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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.

DEKRA Testing and Certification is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

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

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification and the Accreditation Bodies.

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 MGU F is an automotive head unit to be installed in cars with the following features: Bluetooth, WLAN, 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 Nº	Description	Model	Serial Nº	Date of reception
56925B/058	Automotive Infotainment System	MGU F	B264D$0K8951102	2019/08/07
56925B/053	GSM Antenna	--	--	2019/05/30
56925B/054	GSM Antenna	--	--	2019/05/30
56925B/055	GSM Antenna	--	--	2019/05/30
56925B/015	Harness	--	--	2019/05/30
56925B/024	Interface Board	--	--	2019/05/30

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

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

Control Nº	Description	Model	Serial Nº	Date of reception
56925B/056	Automotive Infotainment System	MGU F	B264D40K8951047	2019/08/07
56925B/015	Harness	--	--	2019/05/30
56925B/024	Interface Board	--	--	2019/05/30

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

Test sample description

Ports…… :	Port name and description	Cable					
		Specified length [m]	Attached during test	Shielded			
	Not provided data		☐	☐			
Supplymentary information to the ports…… :	Not provided data						
Rated power supply .....:	Voltage and Frequency	Reference poles					
		L1	L2	L3	N	PE	
	☒ DC: 12Vdc.						
Rated Power .....:	Not provided data						
Clock frequencies.....:	Not provided data						
Other parameters .....:	Not provided data						
Software version .....:	19w13.2-1-36						
Hardware version .....:	HW3.1						
Dimensions in mm (W x H x D)...:	Not provided data						
Mounting position .....:	☒ Other: Car radio						
Modules/parts.....:	Module/parts of test item	Type	Manufacturer				
	Not provided data						

Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH

BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-06-06
Date (finish)	2019-08-30

Document history

Report number	Date	Description
56925RRF.002	2019-11-06	First release

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
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 ºC Max. = 35 ºC
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: Nicolás Salguero, Cristina Calle, Ignacio Cabra, José Gabriel Pendón, José Manuel Jiménez, Francisco José Alcaide, Jaime Barranquero, Miguel Ángel Torres.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	EMI Test Receiver ROHDE AND SCHWARZ ESR7	2019/10	2021/10
3.	RF pre-amplifier 10 MHz-6 GHz Bonn Elektronik BLNA 0160-01N	2019/02	2020/025
4.	Biconical/Log Antenna ETS LINDGREN 3142E	2017/04	2020/04
5.	Spectrum analyser Rohde & Schwarz FSW50	2018/02	2020/02
6.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2019/04	2020/04
7.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2016/11	2019/11
8.	DC Power Supply Keysight Technologies U8002A	---	---
9.	Digital multimeter FLUKE 179	2019/06	2020/06
10.	RF Pre-amplifier 30 dB, 18 GHz-40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
11.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2018/07	2021/07

Conducted Measurements

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
2.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2017/07	2019/07
3.	Chamber HERAEUS VMT 04/35	2018/06	2020/06
4.	DC Power Supply 40V/40A Rohde & Schwarz NGPE40	2018/02	2021/02

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	Transmitter 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	Transmitter 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 (U-NII-1)

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	
Supplementary information and remarks: None.			

C. 5.725 GHz – 5.85 GHz Band (U-NII-3)

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.	Undesirable Radiated Emissions (Transmitter) 1 to 40 GHz	P	
Supplementary information and remarks: None.			

Appendix A: Test Common requirements for all bands

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

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

SPECIFICATION:

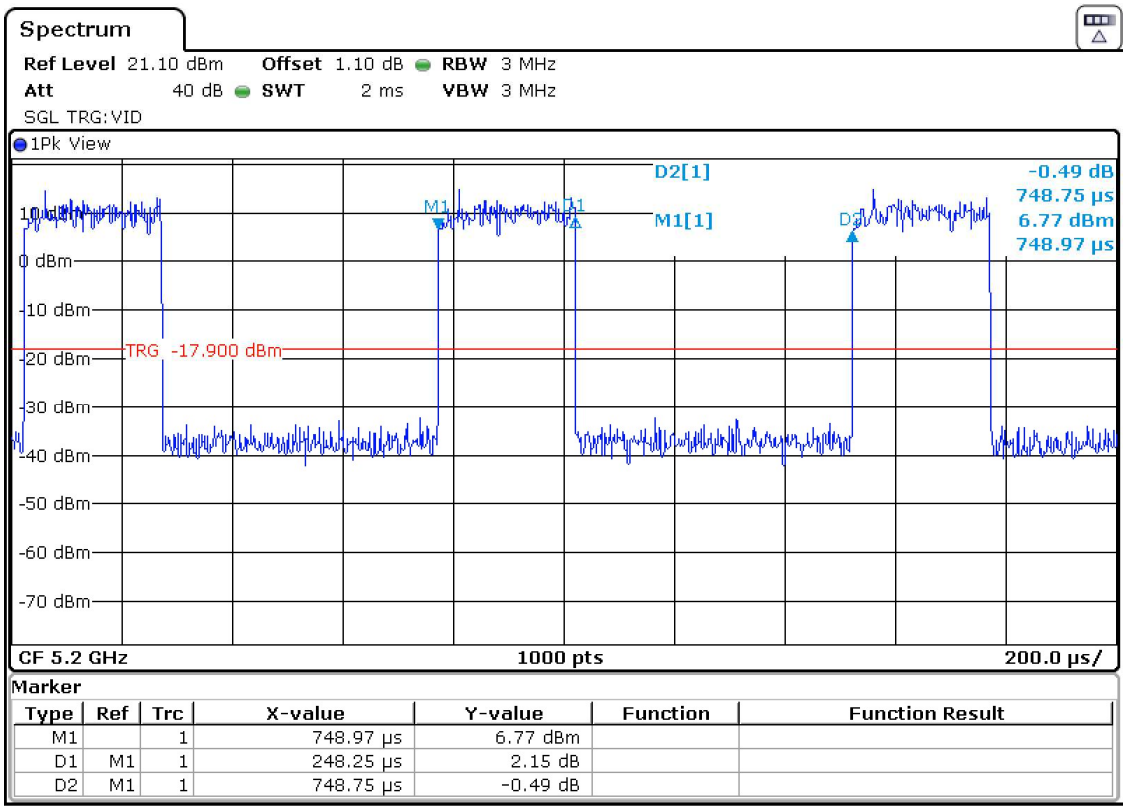
When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 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:

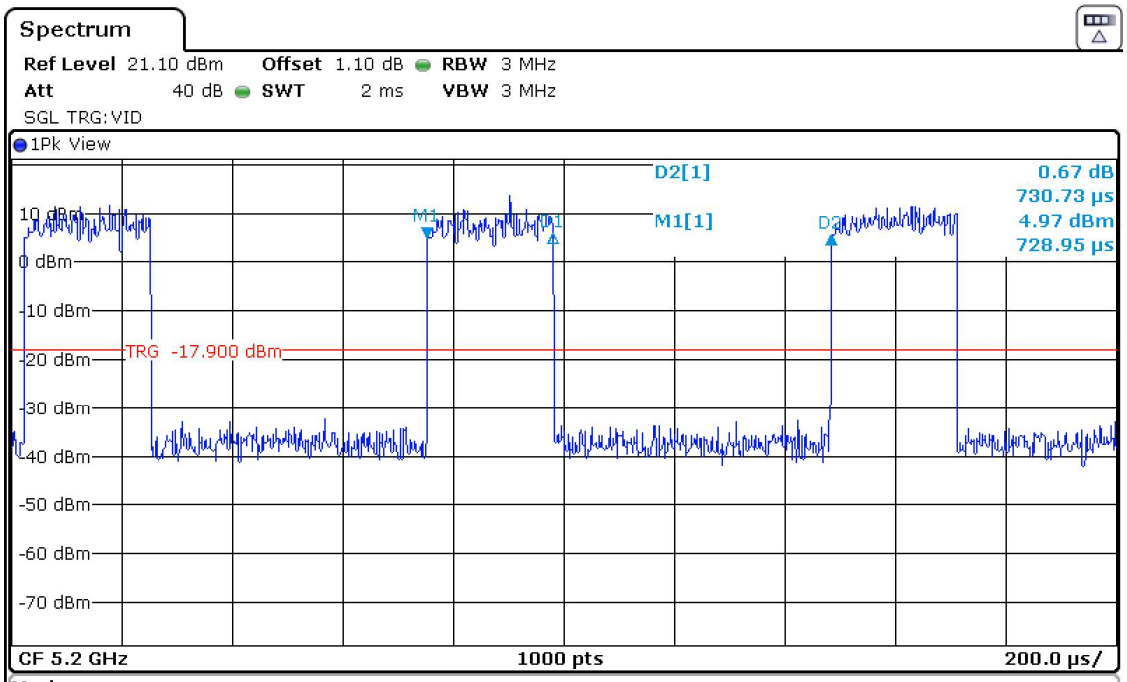
The results below are for data rates with a duty cycle less than 98%.

Mode	Pulse Duration (us)	Period (us)	Duty Cycle correction (dB)
802.11a / 20 MHz	248.248	748.749	4.794504971
802.11n / 20 MHz	228.23	730.73	5.053842073
802.11ac / 20 MHz	200.2	702.7	5.453058804
802.11n / 40 MHz	130.13	630.63	6.853971971
802.11ac / 40 MHz	114.11	612.61	7.298603764
802.11ac / 80 MHz	75.08	570.57	8.807846692

Mode 802.11 a20:



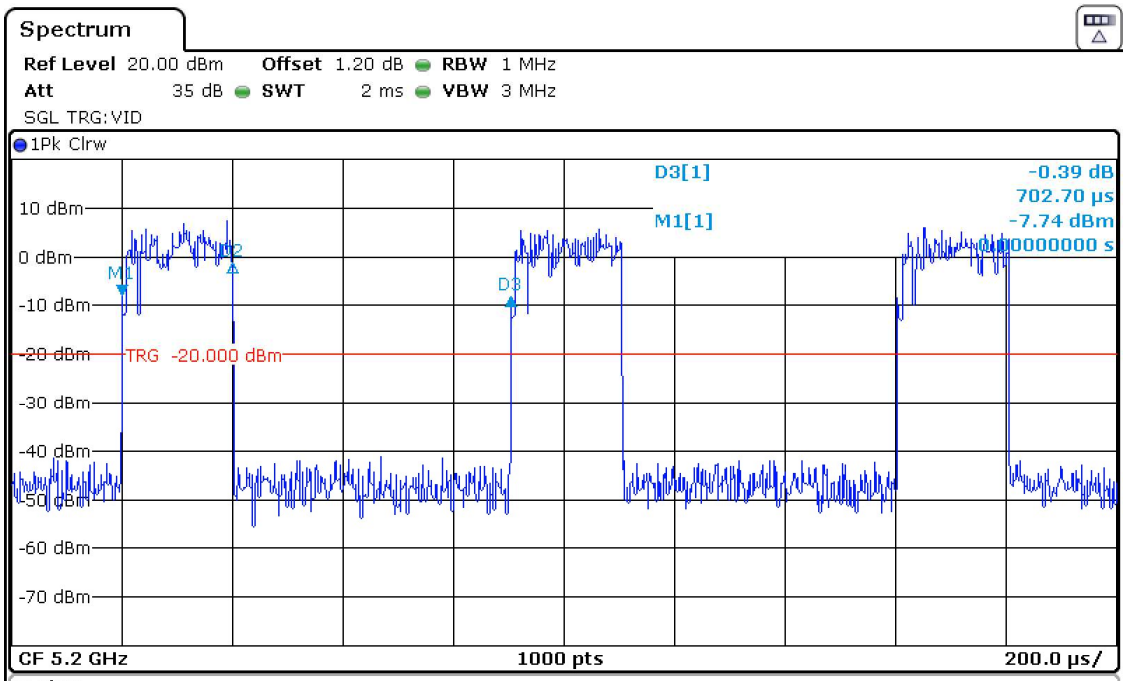
Mode 802.11 n20:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	728.95 µs	4.97 dBm		
D1	M1	1	228.23 µs	0.80 dB		
D2	M1	1	730.73 µs	0.67 dB		

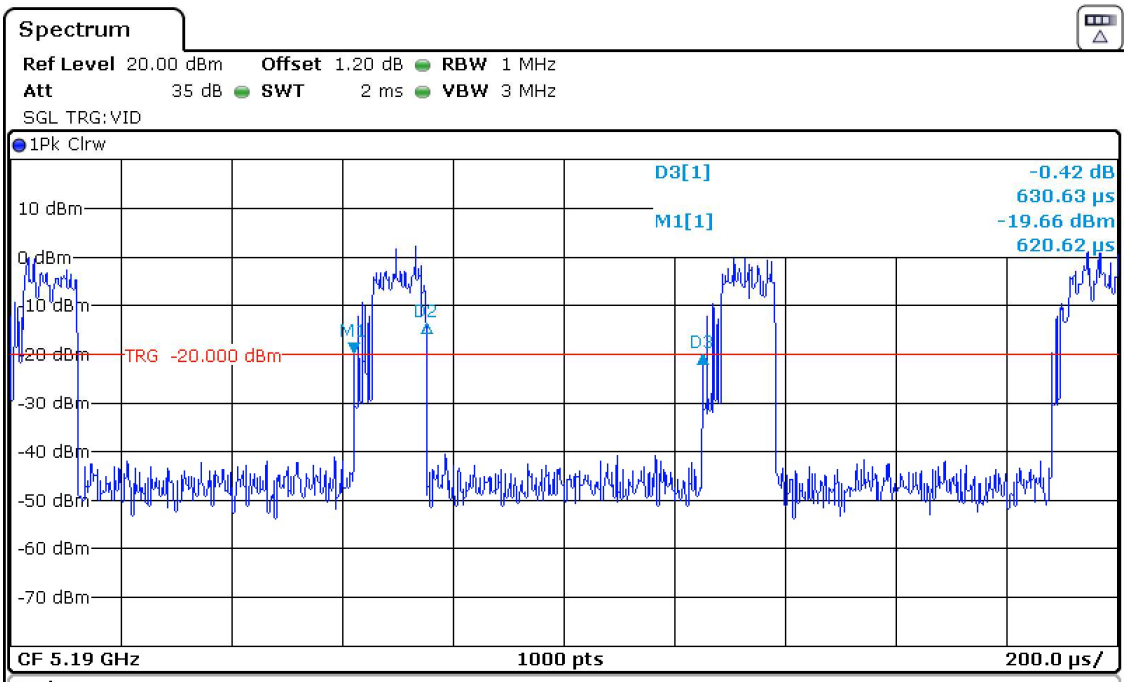
Mode 802.11 ac20:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	-1.3 as	-7.74 dBm		
D2	M1	1	200.2 µs	6.40 dB		
D3	M1	1	702.7 µs	-0.39 dB		

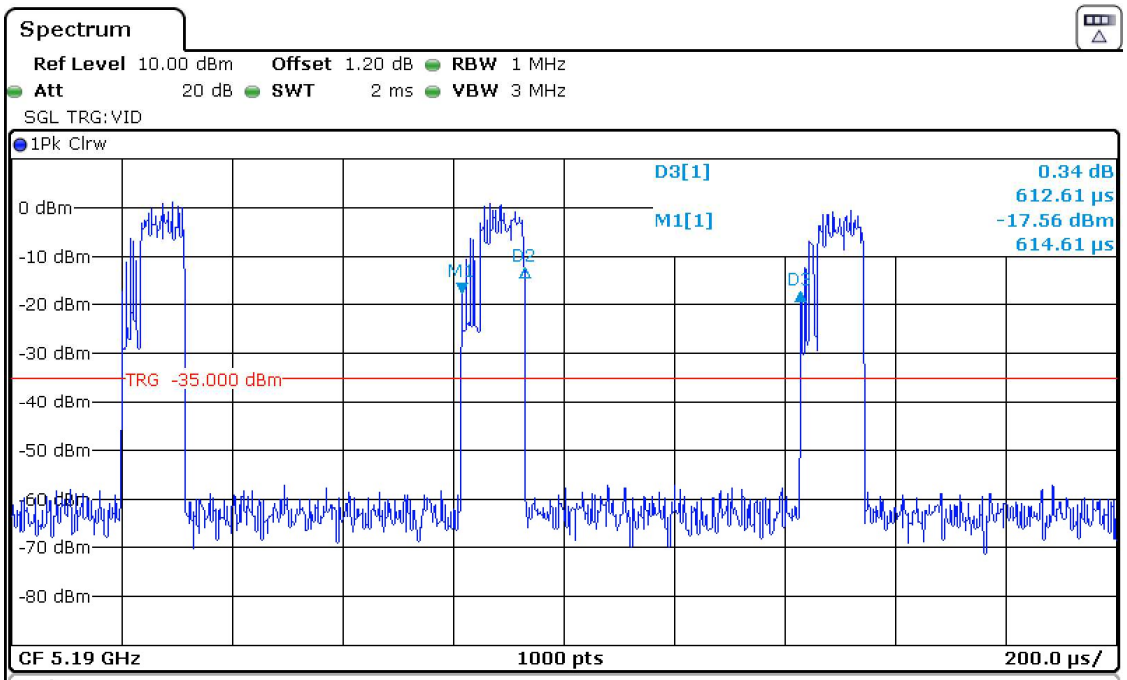
Mode 802.11 n40:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	620.62 µs	-19.66 dBm		
D2	M1	1	130.13 µs	5.96 dB		
D3	M1	1	630.63 µs	-0.42 dB		

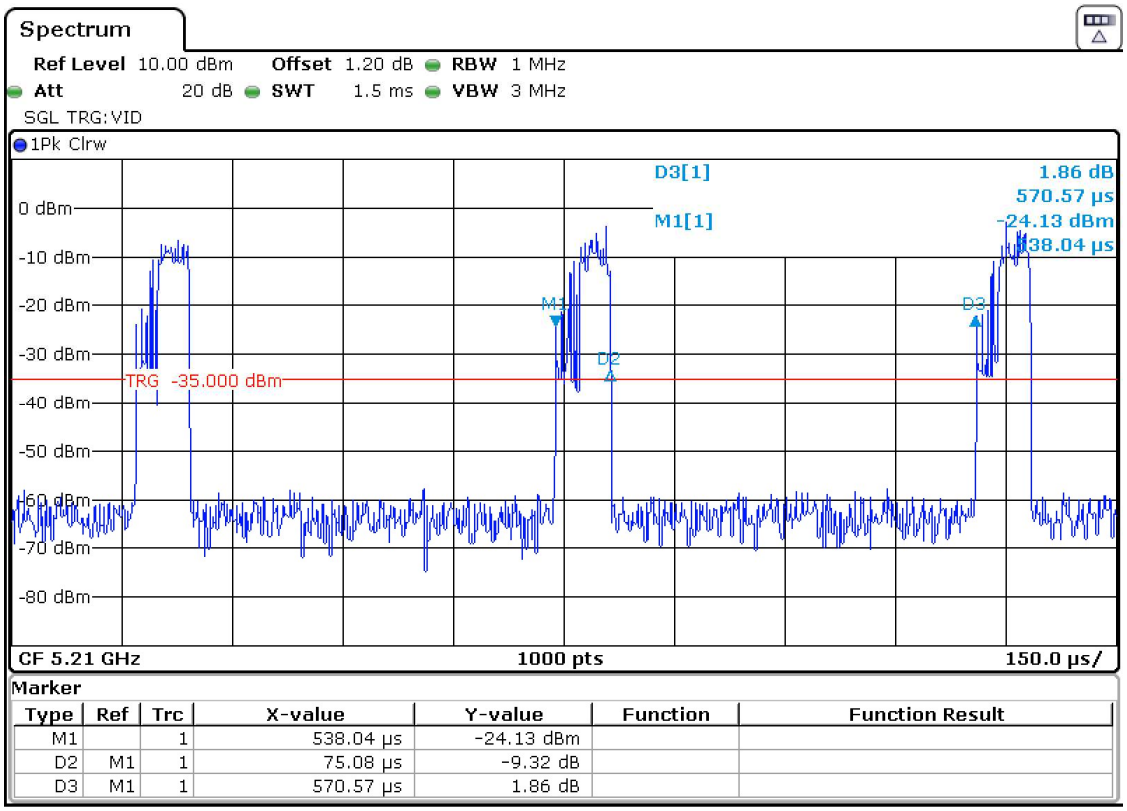
Mode 802.11 ac40:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	614.61 µs	-17.56 dBm		
D2	M1	1	114.11 µs	5.20 dB		
D3	M1	1	612.61 µs	0.34 dB		

Mode 802.11 ac80:



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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	538.04 µs	-24.13 dBm		
D2	M1	1	75.08 µs	-9.32 dB		
D3	M1	1	570.57 µs	1.86 dB		

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

The following modes and date 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 VHT20: MCS0
- 802.11ac VHT40: MCS0
- 802.11ac VHT80: MCS0

U-NII-1 (5150-5250 MHz)

Mode 802.11 a20:

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
99% Occupied Bandwidth (MHz)	17.16	17.16	17.16
Measurement uncertainty (kHz)	<±40.04		

Mode 802.11 n20 (HT20):

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
99% Occupied Bandwidth (MHz)	18.48	18.48	18.52
Measurement uncertainty (kHz)	<±40.04		

Mode 802.11 ac20 (HT20):

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
99% Occupied Bandwidth (MHz)	18.4	18.44	18.4
Measurement uncertainty (kHz)	<±40.04		

Mode 802.11 n40 (HT40):

Channels	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
99% Occupied Bandwidth (MHz)	36.48	36.40
Measurement uncertainty (kHz)	<±70.07	

Mode 802.11 ac40 (HT40):

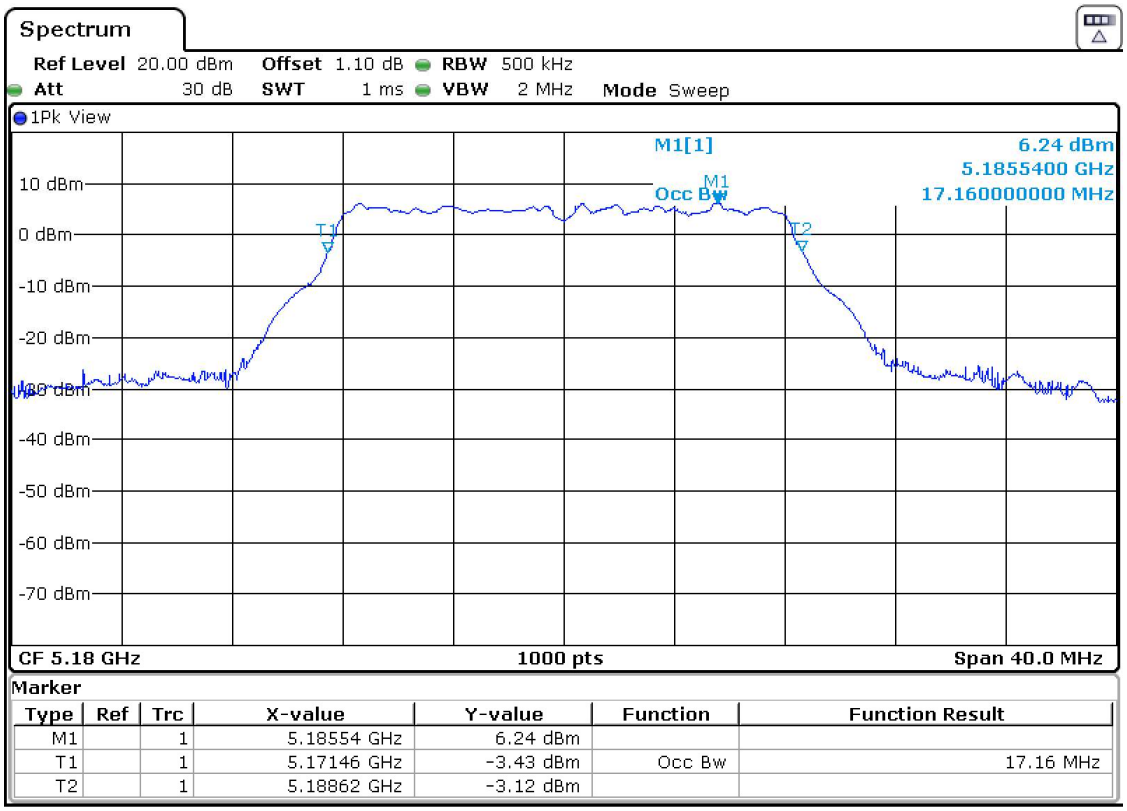
Channels	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
99% Occupied Bandwidth (MHz)	36.48	36.40
Measurement uncertainty (kHz)	<±70.07	

Mode 802.11 ac80 (VHT80):

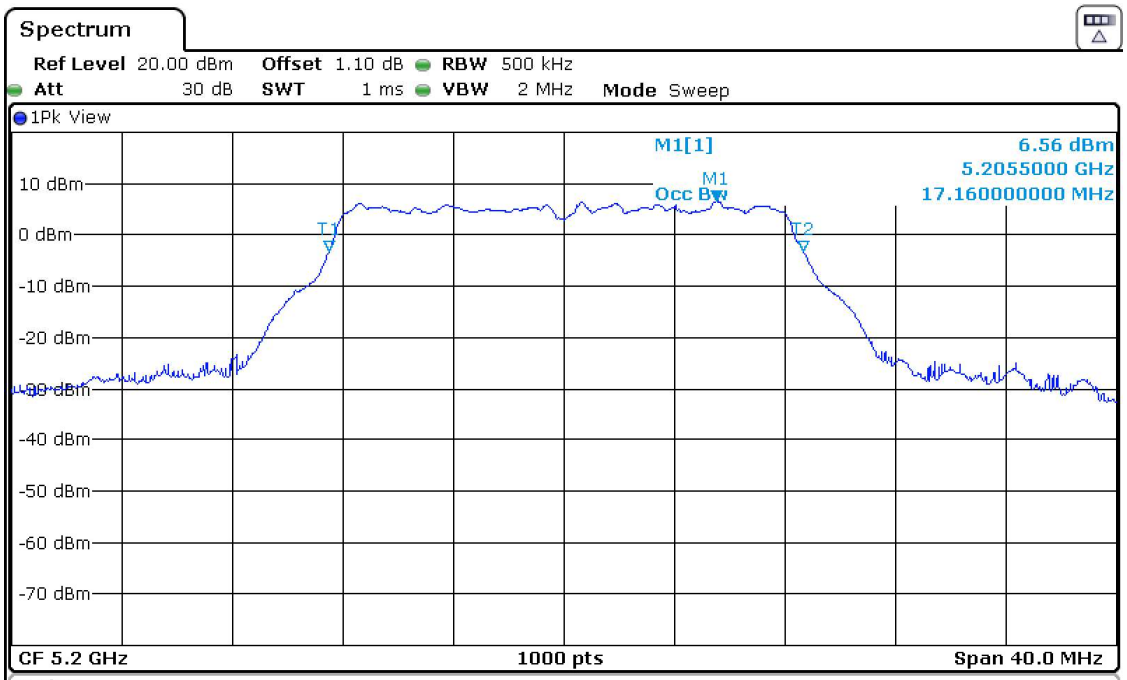
Channel	Single Channel 42 (5210 MHz)
99% Occupied Bandwidth (MHz)	75.84
Measurement uncertainty (kHz)	<±110.11

Mode 802.11 a20:

- Low Channel 36 (5180 MHz):



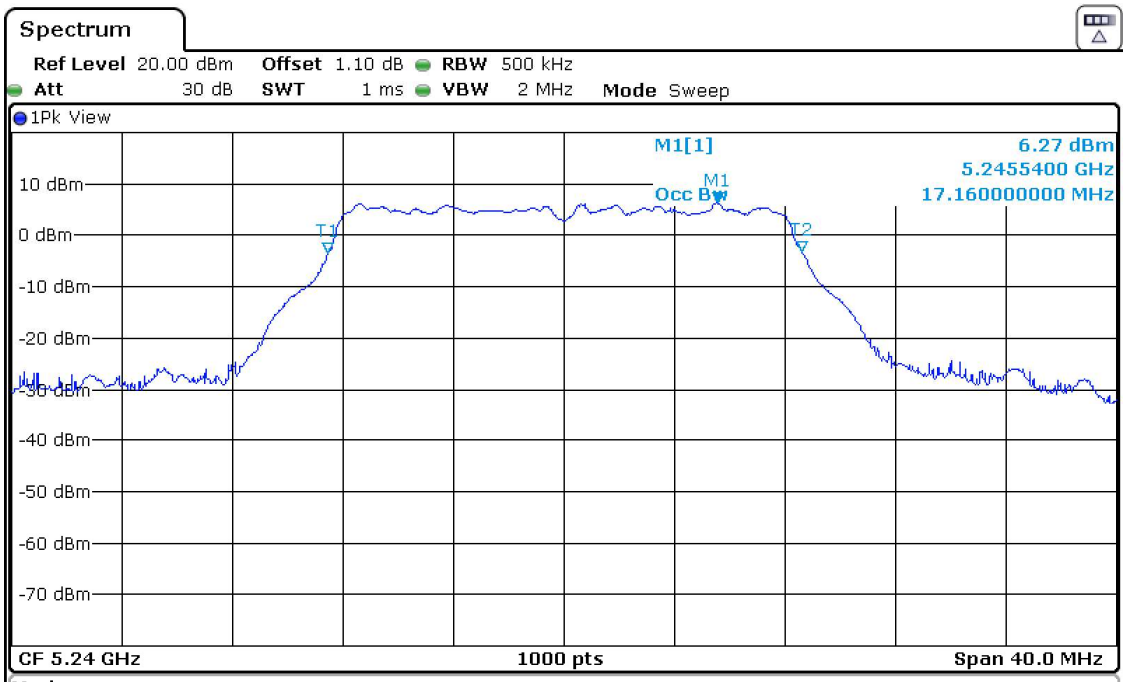
- Middle Channel 40 (5200 MHz):



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.2055 GHz	6.56 dBm		
T1		1	5.1915 GHz	-3.13 dBm	Occ Bw	17.16 MHz
T2		1	5.20866 GHz	-3.19 dBm		

- High Channel 48 (5240 MHz):



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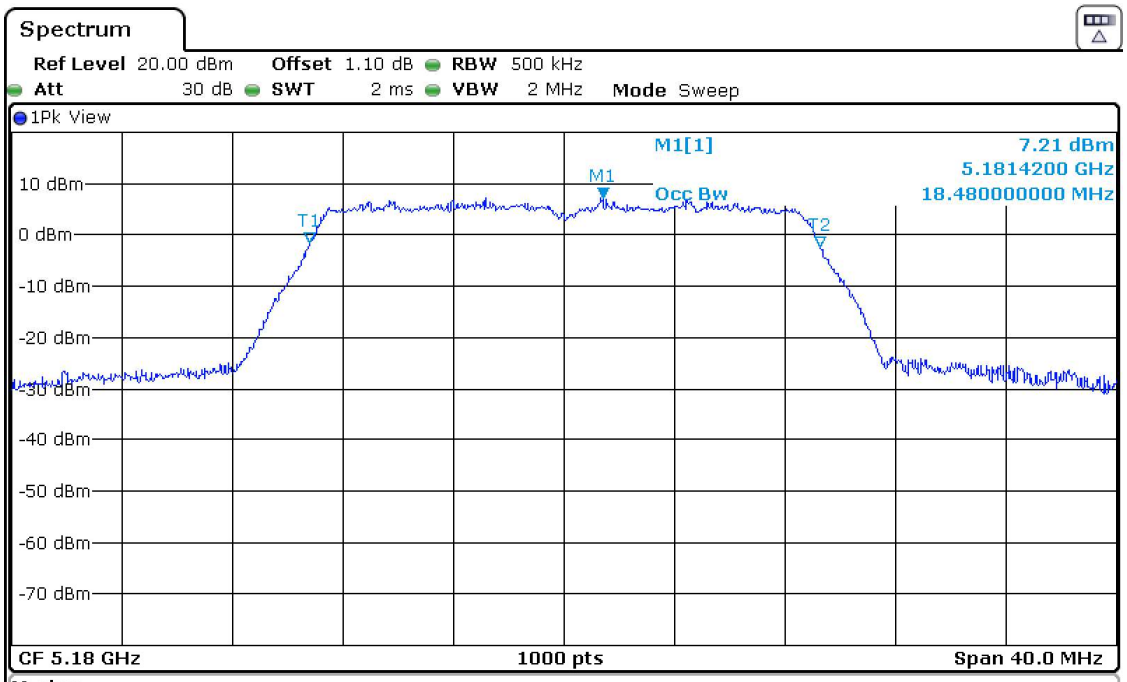
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.24554 GHz	6.27 dBm		
T1		1	5.23146 GHz	-3.56 dBm	Occ Bw	17.16 MHz
T2		1	5.24862 GHz	-3.22 dBm		

Mode 802.11 n20 HT20:

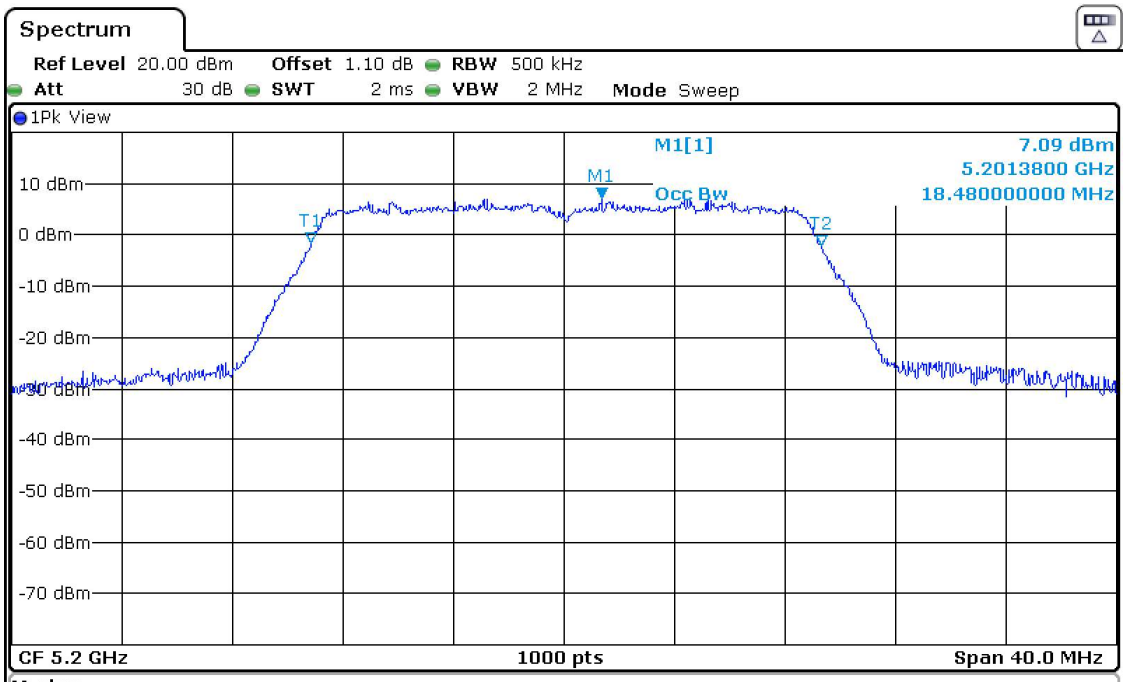
- Low Channel 36 (5180 MHz):



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.18142 GHz	7.21 dBm		
T1		1	5.17078 GHz	-1.62 dBm	Occ Bw	18.48 MHz
T2		1	5.18926 GHz	-2.33 dBm		

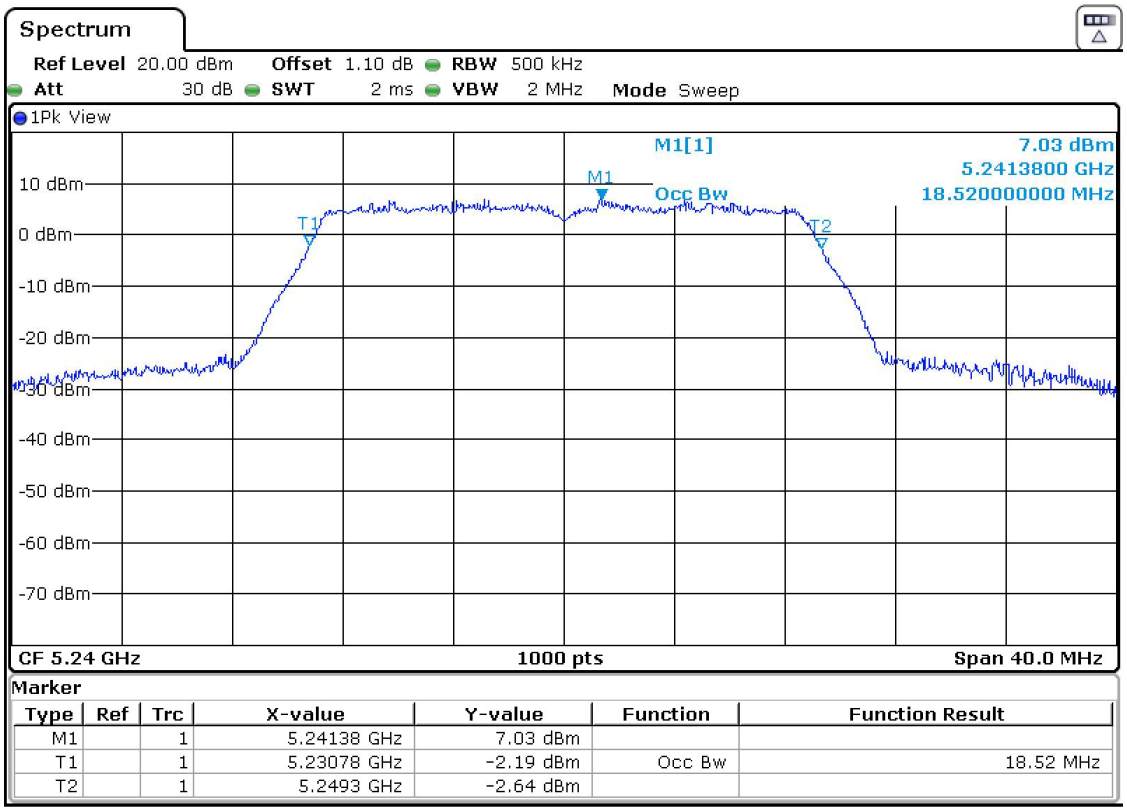
- Middle Channel 40 (5200 MHz):



Marker

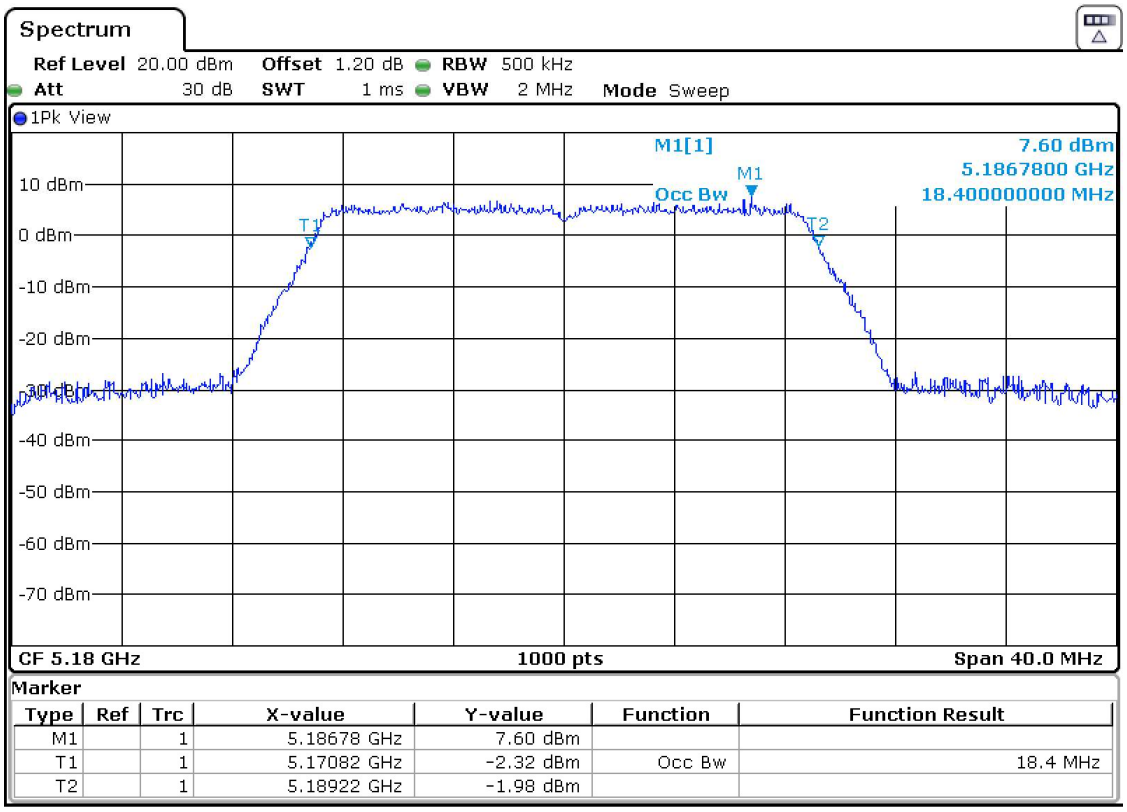
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.20138 GHz	7.09 dBm		
T1		1	5.19082 GHz	-1.41 dBm	Occ Bw	18.48 MHz
T2		1	5.2093 GHz	-2.19 dBm		

- High Channel 48 (5240 MHz):

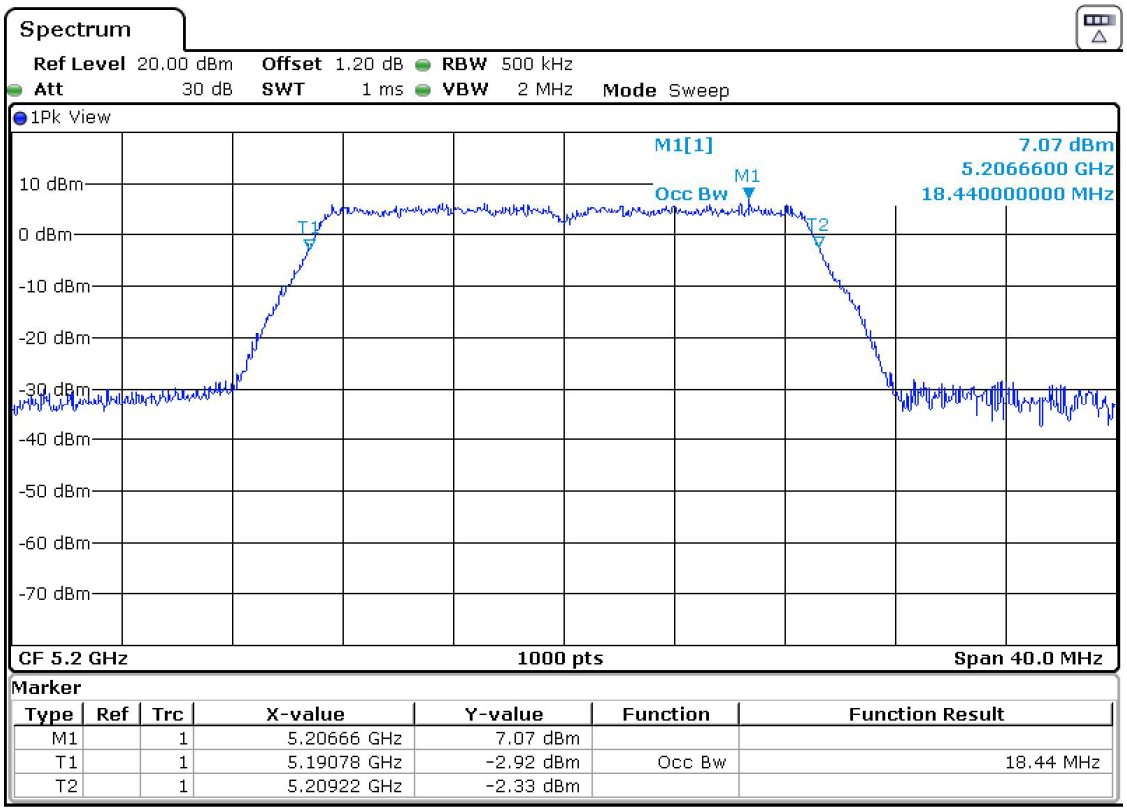


Mode 802.11 ac20 (HT20):

- Low Channel 36 (5180 MHz):



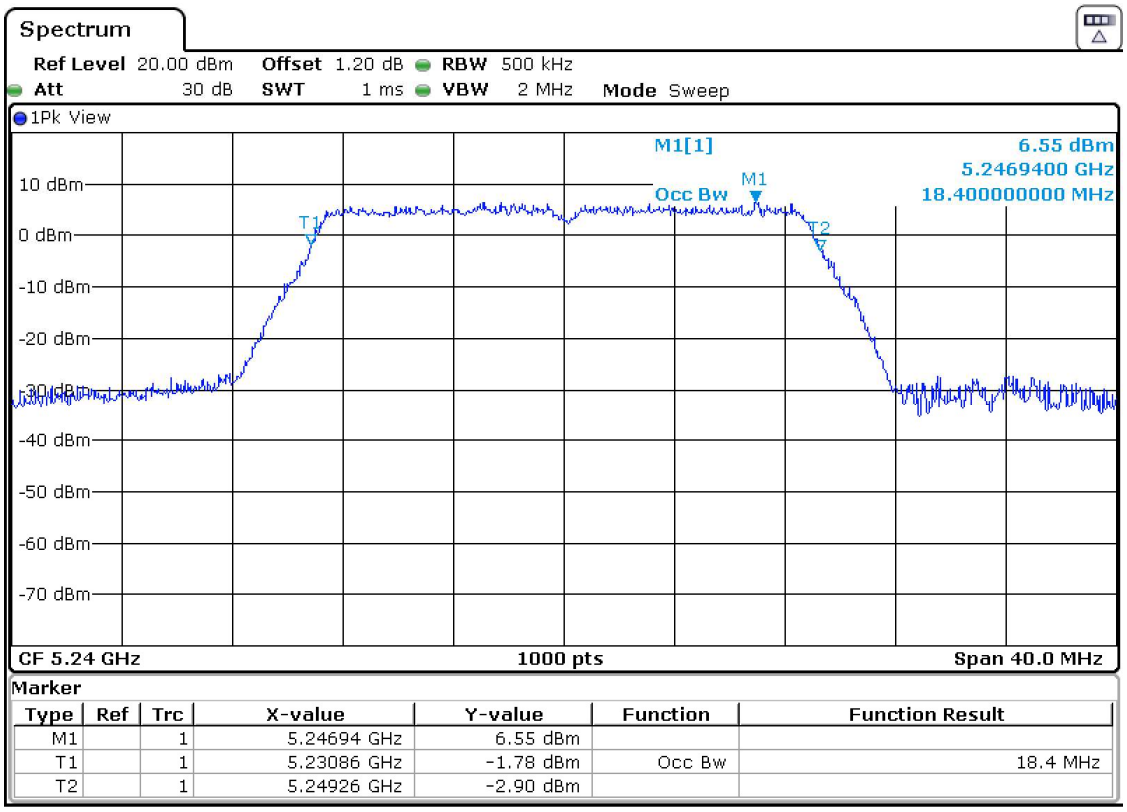
- Middle Channel 40 (5200 MHz):



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.20666 GHz	7.07 dBm		
T1		1	5.19078 GHz	-2.92 dBm	Occ Bw	18.44 MHz
T2		1	5.20922 GHz	-2.33 dBm		

- High Channel 48 (5240 MHz):

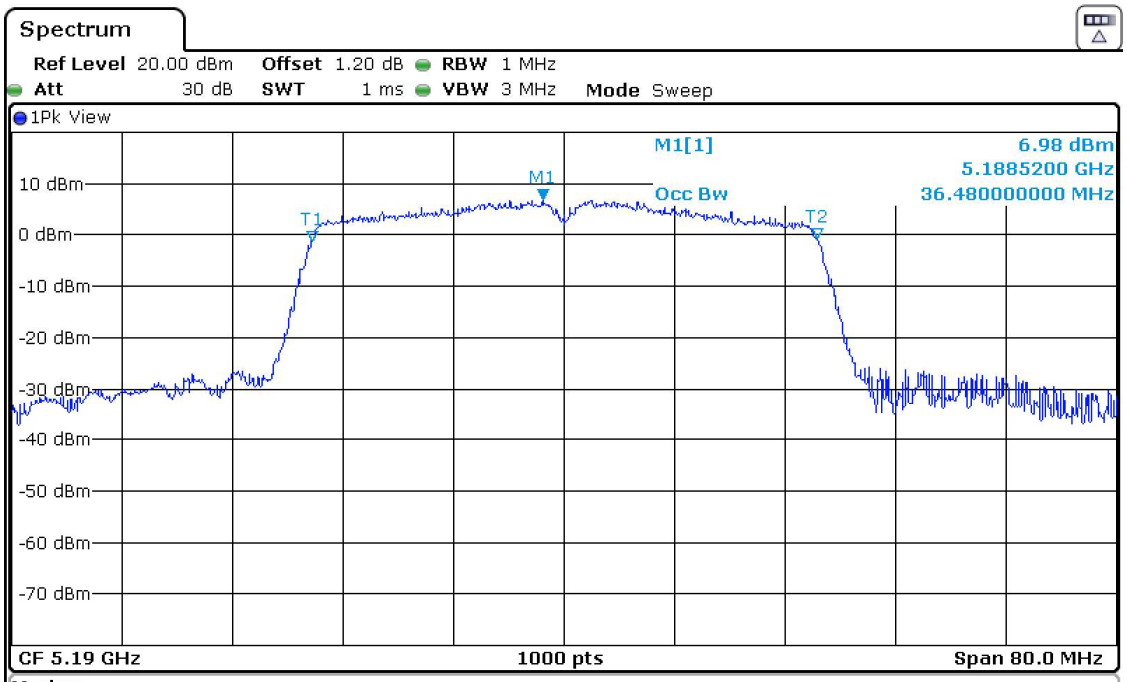


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.24694 GHz	6.55 dBm		
T1		1	5.23086 GHz	-1.78 dBm	Occ Bw	18.4 MHz
T2		1	5.24926 GHz	-2.90 dBm		

Mode 802.11 n40 (HT40):

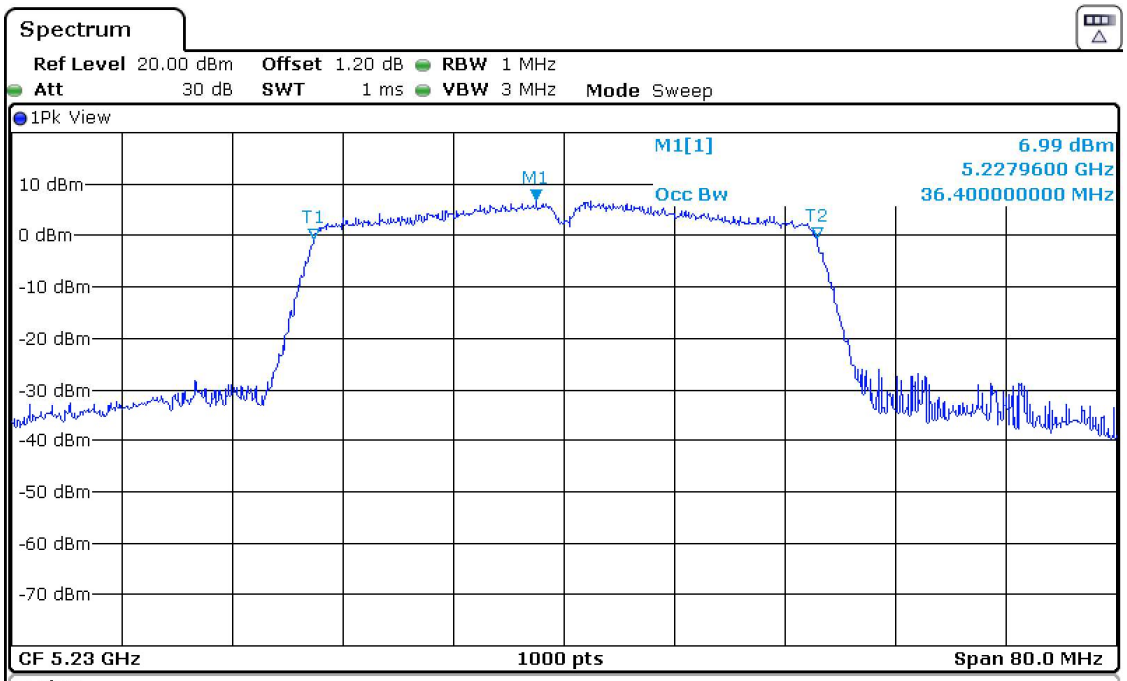
- Low Channel 38 (5190 MHz):



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.18852 GHz	6.98 dBm		
T1		1	5.1718 GHz	-1.16 dBm	Occ Bw	36.48 MHz
T2		1	5.20828 GHz	-0.81 dBm		

- High Channel 46 (5230 MHz):

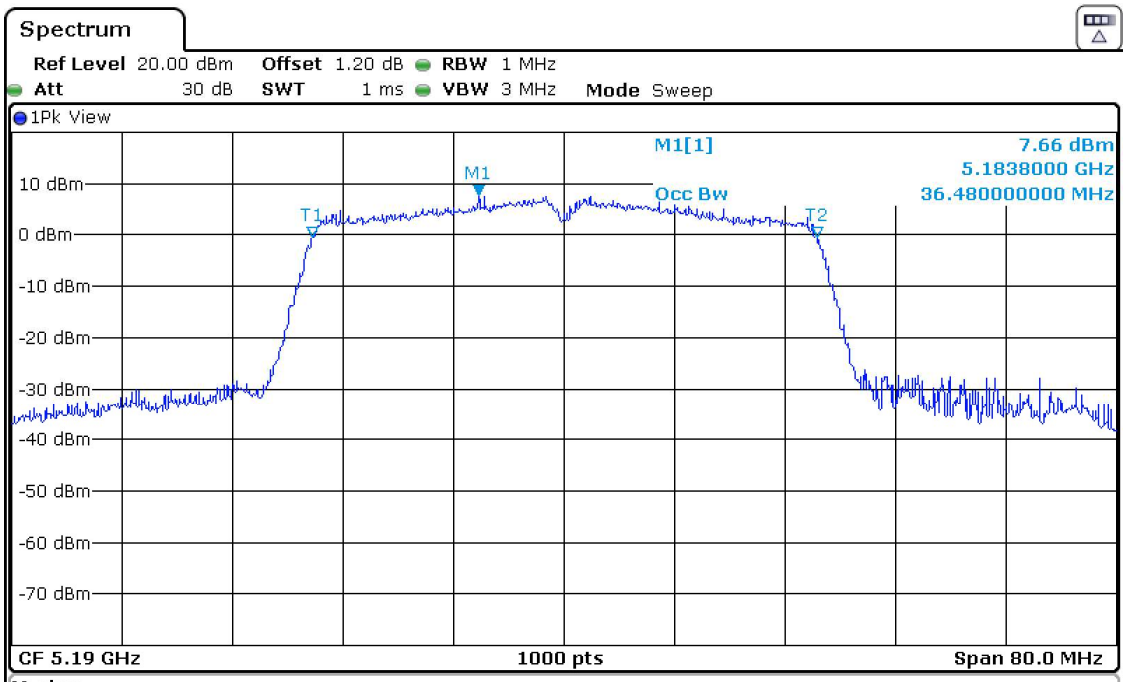


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.22796 GHz	6.99 dBm		
T1		1	5.21188 GHz	-0.61 dBm	Occ Bw	36.4 MHz
T2		1	5.24828 GHz	-0.57 dBm		

Mode 802.11 ac40 (HT40):

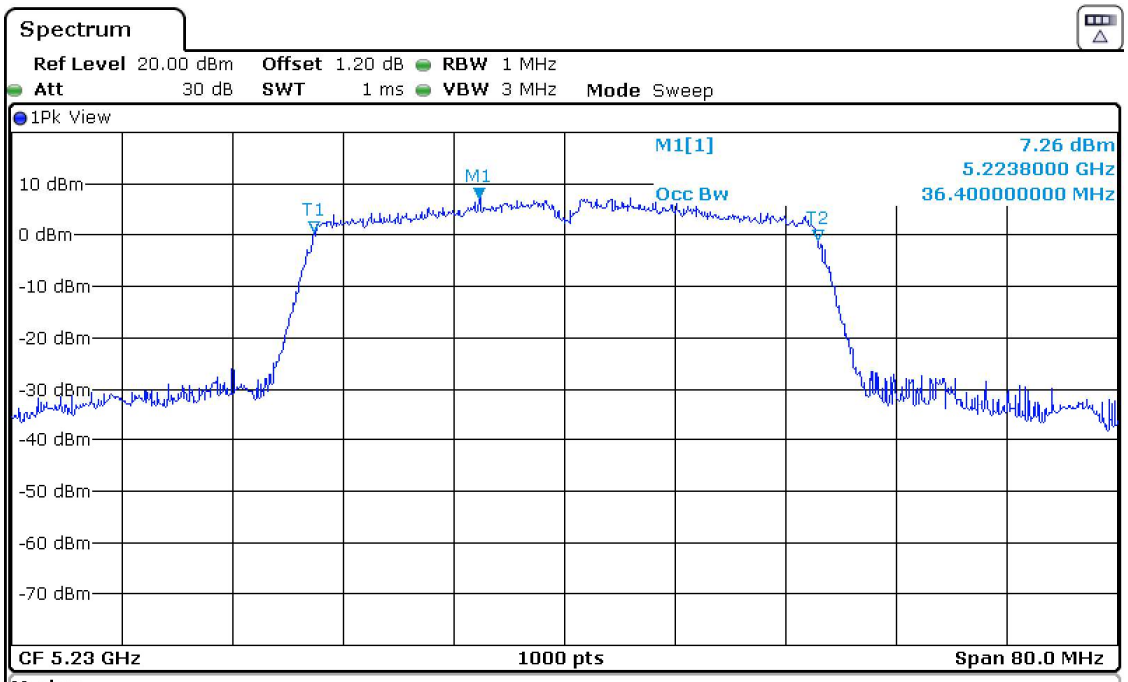
- Low Channel 38 (5190 MHz):



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.1838 GHz	7.66 dBm		
T1		1	5.1718 GHz	-0.55 dBm	Occ Bw	36.48 MHz
T2		1	5.20828 GHz	-0.40 dBm		

- High Channel 46 (5230 MHz):

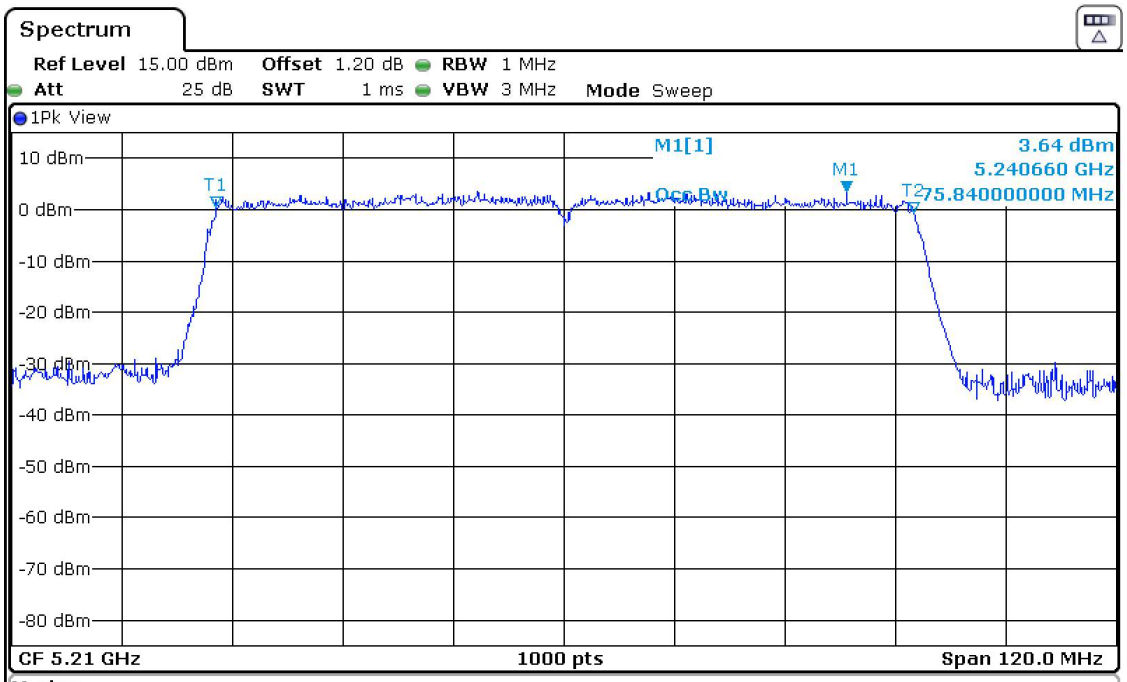


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.2238 GHz	7.26 dBm		
T1		1	5.21188 GHz	0.68 dBm	Occ Bw	36.4 MHz
T2		1	5.24828 GHz	-1.09 dBm		

Mode 802.11 ac80 (VHT80):

- Single Channel 42 (5210 MHz):



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.24066 GHz	3.64 dBm		
T1		1	5.17214 GHz	0.45 dBm	Occ Bw	75.84 MHz
T2		1	5.24798 GHz	-0.55 dBm		

U-NII-3 (5725-5850 MHz)

Mode 802.11 a20:

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
99% Occupied Bandwidth (MHz)	17.16	17.16	17.20
Measurement uncertainty (kHz)	<±40.04		

Mode 802.11 n20 (HT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
99% Occupied Bandwidth (MHz)	18.48	18.48	18.48
Measurement uncertainty (kHz)	<±40.04		

Mode 802.11 ac20 (HT20):

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
99% Occupied Bandwidth (MHz)	18.44	18.48	18.48
Measurement uncertainty (kHz)	<±40.04		

Mode 802.11 n40 (HT40):

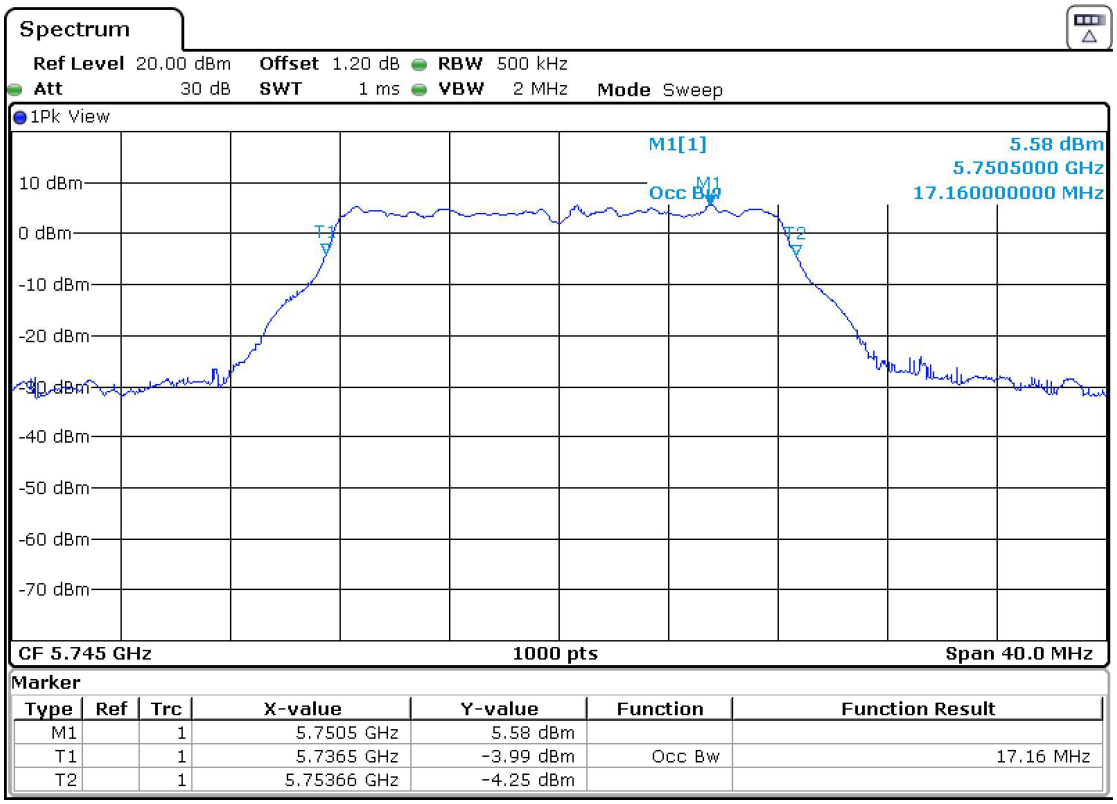
Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
99% Occupied Bandwidth (MHz)	36.56	36.56
Measurement uncertainty (kHz)	<±70.07	

Mode 802.11 ac40 (HT40):

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
99% Occupied Bandwidth (MHz)	36.56	36.56
Measurement uncertainty (kHz)	<±70.07	

Mode 802.11 ac80 (VHT80):

Channel	Single Channel 155 (5775 MHz)
99% Occupied Bandwidth (MHz)	75.96
Measurement uncertainty (kHz)	<±110.11

Mode 802.11 a20:

- Low Channel 149 (5745 MHz):