FCC 47 CFR PART 15 SUBPART C: 2014 AND ANSI C63.10: 2009

TEST REPORT

For

Smart I/O+ Controller

Model: KT-61205W

Data Applies To: KT-61220W; KT-63511W; KT-63514W

Brand: KEYSTONE MICROTECH

Issued for

Keystone Microtech Corporation

9F., No.255,Dong Sec. 1, Guangming 6th Rd., Jhubei City, Hsinchu County, Taiwan (R.O.C.)

Issued by

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Date of Issue: September 3, 2015

Testing Laboratory
1109

REVISION HISTORY

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	September 3, 2015	Initial Issue	ALL	Eva Lin

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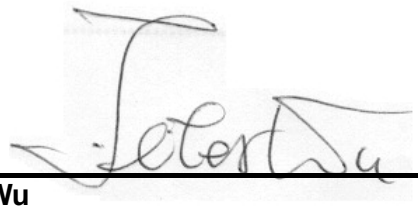
1. TEST REPORT CERTIFICATION

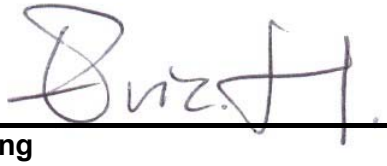
Applicant	:	**Keystone Microtech Corporation** 9F., No.255,Dong Sec. 1, Guangming 6th Rd., Jhubei City, Hsinchu County, Taiwan (R.O.C.)
Manufacturer	:	**GIGANTEK KING TECHNOLOGY CO., LTD.** No.79, Lianxing 2nd St., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)
Equipment Under Test	:	Smart I/O+ Controller
Model	:	KT-61205W
Data Applies To	:	KT-61220W; KT-63511W; KT-63514W
Brand	:	KEYSTONE MICROTECH
Date of Test	:	July 14, 2015 ~ August 13, 2015

APPLICABLE STANDARD	
STANDARD	**TEST RESULT**
FCC Part 15 Subpart C: 2014 AND ANSI C63.10: 2009	No non-compliance noted

Approved by: ***Reviewed by:***



Jeter Wu
Assistant Manager



Eric Huang
Assistant Section Manager

2. EUT DESCRIPTION

Product Name	Smart I/O+ Controller
Model	KT-61205W
Data Applies To	KT-61220W; KT-63511W; KT-63514W
Brand	KEYSTONE MICROTECH
Received Date	July 07, 2015
Frequency Range	IEEE 802.11b/g, 802.11n HT20 : 2412MHz~2462MHz IEEE 802.11n HT40: 2422MHz~2452MHz
Transmit Power	IEEE 802.11b Mode : 23.07dBm (202.768mW) IEEE 802.11g Mode : 22.55dBm (179.887mW) IEEE 802.11n HT20 Mode : 22.57dBm (180.717mW) IEEE 802.11n HT40 Mode : 21.78dBm (150.661mW)
Channel Spacing	IEEE 802.11b/g, 802.11n HT20/HT40: 5MHz
Channel Number	IEEE 802.11b/g, 802.11n HT20: 11 Channels IEEE 802.11n HT40 : 7 Channels
Transmit Data Rate	IEEE 802.11b Mode: 1, 2, 5.5, 11 Mbps IEEE 802.11g Mode: 6, 9, 12, 18, 24, 36, 48, 54 Mbps IEEE 802.11n (HT20): 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65, 72.2 Mbps IEEE 802.11n (HT40): 15, 30, 45, 60, 90, 120, 135, 150 Mbps
Type of Modulation	IEEE 802.11b：DSSS (CCK, DQPSK, DBPSK)
	IEEE 802.11g：OFDM (64QAM, 16QAM, QPSK, BPSK)
	IEEE 802.11n HT20/HT40：OFDM (64QAM, 16QAM, QPSK, BPSK)
Frequency Selection	By software / firmware
Antenna Type	**Antenna (1TX1RX)** Manufacturer: Long Cheng Tech.Int'l Co. Ltd. Type: Dipole Antenna Model: F1B-003404-MMP Gain：2.0 dBi
Temperature Range	-10°C ~ +70°C
Software Version	KT-61205W: v100b0012-100b0008-100b0009 KT-61220W: v100b0012-100b0008-100b0009 KT-63511W: v100b0020-100b0011 KT-63514W: v100b0020-100b0011
Hardware Version	KT-61205W: 855KT-612050-811-B10 & 855KT-612050-411-B10 KT-61220W: 855KT-612050-811-B10 & 855KT-612200-411-B10 KT-63511W: 855KT-612050-811-B10 KT-63514W: 855KT-612050-811-B10

REMARK:

1. The sample **(KT-61205W)** selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **2ACEXKT-61205W** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the User's manual of the EUT.
4. The different of the each model is shown as below:

Model	Discrepancy
KT-61205W	◎Ethernet 10/100 Mbps ◎2.4GHz, IEEE802.11b/g/n 1T1R ◎USB HOST 2.0 ◎RS232/RS485 configurable port * 2 ports ◎12 DIO
KT-61220W	◎Ethernet 10/100 Mbps ◎2.4GHz, IEEE802.11b/g/n 1T1R ◎USB HOST 2.0 ◎RS232/RS485 configurable port * 2 ports ◎6 AI
KT-63511W	◎Cloud Enabler ◎Ethernet 10/100 Mbps ◎2.4GHz, IEEE802.11b/g/n 1T1R ◎USB HOST 2.0 ◎RS232/RS485 configurable port * 1 ports ◎128 Registers(SW)
KT-63514W	◎Cloud Enabler ◎Ethernet 10/100 Mbps ◎2.4GHz, IEEE802.11b/g/n 1T1R ◎USB HOST 2.0 ◎RS232/RS485 configurable port * 2 ports ◎256 Registers(SW)

3. DESCRIPTION OF TEST MODES

The EUT is a 11n router. It has two transmitter chains and two receive chains (2x2 configurations). The 2x2 configuration is implemented with two outside chains (Chain 0).

The RF chipset is manufactured by Realtek Corporation.

The antenna peak gain 2.0dBi (highest gain) were chosen for full testing.

IEEE 802.11 b ,802.11g ,802.11n HT20 mode (DTS Band)

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2412
Middle	2437
High	2462

IEEE 802.11b mode: 1Mbps long data rate (worst case) were chosen for full testing.

IEEE 802.11g mode: 6Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT20 mode: 13Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT40 mode (DTS Band)

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2422
Middle	2437
High	2452

IEEE 802.11n HT40 mode: 27Mbps data rate (worst case) were chosen for full testing.

The worst-case data rates are determined according to the description above, based on the investigations by measuring the PSD, peak power and average power across all the data rates, bandwidths, modulations and spatial stream modes.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10 and FCC CFR 47 15.207, 15.209 and 15.247.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW-1037 and 455173).

5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccsrf.com

6. CALIBRATION AND UNCERTAINTY

6.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

6.2 MEASUREMENT UNCERTAINTY

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

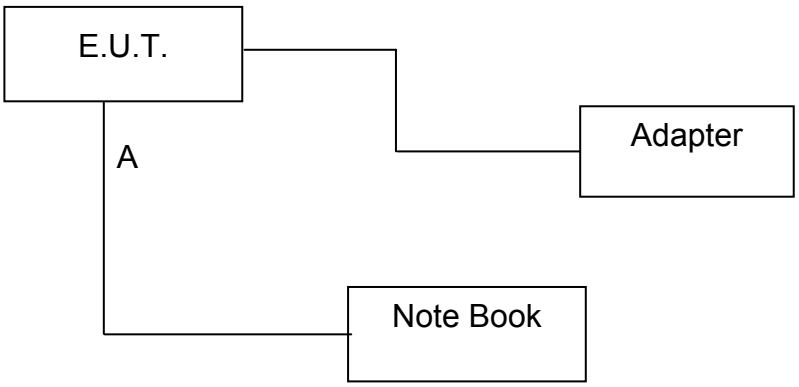
PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz Test Site : OATS-6	±3.59dB
Radiated Emission, 200 to 1000 MHz Test Site : OATS-6	±3.27dB
Radiated Emission, 1 to 26.5 GHz	± 3.20dB
Power Line Conducted Emission	± 2.90dB

Uncertainty figures are valid to a confidence level of 95%, K=2

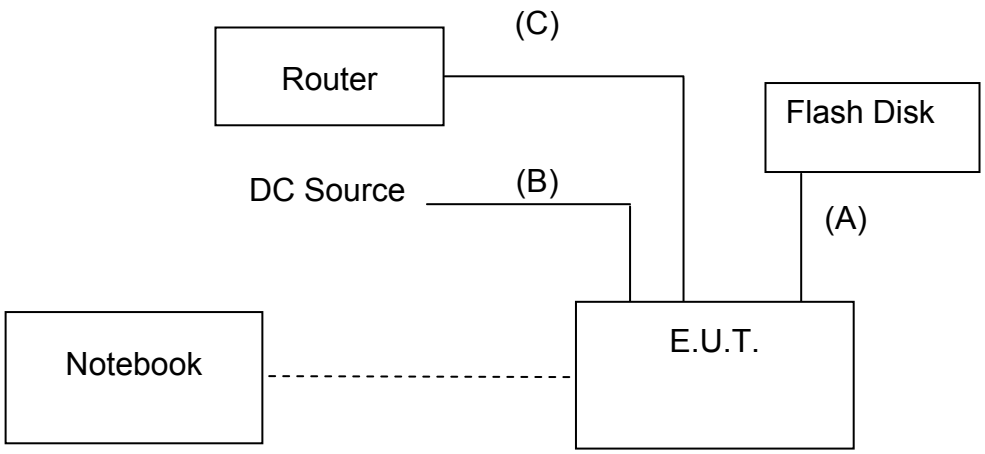
7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

FOR RF TEST



FOR EMI TEST



7.2 SUPPORT EQUIPMENT

RF test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1.	Note Book	Acer	AS 3830TG	DOC	Power cable, unshd, 1.6m
2	Adapter	MCE	YMC18-3UW	DOC	Power cable, unshd, 1.6m, 1 core

No.	Signal cable description	
A	LAN cable	Unshielded, 10m, 1pcs. with one core

EMI test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Note Book	TOSHIBA	Satellite L730	N/A	Power cable, unshd, 1.6m
2	Flash Disk	Kingston	DTIG3/8GB	D43254	N/A
3	Router	D-Link	DWR-113	N/A	Power cable, unshd, 1.8m

No.	Signal cable description	
A	USB cable	Unshielded, 19米, 1件
B	Ethernet cable	Unshielded, 10米, 1件
C	Power cable	Unshielded, 0.05米, 1件

REMARK:

1. All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.
2. Grounding was established in accordance with the manufacturer’s requirements and conditions for the intended use.

7.3 EUT OPERATING CONDITION

RF Setup

1. Set up all computers like the setup diagram.
2. The “MP_TEST” software was used for testing.
3. Choose IC TYPE “RTL_8188E”.

TX Mode:

- ⇨ **Tx Mode:CCK、OFDM、HT MixMode** (Bandwidth: 20、40)
- ⇨ **Tx Data Rate: 1Mbps long** (IEEE 802.11b mode ,chain 0 TX)
  6Mbps (IEEE 802.11g mode ,chain 0 TX)
  6.5Mbps (IEEE 802.11n HT20 mode ,chain 0 TX)
  13 Mbps (IEEE 802.11n HT40 mode, chain 0 TX**)**

Power control mode

Target Power: IEEE 802.11b Channel Low (2412MHz) = **51 (Chain 0)**
IEEE 802.11b Channel Middle (2437MHz) = **50 (Chain 0)**
IEEE 802.11b Channel High (2462MHz) = **49 (Chain 0)**
Target Power: IEEE 802.11g Channel Low (2412MHz) = **51 (Chain 0)**
IEEE 802.11g Channel Middle (2437MHz) = **51 (Chain 0)**
IEEE 802.11g Channel High (2462MHz) = **51 (Chain 0)**
Target Power: IEEE 802.11n HT20 Channel Low (2412MHz) = **50 (Chain 0)**
IEEE 802.11n HT20 Channel Middle (2437MHz) = **51 (Chain 0)**
IEEE 802.11n HT20 Channel High (2462MHz) = **51 (Chain 0)**
Target Power: IEEE 802.11n HT40 Channel Low (2422MHz) = **49 (Chain 0)**
IEEE 802.11n HT40 Channel Middle (2437MHz) = **50 (Chain 0)**
IEEE 802.11n HT40 Channel High (2452MHz) = **50 (Chain 0)**

(2) **RX Mode：**

Start RX

3. All of the function are under run.
4. Start test.

RX Mode：

Test Item packets RX
Start RX

Normal Link Setup

1. Set up all computers like the setup diagram.
2. All of the function are under run.
3. Notebook PC (2) ping 192.168.0.10 –t to Notebook PC (1).
4. Notebook PC (1) ping 192.168.0.20 –t to Notebook PC (2).
5. Notebook PC (1) ping 192.168.0.50 –t to Wireless Access Point (3).

Start test.

8. APPLICABLE LIMITS AND TEST RESULTS

8.1 6DB BANDWIDTH

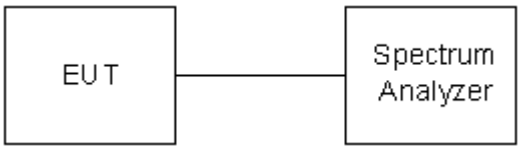
LIMIT

§ 15.247(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	JAN. 23, 2016

TEST SETUP



TEST PROCEDURE

1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW) ≥ 3 x 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) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

TEST RESULTS

No non-compliance noted.

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	9.73	500	PASS
Middle	2437	10.10	500	PASS
High	2462	10.10	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	16.59	500	PASS
Middle	2437	16.59	500	PASS
High	2462	16.59	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	17.81	500	PASS
Middle	2437	17.79	500	PASS
High	2462	17.80	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 13Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

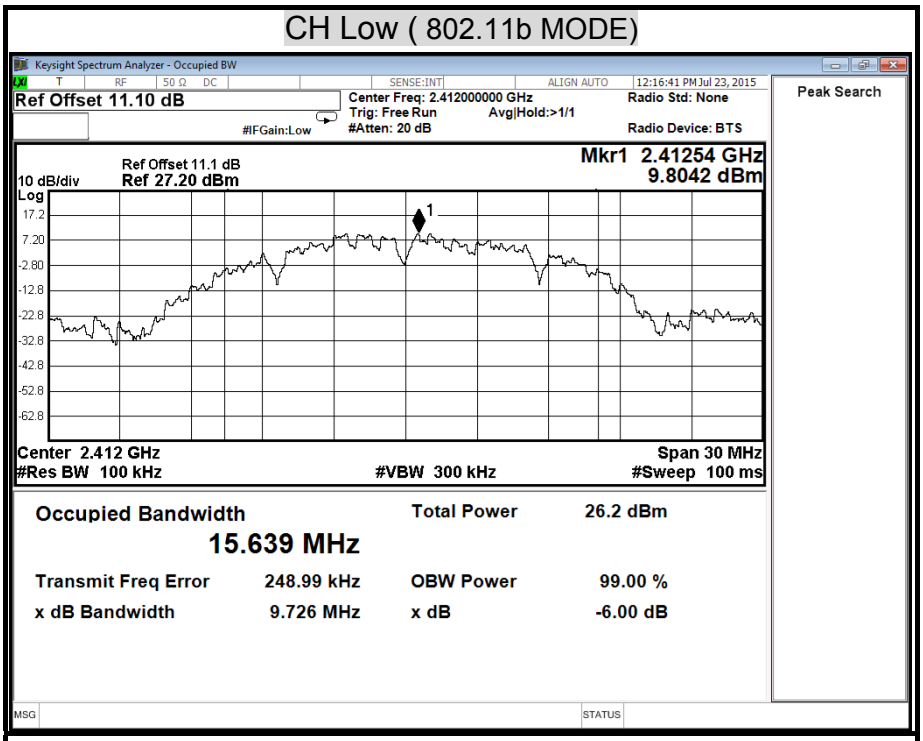
IEEE 802.11n HT40 mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2422	36.39	500	PASS
Middle	2437	36.39	500	PASS
High	2452	36.39	500	PASS

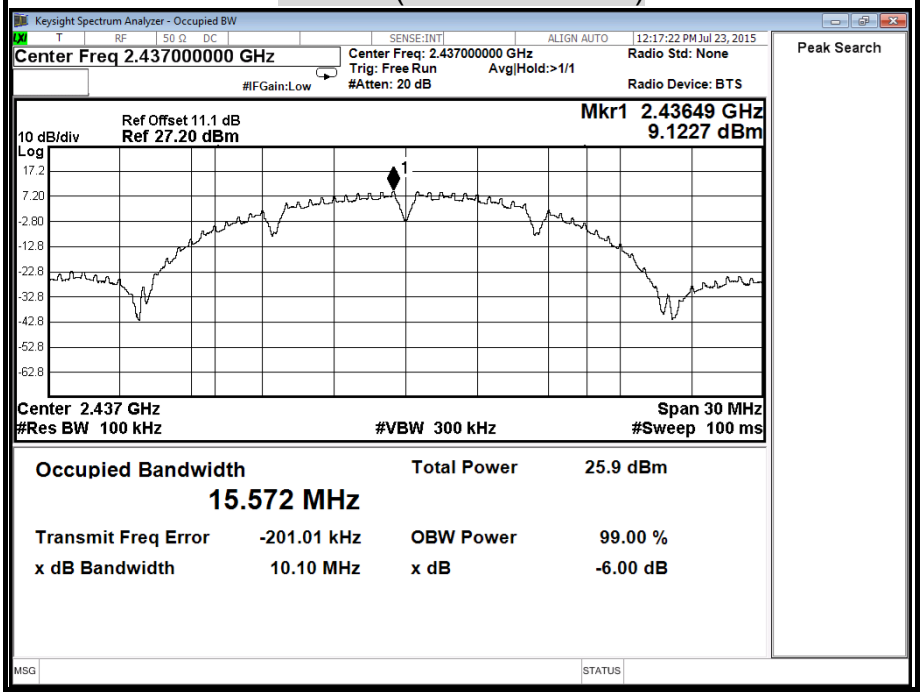
NOTE : 1. At finial test to get the worst-case emission at 27Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

6dB BANDWIDTH (802.11b MODE)

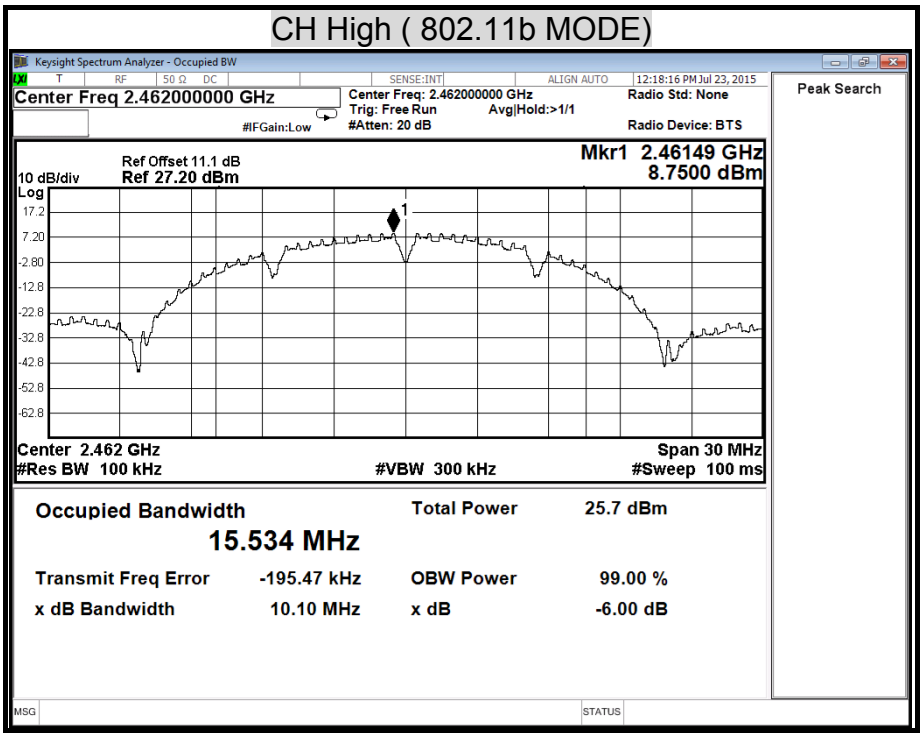
CH Low (802.11b MODE)



CH Mid (802.11b MODE)

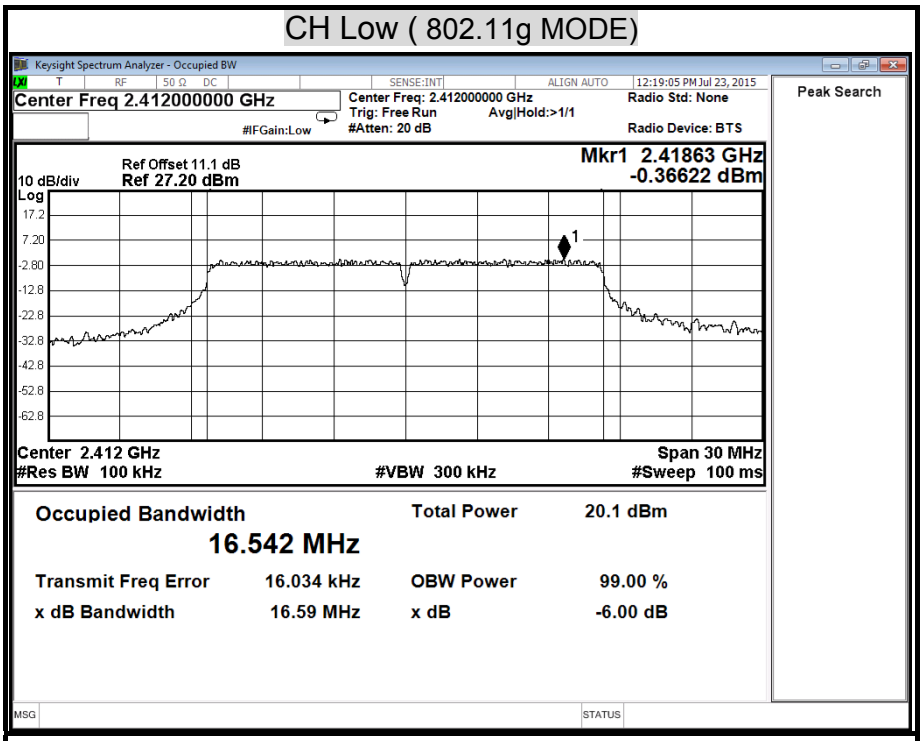


CH High (802.11b MODE)

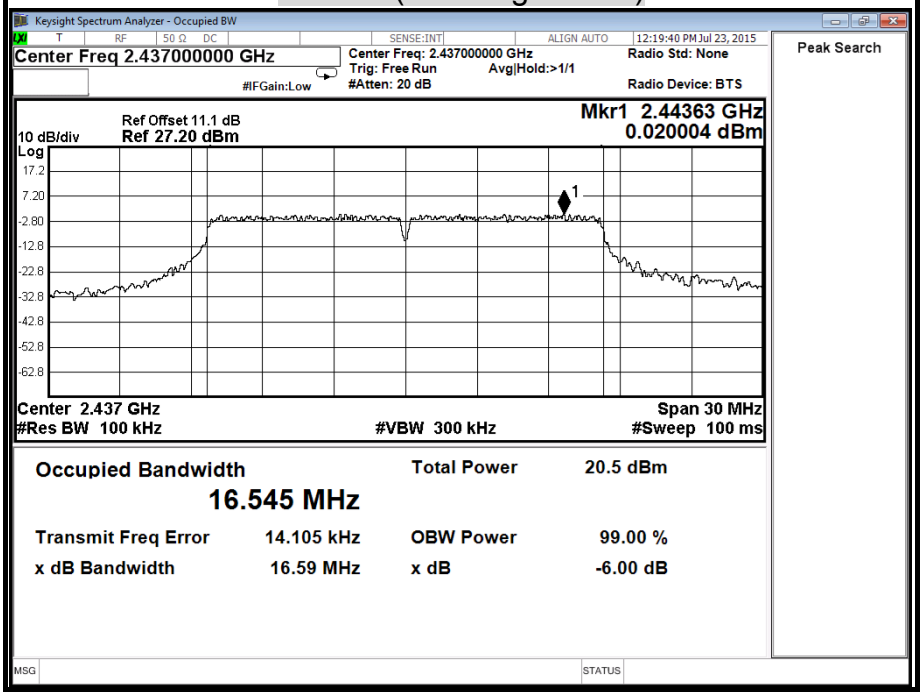


6dB BANDWIDTH (802.11g MODE)

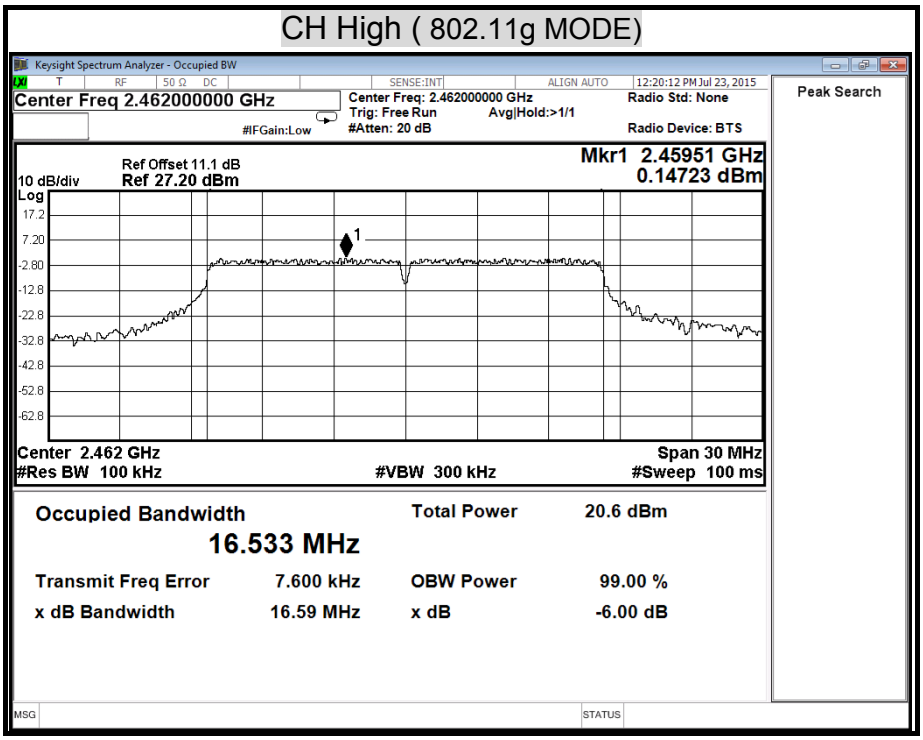
CH Low (802.11g MODE)



CH Mid (802.11g MODE)

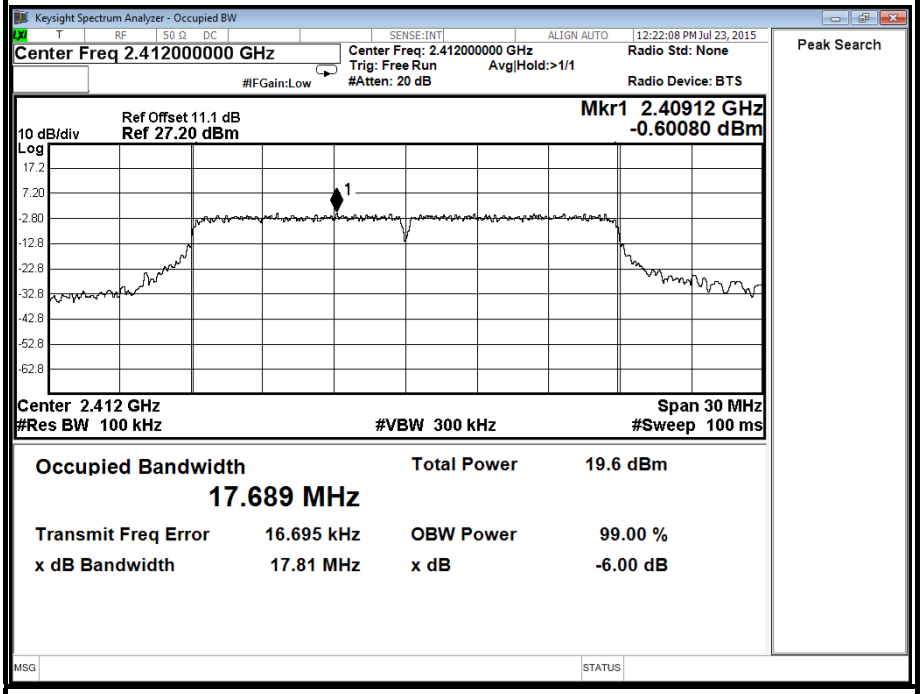


CH High (802.11g MODE)

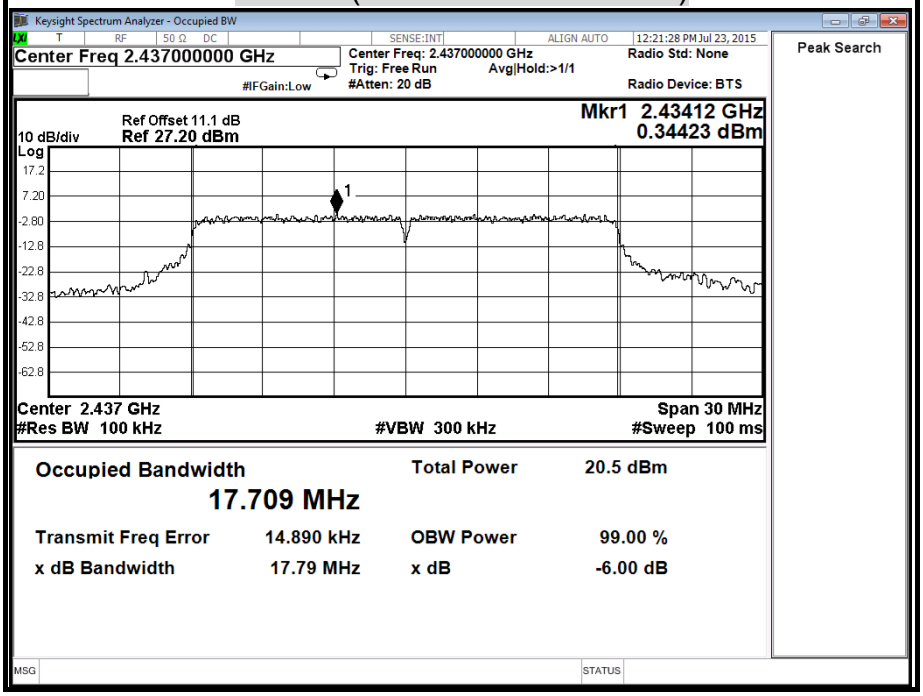


6dB BANDWIDTH (802.11n HT20 MODE)

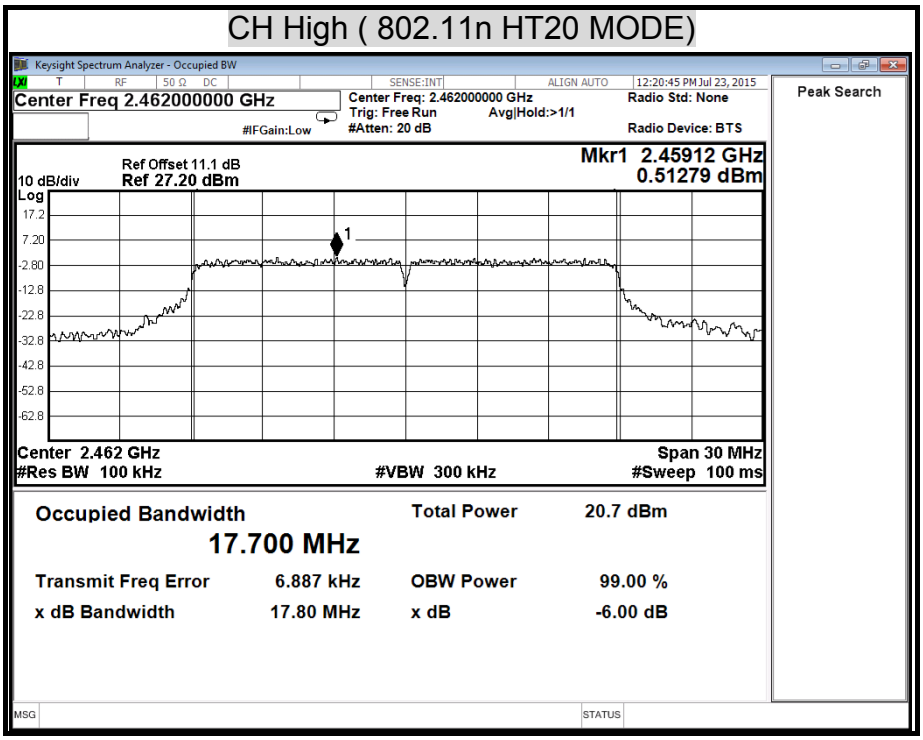
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

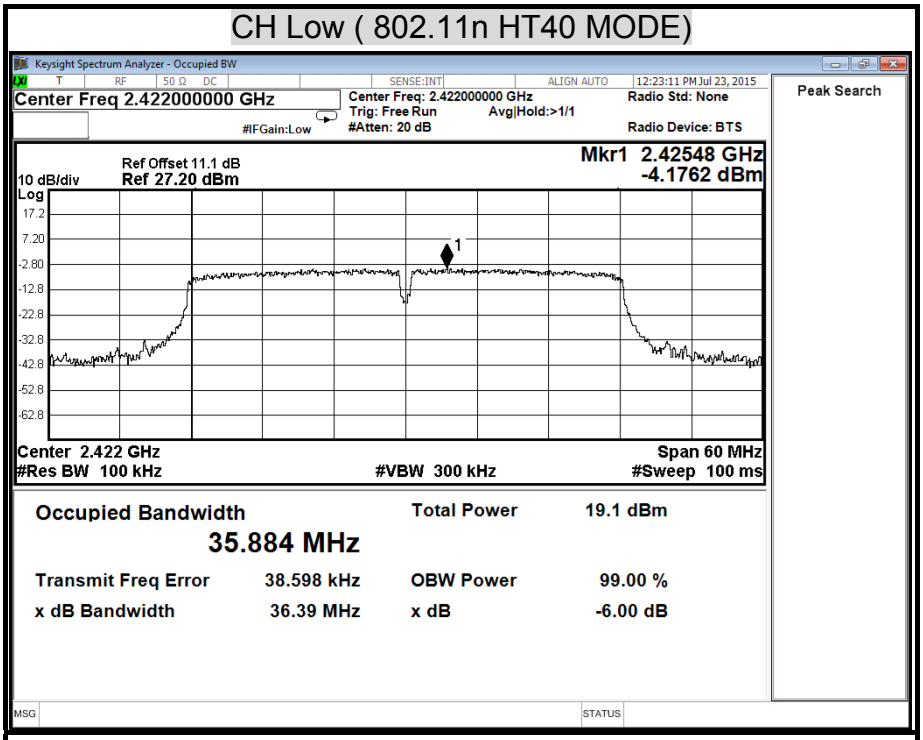


CH High (802.11n HT20 MODE)

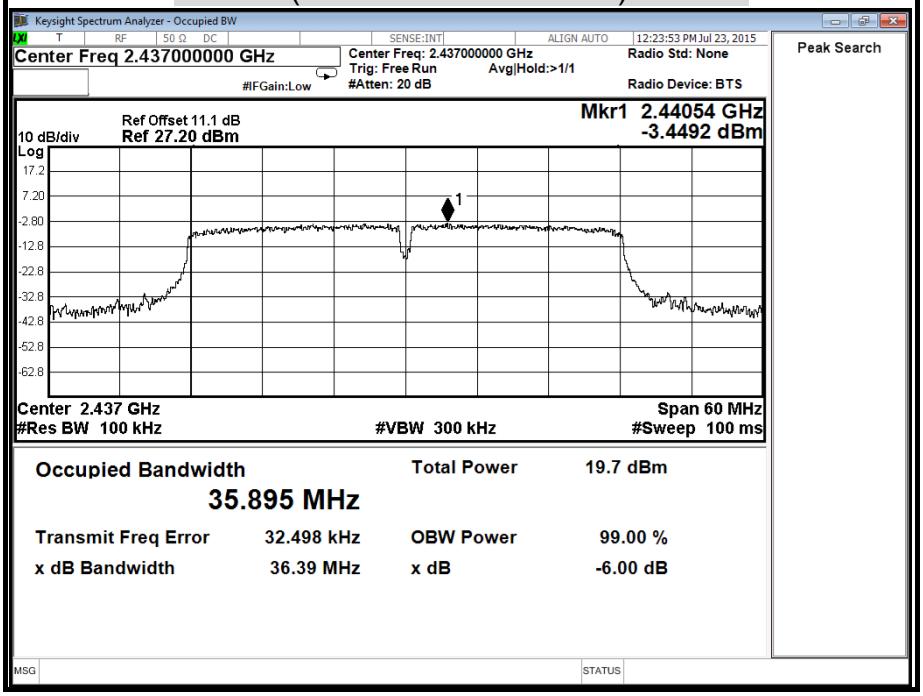


6dB BANDWIDTH (802.11n HT40 MODE)

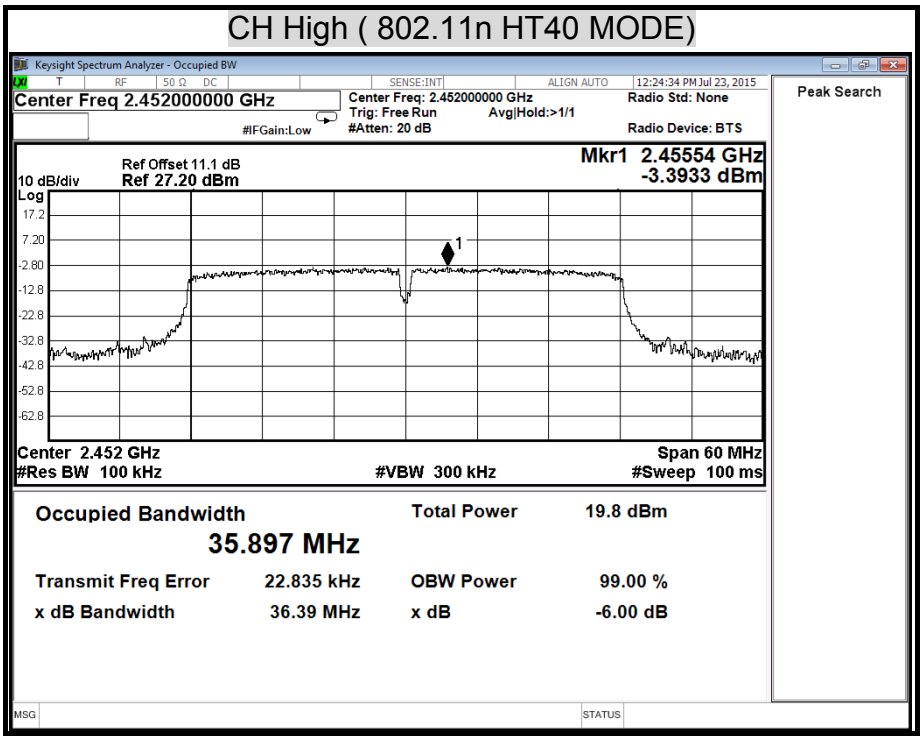
CH Low (802.11n HT40 MODE)



CH Mid (802.11n HT40 MODE)-Chain 0



CH High (802.11n HT40 MODE)



8.2 MAXIMUM PEAK OUTPUT POWER

LIMIT

§ 15.247(b) The maximum peak output power of the intentional radiator shall not exceed the following :

§ 15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands : 1 watt.

§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2), and (b)(3) of this section , as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

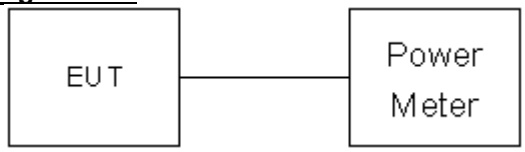
TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	JAN. 23, 2016
Power Meter	Anritsu	ML2487A	6K00003888	JUN. 24, 2016

TEST SETUP

For Peak Power

For Average Power



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 5.2.1.2 and 5.2.2.1.

5.2.1.2 Measurement Procedure PK2:

1. Set the RBW = 1 MHz.
2. Set the VBW ≥ 3 RBW
3. Set the span ≥ 1.5 x DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function,
9. Sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

Average Power

Connect the EUT to power meter, set the center frequency of the power meter to the channel center frequency.

TEST RESULTS

No non-compliance noted

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	23.07	30.00	PASS
Middle	2437	22.74	30.00	PASS
High	2462	22.33	30.00	PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	22.07	30.00	PASS
Middle	2437	22.36	30.00	PASS
High	2462	22.55	30.00	PASS

NOTE : 1.At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	21.59	30.00	PASS
Middle	2437	22.57	30.00	PASS
High	2462	22.34	30.00	PASS

NOTE : 1. At finial test to get the worst-case emission at 13Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT40 mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2422	20.96	30.00	PASS
Middle	2437	21.57	30.00	PASS
High	2452	21.78	30.00	PASS

NOTE : 1. At finial test to get the worst-case emission at 27Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

Average Power Data

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2412	20.02
Middle	2437	19.86
High	2462	19.67

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2412	14.77
Middle	2437	15.17
High	2462	15.41

IEEE 802.11n HT20 mode

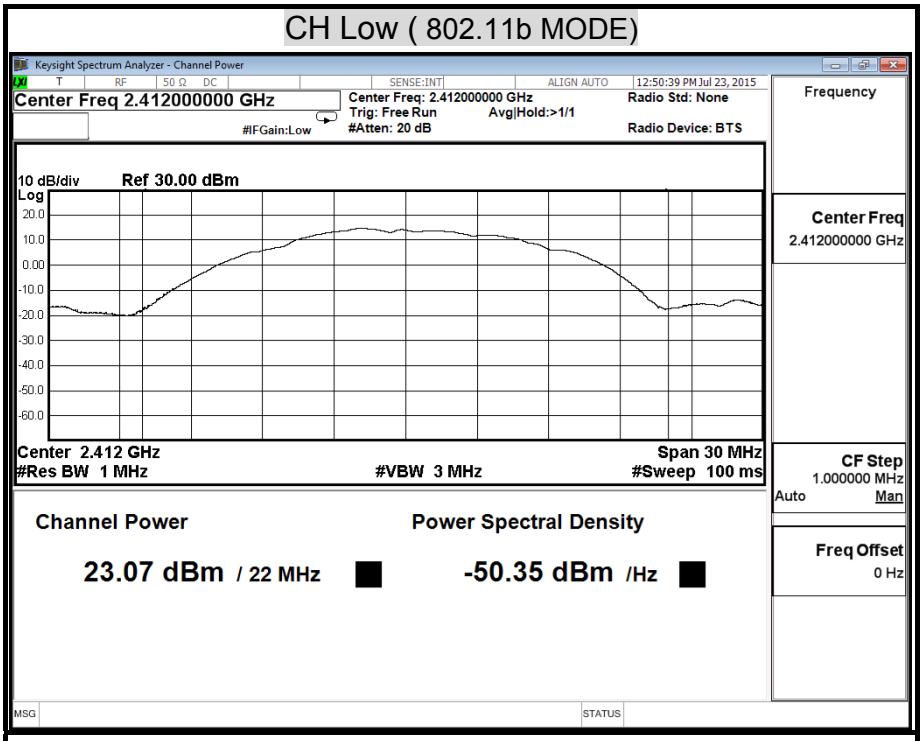
Channel	Channel Frequency (MHz)	Average Power (dBm)
		Chain 0
Low	2412	14.30
Middle	2437	15.14
High	2462	15.30

IEEE 802.11n HT40 mode

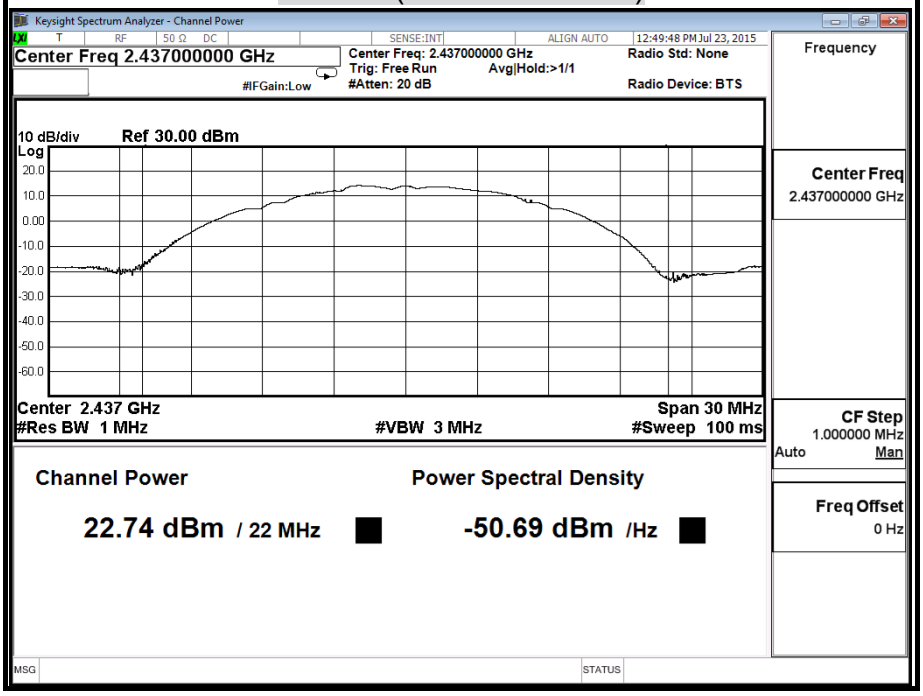
Channel	Channel Frequency (MHz)	Average Power (dBm)
		Chain 0
Low	2422	13.51
Middle	2437	14.18
High	2452	14.36

MAXIMUM PEAK OUTPUT POWER (802.11b MODE)

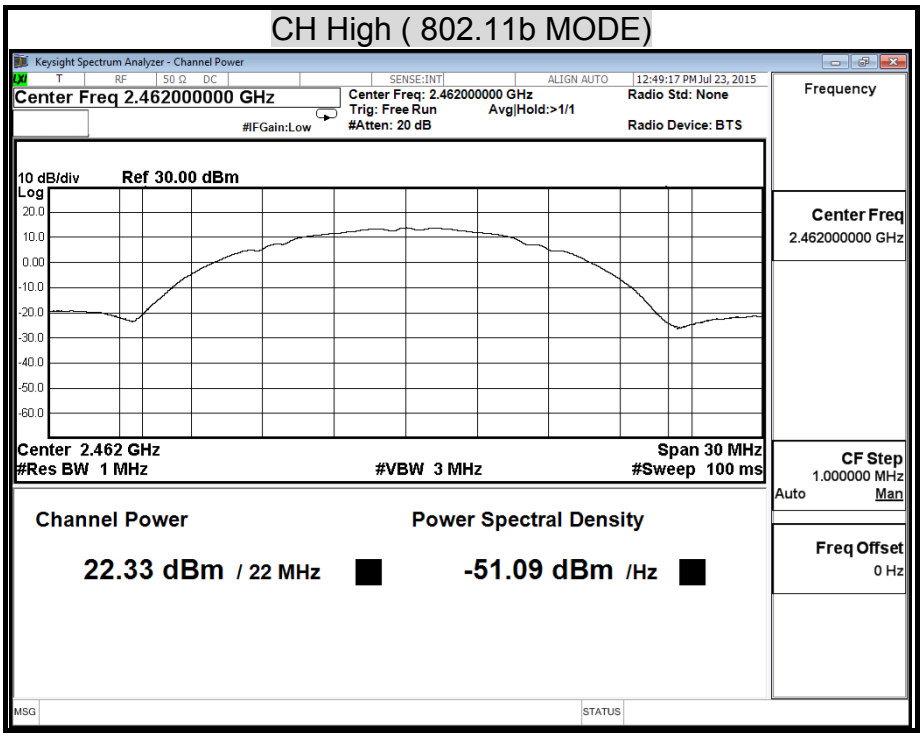
CH Low (802.11b MODE)



CH Mid (802.11b MODE)

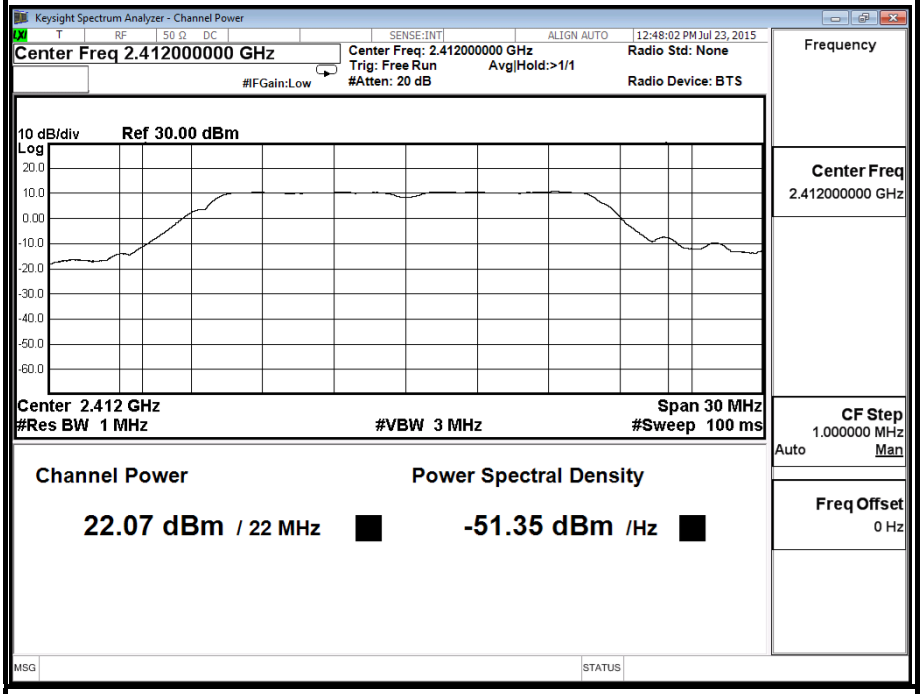


CH High (802.11b MODE)

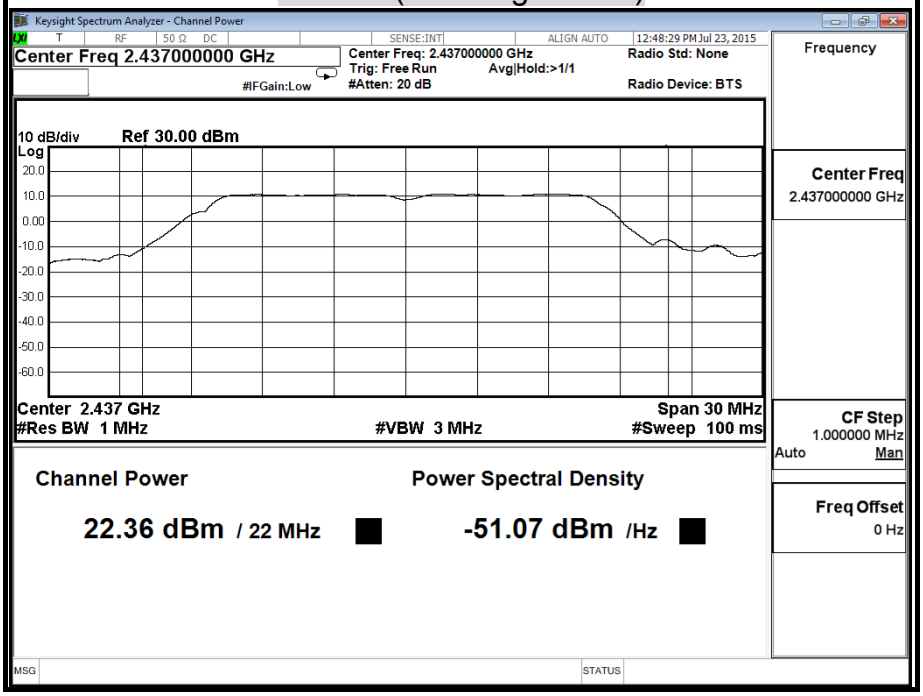


MAXIMUM PEAK OUTPUT POWER (802.11g MODE)

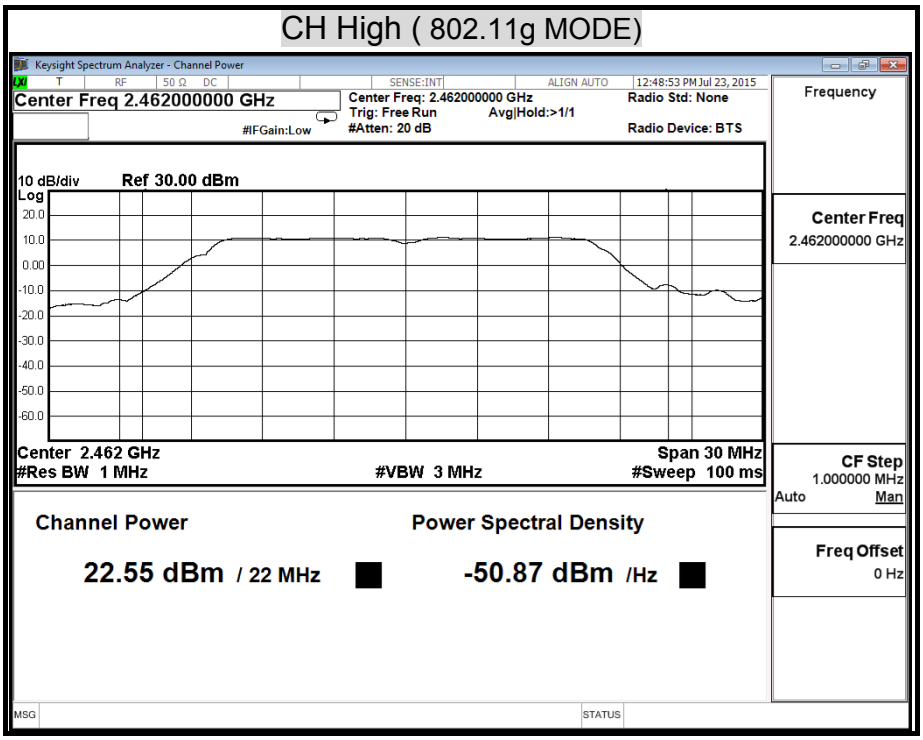
CH Low (802.11g MODE)



CH Mid (802.11g MODE)

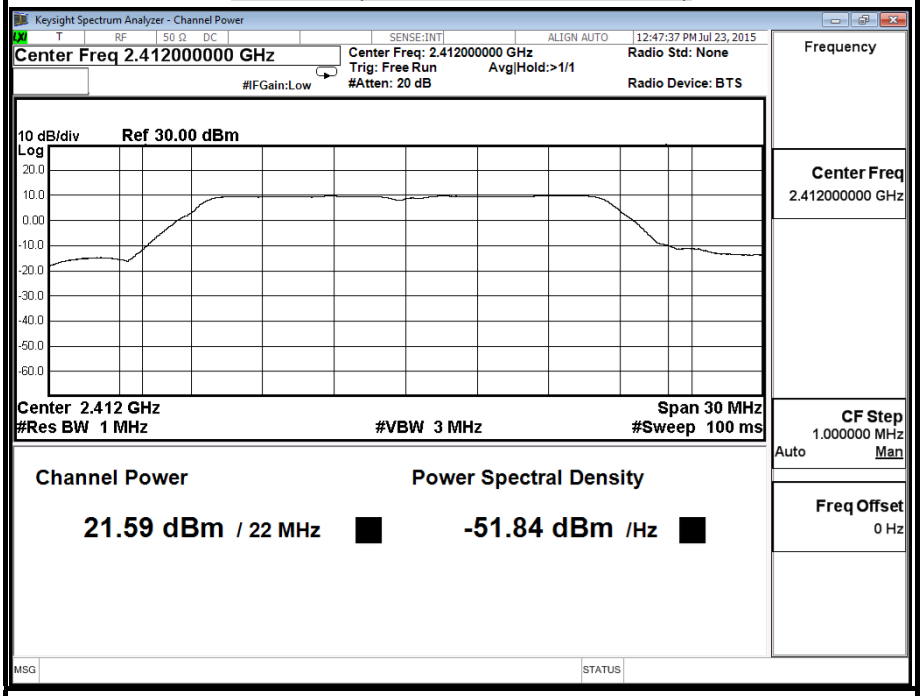


CH High (802.11g MODE)

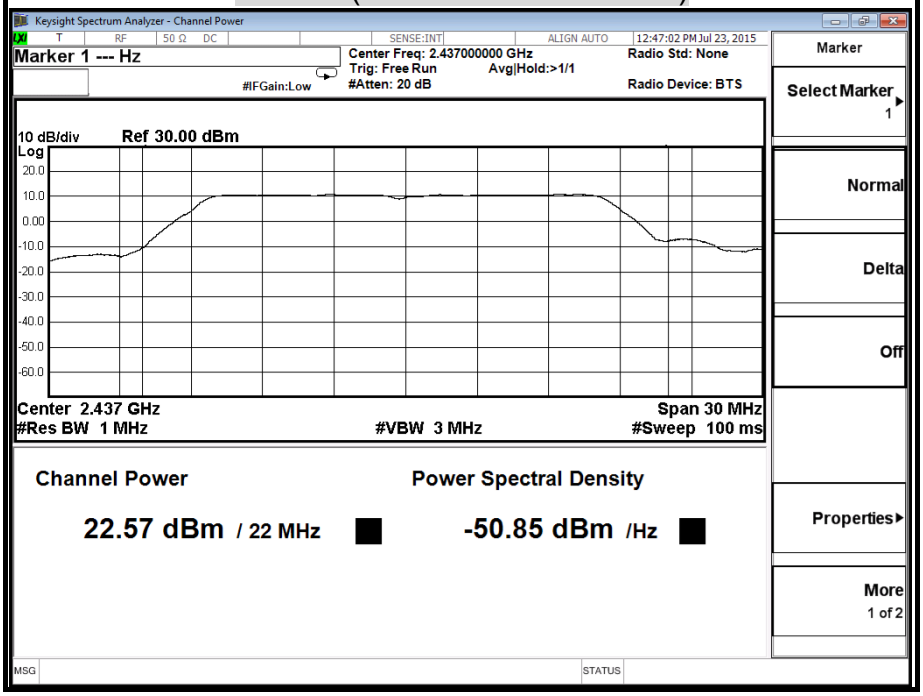


MAXIMUM PEAK OUTPUT POWER (802.11n HT20 MODE)

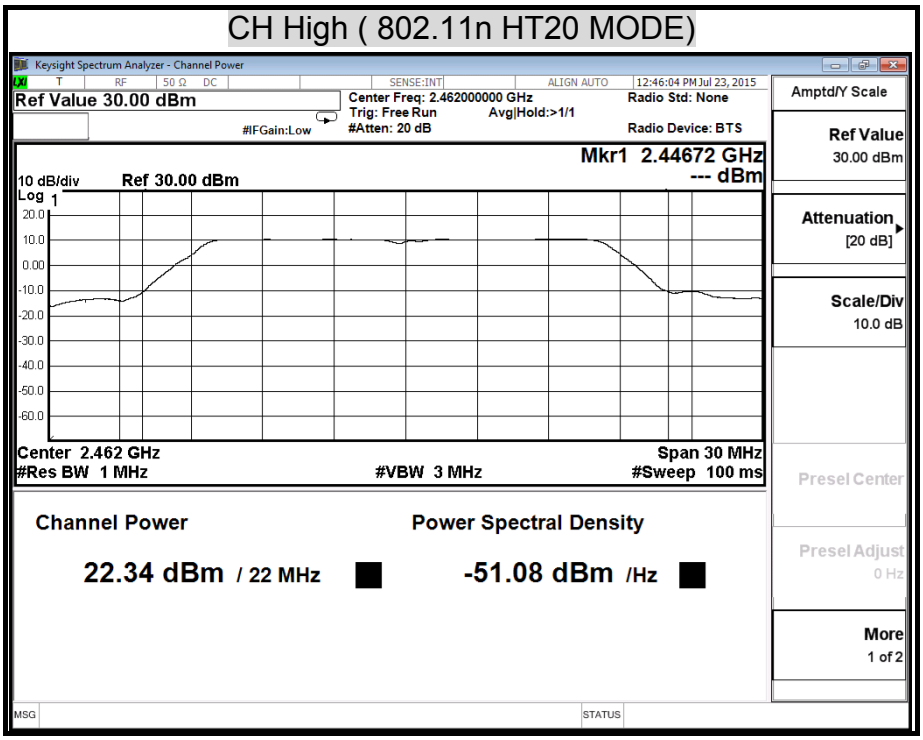
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

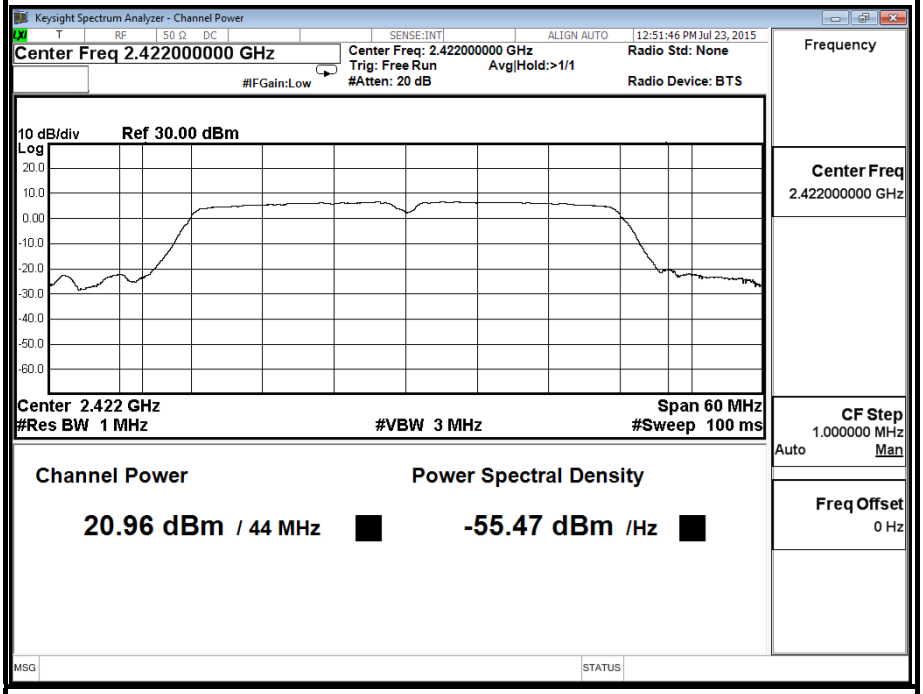


CH High (802.11n HT20 MODE)

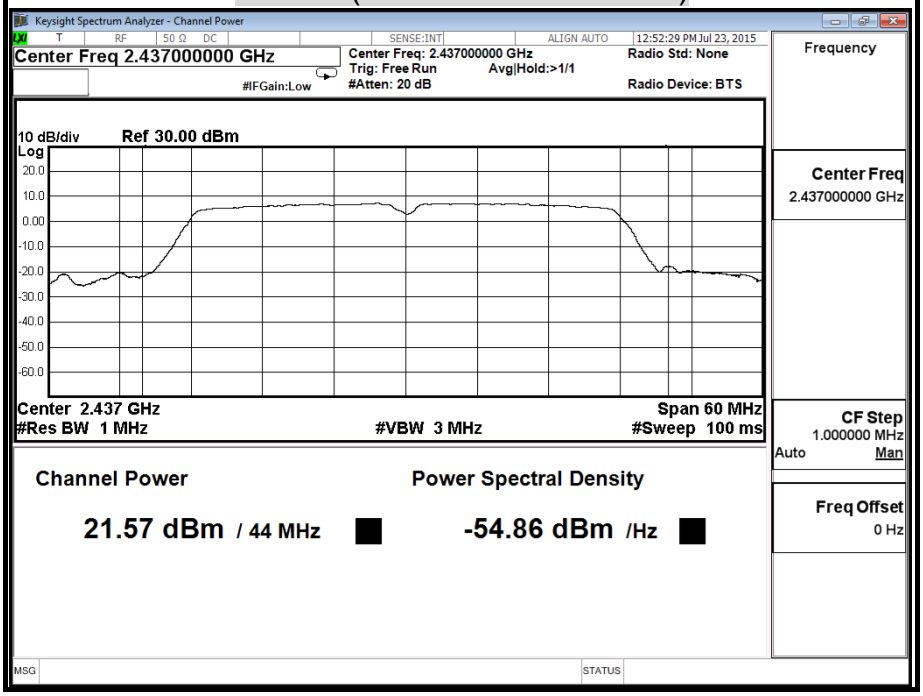


MAXIMUM PEAK OUTPUT POWER (802.11n HT40 MODE)

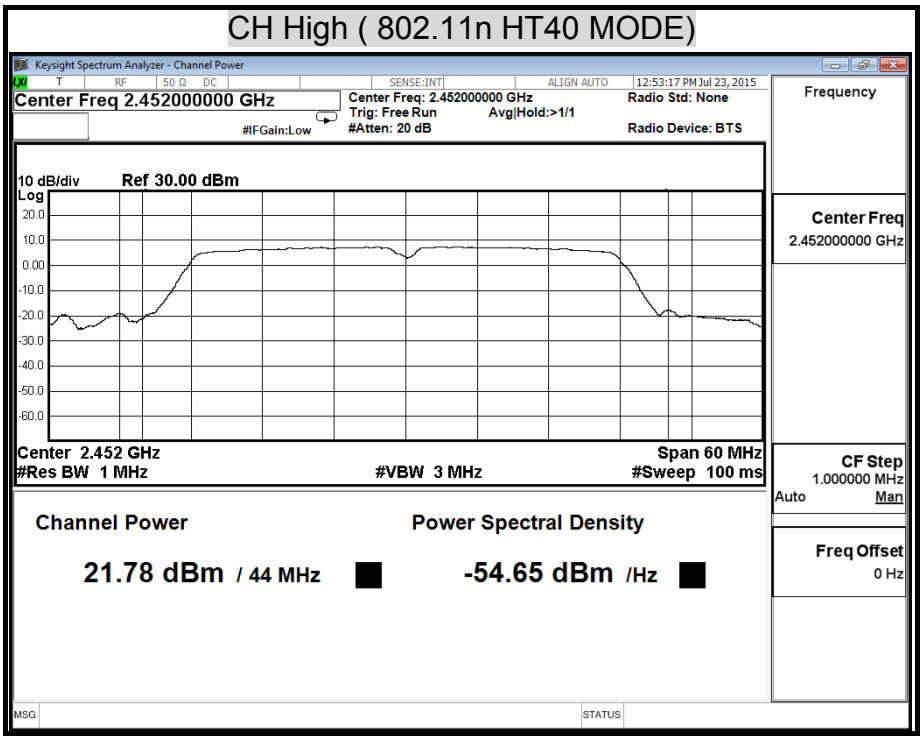
CH Low (802.11n HT40 MODE)



CH Mid (802.11n HT40 MODE)



CH High (802.11n HT40 MODE)



8.3 DUTY CYCLE

LIMIT

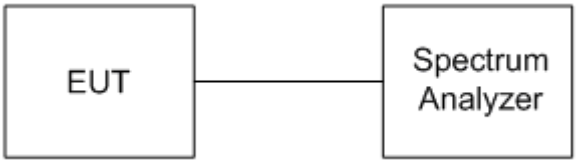
Nil (No dedicated limit specified in the Rules)

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	JAN. 23, 2016

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

TEST RESULTS

No non-compliance noted.

TEST DATA

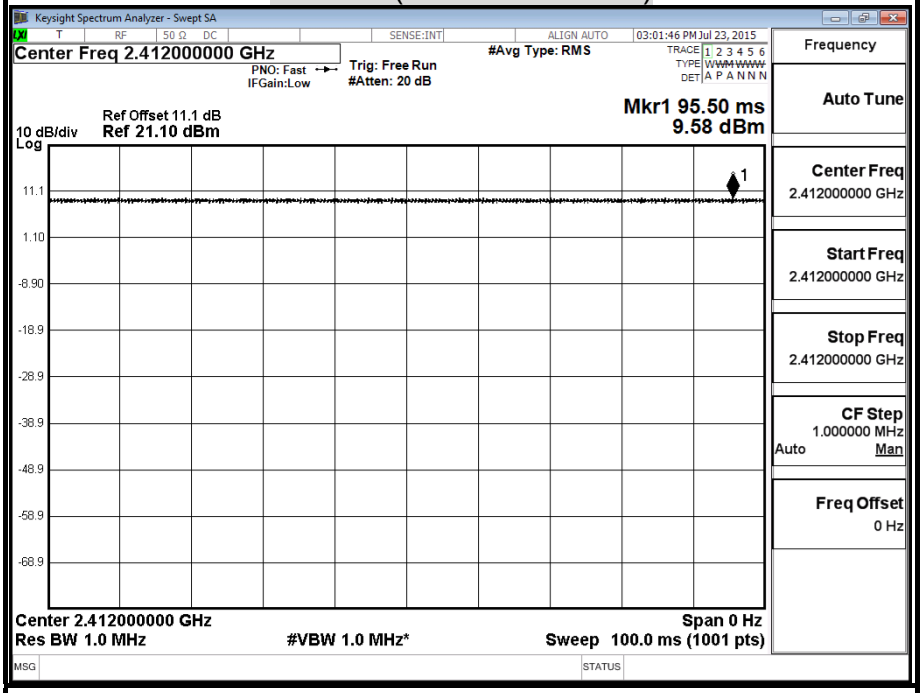
	us	Times	Ton	Total Ton time(ms)
Ton1	100000.000	1	100000.000	100.000
Ton2		0	0.000	
Ton3		0	0.000	
Tp				100.000

Ton	100.000		
Tp(Ton+Toff)	100.000		
Duty Cycle	1.000	100	%
Duty Factor	0.000		

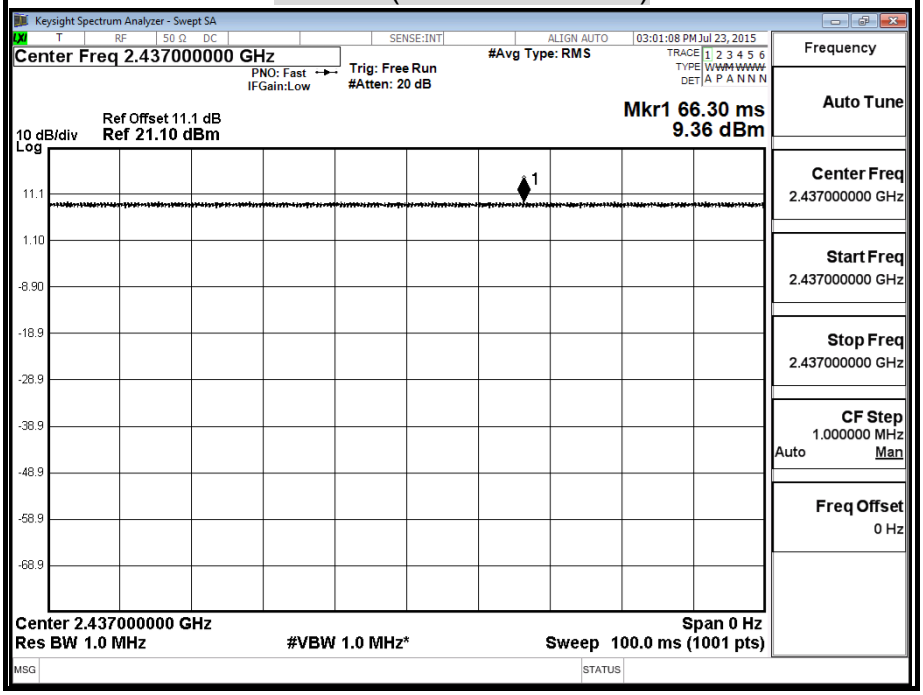
TEST PLOT

Duty Cycle (IEEE 802.11b MODE)

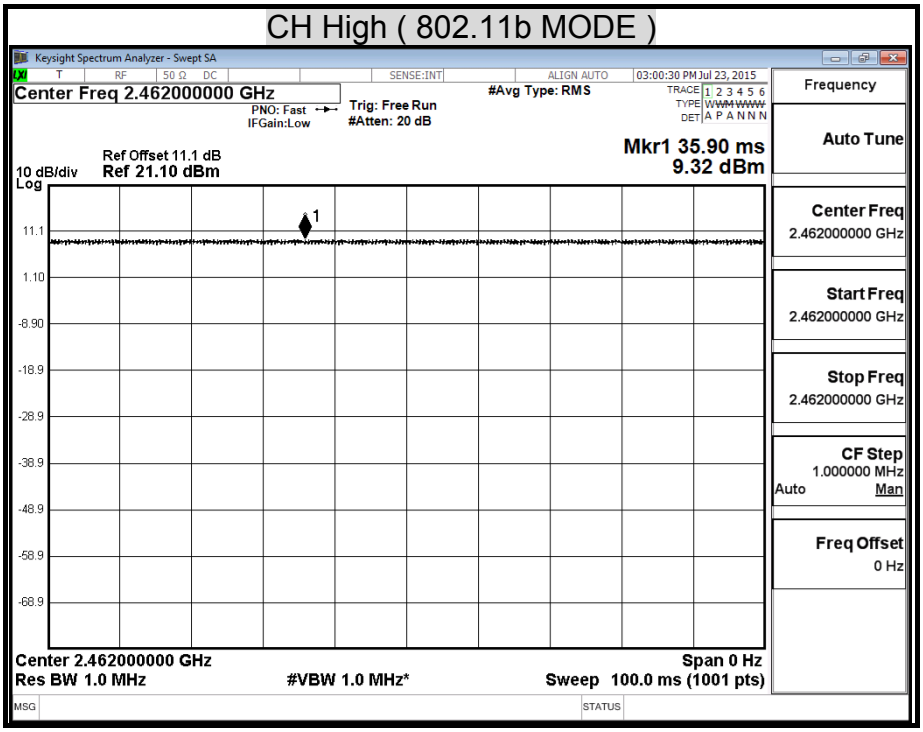
CH Low (802.11b MODE)



CH Mid (802.11b MODE)

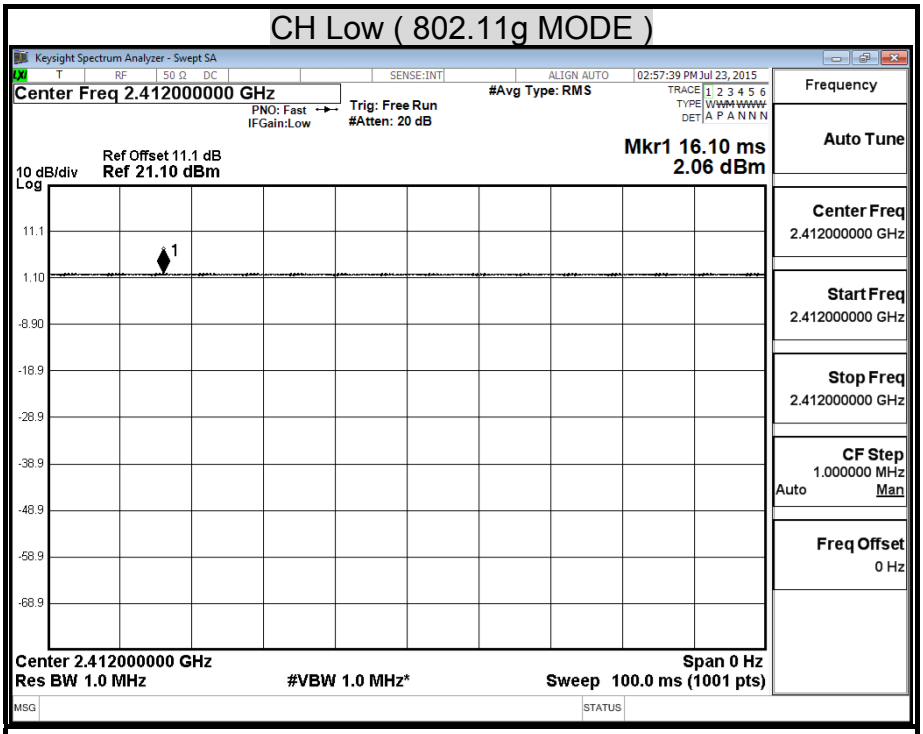


CH High (802.11b MODE)

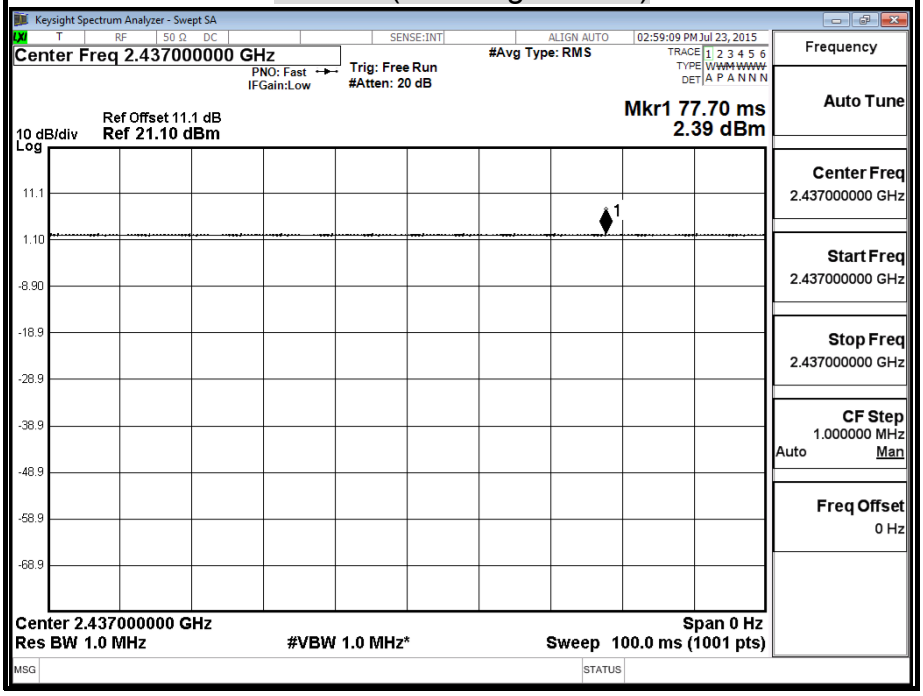


Duty Cycle (IEEE 802.11g MODE)

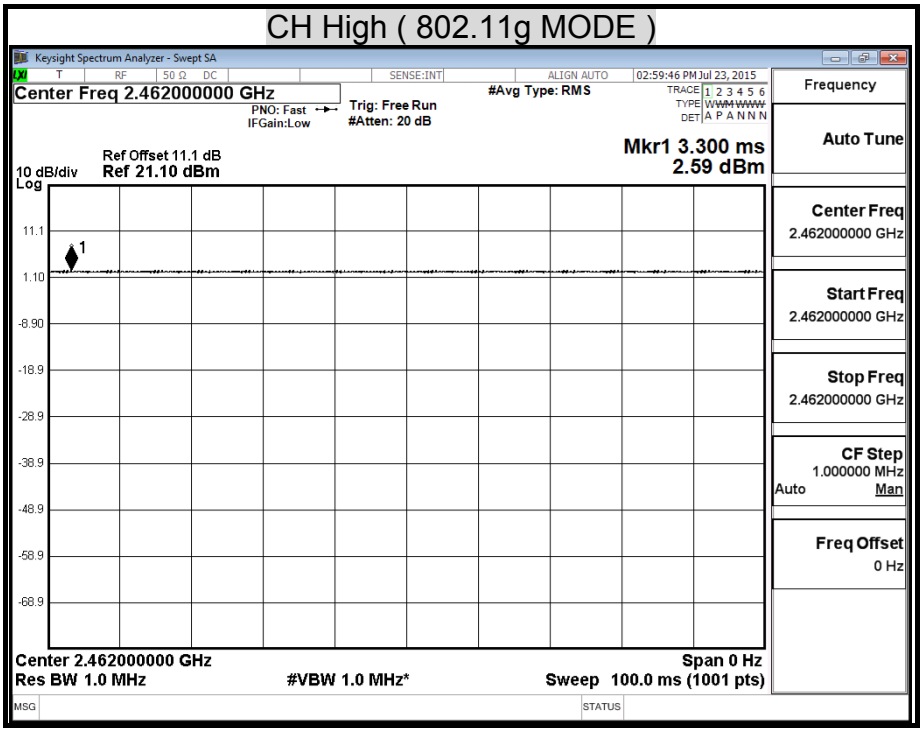
CH Low (802.11g MODE)



CH Mid (802.11g MODE)

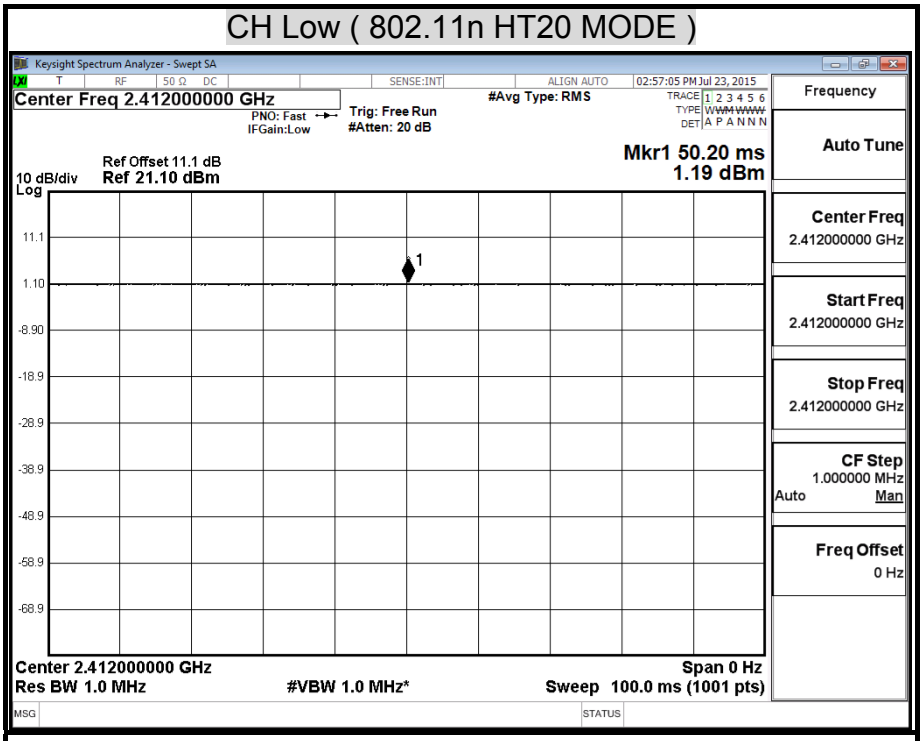


CH High (802.11g MODE)

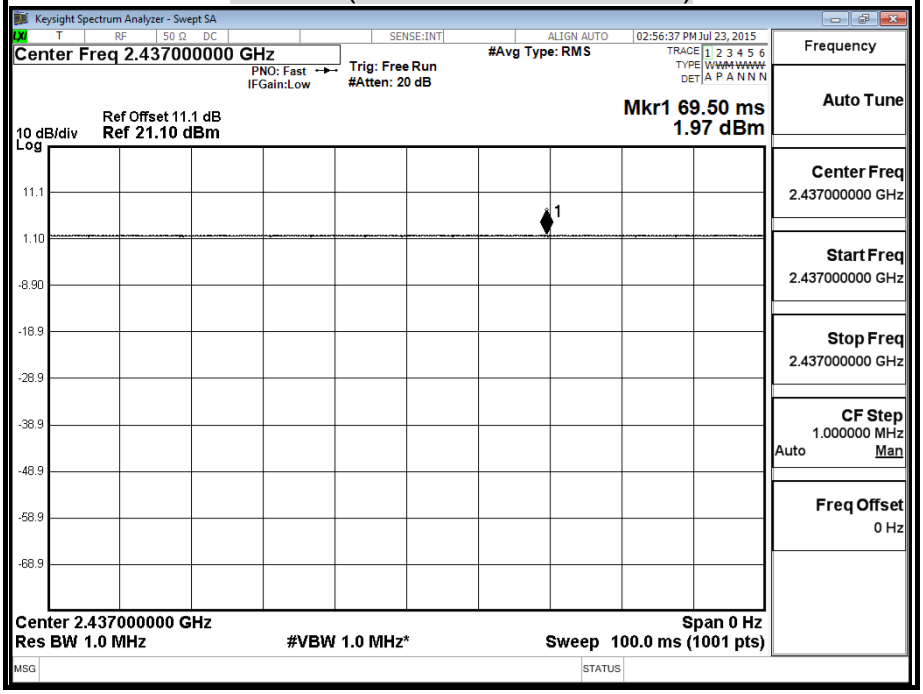


Duty Cycle (802.11n HT20 MODE)

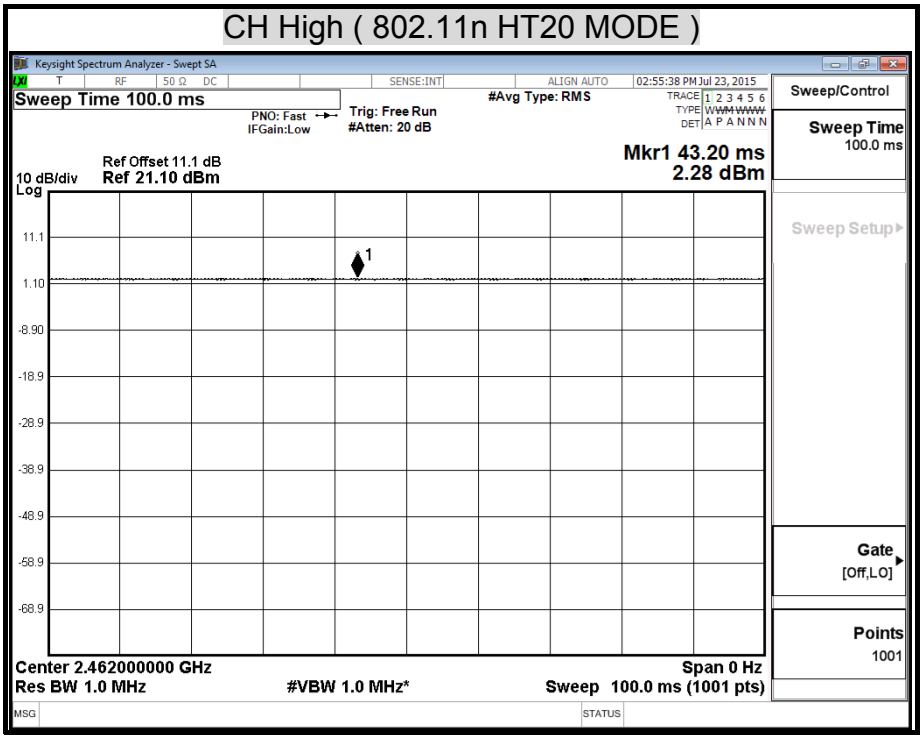
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

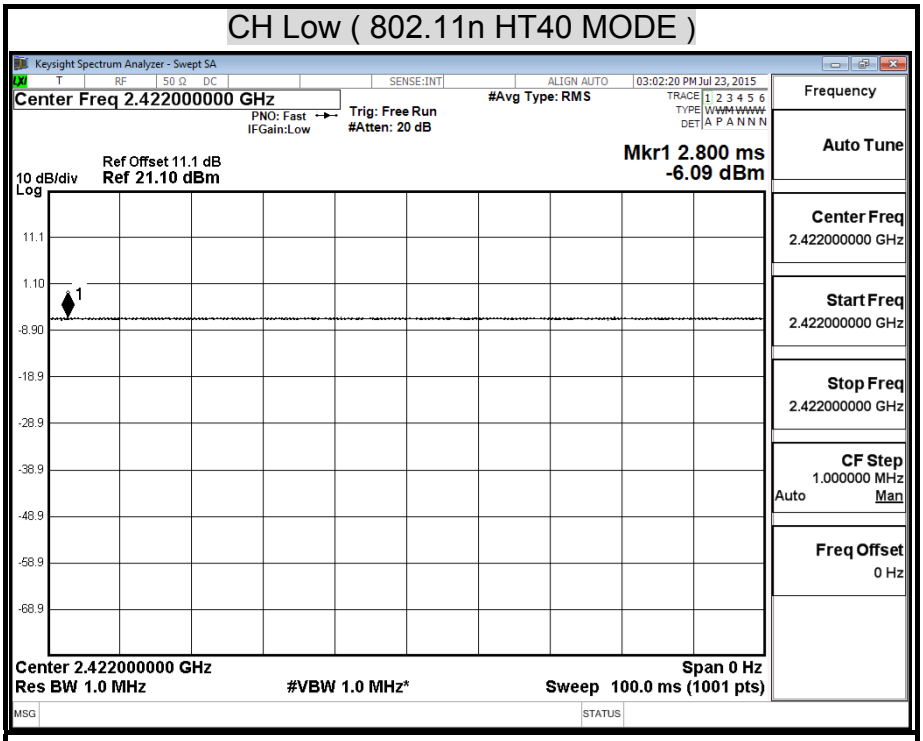


CH High (802.11n HT20 MODE)

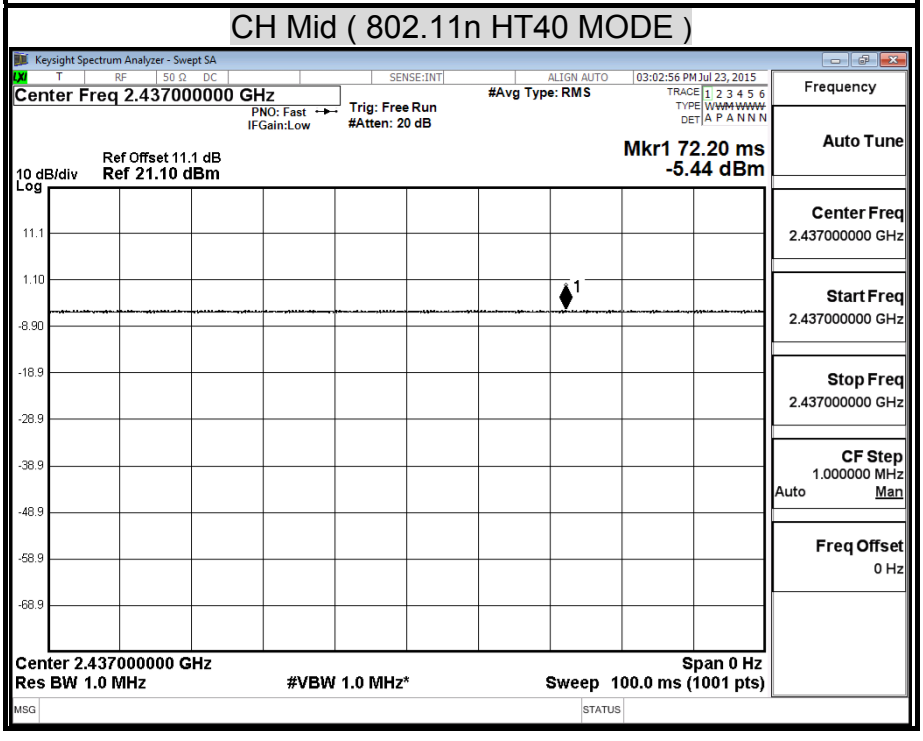


Duty Cycle (802.11n HT40 MODE)

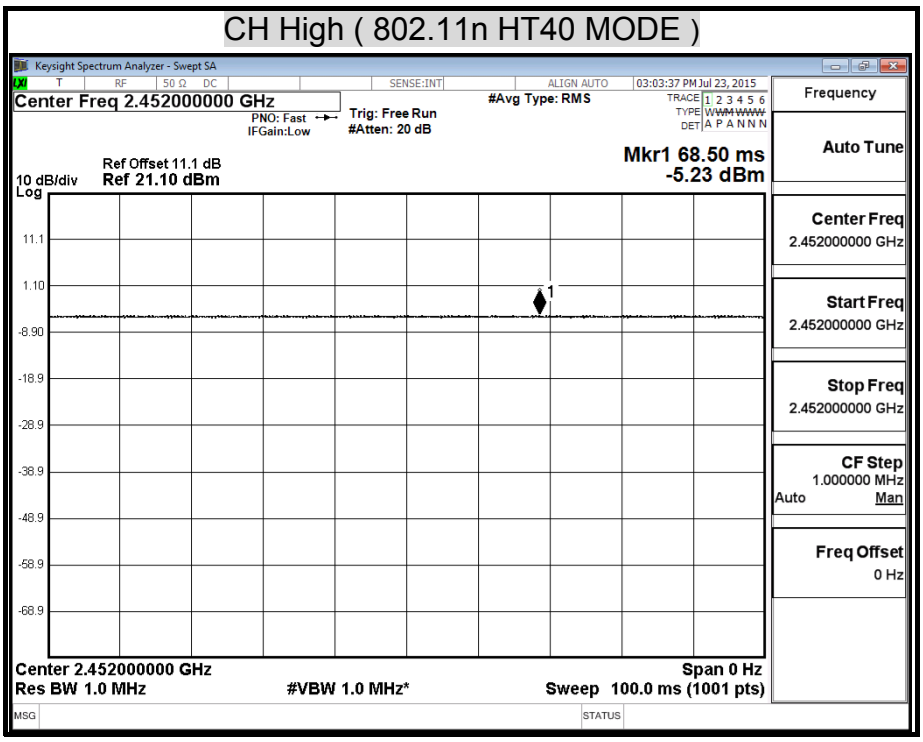
CH Low (802.11n HT40 MODE)



CH Mid (802.11n HT40 MODE)



CH High (802.11n HT40 MODE)



8.4 POWER SPECTRAL DENSITY

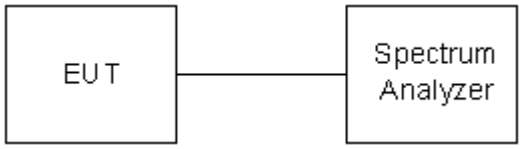
LIMIT

§ 15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	JAN. 23, 2016

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 5.3.1.

5.3.1 Measurement Procedure PKPSD:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST RESULTS

IEEE 802.11b mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-4.55	8.00	-12.55	PASS
Middle	2437	-9.51	8.00	-17.51	PASS
High	2462	-10.28	8.00	-18.28	PASS

NOTE : 1. At finial test to get the worst-case emission at 1long Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	0.22	8.00	-7.78	PASS
Middle	2437	0.60	8.00	-7.41	PASS
High	2462	0.69	8.00	-7.31	PASS

NOTE : 1. At finial test to get the worst-case emission at 6Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	PPSD Chain0 (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	0.19	8.00	-7.81	PASS
Middle	2437	0.95	8.00	-7.05	PASS
High	2462	1.21	8.00	-6.79	PASS

NOTE : 1. At finial test to get the worst-case emission at 13Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

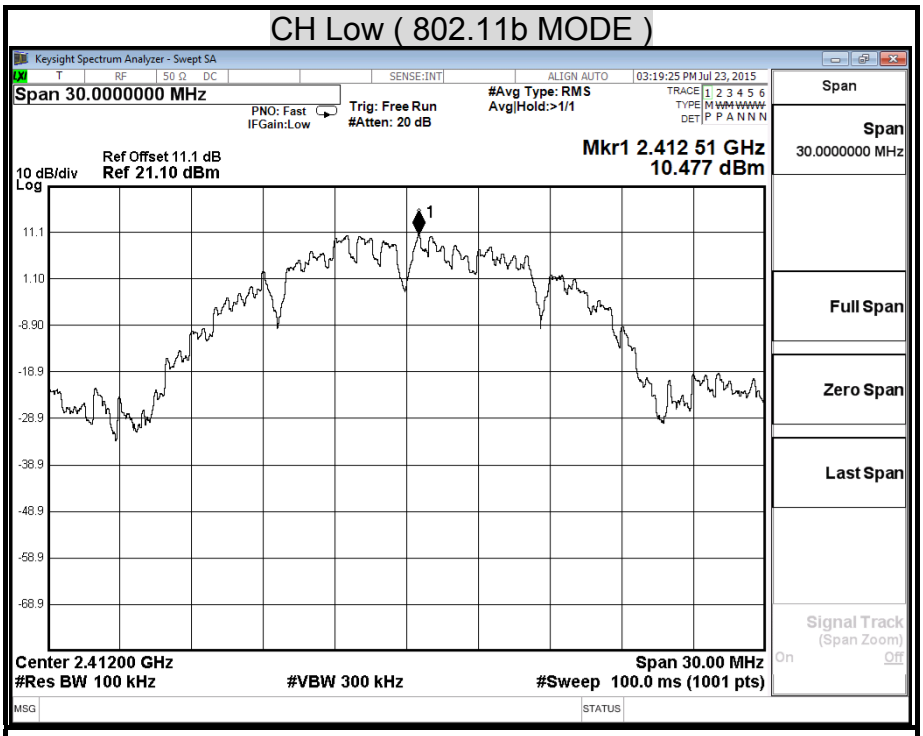
IEEE 802.11n HT40 mode

Channel	Frequency (MHz)	PPSD Chain0 (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2422	-3.63	8.00	-11.63	PASS
Middle	2437	-3.36	8.00	-11.36	PASS
High	2452	-2.89	8.00	-10.89	PASS

NOTE : 1. At finial test to get the worst-case emission at 27Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

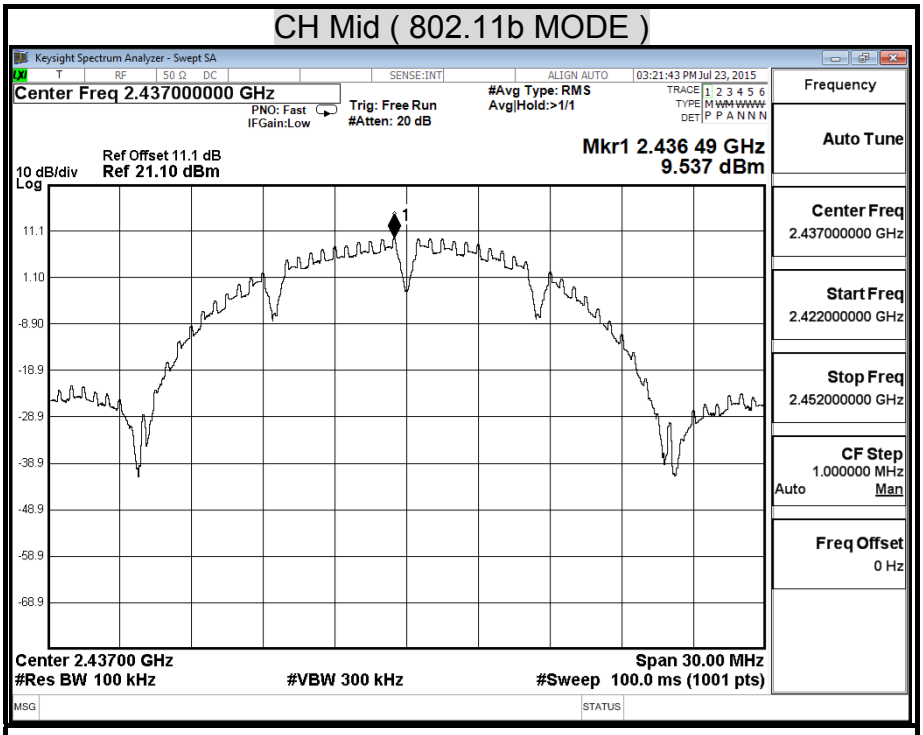
POWER SPECTRAL DENSITY (IEEE 802.11b MODE)

CH Low (802.11b MODE)

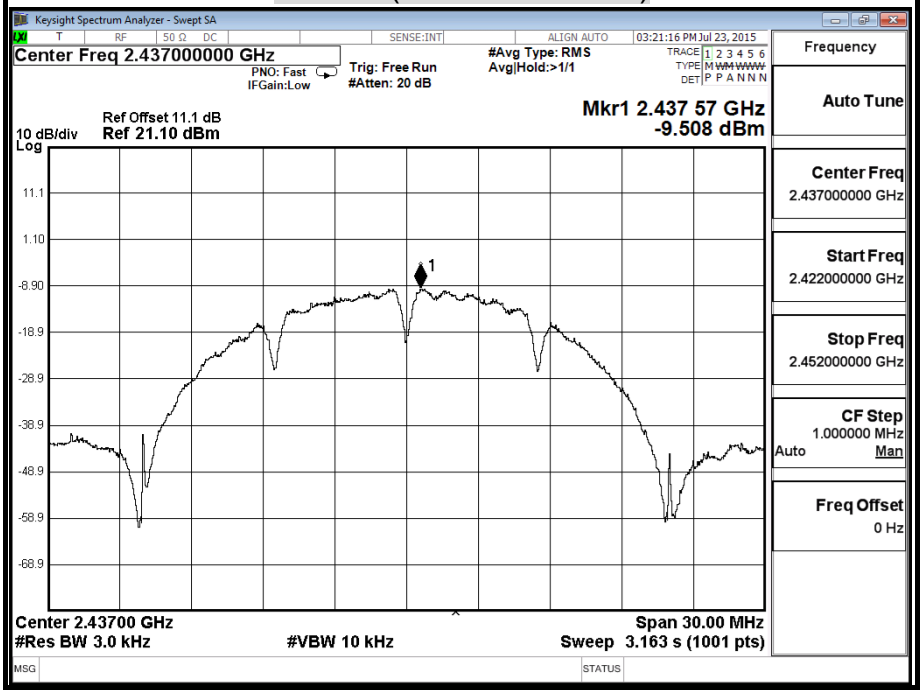


CH Low (802.11b MODE)

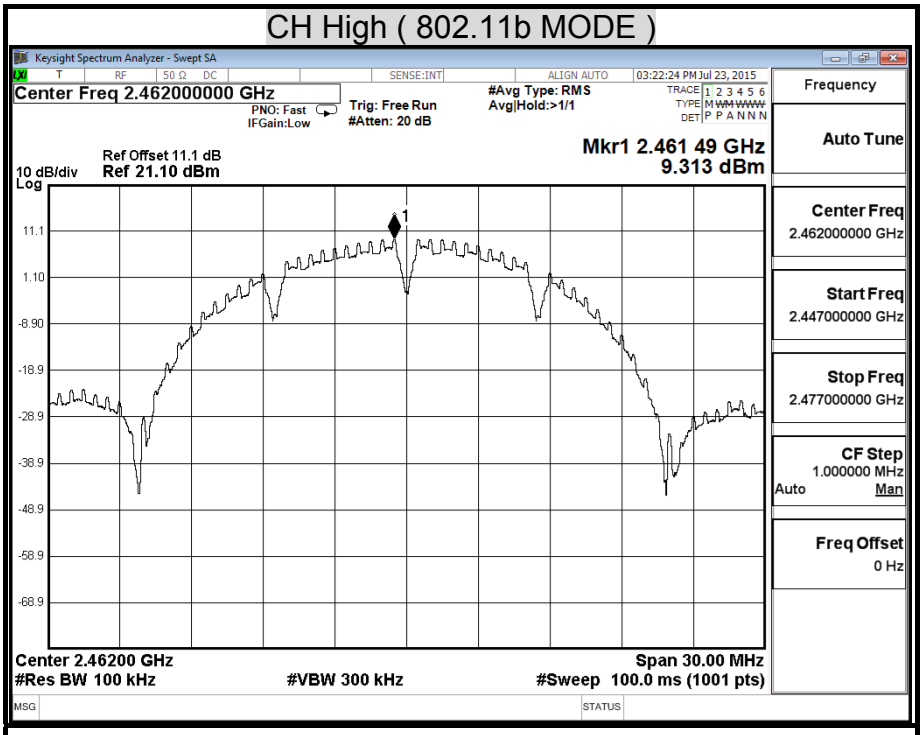
CH Mid (802.11b MODE)



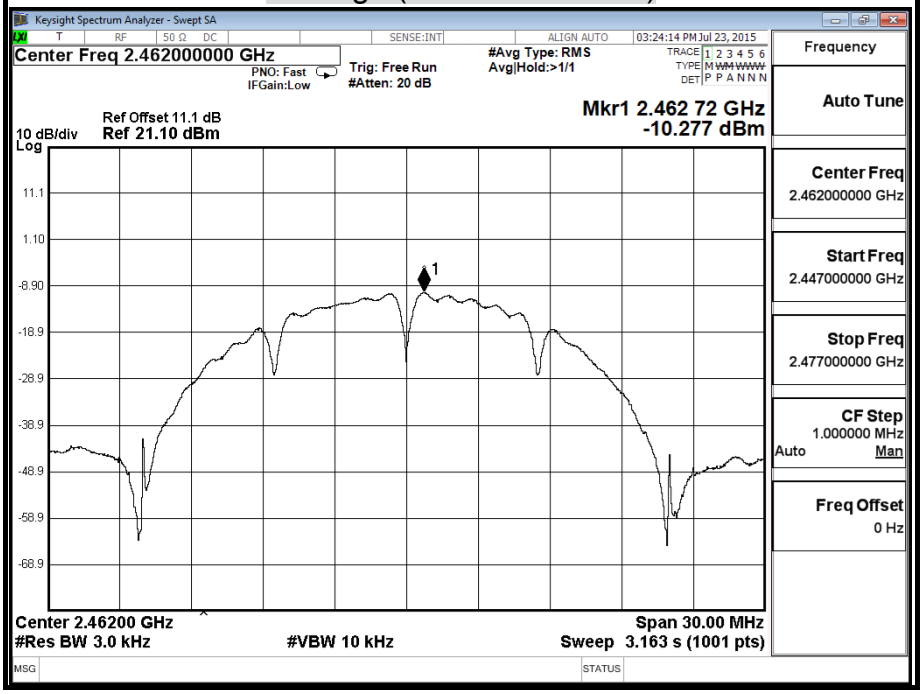
CH Mid (802.11b MODE)



CH High (802.11b MODE)

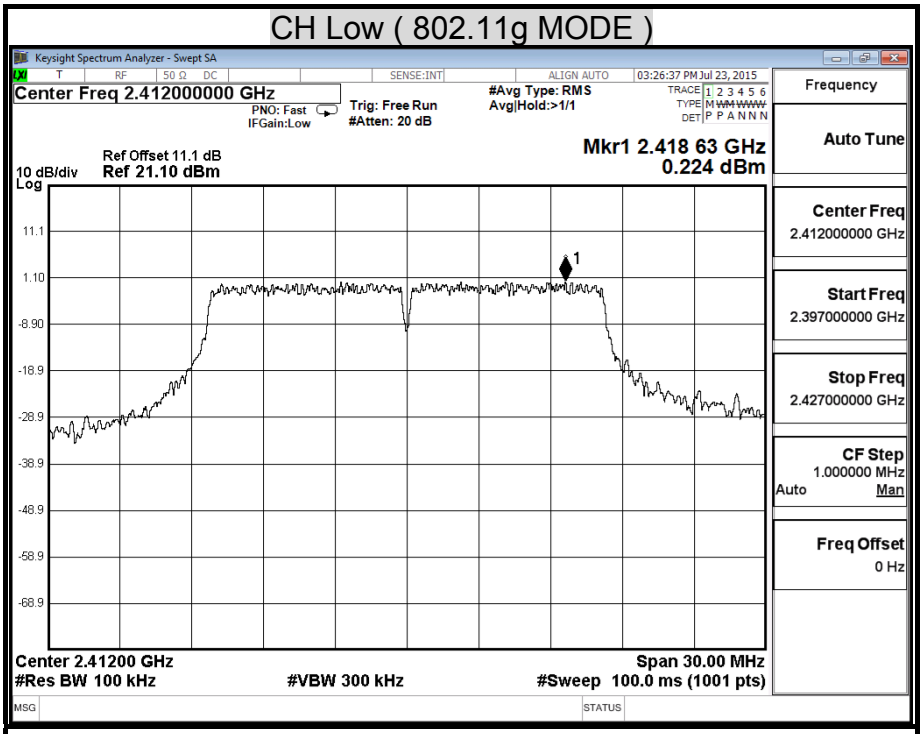


CH High (802.11b MODE)

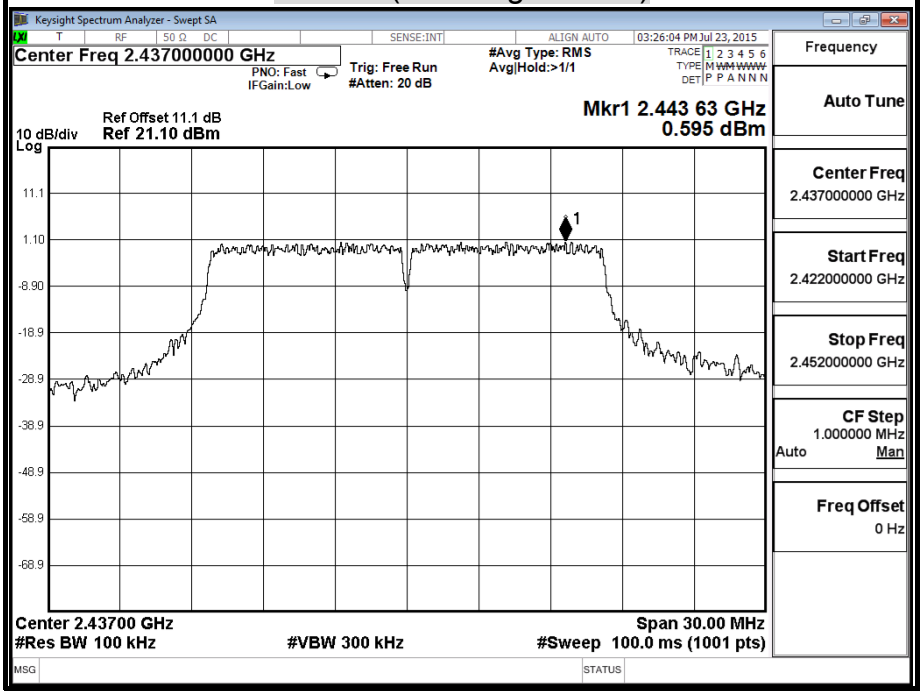


POWER SPECTRAL DENSITY (IEEE 802.11g MODE)

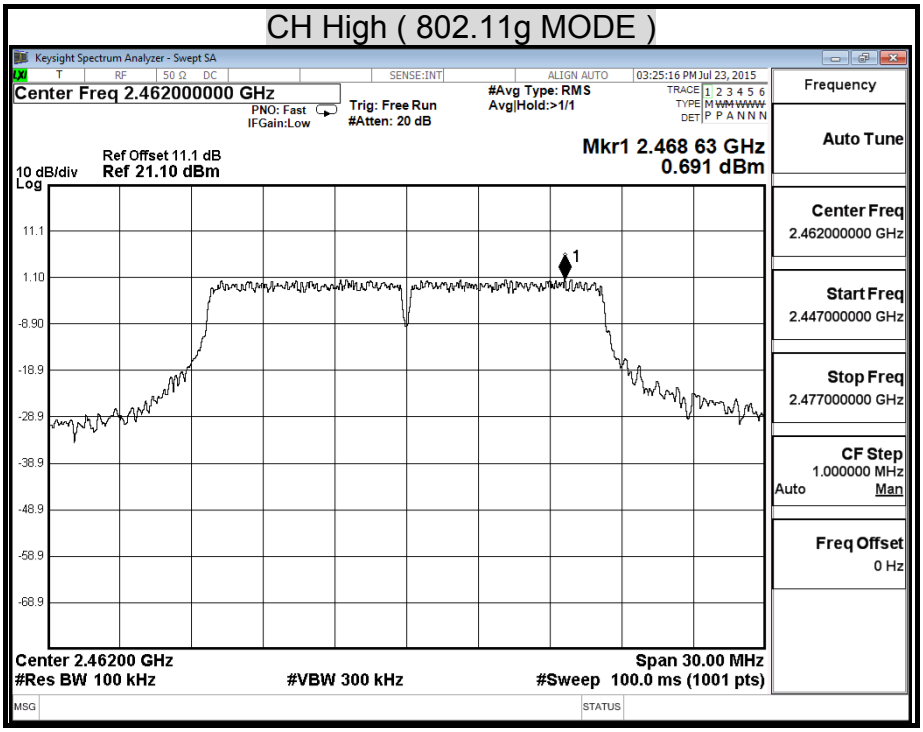
CH Low (802.11g MODE)



CH Mid (802.11g MODE)

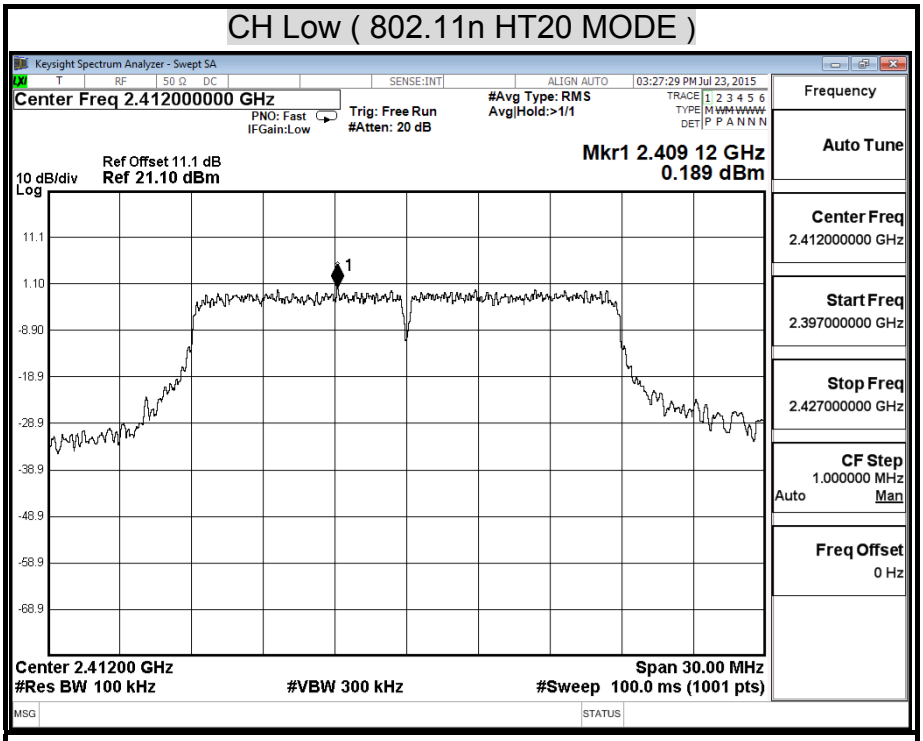


CH High (802.11g MODE)

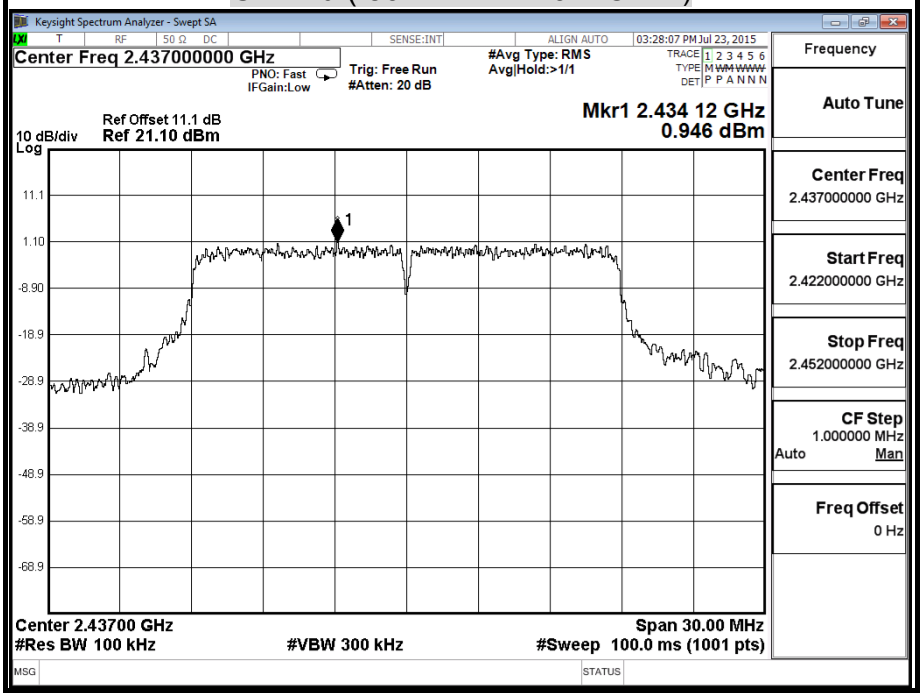


POWER SPECTRAL DENSITY (802.11n HT20 MODE)

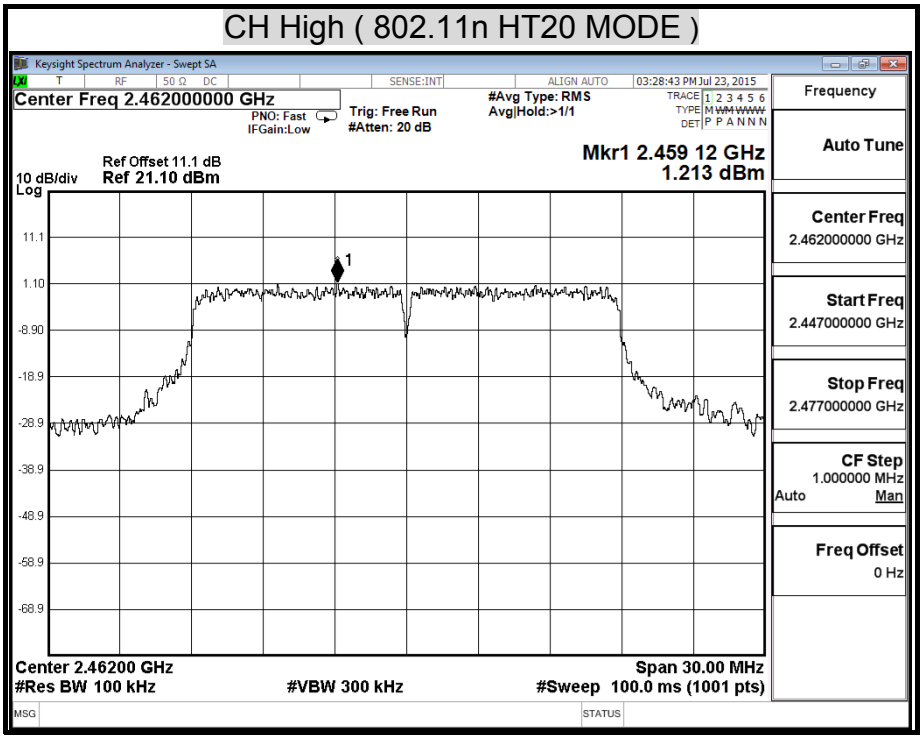
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

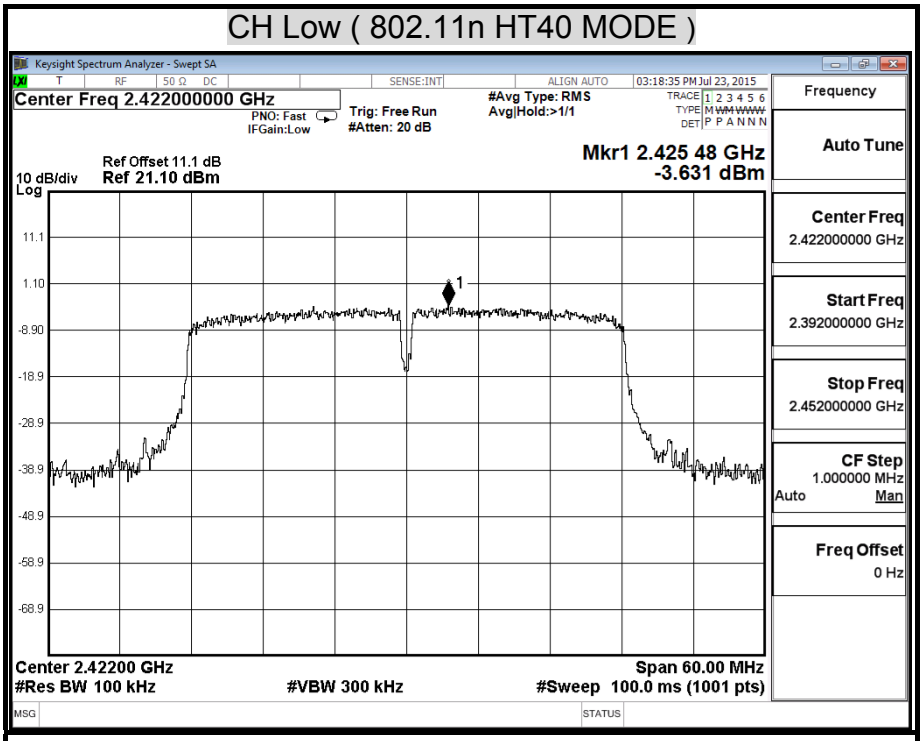


CH High (802.11n HT20 MODE)

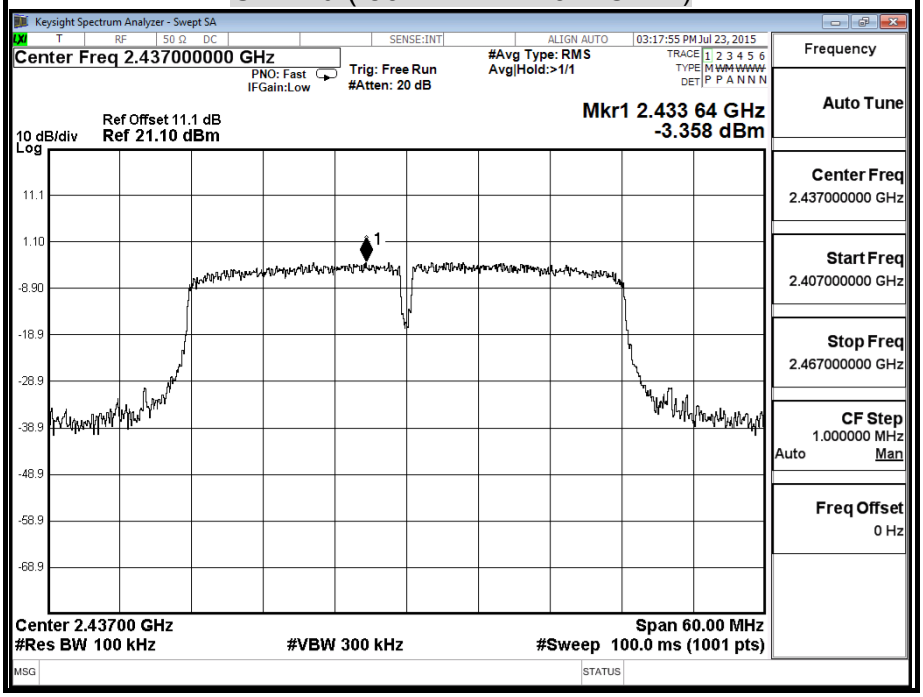


POWER SPECTRAL DENSITY (802.11n HT40 MODE)

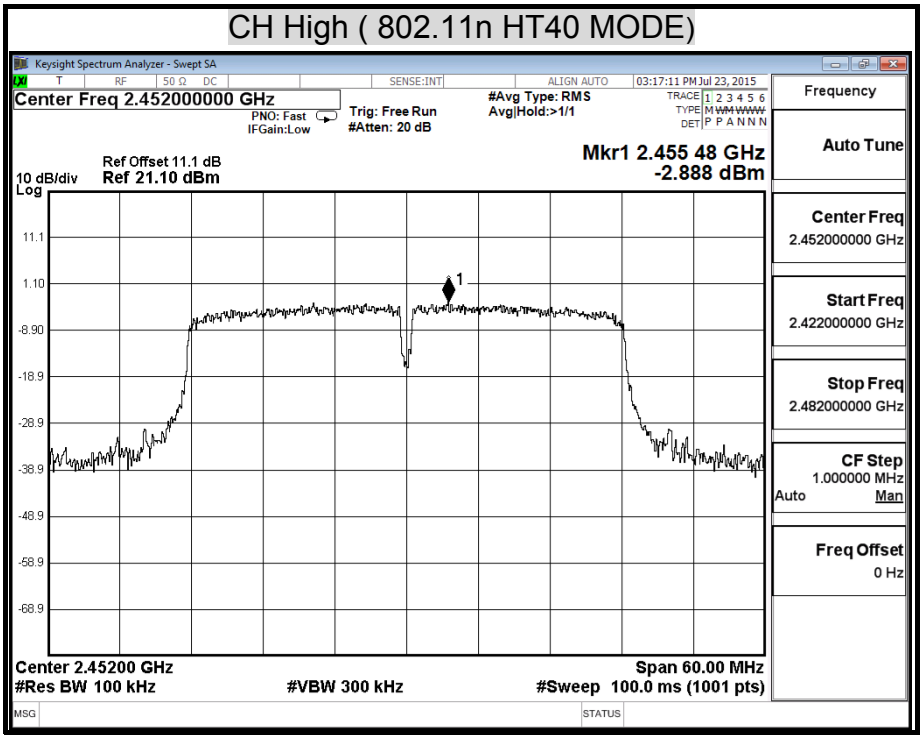
CH Low (802.11n HT40 MODE)



CH Mid (802.11n HT40 MODE)



CH High (802.11n HT40 MODE)



8.5 CONDUCTED SPURIOUS EMISSION

LIMITS

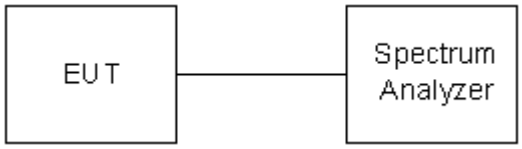
§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the and that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	JAN. 23, 2016

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

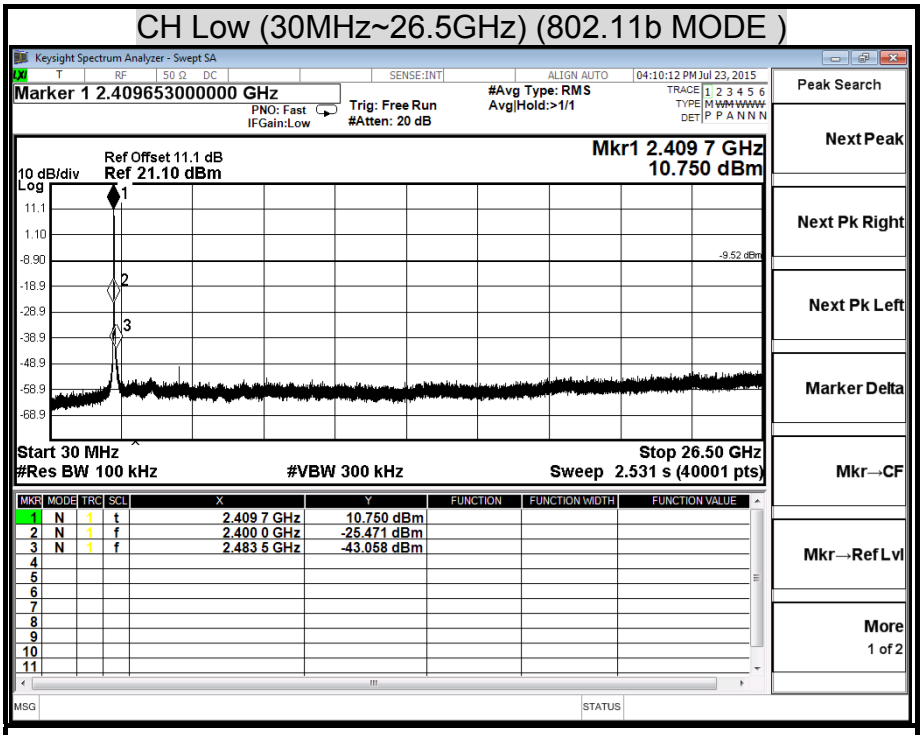
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

TEST RESULTS

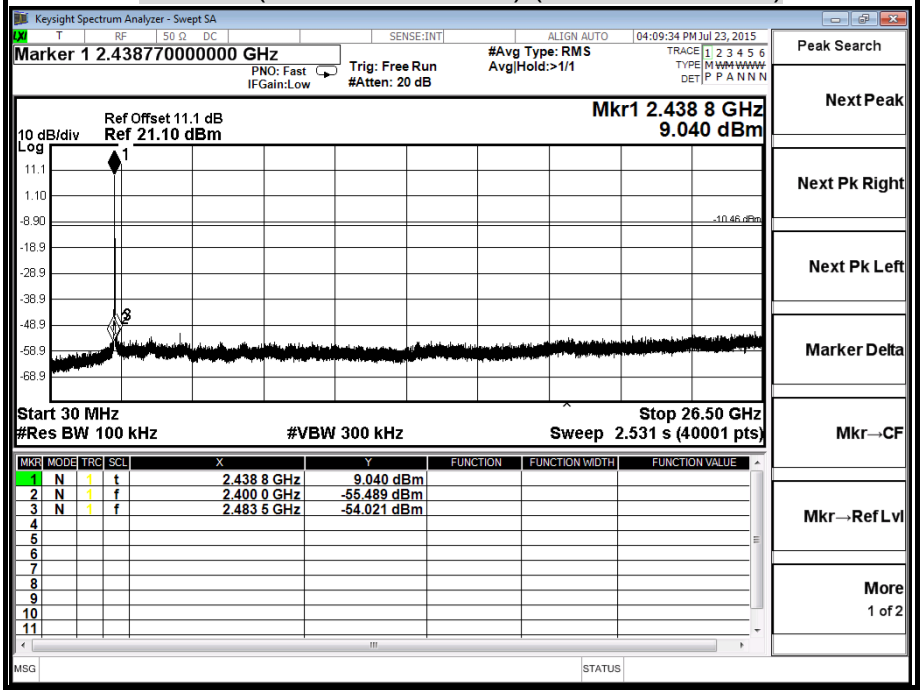
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

(IEEE 802.11b MODE)

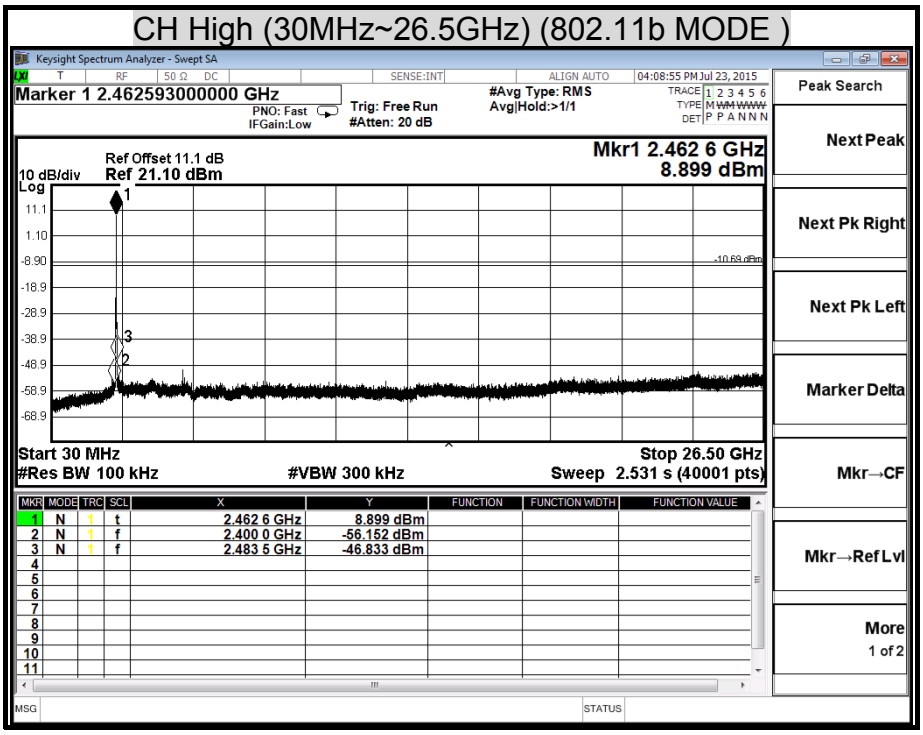
CH Low (30MHz~26.5GHz) (802.11b MODE)



CH Mid (30MHz~26.5GHz) (802.11b MODE)



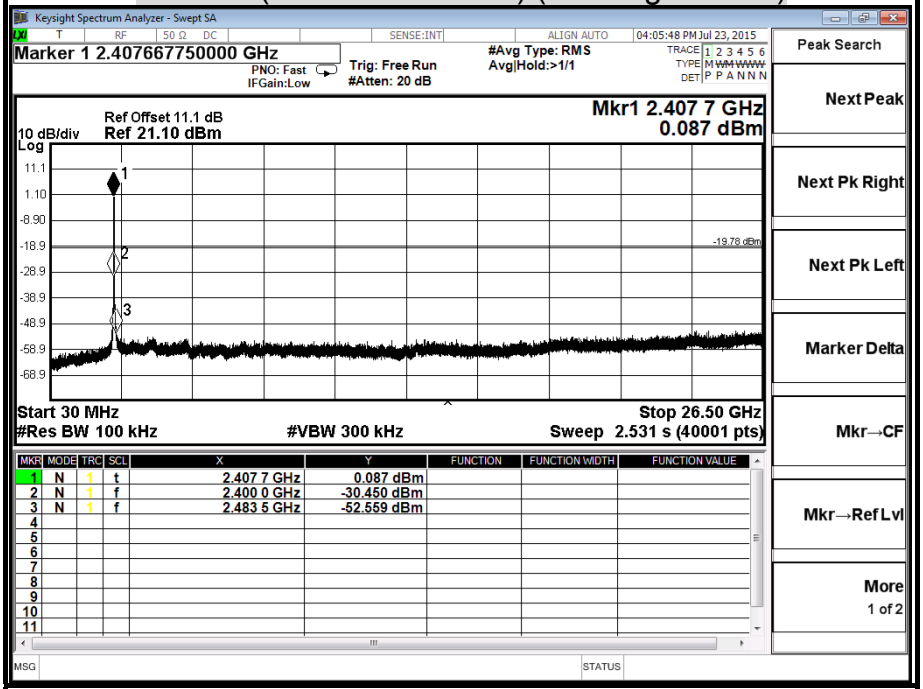
CH High (30MHz~26.5GHz) (802.11b MODE)



OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

(802.11g MODE)

CH Low (30MHz~26.5GHz) (802.11g MODE)



CH Mid (30MHz~26.5GHz) (802.11g MODE)