**Occupied Bandwidth 99%**                    Test Mode: 802.11a   &   ANT 2   &   Ch.52
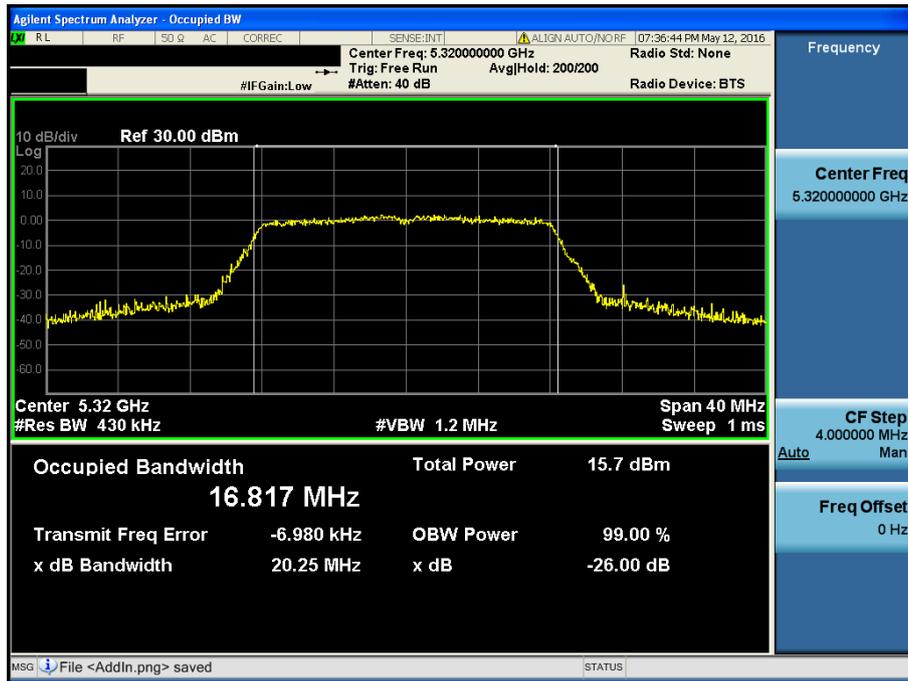
Agilent Spectrum Analyzer - Occupied BW

| | |
|---|---|
| LXI R L       RF       50 Ω   AC       CORREC | SENSE:INT        ⚠ ALIGN AUTO/NORF   07:35:19 PM May 12, 2016 |

Center Freq: 5.260000000 GHz        Radio Std: None
Trig: Free Run        Avg|Hold: 200/200
#IFGain:Low        #Atten: 40 dB        Radio Device: BTS

Frequency

10 dB/div        Ref 30.00 dBm
Log
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0

Center Freq
5.260000000 GHz

Center  5.26 GHz                                        Span 40 MHz
#Res BW  430 kHz                        #VBW  1.2 MHz        Sweep  1 ms

CF Step
4.000000 MHz
Auto        Man

| Occupied Bandwidth | Total Power | 14.5 dBm |
|---|---|---|
| 16.945 MHz | | |
| Transmit Freq Error        42.746 kHz | OBW Power | 99.00 % |
| x dB Bandwidth               20.04 MHz | x dB | -26.00 dB |

Freq Offset
0 Hz

MSG                                        STATUS


**Occupied Bandwidth 99%**                    Test Mode: 802.11a   &   ANT 2   &   Ch.60

Agilent Spectrum Analyzer - Occupied BW

| | |
|---|---|
| LXI R L       RF       50 Ω   AC       CORREC | SENSE:INT        ⚠ ALIGN AUTO/NORF   07:35:43 PM May 12, 2016 |

Center Freq: 5.300000000 GHz        Radio Std: None
Trig: Free Run        Avg|Hold: 200/200
#IFGain:Low        #Atten: 40 dB        Radio Device: BTS

Frequency

10 dB/div        Ref 30.00 dBm
Log
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0

Center Freq
5.300000000 GHz

Center  5.3 GHz                                        Span 40 MHz
#Res BW  430 kHz                        #VBW  1.2 MHz        Sweep  1 ms

CF Step
4.000000 MHz
Auto        Man

| Occupied Bandwidth | Total Power | 15.4 dBm |
|---|---|---|
| 16.872 MHz | | |
| Transmit Freq Error        -25.002 kHz | OBW Power | 99.00 % |
| x dB Bandwidth               20.07 MHz | x dB | -26.00 dB |

Freq Offset
0 Hz

MSG                                        STATUS
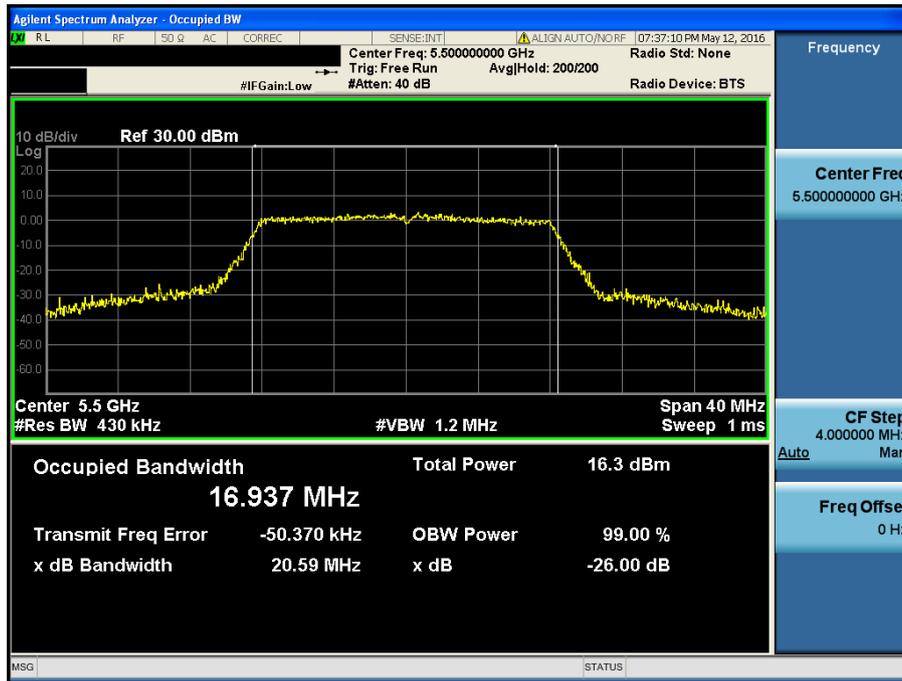
**Occupied Bandwidth 99%**                    Test Mode: 802.11a  &  ANT 2  &  Ch.64

**Occupied Bandwidth 99%**                    Test Mode: 802.11a   &   ANT 2   &   Ch.100



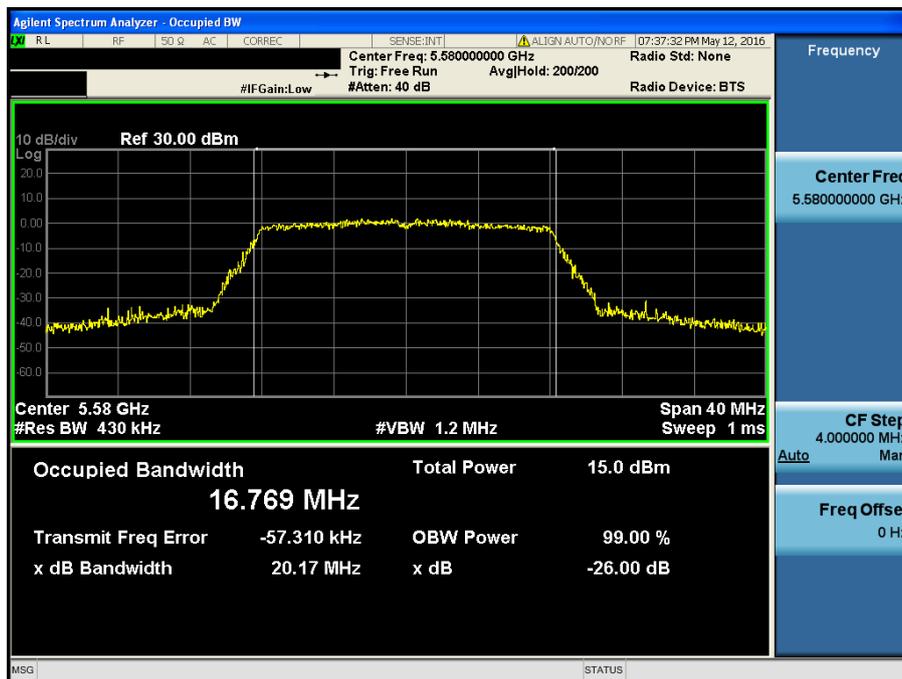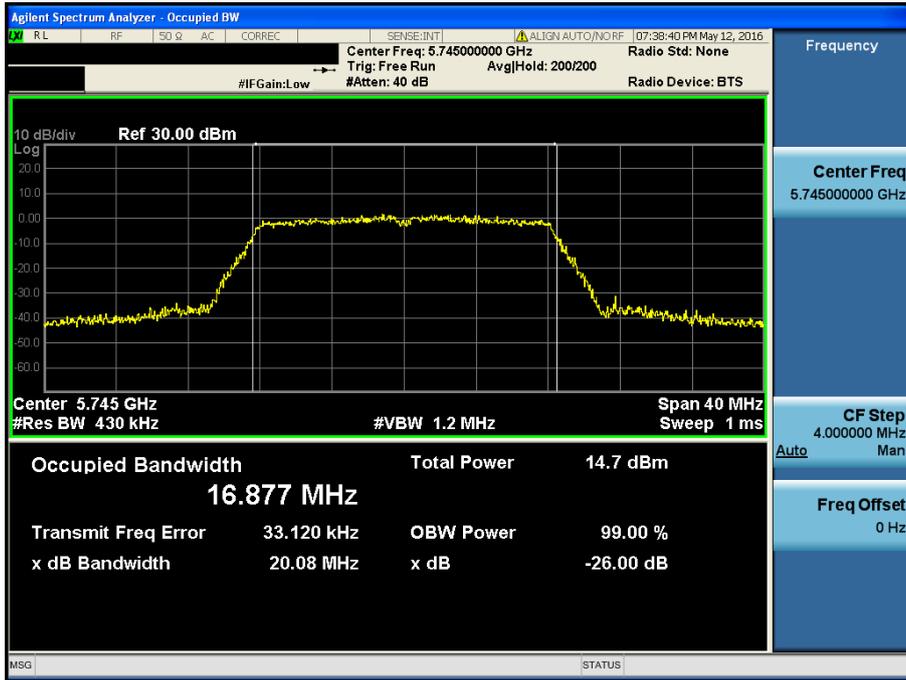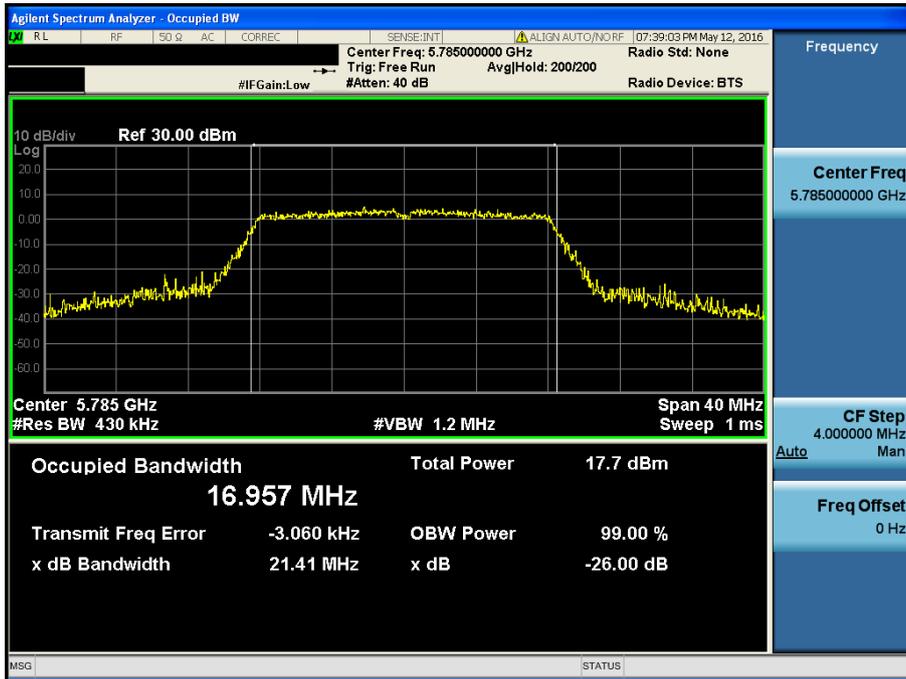**Occupied Bandwidth 99%**                    Test Mode: 802.11a   &   ANT 2   & Ch.116

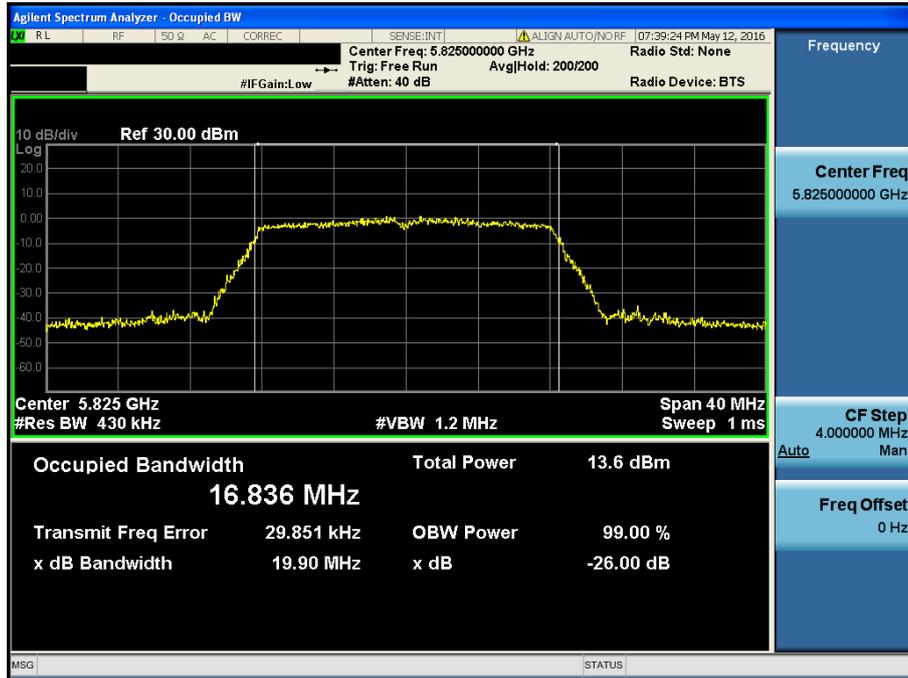## Occupied Bandwidth 99%          Test Mode: 802.11a   &   ANT 2   &   Ch.149



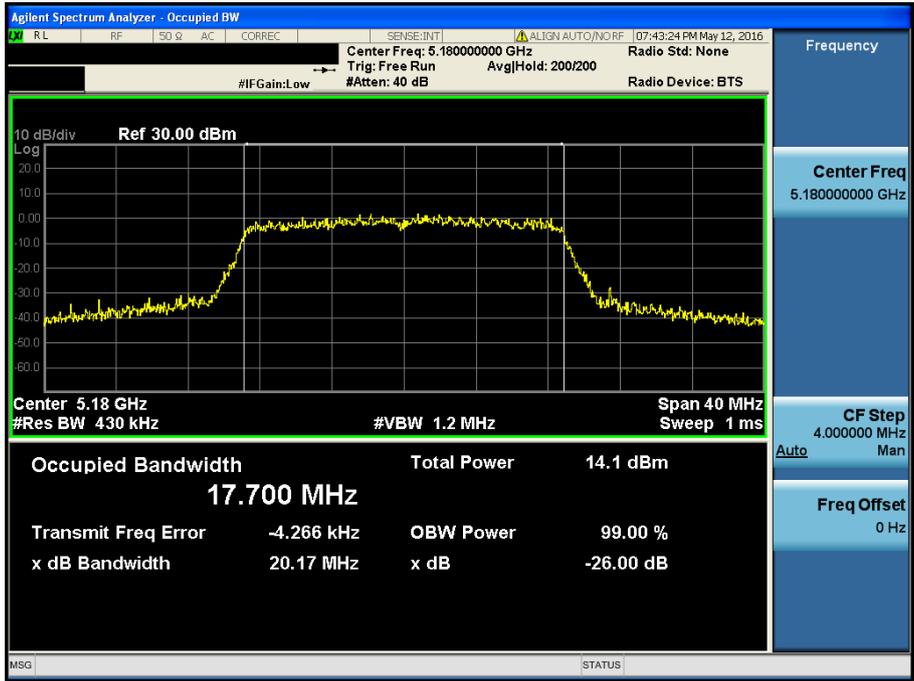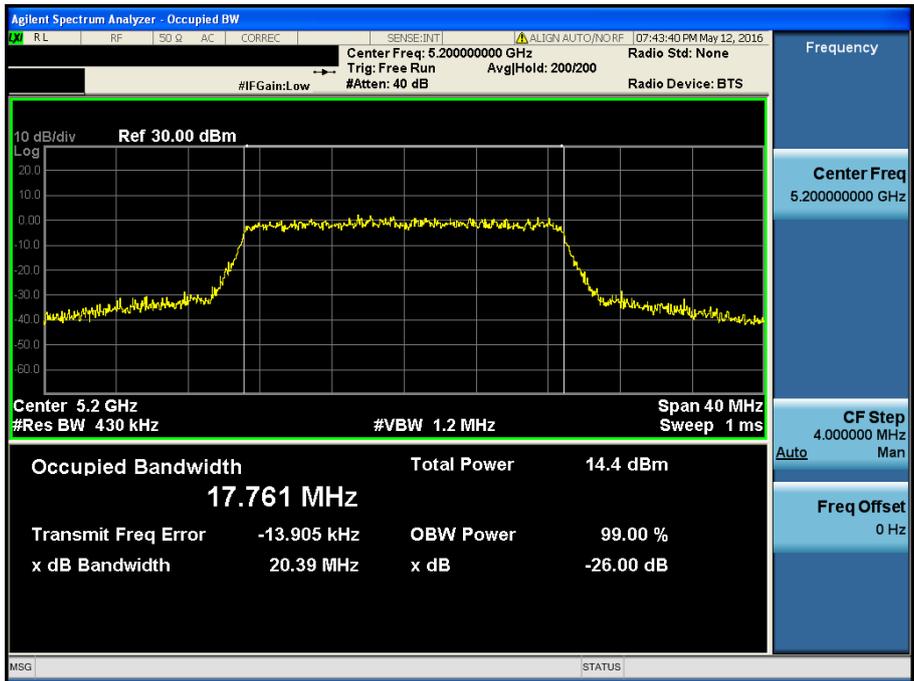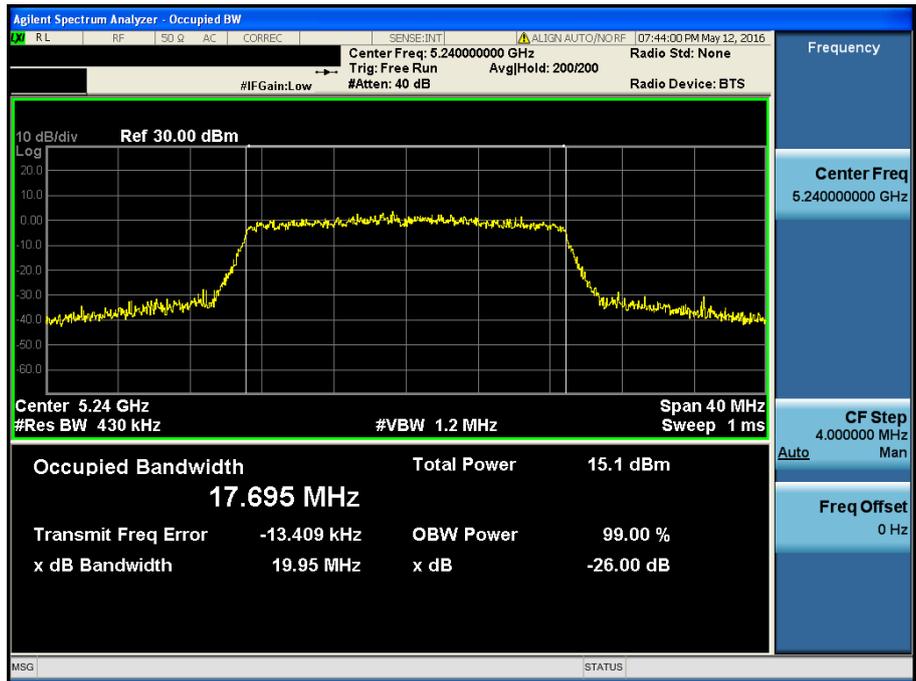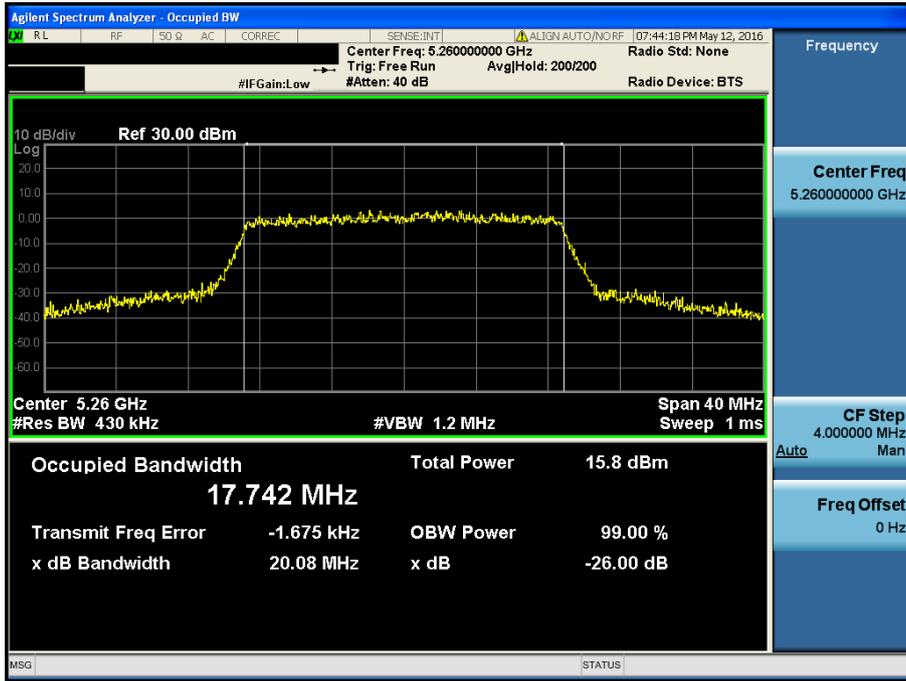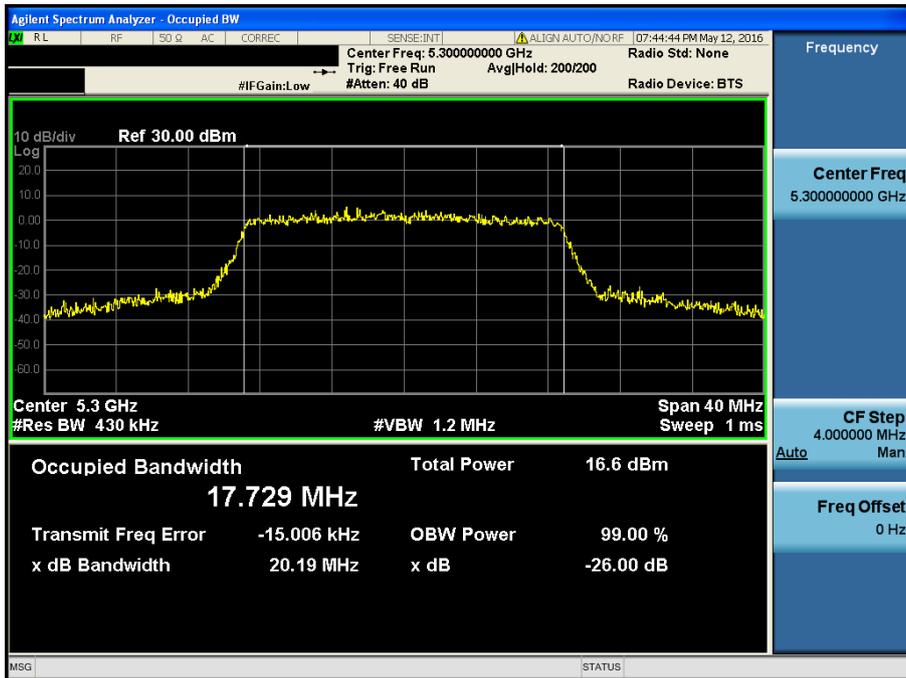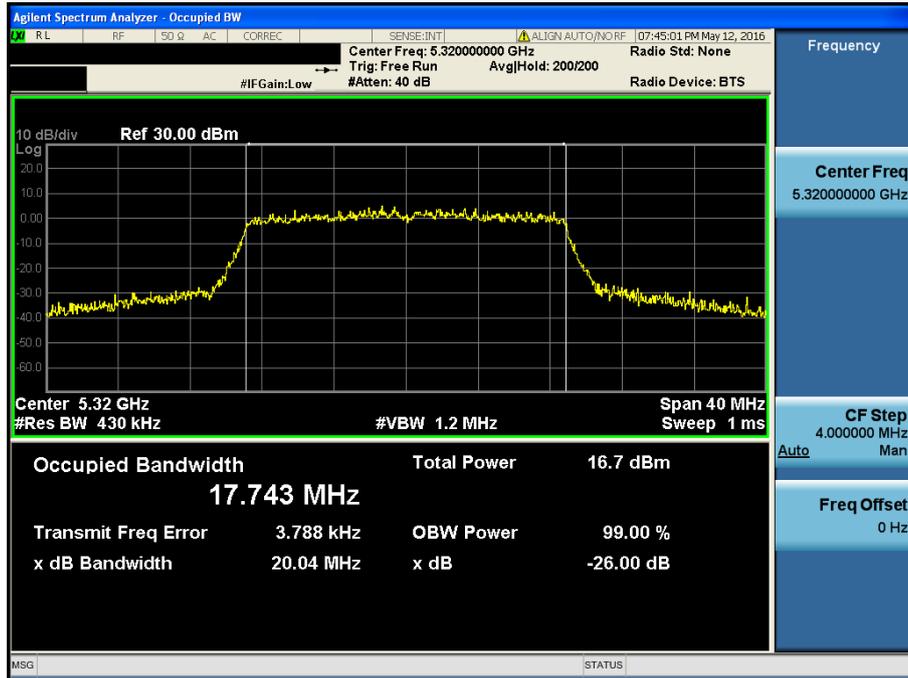## Occupied Bandwidth 99%          Test Mode: 802.11a   &   ANT 2   & Ch.157

## Occupied Bandwidth 99%                  Test Mode: 802.11a  &  ANT 2  &  Ch.165

**Occupied Bandwidth 99%**                    Test Mode: 802.11n HT20   &   ANT 2   &   Ch.36



**Occupied Bandwidth 99%**                    Test Mode: 802.11n HT20   &   ANT 2   & Ch.40

**Occupied Bandwidth 99%**                Test Mode: 802.11n HT20  &  ANT 2  &  Ch.48

**Occupied Bandwidth 99%**          Test Mode: 802.11n HT20  &  ANT 2  &  Ch.52
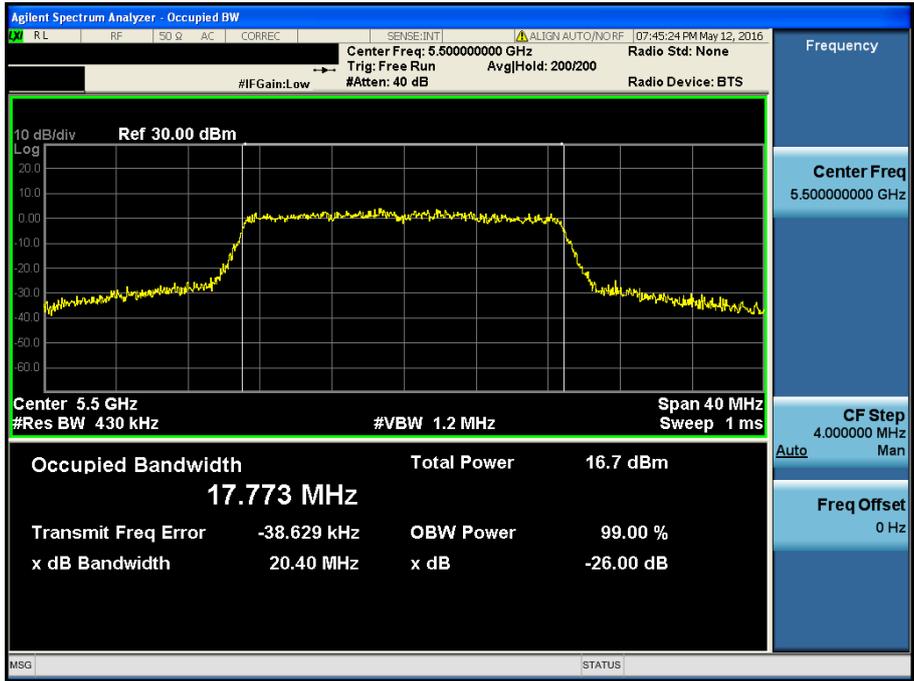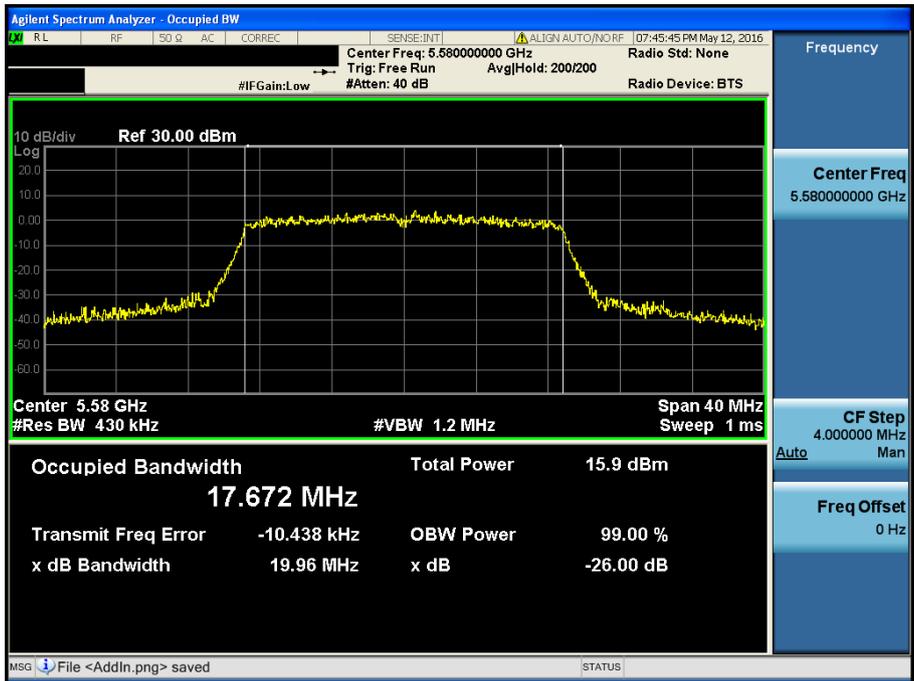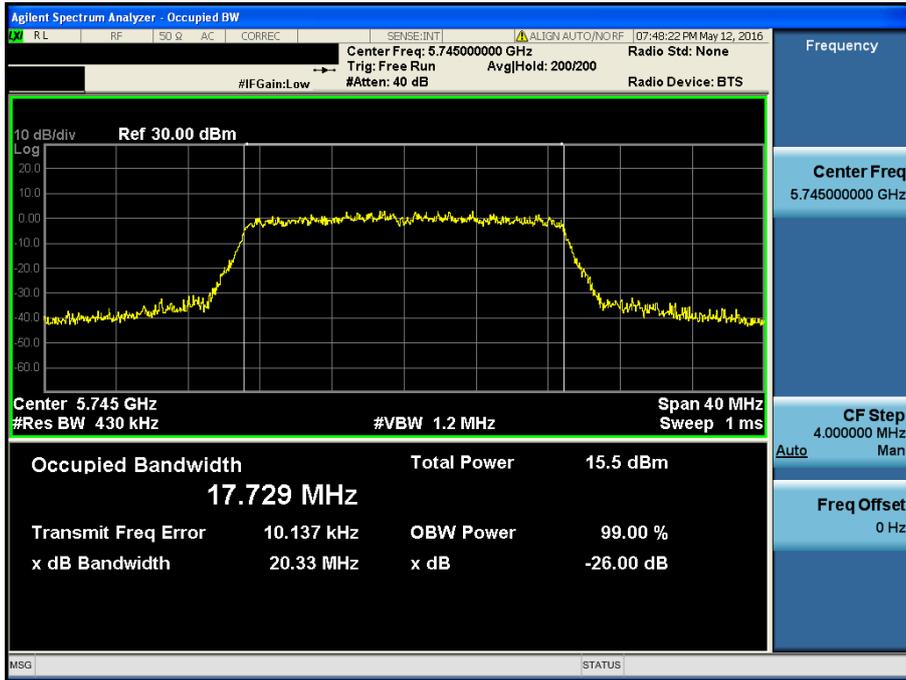


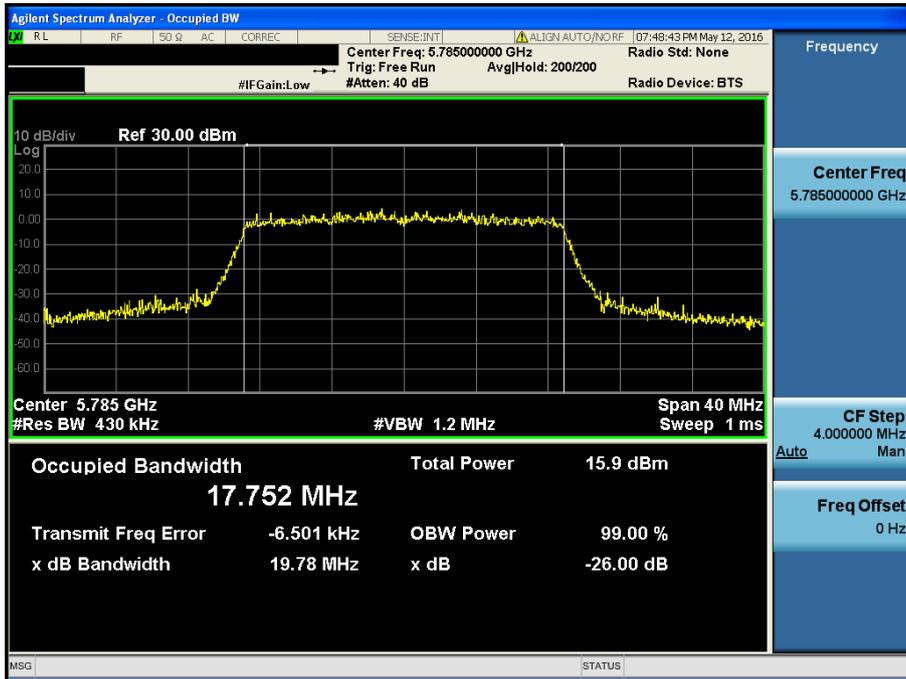**Occupied Bandwidth 99%**          Test Mode: 802.11n HT20  &  ANT 2  &  Ch.60

## Occupied Bandwidth 99%          Test Mode: 802.11n HT20   &   ANT 2   &   Ch.64

**Occupied Bandwidth 99%**                    Test Mode: 802.11n HT20  &  ANT 2  &  Ch.100



**Occupied Bandwidth 99%**                    Test Mode: 802.11n HT20  &  ANT 2  &  Ch.116

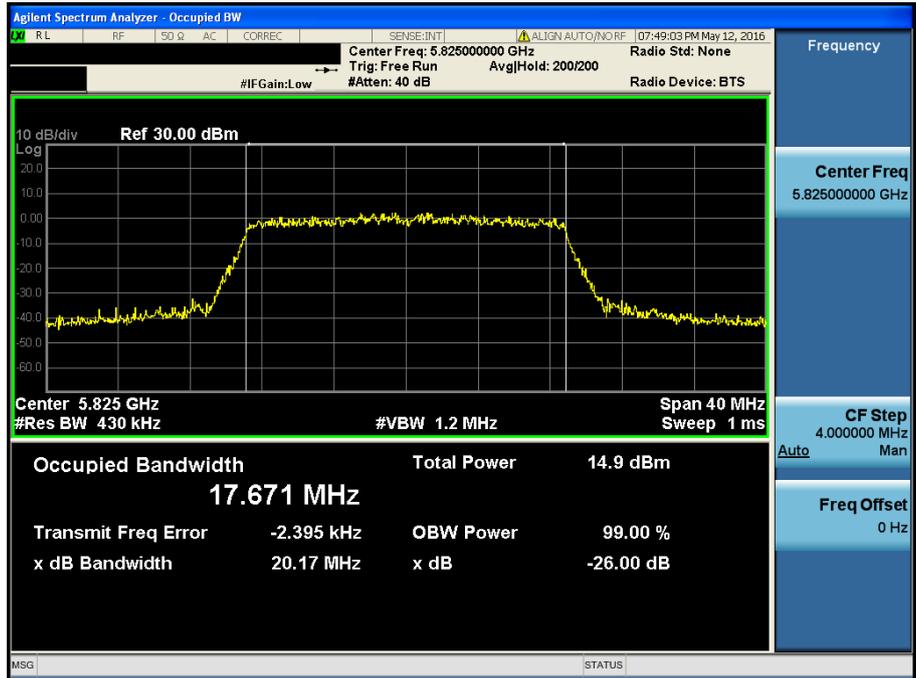**Occupied Bandwidth 99%**          Test Mode: 802.11n HT20  &  ANT 2  &  Ch.149



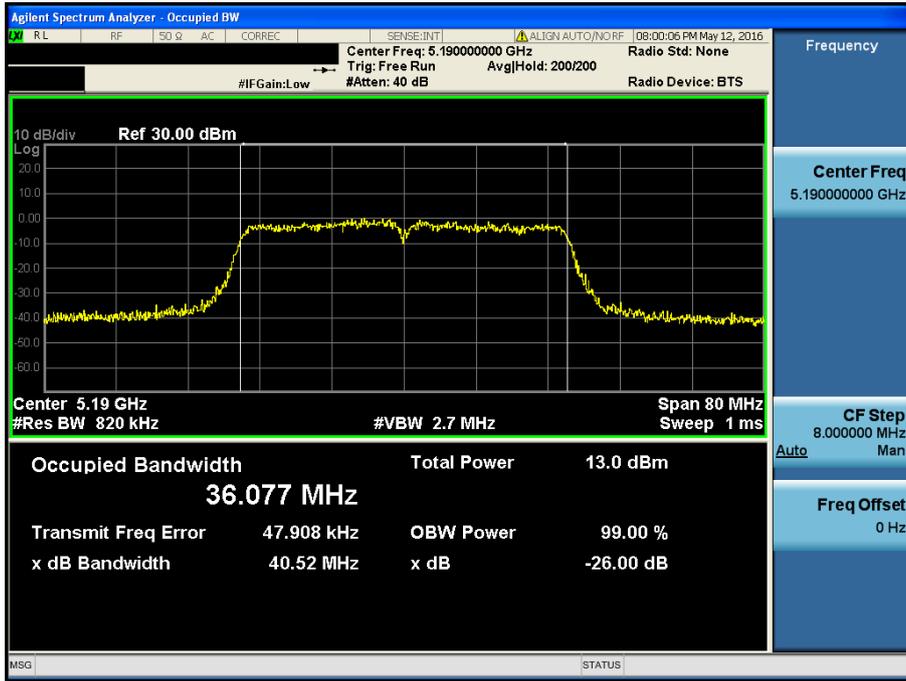**Occupied Bandwidth 99%**          Test Mode: 802.11n HT20  &  ANT 2  &  Ch.157

**Occupied Bandwidth 99%**                    Test Mode: 802.11n HT20   &   ANT 2   &   Ch.165

## Occupied Bandwidth 99%          Test Mode: 802.11n HT40  &  ANT 2  &  Ch.38



## Occupied Bandwidth 99%          Test Mode: 802.11n HT40  &  ANT 2  &  Ch.46
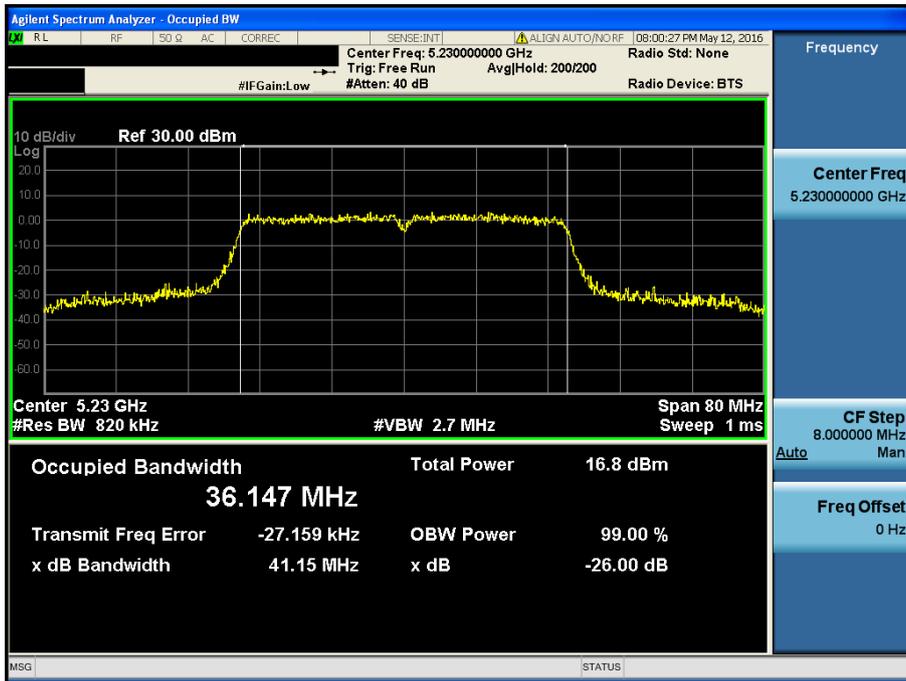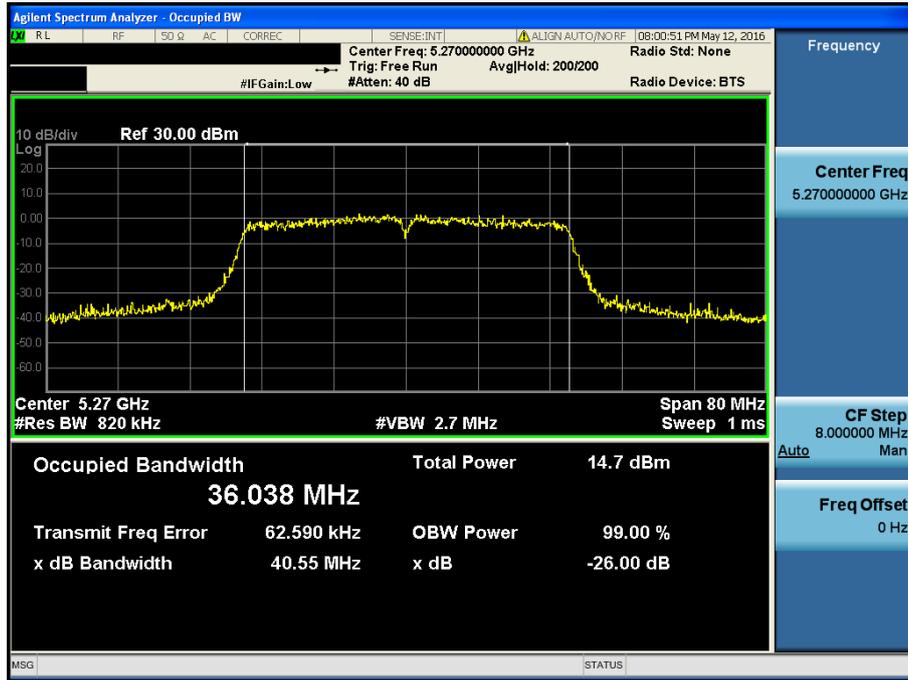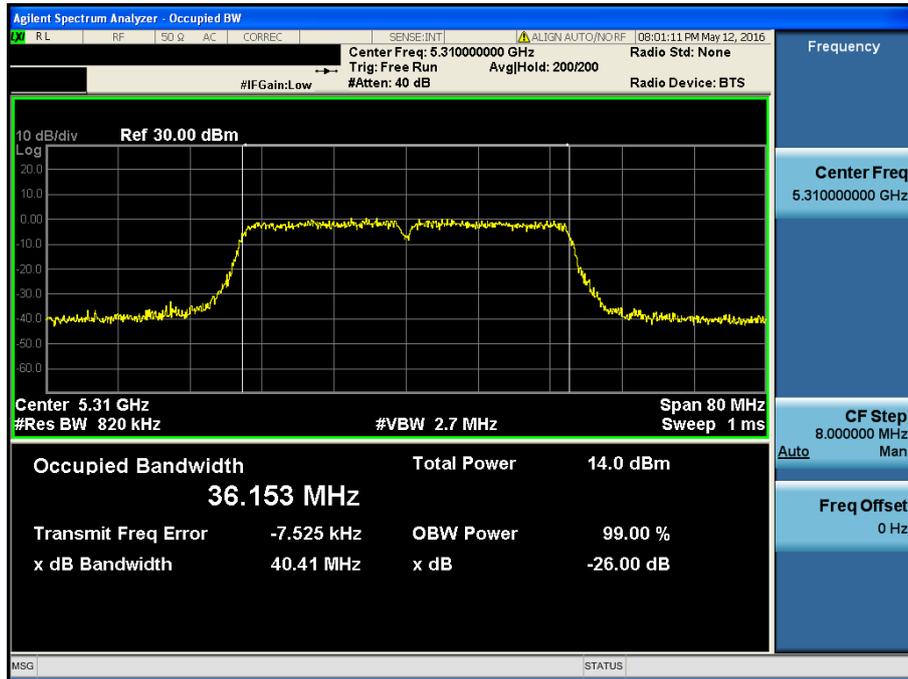
**Occupied Bandwidth 99%**          Test Mode: 802.11n HT40  &  ANT 2  &  Ch.54
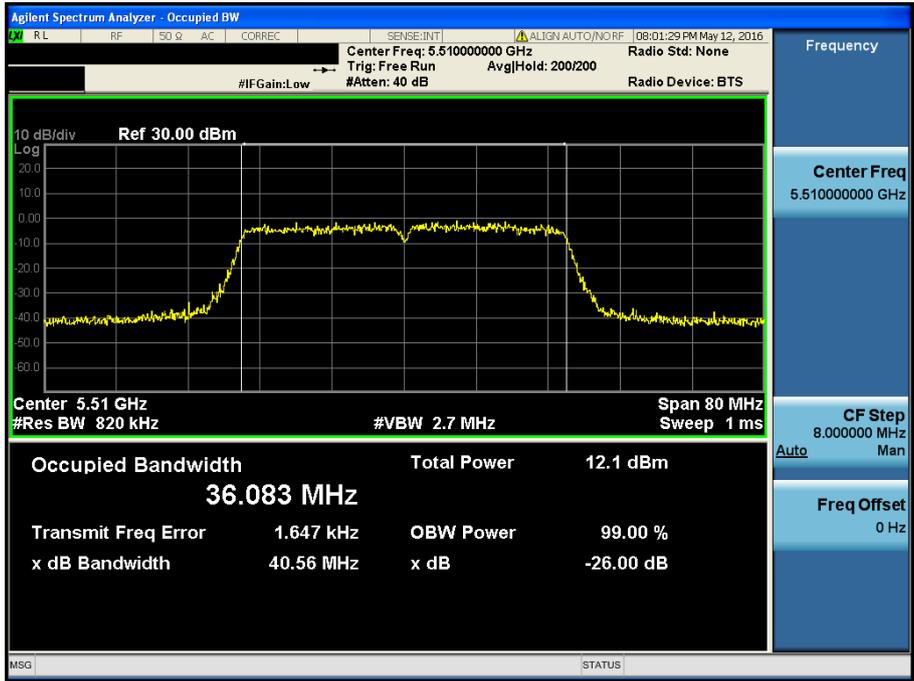


**Occupied Bandwidth 99%**          Test Mode: 802.11n HT40  &  ANT 2  &  Ch.62
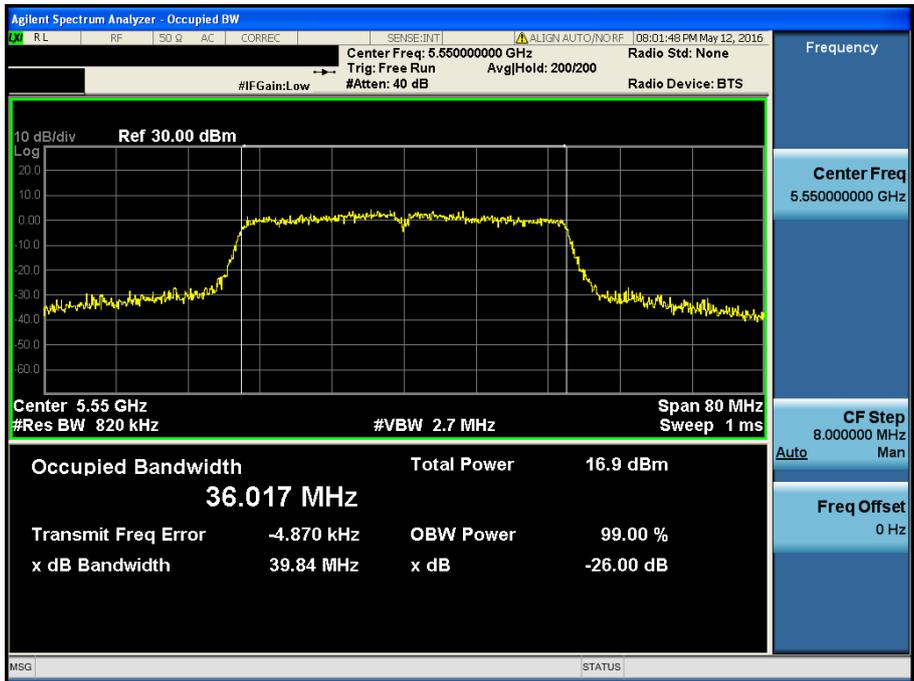
**Occupied Bandwidth 99%**            Test Mode: 802.11n HT40  &  ANT 2  &  Ch.102



**Occupied Bandwidth 99%**            Test Mode: 802.11n HT40  &  ANT 2  &  Ch.110

## Occupied Bandwidth 99%          Test Mode: 802.11n HT40  &  ANT 2  &  Ch.151



## Occupied Bandwidth 99%          Test Mode: 802.11n HT40  &  ANT 2  &  Ch.159

**Occupied Bandwidth 99%**          Test Mode: 802.11ac VHT80   &   ANT 2   &   Ch.42



**Occupied Bandwidth 99%**          Test Mode: 802.11ac VHT80   &   ANT 2   &   Ch.58

**Occupied Bandwidth 99%**          Test Mode: 802.11ac VHT80   &   ANT 2   &   Ch.106



**Occupied Bandwidth 99%**          Test Mode: 802.11ac VHT80   &   ANT 2   &   Ch.155

## Occupied Bandwidth 99%          Test Mode: 802.11a & ANT 2 & Ch.144
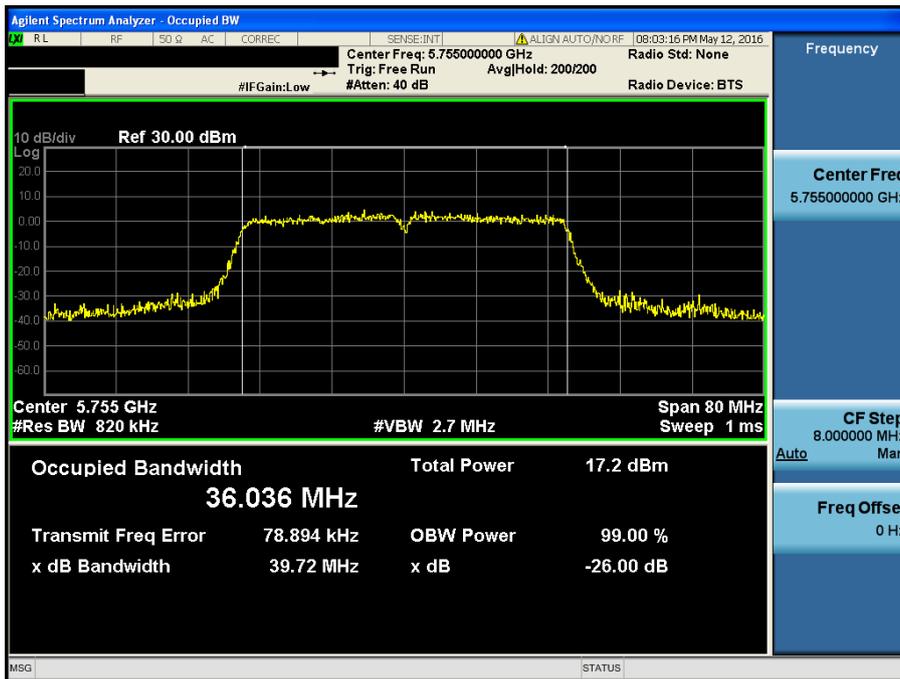


## Occupied Bandwidth 99%          Test Mode: 802.11n HT20 & ANT 2 & Ch.144

**Occupied Bandwidth 99%**          Test Mode: 802.11n HT40  &  ANT 2  &  Ch.142



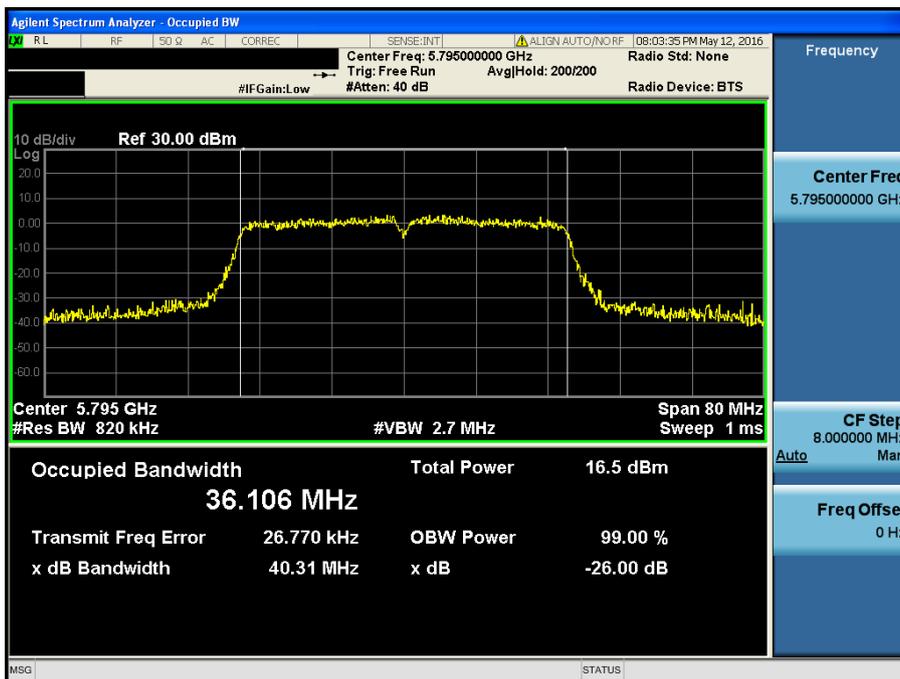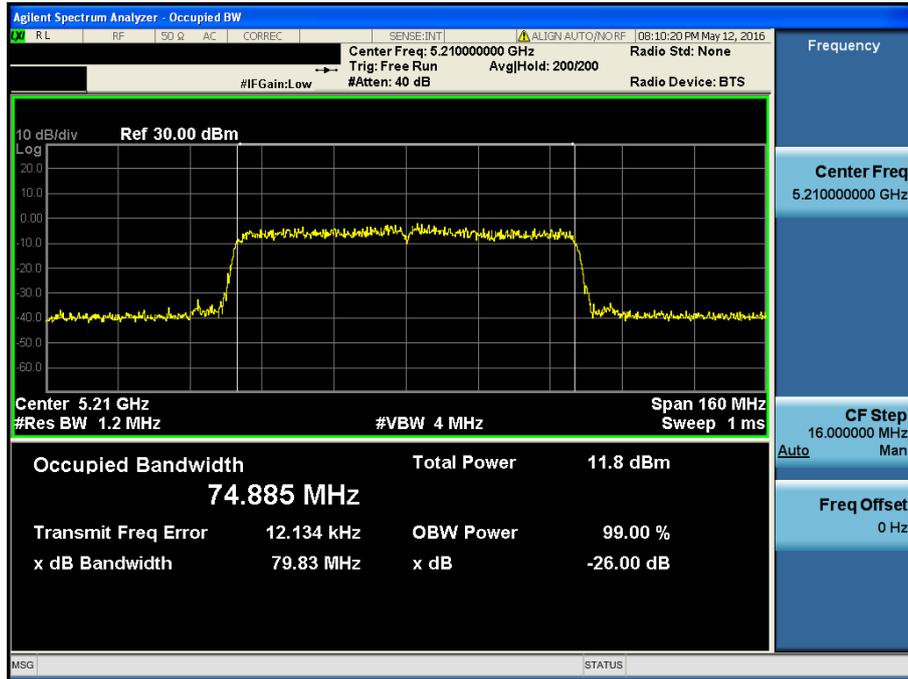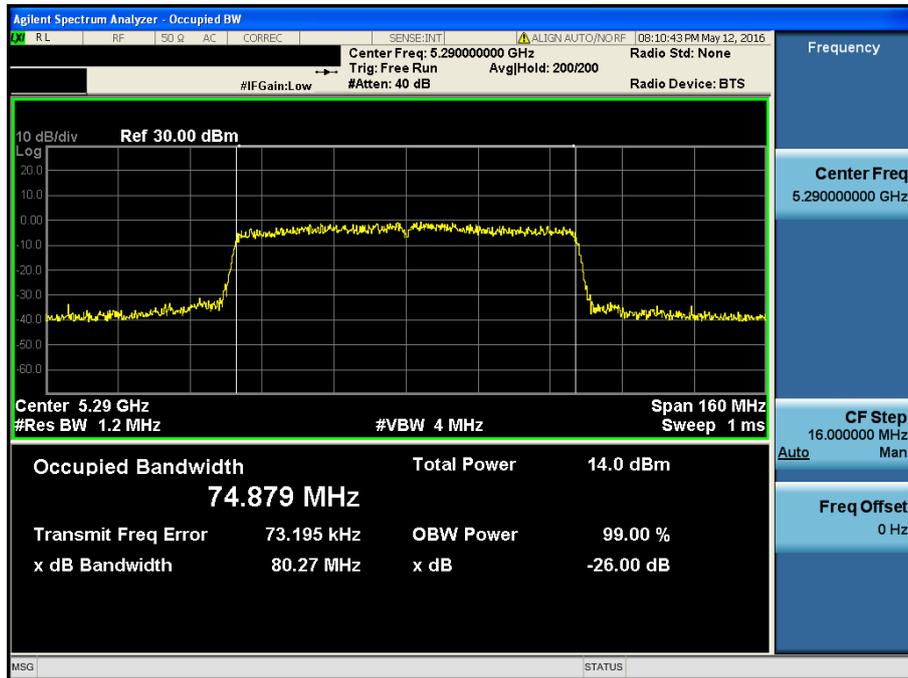**Occupied Bandwidth 99%**          Test Mode: 802.11ac VHT80  &  ANT 2  &  Ch.138
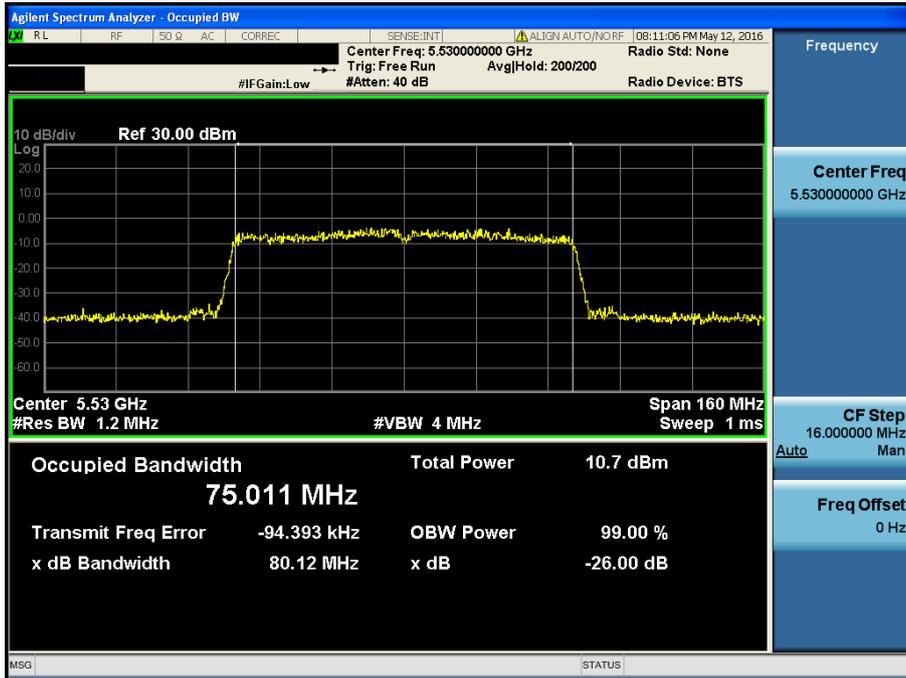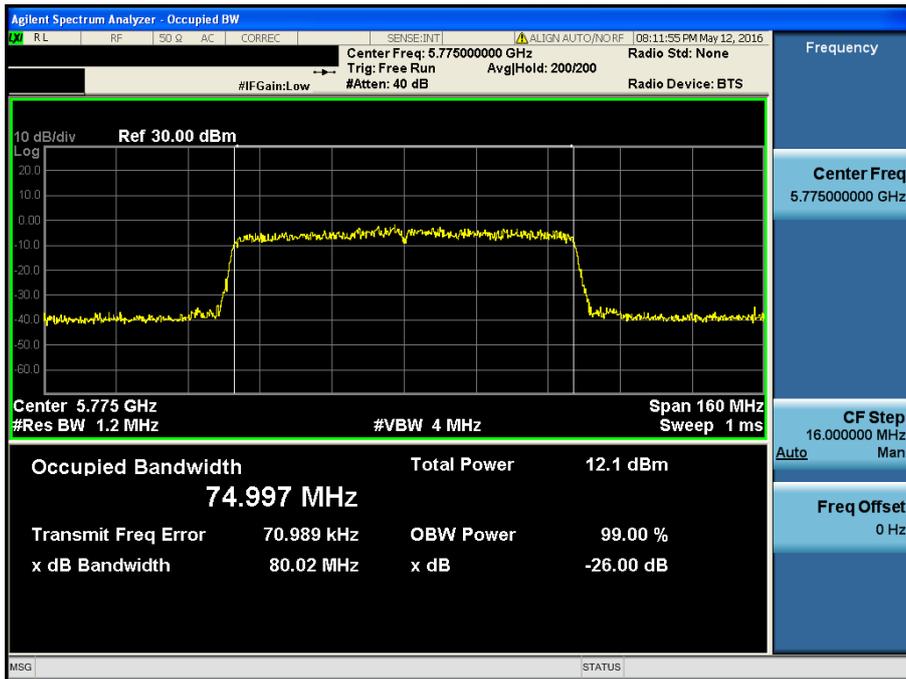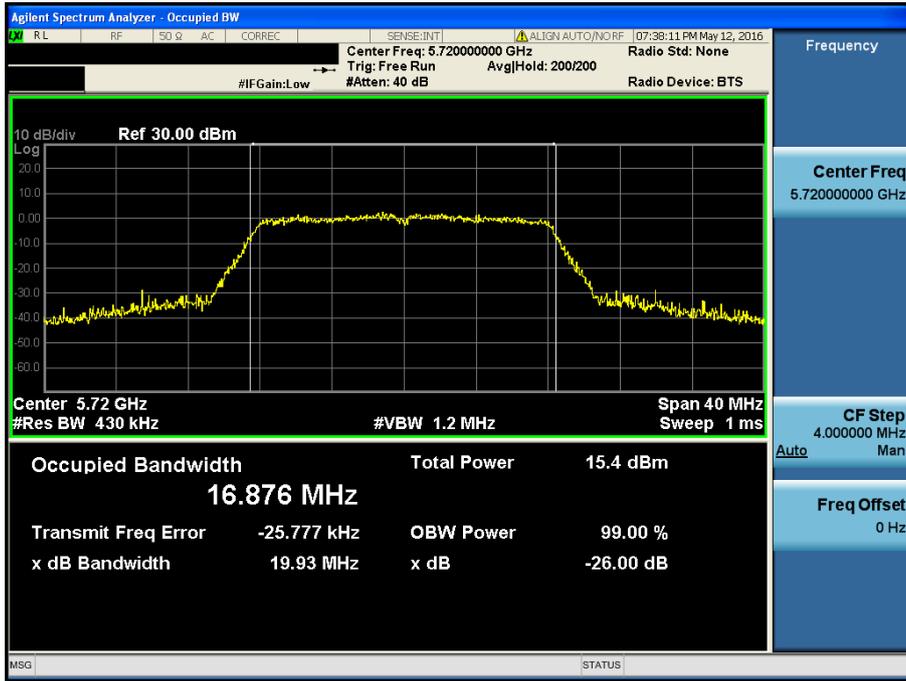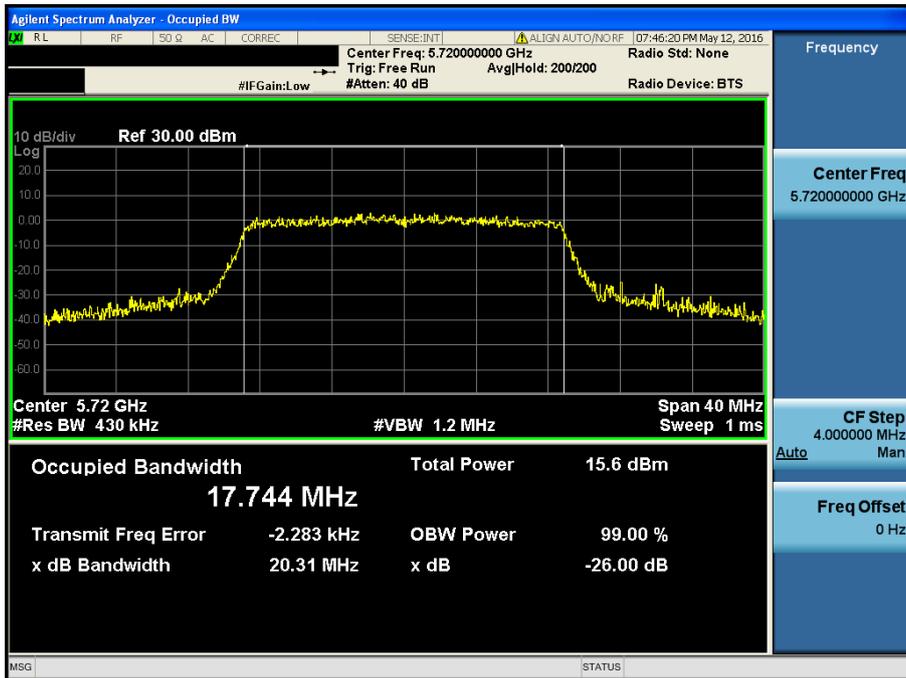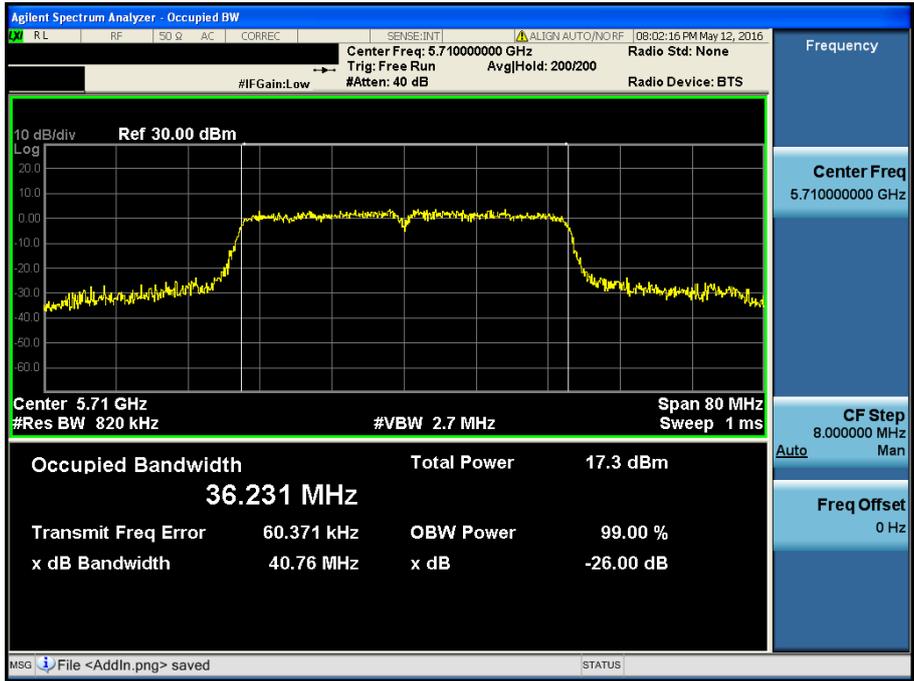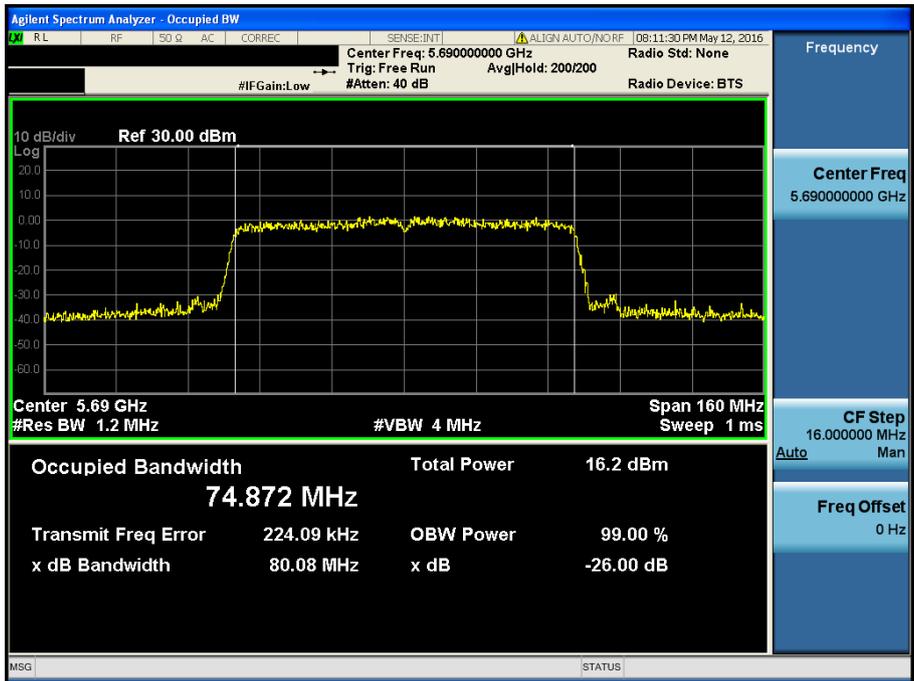
# 9. LIST OF TEST EQUIPMENT

| Type | Manufacturer | Model | Cal.Date (yy/mm/dd) | Next.Cal.Date (yy/mm/dd) | S/N |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent Technologies | N9020A | 16/01/06 | 17/01/06 | MY48011146 |
| Spectrum Analyzer | Agilent Technologies | N9020A | 16/01/06 | 17/01/06 | MY46471096 |
| Dynamic Measurement DC Source | Agilent Technologies | 66332A | 15/10/19 | 16/10/19 | MY43000394 |
| Power Meter & Wide Bandwidth Sensor | Anritsu | ML2495A / MA2490A | 15/10/20 | 16/10/20 | 1338003 / 1249304 |
| Temp & Humi Test Chamber | JISICO | KR-100/J-RHC2 | 15/09/10 | 16/09/10 | 30604493/021031 |
| 10W 30dB Attenuator | SRTechnology | F01-D1230-01 | 15/10/21 | 16/10/21 | 13092401 |
| Termination | SigaTek | 1402 | 15/10/08 | 16/10/08 | 9 |
| Thermohygrometer | BODYCOM | BJ5478 | 16/04/22 | 17/04/22 | 120612-1 |
| Signal Generator | Rohde Schwarz | SMF100A | 15/06/29 | 16/06/29 | 102341 |
| Digital Multimeter | HP | 34401A | 16/02/25 | 17/02/25 | 3146A13475 |
| Loop Antenna | Schwarzbeck | FMZB1513 | 16/04/22 | 18/04/22 | 1513-128 |
| TRILOG Broadband Test-Antenna | Schwarzbeck | VULB 9161 | 14/07/10 | 16/07/10 | 4070 |
| Horn Antenna | ETS-Lindgren | 3115 | 15/02/09 | 17/02/09 | 9202-3820 |
| Horn Antenna | A.H.Systems Inc. | SAS-574 | 15/04/30 | 17/04/30 | 154 |
| Highpass Filter | Wainwright Instruments | WHNX6-6320-8000-26500-40CC | 15/09/23 | 16/09/23 | 1 |
| PreAmplifier | TSJ | MLA-010K01-B01-27 | 16/03/10 | 17/03/10 | 1844539 |
| PreAmplifier | Agilent | 8449B | 16/02/24 | 17/02/24 | 3008A00370 |
| EMI Test Receiver | Rohde Schwarz | ESU | 15/07/14 | 16/07/14 | 100469 |
| EMI Test Receiver | Rohde Schwarz | ESCI | 16/02/25 | 17/02/25 | 100364 |
| Single-Phase Master | NF | 4420 | 15/09/09 | 16/09/09 | 3049354420023 |
| Artificial Mains Network | Narda S.T.S. / PMM | PMM L2-16B | 15/06/26 | 16/06/26 | 000WX20305 |
| CABLE | DTNC | CABLE | N/A | N/A | C-016-2 |
| CABLE | DTNC | CABLE | N/A | N/A | C-016-3 |
| CABLE | DTNC | CABLE | N/A | N/A | C-016-4 |
| CABLE | DTNC | CABLE | N/A | N/A | RF2-106 |
| CABLE | DTNC | CABLE | N/A | N/A | RF1-008 |
| CABLE | DTNC | CABLE | N/A | N/A | RF2-23 |
| CABLE | DTNC | CABLE | N/A | N/A | RF2-24 |
| CABLE | DTNC | CABLE | N/A | N/A | RF2-25 |
| CABLE | DTNC | CABLE | N/A | N/A | RF2-26 |

# APPENDIX I

## Conducted Test set up Diagram

▪ **Conducted Measurement**



Cable A
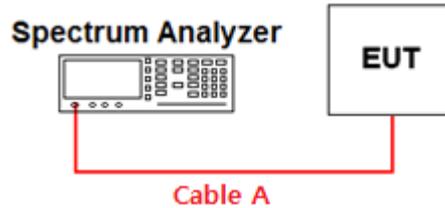
# APPENDIX II

## Duty Cycle Information

◼ **Test Procedure**

**Duty Cycle [X = On Time / ( On + Off time )]** is measured using Measurement Procedure **of KDB789033 D02**
1. Set the center frequency of the spectrum analyzer to the center frequency of the transmission.
2. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value.
3. Set VBW ≥ RBW. Set detector = peak.
4. Note : The zero-span measurement method shall not be used unless both **RBW and VBW are > 50/$T$**, where $T$ is defined in section II.B.1.a), and **the number of sweep points across duration $T$ exceeds 100**. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T$ ≤ 16.7 microseconds.)

   $T$ : The minimum transmission duration over which the transmitter is on and is transmitting
      at its maximum power control level for the tested mode of operation.
      (**$T$ = On time** of the above table since the EUT operates with above fixed Duty Cycle and it is the
         minimum On time)

◾ **Test Results:**

**Single Transmit**

| Mode | Channel | Tested Frequency [MHz] | Maximum Achievable Duty Cycle ($x$) = On / (On+Off) | | | Duty Cycle Correction Factor [dB] | 50/$T$ [kHz] |
|---|---|---|---|---|---|---|---|
| | | | On Time [ms] | On+OffTime [ms] | $x$ | | |
| 802.11a | 36 | 5180 | 1.43 | 1.65 | 86.67 | 0.63 | 34.97 |
| 802.11n (HT20) | 36 | 5180 | 1.34 | 1.56 | 85.90 | 0.67 | 37.31 |
| 802.11n (HT40) | 38 | 5190 | 0.68 | 0.88 | 76.53 | 1.17 | 73.53 |
| 802.11ac (VHT80) | 42 | 5210 | 0.33 | 0.54 | 61.48 | 2.12 | 151.52 |

**Multiple Transmit**

| Mode | Channel | Tested Frequency [MHz] | Maximum Achievable Duty Cycle ($x$) = On / (On+Off) | | | Duty Cycle Correction Factor [dB] | 50/$T$ [kHz] |
|---|---|---|---|---|---|---|---|
| | | | On Time [ms] | On+OffTime [ms] | $x$ | | |
| 802.11a | 36 | 5180 | 1.43 | 1.65 | 86.67 | 0.63 | 34.97 |
| 802.11n (HT20) | 36 | 5180 | 0.70 | 0.90 | 77.14 | 1.13 | 71.43 |
| 802.11n (HT40) | 38 | 5190 | 0.36 | 0.56 | 63.39 | 1.98 | 138.89 |
| 802.11ac (VHT80) | 42 | 5210 | 0.19 | 0.40 | 48.23 | 3.17 | 263.16 |

## Single Transmit

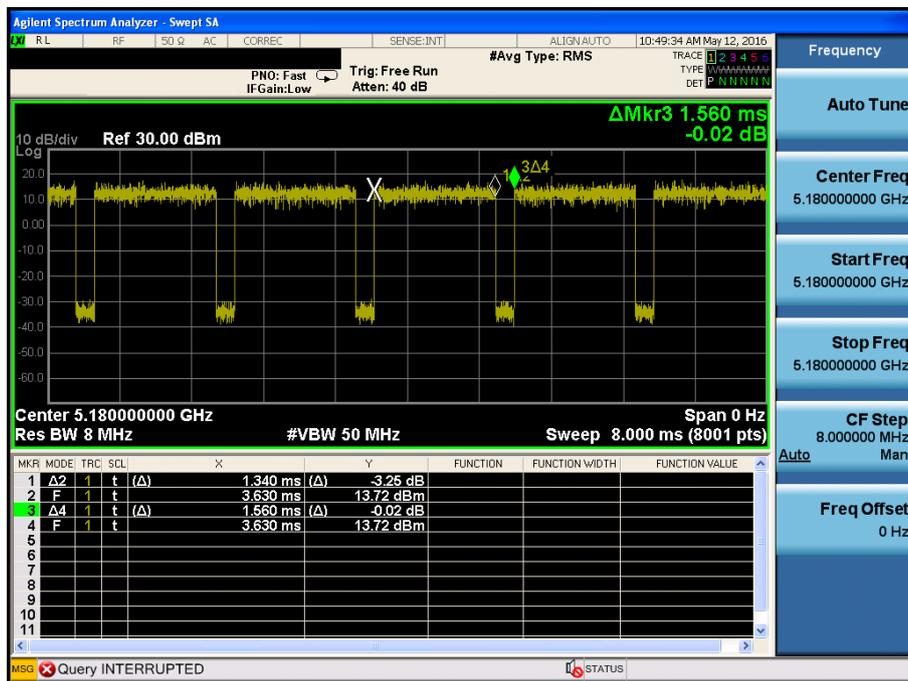### Duty Cycle                                    Test Mode: 802.11a  &  Ch.36
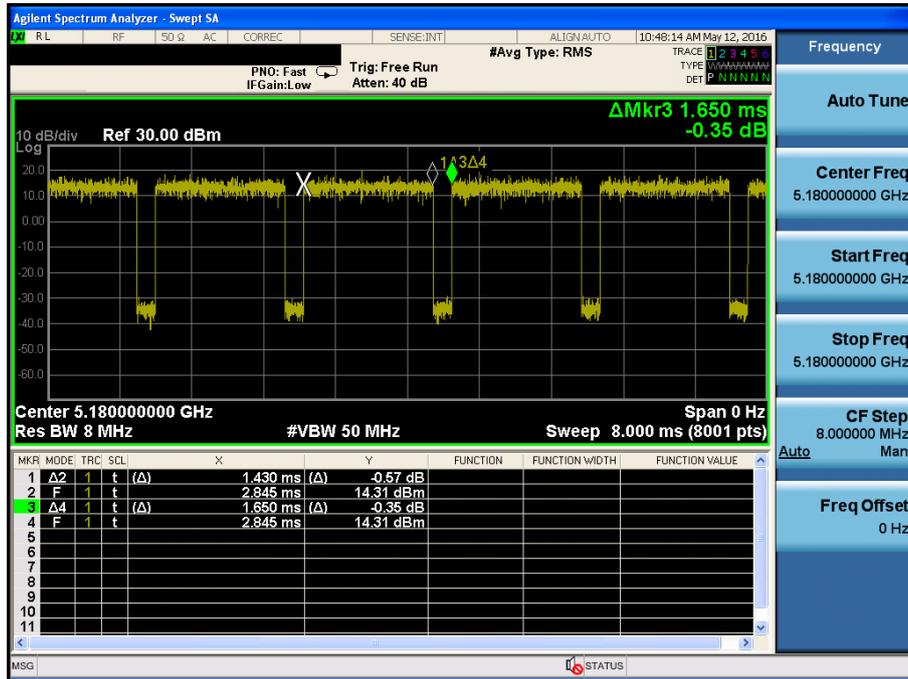


### Duty Cycle                                    Test Mode: 802.11n HT20  &  Ch.36
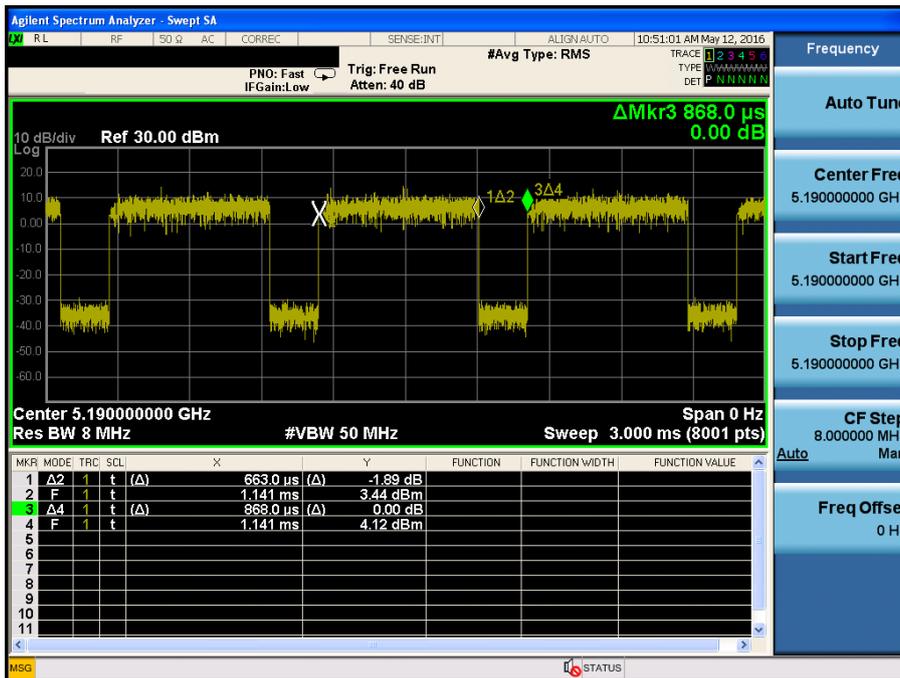
**Duty Cycle**                              Test Mode: 802.11n HT40  &  Ch.38
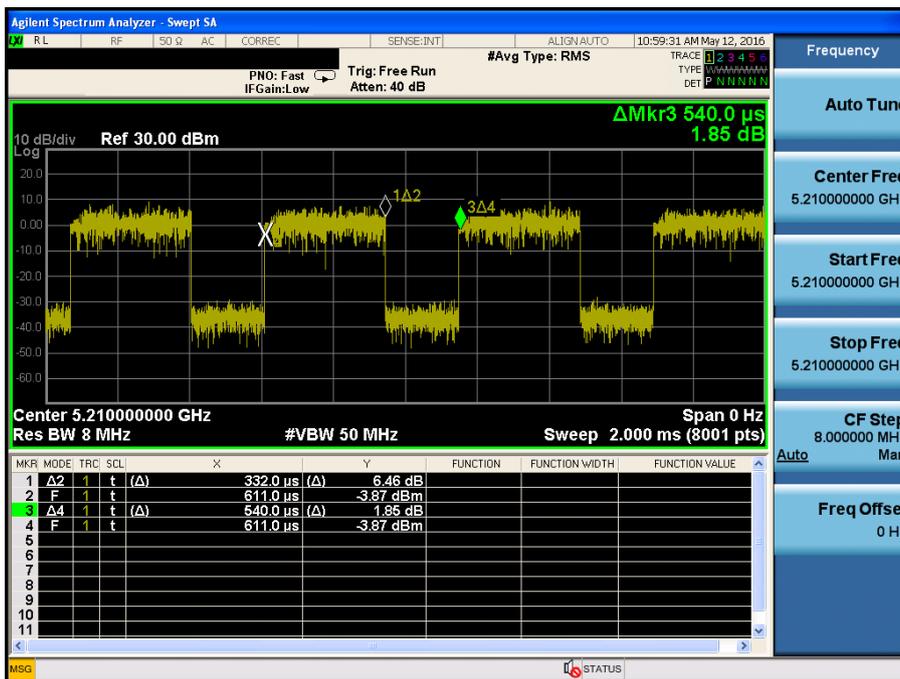


**Duty Cycle**                              Test Mode: 802.11ac VHT80  &  Ch.42

## Multiple Transmit

### Duty Cycle                                          Test Mode: 802.11a  &  Ch.36



### Duty Cycle                                          Test Mode: 802.11n HT20  &  Ch.36

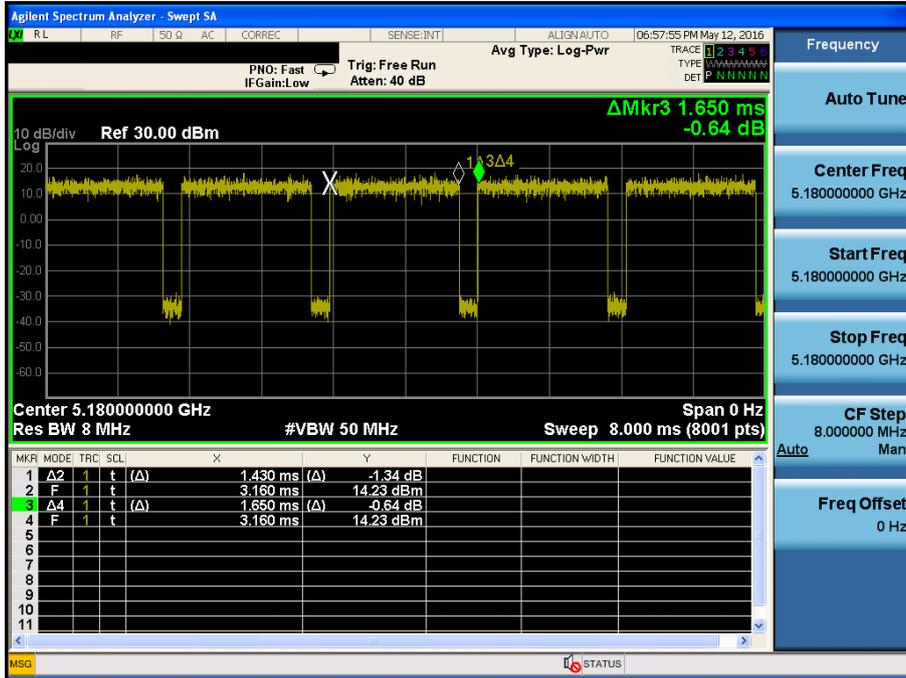**Duty Cycle**                              Test Mode: 802.11n HT40   &   Ch.38



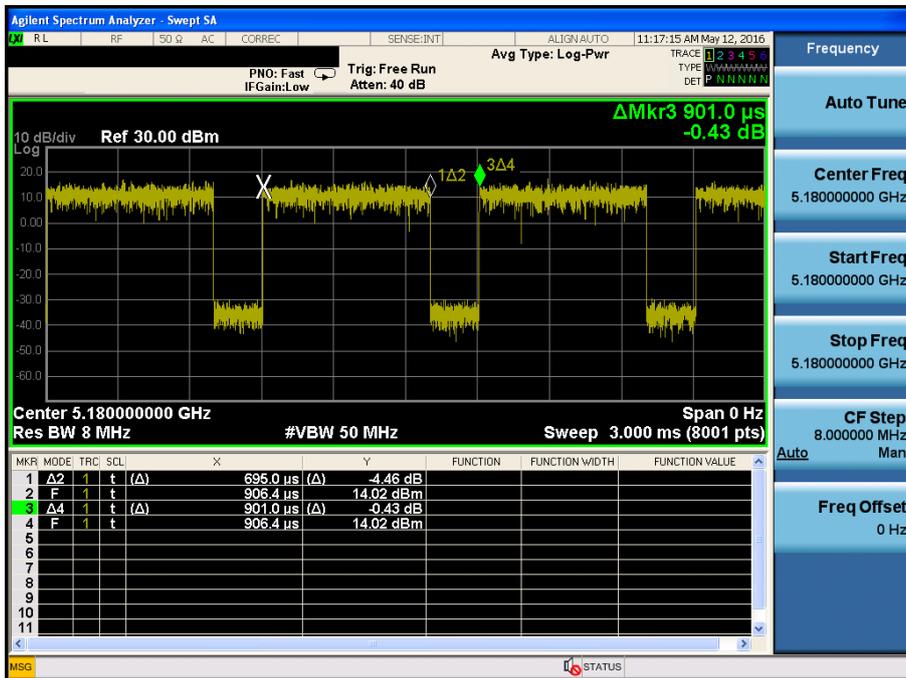**Duty Cycle**                              Test Mode: 802.11ac VHT80   &   Ch.42

## Cross band 5.7G

### Duty Cycle

Test Mode: 802.11a  &  Ch.149



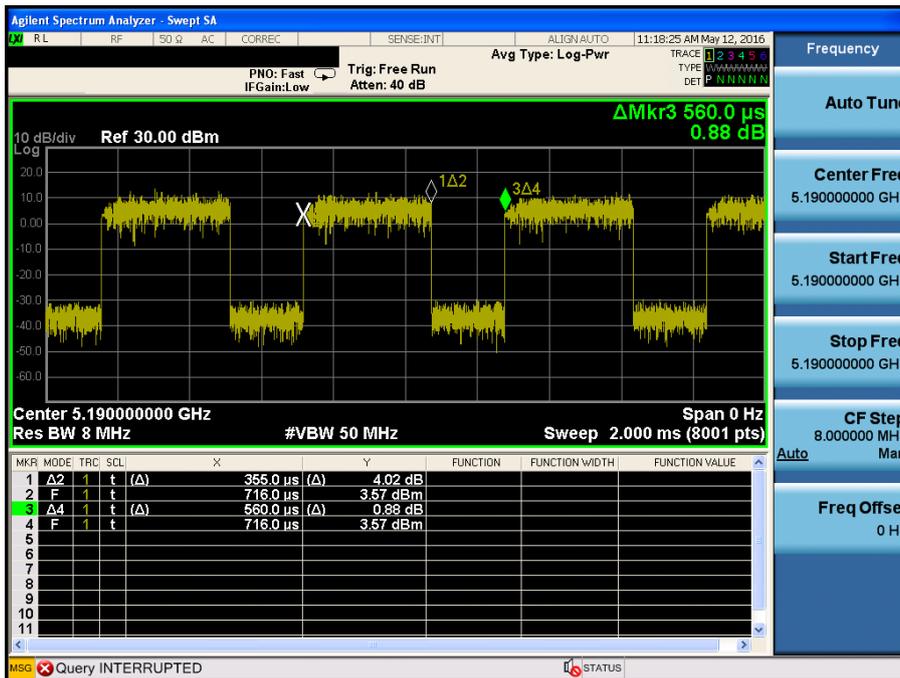### Duty Cycle

Test Mode: 802.11n HT20  &  Ch.149

**Duty Cycle**                               Test Mode: 802.11n HT40  &  Ch.151
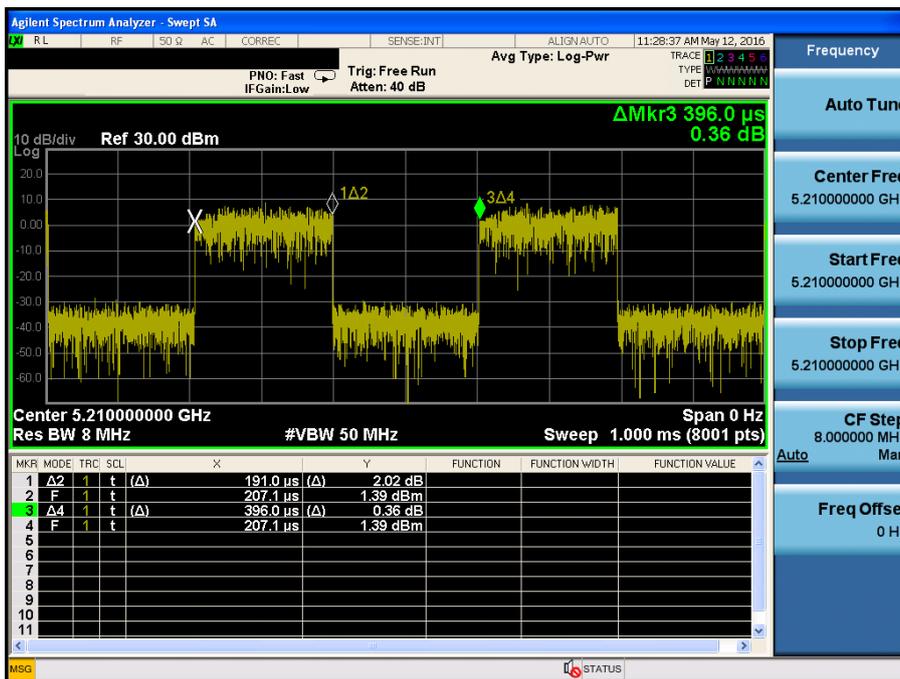


**Duty Cycle**                               Test Mode: 802.11ac VHT80  &  Ch.155
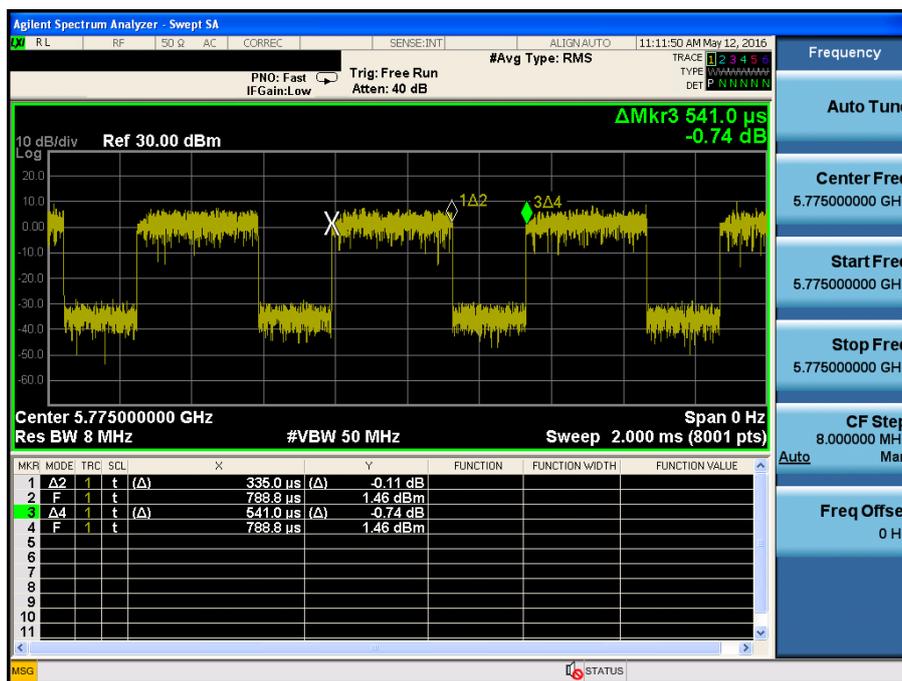
## Cross band 5.7G

### Duty Cycle                                        Test Mode: 802.11a  &  Ch.149
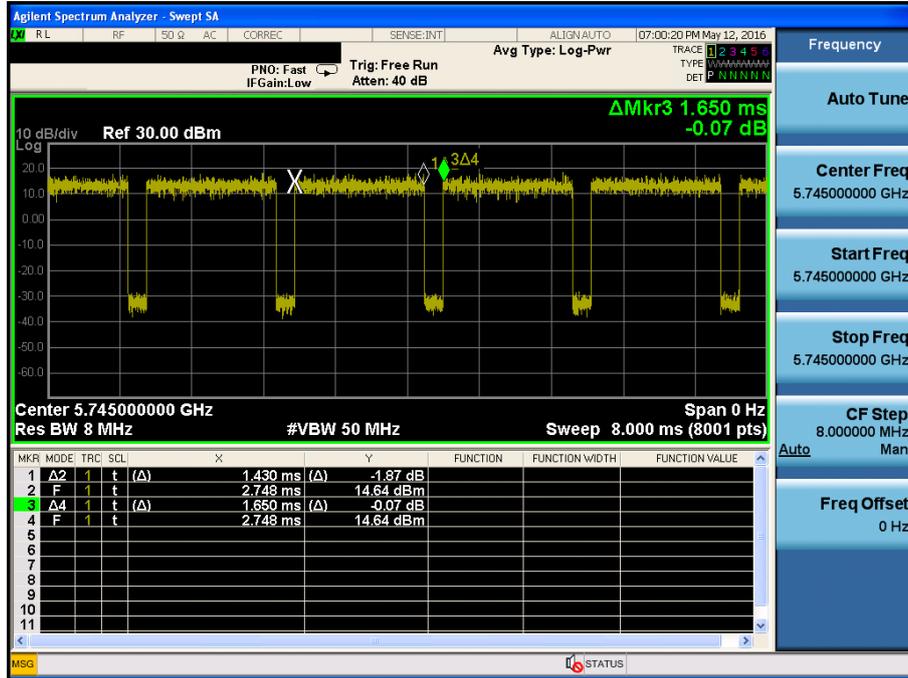


### Duty Cycle                                        Test Mode: 802.11n HT20  &  Ch.149
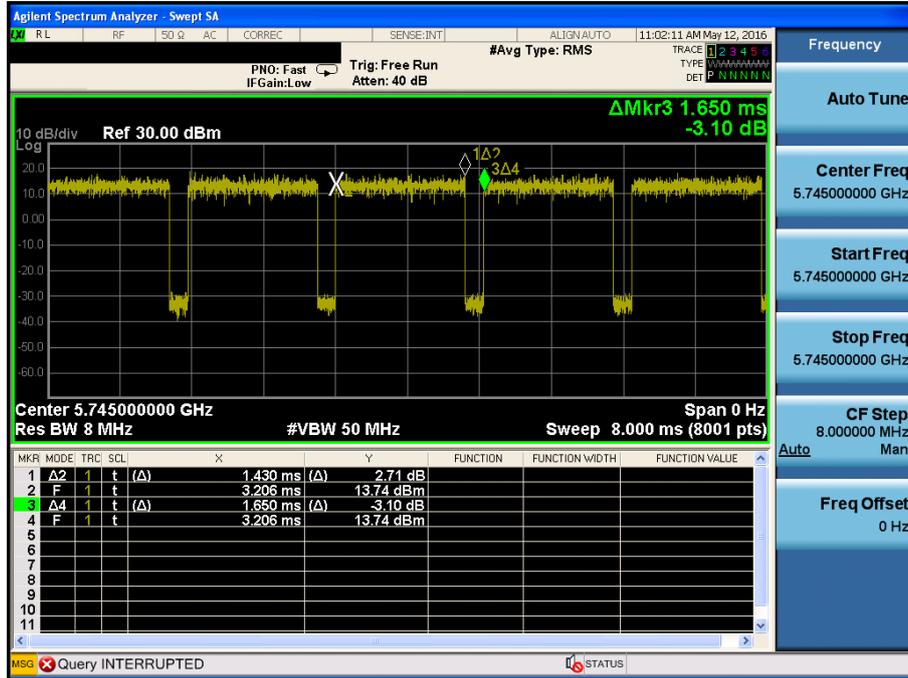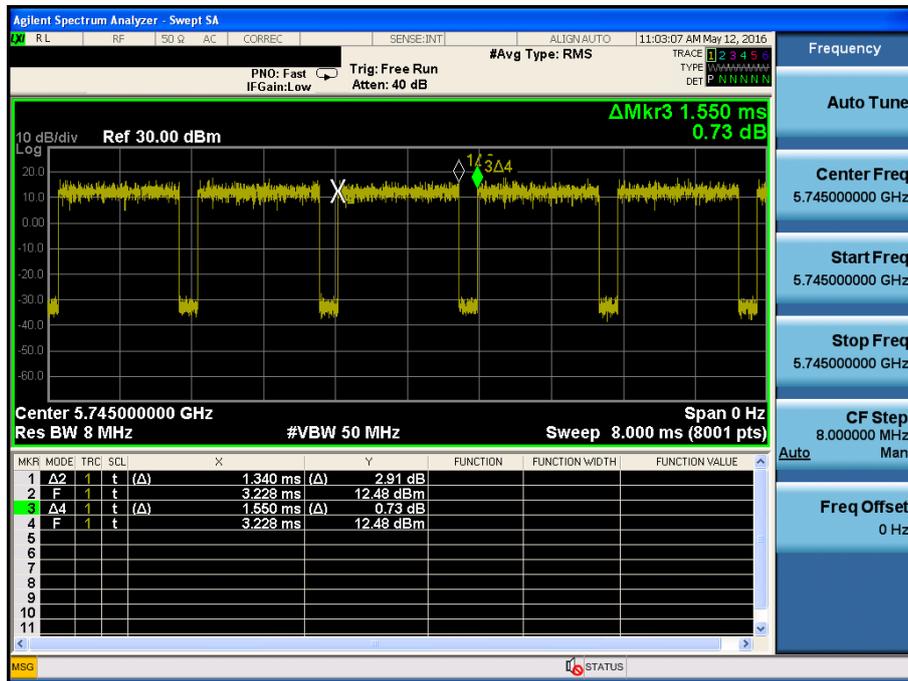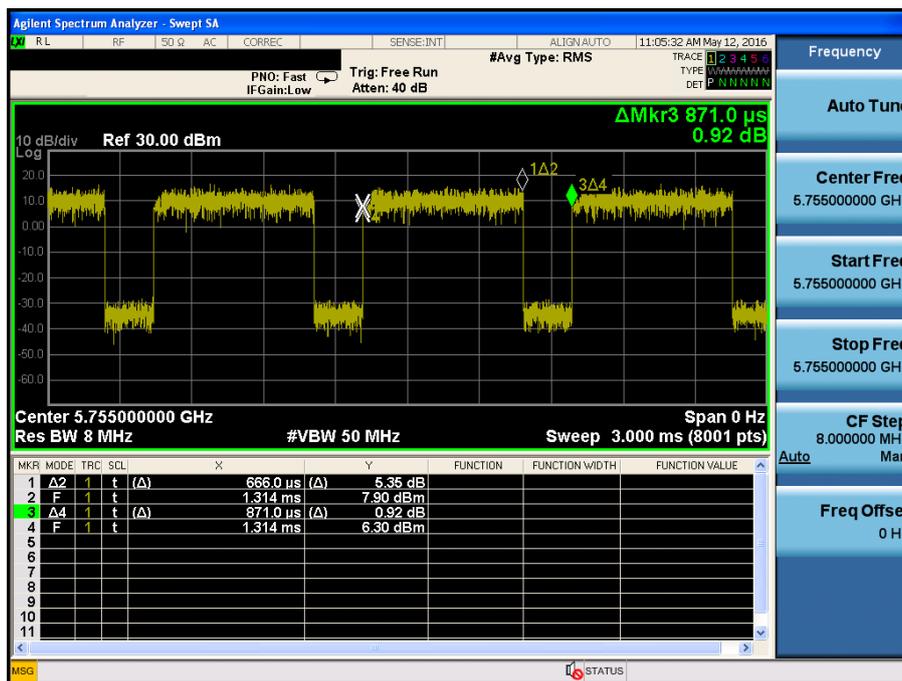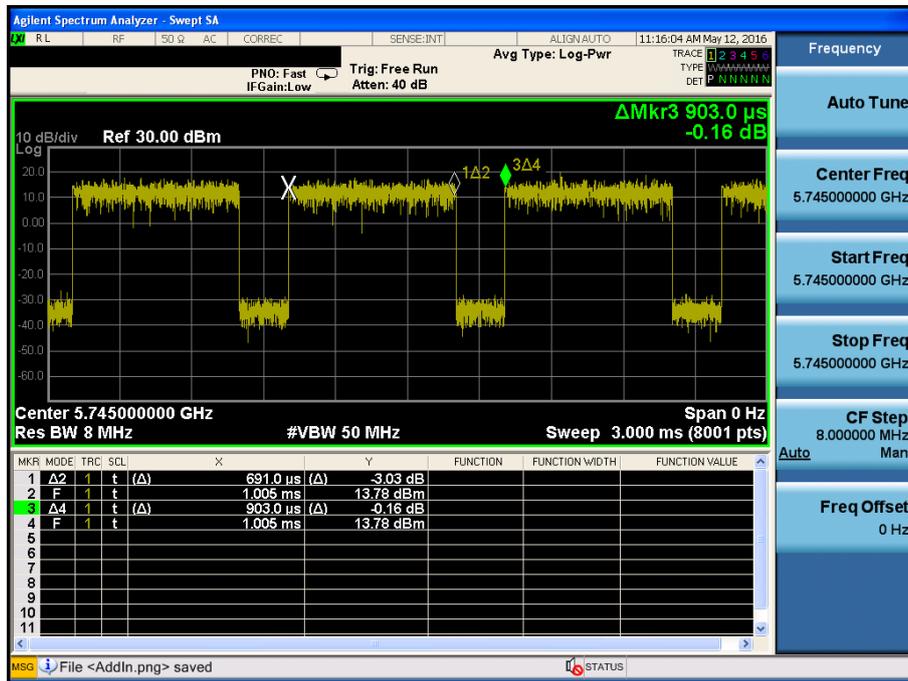
## Duty Cycle

Test Mode: 802.11n HT40 & Ch.151
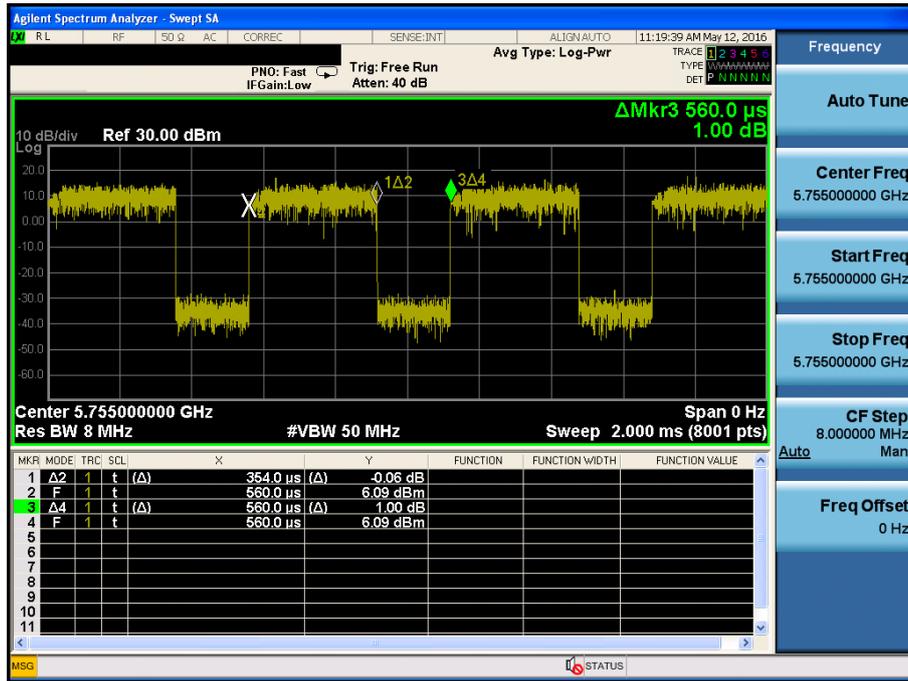


## Duty Cycle

Test Mode: 802.11ac VHT80 & Ch.155
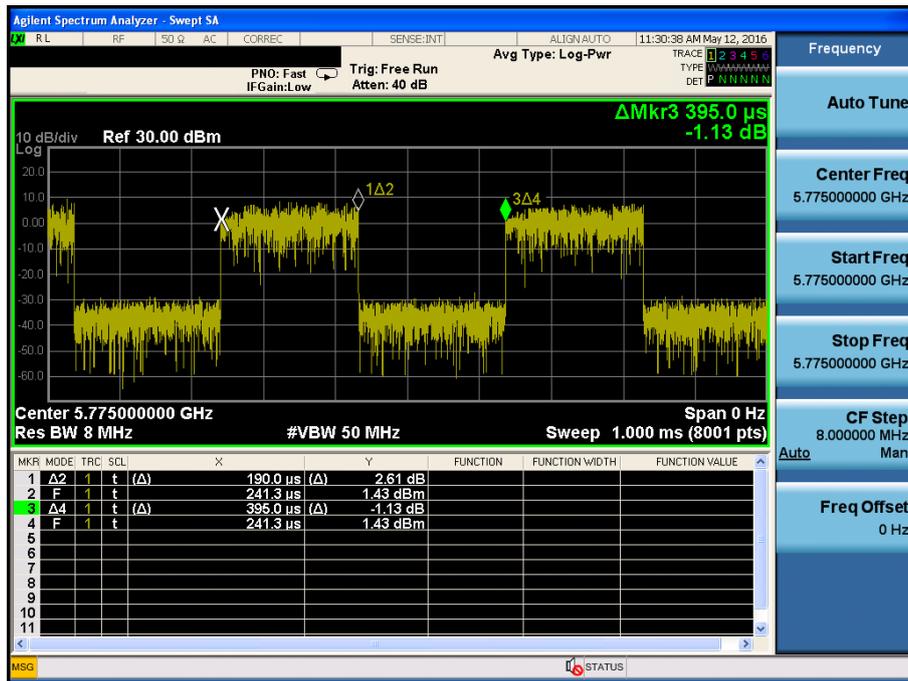
# APPENDIX III

## Unwanted Emissions (Radiated) Test Plot _ Multiple Transmit

**802.11a   &   U-NII 1   &   Ch.36   &   Z axis   &   Ver**                    **Detector Mode : PK**
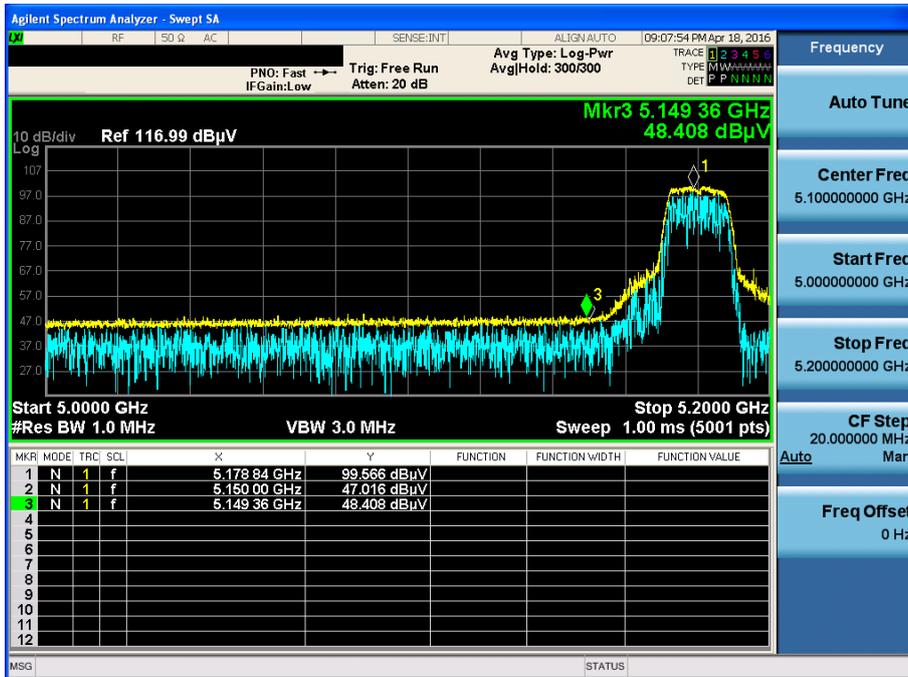


**802.11a   &   U-NII 1   &   Ch.36   &   Z axis   &   Ver**                    **Detector Mode : AV**
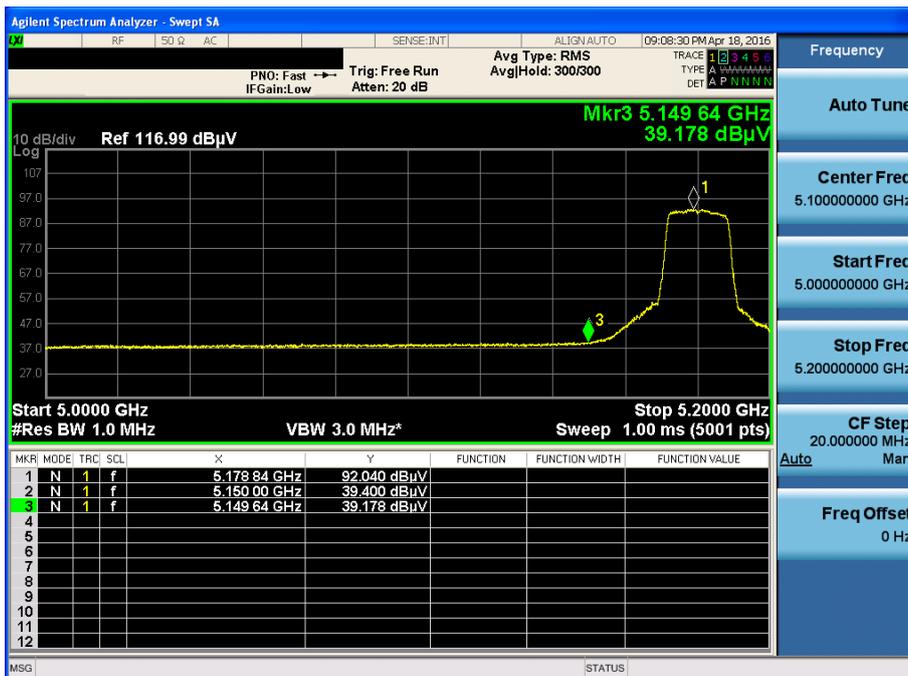
**802.11a  &  U-NII 1  &  Ch.40  &  Z axis  &  Hor**          **Detector Mode : PK**
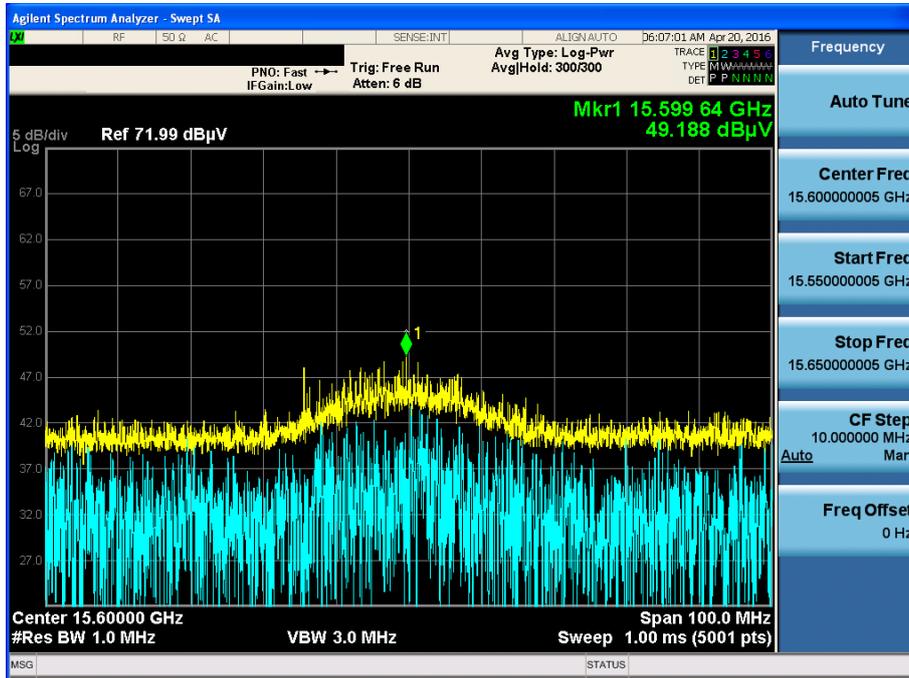


**802.11a  &  U-NII 1  &  Ch.40  &  Z axis  &  Hor**          **Detector Mode : AV**

**802.11a   &   U-NII 1   &   Ch.48   &   Y axis   &   Ver**          **Detector Mode : PK**



**802.11a   &   U-NII 1   &   Ch.48   &   Y axis   &   Ver**          **Detector Mode : AV**

**802.11a  &  U-NII 2A  &  Ch.52  &  Y axis  &  Ver**                    **Detector Mode : PK**



**802.11a  &  U-NII 2A  &  Ch.52  &  Y axis  &  Ver**                    **Detector Mode : AV**

## 802.11a  &  U-NII 2C  &  Ch.100  &  Z axis  &  Hor                    Detector Mode : PK



## 802.11a  &  U-NII 2C  &  Ch.100  &  Z axis  &  Hor                    Detector Mode : AV

**802.11a  &  U-NII 2C  &  Ch.116  &  Y axis  &  Hor          Detector Mode : PK**

**802.11a  &  U-NII 3  &  Ch.149  &  Z axis  &  Ver**                    **Detector Mode : PK**

| Agilent Spectrum Analyzer - Swept SA | | | | | |
|---|---|---|---|---|---|

Mkr4 5.714 77 GHz
53.932 dBµV

Ref 111.99 dBµV

10 dB/div
Log

Start 5.70500 GHz                                                  Stop 5.75500 GHz
#Res BW 1.0 MHz          VBW 3.0 MHz          Sweep 1.00 ms (5001 pts)

| MKR | MODE | TRC | SCL | X | Y | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 5.745 36 GHz | 101.363 dBµV | | | |
| 2 | N | 1 | f | 5.725 00 GHz | 57.451 dBµV | | | |
| 3 | N | 1 | f | 5.715 00 GHz | 45.784 dBµV | | | |
| 4 | N | 1 | f | 5.714 77 GHz | 53.932 dBµV | | | |
| 5 | N | 1 | f | 5.723 98 GHz | 61.162 dBµV | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | | | | | | | |
| 12 | | | | | | | | |

MSG                                                              STATUS

Frequency

Auto Tune

Center Freq
5.730000000 GHz

Start Freq
5.705000000 GHz

Stop Freq
5.755000000 GHz

CF Step
2.412000000 GHz
Auto          Man

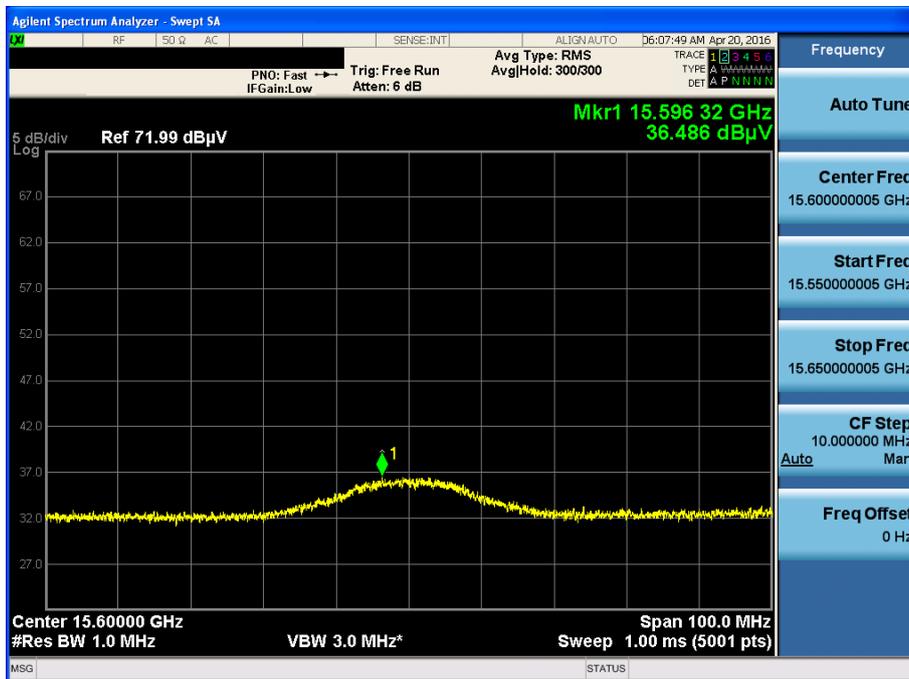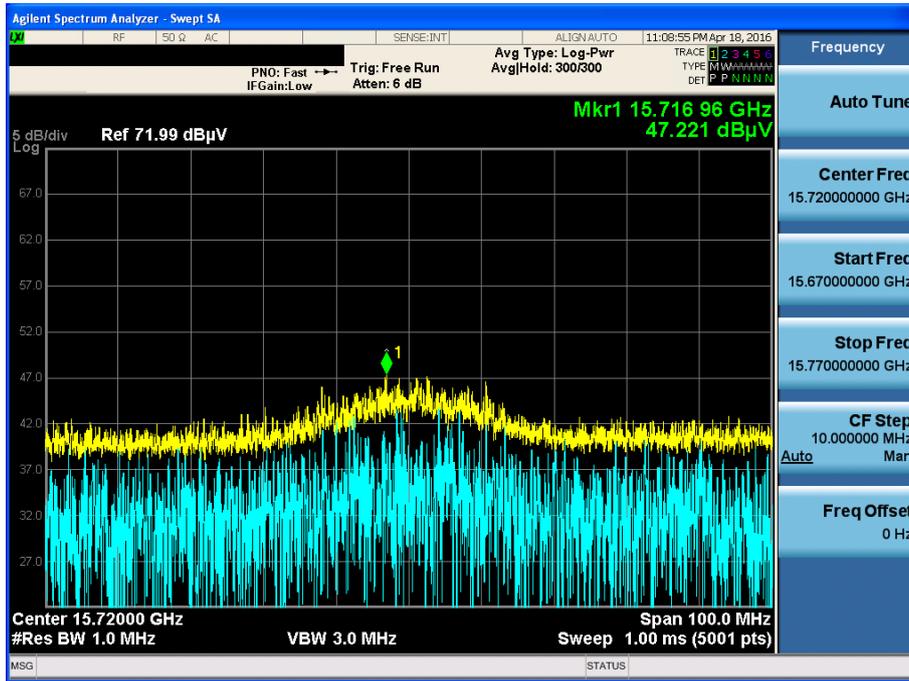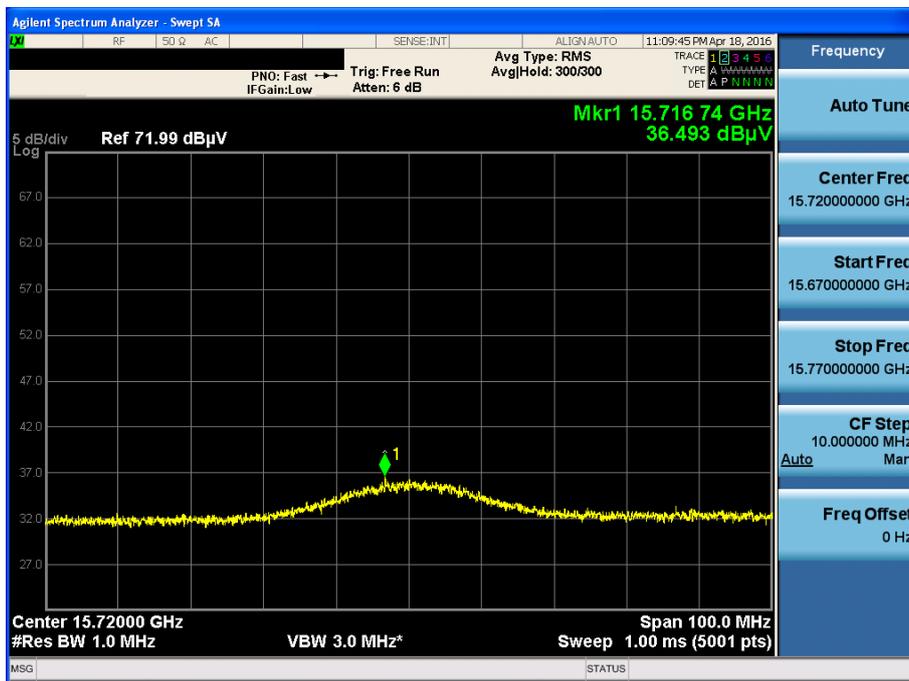Freq Offset
0 Hz

### 802.11a  &  U-NII 3  &  Ch.157  &  Y axis  &  Hor          Detector Mode : PK



### 802.11a  &  U-NII 3  &  Ch.157  &  Y axis  &  Hor          Detector Mode : AV
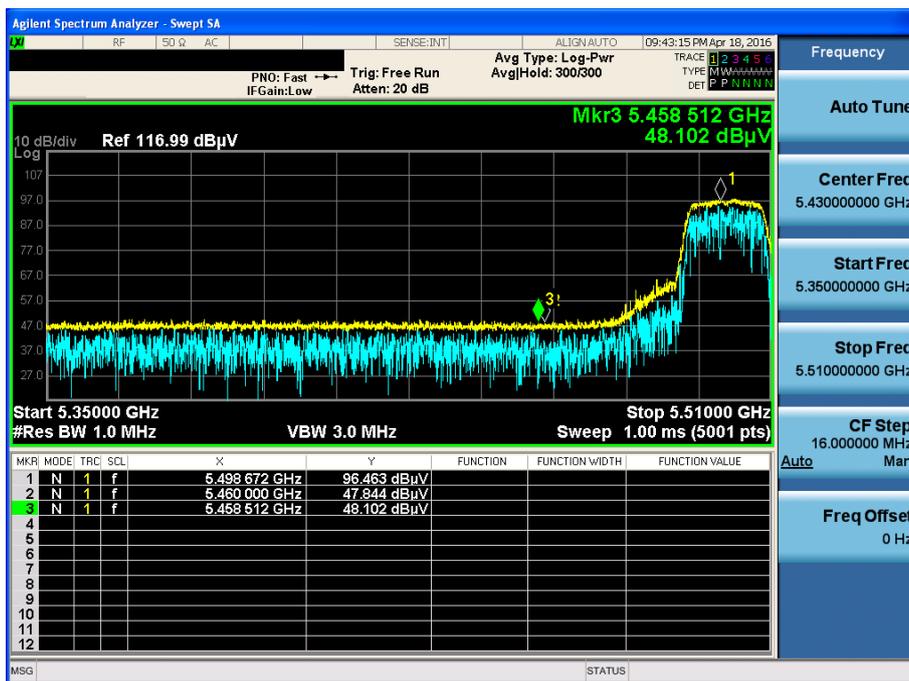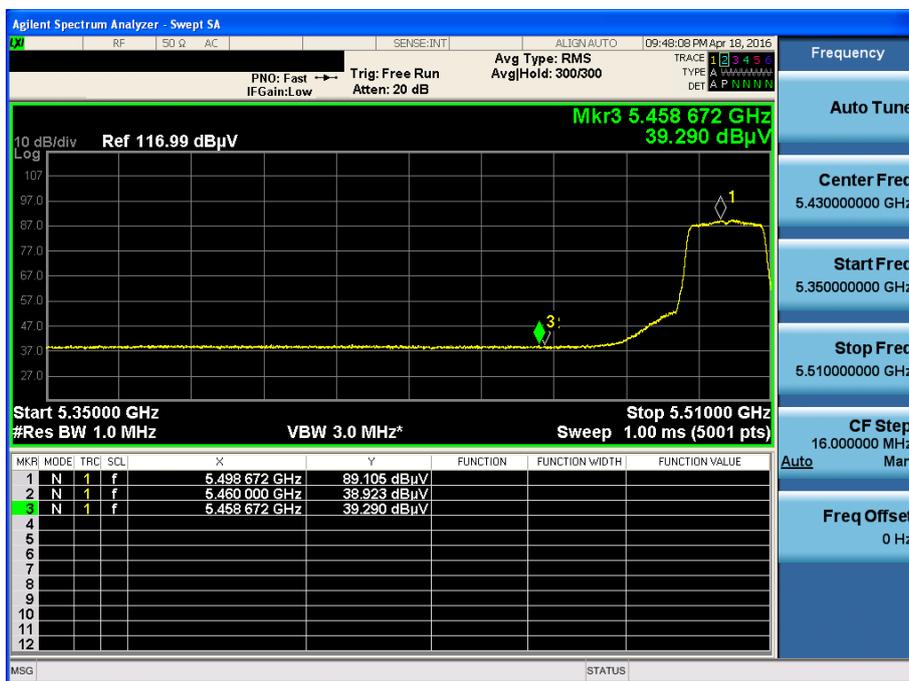
**802.11a  &  U-NII 3  &  Ch.165  &  Z axis  &  Ver**                    **Detector Mode : PK**

**802.11n(HT20)   &   U-NII 1   &   Ch.36   &   Z axis   &   Ver          Detector Mode : PK**



**802.11n(HT20)   &   U-NII 1   &   Ch.36   &   Z axis   &   Ver          Detector Mode : AV**

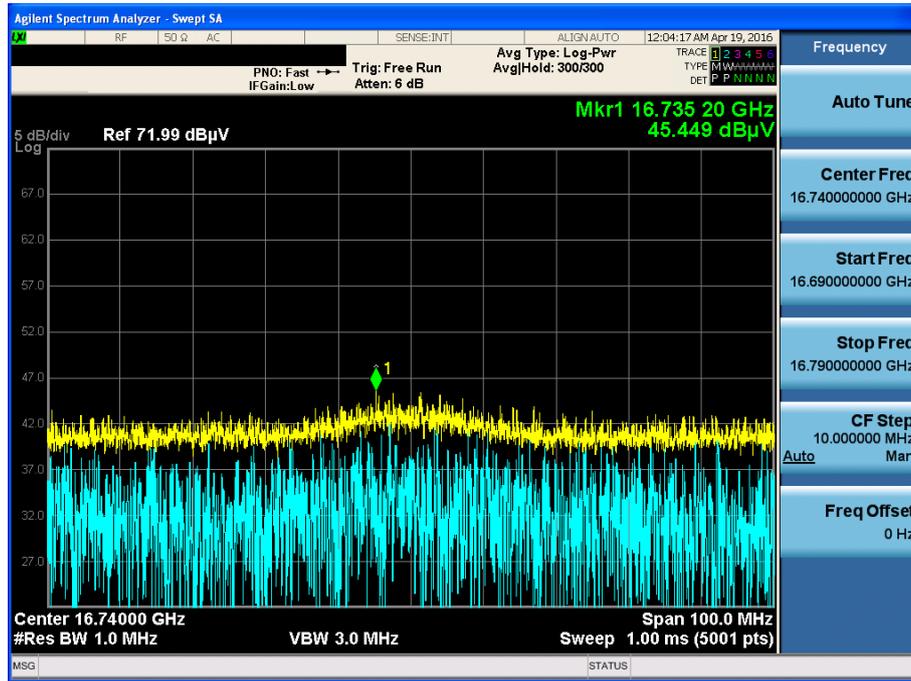**802.11n(HT20)   &   U-NII 1   &   Ch.40   &   Y axis   &   Hor**          **Detector Mode : PK**



**802.11n(HT20)   &   U-NII 1   &   Ch.40   &   Y axis   &   Hor**          **Detector Mode : AV**

**802.11n(HT20)   &   U-NII 1   &   Ch.48   &   Y axis   &   Hor          Detector Mode : PK**



**802.11n(HT20)   &   U-NII 1   &   Ch.48   &   Y axis   &   Hor          Detector Mode : AV**
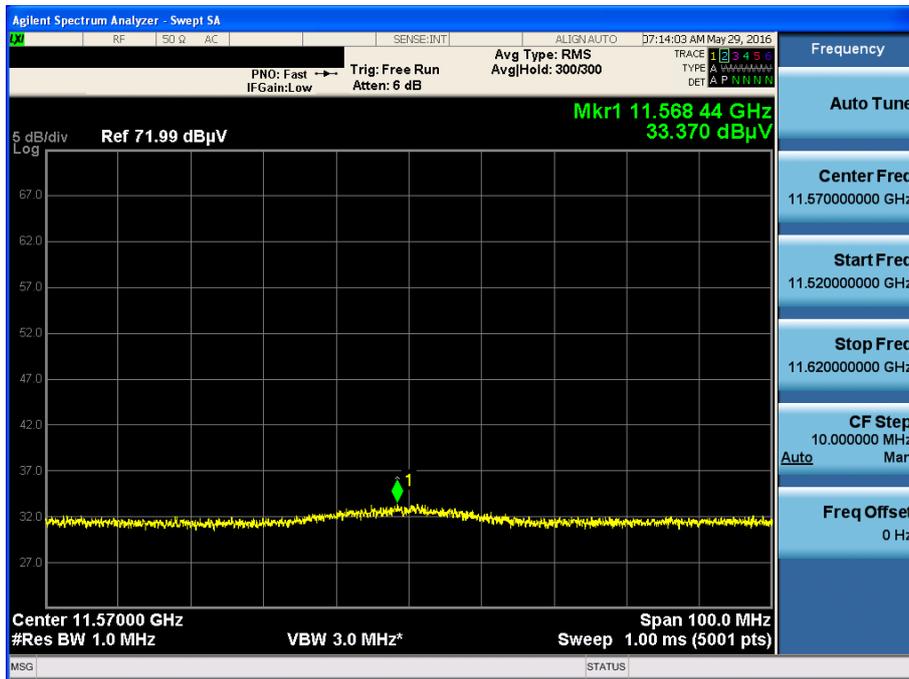
**802.11n(HT20)   &   U-NII 2A   &   Ch.52   & Zaxis   &   Hor**          **Detector Mode : PK**



**802.11n(HT20)   &   U-NII 2A   &   Ch.52   & Zaxis   &   Hor**          **Detector Mode : AV**

**802.11n(HT20)   &   U-NII 2A   &   Ch.60   & Y axis   &   Ver**          **Detector Mode : PK**



**802.11n(HT20)   &   U-NII 2A   &   Ch.60   & Y axis   &   Ver**          **Detector Mode : AV**

## 802.11n(HT20)  &  U-NII 2A  &  Ch.64  & Z axis  &  Ver          Detector Mode : PK



## 802.11n(HT20)  &  U-NII 2A  &  Ch.64  & Z axis  &  Ver          Detector Mode : AV
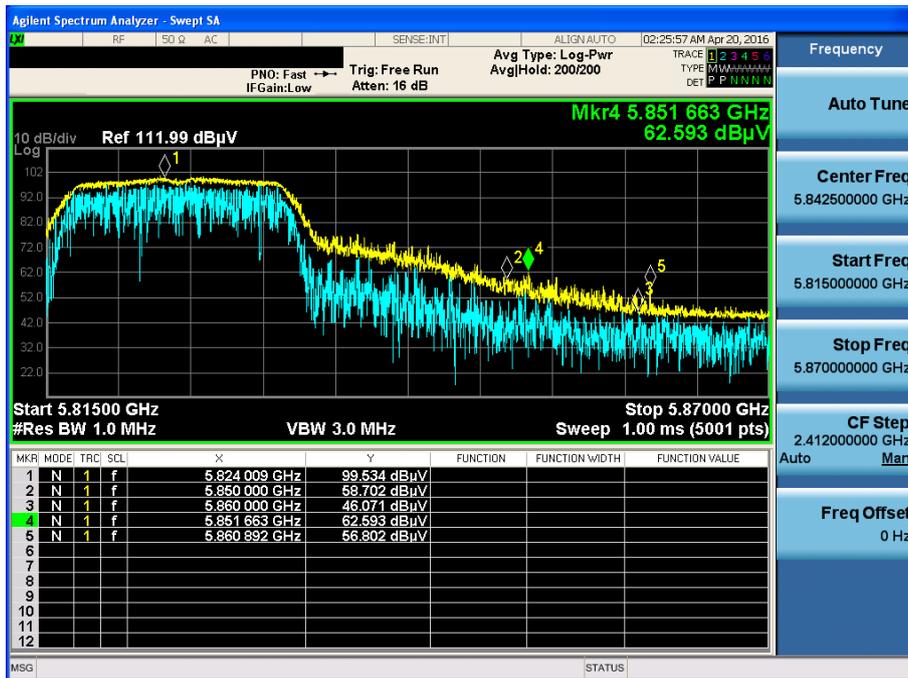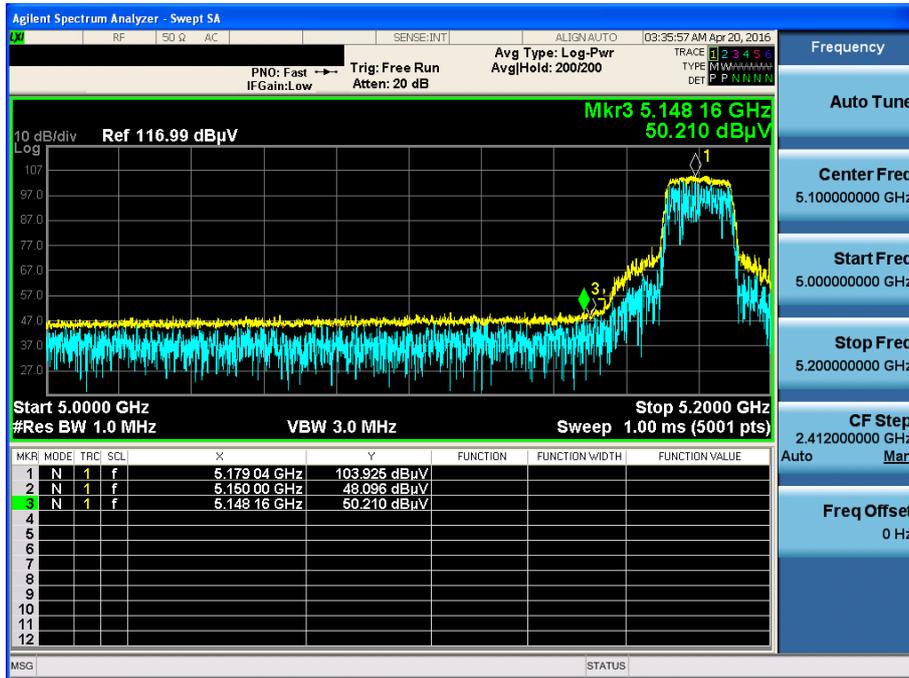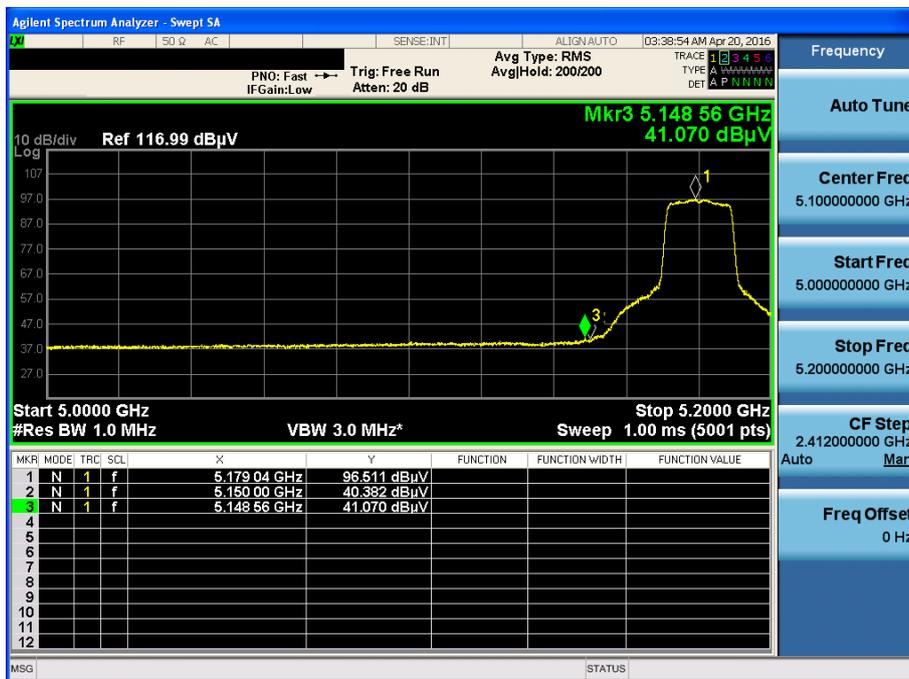
**802.11n(HT20)   &   U-NII 2C   &   Ch.100   &   Z axis   &   Hor          Detector Mode : PK**


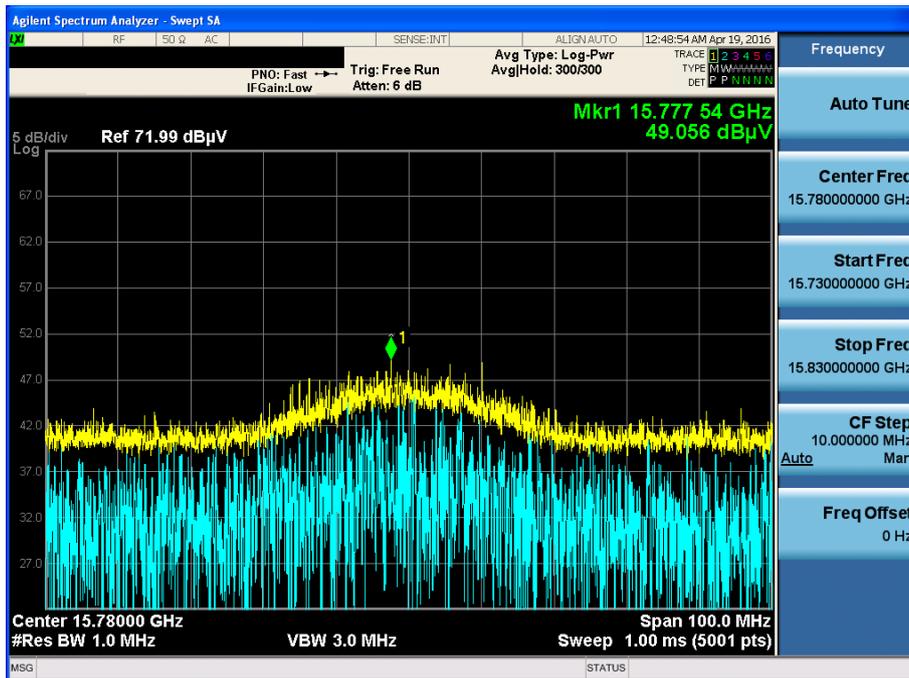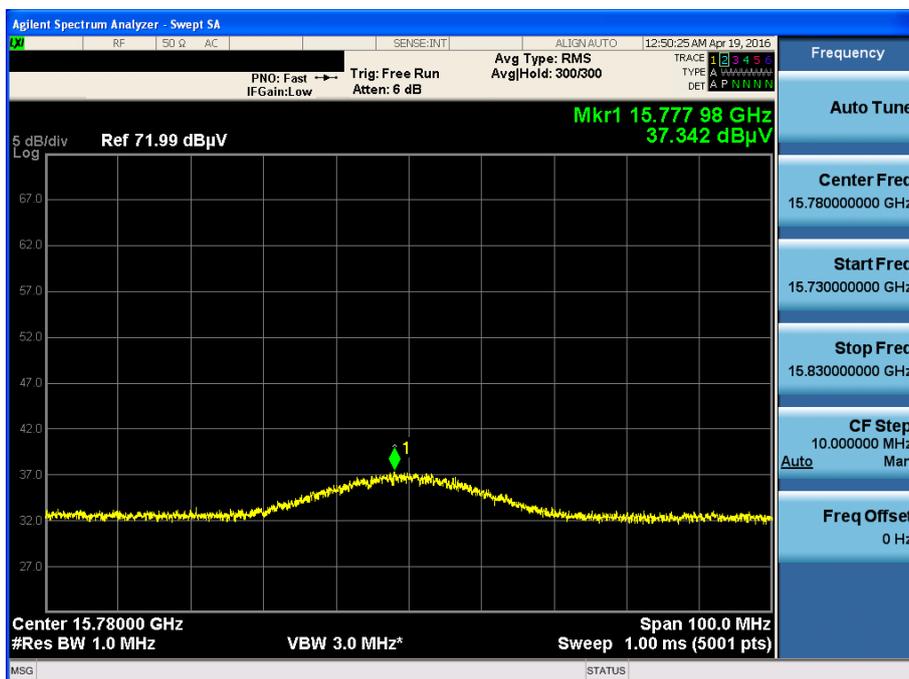
**802.11n(HT20)   &   U-NII 2C   &   Ch.100   &   Z axis   &   Hor          Detector Mode : AV**

**802.11n(HT20)   &   U-NII 2C   &   Ch.100   &   Y axis   &   Hor          Detector Mode : PK**

**802.11n(HT20)  &  U-NII 3  &  Ch.149  &  Z axis  &  Ver          Detector Mode : PK**

| MKR | MODE | TRC | SCL | X | Y | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |
|-----|------|-----|-----|---|---|----------|----------------|----------------|
| 1 | N | 1 | f | 5.743 95 GHz | 102.482 dBμV | | | |
| 2 | N | 1 | f | 5.725 00 GHz | 65.582 dBμV | | | |
| 3 | N | 1 | f | 5.715 00 GHz | 52.686 dBμV | | | |
| 4 | N | 1 | f | 5.714 94 GHz | 54.198 dBμV | | | |
| 5 | N | 1 | f | 5.724 02 GHz | 65.727 dBμV | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | | | | | | | |
| 12 | | | | | | | | |

**802.11n(HT20)   &   U-NII 3   &   Ch.157   &   Y axis   &   Hor          Detector Mode : PK**



**802.11n(HT20)   &   U-NII 3   &   Ch.157   &   Y axis   &   Hor          Detector Mode : AV**

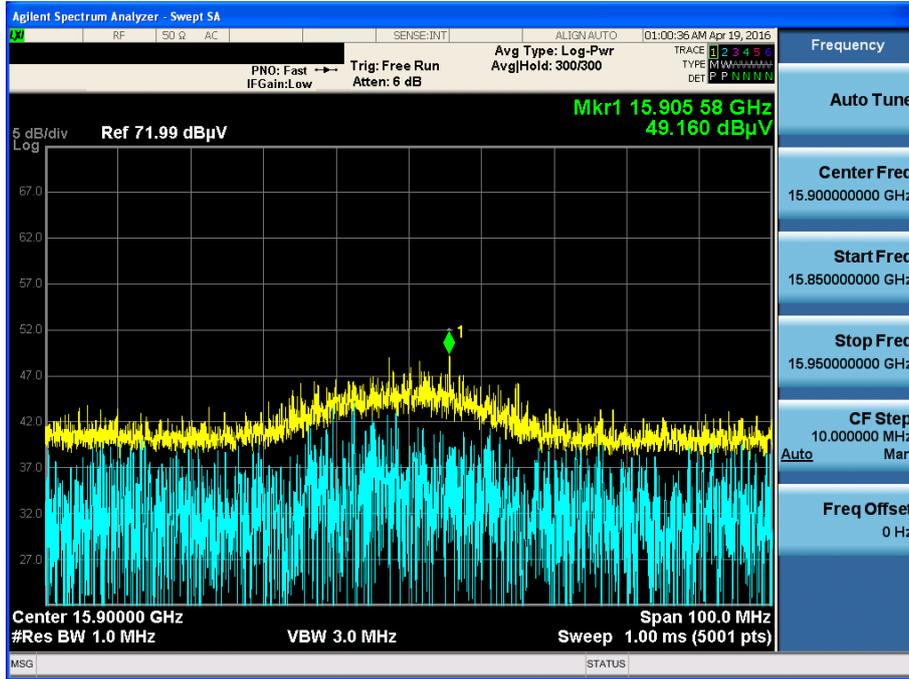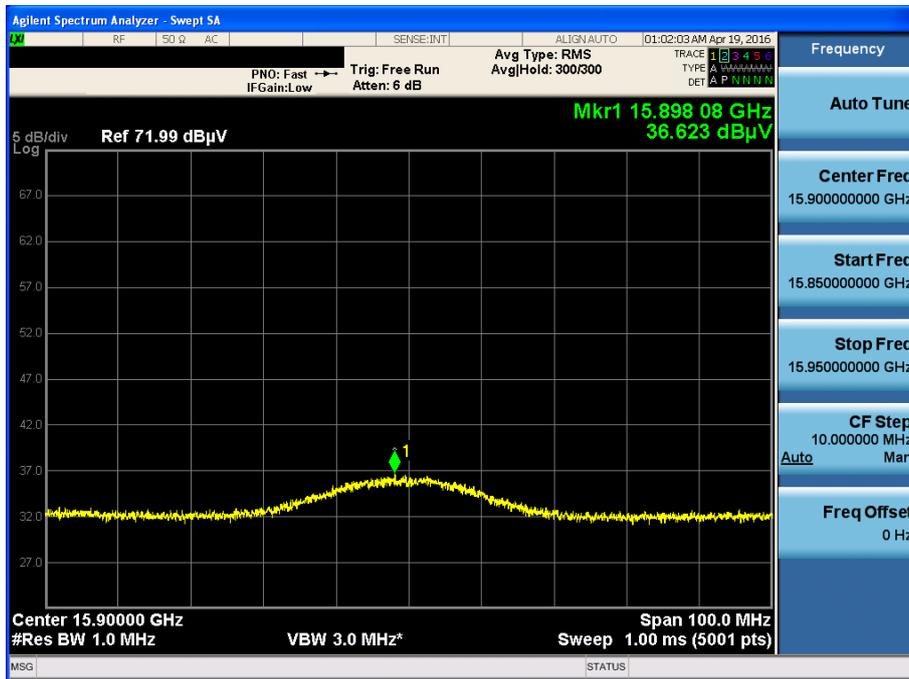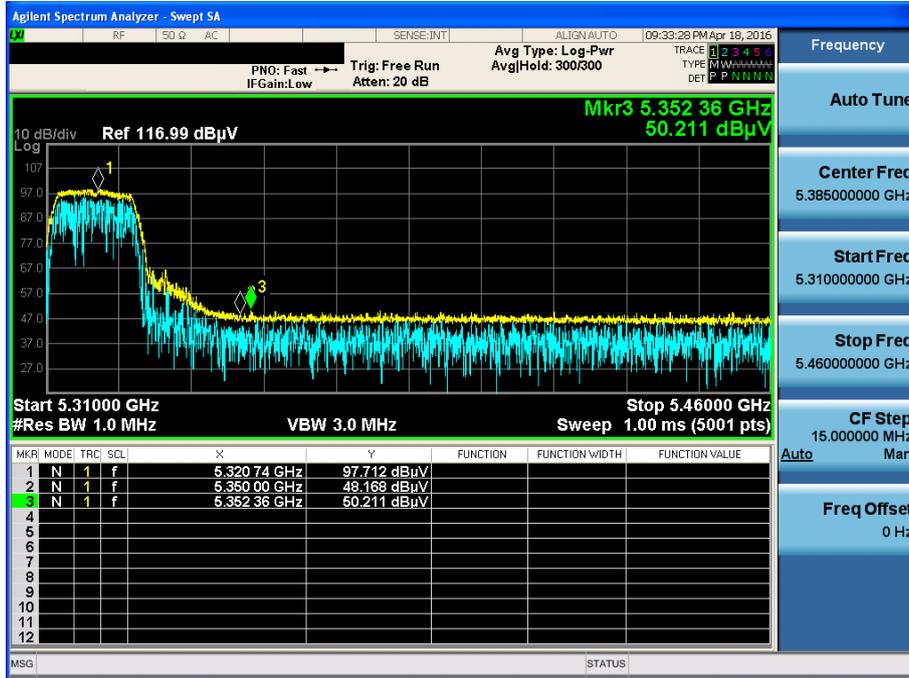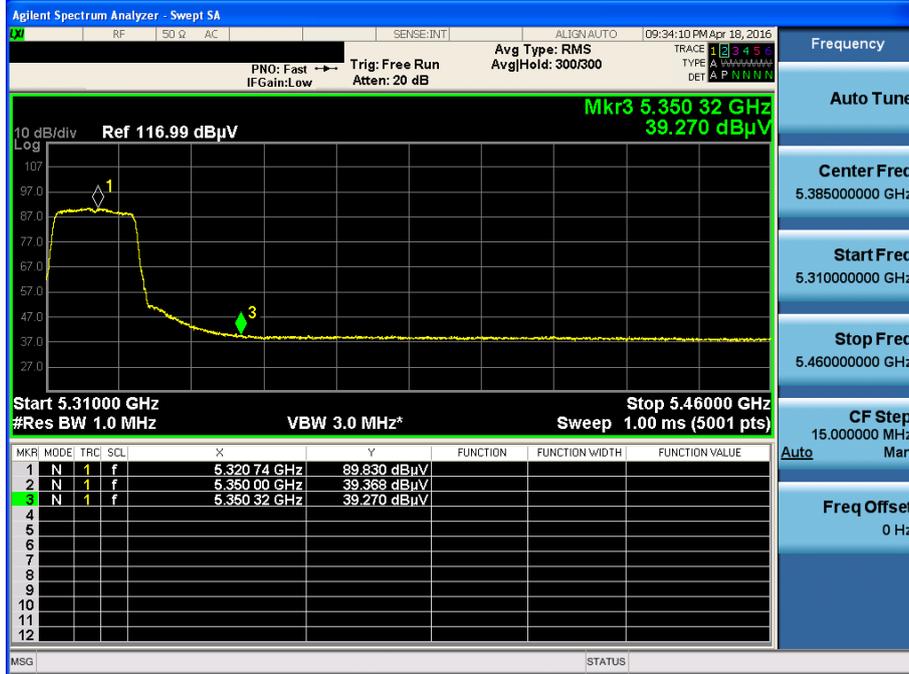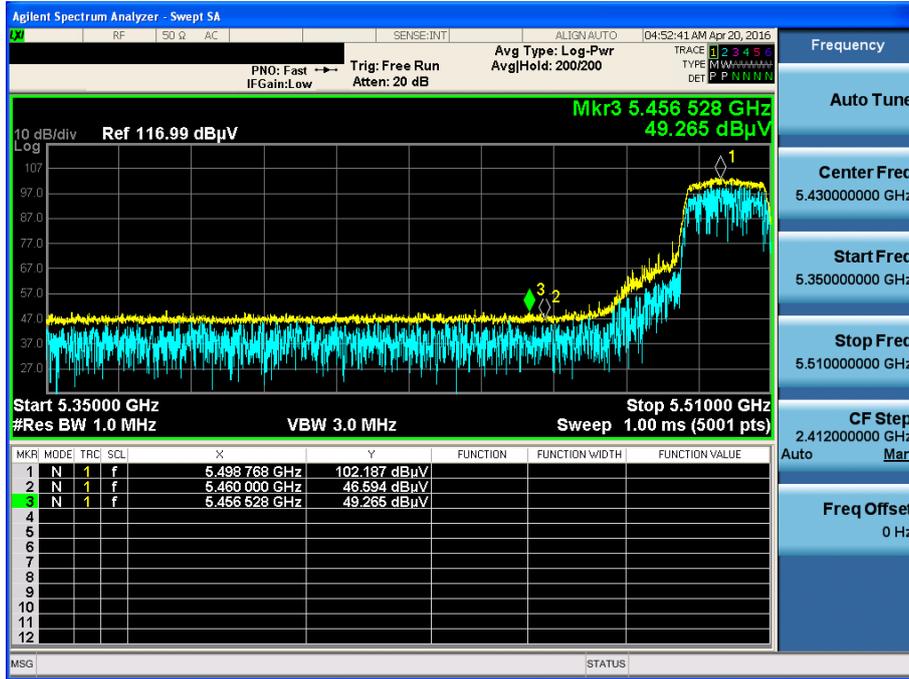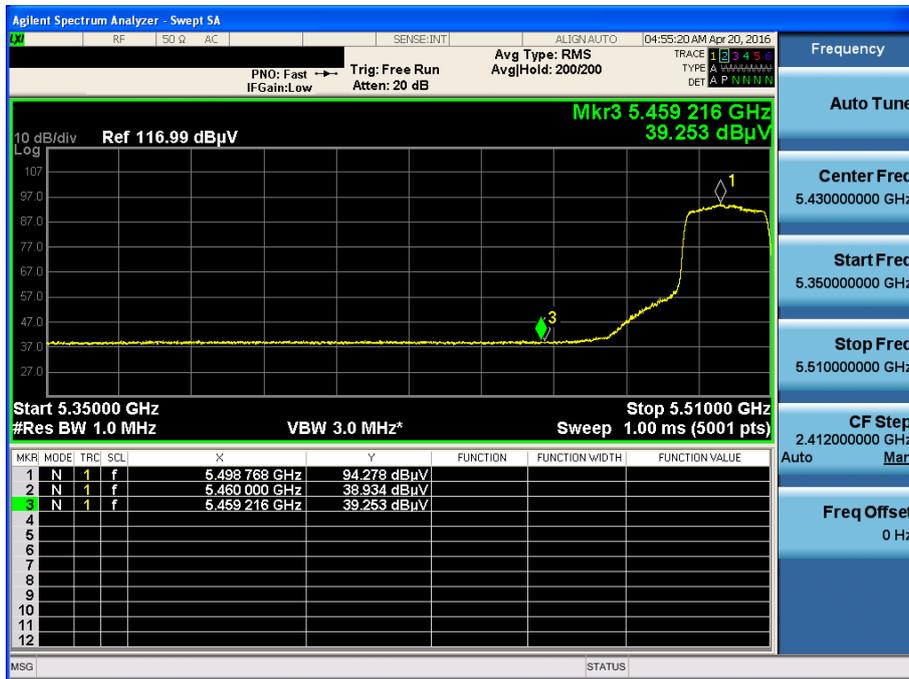**802.11n(HT20)   &   U-NII 3   &   Ch.165   & Z axis   &   Ver**          **Detector Mode : PK**



Agilent Spectrum Analyzer - Swept SA

| MKR | MODE | TRC | SCL | X | Y | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |
|-----|------|-----|-----|---|---|----------|----------------|----------------|
| 1 | N | 1 | f | 5.824 009 GHz | 101.299 dBµV | | | |
| 2 | N | 1 | f | 5.850 000 GHz | 57.391 dBµV | | | |
| 3 | N | 1 | f | 5.860 000 GHz | 50.537 dBµV | | | |
| 4 | N | 1 | f | 5.850 827 GHz | 61.843 dBµV | | | |
| 5 | N | 1 | f | 5.862 575 GHz | 56.874 dBµV | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | | | | | | | |
| 12 | | | | | | | | |

**802.11n(HT40)   &   U-NII 1   &   Ch.38   &   X axis   &   Hor**                    **Detector Mode : PK**



**802.11n(HT40)   &   U-NII 1   &   Ch.38   &   X axis   &   Hor**                    **Detector Mode : AV**

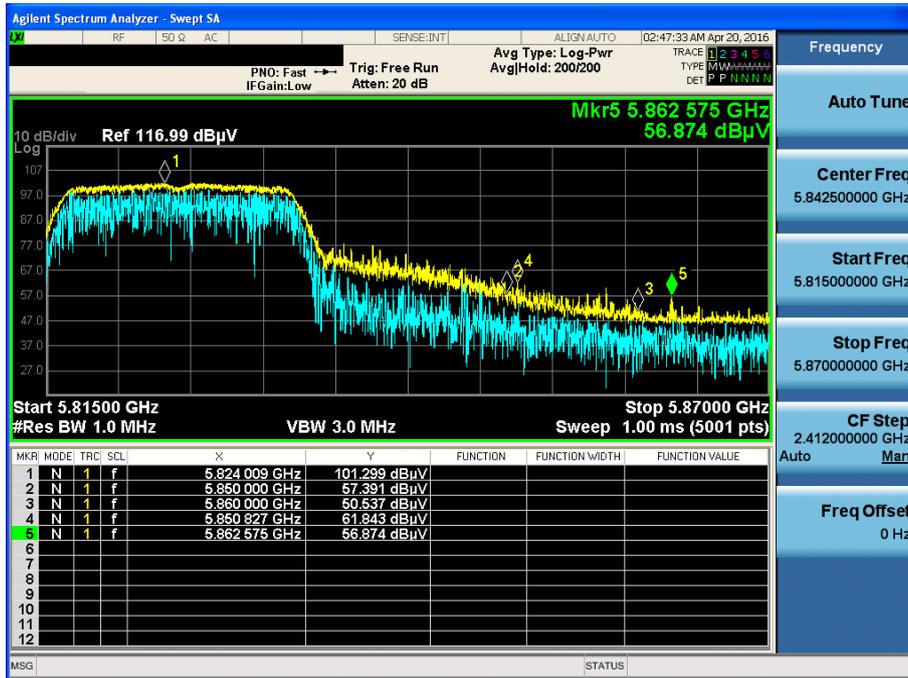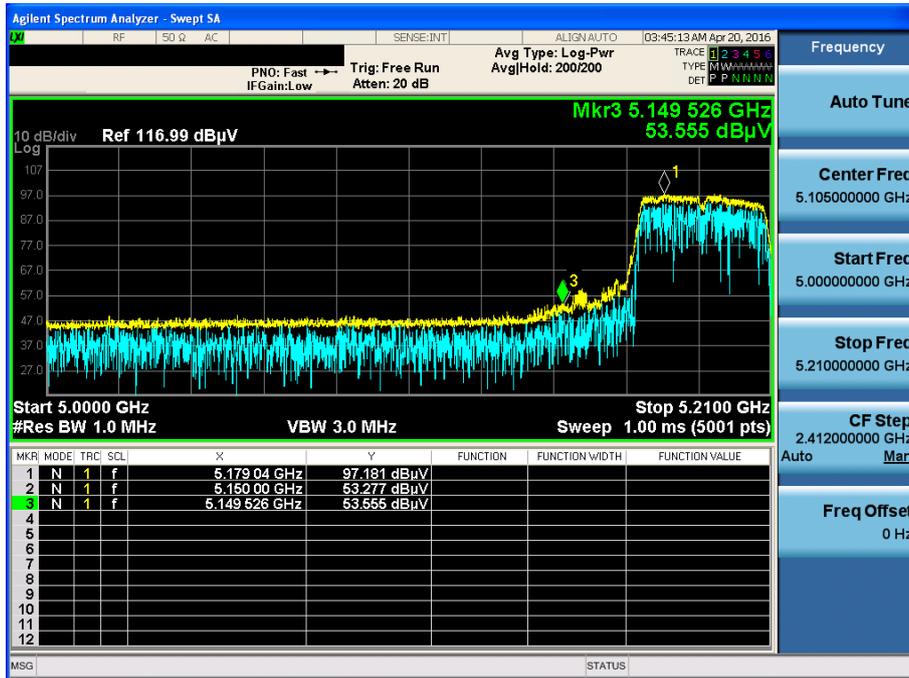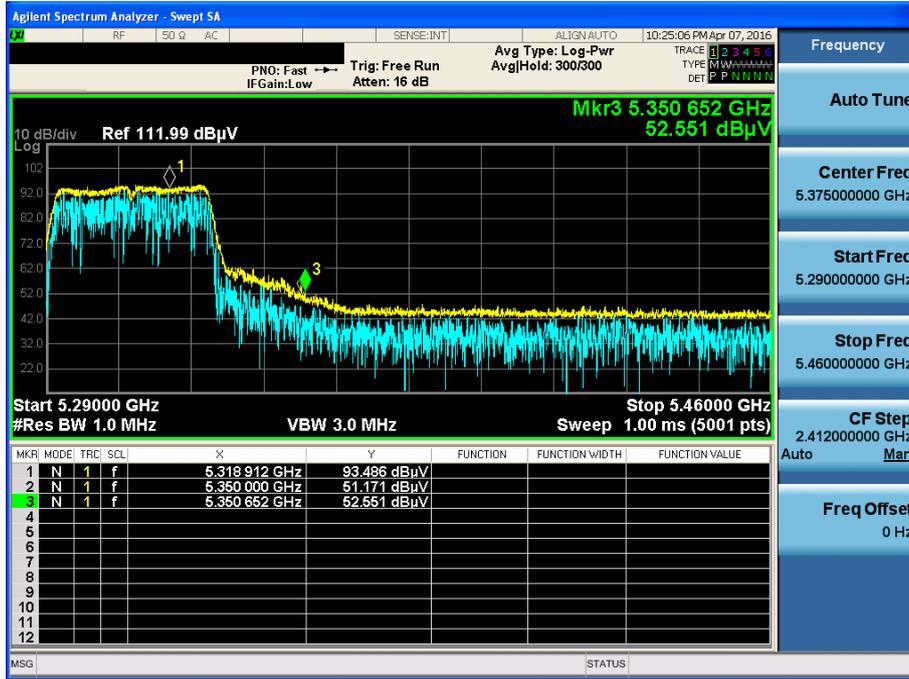## 802.11n(HT40)  &  U-NII 1  &  Ch.46  &  Z axis  &  Hor          Detector Mode : PK



## 802.11n(HT40)  &  U-NII 1  &  Ch.46  &  Z axis  &  Hor          Detector Mode : AV

## 802.11n(HT40)   &   U-NII 2A   &   Ch.54   &   Z axis   &   Hor          Detector Mode : PK



## 802.11n(HT40)   &   U-NII 2A   &   Ch.54   &   Z axis   &   Hor          Detector Mode : AV

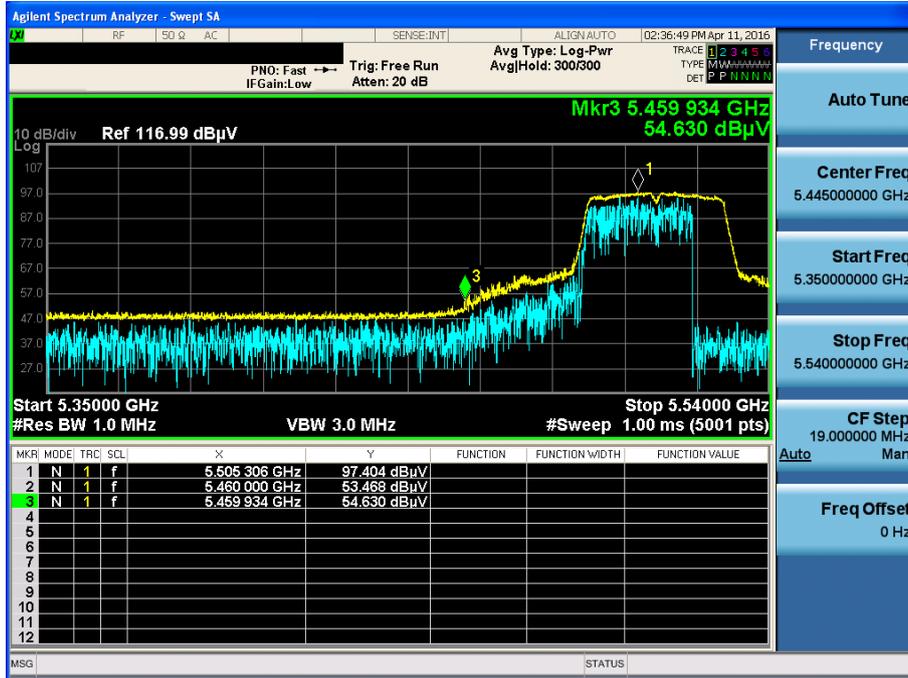**802.11n(HT40)   &   U-NII 2A   &   Ch.62   &   Z axis   &   Ver                    Detector Mode : PK**



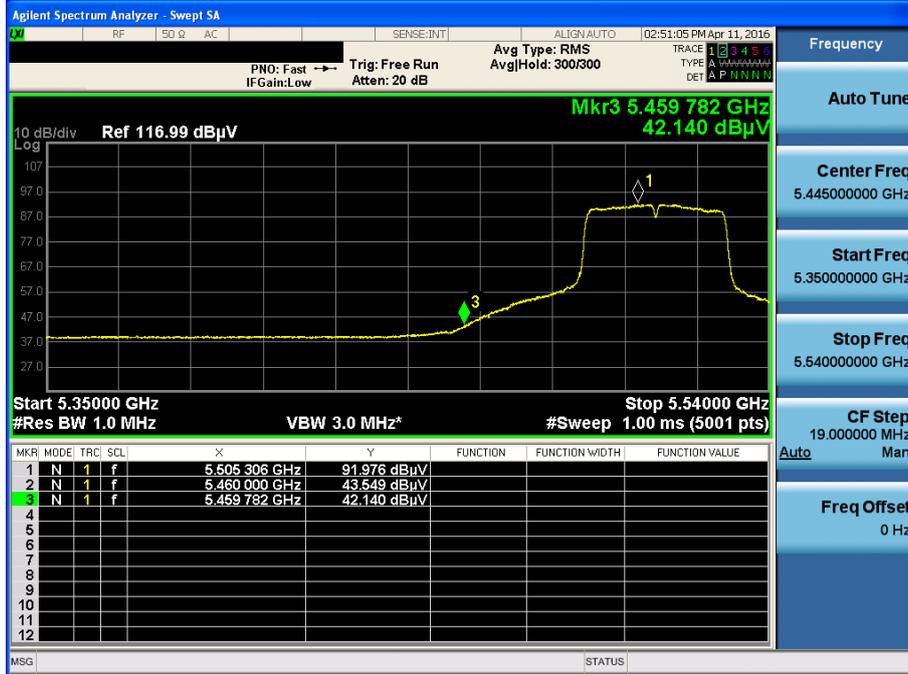**802.11n(HT40)   &   U-NII 2A   &   Ch.62   &   Z axis   &   Ver                    Detector Mode : AV**

**802.11n(HT40)  &  U-NII 2C  &  Ch.102  & X axis  &  Hor**          **Detector Mode : PK**



**802.11n(HT40)  &  U-NII 2C  &  Ch.102  & X axis  &  Hor**          **Detector Mode : AV**

**802.11n(HT40)   &   U-NII 2C   &   Ch.110   &   Z axis   &   Hor            Detector Mode : PK**
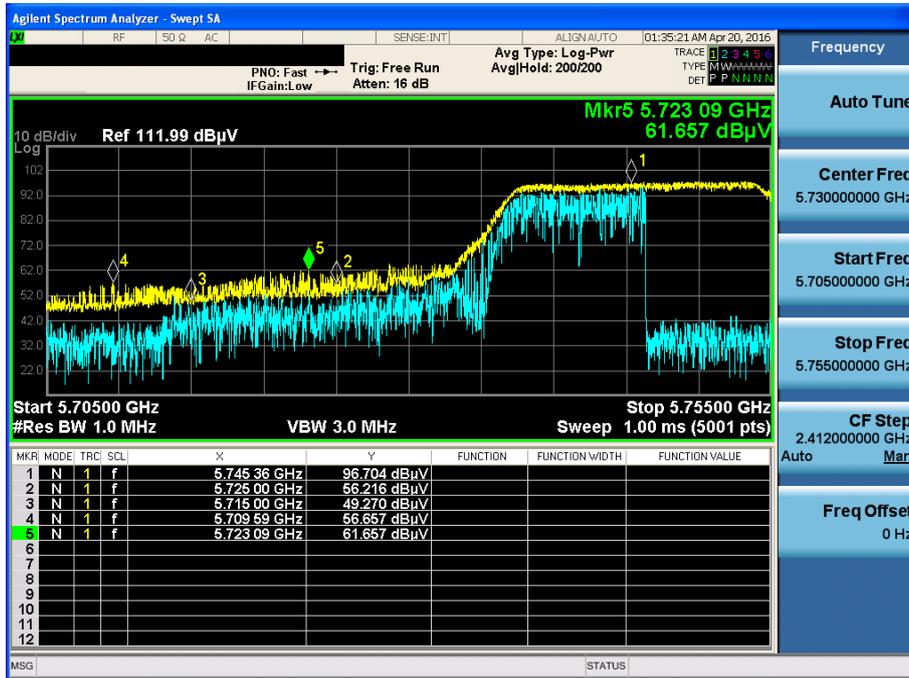
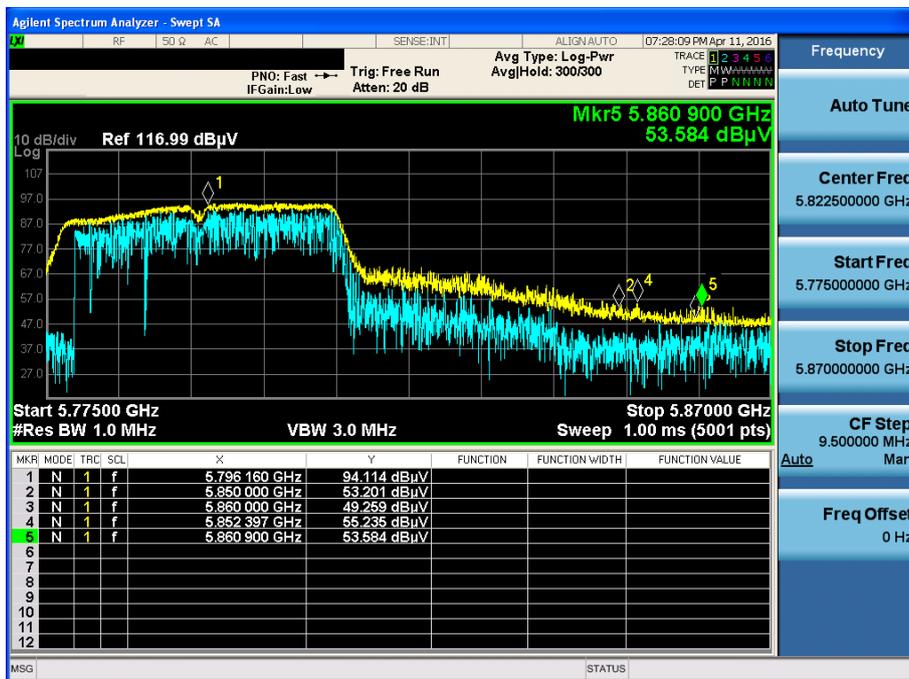### 802.11n(HT40)   &   U-NII 3   &   Ch.151   &   X axis   &   Hor          Detector Mode : PK


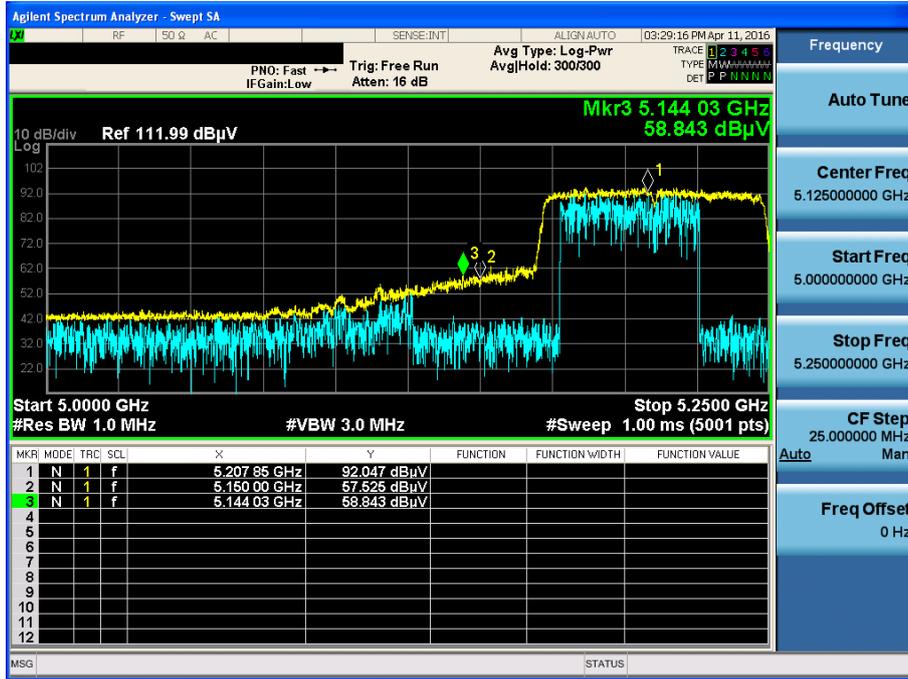
### 802.11n(HT40)   &   U-NII 3   &   Ch.159   &   Z axis   &   Ver          Detector Mode : PK

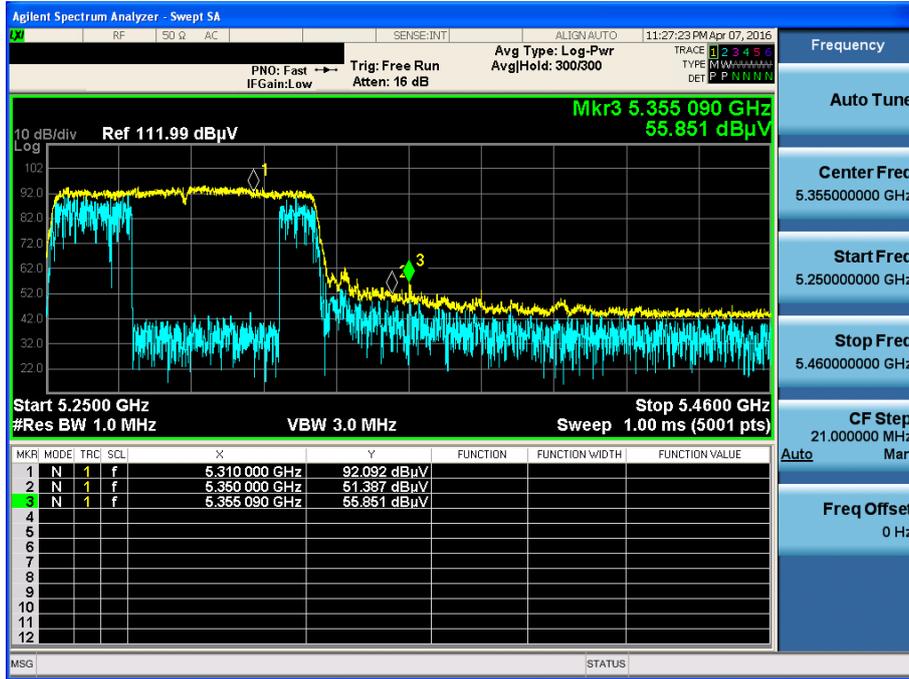**802.11ac(VHT80)   &   U-NII 1   &   Ch.42   &   Z axis   &   Hor          Detector Mode : PK**



**802.11ac(VHT80)   &   U-NII 1   &   Ch.42   &   Z axis   &   Hor          Detector Mode : AV**

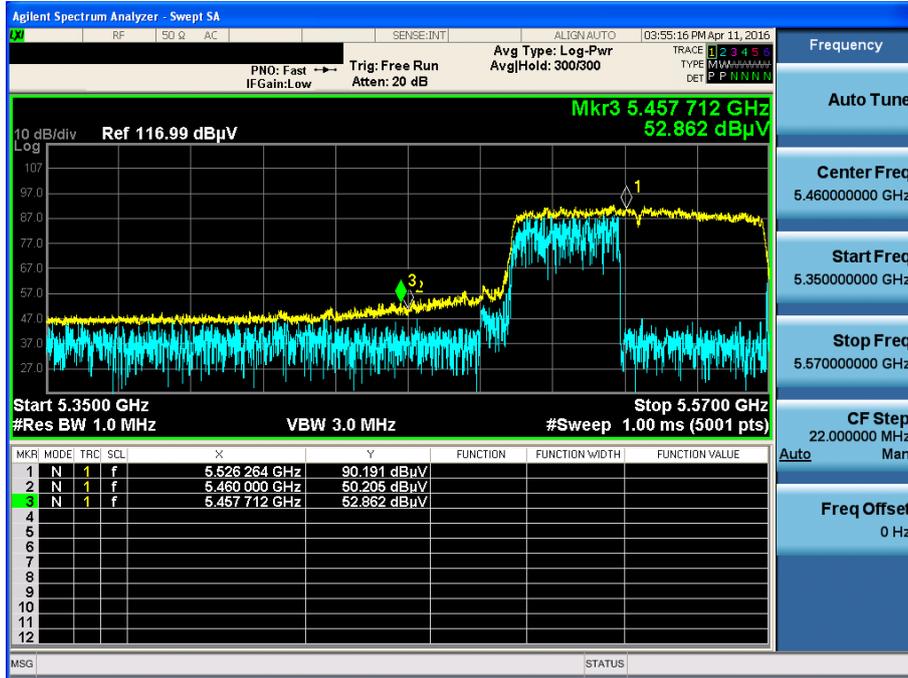**802.11ac(VHT80)  &  U-NII 2A  &  Ch.58  &  X axis  &  Hor          Detector Mode : PK**



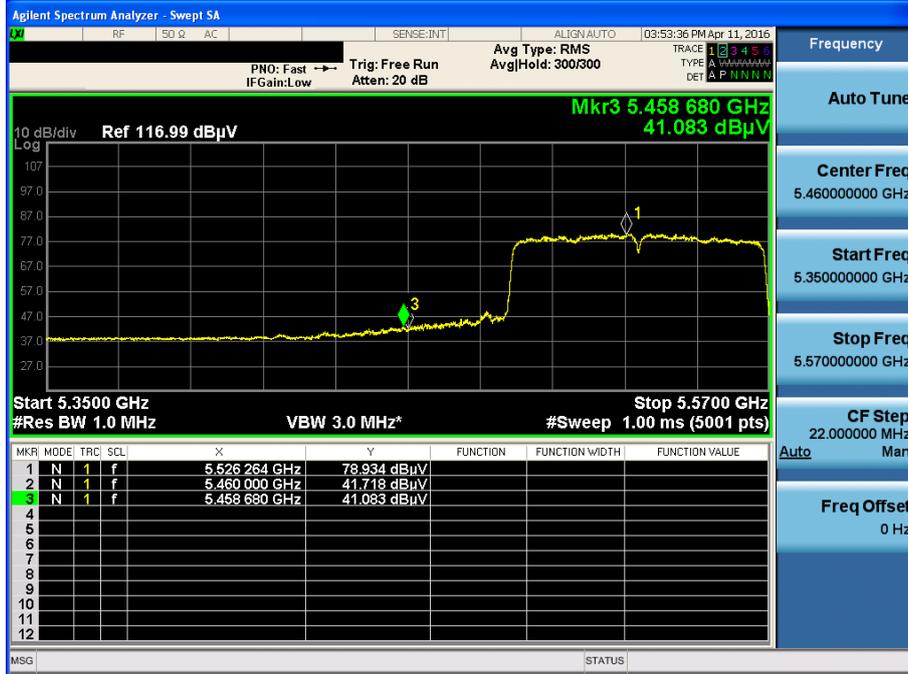**802.11ac(VHT80)  &  U-NII 2A  &  Ch.58  &  X axis  &  Hor          Detector Mode : AV**

**802.11ac(VHT80)  &  U-NII 2A  &  Ch.106  &  Z axis  &  Ver**          **Detector Mode : PK**



**802.11ac(VHT80)  &  U-NII 2A  &  Ch.106  &  Z axis  &  Ver**          **Detector Mode : AV**

**802.11ac(VHT80)   &   U-NII 3   &   Ch.155   &   Z axis   &   Ver          Detector Mode : PK**

**802.11a  &  Cross  &  Ch.144  &  Y axis  &  Ver**                        **Detector Mode : PK**



**802.11n(HT20)  &  Cross  &  Ch.144  &  Y axis  &  Ver**                **Detector Mode : PK**

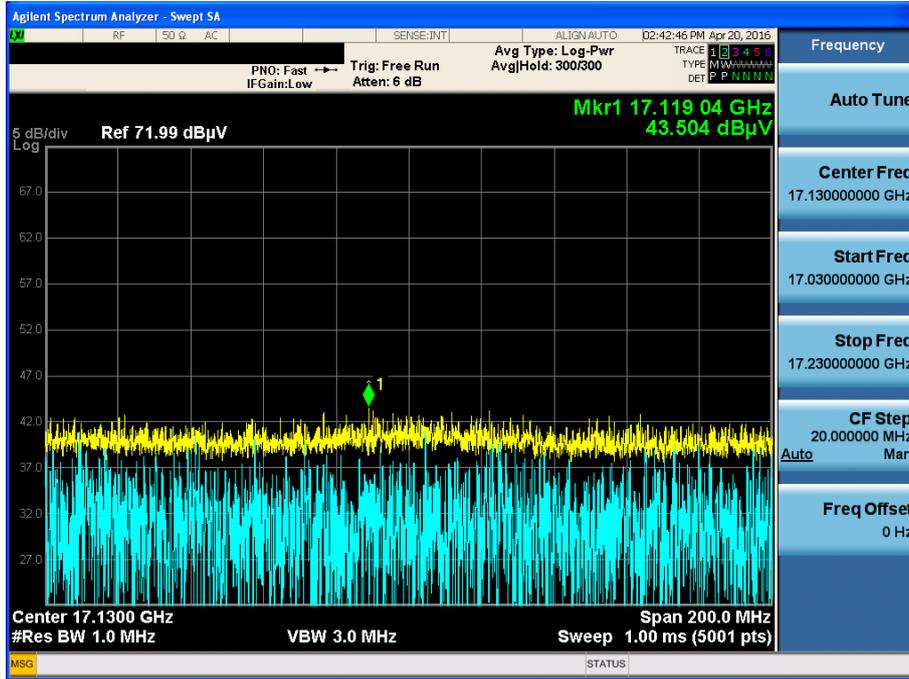**802.11n(HT40)   &   Cross   &   Ch.142   &   Z axis   &   Hor          Detector Mode : PK**



**802.11ac(VHT80)   &   Cross   &   Ch.138   &   Z axis   &   Hor          Detector Mode : PK**