

  ENSAYOS Nº 51/LE147		FCC LISTED, REGISTRATION NUMBER: 720267 ISED LISTED REGISTRATION NUMBER 4621A-2,4621A-4	Test report No: NIE: 56944RRF.006
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	27-inch iMac with Retina 5K display		
Trademark	Apple		
Model and /or type reference	A2115		
Other identification of the product	FCC ID: BCGA2115 IC: 579C-A2115		
Features	IEEE 802.11a/b/g/n/ac radio and Bluetooth radio		
Applicant	Apple INC, One Apple Park Way, Cupertino, California 95014, USA		
Test method requested, standard	USA FCC Part 15.407 10-1-17 Edition: Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. Band U-NII-3 (5725 MHz – 5850 MHz). USA FCC Part 15.209 10-1-17 Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). 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)	A. Llamas p.a. RF Lab. Manager
Date of issue	2019-03-06
Report template No	FDT08_21

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Competences and guarantees

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DEKRA Testing and Certification is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

DEKRA Testing and Certification is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: ISSED 4621A-2 and ISSED 4621A-4.

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.

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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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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

iMac desktop computer with IEEE 802.11 a/b/g/n/ac radio and Bluetooth radio.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

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
56944/06	iMac with Retina 5K display	A2115	C02WW002K1R4	2018-08-16

Auxiliary elements used with the sample S/01

Control N°	Description	Model	Serial N°	Date of reception
56943/03	Keyboard	A1243	---	2018-04-09
56943/05	Power Cable	---	---	2018-04-09
56943/07	Mouse	A1152	---	2018-04-09
56943/09	USB-C to VGA converter	A1620	---	2018-04-09
56943/11	USB to thunderbolt	A1790	---	2018-04-09
56943/13	Earphones	---	---	2018-04-09

1. Sample S/01 has undergone the following test(s):

Band-edge emissions compliance (Transmitter) indicated in Appendixes B, C, D and E. It was determined as the worst case.

Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
56944/05	iMac with Retina 5K display	A2115	C02WW01EKFGK	2018-08-16

Auxiliary elements used with the sample S/02

Control N°	Description	Model	Serial N°	Date of reception
56943/04	Keyboard	A1243	---	2018-04-09
56943/06	Power Cable	---	---	2018-04-09
56943/08	Mouse	A1152	---	2018-04-09
56943/10	USB-C to VGA converter	A1620	---	2018-04-09
56943/12	USB to thunderbolt	A1790	---	2018-04-09
56943/14	Earphones	---	---	2018-04-09

1. Sample S/02 has undergone the following test(s):

Emission limitations radiated (Transmitter) indicated in Appendixes B, C, D and E. It was determined as the worst case.

Sample S/03 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
56944/14	iMac with Retina 5K display	A2115	C02X300EKFDN	2018-09-03

Auxiliary elements used with the sample S/03

Control N°	Description	Model	Serial N°	Date of reception
56943/04	Keyboard	A1243	---	2018-04-09
56944/13	Power Cable	---	---	2018-04-09
56943/08	Mouse	A1152	---	2018-04-09

1. Sample S/03 has undergone the following test(s):

All conducted tests indicated in Appendixes A, B, C, D and E.

Test sample description

Ports..... :	Port name and description	Cable					
		Specified length [m]	Attached during test	Shielded			
			☐	☐			
			☐	☐			
			☐	☐			
			☐	☐			
			☐	☐			
	Supplementary information to the ports..... :						
Rated power supply ... :	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☒	AC: 120 / 60 Hz	☒	☐	☐	☒	☒
	☐	AC:	☐	☐	☐	☐	☐
	☐	DC:					
☐	DC:						
Rated Power							

Clock frequencies..... :			
Other parameters :			
Software version :	18A334		
Hardware version :	EVT		
Dimensions in cm (W x H x D) :	65cm wide, 51.65cm high, 20.3cm deep		
Mounting position :	☒	Table top equipment	
	☐	Wall/Ceiling mounted equipment	
	☐	Floor standing equipment	
	☐	Hand-held equipment	
	☐	Other:	
Modules/parts..... :	Module/parts of test item	Type	Manufacturer
Accessories (not part of the test item) :	Description	Type	Manufacturer
	Keyboard	A1243	Apple
	Power Cable	---	Apple
	Mouse	A1152	Apple
	USB-C to VGA converter	A1620	Apple
	USB to thunderbolt	A1790	Apple
	Earphones	---	Apple
Documents as provided by the applicant :	Description	File name	Issue date

Copy of marking plate:



Identification of the client

Apple INC

One Apple Park Way, Cupertino, California 95014, USA

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2018-08-24
Date (finish)	2019-01-25

Document history

Report number	Date	Description
56944RRF.006	2019-03-06	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 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

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
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

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
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

Remarks and comments

The tests have been performed by the technical personnel: Ignacio Cabra, Jose Alberto Aranda, Francisco José Alcaide, Jaime Barranquero, Juan Carlos Fuentes, Miguel Angel Torres.

Used instrumentation:

Radiated Measurements

		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
3.	Multi Device Controller EMCO 2090	N.A.	N.A.
4.	Positioning Controller INNCO CO3000	N.A.	N.A.
5.	BiconicalLog antenna ETS LINDGREN 3142E	2017/09	2020/09
6.	BiconicalLog antenna ETS LINDGREN 3142E	2018/07	2021/07
7.	Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2016/11	2019/11
8.	Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2018/06	2021/06
9.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2017/04	2020/04
10.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2018/07	2021/07
11.	EMI Test Receiver R&S ESR7	2018/10	2020/10
12.	EMI Test Receiver R&S ESR7	2018/10	2020/10
13.	Spectrum analyser Rohde & Schwarz FSV40	2018/02	2020/02
14.	Spectrum analyser Rohde & Schwarz FSV40	2017/07	2019/07
15.	RF pre-amplifier 30MHz-6 GHz Bonn Elektronik BLNA 0360-01N	2018/07	2019/07
16.	RF pre-amplifier 10MHz-6 GHz Bonn Elektronik BLNA 0160-01N	2017/09	2019/03
17.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2018/03	2019/03
18.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-3A	2018/03	2019/03
19.	RF pre-amplifier 18-40 GHz Bonn Elektronik BLMA 1840-1M	2018/03	2019/03
20.	RF pre-amplifier 18-40 GHz NARDA JS44-18004000-33-8P	2018/02	2019/02
21.	RF High Pass Filter 3-18 GHz WAINWRIGHT INSTRUMENTS WHK 3.0/18G-10SS	2017/04	2019/04
22.	RF High Pass Filter 3-18 GHz TEMSTRON ST-3GA2833-HS	2018/09	2019/09
23.	RF Low Pass Filter DC-1GHz WAINWRIGHT INSTRUMENTS WLK1000-6SS	2018/06	2020/06
24.	RF High Pass Filter 18-26.5 GHz MicroWave Circuits H18G26G1	2017/04	2019/04
25.	RF High Pass Filter 18-40GHz TEMSTRON ST-18G-40G-798S	2018/12	2019/12
26.	RF High Pass Filter 18-40GHz TEMSTRON ST-18G-40G-798S	2018/12	2019/12
27.	AC Power Supply Elgar CS-AC35(351SL)	2016/05	2019/05
28.	AC Power Supply California Instruments 5001iM-400	2018/11	2020/11

Conducted Measurements

	Last Cal. date	Cal. due date
1. Spectrum analyser Rohde & Schwarz FSV40	2017/07	2019/07
2. AC Power Supply Elgar CS-AC35(351SL)	2016/05	2019/05
3. Spectrum analyser Rohde & Schwarz FSW50	2018/02	2020/02
4. EMI Test Receiver R&S ESR7	2018/10	2020/10

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
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 15.35(c) / RSS-Gen 6.10	Transmitter Duty Cycle	P	
FCC 15.407(g) / RSS-Gen 6.11	Transmitter Frequency Stability (Temperature & Voltage Variation)	N/M	See (4)
FCC 15.407(h)(1) / RSS-247 6.2	Transmitter Power Control	N/M	See (5)
<u>Supplementary information and remarks:</u>			
(1) There are two manufacturer of the WiFi/Bluetooth radio modules, manufacturer 1 and manufacturer 2. (2) The WiFi/Bluetooth radio modules have the same mechanical outline (i.e. the same packaging dimension and pin layout), use the same on-board antenna matching circuit, have an identical antenna structure and are built and tested to conform to the same specification and to operate within the same tolerances. (3) Preliminary testing was performed on the two manufacturers to determine the worst case. (4) 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 users manual. (5) TPC was not measured because the e.i.r.p is less than 27 dBm.			

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 Peak Power Spectral Density	P	
RSS-247 6.2.1.1	Transmitter EIRP Spectral Density	P	
FCC 15.407(b) (1) /RSS-247 6.2.1.2	Transmitter Band Edge Radiated Emissions	P	
FCC 15.407 (b)(1) (6) / RSS-247 6.2.1.2	Transmitter Out of Band Radiated Emissions	P	
<u>Supplementary information and remarks:</u> (1) There are two manufacturer of the WiFi/Bluetooth radio modules, manufacturer 1 and manufacturer 2. (2) The WiFi/Bluetooth radio modules have the same mechanical outline (i.e. the same packaging dimension and pin layout), use the same on-board antenna matching circuit, have an identical antenna structure and are built and tested to conform to the same specification and to operate within the same tolerances. (3) Preliminary testing was performed on the two manufacturers to determine the worst case.			

C. 5.25 GHz – 5.35 GHz Band

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.407(a)(2) / RSS-247 6.2.2.1 (a)	Transmitter Maximum Conducted Output Power	P	
RSS-247 6.2.2.1 (b)	Transmitter Maximum Equivalent Isotropically Radiated Power	P	
FCC 15.407 (a) (2) / RSS-247 6.2.2.1 (a)	Transmitter Peak Power Spectral Density	P	
FCC 15.407 (b) (2) / RSS-247 6.2.2.2	Transmitter Band Edge Radiated Emissions	P	
FCC 15.407 (b) (2) (6) / RSS-247 6.2.2.2	Transmitter Out of Band Radiated Emissions	P	
<u>Supplementary information and remarks:</u> (1) There are two manufacturer of the WiFi/Bluetooth radio modules, manufacturer 1 and manufacturer 2. (2) The WiFi/Bluetooth radio modules have the same mechanical outline (i.e. the same packaging dimension and pin layout), use the same on-board antenna matching circuit, have an identical antenna structure and are built and tested to conform to the same specification and to operate within the same tolerances. (3) Preliminary testing was performed on the two manufacturers to determine the worst case.			

D. 5.47 GHz – 5.725 GHz Band

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.407 (a) (2) / RSS-247 6.2.3.1	Transmitter Maximum conducted Output Power	P	
RSS-247 6.2.3.1	Transmitter Maximum Equivalent Isotropically Radiated Power	P	
FCC 15.407 (a) (2) / RSS-247 6.2.3.1	Transmitter Peak Power Spectral Density	P	
FCC 15.407 (b) (3) / RSS-247 6.2.3.2	Transmitter Band Edge Radiated Emissions	P	
FCC 15.407 (b) (3) (6) / RSS-247 6.2.3.2	Transmitter Out of Band Radiated Emissions	P	
<u>Supplementary information and remarks:</u> (1) There are two manufacturer of the WiFi/Bluetooth radio modules, manufacturer 1 and manufacturer 2. (2) The WiFi/Bluetooth radio modules have the same mechanical outline (i.e. the same packaging dimension and pin layout), use the same on-board antenna matching circuit, have an identical antenna structure and are built and tested to conform to the same specification and to operate within the same tolerances. (3) Preliminary testing was performed on the two manufacturers to determine the worst case.			

E. 5.725 GHz – 5.85 GHz Band

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC Part 15.407 (a) (3) / RSS-247 6.2.4.1	Transmitter Maximum conducted Output Power	P	
RSS-Gen 6.12 / RSS-247 6.2.4.1	Transmitter Maximum Equivalent Isotropically Radiated Power	P	
FCC 15.407(e) / RSS-247 Clause 6.2.4.1.	6 dB bandwidth.	P	
FCC 15.407 (a) (3) / RSS-247 Clause 6.2.4.1	Transmitter Peak Power Spectral Density	P	
FCC 15.407 (b) (4) / RSS-247 6.2.4.2	Transmitter Band Edge Radiated Emissions	P	
FCC 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> (1) There are two manufacturer of the WiFi/Bluetooth radio modules, manufacturer 1 and manufacturer 2. (2) The WiFi/Bluetooth radio modules have the same mechanical outline (i.e. the same packaging dimension and pin layout), use the same on-board antenna matching circuit, have an identical antenna structure and are built and tested to conform to the same specification and to operate within the same tolerances. (3) Preliminary testing was performed on the two manufacturers to determine the worst case.			

Appendix A: Test Common requirements for all bands

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RSS-Gen 6.6 / RSS-247 6.2. Transmitter 99% Occupied Bandwidth17

FCC Section 15.407 Subclause 15.403(i) Transmitter 26 dB Emission Bandwidth (EBW)34

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

SPECIFICATION

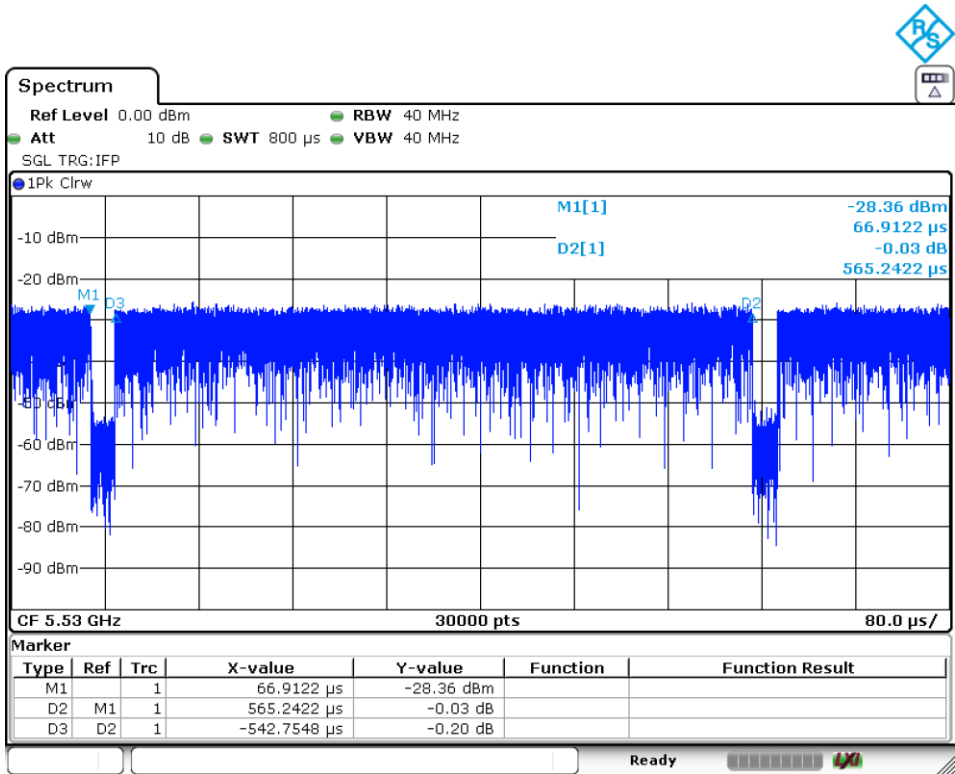
When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 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%. The results for all rest of modes having a value > 98%.

Mode	Pulse Duration (us)	Period (us)	Duty Cycle (dB)
802.11 / 80 MHz	542,7548	565,2422	0,18

802.11 / 80 MHz / SISO



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

The client supplied U.FL RF cables with the EUT in order to perform conducted measurements. The measured additional path loss was included in any path loss calculations.

Measurements were performed on the SISO modes for testing:

- 802.11a: 6 Mbit/s / SISO on Core Aux
- 802.11n HT20: MCS0 / SISO on Core Aux
- 802.11n HT40: MCS0 / SISO on Core Aux
- 802.11ac VHT80: MCS0x1 / SISO on Core Aux

Mode : 802.11a - 20MHz – SISO – CORE Aux

	Occ. BW (MHz)	Measurement uncertainty (dB)
channel 36 (5180 MHz)	18	<±40.04
channel 40 (5200 MHz)	18.78	
channel 48 (5240 MHz)	18.96	
channel 52 (5260 MHz)	18.84	
channel 56 (5280 MHz)	18.90	
channel 64 (5320 MHz)	18.06	
channel 100 (5500 MHz)	18	
channel 116 (5580 MHz)	19.80	
channel 140 (5700 MHz)	18	
channel 144 (5720 MHz)	18.72	
channel 149 (5745 MHz)	19.86	
channel 157 (5785 MHz)	19.50	
channel 165 (5825 MHz)	20.40	

Mode : 802.11n HT20 - 20MHz – SISO – CORE Aux

	Occ. BW (MHz)	Measurement uncertainty (dB)
channel 36 (5180 MHz)	19.02	<±40.04
channel 40 (5200 MHz)	19.98	
channel 48 (5240 MHz)	20.22	
channel 52 (5260 MHz)	20.10	
channel 56 (5280 MHz)	20.28	
channel 64 (5320 MHz)	19.08	
channel 100 (5500 MHz)	19.02	
channel 116 (5580 MHz)	21.78	
channel 140 (5700 MHz)	19.02	
channel 144 (5720 MHz)	19.92	
channel 149 (5745 MHz)	21.60	
channel 157 (5785 MHz)	21.18	
channel 165 (5825 MHz)	22.98	

Mode : 802.11n HT40 - 40MHz – SISO – CORE Aux

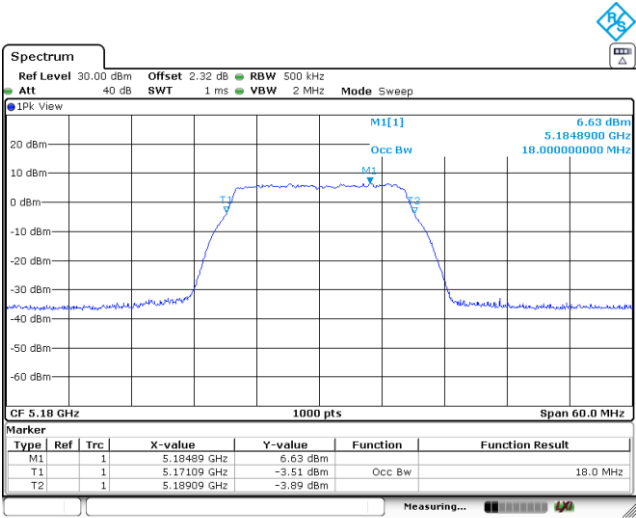
	Occ. BW (MHz)	Measurement uncertainty (dB)
channel 38 (5190 MHz)	36.96	<±70.07
channel 46 (5230 MHz)	37.68	
channel 54 (5270 MHz)	37.80	
channel 62 (5310 MHz)	37.08	
channel 102 (5510 MHz)	37.08	
channel 110 (5550 MHz)	56.52	
channel 134 (5670 MHz)	37.32	
channel 142 (5710 MHz)	48.72	
channel 151 (5755 MHz)	38.16	
channel 159 (5795 MHz)	47.28	

Mode : 802.11ac VHT80 - 80MHz – SISO – CORE Aux

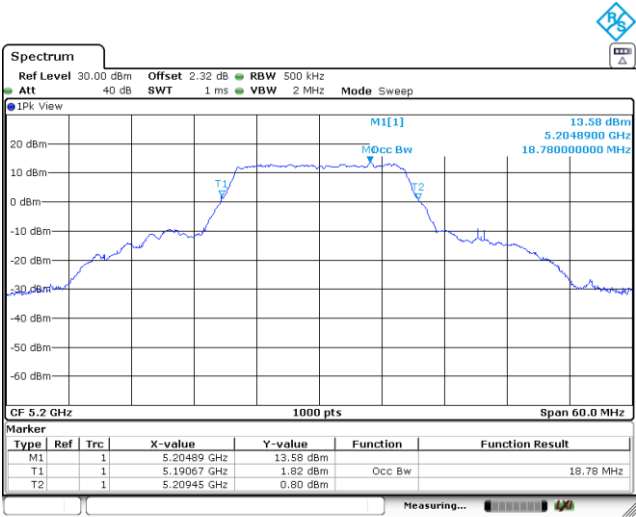
	Occ. BW (MHz)	Measurement uncertainty (dB)
channel 42 (5210 MHz)	76	<±110.11
channel 58 (5290 MHz)	76.20	
channel 106 (5530 MHz)	76	
channel 138 (5690 MHz)	77.20	
channel 155 (5775 MHz)	76.60	

Mode : 802.11a - 20MHz – SISO – CORE Aux

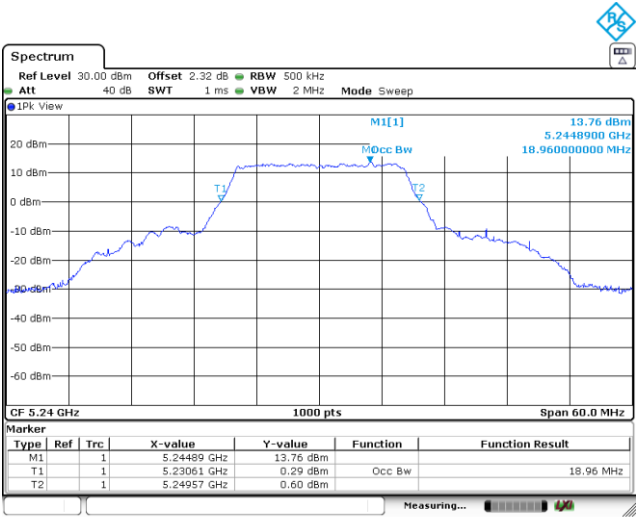
channel 36 (5180 MHz)



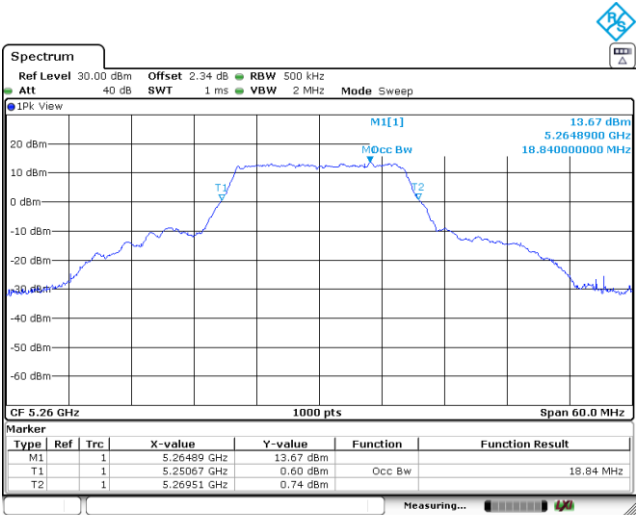
channel 40 (5200 MHz)



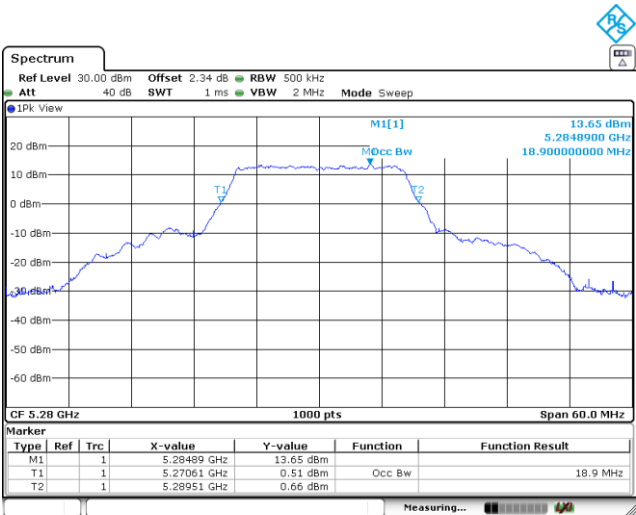
channel 48 (5240 MHz)



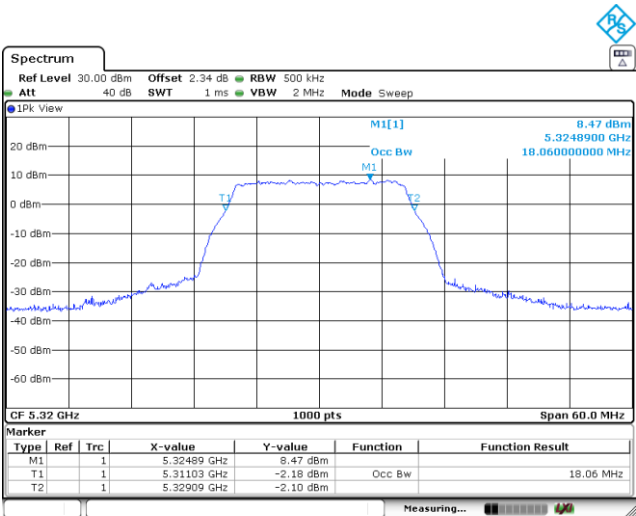
channel 52 (5260 MHz)



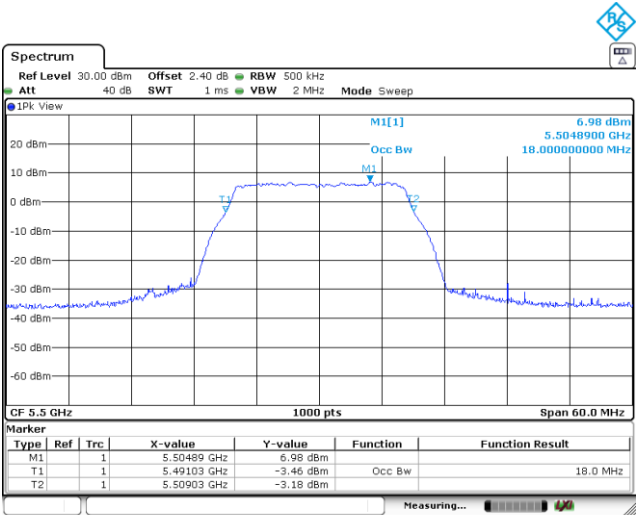
channel 56 (5280 MHz)



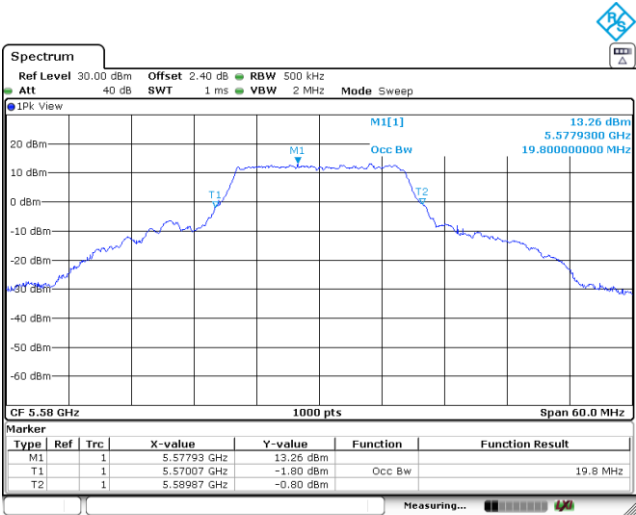
channel 64 (5320 MHz)



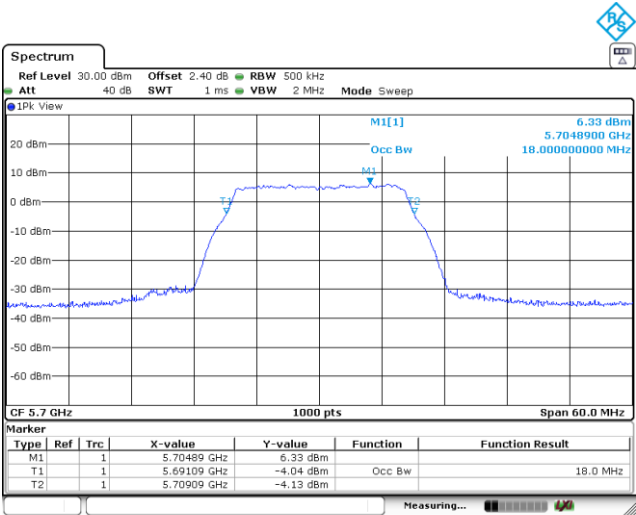
channel 100 (5500 MHz)



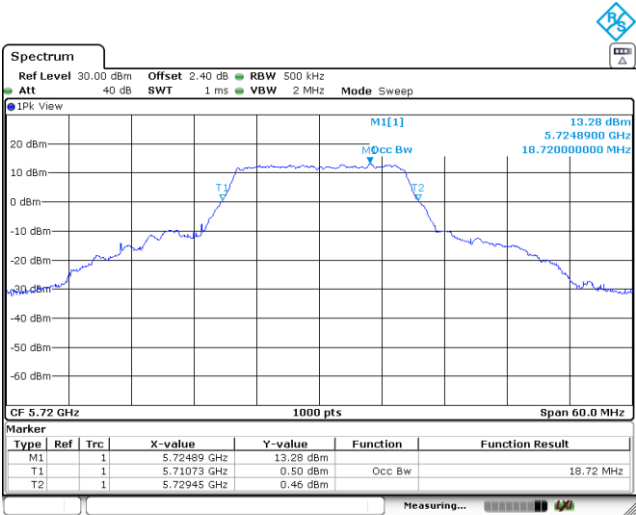
channel 116 (5580 MHz)



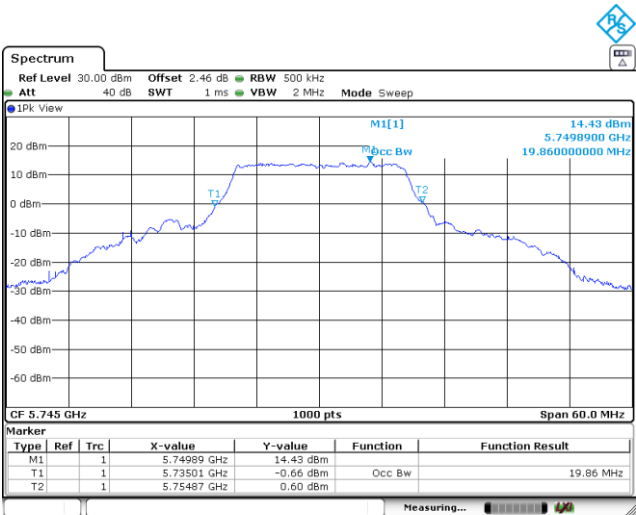
channel 140 (5700 MHz)



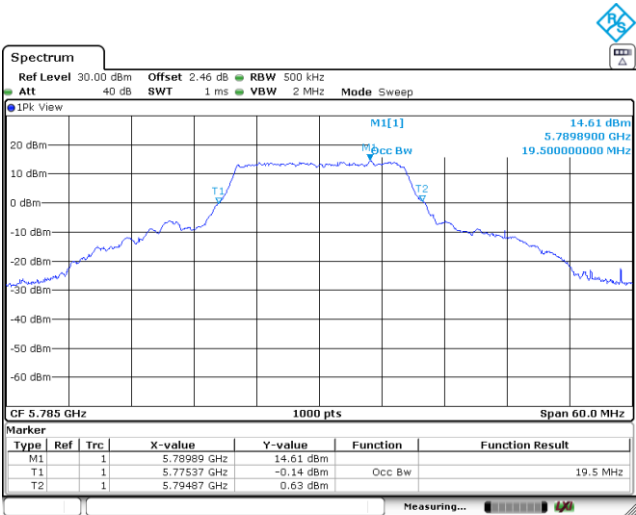
channel 144 (5720 MHz)



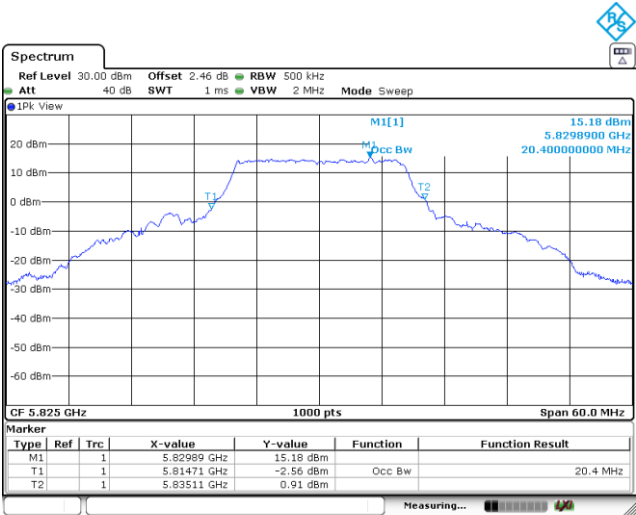
channel 149 (5745 MHz)



channel 157 (5785 MHz)

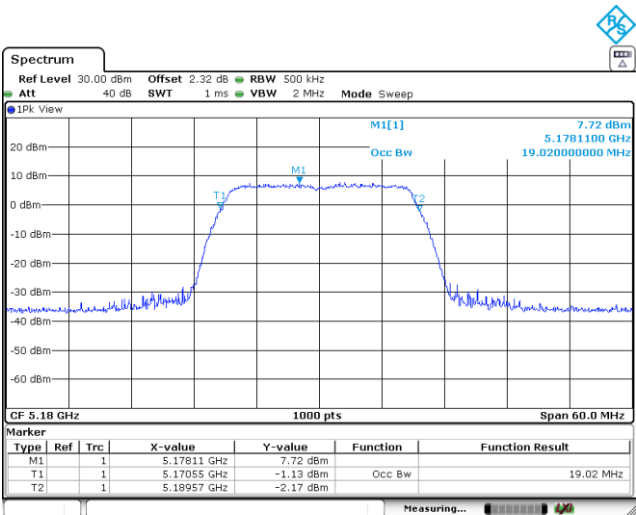


channel 165 (5825 MHz)

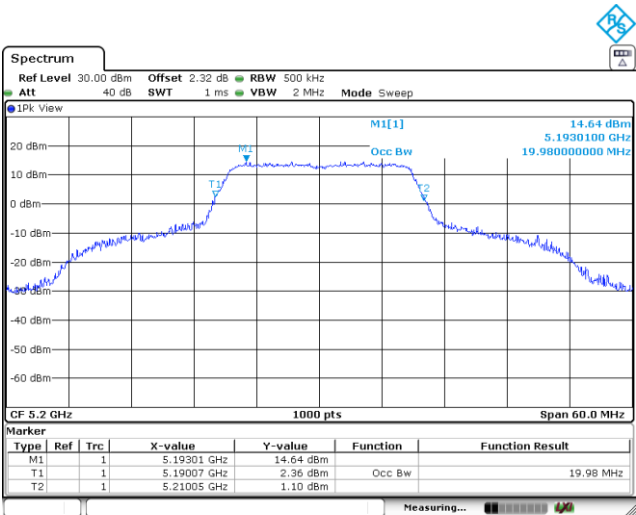


Mode : 802.11n HT20 - 20MHz – SISO – CORE Aux

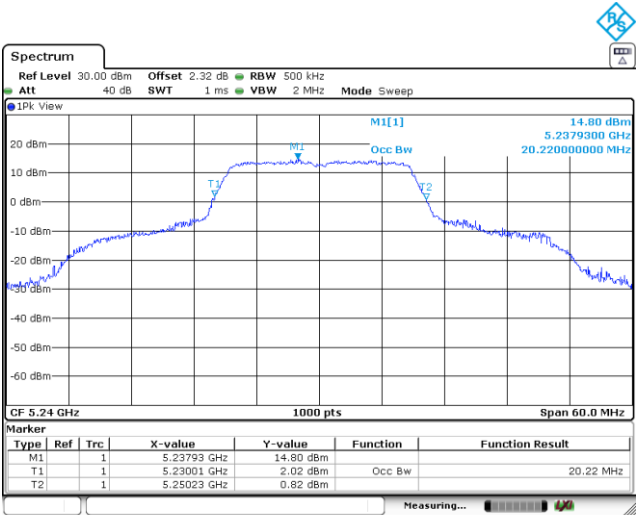
channel 36 (5180 MHz)



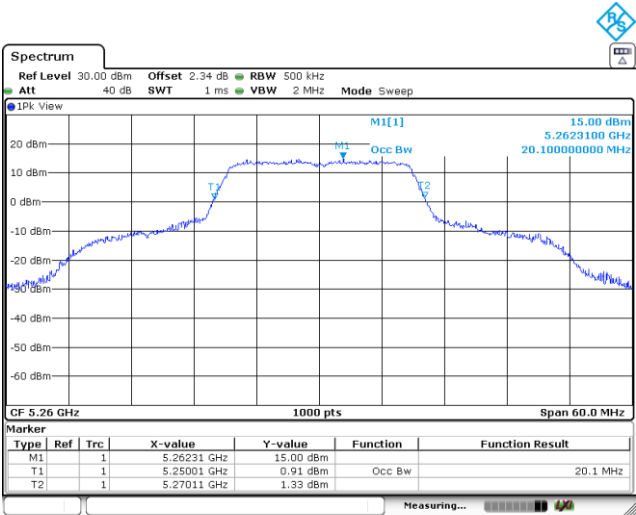
channel 40 (5200 MHz)



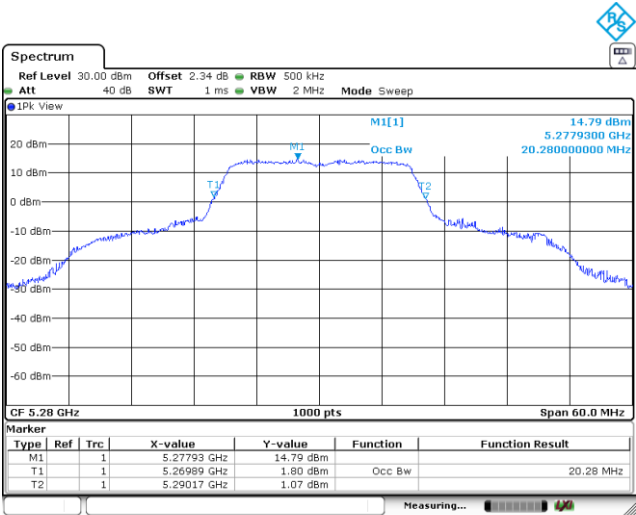
channel 48 (5240 MHz)



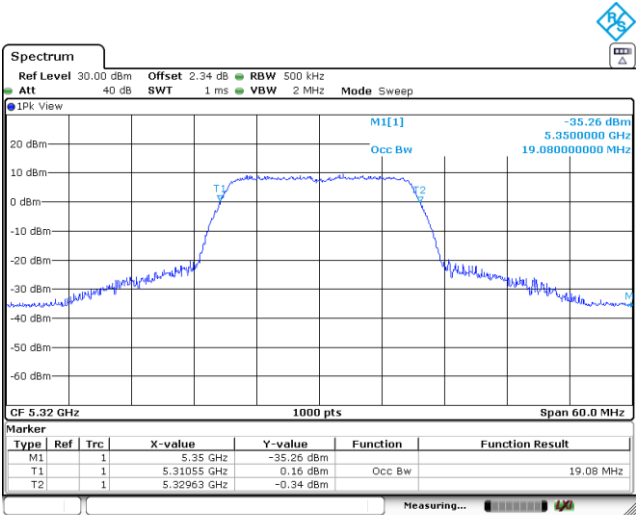
channel 52 (5260 MHz)



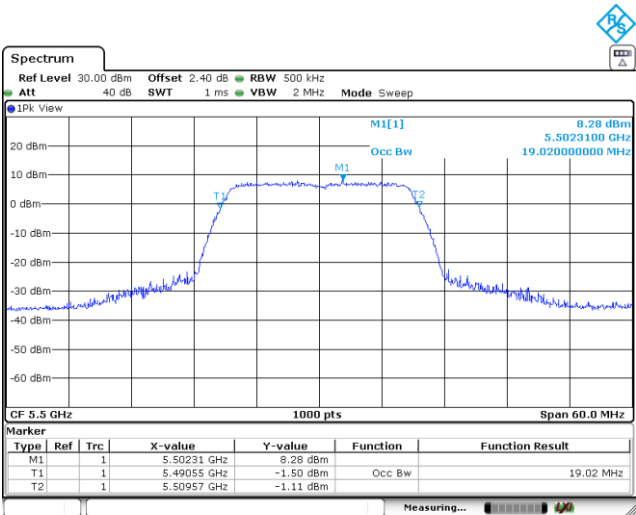
channel 56 (5280 MHz)



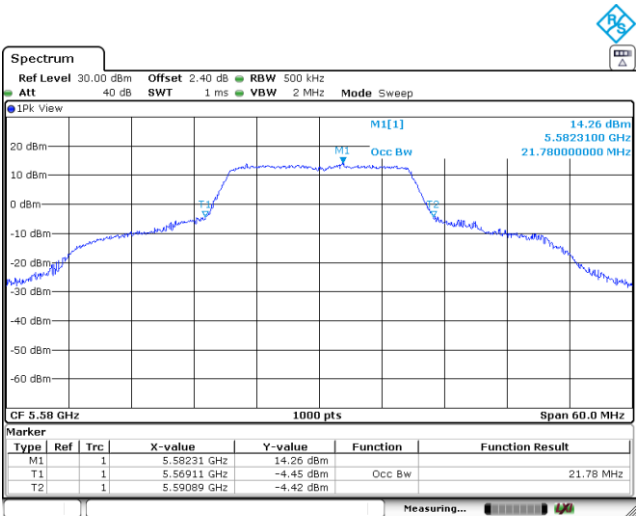
channel 64 (5320 MHz)



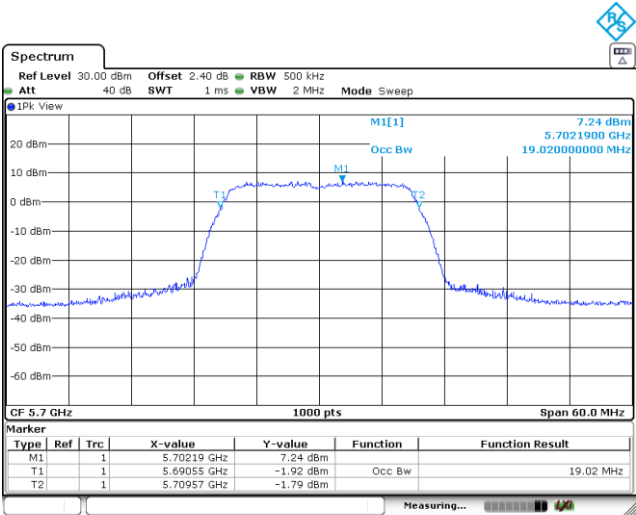
channel 100 (5500 MHz)



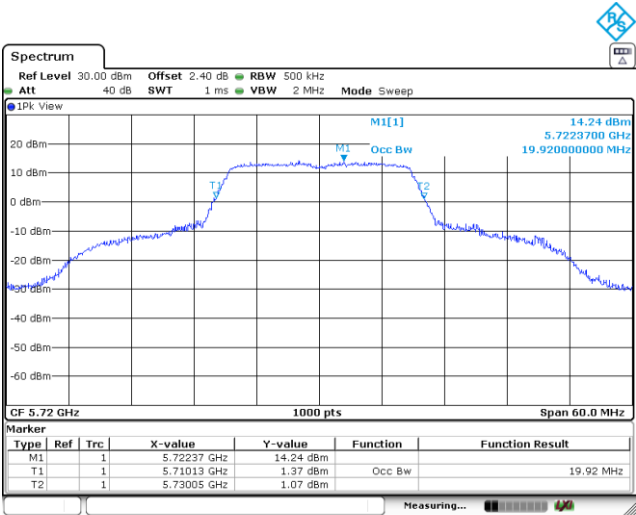
channel 116 (5580 MHz)



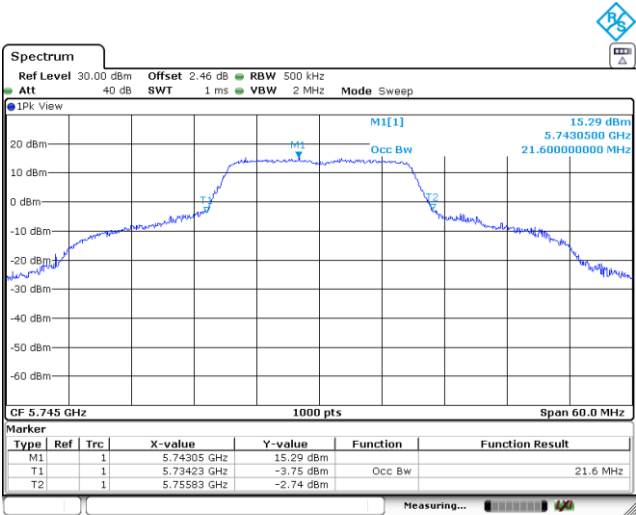
channel 140 (5700 MHz)



channel 144 (5720 MHz)



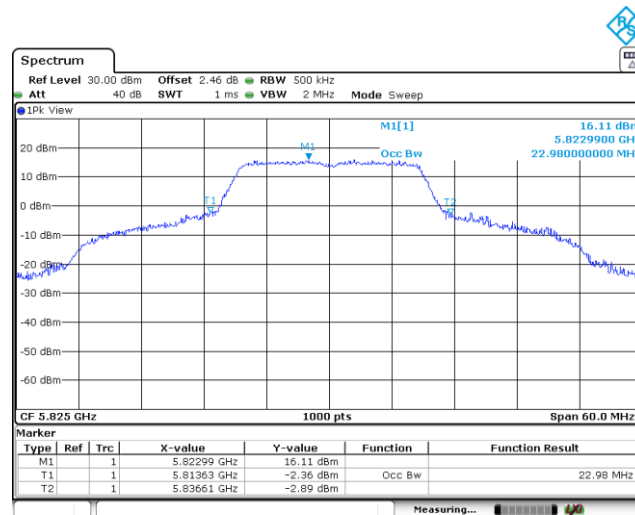
channel 149 (5745 MHz)



channel 157 (5785 MHz)

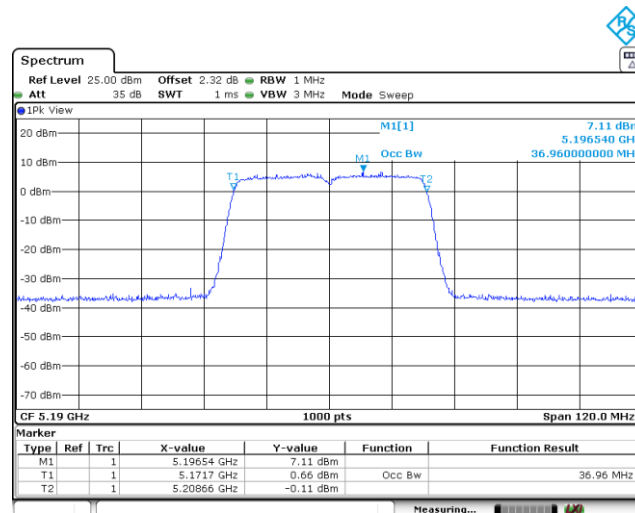


channel 165 (5825 MHz)

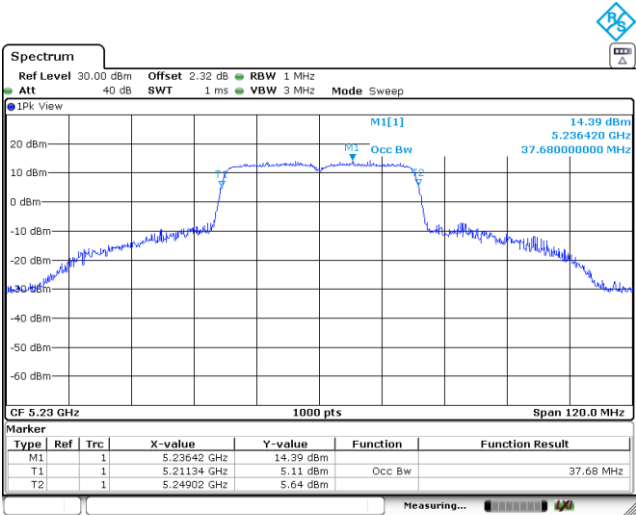


Mode : 802.11n HT40 - 40MHz – SISO – CORE Aux

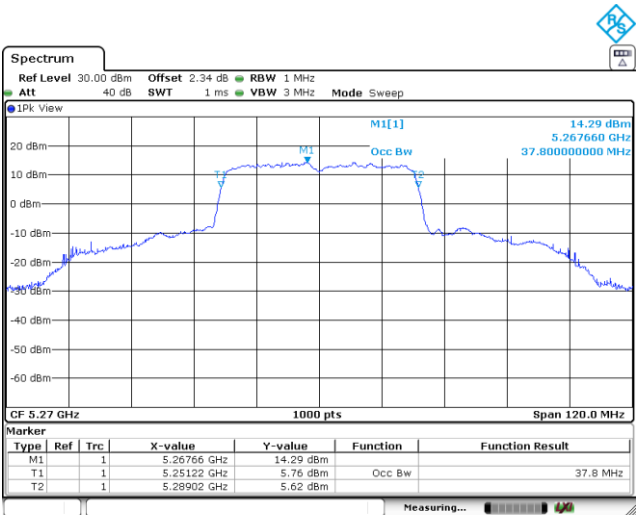
channel 38 (5190 MHz)



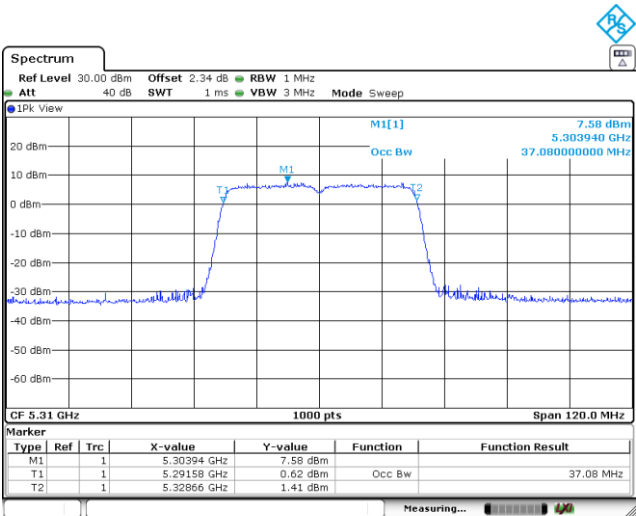
channel 46 (5230 MHz)



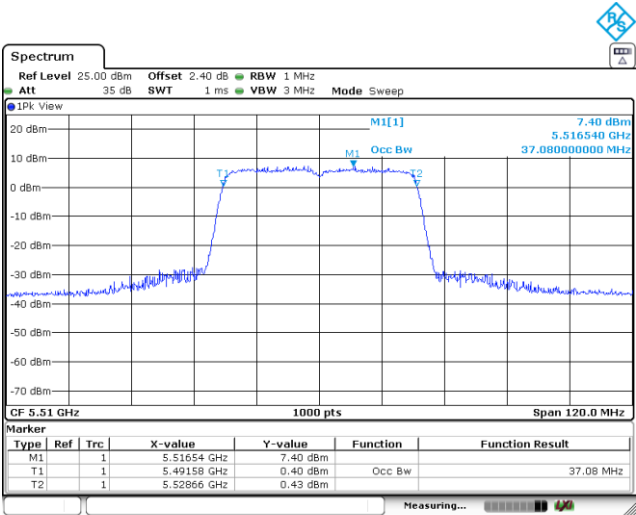
channel 54 (5270 MHz)



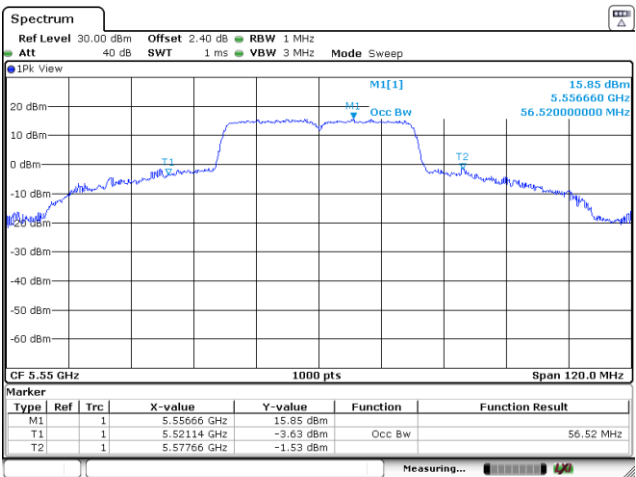
channel 62 (5310 MHz)



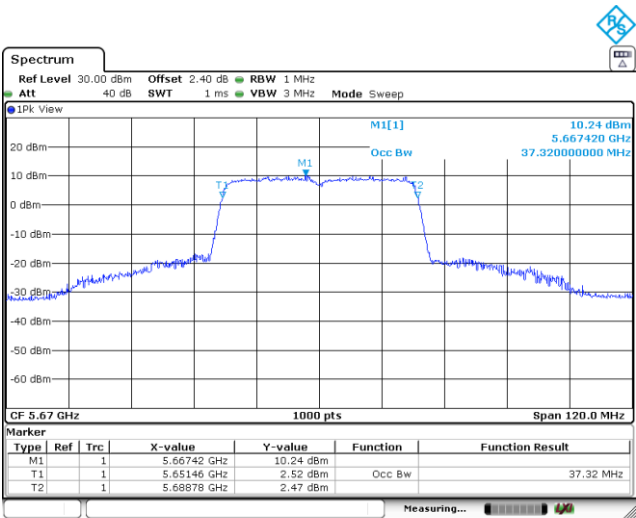
channel 102 (5510 MHz)



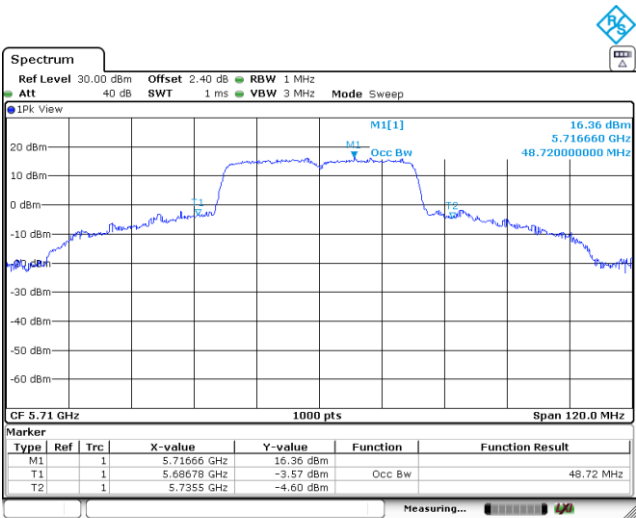
channel 110(5550 MHz)



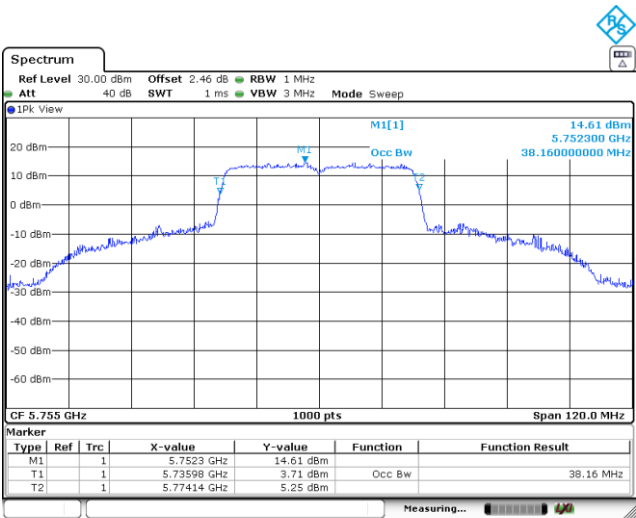
channel 134 (5670 MHz)



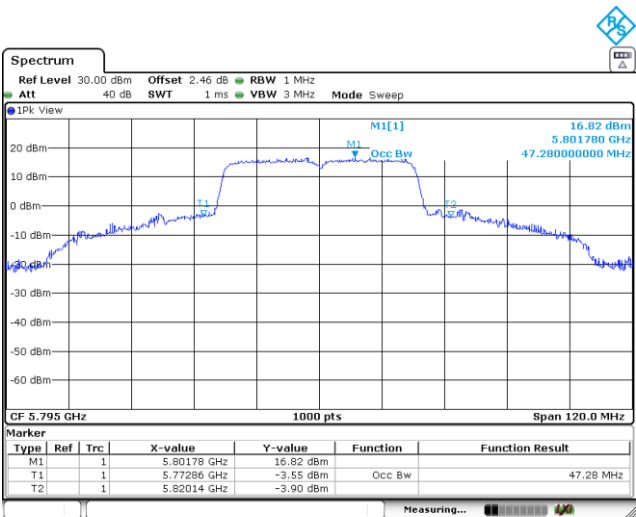
channel 142 (5710 MHz)



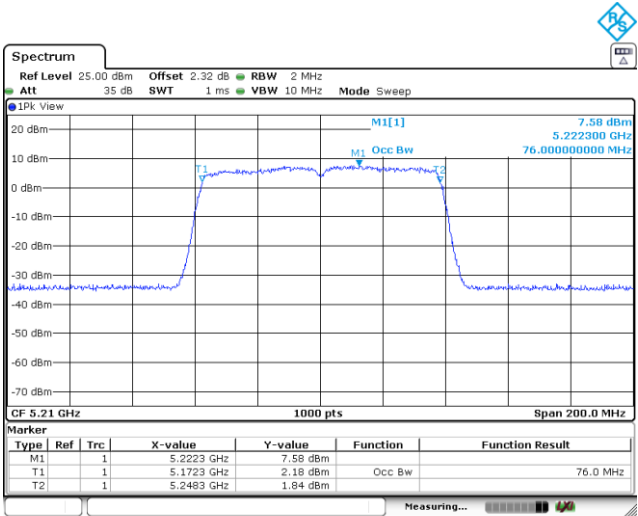
channel 151 (5755 MHz)



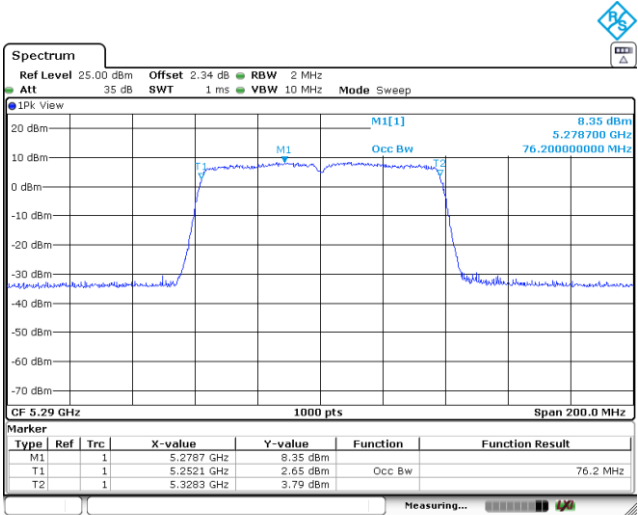
channel 159 (5795 MHz)



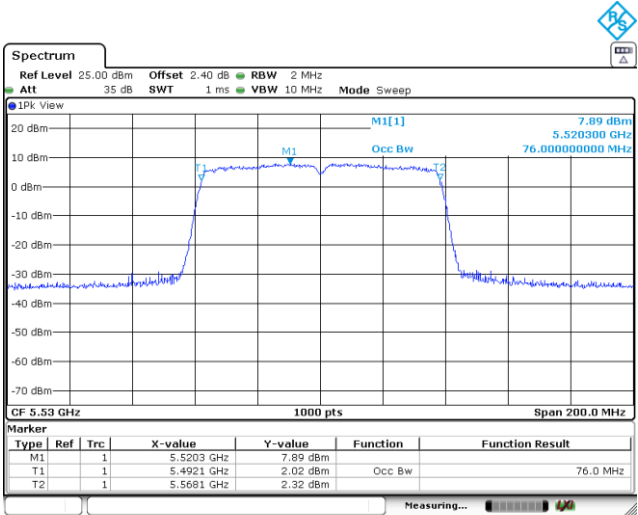
Mode : 802.11ac VHT80 - 80MHz – SISO – CORE Aux
channel 42 (5210 MHz)



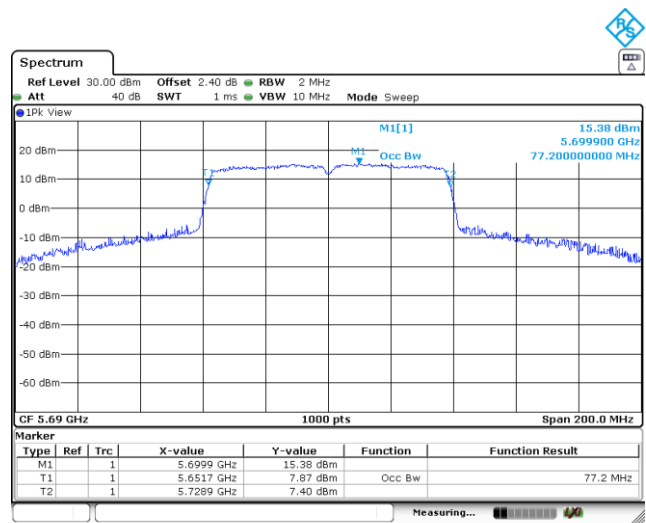
channel 58 (5290 MHz)



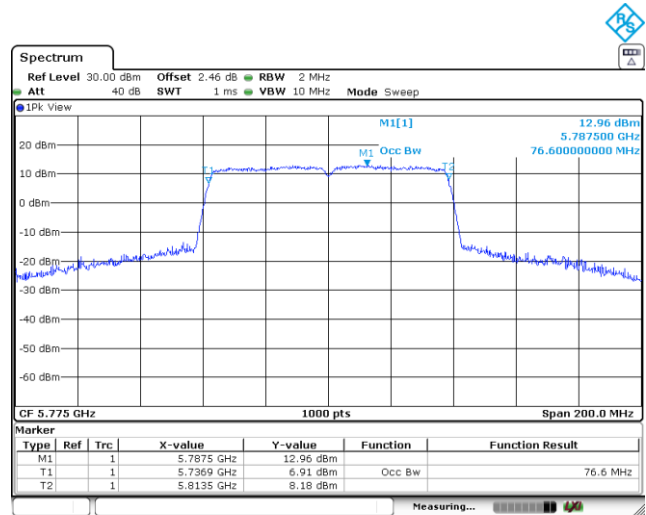
channel 106 (5530 MHz)



channel 138 (5690 MHz)



channel 155 (5775 MHz)



FCC Section 15.407 Subclause 15.403(i) Transmitter 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 client supplied U.FL RF cables with the EUT in order to perform conducted measurements. The measured additional path loss was included in any path loss calculations.

The customer declared the worst case SISO for testing which were:

- 802.11a: 6 Mbit/s / SISO on Core Aux
- 802.11n HT20: MCS0 / SISO on Core Aux
- 802.11n HT40: MCS0 / SISO on Core Aux
- 802.11ac VHT80: MCS0x1 / SISO on Core Aux

Mode : 802.11a - 20MHz – SISO – CORE Aux

	26dB Emission Bandwidth (MHz)	Measurement uncertainty (dB)
channel 36 (5180 MHz)	22.318	<±40.04
channel 40 (5200 MHz)	32.644	
channel 48 (5240 MHz)	34.130	
channel 52 (5260 MHz)	32.669	
channel 56 (5280 MHz)	32.670	
channel 64 (5320 MHz)	22.313	
channel 100 (5500 MHz)	22.278	
channel 116 (5580 MHz)	35.887	
channel 140 (5700 MHz)	22.313	
channel 144 (5720 MHz) U-NII-2C and U-NII-3 Bands	31.813	
channel 144 (5720 MHz) U-NII-2C	21.436	
channel 149 (5745 MHz)	37.302	
channel 157 (5785 MHz)	37.997	
channel 165 (5825 MHz)	37.808	

Mode : 802.11n HT20 - 20MHz – SISO – CORE Aux

	26dB Emission Bandwidth (MHz)	Measurement uncertainty (dB)
channel 36 (5180 MHz)	22.614	<±40.04
channel 40 (5200 MHz)	39.312	
channel 48 (5240 MHz)	41.313	
channel 52 (5260 MHz)	37.319	
channel 56 (5280 MHz)	39.622	
channel 64 (5320 MHz)	22.659	
channel 100 (5500 MHz)	22.664	
channel 116 (5580 MHz)	42.960	
channel 140 (5700 MHz)	22.669	
channel 144 (5720 MHz) U-NII-2C and U-NII-3 Bands	39.359	
channel 144 (5720 MHz) U-NII-2C Band	23.139	
channel 149 (5745 MHz)	43.134	
channel 157 (5785 MHz)	42.400	
channel 165 (5825 MHz)	43.293	

Mode : 802.11n HT40 - 40MHz – SISO – CORE Aux

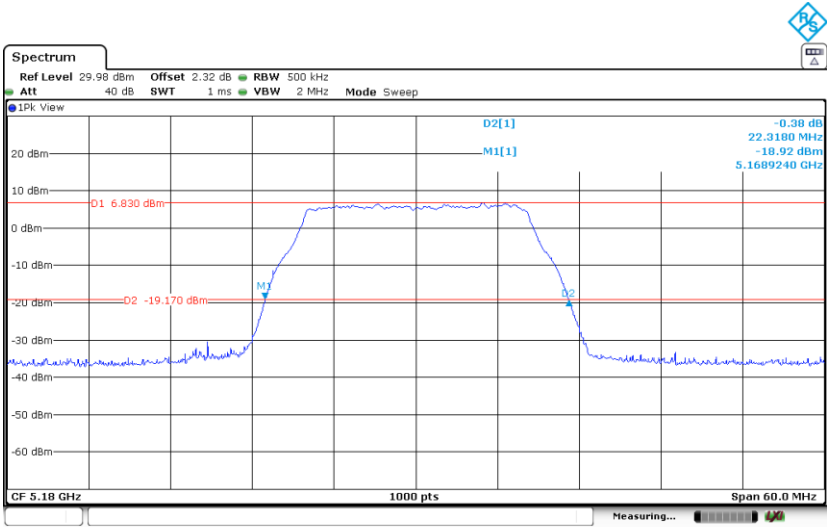
	26dB Emission Bandwidth (MHz)	Measurement uncertainty (dB)
channel 38 (5190 MHz)	41.700	<±70.07
channel 46 (5230 MHz)	65.812	
channel 54 (5270 MHz)	63.030	
channel 62 (5310 MHz)	41.680	
channel 102 (5510 MHz)	41.337	
channel 110 (5550 MHz)	96.630	
channel 118 (5590 MHz)	98.490	
channel 134 (5670 MHz)	41.666	
channel 142 (5710 MHz) U-NII-2C and U-NII-3 Bands	93.264	
channel 142 (5710 MHz) U-NII-2C Band	61.620	
channel 151 (5755 MHz)	80.260	
channel 159 (5795 MHz)	92.465	

Mode : 802.11ac VHT80 - 80MHz – SISO – CORE Aux

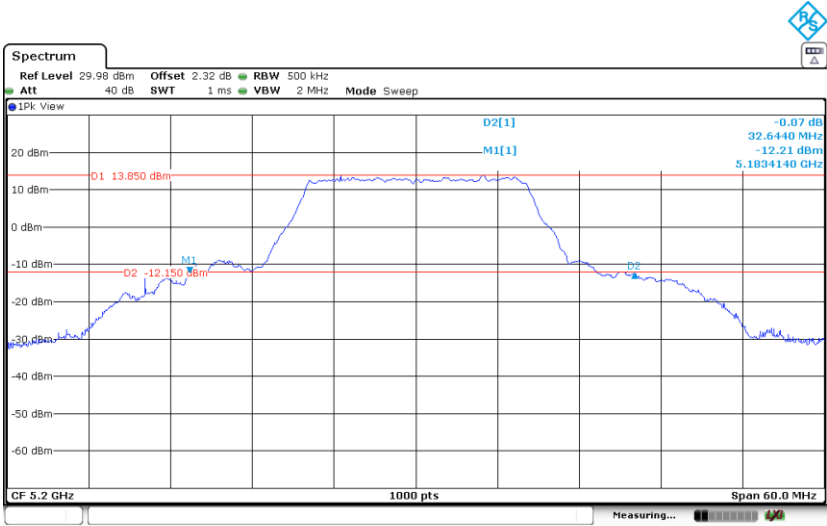
	26dB Emission Bandwidth (MHz)	Measurement uncertainty (dB)
channel 42 (5210 MHz)	84.111	<±110.11
channel 58 (5290 MHz)	84.001	
channel 106 (5530 MHz)	84.016	
channel 122 (5610 MHz)	100.74	
channel 138 (5690 MHz) U-NII-2C and U-NII-3 Bands	142.510	
channel 138 (5690 MHz) U-NII-2C Band	100.370	
channel 155 (5775 MHz)	84.36	

Mode : 802.11a - 20MHz – SISO – CORE AUX

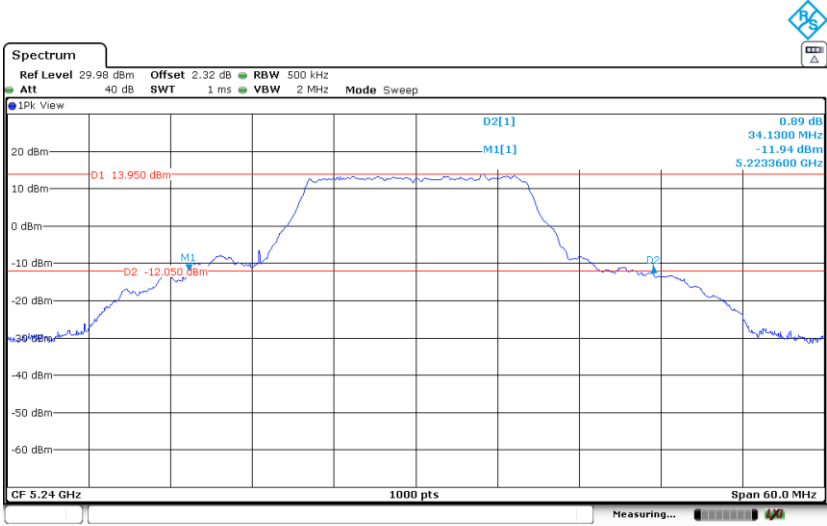
channel 36 (5180 MHz)



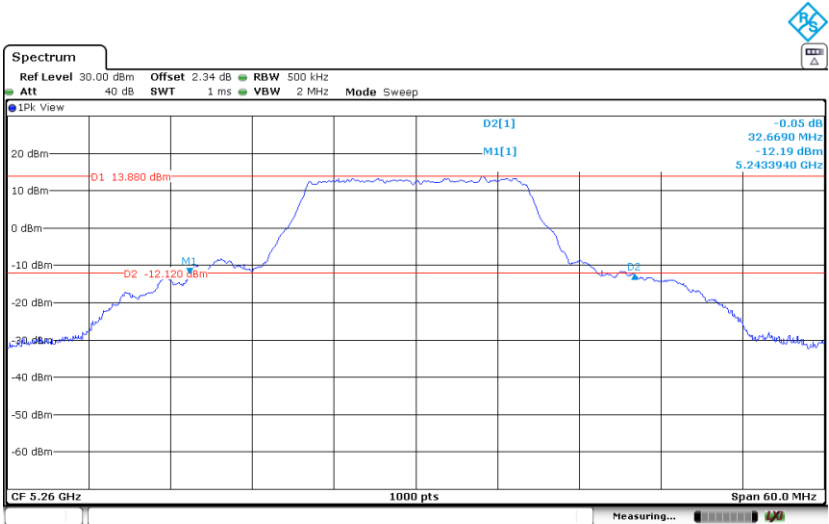
channel 40 (5200 MHz)



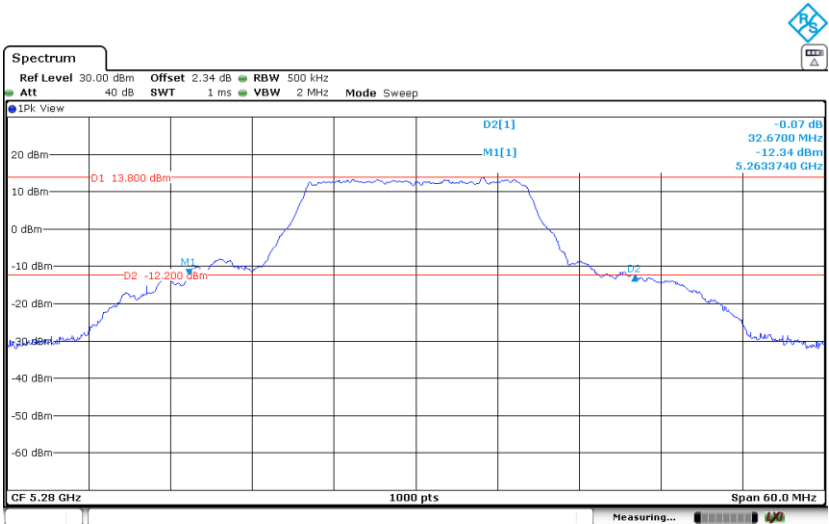
channel 48 (5240 MHz)



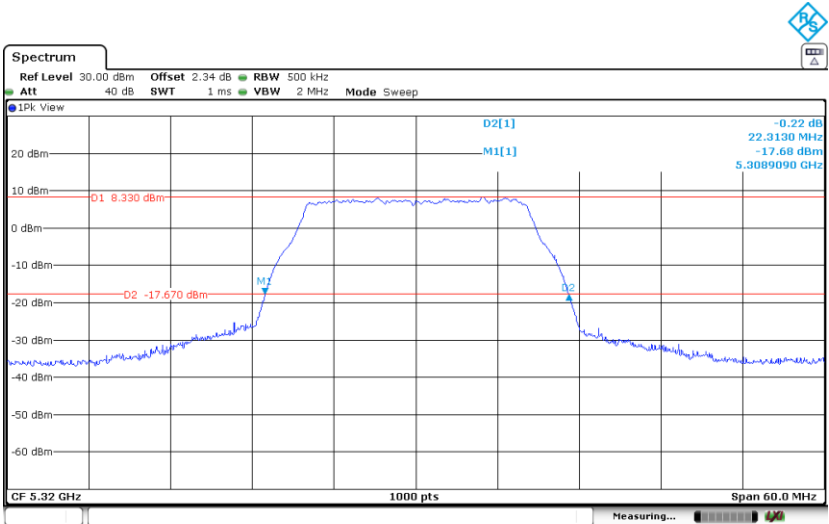
channel 52 (5260 MHz)



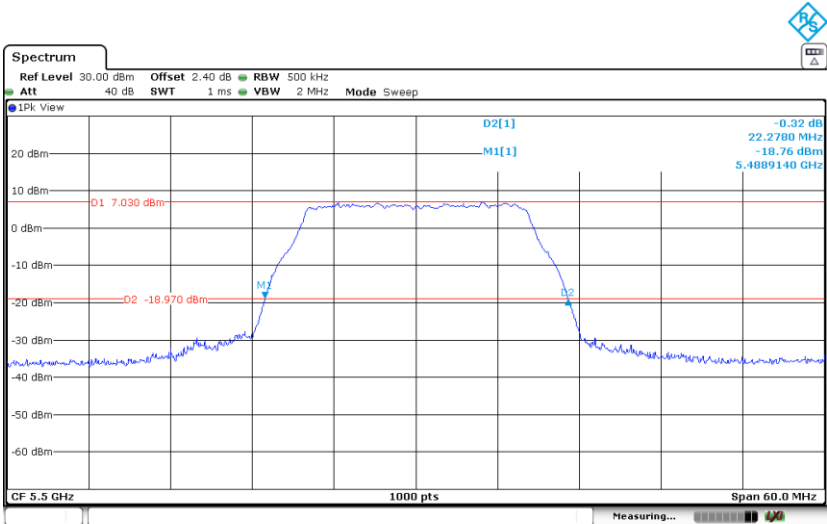
channel 56 (5280 MHz)



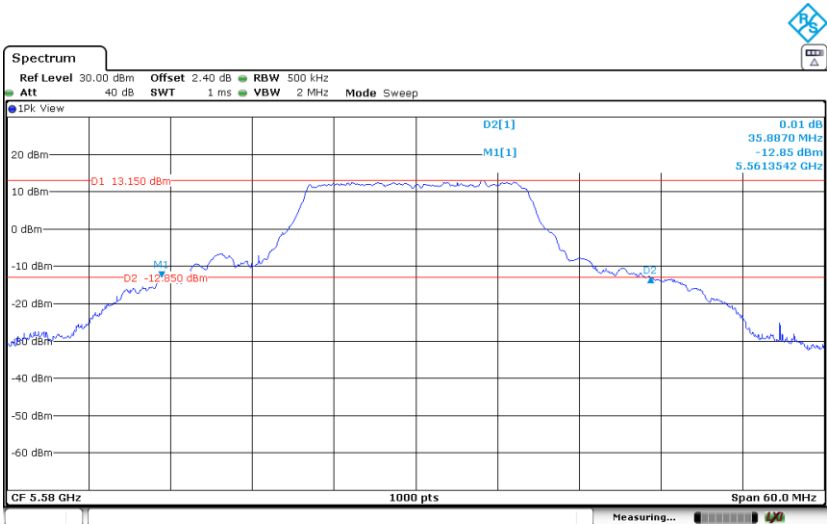
channel 64 (5320 MHz)



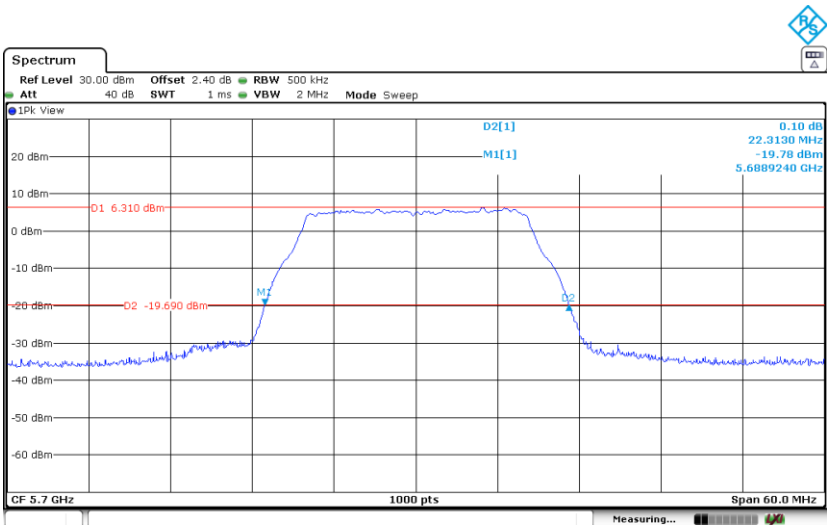
channel 100 (5500 MHz)



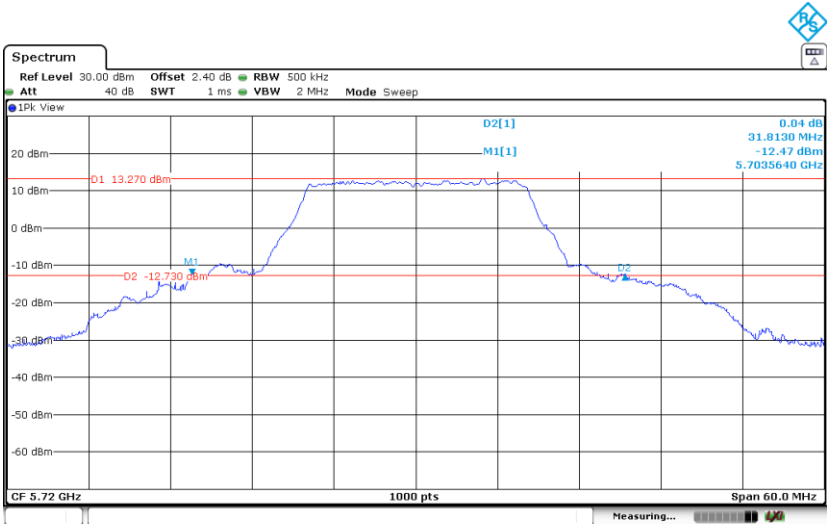
channel 116 (5580 MHz)



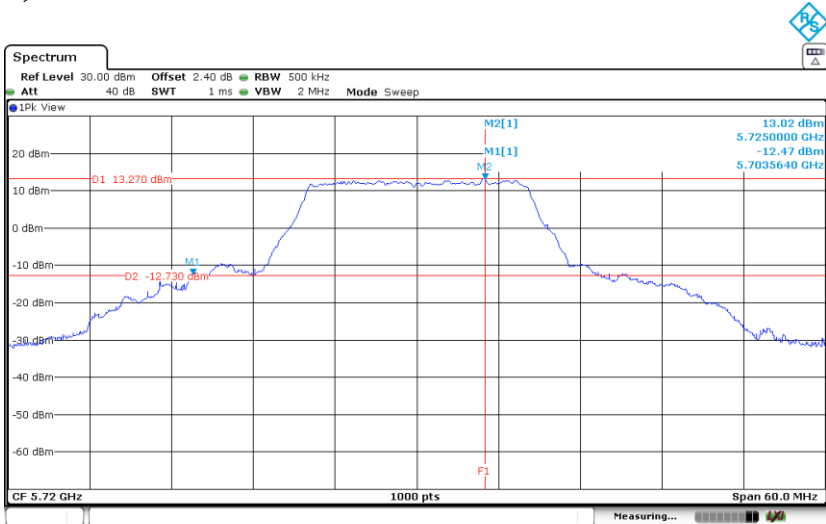
channel 140 (5700 MHz)



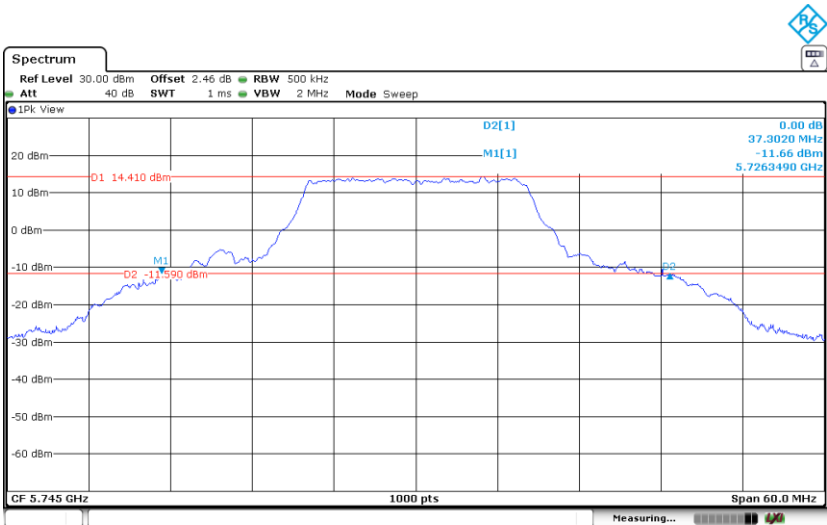
channel 144 (5720 MHz) U-NII-2C and U-NII-3 Bands



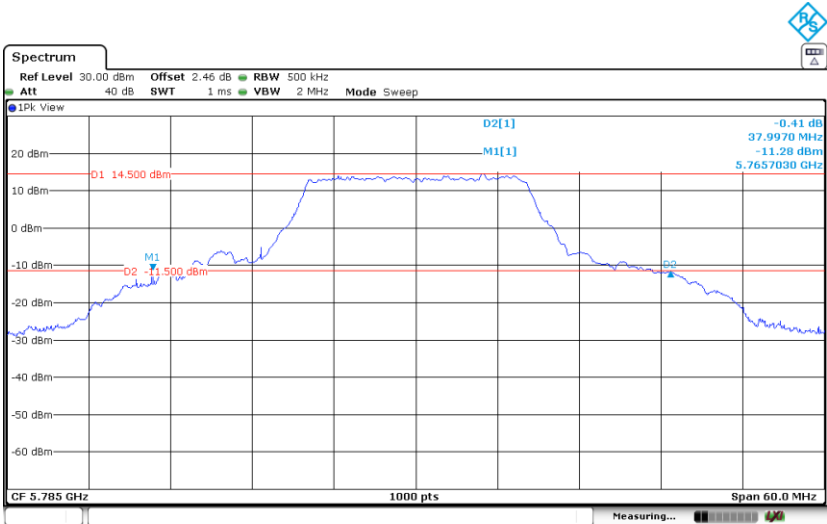
channel 144 (5720 MHz) U-NII-2C Band



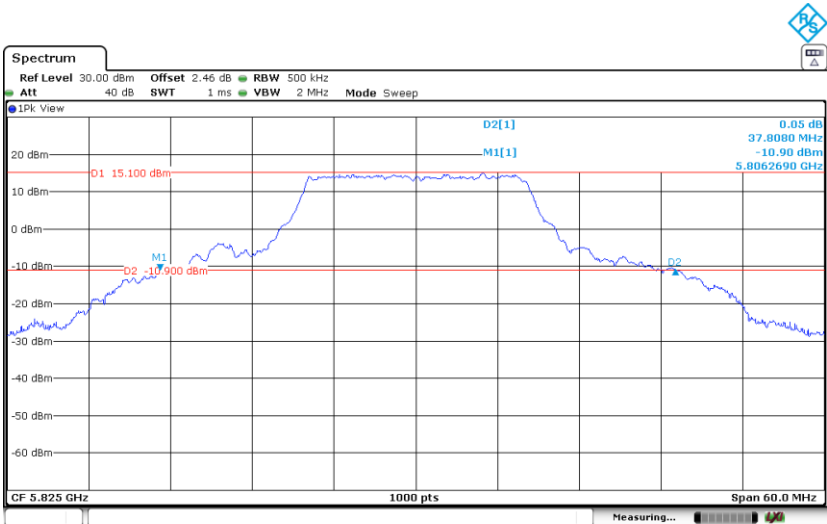
channel 149 (5745 MHz)



channel 157 (5785 MHz)

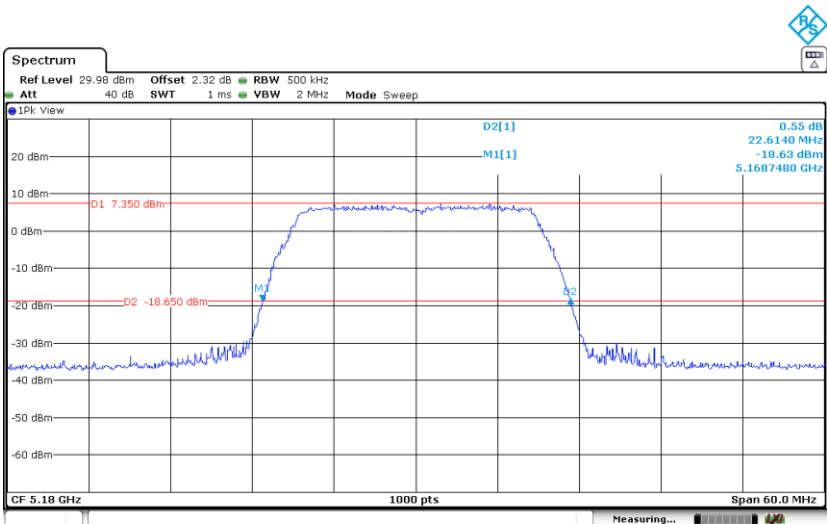


channel 165 (5825 MHz)

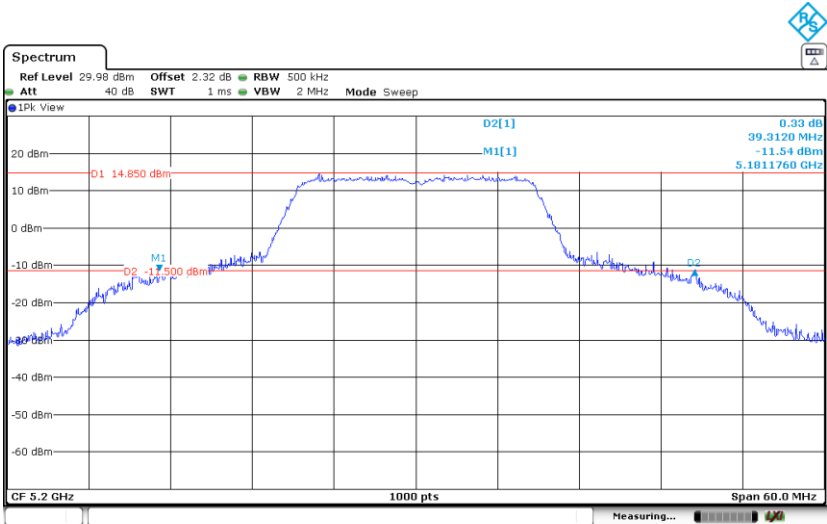


Mode : 802.11n HT20 - 20MHz – SISO – CORE Aux

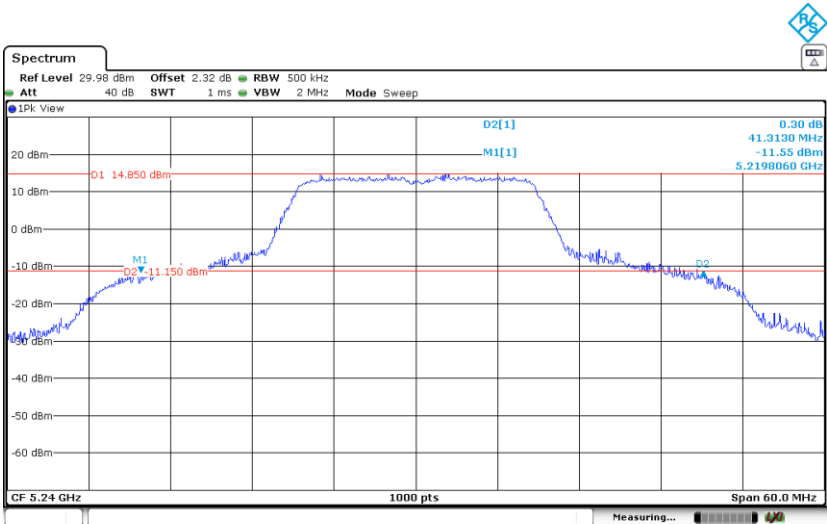
channel 36 (5180 MHz)



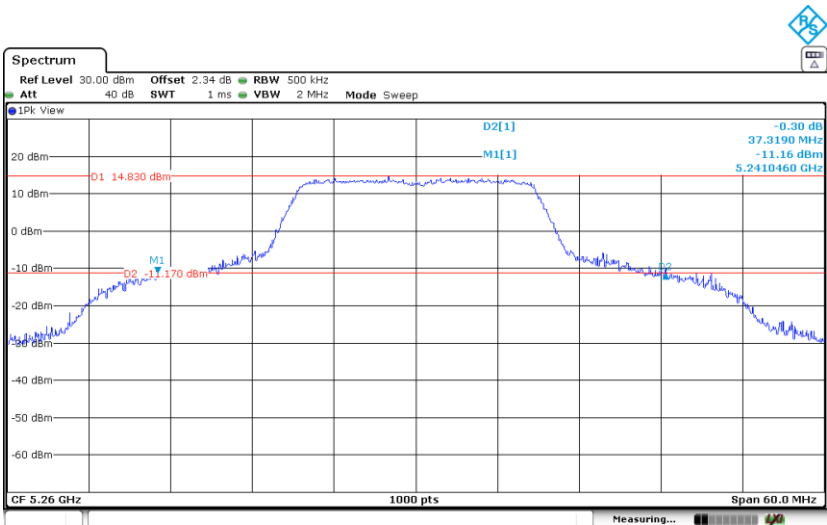
channel 40 (5200 MHz)



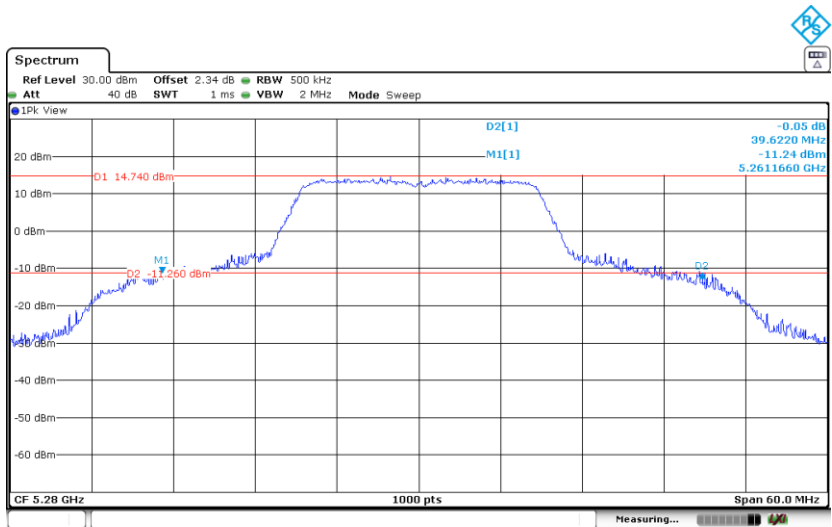
channel 48 (5240 MHz)



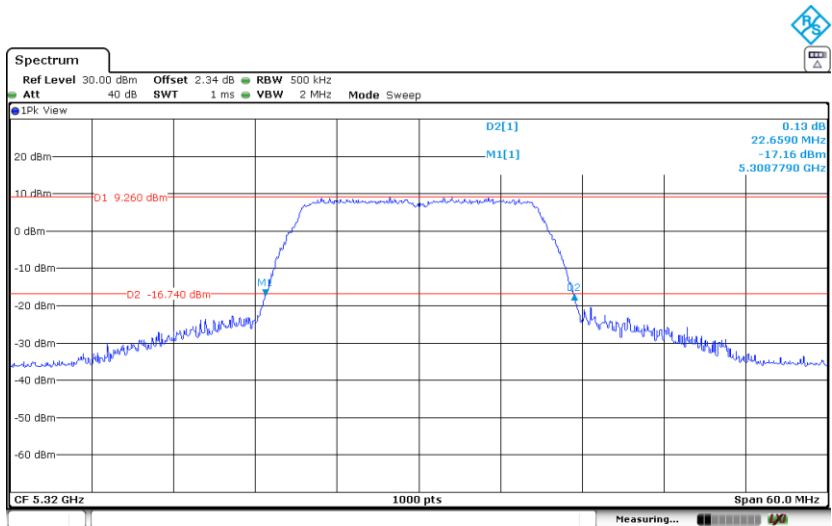
channel 52 (5260 MHz)



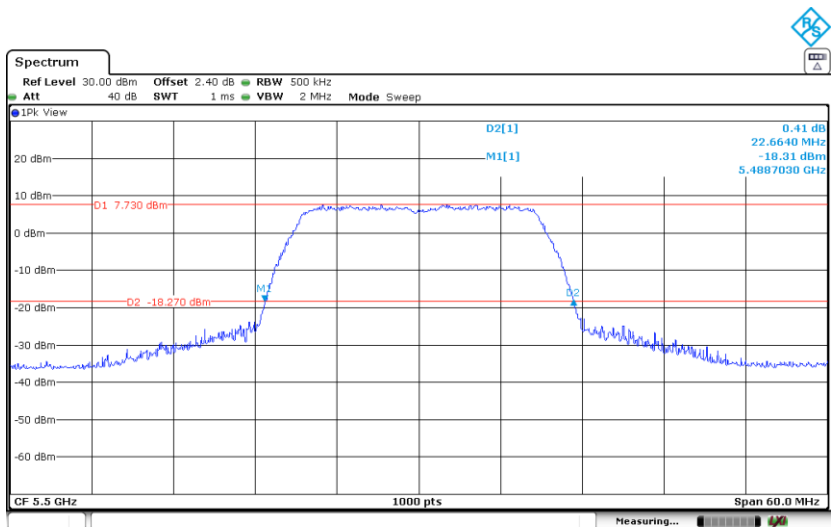
channel 56 (5280 MHz)



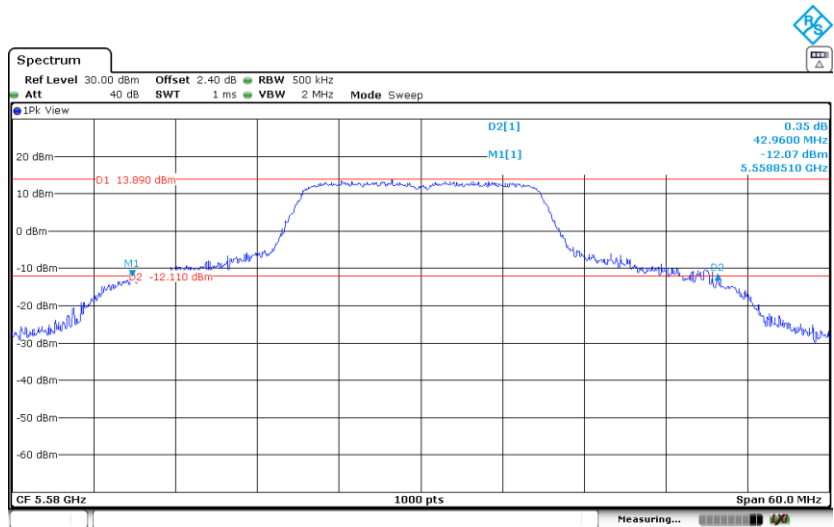
channel 64 (5320 MHz)



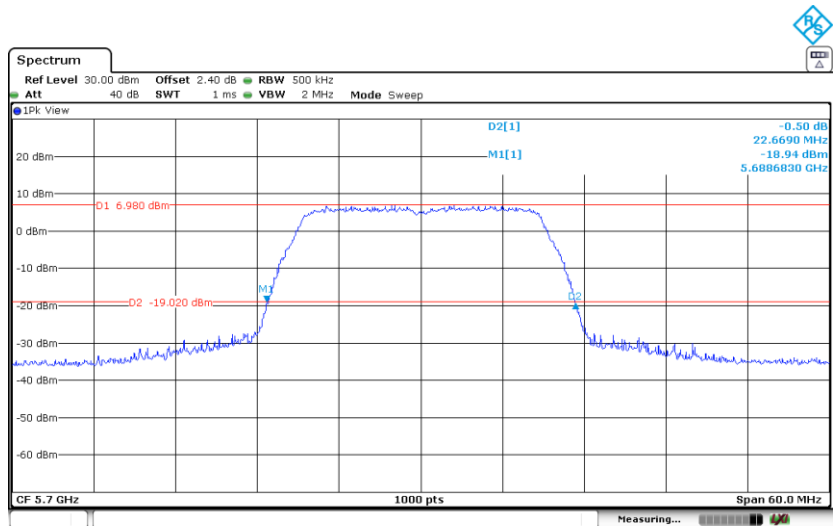
channel 100 (5500 MHz)



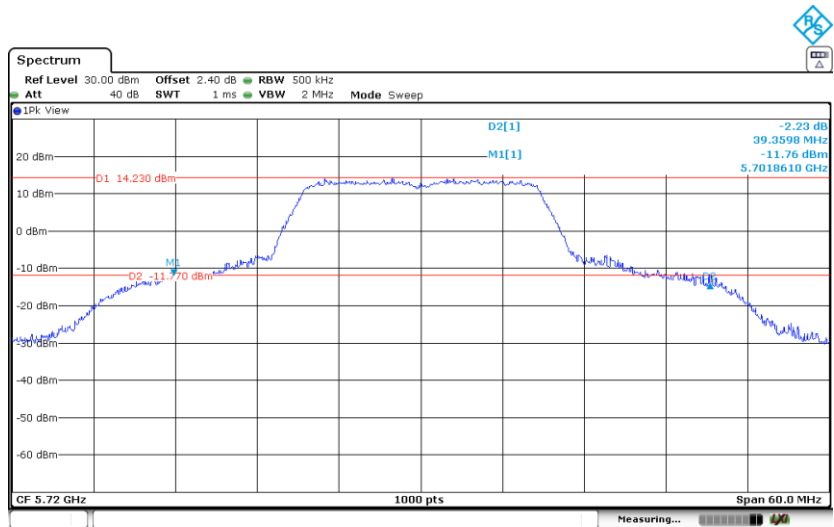
channel 116 (5580 MHz)



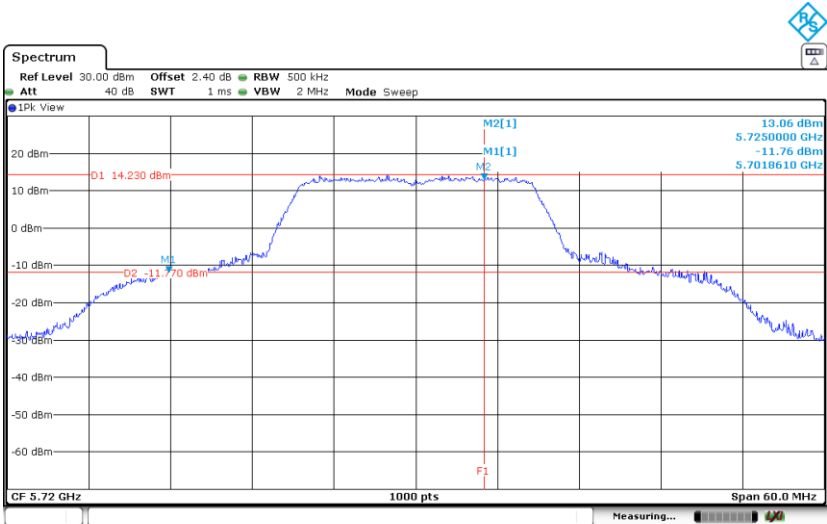
channel 140 (5700 MHz)



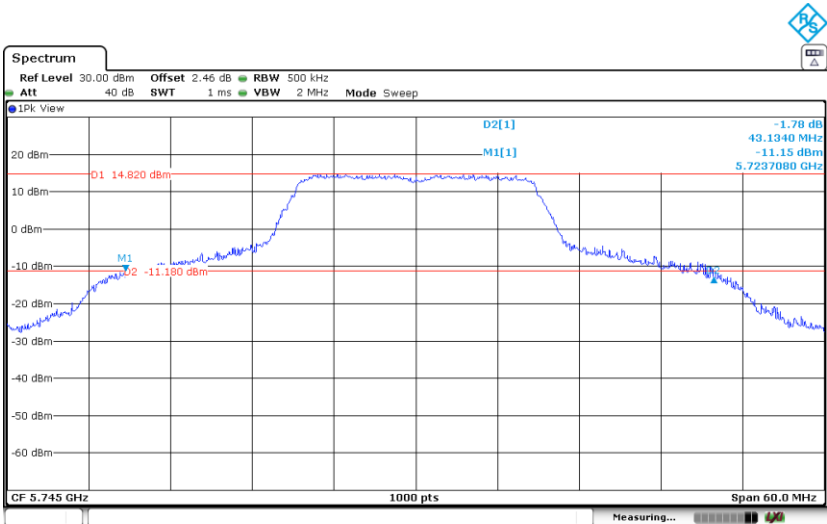
channel 144 (5720 MHz) U-NII-2C and U-NII-3 Bands



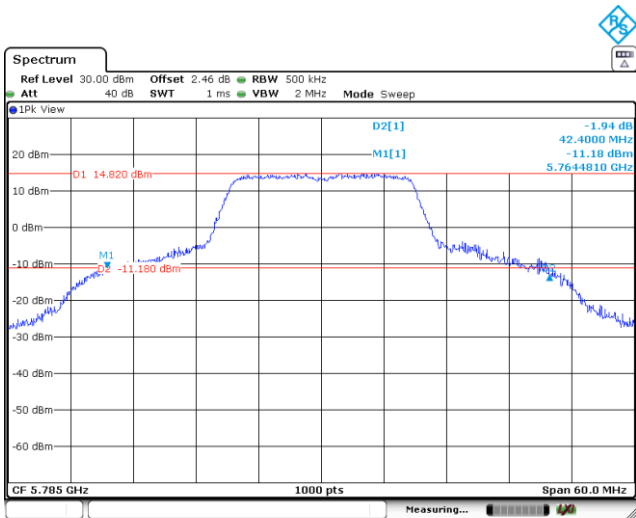
channel 144 (5720 MHz) U-NII-2C Band



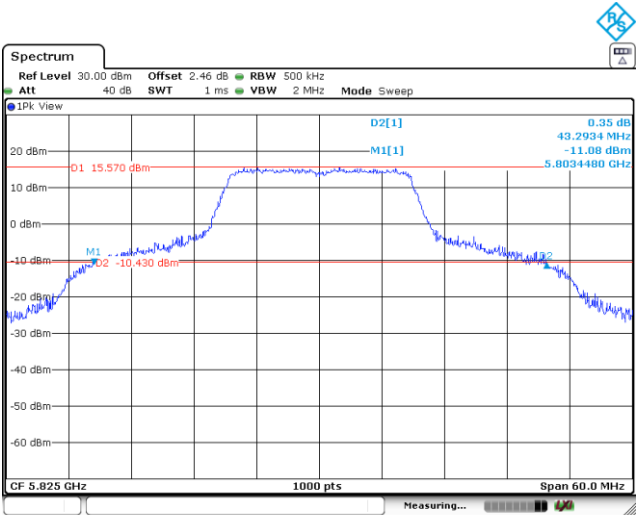
channel 149 (5745 MHz)



channel 157 (5785 MHz)

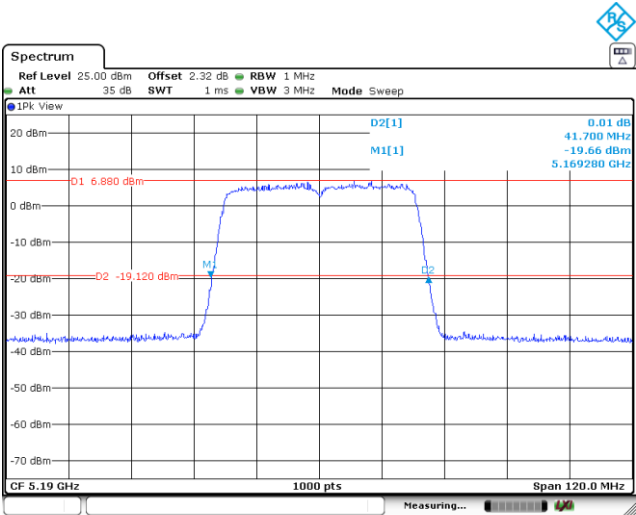


channel 165 (5825 MHz)

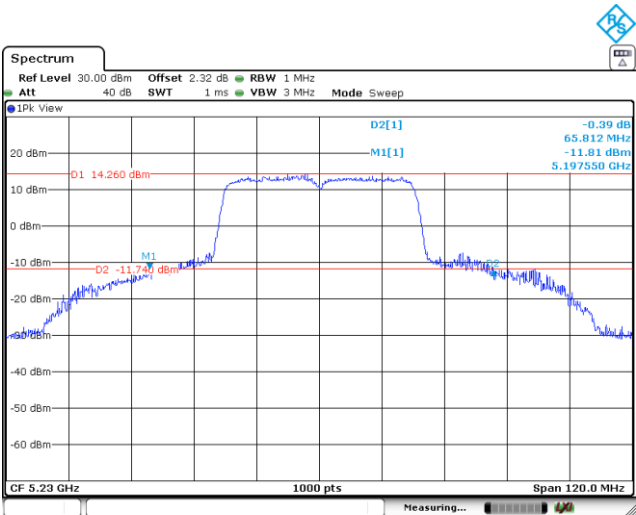


Mode : 802.11n HT40 - 40MHz – SISO – CORE Aux

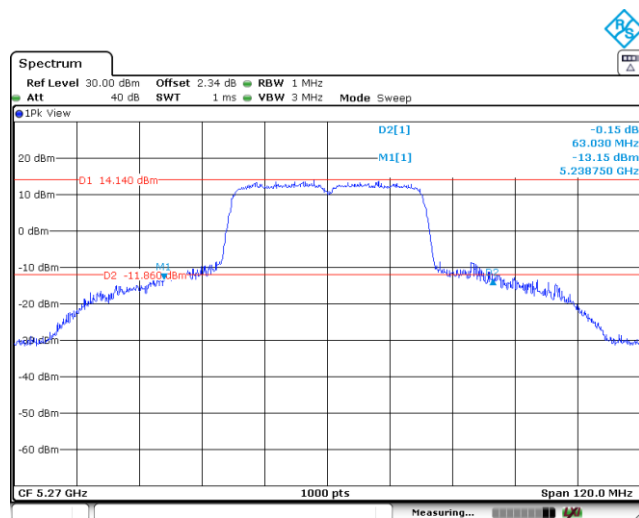
channel 38 (5190 MHz)



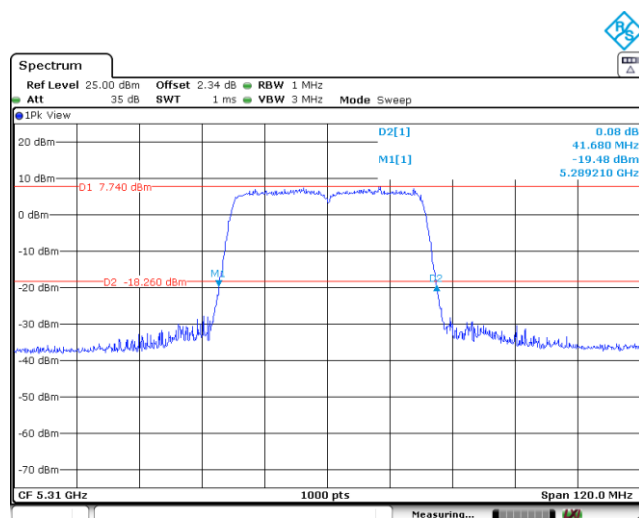
channel 46 (5230 MHz)



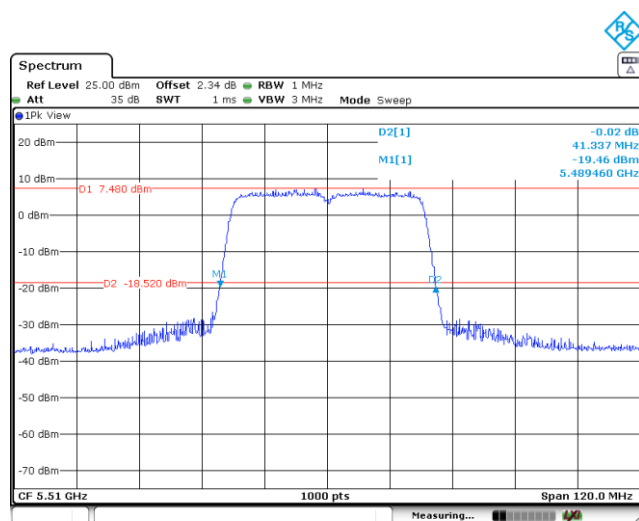
channel 54 (5270 MHz)



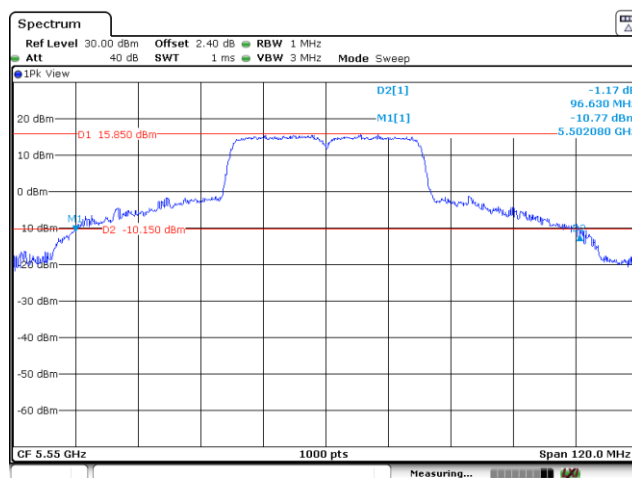
channel 62 (5310 MHz)



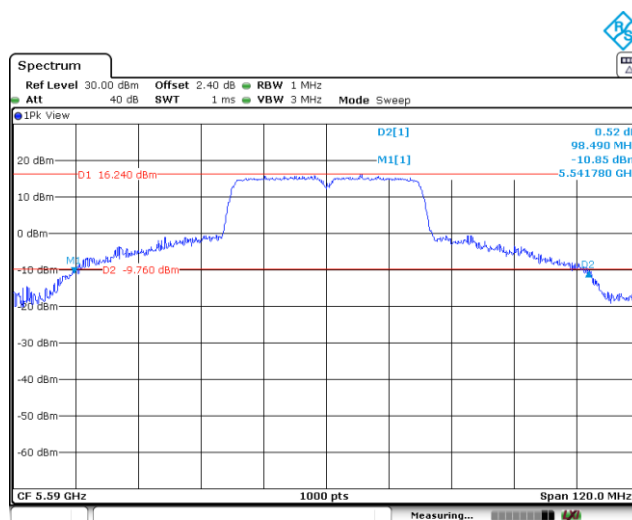
channel 102 (5510 MHz)



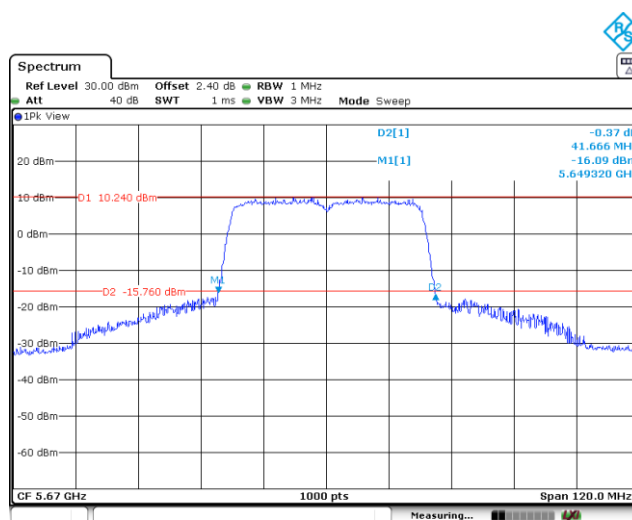
channel 110 (5550 MHz)

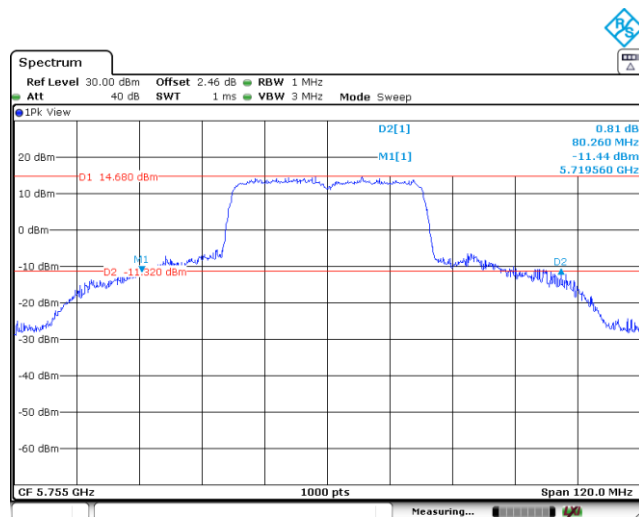
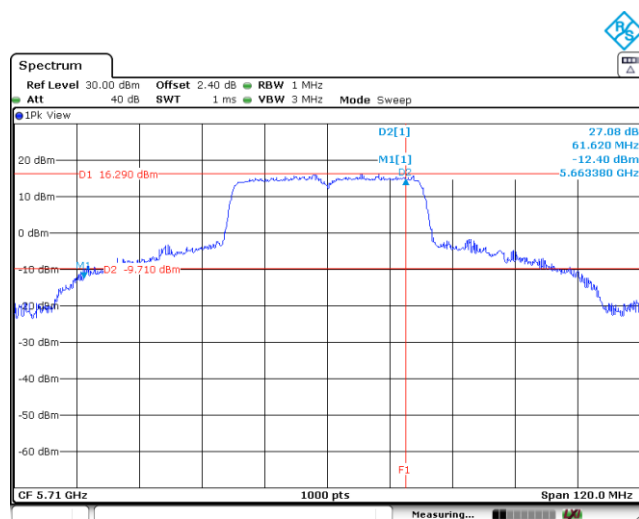
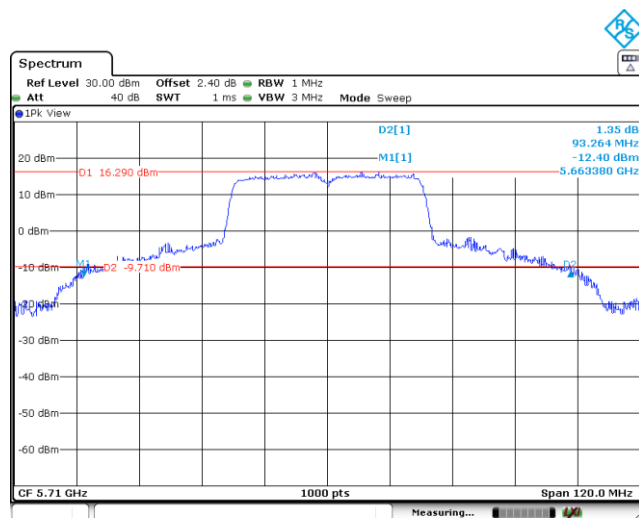


channel 118 (5590 MHz)

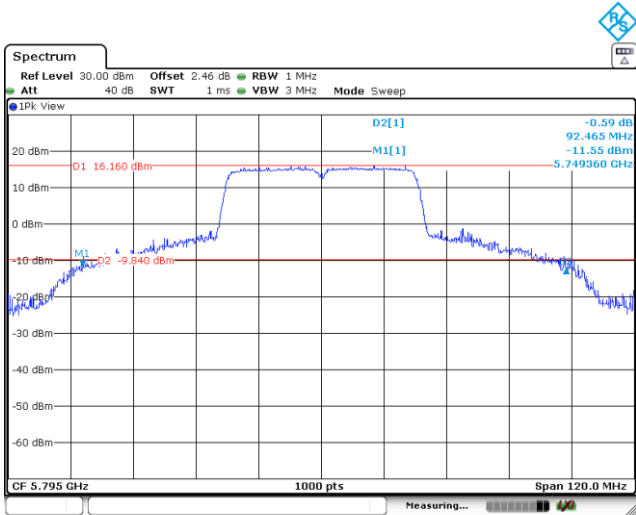


channel 134 (5670 MHz)

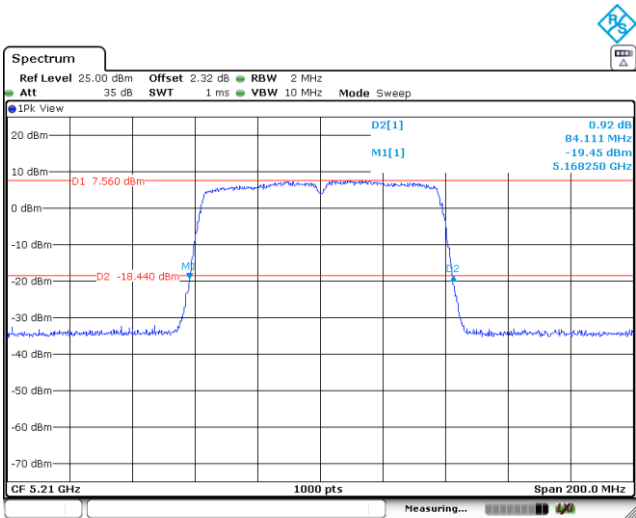




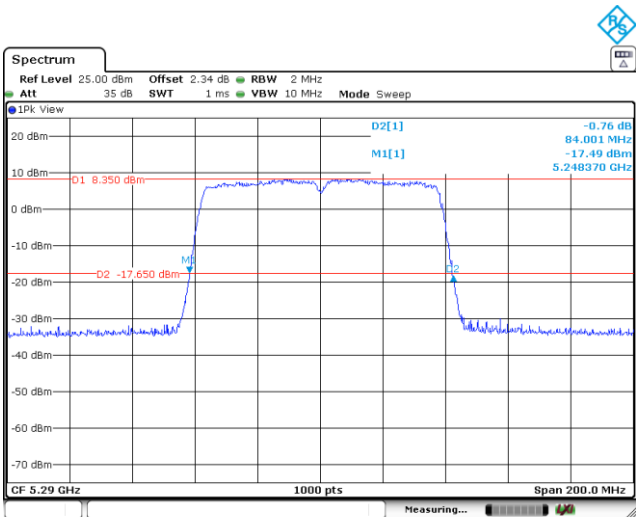
channel 159 (5795 MHz)



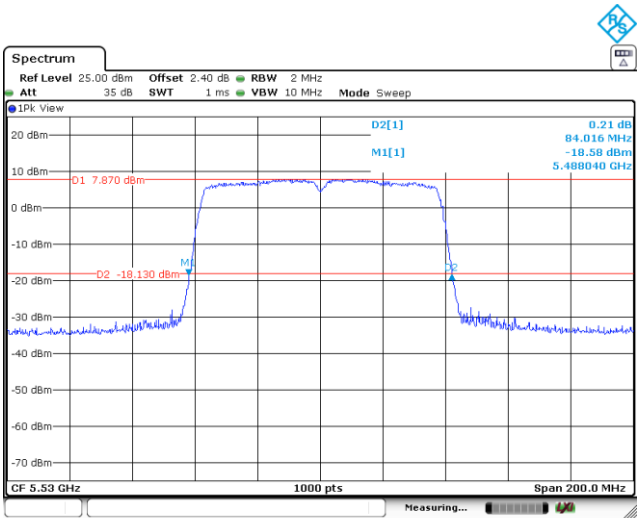
Mode : 802.11ac VHT80 - 80MHz – SISO – CORE Aux
channel 42 (5210 MHz)



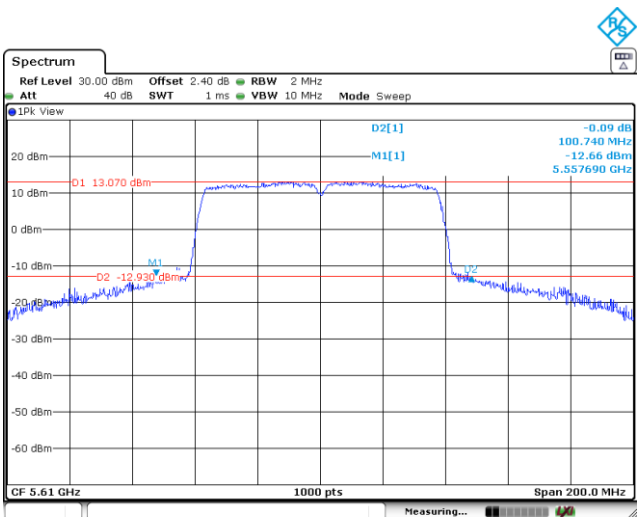
channel 58 (5290 MHz)



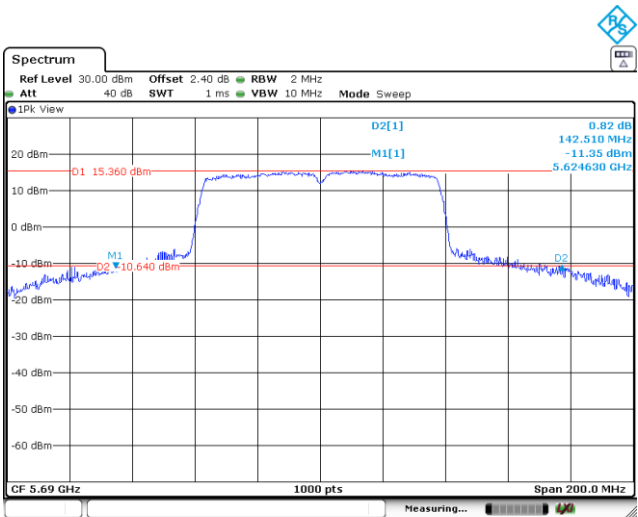
channel 106 (5530 MHz)



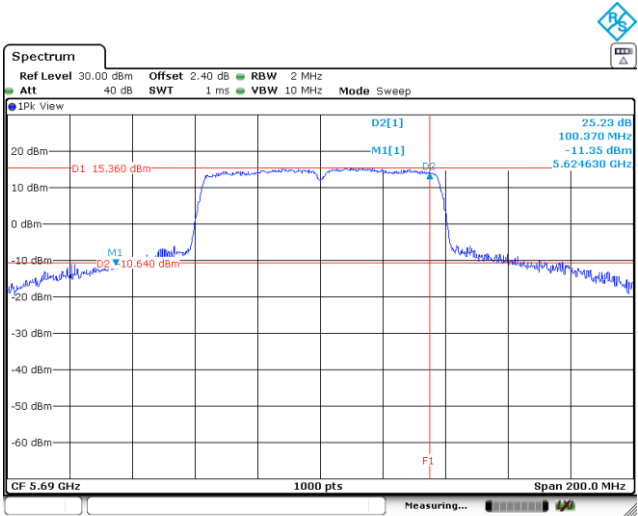
channel 122 (5610 MHz)



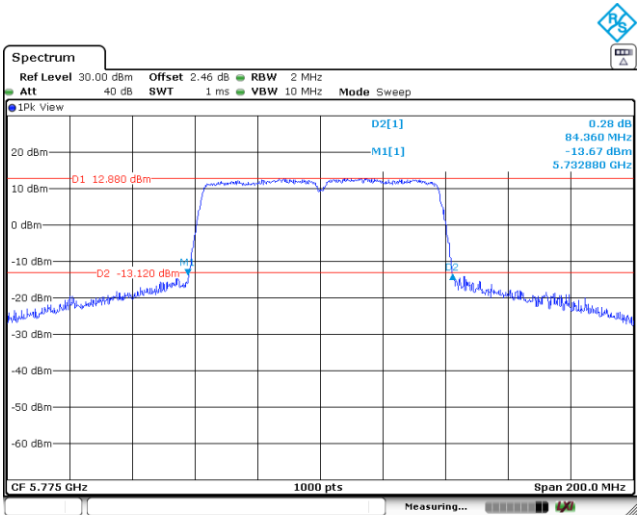
channel 138 (5690 MHz) U-NII-2C and U-NII-3 Bands



channel 138 (5690 MHz) U-NII-2C Band



channel 155 (5775 MHz)



Appendix B: Test result for 5.15GHz – 5.25GHz.

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TEST CONDITIONS

Power supply (V):

Vnominal = 120 Vac

Type of power supply = AC voltage main supply.

Type of antenna = Internal antenna.

Declared Gain for antenna (maximum):

G_{COREAUX} = 4.15 dBi

Technology Tested:	WLAN (IEEE 802.11 a,n,ac) / U-NII	
Modes:	802.11a: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps (SISO)	
	802.11n HT20: MCS0 to MCS7	
	802.11n HT40: MCS0 to MCS7	
	802.11ac VHT20: MCS0 to MCS8	
	802.11ac VHT40: MCS0 to MCS9	
	802.11ac VHT80: MCS0 to MCS9	
Setting of cores / ports:	Aux	
Beamforming:	No	
Frequency Range:	5150 MHz to 5250 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Lowest: 36	5180
	Middle: 40	5200
	Highest: 48	5240
Channel Spacing:	40 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Lowest: 38	5190
	Highest: 46	5230
Channel Spacing:	80 MHz	
Transmit Channels	Middle: 42	5210

The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power in all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode for the channel under test.

For all modes, the EUT was configured in test mode using a software application. The application was used to enable a continuous transmission and to select the test channels as required. The client supplied scripts to configure the EUT. The customer supplied a document containing the setup instructions.

The customer declared the worst case for testing which were:

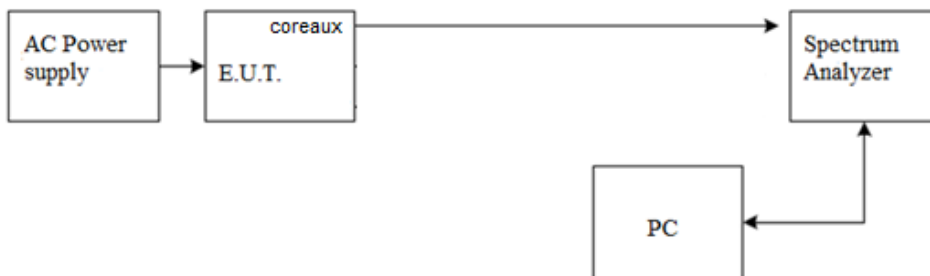
- 802.11a: 6 Mbit/s / SISO on Core Aux
- 802.11n HT20: MCS0 / SISO on Core Aux
- 802.11n HT40: MCS0 / SISO on Core Aux
- 802.11ac VHT80: MCS0x1 / SISO on Core Aux

The client supplied U.FL RF cables with the EUT in order to perform conducted measurements. The measured additional path loss was included in any path loss calculations.

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and connected to the spectrum analyzer using a low loss RF cable. The reading in the spectrum analyzer is corrected taking into account the internal and external RF cable loss.

For all modes:



The AC supply voltage is applied using an external power supply.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the center of the chamber turntable to perform the measurements below 1GHz and The EUT was placed at a height of 1.5 meters above the test chamber floor in the center of the chamber turntable to perform the measurements above 1GHz. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.