TEST REPORT

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Report No.:
CTK-2018-01333

1. Client

◦ Name : KAONMEDIA Co., Ltd.

◦ Address : KAONMEDIA Building, 884-3 Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea

◦ Date of Receipt : 2018-02-14

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: Layer3 TV / Client VM3000C

5. Date of Test : 2018-04-24 to 2018-05-16

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

7. Testing Environment: Temp.: (23 ± 5) ℃, Humidity: (50 ± 3) % 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 Ji-Hye, Kim: (Signature)	Technical Manager Won-Jae, Hwang: (Signature)

2018-05-18

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

REPORT REVISION HISTORY

Date	Revision	Page No
2018-05-18	Issued (CTK-2018-01333)	all

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1. 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 : Kim tae-Sung E-mail : kkam@kaonmedia.com Tel : +82-31-724-8861

1.2 Product Information

FCC ID	WQTVM3000C
Product Description	Layer3 TV
Model name	Client VM3000C
Variant Model name	-
Operating Frequency	2 412 MHz – 2 462 MHz
RF Output Power	802.11b : 23.57 dBm (227.51 mW) 802.11g : 15.87 dBm (38.62 mW) CDD Mode_802.11n_HT20 : 14.57 dBm (28.61 mW) CDD Mode_802.11n_HT40 : 10.89 dBm (12.27 mW) SDM Mode_802.11n_HT20 : 14.84 dBm (30.47 mW) SDM Mode_802.11n_HT40 : 11.40 dBm (13.80 mW)
Antenna Specification	Antenna type : PCB Antenna Peak Gain : 2 dBi
Number of channels	11
Type of Modulation	802.11b : DSSS 802.11g/n : OFDM
Data Rate	802.11b : 11 / 5.5 / 2 / 1 Mbps 802.11g : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n: MCS0-7, up to 450 Mbps
Power Source	DC 12 V(Adapter)
Hardware Rev	V1.0
Software Rev	V1.0

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253R6N
AC/DC Adapter	HP	HSTNN-CA40	-
AD/DC Adapter	I.T.E POWER SUPPLY ALSO LISTED	SQUS50-120333	-

2. 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	**MSIP**	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. Test Specifications

3.1 Standards

FCC Part Section(s)	Requirement(s)	Status (Note 1)	Test Condition
15.247(a)	6 dB Bandwidth	C	Conducted
15.247(b)	Maximum Output Power	C	
15.247(d)	Conducted Spurious emission	C	
15.247(d)	Unwanted Emission(Conducted)	C	
15.247(e)	Power Spectral Density	C	
15.209	Radiated Emissions	C	Radiated
15.207	AC Conducted Emission	C	Line Conducted
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
Note 2: The data in this test report are traceable to the national or international standards.			
Note 3: The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013			
Note 4: The tests were performed according to the method of measurements prescribed in KDB No.558074.			

3.2 Mode of operation during the test

The EUT 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.
For WLAN function, the engineering test program was provided and enabled to make EUT continuous transmit.
All modulation modes were tests. The results are only attached worst cases.

Test Frequency
- 802.11b, 802.11g, 802.11n_HT20

Lowest channel	Middle channel	Highest channel
2 412 MHz	2 437 MHz	2 462 MHz

- 802.11n_HT40

Lowest channel	Middle channel	Highest channel
2 422 MHz	2 437 MHz	2 452 MHz

Test mode
- CDD mode

Test mode	Modulation	Data rate	Duty Cycle	Duty Cycle Factor
802.11b	DSSS	1 Mbps	95.2%	0.21 dB
802.11g	OFDM	6 Mbps	95.3%	0.21 dB
802.11n_HT20	OFDM	MCS 0	95.2%	0.21 dB
802.11n_HT40	OFDM	MCS 0	90.6%	0.43 dB

- SDM mode

Test mode	Modulation	Data rate	Duty Cycle	Duty Cycle Factor
802.11n_HT20	OFDM	MCS 16	87.3%	0.59 dB
802.11n_HT40	OFDM	MCS 16	78.0%	1.08 dB

3.3 Device Modifications

The following modifications were necessary for compliance:

Not applicable

3.4 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 ≤ 1 GHz)	± 4.0 dB
Radiated Emissions (f > 1 GHz)	± 5.0 dB

3.5 Test Software

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	TOYO EMI software EP5RE Ver. 5.1.0
Line Conducted Test	ESCI7, ESCI3 : EMC32 Ver. 8.50.0 ESR7 : EMC32 Ver. 8.53.0

4. 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 ≥ 3 x 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:

CDD Mode_ANT0

	6 dB Bandwidth and 99% Bandwidth (MHz)					
Mode	802.11b		802.11g		802.11n_HT20	
Frequency	6dB	99%	6dB	99%	6dB	99%
2 412 MHz	8.66	11.41	16.16	16.50	17.26	17.68
2 437 MHz	9.10	11.54	16.40	16.52	17.39	17.71
2 462 MHz	9.09	11.88	16.13	16.46	17.31	17.64

	6 dB Bandwidth and 99% Bandwidth (MHz)	
Mode	802.11n HT40	
Frequency	6dB	99%
2 422 MHz	36.36	36.24
2 437 MHz	35.81	36.19
2 452 MHz	35.51	35.94

CDD Mode_ANT1

	6 dB Bandwidth and 99% Bandwidth (MHz)					
Mode	802.11b		802.11g		802.11n_HT20	
Frequency	6dB	99%	6dB	99%	6dB	99%
2 412 MHz	8.64	11.48	16.36	16.48	17.34	17.67
2 437 MHz	9.08	11.69	16.40	16.52	17.61	17.72
2 462 MHz	9.11	11.95	16.10	16.46	17.20	17.65

	6 dB Bandwidth and 99% Bandwidth (MHz)	
Mode	802.11n HT40	
Frequency	6dB	99%
2 422 MHz	36.38	36.20
2 437 MHz	36.00	36.20
2 452 MHz	35.49	35.98

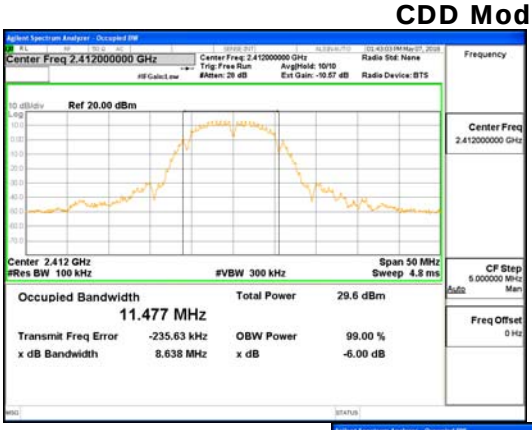
CDD Mode_ANT2

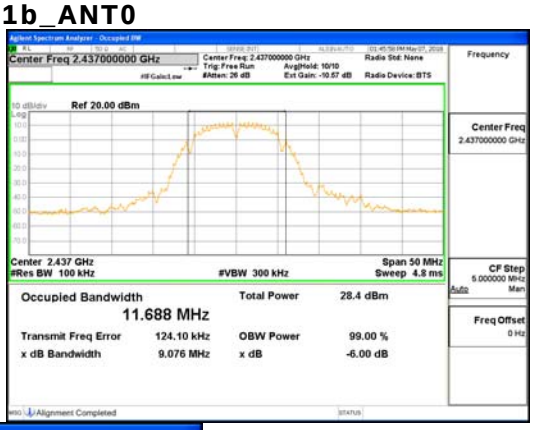
	6 dB Bandwidth and 99% Bandwidth (MHz)					
Mode	802.11b		802.11g		802.11n_HT20	
Frequency	6dB	99%	6dB	99%	6dB	99%
2 412 MHz	9.09	11.50	16.38	16.51	17.27	17.70
2 437 MHz	8.65	11.52	16.39	16.52	17.41	17.72
2 462 MHz	8.65	11.76	16.14	16.48	17.39	17.67

	6 dB Bandwidth and 99% Bandwidth (MHz)	
Mode	802.11n HT40	
Frequency	6dB	99%
2 422 MHz	36.39	36.24
2 437 MHz	35.80	36.14
2 452 MHz	35.44	35.98

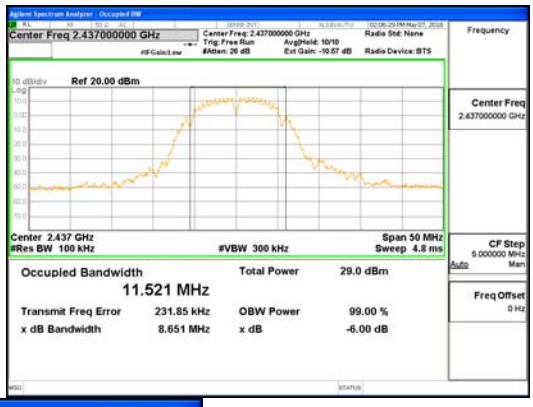
See next pages for actual measured spectrum plots.

CDD Mode_802.11b_ANT0



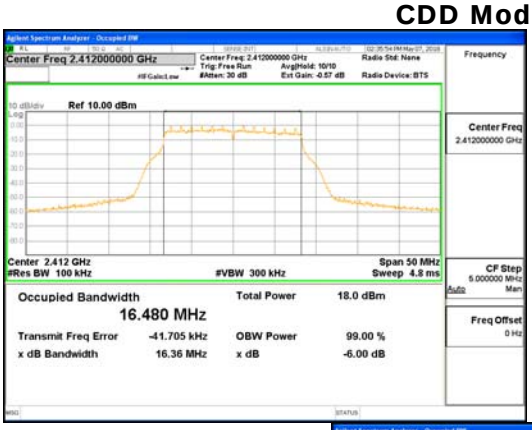


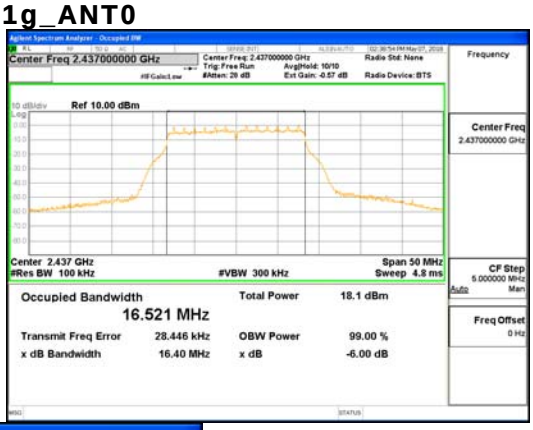
CDD Mode_802.11b_ANT1



CDD Mode_802.11b_ANT2

CDD Mode_802.11g_ANT0

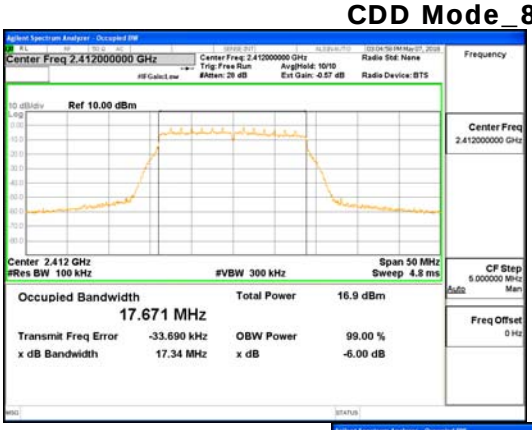


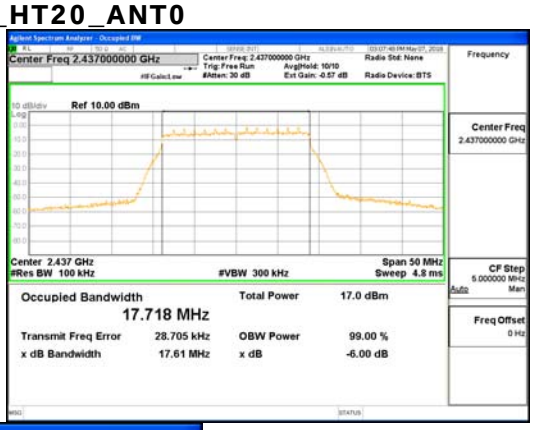


CDD Mode_802.11g_ANT1

CDD Mode_802.11g_ANT2

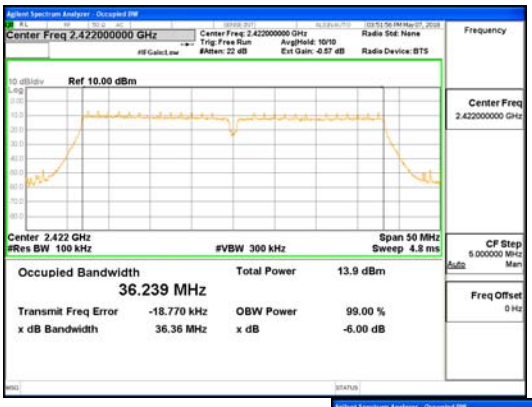
CDD Mode_802.11n_HT20_ANT0

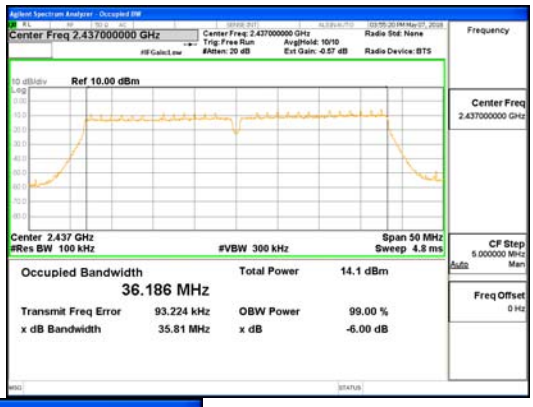




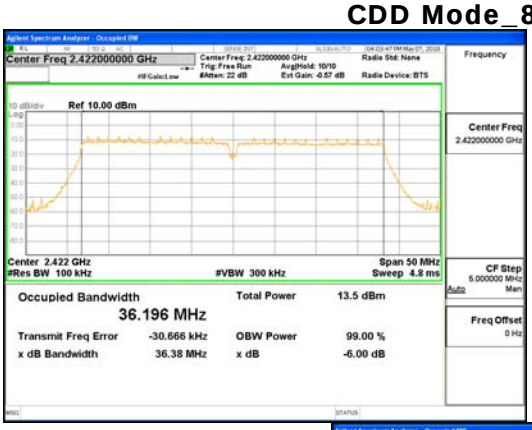
CDD Mode_802.11n_HT20_ANT1

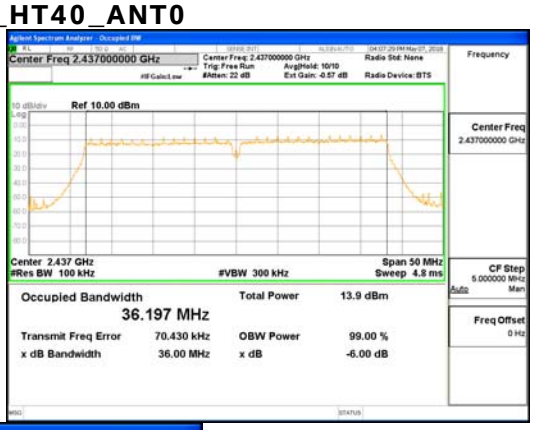
CDD Mode_802.11n_HT20_ANT2



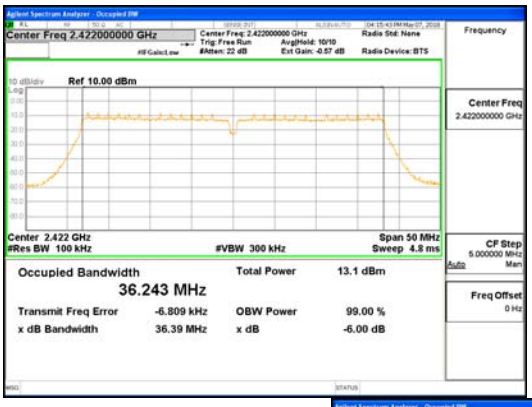


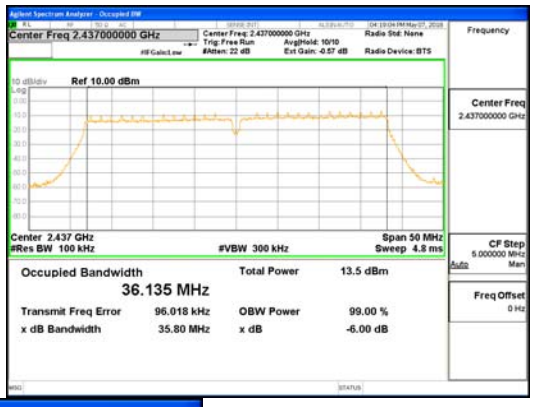
CDD Mode_802.11n_HT40_ANT0





CDD Mode_802.11n_HT40_ANT1





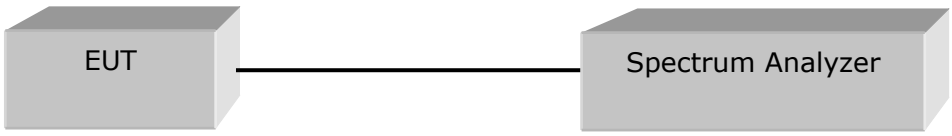
CDD Mode_802.11n_HT40_ANT2

4.2 OUTPUT POWER

Test Procedures

Average Power(Procedure 9.2.2.2 in KDB 558074, Method AVGSA-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 ≥ 1.5 x OBW

b) RBW = 1 MHz

c) VBW ≥ 3 x RBW

d) Sweep time = auto

e) Detector = RMS

f) average at least 100

g) Duty cycle factor = 10log(1/x)

CDD Mode	802.11b	0.21 dB
	802.11g	0.21 dB
	802.11n_HT20	0.21 dB
	802.11n_HT40	0.43 dB
SDM Mode	802.11n_HT20	0.59 dB
	802.11n_HT40	1.08 dB

Limit

Operating Mode	Mode	ANT Configuration	ANT Gain (dBi)	Limit (dBm)
SISO	802.11b/g/n	ANT0	2.00	30.00
SISO	802.11b/g/n	ANT1	2.00	30.00
SISO	802.11b/g/n	ANT2	2.00	30.00
MIMO (2Tx)	802.11g/n	ANT0 + ANT1	5.01	30.00
MIMO (3Tx)	802.11g/n	ANT0 + ANT1 + ANT2	6.77	29.23

Test Data

CDD Mode_ANT0

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	21.57	0.21	21.78	30.00	8.22
	2 437	20.13	0.21	20.34	30.00	9.66
	2 462	23.36	0.21	23.57	30.00	6.43
802.11g	2 412	10.00	0.21	10.21	30.00	19.79
	2 437	11.02	0.21	11.23	30.00	18.77
	2 462	10.89	0.21	11.10	30.00	18.90
802.11n _HT20	2 412	9.29	0.21	9.50	30.00	20.50
	2 437	9.99	0.21	10.20	30.00	19.80
	2 462	10.01	0.21	10.22	30.00	19.78
802.11n _HT40	2 422	5.34	0.43	5.77	30.00	24.23
	2 437	5.71	0.43	6.14	30.00	23.86
	2 452	5.81	0.43	6.24	30.00	23.76

CDD Mode_ANT1

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	21.58	0.21	21.79	30.00	8.21
	2 437	20.46	0.21	20.67	30.00	9.33
	2 462	22.93	0.21	23.14	30.00	6.86
802.11g	2 412	10.15	0.21	10.36	30.00	19.64
	2 437	10.34	0.21	10.55	30.00	19.45
	2 462	10.46	0.21	10.67	30.00	19.33
802.11n _HT20	2 412	8.72	0.21	8.93	30.00	21.07
	2 437	8.97	0.21	9.18	30.00	20.82
	2 462	9.10	0.21	9.31	30.00	20.69
802.11n _HT40	2 422	5.13	0.43	5.56	30.00	24.44
	2 437	5.64	0.43	6.07	30.00	23.93
	2 452	5.77	0.43	6.2	30.00	23.80

CDD Mode_ANT2

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	21.44	0.21	21.65	30.00	8.35
	2 437	20.91	0.21	21.12	30.00	8.88
	2 462	22.71	0.21	22.92	30.00	7.08
802.11g	2 412	10.49	0.21	10.70	30.00	19.30
	2 437	11.25	0.21	11.46	30.00	18.54
	2 462	10.78	0.21	10.99	30.00	19.01
802.11n _HT20	2 412	9.13	0.21	9.34	30.00	20.66
	2 437	9.73	0.21	9.94	30.00	20.06
	2 462	9.46	0.21	9.67	30.00	20.33
802.11n _HT40	2 422	4.62	0.43	5.05	30.00	24.95
	2 437	5.10	0.43	5.53	30.00	24.47
	2 452	5.47	0.43	5.90	30.00	24.10

CDD Mode_ANT0 + ANT1

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11g	2 412	13.09	0.21	13.30	30.00	16.70
	2 437	13.70	0.21	13.91	30.00	16.09
	2 462	13.69	0.21	13.90	30.00	16.10
802.11n _HT20	2 412	12.02	0.21	12.23	30.00	17.77
	2 437	12.52	0.21	12.73	30.00	17.27
	2 462	12.59	0.21	12.80	30.00	17.20
802.11n _HT40	2 422	8.25	0.43	8.68	30.00	21.32
	2 437	8.69	0.43	9.12	30.00	20.88
	2 452	8.80	0.43	9.23	30.00	20.77

CDD Mode_ANT0 + ANT1 + ANT2

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11g	2 412	14.99	0.21	15.20	29.23	14.03
	2 437	15.66	0.21	15.87	29.23	13.36
	2 462	15.49	0.21	15.70	29.23	13.53
802.11n _HT20	2 412	13.82	0.21	14.03	29.23	15.20
	2 437	14.36	0.21	14.57	29.23	14.66
	2 462	14.31	0.21	14.52	29.23	14.71
802.11n _HT40	2 422	9.81	0.43	10.24	29.23	18.99
	2 437	10.26	0.43	10.69	29.23	18.54
	2 452	10.46	0.43	10.89	29.23	18.34

SDM Mode_ANT0

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11n _HT20	2 412	9.16	0.59	9.75	30.00	20.25
	2 437	9.89	0.59	10.48	30.00	19.52
	2 462	9.53	0.59	10.12	30.00	19.88
802.11n _HT40	2 422	4.66	1.08	5.74	30.00	24.26
	2 437	5.63	1.08	6.71	30.00	23.29
	2 452	5.70	1.08	6.78	30.00	23.22

SDM Mode_ANT1

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11n _HT20	2 412	8.04	0.59	8.63	30.00	21.37
	2 437	8.93	0.59	9.52	30.00	20.48
	2 462	8.92	0.59	9.51	30.00	20.49
802.11n _HT40	2 422	4.55	1.08	5.63	30.00	24.37
	2 437	5.34	1.08	6.42	30.00	23.58
	2 452	5.47	1.08	6.55	30.00	23.45

SDM Mode_ANT2

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11n _HT20	2 412	9.15	0.59	9.74	30.00	20.26
	2 437	9.56	0.59	10.15	30.00	19.85
	2 462	9.20	0.59	9.79	30.00	20.21
802.11n _HT40	2 422	5.05	1.08	6.13	30.00	23.87
	2 437	5.28	1.08	6.36	30.00	23.64
	2 452	5.47	1.08	6.55	30.00	23.45

SDM Mode_ANT0 + ANT1

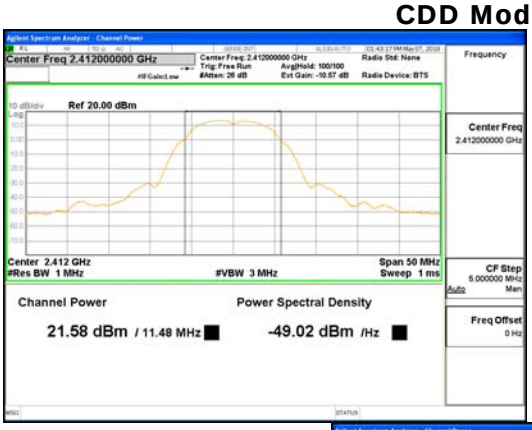
Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11n _HT20	2 412	11.65	0.59	12.24	30.00	17.76
	2 437	12.45	0.59	13.04	30.00	16.96
	2 462	12.25	0.59	12.84	30.00	17.16
802.11n _HT40	2 422	7.62	1.08	8.70	30.00	21.30
	2 437	8.50	1.08	9.58	30.00	20.42
	2 452	8.60	1.08	9.68	30.00	20.32

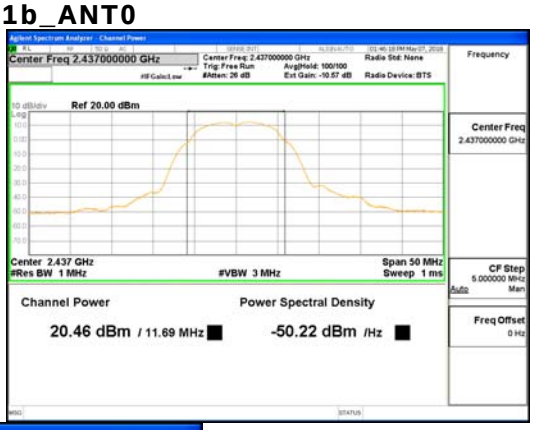
SDM Mode_ANT0 + ANT1 + ANT2

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin(dB)
802.11n _HT20	2 412	13.59	0.59	14.18	29.23	15.05
	2 437	14.25	0.59	14.84	29.23	14.39
	2 462	14.00	0.59	14.59	29.23	14.64
802.11n _HT40	2 422	9.53	1.08	10.61	29.23	18.62
	2 437	10.19	1.08	11.27	29.23	17.96
	2 452	10.32	1.08	11.40	29.23	17.83

See next pages for actual measured spectrum plots.

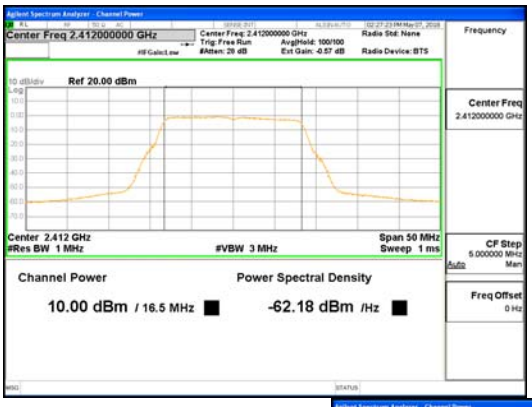
CDD Mode_802.11b_ANT0



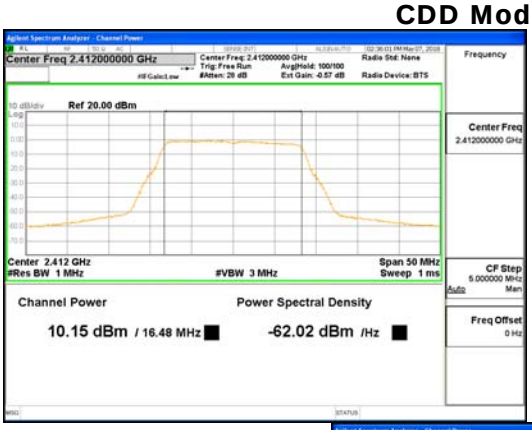


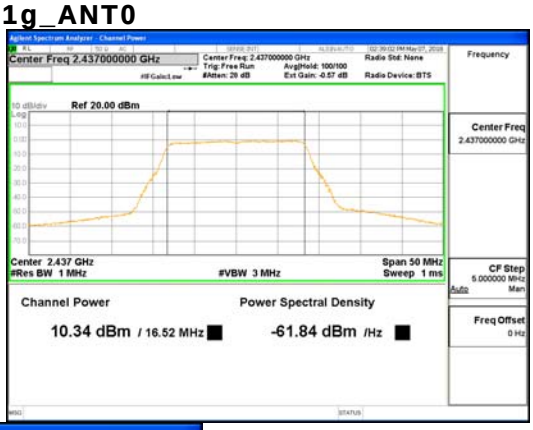
CDD Mode_802.11b_ANT1

CDD Mode_802.11b_ANT2



CDD Mode_802.11g_ANT0

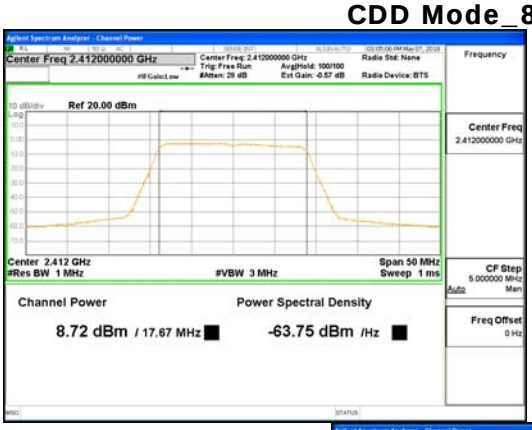


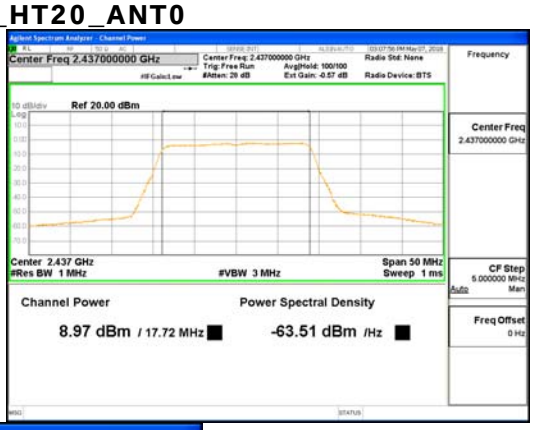


CDD Mode_802.11g_ANT1

CDD Mode_802.11g_ANT2

CDD Mode_802.11n_HT20_ANT0

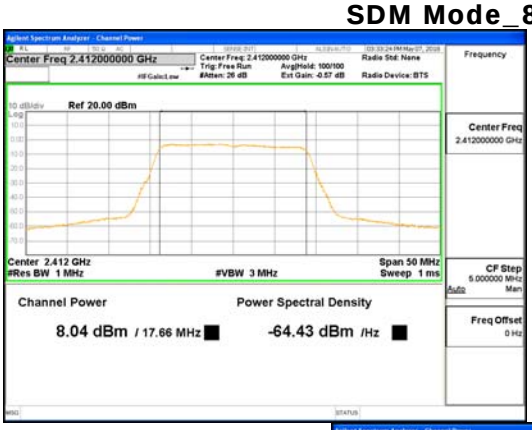


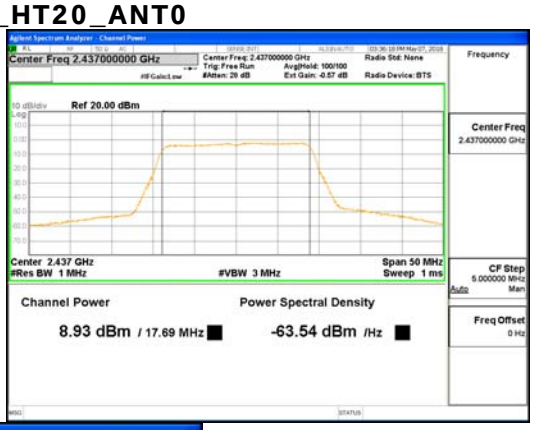


CDD Mode_802.11n_HT20_ANT1

CDD Mode_802.11n_HT20_ANT2

SDM Mode_802.11n_HT20_ANT0





SDM Mode_802.11n_HT20_ANT1

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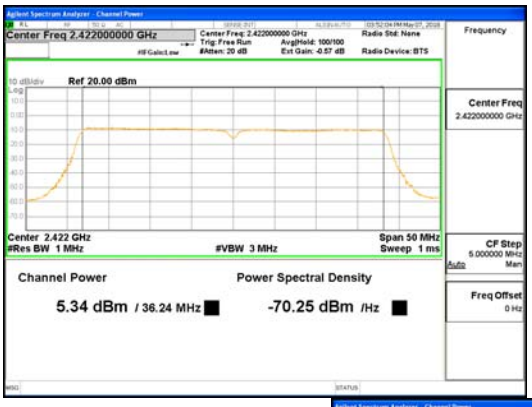

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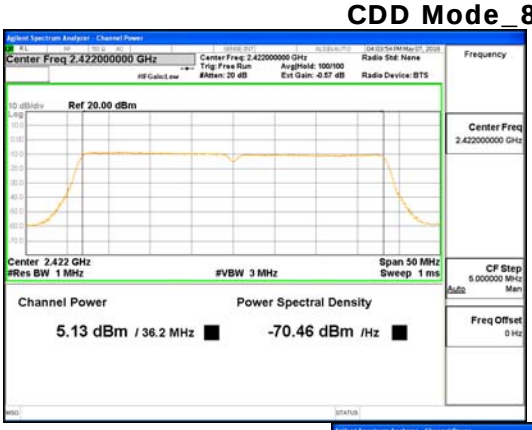

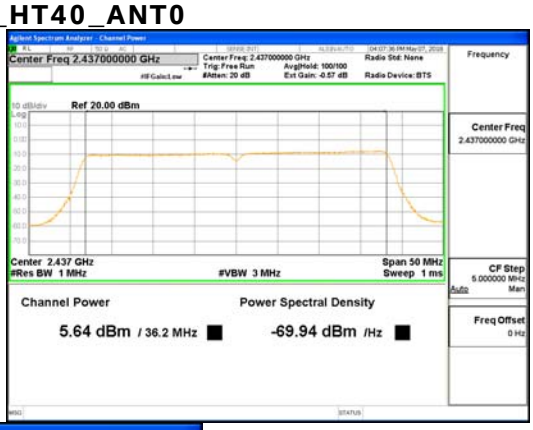

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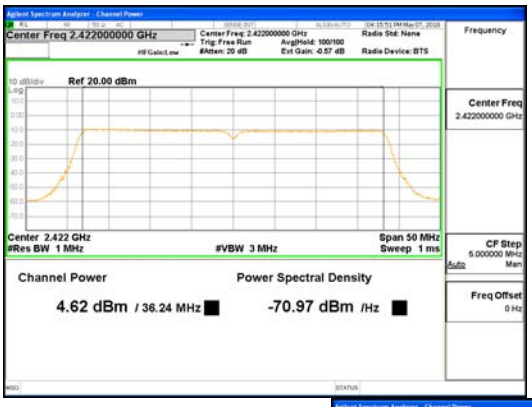

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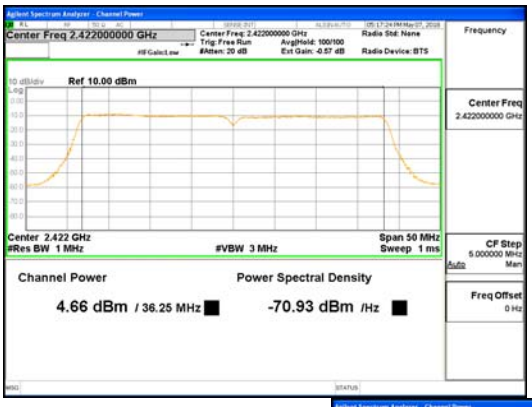

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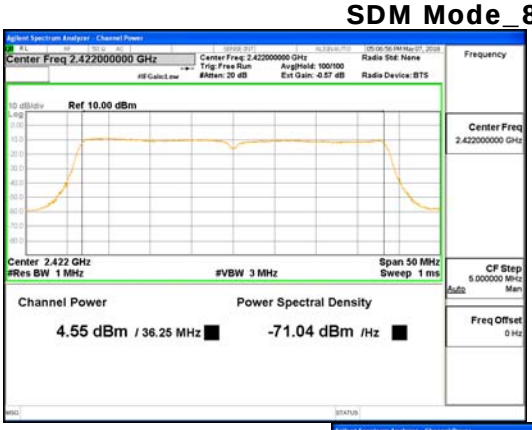

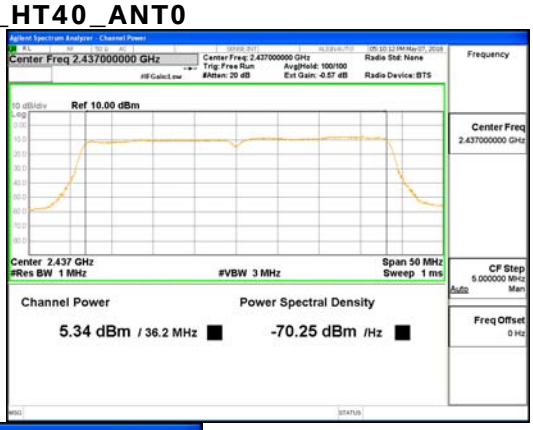

SDM Mode_802.11n_HT40_ANT1

SDM Mode_802.11n_HT40_ANT2