

TEST REPORT



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2018-02326
Page (1) / (56) Pages

1. Client

- Name : KAONMEDIA Co., Ltd.
- Address : KAONMEDIA Building, 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
- Date of Receipt : 2018-05-17

2. Manufacturer

- Name : KAONMEDIA Co., Ltd.
- Address : KAONMEDIA Building, 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea

3. Use of Report : For FCC Certification

4. Test Sample / Model: KSTB2020_NCTC_STB / KSTB2020

5. Date of Test : 2018-06-25 to 2018-06-29

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247

7. Testing Environment: Temp.: (23 ± 1) °C, Humidity: (48 ± 5) % R.H.

8. Test Results : Compliance

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.

Affirmation	Tested by	Technical Manager
	Bongseok Kim: (Signature) 	Young-taek Lee: (Signature) 

2018-07-31

Republic of KOREA **CTK Co., Ltd.**



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2018-02326
Page (2) / (56)Pages

REPORT REVISION HISTORY

Date	Revision	Page No
2018-07-31	Issued (CTK-2018-02326)	all

This report shall not be reproduced except in full, without the written approval of CTK Co., Ltd. This document may be altered or revised by CTK Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by CTK Co., Ltd. will constitute fraud and shall nullify the document.

CONTENTS

1.0 General Product Description	4
1.1 Client Information	4
1.2 Product Information.....	4
1.3 Peripheral Devices	4
2.0 Facility and Accreditations	5
2.1 Test Facility.....	5
2.2 Laboratory Accreditations and Listings	5
2.3 Calibration Details of Equipment Used for Measurement	5
3.0 Test Specifications.....	6
3.1 Standards.....	6
3.2 Mode of operation during the test.....	7
3.3 Maximum Measurement Uncertainty	7
4.0 Technical Characteristic Test	8
4.1 6dB Bandwidth.....	8
4.2 Maximum peak Conducted Output Power.....	18
4.3 Power Spectral Density	24
4.4 Band Edge & Conducted Spurious emission.....	30
4.5 Radiated Emissions.....	39
4.6 AC Conducted Emissions	53
APPENDIX A – Test Equipment Used For Tests	56

1.0 General Product Description

1.1 Client Information

Company	KAONMEDIA Co., Ltd.
Contact Point	KAONMEDIA Building, 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
Contact Person	Name : Choi Sung Ho E-mail : shchoi@kaonmedia.com Tel : +82-31-724-8861

1.2 Product Information

FCC ID	WQTKSTB2020
Product Description	KSTB2020_NCTC_STB
Model name	KSTB2020
Variant Model name	KSTB2076 (Variant model has no difference from basic model, except for model name)
Operating Frequency	2 412 MHz - 2 462 MHz (Bandwidth 20 MHz) 2 422 MHz - 2 452 MHz (Bandwidth 40 MHz)
RF Output Power	802.11b : 16.24 dBm (42.07 mW) 802.11g : 13.98 dBm (25.00 mW) 802.11n(HT20) : 14.34 dBm (27.16 mW) 802.11n(HT40) : 12.29 dBm (16.94 mW)
Antenna type	PCB Antenna
Antenna gain	1.9 dBi
Type of Modulation	802.11b : DSSS 802.11g/n : OFDM
Power Source	DC 12 V (Adapter)

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253R6P
AC/DC Adapter	HP	HSTNN-LA40	7628011101

2.0 Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
CANADA	ISED	ISED EMI (3/10m test site)	8737A-2	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	NRRA	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	KR0025	

2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

3.0 Test Specifications

3.1 Standards

Section in FCC	Section in RSS	Requirement(s)	Status (Note 1)	Test Condition
15.247(a)	RSS-247 5.2(a)	6 dB Bandwidth	C	Conducted
15.247(e)	RSS-247 5.2(b)	Transmitter power spectral density	C	
15.247(b)	RSS-247 5.4(d)	Maximum peak conducted output power	C	
15.247(d)	RSS-247 5.5	Unwanted emission	C	
15.209	RSS-Gen 6.13	Transmitter emission	C	Radiated
15.207(a)	RSS-Gen 8.8	AC Conducted Emission	C	Line Conducted
<u>Note 1:</u> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
<u>Note 2:</u> The data in this test report are traceable to the national or international standards.				
<u>Note 3:</u> The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013, RSS-247 Issue 2				
<u>Note 4:</u> The tests were performed according to the method of measurements prescribed in KDB No.558074.				

3.2 Mode of operation during the test

The UUT is operated in a manner representative of the typical of the equipments.
During at testing, system components were manipulated within the confines of typical usage to maximize each emission. All modulation modes were tests.
The results are only attached worst cases.

Test mode & Worst case

Mode	Worst case(Data rate)
802.11b	11 Mbps
802.11g	12 Mbps
802.11n(HT20)	MCS 3
802.11n(HT40)	MCS 3

Test Frequency & Bandwidth

Bandwidth	Lowest channel	Middle channel	Highest channel
20 MHz	2 412 MHz	2 437 MHz	2 462 MHz
40 MHz	2 422 MHz	2 437 MHz	2 452 MHz

Antenna

Antenna system	Mode	Antenna
SISO	802.11b/g	ANT 0
	802.11b/g	ANT 1
MIMO	802.11n	ANT 0 + ANT 1

Duty cycle

Mode	Duty cycle (%)
802.11b	89.7
802.11g	86.5
802.11n(HT20)	76.2
802.11n(HT40)	66.1

3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
Coverage factor $k = 2$, Confidence levels of 95 %

Description	Uncertainty
Conducted RF Output Power	± 1.5 dB
Power Spectral Density	± 1.5 dB
Occupied Bandwidth	± 0.1 MHz
Unwanted Emission(conducted)	± 3.0 dB
Radiated Emissions ($f \leq 1$ GHz)	± 4.0 dB
Radiated Emissions ($f > 1$ GHz)	± 5.0 dB

4.0 Technical Characteristic Test

4.1 6dB Bandwidth

Test Procedures (ANSI C63.10-2013 6.9.2)

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Procedures (ANSI C63.10-2013 6.9.3)

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 100 kHz
- b) VBW $\geq 3 \times$ RBW
- c) Detector = peak
- d) Trace mode = Max hold
- e) Sweep = auto couple
- f) Allow trace to fully stabilize
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Limit :

6 dB Bandwidth > 500kHz

Test Data:

ANT 0

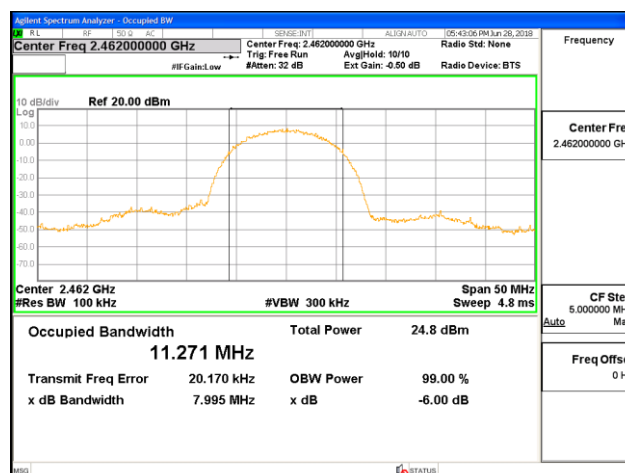
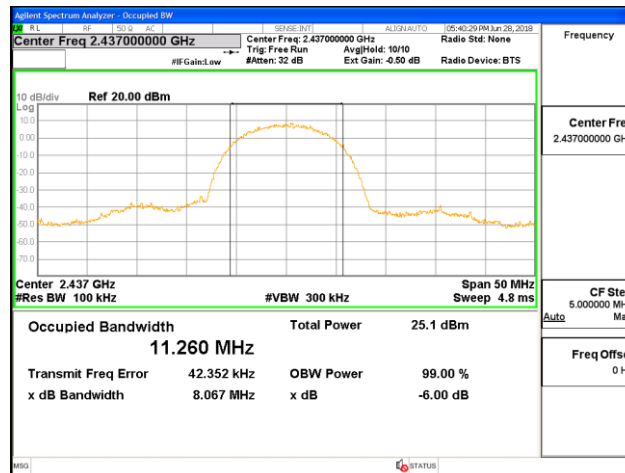
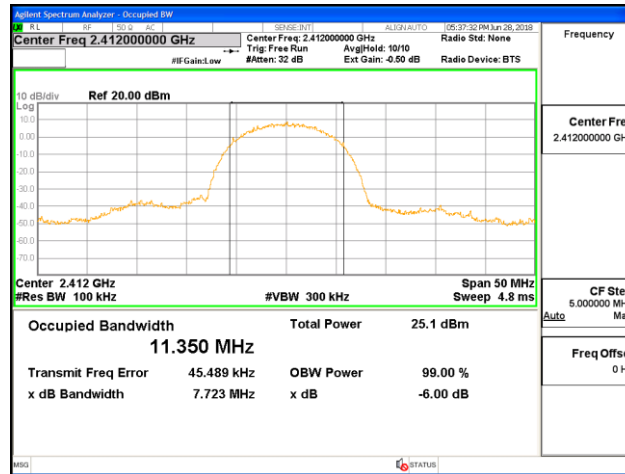
Mode	Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
802.11b	Low	2 412	7.723	11.350	Complies
	Middle	2 437	8.067	11.260	
	High	2 462	7.995	11.271	
802.11g	Low	2 412	16.430	16.516	
	Middle	2 437	16.430	16.510	
	High	2 462	16.430	16.513	
802.11n (HT20)	Low	2 412	17.750	17.701	
	Middle	2 437	17.760	17.701	
	High	2 462	17.760	17.704	
802.11n (HT40)	Low	2 422	36.510	36.196	
	Middle	2 437	36.490	36.173	
	High	2 452	36.480	36.185	

ANT 1

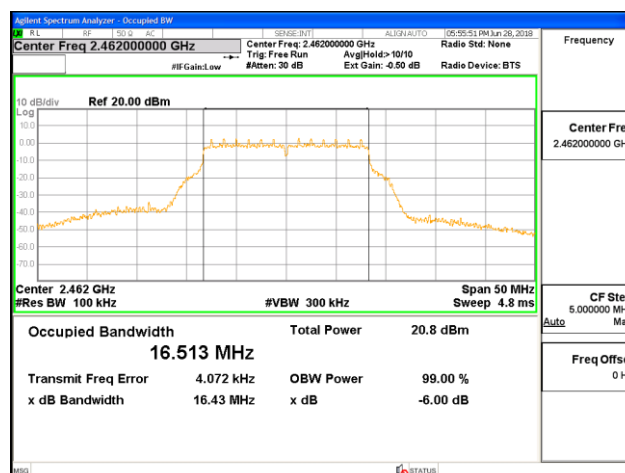
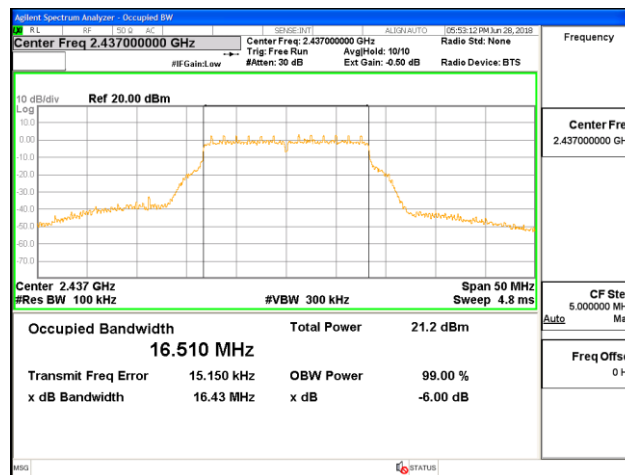
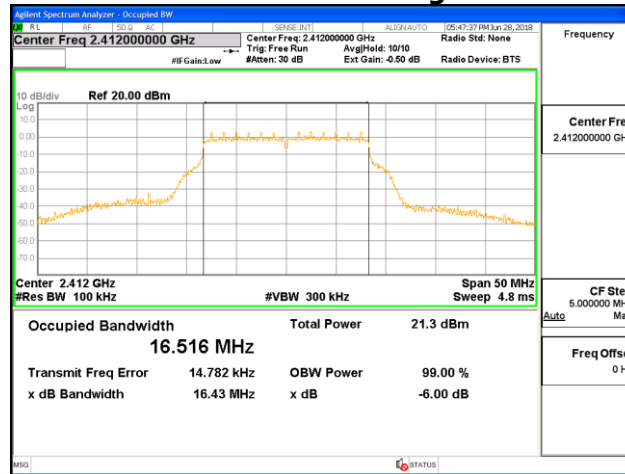
Mode	Channel	Frequency [MHz]	6 dB Bandwidth [MHz]	99% Bandwidth [MHz]	Result
802.11b	Low	2 412	8.393	11.329	Complies
	Middle	2 437	8.086	11.323	
	High	2 462	8.068	11.239	
802.11g	Low	2 412	16.440	16.516	
	Middle	2 437	16.440	16.512	
	High	2 462	16.430	16.514	
802.11n (HT20)	Low	2 412	17.760	17.690	
	Middle	2 437	17.770	17.695	
	High	2 462	17.770	17.695	
802.11n (HT40)	Low	2 422	36.500	36.185	
	Middle	2 437	36.470	36.192	
	High	2 452	36.470	36.204	

See next pages for actual measured spectrum plots.

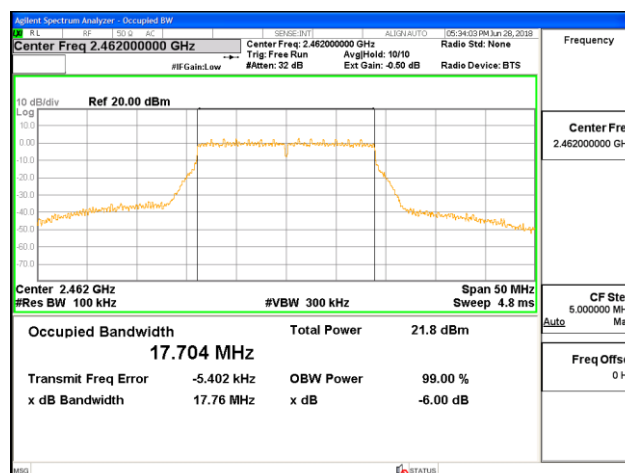
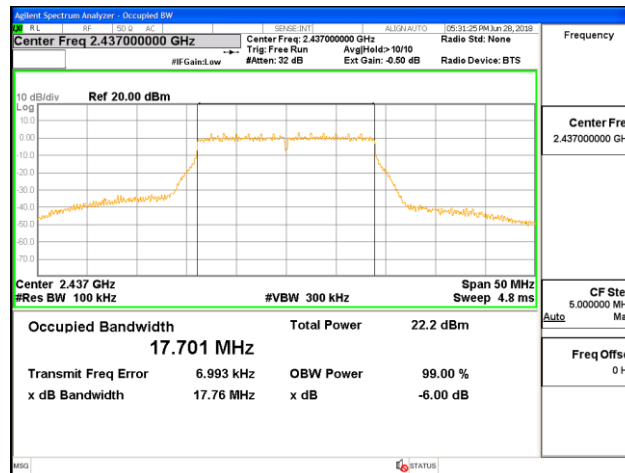
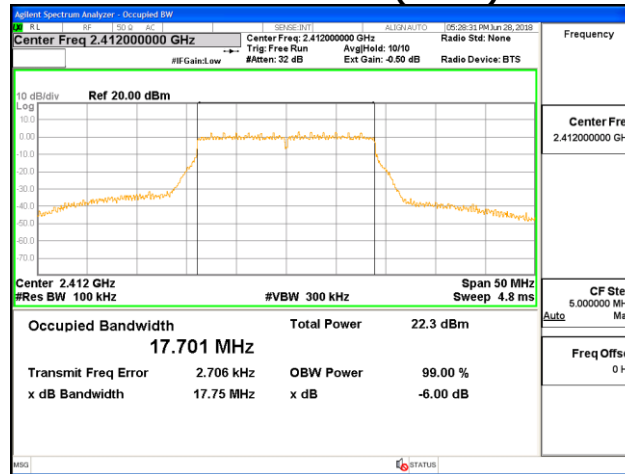
ANT 0 - 802.11b



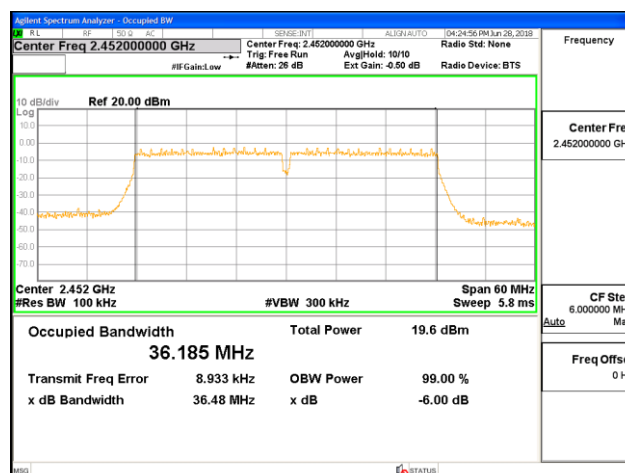
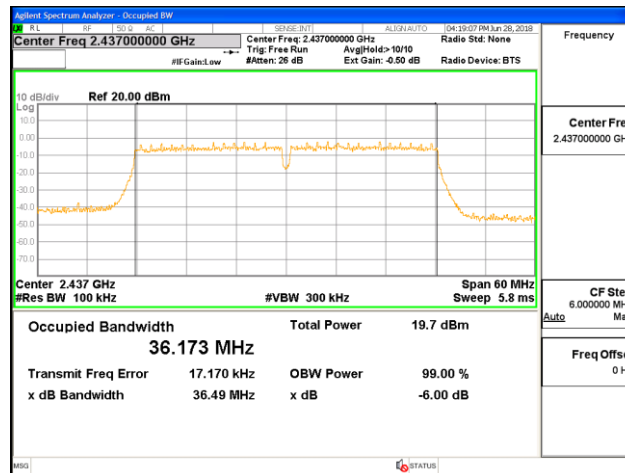
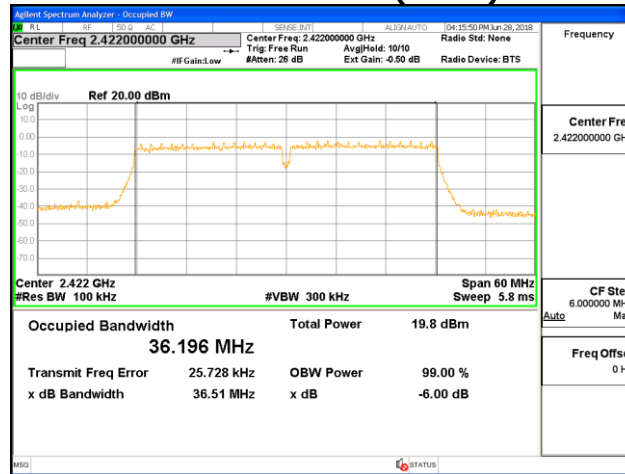
ANT 0 - 802.11g



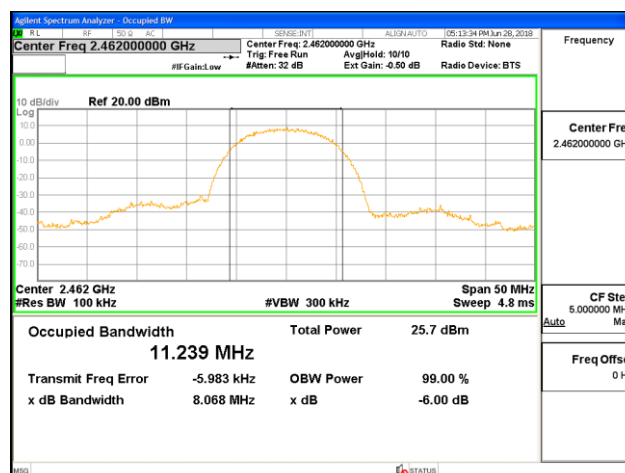
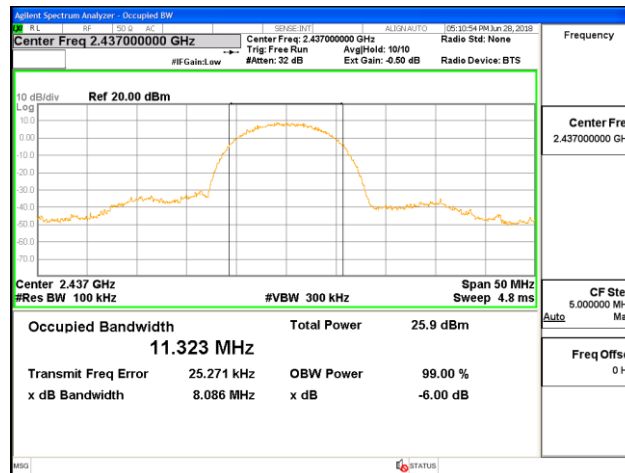
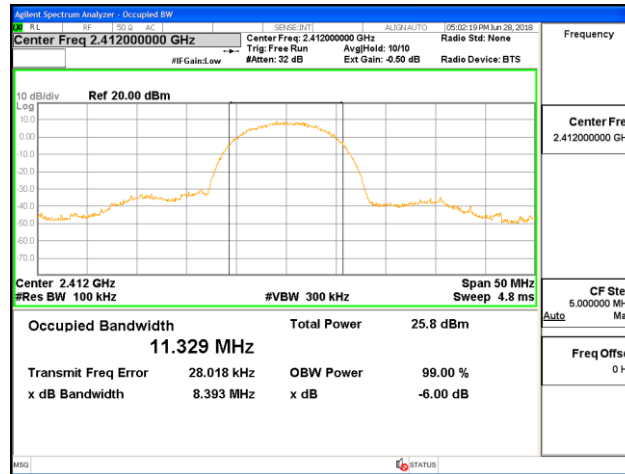
ANT 0 - 802.11n(HT20)



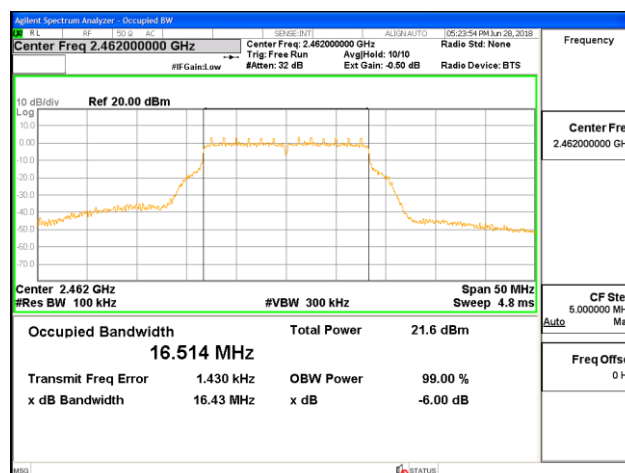
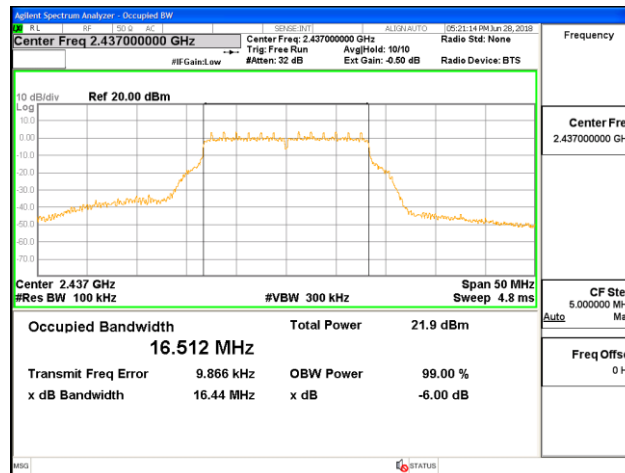
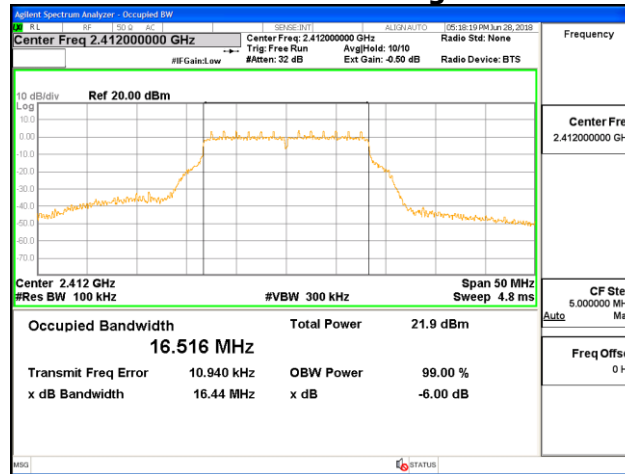
ANT 0 - 802.11n(HT40)



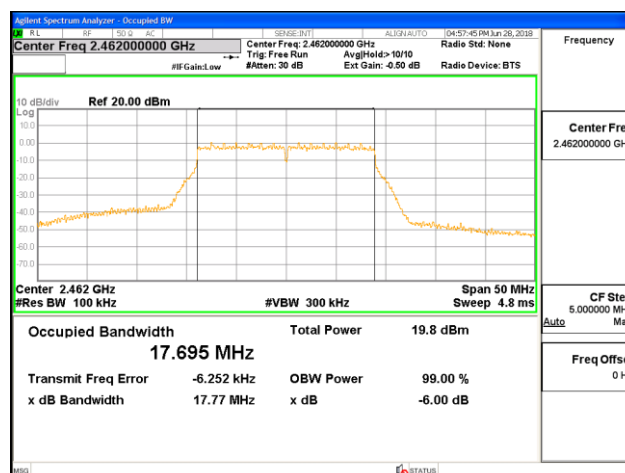
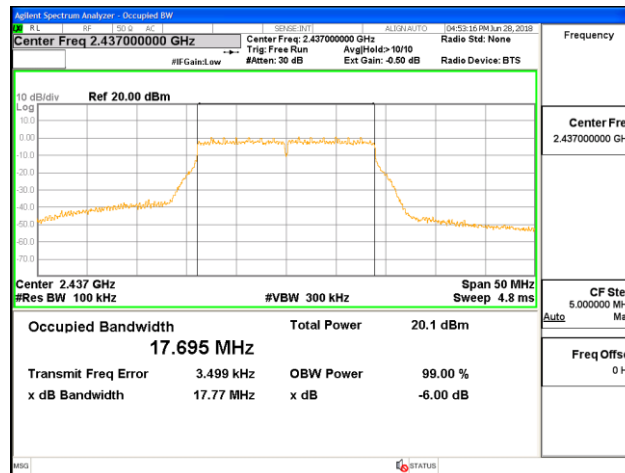
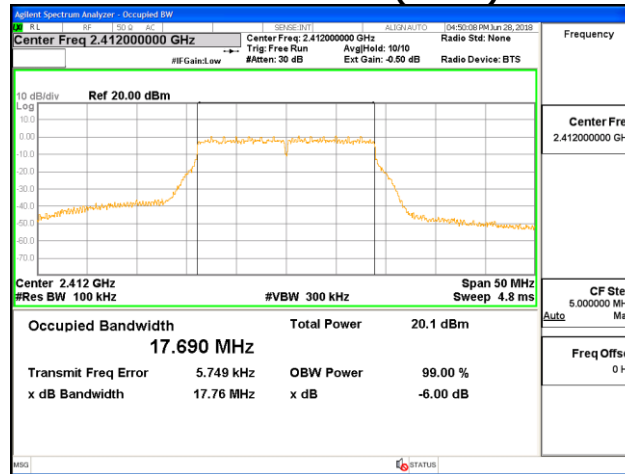
ANT 1 - 802.11b



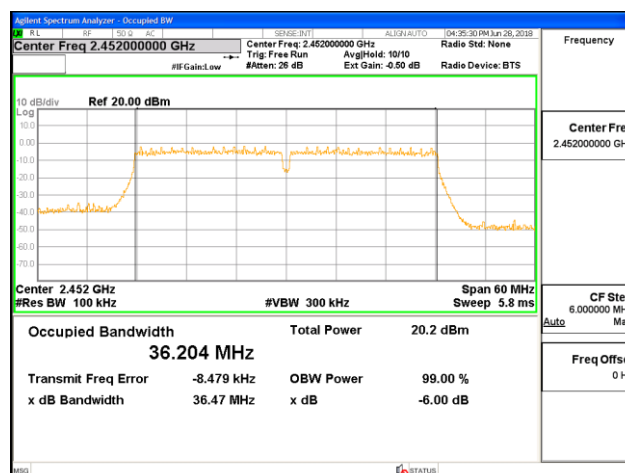
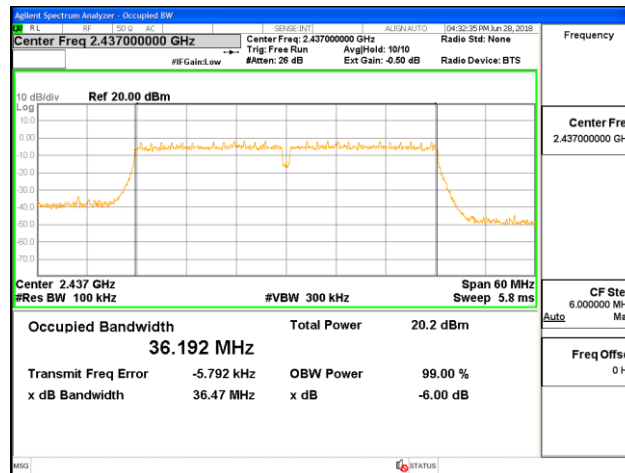
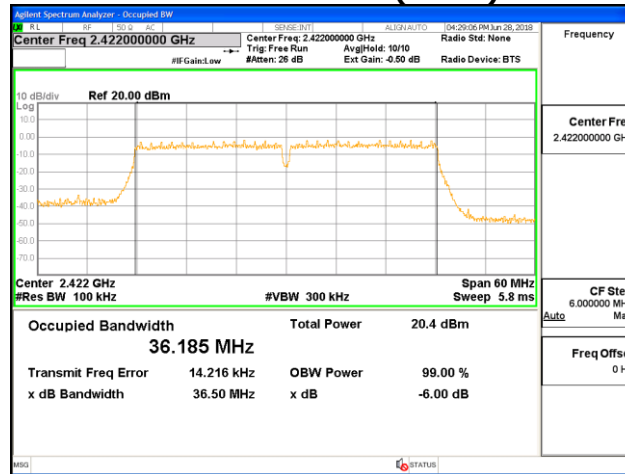
ANT 1 - 802.11g



ANT 1 - 802.11n(HT20)



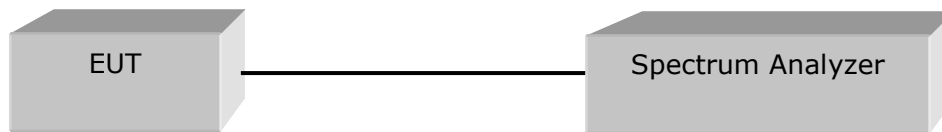
ANT 1 - 802.11n(HT40)



4.2 Maximum peak Conducted Output Power

Test Procedures(ANSI C63.10-2013 11.9.2.2.2)

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.



Test Settings:

Center frequency = the highest, middle and the lowest channels

- a) span $\geq 1.5 \times \text{OBW}$
- b) RBW = 1% to 5% of the OBW, not to exceed 1 MHz
- c) VBW $\geq 3 \times \text{RBW}$
- d) Sweep point $\geq (2 \times \text{SPAN} / \text{RBW})$
- e) Detector = RMS
- f) Sweep time = auto
- g) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges.

Limit

Maximum Output Power < 1 W (30 dBm)

Test Data

ANT 0

Mode	Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
802.11b	Low	2 412	15.41	30	Complies
	Middle	2 437	15.10		
	High	2 462	15.14		
802.11g	Low	2 412	13.15		
	Middle	2 437	13.23		
	High	2 462	12.86		

ANT 1

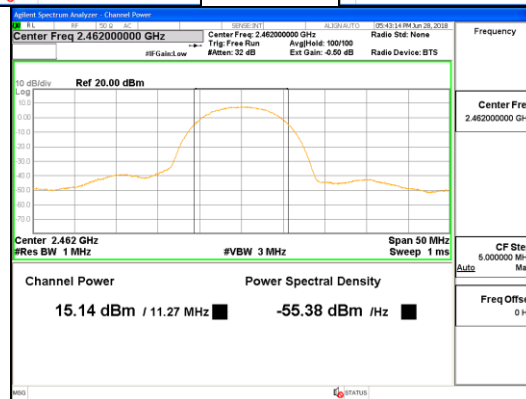
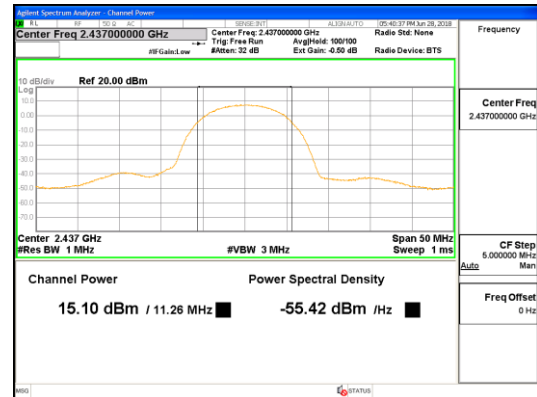
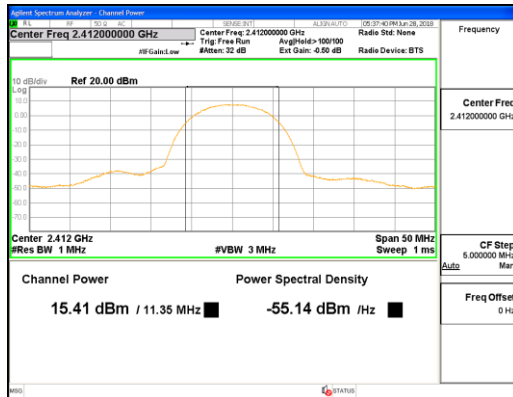
Mode	Channel	Frequency [MHz]	Measurement data [dBm]	Limit [dBm]	Result
802.11b	Low	2 412	16.24	30	Complies
	Middle	2 437	16.22		
	High	2 462	15.97		
802.11g	Low	2 412	13.98		
	Middle	2 437	13.93		
	High	2 462	13.66		

ANT 0 + ANT 1

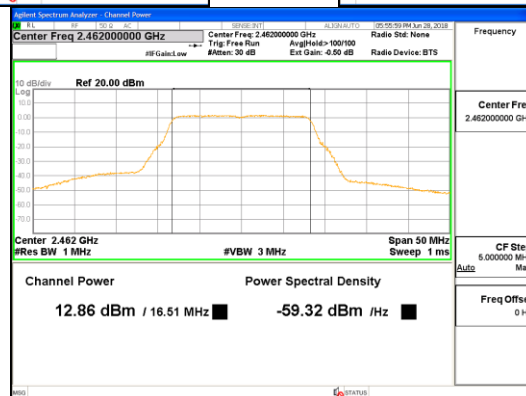
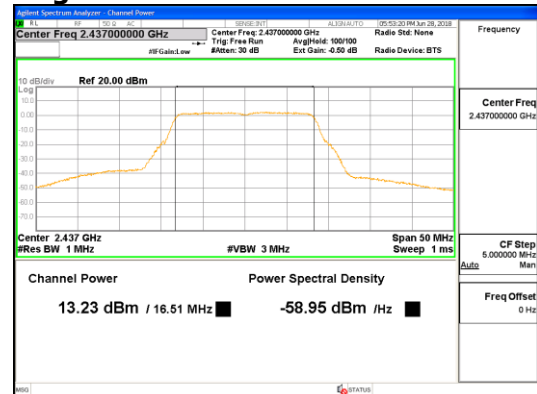
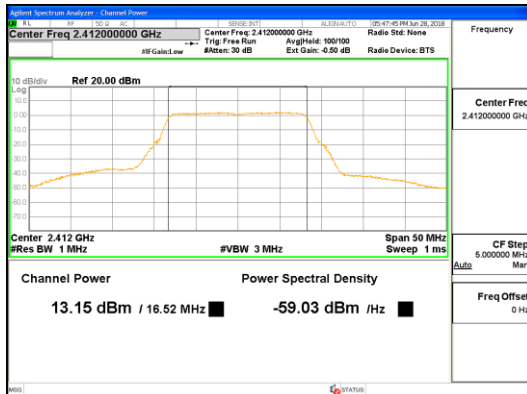
Mode	Frequency [MHz]	ANT 0 [dBm]	ANT 1 [dBm]	ANT 0 + ANT 1 [dBm]	Limit [dBm]	Result
802.11n (HT20)	2 412	12.28	10.11	14.34	30	
	2 437	12.23	10.07	14.29		
	2 462	11.98	9.72	14.01		
802.11n (HT40)	2 412	9.00	9.54	12.29		
	2 437	8.88	9.26	12.08		
	2 462	8.81	9.24	12.04		

See next pages for actual measured spectrum plots.

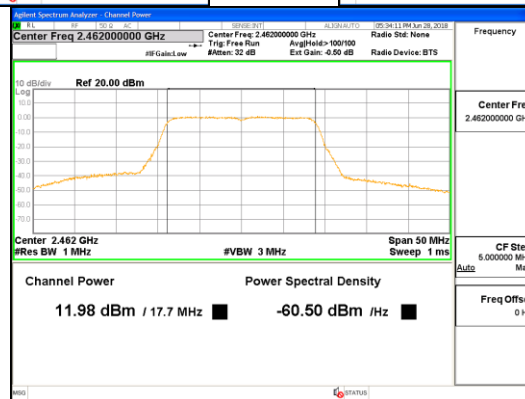
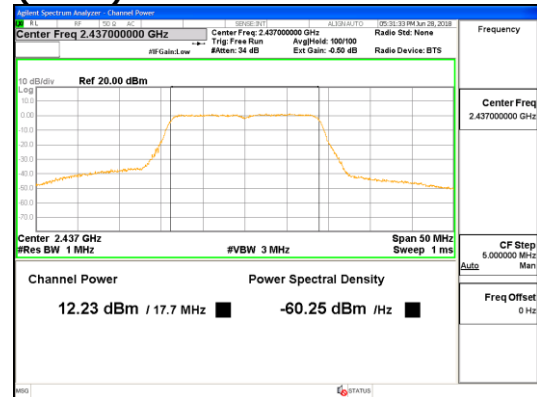
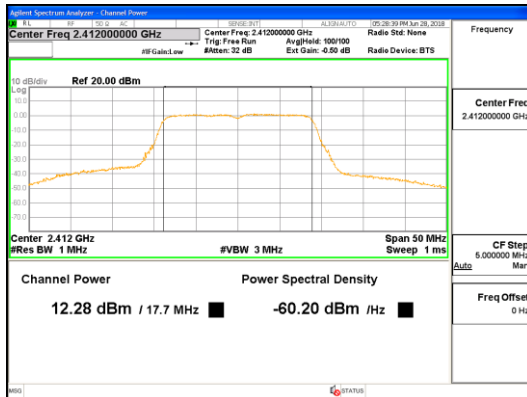
ANT 0 - 802.11b



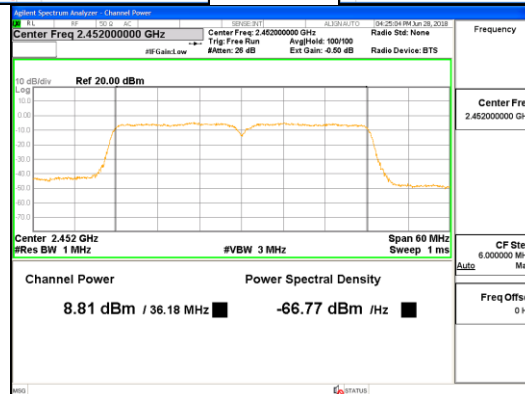
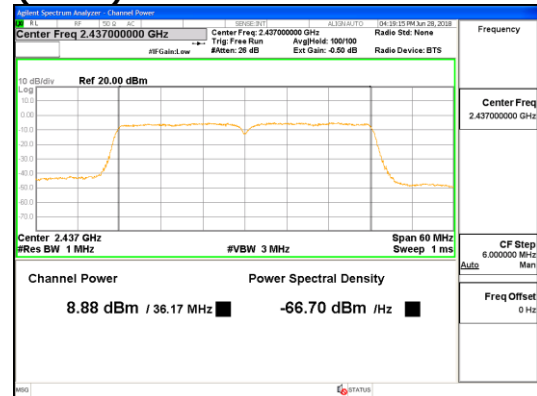
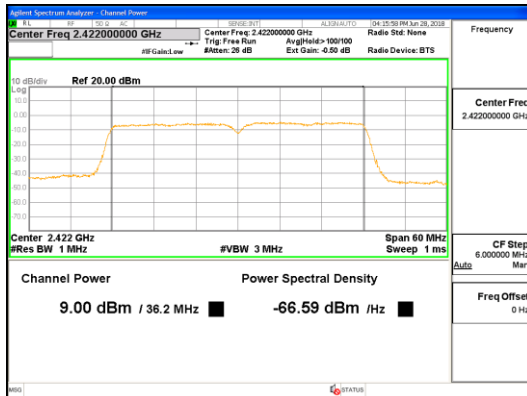
ANT 0 - 802.11g



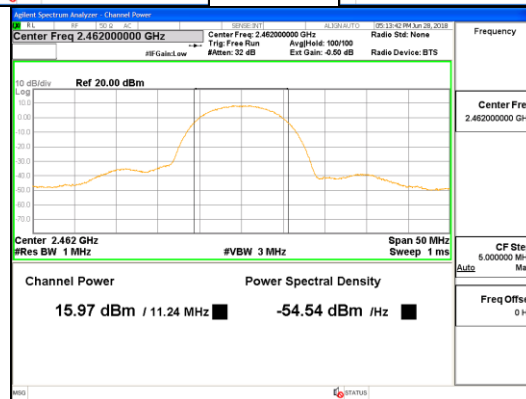
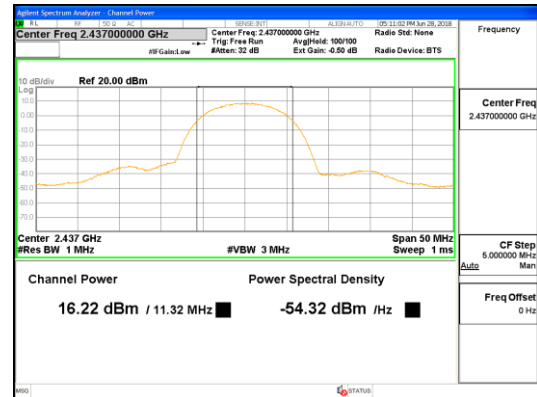
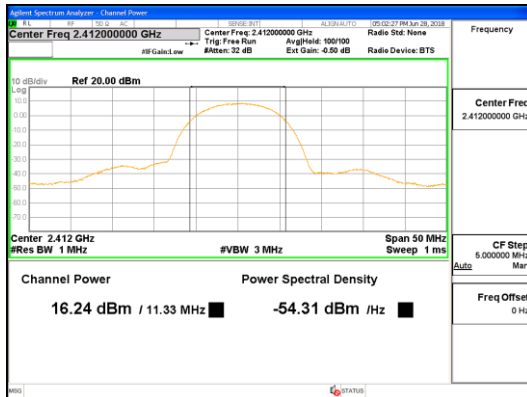
ANT 0 - 802.11n(HT20)



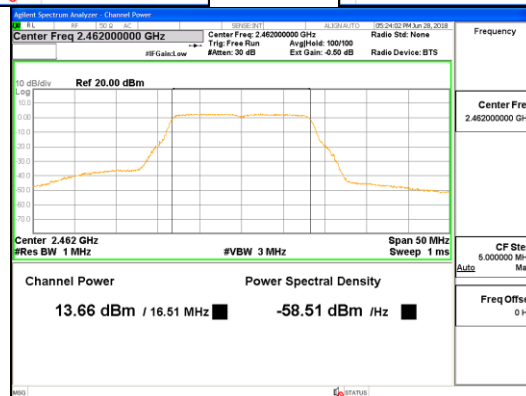
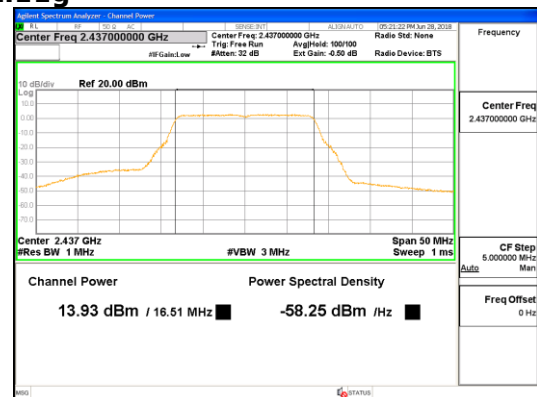
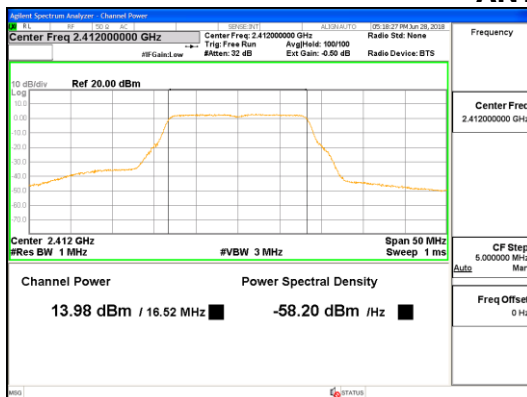
ANT 0 - 802.11n(HT40)



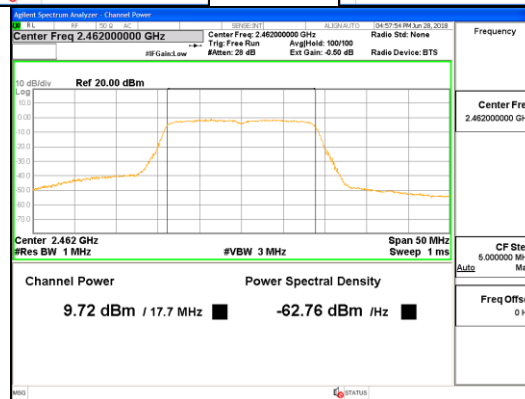
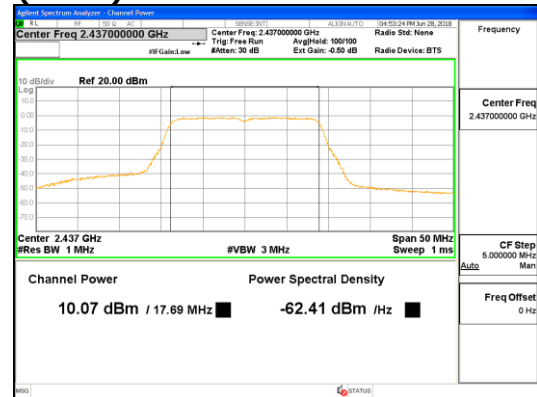
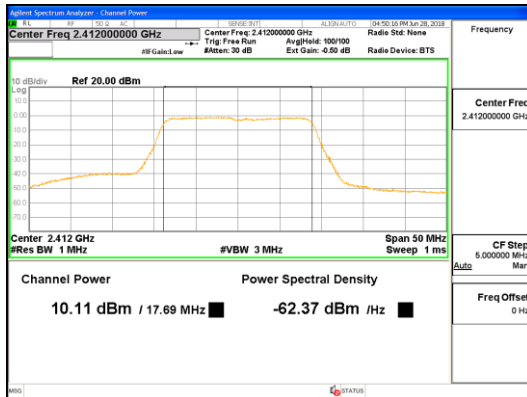
ANT 1 - 802.11b



ANT 1 - 802.11g



ANT 1 - 802.11n(HT20)



ANT 1 - 802.11n(HT40)

