FCC 47 CFR PART15 SUBPART E

For

Prepared by

Product Name: Intelligent Biometric Identification Terminal

Brand Name: opzoon

Model No.: OFR-T1-S

Series Model.:N/A

FCC ID: 2AN4A-OPS1AA001

Test Report Number:

C171101R02-RPW1

Issued for

Opzoon Technology Co., Ltd.

11th floor, Tower B, Yintai Center 2 Jianguomenwai St., Beijing, China 100022

Issued by

Compliance Certification Services Inc.

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TESTING CERT #2541.01

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	December 4, 2017	C171101R02-RPW1	ALL	N/A
01	January 19,2017	C171101R02-RPW1	P62	Revise the PSD limit

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1 TEST RESULT CERTIFICATION

Product Name:	Intelligent Biometric Identification Terminal
Trade Name:	opzoon
Model Name.:	OFR-T1-S
Series Model:	N/A
Applicant Discrepancy:	Initial
Device Category:	mobile unit
Date of Test:	November 23, 2017~November 30, 2017
Applicant:	**Opzoon Technology Co., Ltd.** 11th floor, Tower B, Yintai Center 2 Jianguomenwai St., Beijing, China 100022
Manufacturer:	**Opzoon Technology Co., Ltd.** 11th floor, Tower B, Yintai Center 2 Jianguomenwai St., Beijing, China 100022
Application Type:	Certification

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart E	No non-compliance noted

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.407and KDB 789033.
The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Jeff.Fang
RF Manager
Compliance Certification Service Inc.

Tested by:

Lily.Wang
Test Engineer
Compliance Certification Service Inc.

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2 EUT DESCRIPTION

Product Name:	Intelligent Biometric Identification Terminal
Brand Name:	opzoon
Model Name:	OFR-T1-S
Series Model:	N/A
Model Discrepancy:	N/A
Power Adapter:	Power Adapter： Model :FSP050-DIBAN2 Input: 100-240V~,1.5A ,50-60Hz Output: 12.0V⎓4.16A MAX(50W MAX)

Frequency Range :

Band	Mode	Frequency Range(MHz)	Number of Channels
Band I UNII-I	IEEE802.11a mode	5150 MHz~5250 MHz	4
	IEEE802.11an HT20 mode		4
	IEEE802.11an HT40 mode		2
	IEEE802.11ac VHT20 mode		4
	IEEE802.11ac VHT40 mode		2
	IEEE802.11ac VHT80 mode		1

Average Transmit Power :	IEEE802.11a mode: 15.05dBm IEEE802.11an HT20 mode: 15.30dBm IEEE802.11an HT40 mode: 14.51dBm IEEE802.11ac VHT20 mode: 15.36dBm IEEE802.11ac VHT40 mode: 14.58dBm IEEE802.11ac VHT80 mode: 13.94dBm
Modulation Technique :	IEEE802.11a mode: OFDM (6,9,12,18,24,36,48 and 54 Mbps) IEEE802.11an HT20 mode: OFDM (MCS0~MCS15) IEEE802.11an HT40 mode: OFDM (MCS0~MCS15) IEEE802.11ac VHT20 mode: OFDM (VHTMCS0~VHTMCS9) IEEE802.11ac VHT40 mode: OFDM (VHTMCS0~VHTMCS9) IEEE802.11ac VHT80 mode: OFDM (VHTMCS0~VHTMCS9)

Antenna Specification:

	Gain(dBi)		
	2.4G	BandI	BandIV
Antenna 1	2.04	3.96	3.40
Antenna 2	2.04	3.96	3.40

Beamforming Function:	☐ With beamforming	☒ Without beamforming

Remark:

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for ***FCC ID: 2AN4A-OPS1AA001***filing to comply with FCC Part 15, Subpart E Rules.

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3 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10:2013 and FCC CFR 47 15.207, 15.209 and 15.407.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

3.2 EUT EXERCISE

The EUT is operated in the engineering mode to fix the Tx frequency for the purposes of measurement.

According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is positioned at 0.8 m above the ground plane. According to the requirements in Section 13.3 of ANSI C63.10:2013, the conducted emission from the EUT is measured in the frequency range between 0.15 MHz and 30MHz, using the CISPR Quasi-Peak detector mode.

Radiated Emissions

Under 1GHz

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.10:2013.

Above 1GHz

The EUT is placed on a turn table, which is 1.5 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.10:2013.

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3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110 0.495 - 0.505 [1] 2.1735 - 2.1905 4.125 - 4.128 4.17725 - 4.17775 4.20725 - 4.20775 6.215 - 6.218 6.26775 - 6.26825 6.31175 - 6.31225 8.291 - 8.294 8.362 - 8.366 8.37625 - 8.38675 8.41425 - 8.41475 12.29 - 12.293 12.51975 - 12.52025 12.57675 - 12.57725 13.36 - 13.41	16.42 - 16.423 16.69475 - 16.69525 16.80425 - 16.80475 25.50 - 25.67 37.50 - 38.25 73.00 - 74.60 74.80 - 75.20 108.00 - 121.94 123 - 138 149.90 - 150.05 156.52475 - 156.52525 156.70 - 156.90 162.0125 - 167.1700 167.72 - 173.20 240 - 285 322.0- 335.4	399.9 - 410 608 - 614 960.0 - 1240 1300 - 1427 1435.0 - 1626.5 1645.5 - 1646.5 1660 - 1710 1718.8 - 1722.2 2200 - 2300 2310 - 2390 2483.5 – 2500.0 2655 - 2900 3260 - 3267 3332 - 3339 3345.8 - 3358.0 3600 - 4400	4.50 - 5.15 5.35 - 5.46 7.25 - 7.75 8.025 - 8.500 9.0 - 9.2 9.3 - 9.5 10.6 - 12.7 13.25 - 13.4 14.47 - 14.5 15.35 - 16.2 17.7 - 21.4 22.01 - 23.12 23.6 - 24.0 31.2 - 31.8 36.43 - 36.5([2])

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

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3.5 DESCRIPTION OF TEST MODES

Description	Modulation Technology	Modulation Type
26dB Bandwidth and 99% bandwidth	OFDM	BPSK
Maximum conducted output power	OFDM	BPSK
Band edges measurement	OFDM	BPSK
Peak Power Spectral Density	OFDM	BPSK
Radiated undesirable emission	OFDM	BPSK
Powerline conducted emission	OFDM	BPSK

IEEE 802.11a mode:

Channel (5180MHz),Channel (5220MHz) and Channel (5240MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11an HT20 mode:

Channel (5180MHz),Channel (5220MHz) and Channel (5240MHz) with MCS0 data rate were chosen for full testing.

IEEE 802.11an HT40 mode:

Channel (5190MHz) and Channel (5230MHz) with MCS0 data rate were chosen for full testing.

IEEE 802.11ac VHT20 mode:

Channel (5180MHz),Channel (5220MHz) and Channel (5240MHz) with VHTMCS0 data rate were chosen for full testing.

IEEE 802.11ac VHT40 mode:

Channel (5190MHz) and Channel (5230MHz) with VHTMCS0 data rate were chosen for full testing.

IEEE 802.11ac VHT80 mode:

Channel (5210MHz) with VHTMCS0 data rate were chosen for full testing.

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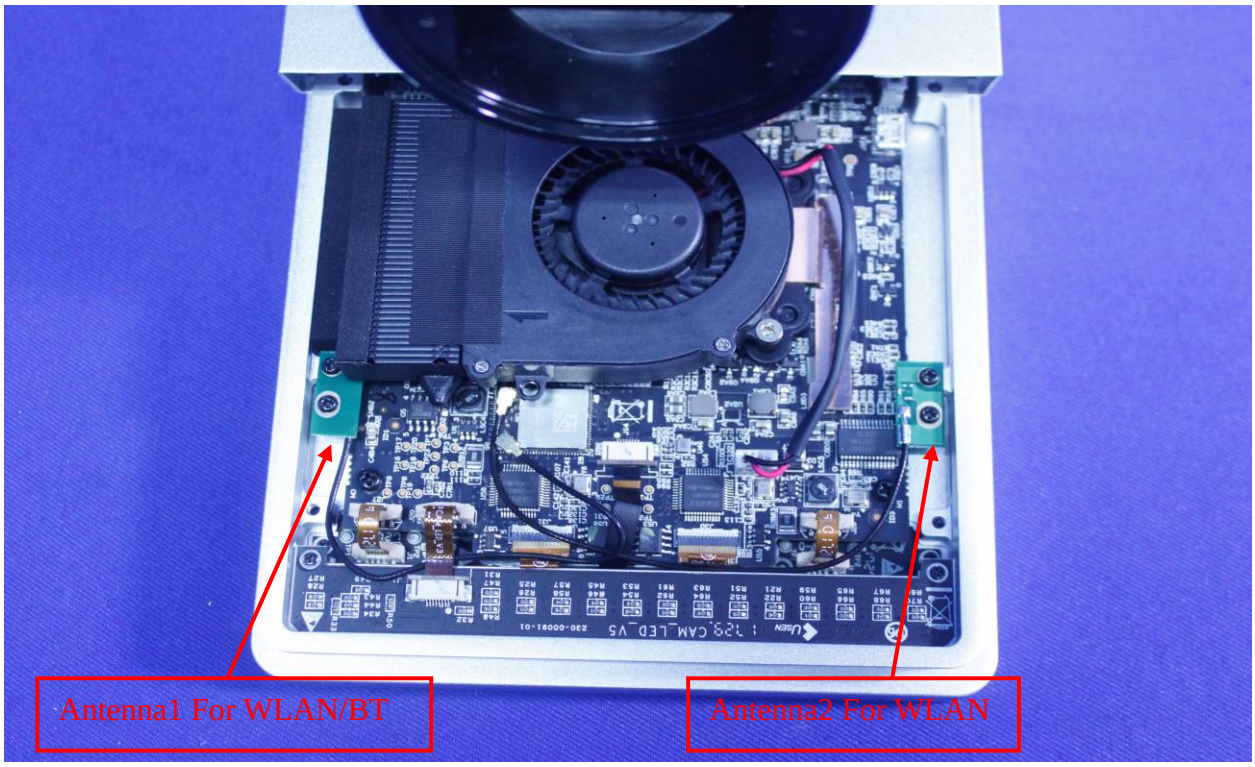
3.6 ANTENNA DESCRIPTION

an intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section”
* the antenna of this EUT is a unique(Slot Antenna for WLAN).
* the EUT complies with the requirement of 15.203.



4 INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

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4.1 MEASUREMENT EQUIPMENT USED

Conducted Emissions Test Site					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Data**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY44020154	2017-9-4	2018-9-3
Spectrum Analyzer	RS	FSU26	200789	2017-7-20	2018-7-19
Power meter	Anritsu	ML2495A	1445010	2017-4-26	2018-4-25
Power sensor	Anritsu	MA2411B	1339220	2017-4-26	2018-4-25
Power SPLITTER	Mini-Circuits	ZN2PD-9G	SF078500430	N.C.R	N.C.R
DC Power Supply	AGILENT	E3632A	MY50340053	N.C.R	N.C.R
Temp. / Humidity Gauge	Anymetre	TH603	CCS007	2017-10-24	2018-10-23
Test Software			EZ-EMC		

977 Chamber					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Data**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY44020154	2017-9-4	2018-9-3
Spectrum Analyzer	RS	FSU26	200789	2017-7-20	2018-7-19
EMI Test Receiver	R&S	ESCI	101378	2017-1-5	2018-1-4
Amplifier	COM-POWER	PAM-840A	461332	2017-8-30	2018-8-29
Amplifier	MITEQ	JS41-00101800-32-10P	1675713	2017-7-20	2018-7-19
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9170	9170-515	2017-3-6	2018-3-5
Bilog Antenna	Sunol	JB1	A062604	2017-5-27	2018-5-26
Bilog Antenna	Sunol	JB1	A110204-1	2017-5-27	2018-5-26
Loop Antenna	Hengweiyi	39501C	2014012	2017-1-5	2018-1-4
Horn-antenna	SCHWARZBECK	9120D	D:266	2017-2-28	2018-2-27
Horn-antenna	SCHWARZBECK	9120D	D:267	2017-11-5	2018-11-4
Turn Table	CT	CT123	4165	N.C.R	N.C.R
Antenna Tower	CT	CTERG23	3256	N.C.R	N.C.R
Controller	CT	CT1OO	95637	N.C.R	N.C.R
Test Software			EZ-EMC		

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Conducted Emission					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Data**	**Calibration Due**
EMI TEST RECEIVER	R&S	ESCI	100781	2017-2-28	2018-2-27
V (V-LISN)	SCHWARZBECK	NNLK 8129	8129-143	2017-10-29	2018-10-28
TWO-LINE V-NETWORK	R&S	ENV216	101604	2017-10-29	2018-10-28
Pulse LIMITER	R&S	ESH3-Z2	100524	2017-1-5	2018-1-4
Test Software			EZ-EMC		

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

4.2 MEASUREMENT UNCERTAINTY

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028-1 [2] and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Table 6 is based on such expansion factors.

Table 6: Maximum measurement uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.129dB
Unwanted Emissions, conducted	±2.406dB
RF Power density, conducted	±2.379dB
Conducted emissions	±2.582dB
All emissions, radiated (Below 1GHz)	±4.725dB
All emissions, radiated (Above 1GHz)	± 4.818dB
Temperature	±0.3dB
Supply voltages	±0.2%

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5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at
☒ **No.10Weiye Rd., Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.**
The sites are constructed in conformance with the requirements of ANSI C63.10:2013 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.3 TABLE OF ACCREDITATIONS AND LISTINGS

FCC –Designation Number: CN1172.

Compliance Certification Services Inc. Kun shan Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Designation Number: CN1172.

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5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	A2LA	47 CFR FCC Part 15/18 (using ANSI C63.10 :2013); VCCI V3; CNS 13438; CNS 13439; CNS 13803; CISPR 11; EN 55011; CISPR 13; EN 55013; CISPR 22:2005; CISPR 22:1997 +A1 :2000+A2 :2002; EN 55022:2006; EN55022 :1998 +A1 :2001+A2 :2003; EN 61000-6-3 (excluding discontinuous interference); EN 61000-6-4; AS/NZS CISPR 22; CAN/CSA-CEI/IEC CISPR 22; EN 61000-3-2; EN 61000-3-3; EN550024; EN 61000-4-2; EN 61000-4-3; EN61000-4-4; EN 61000-4-5; EN 61000-4-6; IEC 61000-4-8; EN 61000-4-11; IEC61000-3-2; IEC61000-3-3; IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-5; IEC 61000-4-6; IEC 61000-4-8; IEC 61000-4-11; EN 300 220-3; EN 300 328; EN 300 330-2; EN 300 440-1; EN 300-440-2; EN 300 893; EN 301 489-01; EN 301 489-3; EN 301 489-07; EN 301 489-17; 47 CFR FCC Part 15, 22, 24	ACCREDITED TESTING CERT #2541.01
USA	FCC	3/10 meter Sites to perform FCC Part 15/18 measurements	CN1172
Japan	VCCI	3/10 meter Sites and conducted test sites to perform radiated/conducted measurements	VCCI R-1600 C-1707 G-216

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6 SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No.	Equipment	Model No.	Serial No.
1	Notebook	E5430	CN8YYW1

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2.Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

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7 FCC PART 15 REQUIREMENTS

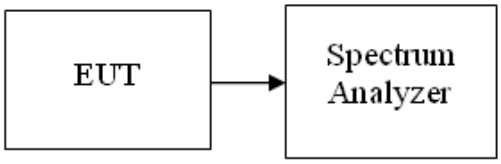
7.1 26 DB EMISSION BANDWIDTH

LIMIT

According to §15.403(i), 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. Compliance with the emissions limits 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 Configuration

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 = approximately 1% of the emission bandwidth, VBW > RBW, Detector = Peak ,Span >26dB bandwidth, and Sweep = auto ,Trace mode = max hold.
4. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
5. Repeat until all the rest channels were investigated.

TEST RESULTS

No non-compliance noted

Test Data

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Test mode: IEEE 802.11a mode/ Chain 0

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	20.064
Mid	5220	20.056
High	5240	20.010

Test mode: IEEE 802.11a mode/ Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	20.123
Mid	5220	20.172
High	5240	20.236

Test mode: IEEE 802.11n HT20MHz mode/ Chain 0

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	20.356
Mid	5220	20.449
High	5240	20.449

Test mode: IEEE 802.11n HT20MHz mode/ Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	20.577
Mid	5220	20.513
High	5240	20.492

Test mode: IEEE 802.11n HT40MHz mode/ Chain 0

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5190	40.709
High	5230	40.709

Test mode: IEEE 802.11n HT40MHz mode/ Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5190	41.096
High	5230	41.288

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Test mode: IEEE 802.11ac VHT20MHz mode/ Chain 0

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	20.421
Mid	5220	20.290
High	5240	20.421

Test mode: IEEE 802.11ac VHT20MHz mode/ Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	20.469
Mid	5220	20.385
High	5240	20.556

Test mode: IEEE 802.11ac VHT40MHz mode/ Chain 0

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5190	40.481
High	5230	40.613

Test mode: IEEE 802.11ac VHT40MHz mode/ Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5190	41.285
High	5230	41.096

Test mode: IEEE 802.11ac VHT80MHz mode/ Chain 0

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Mid	5210	82.019

Test mode: IEEE 802.11ac VHT80MHz mode/ Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Mid	5210	82.531

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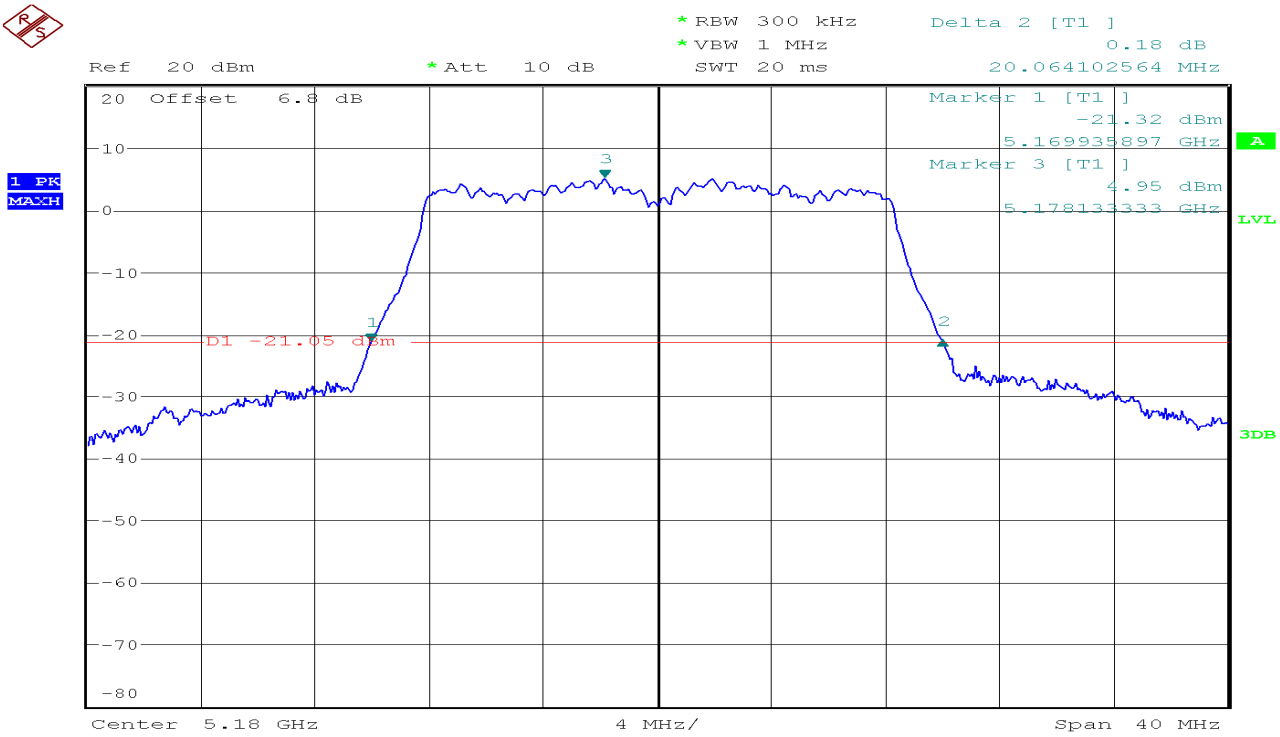
Test Plot

IEEE 802.11a mode/Chain 0:

CH Low



CH Mid

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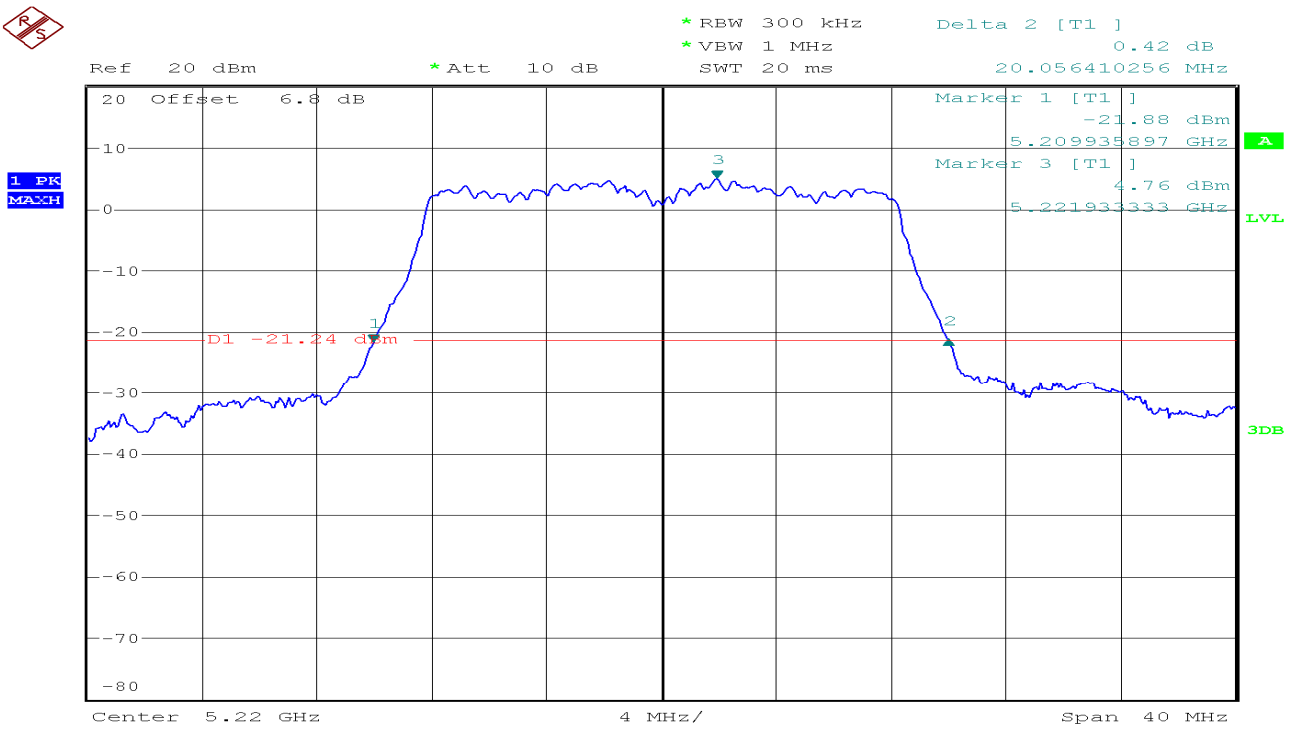

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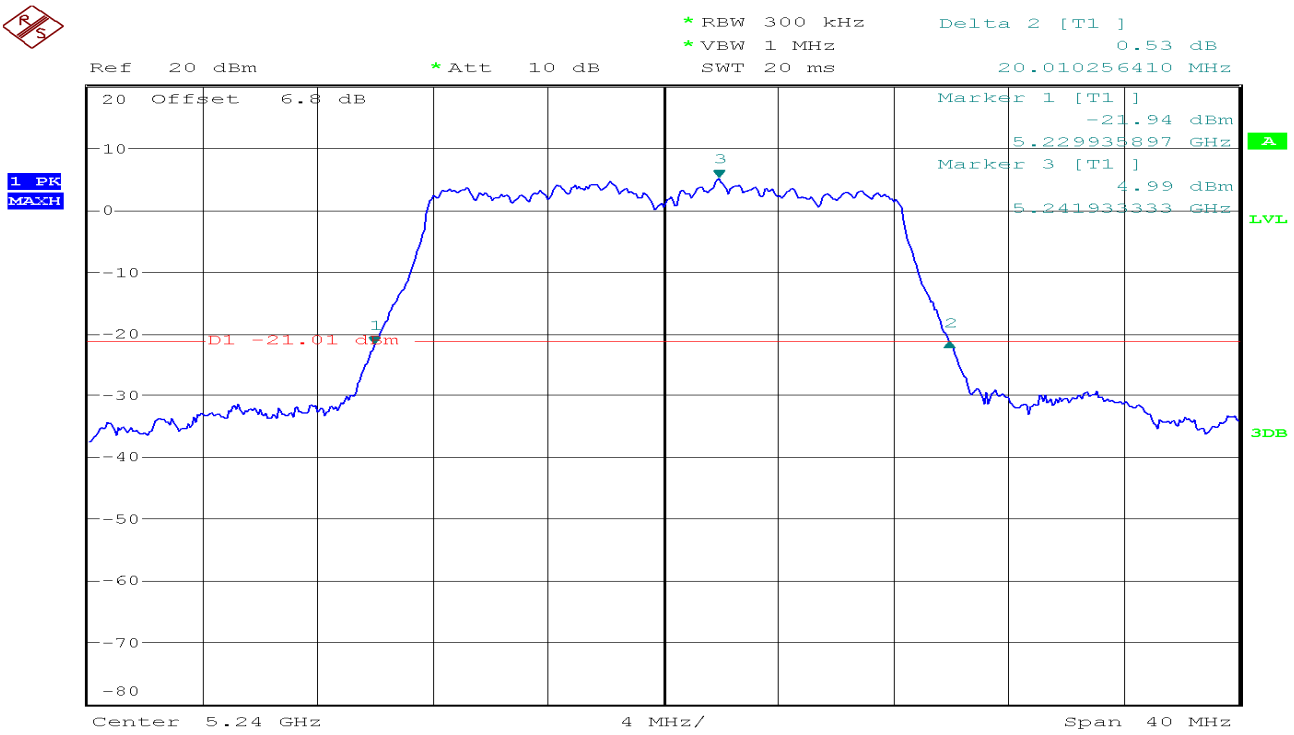
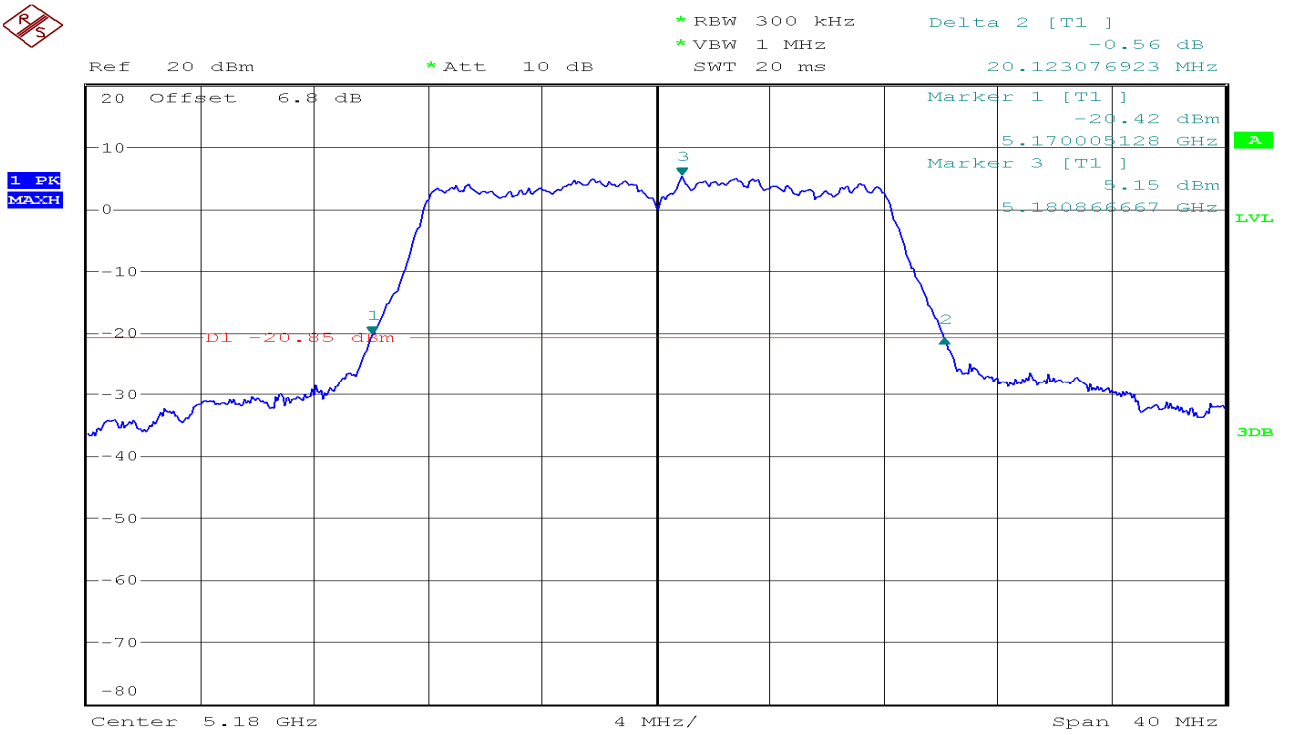
CH High



IEEE 802.11a mode/Chain 1:

CH Low



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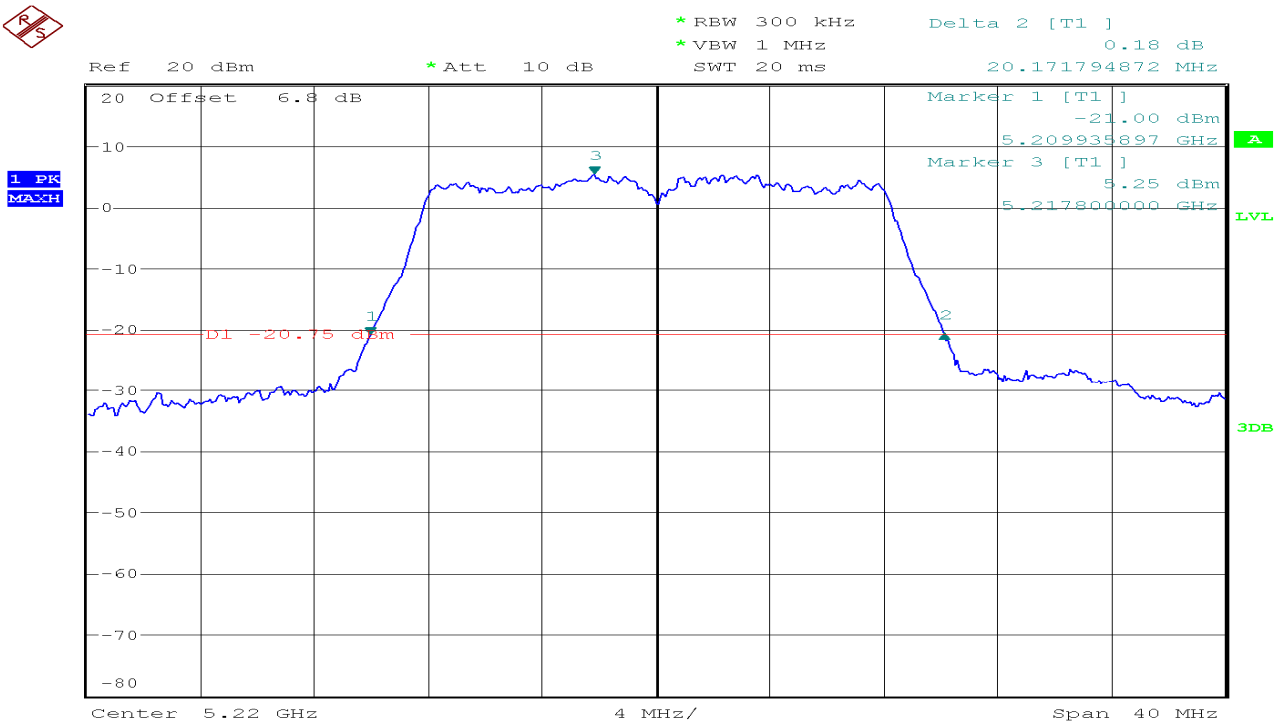
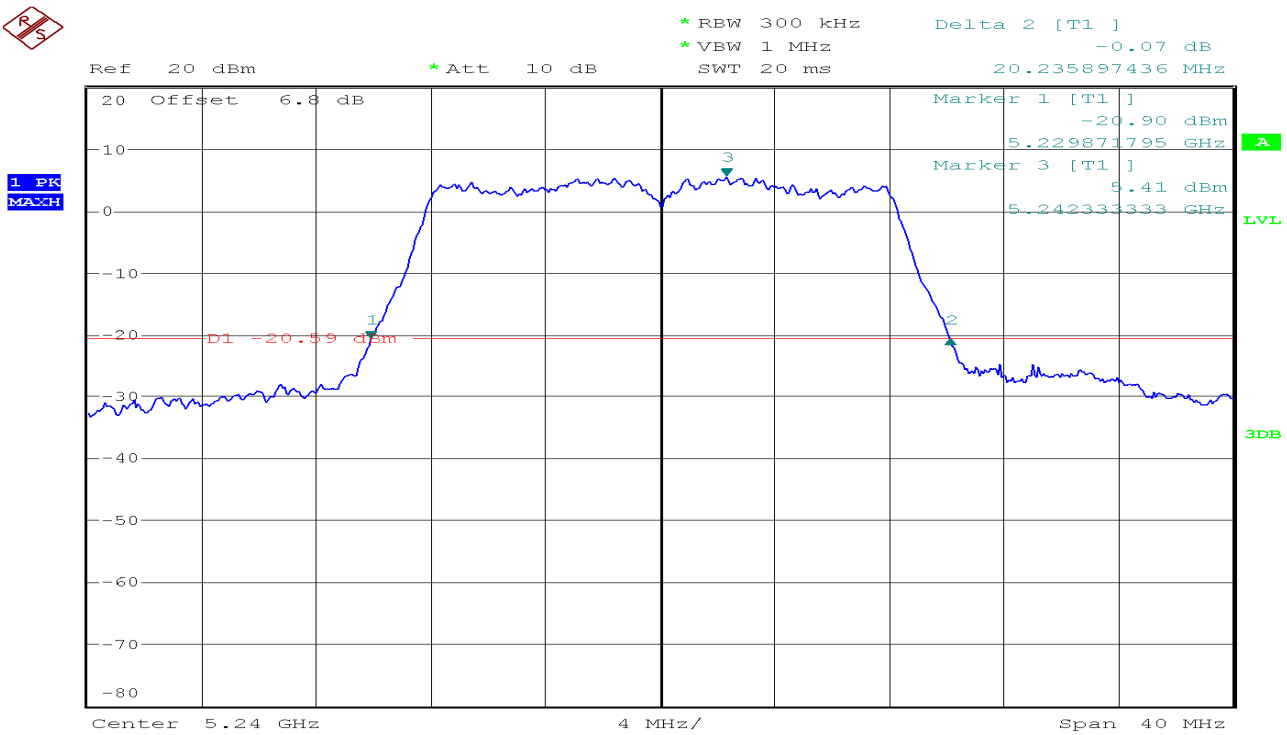
CH Mid



CH High



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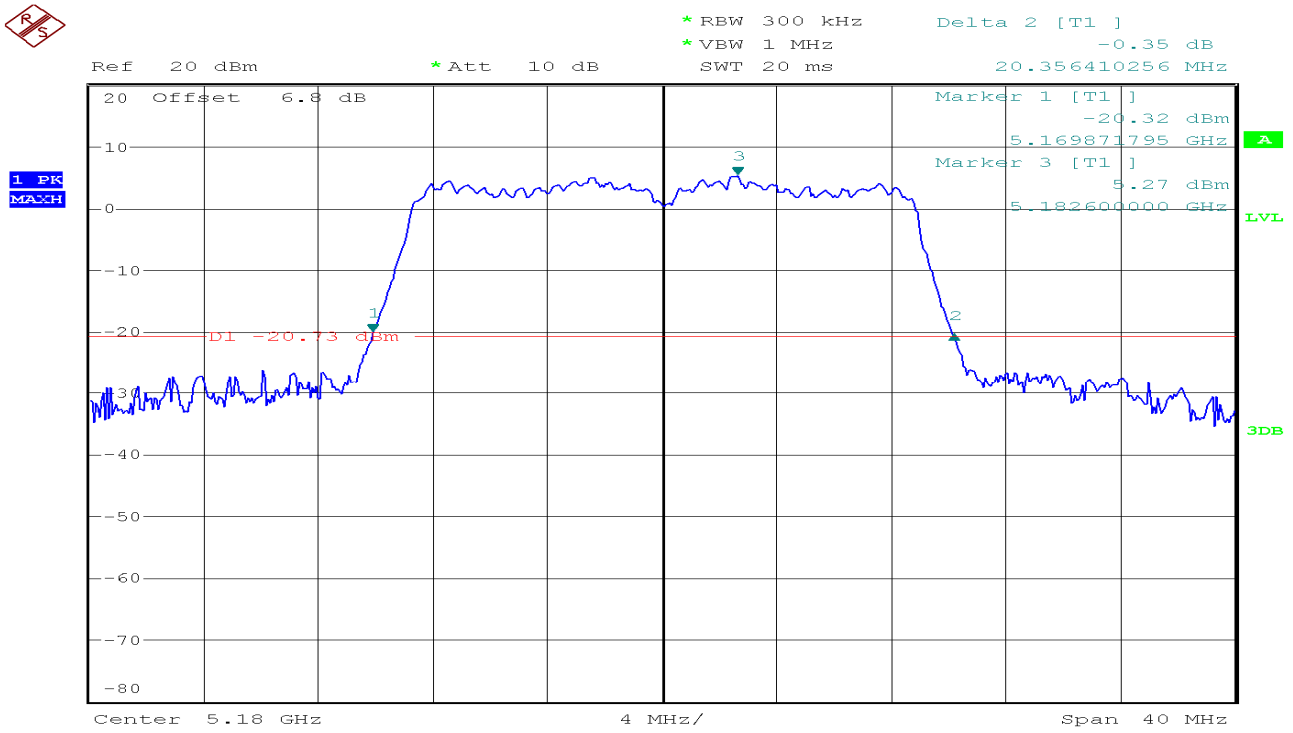
IEEE 802.11n HT20 mode/Chain 0:

CH Low



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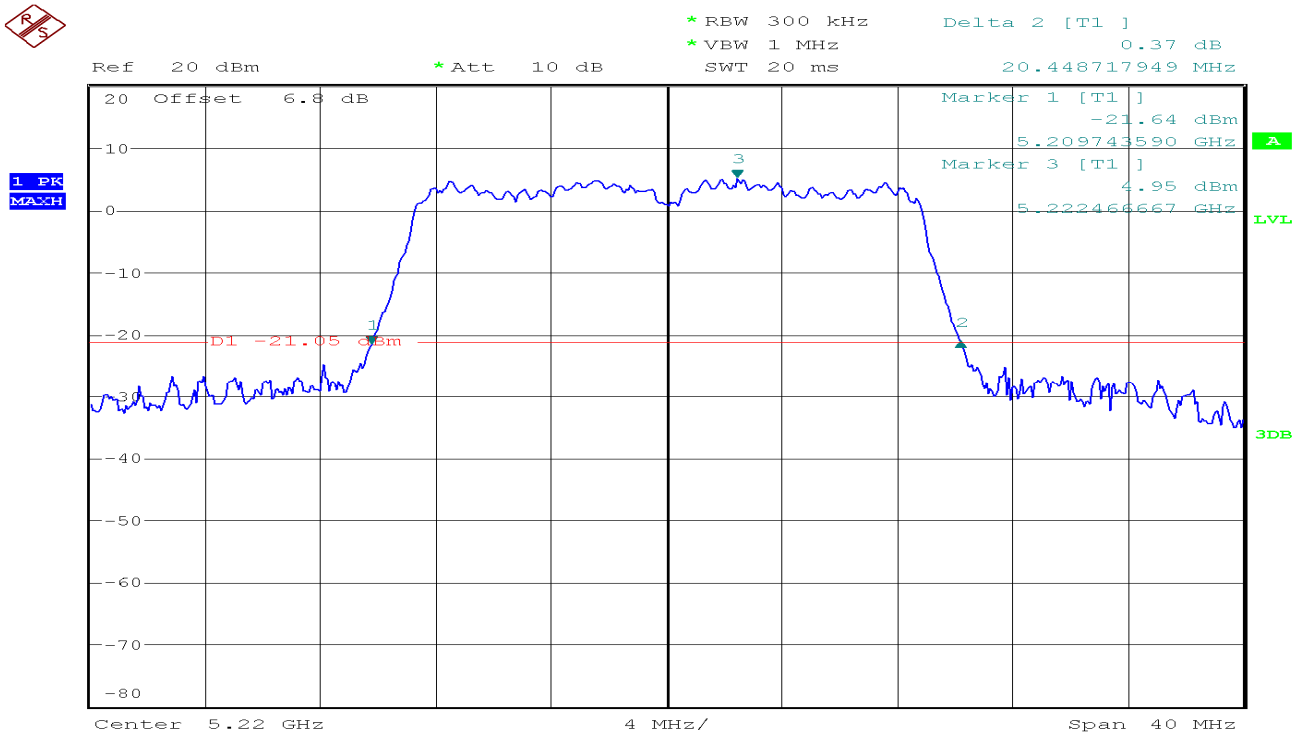

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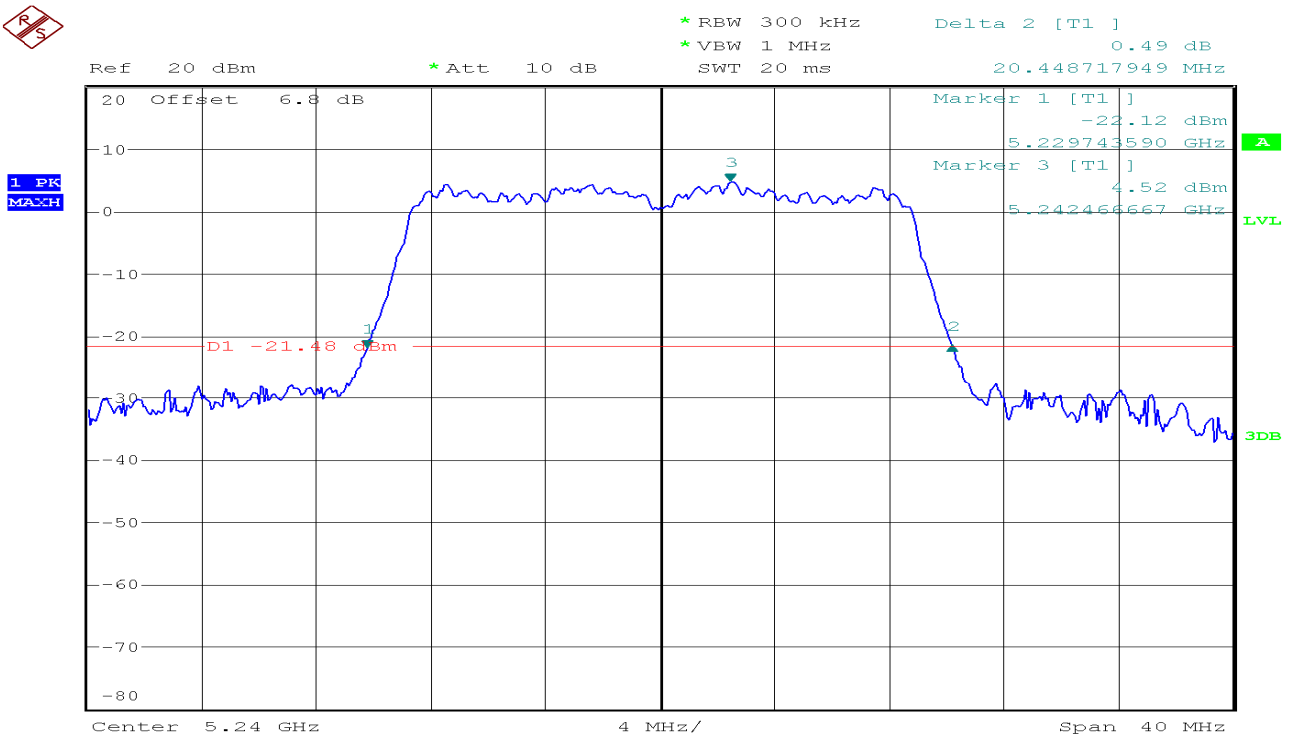
CH High



IEEE 802.11n HT20 mode/Chain 1:

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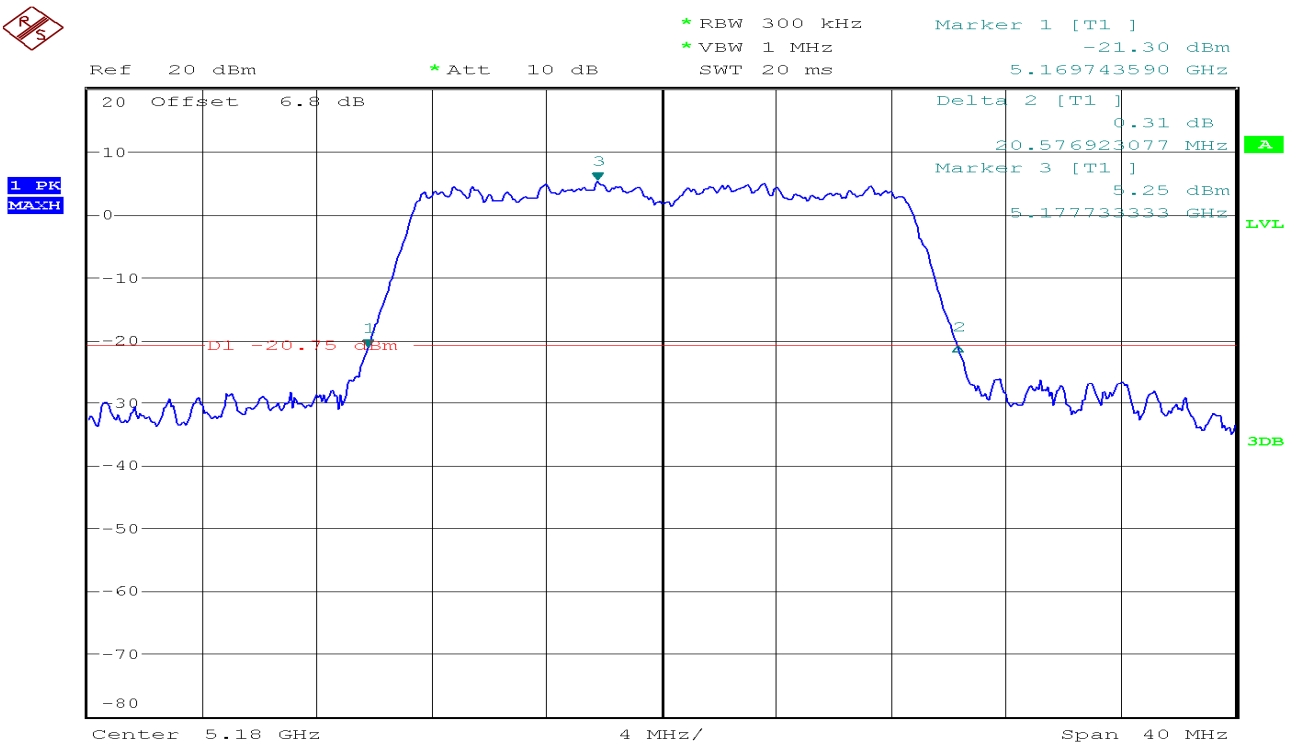

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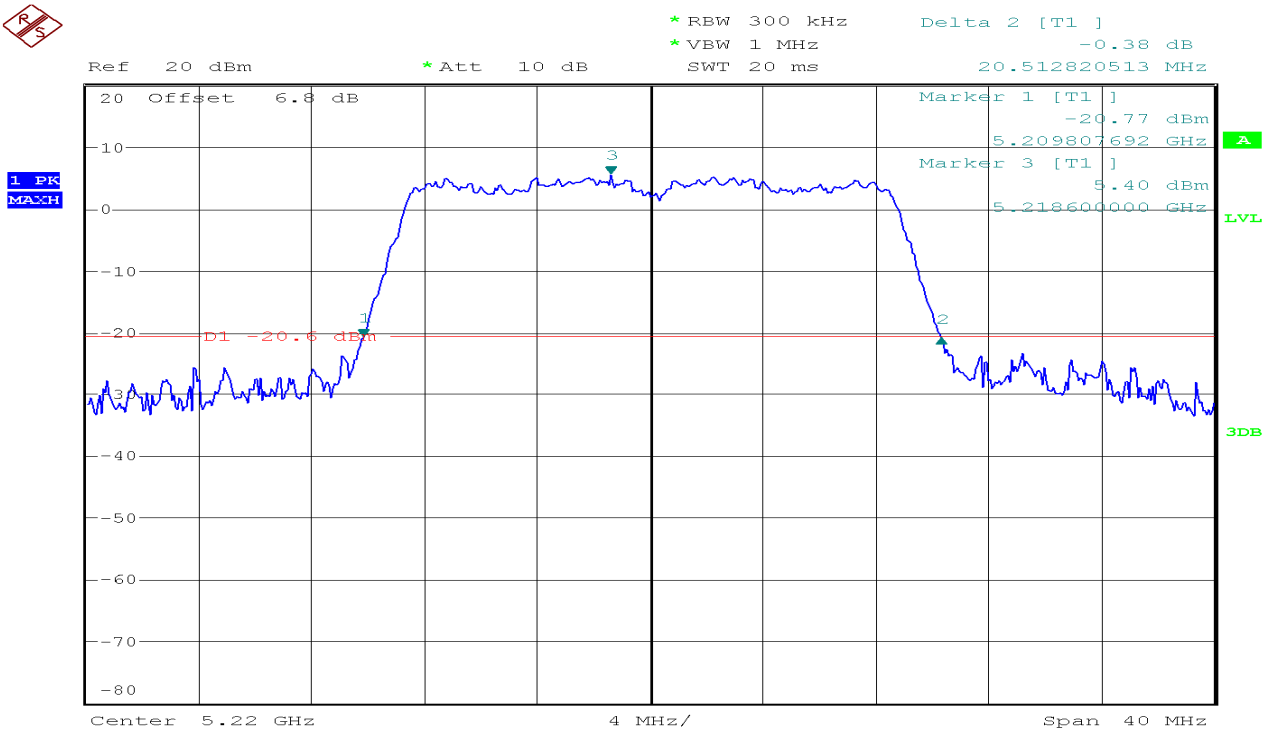
CH Mid



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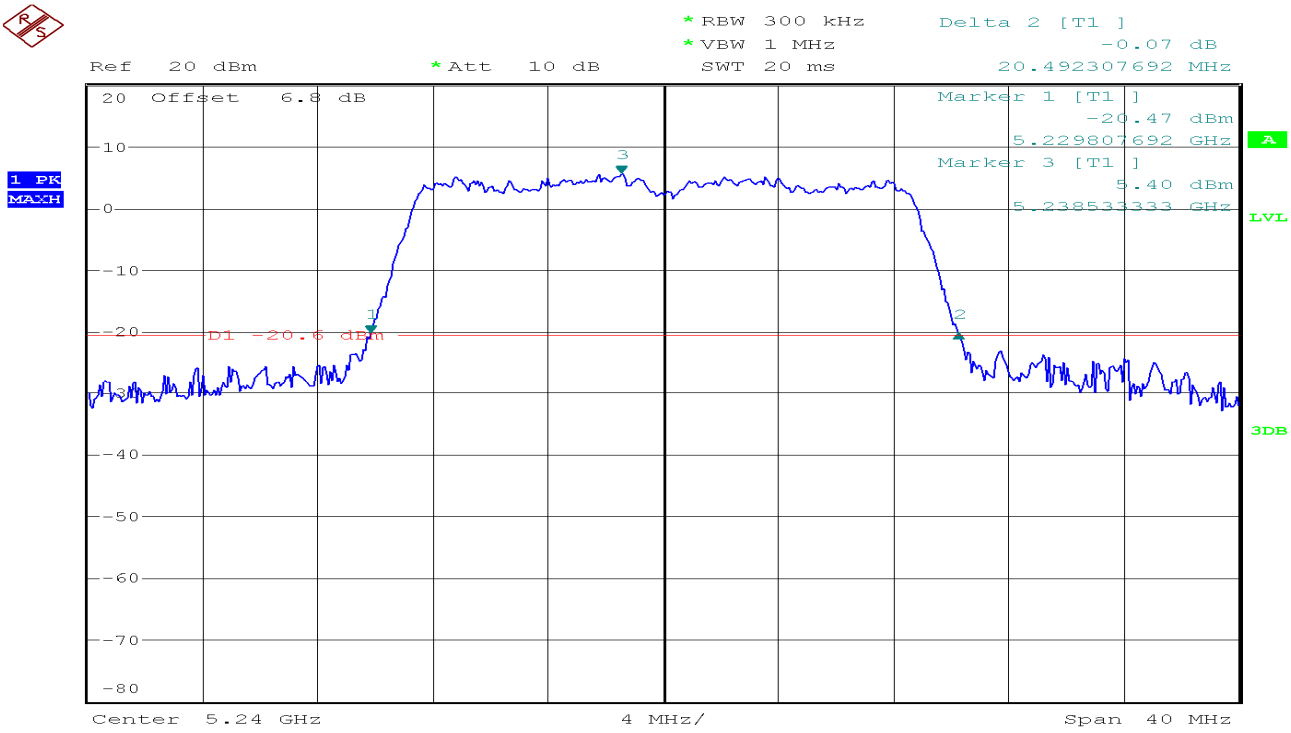

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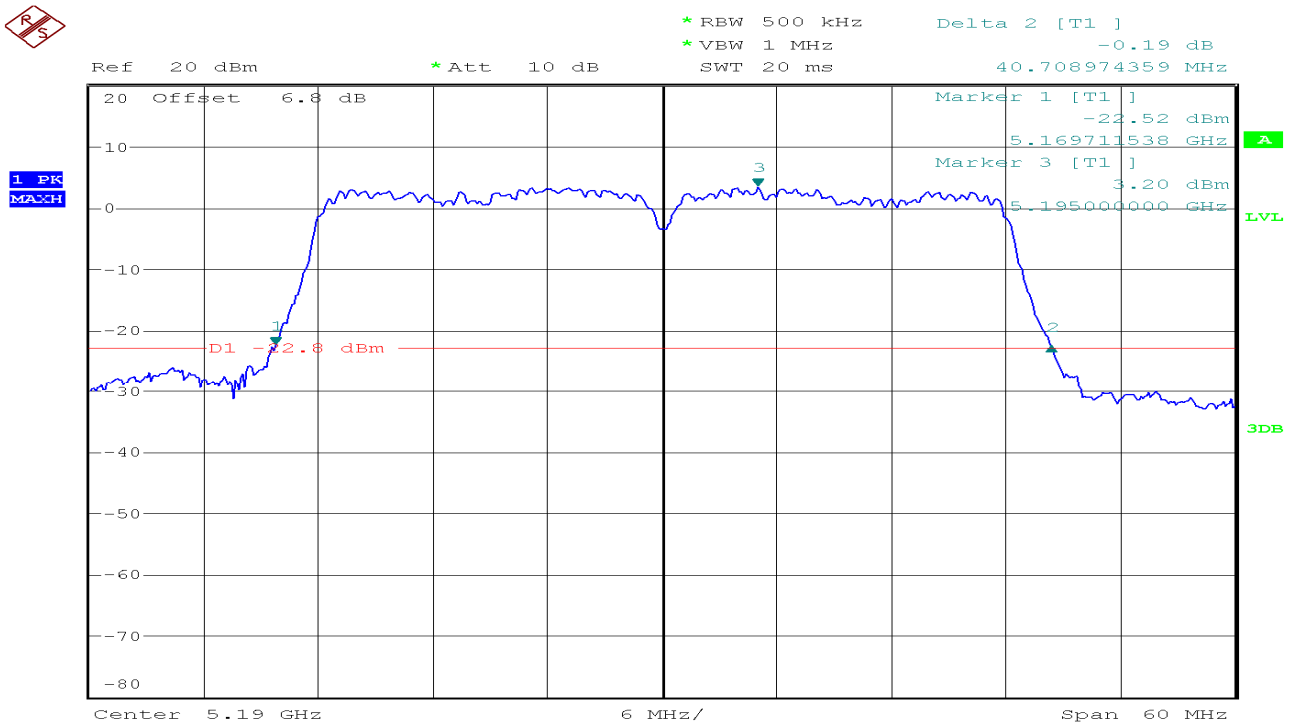
IEEE 802.11n HT40 mode/Chain 0:

CH Low



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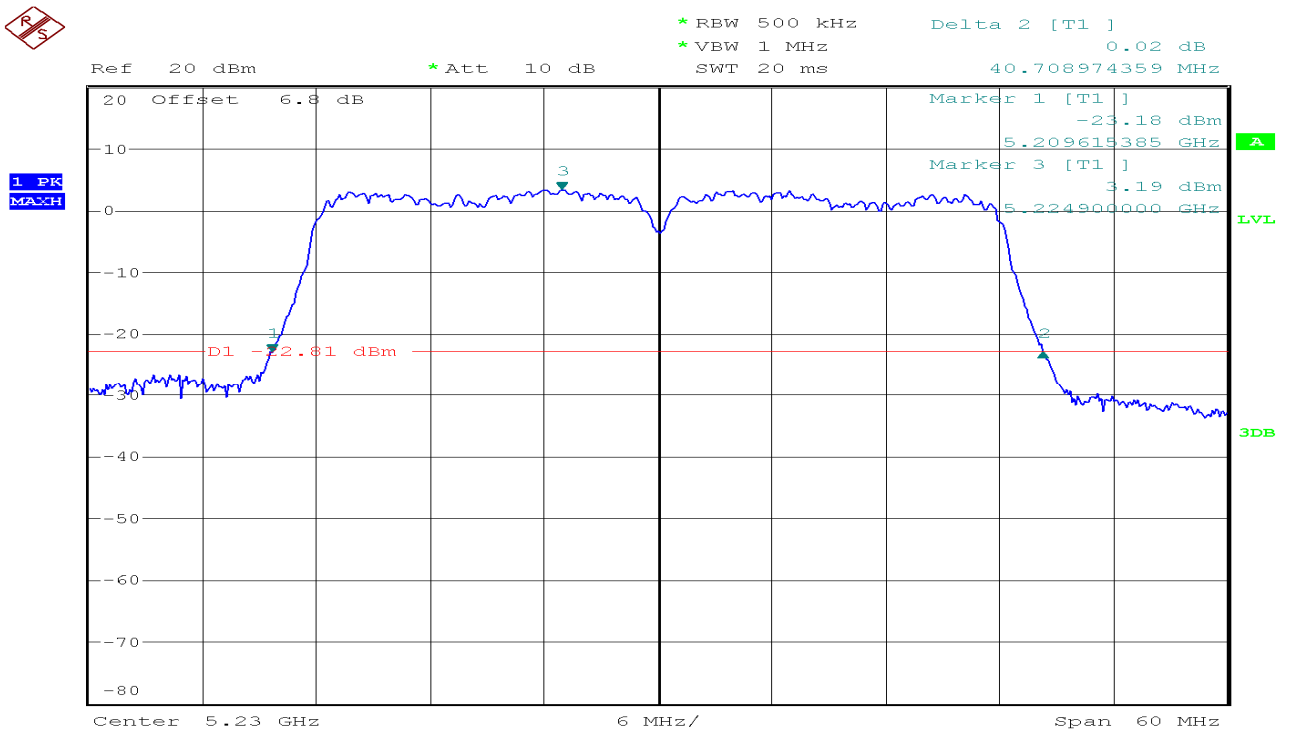

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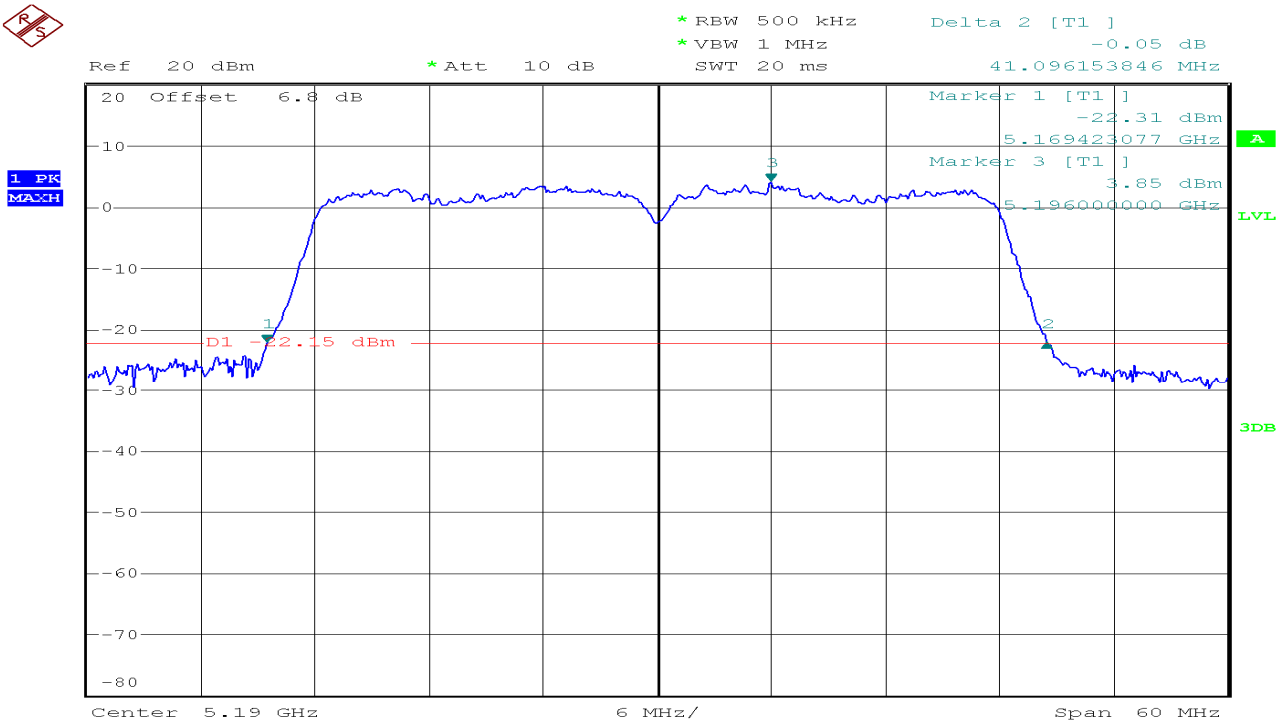
IEEE 802.11n HT40 mode/Chain 1:

CH Low



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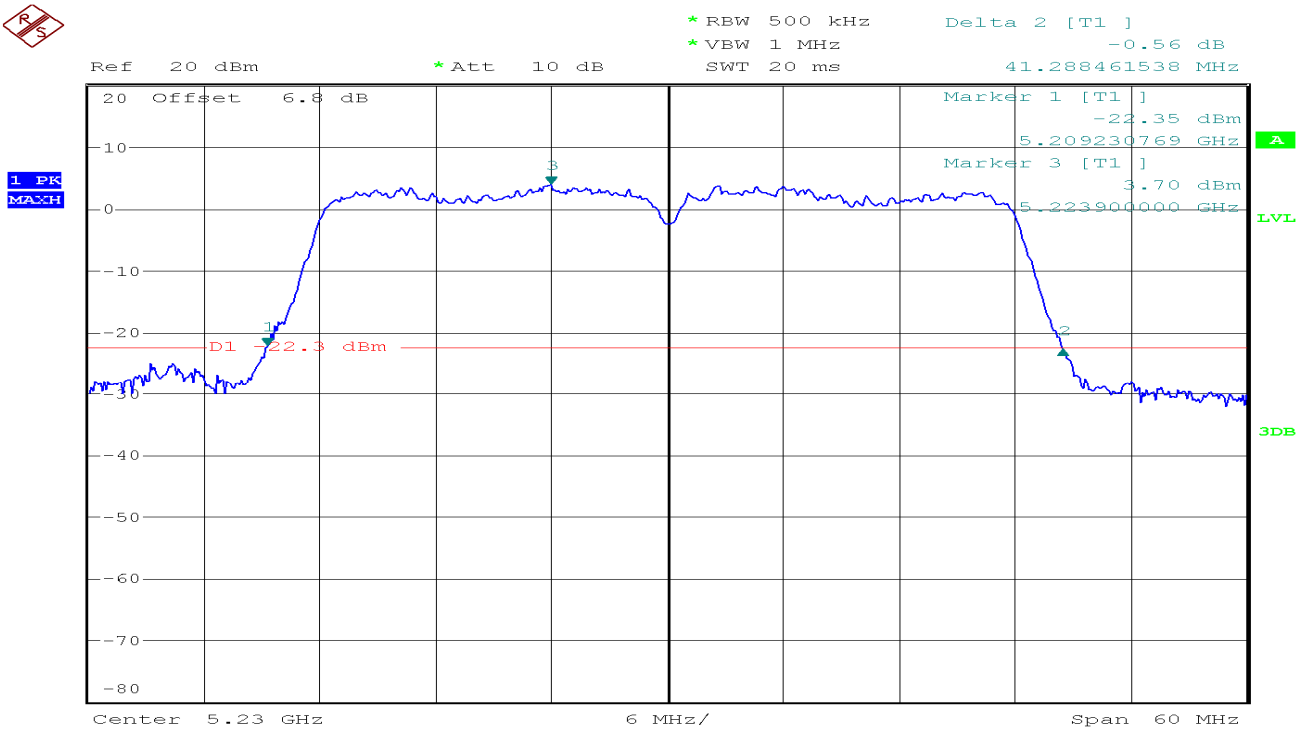

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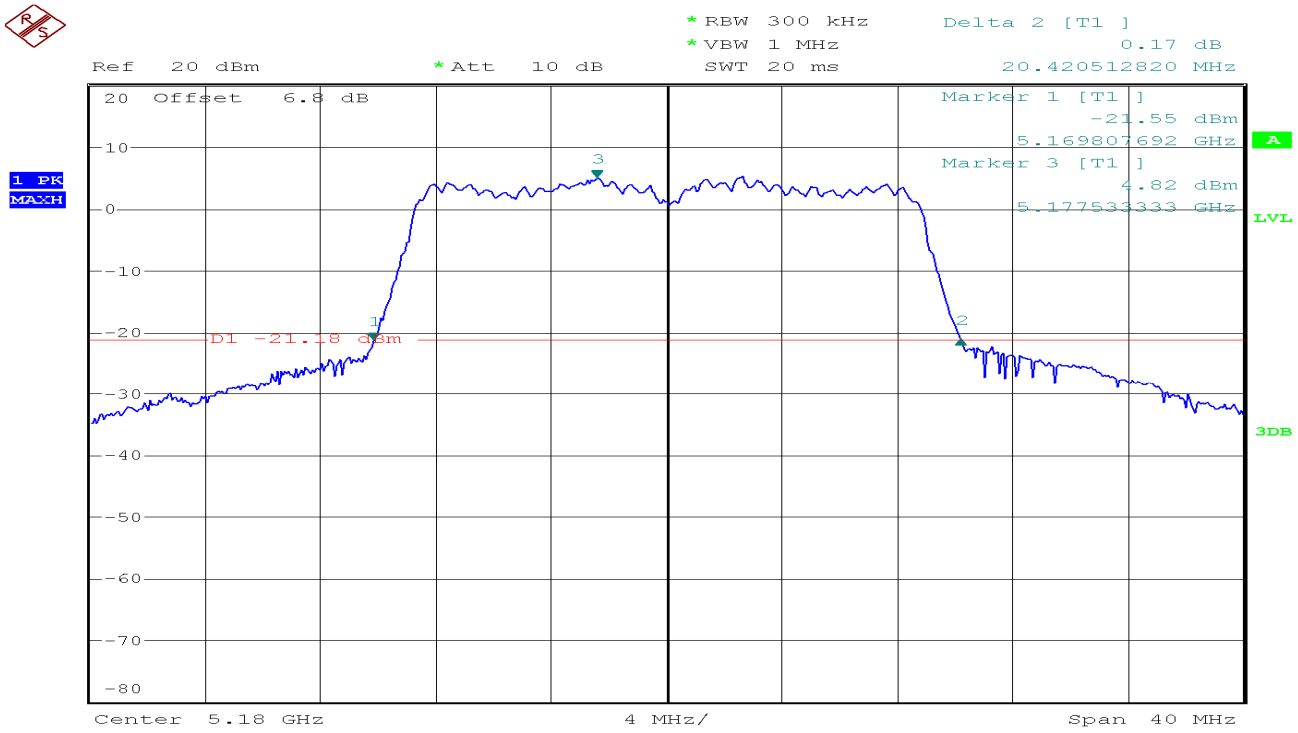
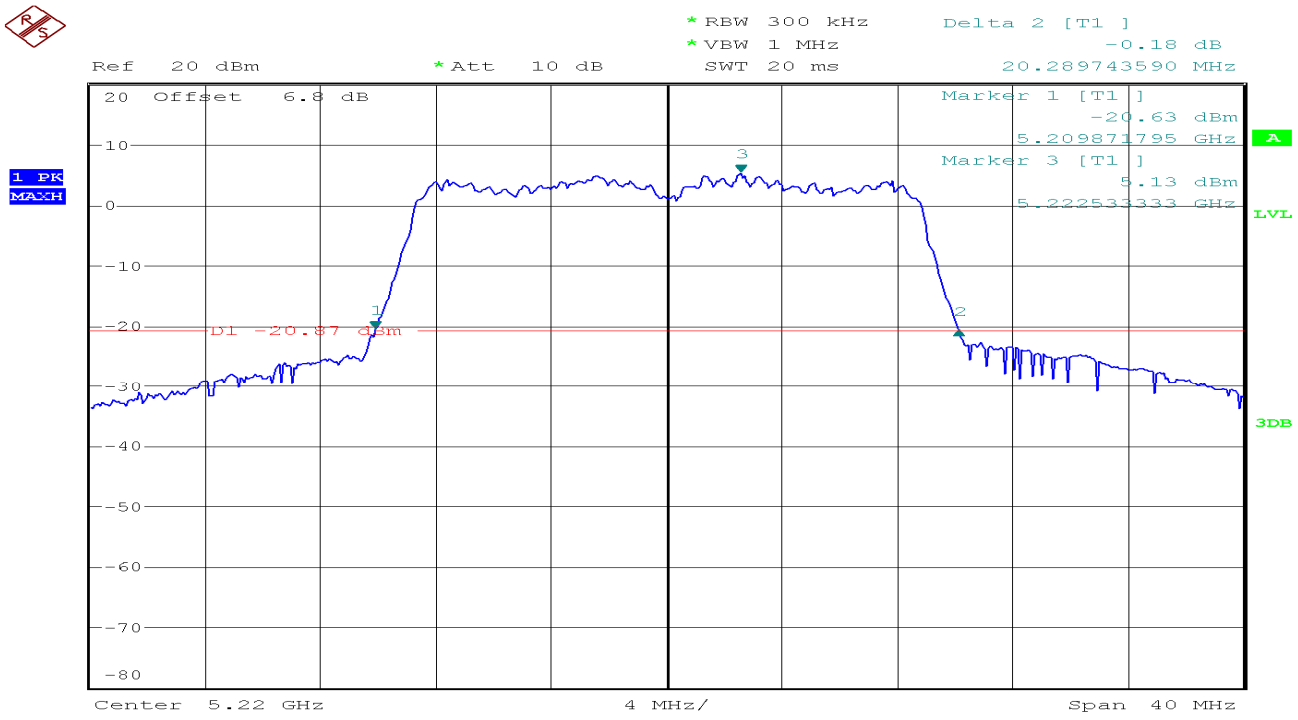
IEEE 802.11ac VHT20 mode/Chain 0:

CH Low



CH Mid



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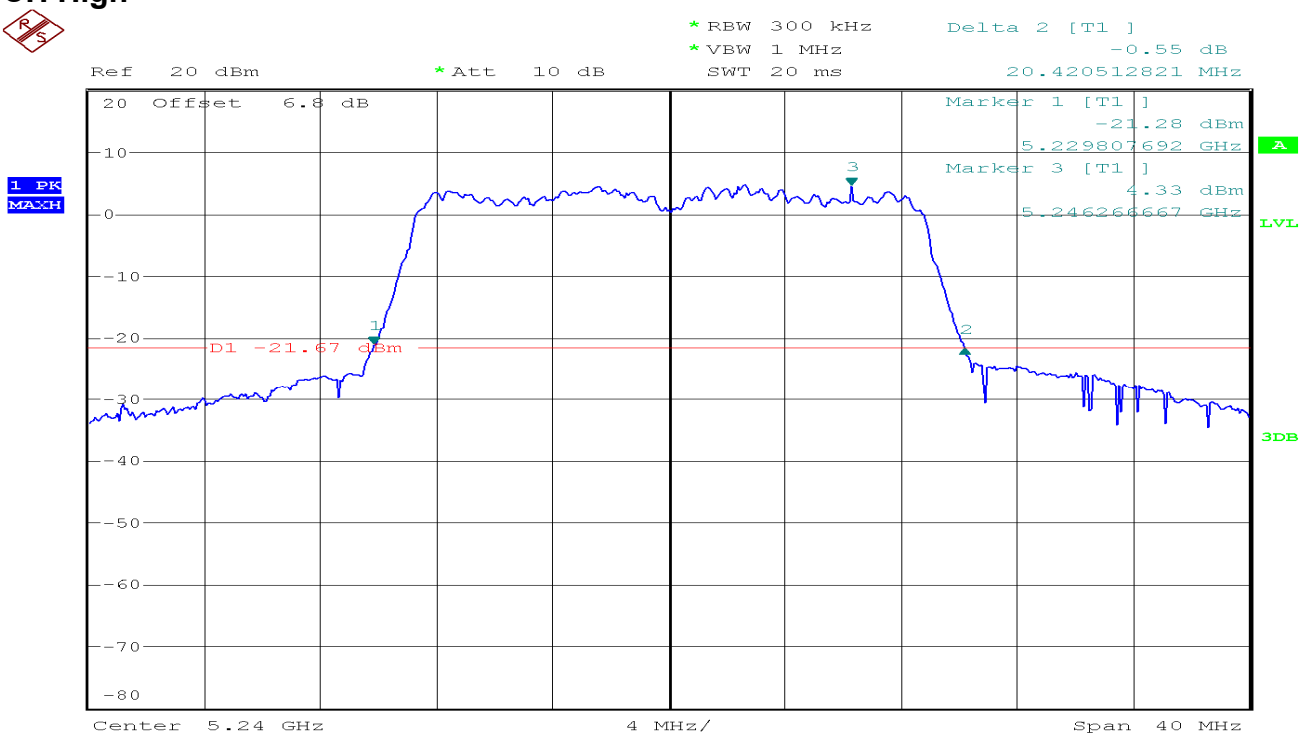
CH High



IEEE 802.11ac VHT20 mode/Chain 1:

CH Low

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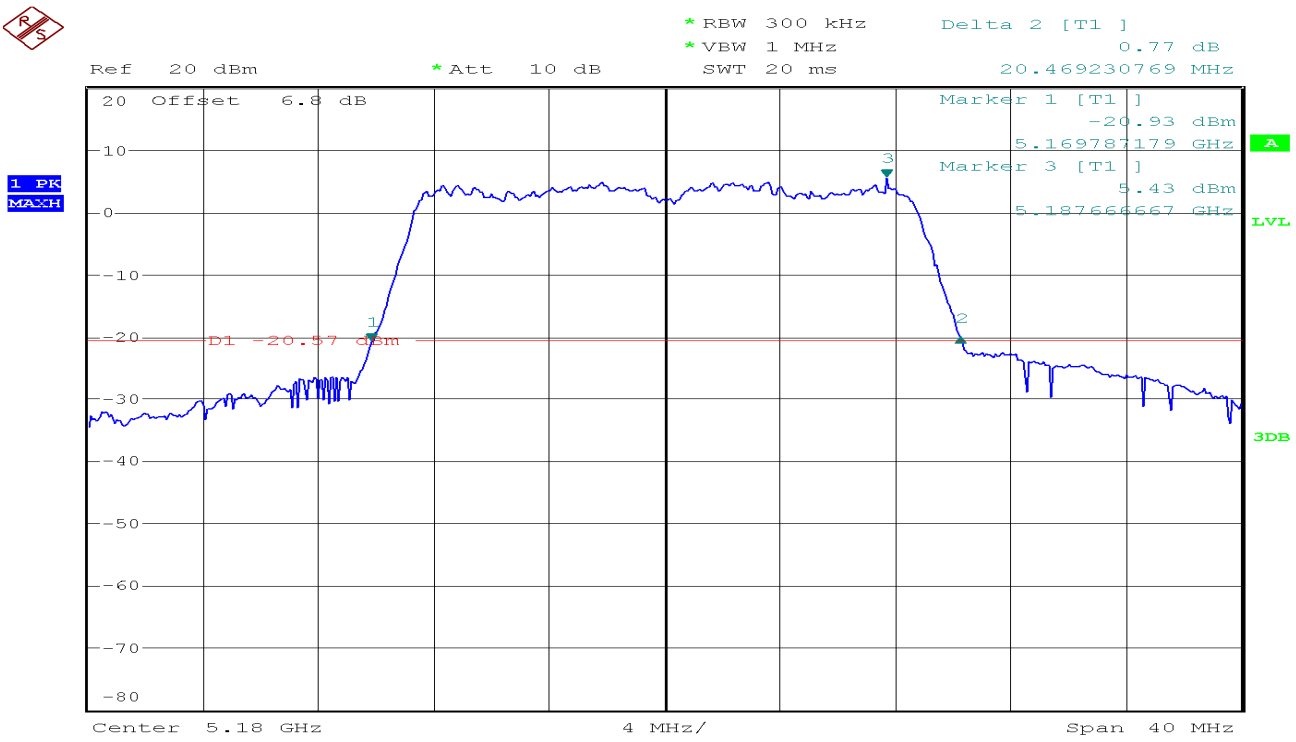

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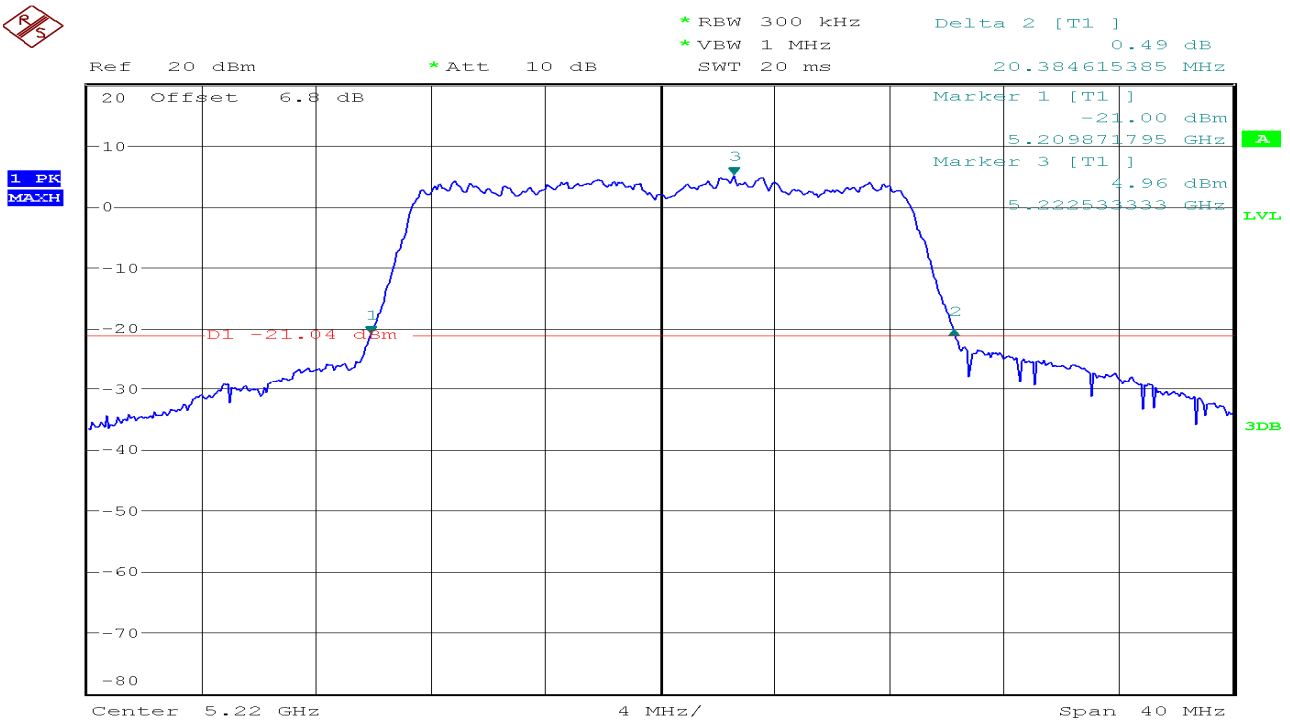
CH Mid



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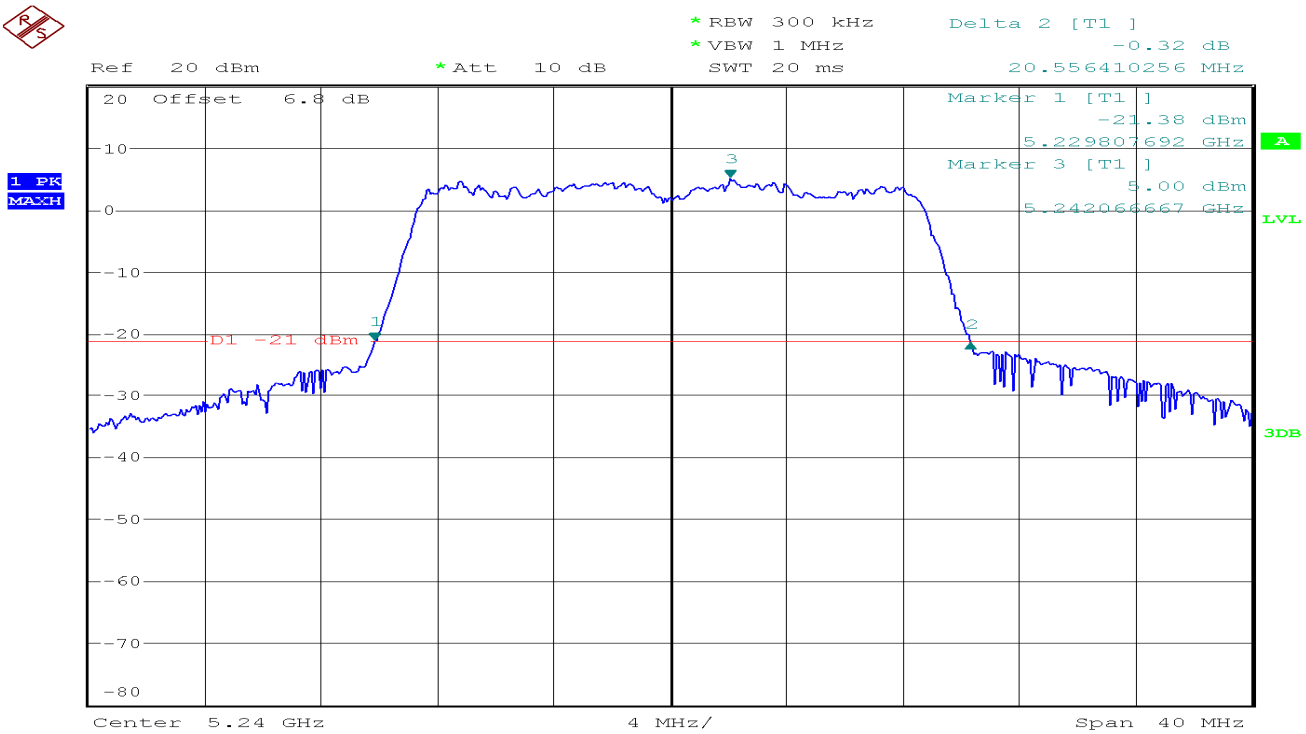

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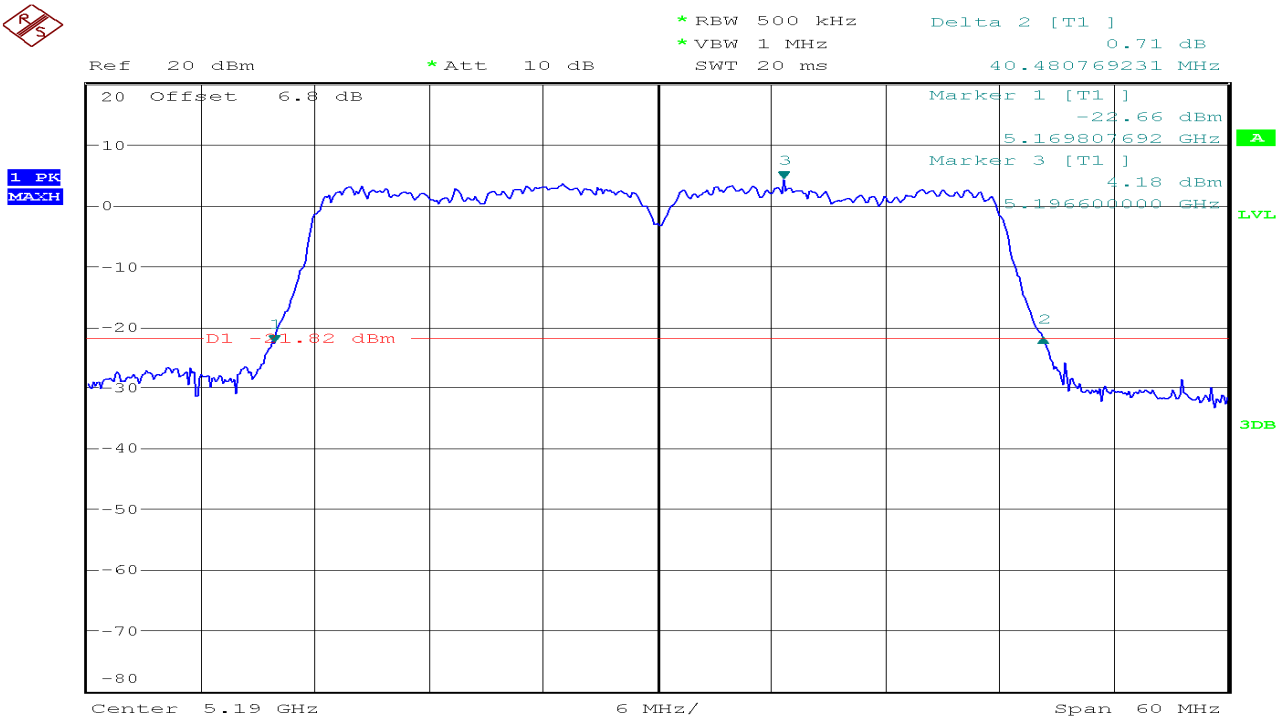
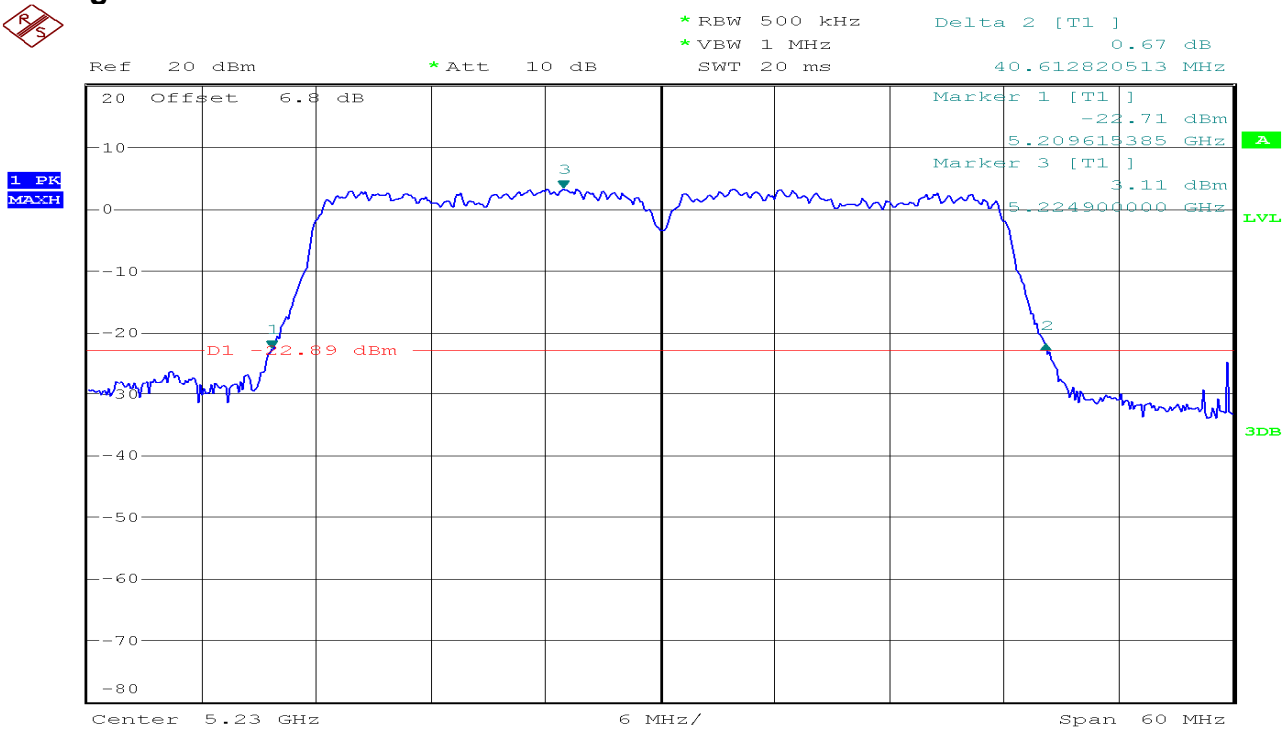
IEEE 802.11ac VHT40 mode/Chain 0:

CH Low



CH High



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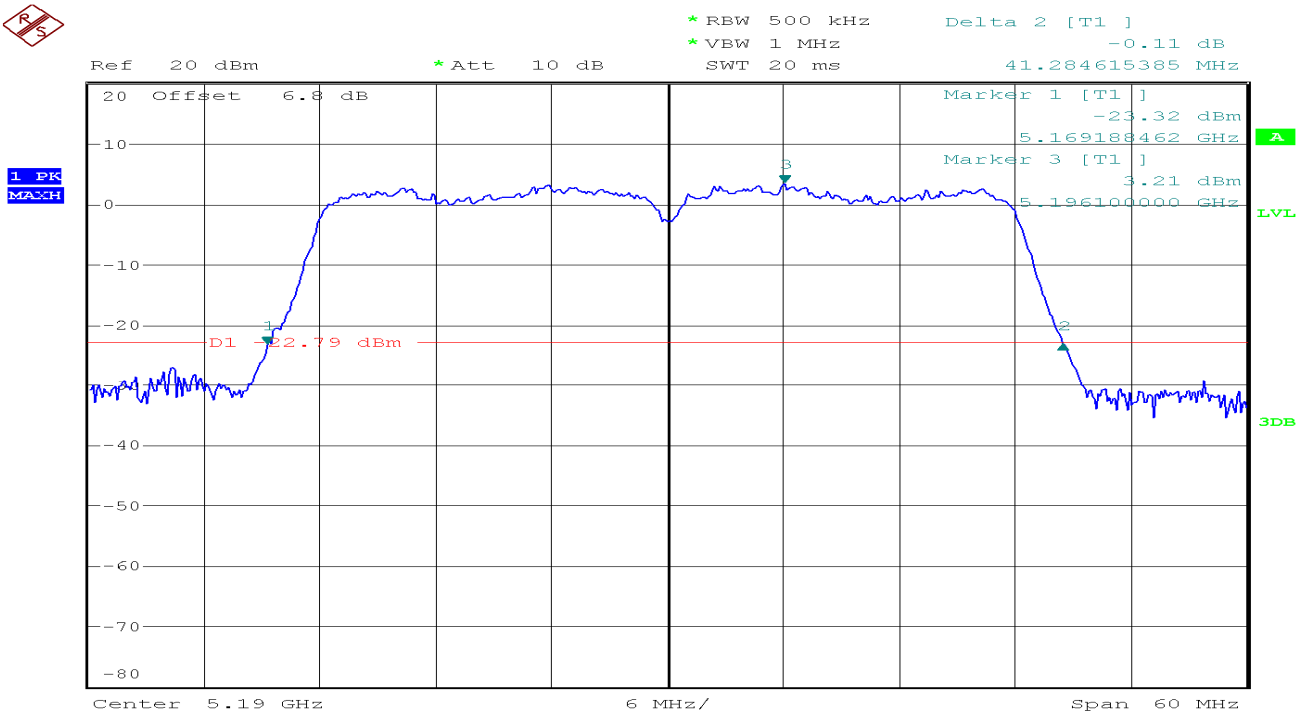
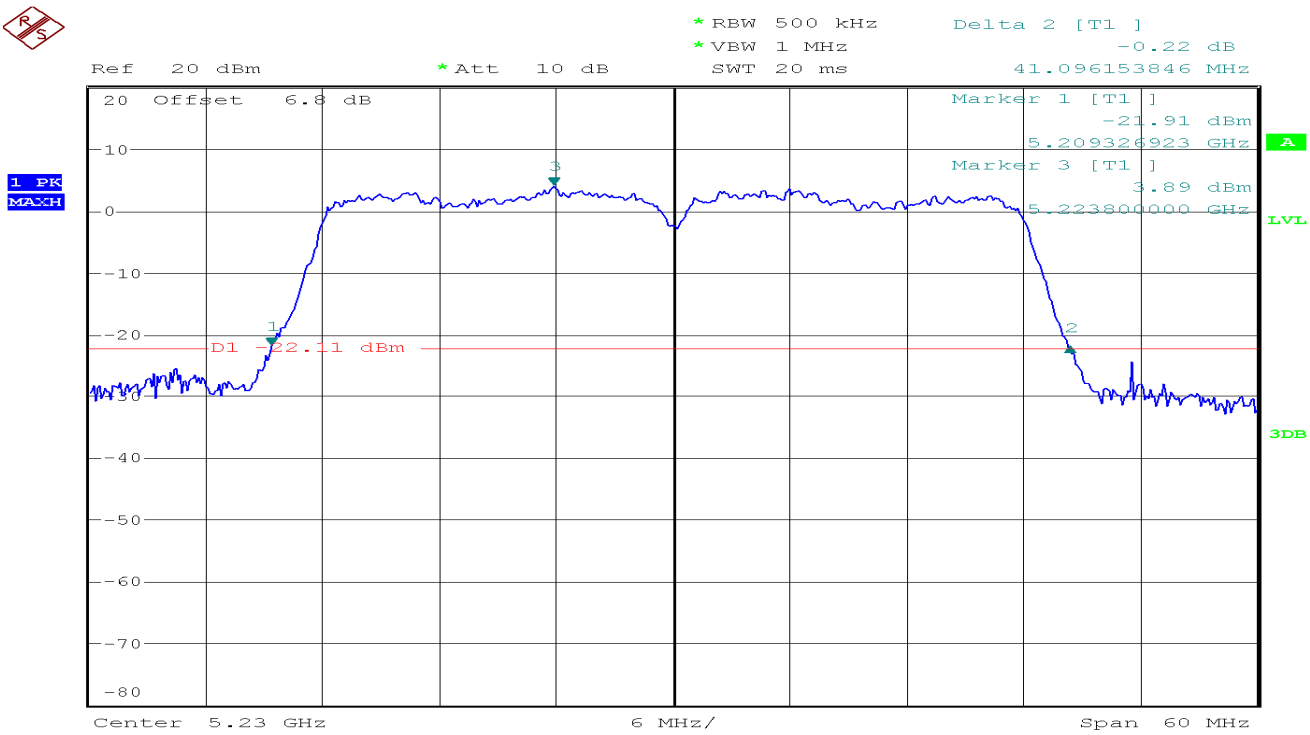
IEEE 802.11ac VHT40 mode/Chain 1:

CH Low



CH High



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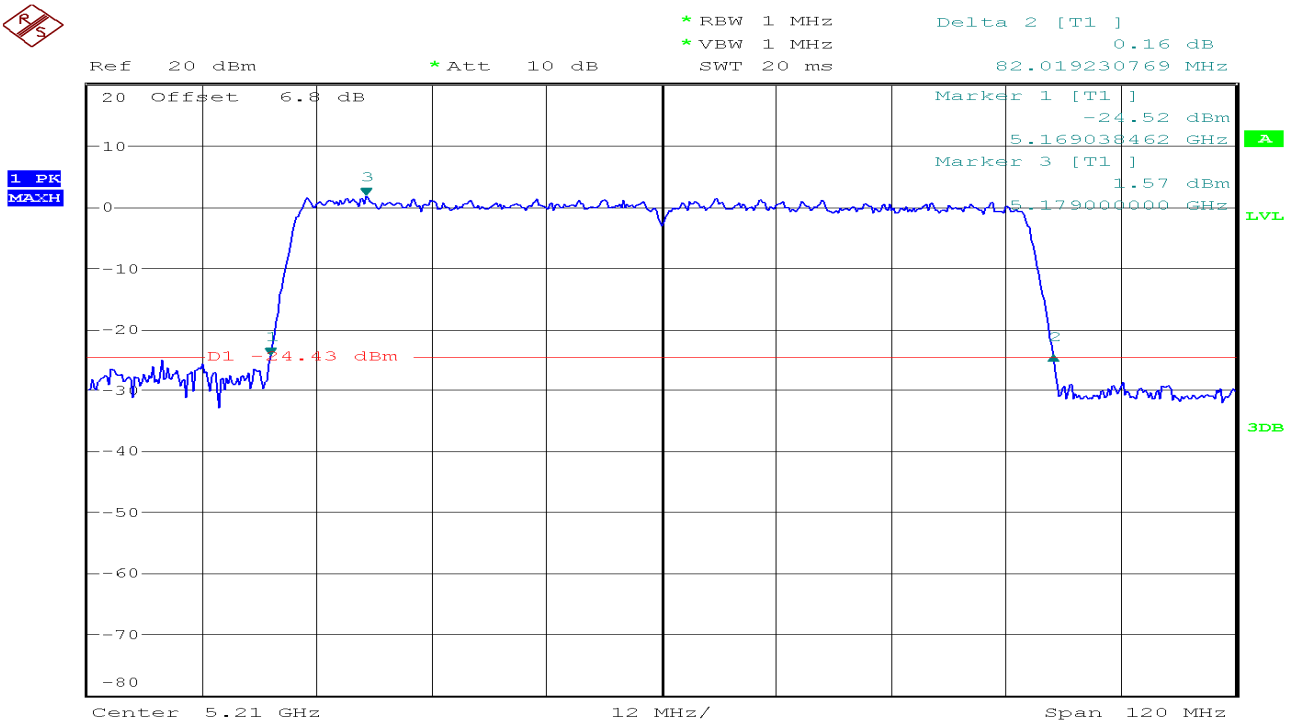
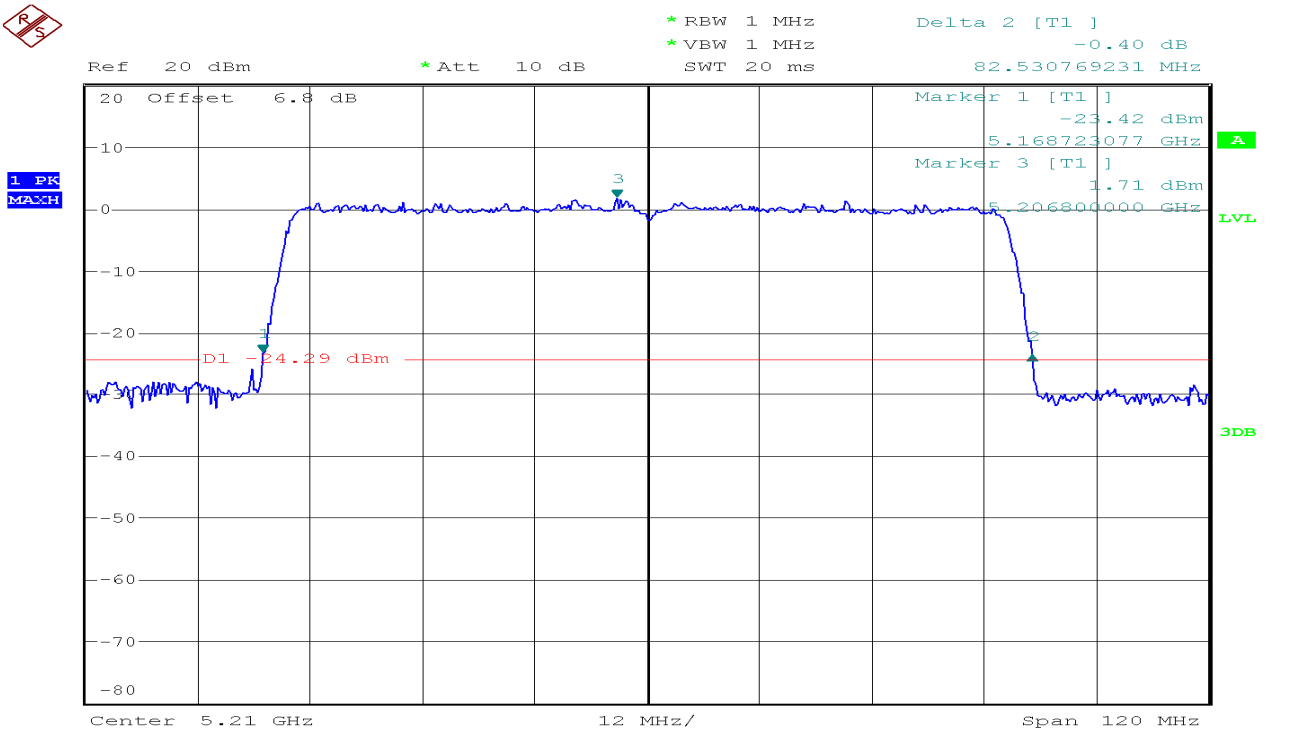
IEEE 802.11ac VHT80 mode/Chain 0:
CH Mid



IEEE 802.11ac VHT80 mode/Chain 1:
CH Mid



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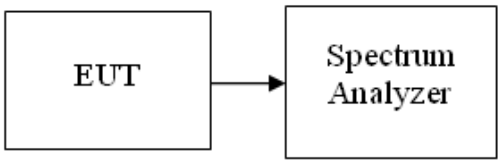
7.2 99% DB EMISSION BANDWIDTH

LIMIT

None; for reporting purposes only.

Test Configuration



Test Procedure

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ⩾ 3 · RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).

TEST RESULTS

No non-compliance noted

Test Data

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Test mode: IEEE 802.11a mode/ Chain 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	16.733
Mid	5220	16.733
High	5240	16.733

Test mode: IEEE 802.11a mode/ Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	16.933
Mid	5220	16.867
High	5240	16.867

Test mode: IEEE 802.11n HT20MHz mode/ Chain 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.800
Mid	5220	17.667
High	5240	17.733

Test mode: IEEE 802.11n HT20MHz mode/ Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.800
Mid	5220	17.800
High	5240	17.800

Test mode: IEEE 802.11n HT40MHz mode / Chain 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	36.200
High	5230	36.200

Test mode: IEEE 802.11n HT40MHz mode / Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	36.300
High	5230	36.200

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Test mode: IEEE 802.11ac VHT20MHz mode / Chain 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.800
Mid	5220	17.667
High	5240	17.800

Test mode: IEEE 802.11ac VHT20MHz mode / Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.733
Mid	5220	17.733
High	5240	17.800

Test mode: IEEE 802.11ac VHT40MHz mode/ Chain 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	36.200
High	5230	36.200

Test mode: IEEE 802.11ac VHT40MHz mode/ Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	36.300
High	5230	36.200

Test mode: IEEE 802.11ac VHT80MHz mode/ Chain 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Mid	5210	76.400

Test mode: IEEE 802.11ac VHT80MHz mode/ Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Mid	5210	76.600

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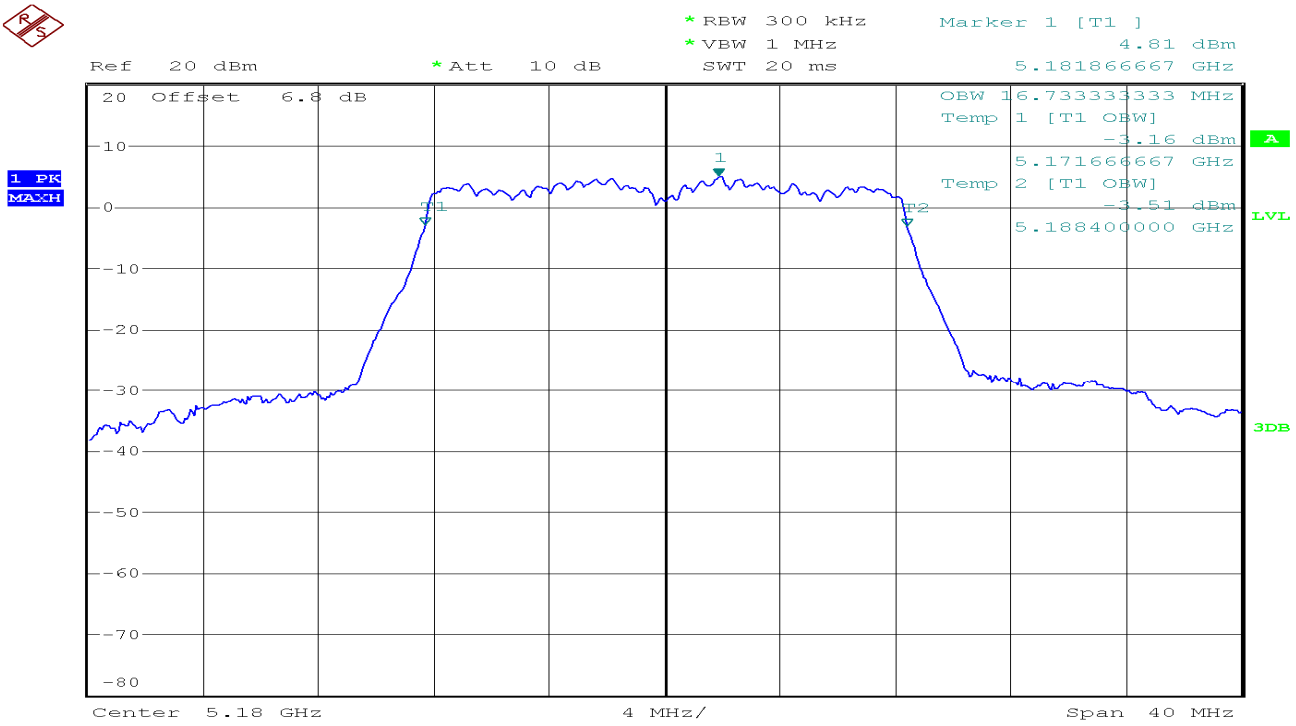
Test Plot

IEEE 802.11a mode/Chain 0:

CH Low



CH Mid

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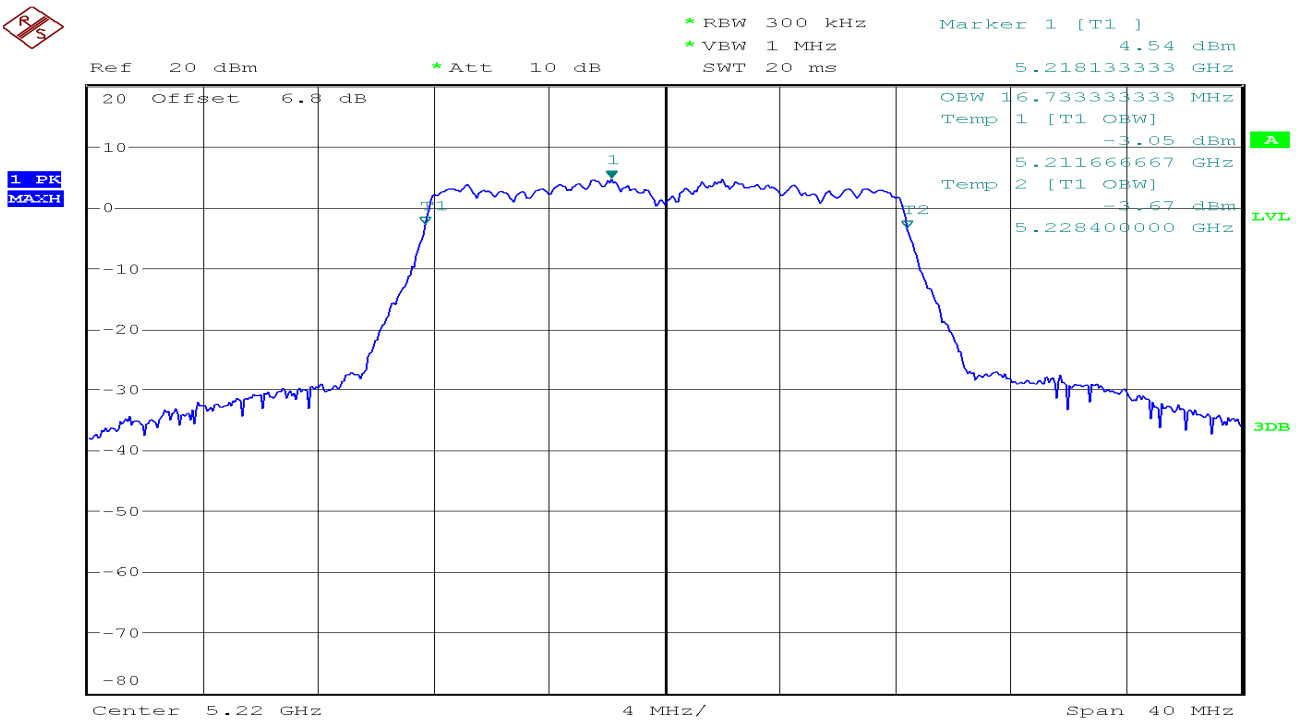

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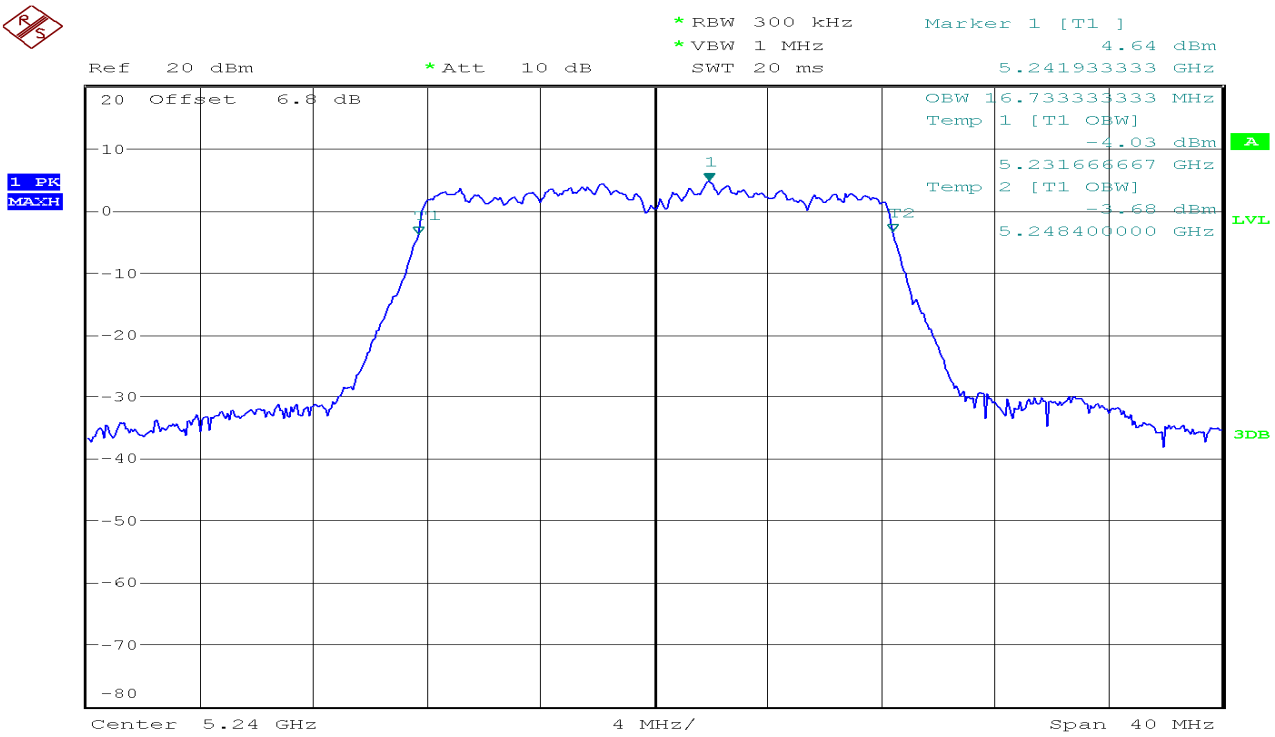
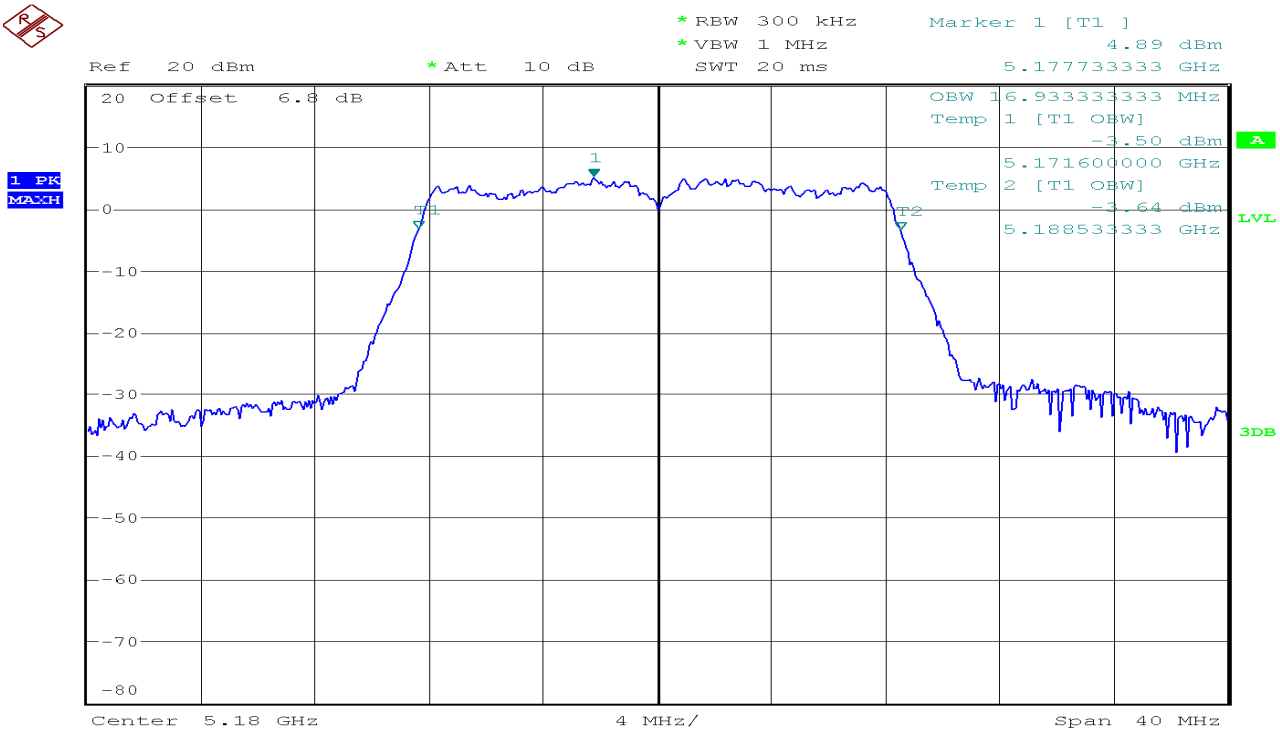
CH High



IEEE 802.11a mode/Chain 1:

CH Low



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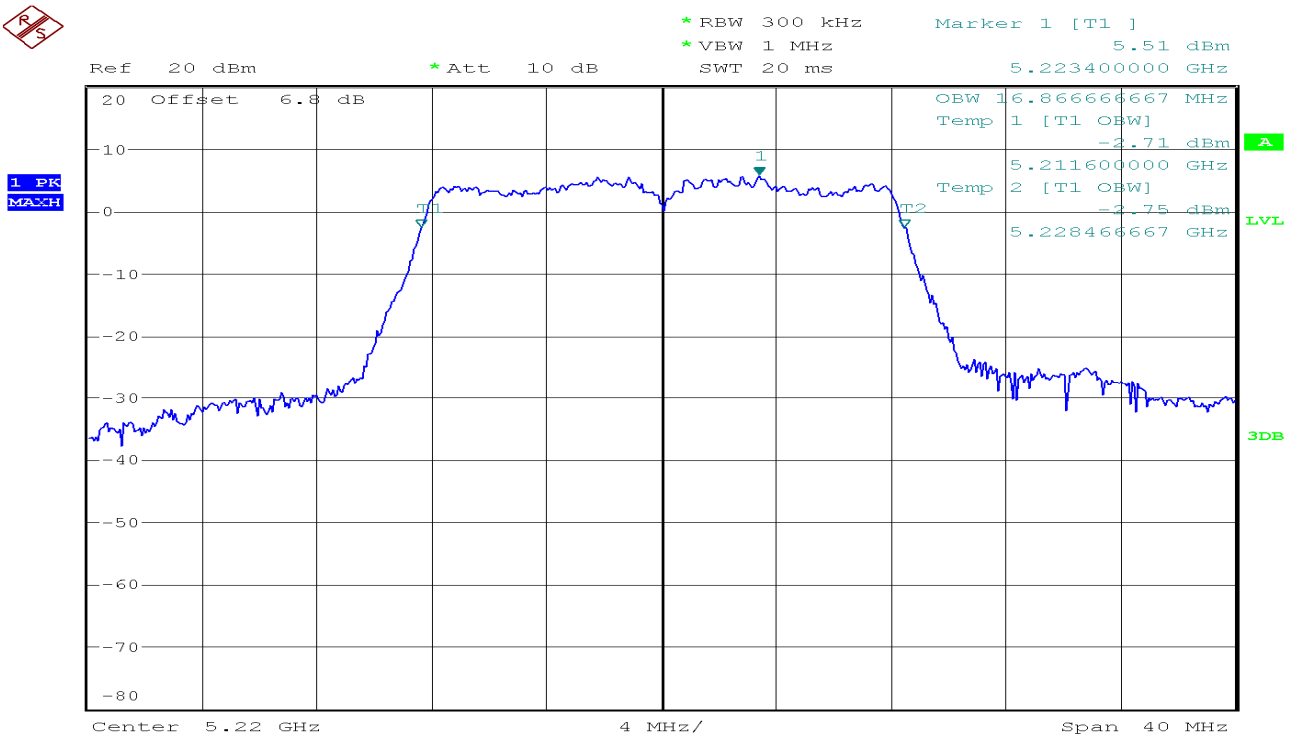
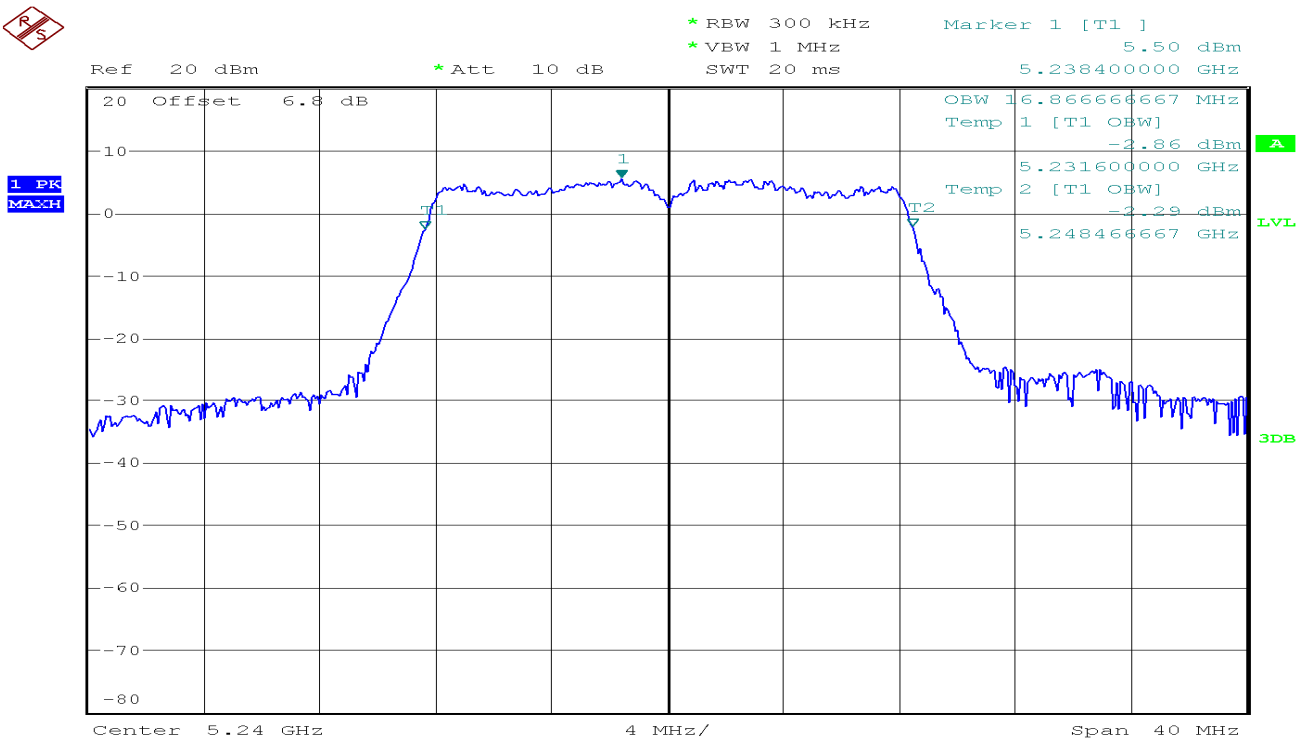
CH Mid



CH High



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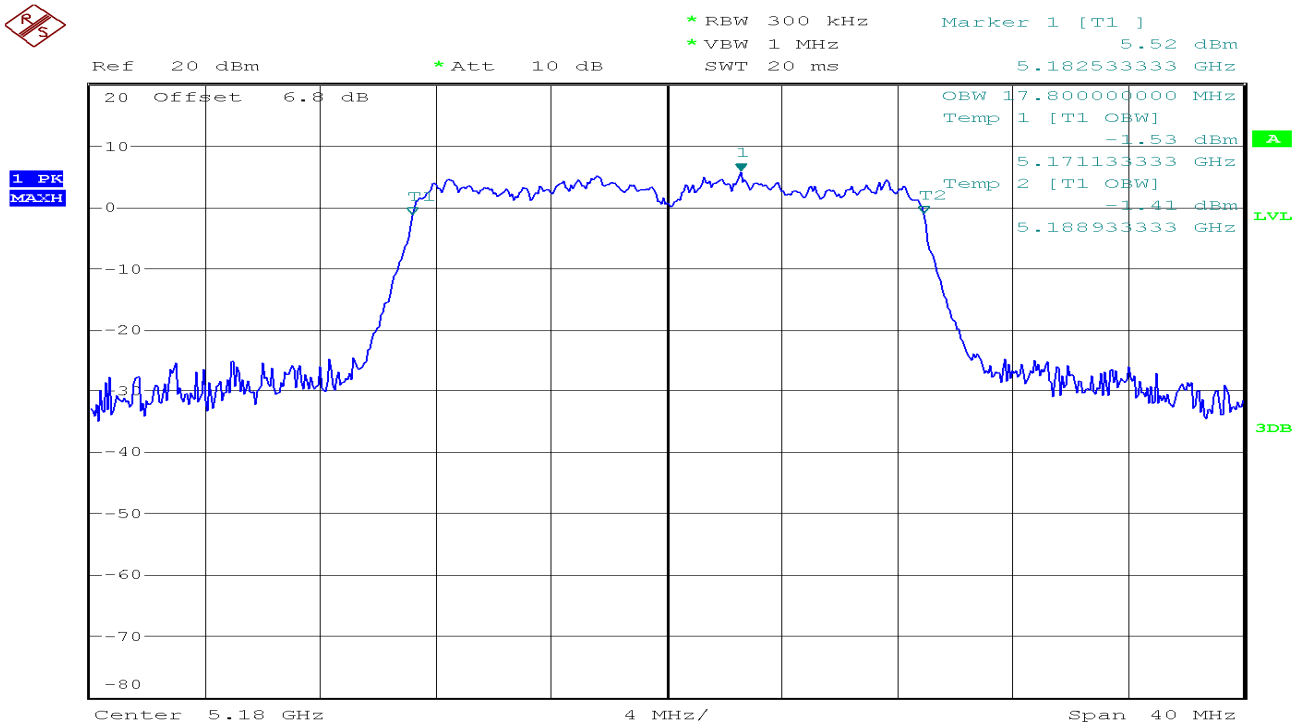
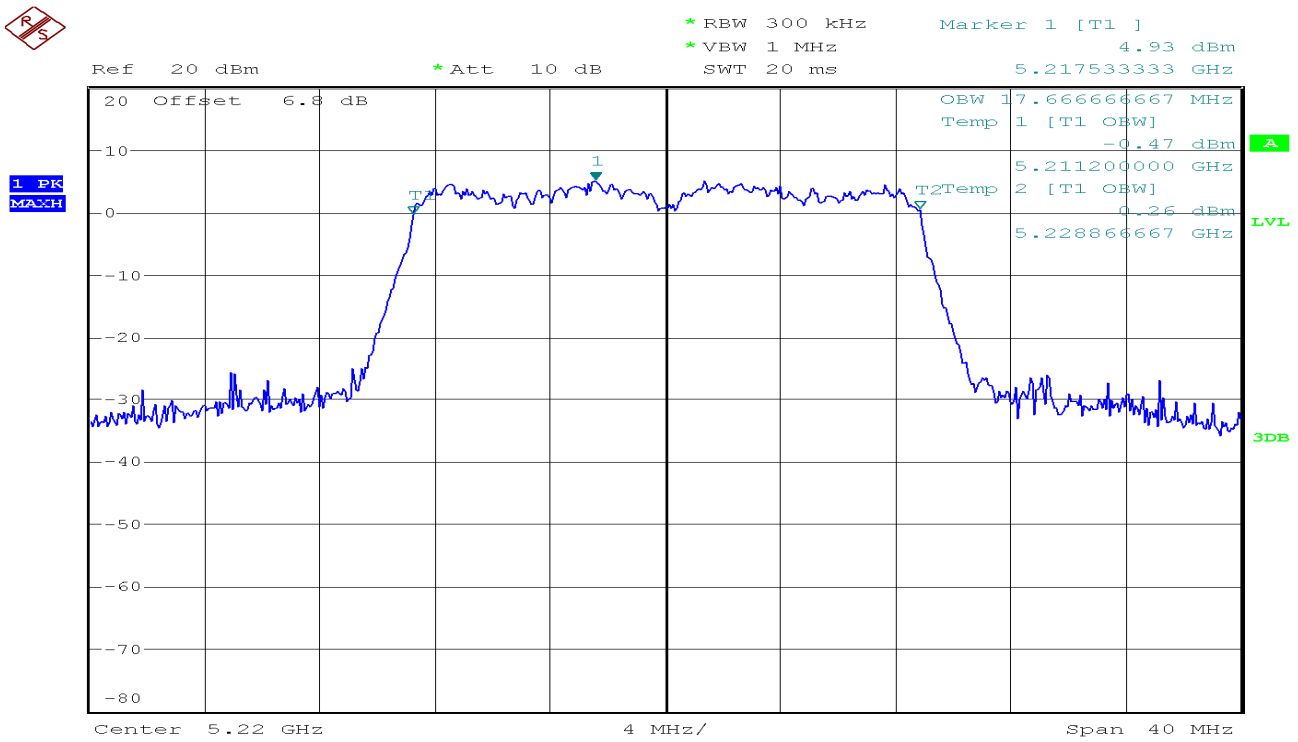
IEEE 802.11n HT20 mode/Chain 0:

CH Low



CH Mid



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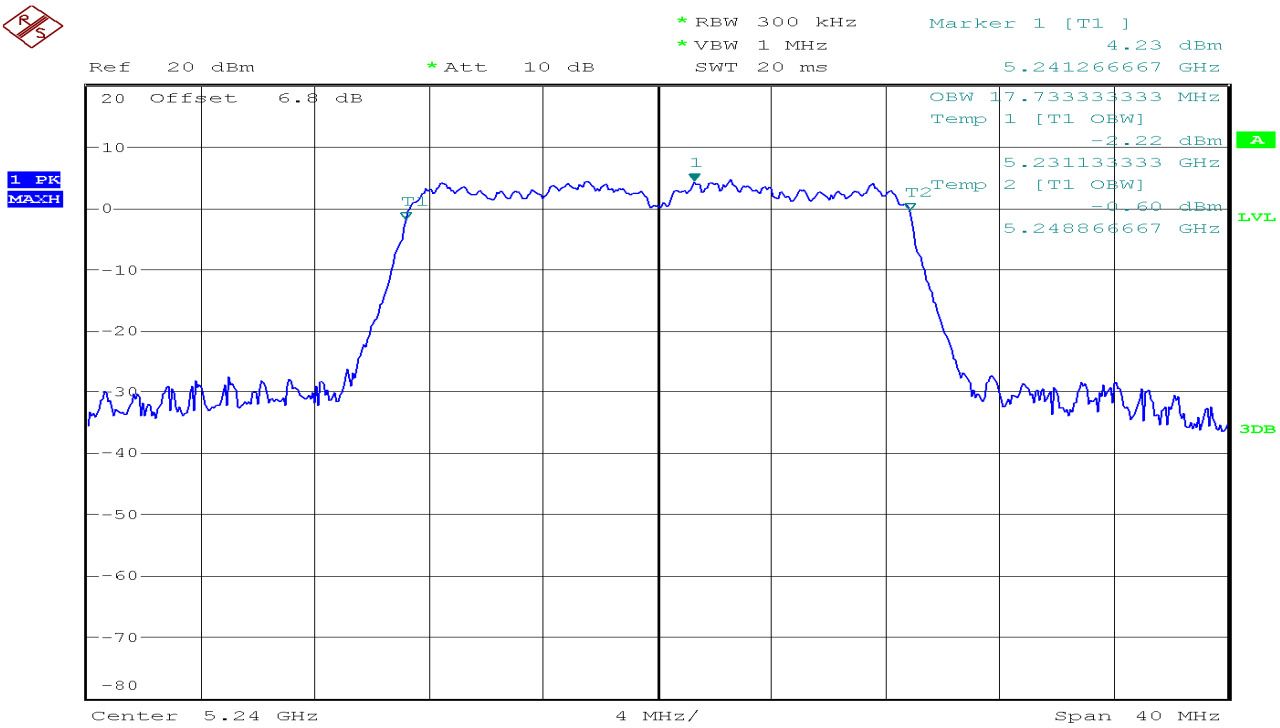
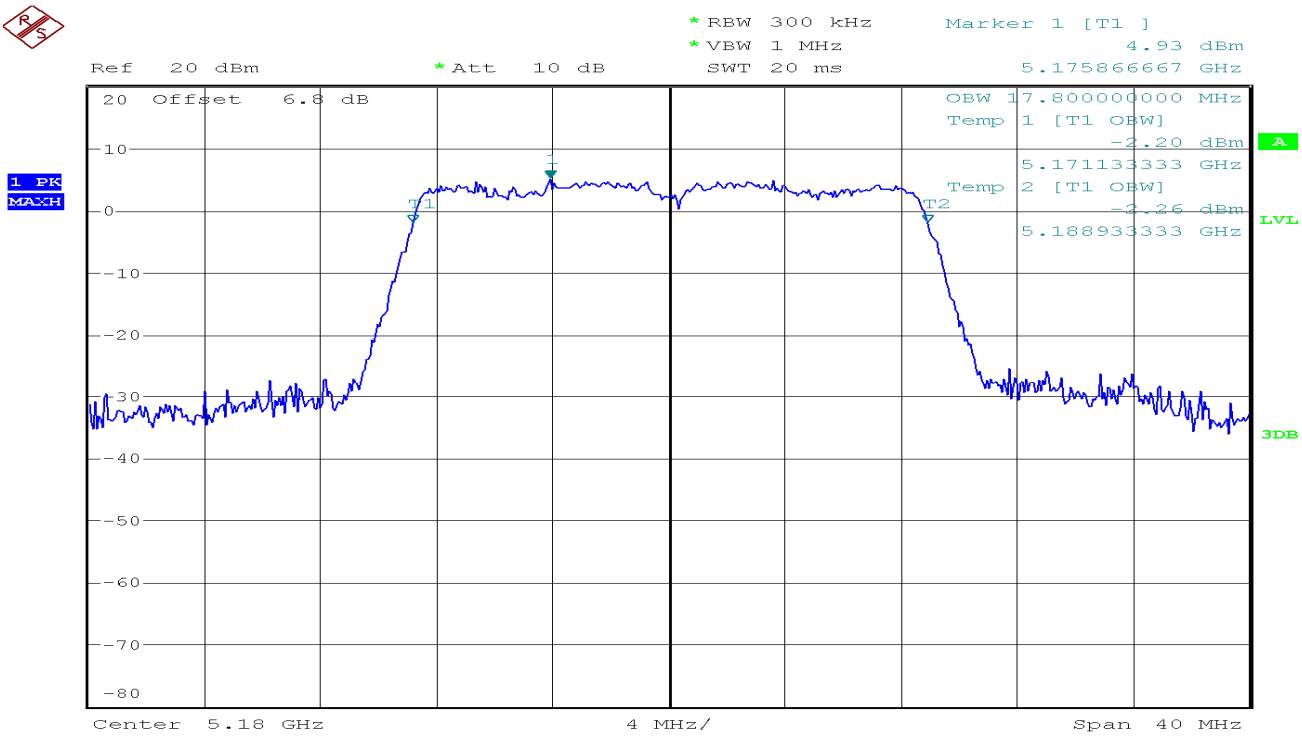
CH High



IEEE 802.11n HT20 mode/Chain 1:

CH Low



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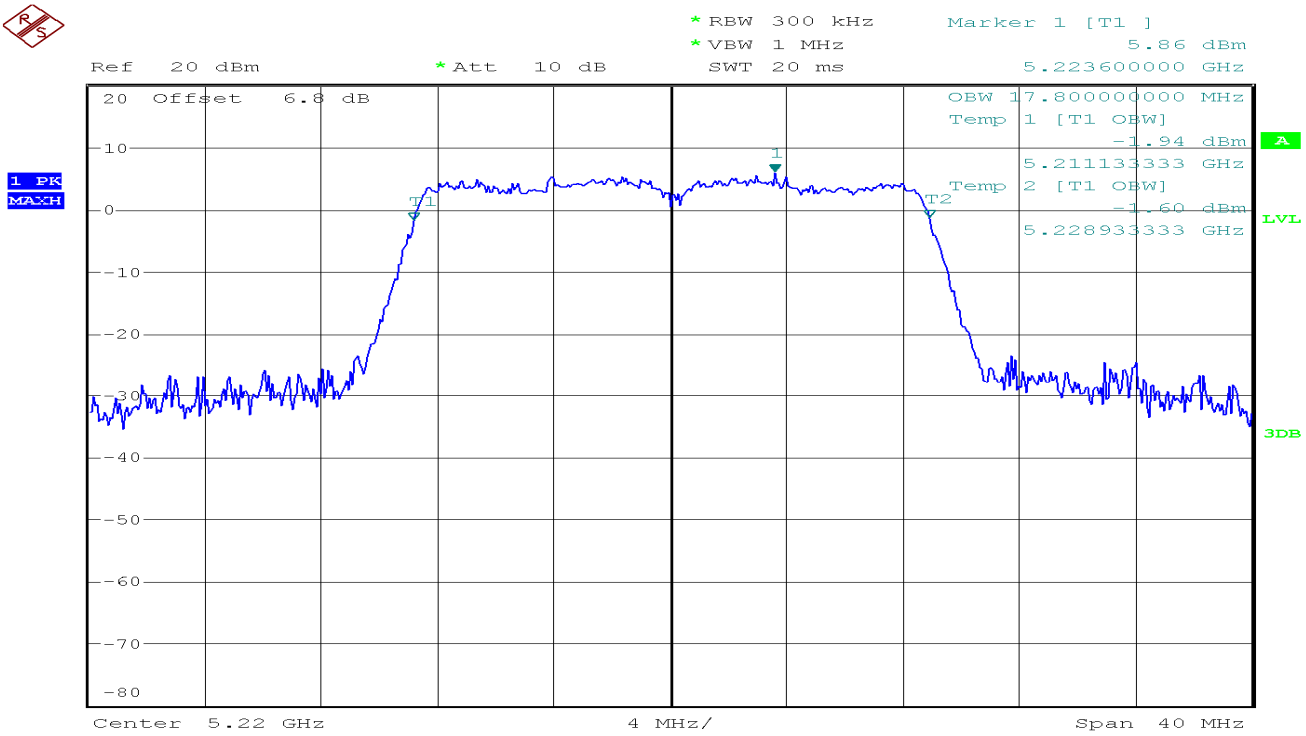
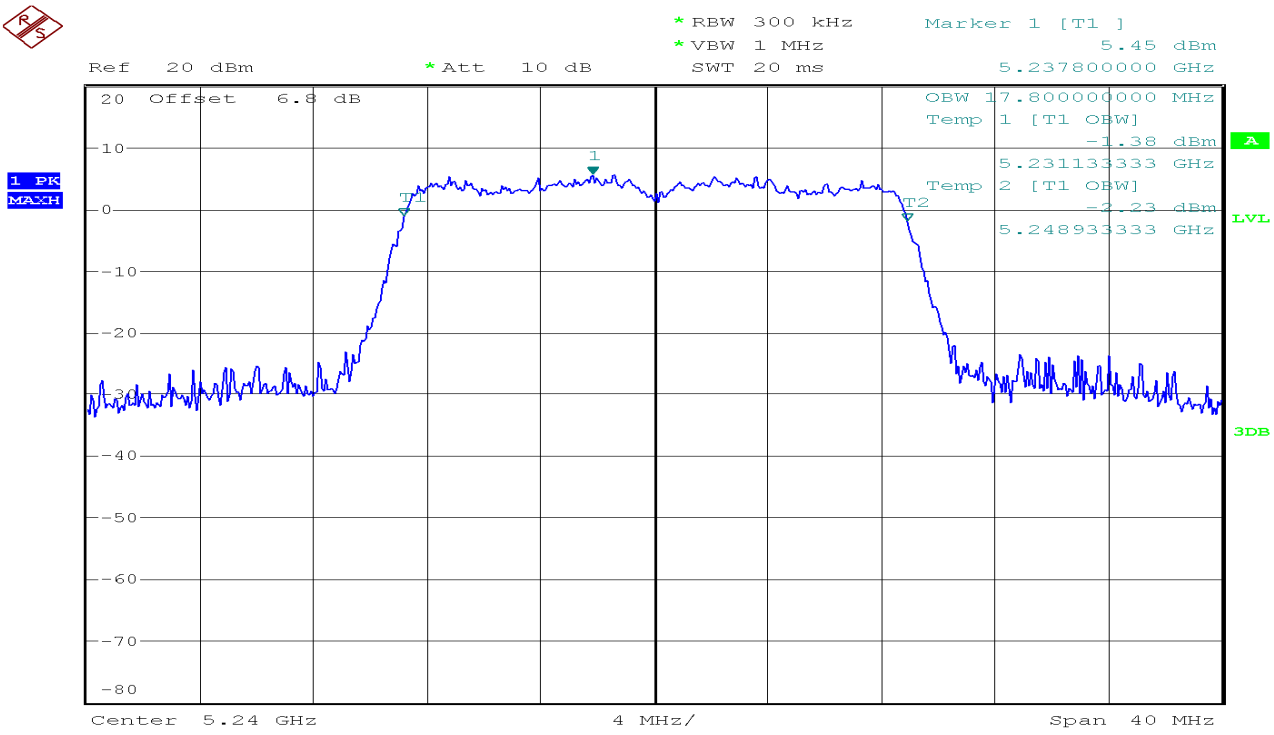
CH Mid



CH High



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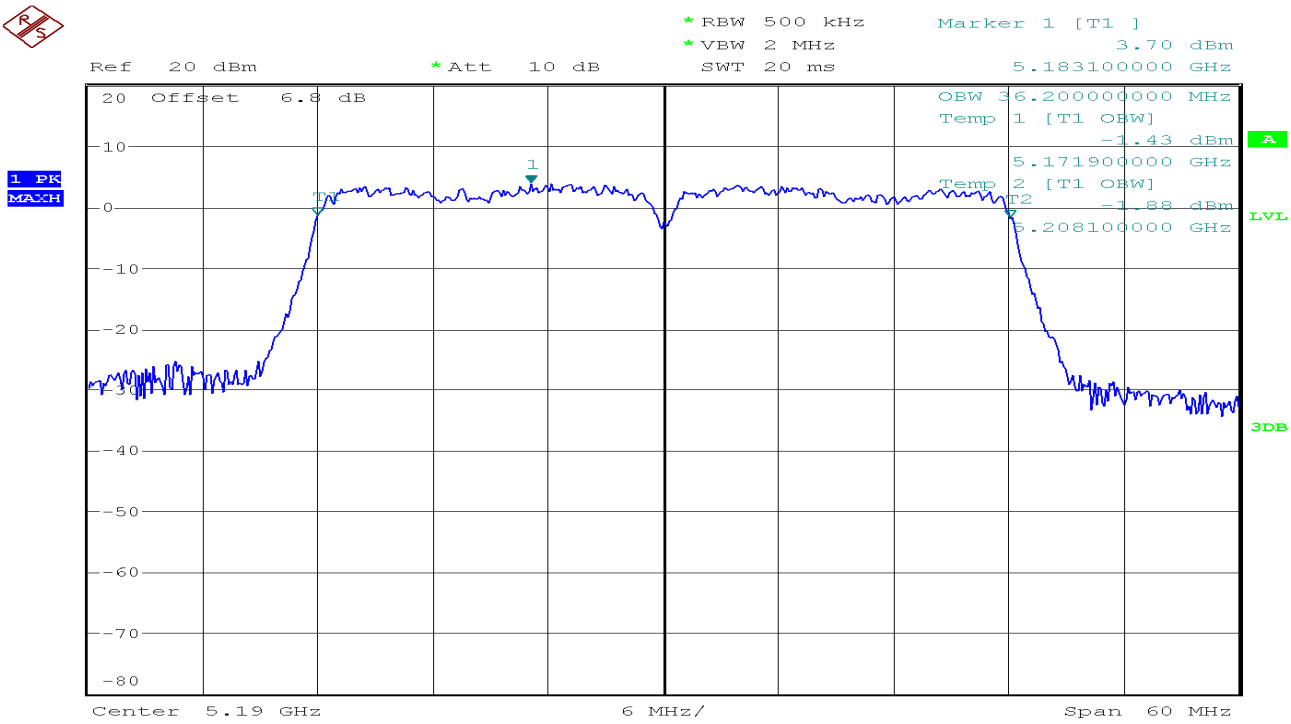
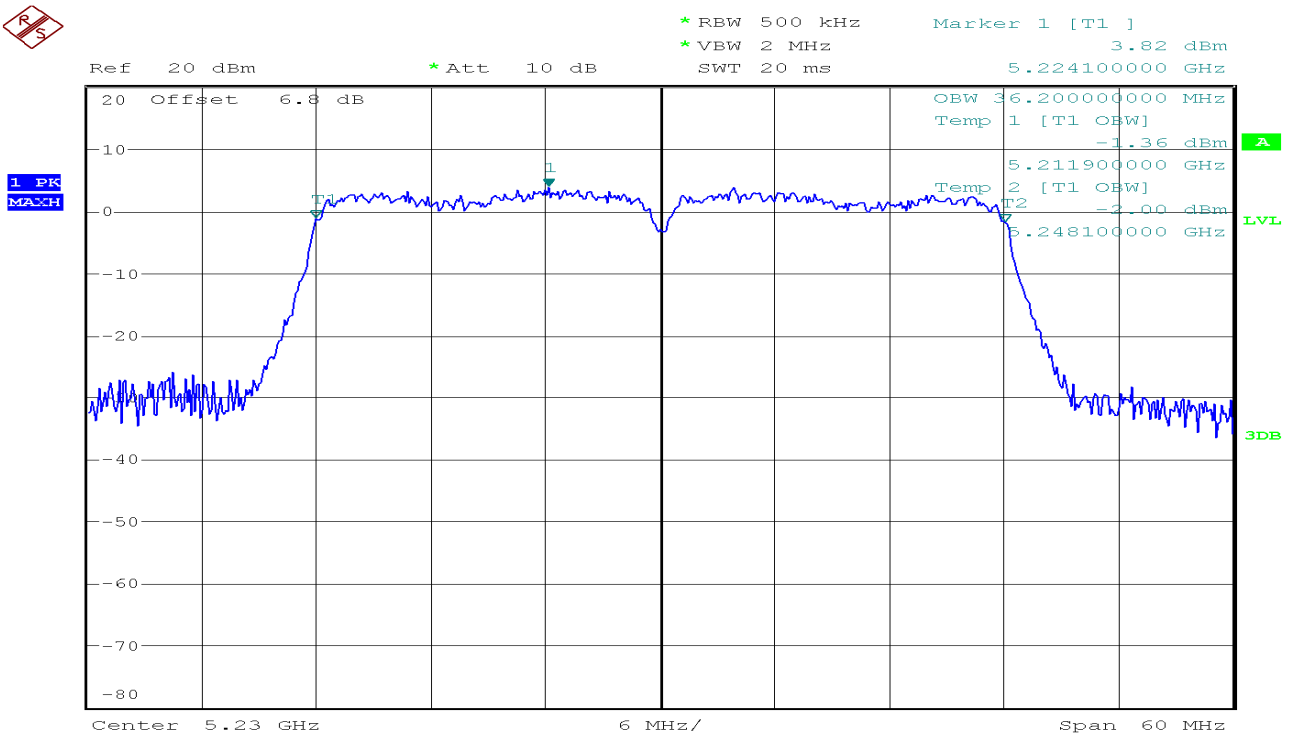
IEEE 802.11n HT40 mode/Chain 0:

CH Low



CH High



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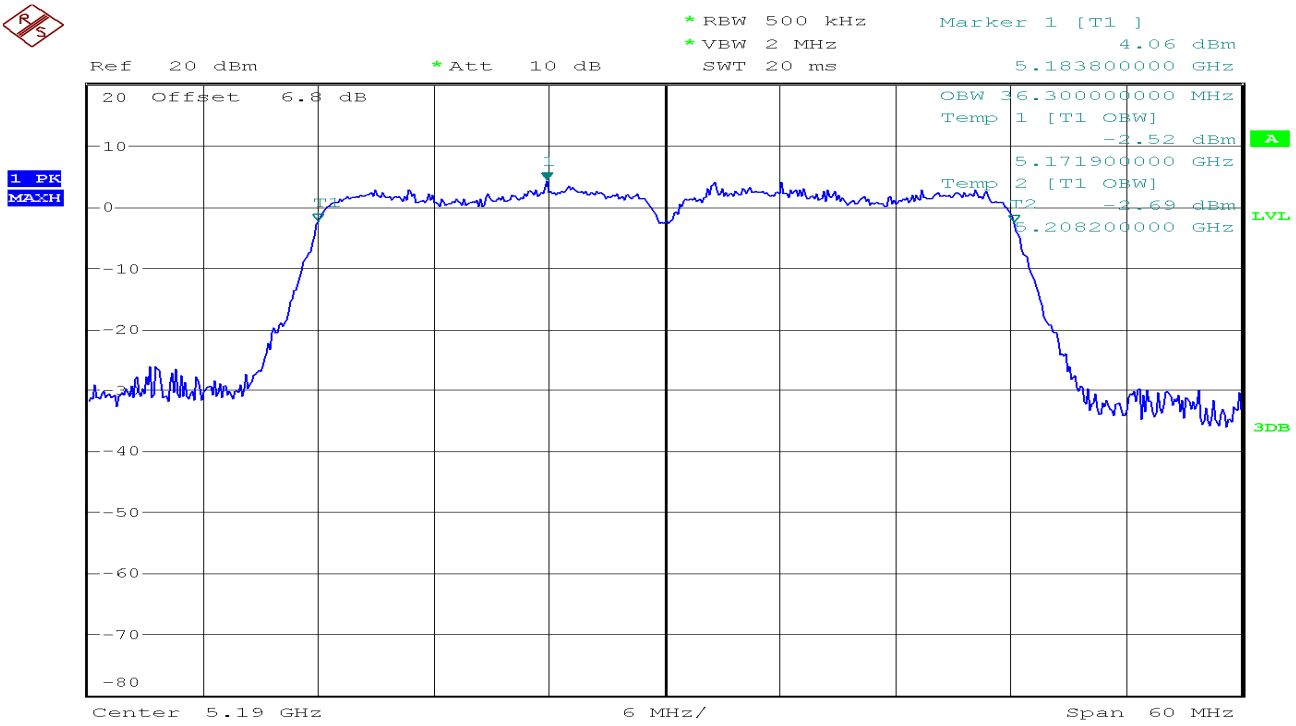
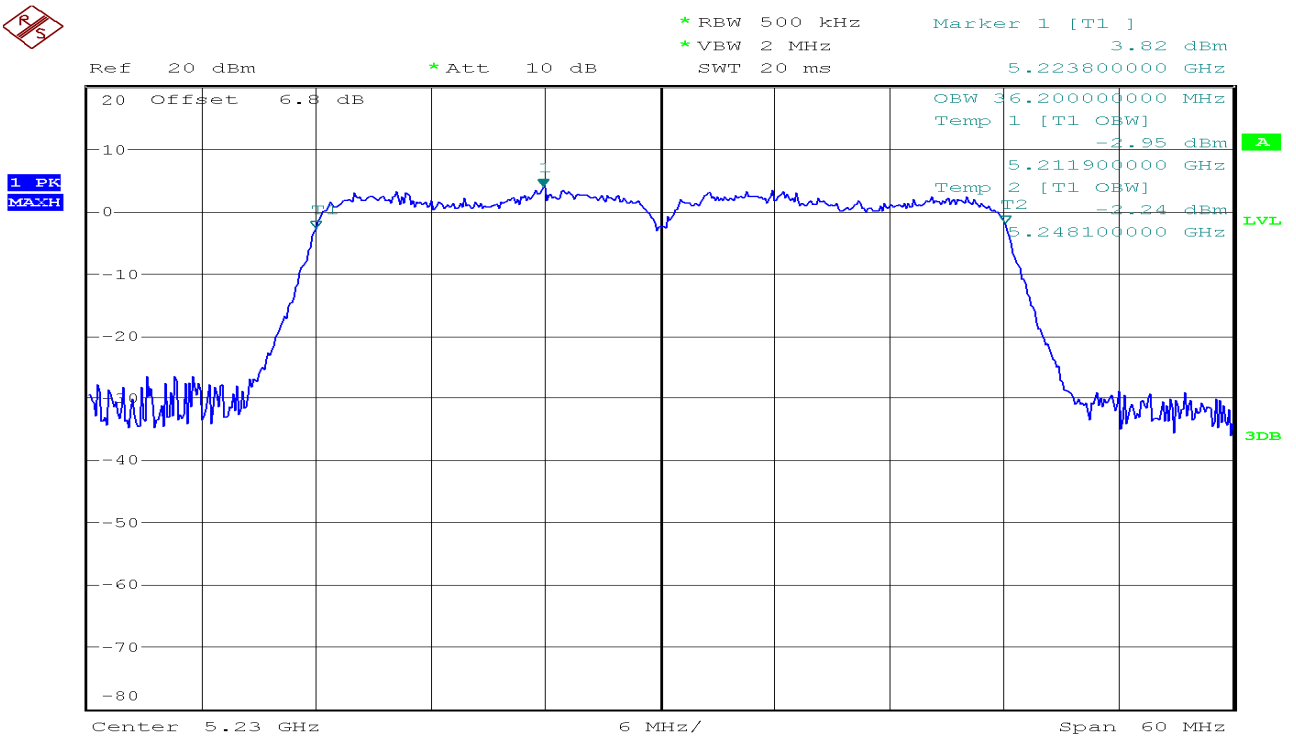
IEEE 802.11n HT40 mode/Chain 1:

CH Low



CH High



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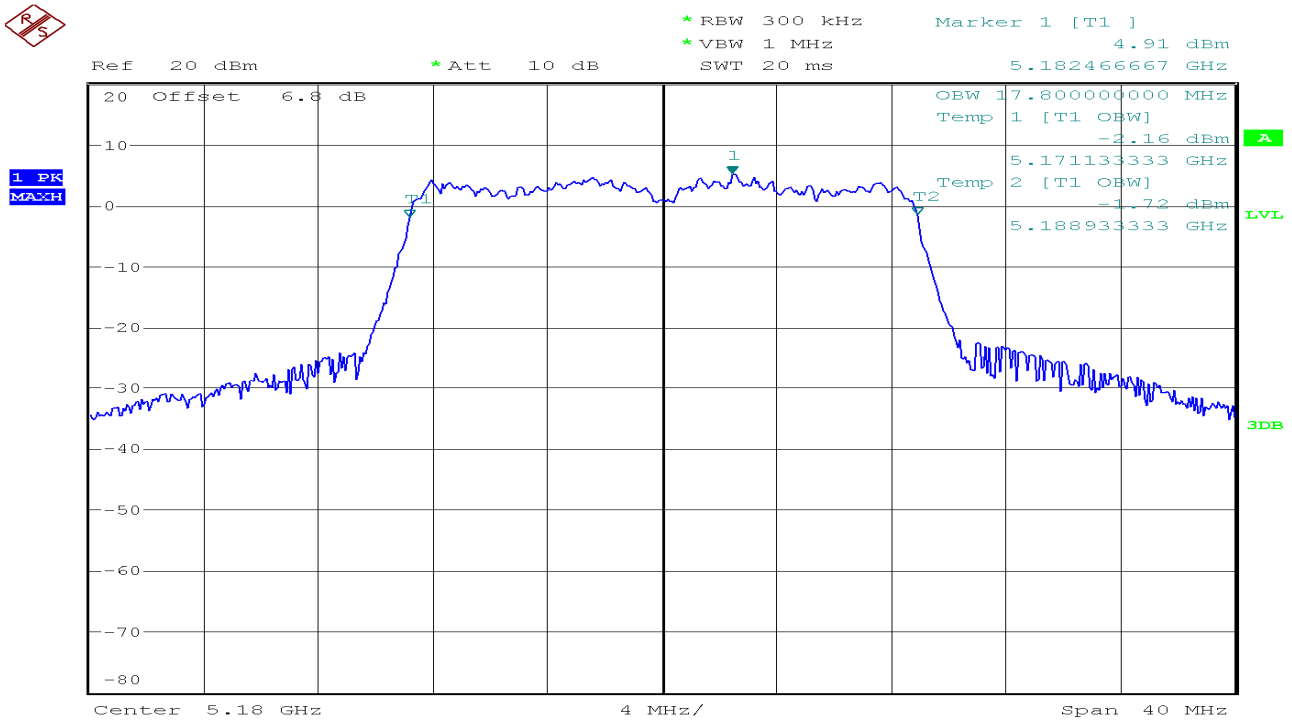
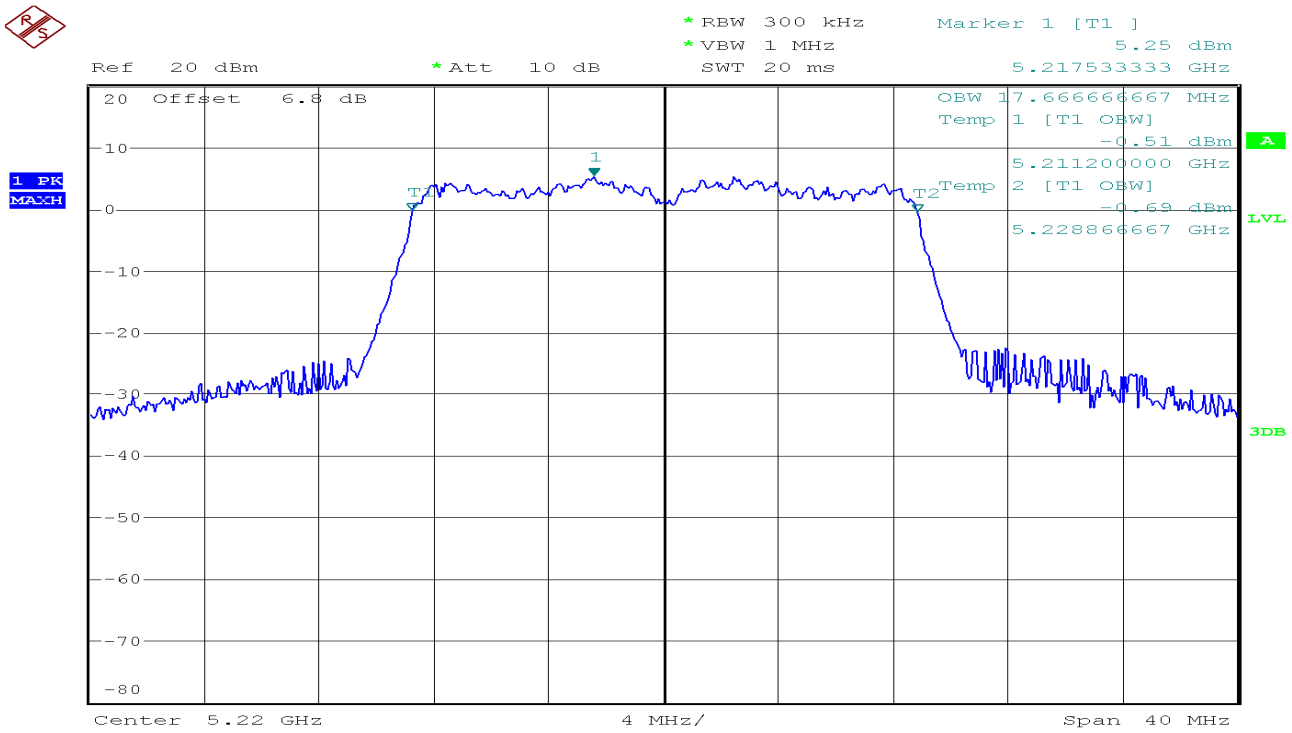
IEEE 802.11ac VHT20 mode/Chain 0:

CH Low



CH Mid



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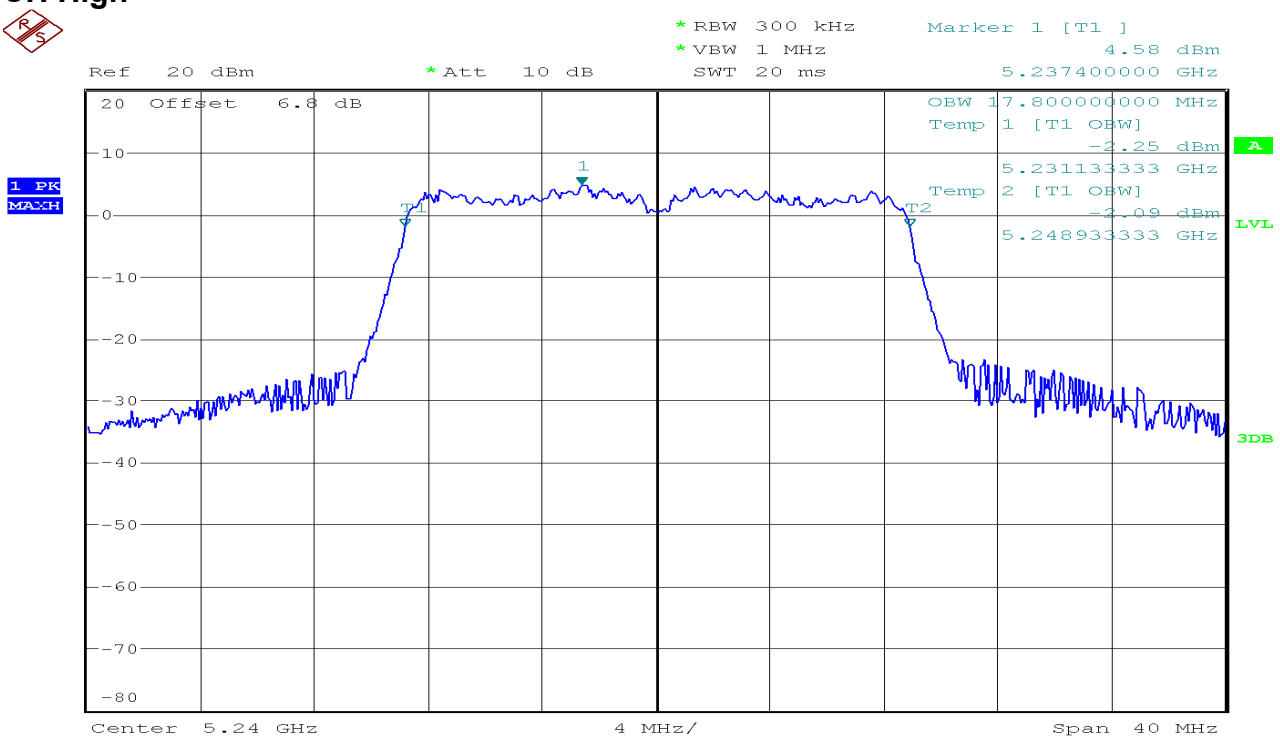
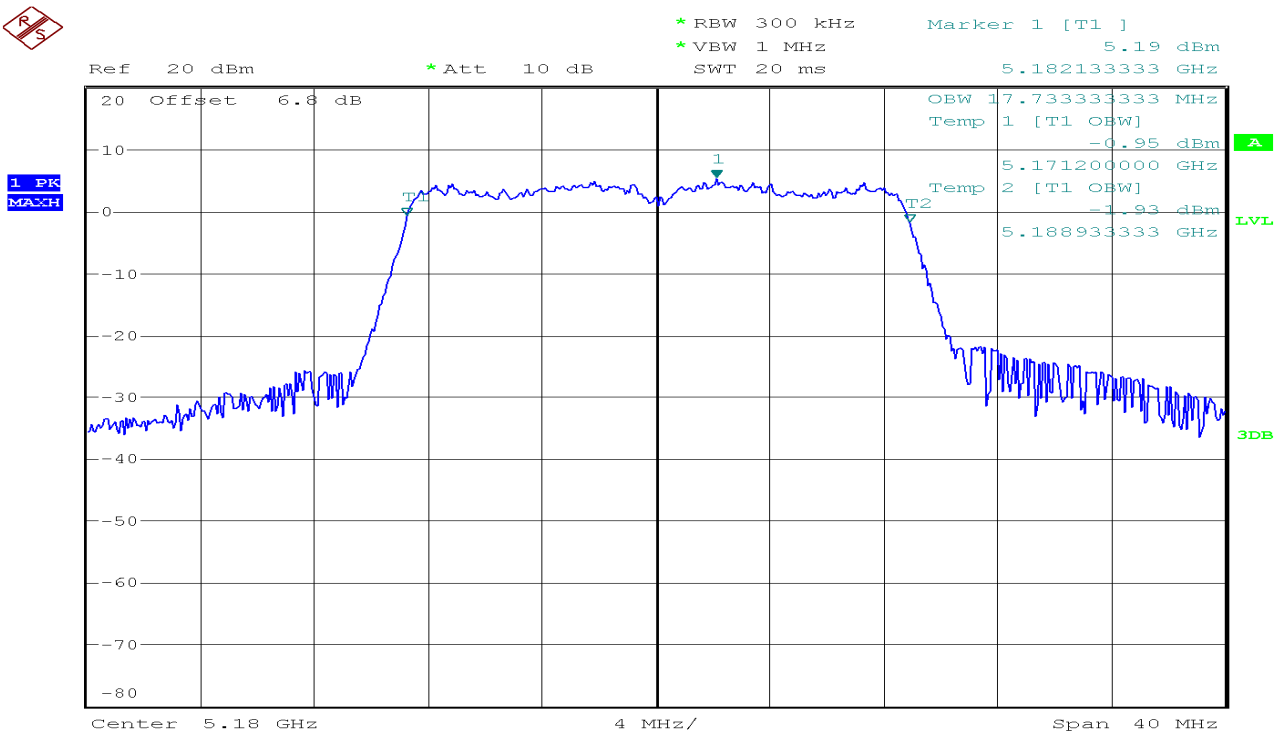
CH High



IEEE 802.11ac VHT20 mode/Chain 1:

CH Low



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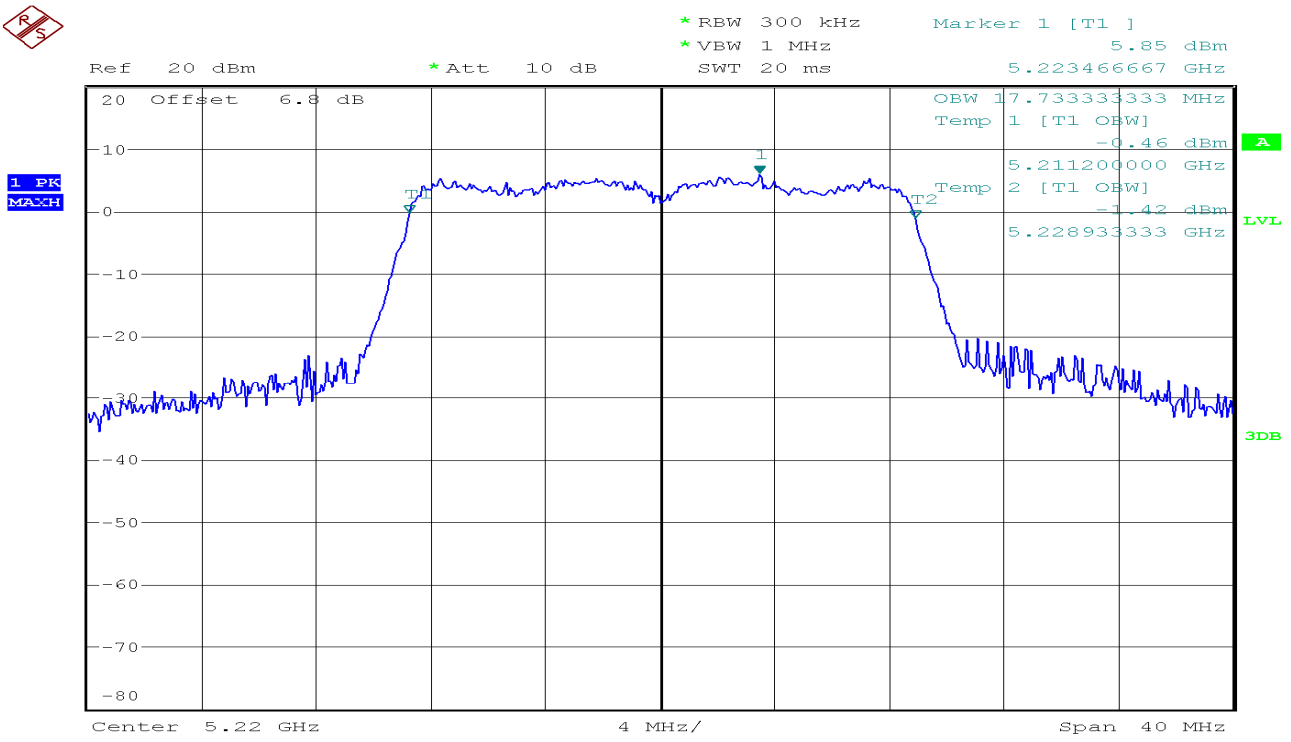
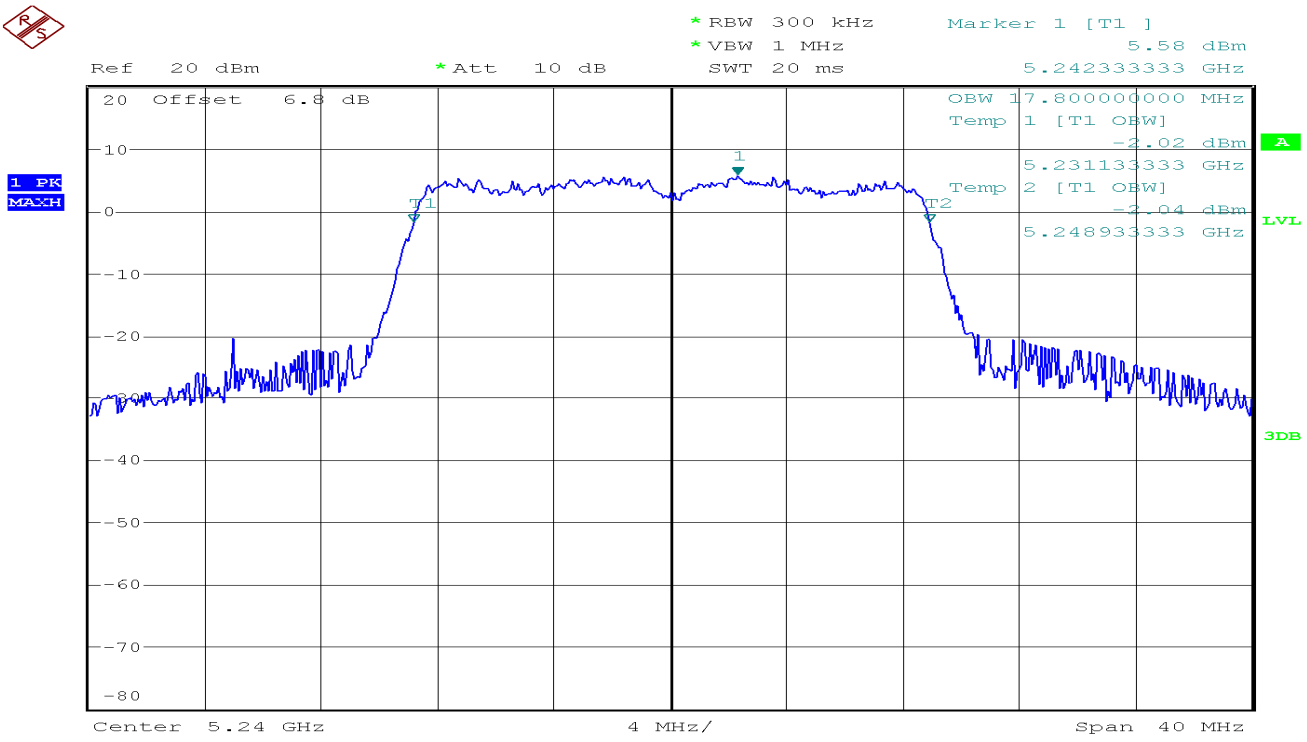
CH Mid



CH High



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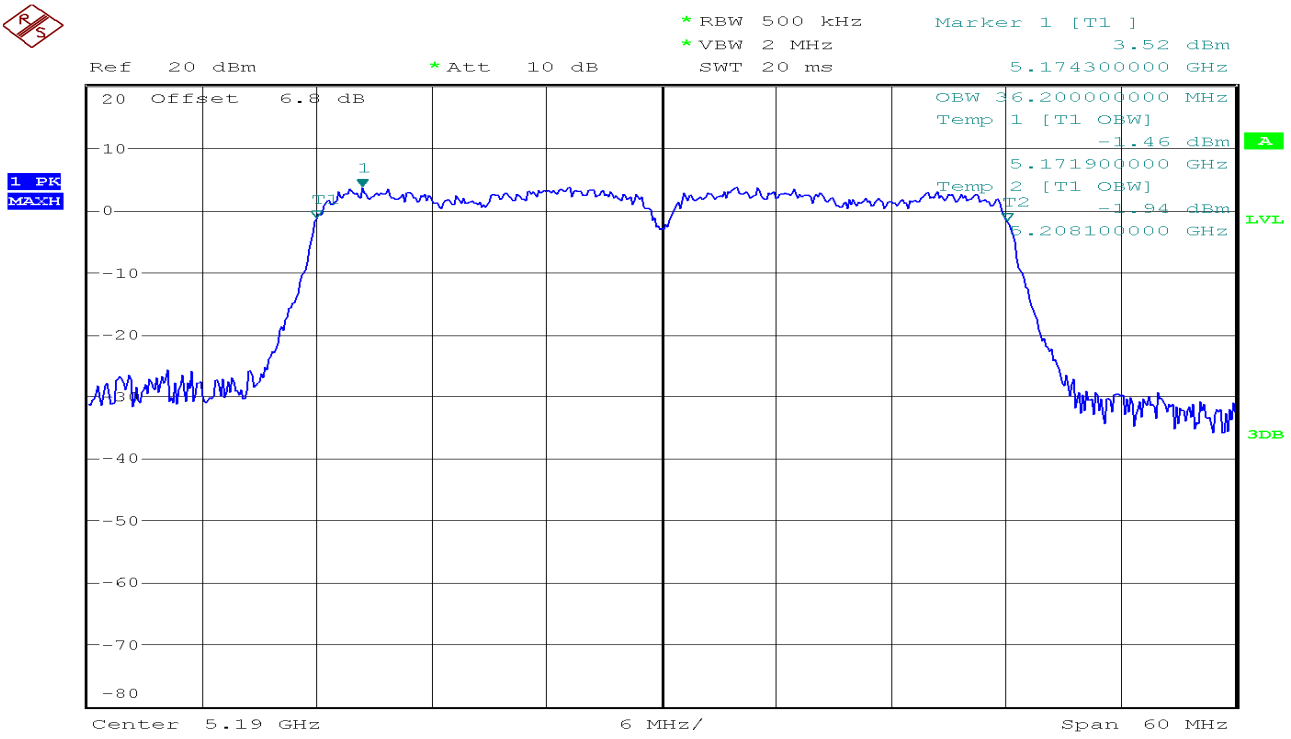
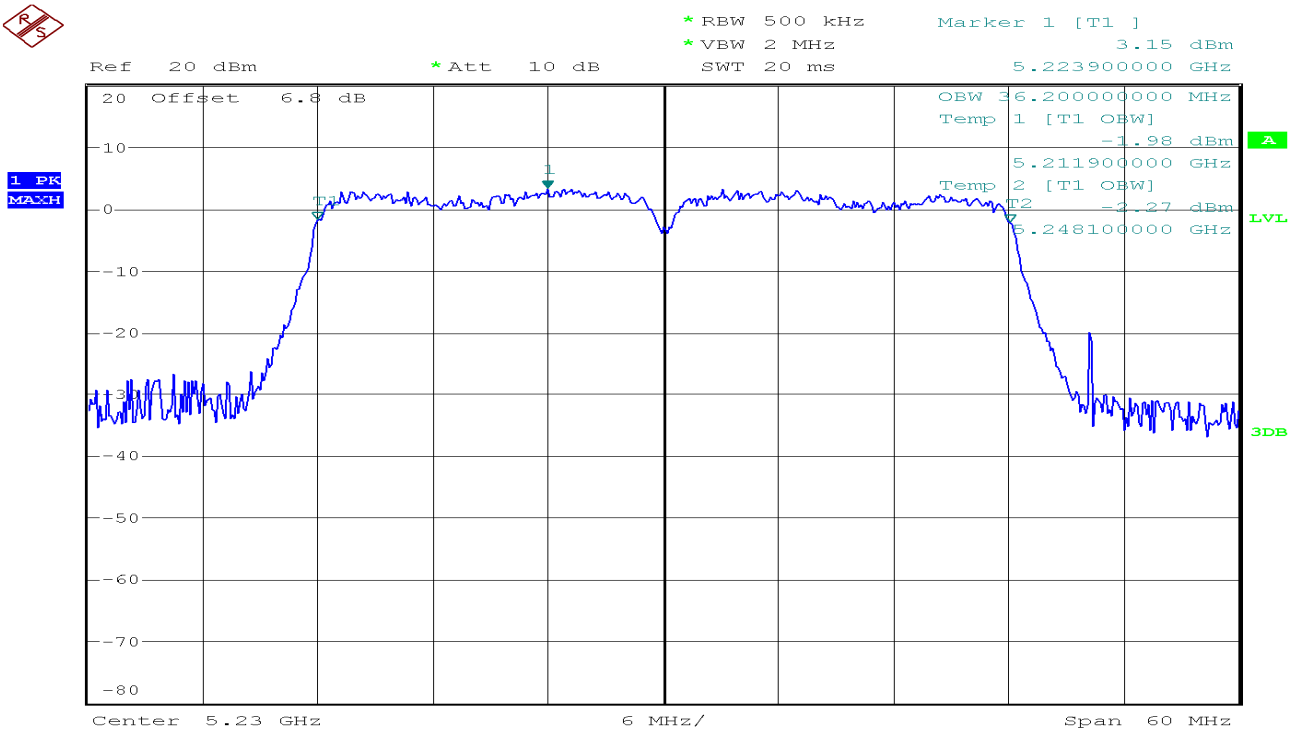
IEEE 802.11ac VHT40 mode/Chain 0:

CH Low



CH High



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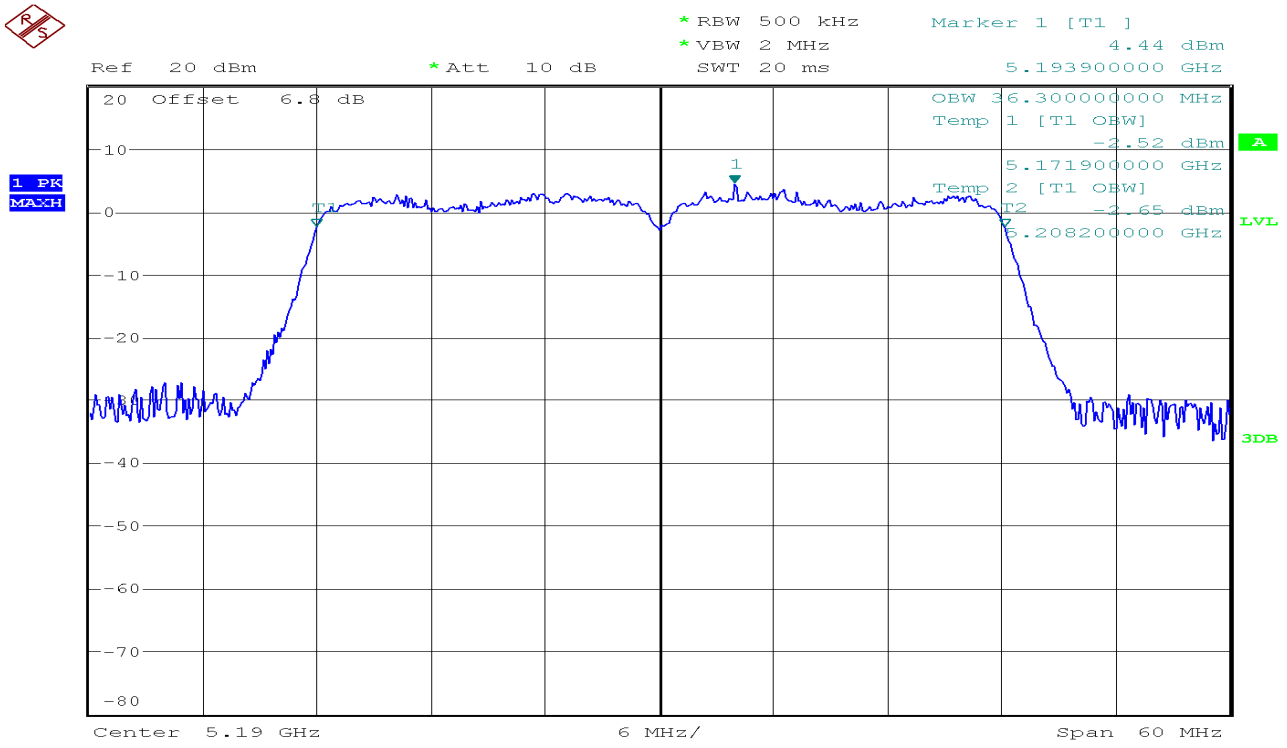
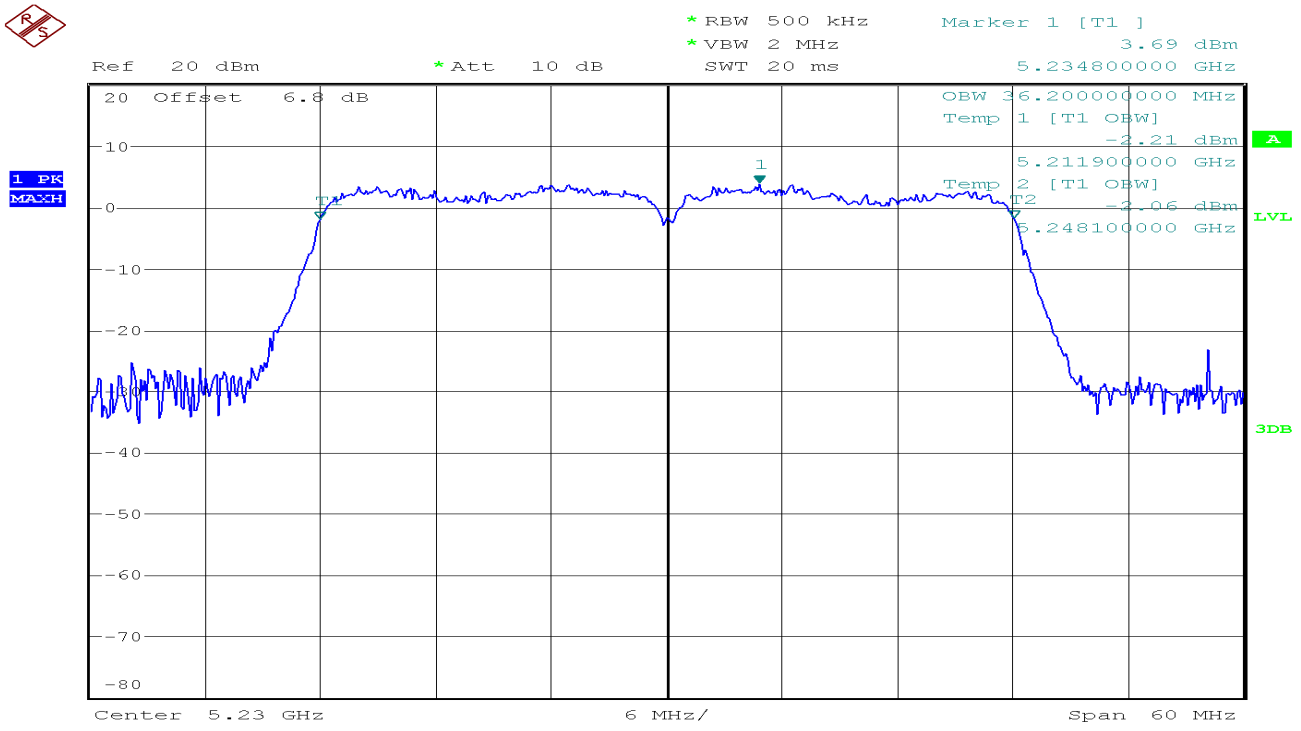
IEEE 802.11ac VHT40 mode/Chain 1:

CH Low



CH High



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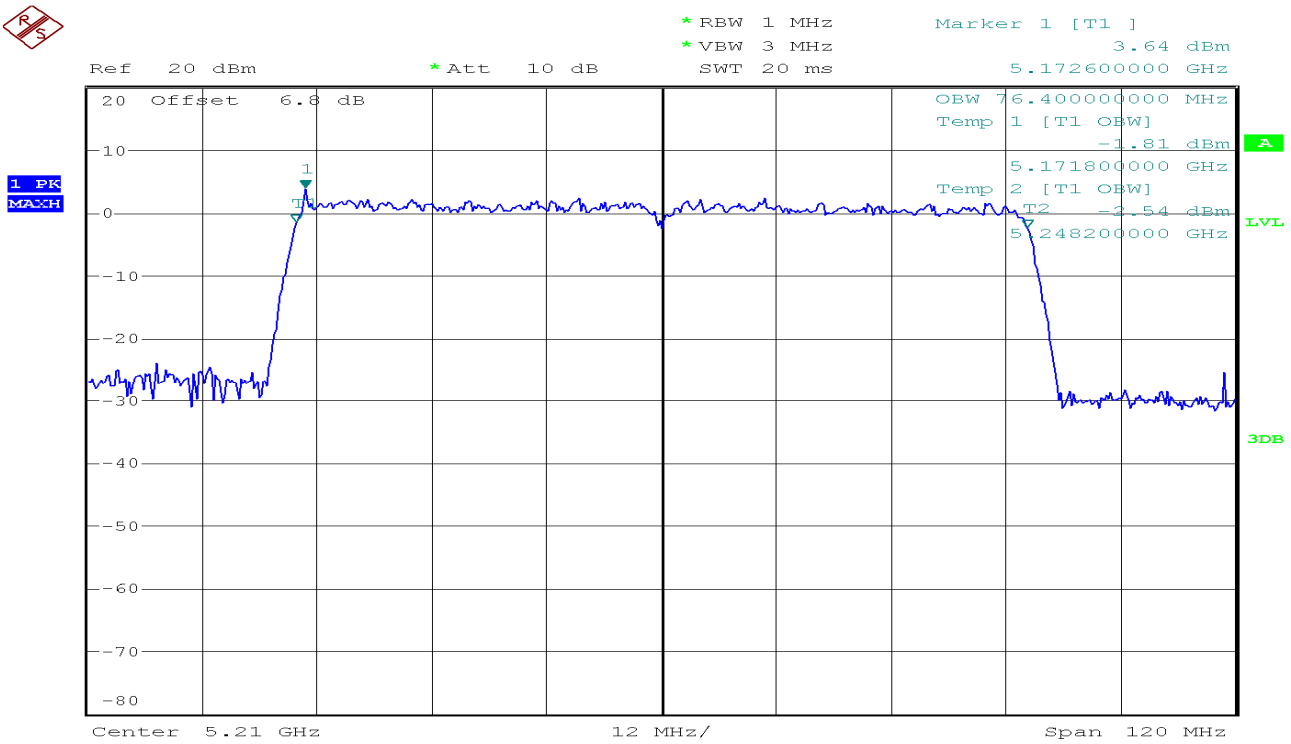
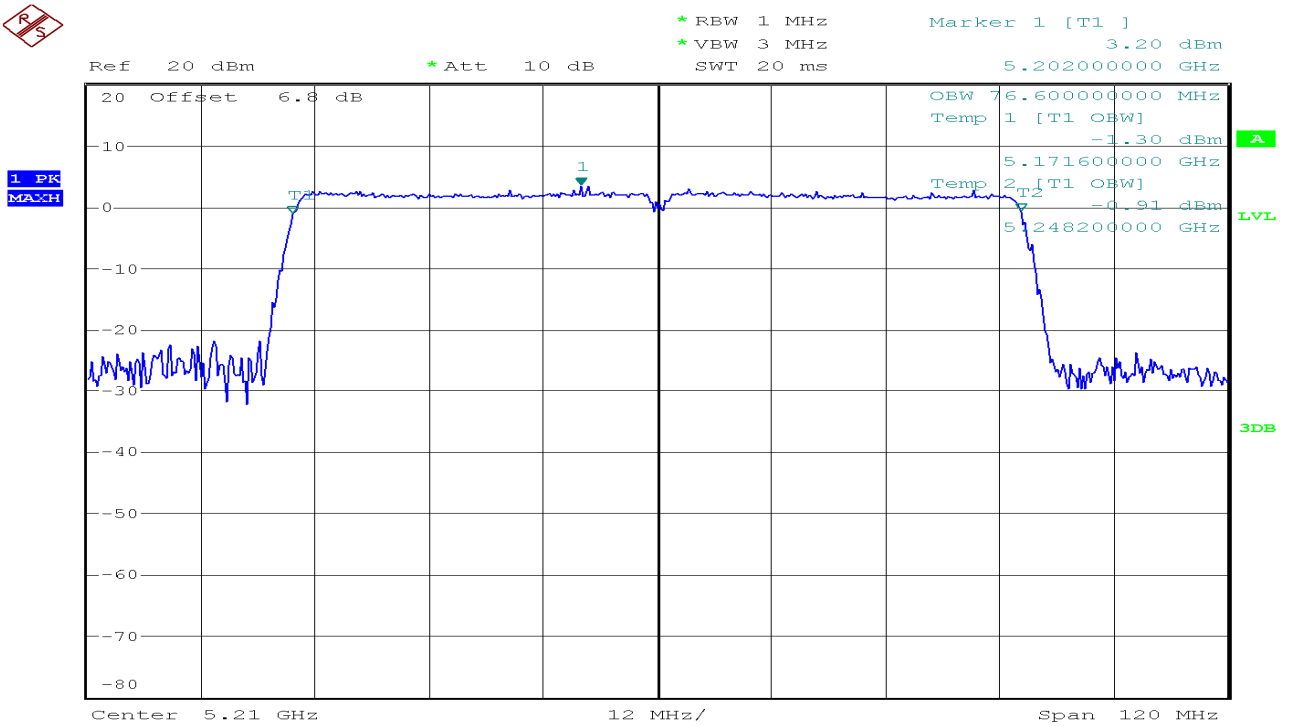
IEEE 802.11ac VHT80 mode/Chain 0:

CH Mid



IEEE 802.11ac VHT80 mode/Chain 1:

CH Mid



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7.3 MAXIMUM CONDUCTED OUTPUT POWER

LIMIT

The peak power shall not exceed the limit as follow:

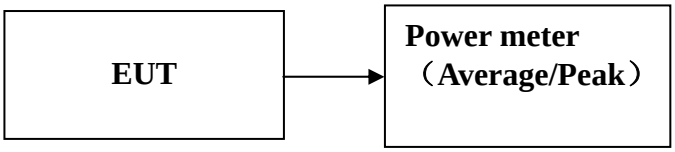
According to §15.407(a),

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

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.

Directional Gain=G_{ANT}=3.96dBi<6dBi

Test Configuration



The EUT was connected to a spectrum analyzer through a 50Ω RF cable.

TEST PROCEDURE

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, 10 log(1/x), where x is the duty cycle.

TEST RESULTS

No non-compliance noted

TEST RESULTS

No non-compliance noted

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Test Data

Test mode: IEEE 802.11a mode

Channel	Frequency (MHz)	Chain 0 AV Output Power (dBm)	Chain 1 AV Output Power (dBm)	Total Maximum Conducted AV Output Power (dBm)	Limit (dBm)
Low	5180	11.71	11.62	14.68	24.00
Mid	5220	11.88	12.05	14.98	24.00
High	5240	11.6	12.44	15.05	24.00

Test mode: IEEE 802.11n HT20MHz mode

Channel	Frequency (MHz)	Chain 0 AV Output Power (dBm)	Chain 1 AV Output Power (dBm)	Total Maximum Conducted AV Output Power (dBm)	Limit (dBm)
Low	5180	12.32	11.66	15.01	24.00
Mid	5220	12.11	12.17	15.15	24.00
High	5240	11.9	12.65	15.30	24.00

Test mode: IEEE 802.11n HT40MHz mode

Channel	Frequency (MHz)	Chain 0 AV Output Power (dBm)	Chain 1 AV Output Power (dBm)	Total Maximum Conducted AV Output Power (dBm)	Limit (dBm)
Low	5190	11.66	11.15	14.42	24.00
High	5230	11.52	11.47	14.51	24.00

Test mode: IEEE 802.11ac VHT20MHz mode

Channel	Frequency (MHz)	Chain 0 AV Output Power (dBm)	Chain 1 AV Output Power (dBm)	Total Maximum Conducted AV Output Power (dBm)	Limit (dBm)
Low	5180	12.43	12.01	15.24	24.00
Mid	5220	12.22	12.48	15.36	24.00
High	5240	11.78	12.67	15.26	24.00

Test mode: IEEE 802.11ac VHT40MHz mode

Channel	Frequency (MHz)	Chain 0 AV Output Power (dBm)	Chain 1 AV Output Power (dBm)	Total Maximum Conducted AV Output Power (dBm)	Limit (dBm)
Low	5190	11.77	11.05	14.44	24.00
High	5230	11.64	11.49	14.58	24.00

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Test mode: IEEE 802.11ac VHT80MHz mode

Channel	Frequency (MHz)	Chain 0 AV Output Power (dBm)	Chain 1 AV Output Power (dBm)	Total Maximum Conducted AV Output Power (dBm)	Limit (dBm)
Mid	5210	11.12	10.73	13.94	24.00

***Remark**:* 1.Total Output Power (dBm) = 10*LOG(10^(Chain 0 Output Power / 10)+10^(Chain 1 *Output Power /10)))*
2.Duty factor has been offseted with cableloss

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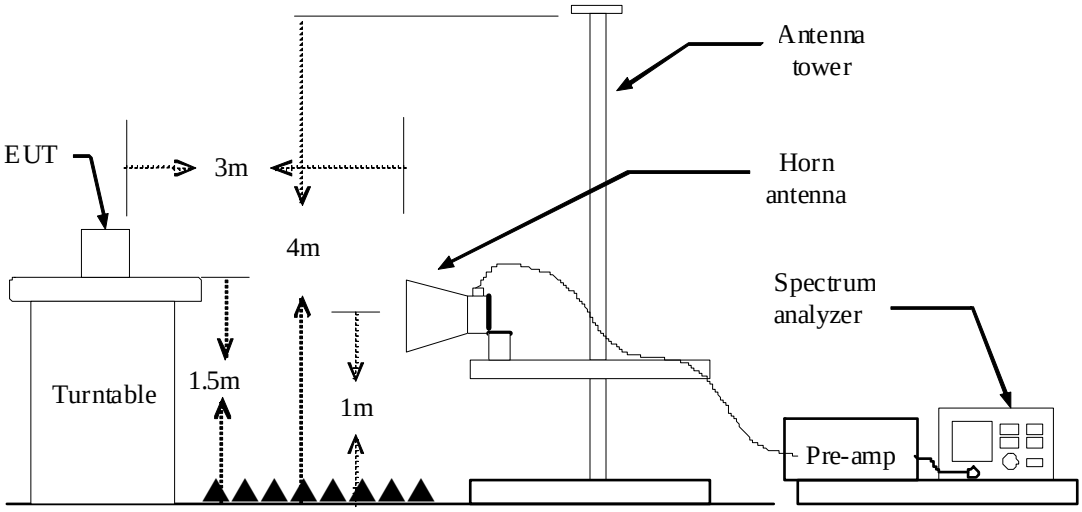
7.4 BAND EDGES MEASUREMENT

LIMIT

According to §15.407(b),
(1) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

Test Configuration



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / Sweep=AUTO

VBW=10Hz,when duty cycle is no less than 98 percent.

VBW≧1/T,when duty cycle is less than 98 percent,where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximun power control level for the tested mode of operation.

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
IEEE 802.11 a	95.2	984	0.001	10Hz
IEEE 802.11n HT20	96.6	994	0.001	10Hz
IEEE 802.11n HT40	95.8	993	0.001	10Hz
IEEE 802.11ac VHT20	96.8	998	0.001	10Hz
IEEE 802.11ac VHT40	96.7	995	0.001	10Hz
IEEE 802.11ac VHT80	95.4	1000	0.001	10Hz

TEST RESULTS

Refer to attach spectrum analyzer data chart.

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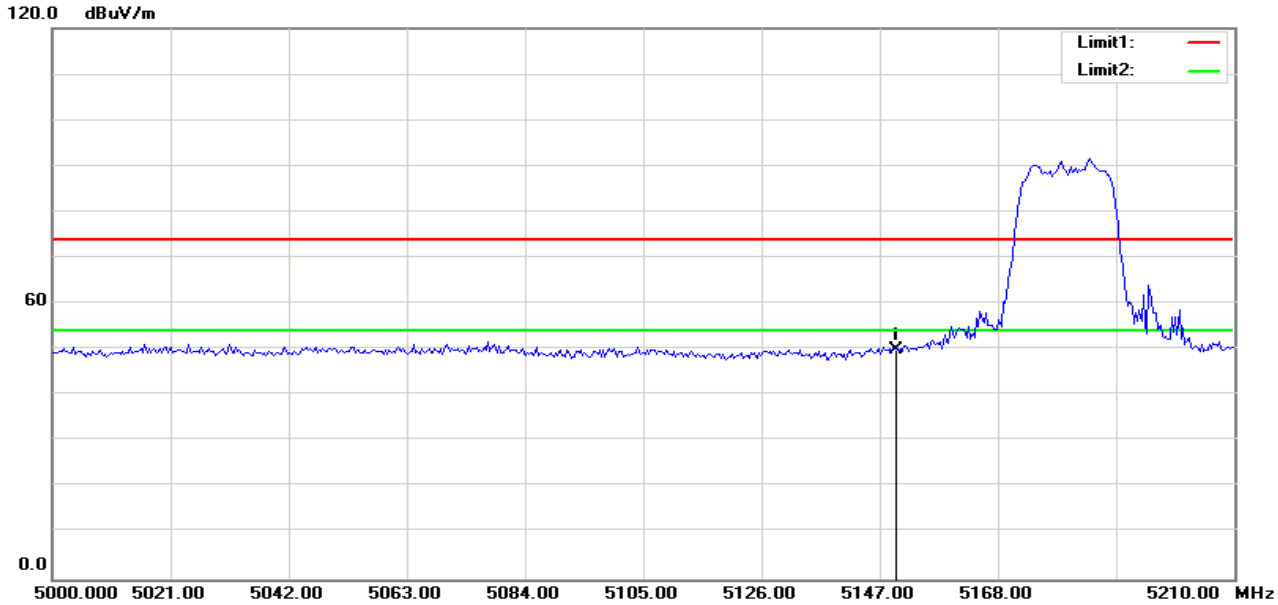
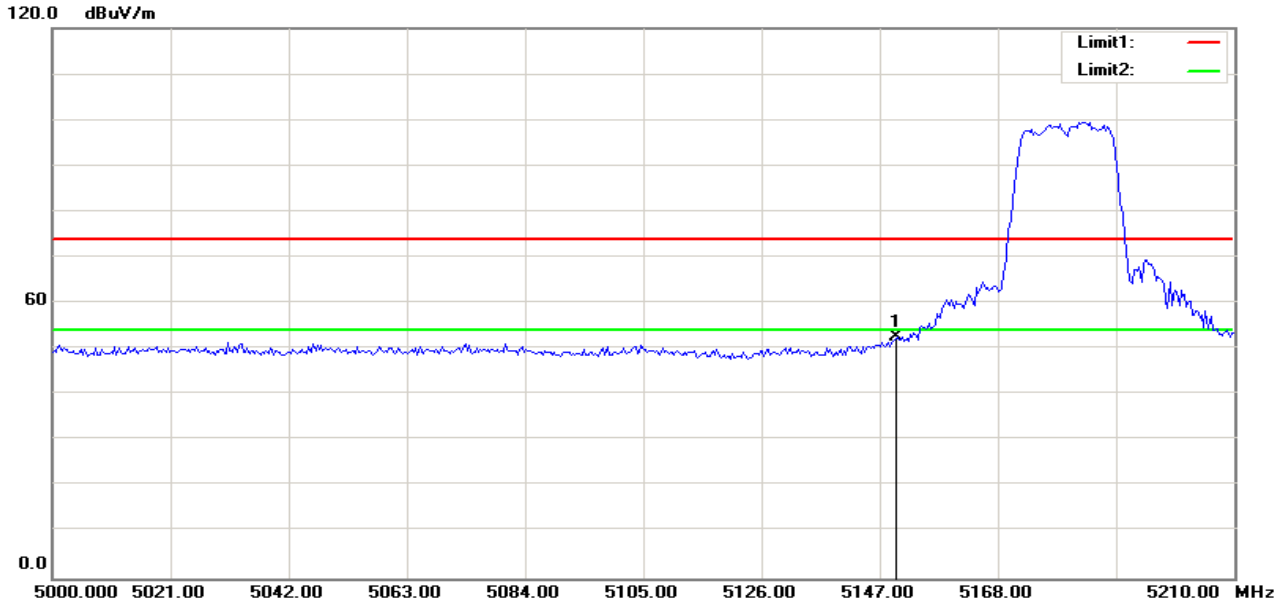
Band Edges (IEEE 802.11a mode)
Polarity: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5150.000	54.39	-4.40	49.99	74.00	-24.01	100	214	peak

Polarity: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5150.000	56.94	-4.40	52.54	74.00	-21.46	100	247	peak

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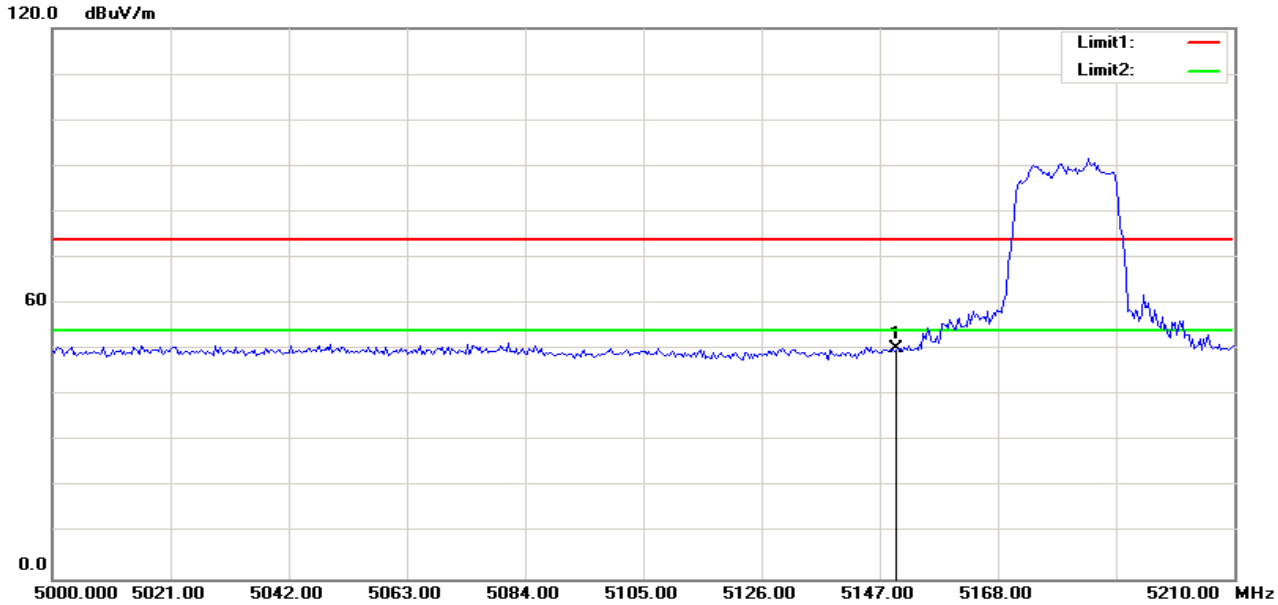
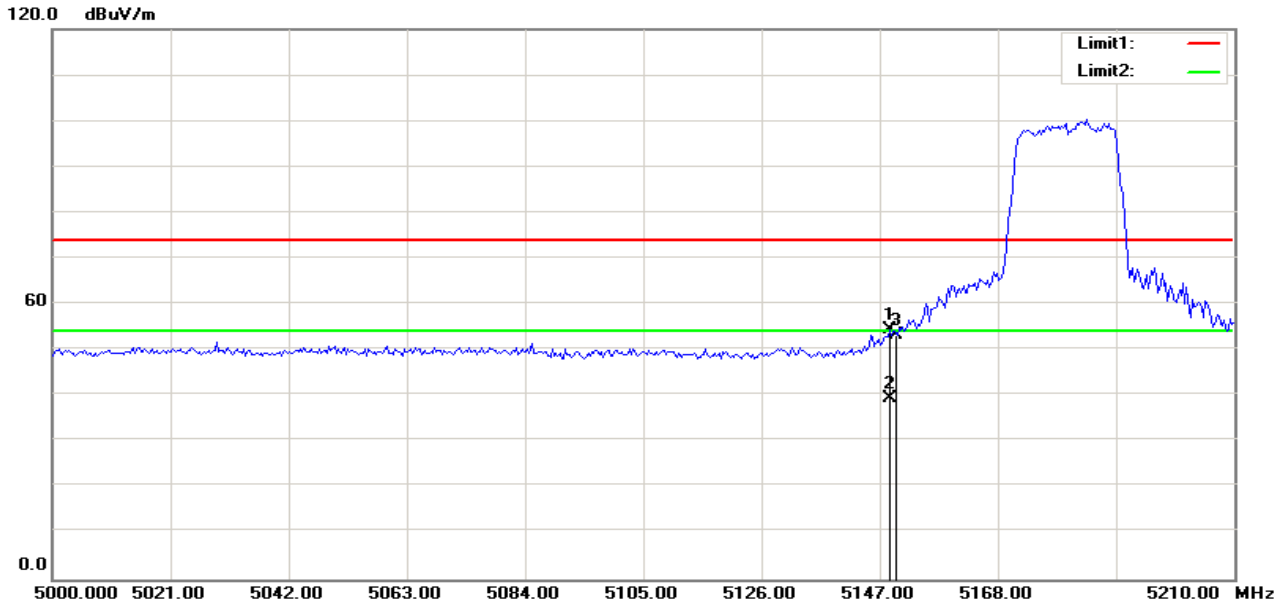
Band Edges (IEEE 802.11n HT20 mode)
Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5150.000	54.66	-4.40	50.26	74.00	-23.74	100	305	peak

Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5148.750	58.74	-4.40	54.34	74.00	-19.66	100	72	peak
2	5148.750	43.98	-4.40	39.58	54.00	-14.42	100	72	AVG
3	5150.000	57.54	-4.40	53.14	74.00	-20.86	100	72	peak

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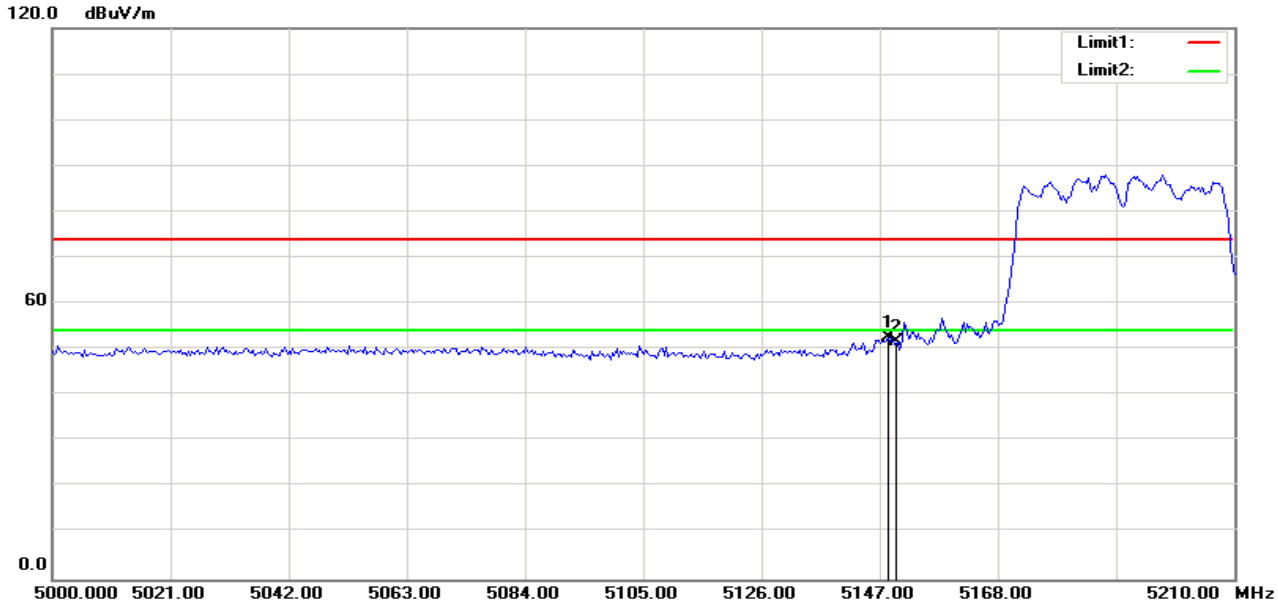
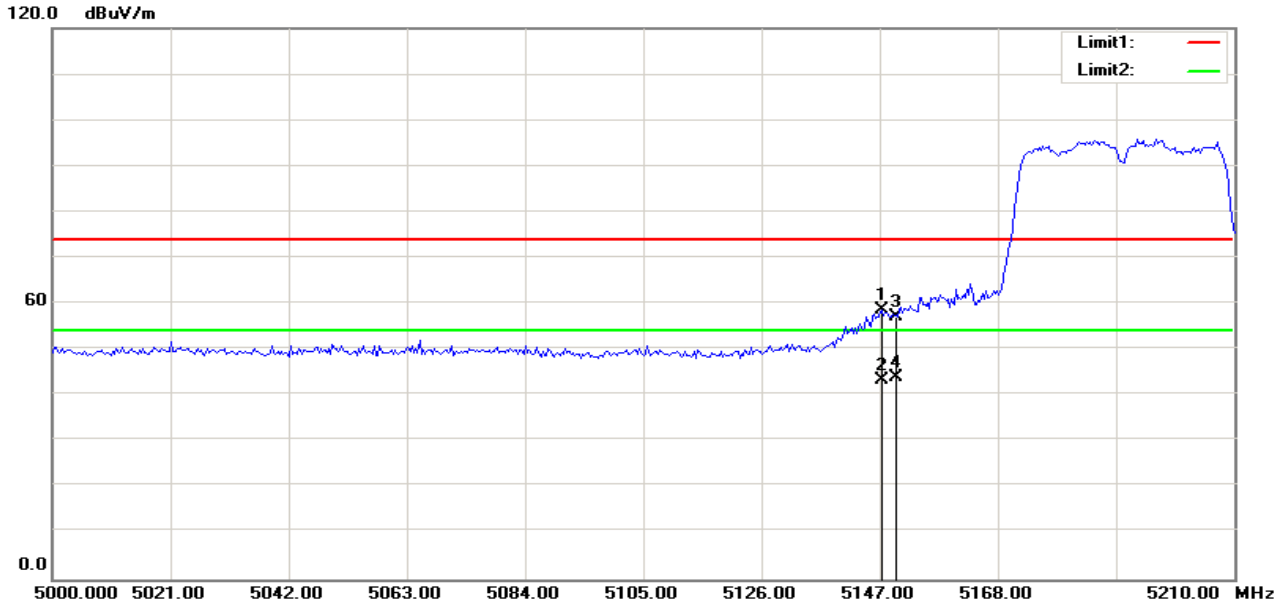
Band Edges (IEEE 802.11n HT40 mode)
Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5148.413	57.04	-4.40	52.64	74.00	-21.36	100	42	peak
2	5150.000	56.05	-4.40	51.65	74.00	-22.35	100	269	peak

Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5147.404	63.15	-4.41	58.74	74.00	-15.26	100	117	peak
2	5147.404	47.70	-4.41	43.29	54.00	-10.71	100	117	AVG
3	5150.000	61.60	-4.40	57.20	74.00	-16.80	100	111	peak
4	5150.000	48.48	-4.40	44.08	54.00	-9.92	100	111	AVG

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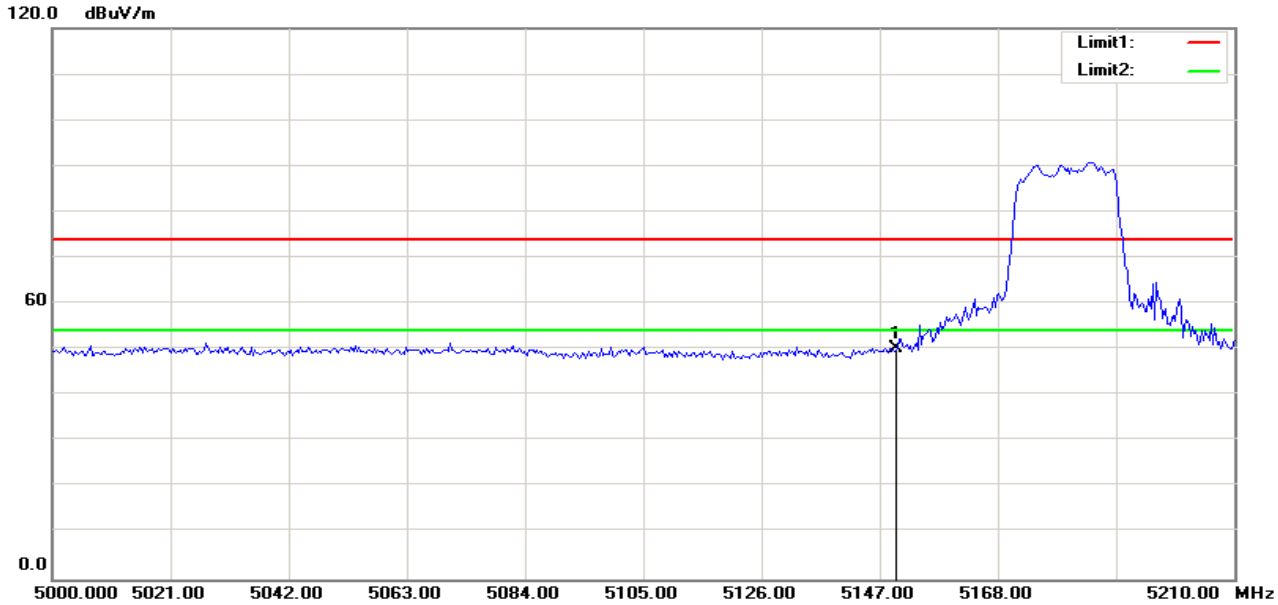
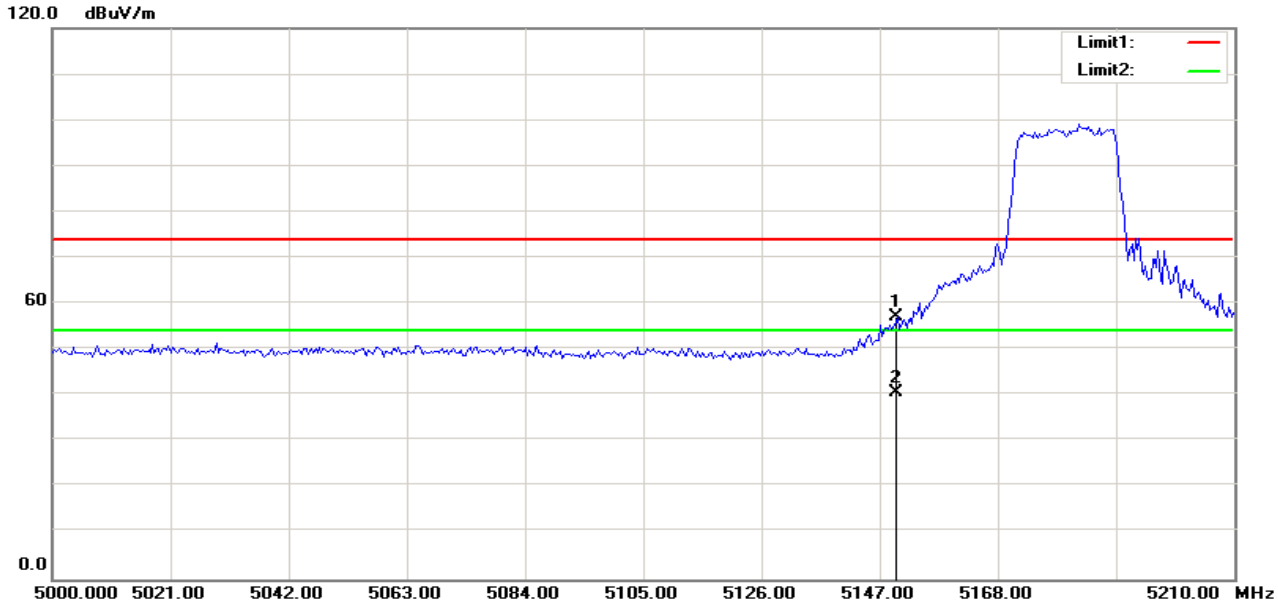
Band Edges (IEEE 802.11ac VHT20 mode)
Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5150.000	54.57	-4.40	50.17	74.00	-23.83	100	137	peak

Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5150.000	61.57	-4.40	57.17	74.00	-16.83	100	99	peak
2	5150.000	44.99	-4.40	40.59	54.00	-13.41	100	99	AVG

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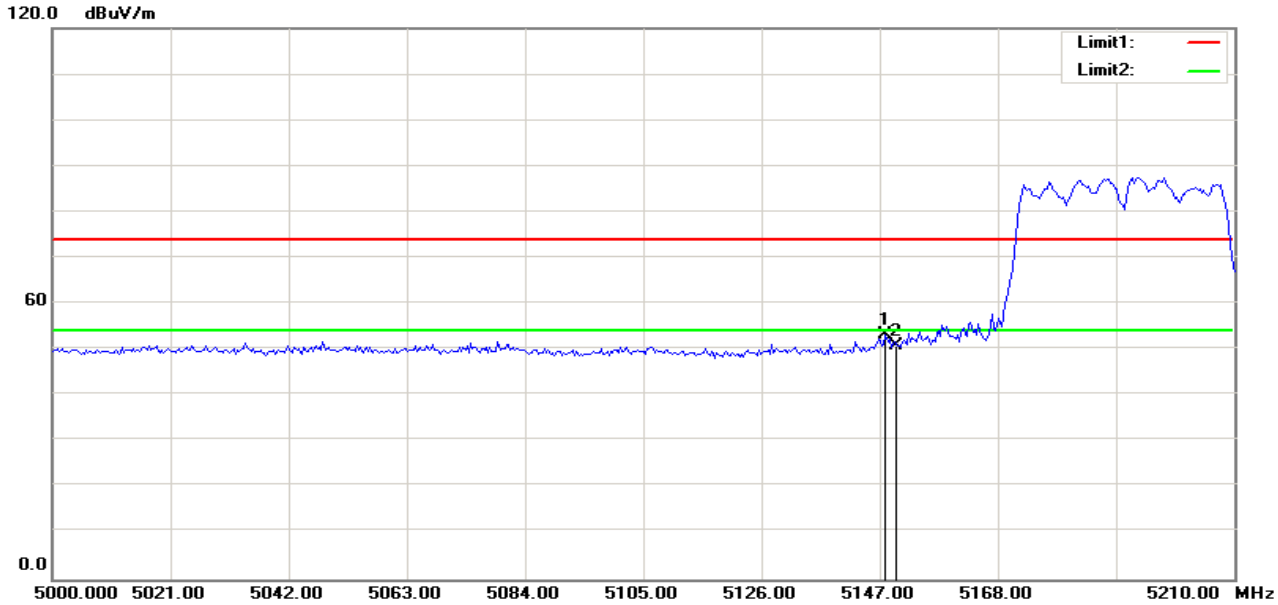
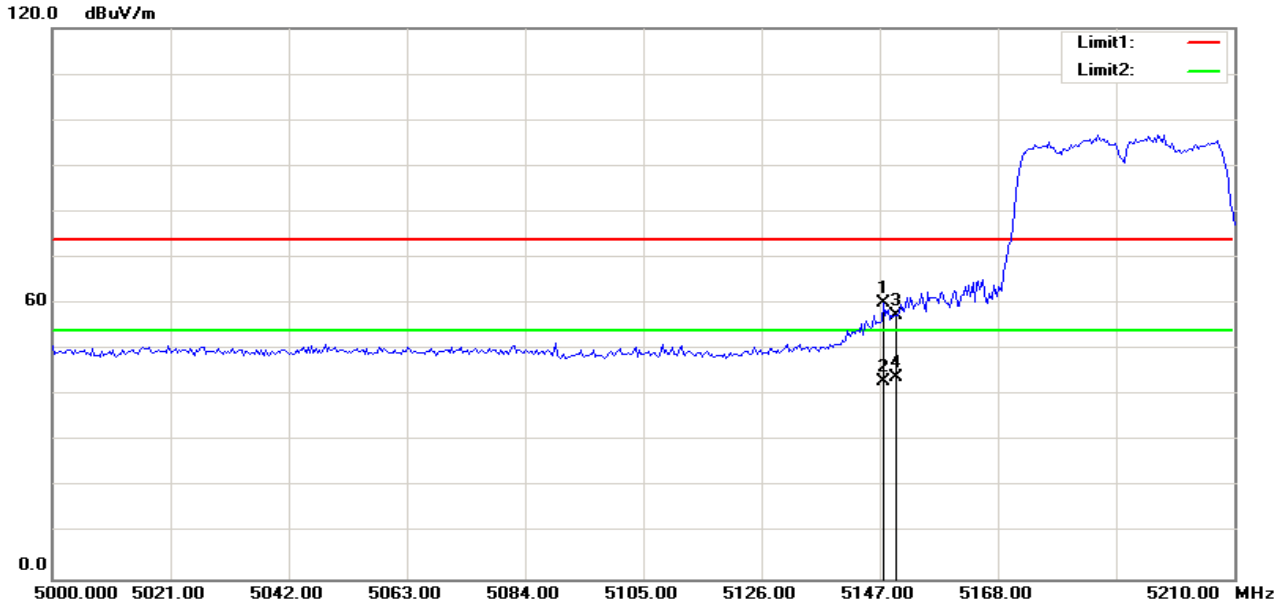
Band Edges (IEEE 802.11ac VHT40 mode)
Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5148.077	57.56	-4.41	53.15	74.00	-20.85	100	40	peak
2	5150.000	55.23	-4.40	50.83	74.00	-23.17	100	171	peak

Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5147.740	64.64	-4.41	60.23	74.00	-13.77	102	61	peak
2	5147.740	47.32	-4.41	42.91	54.00	-11.09	102	61	AVG
3	5150.000	61.76	-4.40	57.36	74.00	-16.64	100	114	peak
4	5150.000	48.33	-4.40	43.93	54.00	-10.07	100	114	AVG

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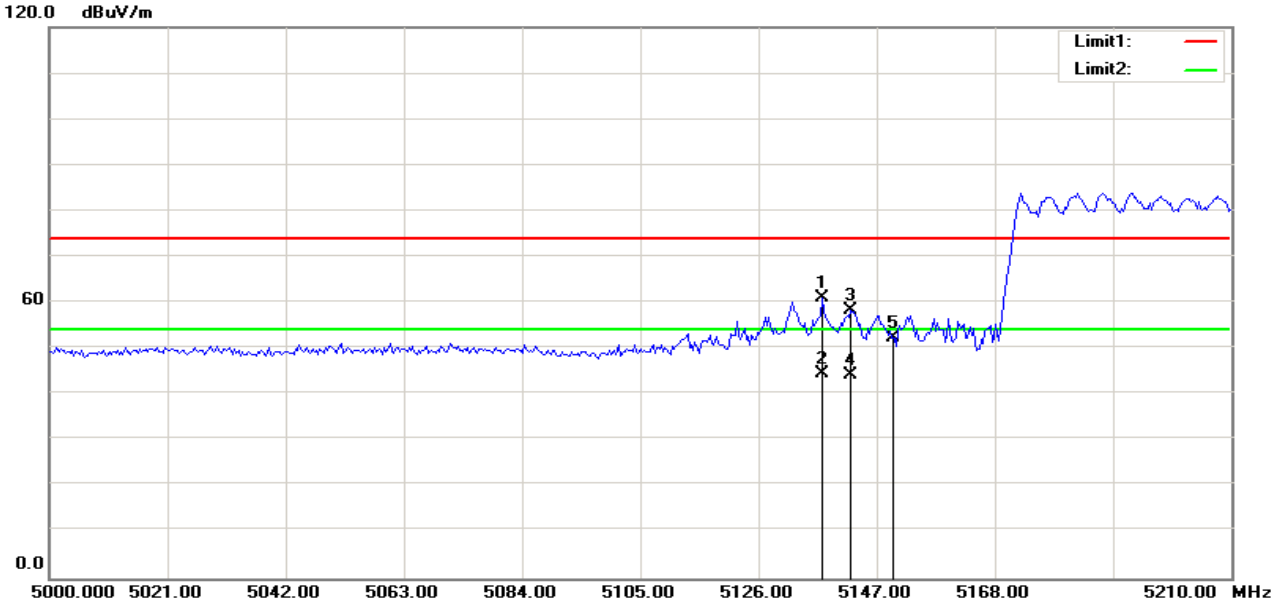
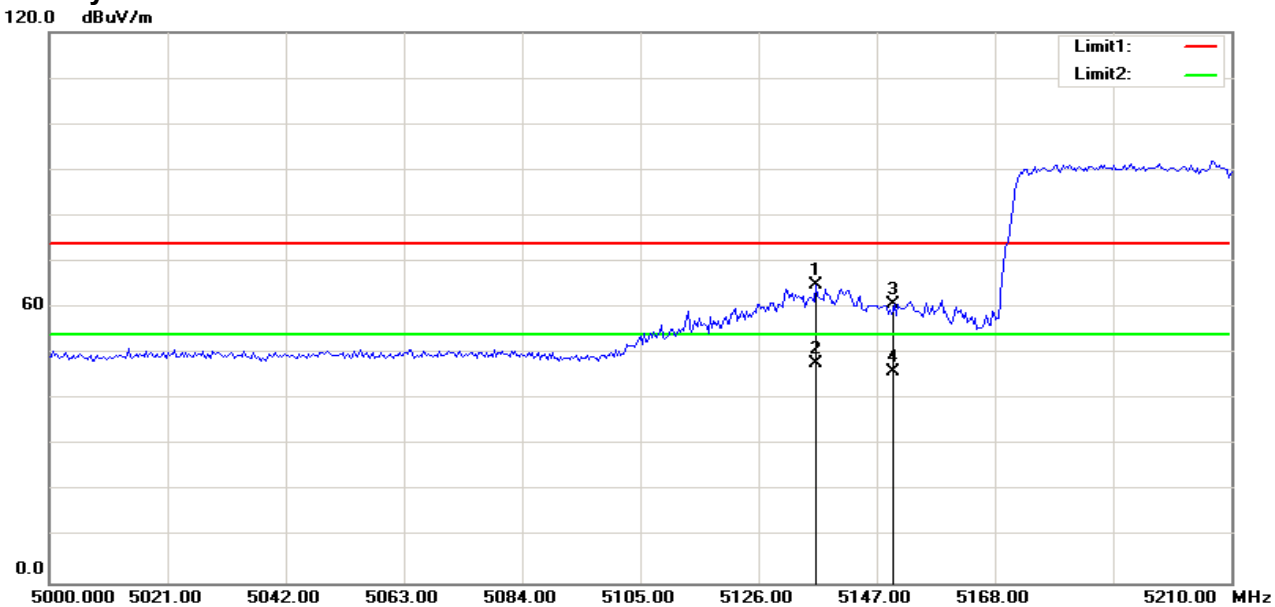
Band Edges (IEEE 802.11ac VHT80 mode)
Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5137.308	65.48	-4.46	61.02	74.00	-12.98	100	54	peak
2	5137.308	49.07	-4.46	44.61	54.00	-9.39	100	54	AVG
3	5142.356	62.70	-4.43	58.27	74.00	-15.73	100	51	peak
4	5142.356	48.64	-4.43	44.21	54.00	-9.79	100	51	AVG
5	5150.000	56.62	-4.40	52.22	74.00	-21.78	100	265	peak

Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5136.298	69.56	-4.46	65.10	74.00	-8.90	100	113	peak
2	5136.298	52.43	-4.46	47.97	54.00	-6.03	100	113	AVG
3	5150.000	65.27	-4.40	60.87	74.00	-13.13	100	78	peak
4	5150.000	50.44	-4.40	46.04	54.00	-7.96	100	78	AVG

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7.5 MAXIMUM POWER SPECTRAL DENSITY

LIMIT

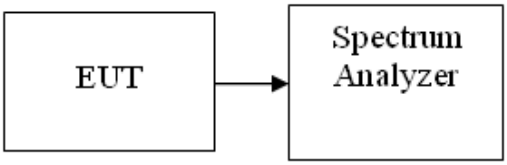
According to §15.407(a),

For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Directional Gain=G_{ANT} + 10 log(N_{ANT}/N_{SS})=3.96+10log(2/1)=6.97dBi > 6dBi

PSD Limit=11.00-(6.97-6)=10.03dBm

Test Configuration



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 must be greater than 26dB bandwidth, adjust as necessary, Sweep= auto, Detector RMS
3. Record the max. reading.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Low	5180	2.03	2.73	5.40	10.03	PASS
Mid	5220	2.24	3.48	5.91	10.03	PASS
High	5240	1.78	3.49	5.73	10.03	PASS

Test mode: IEEE 802.11n HT20MHz mode

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Low	5180	1.95	2.57	5.28	10.03	PASS
Mid	5220	2.10	3.09	5.63	10.03	PASS
High	5240	1.63	3.03	5.40	10.03	PASS

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Test mode: IEEE 802.11n HT40MHz mode

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Low	5190	-1.81	-1.15	1.54	10.03	PASS
High	5230	-1.23	-1.08	1.86	10.03	PASS

Test mode: IEEE 802.11ac VHT20MHz mode

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Low	5180	1.47	2.25	4.89	10.03	PASS
Mid	5220	2.03	3.29	5.72	10.03	PASS
High	5240	1.98	2.94	5.50	10.03	PASS

Test mode: IEEE 802.11ac VHT40MHz mode

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Low	5190	-1.75	-0.92	1.70	10.03	PASS
High	5230	-1.61	-0.81	1.82	10.03	PASS

Test mode: IEEE 802.11ac VHT80MHz mode

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Mid	5210	-6.09	-5.14	-2.58	10.03	PASS

***Remark**: 1.*Total PPSD(dBm) = 10*LOG(10^(Chain 0 PPSD / 10)+10^(Chain 1 PPSD /10))

2.Duty factor has been offseted with cableloss

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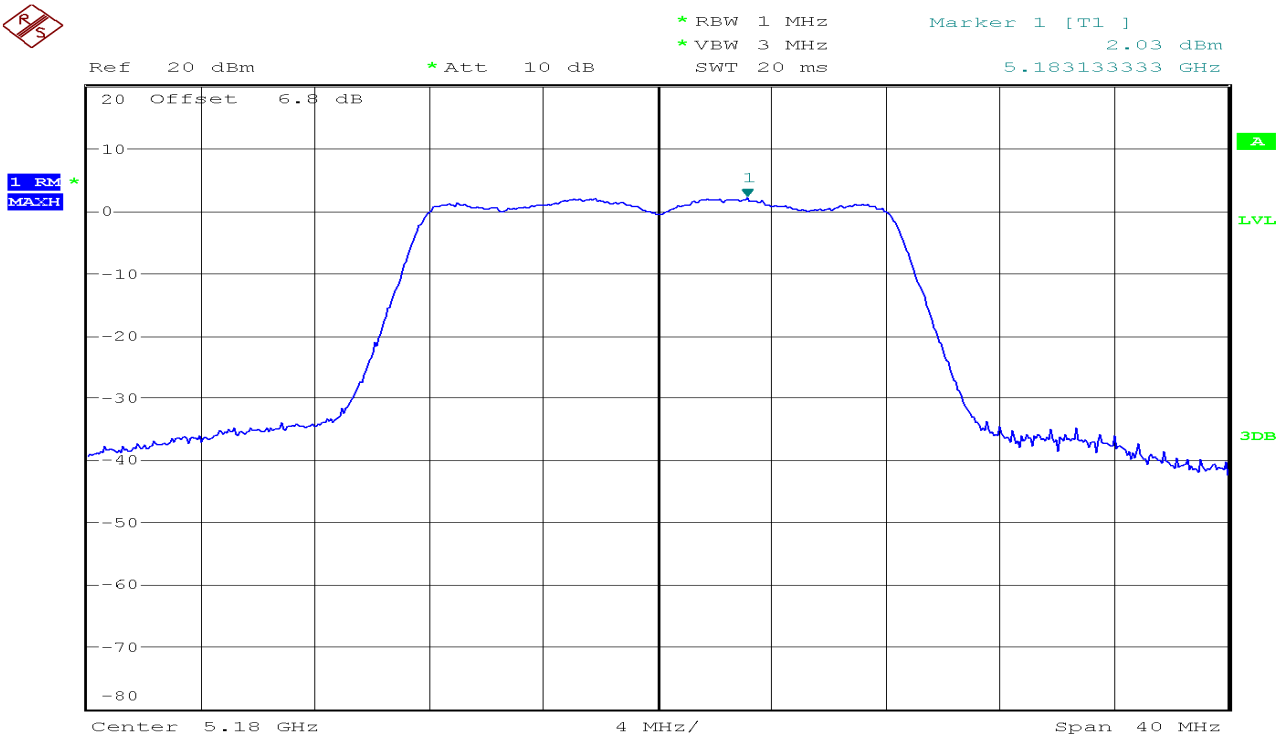
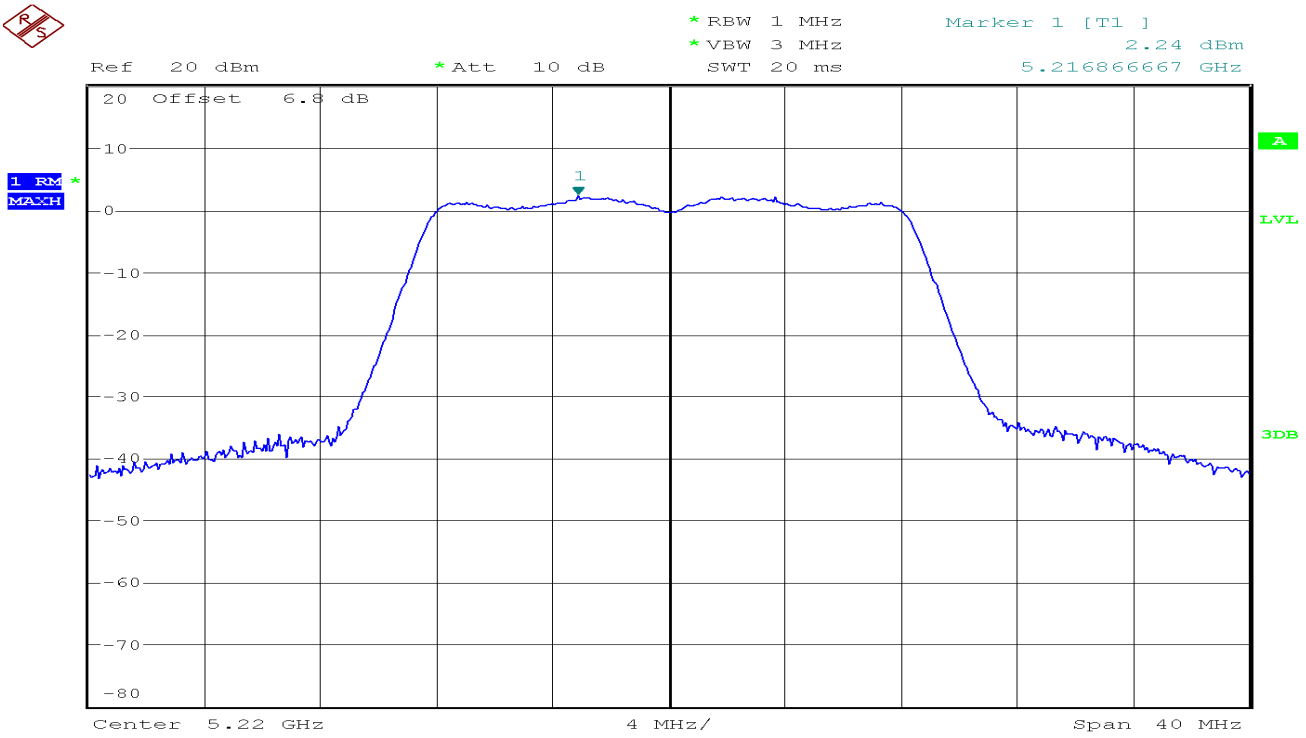
Test Plot
IEEE 802.11a mode/Chain 0:

CH Low



CH Mid



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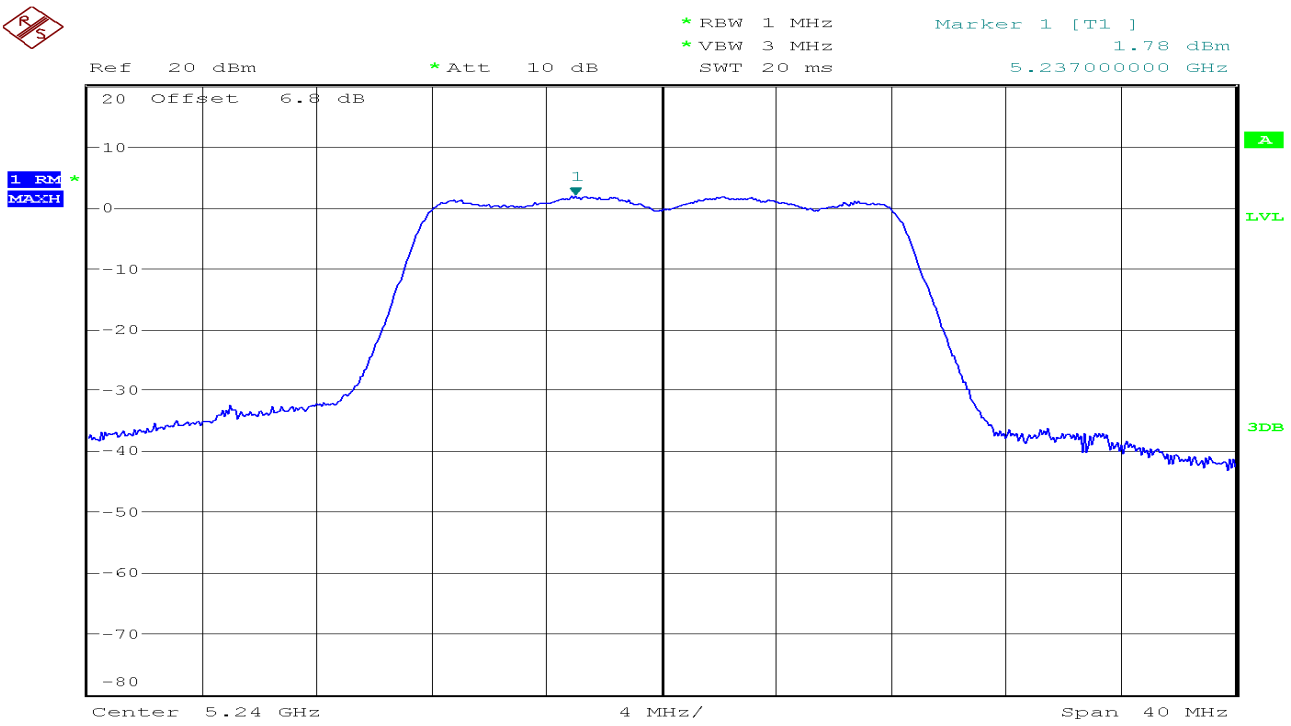
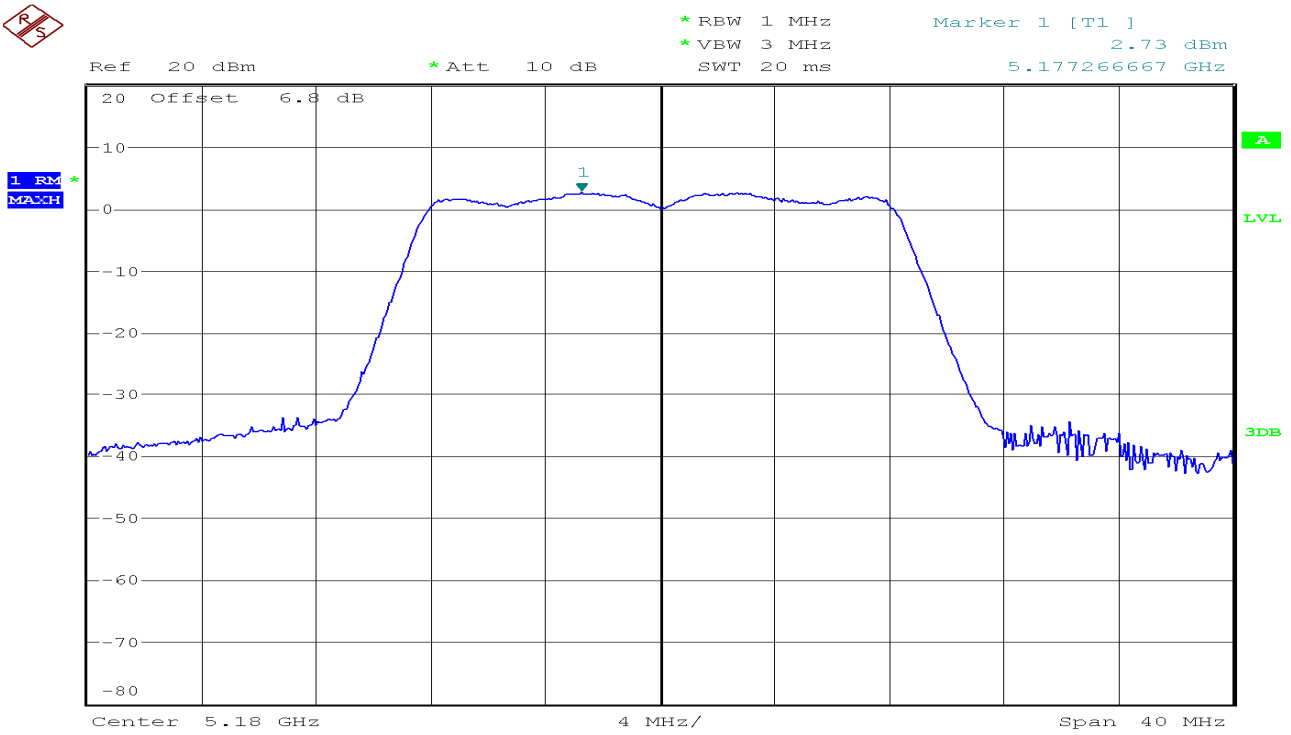
CH High



IEEE 802.11a mode/Chain 1:

CH Low



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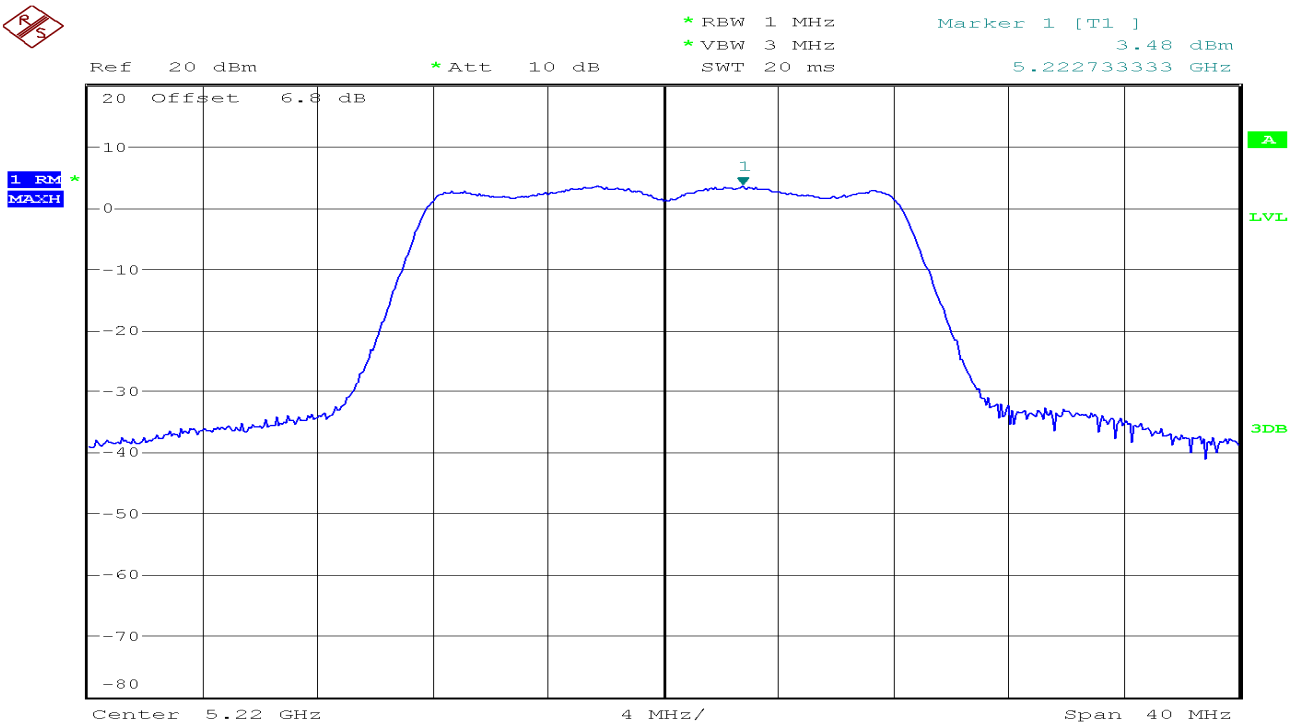
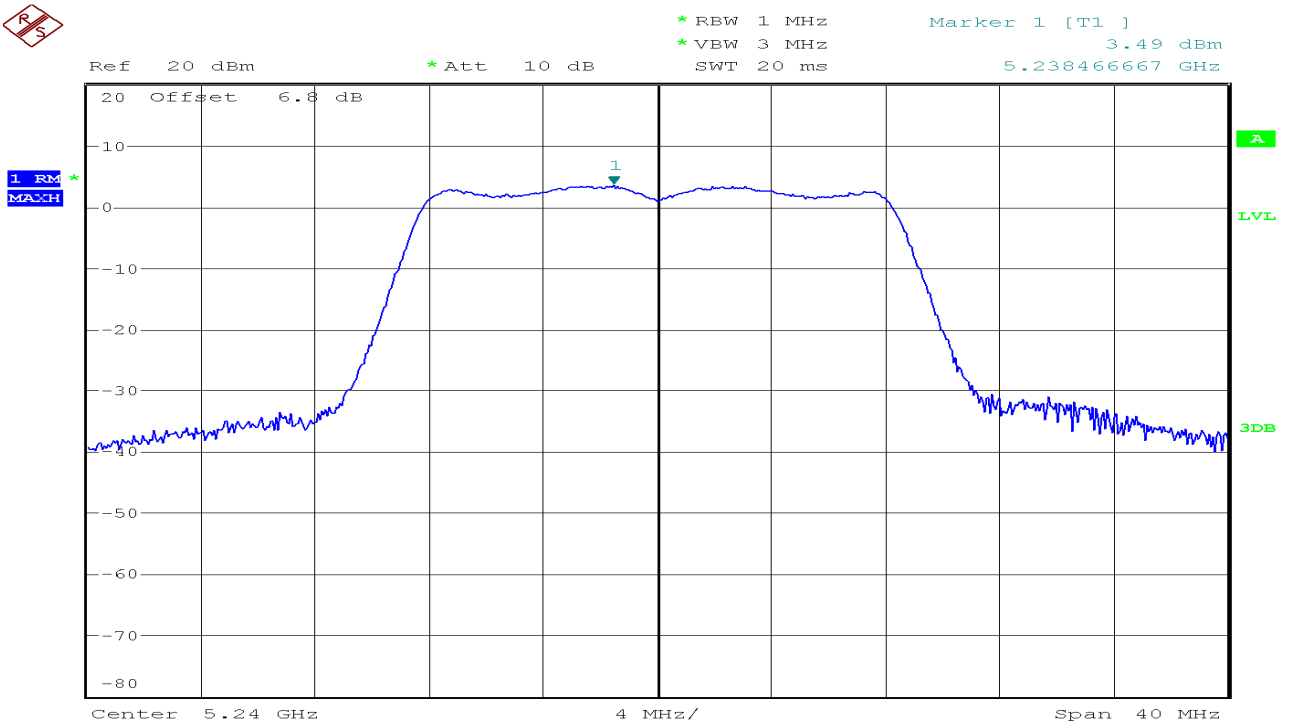
CH Mid



CH High



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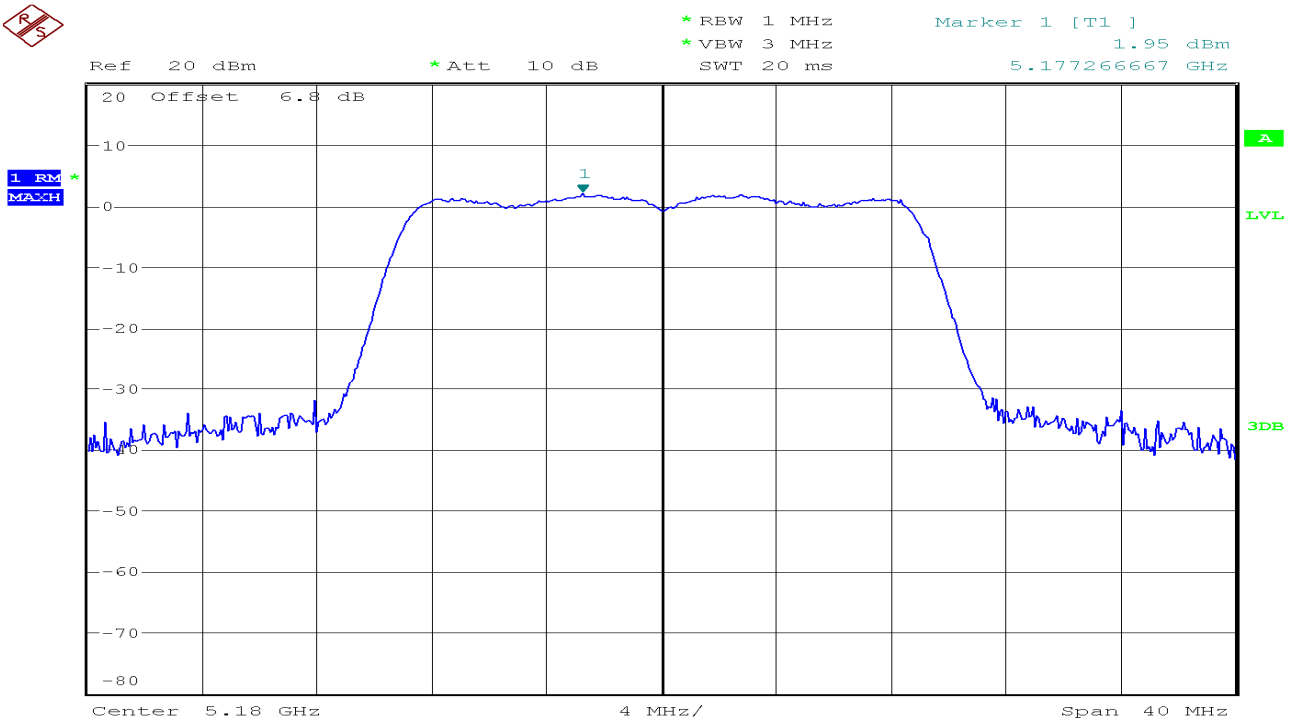
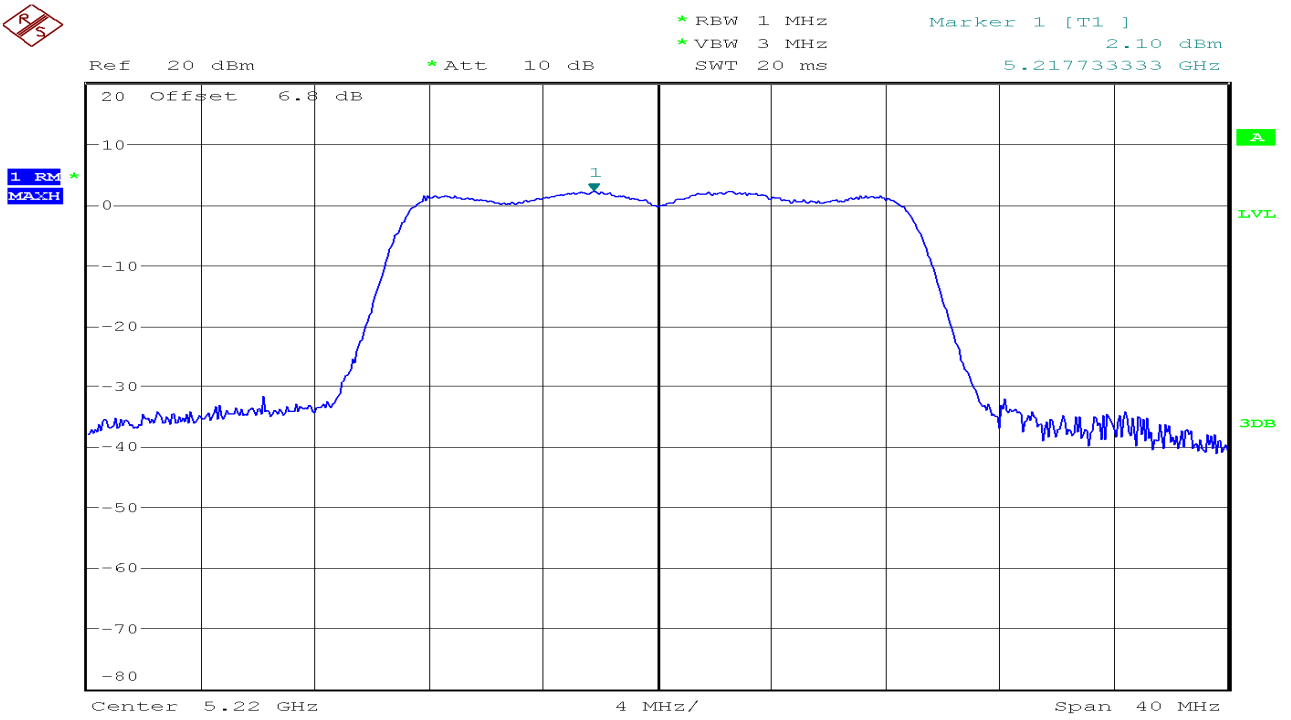
IEEE 802.11n HT20 mode/Chain 0:

CH Low



CH Mid



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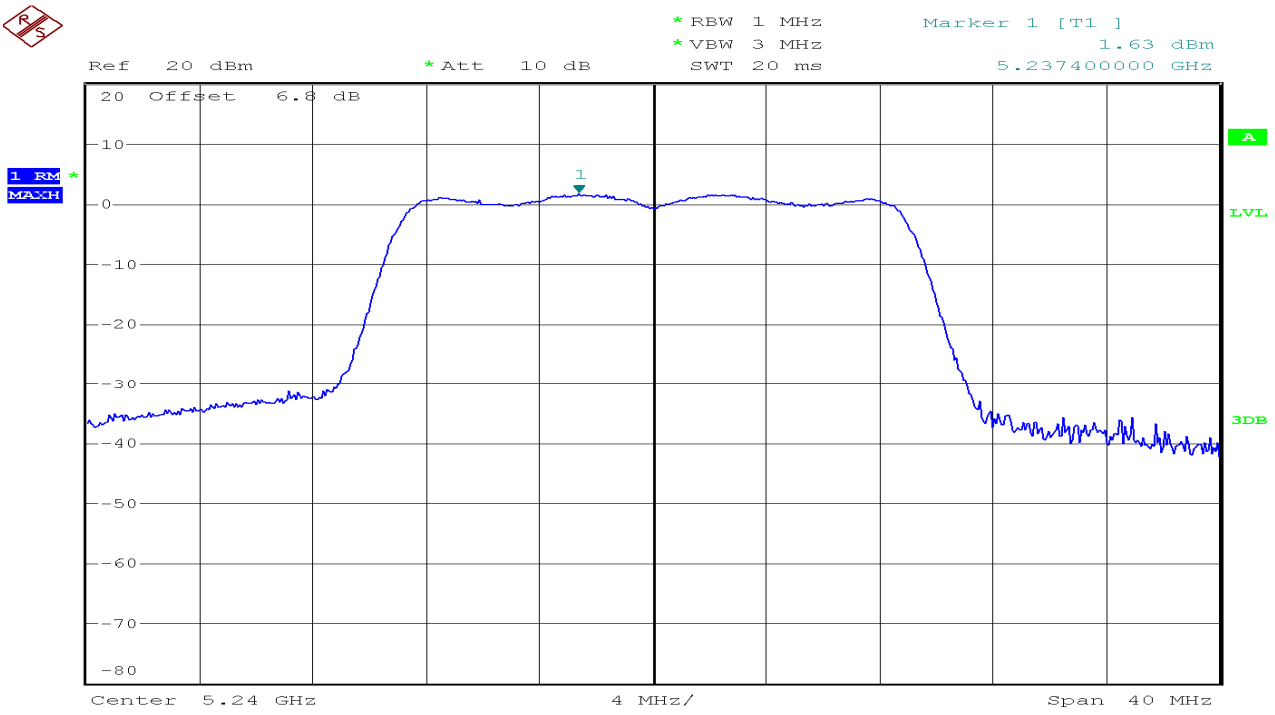
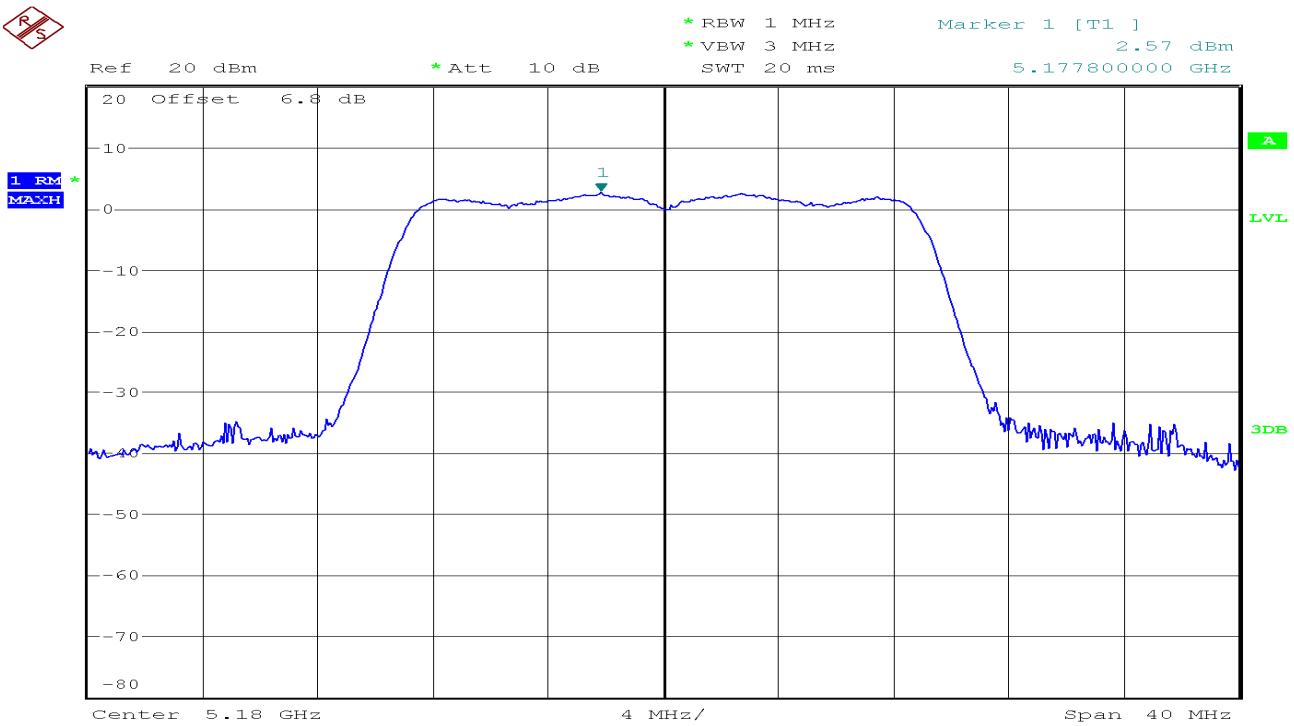
CH High



IEEE 802.11n HT20 mode/Chain 1:

CH Low



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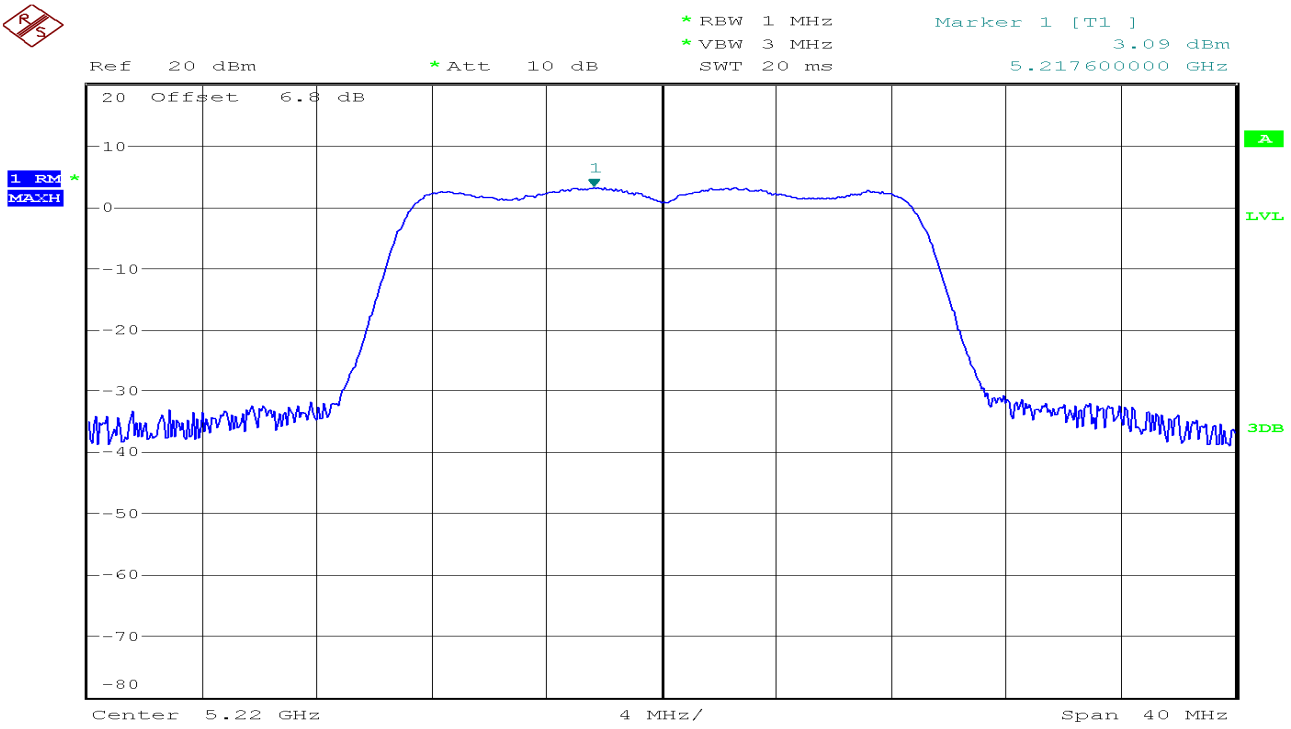
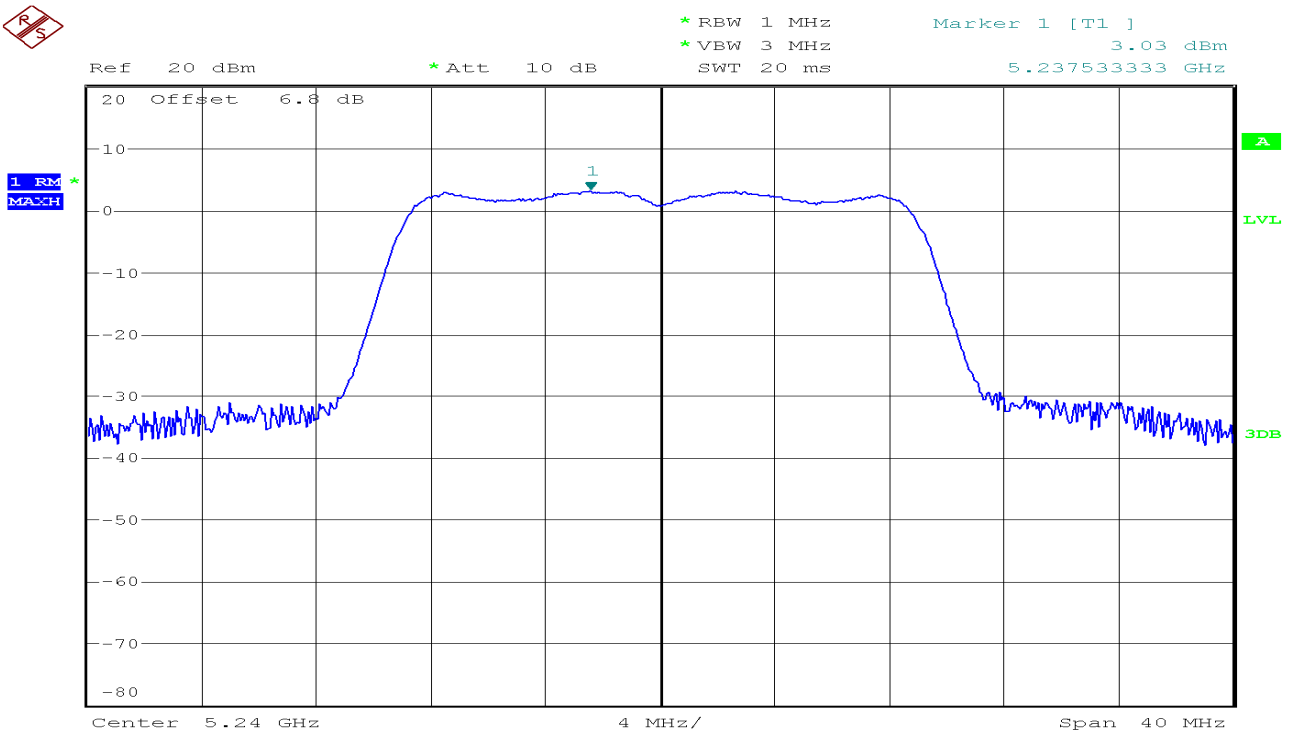
CH Mid



CH High



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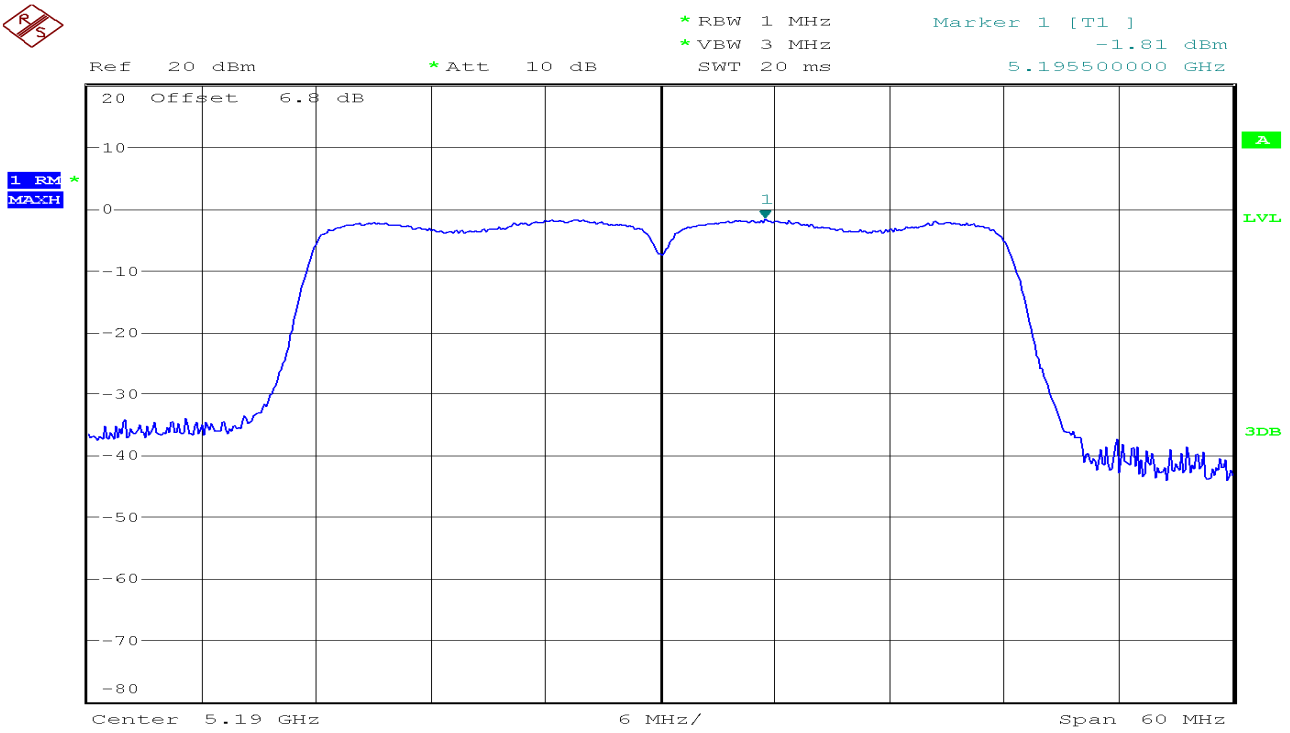
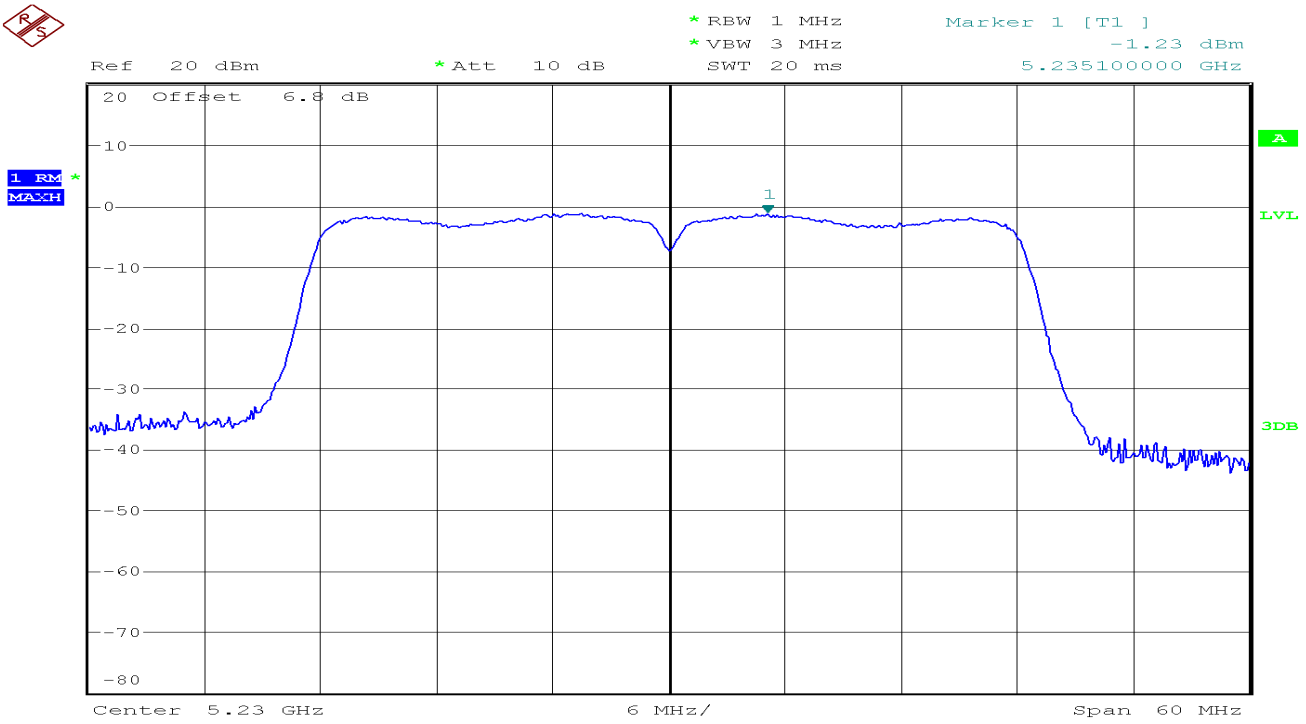
IEEE 802.11n HT40 mode/Chain 0:

CH Low



CH High



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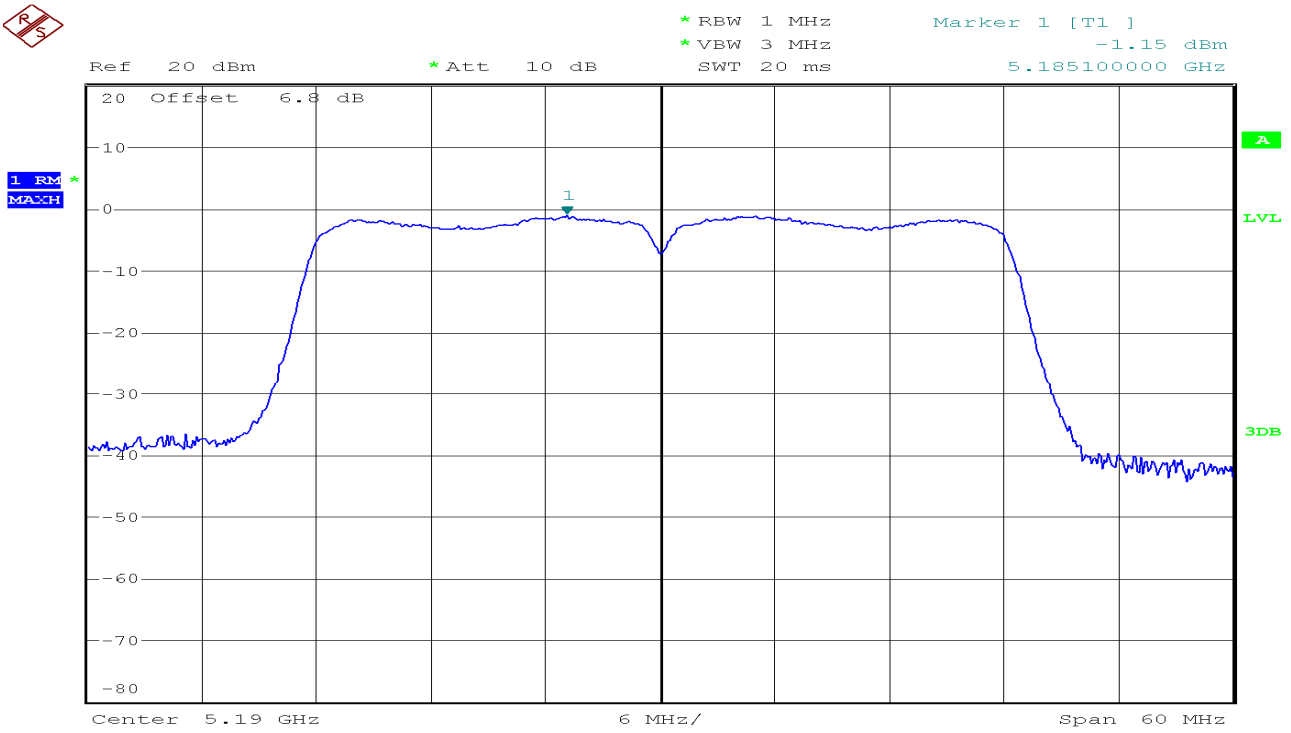
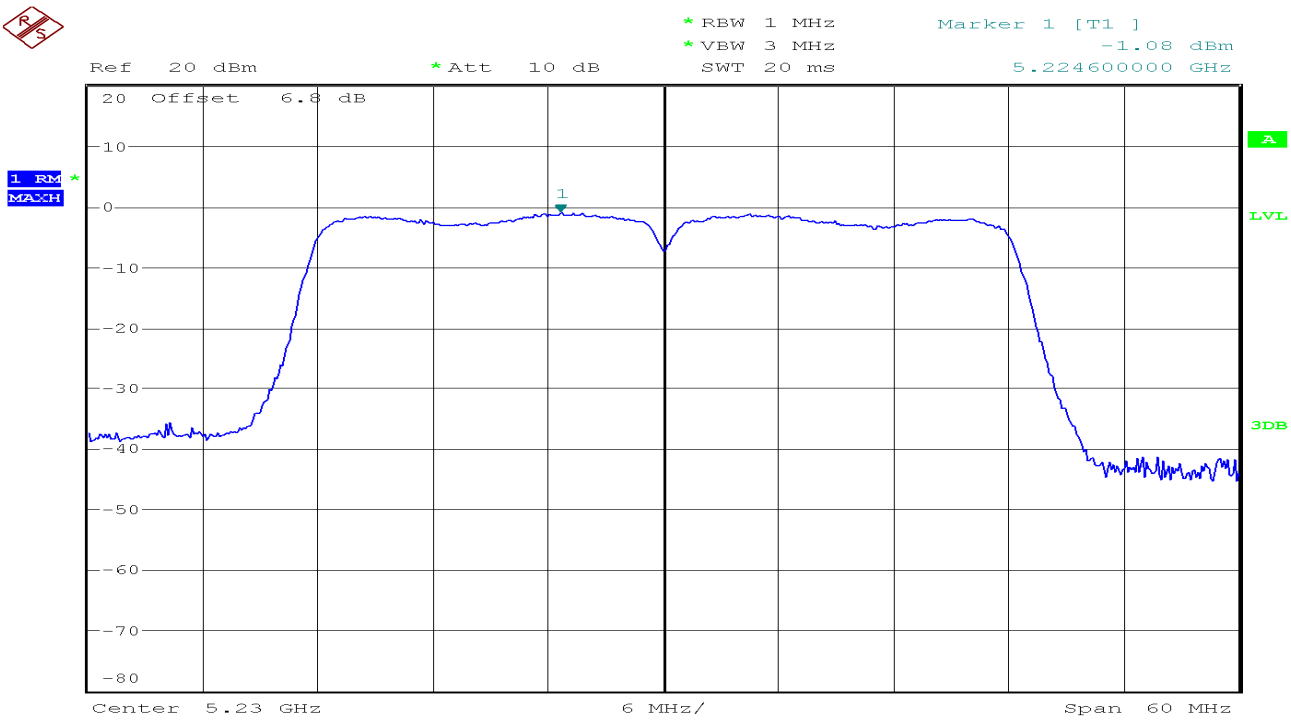
IEEE 802.11n HT40 mode/Chain 1:

CH Low



CH High



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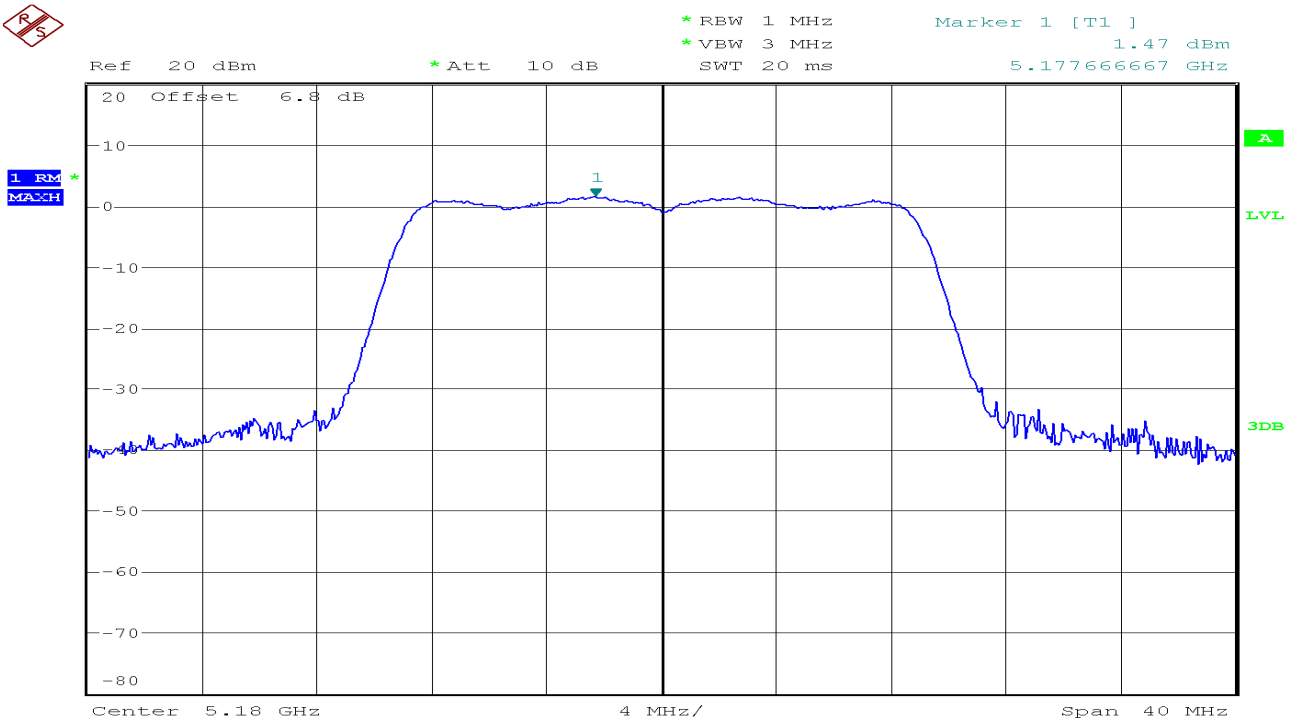
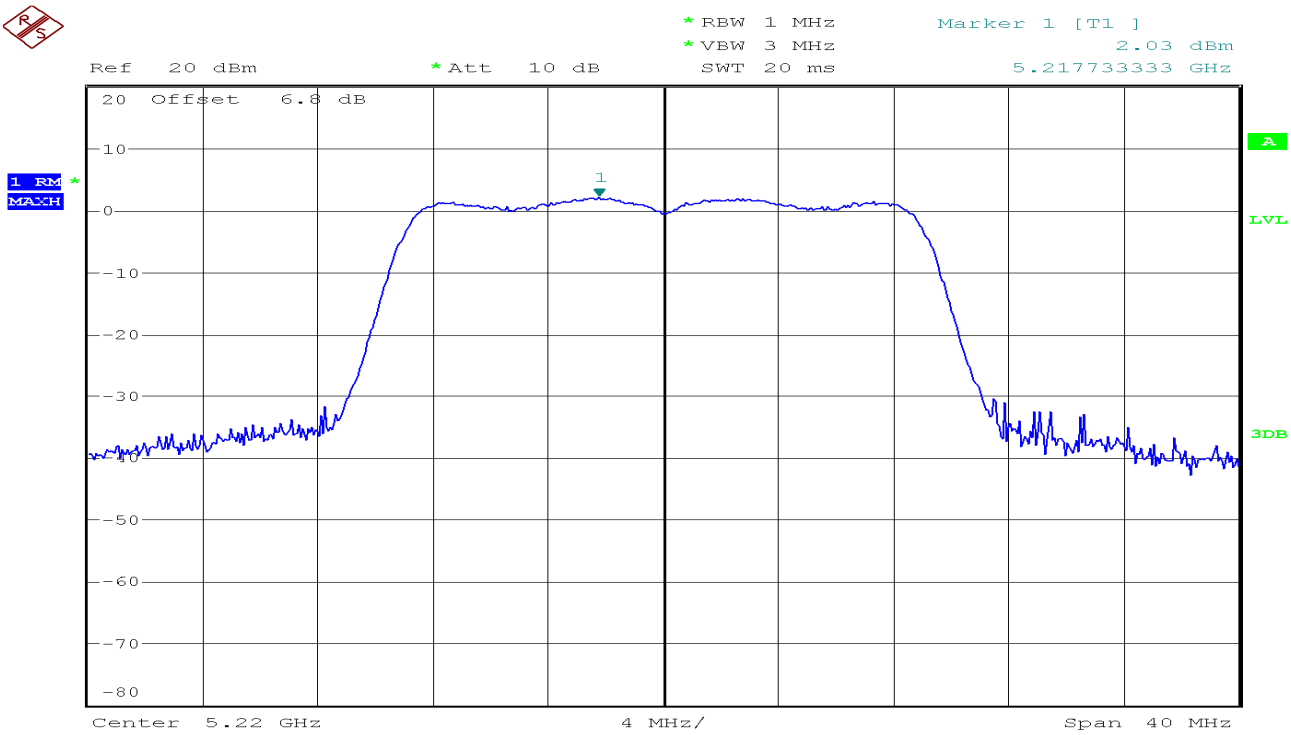
IEEE 802.11ac VHT20 mode/Chain 0:

CH Low



CH Mid



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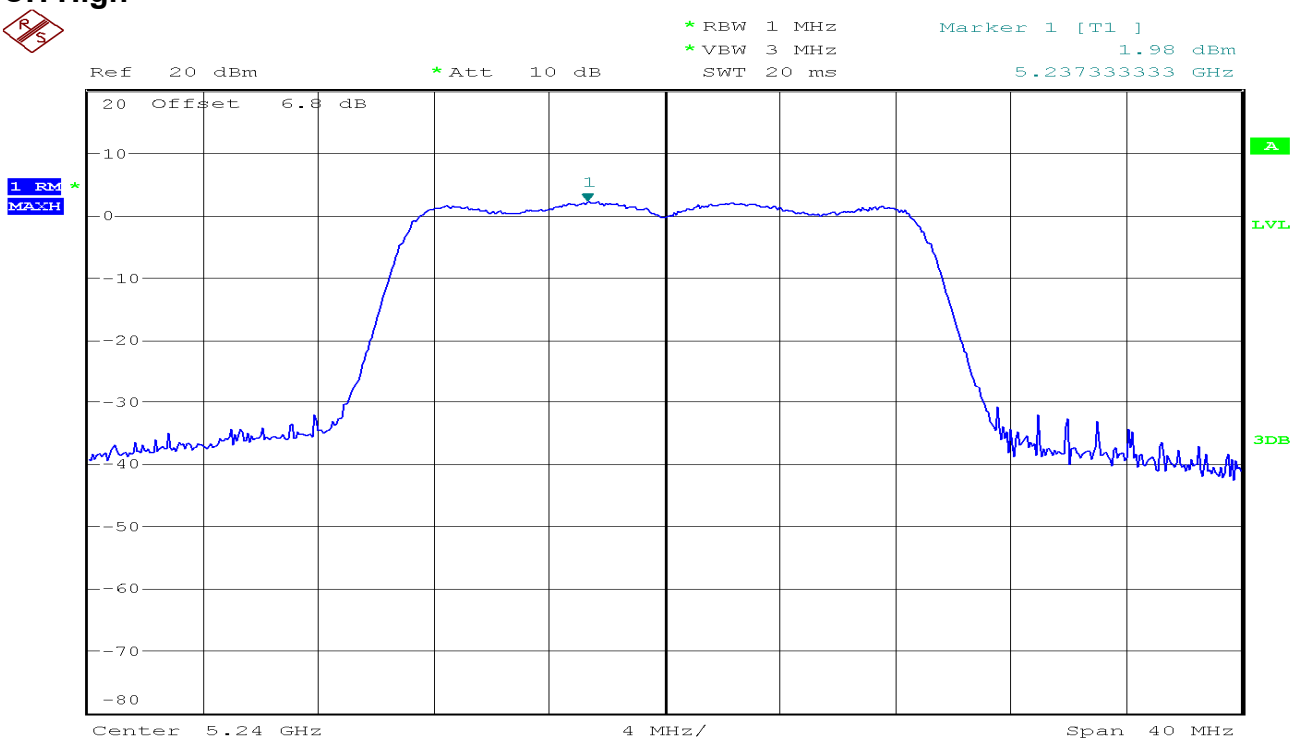
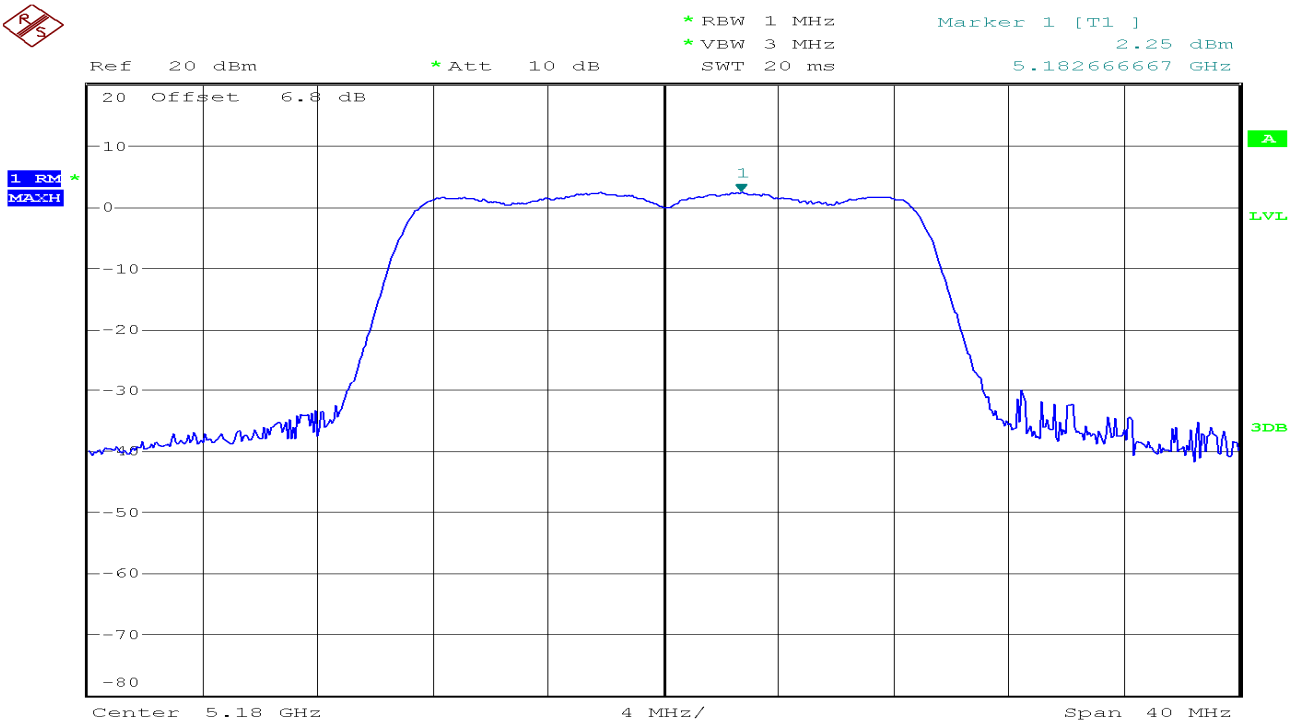
CH High



IEEE 802.11ac VHT20 mode/Chain 1:

CH Low



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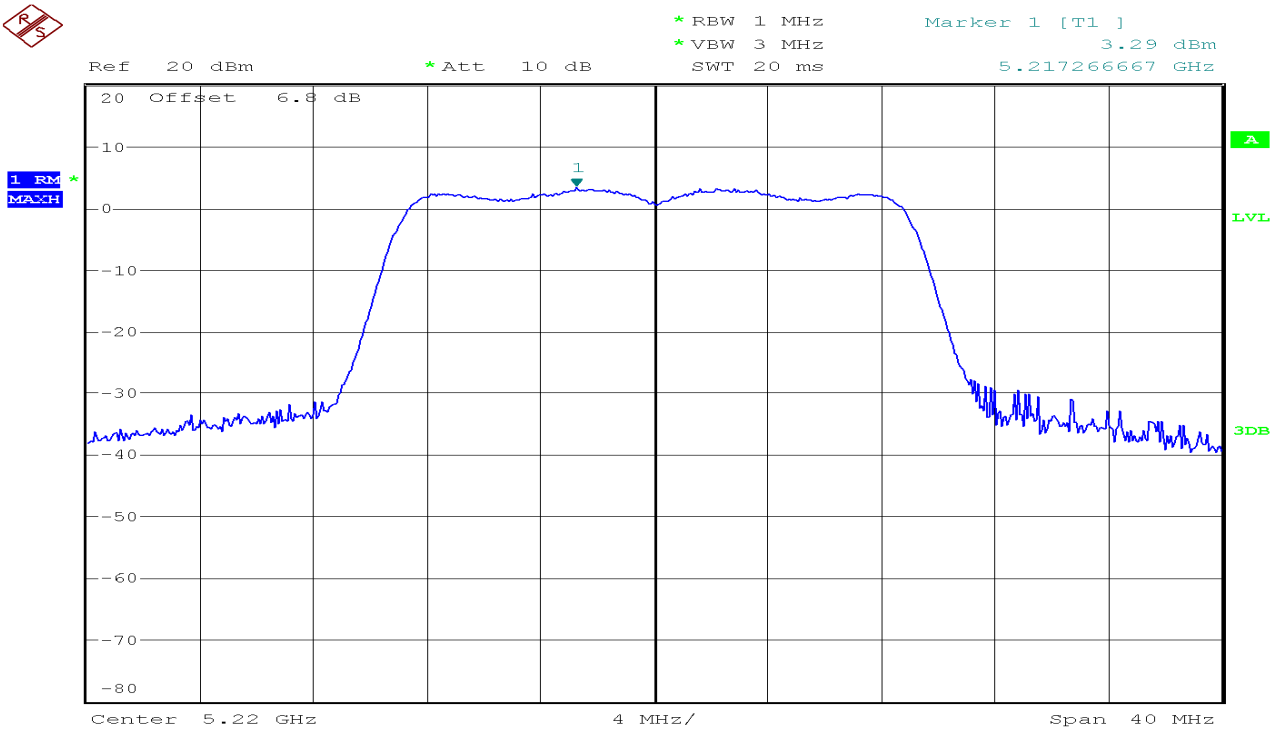
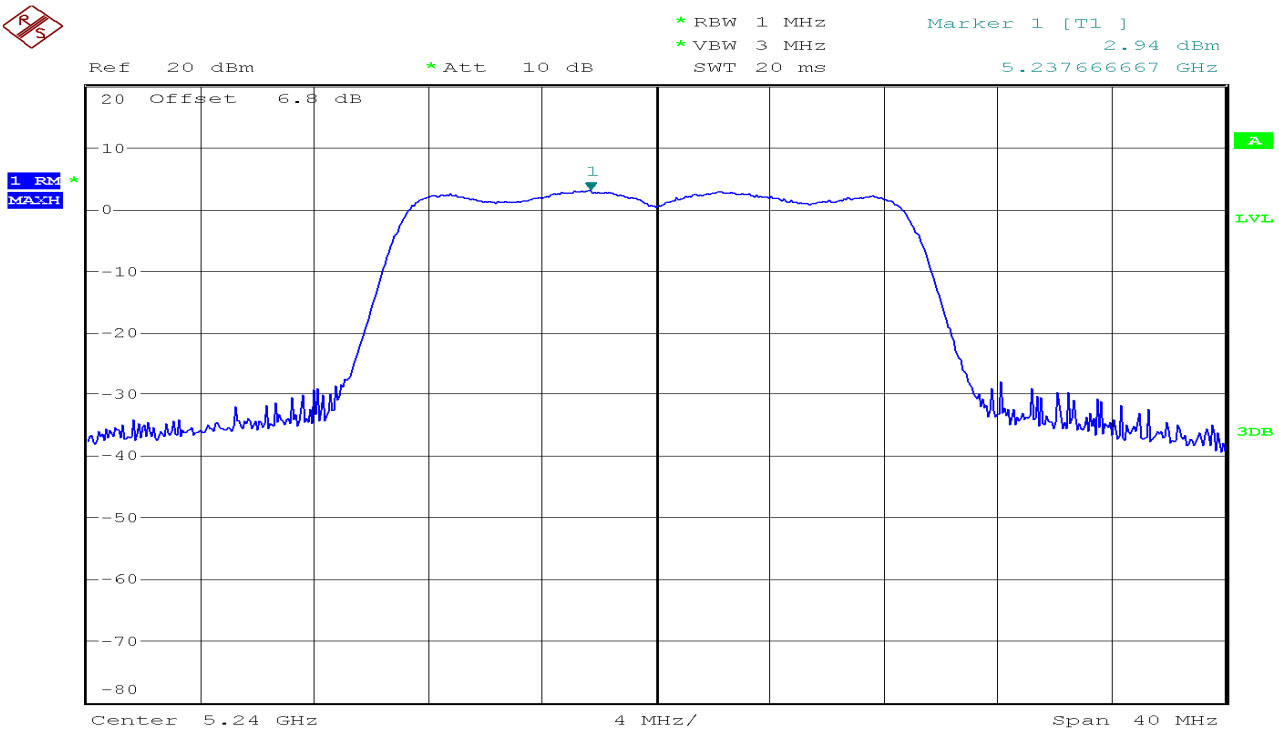
CH Mid



CH High



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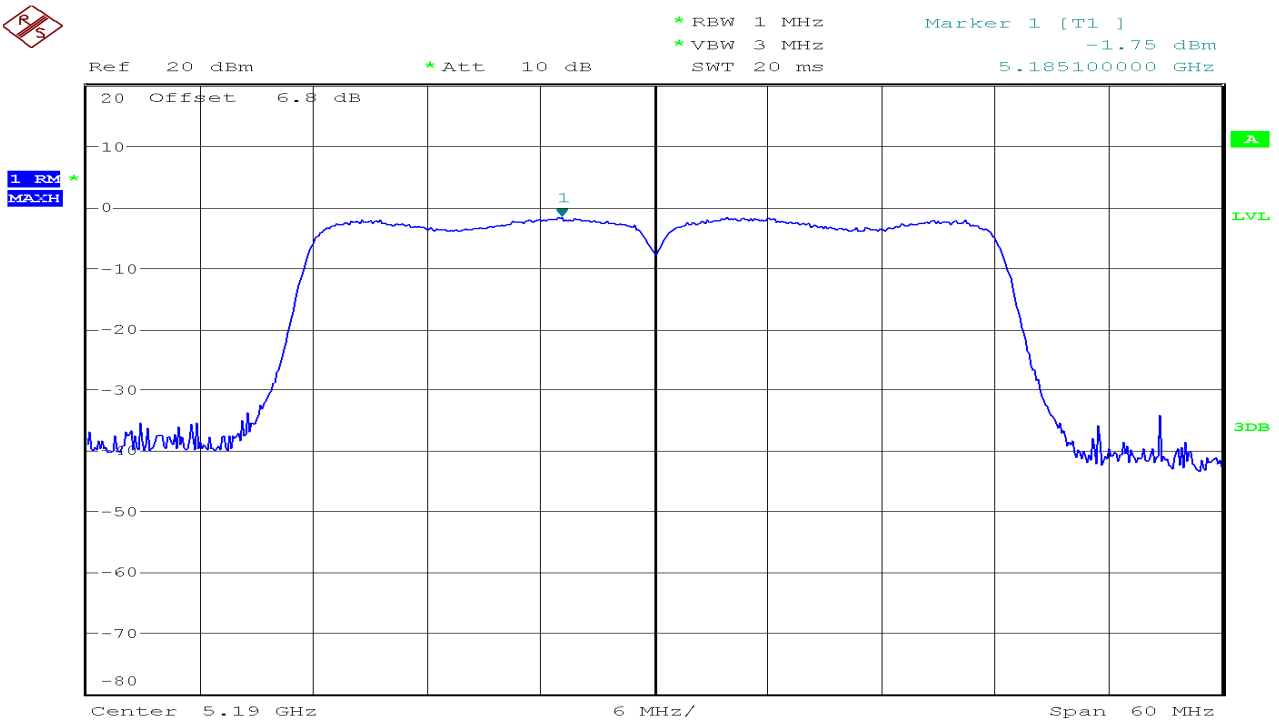
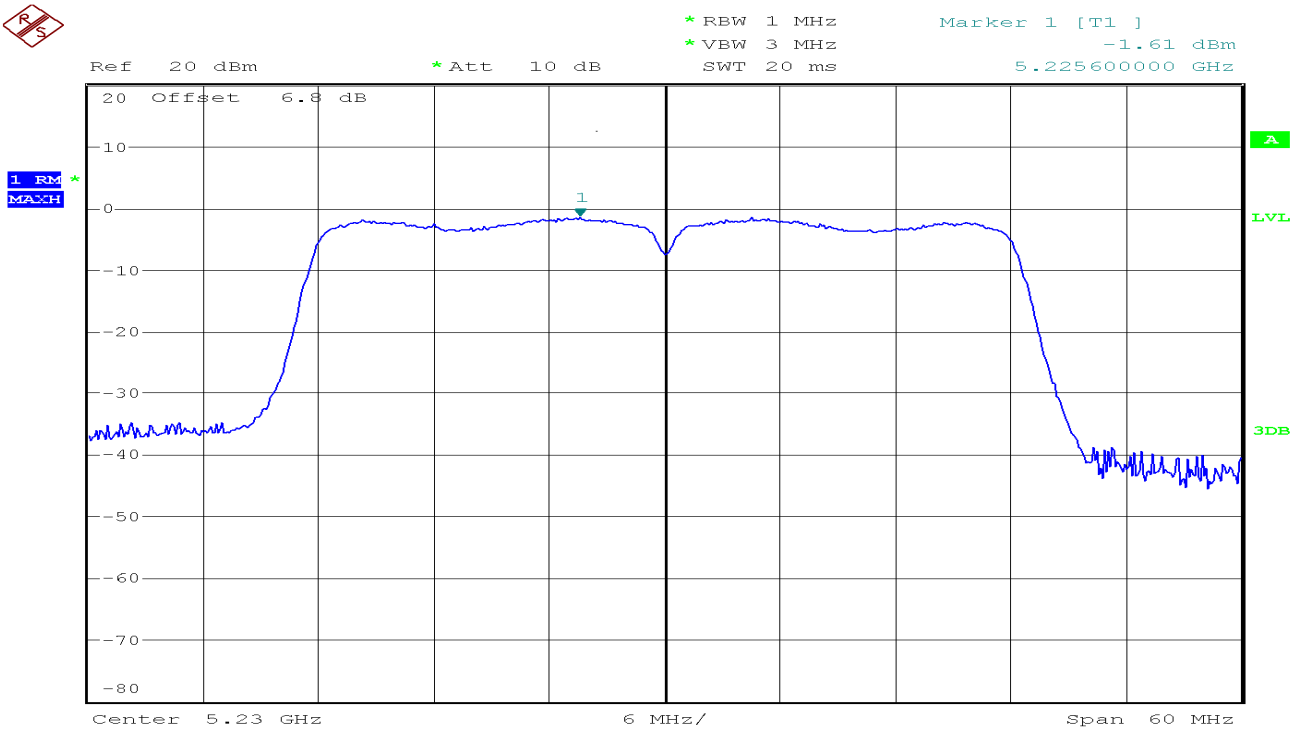
IEEE 802.11ac VHT40 mode/Chain 0:

CH Low



CH High



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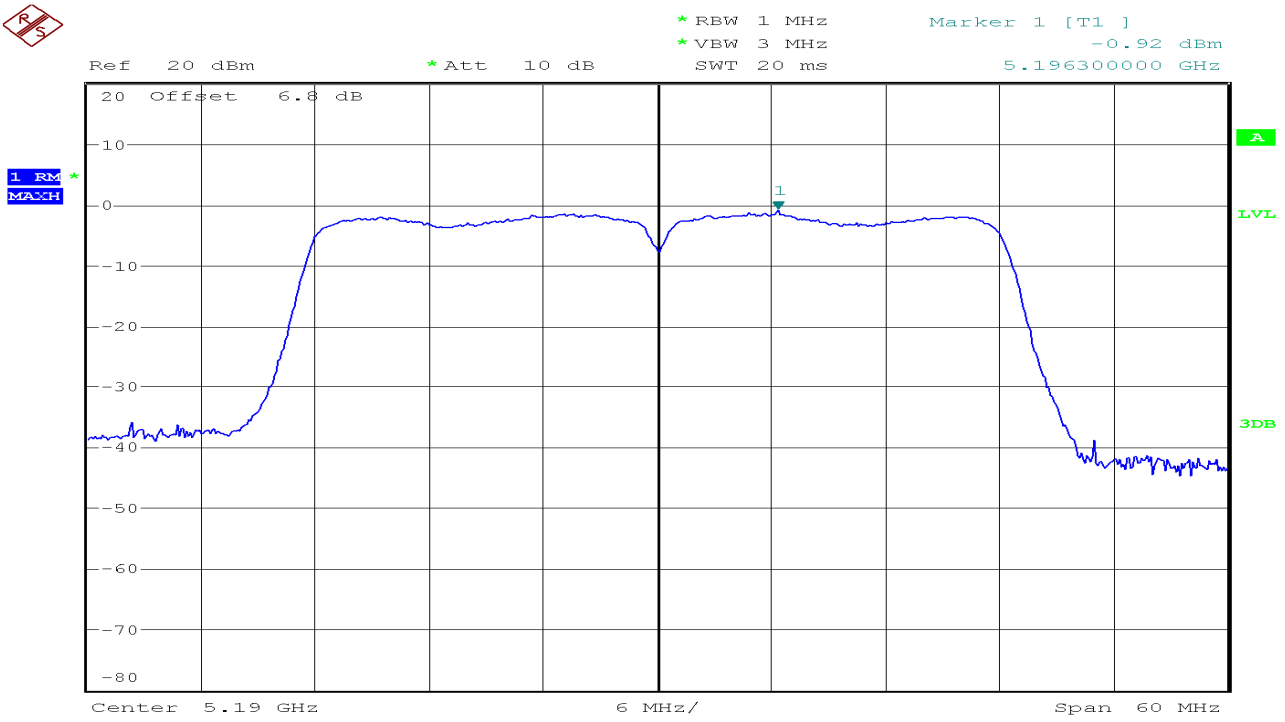
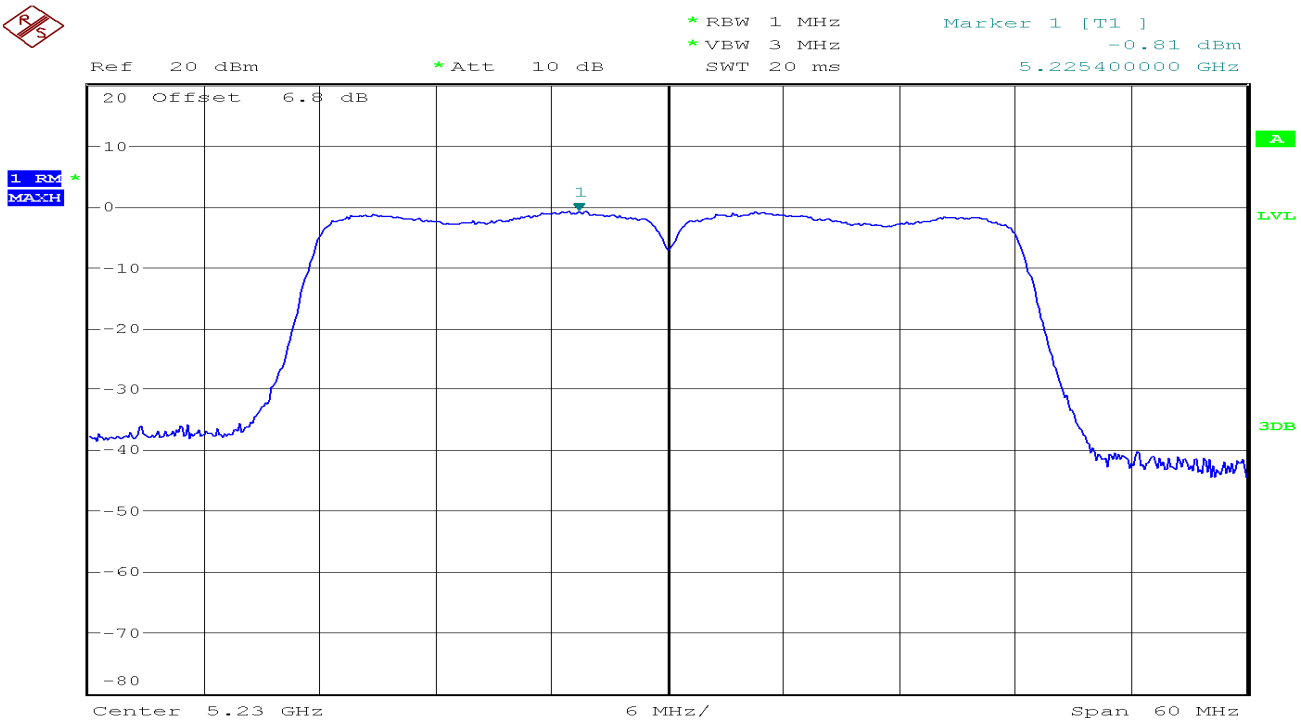
IEEE 802.11ac VHT40 mode/Chain 1:

CH Low



CH High



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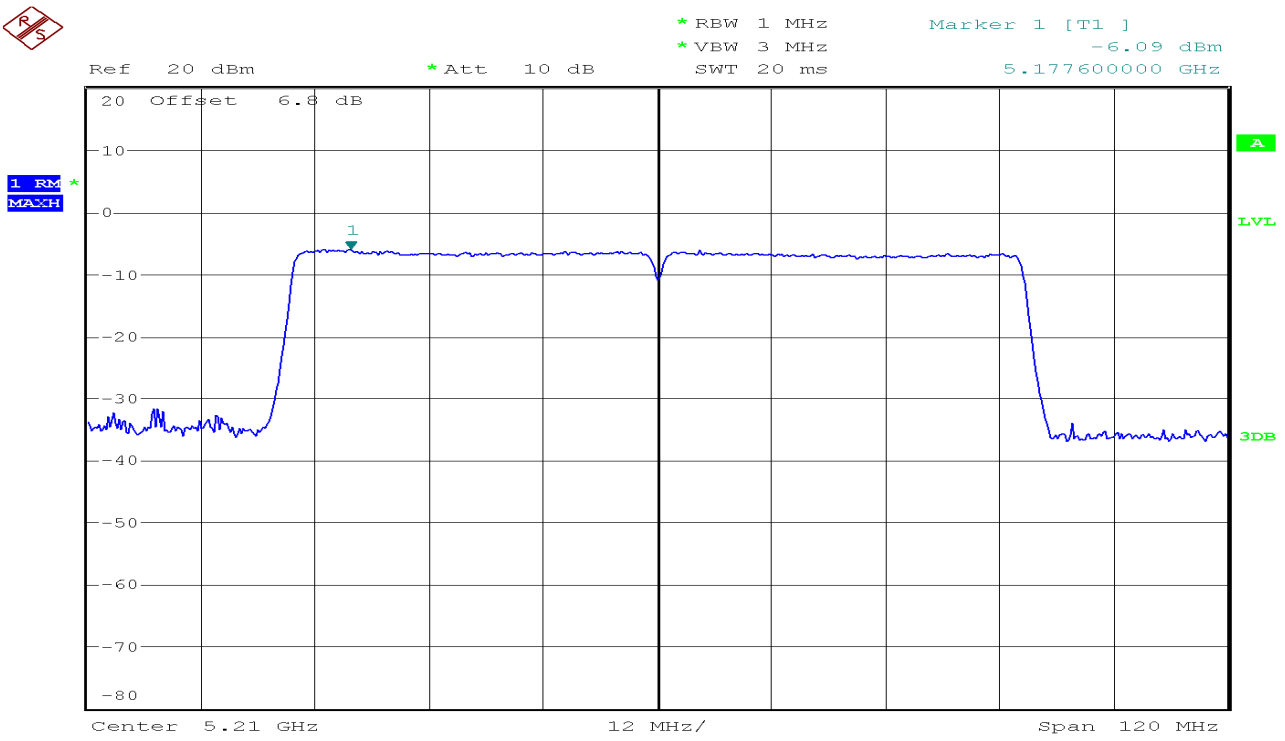
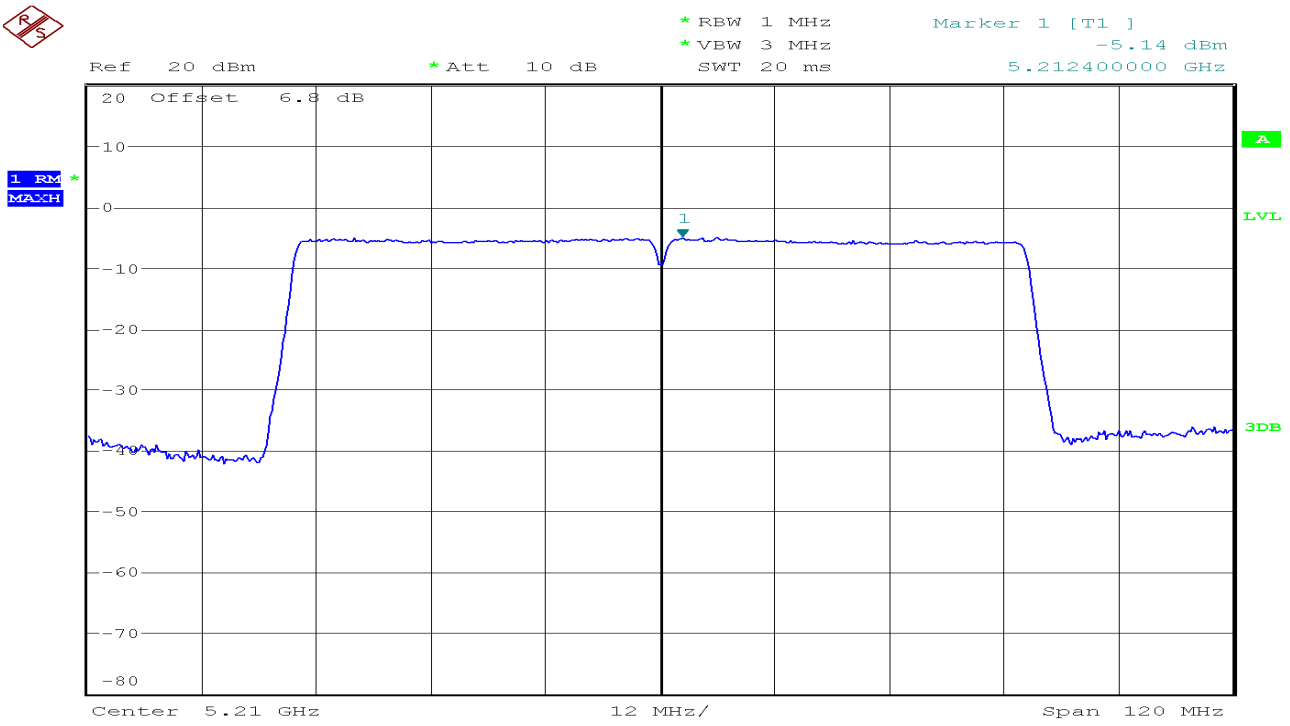
IEEE 802.11ac VHT80 mode/Chain 0:
CH Mid



IEEE 802.11ac VHT80 mode/Chain 1:
CH Mid



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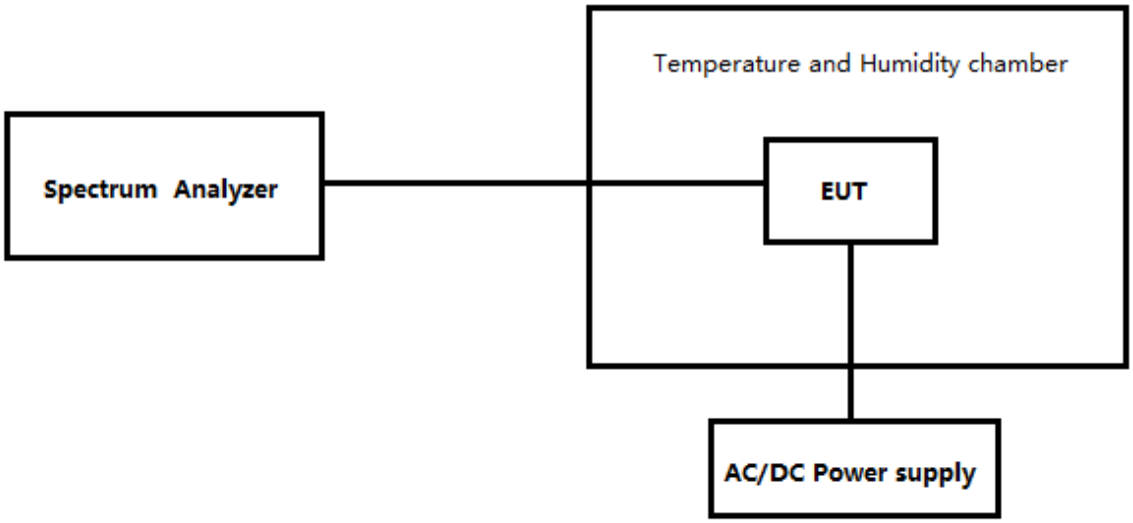
7.6 FREQUENCY STABILITY MEASUREMENT

LIMIT

According to §15.407(g),Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

TEST CONFIGURATION



TEST PROCEDURE

1. To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.
2. The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10dB lower than the measured peak value.
3. The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

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TEST RESULTS

U-NII-1-(5150MHz-5250MHz)					
Freq.(MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)	Temperature (°C)	Voltage (V)
5180	5180.014	0.014	2.70	25	V_{min}
5180	5180.033	0.033	6.37	25	V_{max}
5180	5180.015	0.015	2.90	25	V_{nor}
5180	5180.027	0.027	5.21	-10	V_{nor}
5180	5180.009	0.009	1.74	50	V_{nor}

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7.7 RADIATED UNDESIRABLE EMISSION

LIMIT

Radiated emissions from 9 kHz to 25 GHz were measured according to the methods defines in ANSI C63.10-2013. The EUT was placed above the ground plane, 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions.

1. For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.
   For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.
   For transmitters operating in the 5470-5600 MHz and 5650-5725MHz band: all emissions outside of the 5470-5600 MHz and 5650-5725MHz band shall not exceed an EIRP of -27 dBm/MHz.
2. KDB789033 v01 G)2)c) As specified in 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in 15.407(b)(4)). However, an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.
3. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

FREQUENCIES(MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE(meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

4. In the emission table above, the tighter limit applies at the band edges.

Frequency (MHz)	Field Strength (µV/m at 3-meter)	Field Strength (dBµV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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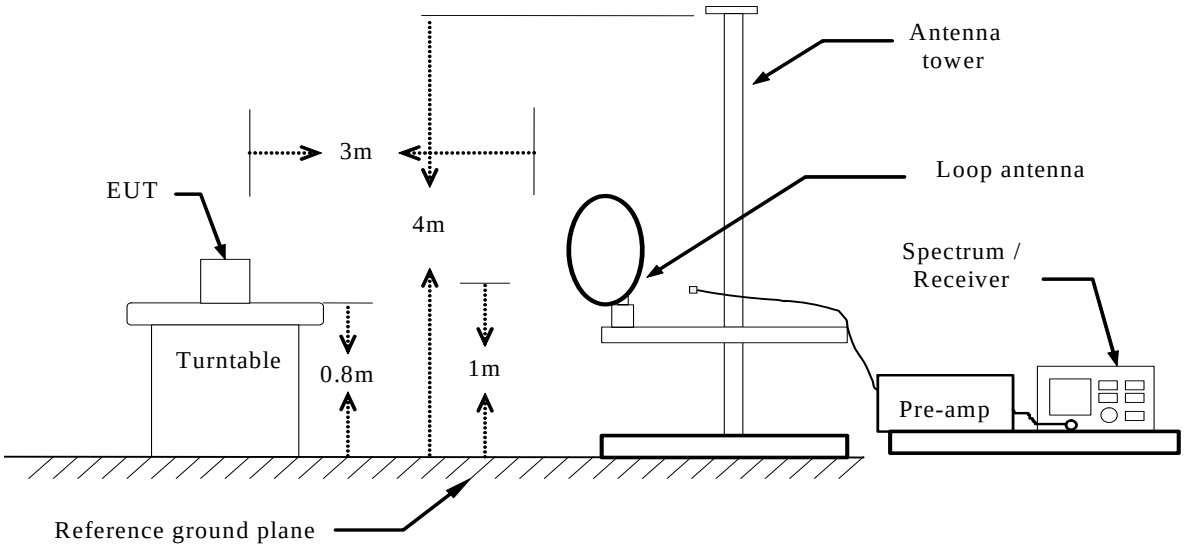
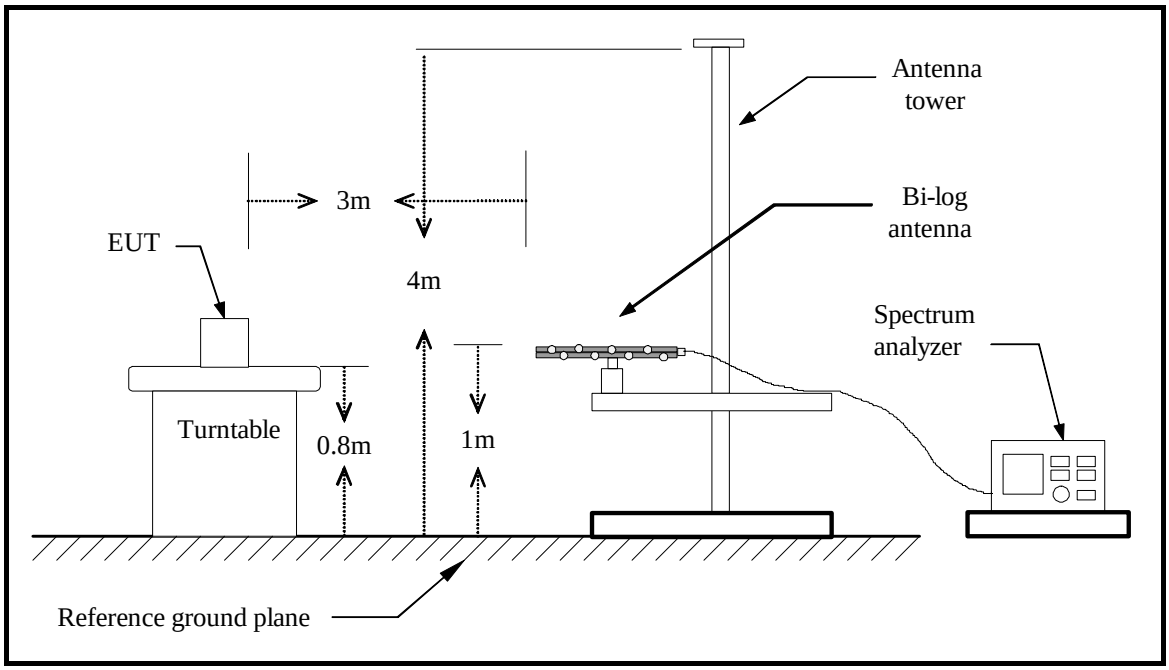
Test Configuration

Below 30MHz



Below 1 GHz



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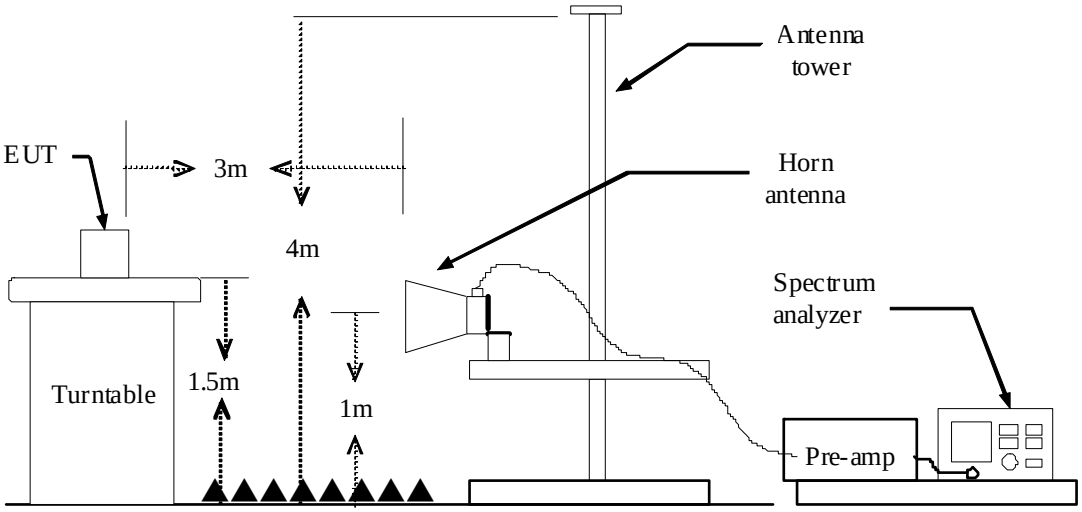
Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable above ground plane, which is 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / Sweep=AUTO

VBW=10Hz,when duty cycle is no less than 98 percent.

VBW≧1/T, when duty cycle is less than 98 percent, where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximun power control level for the tested mode of operation.

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
IEEE 802.11 a	95.2	984	0.001	10Hz
IEEE 802.11n HT20	96.6	994	0.001	10Hz
IEEE 802.11n HT40	95.8	993	0.001	10Hz
IEEE 802.11ac VHT20	96.8	998	0.001	10Hz
IEEE 802.11ac VHT40	96.7	995	0.001	10Hz
IEEE 802.11ac VHT80	95.4	1000	0.001	10Hz

7. Repeat above procedures until the measurements for all frequencies are complete.

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TEST RESULTS

Test Result of Radiated Emission

Below 30MHz

The interference of the frequency value is lower than the limit below 20 db, measured as the background noise values and will not be recorded.

30MHz-1GHz

Operation Mode:	Normal Link	**Test Date:**	2017-11-30
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	48% RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
120.0050	V	23.67	12.86	36.53	43.50	-6.97	QP
179.9940	V	26.32	12.86	39.18	43.50	-4.32	QP
351.0700	V	23.04	14.62	37.66	46.00	-8.34	peak
435.4600	V	21.65	17.65	39.30	46.00	-6.70	peak
553.9800	V	18.29	19.86	38.15	46.00	-7.85	QP
791.9930	V	18.55	23.51	42.06	46.00	-3.94	QP
119.2400	H	22.21	12.82	35.03	43.50	-8.47	peak
179.3800	H	23.78	12.90	36.68	43.50	-6.82	peak
239.5200	H	25.71	12.25	37.96	46.00	-8.04	peak
299.6600	H	23.93	13.98	37.91	46.00	-8.09	peak
563.5000	H	16.93	20.13	37.06	46.00	-8.94	peak
791.9840	H	16.87	23.51	40.38	46.00	-5.62	QP

Remark:

1. Measuring frequencies from 30 MHz to the 1GHz.(no emission found from the lowest internal used/generated frequency to 30MHz)
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

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Above 1 GHz

Operation Mode:	Tx / IEEE 802.11a mode CH Low	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11338.942	36.78	11.96	48.74	74.00	-25.26	100	286	peak
2	15915.865	34.39	13.15	47.54	74.00	-26.46	100	163	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11625.000	36.29	11.20	47.49	74.00	-26.51	100	310	peak
2	16855.769	32.94	15.33	48.27	74.00	-25.73	100	107	peak
N/A									

Operation Mode:	Tx / IEEE 802.11a mode CH Mid	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11420.673	36.59	11.73	48.32	74.00	-25.68	100	340	peak
2	15548.077	33.68	12.01	45.69	74.00	-28.31	100	8	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11216.346	38.58	12.31	50.89	74.00	-23.11	100	140	peak
2	15997.596	34.48	13.40	47.88	74.00	-26.12	100	14	peak
N/A									

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Operation Mode:	Tx / IEEE 802.11a mode CH High	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	12245.500	37.50	11.33	48.83	74.00	-25.17	100	114	peak
2	16529.500	34.18	15.83	50.01	74.00	-23.99	100	164	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11021.500	34.98	12.86	47.84	74.00	-26.16	100	223	peak
2	16427.500	31.00	15.52	46.52	74.00	-27.48	100	337	peak
N/A									

Operation Mode:	TX / IEEE 802.11n HT20 mode /CH Low	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11911.058	37.25	10.49	47.74	74.00	-26.26	100	181	peak
2	16610.577	30.35	15.71	46.06	74.00	-27.94	100	139	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11338.942	37.58	11.96	49.54	74.00	-24.46	100	137	peak
2	16447.115	32.83	15.62	48.45	74.00	-25.55	100	360	peak
N/A									

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Operation Mode:	TX / IEEE 802.11n HT20 mode /CH Mid	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11461.539	36.68	11.62	48.30	74.00	-25.70	100	23	peak
2	17060.096	32.20	15.41	47.61	74.00	-26.39	100	49	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11747.596	37.86	10.90	48.76	74.00	-25.24	100	224	peak
2	16610.577	30.16	15.71	45.87	74.00	-28.13	100	242	peak
N/A									

Operation Mode:	TX / IEEE 802.11n HT20 mode /CH High	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11747.596	37.24	10.90	48.14	74.00	-25.86	100	46	peak
2	17223.558	31.11	16.23	47.34	74.00	-26.66	100	15	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11216.346	39.66	12.31	51.97	74.00	-22.03	100	84	peak
2	16487.981	31.26	15.82	47.08	74.00	-26.92	100	52	peak
N/A									

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Operation Mode:	TX / IEEE 802.11n HT40 mode /CH Low	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11379.808	39.03	11.85	50.88	74.00	-23.12	100	6	peak
2	16161.058	33.70	14.21	47.91	74.00	-26.09	100	77	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	12033.654	36.52	10.42	46.94	74.00	-27.06	100	56	peak
2	15997.596	33.78	13.40	47.18	74.00	-26.82	100	360	peak
N/A									

Operation Mode:	TX / IEEE 802.11n HT40 mode /CH High	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	10930.289	39.99	12.65	52.64	74.00	-21.36	100	292	peak
2	16120.192	33.33	14.00	47.33	74.00	-26.67	100	181	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11461.539	37.58	11.62	49.20	74.00	-24.80	100	115	peak
2	16201.923	33.71	14.41	48.12	74.00	-25.88	100	78	peak
N/A									

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Operation Mode:	TX / IEEE 802.11ac VHT20 mode /CH Low	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	10521.635	40.85	11.05	51.90	74.00	-22.10	100	353	peak
2	14894.231	36.02	15.45	51.47	74.00	-22.53	100	62	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	10725.961	40.02	11.85	51.87	74.00	-22.13	100	3	peak
2	15098.558	32.22	14.71	46.93	74.00	-27.07	100	128	peak
N/A									

Operation Mode:	TX / IEEE 802.11ac VHT20 mode /CH Mid	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	10930.289	39.94	12.65	52.59	74.00	-21.41	100	129	peak
2	15221.154	33.08	13.84	46.92	74.00	-27.08	100	246	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	10848.558	39.65	12.33	51.98	74.00	-22.02	100	232	peak
2	15221.154	32.91	13.84	46.75	74.00	-27.25	100	6	peak
N/A									

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Operation Mode:	TX / IEEE 802.11ac VHT20 mode /CH High	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11216.346	39.36	12.31	51.67	74.00	-22.33	100	280	peak
2	15507.211	34.64	11.88	46.52	74.00	-27.48	100	318	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11093.750	39.34	12.66	52.00	74.00	-22.00	100	2	peak
2	15466.346	34.31	12.10	46.41	74.00	-27.59	100	61	peak
N/A									

Operation Mode:	TX / IEEE 802.11ac VHT40 mode /CH Low	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	11298.077	38.27	12.08	50.35	74.00	-23.65	100	310	peak
2	17387.019	33.21	17.05	50.26	74.00	-23.74	100	255	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	10644.231	40.76	11.53	52.29	74.00	-21.71	100	353	peak
2	15221.154	32.70	13.84	46.54	74.00	-27.46	100	361	peak
N/A									

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Operation Mode:	TX / IEEE 802.11ac VHT40 mode /CH High	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	10725.961	40.30	11.85	52.15	74.00	-21.85	100	129	peak
2	15425.481	34.62	12.39	47.01	74.00	-26.99	100	63	peak
N/A									

Vertical

No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	10644.231	40.07	11.53	51.60	74.00	-22.40	100	228	peak
2	15466.346	34.72	12.10	46.82	74.00	-27.18	100	266	peak
N/A									

Operation Mode:	TX / IEEE 802.11ac VHT80 mode /CH Mid	**Test Date:**	2017-11-28
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	55% RH	**Polarity:**	Ver. / Hor.

Horizontal

No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	10971.154	39.36	12.81	52.17	74.00	-21.83	100	259	peak
2	15221.154	32.58	13.84	46.42	74.00	-27.58	100	3	peak
N/A									

Vertical

No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	11134.615	40.19	12.54	52.73	74.00	-21.27	100	79	peak
2	15262.019	31.26	13.55	44.81	74.00	-29.19	100	93	peak
N/A									

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7.8 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

** Decreases with the logarithm of the frequency.*

TEST CONFIGURATION

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Test Data

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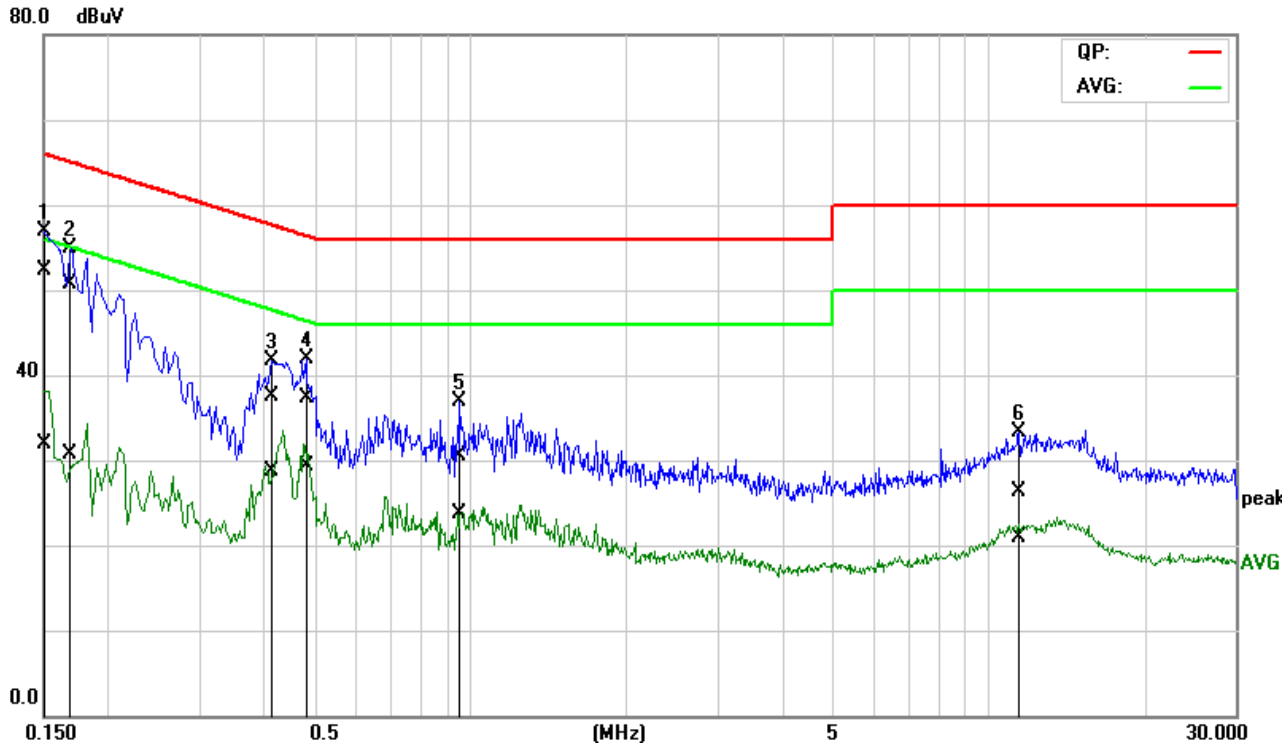
Job No.:	C171101R02	Date:	2017/11/30
Model No.:	OFR-T1-S	Time:	18:39:30
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	Lily.Wang
Line:	L1	Test Voltage:	AC 120V/60Hz
Model:		Description:	

L1



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1*	0.1503	31.66	11.35	20.59	52.25	31.94	65.98	55.98	-13.73	-24.04	Pass
2	0.1680	30.05	10.18	20.56	50.61	30.74	65.06	55.06	-14.45	-24.32	Pass
3	0.4144	17.02	8.13	20.53	37.55	28.66	57.56	47.56	-20.01	-18.90	Pass
4	0.4854	16.91	8.75	20.49	37.40	29.24	56.25	46.25	-18.85	-17.01	Pass
5	0.9523	10.09	3.15	20.51	30.60	23.66	56.00	46.00	-25.40	-22.34	Pass
6	11.5150	5.46	0.14	20.81	26.27	20.95	60.00	50.00	-33.73	-29.05	Pass

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

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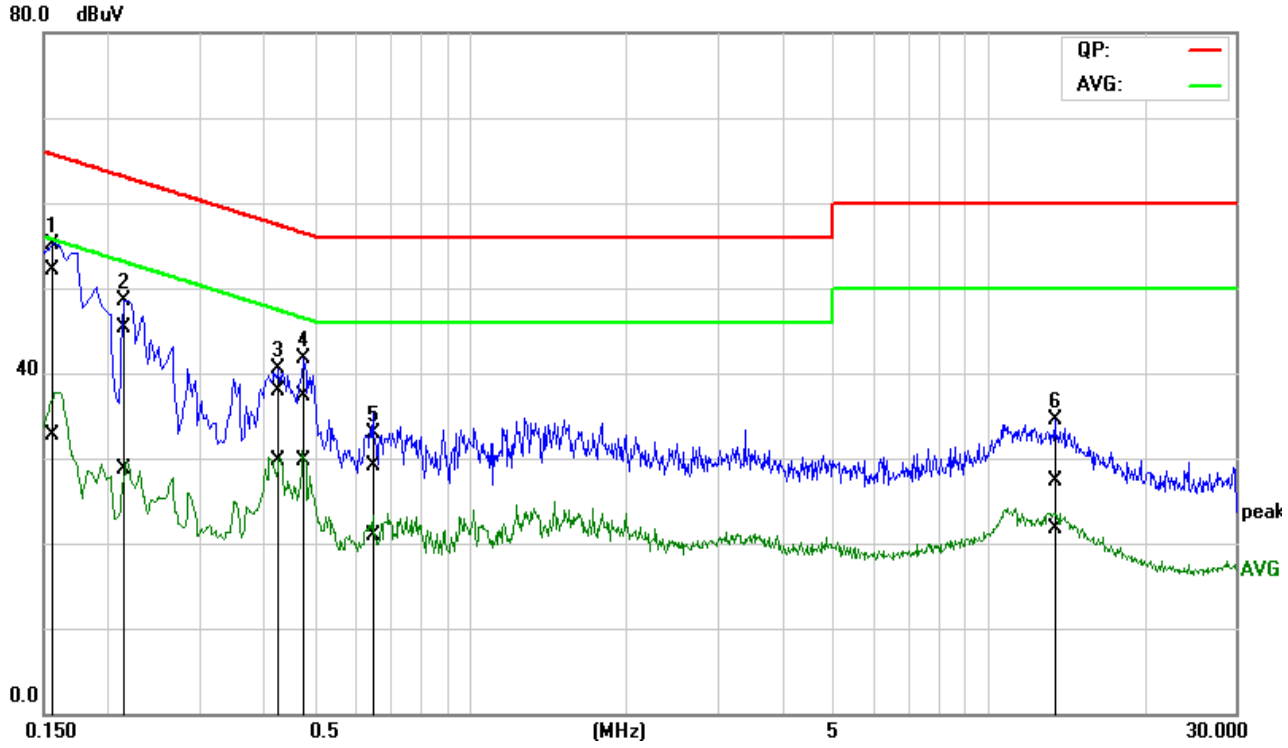
Job No.:	C171101R02	Date:	2017/11/30
Model No.:	OFR-T1-S	Time:	18:44:24
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	Lily.Wang
Line:	L2	Test Voltage:	AC 120V/60Hz
Model:		Description:	

L2



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1*	0.1536	31.73	12.29	20.36	52.09	32.65	65.80	55.80	-13.71	-23.15	Pass
2	0.2140	24.88	8.21	20.41	45.29	28.62	63.05	53.05	-17.76	-24.43	Pass
3	0.4279	17.42	9.19	20.45	37.87	29.64	57.29	47.29	-19.42	-17.65	Pass
4	0.4750	16.82	9.20	20.45	37.27	29.65	56.43	46.43	-19.16	-16.78	Pass
5	0.6560	8.71	0.49	20.46	29.17	20.95	56.00	46.00	-26.83	-25.05	Pass
6	13.4910	6.49	0.89	20.85	27.34	21.74	60.00	50.00	-32.66	-28.26	Pass

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

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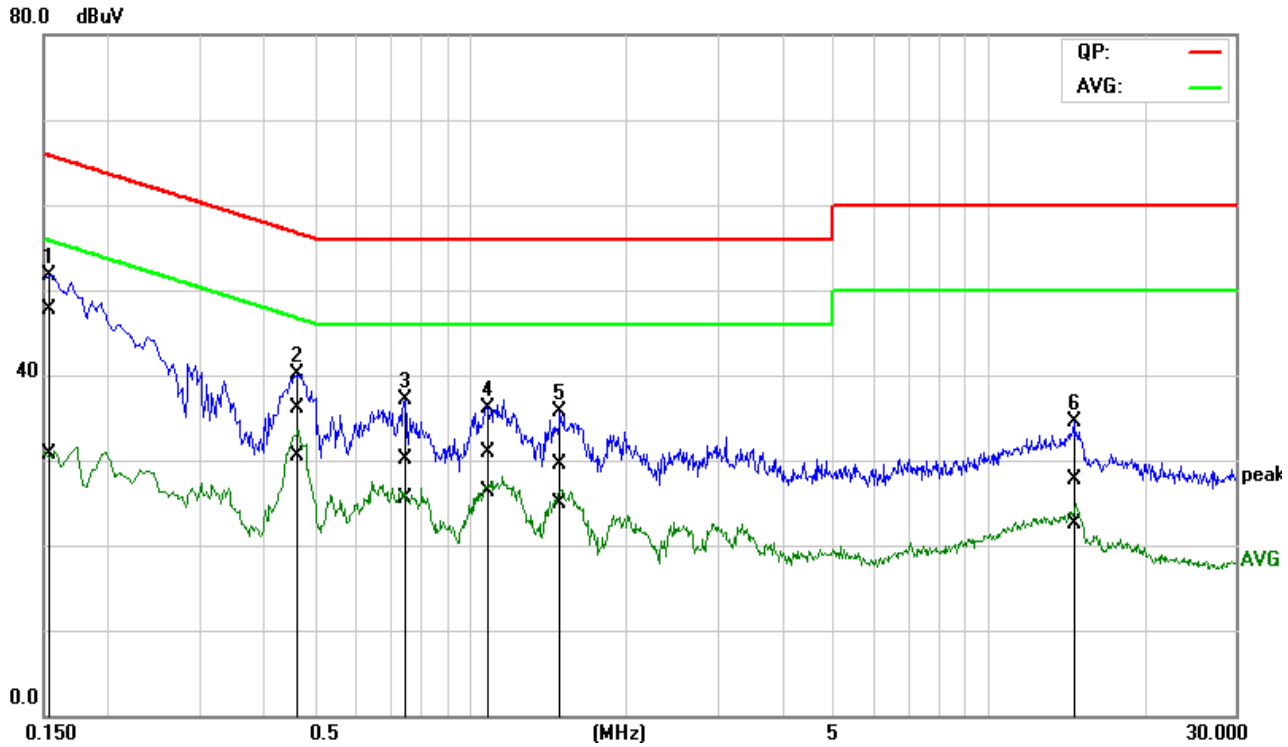
Job No.:	C171101R02	Date:	2017/11/30
Model No.:	OFR-T1-S	Time:	18:52:16
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	Lily.Wang
Line:	L1	Test Voltage:	AC 240V/60Hz
Model:		Description:	

L1



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1539	27.05	10.11	20.58	47.63	30.69	65.79	55.79	-18.16	-25.10	Pass
2*	0.4599	15.69	9.98	20.49	36.18	30.47	56.69	46.69	-20.51	-16.22	Pass
3	0.7474	9.67	4.93	20.50	30.17	25.43	56.00	46.00	-25.83	-20.57	Pass
4	1.0876	10.46	5.79	20.43	30.89	26.22	56.00	46.00	-25.11	-19.78	Pass
5	1.5002	8.99	4.38	20.45	29.44	24.83	56.00	46.00	-26.56	-21.17	Pass
6	14.5806	6.87	1.77	20.78	27.65	22.55	60.00	50.00	-32.35	-27.45	Pass

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

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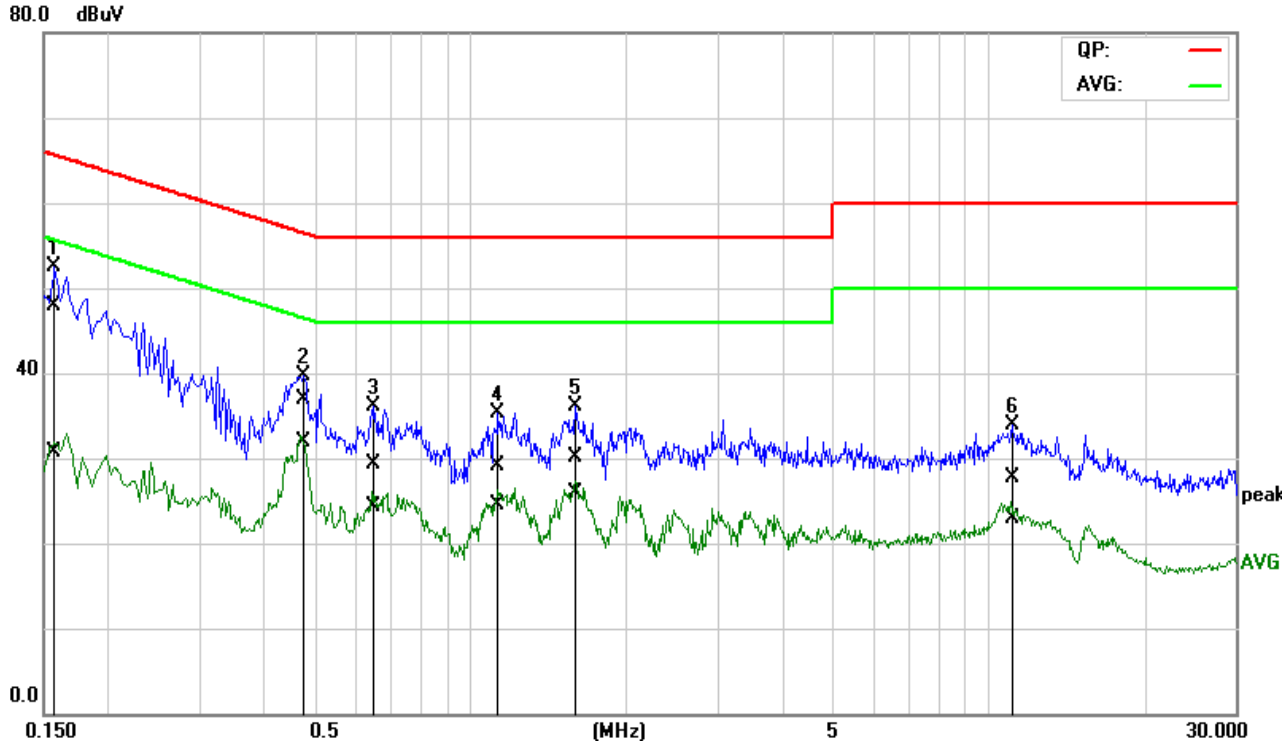
Job No.:	C171101R02	Date:	2017/11/30
Model No.:	OFR-T1-S	Time:	18:58:36
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	Lily.Wang
Line:	L2	Test Voltage:	AC 240V/60Hz
Model:		Description:	

L2



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1572	27.45	10.36	20.37	47.82	30.73	65.61	55.61	-17.79	-24.88	Pass
2*	0.4738	16.47	11.38	20.45	36.92	31.83	56.45	46.45	-19.53	-14.62	Pass
3	0.6535	8.82	3.78	20.46	29.28	24.24	56.00	46.00	-26.72	-21.76	Pass
4	1.1141	8.69	4.08	20.46	29.15	24.54	56.00	46.00	-26.85	-21.46	Pass
5	1.5915	9.67	5.33	20.49	30.16	25.82	56.00	46.00	-25.84	-20.18	Pass
6	11.0443	6.81	1.99	20.93	27.74	22.92	60.00	50.00	-32.26	-27.08	Pass

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

*R*emark:

1.The measuring frequencies range between 0.15 MHz and 30 MHz.

2.The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.

3."---" denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.

4.The IF bandwidth of SPA between 0.15MHz and 30MHz was 10KHz. The IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz.

END OF REPORT

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