EMITECH GROUPE

RR051-17-104757-1-A Ed. 0

Certification Radio test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
Parrot BLUEGRASS

FCC ID: 2AG6ICHIMERA

Company:
PARROT DRONES

Distribution: Mr EL HANBALI **(Company:** PARROT DRONES)

Number of pages: 135 with 6 appendixes

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval Name and Function	Visa
0	16-Nov-17	Creation	M. DUMESNIL, Radio Technical Manager	

Duplication of this document is only permitted for an integral photographic facsimile. It includes the number of pages referenced here above.
This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.

DESIGNATION OF PRODUCT:	**Parrot BLUEGRASS**
Serial number (S/N):	DV04
Reference / model (P/N):	CHIMERA
Software version:	RF software
MANUFACTURER:	PARROT DRONES

COMPANY SUBMITTING THE PRODUCT:

Company:	PARROT DRONES
Address:	174 QUA DE JEMMAPES 7501 PARIS FRANCE
Responsible:	Mr EL HANBALI
Persons present during the tests:	Mr EL HANBALI
DATES OF TEST:	From 31-Oct-17 to 8-Nov-17
TESTING LOCATION:	EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE FCC Accredited under US-EU MRA Designation Number: FR0009 Test Firm Registration Number: 873677
TESTED BY:	T. LEDRESSEUR ***VISA:***
WRITTEN BY:	T. LEDRESSEUR

CONTENTS

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **Parrot BLUEGRASS**, in accordance with normative reference.

The product integrates a WLAN radio part.
See test report RR051-17-104757-2-A for test on 2.4GHz band and RR051-17-104757-3-A for test on non-radio part.

2. PRODUCT DESCRIPTION

Class:	B
Utilization:	Residential
Antenna type and gain:	2 integral identical antennas 2.8 dBi for U-NII-1 band and 4.2 dBi for U-NII-3 band
Operating frequency range:	From 5150 MHz to 5250 MHz band U-NII-1 From 5725 MHz to 5850 MHz band U-NII-3
Number of channels:	4 for band 5150MHz to 5250 MHz 5 for band 5725MHz to 5850 MHz
Channel spacing:	20 MHz
Modulation:	OFDM: BPSK OFDM: 64-QAM
Power source:	14.8Vdc by internal battery The battery is rechargeable outside the product.
Mode tested:	802.11 a 802.11 n
Data rate:	For 802.11a: 6Mbit/s For 802.11n: MCS0
Channel tested:	
Band U-NII-1:	Chanel 36, 5180 MHz Chanel 40, 5200 MHz Chanel 48, 5240 MHz
Band U-NII-3:	Chanel 149, 5745 MHz Chanel 157, 5785 MHz Chanel 165, 5825 MHz

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.
They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 FCC Part 15 (2017)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for ComplianceTesting of Unlicensed Wireless Devices.
789033 D02 General UNII Test Procedures New Rules v01r04	Guidelines for compliances testing of unlicensed national information infrastructure (U-NII) devices pat 15, subpart E
662911 D01 Multiple Transmitter Output V02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
447498 D01 General RF Exposure Guidance v06	RF Exposure procedures and equipment authorization policies for mobile and portable equipment

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart C – Intentional Radiators
- Paragraph 203: Antenna requirement
- Paragraph 205: Restricted bands of operation
- Paragraph 207: Conducted limits
- Paragraph 209: Radiated emission limits; general requirements

Subpart E – Unlicensed national information infrastructure devices
- Paragraph 407: General technical requirements

5. TEST EQUIPMENT CALIBRATION DATES

Emitech Number	Model	Type	Last verification	Next verification	Validity
0000	BAT-EMC V3.6.0.32	Software	/	/	/
4087	Filtek LP03/1000-7GH	Low Pass Filter	05/04/2016	05/04/2018	05/06/2018
4088	R&S FSP40	Spectrum Analyzer	29/10/2015	29/10/2017	29/12/2017
4353	ATM WR28	Antenna	16/05/2016	16/05/2019	16/07/2019
4354	ALC ALS2640-30-10	Low-noise amplifier	18/11/2016	18/11/2017	18/01/2018
6606	Microtronics LPM 15601	Low Pass Filter	04/08/2017	04/08/2019	04/10/2019
6607	Microtronics HPM 15600	High Pass Filter	04/08/2017	04/08/2019	04/10/2019
7190	R&S HL223	Antenna	15/03/2016	15/03/2019	15/05/2019
8511	HP 8447D	Low-noise amplifier	28/11/2016	28/11/2017	28/01/2018
8526	Schwarzbeck VHBB 9124	Biconical antenna	12/06/2015	12/06/2018	12/08/2018
8528	Schwarzbeck VHA 9103	Biconical antenna	15/03/2016	15/03/2019	15/05/2019
8535	EMCO 3115	Antenna	10/02/2016	10/02/2020	10/04/2020
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	12/06/2015	12/06/2018	12/08/2018
8549	Midwest Microwave 20dB	Attenuator	09/06/2016	09/06/2018	09/08/2018
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8704	LUCIX Corp S180265L3201 LNA	Low-noise amplifier	02/05/2017	02/05/2018	02/07/2018
8707	R&S ESI7	Test receiver	07/06/2016	07/06/2018	07/08/2018
8732	Emitech	OATS	11/10/2016	11/10/2019	11/12/2019
8750	La Crosse Technology WS-9232	Meteo station	23/09/2016	23/09/2018	23/11/2018
8786	ETS Lindgren 3160-09	Antenna	16/05/2016	16/05/2019	16/07/2019
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9403	R&S ESU8	Spectrum Analyzer	11/08/2016	11/08/2018	11/10/2018
10739	LUCIX Corp S005180M3201	Low-noise amplifier	29/03/2017	29/03/2018	29/05/2018
11592	R&S NRV-Z86	Power Sensor	02/03/2017	02/03/2018	02/05/2018
14476	Fluke 177	Multimeter	20/03/2017	20/03/2018	20/05/2018
14539	R&S FSL18	Spectrum Analyzer	02/06/2017	02/06/2018	02/08/2018

6. TESTS RESULTS SUMMARY

6.1 intentional radiator (subpart C)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				*Note 1*
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS			X		
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				*Note 2*

NAp: Not Applicable NAs: Not Asked

Note 1: Integral antenna with standard connector.

Note 2: See FCC part 15.407.

6.2 unlicensed national information infrastructure device (subpart E)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.407	GENERAL TECHNICAL REQUIREMETS					
	a) Power limits					*Note 1, Note 2*
	a) (1) in the bands 5150–5250 MHz	X				
	a) (2) in the bands 5250–5350 MHz and 5470-5725 MHz			X		
	a) (3) in the bands 5725–5825 MHz	X				
	a) (4) maximum conducted output power	X				
	a) 5) peak power spectral density	X				*Note 1, Note 2*
	b) Undesirable emission limits					
	b) (1) outside of the bands 5150–5250 MHz	X				
	b) (2) outside of the bands 5250–5350 MHz			X		
	b) (3) outside of the bands 5470-5725 MHz			X		
	b) (4) outside of the bands 5725–5825 MHz	X				

NAp: Not Applicable NAs: Not Asked

Note 1: the product is a drone so the limits applicable are a mobile limit

Note 2: The bandwidth plots are on appendixes.

RF EXPOSURE:

Maximum conducted measured power = 18.24 dBm at 5825 MHz
With *Gain = 4.2dBi*
EIRP= 22.44 dBm

In accordance with KDB 447498 D01 General RF Exposure Guidance v06:

*PSD= EIRP/(4*π*R²)*

- ⇨ *175.39/(4*π*(20 cm)²)*= 0.0349 ***mW/cm² (limit = 1 mW/cm² above 1500 MHz)***

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

7. MEASUREMENT UNCERTAINTY

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s)

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for normal distribution corresponds to a coverage probability of approximately 95%.

Parameter	Emitech Uncertainty
RF power, conducted	± 0.75dB
Radiated emission valid to 26 GHz F < 62.5 MHz: 62.5 MHz < F < 1 GHz: 1 GHz < F < 26 GHz:	 ± 5.14 dB ± 5.13 dB ± 5.16 dB
AC Power Lines conducted emissions	± 3.38 dB
Temperature	± 1 °C
Humidity	± 5 %

8. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS

Temperature (°C) : 22 **Humidity (%HR):** 40 **Date :** November 6, 2017

Technician : T. LEDRESSEUR

Standard: FCC Part 15

Test procedure: Paragraph 15.215

Test set up:

Test realized in near field. All field strength measurements are correlated with the radiated maximum peak output power

Test operating condition of the equipment:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

We used for power source the internal fully charged battery

Results:

Band U-NII-1 – mode 802.11a

According to part 15.407 the authorized band is 5150 MHz to 5350 MHz

Sample N° 1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5180	108	Peak	5140.84	51.88	56.12	74	17.88
5180	108	Average	5142	63.7	44.3	54	9.7
5240	107	Peak	5356.01	50.78	57.22	74	16.78
5240	107	Average	5355.62	63.97	44.03	54	9.97

(1) Marker-Delta method

Band U-NII-1 – mode 802.11n

According to part 15.407 the authorized band is 5150 MHz to 5350 MHz

Sample N° 1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5180	108	Peak	5141.34	50.01	56.99	74	17.01
5180	108	Average	5141.38	63.46	43.54	54	10.46
5240	107	Peak	5360.68	51.36	55.64	74	18.36
5240	107	Average	5355.11	63.22	43.78	54	10.22

(1) Marker-Delta method

Band U-NII-3 – mode 802.11a

According to part 15.407 the authorized band is 5725 MHz to 5850 MHz

Sample N° 1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBµV/m)	Calculated Max Out-of-Band Emission Level EIRP (dBm/MHz) (2)	Limit EIRP (dBm/MHz)	Margin (dB)
5745	113	Peak	5724.53	38.31	74.69	-20.54	15.6	36.14
5825	113	Peak	5850	49.45	63.55	-31.68	15.6	47.28

(1) Marker-Delta method
(2) According KDB 412172: EIRP = (E x d)2 /30

Band U-NII-3 – mode 802.11n

According to part 15.407 the authorized band is 5725 MHz to 5850 MHz

Sample N° 1:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (3)	Calculated Max Out-of-Band Emission Level (dBµV/m)	Calculated Max Out-of-Band Emission Level EIRP (dBm/MHz) (4)	Limit EIRP (dBm/MHz)	Margin (dB)
5745	113	Peak	5724.63	38.43	74.57	-20.66	15.6	36.26
5825	113	Peak	5850	49.11	63.89	-31.34	15.6	46.94

(1) Marker-Delta method
(2) According KDB 412172: EIRP = (E x d)2 /30

Test conclusion:

RESPECTED STANDARD

9. POWER LIMITS

Temperature (°C) : 22 **Humidity (%HR):** 40 **Date :** November 6, 2017

Technician : T. LEDRESSEUR

Standard: FCC Part 15

Test procedure: paragraph 15.407 a (1.i) and (3)

Method: PM-G paragraph II.E.3.b of KDB 789033

Test set up:

The power sensor was used on each output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level. Then the results were summed in linear power unit.

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

We used for power source the internal fully charged battery

Results:

Band U-NII-1

Sample N° 1 Channel 36 (F = 5180 MHz) – Mode 802.11.a

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
10.41	9.6	10.99	9.12	0.02	1

(1) For 2 antennas with 2.8 dBi

Sample N° 1 Channel 40 (F = 5200 MHz) – Mode 802.11.a

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
10.55	9.6	11.35	9.12	0.02	1

(2) For 2 antennas with 2.8 dBi

Sample N° 1 Channel 48 (F = 5240 MHz) – Mode 802.11.a

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
10.41	9.2	10.99	8.32	0.019	1

(1) For 2 antennas with 2.8 dBi

Band U-NII-1

Sample N° 1 Channel 36 (F = 5180 MHz) – Mode 802.11.n

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
10.9	9.55	10.3	9.02	0.021	1

(1) For 2 antennas with 2.8 dBi

Sample N° 1 Channel 40 (F = 5200 MHz) – Mode 802.11.n

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
10.85	9.52	12.16	8.95	0.021	1

(1) For 2 antennas with 2.8 dBi

Sample N° 1 Channel 48 (F = 5240 MHz) – Mode 802.11.n

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
10.4	9	10.96	7.94	0.019	1

(1) For 2 antennas with 2.8 dBi

Band U-NII-3

Sample N° 1 Channel 149 (F = 5745 MHz) – Mode 802.11.a

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
15.4	14.5	34.67	28.18	0.063	1

(1) For 2 antennas with 4.2 dBi

Sample N° 1 Channel 157 (F = 5785 MHz) – Mode 802.11.a

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
15.5	14.4	35.48	27.54	0.063	1

(1) For 2 antennas with 4.2 dBi

Sample N° 1 Channel 165 (F = 5825 MHz) – Mode 802.11.a

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
15.7	14.7	37.15	29.51	0.067	1

(1) For 2 antennas with 4.2 dBi

Band U-NII-3

Sample N° 1 Channel 149 (F = 5745 MHz) – Mode 802.11.n

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
15.3	14.5	33.88	28.18	0.062	1

(1) For 2 antennas with 4.2 dBi

Sample N° 1 Channel 157 (F = 5785 MHz) – Mode 802.11.n

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
15.4	14.3	34.67	26.92	0.062	1

(1) For 2 antennas with 4.2 dBi

Sample N° 1 Channel 165 (F = 5825 MHz) – Mode 802.11.n

Conducted Power (dBm):		Conducted Power (mW):		Total Conducted power (W)	Limit (W) (1)
Chain 1	Chain 2	Chain 1	Chain 2		
15.6	14.68	36.31	29.38	0.066	1

(1) For 2 antennas with 4.2 dBi

Test conclusion:

RESPECTED STANDARD

10. INTENTIONAL RADIATOR

Temperature (°C) : 22 / 21.5 **Humidity (%HR):** 43 / 40 **Date :** November 7, 2017 and November 8, 2017

Technician : T. LEDRESSEUR

Standard: FCC Part 15

Test procedure: paragraph 15.205, paragraph 15.209, paragraph 15.407 (b)

Method: paragraph II.G.2.b of KDB 789033
paragraph II.G.4.b of KDB 789033
paragraph II.G.5.b of KDB 789033
paragraph II.G.6.b of KDB 789033 (method AD)

Test set up:

First an exploratory radiated measurement was performed. During this phase the product is oriented in three orthogonal planes.
Then the final measurement is realized with the product on the most critical orientation.
The measure is realized on open area test site under 1 GHz and in anechoic chamber above 1 GHz.

When the system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.65 m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

Frequency range: From 9 kHz to 40 GHz

Detection mode: Quasi-peak (F < 1 GHz) Peak / Average (F > 1 GHz)

Bandwidth: 200Hz (9 kHz < F < 150kHz)
9 kHz (150 kHz < F < 30MHz)
120 kHz (30 MHz < F < 1 GHz)
1 MHz (F > 1 GHz)

Distance of antenna: 10 m below 1 GHz
3 m between 1 GHz and 18 GHz
1 m between 18 GHz and 26 GHz
60 cm between 26 GHz and 40 GHz

Antenna height: 1 to 4 meters (in open area test site) /1.65 meter (in anechoic room)

Antenna polarization: vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

We used for power source the internal fully charged battery

Duty cycle factor for average measure = 10 log(1/x) = 4.5

With x = 53/(53+98)

This factor is already included on the results (tables and graphs)

Results:

Band U-NII-1

Sample N° 1 Channel 36 (F = 5180 MHz) – Mode 802.11.a

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5100 (1)	P	150	1000	60.8		74	13.2
5100 (1)	AV	150	1000	52.95		54	1.05
5396 (1)	P	150	1000	53.85		74	20.15
5396 (1)	AV	150	1000	48.48		54	5.52
6933	P	150	1000	51.16	-44.07	-27	17.07

P= Peak, QP=Quasi-peak, Av=Average

(1) Restricted band

Sample N° 1 Channel 40 (F = 5200 MHz) – Mode 802.11.a

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5120 (2)	P	150	1000	59.41		74	14.59
5120 (2)	AV	150	1000	48.76		54	5.24
5360 (2)	P	150	1000	55.94		74	18.06
5360 (2)	AV	150	1000	45.39		54	8.61
6960	P	150	1000	52.82	-42.41	-27	15.41

P= Peak, QP=Quasi-peak, Av=Average

(2) Resticted band

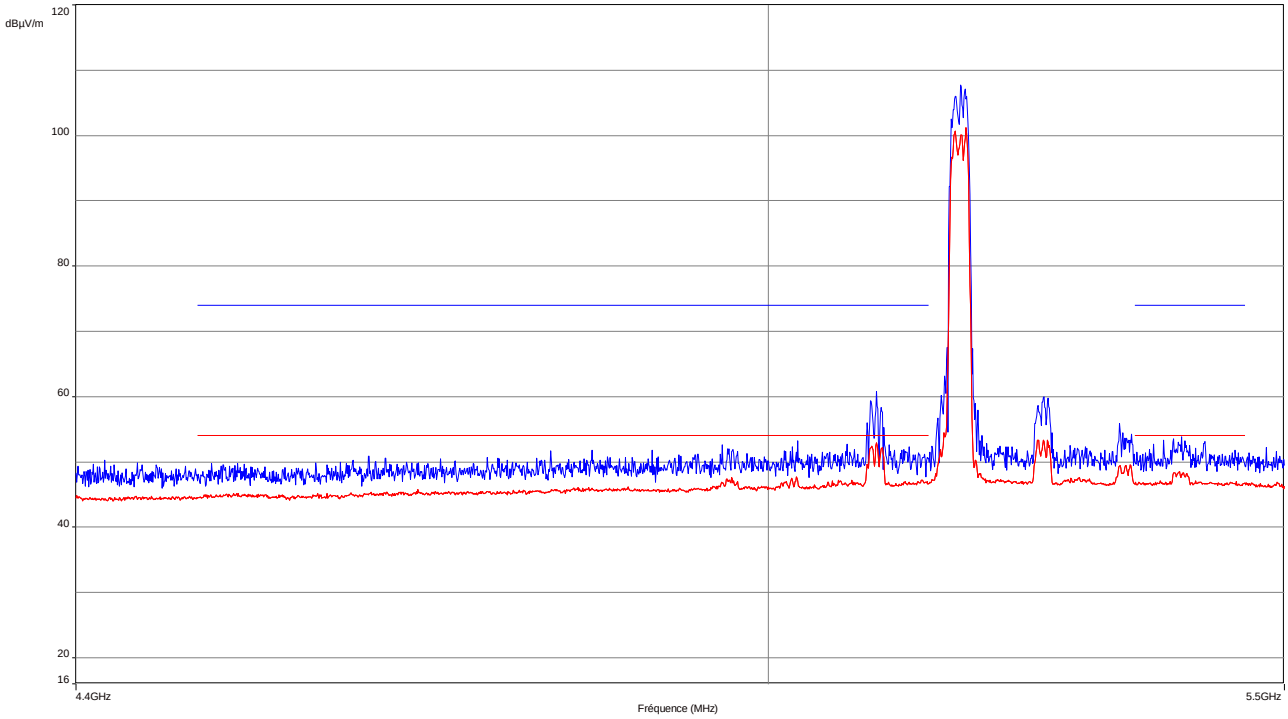
Sample N° 1 Channel 48 (F = 5240 MHz) – Mode 802.11.a

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5394 (3)	P	150	1000	56.8		74	17.2
5394 (3)	AV	150	1000	46.55		54	7.45
6960	P	150	1000	52.54	-42.69	-27	15.69

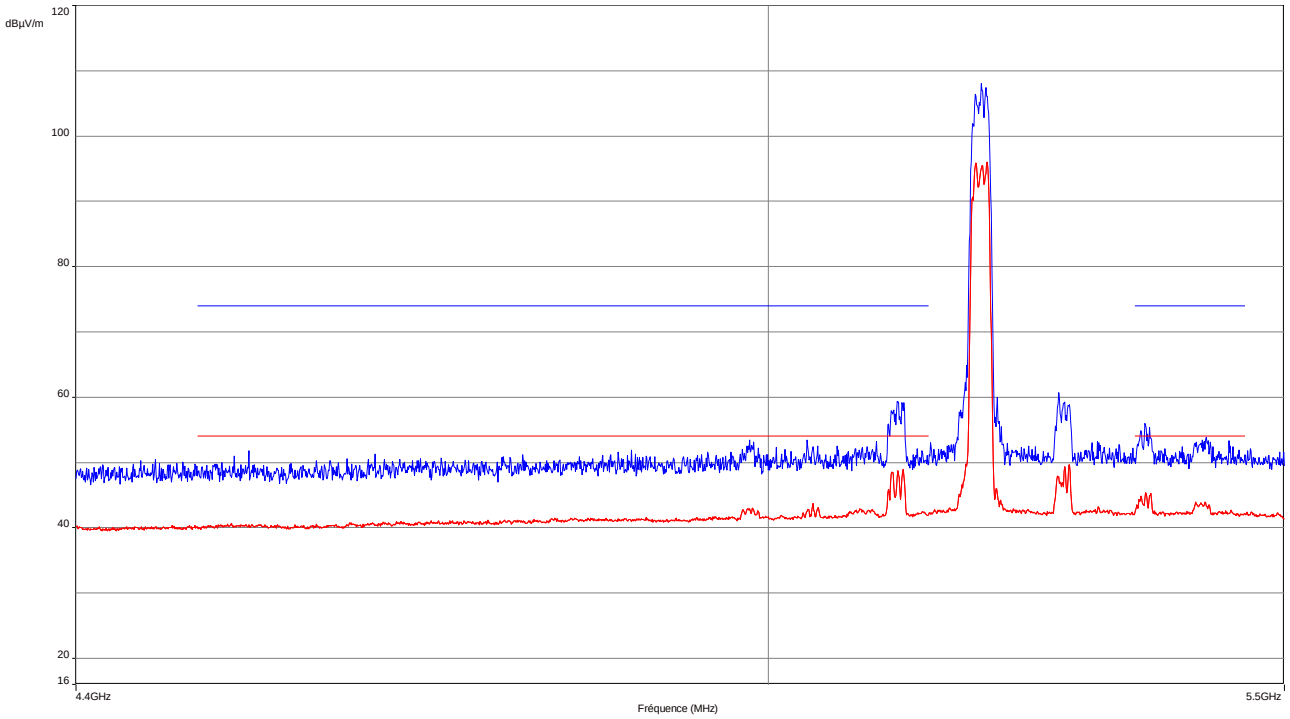
P= Peak, QP=Quasi-peak, Av=Average
(3) Restricted band

Band edge realized on worst critical positions.

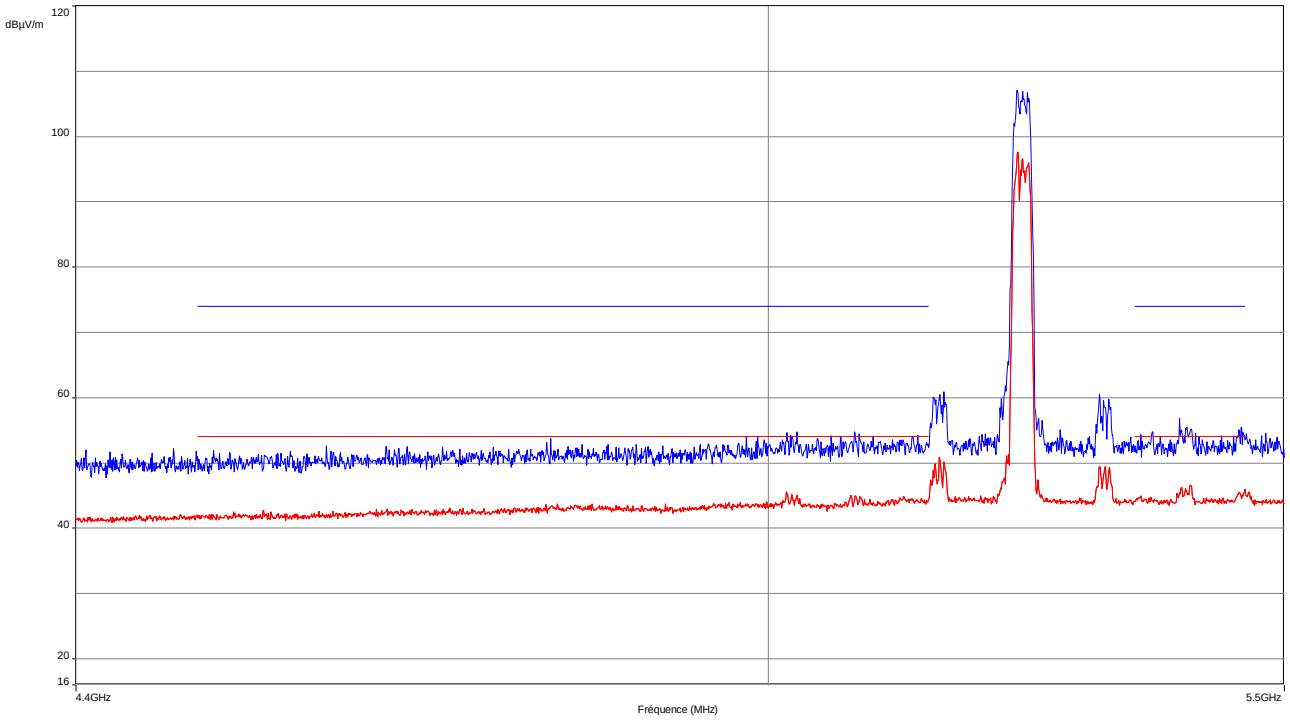
Low Channel



Central Channel



High channel



Band U-NII-1

Sample N° 1 Channel 36 (F = 5180 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5106.7 (4)	P	150	1000	60.6		74	13.4
5106.7 (4)	AV	150	1000	53.6		54	0.4
5394.7 (4)	P	150	1000	54.87		74	19.13
5394.7 (4)	AV	150	1000	48.66		54	5.34
6933	P	150	1000	51.16	-44.07	-27	17.07

P= Peak, QP=Quasi-peak, Av=Average
(4) Restricted band

Sample N° 1 Channel 40 (F = 5200 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5126 (5)	P	150	1000	61.09		74	12.91
5126 (5)	AV	150	1000	52.84		54	1.16
5360.7 (5)	P	150	1000	57.05		74	16.95
5360.7 (5)	AV	150	1000	49.66		54	4.34
6960	P	150	1000	52.82	-42.41	-27	15.41

P= Peak, QP=Quasi-peak, Av=Average
(5) Restricted band

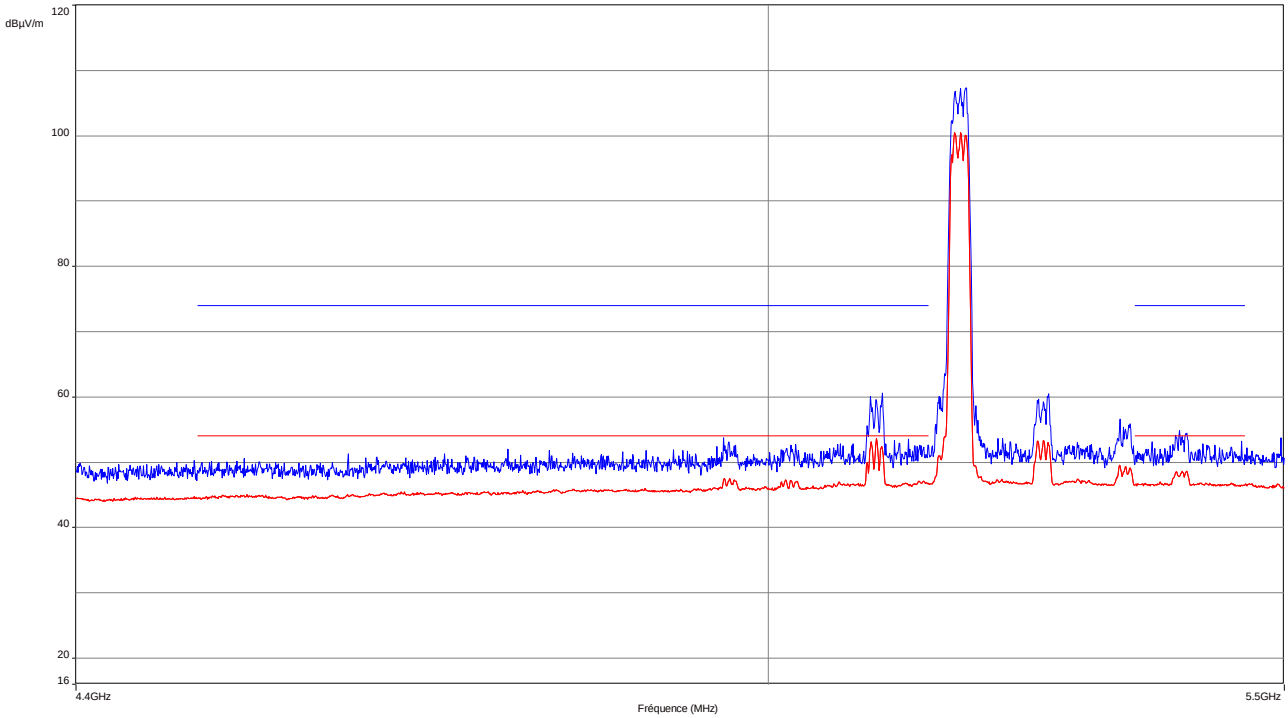
Sample N° 1 Channel 48 (F = 5240 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5021.3 (6)	P	150	1000	55.03		74	18.97
5021.3 (6)	AV	150	1000	49.05		54	4.95
5405 (6)	P	150	1000	57.61		74	16.39
5405 (6)	AV	150	1000	50.23		54	3.77
6987	P	150	1000	52.54	-42.69	-27	15.69

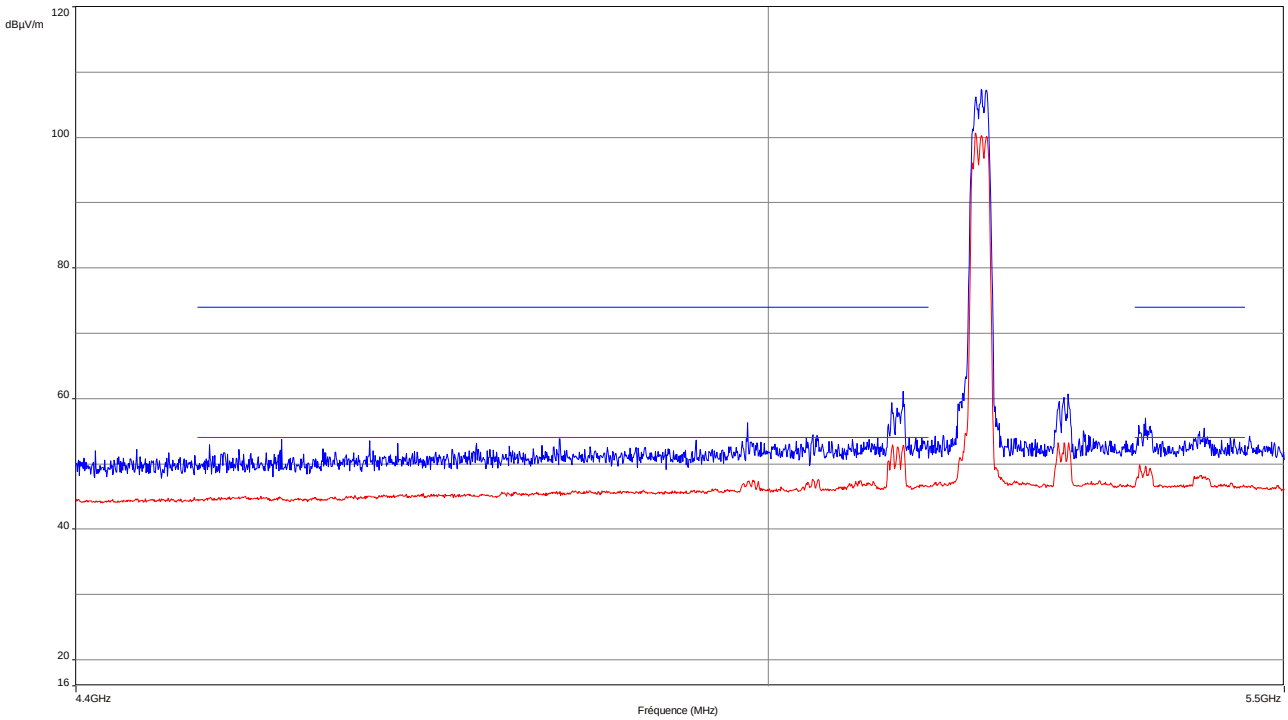
P= Peak, QP=Quasi-peak, Av=Average
(6) Restricted band

Band edge realized on worst critical positions.

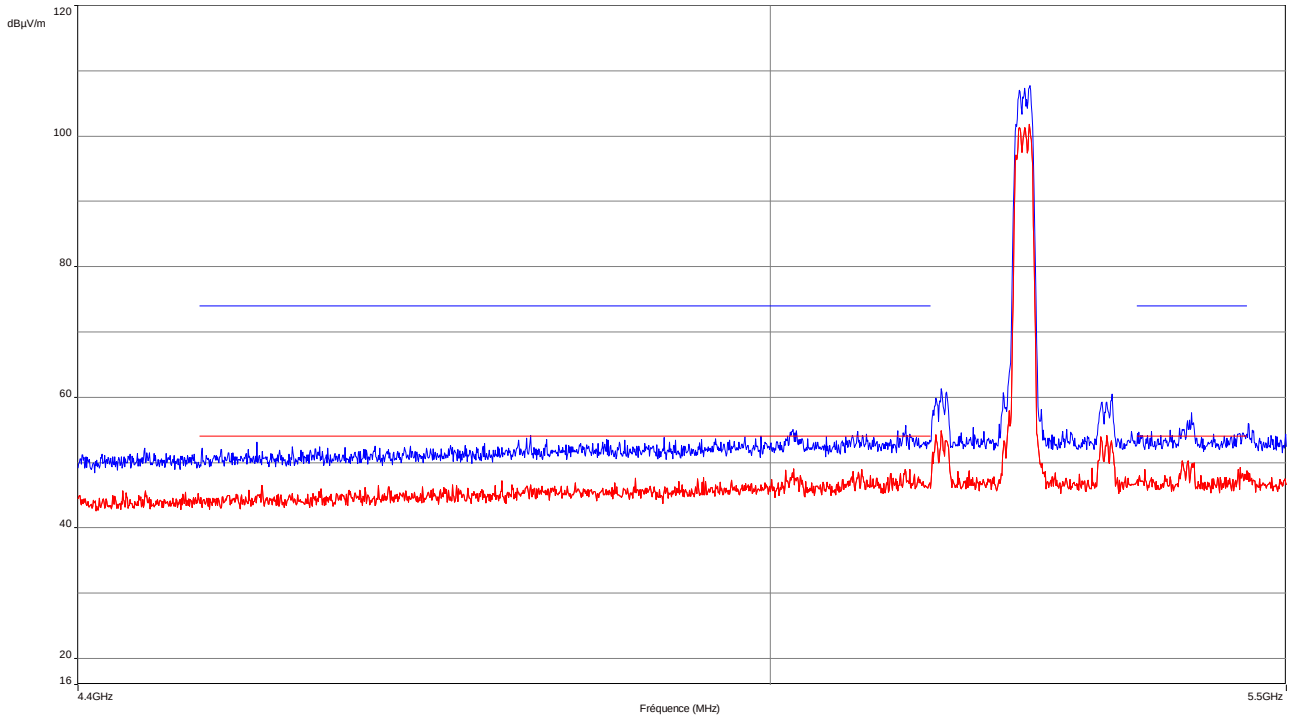
Low Channel



Central Channel



High channel



Band U-NII-3

Sample N° 1 Channel 149 (F = 5745 MHz) – Mode 802.11.a

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5261.4 (7)	P	150	1000	58.49	-36.74	-27	9.7
6226.7 (7)	P	150	1000	52.53	-42.70	-27	15.7

P= Peak, QP=Quasi-peak, Av=Average
(7) Restricted band

Sample N° 1 Channel 157 (F = 5785 MHz) – Mode 802.11.a

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5299.5 (8)	P	150	1000	58.03	-37.20	-27	10.2
6269 (8)	P	150	1000	55.96	-39.27	-27	12.3

P= Peak, QP=Quasi-peak, Av=Average
(8) Restricted band

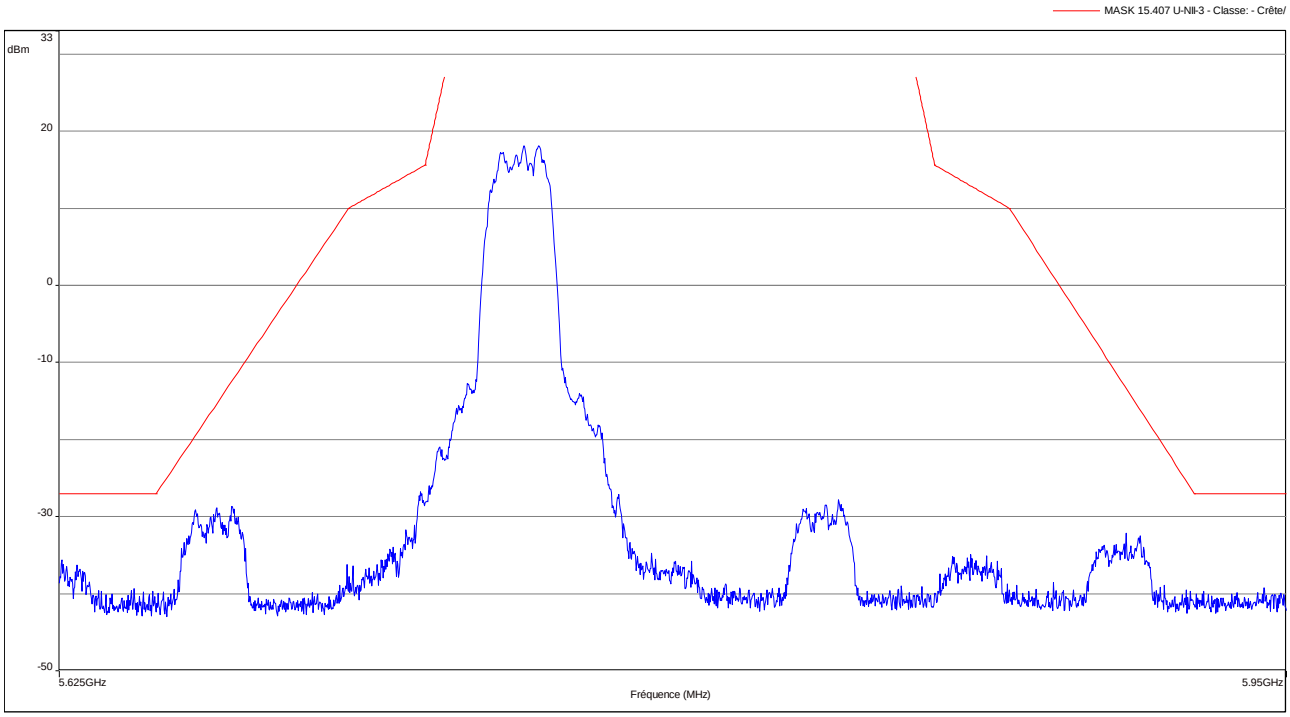
Sample N° 1 Channel 165 (F = 5825 MHz) – Mode 802.11.a

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5340 (9)	P	150	1000	59.15	-36.08	-27	9.1
5986 (9)	P	150	1000	60.51	-34.72	-27	7.7
6315 (9)	P	150	1000	56.95	-38.28	-27	11.28

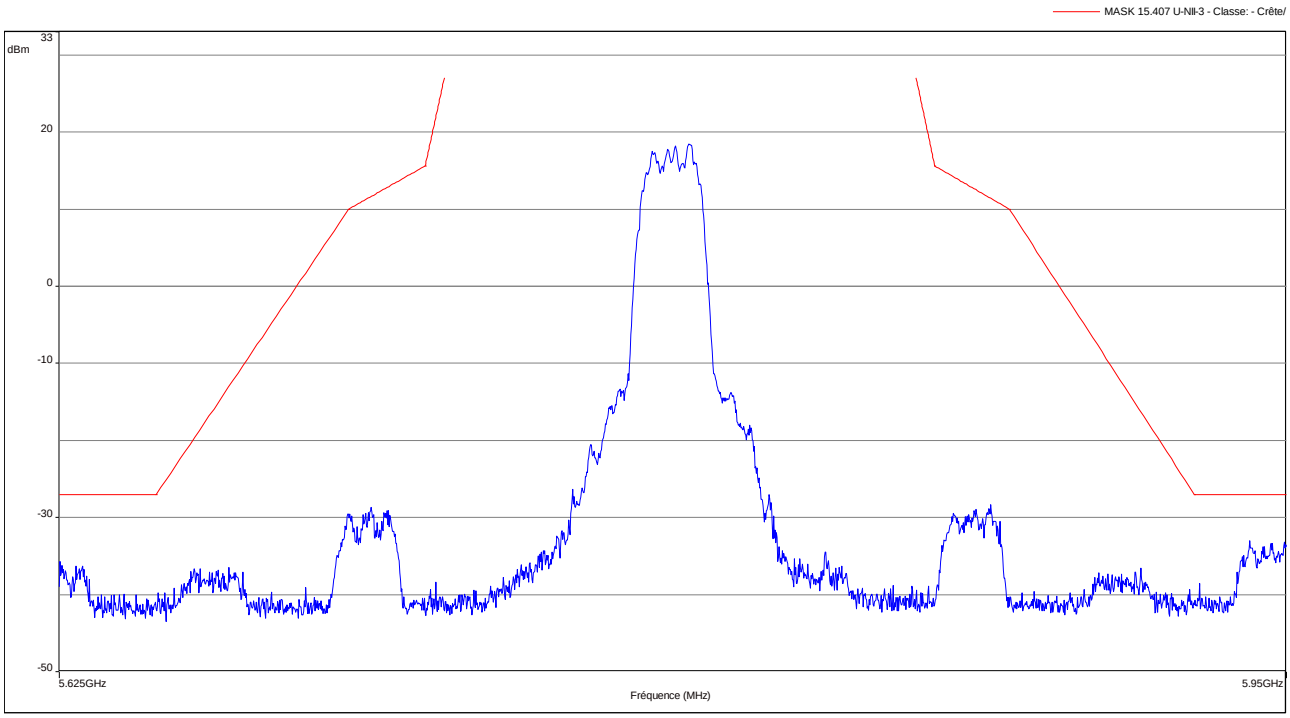
P= Peak, QP=Quasi-peak, Av=Average
(9) Restricted band

Spectrum mask realized on worst critical position

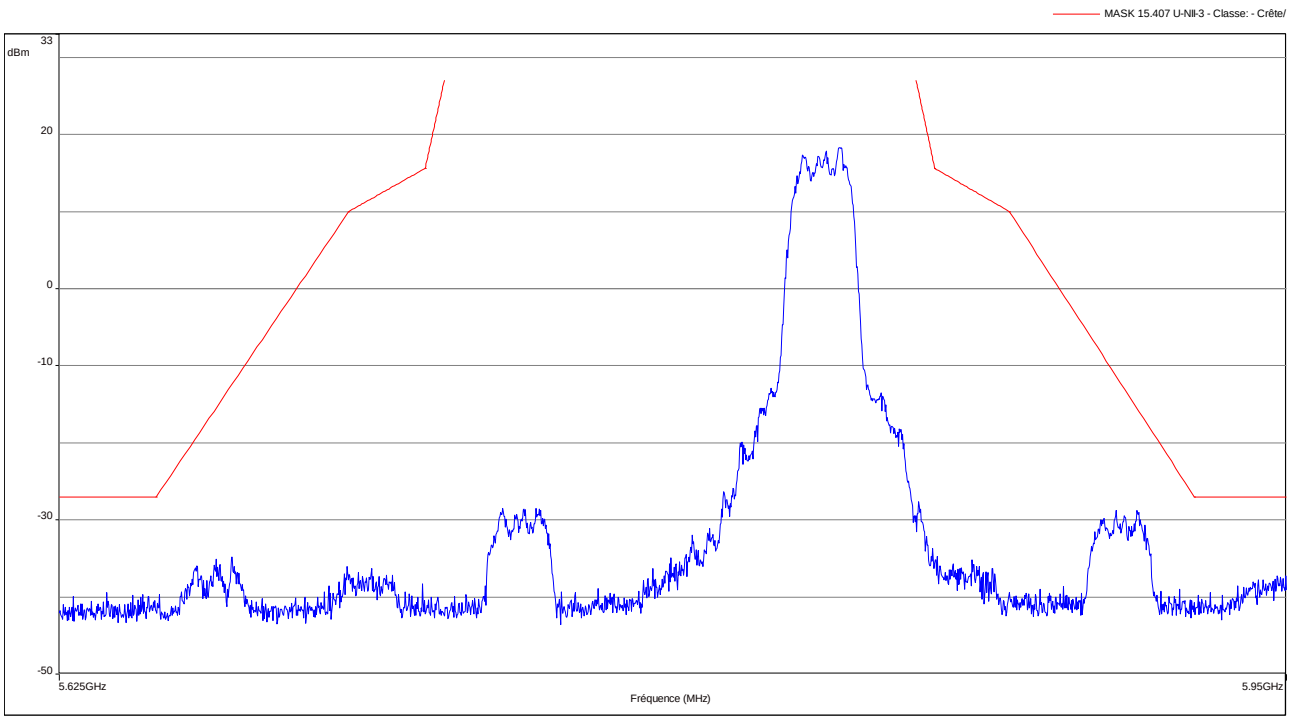
Low Channel



Central Channel

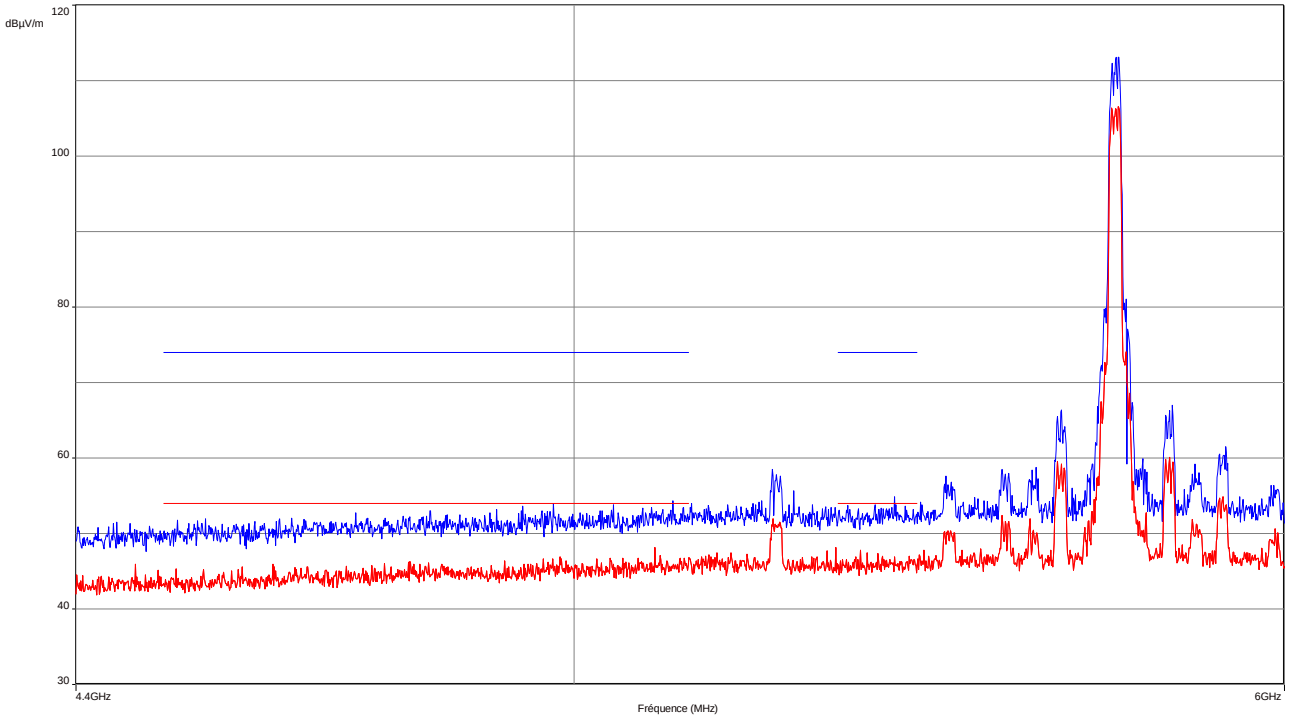


High Channel

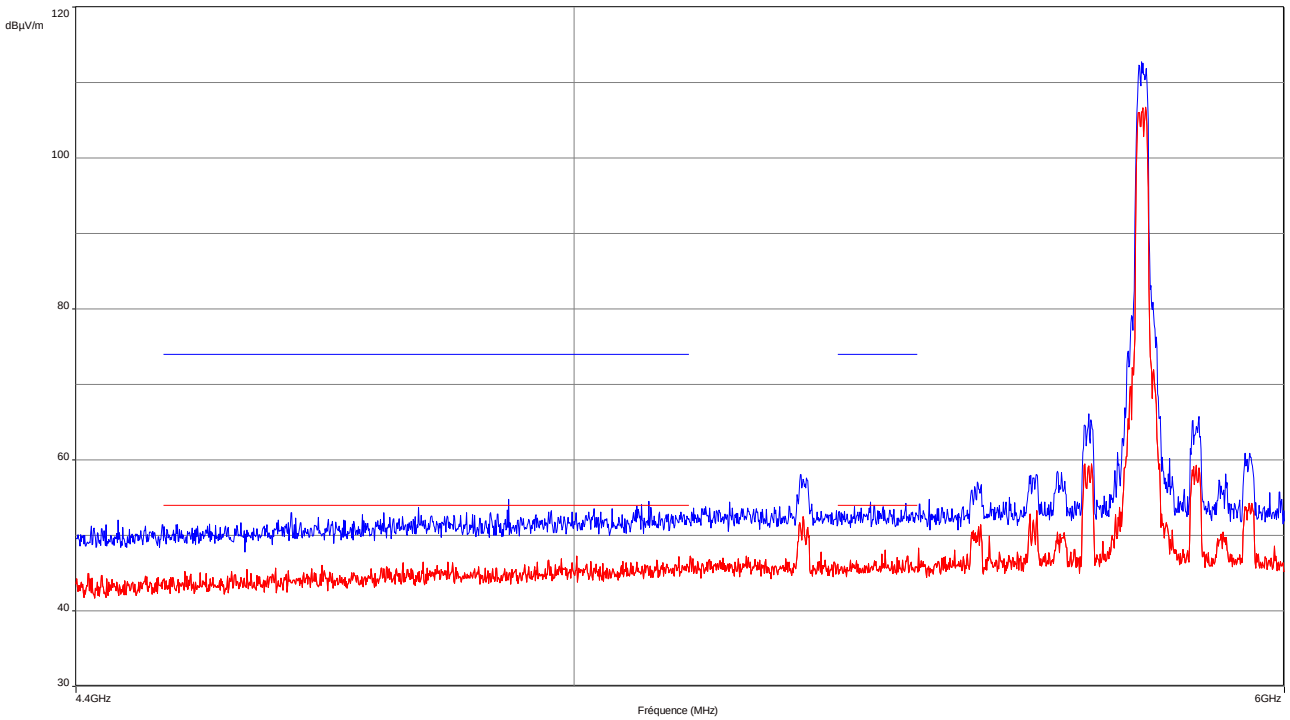


Band edge realized on worst critical positions.

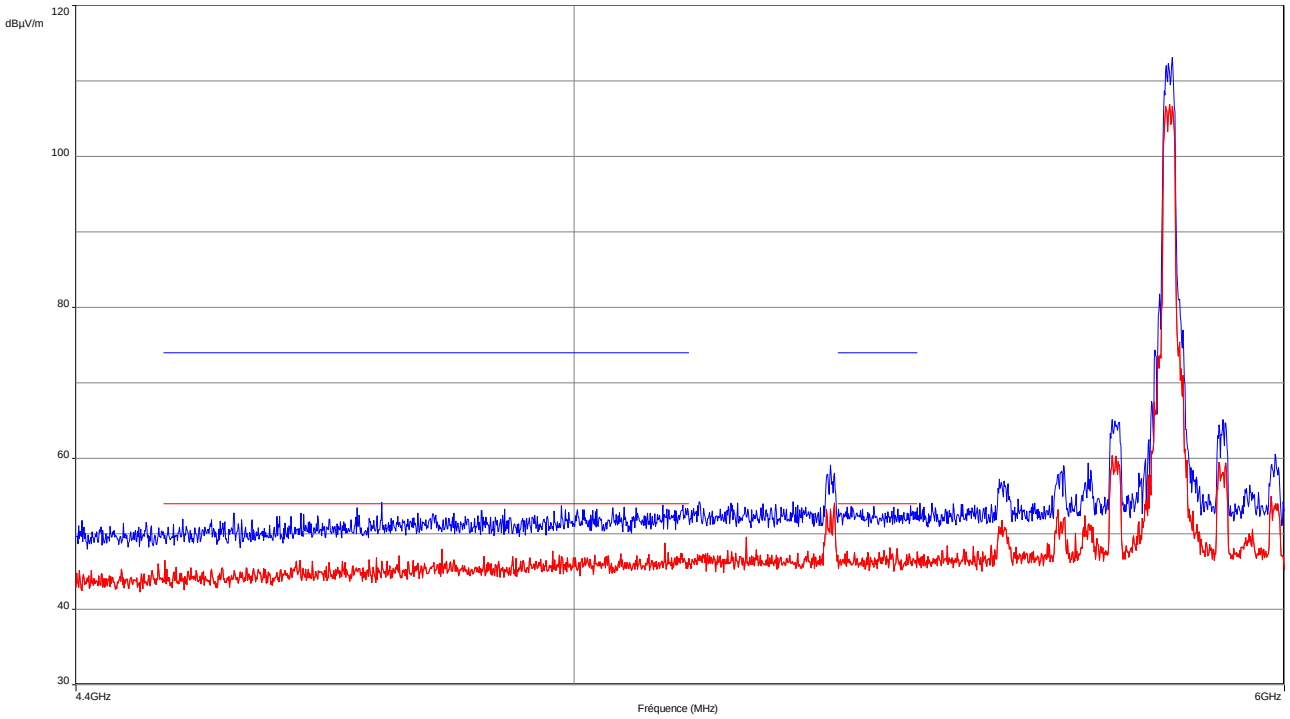
Low Channel



Central Channel



High Channel



Band U-NII-3

Sample N° 1 Channel 149 (F = 5745 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5272 (10)	P	150	1000	59	-36.23	-27	9.1
6226.7 (10)	P	150	1000	52.53	-42.70	-27	15.7

P= Peak, QP=Quasi-peak, Av=Average
(10) Restricted band

Sample N° 1 Channel 157 (F = 5785 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5302 (11)	P	150	1000	58.94	-36.29	-27	7.7
6269 (11)	P	150	1000	55.96	-39.27	-27	12.3

P= Peak, QP=Quasi-peak, Av=Average
(11) Restricted band

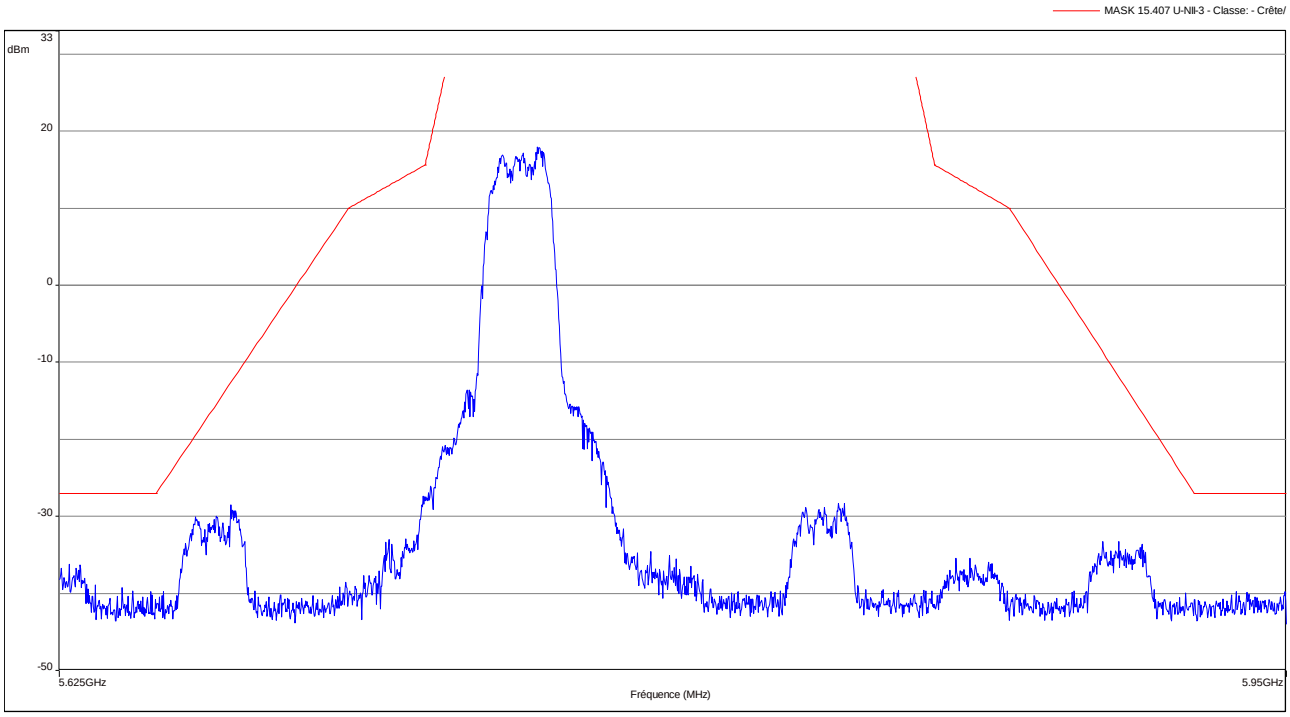
Sample N° 1 Channel 165 (F = 5825 MHz) – Mode 802.11.n

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Field strength Measured at 3 m (dBµV/m)	EIRP computed at 3 m (dBm/MHz)	Limits (dBµV/m) or (dBm/MHz)	Margin (dB)
5344.5 (12)	P	150	1000	58.46	-36.77	-27	11.28
5980 (12)	P	150	1000	60.29	-34.94	-27	9.1
6315 (12)	P	150	1000	56.95	-38.28	-27	11.28

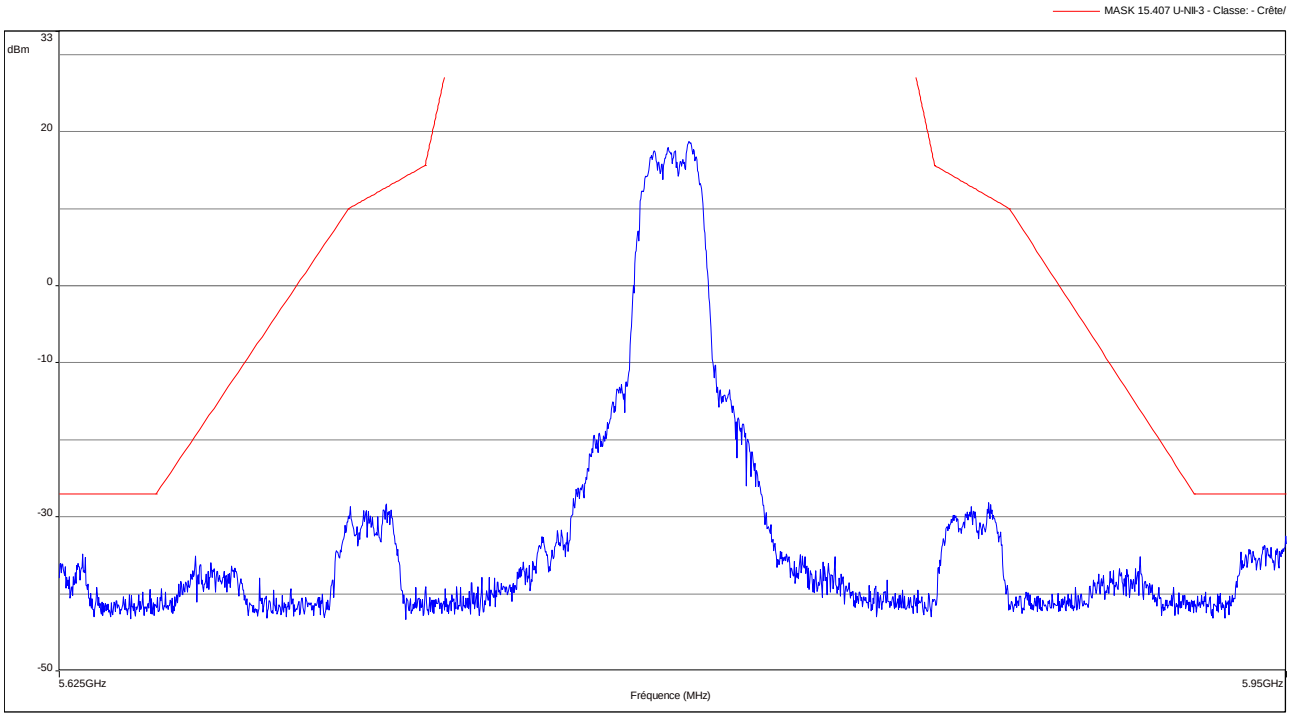
P= Peak, QP=Quasi-peak, Av=Average
(12) Restricted band

Spectrum mask realized on worst critical position

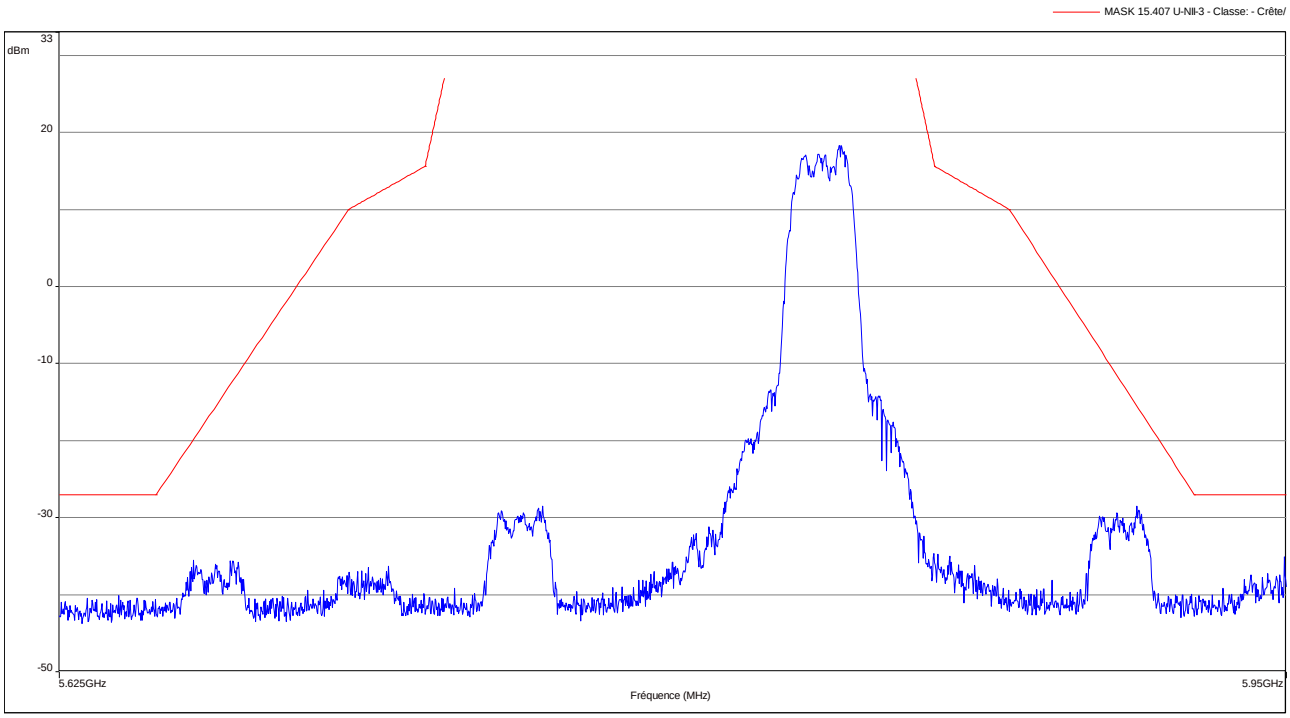
Low Channel



Central Channel

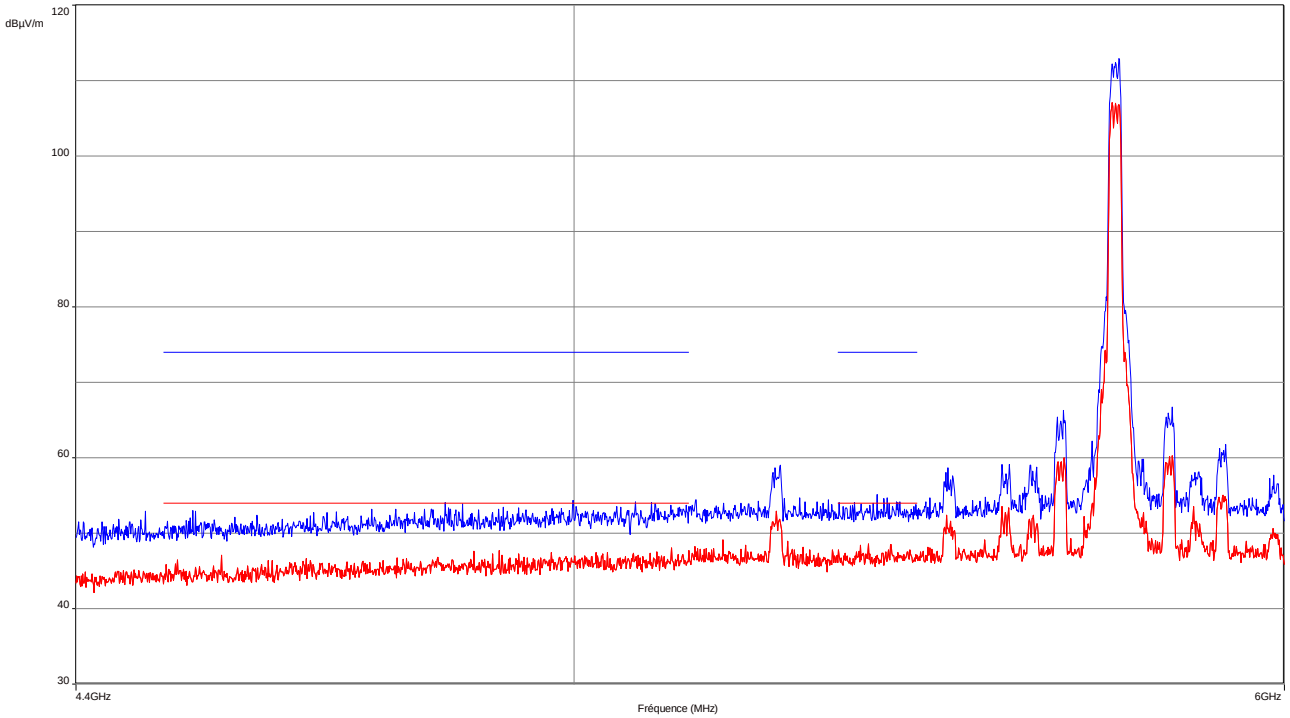


High Channel

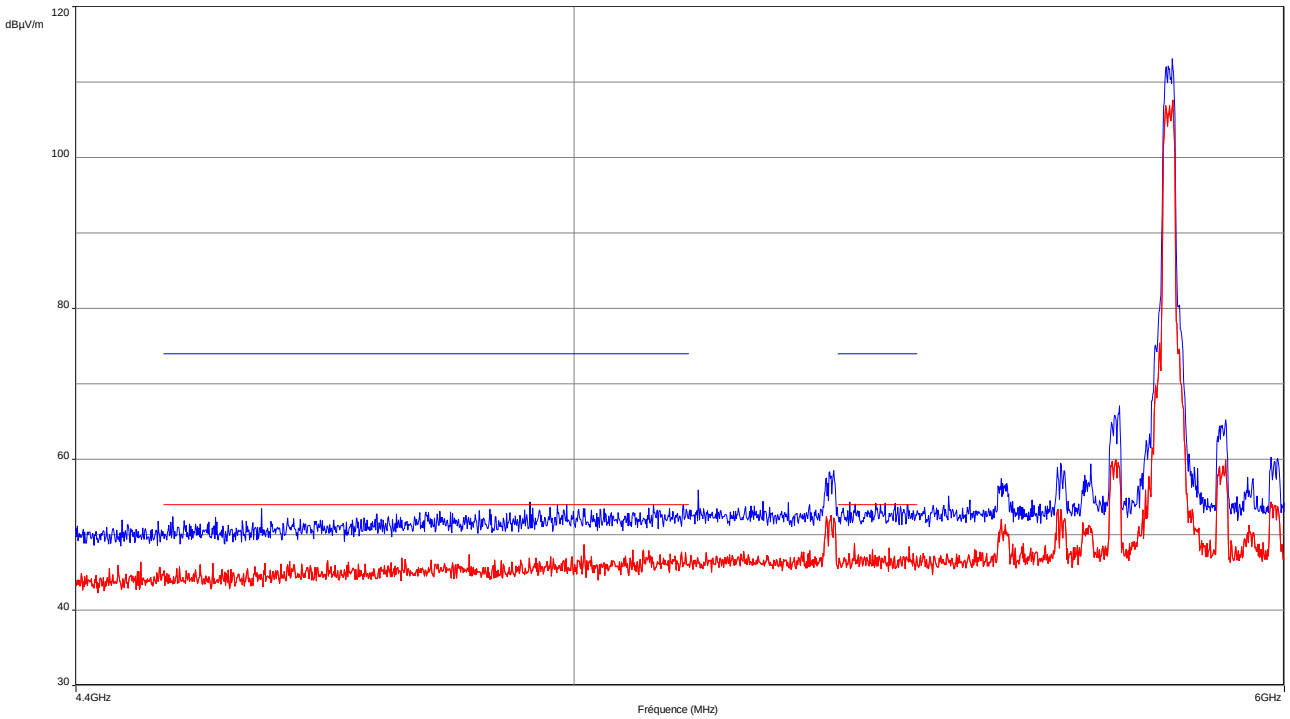


Band edge realized on worst critical positions.

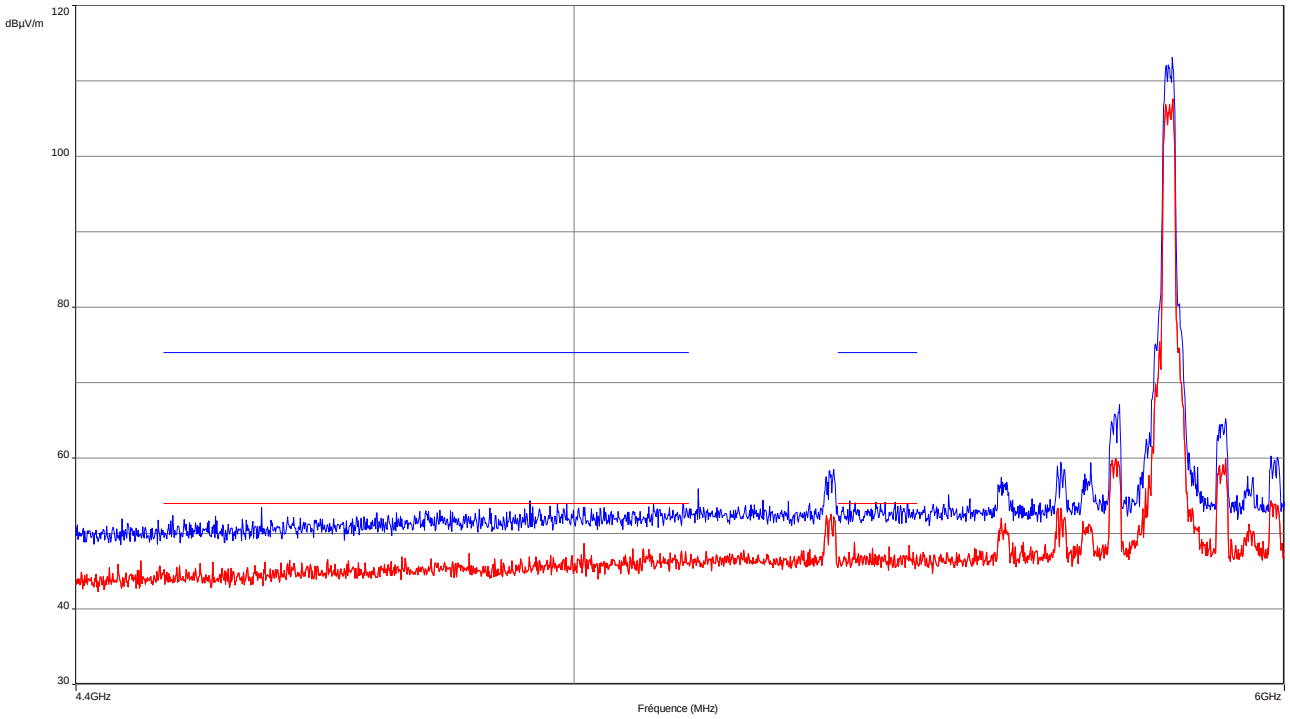
Low Channel



Central Channel



High Channel



Applicable limits in the restricted band:

for 9 kHz ≤ F ≤ 490 kHz : 2400/F(kHz) at 300 meters
for 490 kHz < F ≤ 1.705 MHz : 24000/F(kHz) at 30 meters
for 1.705 MHz < F ≤ 30 MHz : 29.5 dBµV/m at 30 meters
for 30 MHz < F ≤ 88 MHz : 40 dBµV/m at 3 meters
for 88 MHz < F ≤ 216 MHz : 43.5 dBµV/m at 3 meters
for 216 MHz < F ≤ 960 MHz : 46 dBµV/m at 3 meters
Above 960 MHz : 54 dBµV/m at 3 meters

Applicable limits in non the restricted band:

UNII-1 and 2: - 27dBm/MHz / MHz
UNII-3 : -27dBm/MHz / MHz or see spectrum mask

Test conclusion:

RESPECTED STANDARD

11. PEAK POWER DENSITY

Temperature (°C) : 22 **Humidity (%HR):** 40 **Date :** November 6, 2017
Technician : T. LEDRESSEUR

Standard: FCC Part 15

Test procedure: paragraph 15.407 a (1.i) and (3)

Method: SA-2 paragraph II.F of KDB 789033 and II.E.2.d of KDB 789033

Test set up:

The measure is realized in conducted mode with an analyser.

Span: 30 MHz
Resolution bandwidth: 1MHz for U-NII-1 band and 500 kHz or U-NII-3 band
Video bandwidth: 3MHz for U-NII-1 band and 2 MHz or U-NII-3 band
Detector: RMS
Number of points: 501
Sweep time: auto
Trace mode: average on 200 traces

The measure is repeated on each output port of the EUT. Then the results were summed in linear power unit

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

We used for power source the internal fully charged battery

- According with KDB 662911 the antenna gain is calculated as follow:

Total gain = antenna gain (dBi) + array gain
With Array Gain = 10 log(NANT/NSS) dB = 3 and with NANT=2 and NSS=1

Total gain = 2.8 +3 = 5.8 dBi for U-NII-1 band
Total gain = 4.2 +3 = 7.2 dBi for U-NII-3 band

The limit is so reduced by 1.2 dBm in order to taken in account the amount in dB that the directional gain of the antenna exceeds 6 dBi for U-NII-3 band

- See appendix 6 for plot

- In addition during the measure the duty cycle for all mode is adjusted as follow:

Ton: 53 µs Toff: 98 µs
Dutyc cycle factor = 10 log(1/x) = 4.5

With x = 53/(53+98)

Results:

Band U-NII-1

Sample N° 1 Channel 36 (F = 5180 MHz) – Mode 802.11.a

Power Spectral Density (dBm/MHz):		Sum of PSD (dBm/MHz)	Duty cycle factor (dB)	PSD (dBm/MHz)	Limit (dBm/MHz)
Chain 1	Chain 2				
-4.12	-5.01	-1.53	4.5	2.97	17

Sample N° 1 Channel 40 (F = 5200 MHz) – Mode 802.11.a

Power Spectral Density (dBm/MHz):		Sum of PSD (dBm/MHz)	Duty cycle factor (dB)	PSD (dBm/MHz)	Limit (dBm/MHz)
Chain 1	Chain 2				
-4.02	-5.37	-1.63	4.5	2.87	17

Sample N° 1 Channel 48 (F = 5240 MHz) – Mode 802.11.a

Power Spectral Density (dBm/MHz):		Sum of PSD (dBm/MHz)	Duty cycle factor (dB)	PSD (dBm/MHz)	Limit (dBm/MHz)
Chain 1	Chain 2				
-4.84	-5.99	-2.37	4.5	2.13	17

Band U-NII-1

Sample N° 1 Channel 36 (F = 5180 MHz) – Mode 802.11.n

Power Spectral Density (dBm/MHz):		Sum of PSD (dBm/MHz)	Duty cycle factor (dB)	PSD (dBm/MHz)	Limit (dBm/MHz)
Chain 1	Chain 2				
-4.01	-5.64	-1.74	4.5	2.76	17

Sample N° 1 Channel 40 (F = 5200 MHz) – Mode 802.11.n

Power Spectral Density (dBm/MHz):		Sum of PSD (dBm/MHz)	Duty cycle factor (dB)	PSD (dBm/MHz)	Limit (dBm/MHz)
Chain 1	Chain 2				
-4.35	-5.53	-1.89	4.5	2.61	17

Sample N° 1 Channel 48 (F = 5240 MHz) – Mode 802.11.n

Power Spectral Density (dBm/MHz):		Sum of PSD (dBm/MHz)	Duty cycle factor (dB)	PSD (dBm/MHz)	Limit (dBm/MHz)
Chain 1	Chain 2				
-4.93	-6.06	-2.45	4.5	2.05	17

Band U-NII-3

Sample N° 1 Channel 149 (F = 5745 MHz) – Mode 802.11.a

Power Spectral Density (dBm/500kHz):		Sum of PSD (dBm/500kHz)	Duty cycle factor (dB)	PSD (dBm/500kHz)	Limit (dBm/500kHz)
Chain 1	Chain 2				
-2.54	-3.12	0.19	4.5	4.69	28.8

Sample N° 1 Channel 157 (F = 5785 MHz) – Mode 802.11.a

Power Spectral Density (dBm/500kHz):		Sum of PSD (dBm/500kHz)	Duty cycle factor (dB)	PSD (dBm/500kHz)	Limit (dBm/500kHz)
Chain 1	Chain 2				
-2.27	-3.15	0.32	4.5	4.82	28.8

Sample N° 1 Channel 165 (F = 5825 MHz) – Mode 802.11.a

Power Spectral Density (dBm/500kHz):		Sum of PSD (dBm/500kHz)	Duty cycle factor (dB)	PSD (dBm/500kHz)	PSD (dBm/500kHz)
Chain 1	Chain 2				
-1.47	-2.37	1.11	4.5	5.61	28.8

Band U-NII-3

Sample N° 1 Channel 149 (F = 5745 MHz) – Mode 802.11.n

Power Spectral Density (dBm/500kHz):		Sum of PSD (dBm/500kHz)	Duty cycle factor (dB)	PSD (dBm/500kHz)	Limit (dBm/500kHz)
Chain 1	Chain 2				
-2.38	-3.46	0.12	4.5	4.62	28.8

Sample N° 1 Channel 157 (F = 5785 MHz) – Mode 802.11.n

Power Spectral Density (dBm/500kHz):		Sum of PSD (dBm/500kHz)	Duty cycle factor (dB)	PSD (dBm/500kHz)	Limit (dBm/500kHz)
Chain 1	Chain 2				
-2.22	-2.95	0.44	4.5	4.94	28.8

Sample N° 1 Channel 165 (F = 5825 MHz) – Mode 802.11.n

Power Spectral Density (dBm/500kHz):		Sum of PSD (dBm/500kHz)	Duty cycle factor (dB)	PSD (dBm/500kHz)	Limit (dBm/500kHz)
Chain 1	Chain 2				
-1.82	-2.83	0.71	4.5	5.21	28.8

Test conclusion:

RESPECTED STANDARD

□□□ End of report, 6 appendixes to be forwarded □□□

APPENDIX 1: Test equipment list

Additional provisions to the general radiated emission limitations

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	EMCO	8535
Multimeter 177	Fluke	14476
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000

Power limits

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Spectrum Analyzer FSL 18	Rohde & Schwarz	14539
Spectrum Analyzer ESU 8	Rohde & Schwarz	9403
Wideband sensor Z86	Rohde & Schwarz	11592
Multimeter 177	Fluke	14476
Meteo station WS-9232	La Crosse Technology	8750

Intentional radiator

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Open test site	EMITECH	8732
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Test receiver ESI7	Rohde & Schwarz	8707
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Log periodic antenna HL223	Rohde & Schwarz	7190
Antenna 3115	EMCO	8535
Antenna M3160-09	ETS-Lindgren	8786
Antenna ATM WR28	Elhyte	4353
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier S005180M3201	LUCIX Corp.	10739
Low-noise amplifier S180265L3201 LNA	LUCIX Corp.	8704
Low-noise amplifier ALC ALS2640-30-10	Elhyte	4354
Low pass filter LP03/1000-7GH	Filtek	4087
Low Pass Filter LPM15601	Microtronics	6606
High Pass Filter LPM15600	Microtronics	6607
Multimeter 177	Fluke	14476
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.6.0.32	0000

Peak power density

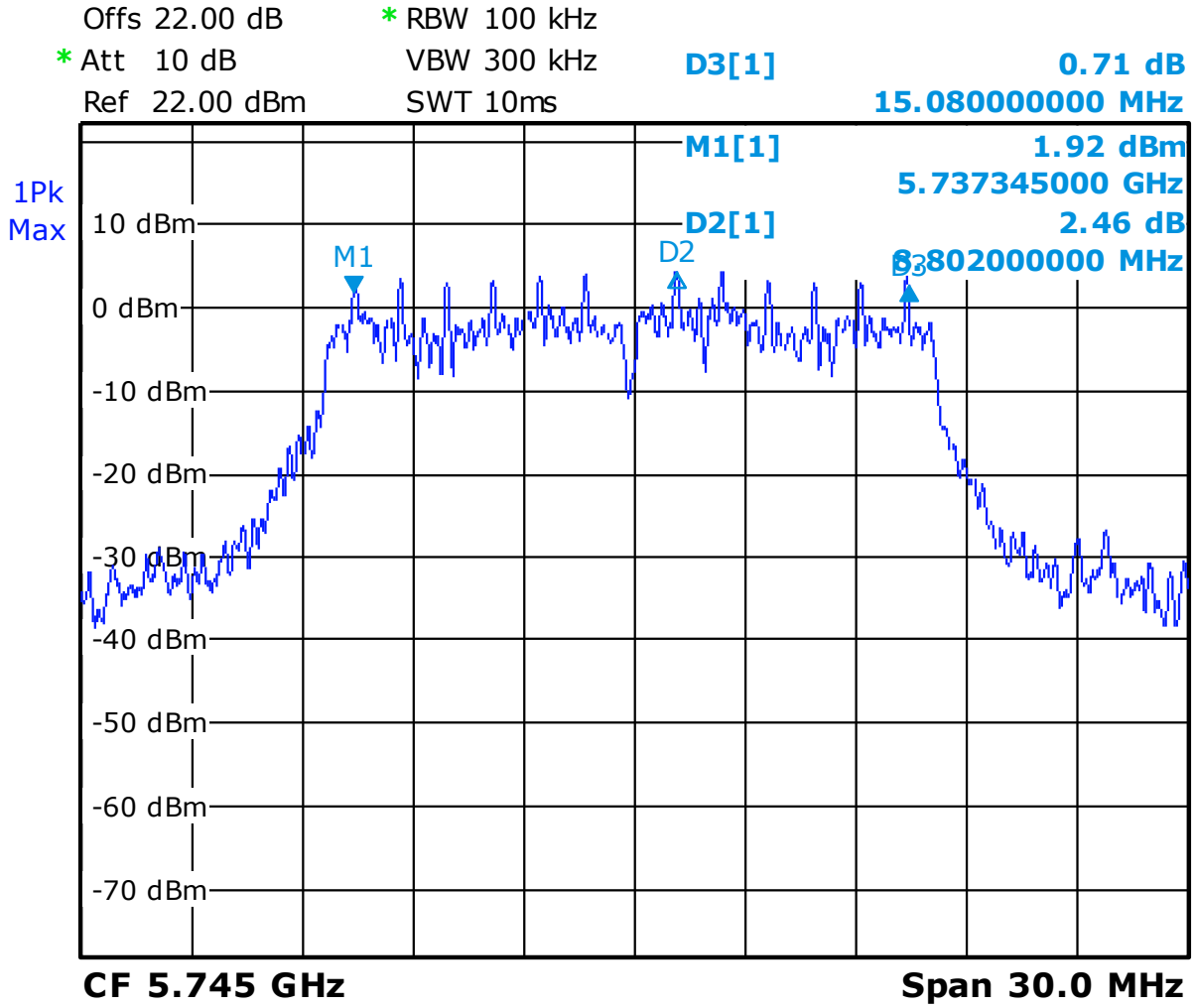
TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Spectrum Analyzer FSL 18	Rohde & Schwarz	14539
Spectrum Analyzer ESU 8	Rohde & Schwarz	9403
Attenuator 20 dB DC-18GHz 20dB	Midwest Microwave	8549
Multimeter 177	Fluke	14476
Meteo station WS-9232	La Crosse Technology	8750

Bandwidth and band edge

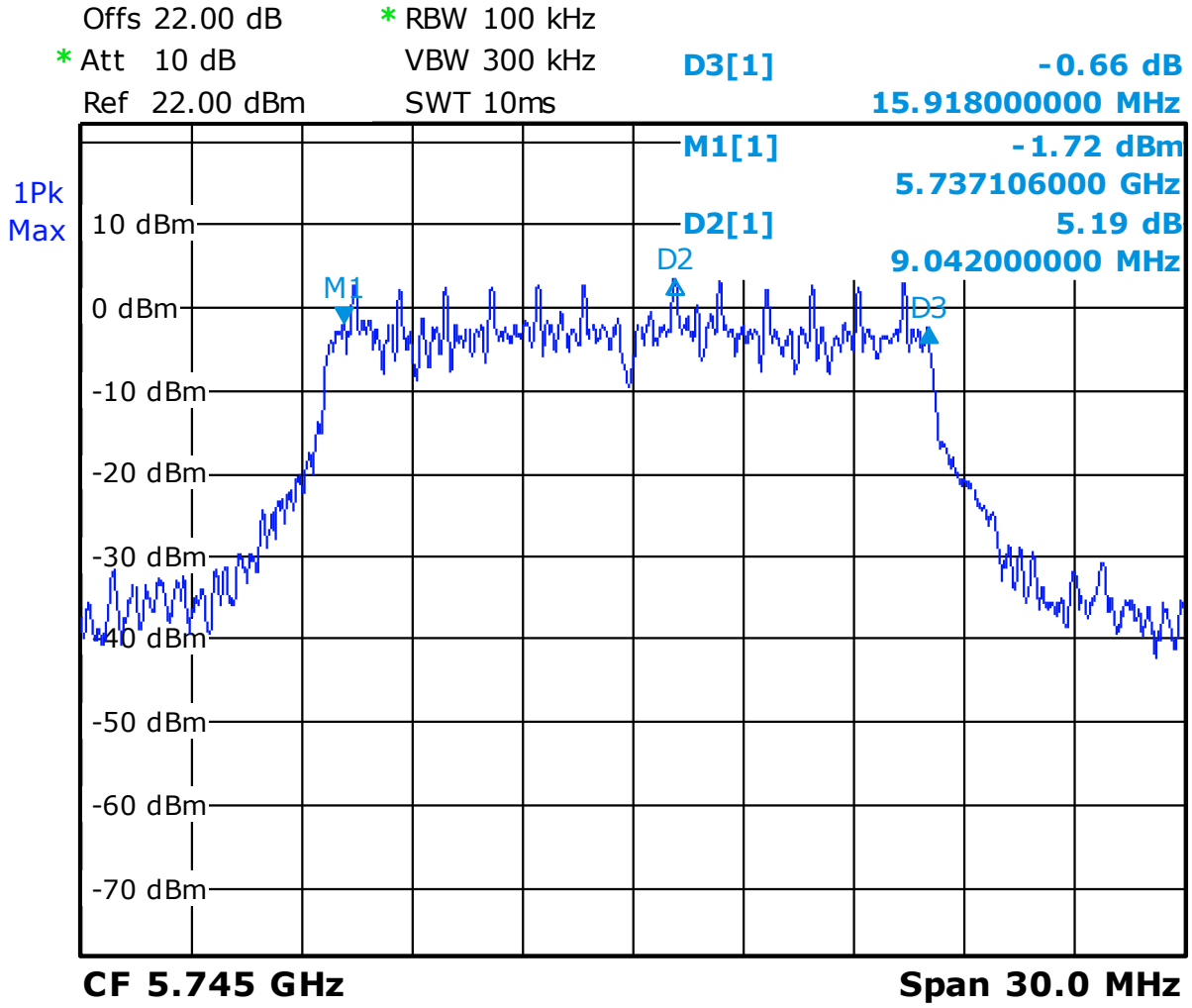
TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Spectrum Analyzer FSL 18	Rohde & Schwarz	14539
Spectrum Analyzer ESU 8	Rohde & Schwarz	9403
Attenuator 20 dB DC-18GHz 20dB	Midwest Microwave	8549
Multimeter 177	Fluke	14476
Meteo station WS-9232	La Crosse Technology	8750

APPENDIX 2: 6 dB bandwidth

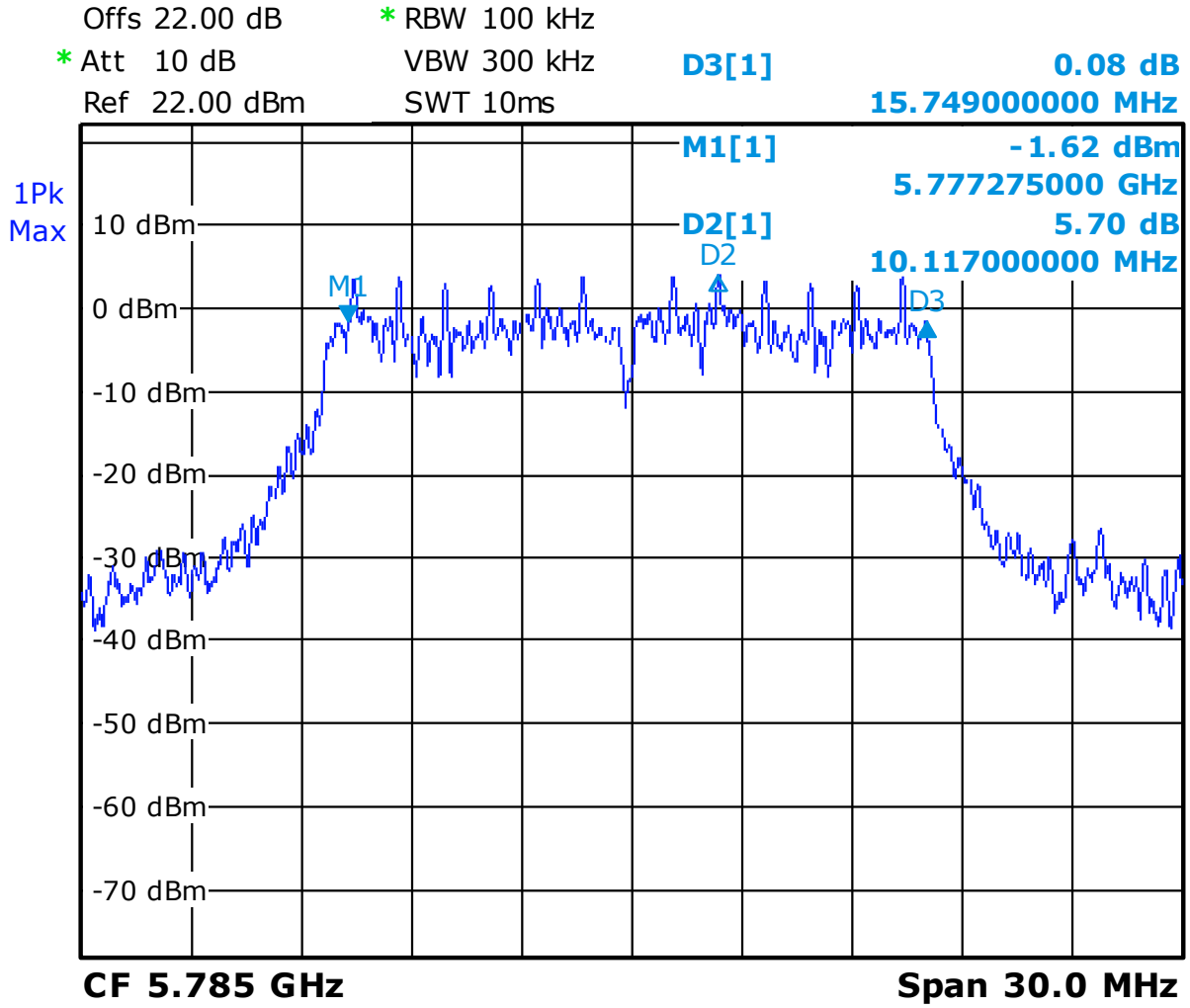
U-NII-3 band - Low Channel – Mode 802.11.a – RF 1



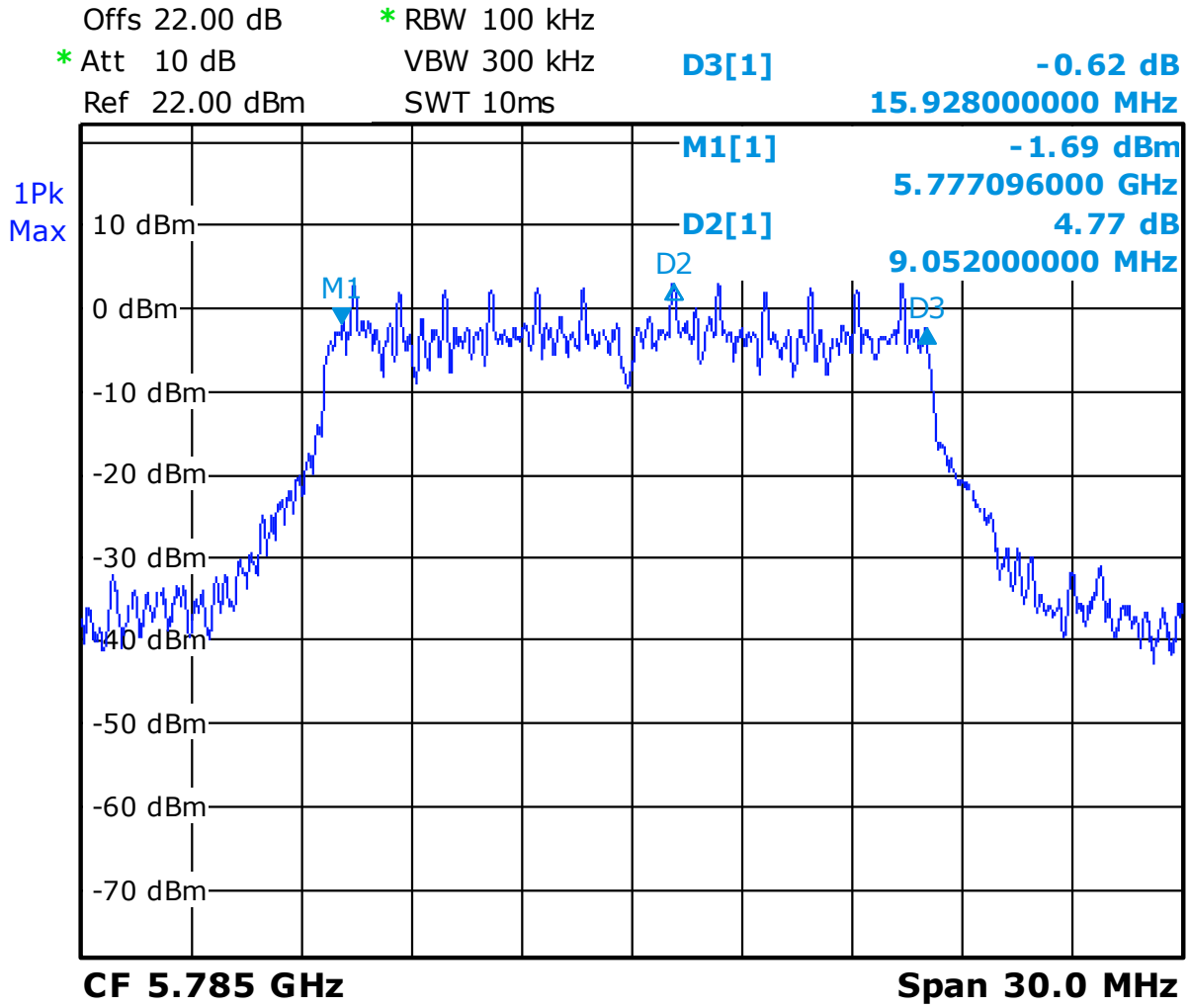
U-NII-3 band - Low Channel – Mode 802.11.a – RF 2



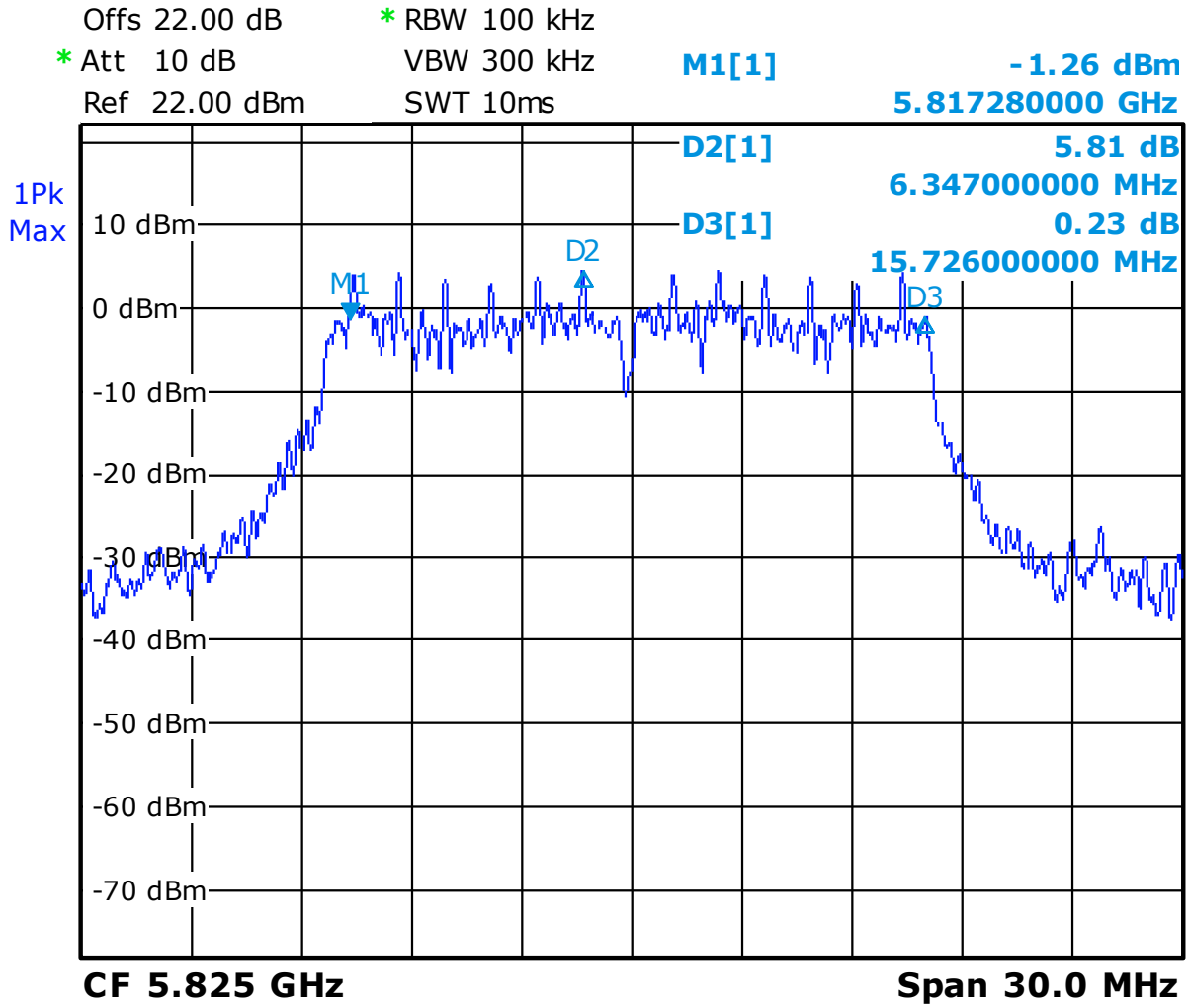
U-NII-3 band – Central Channel – Mode 802.11.a – RF 1



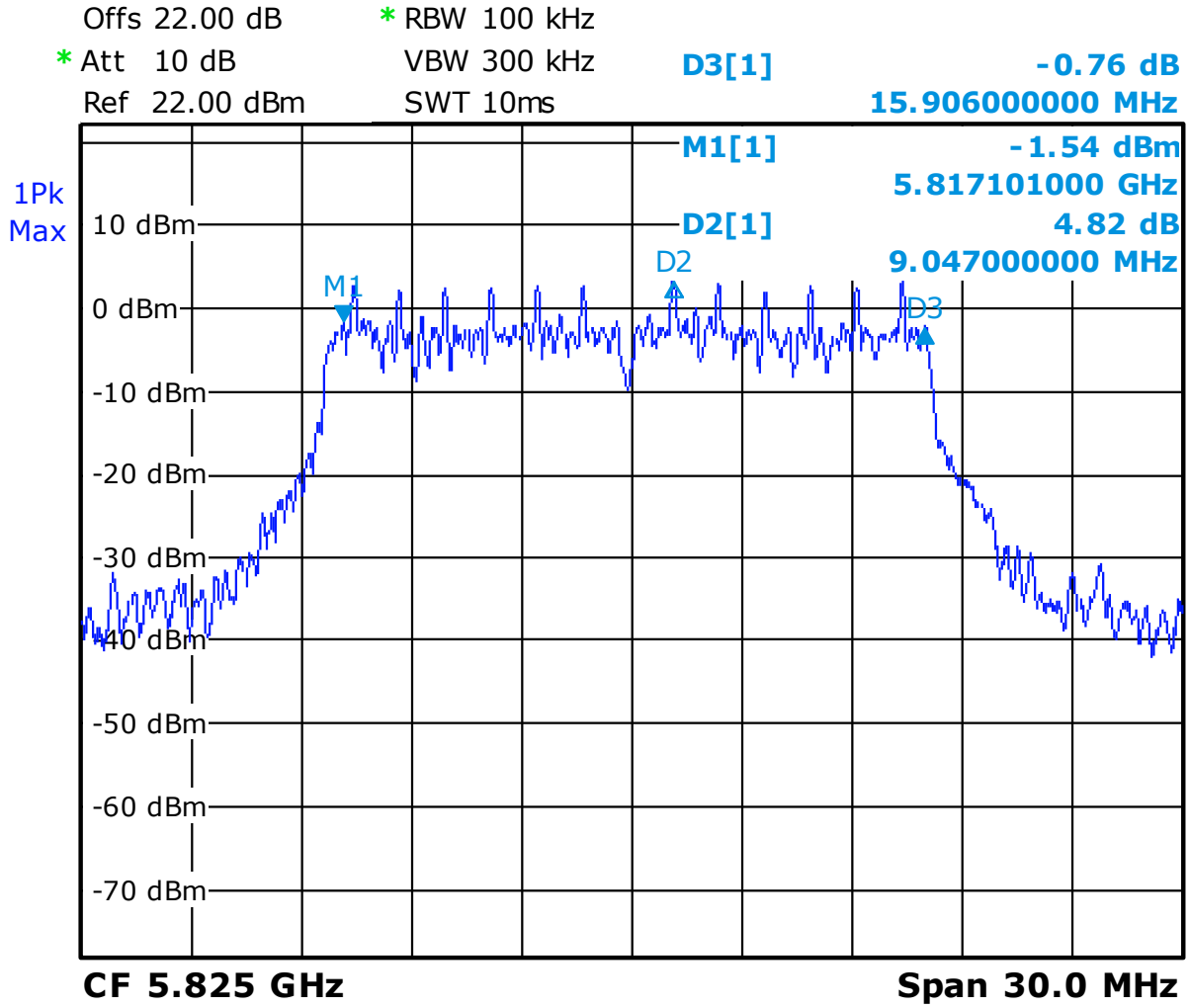
U-NII-3 band – Central Channel – Mode 802.11.a – RF 2



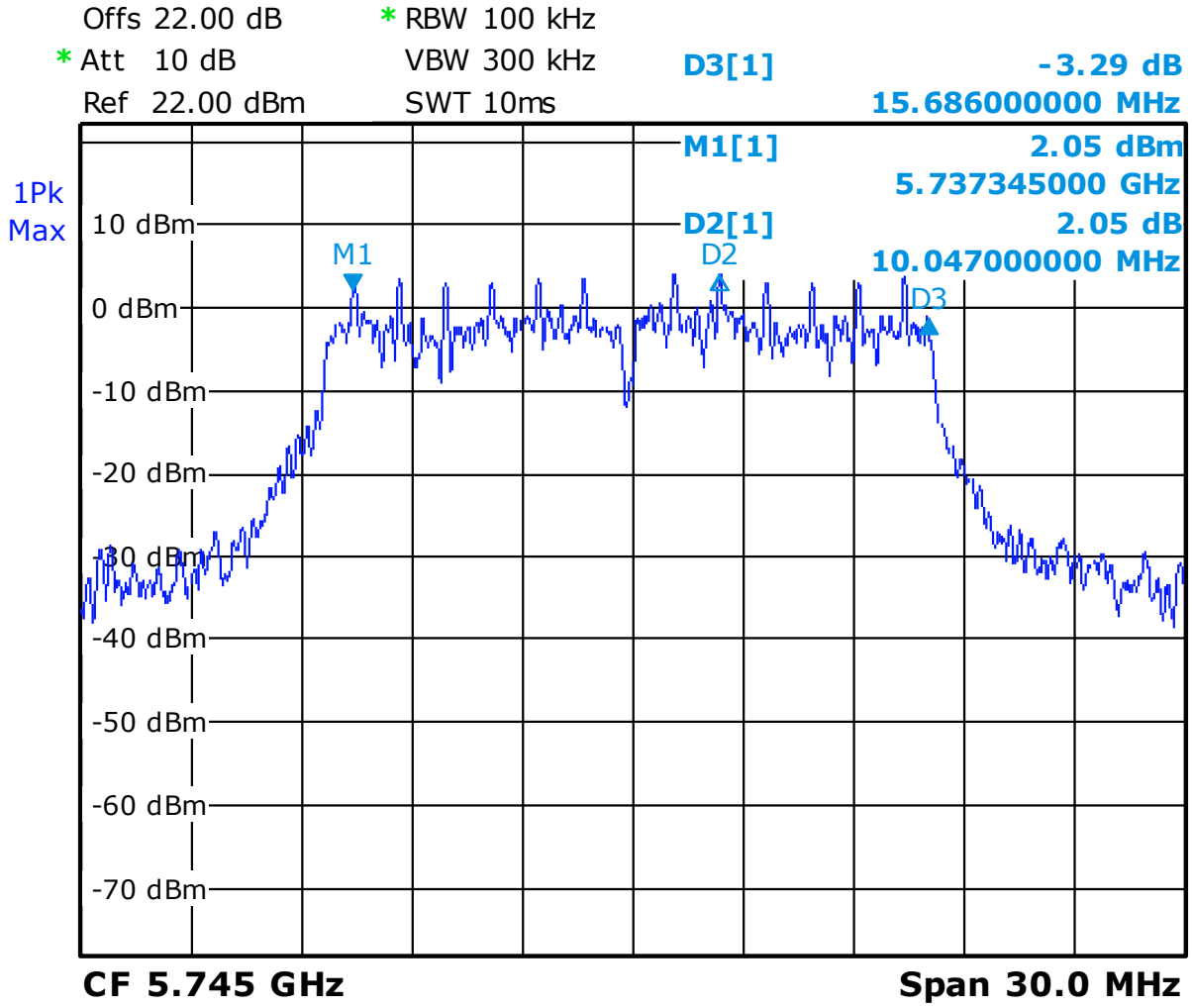
U-NII-3 band - High Channel – Mode 802.11.a – RF1



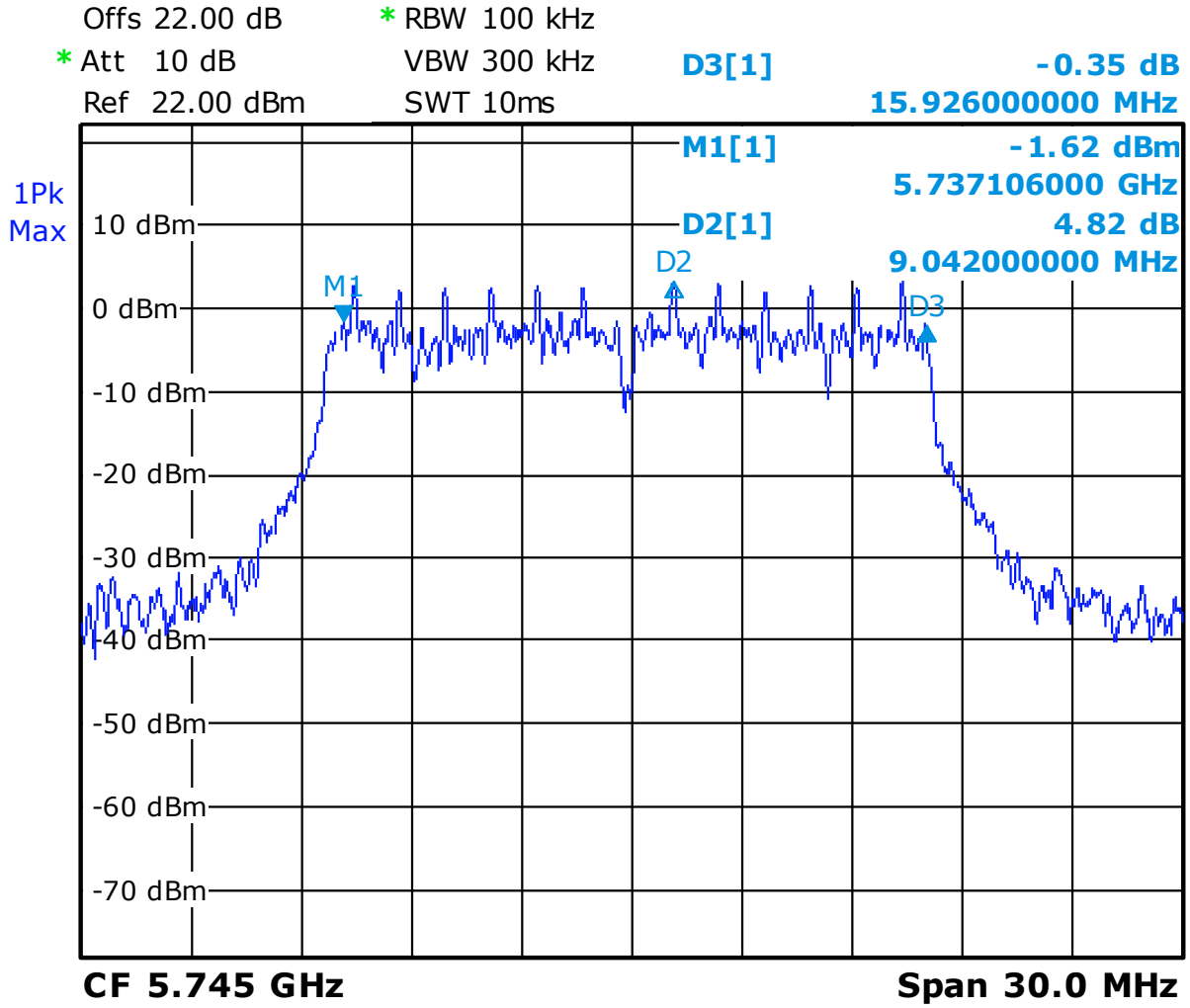
U-NII-3 band - High Channel – Mode 802.11.a – RF2



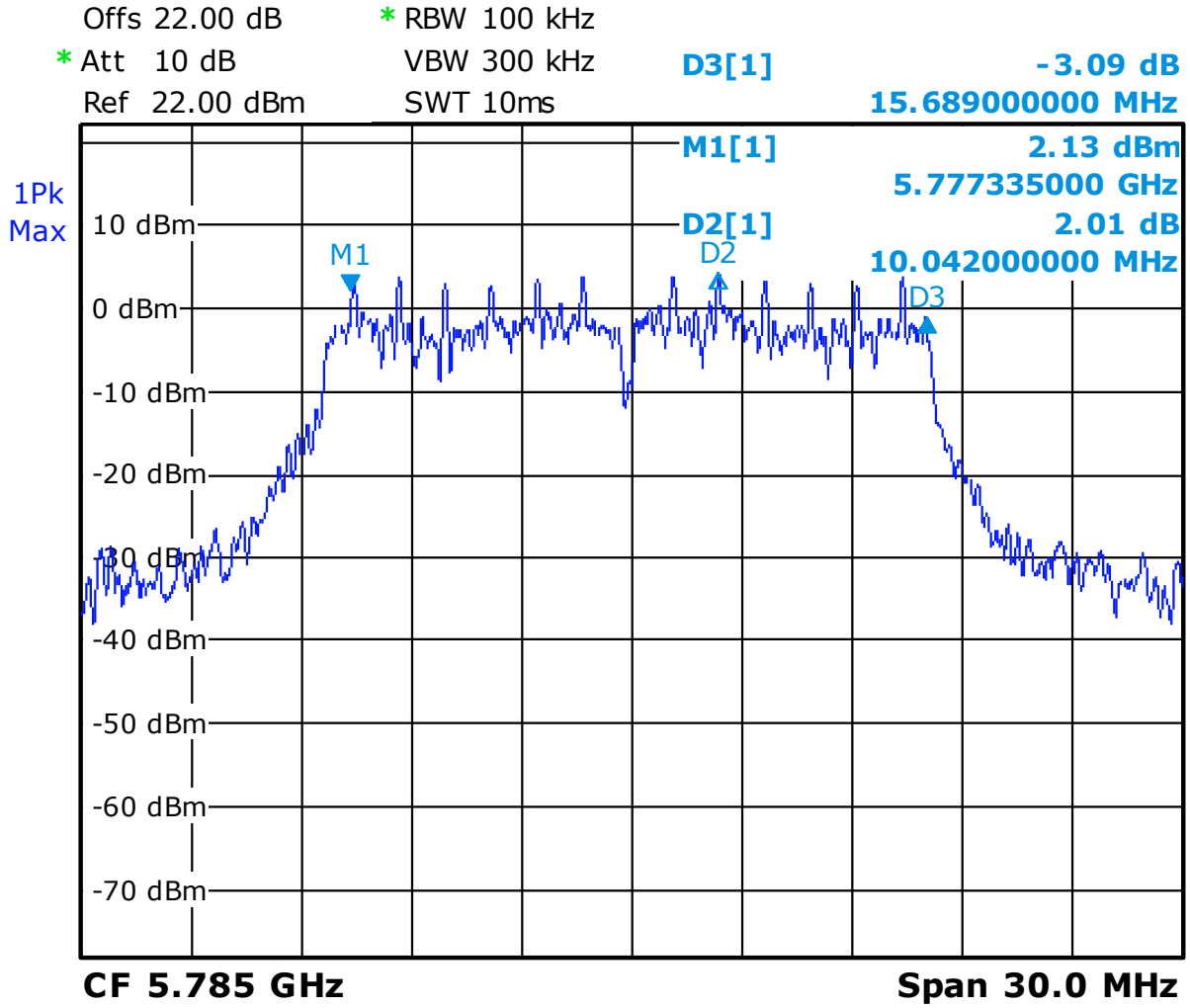
U-NII-3 band - Low Channel – Mode 802.11.n – RF 1



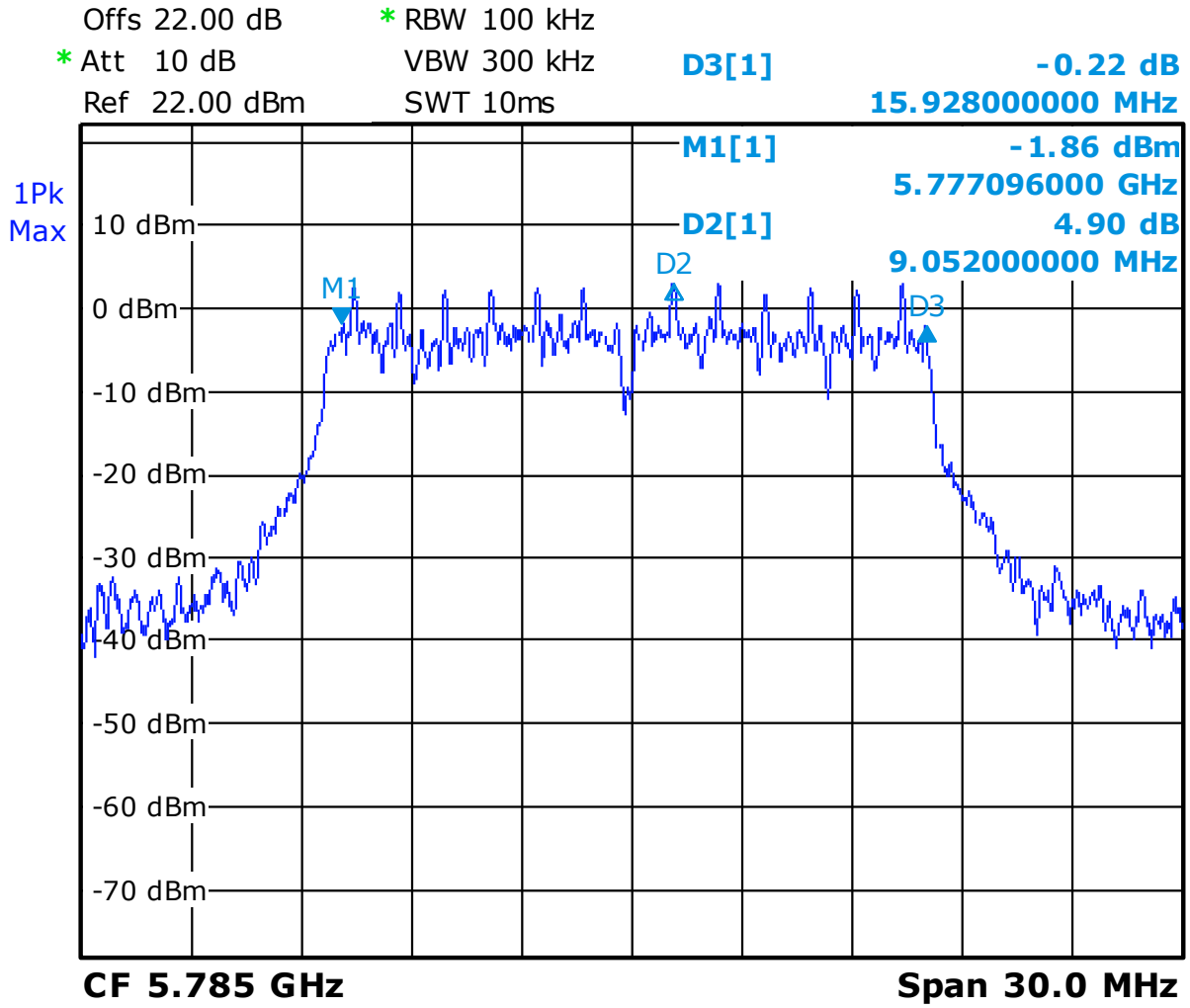
U-NII-3 band - Low Channel – Mode 802.11.n – RF 2



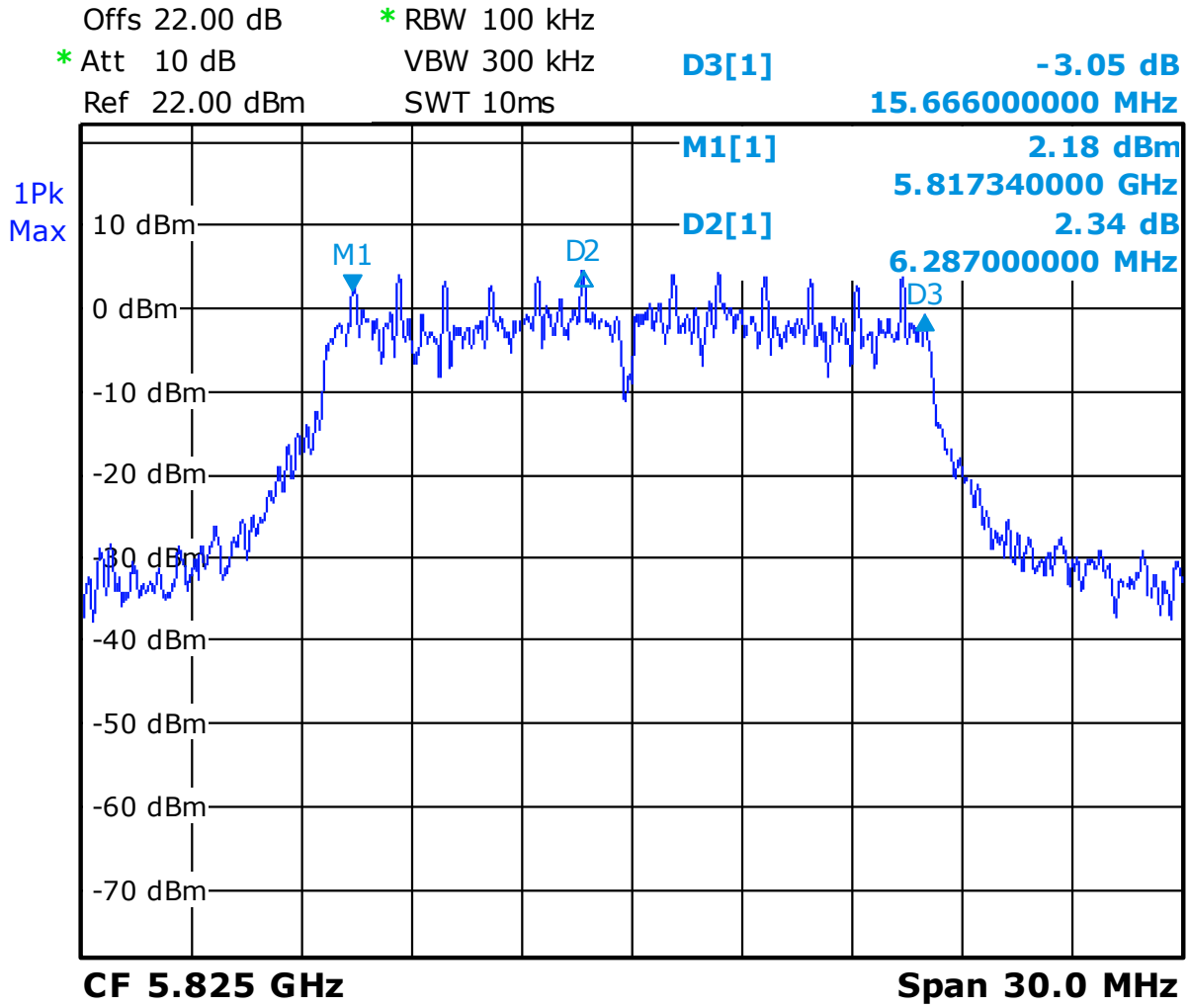
U-NII-3 band – Central Channel – Mode 802.11.n – RF 1



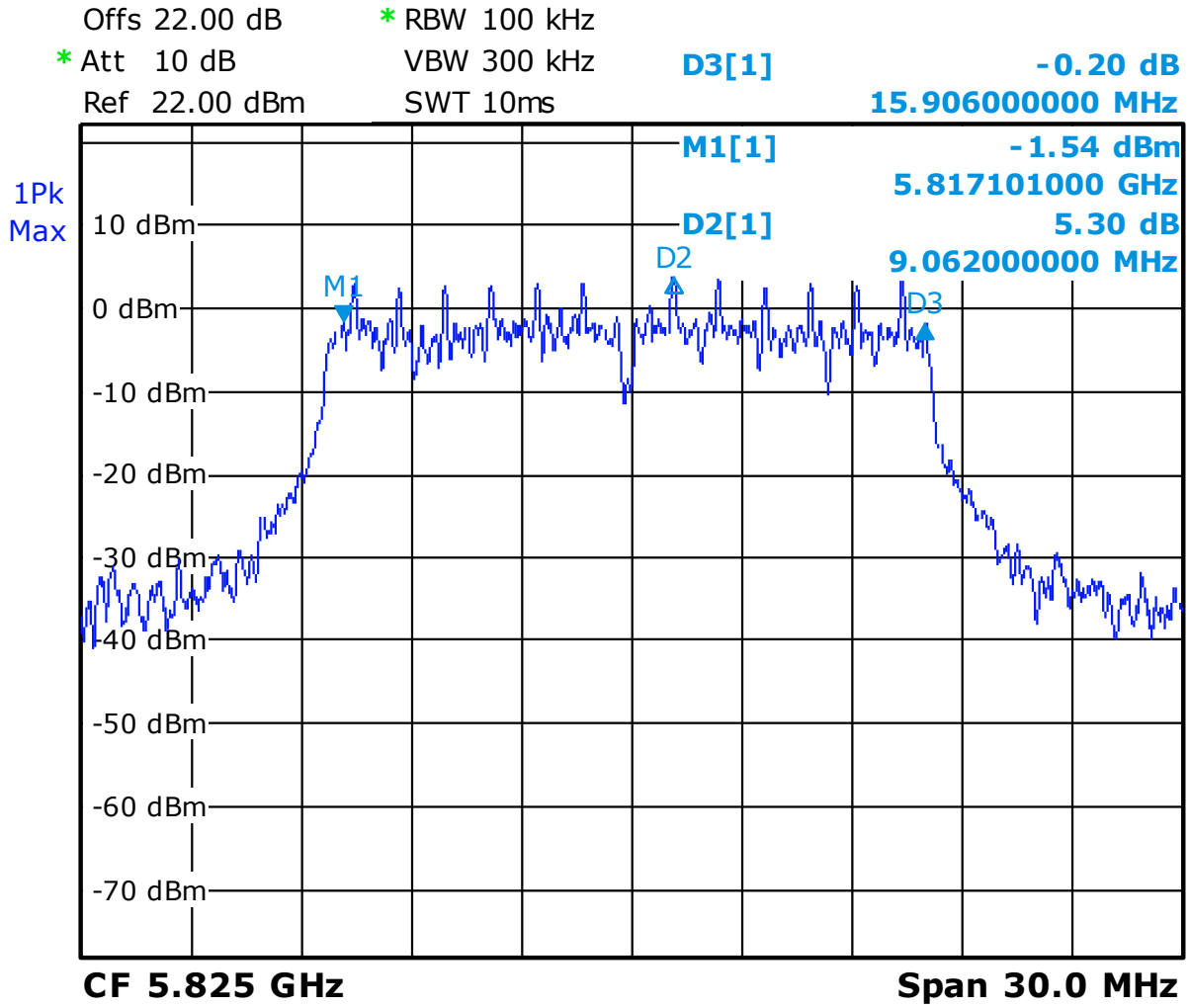
U-NII-3 band – Central Channel – Mode 802.11.n – RF 2



U-NII-3 band - High Channel – Mode 802.11.n – RF1

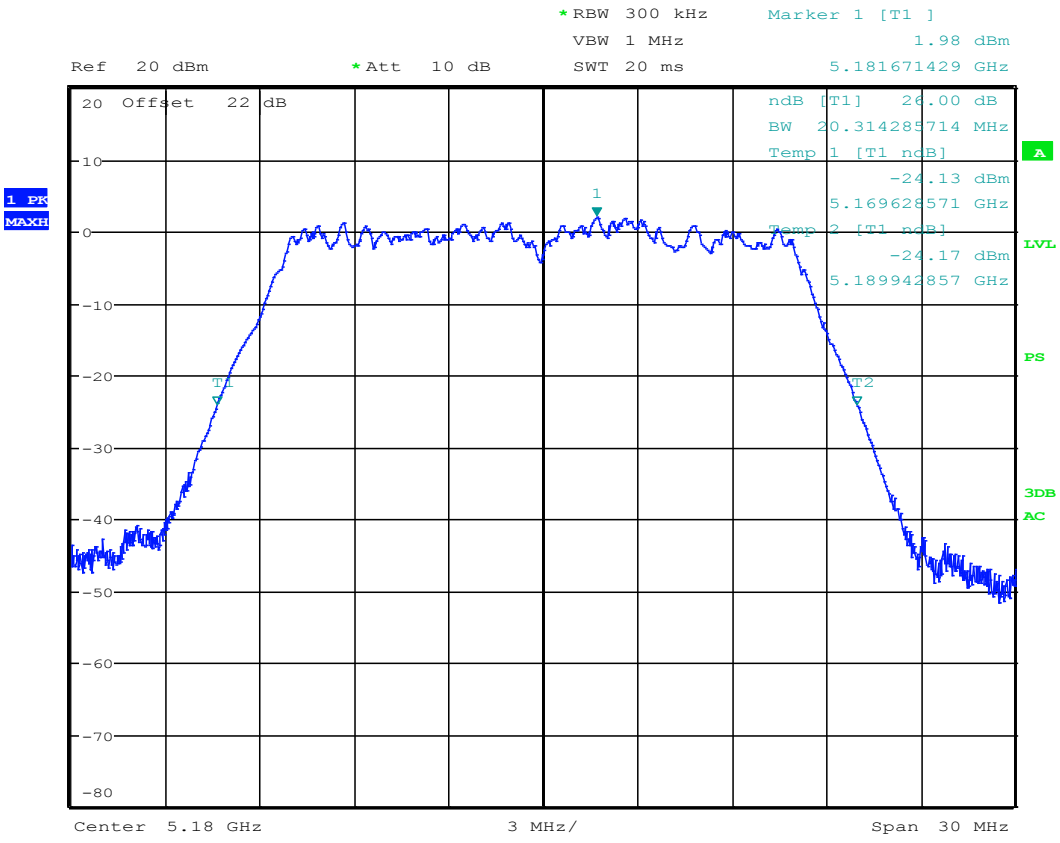


U-NII-3 band - High Channel – Mode 802.11.n – RF2

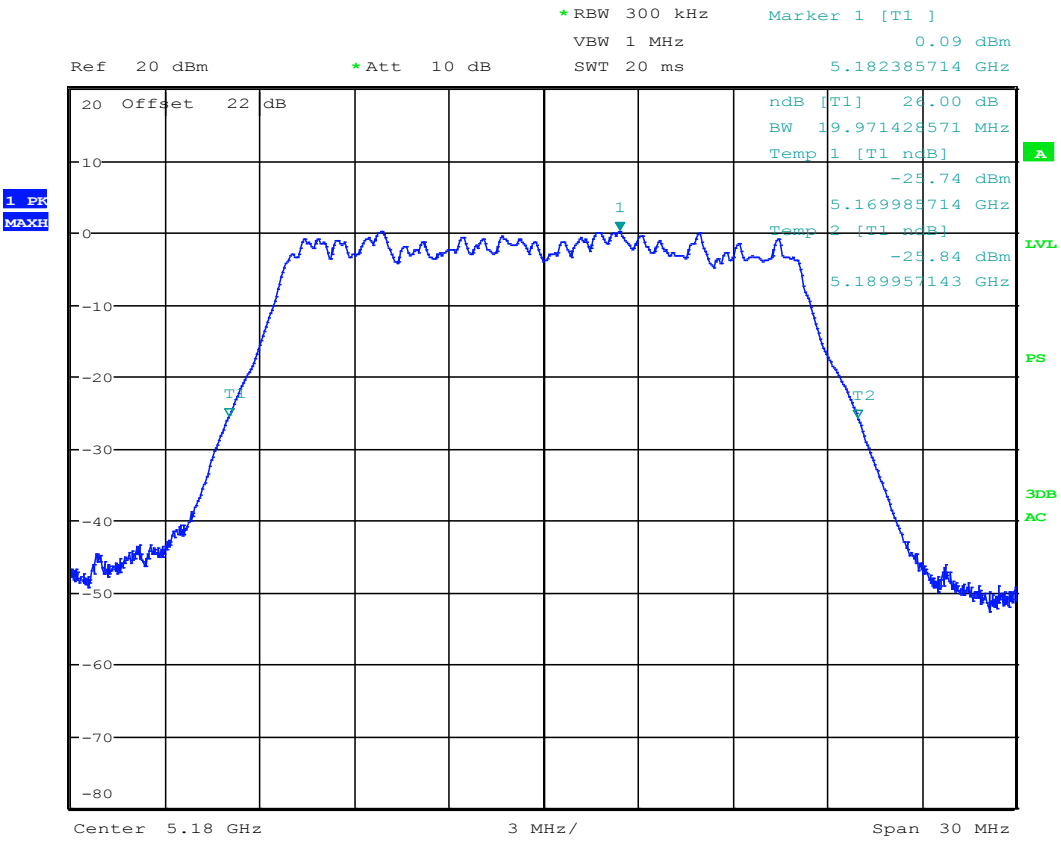


APPENDIX 3: 26 dB bandwidth

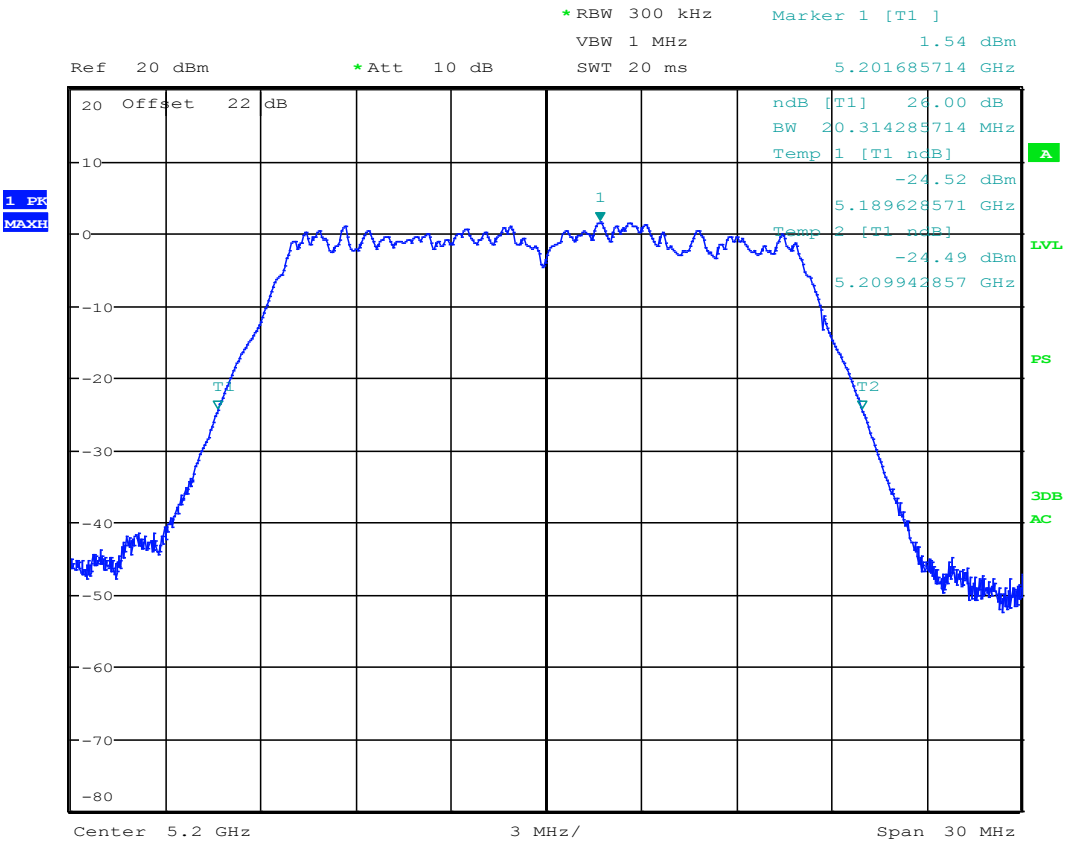
U-NII-1 band - Low Channel – Mode 802.11.a – RF 1



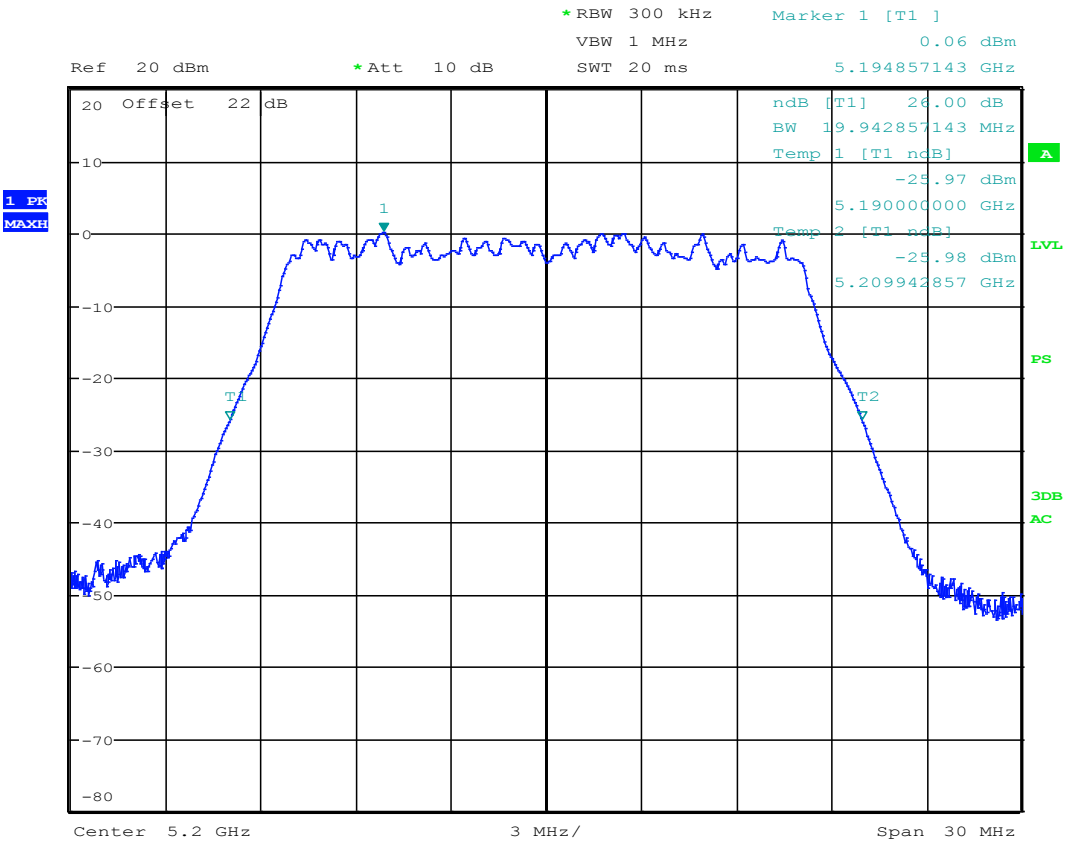
U-NII-1 band - Low Channel – Mode 802.11.a – RF 2



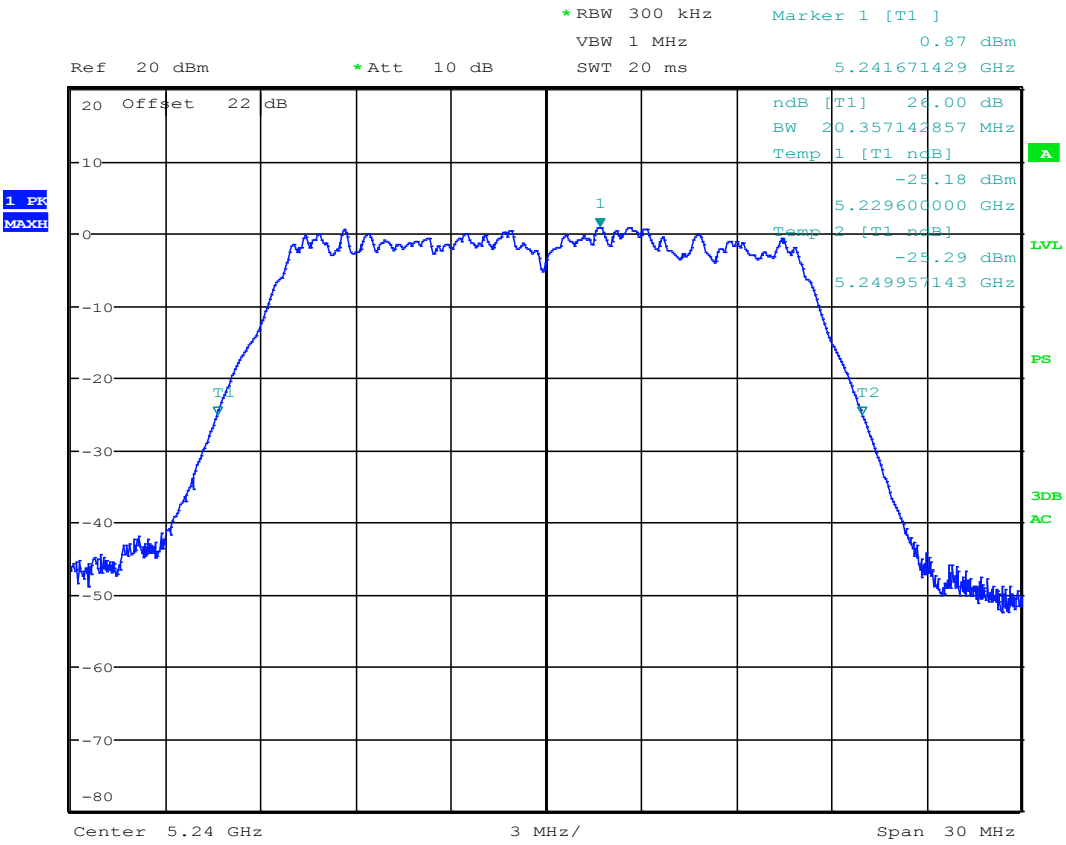
U-NII-1 band – Central Channel – Mode 802.11.a – RF 1



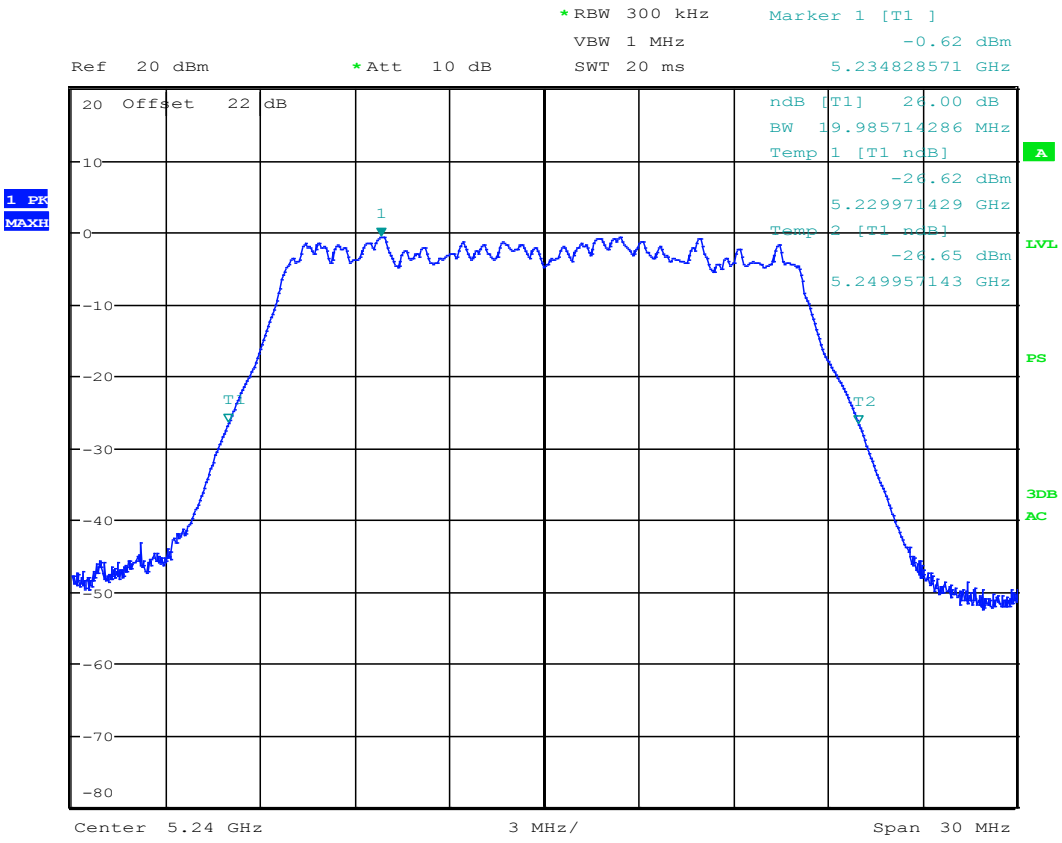
U-NII-1 band – Central Channel – Mode 802.11.a – RF 2



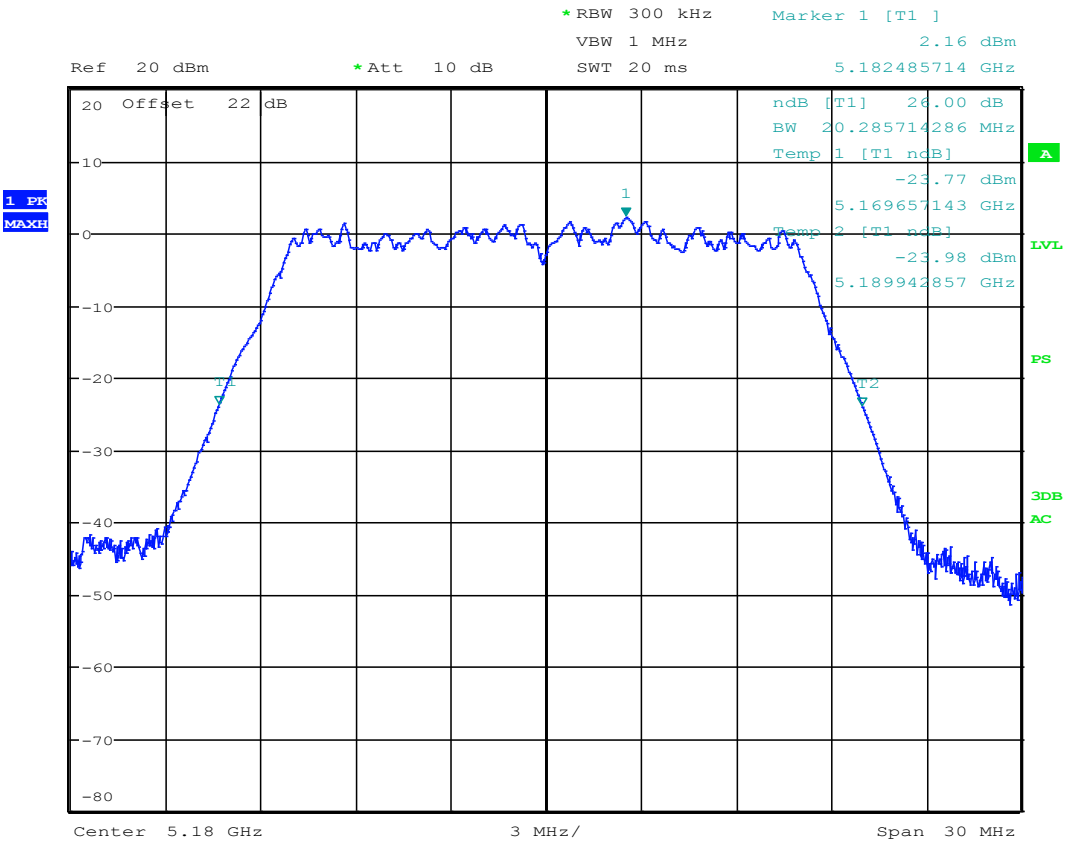
U-NII-1 band - High Channel – Mode 802.11.a – RF1



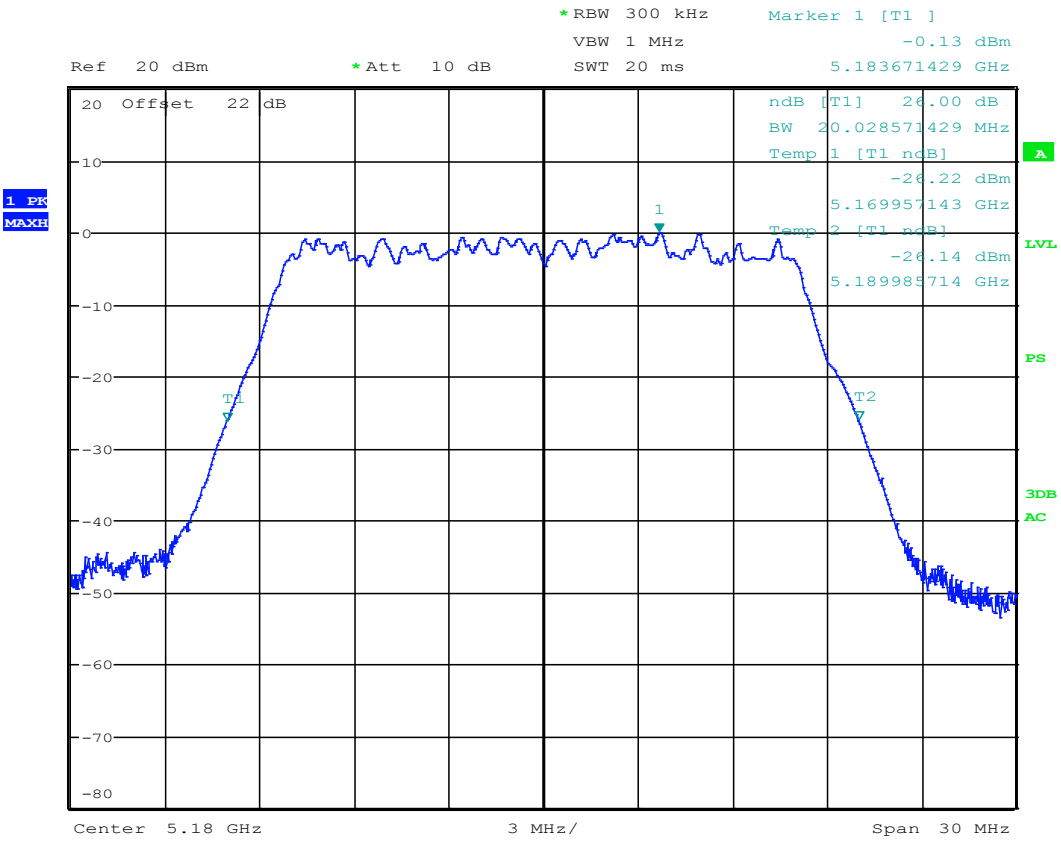
U-NII-1 band - High Channel – Mode 802.11.a – RF2



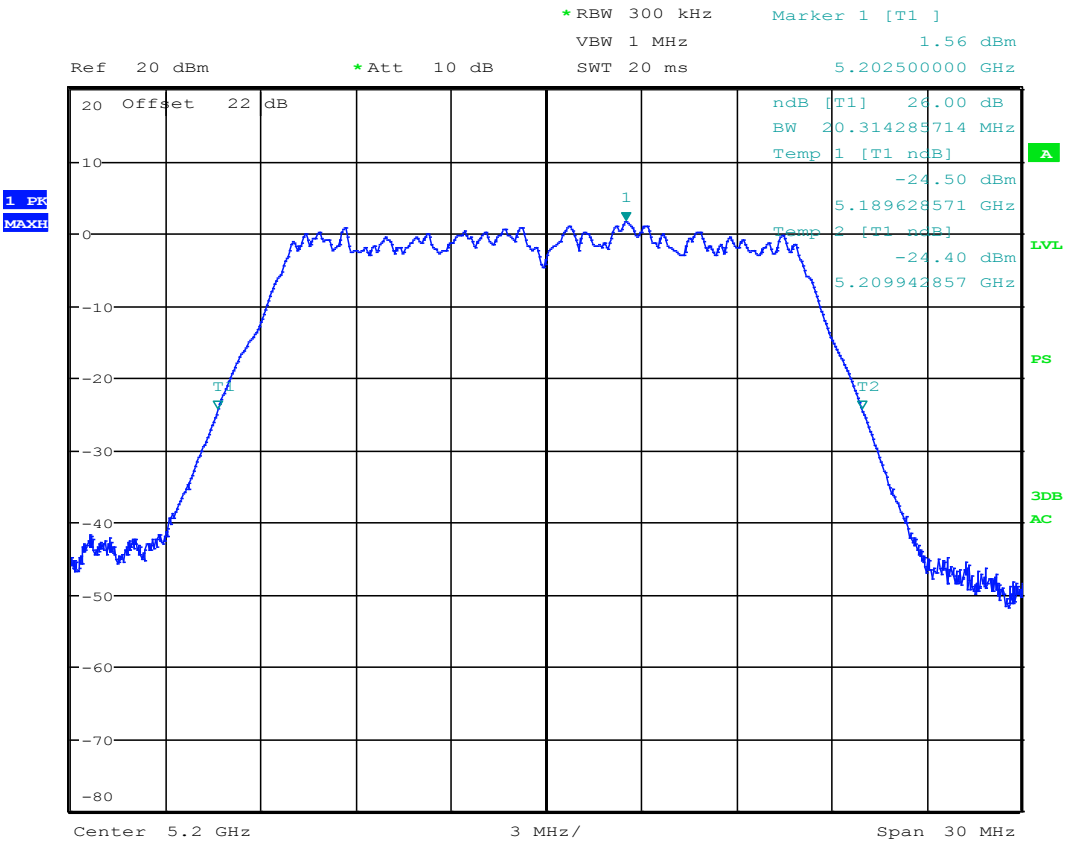
U-NII-1 band - Low Channel – Mode 802.11.n – RF 1



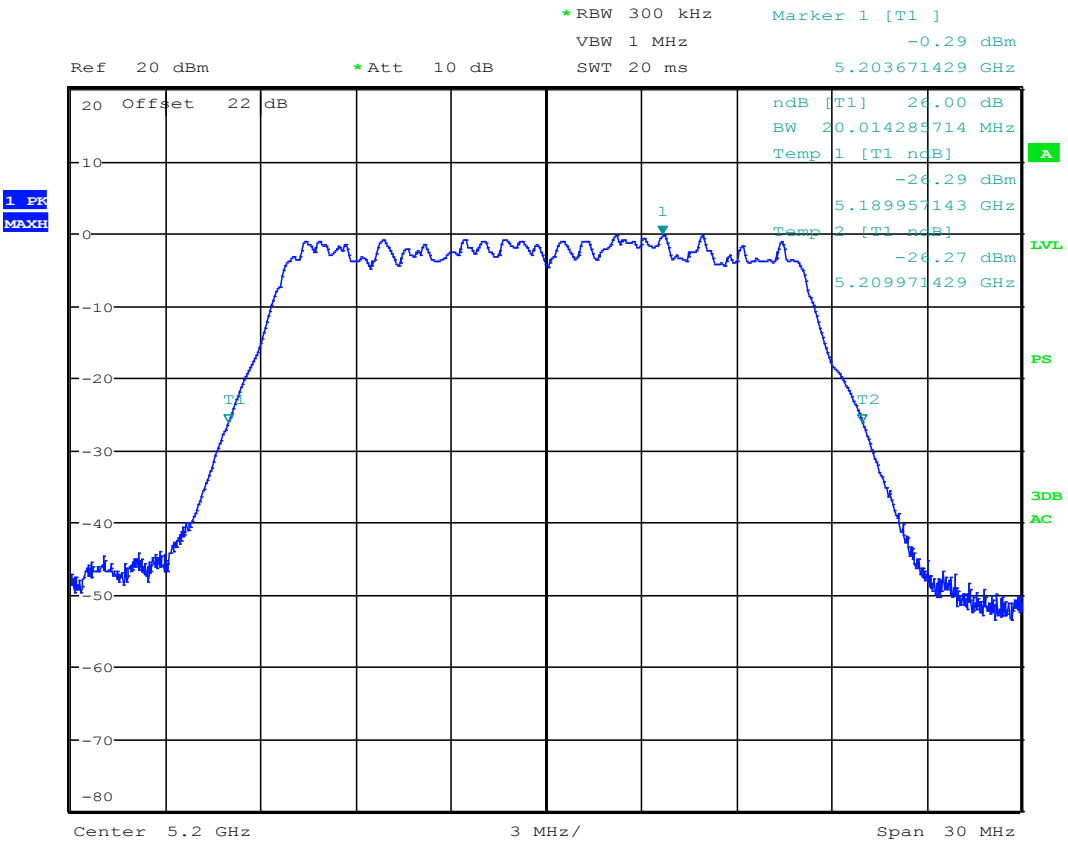
U-NII-1 band - Low Channel – Mode 802.11.n – RF 2



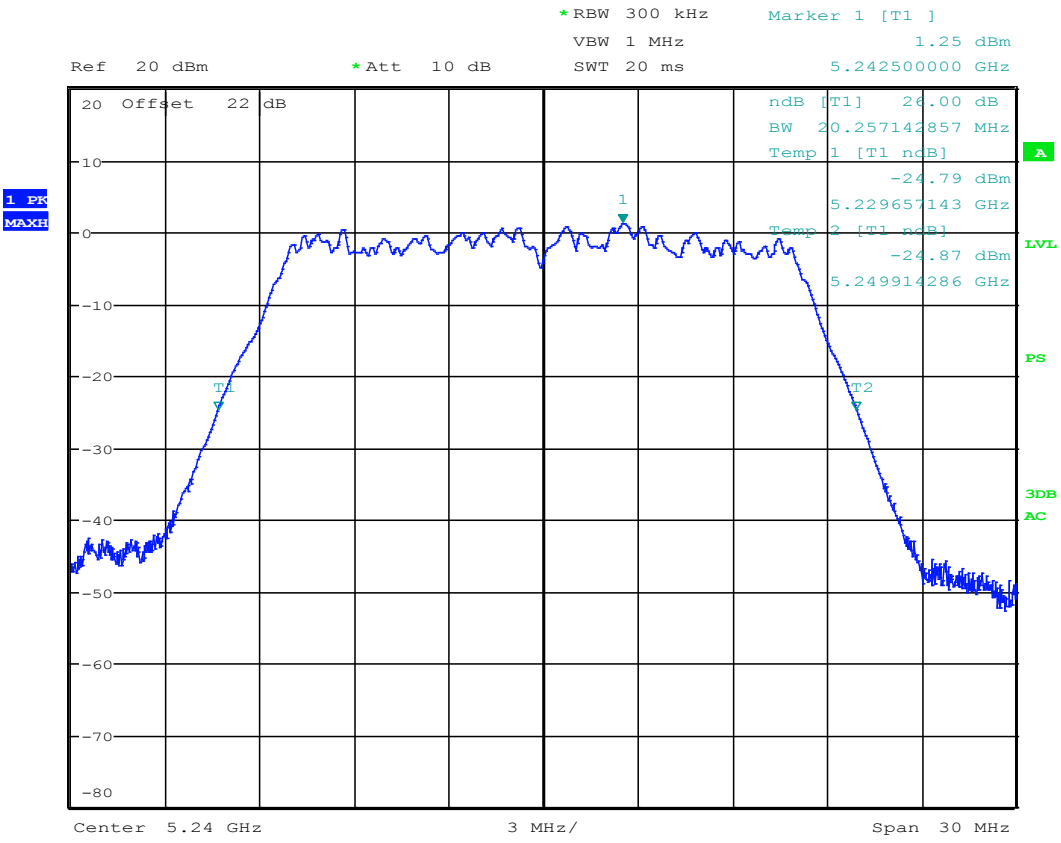
U-NII-1 band – Central Channel – Mode 802.11.n – RF 1



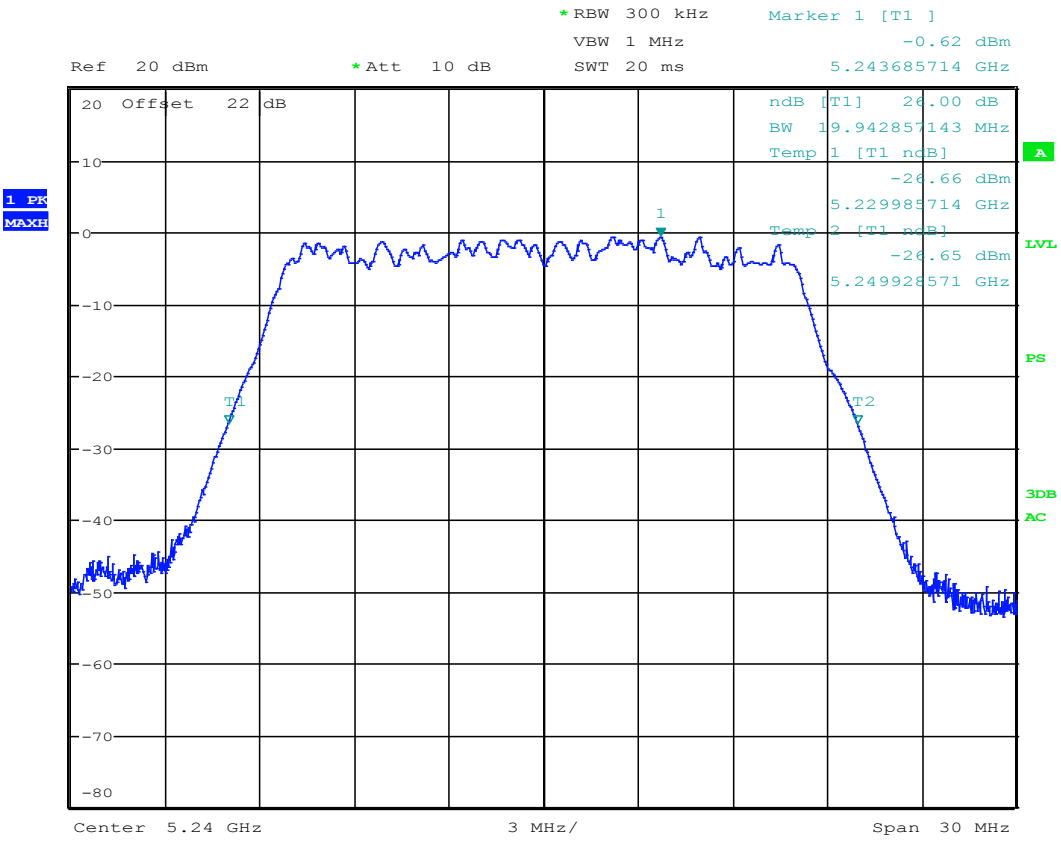
U-NII-1 band – Central Channel – Mode 802.11.n – RF 2



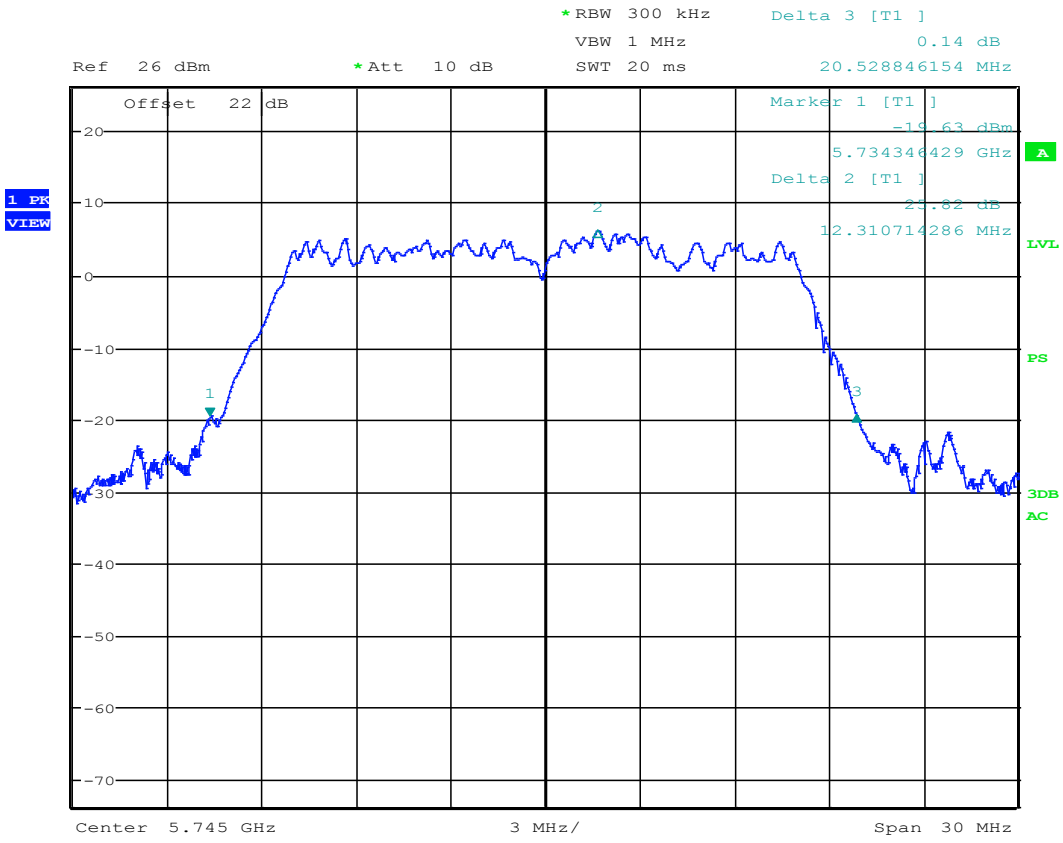
U-NII-1 band - High Channel – Mode 802.11.n – RF1



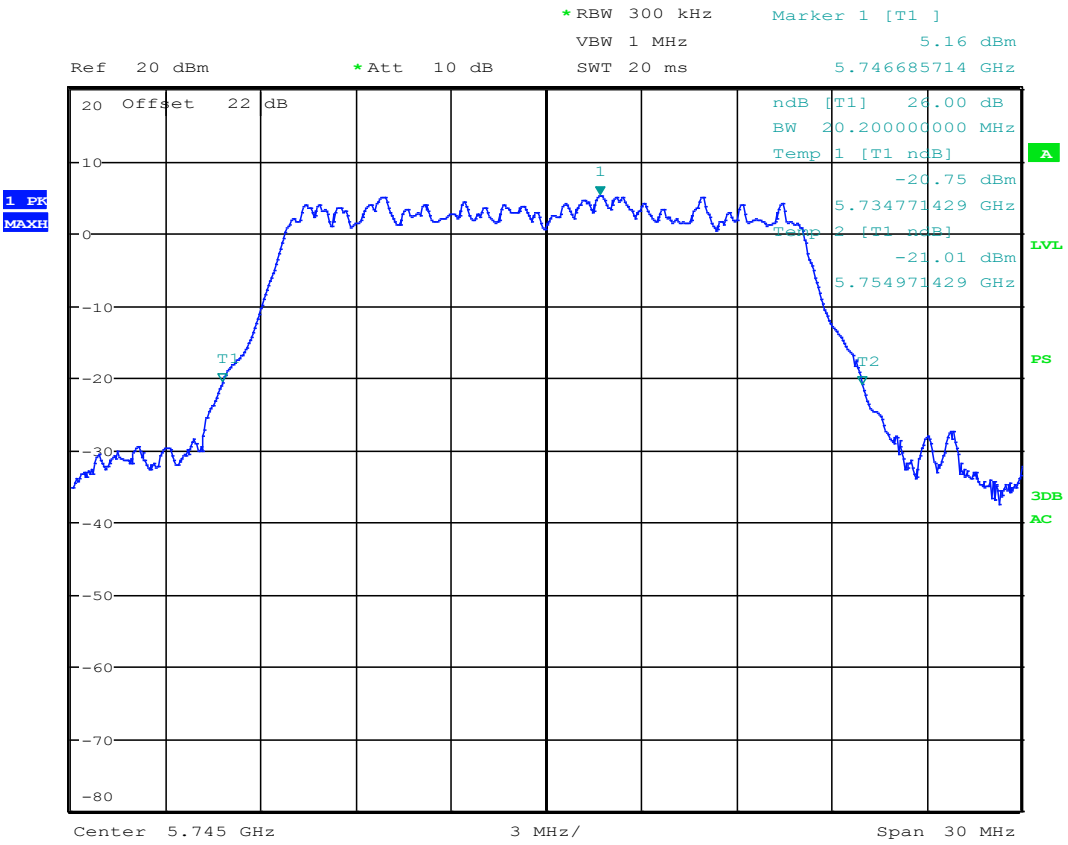
U-NII-1 band - High Channel – Mode 802.11.n – RF2



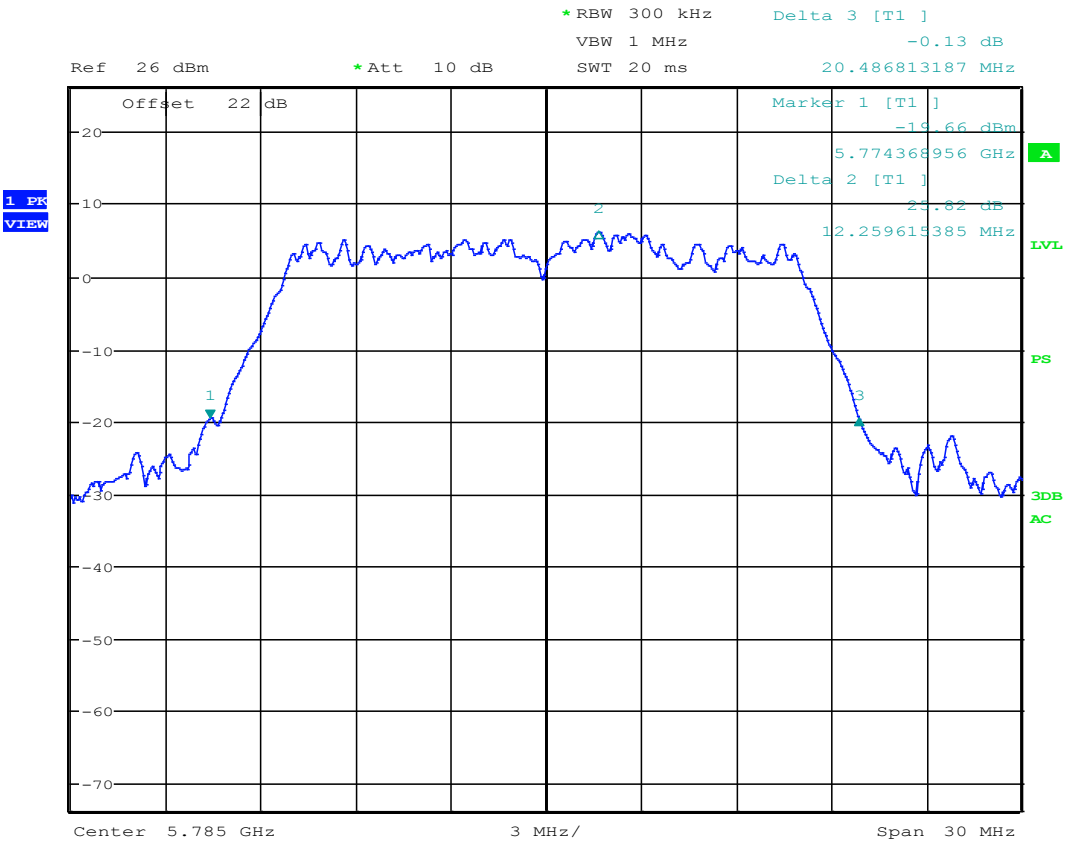
U-NII-3 band - Low Channel – Mode 802.11.a – RF 1



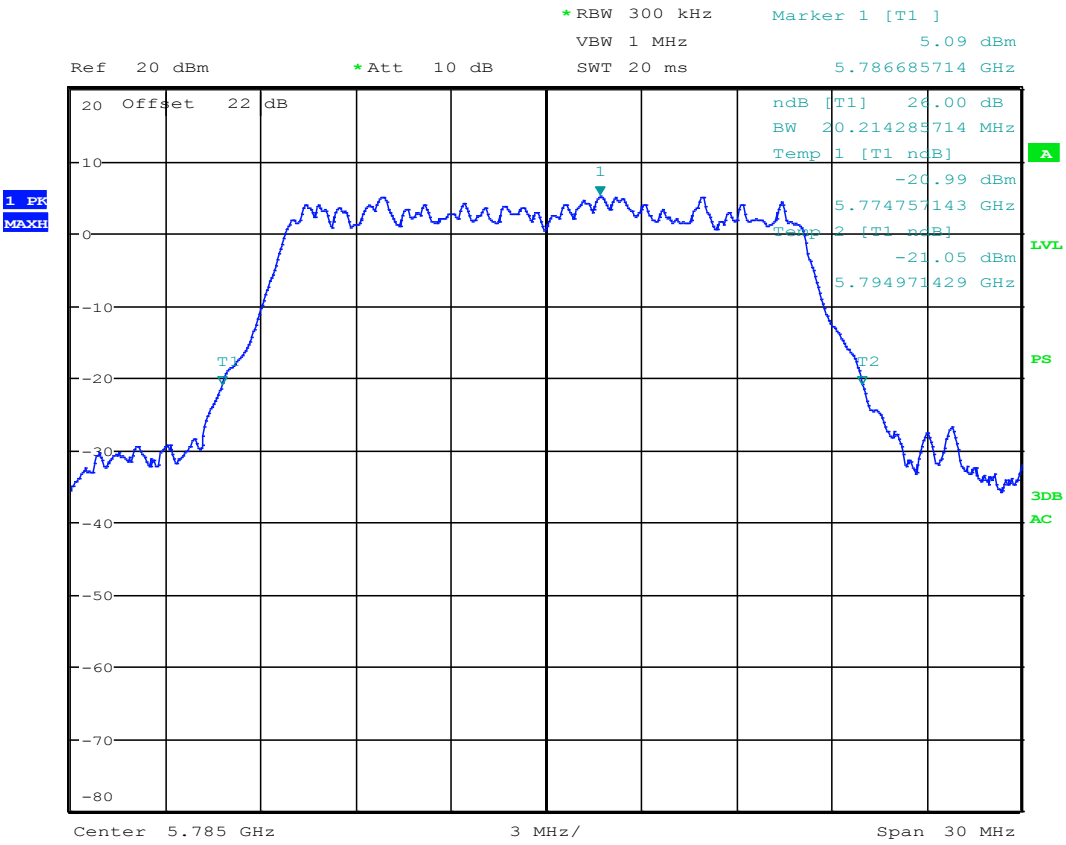
U-NII-3 band - Low Channel – Mode 802.11.a – RF 2



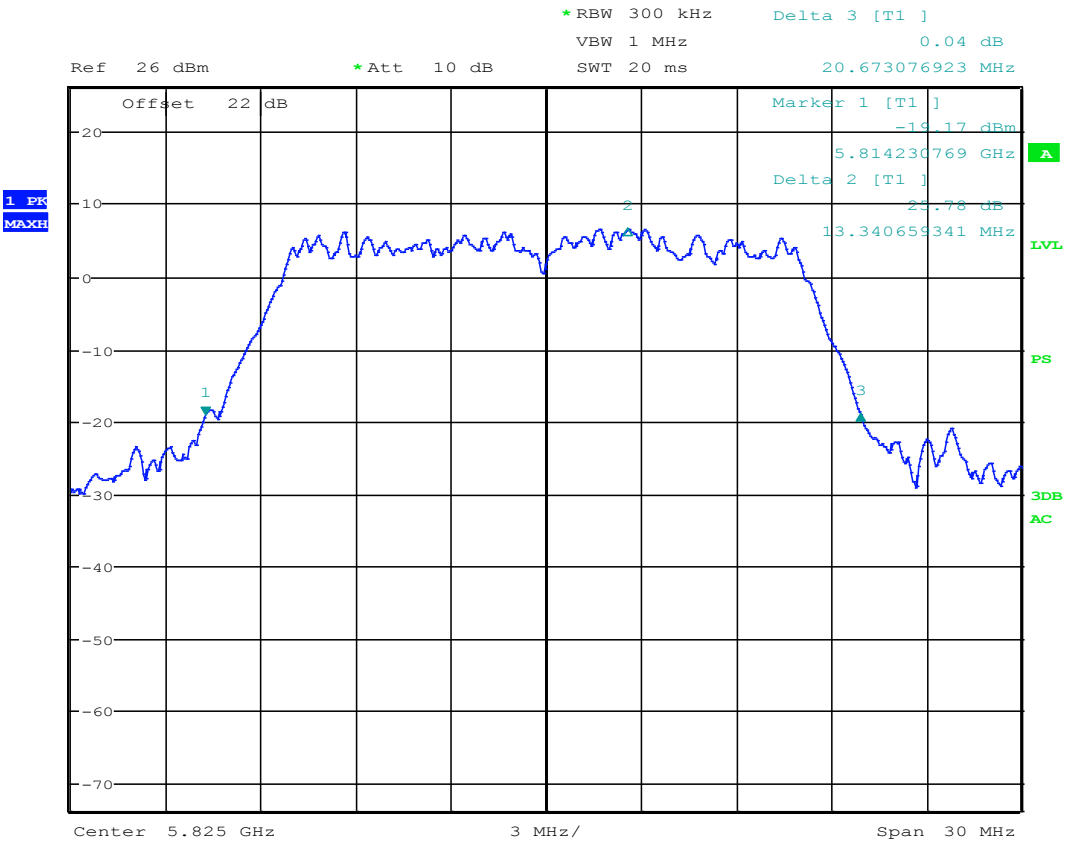
U-NII-3 band – Central Channel – Mode 802.11.a – RF 1



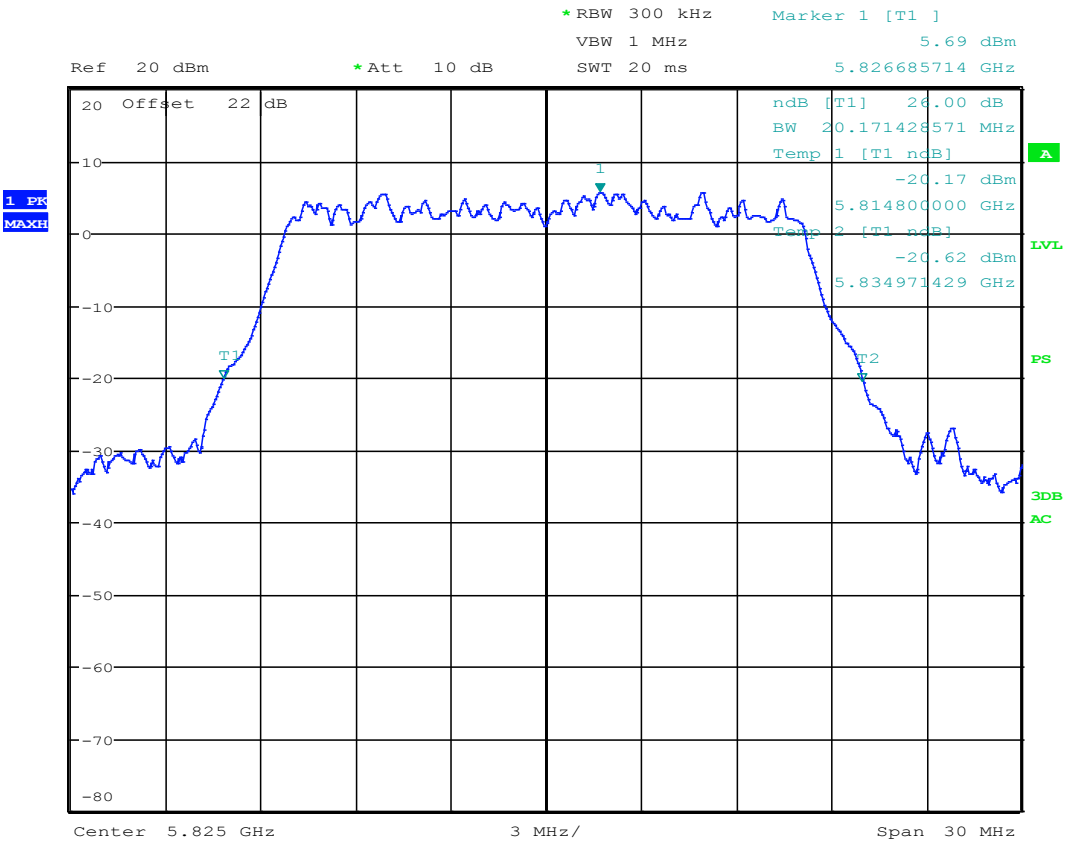
U-NII-3 band – Central Channel – Mode 802.11.a – RF 2



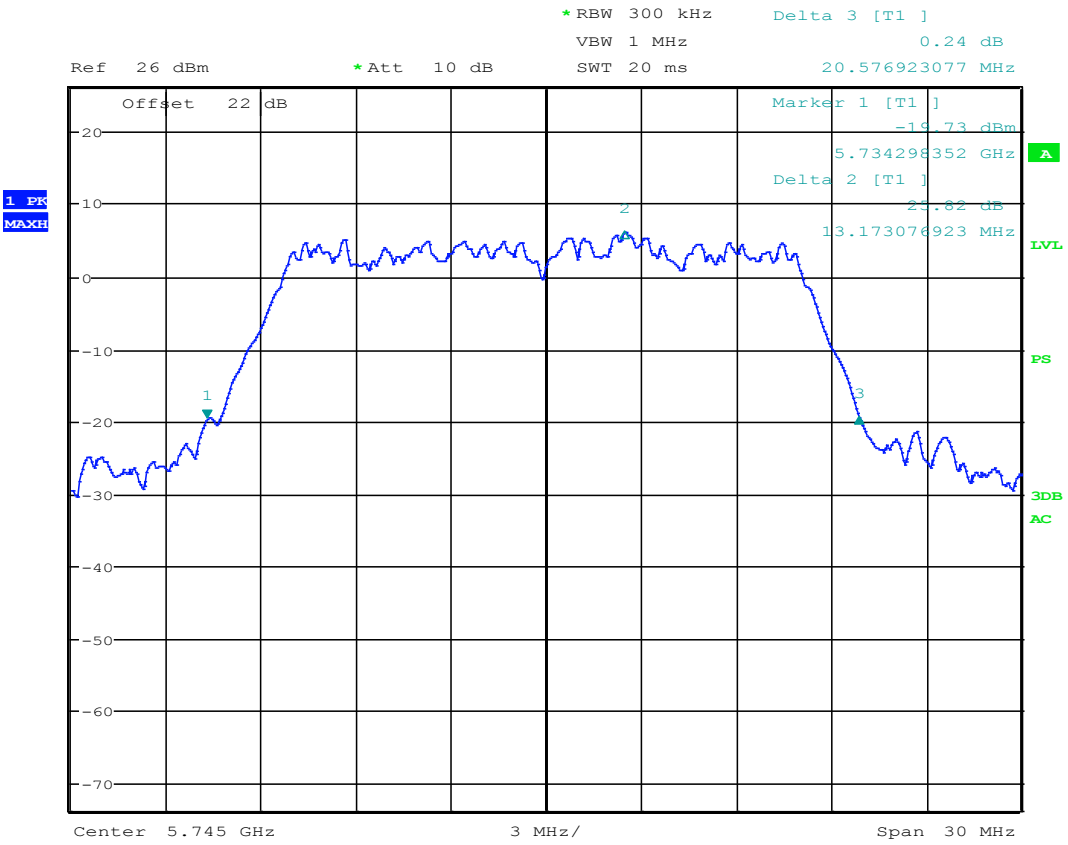
U-NII-3 band - High Channel – Mode 802.11.a – RF1



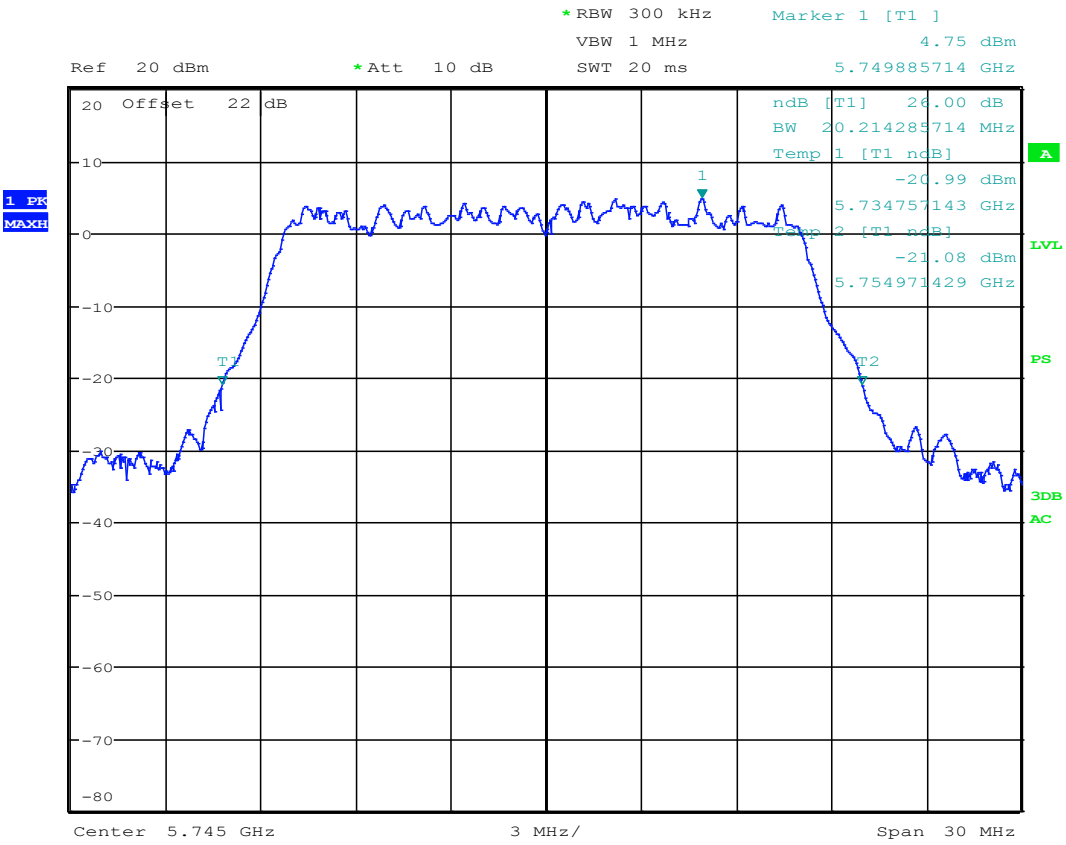
U-NII-3 band - High Channel – Mode 802.11.a – RF2



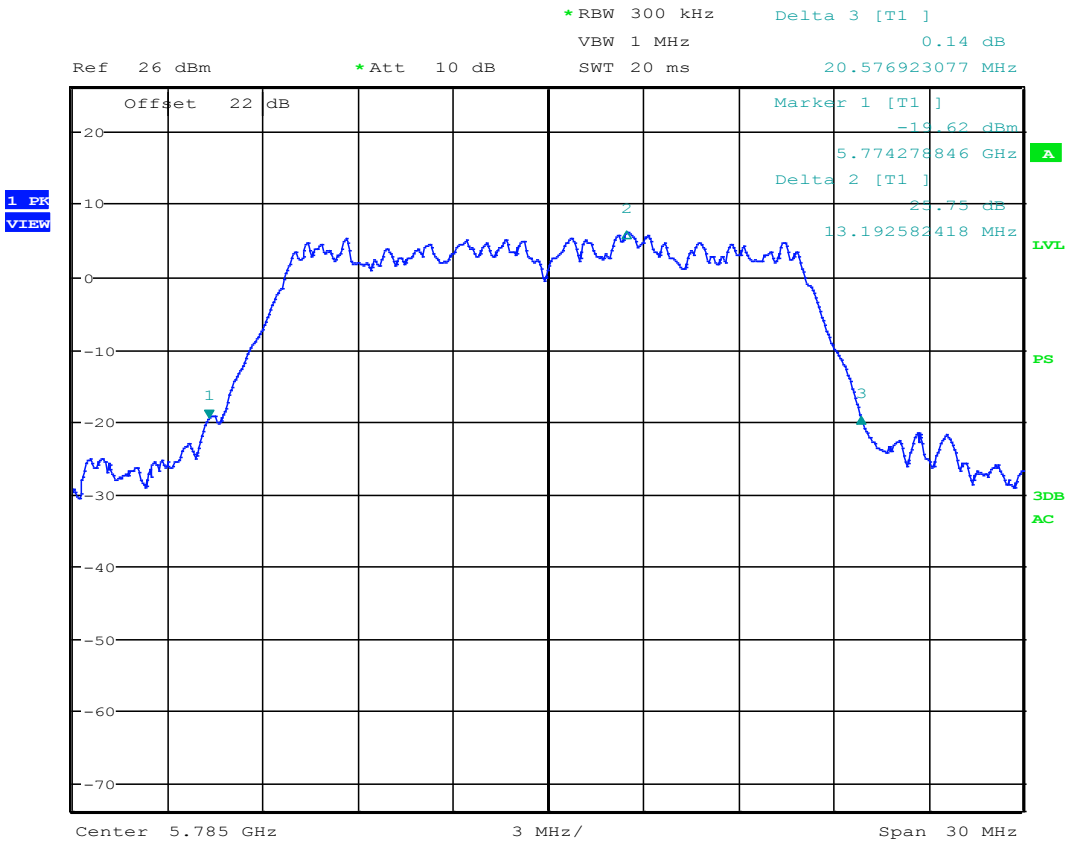
U-NII-3 band - Low Channel – Mode 802.11.n – RF 1



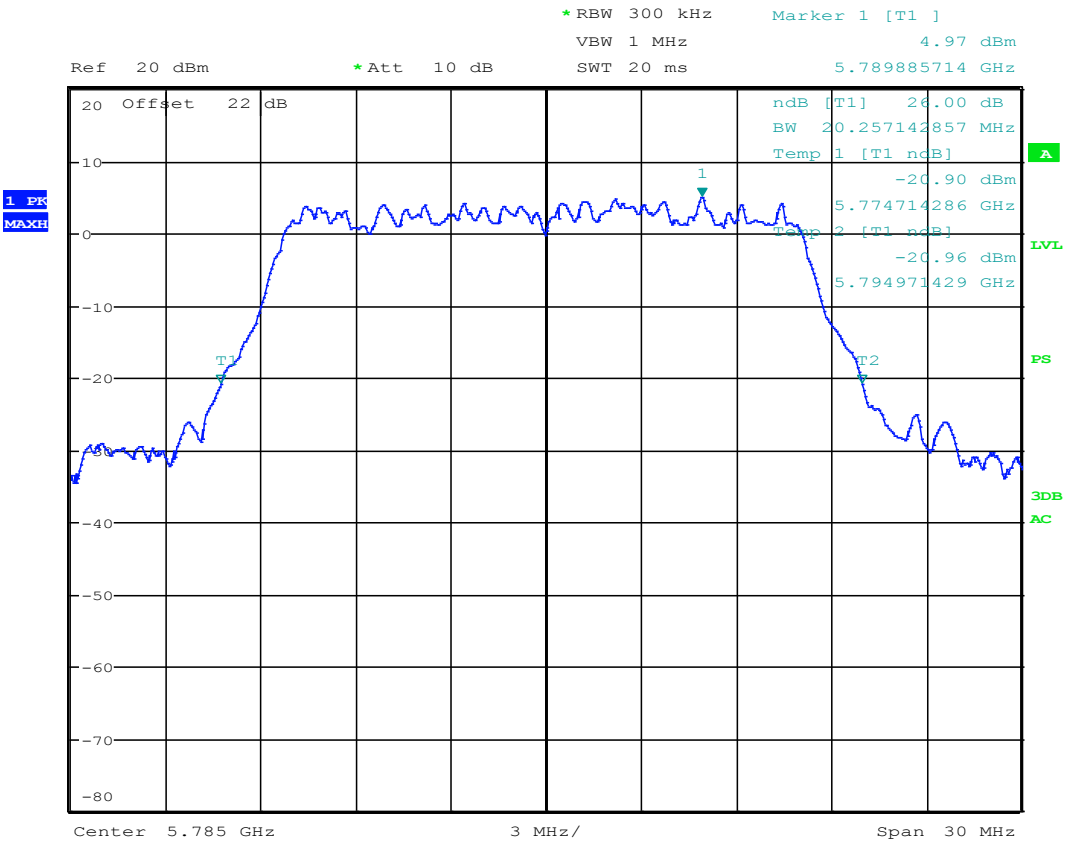
U-NII-3 band - Low Channel – Mode 802.11.n – RF 2



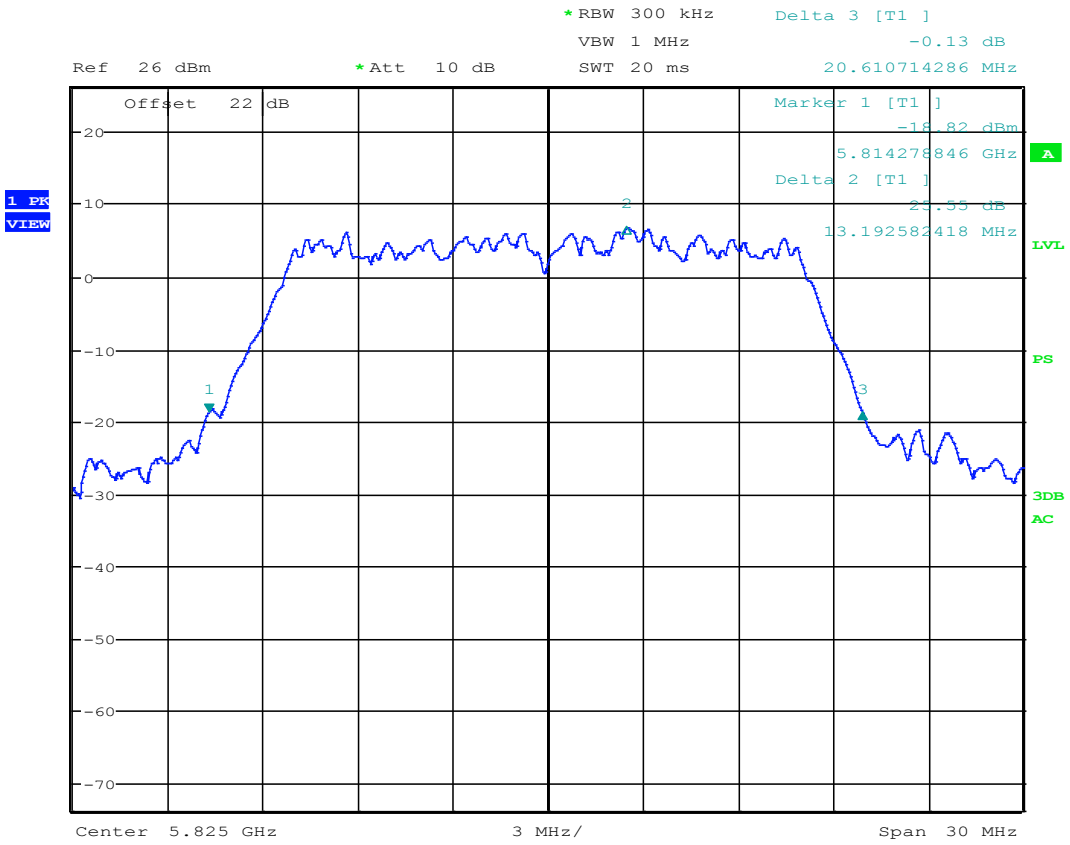
U-NII-3 band – Central Channel – Mode 802.11.n – RF 1



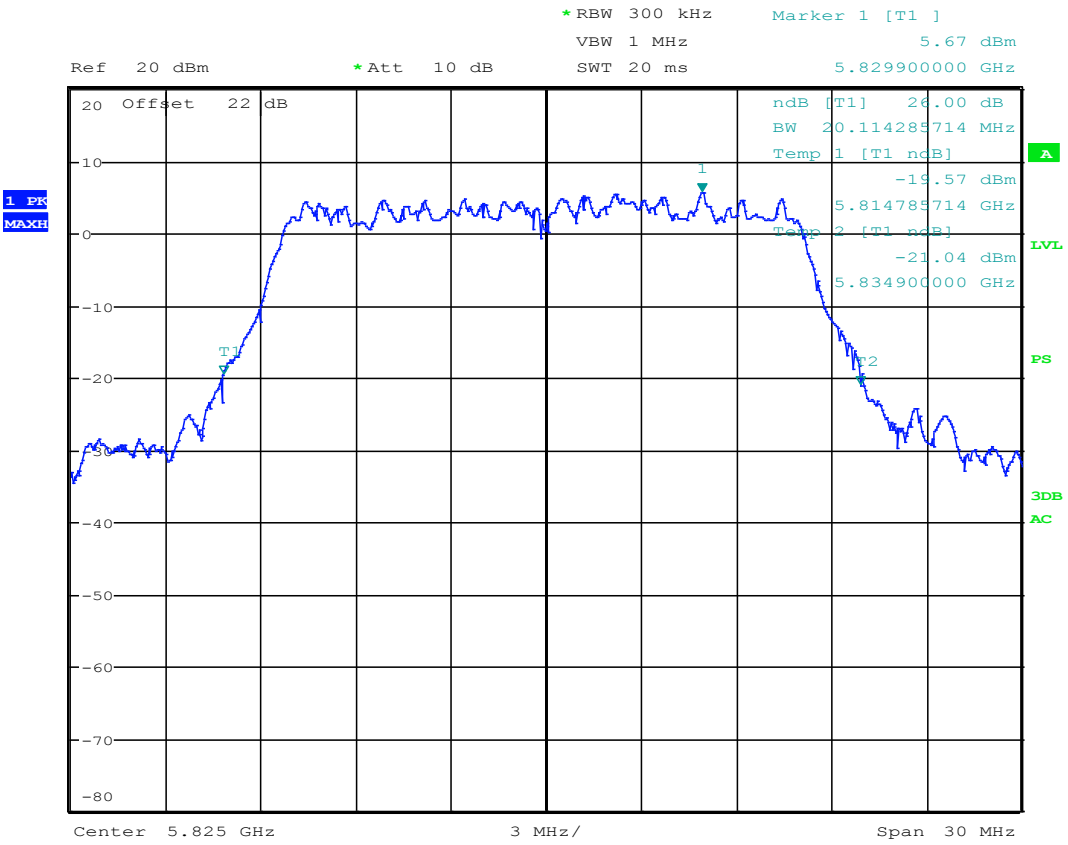
U-NII-3 band – Central Channel – Mode 802.11.n – RF 2



U-NII-3 band - High Channel – Mode 802.11.n – RF1

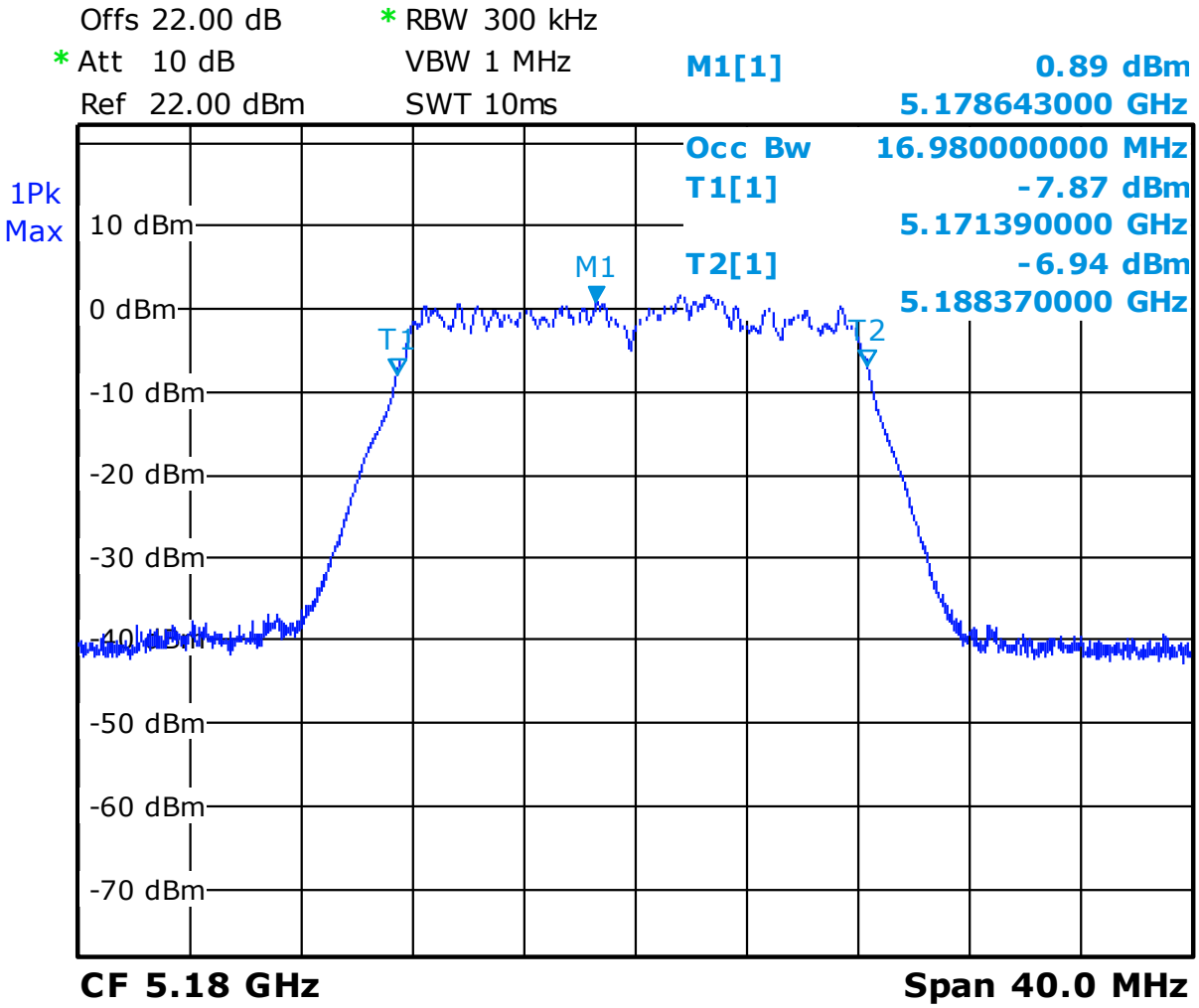


U-NII-3 band - High Channel – Mode 802.11.n – RF2

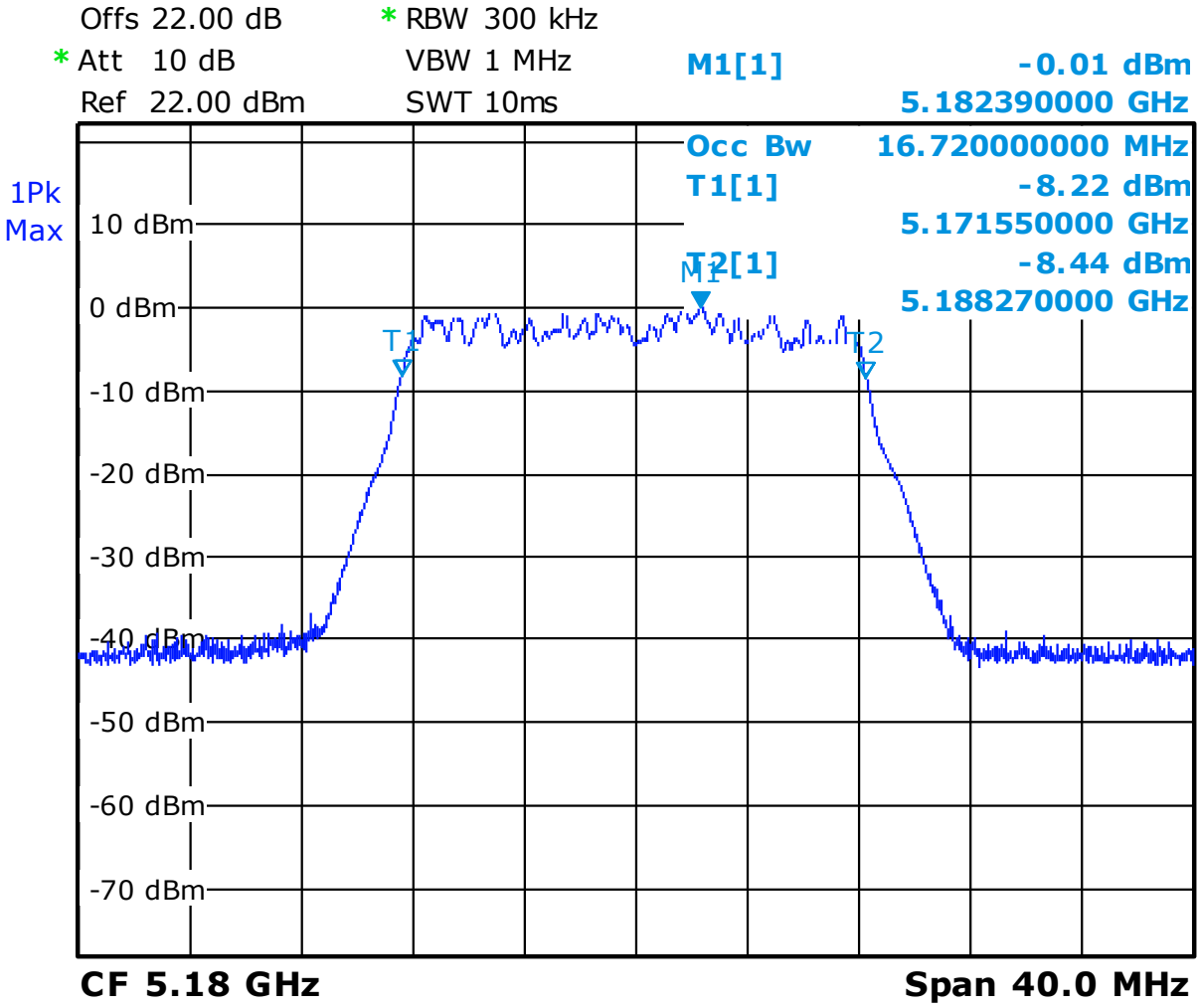


APPENDIX 4: 99% bandwidth

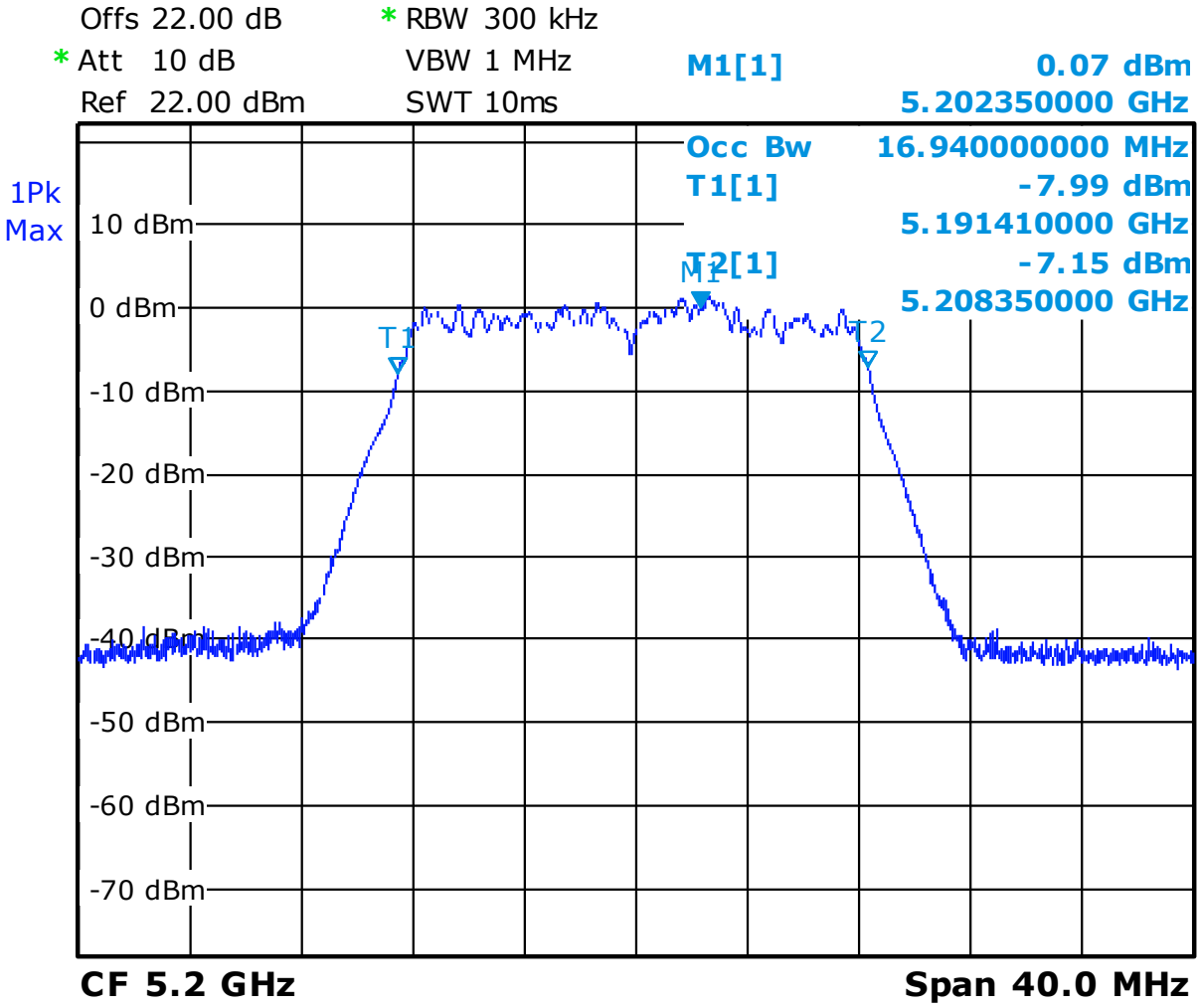
U-NII-1 band - Low Channel – Mode 802.11.a – RF 1



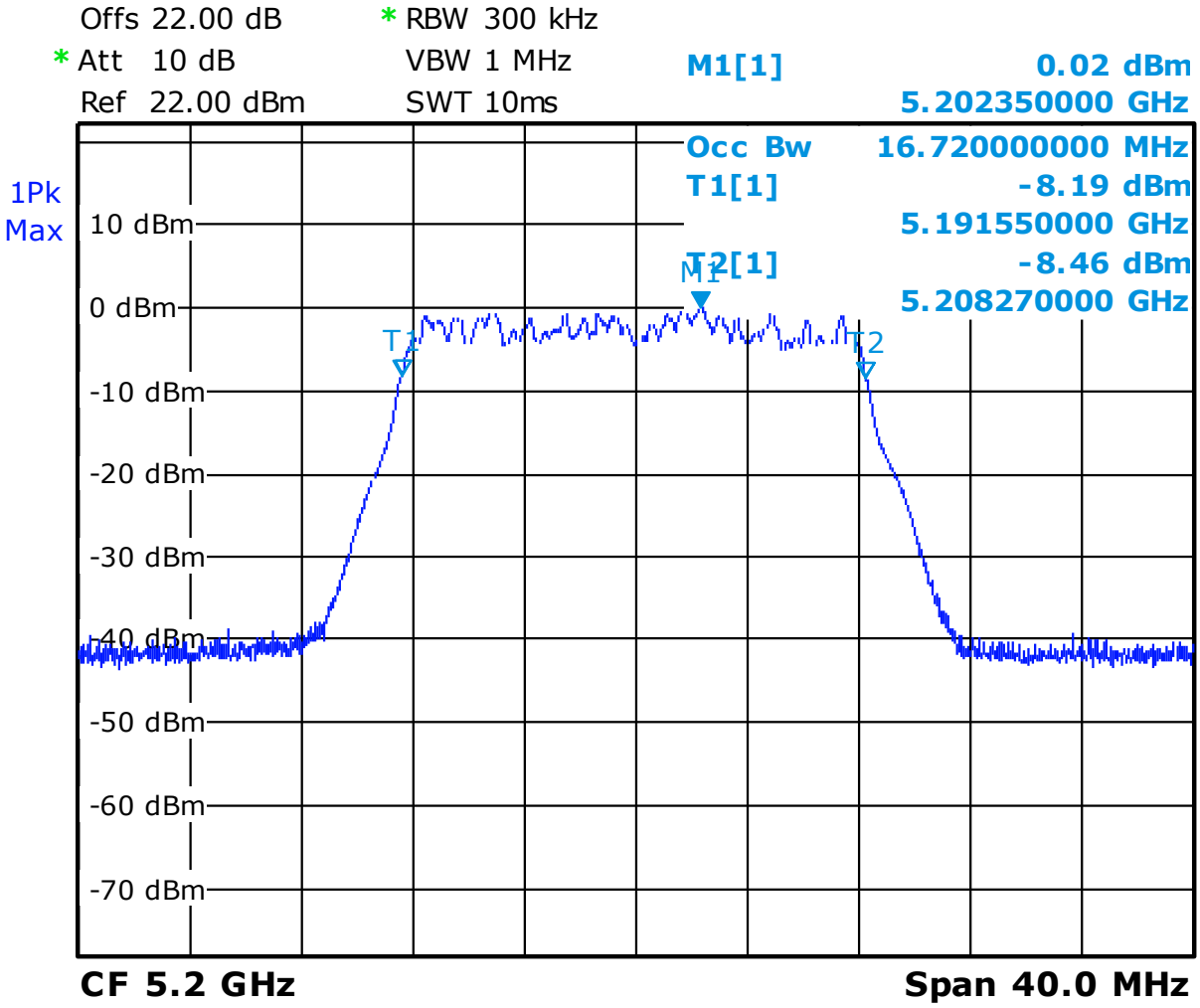
U-NII-1 band - Low Channel – Mode 802.11.a – RF 2



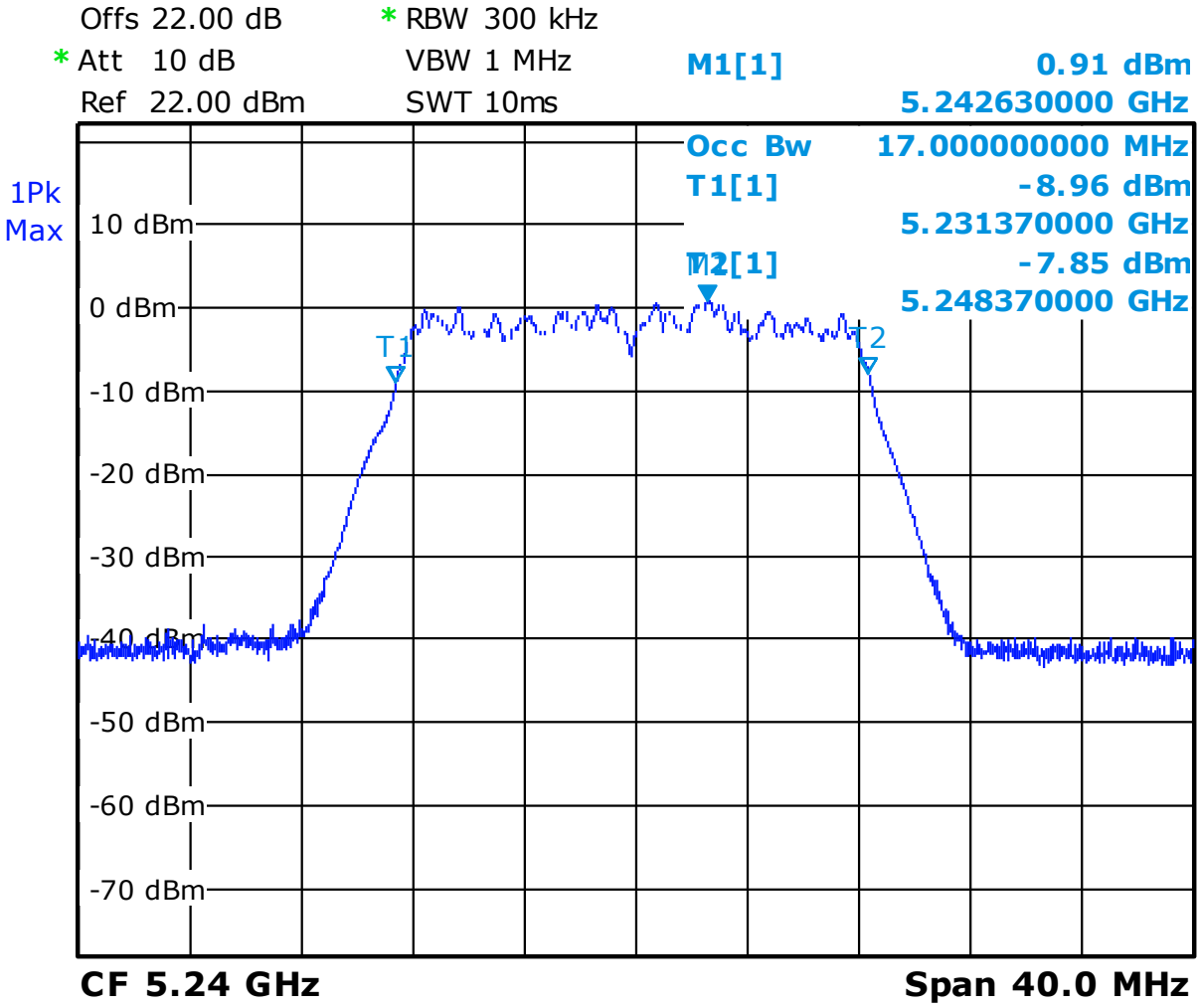
U-NII-1 band – Central Channel – Mode 802.11.a – RF 1



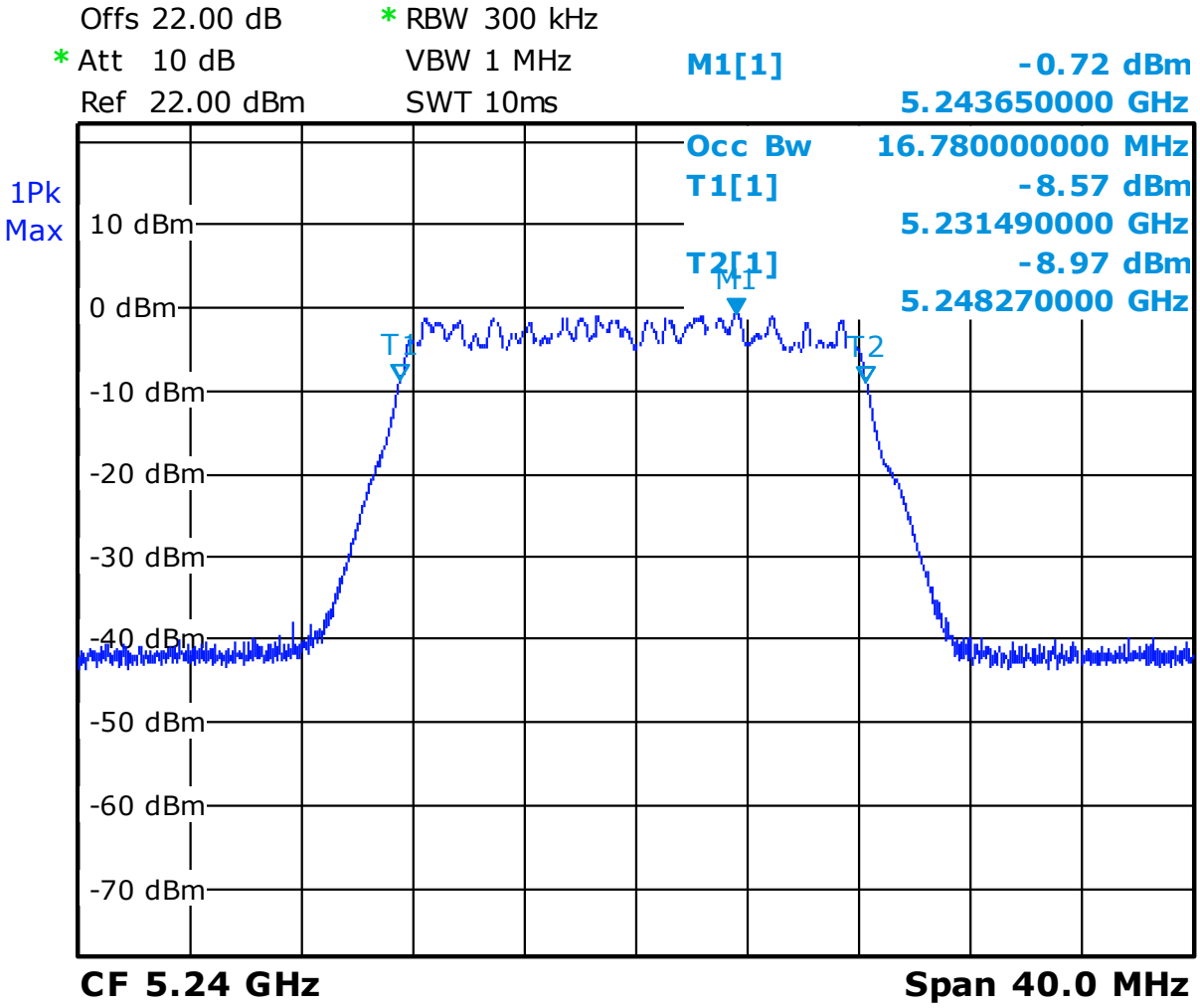
U-NII-1 band – Central Channel – Mode 802.11.a – RF 2



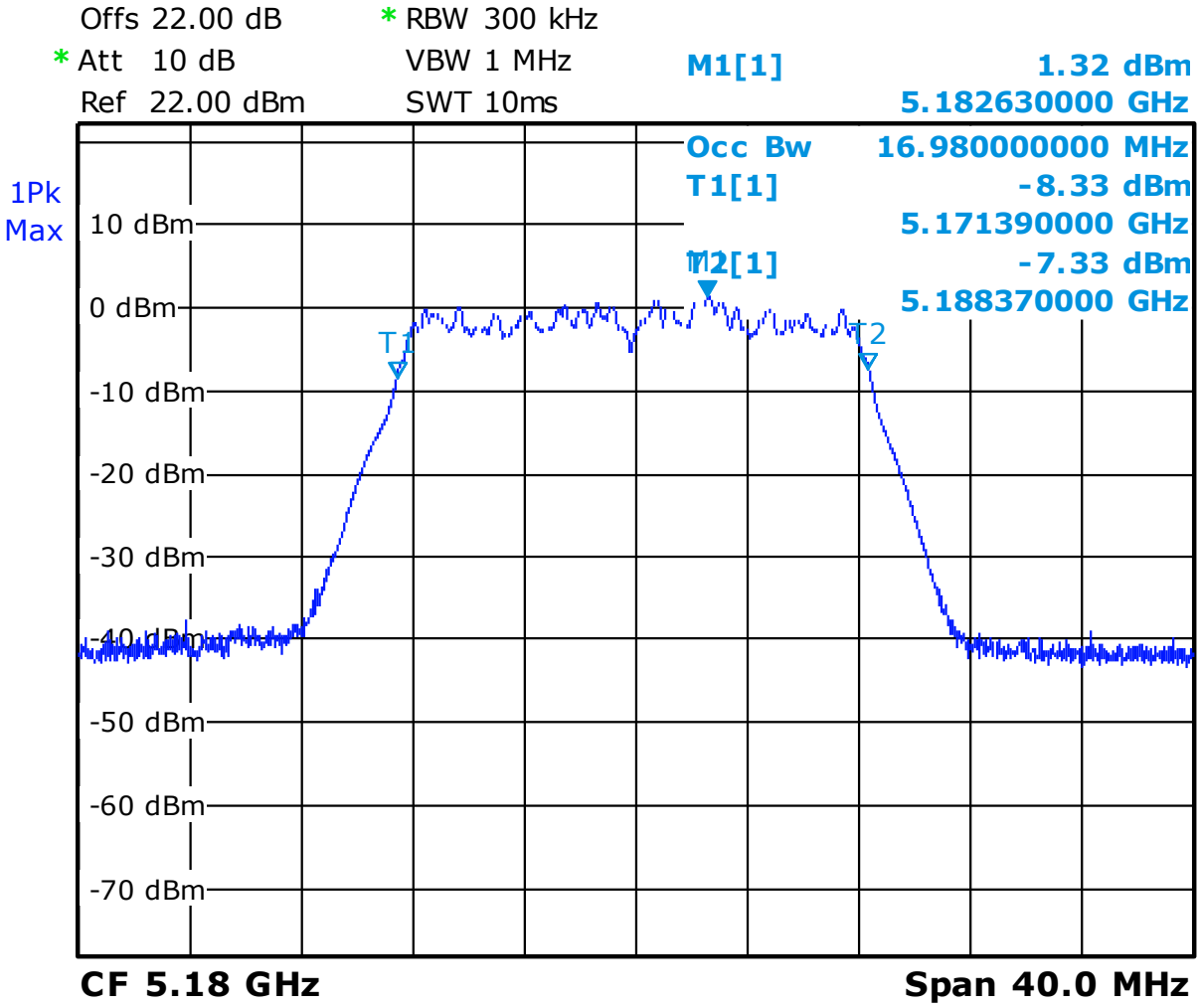
U-NII-1 band - High Channel – Mode 802.11.a – RF1



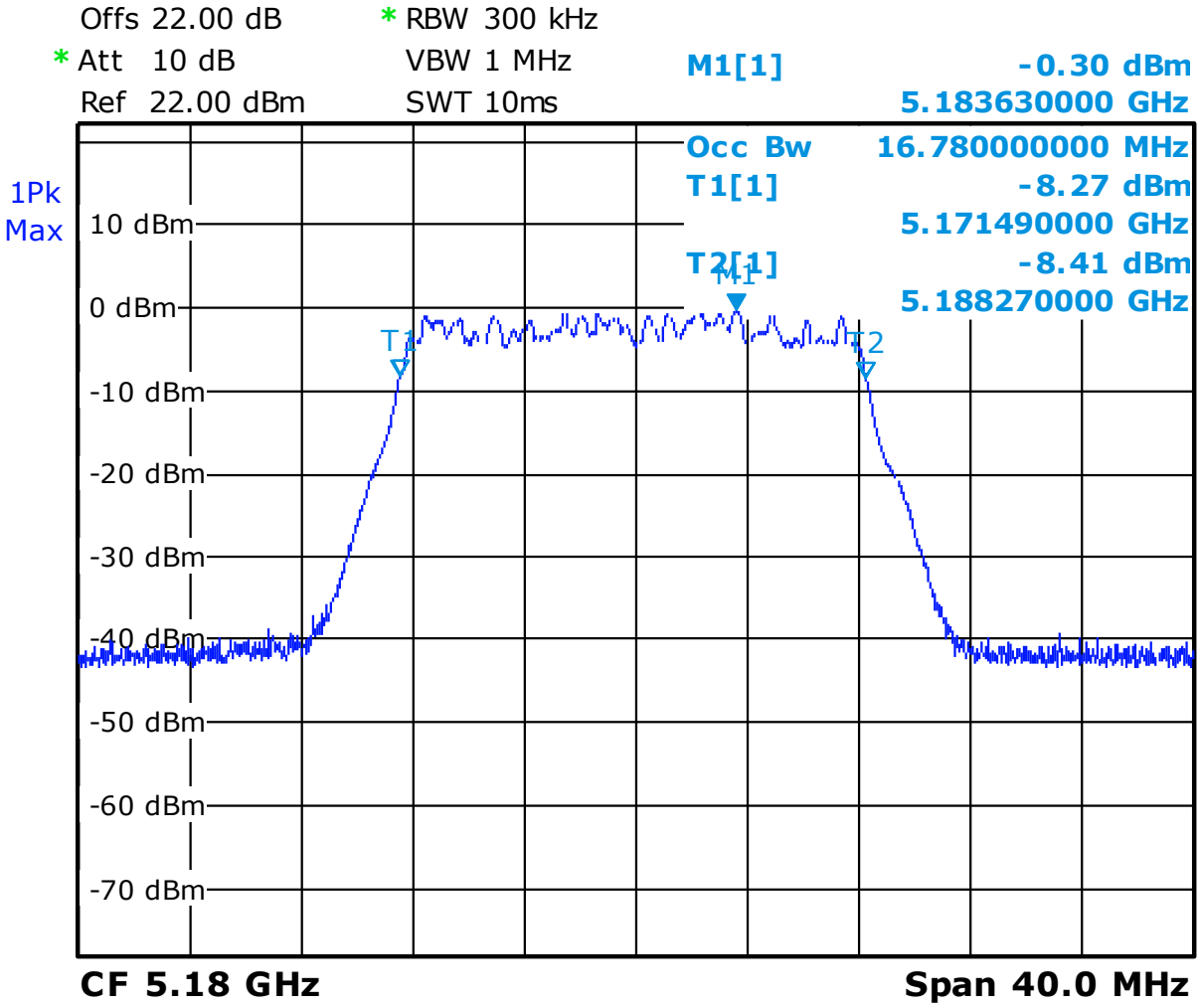
U-NII-1 band - High Channel – Mode 802.11.a – RF2



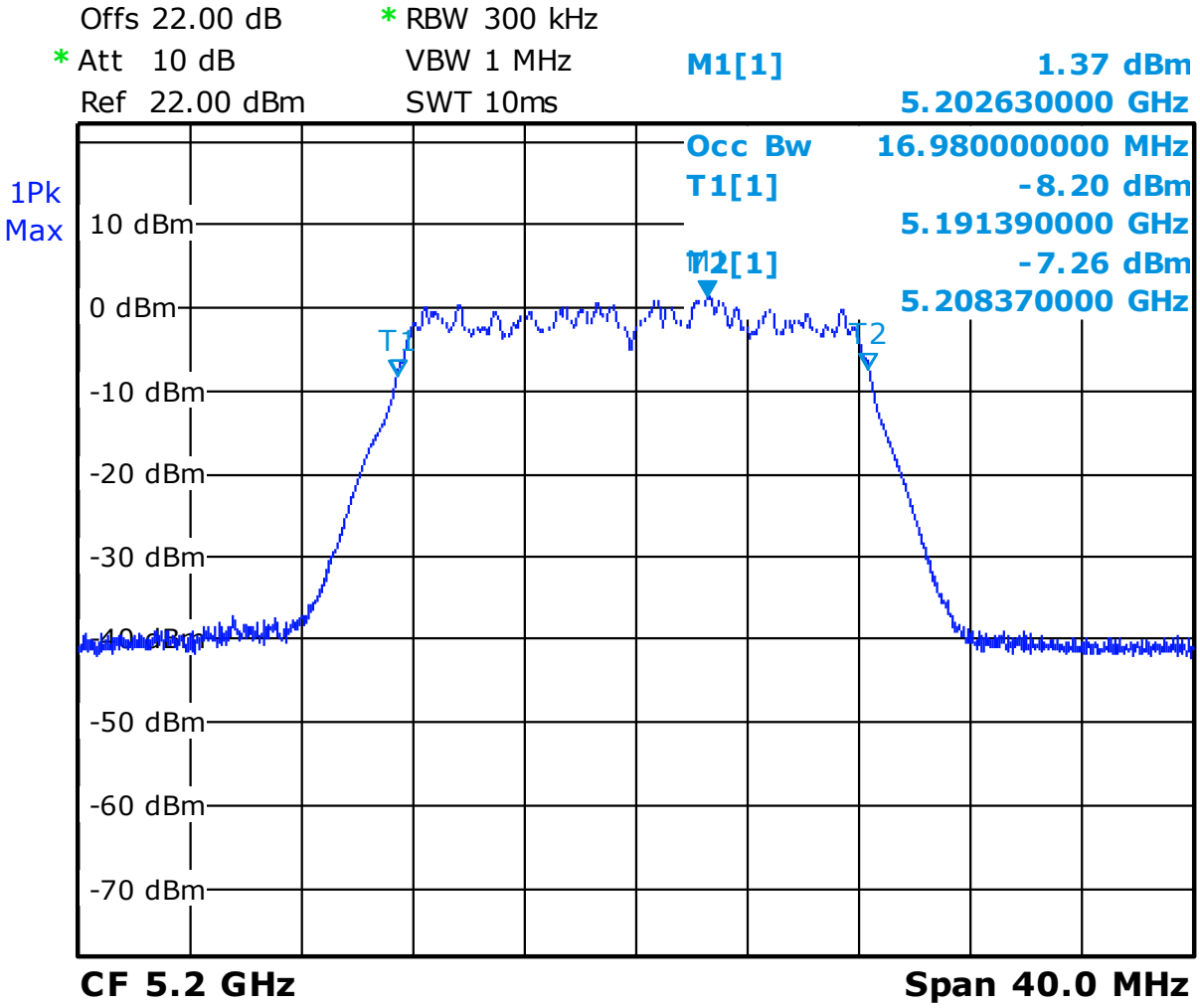
U-NII-1 band - Low Channel – Mode 802.11.n – RF 1



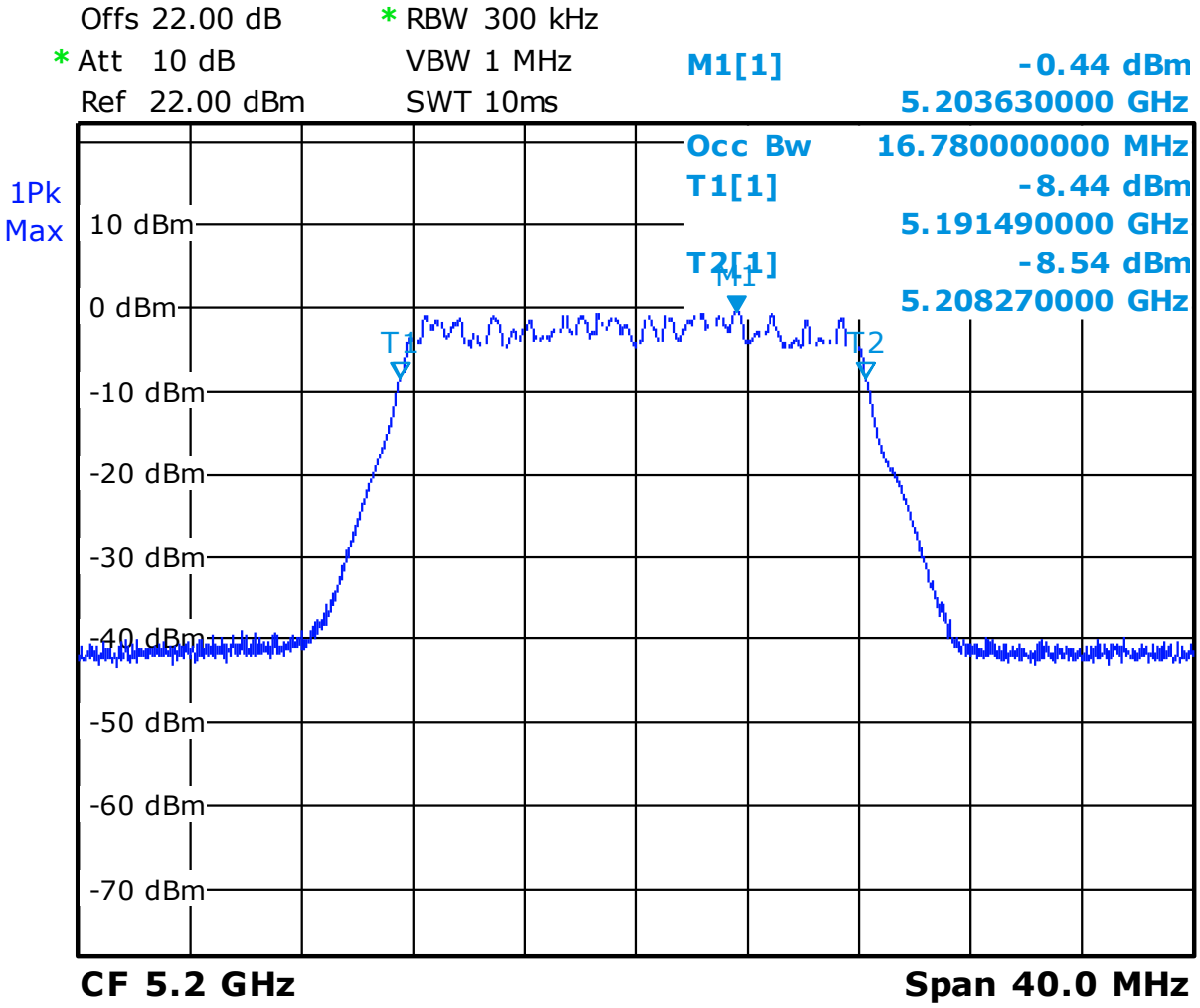
U-NII-1 band - Low Channel – Mode 802.11.n – RF 2



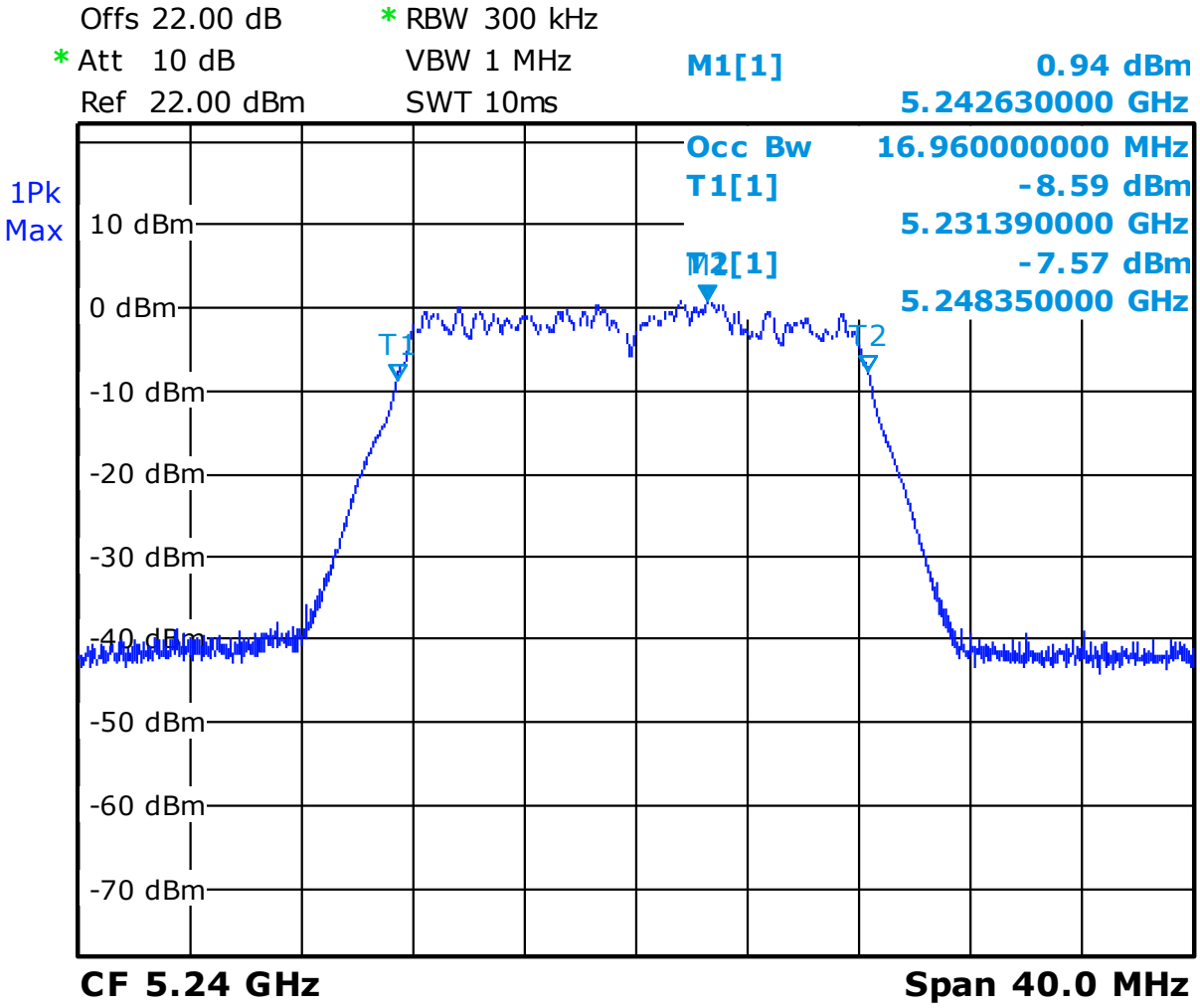
U-NII-1 band – Central Channel – Mode 802.11.n – RF 1



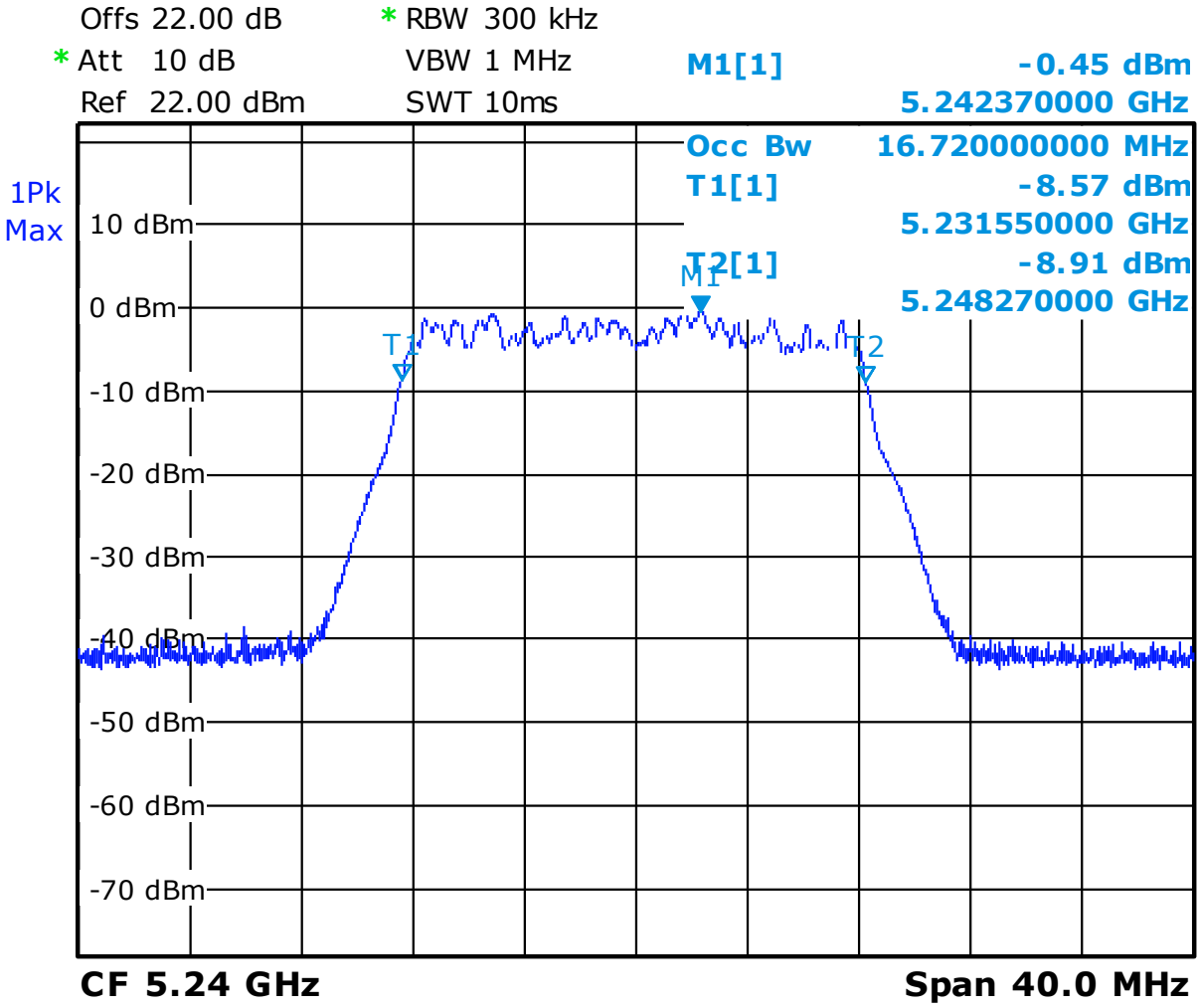
U-NII-1 band – Central Channel – Mode 802.11.n – RF 2



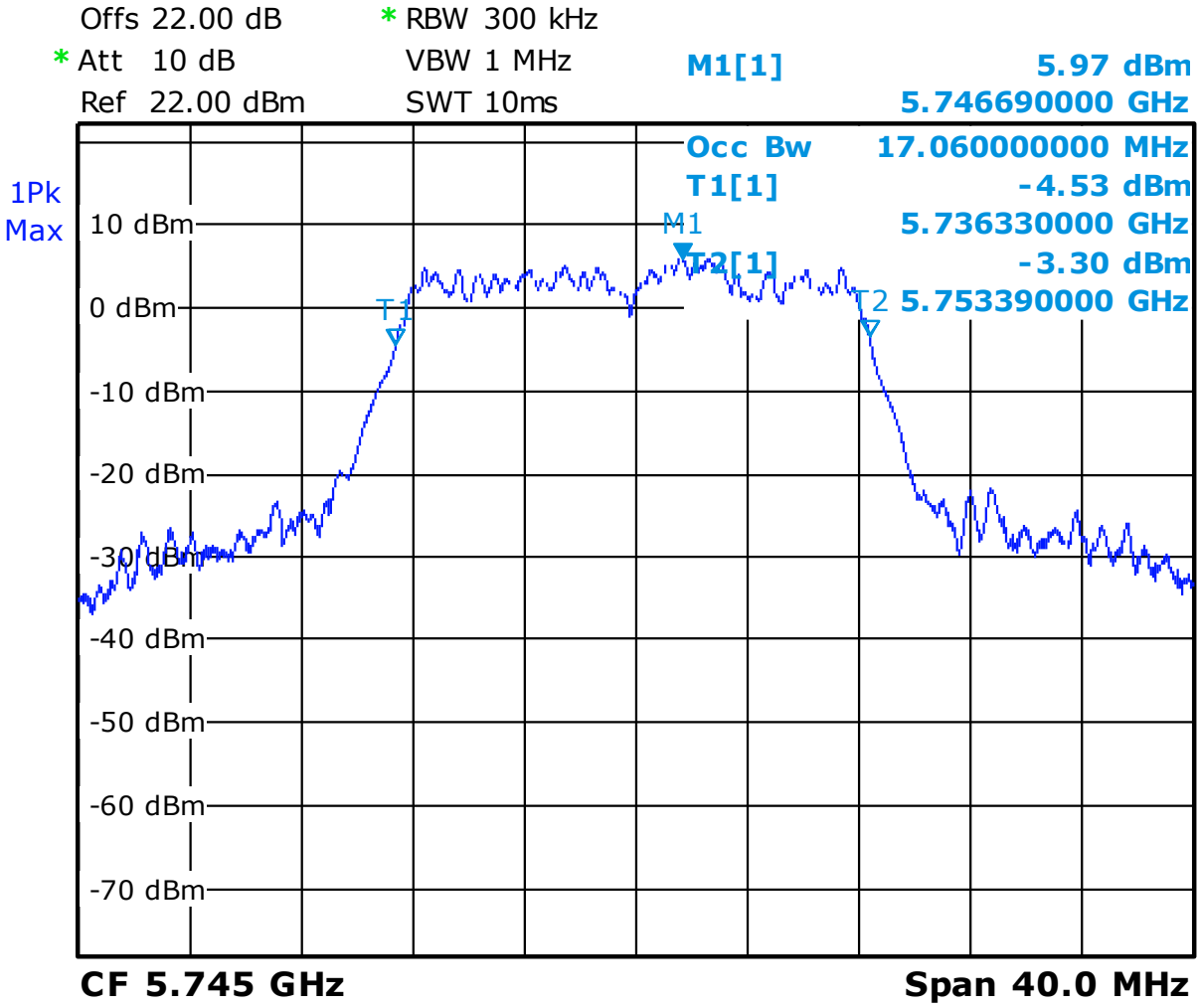
U-NII-1 band - High Channel – Mode 802.11.n – RF1



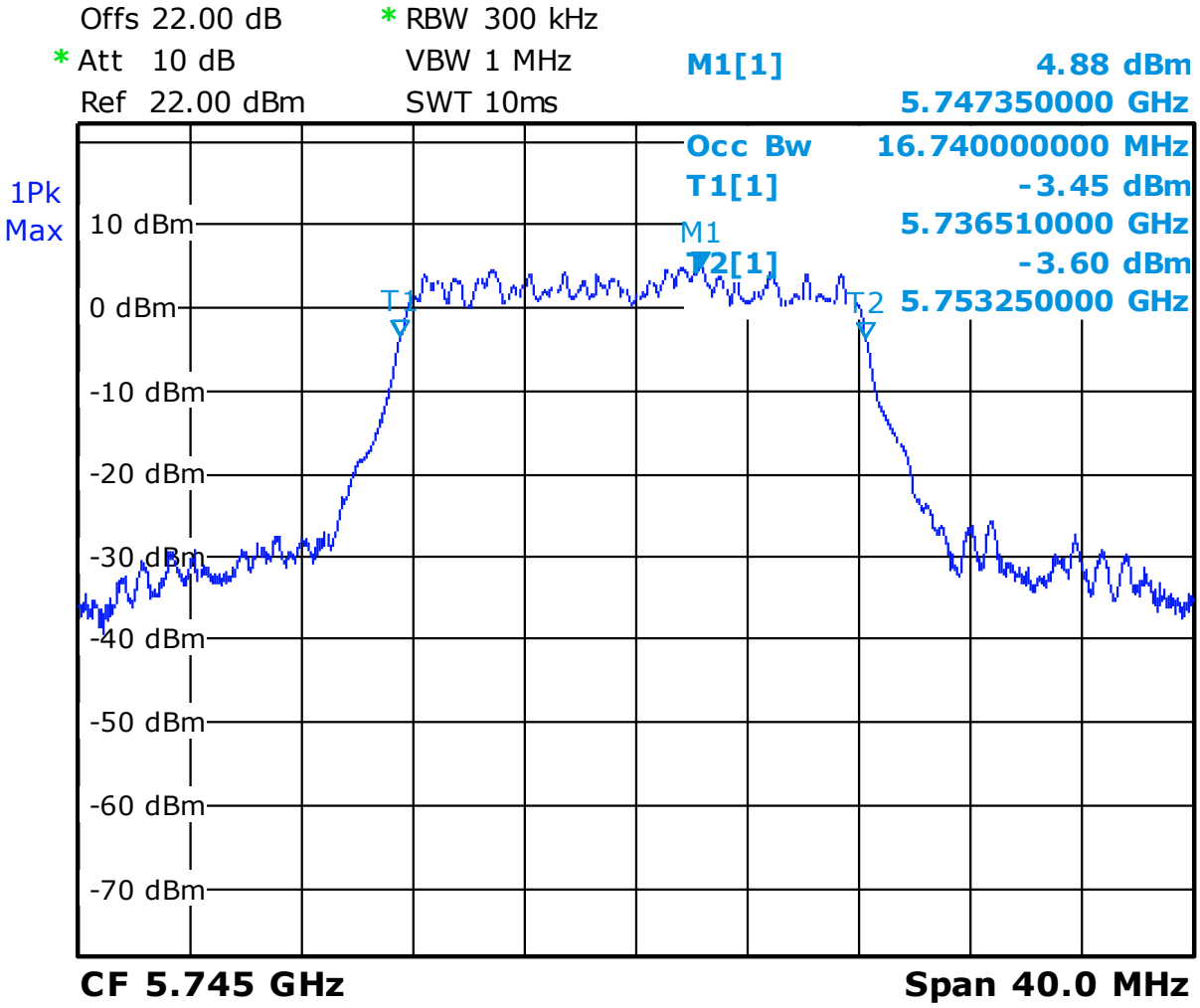
U-NII-1 band - High Channel – Mode 802.11.n – RF2



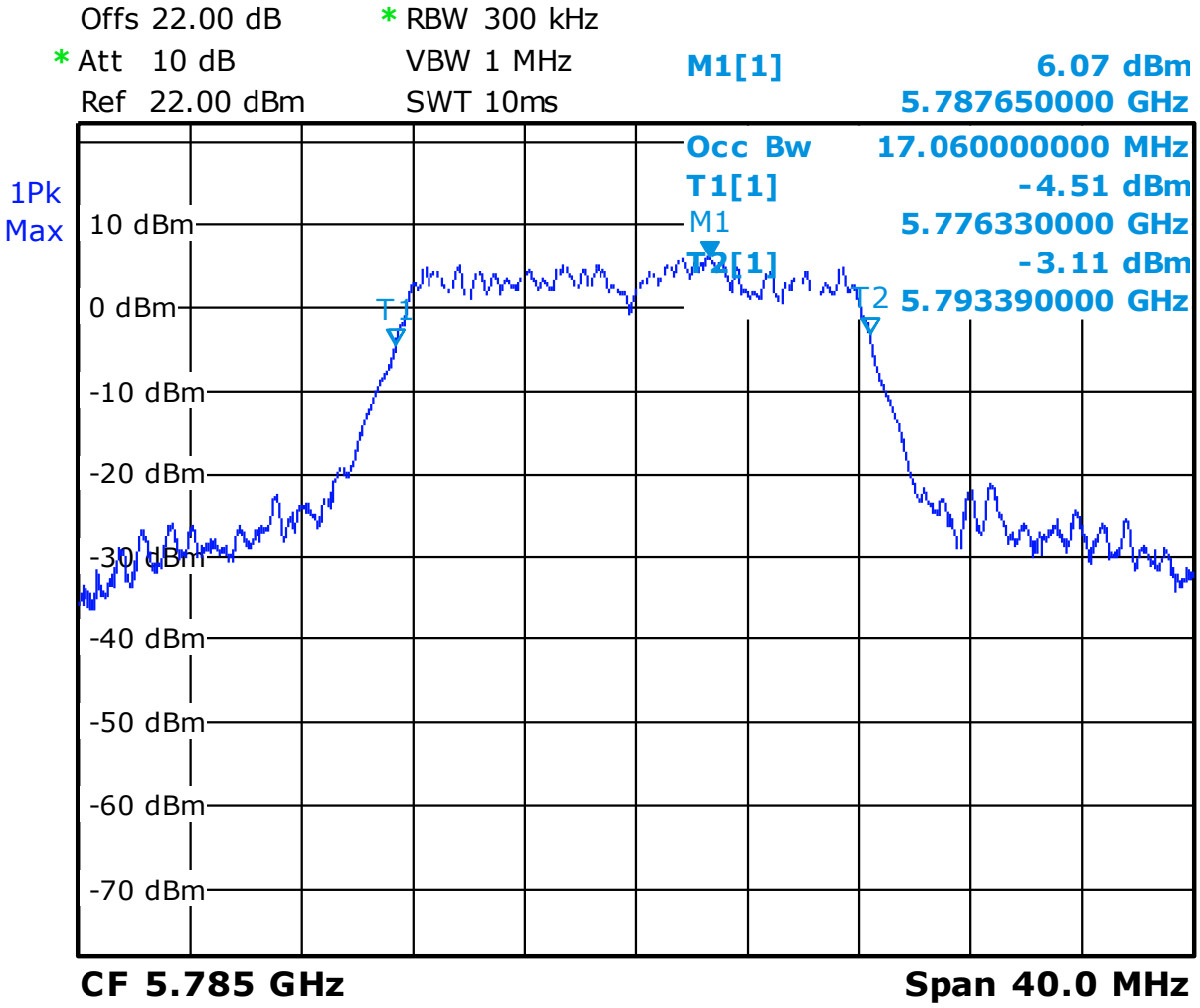
U-NII-3 band - Low Channel – Mode 802.11.a – RF 1



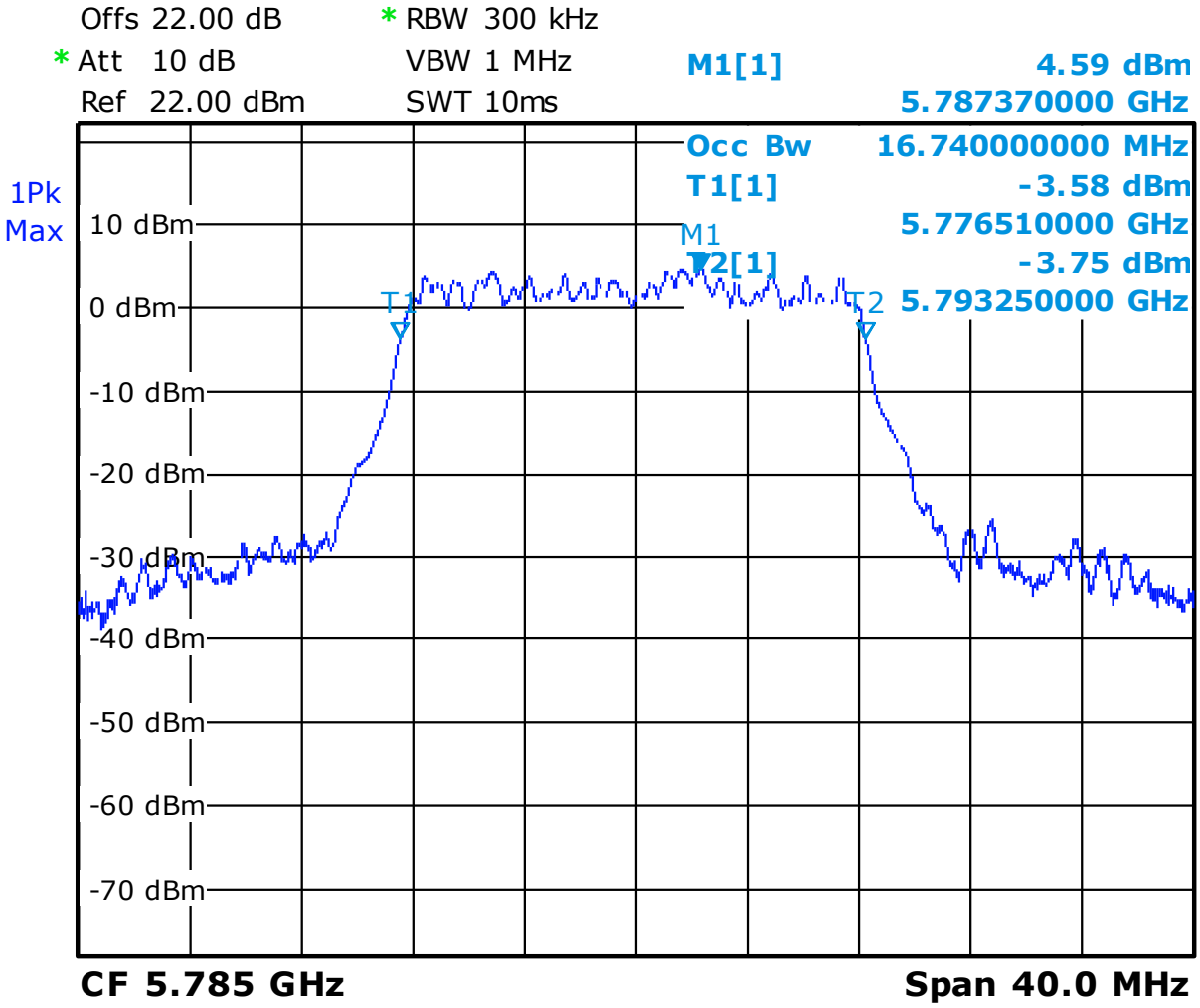
U-NII-3 band - Low Channel – Mode 802.11.a – RF 2



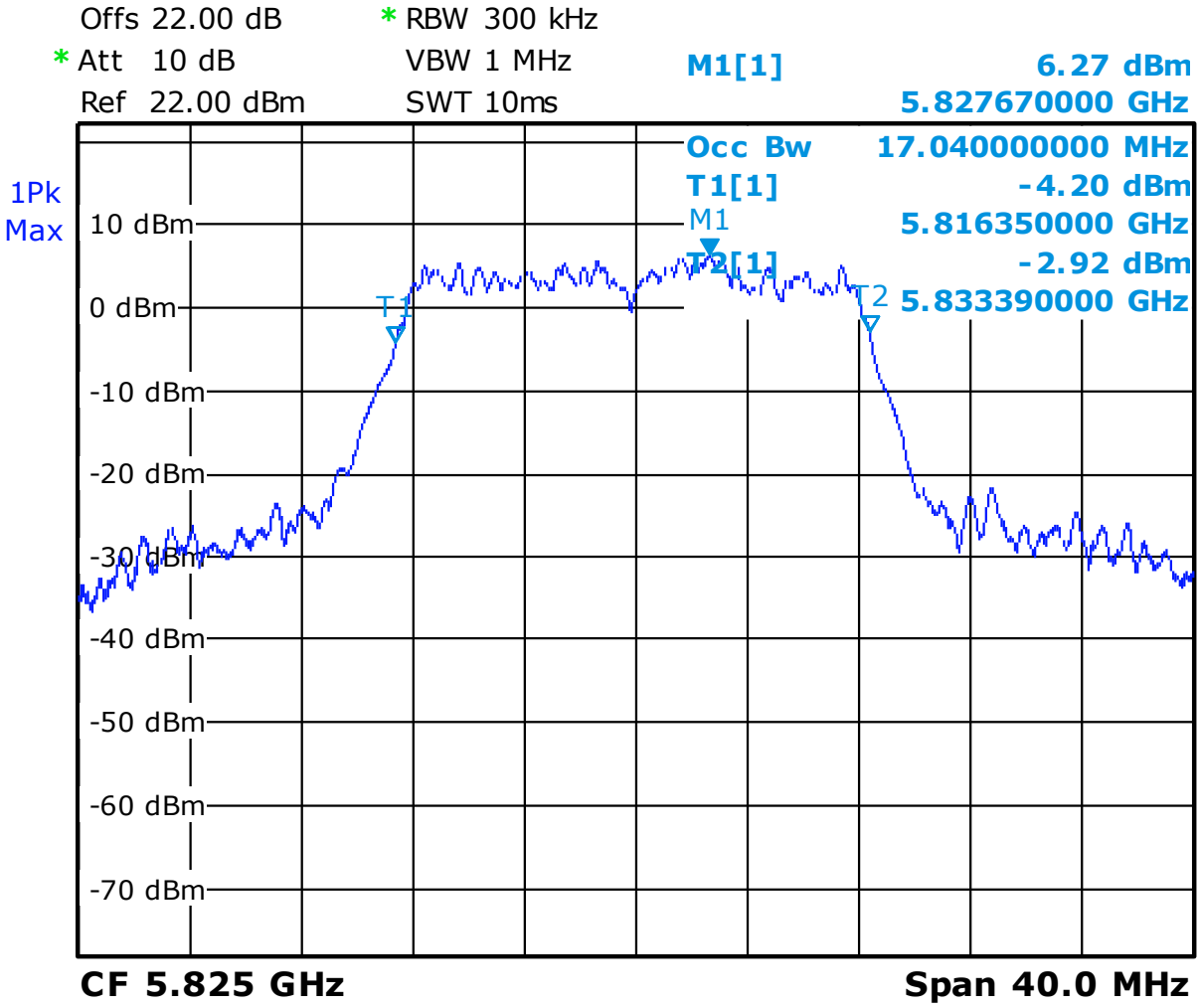
U-NII-3 band – Central Channel – Mode 802.11.a – RF 1



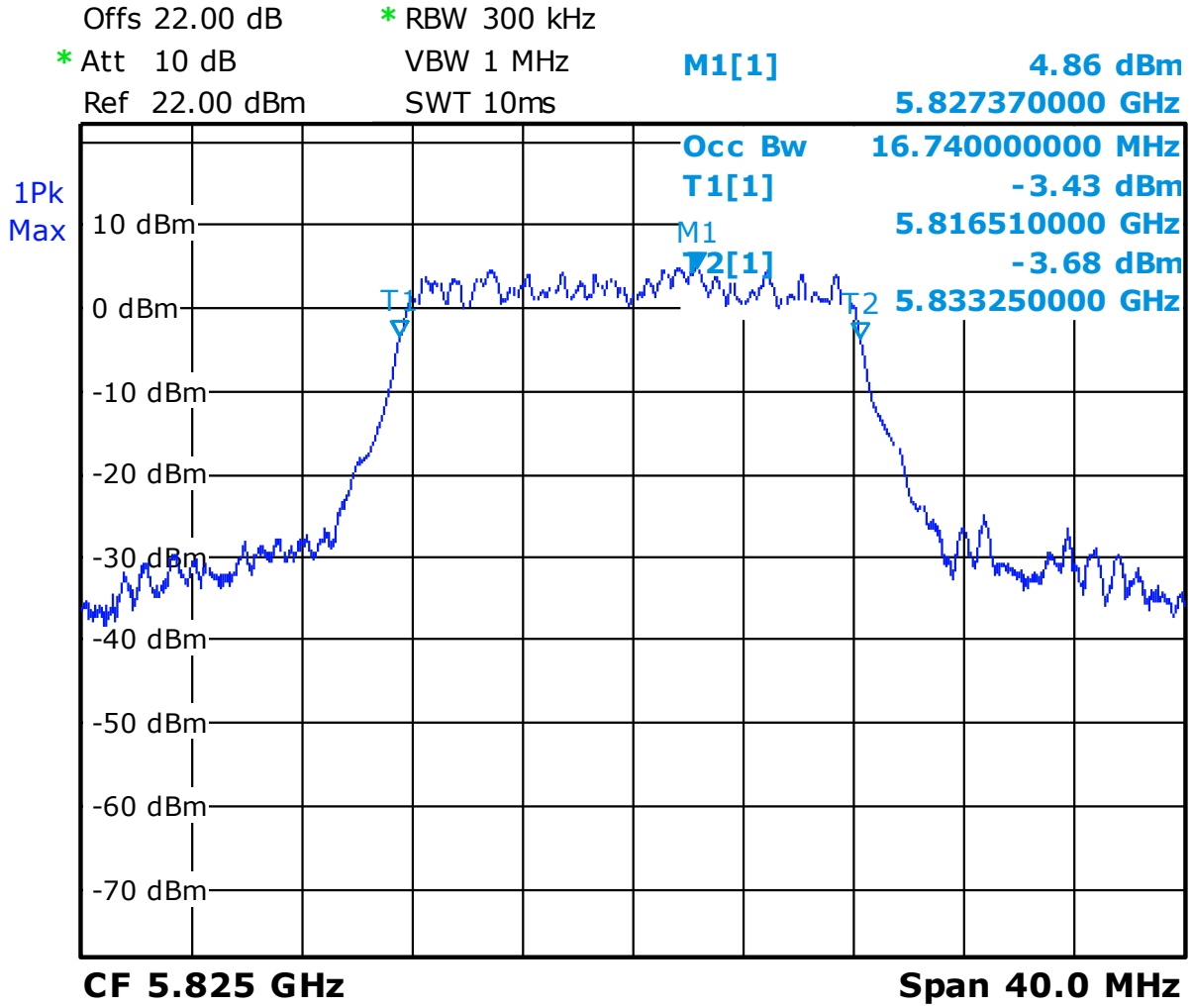
U-NII-3 band – Central Channel – Mode 802.11.a – RF 2



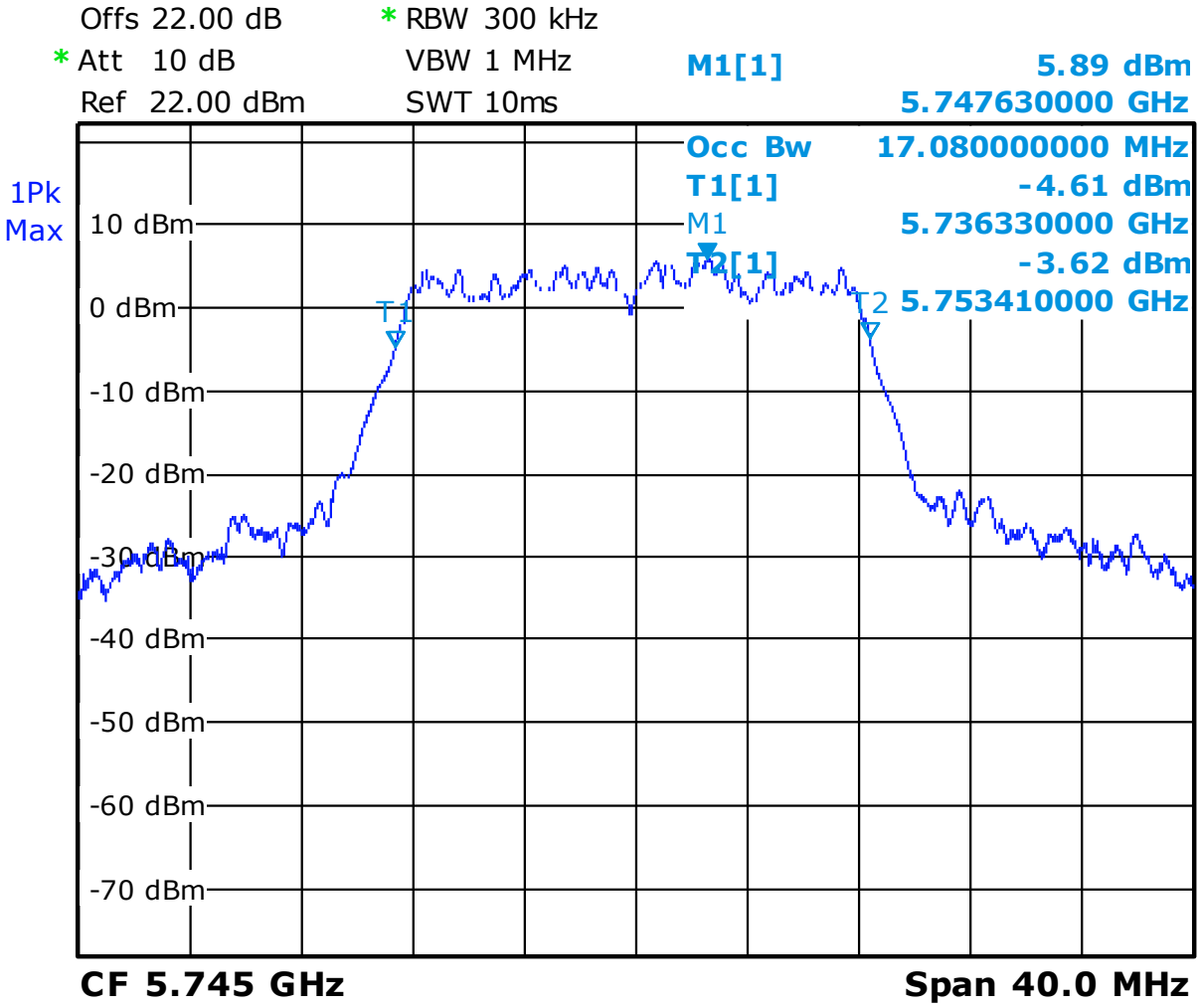
U-NII-3 band - High Channel – Mode 802.11.a – RF1



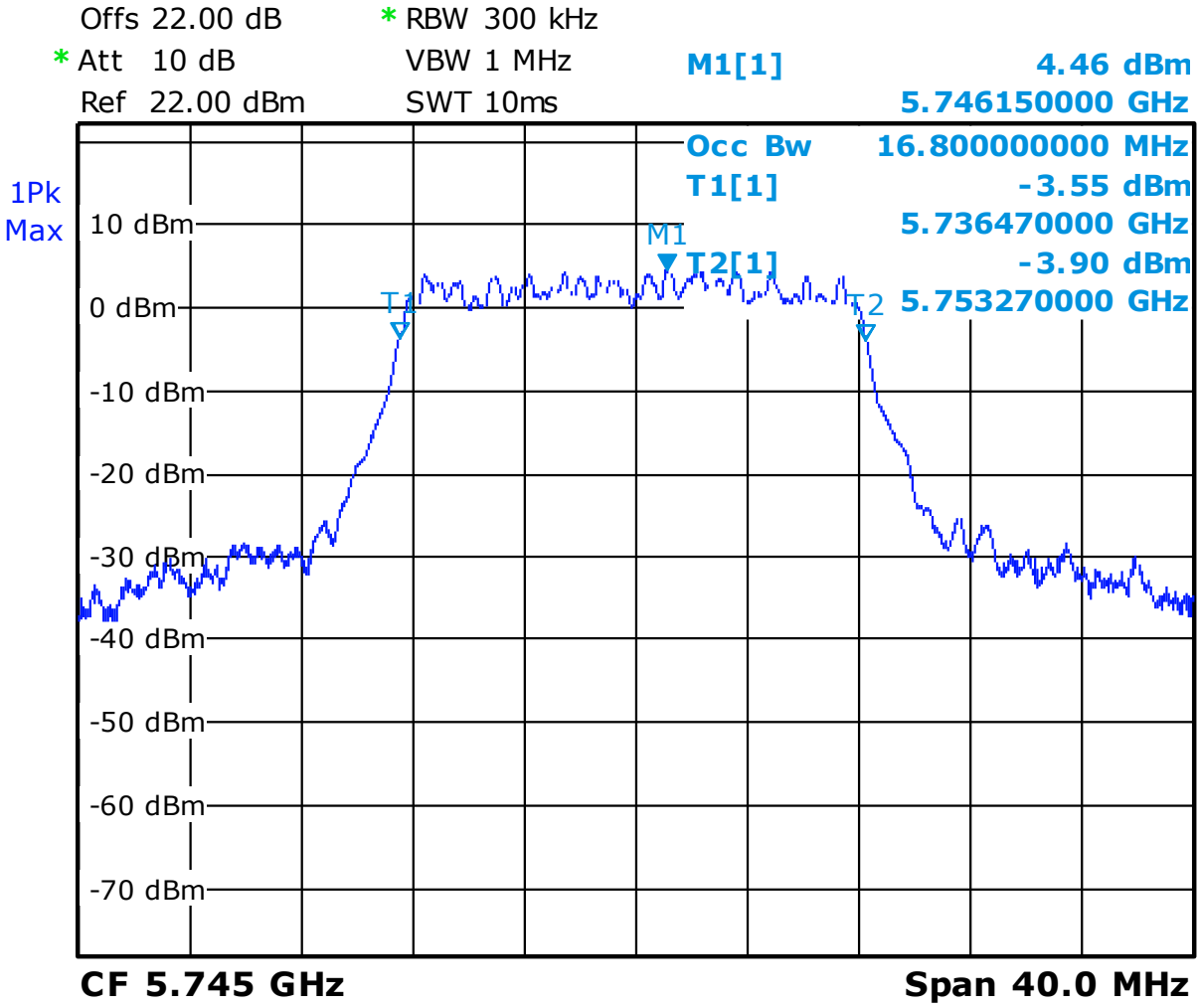
U-NII-3 band - High Channel – Mode 802.11.a – RF2



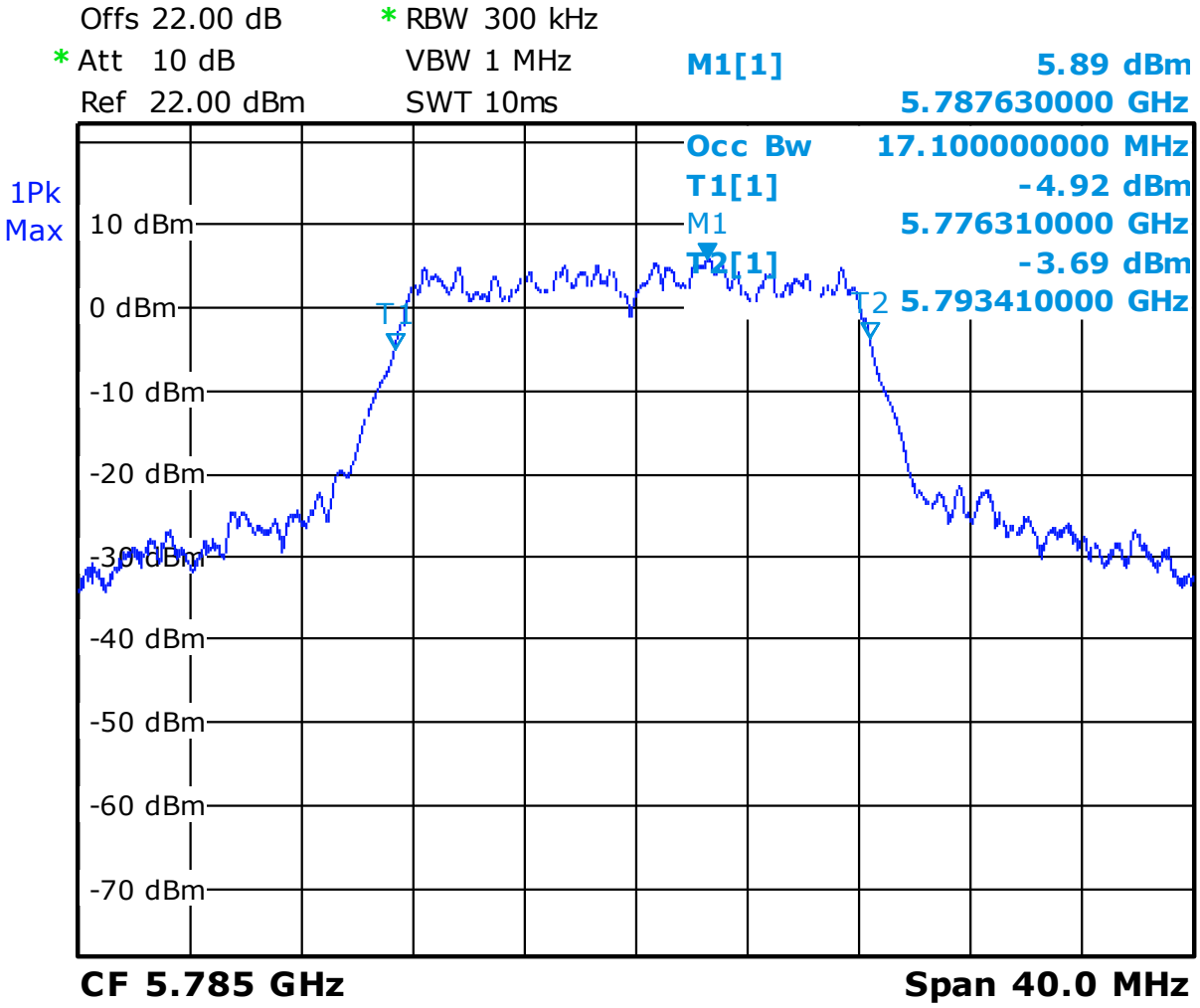
U-NII-3 band - Low Channel – Mode 802.11.n – RF 1



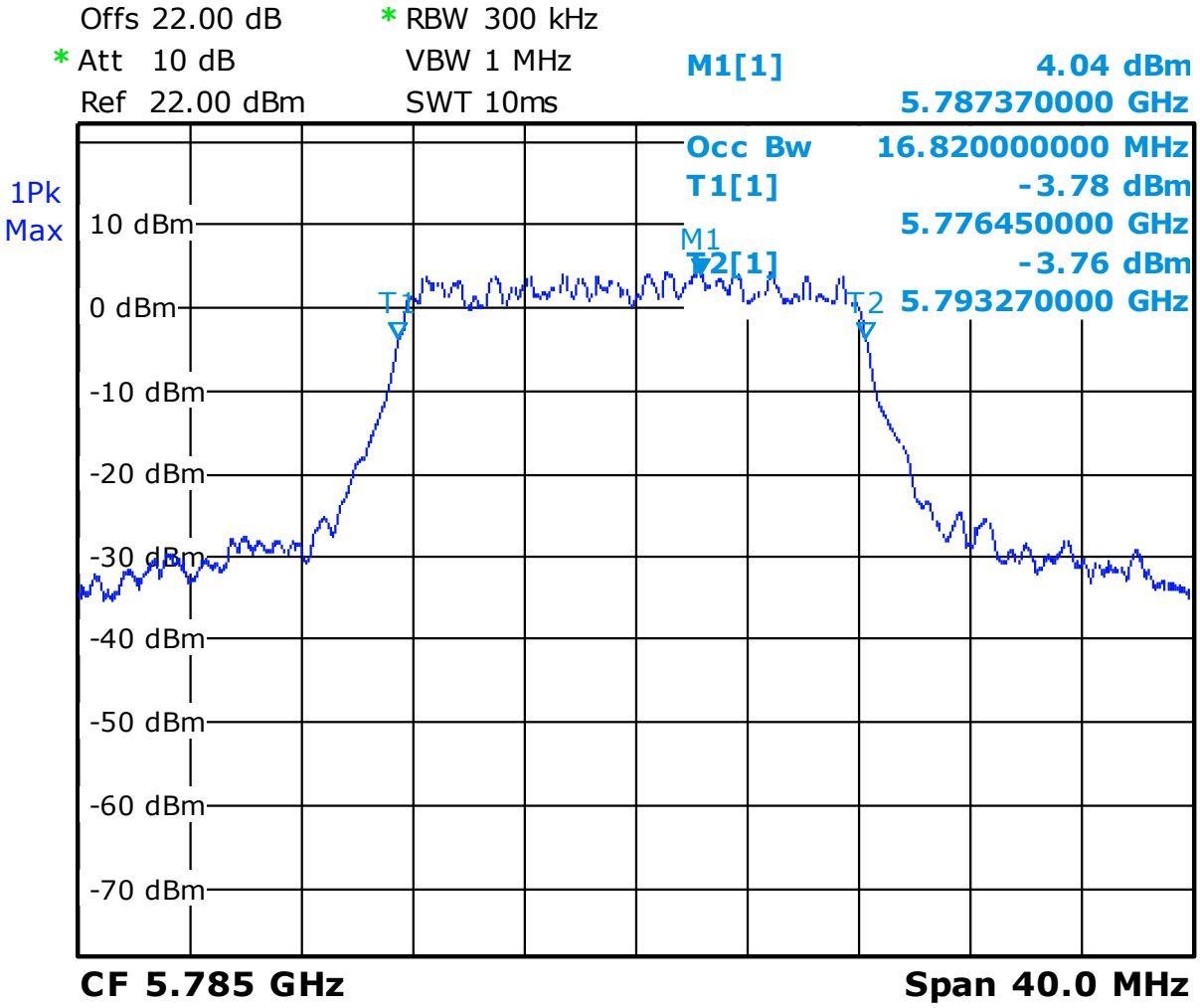
U-NII-3 band - Low Channel – Mode 802.11.n – RF 2



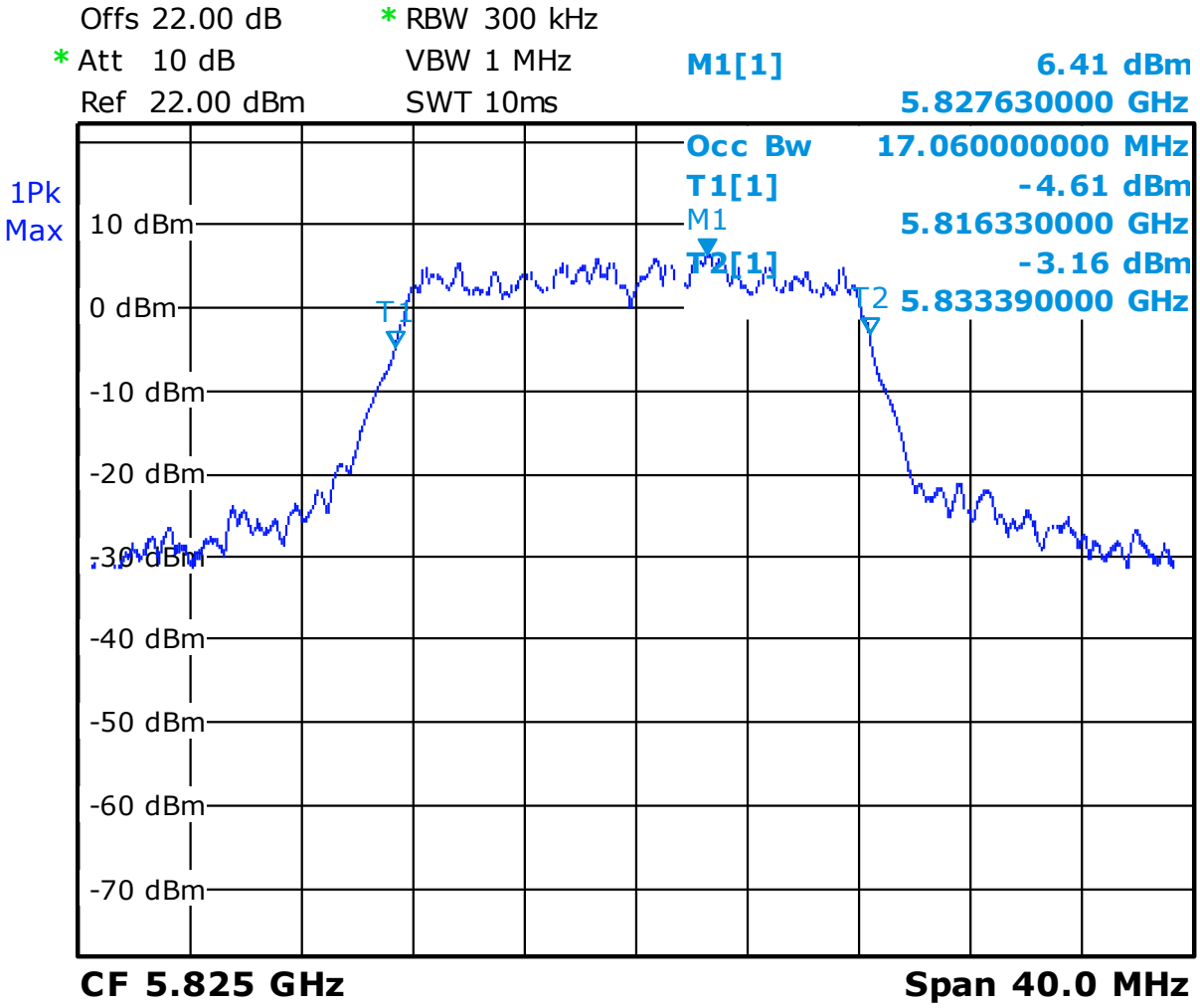
U-NII-3 band – Central Channel – Mode 802.11.n – RF 1



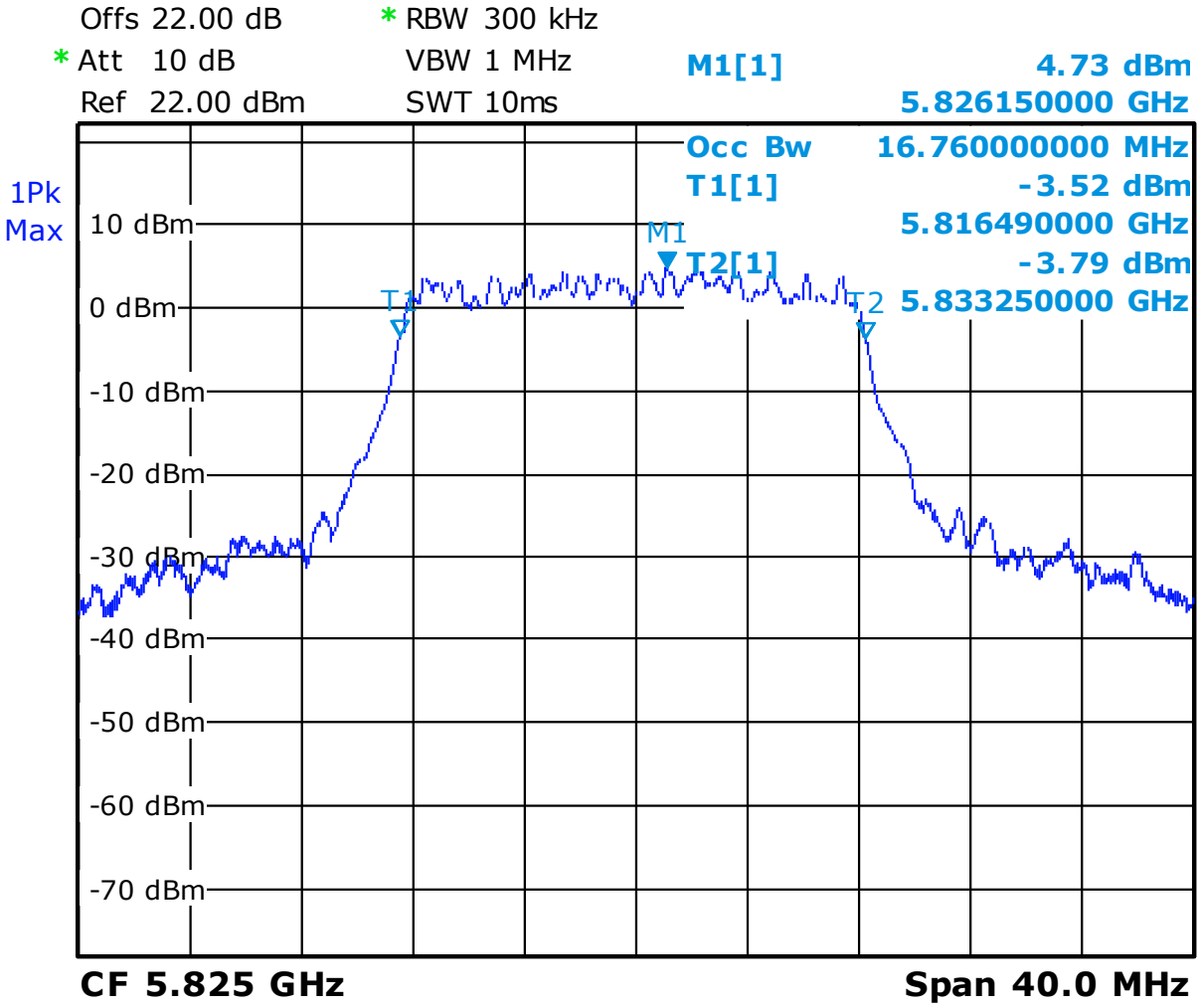
U-NII-3 band – Central Channel – Mode 802.11.n – RF 2



U-NII-3 band - High Channel – Mode 802.11.n – RF1

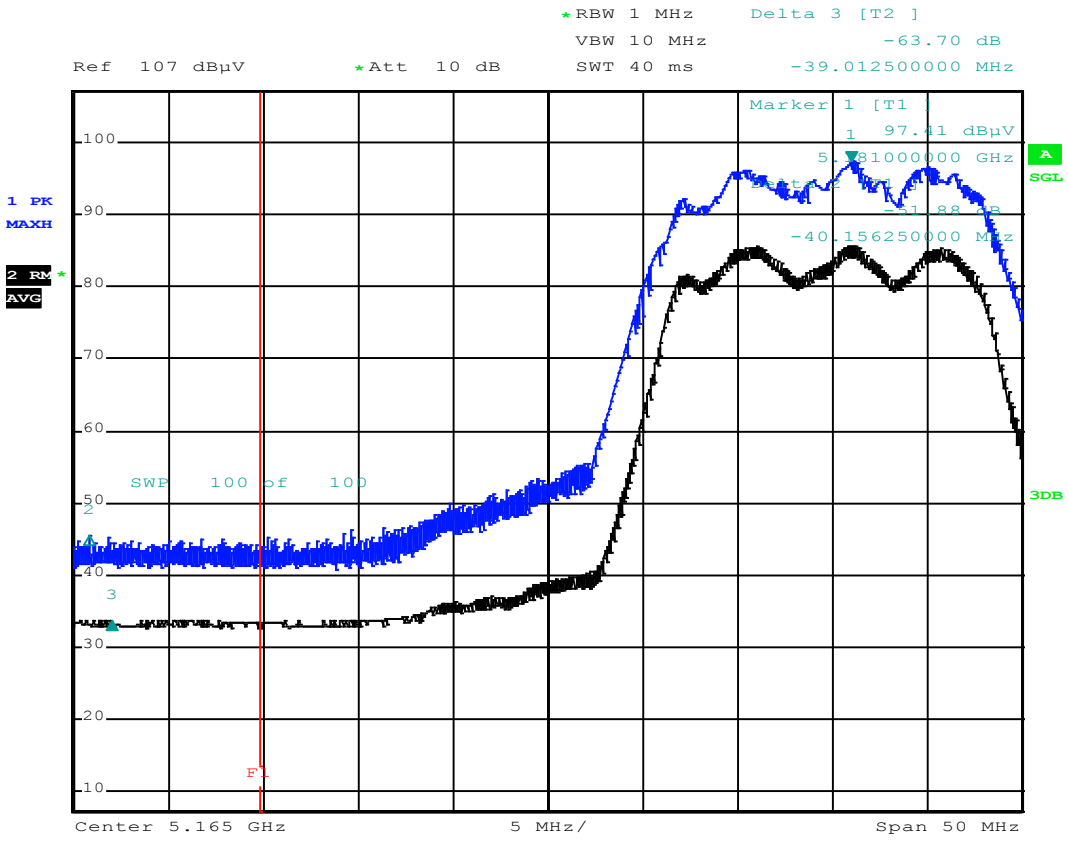


U-NII-3 band - High Channel – Mode 802.11.n – RF2

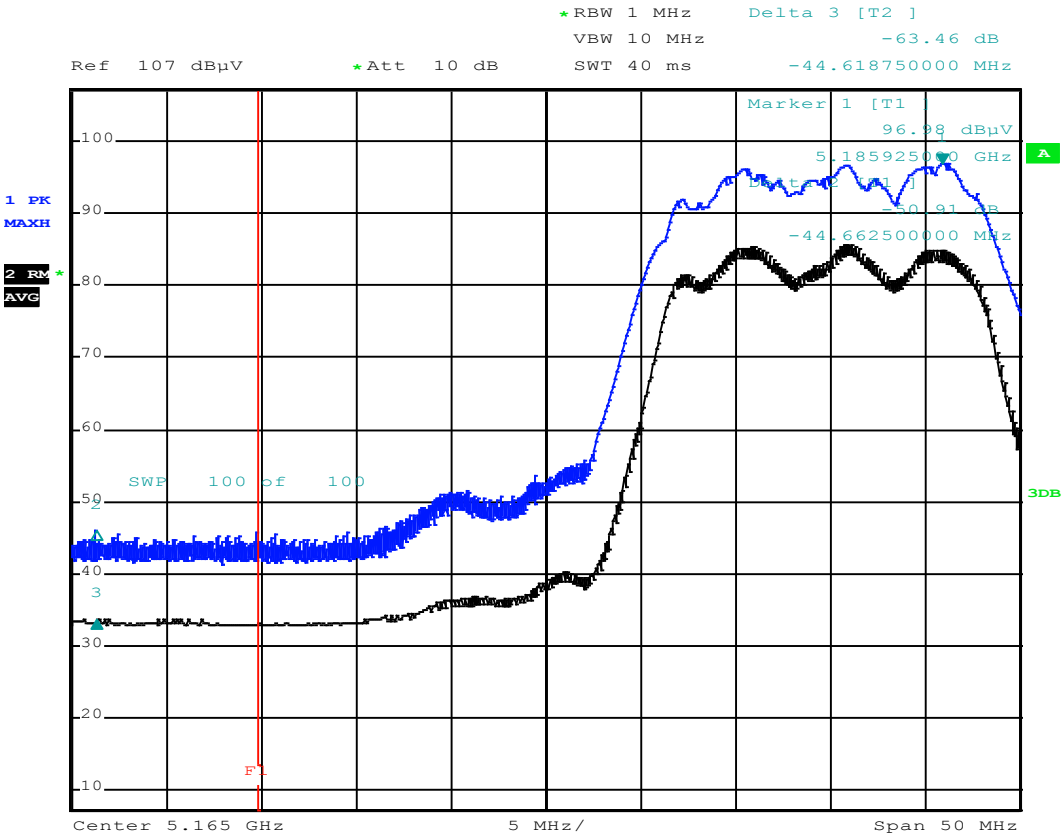


APPENDIX 5: Band edge

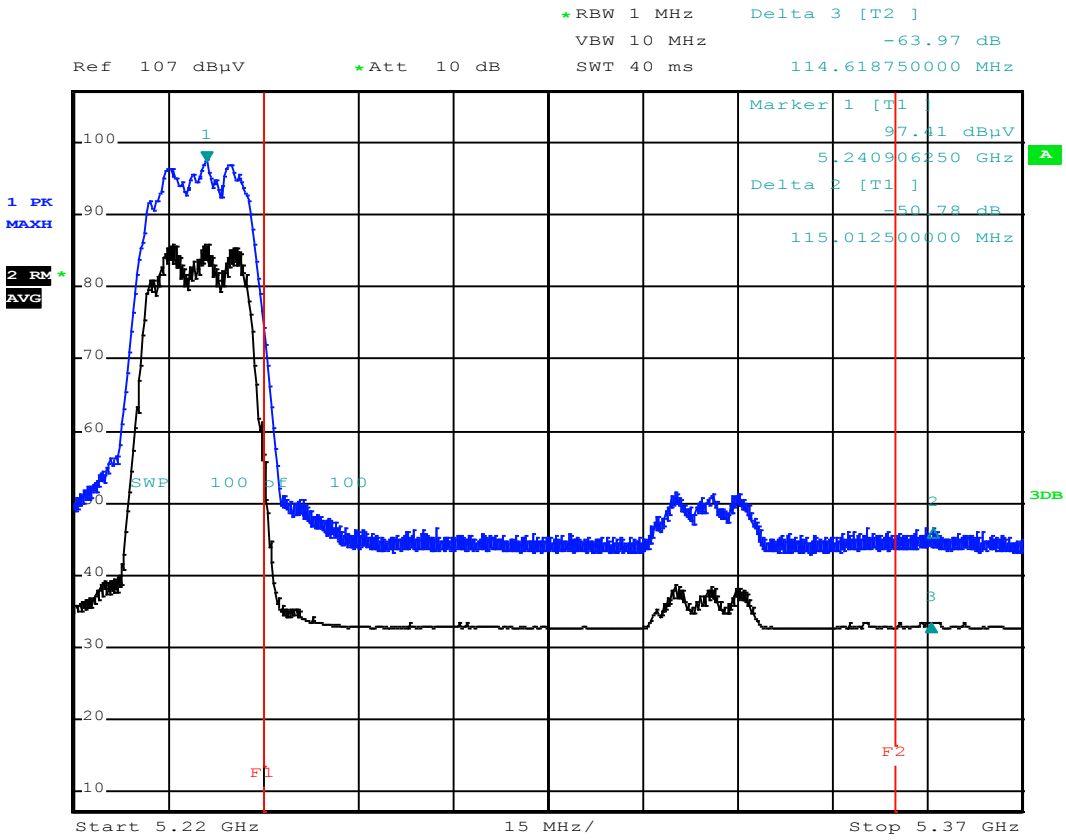
U-NII-1 band - Low Channel – Mode 802.11.a



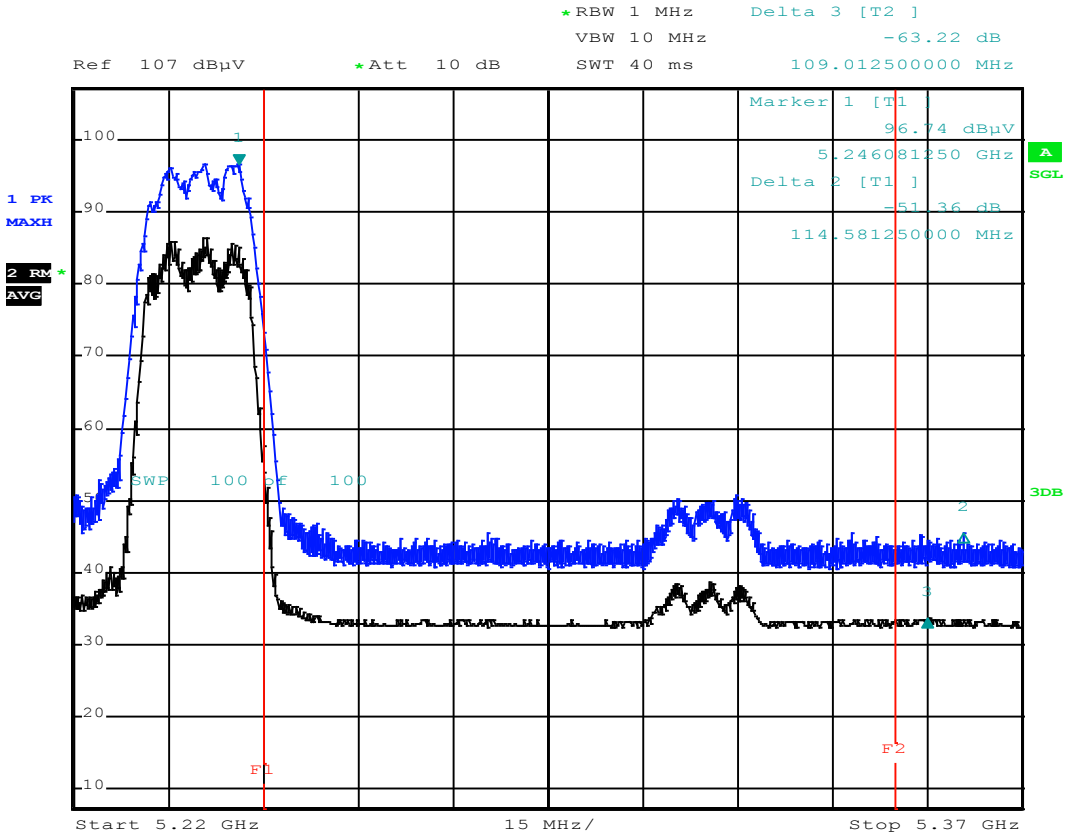
U-NII-1 band - Low Channel – Mode 802.11.n



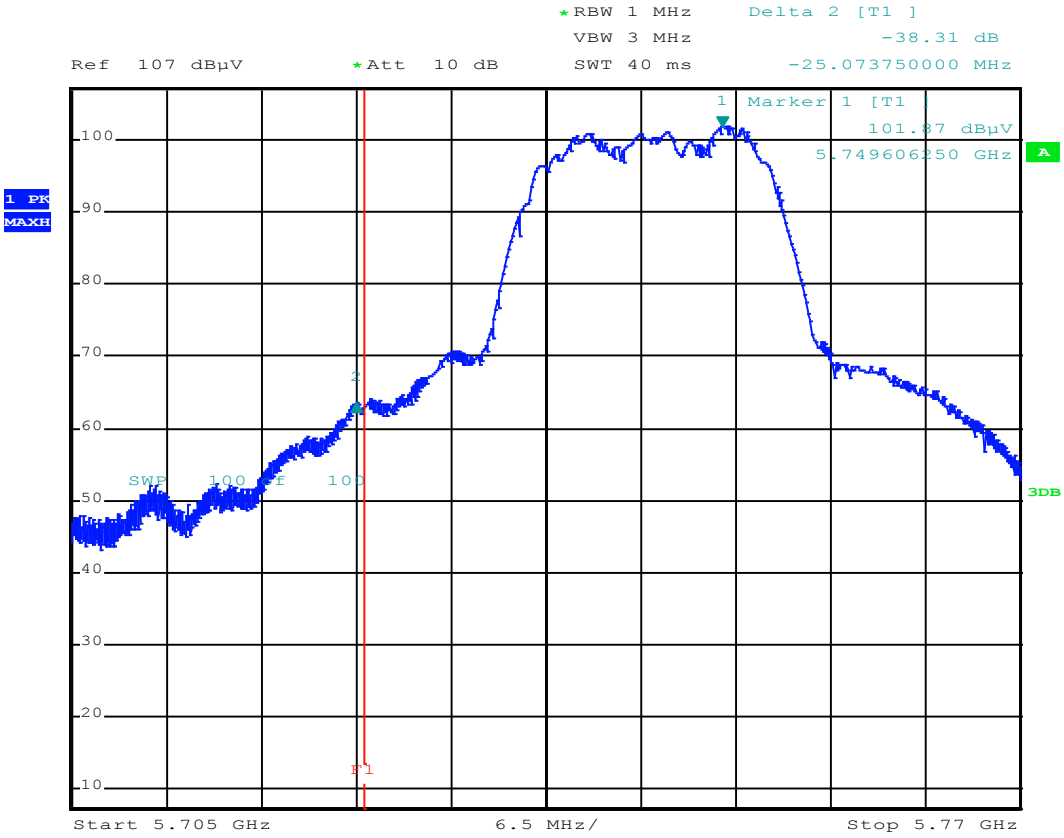
U-NII-1 band - High Channel – Mode 802.11.a



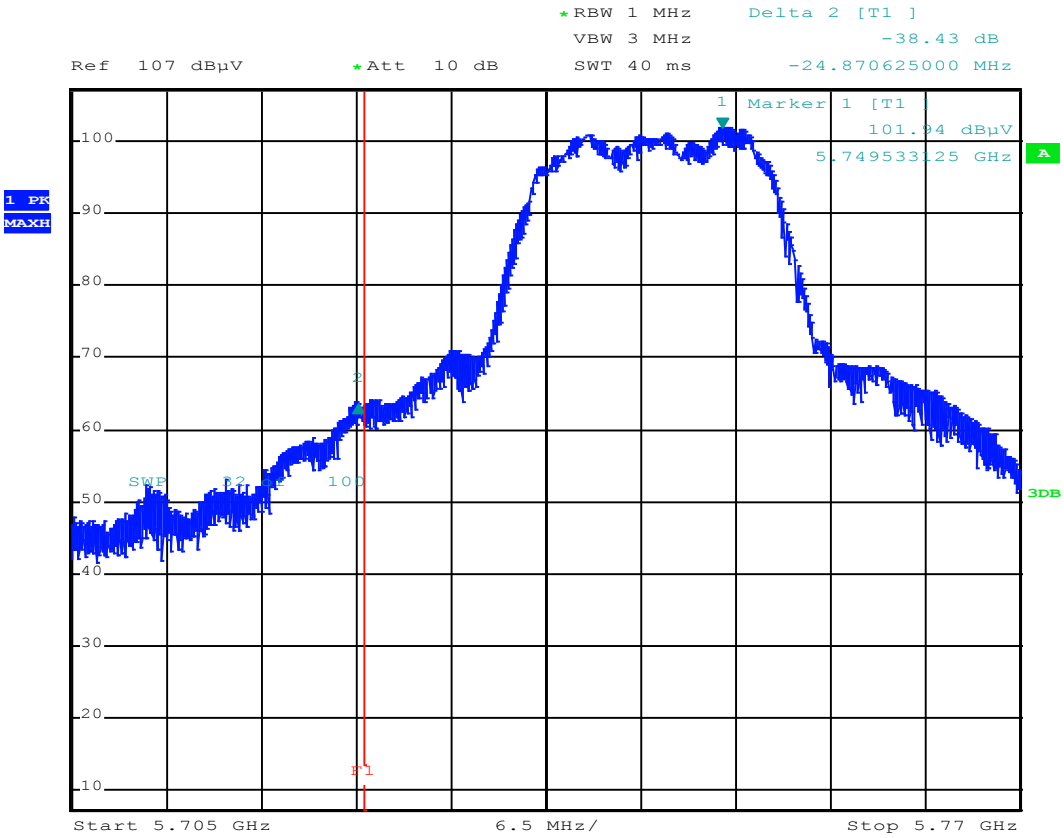
U-NII-1 band - High Channel – Mode 802.11.n



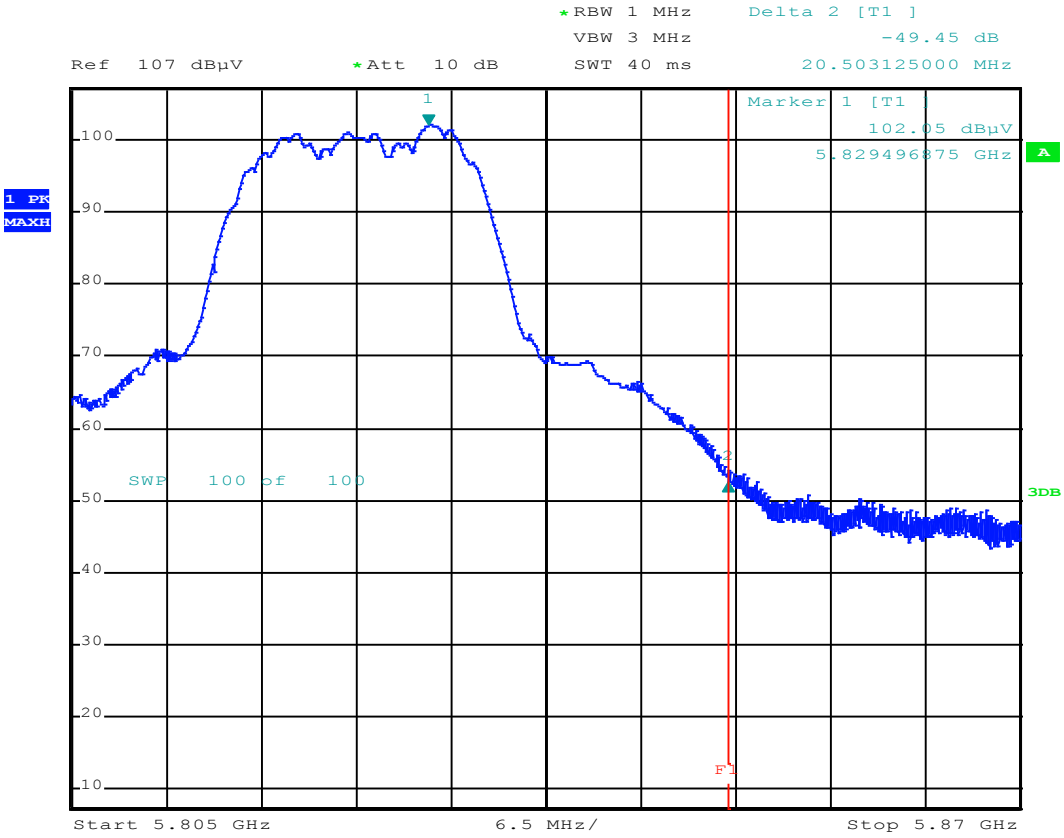
U-NII-3 band - Low Channel – Mode 802.11.a



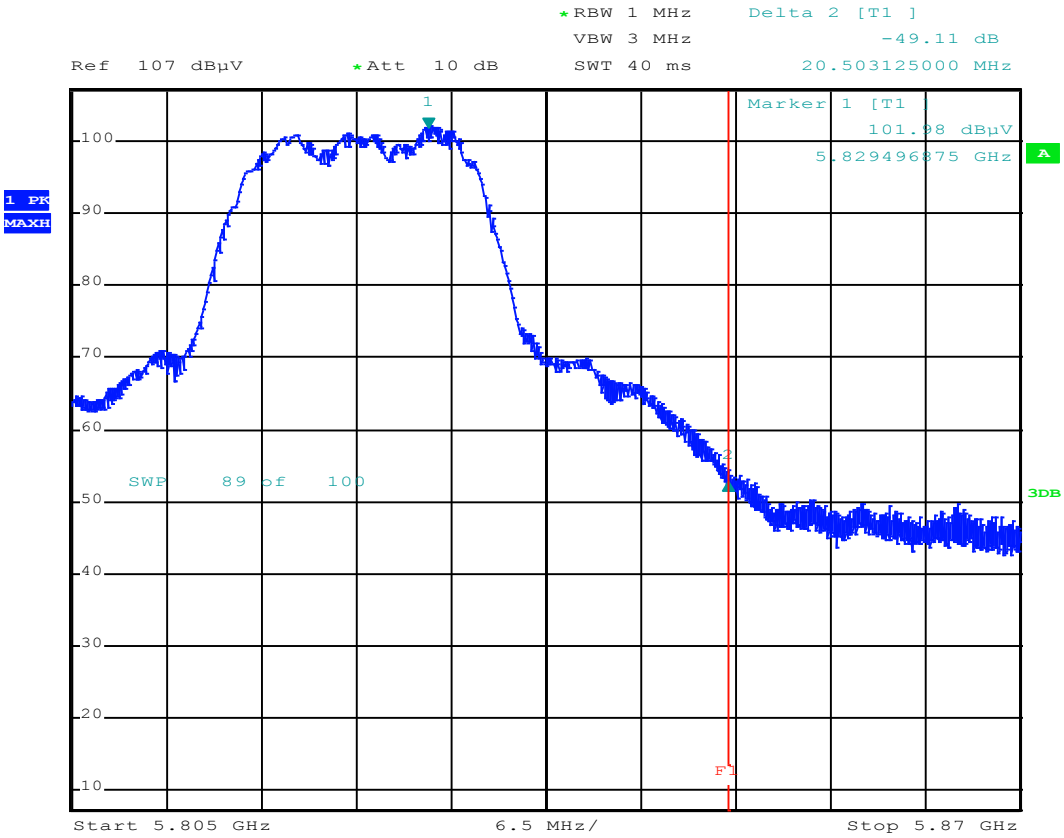
U-NII-3 band - Low Channel – Mode 802.11.n



U-NII-3 band - High Channel – Mode 802.11.a

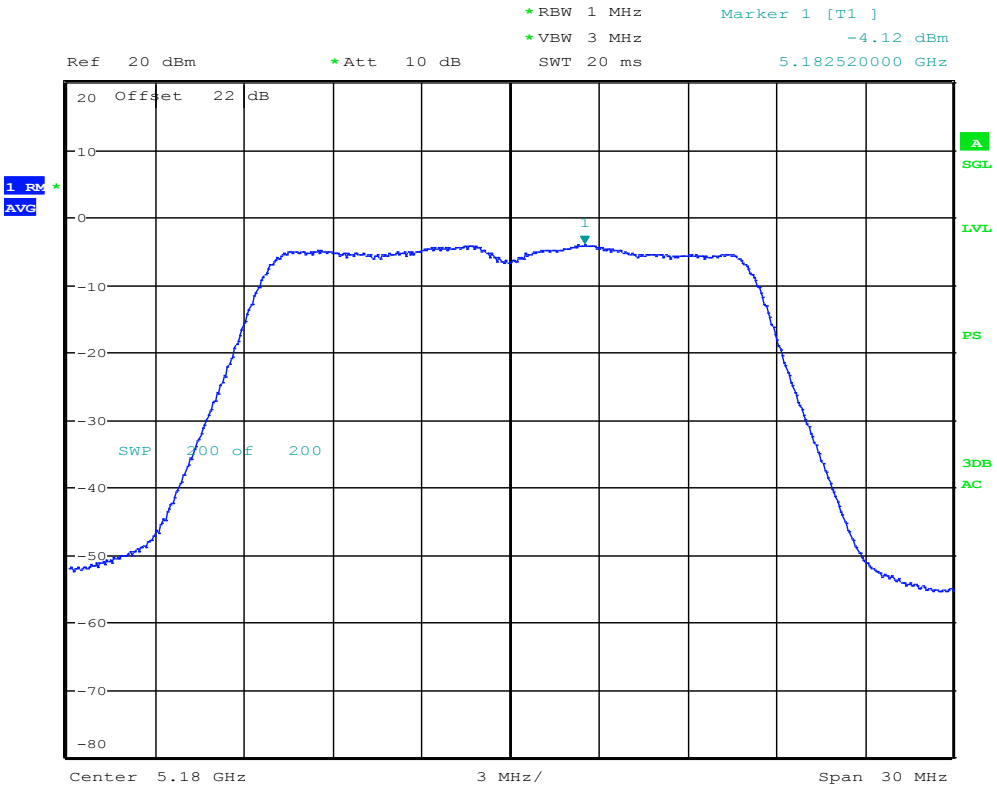


U-NII-3 band - High Channel – Mode 802.11.n

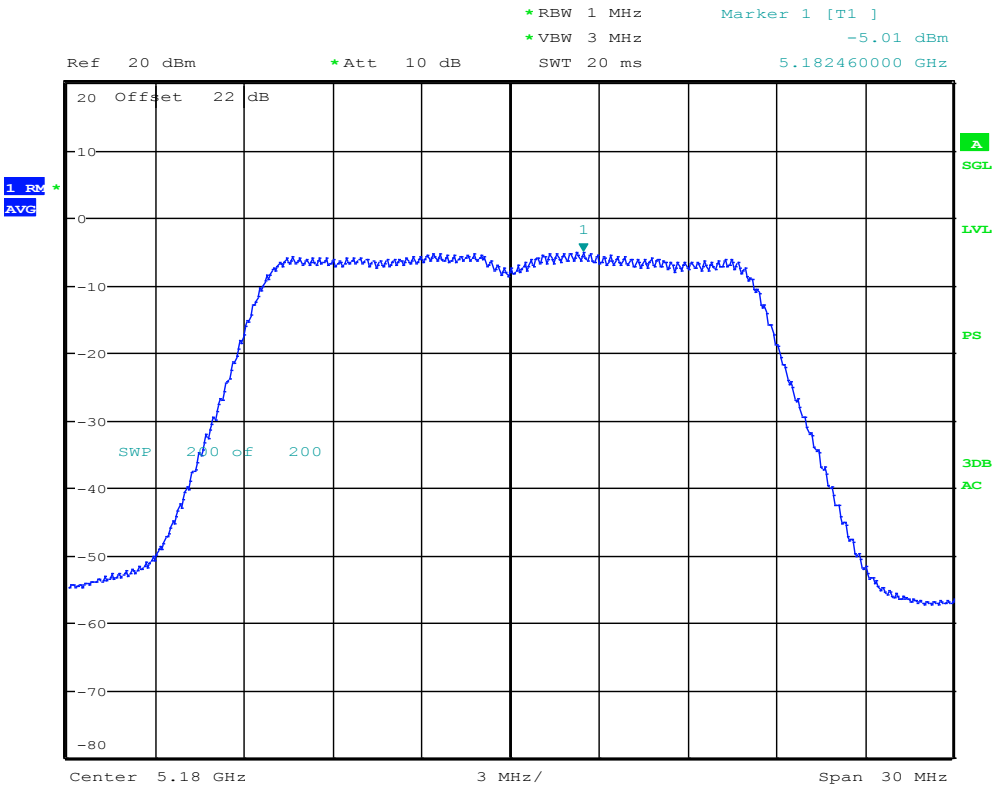


APPENDIX 6: Power Spectral Density

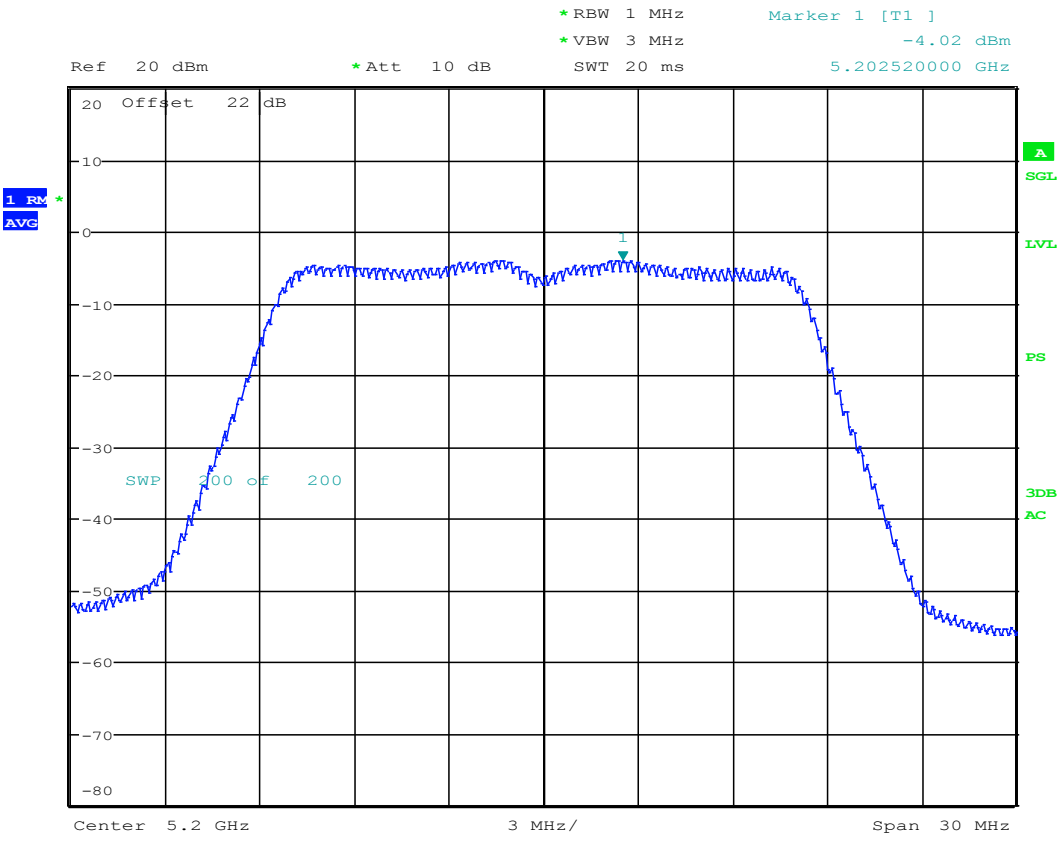
U-NII-1 band - Low Channel – Mode 802.11.a – RF 1



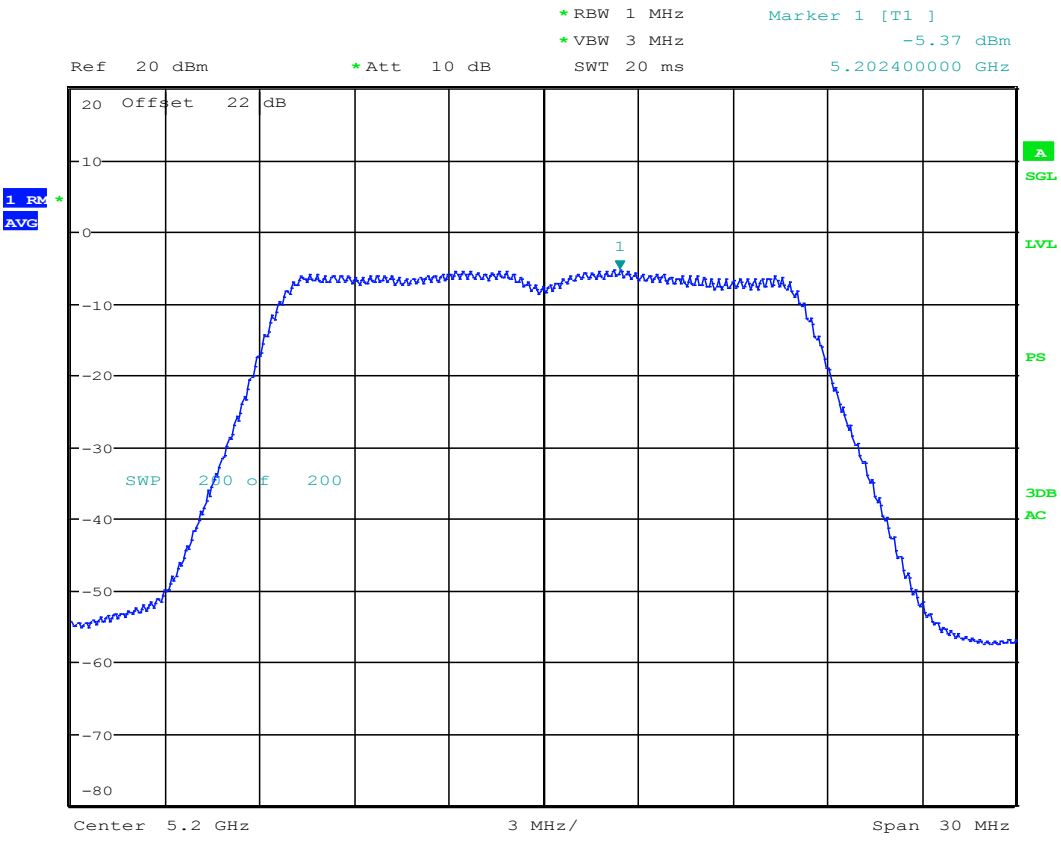
U-NII-1 band - Low Channel – Mode 802.11.a – RF 2



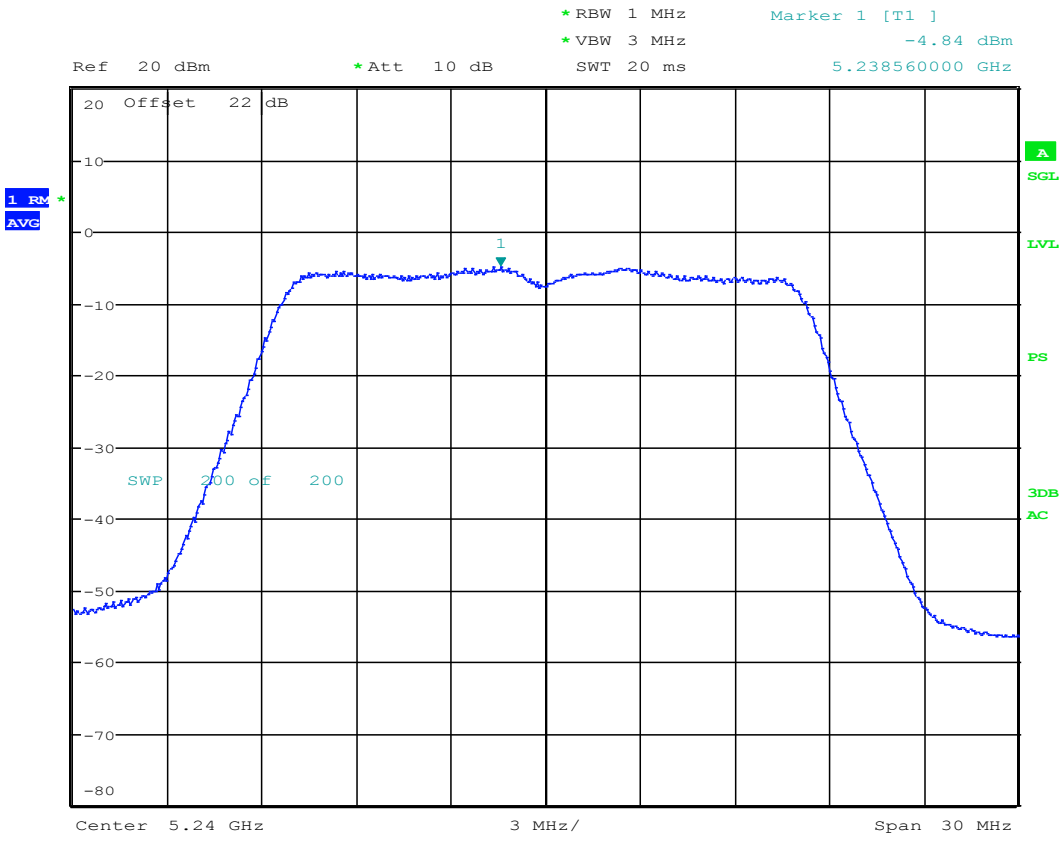
U-NII-1 band – Central Channel – Mode 802.11.a – RF 1



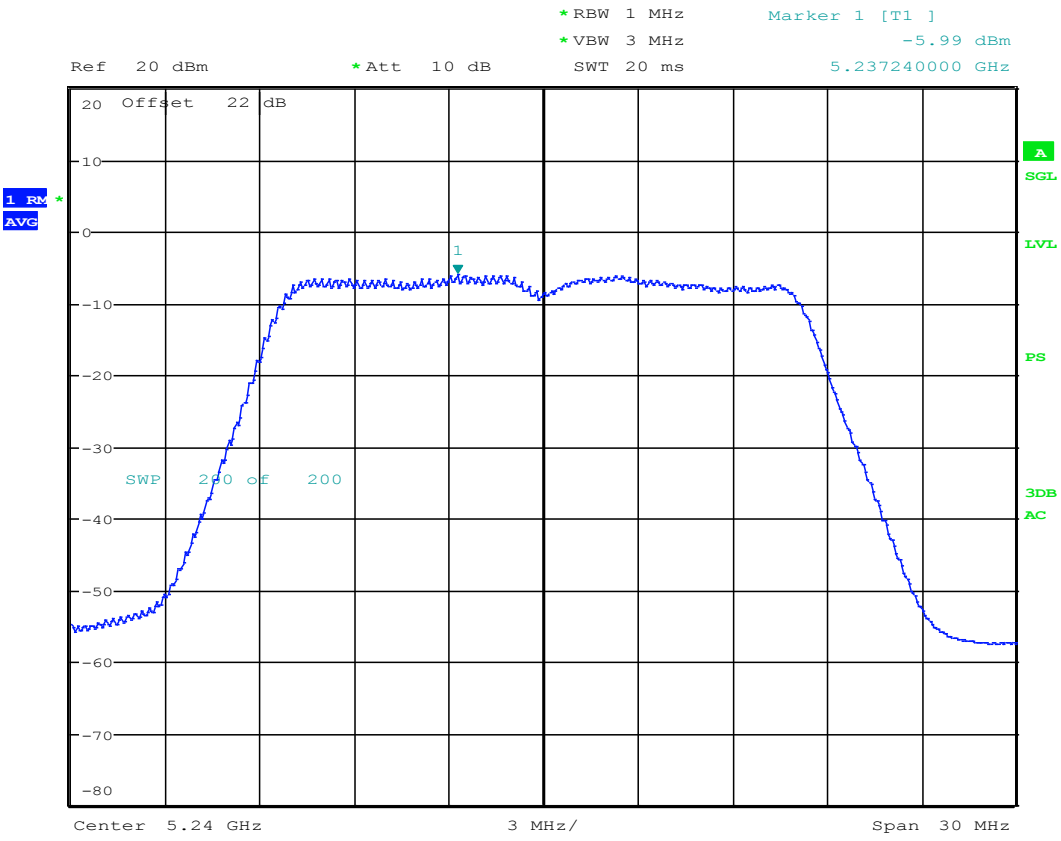
U-NII-1 band – Central Channel – Mode 802.11.a – RF 2



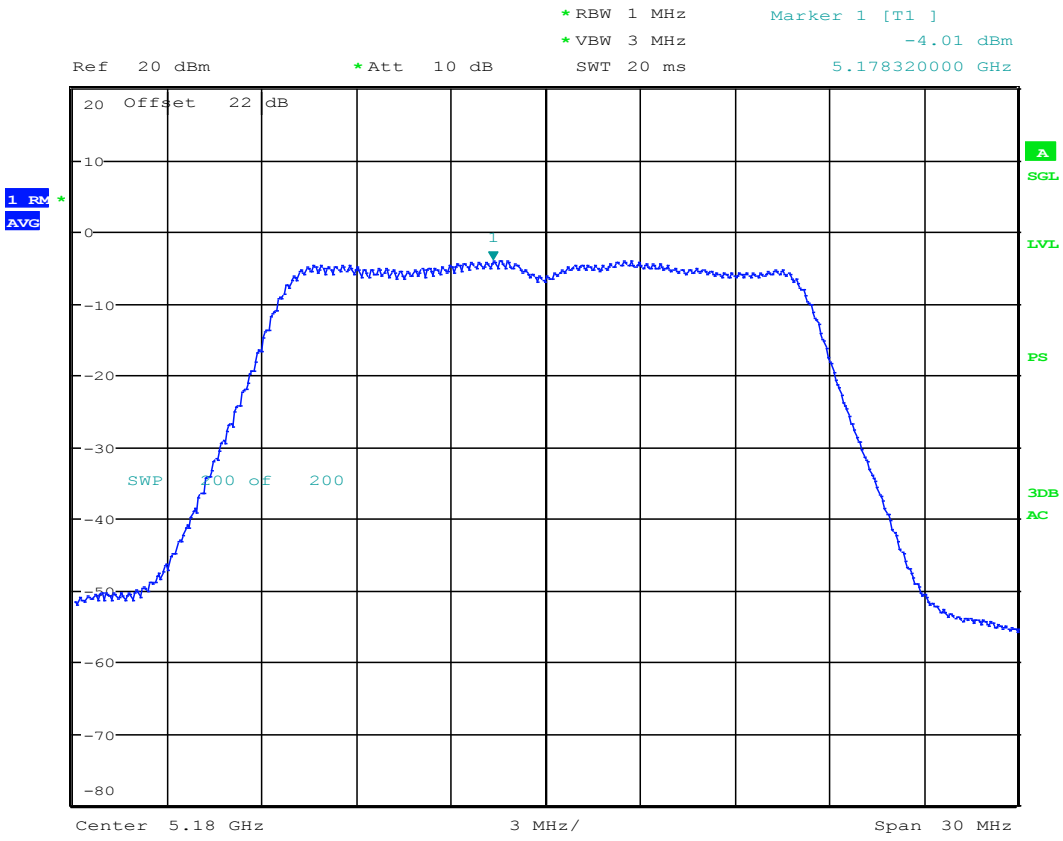
U-NII-1 band - High Channel – Mode 802.11.a – RF1



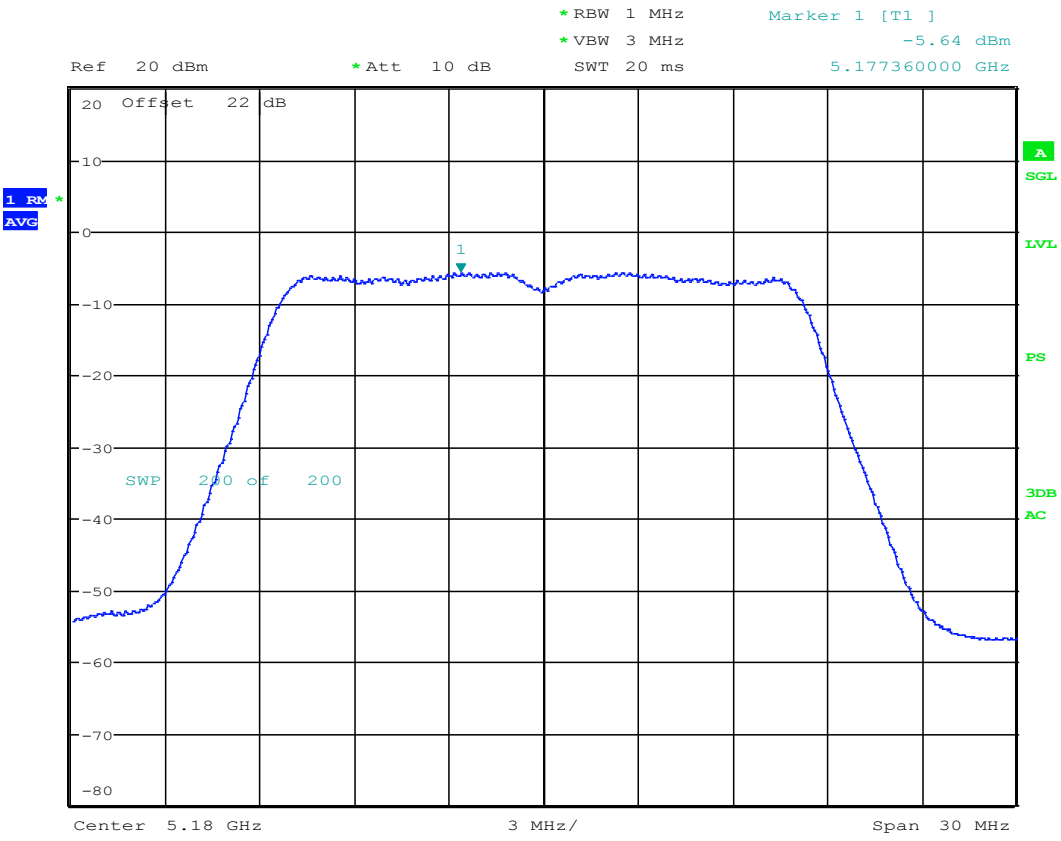
U-NII-1 band - High Channel – Mode 802.11.a – RF2



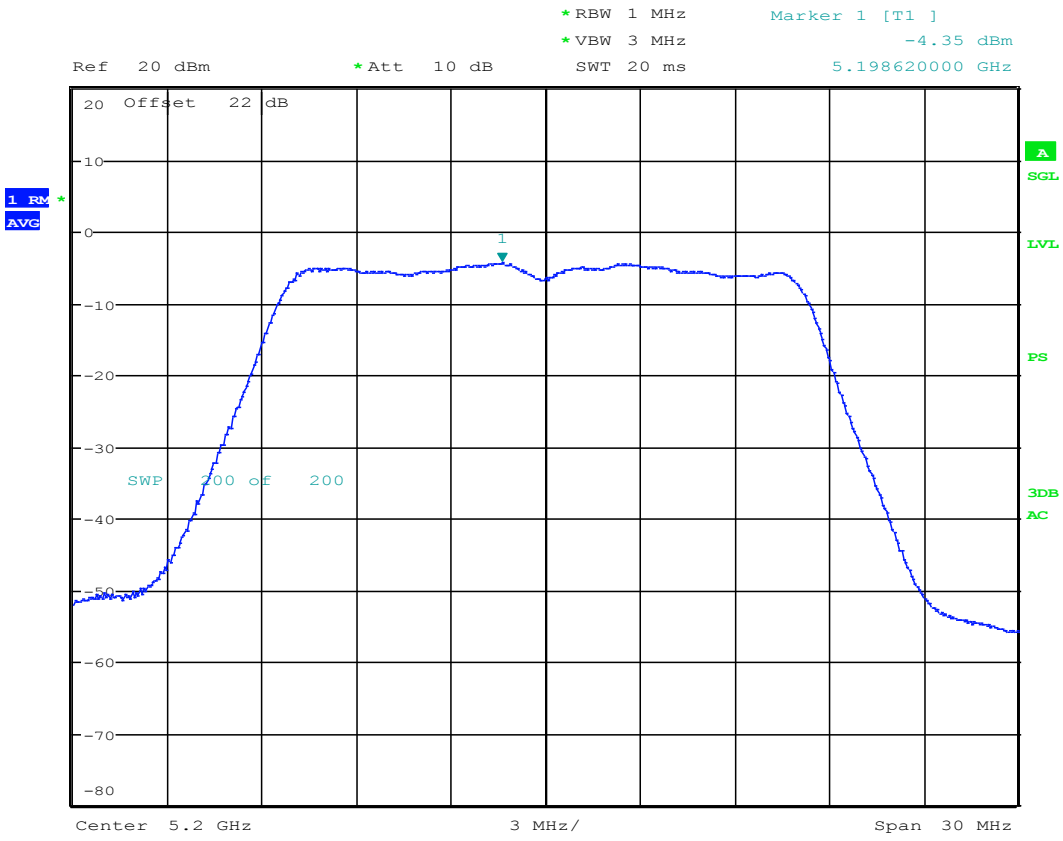
U-NII-1 band - Low Channel – Mode 802.11.n – RF 1



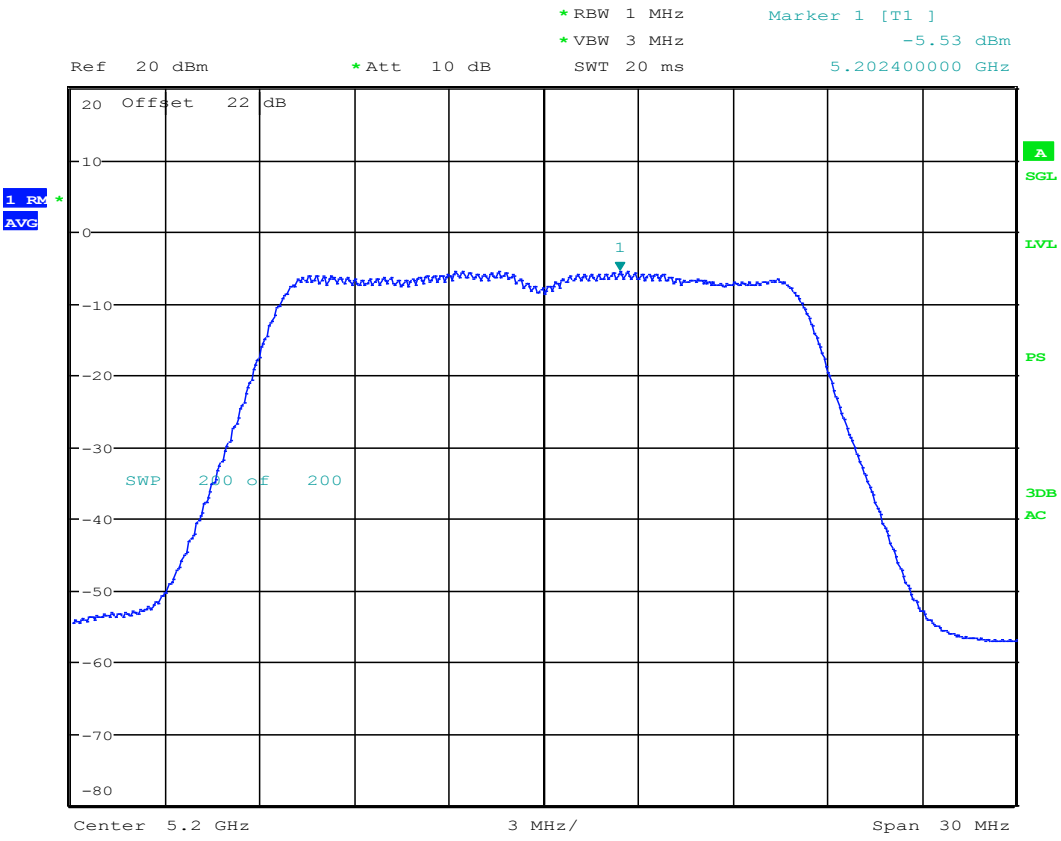
U-NII-1 band - Low Channel – Mode 802.11.n – RF 2



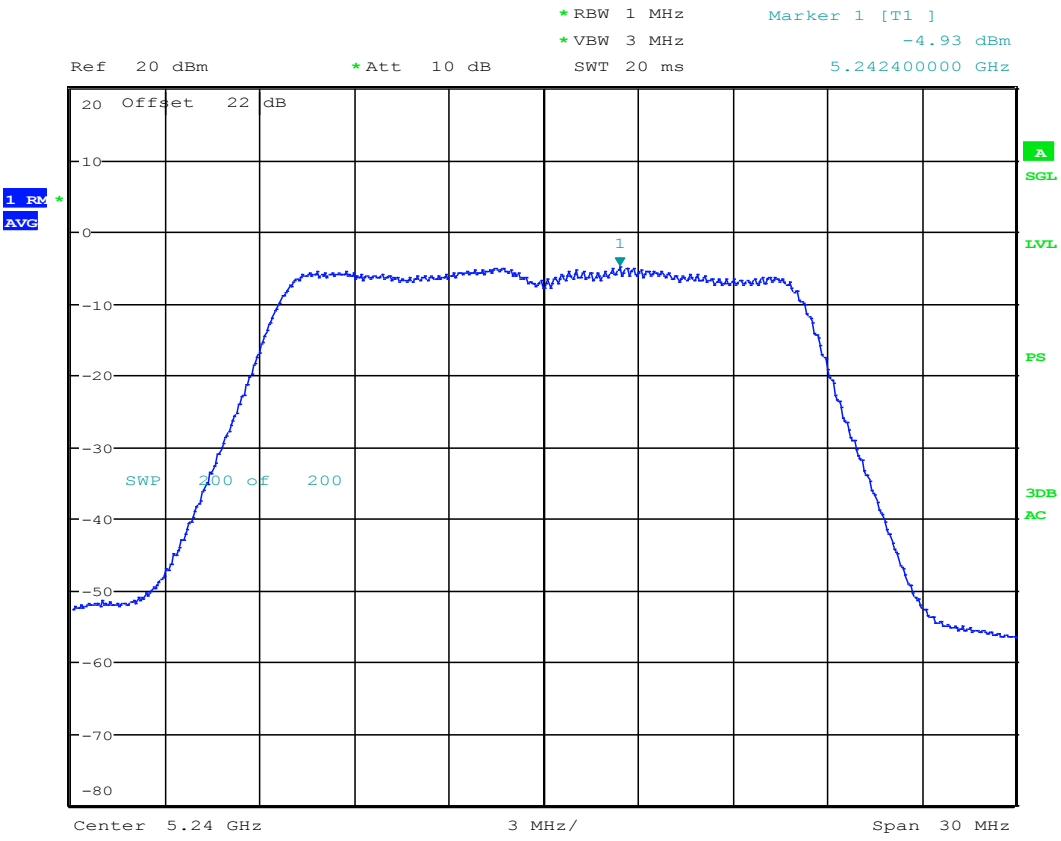
U-NII-1 band – Central Channel – Mode 802.11.n – RF 1



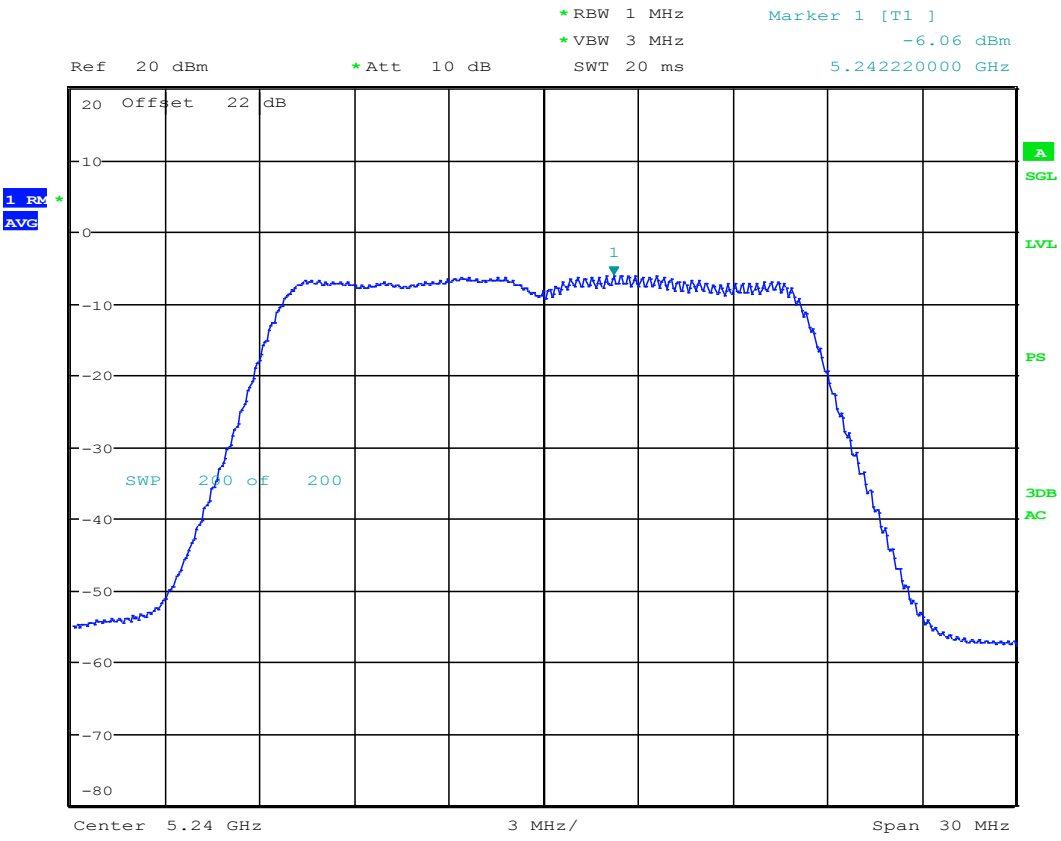
U-NII-1 band – Central Channel – Mode 802.11.n – RF 2



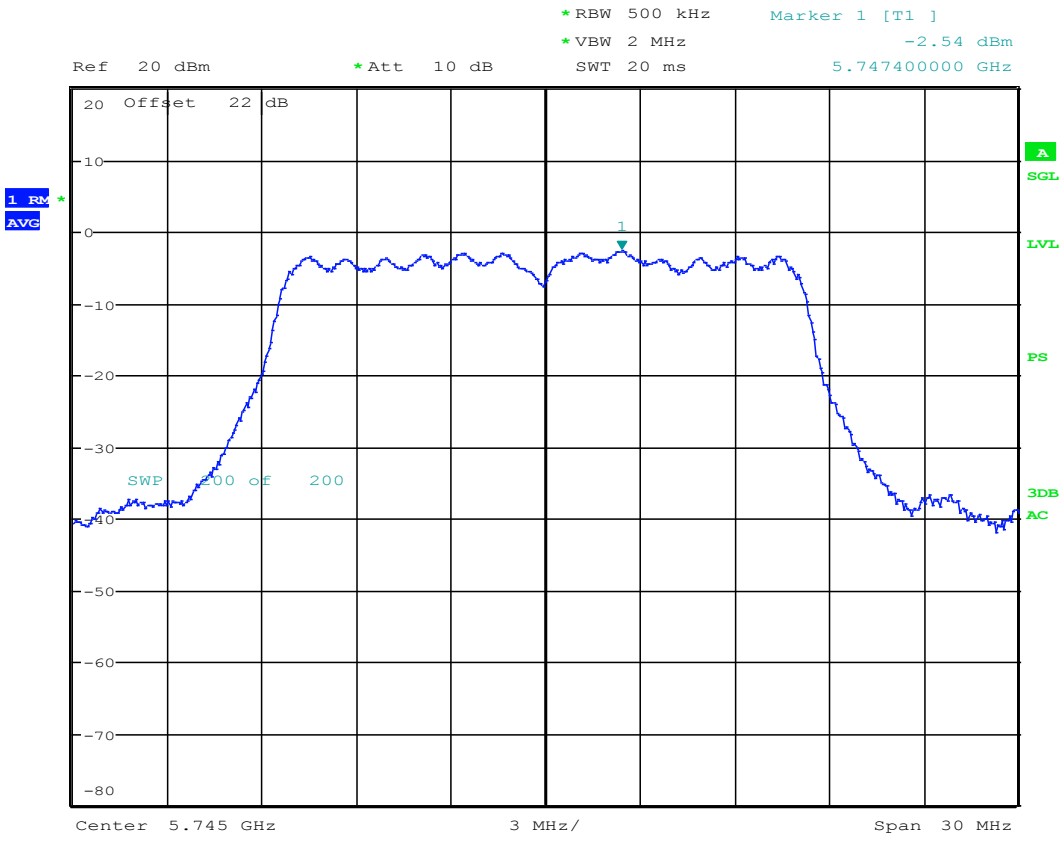
U-NII-1 band - High Channel – Mode 802.11.n – RF1



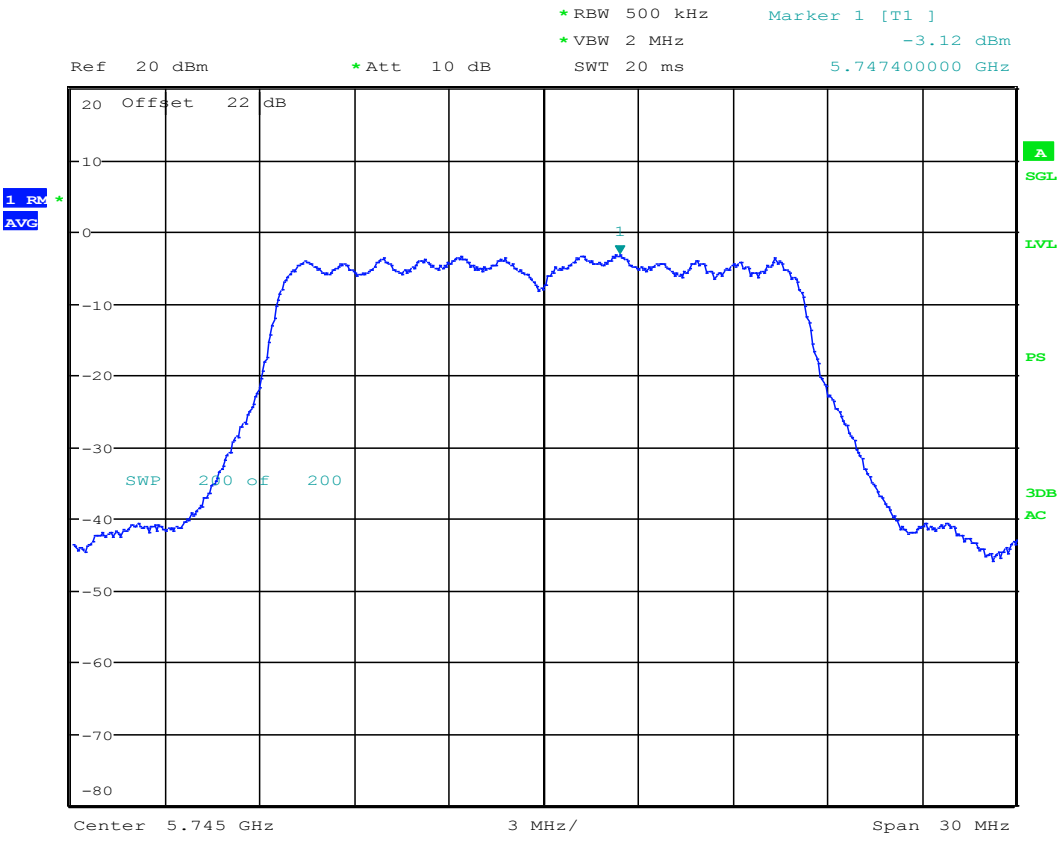
U-NII-1 band - High Channel – Mode 802.11.n – RF2



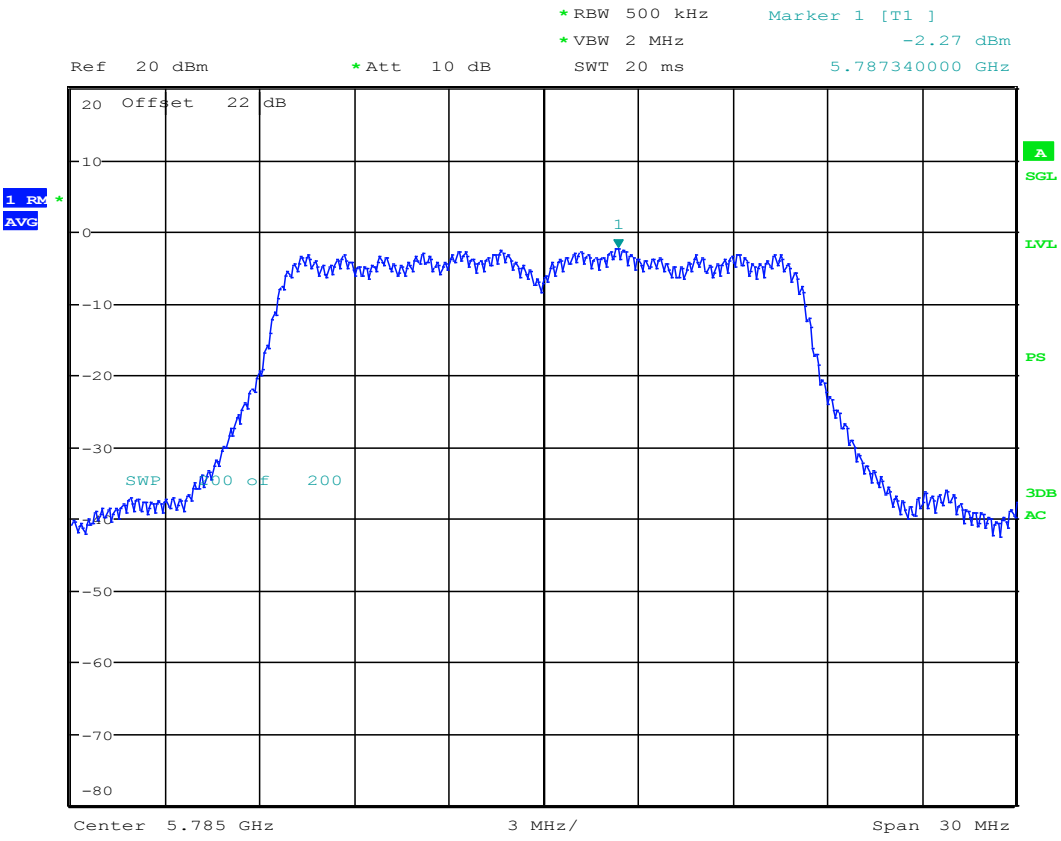
U-NII-3 band - Low Channel – Mode 802.11.a – RF 1



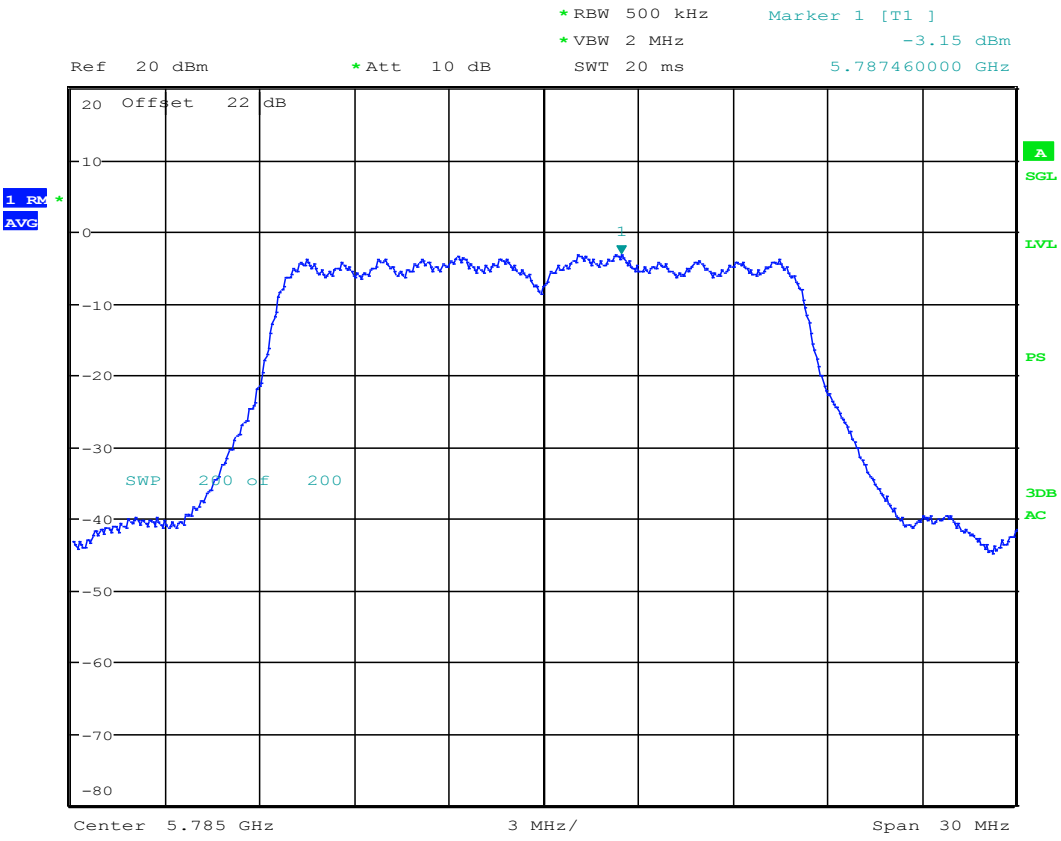
U-NII-3 band - Low Channel – Mode 802.11.a – RF 2



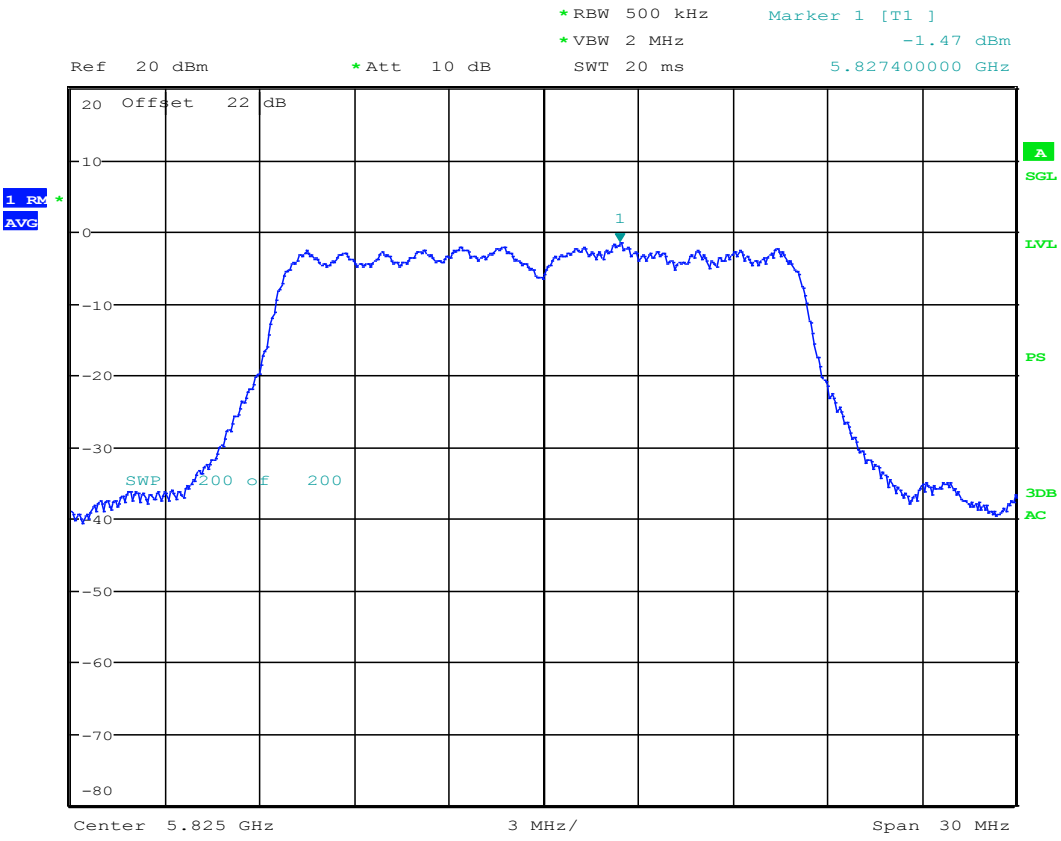
U-NII-3 band – Central Channel – Mode 802.11.a – RF 1



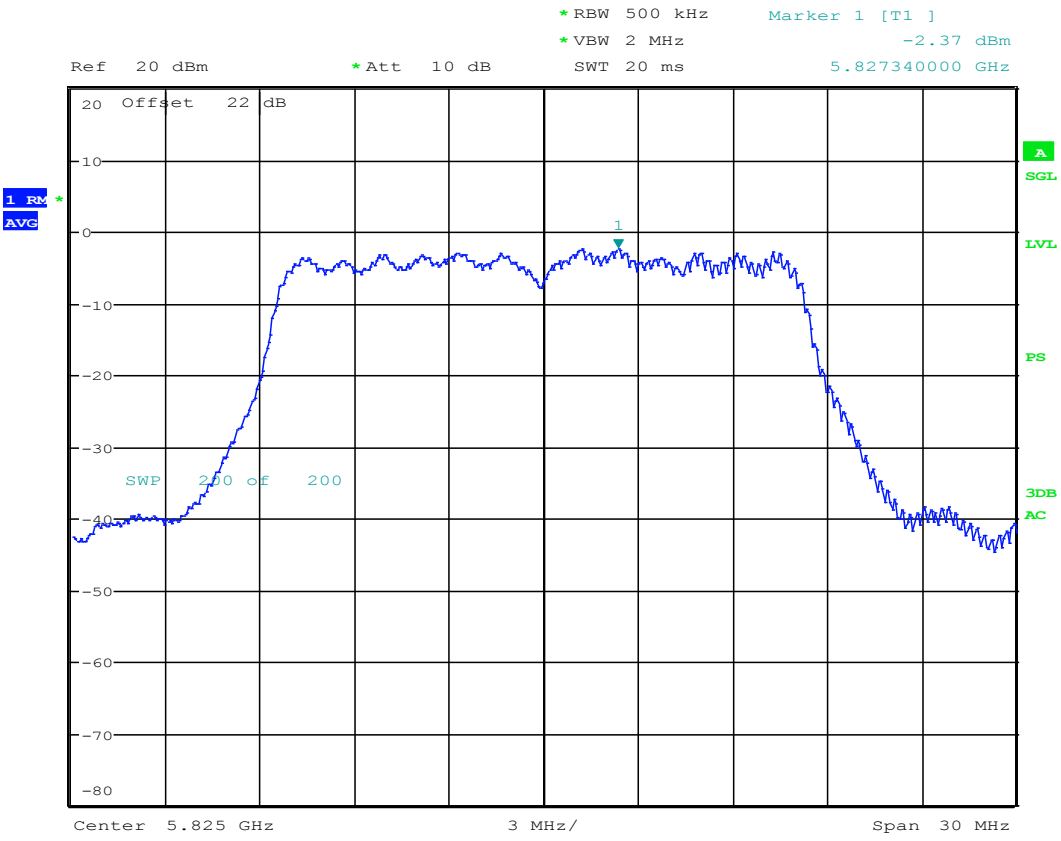
U-NII-3 band – Central Channel – Mode 802.11.a – RF 2



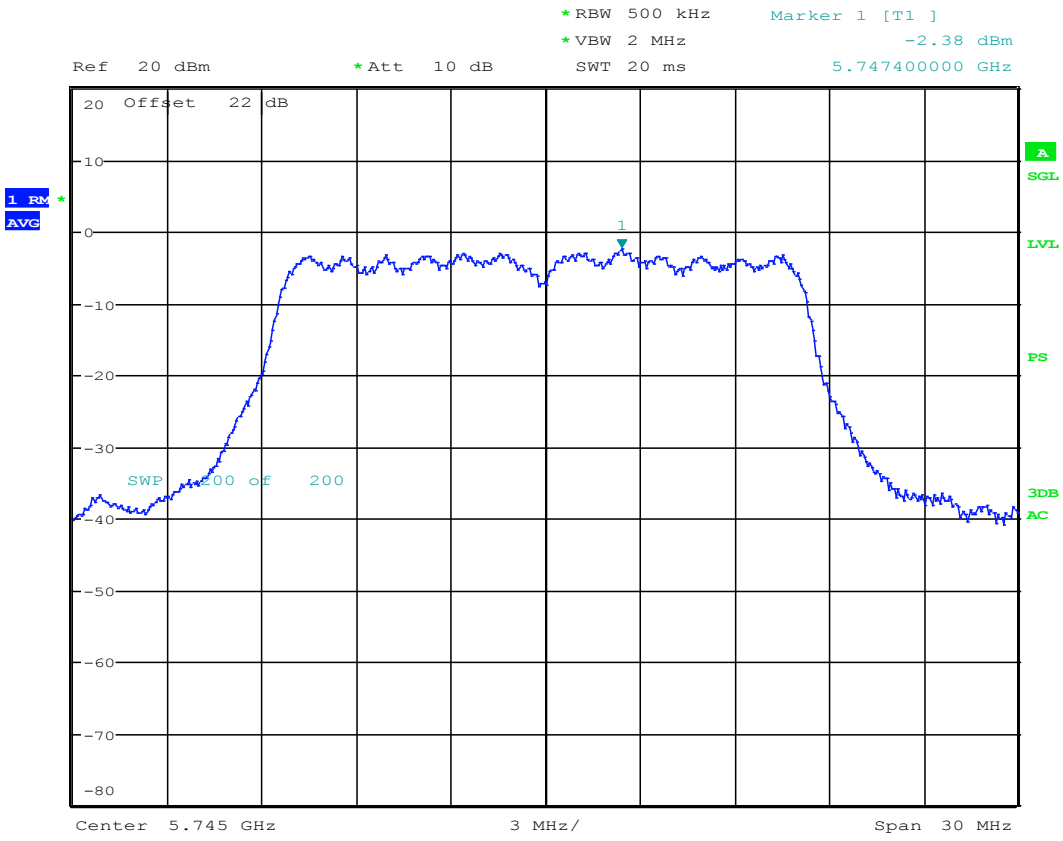
U-NII-3 band - High Channel – Mode 802.11.a – RF1



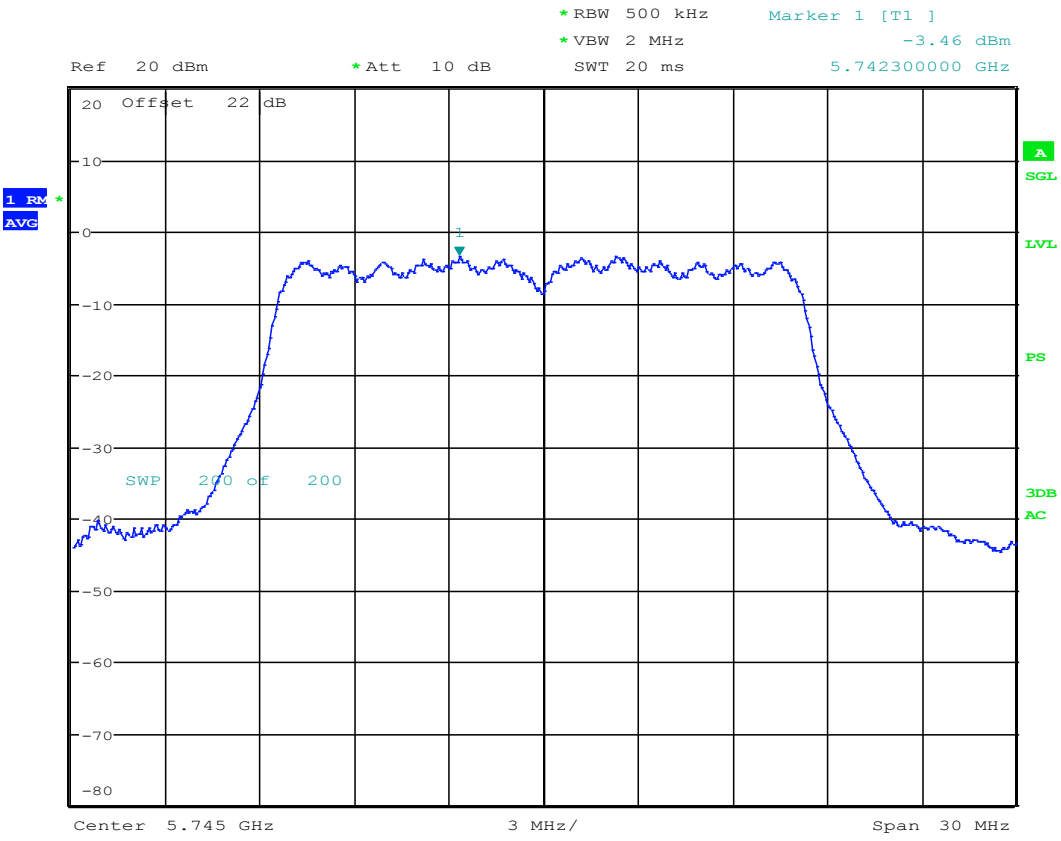
U-NII-3 band - High Channel – Mode 802.11.a – RF2



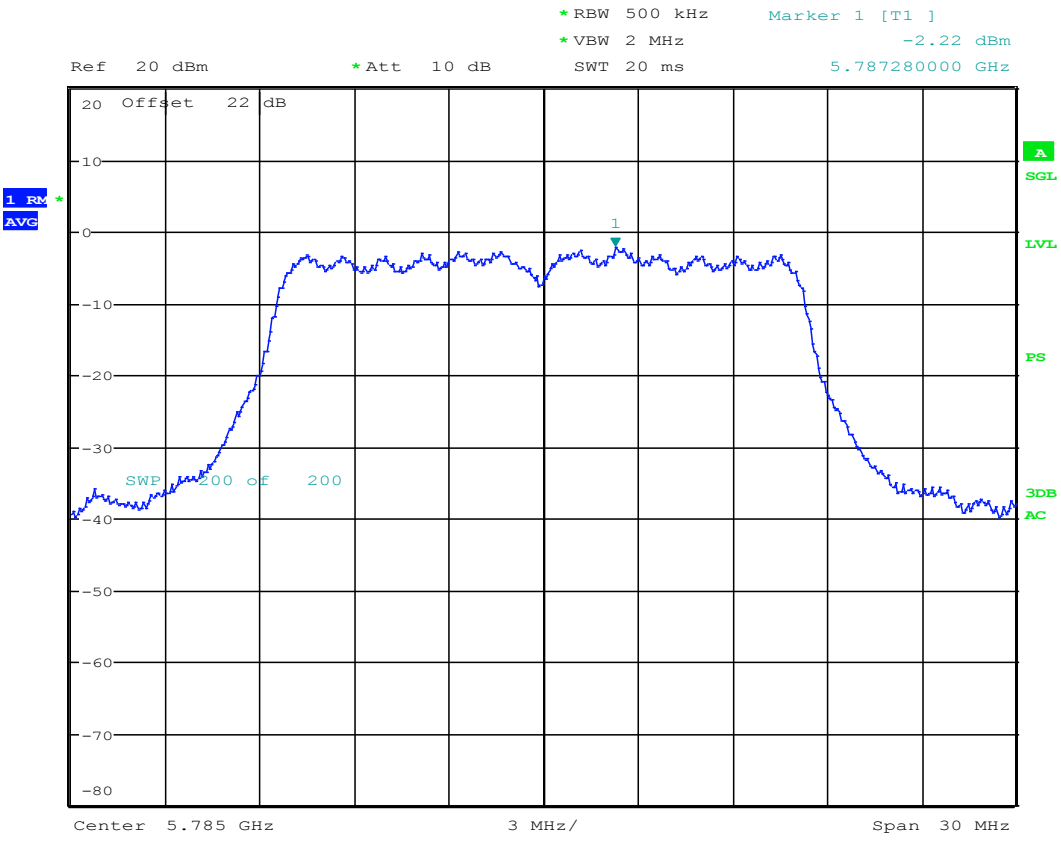
U-NII-3 band - Low Channel – Mode 802.11.n – RF 1



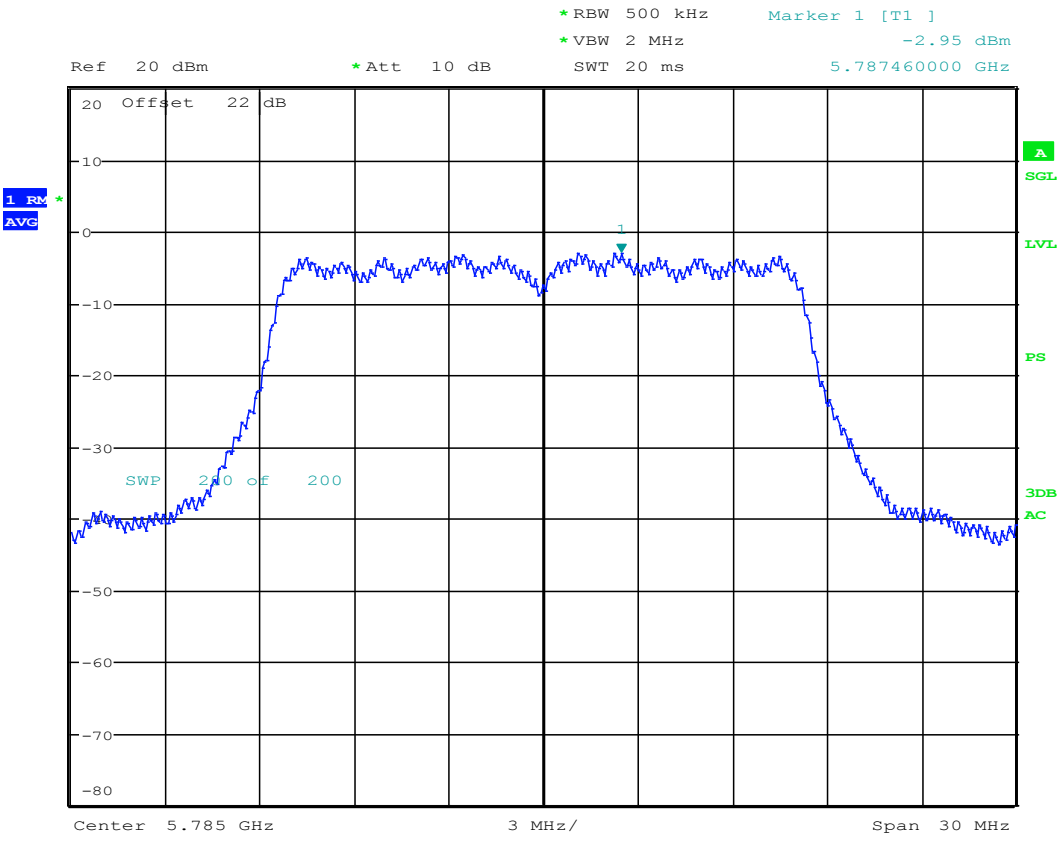
U-NII-3 band - Low Channel – Mode 802.11.n – RF 2



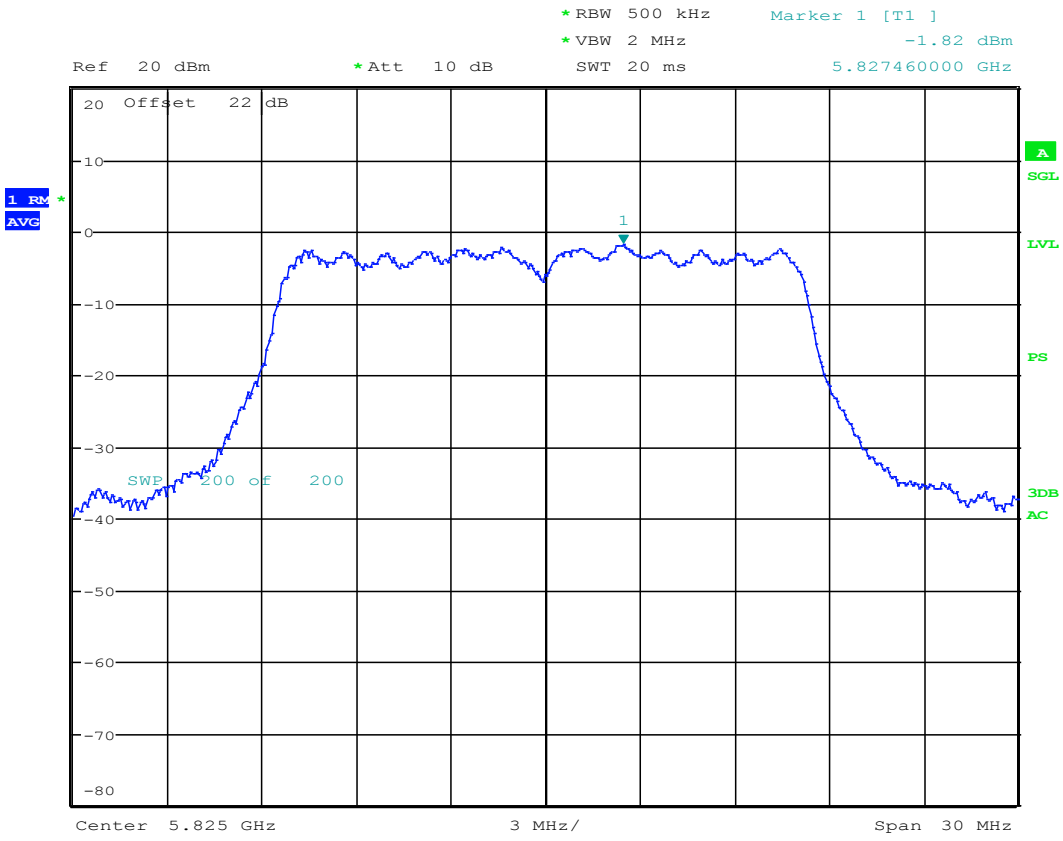
U-NII-3 band – Central Channel – Mode 802.11.n – RF 1



U-NII-3 band – Central Channel – Mode 802.11.n – RF 2



U-NII-3 band - High Channel – Mode 802.11.n – RF1



U-NII-3 band - High Channel – Mode 802.11.n – RF2