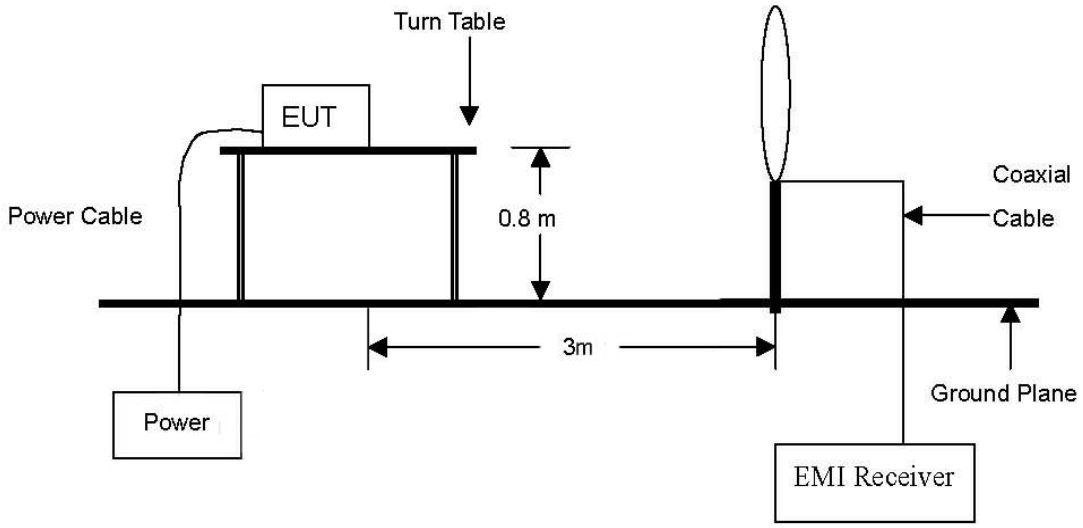
2. Transmitter radiated spurious emissions

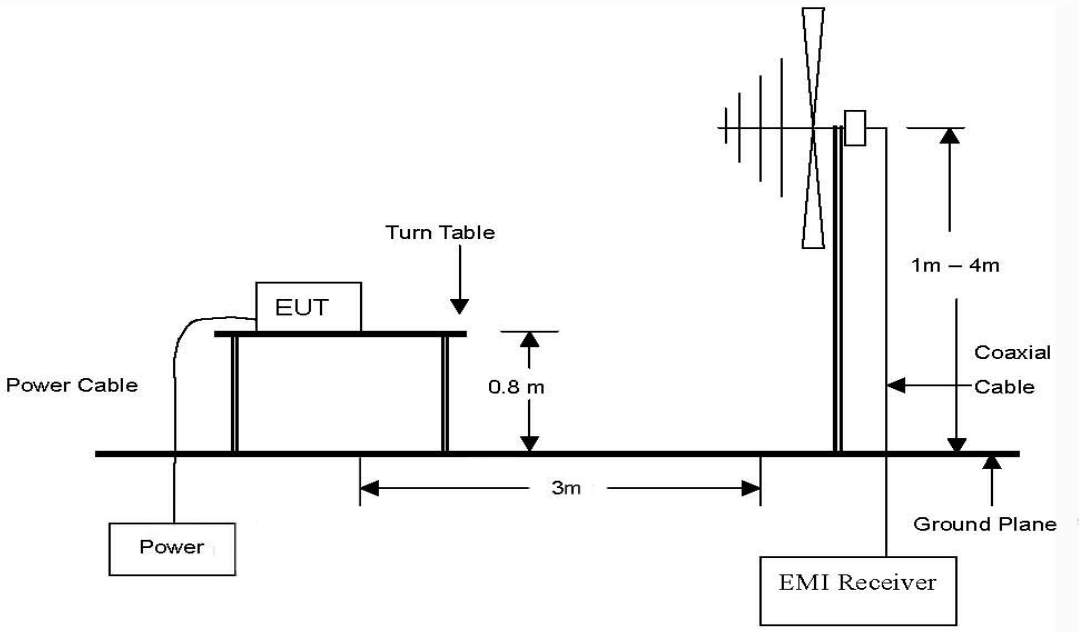
2.1. Test setup

2.1.1. Transmitter Radiated Spurious Emissions

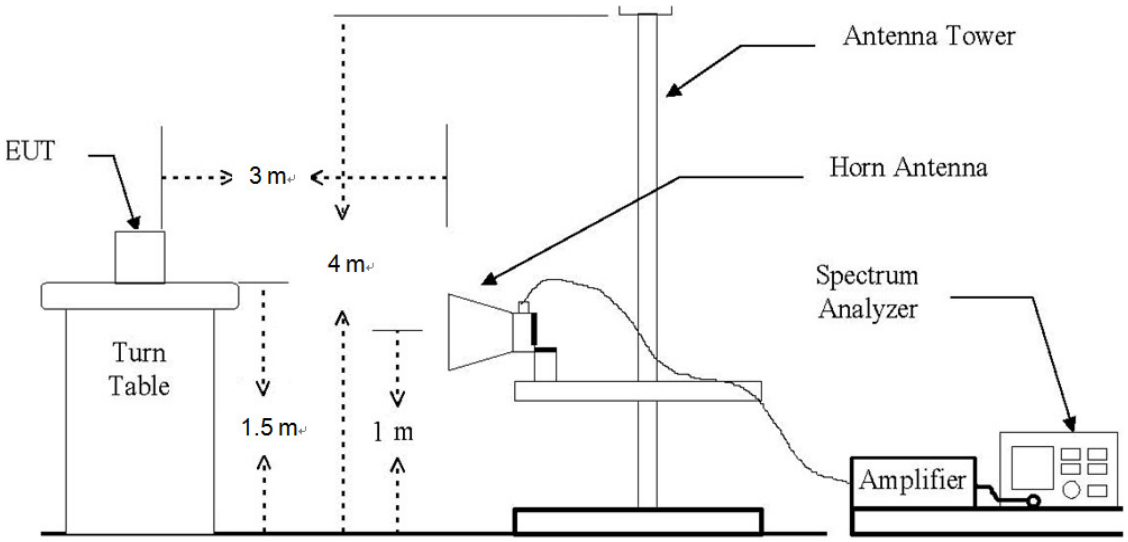
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



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 within the frequency range from the band edge to 10 ㎒ above or below the band edge shall not exceed an e.i.r.p. of -17 ㏈ m/㎒; for frequencies 10 ㎒ or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 ㏈ m/㎒.

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

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2.3. Test procedures

Radiated spurious emissions from the EUT were measured according to the dictates in section G of KDB 789033 D02 v01r02 and ANSI C63.10-2009.

Remark:
Testing for radiated emissions above 1 ㎓ was performed with the EUT elevated at 1.5 m instead of 0.8 m. 1.5 m is the required height in ANSI C63.10:2013 as referenced by RSS-GEN issue 4. This test height has been permitted by FCC as discussed in FCC-TCB conference call in December 2014.

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.

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 meters 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.

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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 dB must be added to the measured emission levels.

- If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

- To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes (X, Y, Z). Worst orthogonal plan of EUT is **Y – axis** during radiation test.

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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 (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
72.03	47.00	Peak	V	10.17	-26.82	30.35	40.00	9.65
168.02	44.30	Peak	H	10.20	-25.93	28.57	43.50	14.93
203.11	47.20	Peak	V	11.85	-25.65	33.40	43.50	10.10
278.36	45.10	Peak	V	14.67	-25.14	34.63	46.00	11.37
345.90	40.60	Peak	H	15.30	-25.12	30.78	46.00	15.22
360.00	38.50	Peak	H	15.75	-25.23	29.02	46.00	16.98
Above 400.00	Not detected	-	-	-	-	-	-	-

Remark:

1. Spurious emissions for all channels and modes were investigated and almost the same below 1 ㎓.
2. Reported spurious emissions are in **11n HT20 (Band 3) / MCS8 / 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 ㏈.

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2.4.2. Radiated Spurious Emission above 1 000 ㎒

802.11a (Band 3)_6 Mbps - ANT1

A. Low Channel (5 745 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 705.33	19.00	Peak	H	34.20	8.66	61.86	68.23	6.37
5 724.55	20.61	Peak	H	34.23	8.59	63.43	78.23	14.80

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 492.52	41.93	Peak	H	38.44	-26.19	54.18	74.00	19.82
*11 488.01	30.55	Average	H	38.44	-26.17	42.82	54.00	11.18
Above 11 500.00	Not detected	-	-	-	-	-	-	-

B. Middle Channel (5 785 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 567.32	39.14	Peak	H	38.43	-25.74	51.83	74.00	22.17
*11 569.93	28.23	Average	H	38.43	-25.71	40.95	54.00	13.05
Above 11 600.00	Not detected	-	-	-	-	-	-	-

C. High Channel (5 825 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 857.74	19.42	Peak	H	34.45	8.61	62.48	78.23	15.75
5 868.42	19.18	Peak	H	34.46	8.60	62.24	68.23	5.99

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 649.36	38.80	Peak	H	38.41	-25.74	51.47	74.00	22.53
*11 649.97	27.99	Average	H	38.41	-25.74	40.66	54.00	13.34
Above 11 700.00	Not detected	-	-	-	-	-	-	-

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802.11a (Band 3)_6 Mbps - ANT2

A. Low Channel (5 745 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 708.98	19.52	Peak	H	34.20	8.65	62.37	68.23	5.86
5 724.58	20.06	Peak	H	34.23	8.59	62.88	78.23	15.35

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 490.94	41.91	Peak	H	38.44	-26.18	54.17	74.00	19.83
*11 491.68	29.98	Average	H	38.44	-26.18	42.24	54.00	11.76
Above 11 500.00	Not detected	-	-	-	-	-	-	-

B. Middle Channel (5 785 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 571.32	41.24	Peak	H	38.43	-25.70	53.97	74.00	20.03
*11 570.12	30.30	Average	H	38.43	-25.71	43.02	54.00	10.98
Above 11 600.00	Not detected	-	-	-	-	-	-	-

C. High Channel (5 825 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 854.19	19.62	Peak	H	34.44	8.61	62.67	78.23	15.56
5 867.59	18.96	Peak	H	34.46	8.60	62.02	68.23	6.21

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 652.18	41.09	Peak	H	38.40	-25.75	53.74	74.00	20.26
*11 652.19	30.11	Average	H	38.40	-25.75	42.76	54.00	11.24
Above 11 700.00	Not detected	-	-	-	-	-	-	-

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802.11n_HT20 (Band 3)_MCS8 - ANT1+2

A. Low Channel (5 745 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 708.11	19.21	Peak	H	34.20	8.65	62.06	68.23	6.17
5 721.02	19.46	Peak	H	34.22	8.60	62.28	78.23	15.95

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 487.24	38.33	Peak	H	38.44	-26.16	50.61	74.00	23.39
*11 489.82	26.67	Average	H	38.44	-26.17	38.94	54.00	15.06
Above 11 500.00	Not detected	-	-	-	-	-	-	-

B. Middle Channel (5 785 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 568.83	37.47	Peak	H	38.43	-25.72	50.18	74.00	23.82
*11 568.37	27.14	Average	H	38.43	-25.72	39.85	54.00	14.15
Above 11 600.00	Not detected	-	-	-	-	-	-	-

C. High Channel (5 825 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 852.07	19.13	Peak	H	34.44	8.61	62.18	78.23	16.05
5 869.22	18.39	Peak	H	34.47	8.60	61.46	68.23	6.77

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 648.55	37.22	Peak	H	38.41	-25.73	49.90	74.00	24.10
*11 647.07	26.19	Average	H	38.41	-25.72	38.88	54.00	15.12
Above 11 700.00	Not detected	-	-	-	-	-	-	-

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802.11n_HT40 (Band 3)_MCS8 - ANT1+2

A. Low Channel (5 755 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 709.00	19.18	Peak	H	34.20	8.65	62.03	68.23	6.20
5 716.64	19.01	Peak	H	34.22	8.62	61.85	78.23	16.38

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 507.92	41.80	Peak	H	38.45	-26.17	54.08	74.00	19.92
*11 510.87	26.27	Average	H	38.45	-26.14	38.58	54.00	15.42
Above 11 600.00	Not detected	-	-	-	-	-	-	-

B. High Channel (5 795 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5 857.96	19.36	Peak	H	34.45	8.61	62.42	78.23	15.81
5 861.34	19.54	Peak	H	34.45	8.60	62.59	68.23	5.64

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*11 585.66	37.29	Peak	H	38.42	-25.60	50.11	74.00	23.89
*11 591.98	26.03	Average	H	38.42	-25.55	38.90	54.00	15.10
Above 11 600.00	Not detected	-	-	-	-	-	-	-

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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)
4. Radiated spurious emission measurement.
   (Actual = Reading + AF + AMP + CL)
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 frequency between 5 715 ㎒ ~ 5 725 ㎒ and 5 850 ㎒ ~ 5 860 ㎒ the limit is determined as 78.23 ㏈㎶/m.
   78.23 ㏈㎶/m = EIRP - 20 log(d) + 104.77 = -17 - 20 log (3) + 104.77
7. According to § 15.31(o), Emission levels are not reported much lower than the limits by over 20 ㏈.

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3. 26 ㏈ Bandwidth

3.1. Test setup

EUT	—	Attenuator	—	Spectrum Analyzer

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.

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 ㏈ 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 %.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

3.4. Test result

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

Band	Mode	Frequency (㎒)	Ch.	Data Rate (Mbps)	26 ㏈ Bandwidth (㎒)
U-NII 3	11a	5 745	149	6	18.90
		5 785	157	6	19.22
		5 825	165	6	19.18
	11n_HT20	5 745	149	MCS8	19.57
		5 785	157	MCS8	19.62
		5 825	165	MCS8	19.60
	11n_HT40	5 755	151	MCS8	40.36
		5 795	159	MCS8	40.44

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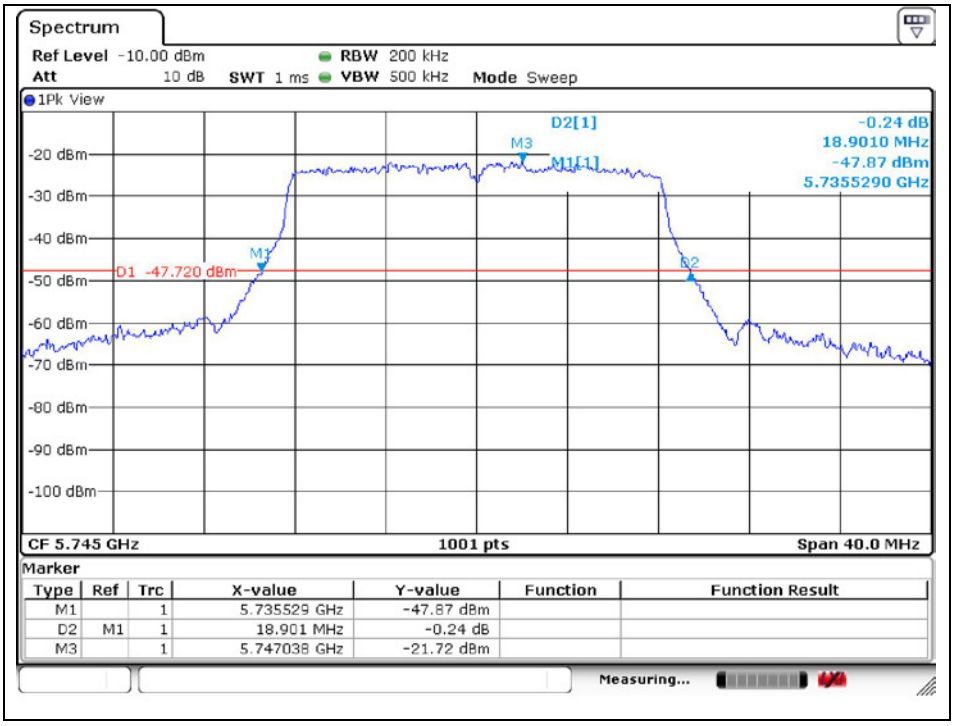
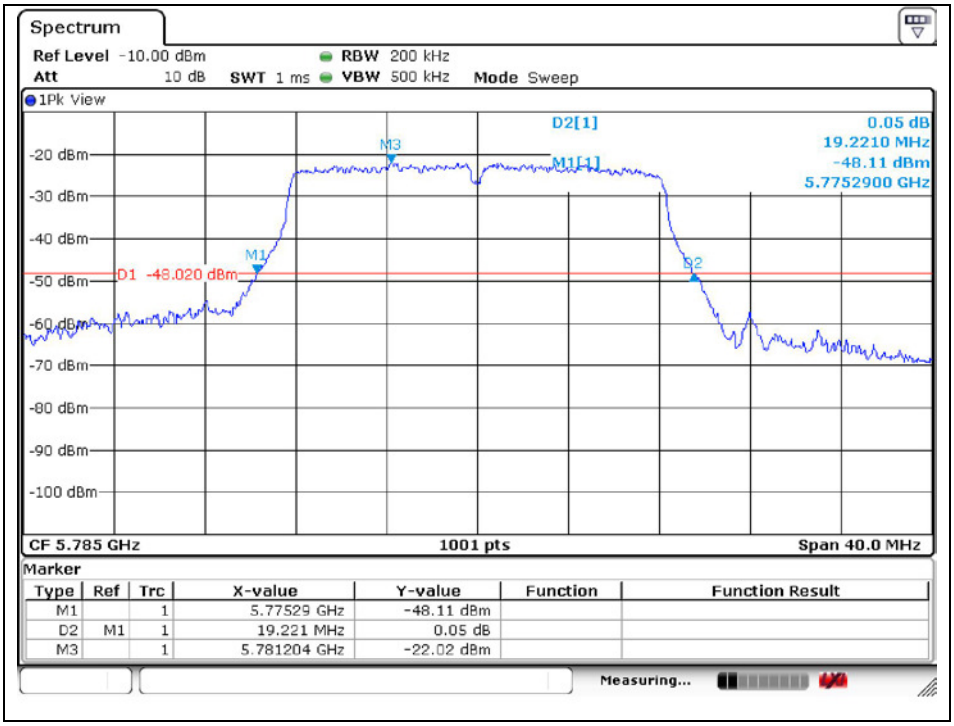
26 dB Bandwidth

802.11a (Band 3)

Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



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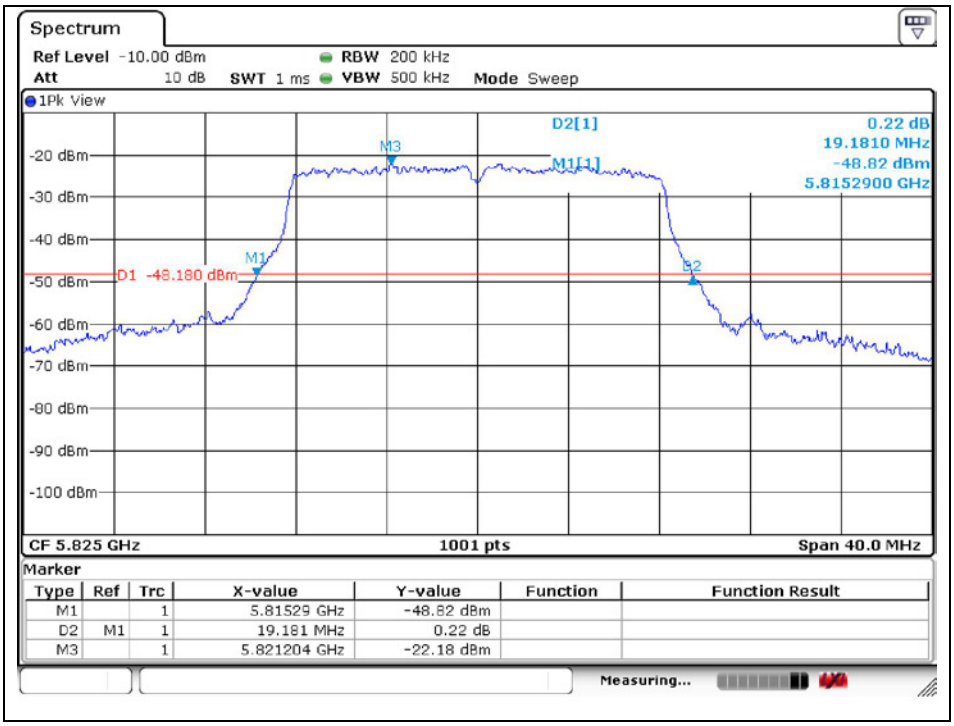
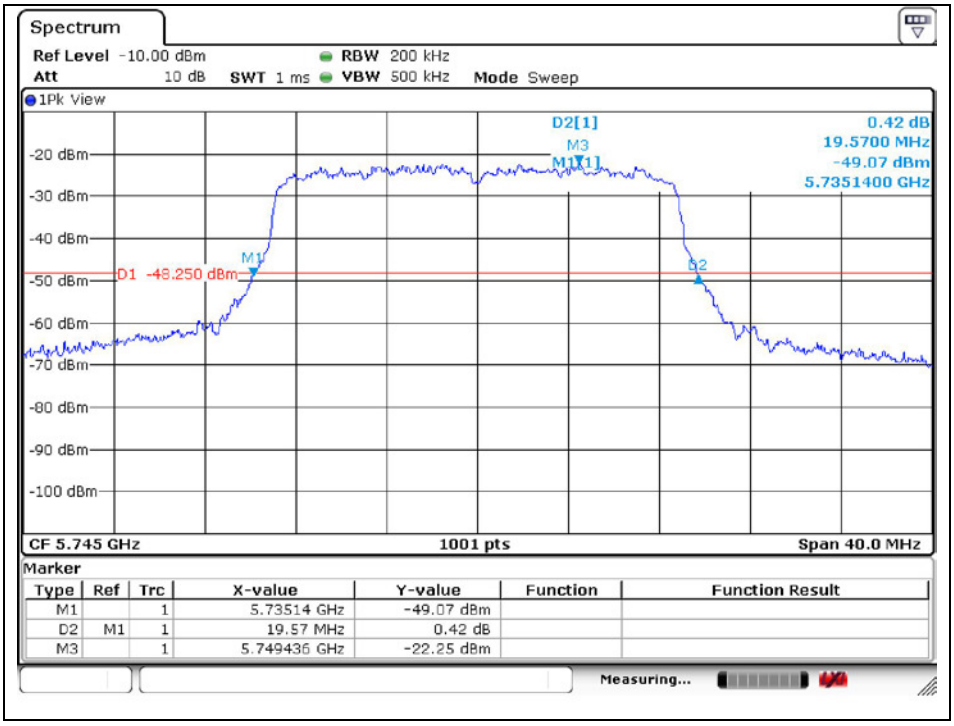
High Channel (5 825 ㎒)

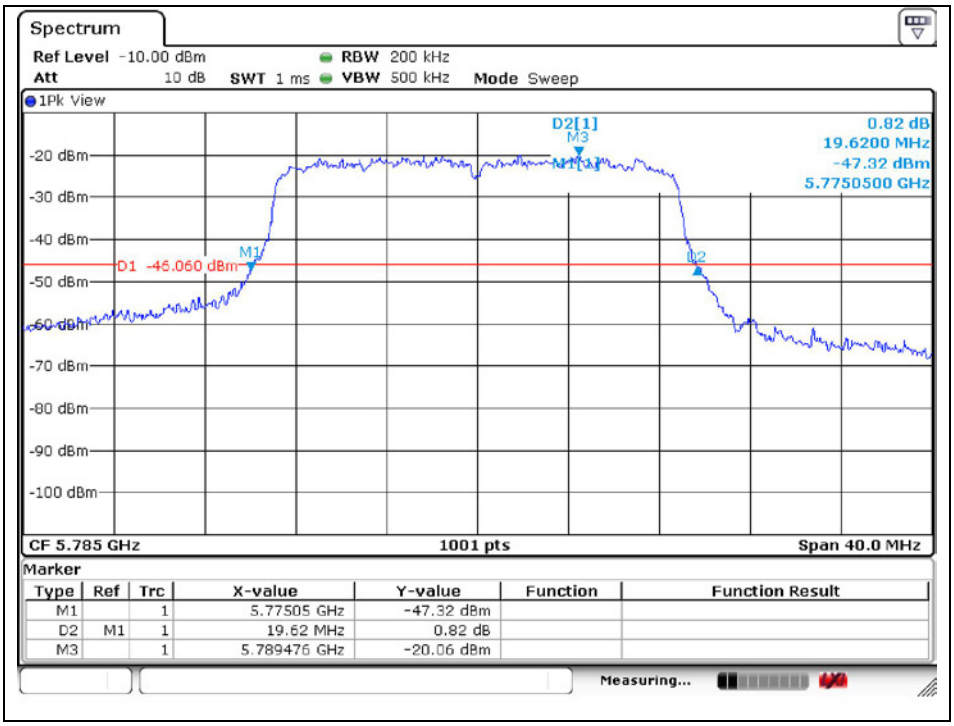


802.11n_HT20 (Band 3)

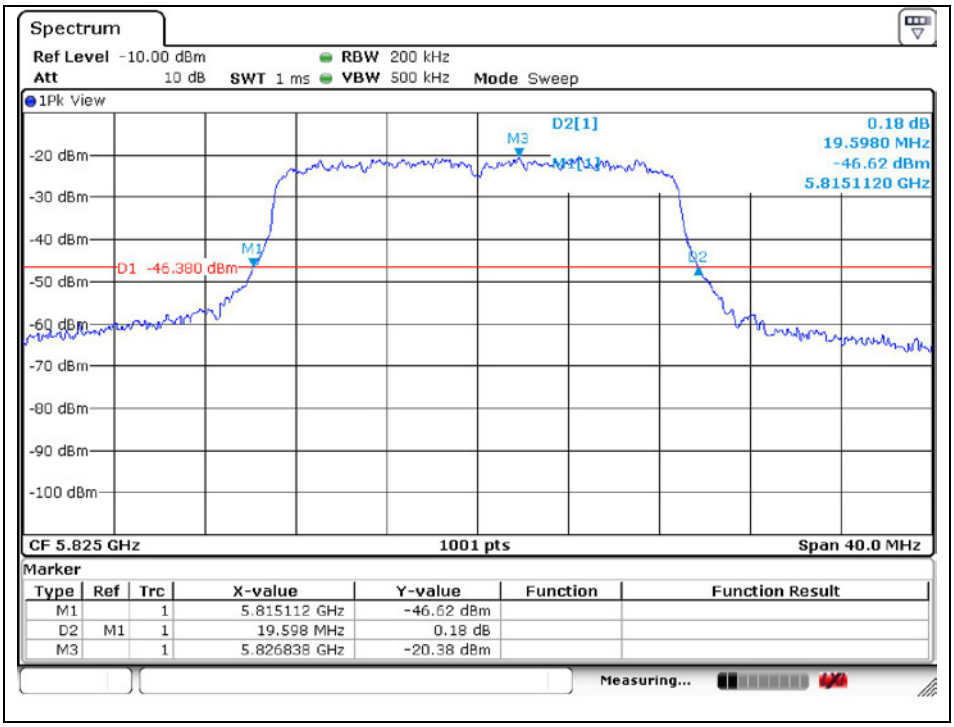
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)



High Channel (5 825 ㎒)



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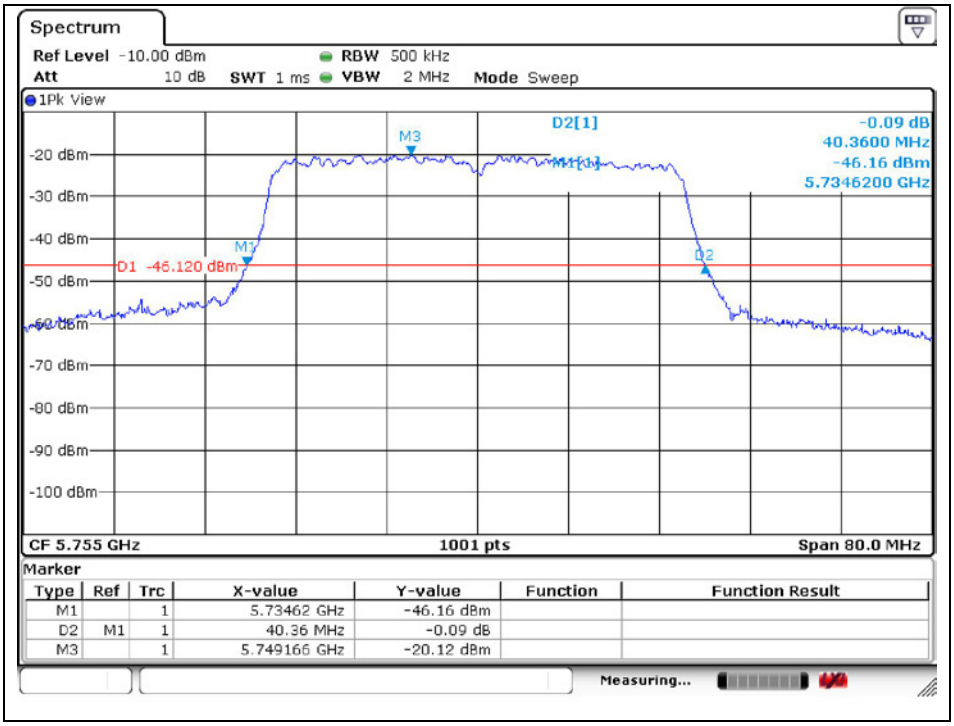
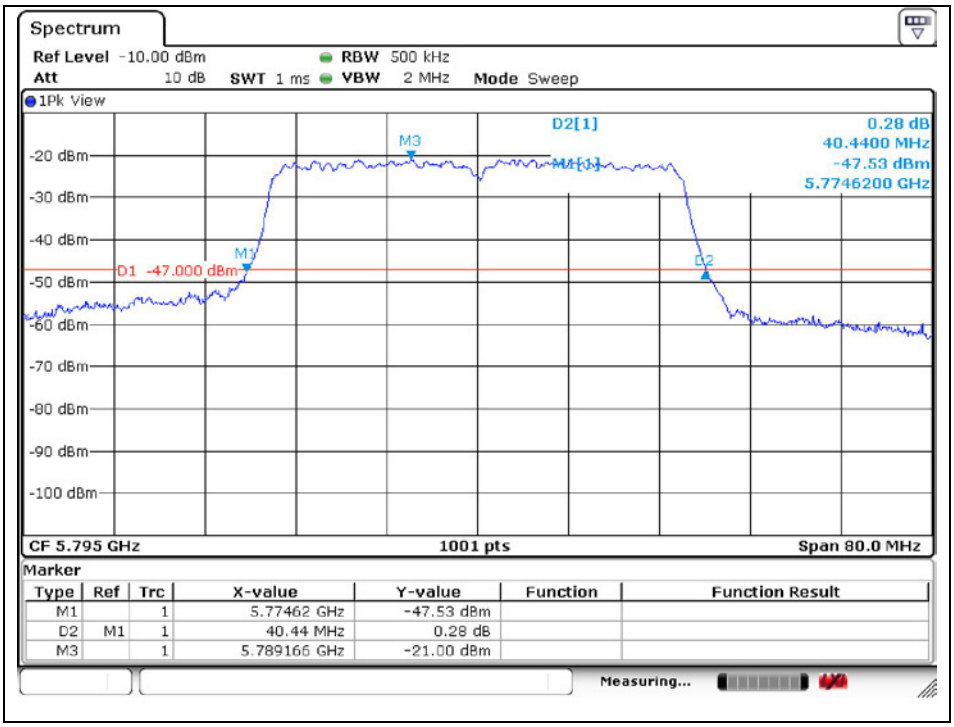
802.11n_HT40 (Band 3)

Low Channel (5 755 ㎒)



High Channel (5 795 ㎒)



4. 6 ㏈ Bandwidth

4.1. Test setup

EUT	—	Attenuator	—	Spectrum Analyzer

4.2. Limit

Within the 5.725-5.85 ㎓ band, the minimum 6 ㏈ 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 ㏈ relative to the maximum level measured in the fundamental emission.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

4.4. Test result

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

Band	Mode	Frequency (㎒)	Ch.	Data Rate (Mbps)	6 ㏈ Bandwidth (㎒)	Minimum Bandwidth (㎑)
U-NII 3	11a	5 745	149	6	16.54	500
		5 785	157	6	16.50	500
		5 825	165	6	16.46	500
	11n_HT20	5 745	149	MCS8	17.66	500
		5 785	157	MCS8	17.66	500
		5 825	165	MCS8	17.62	500
	11n_HT40	5 755	151	MCS8	36.52	500
		5 795	159	MCS8	36.52	500

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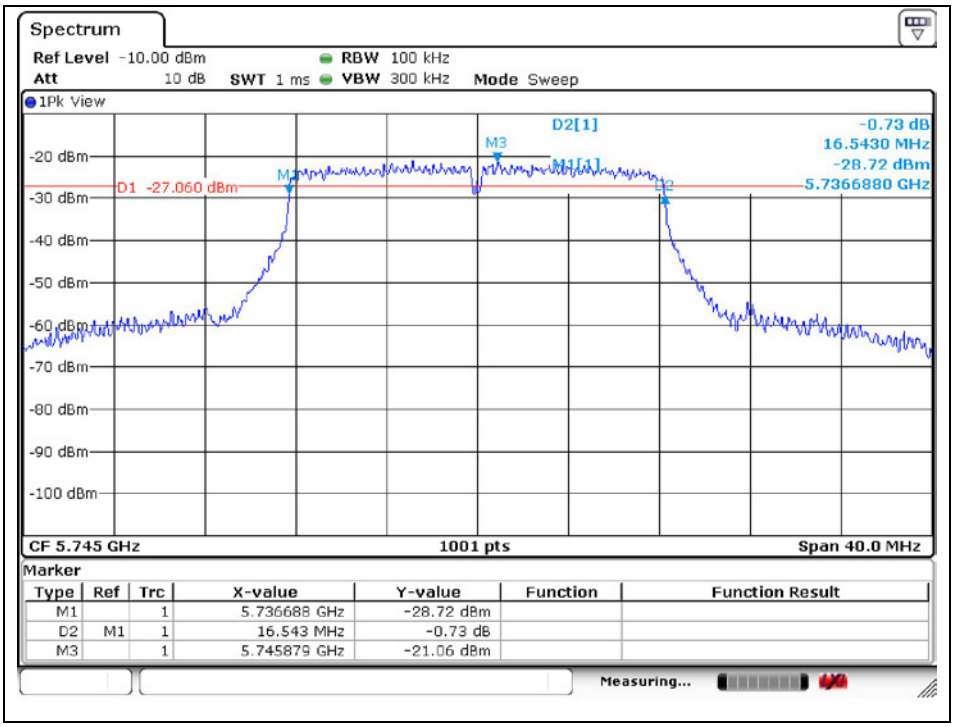
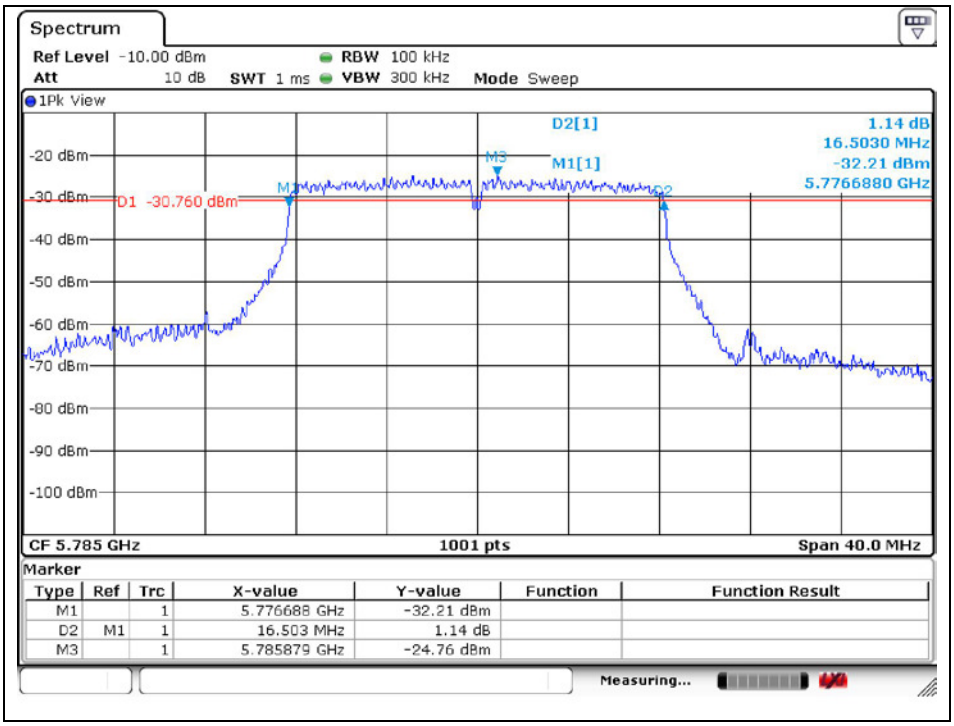
802.11a (Band 3)

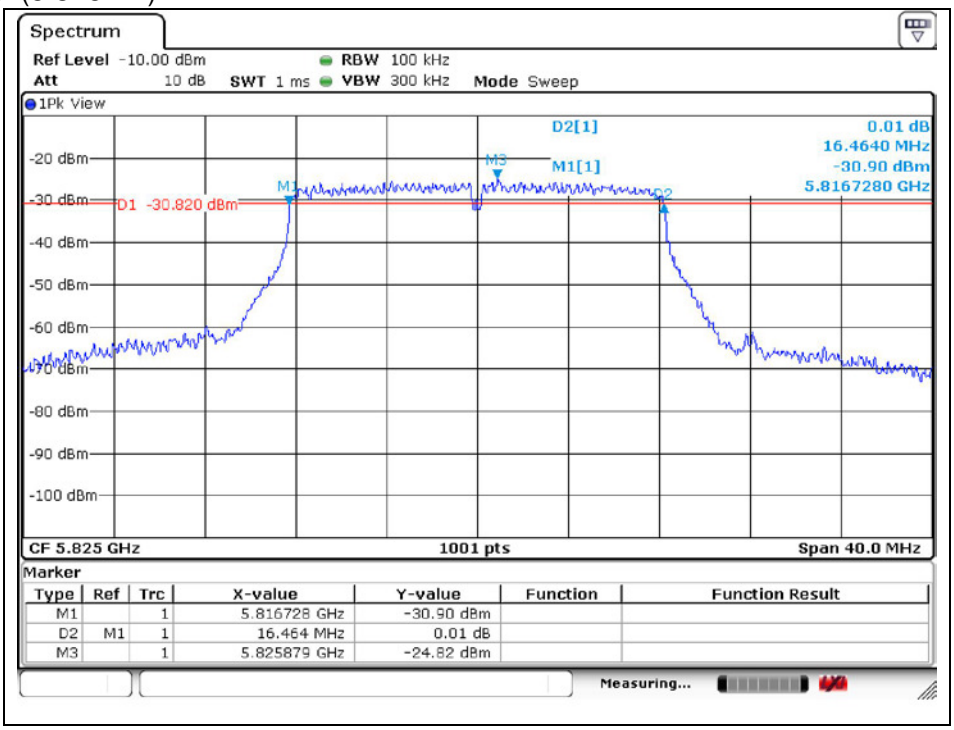
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

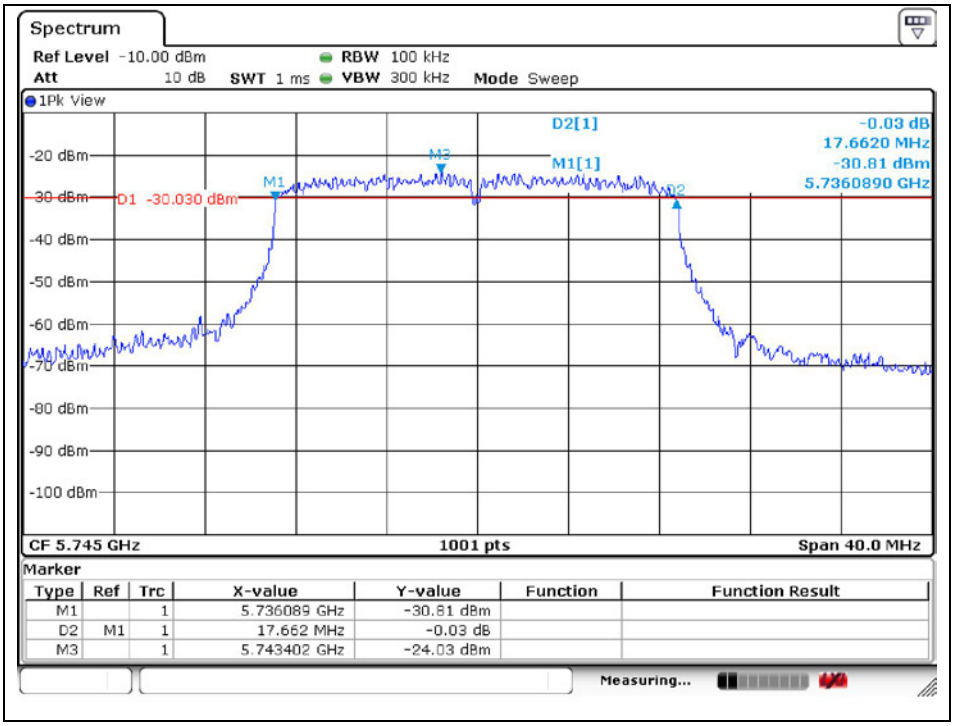


High Channel (5 825 ㎒)

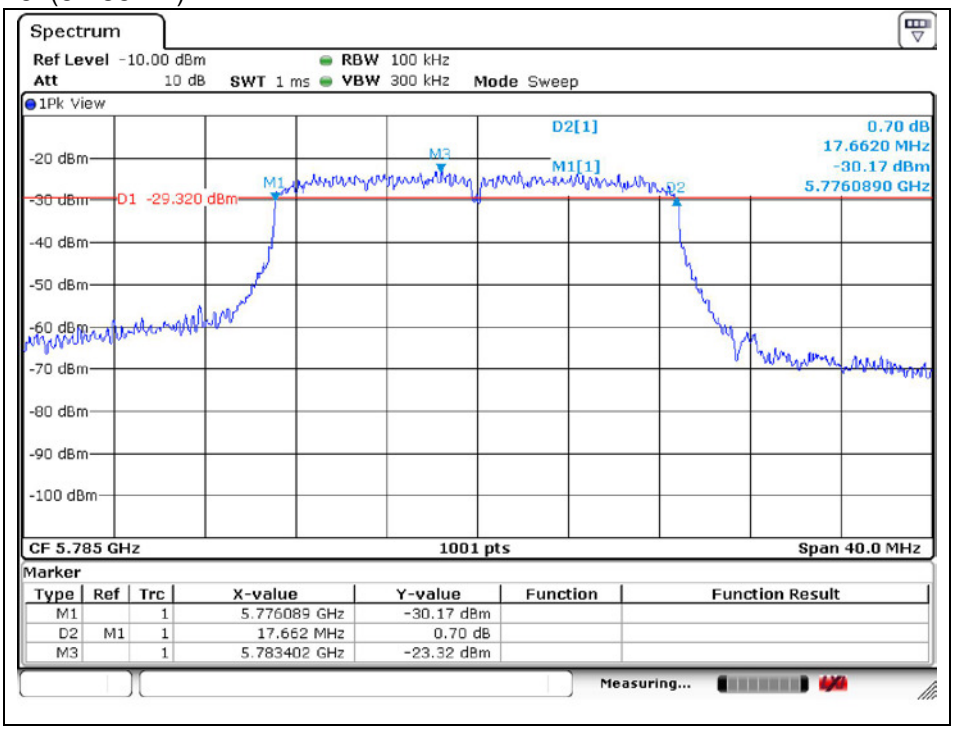


802.11n_HT20 (Band 3)

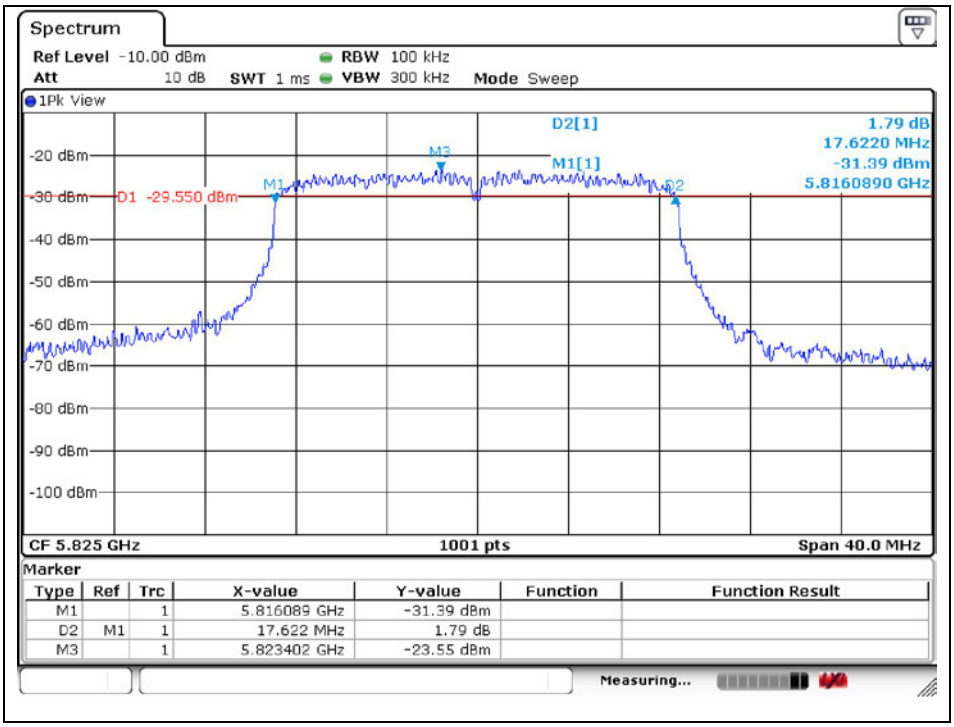
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

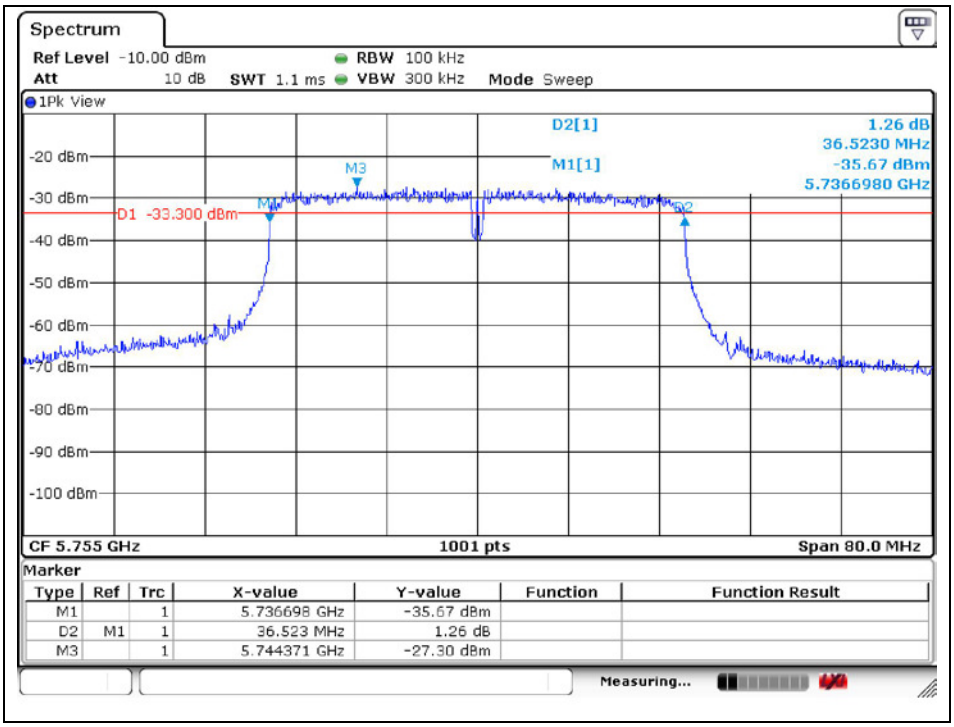


High Channel (5 825 ㎒)

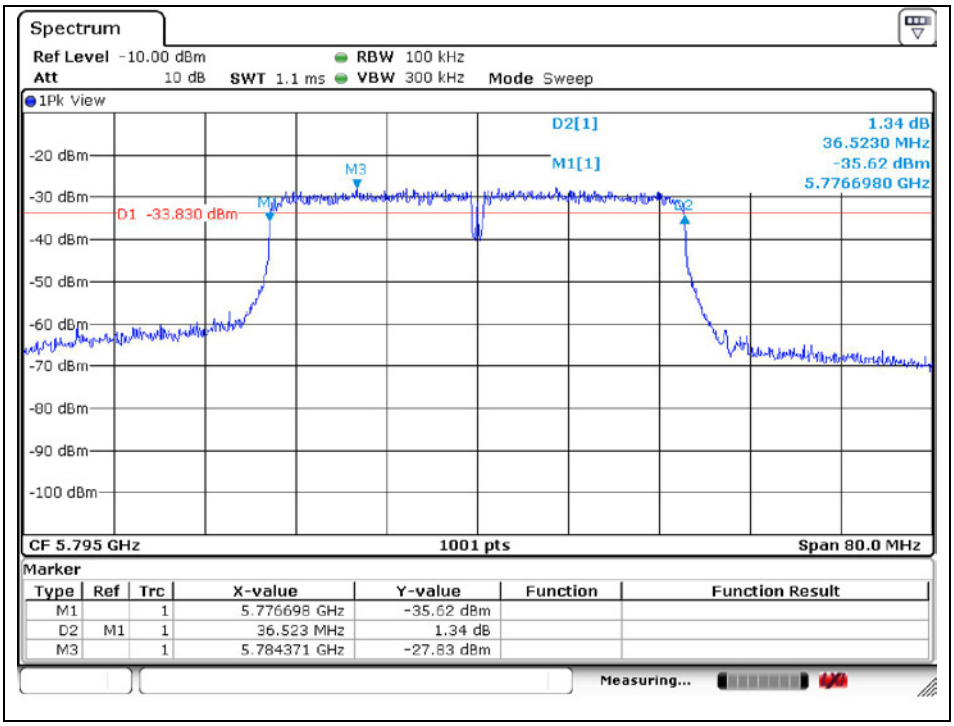


802.11n_HT40 (Band 3)

Low Channel (5 755 ㎒)

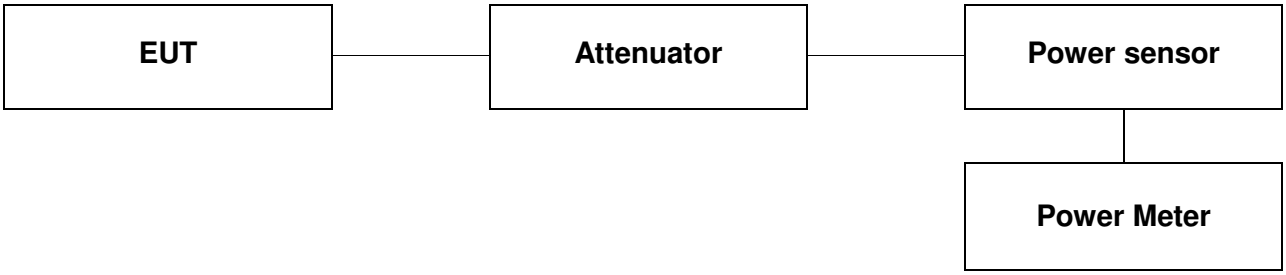


High Channel (5 795 ㎒)



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.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

5.3. Test procedure

1. This measurement settings are specified in section E.3.a 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 ㎧ m 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).

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

5.4. Test result

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

- 11a

U-NII 3		Frequency (MHz)	Conducted Power (dBm)							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
ANT1	Mea. average	5 745	11.48	11.48	11.46	11.52	11.51	11.42	11.42	11.40
	Result		11.48	11.48	11.46	11.52	11.51	11.42	11.42	11.40
	Mea. average	5 785	11.54	11.53	11.53	11.57	11.56	11.49	11.50	11.48
	Result		11.54	11.53	11.53	11.57	11.56	11.49	11.50	11.48
	Mea. average	5 825	11.30	11.28	11.26	11.33	11.32	11.27	11.30	11.28
	Result		11.30	11.28	11.26	11.33	11.32	11.27	11.30	11.28
ANT2	Mea. average	5 745	11.45	11.43	11.41	11.48	11.40	11.40	11.40	11.34
	Result		11.45	11.43	11.41	11.48	11.40	11.40	11.40	11.34
	Mea. average	5 785	11.83	11.83	11.81	11.86	11.83	11.76	11.77	11.75
	Result		11.83	11.83	11.81	**11.86**	11.83	11.76	11.77	11.75
	Mea. average	5 825	11.27	11.26	11.25	11.30	11.29	11.26	11.24	11.23
	Result		11.27	11.26	11.25	11.30	11.29	11.26	11.24	11.23

Mode	Duty cycle							
	Data Rate [Mbps]							
11a	6	9	12	18	24	36	48	54
Duty Cycle (%)	100	100	100	100	100	100	100	100
Correction factor (dB)	0	0	0	0	0	0	0	0

Remark:

1. Result (dBm) = Average (dBm) + Correction factor (dB)
2. Duty cycle (%) = (Tx on time / Tx on + off time) x 100
3. Correction factor (dB) = 10 log (1/duty cycle (ms))

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- 11n_HT20

U-NII 3		Frequency (㎒)	Conducted Power (㏈m)							
			Data Rate [Mbps]							
			0	1	2	3	4	5	6	7
ANT1	Mea. average	5 745	11.10	11.05	11.23	11.29	11.31	11.35	11.32	11.44
	Result		11.10	11.05	11.23	11.29	11.31	11.35	11.32	11.44
	Mea. average	5 785	11.60	11.57	11.72	11.77	11.81	11.92	11.85	11.92
	Result		11.60	11.57	11.72	11.77	11.81	11.92	11.85	11.92
	Mea. average	5 825	11.55	11.54	11.67	11.72	11.78	11.80	11.81	11.86
	Result		11.55	11.54	11.67	11.72	11.78	11.80	11.81	11.86
ANT2	Mea. average	5 745	11.56	11.46	11.50	11.52	11.53	11.54	11.48	11.54
	Result		11.56	11.46	11.50	11.52	11.53	11.54	11.48	11.54
	Mea. average	5 785	11.22	11.18	11.31	11.38	11.42	11.42	11.39	11.43
	Result		11.22	11.18	11.31	11.38	11.42	11.42	11.39	11.43
	Mea. average	5 825	11.66	11.61	11.71	11.75	11.78	11.83	11.77	11.84
	Result		11.66	11.61	11.71	11.75	11.78	11.83	11.77	11.84

Band			Frequency (㎒)	Conducted Power (㏈m)							
				Data Rate [MCS]							
				8	9	10	11	12	13	14	15
U-NII 3	ANT1	Mea. average	5 745	10.89	10.88	10.85	10.82	10.74	10.71	10.70	10.69
	ANT2	Mea. average		11.02	11.01	10.95	10.92	10.85	10.84	10.83	10.81
	ANT1+2 Result			13.97	13.96	13.91	13.88	13.81	13.79	13.78	13.76
	ANT1	Mea. average	5 785	11.02	10.98	10.88	10.82	10.80	10.77	10.75	10.74
	ANT2	Mea. average		10.88	10.87	10.83	10.77	10.74	10.73	10.70	10.69
	ANT1+2 Result			13.96	13.94	13.87	13.81	13.78	13.76	13.74	13.73
	ANT1	Mea. average	5 825	11.01	10.99	10.92	10.86	10.85	10.84	10.81	10.79
	ANT2	Mea. average		11.05	11.05	11.04	11.01	10.89	10.88	10.85	10.83
	ANT1+2 Result			**14.04**	14.03	13.99	13.95	13.88	13.87	13.84	13.82

Mode	Duty cycle							
	Data Rate [MCS]							
11n_HT20	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Duty Cycle (%)	100	100	100	100	100	100	100	100
Correction factor (㏈)	0	0	0	0	0	0	0	0
11n_HT20	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Duty Cycle (%)	100	100	100	100	100	100	100	100
Correction factor (㏈)	0	0	0	0	0	0	0	0

Remark:

1. Result (㏈m) = Average (㏈m) + Correction factor (㏈)
2. Duty cycle (%) = (Tx on time / Tx on + off time) x 100
3. Correction factor (㏈) = 10 log (1/duty cycle (㎳))
4. According to KDB 662911 D01 v02r01, power spectral density of each port (Ant1 + Ant2) was combined by using below calculation.
   Power: 10log{10^(ANT1 power/10)+10^(ANT2 power/10)}

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- 11n_HT40

U-NII 3		Frequency (㎒)	Conducted Power (㏈m)							
			Data Rate [Mbps]							
			0	1	2	3	4	5	6	7
ANT1	Mea. average	5 755	11.60	11.66	11.68	11.77	11.77	11.83	11.86	11.89
	Result		11.60	11.66	11.68	11.77	11.77	11.83	11.86	11.89
	Mea. average	5 795	11.59	11.60	11.64	11.67	11.68	11.70	11.71	11.71
	Result		11.59	11.60	11.64	11.67	11.68	11.70	11.71	11.71
ANT2	Mea. average	5 755	11.34	11.43	11.46	11.47	11.49	11.55	11.56	11.58
	Result		11.34	11.43	11.46	11.47	11.49	11.55	11.56	11.58
	Mea. average	5 795	11.39	11.50	11.54	11.57	11.61	11.62	11.63	11.64
	Result		11.39	11.50	11.54	11.57	11.61	11.62	11.63	11.64

Band			Frequency (㎒)	Conducted Power (㏈m)							
				Data Rate [MCS]							
				8	9	10	11	12	13	14	15
U-NII 3	ANT1	Mea. average	5 755	11.04	11.02	10.94	10.89	10.84	10.82	10.77	10.76
	ANT2	Mea. average		10.98	10.95	10.94	10.89	10.85	10.82	10.77	10.74
	ANT1+2 Result			**14.02**	14.00	13.95	13.90	13.86	13.83	13.78	13.76
	ANT1	Mea. average	5 795	10.87	10.85	10.80	10.79	10.74	10.72	10.71	10.64
	ANT2	Mea. average		11.04	11.03	10.95	10.94	10.89	10.87	10.69	10.61
	ANT1+2 Result			13.97	13.95	13.89	13.88	13.83	13.81	13.71	13.64

Mode	Duty cycle							
	Data Rate [MCS]							
11n_HT40	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Duty Cycle (%)	100	100	100	100	100	100	100	100
Correction factor (㏈)	0	0	0	0	0	0	0	0
11n_HT40	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Duty Cycle (%)	100	100	100	100	100	100	100	100
Correction factor (㏈)	0	0	0	0	0	0	0	0

Remark:

1. Result (㏈m) = Average (㏈m) + Correction factor (㏈)
2. Duty cycle (%) = (Tx on time / Tx on + off time) x 100
3. Correction factor (㏈) = 10 log (1/duty cycle (㎳))
4. According to KDB 662911 D01 v02r01, power spectral density of each port (Ant1 + Ant2) was combined by using below calculation.
   Power: 10log{10^(ANT1 power/10)+10^(ANT2 power/10)}

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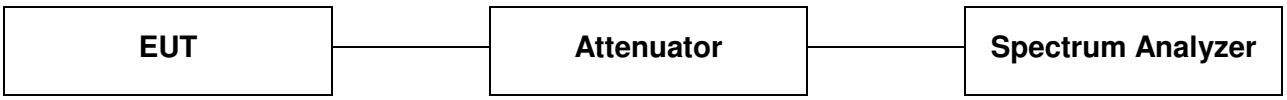
6. Peak Power Spectral Density

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.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

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.1.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.

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6.4. Test result

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

Band	Mode	Frequency (㎒)	Ch.	Data Rate	PPSD (㏈m)	Limit (㏈m/500 ㎑)
U-NII 3	11a - ANT1	5 745	149	6	-3.50	30
		5 785	157	6	-3.85	30
		5 825	165	6	-3.77	30
	11a - ANT2	5 745	149	6	-3.33	30
		5 785	157	6	-3.36	30
		5 825	165	6	-3.80	30

Band	Mode	Frequency (㎒)	Ch.	Data Rate (Mbps)	ANT1	ANT2	ANT1+2	Limit (㏈m/500 ㎑)
					Measured PPSD (㏈m)	Measured PPSD (㏈m)	PPSD (㏈m)	
U-NII 3	11n_HT20	5 745	149	MCS8	-3.61	-3.57	-0.58	30
		5 785	157	MCS8	-3.66	-3.57	-0.60	30
		5 825	165	MCS8	-3.88	-3.57	-0.71	30
	11n_HT40	5 755	151	MCS8	-6.69	-5.37	-2.97	30
		5 795	159	MCS8	-6.89	-5.81	-3.31	30

Note :

PPSD = Measured PPSD or Measured PPSD (ANT1+2)

According to KDB 662911 D01 v02r01, power spectral density of each port (ANT1 + ANT2) was combined by using below calculation.

PSD: 10log{10^(ANT1 psd/10)+10^(ANT2 psd/10)}

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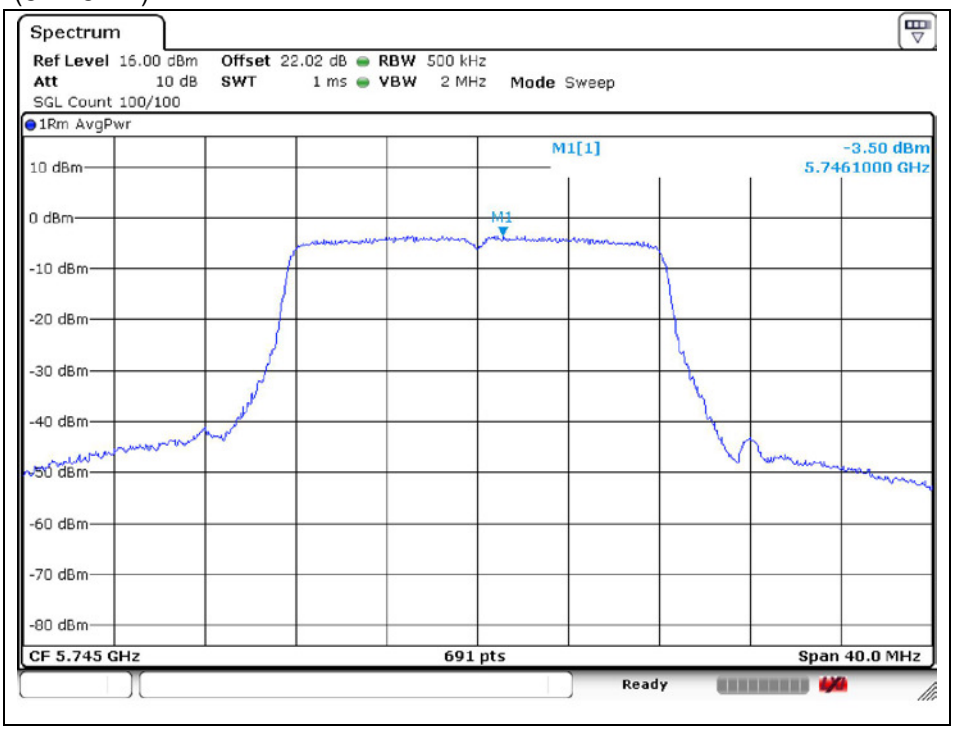
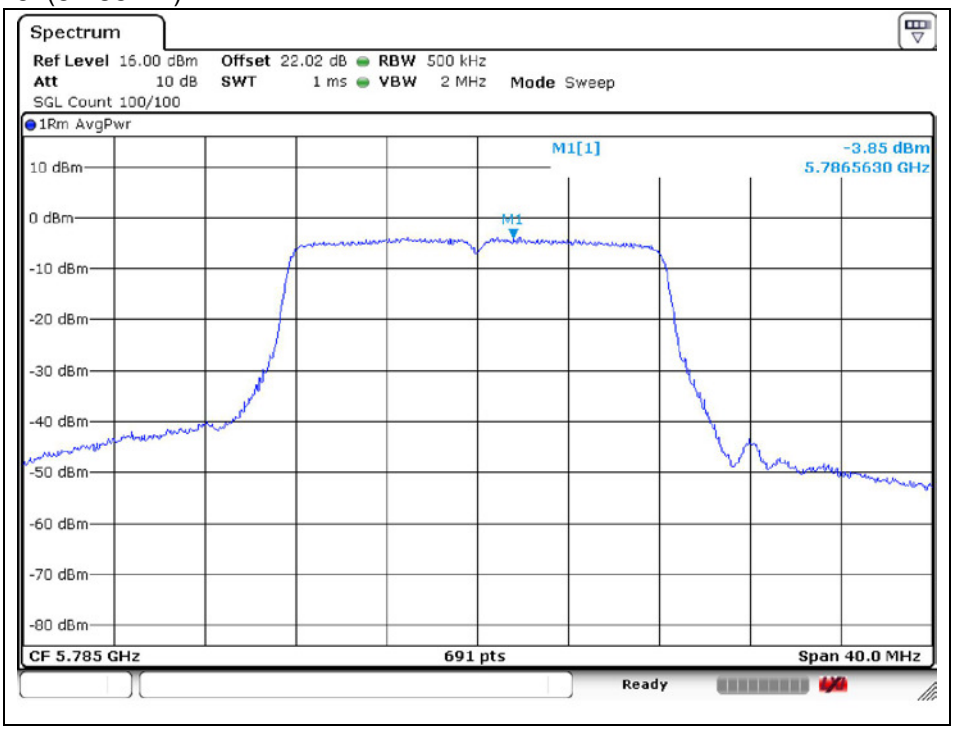
802.11a (Band 3) - ANT1

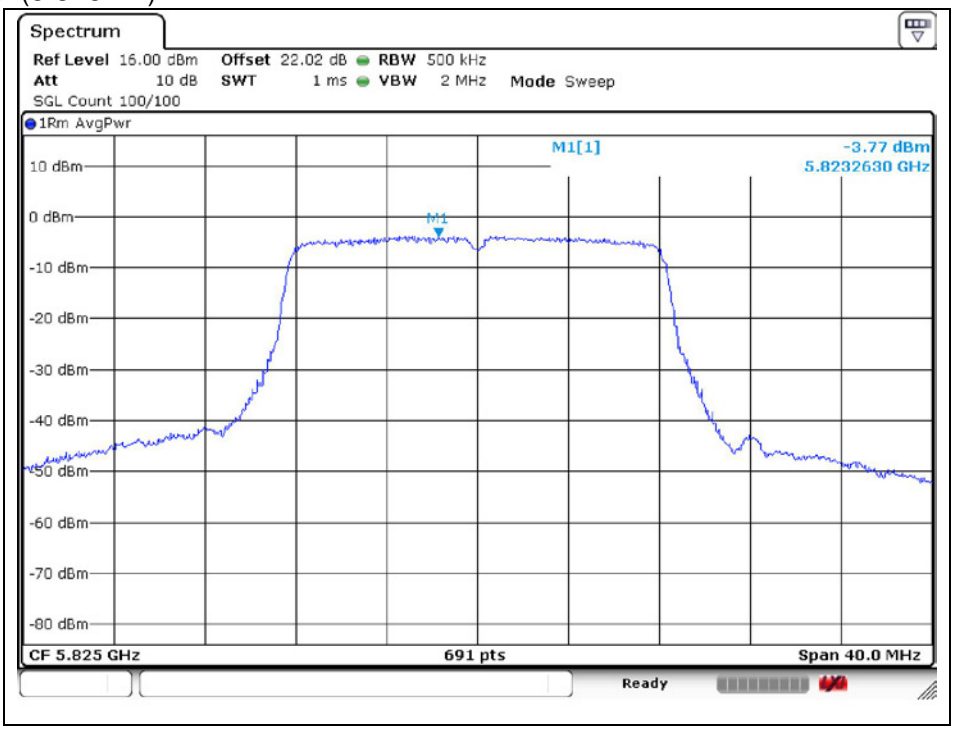
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

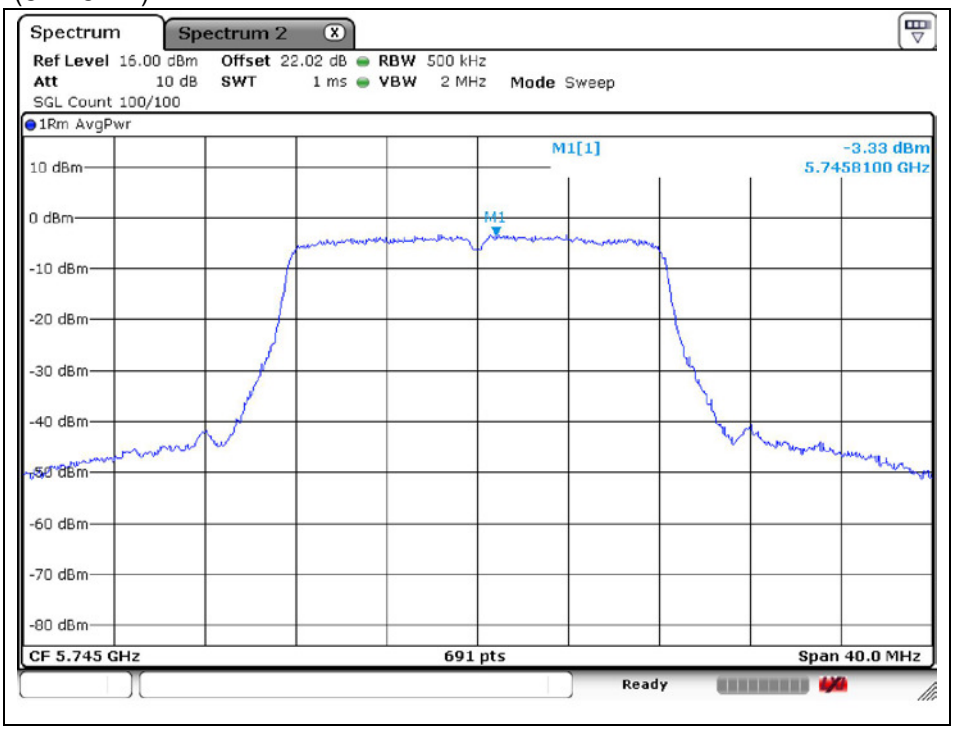


High Channel (5 825 ㎒)

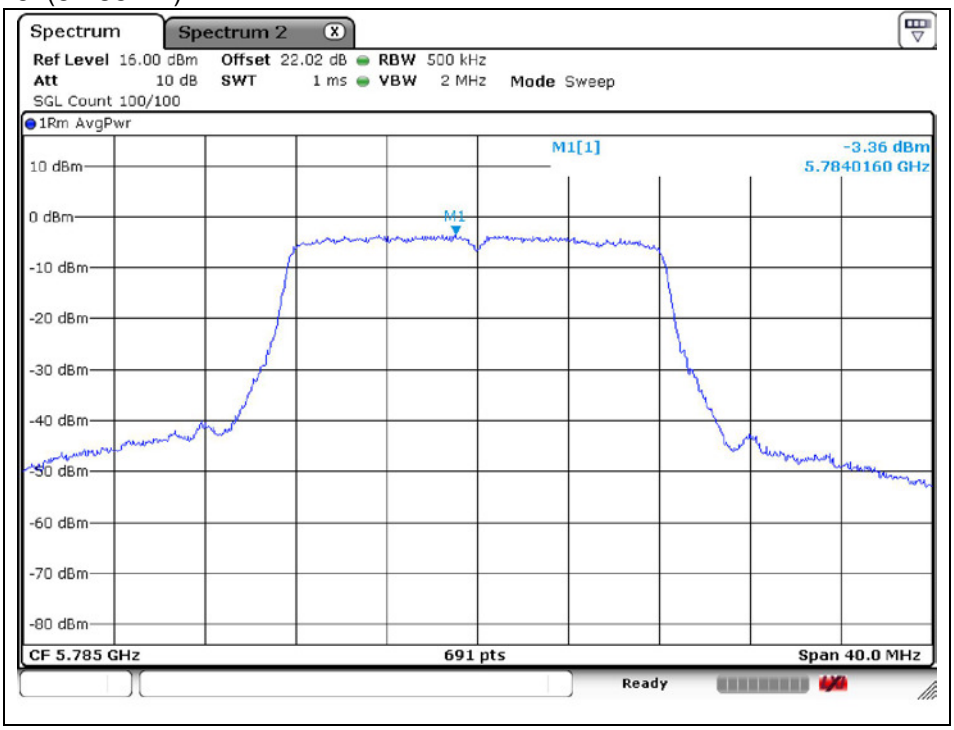


802.11a (Band 3) - ANT2

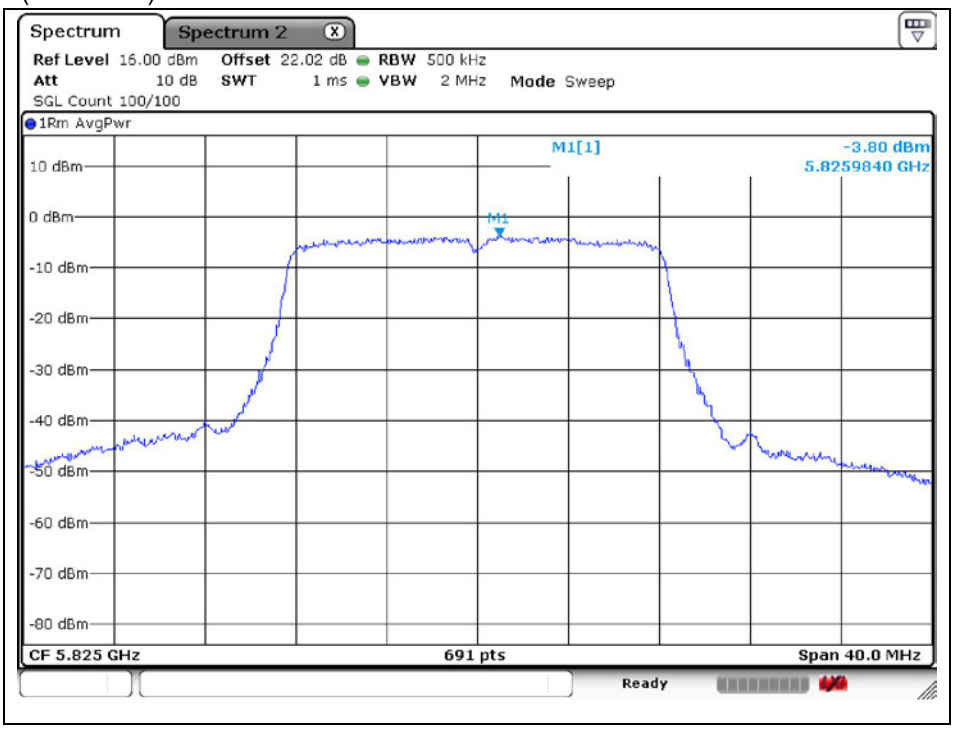
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)



High Channel (5 825 ㎒)



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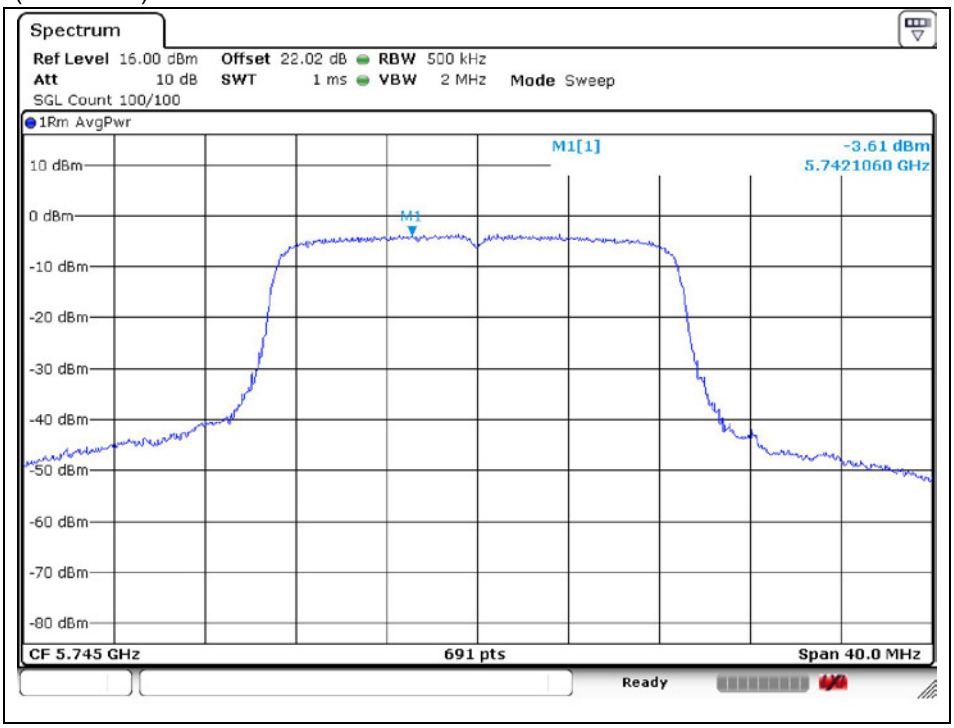
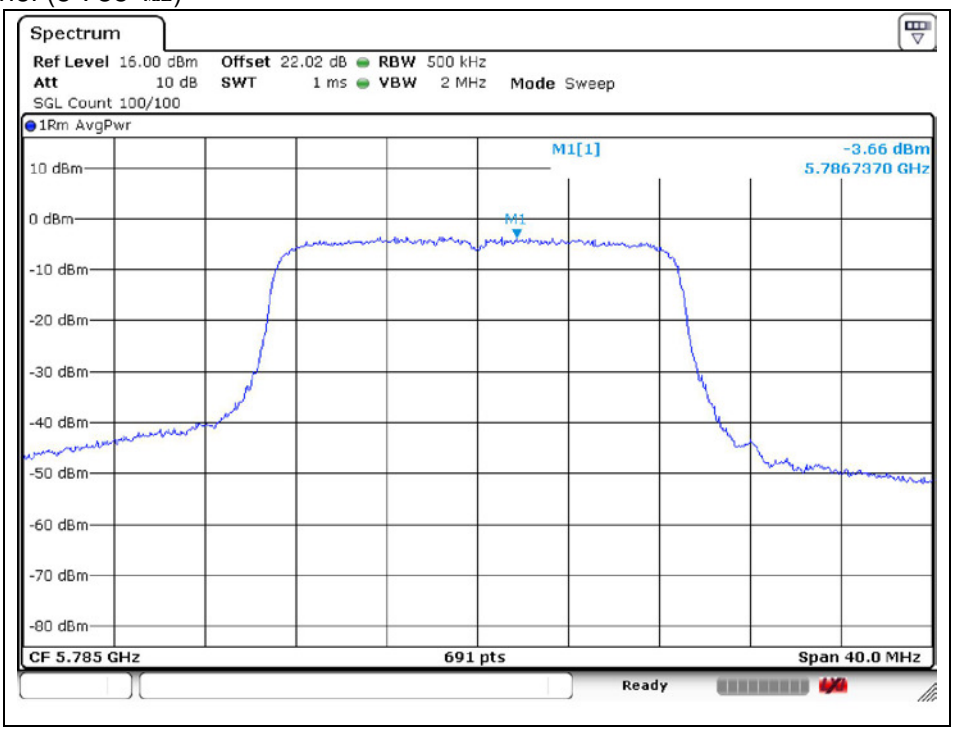
802.11n_HT20 (Band 3) - ANT1

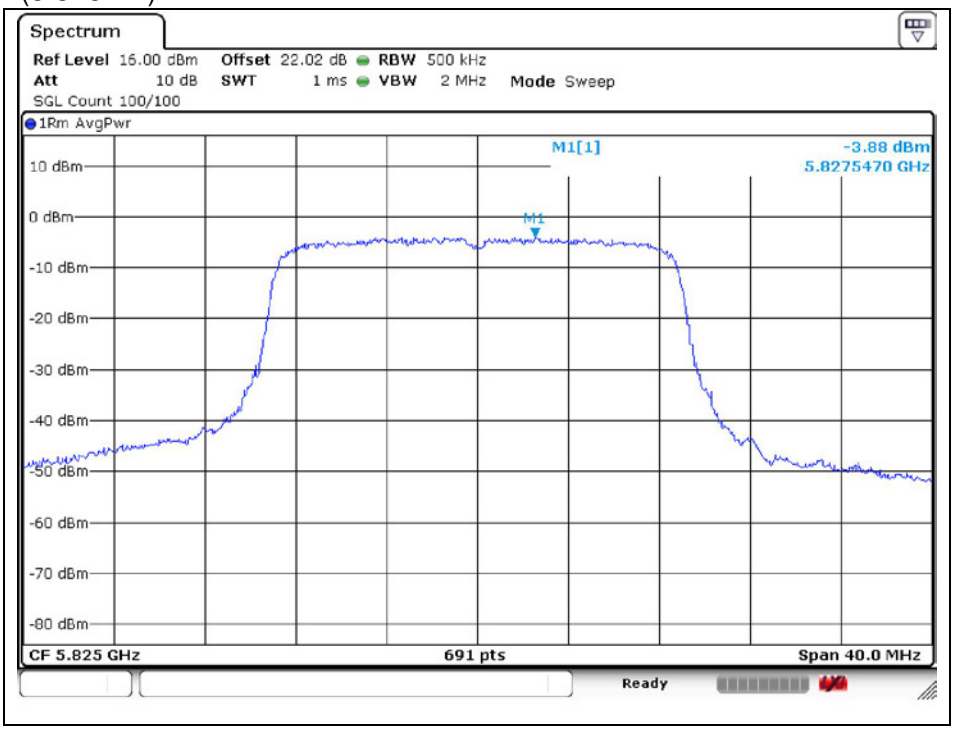
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

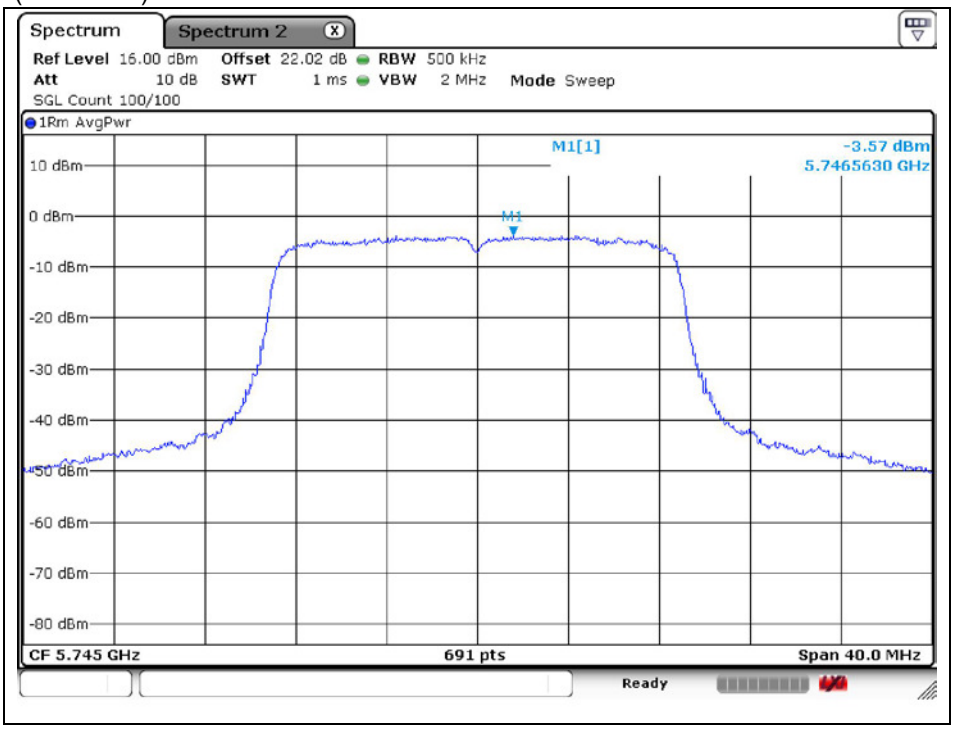


High Channel (5 825 ㎒)

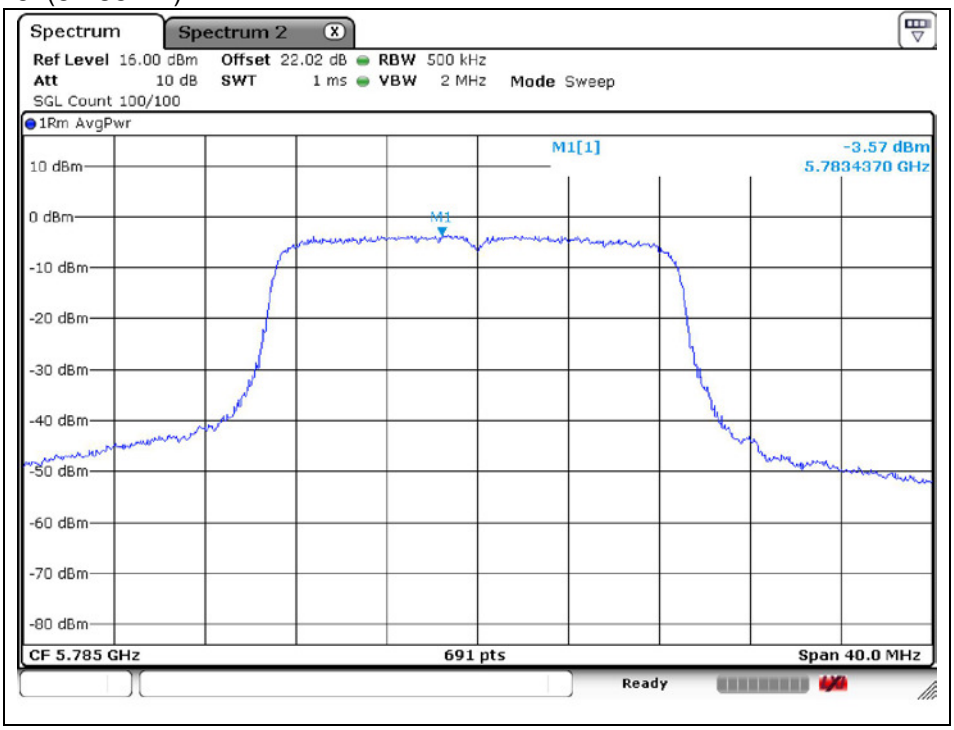


802.11n_HT20 (Band 3) - ANT2

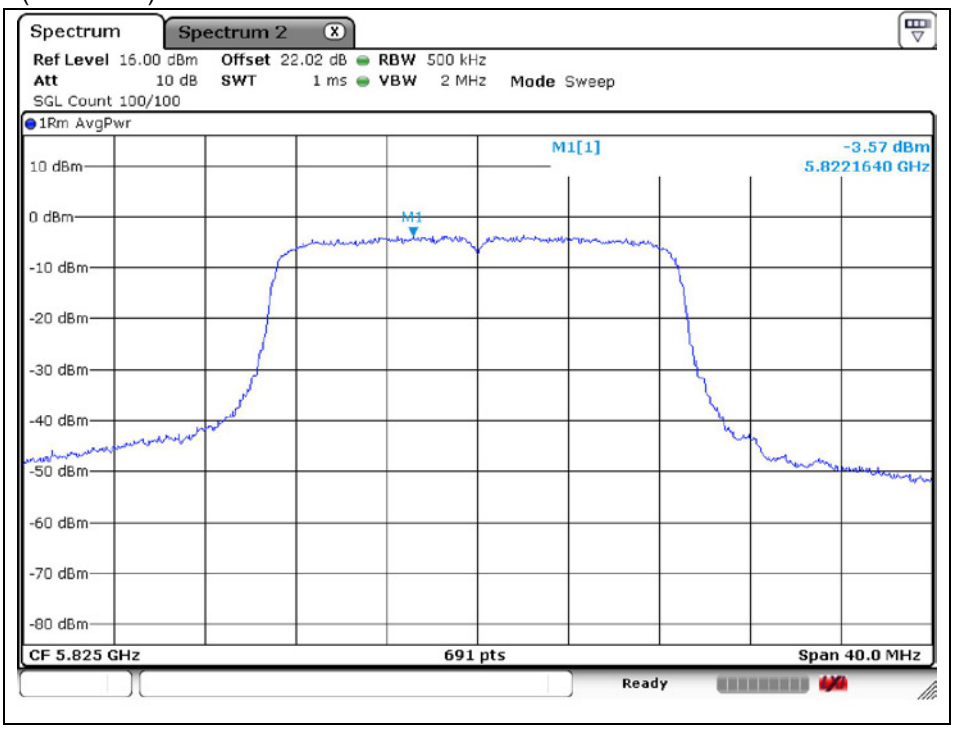
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)



High Channel (5 825 ㎒)



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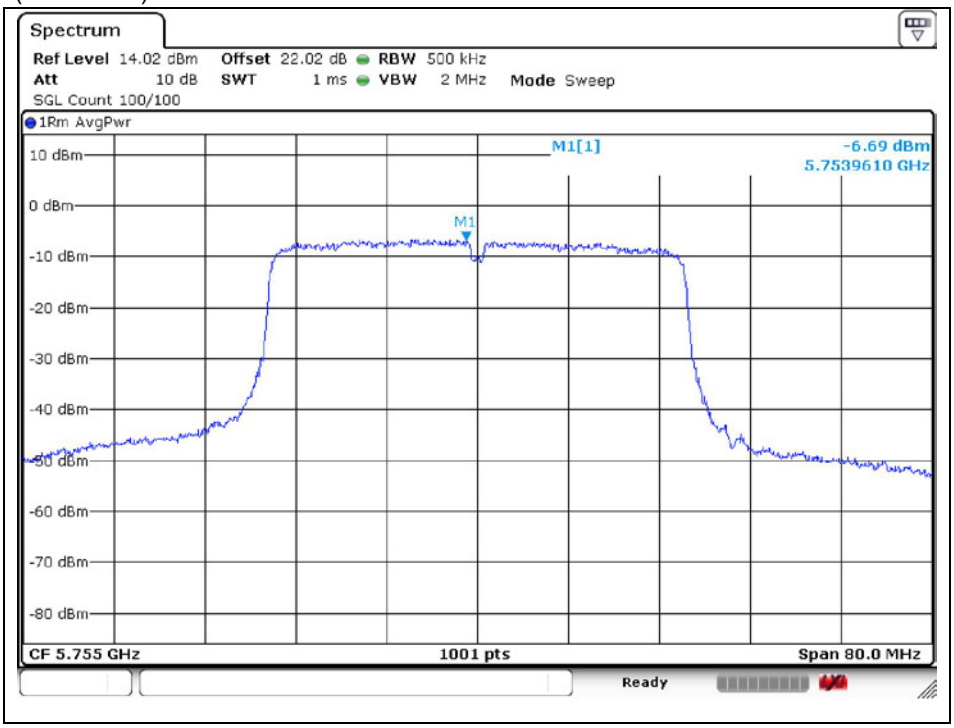
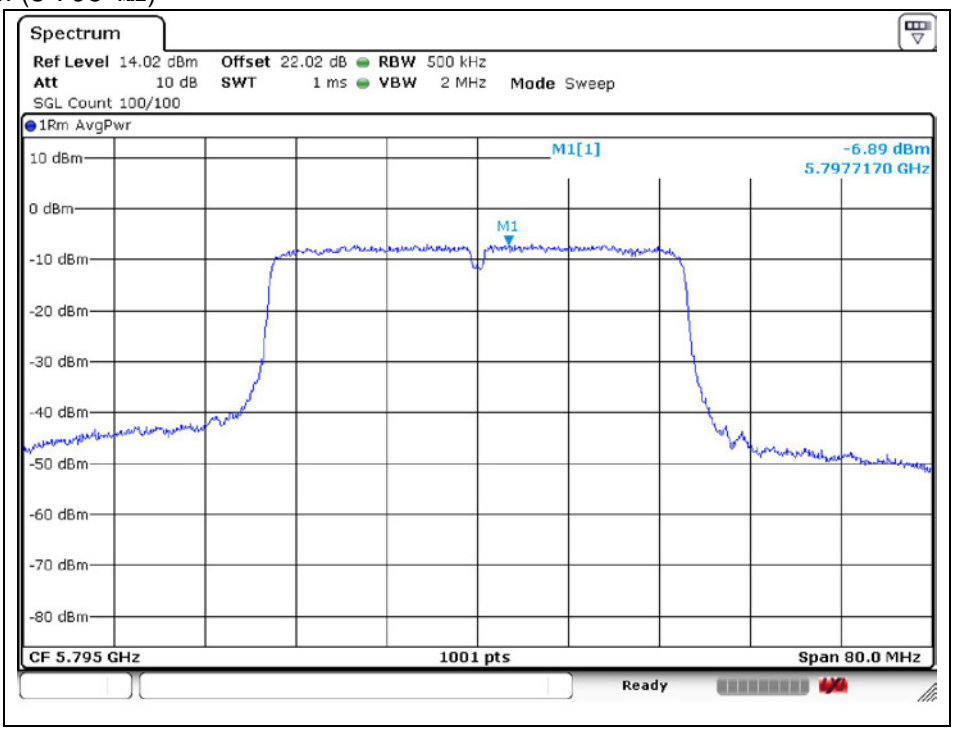
802.11n_HT40 (Band 3) - ANT1

Low Channel (5 755 ㎒)



High Channel (5 795 ㎒)



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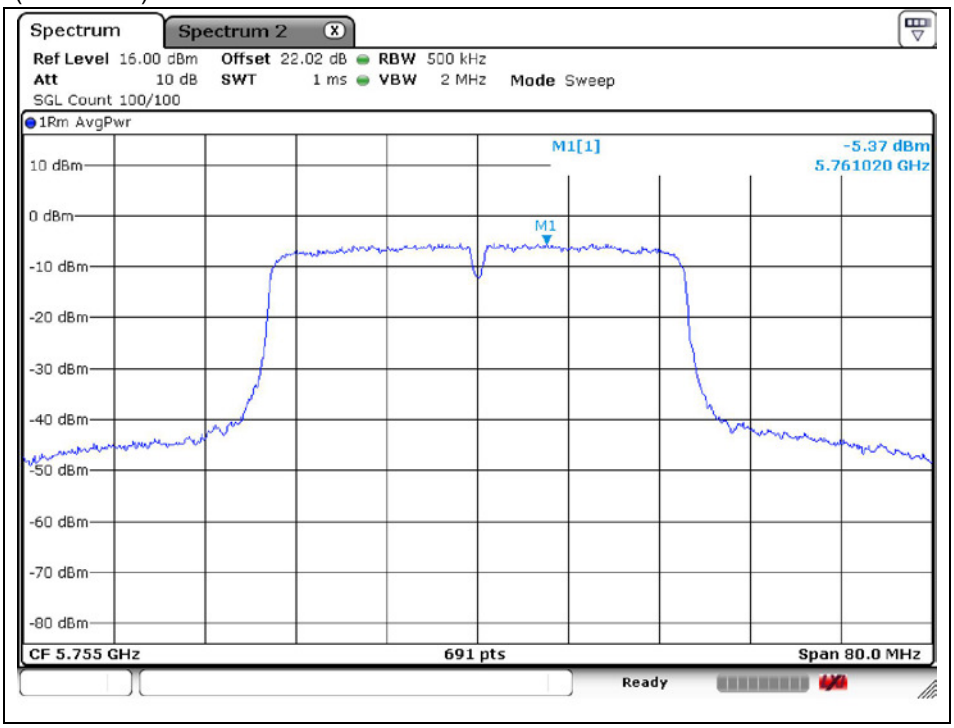
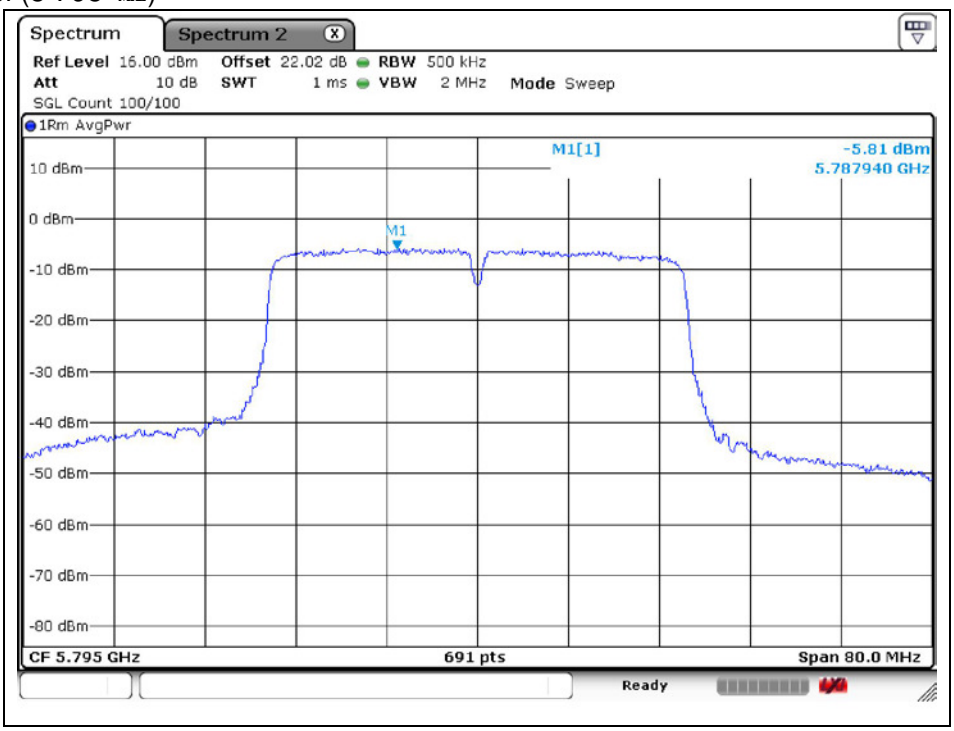
802.11n_HT40 (Band 3) - ANT2

Low Channel (5 755 ㎒)



High Channel (5 795 ㎒)



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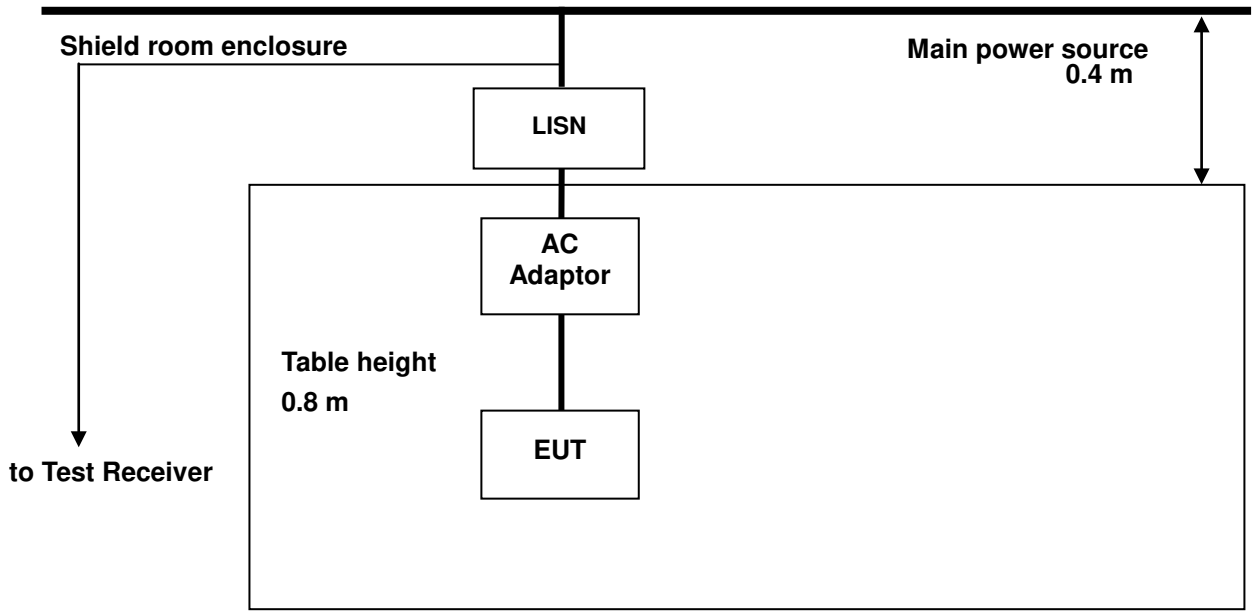
7. AC Power Line Conducted Emission

7.1. Test Setup



7.2. Limit

According to §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 μH /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 (dBμV)	
	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 C63.10-2009

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.

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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
0.17	50.30	32.00	N	64.96	54.96	14.66	22.96
0.23	42.80	29.10	N	62.45	52.45	19.65	23.35
0.28	37.90	26.00	N	60.82	50.82	22.92	24.82
0.39	30.40	18.60	N	58.06	48.06	27.66	29.46
4.16	17.40	9.10	N	56.00	46.00	38.60	36.90
4.93	21.00	11.00	N	56.00	46.00	35.00	35.00
0.17	54.90	38.70	H	64.96	54.96	10.06	16.26
0.18	49.90	28.30	H	64.49	54.49	14.59	26.19
0.23	42.70	23.30	H	62.45	52.45	19.75	29.15
0.24	40.90	21.20	H	62.10	52.10	21.20	30.90
0.28	38.60	21.60	H	60.82	50.82	22.22	29.22
4.50	16.50	9.00	H	56.00	46.00	39.50	37.00

Remark;

1. Line (H): Hot, Line (N): Neutral.
2. All modes of operation were investigated and the worst-case emissions were reported using 11n_HT20 (Band 3), MCS8, 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.

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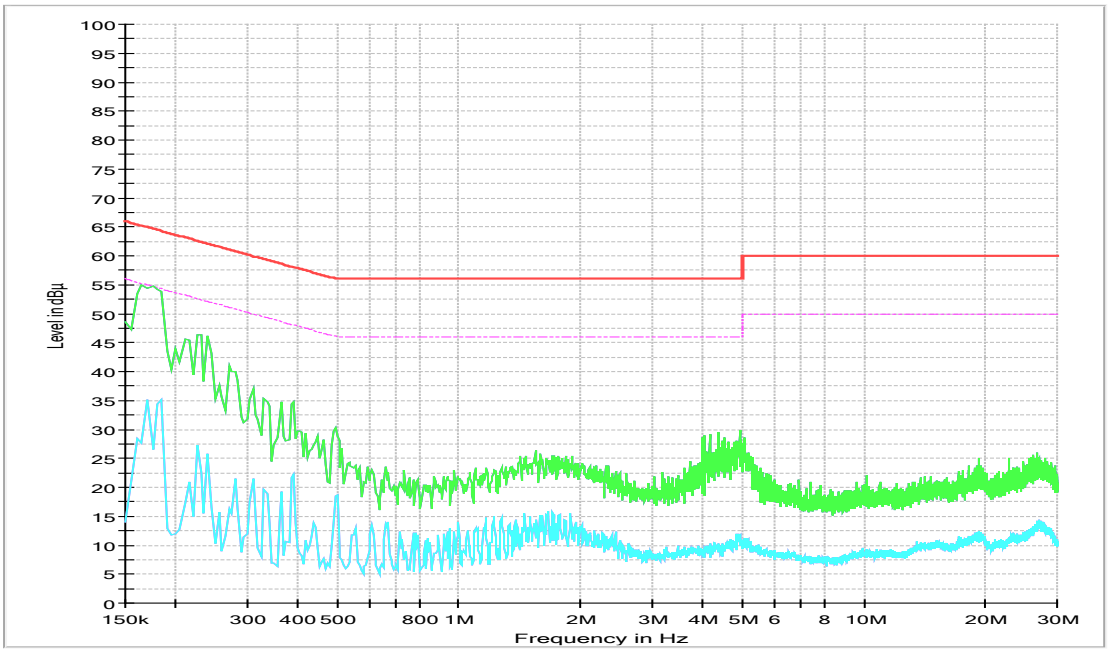
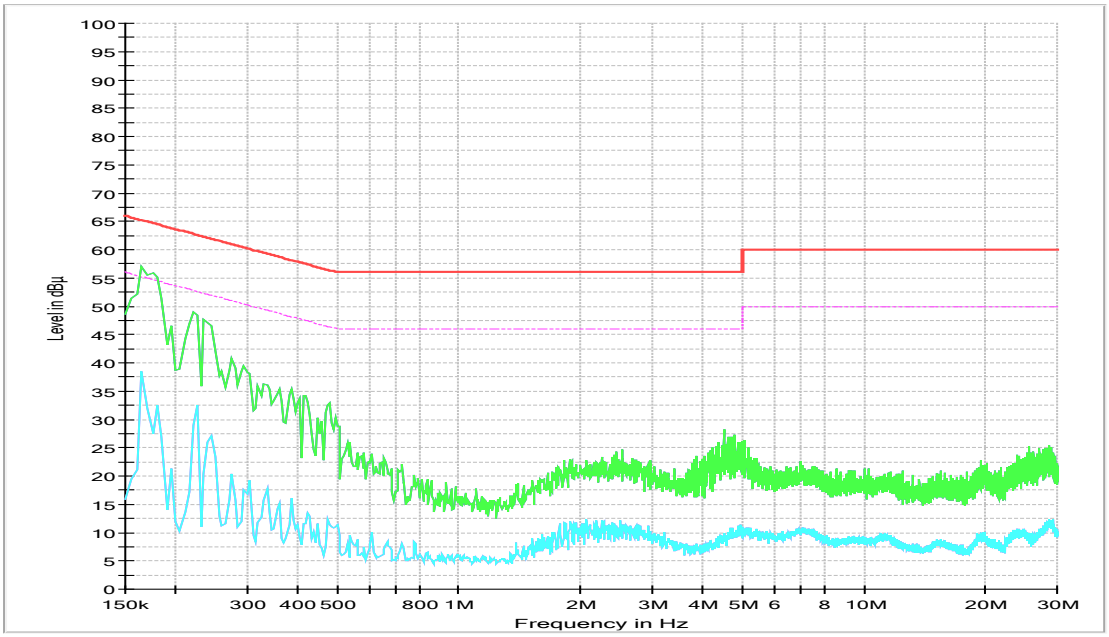
Plots of Conducted Power line

Test mode: (Neutral)



Test mode: (Hot)



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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 Fixed type and peak max gain of antenna as below.

Band	5 745 MHz – 5 825 MHz
Mode	11a/n_HT20, HT40
ANT1 Gain	2.48 dBi
ANT2 Gain	1.21 dBi

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

(i) If transmit signals are correlated, then

Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \ldots + 10^{G_N/20})^2/N_{ANT}]$ 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.]

Directional Gain = 4.88 dBi