

**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C REQUIREMENT**

OF

600Mbps 11AC Wireless Dual Band USB Adapter

Model No.: BL-WDN600

FCC ID: S8J-WDN600

Trademark: LB-LINK

Report No.: KAD141222061E

Issue Date: March 26, 2015

Prepared for

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Prepared by

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DONGGUAN EMTEK CO., LTD.**

VERIFICATION OF COMPLIANCE

Applicant:	Shenzhen Bilian Electronic Co., Ltd. Building B1, Zhongxing Industrial Zone, Juling Jutang Community, Guanlan street, Bao'an, Shenzhen China
Manufacturer:	Shenzhen Bilian Electronic Co., Ltd. Building B1, Zhongxing Industrial Zone, Juling Jutang Community, Guanlan street, Bao'an, Shenzhen China
Product Description:	600Mbps 11AC Wireless Dual Band USB Adapter
Model Number:	BL-WDN600
Trade Mark:	LB-LINK
Date of Test:	December 22, 2014 to February 02, 2015

We hereby certify that:

The above equipment was tested by DONGGUAN EMTEK CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2014) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247(2014).

Approved By



**Sam Lv / Q.A. Manager
DONGGUAN EMTEK CO., LTD.**

Modified Information

Version	Summary	Revision Date	Report No.
Ver.1.0	Original Report	/	KAD141222061E

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APPENDIX I (PHOTOS OF EUT)(3PAGES)

1. General Information

1.1 Product Description

A major technical descriptions of EUT is described as following:

Operation Frequency:	2412-2462MHz for 802.11b/g/n(HT20) 2422-2452MHz for 802.11n(HT40) 5725-5850MHz for 802.11a/n/ac
Modulation:	802.11b: DSSS(DBPSK/DQPSK/CCK) 802.11g/n: OFDM(BPSK/QPSK/16QAM/64QAM) 802.11ac:OFDM(BPSK/QPSK/16QAM/64QAM/256QAM)
Max Output Power:	For 2412-2462MHz: 802.11b: 11.65dBm(0.01462W) 802.11g: 10.33dBm (0.01079W) 802.11n(HT20): 10.26dBm(0.01062W) 802.11n(HT40): 9.46dBm (0.00883W) For 5725-5850MHz: 802.11a: 4.96dBm(0.00313W) 802.11n(HT20): 3.23dBm(0.00210W) 802.11n(HT40): 3.15dBm(0.00207W) 802.11ac(HT20): 4.86dBm(0.00306W) 802.11ac(HT40): 3.16dBm(0.00207W) 802.11ac(HT80): 2.05dBm(0.00160W)
Antenna Type:	External antenna
Number Channel:	11 Channels for 802.11b/g/n(HT20) 7 Channels for 802.11n(HT40)
Antenna Gain:	5dBi
Power Supply:	DC from PC

1.2 Related Submittal(s) / Grant(s)

This submittal(s) (test report) is intended for filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system is compliance with Subpart B is authorized under a DOC procedure.

1.3 Test Methodology

All the test program has follow FCC new test procedure KDB558074 D01 v03r02, Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 (2014). Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Special Accessories

Not available for this EUT intended for grant.

1.5 Equipment Modifications

Not available for this EUT intended for grant.

1.6 Test Facility

Site Description

EMC Lab :

Accredited by FCC, June 18, 2014
The Certificate Number is 247565

Accredited by Industry Canada, February 19, 2014
The Certificate Number is 9444A

Name of Firm : DONGGUAN EMTEK CO., LTD.
Site Location : No.281, Guantai Road, Nancheng District,
Dongguan, Guangdong, China

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4-2014 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. Emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-2014.

2.4 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

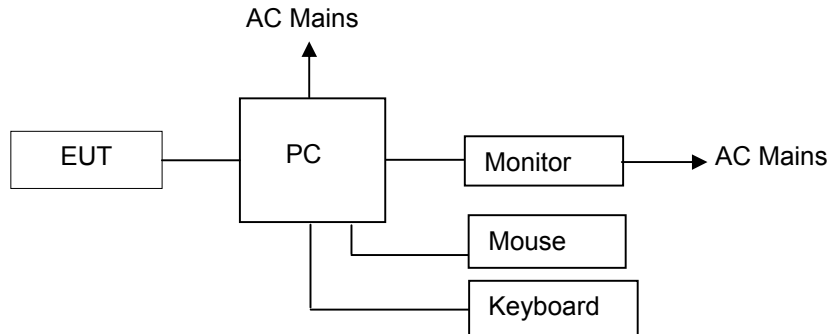


Table 2-1 Equipment Used in Tested System

Item	Equipment	Trademark	Model No.	FCC ID	Note
1.	600Mbps 11AC Wireless Dual Band USB Adapter	LB-LINK	BL-WDN600	S8J-WDN600	EUT
2.	PC	DELL	OPTIRLEX 760	N/A	Support Equipment
3.	LCD Monitor	DELL	E1909WF	N/A	Support Equipment
4.	Mouse	DELL	M-UAR DEL7	N/A	Support Equipment
5.	Keyboard	DELL	L30U	N/A	Support Equipment

Note:

- (1) Unless otherwise denoted as EUT in 『Remark』 column, device(s) used in tested system is a support equipment.

3. Carrier Frequency and Channel

For 2.4G Band:

There are two bandwidth systems.

For 20MHz bandwidth systems, use Channel 1-Channel 11.

For 40MHz band width systems, use Channel 3-Channel 9.

Frequency Band	Channel	Frequency (MHz)	Channel	Frequency (MHz)
2400-2483.5MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

For 5G Band:

There are three bandwidth systems.

For 20MHz bandwidth systems, use Channel 149, 153, 157, 161, 165

For 40MHz band width systems, use Channel 151, 159

For 40MHz band width systems, use Channel 155

Frequency Band	Channel	Frequency (MHz)	Channel	Frequency (MHz)
5725-5850MHz Band 4	149	5745	157	5785
	151	5755	159	5795
	153	5765	161	5805
	155	5775	165	5825

Test Frequency and Channel for 802.11 b/g/n (HT20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	6	2437	11	2462

Test Frequency and channel for 802.11 n (HT40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	6	2437	9	2452

Test Frequency and channel for 5725-5850MHz Band 4:

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	157	5785	165	5825

4. Summary of Test Results

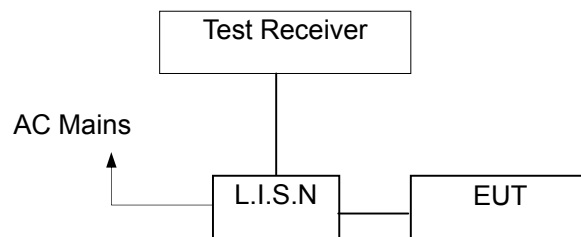
FCC Rules	Description Of Test	Result
§15.207	AC Power Conducted Emission	Pass
§15.247(d), §15.209	Radiated Emission	Pass
§15.247(a)(2)	6dB bandwidth	Pass
§15.247(b)(3)	Max Peak output Power test	Pass
§15.247(e)	Power density	Pass
§15.247(d)	Band edge test	Pass
§15.247(d)	Antenna Port Emission	Pass
§15.247(b)&§15.203	Antenna Application	Pass

5. Conducted Emissions Test

5.1 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

5.2 Test SET-UP (Block Diagram of Configuration)



5.3 Measurement Equipment Used

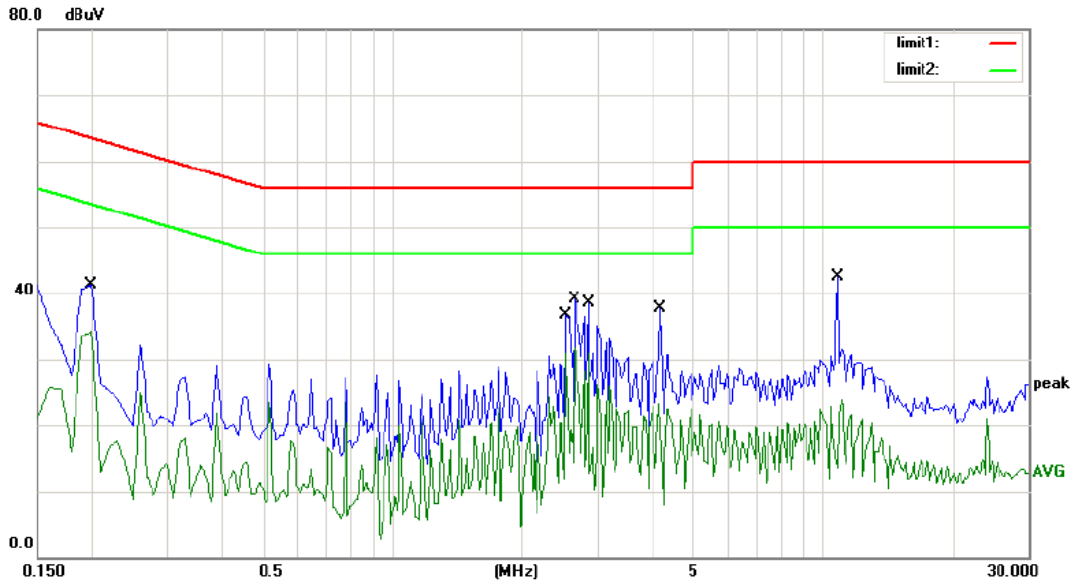
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde&Schwarz	ESCS30	100018	May 16, 2014	1 Year
2.	L.I.S.N.	Rohde&Schwarz	ENV216	100017	May 16, 2014	1Year
3.	RF Switching Unit	CDS	RSU-M2	38401	May 16, 2014	1Year

5.4 Conducted Emission Limit

Conducted Emission Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

- Note:** 1. The lower limit shall apply at the transition frequencies
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

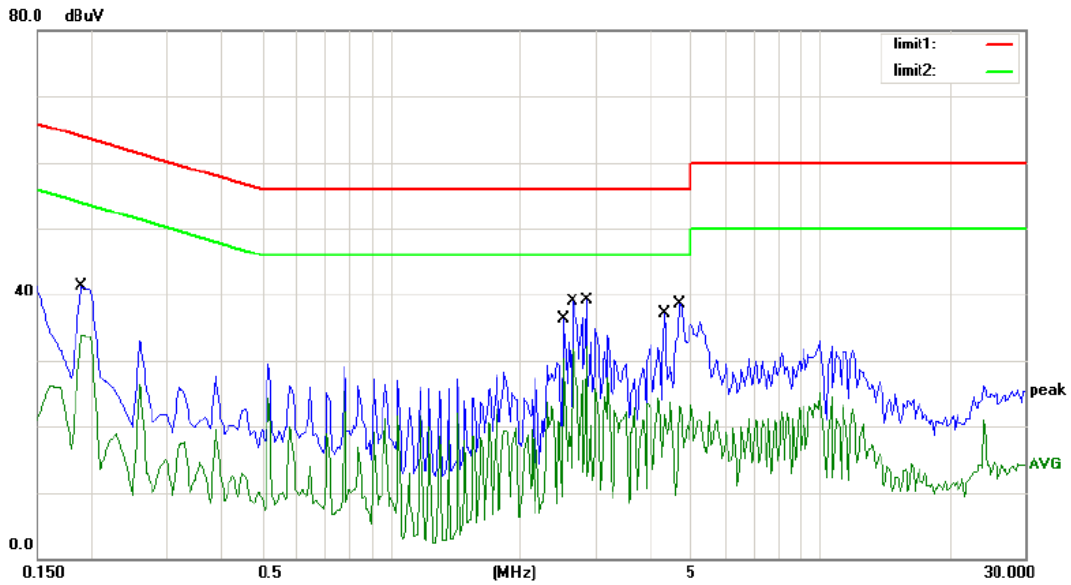
5.5 Measurement Result



Site site #1 Phase: **L1** Temperature: 24
 Limit: (CE)FCC PART 15 class B_QP Power: Connect to PC Humidity: 55 %
 Mode: TX
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.2000	41.34	0.00	41.34	63.61	-22.27	QP	
2		0.2000	34.23	0.00	34.23	53.61	-19.38	AVG	
3		2.5200	36.63	0.00	36.63	56.00	-19.37	QP	
4		2.5200	30.98	0.00	30.98	46.00	-15.02	AVG	
5		2.6600	39.09	0.00	39.09	56.00	-16.91	QP	
6	*	2.6600	31.65	0.00	31.65	46.00	-14.35	AVG	
7		2.8600	38.51	0.00	38.51	56.00	-17.49	QP	
8		2.8600	30.80	0.00	30.80	46.00	-15.20	AVG	
9		4.2000	37.80	0.00	37.80	56.00	-18.20	QP	
10		4.2000	23.30	0.00	23.30	46.00	-22.70	AVG	
11		10.8000	42.46	0.00	42.46	60.00	-17.54	QP	
12		10.8000	22.80	0.00	22.80	50.00	-27.20	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver.



Site site #1 Phase: **N** Temperature: 24
 Limit: (CE)FCC PART 15 class B_QP Power: Connect to PC Humidity: 55 %
 Mode: TX
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1904	41.23	0.00	41.23	64.02	-22.79	QP	
2		0.1904	33.88	0.00	33.88	54.02	-20.14	AVG	
3		2.5200	36.31	0.00	36.31	56.00	-19.69	QP	
4		2.5200	30.38	0.00	30.38	46.00	-15.62	AVG	
5		2.6600	38.89	0.00	38.89	56.00	-17.11	QP	
6		2.6600	31.73	0.00	31.73	46.00	-14.27	AVG	
7		2.8600	39.02	0.00	39.02	56.00	-16.98	QP	
8	*	2.8600	32.13	0.00	32.13	46.00	-13.87	AVG	
9		4.3400	37.03	0.00	37.03	56.00	-18.97	QP	
10		4.3400	23.63	0.00	23.63	46.00	-22.37	AVG	
11		4.7200	38.58	0.00	38.58	56.00	-17.42	QP	
12		4.7200	23.05	0.00	23.05	46.00	-22.95	AVG	

*:Maximum data x:Over limit l:over margin Comment: Factor build in receiver.

6. Radiated Emission Test

6.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured was complete.

The EUT's antenna was pre-tested under the following modes:

Test Mode	Description
Mode A	X-Y axis
Mode B	Y-Z axis
Mode C	X-Z axis

From the above modes, the worst case was found in Mode A. Therefore only the test data of the mode was recorded in this report.

When spectrum scanned from 30MHz to 1GHz setting resolution bandwidth 120KHz and video bandwidth 300KHz:

EMI Test Receiver	Setting
Attenuation	Auto
RB	120KHz
VB	300KHz
Detector	QP
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz:

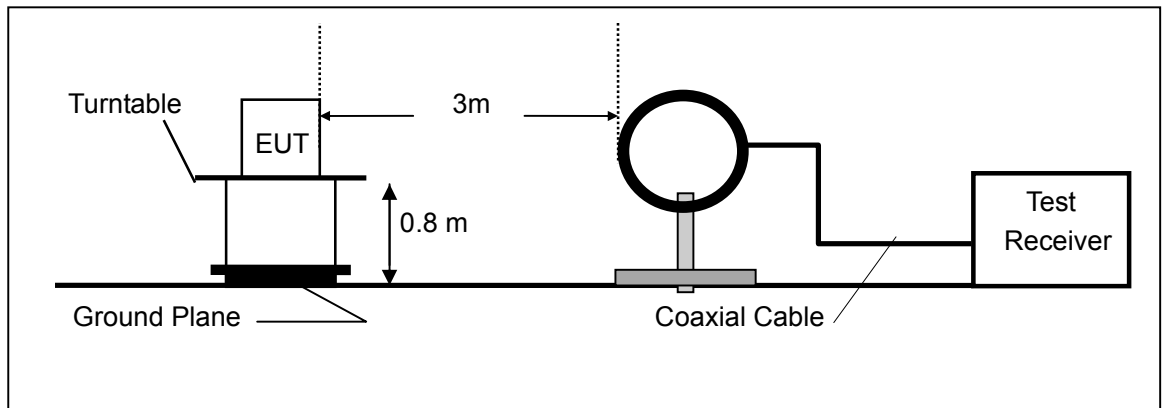
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 10Hz:

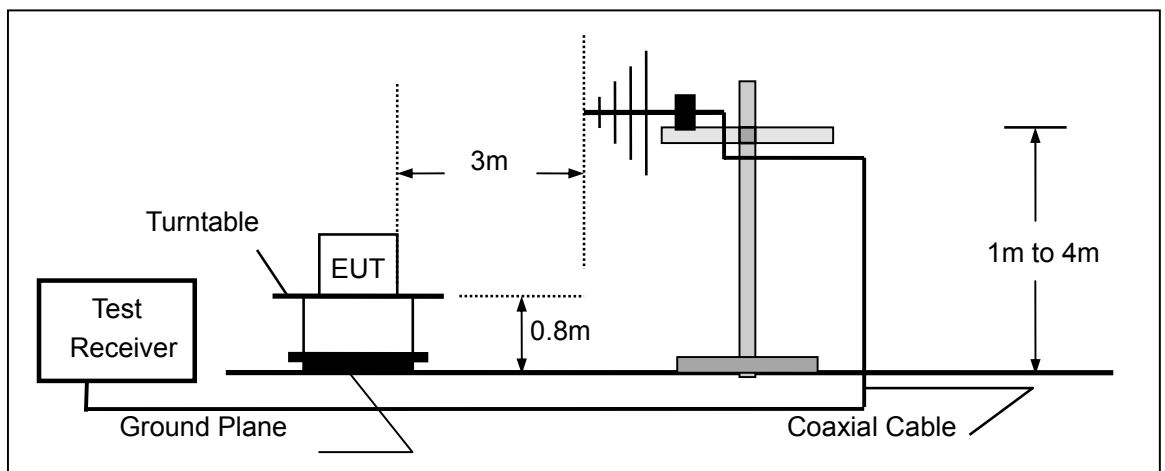
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Peak
Trace	Max hold

6.2 Test SET-UP (Block Diagram of Configuration)

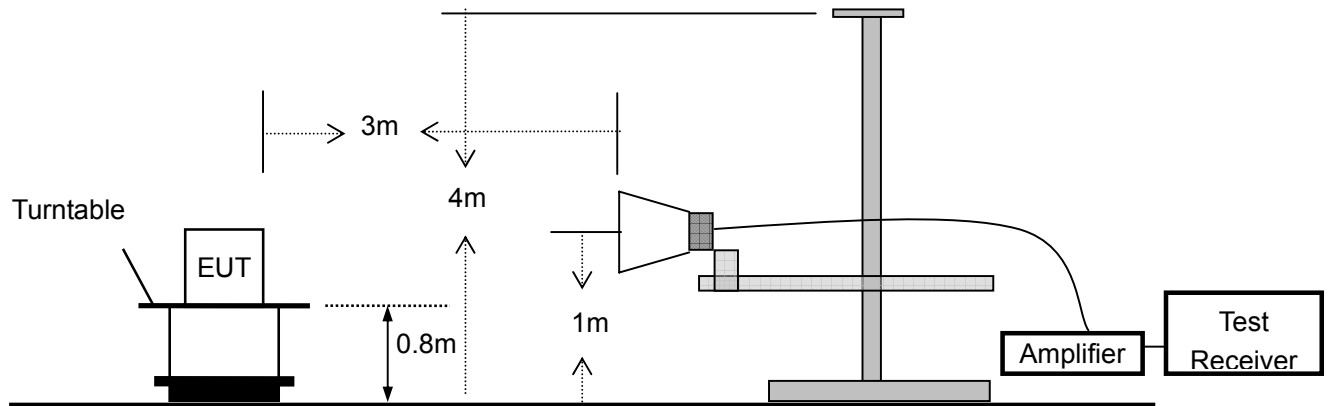
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



6.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	05/16/2014	05/15/2015
Spectrum Analyzer	HP	E4407B	839840481	05/16/2014	05/15/2015
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	05/16/2014	05/15/2015
Pre-Amplifier	HP	8447D	2944A07999	05/16/2014	05/15/2015
Bilog Antenna	Schwarzbeck	VULB9163	142	05/19/2014	05/18/2015
Loop Antenna	Schwarzbeck	FMZB 1519	012	05/19/2014	05/18/2015
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170399	05/19/2014	05/18/2015
Horn Antenna	Schwarzbeck	BBHA 9120	D143	05/19/2014	05/18/2015
Spectrum Analyzer	Agilent	E4446A	US44300399	05/16/2014	05/15/2015

6.4 Radiated Emission Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table 15.209(a):

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

- Remark 1. Emission level in dBuV/m=20 log (uV/m)
: 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205, and the emissions located in restricted bands also comply with 15.209 limit.

6.5 Measurement Result

Below 30MHz:

All the modulation modes were tested the data of the test mode are recorded in the following pages.

Operation Mode:	TX Mode	Test Date :	January 16, 2015
Frequency Range:	9KHz~30MHz	Temperature :	28°C
Test Result:	PASS	Humidity :	60 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

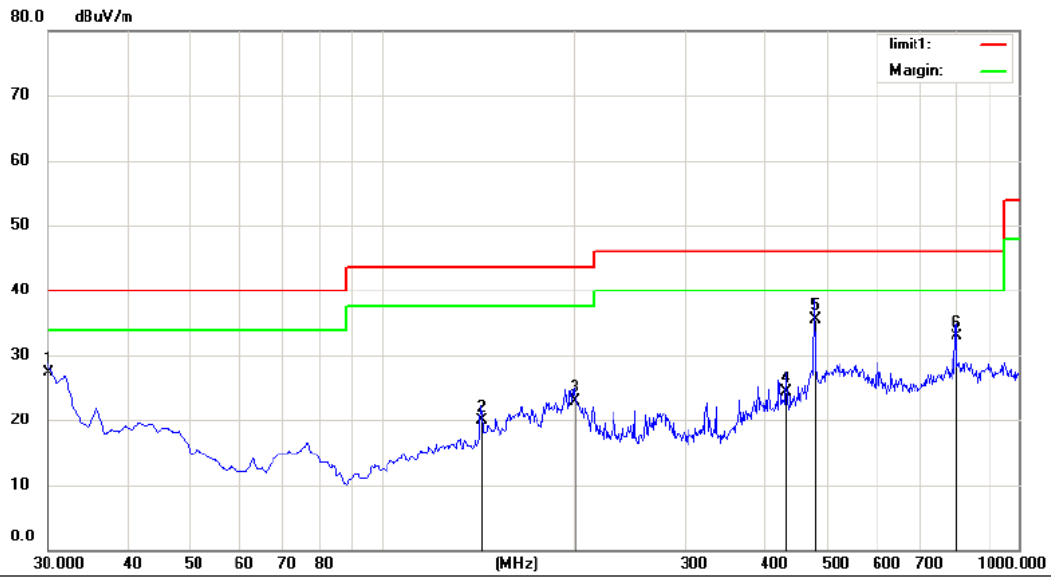
Distance extrapolation factor = $40 \log(\text{Specific distance} / \text{test distance})$ (dB);

Limit line = Specific limits (dBuV) + distance extrapolation factor.

Below 1000MHz:

All the modulation modes were tested the data of the worst mode (TX 802.11b) are recorded in the following pages and the others modulation methods do not exceed the limits.

Please refer to the following test plots:

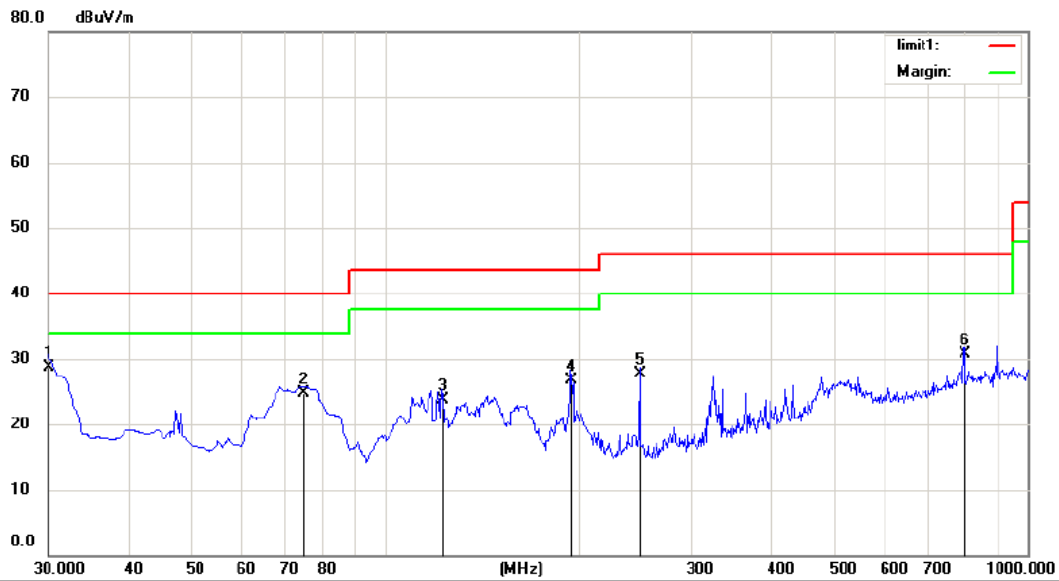


Site Chamber #1 Polarization: **Horizontal** Temperature: 26
 Limit: (RE)FCC PART 15 class B 3m Power: Connect to PC Humidity: 55 %
 Mode: TX
 Note:

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Detector	Comment
1	30.0000	42.55	-15.15	27.40	40.00	-12.60			QP	
2	143.4900	37.18	-17.29	19.89	43.50	-23.61			QP	
3	200.7200	40.62	-17.68	22.94	43.50	-20.56			QP	
4	431.5800	35.60	-11.32	24.28	46.00	-21.72			QP	
5 *	480.0800	46.08	-10.54	35.54	46.00	-10.46			QP	
6	800.1800	37.95	-5.13	32.82	46.00	-13.18			QP	

*:Maximum data x:Over limit !:over margin

Operator: Snake



Site Chamber #1 Polarization: **Vertical** Temperature: 26
 Limit: (RE)FCC PART 15 class B 3m Power: Connect to PC Humidity: 55 %

Mode: TX

Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1	*	30.0000	43.81	-15.15	28.66	40.00	-11.34	QP		
2		74.6200	47.47	-22.69	24.78	40.00	-15.22	QP		
3		123.1200	40.38	-16.61	23.77	43.50	-19.73	QP		
4		194.9000	44.62	-17.88	26.74	43.50	-16.76	QP		
5		250.1900	43.10	-15.48	27.62	46.00	-18.38	QP		
6		800.1800	35.76	-5.13	30.63	46.00	-15.37	QP		

*:Maximum data x:Over limit !:over margin

Operator: Snake

Above 1000MHz:

Operation Mode: 802.11b Lowest

Test Date : January 16, 2015

Freq. (MHz)	Ant. Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4824	V	65.33	46.23	74	54	-8.67	-7.77
7236	V	64.08	45.01	74	54	-9.92	-8.99
9648	V	63.72	44.72	74	54	-10.28	-9.28
12060	V	62.15	43.92	74	54	-11.85	-10.08
14472	V	60.95	42.13	74	54	-13.05	-11.87
16884	V	57.49	40.82	74	54	-16.51	-13.18
4824	H	66.13	45.33	74	54	-7.87	-8.67
7236	H	65.71	44.15	74	54	-8.29	-9.85
9648	H	64.03	43.92	74	54	-9.97	-10.08
12060	H	63.18	42.08	74	54	-10.82	-11.92
14472	H	62.82	41.37	74	54	-11.18	-12.63
16884	H	60.79	40.92	74	54	-13.21	-13.08

Operation Mode: 802.11b Middle

Test Date : January 16, 2015

Freq. (MHz)	Ant. Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4874	V	64.95	45.39	74	54	-9.05	-8.61
7311	V	63.13	44.13	74	54	-10.87	-9.87
9688	V	62.72	42.69	74	54	-11.28	-11.31
12185	V	60.39	40.38	74	54	-13.61	-13.62
14622	V	58.72	39.25	74	54	-15.28	-14.75
17059	V	57.16	37.15	74	54	-16.84	-16.85
4874	H	65.38	46.33	74	54	-8.62	-7.67
7311	H	64.08	45.03	74	54	-9.92	-8.97
9688	H	63.92	44.38	74	54	-10.08	-9.62
12185	H	62.56	43.19	74	54	-11.44	-10.81
14622	H	61.07	42.29	74	54	-12.93	-11.71
17059	H	60.92	41.72	74	54	-13.08	-12.28

Operation Mode: 802.11b Highest

Test Date : January 16, 2015

Freq. (MHz)	Ant. Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4924	V	67.33	44.33	74	54	-6.67	-9.67
7386	V	66.82	43.15	74	54	-7.18	-10.85
9848	V	65.13	42.08	74	54	-8.87	-11.92
12310	V	64.08	41.92	74	54	-9.92	-12.08
14772	V	63.34	40.34	74	54	-10.66	-13.66
17234	V	62.13	39.72	74	54	-11.87	-14.28
4924	H	65.79	45.1	74	54	-8.21	-8.9
7386	H	64.38	44.19	74	54	-9.62	-9.81
9848	H	63.82	43.38	74	54	-10.18	-10.62
12310	H	62.49	42.18	74	54	-11.51	-11.82
14772	H	60.28	41.01	74	54	-13.72	-12.99
17234	H	57.49	40.95	74	54	-16.51	-13.05

All emissions not reported were more than 20dB below the specified limit or in the noise floor.

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) Data of measurement within this frequency range shown “ – ” in the table above means the reading of emissions are attenuated more than 20Db below the permissible limits or the field strength is too small to be measured.

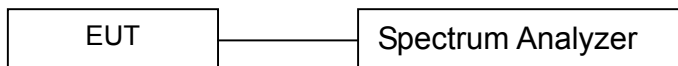
7. 6dB Bandwidth Test

7.1 Measurement Procedure

The EUT was operating in IEEE 802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40) mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

1. Set resolution bandwidth (RBW) = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequency) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.2 Test SET-UP (Block Diagram of Configuration)



7.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	FSV30	1321.3008K	05/16/2014	05/15/2015

7.4 Measurement Results

6 Bandwidth Test Data Chart:

IEEE 802.11b			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2412	10030	>500	Pass
2437	10030	>500	
2462	10030	>500	

IEEE 802.11g			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2412	16304	>500	Pass
2437	16304	>500	
2462	16304	>500	

IEEE 802.11n(HT20)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2412	16883	>500	Pass
2437	16903	>500	
2462	17023	>500	

IEEE 802.11n(HT40)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2422	35724	>500	Pass
2437	35964	>500	
2452	36004	>500	

For 5GHz Band:

IEEE 802.11a			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
5745	10010	>500	Pass
5785	9990	>500	
5825	10010	>500	

IEEE 802.11n(HT20)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
5745	16284	>500	Pass
5785	16304	>500	
5825	16304	>500	

IEEE 802.11n(HT40)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
5755	16404	>500	Pass
5795	16084	>500	

IEEE 802.11ac(HT20)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
5745	17023	>500	Pass
5785	17003	>500	
5825	17023	>500	

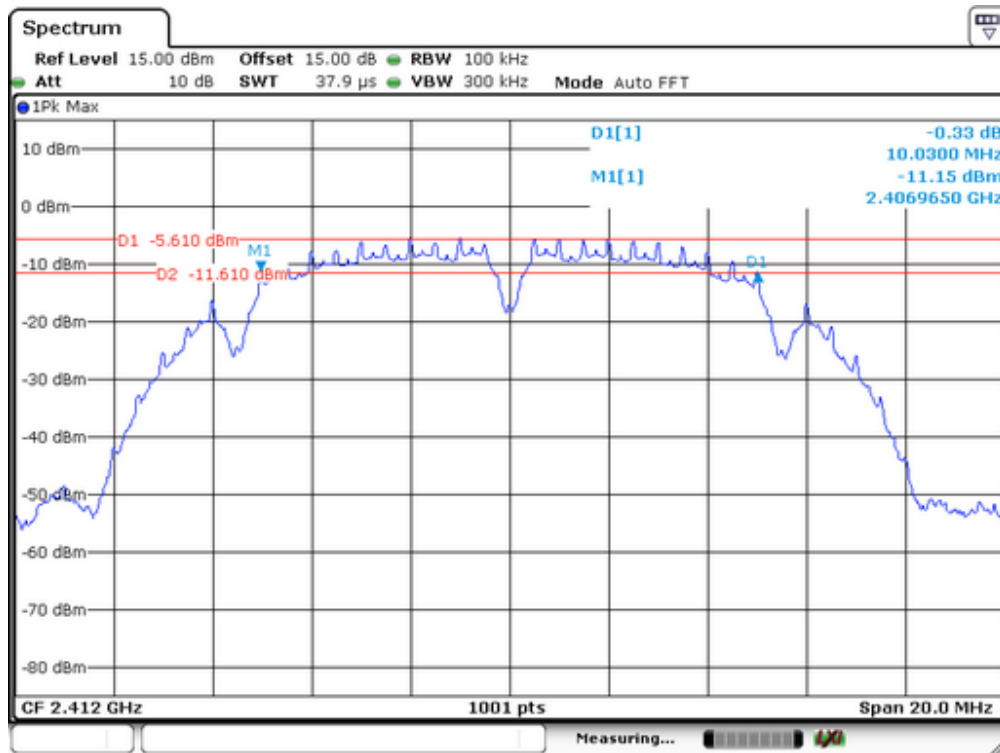
IEEE 802.11ac(HT40)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
5755	16404	>500	Pass
5795	16084	>500	

IEEE 802.11ac(HT80)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
5775	75205	>500	Pass

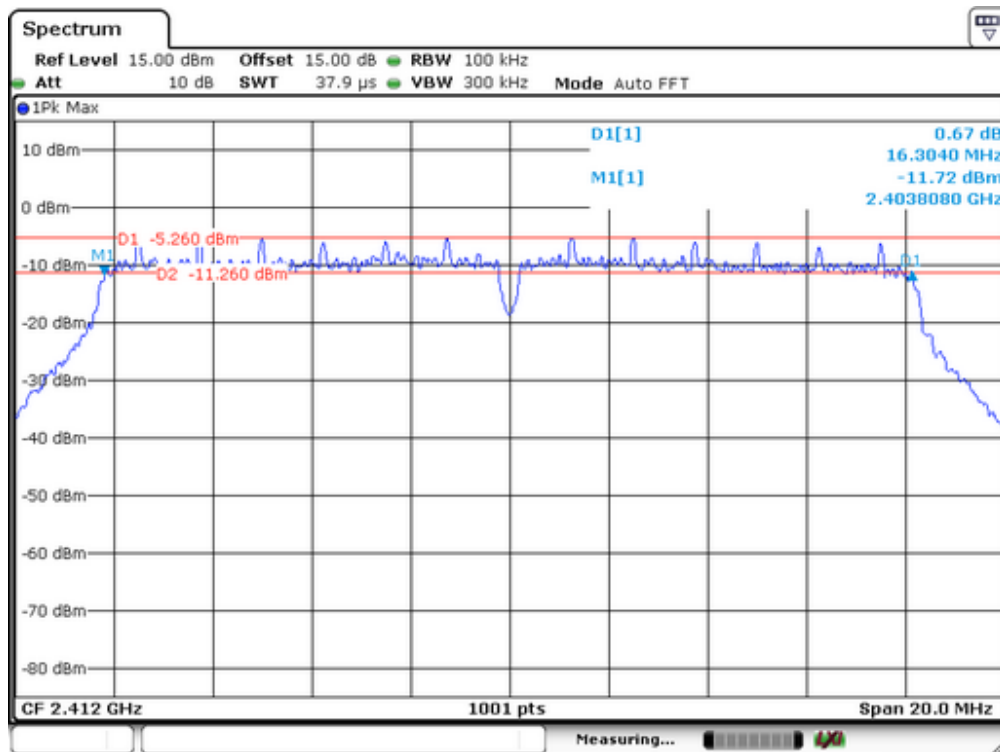
Note: All the test values were listed in the report.

For plots, only the channels with worst result was shown.

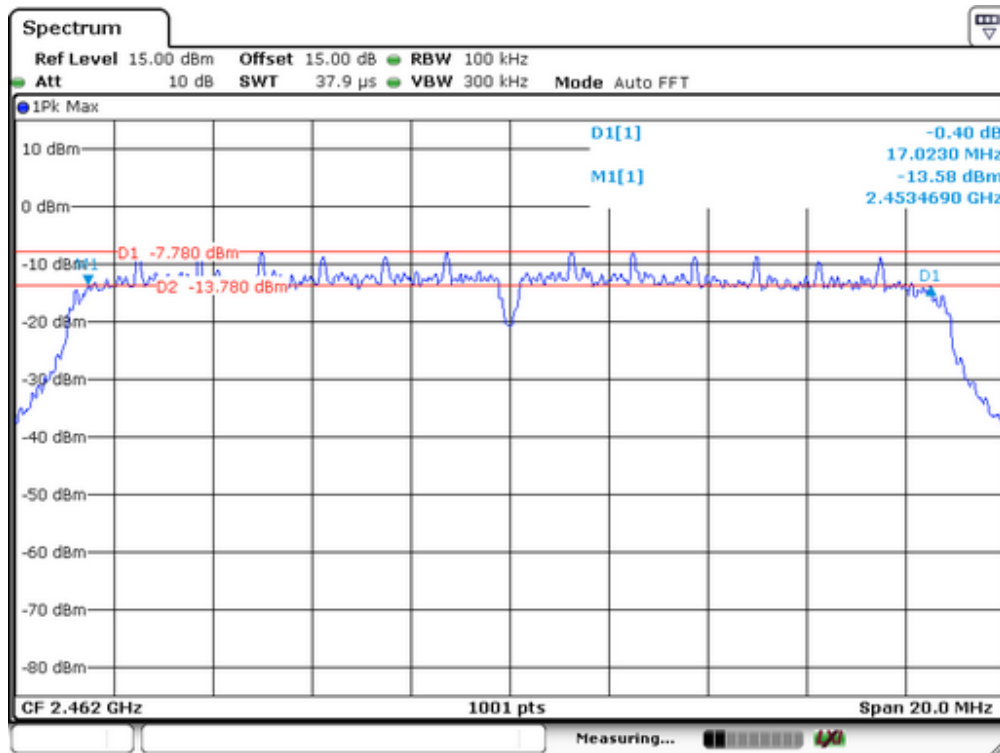
6dB Bandwidth Plot on Configuration IEEE 802.11b/2412MHz



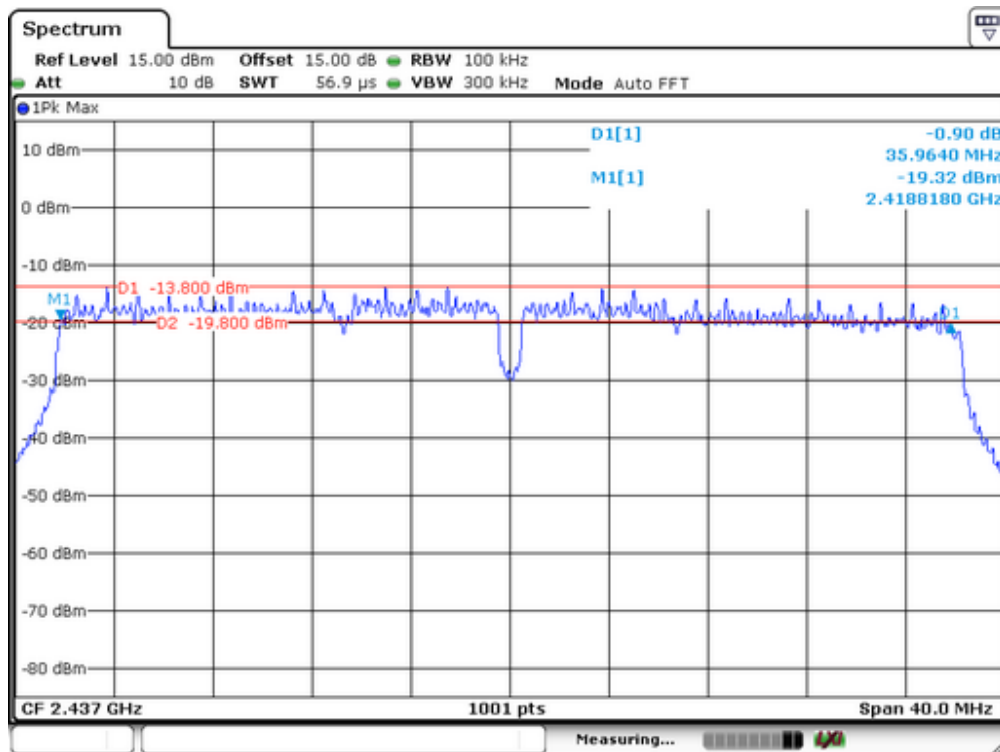
6dB Bandwidth Plot on Configuration IEEE 802.11g/2412MHz



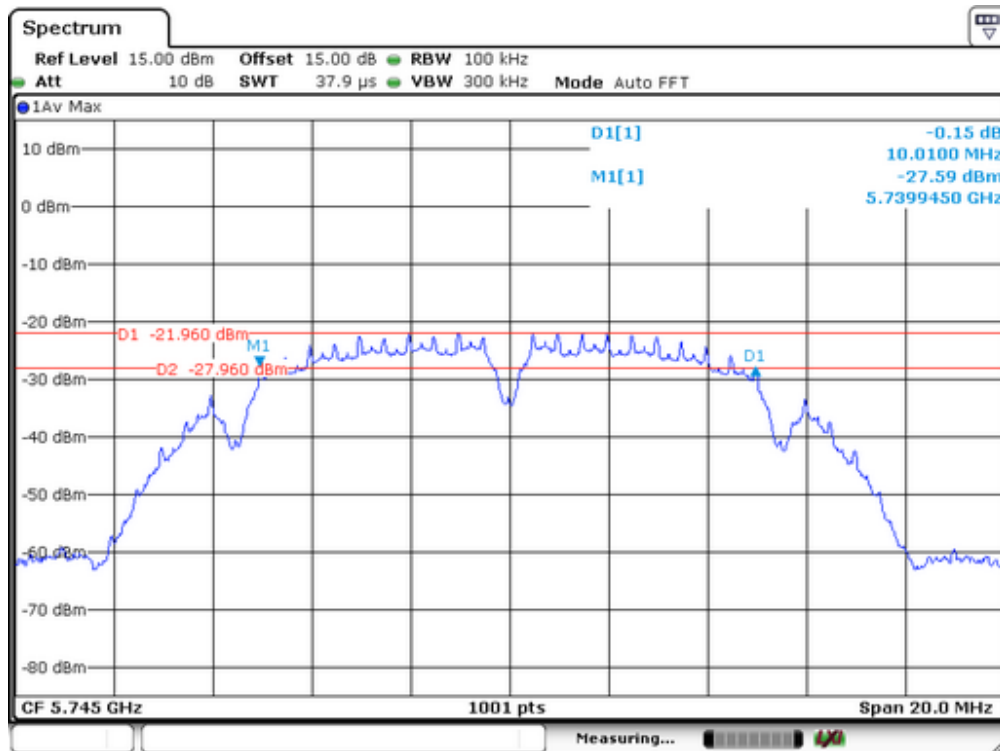
6dB Bandwidth Plot on Configuration IEEE 802.11n(HT20)/2462MHz



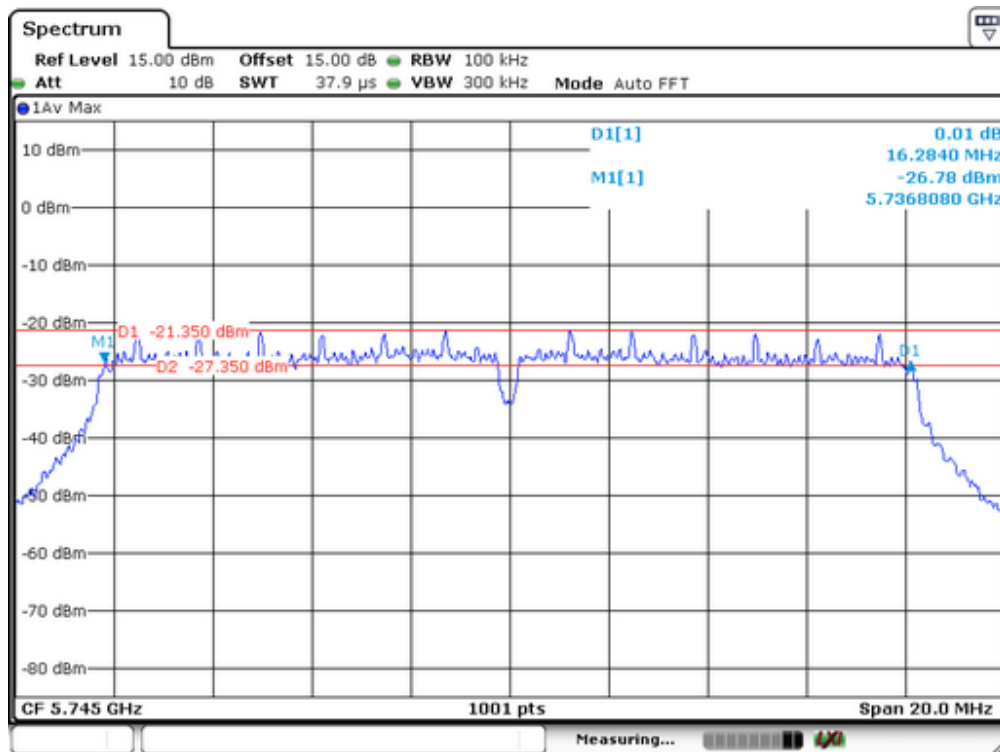
6dB Bandwidth Plot on Configuration IEEE 802.11n(HT40)/2437MHz



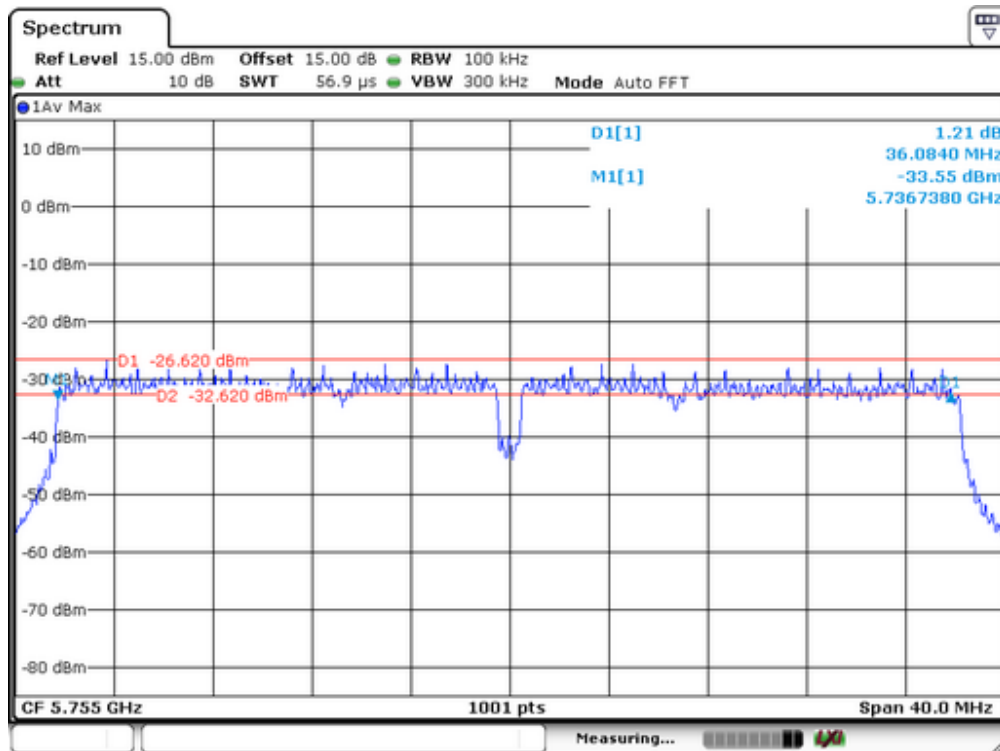
6dB Bandwidth Plot on Configuration IEEE 802.11a/5745MHz



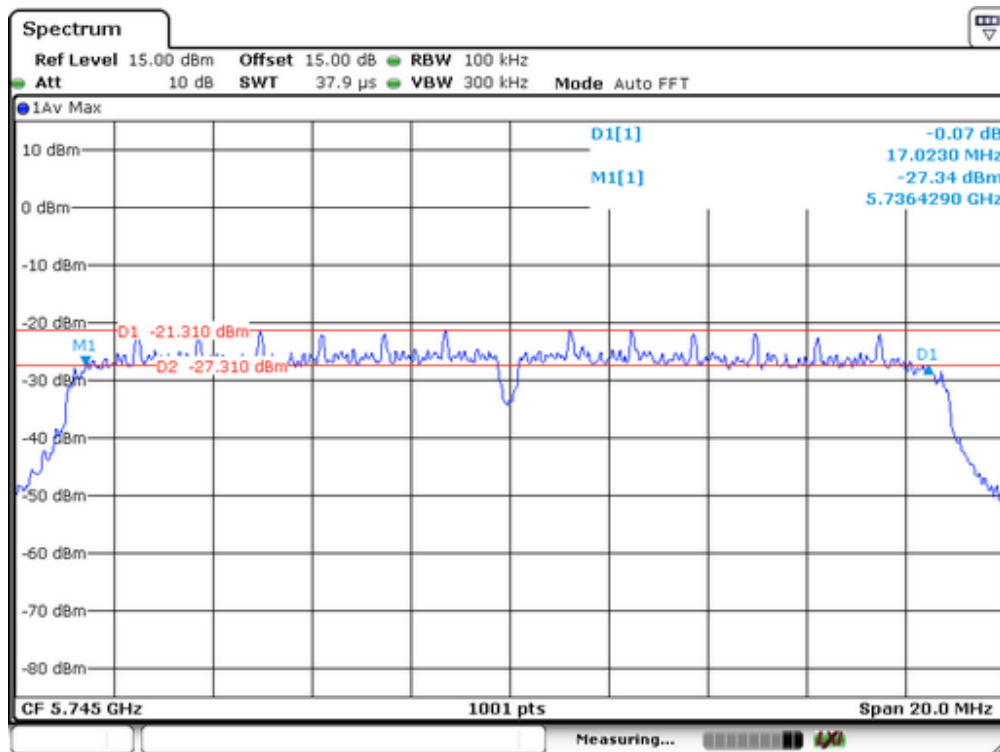
6dB Bandwidth Plot on Configuration IEEE 802.11n(HT20)/5745MHz



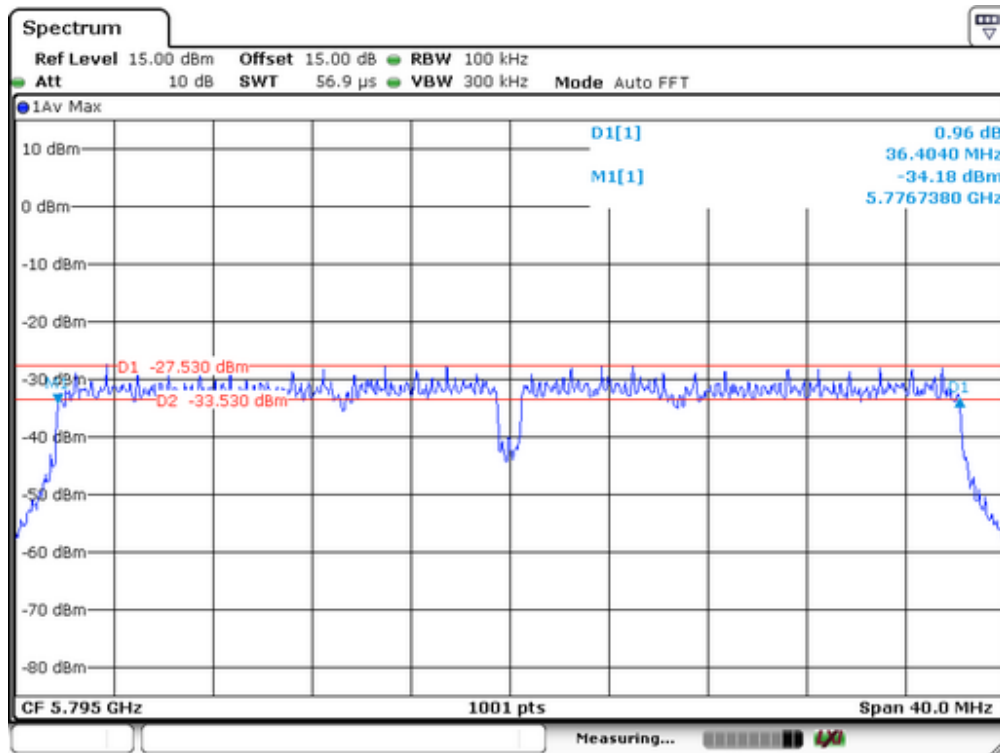
6dB Bandwidth Plot on Configuration IEEE 802.11n(HT40)/5755MHz



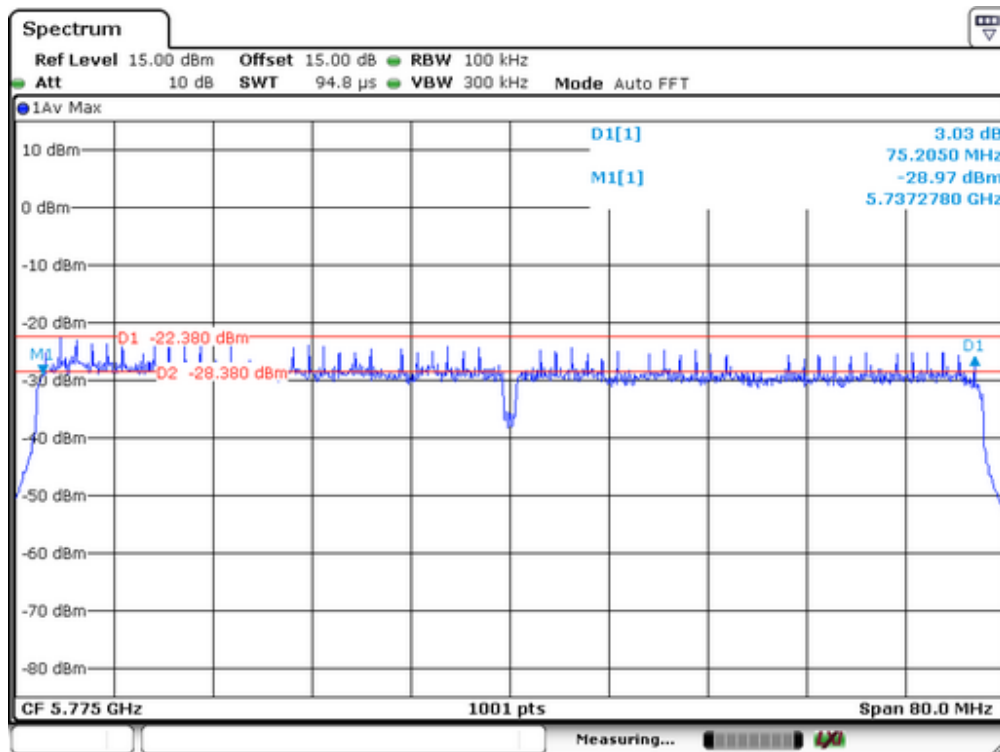
6dB Bandwidth Plot on Configuration IEEE 802.11ac(HT20)/5745MHz



6dB Bandwidth Plot on Configuration IEEE 802.11ac(HT40)/5795MHz



6dB Bandwidth Plot on Configuration IEEE 802.11ac(HT80)/5775MHz



8. Maximum Peak Output Power Test

8.1 Measurement Procedure

The maximum peak conducted output power can be measured using a broadband peak RF power meter. The power meter must have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast, average-responding diode type sensor.

- a. The Transmitter output (antenna port) was connected to the power meter.
- b. Turn on the EUT and power meter and then record the peak power value.
- c. Repeat above procedures on all channels needed to be tested.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used

EQUIPMENT TYPE	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power meter	ML2495A	0824006	05/16/2014	05/15/2015
Power sensor	MA2411B	0738172	05/16/2014	05/15/2015

8.4 Peak Power output limit

The maximum peak power shall be less 1Watt(30dBm).

8.5 Measurement Results

For 2.4GHz Band:

Test Channel	Max Output Power (dBm)				Limit(dBm)	Result
	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)		
Lowest	11.65	10.33	10.26	9.46	30	Pass
Middle	10.84	9.42	8.89	8.24		
Highest	10.23	8.72	7.49	7.69		

For 5GHz Band:

Test Channel	Max Output Power (dBm)						Limit (dBm)	Result
	802.11a	802.11n (HT20)	802.11n (HT40)	802.11ac (HT20)	802.11ac (HT40)	802.11a (HT80)		
Lowest	4.96	3.23	3.15	4.86	3.16	2.05	30	Pass
Middle	3.85	2.79	2.95	3.79	2.69			
Highest	3.46	2.53		3.26				

9. Band Edge Test

9.1 Measurement Procedure

For Conducted Test

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

For Radiated emission Test

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Repeat above procedures until all frequency measured were complete.

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz.

EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 10Hz.

EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Peak
Trace	Max hold

9.2 Test SET-UP (Block Diagram of Configuration)

As 6.2 Test set up (B) and (C)

9.3 Measurement Equipment Used

Same as 6.3 Radiated Emission Measurement.

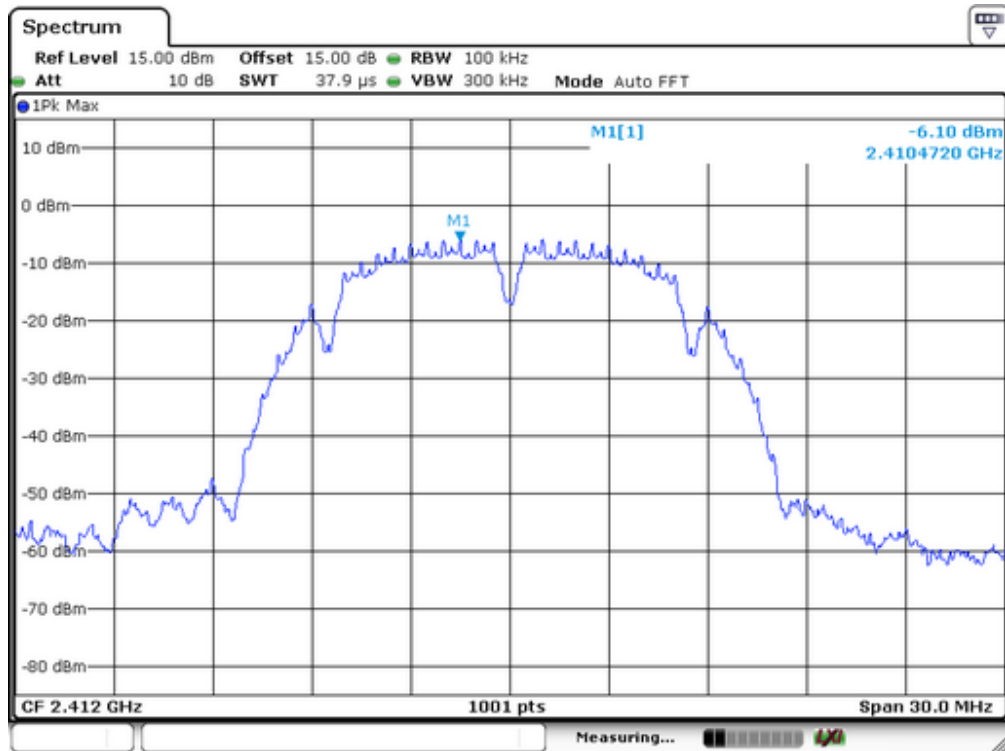
9.4 Measurement Results

All the test values wer listed in the report.
For plots, only the channel with worst result was shown.

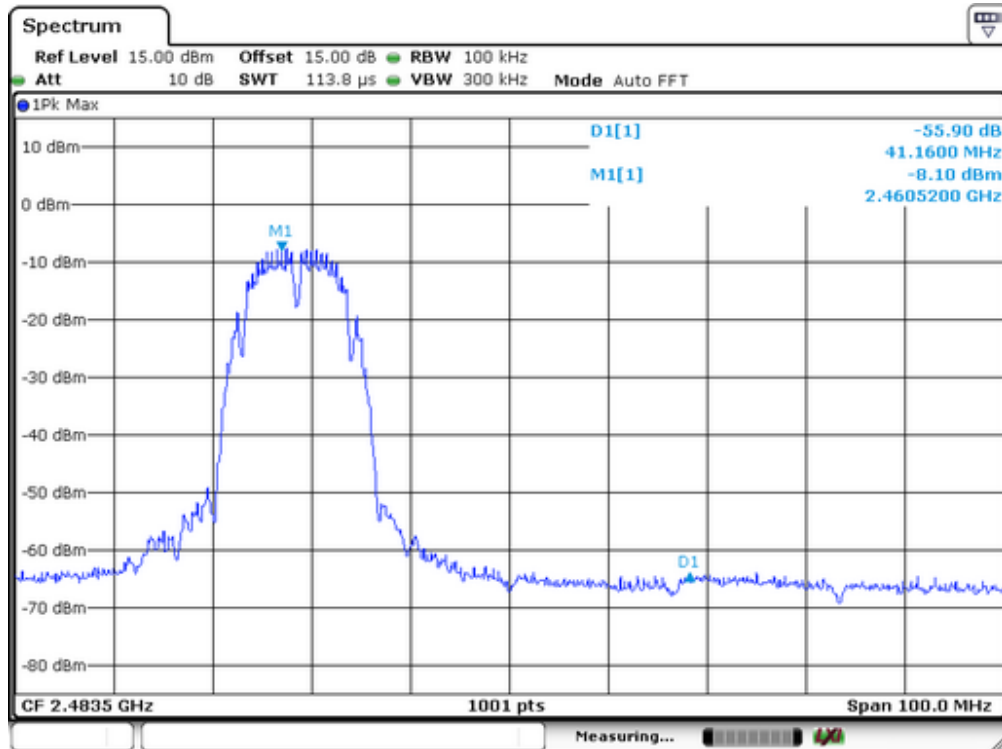
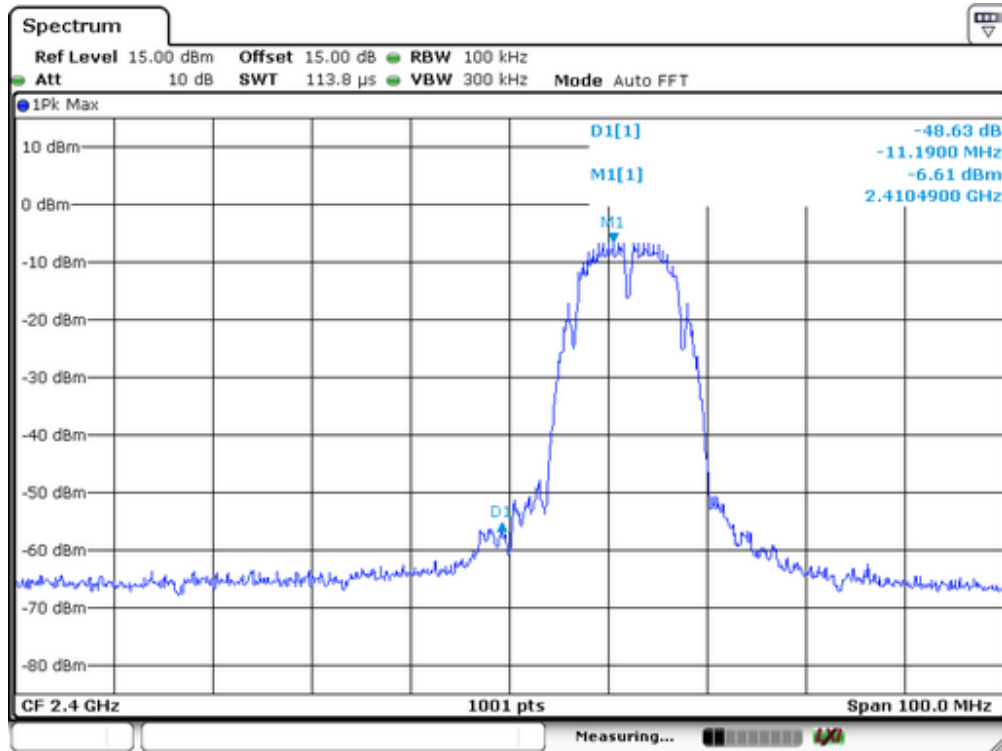
1. Conducted Test

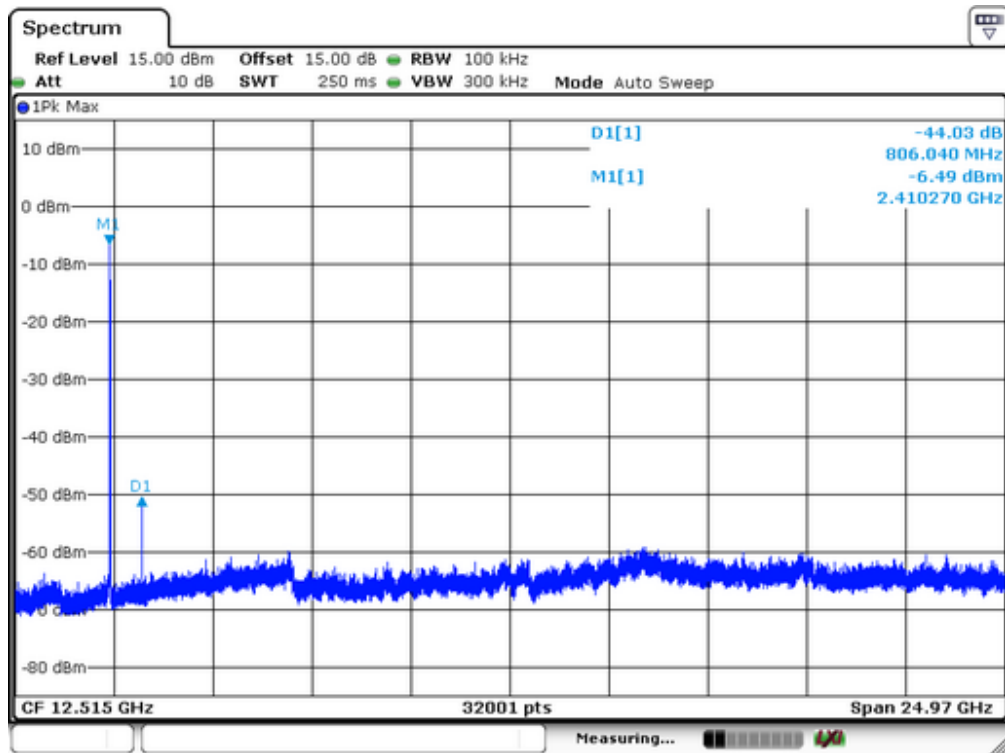
For 2.4G Band

Test Mode: IEEE 802.11b

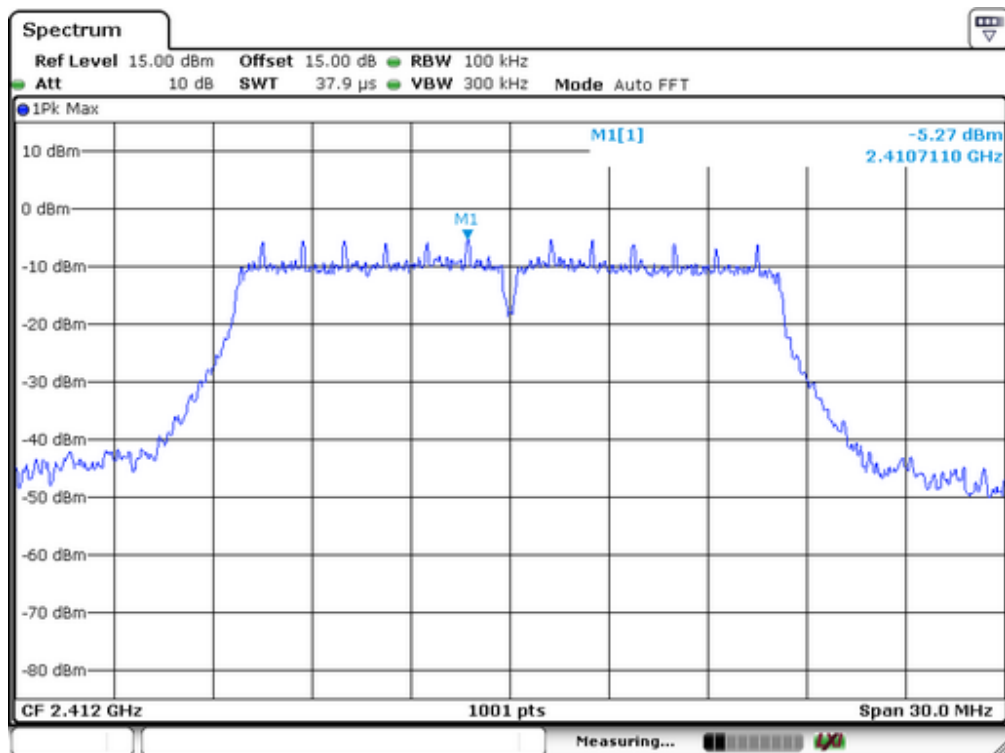


Lowest Channel

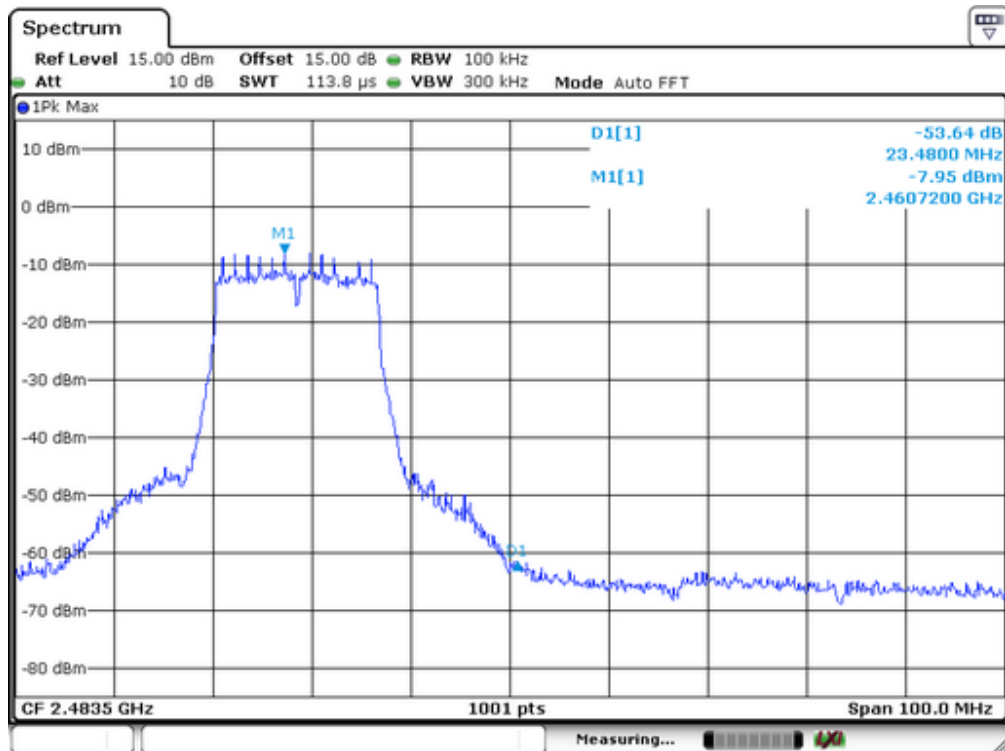
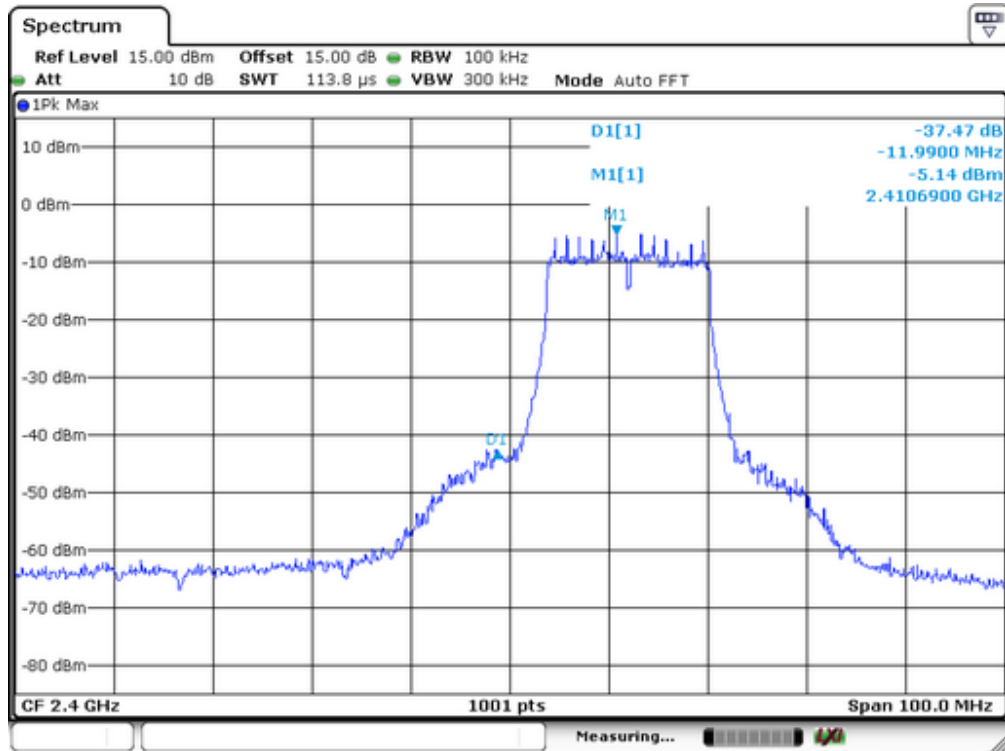


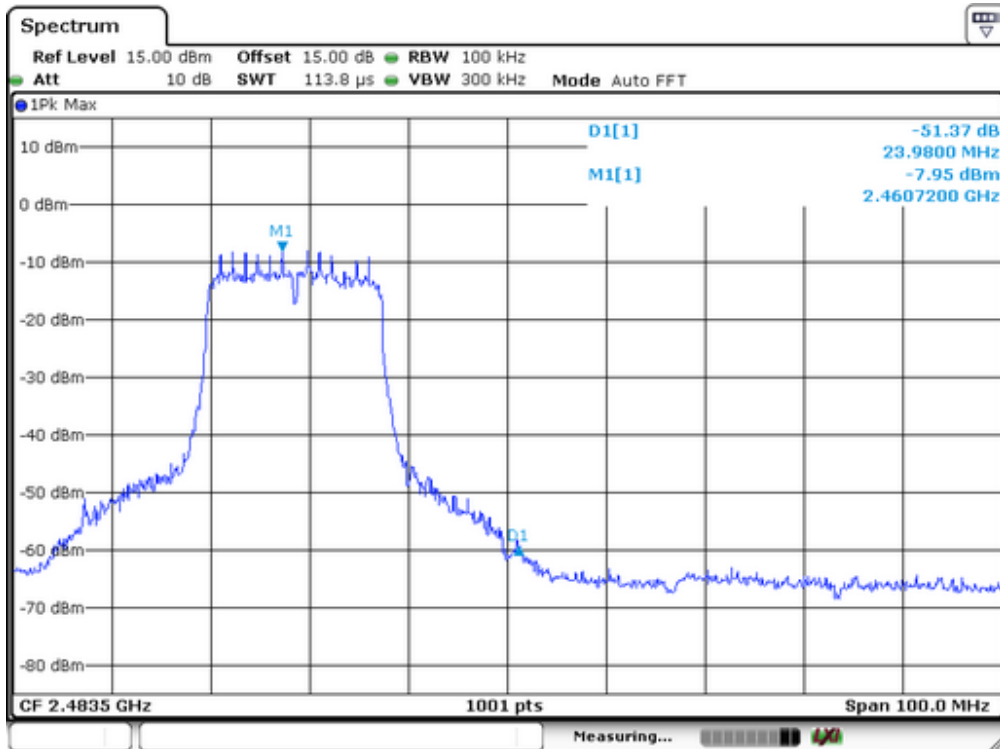
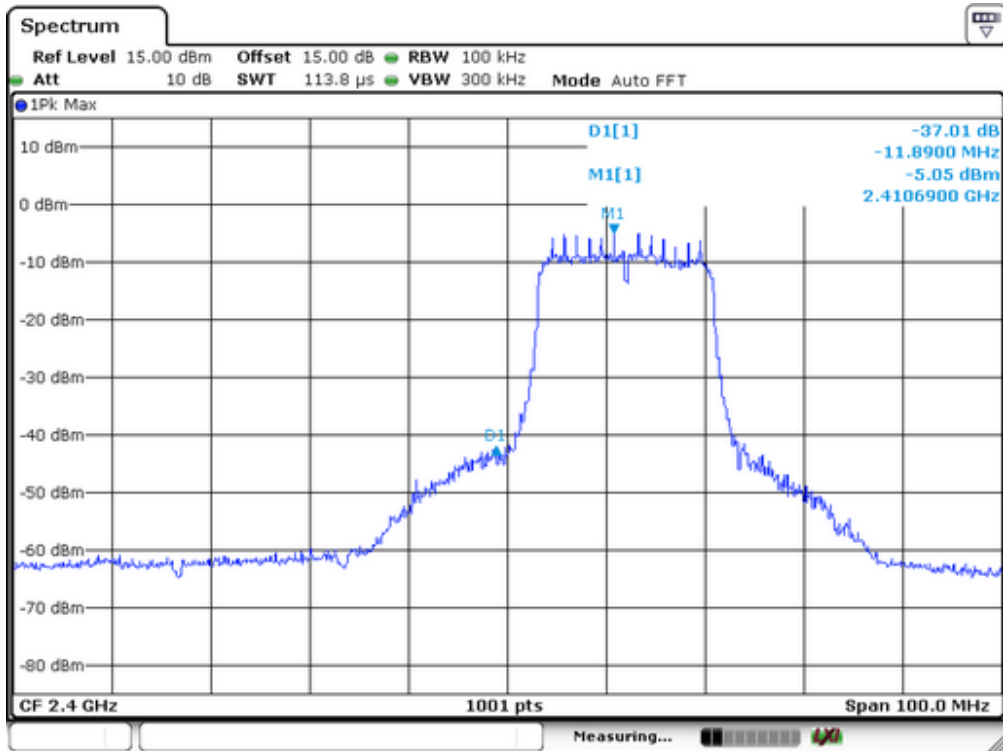


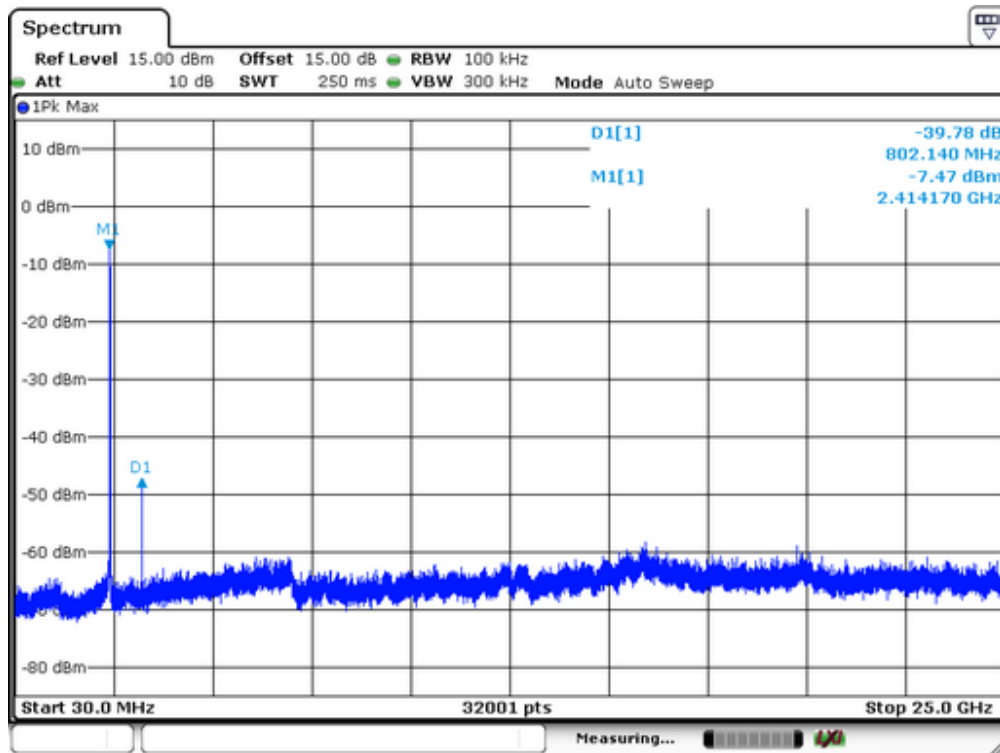
Test Mode: IEEE 802.11g



Lowest Channel

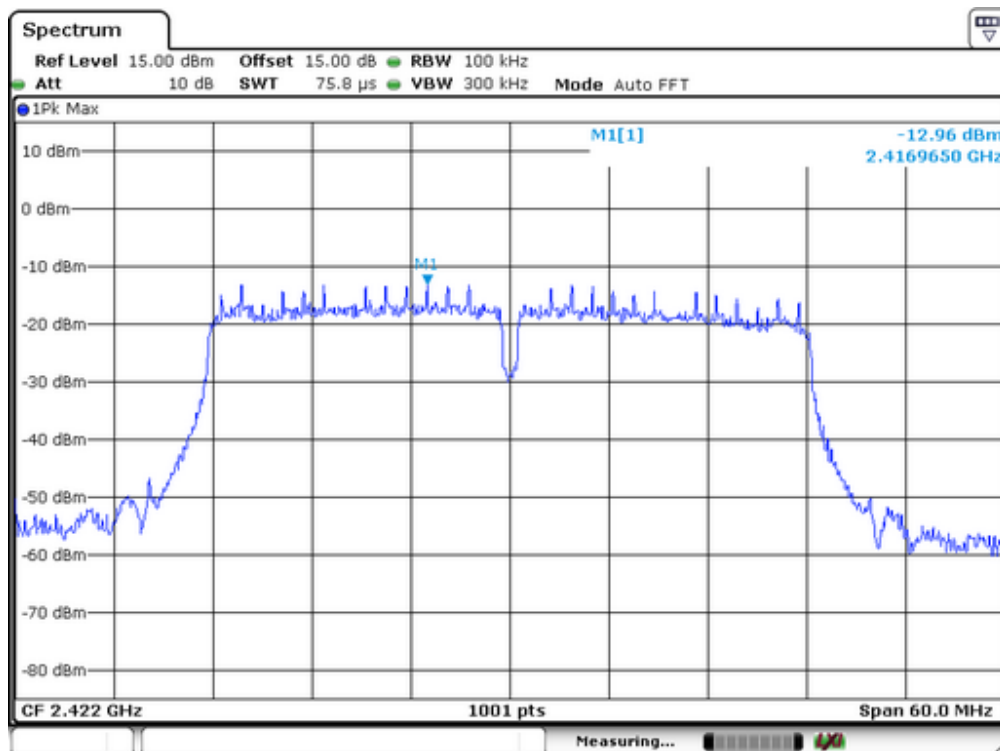




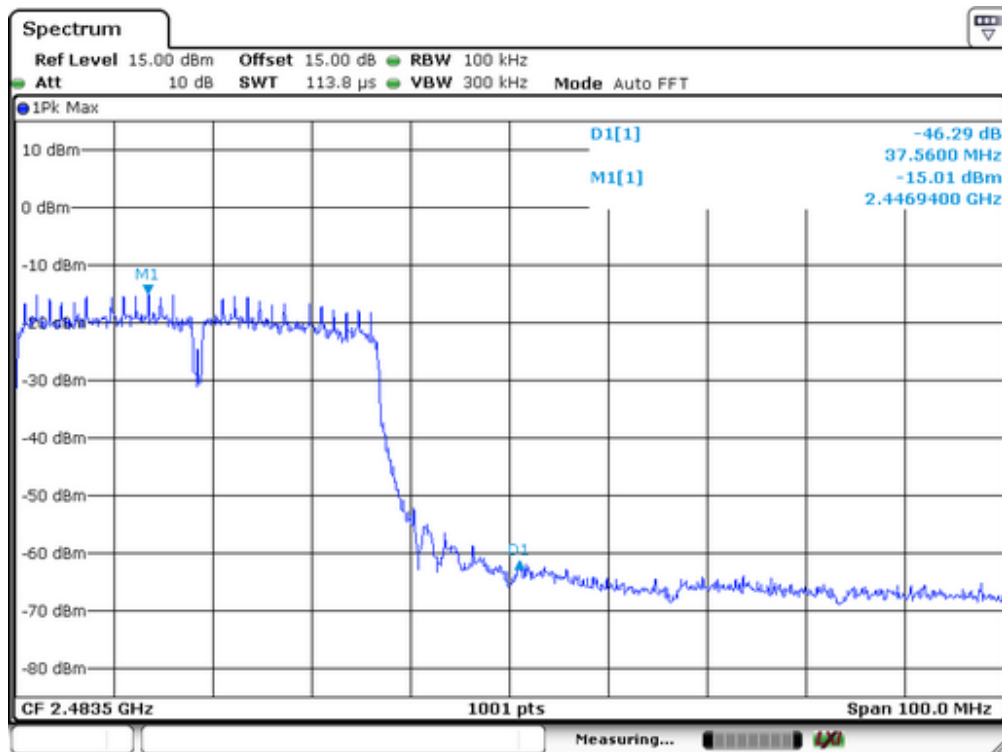
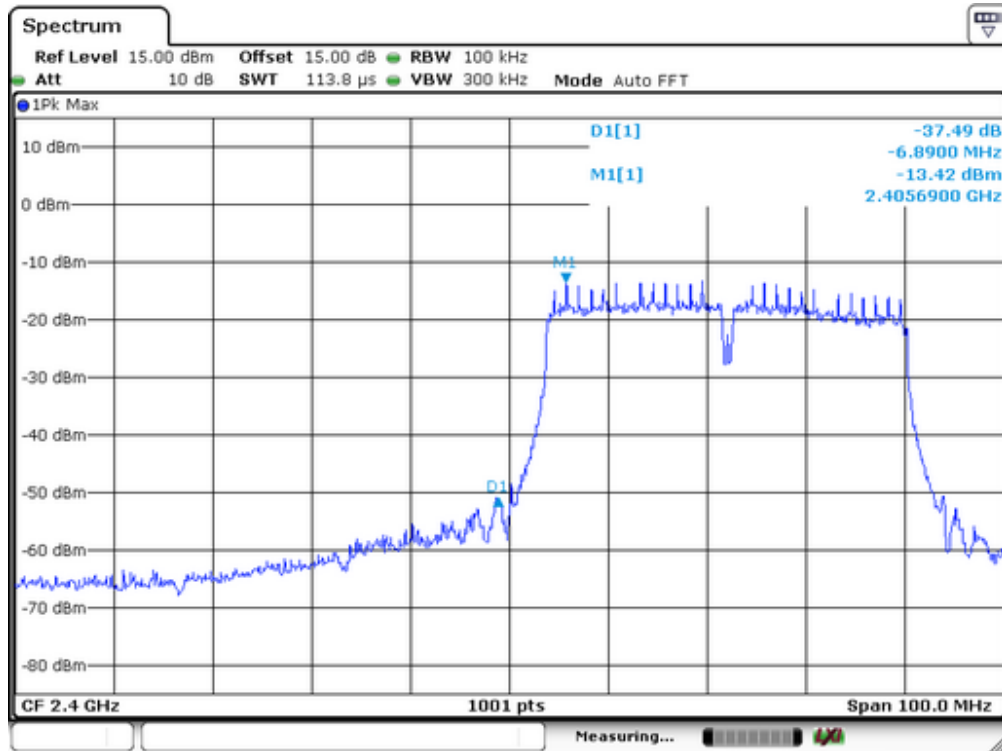


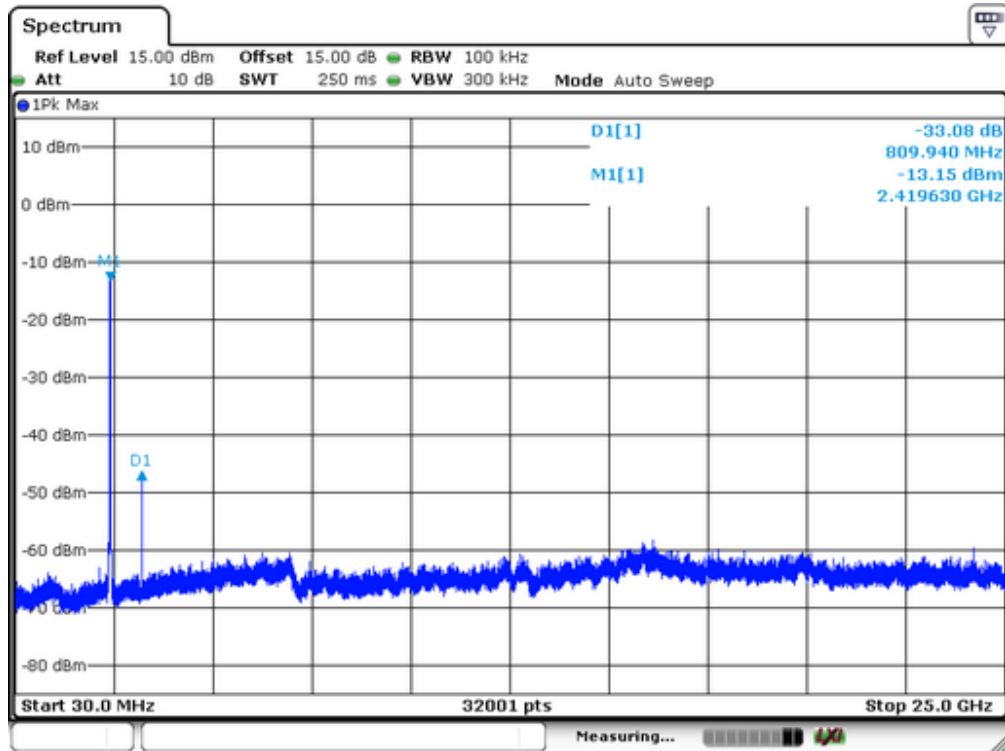
Lowest Channel

Test Mode: IEEE 802.11n(HT40)



Lowest Channel

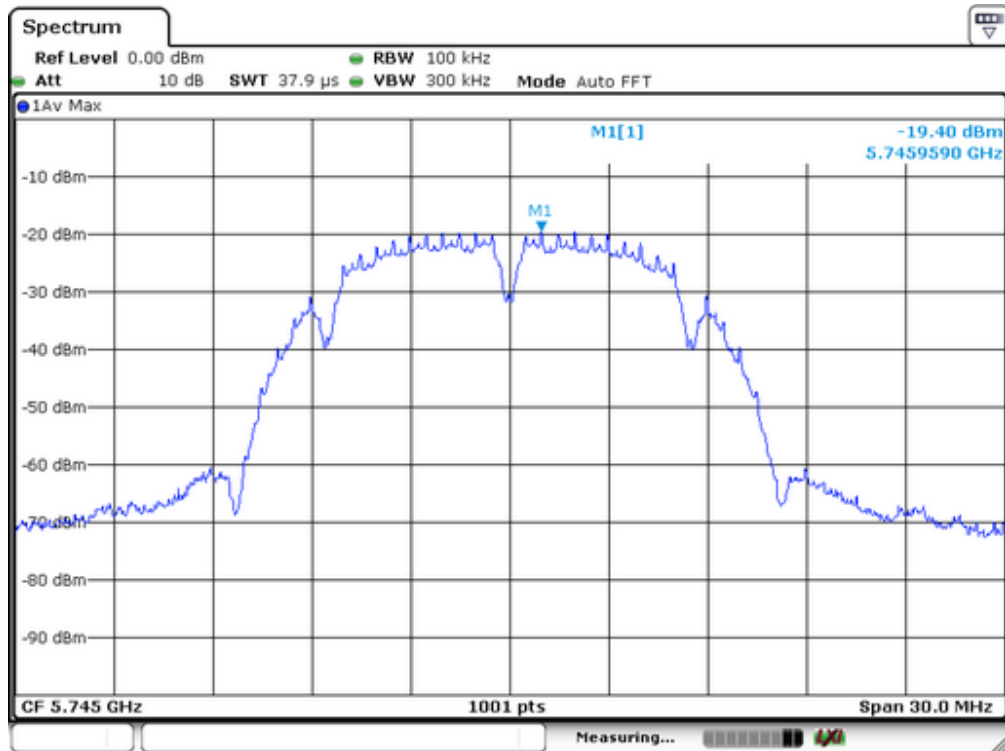




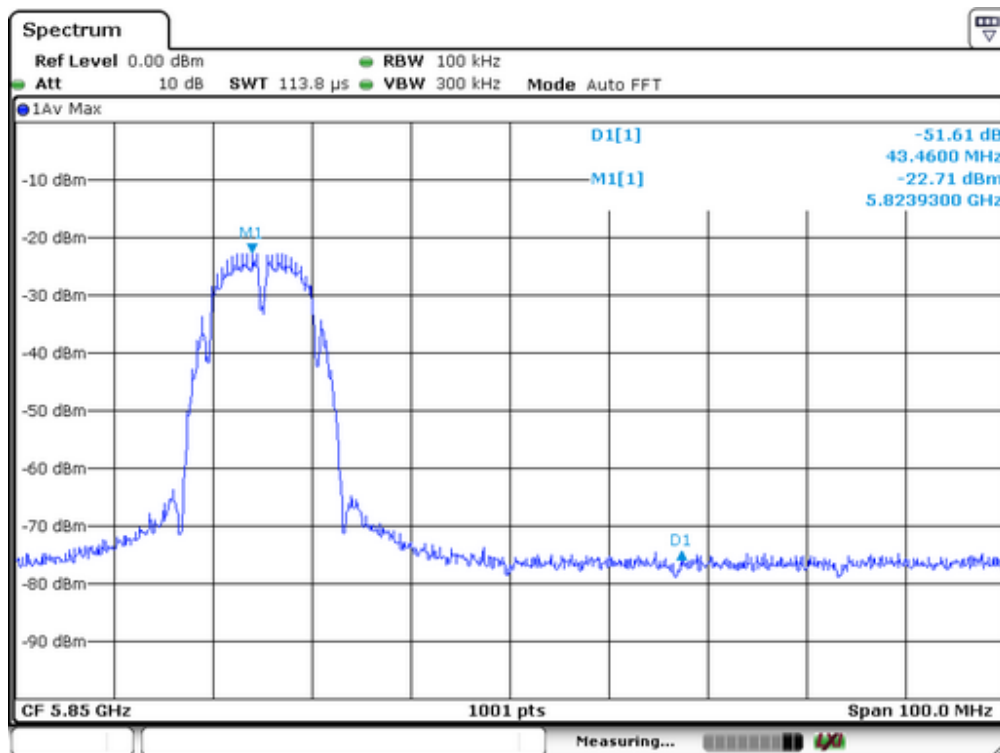
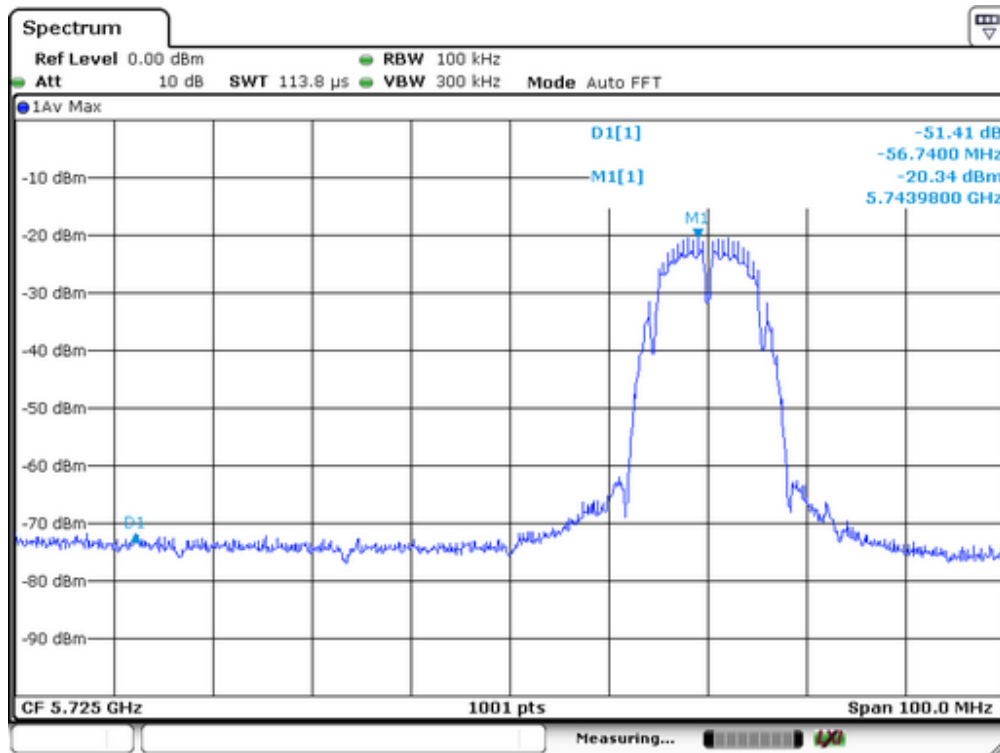
Lowest Channel

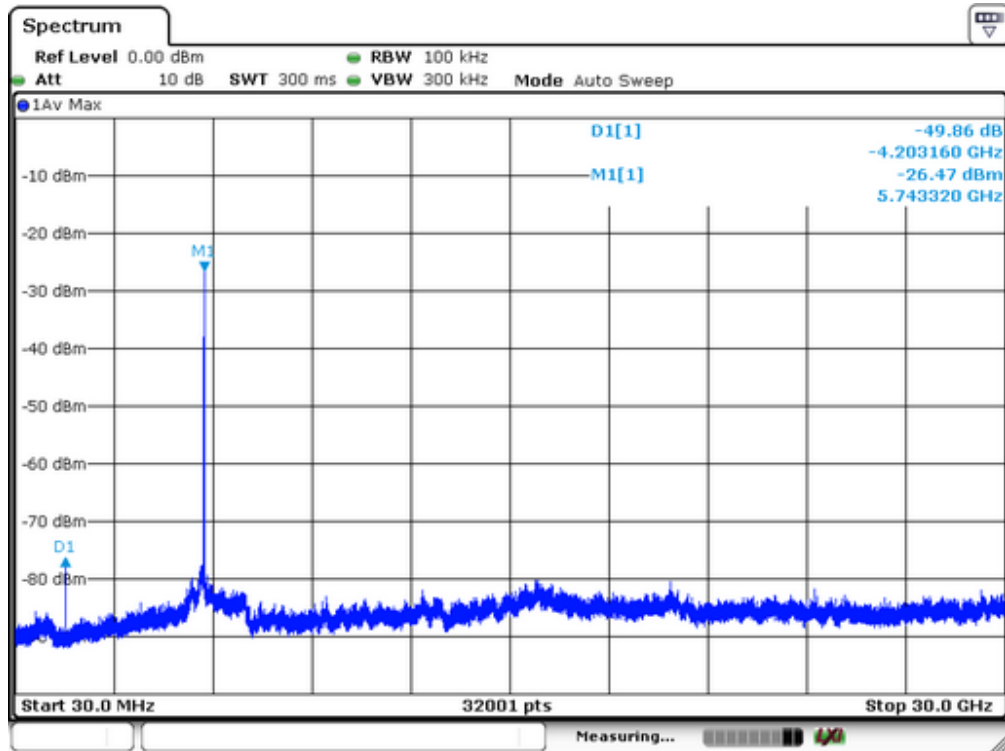
For 5G Band

Test Mode: IEEE 802.11a



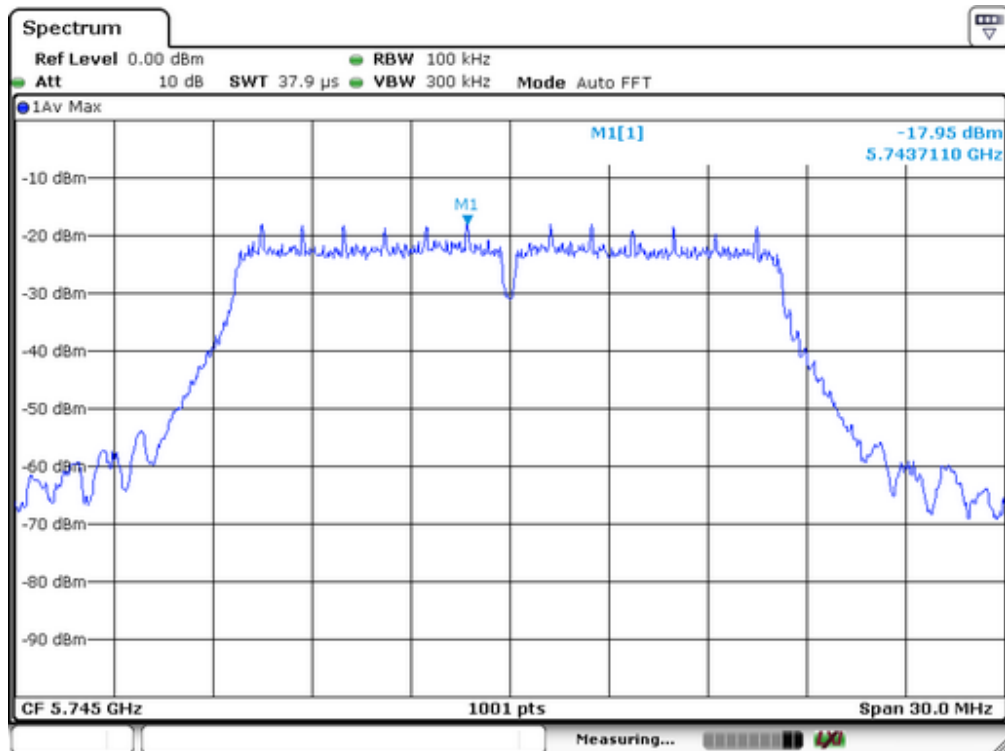
Lowest Channel



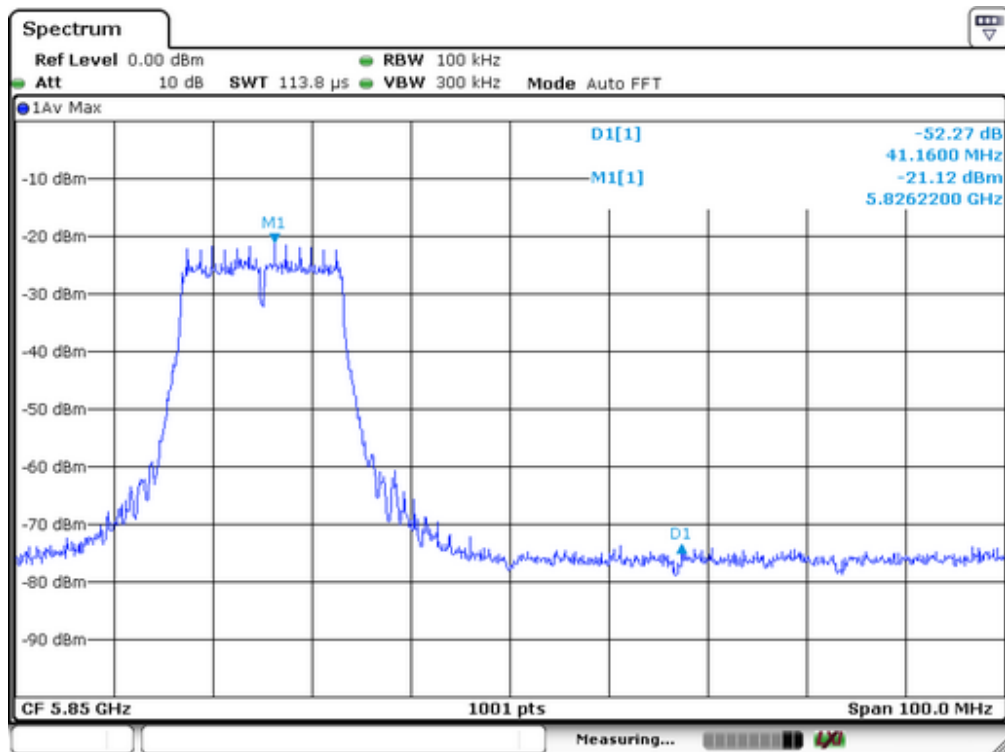
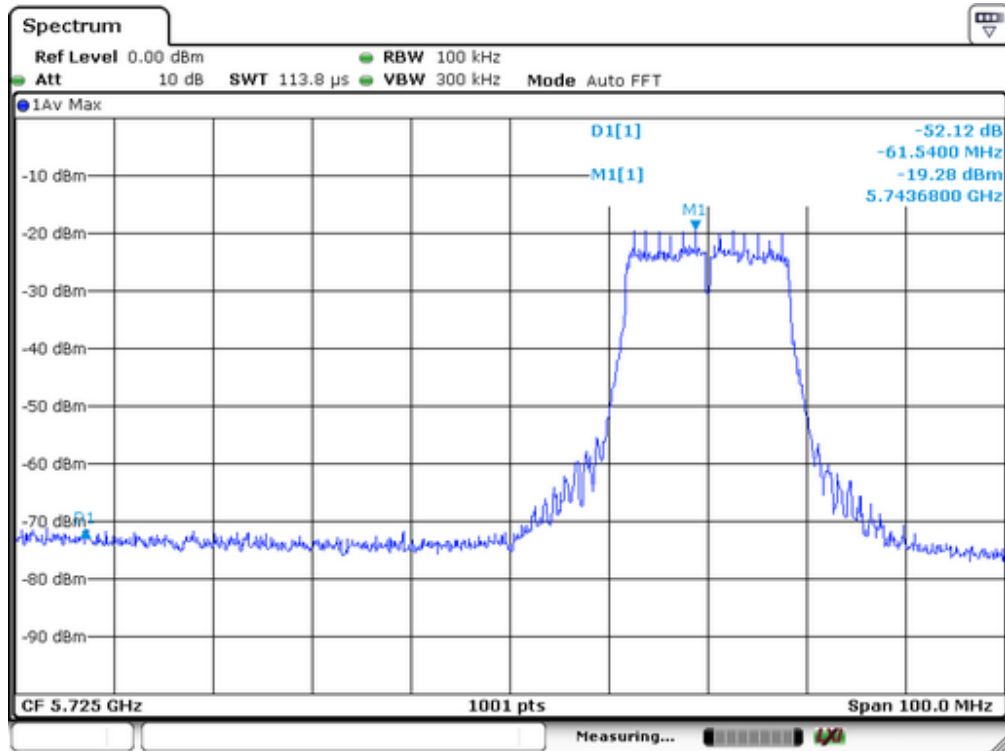


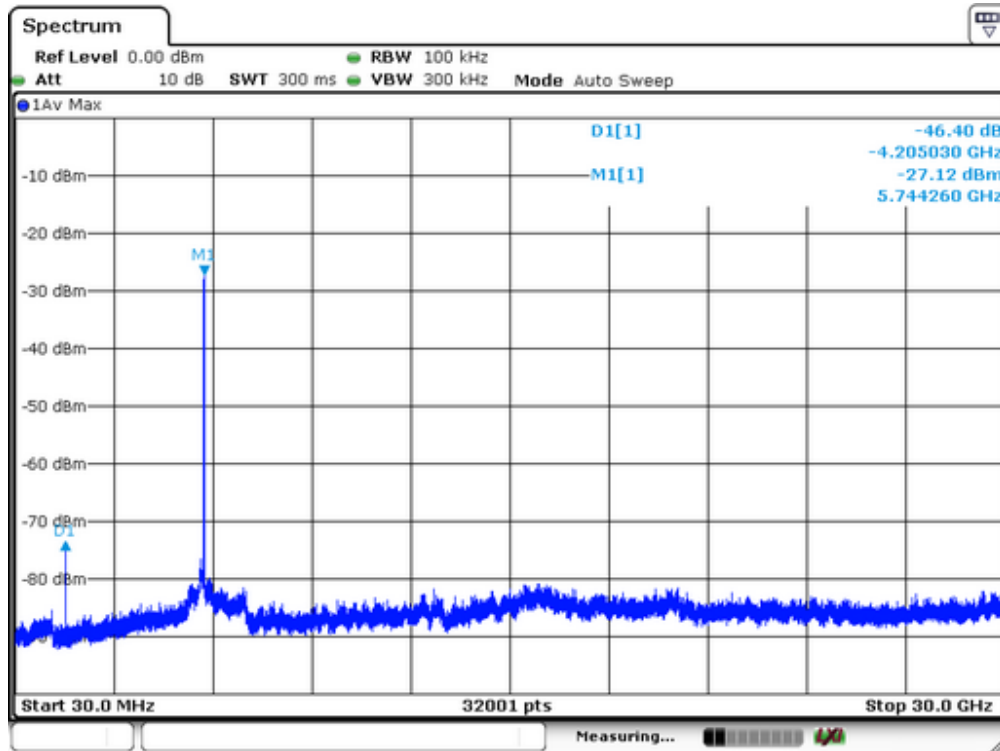
Lowest Channel

Test Mode: IEEE 802.11n(HT20)



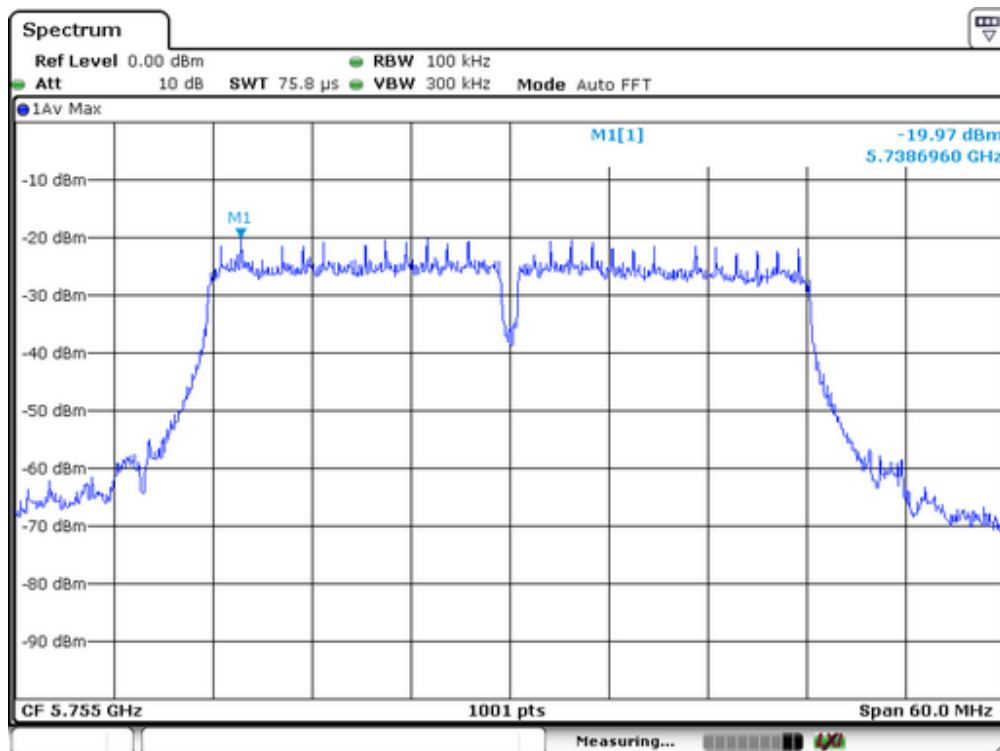
Lowest Channel



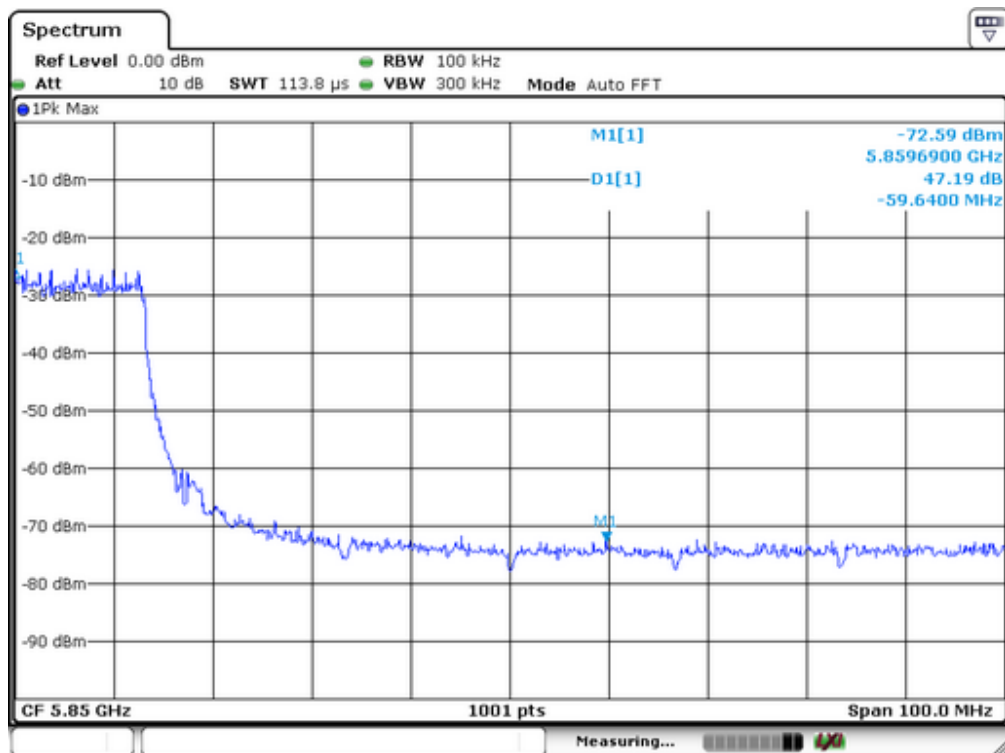
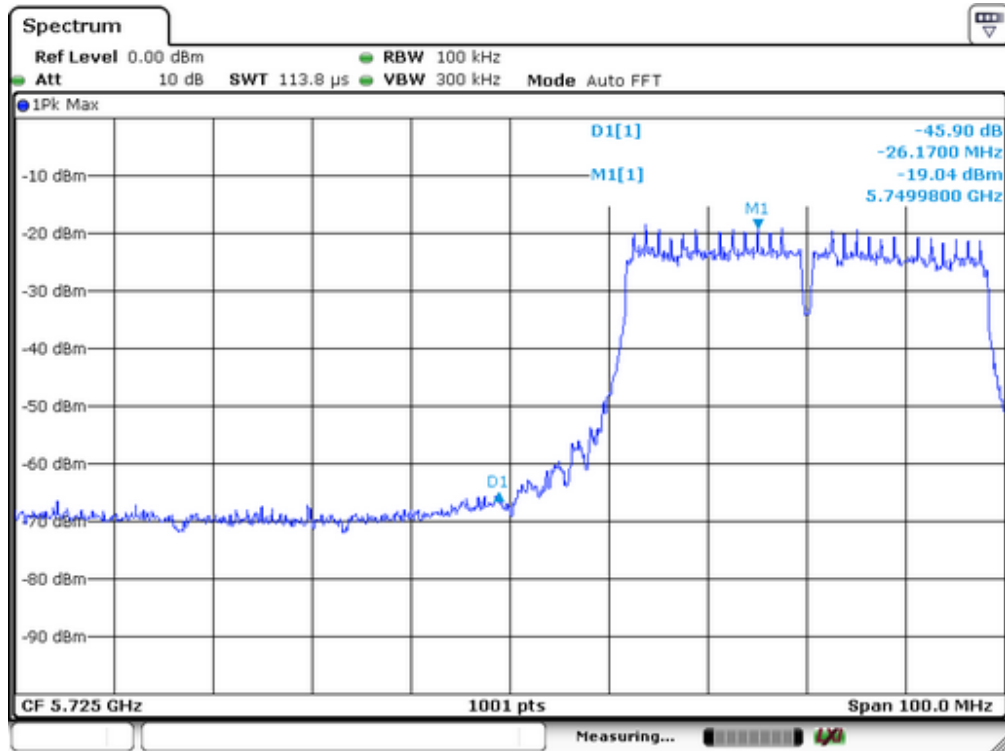


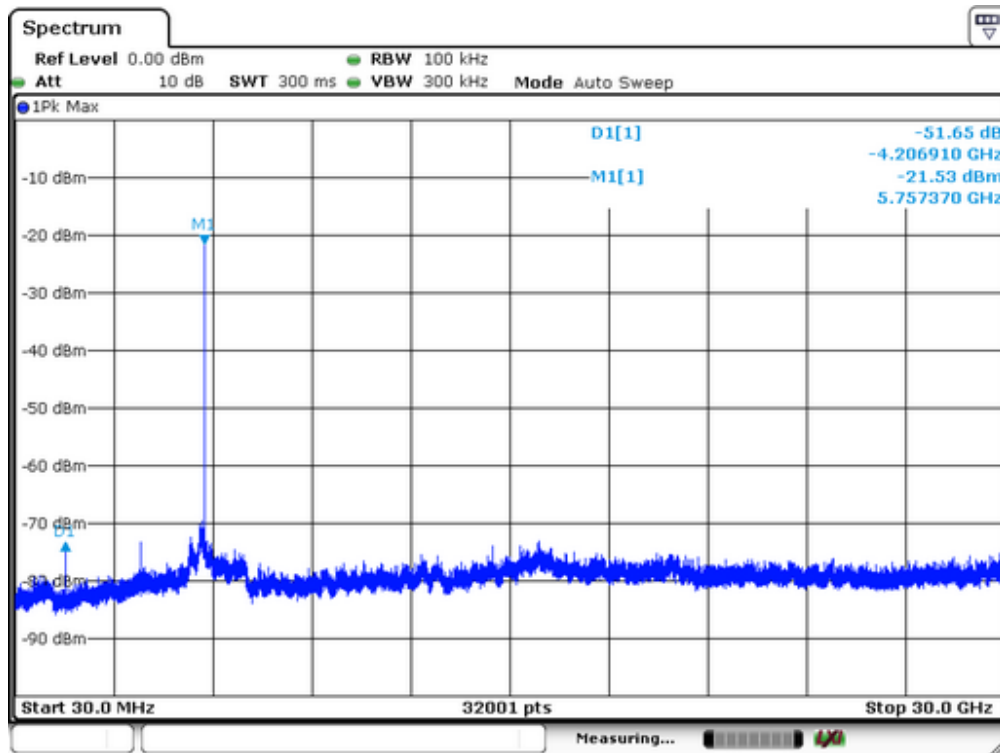
Lowest Channel

Test Mode: IEEE 802.11n(HT40)



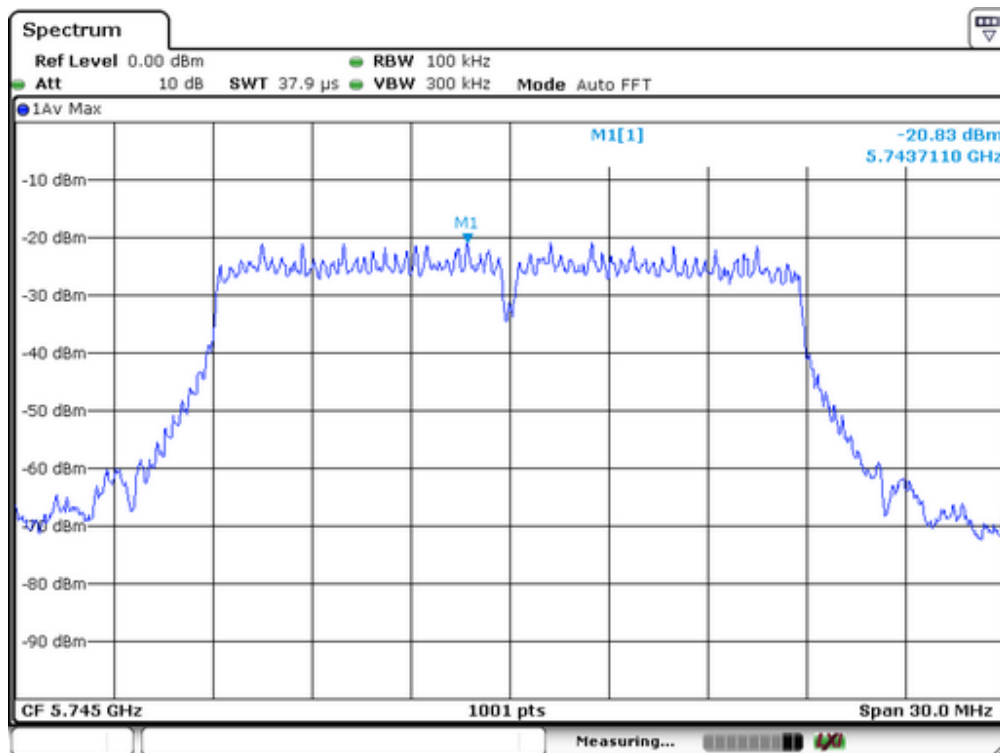
Lowest Channel



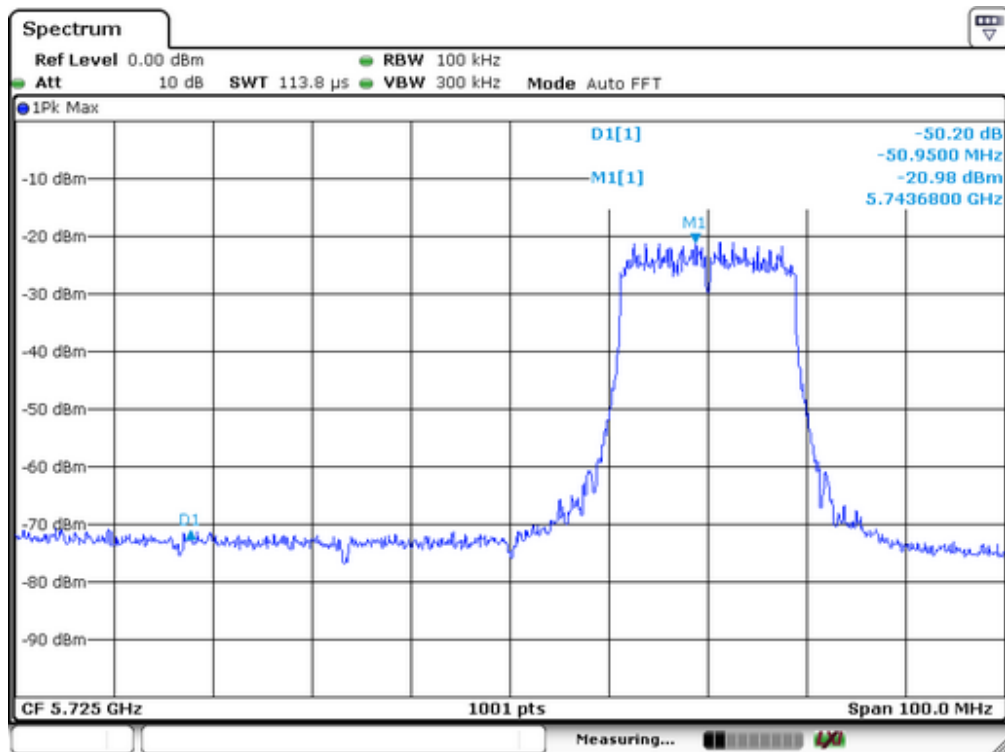
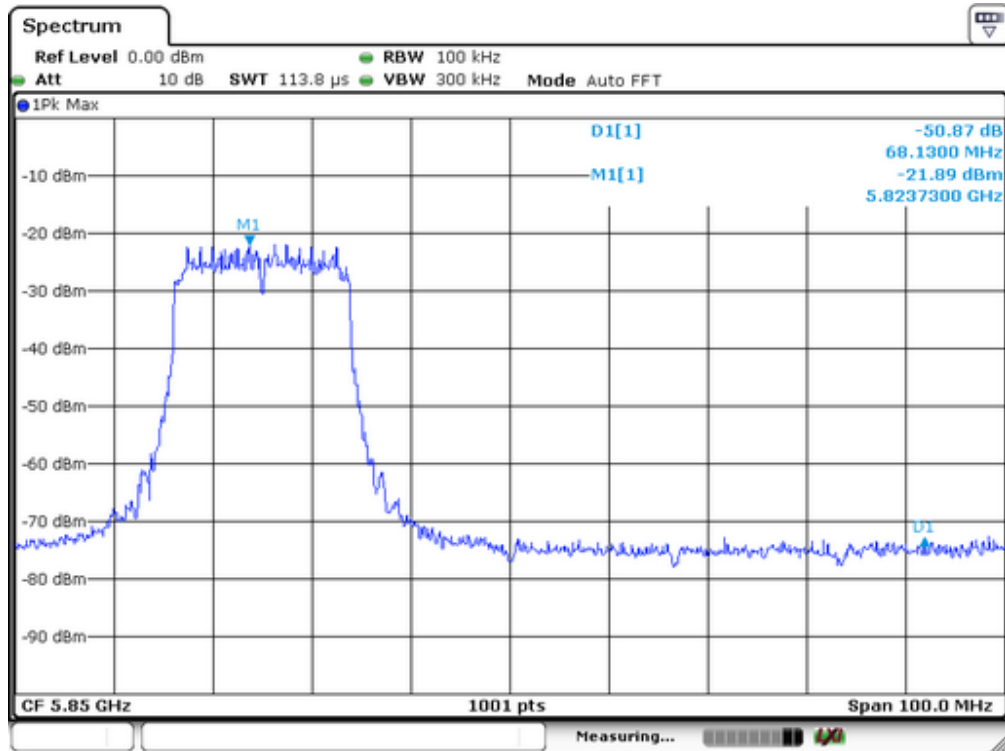


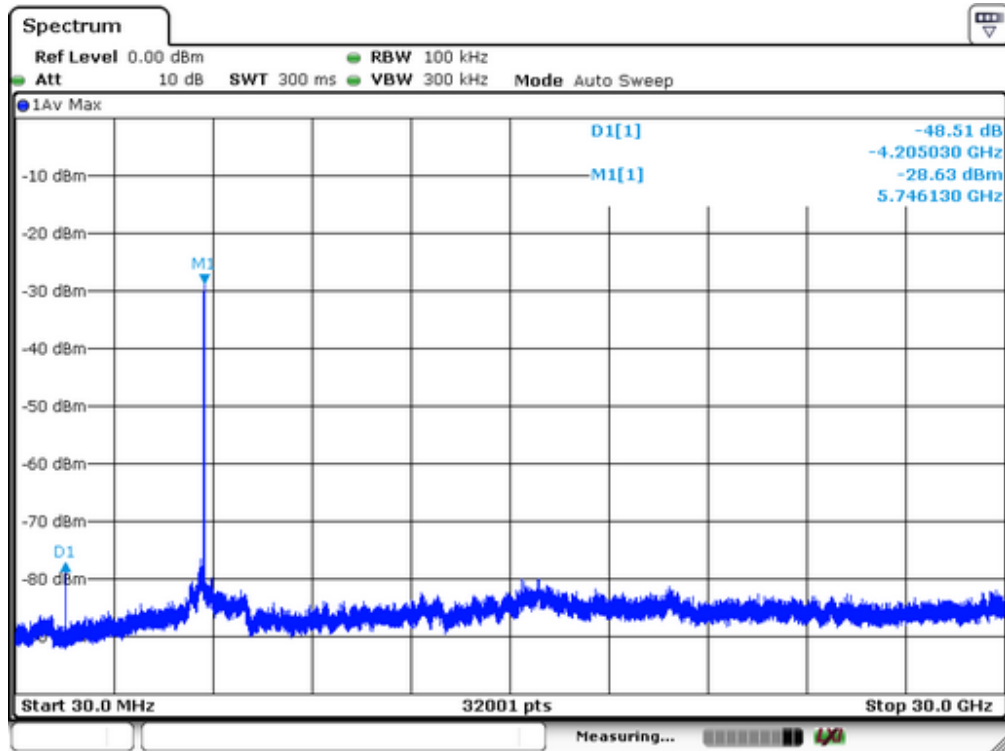
Lowest Channel

Test Mode: IEEE 802.11ac(HT20)



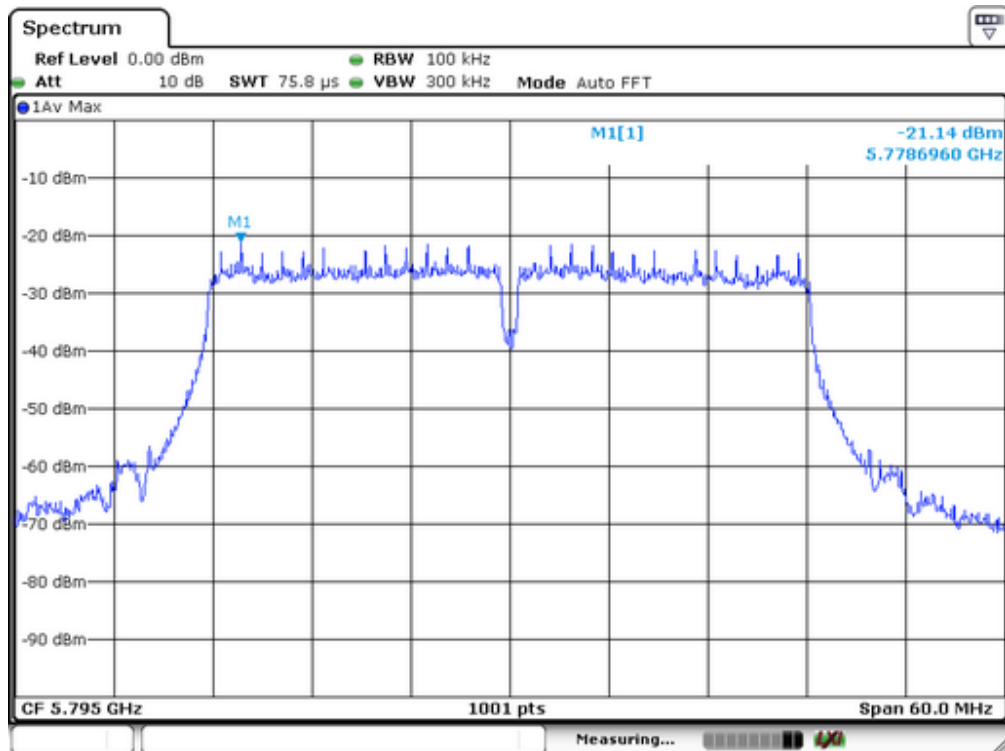
Lowest Channel



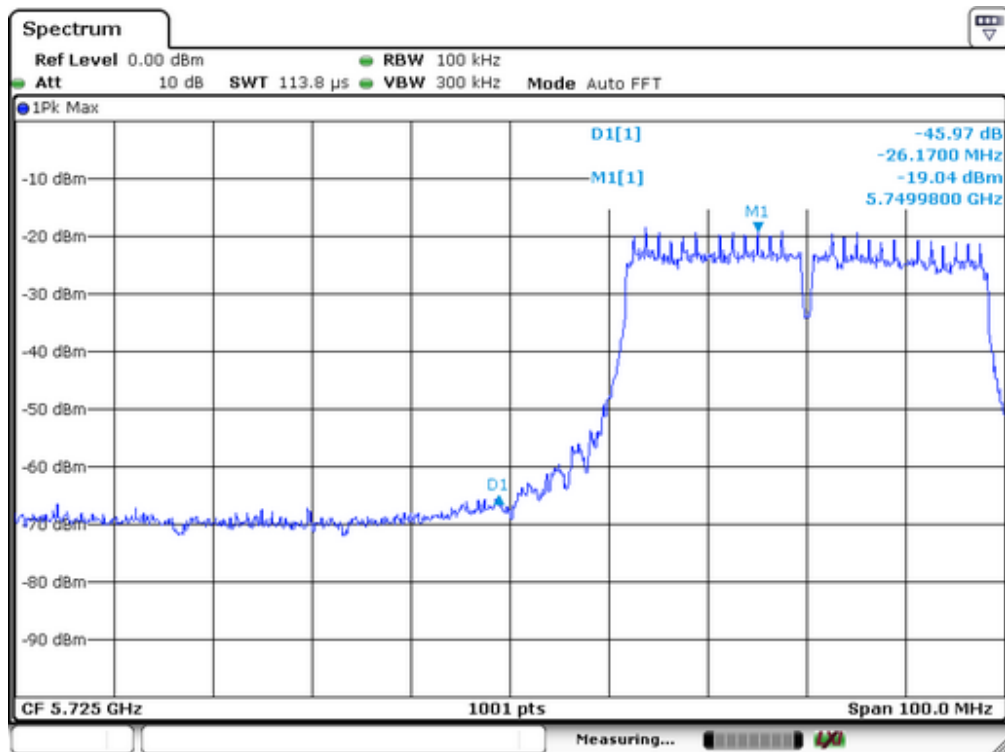
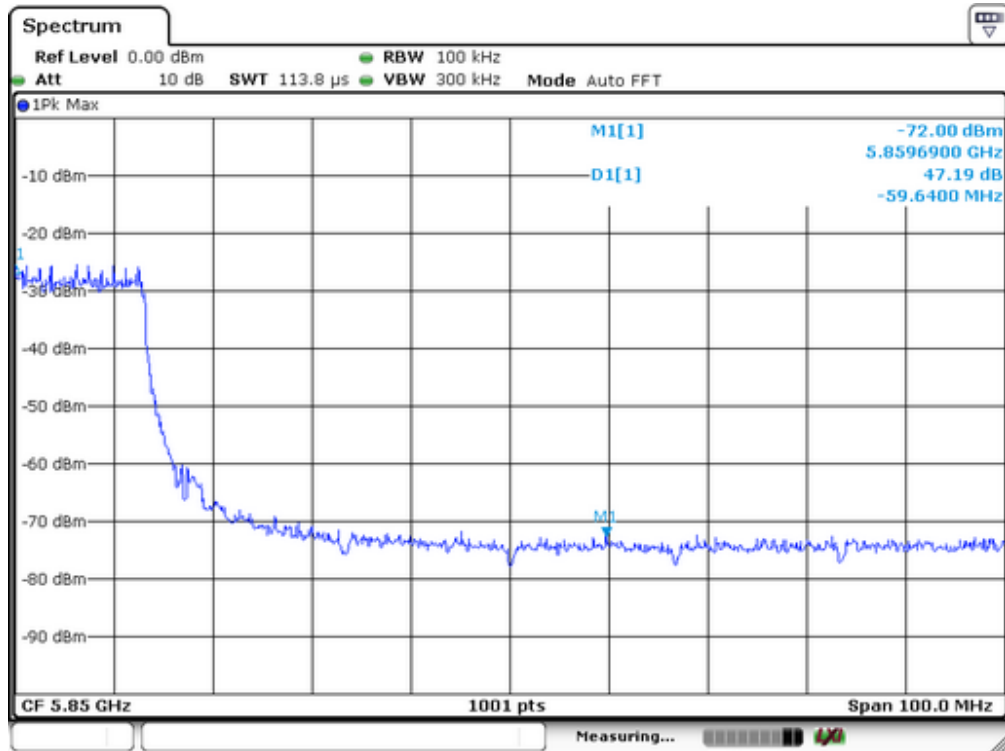


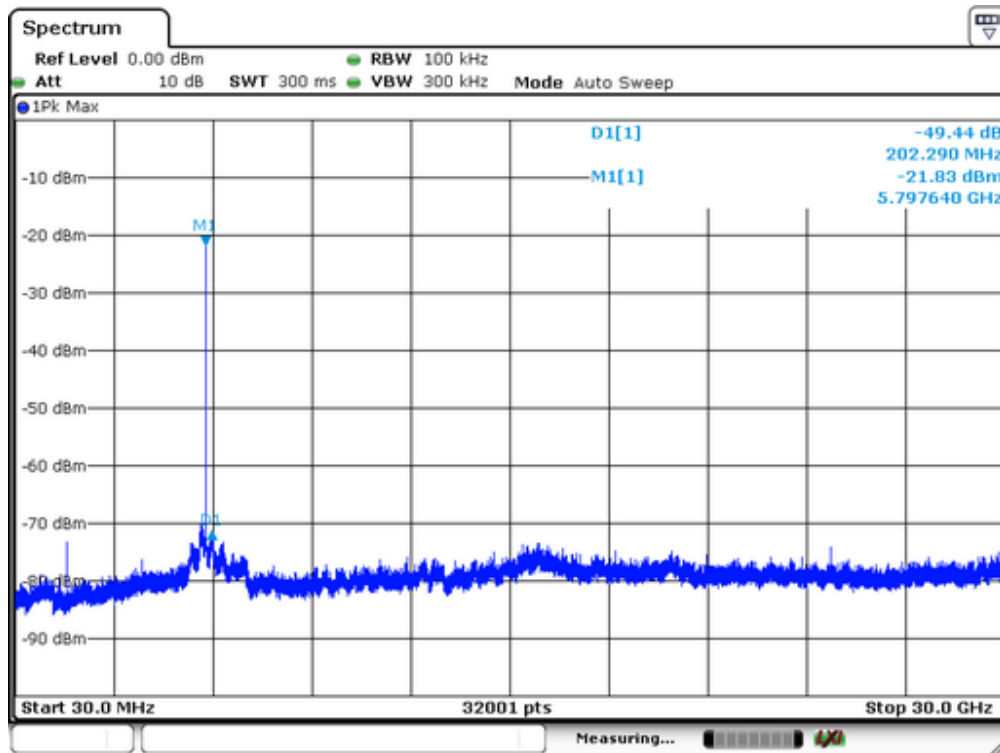
Lowest Channel

Test Mode: IEEE 802.11ac(HT40)



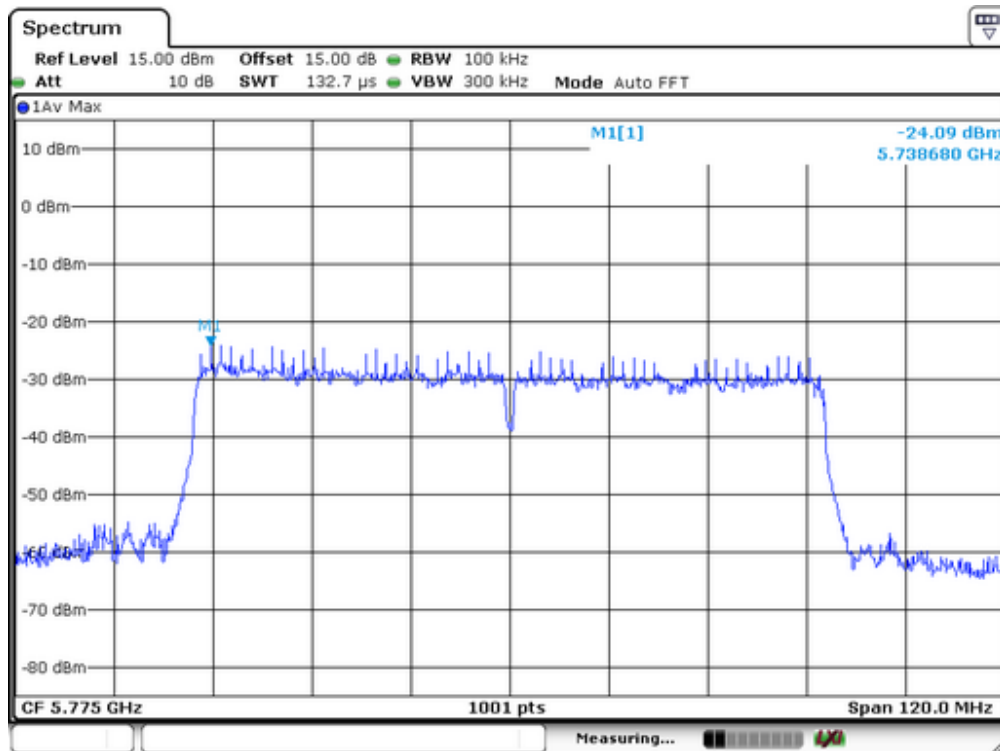
Highest Channel

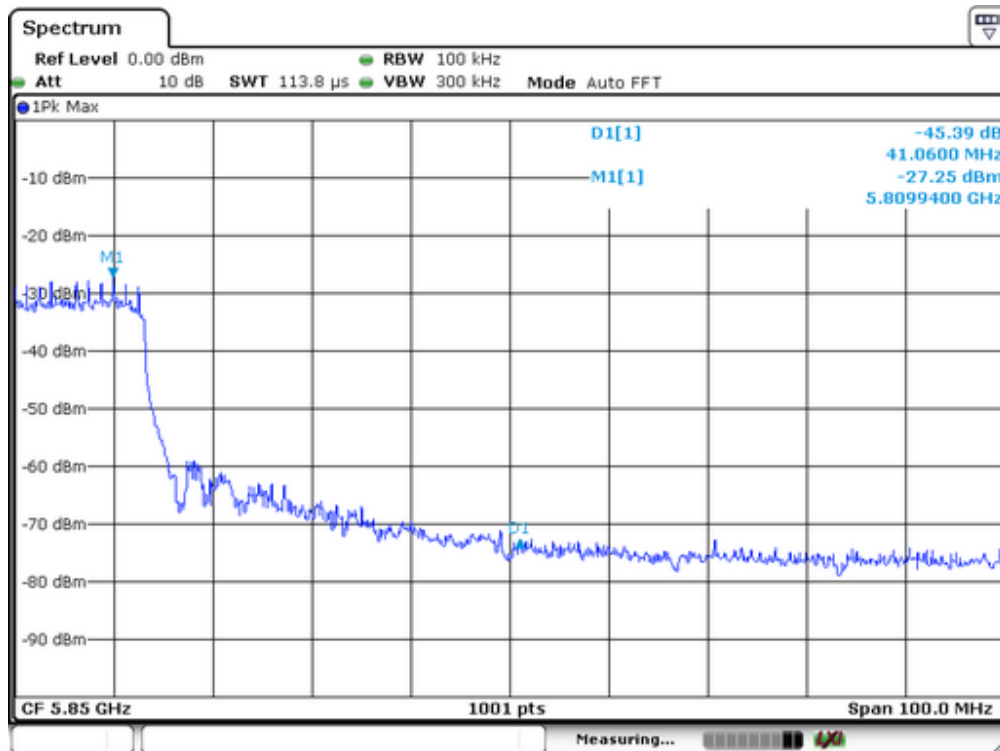
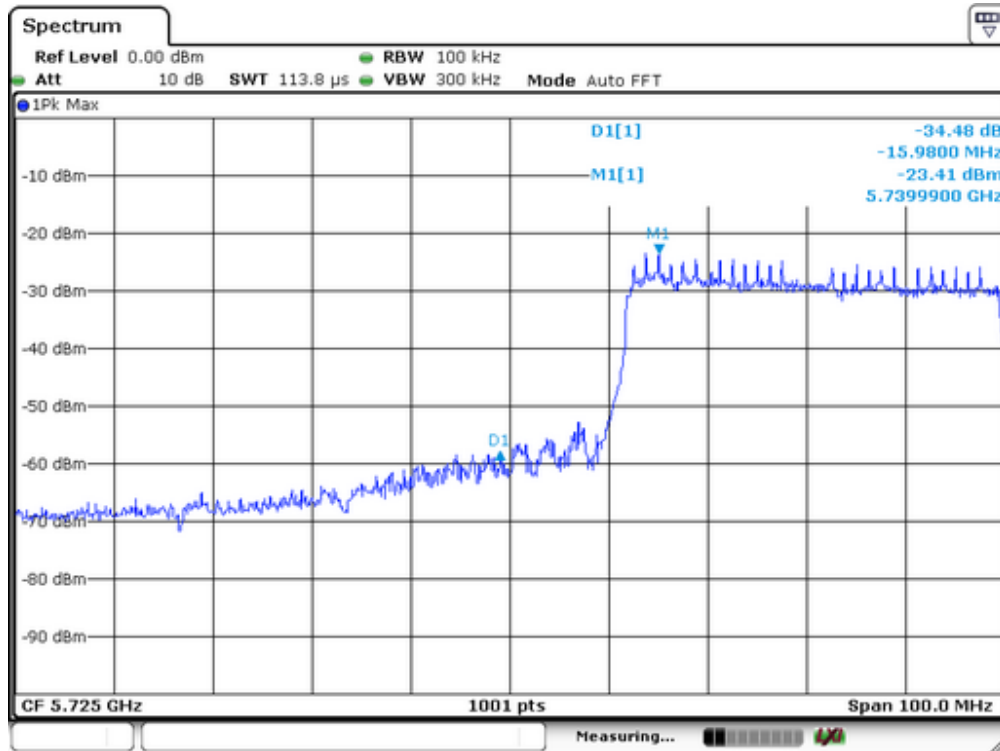


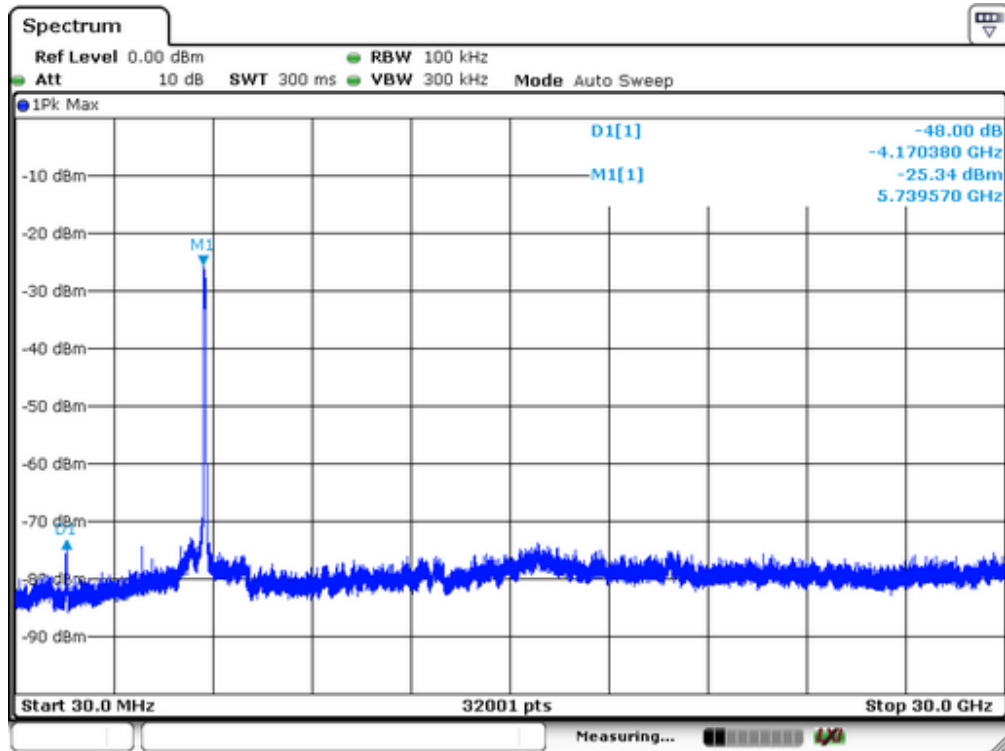


Highest Channel

Test Mode: IEEE 802.11ac(HT80)







2. Radiated emission Test

Test Date : January 16, 2015 Temperature : 28 °C
 Test By: Andy Humidity : 65 %

IEEE 802.11b							
Frequency (MHz)	Antenna polarization	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Margin (dB)	
	(H/V)	PK	AV	PK	AV	PK	AV
<2400	H	65.03	42.05	74	54	-8.97	-11.95
<2400	V	60.18	37.42	74	54	-13.82	-16.58
>2483.5	H	64.25	43.19	74	54	-9.75	-10.81
>2483.5	V	59.35	39.04	74	54	-14.65	-14.96

IEEE 802.11g							
Frequency (MHz)	Antenna polarization	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Margin (dB)	
	(H/V)	PK	AV	PK	AV	PK	AV
<2400	H	65.71	45.06	74	54	-8.29	-8.94
<2400	V	60.33	40.35	74	54	-13.67	-13.65
>2483.5	H	64.08	44.72	74	54	-9.92	-9.28
>2483.5	V	58.43	39.56	74	54	-15.57	-14.44

IEEE 802.11n(HT20)							
Frequency (MHz)	Antenna polarization	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Margin (dB)	
	(H/V)	PK	AV	PK	AV	PK	AV
<2400	H	67.02	45.72	74	54	-6.98	-8.28
<2400	V	62.49	40.16	74	54	-11.51	-13.84
>2483.5	H	66.38	44.82	74	54	-7.62	-9.18
>2483.5	V	60.37	39.42	74	54	-13.63	-14.58

IEEE 802.11n(HT40)							
Frequency (MHz)	Antenna polarization	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Margin (dB)	
	(H/V)	PK	AV	PK	AV	PK	AV
<2400	H	63.18	46.13	74	54	-10.82	-7.87
<2400	V	57.13	40.28	74	54	-16.87	-13.72
>2483.5	H	64.85	45.08	74	54	-9.15	-8.92
>2483.5	V	58.96	37.23	74	54	-15.04	-16.77

10. Power Spectral Density

10.1 Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	FSV30	1321.3008K	05/16/2014	05/15/2015

10.2 Measuring Instruments and Setting

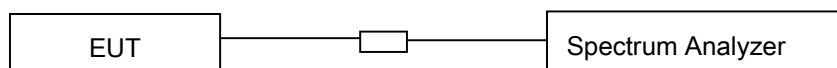
The following table is the setting of spectrum analyzer.

Spectrum analyzer	Setting
Attenuation	Auto
Span Frequency	Set the span to 1.5 times the DTS bandwidth.
RB	3KHz
VB	10KHz
Detector	Peak
Trace	Max hold
Sweep Time	Automatic

10.3 Test Procedures

- The transmitter output (antenna port) was connected to the spectrum analyzer.
- Set analyzer center frequency to DTS channel center frequency.
- Set the analyzer span to a minimum of 1.5 times the DTS bandwidth.
- Set the RBW=100KHz. Set the VBW=300KHz
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

10.4 Block Diagram of Test Setup



10.5 Limit

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3 kHz bandwidth.

10.6 Test Result

Spectrum Detector: PK Test Date : January 16, 2015
 Test By: Andy Temperature : 28°C
 Humidity : 60%

For 2.4GHz Band:

IEEE 802.11b			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
2412	-23.42	8	Pass
2437	-23.06		
2462	-24.90		

IEEE 802.11g			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
2412	-21.10	8	Pass
2437	-21.77		
2462	-23.22		

IEEE 802.11n(HT20)			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
2412	-19.69	8	Pass
2437	-21.38		
2462	-22.82		

IEEE 802.11n(HT40)			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
2422	-28.16	8	Pass
2437	-25.09		
2452	-30.29		

For 5GHz Band:

IEEE 802.11a			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
5745	-40.66	8	Pass
5785	-42.21		
5825	-42.44		

IEEE 802.11n(HT20)			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
5745	-38.93	8	Pass
5785	-40.38		
5825	-40.77		

IEEE 802.11n(HT40)			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
5755	-41.46	8	Pass
5795	-42.04		

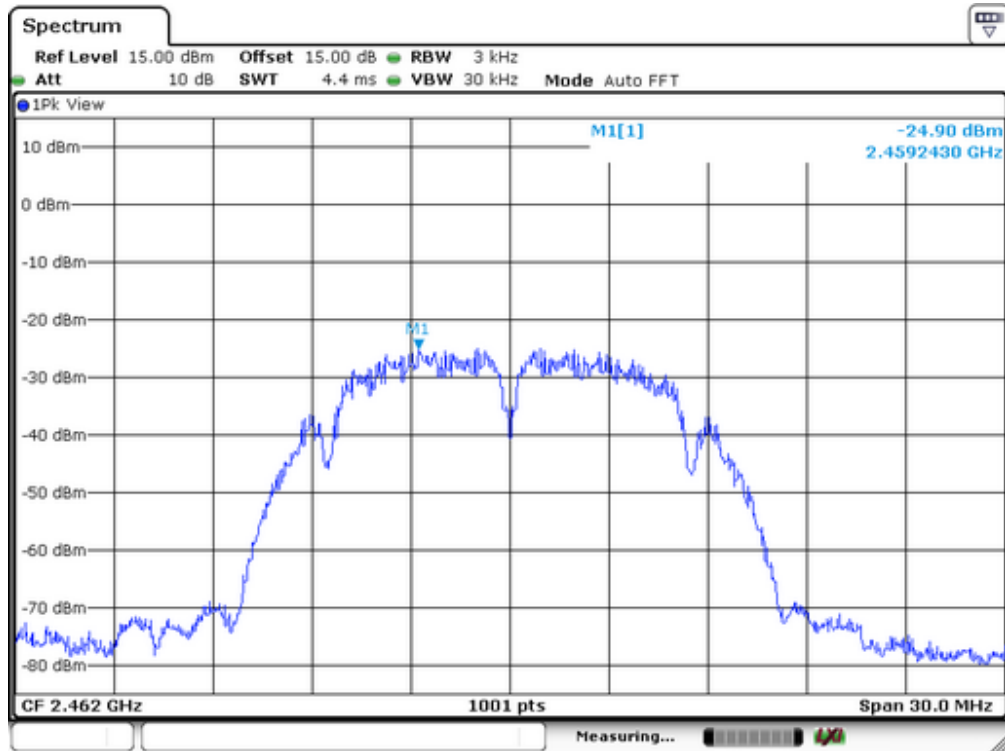
IEEE 802.11ac(HT20)			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
5745	-41.96	8	Pass
5785	-42.91		
5825	-43.77		

IEEE 802.11ac(HT40)			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
5755	-40.88	8	Pass
5795	-43.77		

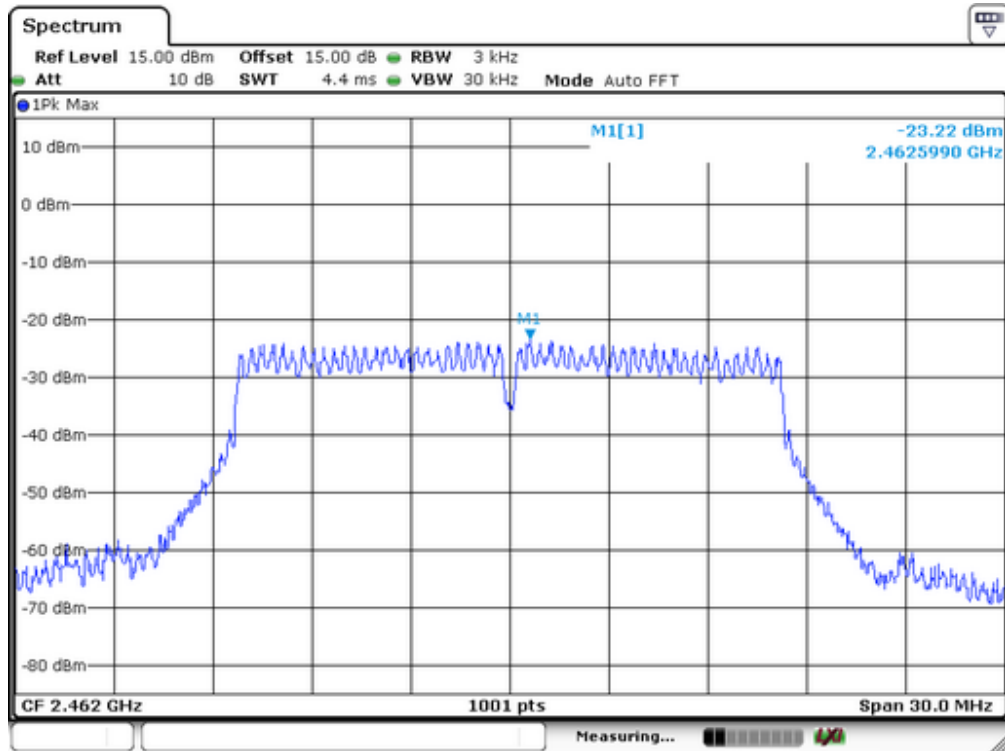
IEEE 802.11ac(HT80)			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
5775	-48.02	8	Pass

Note: All the test values wer listed in the report.
For plots, only the channel with worst result was shown.

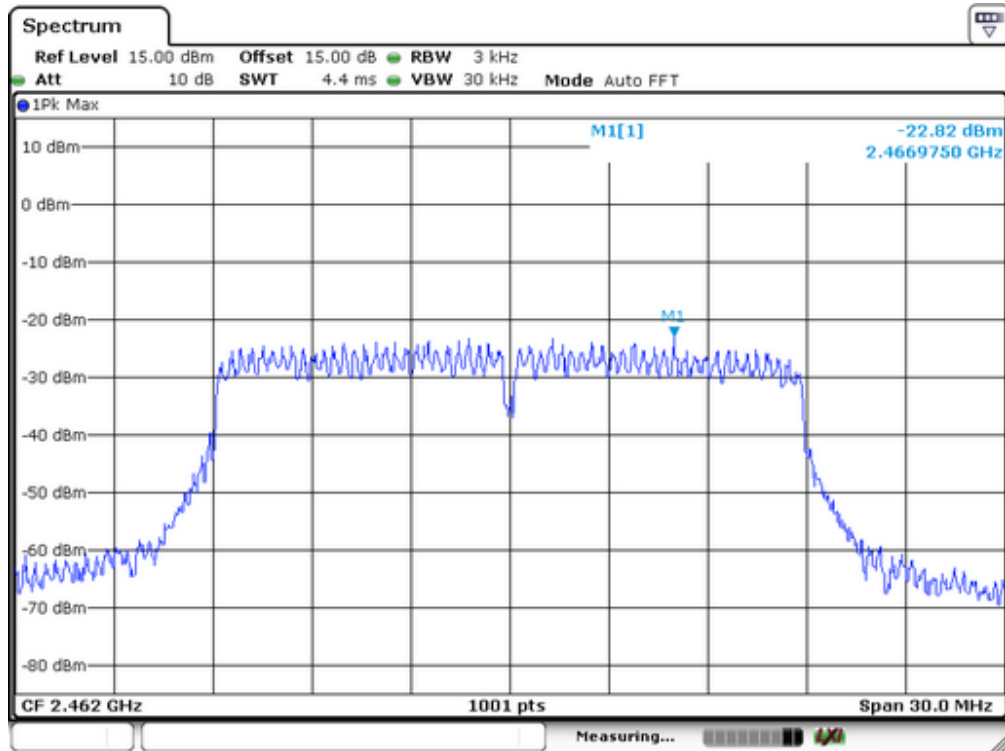
Power Density Plot on Configuration IEEE 802.11b/2462MHz



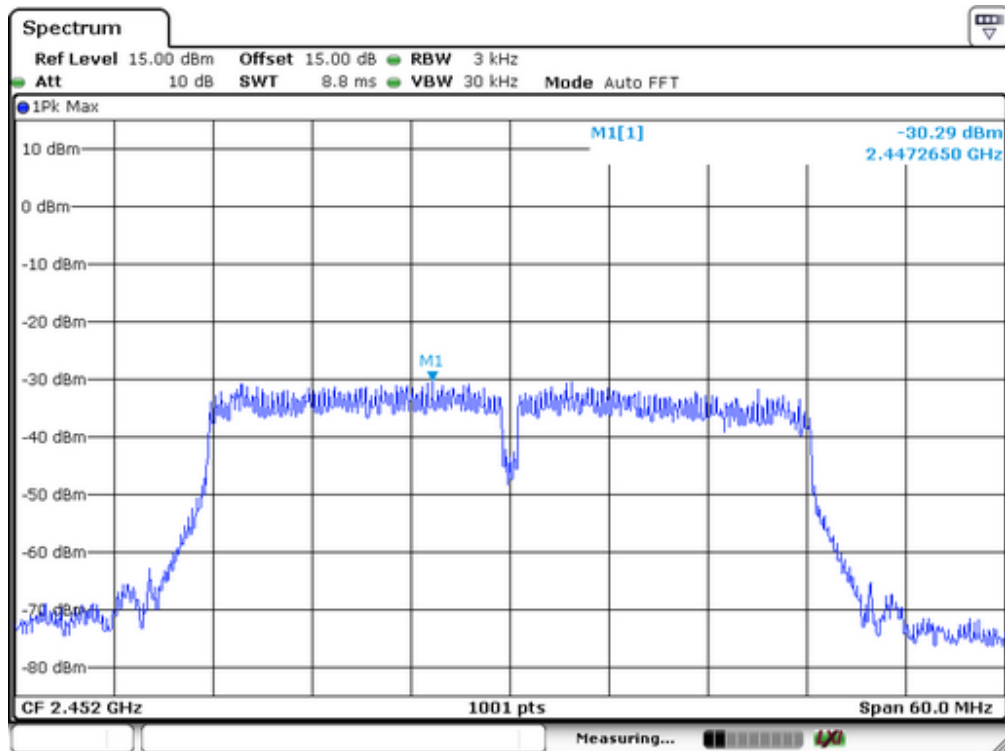
Power Density Plot on Configuration IEEE 802.11g/2462MHz



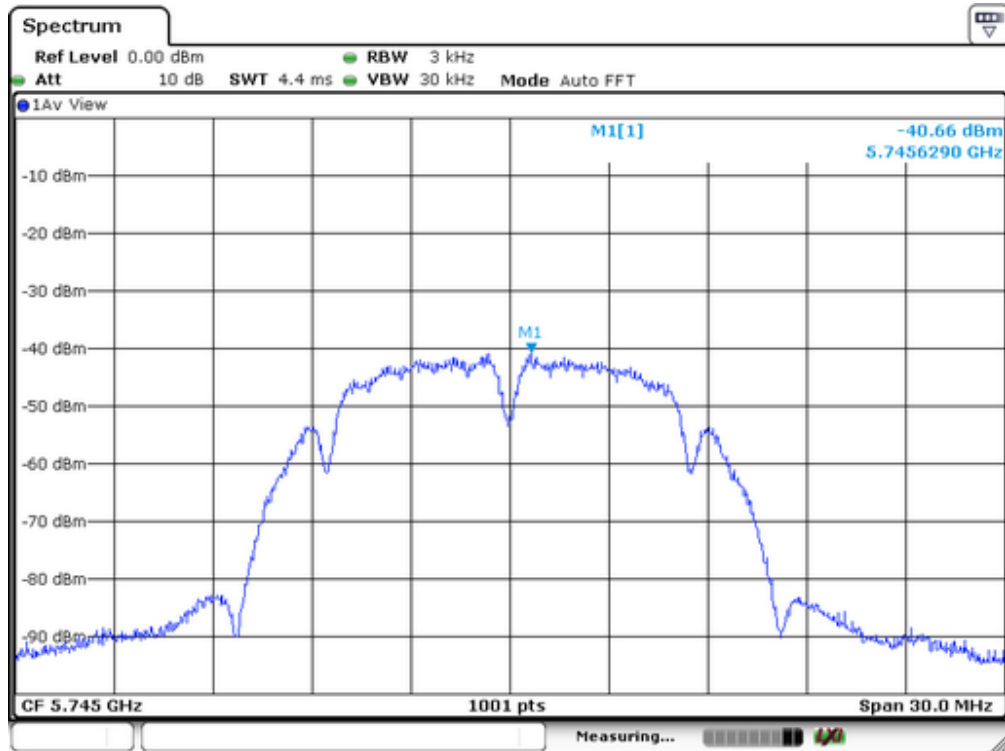
Power Density Plot on Configuration IEEE 802.11n(HT20)/2462MHz



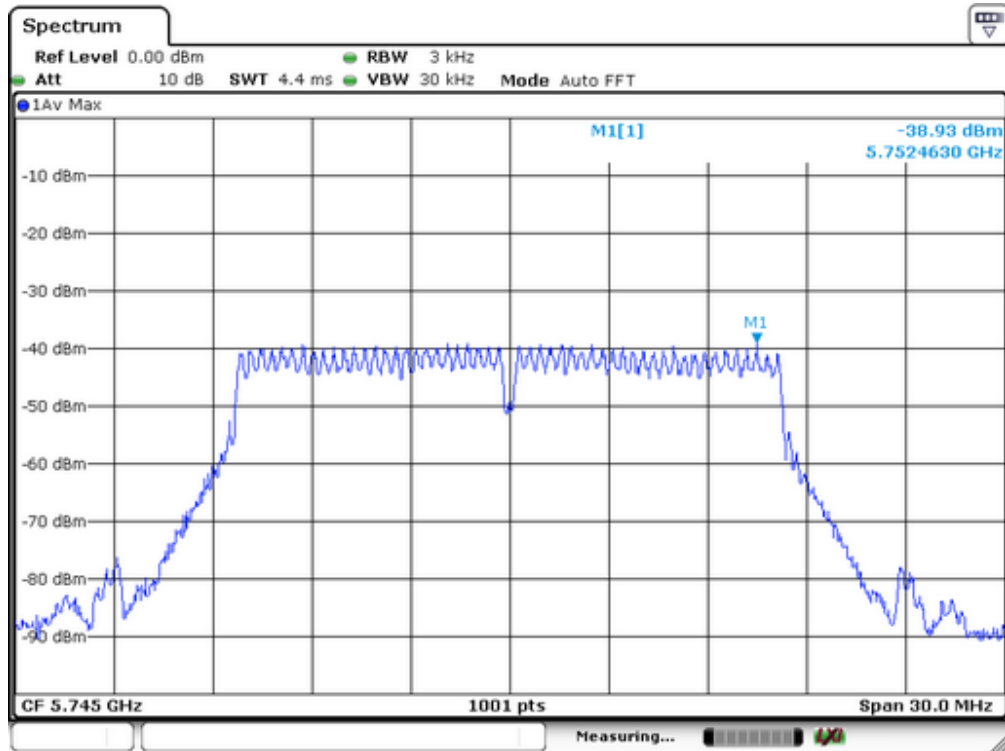
Power Density Plot on Configuration IEEE 802.11n(HT40)/2452MHz



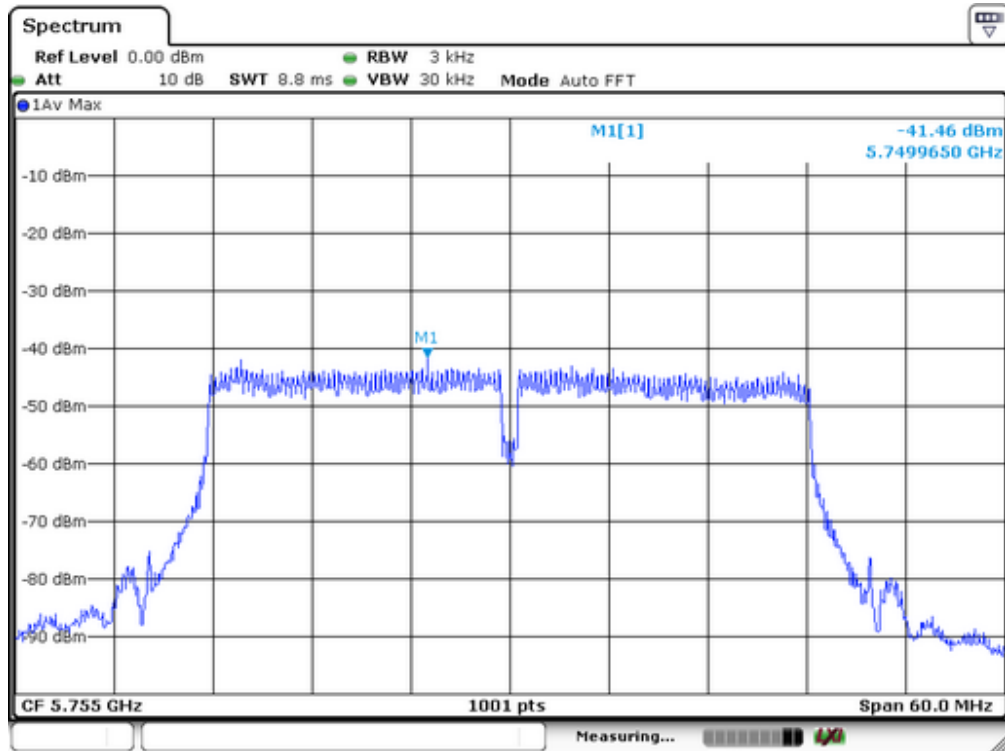
Power Density Plot on Configuration IEEE 802.11a/5745MHz



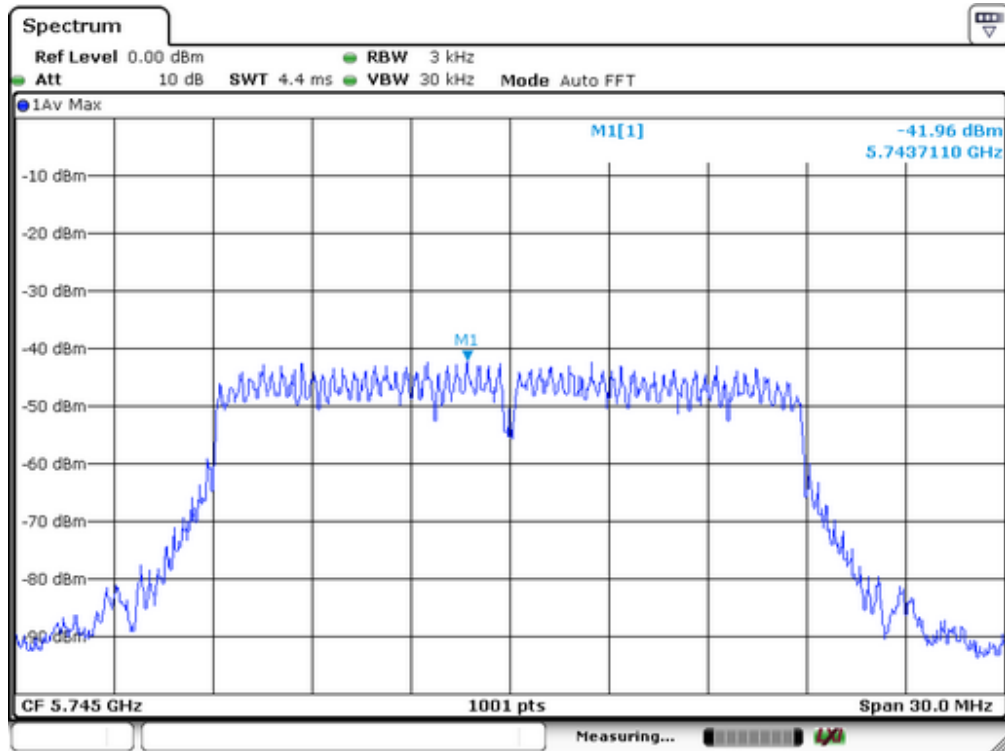
Power Density Plot on Configuration IEEE 802.11n(HT20)/5745MHz



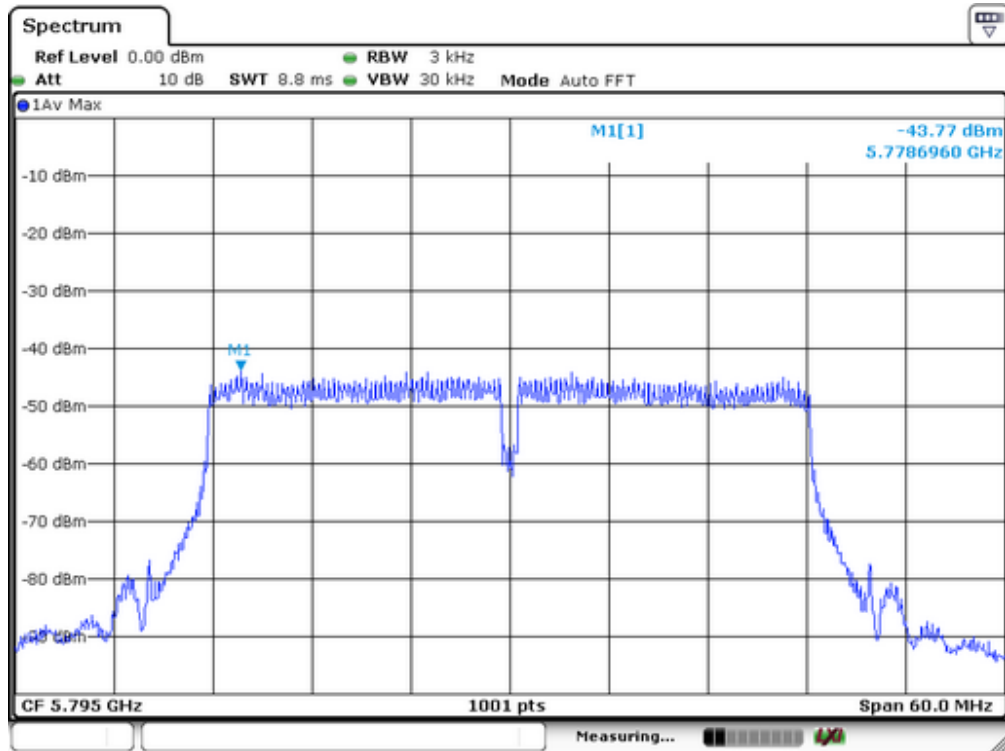
Power Density Plot on Configuration IEEE 802.11n(HT40)/5755MHz



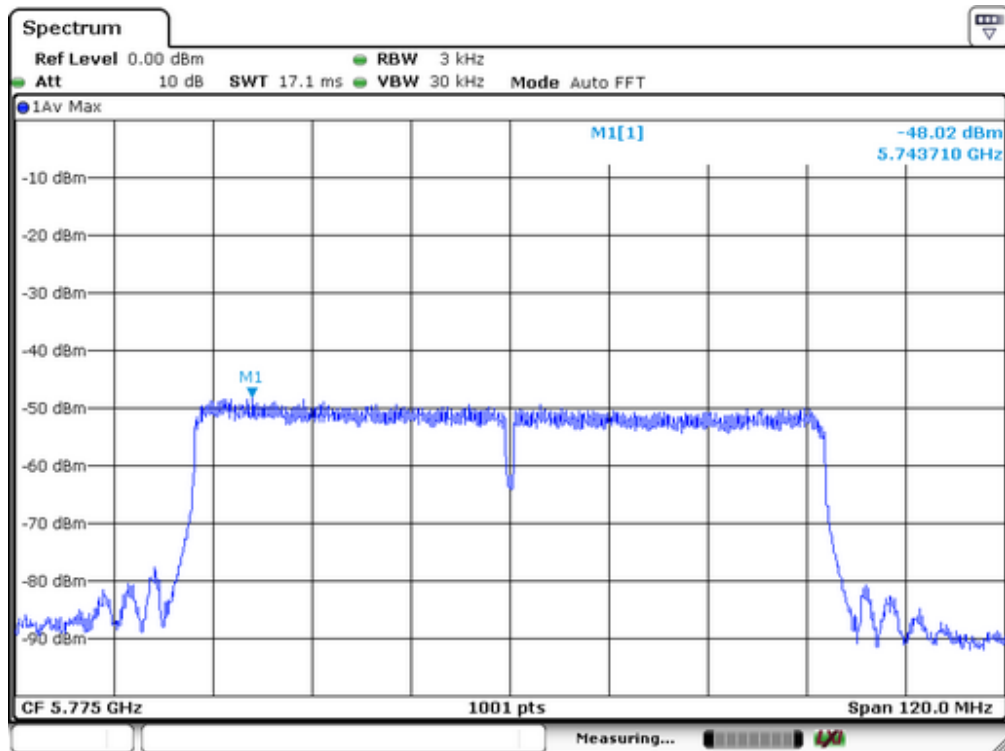
Power Density Plot on Configuration IEEE 802.11ac(HT20)/5745MHz



Power Density Plot on Configuration IEEE 802.11ac(HT40)/5795MHz



Power Density Plot on Configuration IEEE 802.11ac(HT80)/5775MHz



11. Antenna Application

12.1 Antenna Requirement

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 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

12.2 Result

The EUT'S antenna, SMA connector which is permanently attached PCB board, and the antenna is fixed on the SMA connector by glue, is external antenna. The antenna's gain is 5dBi and meets the requirement.

APPENDIX I (PHOTOS OF EUT)



