

Venstar, Inc.

TEST REPORT FOR

Smart Thermostat
Model: Amana

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.247
(DTS 2400-2483.5MHz)

Report No.: 107308-7

Date of issue: October 26, 2022



Test Certificate # 803.01

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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Representative: Corey McTigue

REPORT PREPARED BY:

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Mariposa, CA 95338

Project Number: 107308

DATE OF EQUIPMENT RECEIPT:

August 1, 2022

DATE(S) OF TESTING:

August 1, 2 & 5, 2022

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Canada	Japan
Canyon Park, Bothell, WA	US0103	US1024	3082C	A-0136
Brea, CA	US0103	US1024	3082D	A-0136
Fremont, CA	US0103	US1024	3082B	A-0136
Mariposa, CA	US0103	US1024	3082A	A-0136

*CKC's list of NIST designated countries can be found at: <https://standards.gov/cabs/designations.html>

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS)

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	Pass
15.247(b)(3)	Output Power	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	Pass
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.247(e)	Power Spectral Density	NA	Pass
15.207	AC Conducted Emissions	NA	Pass

NA = Not Applicable

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1 (Conducted Unit)

Equipment Tested:

Device	Manufacturer	Model #	S/N
Smart Thermostat	Venstar, Inc.	Amana	2205000004

Support Equipment:

Device	Manufacturer	Model #	S/N
24V AC power supply	Generic	MKA-412400200	NA

Configuration 2 (Radiated unit)

Equipment Tested:

Device	Manufacturer	Model #	S/N
Smart Thermostat	Venstar, Inc.	Amana	2205000018

Support Equipment:

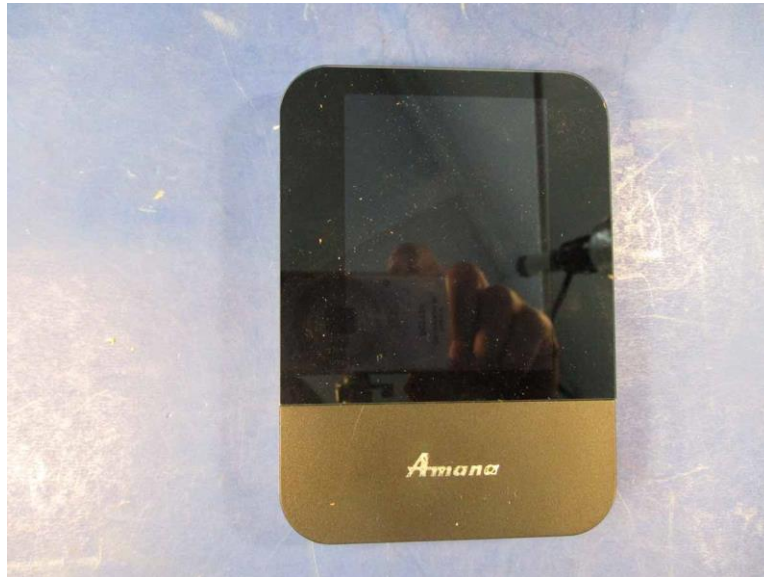
Device	Manufacturer	Model #	S/N
24V AC power supply	Generic	MKA-412400200	NA

General Product Information:

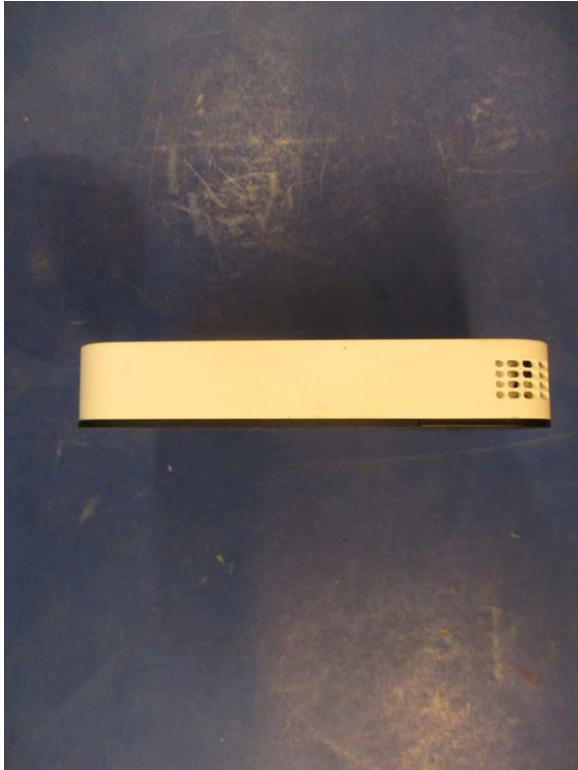
Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	802.11b/n20
Operating Frequency Range:	2412-2462MHz
Modulation Type(s):	CCK/QPSK(11Mbps), 64-QAM (MCS7)
Maximum Duty Cycle:	98%
Number of TX Chains:	1
Antenna Type(s) and Gain:	Integral Inverted (IFA) -0.97 dBi See appendix B for antenna gain verification
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	24VAC
Firmware / Software used for Test:	Test mode V 2.9.3

The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.

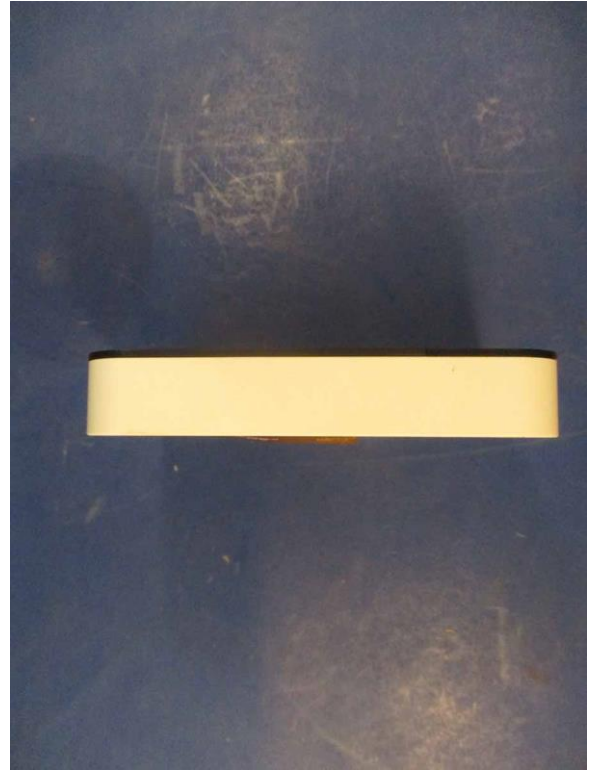
EUT Photo(s)



EUT, View 1



EUT, View 2



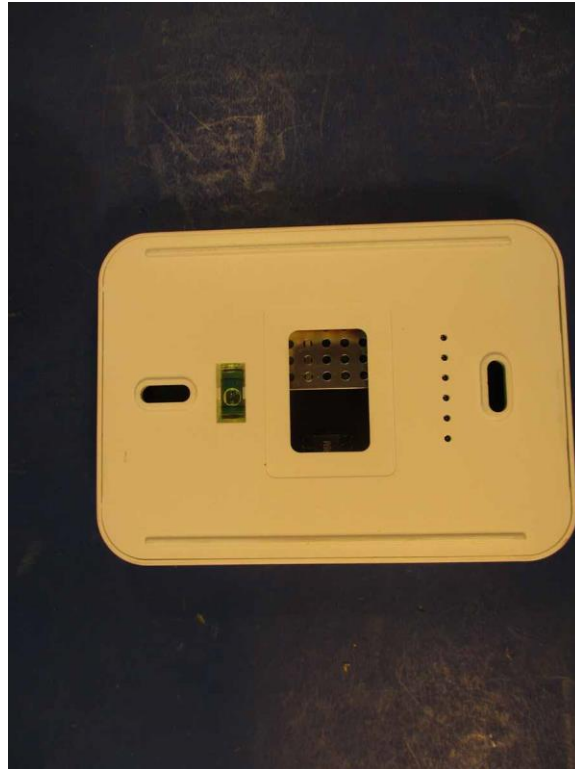
EUT, View 3



EUT, View 4



EUT, View 5



EUT, View 6



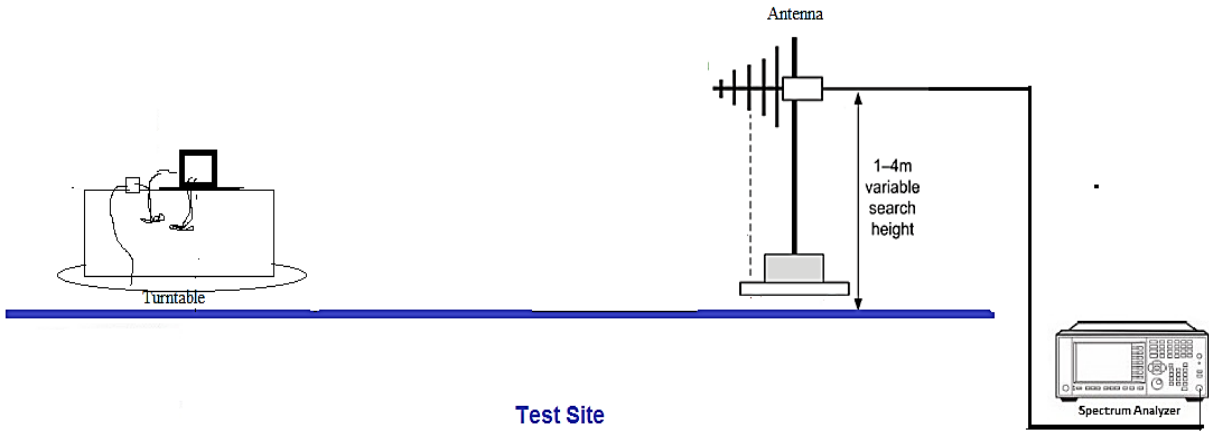
EUT, View 7

Support Equipment Photo(s)

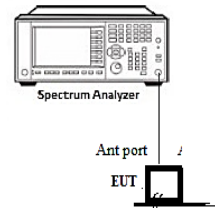


Block Diagram of Test Setup(s)

Radiated test setup



Conducted test setup



FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 558074	Test Date(s):	8/1/2022
Configuration:	1		
Test Setup:	The EUT is placed on the test bench, RF parameter is evaluated at the antenna port. Frequency range: 2412-2462MHz, TX 2412MHz, 2437MHz, 2462MHz Modulation: 802.11b 11 Mbps 802.11n20 MCS7 Power Setting: 802.11b =17dBm 802.11n20 = 12dBm		

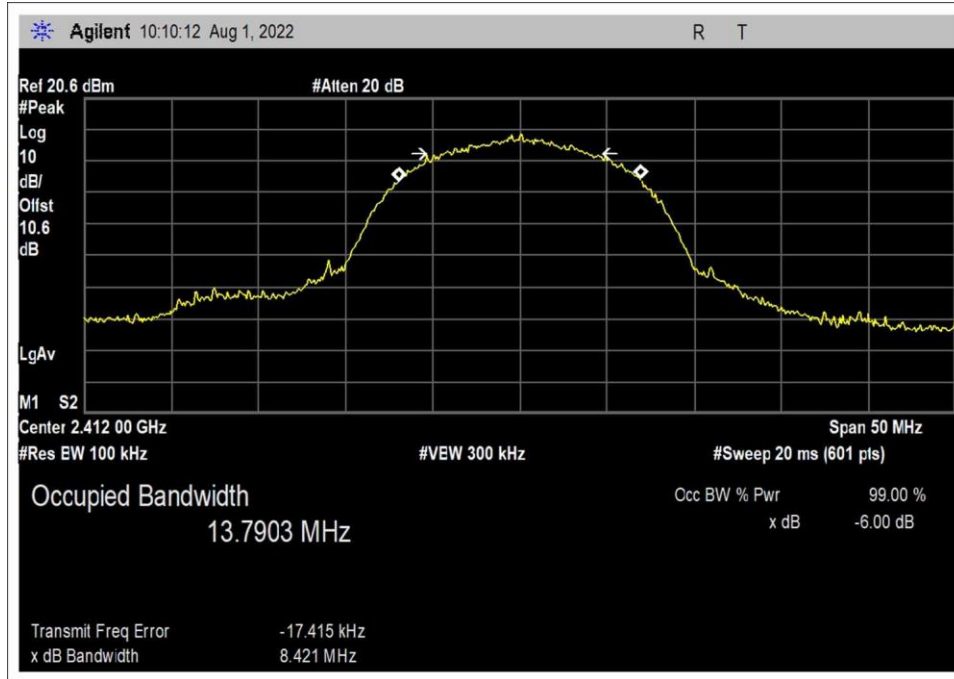
Environmental Conditions			
Temperature (°C)	26	Relative Humidity (%):	48

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02869	Spectrum Analyzer	Agilent	E4440A	8/16/2021	8/16/2022
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	1/14/2022	1/14/2024
P07658	Cable	Astrolab, Inc.	32022-29094K-29094K-24TC	6/22/2022	6/22/2024

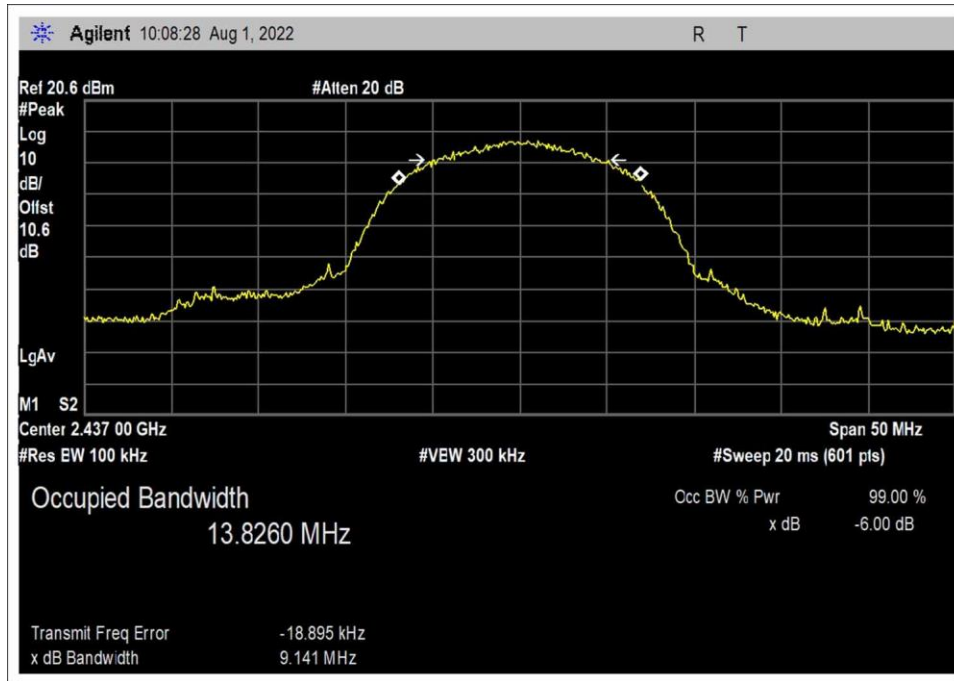
Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2412	1	CCK/QPSK(802.11b)	8421	≥500	Pass
2437	1	CCK/QPSK(802.11b)	9141	≥500	Pass
2462	1	CCK/QPSK(802.11b)	8580	≥500	Pass
2412	1	64-QAM (802.11n20)	16704	≥500	Pass
2437	1	64-QAM (802.11n20)	16294	≥500	Pass
2462	1	64-QAM (802.11n20)	15708	≥500	Pass

Plot(s)

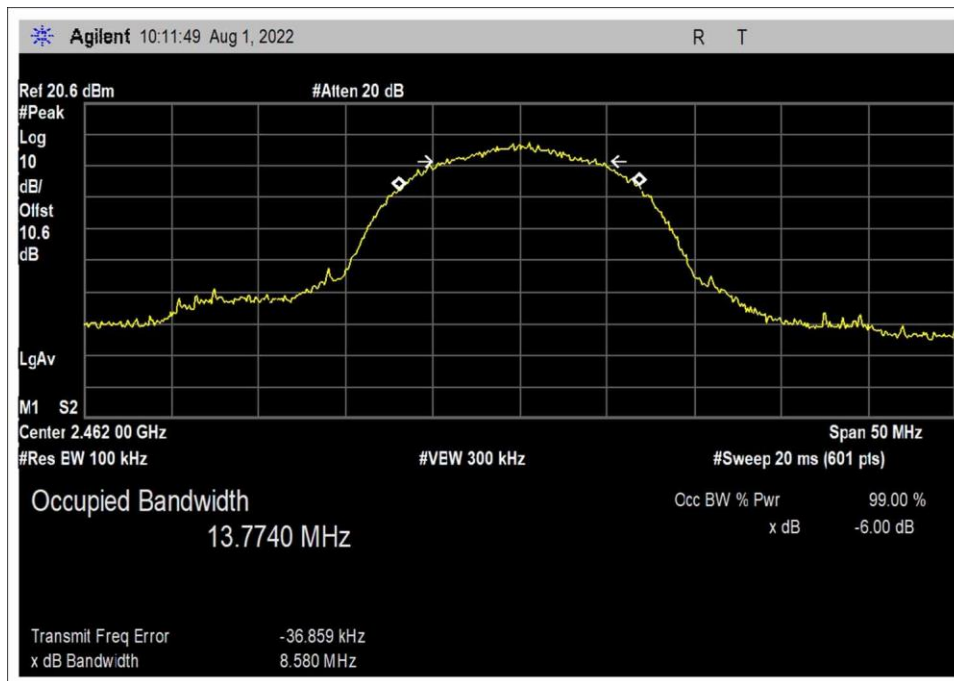
802.11b



Low Channel

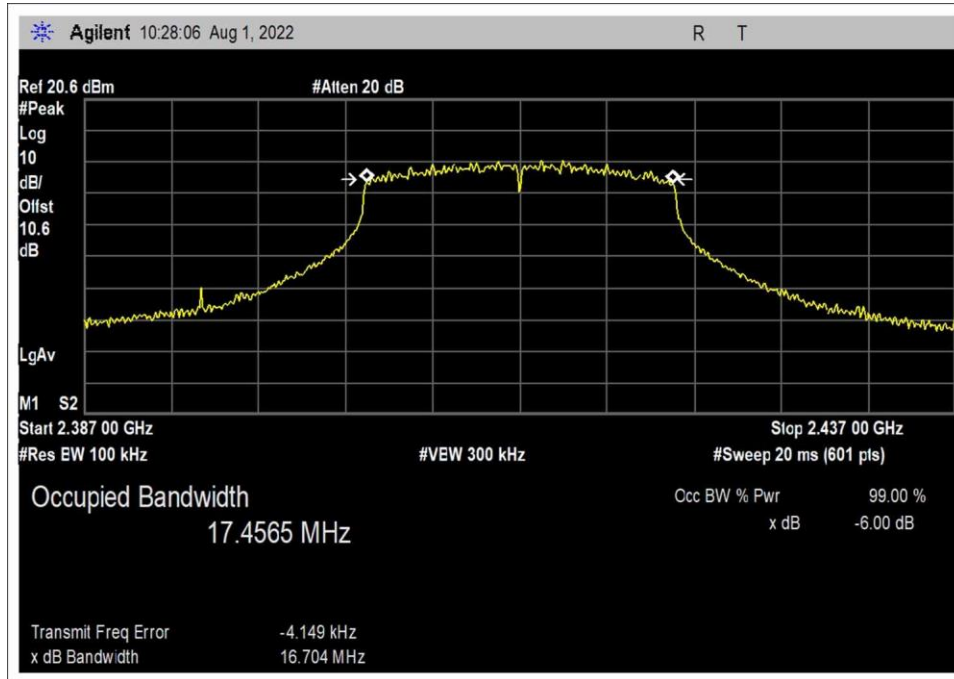


Middle Channel

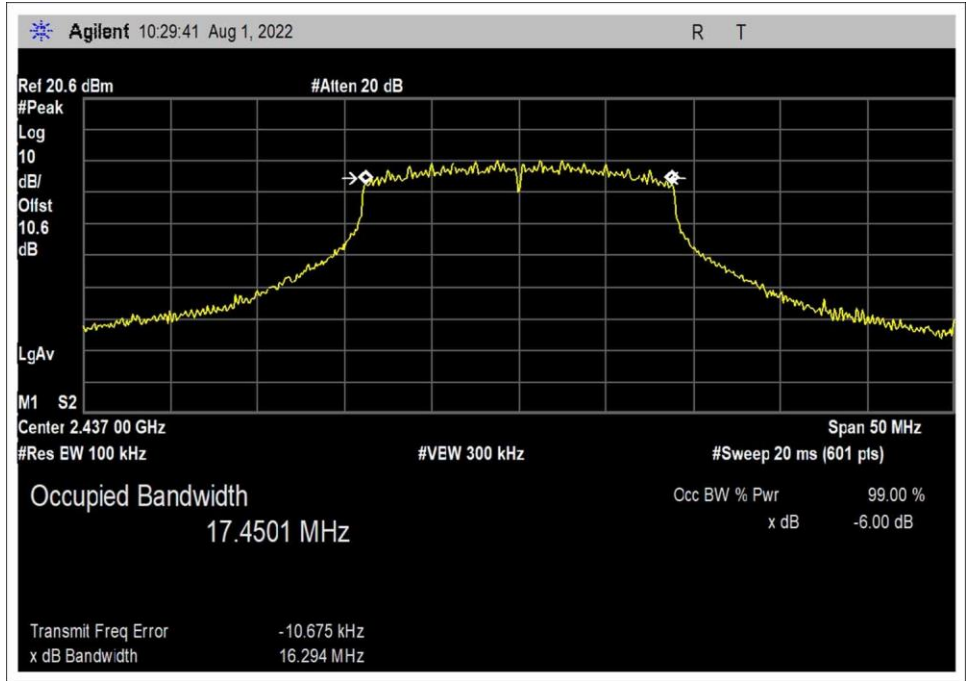


High Channel

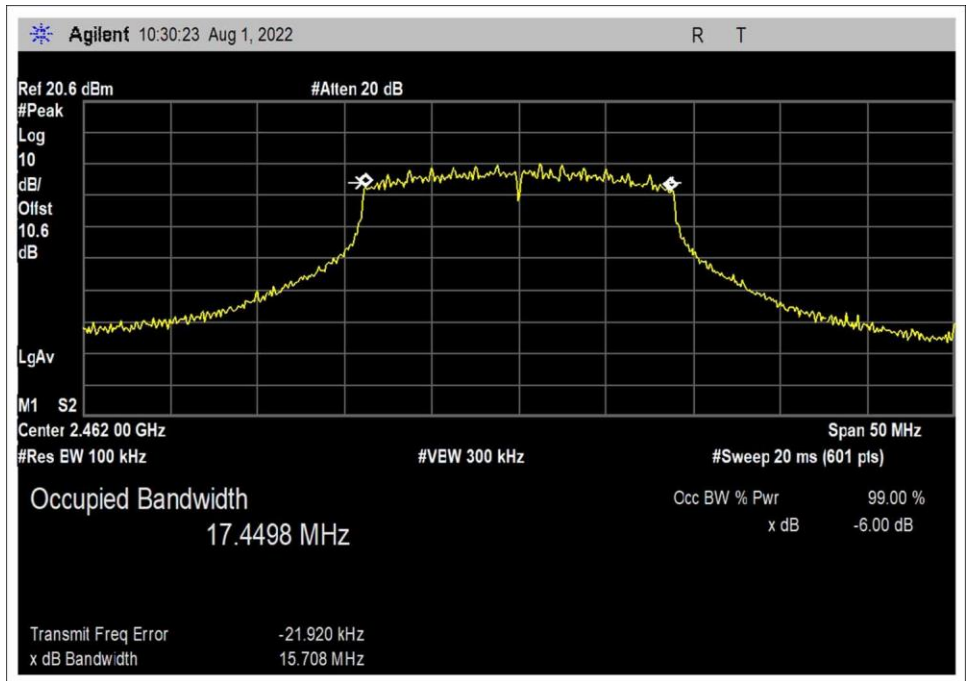
802.11n20



Low Channel

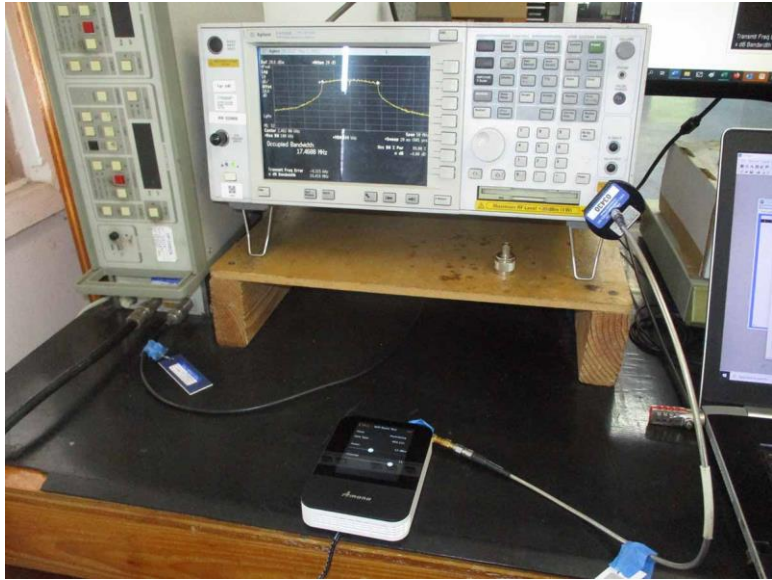


Middle Channel



High Channel

Test Setup Photo(s)



15.247(b)(3) Output Power

Test Setup / Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 558074	Test Date(s):	8/1/2022
Configuration:	1		
Test Setup:	The EUT is placed on the test bench, RF parameter is evaluated at the antenna port. Frequency range: 2412-2462MHz, TX 2412MHz, 2437MHz, 2462MHz Modulation: 802.11b 11 Mbps 802.11n20 MCS7 Power Setting: 802.11b =17dBm 802.11n20 = 12dBm		

Environmental Conditions			
Temperature (°C)	26	Relative Humidity (%):	48

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02869	Spectrum Analyzer	Agilent	E4440A	8/16/2021	8/16/2022
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	1/14/2022	1/14/2024
P07658	Cable	Astrolab, Inc.	32022-29094K-29094K-24TC	6/22/2022	6/22/2024

Test Data Summary - Voltage Variations					
Frequency (MHz)	Modulation / Ant Port	V _{Minimum} (dBm)	V _{Nominal} (dBm)	V _{Maximum} (dBm)	Max Deviation from V _{Nominal} (dB)
2412	CCK/QPSK(802.11b) /1	16.4	16.1	16.0	0.4
2437	CCK/QPSK(802.11b) /1	16.1	15.9	15.8	0.1
2462	CCK/QPSK(802.11b)/ 1	15.8	15.6	15.4	0.2
2412	64-QAM (802.11n20) /1	10.9	10.9	10.8	0.1
2437	64-QAM (802.11n20) /1	10.6	10.8	10.7	0.2
2462	64-QAM (802.11n20) /1	10.3	10.4	10.2	0.2

Test performed using operational mode with the highest output power, representing worst case.

Parameter Definitions:

Measurements performed at input voltage V_{Nominal} ± 15%.

Parameter	Value
V _{Nominal} :	24.0
V _{Minimum} :	20.4
V _{Maximum} :	27.6

Power Output Test Data Summary - RF Conducted Measurement

Measurement Option: AVGSA-1					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2412	CCK/QPSK(802.11b)	IFA -0.97dBi	16.1	≤ 30	Pass
2437	CCK/QPSK(802.11b)	IFA -0.97dBi	15.9	≤ 30	Pass
2462	CCK/QPSK(802.11b)	IFA -0.97dBi	15.6	≤ 30	Pass
2412	64-QAM (802.11n20)	IFA -0.97dBi	10.9	≤ 30	Pass
2437	64-QAM (802.11n20)	IFA -0.97dBi	10.8	≤ 30	Pass
2462	64-QAM (802.11n20)	IFA -0.97dBi	10.4	≤ 30	Pass

For fixed point-to-point antennas, the limit is calculated in accordance with 15.247(c)(1):

$$Limit = 30 - Roundup\left(\frac{G-6}{3}\right)$$

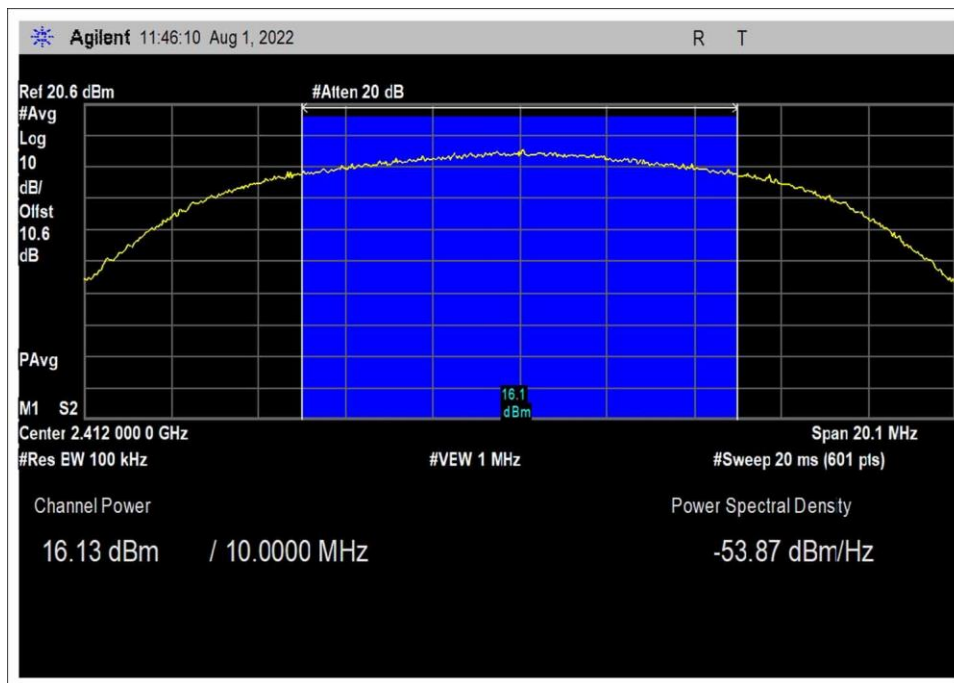
For directional beamforming antennas, the limit is calculated in accordance with 15.247(c)(2) and KDB 662911.

For all other antennas, the limit is calculated according to a maximum of 1W (30 dBm) conducted power with a maximum of 6dBi gain antenna in accordance with 15.247(b)

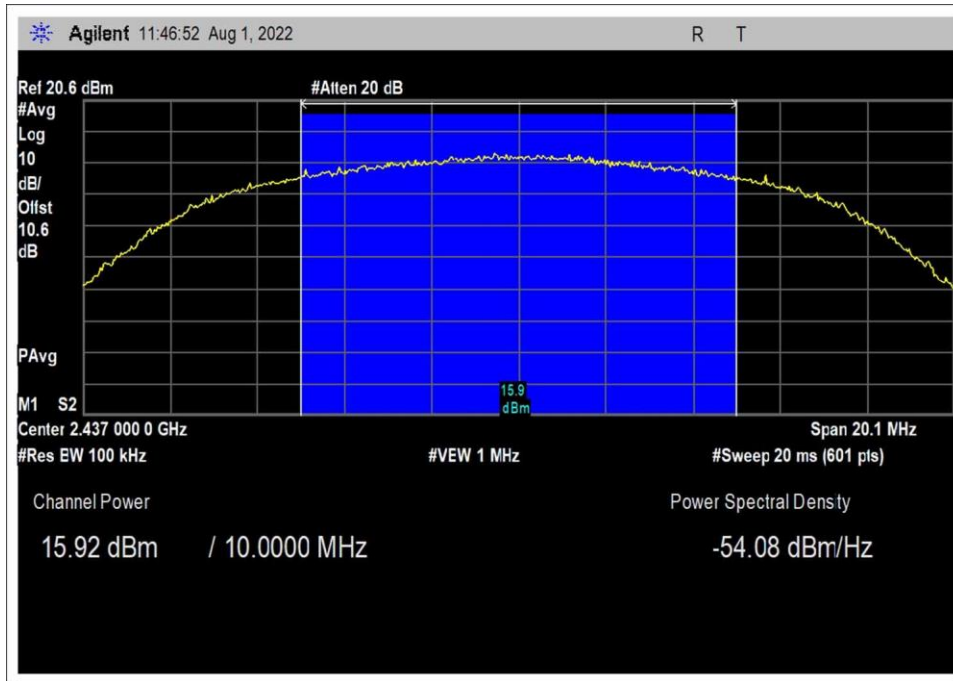
$$Limit = 30 - Roundup(G - 6)$$

Plots

802.11b



Low Channel

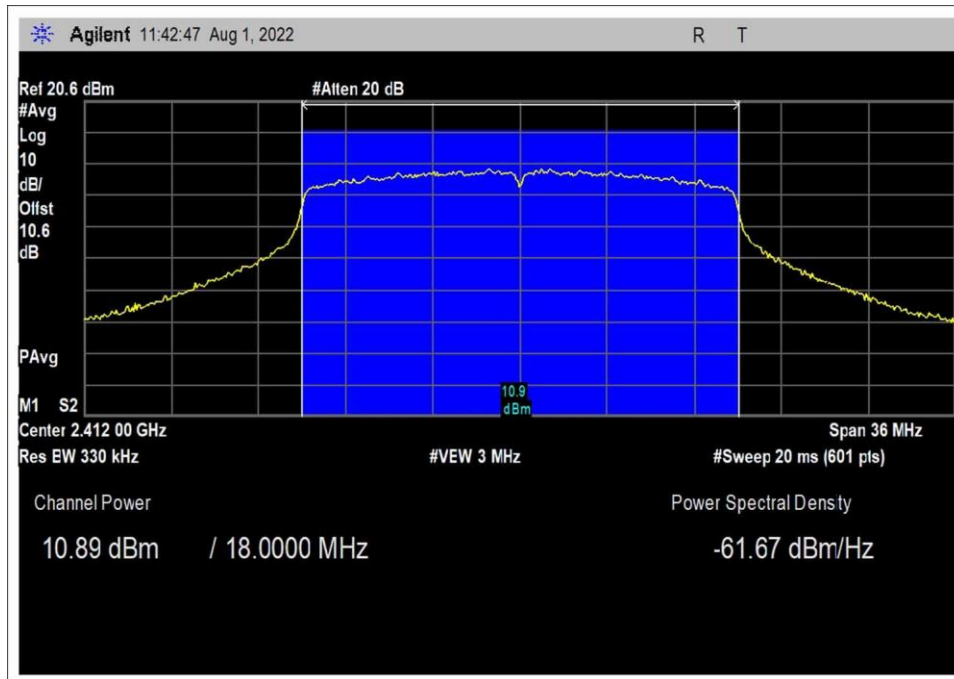


Middle Channel

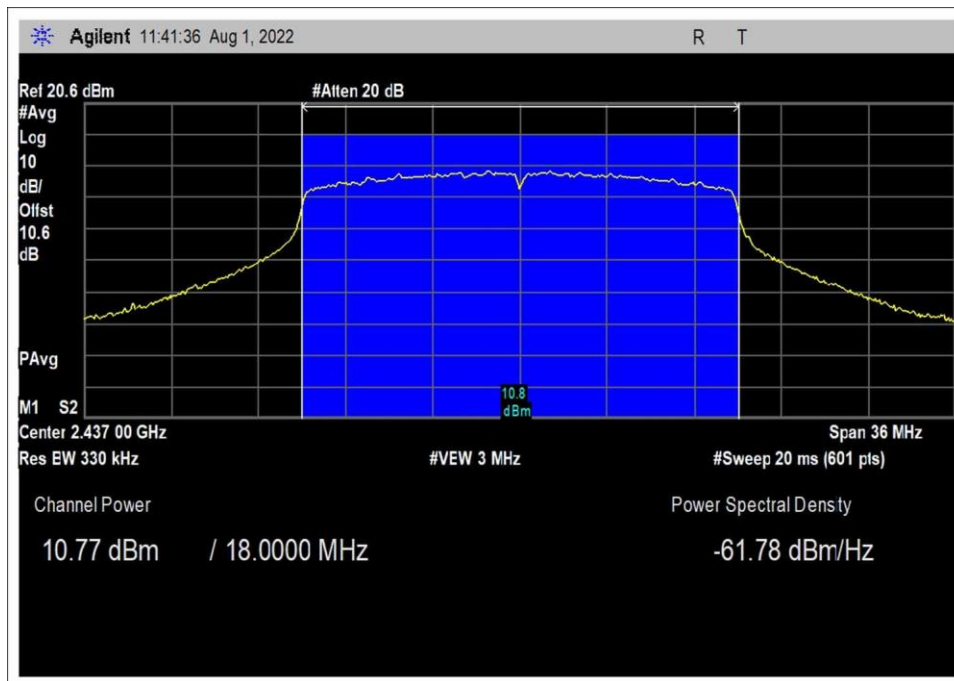


High Channel

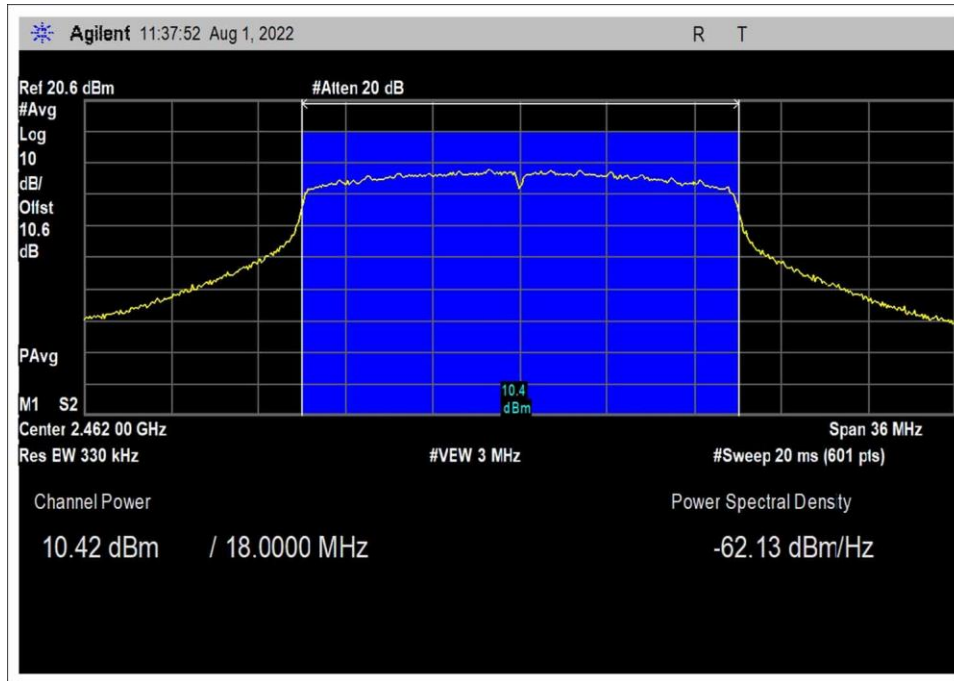
802.11n20



Low Channel

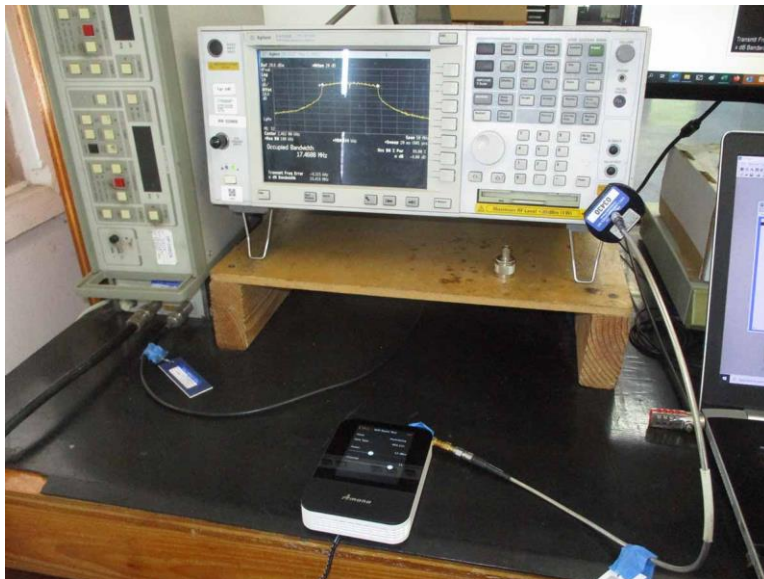


Middle Channel



High Channel

Test Setup Photo(s)



15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc • 110 N. Olinda Place • Brea, CA • 714 993 6112
 Customer: **Venstar, Inc.**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **107308** Date: 8/1/2022
 Test Type: **Conducted Emissions** Time: 15:08:01
 Tested By: E. Wong Sequence#: 1
 Software: EMITest 5.03.20 120/60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The EUT is placed on the test bench, RF parameter evaluated at the antenna port.

Frequency range: 2412-2462MHz, TX 2412MHz, 2437MHz, 2462MHz

Protocol
 802.11b 11Mbps,
 802.11n20 MCS7

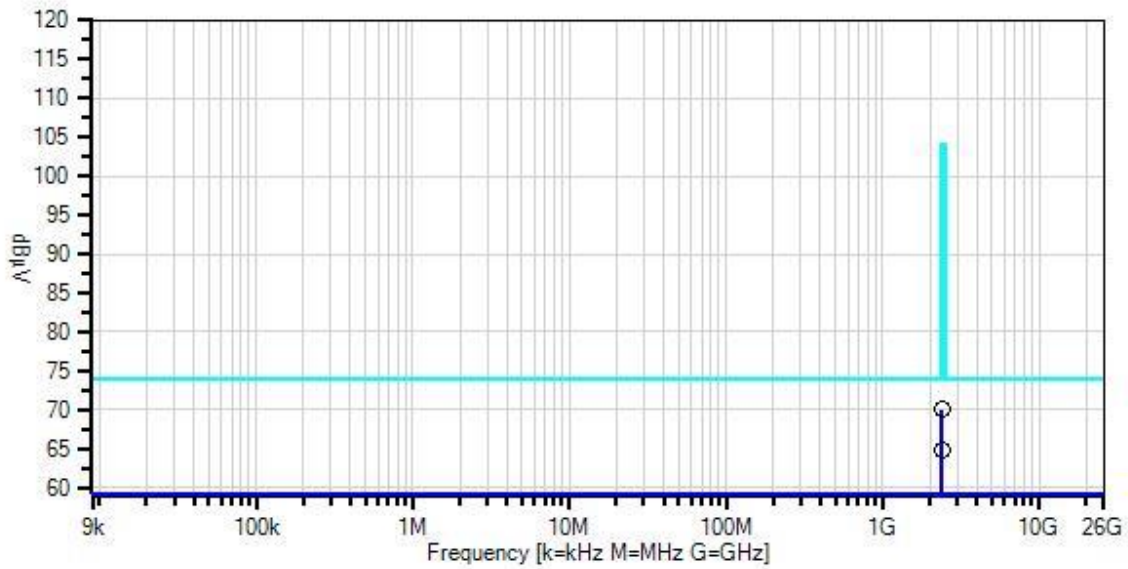
Power Setting:
 802.11b =17dBm
 802.11n20 = 12dBm

Frequency range of measurement = 9kHz- 25GHz. 9 kHz -25000MHz; RBW=100kHz,VBW=300kHz.

Test environment conditions:
 Temperature: 27°C
 Humidity: 44%
 Pressure: 100kPa

Site A
 Test Method: ANSI C63.10-2013

Venstar, Inc. WO#: 107308 Sequence#: 1 Date: 8/1/2022
 15.247(d) Conducted Spurious Emissions Test Lead: 120/60Hz Antenna port



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/16/2021	8/16/2022
T2	AN03430	Attenuator	75A-10-12	1/14/2022	1/14/2024
T3	ANP07658	Cable	32022-29094K- 29094K-24TC	6/22/2022	6/22/2024

Measurement Data:

Reading listed by margin.

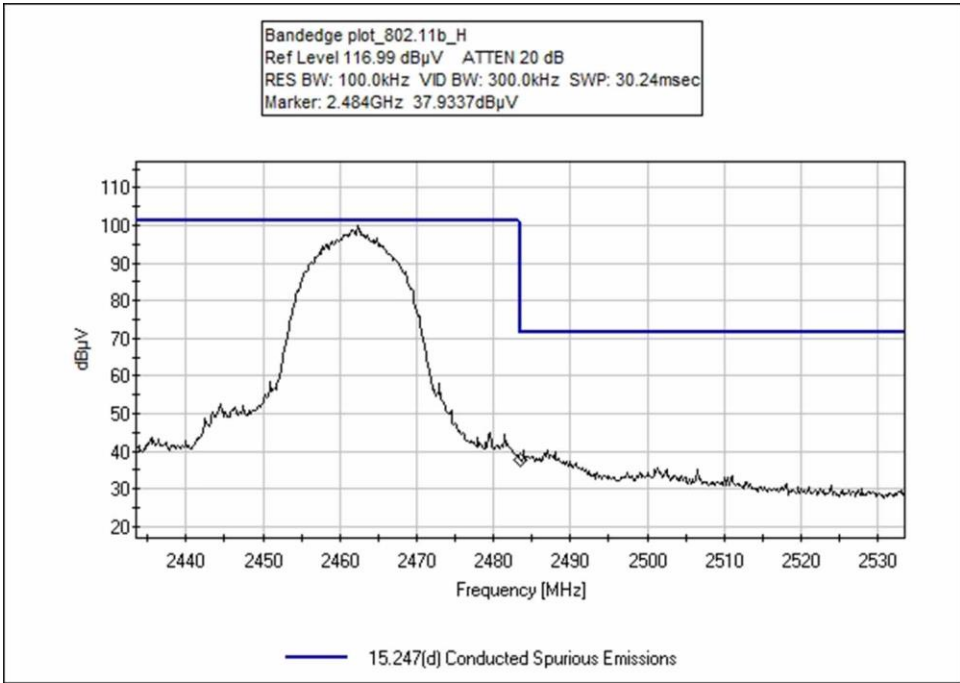
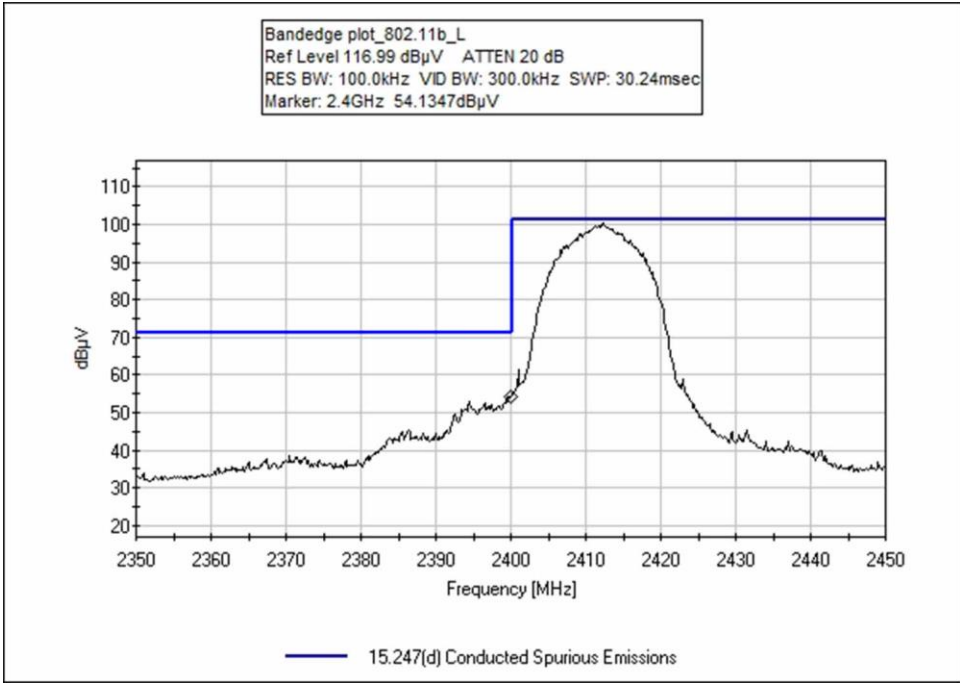
Test Lead: Antenna port

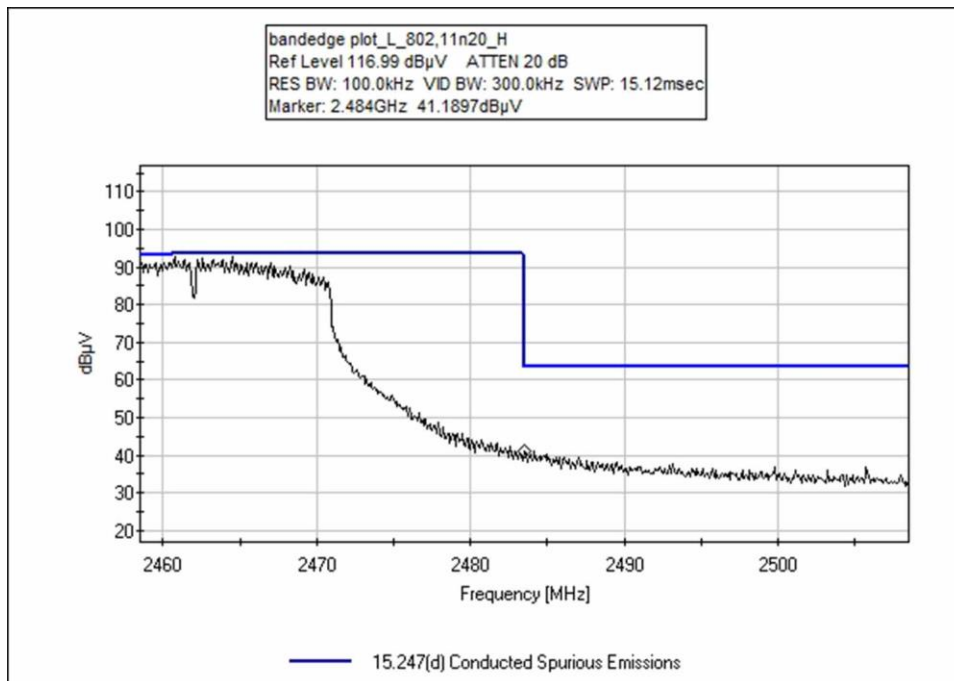
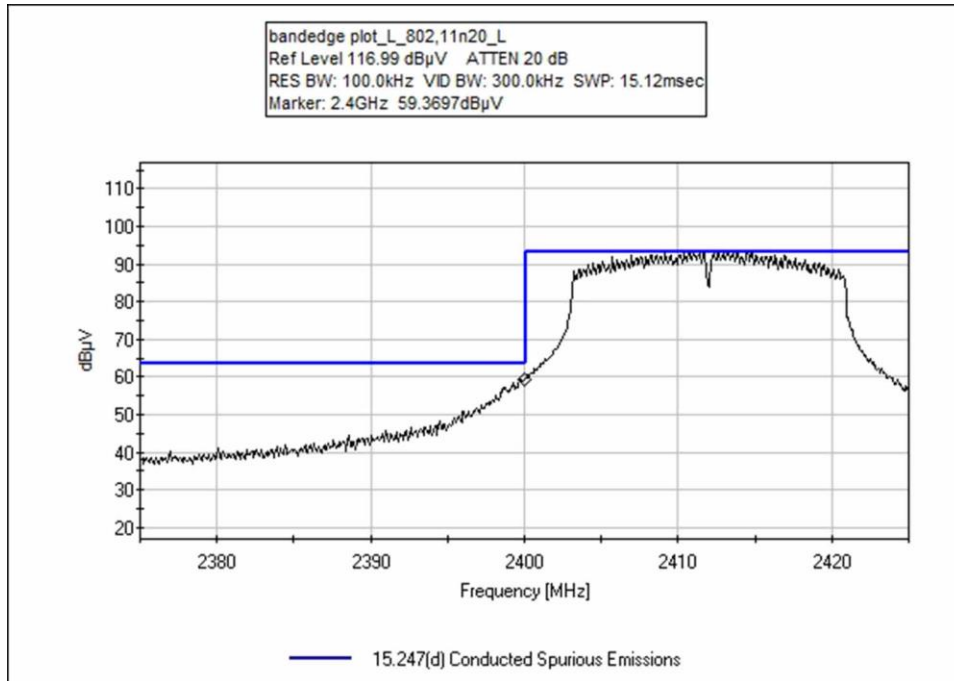
#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	2400.000M	59.4	+0.0	+10.1	+0.5		+0.0	70.0	74.0 bandedge_L_802.1 1n20	-4.0	Anten
2	2400.000M	54.1	+0.0	+10.1	+0.5		+0.0	64.7	82.0 bandedge_L_802.1 1b	-17.3	Anten
3	2483.500M	41.2	+0.0	+10.1	+0.4		+0.0	51.7	74.0 bandedge_H_802.1 1n20	-22.3	Anten
4	4924.000M	40.1	+0.0	+10.5	+0.7		+0.0	51.3	82.0 802.11b_2462MHz	-30.7	Anten
5	2483.500M	38.7	+0.0	+10.1	+0.4		+0.0	49.2	82.0 bandedge_H_802.1 1b	-32.8	Anten
6	4874.000M	35.0	+0.0	+10.4	+0.7		+0.0	46.1	82.0 802.11b_2462MHz	-35.9	Anten
7	4824.000M	35.1	+0.0	+10.3	+0.7		+0.0	46.1	82.0 802.11b_2412MHz	-35.9	Anten
8	4825.700M	25.6	+0.0	+10.3	+0.7		+0.0	36.6	74.0 802.11n20_2412M Hz	-37.4	Anten
9	4919.000M	25.1	+0.0	+10.5	+0.7		+0.0	36.3	74.0 802.11n20_2462M Hz	-37.7	Anten
10	4874.000M	24.1	+0.0	+10.4	+0.7		+0.0	35.2	74.0 802.11n20_2437M Hz	-38.8	Anten
11	7386.000M	31.5	+0.0	+10.4	+0.8		+0.0	42.7	82.0 802.11b_2462MHz	-39.3	Anten
12	7235.300M	30.7	+0.0	+10.2	+0.9		+0.0	41.8	82.0 802.11b_2412MHz	-40.2	Anten
13	7310.700M	30.5	+0.0	+10.3	+0.9		+0.0	41.7	82.0 802.11b_2462MHz	-40.3	Anten
14	2312.000M	29.2	+0.0	+10.1	+0.5		+0.0	39.8	82.0 802.11b_2462MHz	-42.2	Anten
15	2288.300M	28.4	+0.0	+10.1	+0.5		+0.0	39.0	82.0 802.11b_2462MHz	-43.0	Anten
16	2257.000M	25.3	+0.0	+10.1	+0.4		+0.0	35.8	82.0 802.11b_2412MHz	-46.2	Anten
17	1207.000M	25.3	+0.0	+10.1	+0.3		+0.0	35.7	82.0 802.11b_2412MHz	-46.3	Anten

Band Edge

Band Edge Summary				
Limit applied: Max Power/100kHz - 30dB (When average power limit is applied)				
Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
2400.0	CCK/QPSK(802.11b)	-42.3	< -25	Pass
2483.5	CCK/QPSK(802.11b)	-57.8	< -25	Pass
2400.0	64-QAM (802.11n20)	-37.0	< -33	Pass
2483.5	64-QAM (802.11n20)	-55.3	< -33	Pass

Band Edge Plots





Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc • 110 N. Olinda Place • Brea, CA • 714 993 6112
 Customer: **Venstar, Inc.**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **107308** Date: 8/1/2022
 Test Type: **Conducted Emissions** Time: 15:08:01
 Tested By: E. Wong Sequence#: 1
 Software: EMITest 5.03.20 120/60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The EUT is placed on the test bench, RF parameter evaluated at the antenna port.

Frequency range: 2412-2462MHz, TX 2412MHz, 2437MHz, 2462MHz

Protocol
 802.11b 11Mbps,
 802.11n20 MCS7

Power Setting:
 802.11b =17dBm
 802.11n20 = 12dBm

Frequency range of measurement = 9kHz- 25 GHz. 9kHz -25000 MHz; RBW=100kHz,VBW=300kHz.

Test environment conditions:
 Temperature: 27°C
 Humidity: 44%
 Pressure: 100kPa

Site A
 Test Method: ANSI C63.10-2013

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/16/2021	8/16/2022
T2	AN03430	Attenuator	75A-10-12	1/14/2022	1/14/2024
T3	ANP07658	Cable	32022-29094K- 29094K-24TC	6/22/2022	6/22/2024

Measurement Data:

Reading listed by margin.

Test Lead: Antenna port

#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	2400.000M	59.4	+0.0	+10.1	+0.5		+0.0	70.0	74.0 bandedge_L_802.1 1n20	-4.0	Anten
2	2400.000M	54.1	+0.0	+10.1	+0.5		+0.0	64.7	82.0 bandedge_L_802.1 1b	-17.3	Anten
3	2483.500M	41.2	+0.0	+10.1	+0.4		+0.0	51.7	74.0 bandedge_H_802.1 1n20	-22.3	Anten
4	4924.000M	40.1	+0.0	+10.5	+0.7		+0.0	51.3	82.0 802.11b_2462MHz	-30.7	Anten
5	2483.500M	38.7	+0.0	+10.1	+0.4		+0.0	49.2	82.0 bandedge_H_802.1 1b	-32.8	Anten
6	4874.000M	35.0	+0.0	+10.4	+0.7		+0.0	46.1	82.0 802.11b_2462MHz	-35.9	Anten
7	4824.000M	35.1	+0.0	+10.3	+0.7		+0.0	46.1	82.0 802.11b_2412MHz	-35.9	Anten
8	4825.700M	25.6	+0.0	+10.3	+0.7		+0.0	36.6	74.0 802.11n20_2412M Hz	-37.4	Anten
9	4919.000M	25.1	+0.0	+10.5	+0.7		+0.0	36.3	74.0 802.11n20_2462M Hz	-37.7	Anten
10	4874.000M	24.1	+0.0	+10.4	+0.7		+0.0	35.2	74.0 802.11n20_2437M Hz	-38.8	Anten
11	7386.000M	31.5	+0.0	+10.4	+0.8		+0.0	42.7	82.0 802.11b_2462MHz	-39.3	Anten
12	7235.300M	30.7	+0.0	+10.2	+0.9		+0.0	41.8	82.0 802.11b_2412MHz	-40.2	Anten
13	7310.700M	30.5	+0.0	+10.3	+0.9		+0.0	41.7	82.0 802.11b_2462MHz	-40.3	Anten
14	2312.000M	29.2	+0.0	+10.1	+0.5		+0.0	39.8	82.0 802.11b_2462MHz	-42.2	Anten
15	2288.300M	28.4	+0.0	+10.1	+0.5		+0.0	39.0	82.0 802.11b_2462MHz	-43.0	Anten
16	2257.000M	25.3	+0.0	+10.1	+0.4		+0.0	35.8	82.0 802.11b_2412MHz	-46.2	Anten
17	1207.000M	25.3	+0.0	+10.1	+0.3		+0.0	35.7	82.0 802.11b_2412MHz	-46.3	Anten

Test Setup Photo(s)



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc • 110 N. Olinda Place • Brea, CA • 714 993 6112
 Customer: **Venstar, Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **107308** Date: 8/4/2022
 Test Type: **Radiated Scan** Time: 09:42:28
 Tested By: E. Wong Sequence#: 2
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

The EUT is placed on the Styrofoam block, positioned as in normal installation, I/O ports are populated with unterminated cable.

Frequency range: 2412-2462MHz, TX 2412MHz, 2437MHz, 2462MHz

Protocol
 802.11b 11Mbps,
 802.11n20 MCS7

Power Setting:
 802.11b =17dBm
 802.11n20 = 12dBm

Frequency range of measurement = 9kHz- 25GHz. 9kHz -150kHz; RBW=200Hz, VBW=600Hz; 150kHz-30 MHz;
 RBW=9kHz, VBW=27kHz; 30MHz-1000MHz; RBW=120kHz, VBW=360kHz, 1000MHz-25000MHz;
 RBW=1MHz, VBW=3MHz.

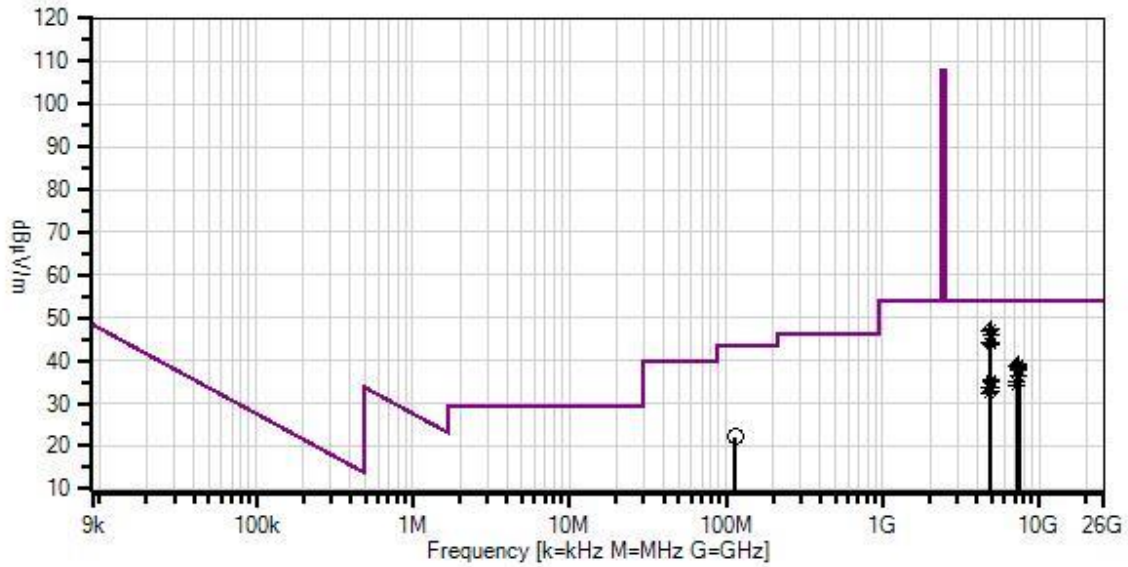
Test environment conditions:
 Temperature: 26°C
 Humidity: 51%
 Pressure: 100kPa
 Site A

Test Method: ANSI C63.10-2013

This data sheet excludes non-intentional radiation.

No emissions found from 150kHz-30MHz.

Venstar, Inc. WO#: 107308 Sequence#: 2 Date: 8/4/2022
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



- Readings
 - × QP Readings
 - ▼ Ambient
 - Peak Readings
 - * Average Readings
- Software Version: 5.03.20
- 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02869	Spectrum Analyzer	E4440A	8/16/2021	8/16/2022
T1	AN00849	Horn Antenna	3115	3/21/2022	3/21/2024
T2	ANP07658	Cable	32022-29094K-29094K-24TC	6/22/2022	6/22/2024
T3	AN00786	Preamp	83017A	5/23/2022	5/23/2024
T4	ANP06360	Cable	L1-PNMMN-48	9/30/2021	9/30/2023
T5	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/17/2021	5/17/2023
	AN03367	Horn Antenna	62-GH-62-25.	8/3/2021	8/3/2023
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	ANP07656	Cable	32022-29094K-29094K-24TC	6/22/2022	6/22/2024
	AN00314	Loop Antenna	6502	3/29/2022	3/29/2024
T6	AN01994	Biconilog Antenna	CBL6111C	6/1/2022	6/1/2024
T7	AN00309	Preamp	8447D	12/13/2021	12/13/2023
T8	ANP05050	Cable	RG223/U	12/24/2020	12/24/2022
T9	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/21/2020	12/21/2022

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dB μ V	T1	T2	T3	T4	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
			T5 dB	T6 dB	T7 dB	T8 dB					
1	4924.033M Ave	45.6	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	47.2	54.0 802.11b_2462MHz	-6.8	Horiz
2	4824.000M Ave	45.7	+33.0 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	47.1	54.0 802.11b_2412MHz	-6.9	Horiz
3	4873.950M Ave	44.5	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	46.1	54.0 802.11b_2437MHz	-7.9	Horiz
4	4874.000M Ave	42.8	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	44.4	54.0 802.11b_2437MHz	-9.6	Vert
5	4824.000M Ave	42.8	+33.0 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	44.2	54.0 802.11b_2412MHz	-9.8	Vert
6	4923.833M Ave	42.0	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	43.6	54.0 802.11b_2462MHz	-10.4	Vert
^	4923.833M	54.6	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	56.2	54.0 802.11b_2462MHz	+2.2	Vert

8	7311.000M Ave	32.6	+36.3 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	39.2	54.0 802.11b_2437MHz	-14.8	Vert
9	7236.000M Ave	32.6	+36.0 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	38.9	54.0 802.11b_2412MHz	-15.1	Horiz
10	7236.000M Ave	32.6	+36.0 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	38.9	54.0 802.11b_2412MHz	-15.1	Vert
11	7311.000M Ave	32.2	+36.3 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	38.8	54.0 802.11n20_2437M Hz	-15.2	Vert
^	7311.000M	43.8	+36.3 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	50.4	54.0 802.11b_2437MHz	-3.6	Vert
^	7311.000M	42.7	+36.3 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	49.3	54.0 802.11n20_2437M Hz	-4.7	Vert
14	7385.750M Ave	31.7	+36.5 +0.2 +0.0	+0.8 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	38.4	54.0 802.11b_2462MHz	-15.6	Horiz
^	7385.750M	44.9	+36.5 +0.2 +0.0	+0.8 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	51.6	54.0 802.11b_2462MHz	-2.4	Horiz
16	7310.917M Ave	31.6	+36.3 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	38.2	54.0 802.11b_2437MHz	-15.8	Horiz
17	7386.000M Ave	31.3	+36.5 +0.2 +0.0	+0.8 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	38.0	54.0 802.11n20_2462M Hz	-16.0	Horiz
^	7386.000M	42.6	+36.5 +0.2 +0.0	+0.8 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	49.3	54.0 802.11n20_2462M Hz	-4.7	Horiz
19	7386.383M Ave	31.2	+36.5 +0.2 +0.0	+0.8 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	37.9	54.0 802.11b_2462MHz	-16.1	Vert
^	7386.383M	43.7	+36.5 +0.2 +0.0	+0.8 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	50.4	54.0 802.11b_2462MHz	-3.6	Vert
21	7311.000M Ave	31.2	+36.3 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	37.8	54.0 802.11n20_2437M Hz	-16.2	Horiz
^	7310.917M	44.3	+36.3 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	50.9	54.0 802.11b_2437MHz	-3.1	Horiz
^	7311.000M	42.0	+36.3 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	48.6	54.0 802.11n20_2437M Hz	-5.4	Horiz

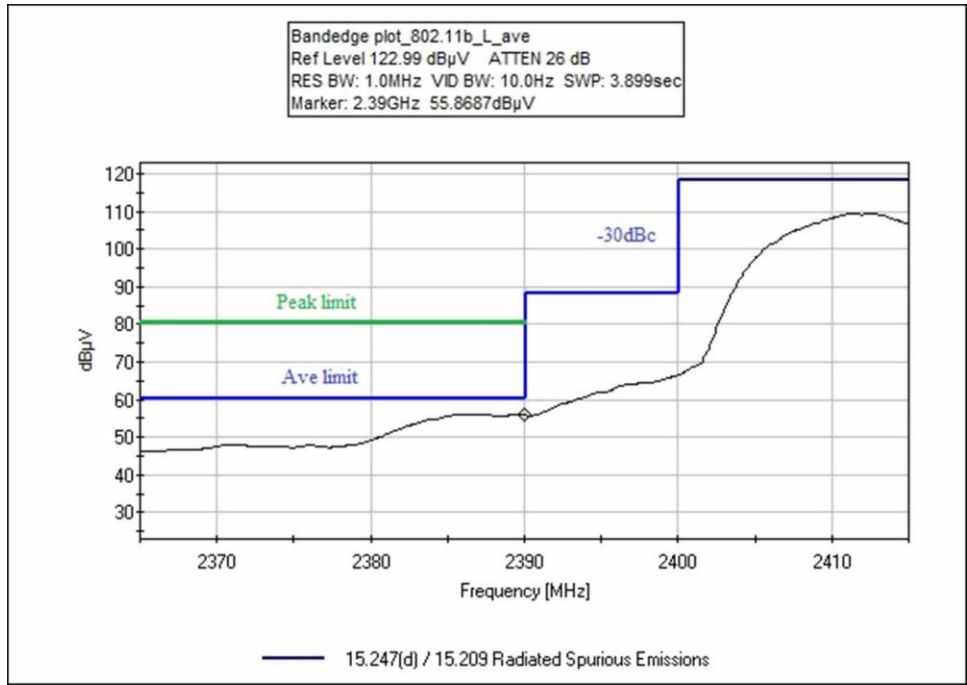
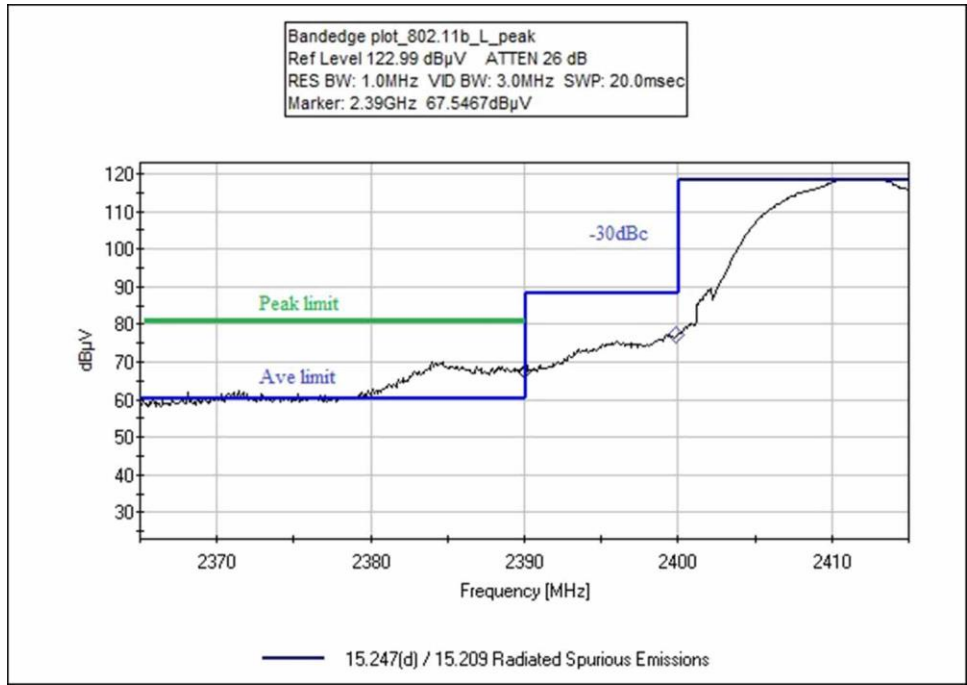
24	7386.000M Ave	29.6	+36.5 +0.2 +0.0	+0.8 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	36.3	54.0 802.11n20_2462M Hz	-17.7	Vert
^	7386.000M	42.1	+36.5 +0.2 +0.0	+0.8 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	48.8	54.0 802.11n20_2462M Hz	-5.2	Vert
26	4874.000M Ave	33.9	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	35.5	54.0 802.11n20_2437M Hz	-18.5	Horiz
^	4873.950M	56.8	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	58.4	54.0 802.11b_2437MHz	+4.4	Horiz
^	4874.000M	49.4	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	51.0	54.0 802.11n20_2437M Hz	-3.0	Horiz
29	4924.000M Ave	33.6	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	35.2	54.0 802.11n20_2462M Hz	-18.8	Horiz
^	4924.033M	58.5	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	60.1	54.0 802.11b_2462MHz	+6.1	Horiz
^	4924.000M	47.9	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	49.5	54.0 802.11n20_2462M Hz	-4.5	Horiz
32	7236.000M Ave	28.8	+36.0 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	35.1	54.0 802.11n20_2412M Hz	-18.9	Vert
^	7236.000M	44.2	+36.0 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	50.5	54.0 802.11b_2412MHz	-3.5	Vert
^	7236.000M	41.9	+36.0 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	48.2	54.0 802.11n20_2412M Hz	-5.8	Vert
35	7236.000M Ave	27.7	+36.0 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	34.0	54.0 802.11n20_2412M Hz	-20.0	Horiz
^	7236.000M	46.4	+36.0 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	52.7	54.0 802.11b_2412MHz	-1.3	Horiz
^	7236.000M	41.1	+36.0 +0.2 +0.0	+0.9 +0.0	-36.9 +0.0	+6.1 +0.0	+0.0	47.4	54.0 802.11n20_2412M Hz	-6.6	Horiz
38	4824.000M Ave	32.4	+33.0 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	33.8	54.0 802.11n20_2412M Hz	-20.2	Horiz
^	4824.000M	58.6	+33.0 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	60.0	54.0 802.11b_2412MHz	+6.0	Horiz
^	4824.000M	46.2	+33.0 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	47.6	54.0 802.11n20_2412M Hz	-6.4	Horiz

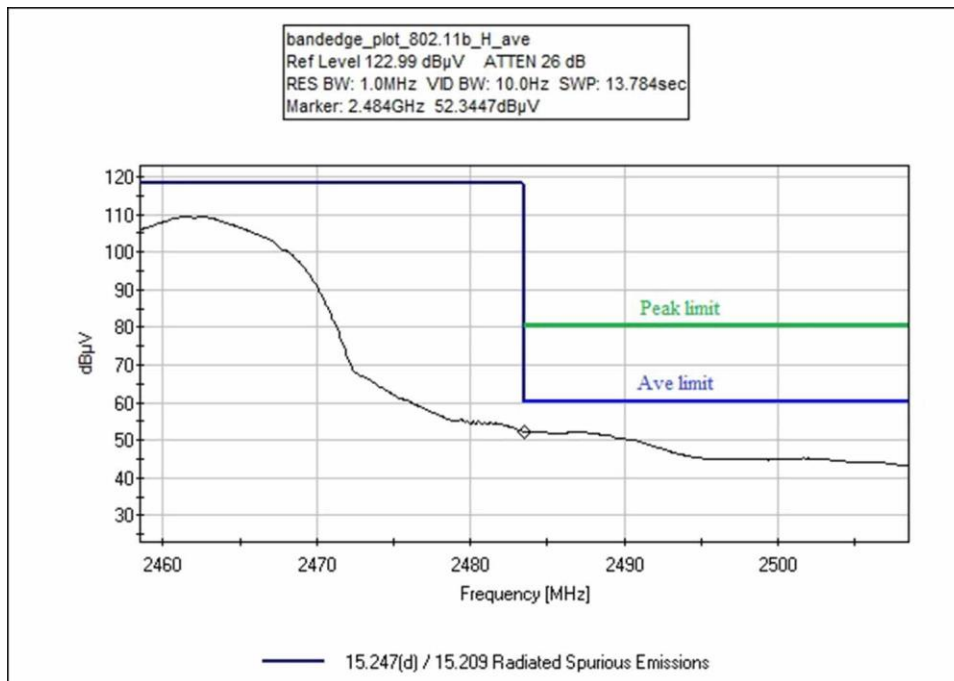
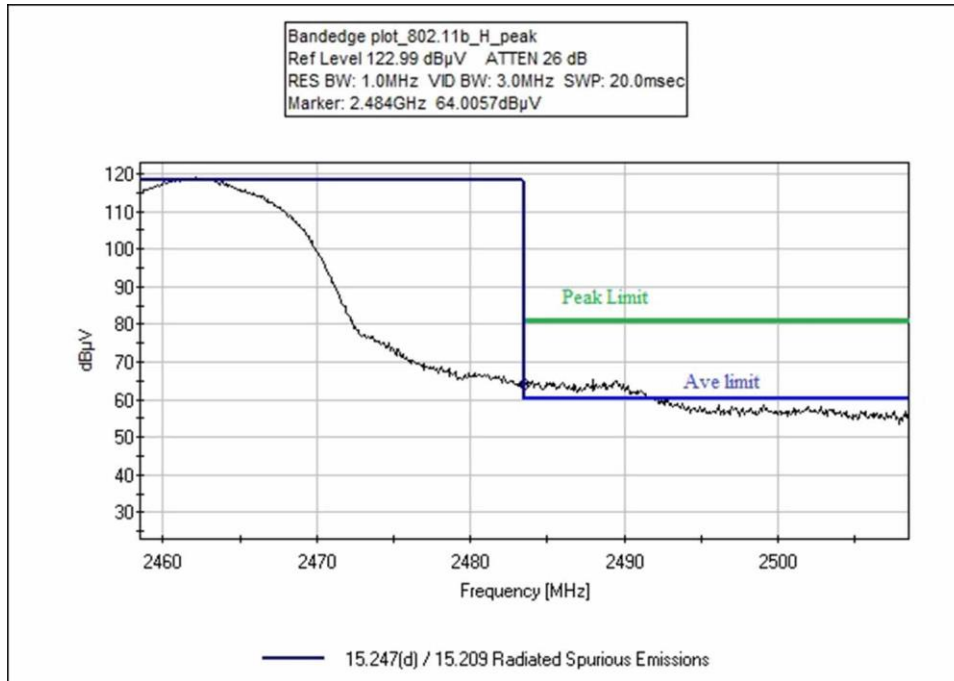
41	4874.000M Ave	32.2	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	33.8	54.0 802.11n20_2437M Hz	-20.2	Vert
^	4874.000M	55.5	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	57.1	54.0 802.11b_2437MHz	+3.1	Vert
^	4874.000M	46.9	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	48.5	54.0 802.11n20_2437M Hz	-5.5	Vert
44	115.383M	31.0	+0.0 +0.0 +1.9	+0.0 +17.1	+0.0 -28.0	+0.0 +0.1	+0.0	22.1	43.5	-21.4	Vert
45	4924.000M Ave	31.0	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	32.6	54.0 802.11n20_2462M Hz	-21.4	Vert
^	4924.000M	45.4	+33.2 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	47.0	54.0 802.11n20_2462M Hz	-7.0	Vert
47	4824.000M Ave	31.0	+33.0 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	32.4	54.0 802.11n20_2412M Hz	-21.6	Vert
^	4824.000M	55.3	+33.0 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	56.7	54.0 802.11b_2412MHz	+2.7	Vert
^	4824.000M	45.8	+33.0 +0.3 +0.0	+0.7 +0.0	-37.4 +0.0	+4.8 +0.0	+0.0	47.2	54.0 802.11n20_2412M Hz	-6.8	Vert

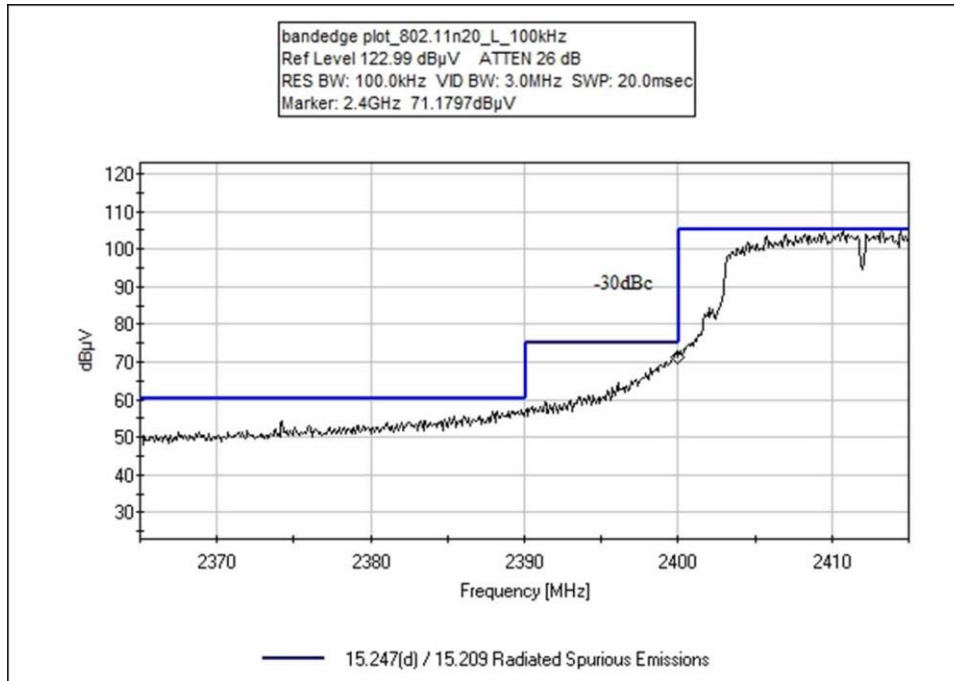
Band Edge

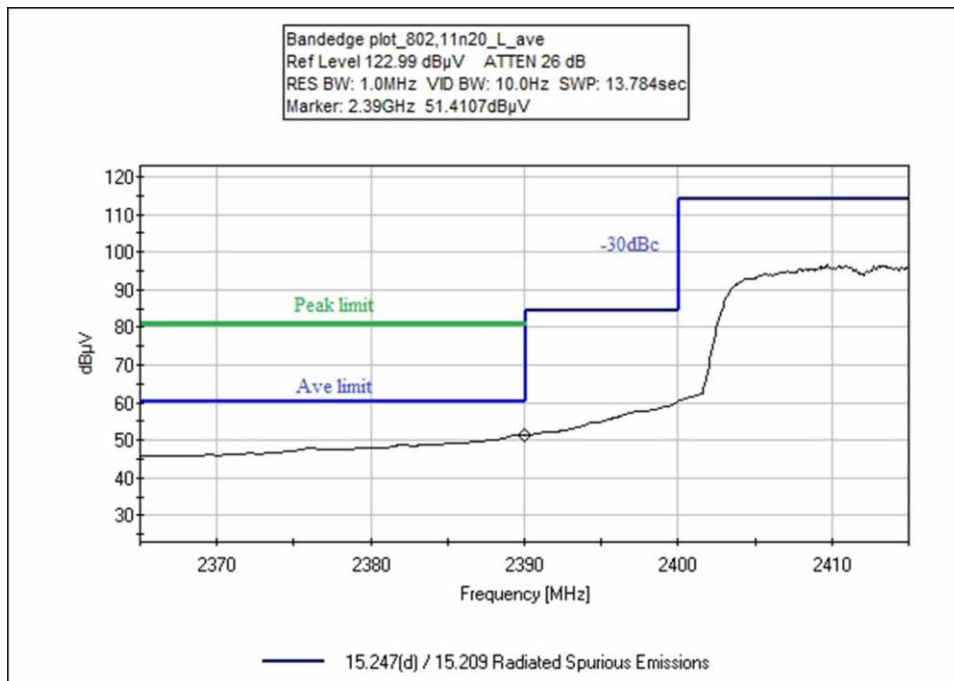
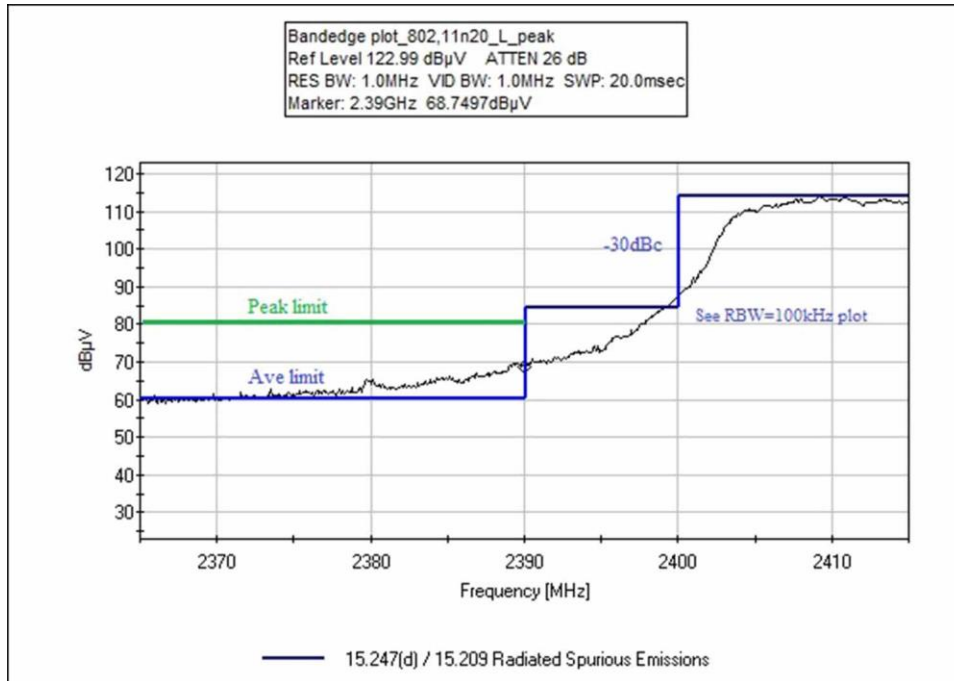
Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	CCK/QPSK(802.11b)	IFA -0.97dBi	61.8 pk	< 74.0	Pass
2390.0	CCK/QPSK(802.11b)	IFA -0.97dBi	49.4 av	< 54.0	Pass
2400.0	CCK/QPSK(802.11b)	IFA -0.97dBi	70.0 pk	< 82.0	Pass
2483.5	CCK/QPSK(802.11b)	IFA -0.97dBi	59.0 pk	<74.0	Pass
2483.5	CCK/QPSK(802.11b)	IFA -0.97dBi	45.7 av	<54.0	Pass
2390.0	64-QAM (802.11n20)	IFA -0.97dBi	60.4 pk	<74.0	Pass
2390.0	64-QAM (802.11n20)	IFA -0.97dBi	45.9 av	<54.0	Pass
2400.0	64-QAM (802.11n20)	IFA -0.97dBi	64.9 pk	< 69.0	Pass
2483.5	64-QAM (802.11n20)	IFA -0.97dBi	61.6 pk	<74.0	Pass
2483.5	64-QAM (802.11n20)	IFA -0.97dBi	43.4 av	<54.0	Pass

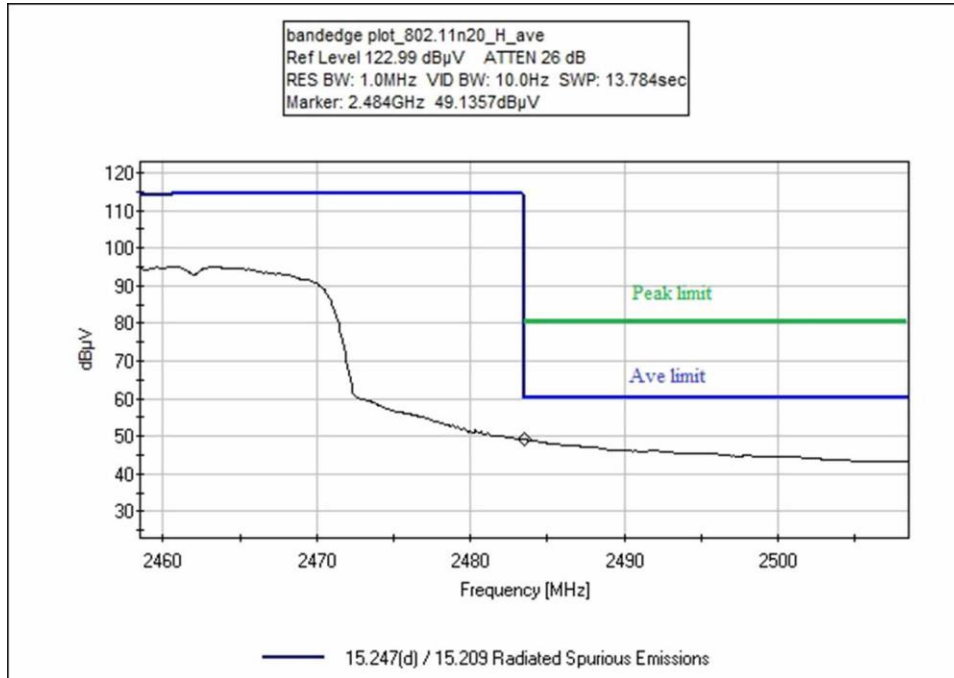
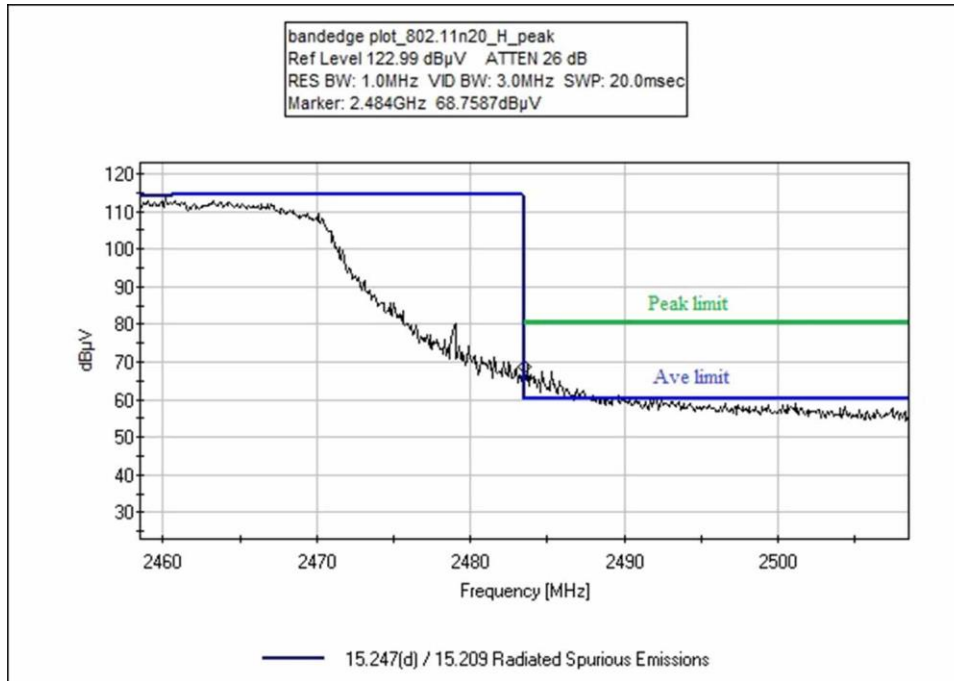
Band Edge Plots











Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc • 110 N. Olinda Place • Brea, CA • 714 993 6112
 Customer: **Venstar, Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **107308** Date: 8/3/2022
 Test Type: **Radiated Scan** Time: 08:53:02
 Tested By: E. Wong Sequence#: 2
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

The EUT is placed on the Styrofoam block, positioned as in normal installation, I/O port are populated with unterminated cable.

Frequency range: 2412-2462MHz
 TX 2412MHz, 2437MHz, /2462MHz

Protocol
 802.11b 11Mbps,
 802.11n20 MCS7

Power Setting:

802.11b =17dBm
 802.11n20 = 12dBm

Frequency range of measurement = bandedge, RBW=100kHz,VBW=300kHz.

Test environment conditions:
 Temperature: 26°C
 Humidity: 51%
 Pressure: 100kPa

Site A
 Test Method: ANSI C63.10-2013

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/16/2021	8/16/2022
T2	AN00849	Horn Antenna	3115	3/21/2022	3/21/2024
T3	ANP07658	Cable	32022-29094K-29094K-24TC	6/22/2022	6/22/2024
T4	AN00786	Preamp	83017A	5/23/2022	5/23/2024
T5	ANP06360	Cable	L1-PNMMN-48	9/30/2021	9/30/2023

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	2400.000M	71.2	+0.0 +3.2	+28.5	+0.5	-38.5	+0.0	64.9	69.0 bandedge_L_802.1 1n20_100kHz	-4.1	Vert
2	2390.000M Ave	55.7	+0.0 +3.2	+28.5	+0.5	-38.5	+0.0	49.4	54.0 bandedge_L_802.1 1b	-4.6	Vert
3	2390.000M Ave	52.2	+0.0 +3.2	+28.5	+0.5	-38.5	+0.0	45.9	54.0 bandedge_L_802.1 1n20	-8.1	Vert
^	2390.000M	68.1	+0.0 +3.2	+28.5	+0.5	-38.5	+0.0	61.8	54.0 bandedge_L_802.1 1b	+7.8	Vert
^	2390.000M	66.7	+0.0 +3.2	+28.5	+0.5	-38.5	+0.0	60.4	54.0 bandedge_L_802.1 1n20	+6.4	Vert
6	2483.500M Ave	52.1	+0.0 +3.3	+28.4	+0.4	-38.5	+0.0	45.7	54.0 bandedge_H_802.1 1b	-8.3	Vert
7	2483.500M Ave	49.8	+0.0 +3.3	+28.4	+0.4	-38.5	+0.0	43.4	54.0 bandedge_H_802.1 1n20	-10.6	Vert
^	2483.500M	68.0	+0.0 +3.3	+28.4	+0.4	-38.5	+0.0	61.6	54.0 bandedge_H_802.1 1n20	+7.6	Vert
^	2483.500M	65.4	+0.0 +3.3	+28.4	+0.4	-38.5	+0.0	59.0	54.0 bandedge_H_802.1 1b	+5.0	Vert
10	2400.000M	76.3	+0.0 +3.2	+28.5	+0.5	-38.5	+0.0	70.0	82.0 bandedge_L2_peak	-12.0	Vert

Test Setup Photo(s)



Below 1GHz, View 1



Below 1GHz, View 2



Below 1GHz, View 3



Above 1GHz, View 1



Above 1GHz, View 2



LT 1GHz, View 1



LT 1GHz, View 2

15.247(e) Power Spectral Density

Test Setup / Conditions / Data			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 558074	Test Date(s):	8/1/2022
Configuration:	1		
Test Setup:	<p>The EUT is placed on the test bench, RF parameter is evaluated at the antenna port.</p> <p>Frequency range: 2412-2462MHz TX 2412MHz, 2437MHz, 2462MHz</p> <p>Modulation: 802.11b 11 Mbps 802.11n20 MCS7</p> <p>Power Setting: 802.11b =17dBm 802.11n20 = 12dBm</p>		

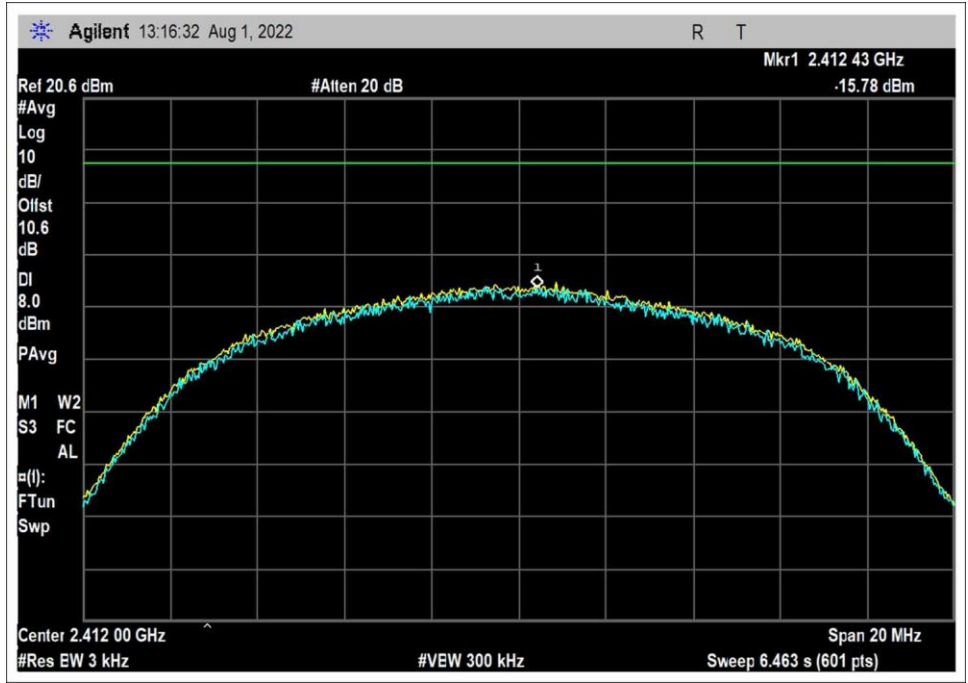
Environmental Conditions			
Temperature (°C)	26	Relative Humidity (%):	48

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02869	Spectrum Analyzer	Agilent	E4440A	8/16/2021	8/16/2022
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	1/14/2022	1/14/2024
P07658	Cable	Astrolab, Inc.	32022-29094K-29094K-24TC	6/22/2022	6/22/2024

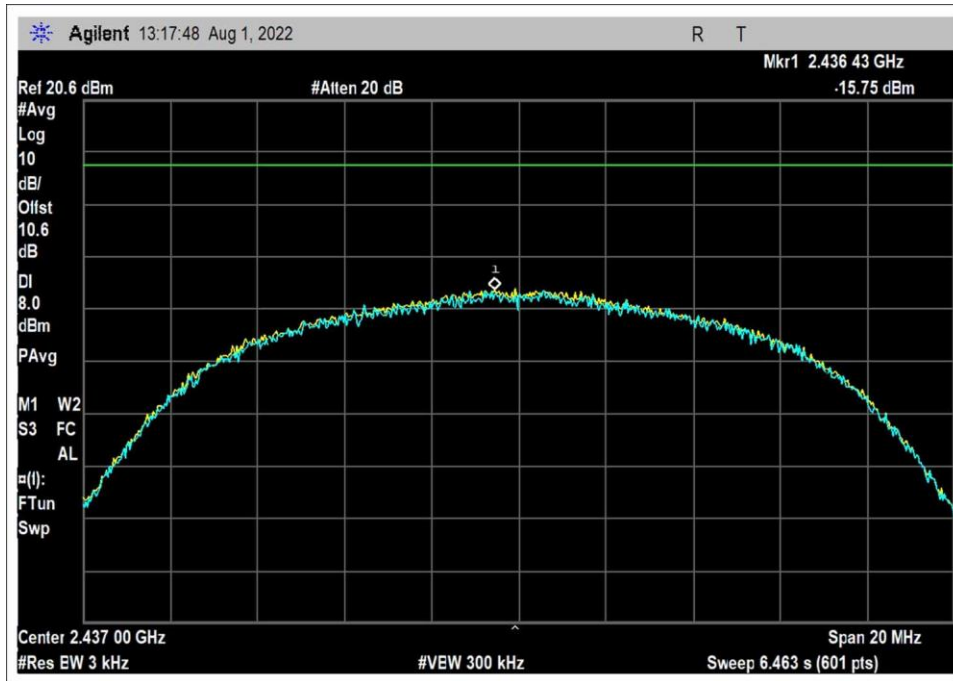
PSD Test Data Summary - RF Conducted Measurement				
Measurement Method: AVGPSD-1				
Frequency (MHz)	Modulation	Measured (dBm/3kHz)	Limit (dBm/3kHz)	Results
2412	CCK/QPSK(802.11b)	-15.8	≤8	Pass
2437	CCK/QPSK(802.11b)	-15.8	≤8	Pass
2462	CCK/QPSK(802.11b)	-16.8	≤8	Pass
2412	64-QAM (802.11n20)	-21.7	≤8	Pass
2437	64-QAM (802.11n20)	-21.7	≤8	Pass
2462	64-QAM (802.11n20)	-23.0	≤8	Pass

Plots

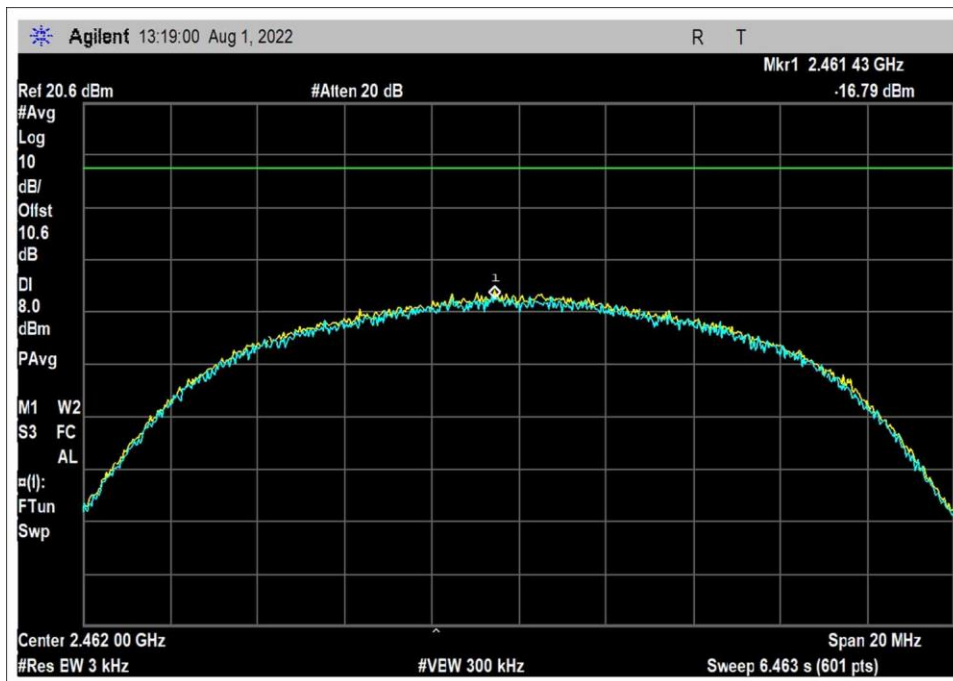
802.11b



Low Channel

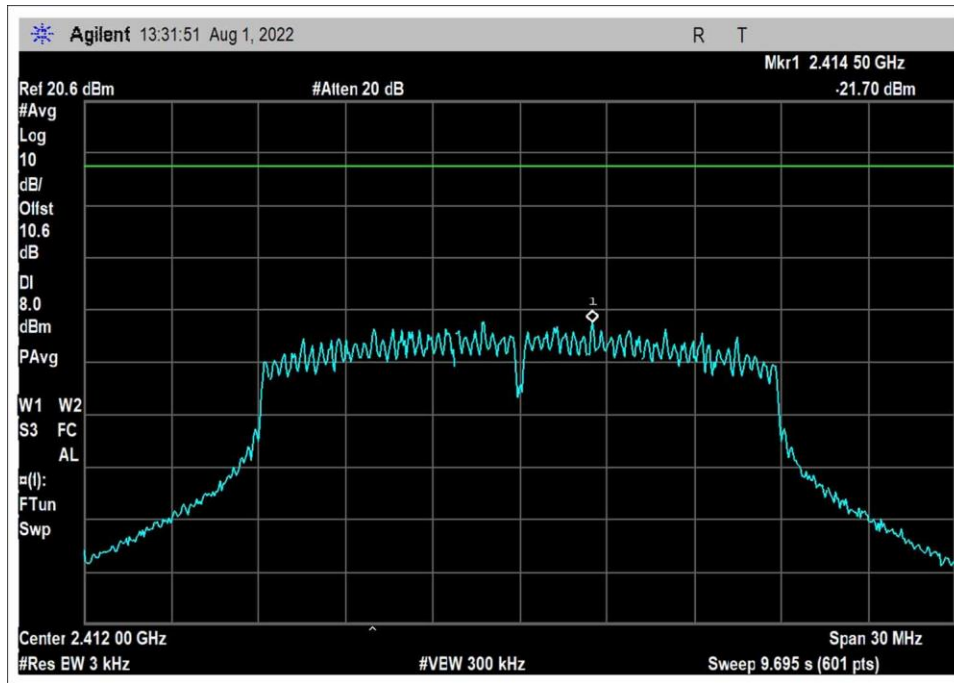


Middle Channel

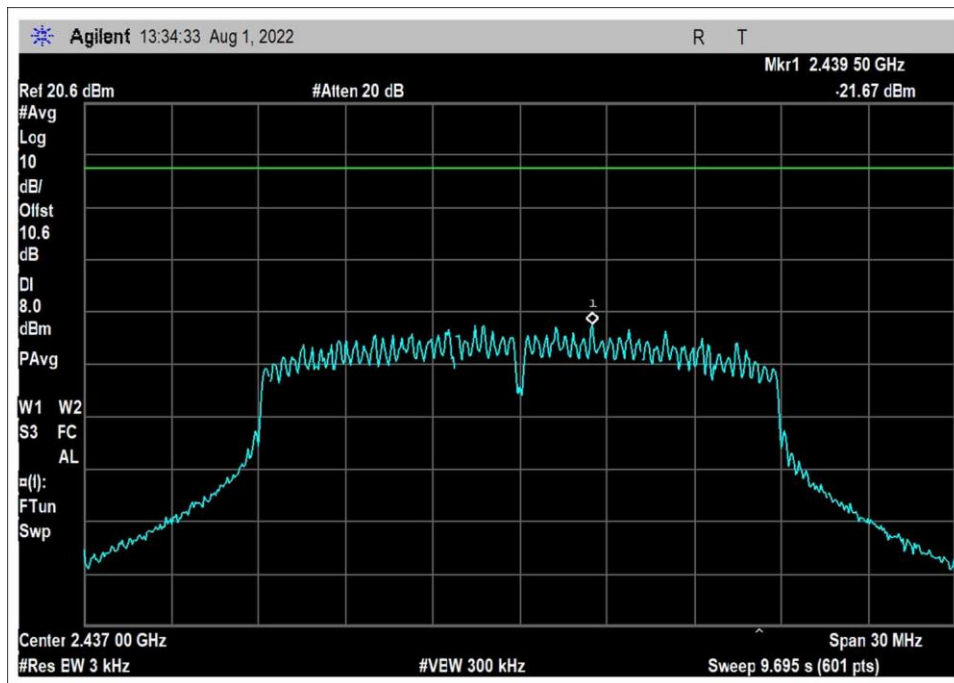


High Channel

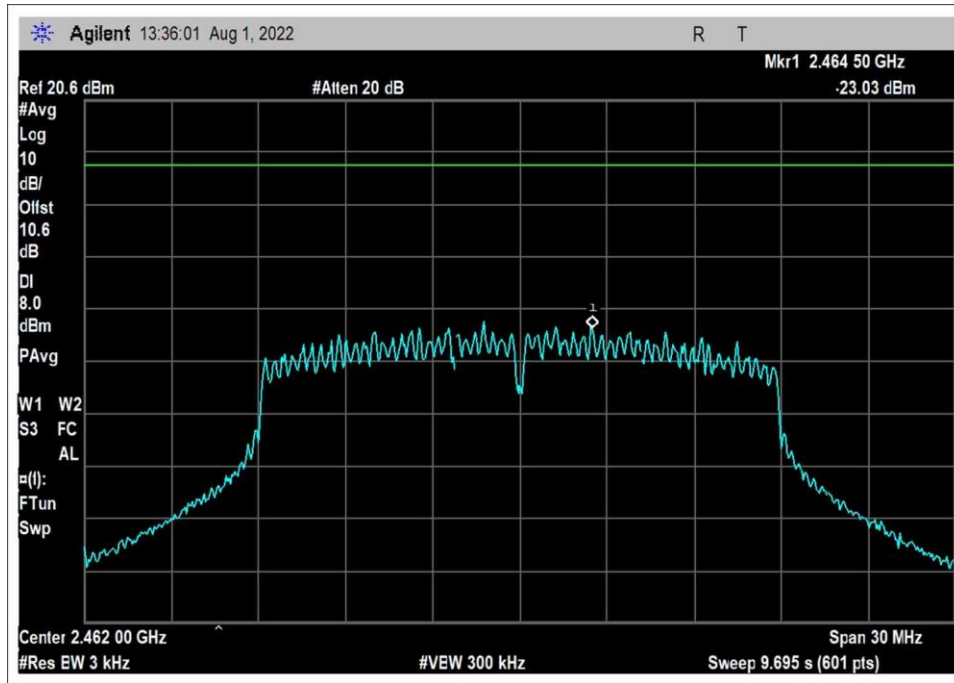
802.11n20



Low Channel

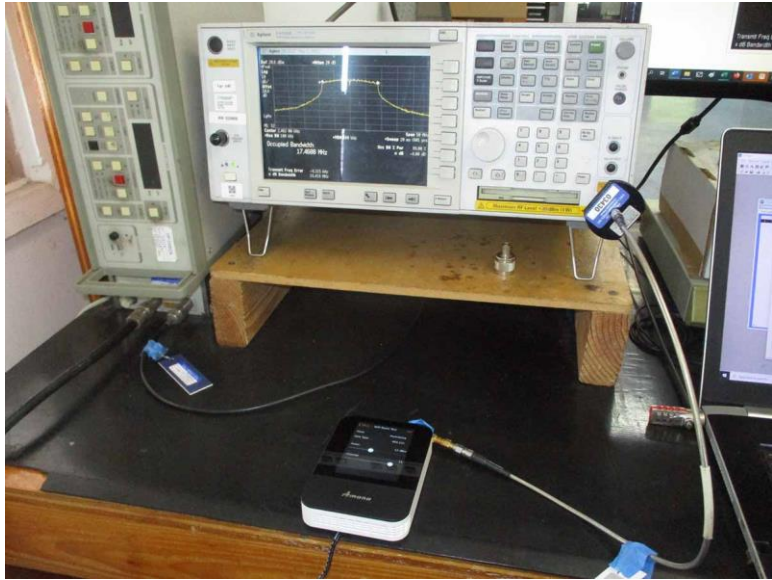


Middle Channel



High Channel

Test Setup Photo(s)



15.207 AC Conducted Emissions

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc • 110 N. Olinda Place • Brea, CA • 714 993 6112
 Customer: **Venstar, Inc.**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **107308** Date: 8/5/2022
 Test Type: **Conducted Emissions** Time: 1:18:03 PM
 Tested By: E. Wong Sequence#: 10
 Software: EMITest 5.03.20 120/60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The EUT is placed on the Styrofoam block, positioned as in normal installation, I/O ports are populated with unterminated cable.

Frequency range: 2412-2462MHz
TX 2437MHz

Protocol
802.11b 11Mbps,

Power Setting:
802.11b =17dBm

Frequency range of measurement = 150kHz- 30MHz, 150kHz-30MHz; RBW=9kHz, VBW=30kHz

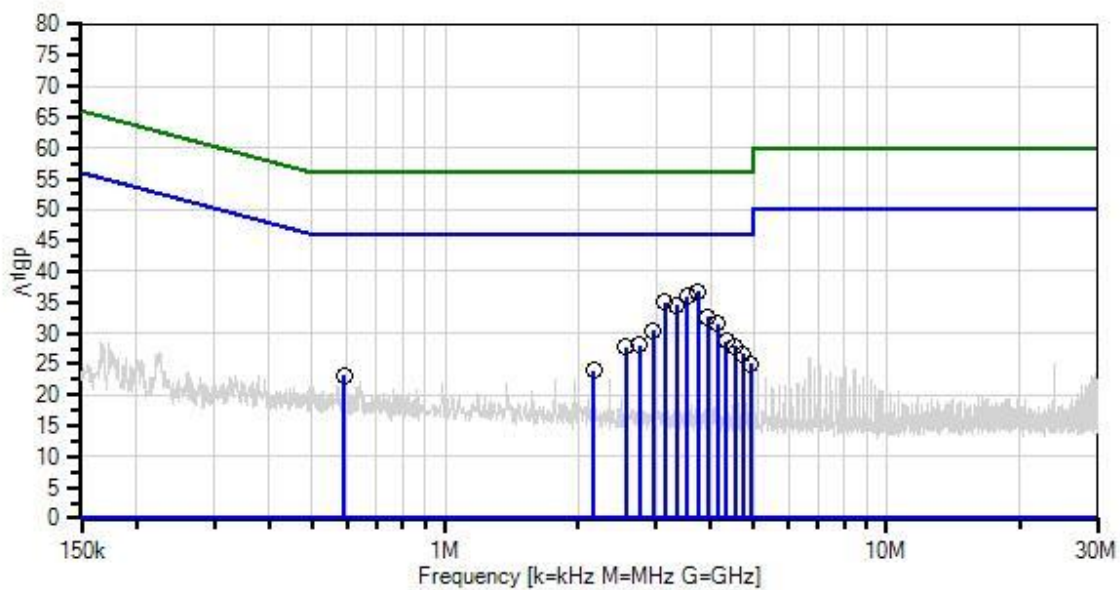
Test environment conditions:

Temperature: 26°C
Humidity: 51%
Pressure: 100kPa

Site A

Test Method: ANSI C63.10-2013

Venstar, Inc. WO#: 107308 Sequence#: 10 Date: 8/5/2022
 15.207 AC Mains - Average Test Lead: 120/60Hz L1-Line



— Sweep Data
 × QP Readings
 Software Version: 5.03.20
 — Readings
 * Average Readings
 — 1 - 15.207 AC Mains - Average
 ○ Peak Readings
 ▼ Ambient
 — 2 - 15.207 AC Mains - Quasi-peak

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02869	Spectrum Analyzer	E4440A	8/16/2021	8/16/2022
T1	ANP07545	Attenuator	SA18N10W-06	1/4/2021	1/4/2023
T2	ANP07338	Cable	2249-Y-240	1/3/2022	1/3/2024
T3	AN02610	High Pass Filter	HE9615-150K-50-720B	9/8/2021	9/8/2023
T4	AN00847.1	50uH LISN-(L) Line 1	3816/2NM	3/18/2022	3/18/2023
	AN00847.1	50uH LISN-(N) Line 2	3816/2NM	3/18/2022	3/18/2023
T5	ANP07738	Cable-Line L1(dB)	90cm-extcord	12/9/2020	12/9/2022
	ANP07738	Cable-Neutral L2(dB)	90cm-extcord	12/9/2020	12/9/2022

Measurement Data:

Reading listed by margin.

Test Lead: L1-Line

#	Freq MHz	Rdng dB μ V	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	3.744M	30.6	+5.7 +0.2	+0.1	+0.1	+0.0	+0.0	36.7	46.0	-9.3	L1-Li
2	3.544M	29.9	+5.7 +0.2	+0.1	+0.1	+0.0	+0.0	36.0	46.0	-10.0	L1-Li
3	3.152M	28.9	+5.7 +0.2	+0.1	+0.1	+0.0	+0.0	35.0	46.0	-11.0	L1-Li
4	3.348M	28.5	+5.7 +0.2	+0.1	+0.1	+0.0	+0.0	34.6	46.0	-11.4	L1-Li
5	3.939M	26.5	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	32.7	46.0	-13.3	L1-Li
6	4.135M	25.4	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	31.6	46.0	-14.4	L1-Li
7	2.953M	24.3	+5.7 +0.2	+0.1	+0.1	+0.0	+0.0	30.4	46.0	-15.6	L1-Li
8	4.330M	22.5	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	28.7	46.0	-17.3	L1-Li
9	2.757M	21.9	+5.7 +0.2	+0.1	+0.1	+0.0	+0.0	28.0	46.0	-18.0	L1-Li
10	4.530M	21.7	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	27.9	46.0	-18.1	L1-Li
11	2.561M	21.8	+5.7 +0.1	+0.1	+0.1	+0.0	+0.0	27.8	46.0	-18.2	L1-Li
12	4.726M	20.4	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	26.6	46.0	-19.4	L1-Li
13	4.922M	18.9	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	25.1	46.0	-20.9	L1-Li
14	2.166M	18.0	+5.7 +0.1	+0.1	+0.1	+0.0	+0.0	24.0	46.0	-22.0	L1-Li
15	591.414k	16.9	+5.8 +0.1	+0.0	+0.3	+0.0	+0.0	23.1	46.0	-22.9	L1-Li

Test Location: CKC Laboratories, Inc • 110 N. Olinda Place • Brea, CA • 714 993 6112
 Customer: **Venstar, Inc.**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **107308** Date: 8/5/2022
 Test Type: **Conducted Emissions** Time: 1:22:02 PM
 Tested By: E. Wong Sequence#: 11
 Software: EMITest 5.03.20 120/60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The EUT is placed on the Styrofoam block, positioned as in normal installation, I/O ports are populated with unterminated cable.

Frequency range: 2412-2462MHz, TX 2437MHz

Protocol:
802.11b 11Mbps,

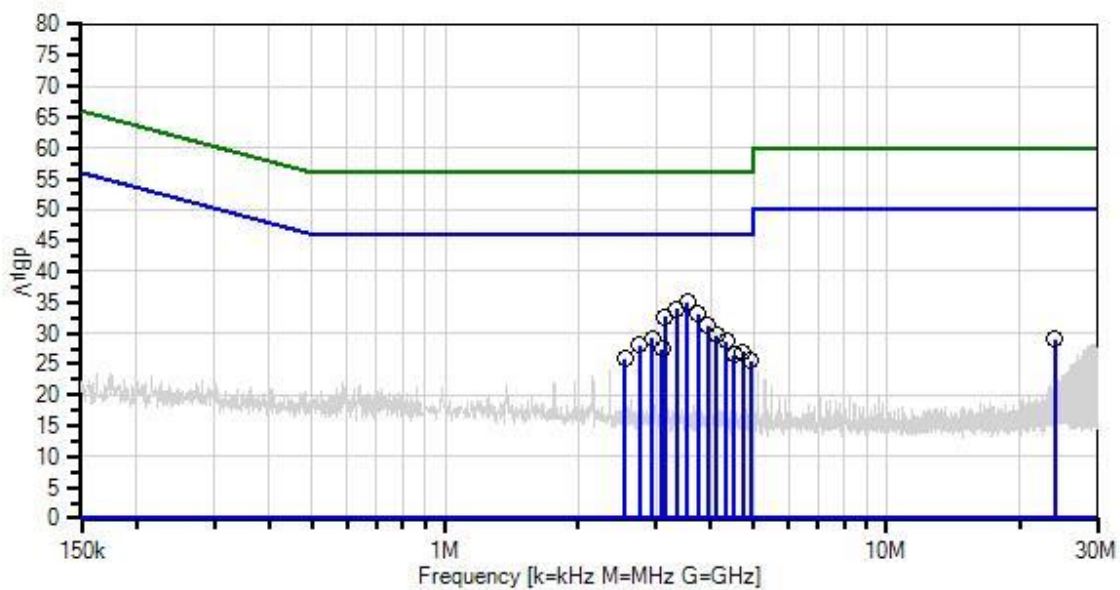
Power Setting:
802.11b =17dBm

Frequency range of measurement = 150kHz- 30MHz, 150kHz-30MHz; RBW=9kHz, VBW=30kHz

Test environment conditions:
 Temperature: 26°C
 Humidity: 51%
 Pressure: 100kPa

Site A
 Test Method: ANSI C63.10-2013

Venstar, Inc. WO#: 107308 Sequence#: 11 Date: 8/5/2022
 15.207 AC Mains - Average Test Lead: 120/60Hz L2-Neutral



— Sweep Data
 × QP Readings
 Software Version: 5.03.20
 — Readings
 * Average Readings
 — 1 - 15.207 AC Mains - Average
 ○ Peak Readings
 ▼ Ambient
 — 2 - 15.207 AC Mains - Quasi-peak

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02869	Spectrum Analyzer	E4440A	8/16/2021	8/16/2022
T1	ANP07545	Attenuator	SA18N10W-06	1/4/2021	1/4/2023
T2	ANP07338	Cable	2249-Y-240	1/3/2022	1/3/2024
T3	AN02610	High Pass Filter	HE9615-150K-50-720B	9/8/2021	9/8/2023
	AN00847.1	50uH LISN-(L) Line 1	3816/2NM	3/18/2022	3/18/2023
T4	AN00847.1	50uH LISN-(N) Line 2	3816/2NM	3/18/2022	3/18/2023
	ANP07738	Cable-Line L1(dB)	90cm-extcord	12/9/2020	12/9/2022
T5	ANP07738	Cable-Neutral L2(dB)	90cm-extcord	12/9/2020	12/9/2022

Measurement Data:

Reading listed by margin.

Test Lead: L2-Neutral

#	Freq MHz	Rdng dB μ V	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	3.539M	28.9	+5.7 +0.2	+0.1	+0.1	+0.0	+0.0	35.0	46.0	-11.0	L2-Ne
2	3.340M	27.8	+5.7 +0.2	+0.1	+0.1	+0.0	+0.0	33.9	46.0	-12.1	L2-Ne
3	3.735M	27.1	+5.7 +0.2	+0.1	+0.1	+0.0	+0.0	33.2	46.0	-12.8	L2-Ne
4	3.144M	26.7	+5.7 +0.1	+0.1	+0.1	+0.0	+0.0	32.7	46.0	-13.3	L2-Ne
5	3.931M	25.1	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	31.3	46.0	-14.7	L2-Ne
6	4.126M	23.5	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	29.7	46.0	-16.3	L2-Ne
7	2.948M	23.1	+5.7 +0.1	+0.1	+0.1	+0.0	+0.0	29.1	46.0	-16.9	L2-Ne
8	4.326M	22.5	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	28.7	46.0	-17.3	L2-Ne
9	2.753M	22.0	+5.7 +0.1	+0.1	+0.1	+0.0	+0.0	28.0	46.0	-18.0	L2-Ne
10	3.097M	21.4	+5.7 +0.1	+0.1	+0.1	+0.0	+0.0	27.4	46.0	-18.6	L2-Ne
11	4.717M	20.8	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	27.0	46.0	-19.0	L2-Ne
12	4.522M	20.3	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	26.5	46.0	-19.5	L2-Ne
13	2.557M	19.9	+5.7 +0.1	+0.1	+0.1	+0.0	+0.0	25.9	46.0	-20.1	L2-Ne
14	4.913M	19.3	+5.7 +0.2	+0.2	+0.1	+0.0	+0.0	25.5	46.0	-20.5	L2-Ne
15	23.998M	21.7	+5.7 +0.8	+0.4	+0.2	+0.2	+0.0	29.0	50.0	-21.0	L2-Ne

Test Setup Photo(s)



Front View



Back View

APPENDIX A ANTENNA GAIN VERIFICATION

Measured power, CW set at lowest channel (test mode only operate at 2412MHz)

2412MHz, power set at 12dBm,

Conducted power = 112.1 dBuV = 5.1 dBm

Radiated field strength = 102.9dBuV/m@3m

Conducted RF output power calculated in accordance with ANSI C63.10.

$$P(W) = \frac{(E \cdot d)^2}{30 G}$$

Or equivalently, in logarithmic form:

$$P(\text{dBm}) = E(\text{dBuV}/\text{m}) + 20\text{LOG}(d) - G - 104.77$$

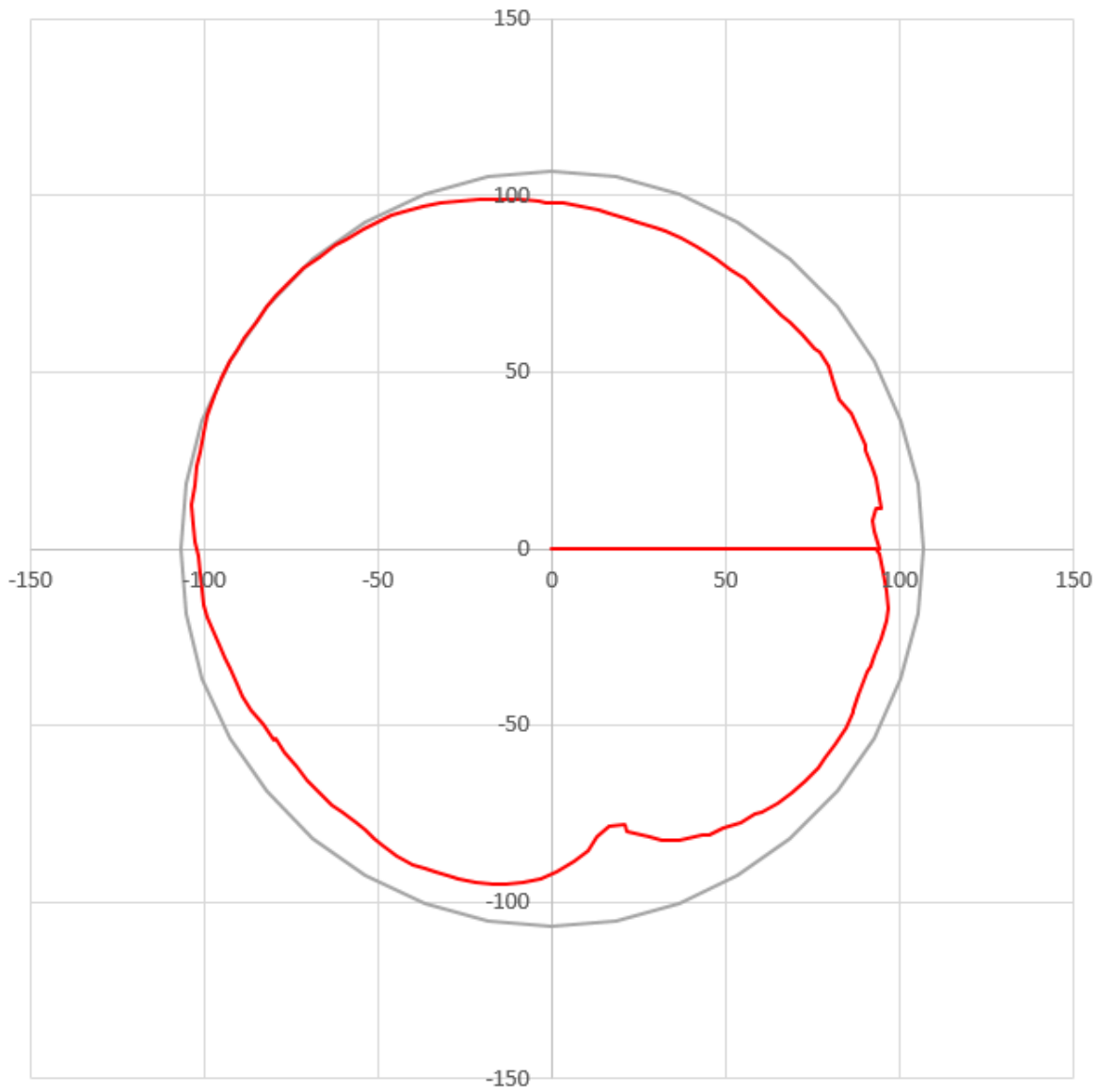
$$5.1\text{dBm} = 102.9 \text{ dBuV}/\text{m}@3\text{m} + 20 \text{ Log}(3) - G - 104.77$$

$$G = 102.9\text{dBuV}/\text{m}@3\text{m} + 20\text{Log}3 - 104.7 - (5.1)$$

$$G = 102.9 + 9.5 - 104.7 - 5.1$$

$$G = +2.6 \text{ dBi}$$

Antenna pattern



Antenna radiation pattern.

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories’ sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.