



**CFR 47 FCC PART 15 SUBPART C**

**CERTIFICATION TEST REPORT**

*For*

**Amcrest 4MP Video Doorbell Camera**

**MODEL NUMBER: AD410**

**PROJECT NUMBER: 4790425401-2.1**

**REPORT NUMBER: 4790425401-2.1-1**

**FCC ID: ZZ2-AD410**

**ISSUE DATE: Jun 23, 2022**

*Prepared for*

**Amcrest Technologies LLC.**

*Prepared by*

**UL-CCIC COMPANY LIMITED**

**No. 2, Chengwan Road, Suzhou Industrial Park, People's Republic of China**

**Tel: + 86-512-6808 6400**

**Fax: + 86-512-6808 4099**

**Website: [www.ul.com](http://www.ul.com)**

Form-ULID-008536-9 V1.0

The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report apply to the test sample(s) mentioned above at the time of the testing period only and are not to be used to indicate applicability to other similar products. This report does not imply that the product(s) has met the criteria for certification.

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	06/23/2022	Initial Issue	

## TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS .....	4
2. TEST METHODOLOGY .....	6
3. FACILITIES AND ACCREDITATION .....	6
4. CALIBRATION AND UNCERTAINTY .....	7
4.1. MEASURING INSTRUMENT CALIBRATION .....	7
4.2. MEASUREMENT UNCERTAINTY .....	7
5. EQUIPMENT UNDER TEST .....	8
5.1. DESCRIPTION OF EUT .....	8
5.2. MAXIMUM OUTPUT POWER .....	9
5.3. CHANNEL LIST .....	9
5.4. TEST CHANNEL CONFIGURATION .....	10
5.5. THE WORSE CASE POWER SETTING PARAMETER .....	10
5.6. DESCRIPTION OF AVAILABLE ANTENNAS .....	11
5.7. THE WORSE CASE CONFIGURATIONS .....	11
5.8. DESCRIPTION OF TEST SETUP .....	12
5.9. MEASURING INSTRUMENT AND SOFTWARE USED .....	13
6. MEASUREMENT METHODS .....	14
7. ANTENNA PORT TEST RESULTS .....	15
7.1. TEST ENVIRONMENT .....	15
7.2. ON TIME AND DUTY CYCLE .....	16
7.3. 6 dB BANDWIDTH .....	19
7.4. CONDUCTED POWER .....	30
7.5. POWER SPECTRAL DENSITY .....	32
7.6. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS .....	43
7.7. RADIATED TEST RESULTS .....	88
7.7.1. LIMITS AND PROCEDURE .....	88
7.7.2. RESTRICTED BANDEDGE .....	93
7.7.3. SPURIOUS EMISSIONS .....	110
8. AC POWER LINE CONDUCTED EMISSIONS .....	168
9. ANTENNA REQUIREMENTS .....	172



## 1. ATTESTATION OF TEST RESULTS

### Applicant Information

Company Name: Amcrest Technologies LLC.  
Address: 16727 Park Row Dr, Houston, TX 77084, United States Of America

### Manufacturer Information

Company Name: Amcrest Technologies LLC.  
Address: 16727 Park Row Dr, Houston, TX 77084, United States Of America

### EUT Description

Product Name: Amcrest 4MP Video Doorbell Camera  
Model Number: AD410  
Model Difference: N/A  
Sample Number: 4991737  
Data of Receipt Sample: May 31,2022  
Date Tested: May 31, 2022– Jun. 22, 2022

### APPLICABLE STANDARDS

#### STANDARD

#### TEST RESULTS

CFR 47 FCC Part 15 Subpart C

PASS



Summary of Test Results			
Clause	Test Items	FCC Rules	Test Results
1	6db DTS Bandwidth	FCC 15.247 (a) (2)	Complied
2	Conducted Power	FCC 15.247 (b) (3)	Complied
3	Power Spectral Density	FCC 15.247 (e)	Complied
4	Conducted Band edge And Spurious emission	FCC 15.247 (d)	Complied
5	Radiated Band edges and Spurious emission	FCC 15.247 (d) FCC 15.209 FCC 15.205	Complied
6	Conducted Emission Test For AC Power Port	FCC 15.207	Complied
7	Antenna Requirement	FCC 15.203	Complied

Remark:

1) The measurement result for the sample received is <Pass> according to < ANSI C63.10-2013, CFR 47 FCC Part 2, CFR 47 FCC Part 15C> when <Accuracy Method> decision rule is applied.

Prepared By:

*Tom Tang*

Tom Tang  
Project Engineer

Reviewed By:

*Leon Wu*

Leon Wu  
Senior Project Engineer

Authorized By:

*Chris Zhong*

Chris Zhong  
Laboratory Leader

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013, CFR 47 FCC Part 2 and CFR 47 FCC Part 15.

## 3. FACILITIES AND ACCREDITATION

Accreditation Certificate	<p><b>A2LA (Certificate No.: 4829.01)</b> <b>UL-CCIC COMPANY LIMITED has been assessed and proved to be in compliance with A2LA.</b></p> <p><b>FCC (FCC Designation No.: CN1247)</b> <b>UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.</b></p> <p><b>IC (IC Designation No.: 25056; CAB No.:CN0073)</b> <b>UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.</b></p>
---------------------------	---

Note 1: All tests measurement facilities use to collect the measurement data are located at No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, People's Republic of China

Note 2: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. These measurements below 30MHz had been correlated to measurements performed on an OFS.

Note 3: The test anechoic chamber in UL-CCIC COMPANY LIMITED had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Conduction emission	3.1dB
Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	3.4dB
Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	3.4dB
Radiation Emission test (1GHz to 26GHz)( include Fundamental emission)	3.7dB (1GHz-18Gz) 4.0dB (18GHz-26.5Gz)

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

Product Name:	Amcrest 4MP Video Doorbell Camera
Model No.:	AD410
Operating Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422MHz to 2452MHz IEEE 802.11a/n/ac 20MHz: 5180MHz to 5240MHz (ISED not include this band), 5260MHz to 5320MHz, 5500MHz to 5720MHz (ISED not include 5600MHz to 5640MHz), 5745MHz to 5825MHz IEEE 802.11n/ac 40MHz: 5190MHz to 5230MHz (ISED not include this band), 5270MHz to 5310MHz, 5510MHz to 5710MHz (ISED not include 5590MHz to 5630MHz), 5755MHz-5795MHz IEEE 802.11ac 80MHz: 5210MHz (ISED not include this channel), 5290MHz, 5530MHz to 5690MHz (ISED not include 5610MHz), 5775MHz
	This report just including 2.4G WIFI part.
Type of Modulation:	IEEE for 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE for 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n (HT20 and HT40): OFDM (64QAM, 16QAM, QPSK, BPSK)
Channels Step:	Channels with 5MHz step
Test software of EUT:	Secure CRT (manufacturer declare)
Antenna Type:	PCB Integral antenna
Antenna Gain:	Antenna1: 1.68 dBi Antenna2: 3.3 dBi Remark: This data is provided by customer and our lab isn't responsible for this data
Test Voltage	AC120/ 60Hz

## 5.2. MAXIMUM OUTPUT POWER

Number of Transmit Chains (NTX)	IEE Std. 802.11	Channel Number	Max AV Conducted Power (dBm)
1	IEEE 802.11B SISO	1-11[11]	18.47
1	IEEE 802.11G SISO	1-11[11]	15.00
1/2	IEEE 802.11nHT20	1-11[11]	15.06
1/2	IEEE 802.11nHT40	3-9[7]	14.64

## 5.3. CHANNEL LIST

Channel List for 802.11b/g/n (20 MHz)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	4	2427	7	2442	10	2457
2	2417	5	2432	8	2447	11	2462
3	2422	6	2437	9	2452		

Channel List for 802.11n (40 MHz)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	5	2432	7	2442	9	2452
4	2427	6	2437	8	2447		

#### 5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
WiFi TX(802.11b)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11g)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11n HT20)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11n HT40)	CH 3, CH 6, CH 9	2422MHz, 2437MHz, 2452MHz

#### 5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band							
Test Software		Secure CRT					
Modulation Mode	Transmit Antenna Number	Test Channel					
		NCB: 20MHz			NCB: 40MHz		
		CH 1	CH 6	CH 11	CH 3	CH 6	CH 9
802.11b	1	N/A	N/A	N/A	/		
802.11g	1	50	50	50			
802.11n HT20	1/2	50	50	50			
802.11n HT40	1/2	/			50	50	50

## 5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)	Directional gain(dBi)
1	2400-2483.5	PCB Integral antenna	1.68	5.53
2	2400-2483.5	PCB Integral antenna	3.3	

Note:

- 1) Directional gain=  $10\log [(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}] = 5.53 \text{ dBi}$
- 2)  $N_{ANT}$ : the number of Antenna
- 3) For this product, it has two antennas, antenna1 and antenna2, but only the 802.11N HT20 and 802.11N HT40 modes can support both the SISO and MIMO technical. For the modes of 11B&11G only the antenna1 is working.

Test Mode	Transmit and Receive Mode	Description
IEEE 802.11b	<input checked="" type="checkbox"/> 1TX, 1RX	Antenna1 can be used as transmitting/receiving antenna independently.
IEEE 802.11g	<input checked="" type="checkbox"/> 1TX, 1RX	Antenna1 can be used as transmitting/receiving antenna independently.
IEEE 802.11N (HT20) MIMO	<input checked="" type="checkbox"/> 2TX, 2RX	Antenna1 or Antenna2 can be used as transmitting/receiving antenna independently.
IEEE 802.11N (HT20) MIMO	<input checked="" type="checkbox"/> 2TX, 2RX	Antenna1 or Antenna2 can be used as transmitting/receiving antenna independently.

Remark:

- 1) For this product, it has two antennas, antenna1 and antenna2, only the 802.11N HT20 and 802.11N HT40 modes can support both the SISO and MIMO technical. For the modes of 11B&11G only the antenna1 is working.
- 2) For the 11N mode (including the 11N HT20 SISO, 11N HT20 MIMO, 11N HT40 SISO, 11N HT40 MIMO), pre-testing all test modes, only the worst case modes is included in this report.

## 5.7. THE WORSE CASE CONFIGURATIONS

For the product, there two transmission antennas, and pre-testing both of them, only the worse data for the antenna is recorded in the report.

Worst-case data rates as provided by the client were:

802.11b mode: 1 Mbps  
802.11g mode: 6 Mbps  
802.11n HT20 mode: MCS0  
802.11n HT40 mode: MCS0

## 5.8. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Description
1	Laptop	ThinkPad	E590	N/A
2	SD Card	N/A	N/A	Supply by UL Lab
3	Fixed Frequency Board	N/A	N/A	Supply by Customer
4	Power Adapter	MASS POWER	ADS-12AM-12 12012-EPCU	INPUT:100-240V~, 50/60Hz, 0.3A OUTPUT:5.0V 1.0A

### I/O PORT

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	USB to TTL	USB	100cm Length	N/A

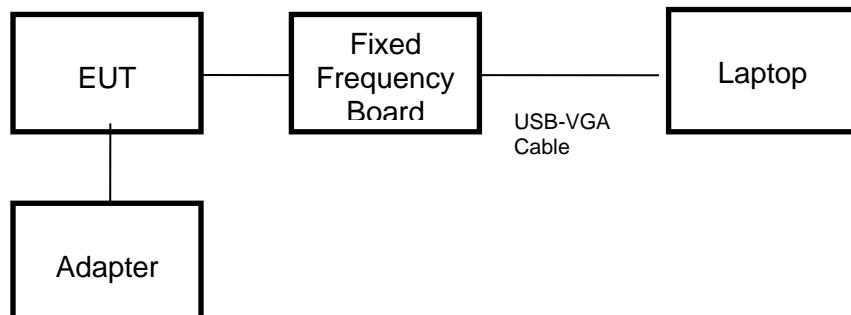
### ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

### TEST SETUP

The EUT can work in an engineer mode with a software through a table PC.

### SETUP DIAGRAM FOR TESTS



Remark: The EUT has been built one SD card during the testing



## 5.9. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions (Instrument)							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESR3	126700	2020-12-05	2021-12-04	2022-12-03
<input checked="" type="checkbox"/>	Two-Line V-Network	R&S	ENV216	126701	2020-12-05	2021-12-04	2022-12-03
Software							
Used	Description		Manufacturer	Name	Version		
<input checked="" type="checkbox"/>	Test Software for Conducted disturbance		R&S	EMC32	Ver. 9.25		
Radiated Emissions (Instrument)							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	Spectrum Analyzer	Keysight	N9010B	155727	2021-05-09	2022-04-09	2023-04-08
<input checked="" type="checkbox"/>	EMI test receiver	R&S	ESR26	126703	2020-12-05	2021-12-04	2022-12-03
<input checked="" type="checkbox"/>	Receiver Antenna (9kHz-30MHz)	Schwarzbeck	FMZB 1513	155456	2018-06-15	2021-06-03	2024-06-02
<input checked="" type="checkbox"/>	Receiver Antenna (30MHz-1GHz)	SunAR RF Motion	JB1	177821	2019-01-28	2022-01-18	2025-01-17
<input checked="" type="checkbox"/>	Receiver Antenna (1GHz-18GHz)	R&S	HF907	126705	2018-01-29	2022-02-28	2025-02-27
<input checked="" type="checkbox"/>	Receiver Antenna (18GHz-26.5GHz)	ETS	3160-10	155565	2019-01-05	2021-07-15	2024-07-14
<input checked="" type="checkbox"/>	Pre-amplification (To 18GHz)	Compliance Direction System Inc.	PAP-1G18-50	177825	2021-03-18	2022-03-01	2023-02-28
<input checked="" type="checkbox"/>	Pre-amplification (To 26.5GHz)	R&S	SCU-26D	135391	2021-12-05	2022-12-04	2022-12-03
<input checked="" type="checkbox"/>	Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	1	2021-05-09	2022-04-09	2023-04-08
<input checked="" type="checkbox"/>	Highpass Filter	Wainwright	WHKX10-2700-3000-18000-40SS	2	2021-05-09	2022-04-09	2023-04-08
Software							
Used	Description		Manufacturer	Name	Version		
<input checked="" type="checkbox"/>	Test Software for Radiated disturbance		Tonscend	JS36-RSE	4.0.0.1		
Other instruments							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	Spectrum Analyzer	Keysight	N9010B	155368	2021-05-09	2022-04-09	2023-04-08
<input checked="" type="checkbox"/>	Power Meter	Keysight	U2021XA	155370	2021-05-09	2022-04-09	2023-04-08

## 6. MEASUREMENT METHODS

No.	Test Item	KDB Name	Section
1	6dB Bandwidth	KDB 558074 D01 15.247 Meas Guidance v05r02	8.2
2	Conducted Output Power	KDB 558074 D01 15.247 Meas Guidance v05r02	8.3.2.3 (Method AVGPM)
3	Power Spectral Density	KDB 558074 D01 15.247 Meas Guidance v05r02	8.4 (Method PKPSD)
4	Out-of-band emissions in non-restricted bands	KDB 558074 D01 15.247 Meas Guidance v05r02	8.5
5	Out-of-band emissions in restricted bands	KDB 558074 D01 15.247 Meas Guidance v05r02	8.6
6	Band-edge	KDB 558074 D01 15.247 Meas Guidance v05r02	8.7
7	Conducted Emission Test For AC Power Port	ANSI C63.10-2013	6.2

## 7. ANTENNA PORT TEST RESULTS

### 7.1. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests
Relative Humidity	55.7%
Atmospheric Pressure:	102kPa
Temperature	23.1°C

## 7.2. ON TIME AND DUTY CYCLE

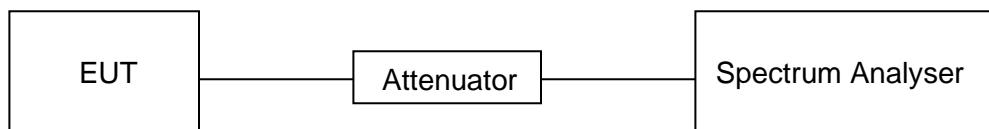
### LIMITS

None; for reporting purposes only

### PROCEDURE

FCC KDB 558074 Zero-Span Spectrum Analyzer Method

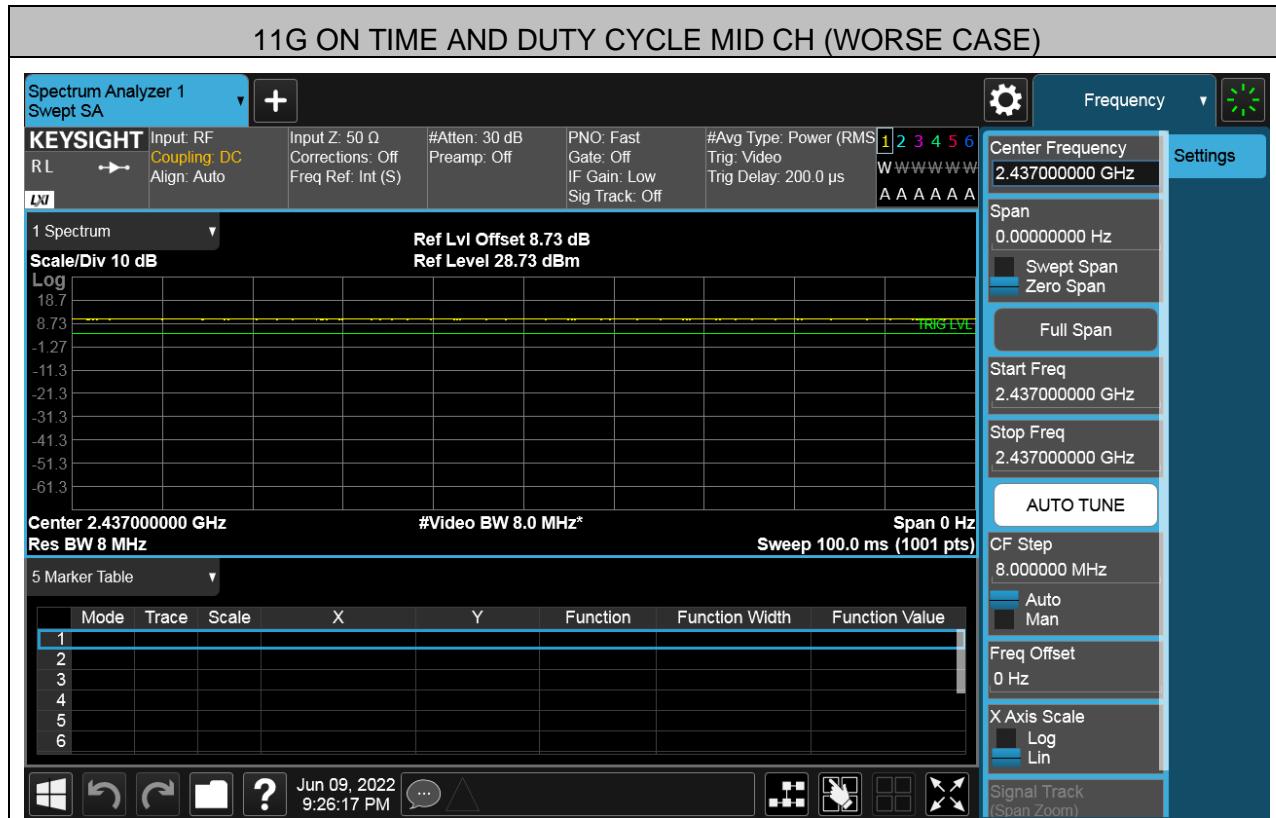
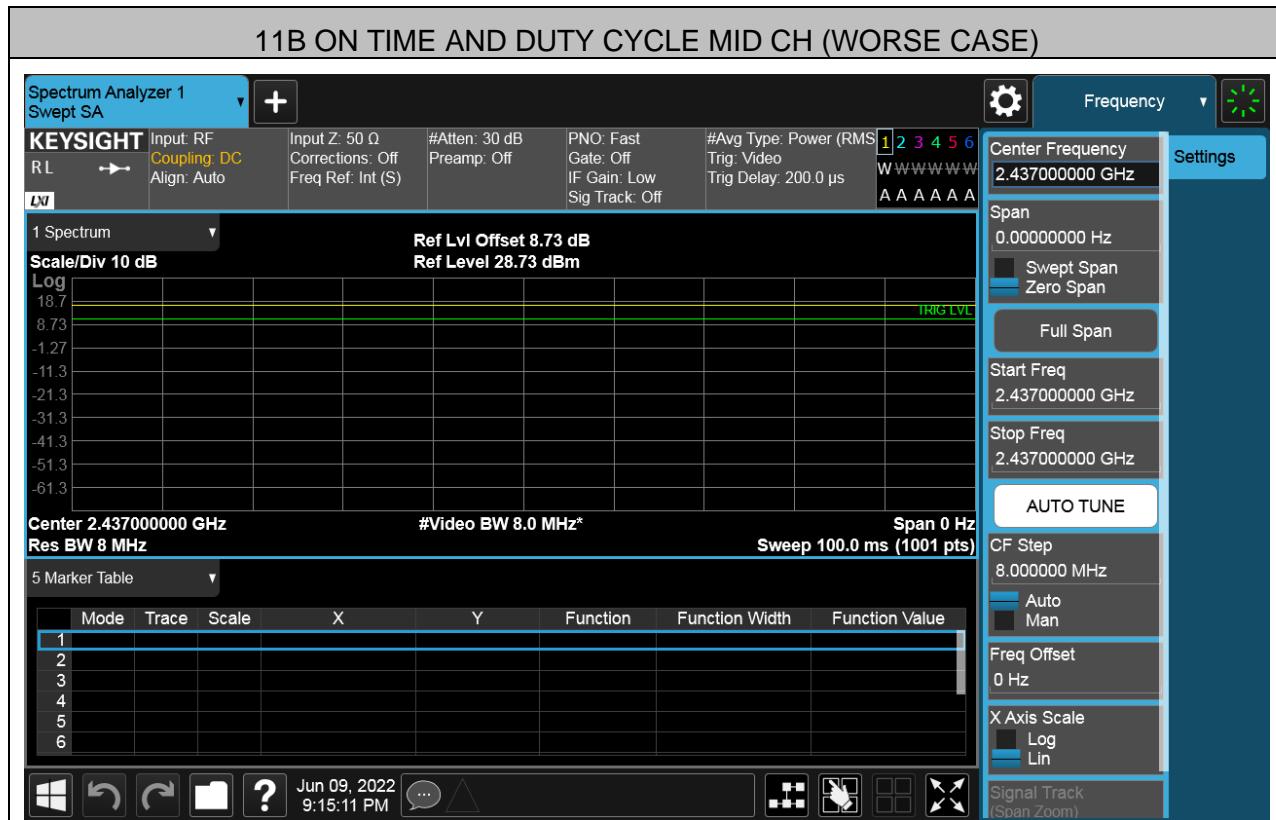
### TEST SETUP

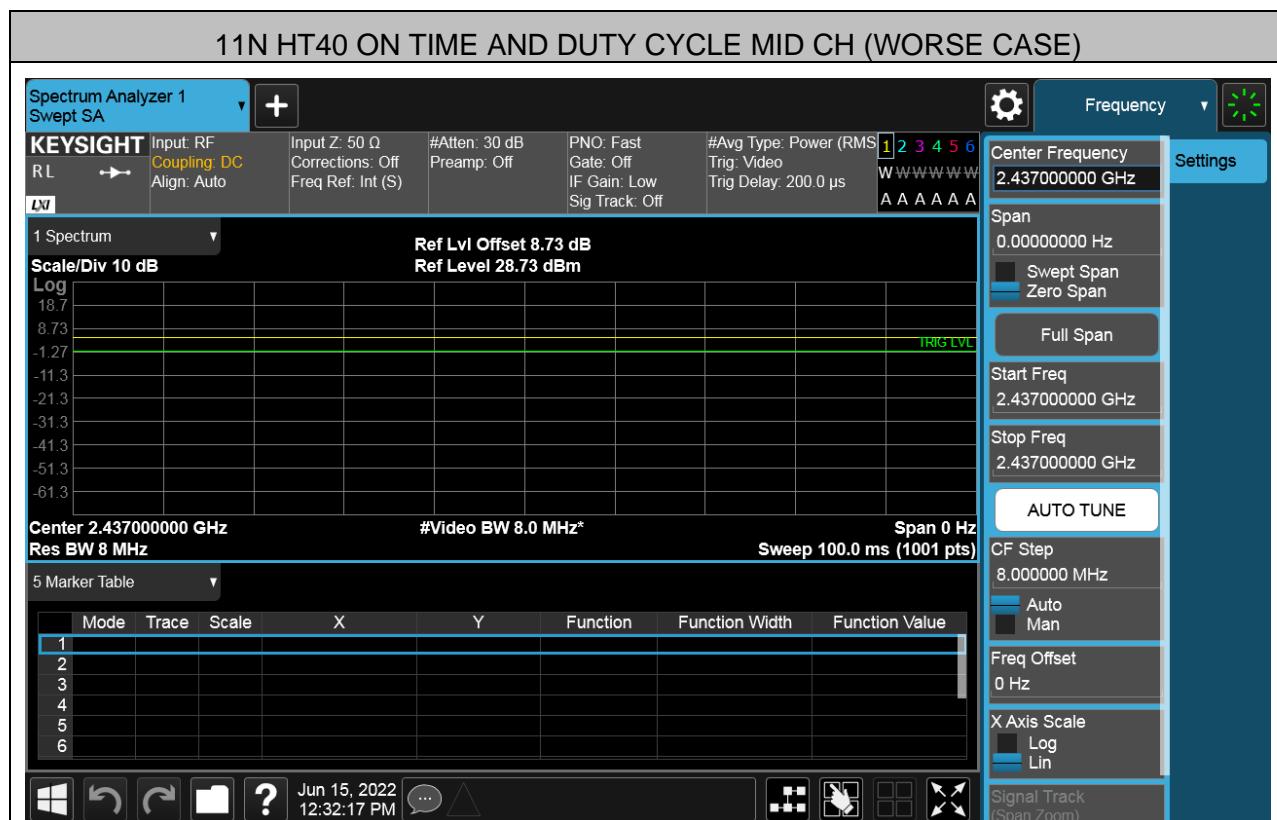
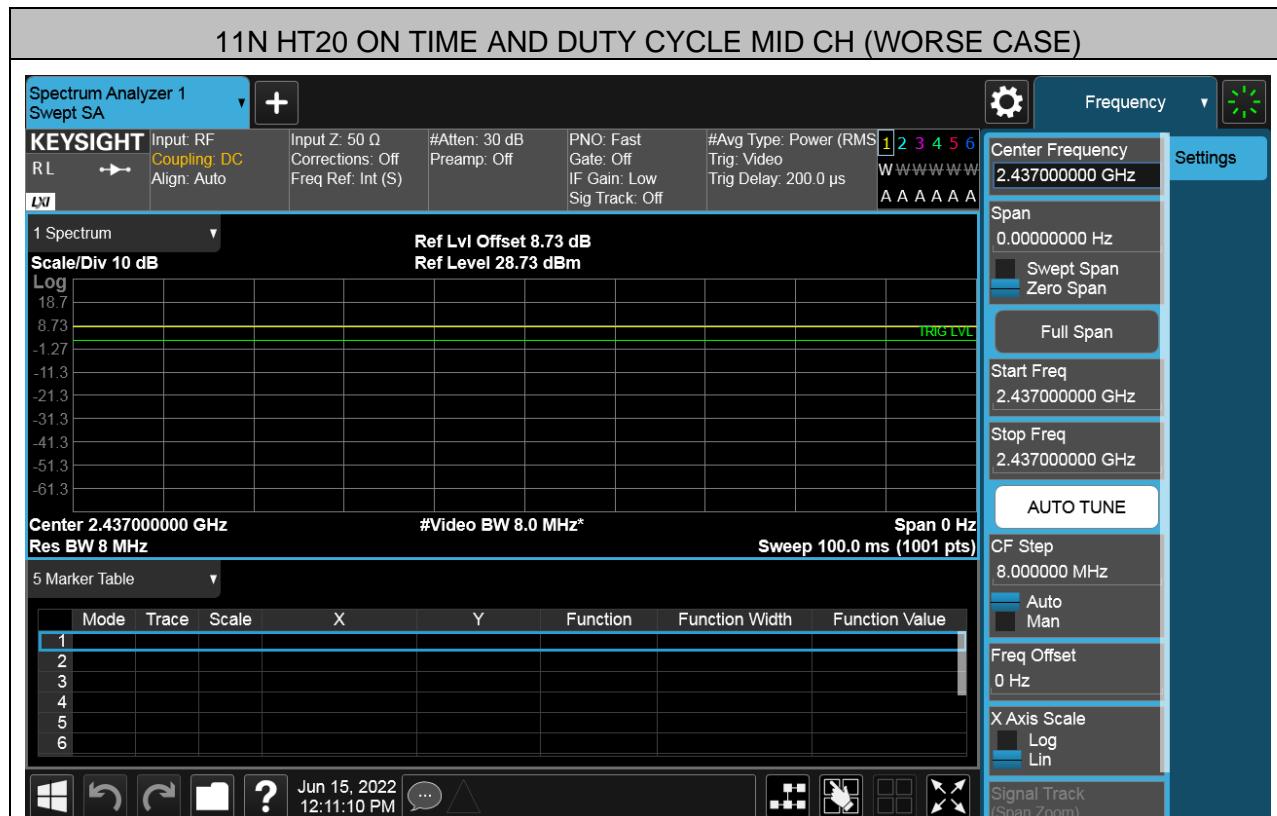


### RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/T Minimum VBW (KHz)
11B	100	100	1	100	0	0.01
11G	100	100	1	100	0	0.01
11N HT20	100	100	1	100	0	0.01
11N HT40	100	100	1	100	0	0.01

Note: 1) Duty Cycle Correction Factor= $10\log(1/x)$ .  
2) Where: x is Duty Cycle(Linear)  
3) Where: T is On Time (transmit duration)  
4) The minimum VBW should be 10Hz if the duty cycle is over 98%.





### 7.3. 6 dB BANDWIDTH

#### LIMITS

FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(a)(2)	6dB Bandwidth	$\geq 500\text{KHz}$	2400-2483.5

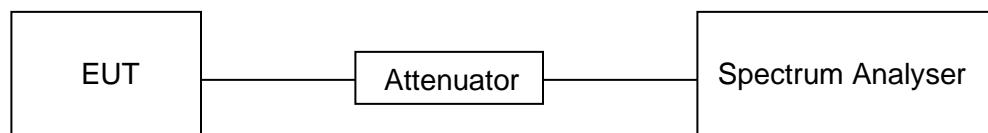
#### TEST PROCEDURE

Refer to FCC KDB 558074, connect the UUT to the spectrum analyzer and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 6dB Bandwidth :100K
VBW	For 6dB Bandwidth : $\geq 3 \times \text{RBW}$
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

#### TEST SETUP



**RESULTS**

Test Mode	Test Antenna	Test Channel	6dB bandwidth (MHz)	Result
11B	Antenna 1	LCH	9.120	Pass
		MCH	9.560	Pass
		HCH	9.120	Pass
11G	Antenna 1	LCH	16.520	Pass
		MCH	16.520	Pass
		HCH	16.520	Pass
11N20 MIMO	Antenna 1	LCH	17.640	Pass
		MCH	17.680	Pass
		HCH	17.640	Pass
	Antenna 2	LCH	17.640	Pass
		MCH	17.680	Pass
		HCH	17.640	Pass
11N40 MIMO	Antenna 1	LCH	36.480	Pass
		MCH	36.480	Pass
		HCH	36.480	Pass
	Antenna 2	LCH	36.480	Pass
		MCH	36.480	Pass
		HCH	36.560	Pass

**Remark:**

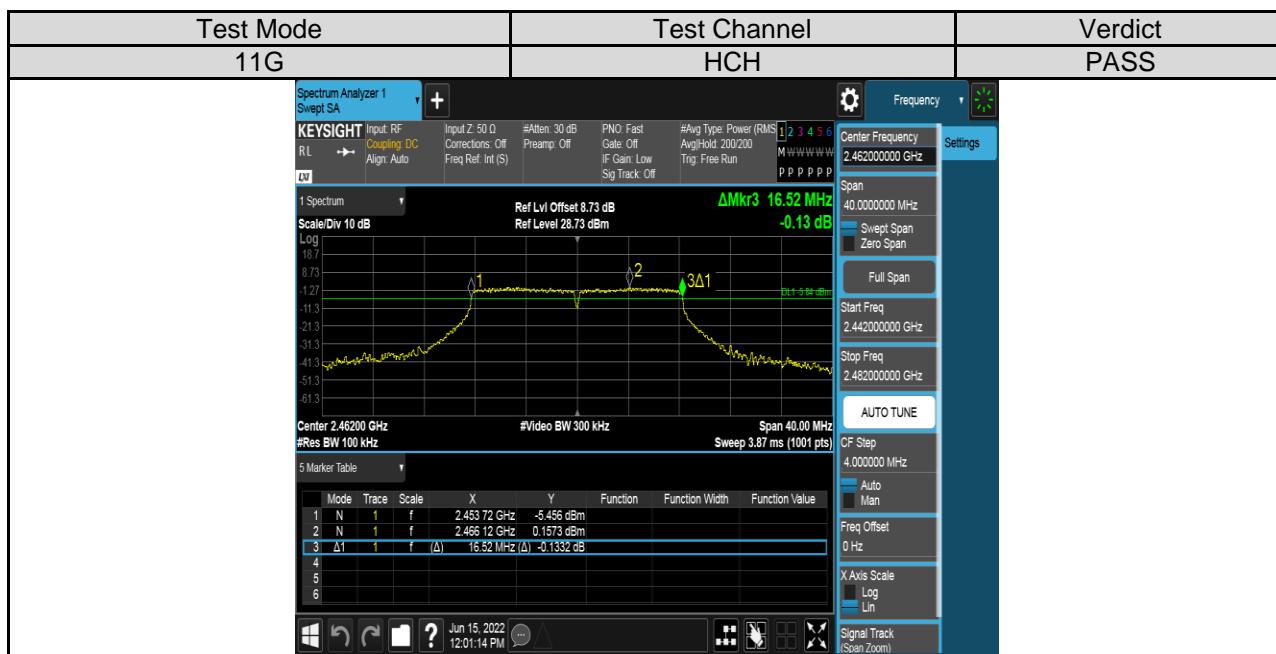
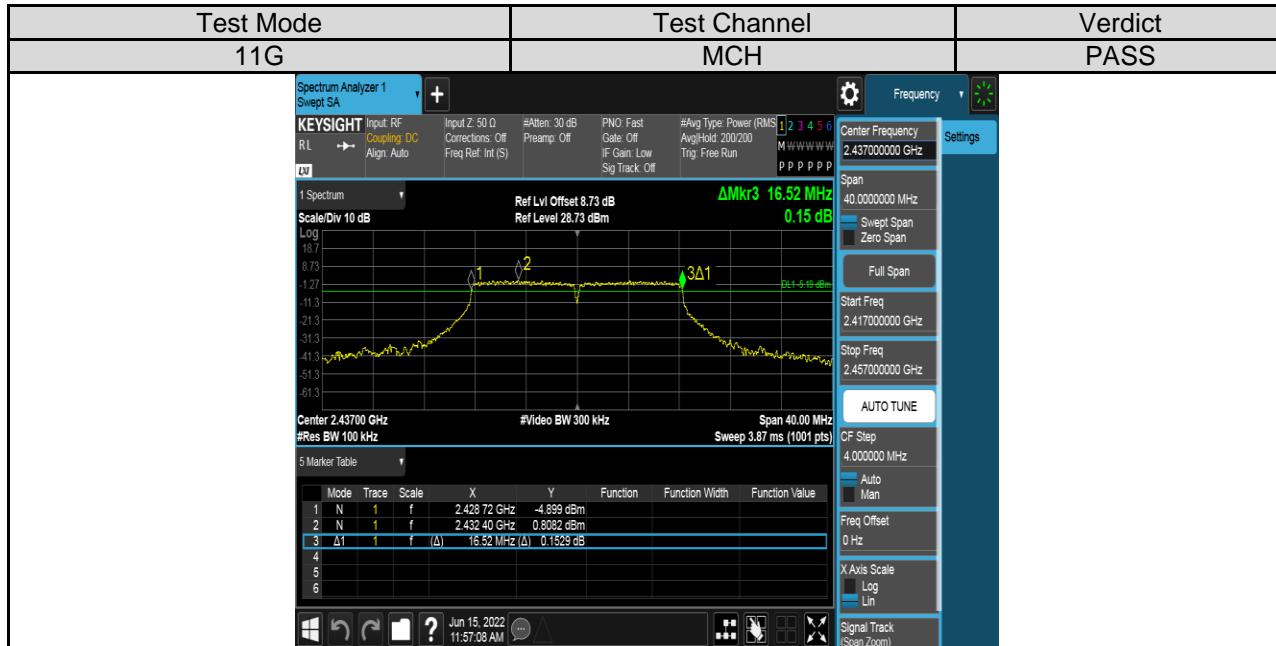
- 1) For this product, it has two antennas, antenna 1 and antenna 2, but only the 802.11N HT20 and 802.11N HT40 modes can support both the SISO and MIMO technical. But for the modes of 11B &11G, only the antenna 1 is working.
- 2) Through pre-testing all the test modes of 11N 20 and 11N40, including SISO and MIMO, but only the data if worse case is included in this test report.

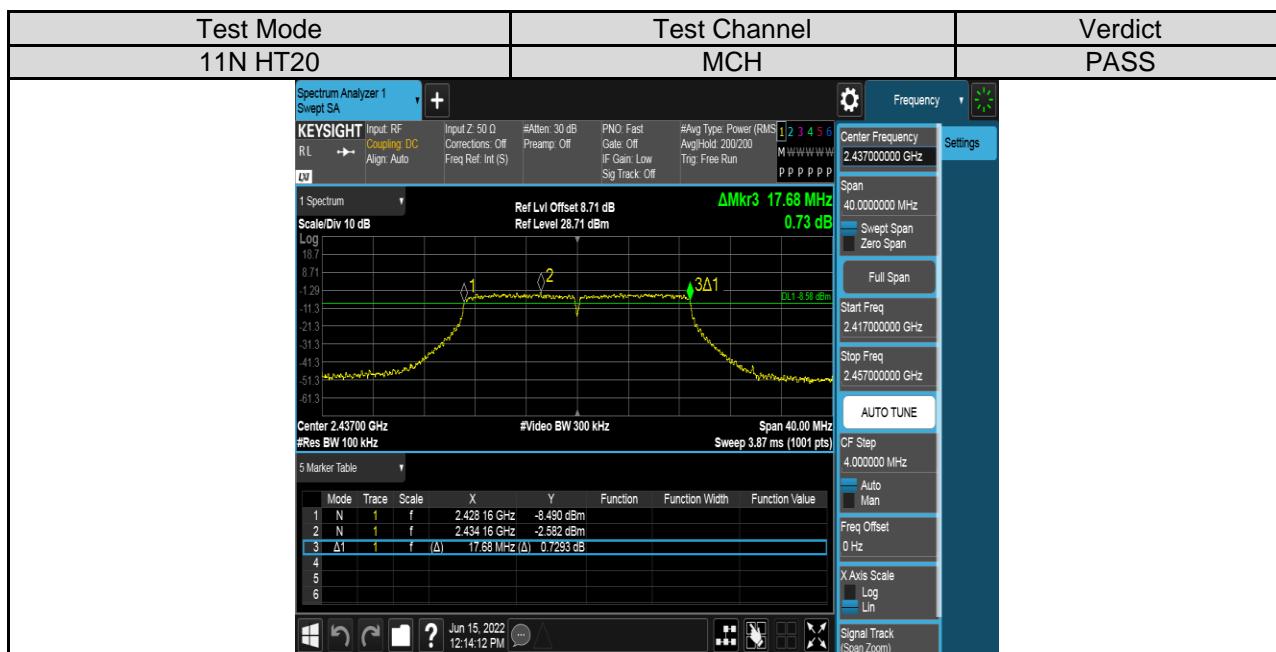
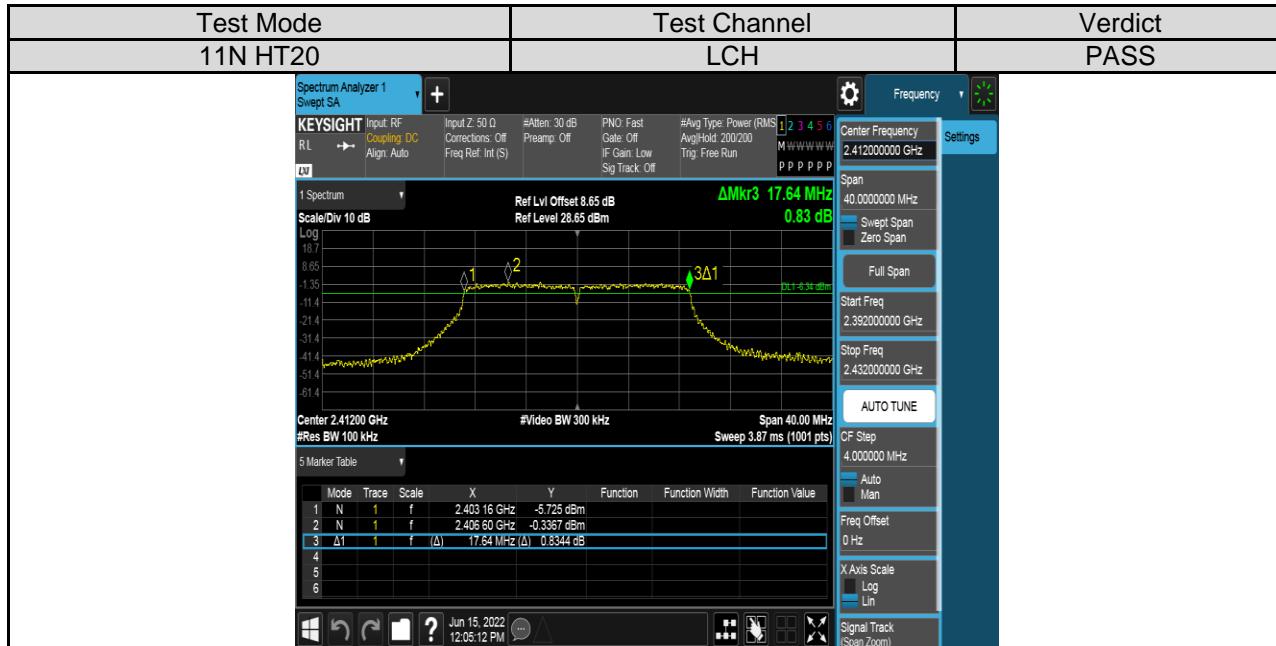
## Test Graphs

### 1) For 6dB Bandwidth Antenna 1 part:

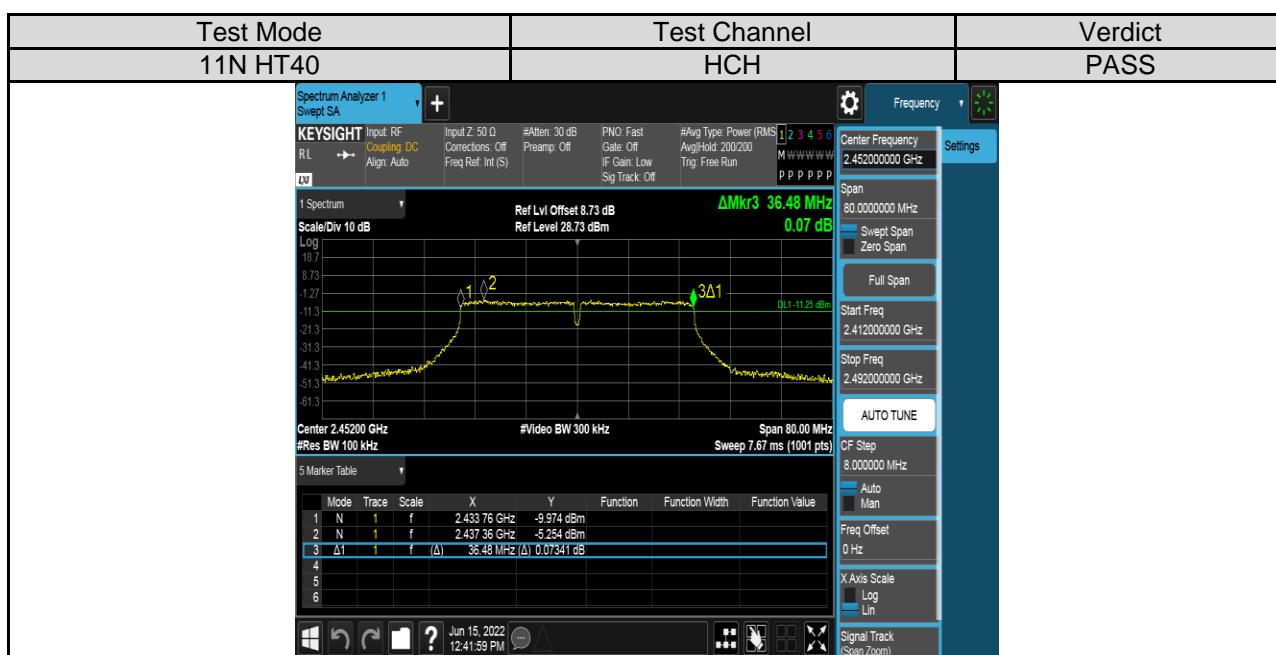
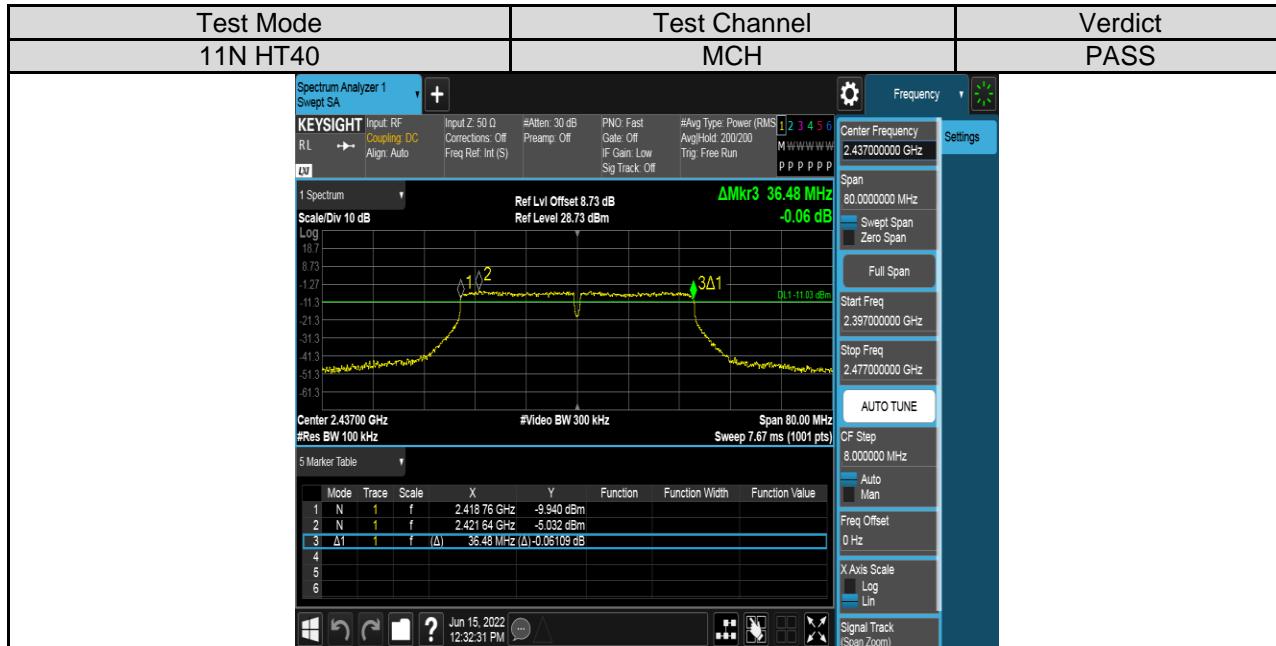


Test Mode	Test Channel	Verdict
11B	HCH	PASS
11G	LCH	PASS

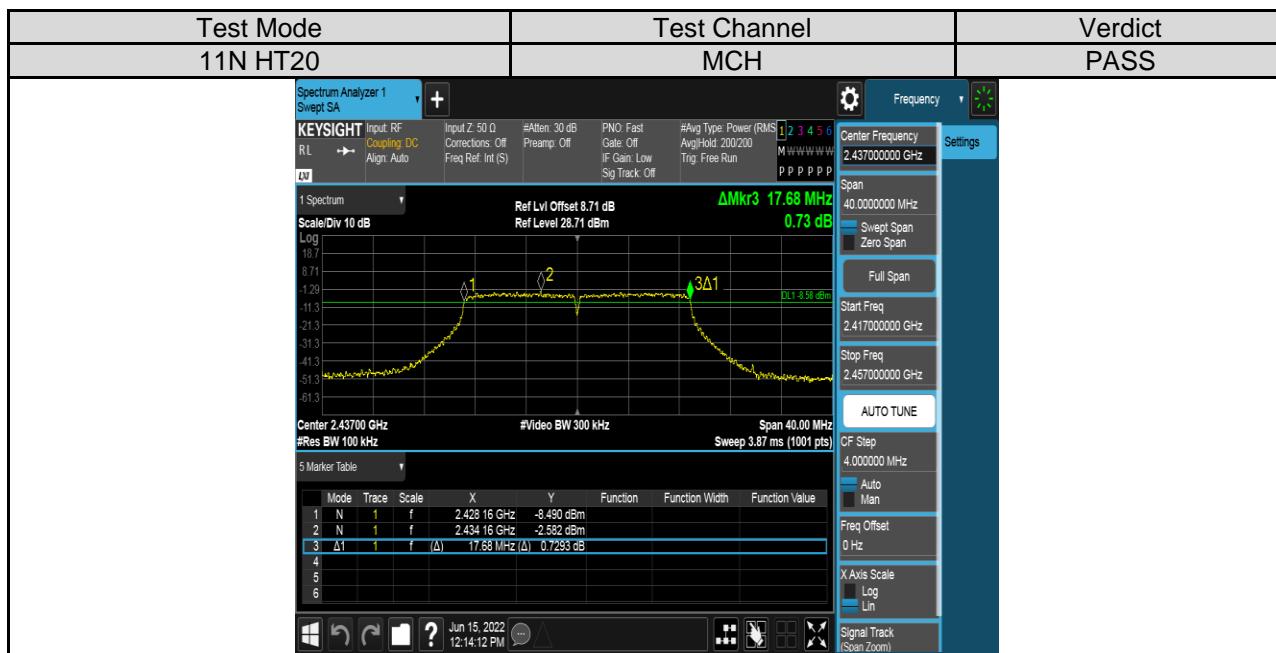
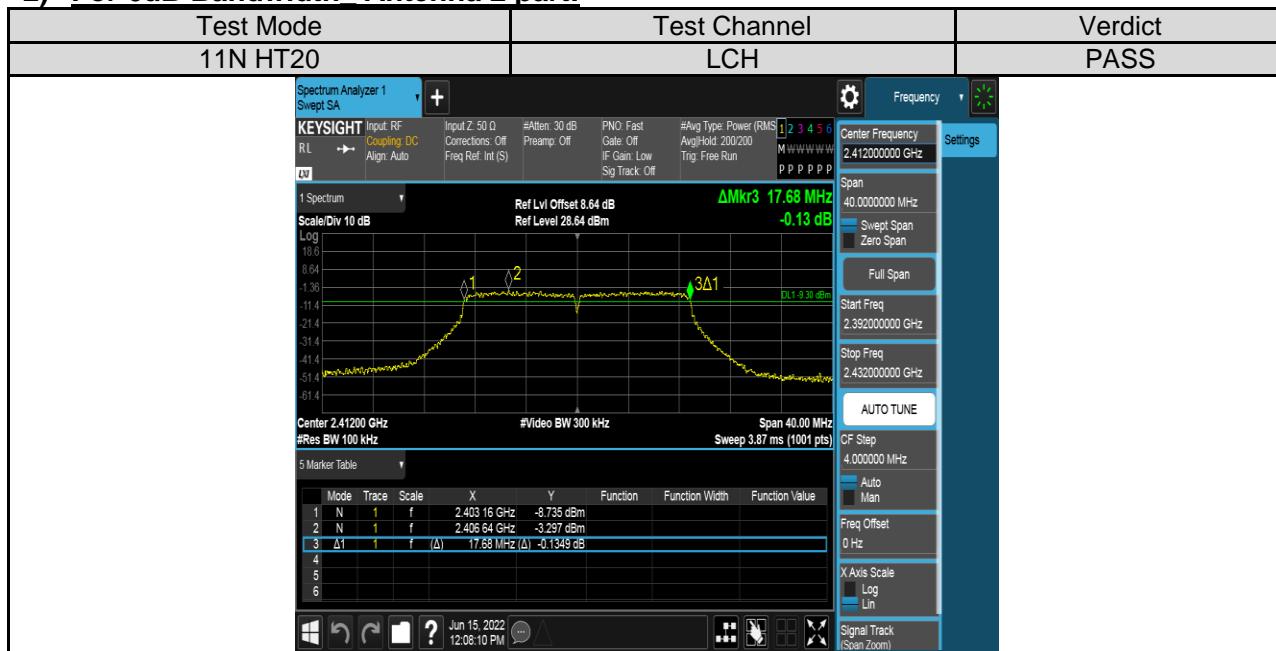




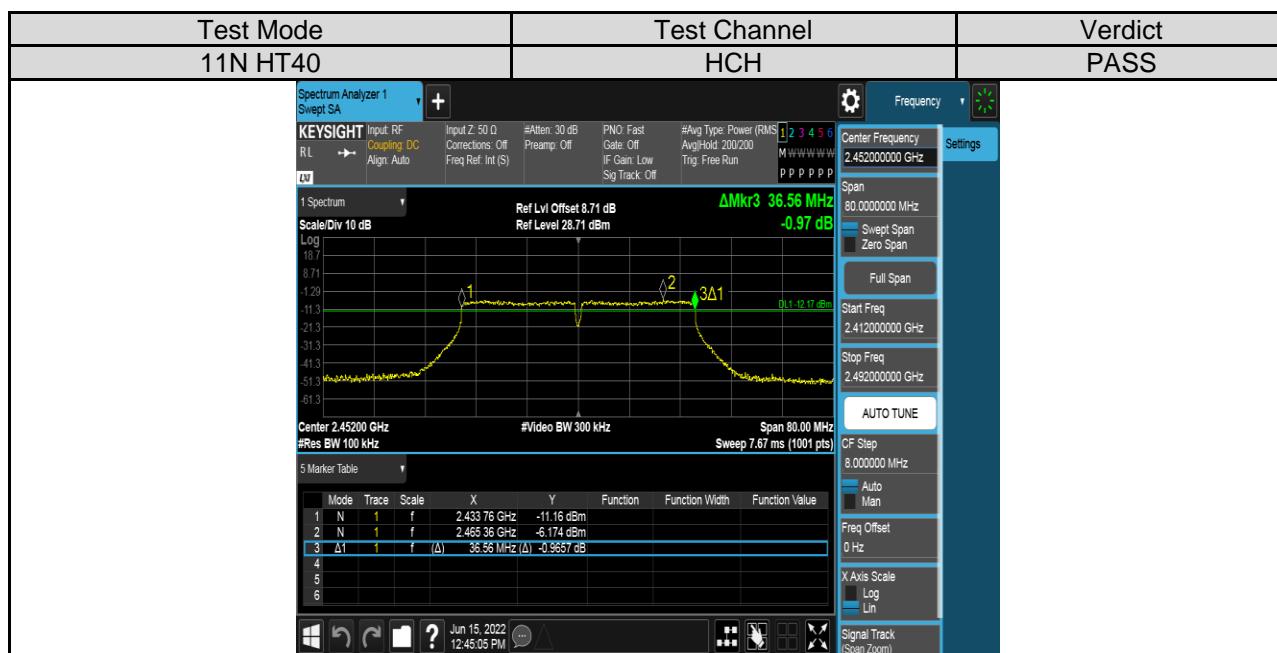
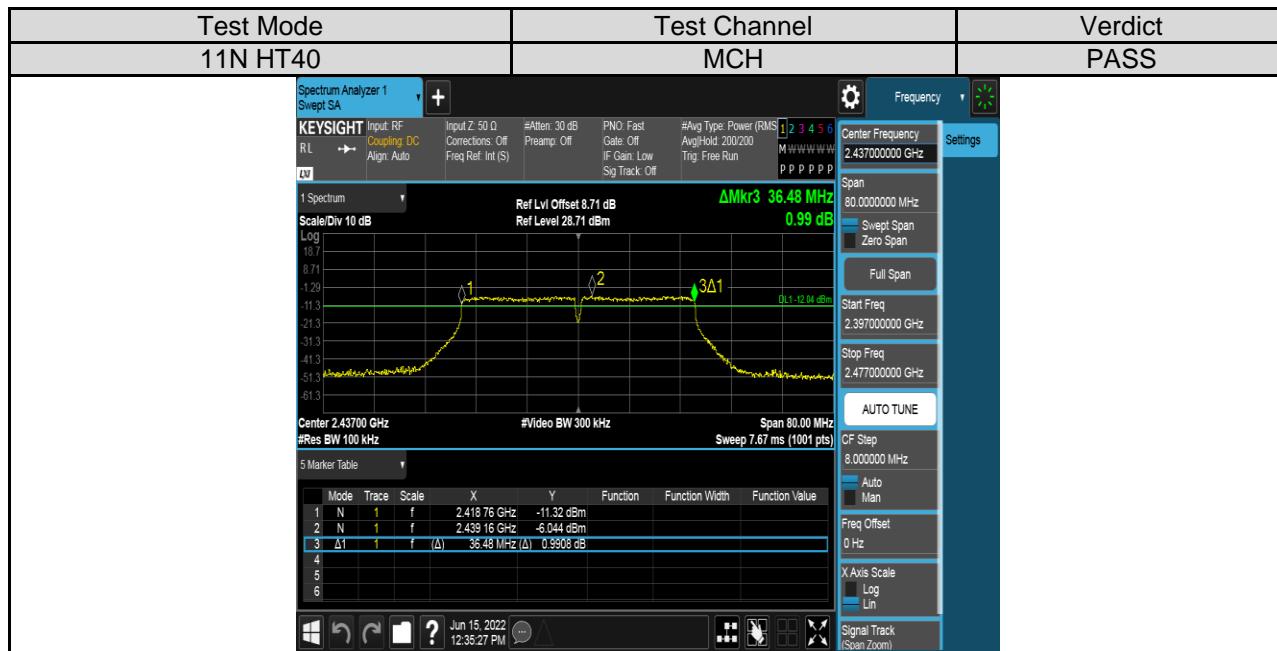
Test Mode	Test Channel	Verdict
11N HT20	HCH	PASS
		PASS



## 2) For 6dB Bandwidth Antenna 2 part:



Test Mode	Test Channel	Verdict
11N HT20	HCH	PASS
11N HT40	LCH	PASS



## 7.4. CONDUCTED POWER

### LIMITS

FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(b)(3)	Output Power	1 watt or 30dBm	2400-2483.5

### TEST PROCEDURE

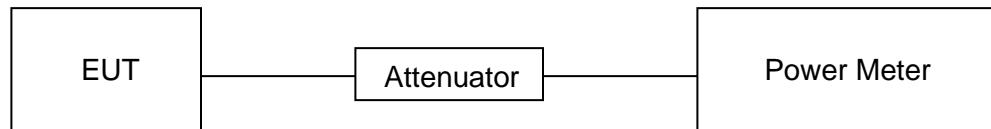
Place the EUT on the table and set it in the transmitting mode.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power Meter.

Measure the power of each channel.

AVG Detector use for AVG result.

### TEST SETUP



## RESULTS

TestMode	Antenna	Frequency[MHz]	Average Powert[dBm]	Verdict
11B	Ant1	2412	18.47	PASS
		2437	17.73	PASS
		2462	17.18	PASS
11G	Ant1	2412	15.00	PASS
		2437	14.85	PASS
		2462	14.36	PASS
11N20MIMO	Ant1	2412	13.12	PASS
	Ant2	2412	10.62	PASS
	total	2412	15.06	PASS
	Ant1	2437	12.37	PASS
	Ant2	2437	11.33	PASS
	total	2437	14.89	PASS
	Ant1	2462	11.70	PASS
	Ant2	2462	11.15	PASS
	total	2462	14.44	PASS
	Ant1	2422	12.28	PASS
11N40MIMO	Ant2	2422	10.60	PASS
	total	2422	14.53	PASS
	Ant1	2437	12.10	PASS
	Ant2	2437	11.10	PASS
	total	2437	14.64	PASS
	Ant1	2452	11.91	PASS
	Ant2	2452	10.96	PASS
	total	2452	14.47	PASS

Remark:

- 1) For all the test results has been adjusted the duty cycle factor.
- 2) For Correction Factor is refer to the result in section 7.2
- 3) For this product, it has two antennas, antenna1 and antenna2, but only the 802.11N HT20 and 802.11N HT40 modes can support both the SISO and MIMO technical. But for the modes of 11B &11G, only the antenna 1 is working.
- 4) Through pre-testing all the test modes of 11N 20 and 11N40, including SISO and MIMO, but only the data if worse case is included in this test report.

## 7.5. POWER SPECTRAL DENSITY

### LIMITS

FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC §15.247 (e)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5

### TEST PROCEDURE

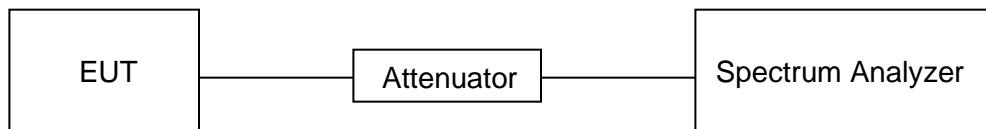
Refer to FCC KDB 558074, connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
VBW	$\geq 3 \times \text{RBW}$
Span	$1.5 \times \text{DTS bandwidth}$
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### TEST SETUP

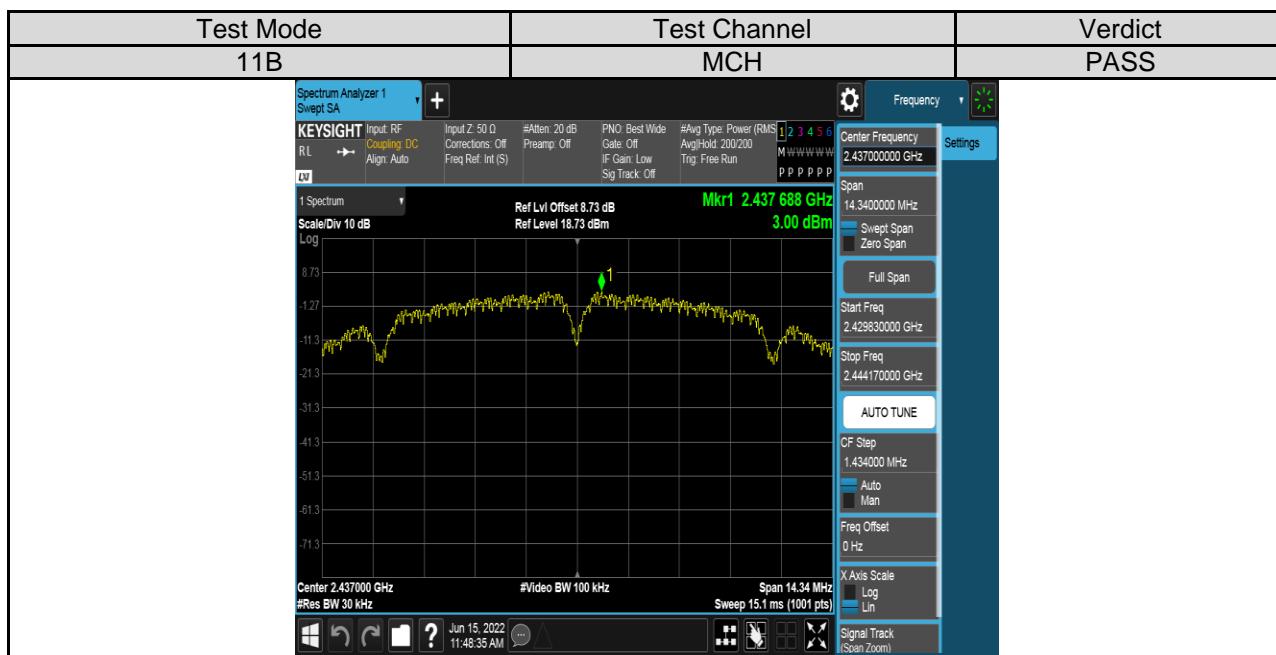
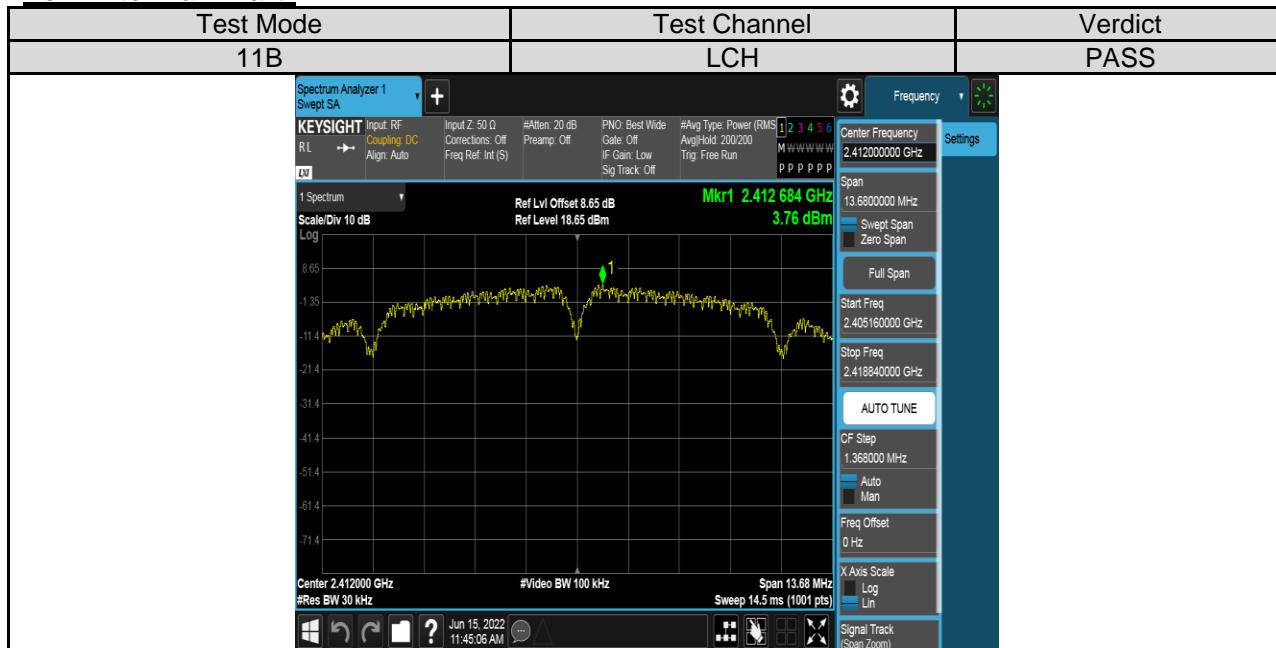


**RESULTS**

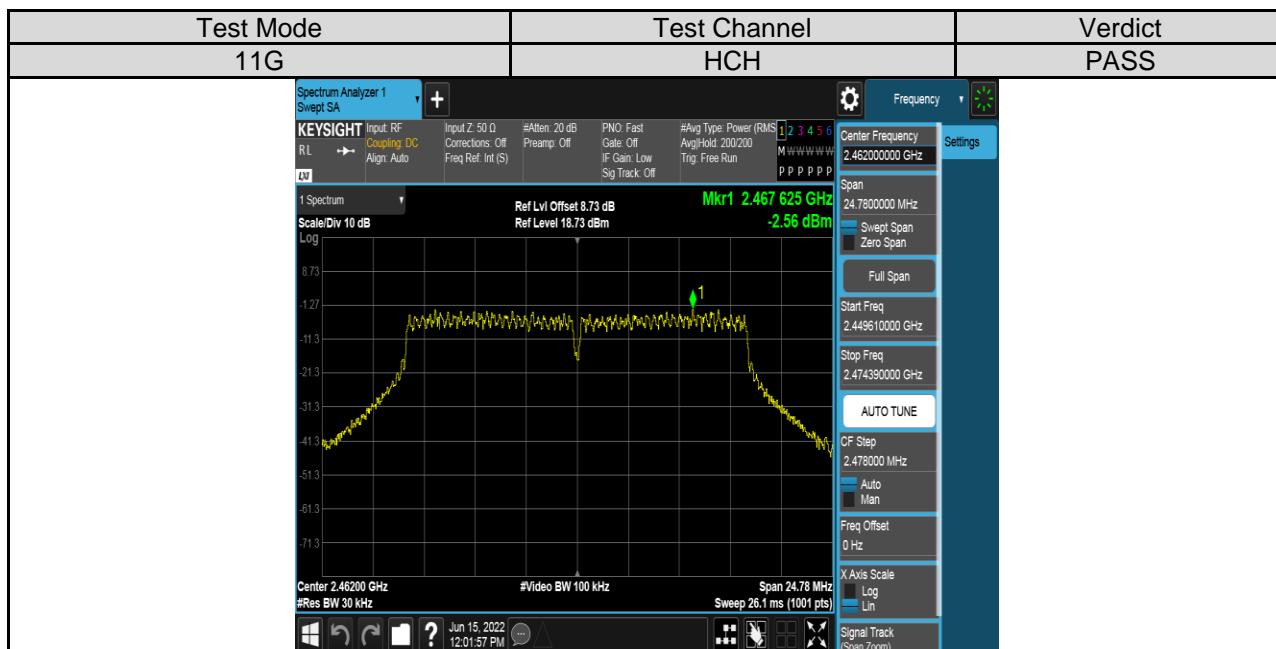
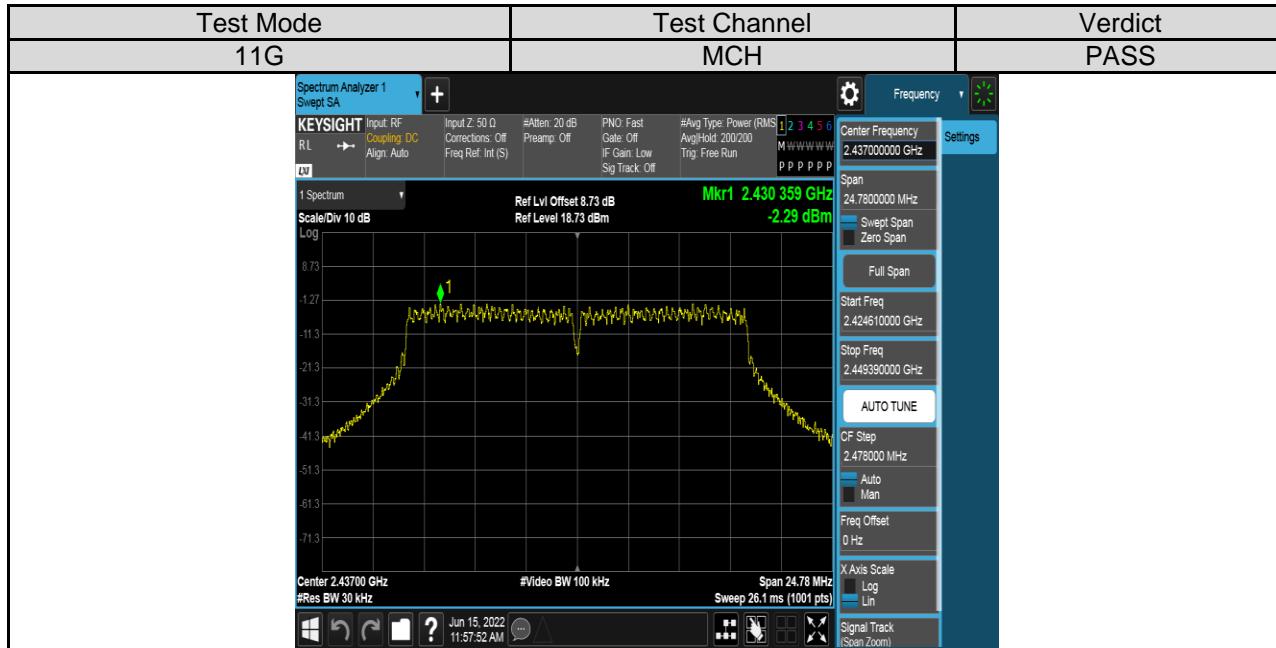
Test Mode	Test Antenna	Test Channel	Maximum Peak power spectral density(dBm/30kHz)	Result	Verdict
11B	Ant1	2412	3.76	≤8.00	PASS
		2437	3.00	≤8.00	PASS
		2462	2.48	≤8.00	PASS
11G	Ant1	2412	-1.50	≤8.00	PASS
		2437	-2.29	≤8.00	PASS
		2462	-2.56	≤8.00	PASS
11N20MIMO	Ant1	2412	-4.03	≤8.00	PASS
	Ant2	2412	-6.44	≤8.00	PASS
	total	2412	-2.07	≤8.00	PASS
	Ant1	2437	-4.50	≤8.00	PASS
	Ant2	2437	-5.59	≤8.00	PASS
	total	2437	-2.00	≤8.00	PASS
	Ant1	2462	-5.37	≤8.00	PASS
	Ant2	2462	-5.74	≤8.00	PASS
	total	2462	-2.54	≤8.00	PASS
11N40MIMO	Ant1	2422	-7.76	≤8.00	PASS
	Ant2	2422	-9.22	≤8.00	PASS
	total	2422	-5.42	≤8.00	PASS
	Ant1	2437	-7.72	≤8.00	PASS
	Ant2	2437	-8.96	≤8.00	PASS
	total	2437	-5.29	≤8.00	PASS
	Ant1	2452	-8.22	≤8.00	PASS
	Ant2	2452	-8.79	≤8.00	PASS
	total	2452	-5.49	≤8.00	PASS

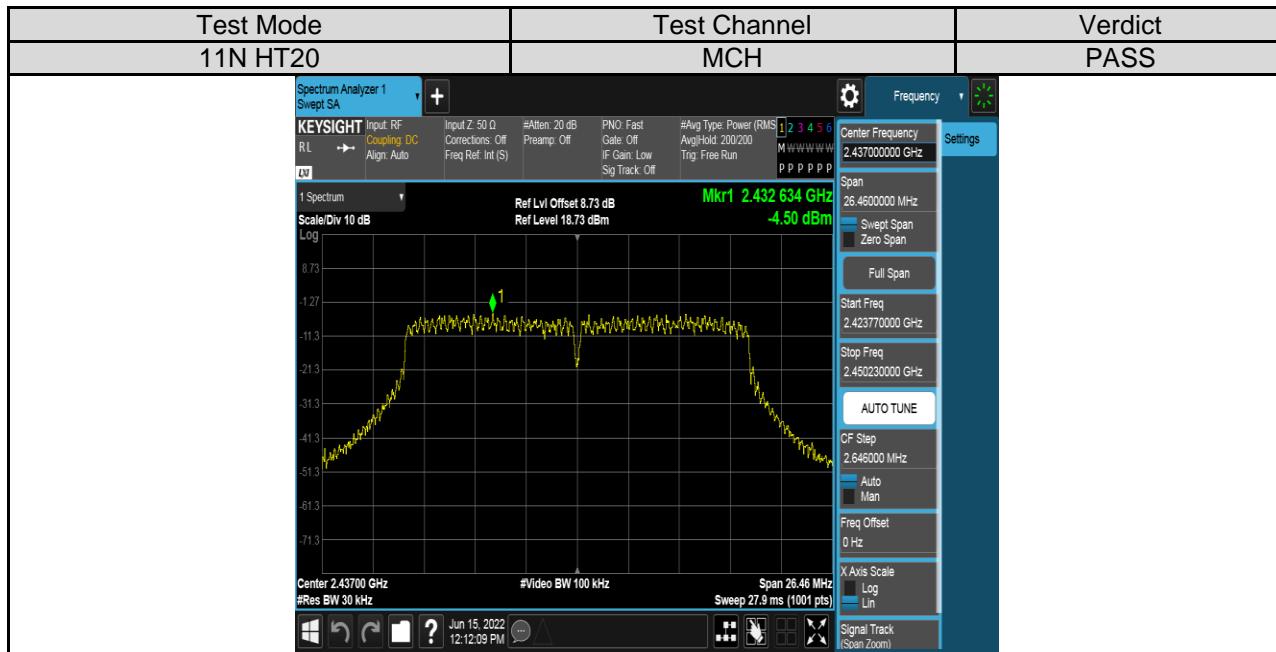
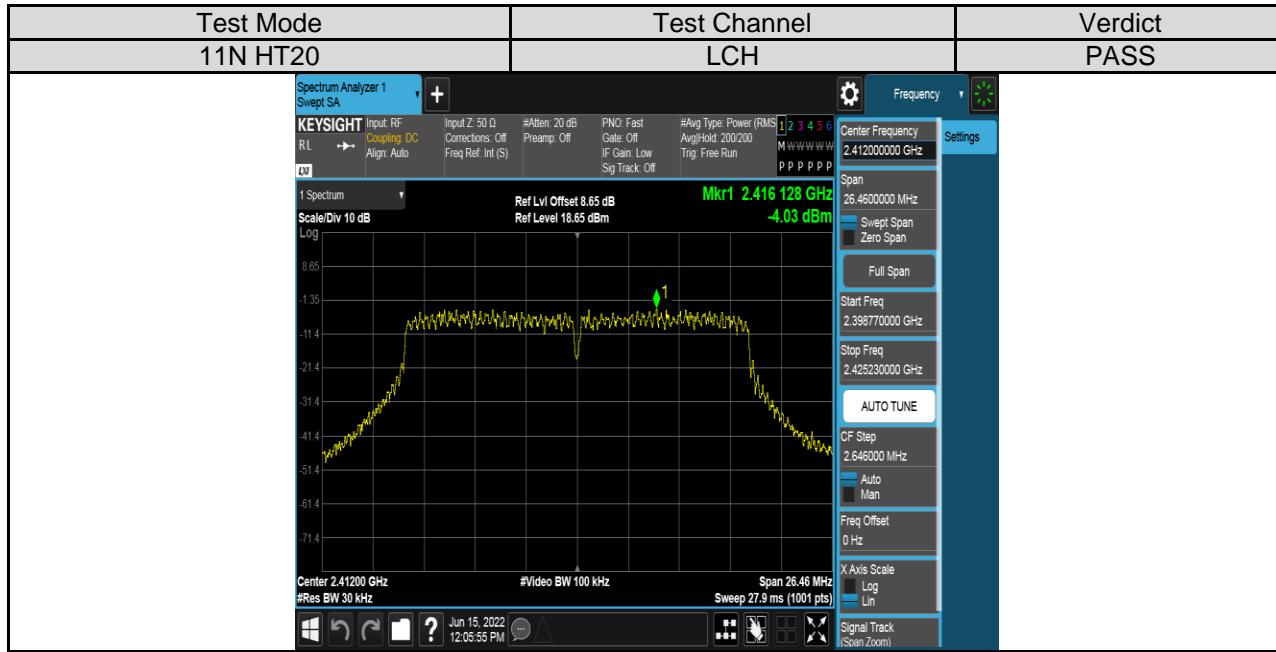
## Remark:

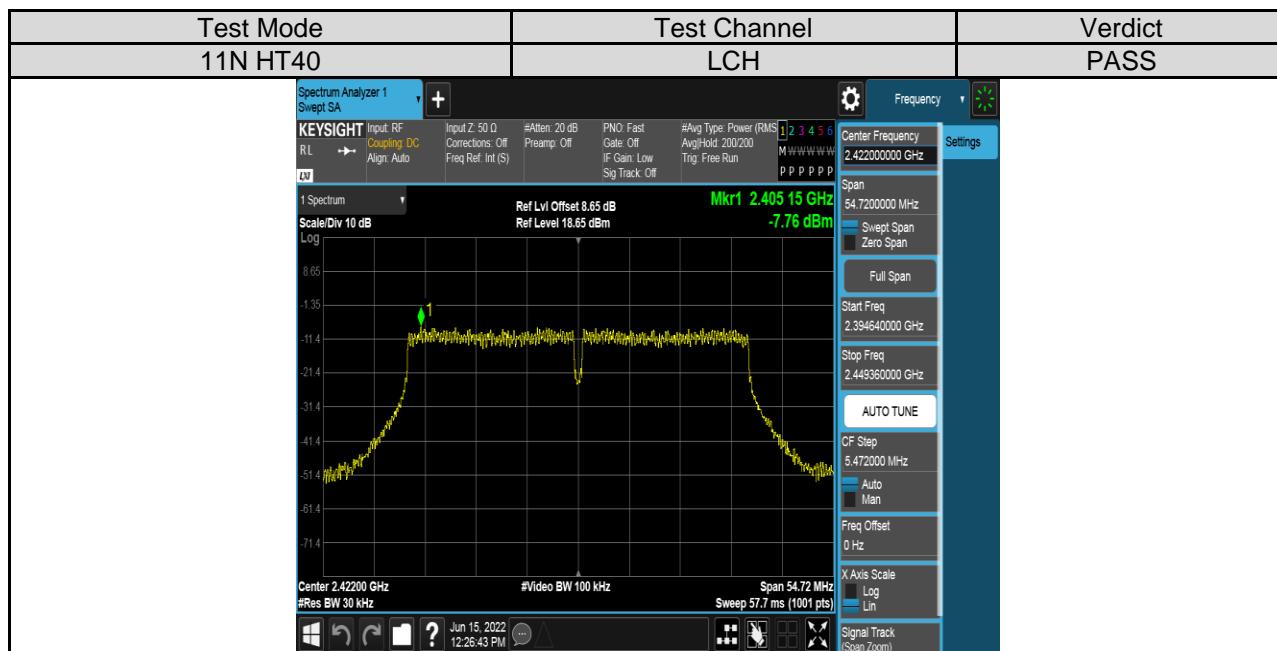
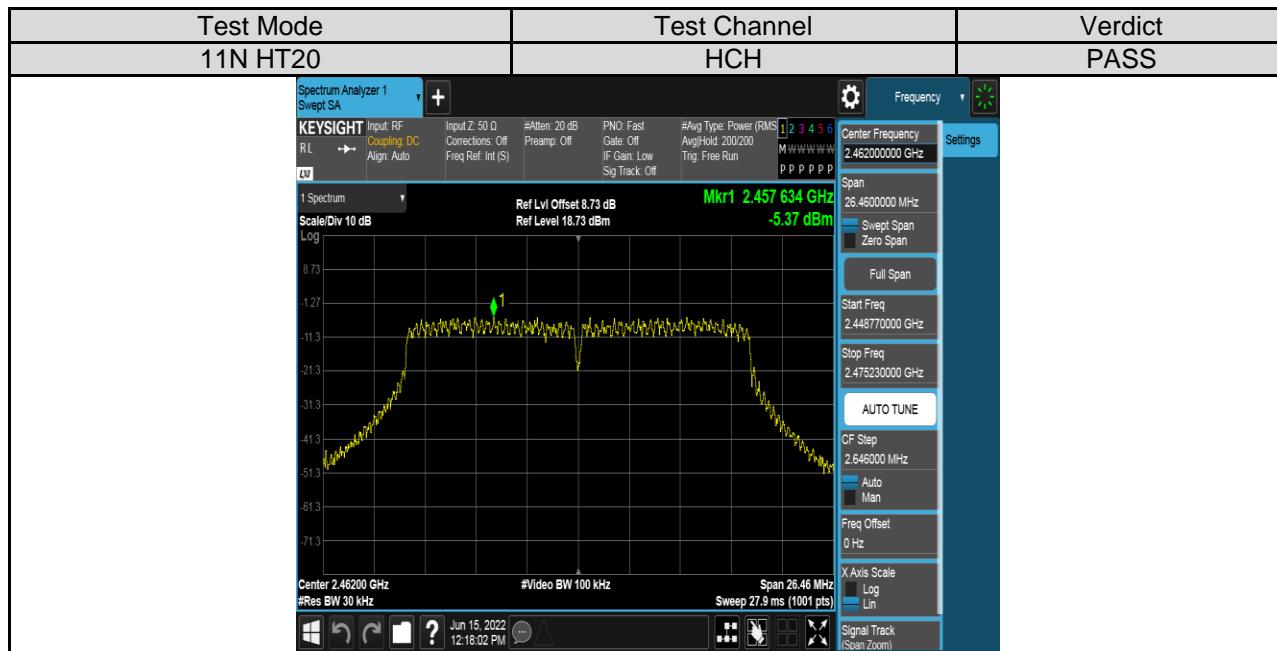
- 1) For this product, it has two antennas, antenna1 and antenna2, but only the 802.11N HT20 and 802.11N HT40 modes can support both the SISO and MIMO technical. But for the modes of 11B &11G, only the antenna 1 is working.
- 2) Through pre-testing all the test modes of 11N 20 and 11N40, including SISO and MIMO, but only the data if worse case is included in this test report.

**Test Graphs:**
**For Antenna 1 Part:**


Test Mode	Test Channel	Verdict
11B	HCH	PASS
		
11G	LCH	PASS
		

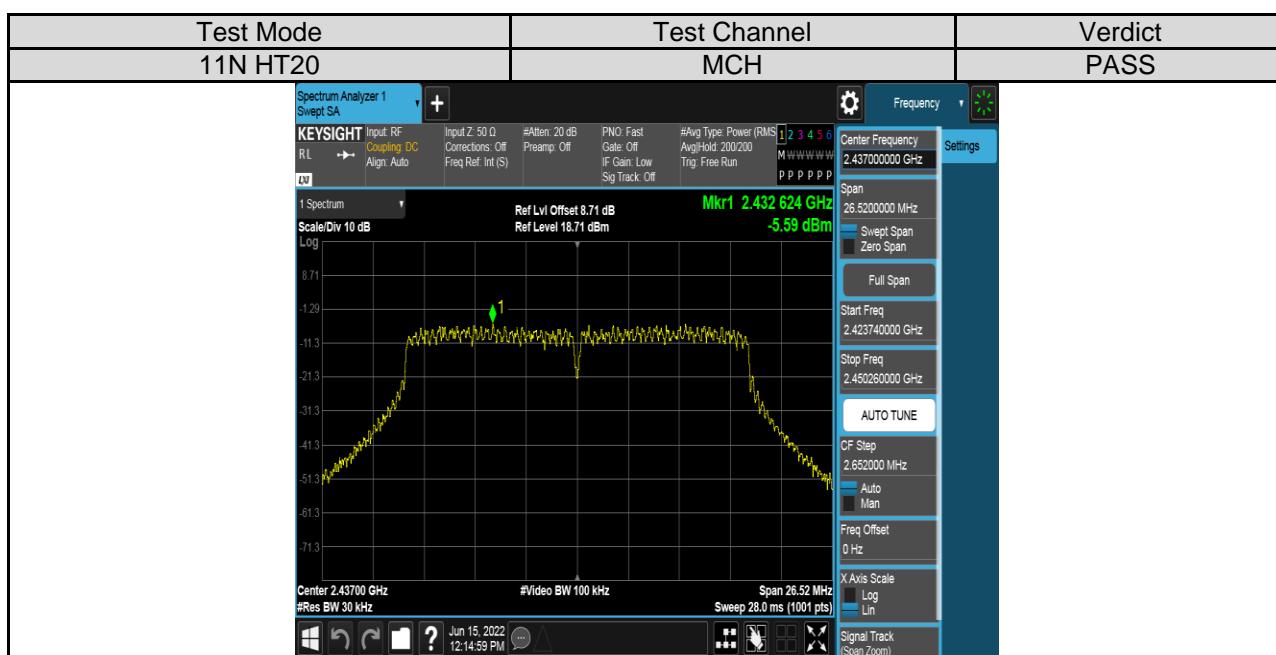
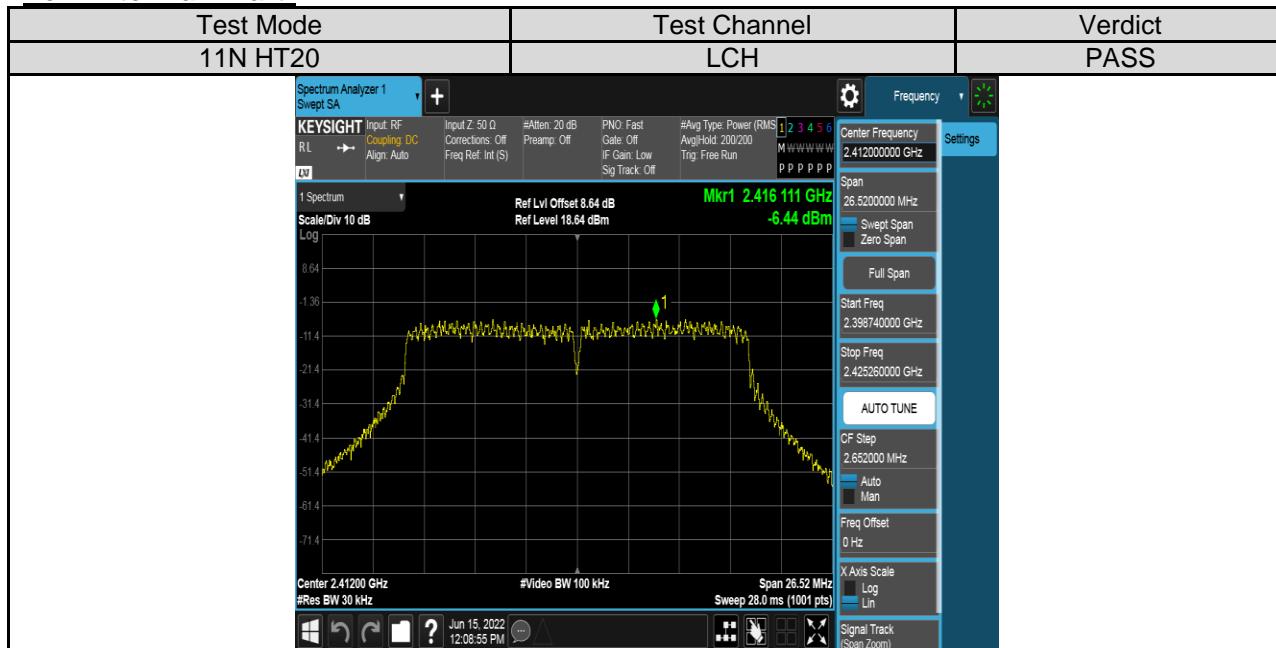


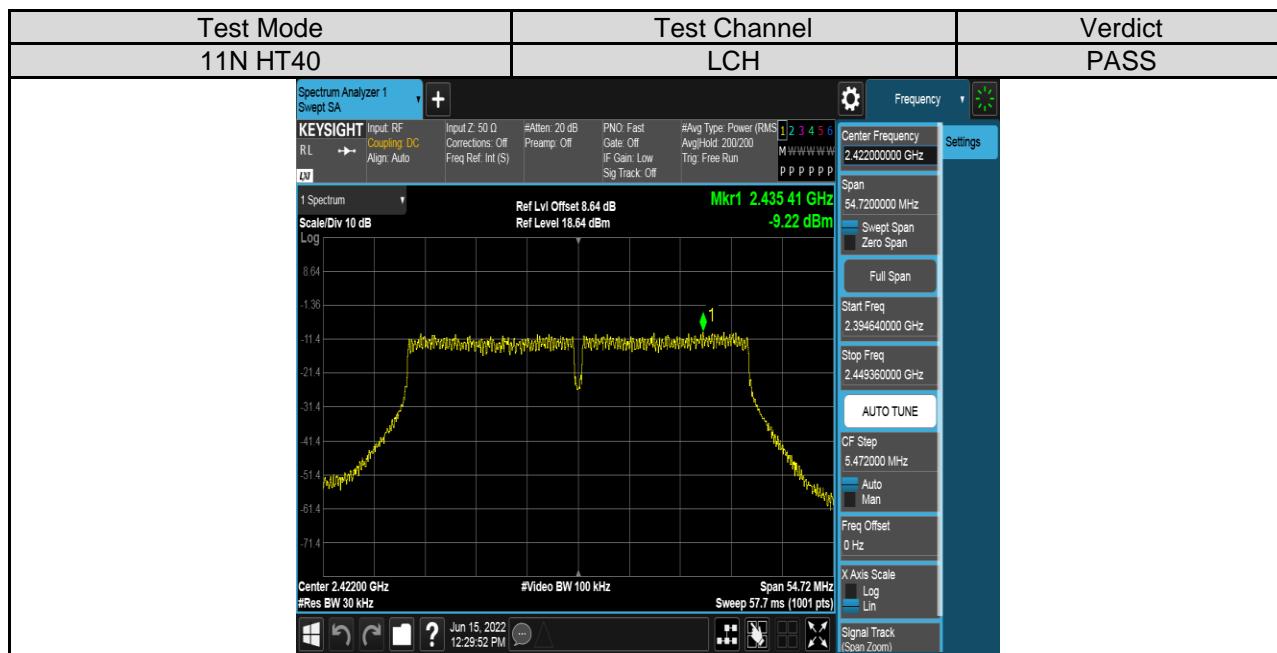
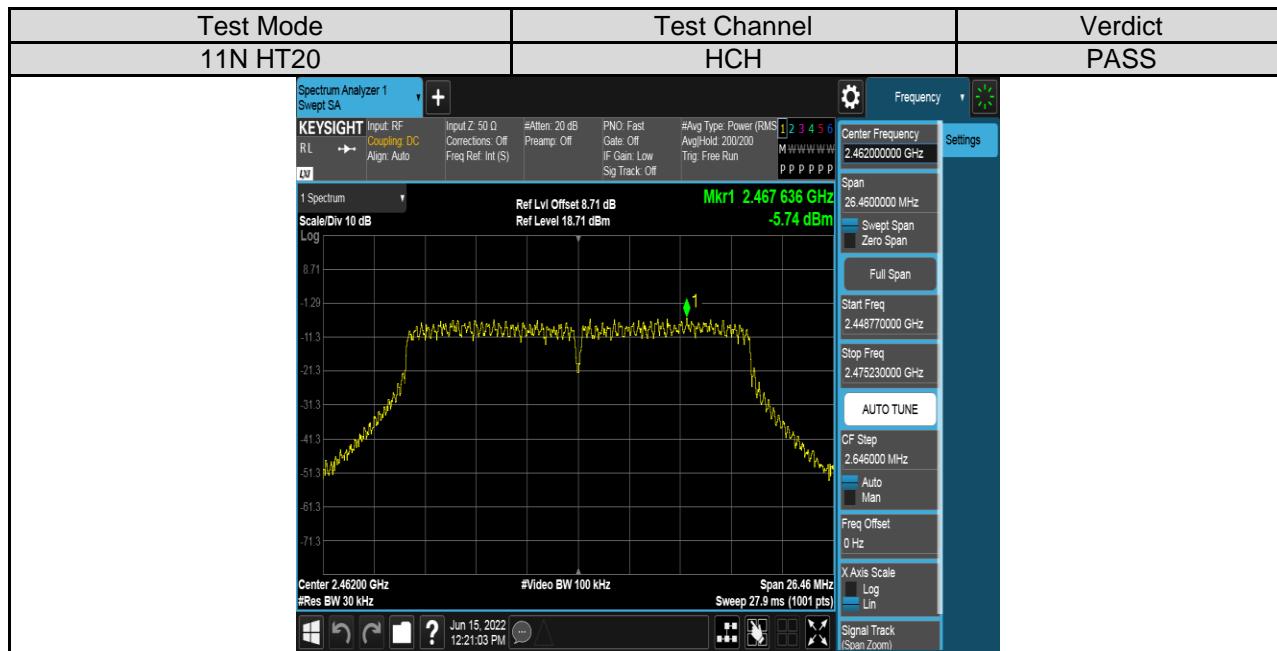


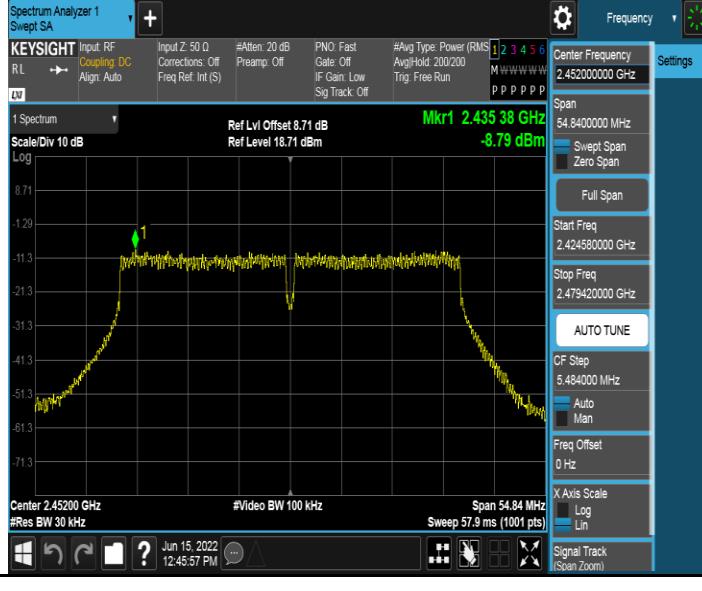


Test Mode	Test Channel	Verdict
11N HT40	MCH	PASS
11N HT40	HCH	PASS

## For Antenna 2 Part:





Test Mode	Test Channel	Verdict
11N HT40	MCH	PASS
		
11N HT40	HCH	PASS
		

## 7.6. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

### LIMITS

FCC Part15 (15.247) Subpart C		
Section	Test Item	Limit
FCC §15.247 (d)	Conducted Bandedge and Spurious Emissions	At least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

### TEST PROCEDURE

Refer to FCC KDB 558074, connect the UUT to the spectrum analyser and use the following

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	100K
VBW	$\geq 3 \times$ RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

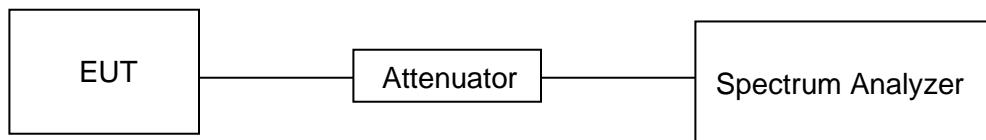
settings:

Use the peak marker function to determine the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100K
VBW	$\geq 3 \times$ RBW
measurement points	$\geq$ span/RBW
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum amplitude level.

### TEST SETUP



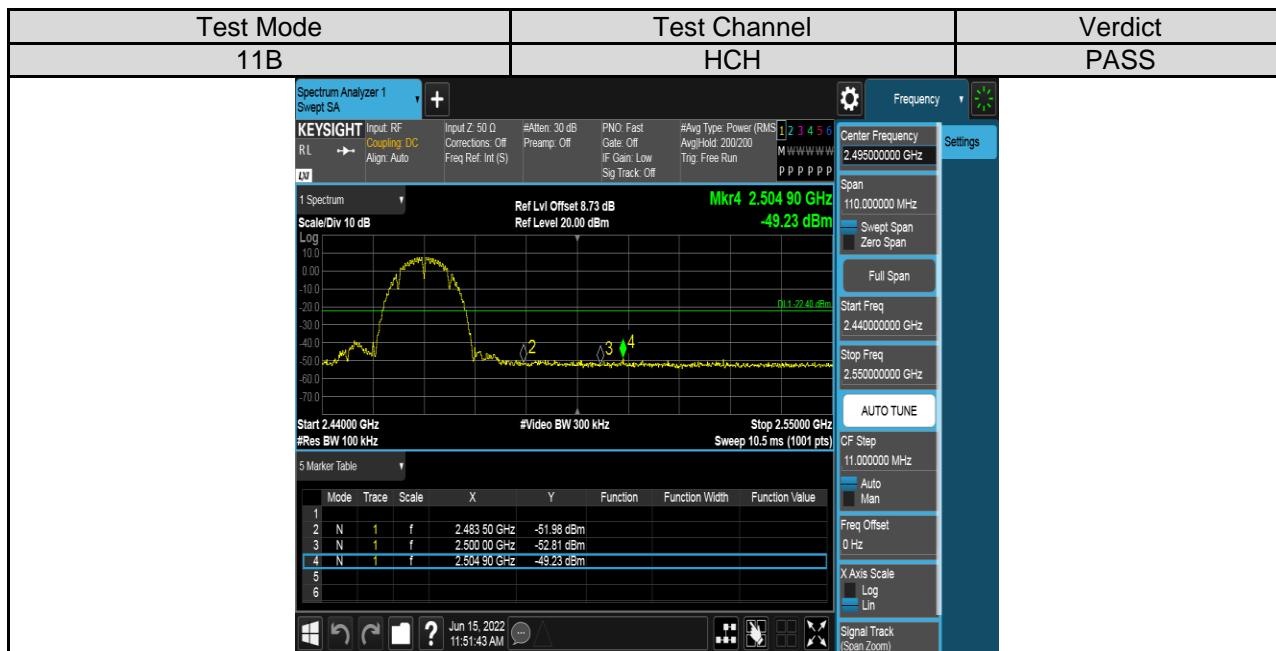
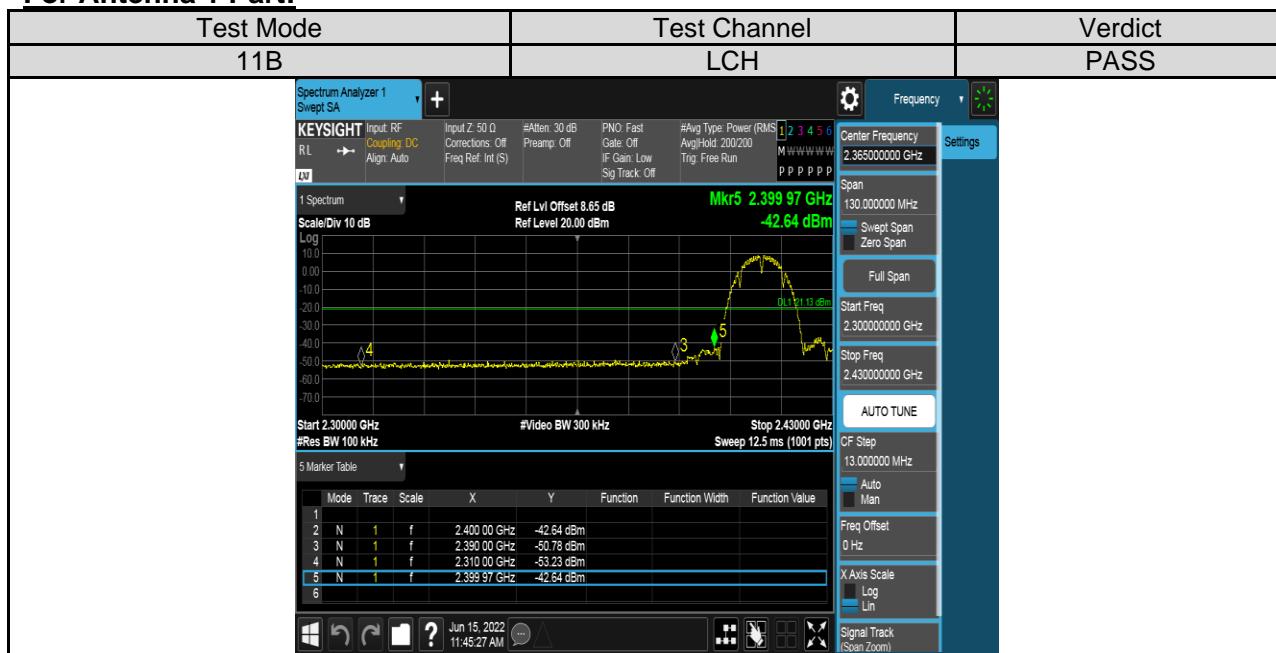
Form-ULID-008536-9 V1.0

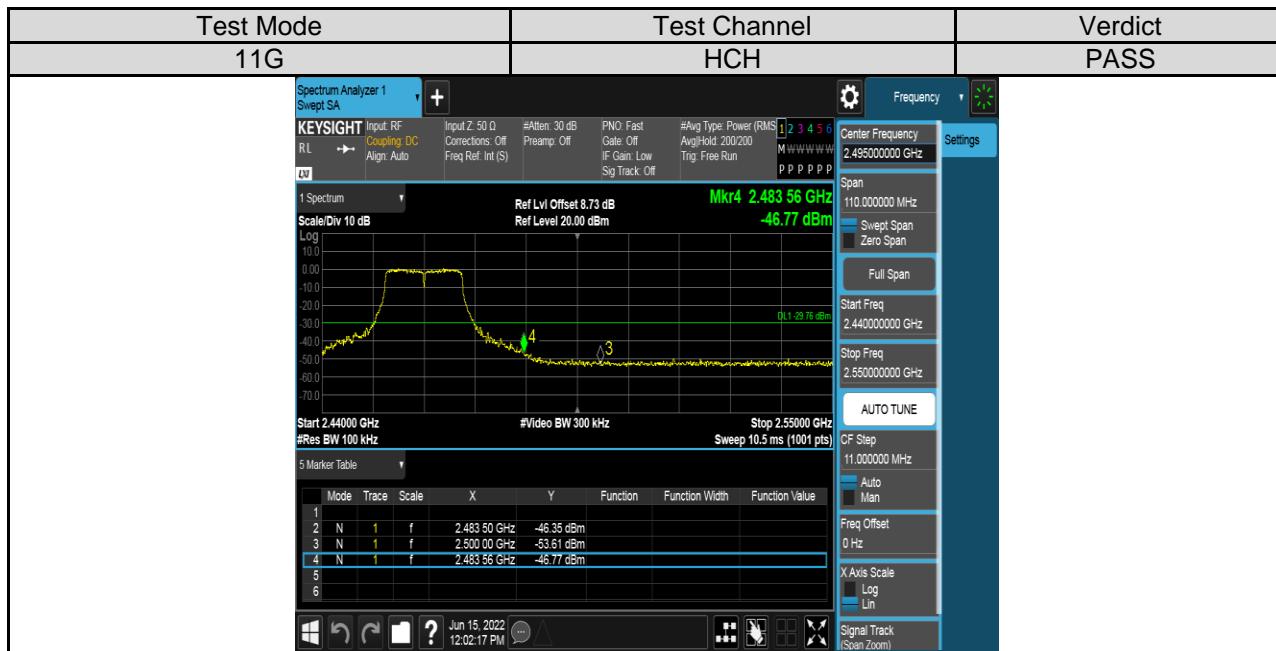
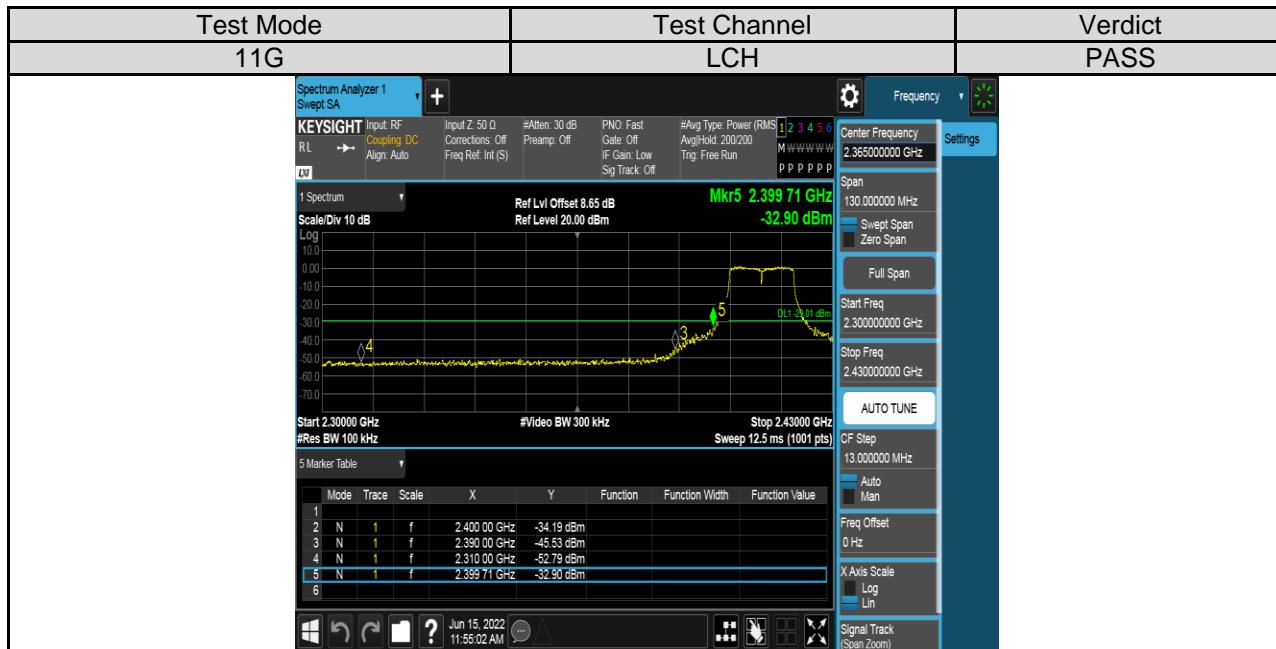
**Part I :Conducted Bandedge****RESULTS TABLE**

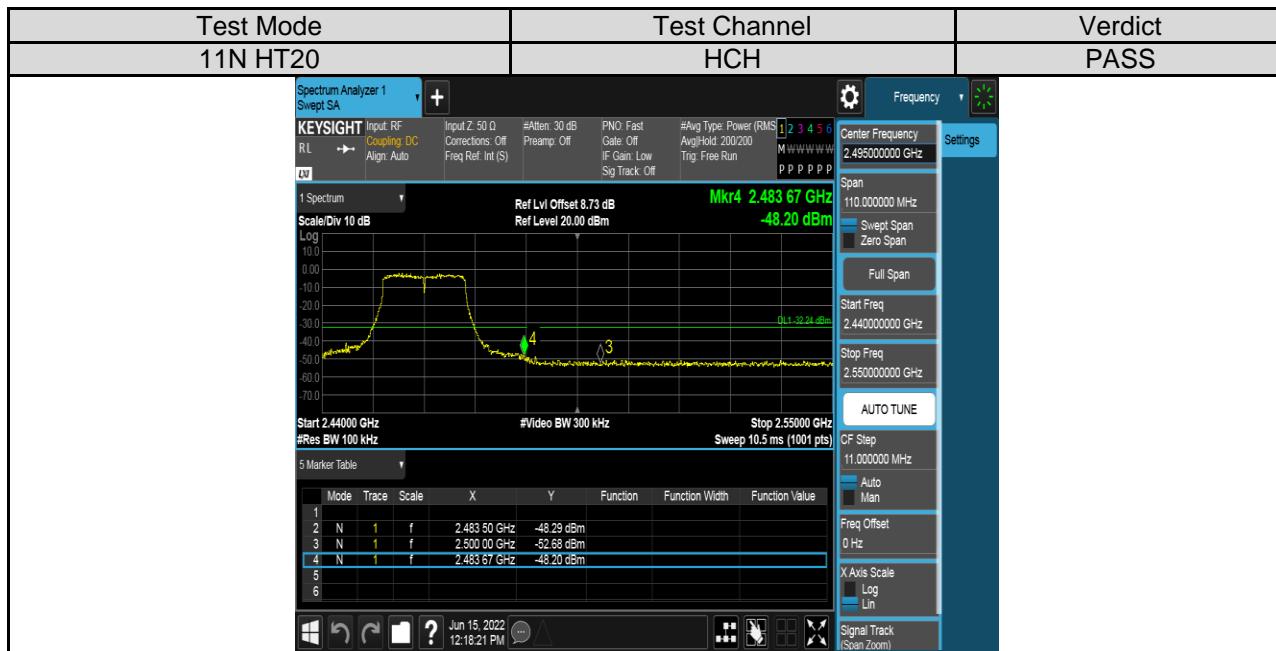
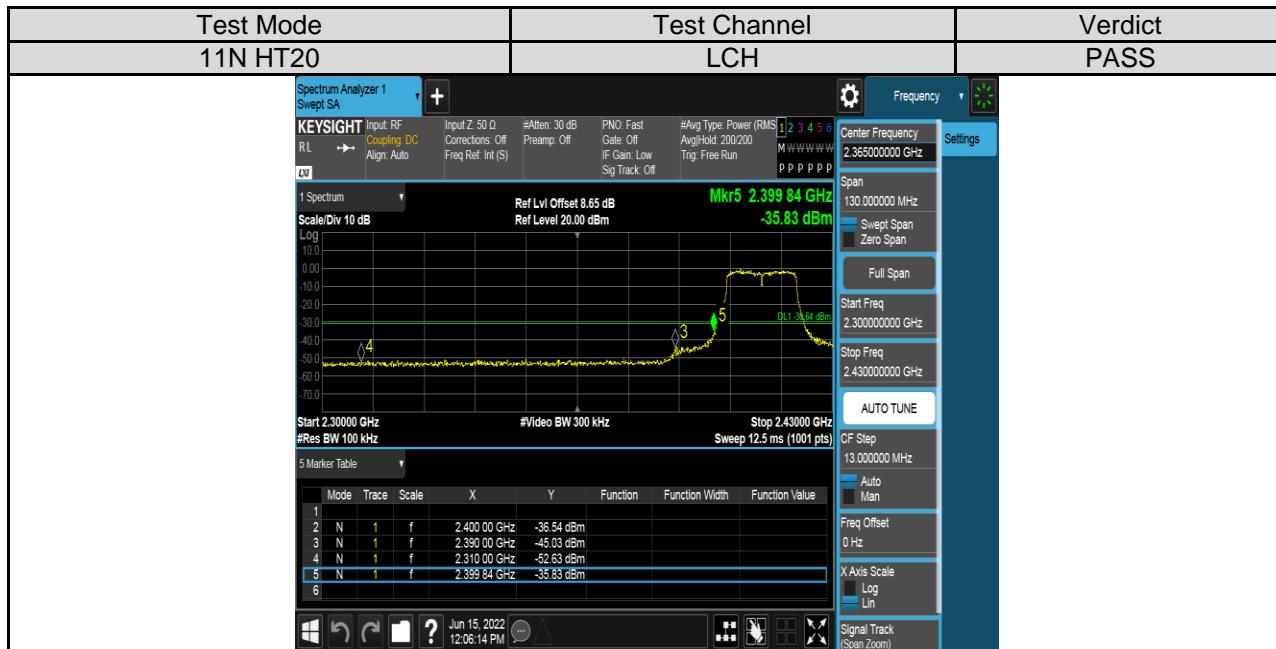
Test Mode	Test Antenna	Test Channel	Test Result	Verdict
11B	Antenna 1	LCH	See the test graphs	PASS
		HCH	See the test graphs	PASS
11G	Antenna 1	LCH	See the test graphs	PASS
		HCH	See the test graphs	PASS
11N20MIMO	Antenna 1	LCH	See the test graphs	PASS
		HCH	See the test graphs	PASS
	Antenna 2	LCH	See the test graphs	PASS
		HCH	See the test graphs	PASS
11N40MIMO	Antenna 1	LCH	See the test graphs	PASS
		HCH	See the test graphs	PASS
	Antenna 2	LCH	See the test graphs	PASS
		HCH	See the test graphs	PASS

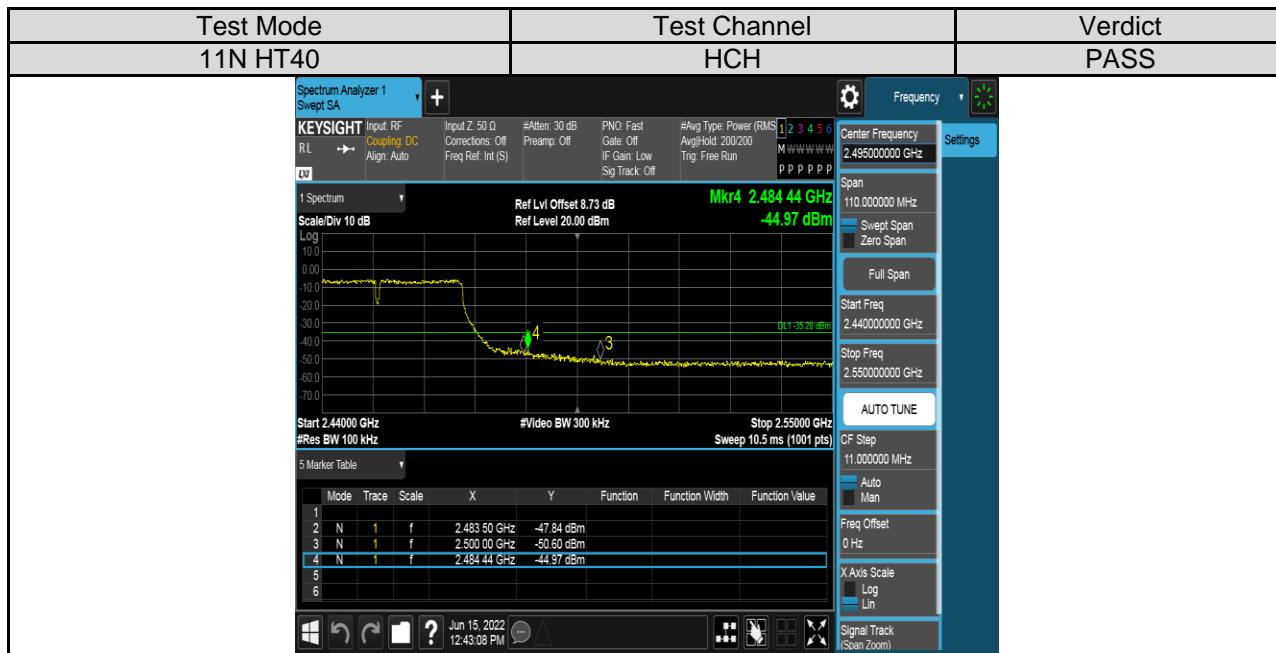
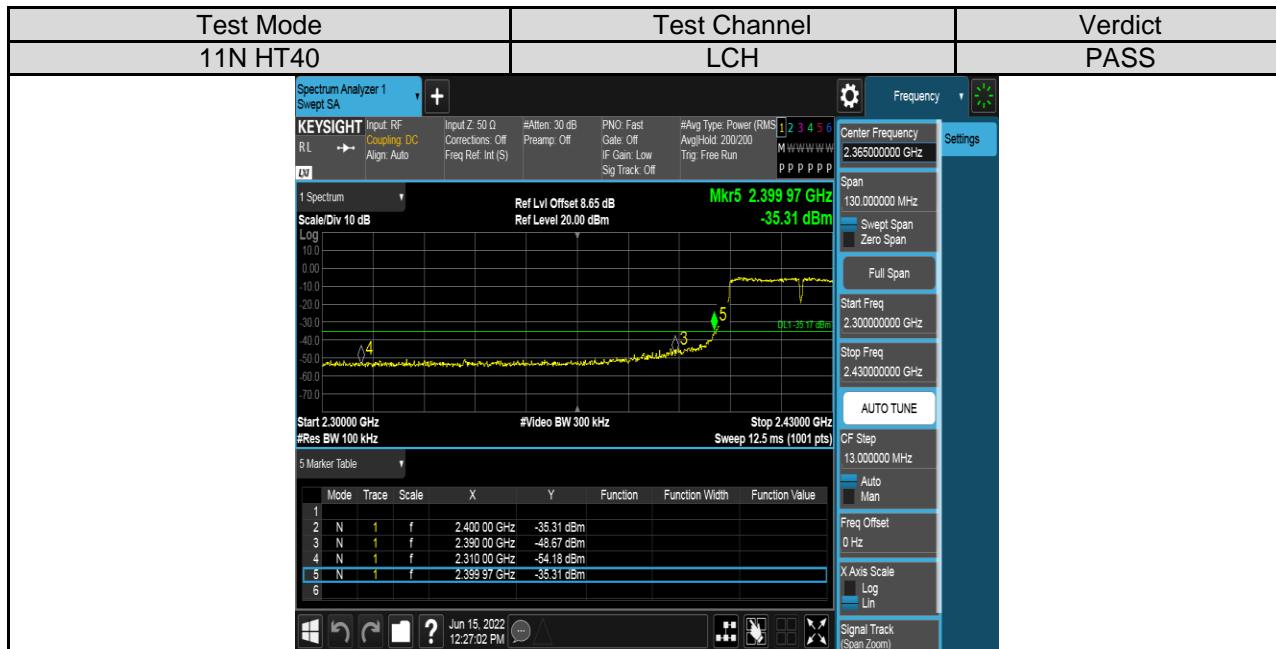
## Remark:

- 1) For this product, it has two antennas, antenna1 and antenna2, but only the 802.11N HT20 and 802.11N HT40 modes can support both the SISO and MIMO technical. But for the modes of 11B &11G, only the antenna 1 is working.
- 2) Through pre-testing all the test modes of 11N 20 and 11N40, including SISO and MIMO, but only the data if worse case is included in this test report.

Test Plots  
 For Antenna 1 Part:








## **For Antenna 2 Part:**

Test Mode	Test Channel	Verdict
11N HT20	LCH	PASS

**Spectrum Analyzer 1**  
Swept SA

**KEYSIGHT** Input: RF  
RL → Coupling: DC  
Align: Auto

Input Z: 50 Ω  
Corrections: Off  
Preamp: Off  
Freq Ref. Int (S)

#Averages: 30 dB  
#Preamp: Off  
PNO: Fast  
Gate: Off  
IF Gain: Low  
Sig Track: Off

#Avg Type: Power (RMS)  
Avg Hold: 200/200  
Trig: Free Run  
P: P P P P P

Frequency: 2.365000000 GHz

Center Frequency: 2.365000000 GHz

Span: 130.00000 MHz

Sweep Span: 130.00000 MHz

Zero Span: 130.00000 MHz

Full Span

Start Freq: 2.300000000 GHz

Stop Freq: 2.430000000 GHz

AUTO TUNE

CF Step: 13.00000 MHz

Auto: Man

Freq Offset: 0 Hz

X Axis Scale: Log

Signal Track (Span Zoom)

1 Spectrum  
Scale/Div 10 dB  
Log

Ref Lvl Offset 8.64 dB  
Ref Level 20.00 dBm

Mkr5 2.399 84 GHz  
-39.07 dBm

Start 2.30000 GHz #Video BW 300 kHz Stop 2.43000 GHz  
#Res BW 100 kHz Sweep 12.5 ms (1001 pts)

5 Marker Table

Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1							
2	N	1	f	2.400 00 GHz	-39.65 dBm		
3	N	1	f	2.390 00 GHz	-50.53 dBm		
4	N	1	f	2.310 00 GHz	-54.16 dBm		
5	N	1	f	2.399 84 GHz	-39.07 dBm		
6							

Jun 15, 2022 12:09:15 PM

Test Mode		Test Channel		Verdict
11N HT20		HCH		PASS

