



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

For

IP CAMERA

MODEL NUMBER: DH-IPC-WL46A

**ADDITIONAL MODEL NUMBER: IPC-WL46A; DH-IPC-WL46A-0280B;
IPC-WL46A-0280B; IPC-L46N-USA; IPC-L46N-CAN; IPC-L46N; IPC-L46; IPC-L46-
USA; IPC-L46-CAN**

PROJECT NUMBER: 4790217753-2

REPORT NUMBER: 4790217753-2-1

FCC ID: SVNDH-IPC-WLX6

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Prepared for

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Prepared by

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Revision History

| Rev. | Issue Date | Revisions | Revised By |
|------|------------|---------------|------------|
| V0 | 01/18/2022 | Initial Issue | |

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Zhejiang Dahua Vision Technology Co., Ltd.

Address: No.1199, Bin'an road, Binjiang District, Hangzhou, P.R.China.

Manufacturer Information

Company Name: Zhejiang Dahua Vision Technology Co., Ltd.
Address: No.1199, Bin'an road, Binjiang District, Hangzhou, P.R.China.

Factory Information

Company Name: ZHEJIANG DAHUA VISION TECHNOLOGY CO.,LTD
Address: No.1199, Bin'an road, Binjiang District, Hangzhou, P.R.China.

Company Name: ZHEJIANG DAHUA ZHILIAN CO.,LTD.
Address: No.28, Dongqiao Road, Dongzhou Street, Fuyang District, Hangzhou,P.R.China.

EUT Description

Product Name: IP CAMERA
Model Name: DH-IPC-WL46A
Additional No.: IPC-WL46A; DH-IPC-WL46A-0280B; IPC-WL46A-0280B; IPC-L46N-USA; IPC-L46N-CAN; IPC-L46N; IPC-L46; IPC-L46-USA; IPC-L46-CAN
Sample Number: 4477838
Data of Receipt Sample: Dec 08, 2021
Date Tested: Dec 09, 2021 ~ Jan 17, 2022

| APPLICABLE STANDARDS | |
|--------------------------|--------------|
| STANDARD | TEST RESULTS |
| CFR 47 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, FCC CFR 47 Part 2, FCC CFR 47 Part 15C> when <Accuracy Method> decision rule is applied.

Prepared By:

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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, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

| | |
|---------------------------|--|
| Accreditation Certificate | <p>A2LA (Certificate No.: 4829.01) UL-CCIC COMPANY LIMITED has been assessed and proved to be in compliance with A2LA.</p> <p>FCC (FCC Designation No.: CN1247) 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.</p> <p>IC (IC Designation No.: 25056; CAB No.:CN0073) 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.</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) | 3.9dB (1GHz-18Gz) 4.2dB (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: | IP CAMERA |
| Model No.: | DH-IPC-WL46A |
| Operating Frequency: | IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11a/n/ac: UNII-1: 5150 ~ 5250 MHz UNII-2A: 5250 ~ 5350 MHz UNII-2C: 5470 ~ 5725 MHz UNII-3: 5725 ~ 5850 MHz For this report is just for 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): OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) IEEE for 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) |
| Channels Step: | Channels with 5MHz step |
| Test software of EUT: | Secure CRT (manufacturer declare) |
| Antenna Type: | Street-lamp-camera antenna |
| Antenna Gain: | Antenna1: 4.22 dBi Antenna2: 4.22 dBi Remark: This data is provided by customer and our lab isn't responsible for this data |
| Test Voltage | AC120V |

Remark:

Model No.:

| Number: | Name: | Number: | Name: | Number: | Name: |
|---------|-----------------|---------|--------------|---------|--------------------|
| 1 | DH-IPC-WL46A | 2 | IPC-WL46A | 3 | DH-IPC-WL46A-0280B |
| 4 | IPC-WL46A-0280B | 5 | IPC-L46N-USA | 6 | IPC-L46N-CAN |
| 7 | IPC-L46N | 8 | IPC-L46 | 9 | IPC-L46-USA |
| 10 | IPC-L46-CAN | | | | |

Only the main model **DH-IPC-WL46A** was tested and only the data of this model is shown in this test report. Since Their electrical circuit design, layout, components used and internal wiring are identical, only the name of the models.

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] | 17.59 |
| 1 | IEEE 802.11G SISO | 1-11[11] | 12.15 |
| 1/2 | IEEE 802.11nHT20 | 1-11[11] | 14.47 |

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 | | |

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 |

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 | N/A | N/A | N/A | | | |
| 802.11n HT20 | 1/2 | 44 | 44 | 44 | | | |
| 802.11n HT40 | / | / | | | / | | |

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

| Ant. | Frequency (MHz) | Antenna Type | Antenna Gain (dBi) | Directional gain(dBi) |
|------|-----------------|----------------------------|--------------------|-----------------------|
| 1 | 2400-2483.5 | Street-lamp-camera antenna | 4.22 | 7.23 |
| 2 | 2400-2483.5 | Street-lamp-camera antenna | 4.22 | |

Note:

- 1) Directional gain= $10\log [(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}] = 7.23 \text{ dBi}$
- 2) N_{ANT} : the number of Antenna
- 3) For this product, it has two antennas, antenna1 and antenna2, but only the 802.11N HT20 mode 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 or Antenna2 can be used as transmitting/receiving antenna independently. |
| IEEE 802.11g | <input checked="" type="checkbox"/> 1TX, 1RX | Antenna1 or Antenna2 can be used as transmitting/receiving antenna independently. |
| IEEE 802.11N (HT20) | <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 mode can support both the SISO and MIMO technical.
- 2) For the 11N mode (including the 11N HT20 SISO, 11N HT20 MIMO), pre-testing all test modes, only worse 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

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 |

I/O PORT

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

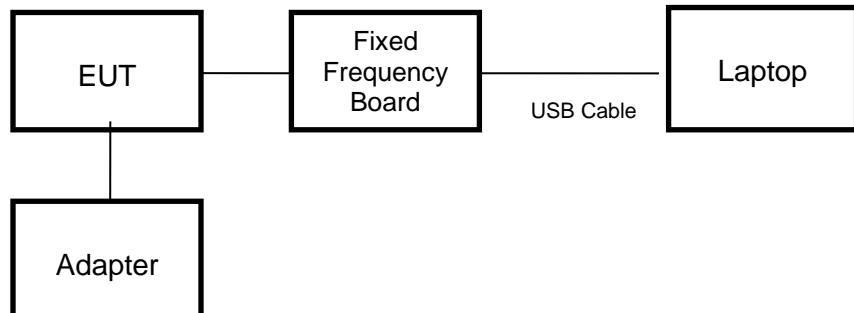
ACCESSORY

| Item | Accessory | Brand Name | Model Name | Description |
|------|------------|------------|---------------------------|--|
| 1 | AC Adapter | AC POWER | ADS-12AM-12 12012-EPCU | INPUT:100-240V,50/60Hz, 0.3A OUTPUT:12V — 1A |

TEST SETUP

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

SETUP DIAGRAM FOR TESTS



Remark: The SD Card is used during all testings.



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 | 2020-05-10 | 2021-05-09 | 2022-05-08 |
| <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 | N/A | 2019-01-28 | 2022-01-27 |
| <input checked="" type="checkbox"/> | Receiver Antenna (1GHz-18GHz) | R&S | HF907 | 126705 | 2018-01-29 | 2019-01-28 | 2022-01-27 |
| <input checked="" type="checkbox"/> | Receiver Antenna (18GHz-26.5GHz) | Schwarzbeck | BBHA9170 | 126706 | 2018-01-06 | 2019-01-05 | 2022-01-04 |
| <input checked="" type="checkbox"/> | Pre-amplification (To 18GHz) | Compliance Direction System Inc. | PAP-1G18-50 | 177825 | 2019-03-18 | 2020-12-05 | 2022-03-25 |
| <input checked="" type="checkbox"/> | Pre-amplification (To 26.5GHz) | R&S | SCU-26D | 135391 | 2020-12-05 | 2021-12-04 | 2022-12-03 |
| <input checked="" type="checkbox"/> | Band Reject Filter | Wainwright | WRCJV8-2350-2400-2483.5-2533.5-40SS | 1 | 2020-05-10 | 2021-05-09 | 2022-05-08 |
| <input checked="" type="checkbox"/> | Highpass Filter | Wainwright | WHKX10-2700-3000-18000-40SS | 2 | 2020-05-10 | 2021-05-09 | 2022-05-08 |
| Software | | | | | | | |
| Used | Description | | Manufacturer | Name | Version | | |
| <input checked="" type="checkbox"/> | Test Software for Radiated disturbance | | Tonscend | TS+ | Ver. 2.5 | | |
| 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 | 2020-05-10 | 2021-05-09 | 2022-05-08 |
| <input checked="" type="checkbox"/> | Power Meter | Keysight | U2021XA | 155370 | 2020-05-10 | 2021-05-09 | 2022-05-08 |

Remark: All relate Radiated Spurious Emissions are tested before Dec 30, 2021

6. MEASUREMENT METHODS

| No. | Test Item | KDB Name | Section |
|-----|---|--|---------|
| 1 | 6dB Bandwidth and 99% 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 |
| 3 | Power Spectral Density | KDB 558074 D01 15.247 Meas Guidance v05r02 | 8.4 |
| 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 | 59.6% |
| Atmospheric Pressure: | 102.1kPa |
| Temperature | 20.1°C |

7.2. ON TIME AND DUTY CYCLE

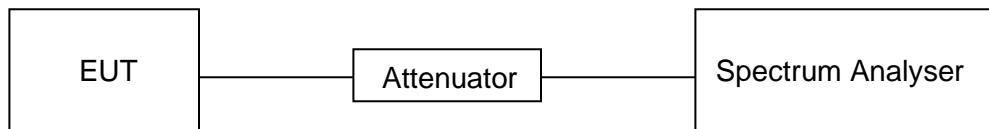
LIMITS

None; for reporting purposes only

PROCEDURE

FCC KDB 558074 Zero-Span Spectrum Analyzer Method

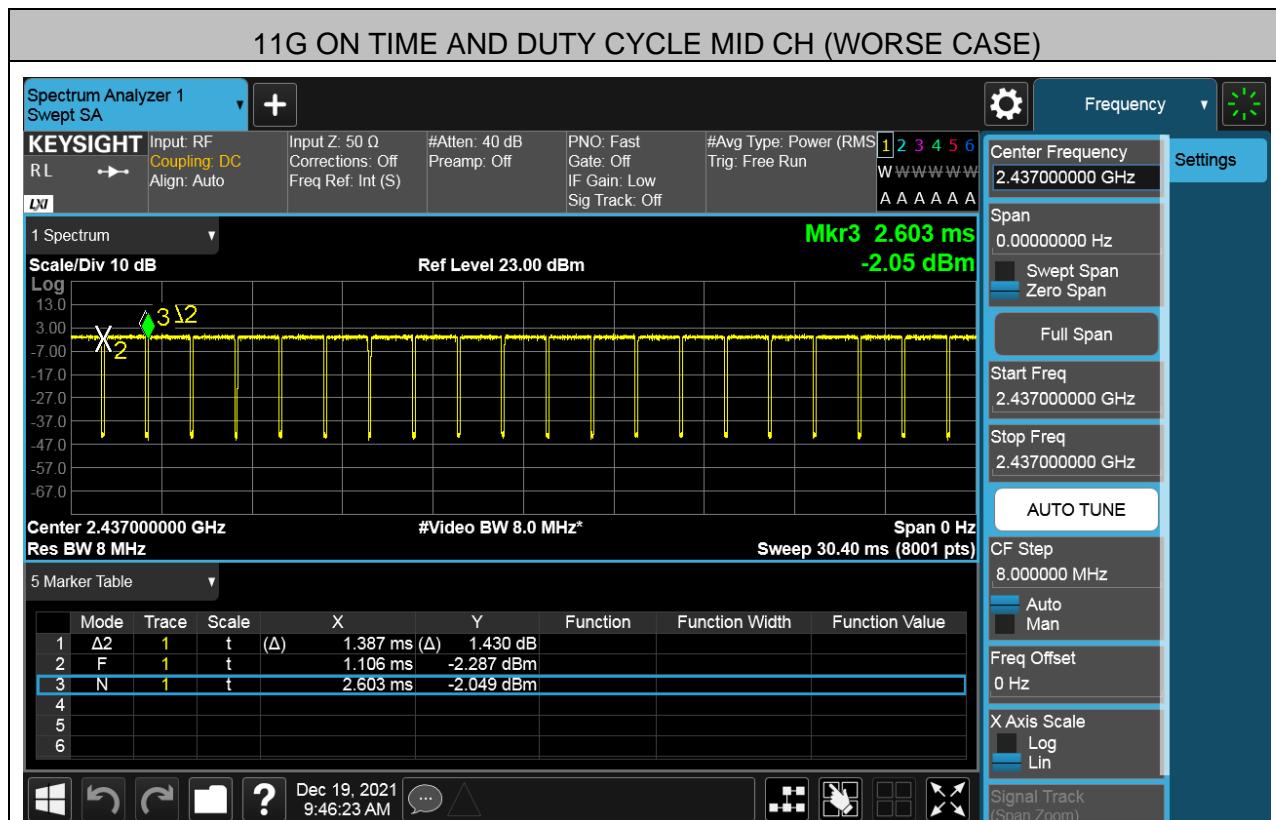
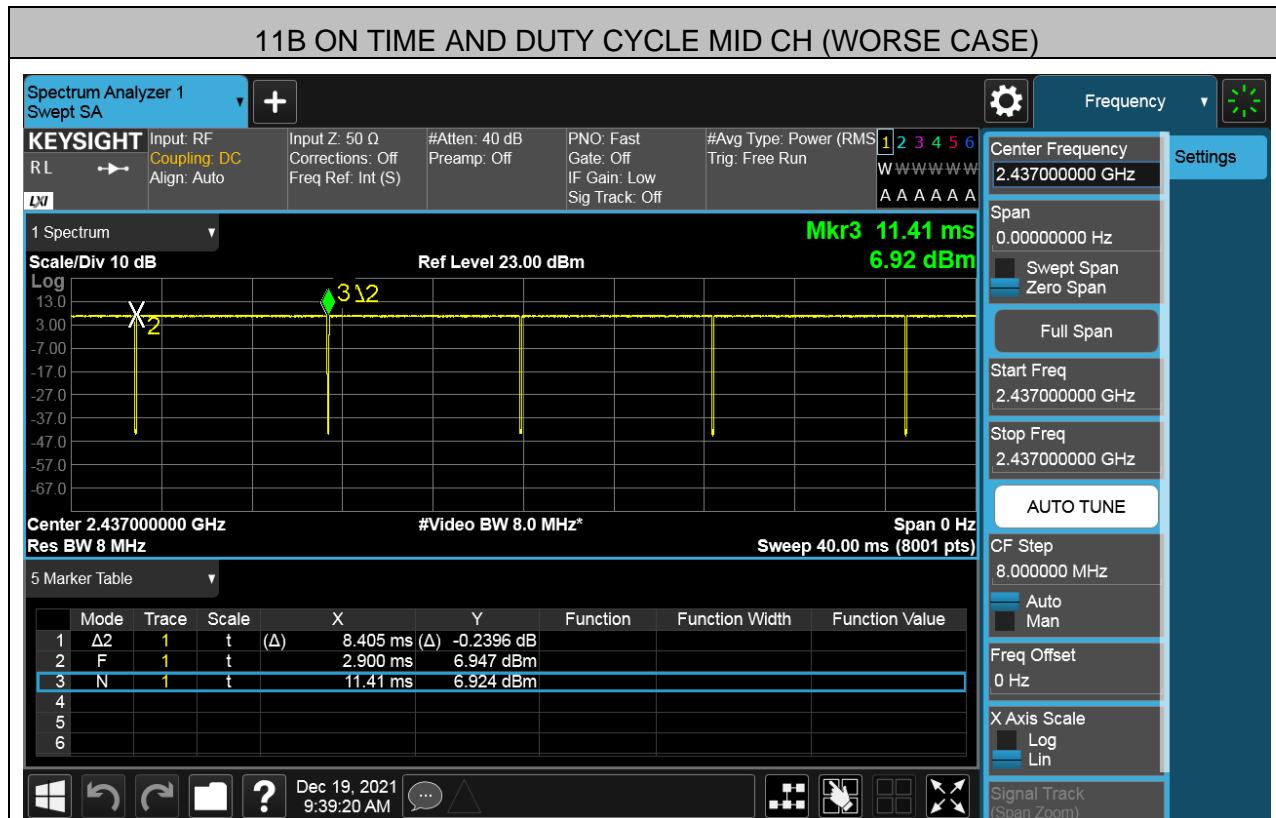
TEST SETUP

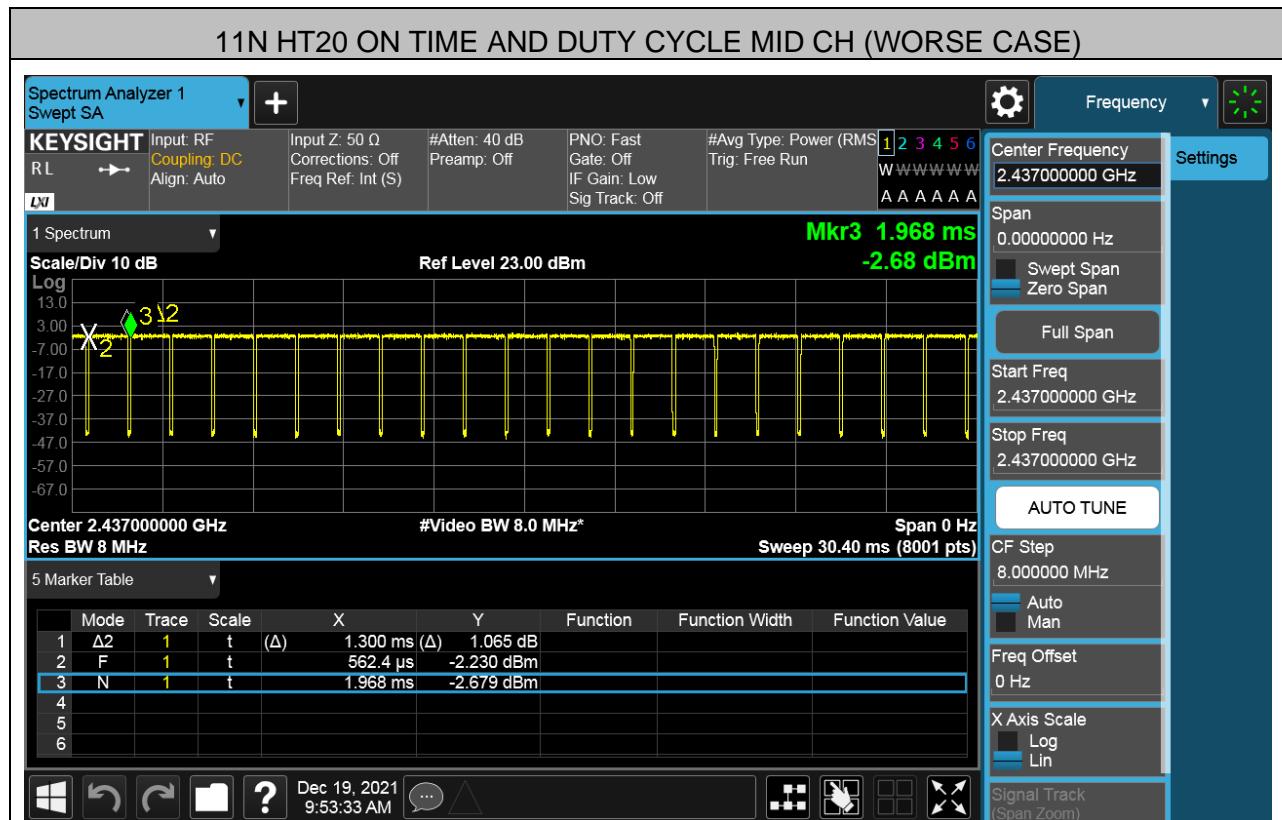


RESULTS

| Mode | On Time (msec) | Period (msec) | Duty Cycle x (Linear) | Duty Cycle (%) | Duty Cycle Correction Factor (db) | 1/T Minimum VBW (KHz) | Final Minimum VBW (KHz) |
|-------------|----------------|---------------|-----------------------|----------------|-----------------------------------|-----------------------|-------------------------|
| 11B | 8.405 | 8.510 | 0.988 | 98.8 | 0.05 | 0.12 | 0.01(Note5) |
| 11G | 1.387 | 1.497 | 0.927 | 92.7 | 0.33 | 0.72 | 1 |
| 11N HT20 | 1.300 | 1.4056 | 0.925 | 92.5 | 0.34 | 0.77 | 1 |

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) Pre-testing Antenna 1 and Antenna 2, and pre-testing SISO and MIMO modes, find Antenna 2 is worse case, and both of them have the same result, so only the data of Antenna2 is shown in this test report.
5) 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 | >= 500KHz | 2400-2483.5 |

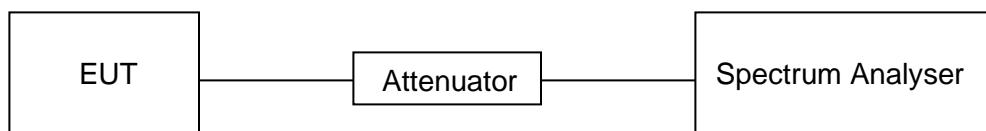
TEST PROCEDURE

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 : $\geq 3 \times$ 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

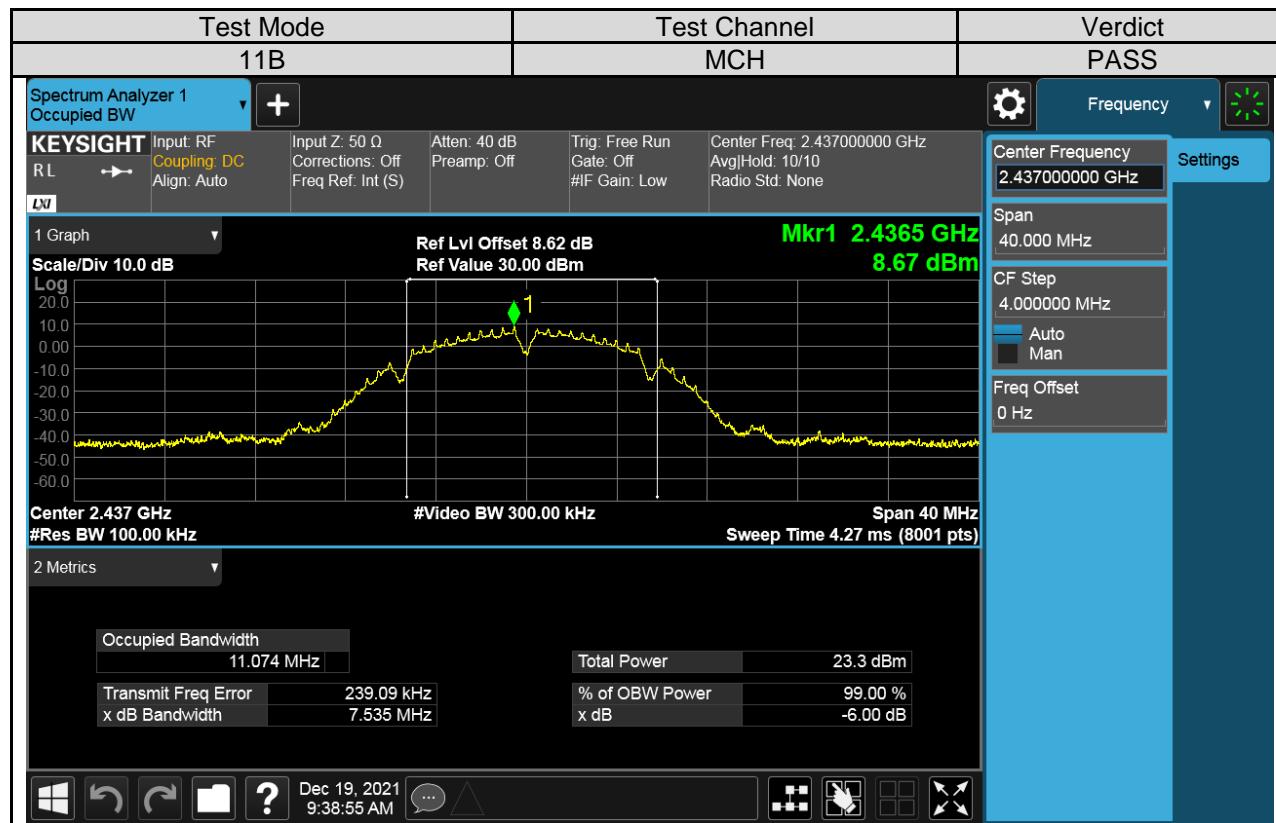
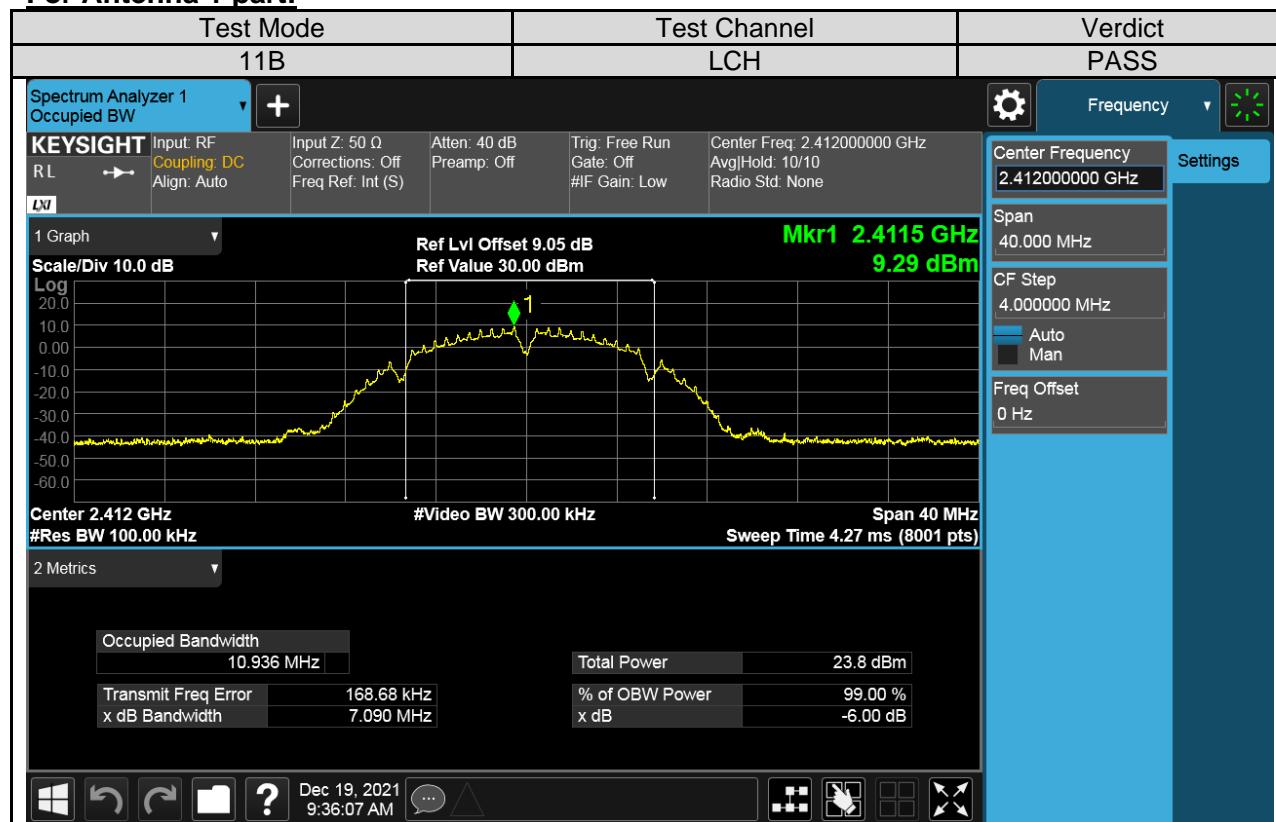


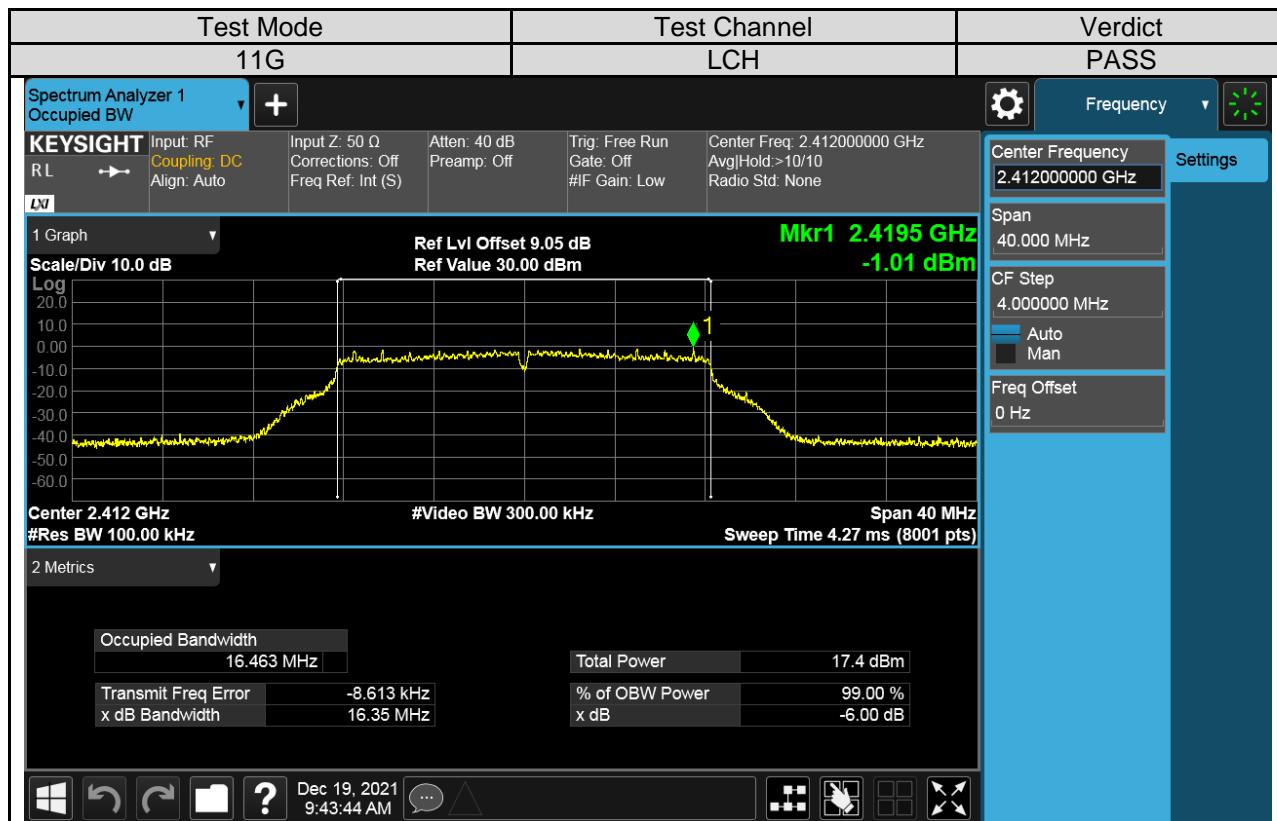
RESULTS

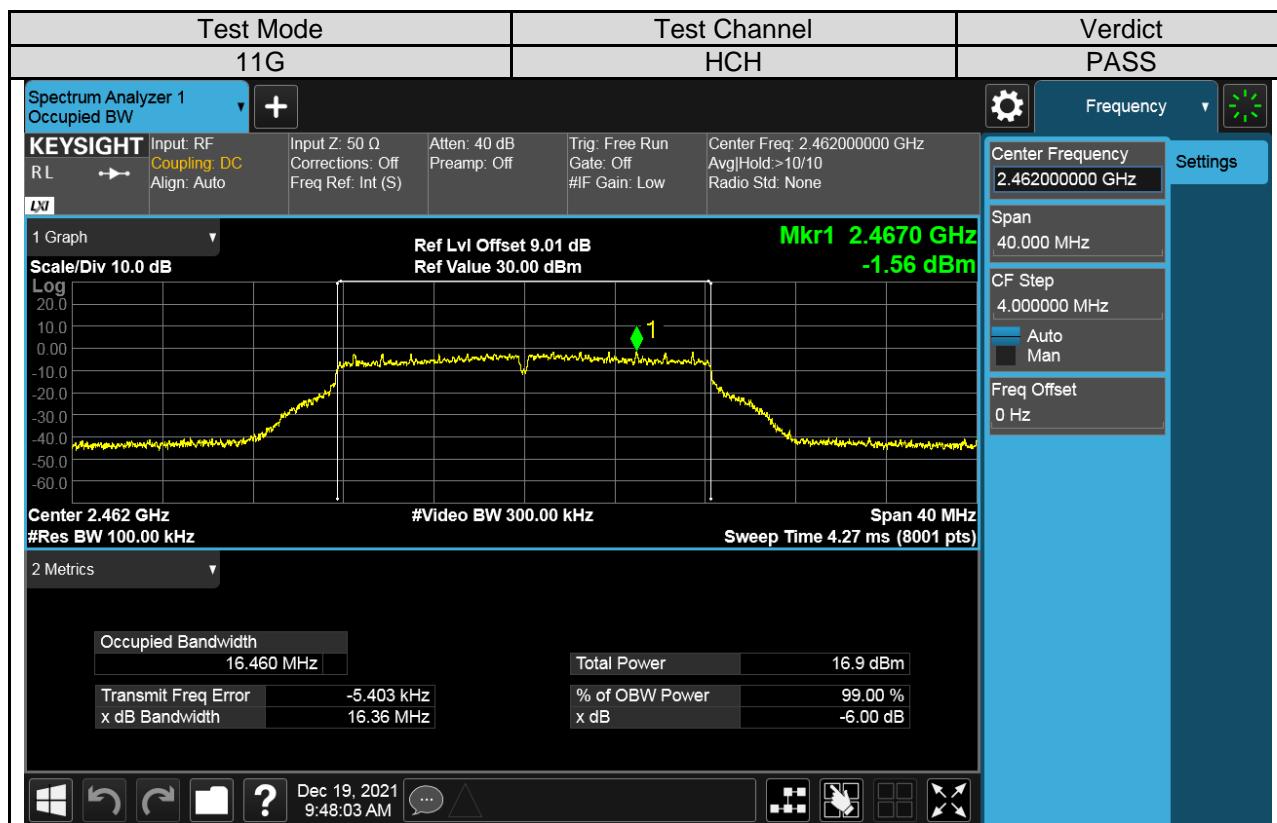
| Test Mode | Test Channel | 6dB bandwidth (MHz) For Antenna 1 | 6dB bandwidth (MHz) For Antenna 2 | Result |
|------------------|--------------|--------------------------------------|--------------------------------------|--------|
| 11B | LCH | 7.090 | 7.091 | Pass |
| | MCH | 7.535 | 7.045 | Pass |
| | HCH | 8.047 | 7.093 | Pass |
| 11G | LCH | 16.35 | 16.39 | Pass |
| | MCH | 16.33 | 16.35 | Pass |
| | HCH | 16.36 | 16.35 | Pass |
| 11N HT20 MIMO | LCH | 17.59 | 17.58 | Pass |
| | MCH | 17.57 | 17.58 | Pass |
| | HCH | 17.36 | 17.59 | Pass |

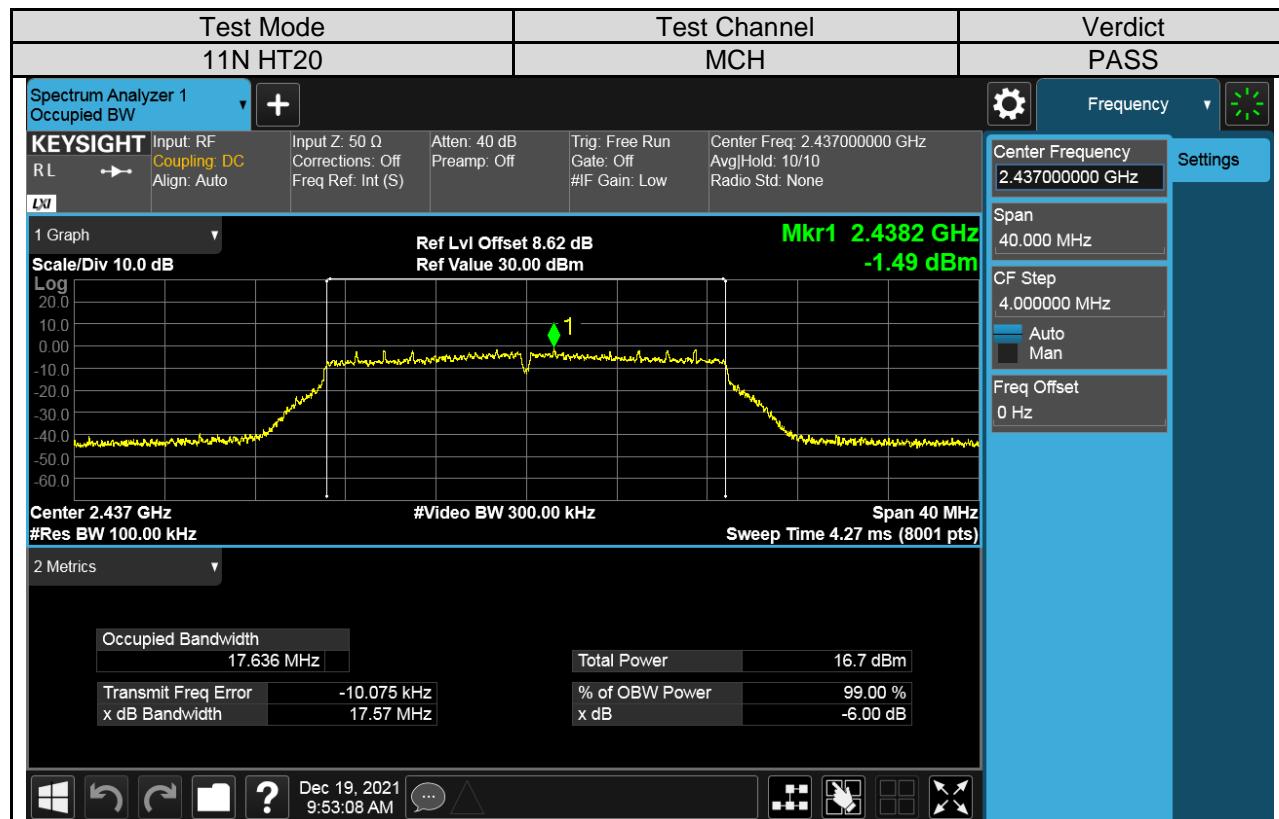
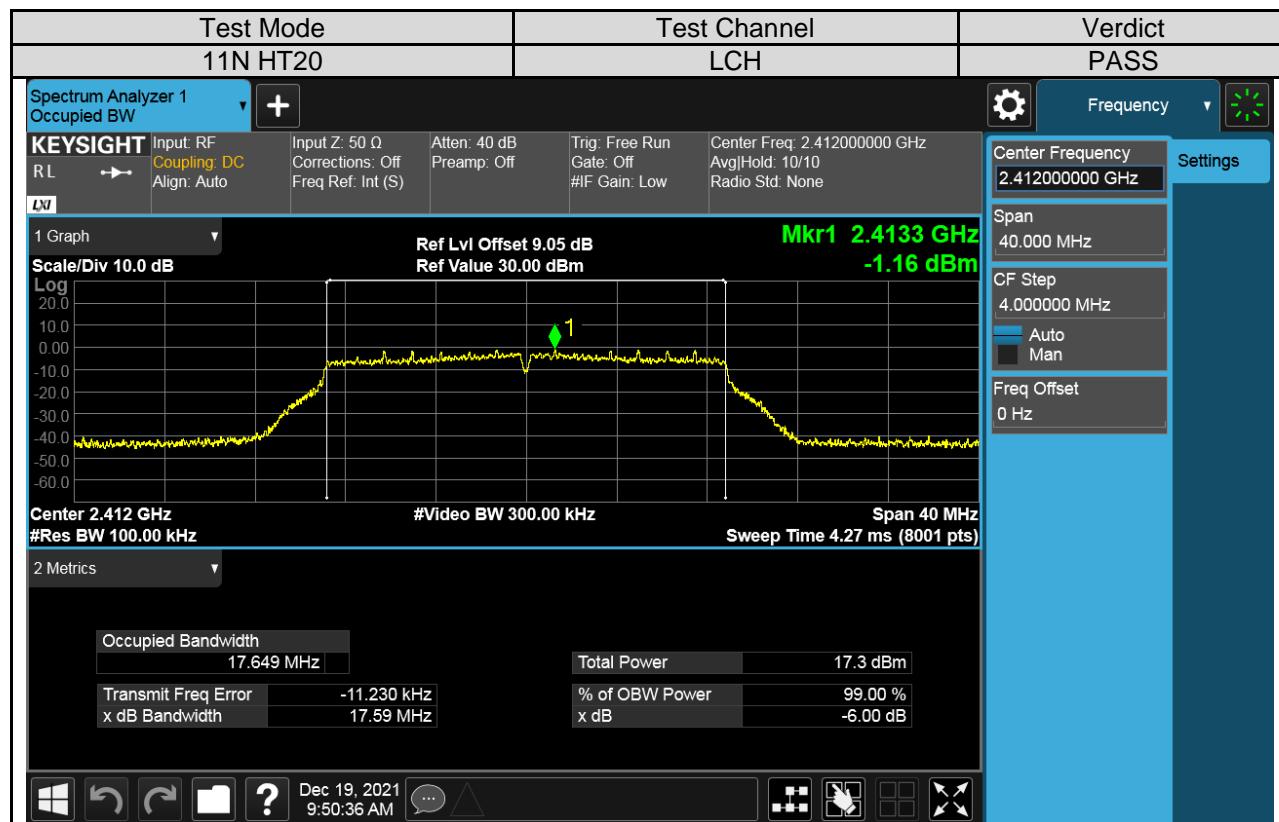
Remark:

- 1) Through pre-testing both the test modes of 11N 20 including SISO and MIMO, but only the data of worse case is included in this test report.

Test Graphs
For Antenna 1 part:








Test Mode
11N HT20

Test Channel
HCH

Verdict
PASS

Spectrum Analyzer 1
Occupied BW

KEYSIGHT
Input: RF
Coupling: DC
Align: Auto

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

Atten: 40 dB
Preamp: Off

Trig: Free Run
Gate: Off
#IF Gain: Low

Center Freq: 2.462000000 GHz
Avg/Hold: 10/10
Radio Std: None

1 Graph
Scale/Div: 10.0 dB
Log

Ref Lvl Offset: 9.01 dB
Ref Value: 30.00 dBm

Mkr1 2.4695 GHz
-1.34 dBm

Center: 2.462 GHz
#Res BW: 100.00 kHz

#Video BW: 300.00 kHz
Span: 40 MHz

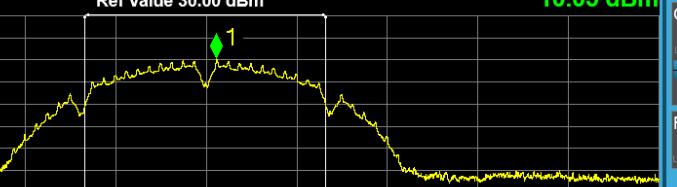
Sweep Time: 4.27 ms (8001 pts)

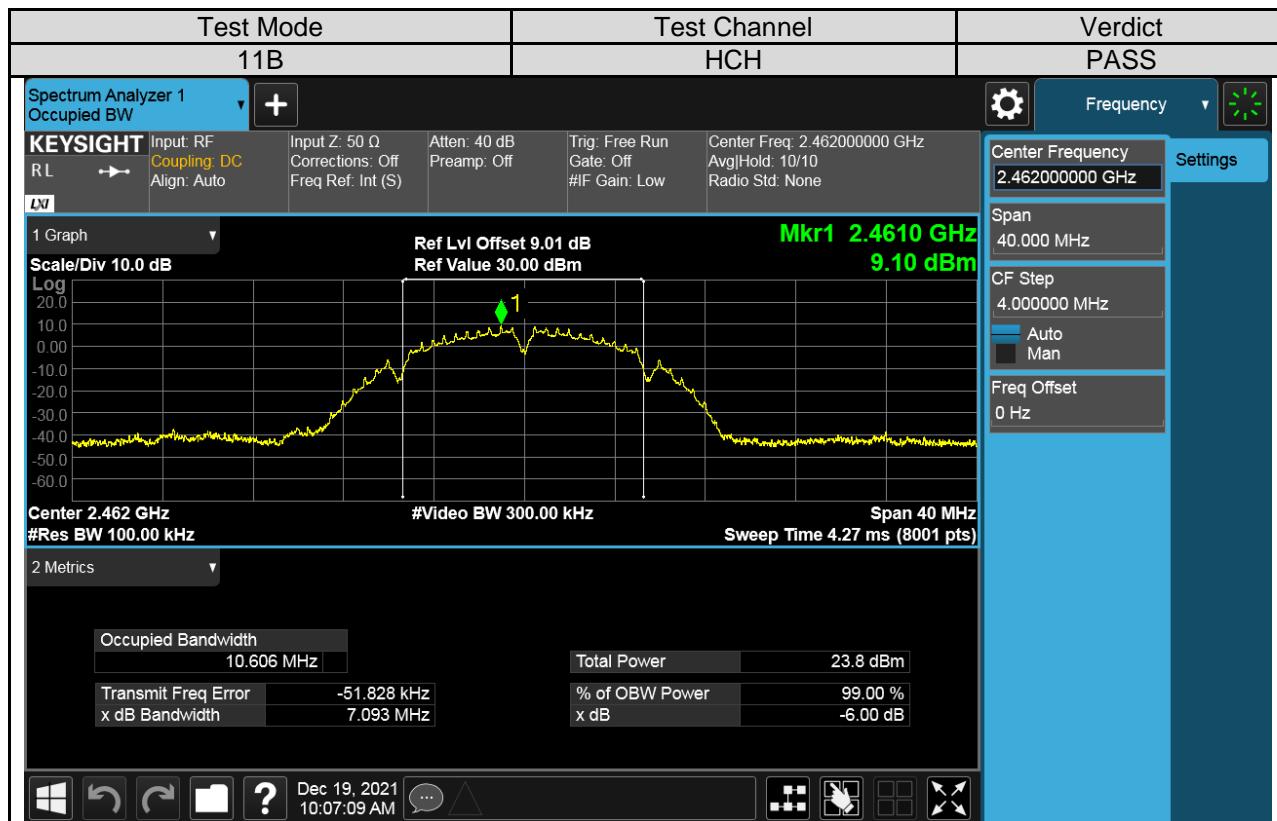
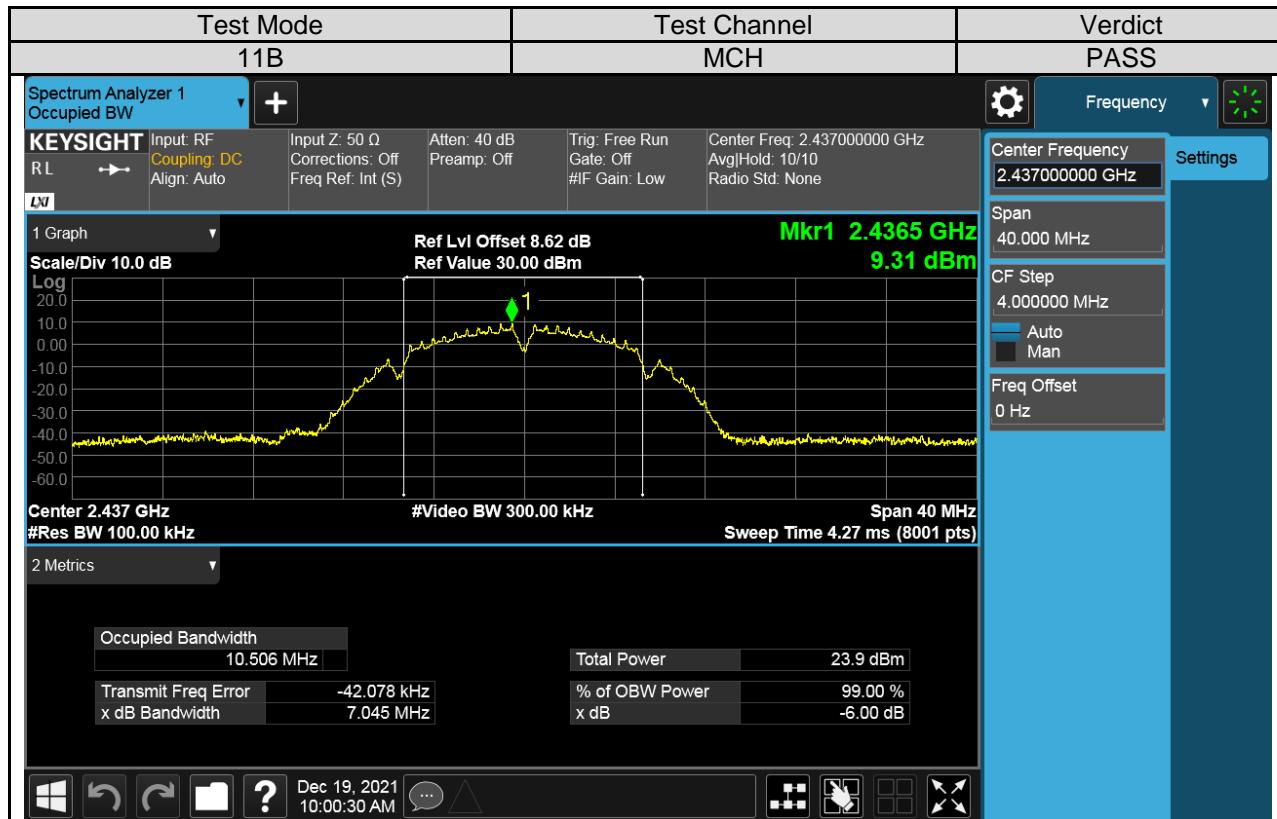
2 Metrics

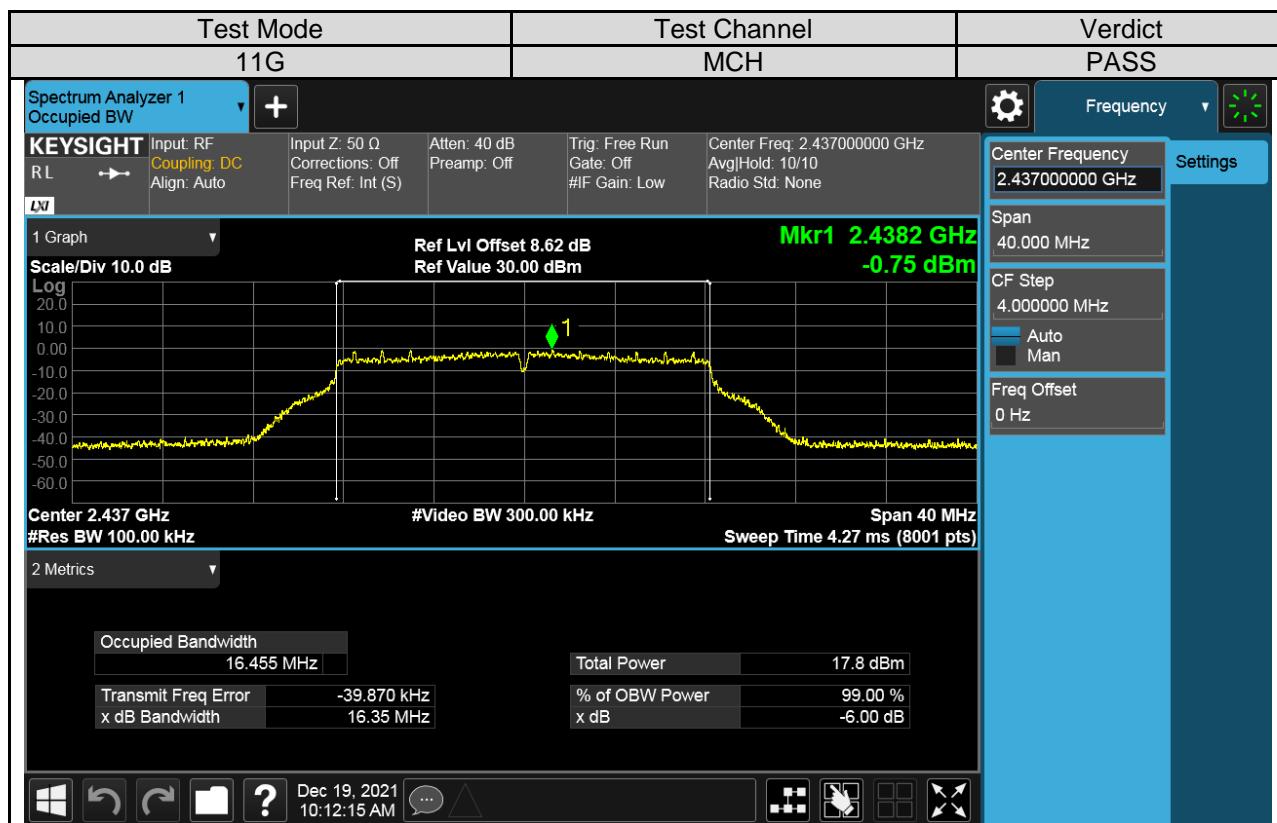
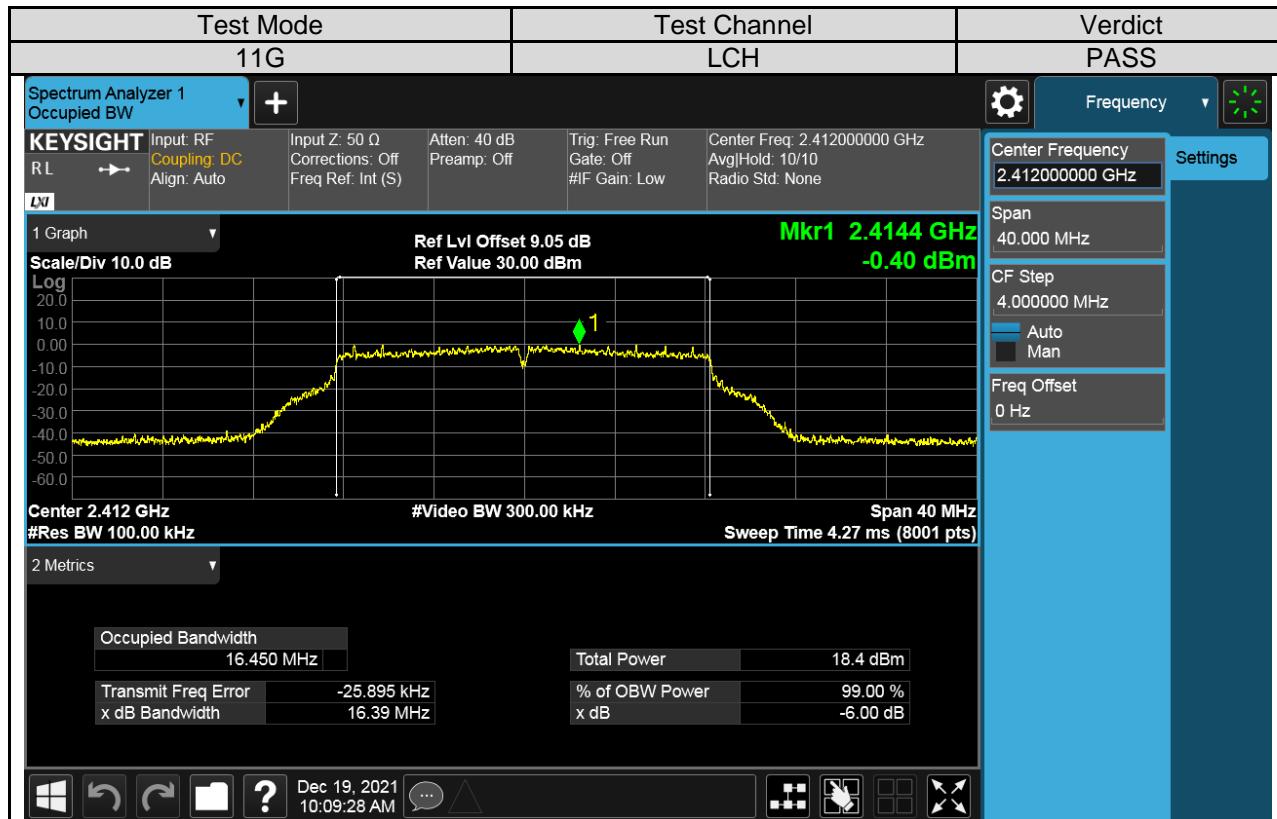
| Occupied Bandwidth | | Total Power | |
|---------------------|-----------|----------------|----------|
| 17.645 MHz | | 16.9 dBm | |
| Transmit Freq Error | 4.210 kHz | % of OBW Power | 99.00 % |
| x dB Bandwidth | 17.36 MHz | x dB | -6.00 dB |

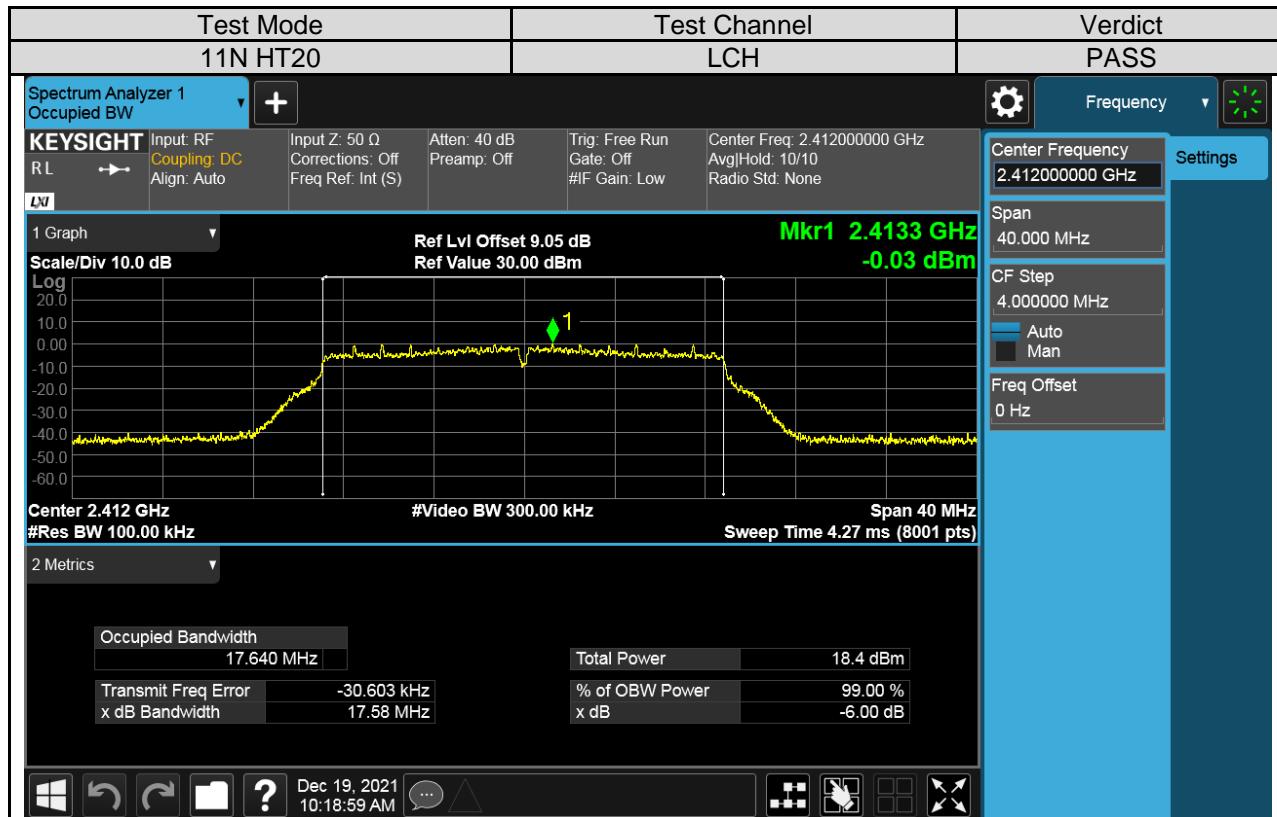
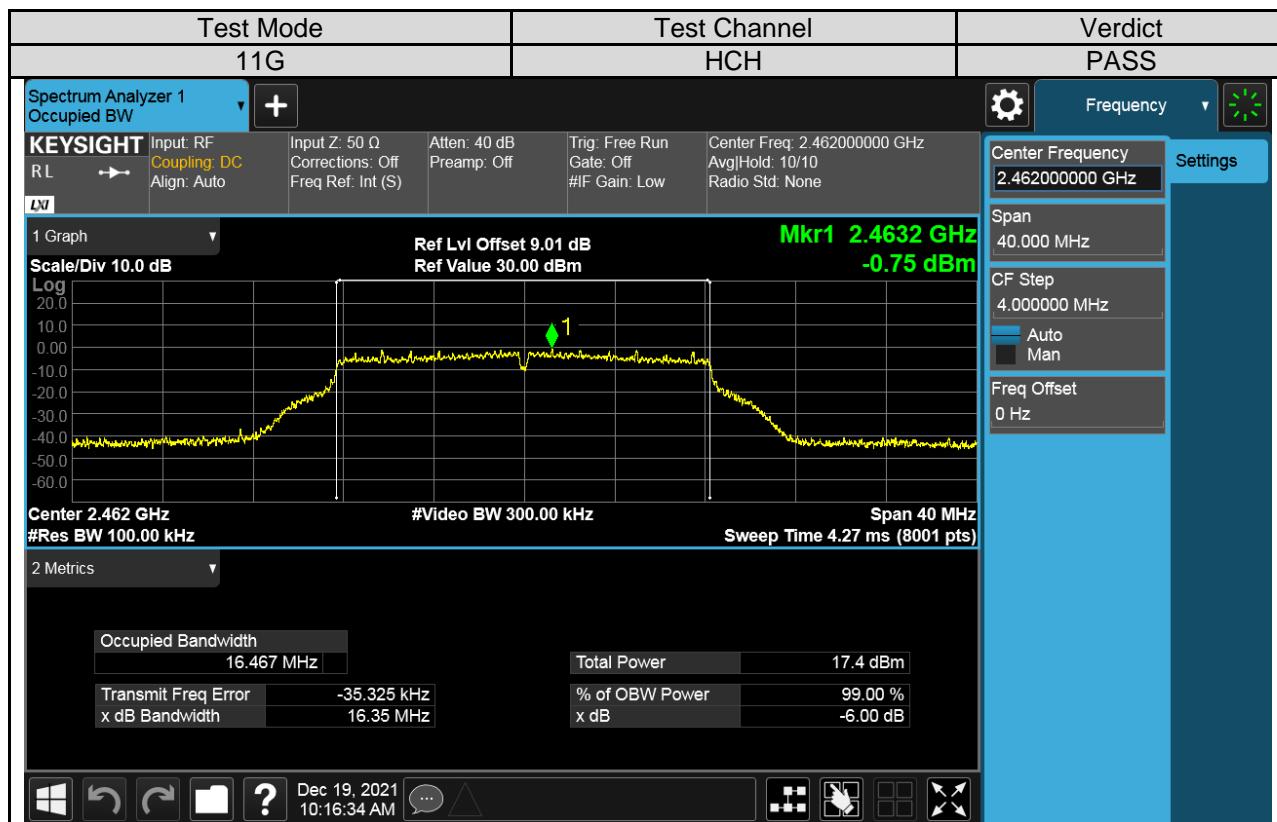
Dec 19, 2021
9:55:11 AM

For Antenna2 part:

| Test Mode | | Test Channel | | Verdict |
|--|--|--|--|--|
| 11B | | LCH | | PASS |
| Spectrum Analyzer 1 Occupied BW | | + | | |
| KEYSIGHT | | Input: RF Coupling: DC Align: Auto | | Input Z: 50 Ω Corrections: Off Freq Ref: Int (S) |
| RL | | Atten: 40 dB Preamp: Off | | Trig: Free Run Gate: Off #IF Gain: Low |
| LN | | Center Freq: 2.412000000 GHz Avg/Hold: 10/10 Radio Std: None | | |
| 1 Graph | | Ref Lvl Offset 9.05 dB Ref Value 30.00 dBm | | Mkr1 2.4125 GHz 10.05 dBm |
| Scale/Div 10.0 dB | | Log | | |
| 20.0 10.0 0.00 -10.0 -20.0 -30.0 -40.0 -50.0 -60.0 | |  | | |
| Center 2.412 GHz #Res BW 100.0 kHz | | #Video BW 300.00 kHz | | Span 40 MHz Sweep Time 4.27 ms (8001 pts) |
| 2 Metrics | | | | |
| Occupied Bandwidth 10.564 MHz | | Total Power 24.5 dBm | | |
| Transmit Freq Error -35.718 kHz | | % of OBW Power 99.00 % | | |
| x dB Bandwidth 7.091 MHz | | x dB -6.00 dB | | |







Test Mode
11N HT20

Test Channel
MCH

Verdict
PASS

Spectrum Analyzer 1
Occupied BW

KEYSIGHT
Input: RF
Coupling: DC
Align: Auto

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

Atten: 40 dB
Preamp: Off

Trig: Free Run
Gate: Off
#IF Gain: Low

Center Freq: 2.437000000 GHz
Avg/Hold: 10/10
Radio Std: None

1 Graph
Scale/Div: 10.0 dB
Log

Ref Lvl Offset: 8.62 dB
Ref Value: 30.00 dBm

Mkr1 2.4382 GHz
-0.72 dBm

Center: 2.437 GHz
#Res BW: 100.00 kHz
#Video BW: 300.00 kHz
Span: 40 MHz
Sweep Time: 4.27 ms (8001 pts)

2 Metrics

| | |
|---------------------|-------------|
| Occupied Bandwidth | 17.660 MHz |
| Transmit Freq Error | -44.714 kHz |
| x dB Bandwidth | 17.58 MHz |
| Total Power | 17.8 dBm |
| % of OBW Power | 99.00 % |
| x dB | -6.00 dB |

Dec 19, 2021
10:21:13 AM

Test Mode
11N HT20

Test Channel
HCH

Verdict
PASS

Spectrum Analyzer 1
Occupied BW

KEYSIGHT Input: RF
Coupling: DC
Align: Auto

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

Atten: 40 dB
Preamp: Off

Trig: Free Run
Gate: Off
#IF Gain: Low

Center Freq: 2.46200000 GHz
Avg/Hold: 10/10
Radio Std: None

1 Graph

Ref Lvl Offset 9.01 dB
Ref Value 30.00 dBm

Mkr1 2.4632 GHz
-1.15 dBm

Scale/Div 10.0 dB

Log

20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0

Center 2.462 GHz
#Res BW 100.00 kHz

#Video BW 300.00 kHz

Span 40 MHz

Sweep Time 4.27 ms (8001 pts)

2 Metrics

Occupied Bandwidth
17.659 MHz

Total Power
17.4 dBm

Transmit Freq Error
-33.862 kHz

% of OBW Power
99.00 %

x dB Bandwidth
17.59 MHz

x dB
-6.00 dB

Dec 19, 2021
10:23:22 AM

Windows Taskbar icons: File, Home, Help, Start, Task View, Taskbar settings, Taskbar icons.

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 |
| 1. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. | | | |
| 2. Limit: Limit=30dBm – (Directional gain -6)dBi=30dBm – (7.23 -6)dBi=28.77 dBm Directional gain = $10\log [(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}] > 6\text{dBi}$, where the NANT is the numbers of antenna. | | | |

TEST PROCEDURE

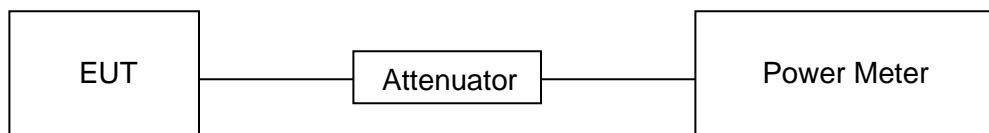
Place the EUT on the table and set it in the transmitting mode.

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

| Test Mode | Test Antenna | Test Channel | Measurement Output Power (AV) | 10log(1/x) Factor | Maximum Conducted Output Power (AV) | Result |
|-----------|--------------|--------------|-------------------------------|-------------------|-------------------------------------|--------|
| | | | dBm | dB | dBm | |
| 11B | Antenna 1 | LCH | 16.65 | N/A(Remark3) | 16.65 | Pass |
| | | MCH | 16.23 | N/A(Remark3) | 16.23 | Pass |
| | | HCH | 16.44 | N/A(Remark3) | 16.44 | Pass |
| | Antenna 2 | LCH | 17.59 | N/A(Remark3) | 17.59 | Pass |
| | | MCH | 16.83 | N/A(Remark3) | 16.83 | Pass |
| | | HCH | 16.76 | N/A(Remark3) | 16.76 | Pass |
| 11G | Antenna 1 | LCH | 10.80 | 0.33 | 11.13 | Pass |
| | | MCH | 10.18 | 0.33 | 10.51 | Pass |
| | | HCH | 10.29 | 0.33 | 10.62 | Pass |
| | Antenna 2 | LCH | 11.82 | 0.33 | 12.15 | Pass |
| | | MCH | 11.03 | 0.33 | 11.36 | Pass |
| | | HCH | 10.76 | 0.33 | 11.09 | Pass |
| 11N20MIMO | Antenna 1 | LCH | 10.53 | 0.34 | 10.87 | Pass |
| | | MCH | 10.00 | 0.34 | 10.34 | Pass |
| | | HCH | 10.14 | 0.34 | 10.48 | Pass |
| | Antenna 2 | LCH | 11.64 | 0.34 | 11.98 | Pass |
| | | MCH | 11.01 | 0.34 | 11.35 | Pass |
| | | HCH | 10.60 | 0.34 | 10.94 | Pass |
| | Antenna 1+2 | LCH | 14.13 | 0.34 | 14.47 | Pass |
| | | MCH | 13.54 | 0.34 | 13.88 | Pass |
| | | HCH | 13.39 | 0.34 | 13.73 | 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 duty cycle is higher than 98% and according to KDB 558074, it is not required to be adjusted with duty factor for output power

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 |
| 1. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. | | | |
| 2. Limit: Limit=8dBm – (Directional gain -6)dBi=8dBm – (7.23 -6)dBi=6.77 dBm Directional gain = $10\log [(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}] > 6\text{dBi}$, where the NANT is the numbers of antenna. | | | |

TEST PROCEDURE

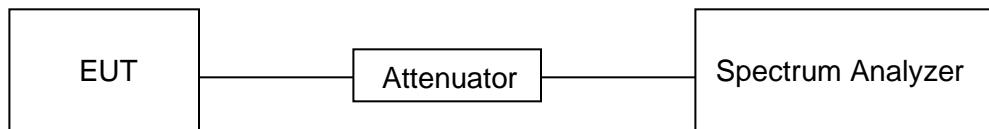
Refer to FCC KDB 558074, connect the UUT to the spectrum analyser and use the following settings:

| | |
|------------------|--|
| 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

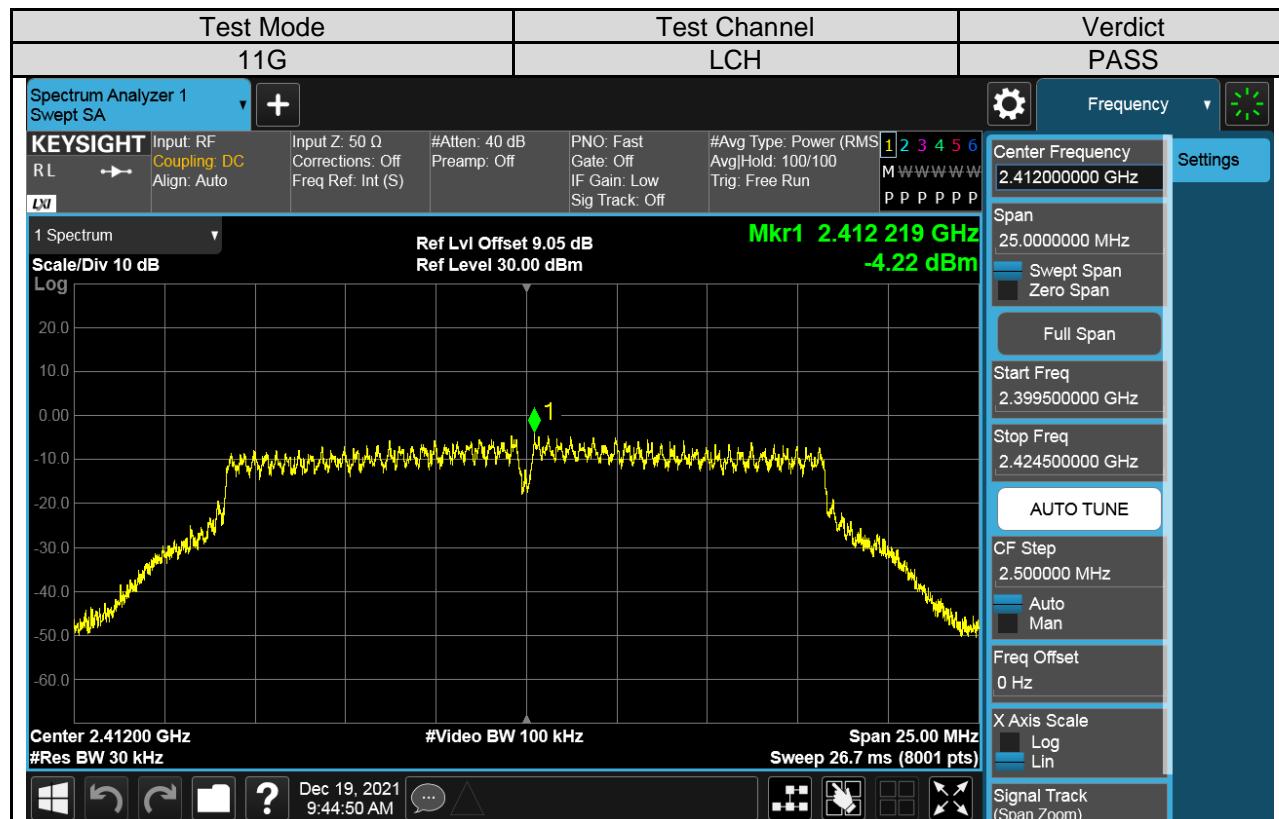


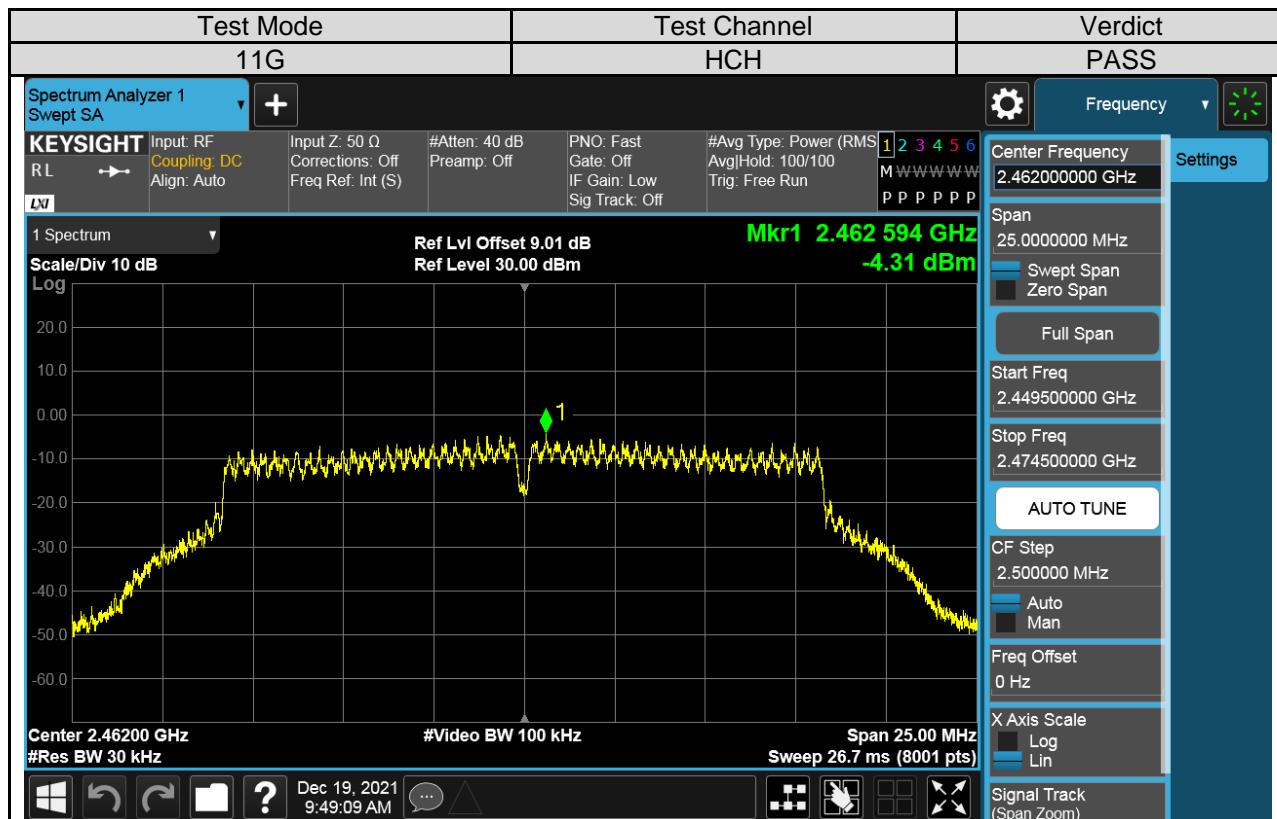
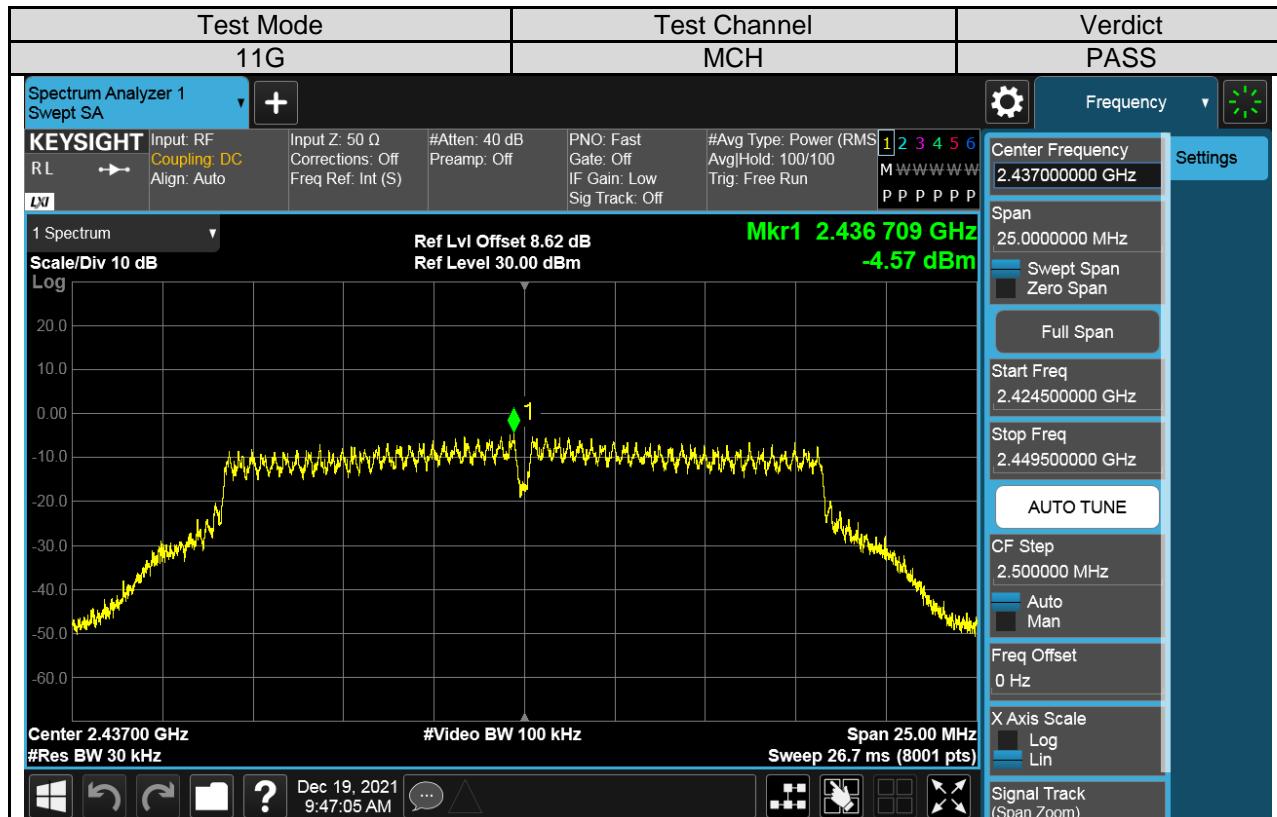
RESULTS

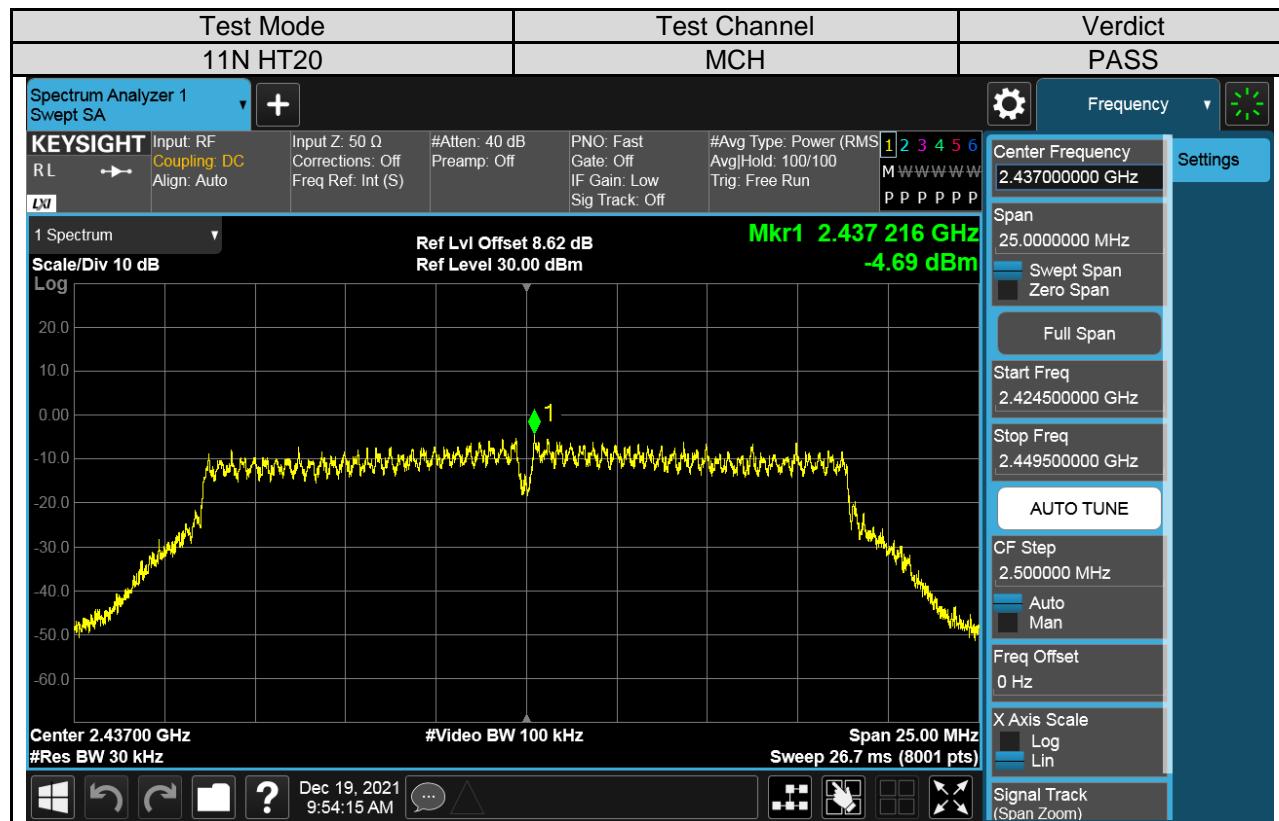
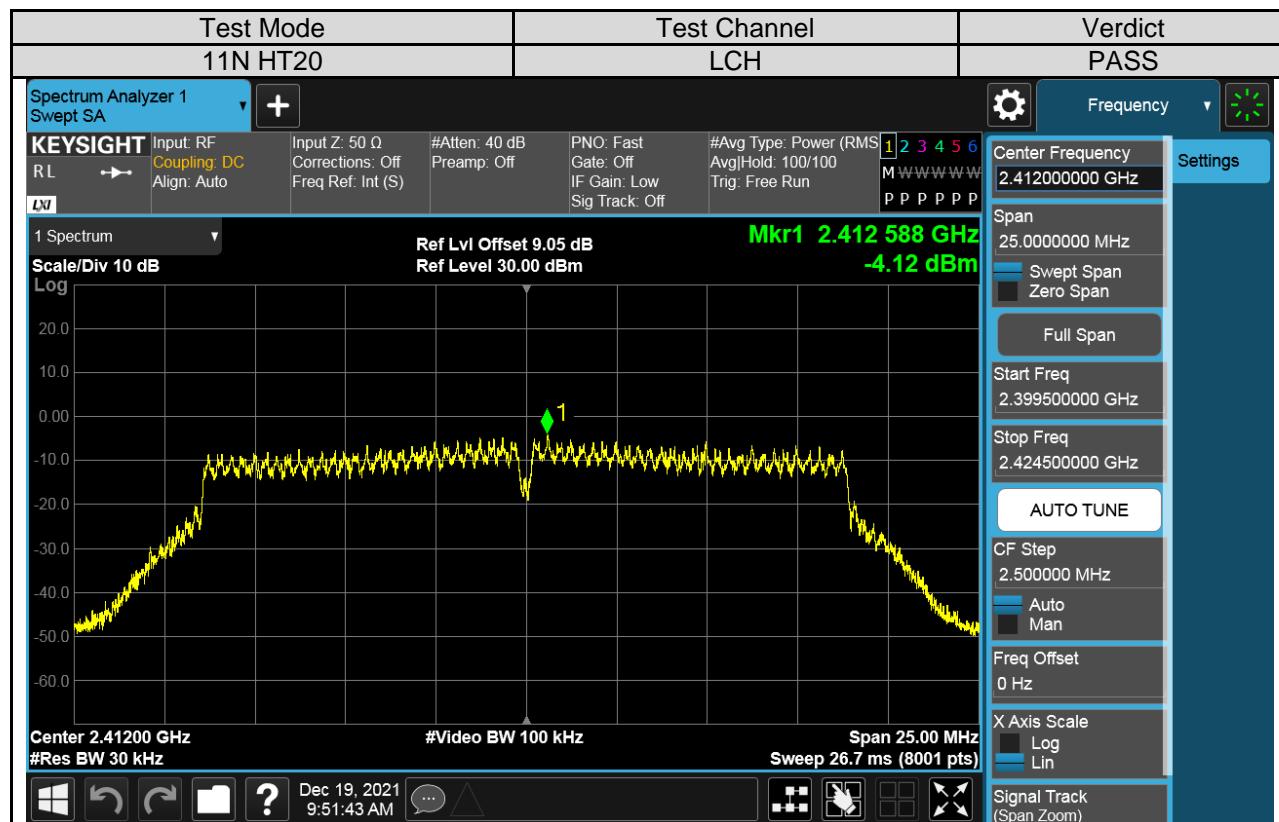
| Test Mode | Test Antenna | Test Channel | Maximum Peak power spectral density | Result |
|------------------|---------------------|---------------------|--|---------------|
| | | | dBm/10kHz | |
| 11B | Antenna 1 | LCH | 4.69 | Pass |
| | | MCH | 4.92 | Pass |
| | | HCH | 4.86 | Pass |
| | Antenna 2 | LCH | 6.98 | Pass |
| | | MCH | 5.54 | Pass |
| | | HCH | 5.14 | Pass |
| 11G | Antenna 1 | LCH | -4.22 | Pass |
| | | MCH | -4.57 | Pass |
| | | HCH | -4.31 | Pass |
| | Antenna 2 | LCH | -3.20 | Pass |
| | | MCH | -3.74 | Pass |
| | | HCH | -4.64 | Pass |
| 11N20MIMO | Antenna 1 | LCH | -4.12 | Pass |
| | | MCH | -4.69 | Pass |
| | | HCH | -5.05 | Pass |
| | Antenna 2 | LCH | -2.95 | Pass |
| | | MCH | -4.23 | Pass |
| | | HCH | -4.45 | Pass |
| | Antenna 1+2 | LCH | -0.49 | Pass |
| | | MCH | -1.44 | Pass |
| | | HCH | -1.73 | Pass |

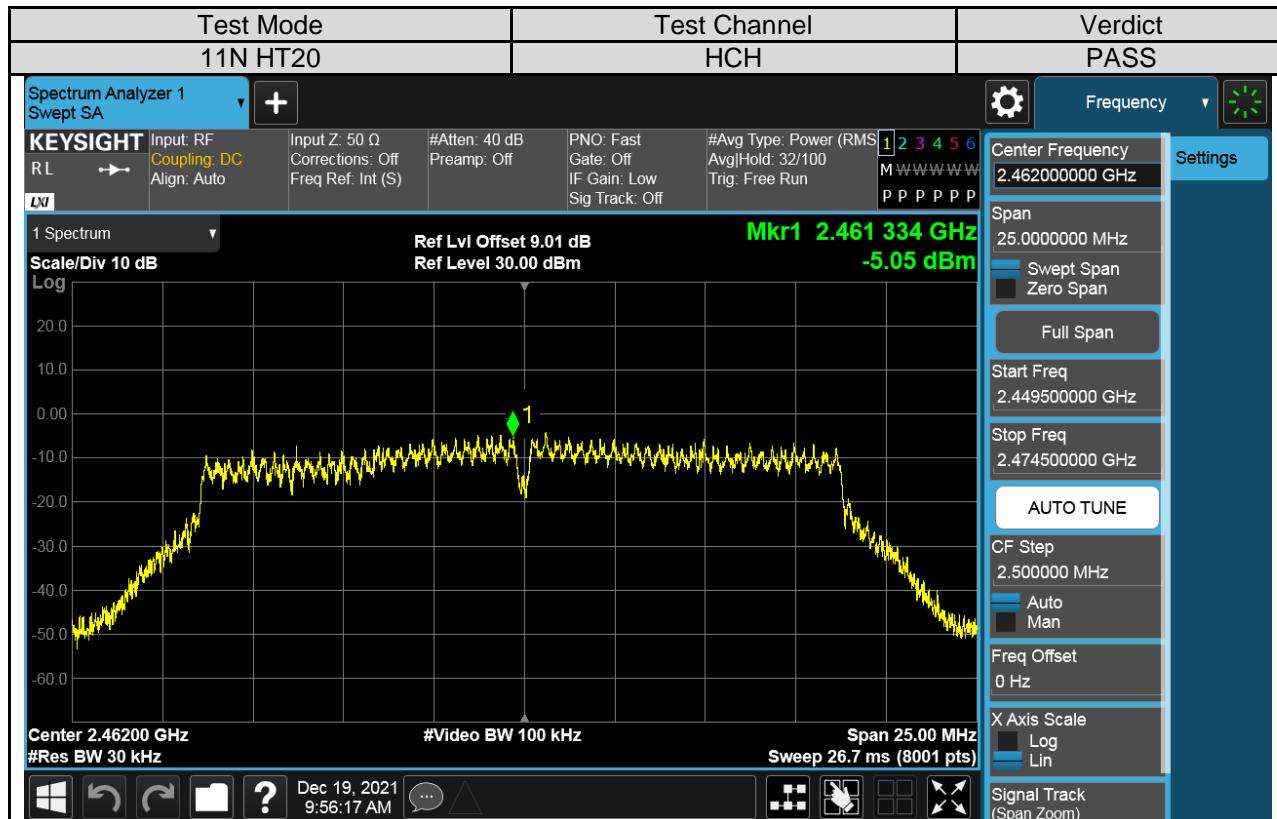
Test Graphs-Antenna 1 Part:









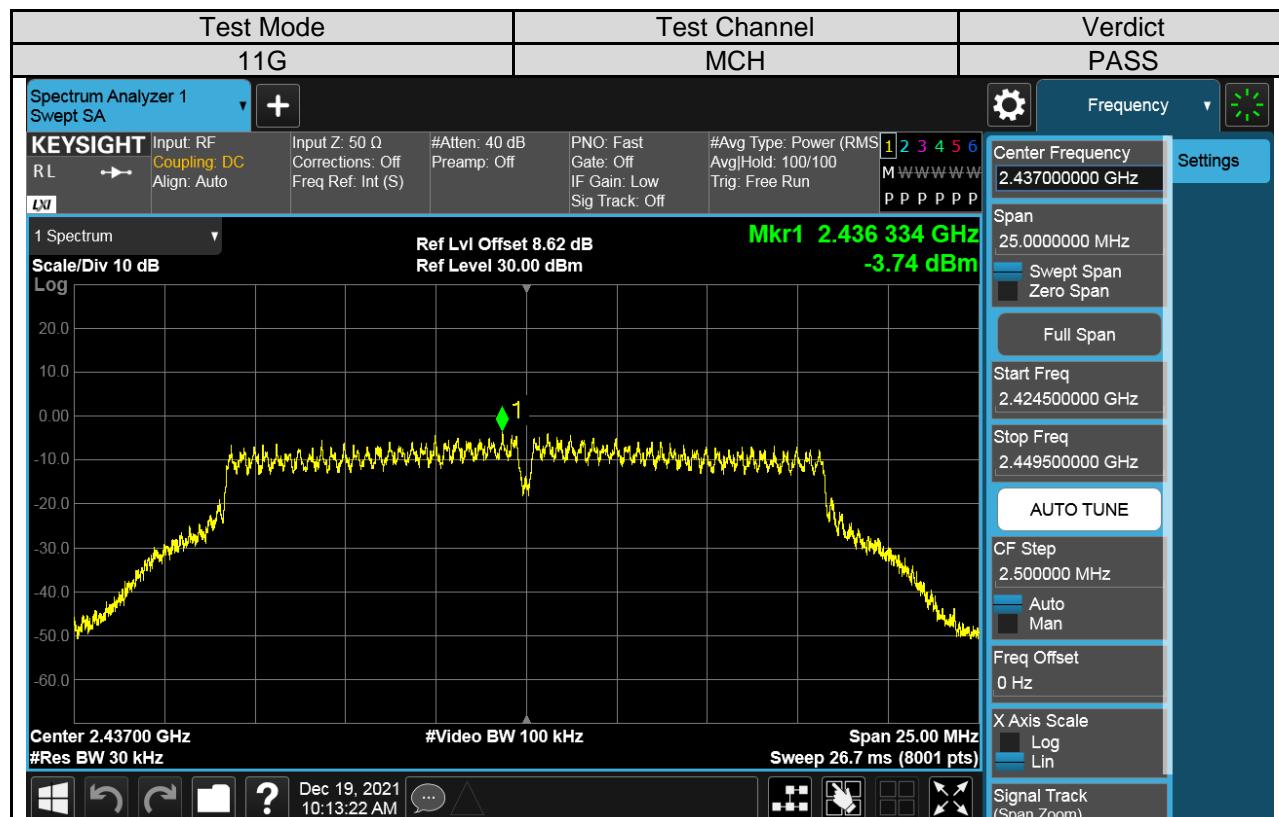
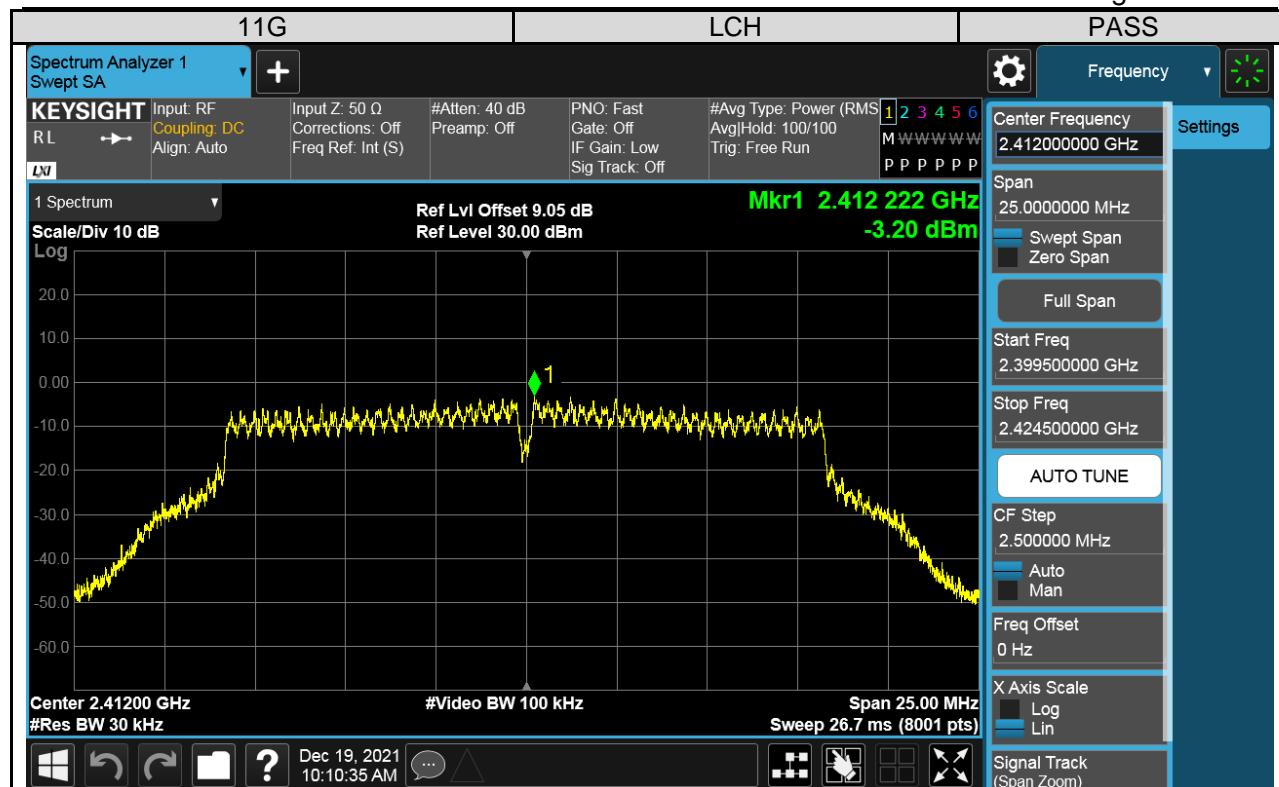


Test Graphs-Antenna 2 Part:

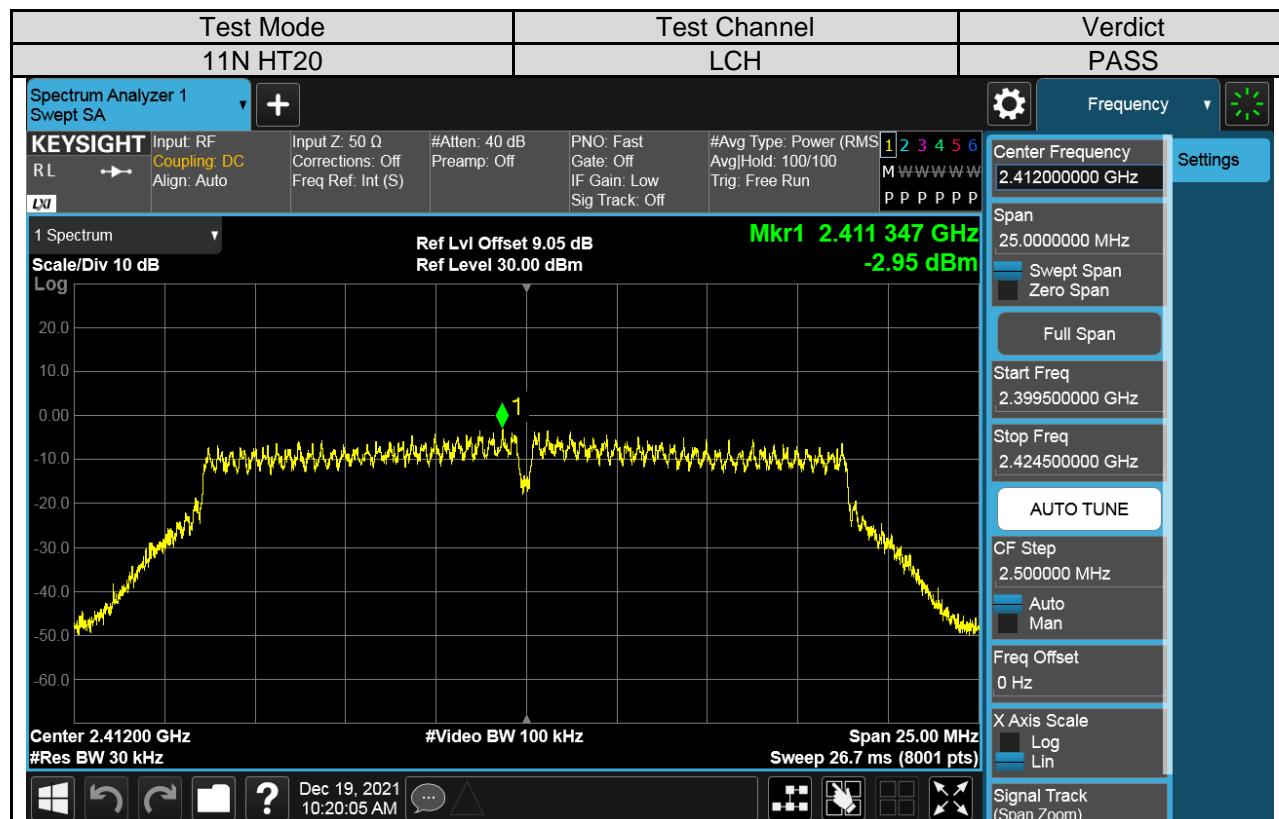
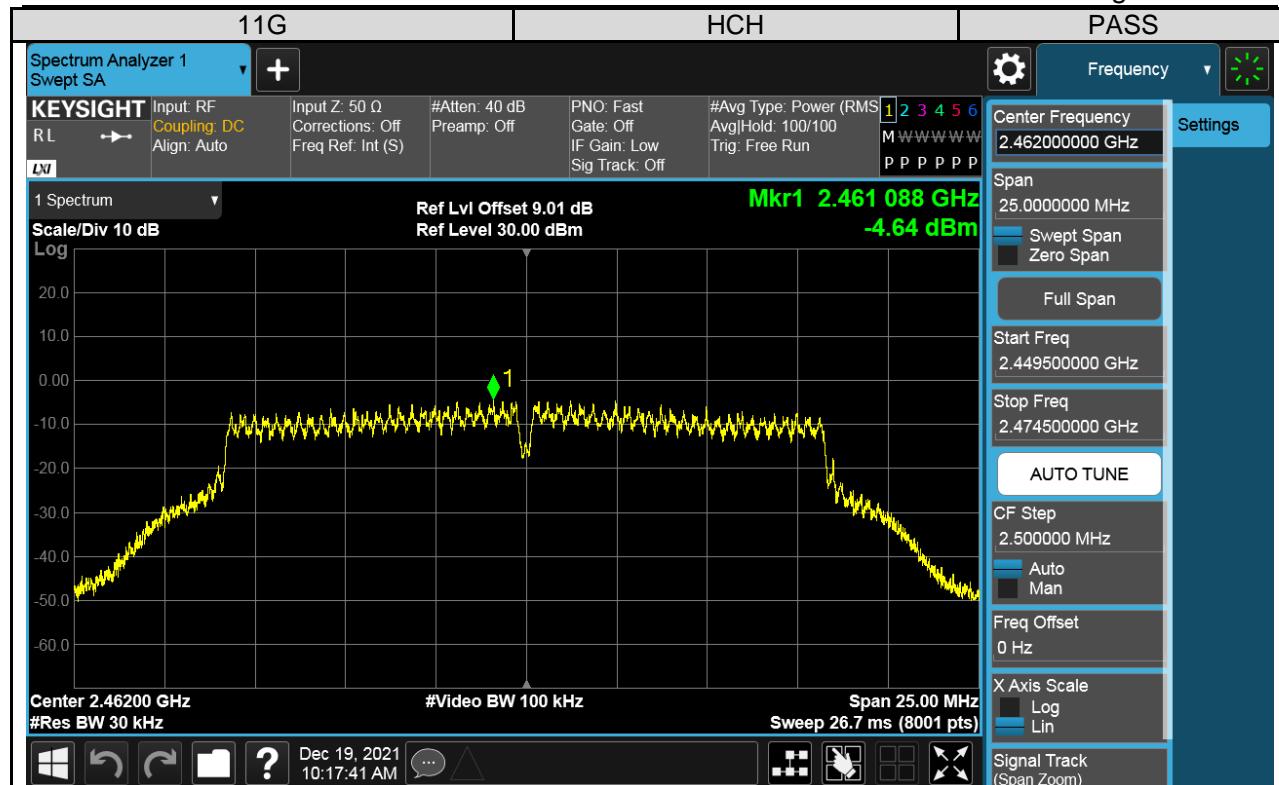




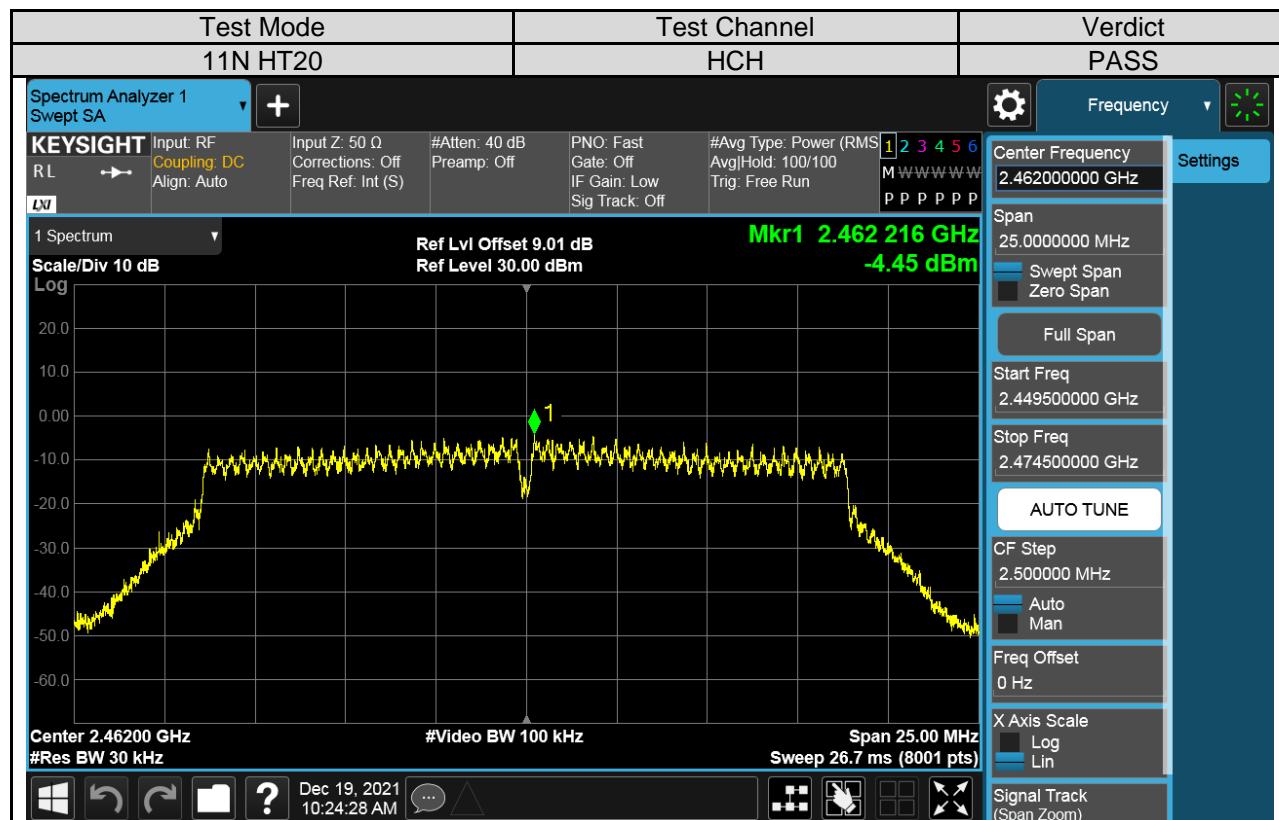
| Test Mode | Test Channel | Verdict |
|-----------|--------------|---------|
|-----------|--------------|---------|



| Test Mode | Test Channel | Verdict |
|-----------|--------------|---------|
|-----------|--------------|---------|



| Test Mode | Test Channel | Verdict |
|-----------|--------------|---------|
|-----------|--------------|---------|



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. |

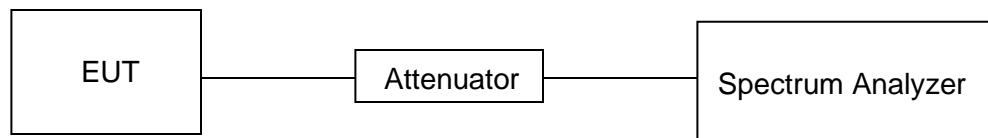
settings:

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



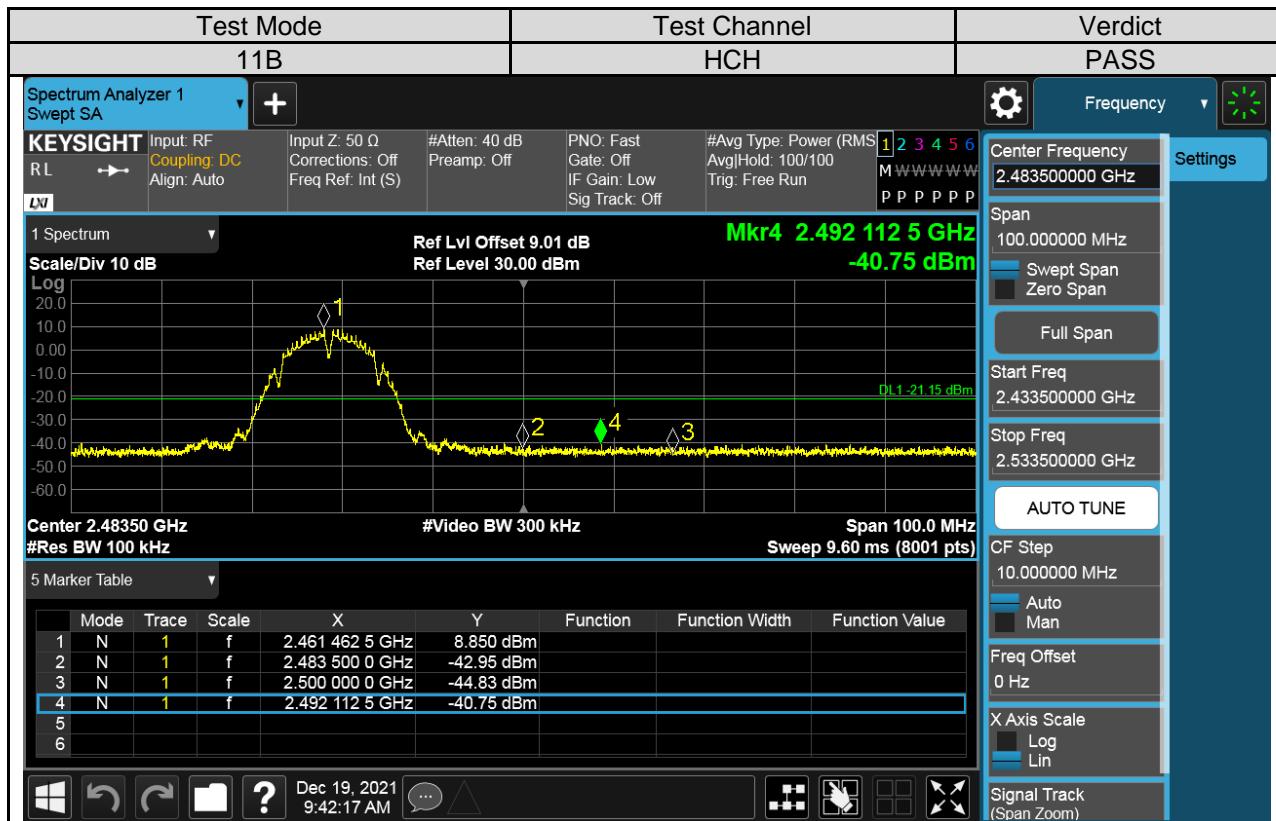
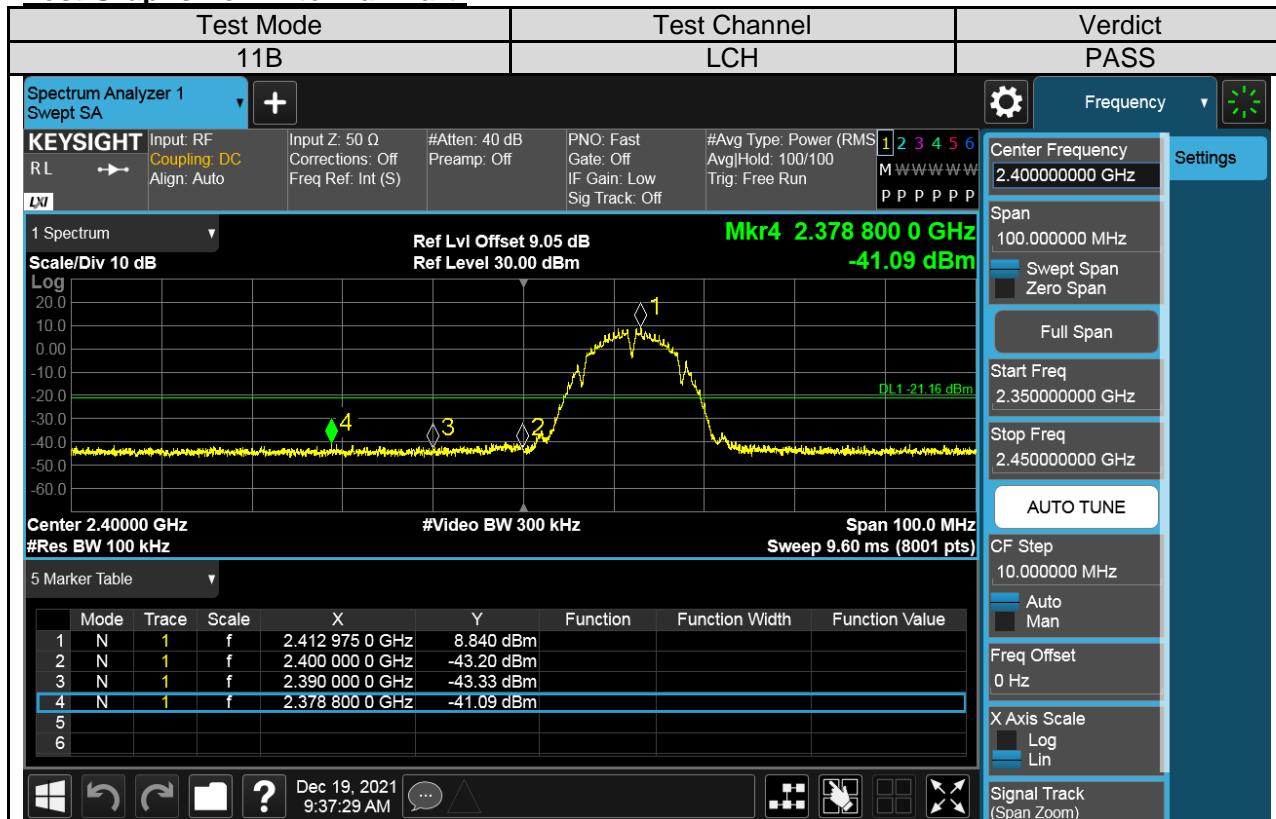
Part I :Conducted Bandedge**RESULTS TABLE**

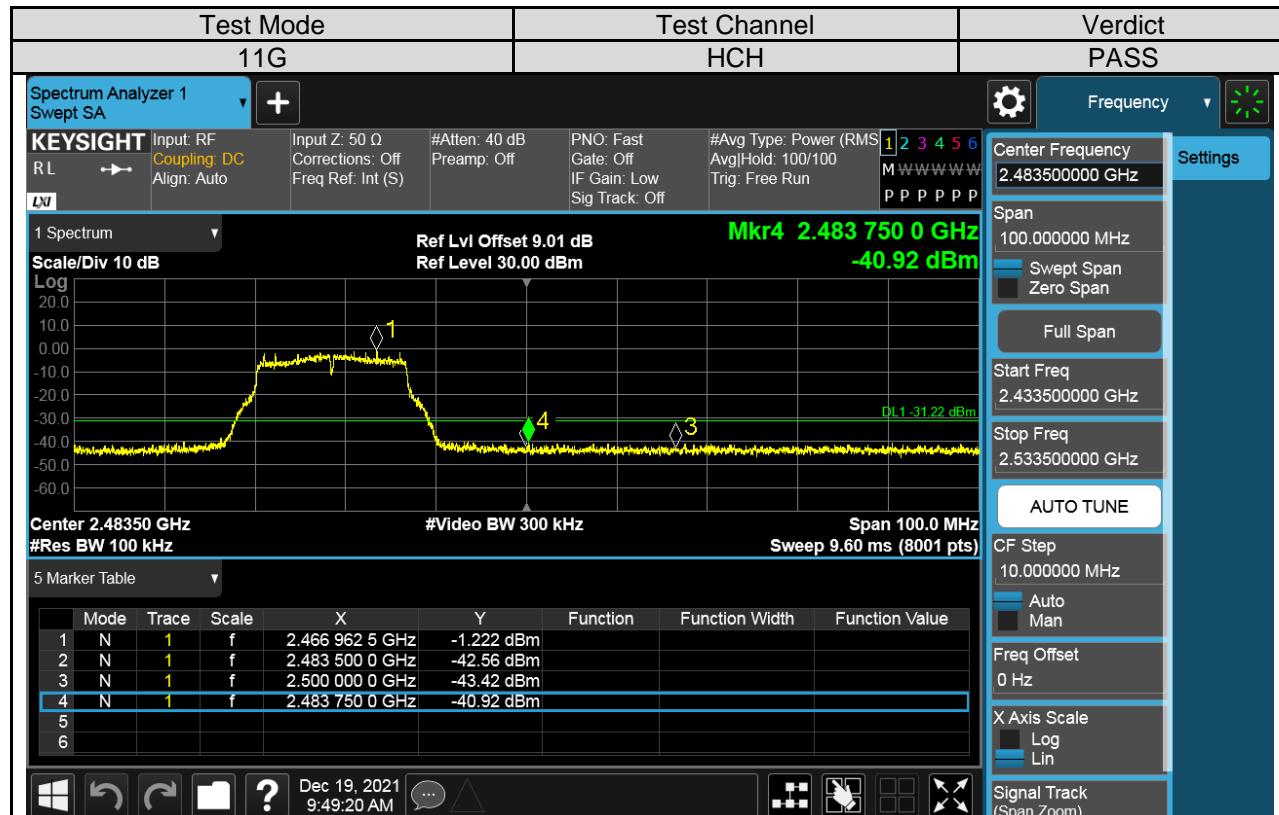
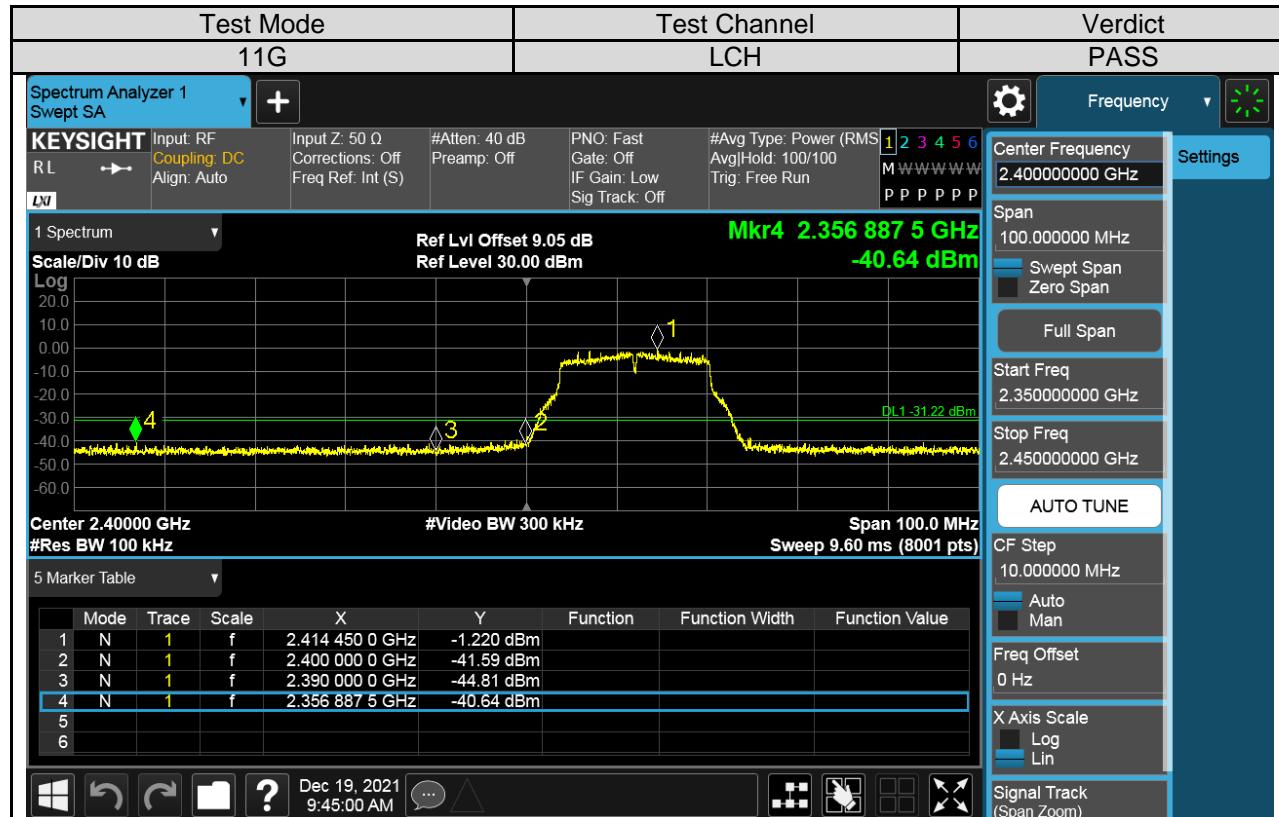
| Test Mode | Test Antenna | Test Channel | Test Result | Verdict |
|-----------|--------------|--------------|---------------------|---------|
| 11B | Antenna 1 | LCH | See the test graphs | PASS |
| | | HCH | See the test graphs | PASS |
| 11G | Antenna 1 | LCH | See the test graphs | PASS |
| | | 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 |

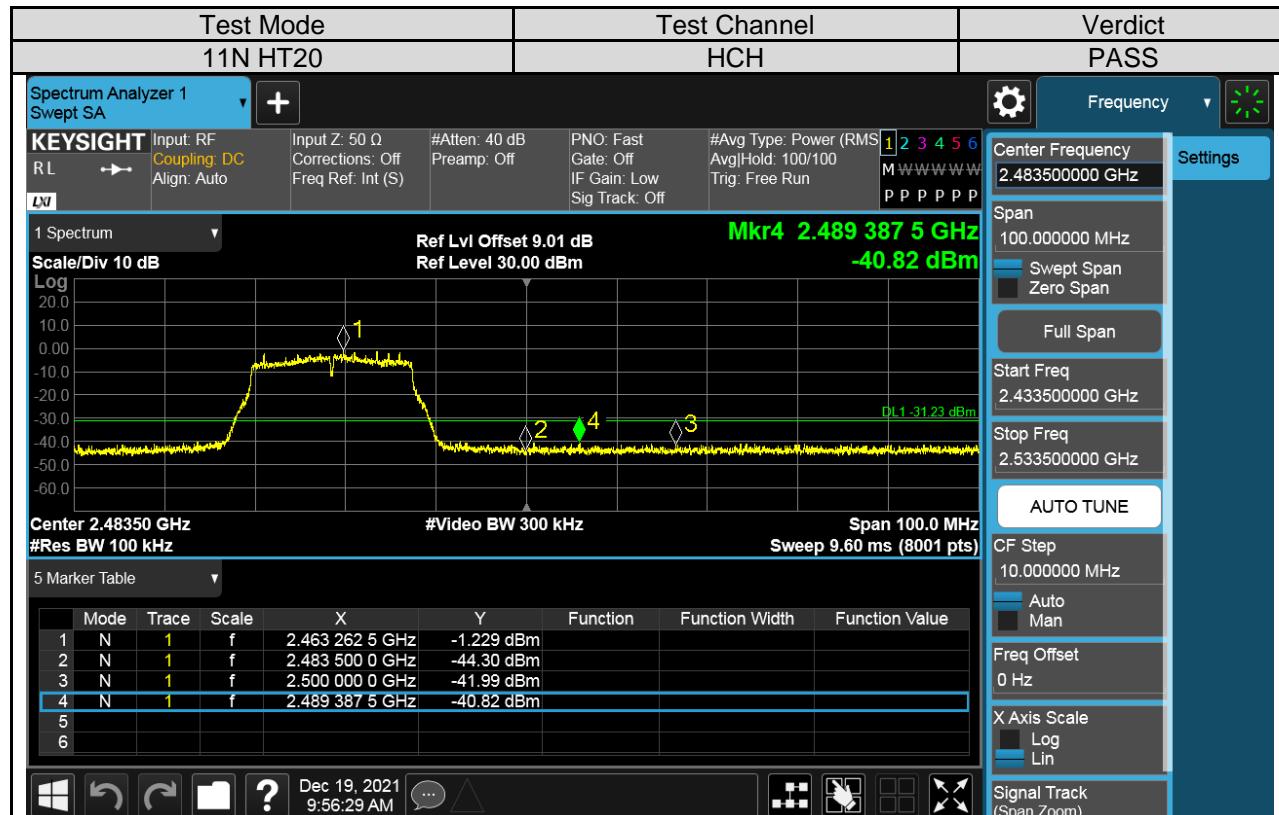
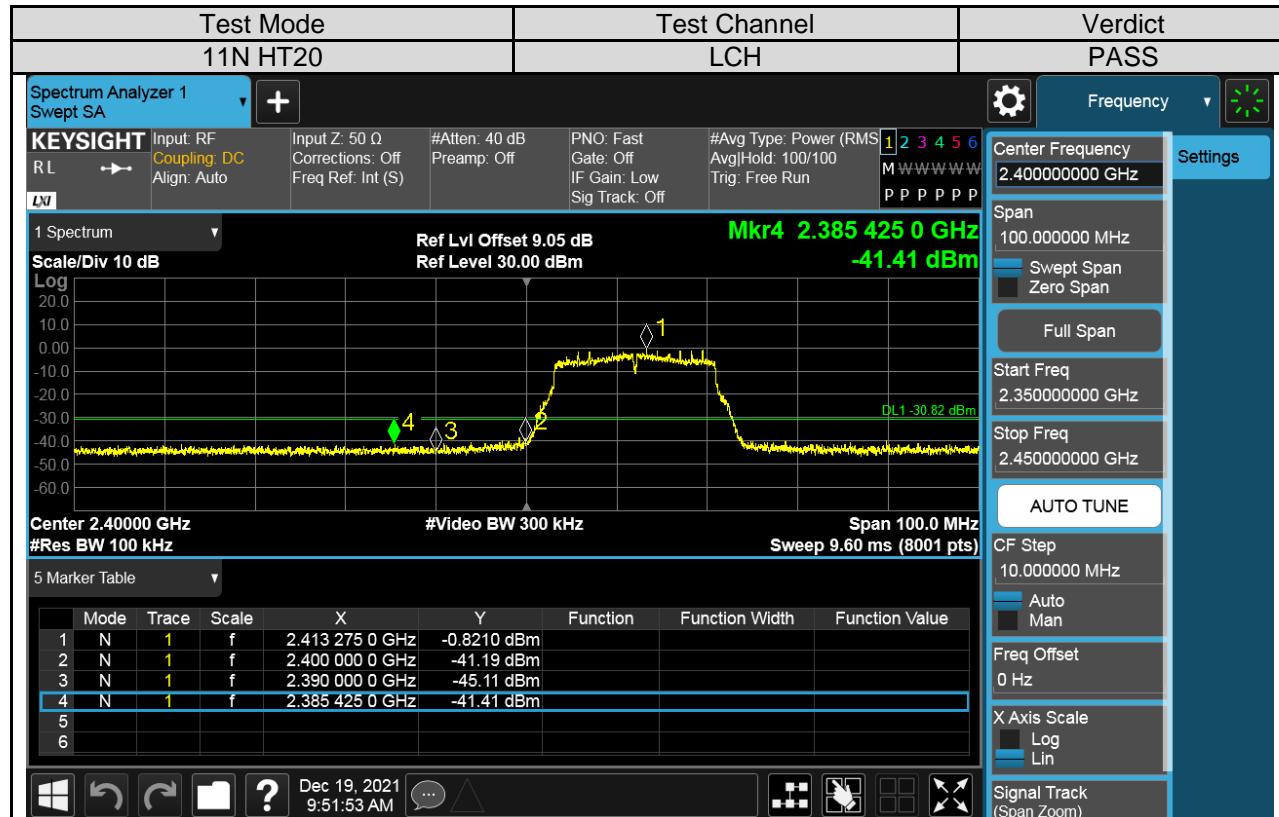
Remark:

- 1) For this product, it has two antennas, antenna1 and antenna2, but only the 802.11N HT20 mode can support both the SISO and MIMO technical.
- 2) Through pre-testing all the test modes of 11N HT20, including SISO and MIMO, but only the data of worse case is included in this test report.

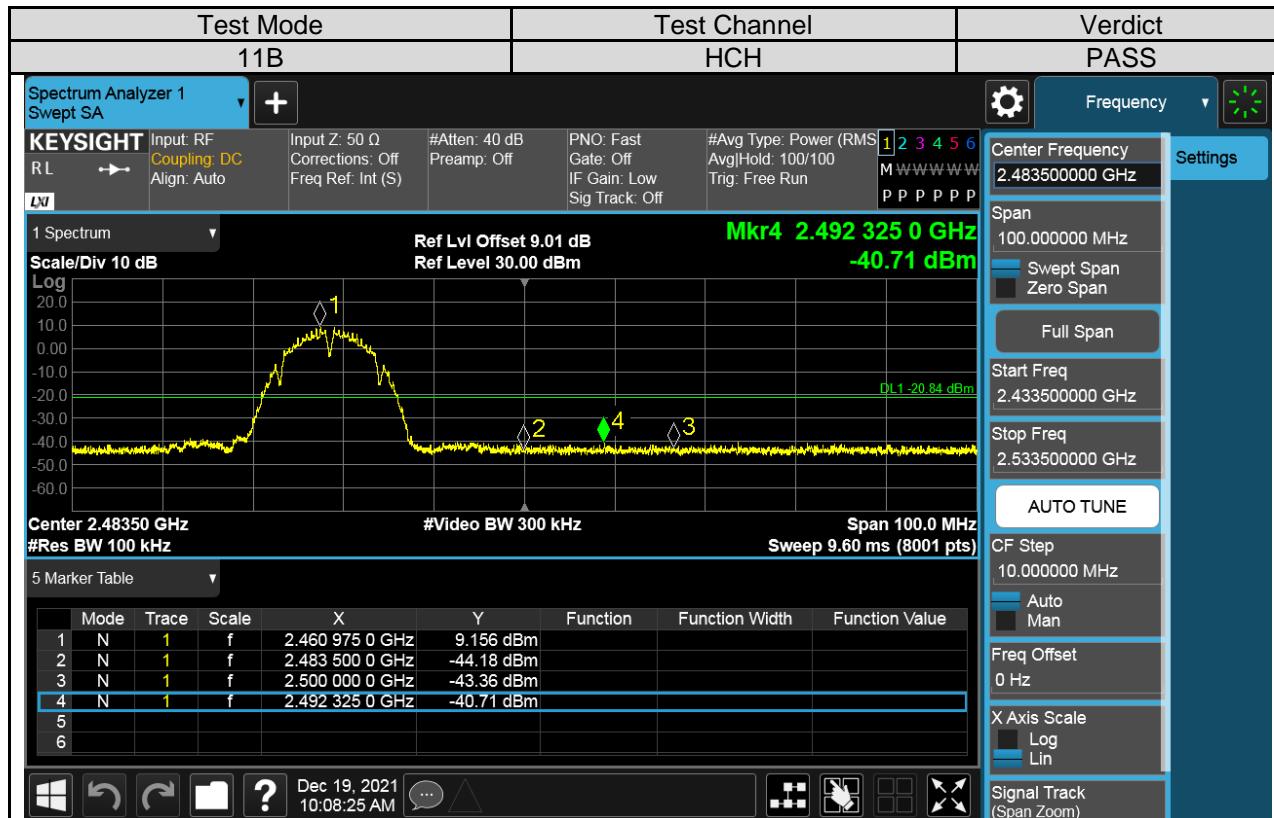
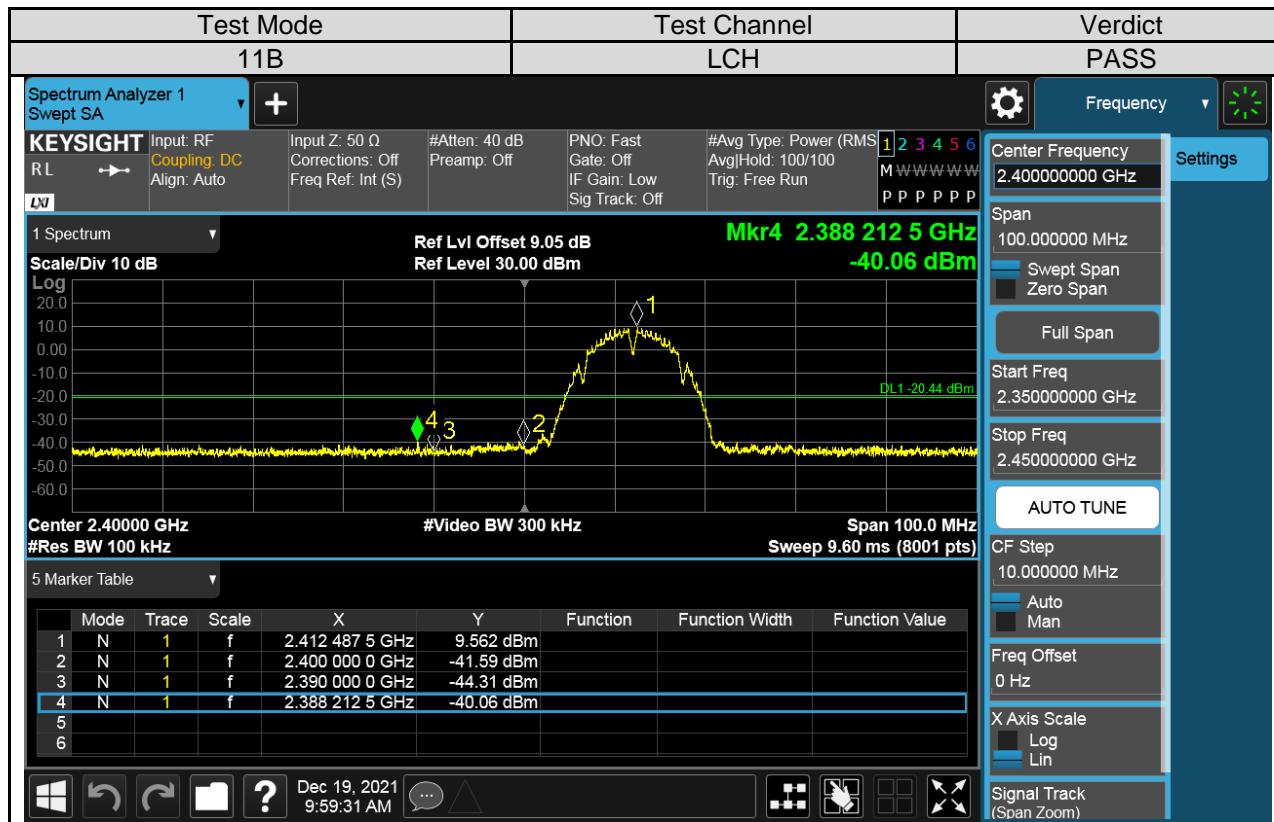
Test Graphs For Antenna1 Part:







Test Graphs For Antenna2 Part:



Test Mode
11G

Test Channel
LCH

Verdict
PASS

Spectrum Analyzer 1
Swept SA

KEYSIGHT Input: RF
R L Coupling: DC
Align: Auto

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

#Atten: 40 dB
Preamp: Off

PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off

#Avg Type: Power (RMS)
Avg|Hold: 100/100
Trig: Free Run

M W W W W W
P P P P P P P

1 Spectrum
Scale/Div 10 dB
Log

Ref Lvl Offset 9.05 dB
Ref Level 30.00 dBm

Mkr4 2.373 662 5 GHz
-40.88 dBm

DL1 -30.40 dBm

Center 2.40000 GHz #Video BW 300 kHz #Res BW 100 kHz

Span 100.0 MHz Sweep 9.60 ms (8001 pts)

5 Marker Table

| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|------|-------|-------|-----------------|-------------|----------|----------------|----------------|
| 1 | N | 1 | f | 2.412 225 0 GHz | -0.4041 dBm | | | |
| 2 | N | 1 | f | 2.400 000 0 GHz | -40.94 dBm | | | |
| 3 | N | 1 | f | 2.390 000 0 GHz | -45.27 dBm | | | |
| 4 | N | 1 | f | 2.373 662 5 GHz | -40.88 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |

Dec 19, 2021 10:10:46 AM

Frequency 2.400000000 GHz

Span 100.000000 MHz

Swept Span

Zero Span

Full Span

Start Freq 2.350000000 GHz

Stop Freq 2.450000000 GHz

AUTO TUNE

CF Step 10.000000 MHz

Auto

Man

Freq Offset 0 Hz

X Axis Scale Log

Lin

Signal Track (Span Zoom)

Test Mode
11N HT20

Test Channel
LCH

Verdict
PASS

Spectrum Analyzer 1
Swept SA

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

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

#Atten: 40 dB
Preamp: Off

PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off

#Avg Type: Power (RMS)
Avg|Hold: 100/100
Trig: Free Run

M W W W W W
P P P P P P P

Frequency
Center Frequency: 2.4000000 GHz

Settings

Span: 100.000000 MHz
Swept Span
Zero Span

Full Span

Start Freq: 2.35000000 GHz

Stop Freq: 2.45000000 GHz

AUTO TUNE

CF Step: 10.000000 MHz
Auto
Man

Freq Offset: 0 Hz

X Axis Scale: Log
Lin

Signal Track (Span Zoom)

1 Spectrum
Scale/Div 10 dB

Log

Ref Lvl Offset 9.05 dB
Ref Level 30.00 dBm

Mkr4 2.380 100 0 GHz
-40.65 dBm

DL1 -30.19 dBm

Center 2.40000 GHz
#Video BW 300 kHz
#Res BW 100 kHz

Span 100.0 MHz
Sweep 9.60 ms (8001 pts)

5 Marker Table

| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|------|-------|-------|-----------------|-------------|----------|----------------|----------------|
| 1 | N | 1 | f | 2.414 462 5 GHz | -0.1865 dBm | | | |
| 2 | N | 1 | f | 2.400 000 0 GHz | -41.62 dBm | | | |
| 3 | N | 1 | f | 2.390 000 0 GHz | -43.73 dBm | | | |
| 4 | N | 1 | f | 2.380 100 0 GHz | -40.65 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |

Dec 19, 2021
10:20:17 AM

Test Mode
11N HT20

Test Channel
HCH

Verdict
PASS

Spectrum Analyzer 1
Swept SA

KEYSIGHT Input: RF
Coupling: DC
Align: Auto

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

#Atten: 40 dB
Preamp: Off

PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off

#Avg Type: Power (RMS)

1 2 3 4 5 6
M W W W W W
P P P P P P

1 Spectrum
Scale/Div 10 dB
Log

Ref Lvl Offset 9.01 dB
Ref Level 30.00 dBm

Mkr4 2.498 175 0 GHz
-40.41 dBm

1 2 3 4

DL1 -31.22 dBm

Center 2.48350 GHz #Video BW 300 kHz Span 100.0 MHz
#Res BW 100 kHz Sweep 9.60 ms (8001 pts)

5 Marker Table

| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|------|-------|-------|-----------------|------------|----------|----------------|----------------|
| 1 | N | 1 | f | 2.464 475 0 GHz | -1.215 dBm | | | |
| 2 | N | 1 | f | 2.483 500 0 GHz | -43.41 dBm | | | |
| 3 | N | 1 | f | 2.500 000 0 GHz | -44.53 dBm | | | |
| 4 | N | 1 | f | 2.498 175 0 GHz | -40.41 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |

Dec 19, 2021 10:24:38 AM

Frequency
2.48350000 GHz

Settings

Span
100.000000 MHz

Swept Span

Zero Span

Full Span

Start Freq
2.43350000 GHz

Stop Freq
2.53350000 GHz

AUTO TUNE

CF Step
10.000000 MHz

Auto

Man

Freq Offset
0 Hz

X Axis Scale
Log

Signal Track
(Span Zoom)

Part II :Conducted Emission

Test Result Table

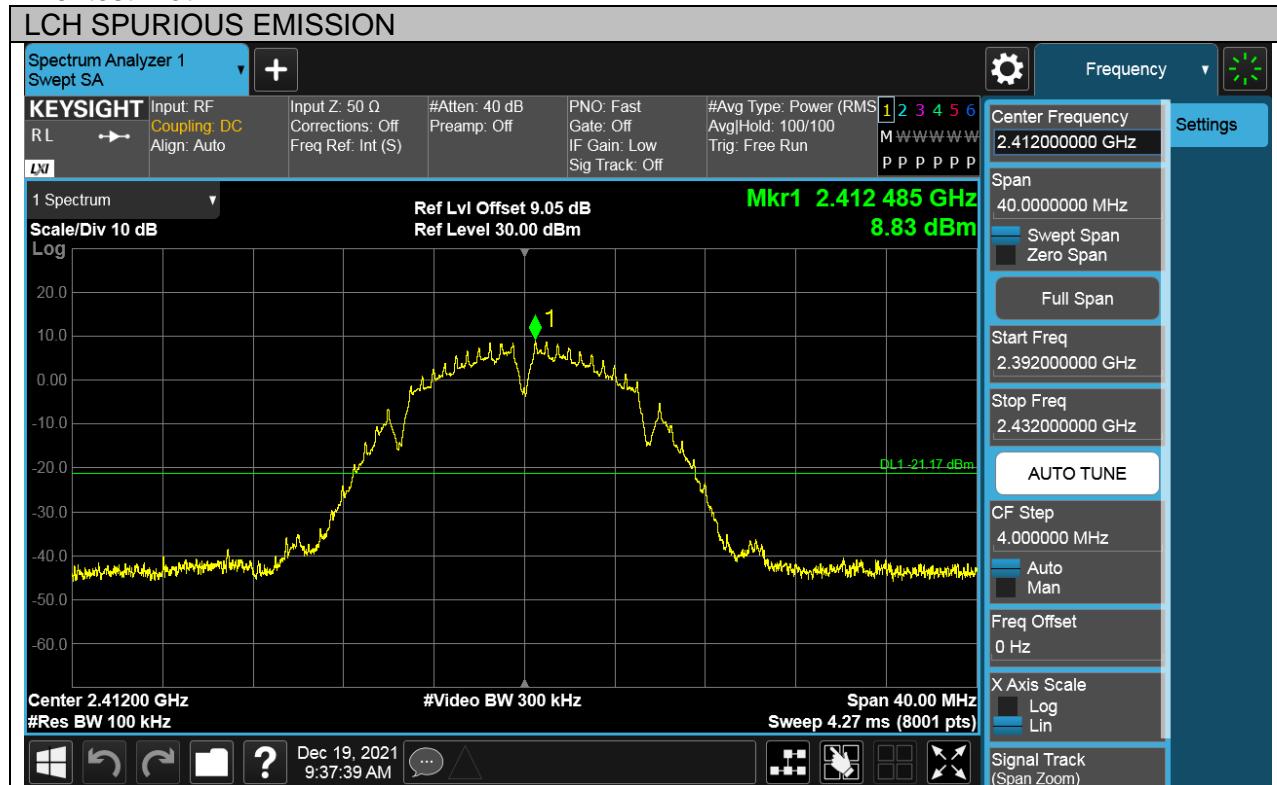
| Test Mode | Test Antenna | Channel | Pref(dBm) | Puw(dBm) | Verdict |
|------------|--------------|---------|---------------------|----------|---------|
| 11B | Antenna 1 | LCH | See the test graphs | <Limit | PASS |
| | | MCH | See the test graphs | <Limit | PASS |
| | | HCH | See the test graphs | <Limit | PASS |
| 11G | Antenna 1 | LCH | See the test graphs | <Limit | PASS |
| | | MCH | See the test graphs | <Limit | PASS |
| | | HCH | See the test graphs | <Limit | PASS |
| 11N20 MIMO | Antenna 1 | LCH | See the test graphs | <Limit | PASS |
| | | MCH | See the test graphs | <Limit | PASS |
| | | HCH | See the test graphs | <Limit | PASS |
| | Antenna 2 | LCH | See the test graphs | <Limit | PASS |
| | | MCH | See the test graphs | <Limit | PASS |
| | | HCH | See the test graphs | <Limit | PASS |
| 11N40 MIMO | Antenna 1 | LCH | See the test graphs | <Limit | PASS |
| | | MCH | See the test graphs | <Limit | PASS |
| | | HCH | See the test graphs | <Limit | PASS |
| | Antenna 2 | LCH | See the test graphs | <Limit | PASS |
| | | MCH | See the test graphs | <Limit | PASS |
| | | HCH | See the test graphs | <Limit | PASS |

Remark:

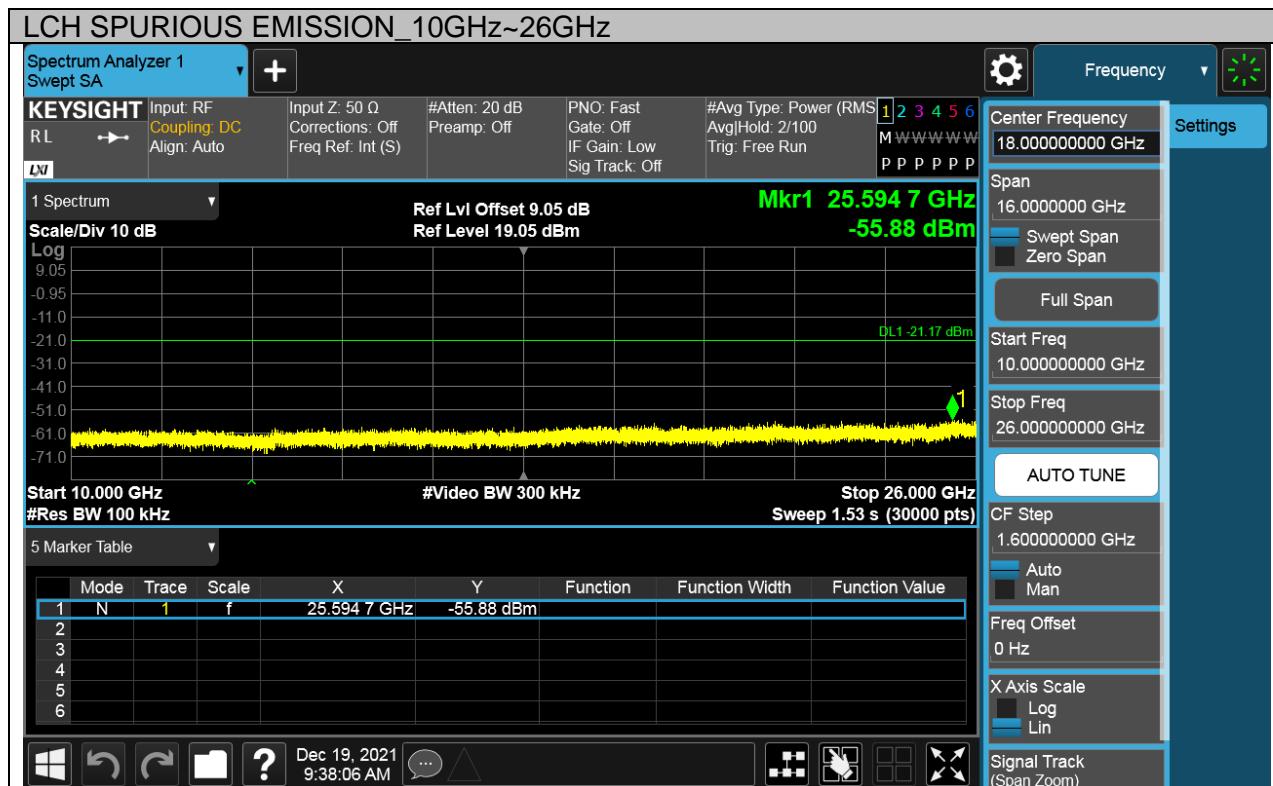
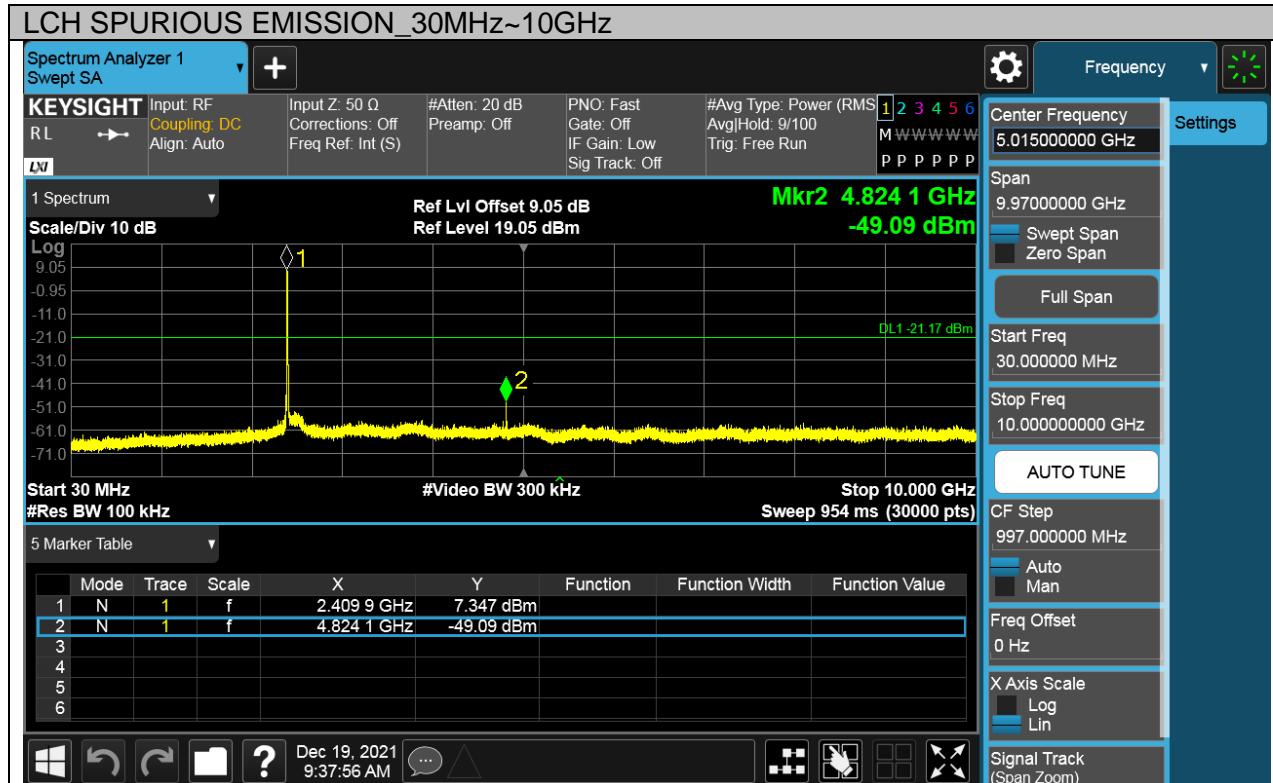
- 1) For this product, it has two antennas, antenna1 and antenna2, but only the 802.11N HT20 mode can support both the SISO and MIMO technical.
- 2) Through pre-testing all the test modes of 11N HT20, including SISO and MIMO, but only the data of worse case is included in this test report.

Test Plots
For Antenna 1 Part:

| Test Mode | Channel | Verdict |
|-----------|---------|---------|
| 11B | LCH | PASS |

Pref test Plot


Puw test Plot

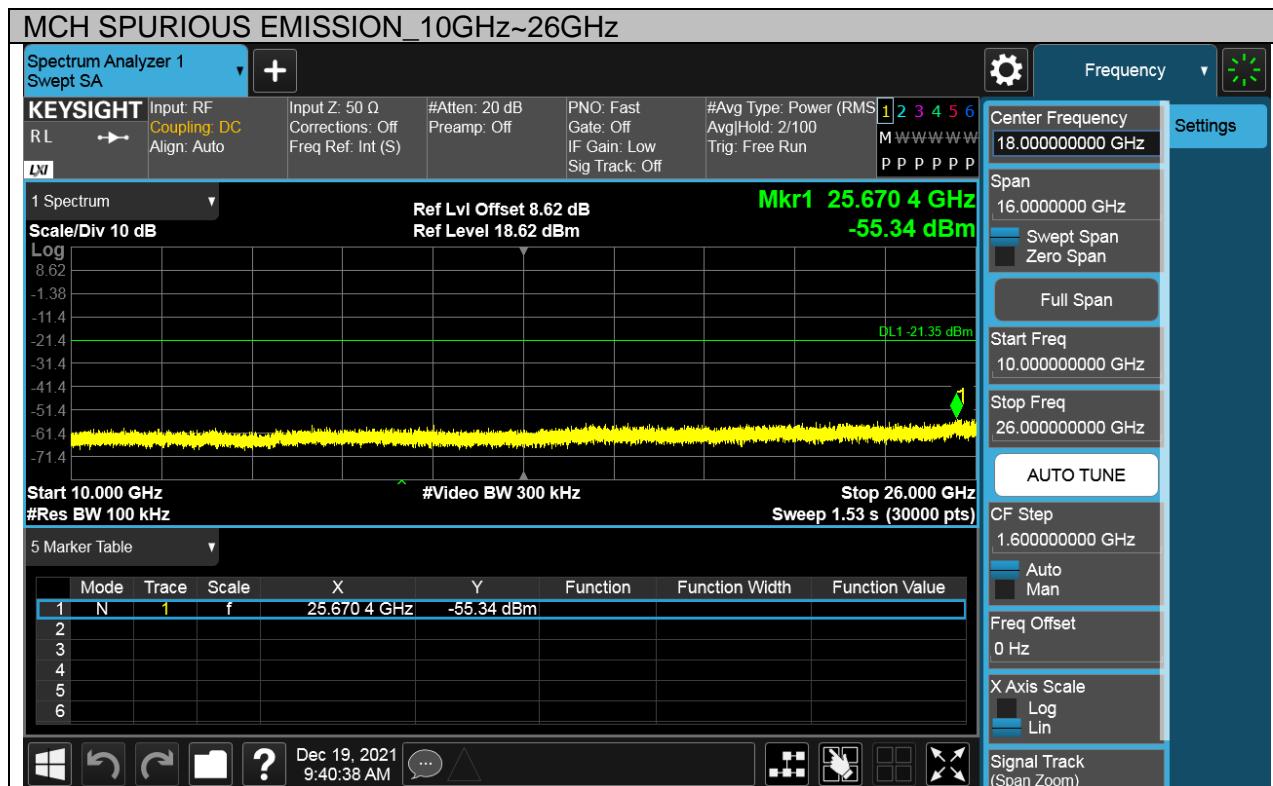
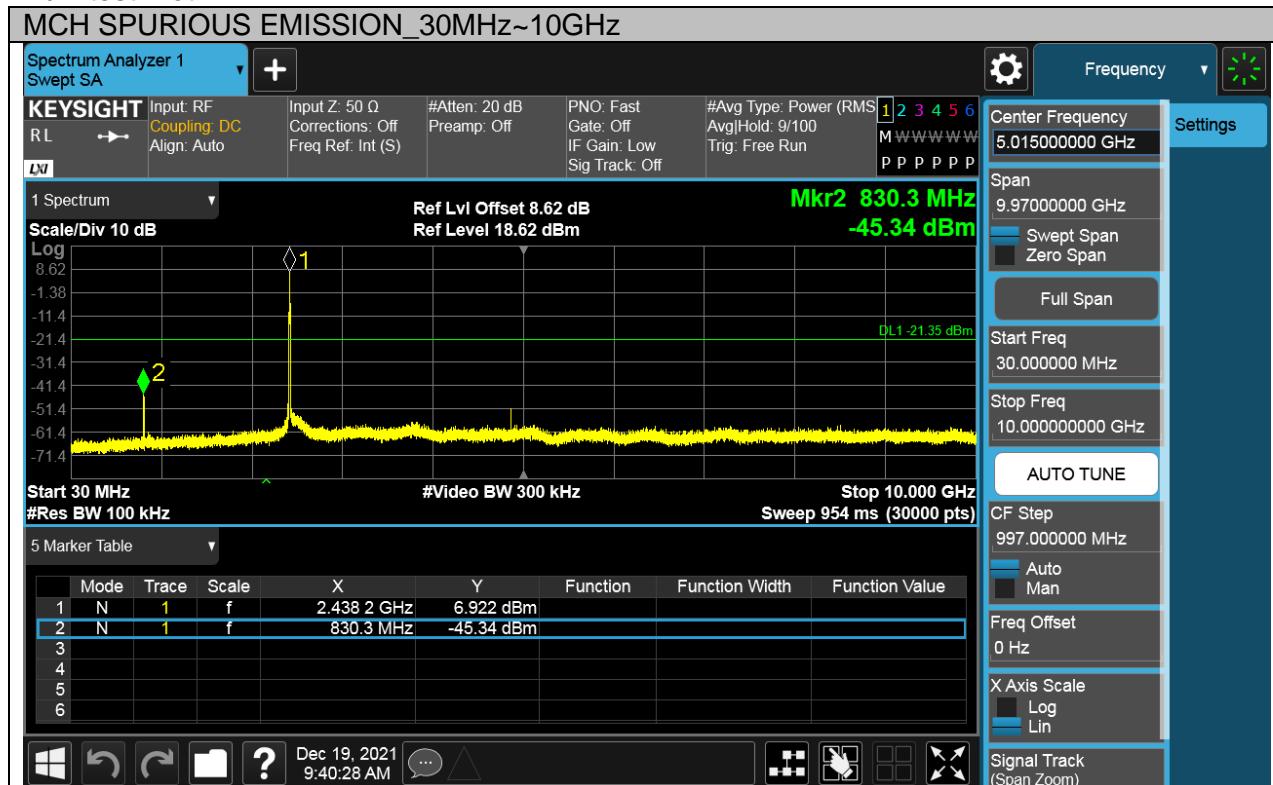


| Test Mode | Channel | Verdict |
|-----------|---------|---------|
| 11B | MCH | PASS |

Pref test Plot

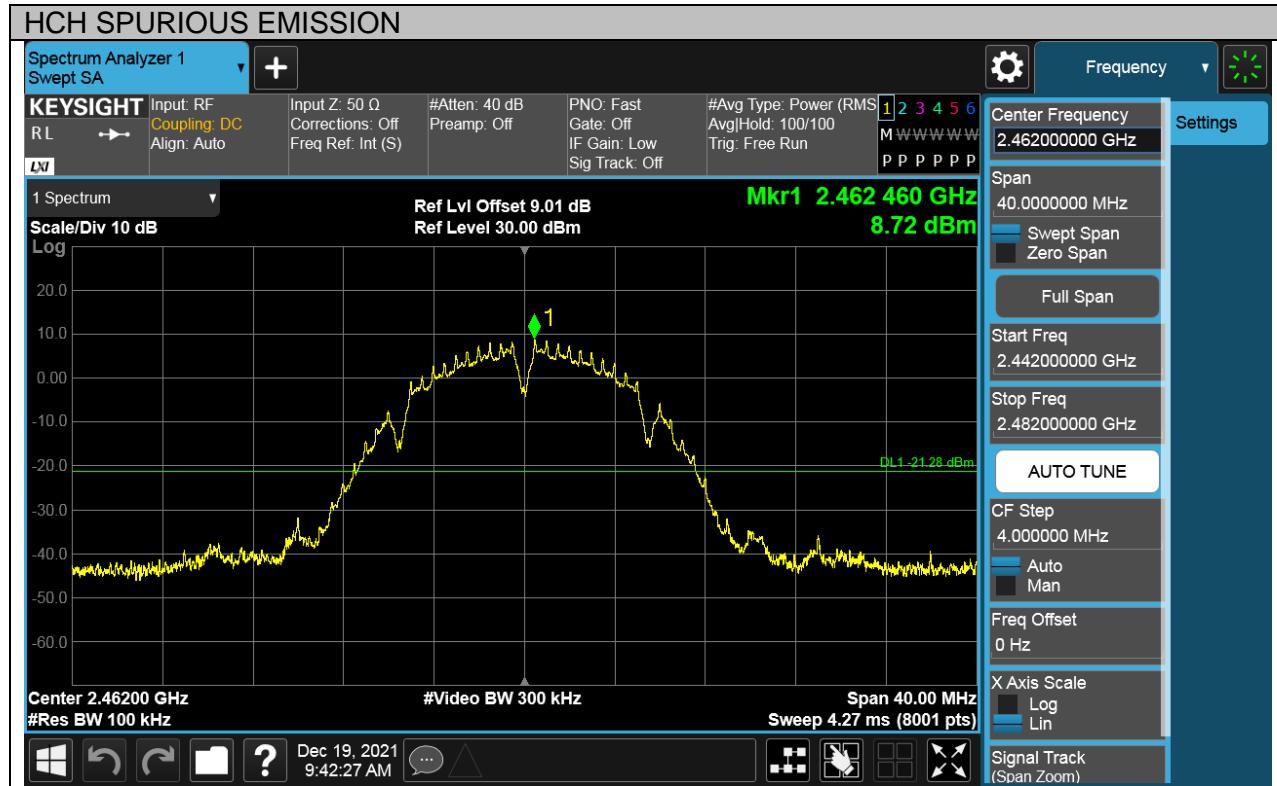


Puw test Plot

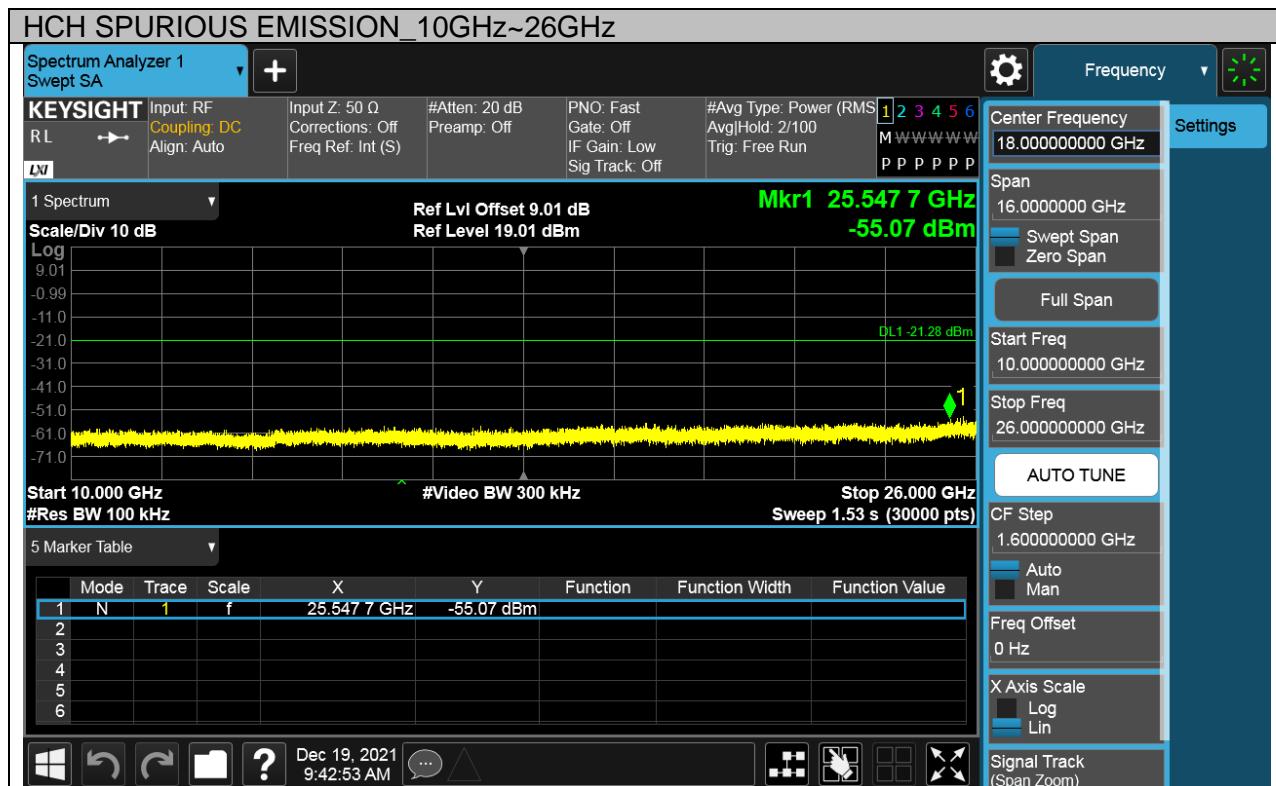
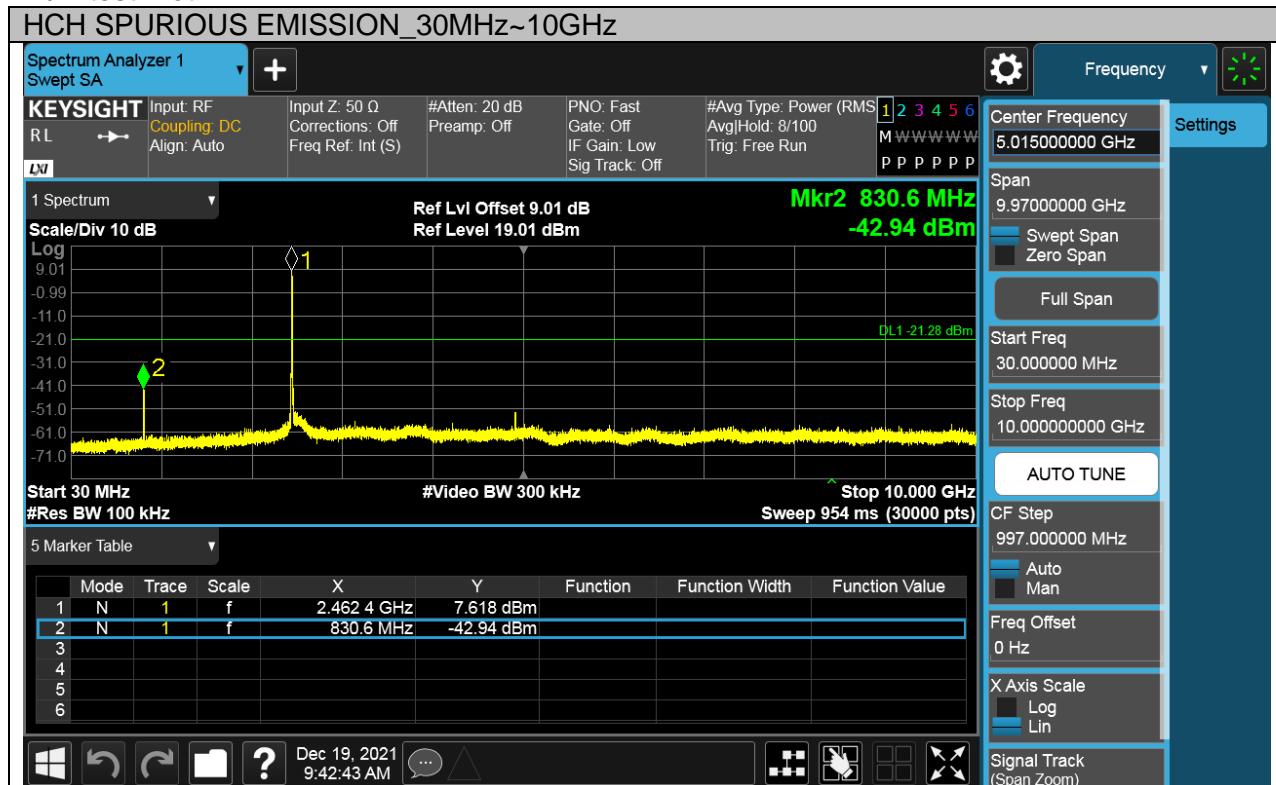


| Test Mode | Channel | Verdict |
|-----------|---------|---------|
| 11B | HCH | PASS |

Pref test Plot



Puw test Plot



| Test Mode | Channel | Verdict |
|-----------|---------|---------|
| 11G | LCH | PASS |

Pref test Plot

