



# **TEST REPORT**

**Report Number. :** 12875574-E3V1

**Applicant :** SONOS, INC.  
614 CHAPALA STREET  
SANTA BARBARA, CA 93101, U.S.A

**Model :** S24

**FCC ID :** SBVRM024

**IC :** 5373A-RM024

**EUT Description :** 802.11 a/b/g/n 4x4 (HT20) Client Device

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART E (EXCEPT DFS)  
ISED RSS-247 ISSUE 2  
ISED RSS-GEN ISSUE 5

**Date Of Issue:**

February 03, 2020

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NVLAP Lab code: 200065-0

## REPORT REVISION HISTORY

| Rev. | Issue<br>Date | Revisions     | Revised By |
|------|---------------|---------------|------------|
| V1   | 2/3/2020      | Initial Issue |            |

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SONOS, INC.  
614 CHAPALA STREET  
SANTA BARBARA, CA 93101, U.S.A.

**EUT DESCRIPTION:** 802.11 a/b/g/n 4x4 (HT20) Client Device

**MODEL:** S24

**SERIAL NUMBER:** D100 1909CP 34-7E-5C-D0-02-60-7 (Conducted Sample)  
D100 1909CP 34-7E-5C-D0-02-5C-3 (Radiated Sample)  
D100 1909CP 34-7E-5C-D0-02-7E-3(Radiated Sample)

**DATE TESTED:** November 11 – December 10, 2019

| APPLICABLE STANDARDS                  |              |
|---------------------------------------|--------------|
| STANDARD                              | TEST RESULTS |
| CFR 47 Part 15 Subpart E (Except DFS) | Complies     |
| ISED RSS-247 Issue 2                  | Complies     |
| ISED RSS-GEN Issue 5                  | Complies     |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

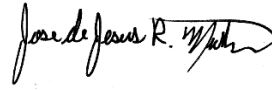
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## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 14-30, FCC KDB 662911 D01 v02r01, FCC KDB 662911 D02 v01, FCC KDB 905462 D06 v02, FCC KDB 789033 D02 v02r01, KDB 414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013, FCC 06-96, RSS-GEN Issue 5, and RSS-247 Issue 2.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street                          | 47266 Benicia Street               | 47658 Kato Rd.                                |
|-----------------------------------------------|------------------------------------|-----------------------------------------------|
| <input checked="" type="checkbox"/> Chamber A | <input type="checkbox"/> Chamber D | <input checked="" type="checkbox"/> Chamber I |
| <input type="checkbox"/> Chamber B            | <input type="checkbox"/> Chamber E | <input type="checkbox"/> Chamber J            |
| <input type="checkbox"/> Chamber C            | <input type="checkbox"/> Chamber F | <input checked="" type="checkbox"/> Chamber K |
|                                               | <input type="checkbox"/> Chamber G | <input type="checkbox"/> Chamber L            |
|                                               | <input type="checkbox"/> Chamber H |                                               |

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

## 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. SAMPLE CALCULATION

#### **RADIATED EMISSIONS**

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)  
 $36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$

#### **MAINS CONDUCTED EMISSIONS**

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.  
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

### 4.3. MEASUREMENT UNCERTAINTY

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

| PARAMETER                                           | UNCERTAINTY |
|-----------------------------------------------------|-------------|
| Worst Case Conducted Disturbance, 9KHz to 0.15 MHz  | 3.39 dB     |
| Worst Case Conducted Disturbance, 0.15 to 30 MHz    | 3.07 dB     |
| Worst Case Radiated Disturbance, 9KHz to 30 MHz     | 2.52 dB     |
| Worst Case Radiated Disturbance, 30 to 1000 MHz     | 4.88 dB     |
| Worst Case Radiated Disturbance, 1000 to 18000 MHz  | 4.24 dB     |
| Worst Case Radiated Disturbance, 18000 to 26000 MHz | 4.37 dB     |
| Worst Case Radiated Disturbance, 26000 to 40000 MHz | 5.17 dB     |

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. EUT DESCRIPTION

The EUT is an 802.11 a/b/g/n 4x4 (HT20) Client Device.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

#### FCC

| Frequency Range (MHz)    | Mode         | Output Power (dBm) | Output Power (mW) |
|--------------------------|--------------|--------------------|-------------------|
| <b>5.2 GHz band, 4TX</b> |              |                    |                   |
| 5180-5240                | 802.11a      | 19.11              | 81.47             |
| 5180-5240                | 802.11n HT20 | 19.09              | 81.10             |
| <b>5.3 GHz band, 4TX</b> |              |                    |                   |
| 5260-5320                | 802.11a      | 18.19              | 65.92             |
| 5260-5320                | 802.11n HT20 | 18.69              | 73.96             |
| <b>5.6 GHz band, 4TX</b> |              |                    |                   |
| 5500-5700                | 802.11a      | 18.34              | 68.23             |
| 5500-5700                | 802.11n HT20 | 18.33              | 68.08             |
| <b>5.8 GHz band, 4TX</b> |              |                    |                   |
| 5725-5850                | 802.11a      | 22.33              | 171.00            |
| 5725-5850                | 802.11n HT20 | 22.40              | 173.78            |

#### IC

| Frequency Range (MHz)    | Mode         | Output Power (dBm) | Output Power (mW) |
|--------------------------|--------------|--------------------|-------------------|
| <b>5.2 GHz band, 4TX</b> |              |                    |                   |
| 5180-5240                | 802.11a      | 16.98              | 49.89             |
| 5180-5240                | 802.11n HT20 | 17.58              | 57.28             |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

| 5GHz Antenna Identification / Max Antenna Gain dBi |                                                        |                                       |                                                          |                                         |
|----------------------------------------------------|--------------------------------------------------------|---------------------------------------|----------------------------------------------------------|-----------------------------------------|
| Frequency Range (MHz)                              | Ant0 Wifi<br>P/N 105-00152<br>Vertical<br>Polarization | Ant1 Wifi<br>Vertical<br>Polarization | Ant2 Wifi<br>P/N 105-00153<br>Horizontal<br>Polarization | Ant3 Wifi<br>Horizontal<br>Polarization |
| U-NII-1 (5180-5240)                                | Chain 0 / 3.7 dBi                                      | Chain 1 / 4.7 dBi                     | Chain 2 / 4.8 dBi                                        | Chain 3 / 3.5 dBi                       |
| U-NII-2 (5260-5320)                                | Chain 0 / 3.7 dBi                                      | Chain 1 / 4.7 dBi                     | Chain 2 / 4.8 dBi                                        | Chain 3 / 3.5 dBi                       |
| U-NII-3 (5500-5720)                                | Chain 0 / 3.7 dBi                                      | Chain 1 / 4.7 dBi                     | Chain 2 / 4.8 dBi                                        | Chain 3 / 3.5 dBi                       |
| U-NII-4 (5745-5825)                                | Chain 0 / 3.7 dBi                                      | Chain 1 / 4.7 dBi                     | Chain 2 / 4.8 dBi                                        | Chain 3 / 3.5 dBi                       |

**NOTE:**

Antenna 1 = Chain 0  
Antenna 2 = Chain 1  
Antenna 3 = Chain 2  
Antenna 4 = Chain 3

### 5.4. SOFTWARE

The test utility software used during testing was:  
Sonos build 55.0-70090\_mainline\_integ\_int\_release

### 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y Left, Y Right, it was determined that Y Left orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y Left orientation.

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

802.11a mode: 6 Mbps  
802.11n HT20mode: MCS0

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Description | Manufacturer | Model       | Serial Number          | FCC ID |
|-------------|--------------|-------------|------------------------|--------|
| Laptop      | Lenovo       | T440p       | SON-00008522           | N/A    |
| AC Adapter  | Lenovo       | ADLX90NDC2A | 11S36200285ZZ3004758D2 | N/A    |

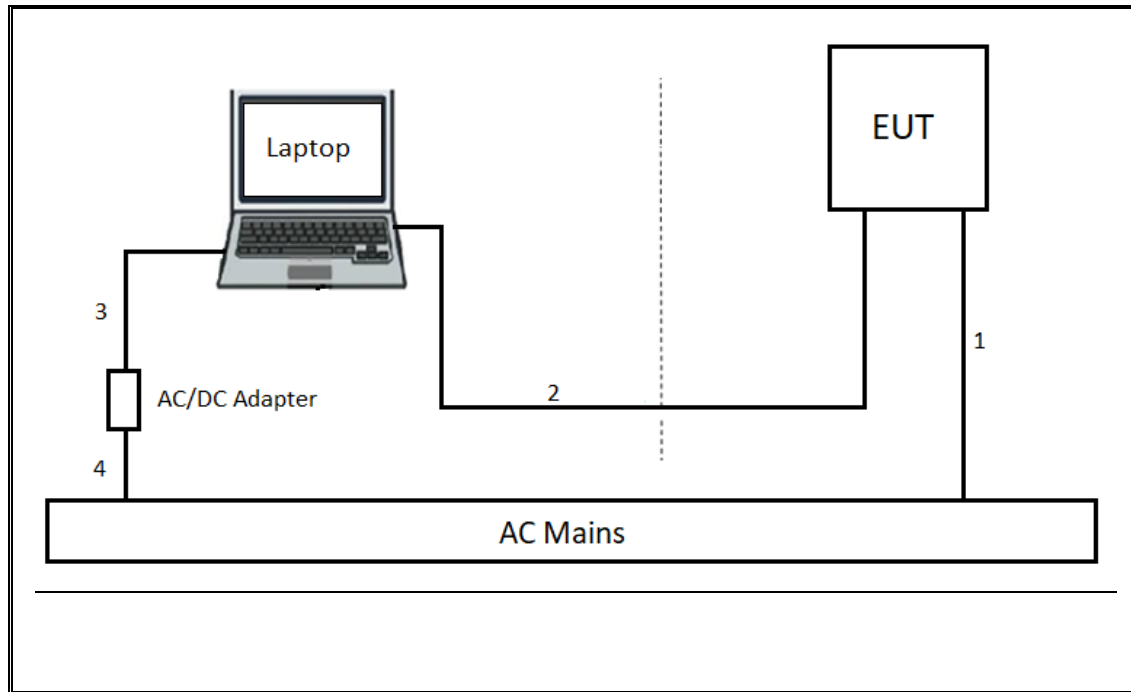
### I/O CABLES

| I/O Cable List |          |                |                |            |                  |                           |
|----------------|----------|----------------|----------------|------------|------------------|---------------------------|
| Cable No       | Port     | # of identical | Connector Type | Cable Type | Cable Length (m) | Remarks                   |
| 1              | AC Power | 1              | AC             | Unshielded | 2                | AC Mains to EUT           |
| 2              | Ethernet | 1              | RJ45           | Unshielded | 10               | EUT to Laptop             |
| 3              | DC Power | 1              | DC             | Shielded   | 1.2              | AC/DC Adapter to Laptop   |
| 4              | AC Power | 1              | AC             | Unshielded | 1                | AC Mains to AC/DC Adapter |

### TEST SETUP

The EUT connected to support laptop via the ethernet cable during testing.  
The test utility software on support laptop exercised the radio card.  
For radiated testing, the support laptop was set up outside the chamber.

## **SETUP DIAGRAMS**



## 6. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 789033 D02 v02r01, Section II B.

6 dB Emission BW: KDB 789033 D02 v02r01, Section II C.2.

26 dB Emission BW: KDB 789033 D02 v02r01, Section II C.1.

99% Occupied BW: KDB 789033 D02 v02r01, Section II D.

Conducted Output Power: KDB 789033 D02 v02r01, Sections II.E.2.b (Method SA-1) II.E.3.b (Method PM-G).

Power Spectral Density: KDB 789033 D02 v02r01, Section II F.

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4.

Unwanted emissions: KDB 789033 D02 v02r01, Sections II.G.3 – II.G.6.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

## 7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| TEST EQUIPMENT LIST                              |                                          |                                     |                                  |            |            |
|--------------------------------------------------|------------------------------------------|-------------------------------------|----------------------------------|------------|------------|
| Description                                      | Manufacturer                             | Model                               | ID Num                           | Cal Due    | Last Cal   |
| Spectrum Analyzer, PXA, 3Hz to 44GHz             | Keysight Technologies (Formerly Agilent) | N9030A                              | T908                             | 01/23/2020 | 01/23/2019 |
| RF Amplifier, 1-18GHz                            | MITEQ                                    | AFS42-00101800-25-S-42              | T1165                            | 11/06/2020 | 11/06/2019 |
| Antenna, Horn 1-18GHz                            | ETS-Lindgren                             | 3117                                | T346                             | 05/14/2020 | 05/14/2019 |
| EMI TEST RECEIVER                                | Rohde & Schwarz                          | ESW44                               | PRE0179372                       | 02/16/2020 | 02/16/2019 |
| Amplifier, 1 to 18GHz, 35dB                      | AMPLICAL                                 | AMP1G18-35                          | T1569                            | 06/04/2020 | 06/04/2019 |
| Antenna                                          | ETS-Lindgren                             | 3117                                | EMC4294                          | 06/14/2020 | 06/14/2019 |
| EMI TEST RECEIVER                                | Rohde & Schwarz                          | ESW44                               | PRE0179376                       | 02/14/2020 | 02/14/2019 |
| Amplifier, 9KHz to 1GHz, 32dB                    | SONOMA INSTRUMENT                        | 310                                 | PRE0180175                       | 05/29/2020 | 06/29/2019 |
| Antenna, Broadband Hybrid, 30MHz to 3GHz         | Sunol Sciences Corp.                     | JB3                                 | PRE0184052                       | 11/12/2020 | 11/12/2019 |
| RF Amplifier, 1-18GHz                            | MITEQ                                    | AFS42-00101800-25-S-42              | PRE0181078                       | 08/24/2020 | 08/24/2019 |
| Antenna, Horn 1-18GHz                            | ETS-Lindgren                             | 3117                                | T862                             | 06/05/2020 | 06/05/2019 |
| Antenna, Active Loop 9KHz to 30MHz               | COM-POWER                                | AL-130R                             | PRE0165308                       | 04/11/2020 | 04/11/2019 |
| Antenna, Horn 18 to 26.5GHz                      | ARA                                      | MWH-1826/B                          | T447                             | 08/13/2020 | 08/13/2019 |
| Rf Amplifier, 18-26.5GHz, 60dB gain              | AMPLICAL                                 | Rf Amplifier, 18-26.5GHz, 60dB gain | PRE0181238                       | 05/01/2020 | 05/01/2019 |
| Antenna, Horn 26.5 to 40GHz                      | ARA                                      | MWH-2640/B                          | T446                             | 08/13/2020 | 08/13/2019 |
| Amplifier, 26 - 40GHz                            | MITEQ                                    | TTA2640-35-HG                       | T1864                            | 03/23/2020 | 03/23/2019 |
| Power Meter, P-series single channel             | Agilent (Keysight) Technologies          | N1911A                              | T1265                            | 01/29/2020 | 01/29/2019 |
| Power Sensor, P-series, 50MHz to 18GHz, Wideband | Agilent (Keysight) Technologies          | N1921A                              | T1227                            | 02/05/2020 | 02/05/2019 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz             | Keysight Technologies (Formerly Agilent) | N9030A                              | T917                             | 01/24/2020 | 01/24/2019 |
| Spectrum Analyzer, PSA, 3Hz to 26.5GHz           | Keysight Technologies (Formerly Agilent) | E4440A                              | T200                             | 01/28/2020 | 01/28/2019 |
| AC Line Conducted                                |                                          |                                     |                                  |            |            |
| EMI Receiver                                     | Rohde & Schwarz                          | ESR                                 | T1436                            | 02/14/2020 | 02/14/2019 |
| LISN for Conducted Emissions CISPR-16            | FCC INC.                                 | FCC LISN 50/250                     | T1310                            | 01/24/2020 | 01/24/2019 |
| Test Software List                               |                                          |                                     |                                  |            |            |
| Radiated Software                                | UL                                       | UL EMC                              | Ver 9.5, September 24, 2019      |            |            |
| Antenna Port Software                            | UL                                       | UL RF                               | Ver 2019.10.18, October 18, 2019 |            |            |
| AC Line Conducted Software                       | UL                                       | UL EMC                              | Ver 9.5, May 26, 2015            |            |            |

## 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME AND DUTY CYCLE

#### LIMITS

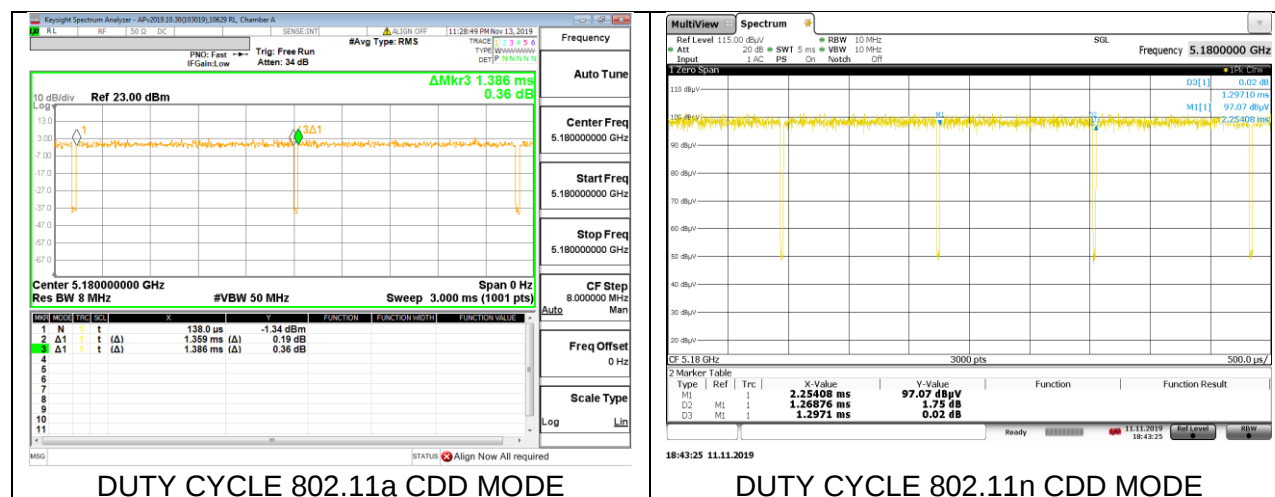
None; for reporting purposes only.

#### PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

#### ON TIME AND DUTY CYCLE RESULTS

| Mode         | ON Time<br>B<br>(msec) | Period<br>(msec) | Duty Cycle<br>x<br>(linear) | Duty<br>Cycle<br>(%) | Duty Cycle<br>Correction Factor<br>(dB) | 1/B<br>Minimum VBW<br>(kHz) |
|--------------|------------------------|------------------|-----------------------------|----------------------|-----------------------------------------|-----------------------------|
| 802.11a      | 1.359                  | 1.386            | 0.981                       | 98.1%                | 0.00                                    | 0.010                       |
| 802.11n HT20 | 1.269                  | 1.297            | 0.978                       | 97.8%                | 0.10                                    | 0.788                       |



## **8.2. 26 dB BANDWIDTH**

### **LIMITS**

None; for reporting purposes only.

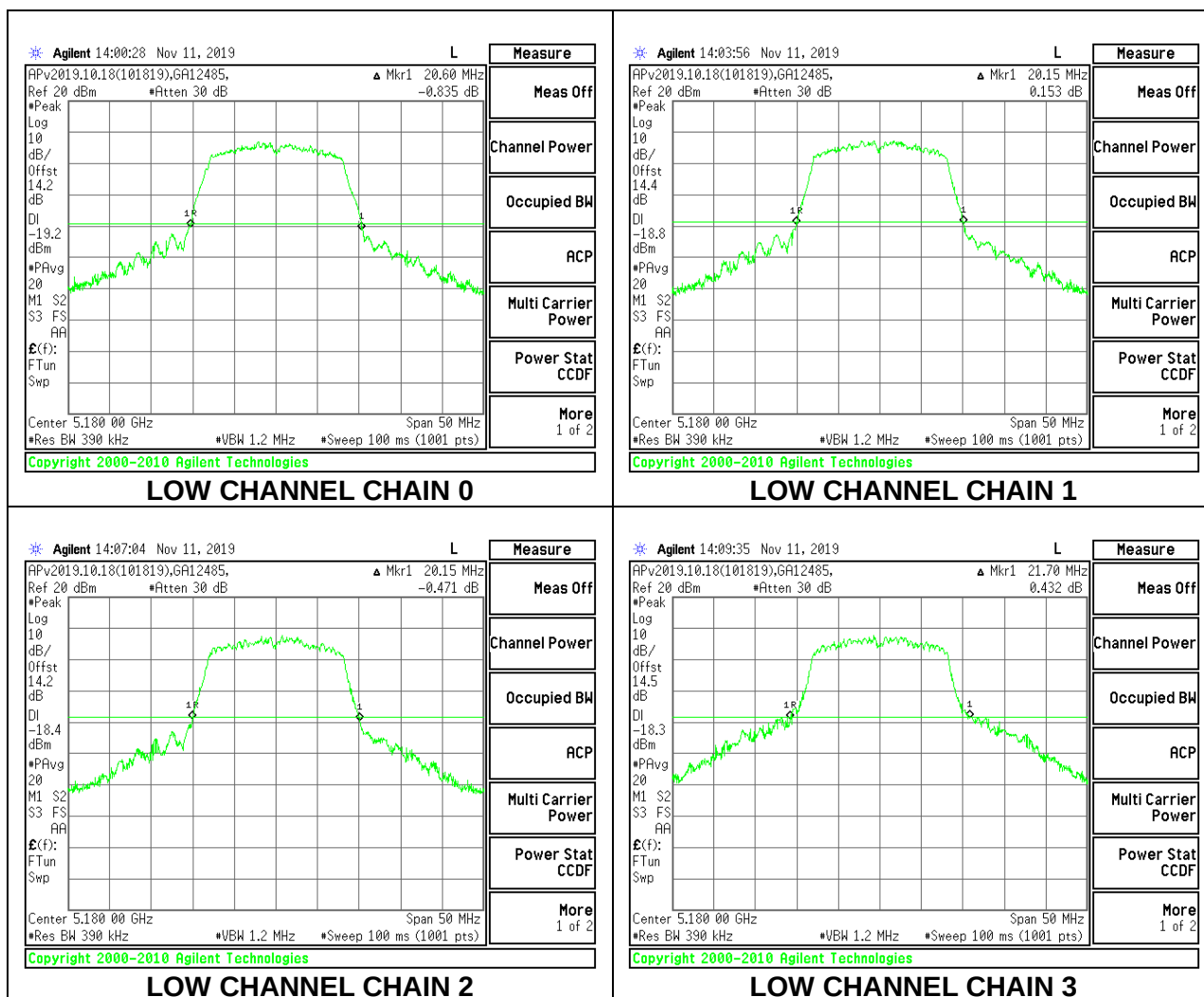
### **RESULTS**

## 8.2.1. 802.11a MODE IN THE 5.2 GHz BAND

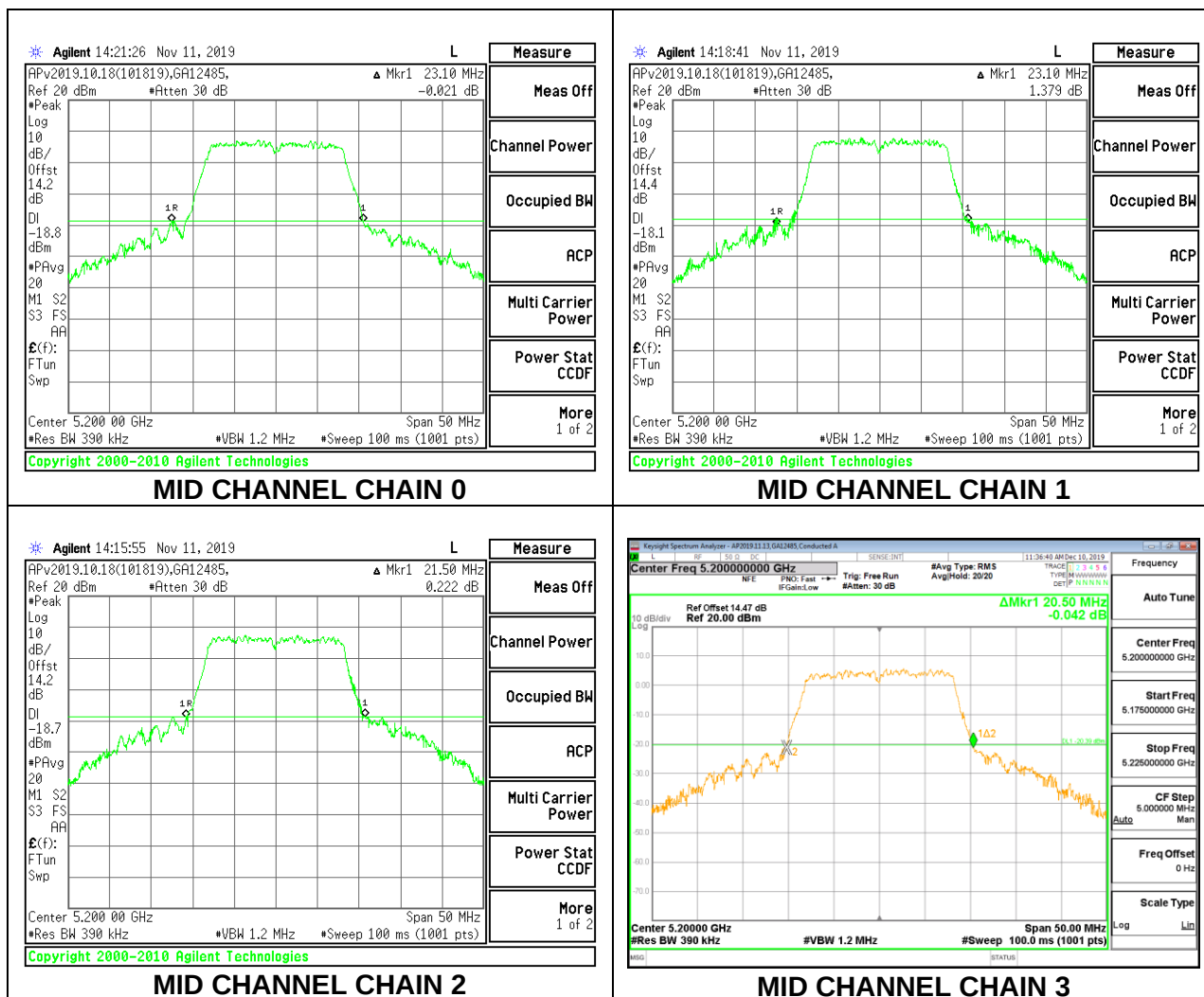
### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 26 dB Bandwidth<br>Chain 0<br>(MHz) | 26 dB Bandwidth<br>Chain 1<br>(MHz) | 26 dB Bandwidth<br>Chain 2<br>(MHz) | 26 dB Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Low     | 5180               | 20.60                               | 20.15                               | 20.15                               | 21.70                               |
| Mid     | 5200               | 23.10                               | 23.10                               | 21.50                               | 20.50                               |
| High    | 5240               | 20.90                               | 20.55                               | 20.50                               | 23.20                               |

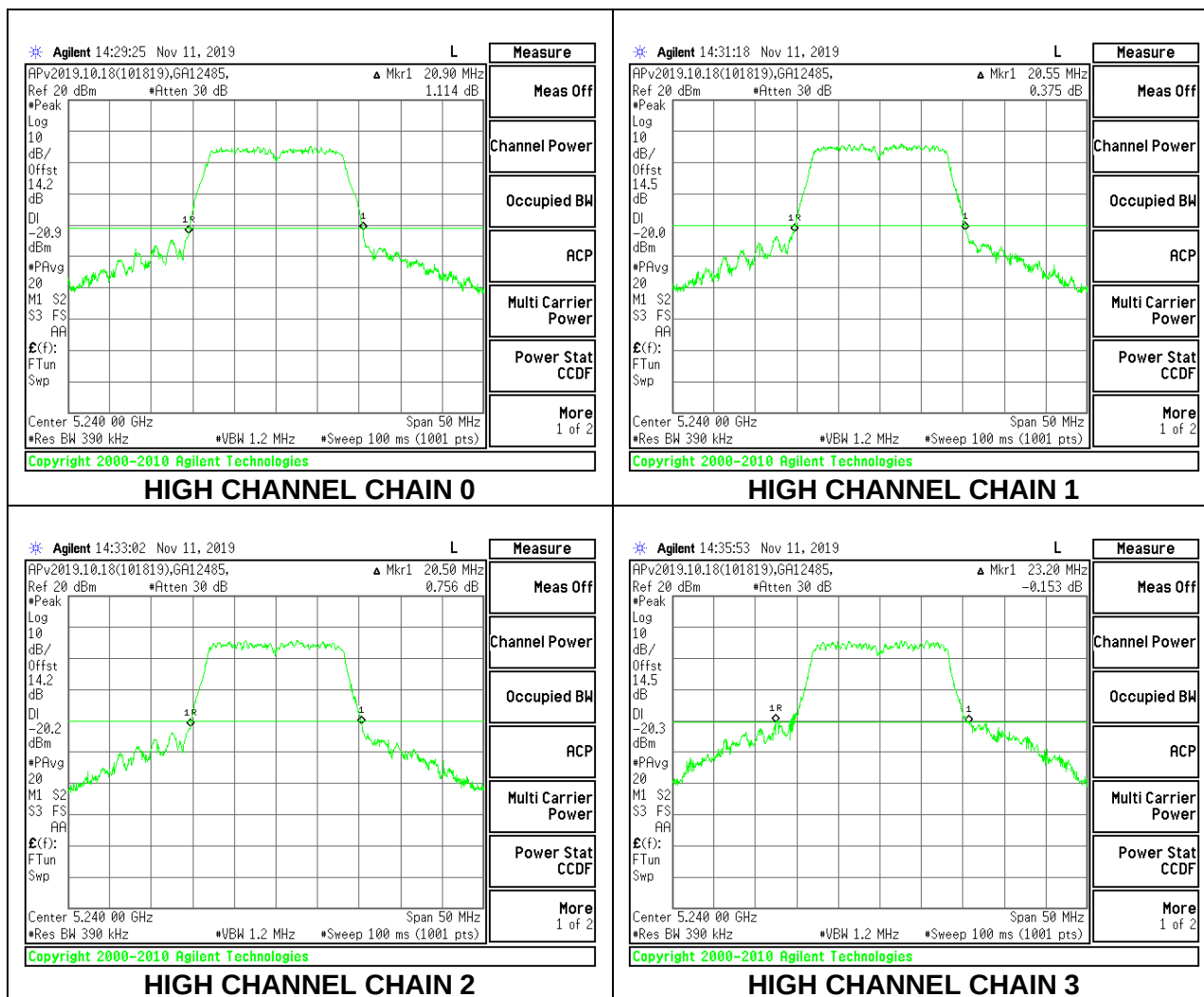
### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

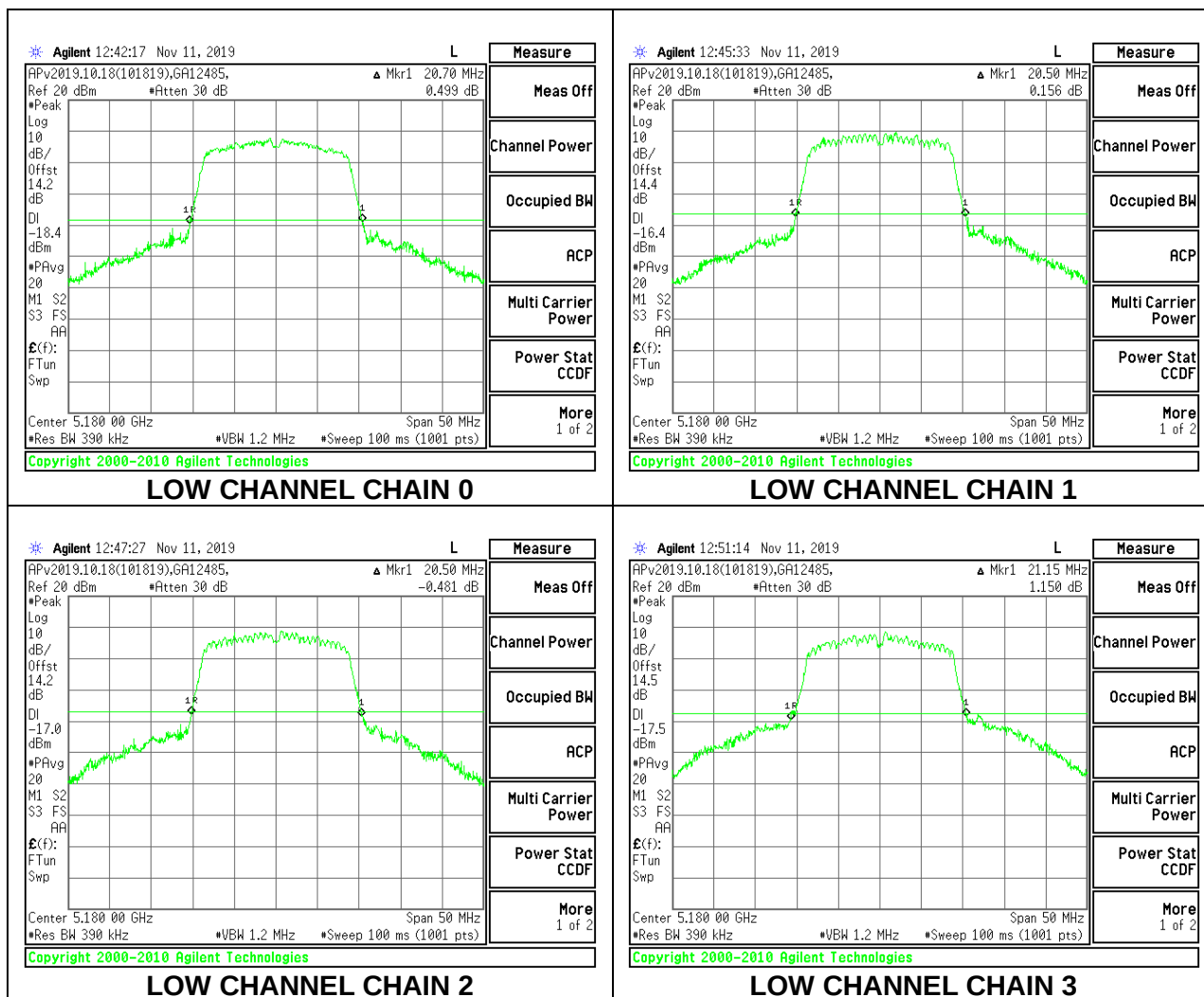


## 8.2.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

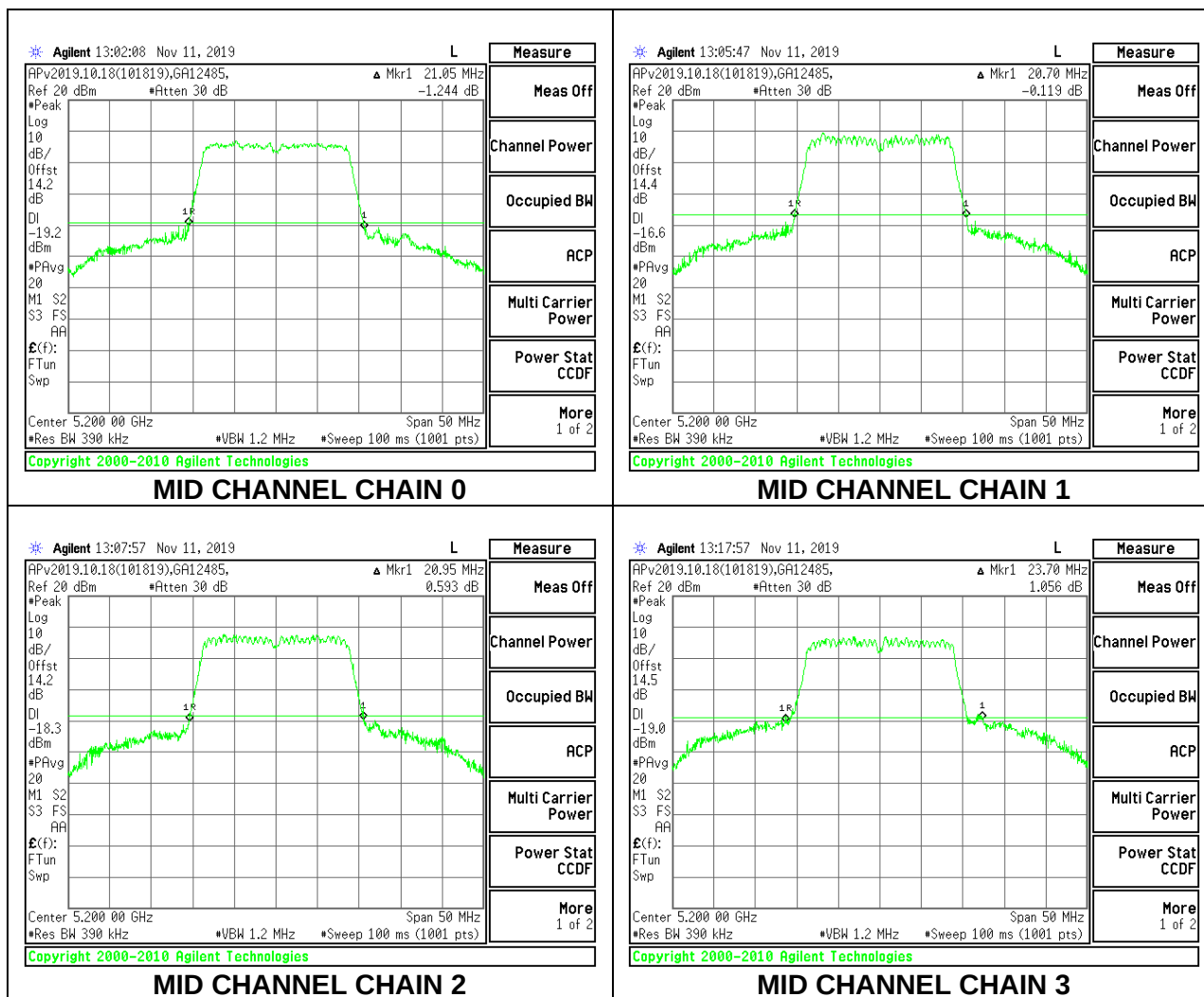
### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 26 dB Bandwidth<br>Chain 0<br>(MHz) | 26 dB Bandwidth<br>Chain 1<br>(MHz) | 26 dB Bandwidth<br>Chain 2<br>(MHz) | 26 dB Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Low     | 5180               | 20.70                               | 20.50                               | 20.50                               | 21.15                               |
| Mid     | 5200               | 21.05                               | 20.70                               | 20.95                               | 23.70                               |
| High    | 5240               | 20.95                               | 20.65                               | 20.75                               | 20.95                               |

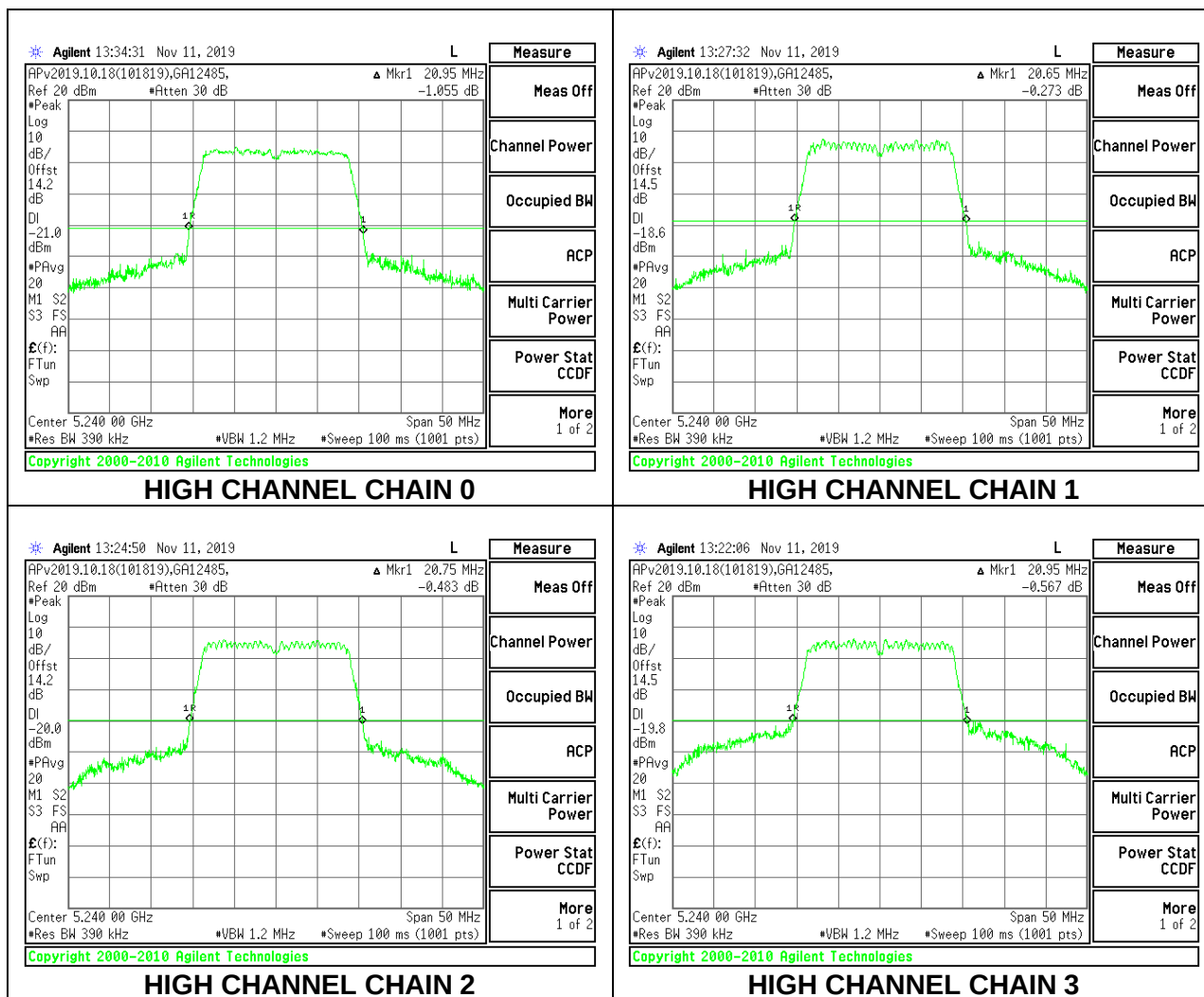
### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

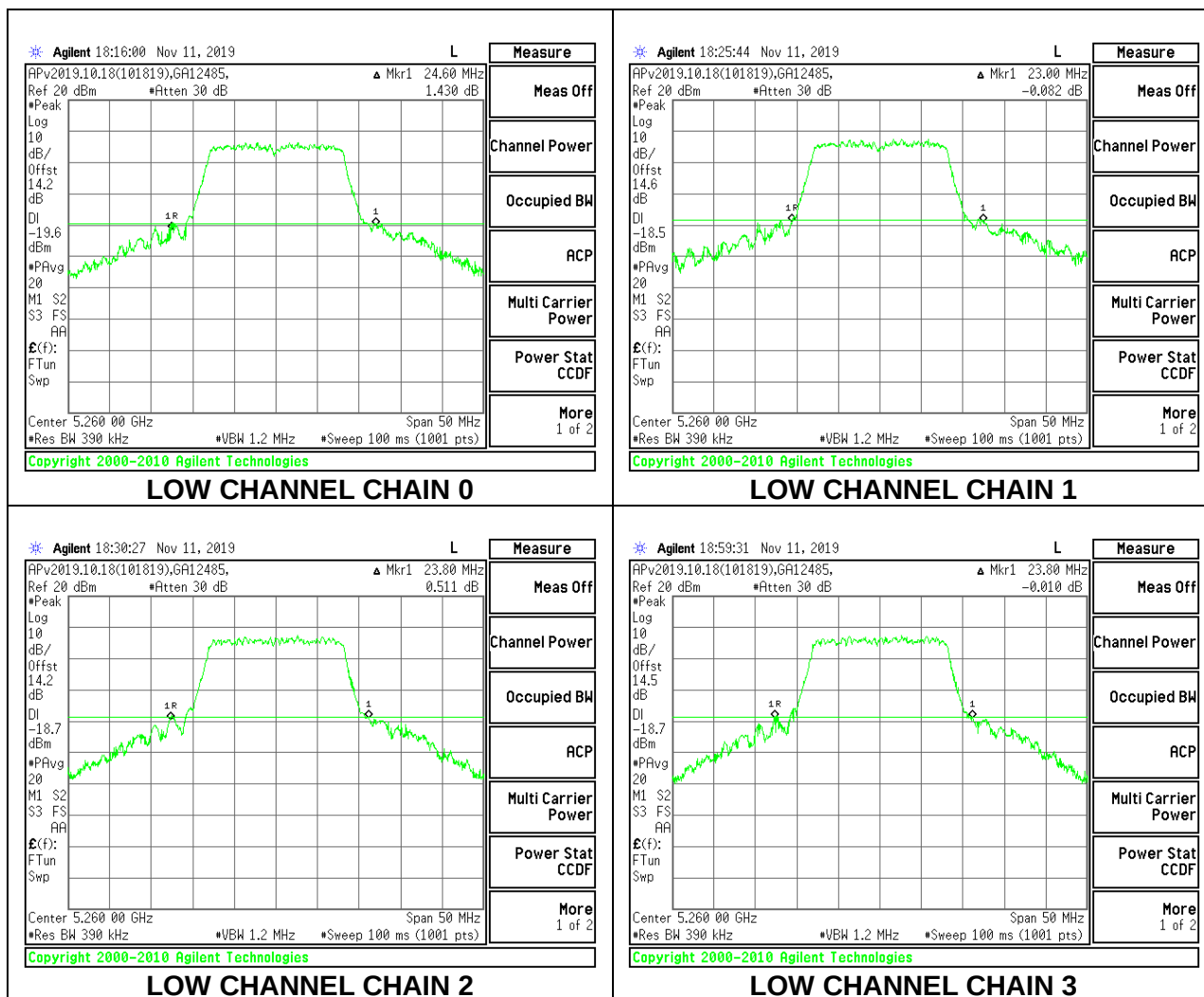


### 8.2.3. 802.11a MODE IN THE 5.3 GHz BAND

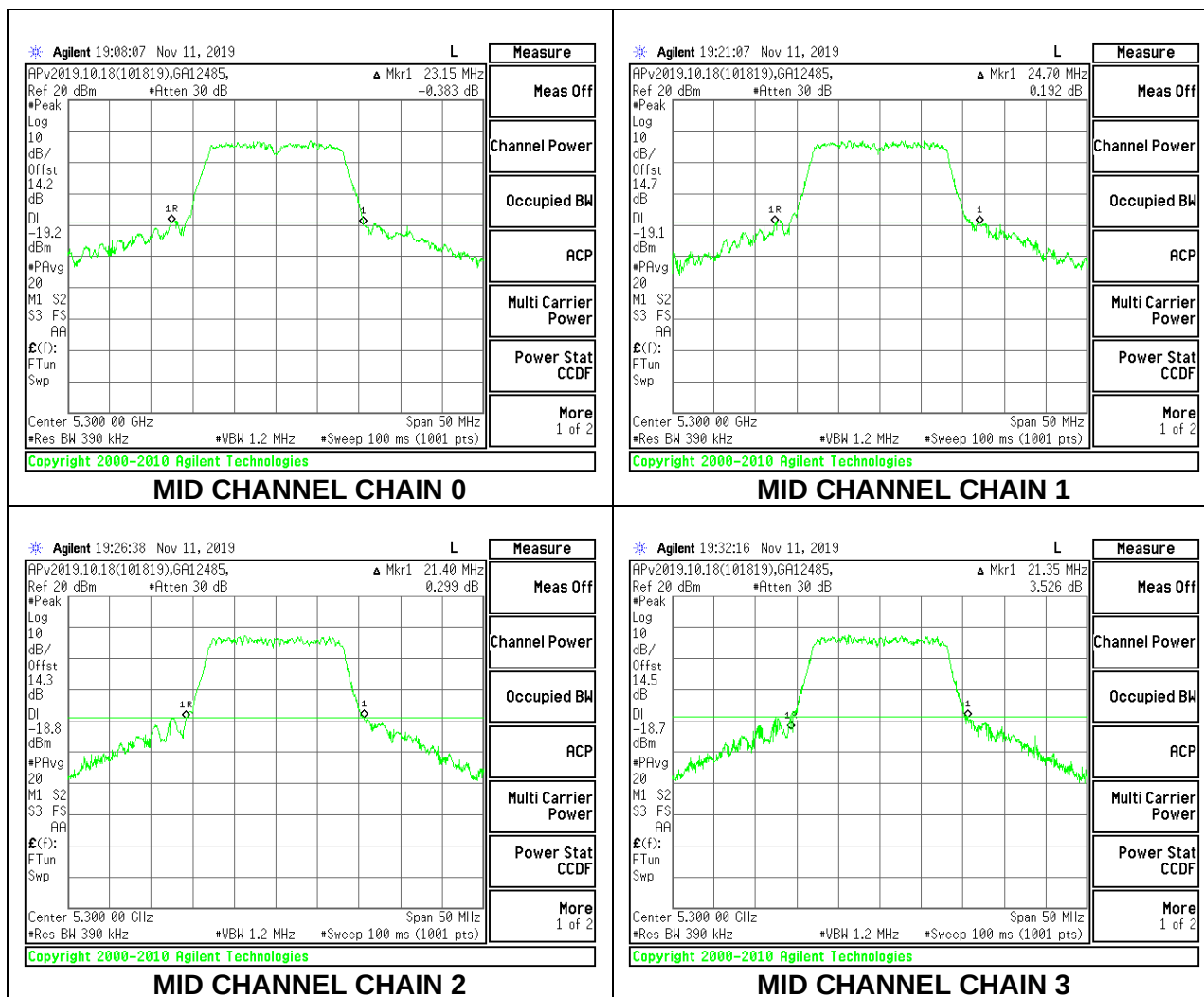
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 26 dB Bandwidth<br>Chain 0<br>(MHz) | 26 dB Bandwidth<br>Chain 1<br>(MHz) | 26 dB Bandwidth<br>Chain 2<br>(MHz) | 26 dB Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Low     | 5260               | 24.60                               | 23.00                               | 23.80                               | 23.80                               |
| Mid     | 5300               | 23.15                               | 24.70                               | 21.40                               | 21.35                               |
| High    | 5320               | 21.20                               | 20.85                               | 20.40                               | 21.70                               |

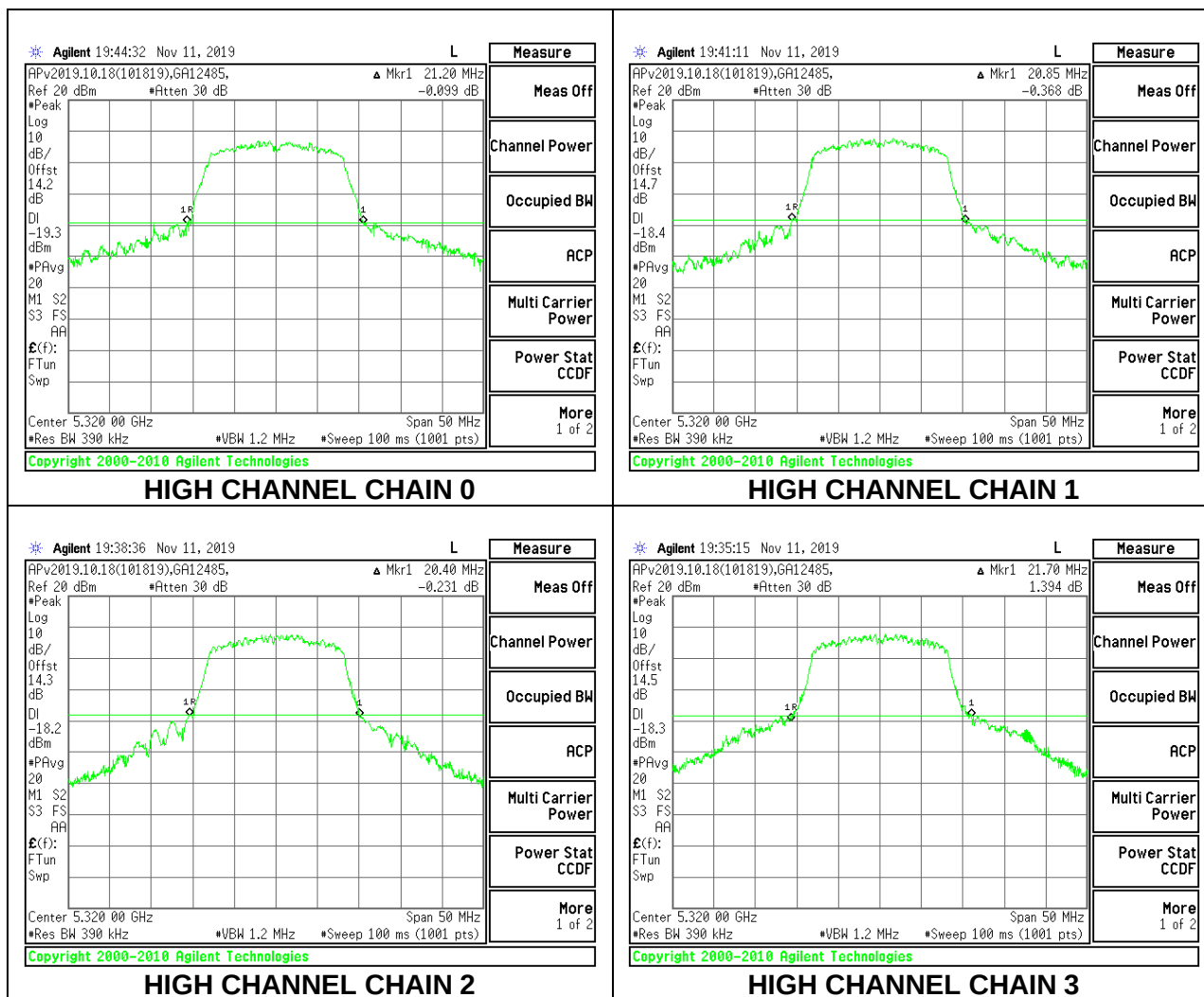
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

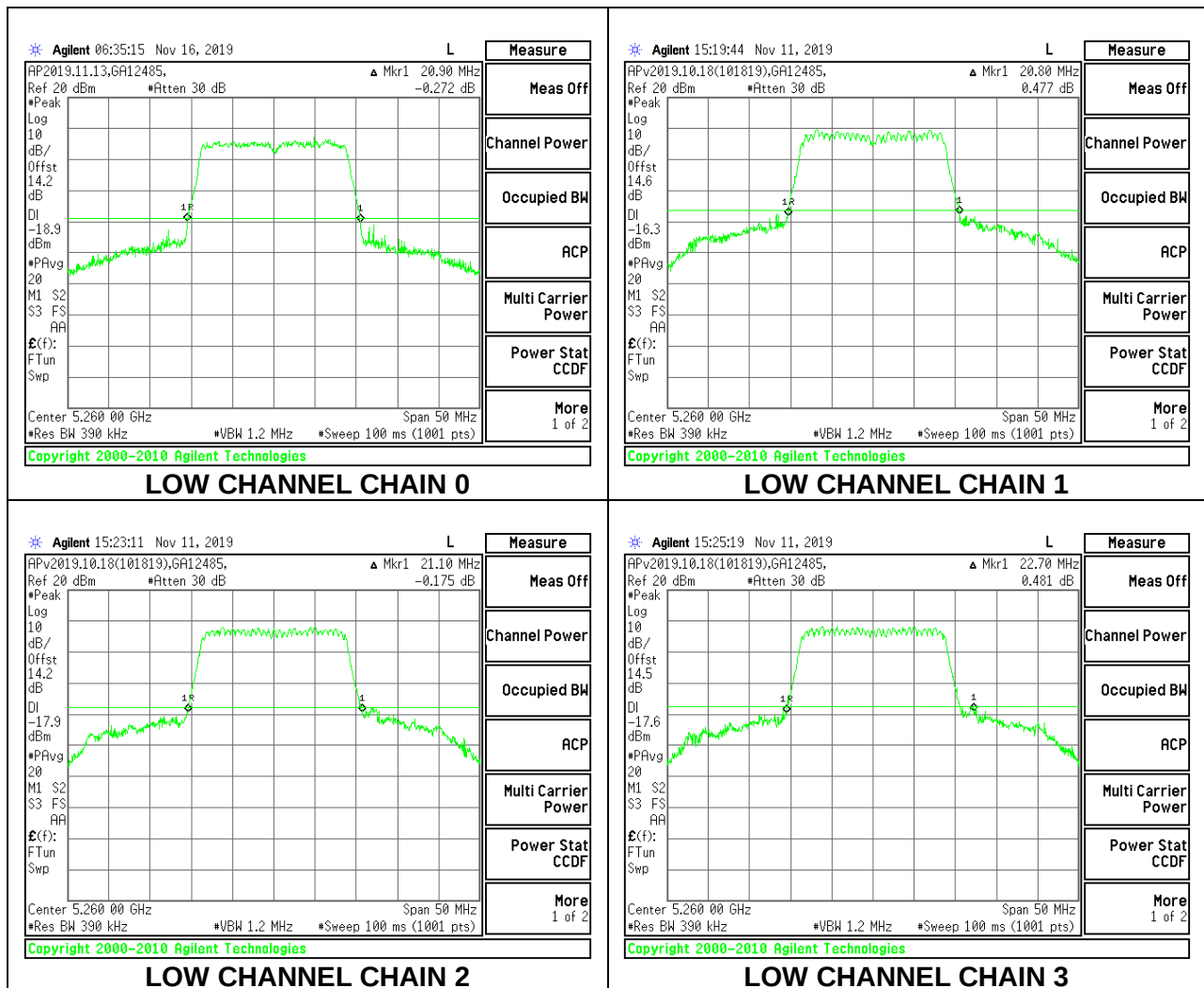


## 8.2.4. 802.11n HT20 MODE IN THE 5.3 GHz BAND

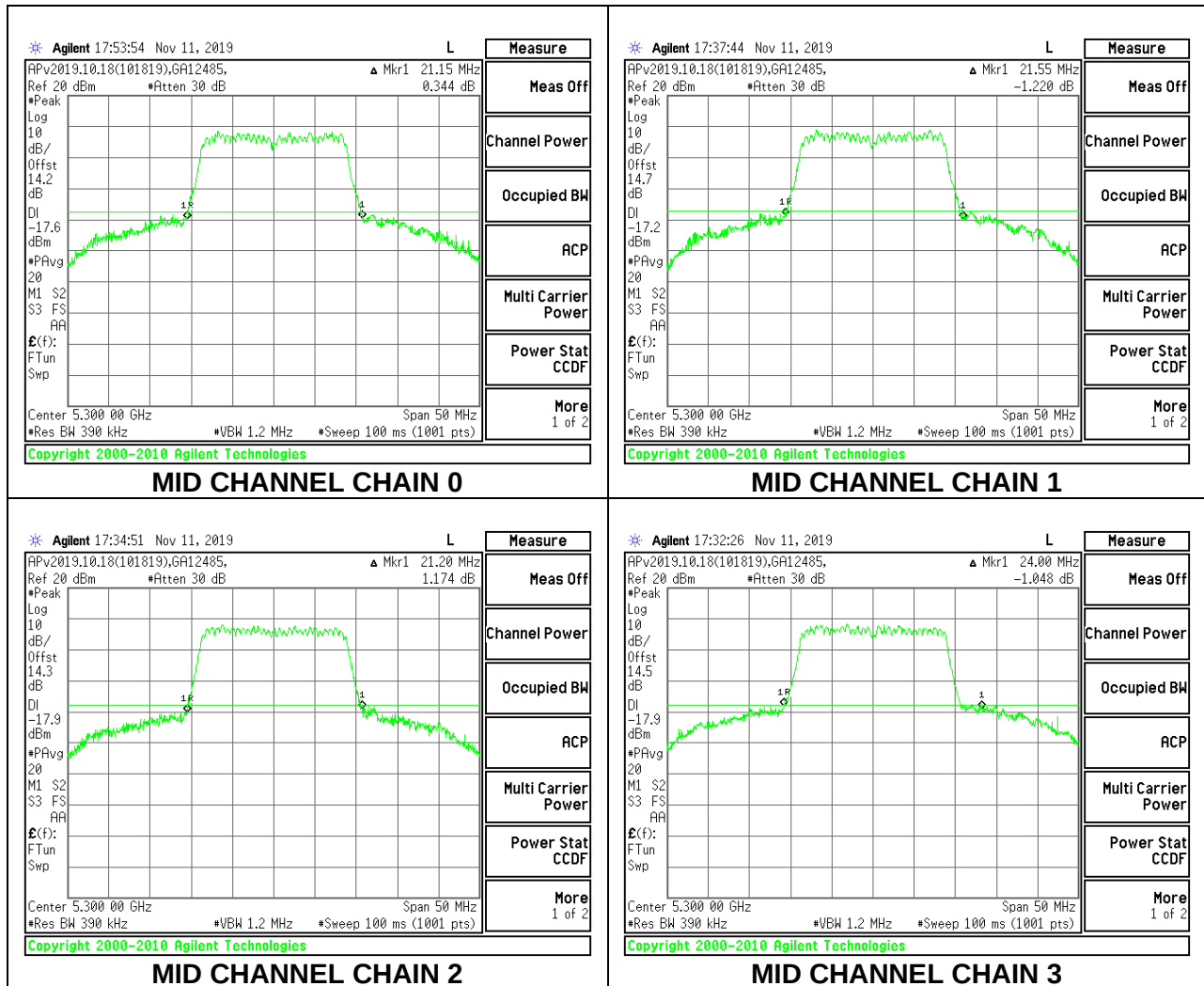
### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 26 dB Bandwidth<br>Chain 0<br>(MHz) | 26 dB Bandwidth<br>Chain 1<br>(MHz) | 26 dB Bandwidth<br>Chain 2<br>(MHz) | 26 dB Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Low     | 5260               | 20.90                               | 20.80                               | 21.10                               | 22.70                               |
| Mid     | 5300               | 21.15                               | 21.55                               | 21.20                               | 24.00                               |
| High    | 5320               | 20.80                               | 20.65                               | 20.45                               | 20.95                               |

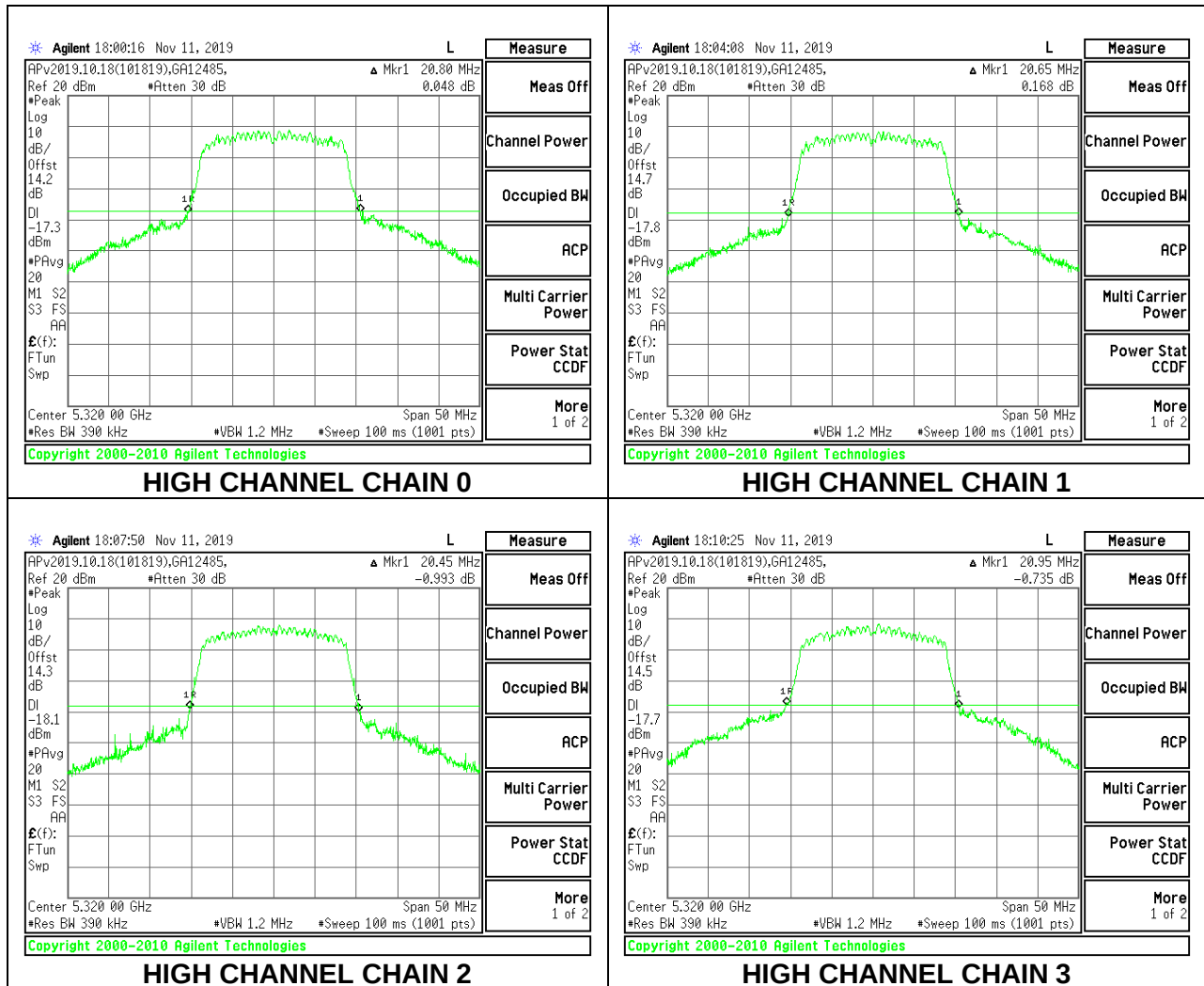
### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

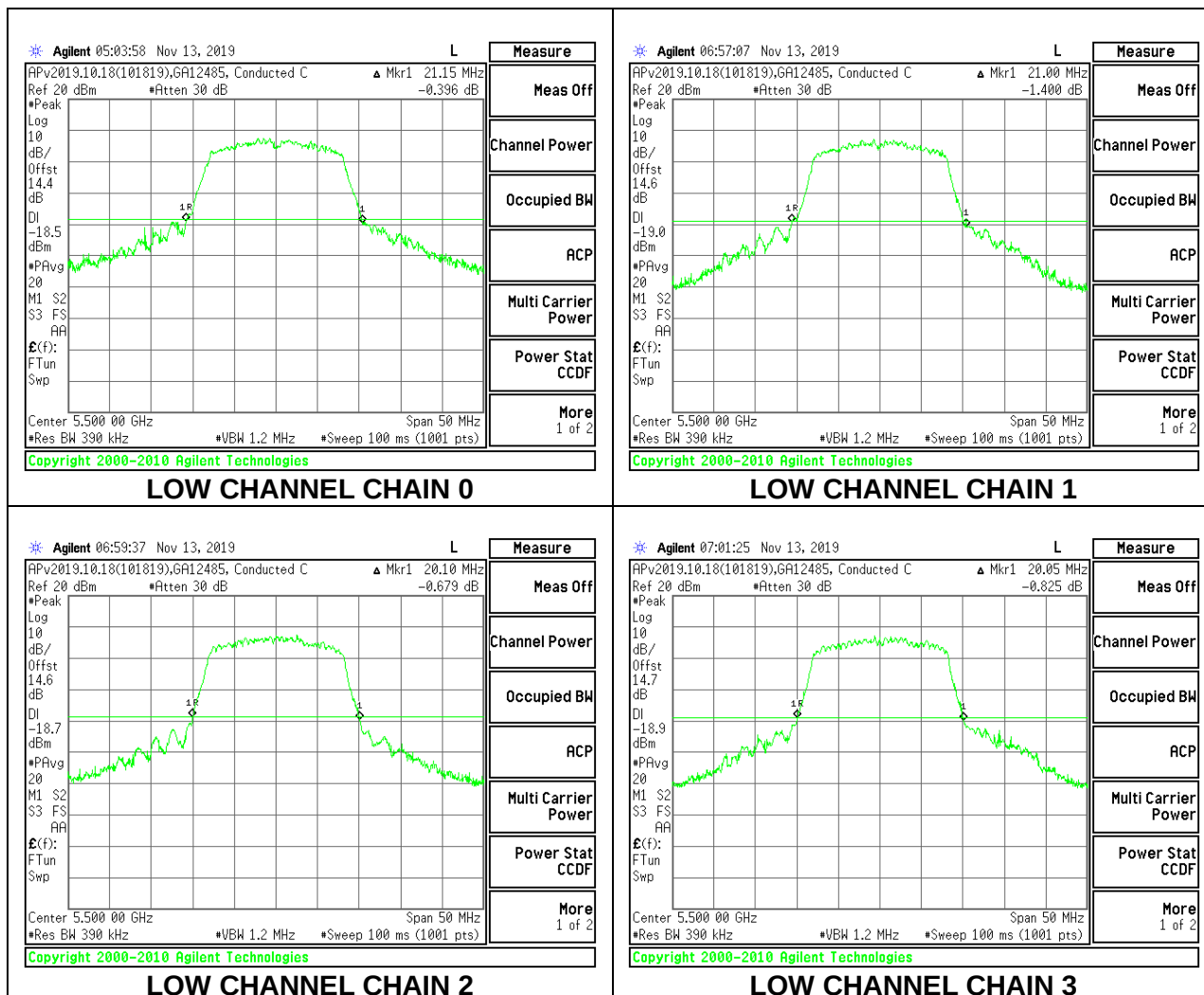


## 8.2.5. 802.11a MODE IN THE 5.6 GHz BAND

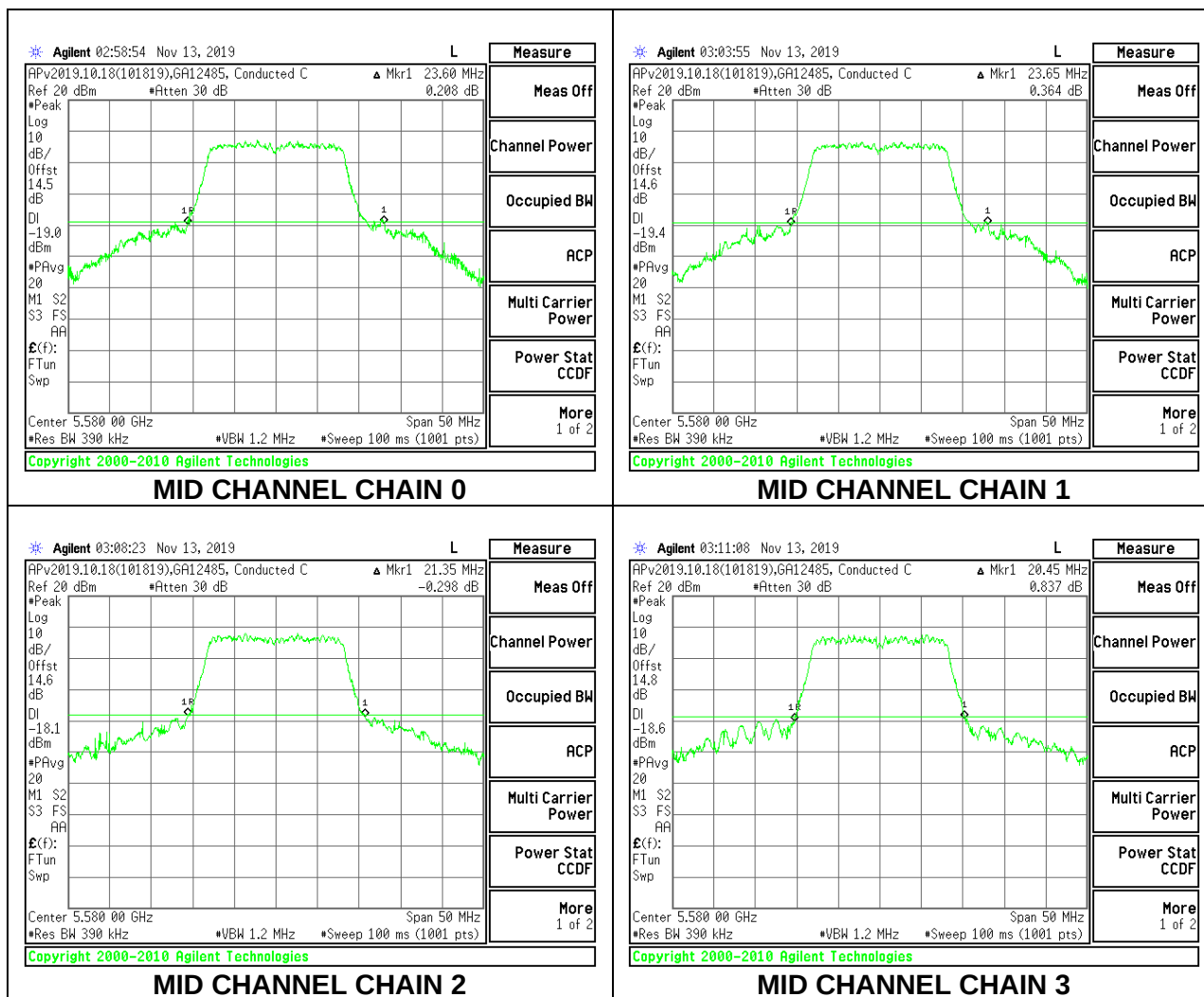
### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 26 dB Bandwidth<br>Chain 0<br>(MHz) | 26 dB Bandwidth<br>Chain 1<br>(MHz) | 26 dB Bandwidth<br>Chain 2<br>(MHz) | 26 dB Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Low     | 5500               | 21.15                               | 21.00                               | 20.10                               | 20.05                               |
| Mid     | 5580               | 23.60                               | 23.65                               | 21.35                               | 20.45                               |
| High    | 5700               | 22.00                               | 20.45                               | 20.15                               | 20.15                               |

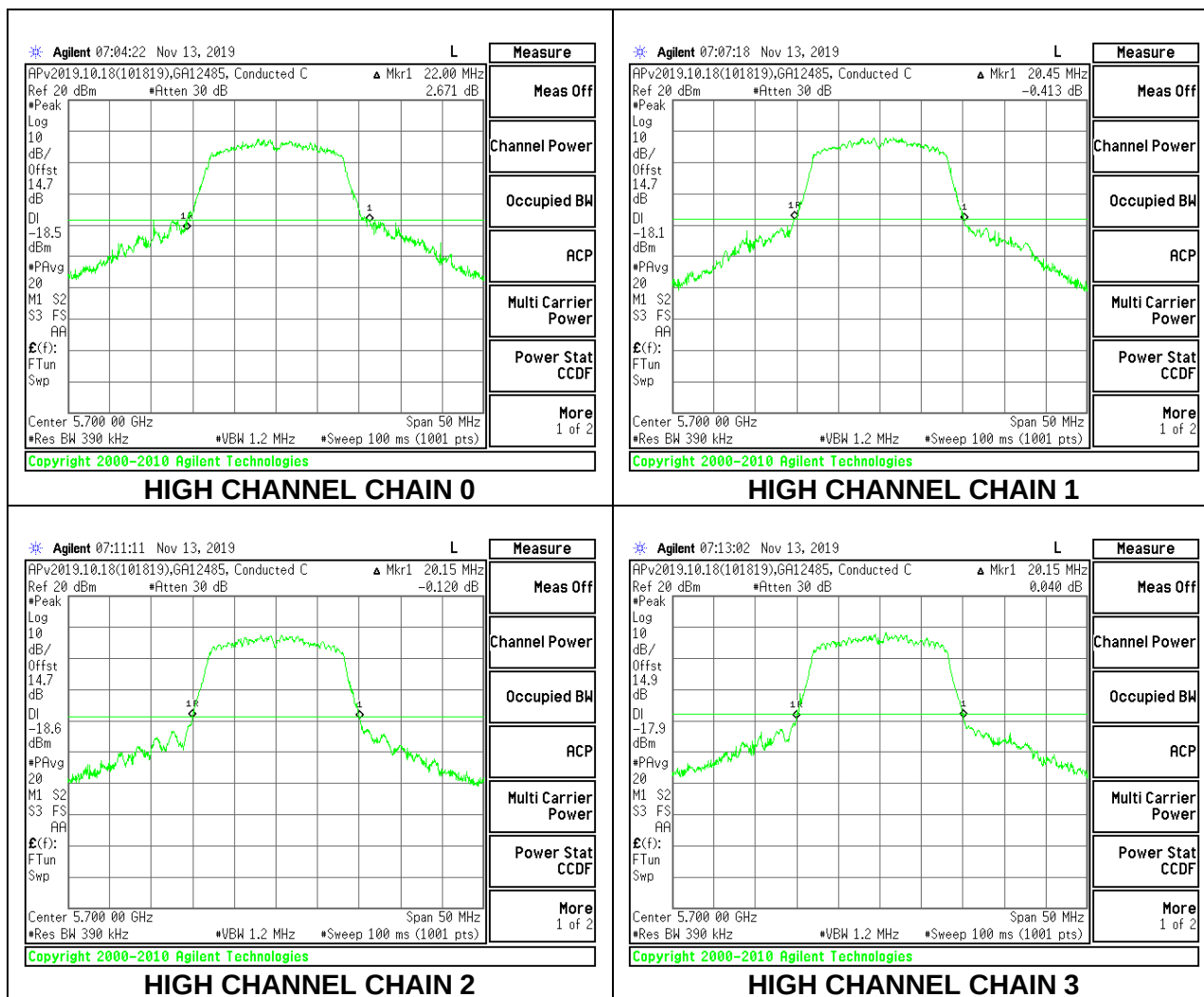
### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

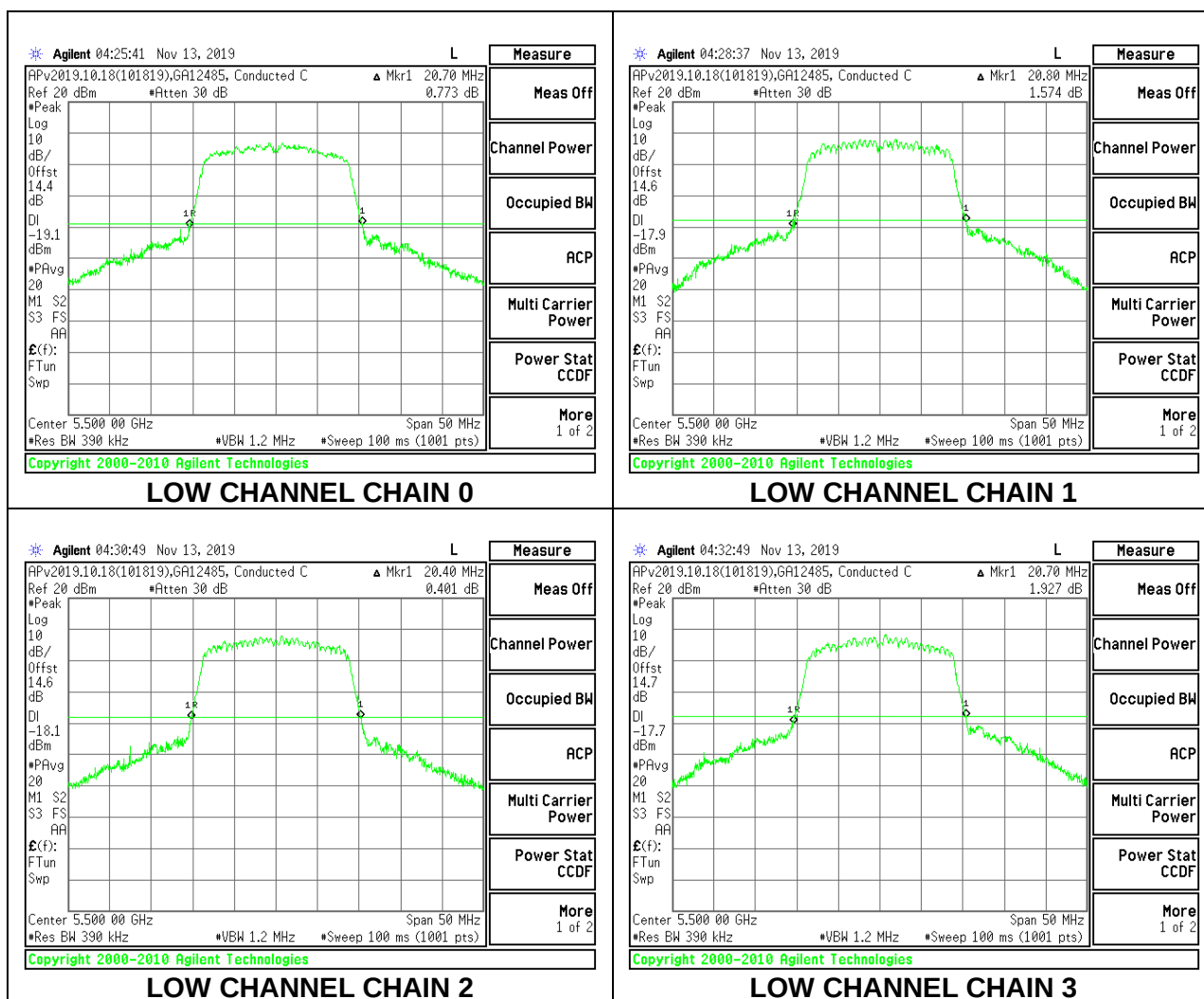


## 8.2.6. 802.11n HT20 MODE IN THE 5.6 GHz BAND

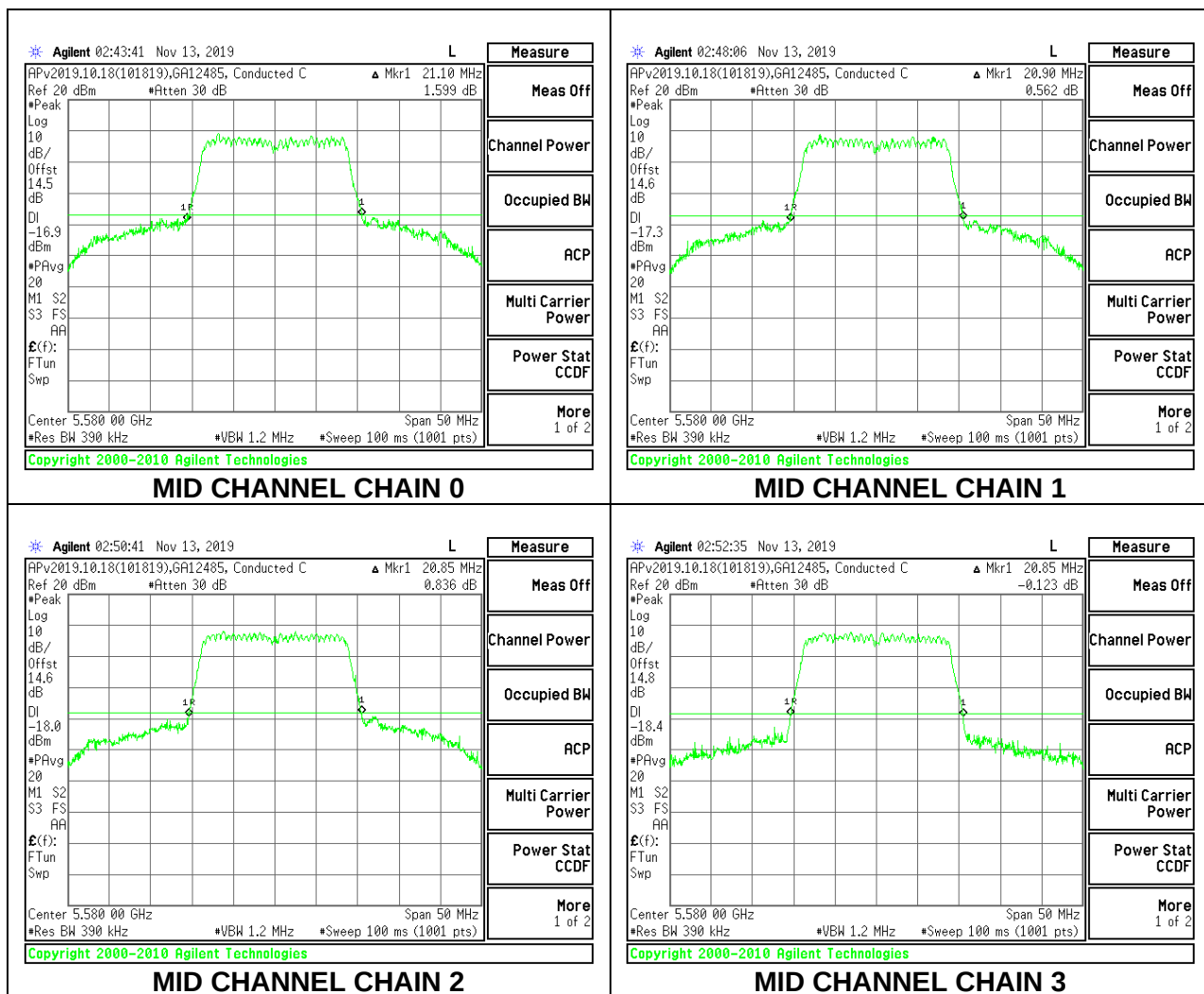
### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency | 26 dB Bandwidth<br>Chain 0<br>(MHz) | 26 dB Bandwidth<br>Chain 1<br>(MHz) | 26 dB Bandwidth<br>Chain 2<br>(MHz) | 26 dB Bandwidth<br>Chain 3<br>(MHz) |
|---------|-----------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Low     | 5500      | 20.70                               | 20.80                               | 20.40                               | 20.70                               |
| Mid     | 5580      | 21.10                               | 20.90                               | 20.85                               | 20.85                               |
| High    | 5700      | 21.05                               | 20.50                               | 20.40                               | 20.50                               |

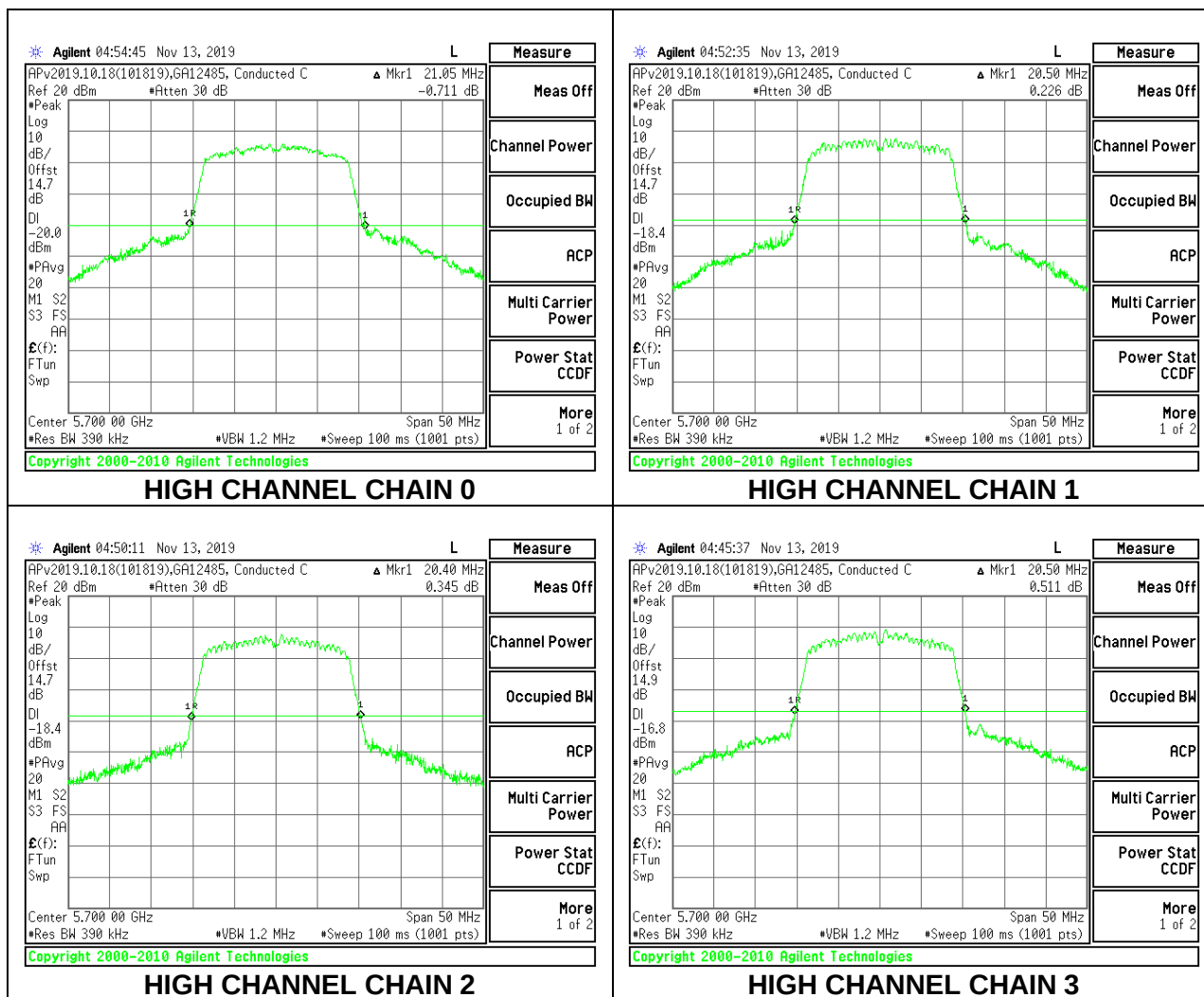
### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

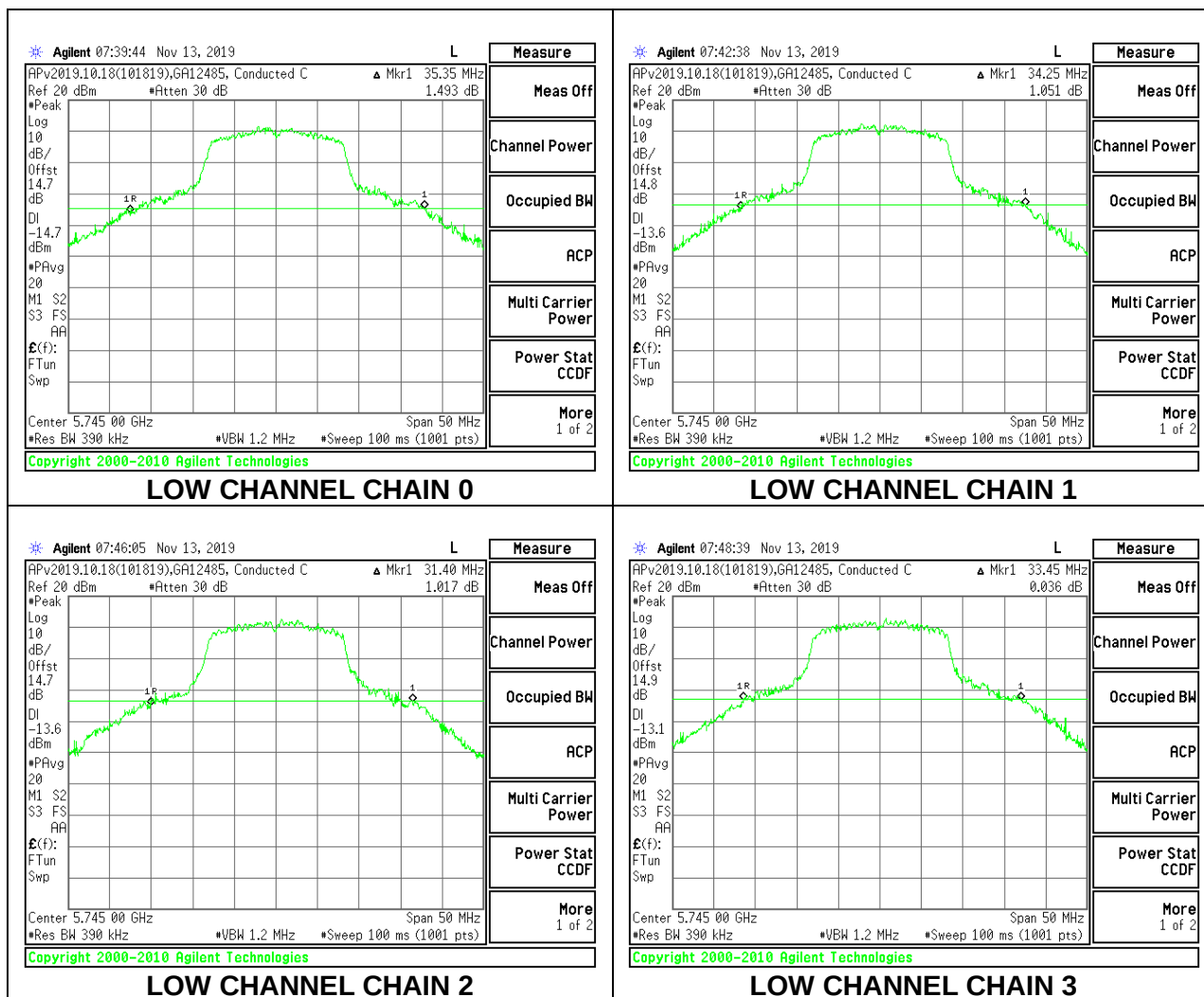


## 8.2.7. 802.11a MODE IN THE 5.8 GHz BAND

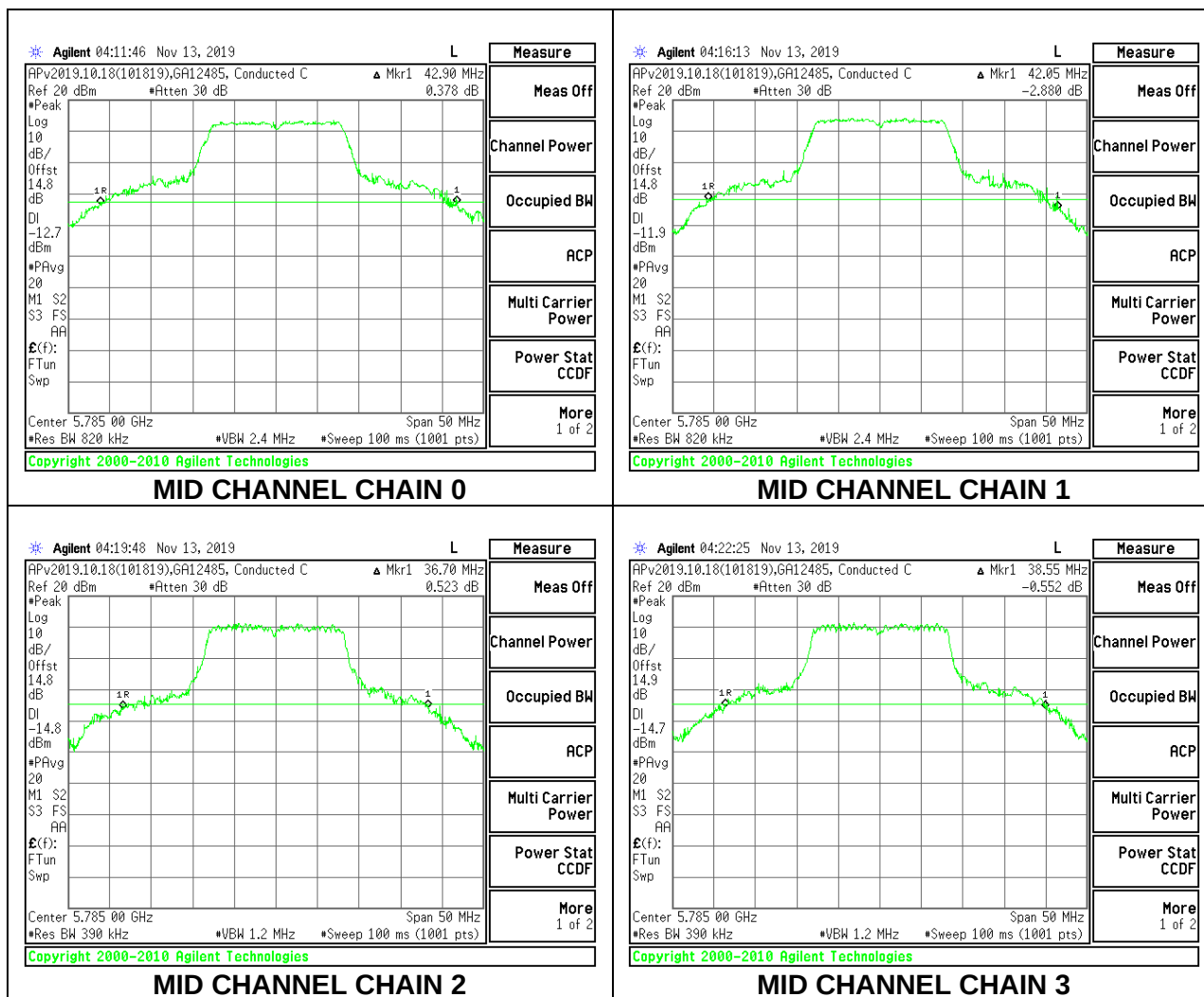
### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 26 dB Bandwidth<br>Chain 0<br>(MHz) | 26 dB Bandwidth<br>Chain 1<br>(MHz) | 26 dB Bandwidth<br>Chain 2<br>(MHz) | 26 dB Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Low     | 5745               | 35.35                               | 34.25                               | 31.40                               | 33.45                               |
| Mid     | 5785               | 42.90                               | 42.05                               | 36.70                               | 38.55                               |
| High    | 5825               | 37.60                               | 34.90                               | 30.95                               | 34.60                               |

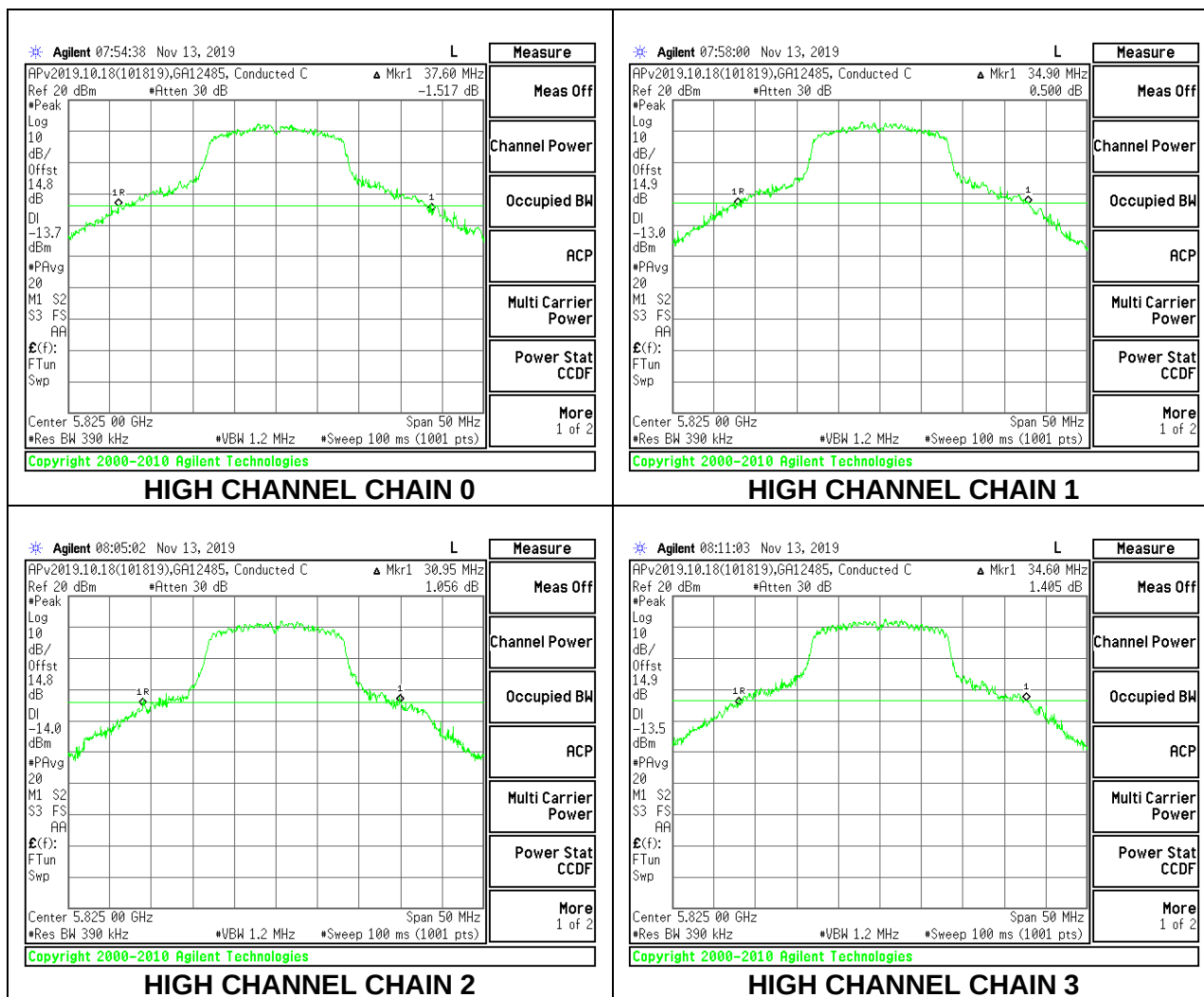
### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

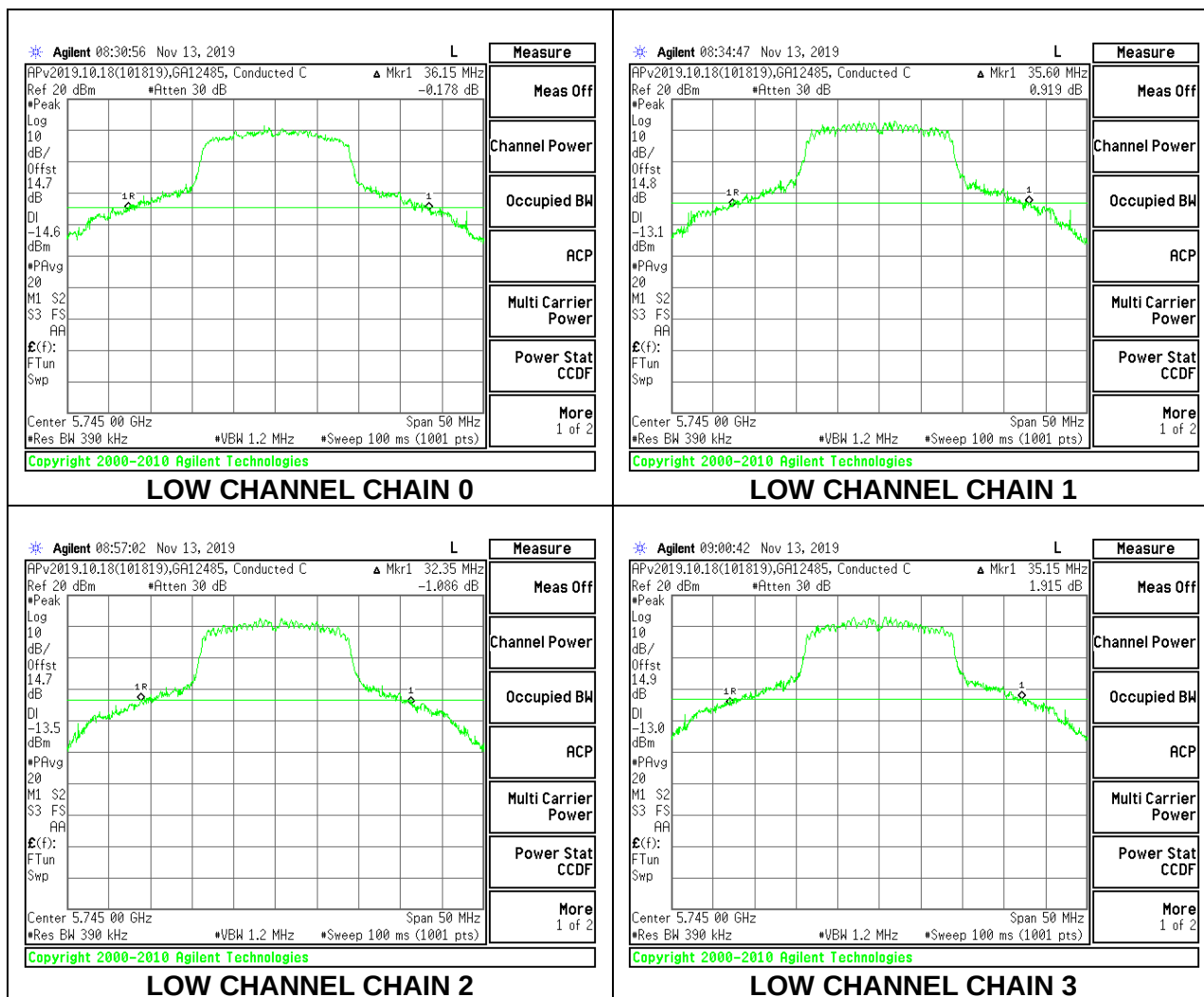


## 8.2.8. 802.11n HT20 MODE IN THE 5.8 GHz BAND

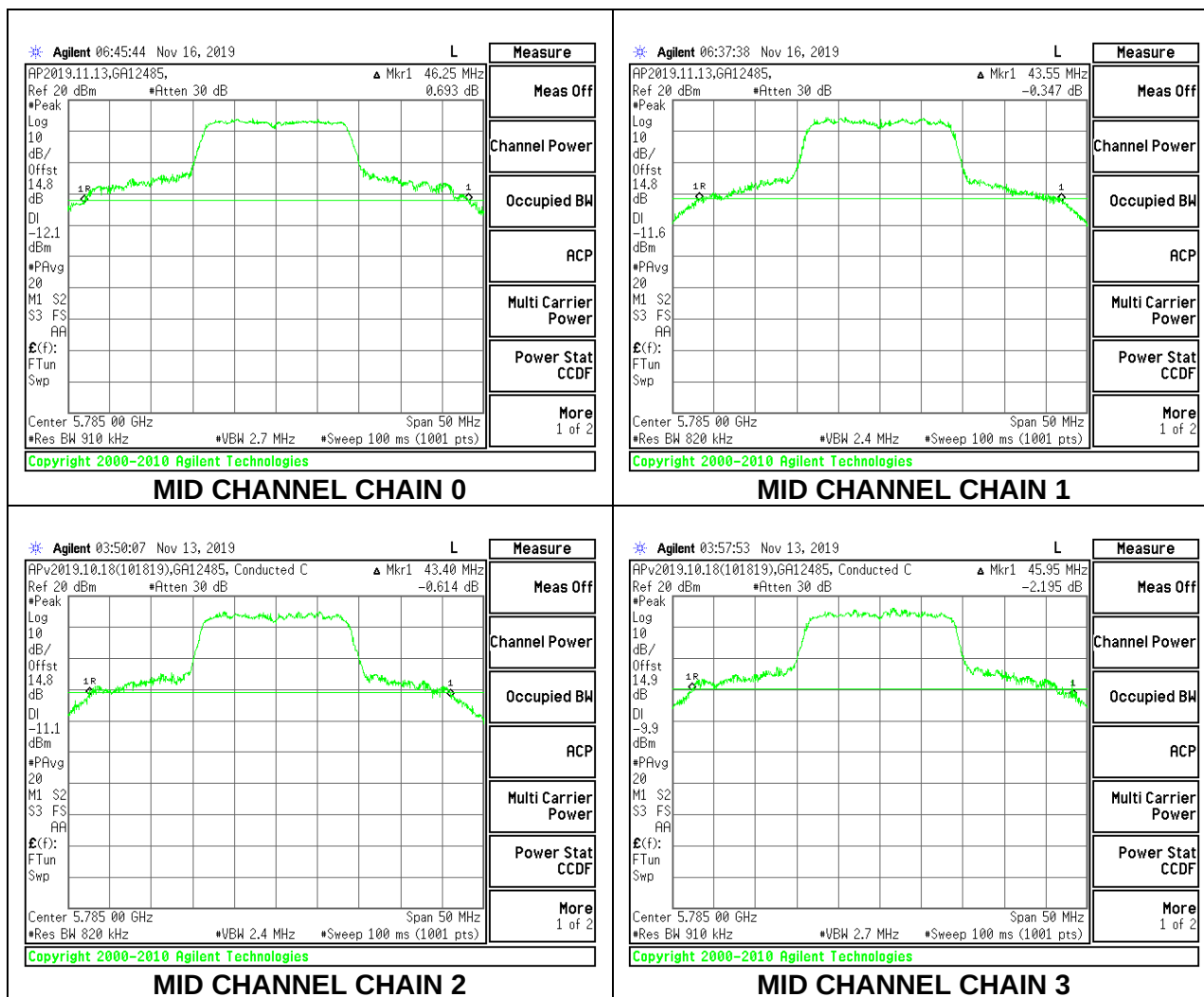
### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency | 26 dB Bandwidth<br>Chain 0<br>(MHz) | 26 dB Bandwidth<br>Chain 1<br>(MHz) | 26 dB Bandwidth<br>Chain 2<br>(MHz) | 26 dB Bandwidth<br>Chain 3<br>(MHz) |
|---------|-----------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Low     | 5745      | 36.15                               | 35.60                               | 32.35                               | 35.15                               |
| Mid     | 5785      | 46.25                               | 43.55                               | 43.40                               | 45.95                               |
| High    | 5825      | 43.95                               | 37.45                               | 29.95                               | 33.80                               |

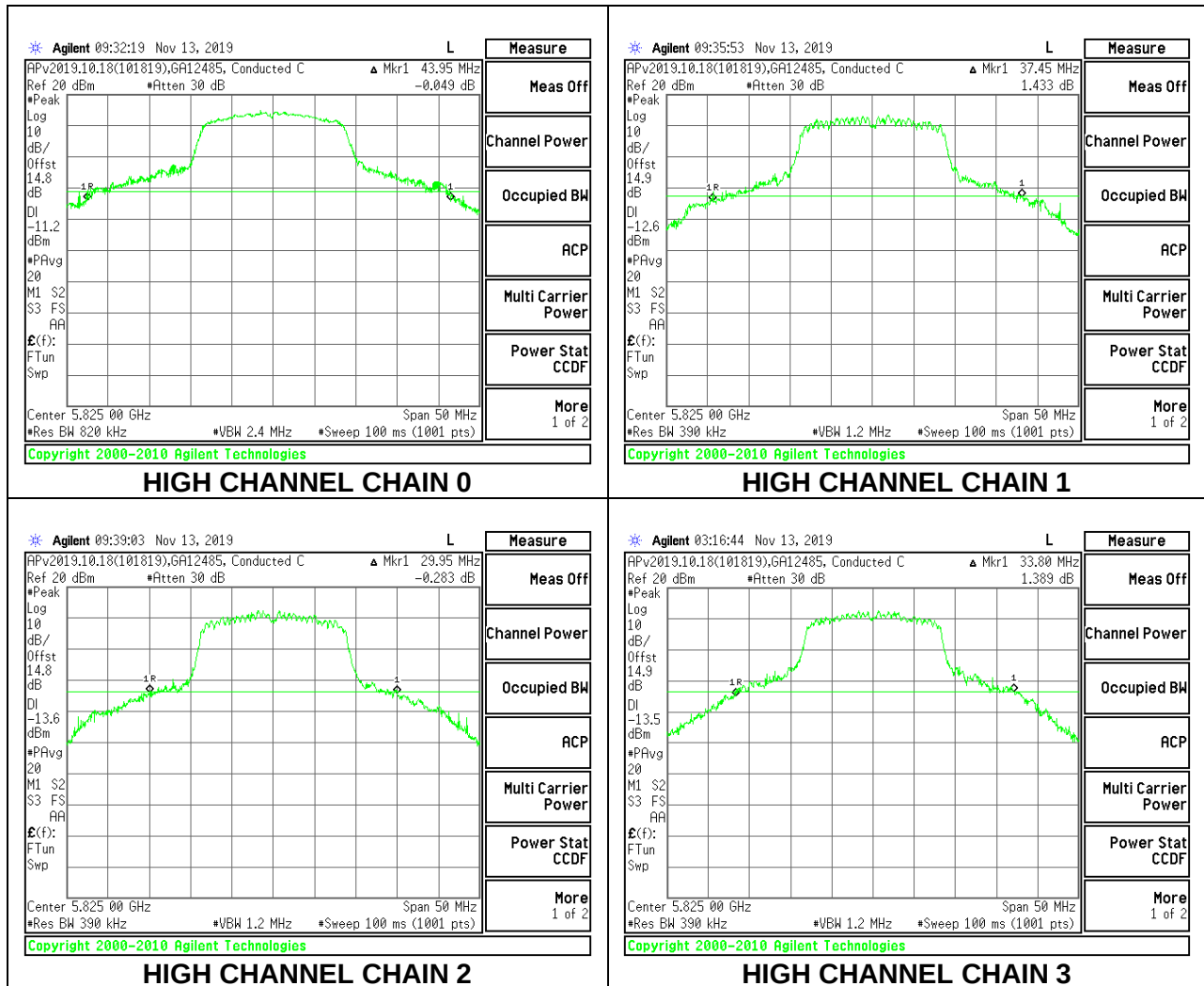
### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL



### **8.3. 99% BANDWIDTH**

#### **LIMITS**

None; for reporting purposes only.

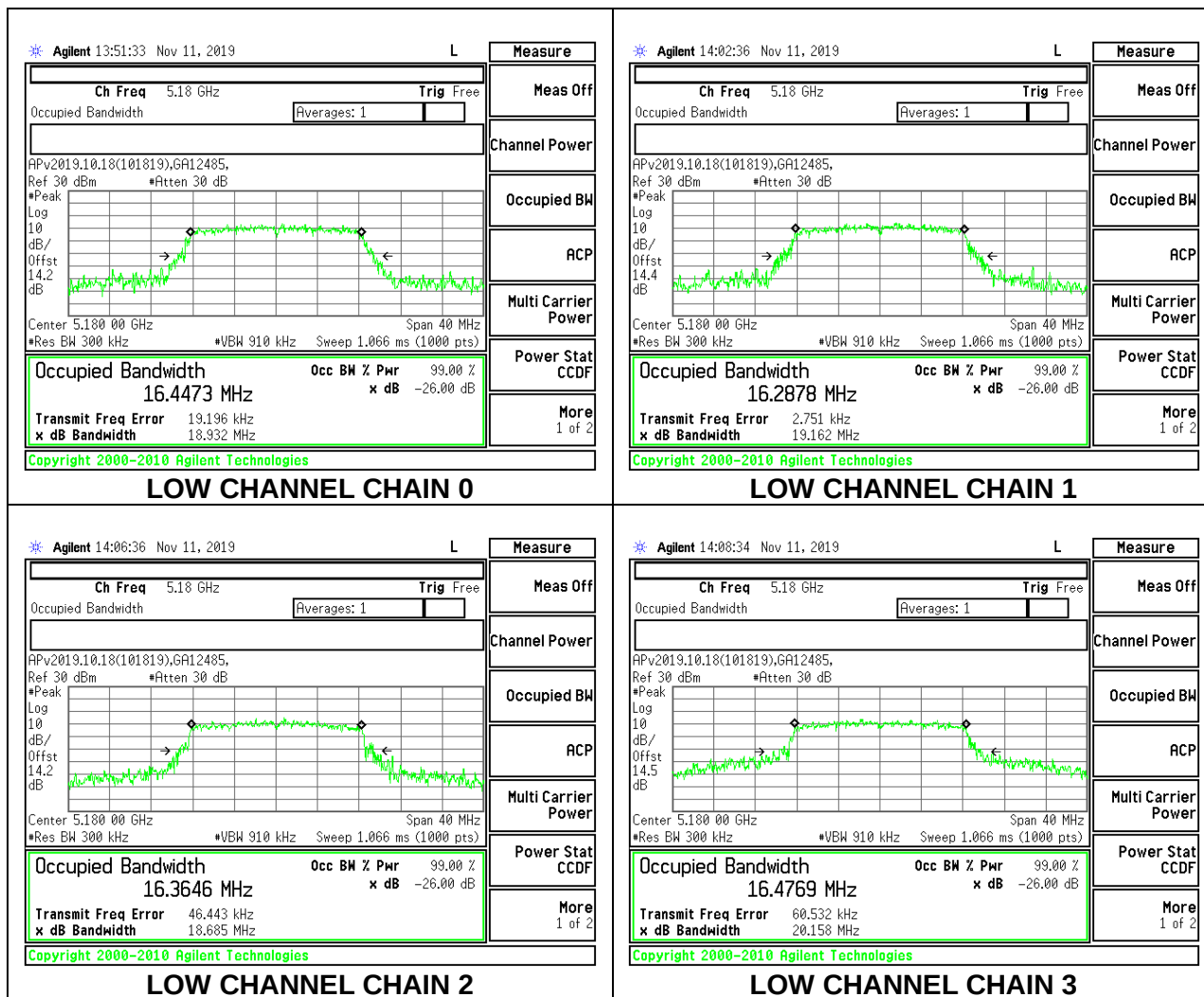
#### **RESULTS**

### 8.3.1. 802.11a MODE IN THE 5.2 GHz BAND

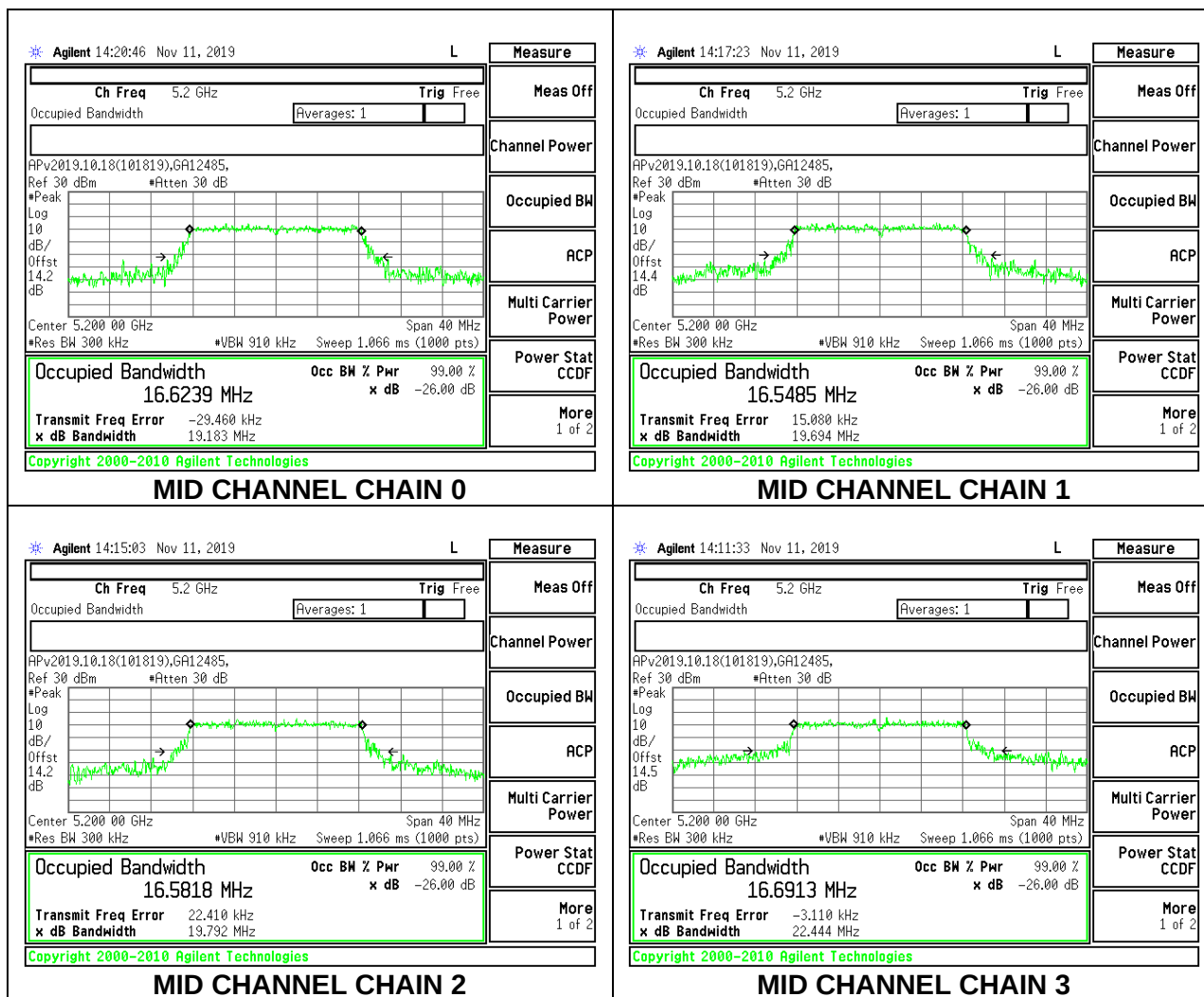
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>Chain 0<br>(MHz) | 99% Bandwidth<br>Chain 1<br>(MHz) | 99% Bandwidth<br>Chain 2<br>(MHz) | 99% Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Low     | 5180               | 16.447                            | 16.288                            | 16.365                            | 16.477                            |
| Mid     | 5200               | 16.624                            | 16.549                            | 16.582                            | 16.691                            |
| High    | 5240               | 16.680                            | 16.545                            | 16.502                            | 16.633                            |

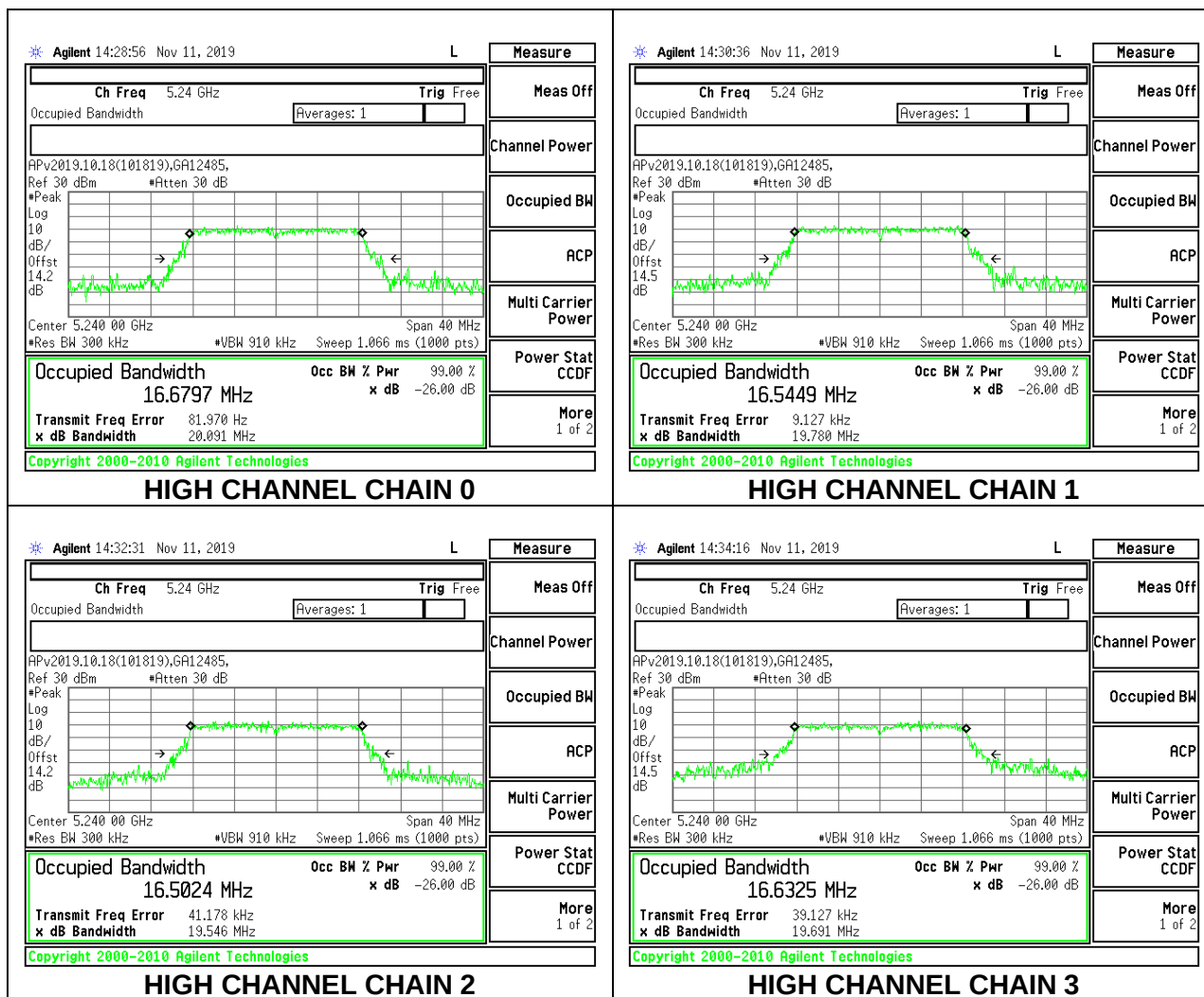
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

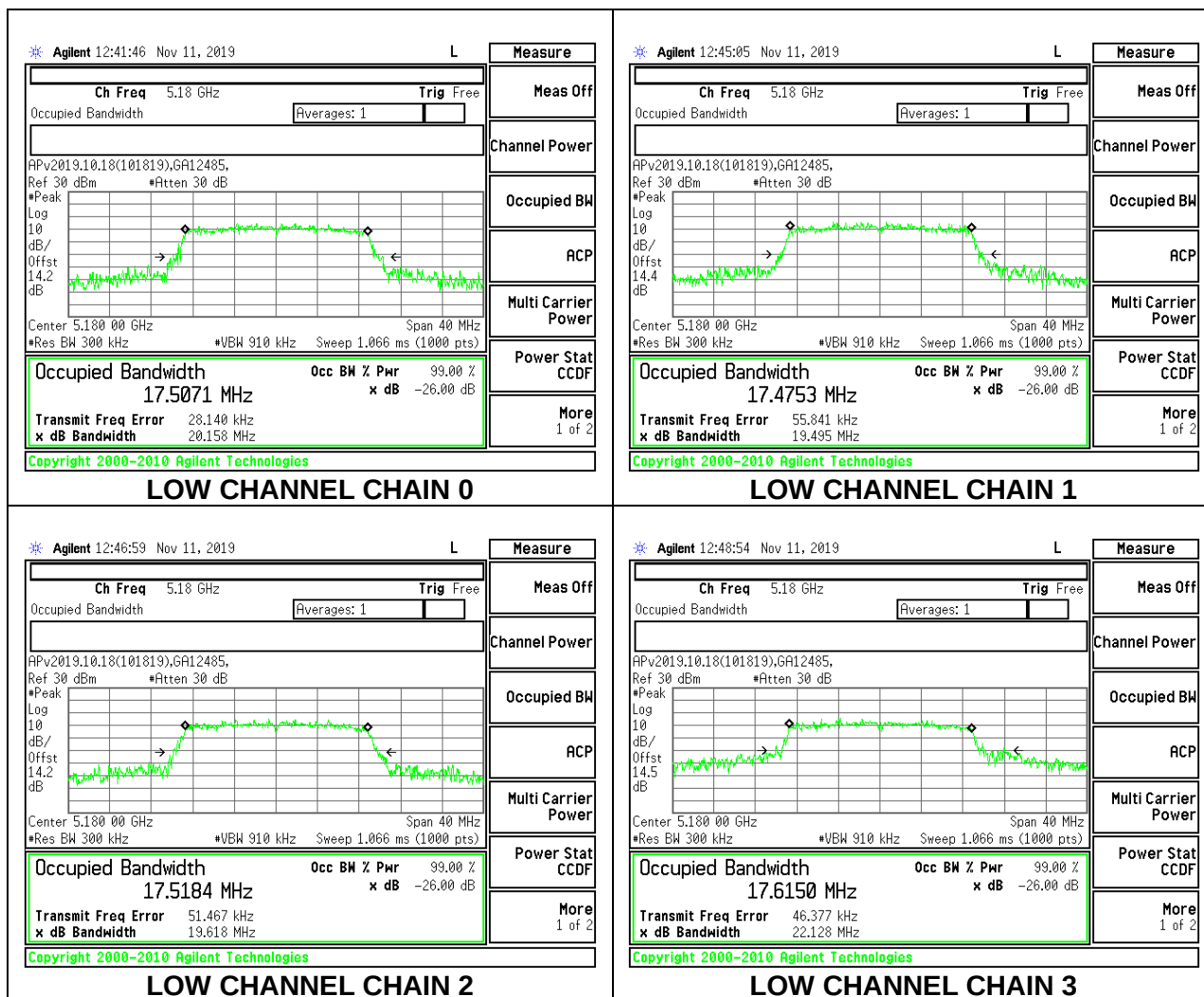


### 8.3.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

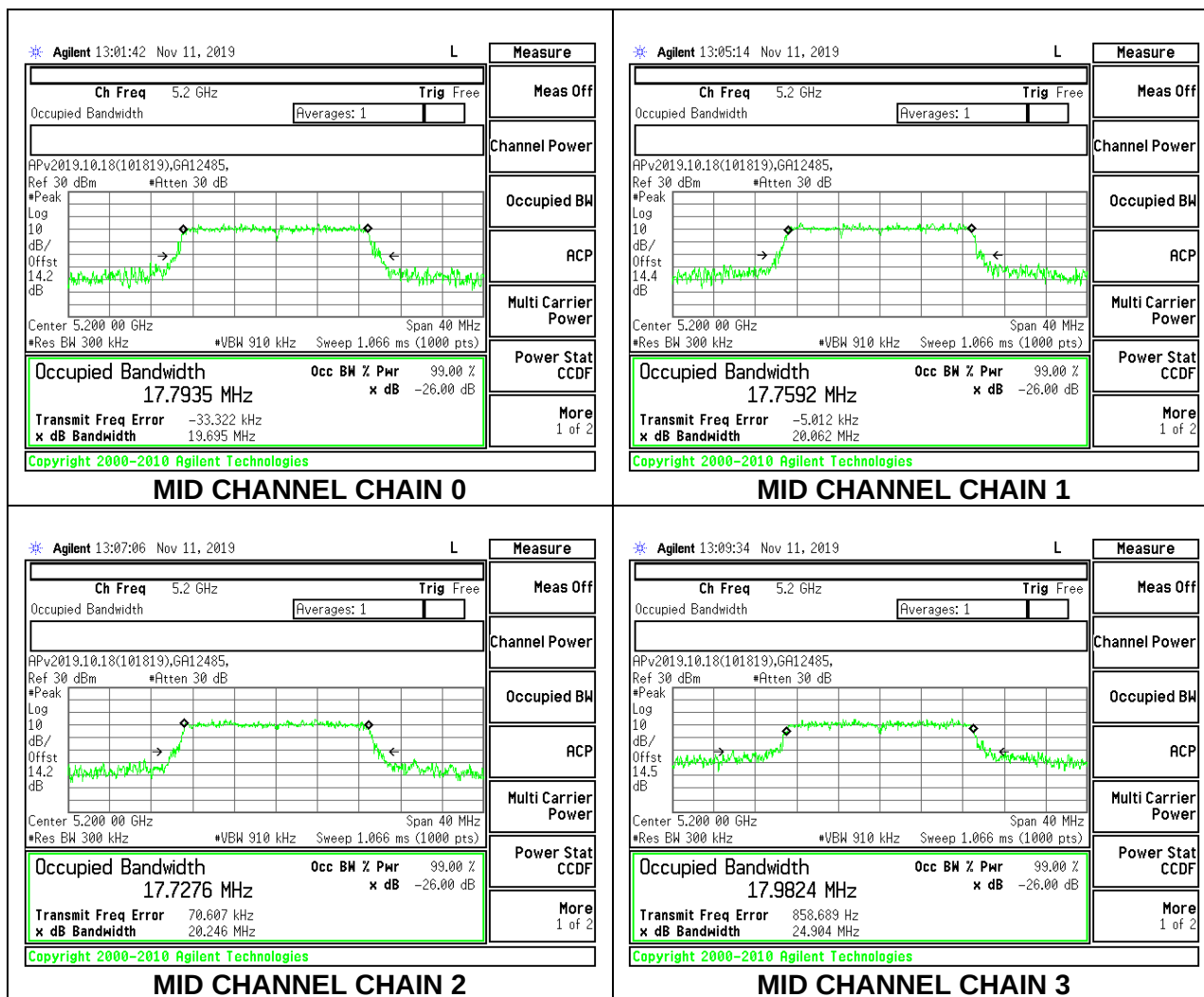
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>Chain 0<br>(MHz) | 99% Bandwidth<br>Chain 1<br>(MHz) | 99% Bandwidth<br>Chain 2<br>(MHz) | 99% Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Low     | 5180               | 17.507                            | 17.475                            | 17.518                            | 17.615                            |
| Mid     | 5200               | 17.794                            | 17.759                            | 17.728                            | 17.982                            |
| High    | 5240               | 17.744                            | 17.739                            | 17.711                            | 17.724                            |

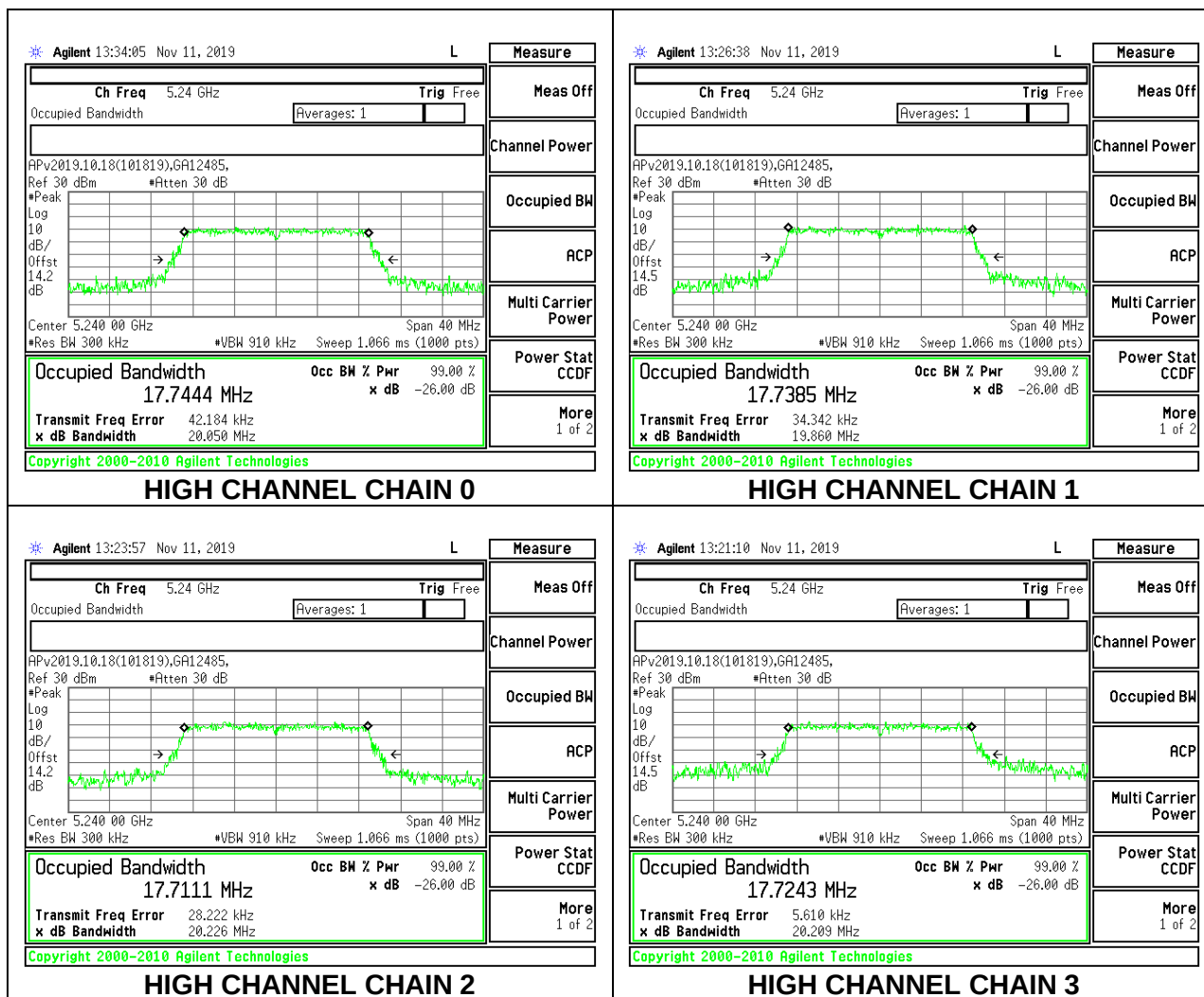
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

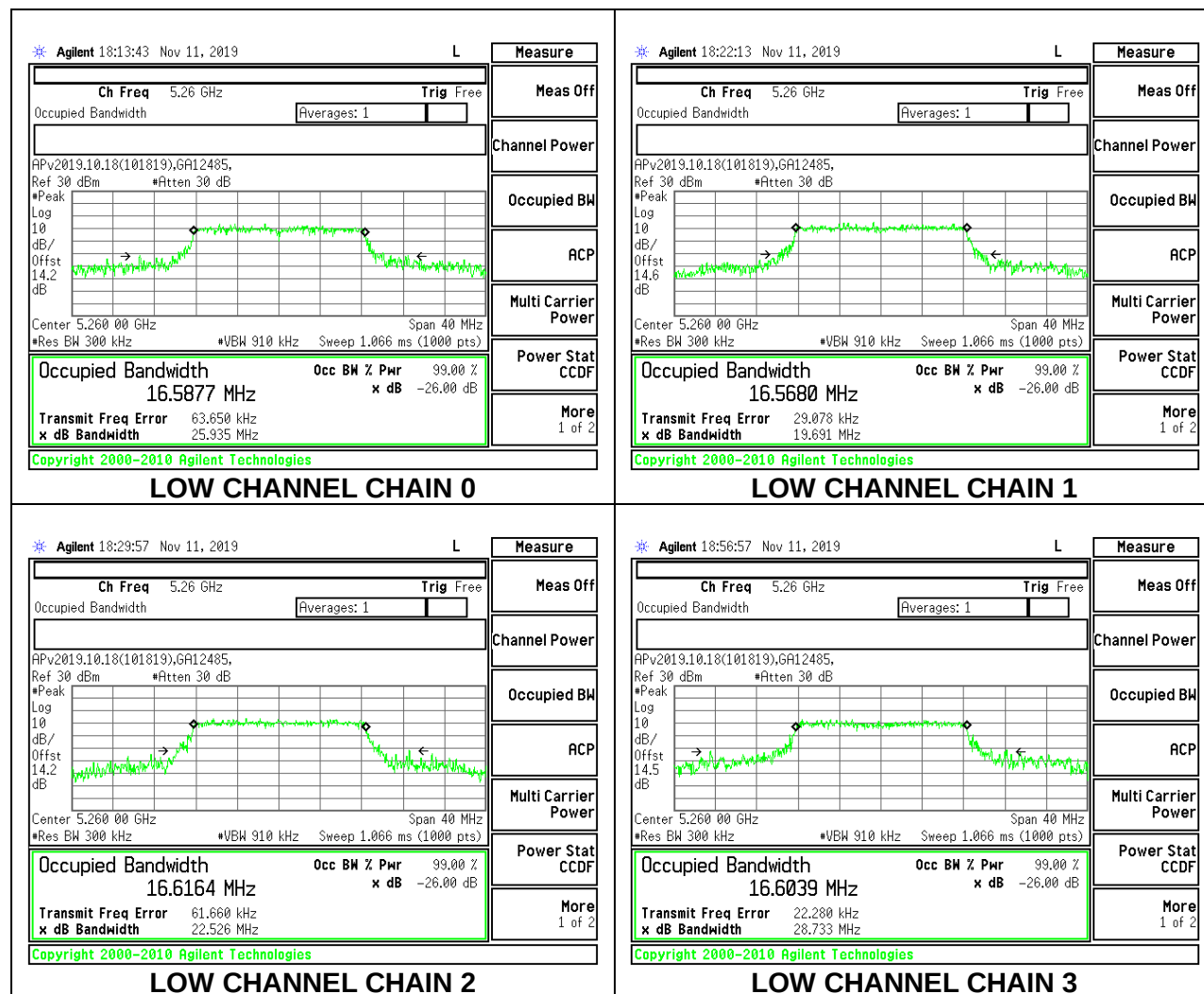


### 8.3.3. 802.11a MODE IN THE 5.3 GHz BAND

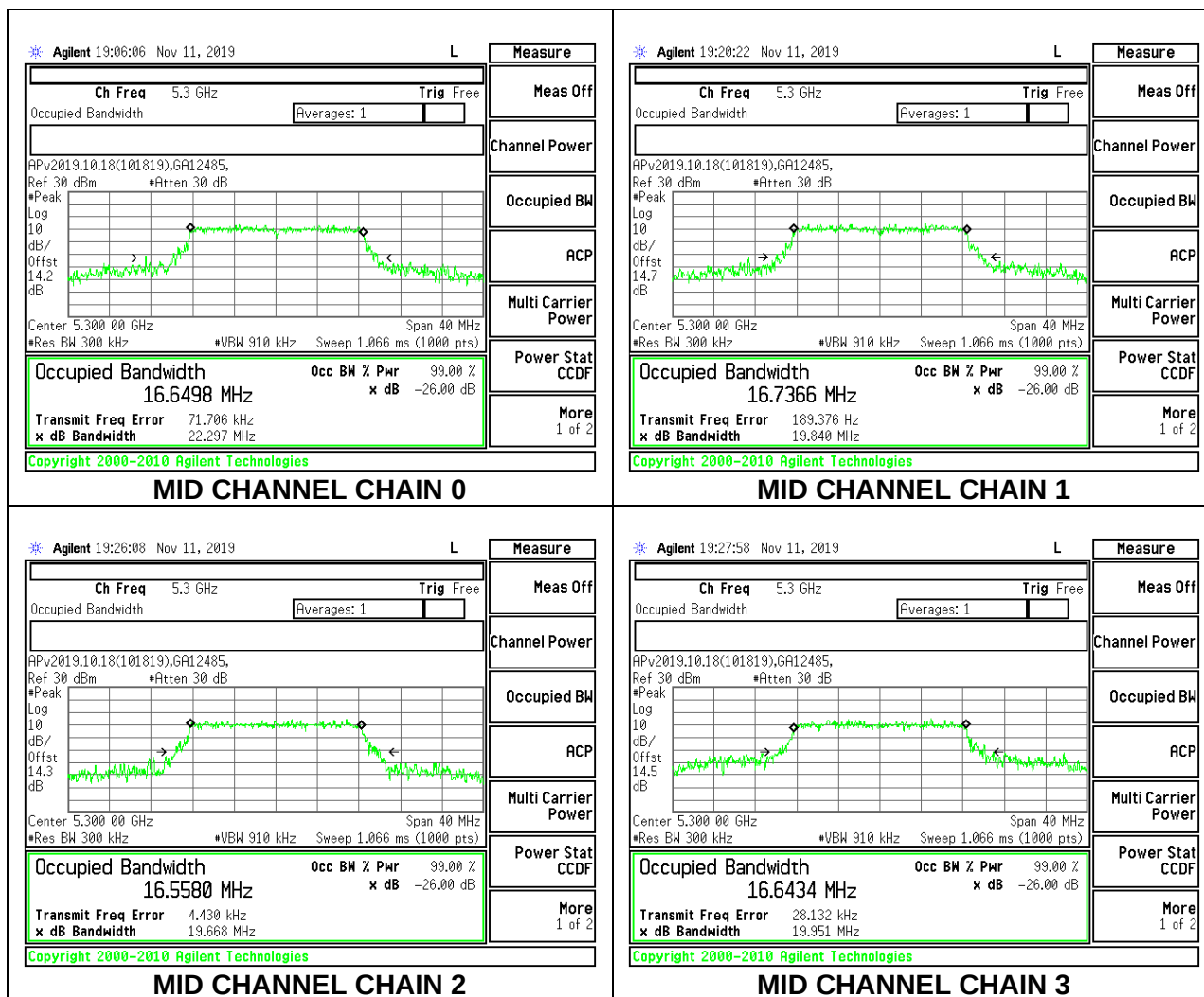
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>Chain 0<br>(MHz) | 99% Bandwidth<br>Chain 1<br>(MHz) | 99% Bandwidth<br>Chain 2<br>(MHz) | 99% Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Low     | 5260               | 16.588                            | 16.568                            | 16.616                            | 16.604                            |
| Mid     | 5300               | 16.650                            | 16.737                            | 16.558                            | 16.643                            |
| High    | 5320               | 16.421                            | 16.246                            | 16.397                            | 16.524                            |

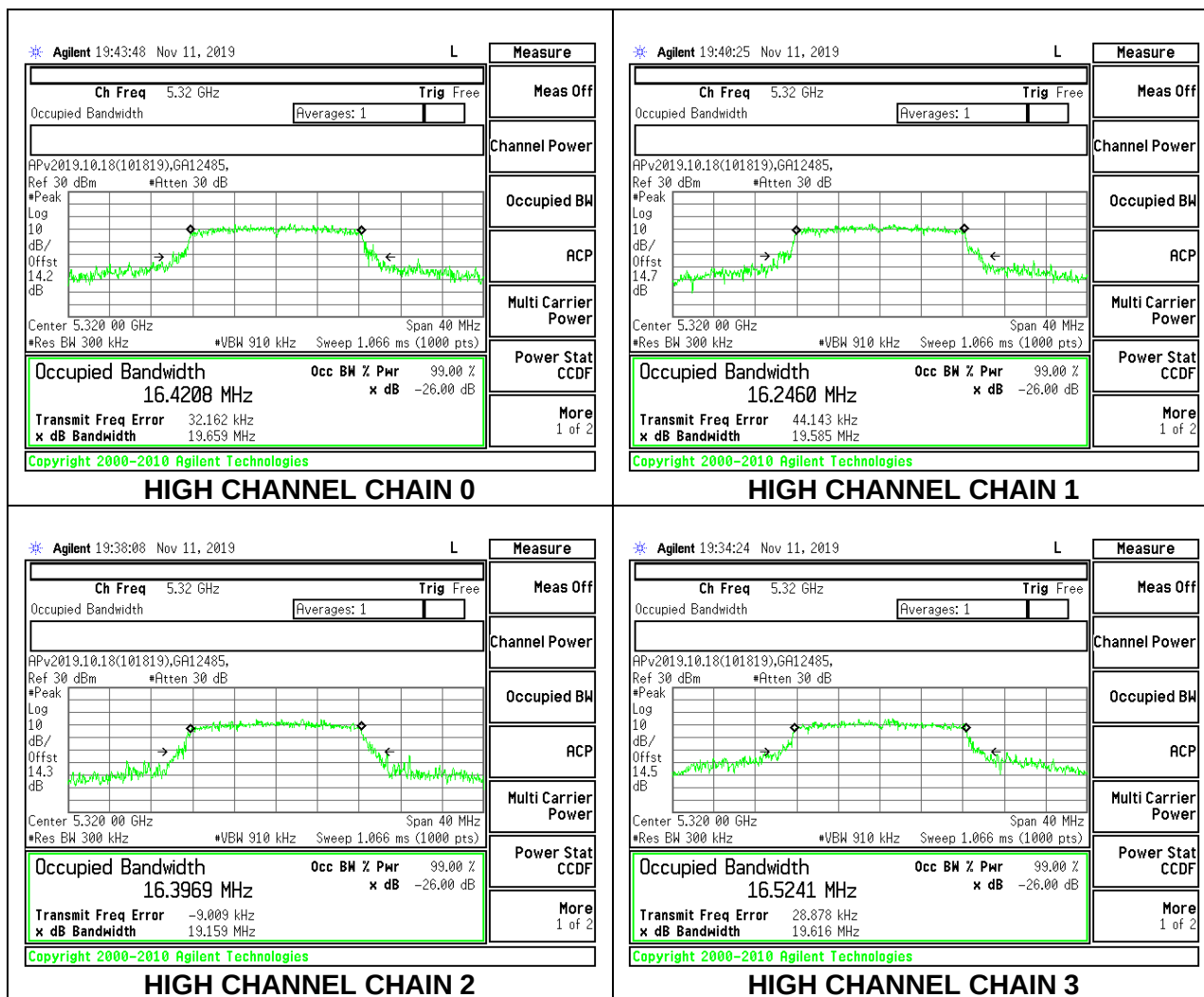
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

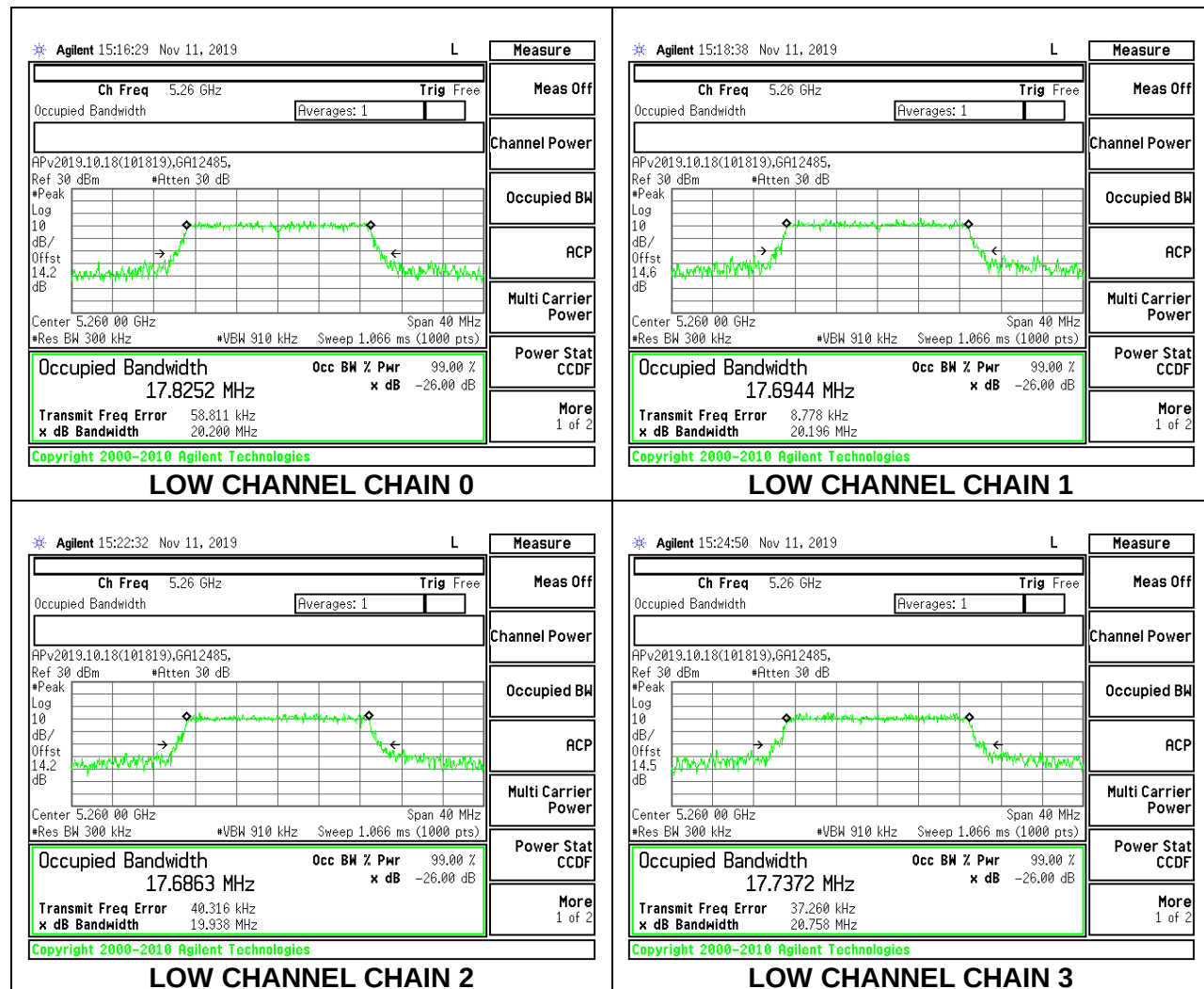


### 8.3.4. 802.11n HT20 MODE IN THE 5.3 GHZ BAND

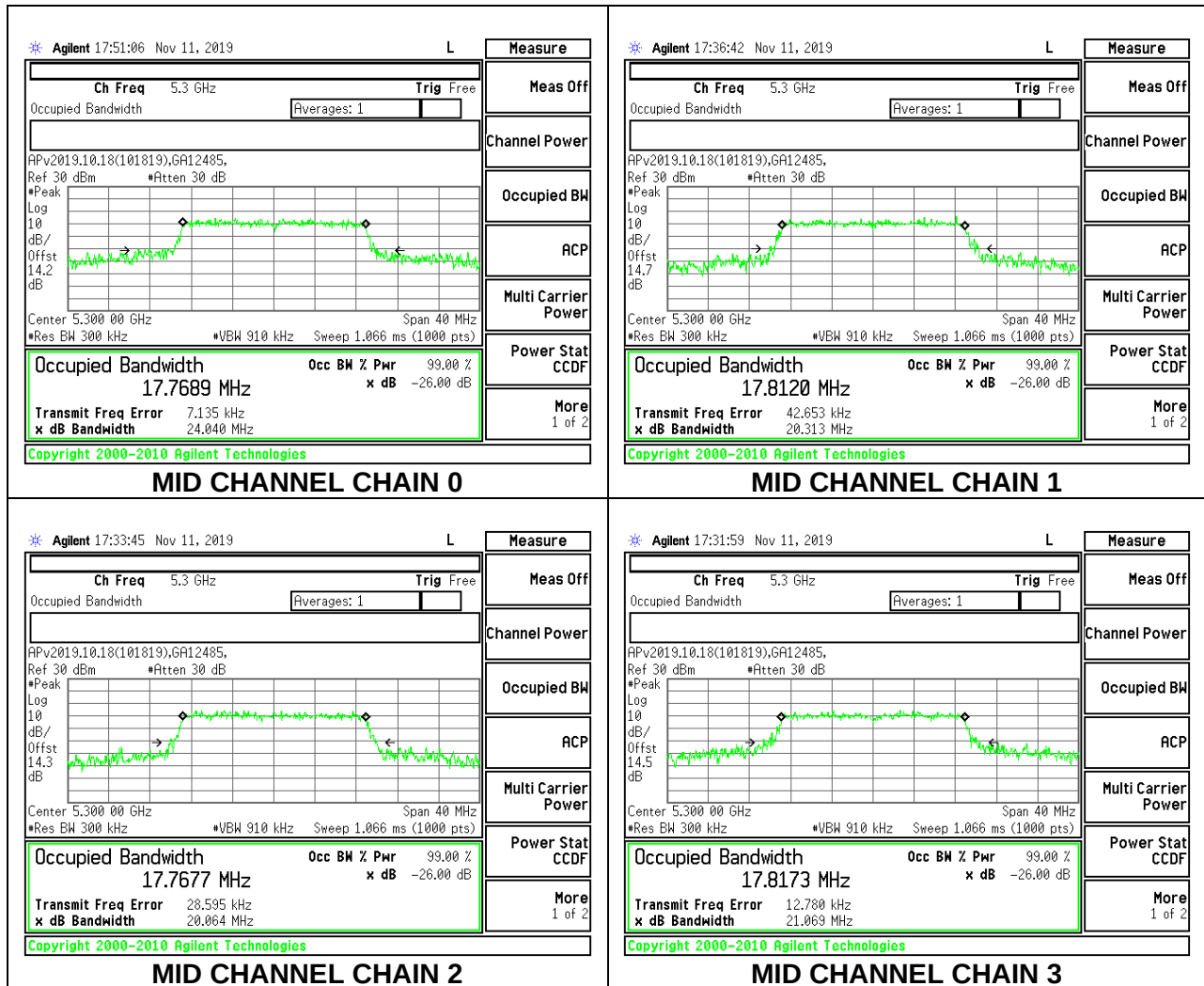
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>Chain 0<br>(MHz) | 99% Bandwidth<br>Chain 1<br>(MHz) | 99% Bandwidth<br>Chain 2<br>(MHz) | 99% Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Low     | 5260               | 17.825                            | 17.694                            | 17.686                            | 17.737                            |
| Mid     | 5300               | 17.769                            | 17.812                            | 17.768                            | 17.817                            |
| High    | 5320               | 17.677                            | 17.514                            | 17.516                            | 17.489                            |

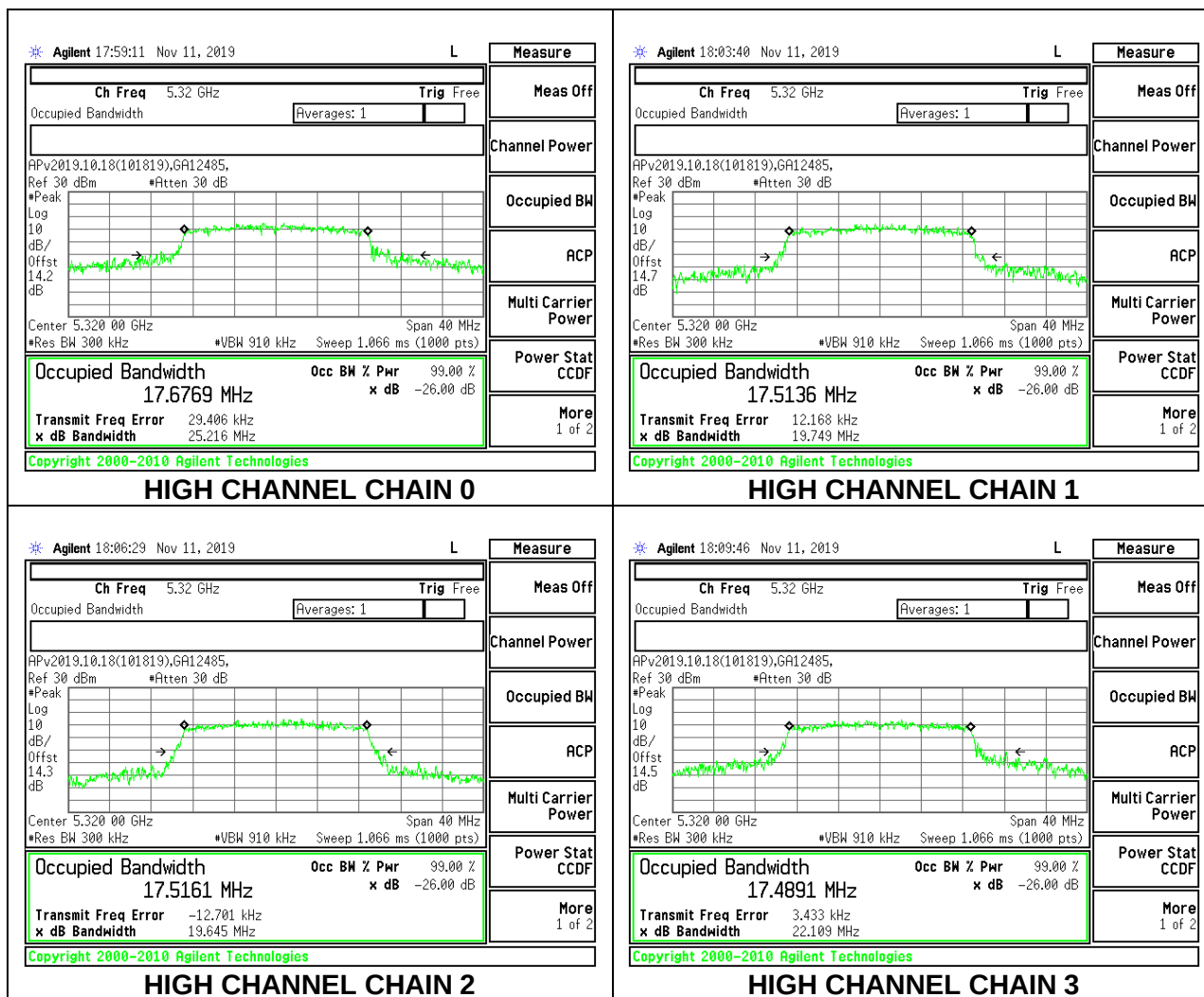
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

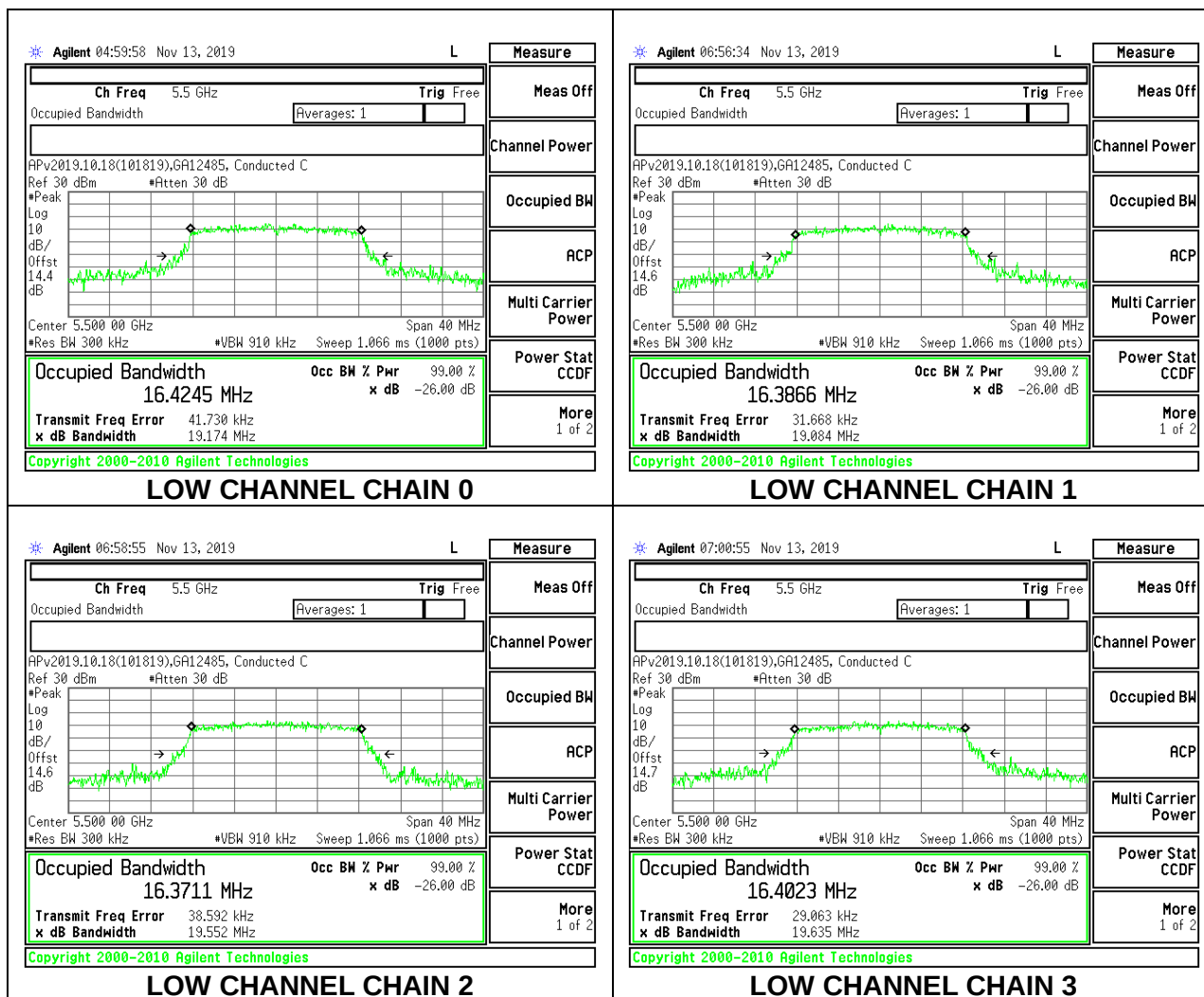


### 8.3.5. 802.11a MODE IN THE 5.6 GHz BAND

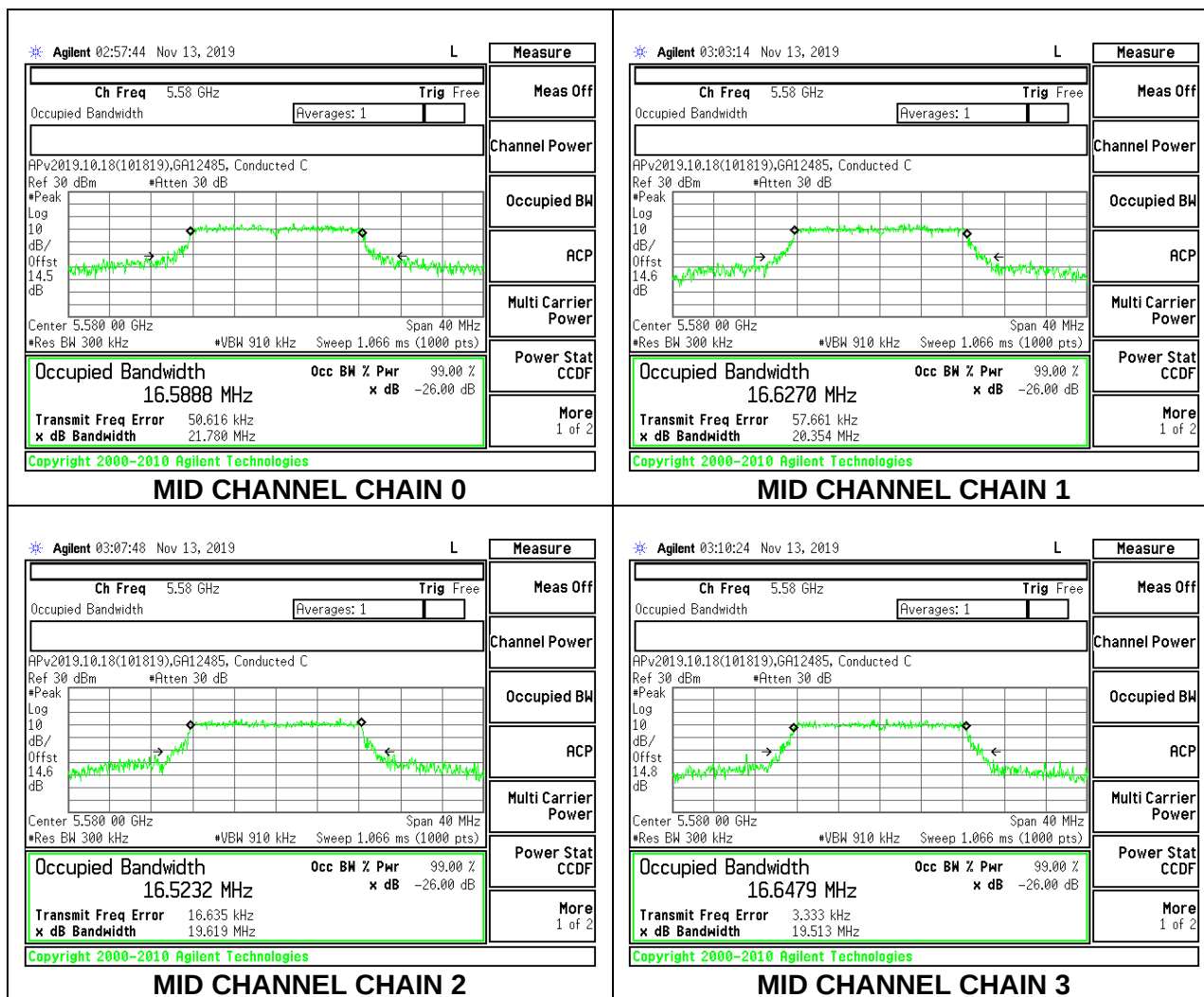
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>Chain 0<br>(MHz) | 99% Bandwidth<br>Chain 1<br>(MHz) | 99% Bandwidth<br>Chain 2<br>(MHz) | 99% Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Low     | 5500               | 16.425                            | 16.387                            | 16.371                            | 16.402                            |
| Mid     | 5580               | 16.589                            | 16.627                            | 16.523                            | 16.648                            |
| High    | 5700               | 16.383                            | 16.394                            | 16.417                            | 16.334                            |

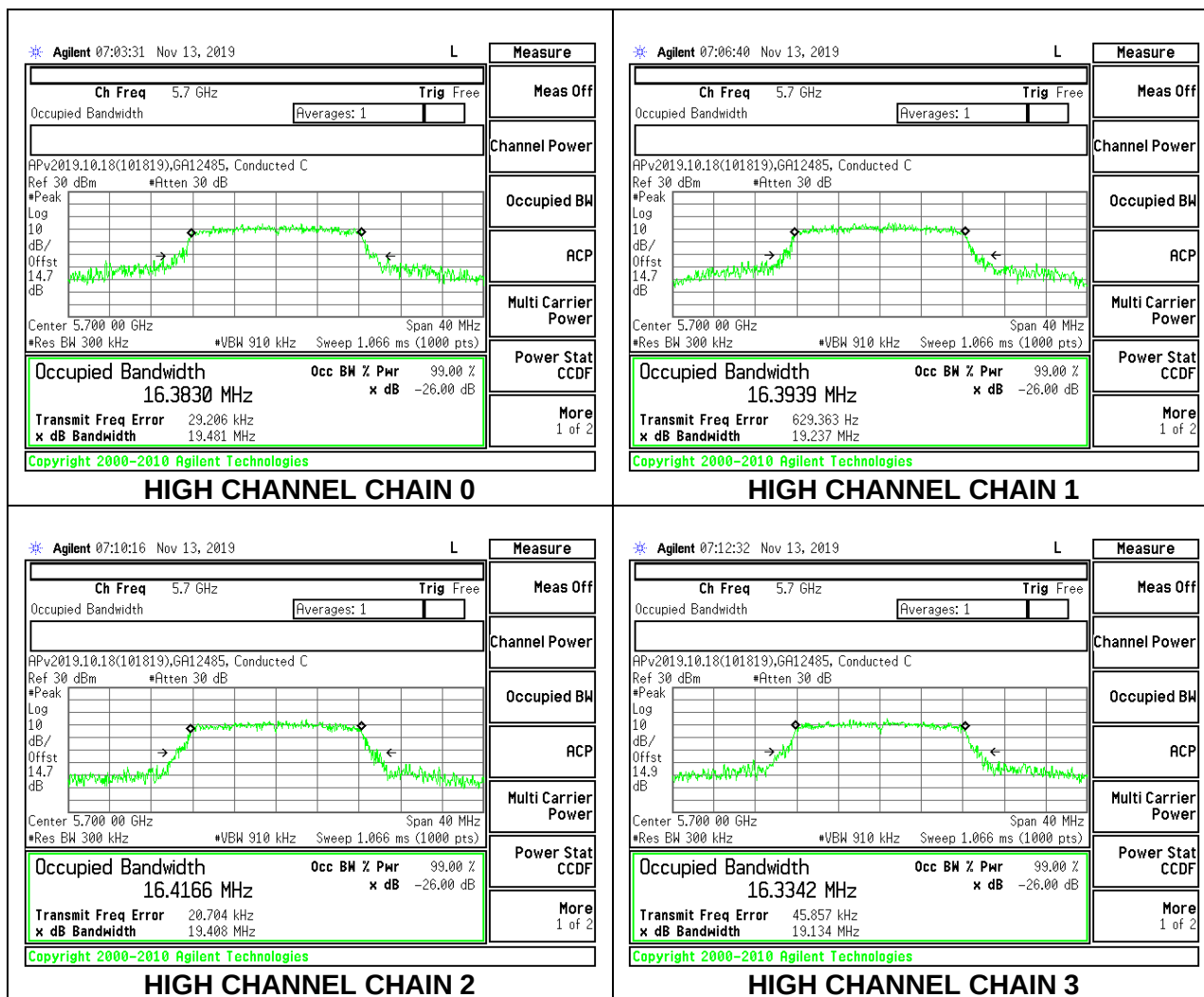
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

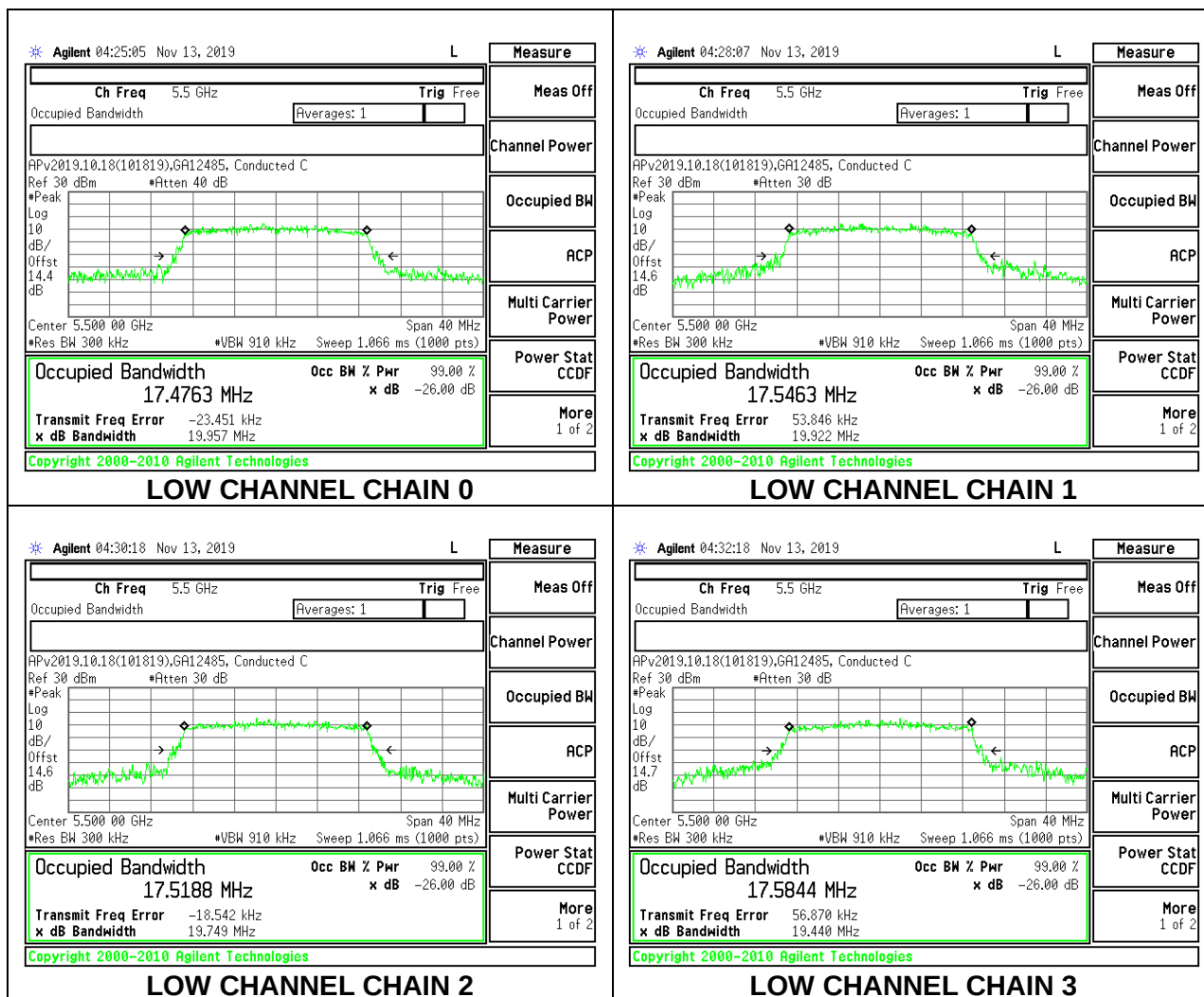


### 8.3.6. 802.11n HT20 MODE IN THE 5.6 GHz BAND

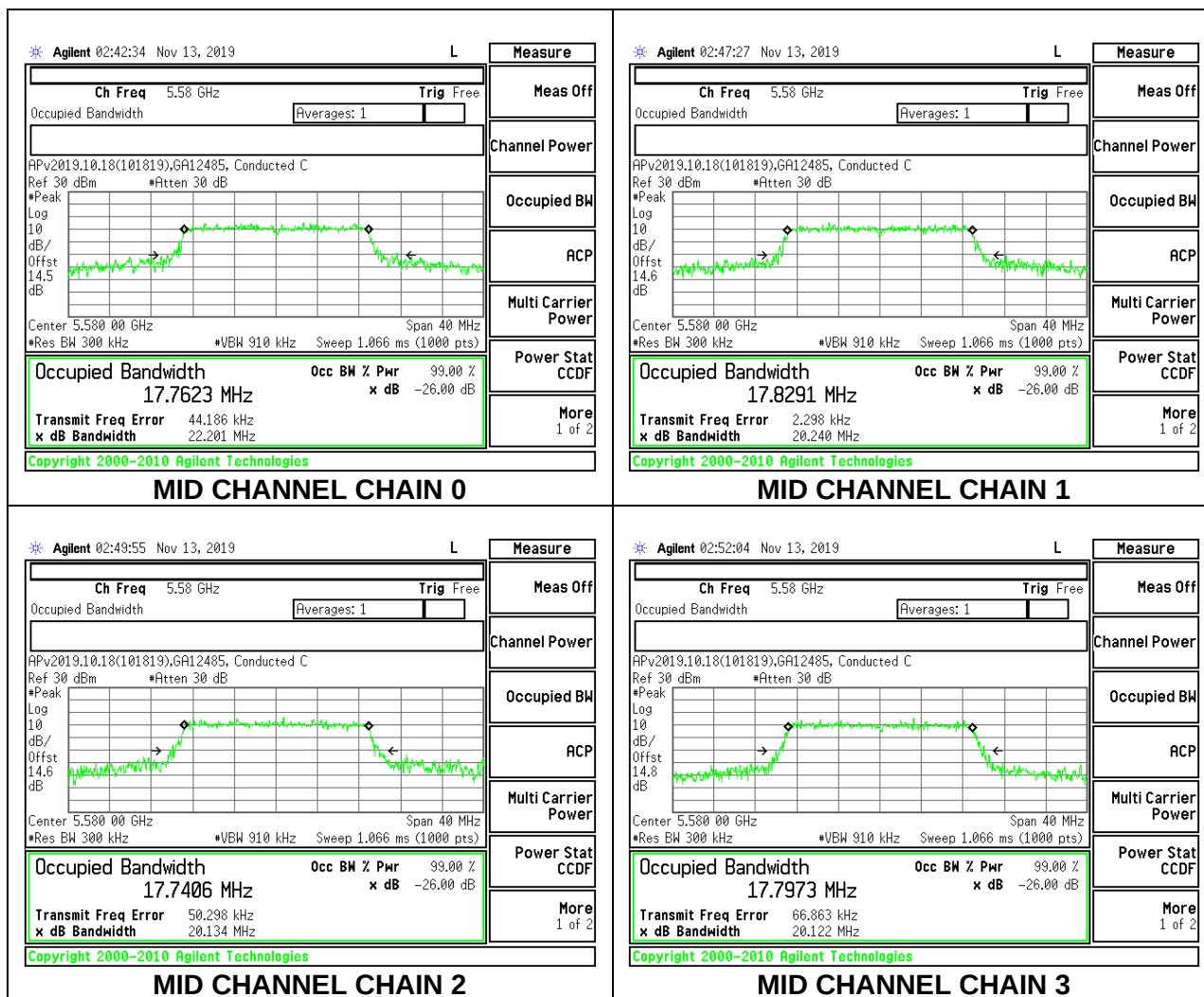
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>Chain 0<br>(MHz) | 99% Bandwidth<br>Chain 1<br>(MHz) | 99% Bandwidth<br>Chain 2<br>(MHz) | 99% Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Low     | 5500               | 17.476                            | 17.546                            | 17.519                            | 17.584                            |
| Mid     | 5580               | 17.762                            | 17.829                            | 17.741                            | 17.797                            |
| High    | 5700               | 17.646                            | 17.513                            | 17.558                            | 17.538                            |

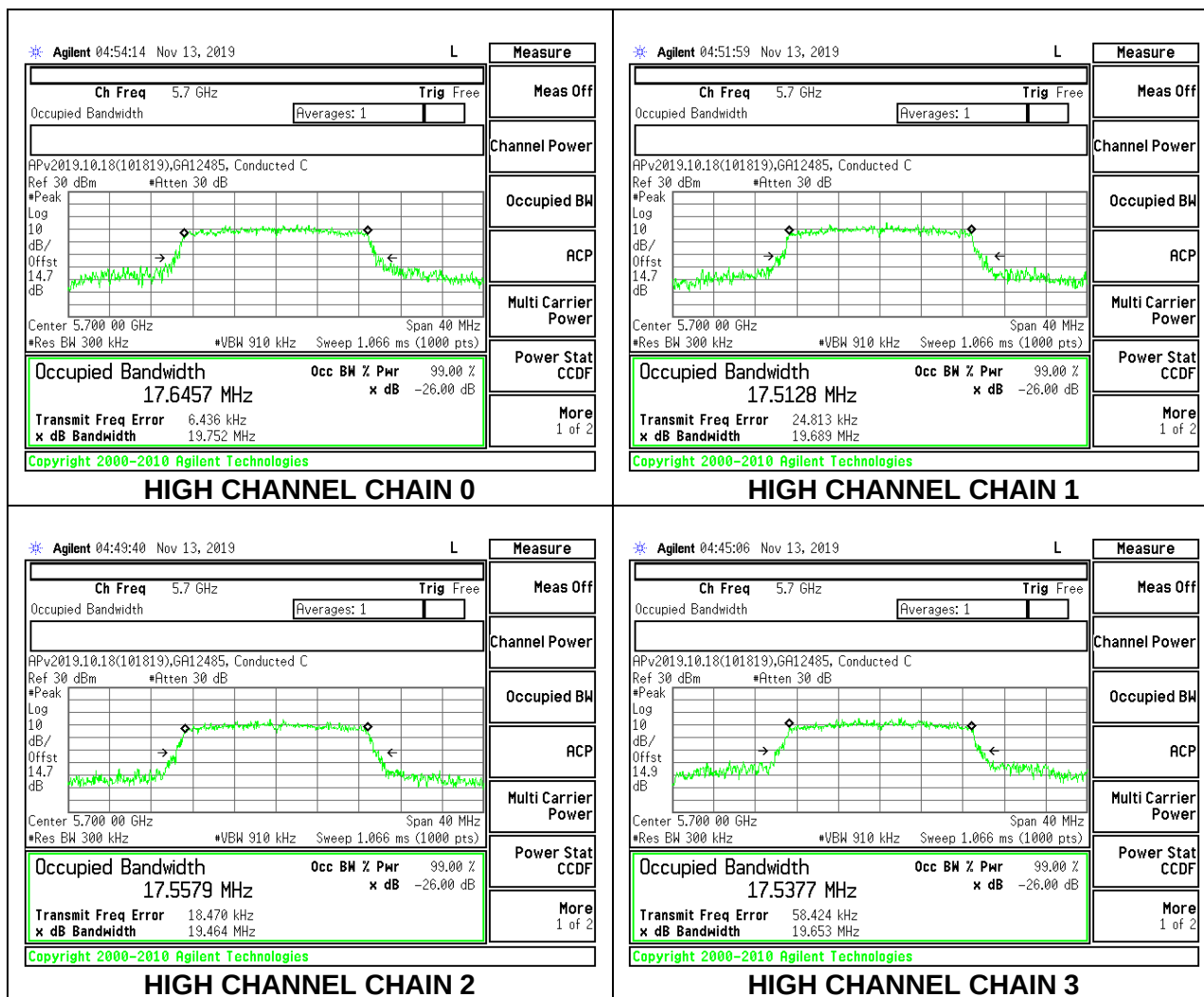
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

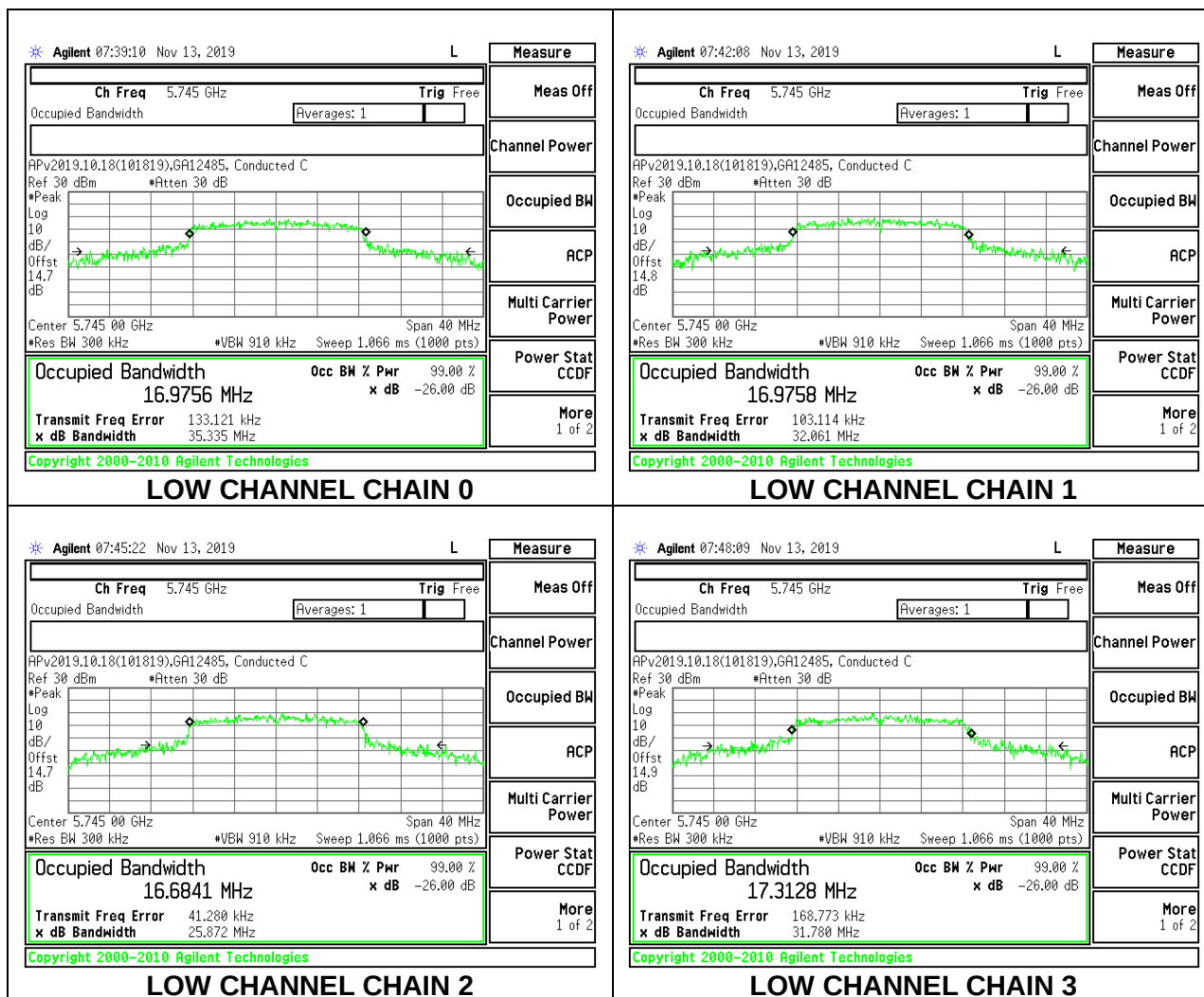


### 8.3.7. 802.11a MODE IN THE 5.8 GHz BAND

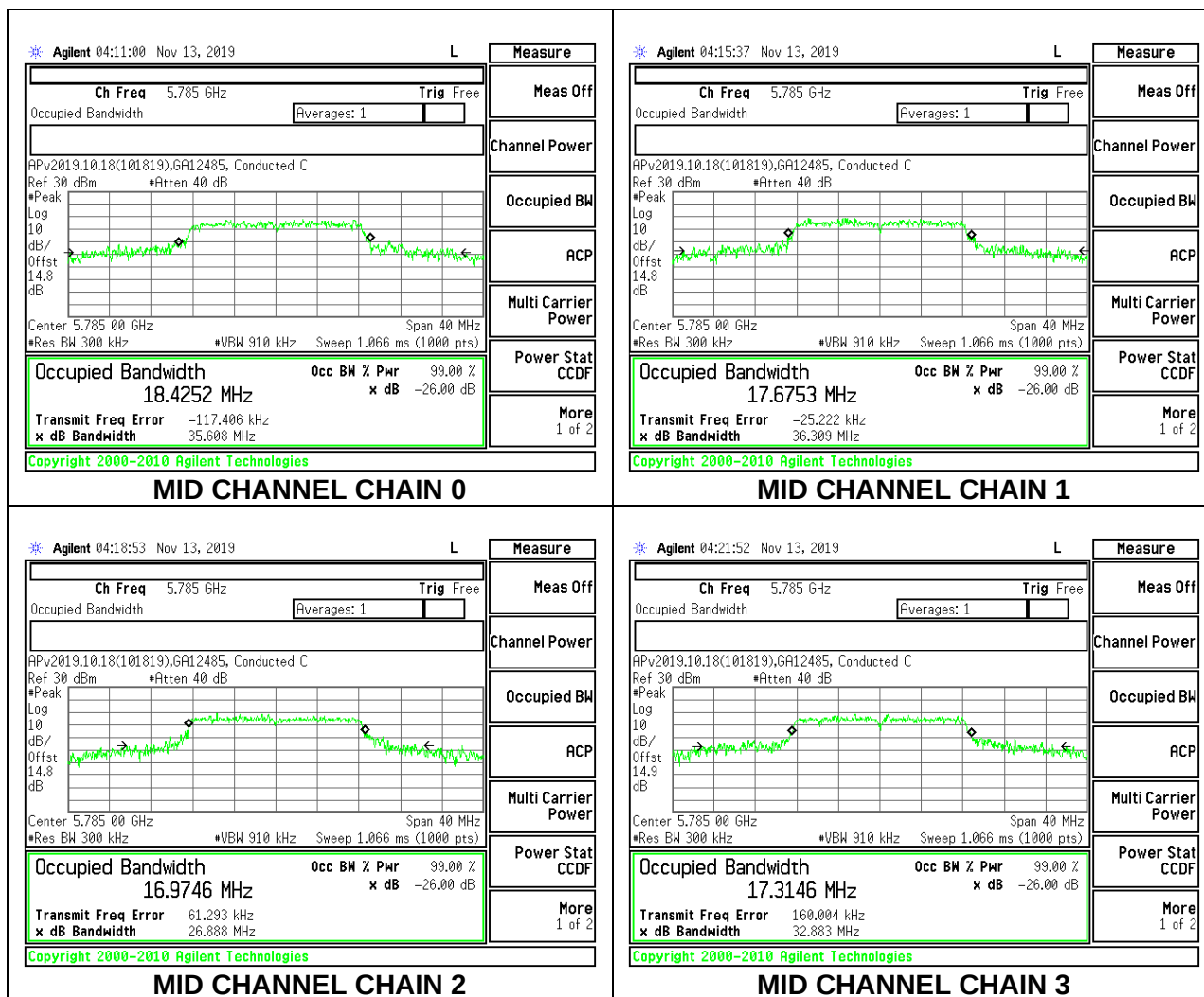
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>Chain 0<br>(MHz) | 99% Bandwidth<br>Chain 1<br>(MHz) | 99% Bandwidth<br>Chain 2<br>(MHz) | 99% Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Low     | 5745               | 16.976                            | 16.976                            | 16.684                            | 17.313                            |
| Mid     | 5785               | 18.425                            | 17.675                            | 16.975                            | 17.315                            |
| High    | 5825               | 18.018                            | 17.764                            | 16.583                            | 17.654                            |

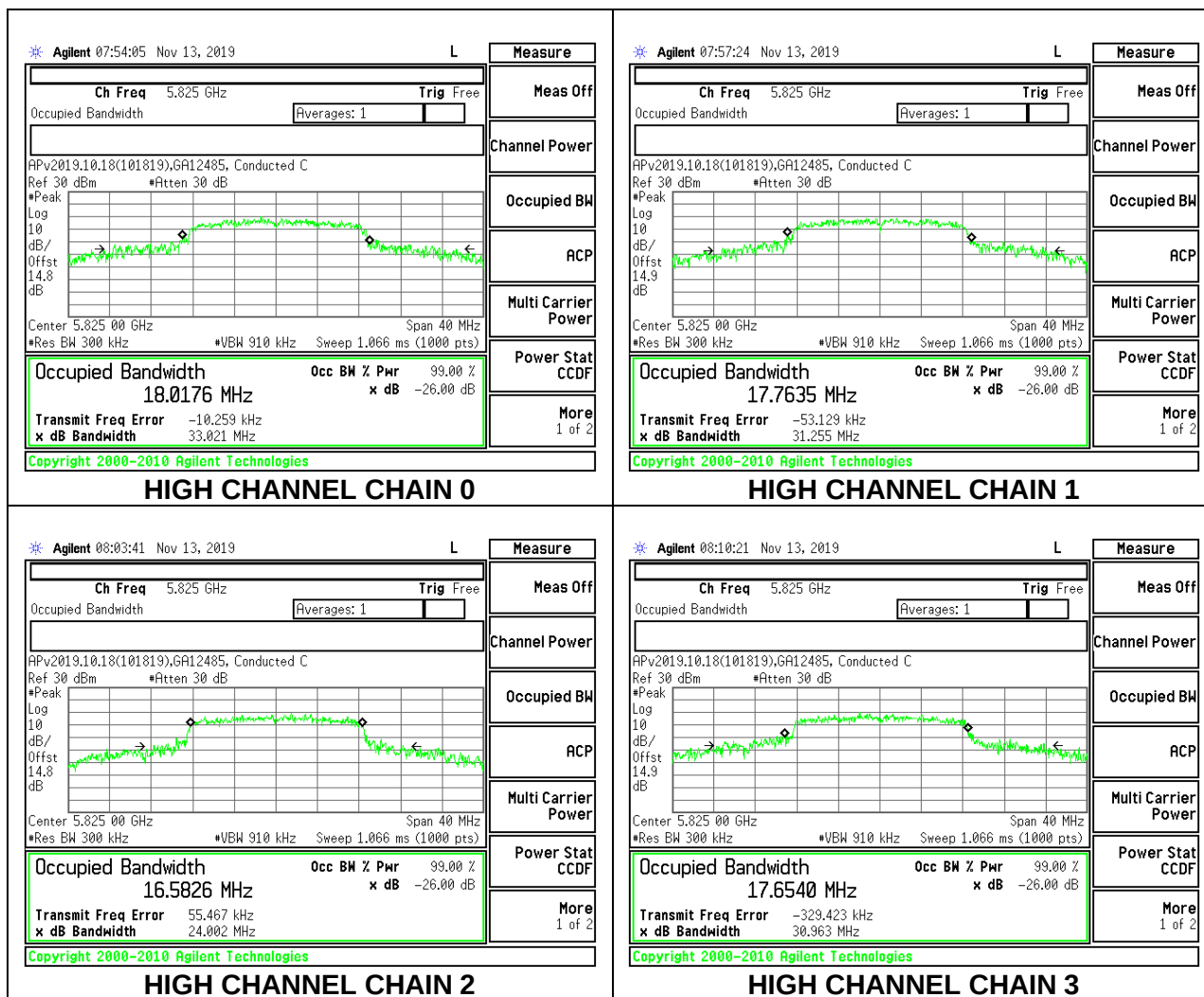
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

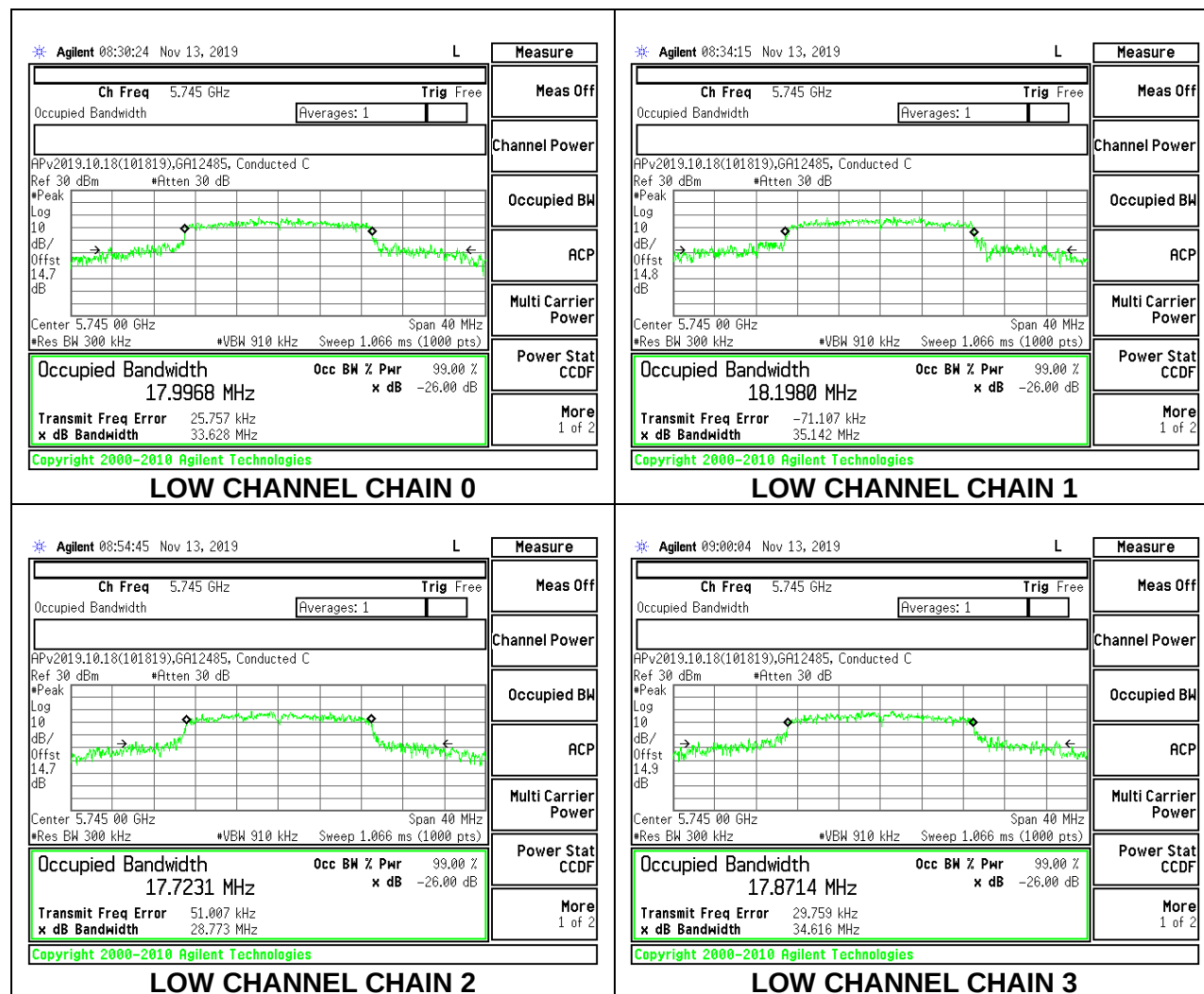


### 8.3.8. 802.11n HT20 MODE IN THE 5.8 GHz BAND

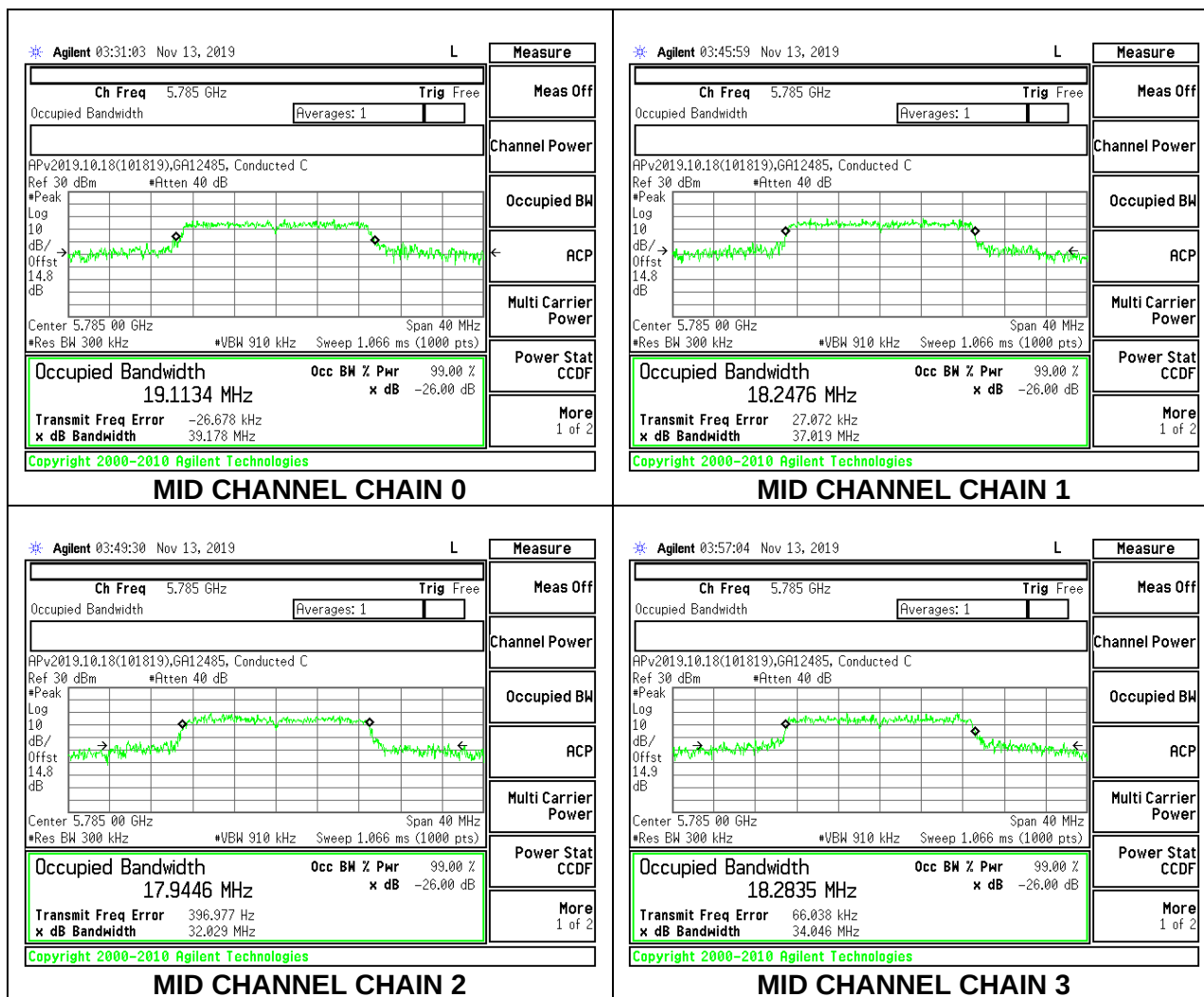
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 99% Bandwidth<br>Chain 0<br>(MHz) | 99% Bandwidth<br>Chain 1<br>(MHz) | 99% Bandwidth<br>Chain 2<br>(MHz) | 99% Bandwidth<br>Chain 3<br>(MHz) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Low     | 5745               | 17.997                            | 18.198                            | 17.723                            | 17.871                            |
| Mid     | 5785               | 19.113                            | 18.248                            | 17.945                            | 18.284                            |
| High    | 5825               | 18.340                            | 17.952                            | 17.698                            | 17.324                            |

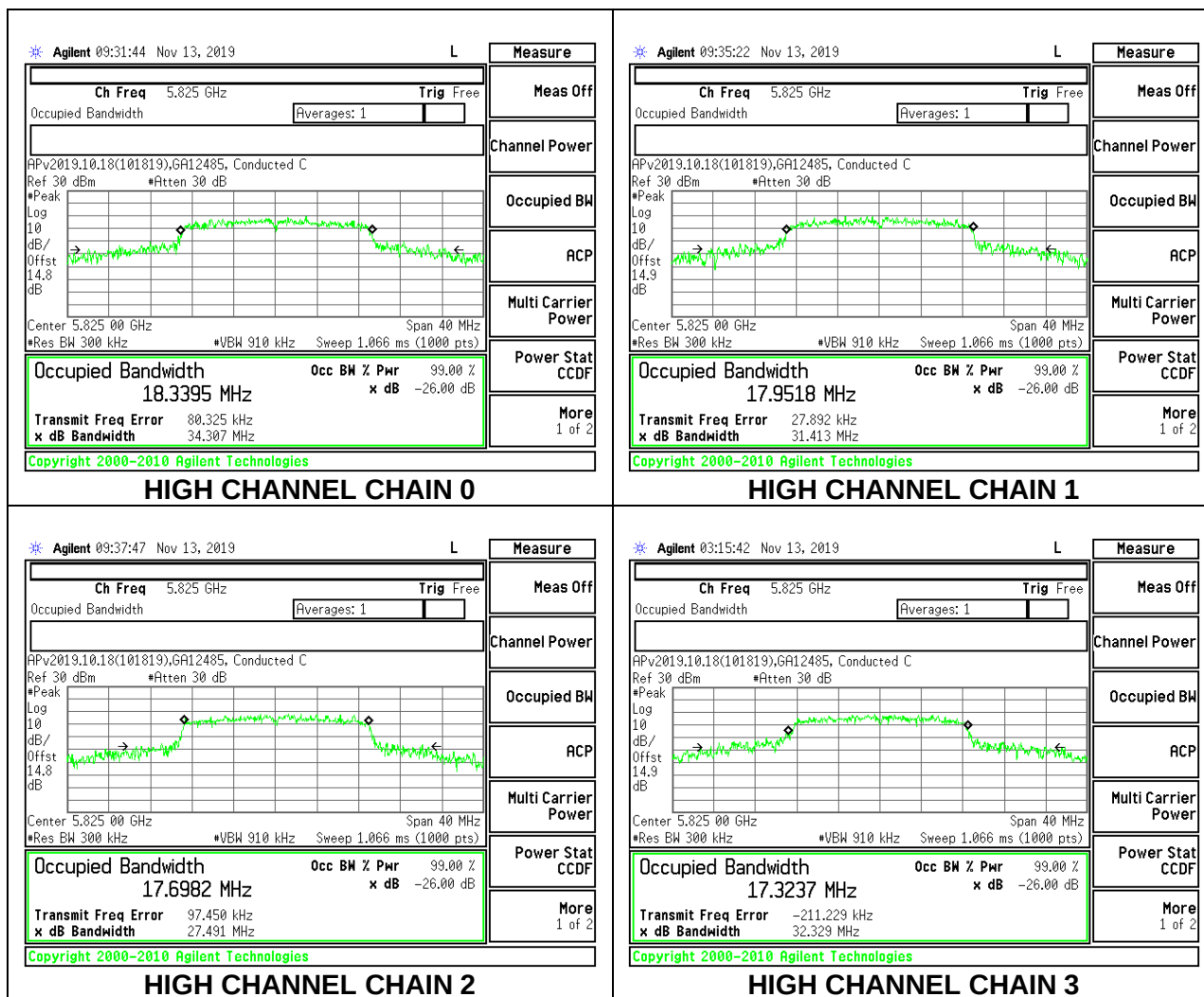
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL



## **8.4. 6 dB BANDWIDTH**

### **LIMITS**

FCC §15.407 (e)

RSS-247 6.2.4.1

The minimum 6 dB bandwidth shall be at least 500 kHz.

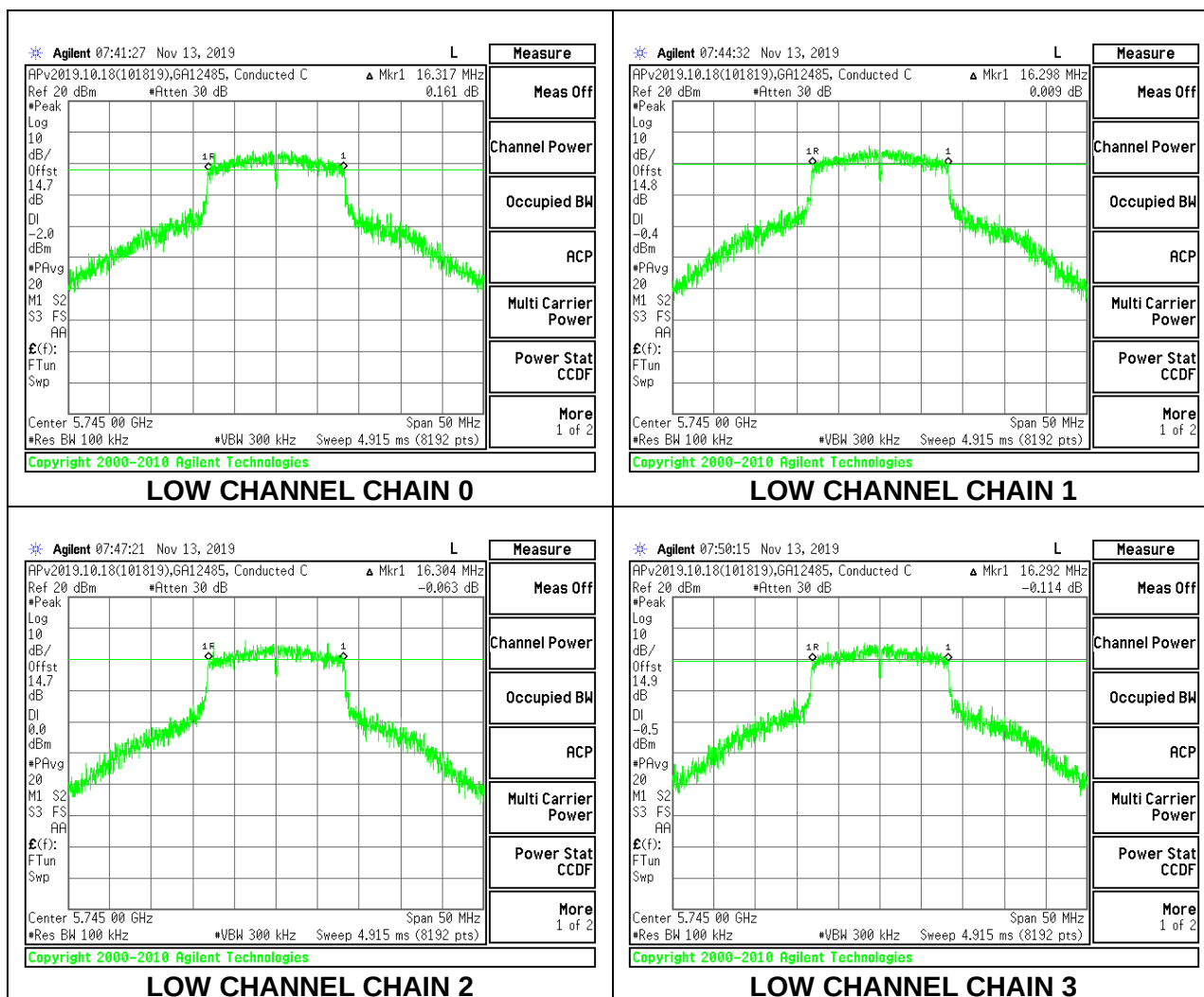
### **RESULTS**

### 8.4.1. 802.11a MODE IN THE 5.8 GHz BAND

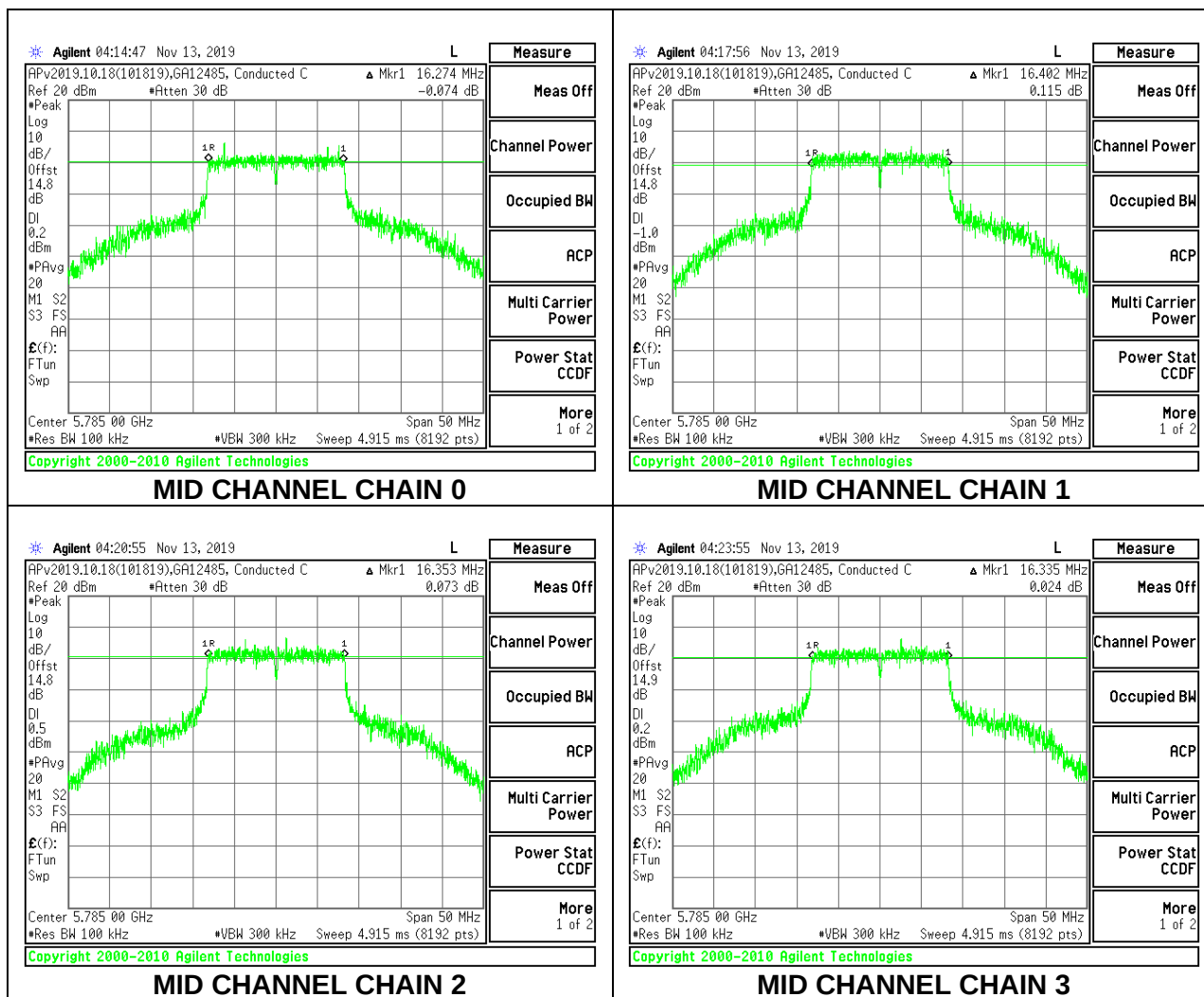
#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 6 dB BW<br>Chain 0<br>(MHz) | 6 dB BW<br>Chain 1<br>(MHz) | 6 dB BW<br>Chain 2<br>(MHz) | 6 dB BW<br>Chain 3<br>(MHz) | Minimum<br>Limit<br>(MHz) |
|---------|--------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|---------------------------|
| Low     | 5745               | 16.317                      | 16.298                      | 16.304                      | 16.292                      | 0.5                       |
| Mid     | 5785               | 16.274                      | 16.402                      | 16.353                      | 16.335                      | 0.5                       |
| High    | 5825               | 16.317                      | 16.366                      | 16.329                      | 16.323                      | 0.5                       |

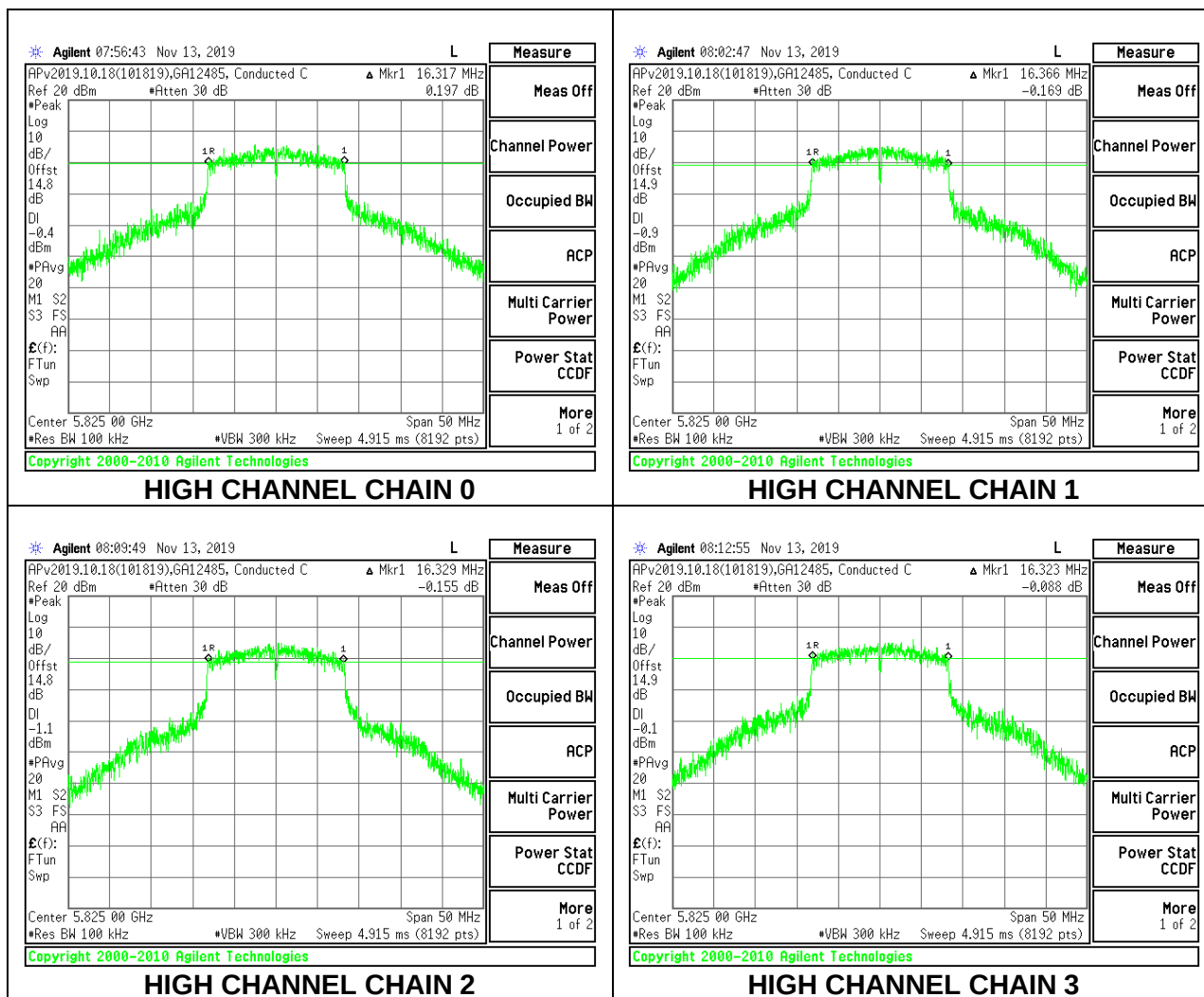
#### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL

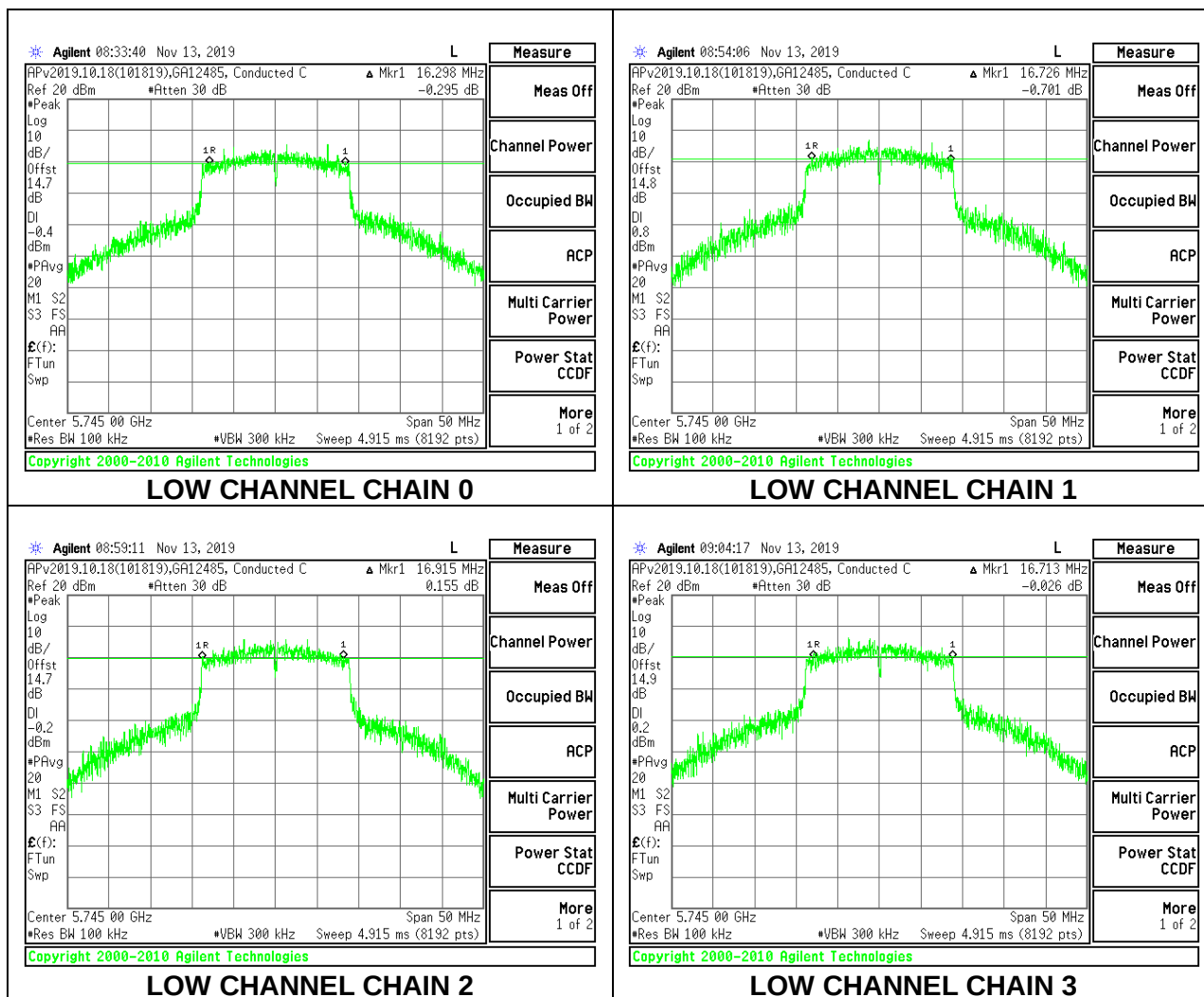


## 8.4.2. 802.11n HT20 MODE IN THE 5.8 GHz BAND

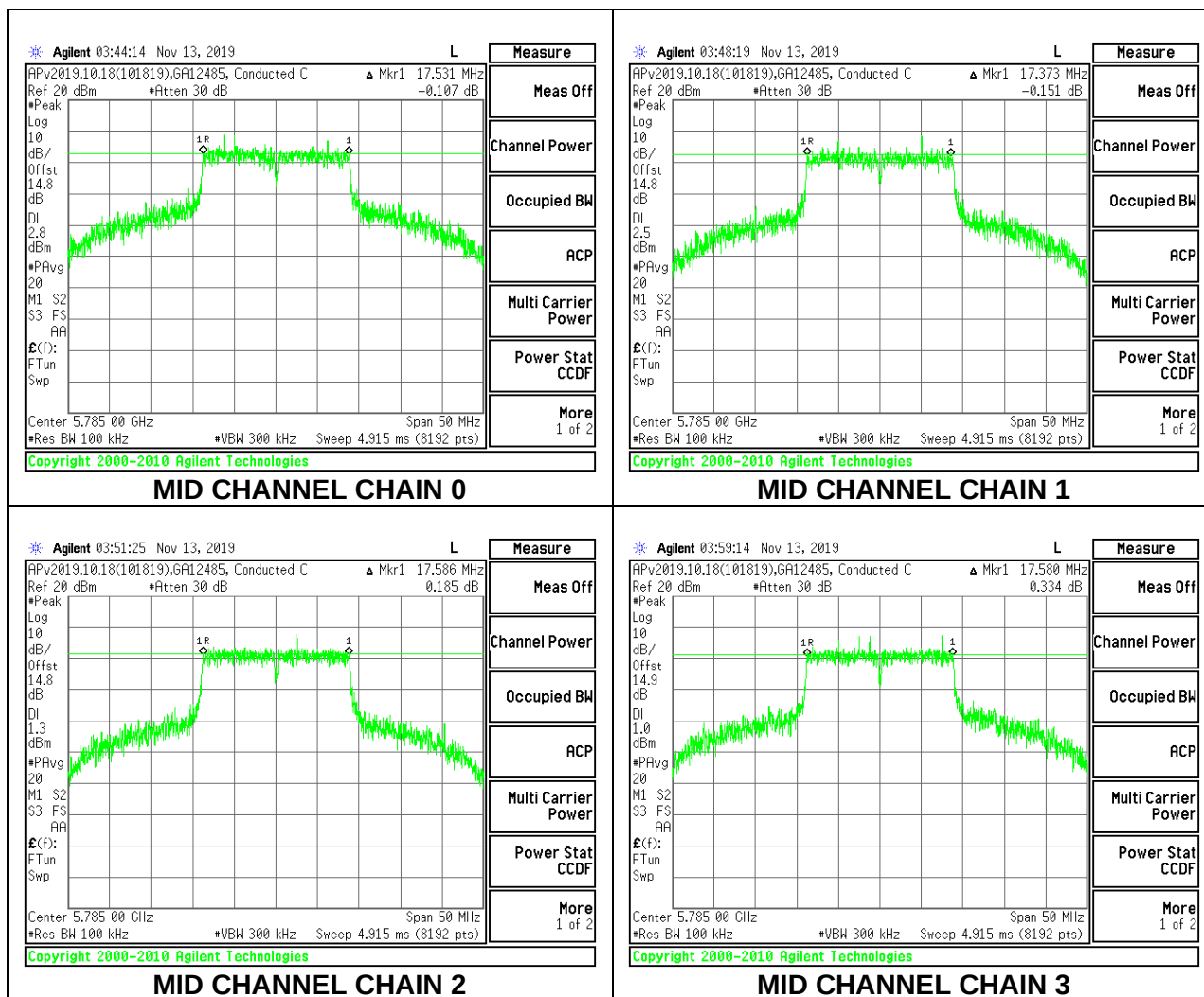
### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | 6 dB BW<br>Chain 0<br>(MHz) | 6 dB BW<br>Chain 1<br>(MHz) | 6 dB BW<br>Chain 2<br>(MHz) | 6 dB BW<br>Chain 3<br>(MHz) | Minimum<br>Limit<br>(MHz) |
|---------|--------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|---------------------------|
| Low     | 5745               | 16.298                      | 16.726                      | 16.915                      | 16.713                      | 0.5                       |
| Mid     | 5785               | 17.531                      | 17.373                      | 17.586                      | 17.580                      | 0.5                       |
| High    | 5825               | 16.280                      | 16.915                      | 16.890                      | 16.690                      | 0.5                       |

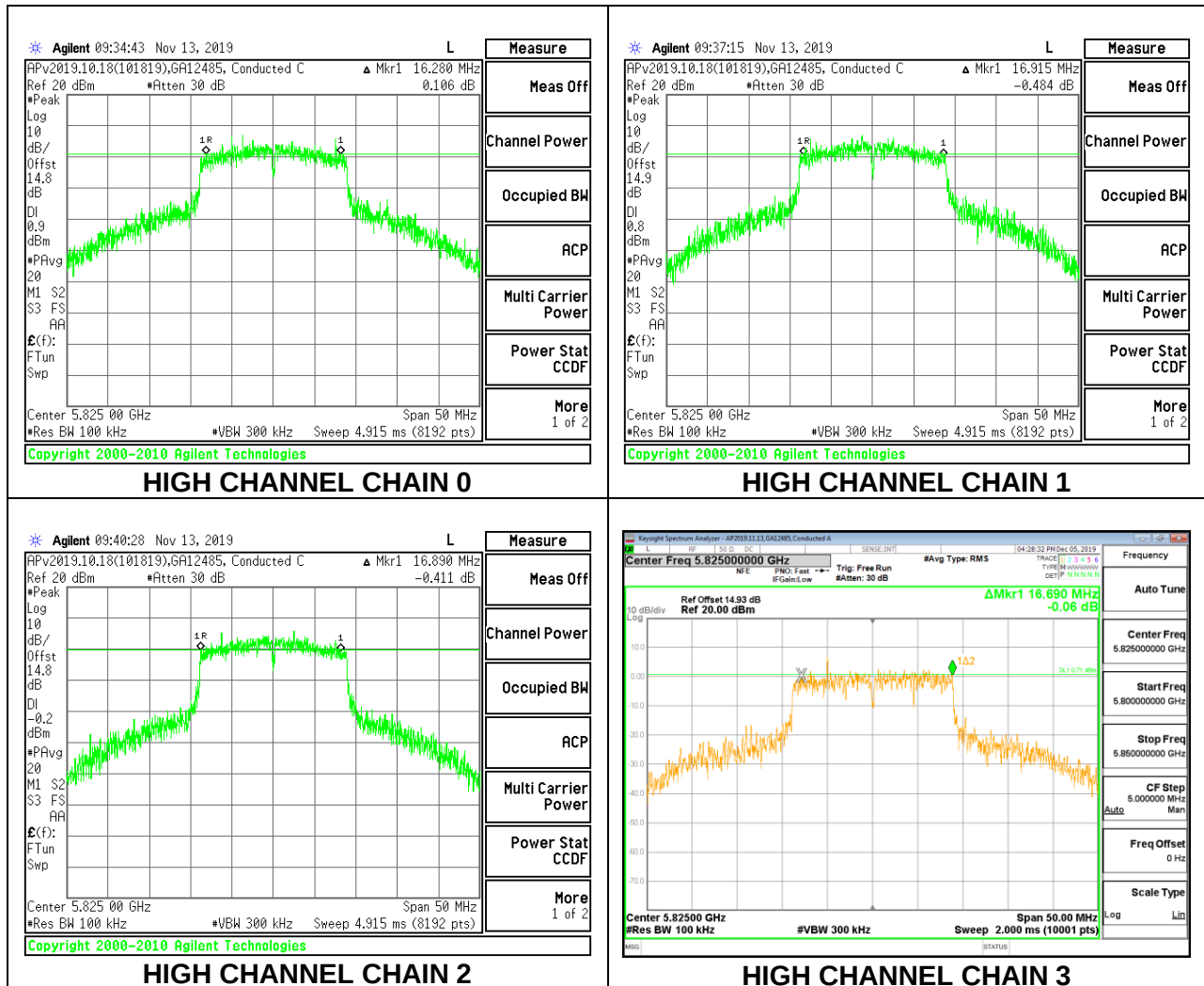
### LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL



## 8.5. OUTPUT POWER AND PSD

### LIMITS

#### FCC §15.407

##### **Band 5.15–5.25 GHz**

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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 6 dBi.

##### **Bands 5.25-5.35 GHz and 5.47-5.725 GHz**

The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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 6 dBi.

##### **Band 5.725-5.85 GHz**

The maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. 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 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

## **RSS-247**

### **Band 5.15-5.25 GHz**

The maximum e.i.r.p. shall not exceed 200 mW or  $10 + 10 \log_{10}B$ , dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

### **Band 5.25-5.35 GHz**

The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10}B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10}B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

### **Bands 5.47-5.6 GHz and 5.65-5.725 GHz**

The maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10}B$ , dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10}B$ , dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

### **Band 5.725-5.85 GHz**

The maximum conducted output power shall not exceed 1 W. The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

## **TEST PROCEDURE**

The measurement method used for output power is KDB 789033 D02 v02r01, Section E.3.b (Method PM-G) and for straddles channels KDB 789033 D02 v02r01, Section E.2.b (Method SA-1) was used.

The measurement method used for power spectral density is KDB 789033 D02 v02r01, Section F

### **DIRECTIONAL ANTENNA GAIN**

Tx chains are uncorrelated for power and correlated for PSD due to the device supporting CDD in all MIMO modes. The directional gains are as follows:

#### Vertical Polarity (***Worst Case***)

| Band<br>(GHz) | Chain 0<br>Antenna<br>Gain<br>(dBi) | Chain 1<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) | Correlated Chains<br>Directional<br>Gain<br>(dBi) |
|---------------|-------------------------------------|-------------------------------------|-----------------------------------------------------|---------------------------------------------------|
| 5.2           | 3.70                                | 4.70                                | 4.23                                                | 7.22                                              |
| 5.3           | 3.70                                | 4.70                                | 4.23                                                | 7.22                                              |
| 5.6           | 3.70                                | 4.70                                | 4.23                                                | 7.22                                              |
| 5.8           | 3.70                                | 4.70                                | 4.23                                                | 7.22                                              |

#### Horizontal Polarity

| Band<br>(GHz) | Chain 2<br>Antenna<br>Gain<br>(dBi) | Chain 3<br>Antenna<br>Gain<br>(dBi) | Uncorrelated Chains<br>Directional<br>Gain<br>(dBi) | Correlated Chains<br>Directional<br>Gain<br>(dBi) |
|---------------|-------------------------------------|-------------------------------------|-----------------------------------------------------|---------------------------------------------------|
| 5.2           | 4.80                                | 3.50                                | 4.20                                                | 7.18                                              |
| 5.3           | 4.80                                | 3.50                                | 4.20                                                | 7.18                                              |
| 5.6           | 4.80                                | 3.50                                | 4.20                                                | 7.18                                              |
| 5.8           | 4.80                                | 3.50                                | 4.20                                                | 7.18                                              |

## RESULTS

### 8.5.1. 802.11a MODE IN THE 5.2 GHz BAND

#### FCC

##### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

###### Antenna Gain and Limits

| Channel | Frequency<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Directional<br>Gain<br>for PSD<br>(dBi) | Power<br>Limit<br>(dBm) | PSD<br>Limit<br>(dBm/<br>1MHz) |
|---------|--------------------|-------------------------------------------|-----------------------------------------|-------------------------|--------------------------------|
| Low     | 5180               | 4.23                                      | 7.22                                    | 24.00                   | 9.78                           |
| Mid     | 5200               | 4.23                                      | 7.22                                    | 24.00                   | 9.78                           |
| High    | 5240               | 4.23                                      | 7.22                                    | 24.00                   | 9.78                           |

|                    |      |                                        |
|--------------------|------|----------------------------------------|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd PSD |
|--------------------|------|----------------------------------------|

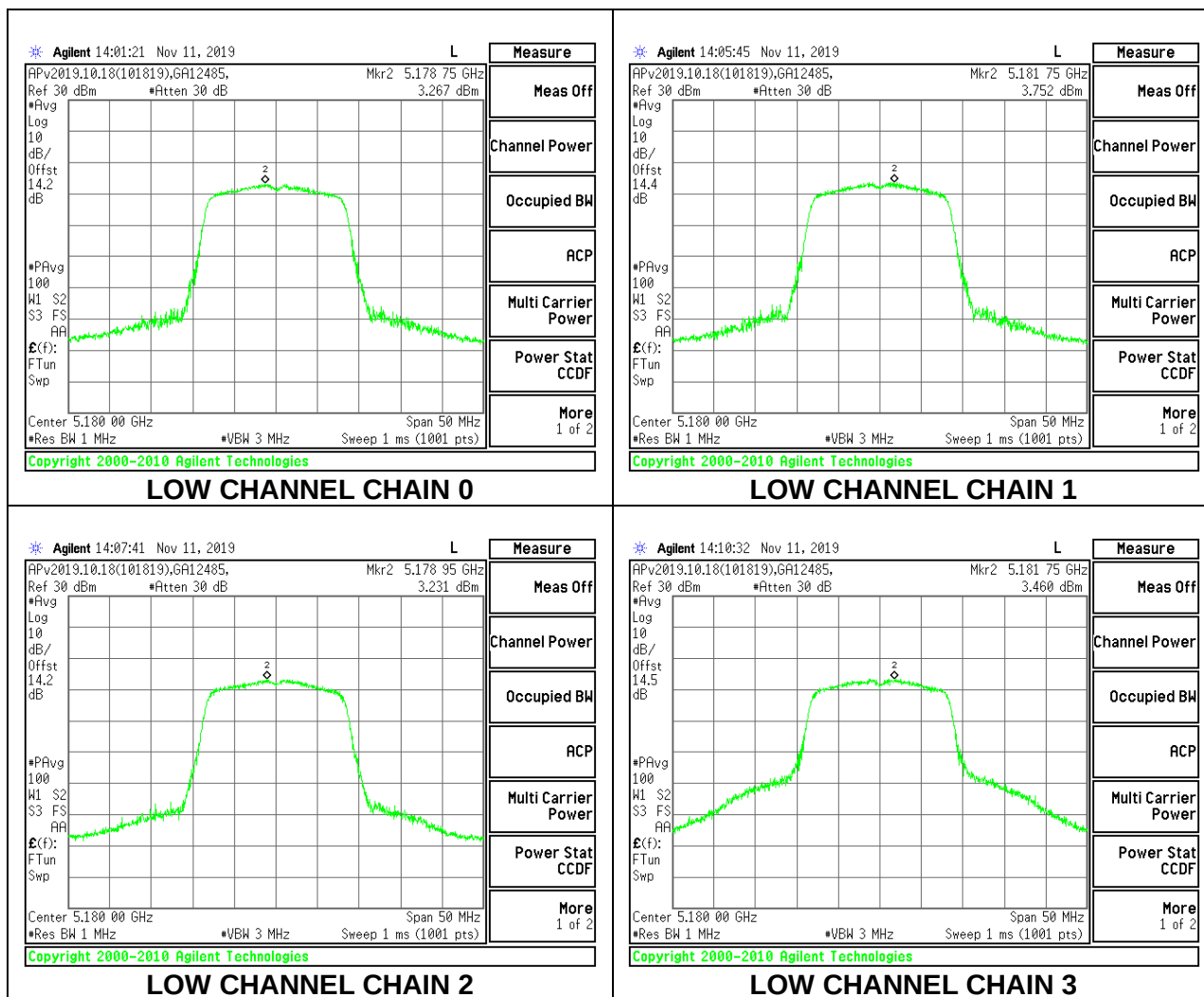
###### Output Power Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Chain 2<br>Meas<br>Power<br>(dBm) | Chain 3<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5180               | 11.74                             | 11.89                             | 11.80                             | 11.78                             | 17.82                             | 24.00                   | -6.18                   |
| Mid     | 5200               | 13.05                             | 13.31                             | 12.99                             | 13.02                             | 19.11                             | 24.00                   | -4.89                   |
| High    | 5240               | 11.19                             | 11.14                             | 11.06                             | 10.95                             | 17.11                             | 24.00                   | -6.89                   |

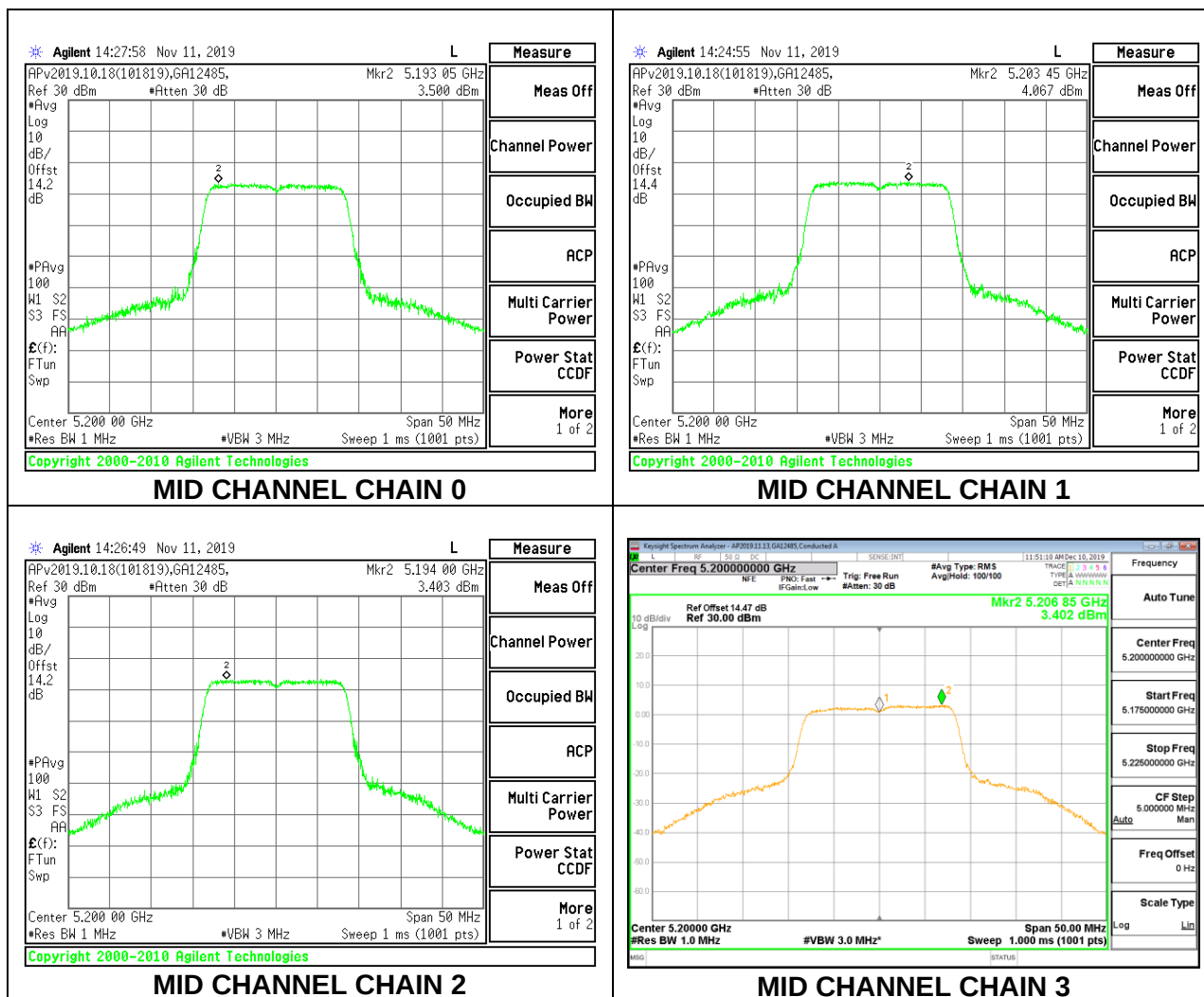
###### PSD Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PSD<br>(dBm/<br>1MHz) | Chain 1<br>Meas<br>PSD<br>(dBm/<br>1MHz) | Chain 2<br>Meas<br>PSD<br>(dBm/<br>1MHz) | Chain 3<br>Meas<br>PSD<br>(dBm/<br>1MHz) | Total<br>Corr'd<br>PSD<br>(dBm/<br>1MHz) | PSD<br>Limit<br>(dBm/<br>1MHz) | PSD<br>Margin<br>(dB) |
|---------|--------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|--------------------------------|-----------------------|
| Low     | 5180               | 3.27                                     | 3.75                                     | 3.23                                     | 3.46                                     | 9.45                                     | 9.78                           | -0.33                 |
| Mid     | 5200               | 3.50                                     | 4.07                                     | 3.40                                     | 3.40                                     | 9.62                                     | 9.78                           | -0.16                 |
| High    | 5240               | 1.59                                     | 2.41                                     | 1.72                                     | 1.84                                     | 7.92                                     | 9.78                           | -1.86                 |

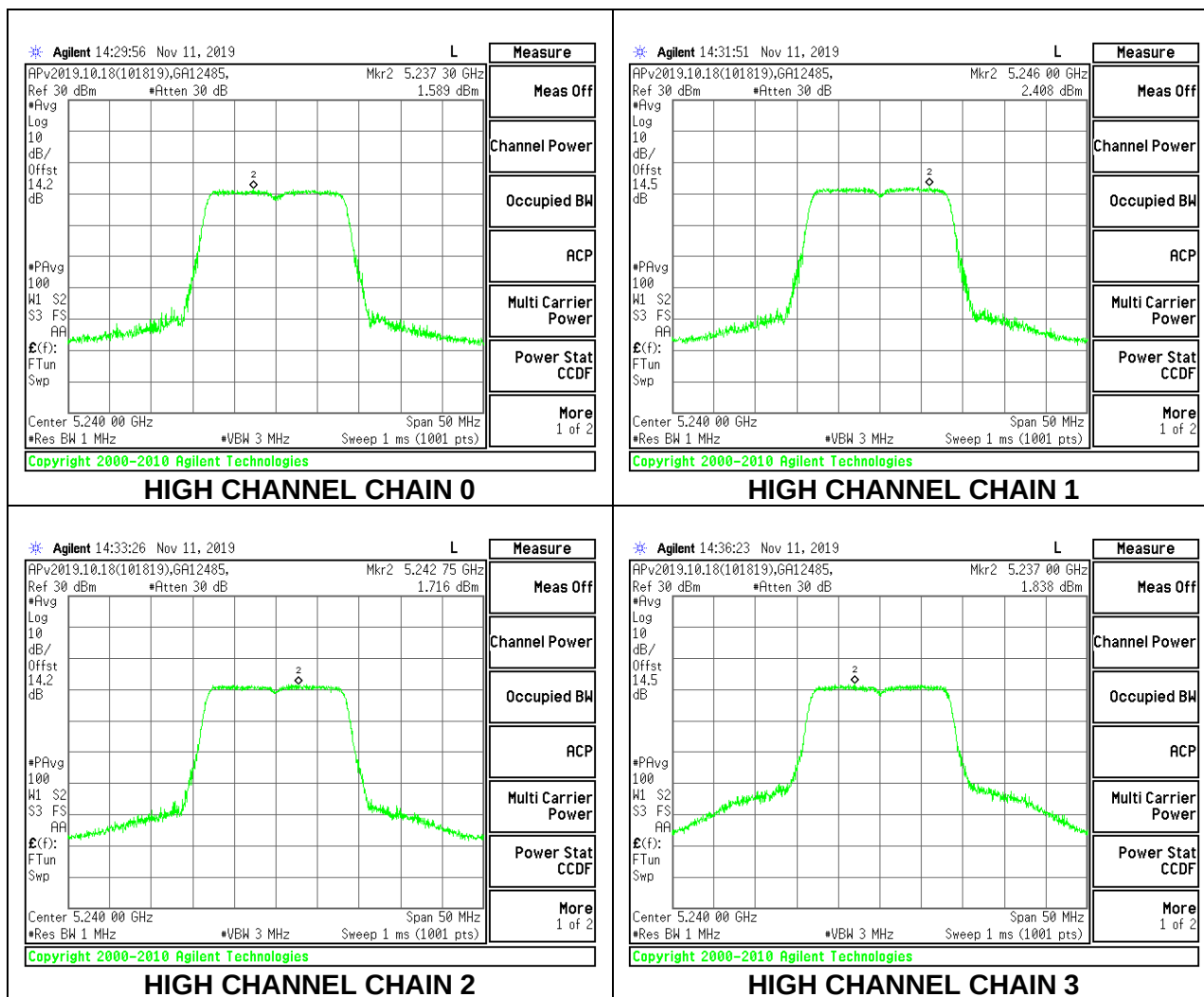
## LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL



# **IC**

|                          |       |              |            |
|--------------------------|-------|--------------|------------|
| <b>Test Engineer ID:</b> | 20756 | <b>Date:</b> | 11/18/2019 |
|--------------------------|-------|--------------|------------|

(Note: IC PSD was tested by radiated method)

## **Bandwidth and Antenna Gain**

| Channel | Frequency<br>(MHz) | Min<br>99%<br>BW<br>(MHz) |
|---------|--------------------|---------------------------|
| Low     | 5180               | 16.288                    |
| Mid     | 5200               | 16.549                    |
| High    | 5240               | 16.502                    |

## **Limits**

| Channel | Frequency<br>(MHz) | ISED<br>EIRP<br>Limit<br>(dBm) | ISED<br>eirp<br>PSD<br>Limit<br>(dBm/<br>1MHz) |
|---------|--------------------|--------------------------------|------------------------------------------------|
| Low     | 5180               | 22.12                          | 10.00                                          |
| Mid     | 5200               | 22.19                          | 10.00                                          |
| High    | 5240               | 22.18                          | 10.00                                          |

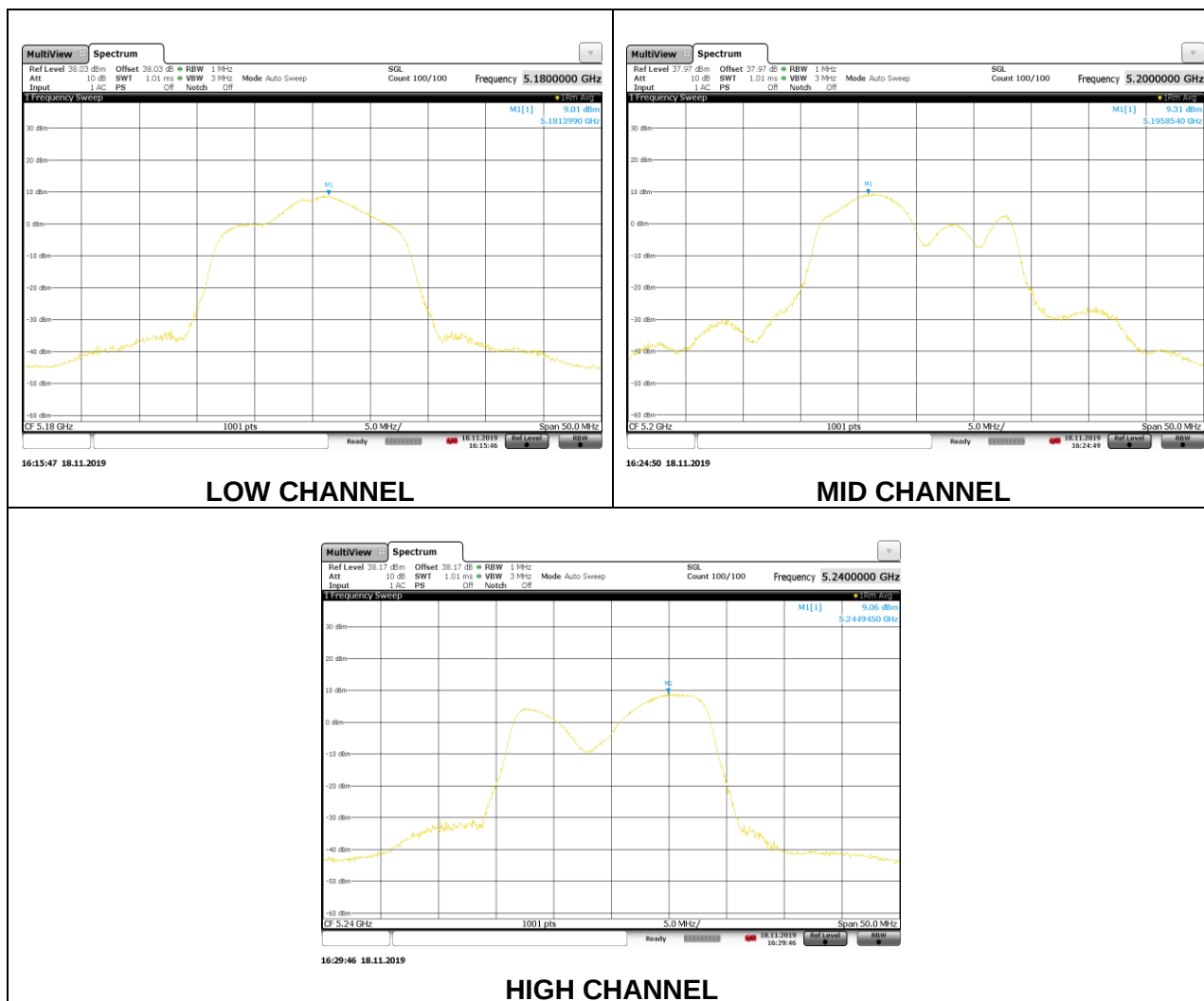
|                           |      |                                               |
|---------------------------|------|-----------------------------------------------|
| <b>Duty Cycle CF (dB)</b> | 0.00 | <b>Included in Calculations of Corr'd PSD</b> |
|---------------------------|------|-----------------------------------------------|

## **Output Power Results**

| Channel | Frequency<br>(MHz) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5180               | 16.07                             | 22.12                   | -6.05                   |
| Mid     | 5200               | 16.98                             | 22.19                   | -5.21                   |
| High    | 5240               | 16.43                             | 22.18                   | -5.75                   |

## **PSD Results**

| Channel | Frequency<br>(MHz) | Total<br>Corr'd<br>PSD<br>(dBm/<br>1MHz) | PSD<br>Limit<br>(dBm/<br>1MHz) | PSD<br>Margin<br>(dB) |
|---------|--------------------|------------------------------------------|--------------------------------|-----------------------|
| Low     | 5180               | 5.181                                    | 10.00                          | -4.82                 |
| Mid     | 5200               | 5.196                                    | 10.00                          | -4.80                 |
| High    | 5240               | 5.245                                    | 10.00                          | -4.76                 |



## 8.5.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

### FCC

#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE

| Channel | Frequency<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Directional<br>Gain<br>for PSD<br>(dBi) | Power<br>Limit<br>(dBm) | PSD<br>Limit<br>(dBm/<br>1MHz) |
|---------|--------------------|-------------------------------------------|-----------------------------------------|-------------------------|--------------------------------|
| Low     | 5180               | 4.23                                      | 7.22                                    | 24.00                   | 9.78                           |
| Mid     | 5200               | 4.23                                      | 7.22                                    | 24.00                   | 9.78                           |
| High    | 5240               | 4.23                                      | 7.22                                    | 24.00                   | 9.78                           |

|                    |      |                                        |
|--------------------|------|----------------------------------------|
| Duty Cycle CF (dB) | 0.10 | Included in Calculations of Corr'd PSD |
|--------------------|------|----------------------------------------|

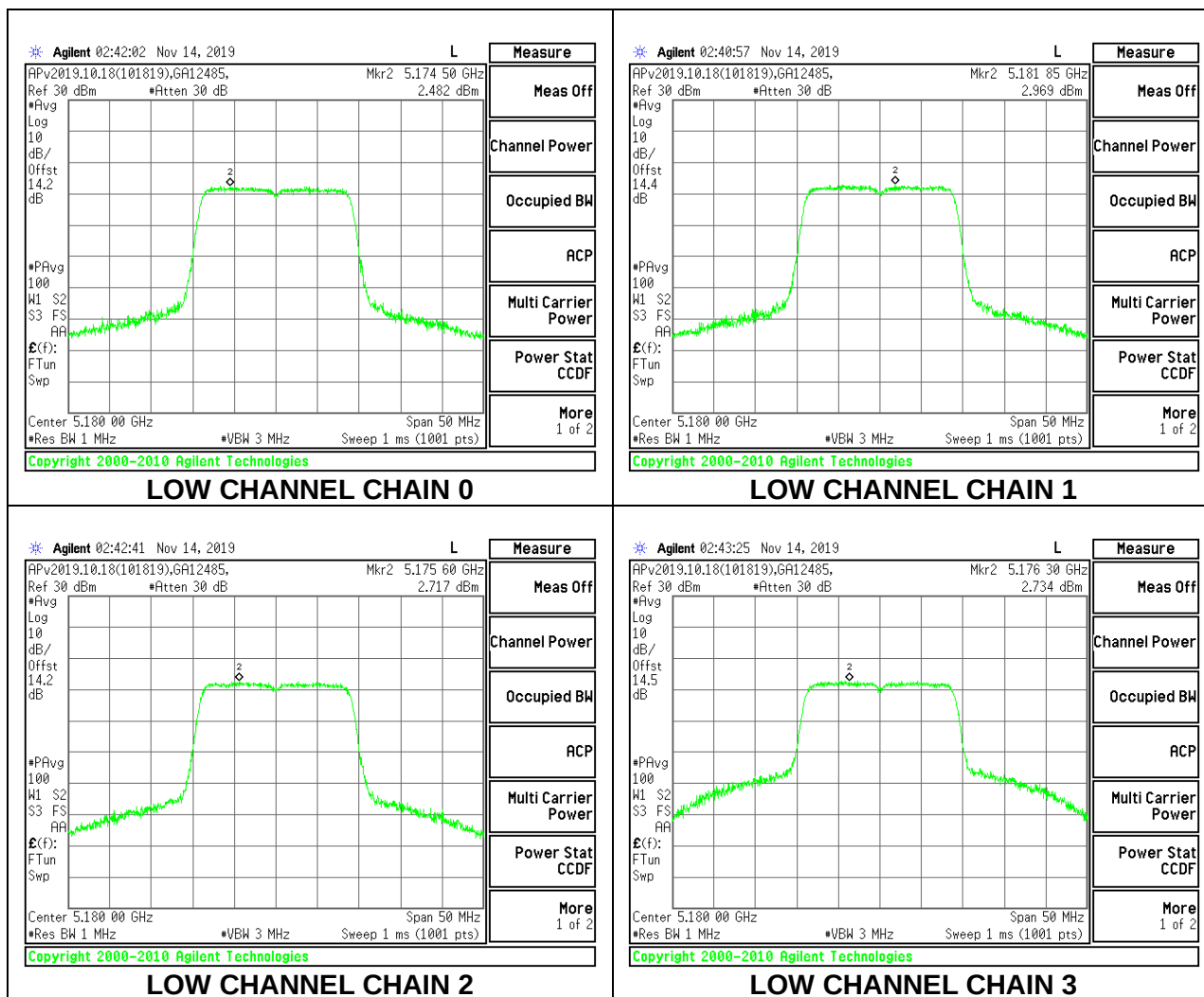
#### Output Power Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Chain 2<br>Meas<br>Power<br>(dBm) | Chain 3<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5180               | 11.61                             | 11.77                             | 11.81                             | 11.61                             | 17.72                             | 24.00                   | -6.28                   |
| Mid     | 5200               | 12.94                             | 13.12                             | 13.09                             | 13.14                             | 19.09                             | 24.00                   | -4.91                   |
| High    | 5240               | 11.04                             | 11.12                             | 11.21                             | 11.06                             | 17.13                             | 24.00                   | -6.87                   |

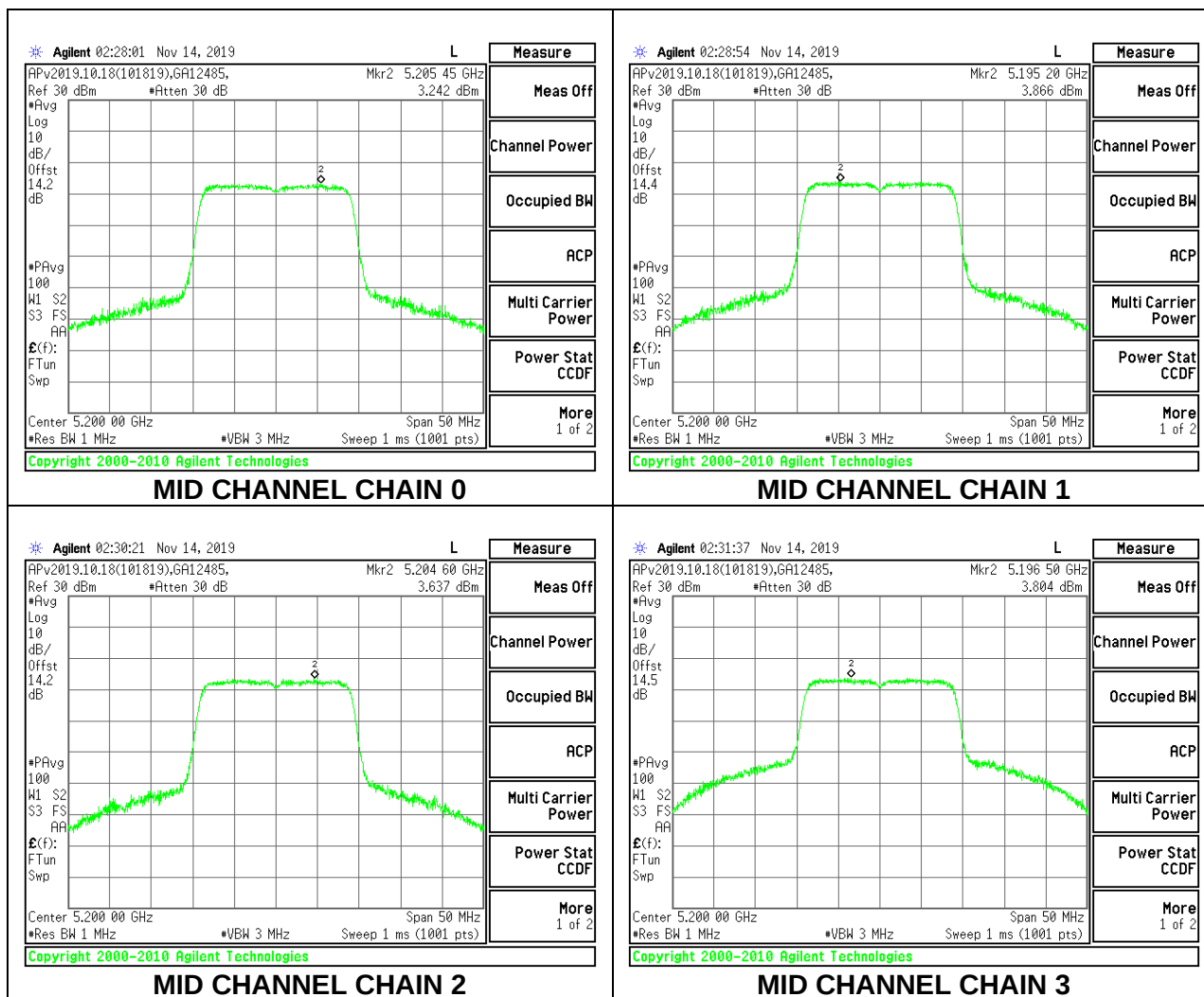
#### PSD Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PSD<br>(dBm/<br>1MHz) | Chain 1<br>Meas<br>PSD<br>(dBm/<br>1MHz) | Chain 2<br>Meas<br>PSD<br>(dBm/<br>1MHz) | Chain 3<br>Meas<br>PSD<br>(dBm/<br>1MHz) | Total<br>Corr'd<br>PSD<br>(dBm/<br>1MHz) | PSD<br>Limit<br>(dBm/<br>1MHz) | PSD<br>Margin<br>(dB) |
|---------|--------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|--------------------------------|-----------------------|
| Low     | 5180               | 2.48                                     | 2.97                                     | 2.72                                     | 2.73                                     | 8.85                                     | 9.78                           | -0.93                 |
| Mid     | 5200               | 3.24                                     | 3.87                                     | 3.64                                     | 3.80                                     | 9.76                                     | 9.78                           | -0.02                 |
| High    | 5240               | 1.34                                     | 2.28                                     | 1.88                                     | 1.62                                     | 7.91                                     | 9.78                           | -1.87                 |

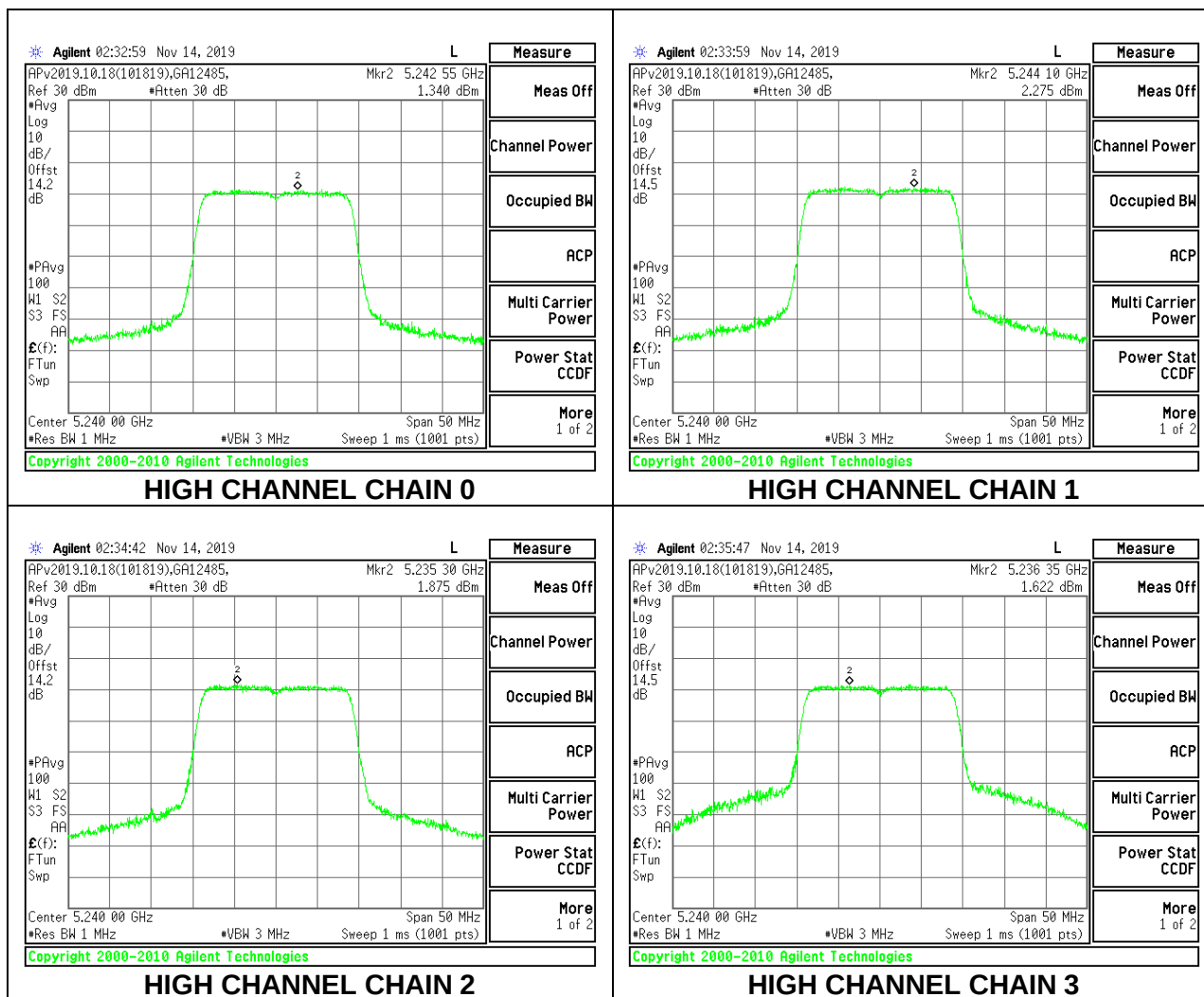
## LOW CHANNEL



## MID CHANNEL



## HIGH CHANNEL



## IC

|                          |       |              |            |
|--------------------------|-------|--------------|------------|
| <b>Test Engineer ID:</b> | 20756 | <b>Date:</b> | 11/18/2019 |
|--------------------------|-------|--------------|------------|

(Note: IC PSD was tested by radiated method)

### Bandwidth and Antenna Gain

| Channel | Frequency<br>(MHz) | Min<br>99%<br>BW<br>(MHz) |
|---------|--------------------|---------------------------|
| Low     | 5180               | 17.475                    |
| Mid     | 5200               | 17.728                    |
| High    | 5240               | 17.711                    |

### Limits

| Channel | Frequency<br>(MHz) | ISED<br>EIRP<br>Limit<br>(dBm) | ISED<br>eirp<br>PSD<br>Limit<br>(dBm/<br>1MHz) |
|---------|--------------------|--------------------------------|------------------------------------------------|
| Low     | 5180               | 22.42                          | 10.00                                          |
| Mid     | 5200               | 22.49                          | 10.00                                          |
| High    | 5240               | 22.48                          | 10.00                                          |

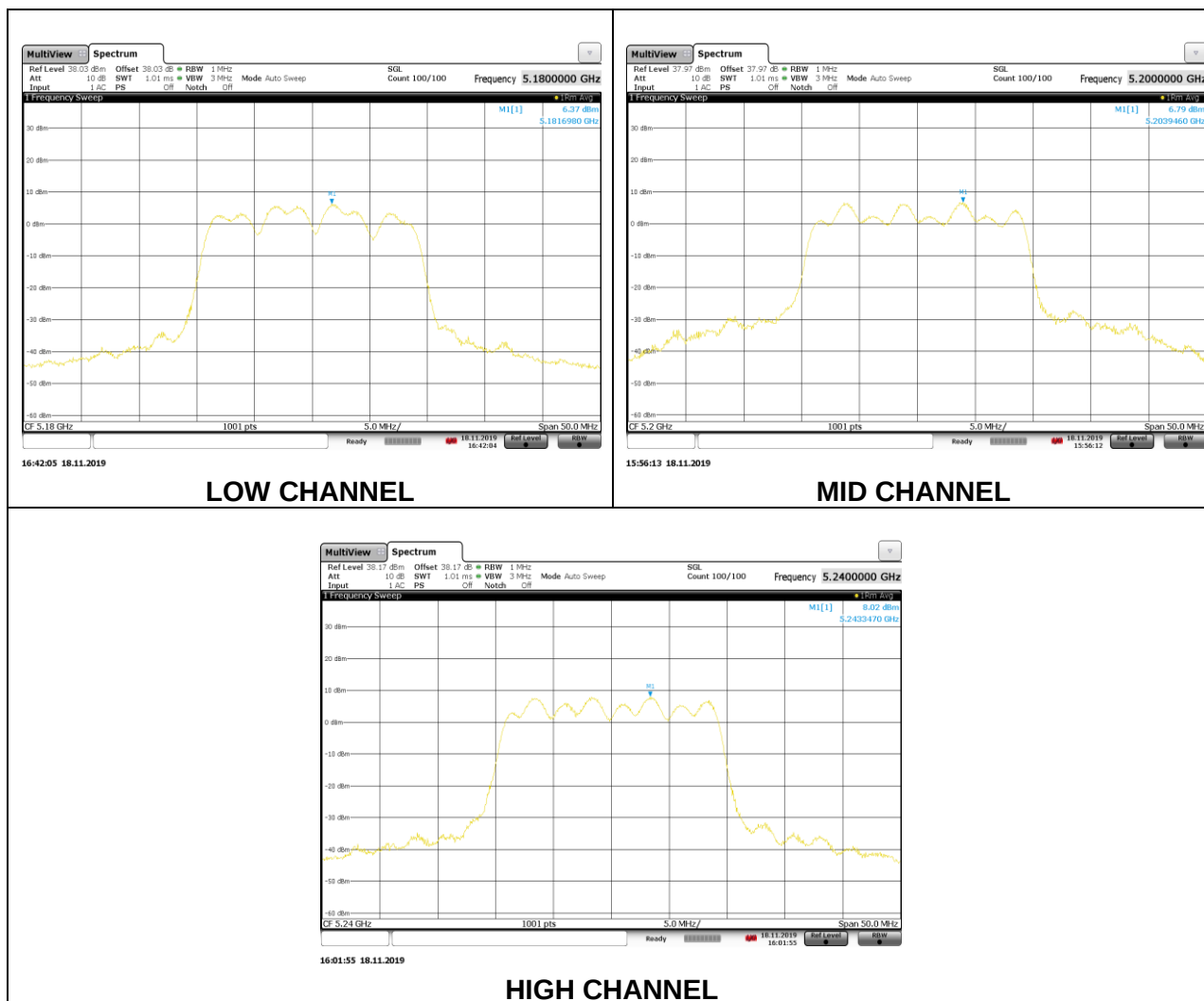
|                           |      |                                               |
|---------------------------|------|-----------------------------------------------|
| <b>Duty Cycle CF (dB)</b> | 0.10 | <b>Included in Calculations of Corr'd PSD</b> |
|---------------------------|------|-----------------------------------------------|

### Output Power Results

| Channel | Frequency<br>(MHz) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5180               | 14.65                             | 22.42                   | -7.77                   |
| Mid     | 5200               | 17.58                             | 22.49                   | -4.91                   |
| High    | 5240               | 17.14                             | 22.48                   | -5.34                   |

### PSD Results

| Channel | Frequency<br>(MHz) | Total<br>Corr'd<br>PSD<br>(dBm/<br>1MHz) | PSD<br>Limit<br>(dBm/<br>1MHz) | PSD<br>Margin<br>(dB) |
|---------|--------------------|------------------------------------------|--------------------------------|-----------------------|
| Low     | 5180               | 5.282                                    | 10.00                          | -4.72                 |
| Mid     | 5200               | 5.304                                    | 10.00                          | -4.70                 |
| High    | 5240               | 5.343                                    | 10.00                          | -4.66                 |



### 8.5.3. 802.11a MODE IN THE 5.3 GHz BAND

#### 4TX Antenna 1 + Antenna 2 + Antenna 3 + Antenna 4 CDD MODE (FCC+IC)

##### Bandwidth and Antenna Gain

| Channel | Frequency<br>(MHz) | Min<br>26 dB<br>BW<br>(MHz) | Min<br>99%<br>BW<br>(MHz) | Directional<br>Gain<br>for Power<br>(dBi) | Direction<br>Gain<br>for PPSD<br>(dBi) |
|---------|--------------------|-----------------------------|---------------------------|-------------------------------------------|----------------------------------------|
| Low     | 5260               | 23.00                       | 16.568                    | 4.23                                      | 7.22                                   |
| Mid     | 5300               | 21.35                       | 16.558                    | 4.23                                      | 7.22                                   |
| High    | 5320               | 20.40                       | 16.246                    | 4.23                                      | 7.22                                   |

##### Limits

| Channel | Frequency<br>(MHz) | FCC<br>Power<br>Limit<br>(dBm) | IC<br>Power<br>Limit<br>(dBm) | IC<br>EIRP<br>Limit<br>(dBm) | Power<br>Limit<br>(dBm) | FCC<br>PPSD<br>Limit<br>(dBm) | IC<br>PSD<br>Limit<br>(dBm) | PPSD<br>Limit<br>(dBm) |
|---------|--------------------|--------------------------------|-------------------------------|------------------------------|-------------------------|-------------------------------|-----------------------------|------------------------|
| Low     | 5260               | 24.00                          | 23.19                         | 29.19                        | 23.19                   | 9.78                          | 11.00                       | 9.78                   |
| Mid     | 5300               | 24.00                          | 23.19                         | 29.19                        | 23.19                   | 9.78                          | 11.00                       | 9.78                   |
| High    | 5320               | 24.00                          | 23.11                         | 29.11                        | 23.11                   | 9.78                          | 11.00                       | 9.78                   |

|                    |      |                                         |
|--------------------|------|-----------------------------------------|
| Duty Cycle CF (dB) | 0.00 | Included in Calculations of Corr'd PPSD |
|--------------------|------|-----------------------------------------|

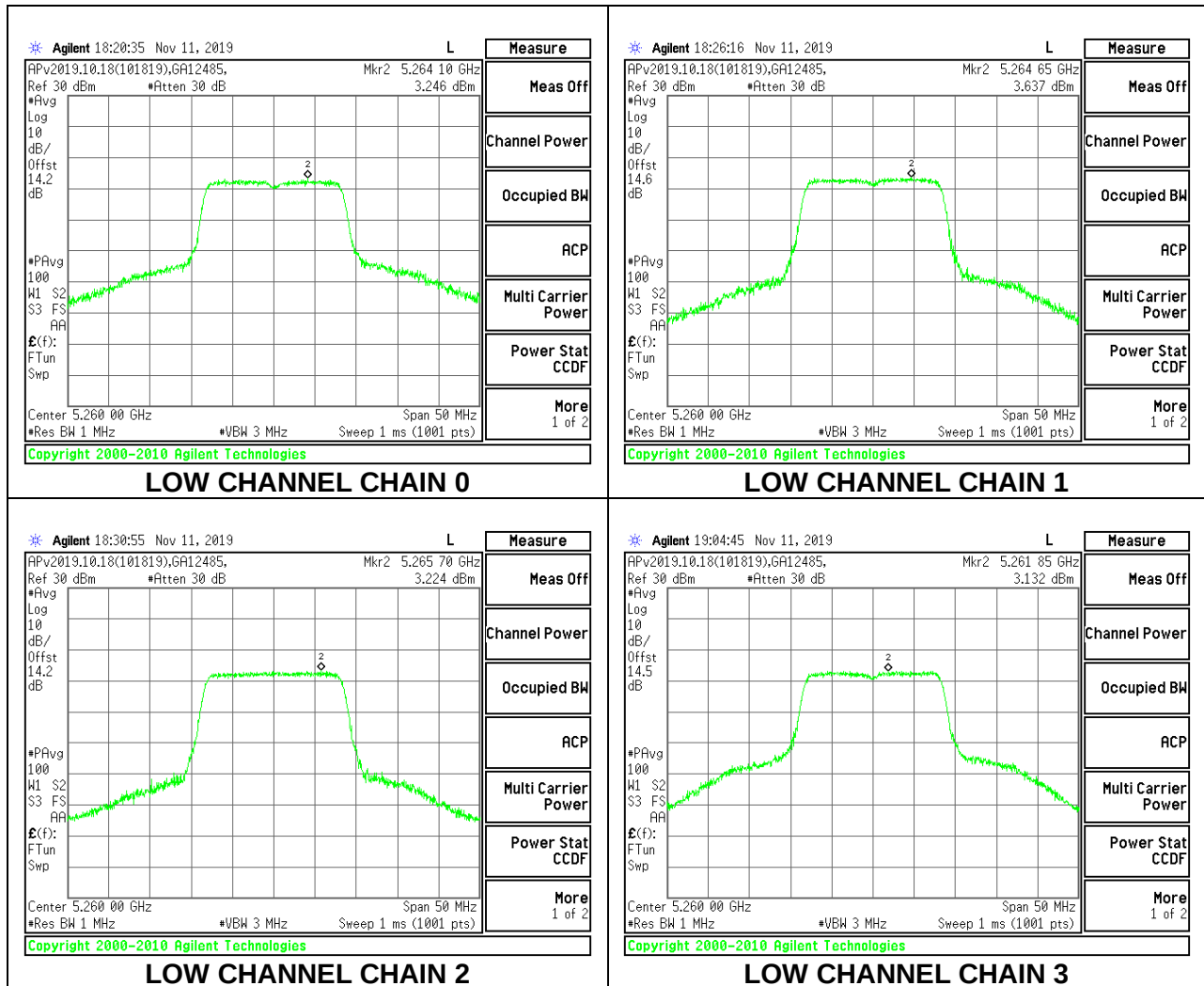
##### Output Power Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>Power<br>(dBm) | Chain 1<br>Meas<br>Power<br>(dBm) | Chain 2<br>Meas<br>Power<br>(dBm) | Chain 3<br>Meas<br>Power<br>(dBm) | Total<br>Corr'd<br>Power<br>(dBm) | Power<br>Limit<br>(dBm) | Power<br>Margin<br>(dB) |
|---------|--------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------|-------------------------|
| Low     | 5260               | 12.08                             | 12.24                             | 12.29                             | 12.05                             | 18.19                             | 23.19                   | -5.01                   |
| Mid     | 5300               | 12.11                             | 12.06                             | 12.23                             | 12.04                             | 18.13                             | 23.19                   | -5.06                   |
| High    | 5320               | 11.02                             | 10.98                             | 11.04                             | 11.12                             | 17.06                             | 23.11                   | -6.05                   |

##### PPSD Results

| Channel | Frequency<br>(MHz) | Chain 0<br>Meas<br>PPSD<br>(dBm/<br>1MHz) | Chain 1<br>Meas<br>PPSD<br>(dBm/<br>1MHz) | Chain 2<br>Meas<br>PPSD<br>(dBm/<br>1MHz) | Chain 3<br>Meas<br>PPSD<br>(dBm/<br>1MHz) | Total<br>Corr'd<br>PPSD<br>(dBm/<br>1MHz) | PPSD<br>Limit<br>(dBm/<br>1MHz) | PPSD<br>Margin<br>(dB) |
|---------|--------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|---------------------------------|------------------------|
| Low     | 5260               | 3.25                                      | 3.64                                      | 3.22                                      | 3.13                                      | 9.34                                      | 9.78                            | -0.44                  |
| Mid     | 5300               | 3.00                                      | 3.25                                      | 3.12                                      | 3.26                                      | 9.18                                      | 9.78                            | -0.60                  |
| High    | 5320               | 3.08                                      | 3.50                                      | 3.35                                      | 3.41                                      | 9.36                                      | 9.78                            | -0.42                  |

## LOW CHANNEL



## MID CHANNEL

