FCC 47 CFR PART 15 SUBPART C AND ANSI C63.10:2013 TEST REPORT

For

Moca AP cable Modem

Model: CGNVM-3589

Data Applies To : CGNVM-3580,CGNVM-3582

Issued for

Hitron Technologies,Inc.

No. 1-8,Lihsin 1st Rd.,HsinChu Science Park,HisnChu,Taiwan 300,R.O.C.

Issued by

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	06/21/2016	Initial Issue	All Page 154	Michelle Chiu
01	06/29/2016	Revised	P. 46,P.48-49	Michelle Chiu

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1. TEST REPORT CERTIFICATION

Applicant	:	Hitron Technologies,Inc.
Address	:	No. 1-8,Lihsin 1st Rd.,HsinChu Science Park,HisnChu,Taiwan 300,R.O.C.
Equipment Under Test	:	Moca AP cable Modem
Model	:	CGNVM-3589
Data Applies To	:	CGNVM-3580,CGNVM-3582
Tested Date	:	March 24 ~ May 09, 2016

APPLICABLE STANDARD	
Standard	**Test Result**
FCC Part 15 Subpart C AND ANSI C63.10:2013	PASS

WE HEREBY CERTIFY THAT: The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Sb. Lu
Sr. Engineer

Reviewed by:

Gundam Lin
Sr. Engineer

2. EUT DESCRIPTION

Product Name	Moca AP cable Modem
Model Number	CGNVM-3589
Data Applies To	CGNVM-3580,CGNVM-3582
Identify Number	T160324S01
Received Date	March 24, 2016
Frequency Range	IEEE 802.11b/g, 802.11gn HT20 Mode: 2412MHz ~ 2462MHz IEEE 802.11gn HT40 Mode: 2422MHz ~ 2452MHz
Transmit Power	IEEE 802.11b Mode: 24.68 dBm (0.2938 W) IEEE 802.11g Mode: 29.55 dBm (0.9016 W) IEEE 802.11gn HT20 Mode: 29.87 dBm (0.9705 W) IEEE 802.11gn HT40 Mode: 29.70 dBm (0.9333 W)
Channel Spacing	5MHz
Channel Number	IEEE 802.11b/g, 802.11gn HT20 Mode: 11 Channels IEEE 802.11gn HT40 Mode: 7 Channels
Transmit Data Rate	IEEE 802.11b Mode: up to 11 Mbps IEEE 802.11g Mode: up to 54 Mbps IEEE 802.11gn HT20 Mode (800ns GI): up to 195.00 Mbps IEEE 802.11gn HT20 Mode (400ns GI): up to 216.60 Mbps IEEE 802.11gn HT40 Mode (800ns GI): up to 390.00 Mbps IEEE 802.11gn HT40 Mode (400ns GI): up to 450.00 Mbps
Type of Modulation	IEEE 802.11b Mode: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g Mode: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11gn HT20/40 Mode: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Type	PIFA Antenna × 3 , Ant. 1 (Chain 0), Antenna Gain: 5.2 dBi Ant. 2 (Chain 1), Antenna Gain: 3.9 dBi Ant. 3 (Chain 2), Antenna Gain: 3.8 dBi
Power Rating	100 - 120Vac, 0.5A, 50-60Hz 11.1Vdc, 5Ah, 55Wh (For Battery)
Test Voltage	120Vac, 60Hz
AC Power Cable Type	Non-shielded, 1.8m × 1 (Detachable)
I/O Port	RJ-45 Port × 4, RJ-11 Port × 2, USB Port × 2, Coaxial Port × 1, Power Port × 1
Signal Cable	Non-shielded RJ-45 cable, 1.5m × 1 (Detachable)

The difference of the series model

Model Number	Difference				
	MoCA	USB	Voice	Enclosure	Battery
CGNVM-3589	V	V	V	Long	V
CGNVM-3582	V	V	X	Short	X
CGNVM-3580	X	V	X	Short	X
Note： "V" means all the same and "X" means the difference.					

Remark:

1. *The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
2. *For more details, please refer to the User's manual of the EUT.*
3. *This submittal(s) (test report) is intended for FCC ID: U4P-CGNVM358 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*
4. *The model CGNVM-3589 was considered the main model for testing.*

3. DESCRIPTION OF TEST MODES

The EUT (Moca AP cable Modem) had been tested under operating condition.

IEEE 802.11b/g, 802.11gn HT20/HT40 Mode: 3TX / 3RX

Ant. 1 / Chain 0 & Ant. 2 / Chain 1 & Ant. 3 / Chain 2 transmit/receive.

Conducted Emission / Radiated Emission Test (Below 1 GHz)

1. The following test modes were scanned during the preliminary test:

No.	Pre-Test mode
1	TX Mode
2	Normal Operating Mode (Full Function)

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

Final Test mode		
Emission	Radiated Emission	Mode 2
	Conducted Emission	Mode 2

Remark: *Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.*

Conducted / Radiated Emission Test (Above 1 GHz)

IEEE 802.11b/g, 802.11gn HT20 Mode:

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 data rate (worst case) was chosen for full testing.
IEEE 802.11g Mode: 6Mbps data rate (worst case) was chosen for full testing.
IEEE 802.11gn HT20 Mode: 6.5Mbps data rate (worst case) was chosen for full testing.

IEEE 802.11gn HT40 Mode:

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 802.11gn HT40 Mode: 13.5Mbps data rate (worst case) was chosen for full testing.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10:2013 and FCC CFR 47, 15.207, 15.209 and 15.247.

5. FACILITIES AND ACCREDITATION

5.1 FACILITIES

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

No.989-1, Wenshan Rd., Shangshan Village,
Qionglin Township, Hsinchu County 30741, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.10:2013 and CISPR 22. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4 and CISPR 16-1-5.

5.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies 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
Japan	VCCI
Taiwan	BSMI
USA	FCC MRA

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

Remark: *FCC Designation Number TW1027.*

5.3 MEASUREMENT UNCERTAINTY

The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4-2.

PARAMETER	UNCERTAINTY
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 30 to 1000 MHz	+/- 3.97
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 1 to 18GHz	+/- 3.58
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 18 to 26 GHz	+/- 3.59
Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 26 to 40 GHz	+/- 3.81
Conducted Emission (Mains Terminals), 9kHz to 30MHz	+/- 2.48

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
Consistent with industry standard (e.g. CISPR 22, clause 11, Measurement Uncertainty) determining compliance with the limits shall be base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.
The acceptable measurement uncertainty value without requiring revision of the compliance statement is base on conducted and radiated emissions being less than U_{CISPR} which is 3.6dB and 5.2dB respectively. CCS values (called U_{Lab} in CISPR 16-4-2) is less than U_{CISPR} as shown in the table above. Therefore, MU need not be considered for compliance.

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

No.	Product	Manufacturer	Model No.	Serial No.
1	Notebook PC	TOSHIBA	PORTEGE R30-A	1E101235H
2	Notebook PC	TOSHIBA	PORTEGE R30-A	4E087535H
3	Notebook PC	TOSHIBA	PORTEGE R30-A	7F097011H
4	Notebook PC	TOSHIBA	PORTEGE R30-A	7F097009H
5	CMTS	ARRIS	C3 CMTS DOCSIS2. OS/N 5157 5186	---
6	Telephone	Panasonic	KX-TS500MXW	4CCLL563640
7	Telephone	Panasonic	KX-TS500MXW	4CCLL563636
8	USB	Kingston	DTSE9	---
9	USB	Kingston	DTSE9	---

No.	Signal Cable Description
1	Non-shielded RJ-45 cable, 10m × 2
2	Non-shielded RJ-45 cable, 1.5m × 2
3	Shielded coaxial cable, 10m × 1
4	Non-shielded RJ-11 cable, 1m × 2

Battery :

Manufacturer	Model No.	Power Rating
GETAC TECH CORP.	HM32 3S2P Battery Pack (PoHS)	11.1Vdc, 5Ah, 55Wh

SETUP DIAGRAM FOR TESTS

EUT & peripherals setup diagram is shown in appendix setup photos.

EUT OPERATING CONDITION

1. EUT & peripherals setup diagram is shown in appendix setup photos.
2. TX Mode:
   - ⇨ **TX Data Rate:** 1Mbps Bandwidth 20 (IEEE 802.11b Mode)
     6Mbps Bandwidth 20 (IEEE 802.11g Mode)
     6.5Mbps Bandwidth 20 (IEEE 802.11gn HT20 Mode)
     13.5Mbps Bandwidth 40 (IEEE 802.11gn HT40 Mode)
   - ⇨ **Power control**
     IEEE 802.11b Mode Channel Low (2412MHz) Chain 0/1/2 Power set 17.5
     IEEE 802.11b Mode Channel Mid (2437MHz) Chain 0/1/2 Power set 18

IEEE 802.11b Mode Channel High (2462MHz) Chain 0/1/2 Power set 18.5
IEEE 802.11g Mode Channel Low (2412MHz) Chain 0/1/2 Power set 15.5
IEEE 802.11g Mode Channel Mid (2437MHz) Chain 0/1/2 Power set 16
IEEE 802.11g Mode Channel High (2462MHz) Chain 0/1/2 Power set 16.5
IEEE 802.11gn HT20 Mode Channel Low (2412MHz) Chain 0/1/2 Power set 15
IEEE 802.11gn HT20 Mode Channel Mid (2437MHz) Chain 0/1/2 Power set 15.5
IEEE 802.11gn HT20 Mode Channel High (2462MHz) Chain 0/1/2 Power set 16
IEEE 802.11gn HT40 Mode Channel Low (2422MHz) Chain 0/1/2 Power set 11.5
IEEE 802.11gn HT40 Mode Channel Mid (2437MHz) Chain 0/1/2 Power set 14
IEEE 802.11gn HT40 Mode Channel High (2452MHz) Chain 0/1/2 Power set 14

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

Normal Mode :

1. EUT & peripherals setup diagram is shown in appendix setup photos.
2. Turn on the power of all equipments.
3. EUT RJ-45 port link to Notebook PC 1(DHCP).
4. EUT RJ-45 port link to Notebook PC 2(DHCP).
5. EUT link to Notebook PC 3 with WiFi 2.4G.
6. EUT link to Notebook PC 4 with WiFi 5G.
7. EUT coaxial port link to CMTS.
8. Notebook PC 1/2/3/4 ping CMTS IP 192.168.10.254.
9. Telnet EUT 192.168.0.1 set telephone voice on.
10. All of the functions are under run
11. Start test.

7. FCC PART 15.247 REQUIREMENTS

7.1 DUTY CYCLE MEASUREMENT

Product Name	Moca AP cable Modem	Test By	Davis Tseng
Test Model	CGNVM-3589	Test Date	2016/04/12
Test Mode	TX Mode	Temp. & Humidity	25°C, 53%

Mode	TX on (ms)	TX on + off (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
IEEE 802.11b	8.196	8.244	99.42%	0.03	0.010
IEEE 802.11g	1.353	1.413	95.75%	0.19	0.739
IEEE 802.11gn HT20	1.264	1.322	95.61%	0.19	0.791
IEEE 802.11gn HT40	0.633	0.671	94.34%	0.25	1.580

7.2 6dB BANDWIDTH

LIMITS

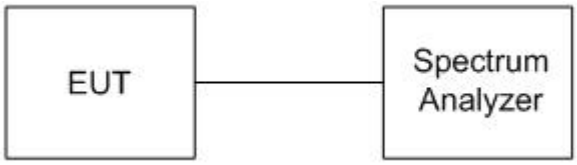
§ 15.247(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Signal Analyzer	Agilent	N9010A	MY52220817	03/15/2017
Test S/W	N/A			

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

TEST SETUP



TEST PROCEDURE

1. The transmitter output was connected to a spectrum analyzer.
2. Set RBW = 100 kHz.
3. Set the video bandwidth (VBW) ≥ 3 x RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST RESULTS

Product Name	Moca AP cable Modem	Test By	Davis Tseng
Test Model	CGNVM-3589	Test Date	2016/04/06
Test Mode	TX Mode	Temp. & Humidity	25°C, 53%

IEEE 802.11b Mode (3TX)

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (kHz)	Result
		Chain 0	Chain 1	Chain 2		
Low	2412	10.03	10.08	10.09	500	PASS
Middle	2437	10.08	10.08	9.50	500	PASS
High	2462	10.06	10.07	10.04	500	PASS

IEEE 802.11g Mode (3TX)

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (kHz)	Result
		Chain 0	Chain 1	Chain 2		
Low	2412	16.30	15.89	16.32	500	PASS
Middle	2437	16.36	16.35	16.07	500	PASS
High	2462	16.35	16.32	16.45	500	PASS

IEEE 802.11gn HT20 Mode (3TX)

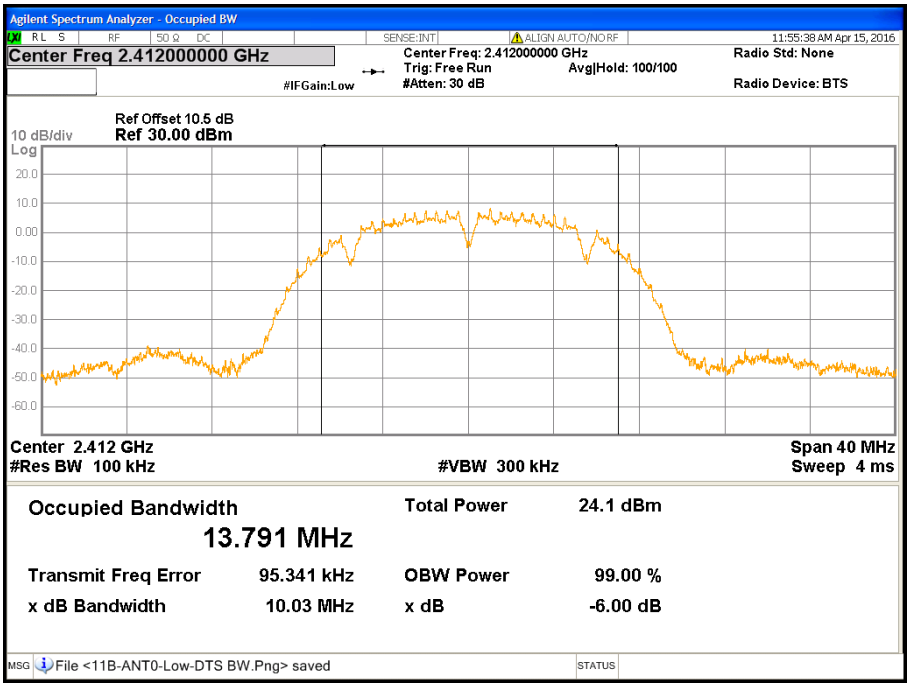
Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (kHz)	Result
		Chain 0	Chain 1	Chain 2		
Low	2412	17.26	16.62	17.27	500	PASS
Middle	2437	17.57	17.33	16.03	500	PASS
High	2462	17.31	17.58	17.59	500	PASS

IEEE 802.11gn HT40 Mode (3TX)

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (kHz)	Result
		Chain 0	Chain 1	Chain 2		
Low	2422	36.34	35.73	35.83	500	PASS
Middle	2437	36.33	33.85	35.70	500	PASS
High	2452	35.72	36.33	35.48	500	PASS

6dB BANDWIDTH

CH Low (IEEE 802.11b Mode / Chain 0)



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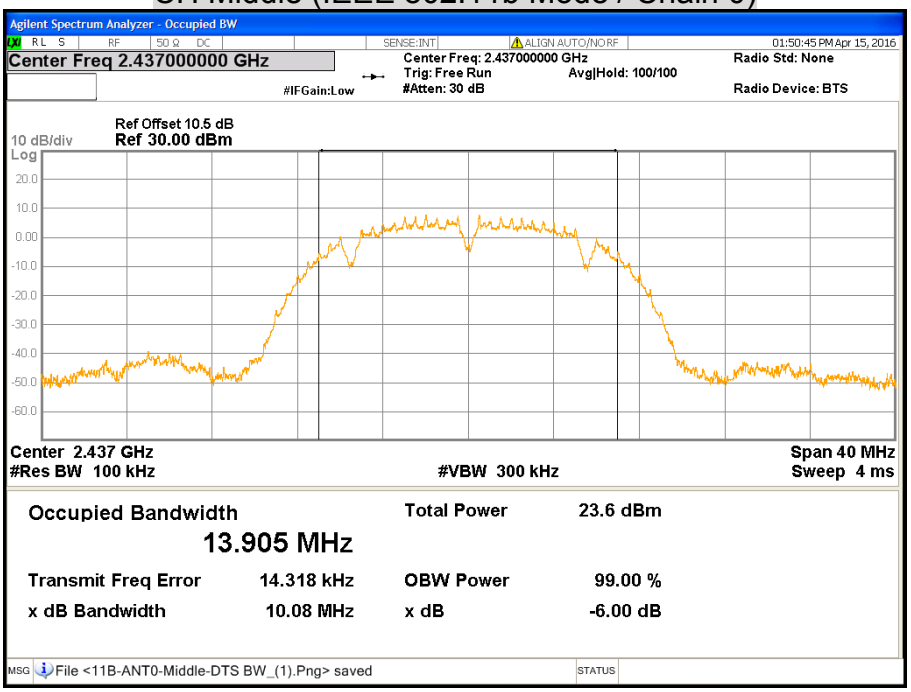

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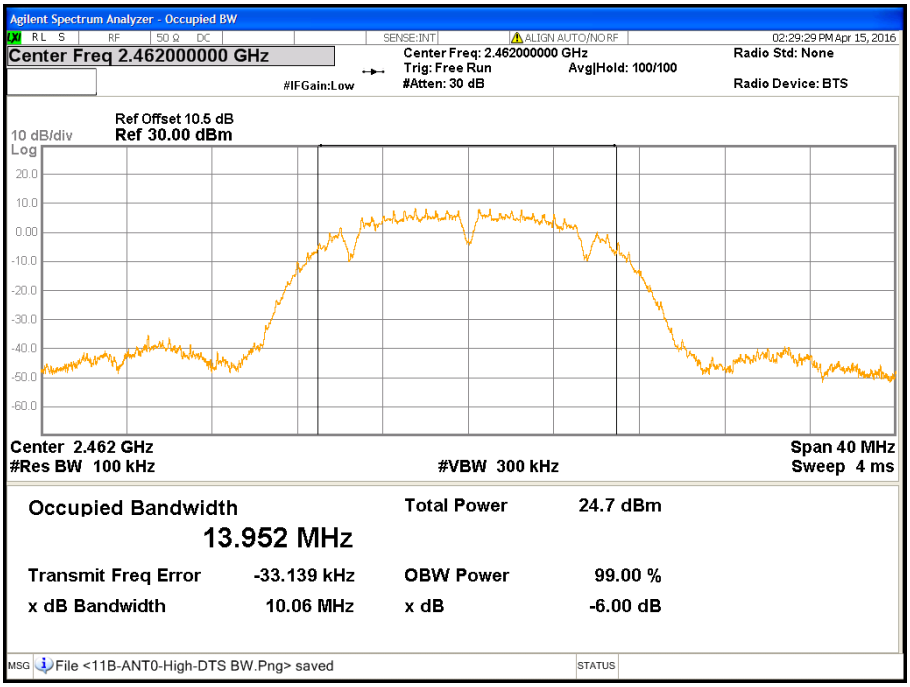

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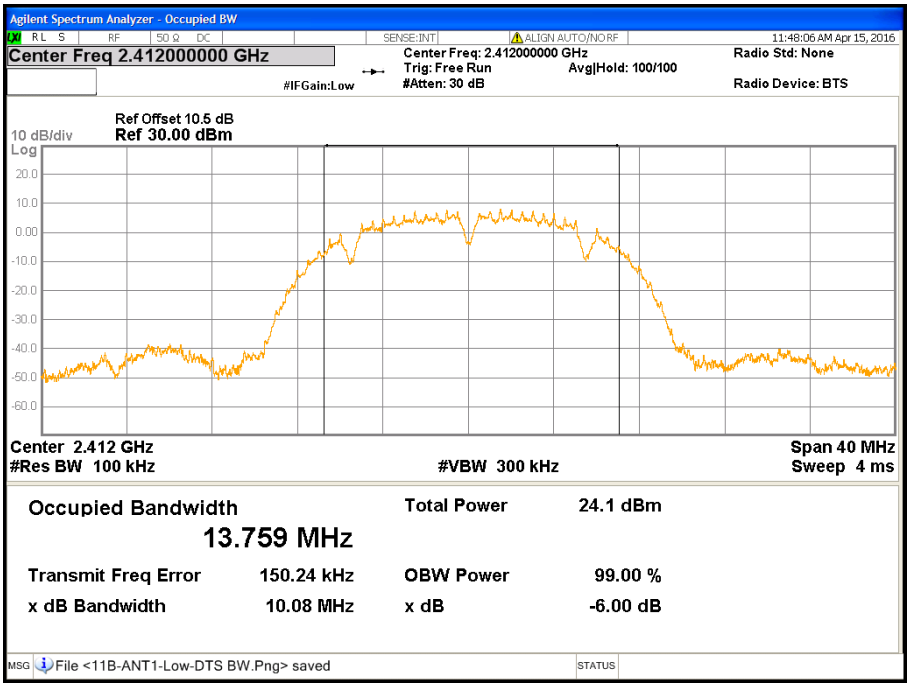

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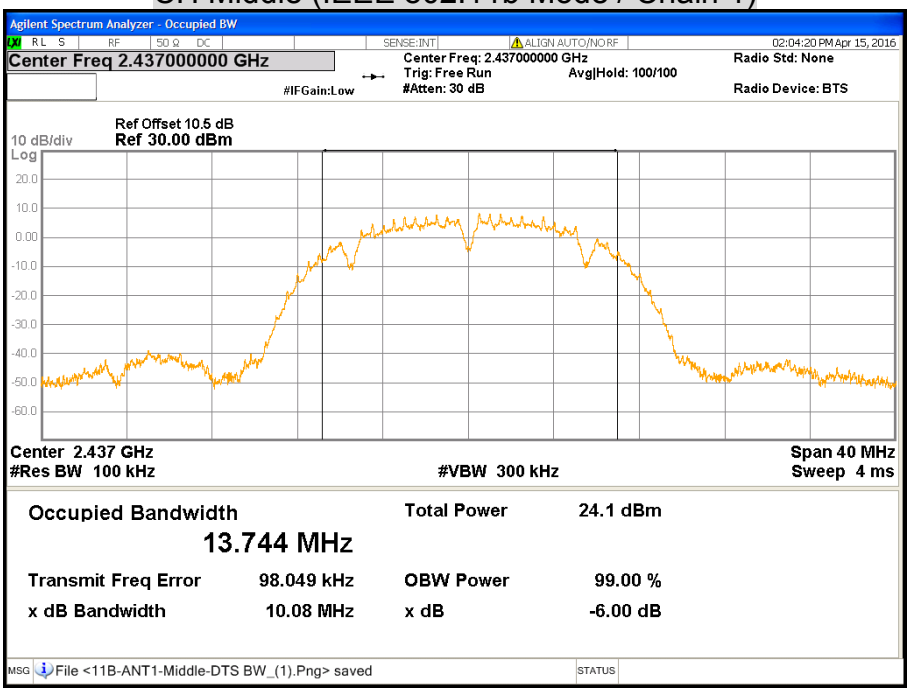

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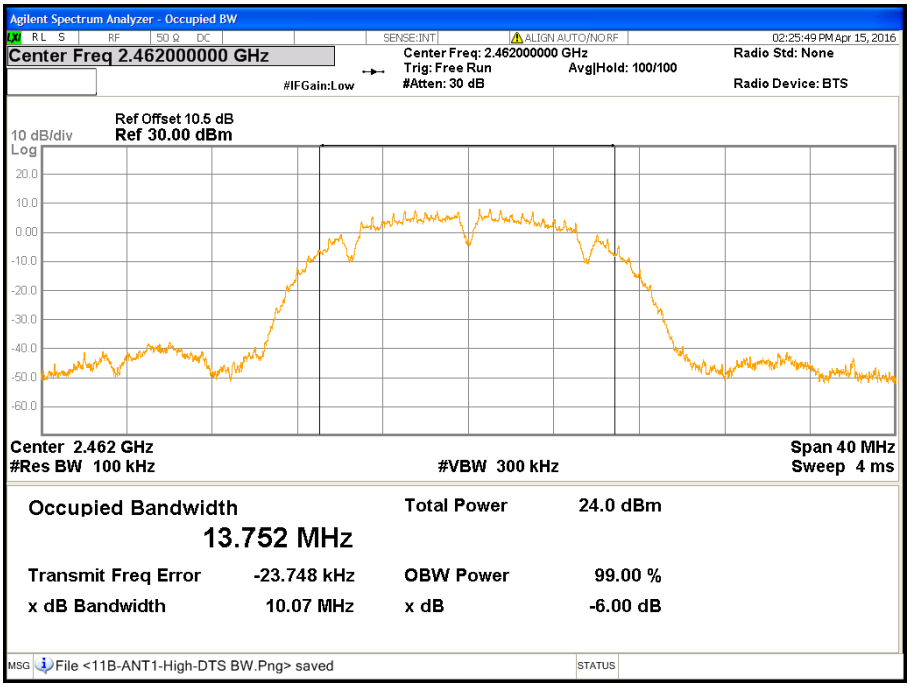

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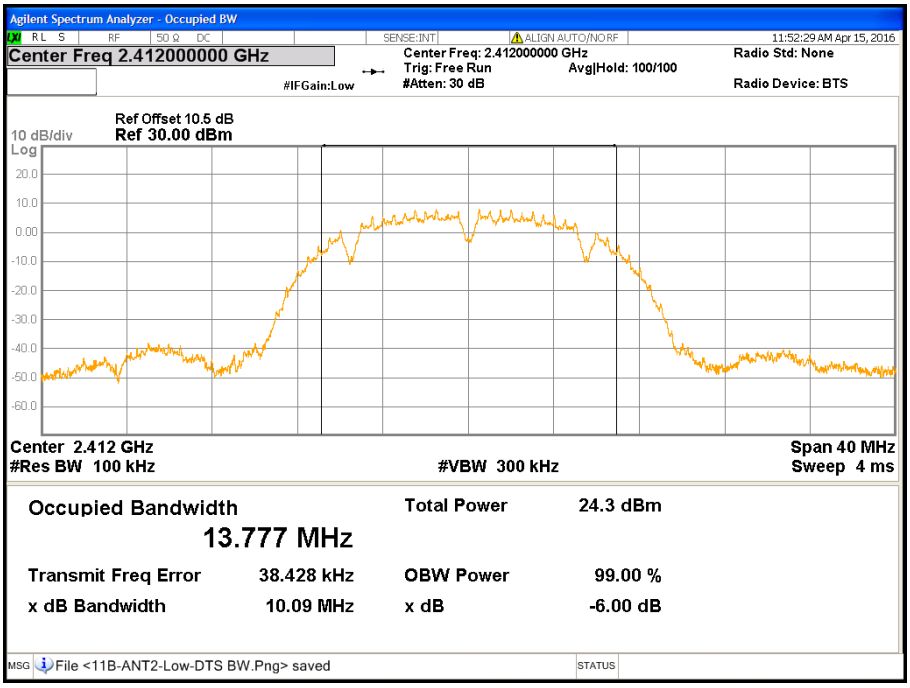

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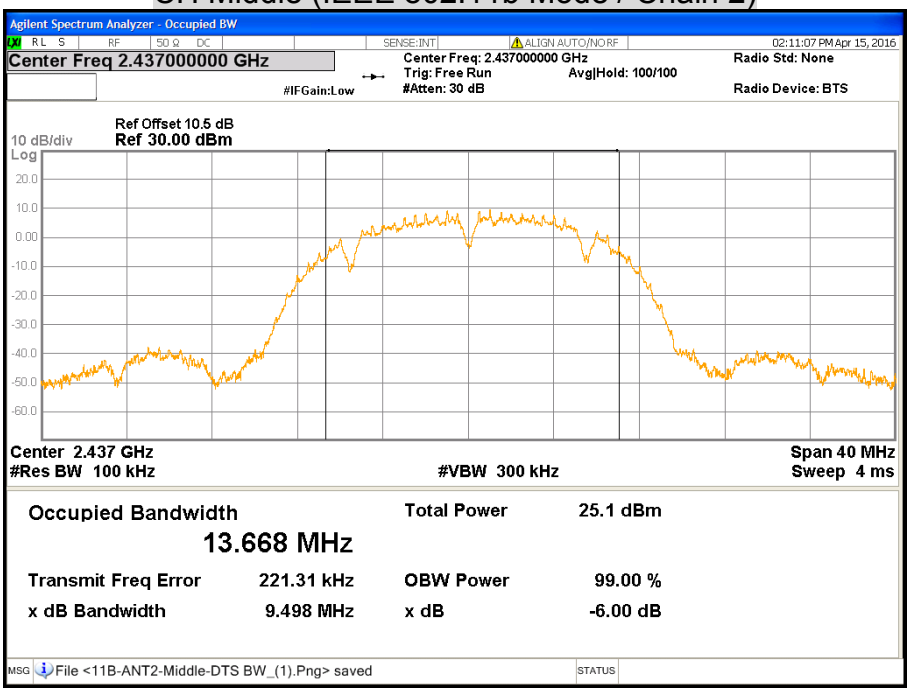

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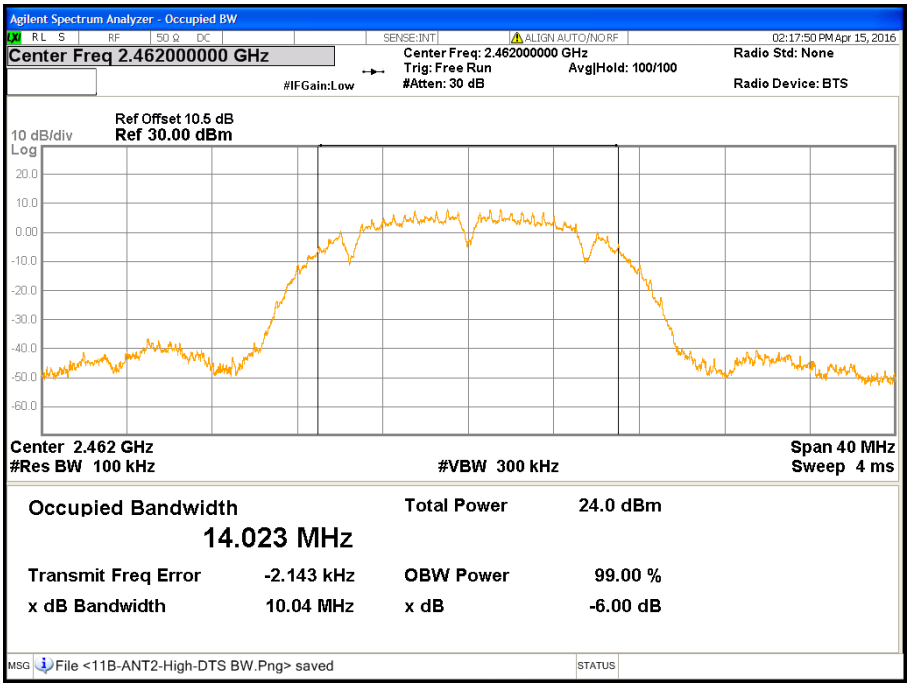

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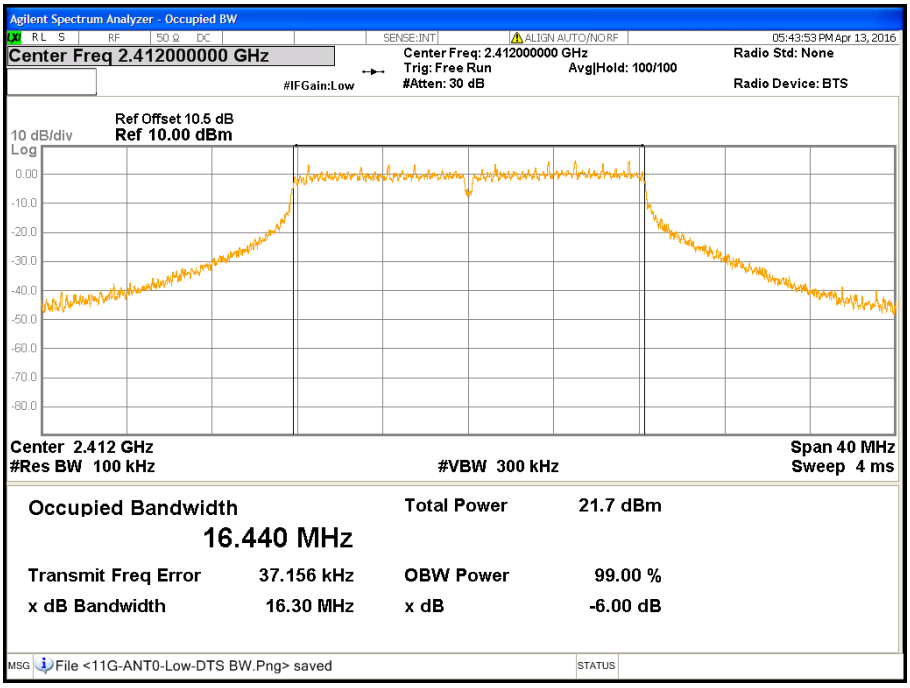

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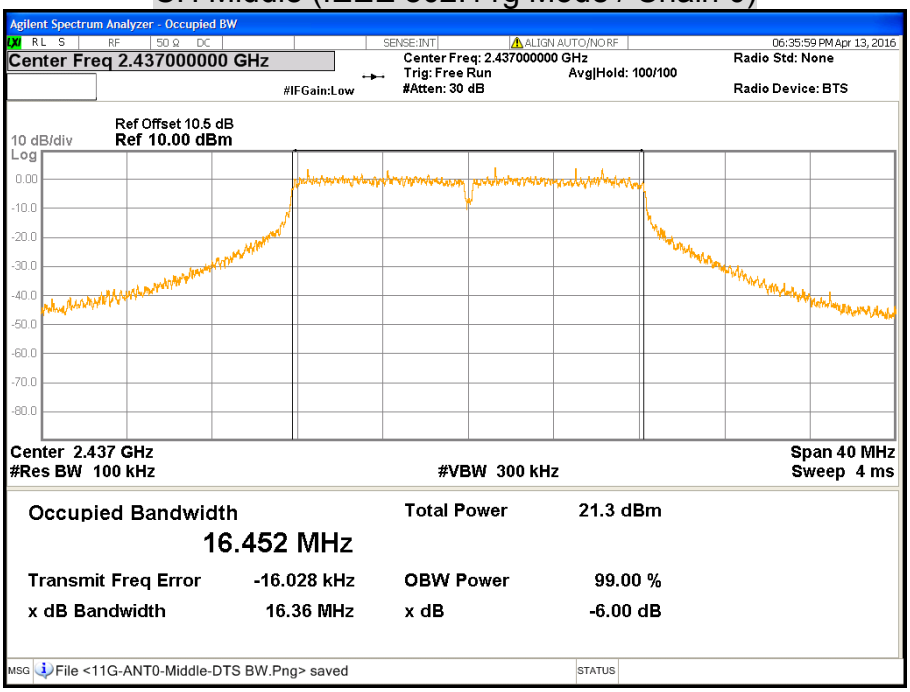

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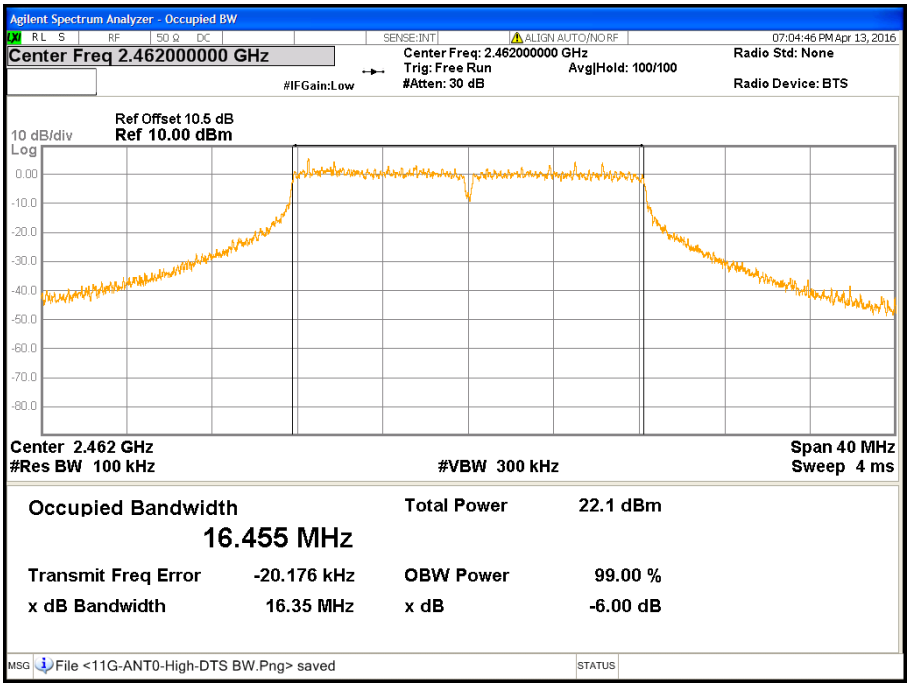

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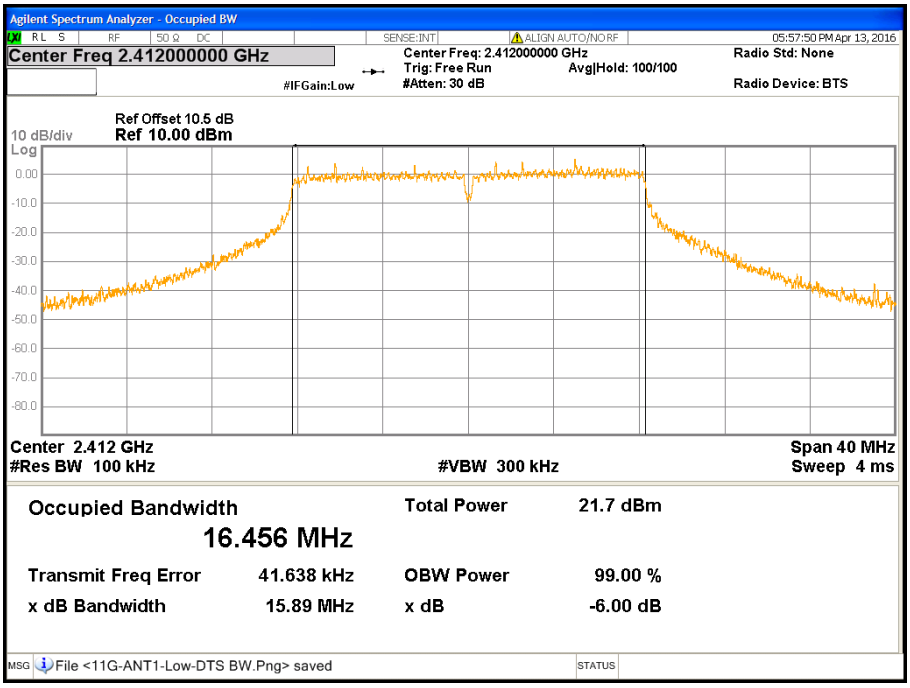

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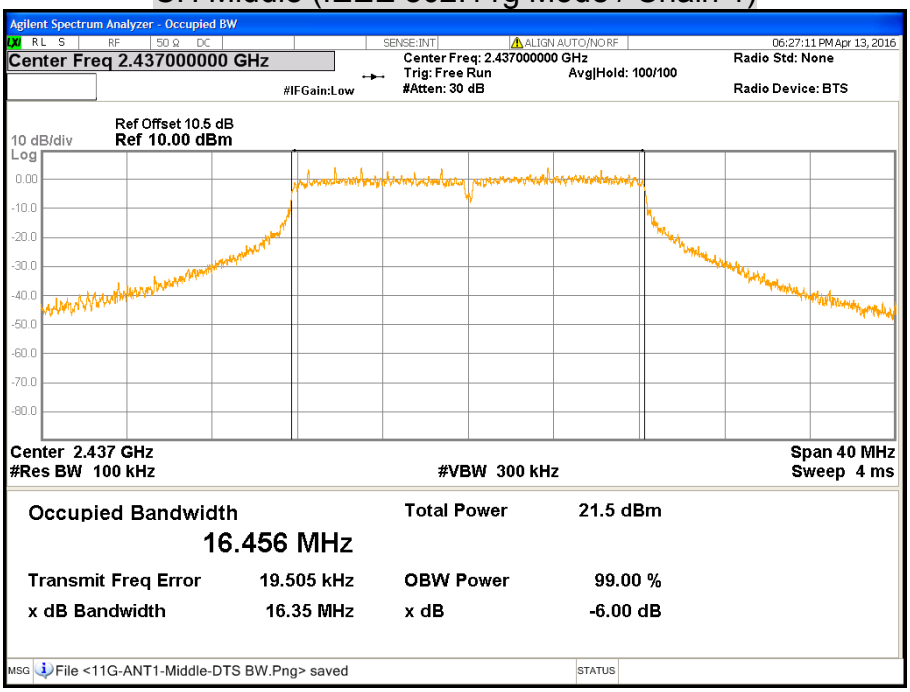

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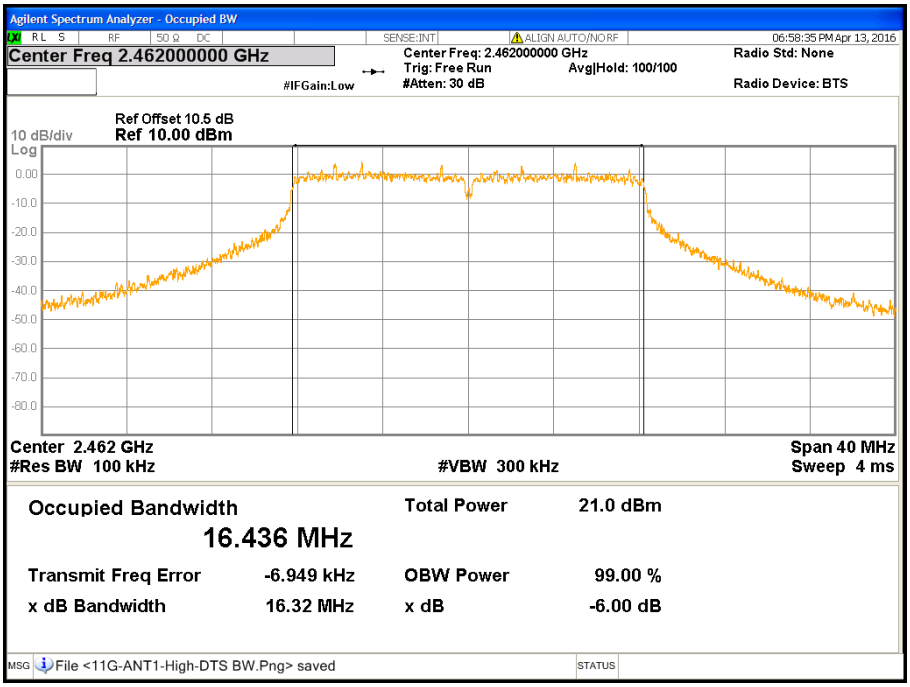

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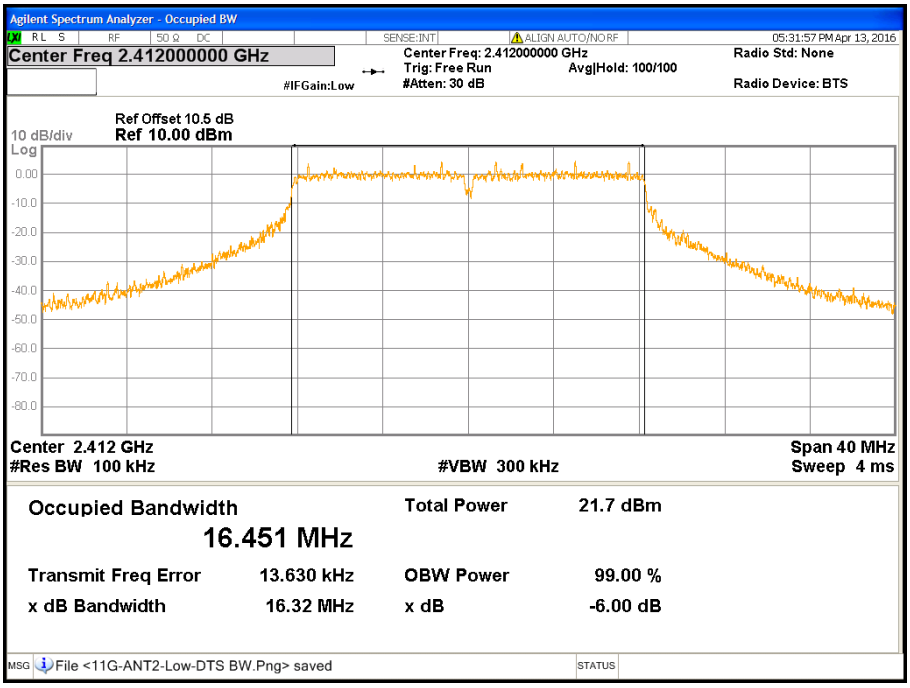

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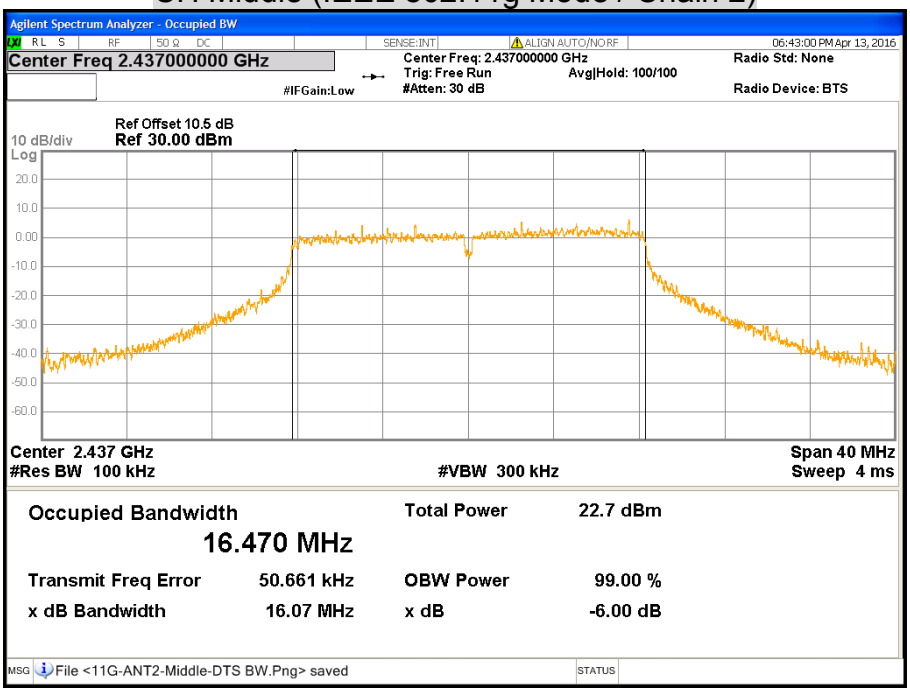

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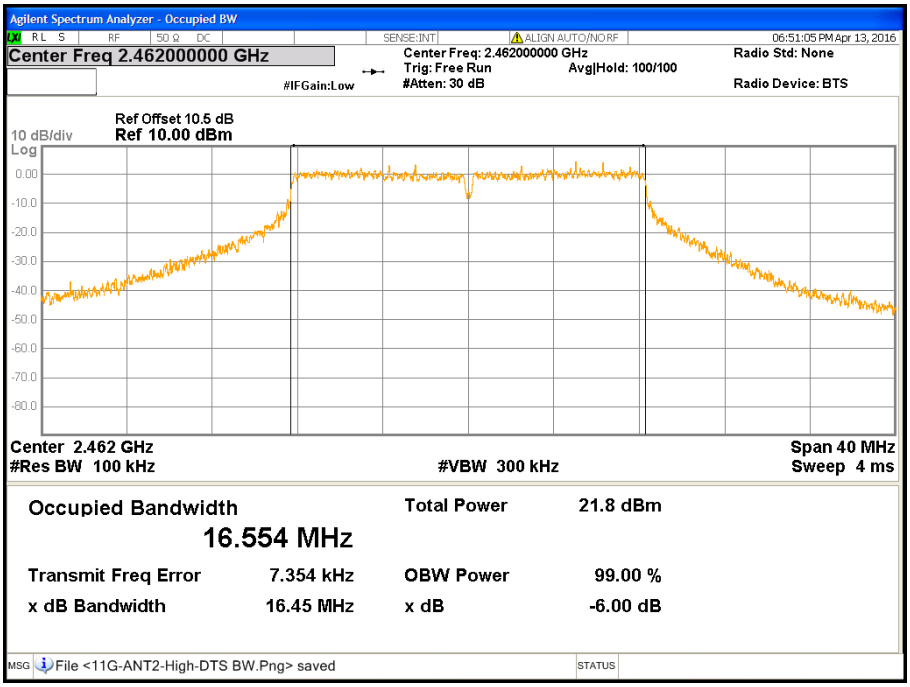

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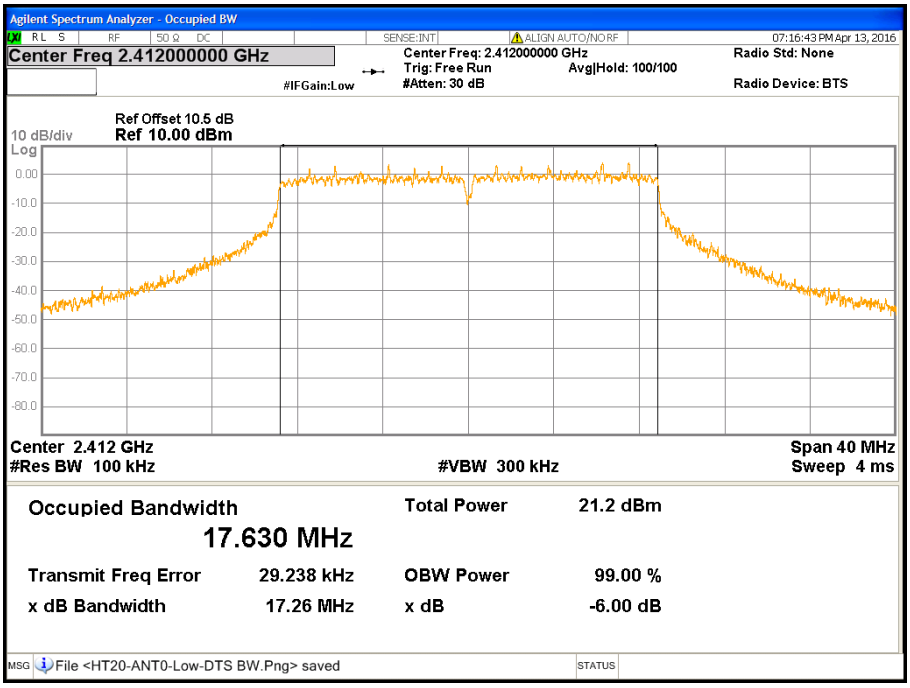

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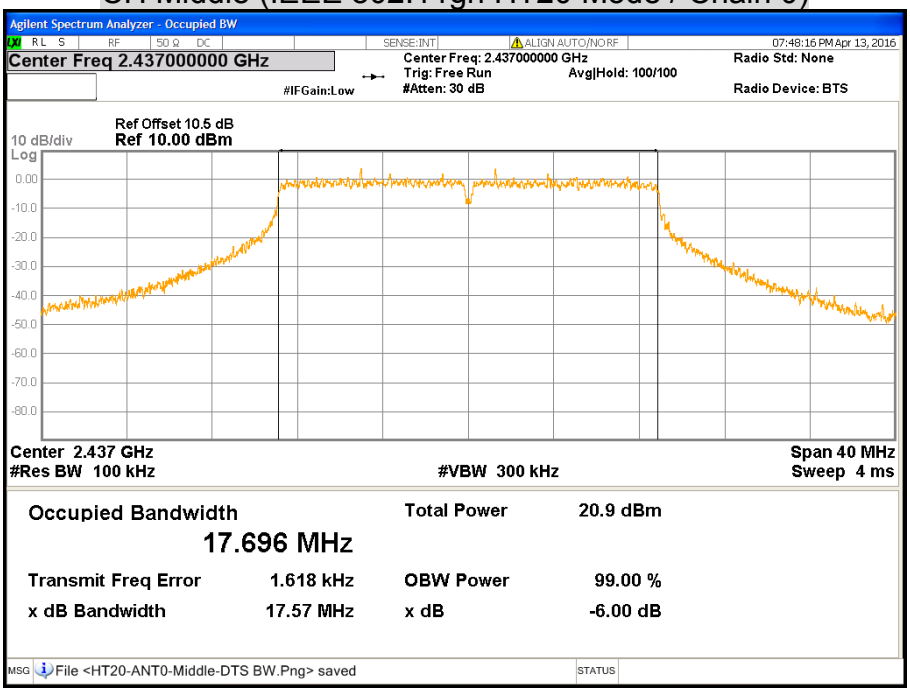

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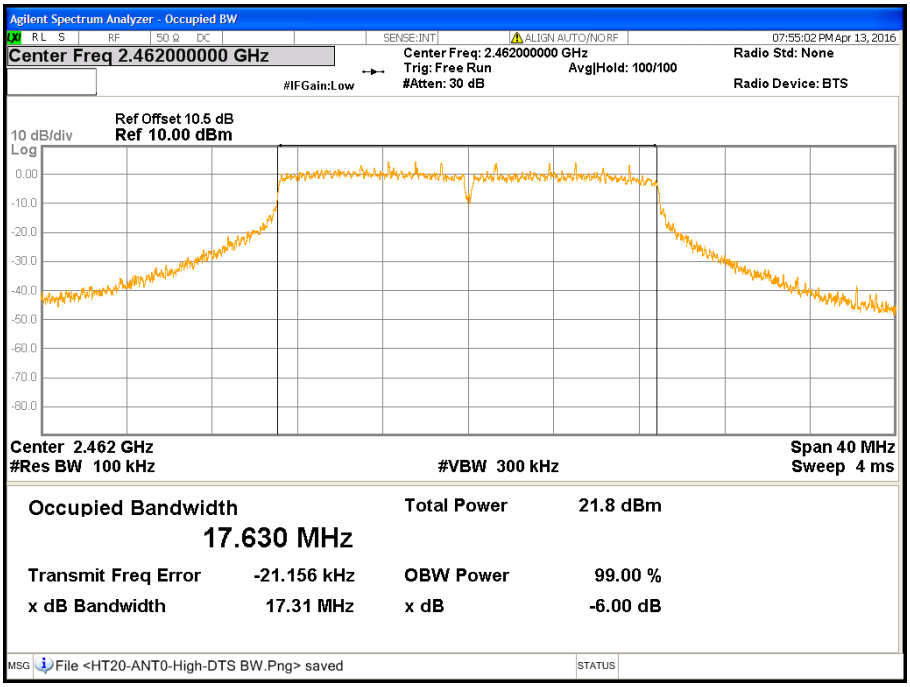

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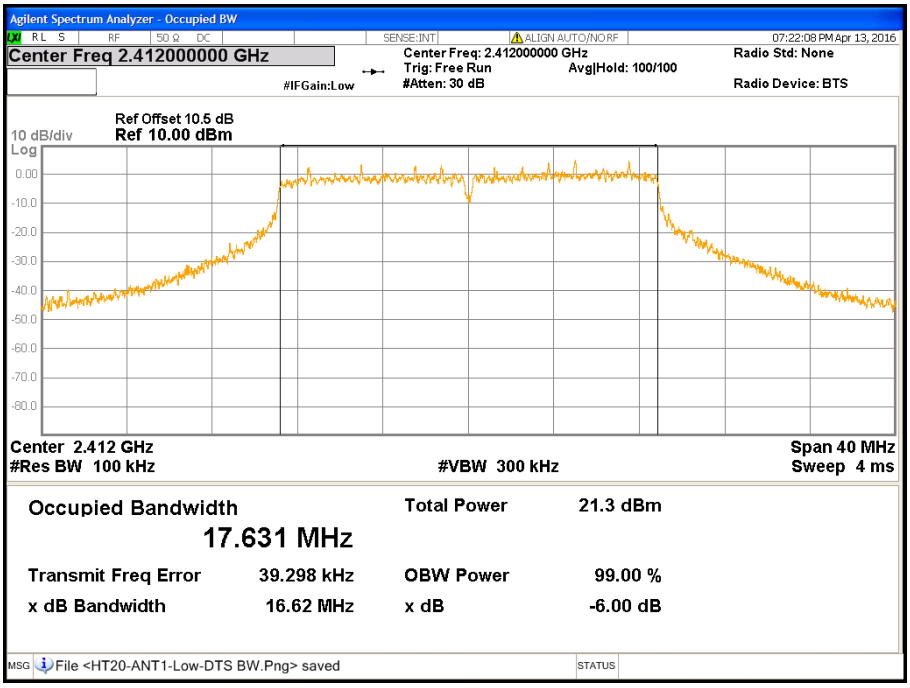
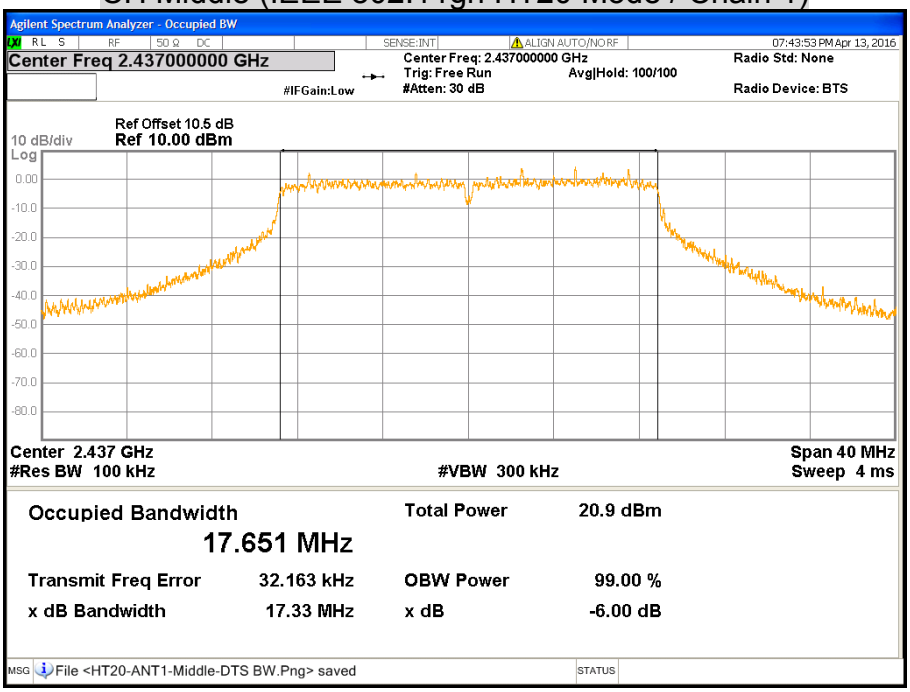
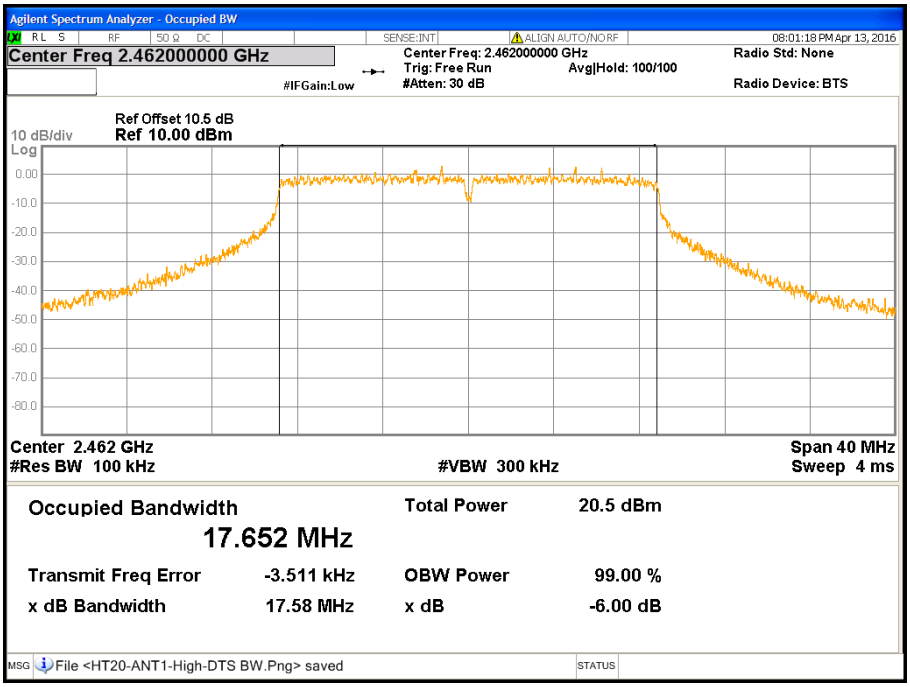


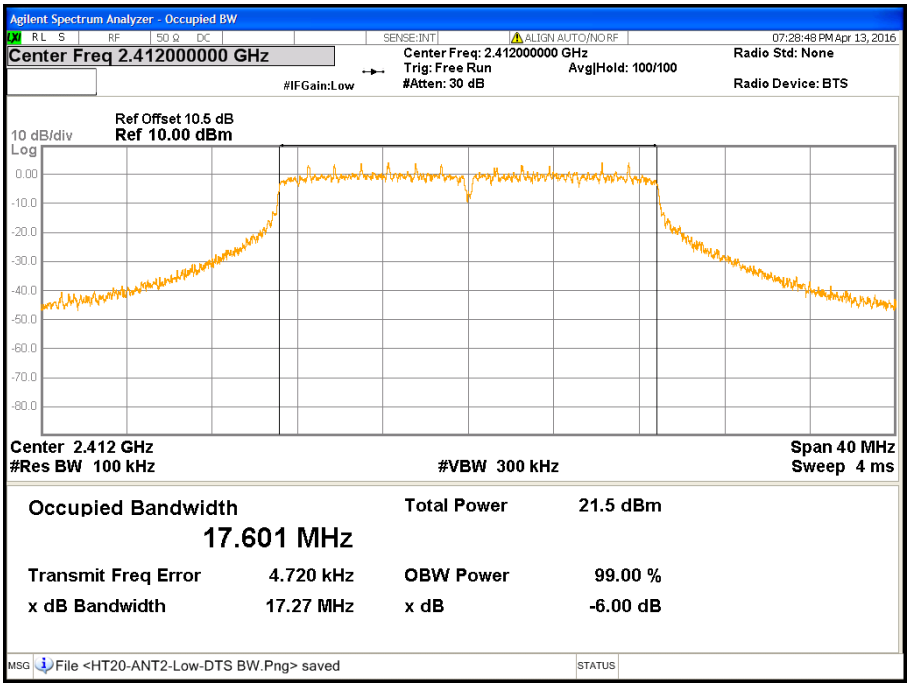
CH Middle (IEEE 802.11gn HT20 Mode / Chain 1)



CH High (IEEE 802.11gn HT20 Mode / Chain 1)



CH Low (IEEE 802.11gn HT20 Mode / Chain 2)



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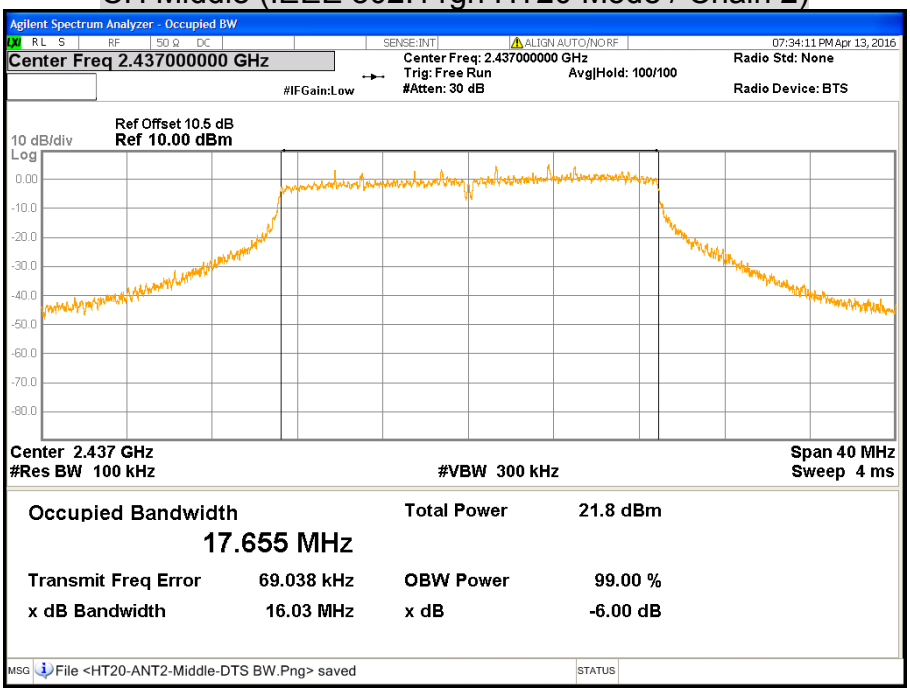
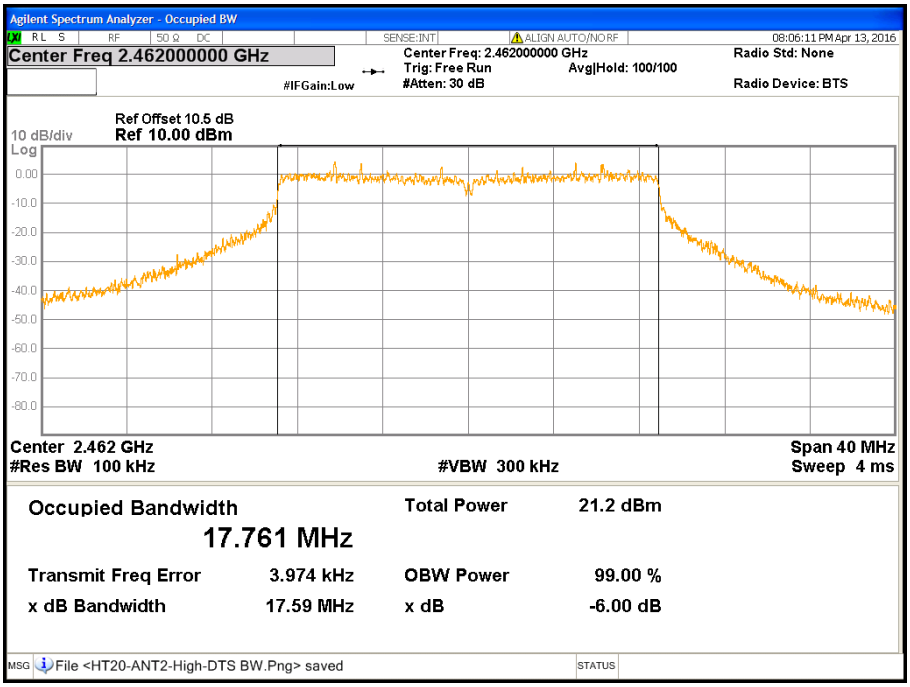
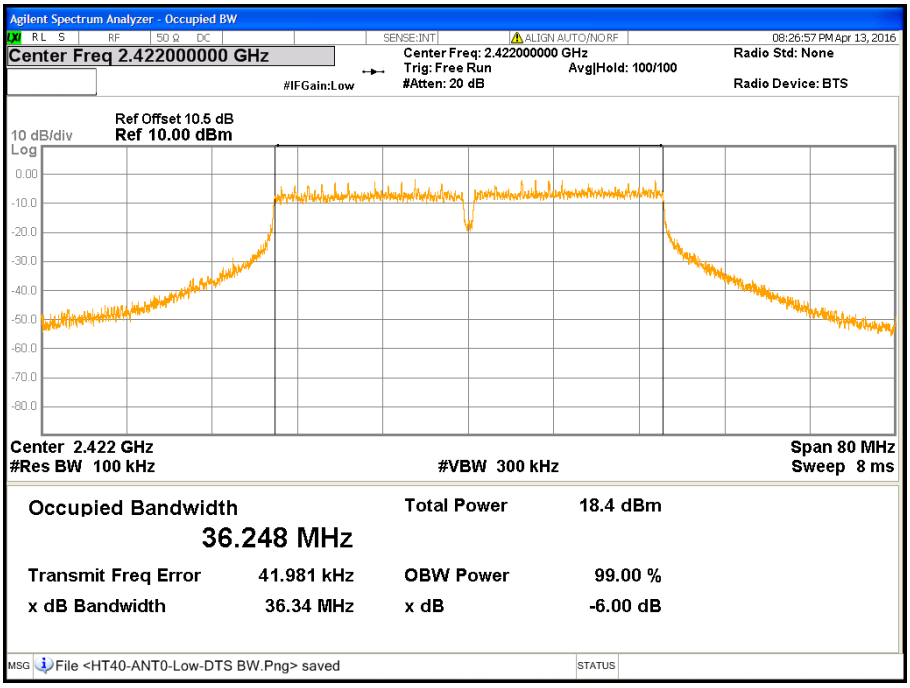


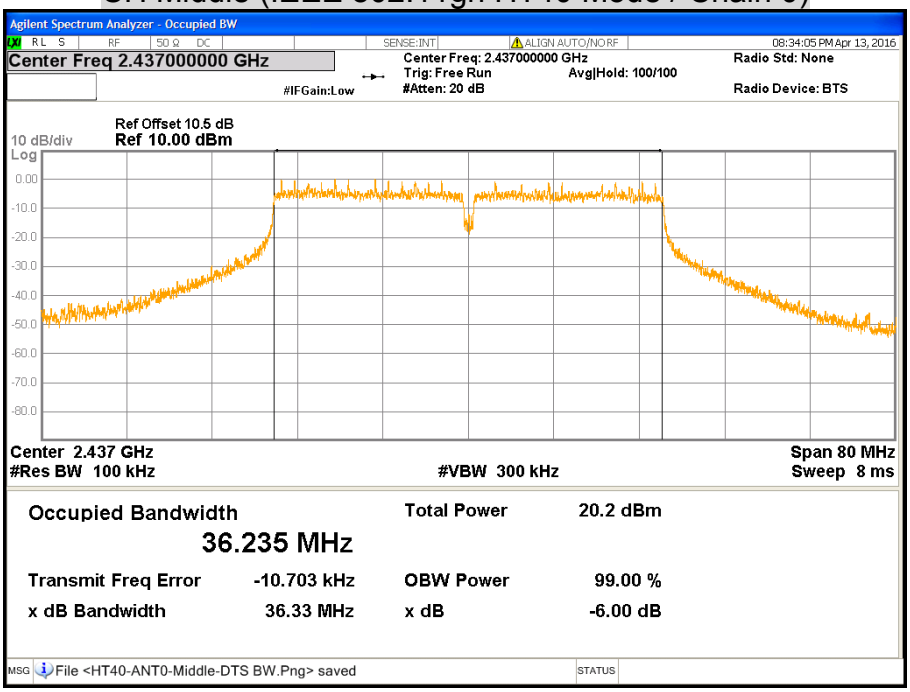
CH High (IEEE 802.11gn HT20 Mode / Chain 2)



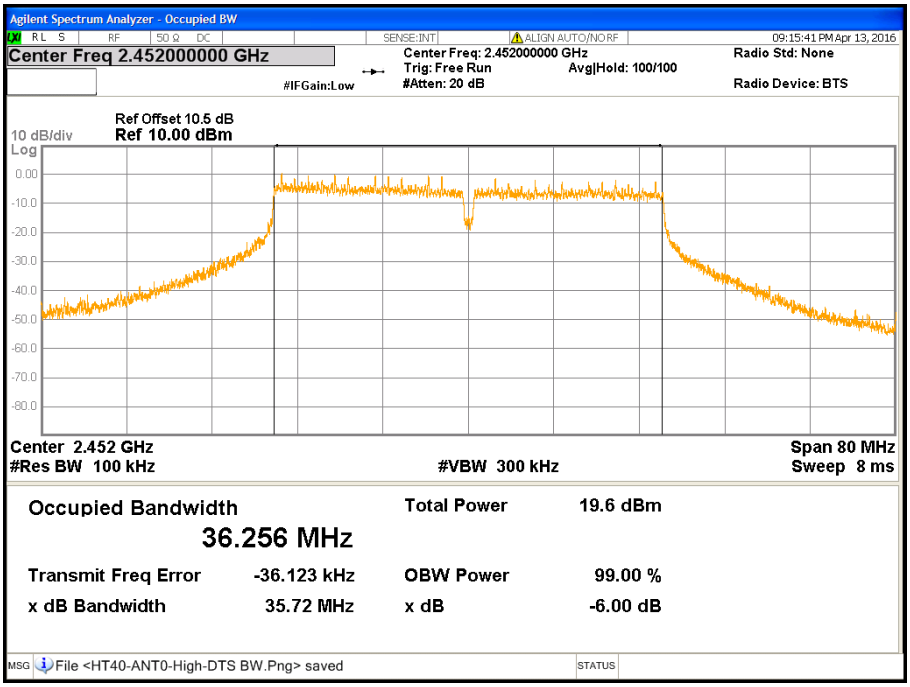
CH Low (IEEE 802.11gn HT40 Mode / Chain 0)



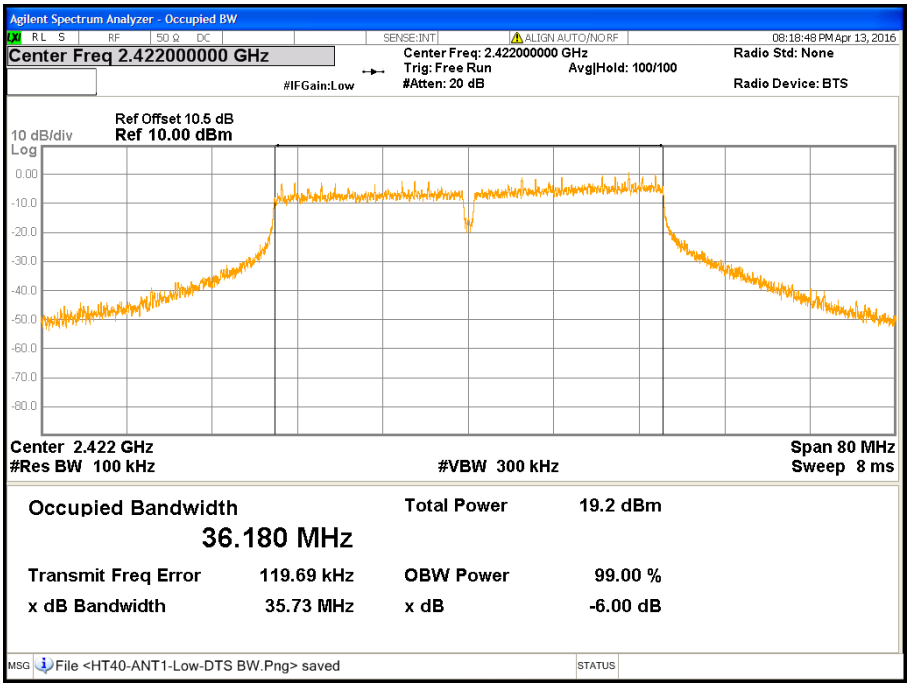
CH Middle (IEEE 802.11gn HT40 Mode / Chain 0)



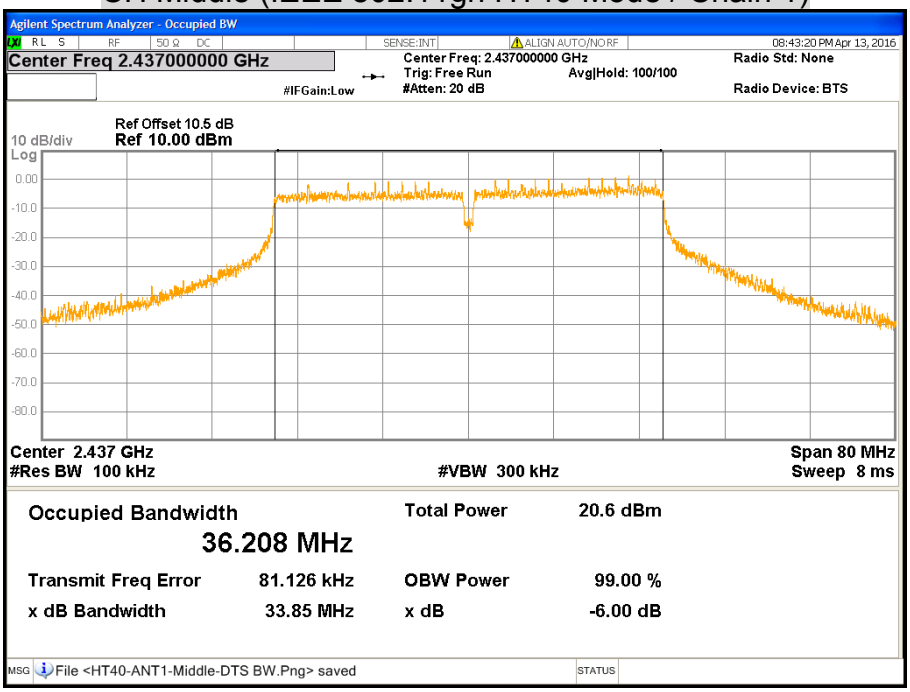
CH High (IEEE 802.11gn HT40 Mode / Chain 0)



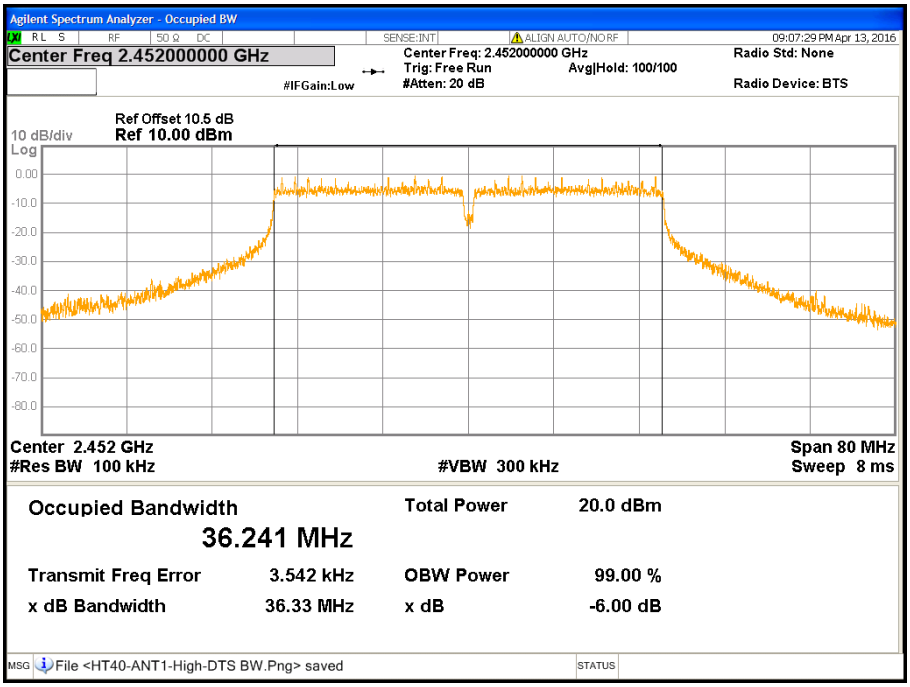
CH Low (IEEE 802.11gn HT40 Mode / Chain 1)



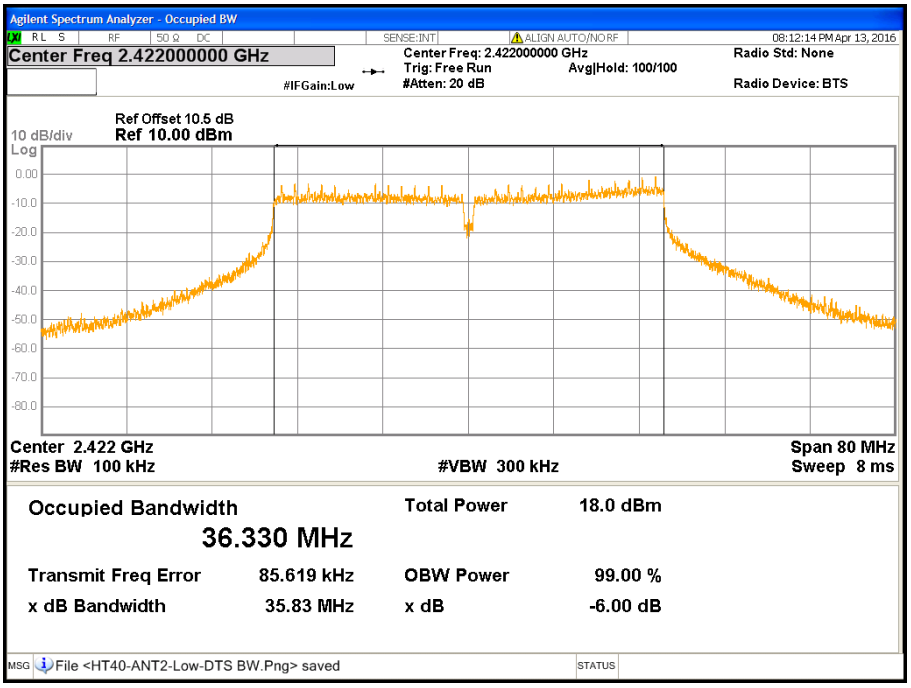
CH Middle (IEEE 802.11gn HT40 Mode / Chain 1)



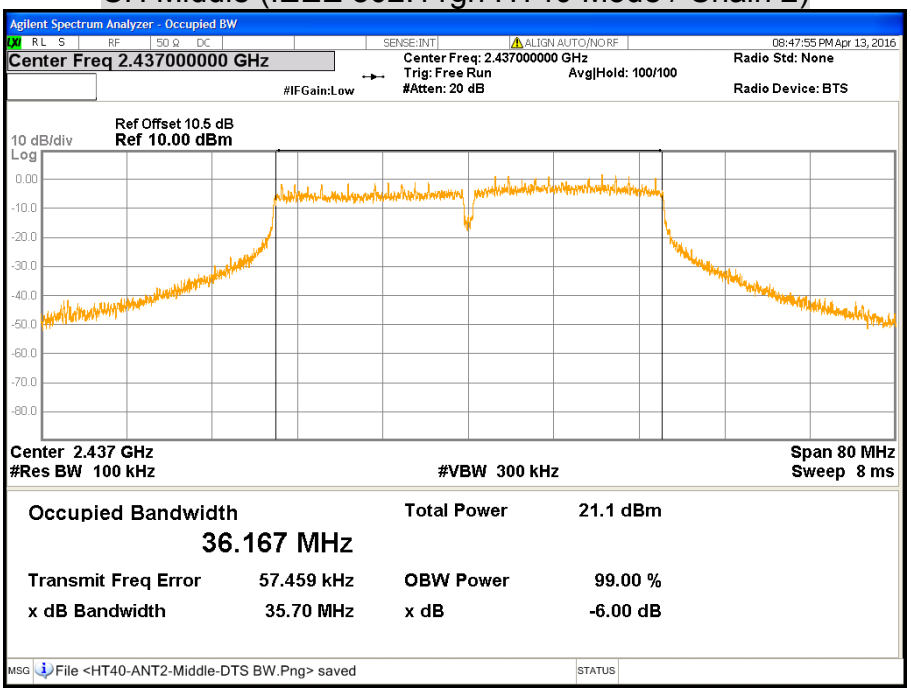
CH High (IEEE 802.11gn HT40 Mode / Chain 1)



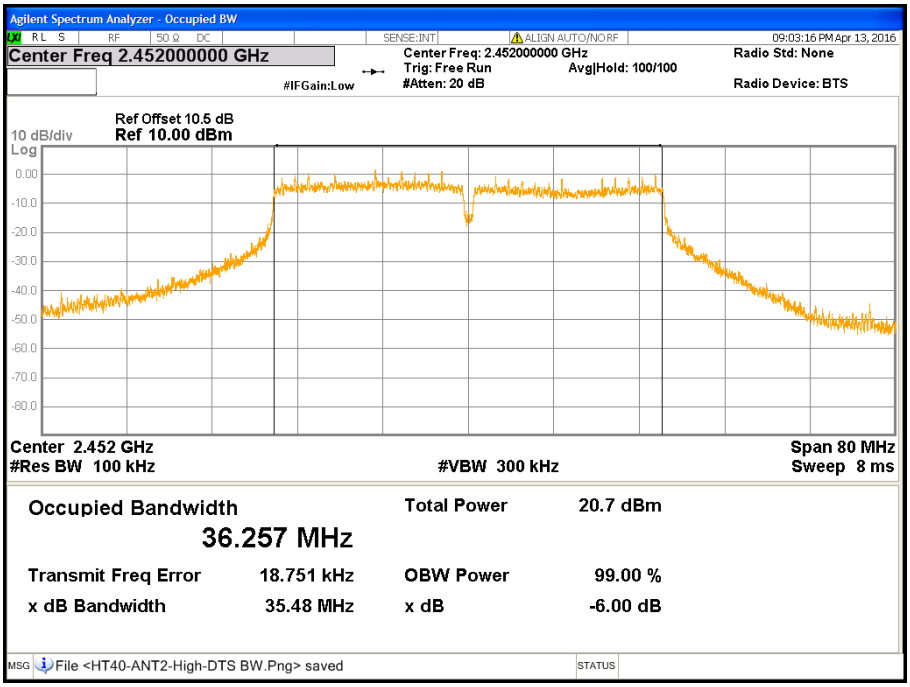
CH Low (IEEE 802.11gn HT40 Mode / Chain 2)



CH Middle (IEEE 802.11gn HT40 Mode / Chain 2)



CH High (IEEE 802.11gn HT40 Mode / Chain 2)



7.3 MAXIMUM PEAK OUTPUT POWER

LIMITS

§ 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.

§ KDB 662911:
If all antennas have the same gain, GANT, Directional gain = GANT + Array Gain, where Array Gain is as follows.
For power measurements on IEEE 802.11 devices
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.
If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream:

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Power Meter	Anritsu	ML2495A	1149001	12/08/2016
Power Sensor	Anritsu	MA2411B	1126148	12/08/2016
Test S/W	N/A			

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

TEST SETUP

TEST PROCEDURE

The transmitter output is connected to the power meter. The power meter is set to the peak power detection.

TEST RESULTS

Product Name	Moca AP cable Modem	Test By	Davis Tseng
Test Model	CGNVM-3589	Test Date	2016/04/06
Test Mode	TX Mode	Temp. & Humidity	25°C, 53%

IEEE 802.11b Mode (3TX)

Channel	Channel Frequency (MHz)	Maximum Peak Output Power							Result
		Chain 0	Chain 1	Chain 2	Total		Limit		
		(dBm)	(dBm)	(dBm)	(dBm)	(W)	(dBm)	(W)	
Low	2412	19.44	19.43	19.93	24.38	0.2742	30.00	1.0000	PASS
Middle	2437	19.72	19.41	20.52	24.68	0.2938	30.00	1.0000	PASS
High	2462	20.33	19.18	19.91	24.60	0.2884	30.00	1.0000	PASS

Remark:

1. *At finial test to get the worst-case emission at 1Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The maximum antenna gain is 5.2dBi which is less than 6dBi, the limit should be 1W.*
4. *Total peak power = Chain 0 + Chain 1 + Chain 2.*

IEEE 802.11g Mode (3TX)

Channel	Channel Frequency (MHz)	Maximum Peak Output Power							Result
		Chain 0	Chain 1	Chain 2	Total		Limit		
		(dBm)	(dBm)	(dBm)	(dBm)	(W)	(dBm)	(W)	
Low	2412	24.23	24.58	24.31	29.15	0.8222	30.00	1.0000	PASS
Middle	2437	24.98	24.85	24.10	29.43	0.8770	30.00	1.0000	PASS
High	2462	24.93	24.25	25.12	29.55	0.9016	30.00	1.0000	PASS

Remark:

1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The maximum antenna gain is 5.2dBi which is less than 6dBi, the limit should be 1W.*
4. *Total peak power = Chain 0 + Chain 1 + Chain 2.*

IEEE 802.11gn HT20 Mode (3TX)

Channel	Channel Frequency (MHz)	Maximum Peak Output Power							Result
		Chain 0	Chain 1	Chain 2	Total		Limit		
		(dBm)	(dBm)	(dBm)	(dBm)	(W)	(dBm)	(W)	
Low	2412	24.75	24.73	24.65	29.48	0.8872	30.00	1.0000	PASS
Middle	2437	25.11	24.91	24.51	29.62	0.9162	30.00	1.0000	PASS
High	2462	25.21	25.38	24.68	29.87	0.9705	30.00	1.0000	PASS

Remark:

1. *At finial test to get the worst-case emission at 6.5Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The maximum antenna gain is 5.2dBi which is less than 6dBi, the limit should be 1W.*
4. *Total peak power = Chain 0 + Chain 1 + Chain 2.*

IEEE 802.11gn HT40 Mode (3TX)

Channel	Channel Frequency (MHz)	Maximum Peak Output Power							Result
		Chain 0	Chain 1	Chain 2	Total		Limit		
		(dBm)	(dBm)	(dBm)	(dBm)	(W)	(dBm)	(W)	
Low	2422	23.06	24.11	23.02	28.20	0.6607	30.00	1.0000	PASS
Middle	2437	25.07	25.18	24.52	29.70	0.9333	30.00	1.0000	PASS
High	2452	25.14	24.37	23.72	29.22	0.8356	30.00	1.0000	PASS

Remark:

1. *At finial test to get the worst-case emission at 13.5Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.*
3. *The maximum antenna gain is 5.2dBi which is less than 6dBi, the limit should be 1W.*
4. *Total peak power = Chain 0 + Chain 1 + Chain 2.*

7.4 AVERAGE POWER

LIMITS

None: For reporting purposes only.

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Power Meter	Anritsu	ML2495A	1149001	12/08/2016
Power Sensor	Anritsu	MA2411B	1126148	12/08/2016
Test S/W	N/A			

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

TEST SETUP

TEST PROCEDURE

The transmitter output is connected to the power meter. The power meter is set to the average power detection.

TEST RESULTS

Product Name	Moca AP cable Modem	Test By	Davis Tseng
Test Model	CGNVM-3589	Test Date	2016/04/06
Test Mode	TX Mode	Temp. & Humidity	25°C, 53%

IEEE 802.11b Mode

Channel	Channel Frequency (MHz)	Average Power (dBm)		
		Chain 0	Chain 1	Chain 2
Low	2412	17.01	17.02	17.21
Middle	2437	17.47	17.02	18.06
High	2462	17.83	16.83	17.36

Remark:
1. *At finial test to get the worst-case emission at 1Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 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)	Average Power (dBm)		
		Chain 0	Chain 1	Chain 2
Low	2412	15.93	16.44	16.24
Middle	2437	16.77	16.31	16.03
High	2462	16.51	15.98	16.52

Remark:
1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*

IEEE 802.11gn HT20 Mode

Channel	Channel Frequency (MHz)	Average Power (dBm)		
		Chain 0	Chain 1	Chain 2
Low	2412	15.91	15.92	15.42
Middle	2437	16.13	15.73	15.58
High	2462	16.01	16.12	15.92

Remark:
1. *At finial test to get the worst-case emission at 6.5Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*

IEEE 802.11gn HT40 Mode

Channel	Channel Frequency (MHz)	Average Power (dBm)		
		Chain 0	Chain 1	Chain 2
Low	2422	12.75	13.98	12.94
Middle	2437	15.21	15.23	14.37
High	2452	14.45	14.05	13.37

Remark:

1. *At finial test to get the worst-case emission at 13.5Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*

7.5 POWER SPECTRAL DENSITY

LIMITS

§ 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.

§ KDB 662911:

If all antennas have the same gain, G_{ANT}, Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

If antenna gains are not equal, the user may use either of the following methods to calculate directional gain, provided that each transmit antenna is driven by only one spatial stream:

Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain; or,

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Signal Analyzer	Agilent	N9010A	MY52220817	03/15/2017
Test S/W	N/A			

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

TEST SETUP

TEST PROCEDURE

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

TEST RESULTS

Product Name	Moca AP cable Modem	Test By	Davis Tseng
Test Model	CGNVM-3589	Test Date	2016/04/06
Test Mode	TX Mode	Temp. & Humidity	25°C, 53%

IEEE 802.11b Mode (3TX)

Channel	Channel Frequency (MHz)	Final RF Power Level in 3KHz BW (dBm)					Result
		Chain 0	Chain 1	Chain 2	Total	Limit	
Low	2412	-0.35	-0.17	-0.28	4.50	4.9	PASS
Middle	2437	-1.35	-0.47	0.67	4.46	4.9	PASS
High	2462	0.52	0.21	-0.68	4.82	4.9	PASS

Remark:
1. *At finial test to get the worst-case emission at 1Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 9.1dBi which is more than 6dBi, the limit should be 4.9 dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2.*

IEEE 802.11g Mode (3TX)

Channel	Channel Frequency (MHz)	Final RF Power Level in 3KHz BW (dBm)					Result
		Chain 0	Chain 1	Chain 2	Total	Limit	
Low	2412	-3.78	-3.03	-3.38	1.39	4.9	PASS
Middle	2437	-3.42	-4.54	-2.16	1.50	4.9	PASS
High	2462	-3.07	-3.80	-3.97	1.18	4.9	PASS

Remark:
1. *At finial test to get the worst-case emission at 6Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 9.1dBi which is more than 6dBi, the limit should be 4.9 dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2.*

IEEE 802.11gn HT20 Mode (3TX)

Channel	Channel Frequency (MHz)	Final RF Power Level in 3KHz BW (dBm)					Result
		Chain 0	Chain 1	Chain 2	Total	Limit	
Low	2412	-5.41	-5.14	-4.33	-0.16	4.9	PASS
Middle	2437	-5.29	-4.68	-3.47	0.36	4.9	PASS
High	2462	-3.22	-4.50	-4.74	0.67	4.9	PASS

Remark:
1. *At finial test to get the worst-case emission at 6.5Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 9.1dBi which is more than 6dBi, the limit should be 4.9 dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2.*

IEEE 802.11gn HT40 Mode (3TX)

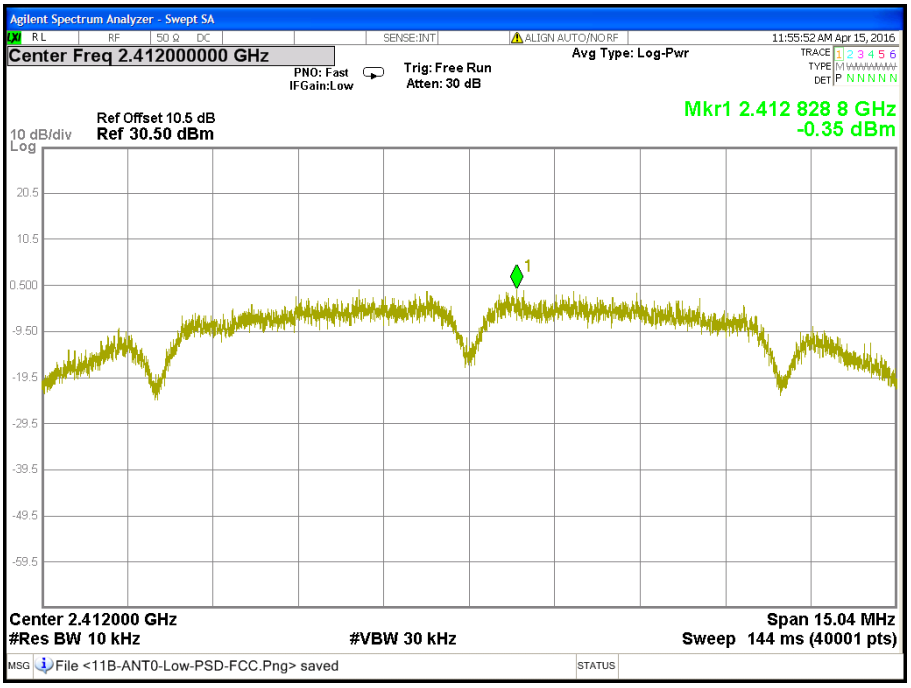
Channel	Channel Frequency (MHz)	Final RF Power Level in 3KHz BW (dBm)					Result
		Chain 0	Chain 1	Chain 2	Total	Limit	
Low	2412	-10.76	-9.22	-8.87	-4.77	4.9	PASS
Middle	2437	-7.56	-8.09	-7.24	-2.85	4.9	PASS
High	2462	-8.93	-9.14	-8.05	-3.91	4.9	PASS

Remark:

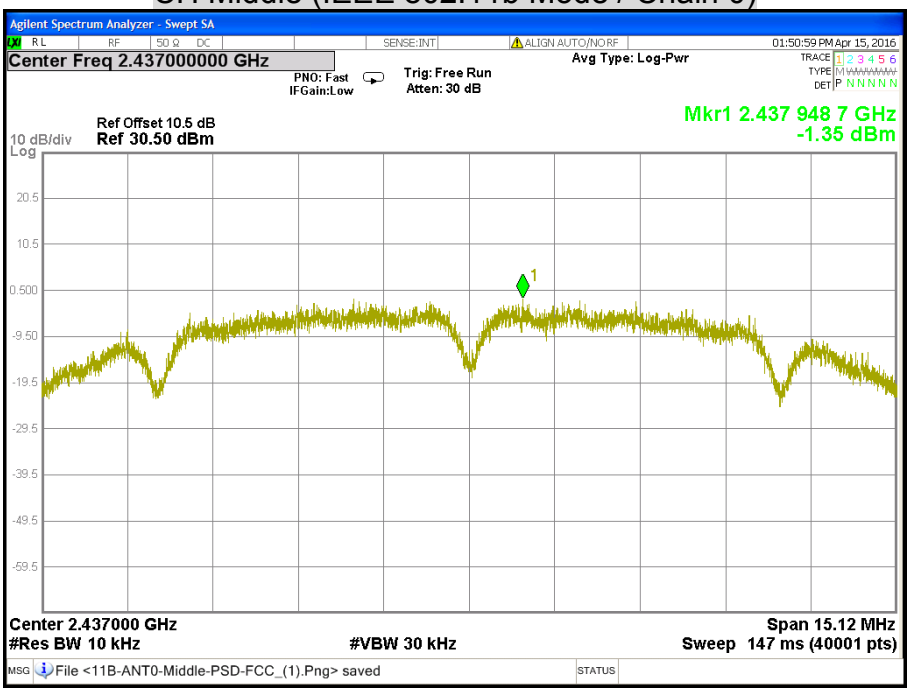
1. *At finial test to get the worst-case emission at 13.5Mbps.*
2. *The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.*
3. *The directional gain is 9.1dBi which is more than 6dBi, the limit should be 4.9 dBm.*
4. *Total power spectral density = Chain 0 + Chain 1 + Chain 2.*

POWER SPECTRAL DENSITY

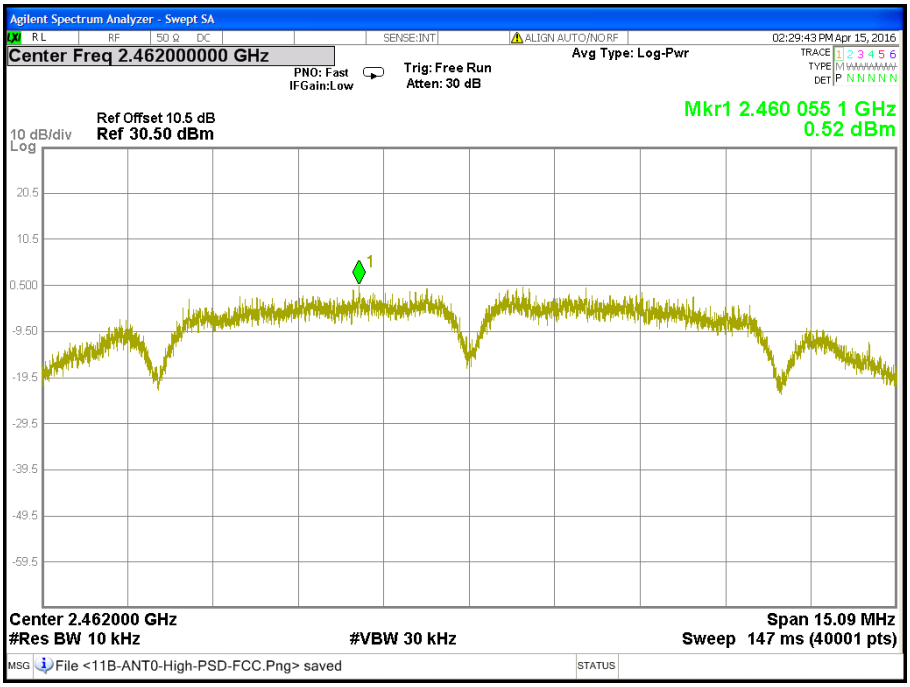
CH Low (IEEE 802.11b Mode / Chain 0)



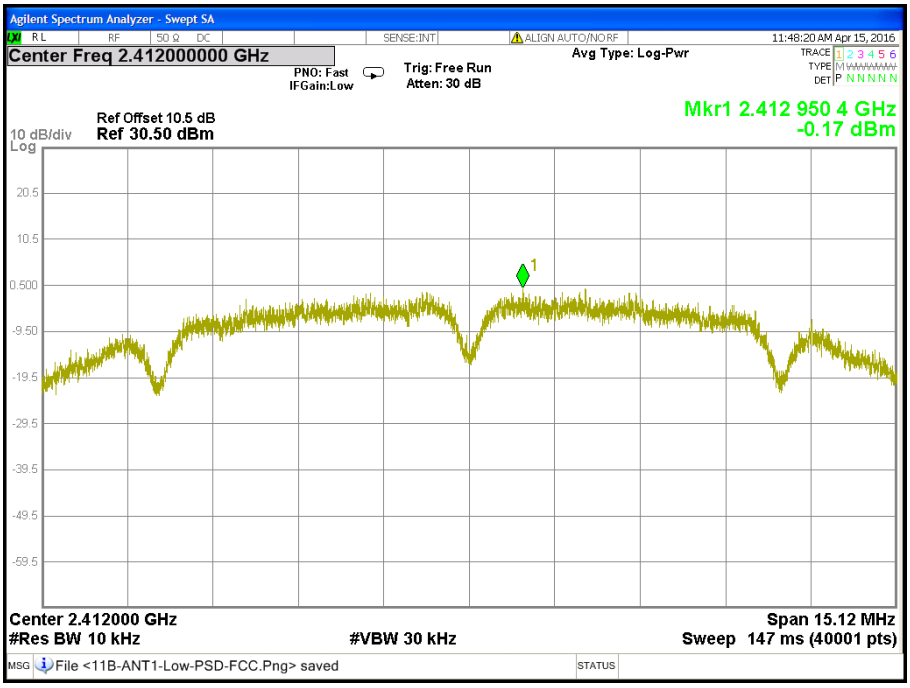
CH Middle (IEEE 802.11b Mode / Chain 0)



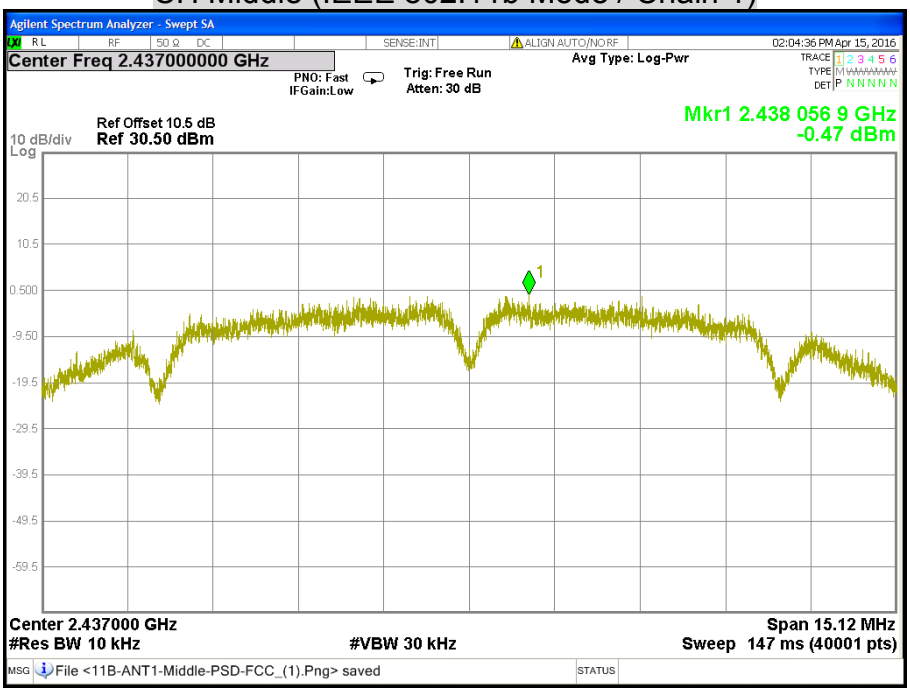
CH High (IEEE 802.11b Mode / Chain 0)



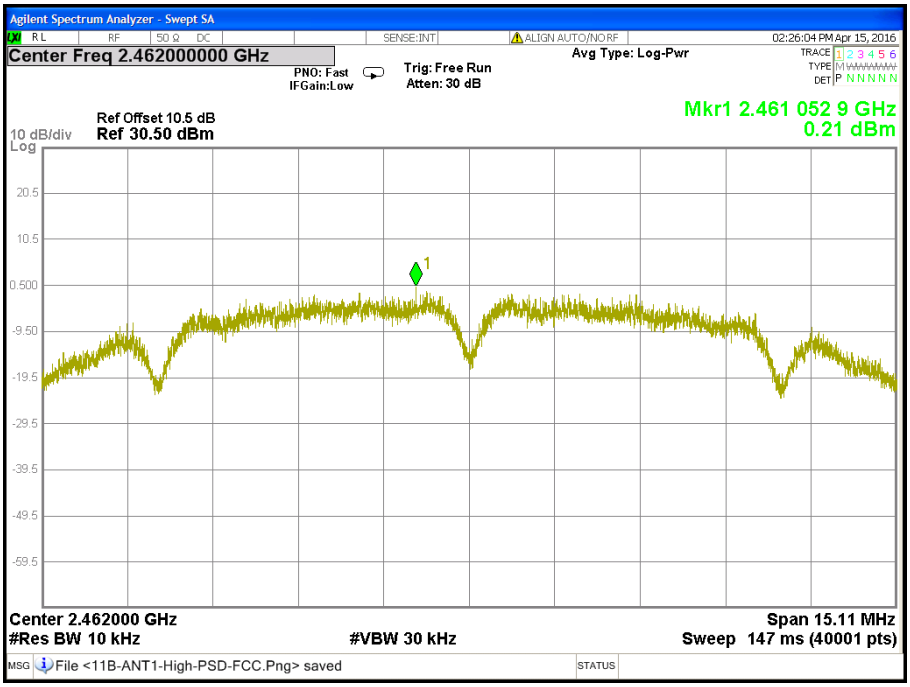
CH Low (IEEE 802.11b Mode / Chain 1)



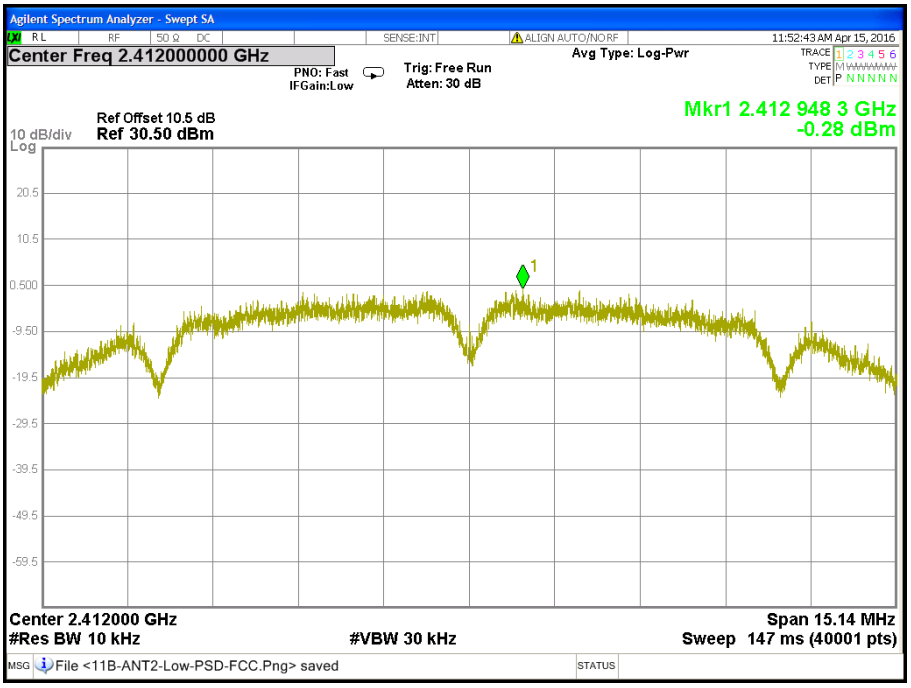
CH Middle (IEEE 802.11b Mode / Chain 1)



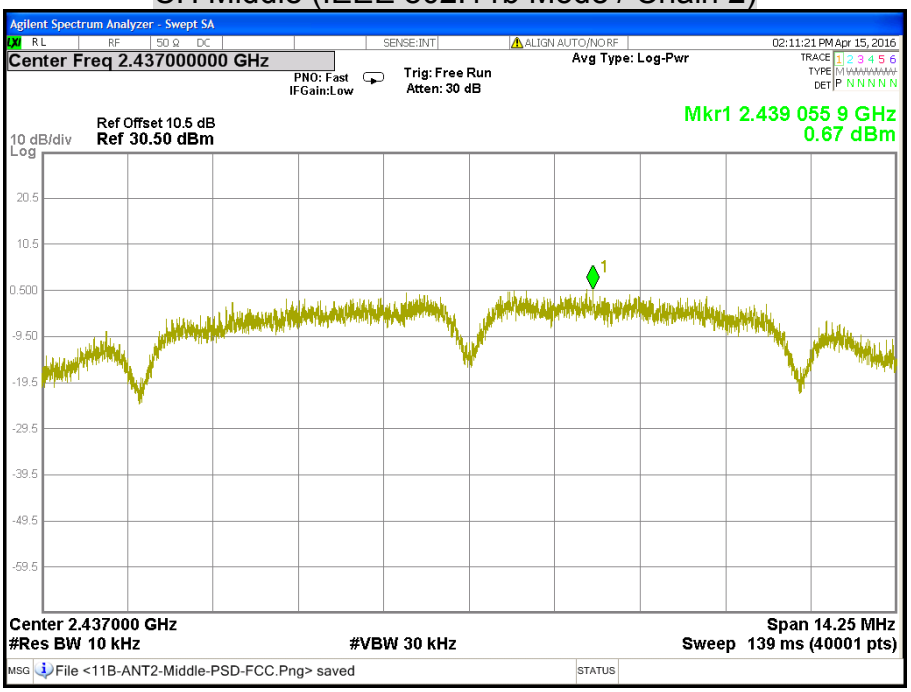
CH High (IEEE 802.11b Mode / Chain 1)



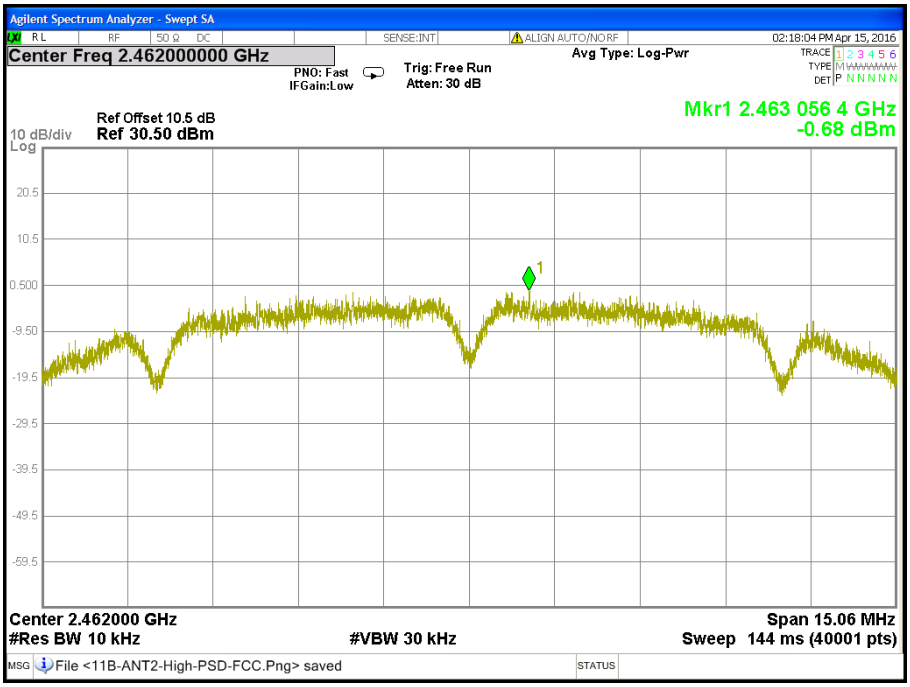
CH Low (IEEE 802.11b Mode / Chain 2)



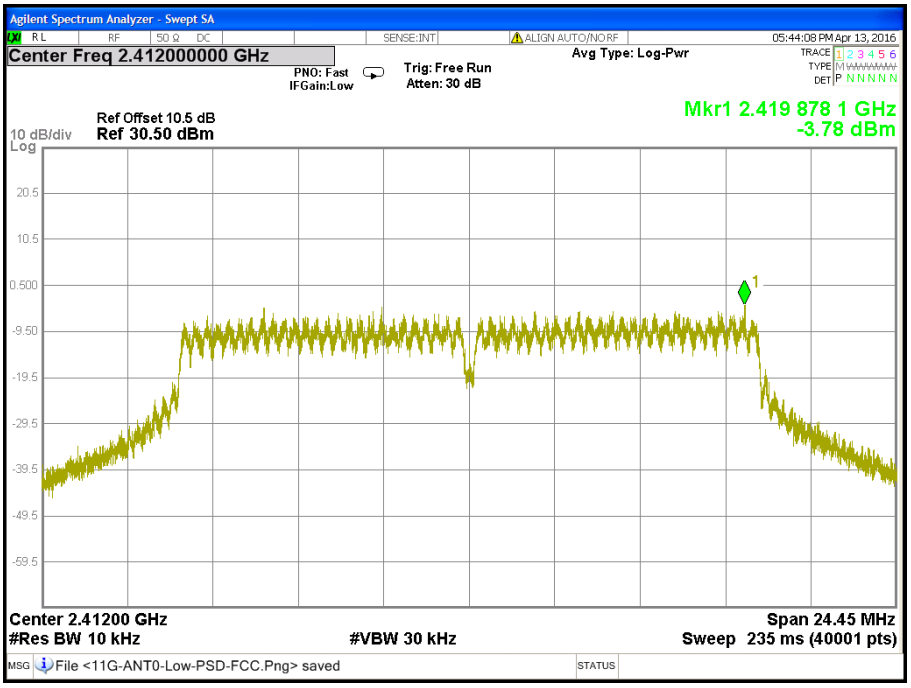
CH Middle (IEEE 802.11b Mode / Chain 2)



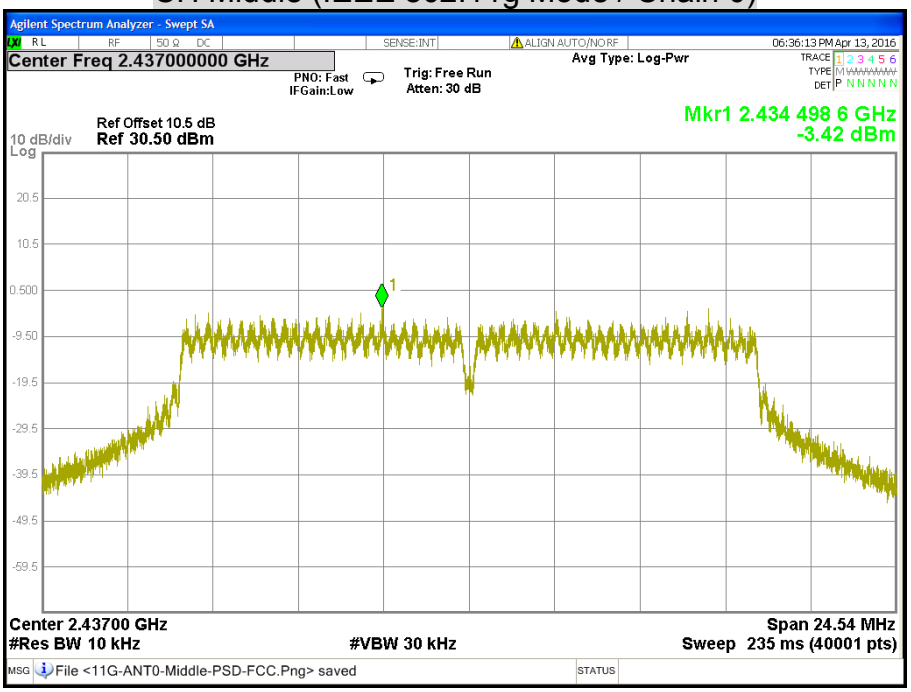
CH High (IEEE 802.11b Mode / Chain 2)



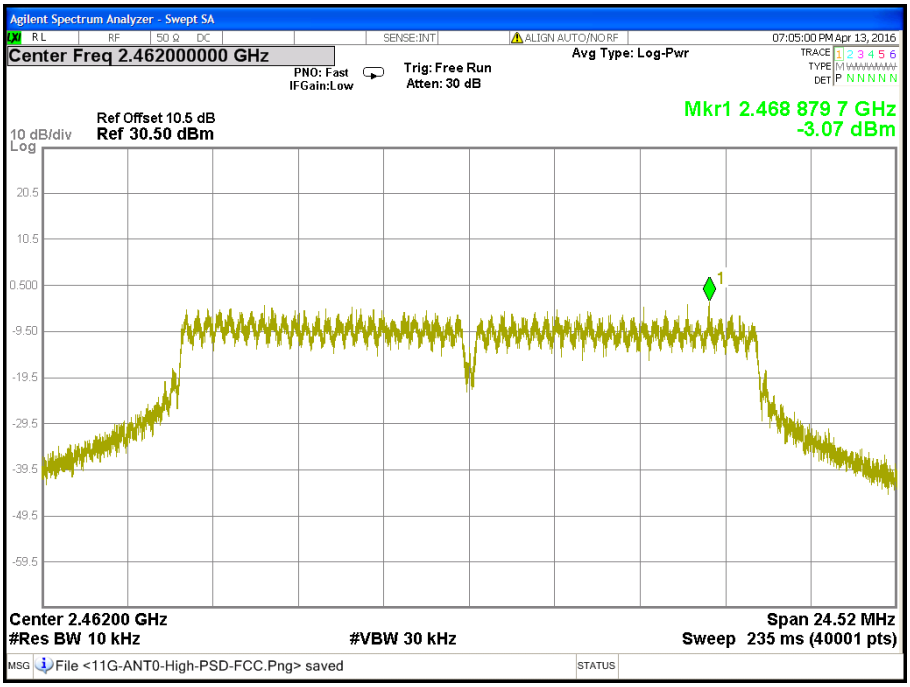
CH Low (IEEE 802.11g Mode / Chain 0)



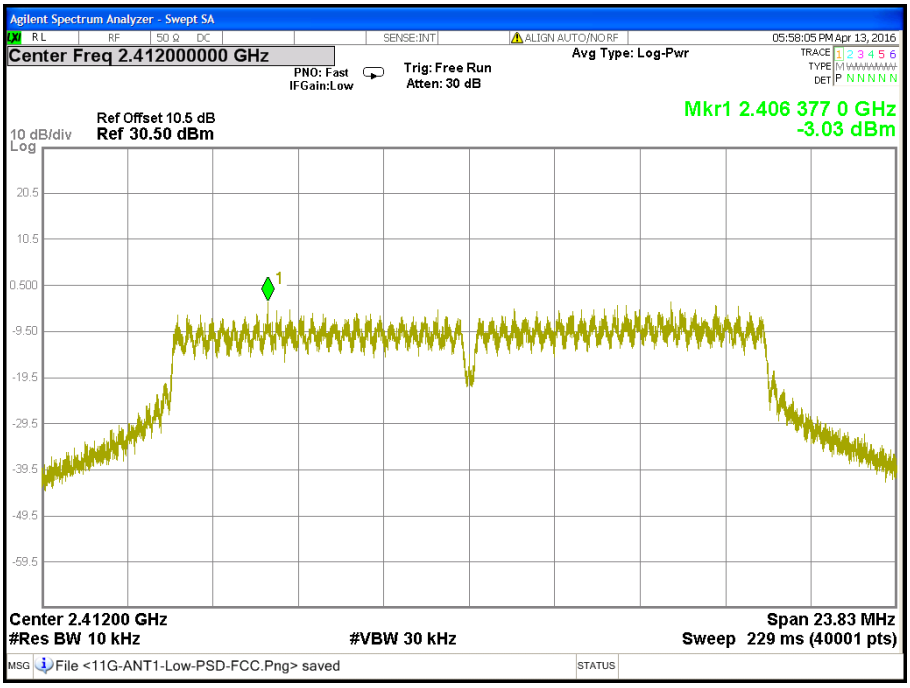
CH Middle (IEEE 802.11g Mode / Chain 0)



CH High (IEEE 802.11g Mode / Chain 0)



CH Low (IEEE 802.11g Mode / Chain 1)



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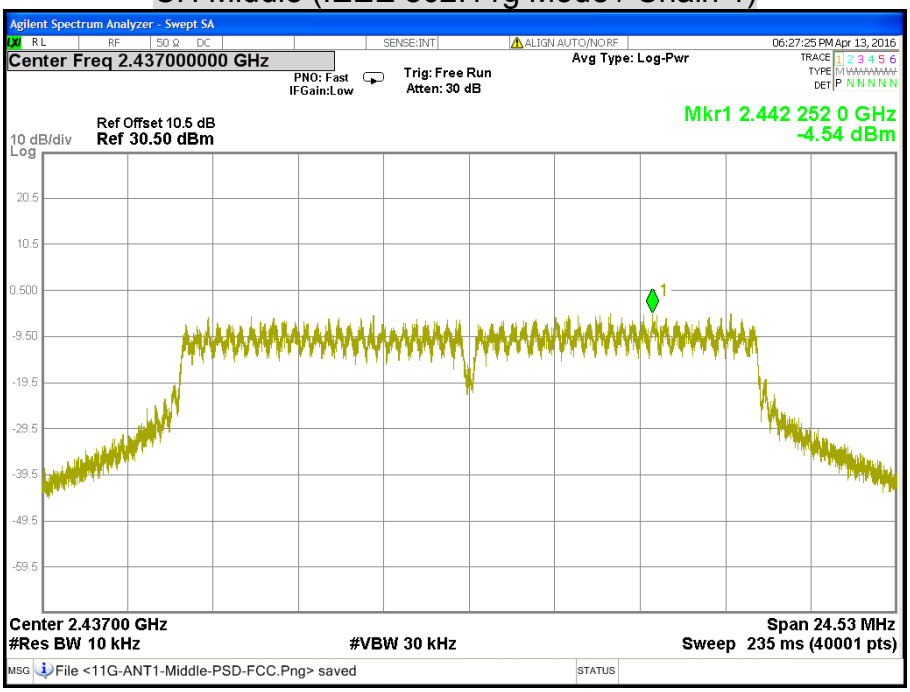
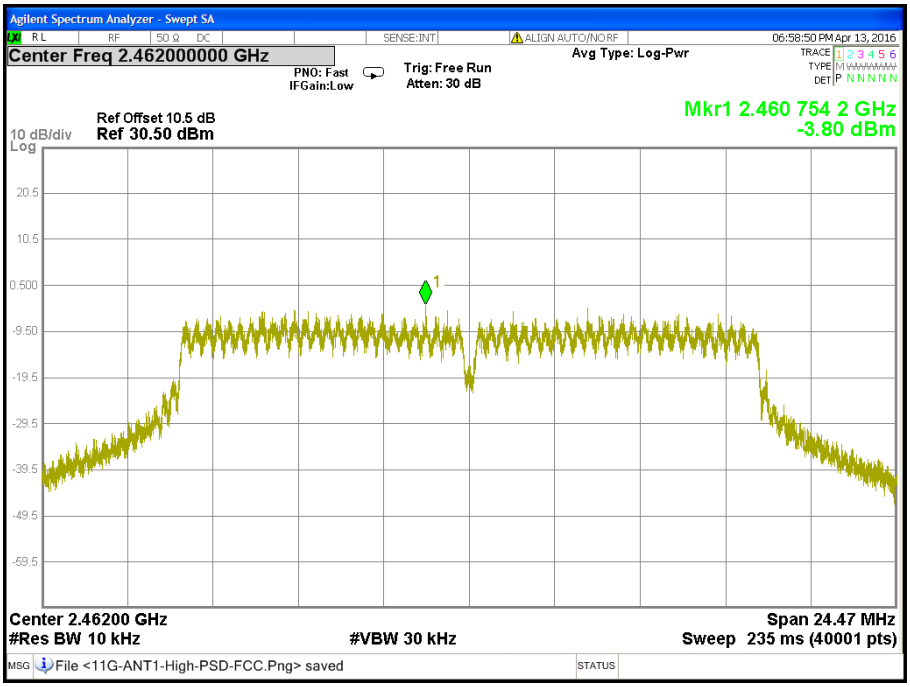
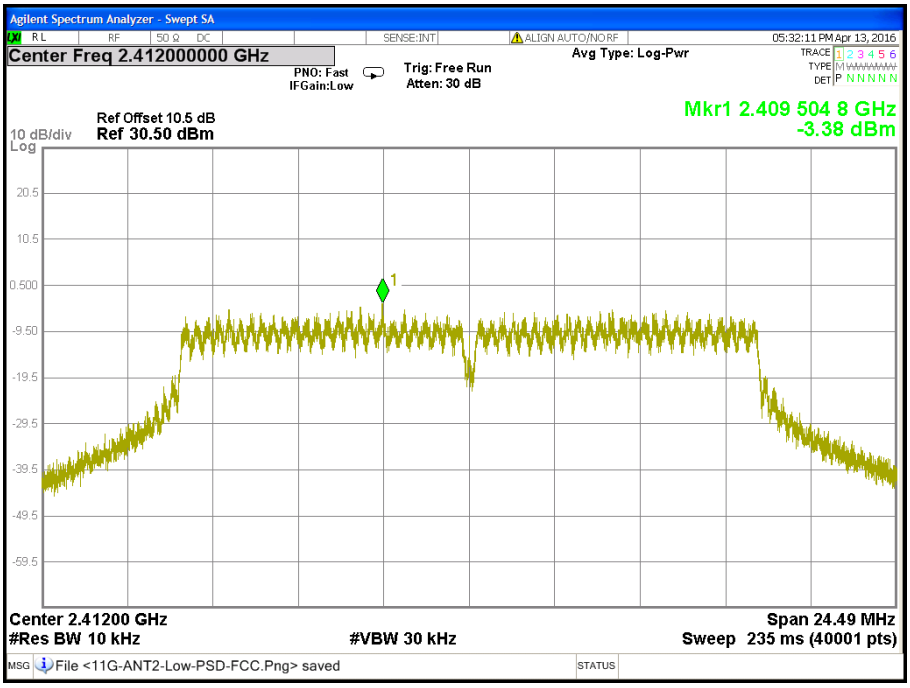


CH High (IEEE 802.11g Mode / Chain 1)



CH Low (IEEE 802.11g Mode / Chain 2)



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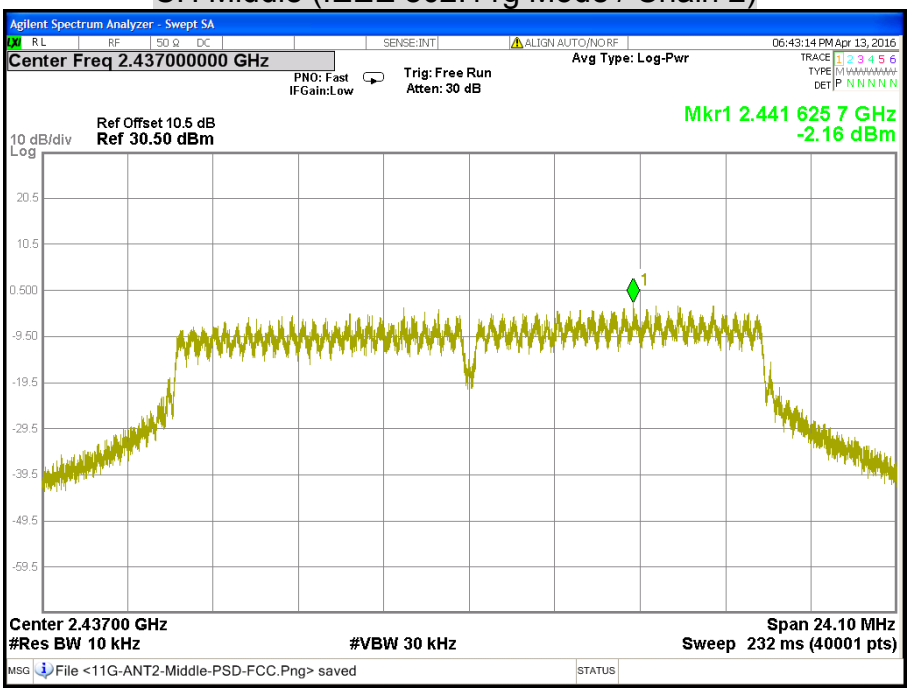

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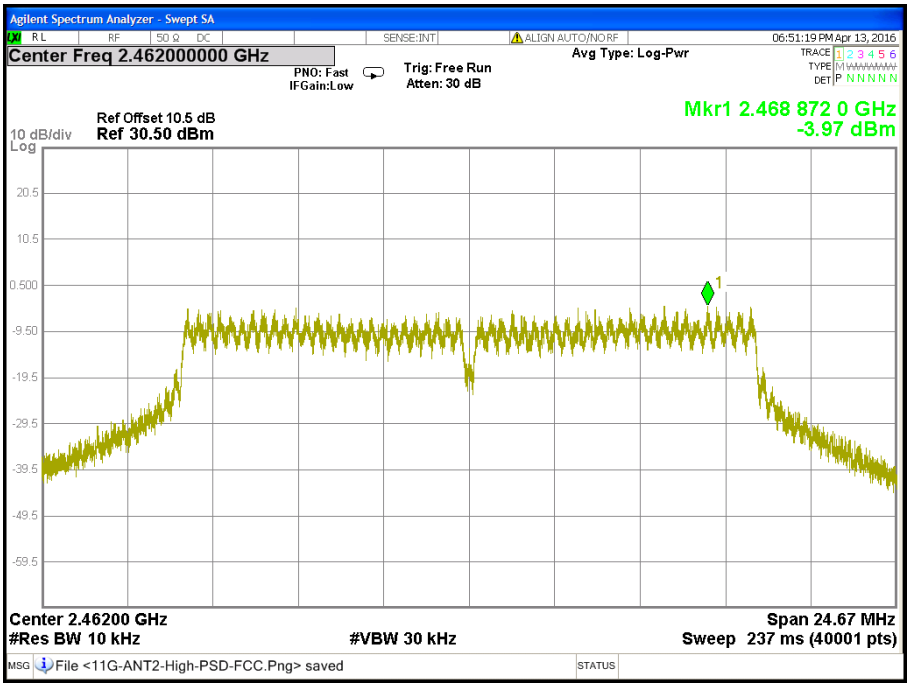
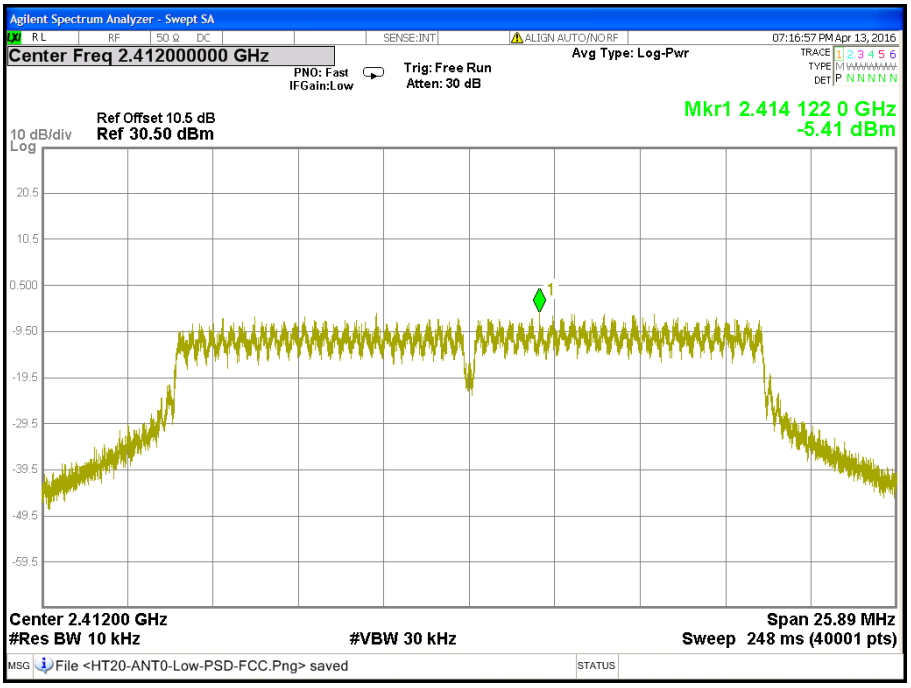


CH Low (IEEE 802.11gn HT20 Mode / Chain 0)



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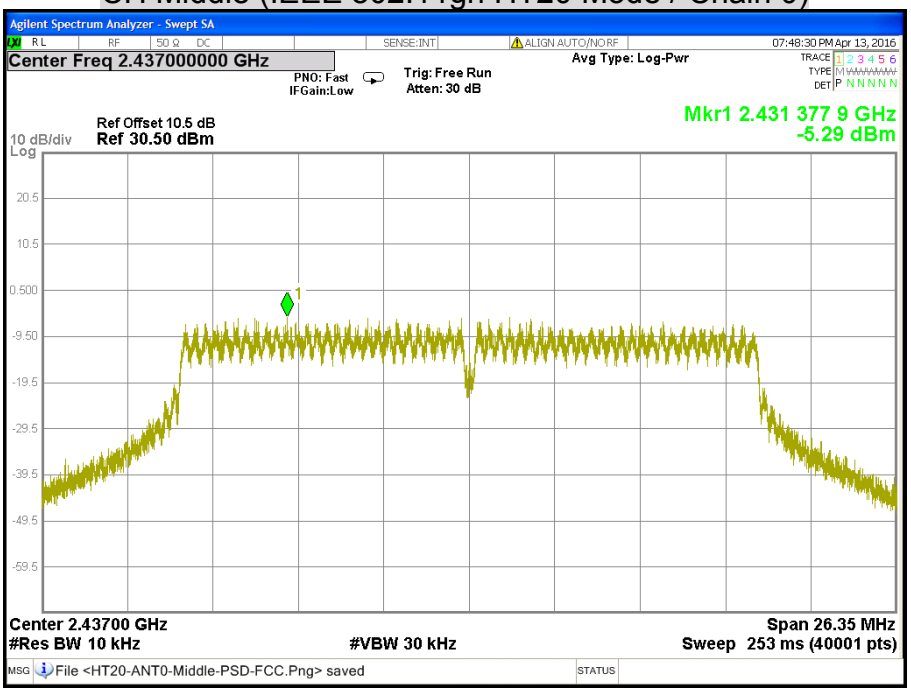

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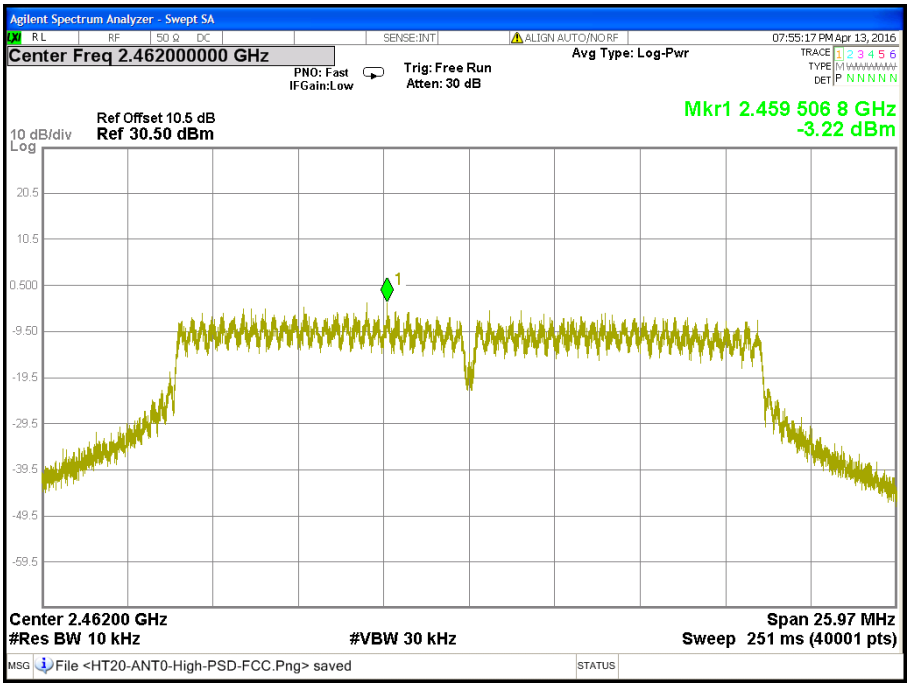
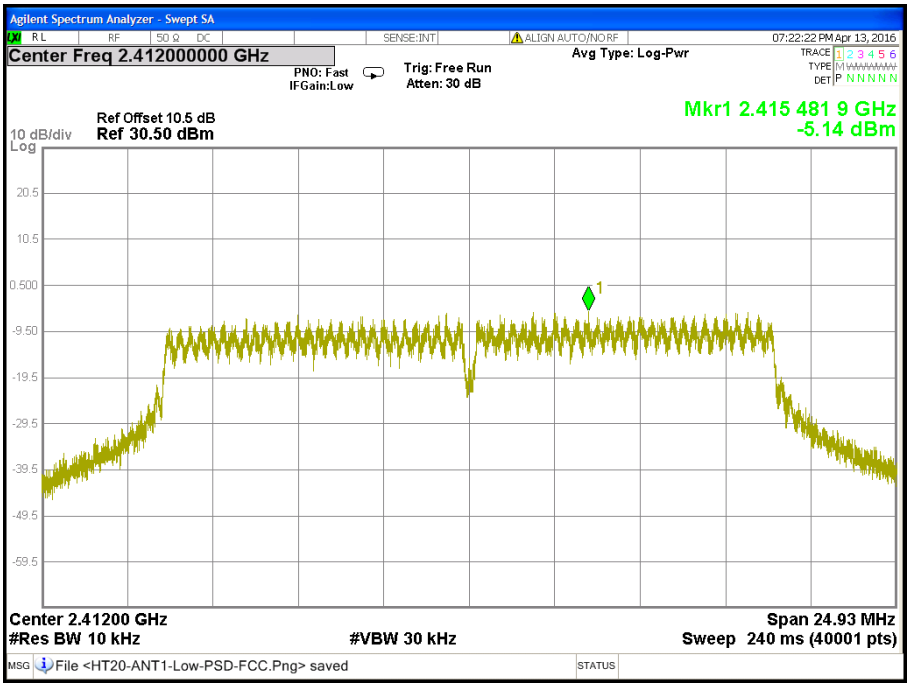
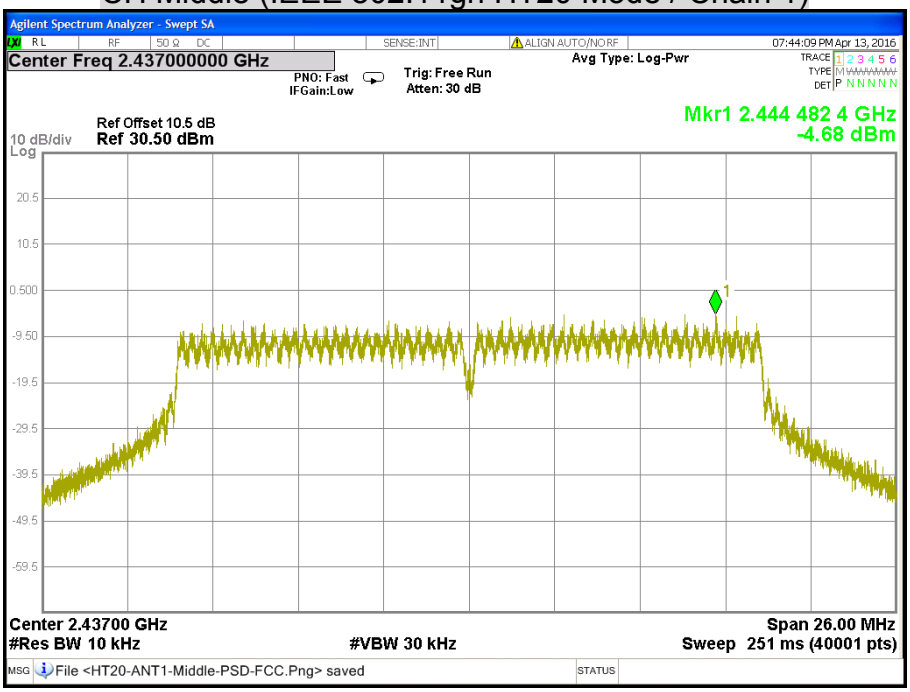


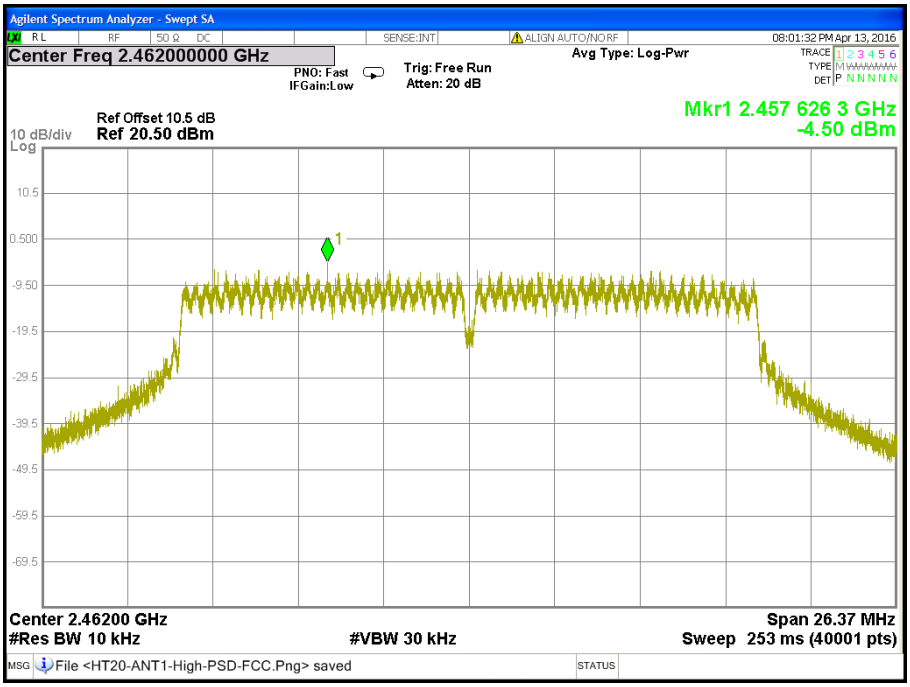
CH Low (IEEE 802.11gn HT20 Mode / Chain 1)



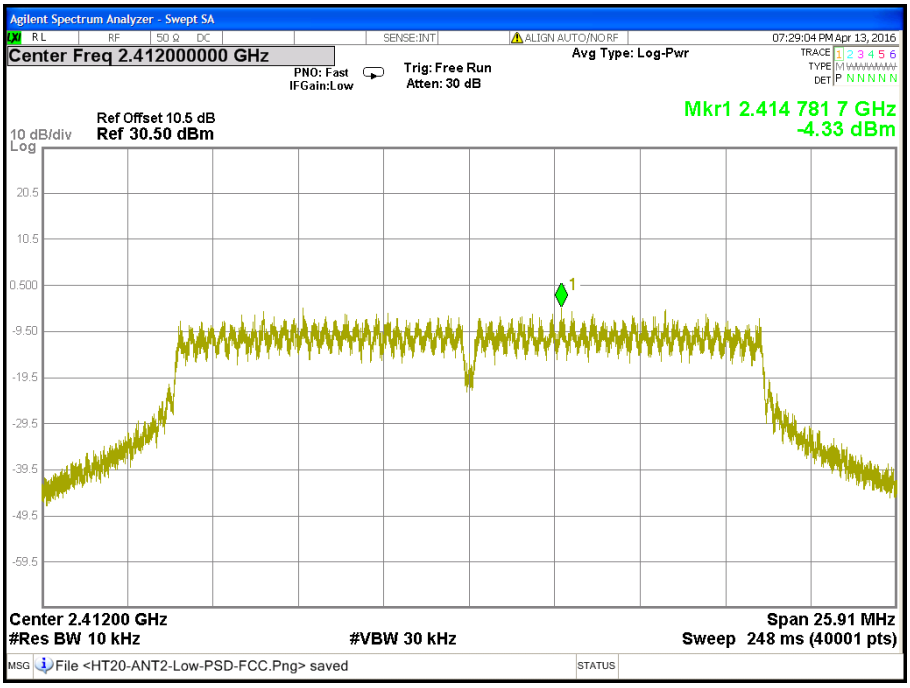
CH Middle (IEEE 802.11gn HT20 Mode / Chain 1)



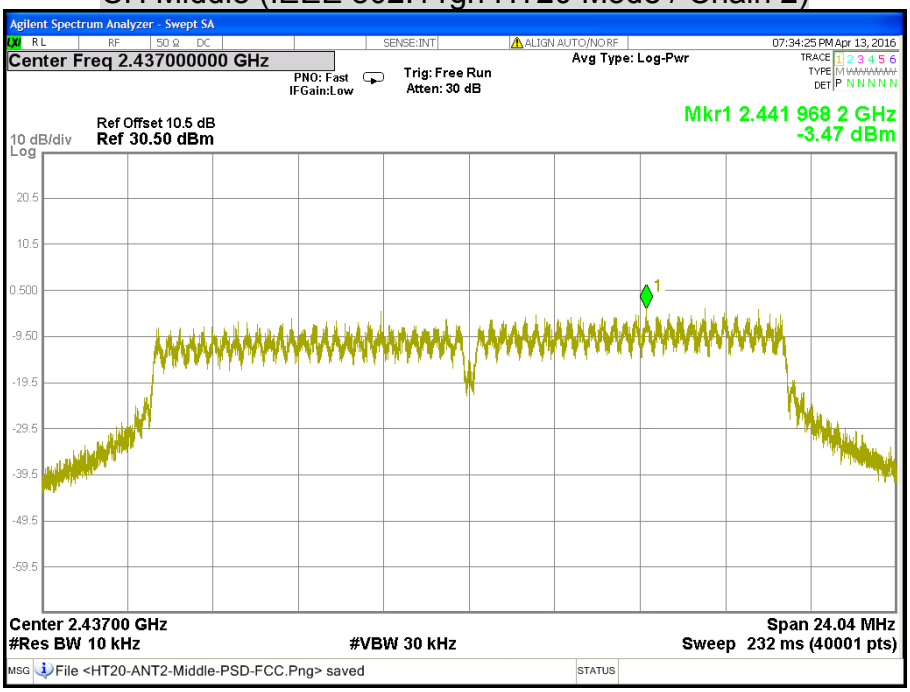
CH High (IEEE 802.11gn HT20 Mode / Chain 1)



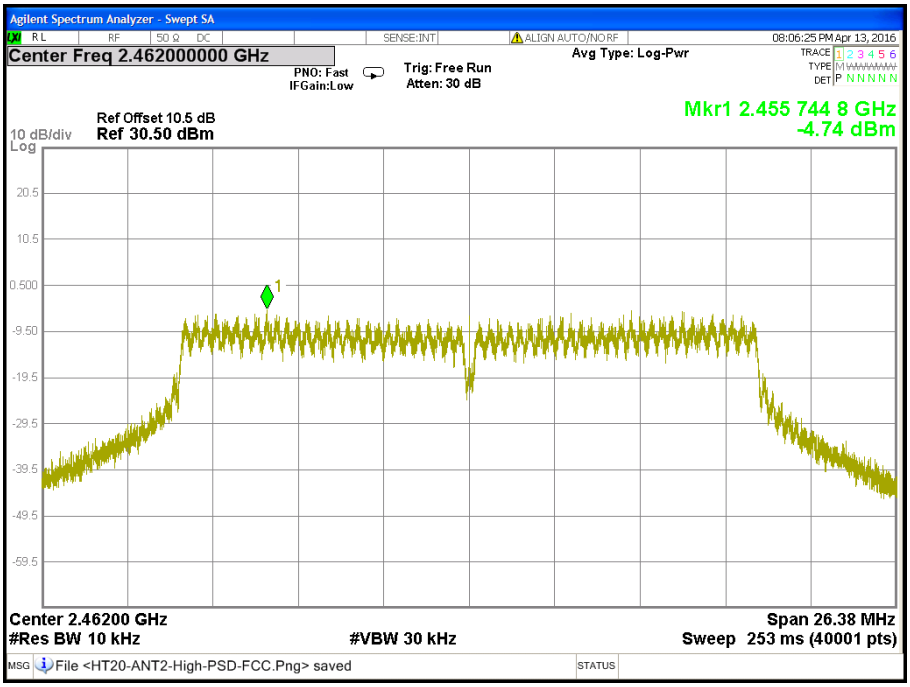
CH Low (IEEE 802.11gn HT20 Mode / Chain 2)



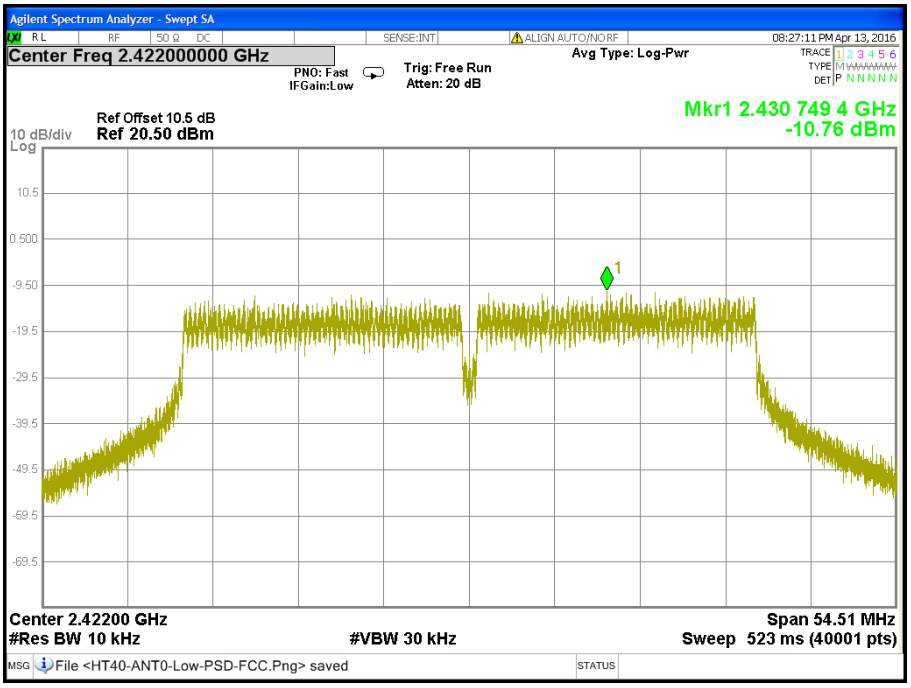
CH Middle (IEEE 802.11gn HT20 Mode / Chain 2)



CH High (IEEE 802.11gn HT20 Mode / Chain 2)



CH Low (IEEE 802.11gn HT40 Mode / Chain 0)



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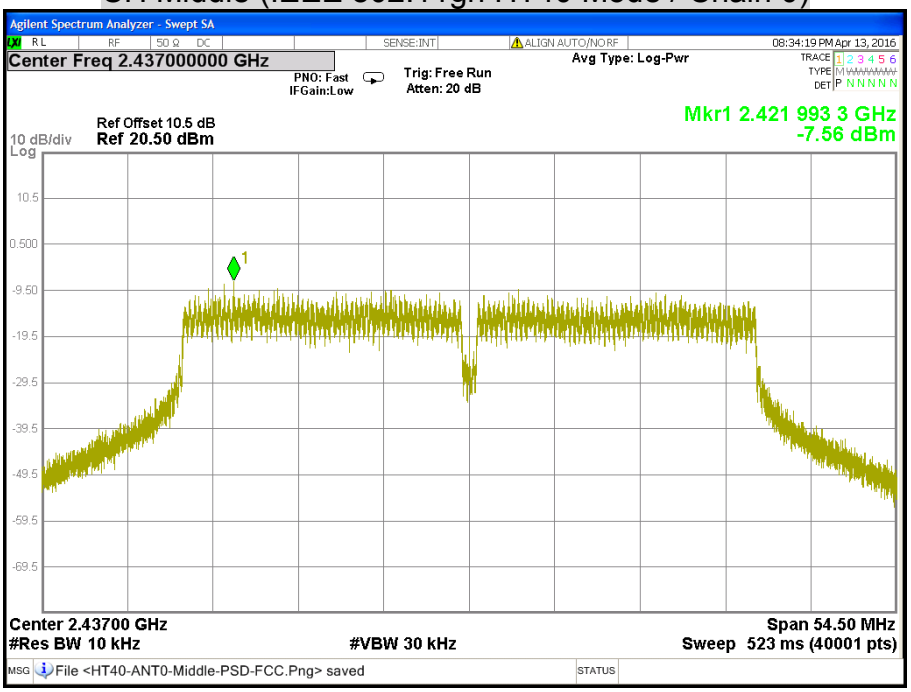

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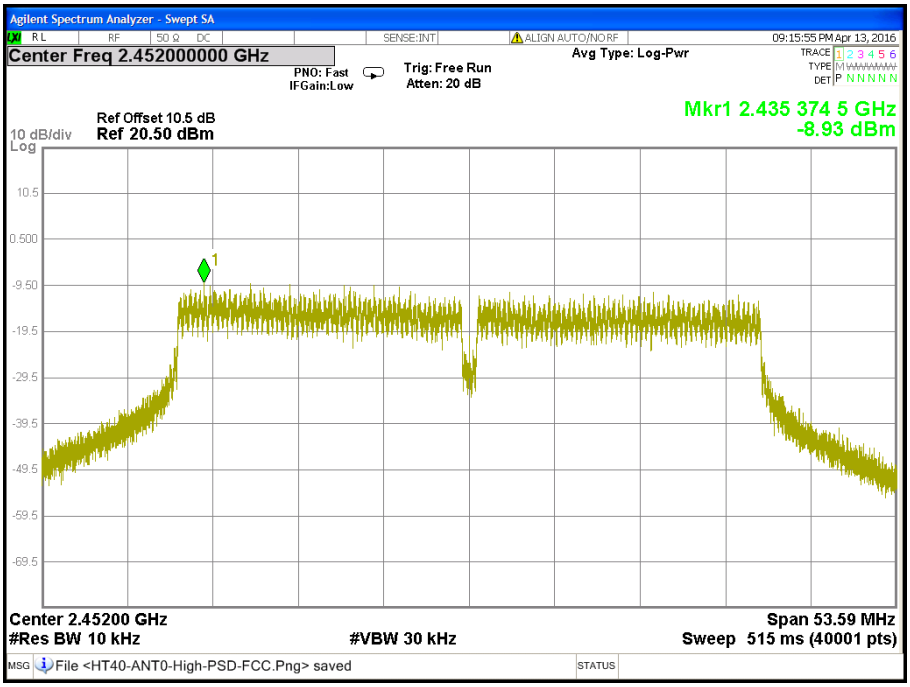
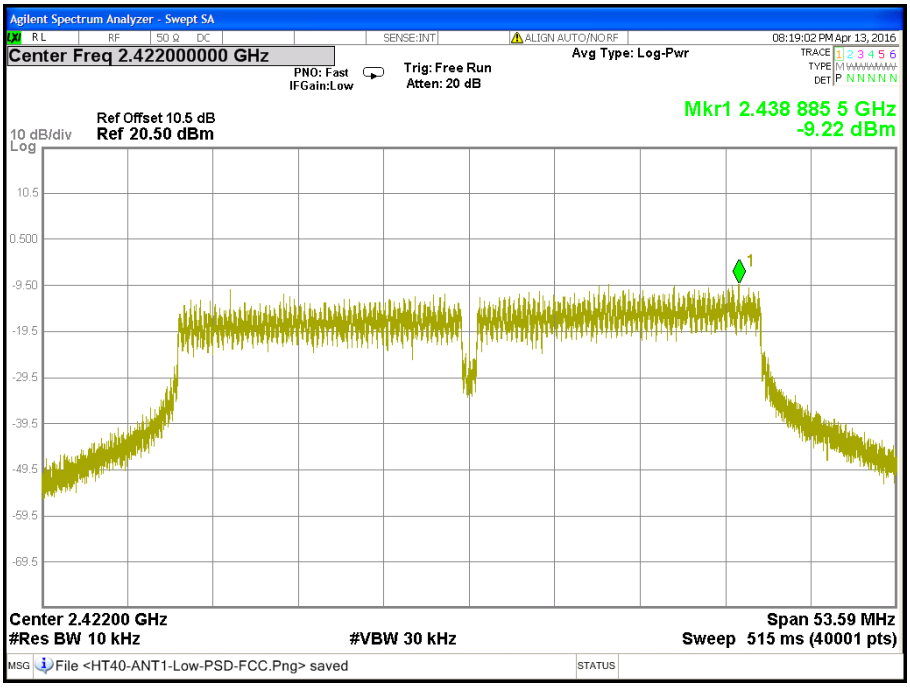
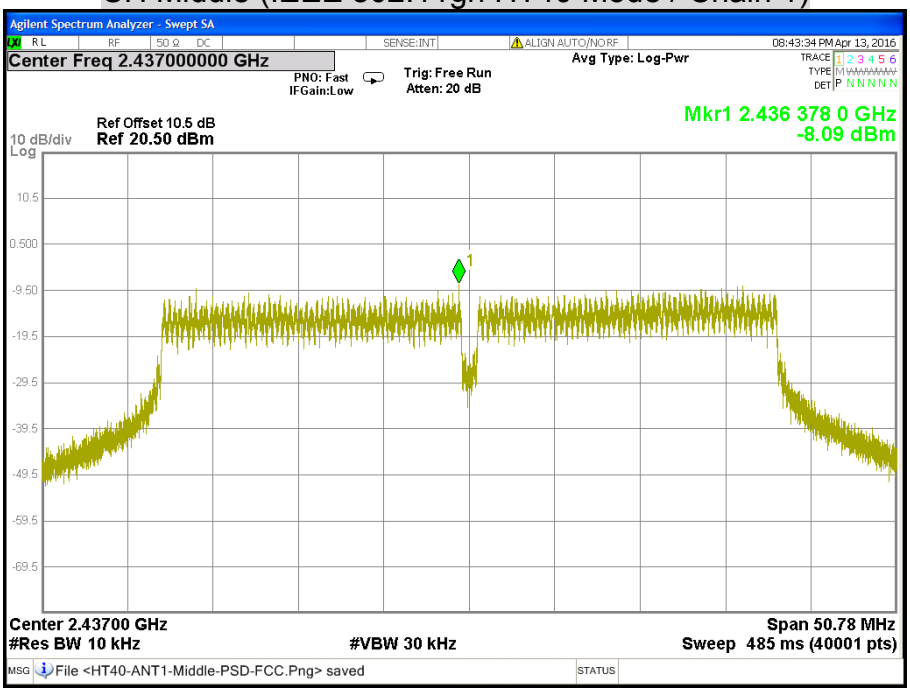


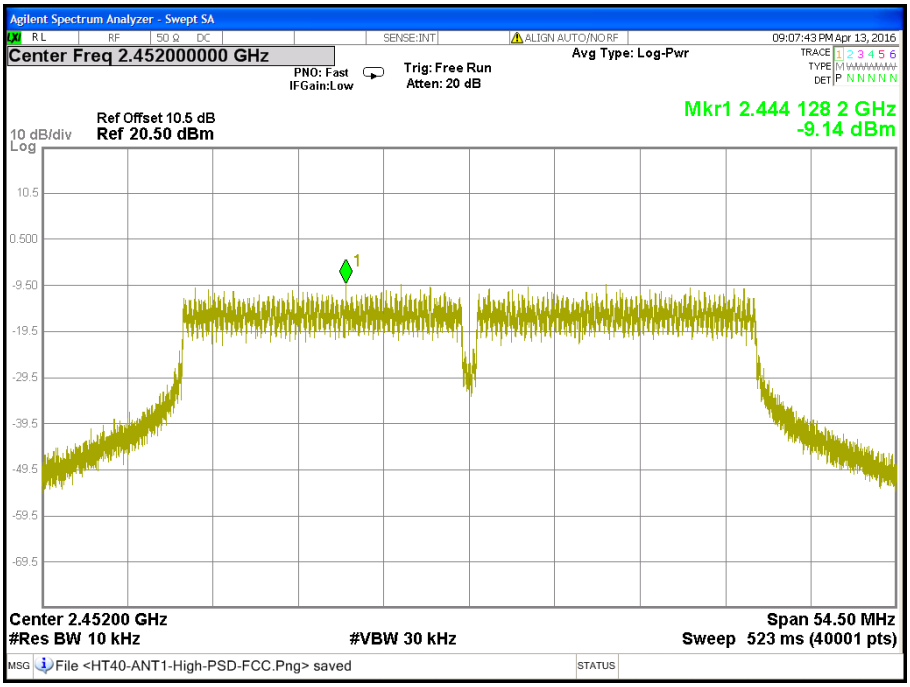
CH Low (IEEE 802.11gn HT40 Mode / Chain 1)



CH Middle (IEEE 802.11gn HT40 Mode / Chain 1)



CH High (IEEE 802.11gn HT40 Mode / Chain 1)



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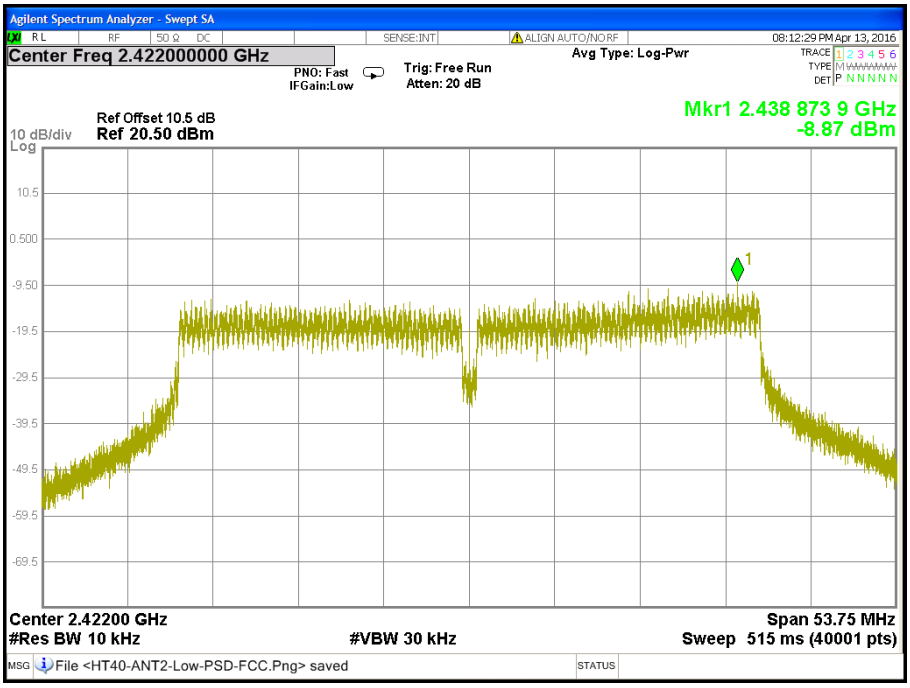
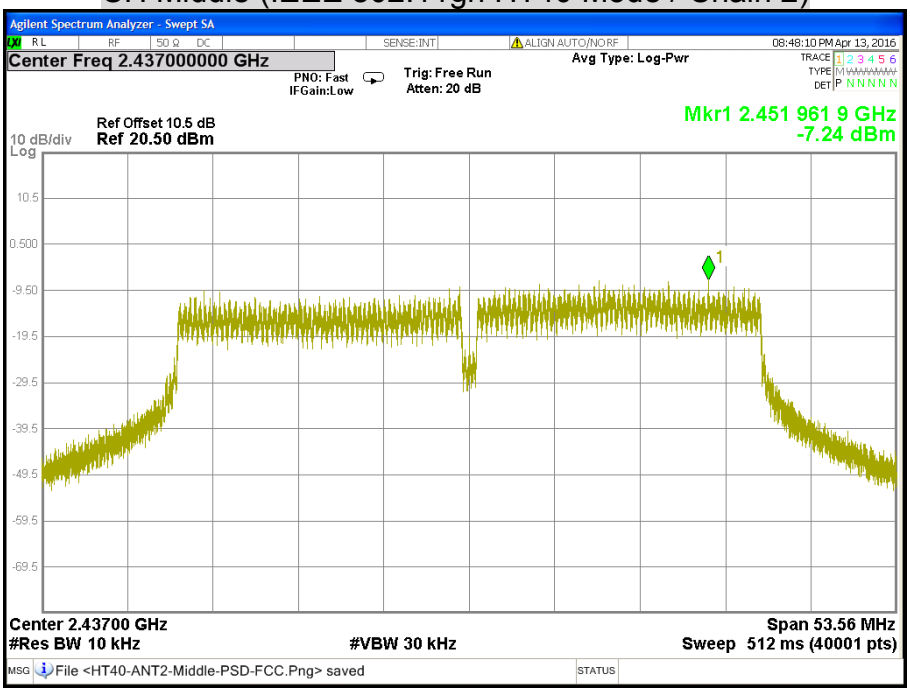


CH Middle (IEEE 802.11gn HT40 Mode / Chain 2)



CH High (IEEE 802.11gn HT40 Mode / Chain 2)