. TEST LATORATORY

#### **1.1. Introduction & Accreditation**

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

#### 1.2. Testing Location

Conducted testing Location: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China100191

Radiated testing Location: CTTL(BDA)

Address:No.18A, Kangding Street, Beijing Economic-TechnologyDevelopment Area, Beijing, P. R. China 100176

#### **1.3. Testing Environment**

Normal Temperature: 15-35℃

Relative Humidity: 20-75%

#### 1.4. Project date

Testing Start Date:	2020-09-23
Testing End Date:	2020-11-12





#### 1.5. Signature

谢禹药

Xie Xiuzhen ( Prepared this test report )

¥. 340

Zheng Wei (Reviewed this test report)

h

Hu Xiaoyu (Approved this test report)





## 2. CLIENT INFORMATION

### 2.1 Applicant Information

Company Name:	Wingtech Group (Hong Kong) Limited			
Address:	Flat/RM 1903, 19/F, Podium Plaza 5 Hanoi Road, Tsim Sha Tsui			
Address.	Kowloon, Hong Kong			
City:	Hong Kong			
Postal Code:	/			
Country:	China			
Telephone:	/			
Fax:	/			

### 2.2 Manufacturer Information

Company Name:	Wingtech Group (Hong Kong) Limited			
Address:	Flat/RM 1903, 19/F, Podium Plaza 5 Hanoi Road, Tsim Sha Tsui			
Auuress.	Kowloon, Hong Kong			
City:	Hong Kong			
Postal Code:	/			
Country:	China			
Telephone:	/			
Fax:	/			





## 3. <u>EQUIPMENT UNDER TEST (EUT) AND</u>

## ANCILLARYEQUIPMENT(AE)

## 3.1. About EUT

Description	4G Mobile Broadband Router
Model name	TMOHS1
FCC ID	2APXW-TMOHS1
WLAN Frequency Band	ISM Bands:
	-5150MHz~5250MHz
	-5250MHz~5350MHz
	-5470MHz~5725MHz
Type of modulation	OFDM
Antenna	Integral Antenna
Voltage	3.85V

### 3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version
EUT1	862448013592736	89527_1_11	TMOHS1_0.01.16
EUT2	862448013593593	89527_1_11	TMOHS1_0.01.16
EUT3	862448013594724	89527_1_11	TMOHS1_0.01.16

\*EUT ID: is used to identify the test sample in the lab internally.

#### 3.3. Internal Identification of AE used during the test

AE ID*	Description	SN
AE1	Battery	/
AE2	charger	/
AE3	USB cable	/

AE1	
Туре	MF01
Manufacturer	Jiade Energy Technology (Zhuhai) Co.,Ltd
Capacity	/
Nominal Voltage	/
AE2	
Model	PA-US5V2A-036
Manufacturer	Huizhou puan electronics co., Itd
Length of cable	/
AE3	
Туре	USB TYPE A to C 2.0 Cable (1.0m)
Manufacturer	Huizhou Washin Electronics Co.,Ltd

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Length of cable

\*AE ID: is used to identify the test sample in the lab internally.

### 3.4. General Description

The Equipment under Test (EUT) is a model of 4G Mobile Broadband Router with integrated antenna and inbuilt battery.

It consists of normal options: travel charger, USB cable.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.

#### 3.5. Interpretation of the Test Environment

For the test methods, the test environment uncertainty figures correspond to an expansion factor k=2.

Measurement Uncertainty

·····,	
Parameter	Uncertainty
temperature	0.48°C
humidity	2 %
DC voltages	0.003V

## 4. <u>REFERENCE DOCUMENTS</u>

#### 4.1. Documents supplied by applicant

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

#### 4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

FCC Part15	Title 47 of the Code of Federal Regulations; Chapter I	2018
FCC Pailing	Part 15 - Radio frequency devices	
	Methods of Measurement of Radio-Noise Emissions from	
ANSI C63.10	Low-Voltage Electrical and Electronic Equipment in the	2013
	Range of 9 kHz to 40 GHz	
UNII: KDB 789033	General U-NII Test Procedures New Rules v02r01	2017-12
D02	General O-Mil Test Flocedules New Rules Vozion	

## 5. LABORATORY ENVIRONMENT

Conducted RF performance testing is performed in shielding room.

EMC performance testing is performed in Semi-anechoic chamber.





## 6. SUMMARY OF TEST RESULTS

#### 6.1. Summary of Test Results

SUMMARY OF MEASUREMENT RESULTS	Sub-clause of Part15E	Sub-clause of IC	Verdict
Maximum Output Power	15.407	/	Р
Peak Power Spectral Density	15.407	/	Р
Occupied 26dB Bandwidth	15.403	/	Р
Band edge compliance (Radiated)	15.209	/	Р
Transmitter spurious emissions (Radiated)	15.407	/	Р
AC Powerline Conducted Emission (150kHz- 30MHz)	15.407	/	Р
99% Occupied bandwidth	/	/	Р
Transmit Power Control	15.407	/	NA

Please refer to **ANNEX A** for detail.

Terms used in Verdict column

Р	Pass, The EUT complies with the essential requirements in the standard.
NM	Not measured, The test was not measured by CTTL
BR	Re-use test data from basic model report.
NA	Not Applicable, The test was not applicable
F	Fail, The EUT does not comply with the essential requirements in the
	standard

#### 6.2. Statements

CTTL has evaluated the test cases requested by the client/manufacturer as listed in section 6.1 of this report for the EUT specified in section 3 according to the standards or reference documents listed in section 4.1.

This report only deals with the WLAN function among the features described in section 3.

#### 6.3. Test Conditions

The Equipment Under Test (EUT) model TMOHS1 (FCC ID: 2APXW-TMOHS1) is a variant product of TMOHS1 (FCC ID: 2APXW-TMOHS1), according to the declaration of changes provided by the applicant and FCC KDB publication 178919 D01.All test results of 5150MHz-5250MHz are derived from test report No.I20Z61602-IOT07. Other frequency band test results are from this report. Please refer Annex B for detail.

For this report, all the test cases are tested under normal temperature and normal voltage, and also under norm humidity, the specific condition is shown as follows:

Temperature	26 °C
Voltage	3.85V
Humidity	44%





## 7. TEST EQUIPMENTS UTILIZED

#### Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Vector Signal Analyzer	FSQ40	200089	Rohde & Schwarz	1 year	2021-05-06
2	LISN	ENV216	101459	R&S	1 year	2021-03-17
3	Test Receiver	ESCI	100766	R&S	1 year	2021-03-10
4	Shielding Room	S81	/	ETS-Lindgren	/	/

#### Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESU26	100376	Rohde & Schwarz	1 year	2021-09-04
2	BiLog Antenna	VULB9163	9163-514	Schwarzbeck	1 year	2021-02-24
3	Dual-Ridge Waveguide Horn Antenna	3117	00058888	ETS-Lindgren	1 year	2021-04-08
4	Dual-Ridge Waveguide Horn Antenna	3116	2663	ETS-Lindgren	1 year	2021-08-05
5	Vector Signal Analyzer	FSV40	101047	Rohde & Schwarz	1 year	2021-05-18





## 8. Measurement Uncertainty

#### 8.1 Transmitter Output Power

Measurement Uncertainty: 0.387dB,k=1.96

#### 8.2 Peak Power Spectral Density

Measurement Uncertainty: 0.705dB,k=1.96

#### 8.3 Occupied Channel Bandwidth

Measurement Uncertainty: 60.80Hz,k=1.96

#### 8.4 Band Edges Compliance

Measurement Uncertainty : 0.62dB,k=1.96

#### **8.5 Spurious Emissions**

#### Conducted (k=1.96)

Frequency Range	Uncertainty(dB)
30MHz ≤ f ≤ 2GHz	1.22
2GHz ≤ f ≤3.6GHz	1.22
3.6GHz ≤ f ≤8GHz	1.22
8GHz ≤ f ≤12.75GHz	1.51
12.75GHz ≤ f ≤26GHz	1.51
26GHz ≤ f ≤40GHz	1.59

#### Radiated (k=2)

Frequency Range	Uncertainty(dB)
9kHz-30MHz	/
30MHz ≤ f ≤ 1GHz	5.40
1GHz ≤ f ≤18GHz	4.32
18GHz ≤ f ≤40GHz	5.26

#### 8.6 AC Power-line Conducted Emission

Measurement Uncertainty : 3.10dB,k=2

## ANNEX A: EUT parameters

Disclaimer: the worse case provided by the client may affect the validity of the measurement results in this report, and the client shall bear the impact and consequences arising therefrom.



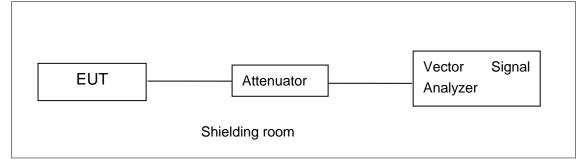


## ANNEX B: MEASUREMENT RESULTS

#### B.1. Measurement Method

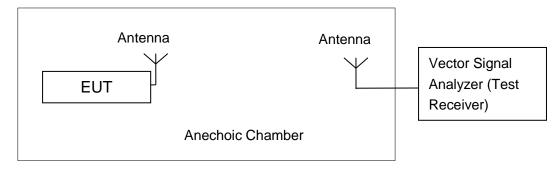
#### **B.1.1. Conducted Measurements**

- 1). Connect the EUT to the test system correctly.
- 2). Set the EUT to the required work mode.
- 3). Set the EUT to the required channel.
- 4). Set the spectrum analyzer to start measurement.
- 5). Record the values. Vector Signal Analyzer



#### **B.1.2. Radiated Emission Measurements**

In the case of radiated emission, the used settings are as follows, Sweep frequency from 30 MHz to 1GHz, RBW = 100 kHz, VBW = 300 kHz; Sweep frequency from 1 GHz to 26GHz, RBW = 1MHz, VBW = 10Hz;



The measurement is made according to KDB 789033

The radiated emission test is performed in semi-anechoic chamber. The distance from the EUT to the reference point of measurement antenna is 3m. The test is carried out on both vertical and horizontal polarization and only maximization result of both polarizations is kept. During the test, the turntable is rotated 360° and the measurement antenna is moved from 1m to 4m to get the maximization result.





#### **B.2. Maximum output Power**

#### Measurement Limit and Method:

Standard	Frequency (MHz)	Limit (dBm)
	5150MHz~5250MHz	24dBm
FCC CRF Part 15.407(a)	5250MHz~5350MHz	24dBm or 11+10logB
	5470MHz~5725MHz	24dBm or 11+10logB

Limit use the less value, and B is the 26dB bandwidth.

The measurementmethod SA-2 is made according to KDB 789033

#### **Measurement Results:**

#### 802.11a mode

	ode Rate Frequency (MHz)										
Mode Rate Frequency (MHz)											
		5180	5200	5240	5260	5280	5320	5500	5580	5700	5720
802.11a	6Mbps	19.64	19.67	19.49	17.50	17.33	17.79	18.00	19.05	17.73	17.99

The data rate 6Mbps is selected as worse condition, and the following cases are performed with this condition.

#### 802.11n-HT20 mode

						Test Res	ult (dBm	)						
Mode	Rate		Frequency (MHz)											
		5180	5200	5240	5260	5280	5320	5500	5580	5700	5720			
802.11n(HT20)	MCS0	18.37	18.40	18.21	17.63	17.50	18.01	17.73	18.80	18.47	18.73			

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11ac-HT20 mode

						Test Re	sult (dBr	n)						
Mode	Rate		Frequency (MHz)											
		5180	5200	5240	5260	5280	5320	5500	5580	5700	5720			
802.11ac(HT20)	MCS0	18.36	18.41	18.21	17.63	17.49	18.02	17.72	18.78	17.99	18.25			

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11n-HT40 mode

				Т	est Result	(dBm)					
Mode	Rate		Frequency (MHz)								
		5190	5230	5270	5310	5510	5550	5670	5710		
802.11n(HT40)	MCS0	17.06	18.69	15.67	15.00	16.17	16.60	17.18	17.64		

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.





#### 802.11ac-HT40 mode

					Test Resu	lt (dBm)			
Mode	Rate	Frequency (MHz)							
		5190	5230	5270	5310	5510	5550	5670	5710
802.11ac(HT40)	MCS0	15.98	18.69	16.94	16.66	16.12	16.56	17.13	17.61

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.

#### 802.11ac-HT80 mode

			Test F	Result (d	Bm)	
Mode	Rate	Frequency (MHz)				
		5210	5290	5530	5610	5690
802.11ac(HT80)	MCS0	16.02	15.16	16.11	16.67	16.68

The data rate MCS0 is selected as worse condition, and the following cases are performed with this condition.





#### **B.3. Peak Power Spectral Density (conducted)**

#### Measurement Limit:

Standard	Frequency (MHz)	Limit (dBm/MHz)
	5150MHz~5250MHz	11
FCC CRF Part 15.407(a)	5250MHz~5350MHz	11
	5470MHz~5725MHz	11

The output power measurement method Section F is made according to KDB 789033

#### **Measurement Results:**

Mode	Frequency	Power Spectral Density (dBm/MHz)	Conclusion
	5180 MHz	9.77	Р
	5200 MHz	9.68	Р
	5240 MHz	9.81	Р
	5260 MHz	7.96	Р
000 11 -	5280 MHz	7.87	Р
802.11a	5320 MHz	7.82	Р
	5500 MHz	8.34	Р
	5580 MHz	7.56	Р
	5700 MHz	6.22	Р
	5720 MHz	5.13	Р
	5180 MHz	8.37	Р
	5200 MHz	8.34	Р
	5240 MHz	8.43	Р
	5260 MHz	8.05	Р
802.11n	5280 MHz	9.01	Р
HT20	5320 MHz	8.14	Р
	5500 MHz	8.08	Р
	5580 MHz	8.21	Р
	5700 MHz	7.85	Р
	5720 MHz	6.62	Р
	5180 MHz	8.38	Р
	5200 MHz	8.33	Р
	5240 MHz	8.44	Р
	5260 MHz	8.05	Р
802.11ac	5280 MHz	8.06	Р
HT20	5320 MHz	8.14	Р
	5500 MHz	8.10	Р
	5580 MHz	8.14	Р
	5700 MHz	7.34	Р
	5720 MHz	6.17	Р
802.11n	5190 MHz	2.89	Р

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HT40	5230 MHz	5.93	Р
	5270 MHz	3.12	Р
	5310 MHz	3.01	Р
	5510 MHz	3.61	Р
	5550 MHz	3.24	Р
	5670 MHz	3.71	Р
	5710 MHz	2.76	Р
	5190 MHz	2.37	Р
	5230 MHz	5.95	Р
	5270 MHz	3.63	Р
802.11ac	5310 MHz	3.52	Р
HT40	5510 MHz	3.54	Р
	5550 MHz	3.24	Р
	5670 MHz	3.67	Р
	5710 MHz	2.75	Р
	5210MHz	-0.23	Р
902 1100	5290MHz	-0.31	Р
802.11ac HT80	5530MHz	0.10	Р
пточ	5610MHz	0.13	Р
	5690 MHz	-0.91	Р

**Conclusion: PASS** 





### B.4. Occupied 26dB Bandwidth(conducted)

#### Measurement Limit:

Standard	Limit (kHz)	
FCC 47 CFR Part 15.403 (i)	/	

The measurement is made according to KDB 789033

#### **Measurement Uncertainty:**

Measurement Uncertainty	60.80Hz
-------------------------	---------

#### Measurement Result:

Mode	Frequency	-	IB Bandwidth IHz)	conclusion
	5180 MHz	Fig.1	20.70	Р
	5200 MHz	Fig.2	20.70	Р
	5240 MHz	Fig.3	20.65	Р
	5260 MHz	Fig.4	20.70	Р
000 44 -	5280 MHz	Fig.5	20.70	Р
802.11a	5320 MHz	Fig.6	20.75	Р
	5500 MHz	Fig.7	20.60	Р
	5580 MHz	Fig.8	20.80	Р
	5700 MHz	Fig.9	20.85	Р
	5720 MHz	Fig.10	20.65	Р
	5180 MHz	Fig.11	20.55	Р
	5200 MHz	Fig.12	21.15	Р
	5240 MHz	Fig.13	21.05	Р
	5260 MHz	Fig.14	21.20	Р
802.11n	5280 MHz	Fig.15	21.05	Р
HT20	5320 MHz	Fig.16	21.15	Р
	5500 MHz	Fig.17	21.00	Р
	5580 MHz	Fig.18	21.10	Р
	5700 MHz	Fig.19	21.20	Р
	5720 MHz	Fig.20	21.15	Р
			· · ·	
	5180 MHz	Fig.21	21.05	Р
	5200 MHz	Fig.22	21.15	Р
	5240 MHz	Fig.23	21.10	Р

802.11ac HT20	5200 MHz	Fig.22	21.15	Р
	5240 MHz	Fig.23	21.10	Р
	5260 MHz	Fig.24	21.15	Р
	5280 MHz	Fig.25	21.10	Р
	5320 MHz	Fig.26	21.10	Р
	5500 MHz	Fig.27	21.10	Р

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5580 MHz	Fig.28	21.15	Р
5700 MHz	Fig.29	21.10	Р
5720 MHz	Fig.30	21.15	Р

	5190 MHz	Fig.31	41.36	Р
	5230 MHz	Fig.32	41.36	Р
	5270 MHz	Fig.33	41.44	Р
802.11n	5310 MHz	Fig.34	41.36	Р
HT40	5510 MHz	Fig.35	41.28	Р
	5550 MHz	Fig.36	41.20	Р
	5670 MHz	Fig.37	42.24	Р
	5710 MHz	Fig.38	41.60	Р

	5190 MHz	Fig.39	41.44	Р
	5230 MHz	Fig.40	41.20	Р
	5270 MHz	Fig.41	41.36	Р
802.11ac	5310 MHz	Fig.42	41.20	Р
HT40	5510 MHz	Fig.43	41.20	Р
	5550 MHz	Fig.44	41.92	Р
	5670 MHz	Fig.45	42.08	Р
	5710 MHz	Fig.46	42.48	Р

	5210MHz	Fig.47	83.68	Р
802.11ac	5290MHz	Fig.48	83.52	Р
HT80	5530MHz	Fig.49	84.00	Р
	5610MHz	Fig.50	83.84	Р
	5690 MHz	Fig.51	84.00	Р

Conclusion: PASS Test graphs as below:





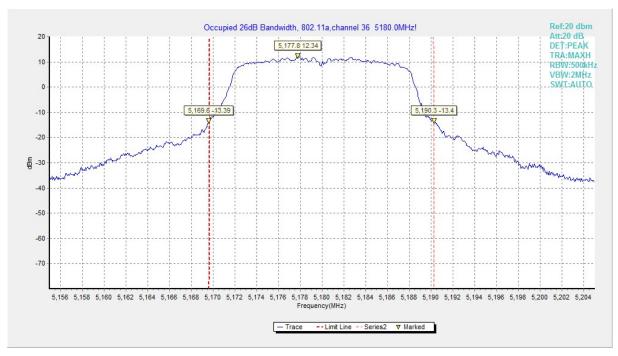


Fig.1 Occupied 26dB Bandwidth (802.11a, 5180MHz)

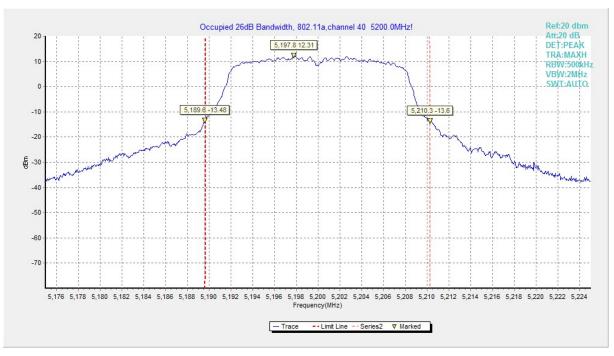


Fig.2 Occupied 26dB Bandwidth (802.11a, 5200MHz)





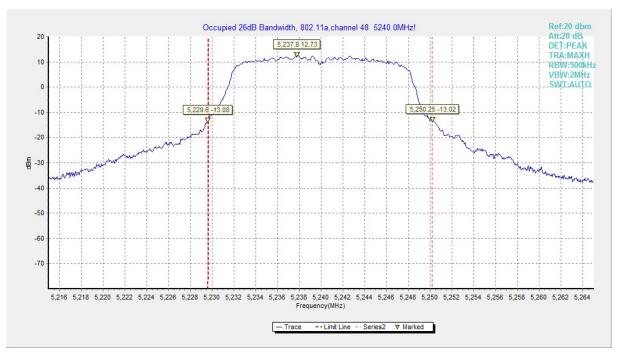


Fig.3 Occupied 26dB Bandwidth (802.11a, 5240MHz)

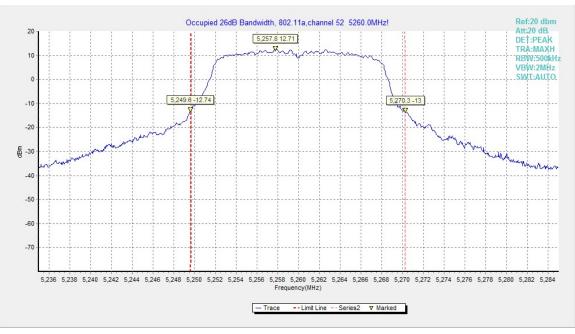


Fig.4 Occupied 26dB Bandwidth (802.11a, 5260MHz)





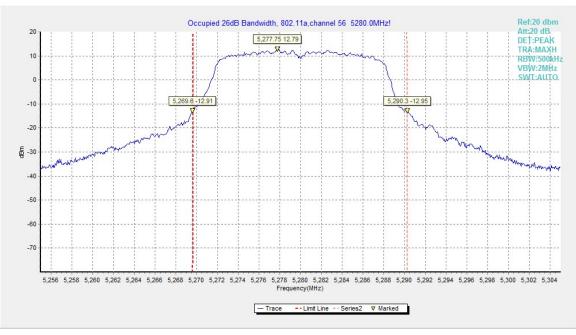


Fig.5 Occupied 26dB Bandwidth (802.11a, 5280MHz)

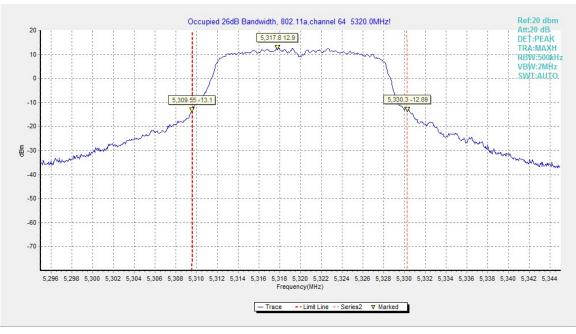


Fig.6 Occupied 26dB Bandwidth (802.11a, 5320MHz)





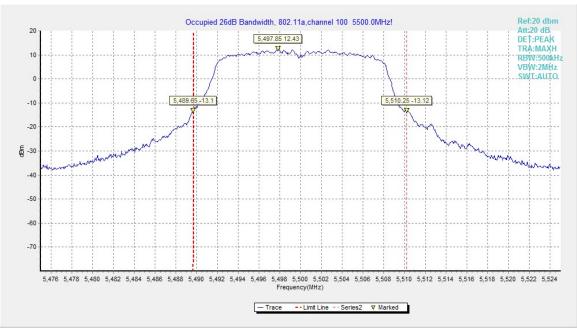


Fig.7 Occupied 26dB Bandwidth (802.11a, 5500MHz)

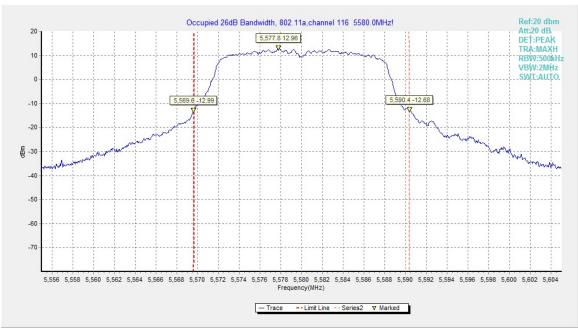


Fig.8 Occupied 26dB Bandwidth (802.11a, 5580MHz)





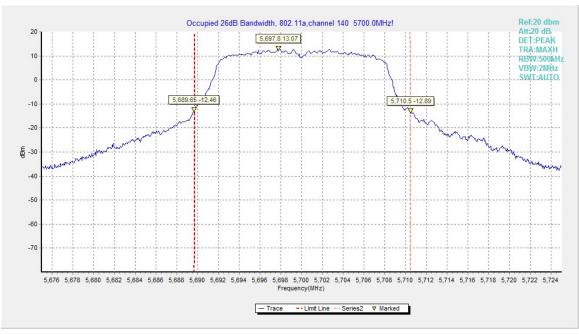


Fig.9 Occupied 26dB Bandwidth (802.11a, 5700MHz)

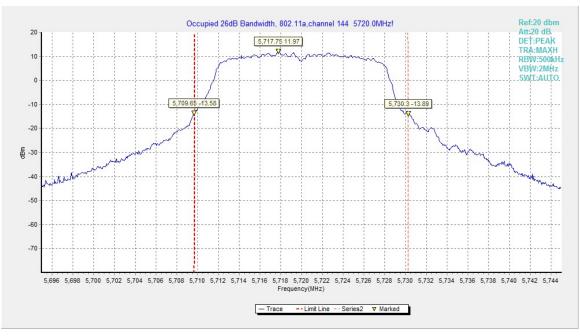


Fig.10 Occupied 26dB Bandwidth (802.11a, 5720MHz)





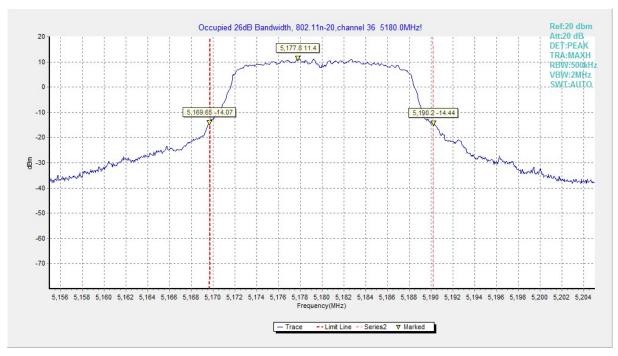


Fig.11 Occupied 26dB Bandwidth (802.11n-HT20, 5180MHz)

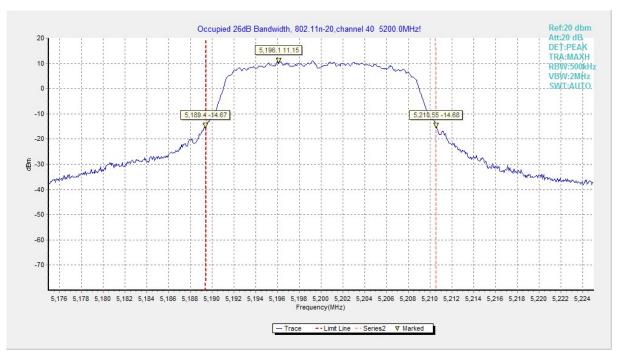


Fig.12 Occupied 26dB Bandwidth (802.11n-HT20, 5200MHz)





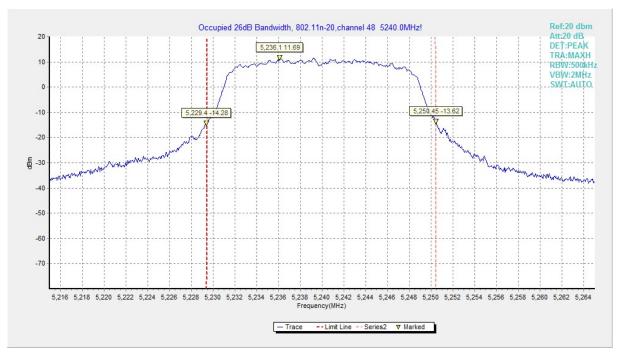


Fig.13 Occupied 26dB Bandwidth (802.11n-HT20, 5240MHz)

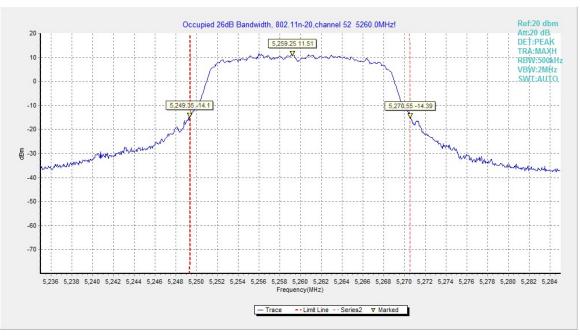


Fig.14 Occupied 26dB Bandwidth (802.11n-HT20, 5260MHz)





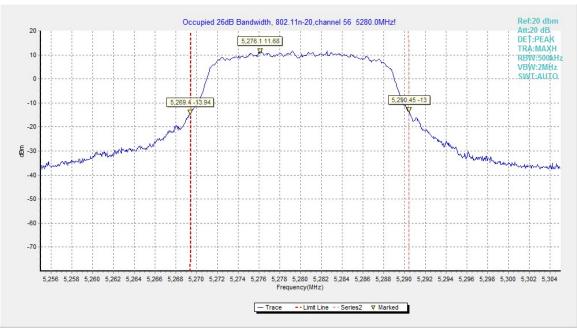


Fig.15 Occupied 26dB Bandwidth (802.11n-HT20, 5280MHz)

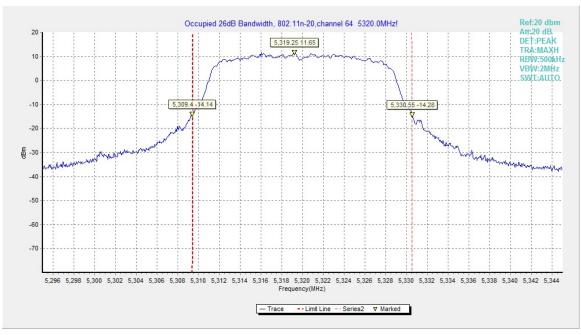


Fig.16 Occupied 26dB Bandwidth (802.11n-HT20, 5320MHz)





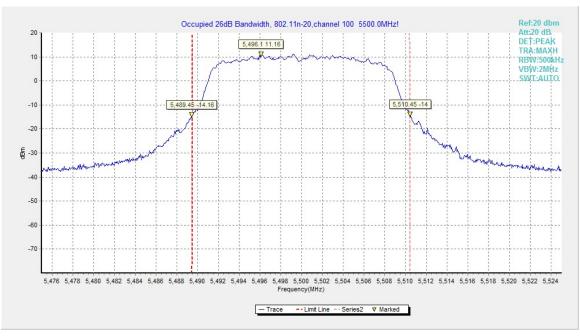


Fig.17 Occupied 26dB Bandwidth (802. 11n-HT20, 5500MHz)

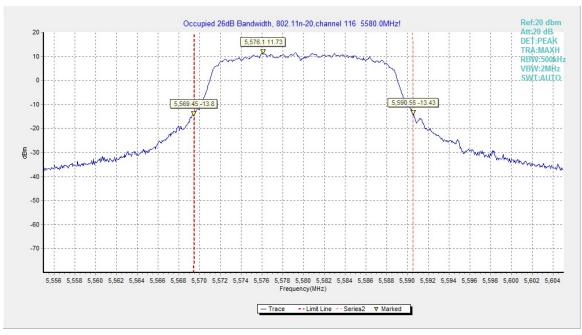


Fig.18 Occupied 26dB Bandwidth (802. 11n-HT20, 5580MHz)





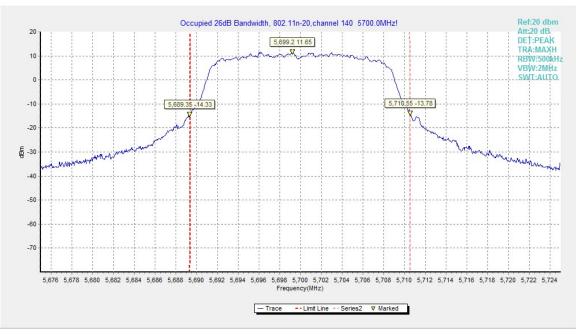


Fig.19 Occupied 26dB Bandwidth (802. 11n-HT20, 5700MHz)

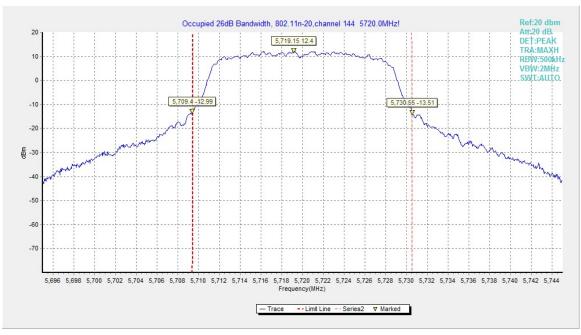


Fig.20 Occupied 26dB Bandwidth (802. 11n-HT20, 5720MHz)





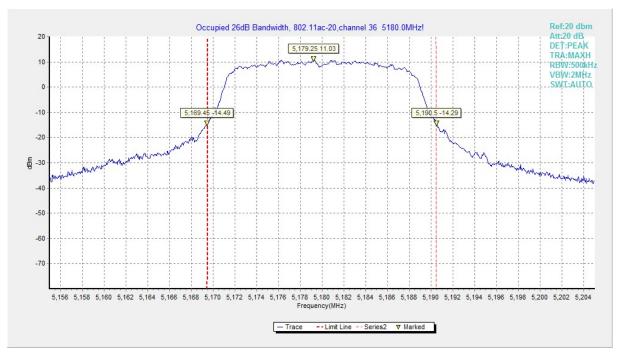


Fig.21 Occupied 26dB Bandwidth (802.11ac-HT20, 5180MHz)

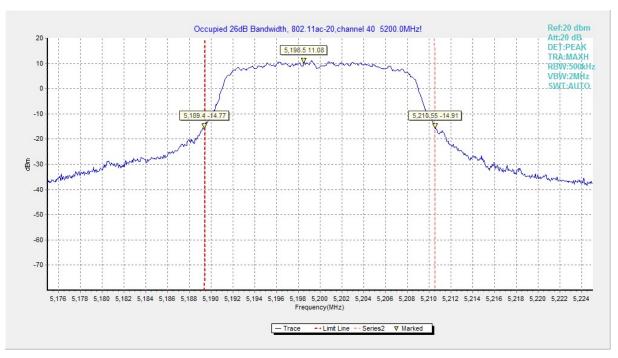


Fig.22 Occupied 26dB Bandwidth (802.11ac-HT20, 5200MHz)





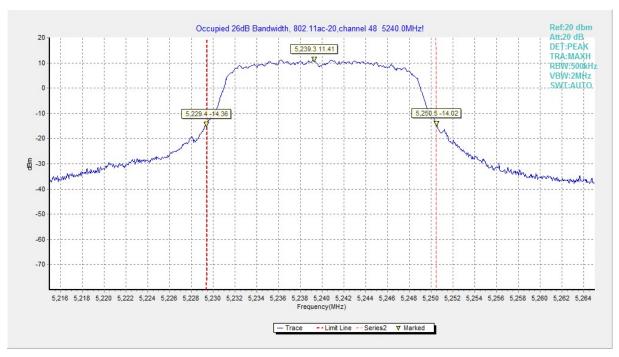


Fig.23 Occupied 26dB Bandwidth (802.11ac-HT20, 5240MHz)

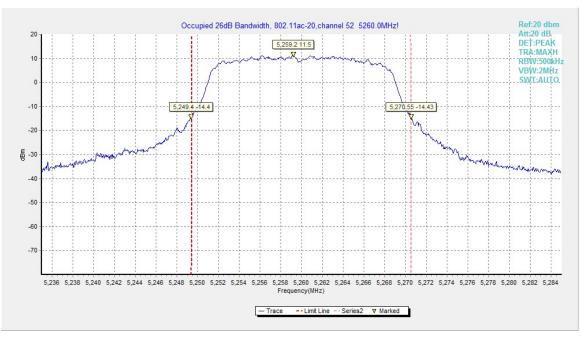


Fig.24 Occupied 26dB Bandwidth (802.11ac-HT20, 5260MHz)





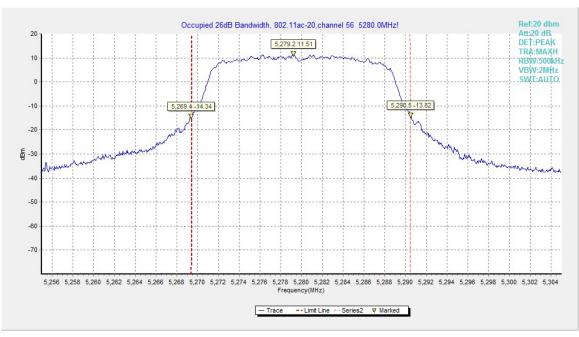


Fig.25 Occupied 26dB Bandwidth (802.11ac-HT20, 5280MHz)

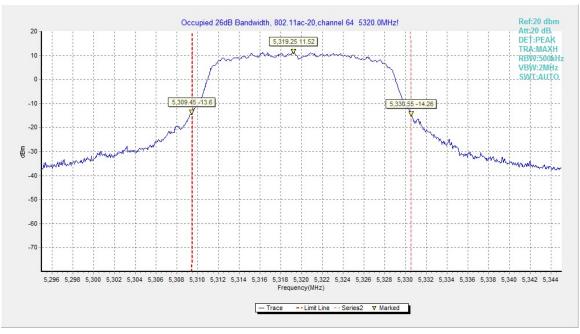


Fig.26 Occupied 26dB Bandwidth (802.11ac-HT20, 5320MHz)





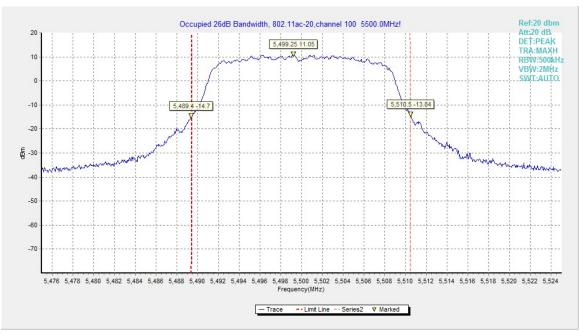


Fig.27 Occupied 26dB Bandwidth (802. 11ac-HT20, 5500MHz)

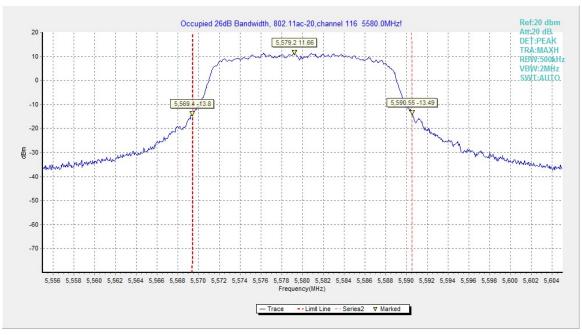


Fig.28 Occupied 26dB Bandwidth (802. 11ac-HT20, 5580MHz)





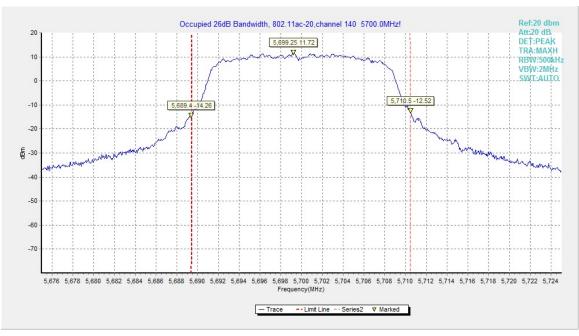


Fig.29 Occupied 26dB Bandwidth (802. 11ac-HT20, 5700MHz)

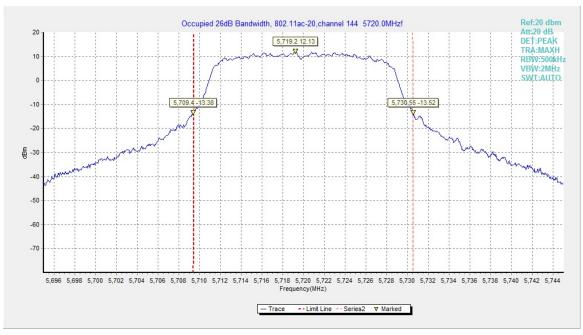


Fig.30 Occupied 26dB Bandwidth (802. 11ac-HT20, 5720MHz)





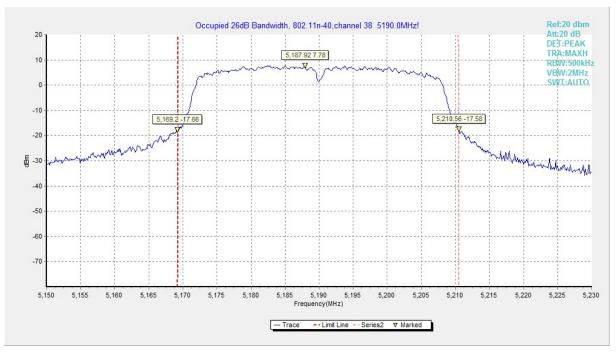


Fig.31 Occupied 26dB Bandwidth (802.11n-HT40, 5190MHz)

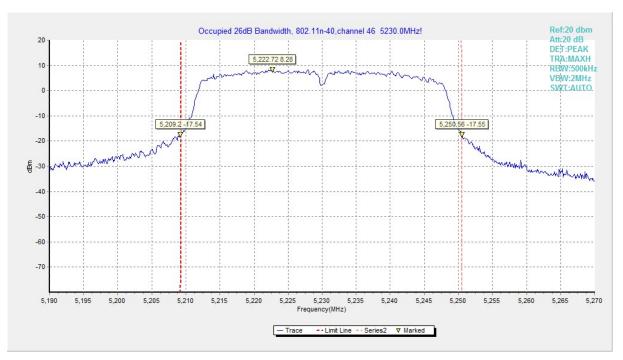


Fig.32 Occupied 26dB Bandwidth (802.11n-HT40, 5230MHz)





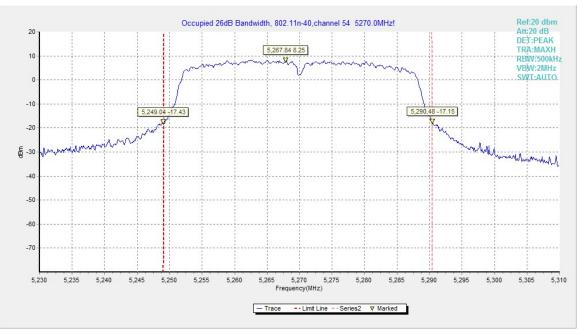


Fig.33 Occupied 26dB Bandwidth (802.11n-HT40, 5270MHz)

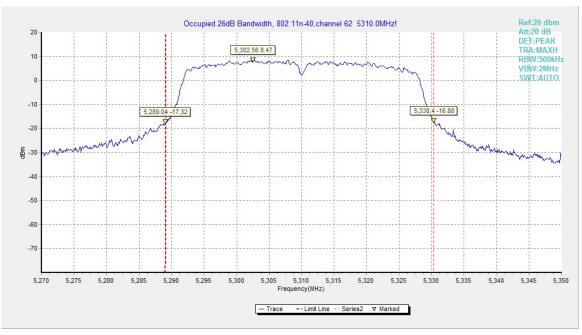


Fig.34 Occupied 26dB Bandwidth (802.11n-HT40, 5310MHz)





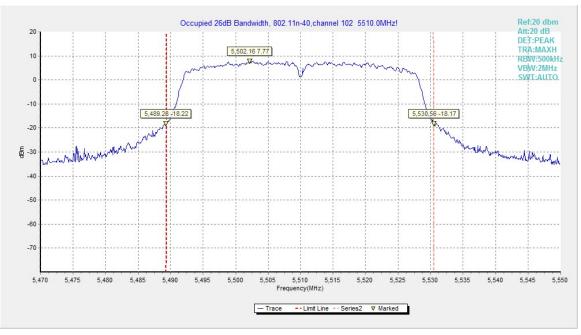


Fig.35 Occupied 26dB Bandwidth (802. 11n-HT40, 5510MHz)

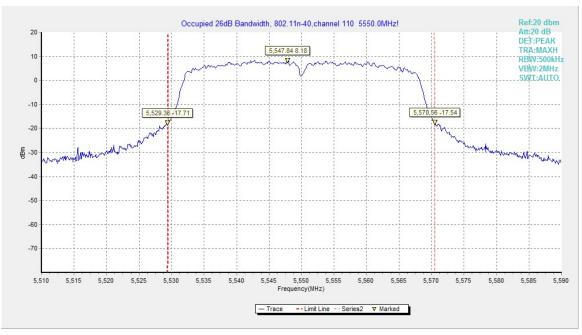


Fig.36 Occupied 26dB Bandwidth (802. 11n-HT40, 5590MHz)