TEST REPORT

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Report No.: CTK-2024-02546

1. Applicant

◦ Name : Haier US Appliance Solutions, Inc.

◦ Address : Appliance Park AP5-2N-65, Louisville, Kentucky, United States, 40225

◦ Date of Receipt : 2024-07-19

2. Manufacturer

◦ Name : Haier US Appliance Solutions, Inc.

◦ Address : Appliance Park AP5-2N-65, Louisville, Kentucky, United States, 40225

3. Use of Report : For FCC Conformance / ISED Conformance

4. Test Sample / Model : Android Board for GEA LCD products / SBC001

5. Date of Test : 2024-08-02 to 2024-09-06

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.247
ISED RSS-247 & RSS-Gen

7. Testing Environment : refer to 8 page

8. Test Results : Compliance

9. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

(Address : (Unhak-Dong) 5, Dongbu-ro 221beon-gil, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea)

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
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Approval	Tested by Ji-Hye, Kim: (Signature)	Technical Manager Won-Jae, Hwang: (Signature)

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2024-09-10

CTK Co., Ltd.

REPORT REVISION HISTORY

Date	Revision	Page No
2024-09-10	Issued (CTK-2024-02546)	all

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1. General Product Description

1.1 Applicant Information

Company	Haier US Appliance Solutions, Inc.
Contact Point	Appliance Park AP5-2N-65, Louisville, Kentucky, United States, 40225
Contact Person	Name : Park, Hansung E-mail : hansung.park@geappliances.com Tel : +82-31-8094-6732 Fax : +82-31-8094-6888

1.2 Product Information

FCC ID	ZKJ-SBC001
ISED	10229A-SBC001
Product Description	Android Board for GEA LCD products
Model name	SBC001
Variant Model name	-
Operating Frequency	2 412 MHz – 2 462 MHz (20MHz_BW) 2 422 MHz – 2 452 MHz (40MHz_BW)
RF Output Power	802.11b : 18.67 dBm (73.62 mW) 802.11g : 17.78 dBm (59.98 mW) 802.11n_HT20 : 18.88 dBm (77.27 mW) 802.11n_HT40 : 17.99 dBm (62.95 mW)
Antenna Specification	Antenna type : Chip Antenna Peak Gain : 2.17 dBi (ANT1, ANT2)
Antenna Configurations	802.11b : SISO(ANT1, ANT2) 802.11g : SISO(ANT1, ANT2) 802.11n : SISO(ANT1, ANT2), MIMO(ANT1+ANT2)
Number of channels	11 (802.11b/g/n_HT20) 7 (802.11n_HT40)
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: up to 300 Mbps
Power Source	DC 5 V
Hardware Rev	HT-PCB-240-A2302B-C-V06
Software Rev	AOSP-1.8.0.10
RF Power setting in Test SW	802.11b : 17 802.11g : 17 802.11n_HT20 : 17 802.11n_HT40 : 16

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253QPR
AC/DC Adapter	HP	HSTNN-LA40	-

1.4 Model Differences

Not applicable

2. Accreditations

2.1 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	CN : 8737A CAB ID : KR0025
KOREA	NRRA	KR0025

2.2 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)	Transmitter Power Spectral Density	C	
15.209	Radiated Emissions	C	Radiated
15.207	AC Conducted Emissions	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			
Note 4: The tests were performed according to the method of measurements prescribed in KDB No.558074, ANSI C63.10-2013			

ISED Part Section(s)	Requirement(s)	Status (Note 1)	Test Condition
RSS-247 5.2(a)	6 dB Bandwidth	C	Conducted
RSS-247 5.4(d)	Maximum Output Power	C	
RSS-247 5.5	Conducted Spurious emission	C	
RSS-247 5.5	Unwanted Emission(Conducted)	C	
RSS-247 5.2(b)	Transmitter Power Spectral Density	C	
RSS-Gen 6.13	Radiated Emissions	C	Radiated
RSS-Gen 8.8	AC Conducted Emissions	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: RSS-247 Issue 3, RSS-GEN Issue 5			
Note 4: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013			

3.2 Testing Environment

Test Item		Test Date	Temperature (℃)	Relative Humidity (%)
Carrier Frequency Separation Number of Hopping Frequencies 20 dB Bandwidth Time of occupancy (Dwell Time) Maximum peak conducted output power Unwanted emission (Conducted)		2024-08-02	23	55
Transmitter emission (Radiated)	1) 9 kHz to 30 MHz	2024-08-23	24	50
	2) 30 MHz to 1 GHz			
	3) 1 GHz to 18 GHz	2024-09-03 to 2024-09-06	23 to 25	55 to 60
	4) 18 GHz to 25 GHz			
	5) Restricted Frequency Bands			
AC Conducted Emission		2024-08-23	24	50

3.3 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. All modulation modes were tests.
The results are only attached worst cases.

Test Frequency & Bandwidth

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

Test mode & Worst case

Test mode	Modulation	Data rate (Worst case)	Duty Cycle	Duty Cycle Factor
802.11b	DSSS	11 Mbps	95.5 %	0.20 dB
802.11g	OFDM	6 Mbps	96.4 %	0.16 dB
802.11n_HT20	OFDM	MCS 0	96.2 %	0.17 dB
802.11n_HT40	OFDM	MCS 0	92.8 %	0.32 dB

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 (C.L.: Approx. 95 %, k = 2)
Power Spectral Density	1.5 dB (C.L.: Approx. 95 %, k = 2)
Occupied Bandwidth	0.1 MHz (C.L.: Approx. 95 %, k = 2)
Unwanted Emission(conducted)	3.0 dB (C.L.: Approx. 95 %, k = 2)
Radiated Emissions (f ≤ 1 GHz)	3.82 dB (C.L.: Approx. 95 %, k = 2)
Radiated Emissions (f > 1 GHz)	4.50 dB (C.L.: Approx. 95 %, k = 2)
Line Conducted Emission	2.00 dB (C.L.: Approx. 95 %, k = 2)

3.5 Test Software

Automation program

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	TOYO EMI software EP5RE Ver. 6.0.1.0
Line Conducted Test	ESCI7, ESCI3 : EMC32 Ver. 8.50.0 ESR7 : EMC32 Ver. 10.20.01

Test program

Conducted Test, Radiated Test, Line Conducted Test	cmd.exe

4. Technical Characteristic Test

4.1 6dB Bandwidth

Test Procedures

KDB 558074 - Section 8.2
ANSI C63.10-2013 - Section 11.8.2
RSS-Gen – Section 6.7

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 - Section 6.9
RSS-Gen – Section 6.7

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.

Minimum Standard :

6 dB Bandwidth	>	500kHz

Test Data :

ANT1

Mode	6 dB Bandwidth and 99 % Bandwidth (MHz)					
	802.11b		802.11g		802.11n_HT20	
Frequency	6 dB	99 %	6 dB	99 %	6 dB	99 %
2 412 MHz	8.33	13.41	15.17	16.37	15.14	17.52
2 437 MHz	8.34	13.40	15.17	16.37	15.18	17.50
2 462 MHz	8.33	13.44	15.17	16.38	15.14	17.52

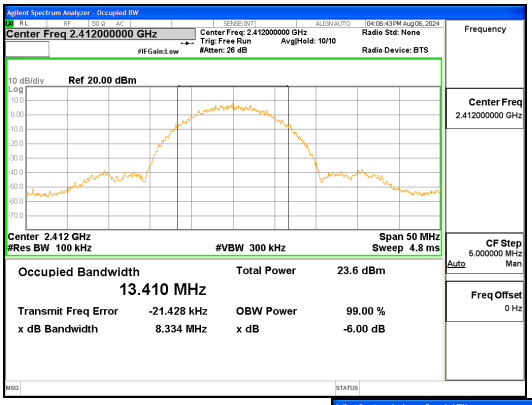
Mode	6 dB Bandwidth and 99 % Bandwidth (MHz)	
	802.11n_HT40	
Frequency	6 dB	99 %
2 422 MHz	35.16	35.84
2 437 MHz	35.13	35.68
2 452 MHz	35.16	35.81

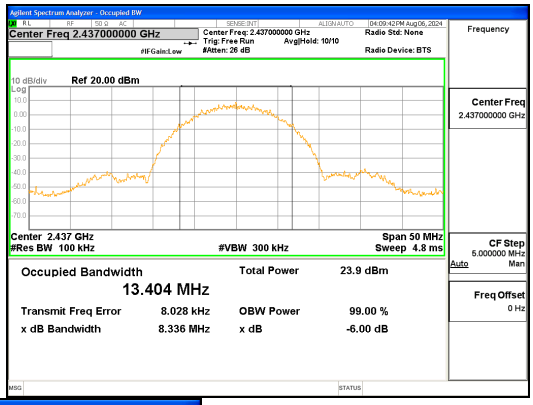
ANT2

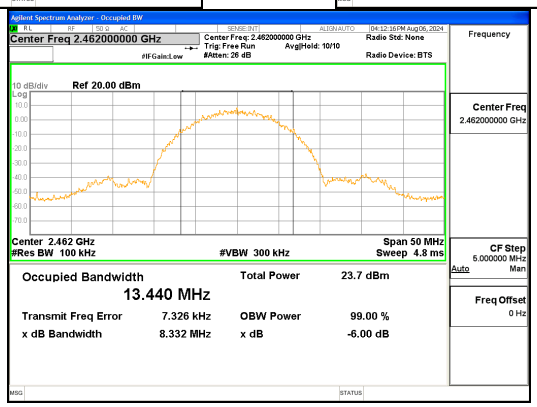
Mode	6 dB Bandwidth and 99 % Bandwidth (MHz)					
	802.11b		802.11g		802.11n_HT20	
Frequency	6 dB	99 %	6 dB	99 %	6 dB	99 %
2 412 MHz	8.34	13.48	15.17	16.39	15.75	17.59
2 437 MHz	8.34	13.42	15.17	16.38	15.73	17.58
2 462 MHz	8.34	13.47	15.17	16.38	15.73	17.52

Mode	6 dB Bandwidth and 99 % Bandwidth (MHz)	
	802.11n_HT40	
Frequency	6 dB	99 %
2 422 MHz	35.12	35.89
2 437 MHz	35.11	35.70
2 452 MHz	35.15	35.83

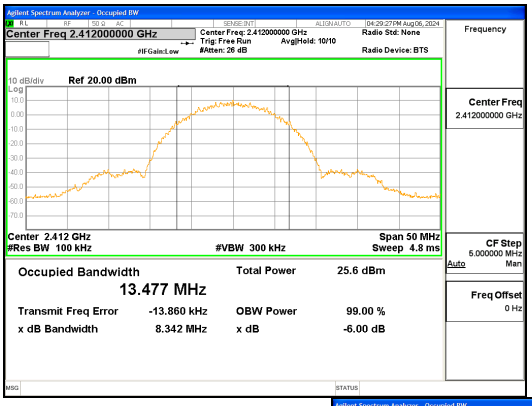
See next pages for actual measured spectrum plots.

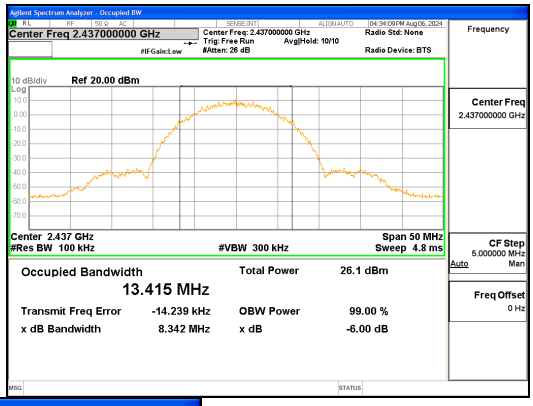


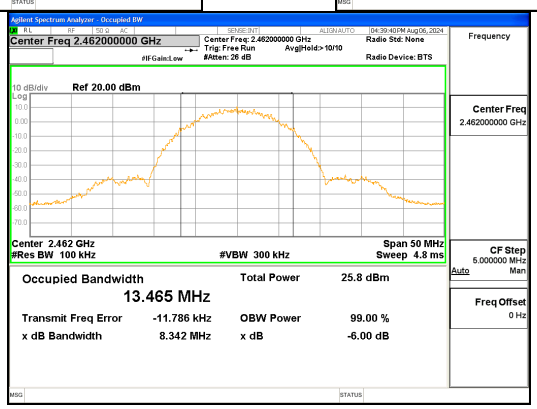




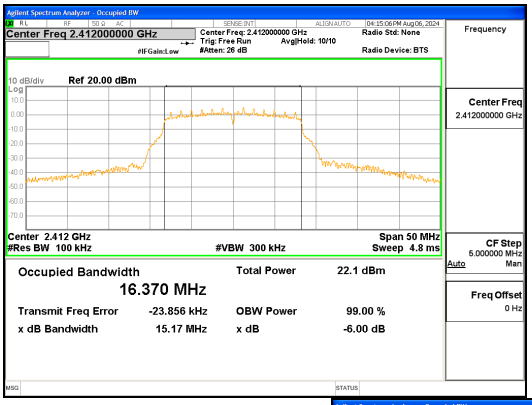
ANT1, 802.11b

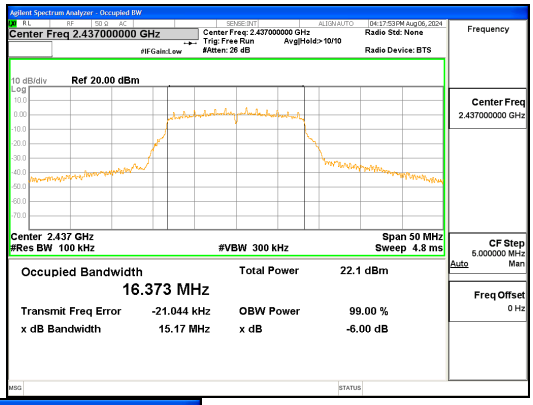


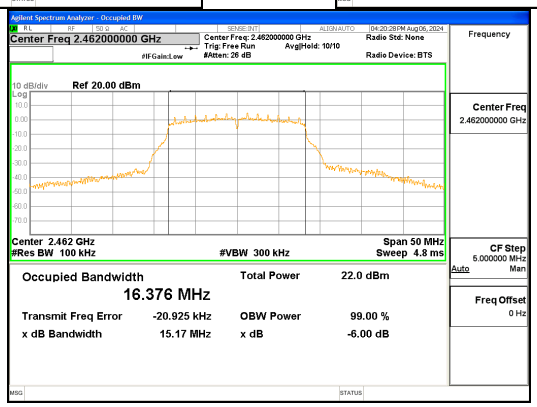




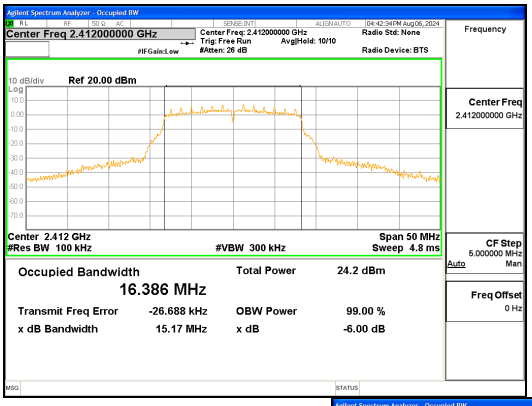
ANT2, 802.11b

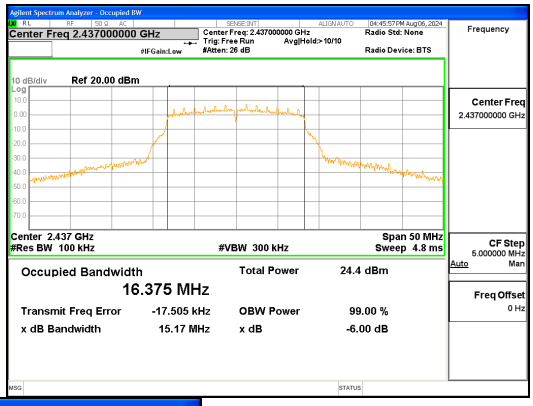


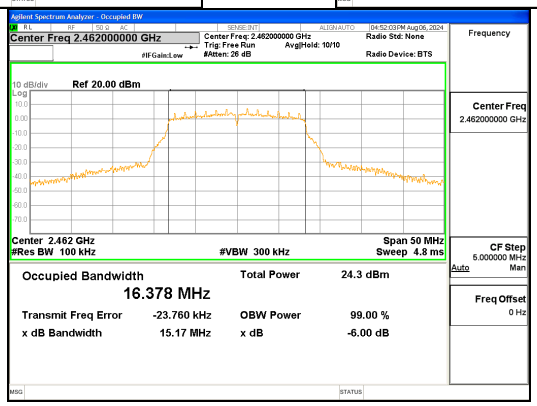




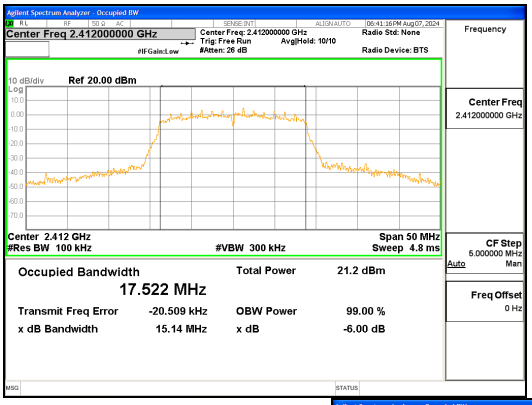
ANT1, 802.11g

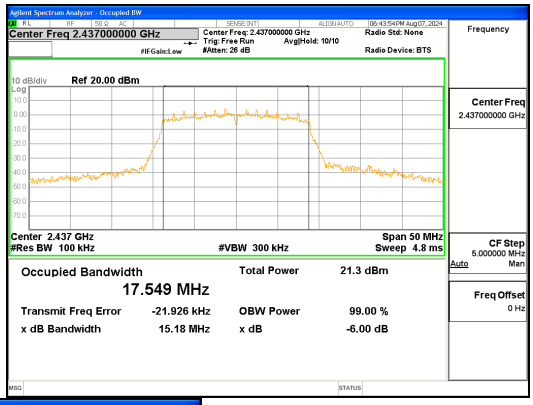


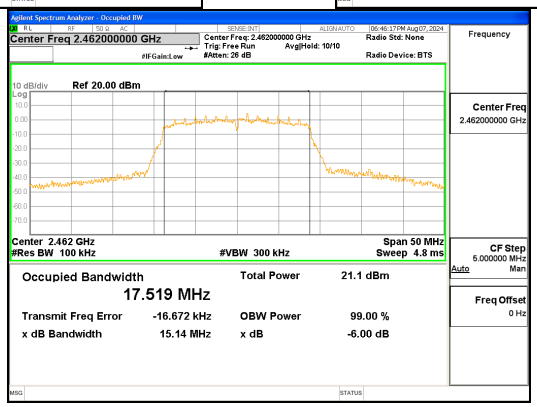




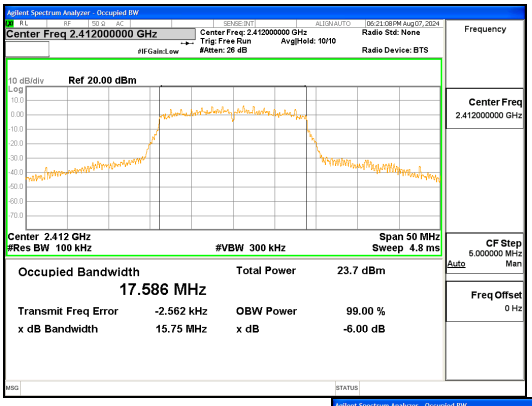
ANT2, 802.11g

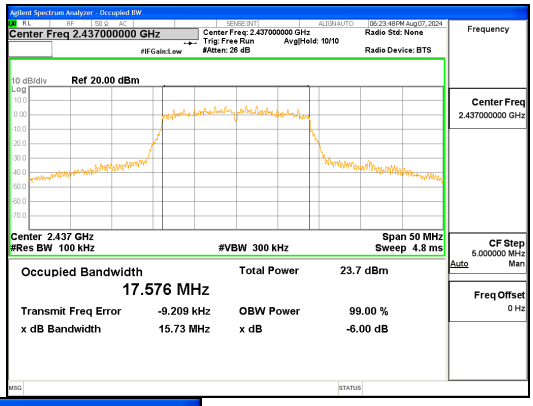


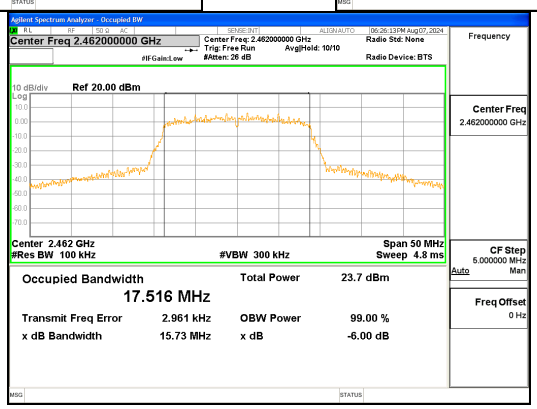




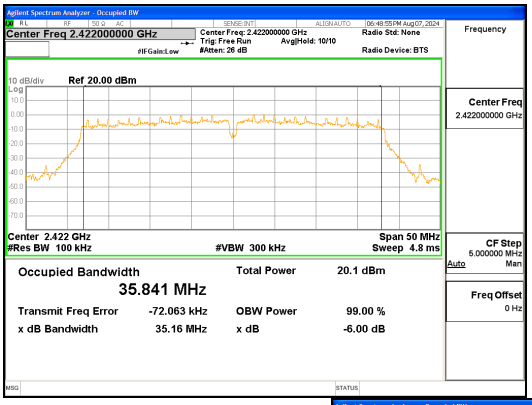
ANT1, 802.11n_HT20

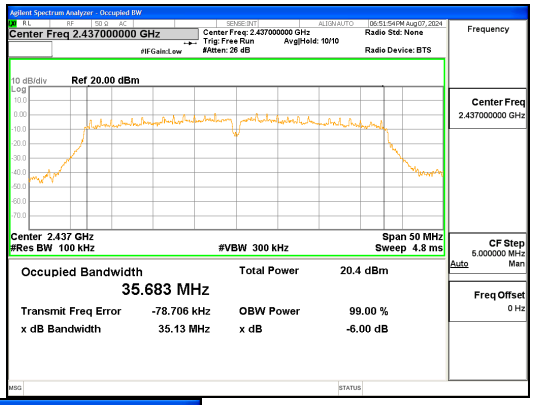


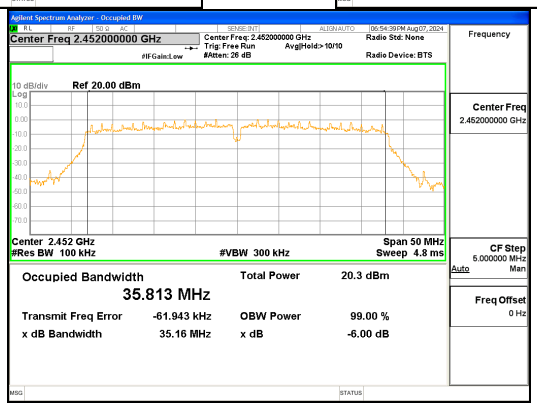




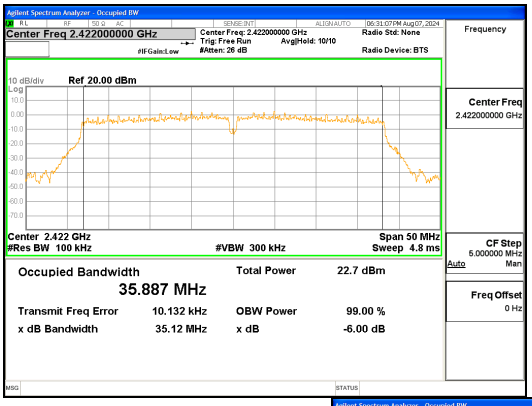
ANT2, 802.11n_HT20

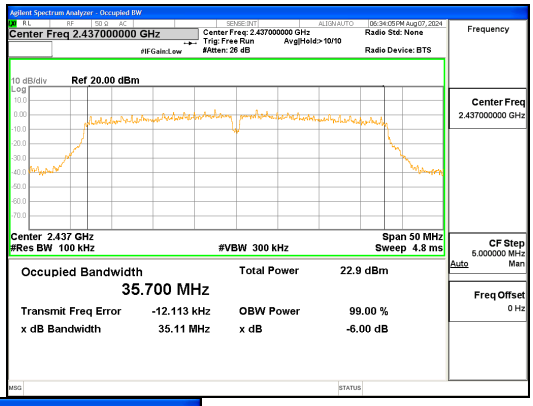


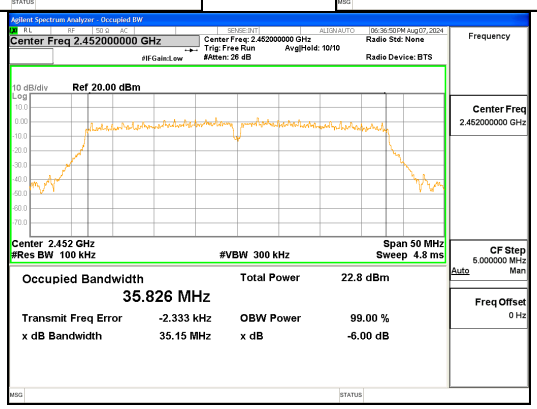




ANT1, 802.11n_HT40







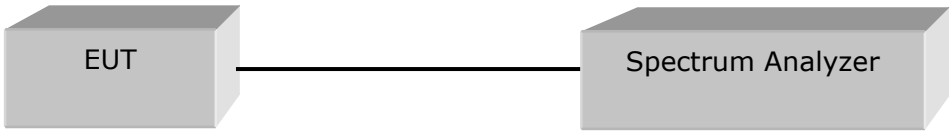
ANT2, 802.11n_HT40

4.2 OUTPUT POWER

Test Procedures

KDB 558074 - Section 8.3.2.2 (Average Power)
ANSI C63.10-2013 - Section 11.9.2.2
KDB 662911 D01, D02 (Multiple Transmitter Output)

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)

Test mode	Duty Cycle Factor
802.11b	0.20 dB
802.11g	0.16 dB
802.11n_HT20	0.17 dB
802.11n_HT40	0.32 dB

Limit

Operating Mode	Mode	ANT Configuration	ANT Gain (dBi)	Limit (dBm)
SISO	802.11b/g/n	ANT1	2.17	30.00
SISO	802.11b/g/n	ANT2	2.17	30.00
MIMO (2Tx)	802.11n	ANT1 + ANT2	5.18	30.00

Test Data :

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	16.16	0.20	16.36	30.00	13.64
	2 437	16.22	0.20	16.42	30.00	13.58
	2 462	16.14	0.20	16.34	30.00	13.66
802.11g	2 412	15.50	0.16	15.66	30.00	14.34
	2 437	15.39	0.16	15.55	30.00	14.45
	2 462	15.32	0.16	15.48	30.00	14.52
802.11n _HT20	2 412	14.42	0.17	14.59	30.00	15.41
	2 437	14.31	0.17	14.48	30.00	15.52
	2 462	14.34	0.17	14.51	30.00	15.49
802.11n _HT40	2 422	13.21	0.32	13.53	30.00	16.47
	2 437	13.47	0.32	13.79	30.00	16.21
	2 452	13.43	0.32	13.75	30.00	16.25

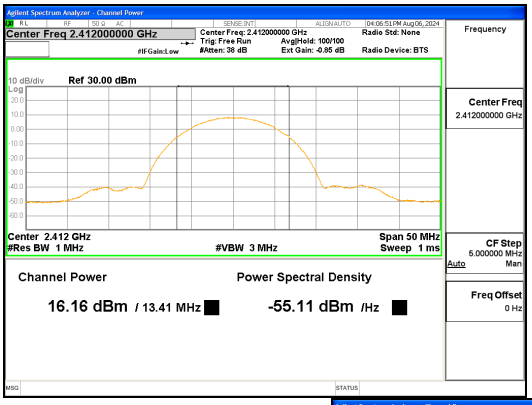
ANT2

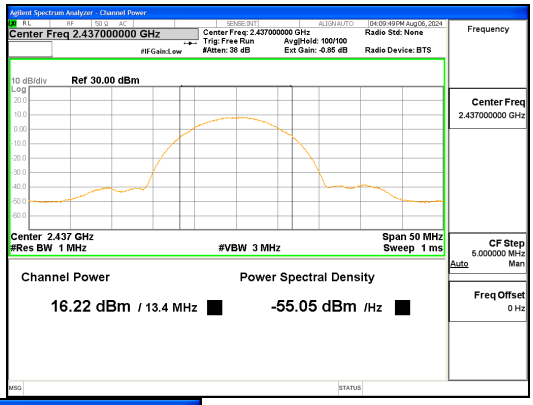
Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11b	2 412	18.00	0.20	18.20	30.00	11.80
	2 437	18.46	0.20	18.66	30.00	11.34
	2 462	18.47	0.20	18.67	30.00	11.33
802.11g	2 412	17.61	0.16	17.77	30.00	12.23
	2 437	17.57	0.16	17.73	30.00	12.27
	2 462	17.62	0.16	17.78	30.00	12.22
802.11n _HT20	2 412	16.66	0.17	16.83	30.00	13.17
	2 437	16.70	0.17	16.87	30.00	13.13
	2 462	16.73	0.17	16.90	30.00	13.10
802.11n _HT40	2 422	15.49	0.32	15.81	30.00	14.19
	2 437	15.59	0.32	15.91	30.00	14.09
	2 452	15.60	0.32	15.92	30.00	14.08

ANT1 + ANT2 (MIMO)

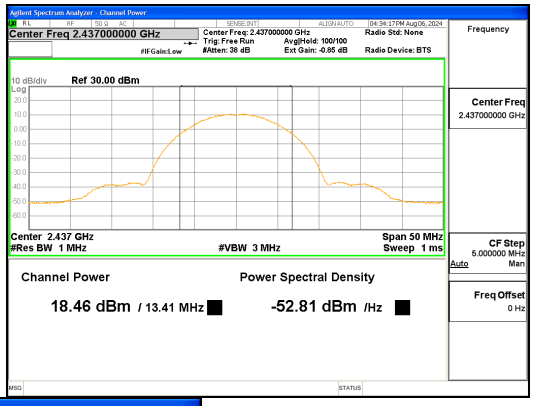
Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11n _HT20	2 412	18.69	0.17	18.86	30.00	11.14
	2 437	18.68	0.17	18.85	30.00	11.15
	2 462	18.71	0.17	18.88	30.00	11.12
802.11n _HT40	2 422	17.51	0.32	17.83	30.00	12.17
	2 437	17.67	0.32	17.99	30.00	12.01
	2 452	17.66	0.32	17.98	30.00	12.02

See next pages for actual measured spectrum plots.

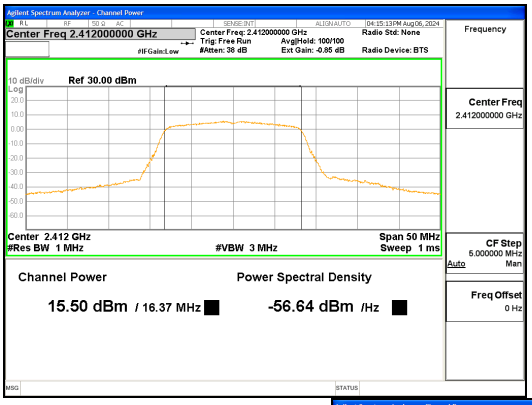


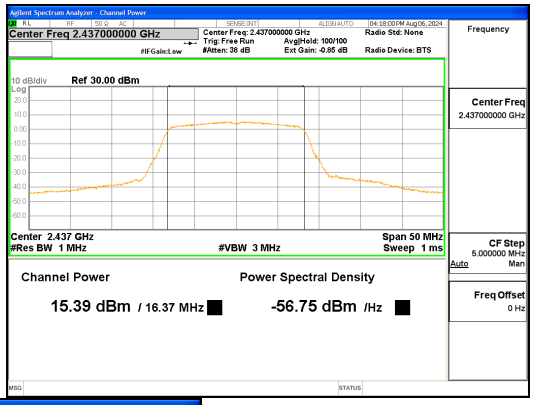


ANT1, 802.11b



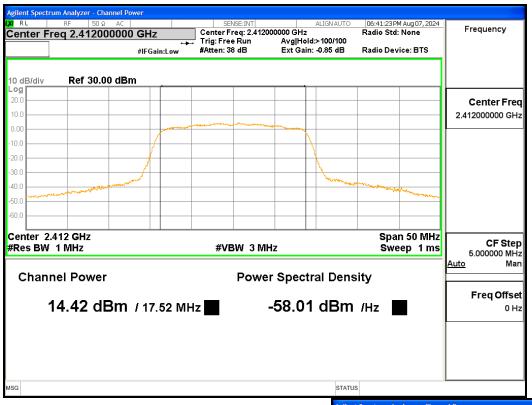
ANT2, 802.11b

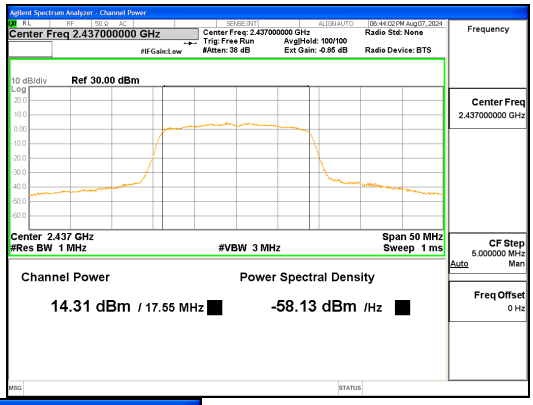




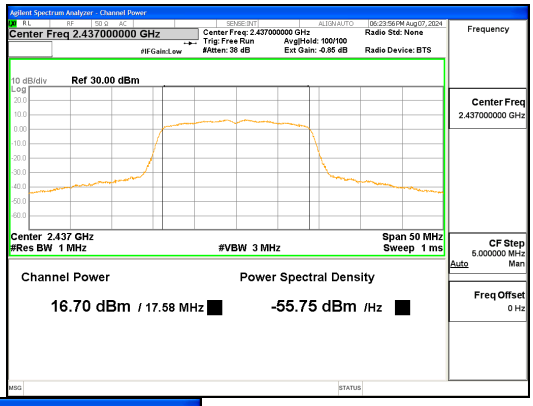
ANT1, 802.11g

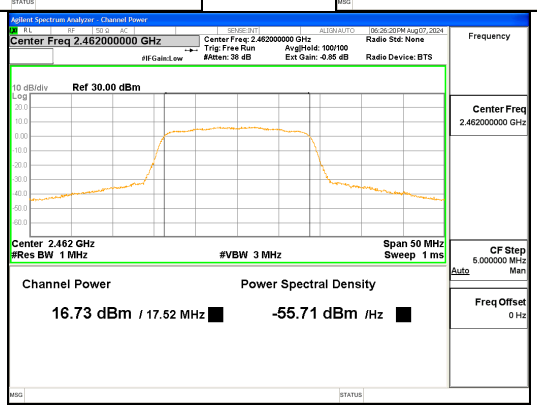
ANT2, 802.11g



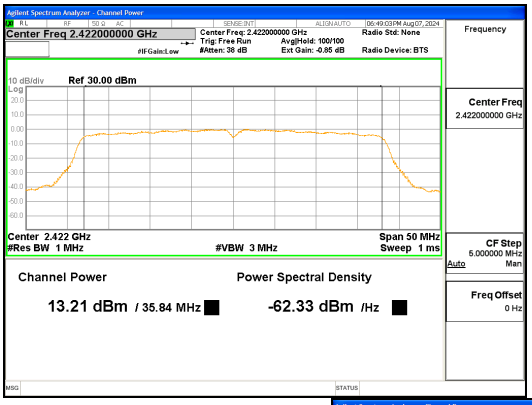


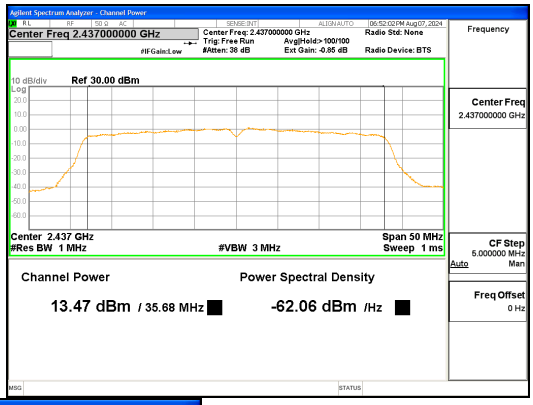
ANT1, 802.11n_HT20

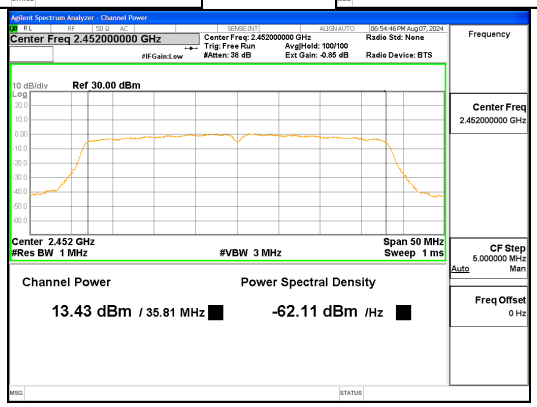




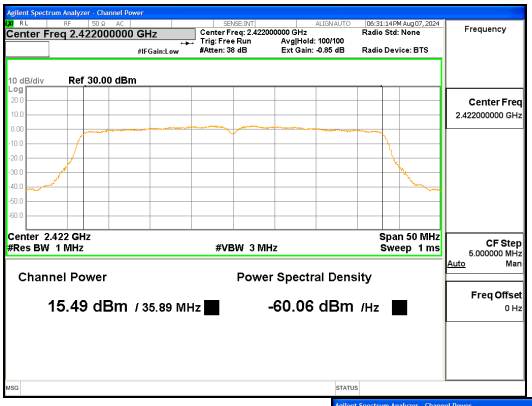
ANT2, 802.11n_HT20

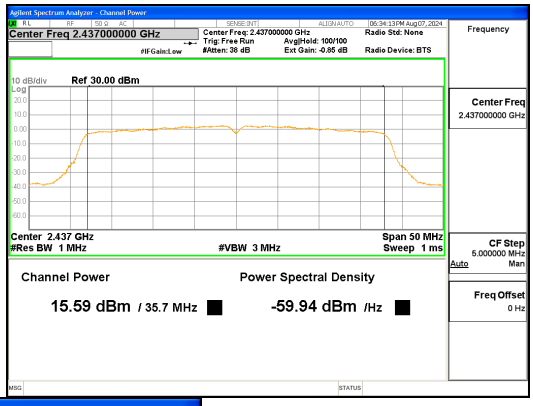


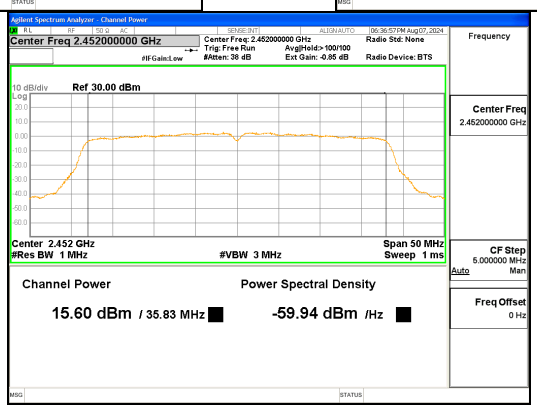




ANT1, 802.11n_HT40







ANT2, 802.11n_HT40