



Test report No:
NIE: 61152RRF.009

Test report

USA FCC Part 15.407, 15.209

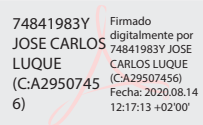
CANADA RSS-247, RSS-Gen

Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements.

Radiated emission limits; general requirements.

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

General Requirements and Information for the Certification of Radio Apparatus.

(*) Identification of item tested	Automotive Infotainment System
(*) Trademark	Mercedes-Benz
(*) Model and /or type reference	NTG7 MID LFT2
Other identification of the product	HW version: D5 SW version: E17.100 FCC ID: 2AOUZNTG7MIDLFT2 IC: 23650-NTG7MIDLFT2
(*) Features	FM/AM/DAB, USB, Bluetooth, WLAN, GNSS.
Applicant	CONTINENTAL AUTOMOTIVE GMBH VDO-Strasse 1, 64832 Babenhausen, Germany
Test method requested, standard	- USA FCC Part 15.407 (10-1-19 Edition): Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. - USA FCC Part 15.209 (10-1-19 Edition): Radiated emission limits; general requirements. - CANADA RSS-247 Issue 2 (February 2017). - CANADA RSS-Gen Issue 5 (March 2019). - Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017. - ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Jose Carlos Luque RF Lab. Supervisor 
Date of issue	2020-08-12
Report template No	FDT08_22 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

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The results presented in this Test Report apply only to the particular item under test established in this document.

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1. This report is only referred to the item that has undergone the test.
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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of NTG7 MID LFT2 is an automotive head unit to be installed in cars with the following features: FM/AM/DAB, USB, Bluetooth, WLAN and GNSS.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of result.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
61152E/076	Automotive Infotainment System	NTG7 MID LFT2	COM652LB000002	2020/04/14
61152E/073	Harness	--	--	2020/04/14
60268/122	RF Cable with 4 Antennas	--	--	2019/09/30

Sample S/01 has undergone the following test(s): All RADIATED tests indicated in Appendixes B and C.

- Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
61152E/076	Automotive Infotainment System	NTG7 MID LFT2	COM652LB000002	2020/04/14
61152E/073	Harness	--	--	2020/04/14

Auxiliary elements used with the Sample S/02:

Control N°	Description	Model	Serial N°	Date of reception
61152E/033	SMA Adapter Cable	--	--	2020/03/24

Sample S/02 has undergone the following test(s): All CONDUCTED tests indicated in Appendixes A, B and C.

Test sample description

Ports..... :	Port name and description		Cable			
			Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾
	Car Connector A		>3m ^(x1)	☒	☐	☐
	Car Connector B		>3m ^(x1)	☒	☐	☐
	Display Connector CID/PIP / RVC		>3m ^(x1)	☒	☒	☐
	USB Connector		<3m ^(x2)	☒	☒	☐
	Eth Connector (BR)		>3m ^(x1)	☒	☐	☐
	BT/WLAN-Antenna		>3m ^(x1)	☒	☒	☐
	FM/AM/DAB Ant		>3m ^(x1)	☒	☒	☐
	GNSS Antenna		>3m ^(x1)	☒	☒	☐
Supplementary information to the ports..... :	-					
Rated power supply	Voltage and Frequency			Reference poles		
				L1	L2	L3
	☒	DC: 12V Car battery / attenuator (9,5-15,5V normal operation)				
Rated Power	9,5-15,5V normal operation					
Clock frequencies.....	see schematics					
Other parameters	See Technical Description					
Software version	E17.100					
Hardware version	D5					
Dimensions in cm (W x H x D)	182 x 78 x 160 mm					
Mounting position	☒	Other: automotive headunit				
Modules/parts.....	Module/parts of test item		Type		Manufacturer	
	n/a		-			
Accessories (not part of the test item)	Description		Type		Manufacturer	
	Display		-		LG	
	HARMANeco RasPi / headless		-		HBAS	

	Cable harness	-	HBAS
	BT/WLAN-Antenna	-	Hirschmann
Documents as provided by the applicant.....:	Description	File name	Issue date
	Technical Description	Technical Description NTG7_A15 200324 SOP2 AllVariant.doc	
	-		

Identification of the client

CONTINENTAL AUTOMOTIVE GMBH
VDO-Strasse 1, 64832 Babenhausen, Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2020-04-28
Date (finish)	2020-05-13

Document history

Report number	Date	Description
61152RRF.009	2020-08-12	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 35 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Nicolas Salguero, Cristina Calle, Miguel Manuel Lopez, Javier Nadales and José Gabriel Pendón.

Used instrumentation:

Radiated Measurements:

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2. Shielded Room ETS LINDGREN S101	N.A.	N.A.
4. RF Pre-amplifier, G>40 dB, 10 MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2020/02	2021/02
5. Hybrid Bilog Antenna 30 MHz - 6 GHz SUNOL SCIENCES CORPORATION JB6	2017*09	2020/09
6. EMI Test Receiver 9 kHz - 7 GHz ROHDE AND SCHWARZ ESR7	2019/10	2021/10
7. RF Pre-amplifier, 30 dB, 500 MHz-18 GHz NARDA AMF-3D-00501800-24-10P	2019/12	2020/12
8. RF Pre-amplifier, G>40dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-1M	2020/05	2021/05
9. Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
10. Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
11. Pre-Amplifier G>30dB 18-40GHz, BONN ELEKTRONIK, BLMA 1840-1M	2019/02	2021/02
12. Signal and Spectrum analyzer 10Hz – 40GHz ROHDE & SCHWARZ FSV40	2019/09	2021/09
13. DC Power Supply Keysight Technologies U8002A	N/A	N/A
14. Digital multimeter FLUKE 179	2019/06	2020/06

Conducted Measurements

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N/A	N/A
2.	DC Power Supply Keysight Technologies U8002A	N/A	N/A
3.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2020/03	2022/03
4.	Digital multimeter FLUKE 179	2019/06	2020/06

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

A. Common requirements for all bands

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.35 (c) / RSS-Gen 6.10	Duty Cycle	P	
RSS-Gen 6.6 / RSS-247 6.2.	Transmitter 99% Occupied Bandwidth	P	
FCC 15.403 (i)	Transmitter 26 dB Emission Bandwidth (EBW)	P	
FCC 15.407 (g) / RSS-Gen 6.11	Frequency Stability (Temperature & Voltage Variation)	N/M	(1)
Supplementary information and remarks:			
(1) The manufacturer is 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 manual.			

B. 5.15 GHz – 5.25 GHz Band

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.407 (a)(1)(iv)	Transmitter Maximum conducted Output Power	P	
RSS-247 6.2.1.1	Transmitter Maximum Equivalent Isotropically Radiated Power EIRP	P	
FCC 15.407 (a)(1)(iv)	Transmitter Maximum Power Spectral Density	P	
RSS-247 6.2.1.1	Transmitter EIRP Spectral Density	P	
FCC 15.407 (b)(1)(6) / RSS-247 6.2.1.2	Transmitter Out of Band Radiated Emissions	P	
FCC 15.407 (b)(1) / RSS-247 6.2.1.2	Transmitter Band Edge Radiated Emissions	P	
<u>Supplementary information and remarks:</u>			
None.			

C. 5.725 GHz – 5.85 GHz Band

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.407 (e) / RSS-247 Clause 6.2.4.1	6 dB Bandwidth.	P	
FCC 15.407 (a)(3) / RSS-247 6.2.4.1	Transmitter Maximum conducted Output Power	P	
FCC 15.407 (a)(3) / RSS-247 Clause 6.2.4.1	Transmitter Maximum Power Spectral Density	P	
FCC 15.407 (b) (4) / RSS-247 6.2.4.2	Transmitter Band Edge Radiated Emissions	P	
FCC 15.407 (b) (4) (6) / RSS-247 6.2.4.2	Transmitter Out of Band Radiated Emissions	P	
<u>Supplementary information and remarks:</u>			
None.			

Appendix A: Test Common requirements for all bands

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FCC 15.403 (i) 26 dB Emission Bandwidth (EBW).....25

FCC 15.35 (c) / RSS-Gen 6.10. Duty Cycle

SPECIFICATION:

When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

RESULTS:

The results below are for data rates with a duty cycle less than 98%. The results for all rest of modes having a value > 98%.

Tests performed on the SISO mode CORE-0_Port3 Antenna.

Sub-band	Technique	Mode	Pulse Duration (us)	Period (us)	Duty Cycle correction (dB)
U-NII-1	SISO	802.11a / 20 MHz	2037.35	2573.19	1.014
U-NII-3	SISO	802.11a / 20 MHz	2029.54	2565.88	1.018
U-NII-1	SISO	802.11n / 20 MHz	1895.30	2433.14	1.085
U-NII-3	SISO	802.11n / 20 MHz	1897.79	2422.59	1.060
U-NII-1	SISO	802.11n / 40 MHz	946.32	1445.48	1.840
U-NII-3	SISO	802.11ac / 40 MHz	929.11	1461.88	1.968
U-NII-1	SISO	802.11ac / 80 MHz	434.48	961.15	3.448
U-NII-3	SISO	802.11ac / 80 MHz	438.15	961.81	3.415

RSS-Gen 6.6 / RSS-247 6.2. 99% Occupied Bandwidth

The following modes and data rates were selected based on preliminary testing that identified those corresponding to the worst cases:

- 802.11a: 6 Mbit/s.
- 802.11n HT20: MCS0.
- 802.11n HT40: MCS0.
- 802.11ac VHT40: MCS0.
- 802.11ac VHT80: MCS0

Tests performed on the SISO mode CORE-0_Port3 Antenna.

SISO CORE-0_Port3 Antenna:

Mode 802.11 a20:

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
99% Occupied Bandwidth (MHz)	16.987	17.013	17.000
Measurement uncertainty (kHz)	<±42.34		

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
99% Occupied Bandwidth (MHz)	17.027	17.027	17.013
Measurement uncertainty (kHz)	<±42.34		

Mode 802.11 n20 (HT20):

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
99% Occupied Bandwidth (MHz)	18.173	18.200	18.147
Measurement uncertainty (kHz)	<±42.34		

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
99% Occupied Bandwidth (MHz)	18.187	18.213	18.160
Measurement uncertainty (kHz)	<±42.34		

Mode 802.11 n40 (HT40):

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
99% Occupied Bandwidth (MHz)	36.267	36.267
Measurement uncertainty (kHz)	<±73.14	

Mode 802.11 ac40 (VHT40):

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
99% Occupied Bandwidth (MHz)	36.293	36.293
Measurement uncertainty (kHz)	<±73.14	

Mode 802.11 ac80 (VHT80):

U-NII-1 (5150-5250 MHz)

Channel	Single Channel 42 (5210 MHz)
99% Occupied Bandwidth (MHz)	75.573
Measurement uncertainty (kHz)	<±146.28

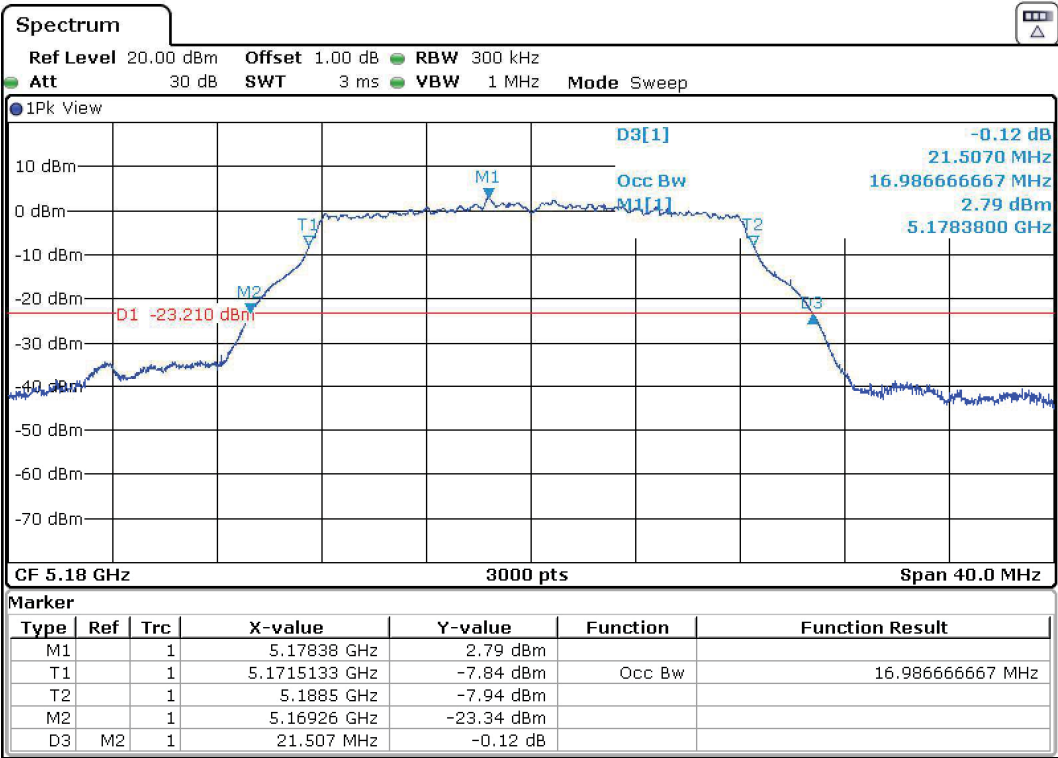
U-NII-3 (5725-5850 MHz)

Channel	Single Channel 155 (5775 MHz)
99% Occupied Bandwidth (MHz)	75.627
Measurement uncertainty (kHz)	<±146.28

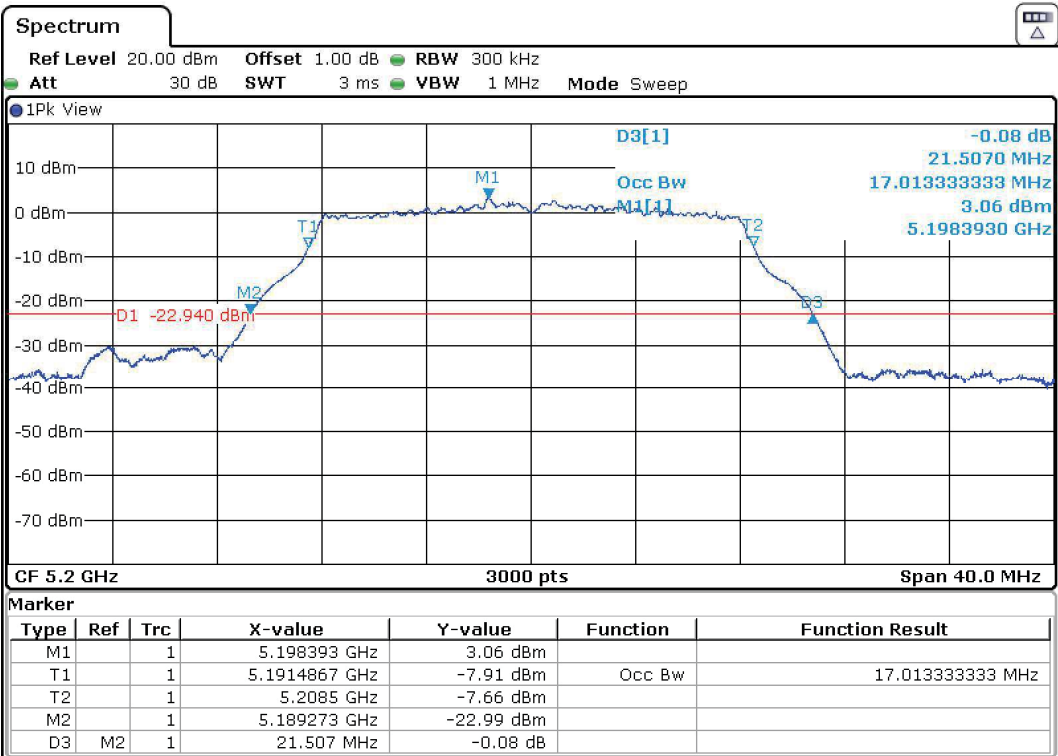
Mode 802.11 a20:

U-NII-1 (5150-5250 MHz)

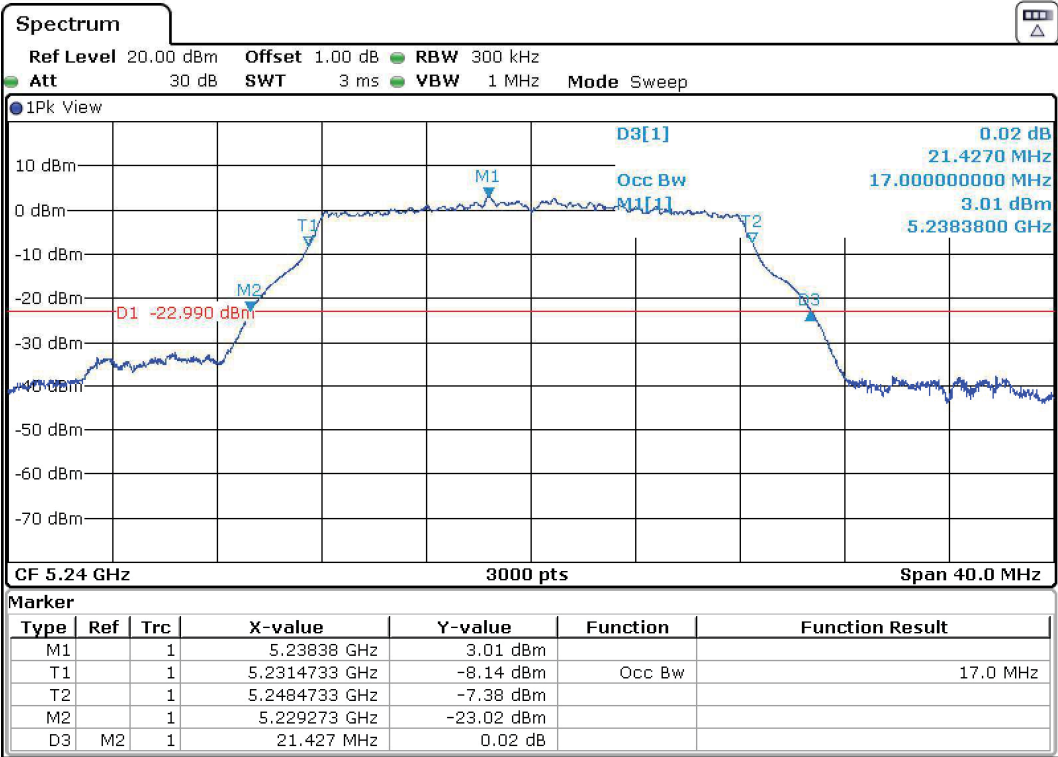
- Low Channel 36 (5180 MHz):



- Middle Channel 40 (5200 MHz):

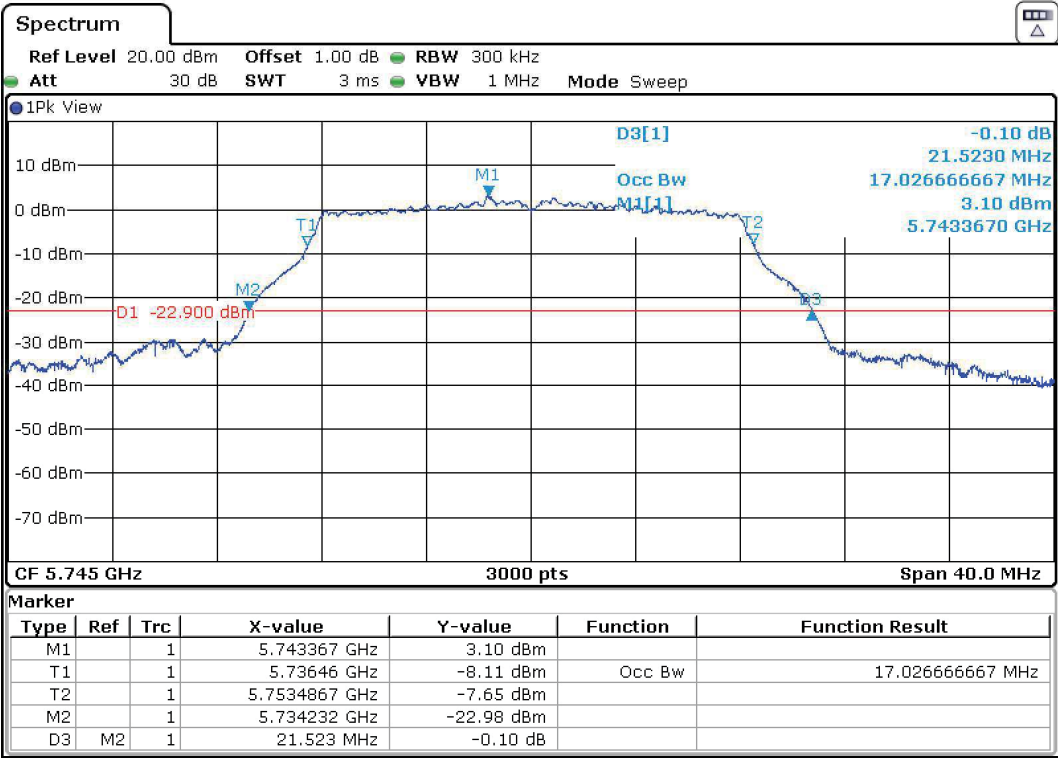


- High Channel 48 (5240 MHz):

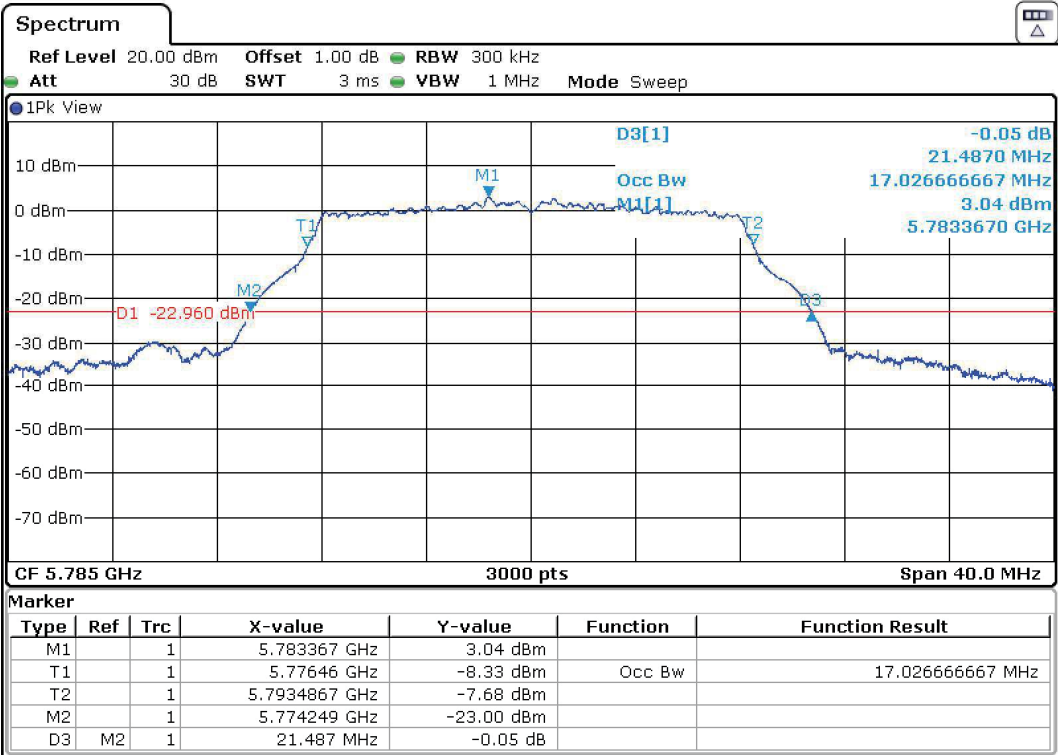


U-NII-3 (5725-5850 MHz)

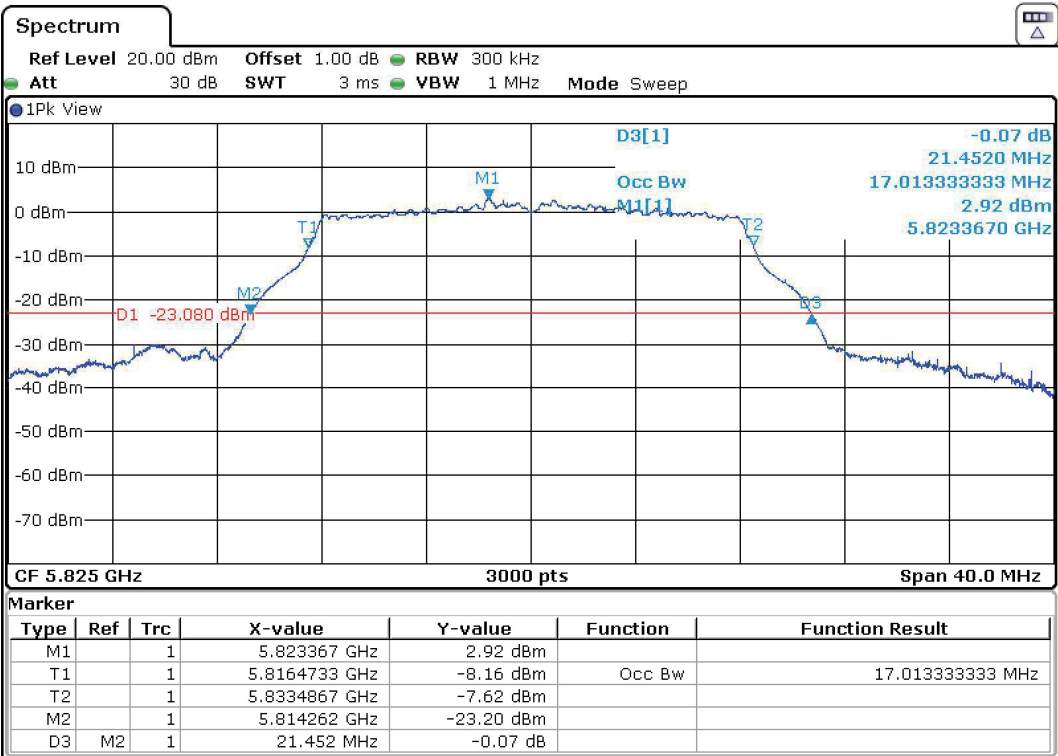
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):



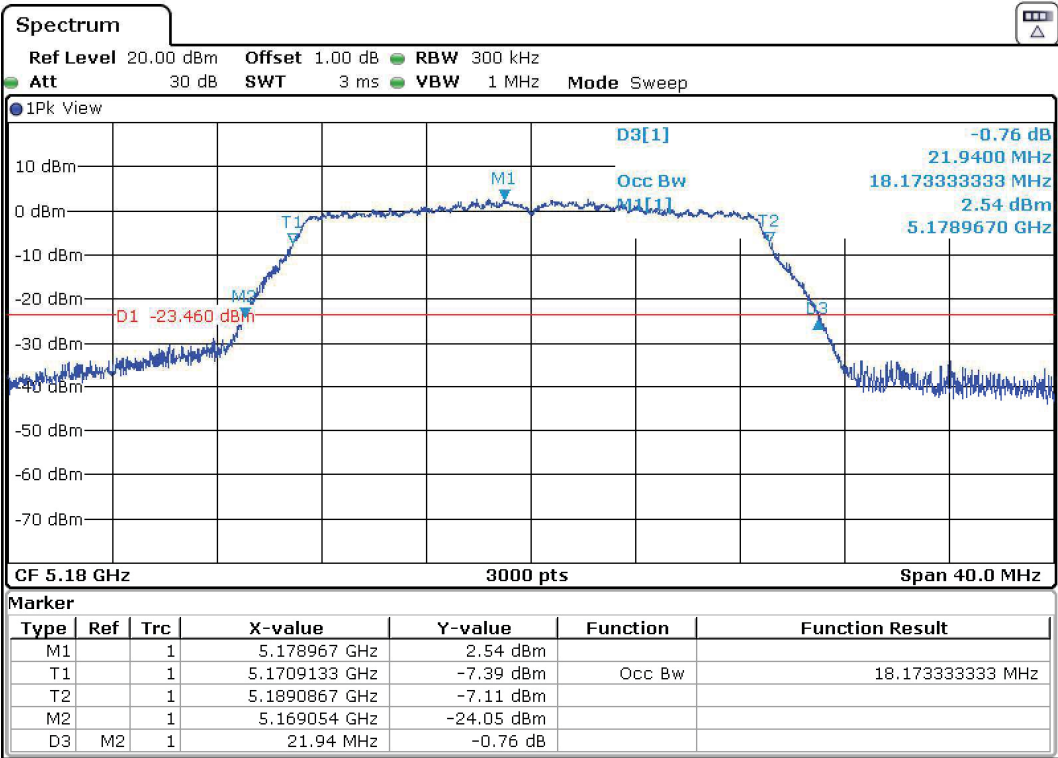
- High Channel 165 (5825 MHz):



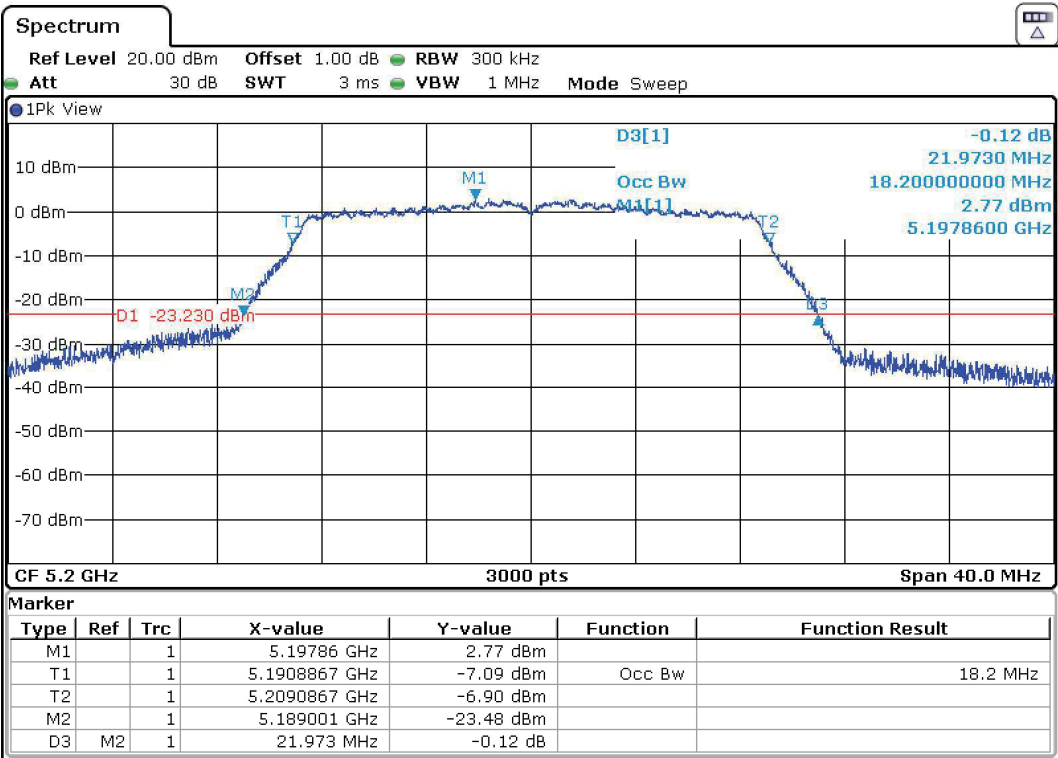
Mode 802.11 n20 HT20:

U-NII-1 (5150-5250 MHz)

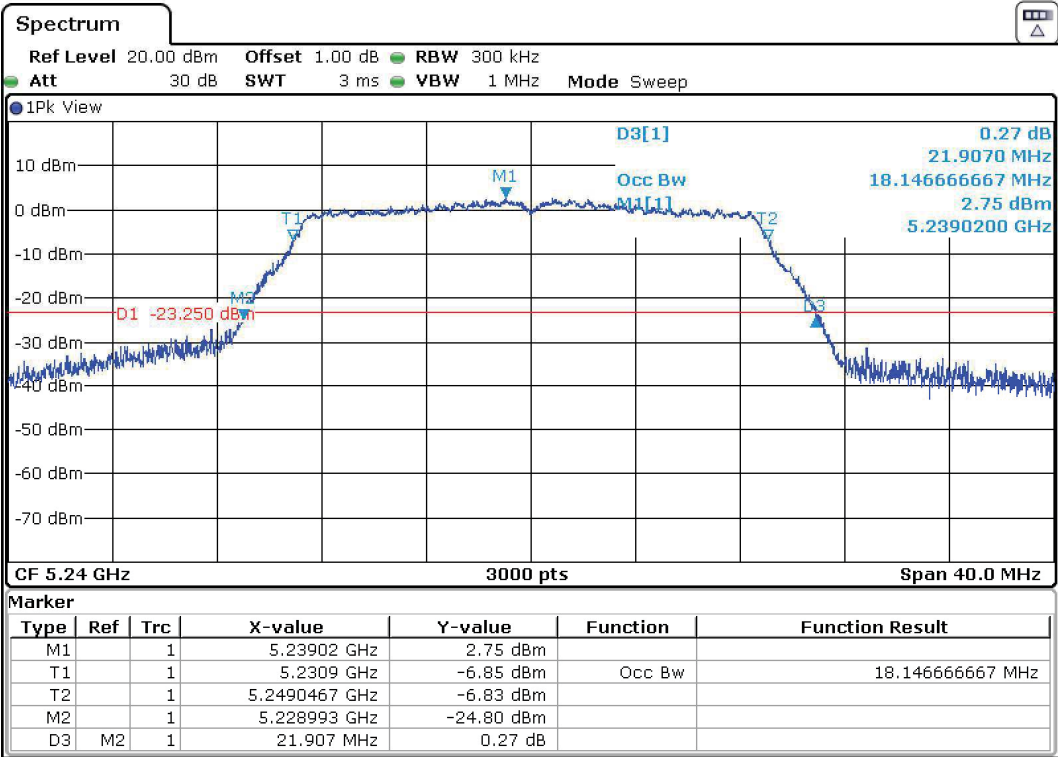
- Low Channel 36 (5180 MHz):



- Middle Channel 40 (5200 MHz):

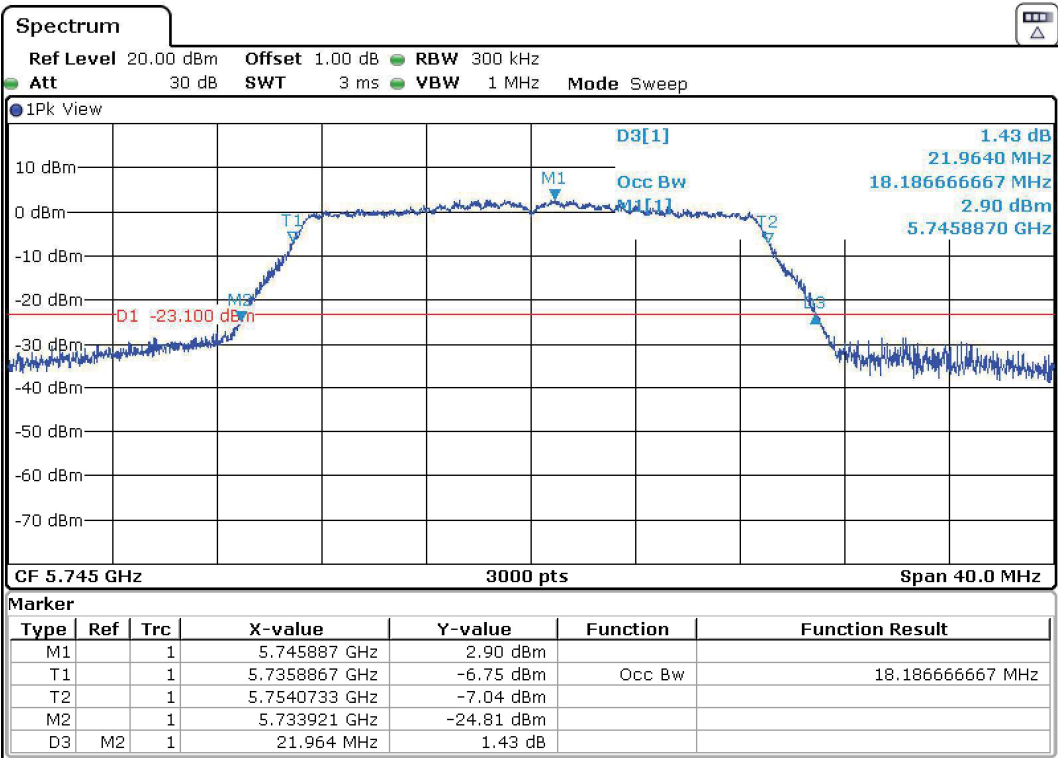


- High Channel 48 (5240 MHz):

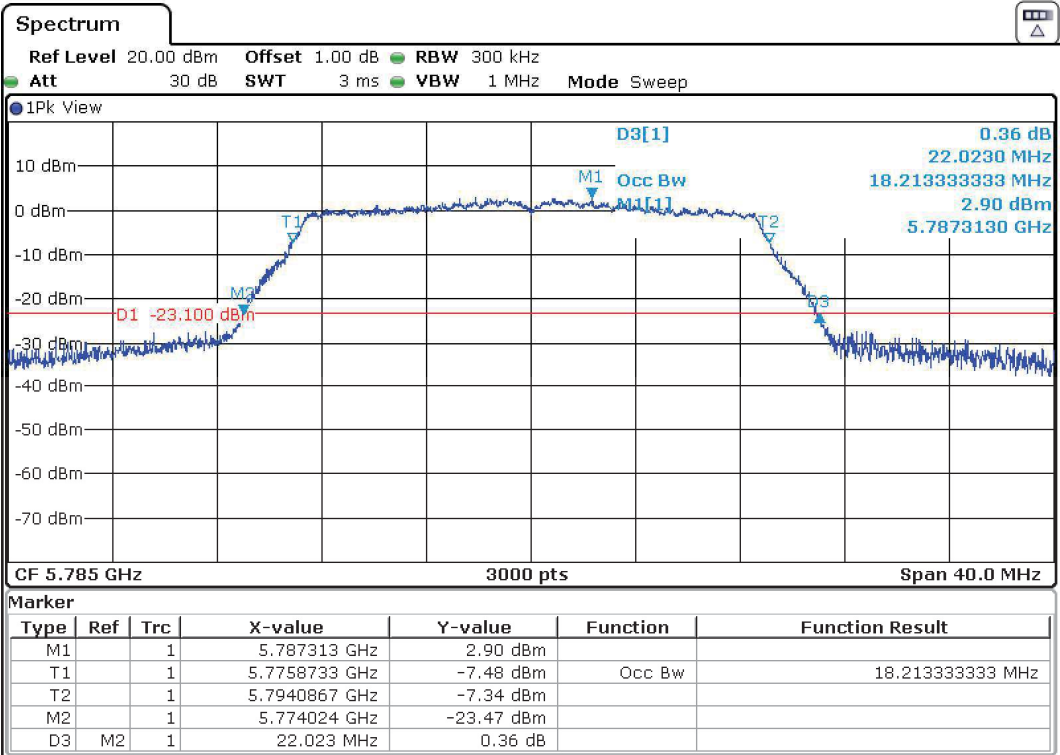


U-NII-3 (5725-5850 MHz)

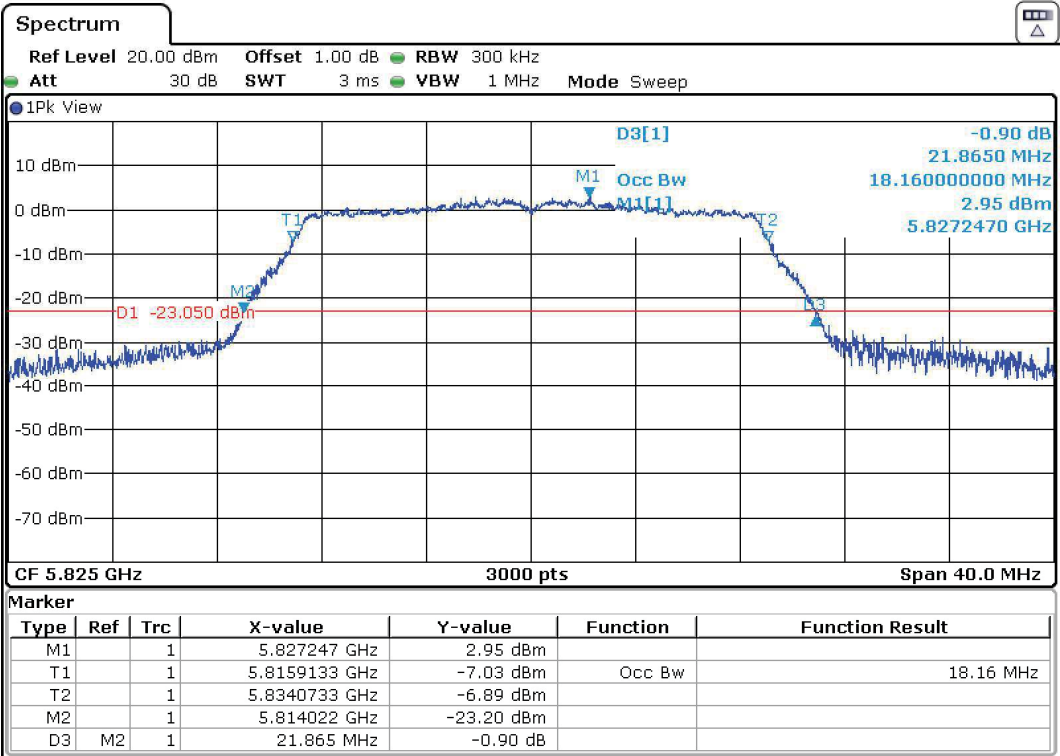
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):



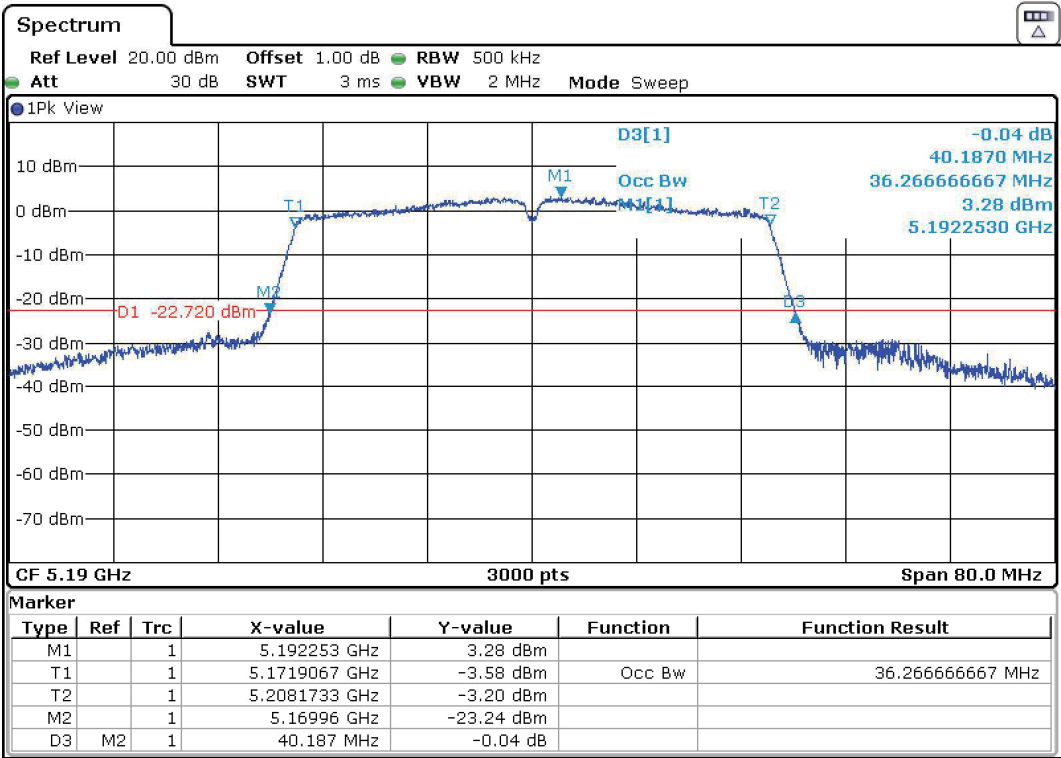
- High Channel 165 (5825 MHz):



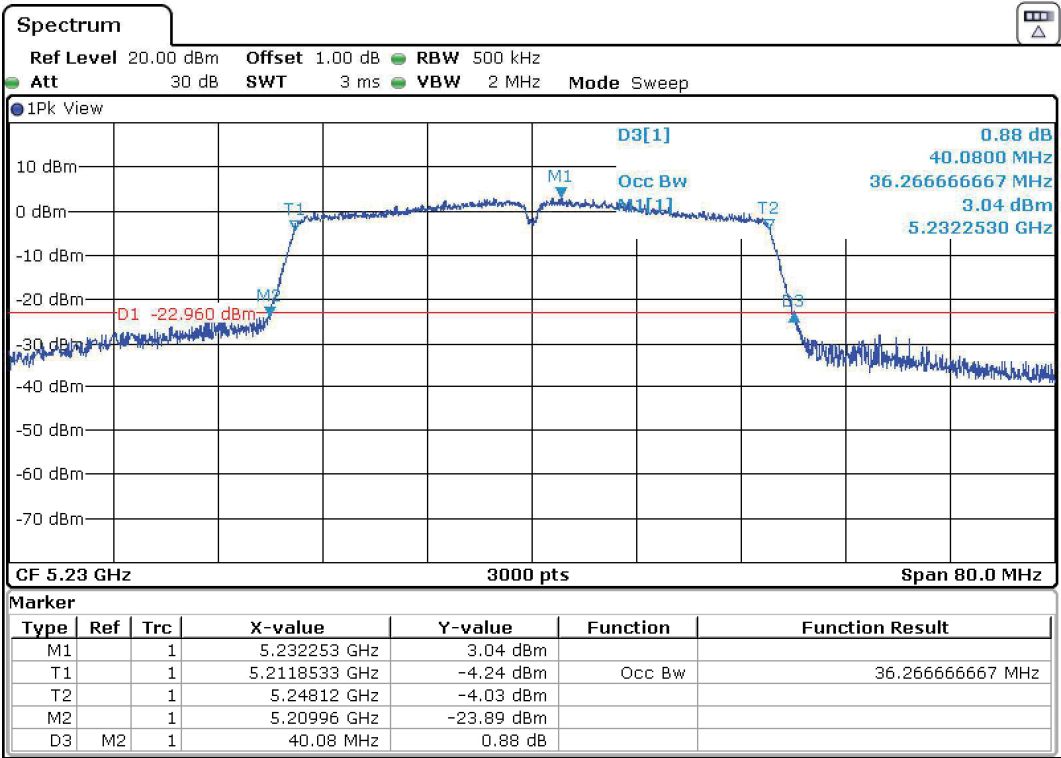
Mode 802.11 n40 (HT40):

U-NII-1 (5150-5250 MHz)

- Low Channel 38 (5190 MHz):



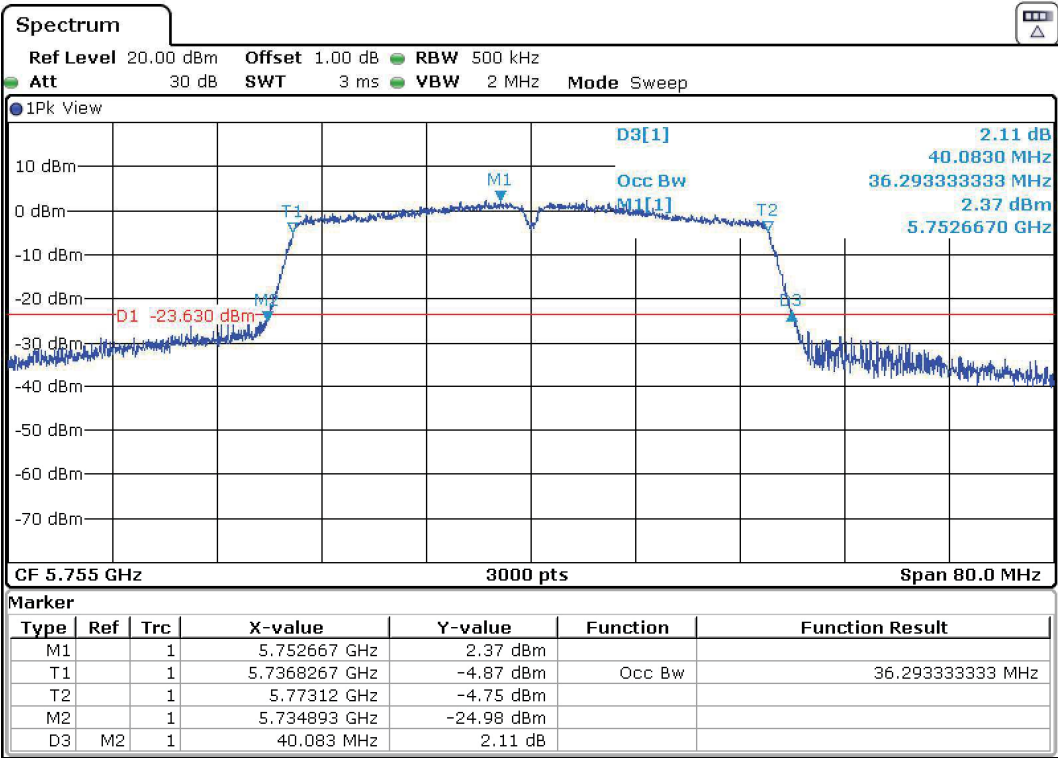
- High Channel 46 (5230 MHz):



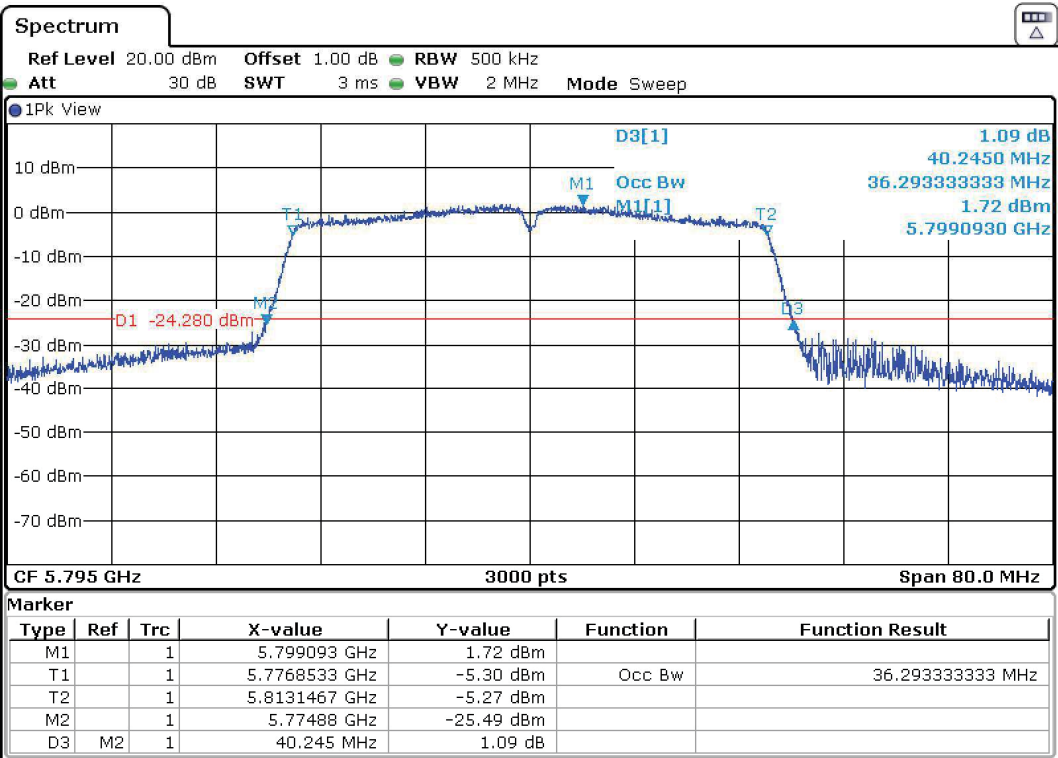
Mode 802.11 ac40 (VHT40):

U-NII-3 (5725-5850 MHz)

- Low Channel 151 (5755 MHz):



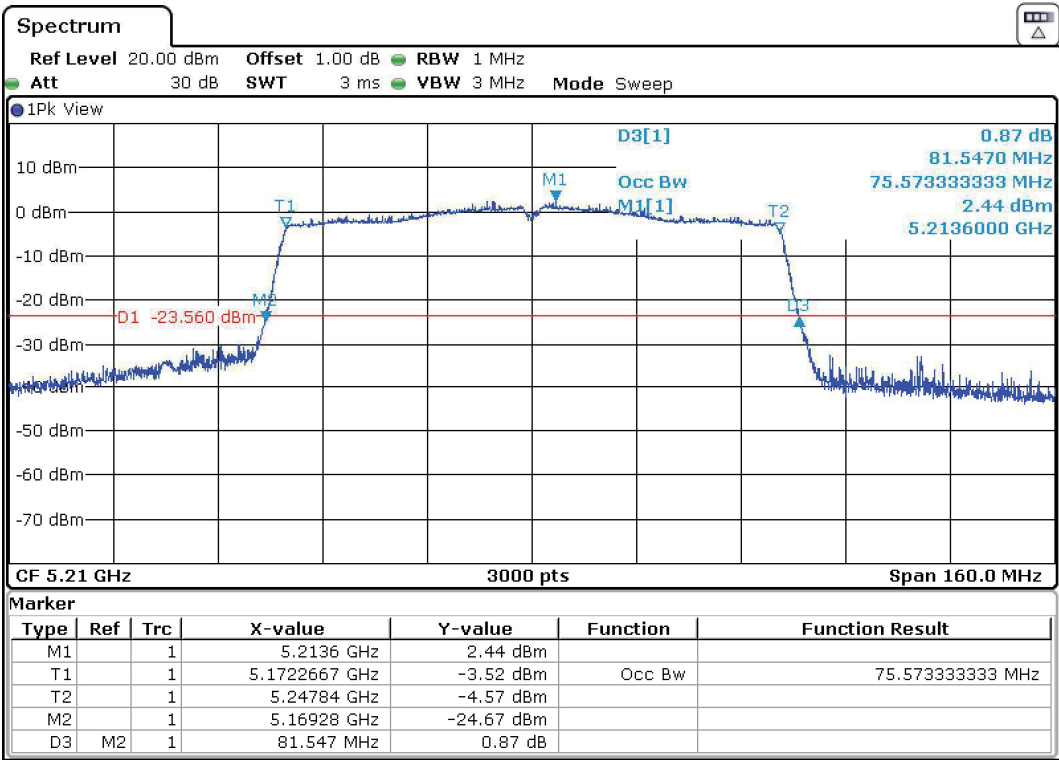
- High Channel 159 (5795 MHz):



Mode 802.11 ac80 (VHT80):

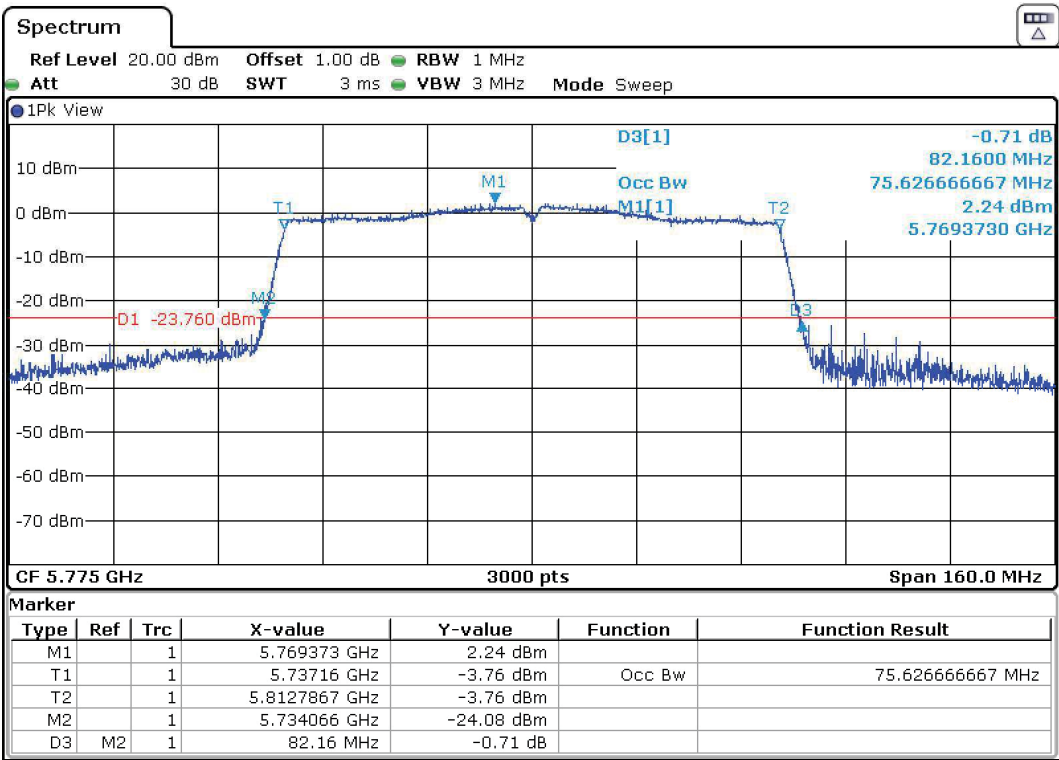
U-NII-1 (5150-5250 MHz)

- Single Channel 42 (5210 MHz):



U-NII-3 (5725-5850 MHz)

- Single Channel 155 (5775 MHz):



FCC 15.403 (i) 26 dB Emission Bandwidth (EBW)

RESULTS:

The 26 dB Emission Bandwidth was measured using the method according to point C) 1) of 789033 D02 General UNII Test Procedures New Rules v02r01.

The following modes and data rates were selected based on preliminary testing that identified those corresponding to the worst cases:

- 802.11a: 6 Mbit/s.
- 802.11n HT20: MCS0.
- 802.11n HT40: MCS0.
- 802.11ac VHT40: MCS0.
- 802.11ac VHT80: MCS0

Tests performed on the SISO mode CORE-0_Port3 Antenna.

SISO CORE-0_Port3 Antenna:

Mode 802.11 a20:

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
26 dB Emission Bandwidth (MHz)	21.507	21.507	21.427
Measurement uncertainty (kHz)	<±42.34		

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
26 dB Emission Bandwidth (MHz)	21.523	21.487	21.452
Measurement uncertainty (kHz)	<±42.34		

Mode 802.11 n20 (HT20):

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
26 dB Emission Bandwidth (MHz)	21.940	21.973	21.907
Measurement uncertainty (kHz)	<±42.34		

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
26 dB Emission Bandwidth (MHz)	21.964	22.023	21.865
Measurement uncertainty (kHz)	<±42.34		

Mode 802.11 n40 (HT40):

U-NII-1 (5150-5250 MHz)

Channels	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
26 dB Emission Bandwidth (MHz)	40.187	40.080
Measurement uncertainty (kHz)	<±73.14	

Mode 802.11 ac40 (VHT40):

U-NII-3 (5725-5850 MHz)

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
26 dB Emission Bandwidth (MHz)	40.083	40.245
Measurement uncertainty (kHz)	<±73.14	

Mode 802.11 ac80 (VHT80):

U-NII-1 (5150-5250 MHz)

Channel	Single Channel 42 (5210 MHz)
26 dB Emission Bandwidth (MHz)	81.547
Measurement uncertainty (kHz)	<±146.28

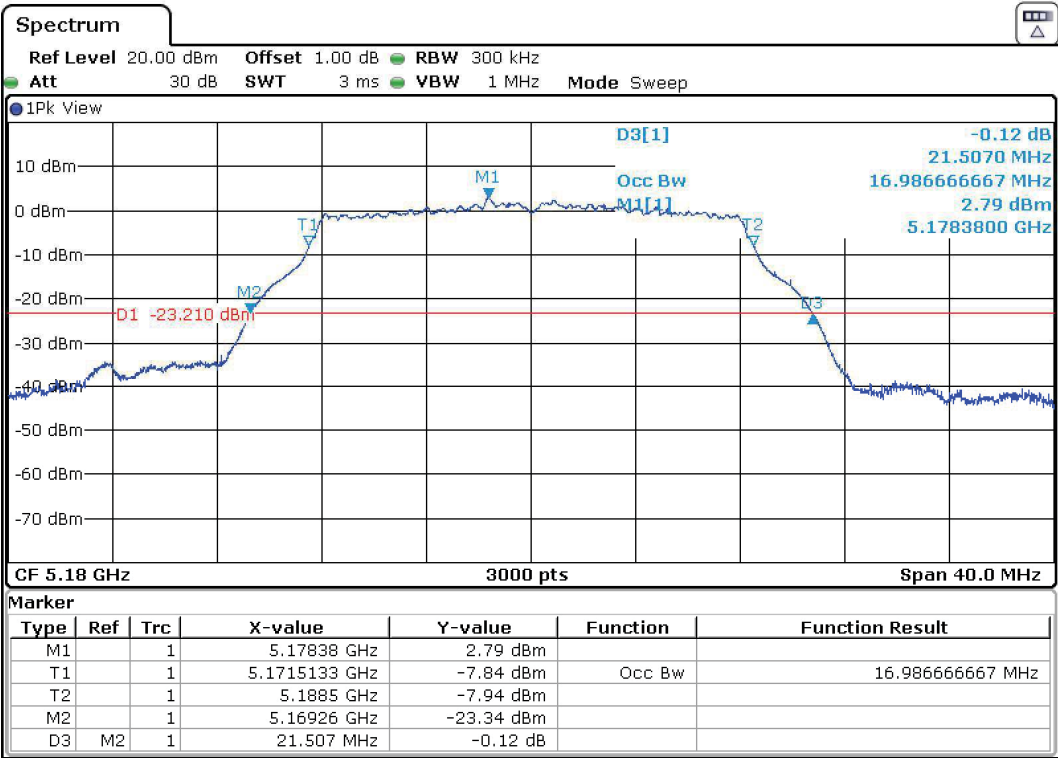
U-NII-3 (5725-5850 MHz)

Channel	Single Channel 155 (5775 MHz)
26 dB Emission Bandwidth (MHz)	82.160
Measurement uncertainty (kHz)	<±146.28

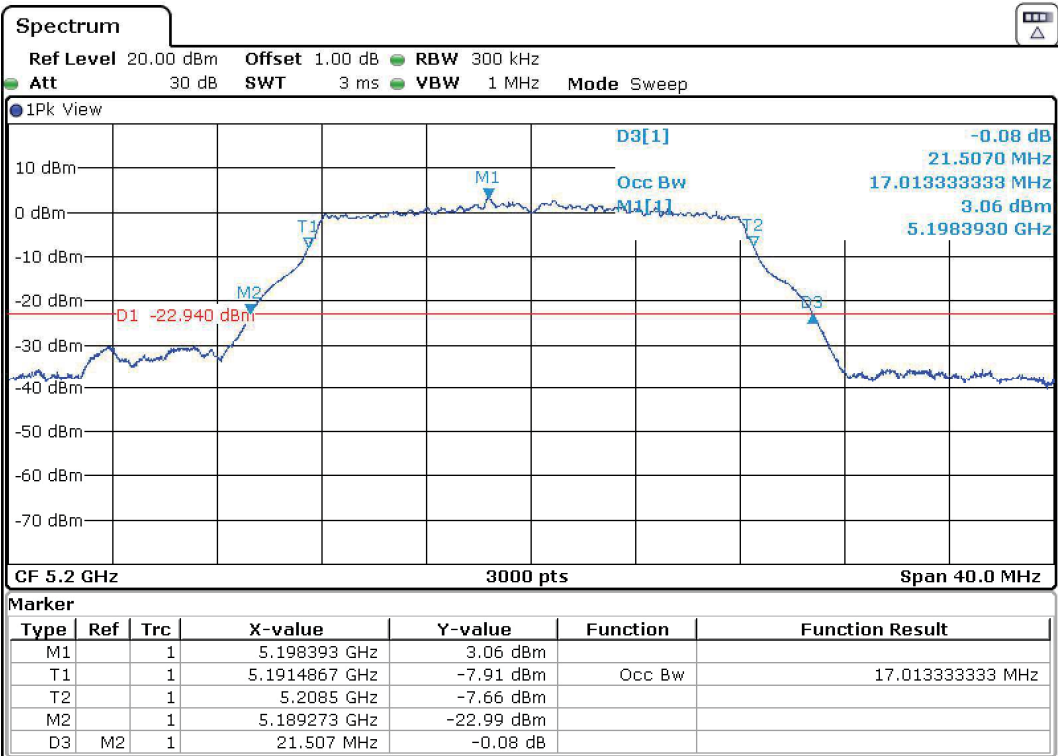
Mode 802.11 a20:

U-NII-1 (5150-5250 MHz)

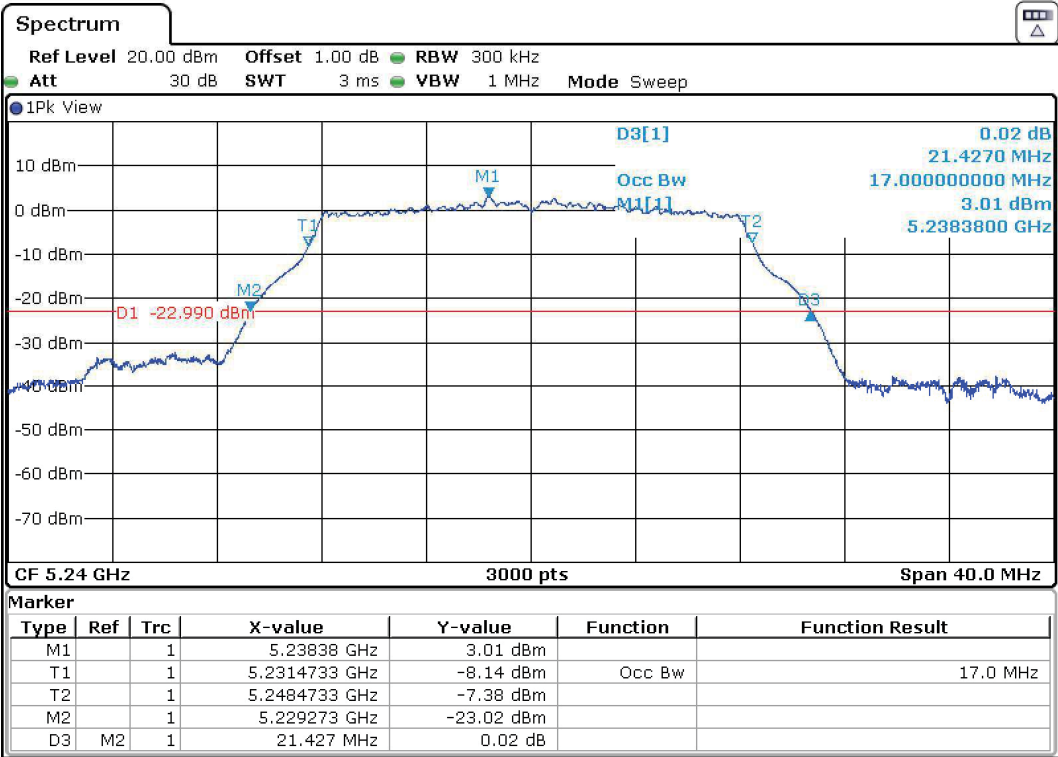
- Low Channel 36 (5180 MHz):



- Middle Channel 40 (5200 MHz):

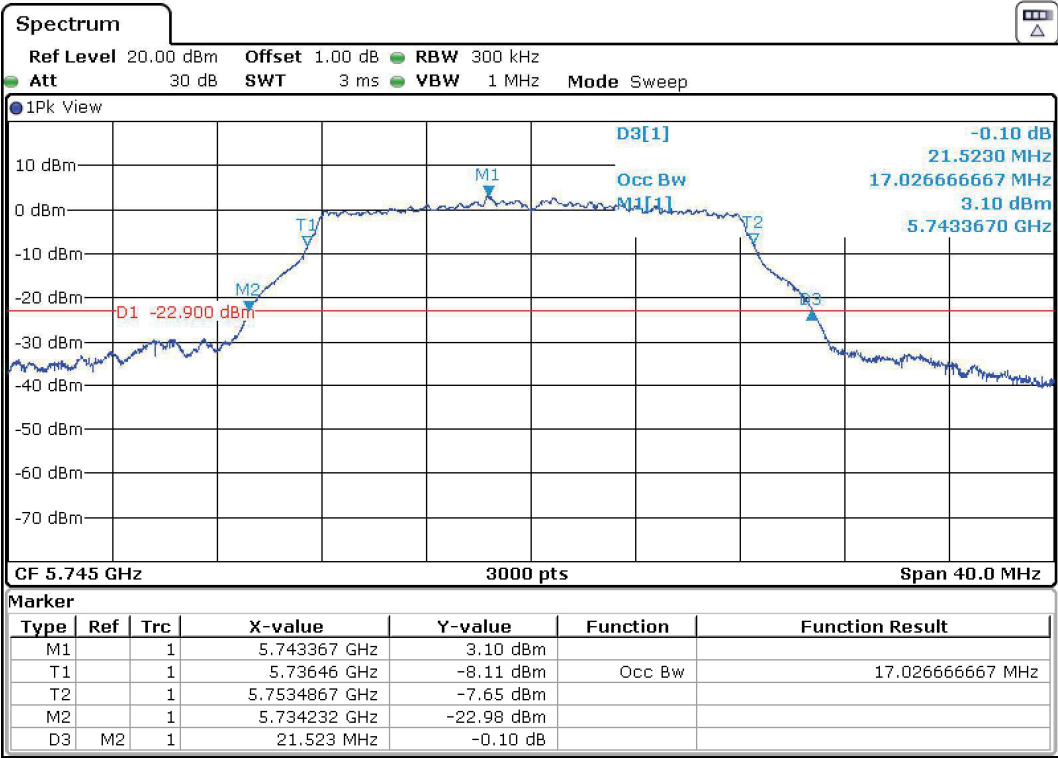


- High Channel 48 (5240 MHz):

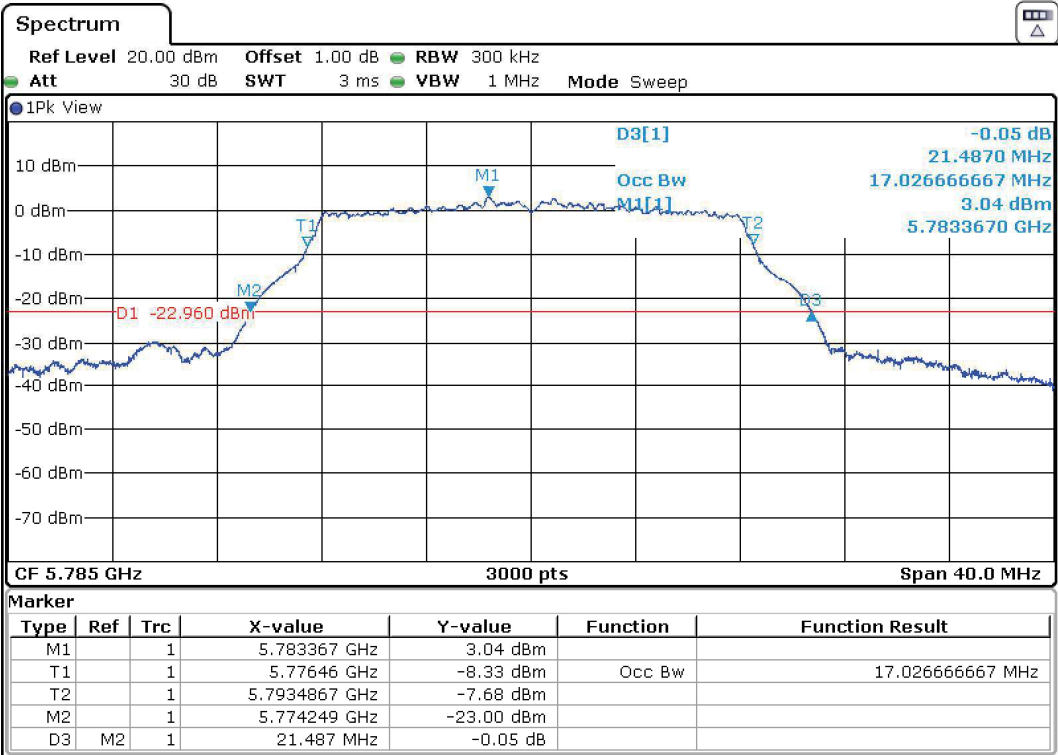


U-NII-3 (5725-5850 MHz)

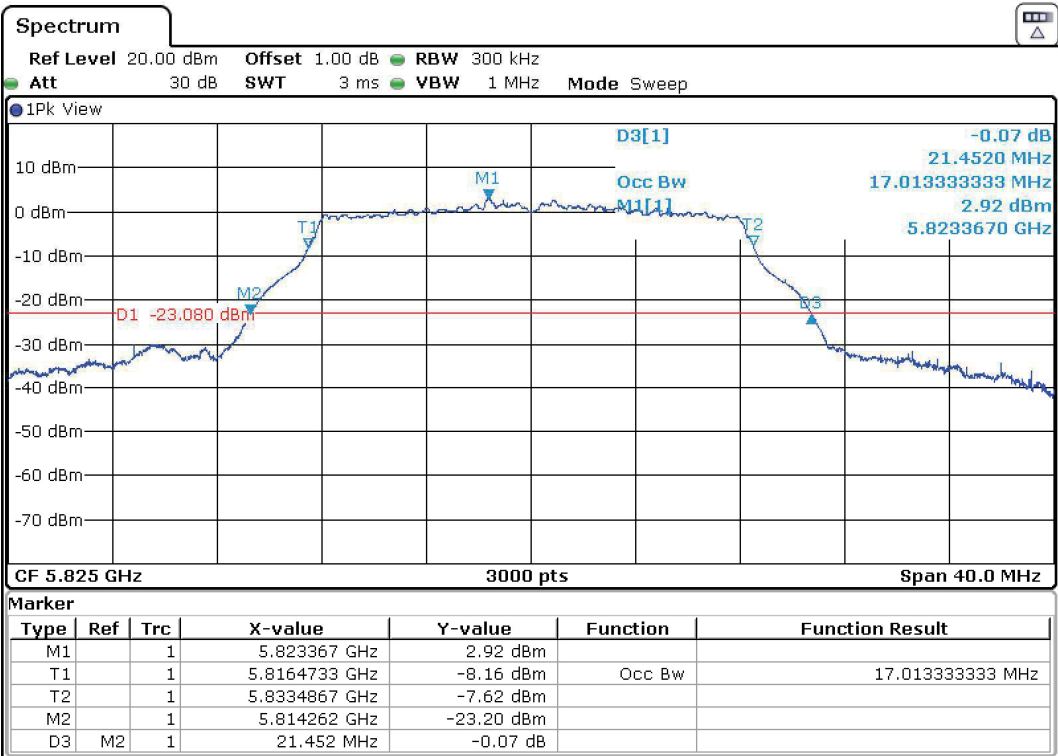
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):



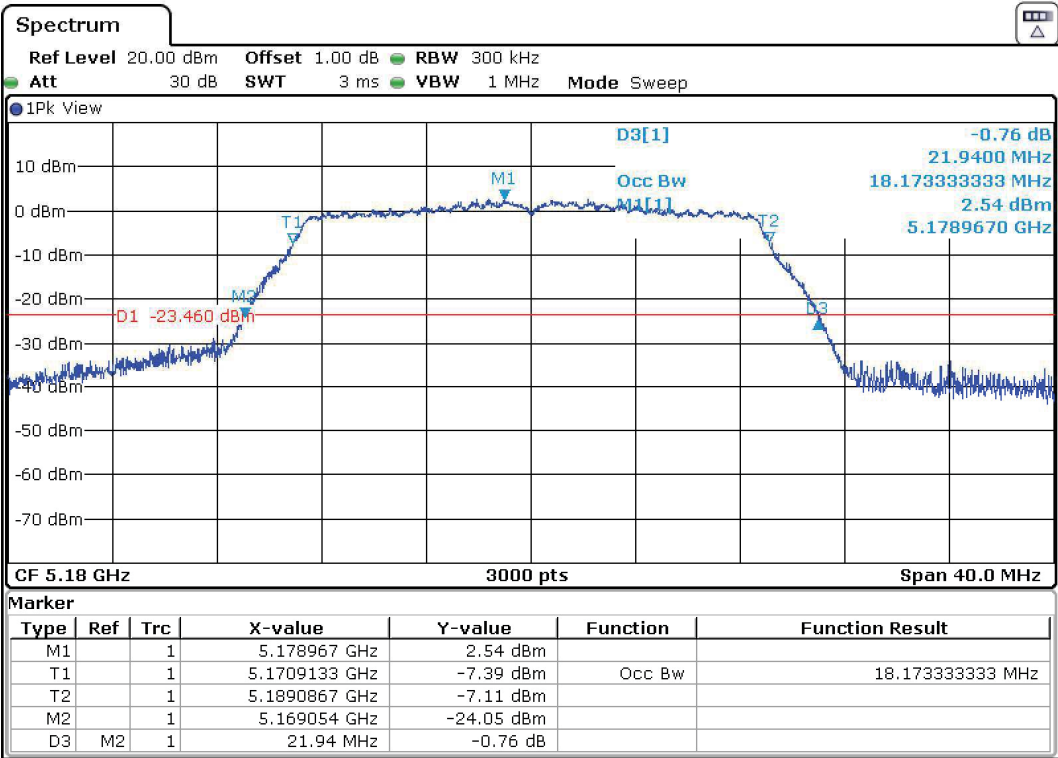
- High Channel 165 (5825 MHz):



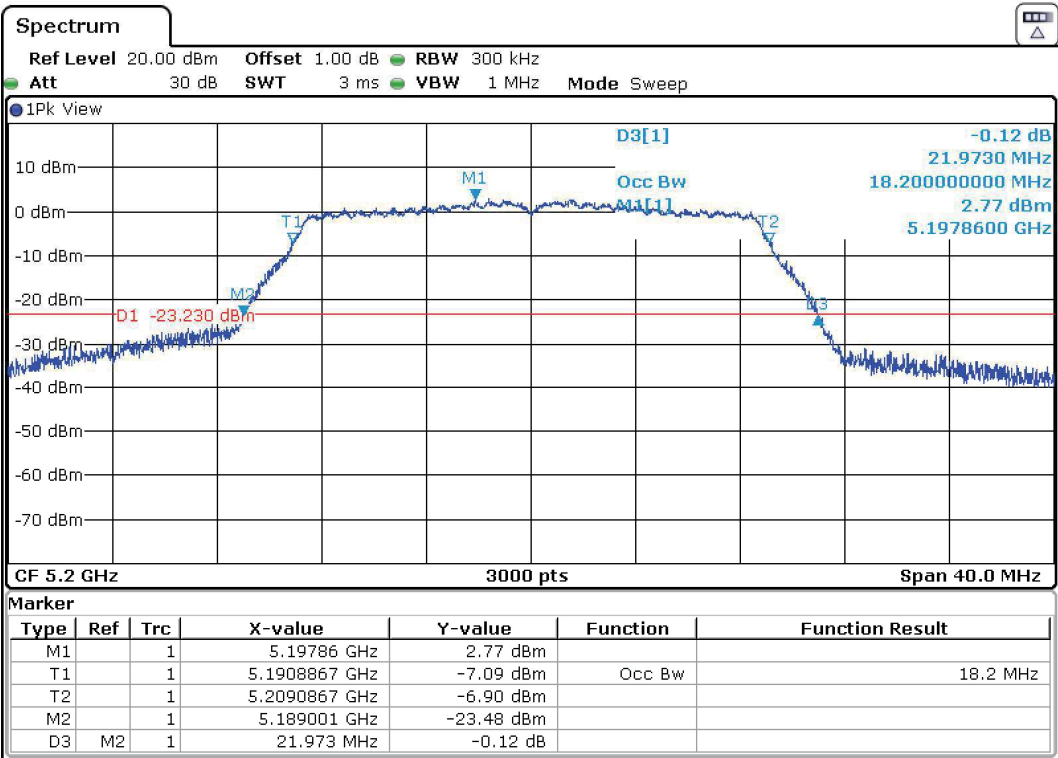
Mode 802.11 n20 HT20:

U-NII-1 (5150-5250 MHz)

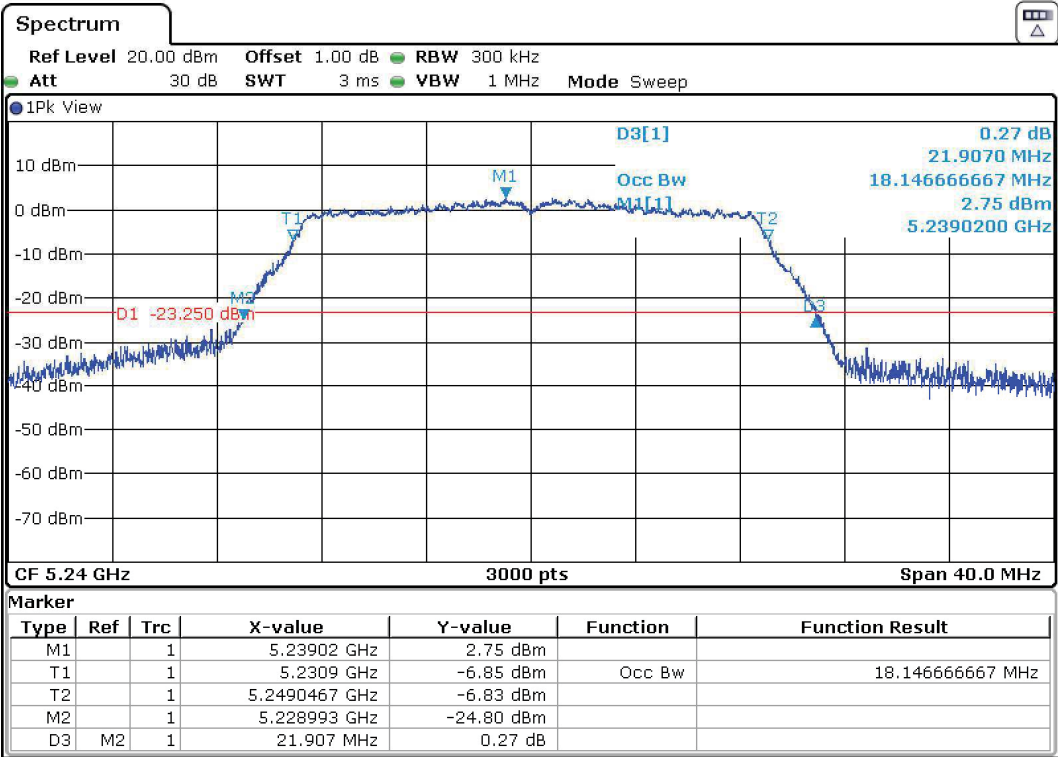
- Low Channel 36 (5180 MHz):



- Middle Channel 40 (5200 MHz):

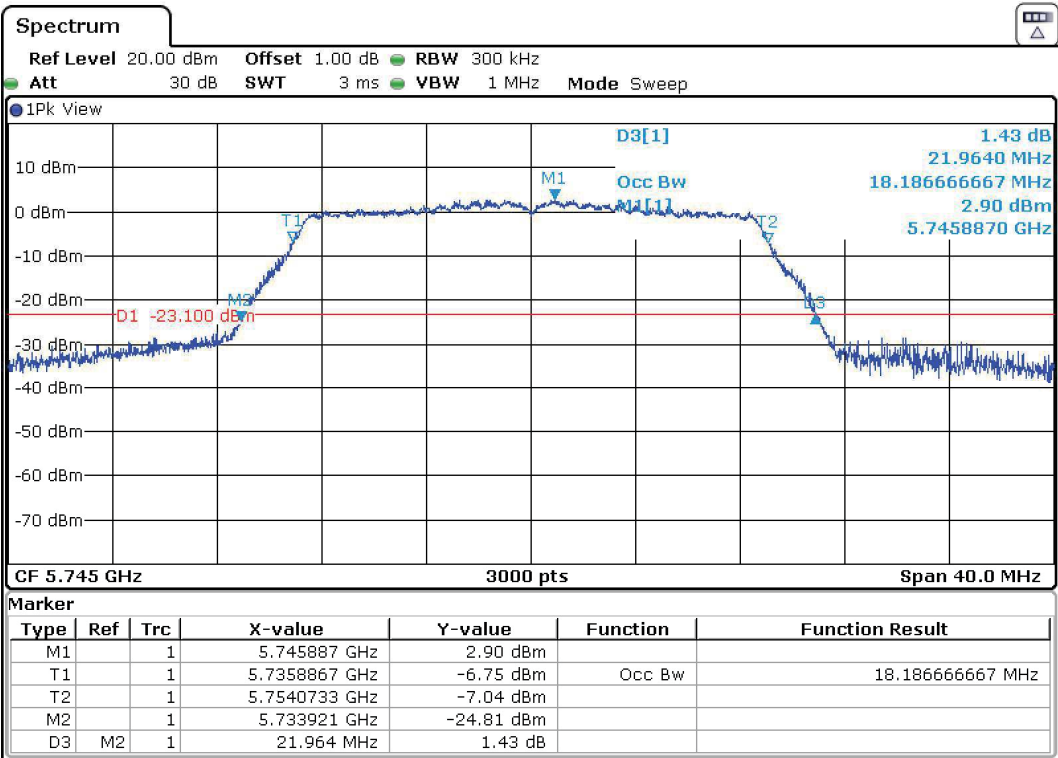


- High Channel 48 (5240 MHz):

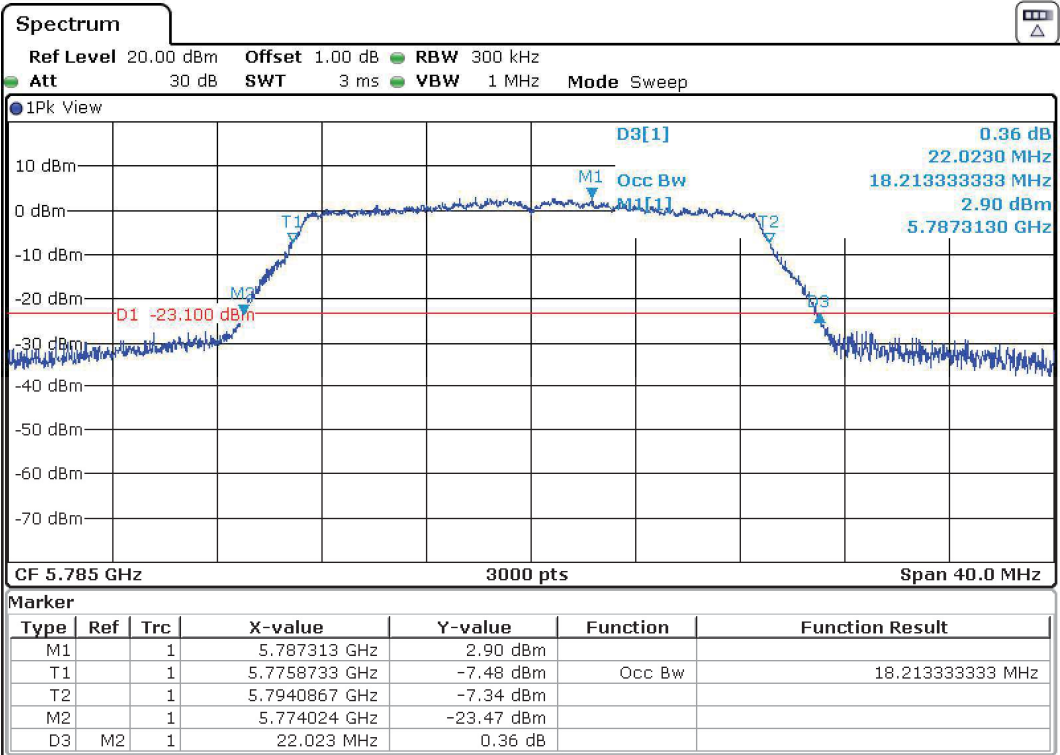


U-NII-3 (5725-5850 MHz)

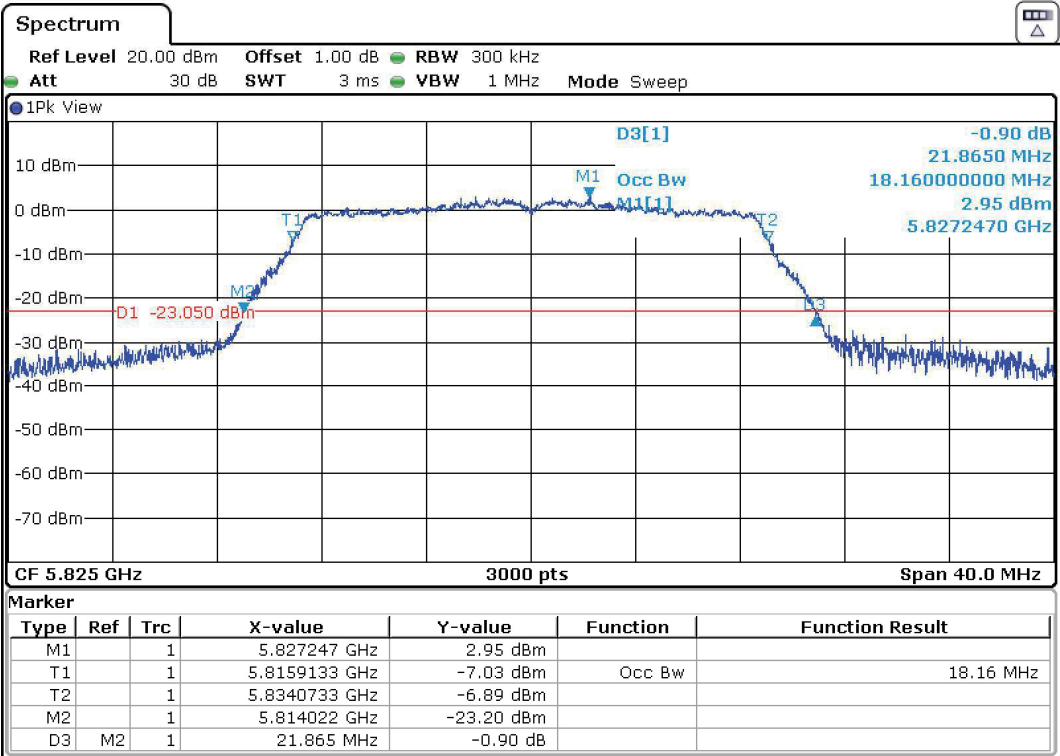
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):



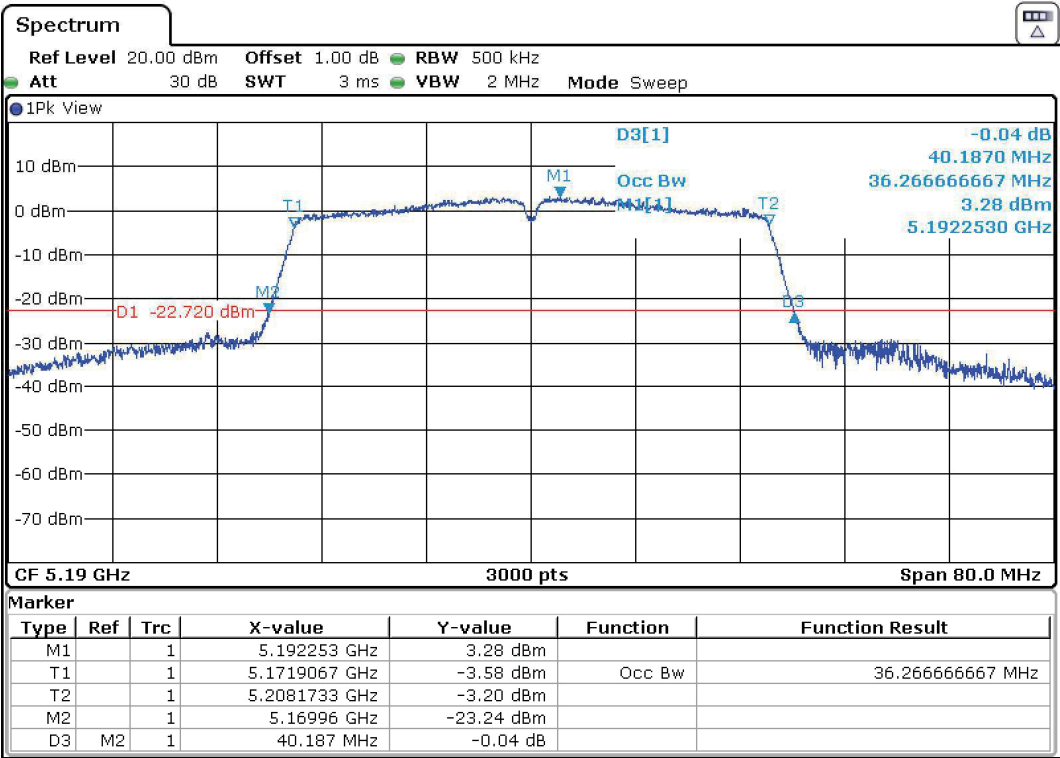
- High Channel 165 (5825 MHz):



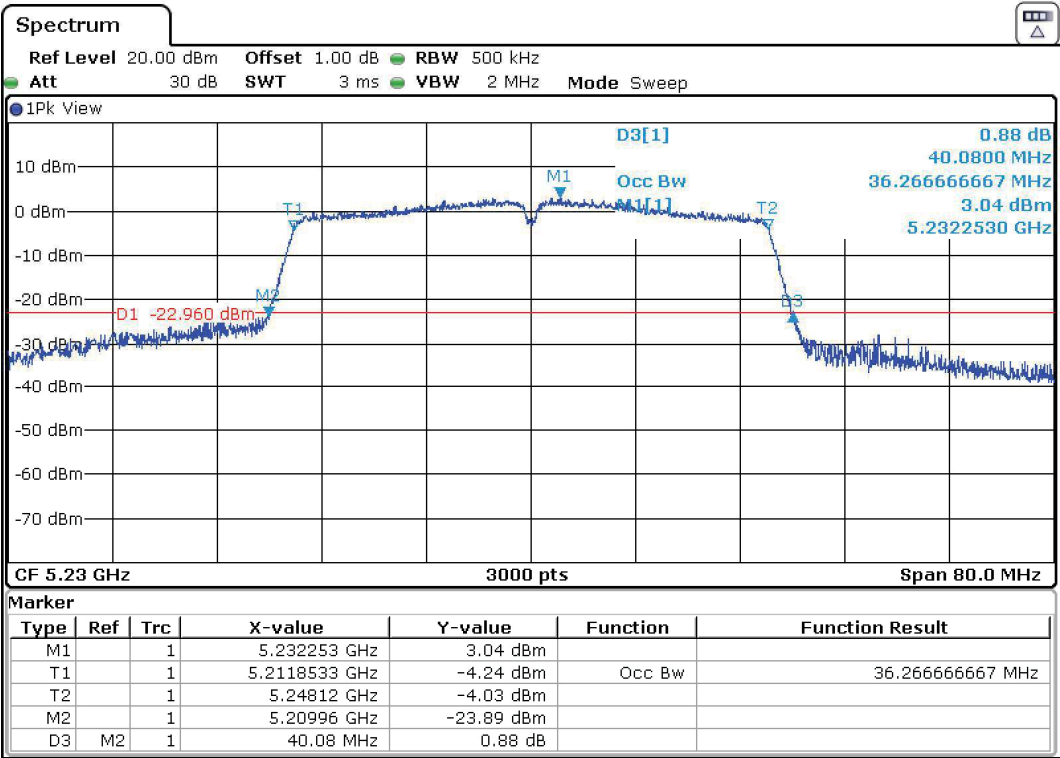
Mode 802.11 n40 (HT40):

U-NII-1 (5150-5250 MHz)

- Low Channel 38 (5190 MHz):



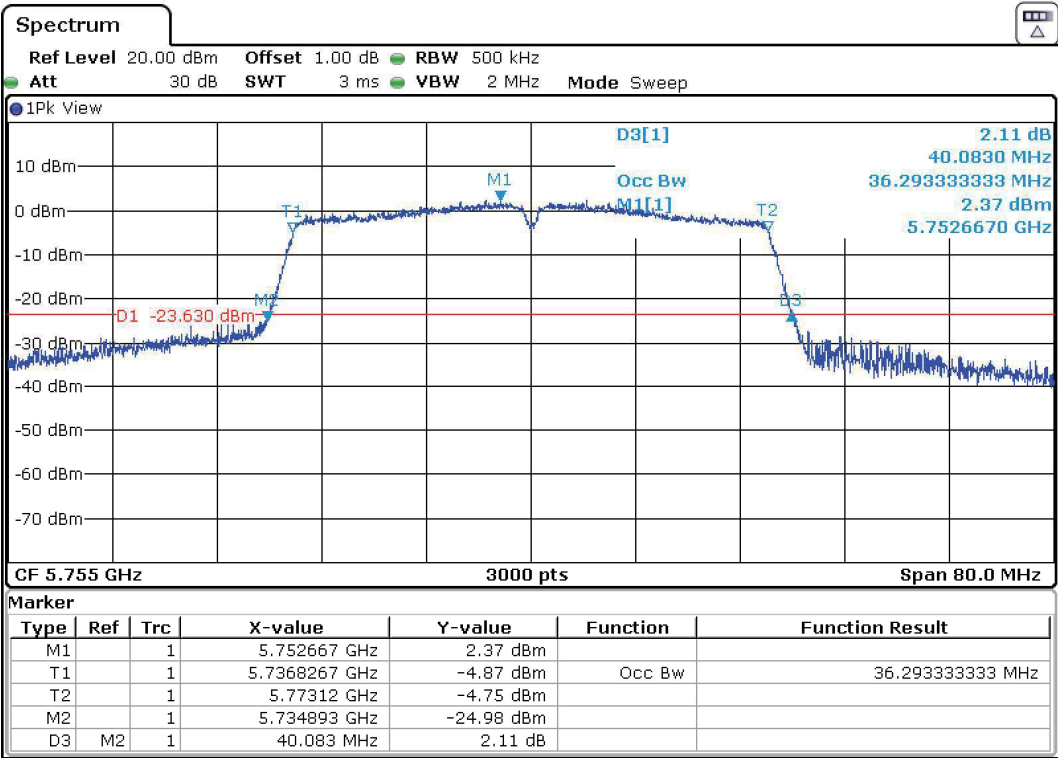
- High Channel 46 (5230 MHz):



Mode 802.11 ac40 (VHT40):

U-NII-3 (5725-5850 MHz)

- Low Channel 151 (5755 MHz):



- High Channel 159 (5795 MHz):

