

TEST REPORT

of

FCC Part 15 Subpart E §15.407
RSS-247 Issue 2, RSS-Gen Issue 5

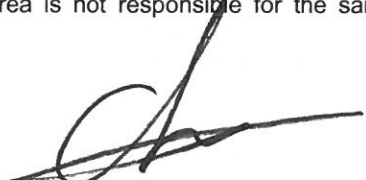
FCC ID: BEJRBHP-B213A
IC Certification: 2703H-RBHPB213A

1. Equipment Under Test : BT + WIFI Combo Module
2. Model Name : RBHP-B213A
3. Variant Model Name(s) : -
4. Applicant : FCC: LG Electronics USA
IC: LG ELECTRONICS INC.
5. Manufacturer : LG INNOTEK CO., LTD. AUTOMOTIVE COMPONENT &
ELECTRONICS BUSINESS UNIT GWANG-JU PLANT
6. Date of Receipt : 2020.01.08
7. Date of Test(s) : 2020.01.09 ~ 2020.03.07
8. Date of Issue : 2020.07.17

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

- 1) The results of this test report are effective only to the items tested.
- 2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.

Tested by:


Jinhyoung Cho

Technical
Manager:


Jungmin Yang

SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Phone No. : +82 31 688 0901

Fax No. : +82 31 688 0921

1.2. Details of Applicant

FCC Applicant : LG Electronics USA

FCC Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 07632

IC Applicant : LG ELECTRONICS INC.

IC Address : 222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, 451-713, Korea (Republic Of)

Contact Person : Han, Kyung-su

Phone No. : +1 201 472 2623

1.3. Details of Manufacturer

Company : LG INNOTEK CO., LTD. AUTOMOTIVE COMPONENT & ELECTRONICS BUSINESS
 UNIT GWANG-JU PLANT

Address : (Jangduk-dong) 26, Hanamsandan 5beon-ro, Gwangsan-gu, Gwangju, 62229, Korea

1.4. Description of EUT

Kind of Product		BT + WIFI Combo Module
Model Name		RBHP-B213A
Serial Number		807GJ030097, 906GJ240613
Power Supply		DC 3.3 V
Frequency Range		5 745 MHz ~ 5 825 MHz (Band 3: 11a/n_HT20, 11ac_VHT20) 5 755 MHz ~ 5 795 MHz (Band 3: 11n_HT40, 11ac_VHT40) 5 775 MHz (Band 3: 11ac_VHT80)
Modulation Technique		OFDM
Number of Channels		5 channels (Band 3: 11a/n_HT20, 11ac_VHT20) 2 channels (Band 3: 11n_HT40, 11ac_VHT40) 1 channel (Band 3: 11ac_VHT80)
Antenna Type		PCB antenna
Antenna Gain	ANT 1	5 745 MHz ~ 5 825 MHz: 0.30 dB i
	ANT 2	5 745 MHz ~ 5 825 MHz: 0 dB i
S/W Version		AVN.GEN5.1.0
H/W version		V1.0

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	Agilent	E8257D	MY51501169	Nov. 21, 2019	Annual	Nov. 21, 2020
Signal Generator	R&S	SMBV100A	255834	Jun. 10, 2019	Annual	Jun. 10, 2020
Spectrum Analyzer	R&S	FSV30	103453	Nov. 06, 2019	Annual	Nov. 06, 2020
Spectrum Analyzer	Agilent	N9030A	US51350132	Nov. 15, 2019	Annual	Nov. 15, 2020
Power Meter	Anritsu	ML2495A	1223004	Jun. 05, 2019	Annual	Jun. 05, 2020
Power Sensor	Anritsu	MA2411B	1207272	Jun. 05, 2019	Annual	Jun. 05, 2020
Attenuator	AEROFLEX / INMET	40AH2W-10	40G-3	Jun. 20, 2019	Annual	Jun. 20, 2020
Low Pass Filter	Mini-Circuits	NLP-1200+	V9500401023-2	Jun. 05, 2019	Annual	Jun. 05, 2020
High Pass Filter	Wainwright Instrument GmbH	WHKX6.0/18G-10SS	51	Jun. 07, 2019	Annual	Jun. 07, 2020
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	15	Jun. 07, 2019	Annual	Jun. 07, 2020
DC Power Supply	R&S	HMP2020	020089489	May 21, 2019	Annual	May 21, 2020
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 13, 2019	Annual	May 13, 2020
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 22, 2019	Biennial	Aug. 22, 2021
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	396	Mar. 21, 2019	Biennial	Mar. 21, 2021
Horn Antenna	R&S	HF906	100326	Feb. 14, 2020	Annual	Feb. 14, 2021
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	BBHA9170431	Sep. 10, 2018	Biennial	Sep. 10, 2020
Test Receiver	R&S	ESU26	100109	Feb. 19, 2020	Annual	Feb. 19, 2021
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383 30516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	SUCOFLEX	104 (3 m)	MY3258414	Jan. 28, 2020	Semi-annual	Jul. 28, 2020
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jan. 28, 2020	Semi-annual	Jul. 28, 2020
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 07/20	Feb. 13, 2020	Semi-annual	Aug. 13, 2020

Note;

Using the software of Teraterm Pro (Version 4.105 SVN# 8433) to testing of EUT.

1.6. Summary of Test Result

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15 Subpart E, IC RSS-247 Issue 2, RSS-Gen Issue 5			
Section in FCC	Section in IC	Test Item(s)	Result
15.205(a) 15.209(a) 15.407(b)(1) 15.407(b)(2) 15.407(b)(3) 15.407(b)(4)	RSS-Gen Issue 5 8.9 RSS-247 Issue 2 6.2.1.2 RSS-247 Issue 2 6.2.2.2 RSS-247 Issue 2 6.2.3.2 RSS-247 Issue 2 6.2.4.2	Transmitter Radiated Spurious Emissions	Complied
15.407(a)	RSS-Gen Issue 5 6.7	26 dB Bandwidth & 99 % Bandwidth	Complied
15.407(e)	RSS-247 Issue 2 6.2.4.1	6 dB Bandwidth	Complied
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	RSS-247 Issue 2 6.2.1.1 RSS-247 Issue 2 6.2.2.1 RSS-247 Issue 2 6.2.3.1 RSS-247 Issue 2 6.2.4.1	Maximum Conducted Output Power	Complied
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	RSS-247 Issue 2 6.2.1.1 RSS-247 Issue 2 6.2.2.1 RSS-247 Issue 2 6.2.3.1 RSS-247 Issue 2 6.2.4.1	Peak Power Spectral Density	Complied
15.207	RSS-Gen Issue 5 8.8	AC Power Line Conducted Emission	N/A ¹⁾

Note;

- 1) The AC power line test was not performed because the EUT use battery power for operation and which do not operate from the AC power lines.

1.7. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL000431	2020.03.20	Initial
1	F690501-RF-RTL000431-1	2020.05.25	Spurious plots have been added
2	F690501-RF-RTL000431-2	2020.07.17	Added the S/W Version, H/W Version and Serial Number

1.8. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 789033 D02 General UNII Test Procedures New Rules v02r01 were used in the measurement of the DUT.

1.9. Sample Calculation

Where relevant, the following sample calculation is provided:

1.9.1. Conducted Test

Offset value (dB) = Attenuator (dB) + Cable loss (dB)

1.9.2. Radiation Test

Field strength level (dB μ V/m) = Measured level (dB μ V) + Antenna factor (dB) + Cable loss (dB) - Amplifier gain (dB)

1.10. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
RF Output Power	± 0.34 dB
Occupied Bandwidth	± 9.66 kHz
Power Spectral Density	± 0.41 dB
Radiated Emission, 9 kHz to 30 MHz	± 3.59 dB
Radiated Emission, below 1 GHz	± 5.88 dB
Radiated Emission, above 1 GHz	± 5.94 dB

Uncertainty figures are valid to a confidence level of 95 %.

1.11. Duty Cycle of EUT

Regarding to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, II.B, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below.

Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value, Set VBW ≥ RBW.

Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100.

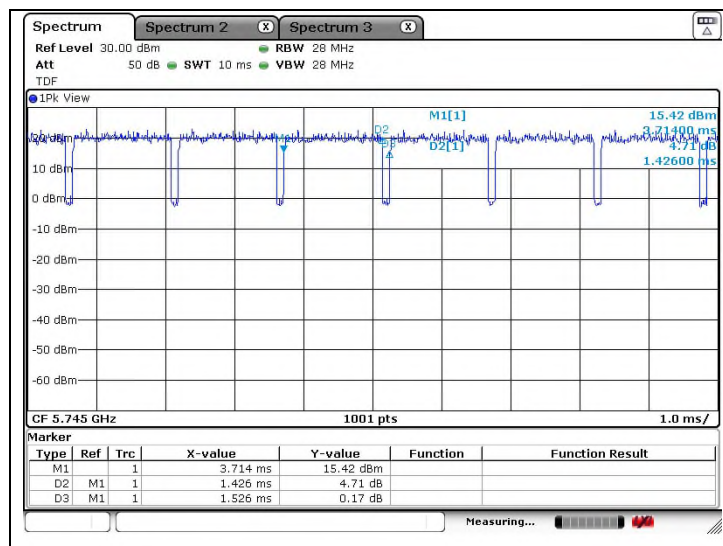
Mode	Data Rate (Mbps)	Duty Cycle (%)	Correction Factor (dB)
11a	6	93.45	0.29
11n_HT20	MCS15	51.43	2.89
11n_HT40	MCS15	41.62	3.81
11ac_VHT80	MCS9	35.44	4.51

Remark;

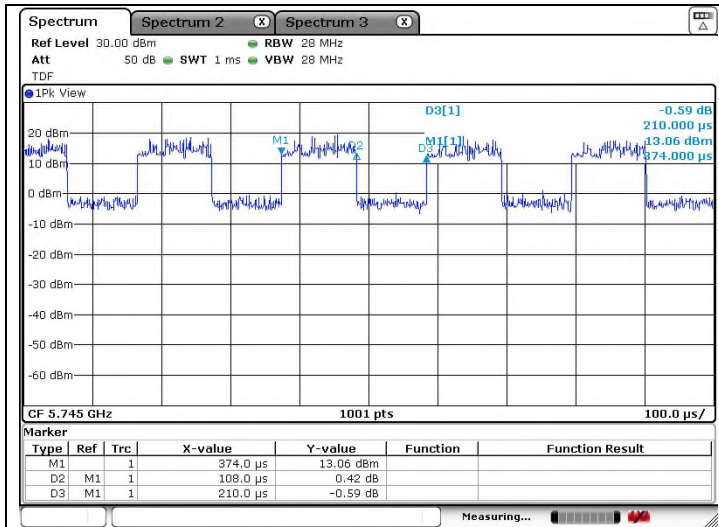
- As measured duty cycles of EUT, all of mode and data rate keep constant period and are converted to log scale (power averaging) to compensate correction factor to result of average test items.
- Duty Cycle (%) = (Tx on time / Tx on + off time) x 100
- Correction Factor (dB) = 10 log (1 / Duty Cycle)

- Test plots

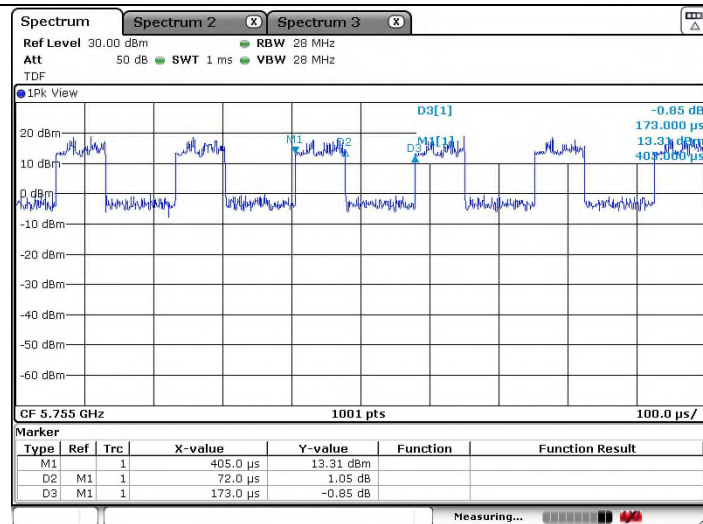
802.11a



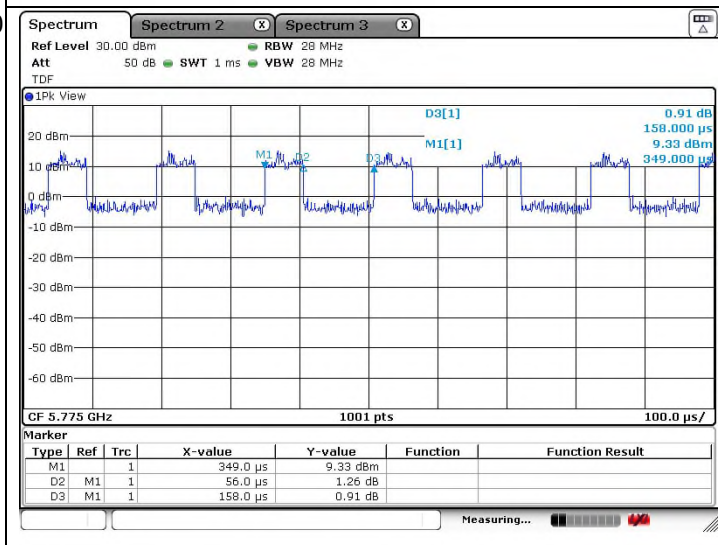
802.11n_HT20



802.11n_HT40



802.11ac_VHT80

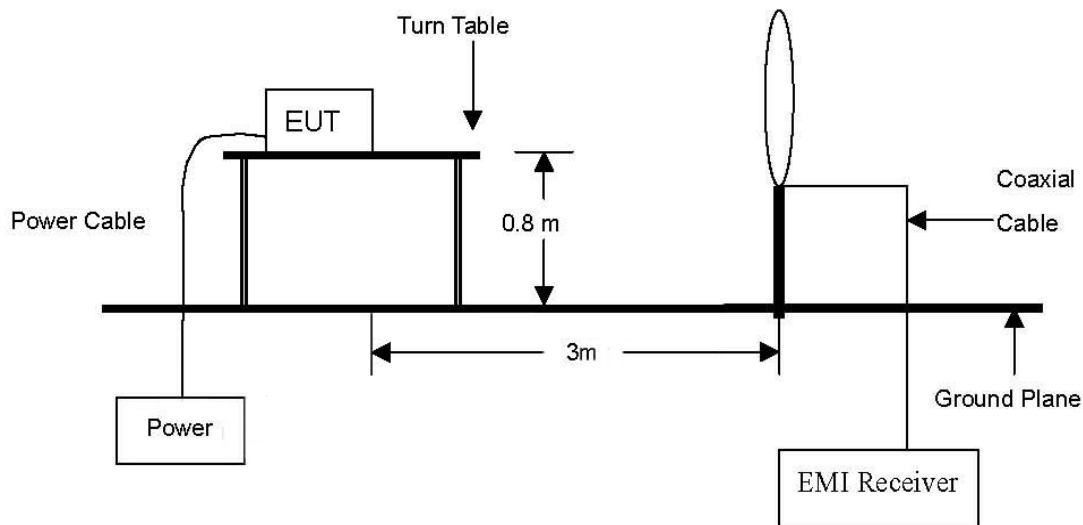


2. Transmitter Radiated Spurious Emissions

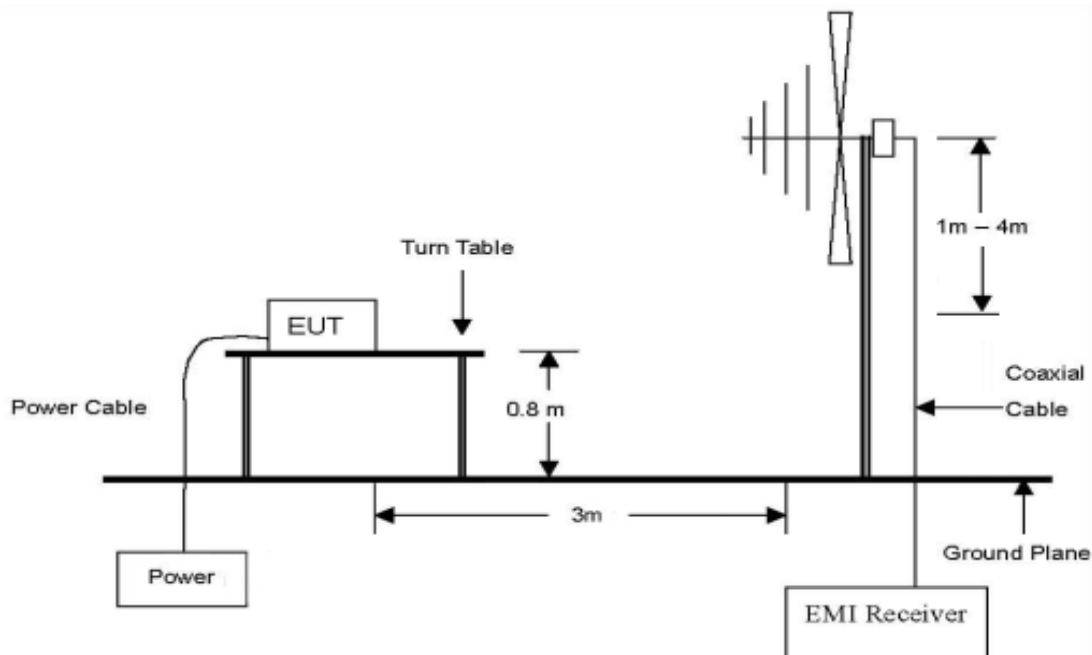
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

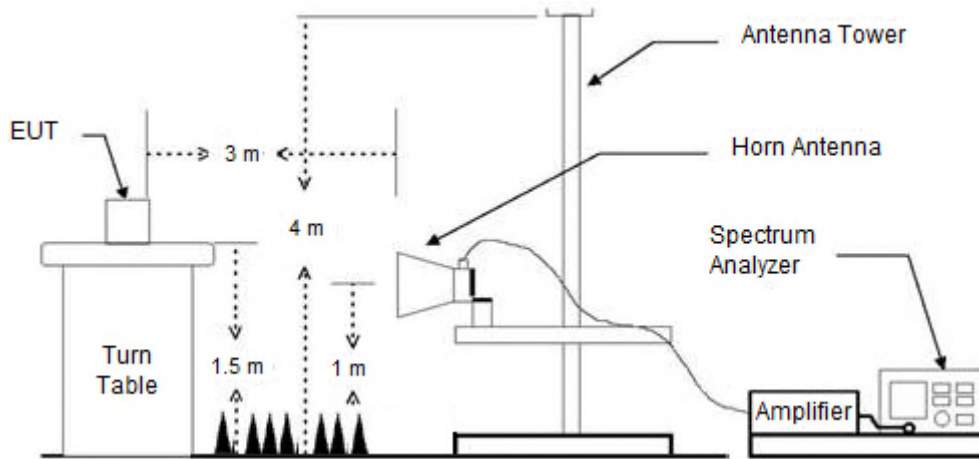
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated from 1 GHz to the 10th harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.



2.2. Limit

2.2.1. FCC

According to § 15.407(b)

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of -27 dB m/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dB m/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dB m/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dB m/MHz at the band edge.

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measurement Distance (Meters)
0.009-0.490	2 400/F(kHz)	300
0.490-1.705	24 000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

2.2.2. IC

According to RSS-247 Issue 2,

6.2.4.2 Frequency band 5 725-5 850 MHz

Devices operating in the band 5 725-5 850 MHz with antenna gain greater than 10 dBi can have unwanted emissions that comply with either the limits in this section or in section 5.5 until six (6) months after the publication date of this standard for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2018.

Devices operating in the band 5 725-5 850 MHz with antenna gain of 10 dBi or less can have unwanted emissions that comply with either the limits in this section or in section 5.5 until April 1, 2018 for certification. Certified devices that do not comply with emission limits in this section shall not be manufactured, imported, distributed, leased, offered for sale or sold after April 1, 2020.

Devices operating in the band 5 725-5 850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

- a) 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- b) 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- c) 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
- d) -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

2.3. Test Procedures

Radiated spurious emissions from the EUT were measured according to the dictates in section G of KDB 789033 D02 General UNII Test Procedures New Rules v02r01 and ANSI C63.10-2013.

2.3.1. Test Procedures for emission below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from above 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site below 1 GHz and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a bi-log antenna, a horn antenna and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note;

All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

- II.G.4. Unwanted emissions measurements below 1 GHz.

Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

- II.G.5. Unwanted maximum emissions measurements above 1 GHz.

Peak emission levels are measured by setting the analyzer as follows:

Set to RBW = 1 MHz, VBW ≥ 3 MHz, Detector = Peak, Sweep time = auto, Trace mode= Max hold.

- II.G.6. Average unwanted emissions measurements above 1 GHz.

Set to RBW = 1 MHz, VBW ≥ 3 MHz, Detector = power averaging (rms), Averaging type = power averaging (rms), Sweep time = auto, Perform a trace average of at least 100 traces If the transmission is continuous, If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 % duty cycle, at least 200 traces shall be averaged.

If tests are performed with the EUT transmitting at a duty cycle less than 98 %, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 % duty cycle. The correction factor is computed as follows:

- If power averaging (rms) mode was used in II.G.6.c)(iv), the correction factor is $10 \log (1/x)$, where x is the duty cycle. For example, if the transmit duty cycle was 50 %, then 3 dB must be added to the measured emission levels.

- Definition of the test orthogonal plan for EUT was described in the test setup photo.

The test orthogonal plan of EUT is Z – axis during radiation test.

2.4. Test Result

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

2.4.1. Radiated Spurious Emission below 1 000 MHz

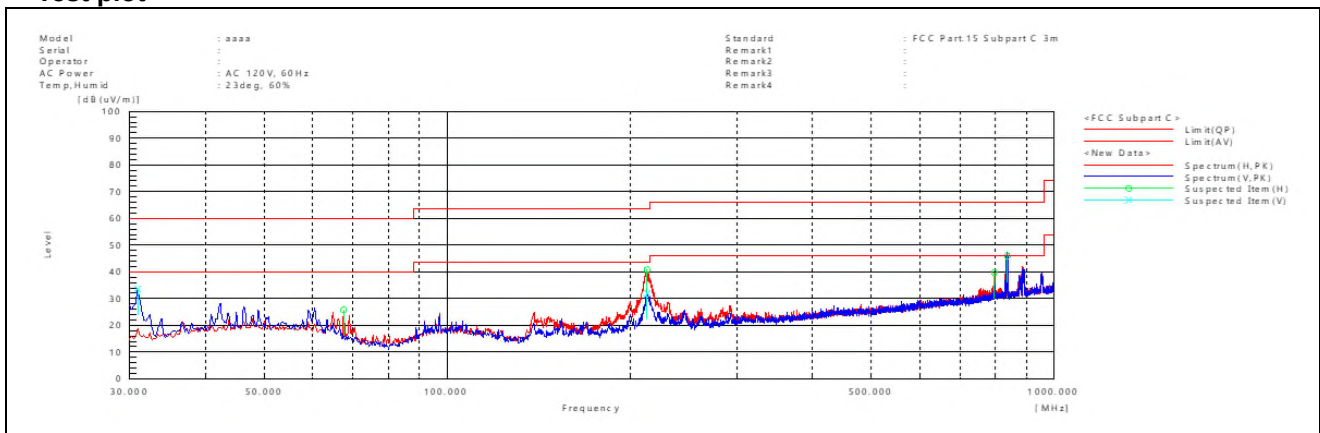
The frequency spectrum from 9 kHz to 1 000 MHz was investigated. All reading values are peak values.

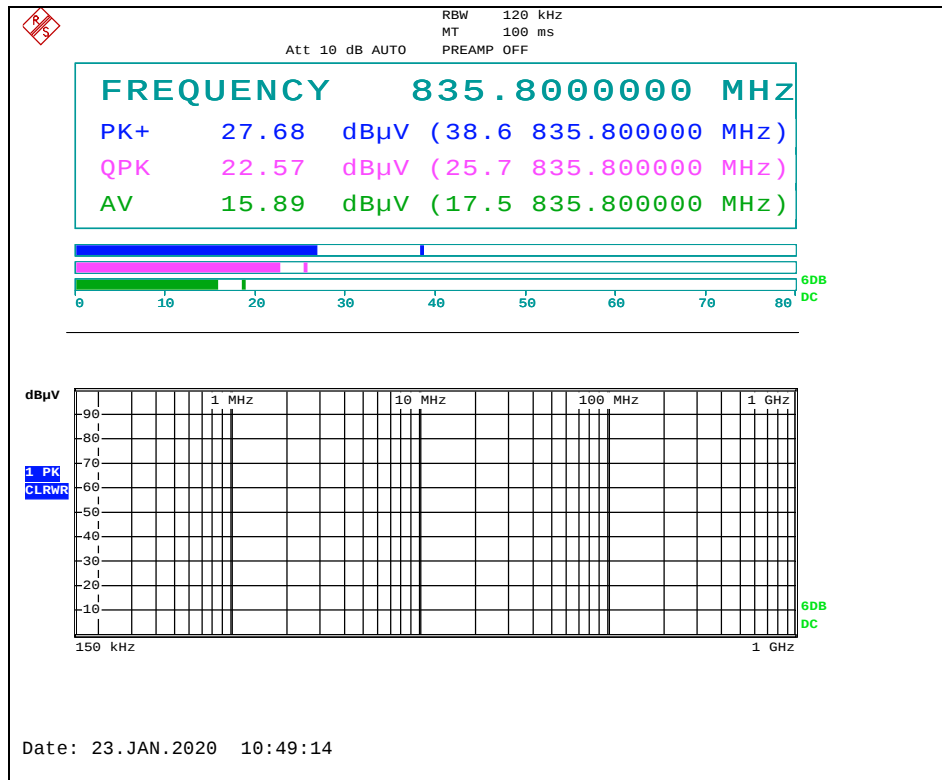
Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
30.97	44.60	Peak	V	15.30	-26.71	33.19	40.00	6.81
67.59	36.10	Peak	H	15.46	-25.98	25.58	40.00	14.42
213.33	38.90	Peak	H	16.90	-25.04	30.76	43.50	12.74
213.57	47.70	Peak	V	16.91	-25.04	39.57	43.50	3.93
796.54	36.10	Peak	V	26.70	-22.58	40.22	46.00	5.78
835.80	25.70	Quasi Peak	H	27.30	-22.43	30.57	46.00	15.43
Above 900.00	Not detected	-	-	-	-	-	-	-

Remark;

1. Spurious emissions for all channels and modes were investigated and almost the same below 1 GHz.
2. Reported spurious emissions are in **11a ANT 2 (Band 3) / 6 Mbps / Middle channel** as worst case among other modes.
3. Radiated spurious emission measurement as below.
 (Actual = Reading + AF + AMP + CL)
4. According to §15.31(o), emission levels are not report much lower than the limits by over 20 dB.

- Test plot





2.4.2. Radiated Spurious Emission above 1 000 MHz

OFDM: 802.11a (6 Mbps) Band 3_ANT 1

A. Low Channel (5 745 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 634.71	47.07	Peak	H	34.00	-32.14		48.93	68.23	19.30
5 698.81	51.17	Peak	H	34.10	-32.07		53.20	104.35	51.15
5 717.45	65.34	Peak	H	34.07	-32.10		67.31	110.11	42.80
5 725.00	72.31	Peak	H	34.05	-32.11		74.25	122.23	47.98

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 825 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 852.19	54.81	Peak	H	34.30	-31.94		57.17	117.23	60.06
5 859.08	50.85	Peak	H	34.32	-31.95		53.22	109.69	56.47
5 900.67	49.23	Peak	H	34.40	-32.01		51.62	86.23	34.61
5 939.04	47.57	Peak	H	34.56	-31.94		50.19	68.23	18.04

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

OFDM: 802.11a (6 Mbps) Band 3_ANT 2

A. Low Channel (5 745 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 637.78	43.76	Peak	H	34.00	-32.15		45.61	68.23	22.62
5 666.05	51.26	Peak	H	34.03	-32.11		53.18	80.10	26.92
5 717.45	58.06	Peak	H	34.07	-32.10		60.03	110.11	50.08
5 725.00	68.01	Peak	H	34.05	-32.11		69.95	122.23	52.28

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 825 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
5 853.57	48.31	Peak	H	34.31	-31.94		50.68	114.09	63.41
5 857.70	46.84	Peak	H	34.32	-31.95		49.21	110.07	60.86
5 898.37	48.52	Peak	H	34.40	-32.01		50.91	87.93	37.02
5 973.28	44.91	Peak	H	34.60	-31.80		47.71	68.49	20.78

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dB μ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

OFDM: 802.11n_HT20 (MCS15) Band 3_ANT 1 + ANT 2

A. Low Channel (5 745 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 648.64	43.68	Peak	H	34.00	-32.13		45.55	68.23	22.68
5 677.72	51.57	Peak	H	34.06	-32.10		53.53	88.74	35.21
5 720.00	65.06	Peak	H	34.06	-32.11		67.01	110.83	43.82
5 722.98	76.64	Peak	H	34.05	-32.11		78.58	117.62	39.04

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 825 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 850.00	59.70	Peak	H	34.30	-31.94		62.06	122.23	60.17
5 856.78	56.13	Peak	H	34.31	-31.95		58.49	110.33	51.84
5 905.72	48.51	Peak	H	34.42	-32.00		50.93	82.49	31.56
5 969.83	43.93	Peak	H	34.60	-31.82		46.71	68.45	21.74

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

OFDM: 802.11n_HT40 (MCS15) Band 3_ANT 1 + ANT 2

A. Low Channel (5 755 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 650.00	46.10	Peak	H	34.00	-32.13		47.97	68.23	20.26
5 697.99	59.26	Peak	H	34.10	-32.07		61.29	103.74	42.45
5 718.68	75.79	Peak	H	34.06	-32.11		77.74	110.46	32.72
5 723.18	76.24	Peak	H	34.05	-32.11		78.18	118.08	39.90

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

B. High Channel (5 795 MHz)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 850.35	54.36	Peak	H	34.30	-31.94		56.72	121.43	64.71
5 858.62	51.24	Peak	H	34.32	-31.95		53.61	109.81	56.20
5 875.39	47.30	Peak	H	34.35	-31.98		49.67	104.94	55.27
5 948.92	43.71	Peak	H	34.60	-31.91		46.40	68.23	21.83

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

OFDM: 802.11ac_VHT80 (MCS9) Band 3_ANT 1 + ANT 2

A. Middle Channel (5 775 MHz)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 646.18	54.95	Peak	H	34.00	-32.14	56.81	68.23	11.42
5 689.80	70.64	Peak	H	34.08	-32.09	72.63	97.68	25.05
5 718.47	72.87	Peak	H	34.06	-32.11	74.82	110.40	35.58
5 723.18	72.41	Peak	H	34.05	-32.11	74.35	118.08	43.73
5 851.50	68.73	Peak	H	34.30	-31.94	71.09	118.81	47.72
5 870.11	66.90	Peak	H	34.34	-31.97	69.27	106.60	37.33
5 881.37	55.12	Peak	H	34.36	-31.98	57.50	100.51	43.01
5 930.54	48.50	Peak	H	34.52	-31.95	51.07	68.23	17.16

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	DF (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Above 1 000.00	Not detected	-	-	-	-	-	-	-	-

Remark;

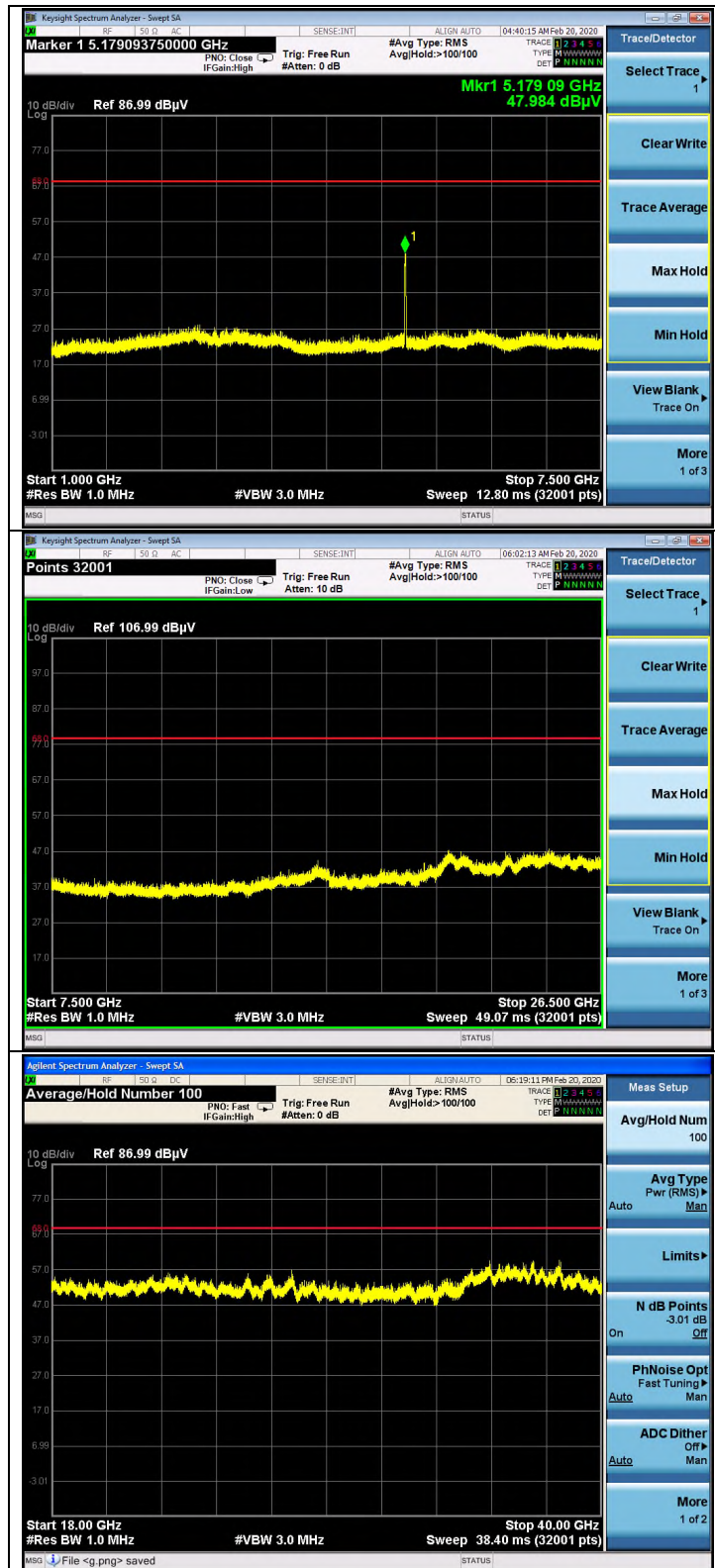
1. “*” means the restricted band.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using Peak / average detector mode if frequency was in restricted band. Otherwise the frequency was out of restricted band, only peak detector should be used.
3. Actual = Reading + AF + AMP + CL
4. If frequency was out of restricted band, the calculation method for peak limit is same as below.

$$68.23 \text{ dB}\mu\text{V/m} = \text{EIRP} - 20 \log(d) + 104.77 = -27 - 20 \log(3) + 104.77$$
5. In case of the emissions within $\pm 75 \text{ MHz}$ from band edge of band 3, limit should be adjusted to emission mask of 15.407(4)(i).
6. According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 dB.
7. The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.

- Test plots

Spurious Emissions Pre-scan

1 000 MHz ~ 40 000 MHz

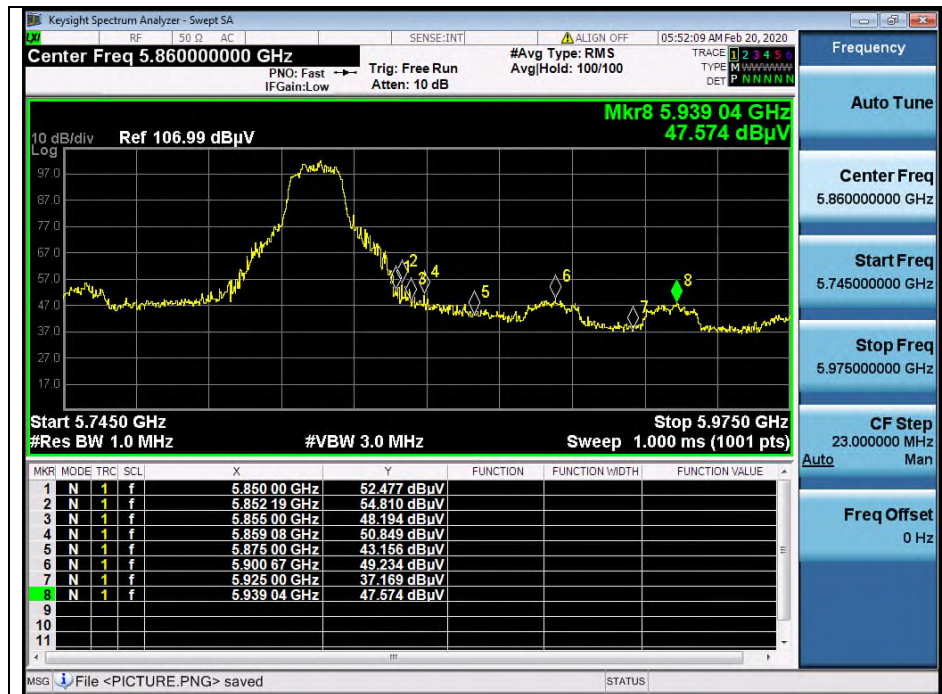


OFDM: 802.11a (6 Mbps)_ANT 1

Low channel Band edge (Peak) - Band 3

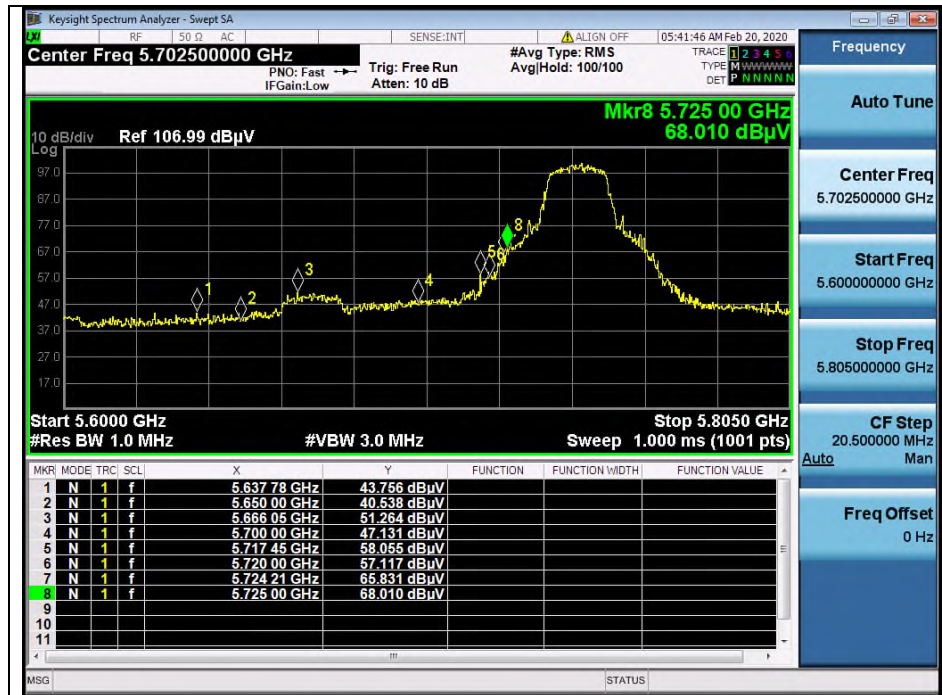


High channel Band edge (Peak) - Band 3

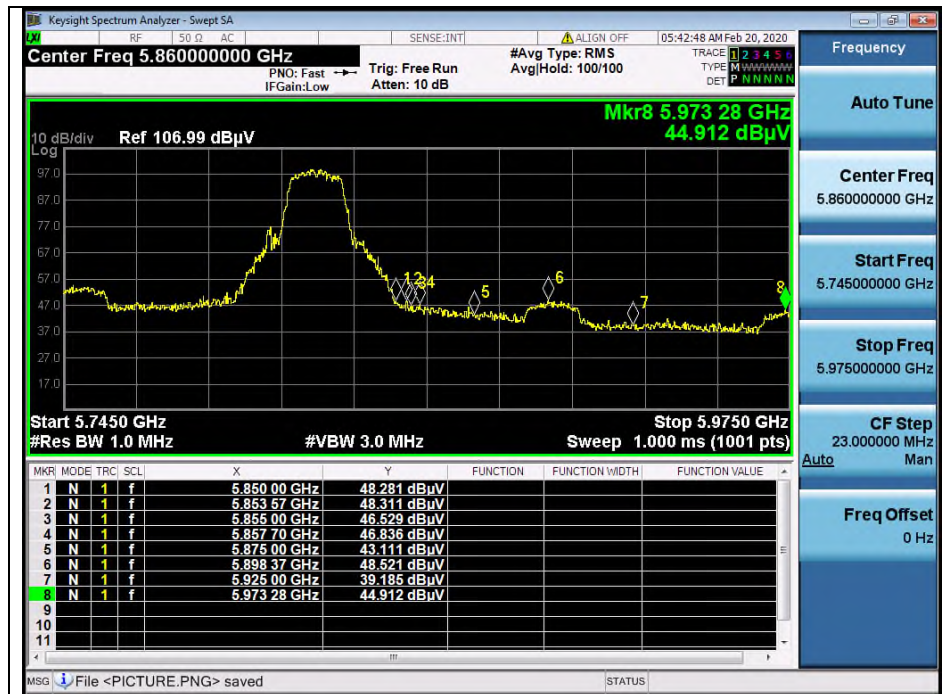


OFDM: 802.11a (6 Mbps)_ANT 2

Low channel Band edge (Peak) - Band 3

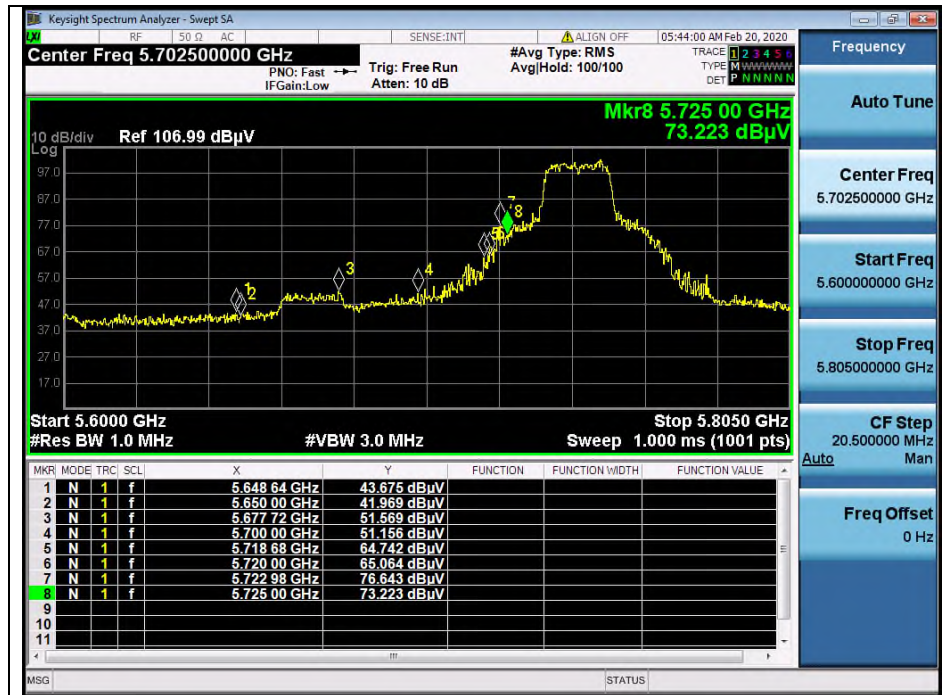


High channel Band edge (Peak) - Band 3

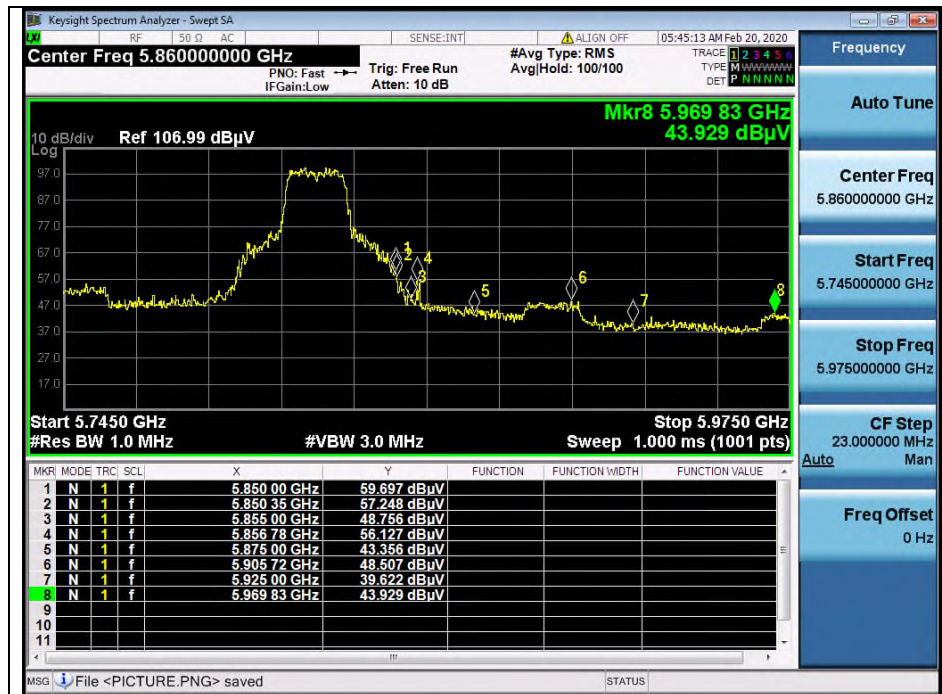


OFDM: 802.11n_HT20 (MCS15)_ANT 1 + ANT 2

Low channel Band edge (Peak) - Band 3



High channel Band edge (Peak) - Band 3



OFDM: 802.11n_HT40 (MCS15)_ANT 1 + ANT 2

Low channel Band edge (Peak) - Band 3



High channel Band edge (Peak) - Band 3

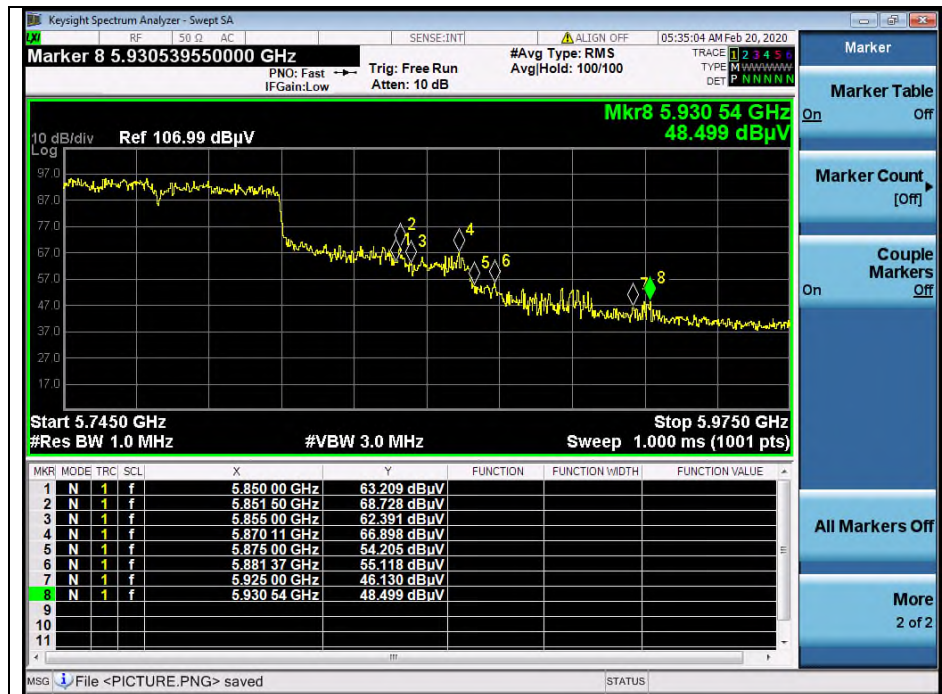


OFDM: 802.11ac_VHT80 (MCS9)_ANT 1 + ANT 2

Middle channel Band edge (Peak) - Band 3



Middle channel Band edge (Peak) - Band 3



3. 26 dB Bandwidth & 99 % Bandwidth

3.1. Test Setup



3.2. Limit

None; for reporting purpose only.

3.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

3.3.1. 26 dB Bandwidth

1. This measurement settings are specified in section II.C.1 of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW = approximately 1 % of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

3.2.2. 99 % Bandwidth

3.2.2.1 FCC

1. This measurement settings are specified in section II.D of KDB 789033 D02 General UNII Test

Procedures New Rules v02r01.

2. Set center frequency to the nominal EUT channel center frequency.
3. Set span = 1.5 times to 5.0 times the OBW.
4. Set RBW = 1 % to 5 % of the OBW.
5. Set VBW $\geq 3 \times$ RBW.
6. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
7. Use the 99 % power bandwidth function of the instrument (if available).
8. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99 % occupied bandwidth is the difference between these two frequencies.

3.2.2.2 IC

- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99 % emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99 % emission bandwidth).

3.4. Test Result

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

Test mode: 11a

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
				ANT 1	ANT 2	ANT 1	ANT 2
U-NII 3	5 745	149	6	21.534	21.187	17.192	17.250
	5 785	157		21.245	21.071	17.077	17.135
	5 825	165		21.187	21.187	17.077	17.077

Test mode: 11n_HT20

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
				ANT 1	ANT 2	ANT 1	ANT 2
U-NII 3	5 745	149	MCS15	21.360	21.245	18.061	18.061
	5 785	157		21.245	21.476	18.061	18.061
	5 825	165		21.418	21.418	18.061	18.061

Test mode: 11n_HT40

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
				ANT 1	ANT 2	ANT 1	ANT 2
U-NII 3	5 755	151	MCS15	39.711	39.826	36.237	36.122
	5 795	159		39.711	39.711	36.237	36.237

Test mode: 11ac_VHT80

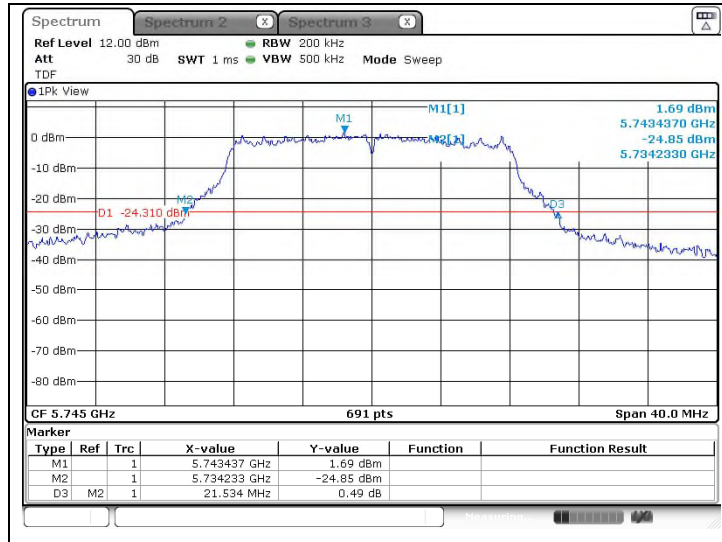
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
				ANT 1	ANT 2	ANT 1	ANT 2
U-NII 3	5 775	155	MCS9	81.968	82.431	75.948	75.948

- Test plots

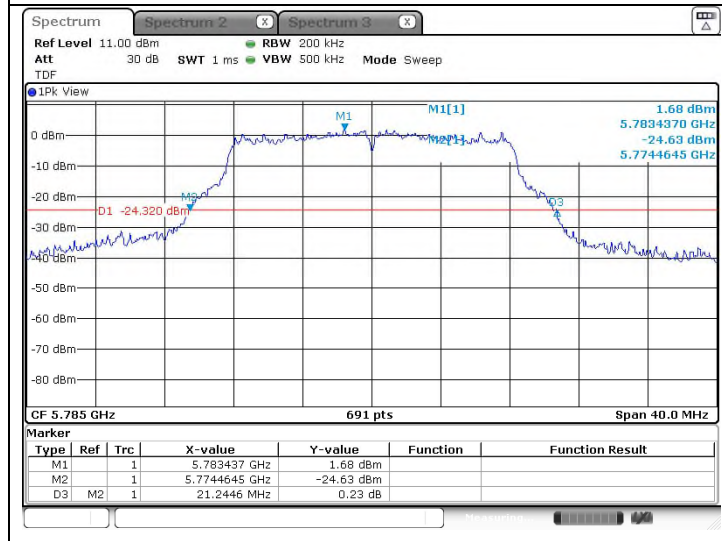
26 dB Bandwidth

802.11a (Band 3)_ANT 1

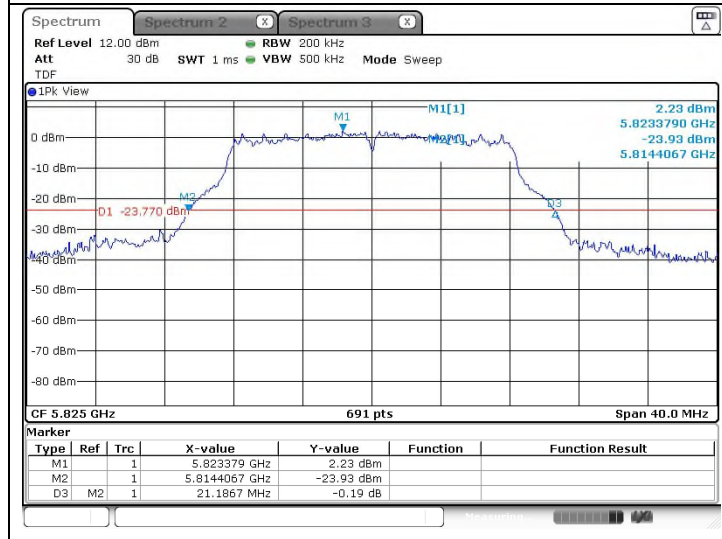
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

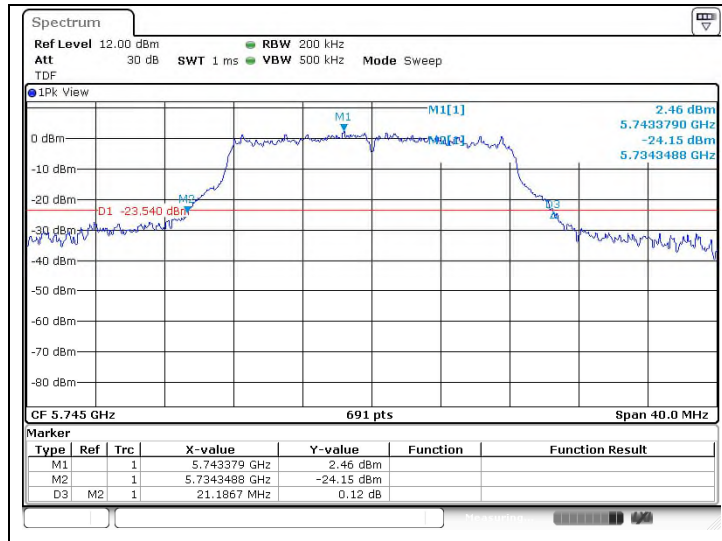


High Channel
(5 825 MHz)

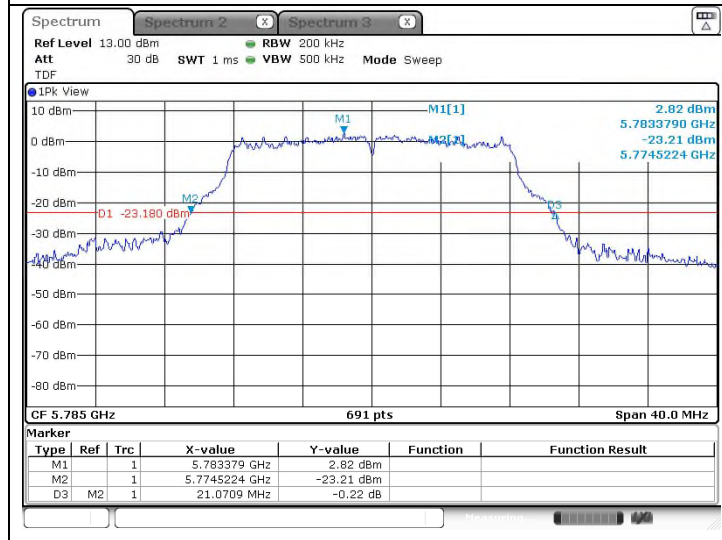


802.11a (Band 3)_ANT 2

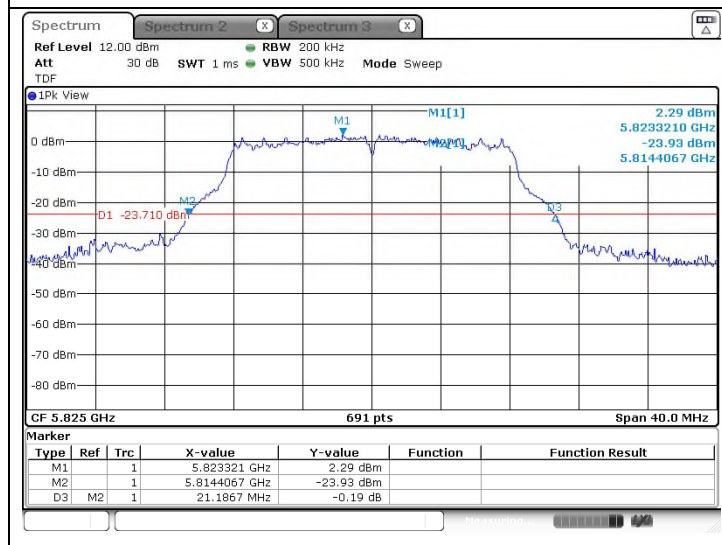
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

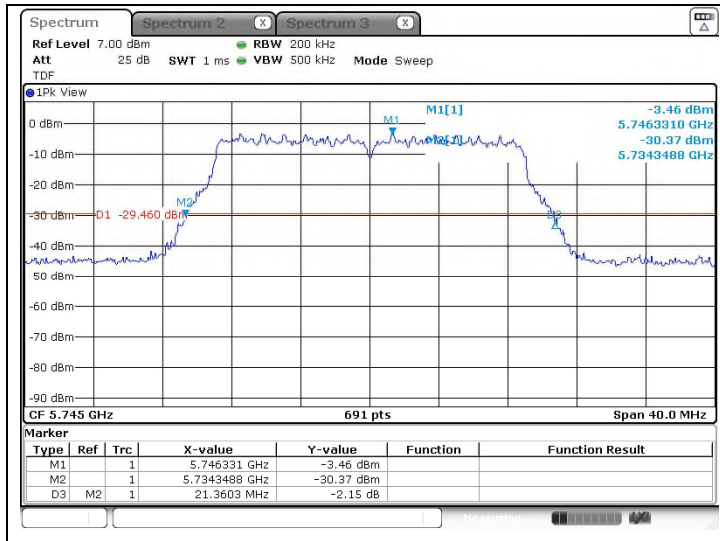


High Channel
(5 825 MHz)

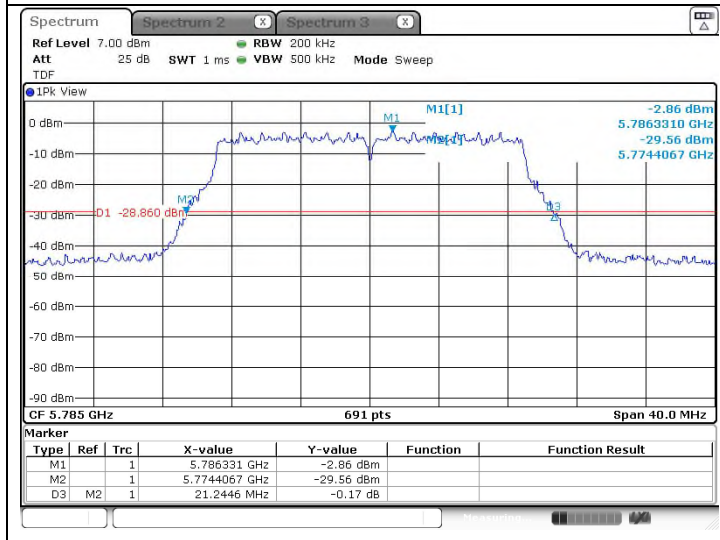


802.11n_HT20 (Band 3)_ANT 1

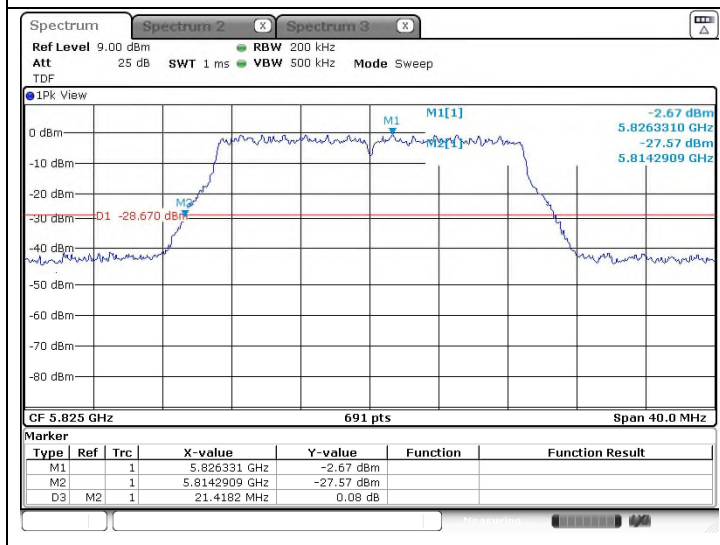
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

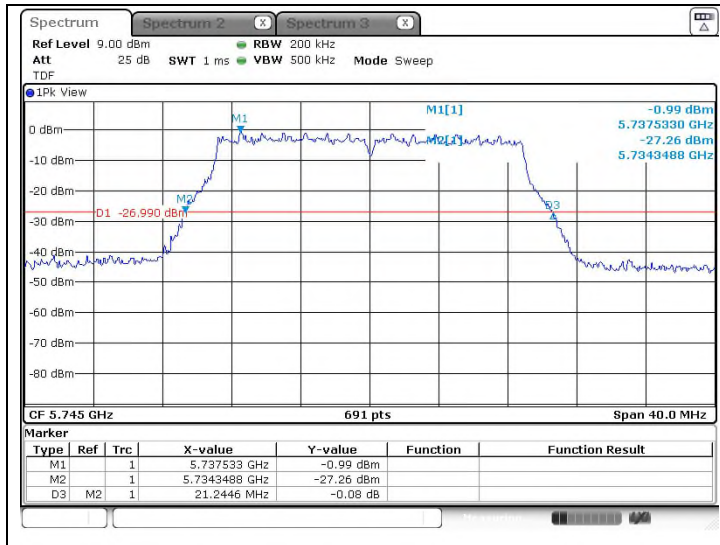


High Channel
(5 825 MHz)

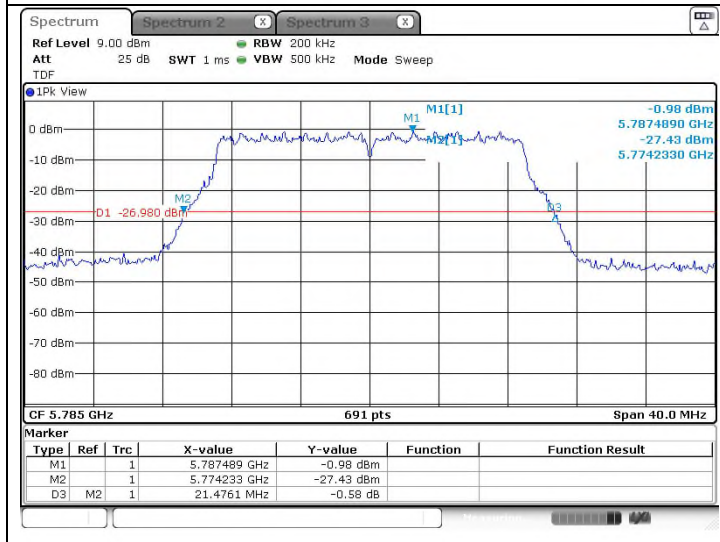


802.11n_HT20 (Band 3)_ANT 2

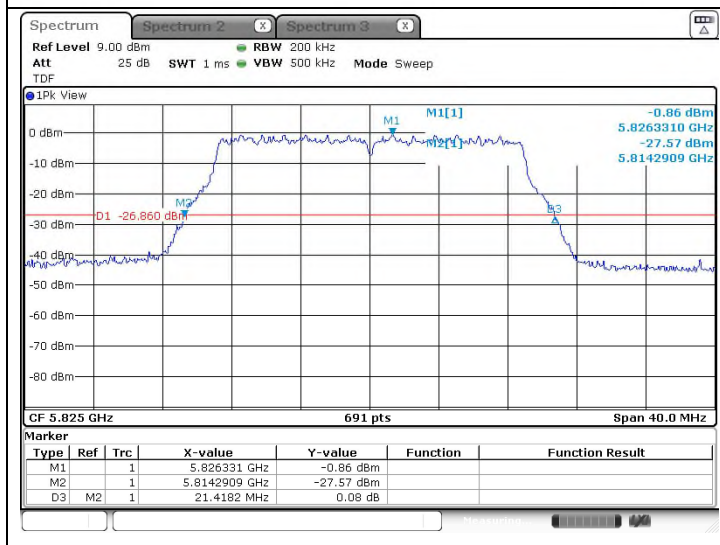
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

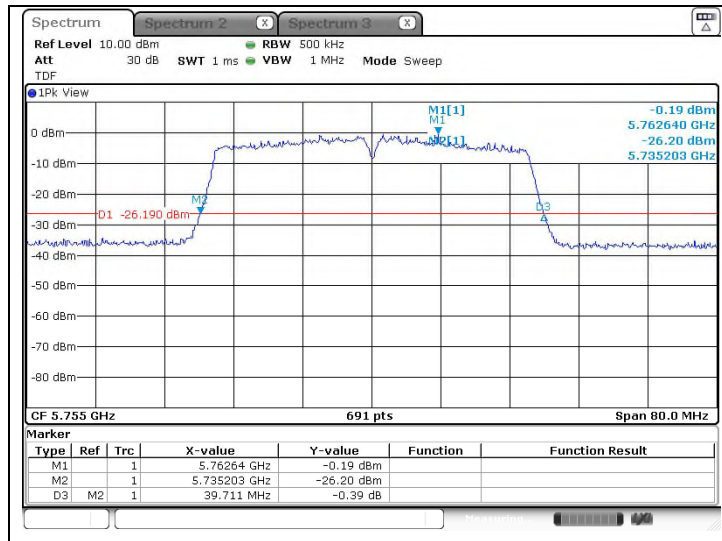


High Channel
(5 825 MHz)

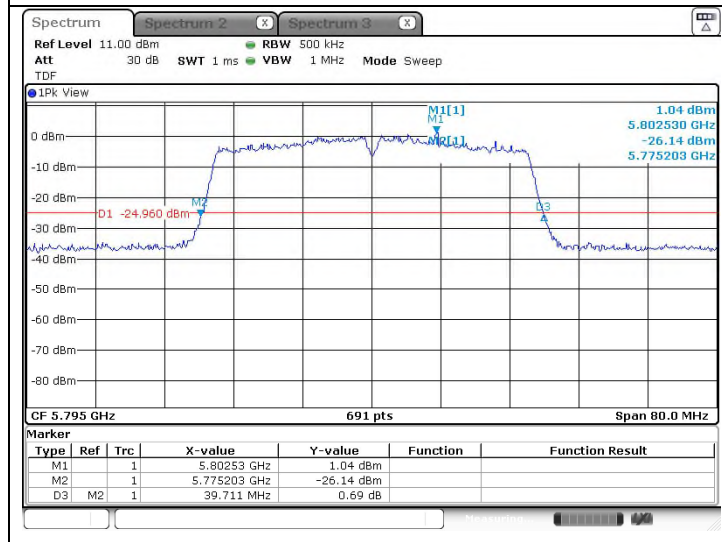


802.11n_HT40 (Band 3)_ANT 1

Low Channel
(5 755 MHz)

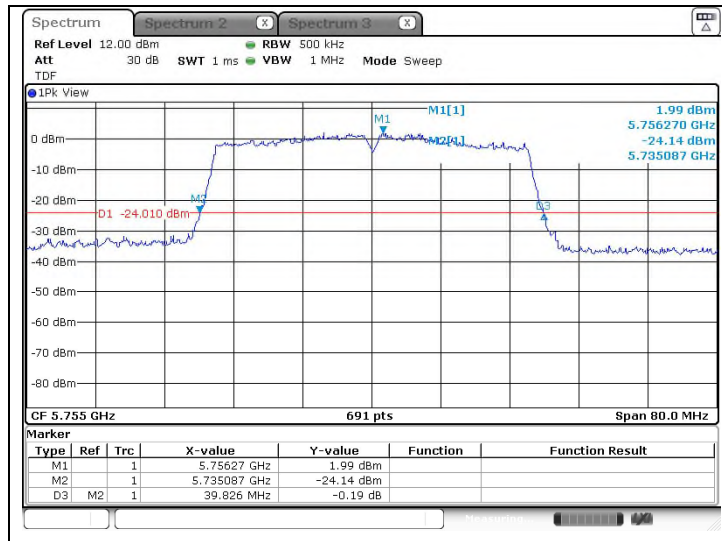


High Channel
(5 795 MHz)

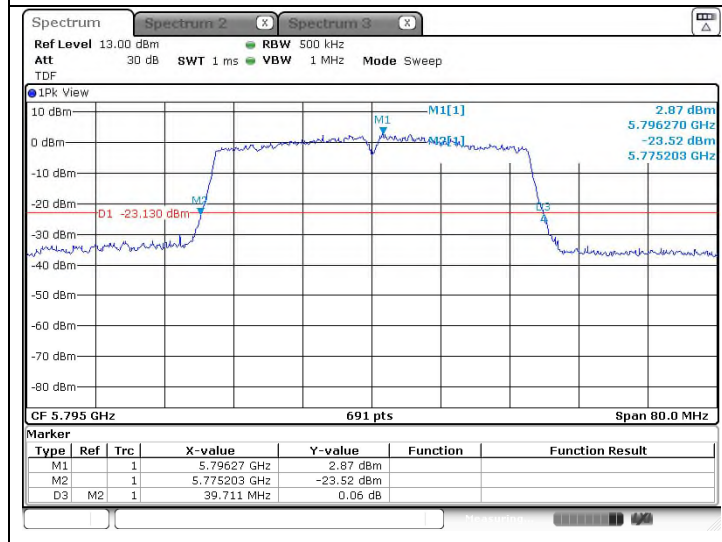


802.11n_HT40 (Band 3)_ANT 2

Low Channel
(5 755 MHz)

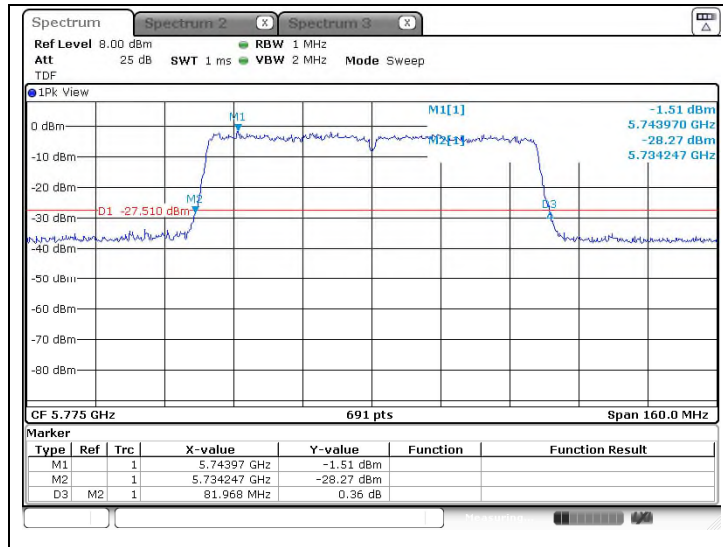


High Channel
(5 795 MHz)



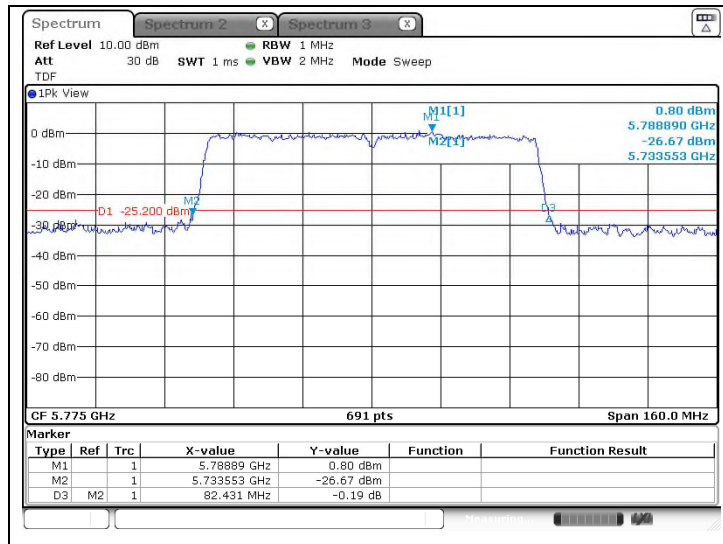
802.11ac_VHT80 (Band 3)_ANT 1

Middle Channel
(5 775 MHz)



802.11ac_VHT80 (Band 3)_ANT 2

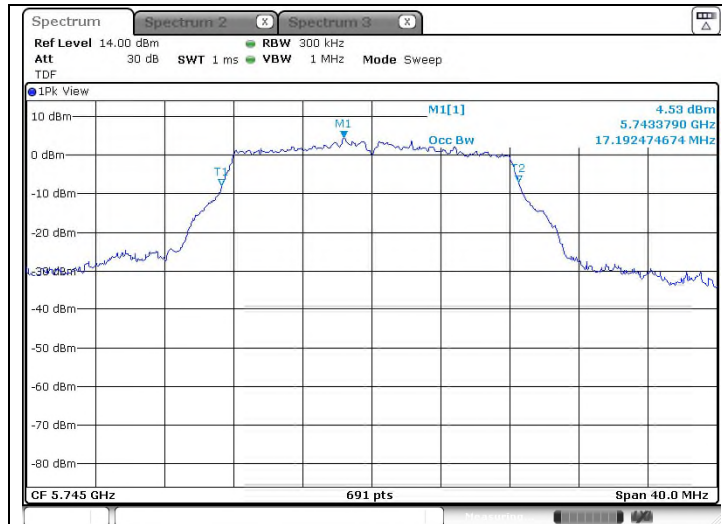
Middle Channel
(5 775 MHz)



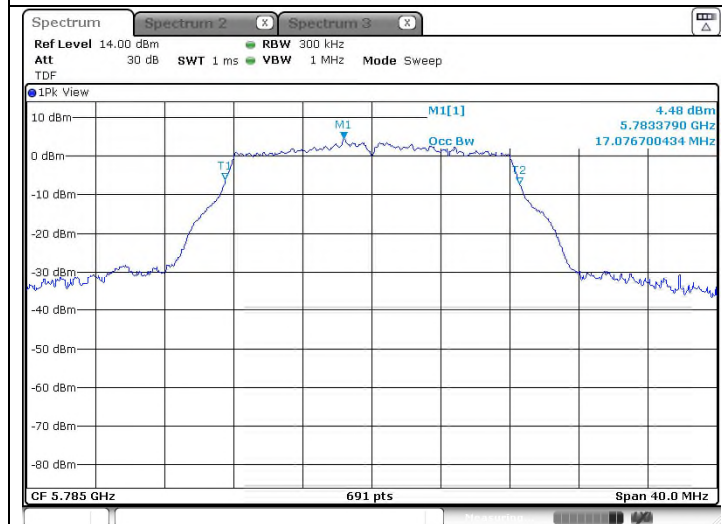
99 % Bandwidth

802.11a (Band 3)_ANT 1

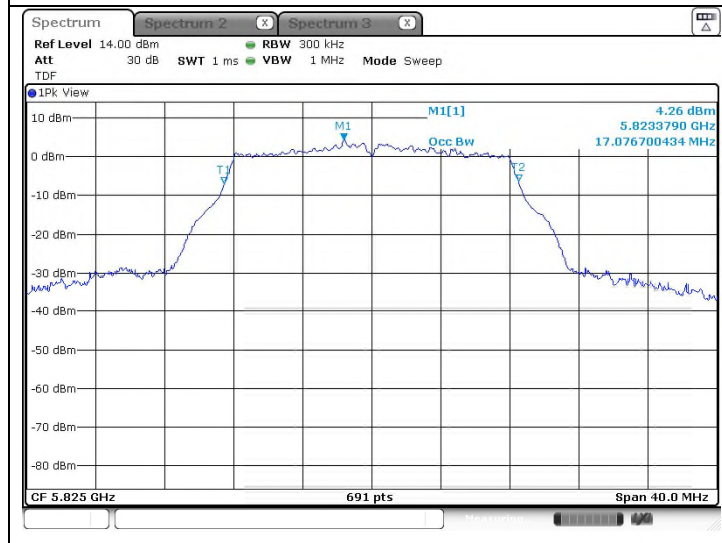
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

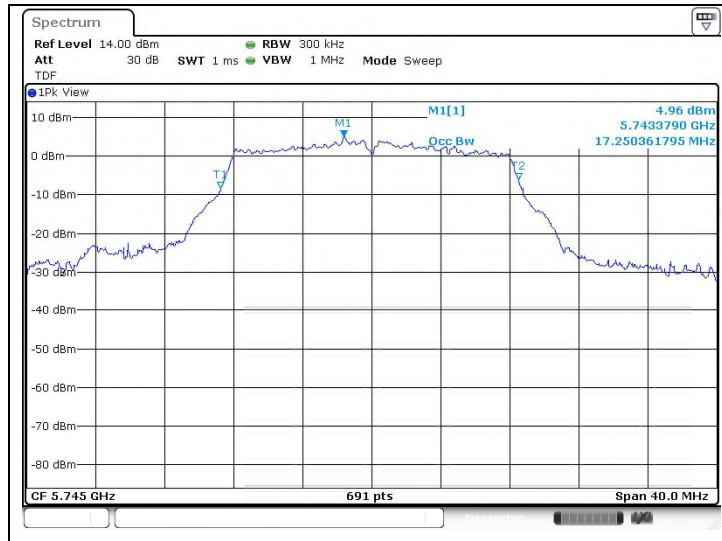


High Channel
(5 825 MHz)

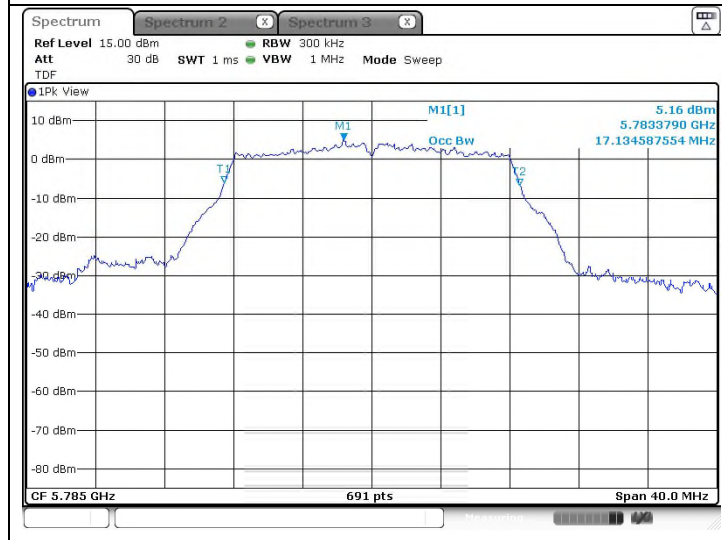


802.11a (Band 3)_ANT 2

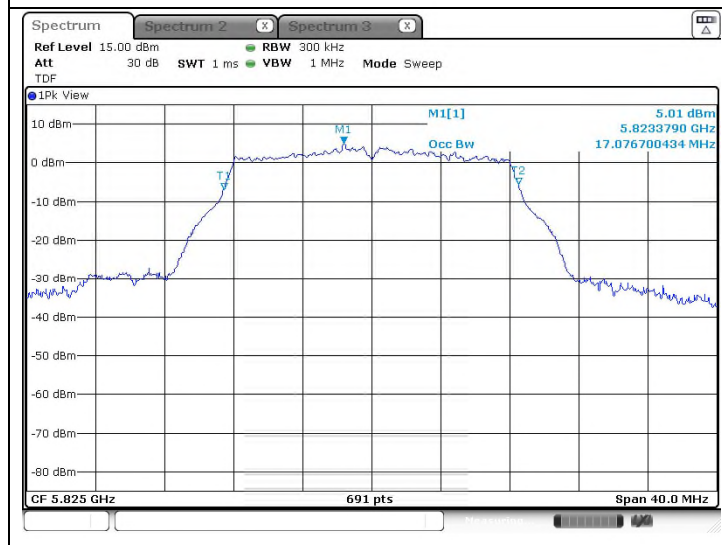
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

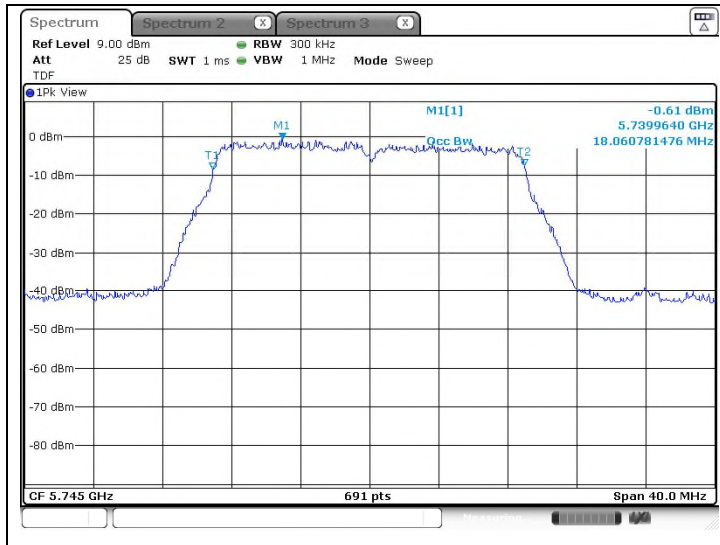


High Channel
(5 825 MHz)

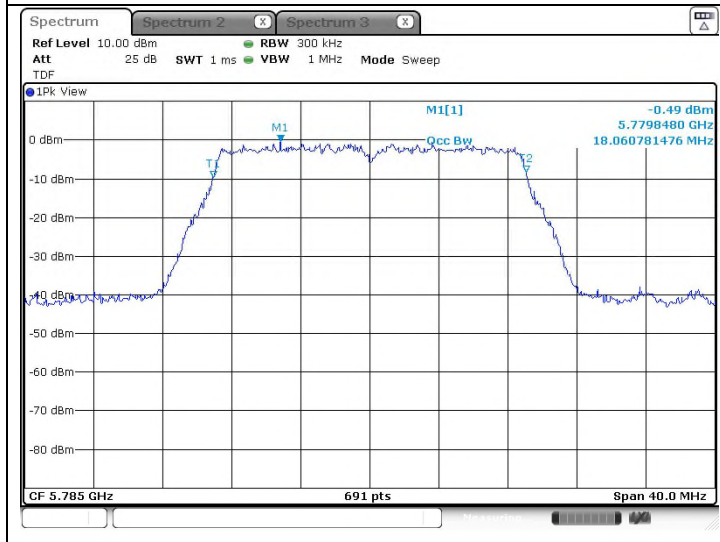


802.11n_HT20 (Band 3)_ANT 1

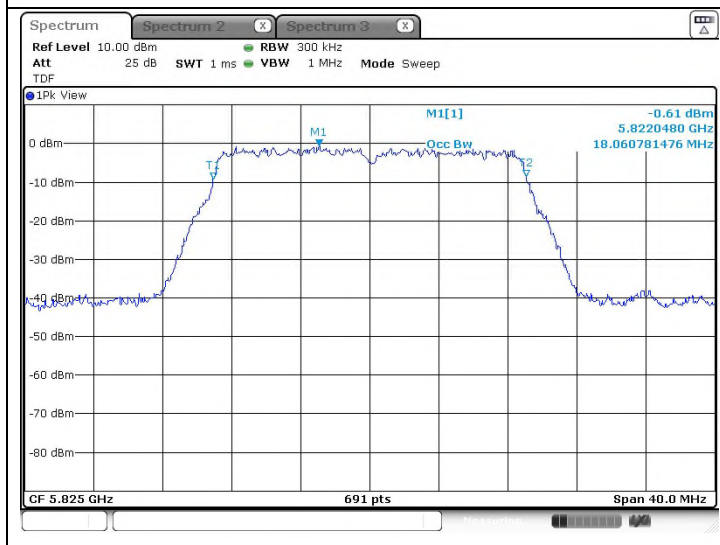
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

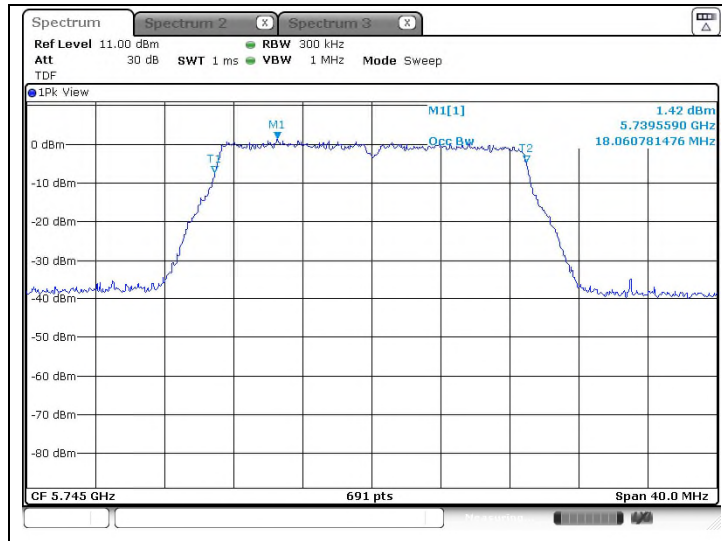


High Channel
(5 825 MHz)

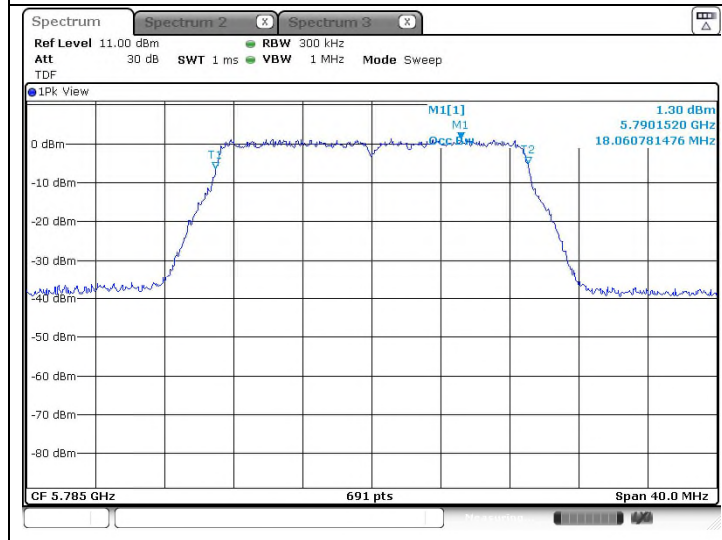


802.11n_HT20 (Band 3)_ANT 2

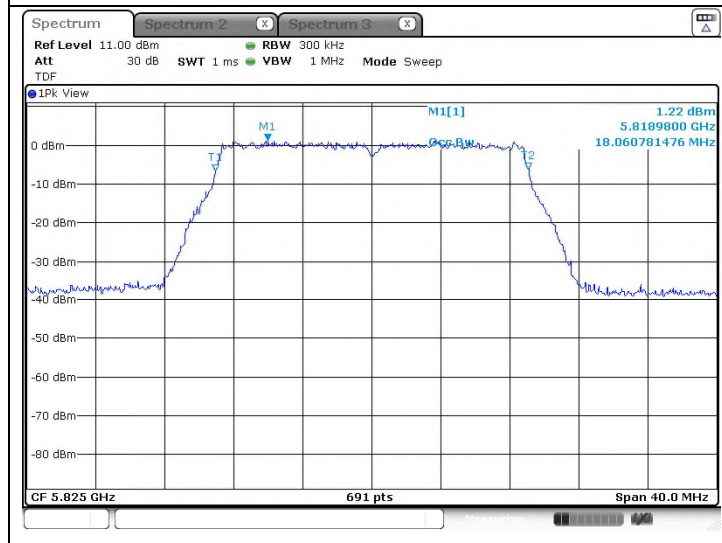
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

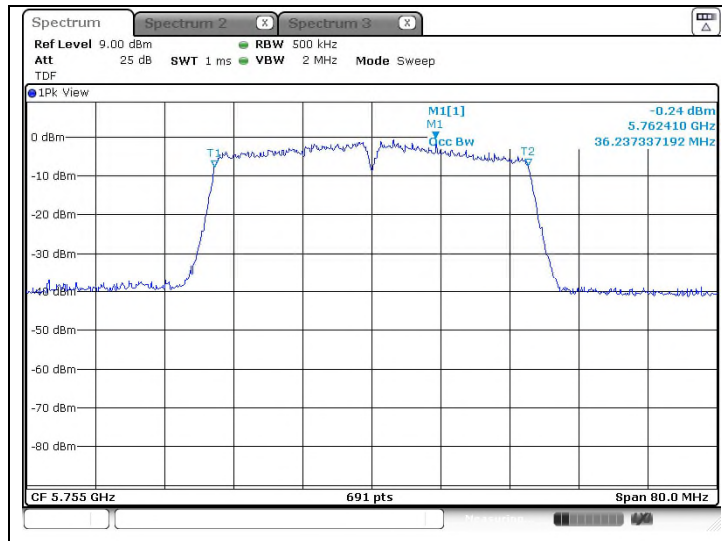


High Channel
(5 825 MHz)

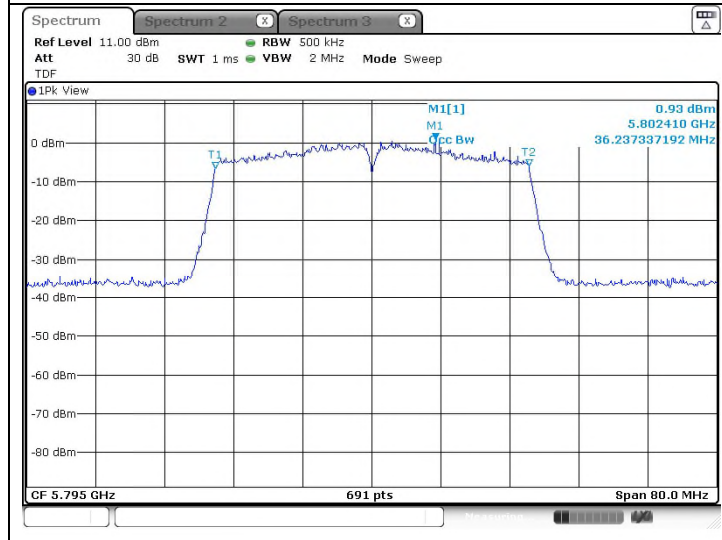


802.11n_HT40 (Band 3)_ANT 1

Low Channel
(5 755 MHz)

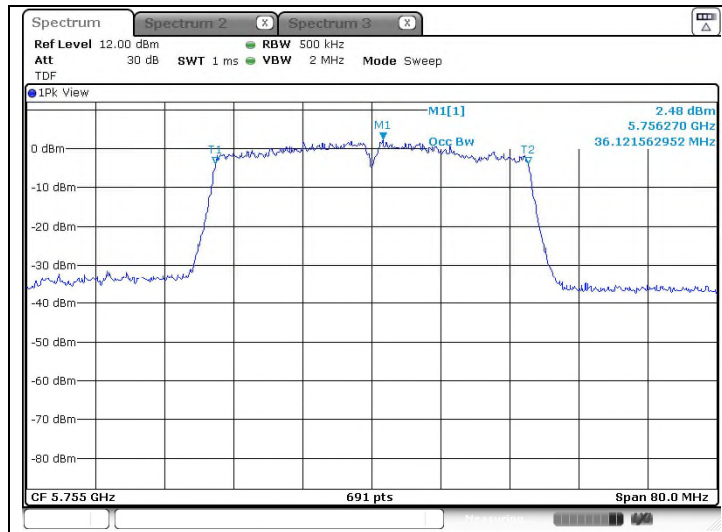


High Channel
(5 795 MHz)

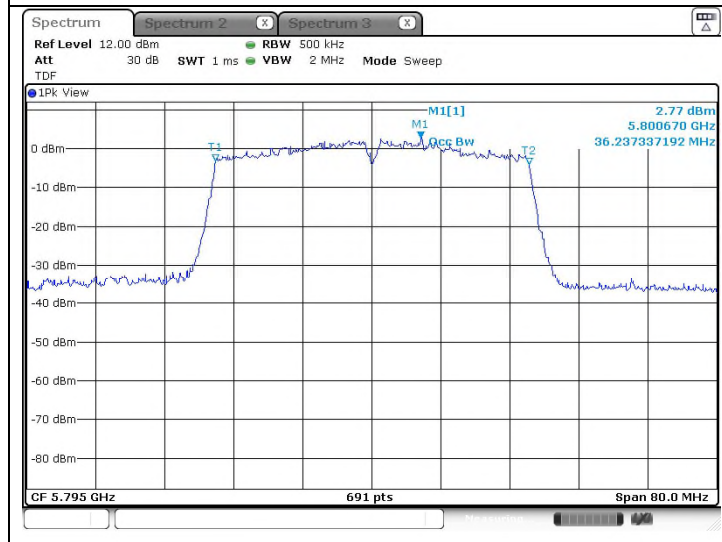


802.11n_HT40 (Band 3)_ANT 2

Low Channel
(5 755 MHz)

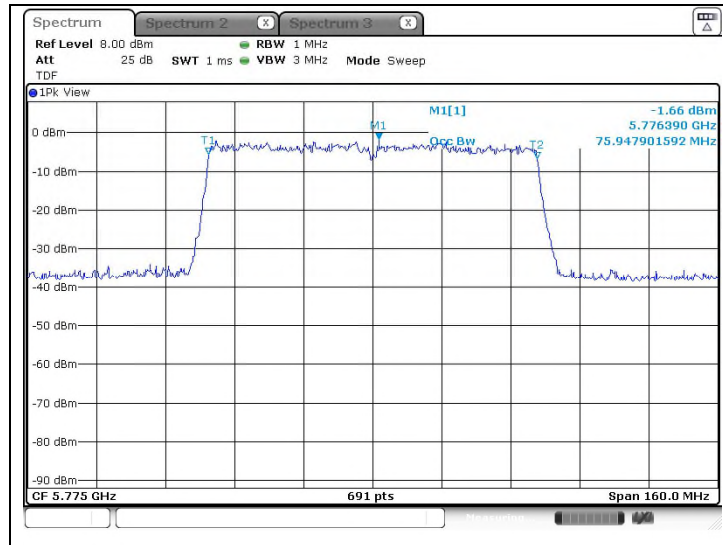


High Channel
(5 795 MHz)



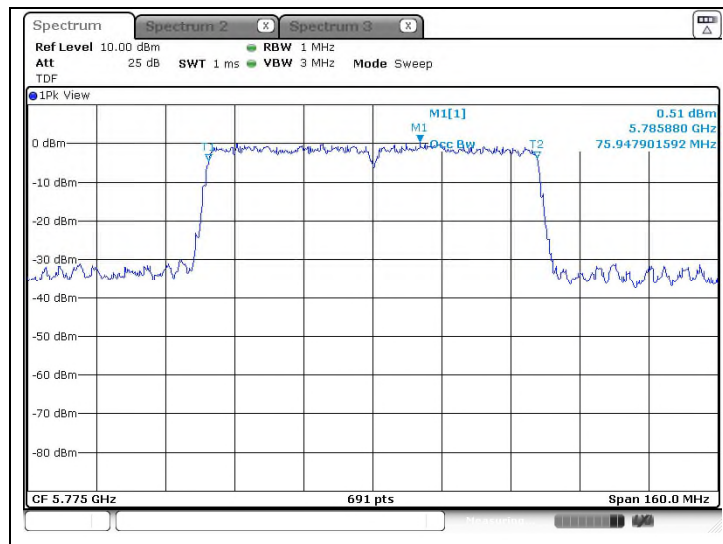
802.11ac_VHT80 (Band 3)_ANT 1

Middle Channel
(5 775 MHz)



802.11ac_VHT80 (Band 3)_ANT 2

Middle Channel
(5 775 MHz)



4. 6 dB Bandwidth

4.1. Test Setup



4.2. Limit

4.2.1. FCC

According to §15.407(e), within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

4.2.2. IC

According to RSS-247 Issue 2, 6.2.4.1, the minimum -6 dB Bandwidth shall be at least 500 kHz.

4.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in section II.C.2 of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW = 100 kHz.
3. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

4.4. Test Result

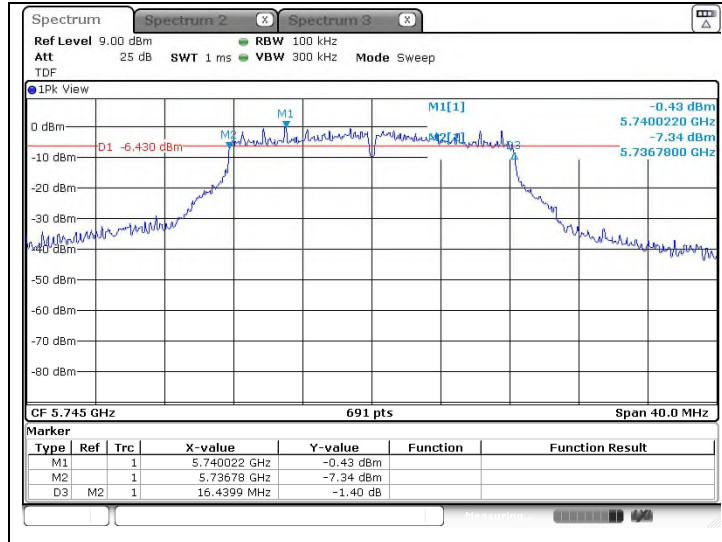
Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 % R.H.

Band	Mode	Frequency (MHz)	Ch.	Data Rate (Mbps)	6 dB Bandwidth (MHz)		Minimum Bandwidth (kHz)
					ANT 1	ANT 2	
U-NII 3	11a	5 745	149	6	16.440	16.440	500
		5 785	157		16.440	16.440	
		5 825	165		16.440	16.440	
	11n_HT20	5 745	149	MCS15	17.829	17.829	
		5 785	157		17.771	17.771	
		5 825	165		17.829	17.771	
	11n_HT40	5 755	151	MCS15	36.237	36.237	
		5 795	159		36.585	36.585	
	11ac_VHT80	5 775	155	MCS9	76.874	76.874	

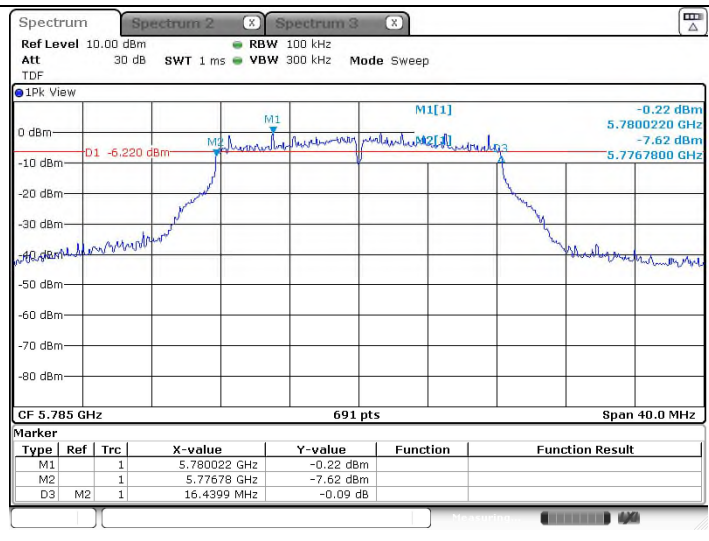
- Test plots

802.11a (Band 3)_ANT 1

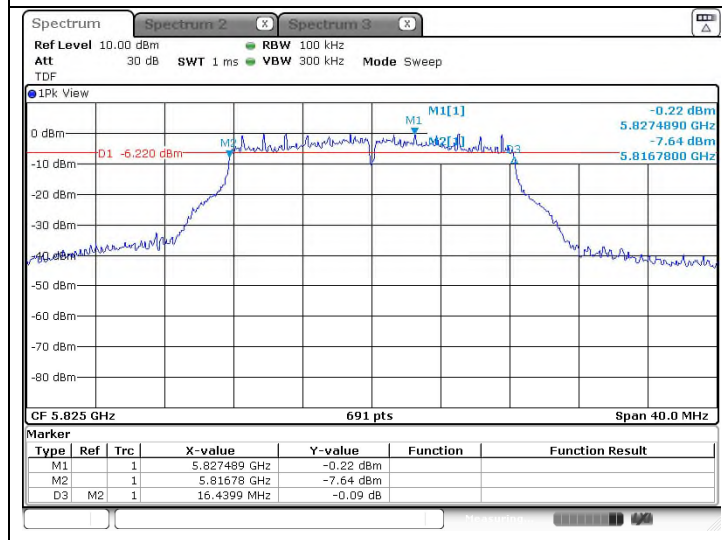
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

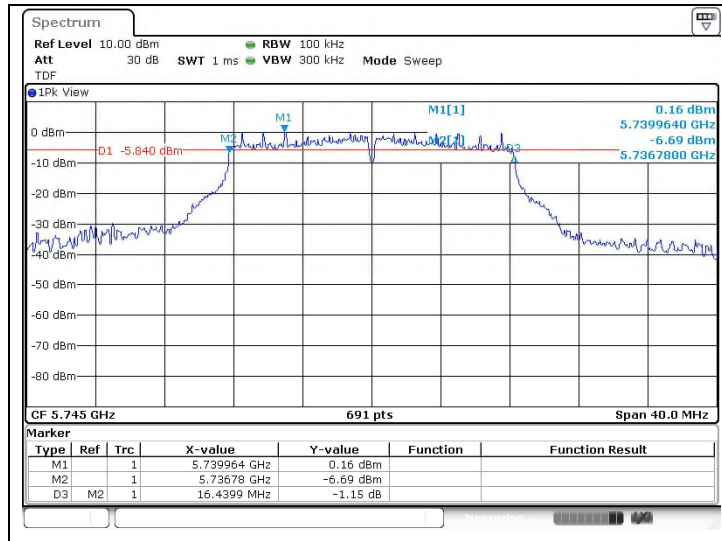


High Channel
(5 825 MHz)

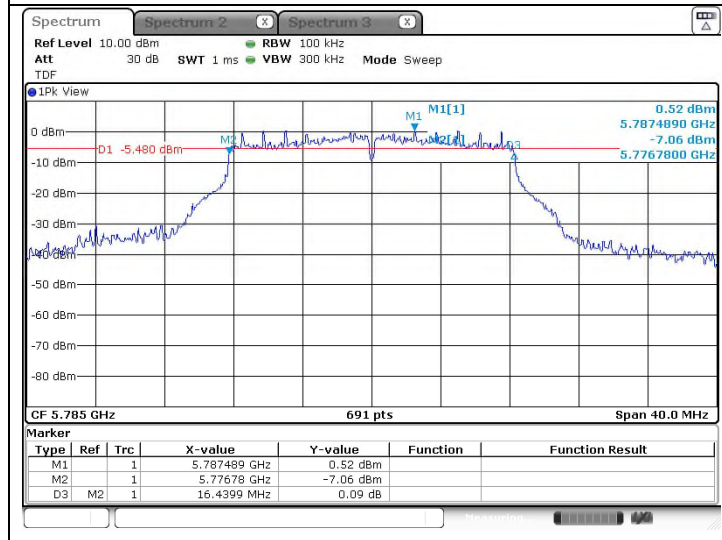


802.11a (Band 3)_ANT 2

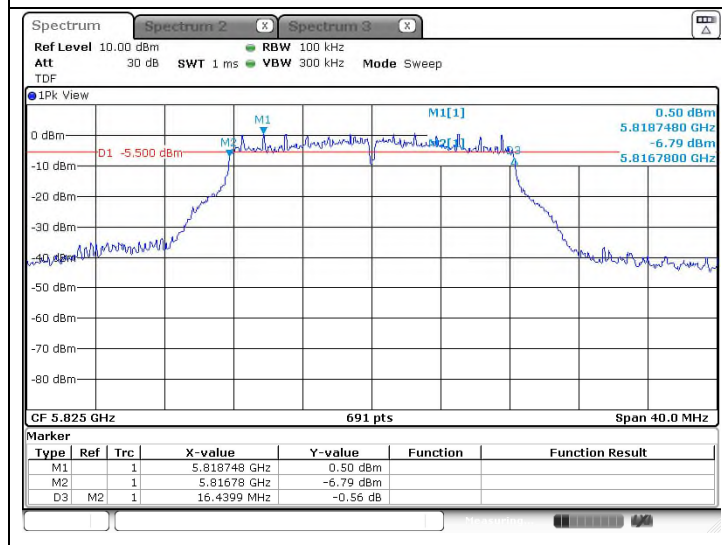
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

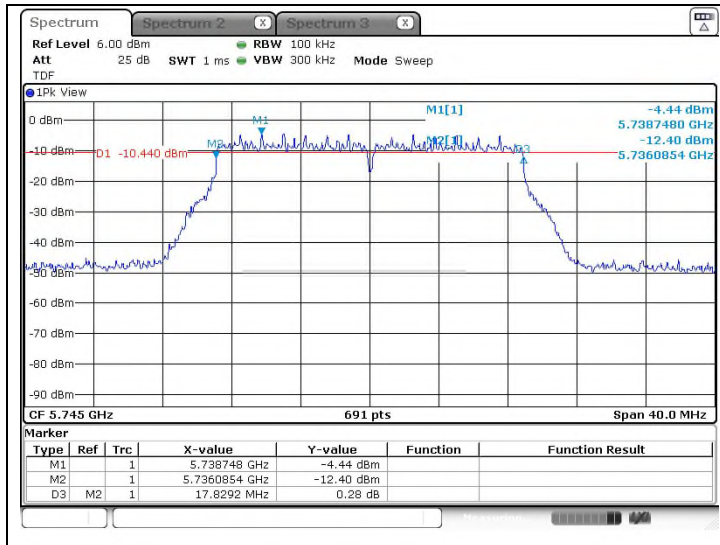


High Channel
(5 825 MHz)

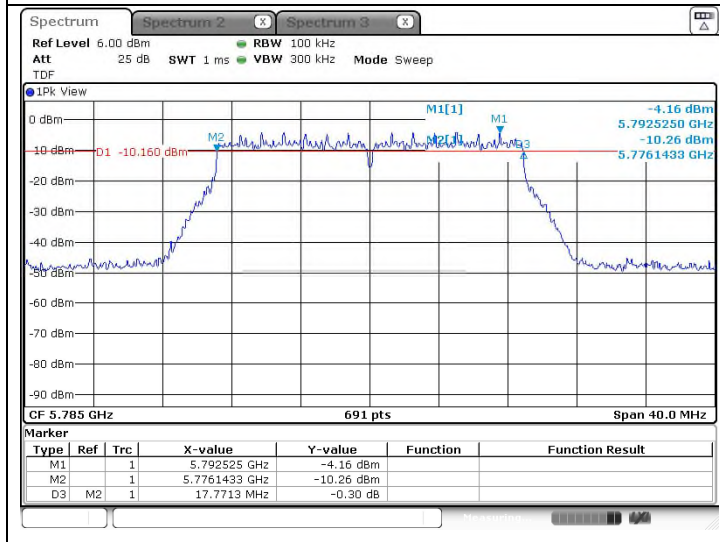


802.11n_HT20 (Band 3)_ANT 1

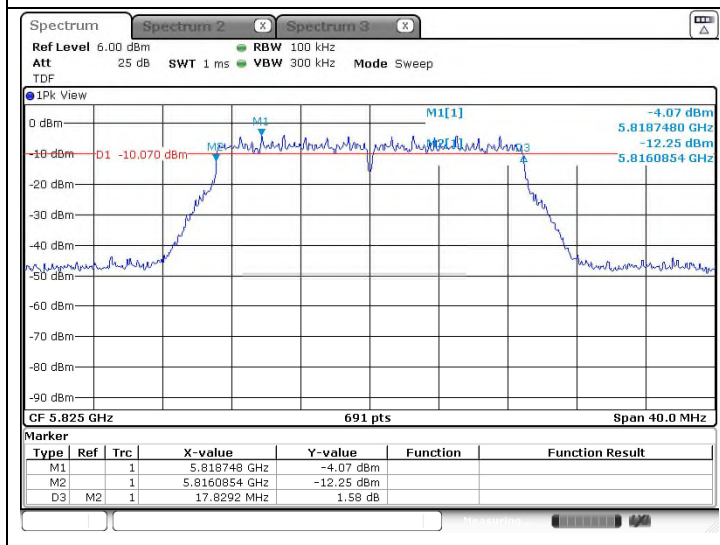
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

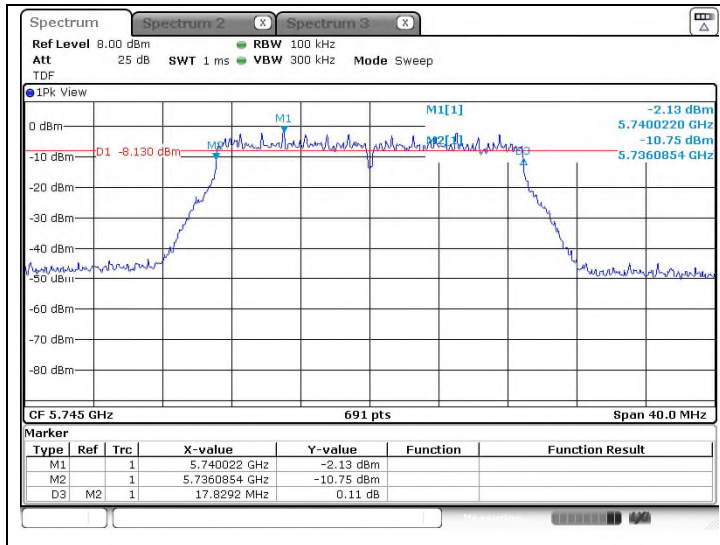


High Channel
(5 825 MHz)

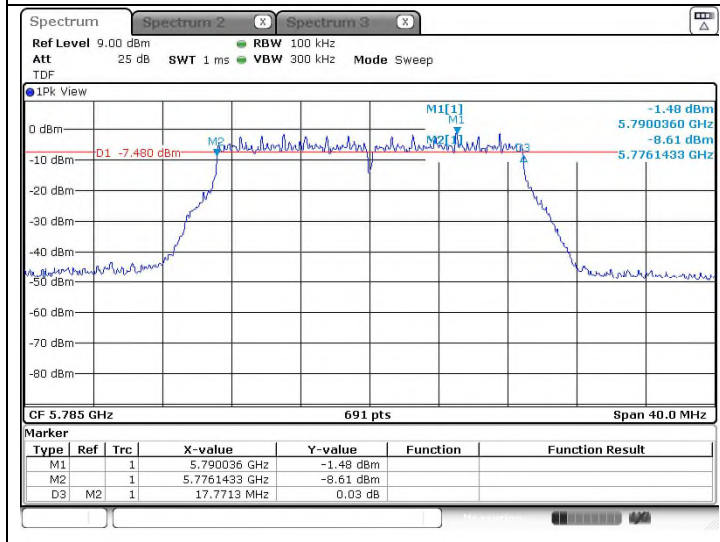


802.11n_HT20 (Band 3)_ANT 2

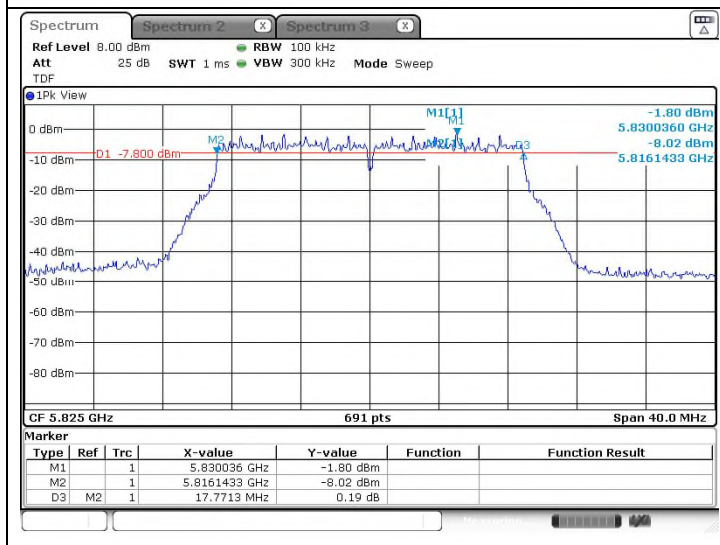
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

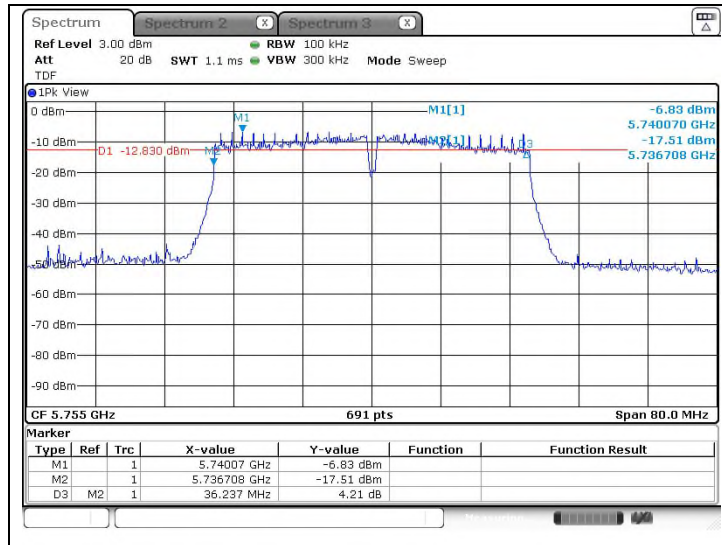


High Channel
(5 825 MHz)

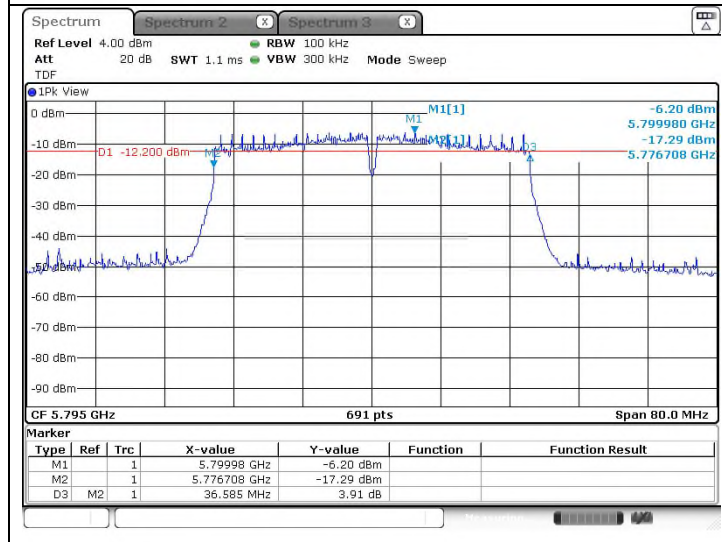


802.11n_HT40 (Band 3)_ANT 1

Low Channel
(5 755 MHz)

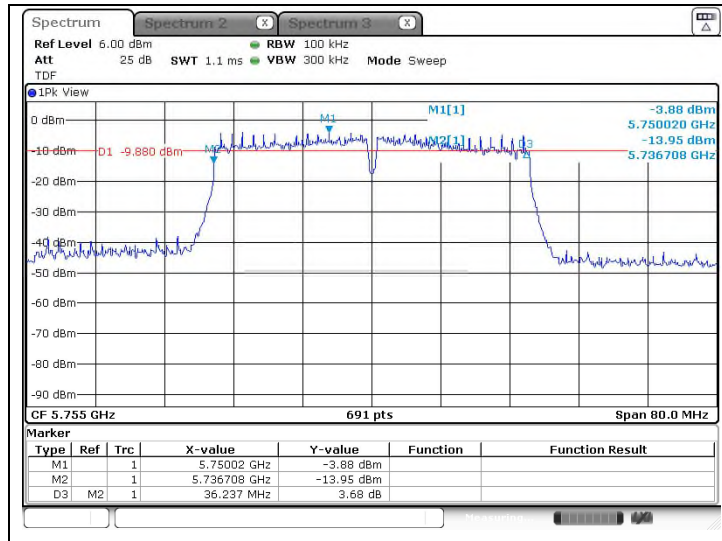


High Channel
(5 795 MHz)

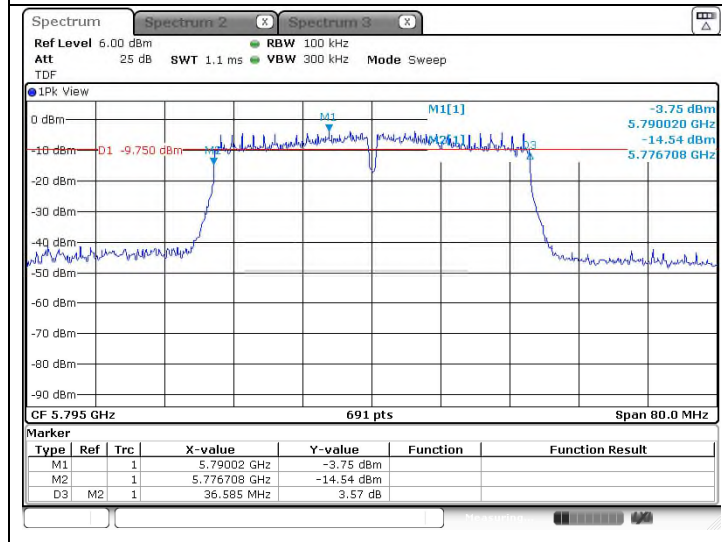


802.11n_HT40 (Band 3)_ANT 2

Low Channel
(5 755 MHz)

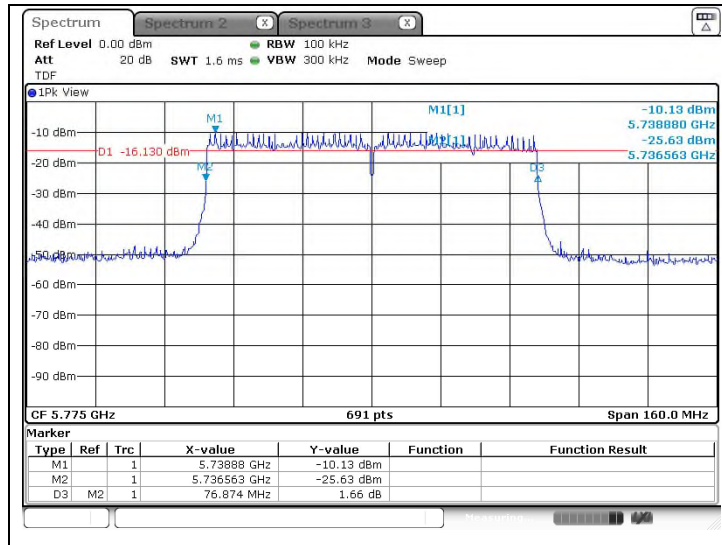


High Channel
(5 795 MHz)



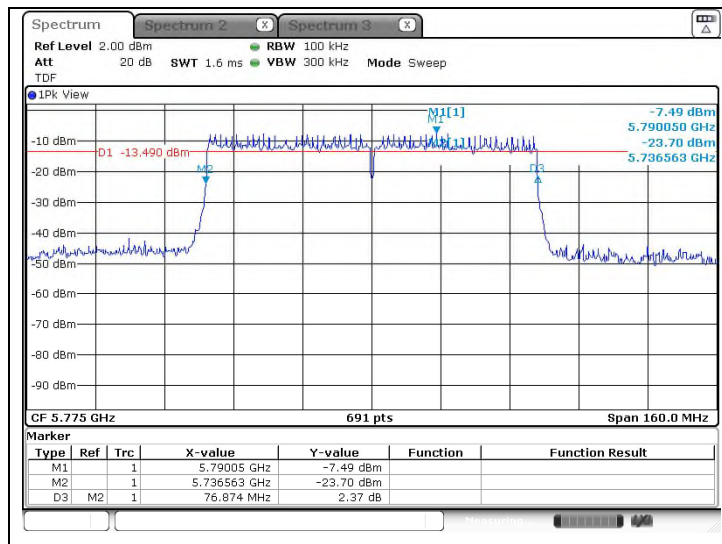
802.11ac_VHT80 (Band 3)_ANT 1

Middle Channel
(5 775 MHz)



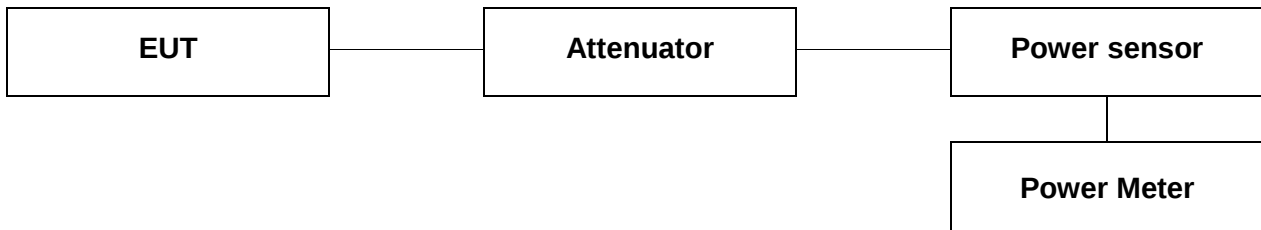
802.11ac_VHT80 (Band 3)_ANT 2

Middle Channel
(5 775 MHz)



5. Maximum Conducted Output Power

5.1. Test Setup



5.2. Limit

5.2.1. FCC

According to 15.407(a)(3)

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

5.2.2. IC

According to RSS-247 Issue 2,

6.2.4.1 Frequency band 5 725-5 850 MHz

For equipment operating in the band 5 725-5 850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint³ systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

5.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in section II.E.3.a of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied:
 - The EUT is configured to transmit continuously or to transmit with a consistent duty cycle.
 - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
 - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
3. If the transmitter does not transmit continuously, measure the duty cycle, x , of the transmitter output signal as described in section II.B.
4. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
5. Adjust the measurement in dBm by adding $10 \log (1/x)$ where x is the duty cycle (e.g., $10 \log (1/0.25)$ if the duty cycle is 25 %).
6. In case of band crossing channels 138, 142 and 144, the measurement is complied with section III.A of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

5.4. Test Result

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

Test mode: 11a_ANT 1

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)	Limit (dB m)
U-NII 3	5 745	6	12.10	0.29	12.39	30
	5 785		12.65		12.94	
	5 825		11.78		12.07	

Test mode: 11a_ANT 2

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)	Limit (dB m)
U-NII 3	5 745	6	13.08	0.29	13.37	30
	5 785		13.41		13.70	
	5 825		12.51		12.80	

Test mode: 11n_HT20_ANT 1 + ANT 2

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)		
			ANT 1	ANT 2	ANT 1 + ANT 2
U-NII 3	5 745	MCS15	5.29	7.95	9.83
	5 785		5.75	8.15	10.12
	5 825		5.02	7.77	9.62

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)	Limit (dB m)
			ANT 1 + ANT 2		ANT 1 + ANT 2	
U-NII 3	5 745	MCS15	9.83	2.89	12.72	30
	5 785		10.12		13.01	
	5 825		9.62		12.51	

Test mode: 11n_HT40_ANT 1 + ANT 2

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)		
			ANT 1	ANT 2	ANT 1 + ANT 2
U-NII 3	5 755	MCS15	4.58	7.62	9.37
	5 795		4.71	7.45	9.30

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)	Limit (dB m)
			ANT 1 + ANT 2		ANT 1 + ANT 2	
U-NII 3	5 755	MCS15	9.37	3.81	13.18	30
	5 795		9.30		13.11	

Test mode: 11ac_VHT80_ANT 1 + ANT 2

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)		
			ANT 1	ANT 2	ANT 1 + ANT 2
U-NII 3	5 755	MCS9	3.81	6.25	8.21

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)	Limit (dB m)
			ANT 1 + ANT 2		ANT 1 + ANT 2	
U-NII 3	5 775	MCS9	8.21	4.51	12.72	30

Remark;

Attenuator and cable offset was compensated in test program (R&S Power Viewer) before measuring.

According to KDB 662911 D01 v02r01, average power of each port (ANT 1+ANT 2) and antenna gain was combined by using below calculation.

Average power: $10 \log \{10^{(\text{ANT 1 power} / 10)} + 10^{(\text{ANT 2 power} / 10)}\}$

Average Power Result(dB m) = Average Power (dB m) + Duty Cycle Correction Factor (dB)

6. Peak Power Spectral Density

6.1. Test Setup



6.2. Limit

6.2.1 FCC

According to 15.407(a)(3)

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

6.2.2 IC

According to RSS-247 Issue 2,

6.2.4.1 Frequency band 5 725-5 850 MHz

For equipment operating in the band 5 725-5 850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint³ systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

6.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in section II.F of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power...". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
3. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
4. Make the following adjustments to the peak value of the spectrum, if applicable:
 - a) **If Method SA-2 or SA-2 Alternative was used, add $10 \log(1/x)$, where x is the duty cycle, to the peak of the spectrum.**
 - b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
5. The result is the Maximum PSD over 1 MHz reference bandwidth.
6. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (*i.e.*, 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
 - a) Set $RBW \geq 1/T$, where T is defined in section II.B.1.a).
 - b) Set $VBW \geq 3$ RBW.
 - c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log(500 \text{ kHz}/RBW)$ to the measured result, whereas $RBW (< 500 \text{ kHz})$ is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
 - d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10 \log(1 \text{ MHz}/RBW)$ to the measured result, whereas $RBW (< 1 \text{ MHz})$ is the reduced resolution bandwidth of spectrum analyzer set during measurement.
 - e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.
7. In case of band crossing channels 138, 142 and 144, the measurement is complied with section III.A of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

6.4. Test Result

Ambient temperature : (23 ± 1) °C
Relative humidity : 47 % R.H.

Test mode: 11a_ANT 1

Band	Frequency (MHz)	Data Rate (Mbps)	PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 745	6	-6.50	0.29	-6.21	30
	5 785		-6.48		-6.19	
	5 825		-6.06		-5.77	

Test mode: 11a_ANT 2

Band	Frequency (MHz)	Data Rate (Mbps)	PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 745	6	-3.87	0.29	-3.58	30
	5 785		-4.16		-3.87	
	5 825		-3.74		-3.45	

Test mode: 11n_HT20_ANT 1 + ANT 2

Band	Frequency (MHz)	Data Rate (Mbps)	PPSD (dB m)		
			ANT 1	ANT 2	ANT 1 + ANT 2
U-NII 3	5 745	MCS15	-9.76	-6.96	-5.13
	5 785		-10.32	-6.98	-5.33
	5 825		-9.54	-6.85	-4.98

Band	Frequency (MHz)	Data Rate (Mbps)	PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PSD (dB m)	Limit (dB m/500 kHz)
			ANT 1 + ANT 2		ANT 1 + ANT 2	
U-NII 3	5 745	MCS15	-5.13	2.89	-2.24	30
	5 785		-5.33		-2.44	
	5 825		-4.98		-2.09	

Test mode: 11n_HT40_ANT 1 + ANT 2

Band	Frequency (MHz)	Data Rate (Mbps)	PPSD (dB m)		
			ANT 1	ANT 2	ANT 1 + ANT 2
U-NII 3	5 755	MCS15	-12.88	-9.78	-8.05
	5 795		-13.10	-9.73	-8.09

Band	Frequency (MHz)	Data Rate (Mbps)	PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PSD (dB m)	Limit (dB m/500 kHz)
			ANT 1 + ANT 2		ANT 1 + ANT 2	
U-NII 3	5 755	MCS15	-8.05	3.81	-4.24	30
	5 795		-8.09		-4.28	

Test mode: 11ac_VHT80_ANT 1 + ANT 2

Band	Frequency (MHz)	Data Rate (Mbps)	PPSD (dB m)		
			ANT 1	ANT 2	ANT 1 + ANT 2
U-NII 3	5 775	MCS9	-16.77	-14.13	-12.24

Band	Frequency (MHz)	Data Rate (Mbps)	PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PSD (dB m)	Limit (dB m/500 kHz)
			ANT 1 + ANT 2		ANT 1 + ANT 2	
U-NII 3	5 775	MCS9	-12.24	4.51	-7.73	30

Remark;

According to KDB 662911 D01 v02r01, power spectral density of each port (ANT 1 + ANT 2) was combined by using below calculation.

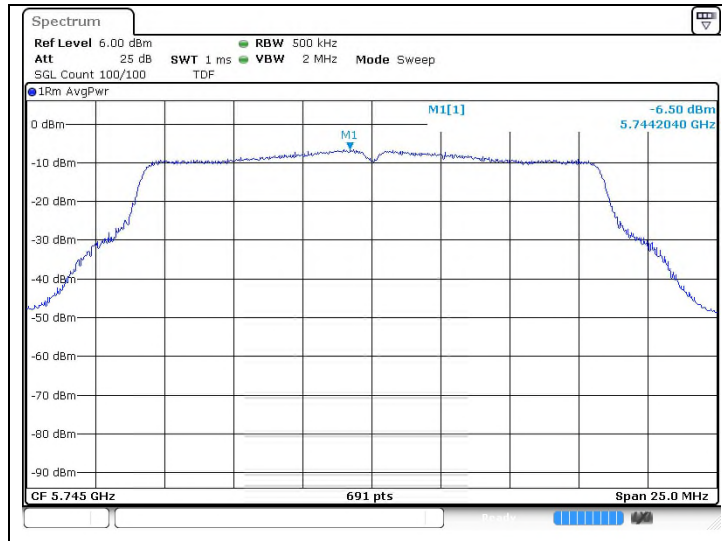
PPSD: $10 \log \{10^{(\text{ANT 1 PSD} / 10)} + 10^{(\text{ANT 2 PSD} / 10)}\}$

Final PSD (dB m) = PSD (dB m) + Duty Correction Correction Factor (dB)

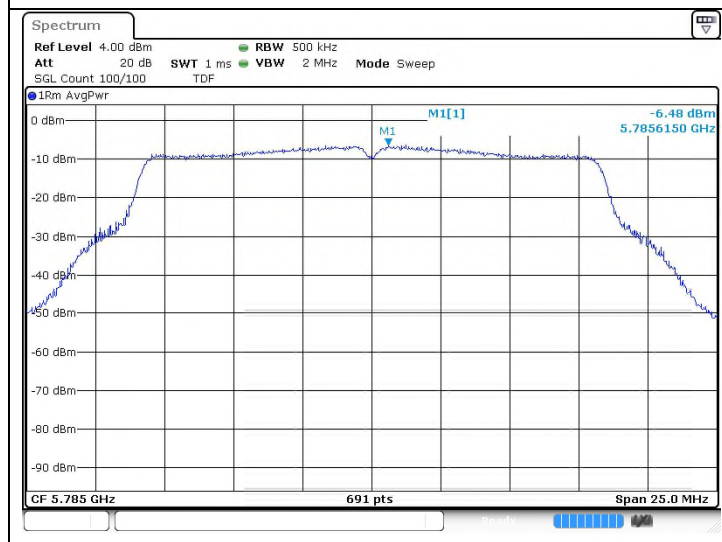
- Test plots

OFDM: 802.11a (Band 3) ANT 1

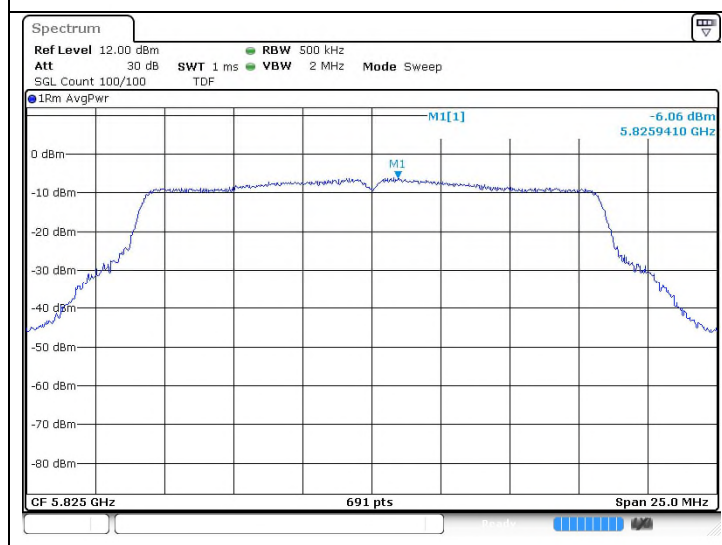
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

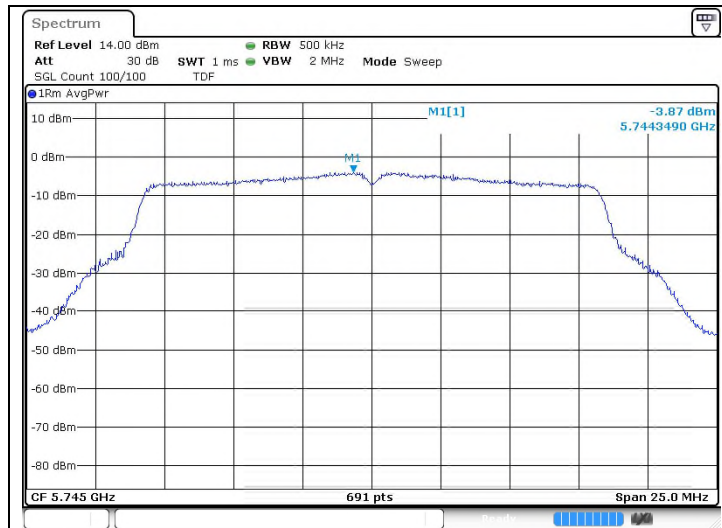


High Channel
(5 825 MHz)

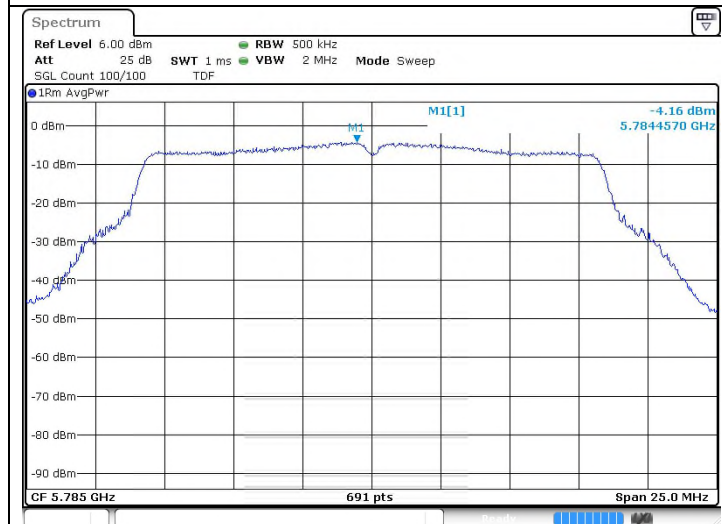


OFDM: 802.11a (Band 3)_ANT 2

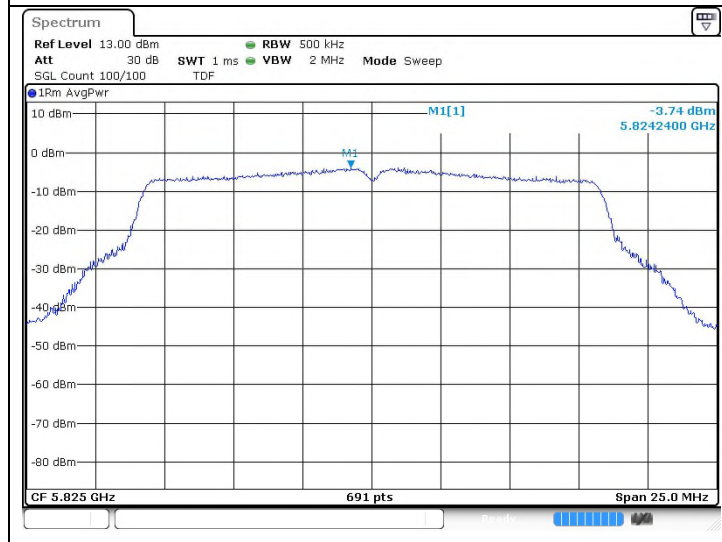
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

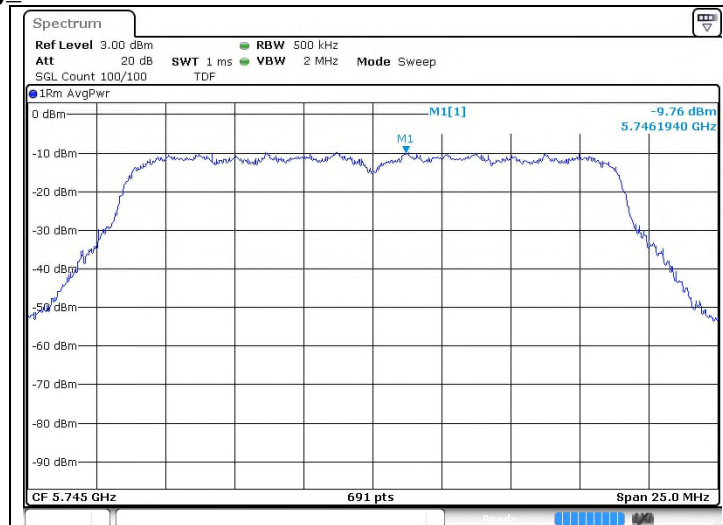


High Channel
(5 825 MHz)

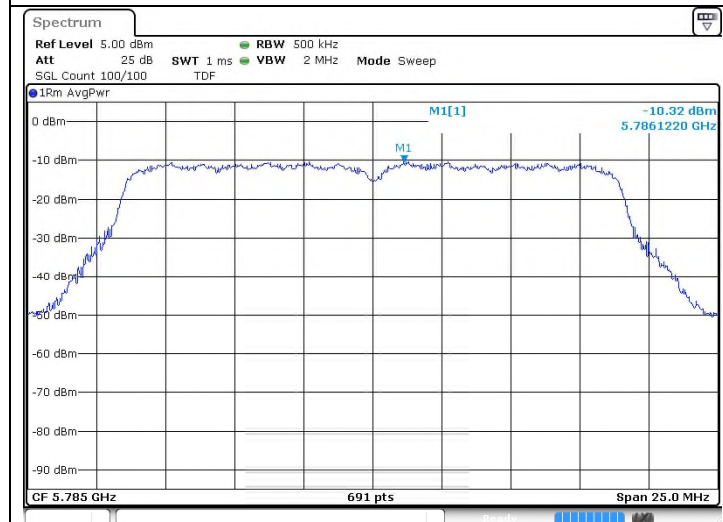


OFDM: 802.11n_HT20 (Band 3) ANT 1

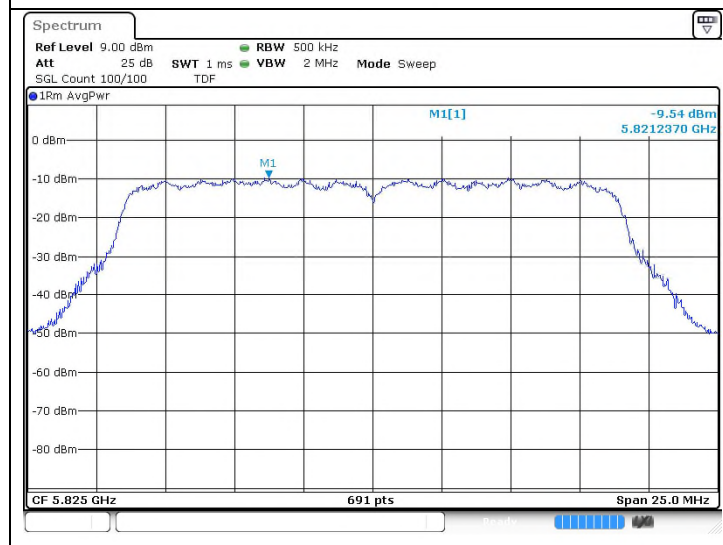
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

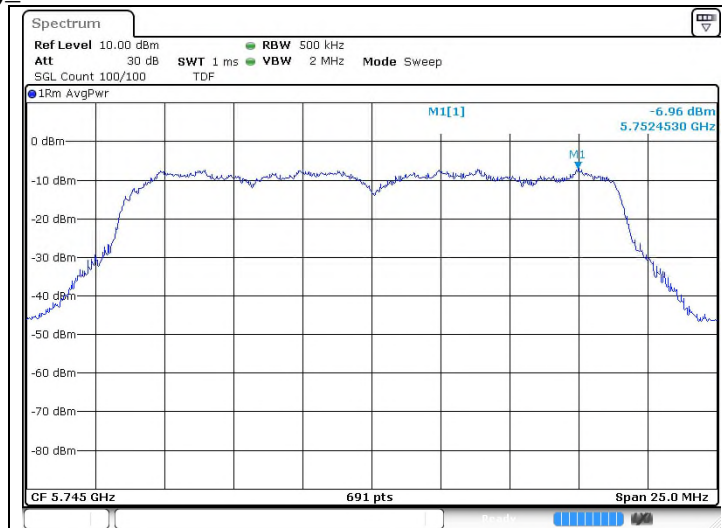


High Channel
(5 825 MHz)

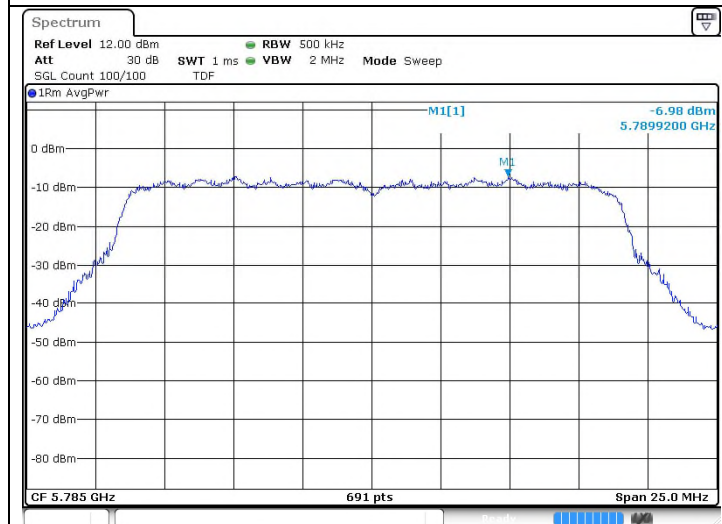


OFDM: 802.11n_HT20 (Band 3) ANT 2

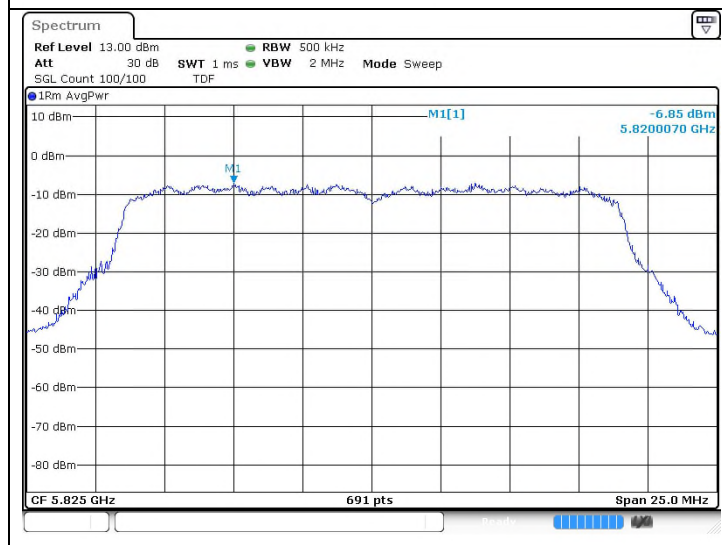
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

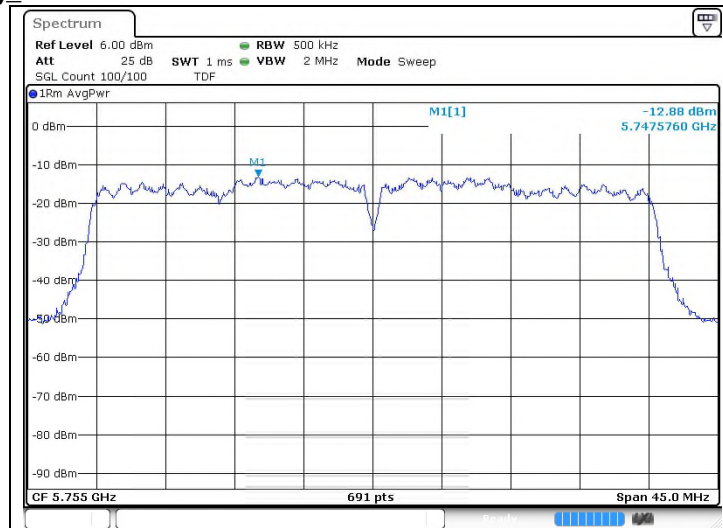


High Channel
(5 825 MHz)

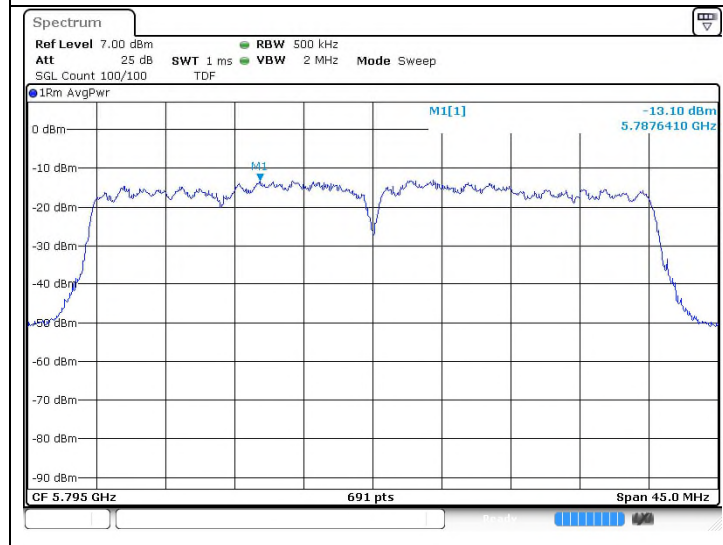


OFDM: 802.11n_HT40 (Band 3)_ANT 1

Low Channel
(5 755 MHz)

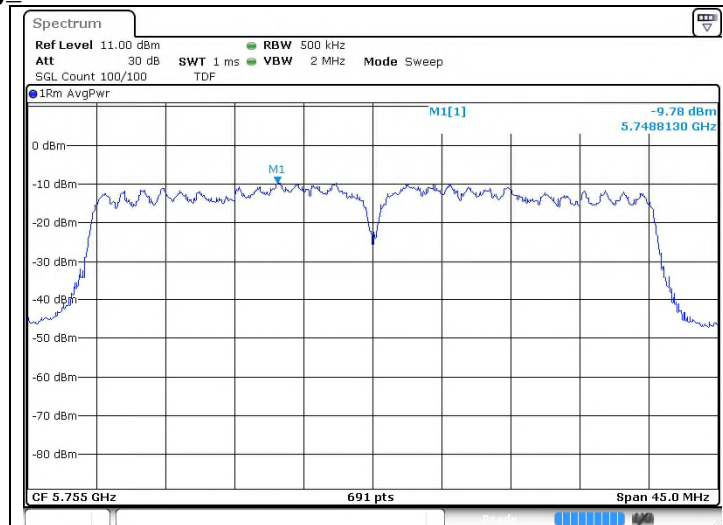


High Channel
(5 795 MHz)

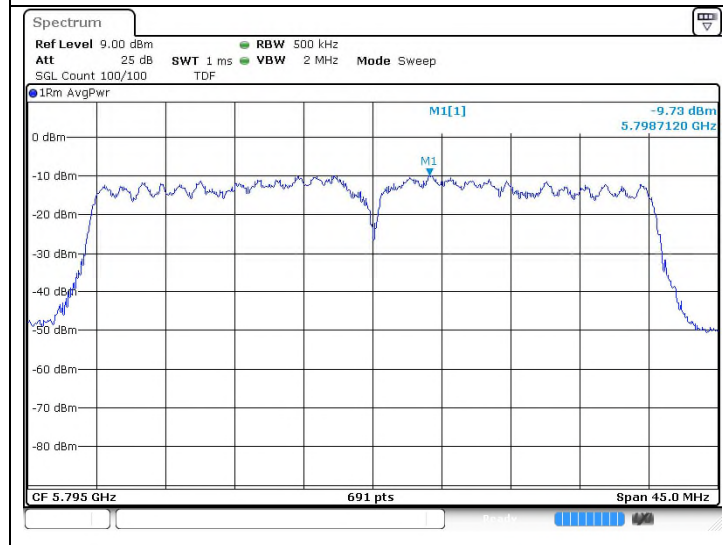


OFDM: 802.11n_HT40 (Band 3)_ANT 2

Low Channel
(5 755 MHz)

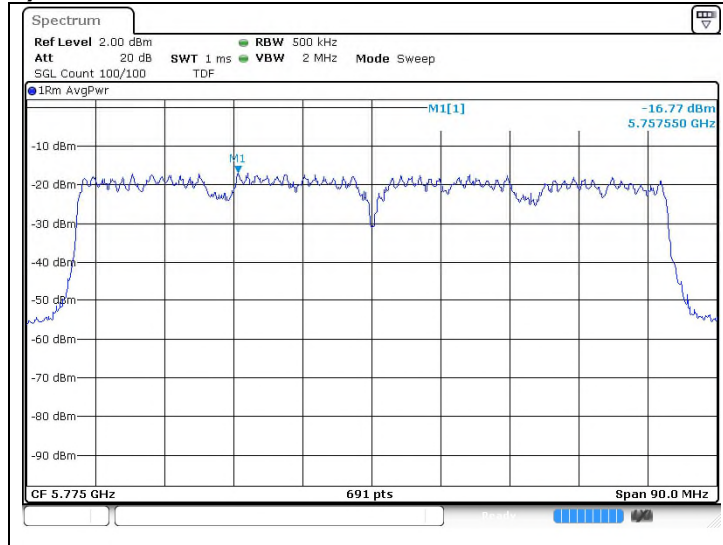


High Channel
(5 795 MHz)



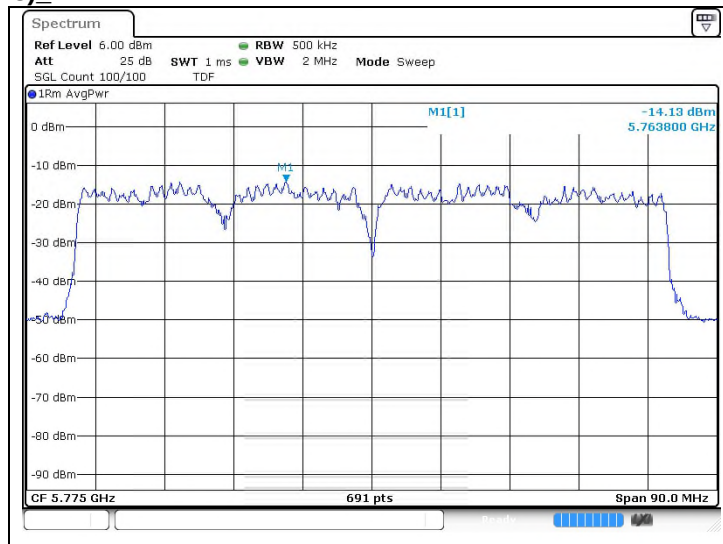
OFDM: 802.11ac_VHT80 (Band 3)_ANT 1

Middle Channel
(5 775 MHz)



OFDM: 802.11ac_VHT80 (Band 3)_ANT 2

Middle Channel
(5 775 MHz)



7. Antenna Requirement

7.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section §15.407 (a) if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

7.2. Antenna Connected Construction

Antenna used in this product is PCB antenna and peak max gain of antenna as below.

Band	5 725 MHz – 5 850 MHz
Mode	11a/n_HT20, HT40, 11ac_VHT20, VHT40, VHT80
ANT 1 Gain	0.30 dBi
ANT 2 Gain	0 dBi
ANT 1 + ANT 2 Gain	3.16 dBi

Unequal antenna gains, with equal transmit powers. For antenna gains given by $G_1, G_2, \dots, G_N$ dBi

(i) If transmit signals are correlated, then

Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$ dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

- End of the Test Report -