# FCC 47 CFR PART 15 SUBPART E AND ANSI C63.4:2003 TEST REPORT

**For**

**WiFi Broadband Router**

**Model : CDW68AAM-U01**

**Data Applies To: WGR-8020**

**Trade Name : AMIT , ZALiP**

**Issued for**

**Advance Multimedia Internet Technology Inc.**

No.28, Lane 31 , Sec. 1 , Huandong Rd. , Sinshih District , Tainan City 74146 , Taiwan

**Issued by**

**Compliance Certification Services Inc.**
**Tainan Lab.**
**No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)**
**TEL: 886-6-580-2201**
**FAX: 886-6-580-2202**

**Issued Date: October 11, 2012**

# Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|---|---|---|---|---|
| 00 | February 13, 2012 | Initial Issue | ALL | Sunny Chang |
| 01 | August 14, 2012 | Update test data | Page 32; 48; 136 | Sunny Chang |
| 02 | October 11, 2012 | Add and update test data | Page 82-83; 86-97 | Sunny Chang |
| | | | | |

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TITLE PAGE NO.

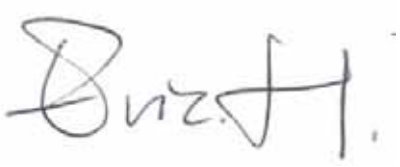
# 1. TEST REPORT CERTIFICATION

| | | |
|---|---|---|
| **Applicant** | ： | Advance Multimedia Internet Technology Inc. |
| **Address** | ： | No.28, Lane 31 , Sec. 1 , Huandong Rd. , Sinshih District , Tainan City 74146 , Taiwan |
| **Manufacturer** | ： | Advance Multimedia Internet Technology Inc. |
| **Address** | ： | No.28, Lane 31 , Sec. 1 , Huandong Rd. , Sinshih District , Tainan City 74146 , Taiwan |
| **Equipment Under Test** | ： | WiFi Broadband Router |
| **Model** | ： | CDW68AAM-U01 |
| **Data Applies To** | ： | WGR-8020 |
| **Trade Name** | ： | AMIT , ZALiP |
| **Tested Date** | ： | November 30, 2011 ~ December 31, 2011 |

| **APPLICABLE STANDARD** | |
|---|---|
| **Standard** | **Test Result** |
| FCC Part 15 Subpart E AND ANSI C63.4:2003 | PASS |

WE HEREBY CERTIFY THAT: The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

***Approved by:*** ***Reviewed by:***



**Jeter Wu**
**Assistant Manager**

**Eric Huang**
**Assistant Section Manager**

# 2. EUT DESCRIPTION

| | |
|---|---|
| **Product Name** | WiFi Broadband Router |
| **Model Number** | CDW68AAM-U01 |
| **Data Applies To** | WGR-8020 |
| **Brand Name** | AMIT , ZALiP |
| **Identify Number** | T11112930802 |
| **Received Date** | November 29, 2011 |
| **Frequency Range** | IEEE 802.11a, 802.11n HT20 : 5180MHz ~ 5240MHz,<br>IEEE 802.11n HT40 : 5180MHz ~ 5230MHz, |
| **Transmit Power** | IEEE 802.11a : 5180MHz ~ 5240MHz : 4.48dBm (2.80543mW)<br>IEEE 802.11n HT20 : 5180MHz ~ 5240MHz : 10.40dBm (10.9722mW)<br>IEEE 802.11n HT40 : 5180MHz ~ 5230MHz : 12.76dBm (18.8768W) |
| **Channel Spacing** | IEEE 802.11a, 802.11n HT20 : 20MHz<br>IEEE 802.11n HT40 : 10MHz |
| **Channel Number** | IEEE 802.11a, 802.11n HT20 : 5180MHz ~ 5240MHz : 4 Channels<br>IEEE 802.11n HT40 : 5180MHz ~ 5230MHz : 5 Channels |
| **Transmit Data Rate** | IEEE 802.11a : 54, 48 ,36, 24, 18, 12, 9, 6 Mbps<br>IEEE 802.11n HT20 : 195, 175.5, 156, 130, 117, 104, 78, 65, 58.5, 52, 39, 26, 19.5, 13, 6.5 Mbps<br>IEEE 802.11n HT40 : 450, 405, 364.5, 324, 300, 270, 243, 216, 162, 150, 135, 121.5, 108, 81, 54, 40.5, 27, 13.5 Mbps |
| **Type of Modulation** | IEEE 802.11a : OFDM (64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n HT20/40 : OFDM (64QAM, 16QAM, QPSK, BPSK) |
| **Antenna Type** | **Three antennas**<br>**Detachable antenna**<br>Manufacture: WIESON TECHNOLOGIES CO., LTD.<br>Type: Dipole Antenna<br>Model: GY121HT467-003<br>Gain: 2.4G: 2.28dBi (2TX2RX);<br>5G: 4.13dBi (3TX3RX)<br>Connector: SMA MALE (RP)<br>**Integrated antenna**<br>Manufacture: WEISON TECHNOLOGIES CO., LTD.<br>Type: Dipole<br>Model: GY121HT467-007<br>Gain: 1.92dBi for 2.4GHz (2TX2RX),<br>3.57dBi for 5GHz (3TX3RX)<br>Connector: SMA MALE(RP) |
| **Power Rating** | 12Vdc; 1.5A(Powered from Adapter) |

| | |
|---|---|
| **Power Source** | **Powered from adapter**<br>Brand: CWT<br>Model: CAP018121<br>Input: 100-240Vac, 47-63Hz, 0.6A<br>Output: 12Vdc, 1.5A |
| **Test Voltage** | 120Vac, 60Hz |

**Operation Frequency:**
**IEEE 802.11a, 802.11nHT20**

| UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) | | | |
|---|---|---|---|
| **CHANNEL** | **MHz** | **CHANNEL** | **MHz** |
| 36 | 5180 | 44 | 5220 |
| 40 | 5200 | 48 | 5240 |

**IEEE 802.11nHT40**

| UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) | | | |
|---|---|---|---|
| **CHANNEL** | **MHz** | **CHANNEL** | **MHz** |
| 36 | 5180 | 44 | 5220 |
| 38 | 5190 | 46 | 5230 |
| 40 | 5200 | | |

***Remark :***

*1. Client consigns only one model sample to test (Model Number: CDW68AAM-U01 (Black)).*
*The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
*2. For more details, please refer to the User's manual of the EUT.*
*3. This submittal(s) (test report) is intended for FCC ID: **PBLCDW68AAMU01** filing to comply with Section 15.407, of the FCC Part 15, Subpart E Rules.*
*4. The listed models(WGR-8020)are all the same of the original model(CDW68AAM-U01), design, except for different models name and is just for the marketing purpose*
*5. To add a series model is for business necessary. The different of the each model is shown as below:*

| **Model** | CDW68AAM-U01<br>WGR-8020 | |
|---|---|---|
| **External Color** | Black | White |
| **Antenna** | **【Detachable antenna*3】**<br>2.28dBi(2.4G)<br>4.13dBi(5G) | **【Integrated antenna*2 + Detachable antenna*1】**<br>1.92dBi(2.4G)<br>3.57dBi(5G) |
| *Remark: More details, please refer to the EUT photo.* | | |

# 3. DESCRIPTION OF TEST MODES

**Conducted Emission / Radiated Emission Test (Below 1 GHz)**

1. The following test modes were scanned during the preliminary test:

| No. | Pre-Test Mode |
|---|---|
| 1 | TX Mode |

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

| Final Test Mode | | |
|---|---|---|
| Emission | Radiated Emission | TX Mode |
| | Conducted Emission | TX Mode |

***Remark :*** *Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.*

**Conducted / Radiated Emission Test (Above 1 GHz)**

**IEEE 802.11a, 802.11n HT20 mode / 5180MHz ~ 5240MHz**

The EUT had been tested under operating condition.

There are three channels have been tested as following :

| Channel | Frequency (MHz) |
|---|---|
| Low | 5180 |
| Middle | 5220 |
| High | 5240 |

IEEE 802.11a mode : 6Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT20 mode : 13Mbps data rate (worst case) were chosen for full testing.

**IEEE 802.11n HT40 mode / 5180MHz ~ 5230MHz**

The EUT had been tested under operating condition.

There are three channels have been tested as following :

| Channel | Frequency (MHz) |
|---|---|
| Low | 5180 |
| Middle | 5200 |
| High | 5230 |

IEEE 802.11n HT40 mode : 13.5Mbps data rate (worst case) were chosen for full testing.

# 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2003 and FCC CFR 47, 15.207, 15.209 and 15.407.

# 5. FACILITIES AND ACCREDITATION

## 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

## 5.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

| | |
|---|---|
| **Taiwan** | TAF |

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

| | |
|---|---|
| **Canada** | Industry Canada |
| **Germany** | TUV NORD |
| **Taiwan** | BSMI |
| **USA** | FCC |

Copies of granted accreditation certificates are available for downloading from our web site, http:///www.ccsrf.com

## 5.3 MEASUREMENT UNCERTAINTY

The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4-2.

| PARAMETER | UNCERTAINTY |
|---|---|
| Radiated Emission, 30 to 200 MHz<br>Test Site : OATS-6 | ±3.38dB |
| Radiated Emission, 200 to 1000 MHz<br>Test Site : OATS-6 | ±3.04dB |
| Radiated Emission, 1 to 26.5 GHz | ± 3.20dB |
| Power Line Conducted Emission | ± 2.01dB |

Uncertainty figures are valid to a confidence level of 95%, K=2

# 6. SETUP OF EQUIPMENT UNDER TEST

## SUPPORT EQUIPMENT

For RF test

| No. | Product | Manufacturer | Model No. | Certify No. | Signal cable |
|---|---|---|---|---|---|
| 1 | Note Book | IBM | T43 | DoC | Power cable, unshd, 1.6m |

| No. | Signal cable description | |
|---|---|---|
| A | DC Power | Unshielded, 1.6m, 1pcs |
| B | LAN Cable | Unshielded, 1.0m, 1pcs |

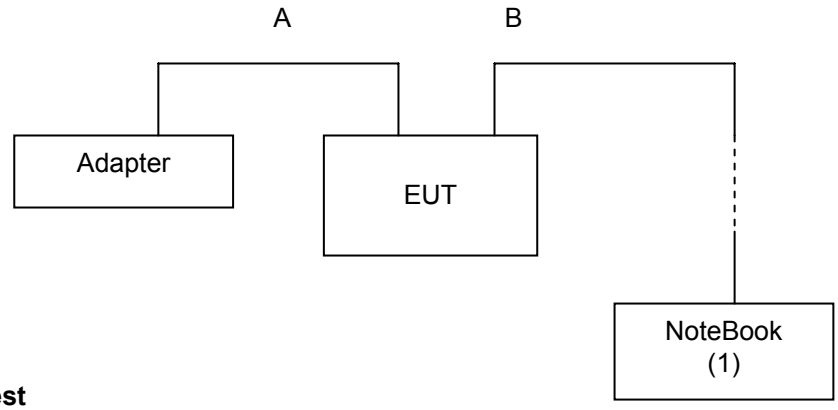
For EMI test

| No. | Product | Manufacturer | Model No. | Certify No. | Signal cable |
|---|---|---|---|---|---|
| 1 | Note Book | IBM | R51 | R33026 | Power cable, unshd, 1.6m |
| 2 | Note Book | IBM | T43 | DoC | Power cable, unshd, 1.6m |
| 3 | Note Book | IBM | R50E | DoC | Power cable, unshd, 1.6m |
| 4 | Flash Disk | Kingston | DTI/512 | DoC | N/A |
| 5 | 3G Modem | NOVATEL | Qualcomm 3G CDMA | PKRNVWMC727 | N/A |
| 6 | HUB | BARRICAD | SMC7008BR | DoC | Power cable, unshd, 1.6m |

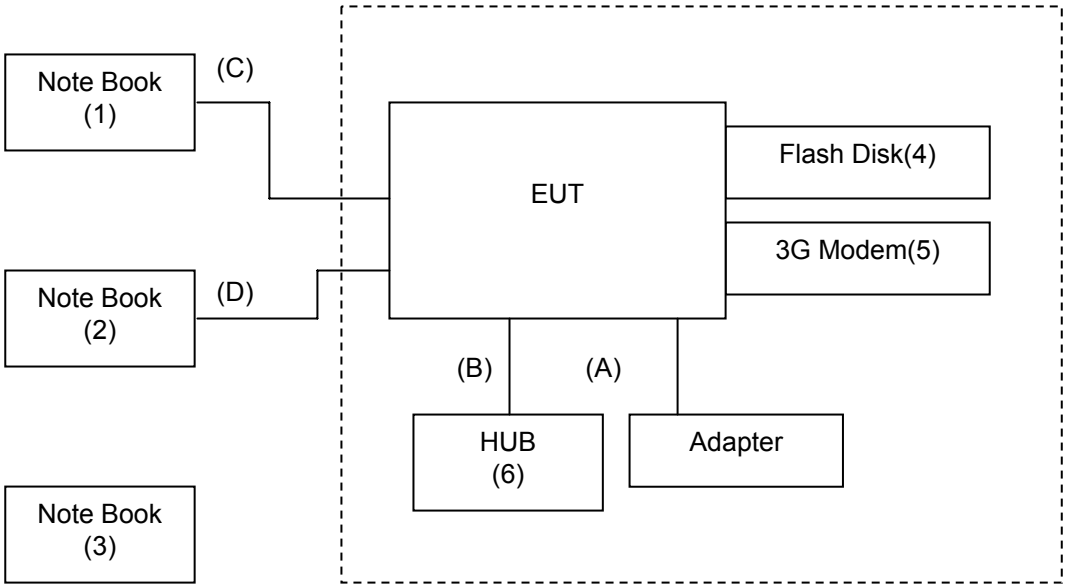
| No. | Signal cable description | |
|---|---|---|
| A | DC Power | Unshielded, 1.6m, 1pcs |
| B | LAN | Unshielded, 2m, 3pcs |
| C | LAN | Unshielded, 10m, 1pcs |
| D | LAN | Unshielded, 10m, 1pcs |

## SETUP DIAGRAM FOR TESTS

**For RF test**




**For EMI test**



## EUT OPERATING CONDITION

**RF Setup** (for External color：Black)

1. Set up all computers like the setup diagram.
2. The “Ralink QA Test Program for “RT3883QA” software was used for testing
   The EUT driver software installed in the host support equipment during testing was
   Ralink QA Test Program for “RT3883QA” Drive

**TX Mode:**

- ⇨ **Tx Mode: OFDM、 HT MixMode** (Bandwidth: 20、40)
- ⇨ **Tx Data Rate: 6Mbps** (IEEE 802.11a mode , TX)
  **19.5Mbps** (IEEE 802.11n HT20 mode ,chain 0, chain 1 , chain 2 TX)
  **40.5Mbps (**IEEE 802.11n HT40 mode, chain 0, chain 1 , chain 2 TX**)**

**Power control mode**

**Target Power:** IEEE 802.11a Channel Low (5180MHz) = 0B
IEEE 802.11a Channel Middle (5220MHz) = 0A
IEEE 802.11a Channel High (5240MHz) = 09

**Target Power:** IEEE 802.11n HT20 Channel Low (5180MHz) = 11 **(Chain 0)**
IEEE 802.11 n HT20 Channel Middle (5220MHz) =11 **(Chain 0)**
IEEE 802.11 n HT20 Channel High (5240MHz) = 0E **(Chain 0)**
IEEE 802.11n HT20 Channel Low (5180MHz) = 0F **(Chain 1)**
IEEE 802.11 n HT20 Channel Middle (5220MHz) = 0E **(Chain 1)**
IEEE 802.11 n HT20 Channel High (5240MHz) = 0D **(Chain 1)**
IEEE 802.11n HT20 Channel Low (5180MHz) = 0C **(Chain 2)**
IEEE 802.11 n HT20 Channel Middle (5220MHz) = 0A **(Chain 2)**
IEEE 802.11 n HT20 Channel High (5240MHz) = 0A **(Chain 2)**

**Target Power:** IEEE 802.11n HT40 Channel Low (5180MHz) = 11 **(Chain 0)**
IEEE 802.11 n HT40 Channel Middle (5200MHz) = 11 **(Chain 0)**
IEEE 802.11 n HT40 Channel High (5230MHz) = 12 **(Chain 0)**
IEEE 802.11n HT40 Channel Low (5180MHz) = 11 **(Chain 1)**
IEEE 802.11 n HT40 Channel Middle (5200MHz) = 11 **(Chain 1)**
IEEE 802.11 n HT40 Channel High (5230MHz) = 12 **(Chain 1)**
EEE 802.11n HT40 Channel Low (5180MHz) = 0D **(Chain 2)**
IEEE 802.11 n HT40 Channel Middle (5200MHz) = 0D **(Chain 2)**
IEEE 802.11 n HT40 Channel High (5230MHz) = 0F **(Chain 2)**

**RX Mode：**

**MAC Address: FFFFFFFFFFFF**

**Start RX**

3. All of the function are under run.
4. Start test.

**Normal Link Setup**

1. Set up all computers like the setup diagram.
2. All of the function are under run.
3. Notebook PC (2) ping 192.168.0.10 –t to Notebook PC (1).
4. Notebook PC (1) ping 192.168.0.20 –t to Notebook PC (2).
5. Notebook PC (1) ping 192.168.0.50 –t to Wireless Access Point (3).

Start test.

# 7. FCC PART 15.407 REQUIREMENTS

## 7.1 26dB BANDWIDTH

**LIMITS**

§ 15.303 (c) (2), For purposes of this subpart, the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

**TEST EQUIPMENT**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSEK 30 | 835253/002 | SEP. 29, 2012 |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year*

**TEST SETUP**


**TEST PROCEDURE**

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low-loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW > 1%EBW, VBW > RBW, Span = 50MHz and Sweep = auto.
4. Mark the –26dBc (upper and lower) frequency of the peak value.
5. Repeat until all the rest channels were investigated.

**TEST RESULTS**

External color：Black

**IEEE 802.11a Mode**

| Channel | Channel Frequency (MHz) | 26dB Bandwidth (kHz) | Pass / Fail |
|---|---|---|---|
| Low | 5180 | 20140.281 | PASS |
| Middle | 5220 | 19839.679 | PASS |
| High | 5240 | 19979.960 | PASS |

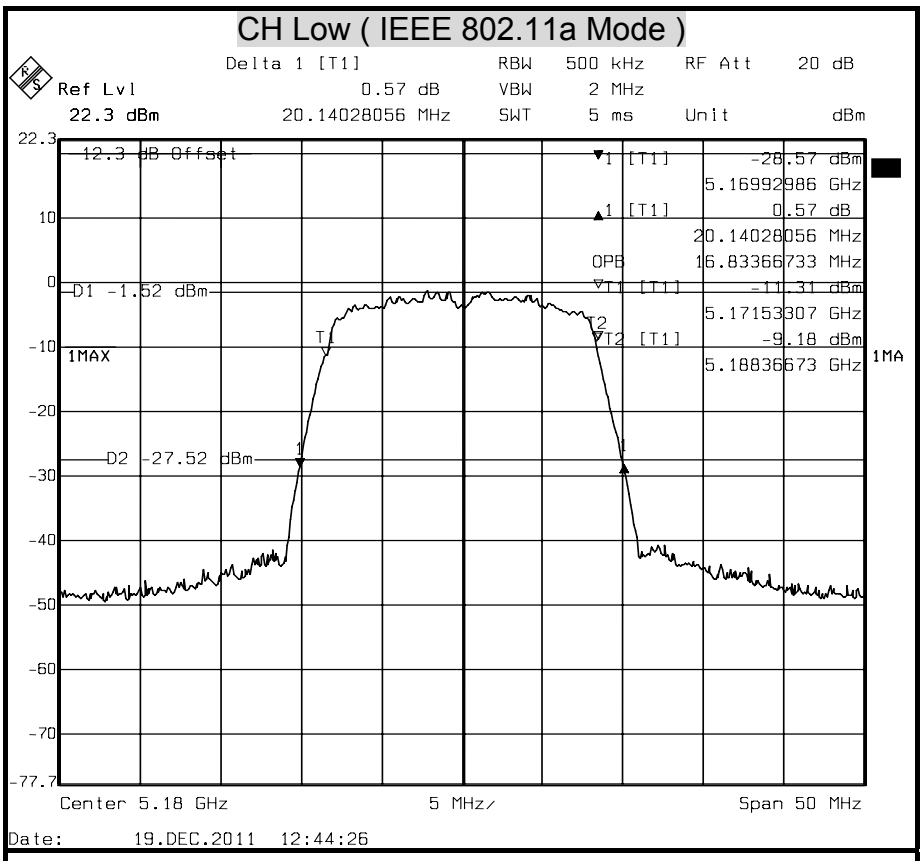
**IEEE 802.11 n HT20 Mode**

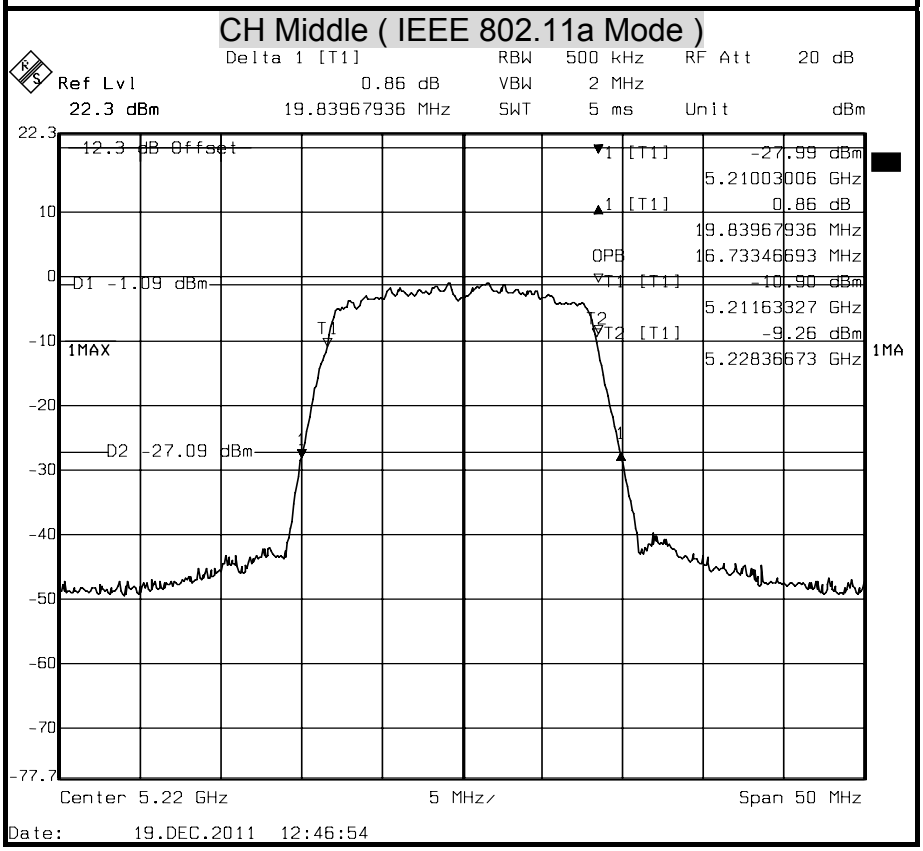
| Channel | Channel Frequency (MHz) | 26dB Bandwidth (kHz) | | | Pass / Fail |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | |
| Low | 5180 | 20040.080 | 19739.479 | 19939.880 | PASS |
| Middle | 5220 | 20040.080 | 19839.679 | 19939.880 | PASS |
| High | 5240 | 20140.281 | 19739.479 | 19839.679 | PASS |

**IEEE 802.11 n HT40 Mode**

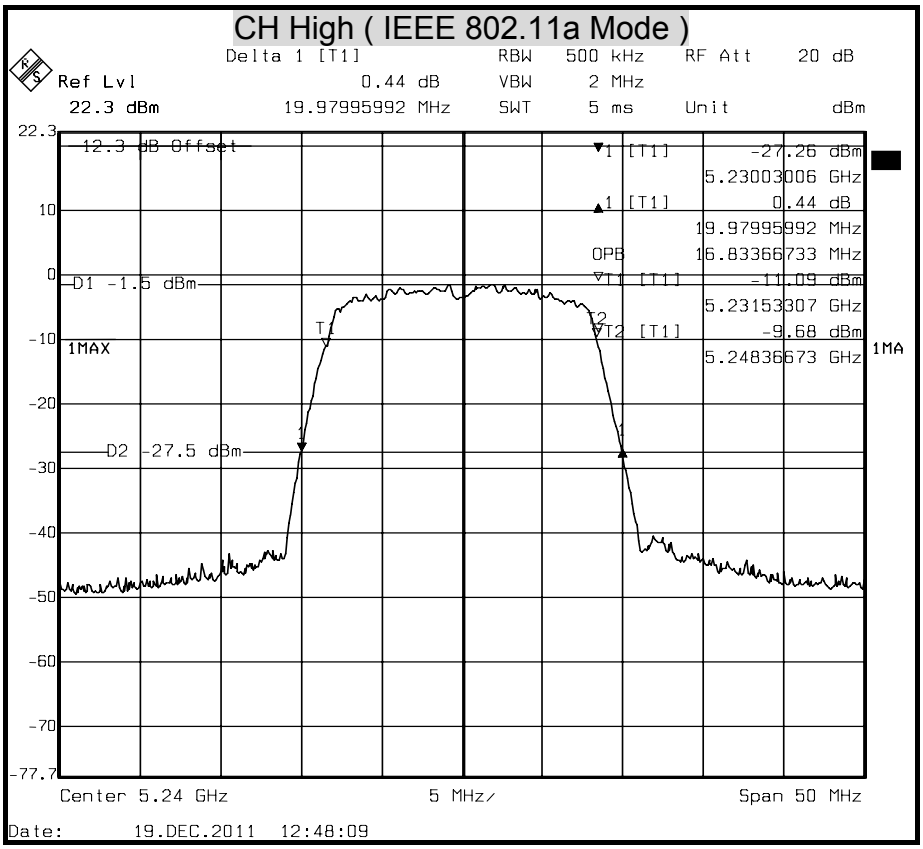
| Channel | Channel Frequency (MHz) | 26dB Bandwidth (kHz) | | | Pass / Fail |
|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | |
| Low | 5180 | 40681.363 | 40881.764 | 41082.164 | PASS |
| Middle | 5200 | 41122.244 | 40721.443 | 41122.244 | PASS |
| High | 5230 | 40781.563 | 40781.563 | 40981.964 | PASS |

## 26dB BANDWIDTH

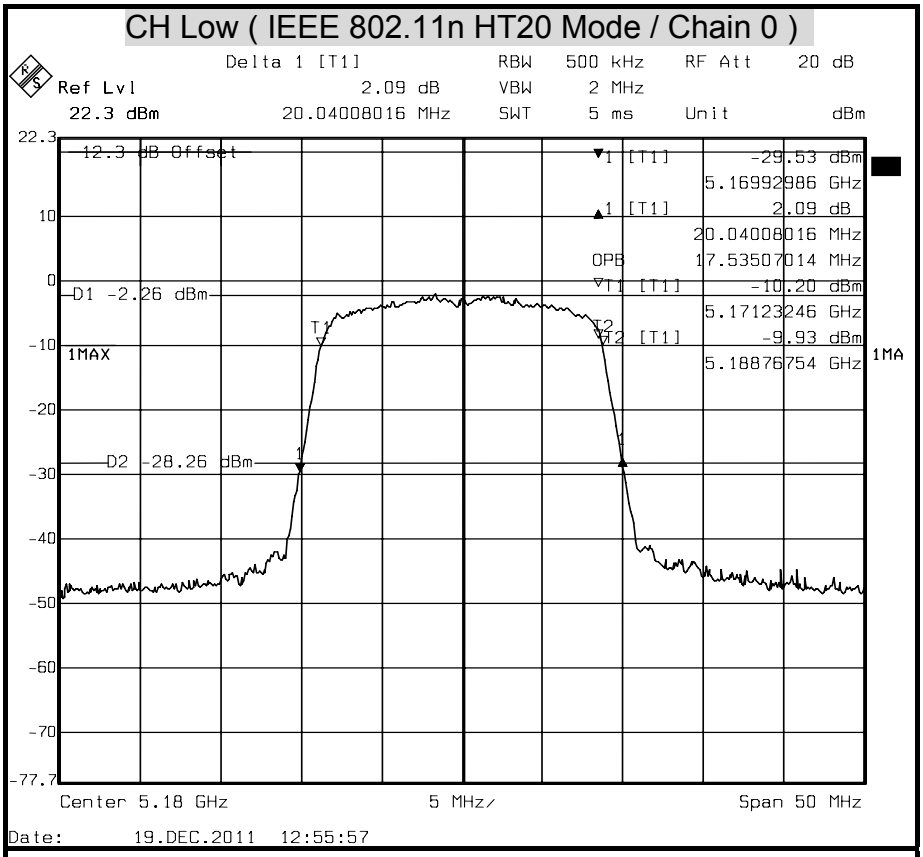


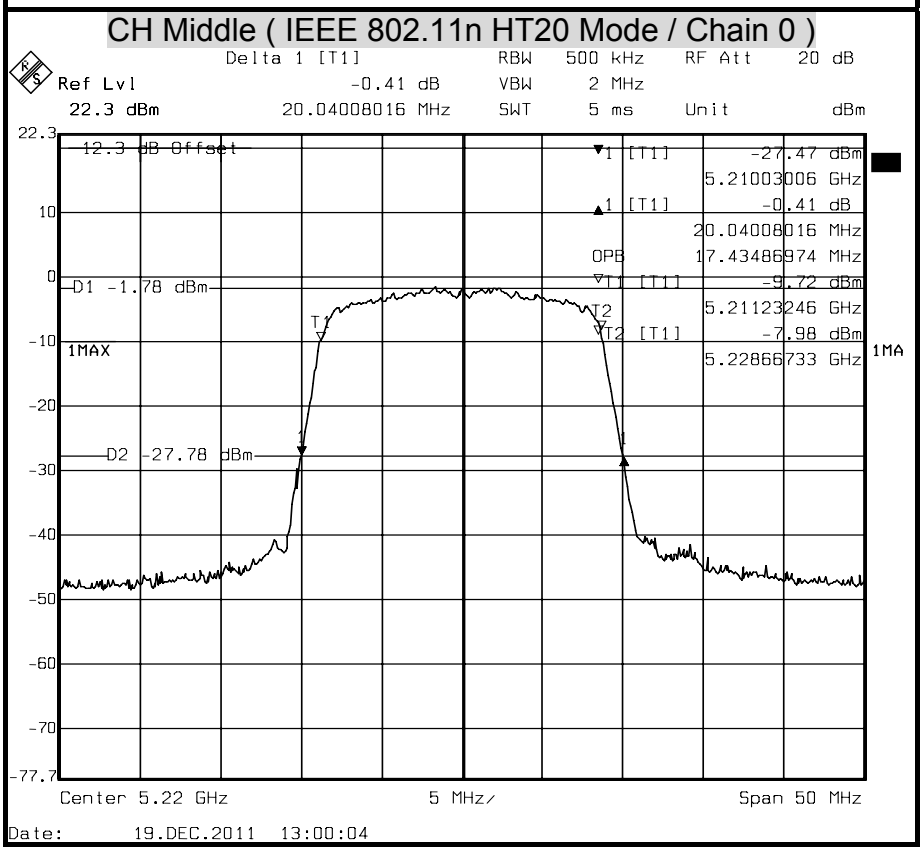
CH High ( IEEE 802.11a Mode )



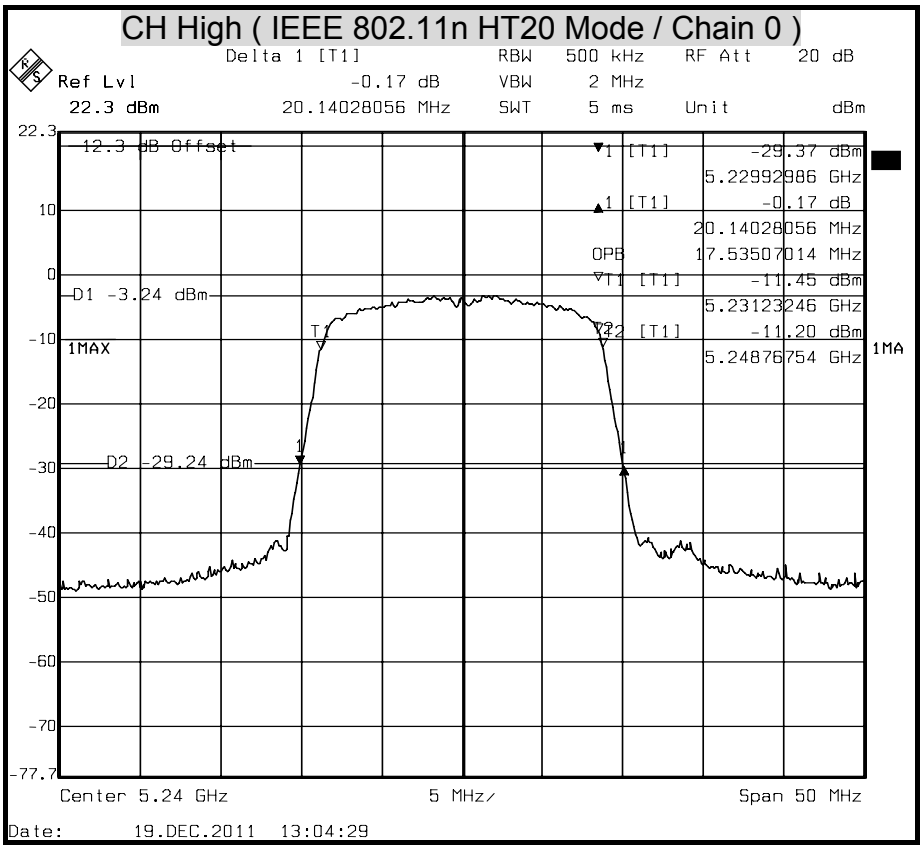
CH Low ( IEEE 802.11n HT20 Mode / Chain 0 )



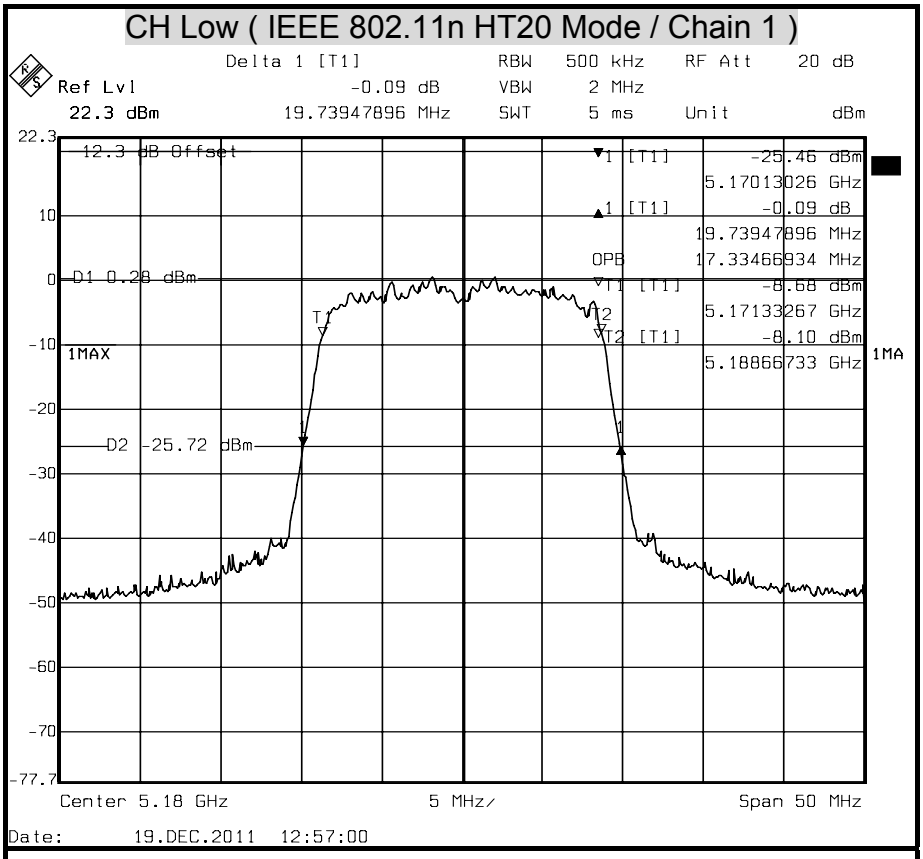

CH Middle ( IEEE 802.11n HT20 Mode / Chain 0 )



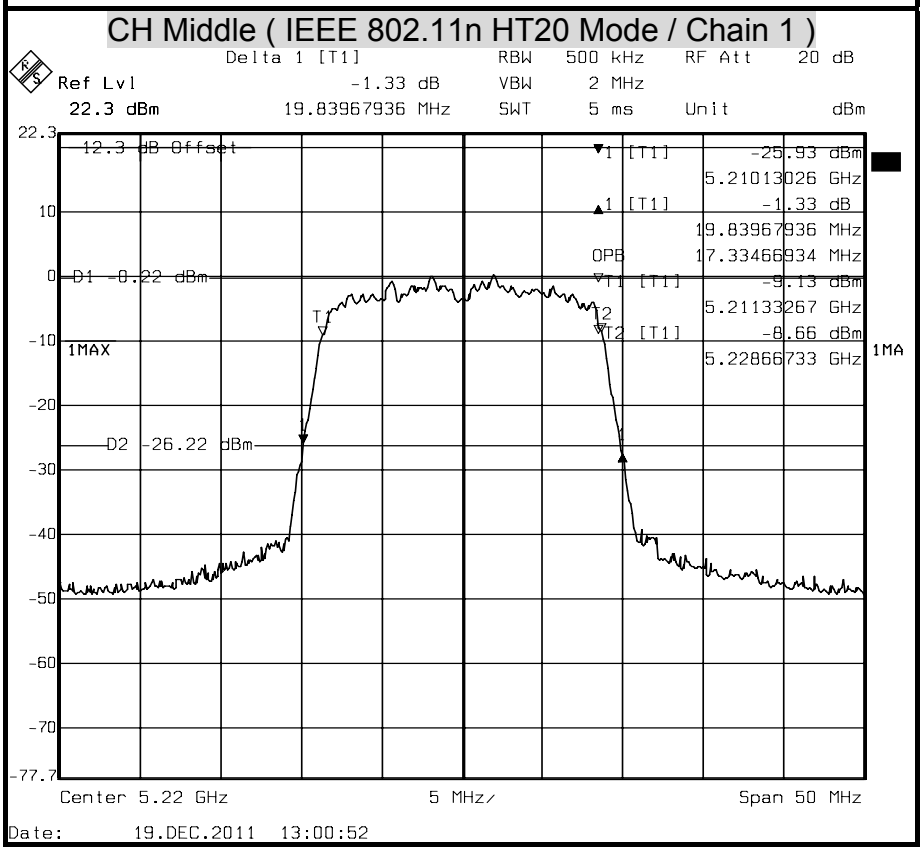
CH High ( IEEE 802.11n HT20 Mode / Chain 0 )



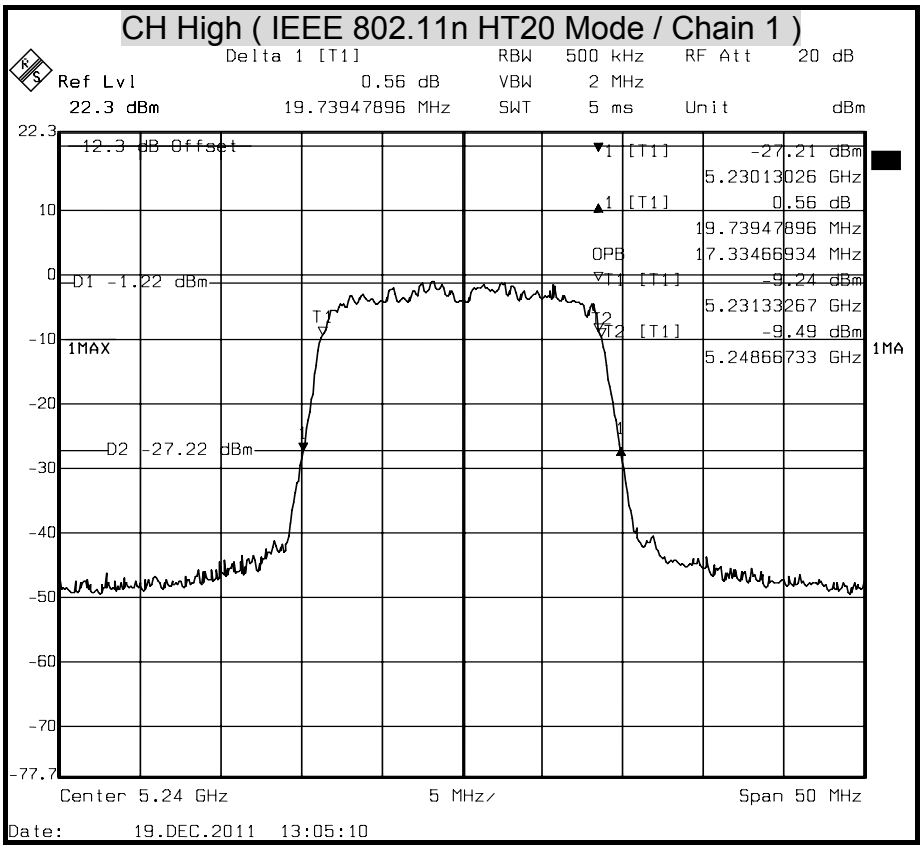
CH Low ( IEEE 802.11n HT20 Mode / Chain 1 )



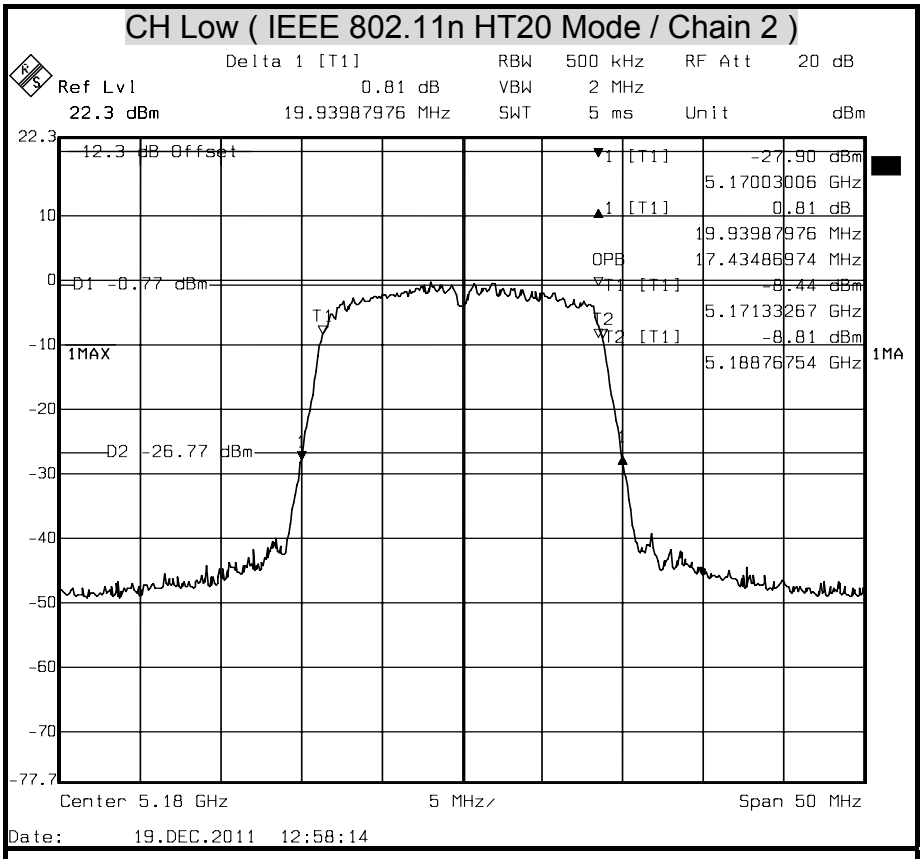

CH Middle ( IEEE 802.11n HT20 Mode / Chain 1 )



CH High ( IEEE 802.11n HT20 Mode / Chain 1 )



CH Low ( IEEE 802.11n HT20 Mode / Chain 2 )

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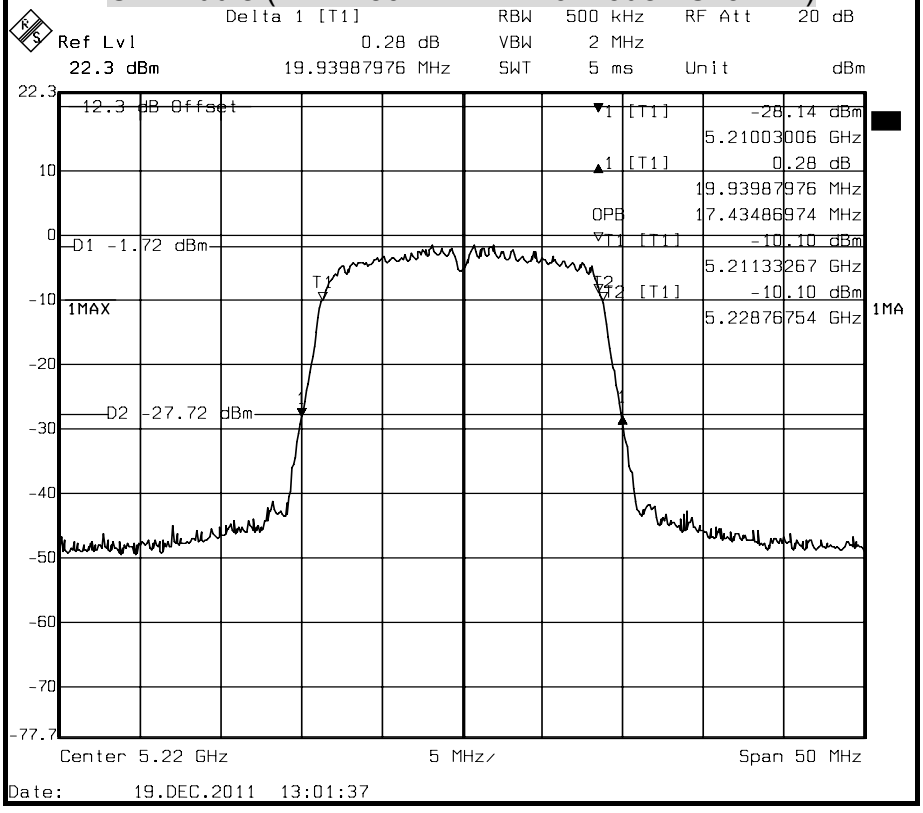

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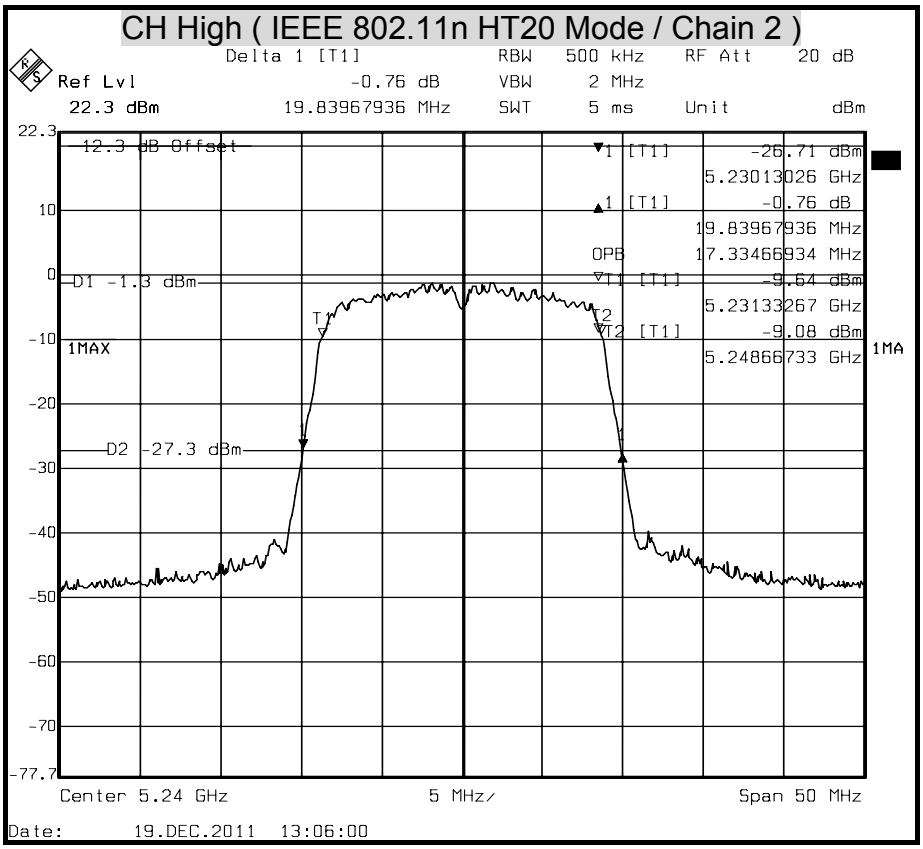

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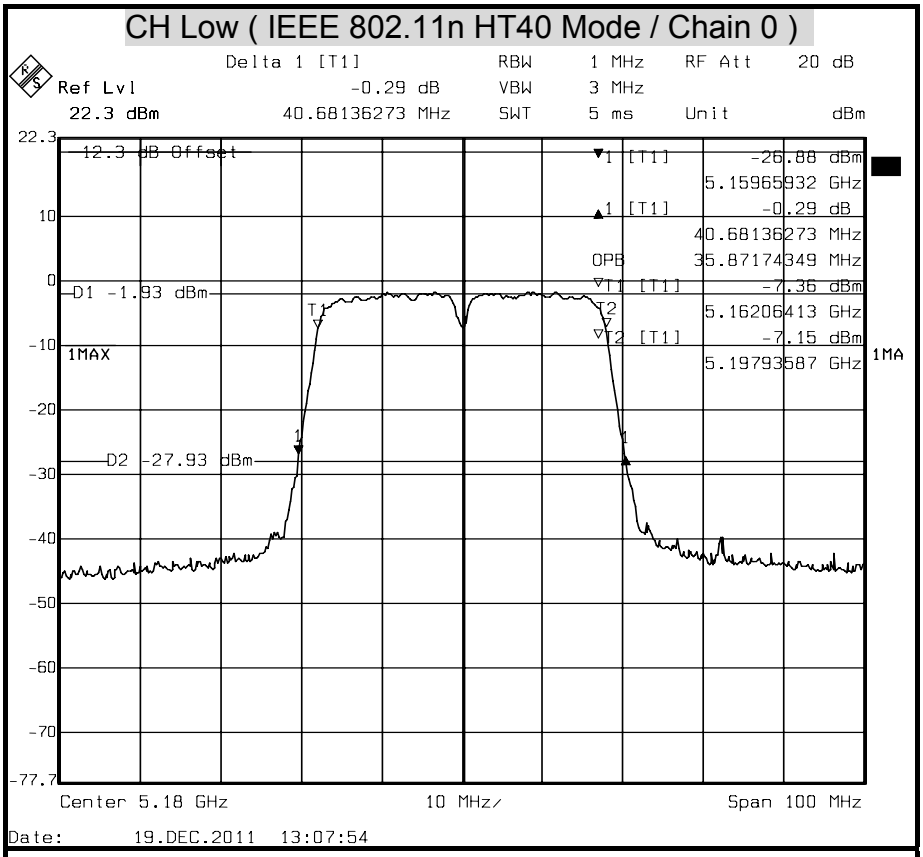
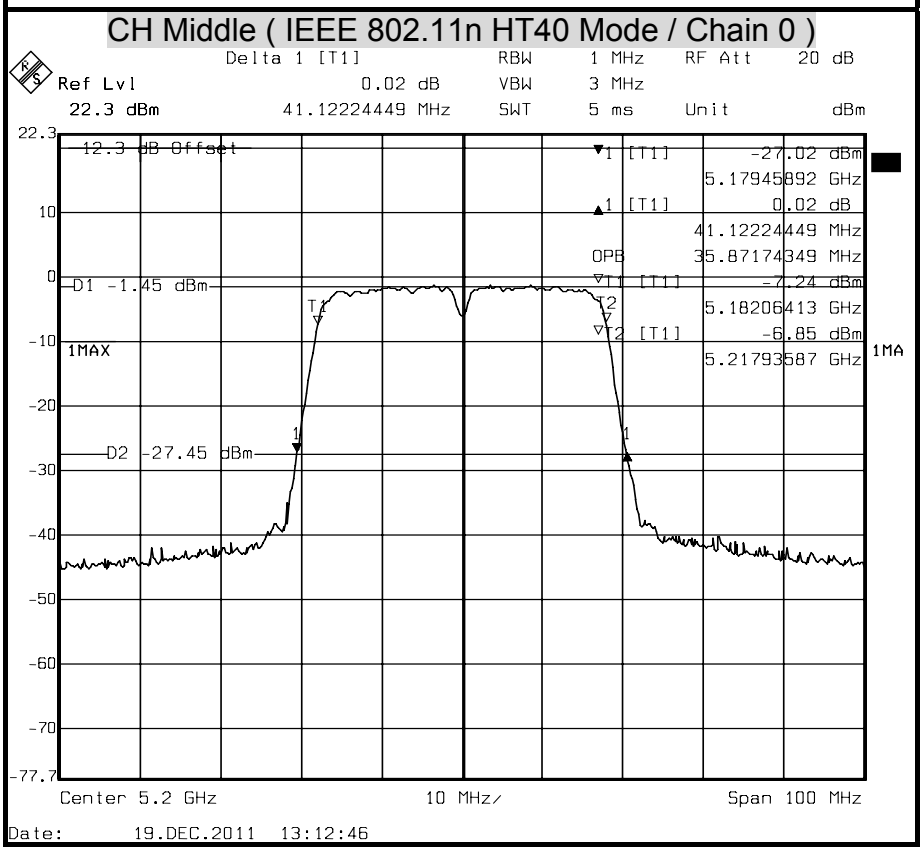



CH Middle ( IEEE 802.11n HT40 Mode / Chain 0 )



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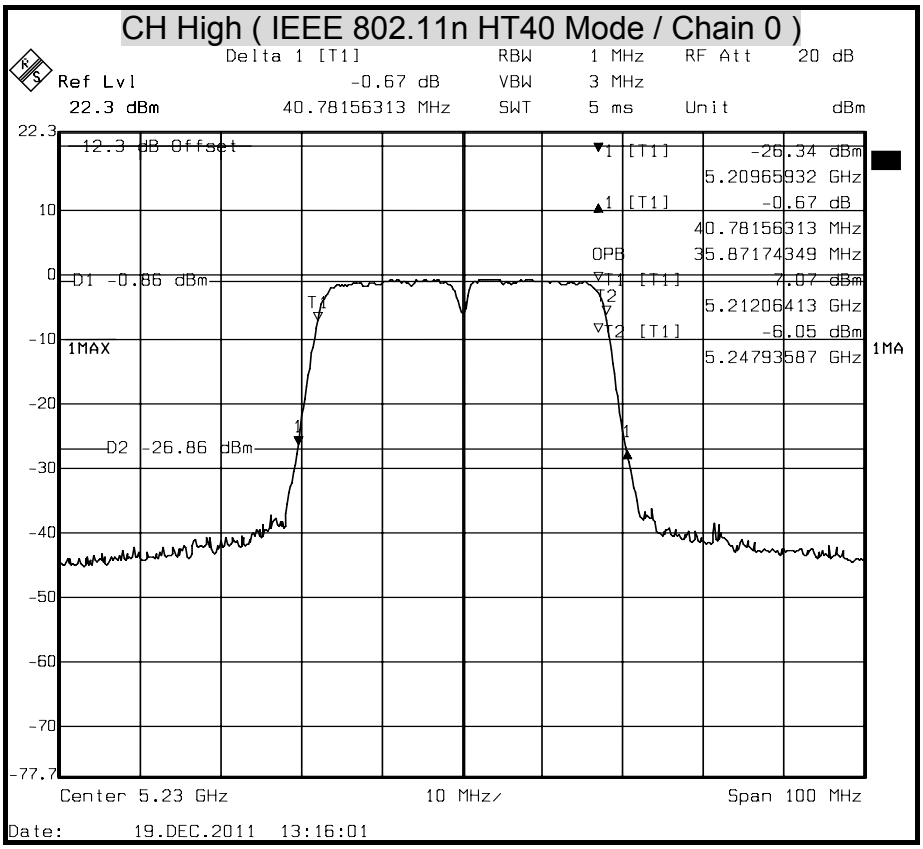
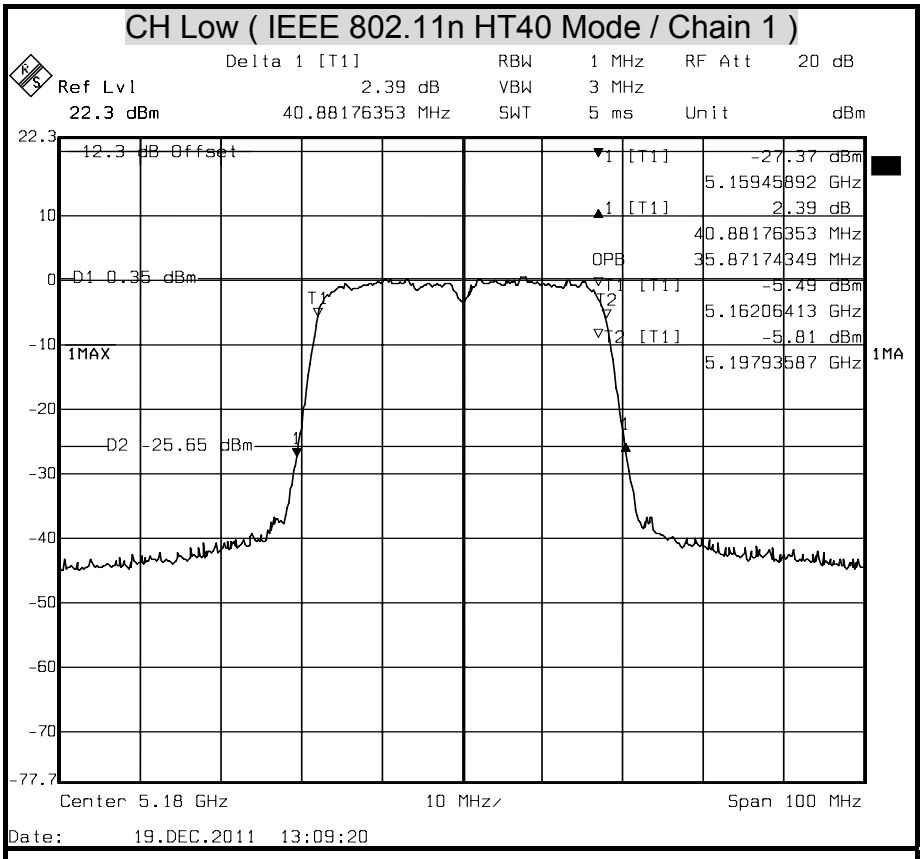
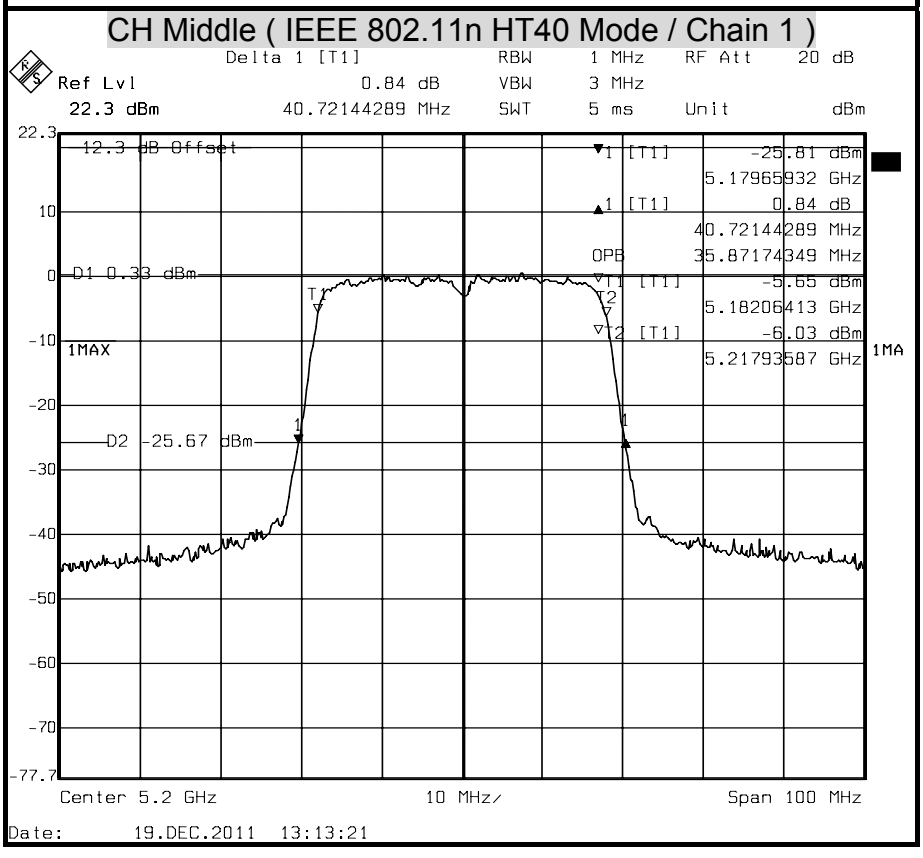


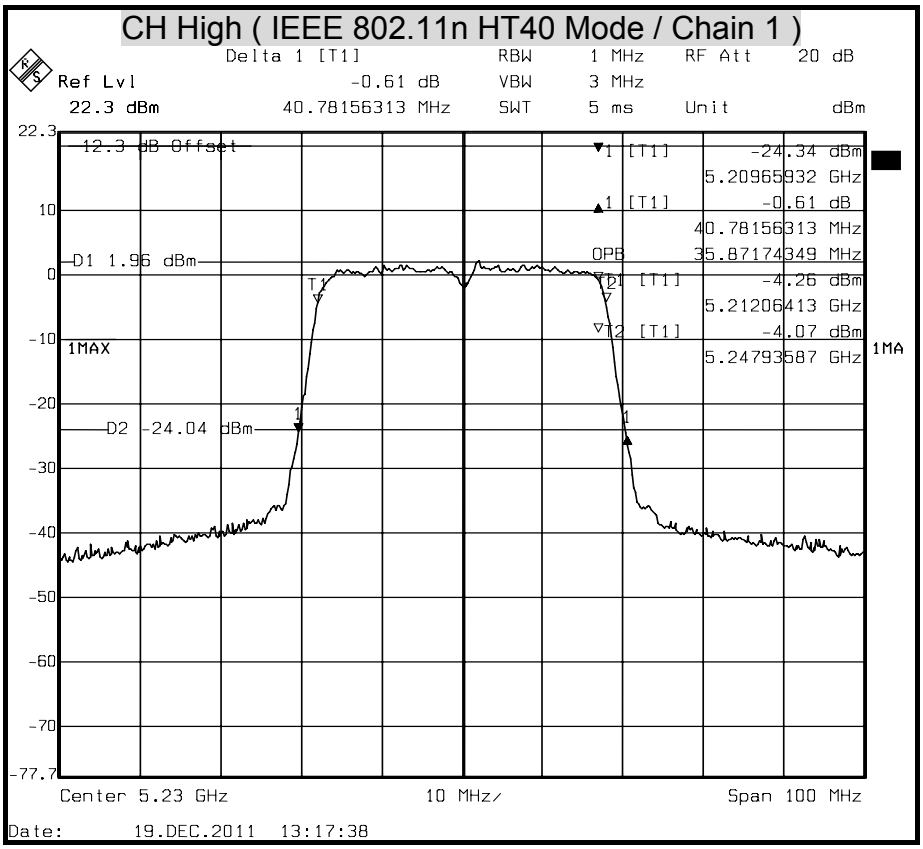
CH Low ( IEEE 802.11n HT40 Mode / Chain 1 )



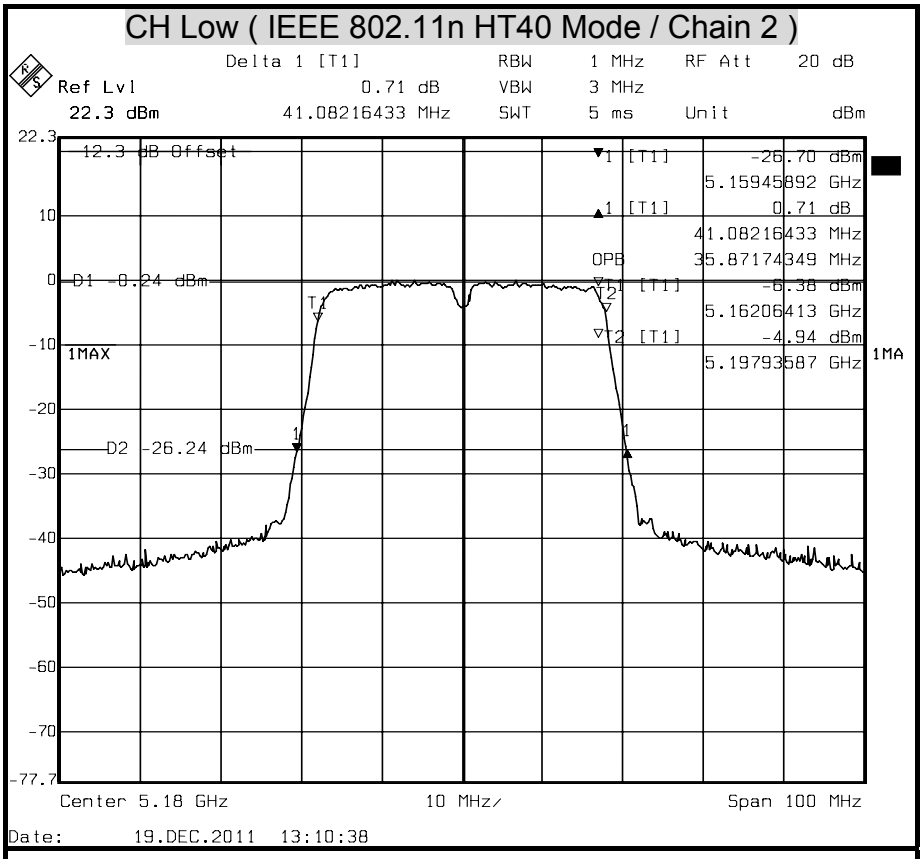

CH Middle ( IEEE 802.11n HT40 Mode / Chain 1 )



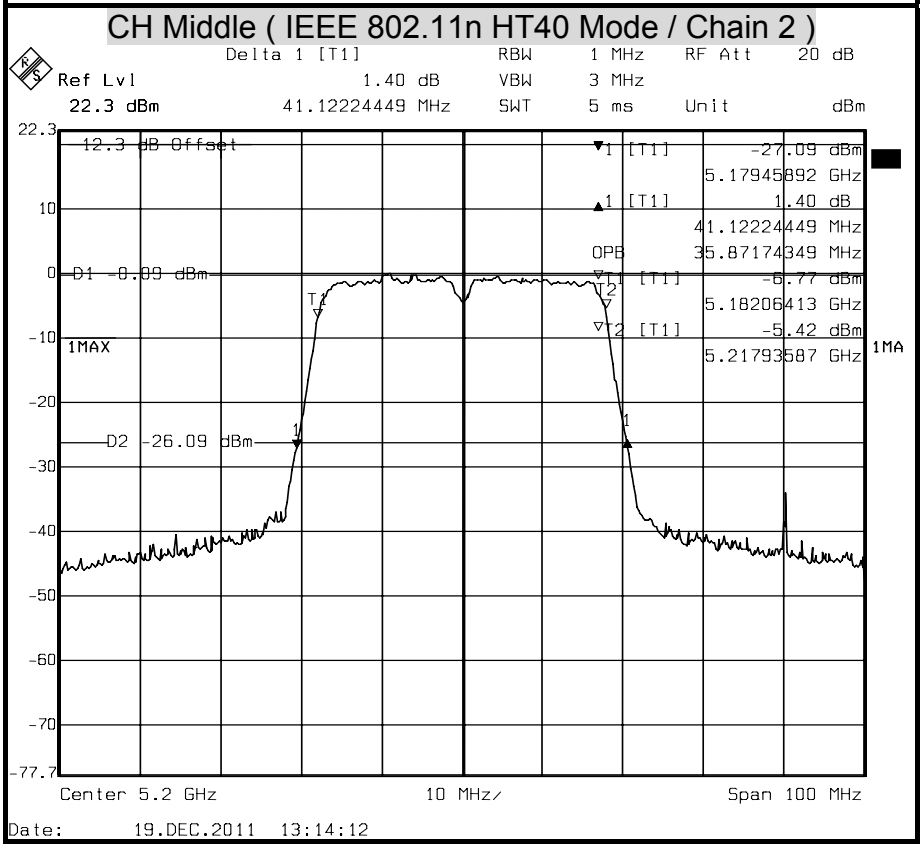
CH High ( IEEE 802.11n HT40 Mode / Chain 1 )



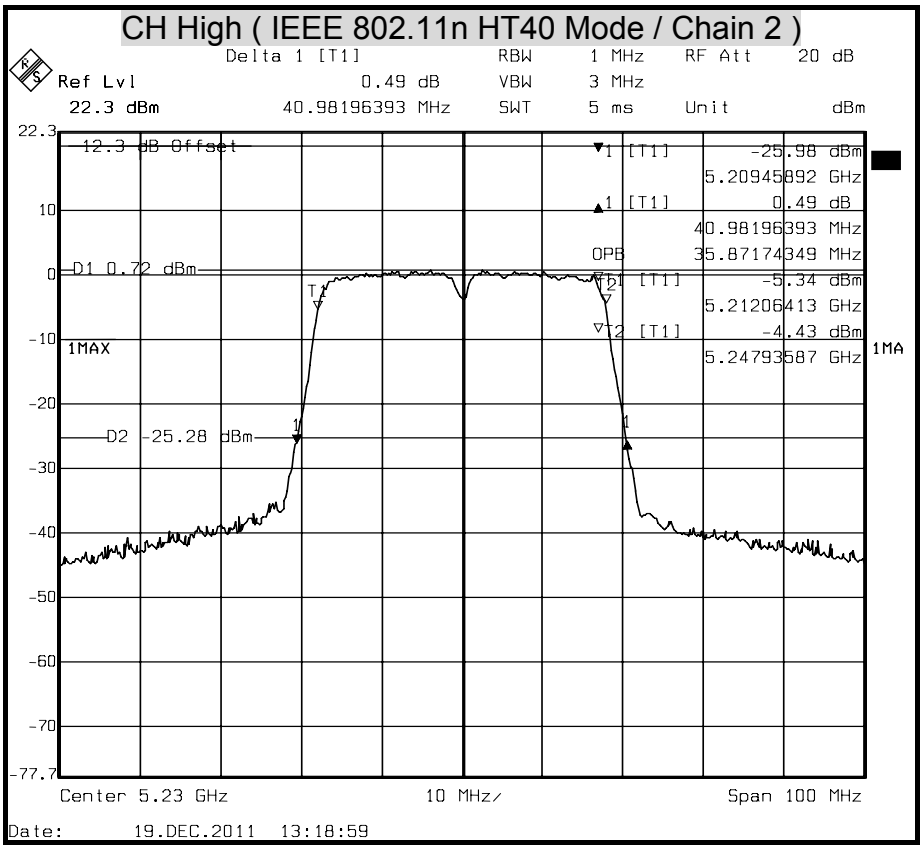
CH Low ( IEEE 802.11n HT40 Mode / Chain 2 )




CH Middle ( IEEE 802.11n HT40 Mode / Chain 2 )



CH High ( IEEE 802.11n HT40 Mode / Chain 2 )



## 7.2 MAXIMUM CONDUCTED OUTPUT POWER

**LIMITS**

§ 15.407(a)

(1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50mW (17dBm) or 4dBm + 10log B, where B is the 26dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4dBm in any 1 MHz band.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26 dB emission bandwidth in MHz.

If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

The peak power shall not exceeded the limit as follows:

External color：Black

**IEEE 802.11a mode**

| Channel | Channel Frequency (MHz) | 26dB Bandwidth (B) (MHz) | 10 Log B (dB) | 4dBm + 10 Log B (dBm) | Maximum Conducted Output Power Limit (dBm) |
|---|---|---|---|---|---|
| Low | 5180 | 20.140 | 13.04 | 17.04 | 17 |
| Middle | 5220 | 19.840 | 12.98 | 16.98 | 17 |
| High | 5240 | 19.980 | 13.01 | 17.01 | 17 |

**IEEE 802.11n HT20 mode**

| Channel | Channel Frequency (MHz) | 26dB Bandwidth (B) (MHz) | | | 10 Log B (dB) | 4dBm + 10 Log B (dBm) | Maximum Conducted Output Power Limit (dBm) |
|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | | | |
| Low | 5180 | 20.040 | 19.739 | 19.940 | 13.02 | 17.02 | 17 |
| Middle | 5220 | 20.040 | 19.840 | 19.940 | 13.02 | 17.02 | 17 |
| High | 5240 | 20.140 | 19.739 | 19.840 | 13.04 | 17.04 | 17 |

**IEEE 802.11n HT40 mode**

| Channel | Channel Frequency (MHz) | 26dB Bandwidth (B) (MHz) | | | 10 Log B (dB) | 4dBm + 10 Log B (dBm) | Maximum Conducted Output Power Limit (dBm) |
|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | | | |
| Low | 5180 | 40.681 | 40.882 | 41.082 | 16.14 | 20.14 | 17 |
| Middle | 5200 | 41.122 | 40.721 | 41.122 | 16.14 | 20.14 | 17 |
| High | 5230 | 40.782 | 40.782 | 40.982 | 16.13 | 20.13 | 17 |

## TEST EQUIPMENT

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Power Meter | Anritsu | ML2487A | 6K00003888 | MAY 30, 2012 |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year*

## TEST SETUP


## TEST PROCEDURE

Set span to encompass the entire emission bandwidth (EBW) of the signal.

Set RBW = 1 MHz / Set VBW = 3 MHz.

Use sample detector mode if bin width (i.e., span/number of points in spectrum display) < 0.5 RBW. Otherwise use peak detector mode. Use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at full control power for entire sweep of every sweep. If the device transmits continuously, with no off intervals or reduced power intervals, the trigger may be set to “free run”. Trace average 100 traces in power averaging mode. Compute power by integrating the spectrum across the 26 dB EBW of the signal. The integration can be performed using the spectrum analyzer’s band power measurement function with band limits set equal to the EBW band edges or by summing power levels in each 1 MHz band in linear power terms. The 1 MHz band power levels to be summed can be obtained by averaging, in linear power terms, power levels in each frequency bin across the 1 MHz.

## TEST RESULTS

External color：Black

**IEEE 802.11a Mode**

| Channel | Channel Frequency (MHz) | Peak Power (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|---|---|---|---|---|
| Low | 5180 | 4.36 | 17 | PASS |
| Middle | 5220 | 4.48 | 17 | PASS |
| High | 5240 | 3.74 | 17 | PASS |

***Remark:***

*1. At finial test to get the worst-case emission at 6Mbps.*
*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

**IEEE 802.11n HT20 Mode**

| Channel | Channel Frequency (MHz) | Peak Power | | | | Peak Power Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Total | | |
| Low | 5180 | 6.13 | 5.55 | 5.16 | 10.40 | 14.10 | PASS |
| Middle | 5220 | 5.47 | 4.42 | 5.09 | 9.79 | 14.10 | PASS |
| High | 5240 | 4.02 | 5.62 | 5.10 | 9.73 | 14.10 | PASS |

***Remark:***

*1. At finial test to get the worst-case emission at 6.5Mbps.*
*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

**IEEE 802.11n HT40 Mode**

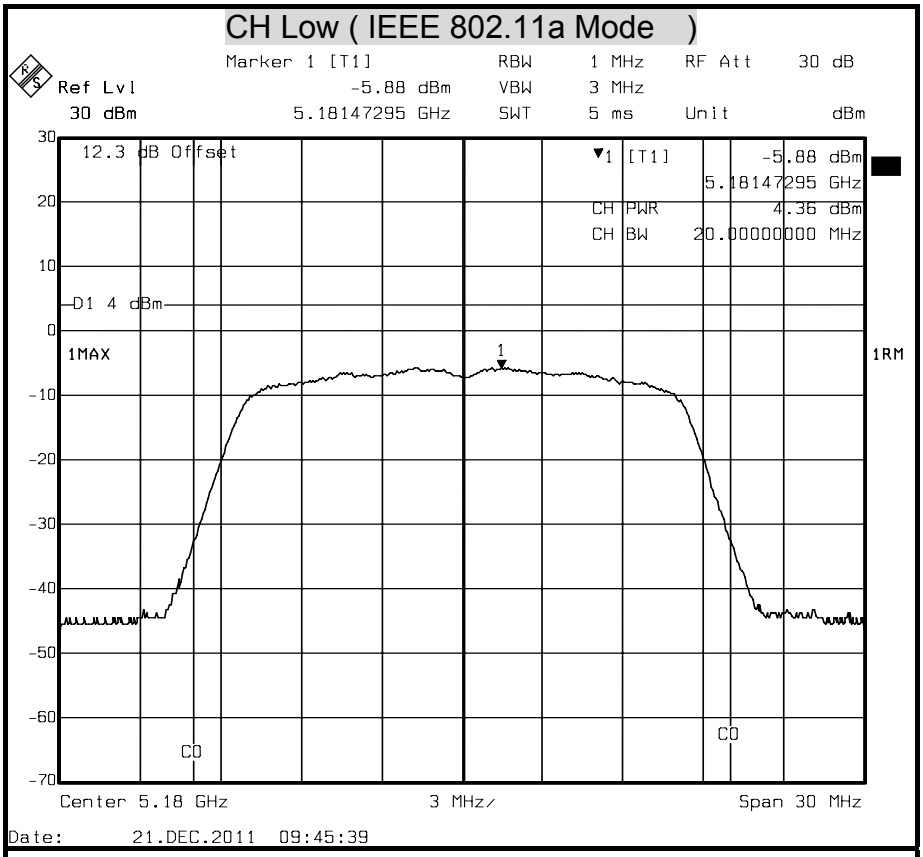
| Channel | Channel Frequency (MHz) | Peak Power | | | | Peak Power Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Total | | |
| Low | 5180 | 3.18 | 7.34 | 7.30 | 11.10 | 14.10 | PASS |
| Middle | 5200 | 6.41 | 7.80 | 7.56 | 12.07 | 14.10 | PASS |
| High | 5230 | 7.76 | 8.25 | 7.94 | 12.76 | 14.10 | PASS |

***Remark:***

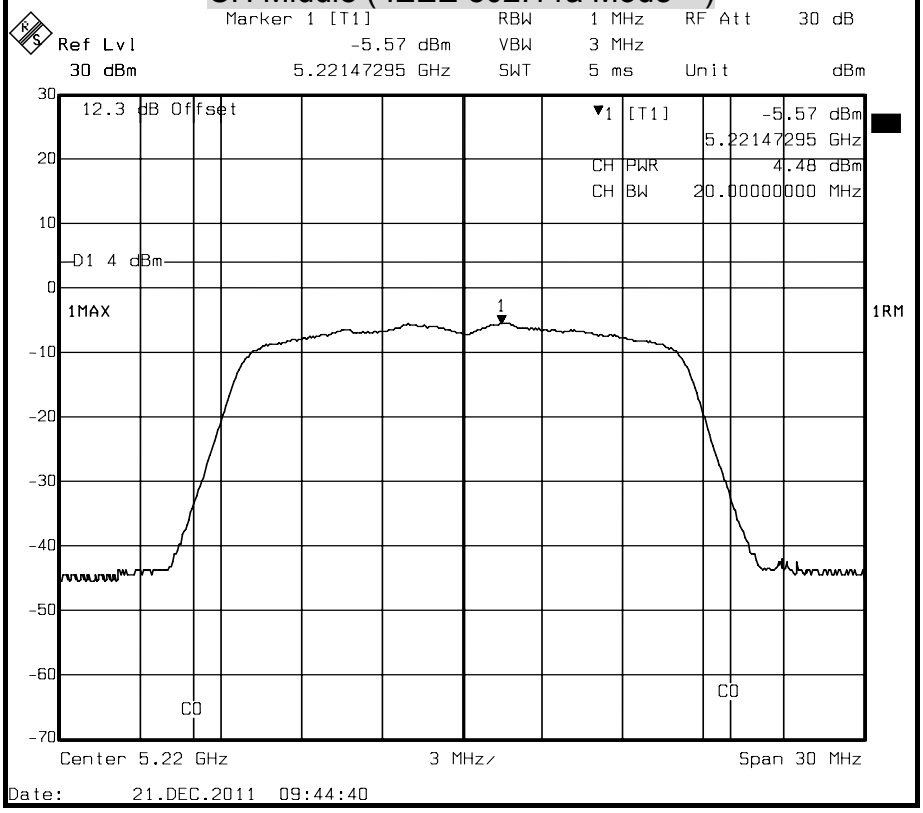
*1. At finial test to get the worst-case emission at 6.5Mbps.*
*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

## MAXIMUM CONDUCTED OUTPUT POWER

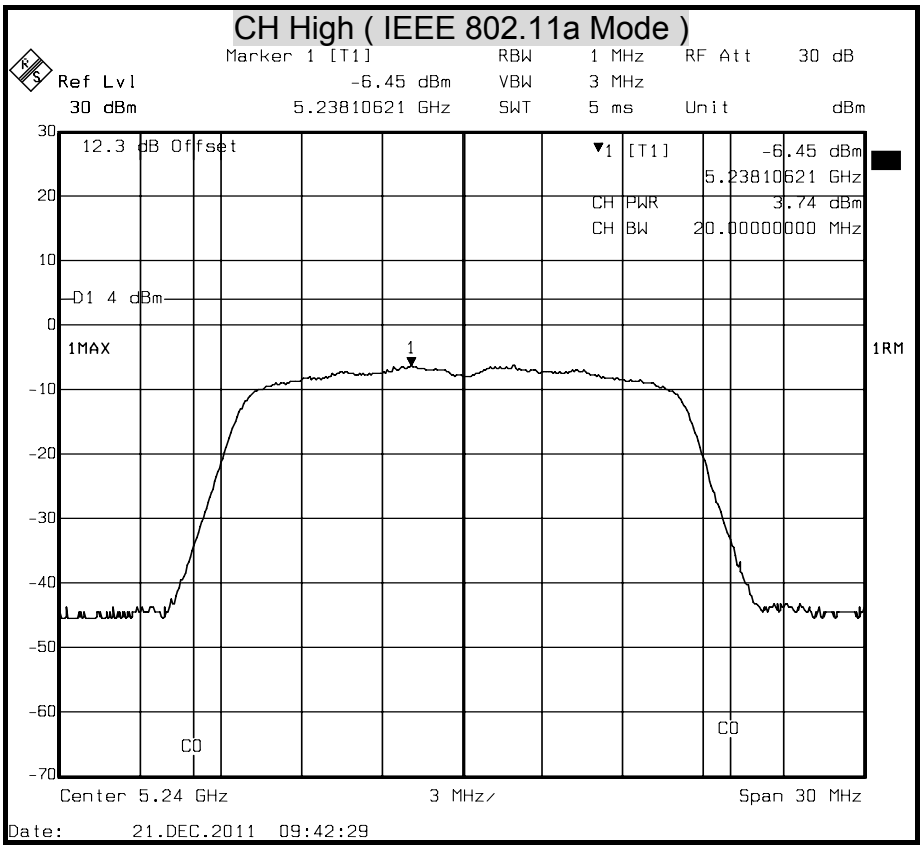
CH Low ( IEEE 802.11a Mode )



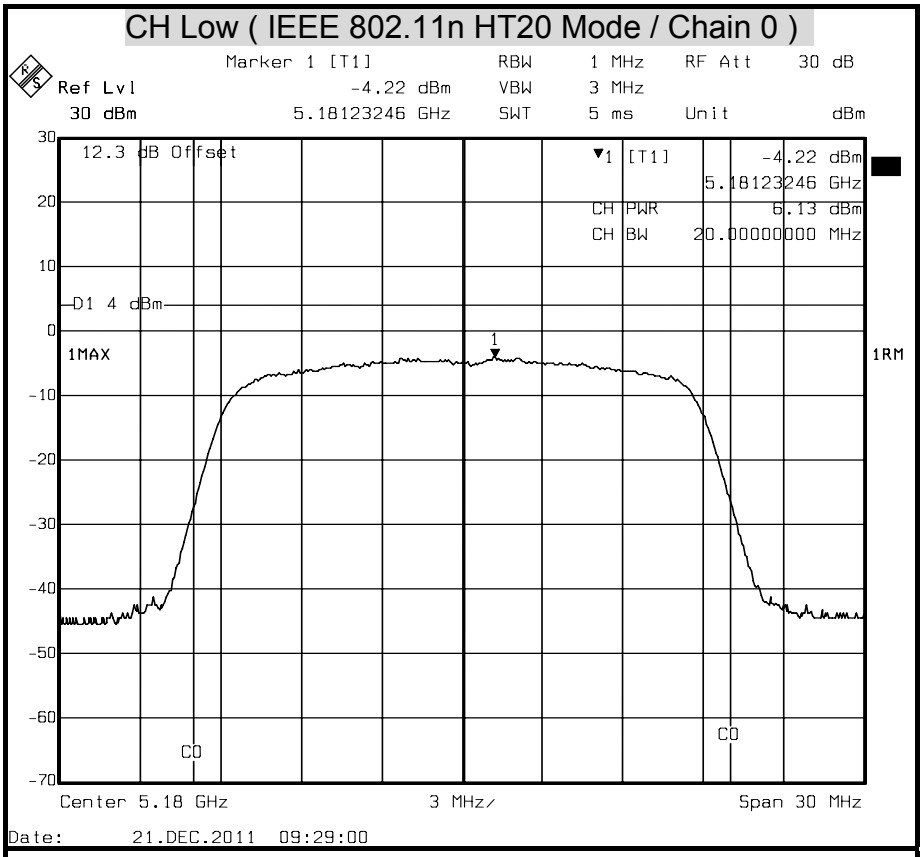

CH Middle ( IEEE 802.11a Mode )



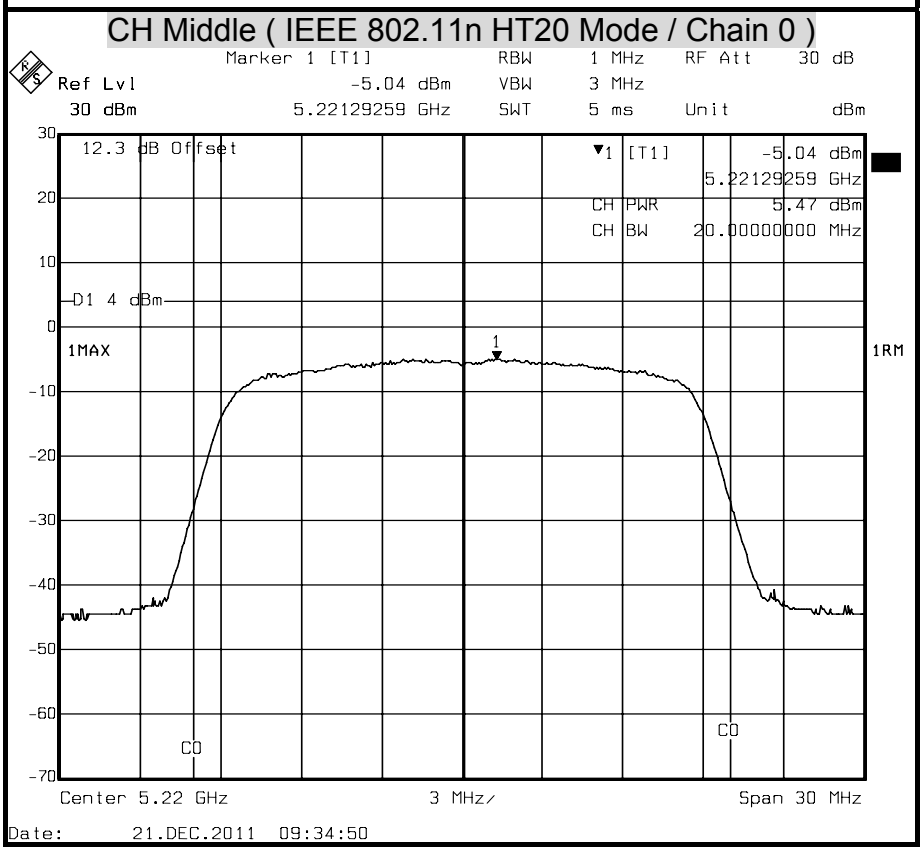
CH High ( IEEE 802.11a Mode )



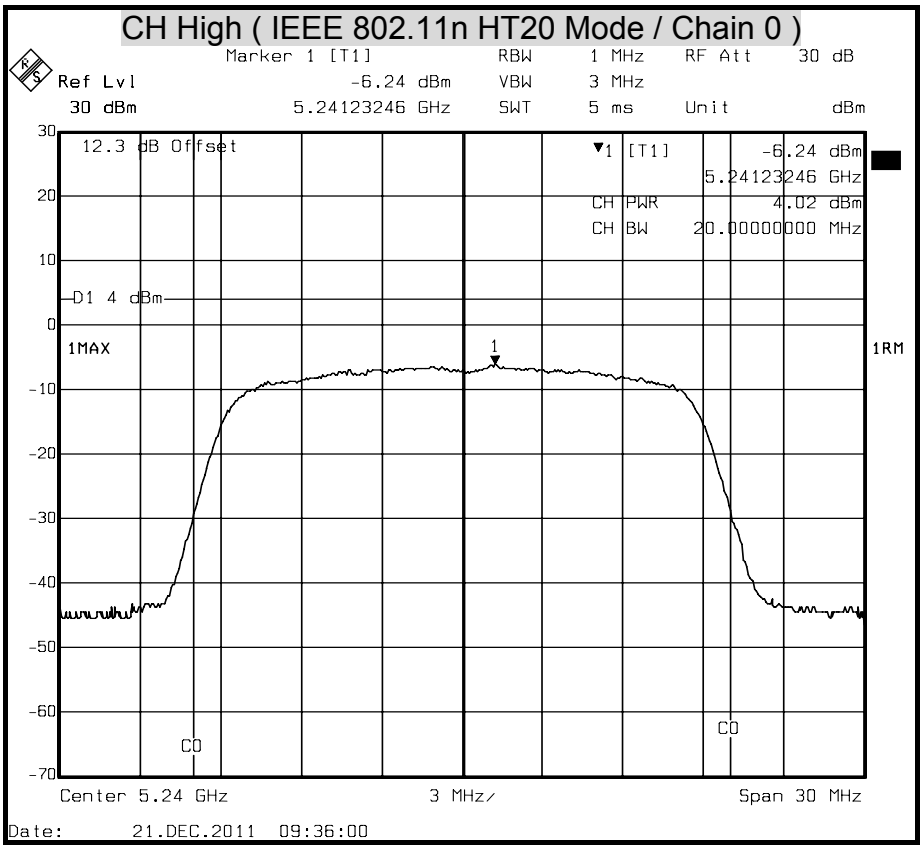
CH Low ( IEEE 802.11n HT20 Mode / Chain 0 )



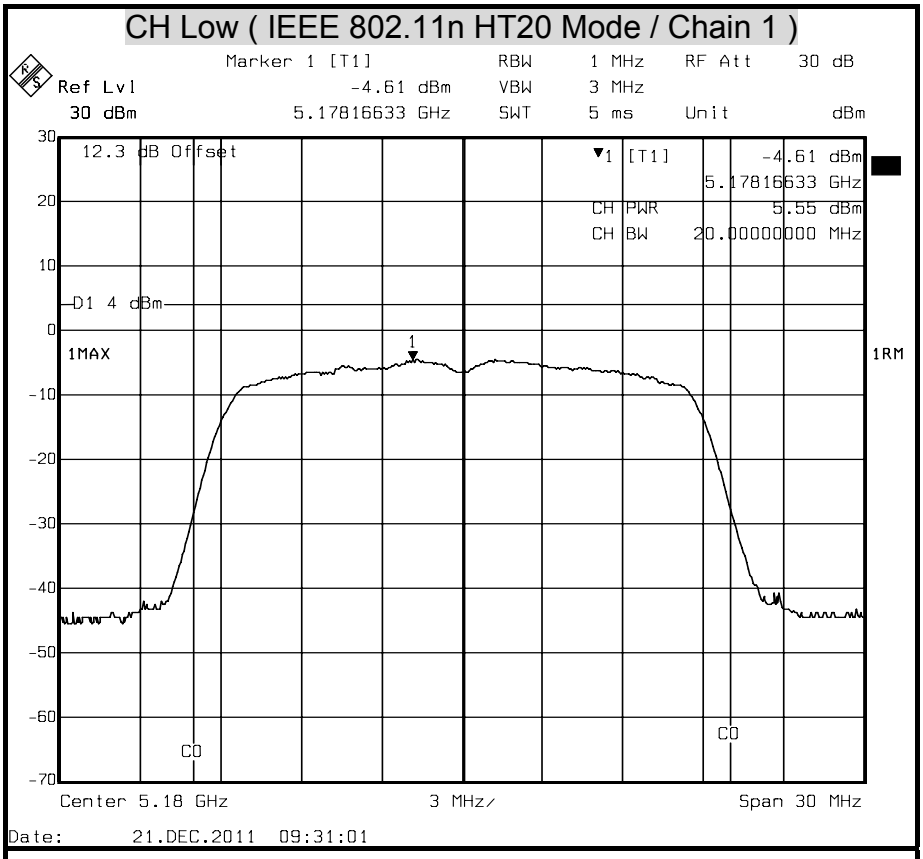

CH Middle ( IEEE 802.11n HT20 Mode / Chain 0 )



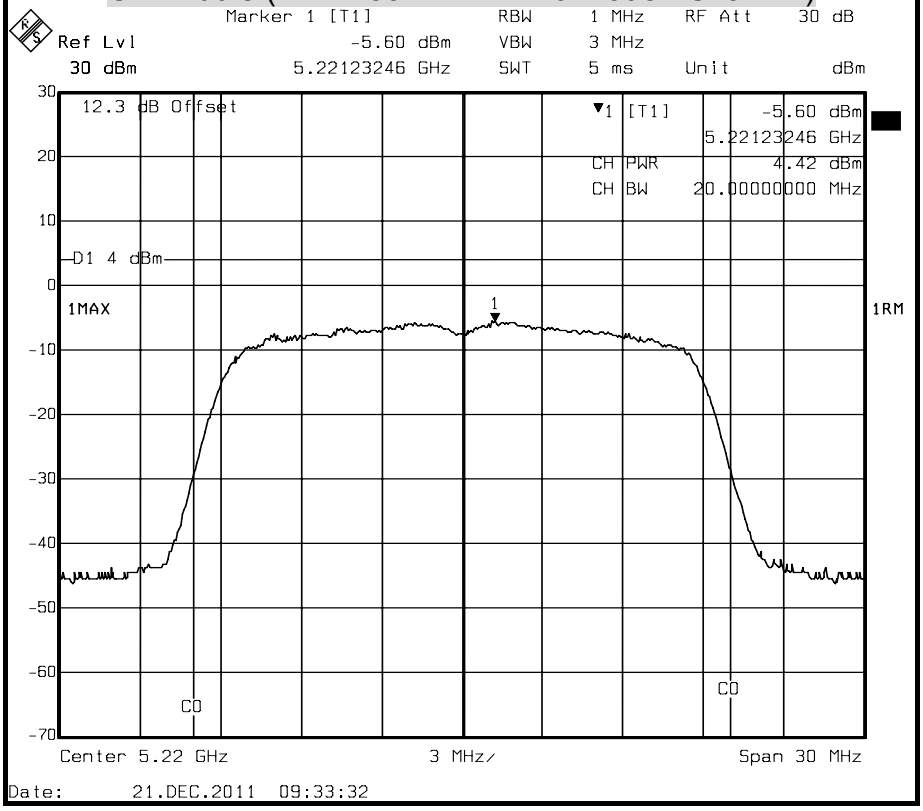
CH High ( IEEE 802.11n HT20 Mode / Chain 0 )



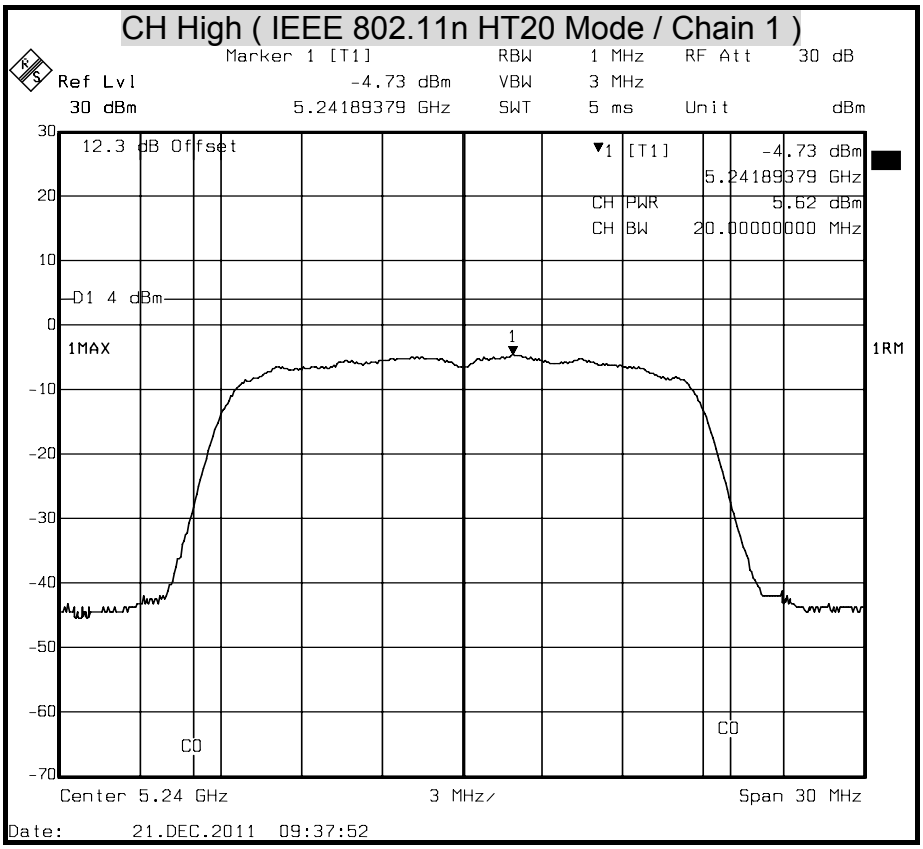
CH Low ( IEEE 802.11n HT20 Mode / Chain 1 )



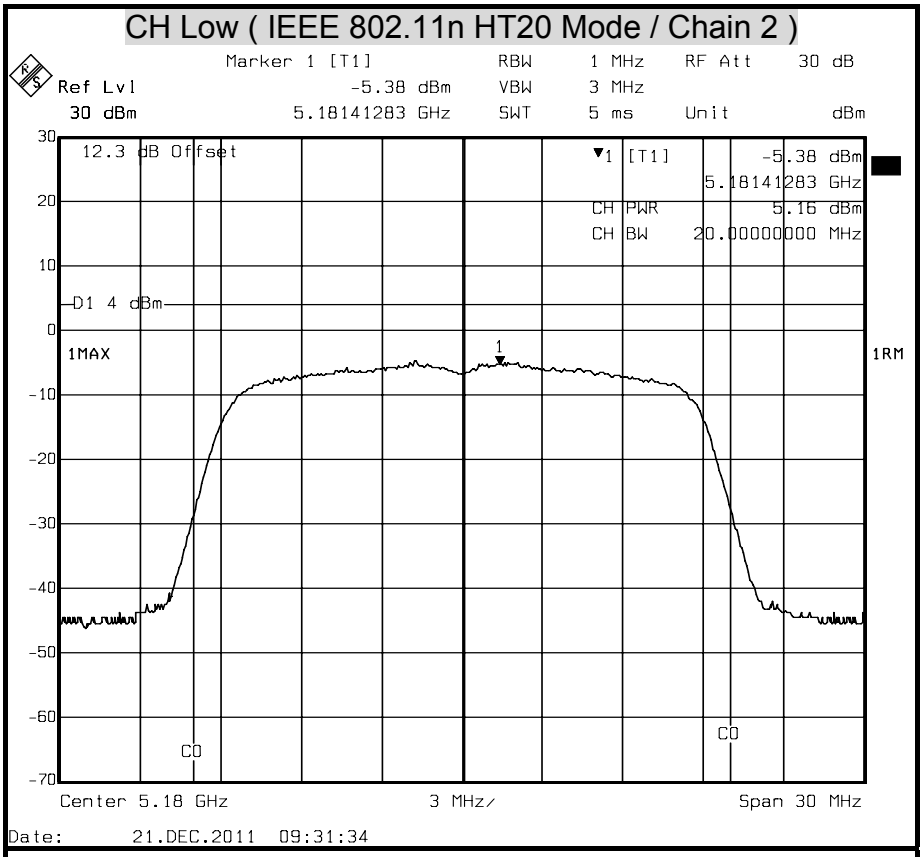

CH Middle ( IEEE 802.11n HT20 Mode / Chain 1 )



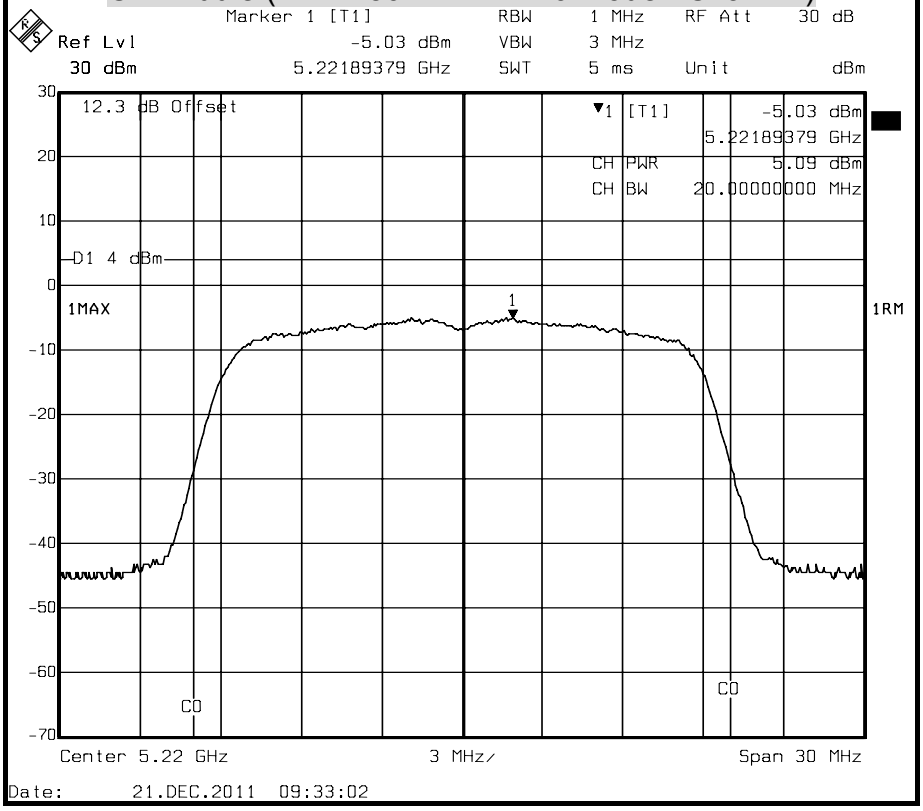
CH High ( IEEE 802.11n HT20 Mode / Chain 1 )



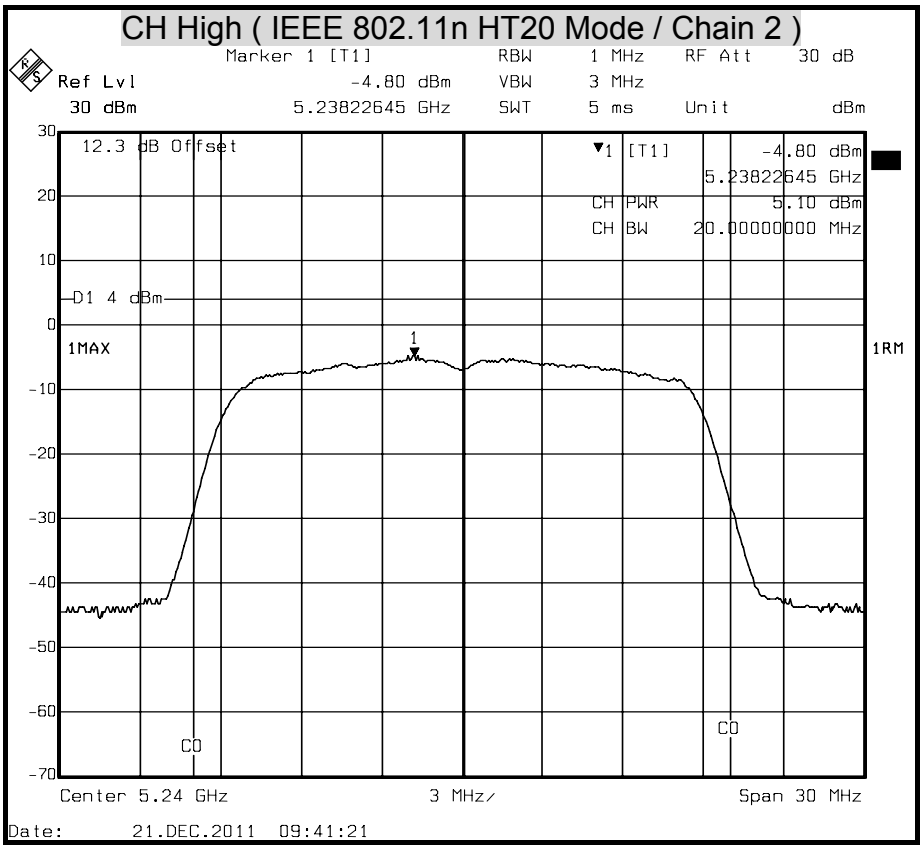
CH Low ( IEEE 802.11n HT20 Mode / Chain 2 )



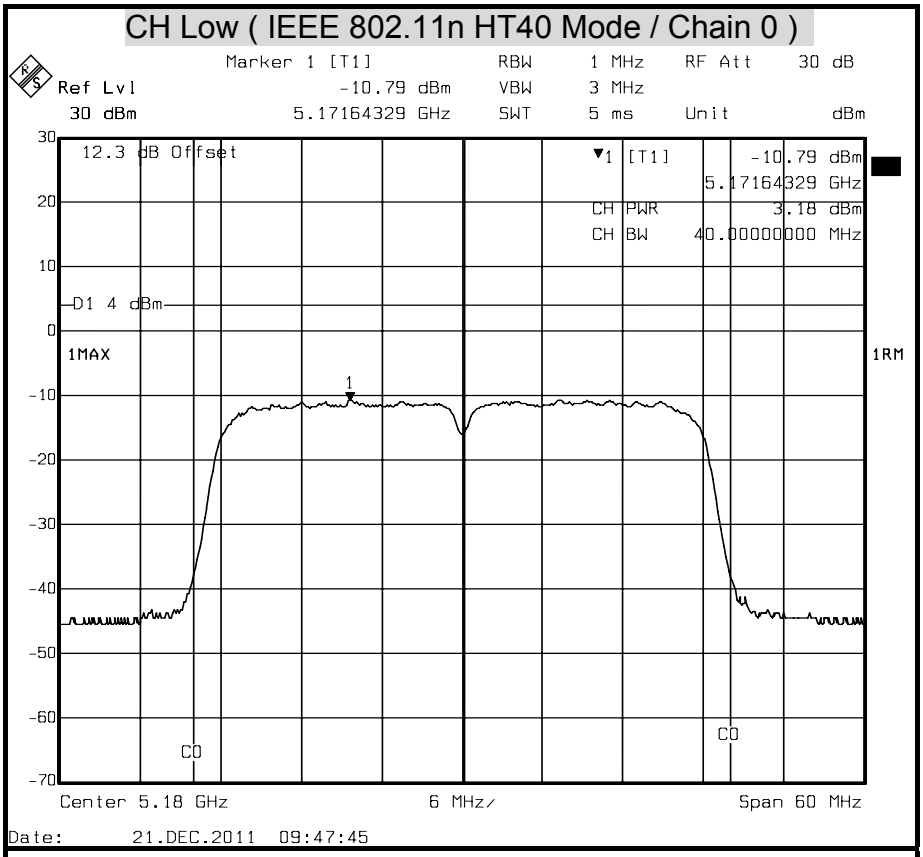

CH Middle ( IEEE 802.11n HT20 Mode / Chain 2 )



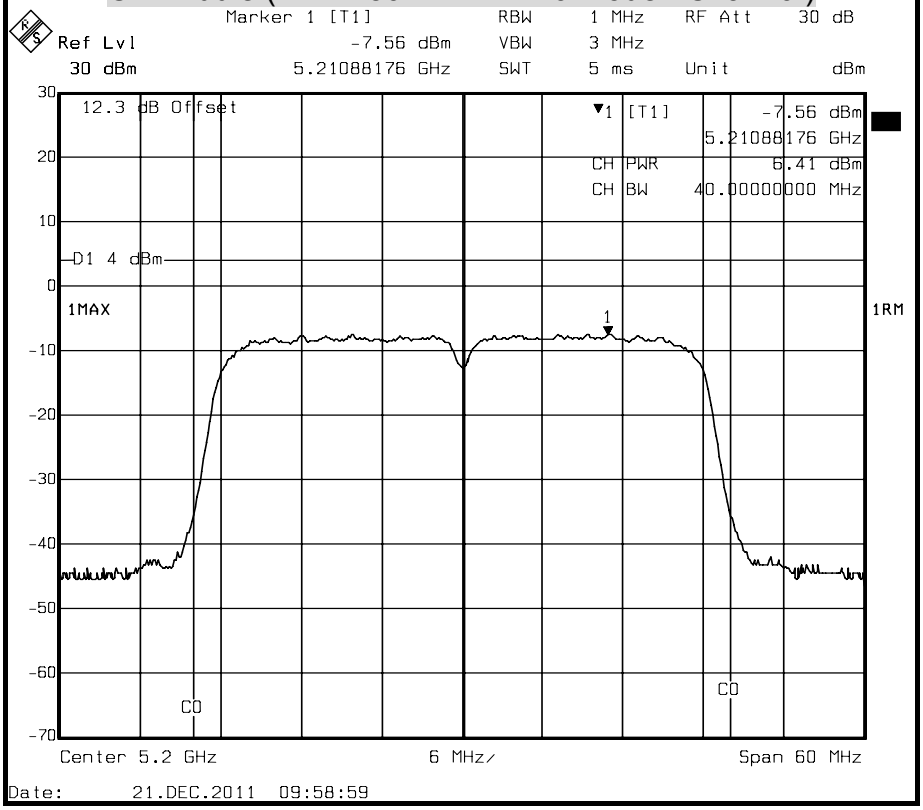
CH High ( IEEE 802.11n HT20 Mode / Chain 2 )



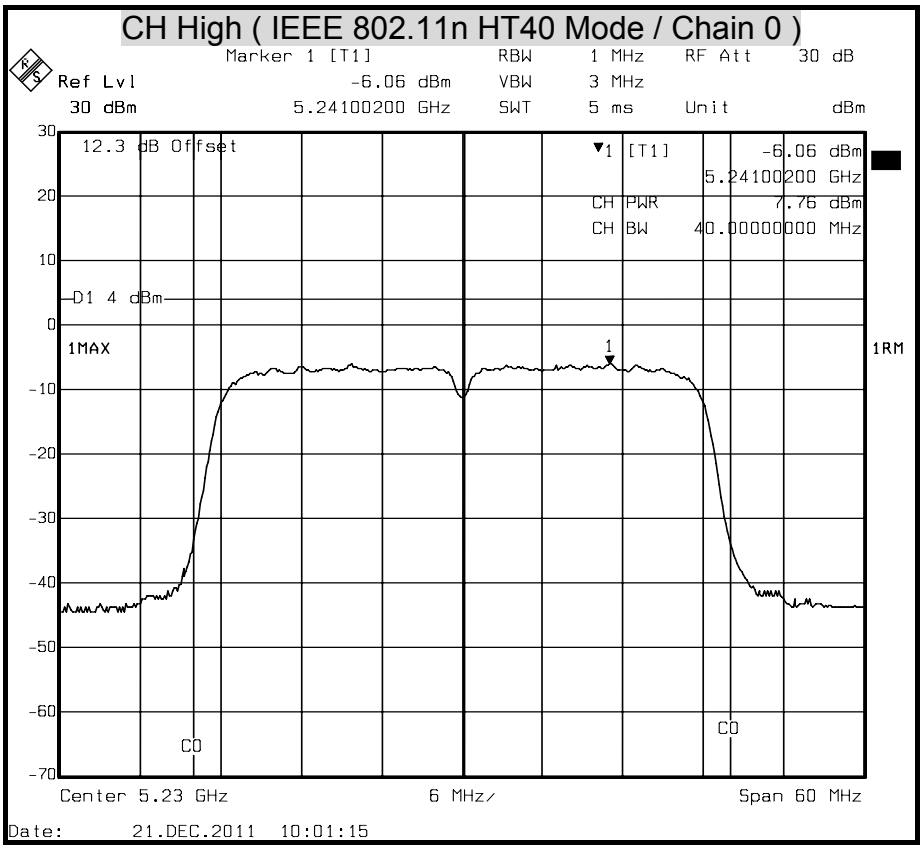
CH Low ( IEEE 802.11n HT40 Mode / Chain 0 )



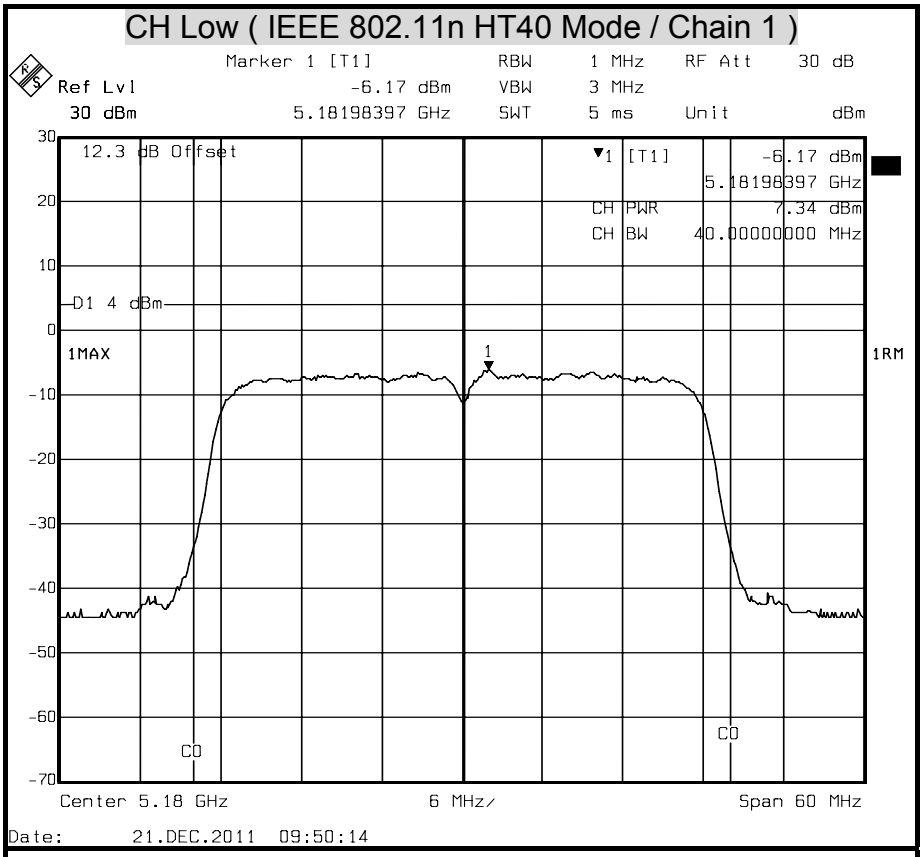

CH Middle ( IEEE 802.11n HT40 Mode / Chain 0 )



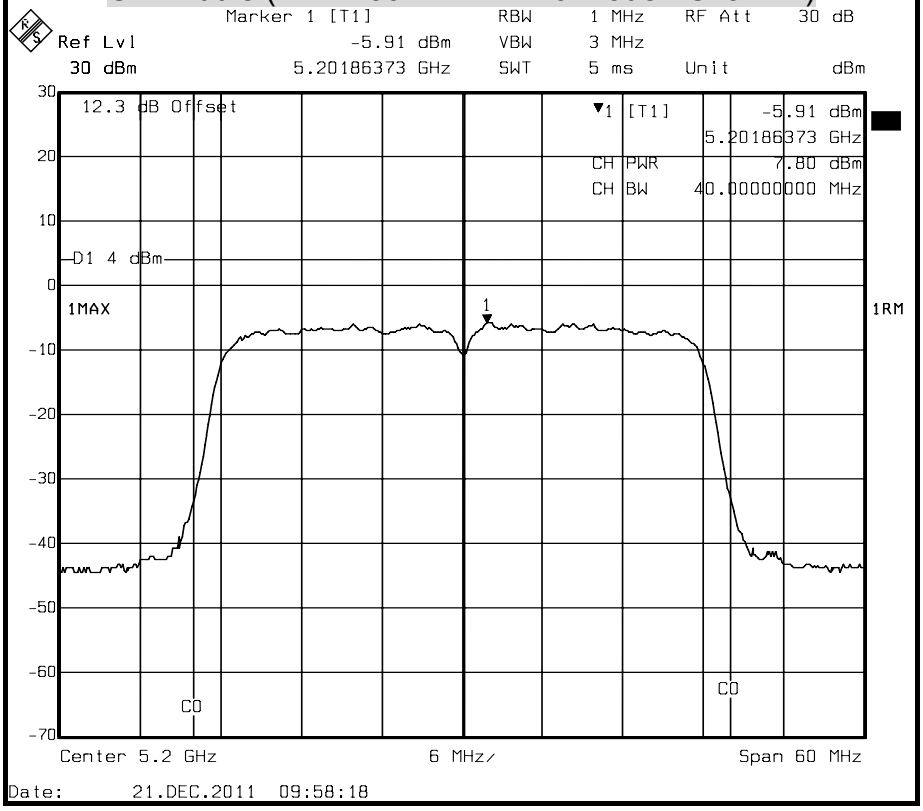
CH High ( IEEE 802.11n HT40 Mode / Chain 0 )



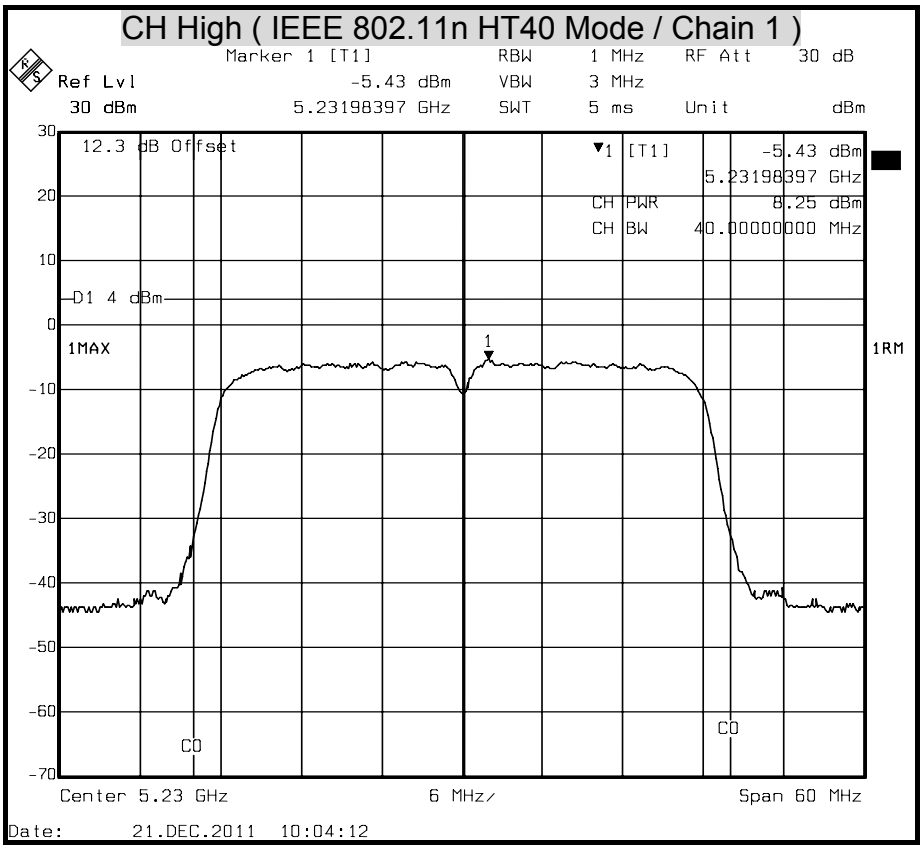
CH Low ( IEEE 802.11n HT40 Mode / Chain 1 )



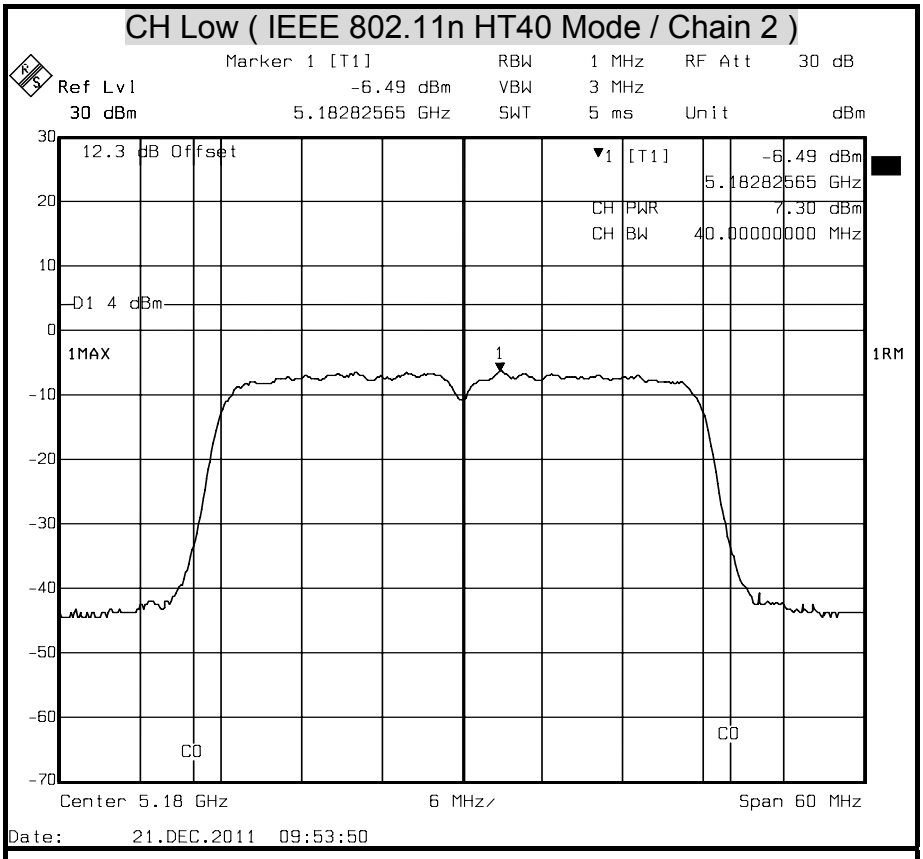

CH Middle ( IEEE 802.11n HT40 Mode / Chain 1 )



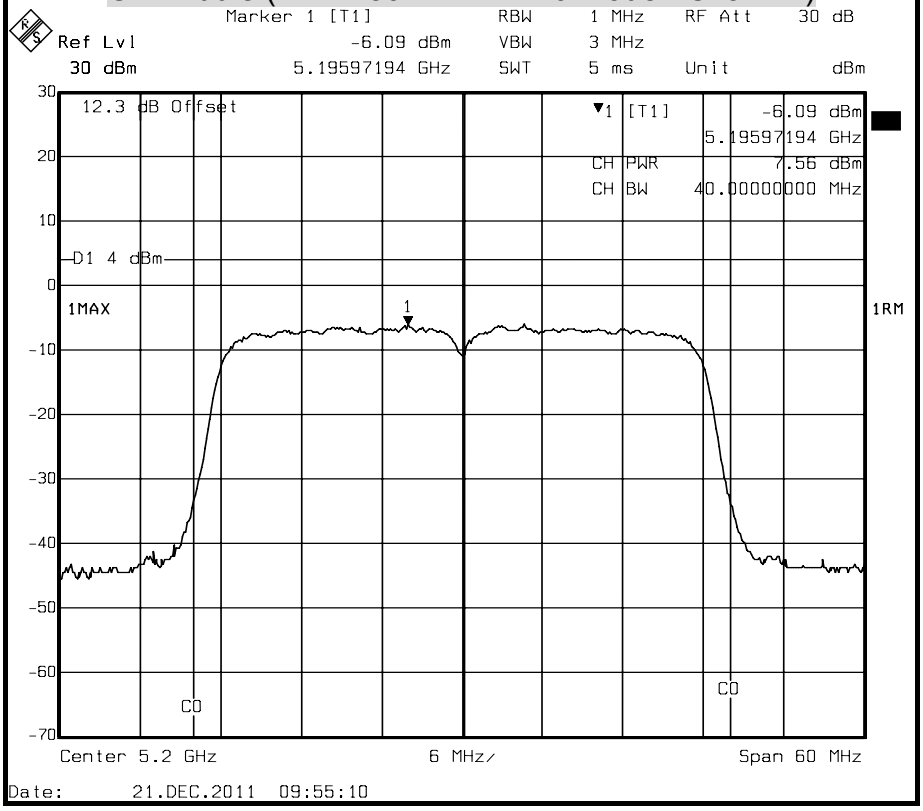
CH High ( IEEE 802.11n HT40 Mode / Chain 1 )



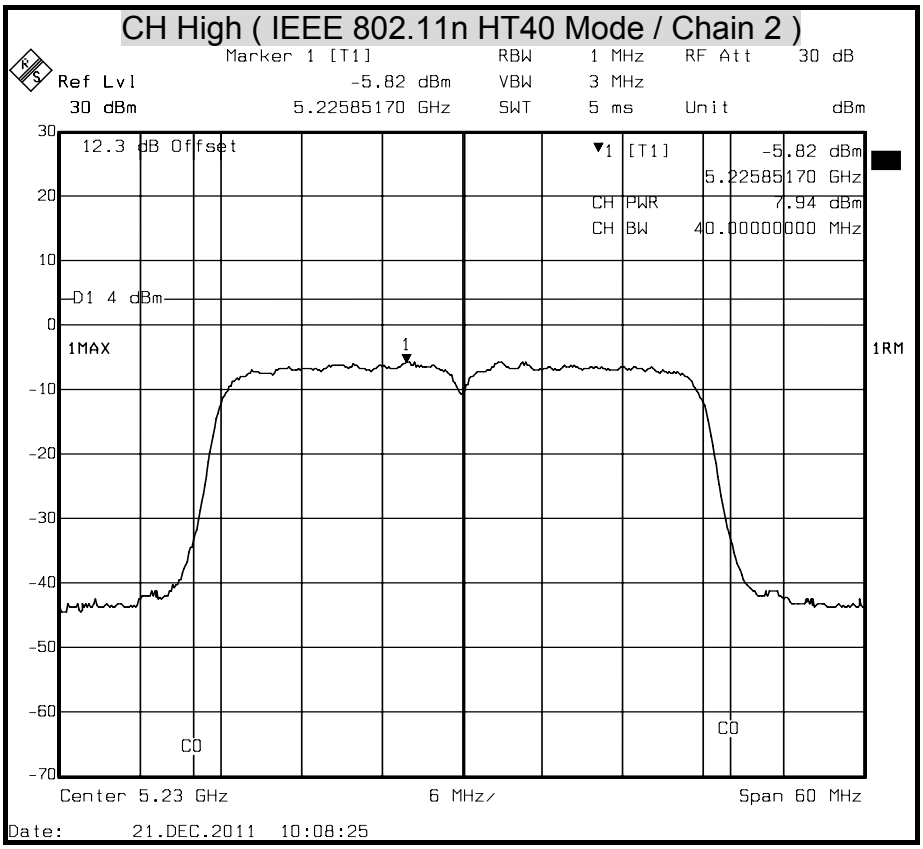
CH Low ( IEEE 802.11n HT40 Mode / Chain 2 )




CH Middle ( IEEE 802.11n HT40 Mode / Chain 2 )



CH High ( IEEE 802.11n HT40 Mode / Chain 2 )



## 7.3 PEAK POWER SPECTRAL DENSITY

**LIMITS**

§ 15.407 (a)

(1) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4dBm in any 1MHz band.

(2) For the band 5.25-5.35 GHz and 5.47-5725 GHz, the peak power spectral density shall not exceed 11dBm in any 1MHz band.

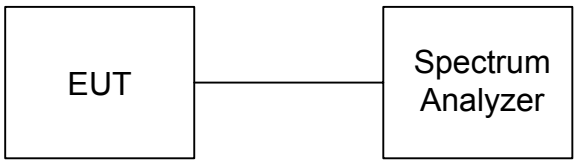
If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

**TEST EQUIPMENT**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | FSU | 200789 | --- | SEP. 29, 2012 |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year*

**TEST SETUP**




**TEST PROCEDURE**

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 1MHz, VBW = 3MHz, Span = Sweep= AUTO
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

## TEST RESULTS

External color：Black

**IEEE 802.11a Mode**

| Channel | Channel Frequency (MHz) | PPSD (dBm) | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|
| Low | 5180 | -5.880 | 4.00 | -9.88 | PASS |
| Middle | 5220 | -5.570 | | -9.57 | PASS |
| High | 5240 | -6.450 | | -10.45 | PASS |

***Remark:***

1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

**IEEE 802.11n HT20 Mode**

| Channel | Channel Frequency (MHz) | PPSD (dBm) | | | | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Tatol | | | |
| Low | 5180 | -4.220 | -4.610 | -5.380 | 0.06 | 1.10 | -1.04 | PASS |
| Middle | 5220 | -5.040 | -5.600 | -5.030 | -0.44 | | -1.54 | PASS |
| High | 5240 | -6.240 | -4.730 | -4.800 | -0.43 | | -1.53 | PASS |

***Remark:***

1. *At finial test to get the worst-case emission at 6.5Mbps*
2. *The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

**IEEE 802.11n HT40 Mode**

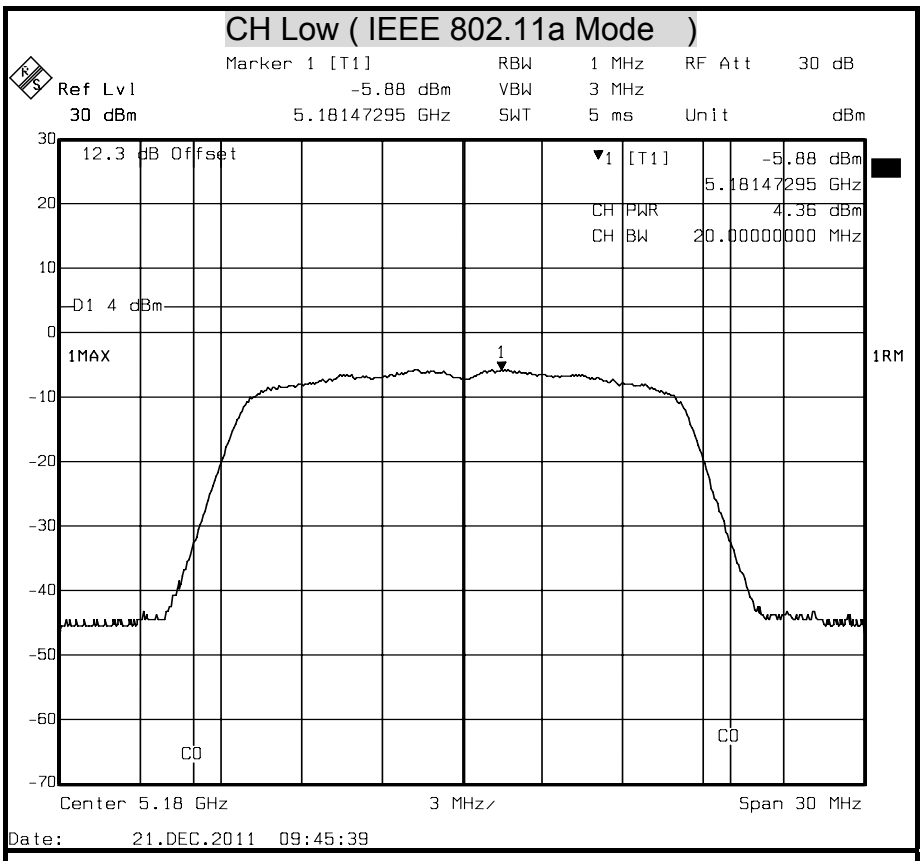
| Channel | Channel Frequency (MHz) | PPSD (dBm) | | | | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|---|---|---|
| | | Chain 0 | Chain 1 | Chain 2 | Tatol | | | |
| Low | 5180 | -10.790 | -6.170 | -6.490 | -2.60 | 1.10 | -3.70 | PASS |
| Middle | 5200 | -7.560 | -5.910 | -6.090 | -1.69 | | -2.79 | PASS |
| High | 5230 | -6.060 | -5.430 | -5.820 | -0.99 | | -2.09 | PASS |

***Remark:***

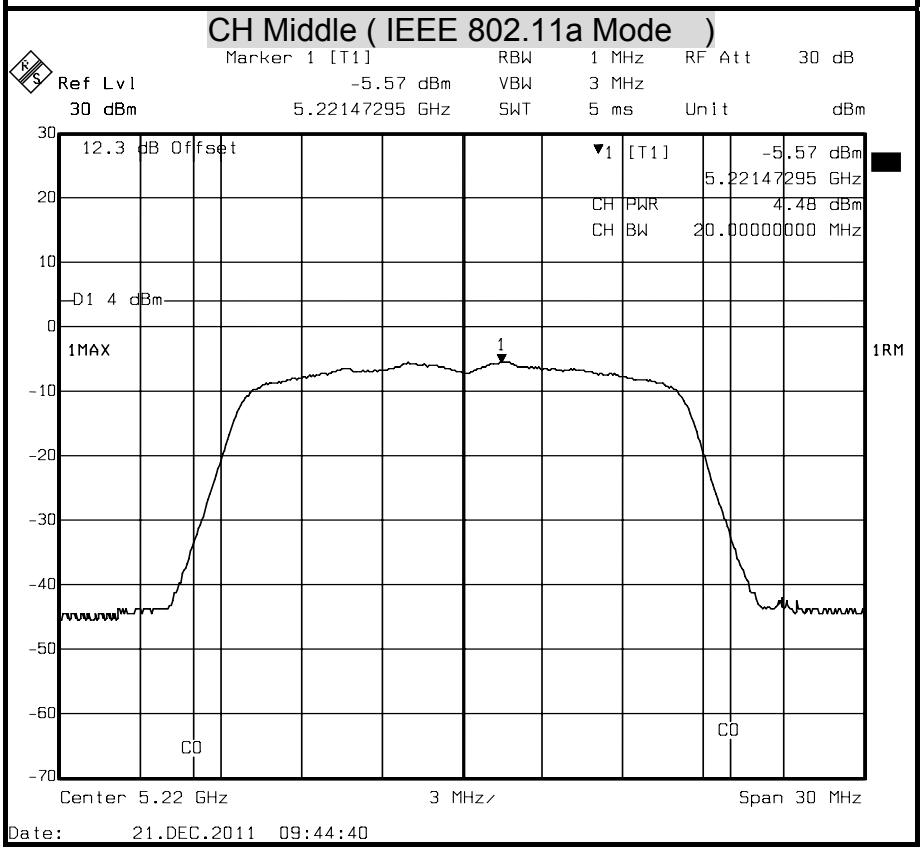
1. *At finial test to get the worst-case emission at 6.5Mbps*
2. *The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

## PEAK POWER SPECTRAL DENSITY

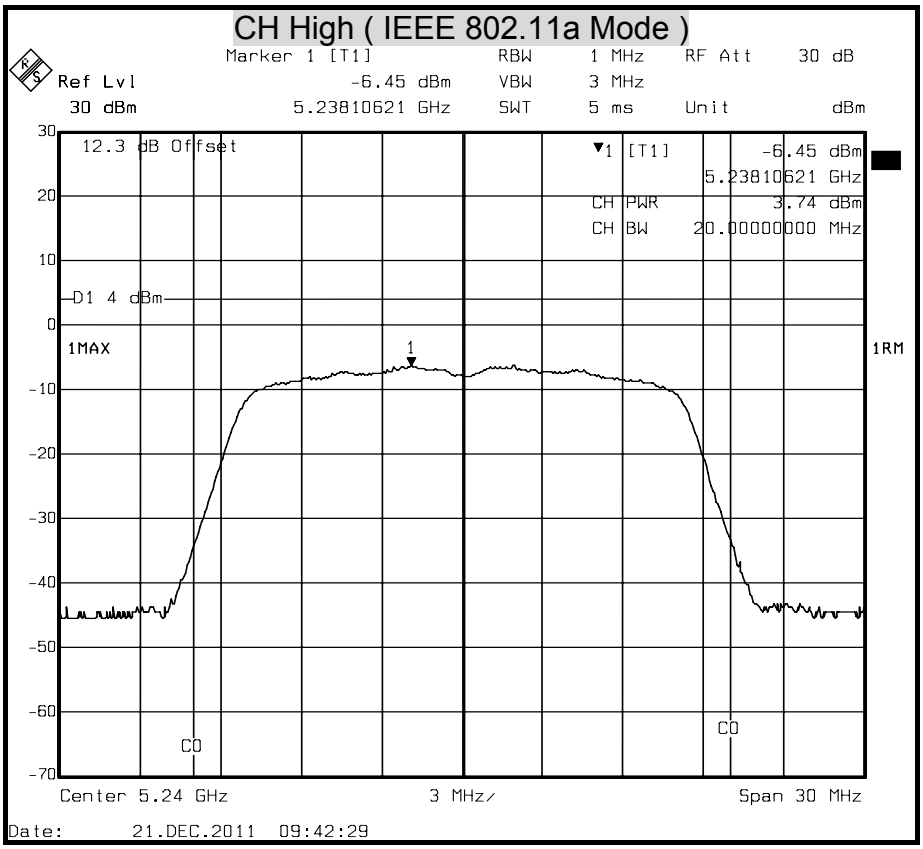
CH Low ( IEEE 802.11a Mode )



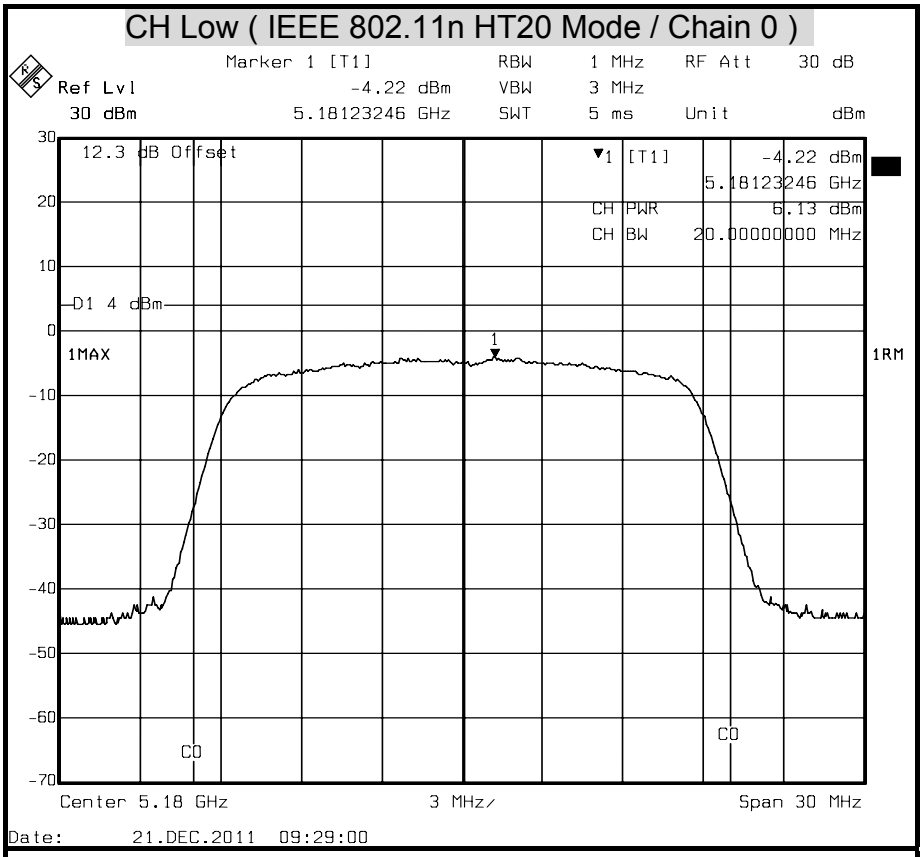

CH Middle ( IEEE 802.11a Mode )



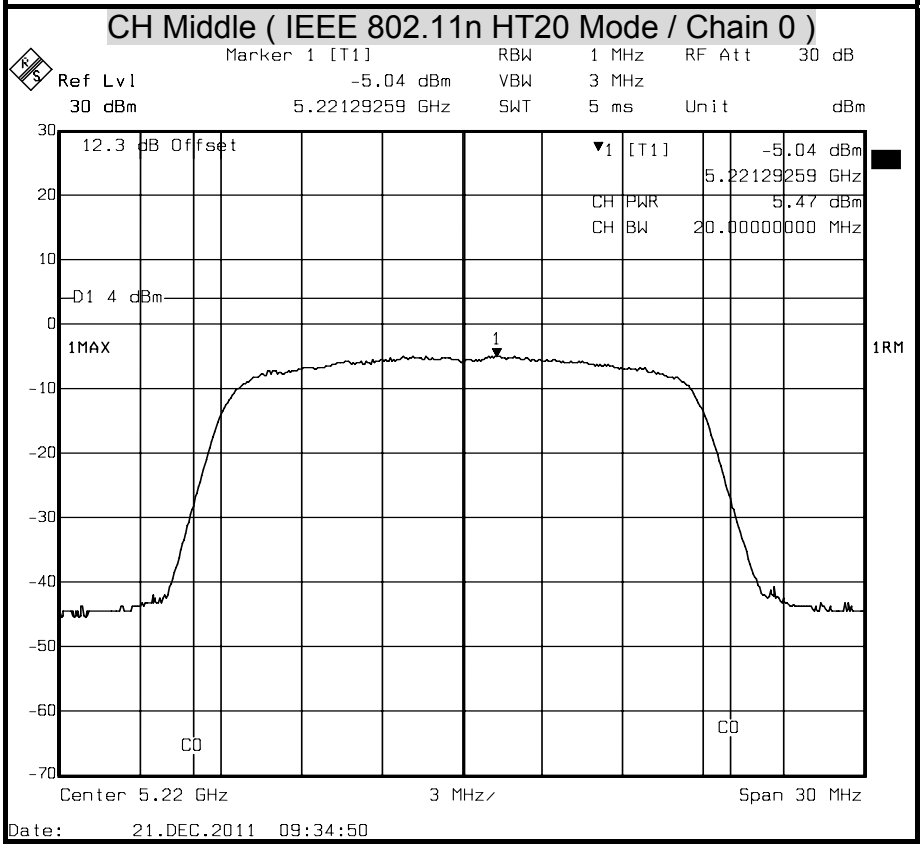
CH High ( IEEE 802.11a Mode )



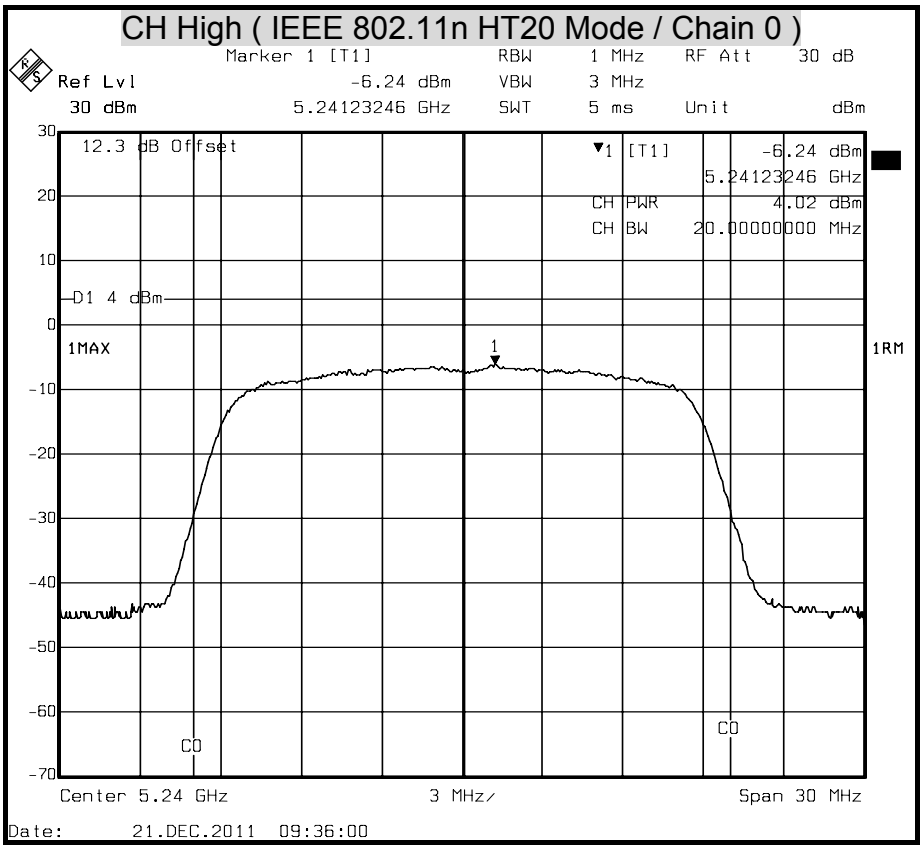
CH Low ( IEEE 802.11n HT20 Mode / Chain 0 )



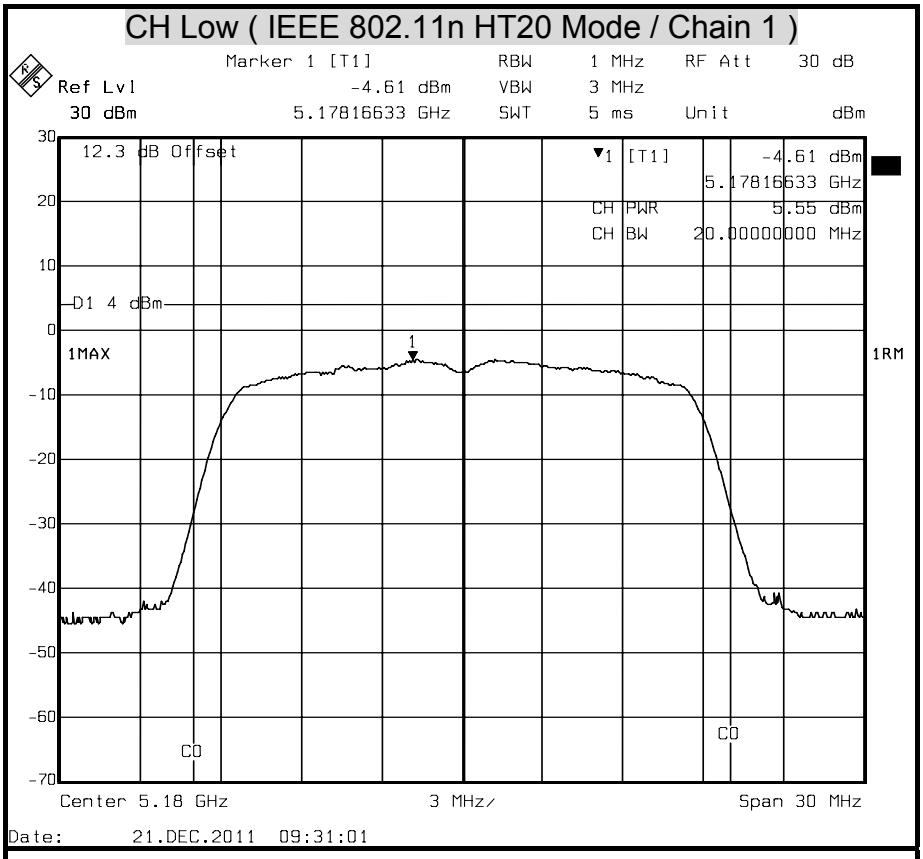

CH Middle ( IEEE 802.11n HT20 Mode / Chain 0 )



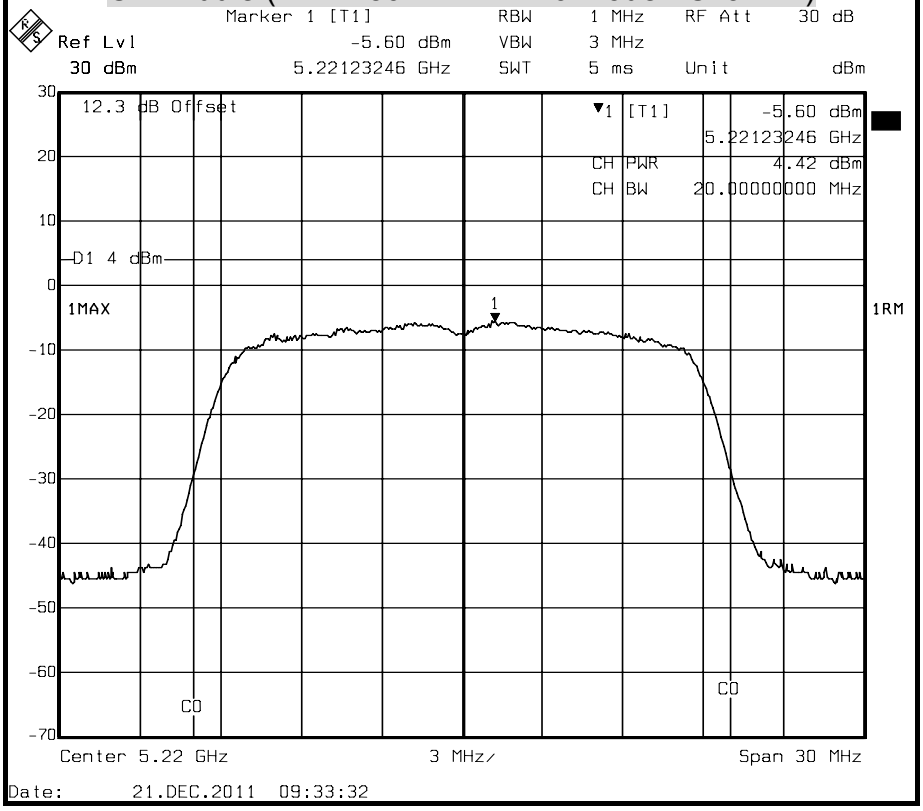
CH High ( IEEE 802.11n HT20 Mode / Chain 0 )



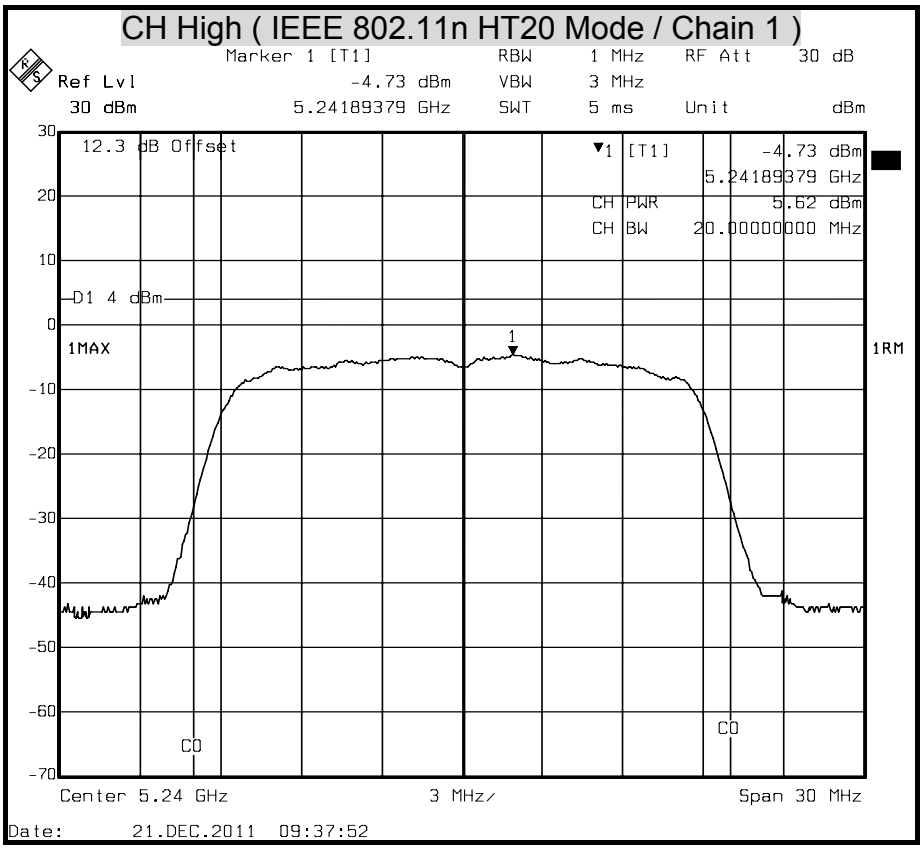
CH Low ( IEEE 802.11n HT20 Mode / Chain 1 )



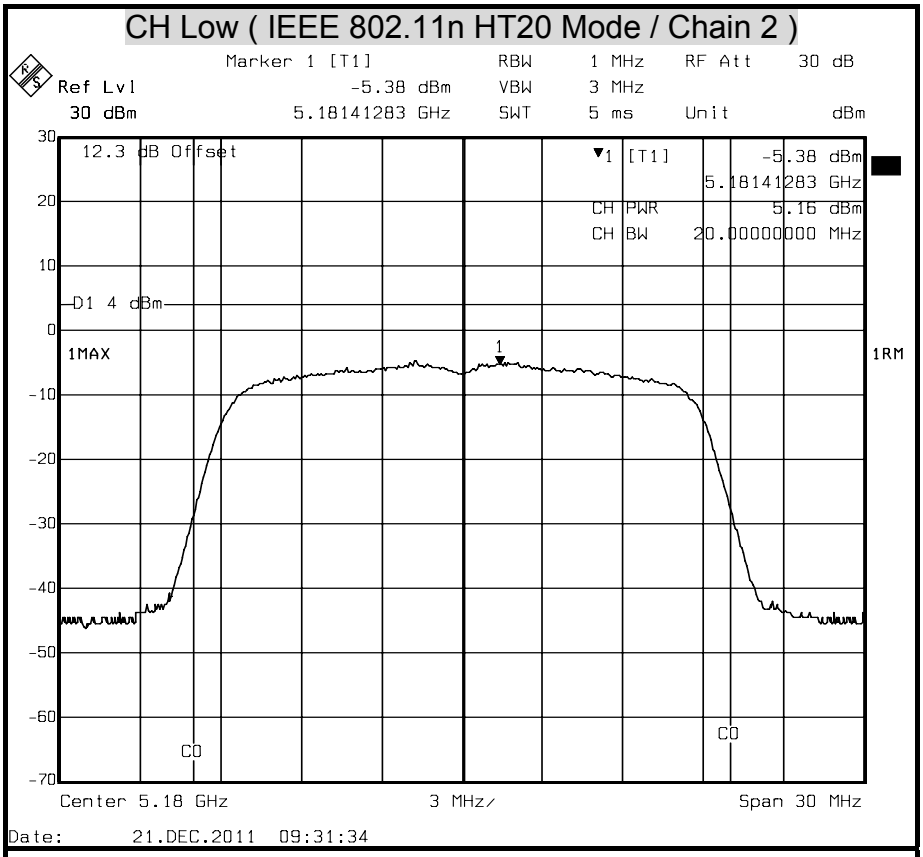

CH Middle ( IEEE 802.11n HT20 Mode / Chain 1 )



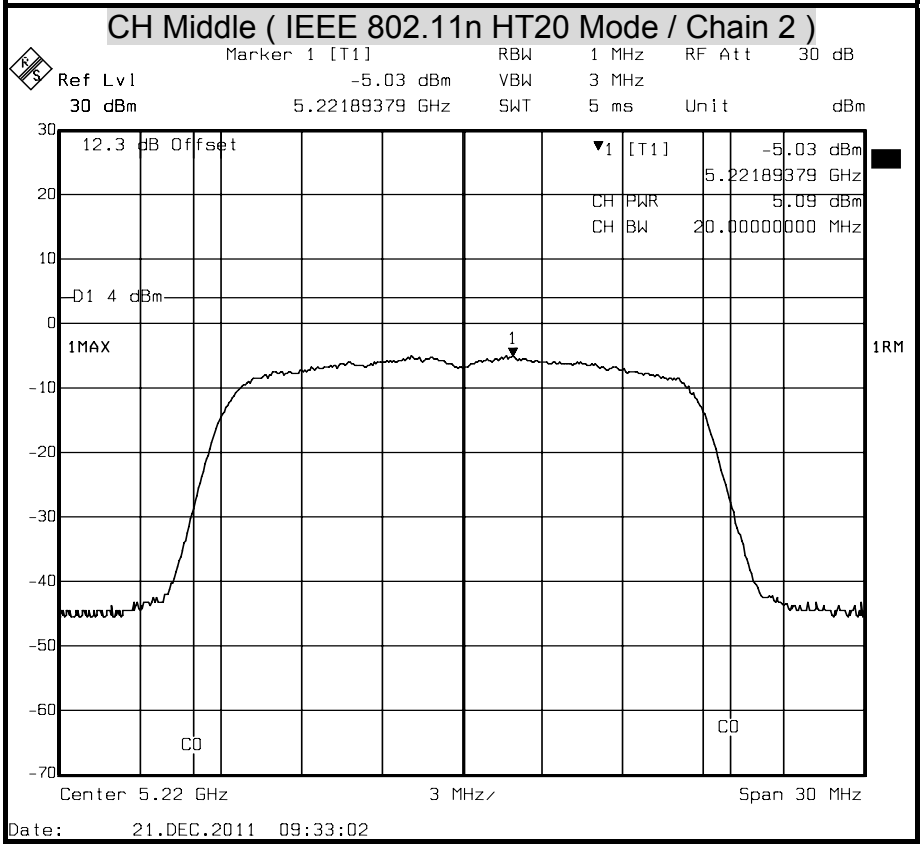
CH High ( IEEE 802.11n HT20 Mode / Chain 1 )



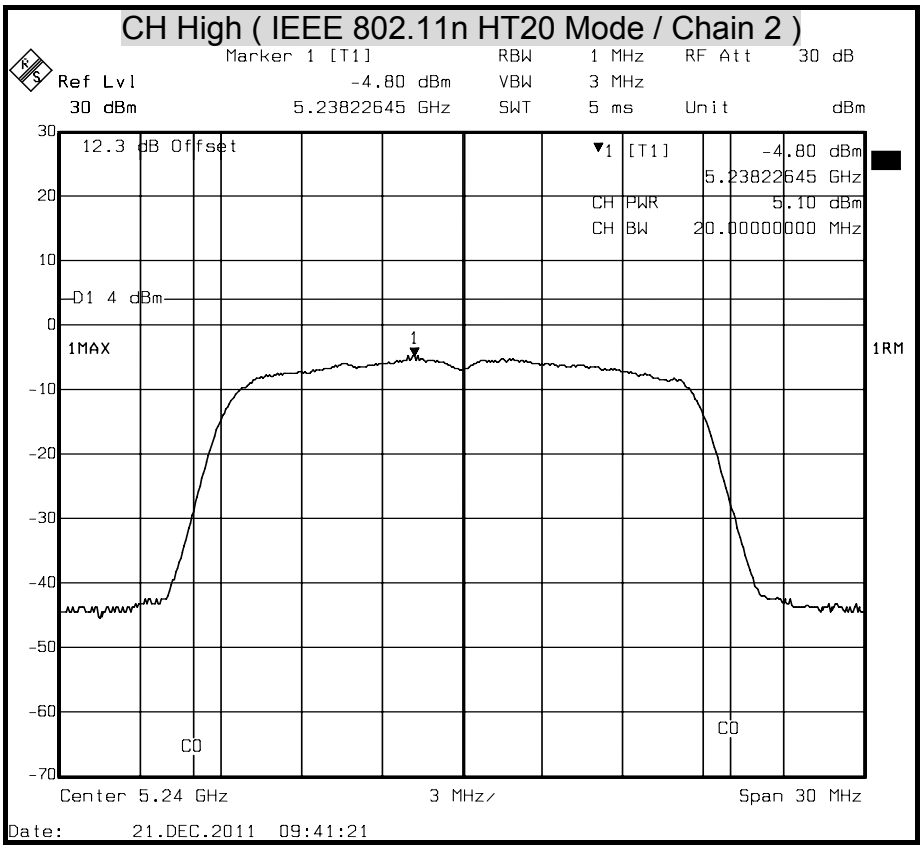
CH Low ( IEEE 802.11n HT20 Mode / Chain 2 )



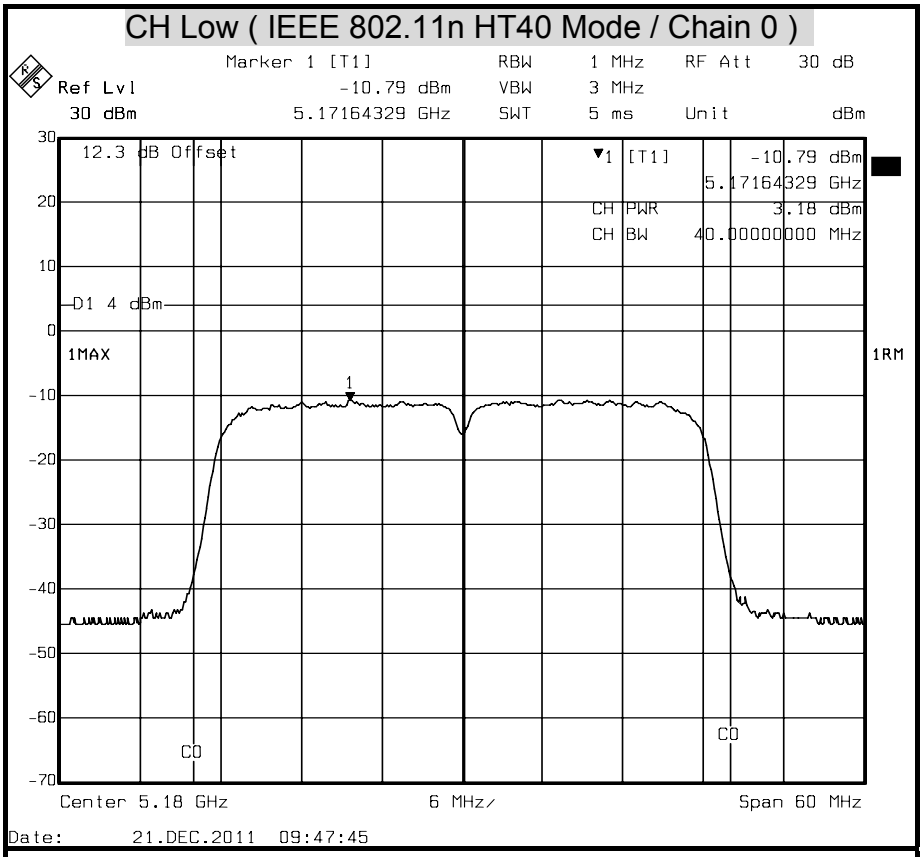

CH Middle ( IEEE 802.11n HT20 Mode / Chain 2 )



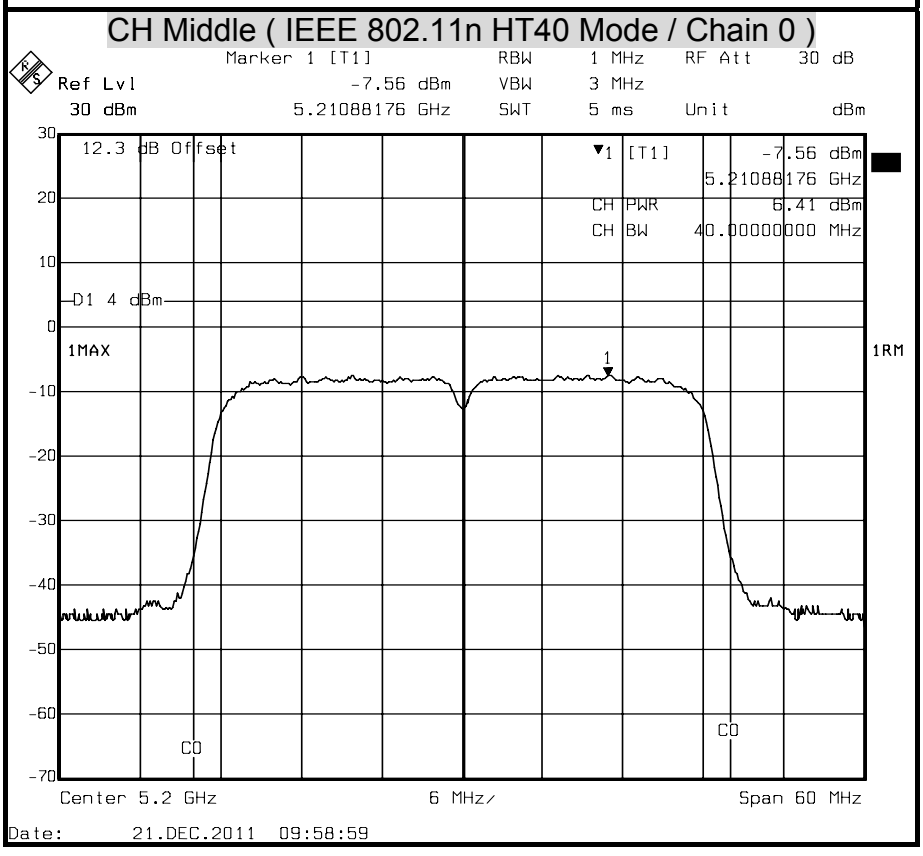
CH High ( IEEE 802.11n HT20 Mode / Chain 2 )



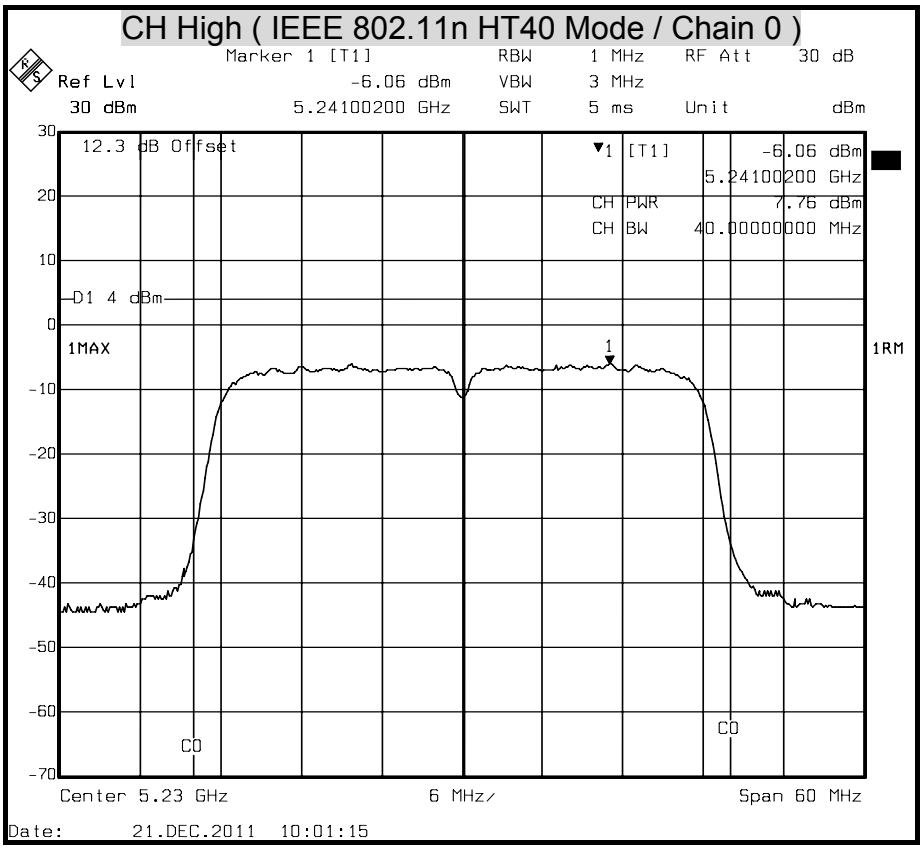
CH Low ( IEEE 802.11n HT40 Mode / Chain 0 )



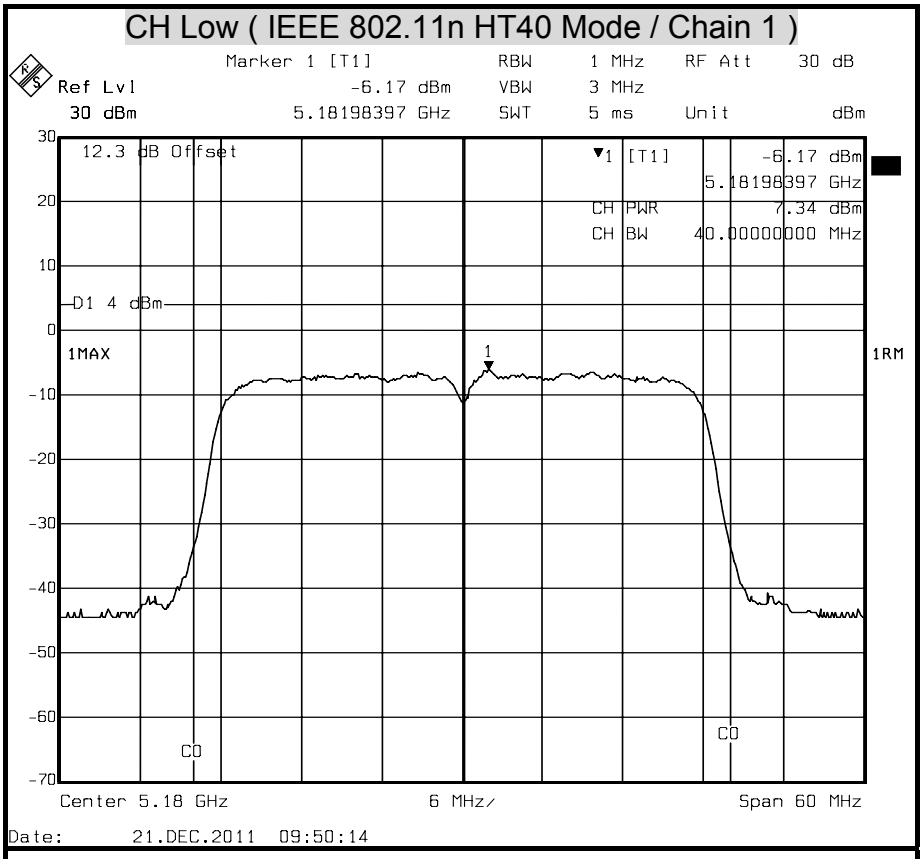

CH Middle ( IEEE 802.11n HT40 Mode / Chain 0 )



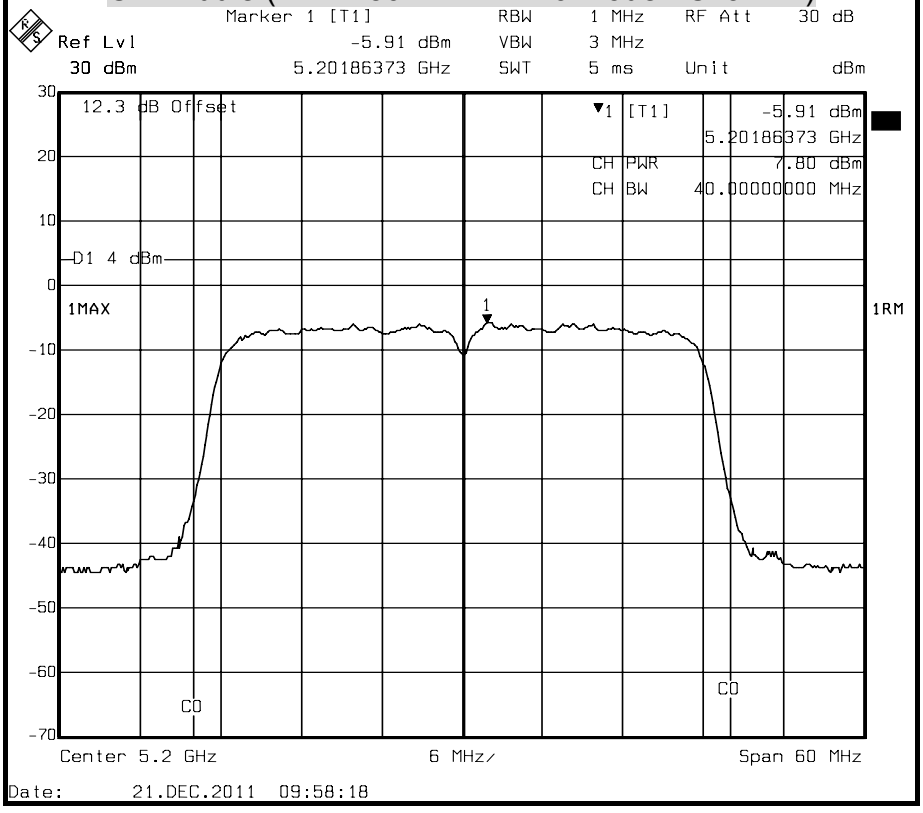
CH High ( IEEE 802.11n HT40 Mode / Chain 0 )



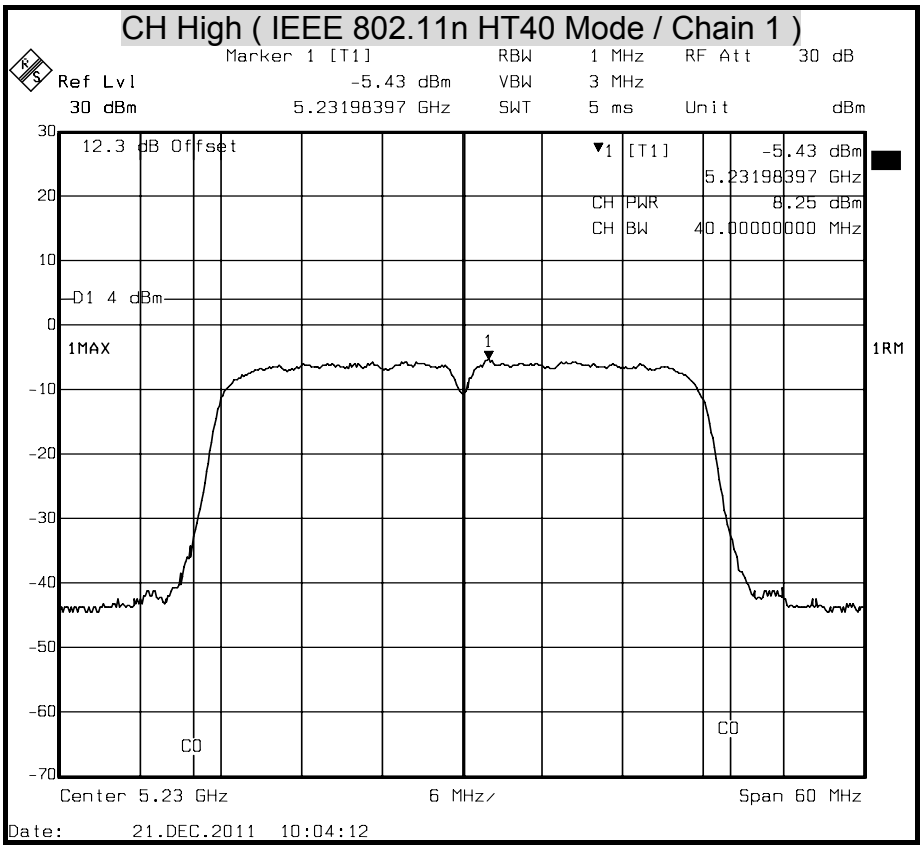
CH Low ( IEEE 802.11n HT40 Mode / Chain 1 )



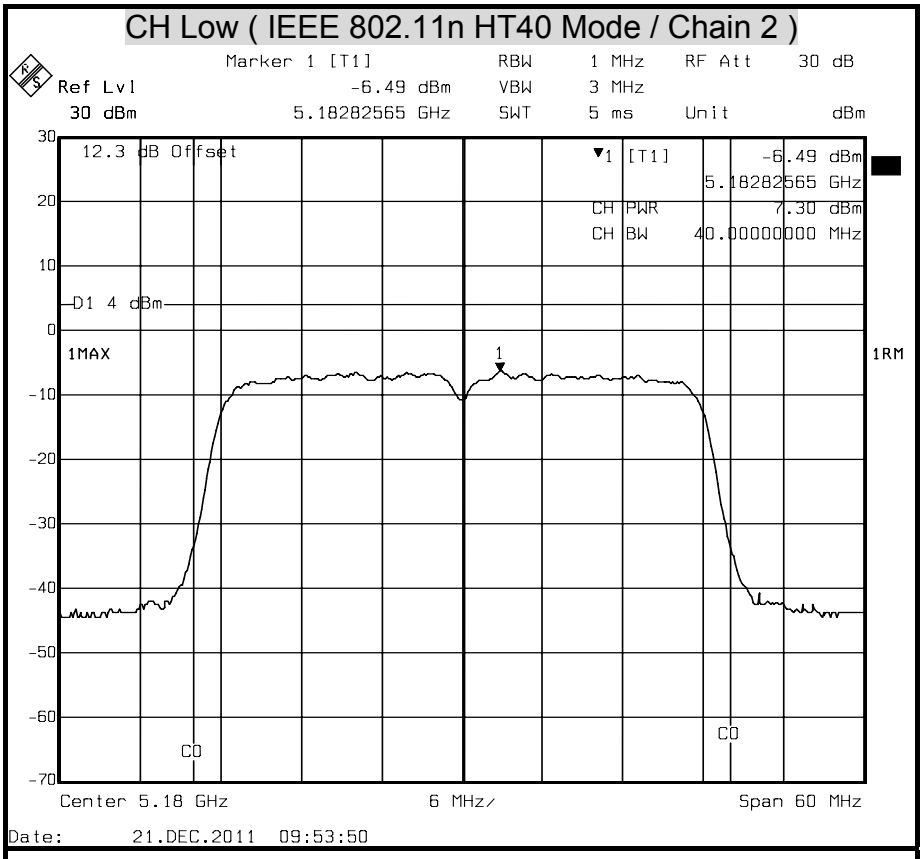

CH Middle ( IEEE 802.11n HT40 Mode / Chain 1 )



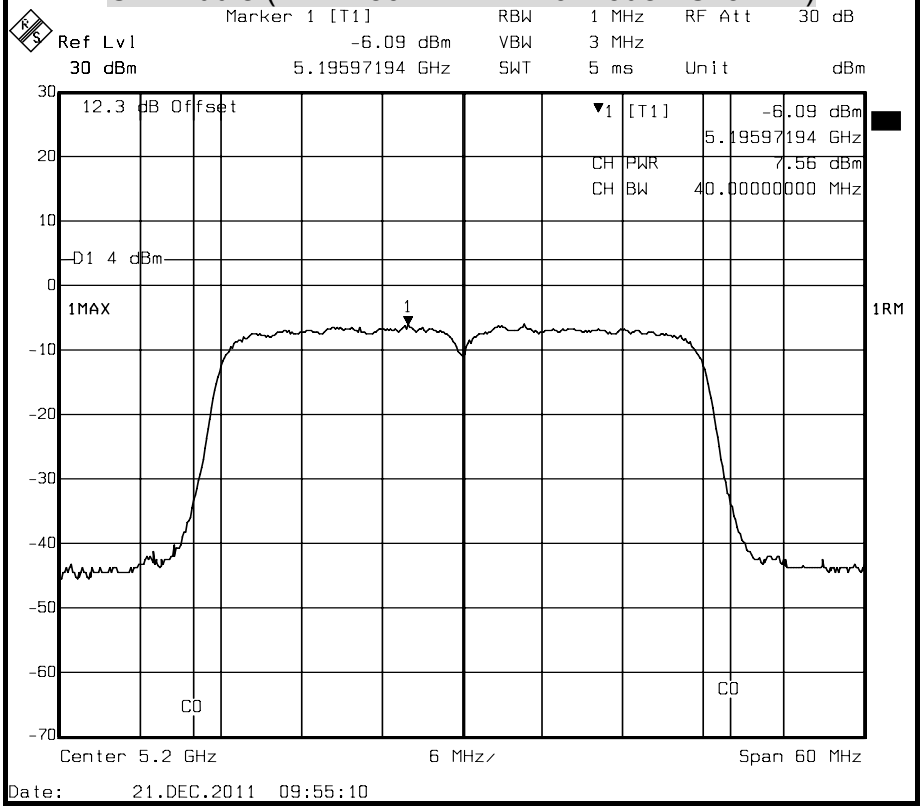
CH High ( IEEE 802.11n HT40 Mode / Chain 1 )



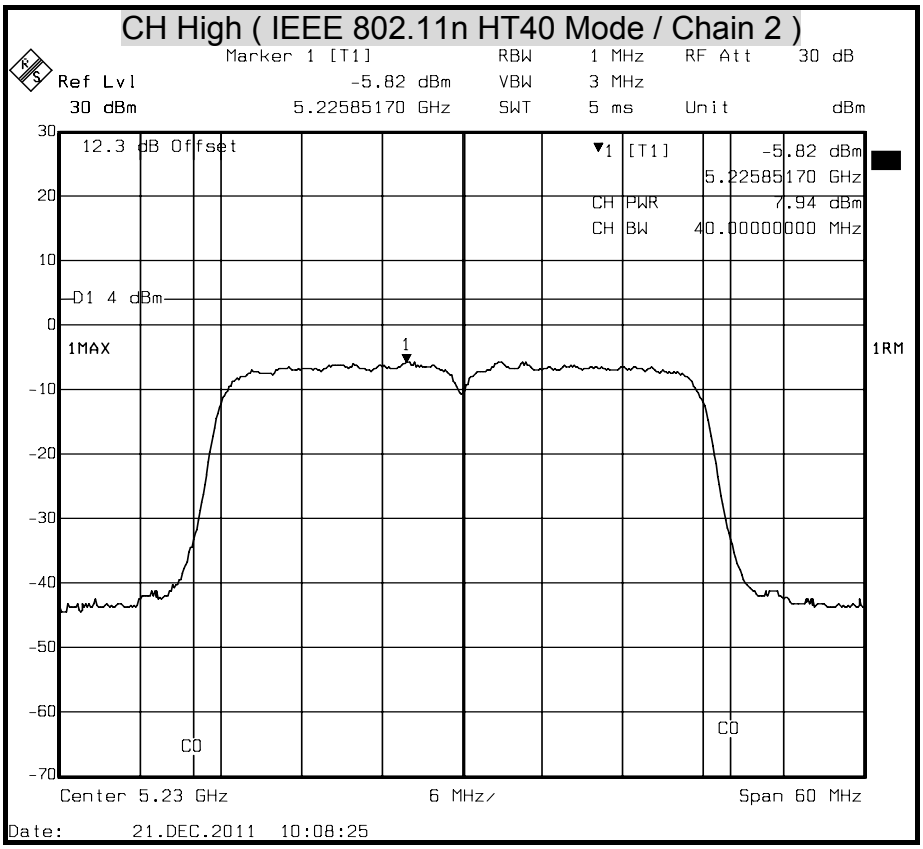
CH Low ( IEEE 802.11n HT40 Mode / Chain 2 )




CH Middle ( IEEE 802.11n HT40 Mode / Chain 2 )



CH High ( IEEE 802.11n HT40 Mode / Chain 2 )



## 7.4 PEAK EXCURSION

**LIMITS**

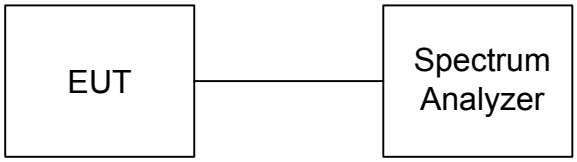
§ 15.407 (a) (6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**TEST EQUIPMENT**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSEK 30 | 835253/002 | SEP. 29, 2012 |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year*

**TEST SETUP**




**TEST PROCEDURE**

The test is performed in accordance with <FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices> – Part 15, Subpart E, August 2002.

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to spectrum.
3. Trace A, Set RBW =1MHz, VBW = 3MHz, Span > 26dB Bandwidth, Max. hold.
   Trace B, Set RBW =1MHz, VBW = 3MHz, Span > 26dB Bandwidth, Setup sample detector and power average mode, to scan 100 times with average.
4. Delta Mark trace A Maximum frequency and trace B same frequency.
5. Repeat the above procedure until measurements for all frequencies were complete.

**TEST RESULTS**

External color：Black

**IEEE 802.11a Mode**

| Channel | Channel Frequency (MHz) | Peak Excursion (dB) | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|
| Low | 5180 | 6.51 | 13.00 | -6.49 | PASS |
| Middle | 5220 | 7.14 | | -5.86 | PASS |
| High | 5240 | 6.63 | | -6.37 | PASS |

***Remark:***

*1. At finial test to get the worst-case emission at 6Mbps.*

*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

**IEEE 802.11n HT20 Mode / Chain 0**

| Channel | Channel Frequency (MHz) | Peak Excursion (dB) | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|
| Low | 5180 | 7.77 | 13.00 | -5.23 | PASS |
| Middle | 5220 | 7.40 | | -5.60 | PASS |
| High | 5240 | 7.00 | | -6.00 | PASS |

***Remark:***

*1. At finial test to get the worst-case emission at 6.5Mbps.*
*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

**IEEE 802.11n HT20 Mode / Chain 1**

| Channel | Channel Frequency (MHz) | Peak Excursion (dB) | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|
| Low | 5180 | 8.23 | 13.00 | -4.77 | PASS |
| Middle | 5220 | 9.00 | | -4.00 | PASS |
| High | 5240 | 8.26 | | -4.74 | PASS |

***Remark:***

*1. At finial test to get the worst-case emission at 6.5Mbps.*
*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

**IEEE 802.11n HT20 Mode / Chain 2**

| Channel | Channel Frequency (MHz) | Peak Excursion (dB) | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|
| Low | 5180 | 7.34 | 13.00 | -5.66 | PASS |
| Middle | 5220 | 6.97 | | -6.03 | PASS |
| High | 5240 | 7.19 | | -5.81 | PASS |

***Remark:***

*1. At finial test to get the worst-case emission at 6.5Mbps.*
*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

**IEEE 802.11n HT40 Mode / Chain 0**

| Channel | Channel Frequency (MHz) | Peak Excursion (dB) | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|
| Low | 5180 | 7.51 | 13.00 | -5.49 | PASS |
| Middle | 5200 | 7.13 | | -5.87 | PASS |
| High | 5230 | 7.67 | | -5.33 | PASS |

***Remark:***

*1. At finial test to get the worst-case emission at 6.5Mbps.*
*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

**IEEE 802.11n HT40 Mode / Chain 1**

| Channel | Channel Frequency (MHz) | Peak Excursion (dB) | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|
| Low | 5180 | 8.50 | 13.00 | -4.50 | PASS |
| Middle | 5200 | 8.31 | | -4.69 | PASS |
| High | 5230 | 8.47 | | -4.53 | PASS |

***Remark:***

*1. At finial test to get the worst-case emission at 6.5Mbps.*
*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

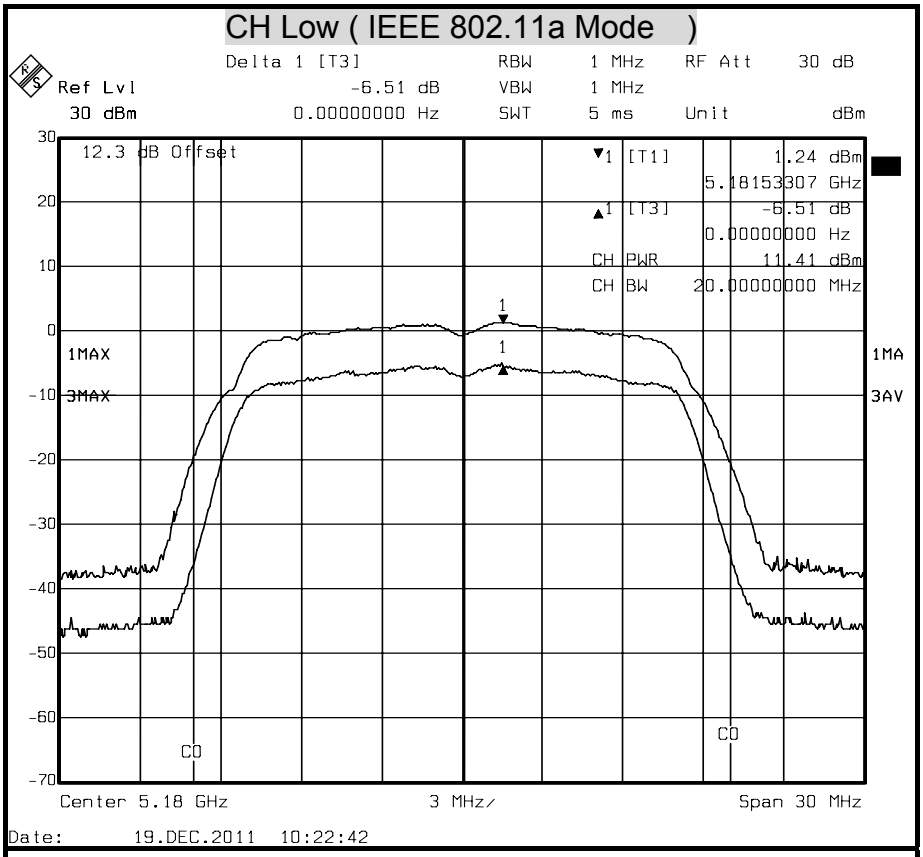
**IEEE 802.11n HT40 Mode / Chain 2**

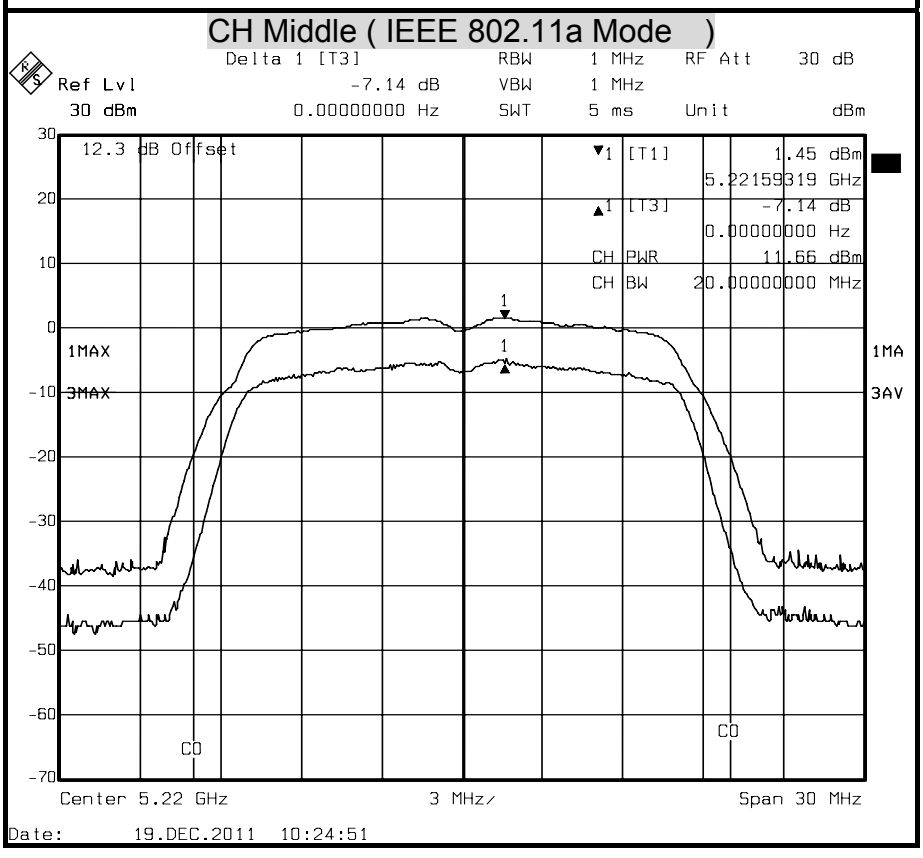
| Channel | Channel Frequency (MHz) | Peak Excursion (dB) | Limit (dBm) | Margin (dB) | Pass / Fail |
|---|---|---|---|---|---|
| Low | 5180 | 7.92 | 13.00 | -5.08 | PASS |
| Middle | 5200 | 7.61 | | -5.39 | PASS |
| High | 5230 | 8.22 | | -4.78 | PASS |

***Remark:***

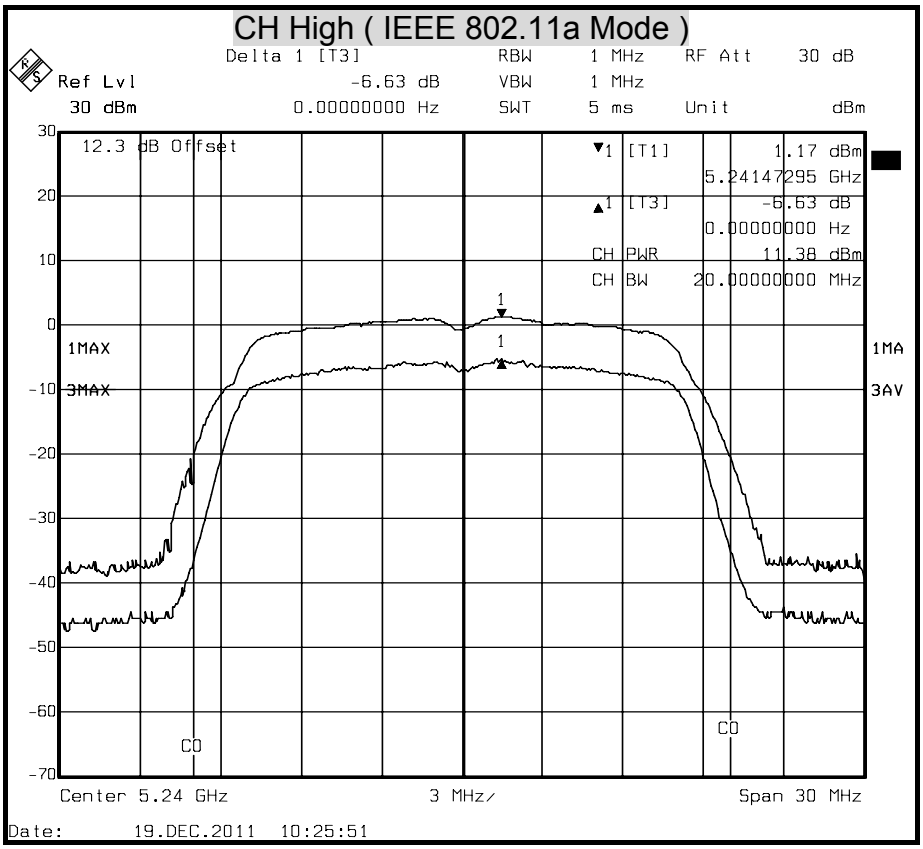
*1. At finial test to get the worst-case emission at 6.5Mbps.*
*2. The cable assembly insertion loss of 12.3dB (including 10 dB pad and 2.3 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.*

## PEAK EXCURSION

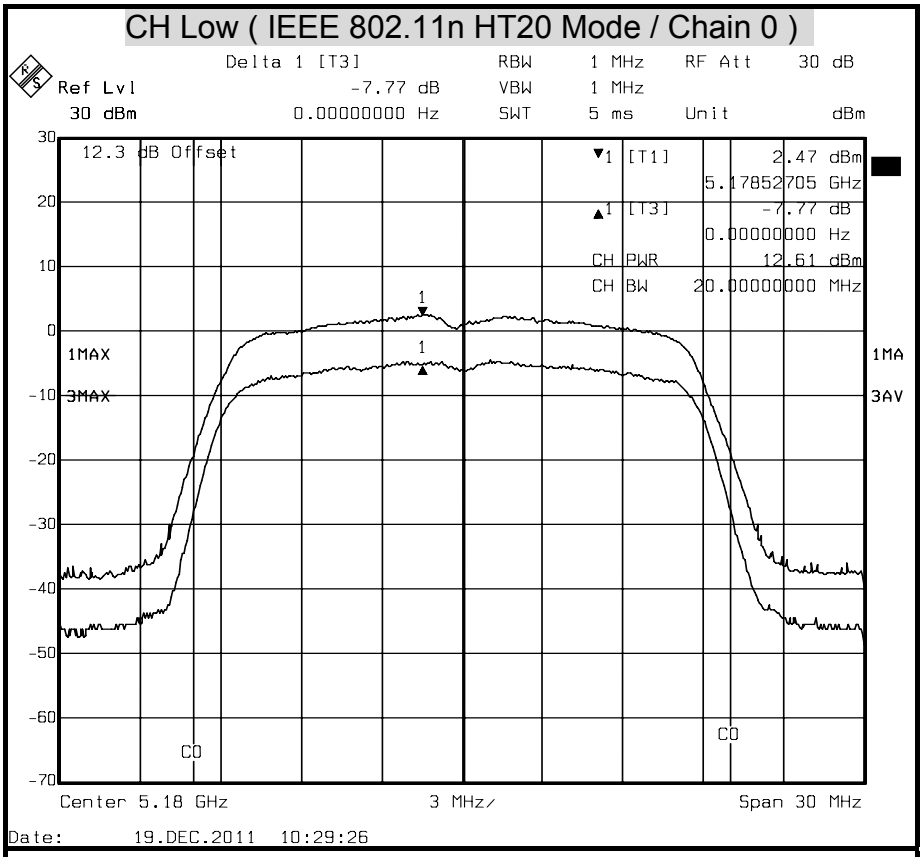


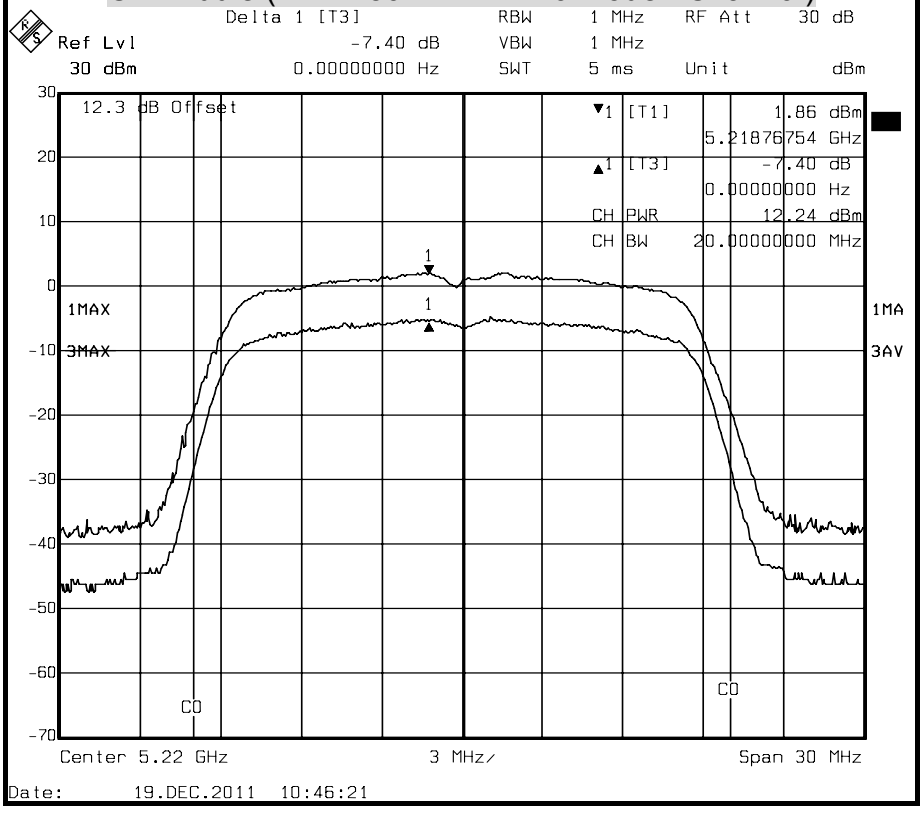
CH High ( IEEE 802.11a Mode )



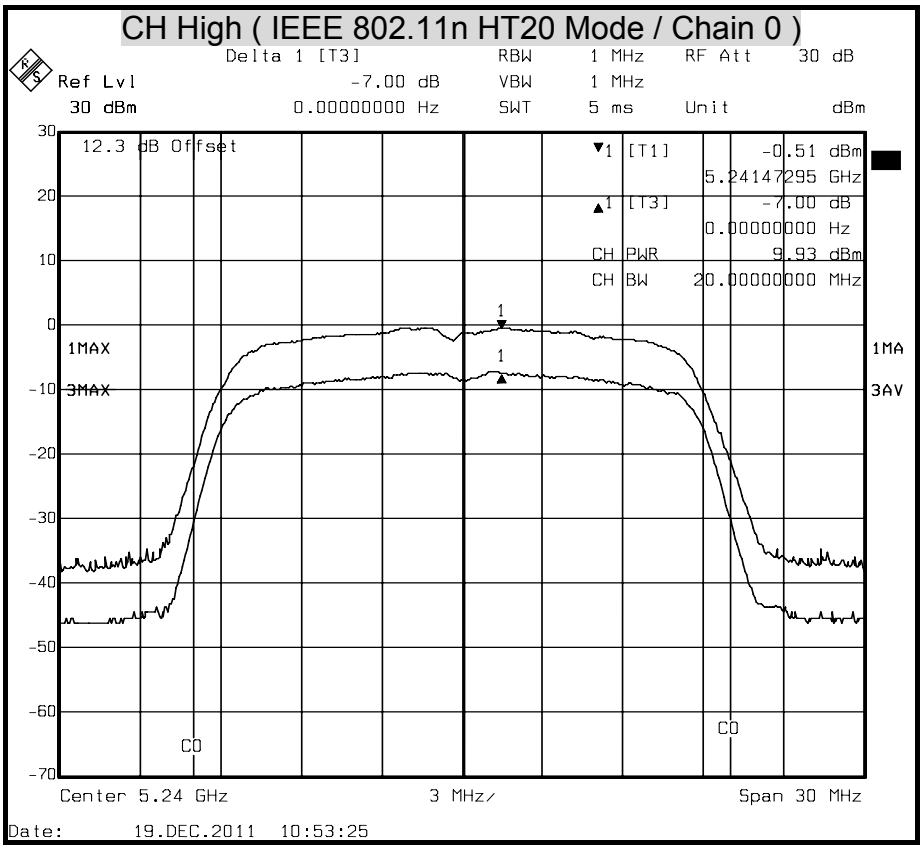
CH Low ( IEEE 802.11n HT20 Mode / Chain 0 )



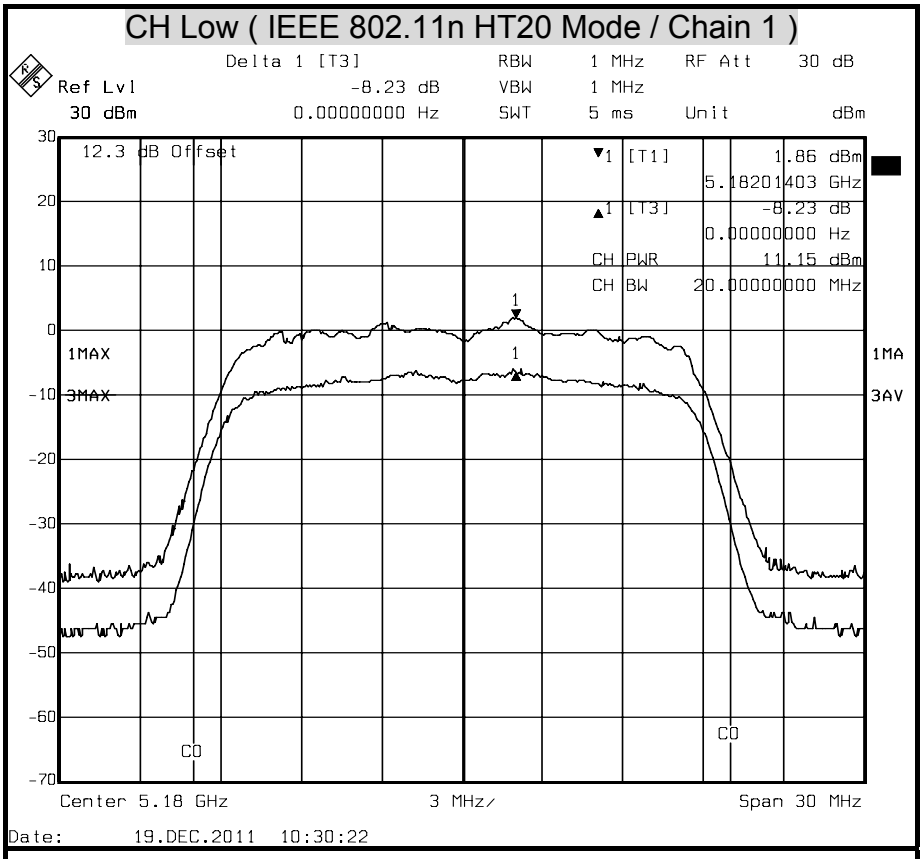

CH Middle ( IEEE 802.11n HT20 Mode / Chain 0 )



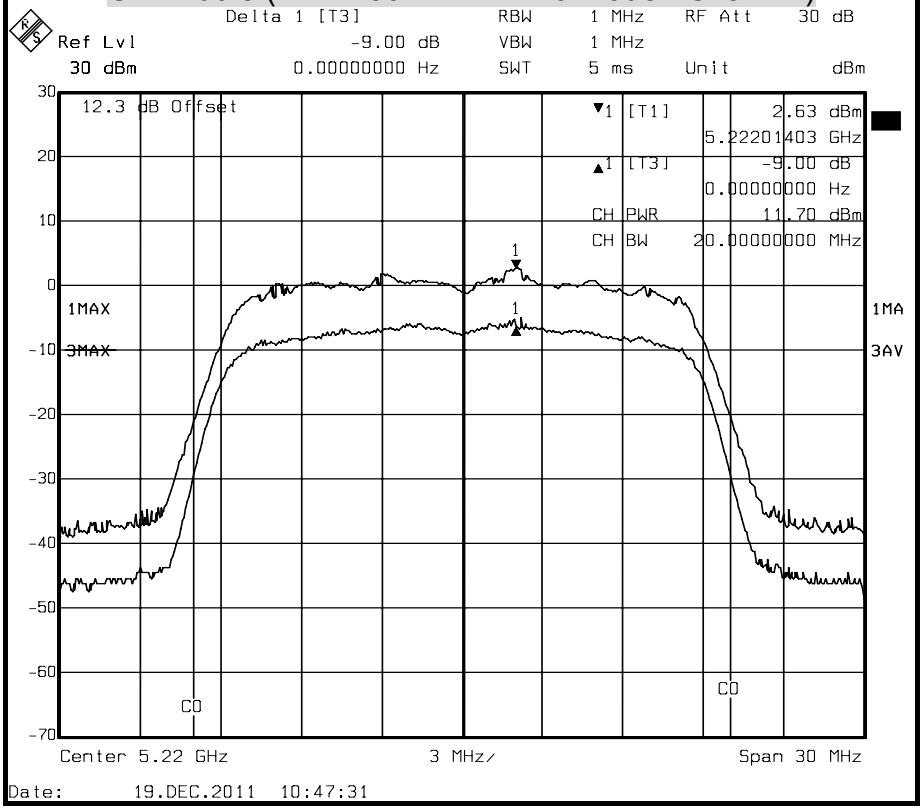
CH High ( IEEE 802.11n HT20 Mode / Chain 0 )



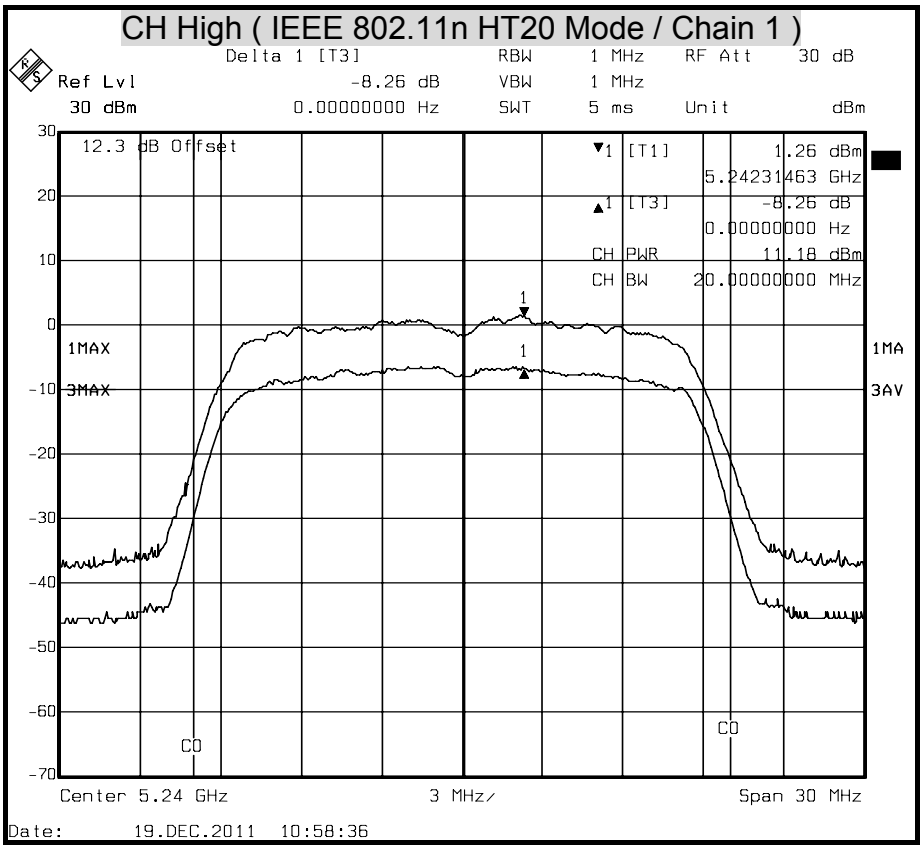
CH Low ( IEEE 802.11n HT20 Mode / Chain 1 )



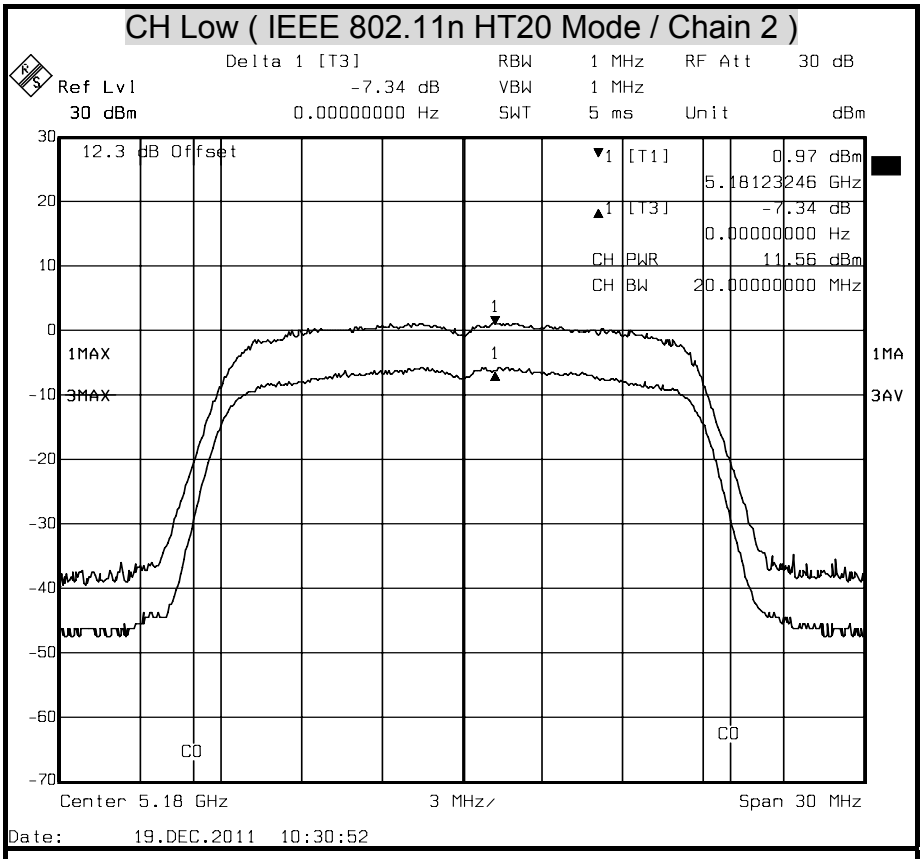

CH Middle ( IEEE 802.11n HT20 Mode / Chain 1 )



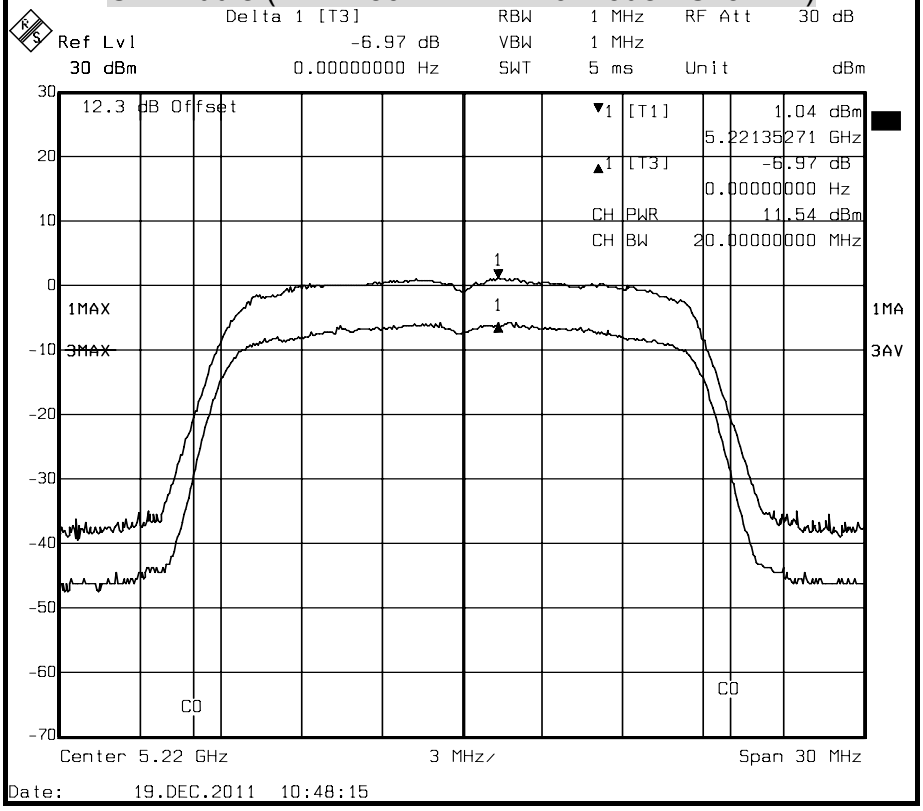
CH High ( IEEE 802.11n HT20 Mode / Chain 1 )



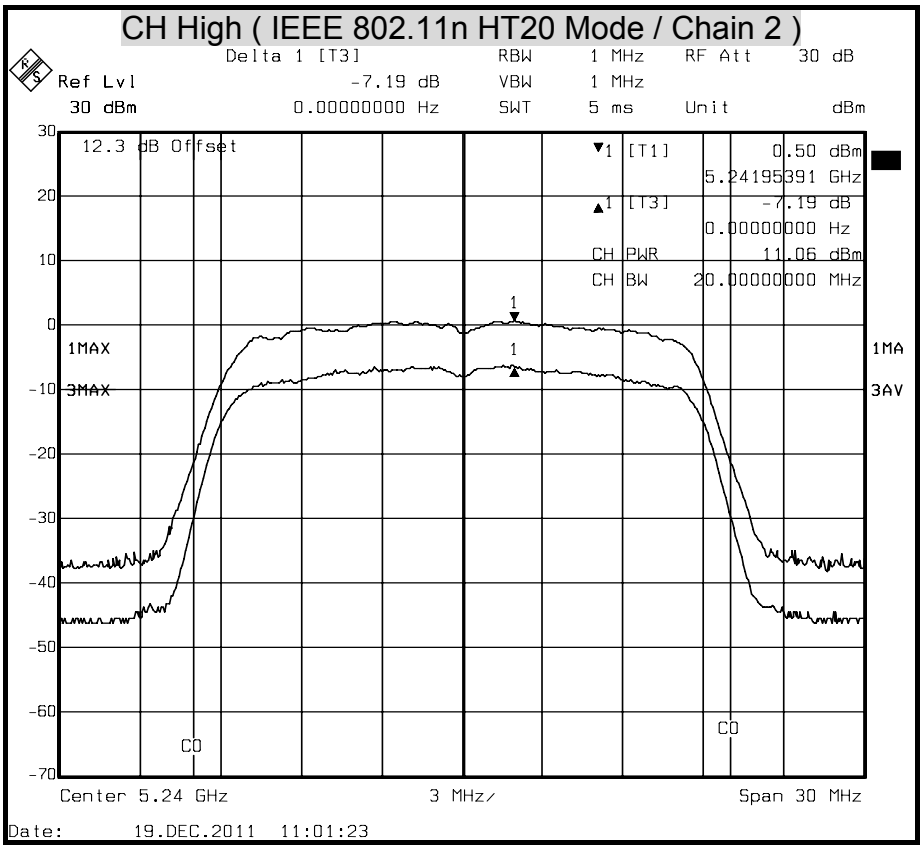
CH Low ( IEEE 802.11n HT20 Mode / Chain 2 )



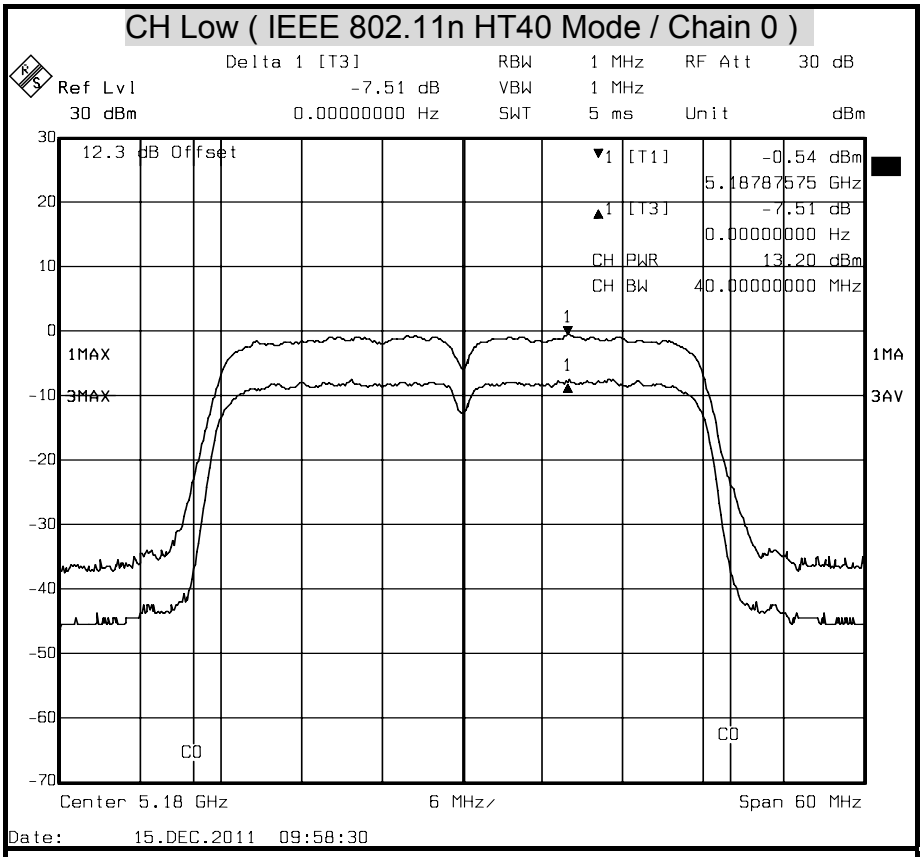

CH Middle ( IEEE 802.11n HT20 Mode / Chain 2 )



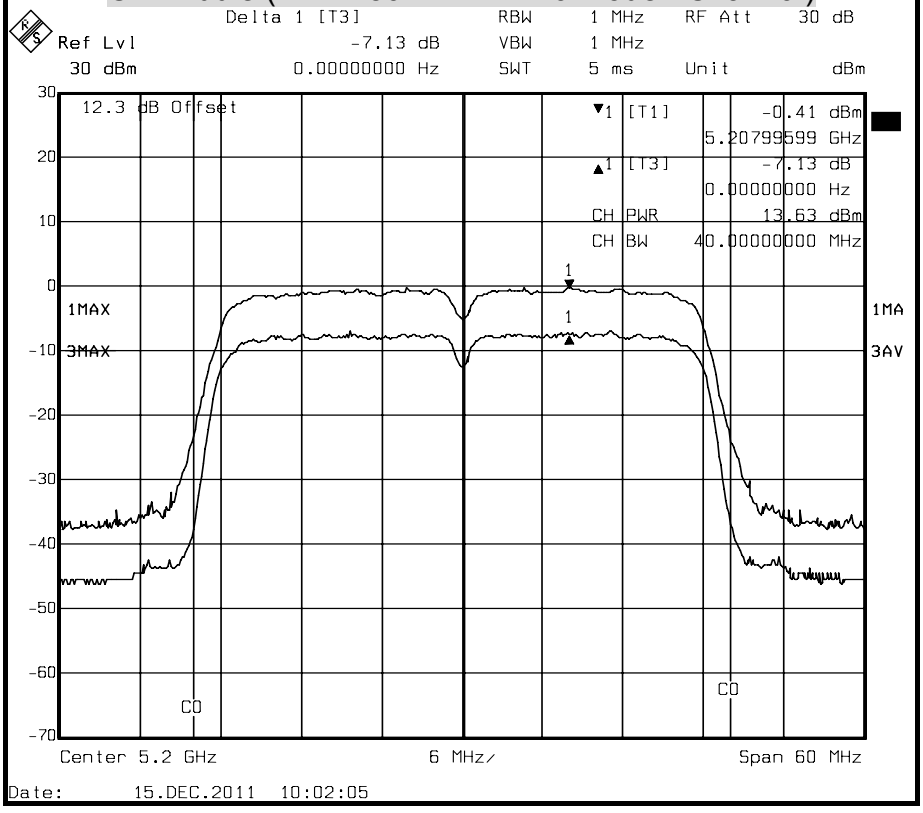
CH High ( IEEE 802.11n HT20 Mode / Chain 2 )



CH Low ( IEEE 802.11n HT40 Mode / Chain 0 )




CH Middle ( IEEE 802.11n HT40 Mode / Chain 0 )



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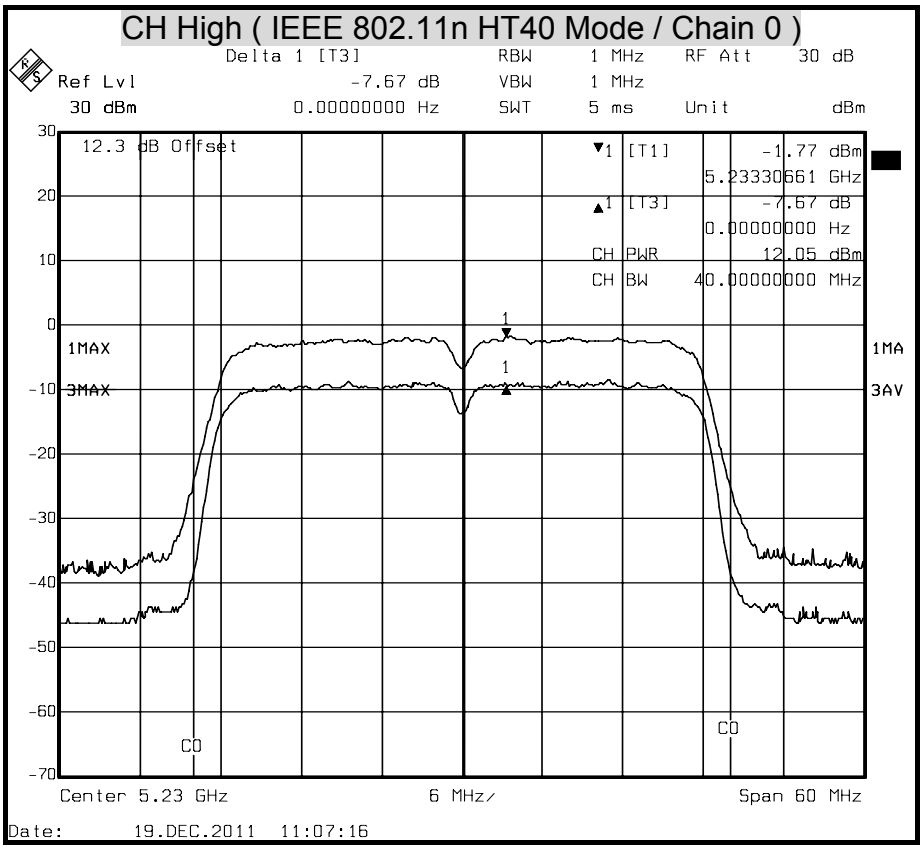
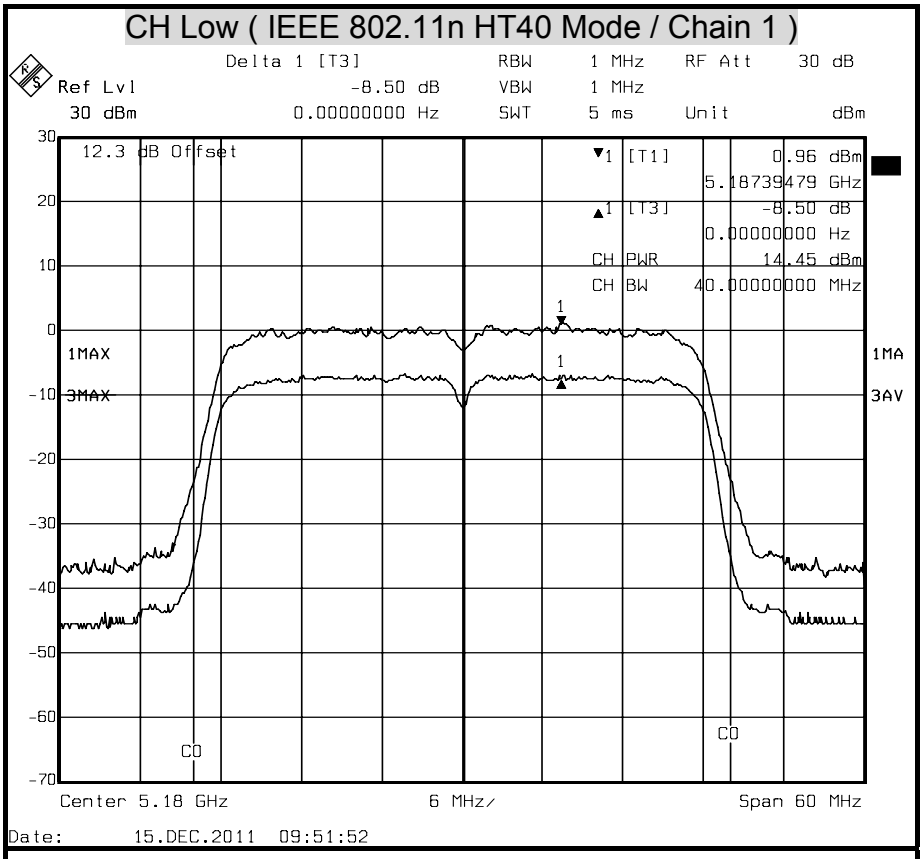
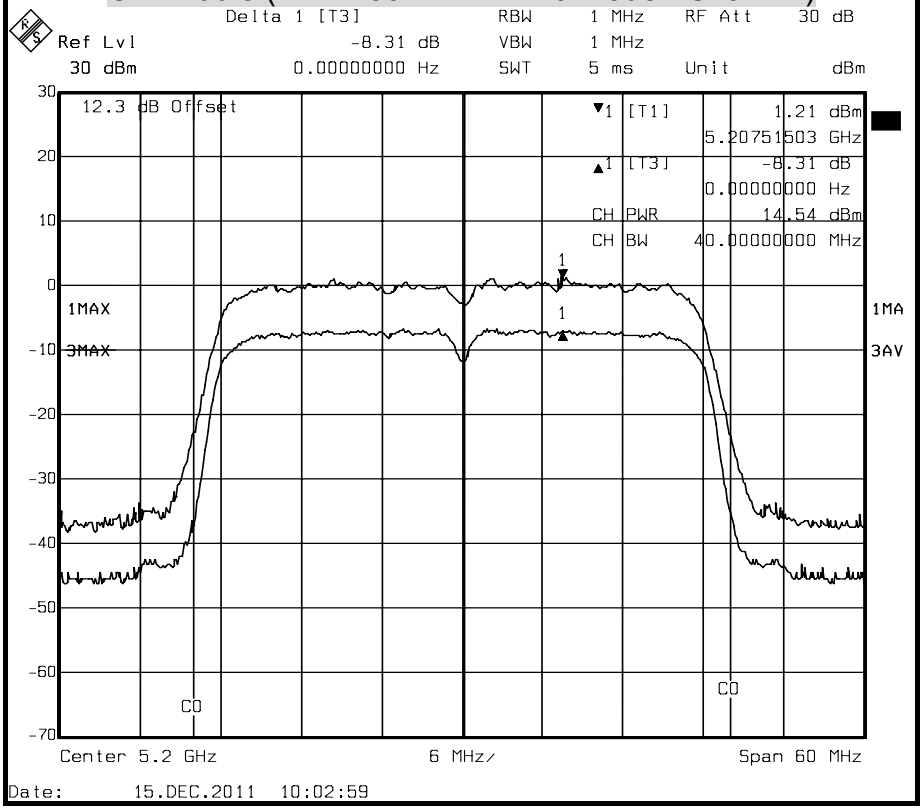


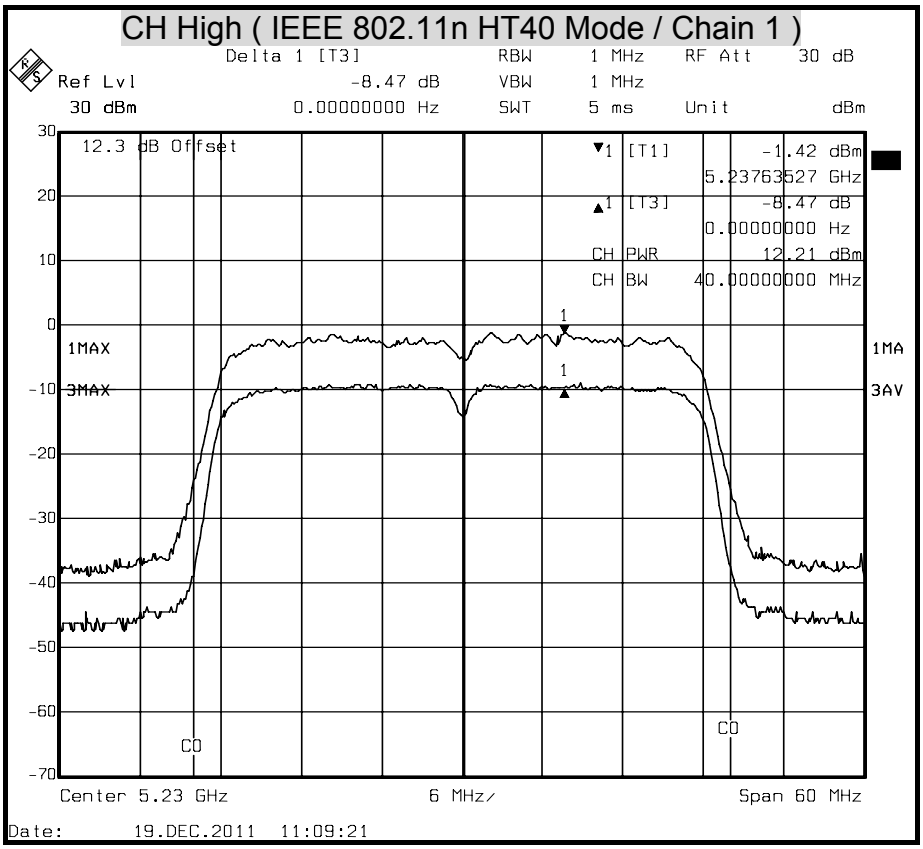
CH Low ( IEEE 802.11n HT40 Mode / Chain 1 )



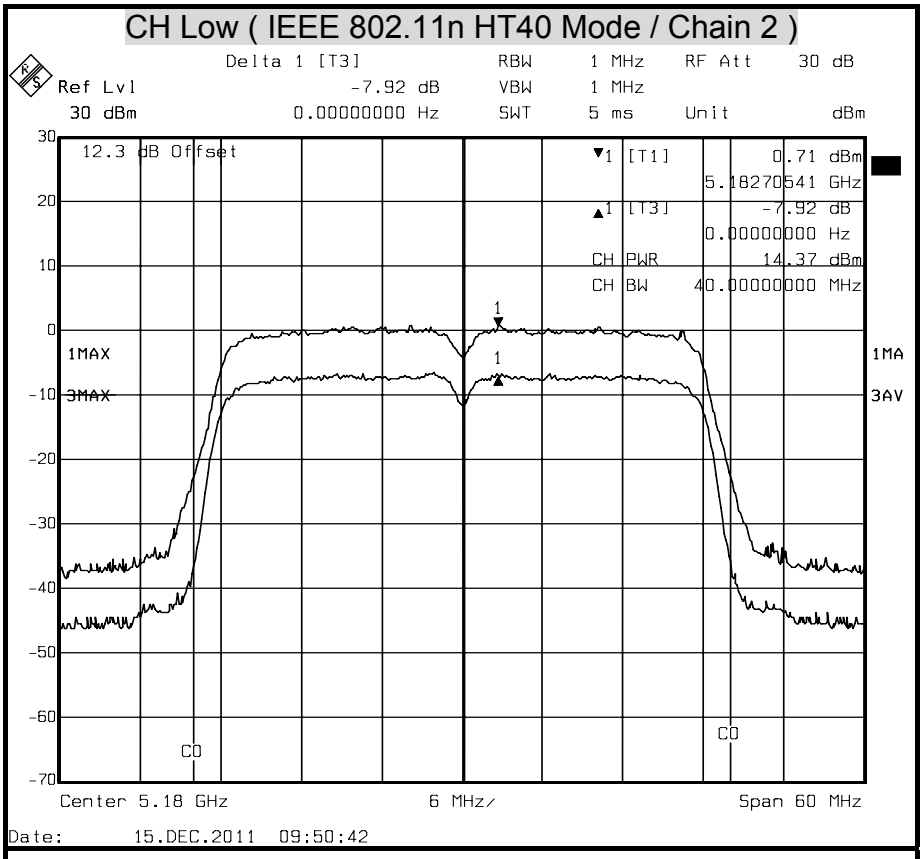

CH Middle ( IEEE 802.11n HT40 Mode / Chain 1 )



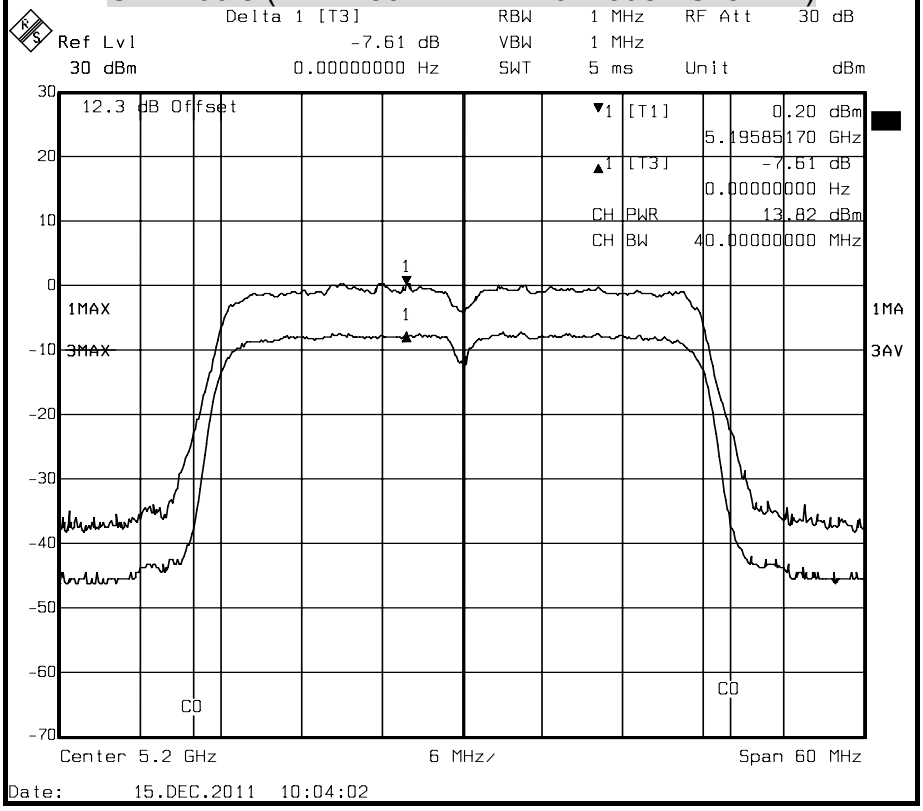
CH High ( IEEE 802.11n HT40 Mode / Chain 1 )



CH Low ( IEEE 802.11n HT40 Mode / Chain 2 )




CH Middle ( IEEE 802.11n HT40 Mode / Chain 2 )



CH High ( IEEE 802.11n HT40 Mode / Chain 2 )