TEST REPORT

of

FCC Part 15 Subpart E §15.407

FCC ID: AK8MP-CL1A

Equipment Under Test	:	Mobile Projector
Model Name	:	MP-CL1A
Applicant	:	Sony Corporation
Manufacturer	:	Sony Corporation
Date of Receipt	:	2016.05.19
Date of Test(s)	:	2016.07.10 ~ 2016.07.20
Date of Issue	:	2016.07.20

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Date:** **2016.07.20**

Jinhyoung Cho

Technical Manager: **Date:** **2016.07.20**

Hyunchae You

Table of contents

1. General information

1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807

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.

Telephone : +82 31 688 0901
FAX : +82 31 688 0921

1.2. Details of applicant

Applicant : Sony Corporation
Address : 1-7-1 Konan Minato-ku, Tokyo, 108-0075 Japan
Contact Person : Kim, Sung-Chul
Phone No. : +82 55 205 0677

1.3. Description of EUT

Kind of Product	Mobile Projector
Model Name	MP-CL1A
Power Supply	DC 3.8 V
Frequency Range	2 402 ㎒ ~ 2 480 ㎒ (Bluetooth), 2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20), 5 745 ㎒ ~ 5 805 ㎒ (Band 3: 11a/n_HT20), 5 755 ㎒ ~ 5 795 ㎒ (Band 3: 11n_HT40)
Modulation Technique	DSSS, OFDM, GFSK, π/4DQPSK, 8DPSK
Number of Channels	79 channel (Bluetooth), 11 channel (11b/g/n_HT20), 4 channel (Band 3: 11a/n_HT20), 2 channel (Band 3: 11n_HT40)
Antenna Type	Insert Mold Antenna
Antenna Gain	2 400 ㎒ ~ 2 483.5 ㎒: -0.60 ㏈i, 5 725 ㎒ ~ 5 850 ㎒: -0.85 ㏈i
H/W Version	Proto1
S/W Version	0.20160629_1

1.4. Declaration by the manufacturer

- EUT is not supported Band1 and Band2.

1.5. Test equipment list

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	Agilent	E8257D	MY51501169	Jul. 07, 2016	Annual	Jul. 07, 2017
Spectrum Analyzer	R&S	FSV30	100768	Mar. 30, 2016	Annual	Mar. 30, 2017
Spectrum Analyzer	Agilent	N9030A	US51350132	Sep. 24, 2015	Annual	Sep. 24, 2016
Power Meter	Anritsu	ML2495A	1223004	Jun. 10, 2016	Annual	Jun. 10, 2017
Power Sensor	Anritsu	MA2411B	1207272	Jun. 10, 2016	Annual	Jun. 10, 2017
Attenuator	MCLI	FAS-23-20	23834	Jun. 08, 2016	Annual	Jun. 08, 2017
Low Pass Filter	Mini-Circuits	NLP-1200+	V8979400903-2	Feb. 29, 2016	Annual	Feb. 29, 2017
High Pass Filter	Wainwright Instrument GmbH	WHNX6.0/18G-10SS	51	Jun. 18, 2016	Annual	Jun. 18, 2017
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	15	Jun. 18, 2016	Annual	Jun. 18, 2017
DC Power Supply	Agilent	U8002A	MY53150029	Jun. 20, 2016	Annual	Jun. 20, 2017
Preamplifier	H.P.	8447F	2944A03909	Aug. 27, 2015	Annual	Aug. 27, 2016
Preamplifier	R&S	SCU-18	10117	Apr. 07, 2016	Annual	Apr. 07, 2017
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 12, 2016	Annual	May 12, 2017
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 19, 2015	Biennial	Aug. 19, 2017
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	396	Jun. 18, 2015	Biennial	Jun. 18, 2017
Horn Antenna	R&S	HF906	100326	Feb. 01, 2016	Biennial	Feb. 01, 2018
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA9170	BBHA9170223	Sep. 01, 2014	Biennial	Sep. 01, 2016
Turn Table	INN-CO systems	CONTROLLER CO3000	N/A	N. C. R	N/A	N. C. R
Antenna Master	INN-CO systems	MA4640-XP-ET	N/A	N. C. R	N/A	N. C. R
Test Receiver	R&S	ESU26	100109	Mar. 07, 2016	Annual	Mar. 07, 2017
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
Test Receiver	R&S	ESCI 7	100911	Dec. 22, 2015	Annual	Dec. 22, 2016
Two-Line V-Network	R&S	ENV216	100190	Dec. 21, 2015	Annual	Dec. 21, 2016
Shield Room	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N/A	N.C.R	N/A	N.C.R

▶ Support equipment

Description	Manufacturer	Model	Serial Number / FCC ID
N/A	-	-	-

1.6. Summary of test result

The EUT has been tested according to the following specifications:

APPLIED STANDARD : FCC Part 15 Subpart E		
Standard section	**Test Item**	**Result**
15.205(a) 15.209(a) 15.407(b)(4)	Transmitter radiated spurious emissions	Complied
15.407(a)	26 ㏈ Bandwidth	Complied
15.407(e)	6 ㏈ Bandwidth	Complied
15.407(a)(3)	Maximum Conducted Output Power	Complied
15.407(a)(3)	Peak power spectral density	Complied
15.207	AC Power Line Conducted Emissions	Complied

1.7. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedure for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 789033_v01r02 were used in the measurement of the DUT.

1.8. Sample calculation

Where relevant, the following sample calculation is provided:

1.8.1. Conducted test

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

1.8.2. Radiation test

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

1.9. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL010143	2016.07.20	Initial

1.10. Duty Cycle of EUT

Regarding to KDB789033 v01r02, B, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below
Set RBW ≥ OBW 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)	Mode	Data Rate (Mbps)	Mode	Data Rate (Mbps)
11a	**6**	**11n_HT20**	**MCS0**	**11n_HT40**	**MCS0**
Duty Cycle (%)	94	Duty Cycle (%)	95	Duty Cycle (%)	91
Correction factor (dB)	0.27	Correction factor (dB)	0.22	Correction factor (dB)	0.41

Remark:

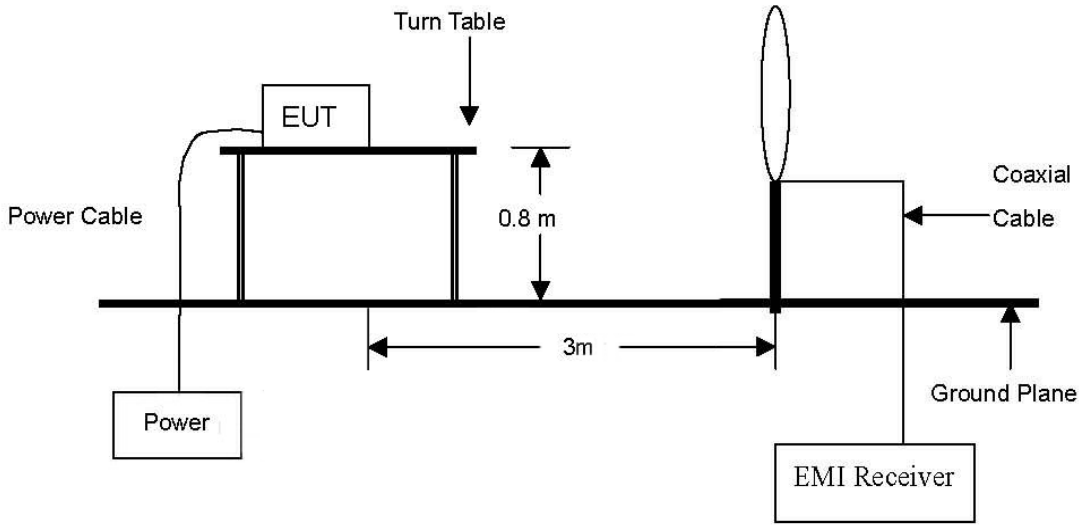
1. As measured duty cycles of EUT, all of mode and data rate keep constant period and are converted to log scale (power averaging) to compensate correction factor to result of average test items.
2. Duty cycle (%) = (Tx on time / Tx on + off time) x 100
3. Correction factor (dB) = 10 log (1 / Duty cycle)

2. Transmitter radiated spurious emissions

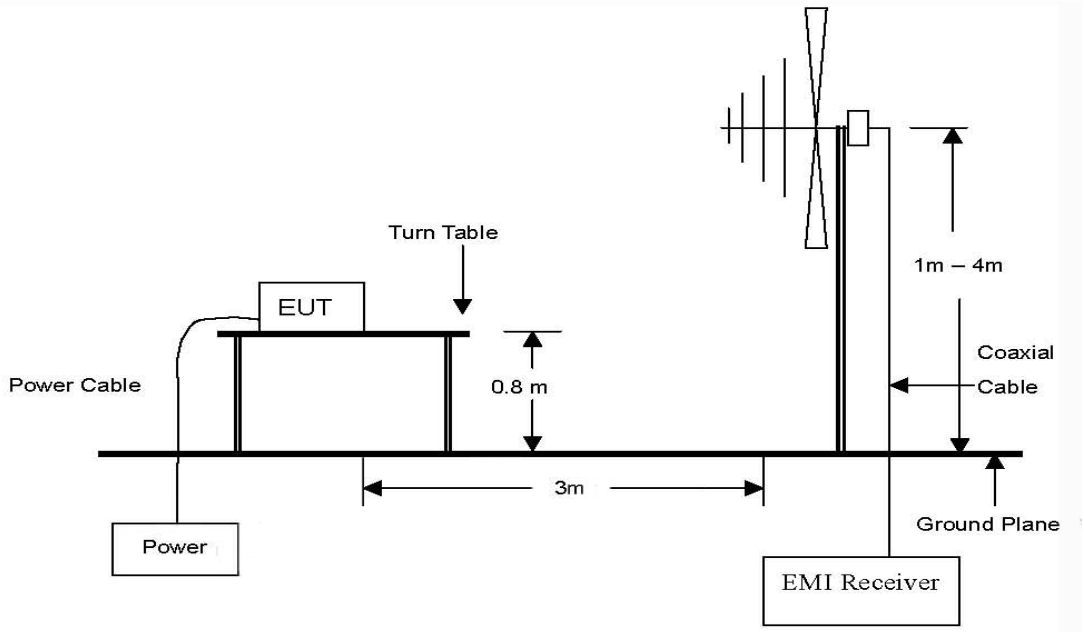
2.1. Test setup

2.1.1. Transmitter Radiated Spurious Emissions

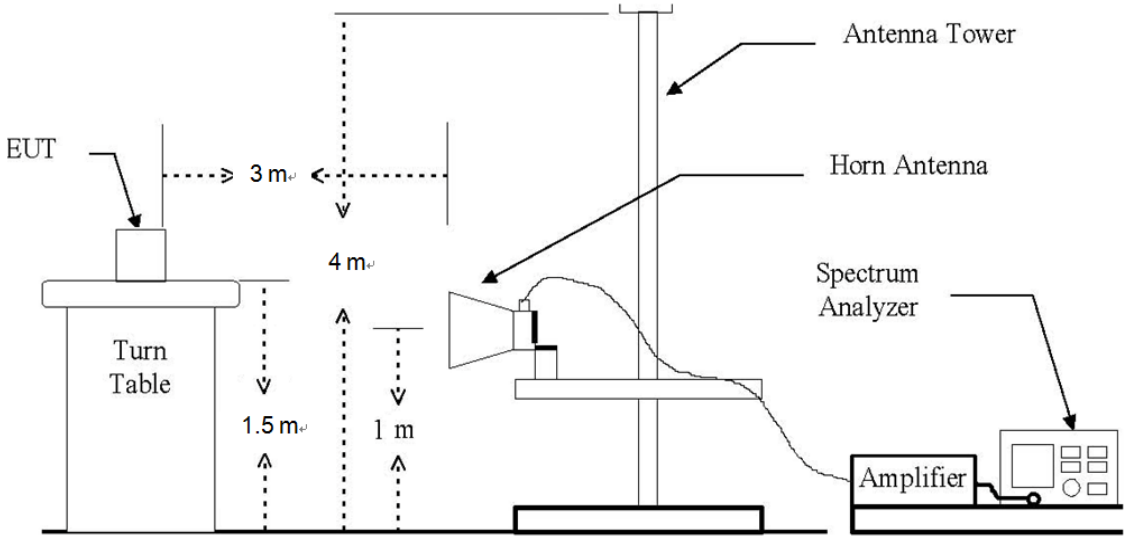
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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



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



2.2. Limit

For transmitters operating in the 5.725-5.85 ㎓ band: all emissions shall be limited to a level of -27 ㏈m/㎒ at 75 ㎒ or more above or below the band edge increasing linearly to 10 ㏈m/㎒ at 20 ㎒ above or below the band edge, and from 25 ㎒ above or below the band edge increasing linearly to a level of 15.6 ㏈m/㎒ at 5 ㎒ above or below the band edge, and from 5 ㎒ above or below the band edge increasing linearly to a level of 27 ㏈m/㎒ 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 (㎒)	Distance (Meters)	Field Strength (㏈㎶/m)	Field Strength (㎶/m)
0.009 - 0.490	300	20 log (2 400/F(㎑))	2 400/F(㎑)
0.490 - 1.705	30	20 log (24 000/F(㎑))	24 000/F(㎑)
1.705 - 30.0	30	29.54	30
30 - 88	3	40.0	100**
88 - 216	3	43.5	150**
216 - 960	3	46.0	200**
Above 960	3	54.0	500

**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 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., §15.231 and §15.241.

2.3. Test procedures

Radiated spurious emissions from the EUT were measured according to the dictates in section G of KDB 789033_v01r02 and ANSI C63.10-2013.

2.3.1. Test Procedures for emission below 30 ㎒

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.

Note;
Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 meter open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

2.3.2. Test Procedures for emission from above 30 ㎒

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 ㎓ and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 ㎓. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, 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 ㎓, 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.
6. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

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.

- The measurements for below 1 ㎓ refer to section II.G.4.
  Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

- The measurements for above 1 ㎓ II.G.5.
  Peak emission levels are measured by setting the analyzer as follows:
  Set to RBW = 1 ㎒, VBW ≥ 3 ㎒, Detector = Peak, Sweep time = auto, Trace mode= max hold.

- The measurements for above 1 ㎓ II.G.6.
Average emission levels are measured by setting the analyzer as follows:
Set to RBW = 1 ㎒, VBW ≥ 3 ㎒, 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 step (iv) above, 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 ㏈ must be added to the measured emission levels.

- Definition of DUT Axis.
  Definition of the test orthogonal plan for EUT was described in the test setup photo.
  The test orthogonal plan of EUT is **X-axis** during radiation test.

2.4. Test result

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

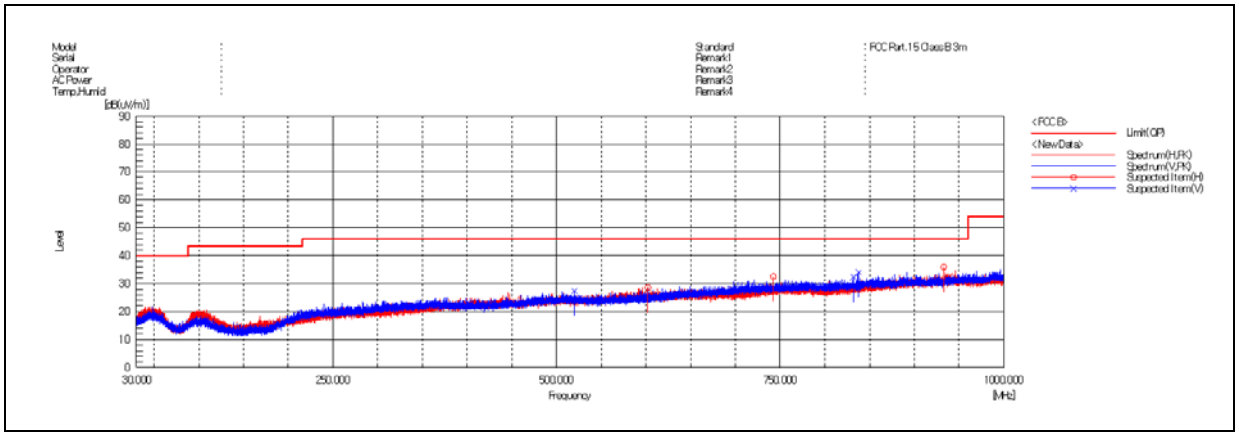
2.4.1. Radiated Spurious Emission below 1 000 ㎒

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

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
520.09	34.50	Peak	V	18.65	-25.64	27.51	46.00	18.49
602.22	34.40	Peak	H	19.94	-25.69	28.65	46.00	17.35
742.51	36.00	Peak	H	21.54	-25.18	32.36	46.00	13.64
831.99	34.20	Peak	V	22.94	-24.78	32.36	46.00	13.64
837.85	35.80	Peak	V	23.03	-24.66	34.17	46.00	11.83
932.99	36.40	Peak	H	23.38	-23.99	35.79	46.00	10.21

Remark:
1. Spurious emissions for all channels and modes were investigated and almost the same below 1 ㎓.
2. Reported spurious emissions are in **11a (Band3) / 6Mbps / High 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 ㏈.

Test plot



2.4.2. Radiated Spurious Emission above 1 000 ㎒
802.11a (Band 3)_6 Mbps

A. Low Channel (5 745 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
5 636.52	14.14	Peak	H	34.08	8.50	-	56.72	68.23	11.51

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*11 488.87	36.16	Peak	H	38.44	-25.43	-	49.17	74.00	24.83
*11 489.28	24.80	Average	H	38.44	-25.43	0.27	38.08	54.00	15.92
Above 11 500.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 785 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*11 572.30	35.81	Peak	H	38.43	-24.95	-	49.29	74.00	24.71
*11 568.85	24.78	Average	H	38.43	-24.97	0.27	38.51	54.00	15.49
Above 11 600.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 805 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
5 939.60	14.95	Peak	H	34.58	9.16	-	58.69	68.23	9.54

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*11 610.84	35.15	Peak	H	38.42	-24.79	-	48.78	74.00	25.22
*11 610.26	24.23	Average	H	38.42	-24.80	0.27	38.12	54.00	15.88
Above 11 700.00	Not detected	-	-	-	-	-	-	-	-

802.11n_HT20 (Band 3)_MCS0

A. Low Channel (5 745 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
5 645.62	14.60	Peak	H	34.10	8.52	-	57.22	68.23	11.01

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*11 488.39	36.36	Peak	H	38.44	-25.42	-	49.38	74.00	24.62
*11 488.36	24.88	Average	H	38.44	-25.42	0.22	38.12	54.00	15.88
Above 11 500.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (5 785 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*11 569.17	35.61	Peak	H	38.43	-24.96	-	49.08	74.00	24.92
*11 571.05	24.75	Average	H	38.43	-24.95	0.22	38.45	54.00	15.55
Above 11 600.00	Not detected	-	-	-	-	-	-	-	-

C. High Channel (5 805 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
5 939.28	13.70	Peak	H	34.58	9.16	-	57.44	68.23	10.79

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*11 609.13	35.05	Peak	H	38.42	-24.79	-	48.68	74.00	25.32
*11 611.67	24.27	Average	H	38.42	-24.79	0.22	38.12	54.00	15.88
Above 11 700.00	Not detected	-	-	-	-	-	-	-	-

802.11n_HT40 (Band 3)_MCS0

A. Low Channel (5 755 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
5 638.48	14.66	Peak	H	34.09	8.51	-	57.26	68.23	10.97

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*11 513.24	35.46	Peak	H	38.45	-25.34	-	48.57	74.00	25.43
*11 511.80	24.87	Average	H	38.45	-25.35	0.41	38.38	54.00	15.62
Above 11 600.00	Not detected	-	-	-	-	-	-	-	-

B. High Channel (5 795 ㎒)

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
5 933.84	14.13	Peak	H	34.57	9.18	-	57.88	68.23	10.35

Radiated Emissions			Ant.	Correction Factors			Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*11 586.95	32.36	Peak	H	38.42	-24.85	-	45.93	74.00	28.07
*11 592.13	24.13	Average	H	38.42	-24.81	0.41	38.15	54.00	15.85
Above 11 600.00	Not detected	-	-	-	-	-	-	-	-

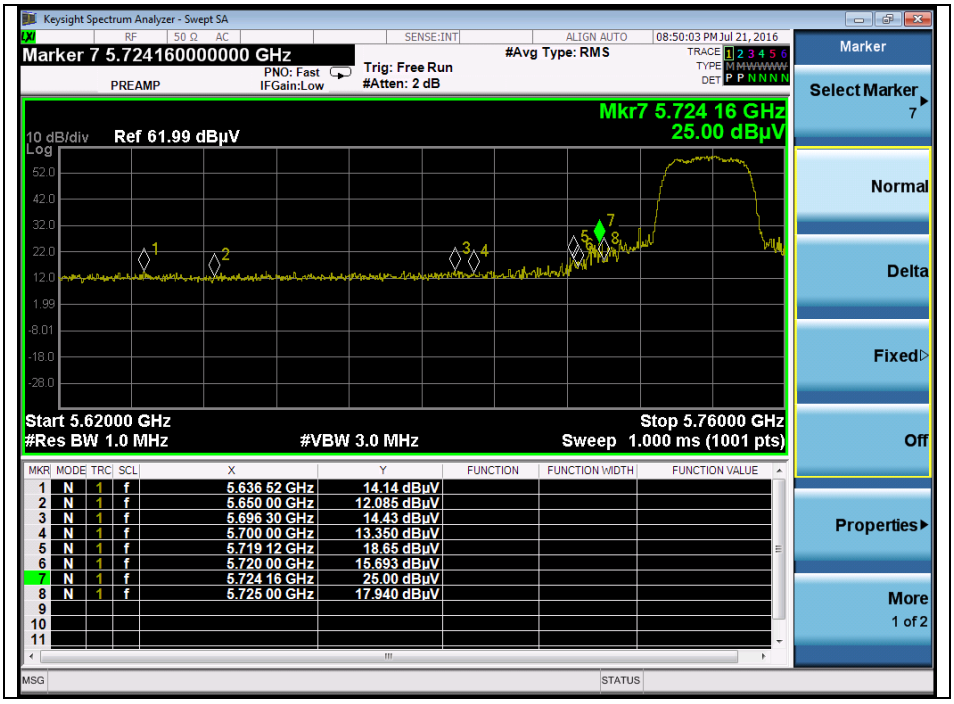
Remark:

1. "*" means the restricted band.
2. Radiated emissions measured in frequency above 1 000 ㎒ 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. Band edge measurement.
   (Actual = Reading + AF + CL + Duty cycle)
4. Radiated spurious emission measurement.
   (Actual = Reading + AF + AMP + CL + Duty cycle)
5. If frequency was out of restricted band, the calculation method for peak limit is same as below.
   68.23 ㏈㎶/m = EIRP - 20 log(d) + 104.77 = -27 - 20 log (3) + 104.77
6. In case of the emissions within ±75 ㎒ from band edge of band 3, limit should be adjusted to emission mask of 15.407(4)(i).
7. According to § 15.31(o), Emission levels are not reported much lower than the limits by over 20 ㏈.

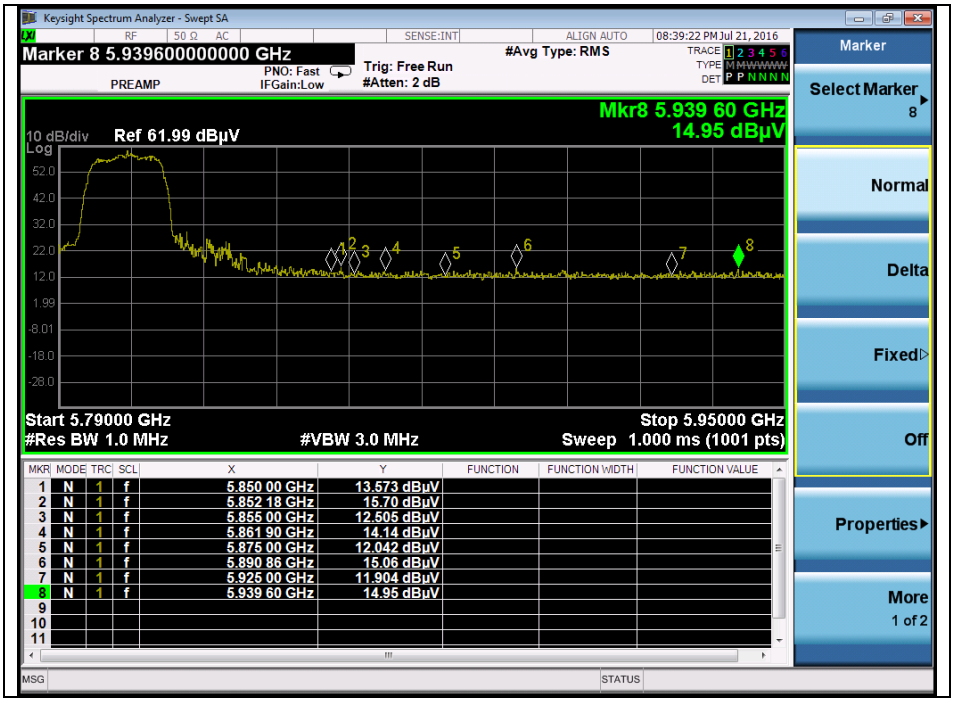
Plots of Spurious Emission

OFDM : 802.11a(6 Mbps)

Low channel Band edge (Peak) - Band 3

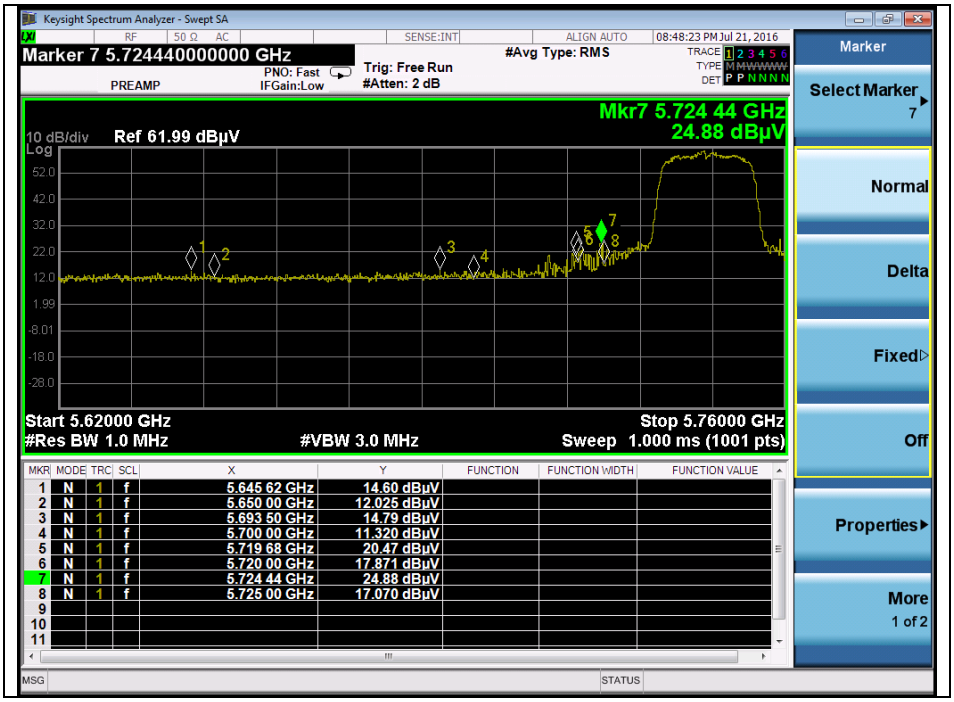


High channel Band edge (Peak) - Band 3

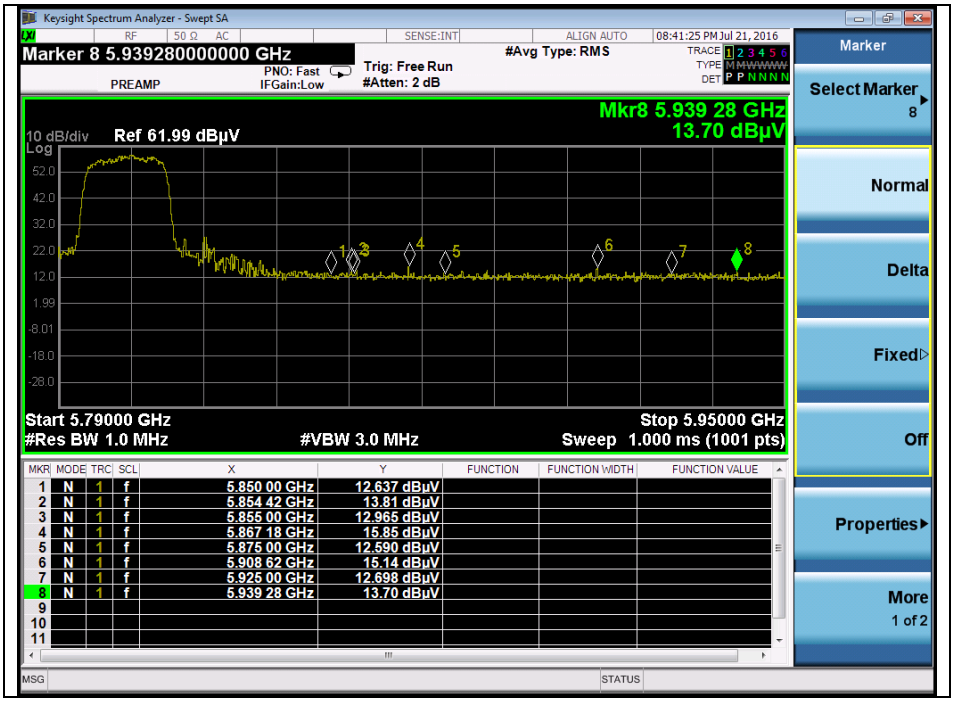


OFDM : 802.11n_HT20(MCS0)

Low channel Band edge (Peak) - Band 3

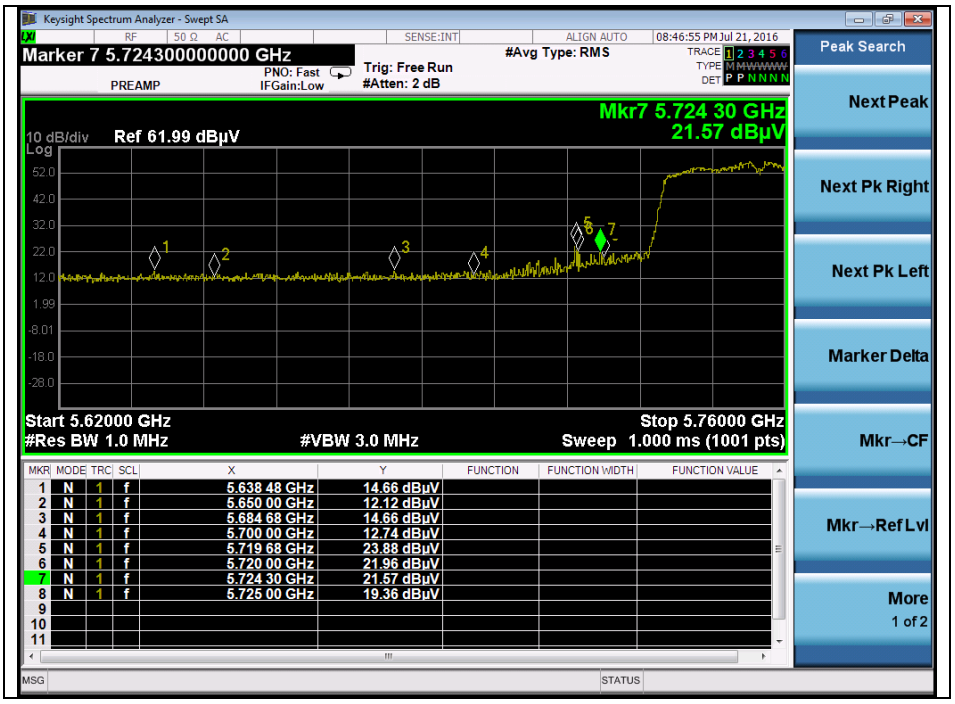


High channel Band edge (Peak) - Band 3

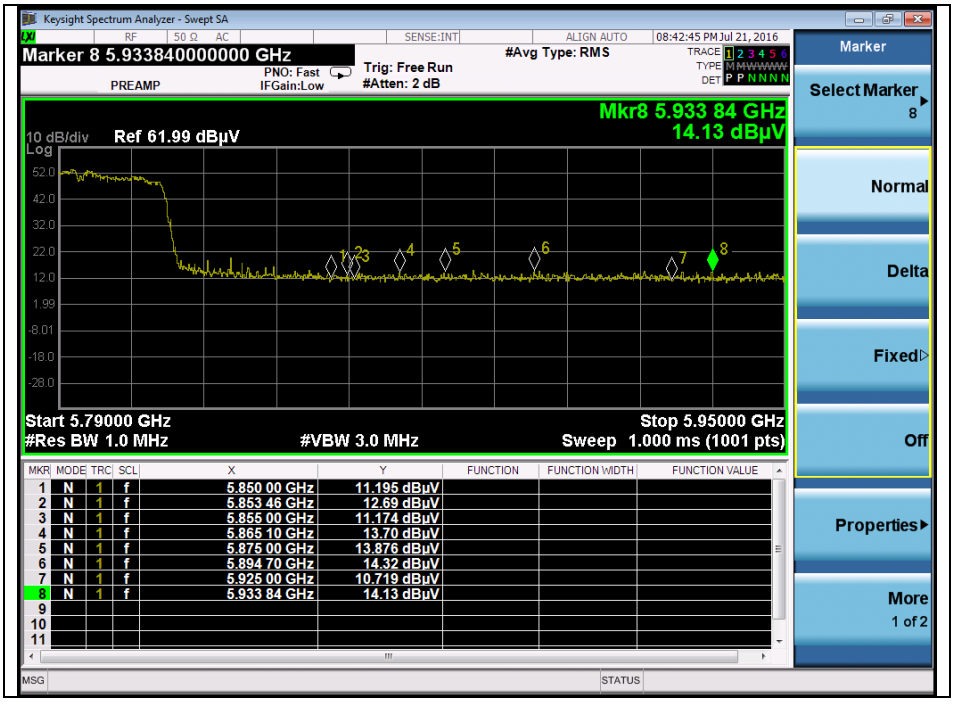


OFDM : 802.11n_HT40(MCS0)

Low channel Band edge (Peak) - Band 3

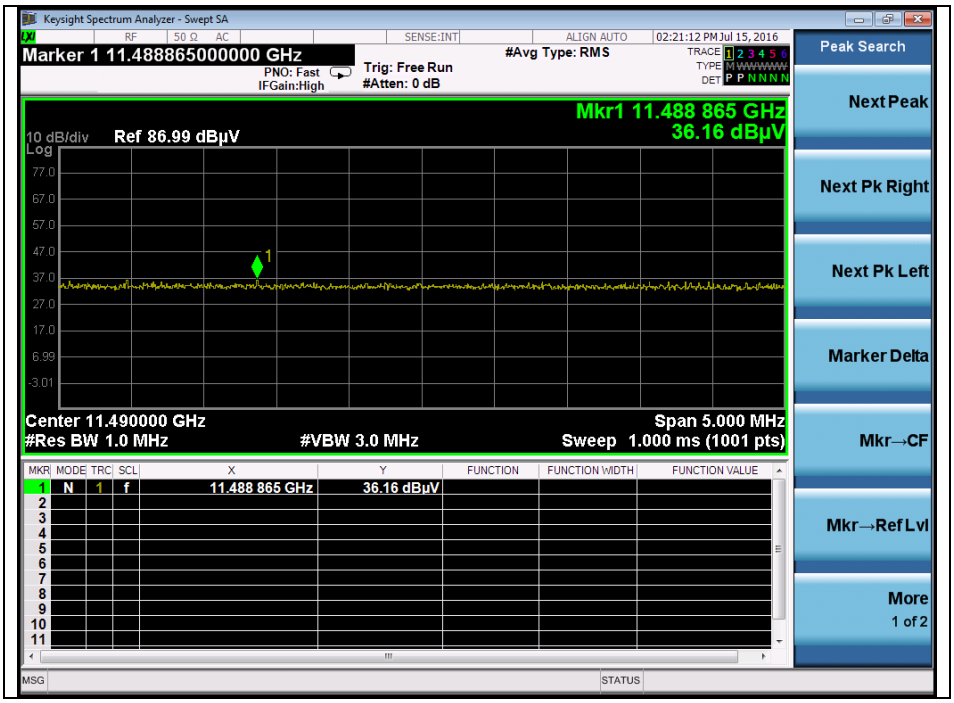


High channel Band edge (Peak) - Band 3

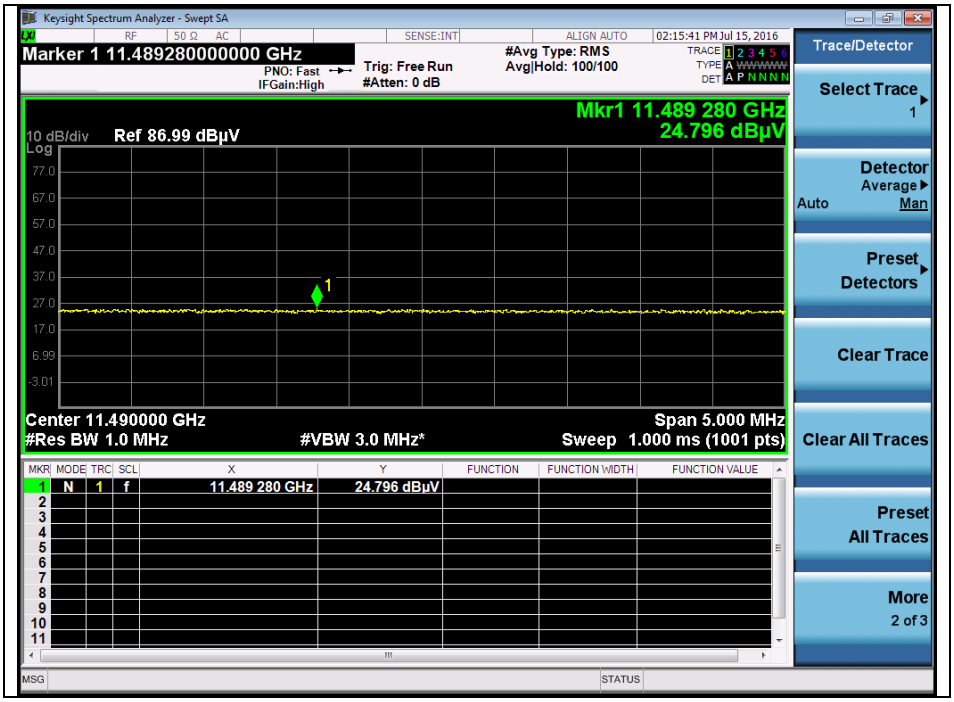


OFDM : 802.11a(6 Mbps)

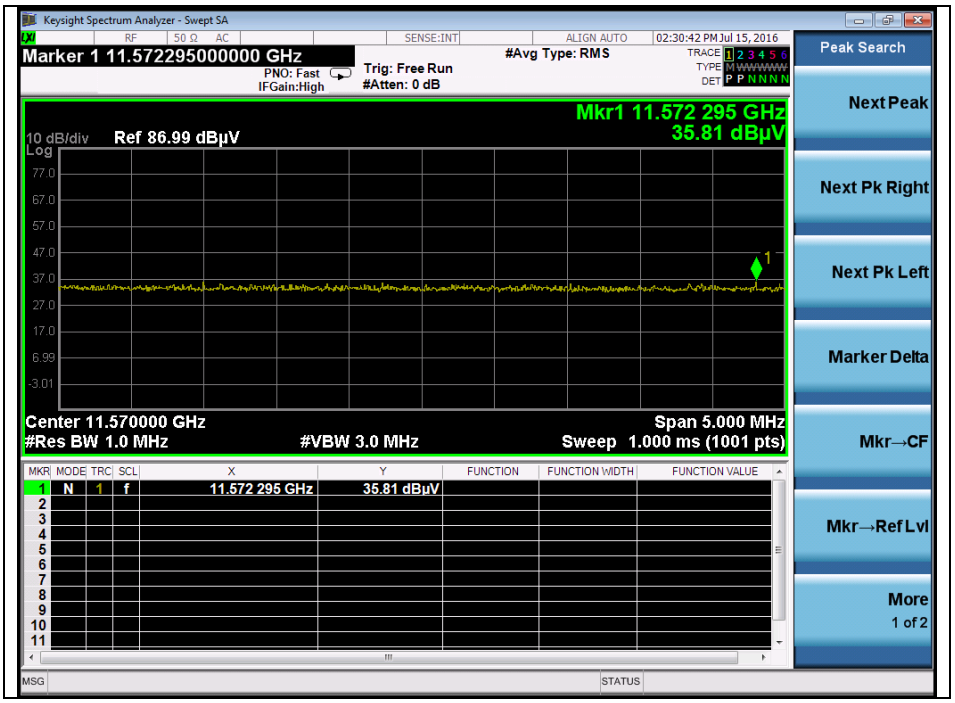
Low channel 2nd harmonic (Peak) - Band 3



Low channel 2nd harmonic (Average) - Band 3

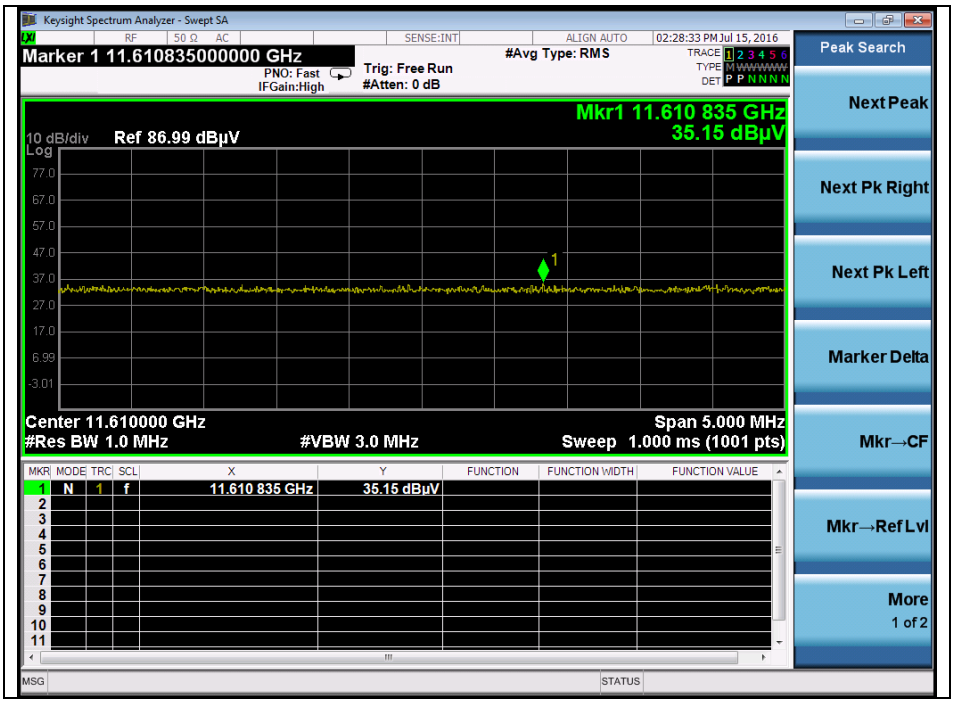


Middle channel 2nd harmonic (Peak) - Band 3

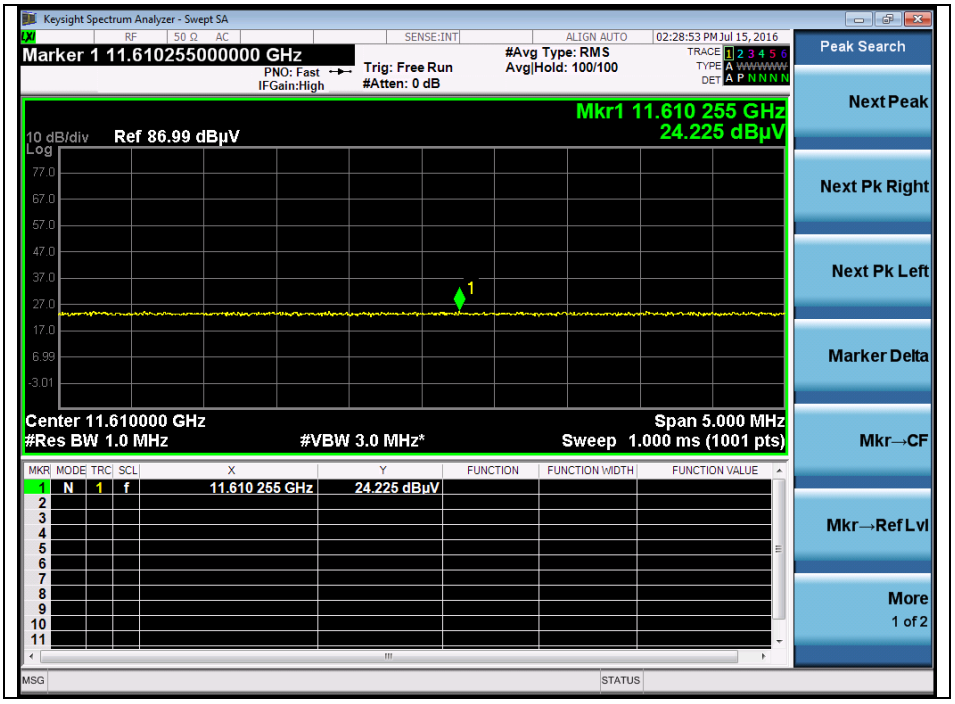


Middle channel 2nd harmonic (Average) - Band 3

High channel 2nd harmonic (Peak) - Band 3

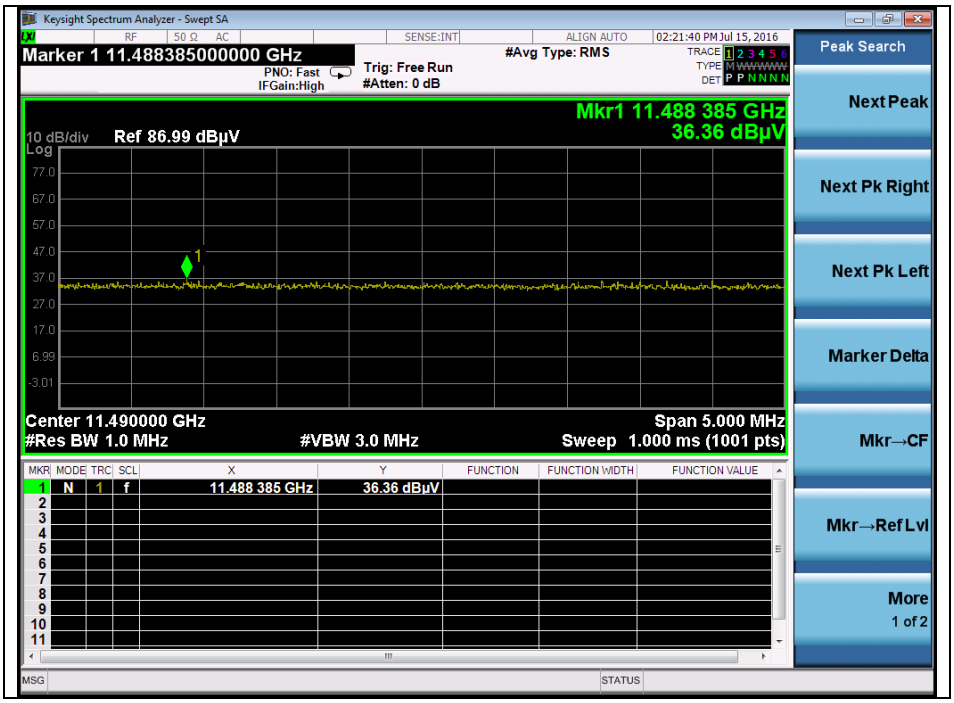


High channel 2nd harmonic (Average) - Band 3

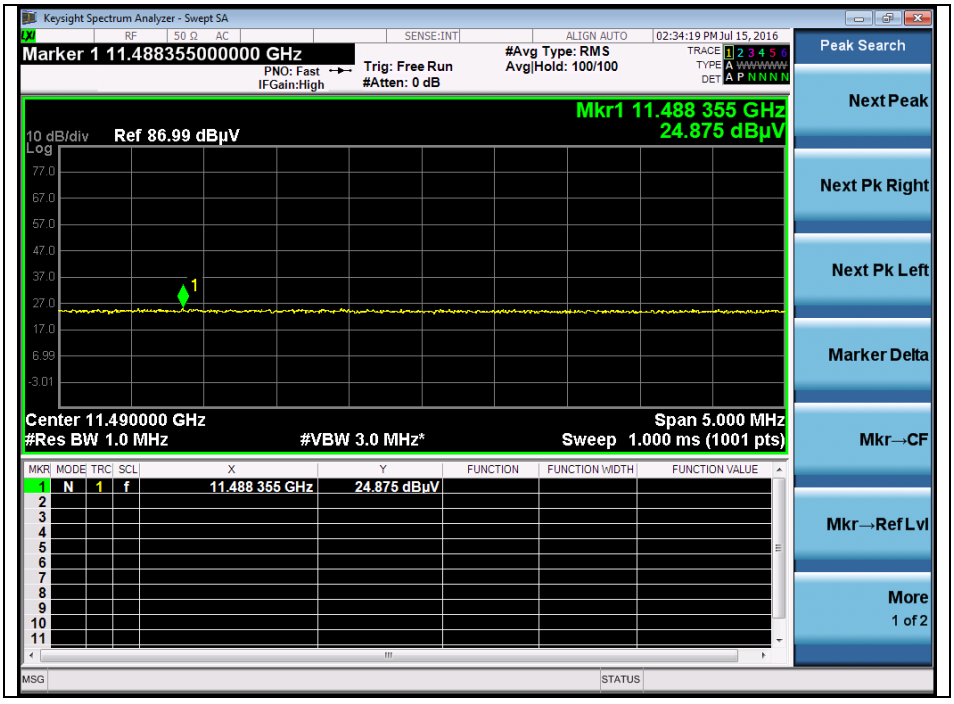


OFDM : 802.11n_HT20(MCS0)

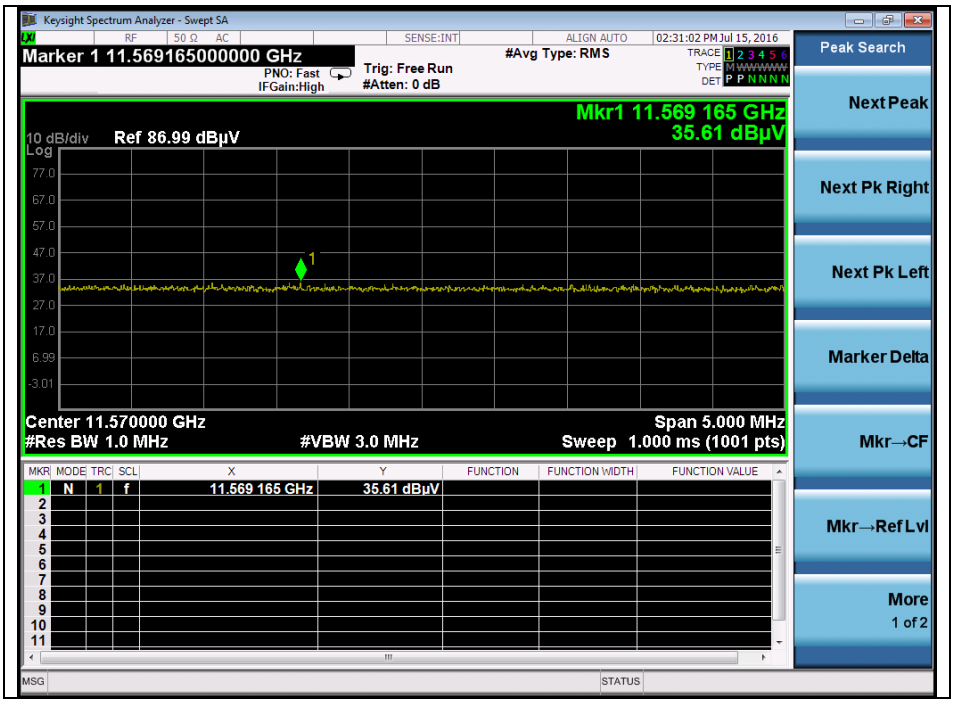
Low channel 2nd harmonic (Peak) - Band 3



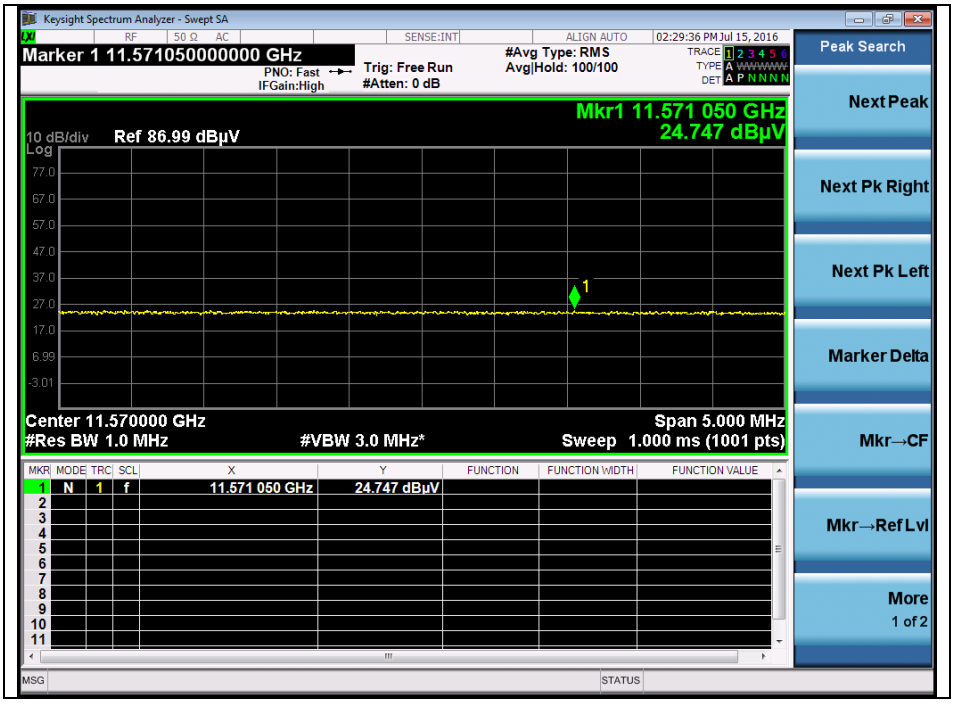
Low channel 2nd harmonic (Average) - Band 3



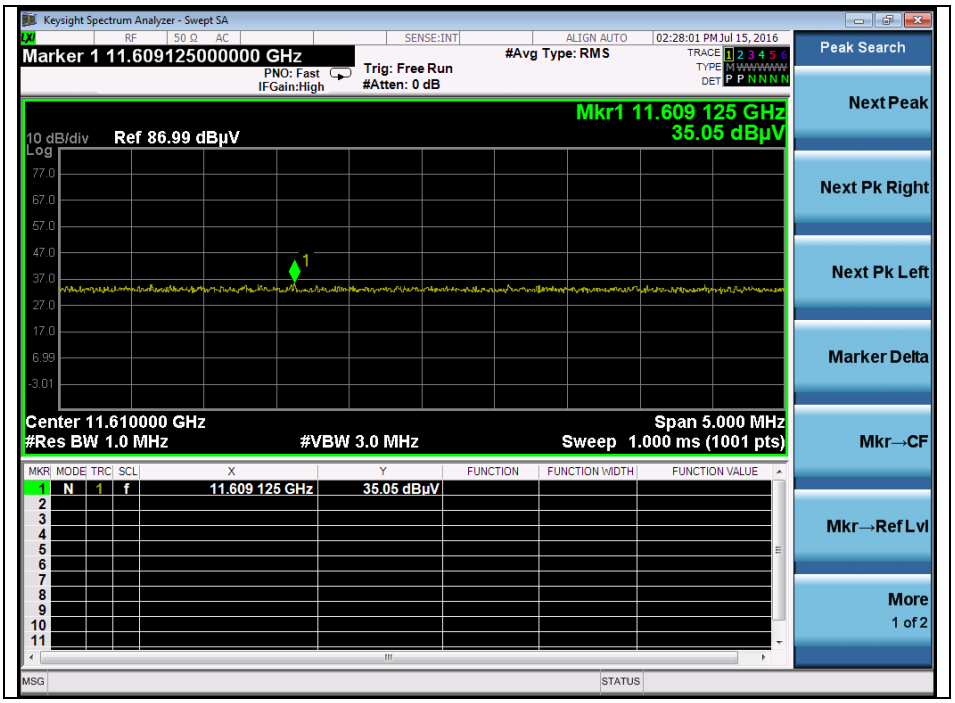
Middle channel 2nd harmonic (Peak) - Band 3



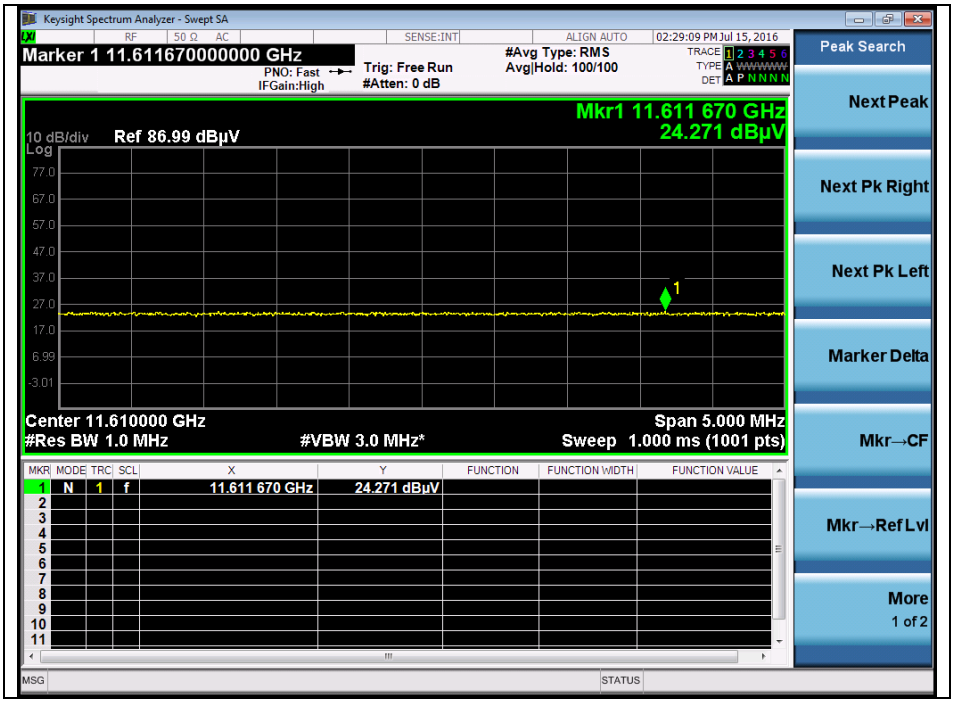
Middle channel 2nd harmonic (Average) - Band 3



High channel 2nd harmonic (Peak) - Band 3

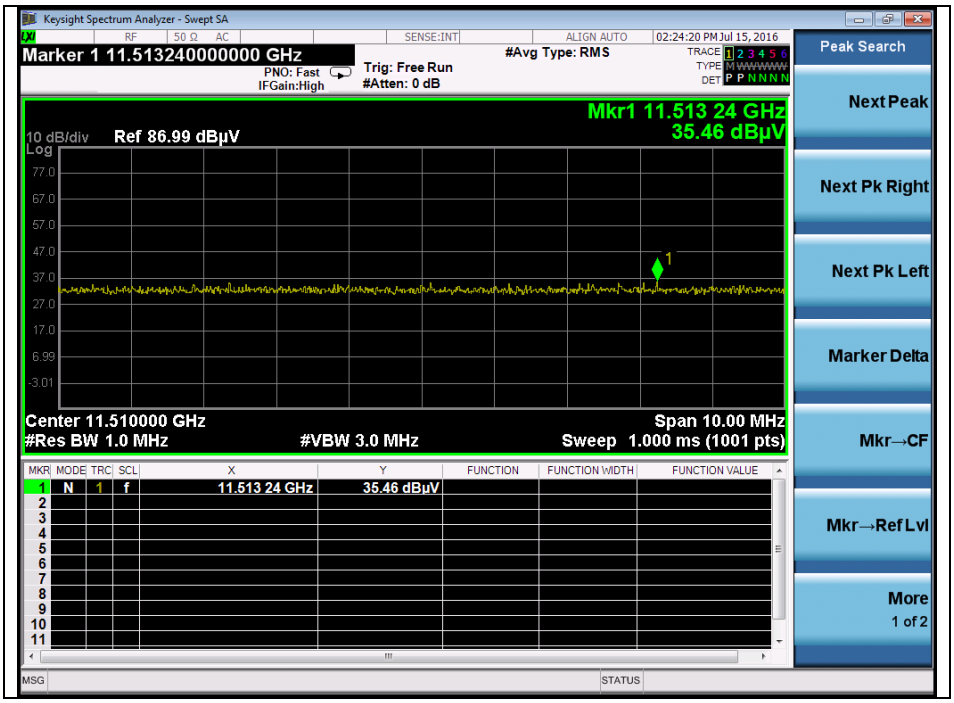


High channel 2nd harmonic (Average) - Band 3

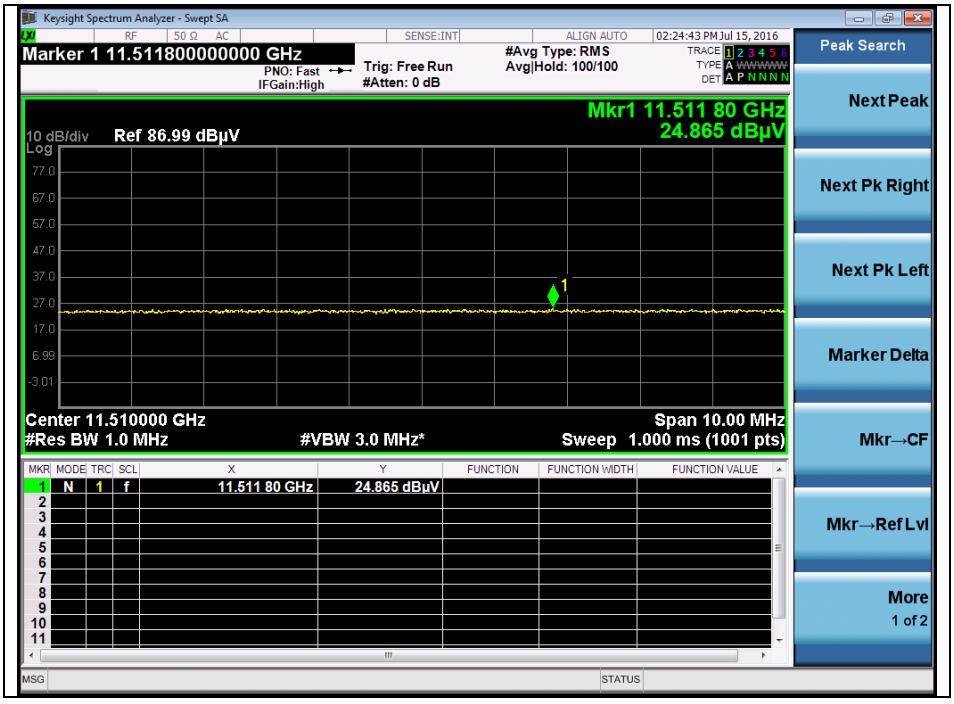


OFDM : 802.11n_HT40(MCS0)

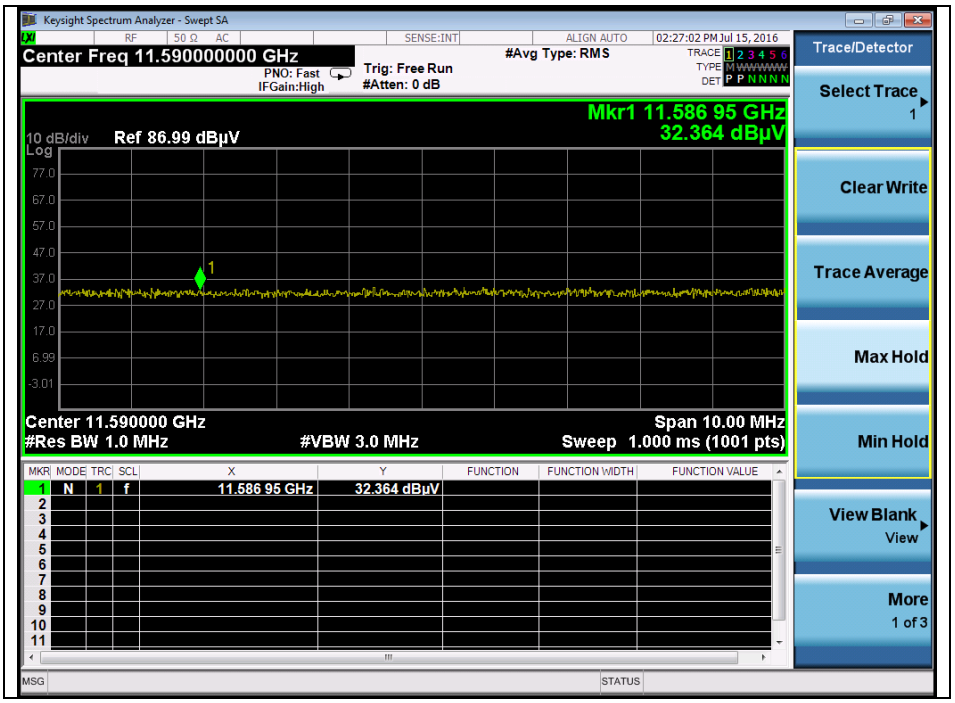
Low channel 2nd harmonic (Peak) - Band 3



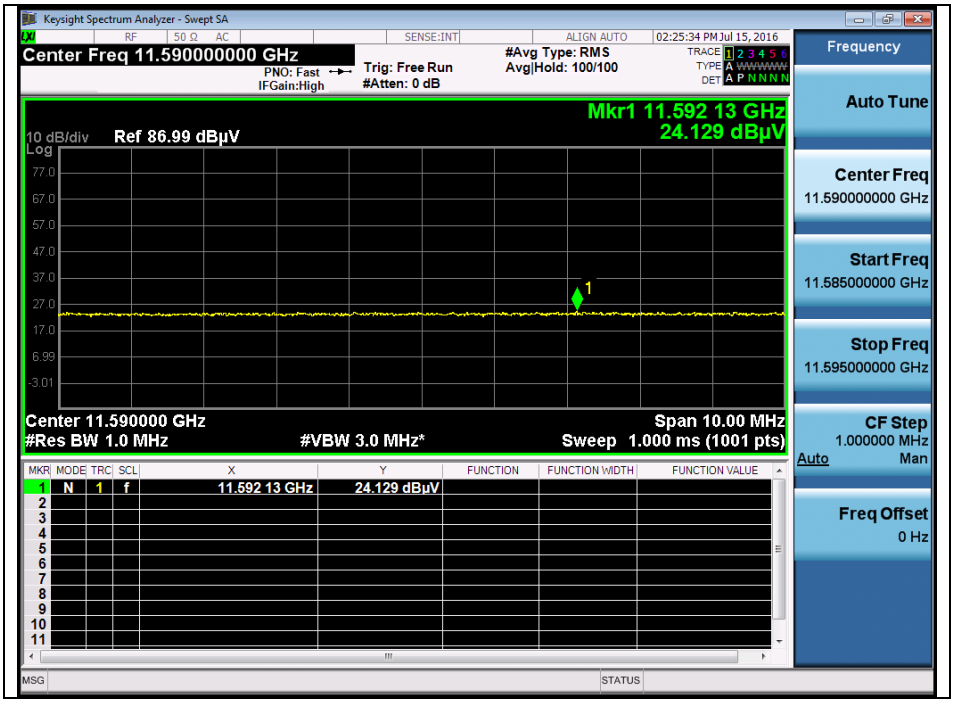
Low channel 2nd harmonic (Average) - Band 3



High channel 2nd harmonic (Peak) - Band 3

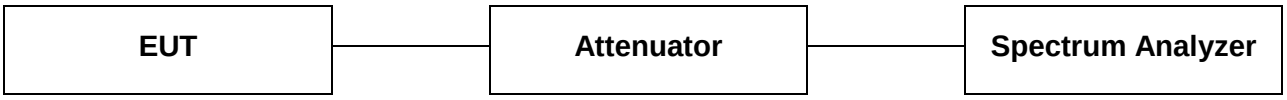


High channel 2nd harmonic (Average) - Band 3



3. 26 dB Bandwidth

3.1. Test setup



3.2. 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.

3.2.1. 26 dB Bandwidth

1. This measurement settings are specified in section C.1 of KDB 789033_D02 v01r02.
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 %.

3.4. Test result

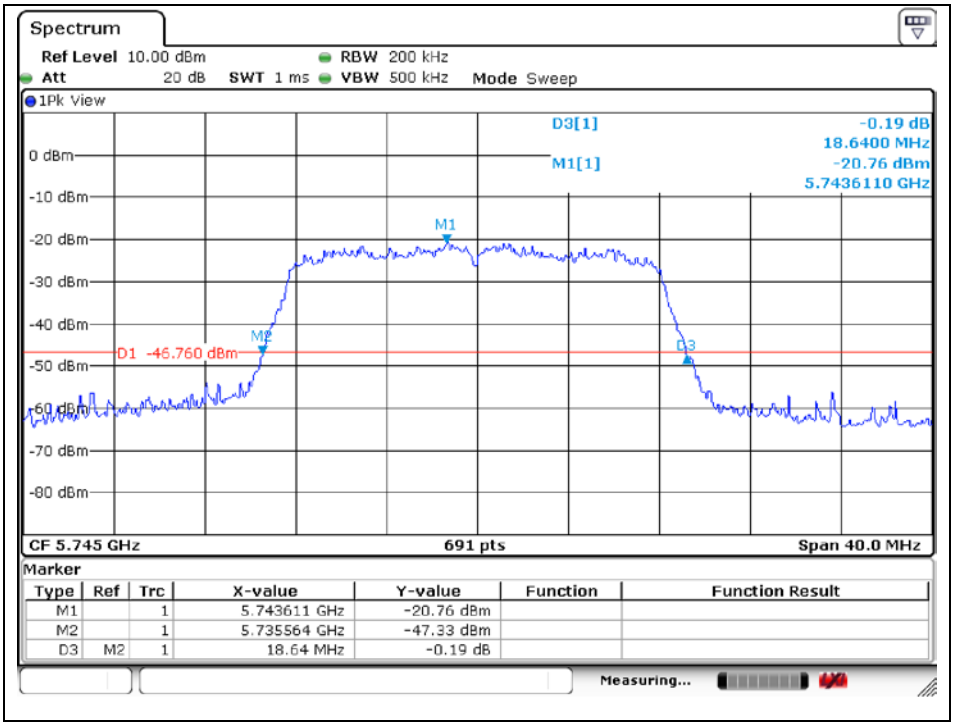
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Band	Mode	Frequency (㎒)	Ch.	Data Rate	26 ㏈ Bandwidth (㎒)
U-NII 3	11a	5 745	149	6 Mbps	18.640
		5 785	157	6 Mbps	18.871
		5 805	161	6 Mbps	18.900
	11n_HT20	5 745	149	MCS0	18.969
		5 785	157	MCS0	19.045
		5 805	161	MCS0	19.131
	11n_HT40	5 755	151	MCS0	40.120
		5 795	159	MCS0	39.730

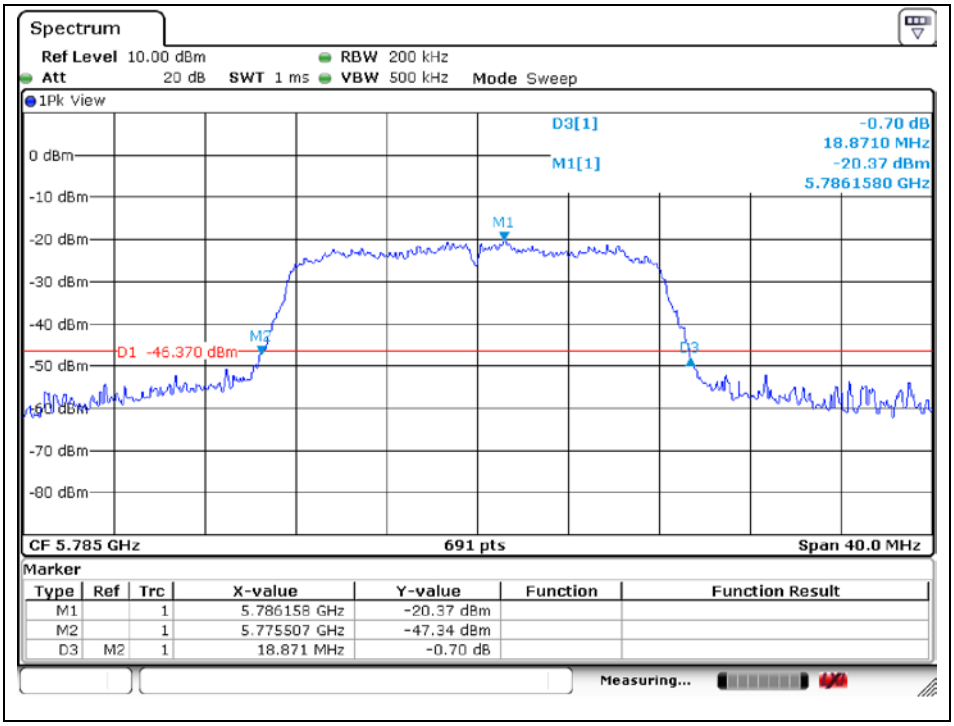
26 dB Bandwidth

802.11a (Band 3)

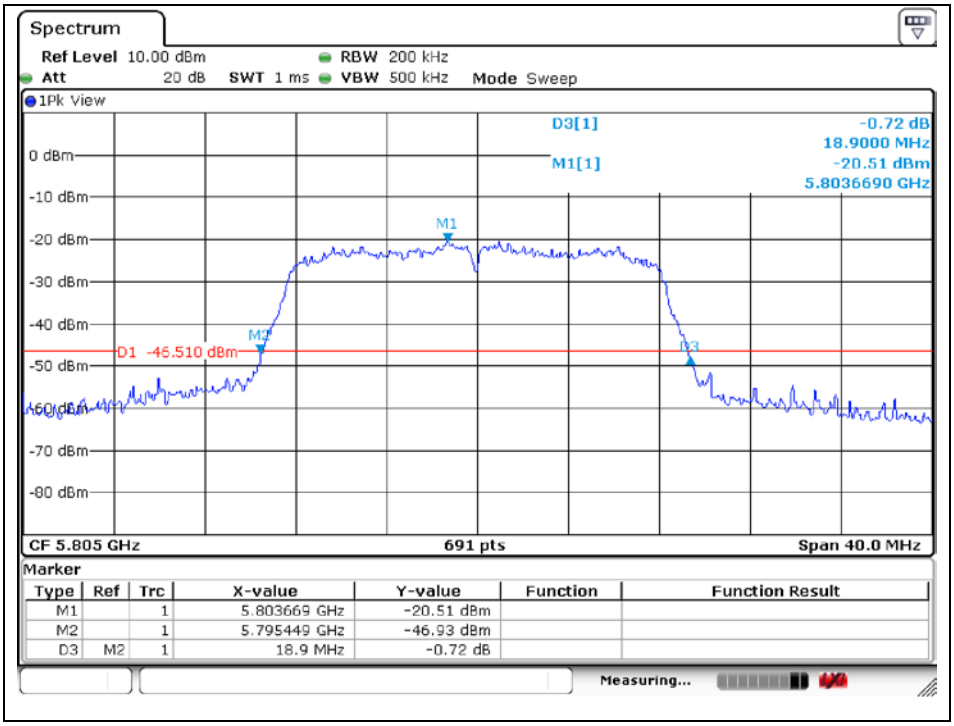
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

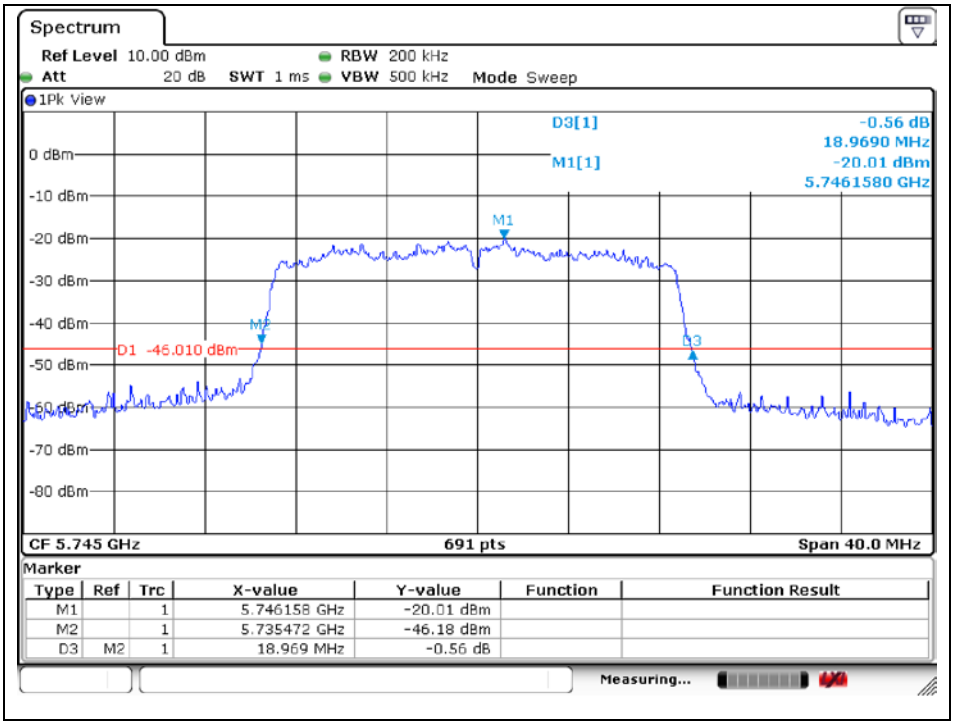


High Channel (5 805 ㎒)

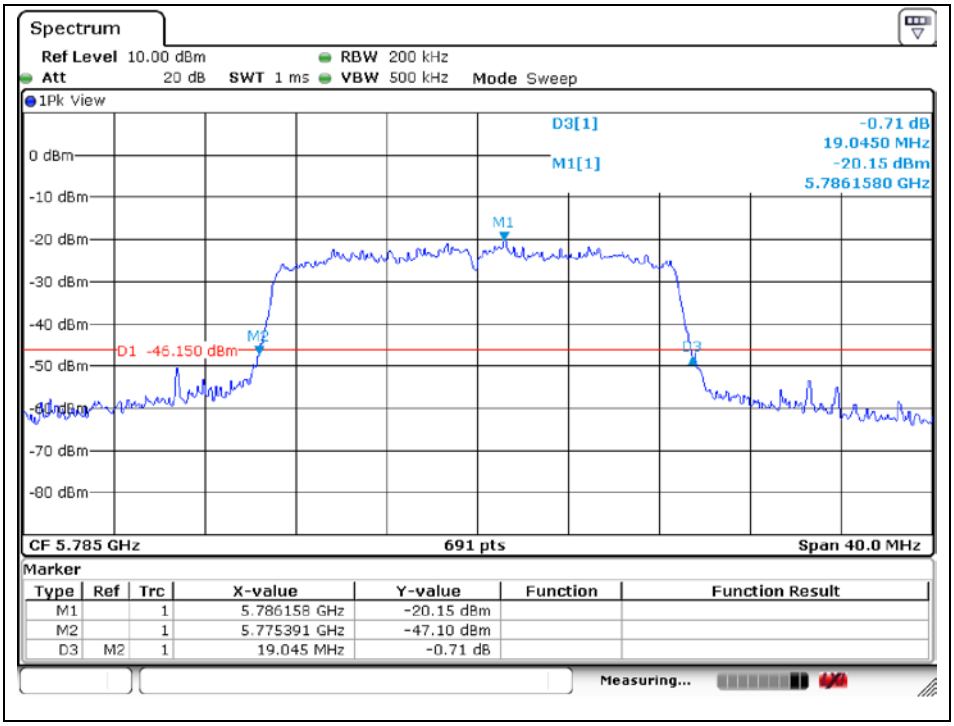


802.11n_HT20 (Band 3)

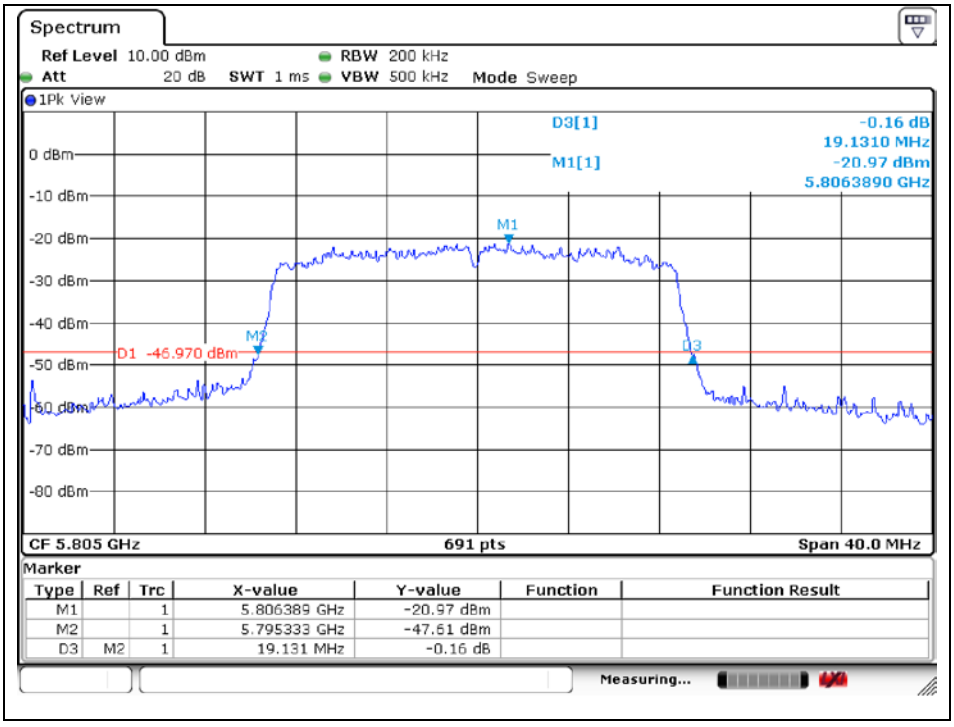
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

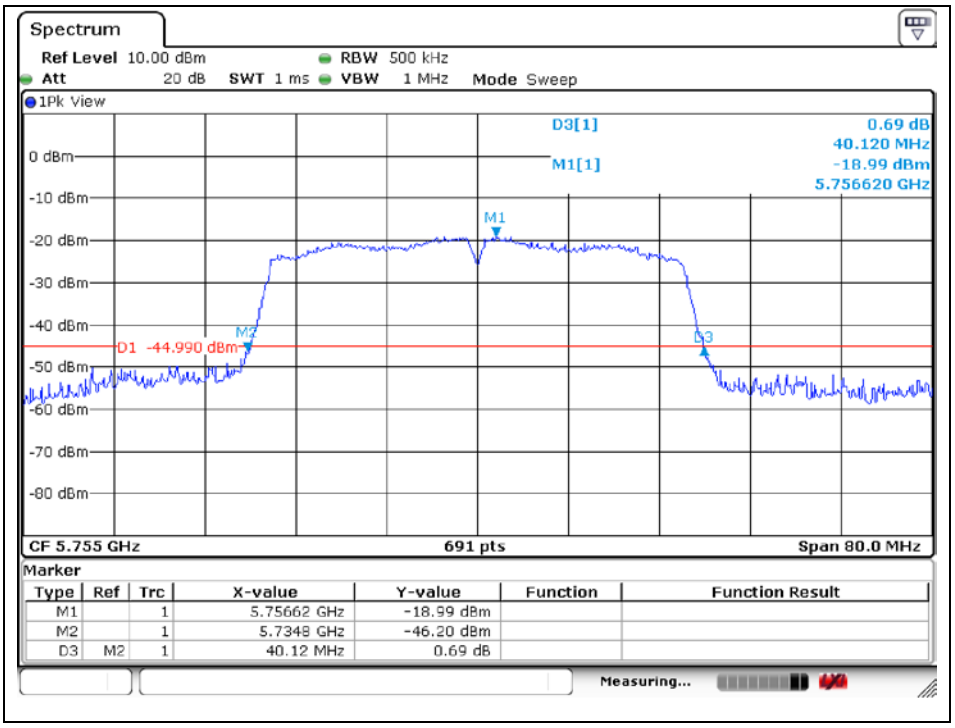


High Channel (5 805 ㎒)

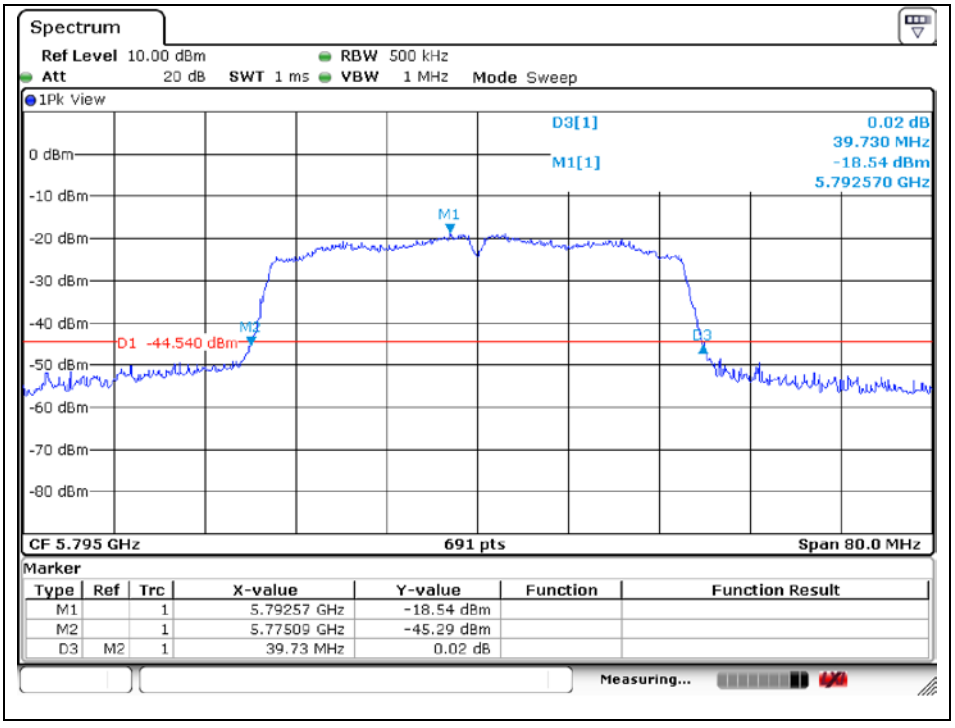


802.11n_HT40 (Band 3)

Low Channel (5 755 ㎒)

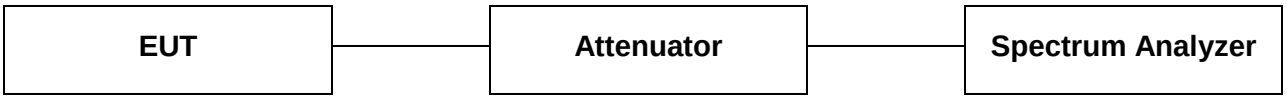


High Channel (5 795 ㎒)



4. 6 dB bandwidth

4.1. Test setup



4.2. Limit

Within the 5.725-5.85 ㎓ band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 ㎑.

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 C.2 of KDB 789033_D02 v01r02.
2. Set RBW = 100 ㎑.
3. Set the video bandwidth (VBW) ≥ 3 x 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.

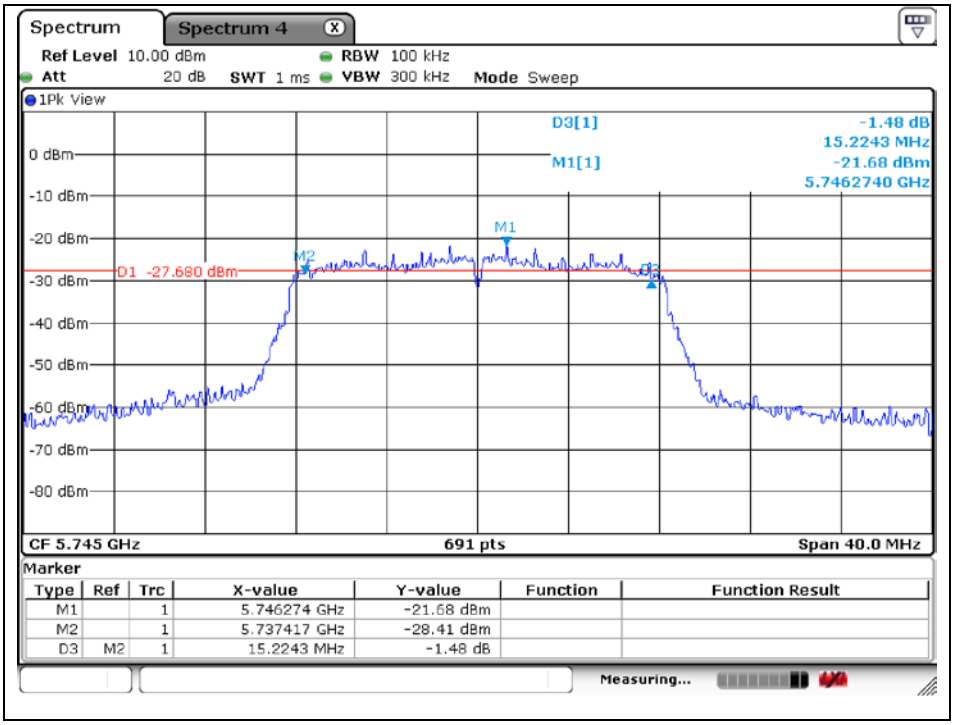
4.4. Test result

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

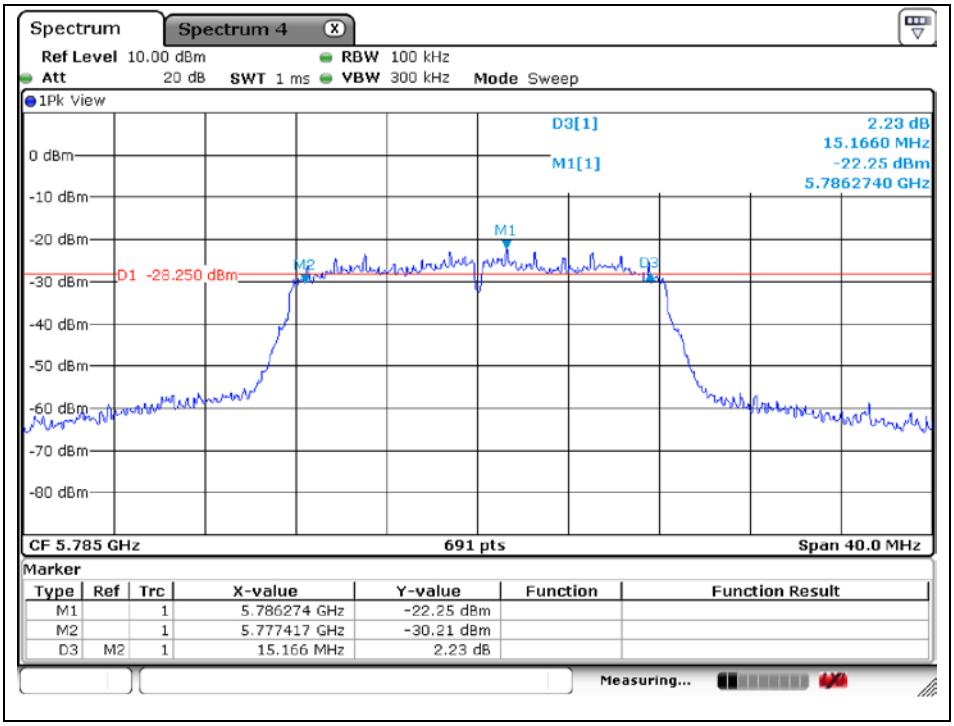
Band	Mode	Frequency (㎒)	Ch.	Data Rate	6 ㏈ Bandwidth (㎒)	Minimum Bandwidth (㎑)
U-NII 3	11a	5 745	149	6 Mbps	15.224	500
		5 785	157	6 Mbps	15.166	
		5 805	161	6 Mbps	15.224	
	11n_HT20	5 745	149	MCS0	16.035	
		5 785	157	MCS0	16.151	
		5 805	161	MCS0	15.196	
	11n_HT40	5 755	151	MCS0	35.250	
		5 795	159	MCS0	35.330	

802.11a (Band 3)

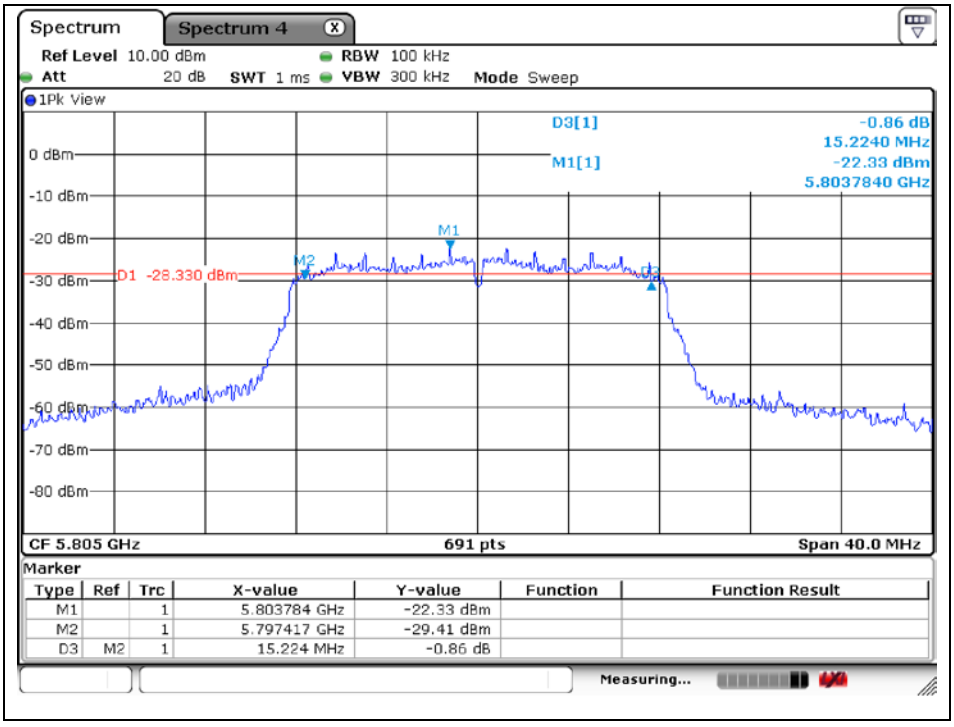
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

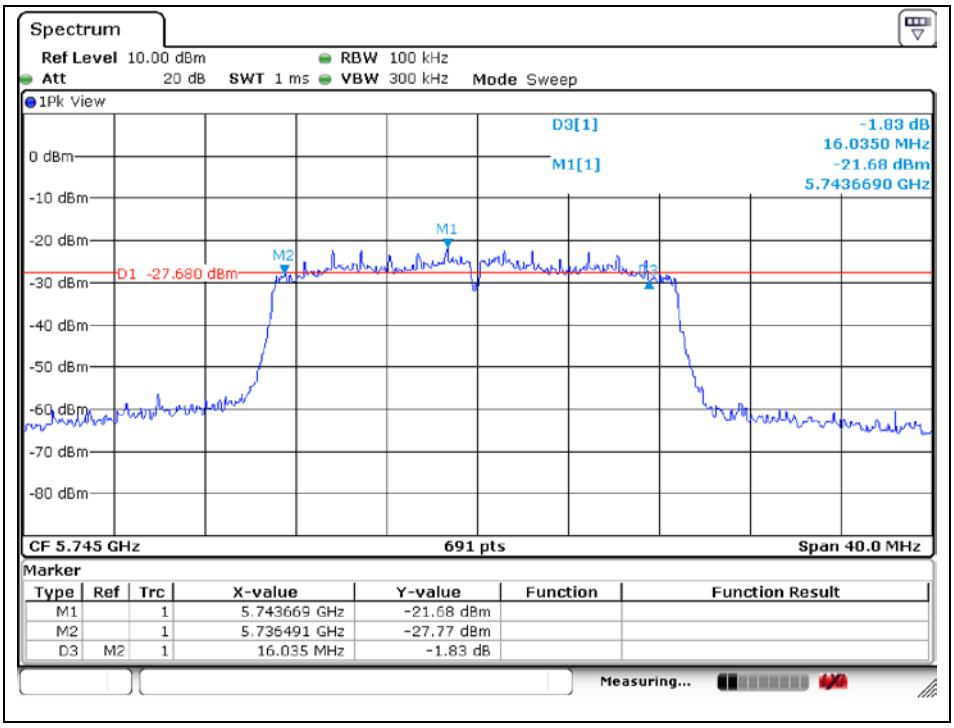


High Channel (5 805 ㎒)

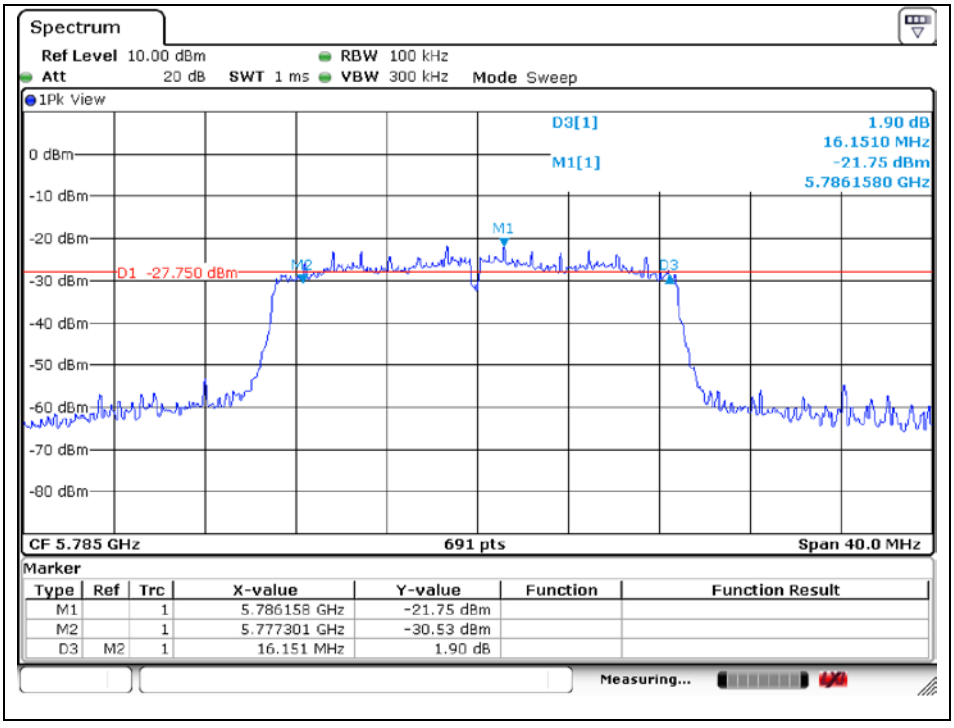


802.11n_HT20 (Band 3)

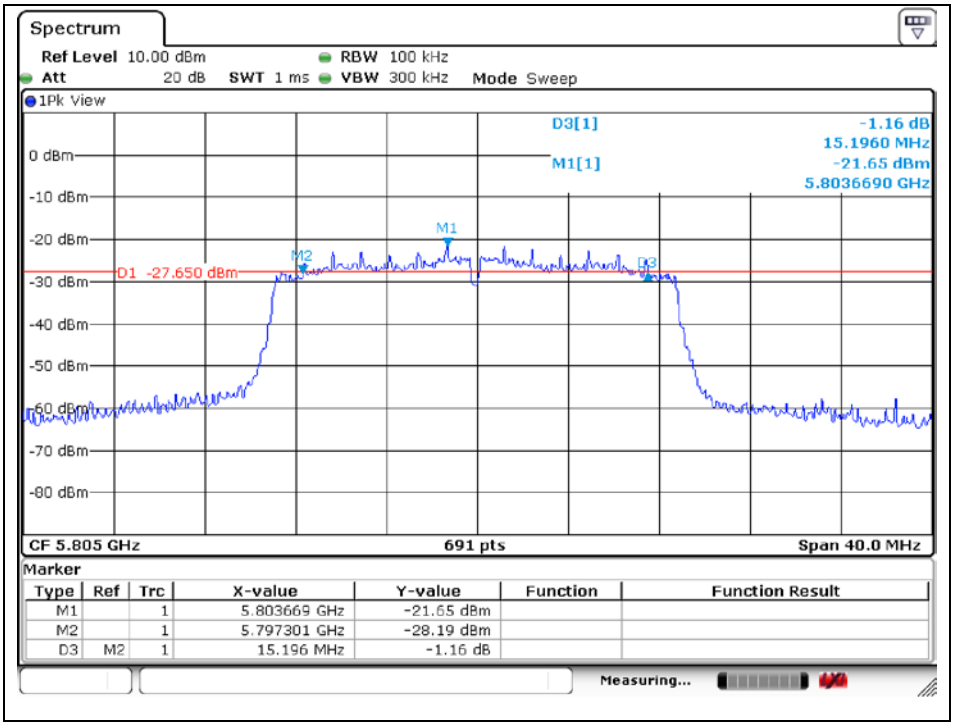
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

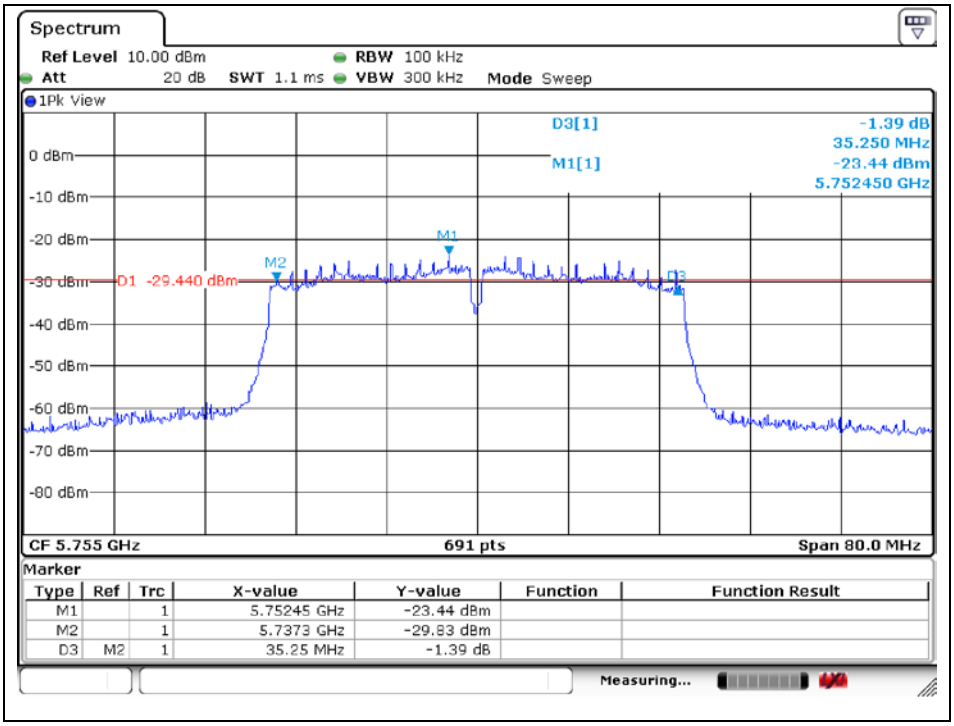


High Channel (5 805 ㎒)

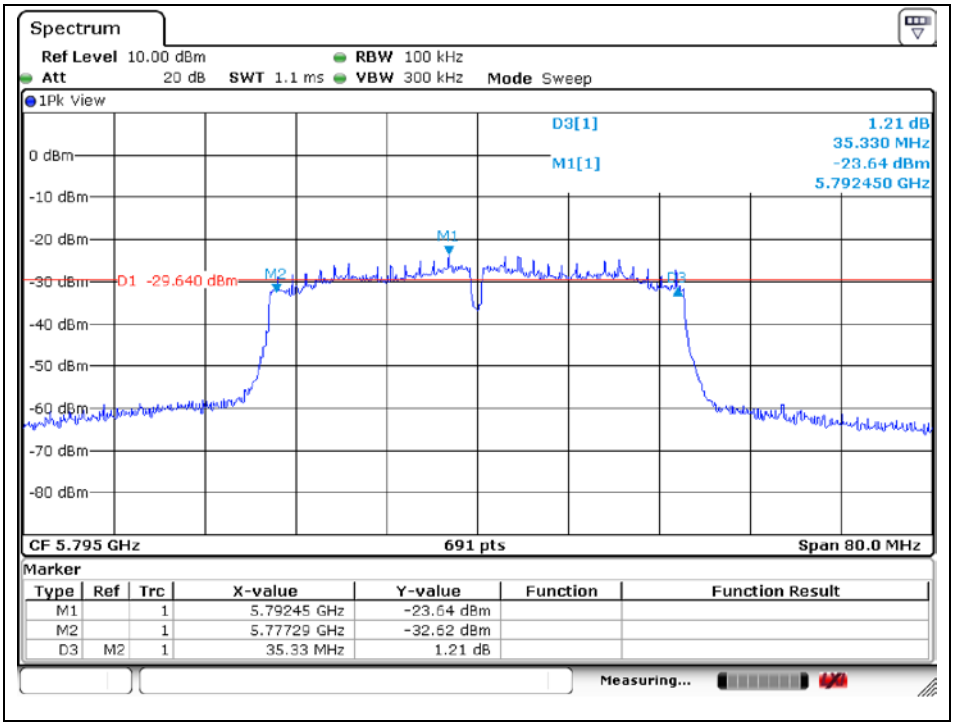


802.11n_HT40 (Band 3)

Low Channel (5 755 ㎒)

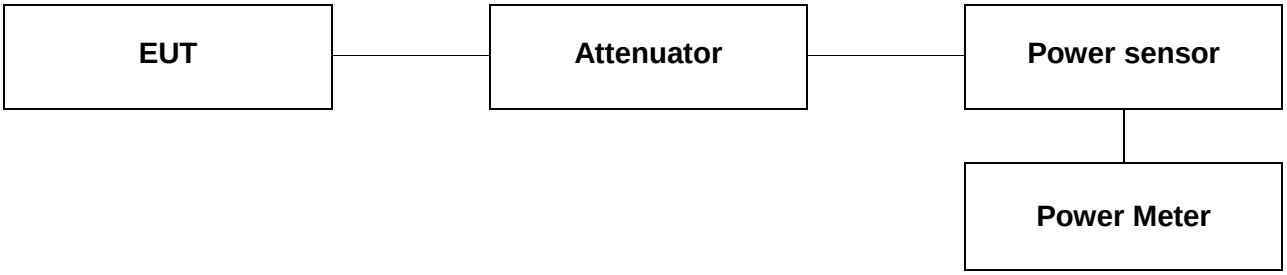


High Channel (5 795 ㎒)



5. Maximum Conducted Output Power

5.1. Test setup



5.2. Limit

FCC 15.407
(a)(3)

For the band 5.725-5.85 ㎓, 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 ㏈m in any 500-㎑ band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i. However, fixed point-to point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 ㏈ i 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.

5.3. Test procedure

1. This measurement settings are specified in section E.3.a and E.2.c of KDB 789033_D02 v01r02.
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 percent).

5.4. Test result

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

- 11a

Band	Frequency (㎒)	Conducted Power (㏈m)			
		Data Rate	Average Power (㏈m)	Duty Correction Factor (㏈)	Average Power Result (㏈m)
U-NII 3	5 745	6 Mbps	9.94	0.27	10.21
	5 785	6 Mbps	10.04	0.27	10.31
	5 805	6 Mbps	10.11	0.27	**10.38**

Remark;

1. Result (㏈m) = Average (㏈m) + Correction factor (㏈)
2. Correction factor (㏈) = 10 log (1/duty cycle (㎳))

- 11n_HT20

Band	Frequency (㎒)	Conducted Power (dB m)			
		Data Rate	Average Power (dB m)	Duty Correction Factor (dB)	Average Power Result (dB m)
U-NII 3	5 745	MCS0	9.81	0.22	10.03
	5 785	MCS0	9.91	0.22	10.13
	5 805	MCS0	10.01	0.22	**10.23**

Remark;

1. Result (dB m) = Average (dB m) + Correction factor (dB)
2. Correction factor (dB) = 10 log (1/duty cycle (㎳))

- 11n_HT40

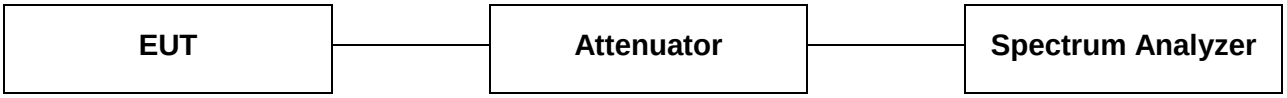
Band	Frequency (㎒)	Conducted Power (dB m)			
		Data Rate	Average Power (dB m)	Duty Correction Factor (dB)	Average Power Result (dB m)
U-NII 3	5 755	MCS0	9.90	0.41	10.31
	5 795	MCS0	10.04	0.41	**10.45**

Remark:

1. Result (dB m) = Average (dB m) + Correction factor (dB)
2. Correction factor (dB) = 10 log (1/duty cycle (㎳))

6. Peak Power Spectral Density

6.1. Test setup



6.2. Limit

FCC 15.407
(a)(3)

For the band 5.725-5.85 ㎓, 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 ㏈m in any 500-㎑ band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i. However, fixed point-to point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 ㏈ i 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.

6.3. 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 F of KDB 789033_D02 v01r02.

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 ㏈ to the final result to compensate for the difference between linear averaging and power averaging.

5. The result is the Maximum PSD over 1 ㎒ reference bandwidth.

6. For devices operating in the bands 5.15-5.25 ㎓, 5.25-5.35 ㎓, and 5.47-5.725 ㎓, the above procedures make use of 1 ㎒ RBW to satisfy directly the 1 ㎒ reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 ㎓, the rules specify a measurement bandwidth of 500 ㎑. Many spectrum analyzers do not have 500 ㎑ RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 ㎒, or 500 ㎑, “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 ㎒, or 500 ㎑). If measurements are performed using a reduced resolution bandwidth (< 1 ㎒, or < 500 ㎑) and integrated over 1 ㎒, or 500 ㎑ bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/*T*, where *T* is defined in section II.B.l.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 ㎑, add 10log(500 ㎑/RBW) to the measured result, whereas RBW (< 500 ㎑) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 ㎒, add 10log(1 ㎒/RBW) to the measured result, whereas RBW (< 1 ㎒) 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.

Note: As a practical matter, it is recommended to use reduced RBW of 100 ㎑ for the sections 5.c) and 5.d) above, since RBW = 100 ㎑ is available on nearly all spectrum analyzers.

6.4. Test result

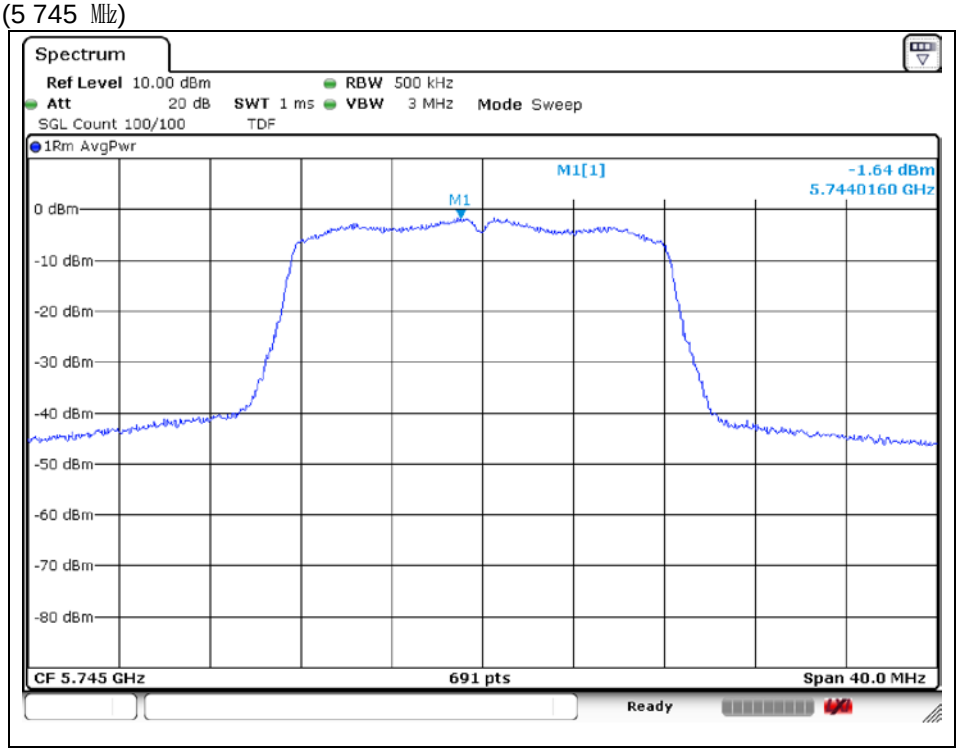
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Band	Mode	Frequency (㎒)	Ch.	Data Rate	Measured PPSD (㏈ m)	Duty Factor (㏈)	Final PPSD (㏈ m)	Limit (㏈ m/500 ㎑)
U-NII 3	11a	5 745	149	6 Mbps	-1.64	0.27	-1.37	30
		5 785	157	6 Mbps	-1.90	0.27	-1.63	
		5 805	161	6 Mbps	-1.71	0.27	-1.44	
	11n_HT20	5 745	149	MCS0	-1.88	0.22	-1.66	
		5 785	157	MCS0	-2.00	0.22	-1.78	
		5 805	161	MCS0	-1.81	0.22	-1.59	
	11n_HT40	5 755	151	MCS0	-4.60	0.41	-4.19	
		5 795	159	MCS0	-4.70	0.41	-4.29	

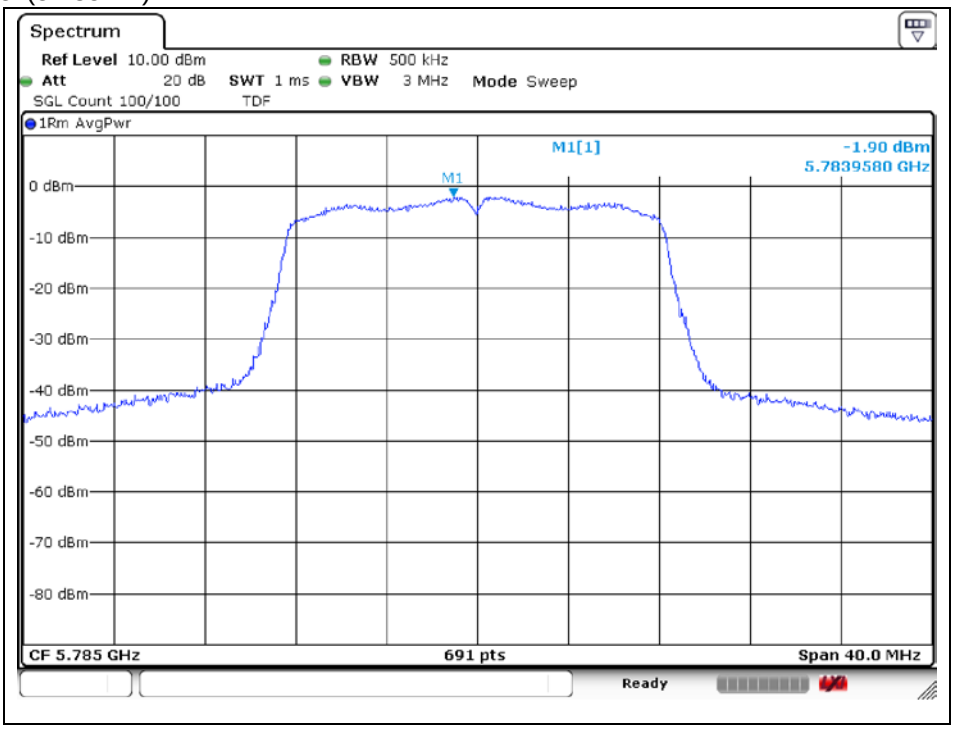
Note: Final PPSD (㏈ m) = Measured PPSD (㏈ m) + Duty Factor (㏈)

802.11a (Band 3)

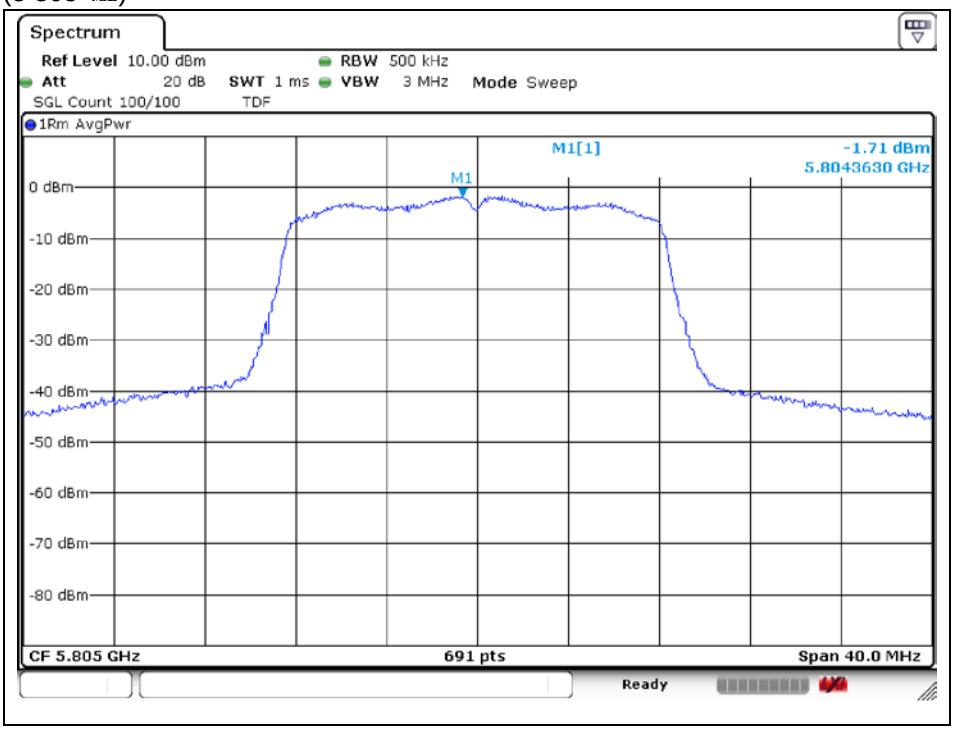
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

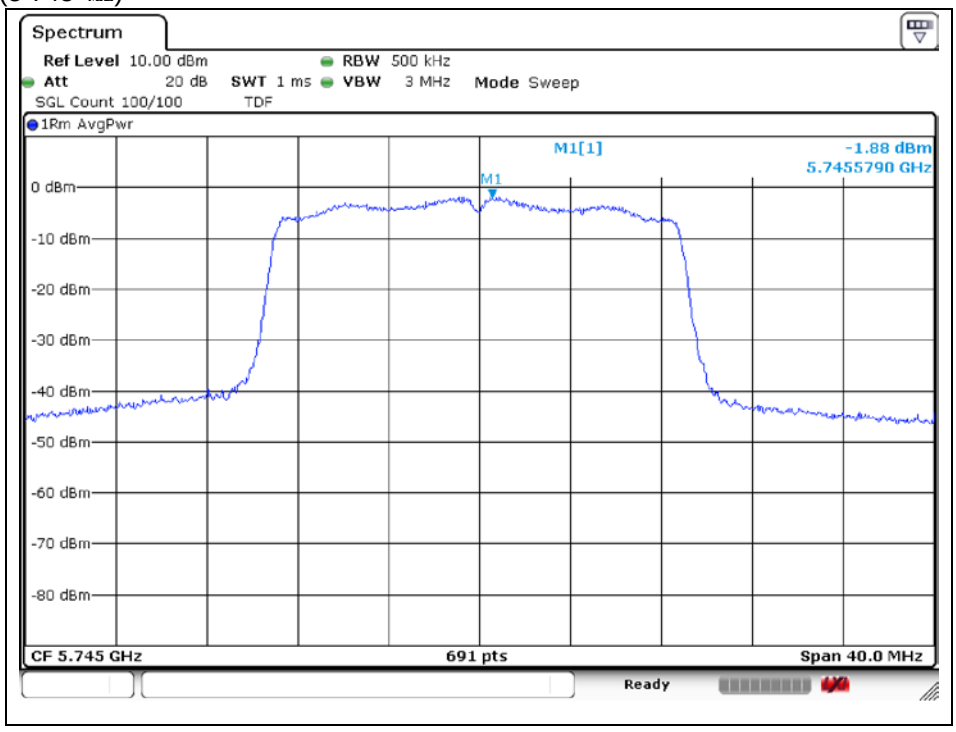


High Channel (5 805 ㎒)

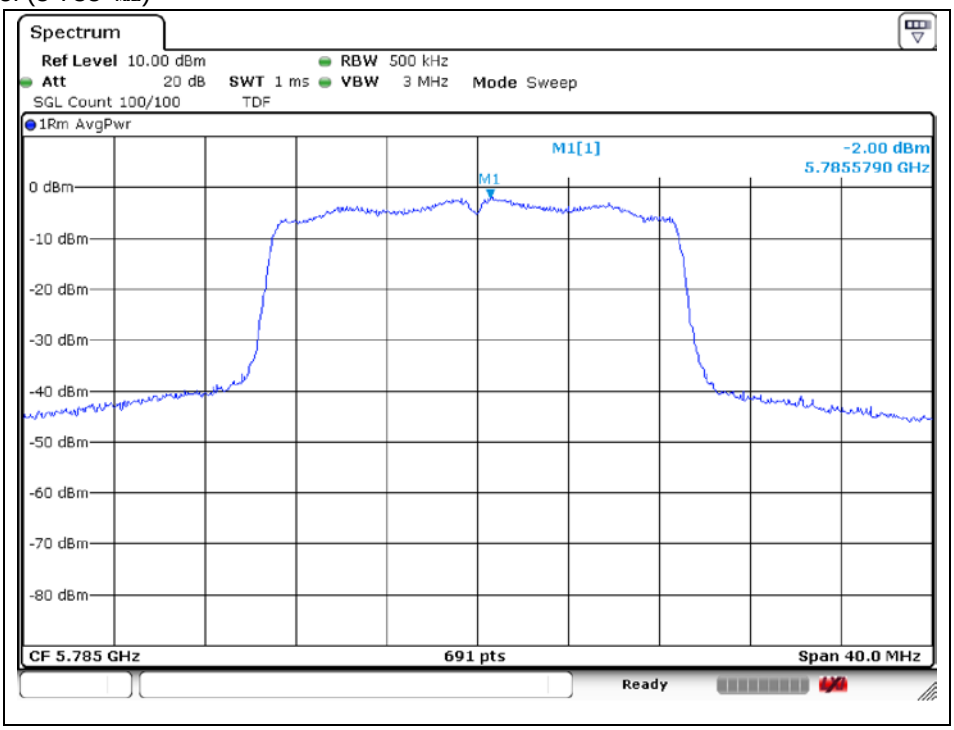


802.11n_HT20 (Band 3)

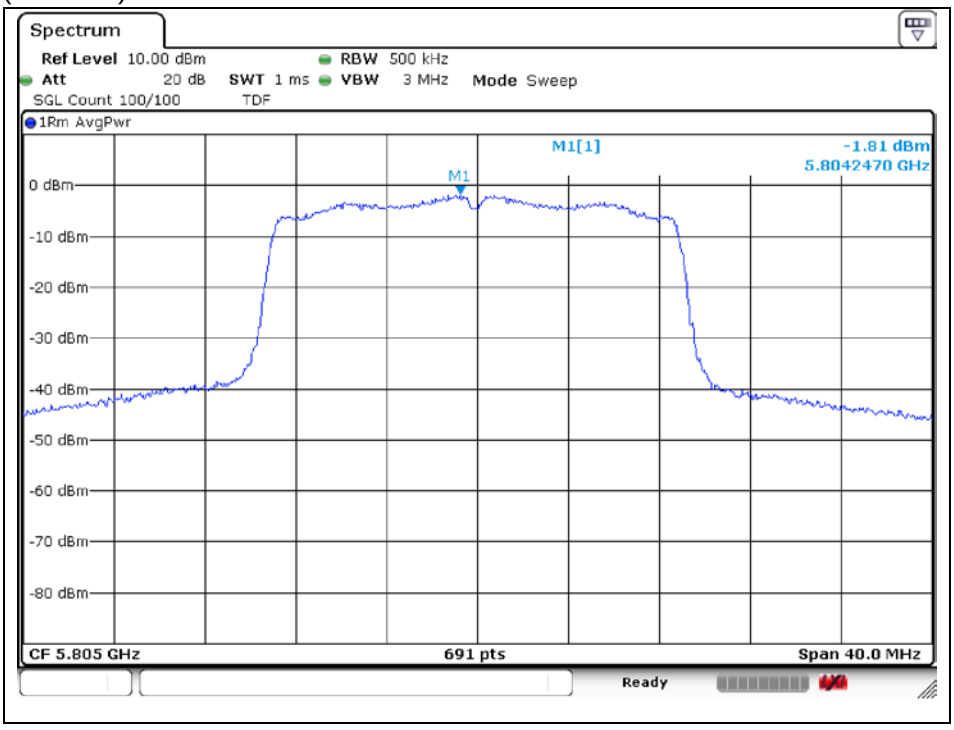
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

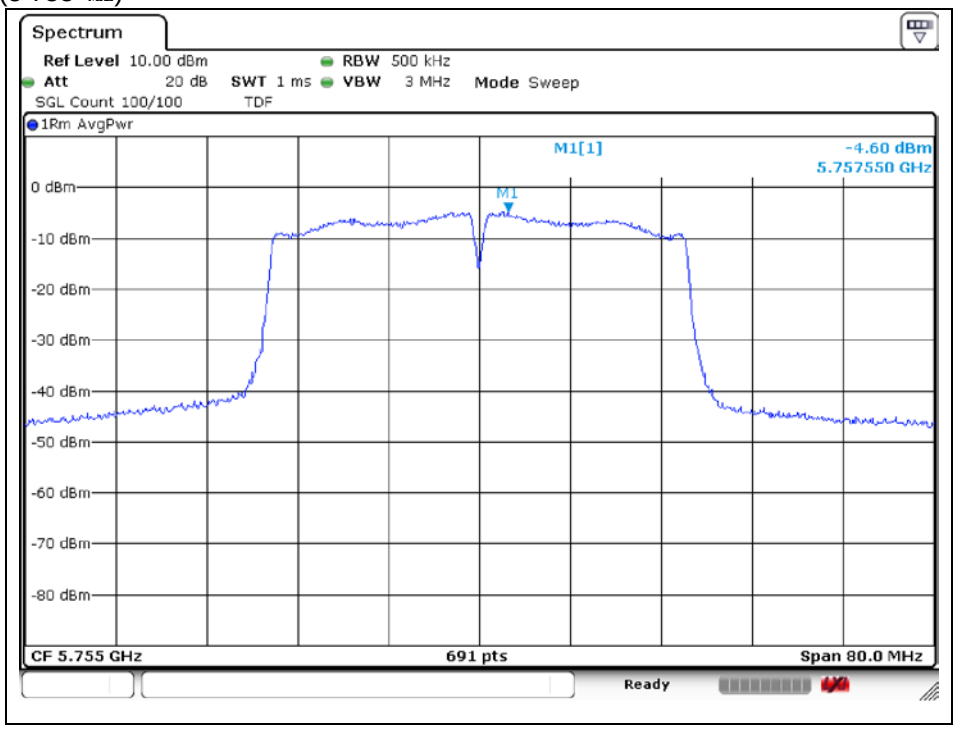


High Channel (5 805 ㎒)

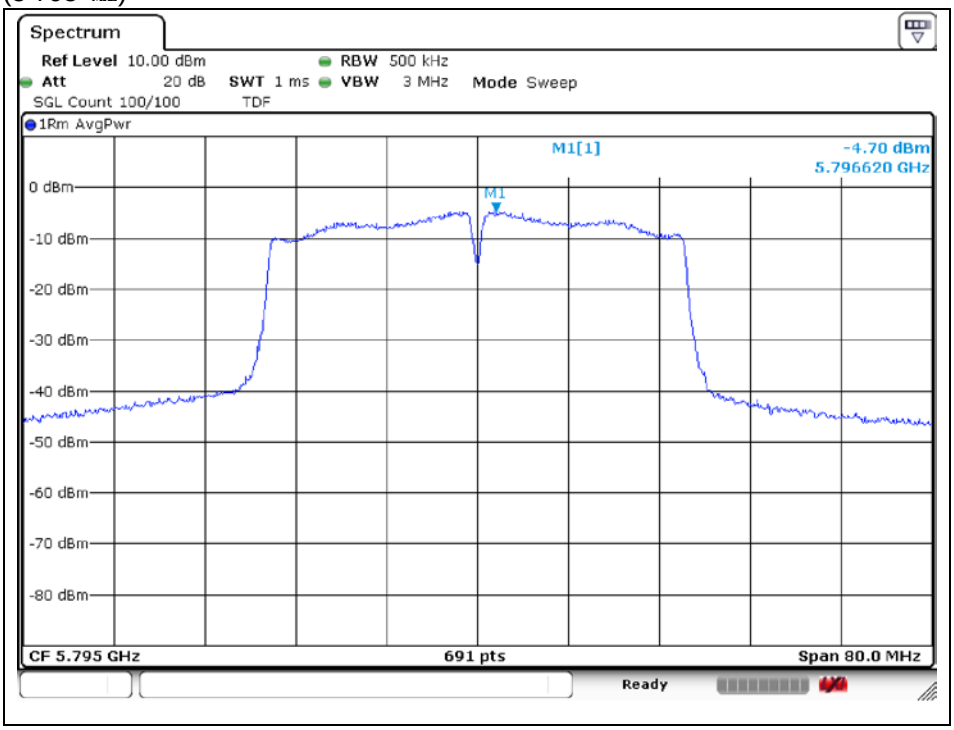


802.11n_HT40 (Band 3)

Low Channel (5 755 ㎒)

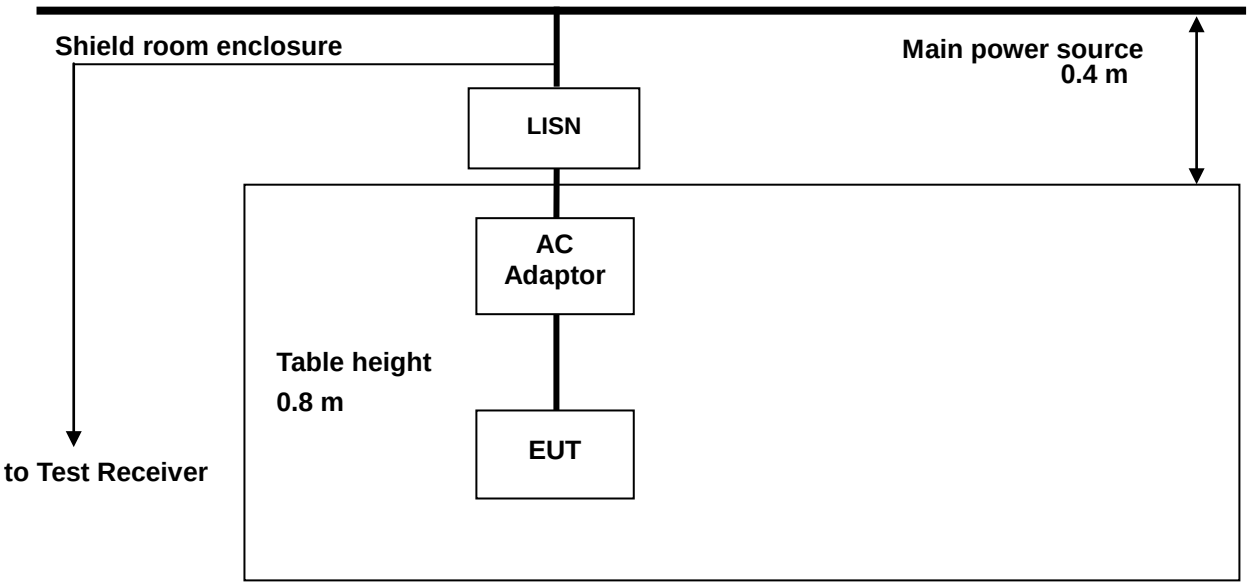


High Channel (5 795 ㎒)



7. AC Power Line Conducted Emission

7.1. Test Setup



7.2. Limit

§15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 ㎌ H /50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	Conducted limit (dB㎶)	
	Quasi-peak	Average
0.15 - 0.50	66 - 56*	56 - 46*
0.50 - 5.00	56	46
5.00 - 30.0	60	50

* Decreases with the logarithm of the frequency.

7.3. Test Procedures

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

AC line conducted emissions from the EUT were measured according to the dictates of ANSI C63.10-2013

1. The test procedure is performed in a 6.5 m × 3.6 m × 3.6 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. The excess power cable between the EUT and the LISN was bundled. All connecting cables of EUT were moved to find the maximum emission.

7.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line

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

Frequency range : 0.15 ㎒ - 30 ㎒
Measured Bandwidth : 9 ㎑

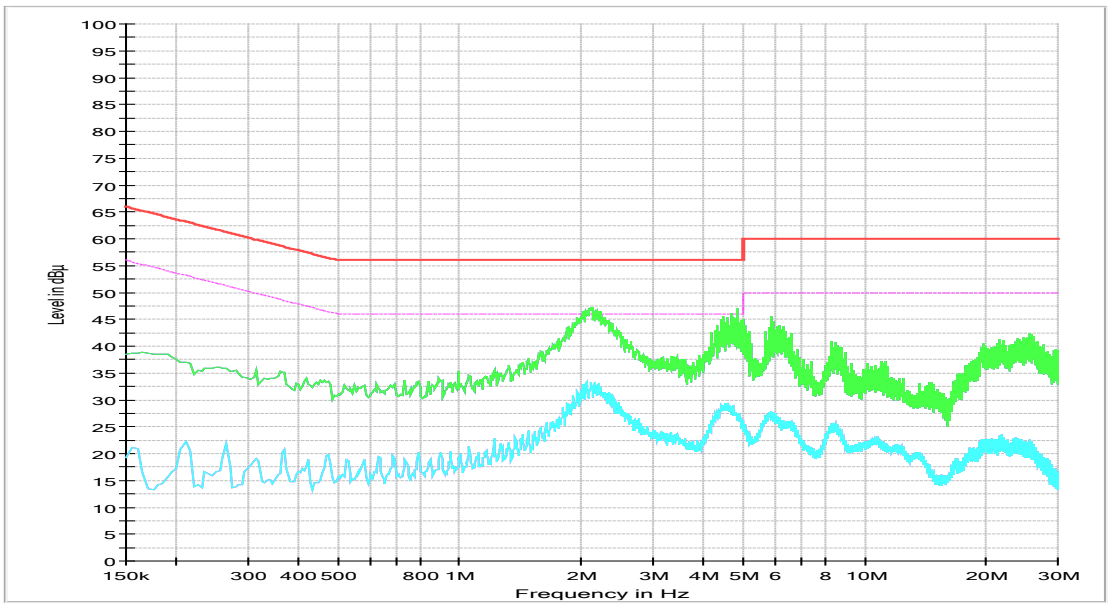
FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
2.13	43.70	32.60	N	56.00	46.00	12.30	13.40
4.54	38.00	29.00	N	56.00	46.00	18.00	17.00
5.87	35.30	27.30	N	60.00	50.00	24.70	22.70
8.43	33.40	25.30	N	60.00	50.00	26.60	24.70
10.74	33.20	25.20	N	60.00	50.00	26.80	24.80
21.78	34.50	22.60	N	60.00	50.00	25.50	27.40
2.11	41.90	31.80	H	56.00	46.00	14.10	14.20
4.60	36.80	28.40	H	56.00	46.00	19.20	17.60
5.89	35.10	25.60	H	60.00	50.00	24.90	24.40
8.38	34.70	25.70	H	60.00	50.00	25.30	24.30
10.57	31.80	23.20	H	60.00	50.00	28.20	26.80
21.77	32.50	22.30	H	60.00	50.00	27.50	27.70

Remark;

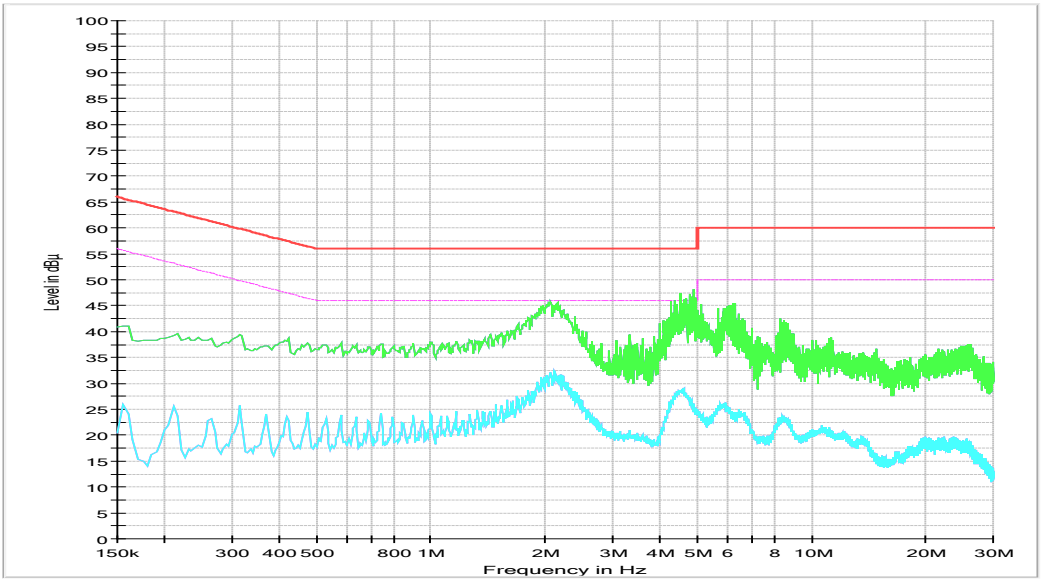
1. Line (H): Hot, Line (N): Neutral.
2. All modes of operation were investigated and the worst-case emissions were reported using 11a Mode, 6Mbps, High channel.
3. Traces shown in plot mad using a peak detector and average detector.
4. The limit for Class B device(s) from 150 ㎑ to 30 ㎒ are specified in Section of the Title 47 CFR.
5. Deviations to the Specifications: None.

Plots of Conducted Power line

Test mode: (Neutral)



Test mode: (Hot)



8. Antenna Requirement

8.1. 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.

8.2. Antenna Connected Construction

Antenna used in this product is Insert Mold type and peak max gain of antenna as below.

Band	5 725 ㎒ – 5 850 ㎒
Mode	11a/n_HT20, HT40
Gain	-0.85 dBi