FCC Part 15E
Measurement and Test Report

For

NEXXT SOLUTIONS

3505 N.W 107TH AVE. MIAMI, Florida 33178, United States

FCC ID: X4YNX12AC

FCC Rule(s):	FCC Part 15E
Product Description:	**Wireless Router**
Tested Model:	**ARNEL904U1**
Report No.:	HCT17GR191E-2
Sample Receipt Date:	October 12, 2017
Tested Date:	October 12~ October 28, 2017
Issued Date:	October 29, 2017
Tested By:	Jason Su/ Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy So / PSQ Manager

Prepared By:

Shenzhen SEM Test Technology Co., Ltd
1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C. 518101, China
Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information	
Applicant:	**NEXXT SOLUTIONS**
Address of applicant:	3505 N.W 107TH AVE. MIAMI, Florida 33178, United States
Manufacturer:	**YICHEN (Shenzhen) Technology Co., Ltd.**
Address of manufacturer:	6th Building, Yasen Industrial Park, Chengxin Road 8, Baolong Industrial Estate, Longgang District, Shenzhen, China.

General Description of EUT	
Product Name:	Wireless Router
Trade Name:	NEXXT
Model No.:	ARNEL904U1
Adding Model(s):	N/A
Rated Voltage:	Input: AC 100-240V 50~60Hz 0.6Amax Output: DC 12V 1A
Power Adapter Model:	RD1201000-CSS-HMG
Note: The test data is gathered from a production sample provided by the manufacturer.	

Technical Characteristics of EUT	
Frequency Range:	IEEE 802.11b: 2412MHz~2462MHz IEEE 802.11g: 2412MHz~2462MHz IEEE 802.11nHT20: 2412MHz~2462MHz, 5180MHz~5240MHz, 5745MHz~5825MHz IEEE 802.11nHT40: 2422MHz~2452MHz, 5180MHz, 5230MHz, 5755MHz, 5795MHz IEEE 802.11nHT80: 5210 MHz, 5775MHz IEEE 802.11a: 5180MHz~5240MHz, 5745MHz~5825MHz
RF Output Power:	5150~5250MHz: 15.73 dBm (Conducted) 5745~5825MHz: 16.66 dBm (Conducted)
Data Rate:	maximum of 150Mbps
Modulation:	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)

	IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT80: OFDM (64QAM, 16QAM, QPSK,BPSK)
Quantity of Channels:	15
Type of Antenna:	5dB Dual Frequency Welding Antenna
Antenna Gain:	5.5dBi
Channel List:	As below table

5G Band 5150~5250 MHz (U-NII-1)				
Frequency Band	**Channel No.**	**Frequency**	**Channel No.**	**Frequency**
5150~5250 MHz Band 1	36	5180 MHz	44	5220 MHz
	38	5190 MHz	46	5230 MHz
	40	5200 MHz	48	5240 MHz
	42	5210 MHz		
Remark: For 20 MHz Bandwidth, use channel 36, 40, 44, 48. For 40 MHz Bandwidth, use channel 38, 46. For 80 MHz Bandwidth, use channel 42.				

5G Band 5725~5850 MHz				
Frequency Band	**Channel No.**	**Frequency**	**Channel No.**	**Frequency**
5725~5850 MHz Band 4	149	5745 MHz	157	5785 MHz
	151	5755 MHz	159	5795 MHz
	153	5765 MHz	161	5805 MHz
	155	5775 MHz	165	5825 MHz
Remark: For 20 MHz Bandwidth, use channel 149, 153, 157, 161, 165. For 40 MHz Bandwidth, use channel 151, 159. For 80 MHz Bandwidth, use channel 155.				

1.2 Test Standards

The following report is prepared on behalf of the **NEXXT SOLUTIONS** in accordance with FCC Part 15, Subpart C&E, and section 15.203, 15.205, 15.207, 15.209 and 15.407 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C&E, and section 15.203, 15.205, 15.207, 15.209 and 15.407 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 789033 D02 v01r04 for Unlicensed National Information Infrastructure (U-NII) Devices and KDB 662911 D01 Multiple Transmitter Output v02r01 shall be performed also.

1.4 Table for parameters of Test Software setting

The test utility software used during testing was "RPTA1-71W.M4300.01.GD.2015Sep1". During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Mode	Test Frequency (MHz)												
	NCB: 20MHz												
	5180	5200	5240	5260	5300	5320	5500	5580	5700	5720	5745	5785	5825
802.11a 6Mbps	19	19	19								15	15	15
802.11n-HT20 MCS0	19	19	19								15	15	15
Mode	NCB: 40MHz									
	5190	5230	5270	5310	5510	5550	5670	5710	5755	5795
802.11n-HT40 MCS0	19	19							15	15
Mode	NCB: 80MHz					
	5210		5290	5530	5610	5690	5775	
802.11ac-HT80 MCS0/Nss2	19						15	

1.5 EUT Operating during test

EUT was programmed to be in continuously transmitting mode. During the test, EUT operation to normal function and programs under WIN XP were executed.

1.6 Test Facility

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.7 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11a	5180MHz,5200MHz,5240MHz,5745MHz, 5785MHz,5825MHz
TM2	802.11n-HT20	5180MHz,5200MHz,5240MHz, 5745MHz, 5785MHz,5825MHz
TM3	802.11n-HT40	5190MHz,5230MHz,5755MHz,5795MHz
TM4	802.11ac-HT80	5210MHz, 5775MHz
Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.		

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Core
Adapter Cable	1.45	Shielded	Without Core

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/
/	/	/	/

1.8 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Power Spectral Density	Conducted	±1.8dB
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	±2.88dB

Transmitter Spurious Emissions	Radiated	±5.1dB

1.9 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2018-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2018-06-07
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-08	2018-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2018-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2017-08-15	2018-08-14
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2017-08-15	2018-08-14
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2017-06-12	2018-06-11
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2017-03-09	2018-03-08

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203; § 15.405	Antenna Requirement	Compliant
§ 15.207; § 15.407(b)(6)	Conducted Emission	Compliant
§ 15.407(a)(1),(2)	Power Spectral Density	Compliant
§ 15.407(e)	Emission Bandwidth and Occupied Bandwidth	Compliant
§ 15.407(a)(1),(2)	Maximum Conducted Output Power	Compliant
§ 15.407(b)(1),(2),(3)	Conducted Spurious Emission	Compliant
§ 15.205; § 15.407(b)(1),(2),(3)	Radiated Emission	Compliant
§ 15.407(g)	Frequency Stability	Compliant
§ 15.407(h)	Dynamic Frequency Selection (DFS)	N/A

N/A: not applicable

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the MPE Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

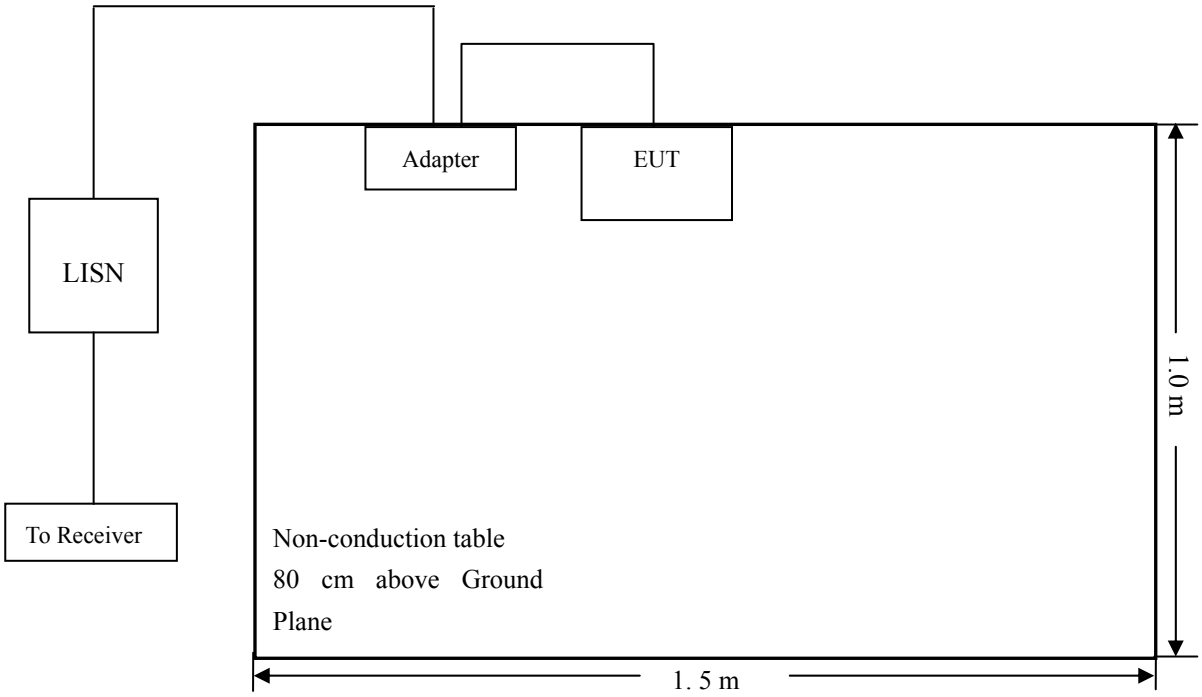
This product has two welding 5dB Dual Frequency Welding Antenna, fulfill the requirement of this section.

5. Conducted Emissions

5.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

5.3 Basic Test Setup Block Diagram



5.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

5.5 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency ..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz
Quasi-Peak Adapter Mode ..... Normal

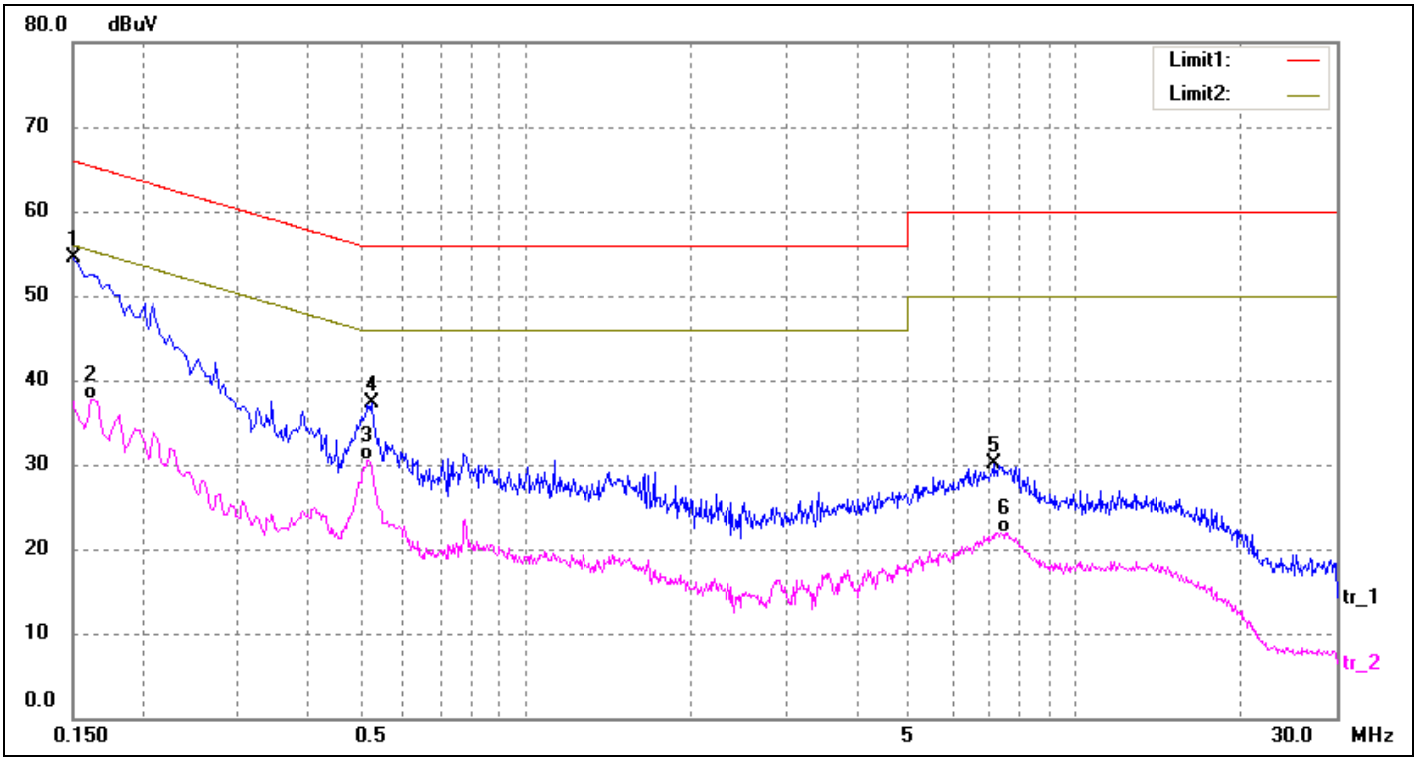
5.6 Summary of Test Results/Plots

According to the data in section 3.8, the EUT complied with the FCC Part 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

5.7 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

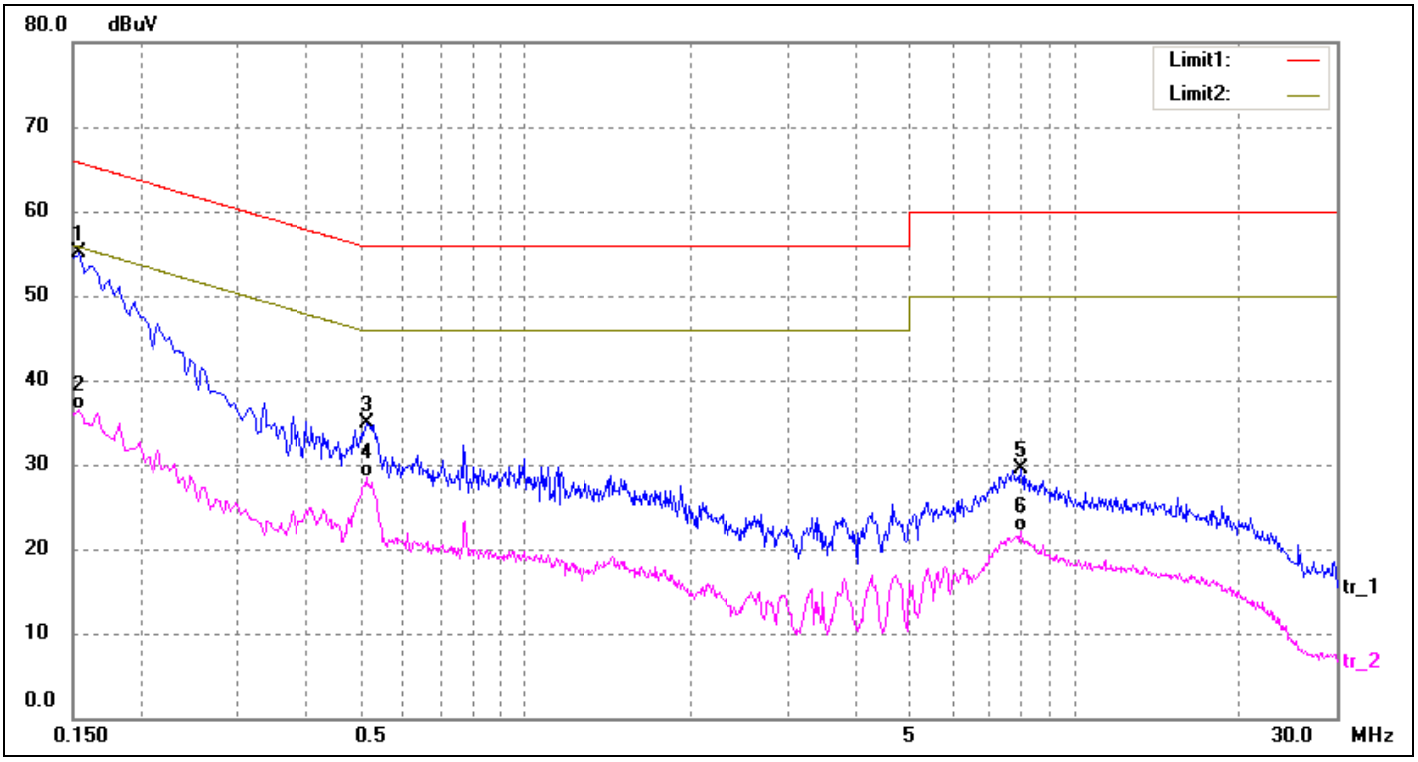
EUT: Wireless Router
Tested Model: ARNEL904U1
Operating Condition: Transmitting
Comment: AC 120V/60Hz; Adapter DC12V/1A
Test Specification: Neutral



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.1500	44.57	9.85	54.42	66.00	-11.58	peak
2	0.1620	27.95	9.84	37.79	55.36	-17.57	AVG
3	0.5180	20.68	9.80	30.48	46.00	-15.52	AVG
4	0.5260	27.53	9.80	37.33	56.00	-18.67	peak
5	7.1140	20.48	9.60	30.08	60.00	-29.92	peak
6	7.5060	12.37	9.59	21.96	50.00	-28.04	AVG

Note:
1. Result Level = Reading Level +Correct Factor (LISN Factor + Pulse Limiter Factor + Cable loss).
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz-150 kHz), 9 kHz (150 kHz-30 MHz), Step size: 4 kHz, Scan time: auto.

EUT:	Wireless Router
Tested Model:	ARNEL904U1
Operating Condition:	Transmitting
Comment:	AC 120V/60Hz; Adapter DC12V/1A
Test Specification:	Line



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.1540	45.16	9.85	55.01	65.78	-10.77	peak
2	0.1540	26.65	9.85	36.50	55.78	-19.28	AVG
3	0.5140	25.12	9.80	34.92	56.00	-21.08	peak
4	0.5140	18.72	9.80	28.52	46.00	-17.48	AVG
5	7.9940	20.00	9.58	29.58	60.00	-30.42	peak
6	7.9940	12.60	9.58	22.18	50.00	-27.82	AVG

Note:

1. Result Level = Reading Level +Correct Factor (LISN Factor + Pulse Limiter Factor + Cable loss).
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz), Step size: 4 kHz, Scan time: auto.

6. Power Spectral Density

6.1 Standard Applicable

Section 15.407(a) Power limits:

(1) For the band 5.15-5.25 GHz.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(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 + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

6.2 Test Procedure

According to 789033 D02 General UNII Test Procedures New Rules v01r04, the following is the measurement procedure.
For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a).
b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

6.3 Environmental Conditions

Temperature:	20° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

6.4 Summary of Test Results/Plots

5150-5250MHz

Operating mode	Test Channel	Power Spectral Density dBm/MHz			Limit (dBm/MHz)
		Chain 1	Chain 2	Total	
802.11a	5180	4.963	0.22	6.22	8.49
	5200	4.167	0.11	5.61	8.49
	5240	4.791	1.80	6.56	8.49
802.11n-HT20	5180	6.663	1.05	7.72	8.49
	5200	6.280	0.17	7.23	8.49
	5240	6.531	2.78	8.06	8.49
802.11n-HT40	5190	5.61	-1.44	6.39	8.49
	5230	5.57	-0.17	6.60	8.49
802.11n-ac80	5210	1.14	-4.83	2.12	8.49

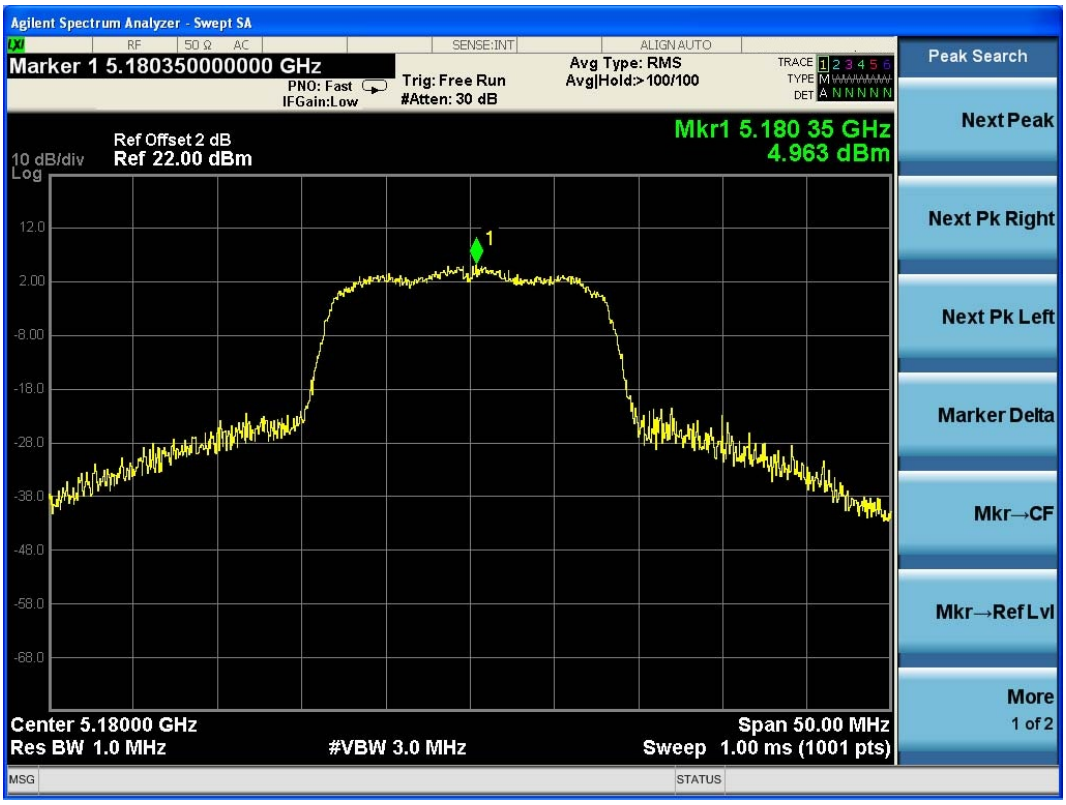
Equivalent Antenna Gain: 8.51 dBi (= 5.5dBi + 10 * log 2)
Limit: 8.49 dBm (= 11 dBm – (8.51 dBi – 6 dBi))

5725-5850MHz

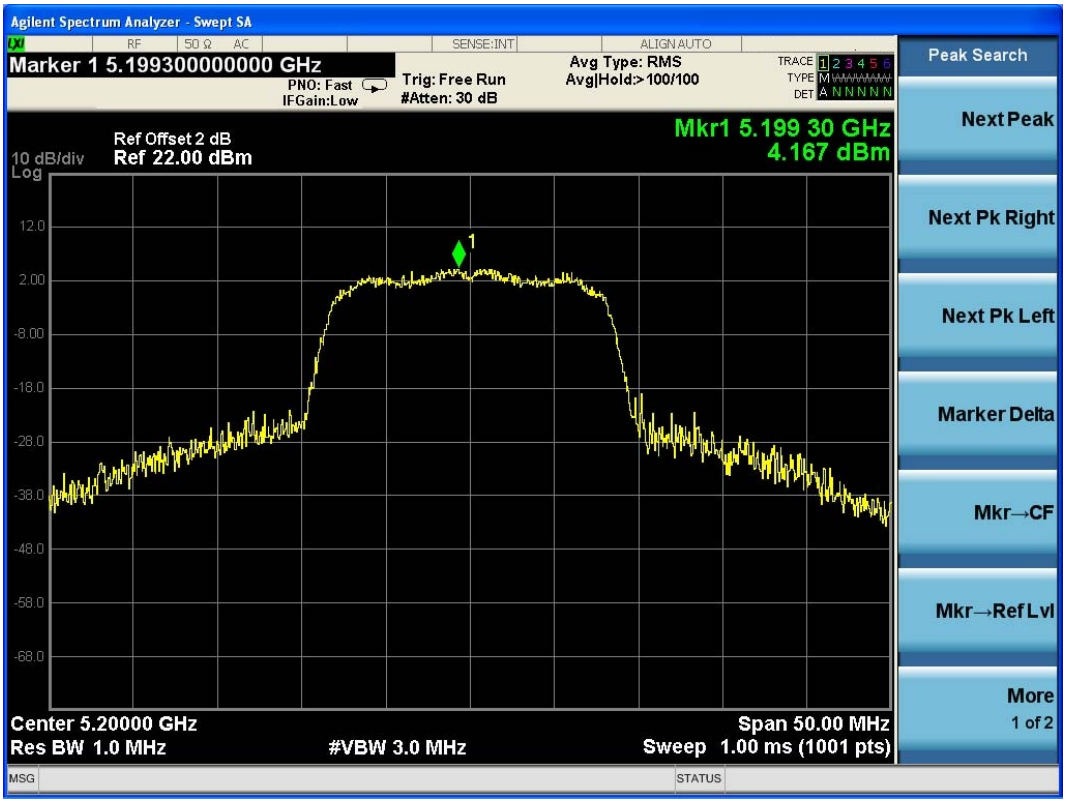
Operating mode	Test Channel	Power Spectral Density dBm/500kHz			Limit (dBm/500kHz)
		Chain 1	Chain 2	Total	
802.11a	5745	6.108	1.69	7.45	27.49
	5785	6.163	2.79	7.81	27.49
	5825	5.349	2.78	7.26	27.49
802.11n-HT20	5745	4.584	0.94	6.14	27.49
	5785	4.932	1.69	6.62	27.49
	5825	3.901	3.53	6.73	27.49
802.11n-HT40	5755	2.77	-0.49	4.45	27.49
	5795	4.01	-2.71	4.85	27.49
802.11n-ac80	5775	0.06	-0.56	2.77	27.49

Equivalent Antenna Gain: 8.51 dBi (= 5.5dBi + 10 * log 2)
Limit: 27.49 dBm (= 30 dBm – (8.51 dBi – 6 dBi))

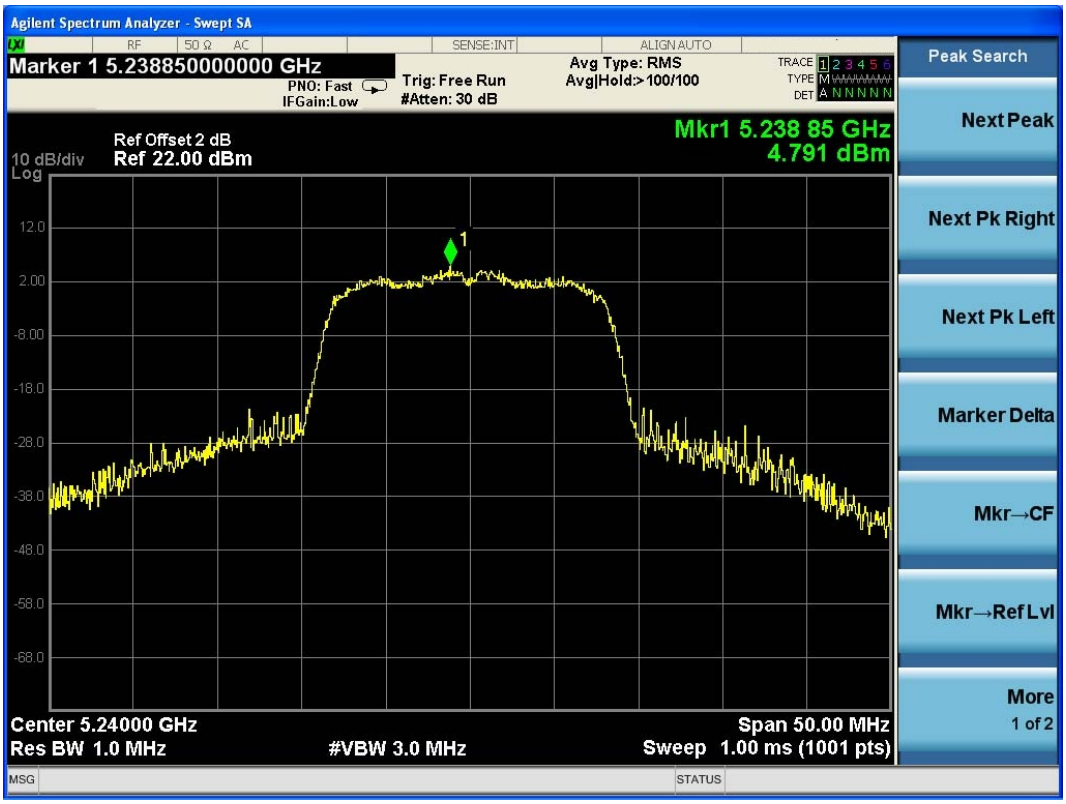
Antenna 1



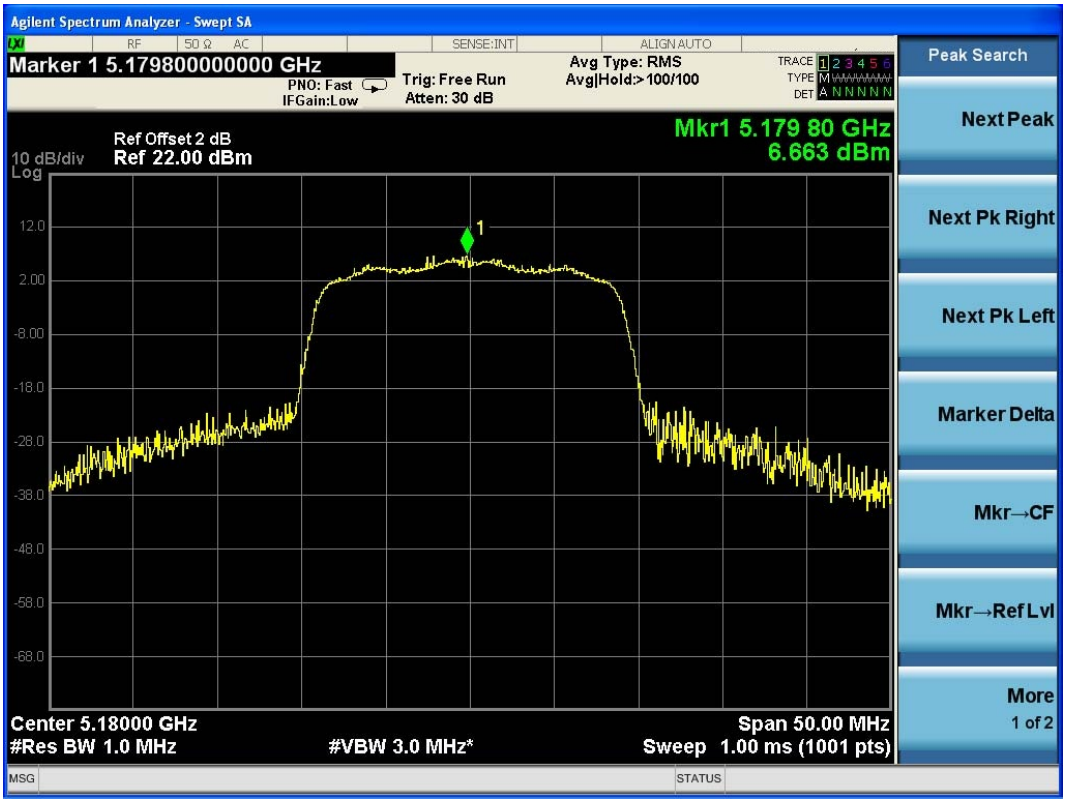
Channel 36: 5180MHz @ 802.11a



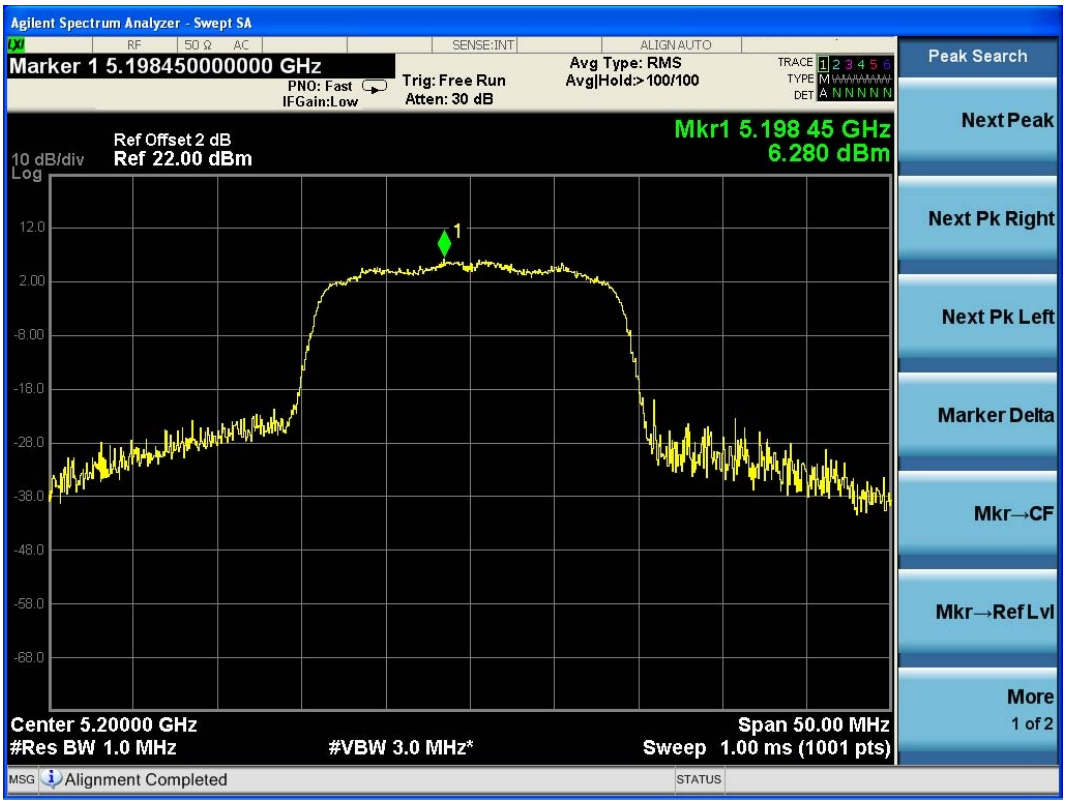
Channel 40: 5200MHz @ 802.11a



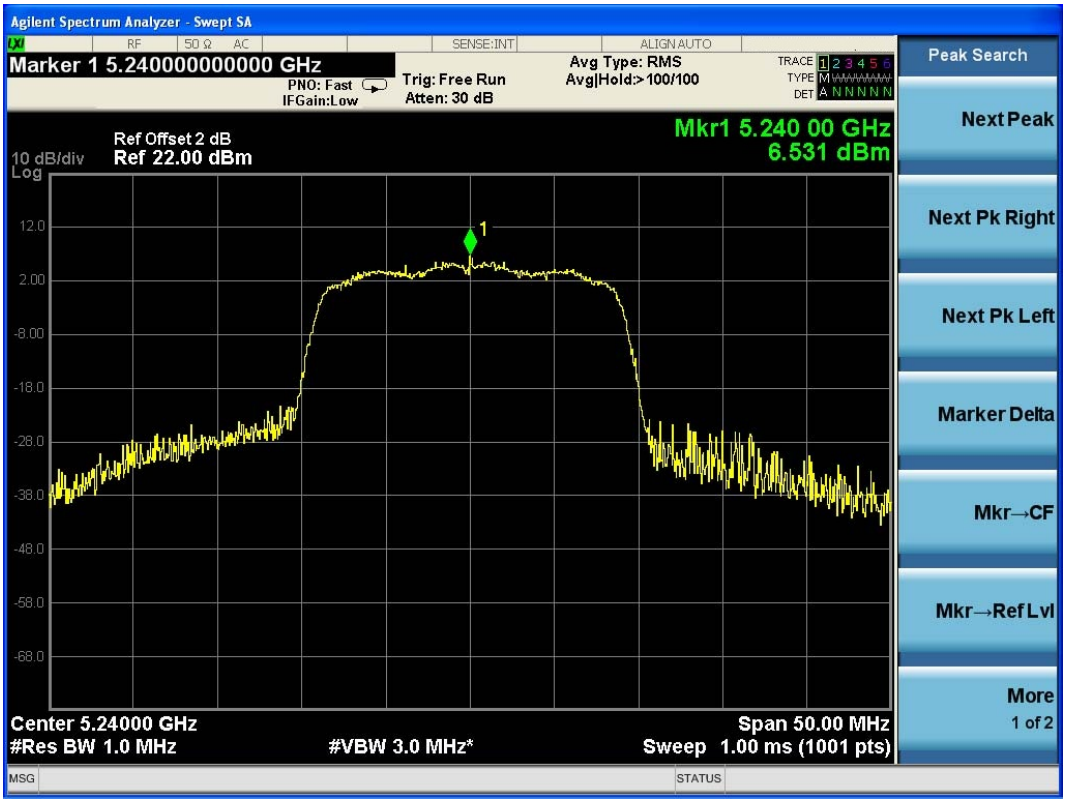
Channel 48: 5240MHz @ 802.11a



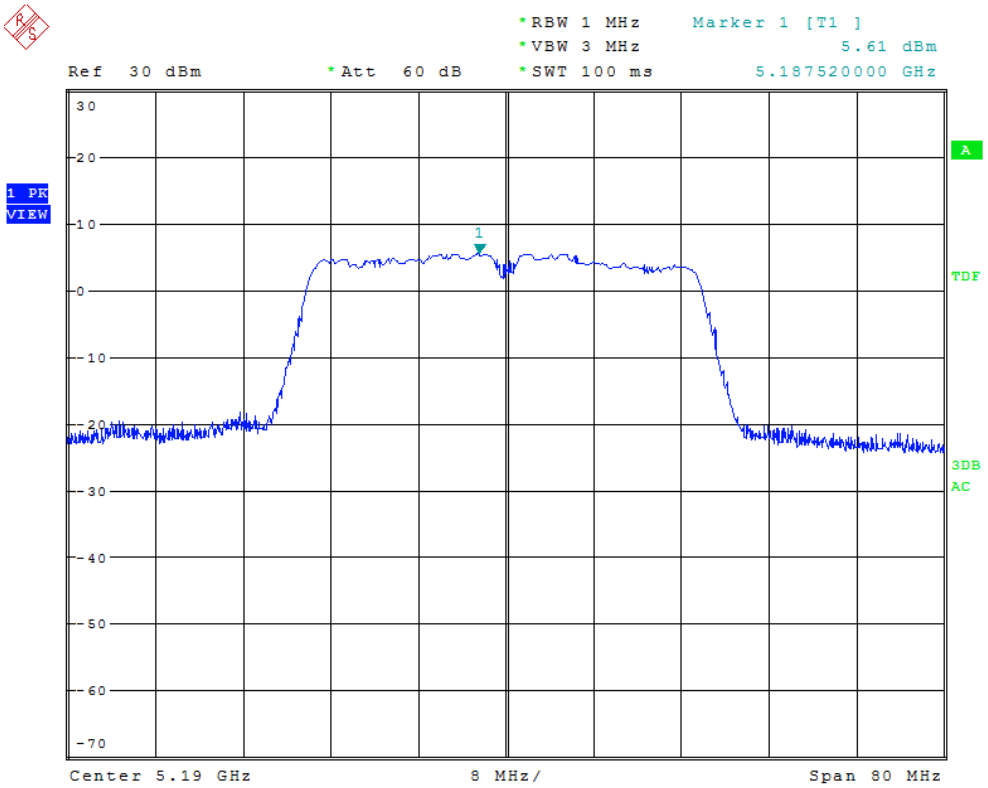
Channel 36: 5180MHz @ 802.11n HT20



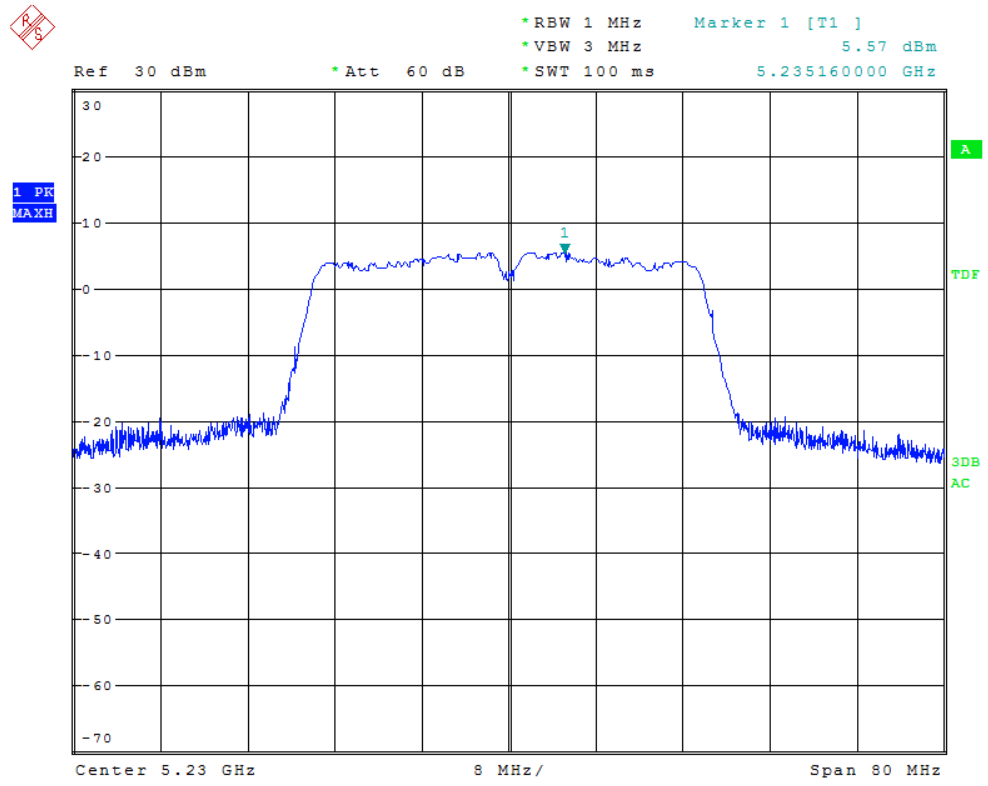
Channel 40: 5200MHz @ 802.11n HT20



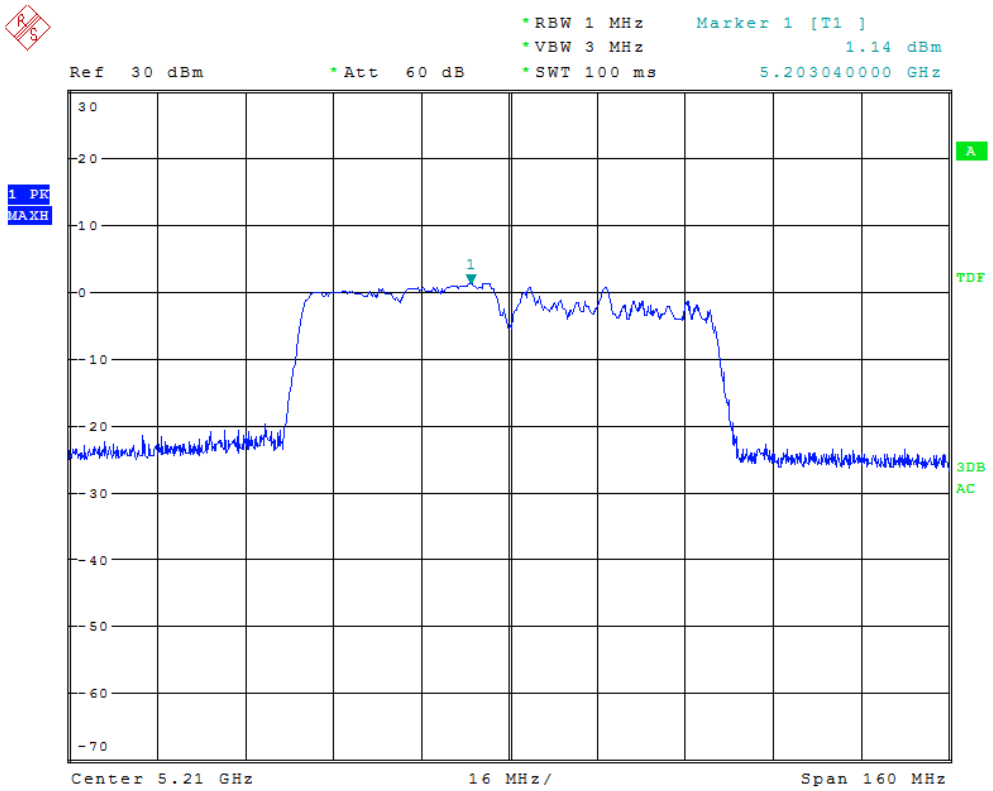
Channel 48: 5240MHz @ 802.11n HT20



Channel 38: 5190MHz @ 802.11n HT40

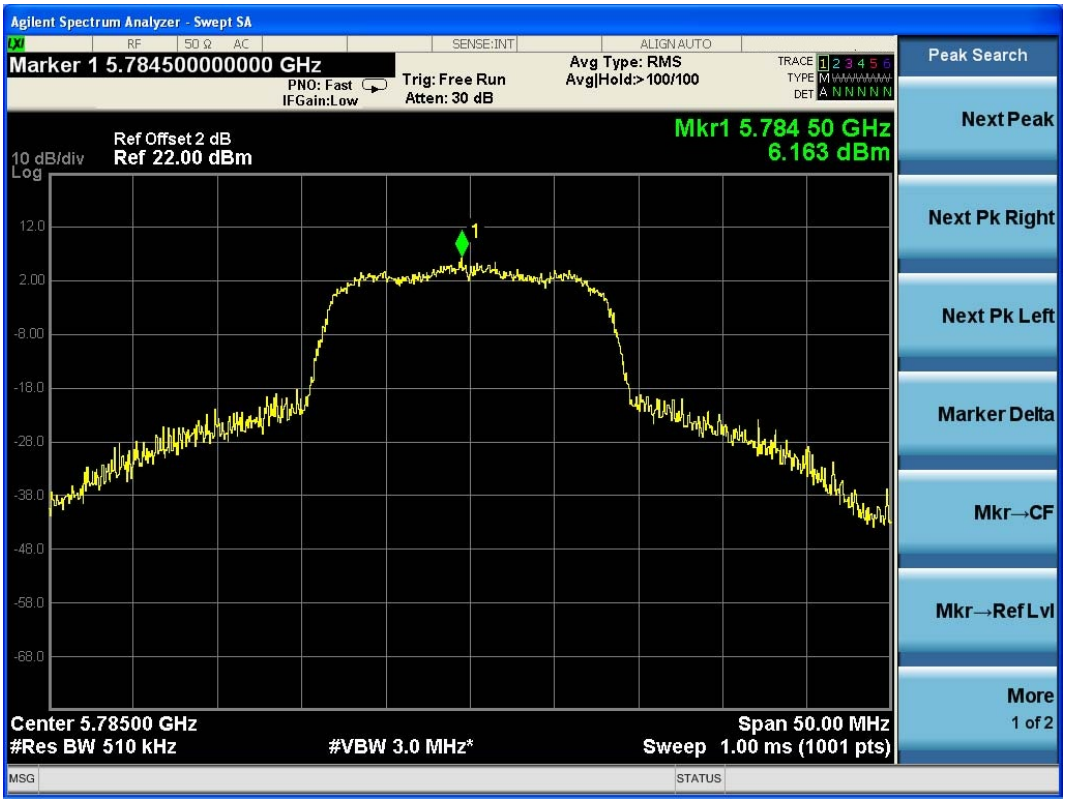


Channel 40: 5230MHz @ 802.11n HT40

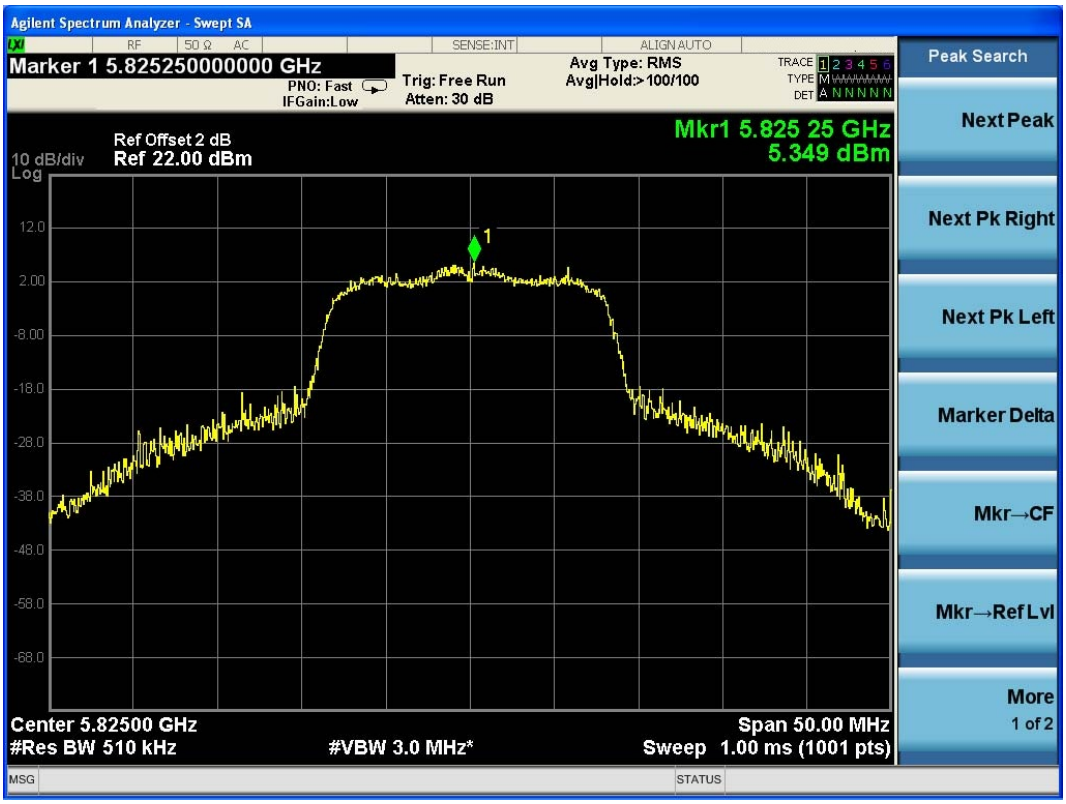


Channel 42: 5210MHz @ 802.11n ac40

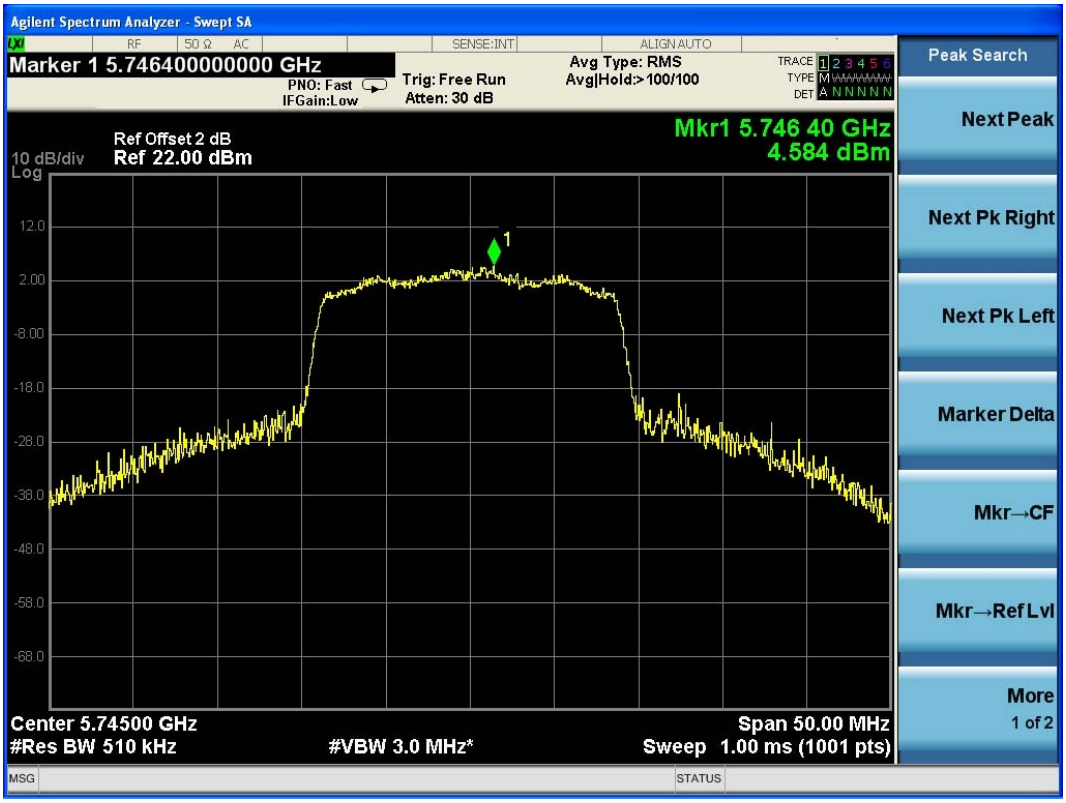
Channel 149: 5745MHz @ 802.11a



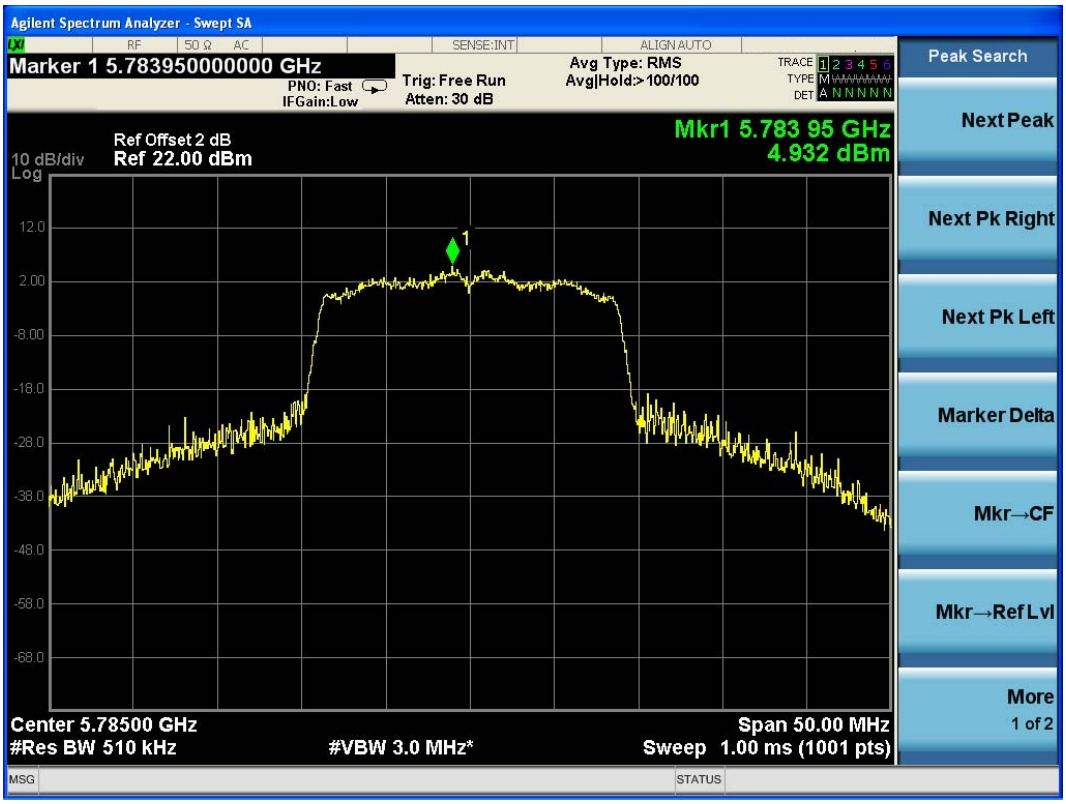
Channel 157: 5785MHz @ 802.11a



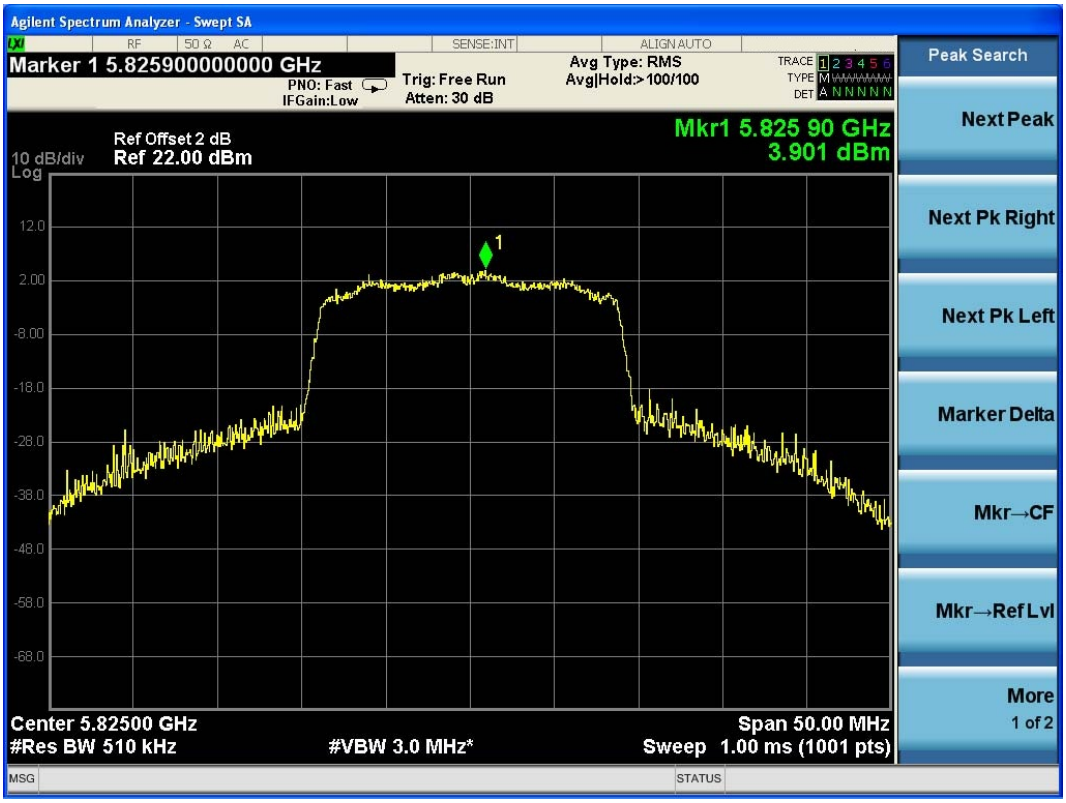
Channel 165: 5825MHz @ 802.11a



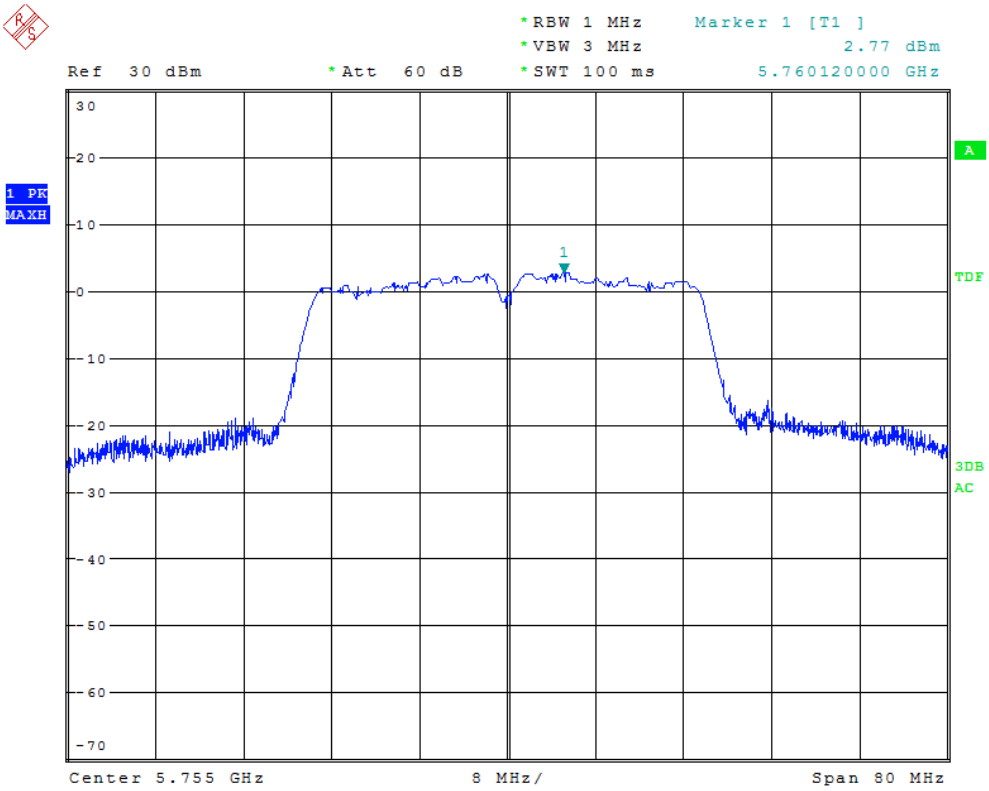
Channel 149: 5745MHz @ 802.11n HT20



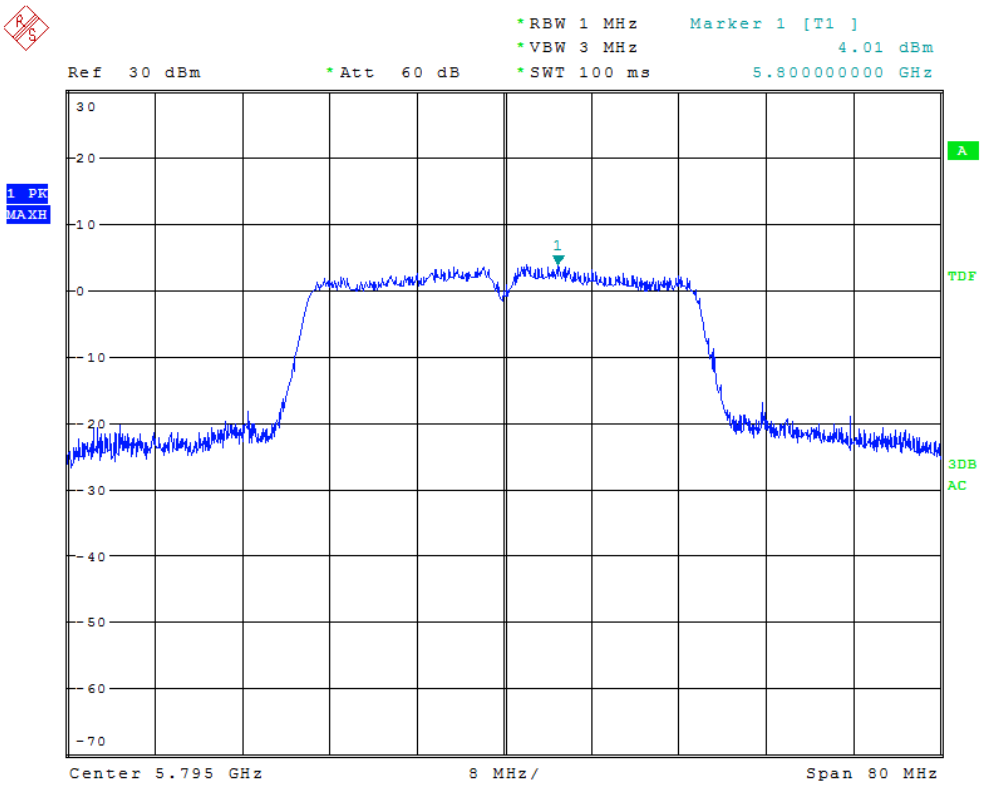
Channel 157: 5785MHz @ 802.11n HT20



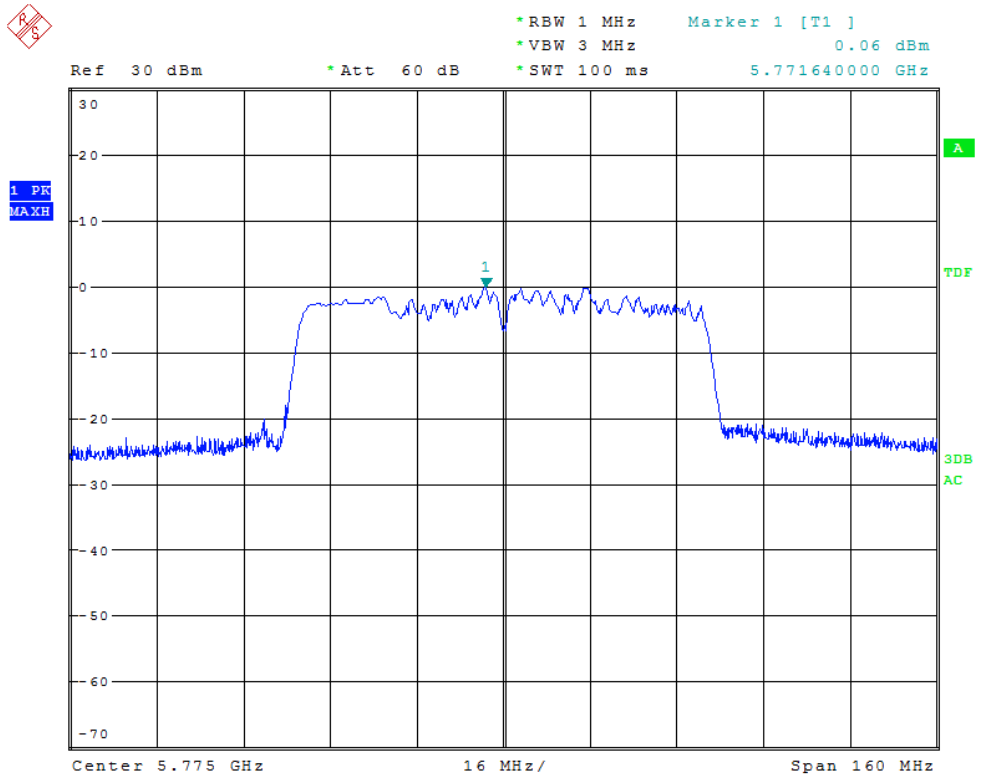
Channel 165: 5825MHz @ 802.11n HT20



Channel 151: 5755MHz @ 802.11n HT40

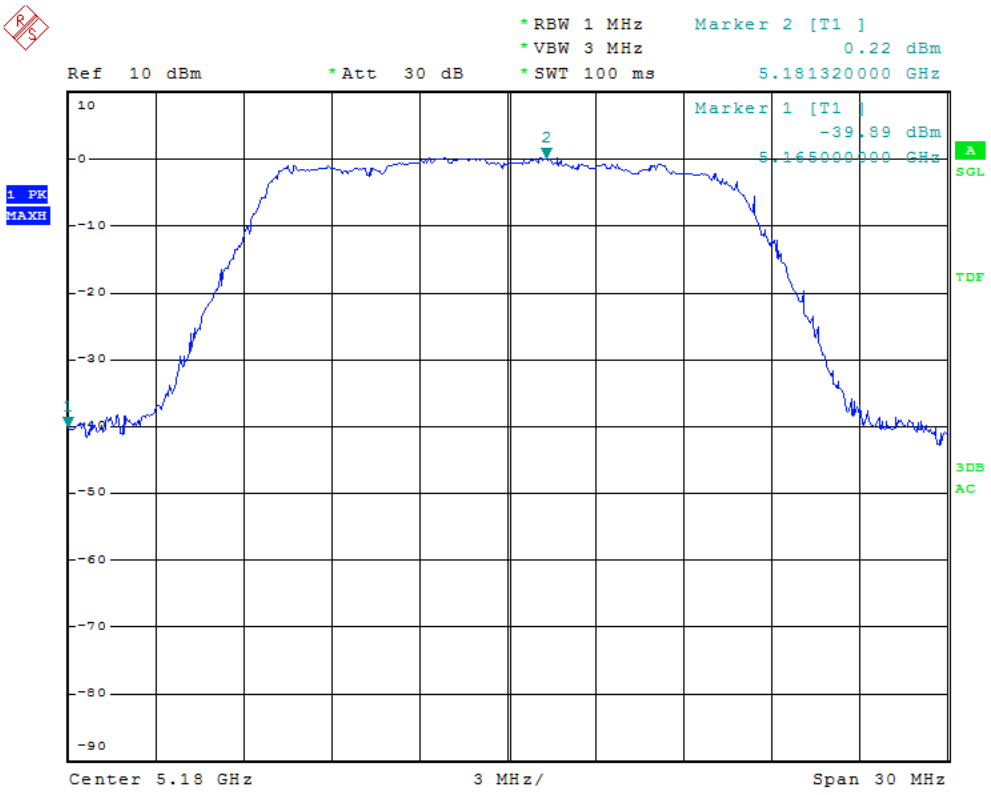


Channel 159: 5795MHz @ 802.11n HT40

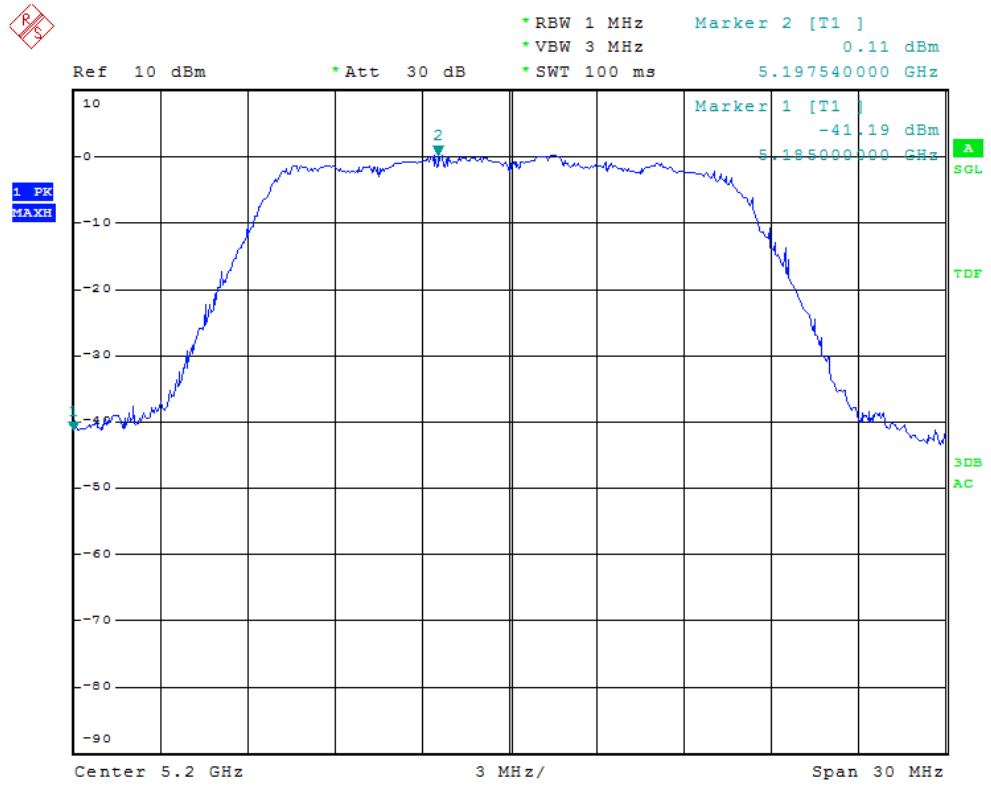


Channel 155: 5775MHz @ 802.11n ac80

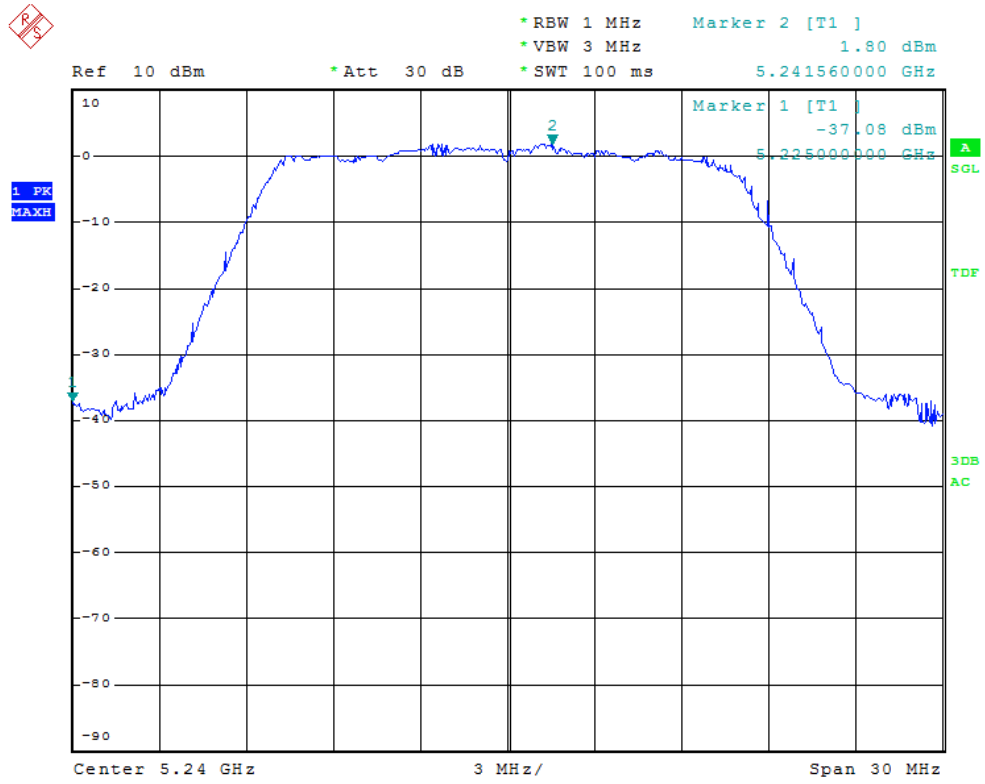
Antenna 2



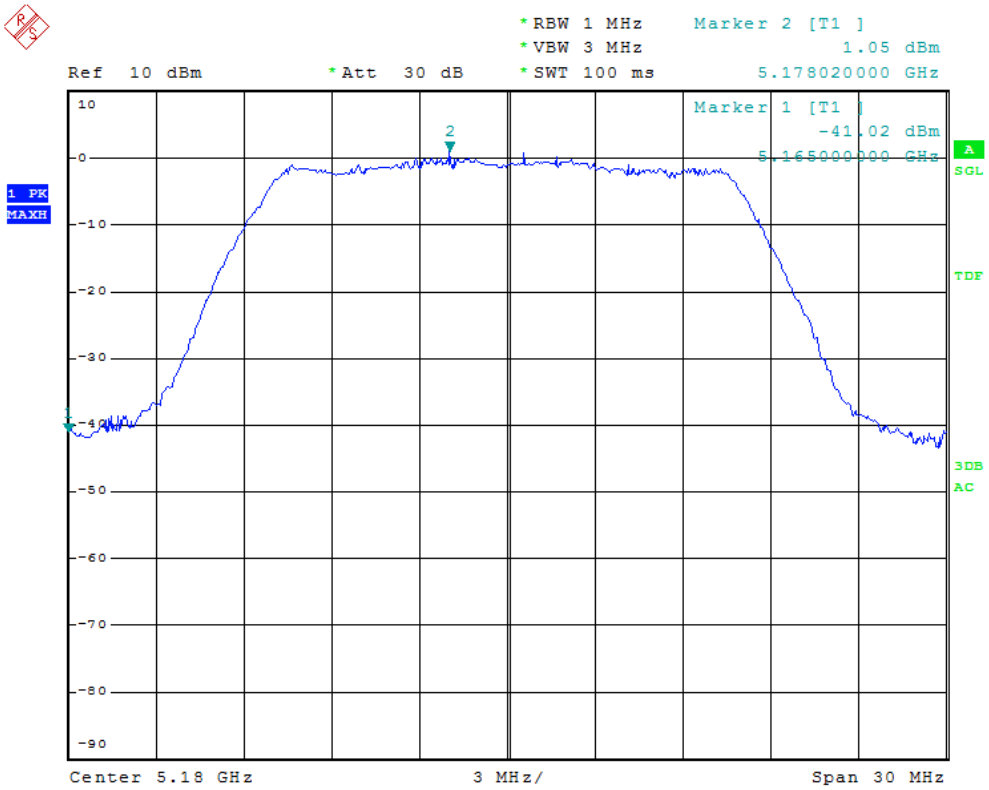
Channel 36: 5180MHz @ 802.11a



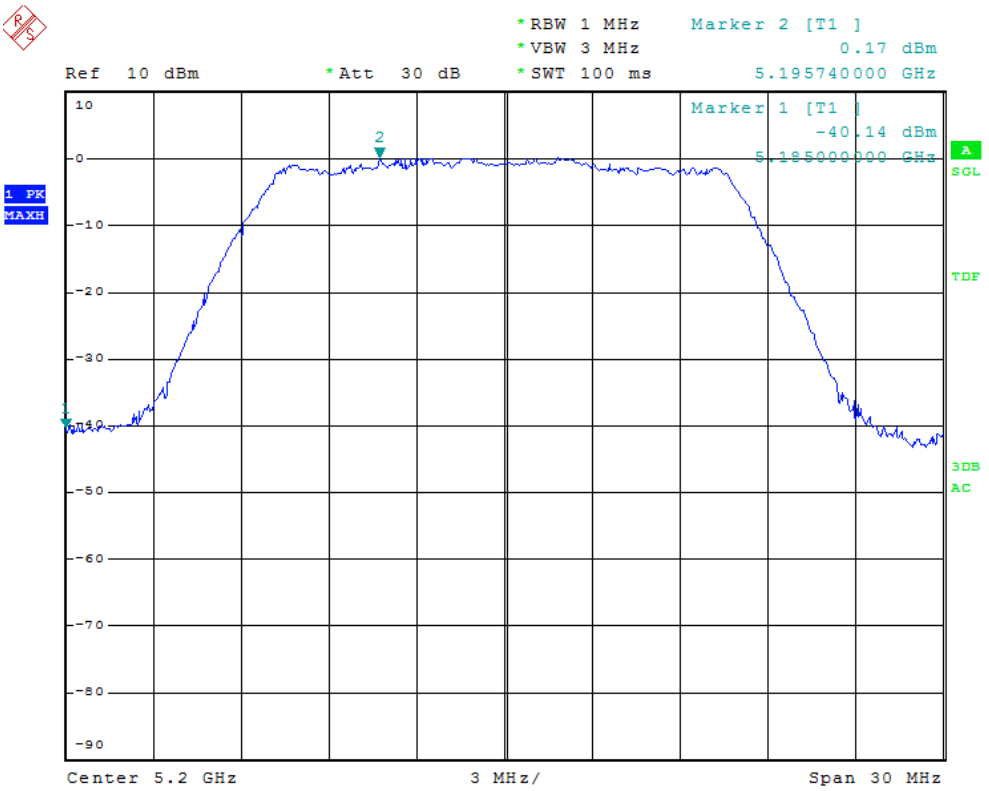
Channel 40: 5200MHz @ 802.11a



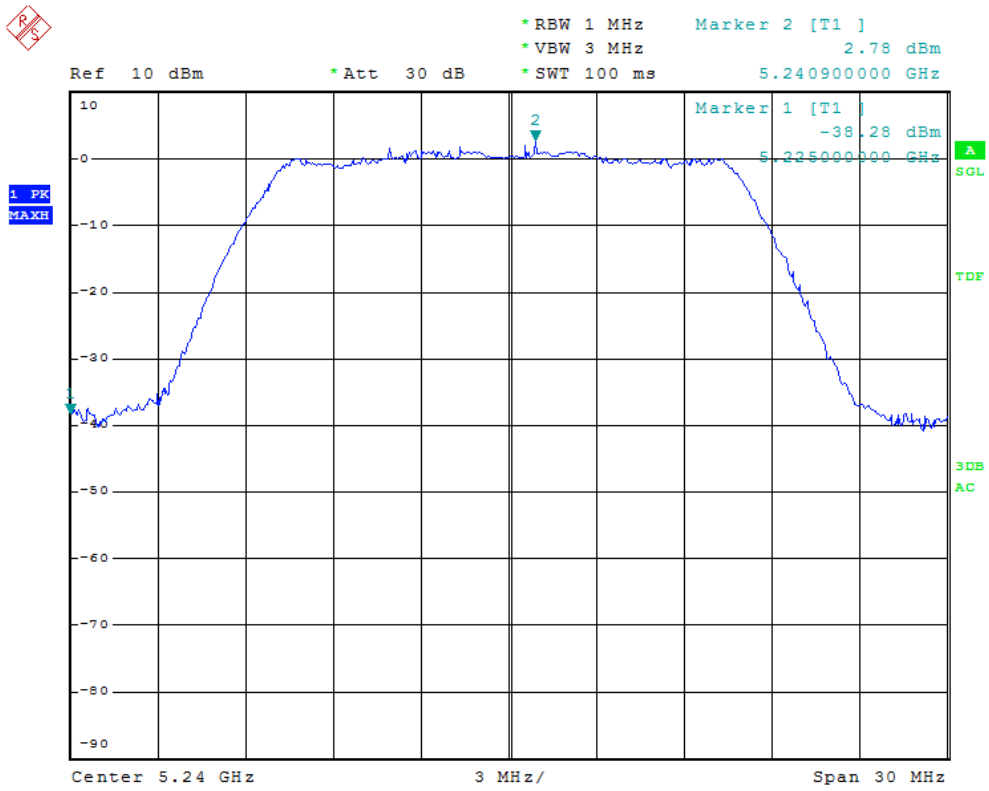
Channel 48: 5240MHz @ 802.11a



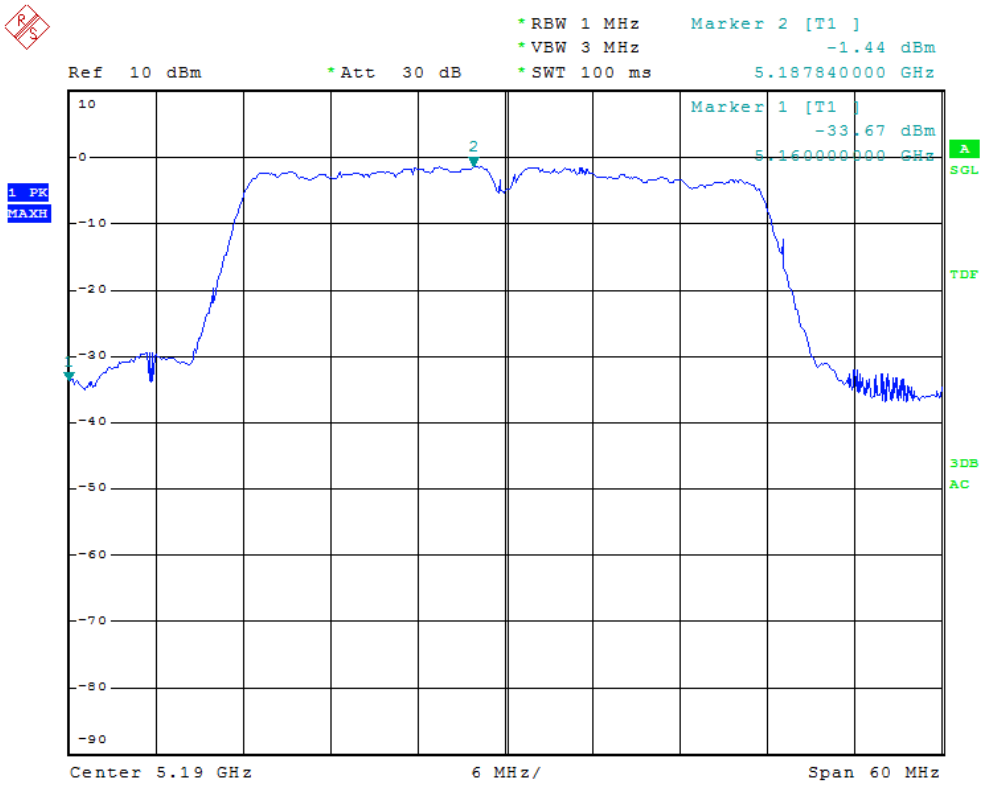
Channel 36: 5180MHz @ 802.11n HT20



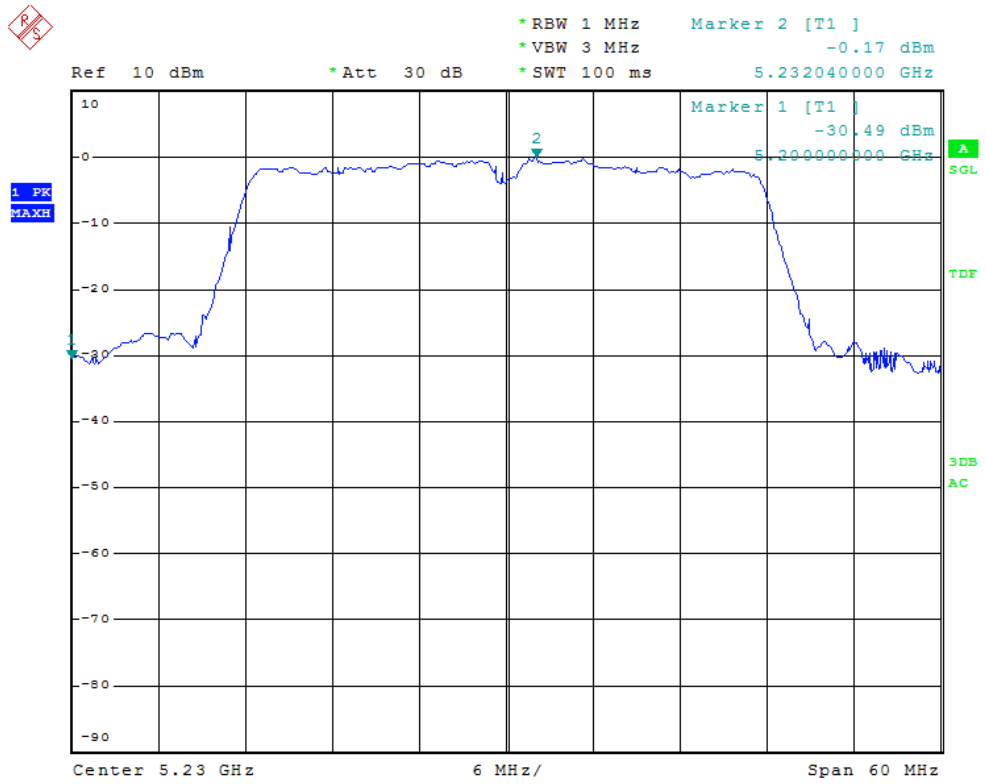
Channel 40: 5200MHz @ 802.11n HT20



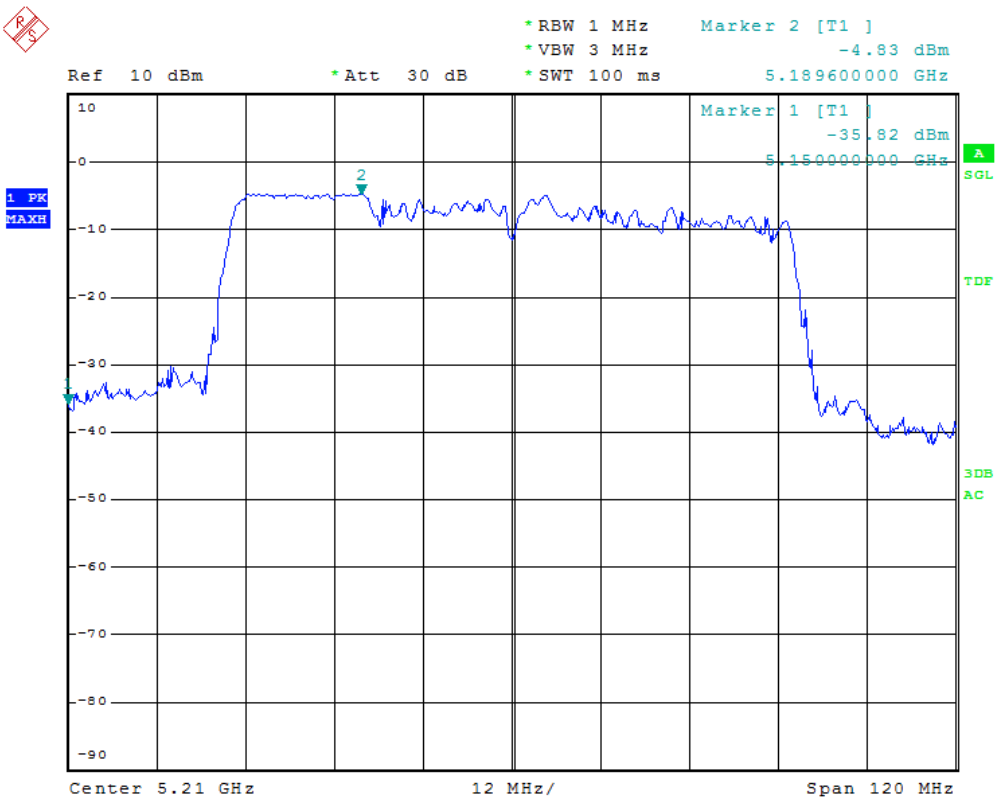
Channel 48: 5240MHz @ 802.11n HT20



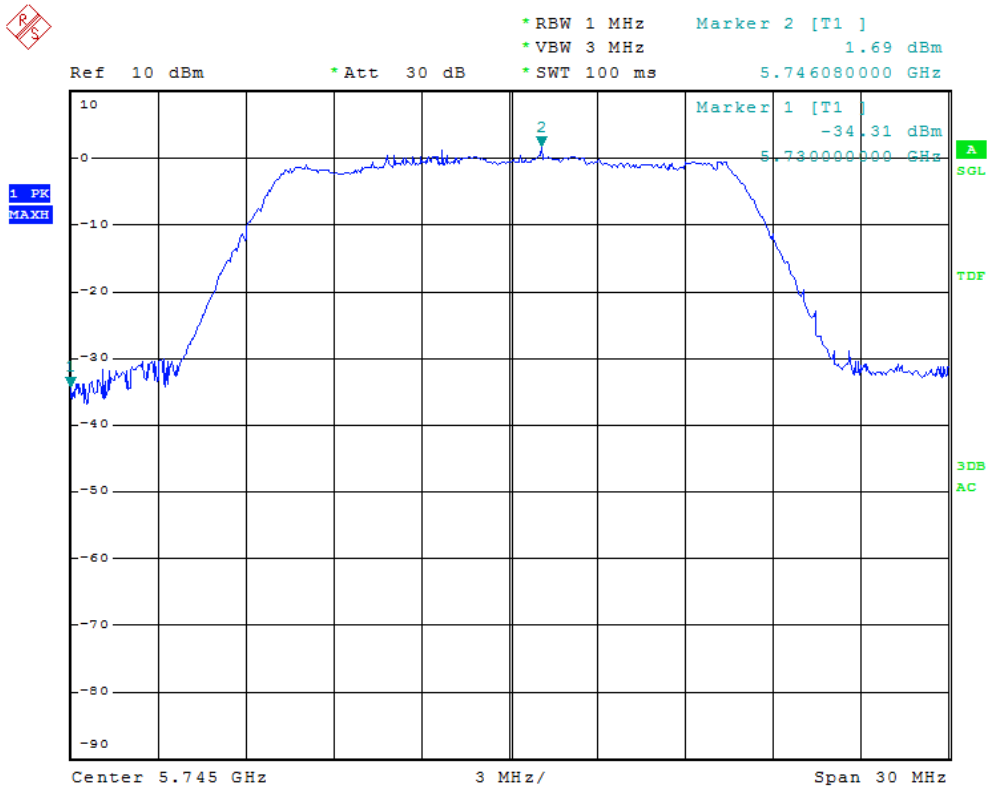
Channel 38: 5190MHz @ 802.11n HT40



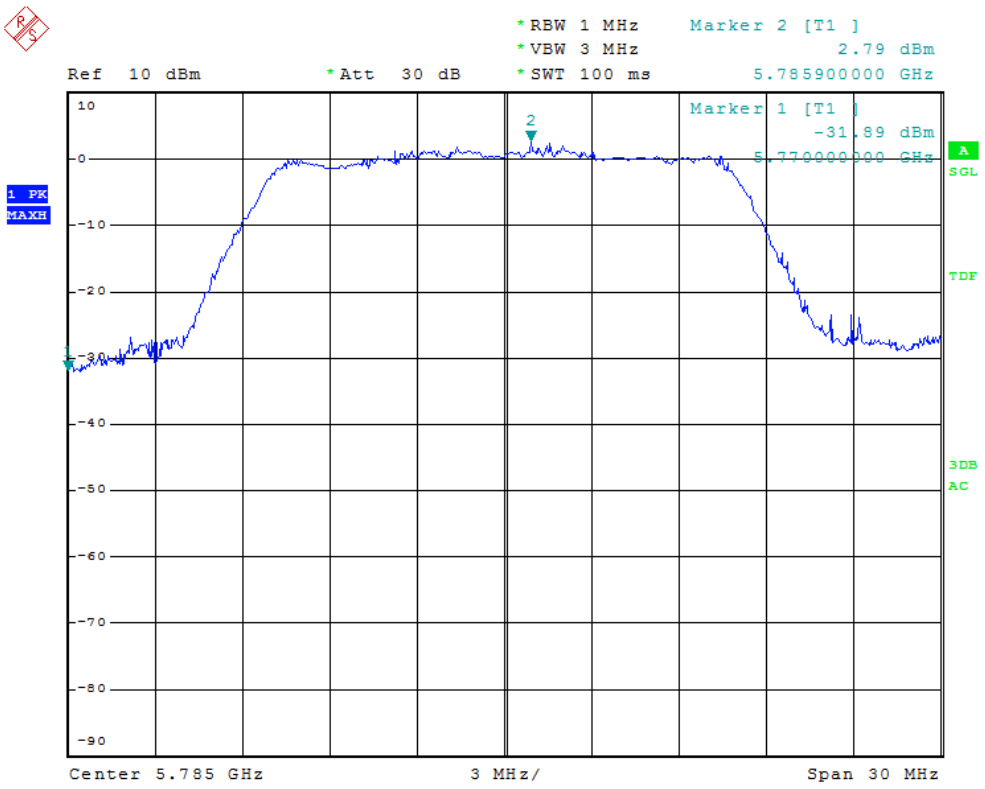
Channel 40: 5230MHz @ 802.11n HT40



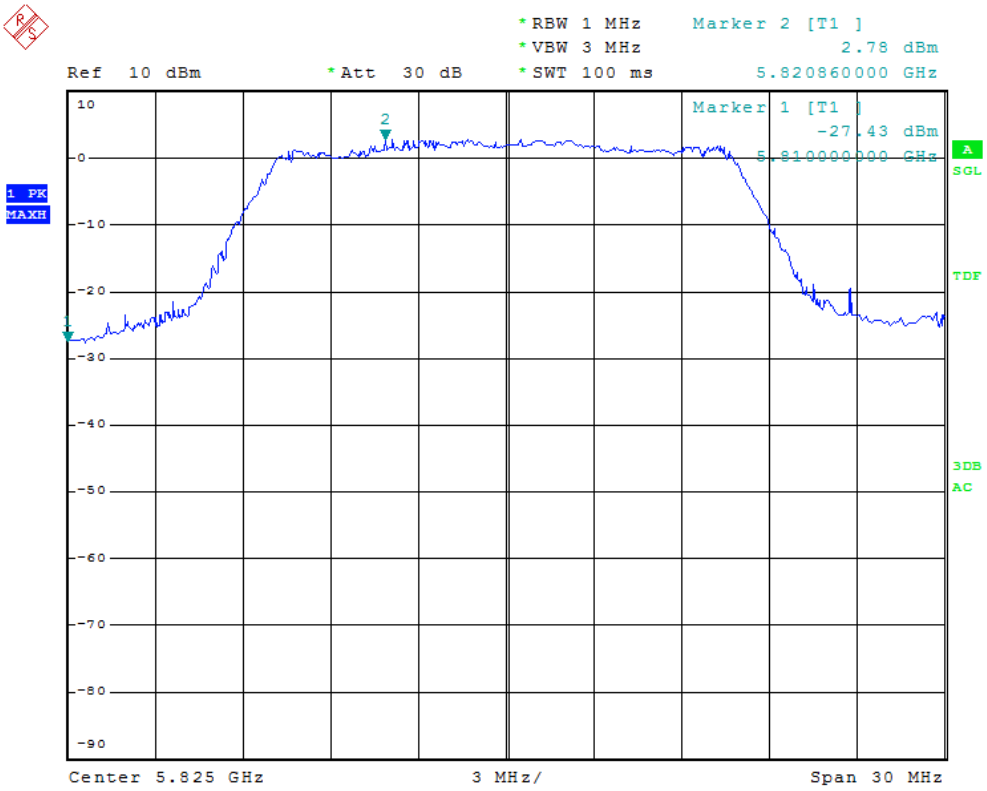
Channel 42: 5210MHz @ 802.11n ac40



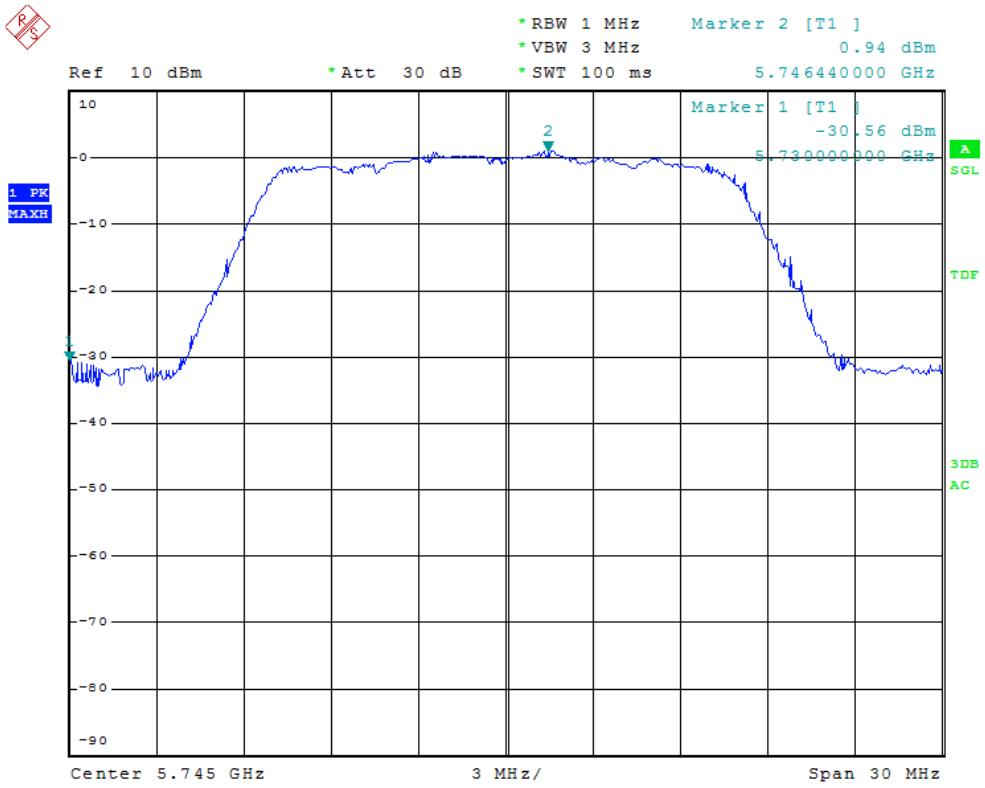
Channel 149: 5745MHz @ 802.11a



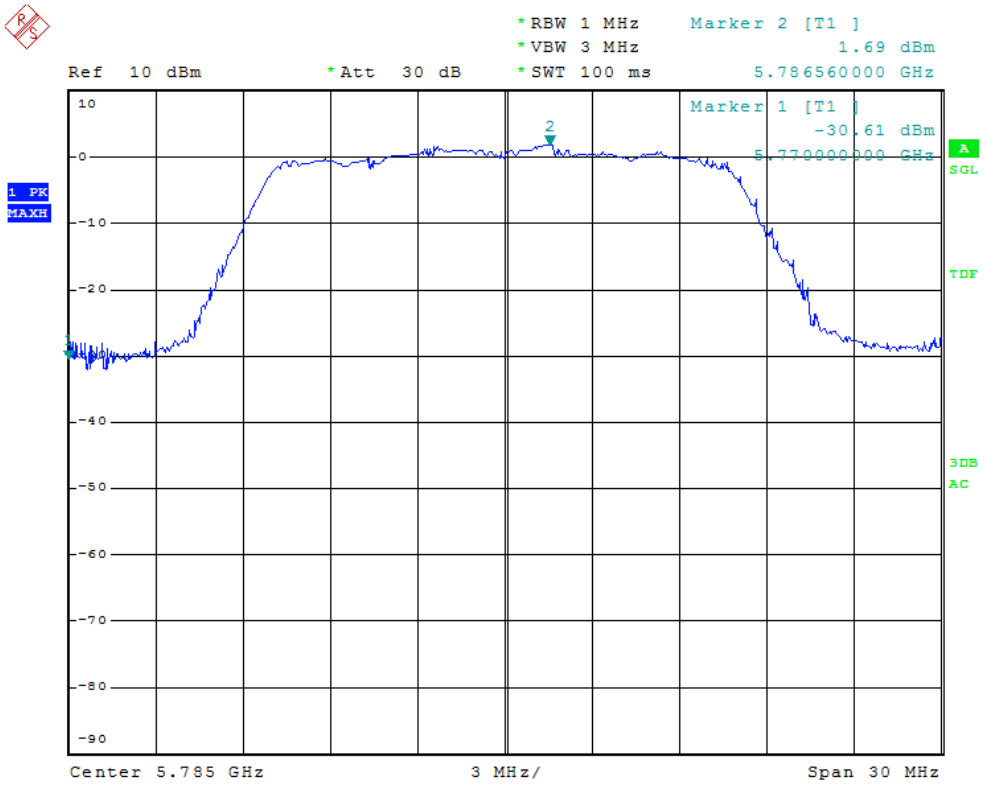
Channel 157: 5785MHz @ 802.11a



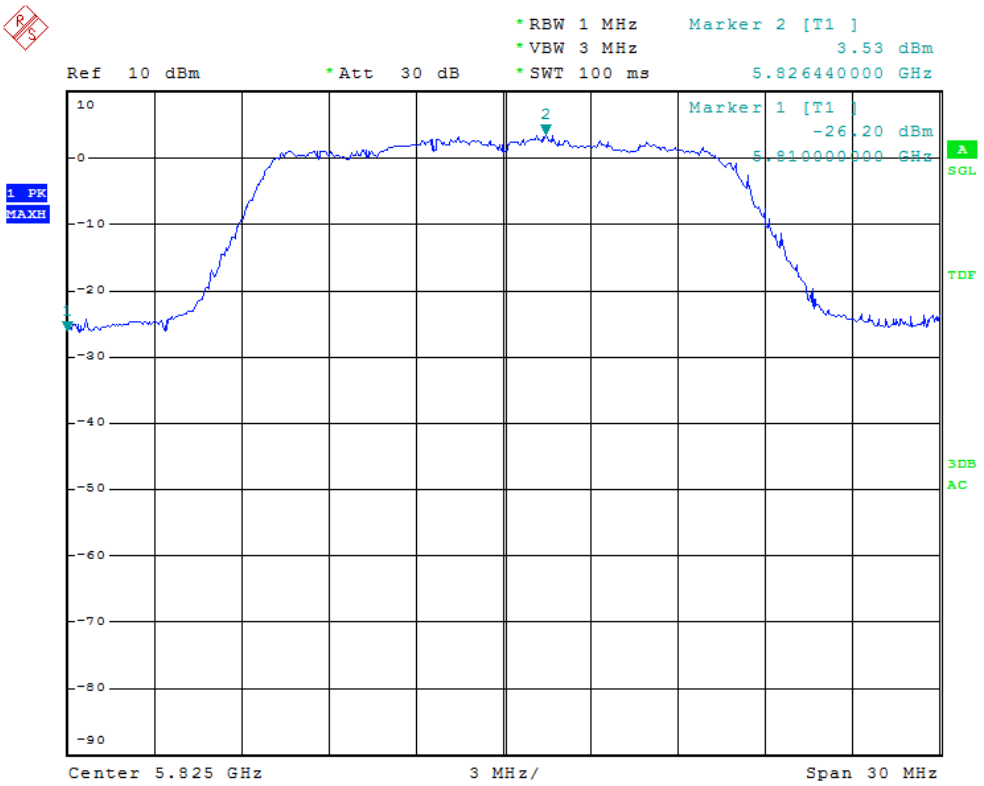
Channel 165: 5825MHz @ 802.11a



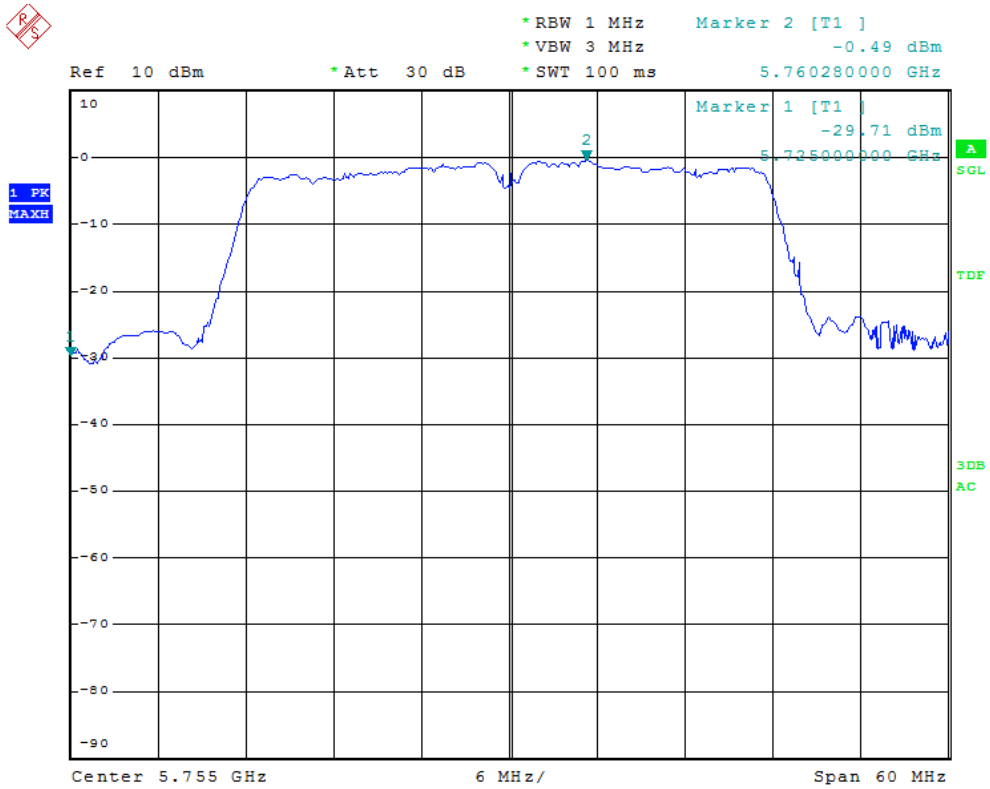
Channel 149: 5745MHz @ 802.11n HT20



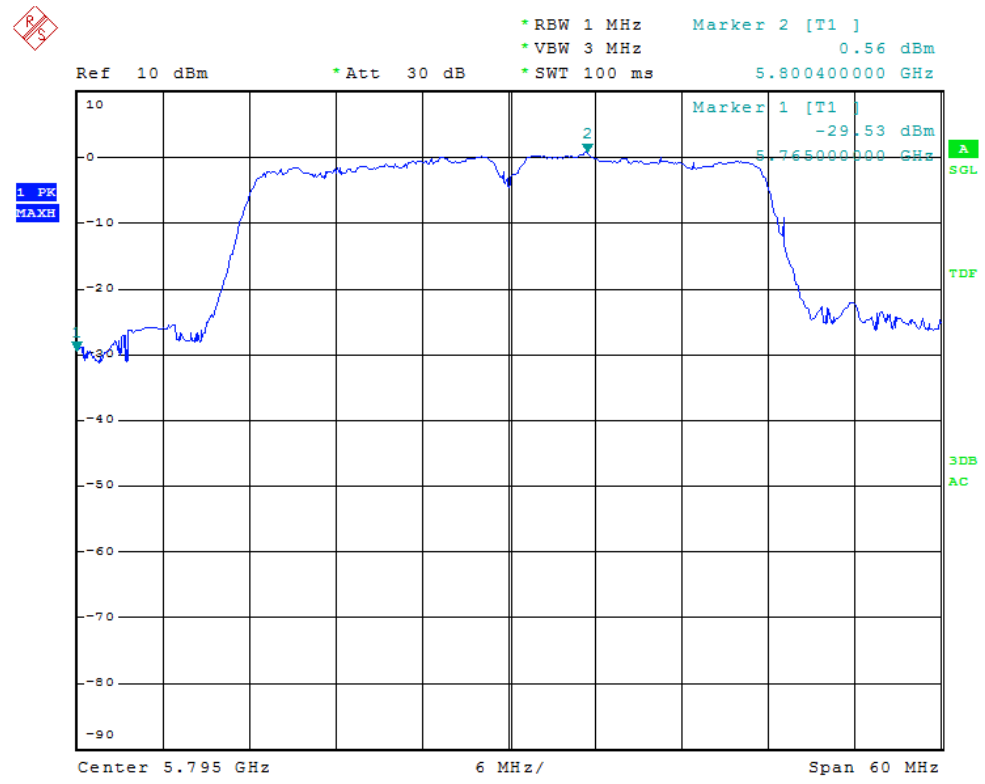
Channel 157: 5785MHz @ 802.11n HT20



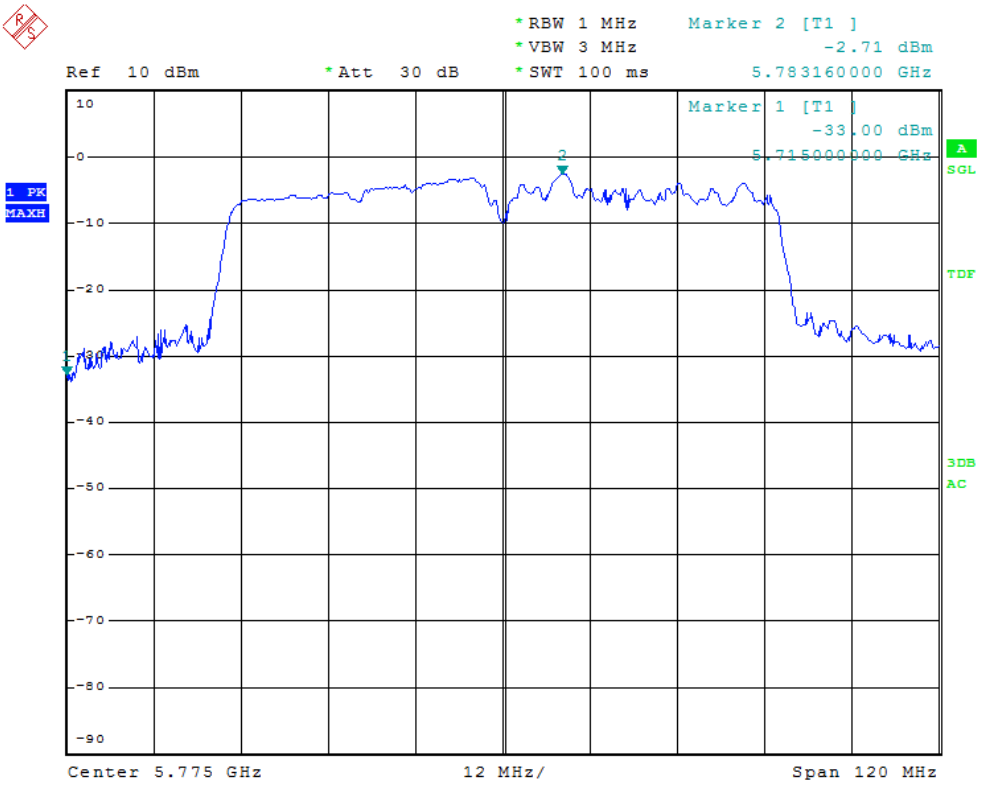
Channel 165: 5825MHz @ 802.11n HT20



Channel 151: 5755MHz @ 802.11n HT40



Channel 159: 5795MHz @ 802.11n HT40



Channel 155: 5775MHz @ 802.11n ac80

7. Emission Bandwidth and Occupied Bandwidth

7.1 Standard Applicable

According to 15.303(c)
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.

According to 15.407 (a) and (e)
(1) For the band 5.15-5.25 GHz.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(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 + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

7.2 Test Procedure

According to 789033 D02 v01r04 section C&D, the following is the measurement procedure.

1. Emission Bandwidth (EBW)
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) 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%.

2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

D. 99 Percent Occupied Bandwidth
The 99-percent occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99-percent occupied bandwidth is required only as a condition for using the optional band-edge measurement techniques described in section II.G.3.d). Measurements of 99-percent occupied bandwidth may also optionally be used in lieu of the EBW to 789033 D02 General UNII Test Procedures New Rules v01r04 define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in section II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

The following procedure shall be used for measuring (99 %) power bandwidth:
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).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are

placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

7.3 Environmental Conditions

Temperature:	24° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

7.4 Summary of Test Results/Plots

Antenna 1:

5150-5250MHz

Test Mode	Test Channel MHz	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit MHz
802.11a	5180	19.03	16.605	Pass
	5200	20.27	16.605	Pass
	5240	19.00	16.567	Pass
802.11n-HT20	5180	19.25	17.521	Pass
	5200	19.93	17.525	Pass
	5240	19.39	17.521	Pass
802.11n-HT40	5190	42.16	36.68	Pass
	5230	41.84	36.56	Pass
802.11n-ac80	5210	84.64	75.68	Pass

5725-5850MHz

Test Mode	Test Channel MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit KHz
802.11a	5745	15.14	16.394	≥500
	5785	15.16	16.396	≥500
	5825	15.15	16.415	≥500
802.11n-HT20	5745	15.11	17.507	≥500
	5785	15.14	17.513	≥500
	5825	15.15	17.518	≥500
802.11n-HT40	5755	36.12	36.76	≥500
	5795	35.80	36.72	≥500
802.11n-ac80	5775	74.68	75.52	≥500

Antenna 2:

5150-5250MHz

Test Mode	Test Channel MHz	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit MHz
802.11a	5180	19.68	17.36	Pass
	5200	19.76	17.28	Pass
	5240	19.84	17.36	Pass
802.11n-HT20	5180	19.68	17.44	Pass
	5200	19.60	17.44	Pass
	5240	19.84	17.52	Pass
802.11n-HT40	5190	42.08	36.48	Pass
	5230	44.32	36.64	Pass
802.11n-ac80	5210	88.68	77.12	Pass

5725-5850MHz

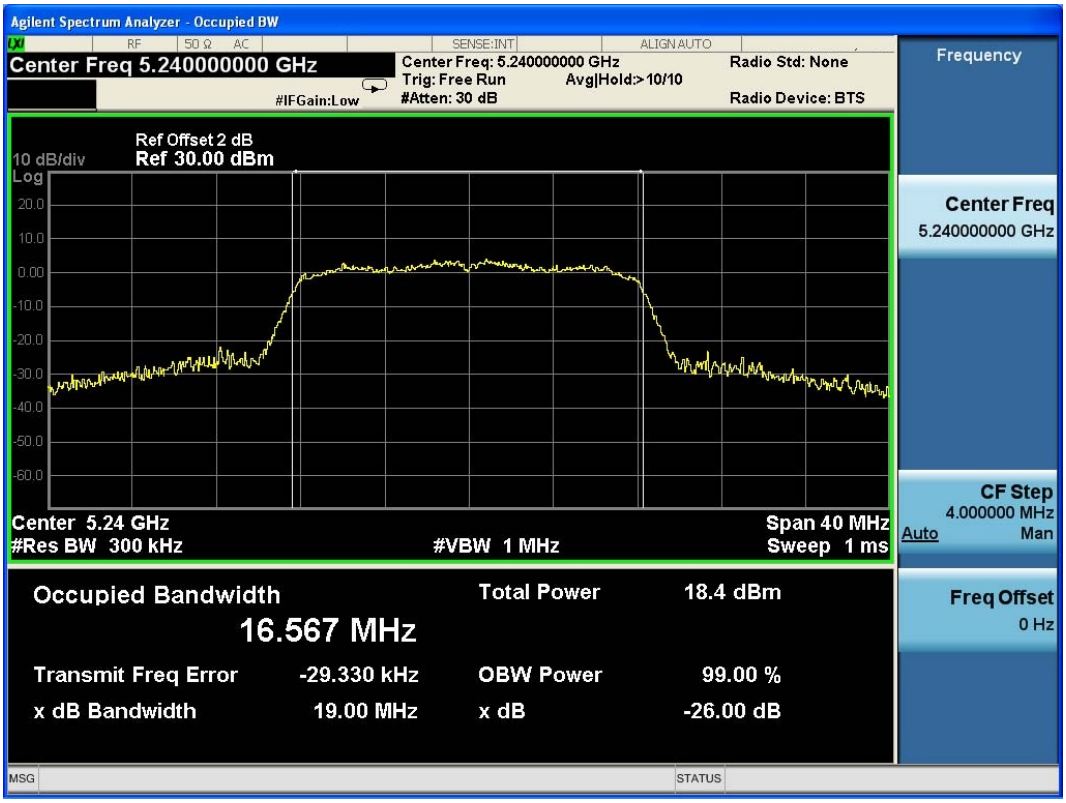
Test Mode	Test Channel MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit KHz
802.11a	5745	16.40	17.52	≥500
	5785	16.08	17.60	≥500
	5825	16.16	17.60	≥500
802.11n-HT20	5745	16.56	17.52	≥500
	5785	16.56	17.68	≥500
	5825	16.56	17.60	≥500
802.11n-HT40	5755	35.84	36.80	≥500
	5795	34.40	36.80	≥500
802.11n-ac80	5775	73.28	77.44	≥500

Antenna 1:

Test Plots:5150-5250MHz

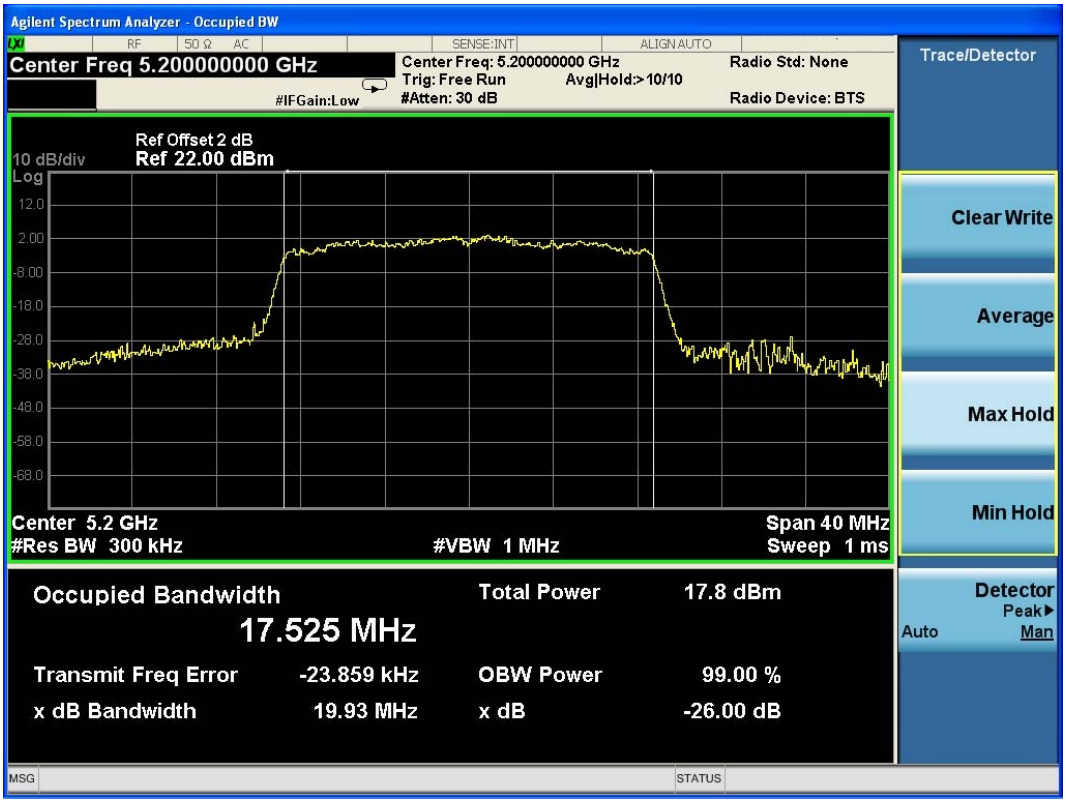
Channel 36: 5180MHz @ 802.11a

Channel 40: 5200MHz @ 802.11a



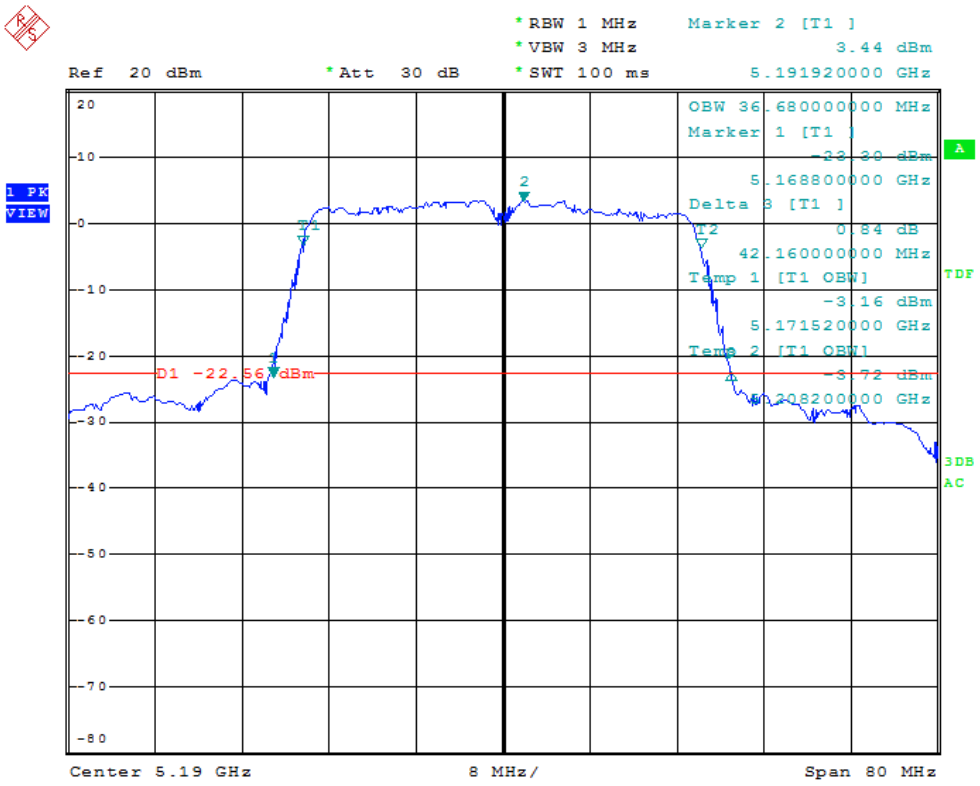
Channel 48: 5240MHz @ 802.11a

Channel 36: 5180MHz @ 802.11n HT20

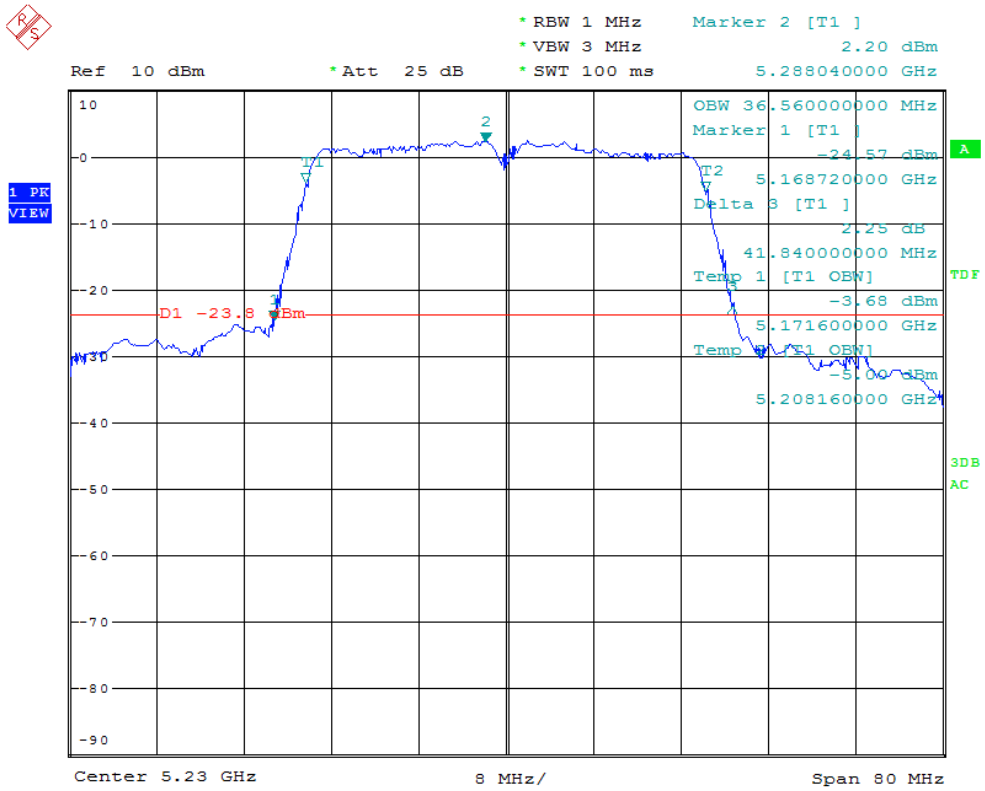


Channel 40: 5200MHz @ 802.11n HT20

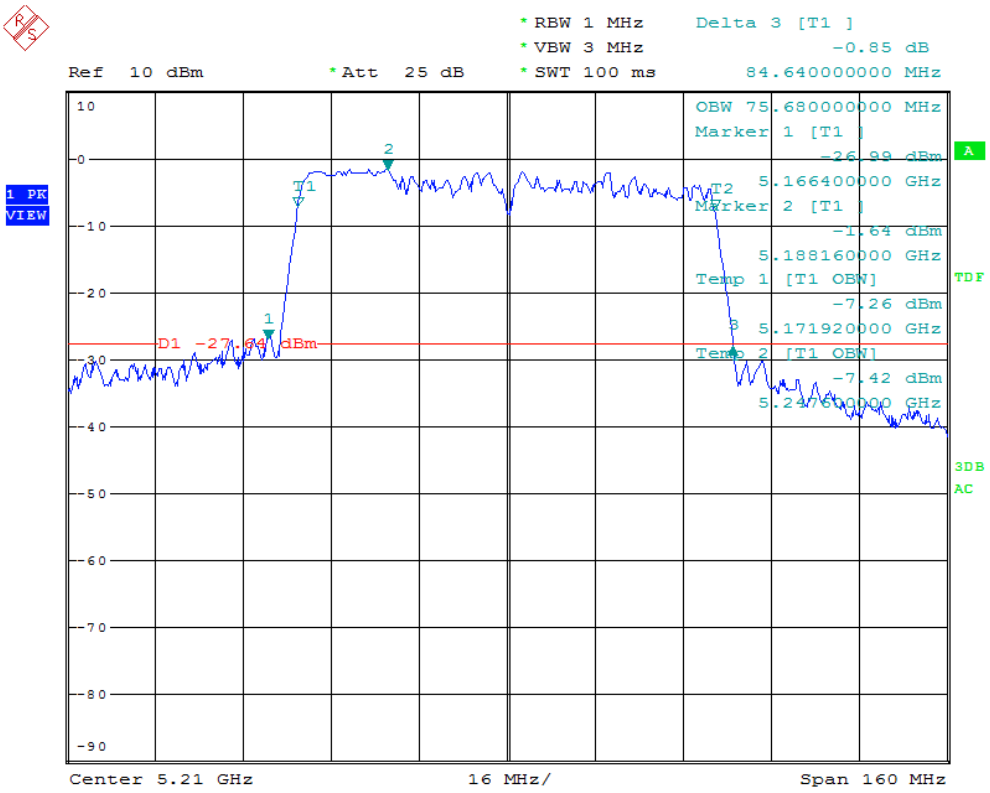
Channel 48: 5240MHz @ 802.11n HT20



Channel 38: 5190MHz @ 802.11n HT40



Channel 40: 5230MHz @ 802.11n HT40



Channel 40: 5210MHz @ 802.11n ac80

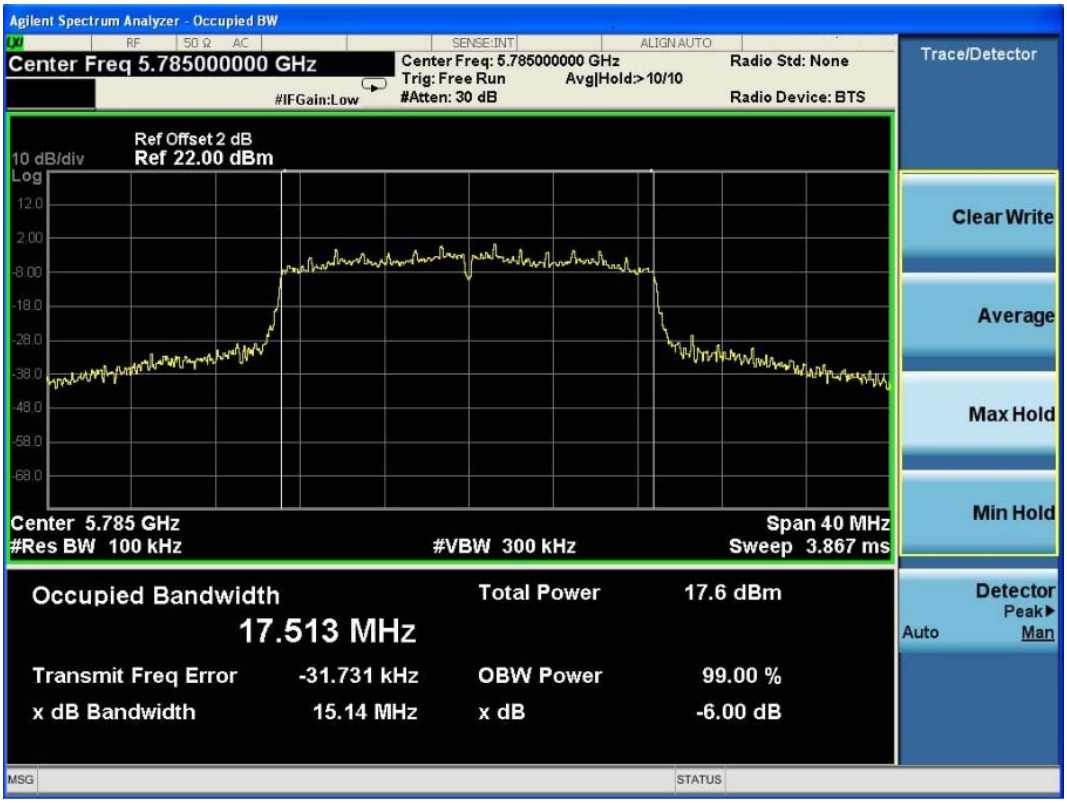
Test Plots: 5725-5850MHz

Channel 149: 5745MHz @ 802.11a

Channel 157: 5785MHz @ 802.11a

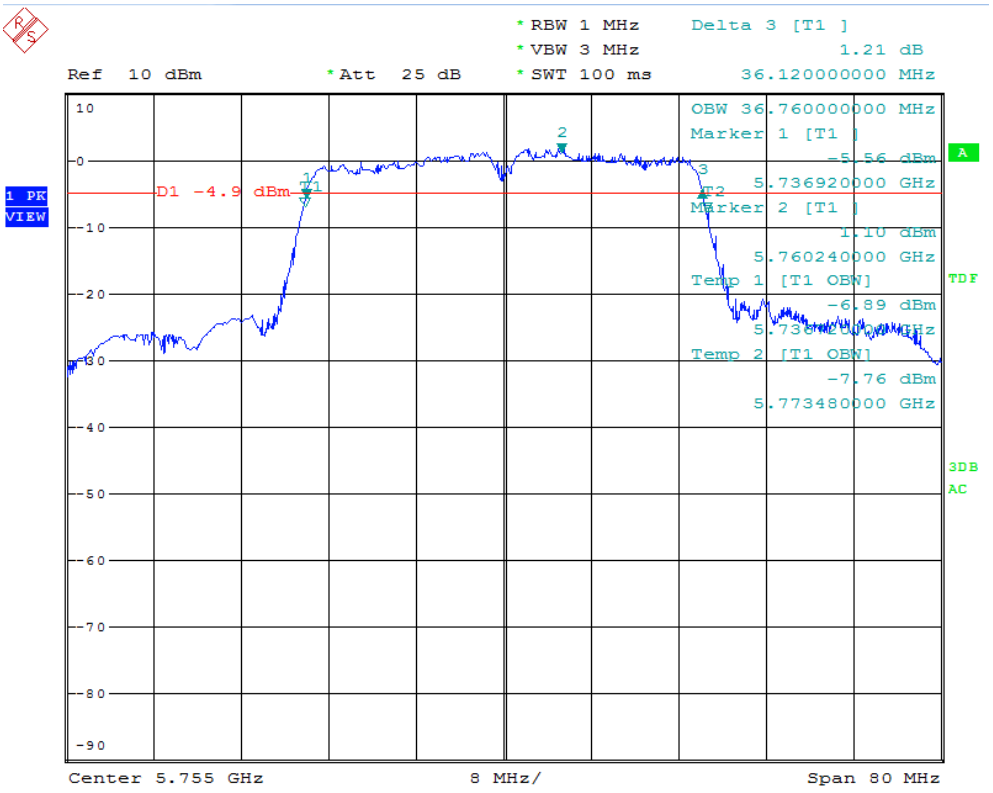
Channel 157: 5825MHz @ 802.11a

Channel 149: 5745MHz @ 802.11n HT20

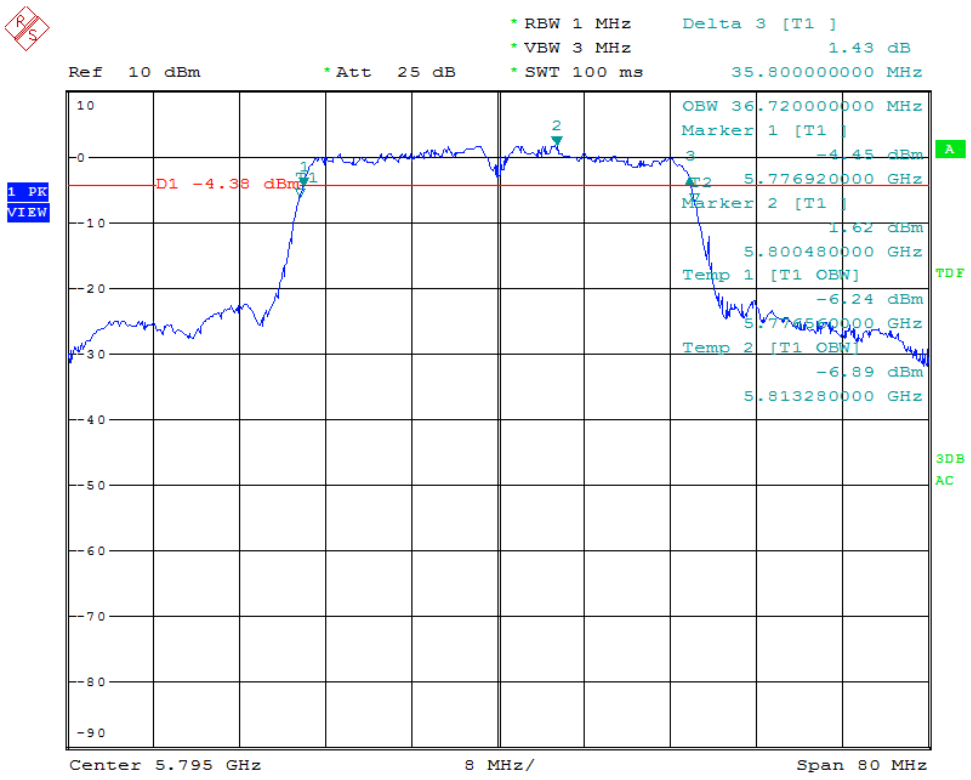


Channel 157: 5785MHz @ 802.11n HT20

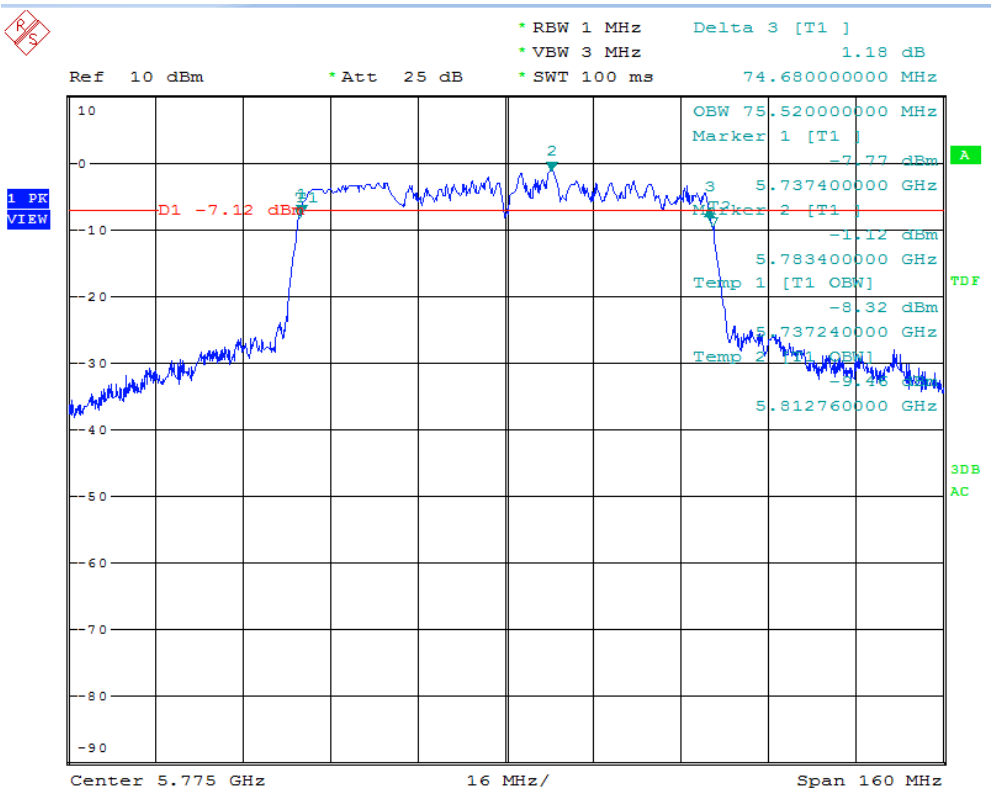
Channel 165: 5825MHz @ 802.11n HT20



Channel 151: 5755MHz @ 802.11n HT40



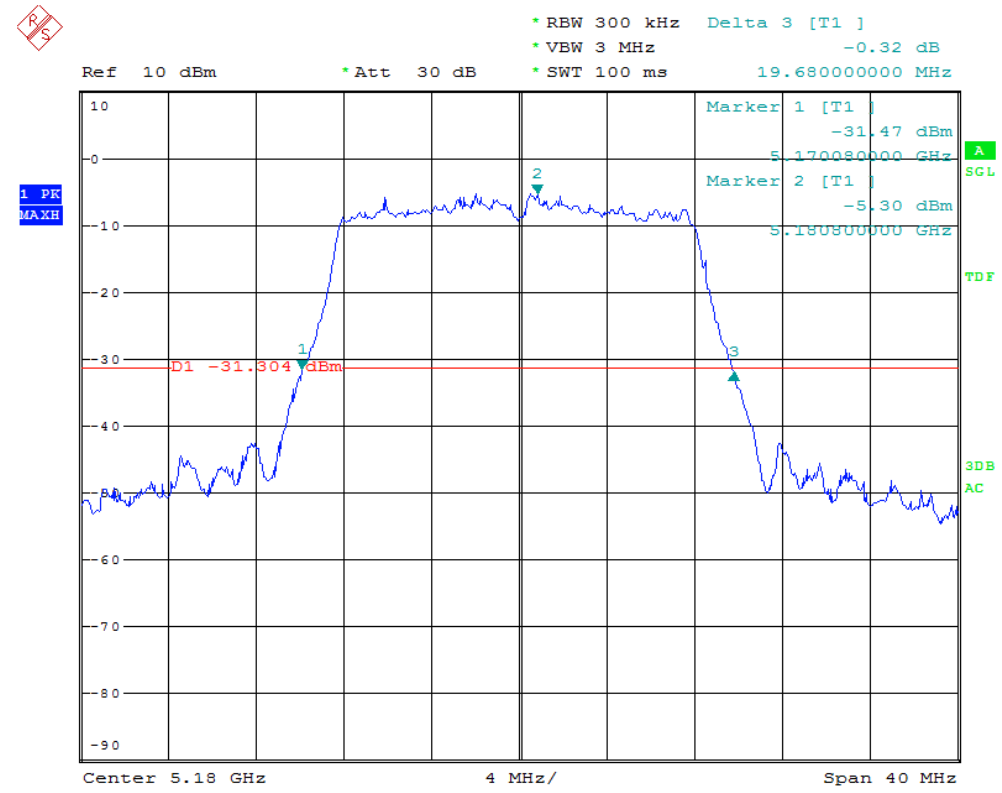
Channel 159: 5795MHz @ 802.11n HT40

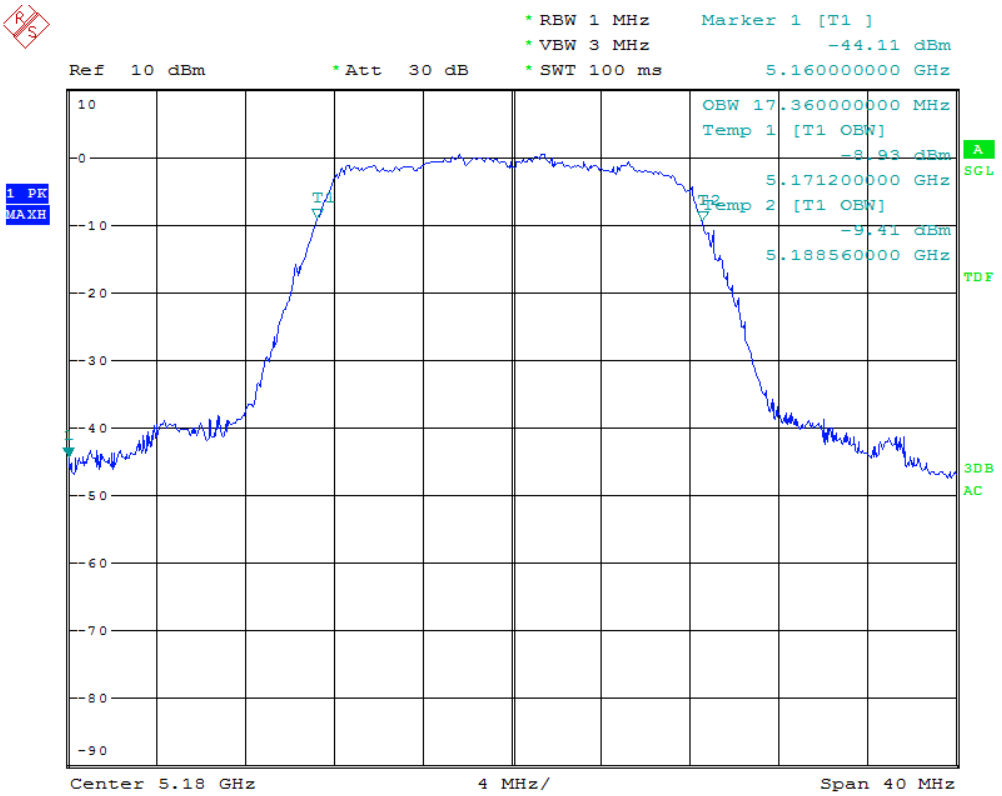


Channel 155: 5775MHz @ 802.11n ac80

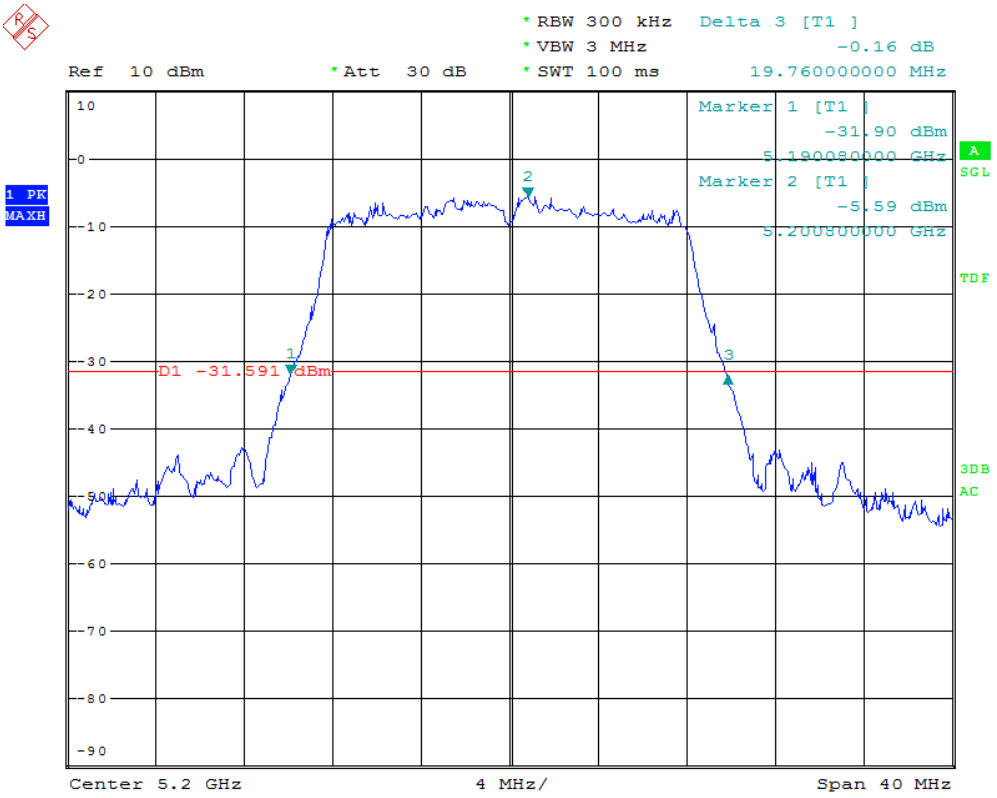
Antenna 2:

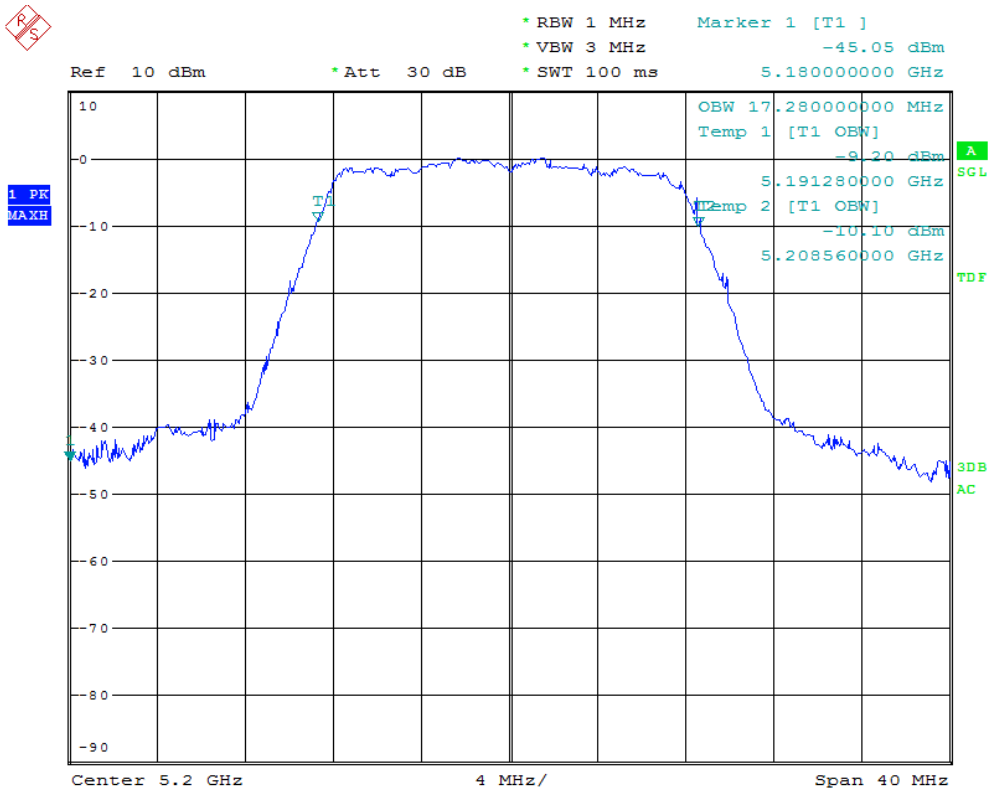
Test Plots:5150-5250MHz



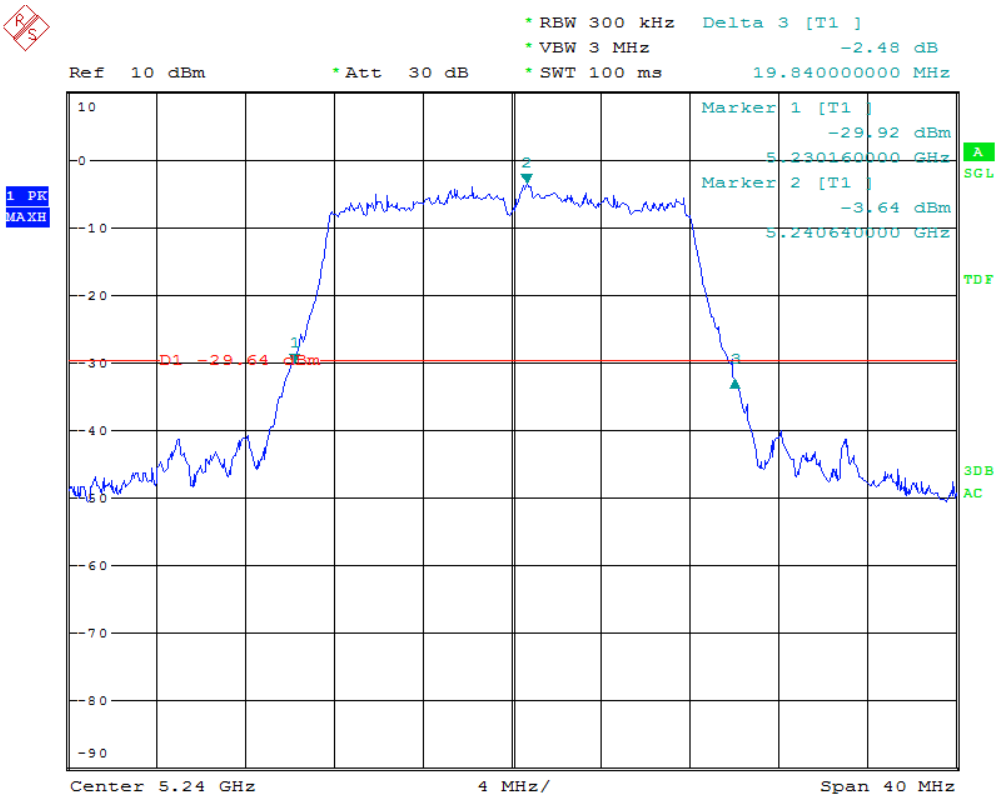


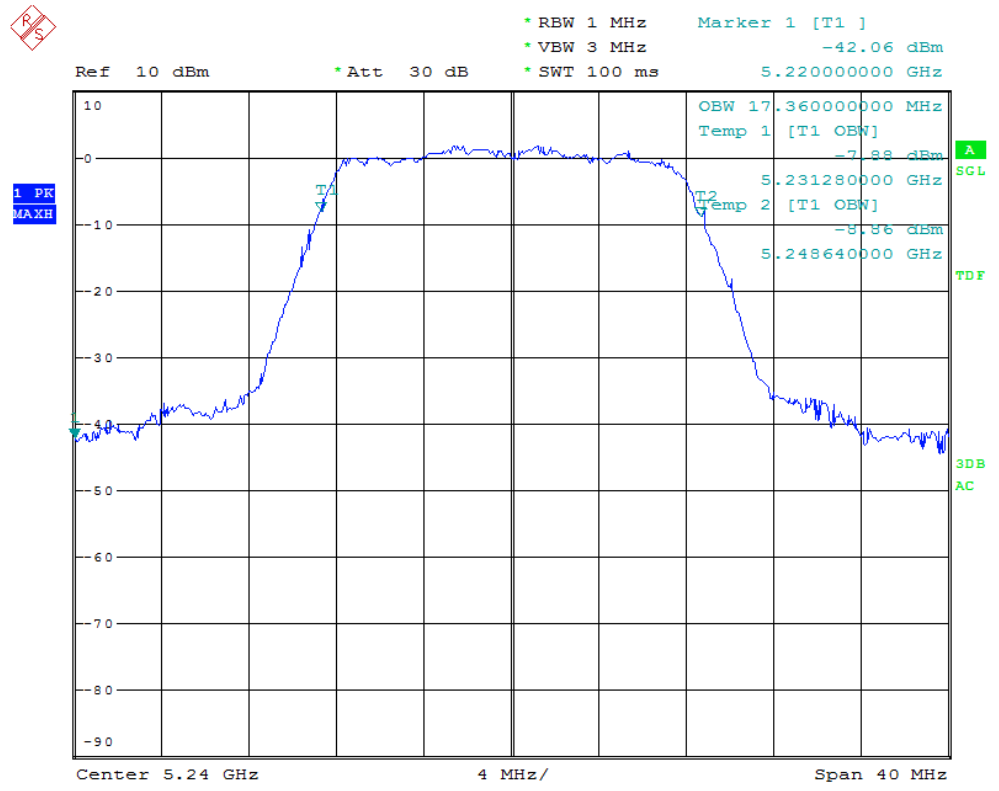
Channel 36: 5180MHz @ 802.11a



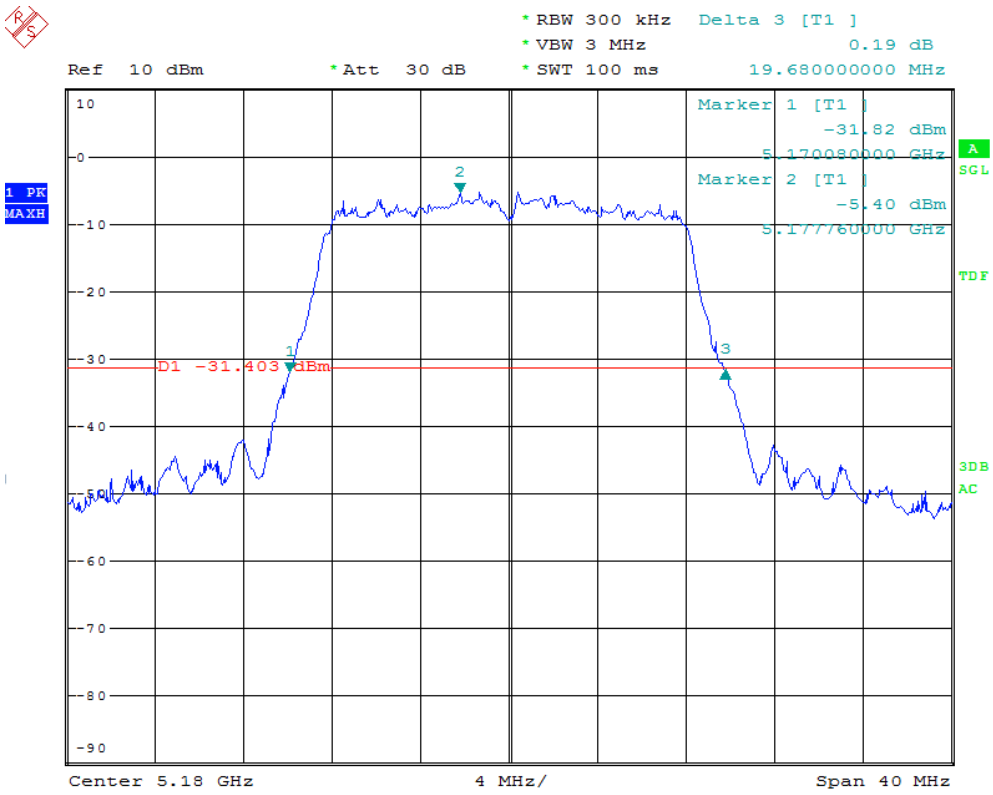


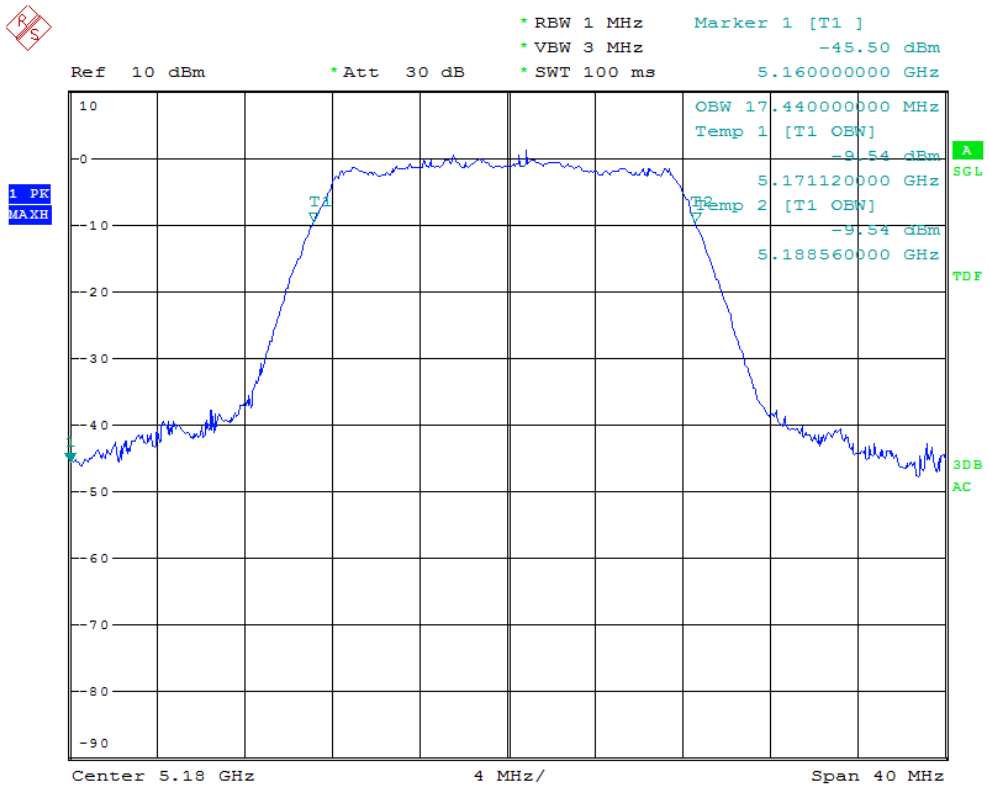
Channel 40: 5200MHz @ 802.11a



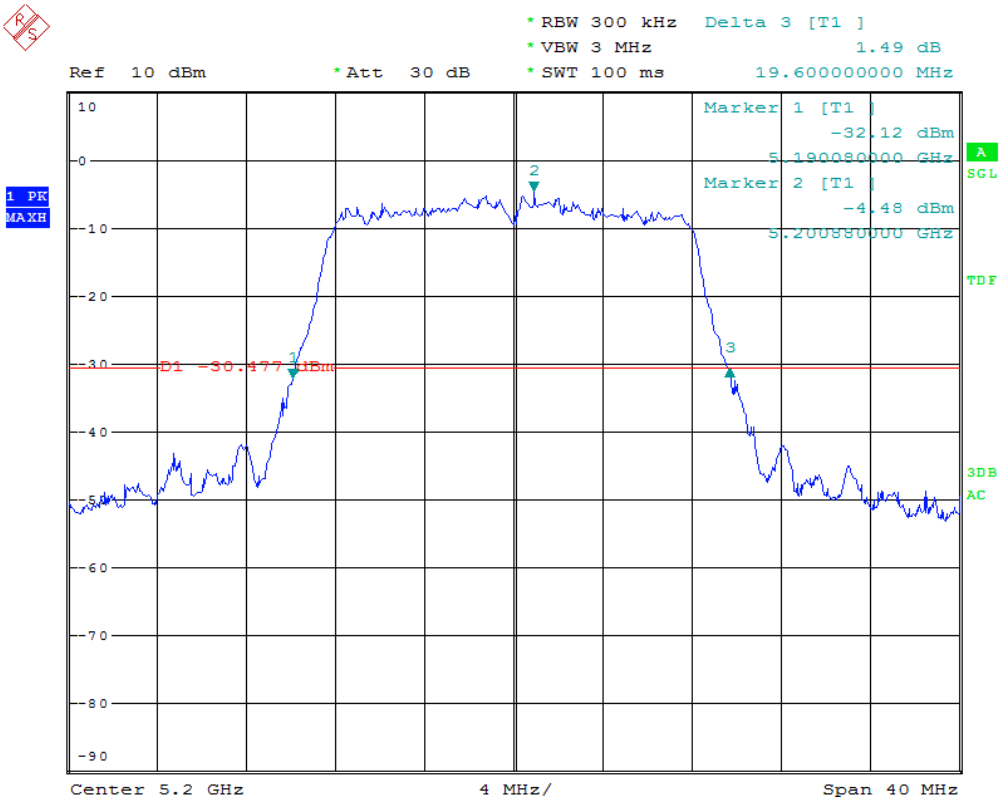


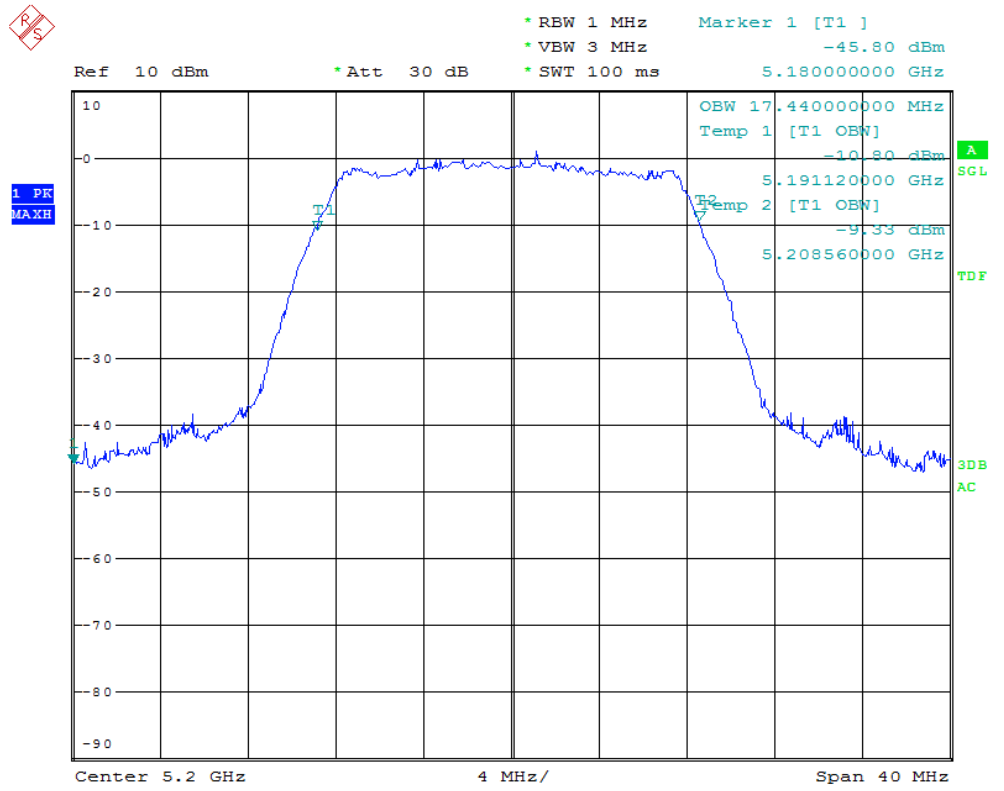
Channel 48: 5240MHz @ 802.11a



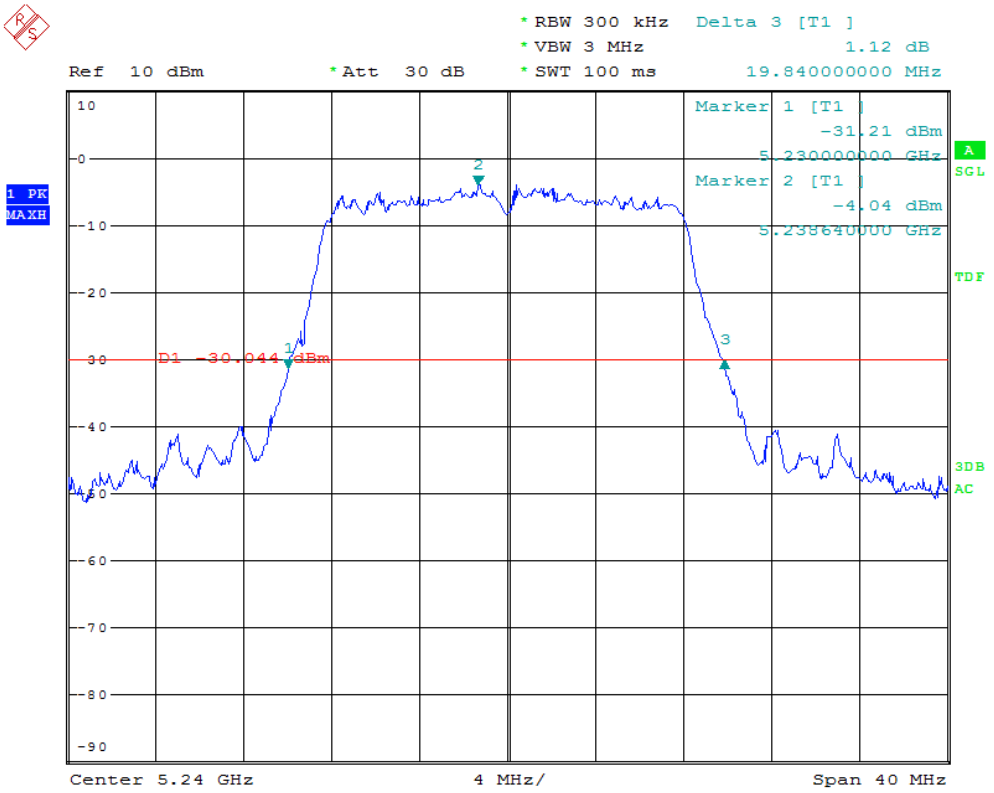


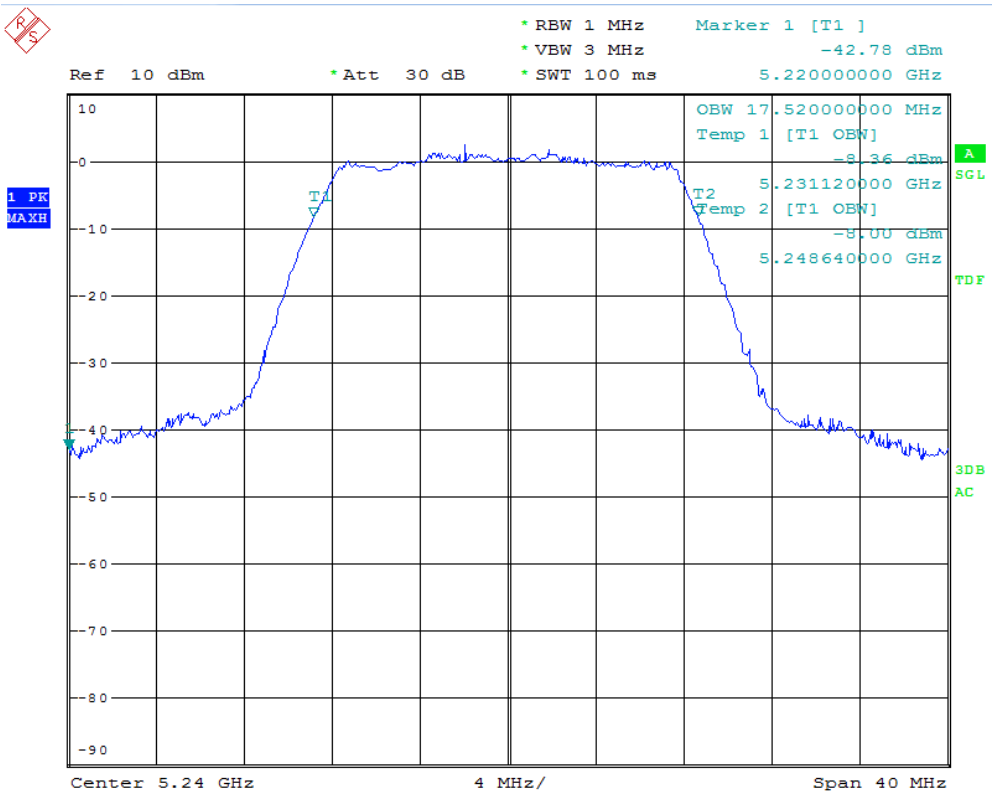
Channel 36: 5180MHz @ 802.11n HT20



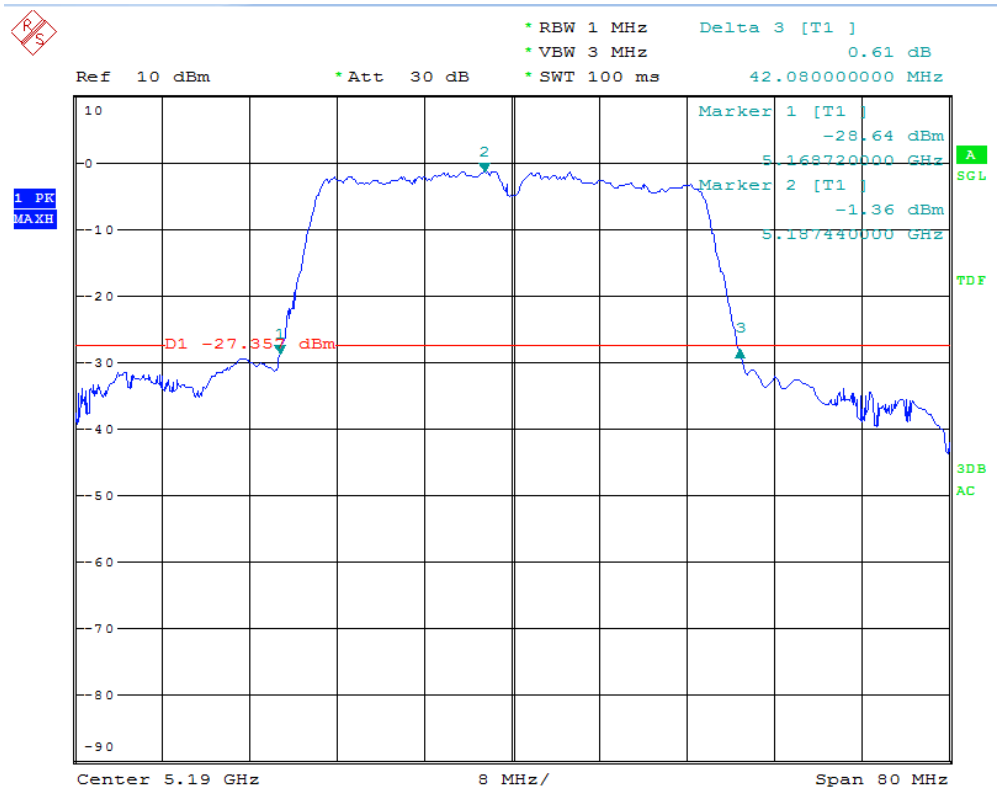


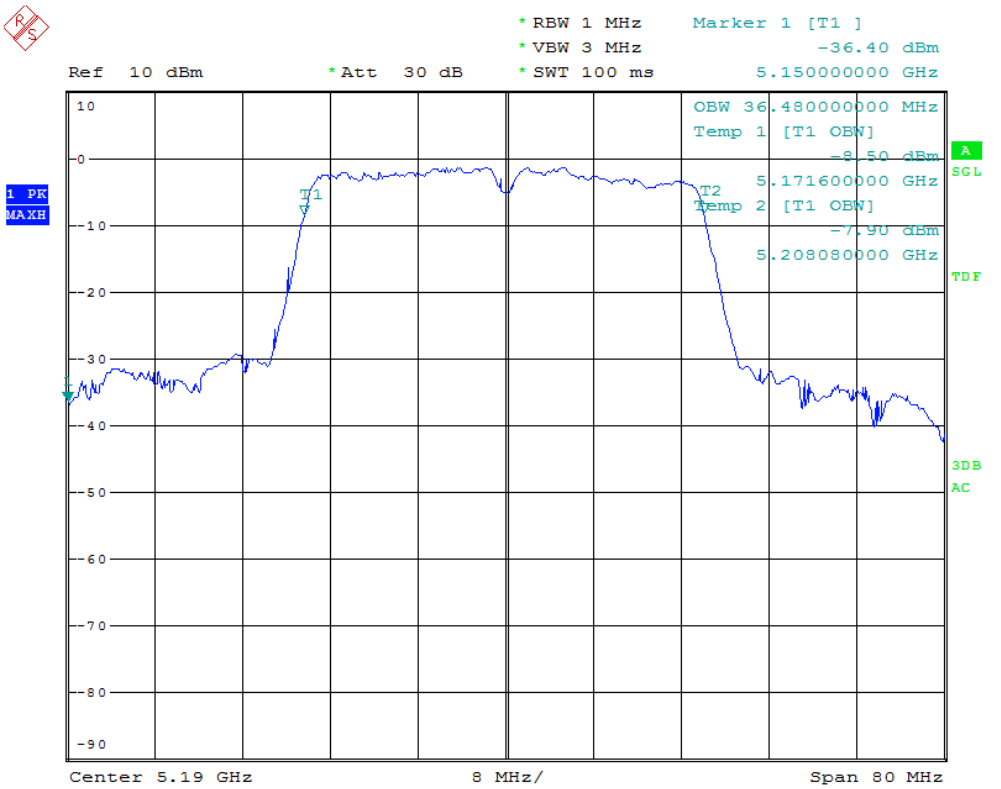
Channel 40: 5200MHz @ 802.11n HT20



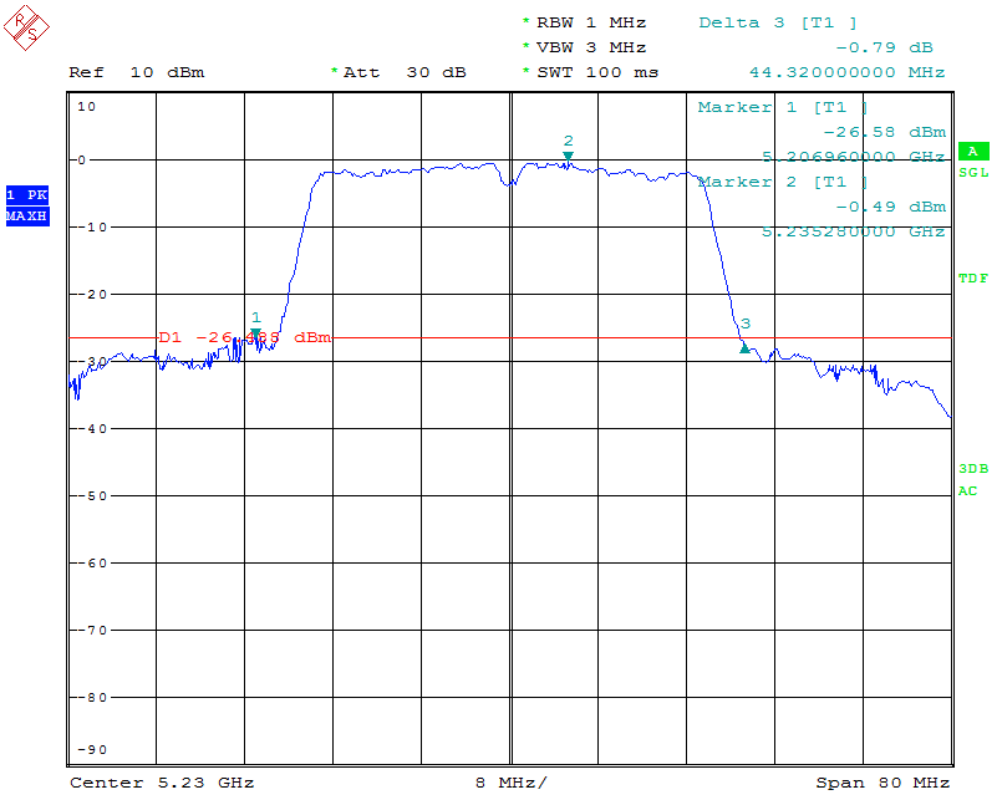


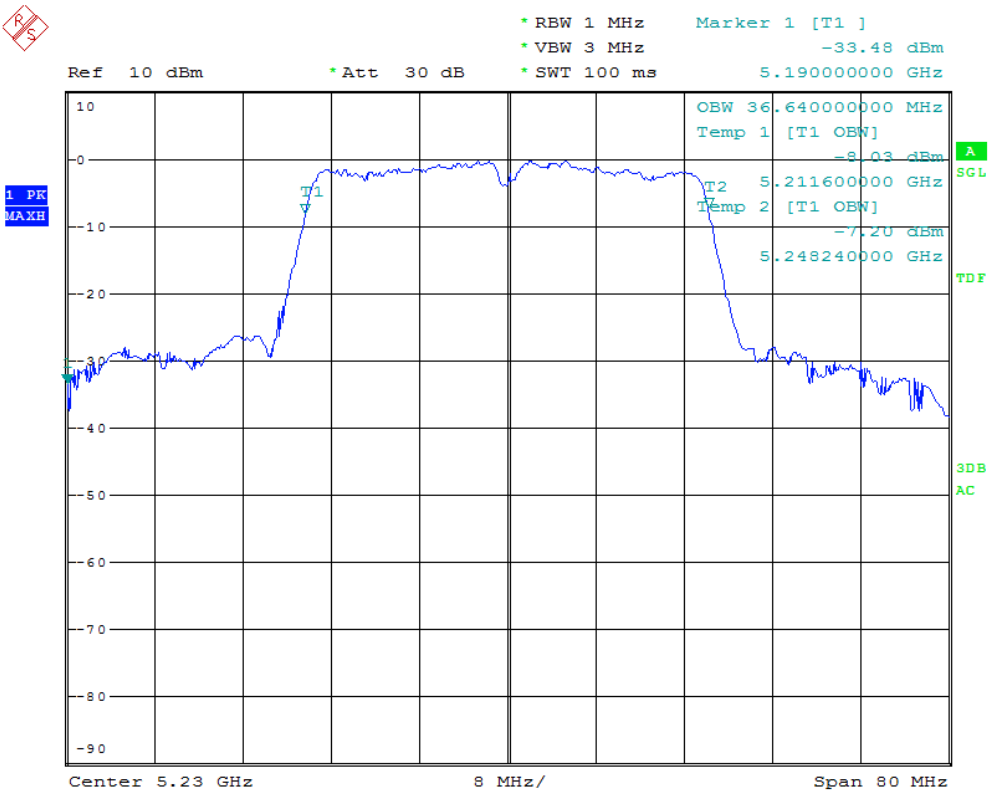
Channel 48: 5240MHz @ 802.11n HT20



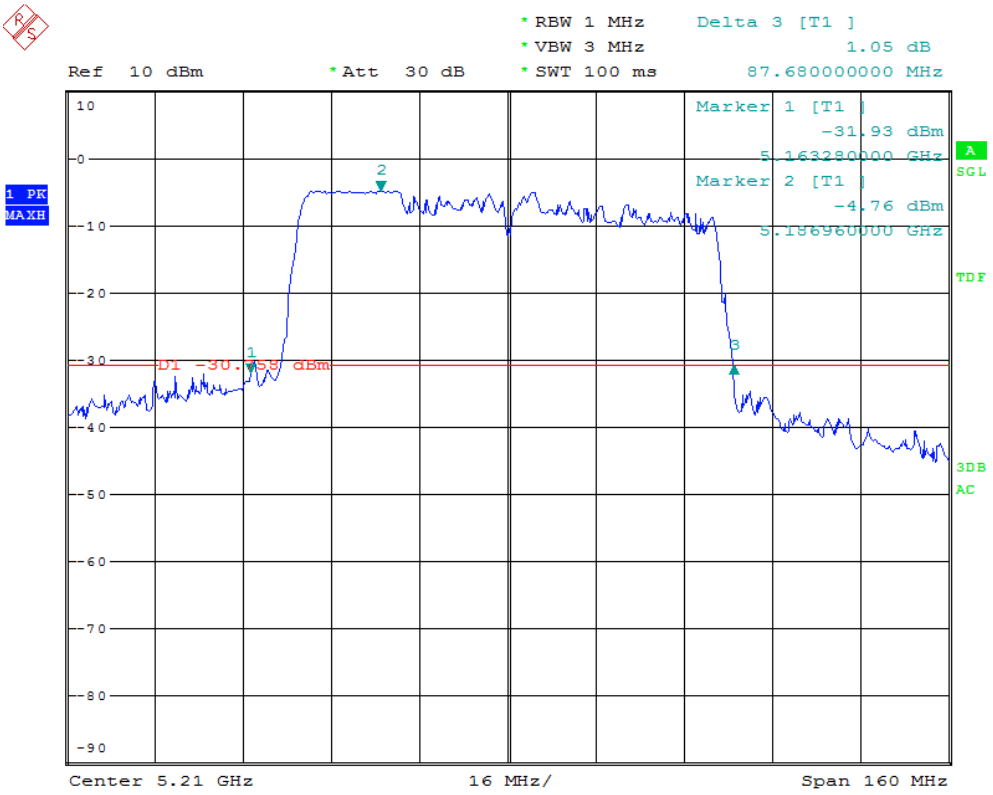


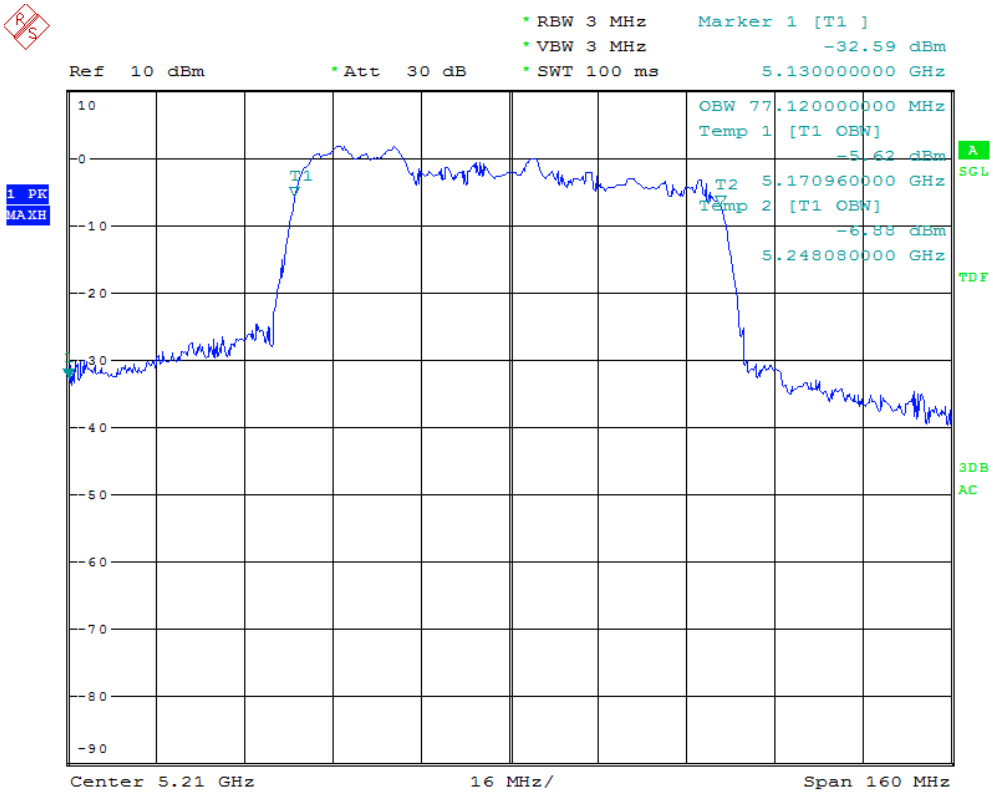
Channel 38: 5190MHz @ 802.11n HT40





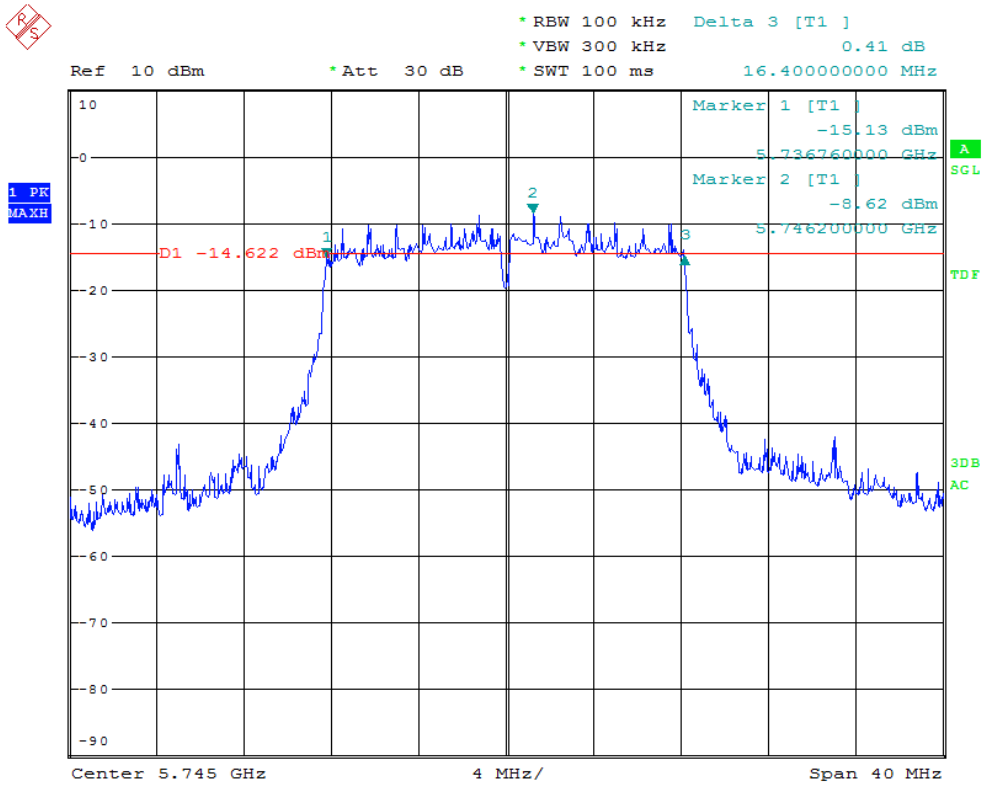
Channel 40: 5230MHz @ 802.11n HT40

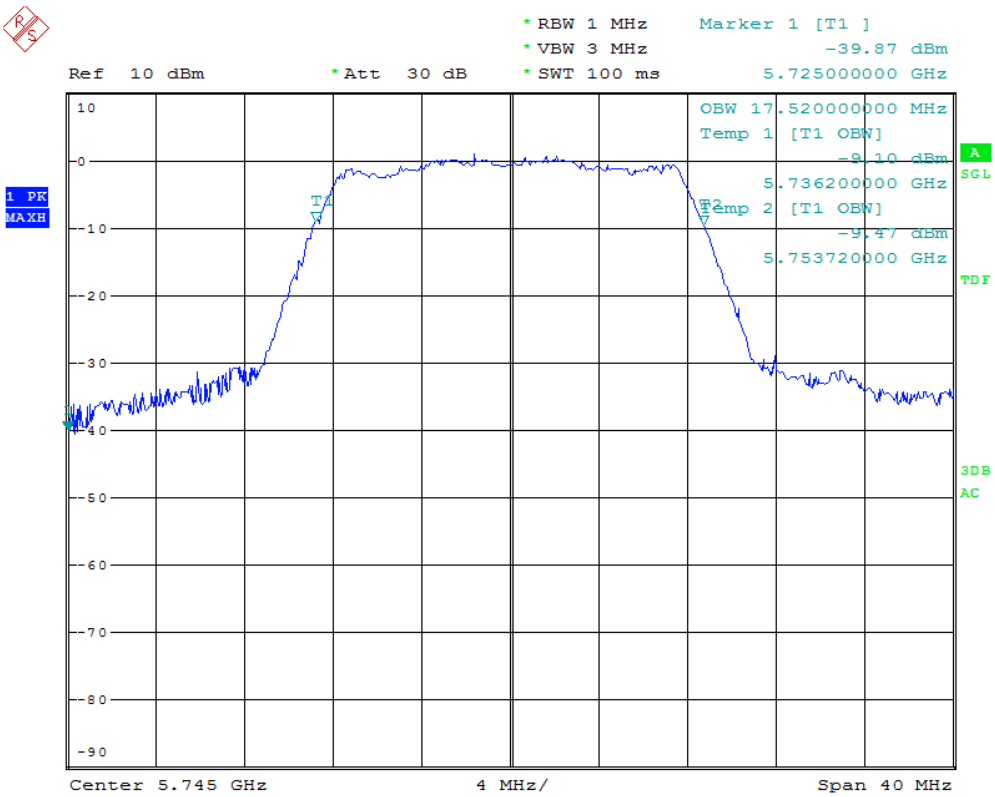




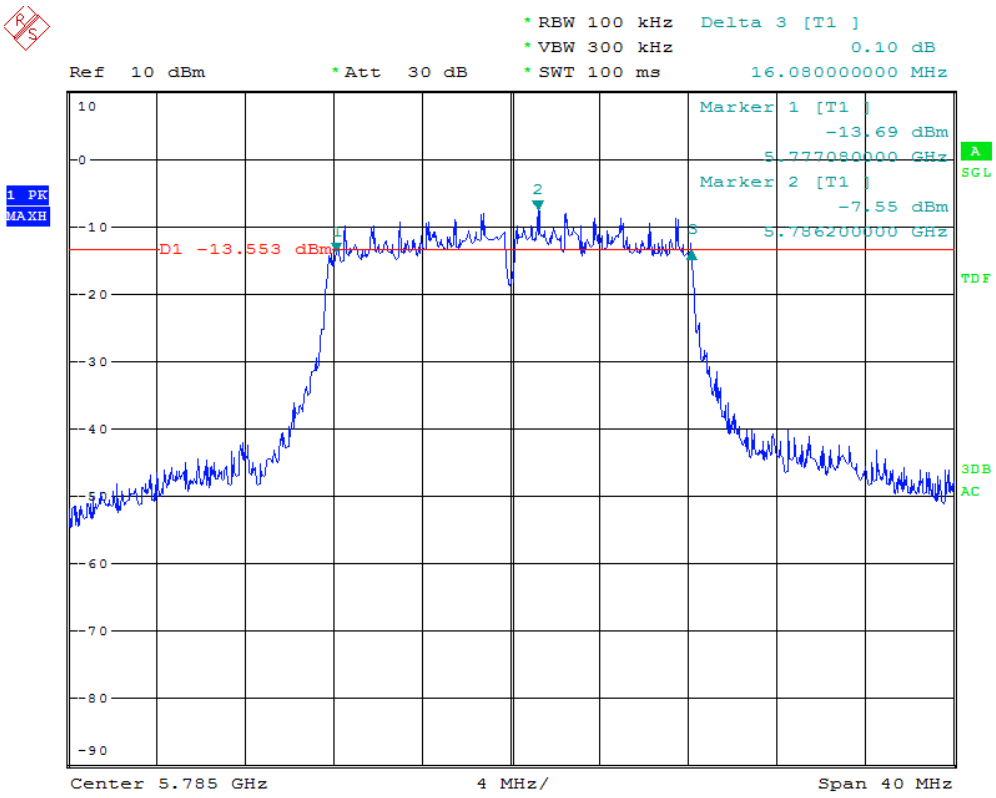
Channel 40: 5210MHz @ 802.11n ac80

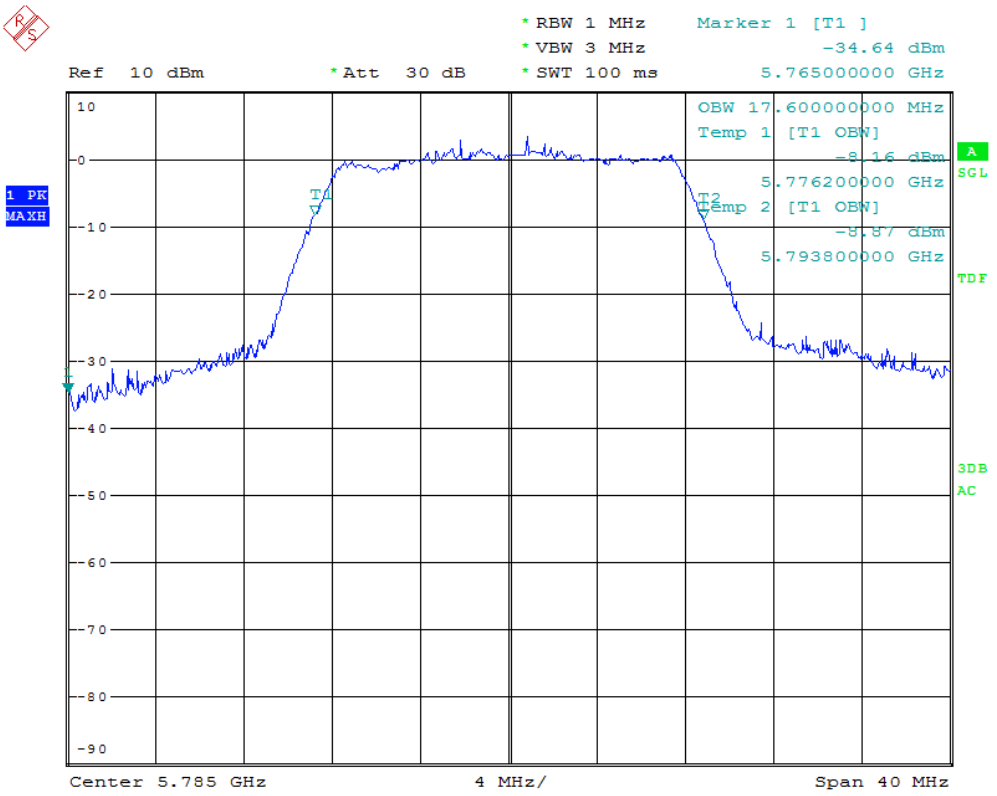
Test Plots: 5725-5850MHz



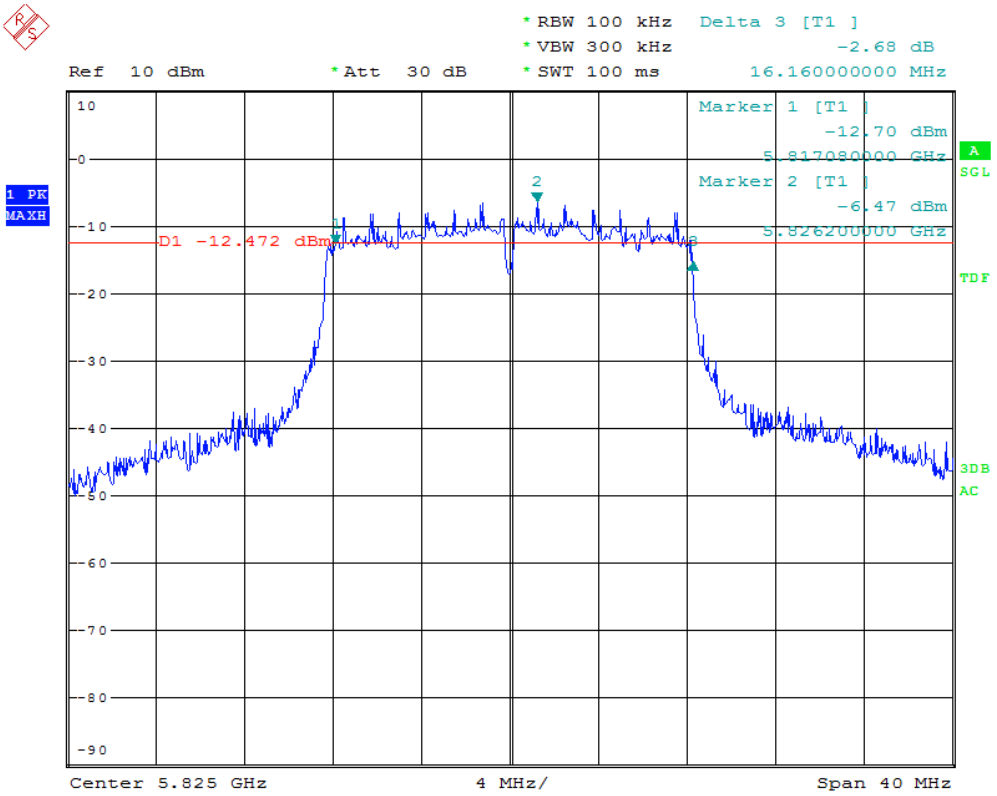


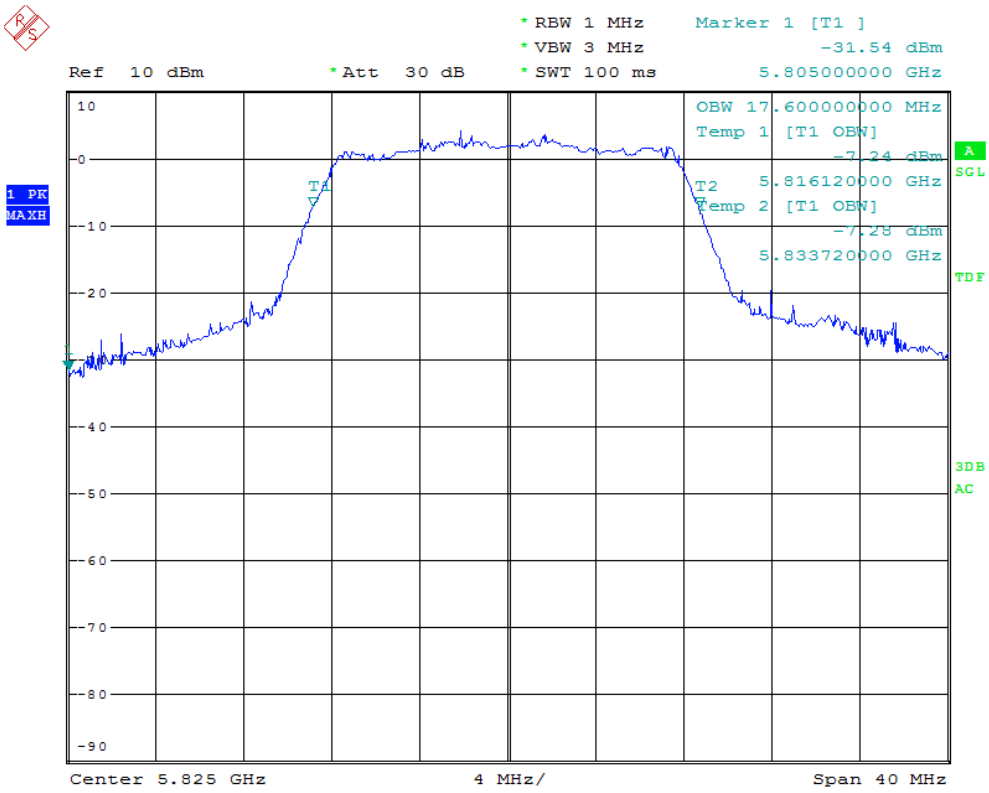
Channel 149: 5745MHz @ 802.11a



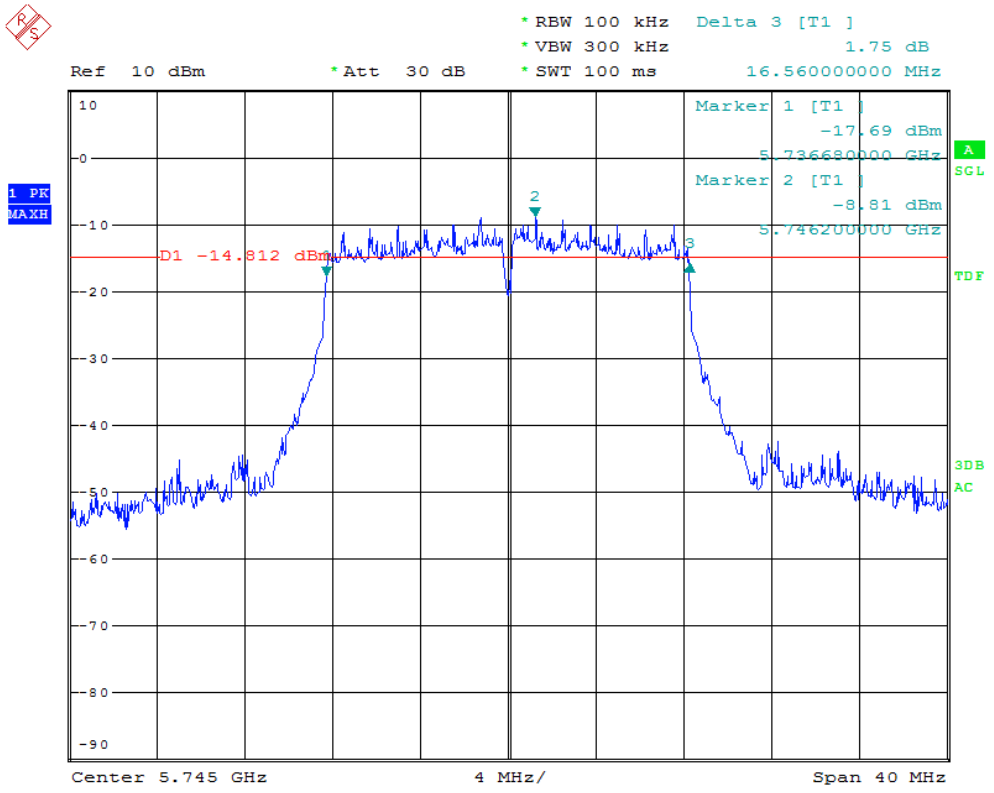


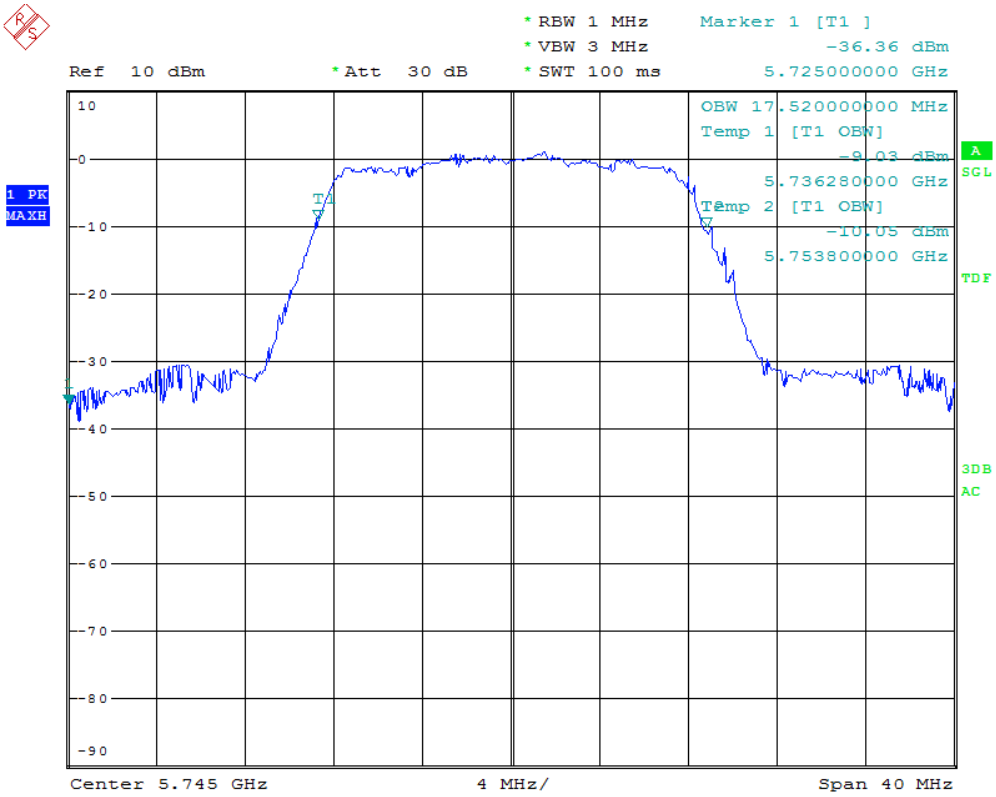
Channel 157: 5785MHz @ 802.11a



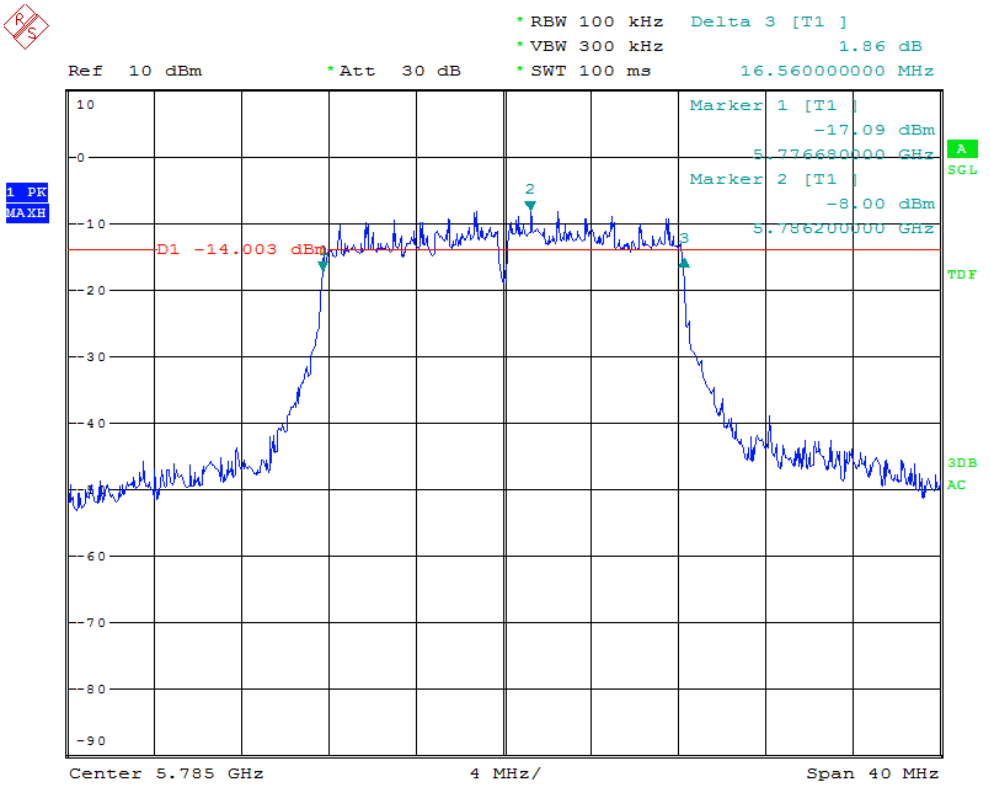


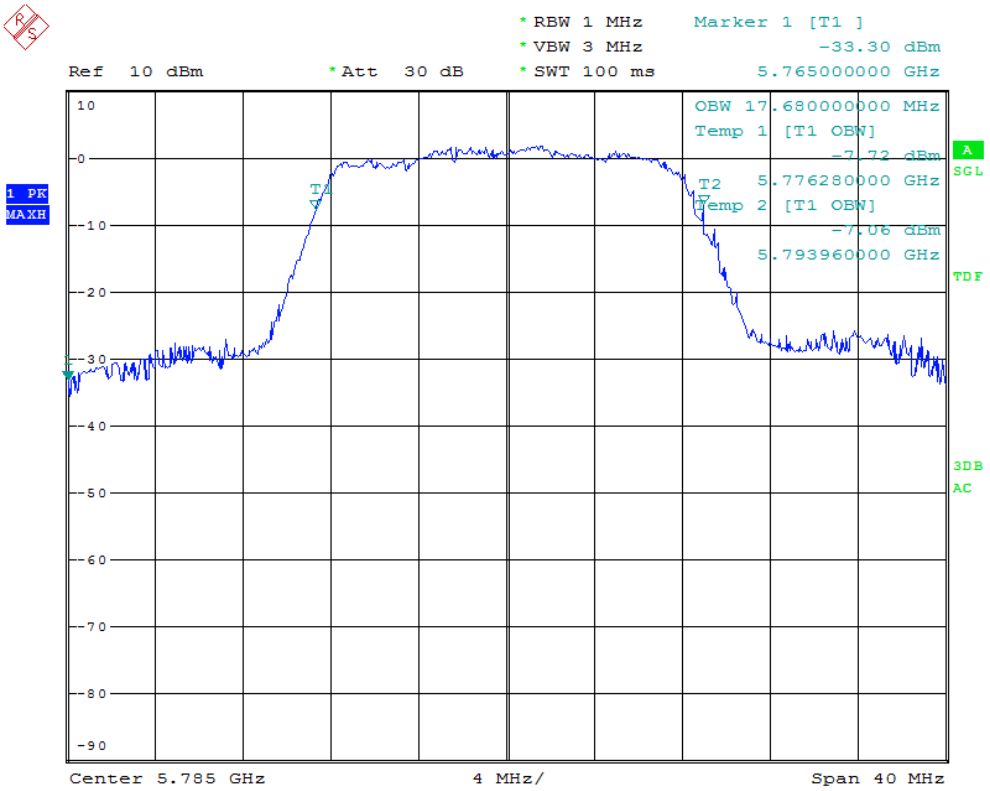
Channel 157: 5825MHz @ 802.11a



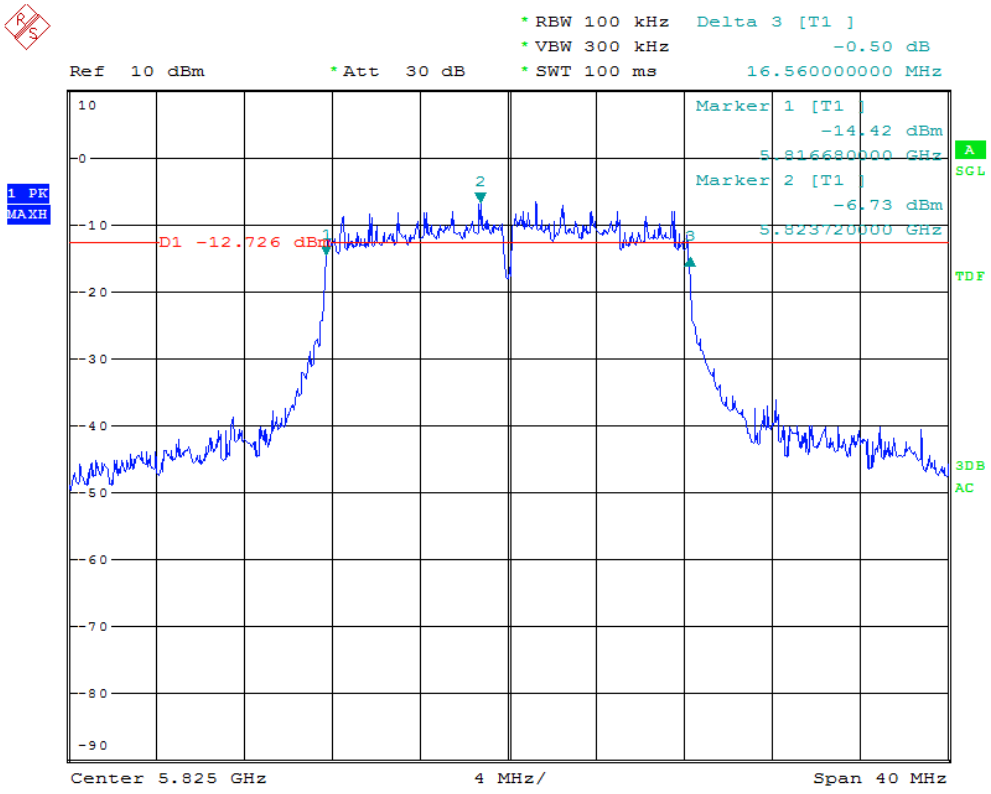


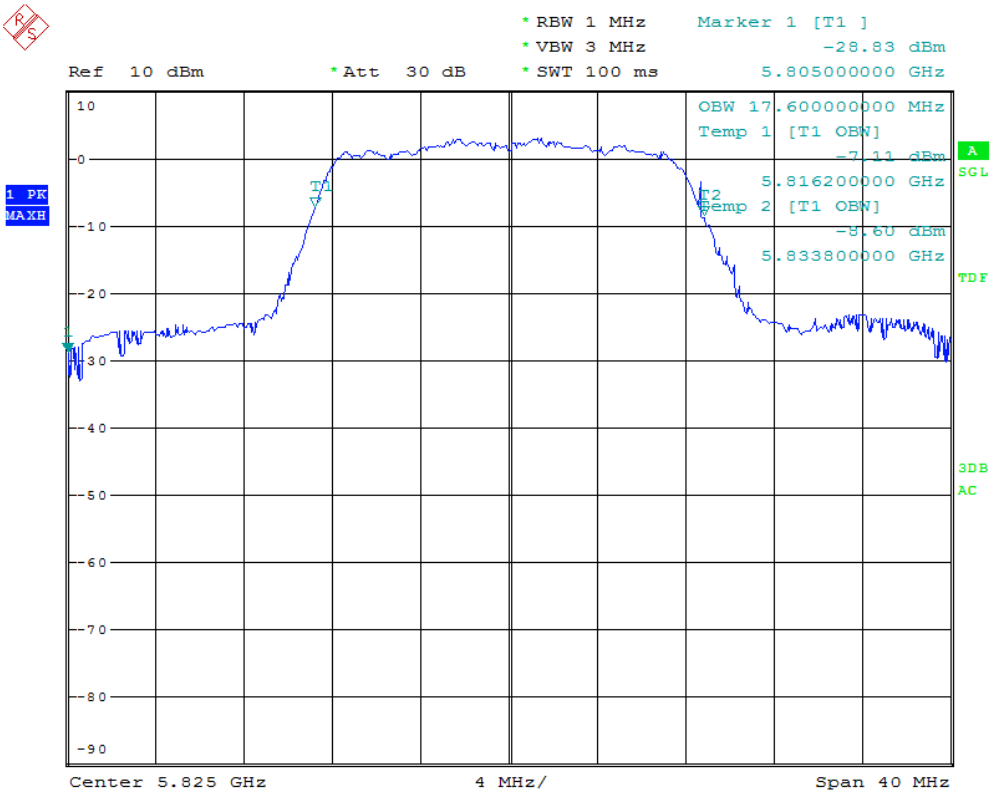
Channel 149: 5745MHz @ 802.11n HT20



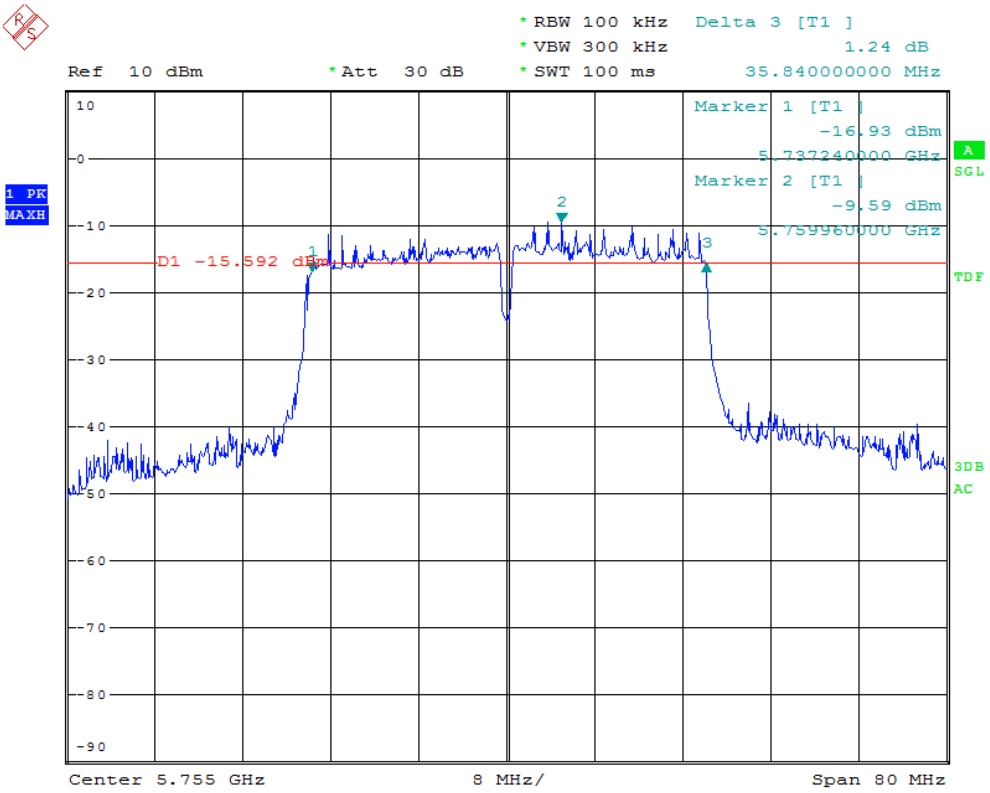


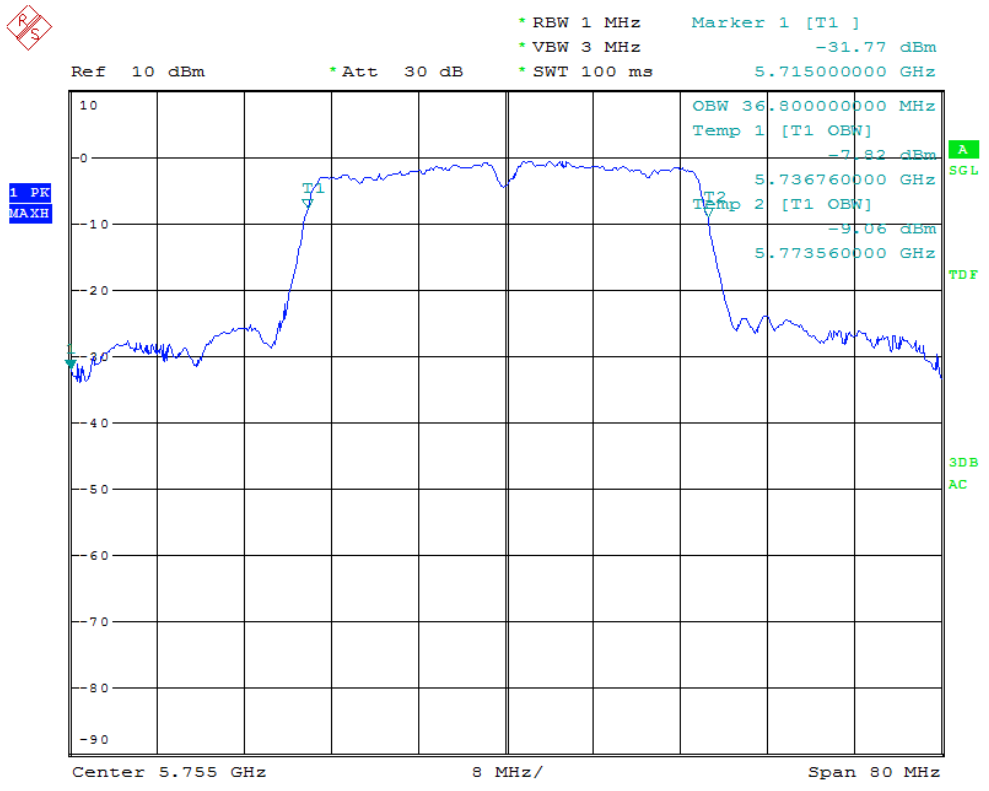
Channel 157: 5785MHz @ 802.11n HT20



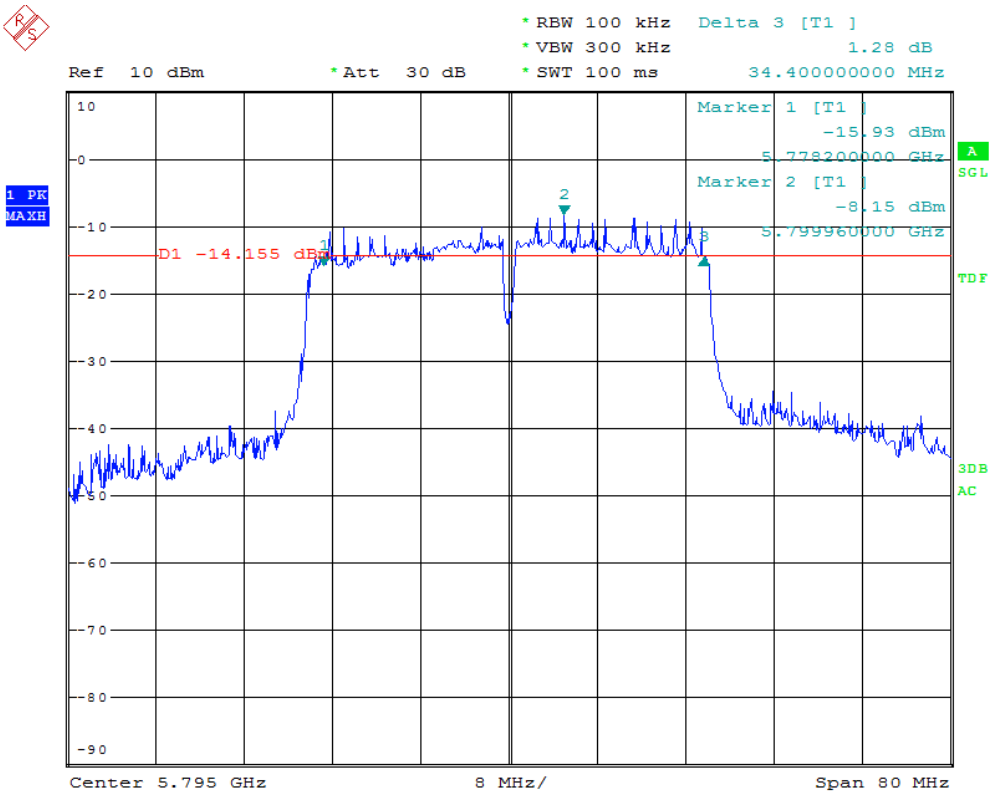


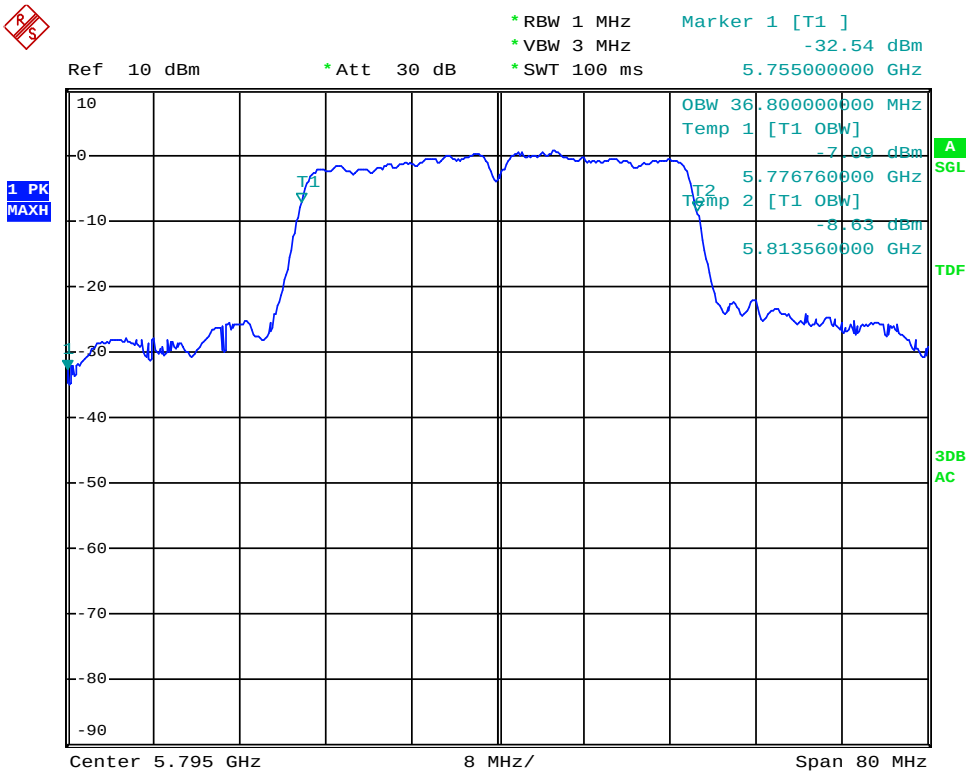
Channel 165: 5825MHz @ 802.11n HT20



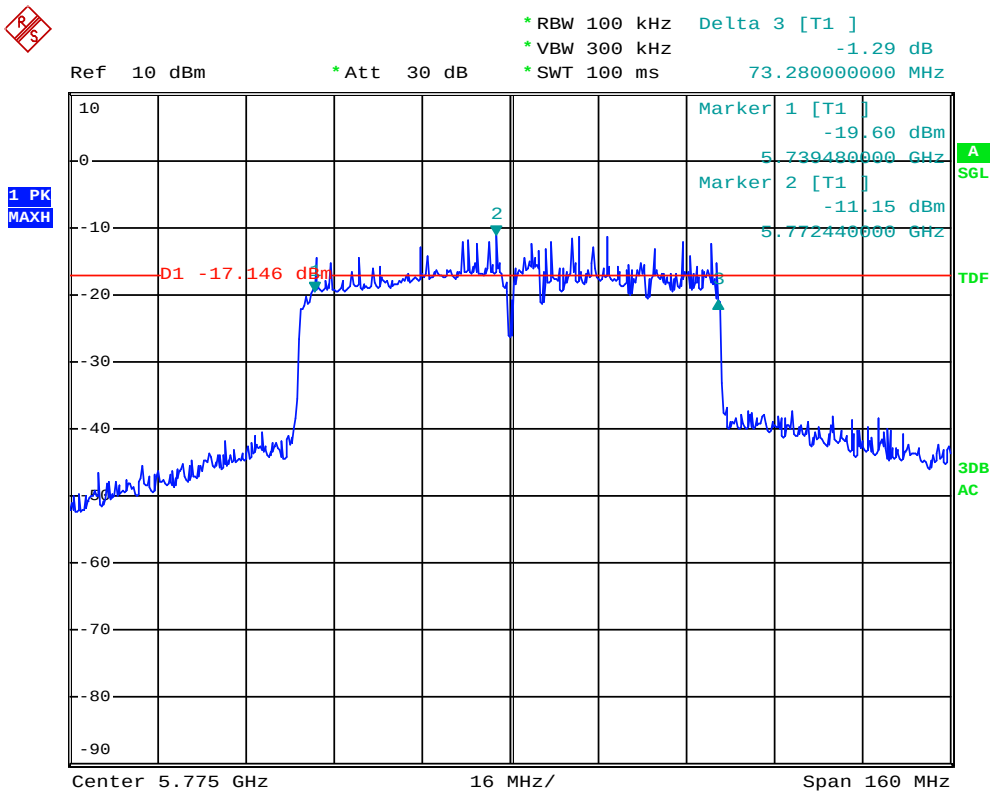


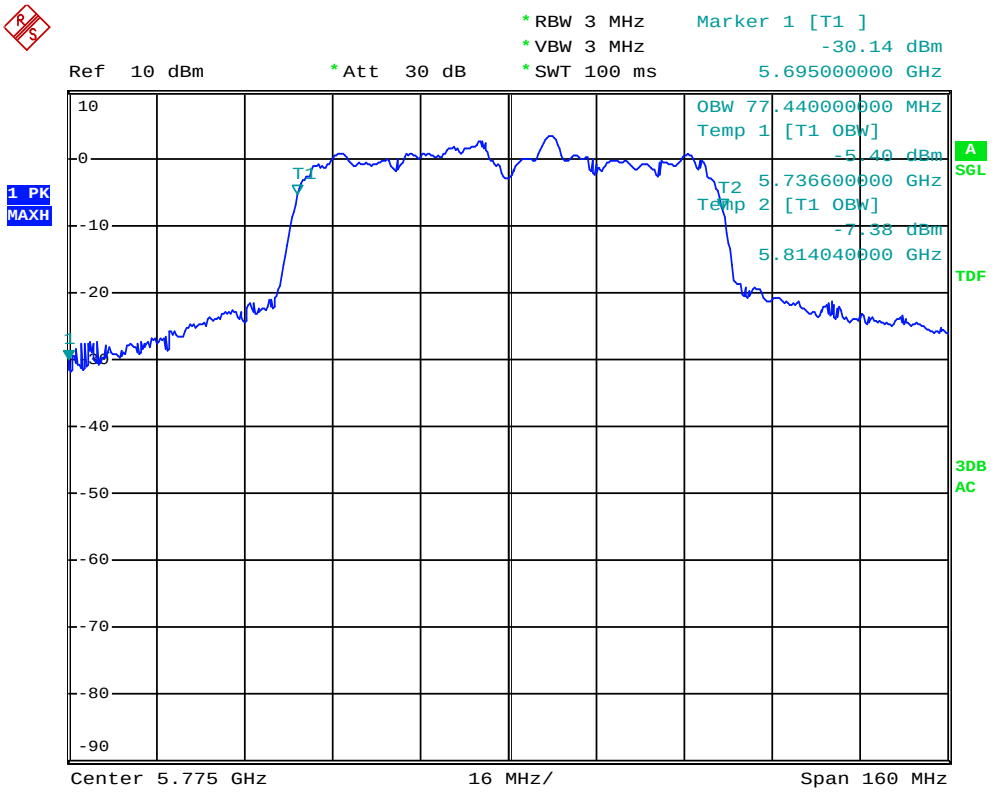
Channel 151: 5755MHz @ 802.11n HT40





Channel 159: 5795MHz @ 802.11n HT40





Channel 155: 5775MHz @ 802.11n ac80

8. Maximum Conducted Output Power

8.1 Standard Applicable

Section 15.407(a) Power limits:

(1) For the band 5.15-5.25 GHz.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(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 + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

8.2 Test Procedure

According to KDB789033 D02 v01r04 section E, the following is the measurement procedure.

(i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(v) Sweep time = auto.

(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".

(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

8.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	65%
ATM Pressure:	1011 mbar

8.4 Summary of Test Results/Plots

For the frequency band 5.15-5.25GHz, 5725-5850GHz

Test mode	Frequency MHz	Output Power (dBm)			Duty factor (dB)	Output Power + Duty factor (dBm)	Output Power + Duty factor mW	Limit mW
		Chain 1	Chain 2	total				
802.11a	5180	12.74	12.51	15.64	0.09	**15.73**	**37.4**	140.9
	5200	12.57	12.47	15.53	0.11	15.64	36.6	140.9
	5240	12.20	12.32	15.27	0.09	15.36	34.4	140.9
	5745	13.46	13.52	16.50	0.10	16.60	45.7	561
	5785	13.28	13.54	16.42	0.09	16.51	44.8	561
	5825	13.47	13.65	16.57	0.09	**16.66**	**46.3**	561
802.11n-HT20	5180	12.09	12.14	15.13	0.13	15.26	33.6	140.9
	5200	12.02	11.83	14.94	0.12	15.06	32.1	140.9
	5240	11.78	11.65	14.73	0.10	14.83	30.4	140.9
	5745	12.46	12.24	15.36	0.11	15.47	35.2	561
	5785	12.27	12.35	15.32	0.12	15.44	35.0	561
	5825	11.84	11.98	14.92	0.06	14.98	31.5	561
802.11n-HT40	5190	10.65	10.84	13.76	0.12	13.88	24.4	140.9
	5230	10.53	10.86	13.71	0.13	13.84	24.2	140.9
	5755	10.61	10.47	13.55	0.09	13.64	22.6	561
	5795	10.56	10.58	13.58	0.08	13.66	23.2	561
802.11n-ac80	5210	6.54	6.47	9.52	0.13	9.65	9.2	140.9
	5775	6.78	6.92	9.86	0.11	9.97	9.9	561

Equivalent Antenna Gain: 8.51 dBi (= 5.5dBi + 10 * log 2)

band 5.15-5.25GHz : 250 mW = 24 dBm , Limit : 140.9 mW = 21.49 dBm (= 24 dBm – (8.51 dBm – 6 dBm)

band 5725-5850GHz : 1000 mW = 30 dBm, Limit : 561 mW = 27.49 dBm (= 30 dBm – (8.51 dBm -6 dBm)

9. Conducted Undesirable Emissions and Band Edge

9.1 Standard Applicable

According to §15.407 (b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:
(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

9.2 Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer via a RF combiner.
2. Set the spectrum analyzer as RBW = 100kHz/1MHz, VBW=300kHz/3MHz, Sweep = auto
3. Set the Lowest, Middle and Highest Transmitting Channel, observed the outside band of 30MHz to 40GHz, then mark the higher-level emission for comparing with the FCC rules.

9.3 Environmental Conditions

Temperature:	21° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

10.4 Summary of Test Results/Plots