Venstar, Inc.

TEST REPORT FOR

Subgig Temperature Humidity Sensor
Model: VENnet Sensor

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(DTS 2400-2483.5MHz)

Report No.: 105151-8

Date of issue: April 2, 2021

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.

Test Certificate # 803.01

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Venstar, Inc.
9250 Owensmouth Avenue
Chatsworth, CA 91311

Representative: Alex Garashin

REPORT PREPARED BY:

Kim Romero
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 105151

DATE OF EQUIPMENT RECEIPT: March 10, 2021
DATE(S) OF TESTING: March 10, 16, 22, and 24, 2021

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	5.03.19

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	NA1

NA = Not Applicable
NA1 = Not applicable because the manufacturer declares the EUT is battery powered.

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

Equipment Tested:

Device	Manufacturer	Model #	S/N
Subgig Temperature Humidity Sensor	Venstar, Inc.	VENnet Sensor	NA

Support Equipment:

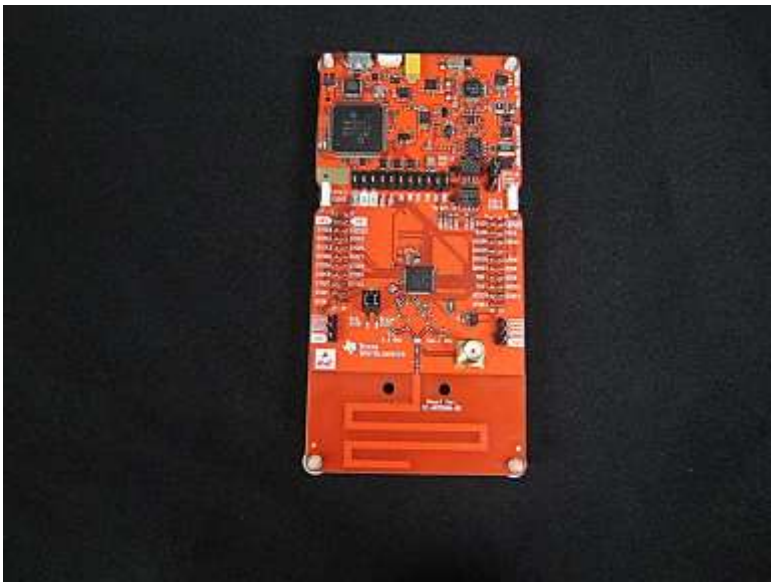
Device	Manufacturer	Model #	S/N
Development Kit	Texas Instruments	CC1352R1	NA
Laptop Computer	Lenovo	ThinkPad T500	L3B3906

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	2.4GHz BLE
Operating Frequency Range:	2404MHz to 2480MHz
Modulation Type(s):	GFSK
Maximum Duty Cycle:	100%
Number of TX Chains:	1
Antenna Type(s) and Gain:	Surface Mount -34.5dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral
Nominal Input Voltage:	One 3V CR2450 Battery
Firmware / Software used for Test:	2.4GHz BLE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) – Packet Tx with AUX_ADV_IND PDU 2.4GHz BLE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) – Packet Tx with AUX_ADV_IND PDU

EUT Photo(s)

Support Equipment Photo(s)

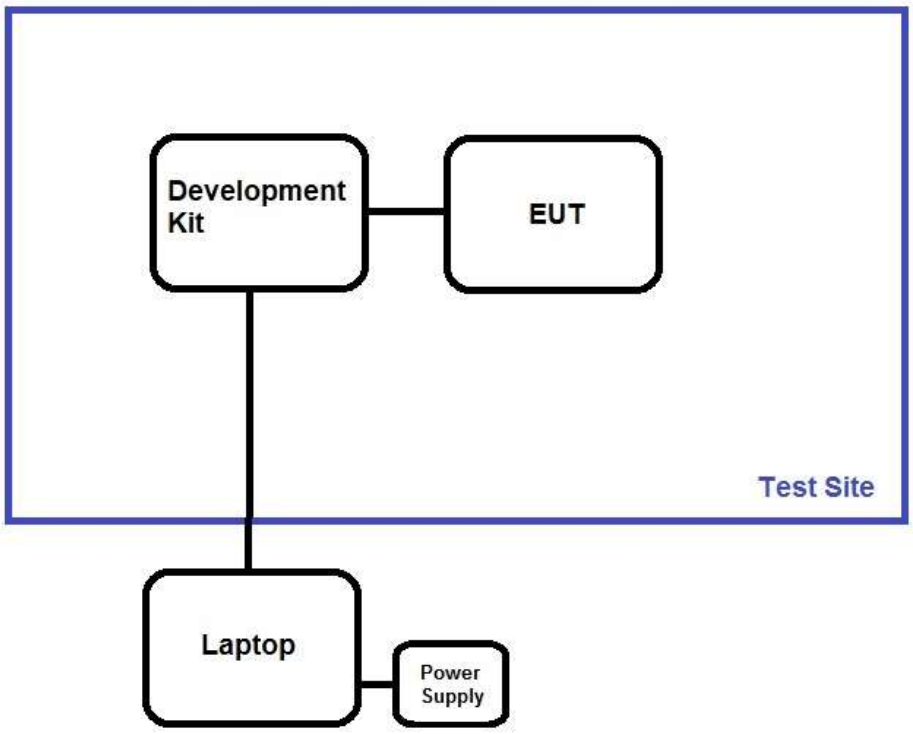


Development Kit

Laptop

Block Diagram of Test Setup(s)

Test Setup Block Diagram



FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

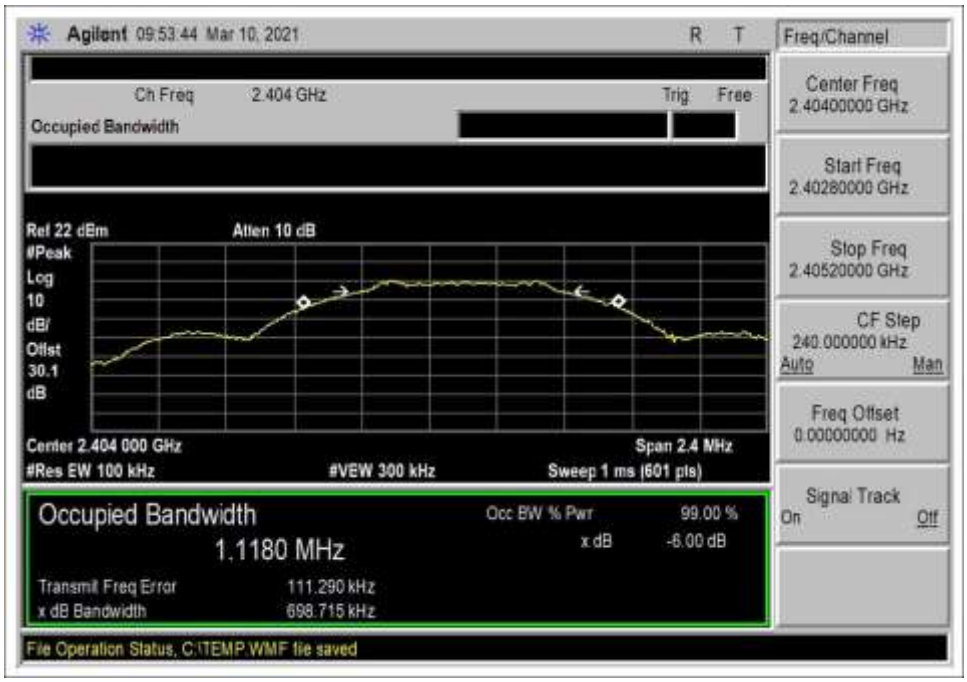
Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.10 (2013), KDB 558074 v05r02: 04/02/2019	Test Date(s):	3/10/2021
Configuration:	1		
Test Setup:	The equipment under test (EUT) and support equipment are located together on the tabletop. The EUT is connected to the Texas Instruments CC1352R1 development board. The board is connected to the support laptop via USB cable. The board is providing 3.3Vdc to the EUT. The support laptop is running Texas Instruments SmartRF Studio 7 software to enable settings of the EUT. Software setting: RF Designed Based On: LAUNCHXL-CC1352R1 Setting Selections: Bluetooth 5, LE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU and Bluetooth 5, LE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU Frequency range: 2404MHz to 2480MHz Low 2404MHz, Middle 2442MHz, High 2480MHz Modulation: GFSK Mode: Continuous TX/ Modulated TX Power Setting: 5dBm		

Environmental Conditions			
Temperature (ºC)	20	Relative Humidity (%):	40

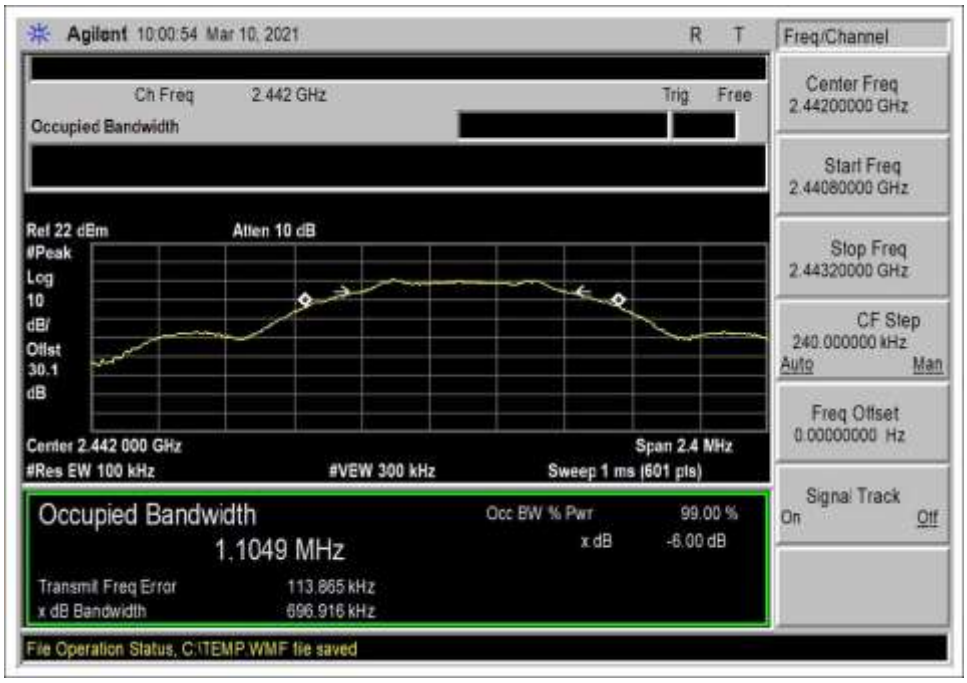
Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02869	Spectrum Analyzer	Agilent	E4440A	8/3/2020	8/3/2021
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P07657	Cable	Astrolab, Inc.	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
2404	1	GFSK (1 Mbps)	698.7	≥500	Pass
2442	1	GFSK (1 Mbps)	696.9	≥500	Pass
2480	1	GFSK (1 Mbps)	698.7	≥500	Pass
2404	1	GFSK (2 Mbps)	1410	≥500	Pass
2442	1	GFSK (2 Mbps)	1424	≥500	Pass
2480	1	GFSK (2 Mbps)	1425	≥500	Pass

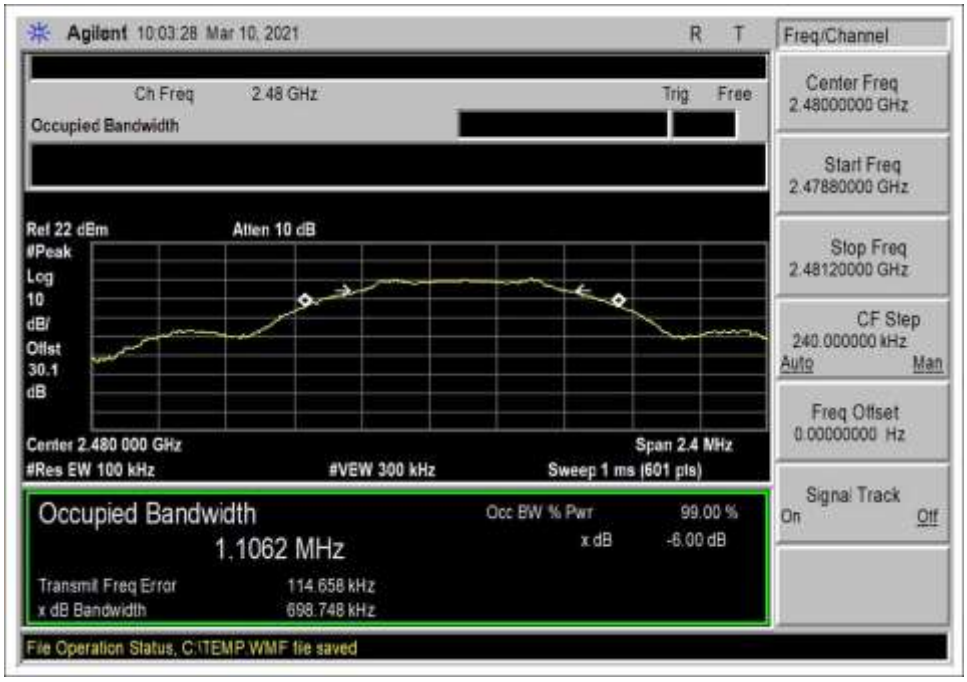
Plot(s)



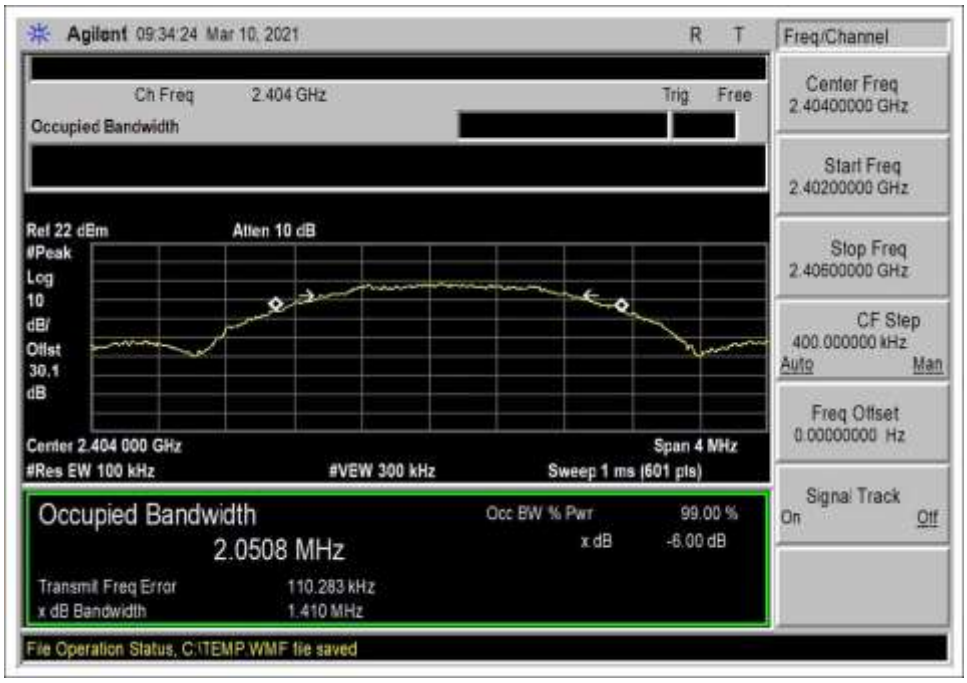
Low Channel, GFSK (1 Mbps)



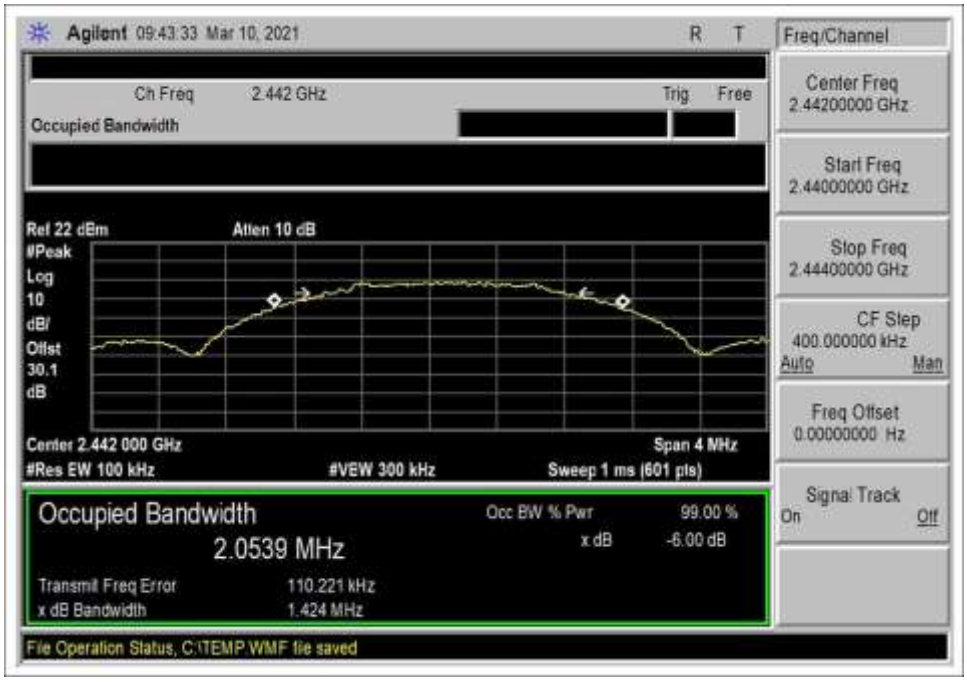
Middle Channel, GFSK (1 Mbps)



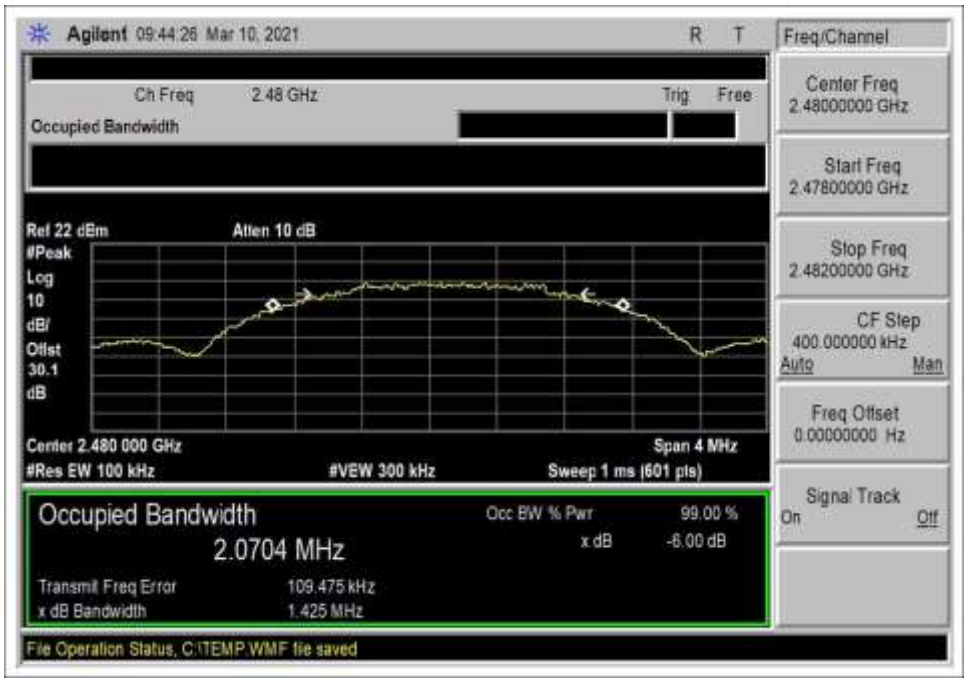
High Channel, GFSK (1 Mbps)



Low Channel, GFSK (2 Mbps)

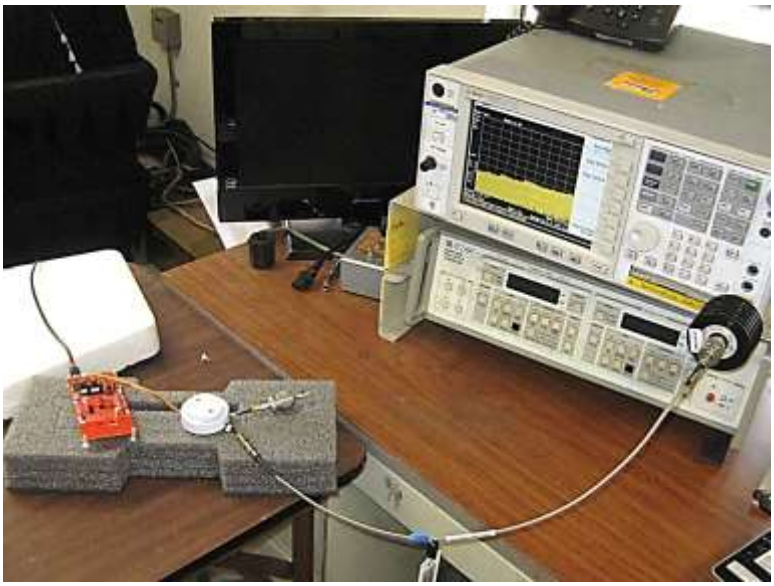


Middle Channel, GFSK (2 Mbps)



High Channel, GFSK (2 Mbps)

Test Setup Photo(s)



15.247(b)(3) Output Power

Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.10 (2013), KDB 558074 v05r02: 04/02/2019	Test Date(s):	3/10/2021
Configuration:	1		
Test Setup:	The equipment under test (EUT) and support equipment are located together on the tabletop. The EUT is connected to the Texas Instruments CC1352R1 development board. The board is connected to the support laptop via USB cable. The board is providing 3.3Vdc to the EUT. The support laptop is running Texas Instruments SmartRF Studio 7 software to enable settings of the EUT. Software setting: RF Designed Based On: LAUNCHXL-CC1352R1 Setting Selections: Bluetooth 5, LE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU and Bluetooth 5, LE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU Frequency range: 2404MHz to 2480MHz Low 2404MHz, Middle 2442MHz, High 2480MHz Modulation: GFSK Mode: Continuous TX/ Modulated TX Power Setting: 5dBm		

Environmental Conditions			
Temperature (ºC)	20	Relative Humidity (%):	40

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02869	Spectrum Analyzer	Agilent	E4440A	8/3/2020	8/3/2021
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P07657	Cable	Astrolab, Inc.	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

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)
2404	GFSK (1 Mbps) / 2	NA	2.57	NA	NA
2442	GFSK (1 Mbps) / 2	NA	2.77	NA	NA
2480	GFSK (1 Mbps) / 2	NA	2.96	NA	NA
2404	GFSK (2 Mbps) / 2	NA	2.62	NA	NA
2442	GFSK (2 Mbps) / 2	NA	2.80	NA	NA
2480	GFSK (2 Mbps) / 2	NA	2.99	NA	NA

Note: The EUT is normally powered by one 3V CR2450 battery. The test was performed with an input voltage equivalent to a brand new fresh CR2450 battery.

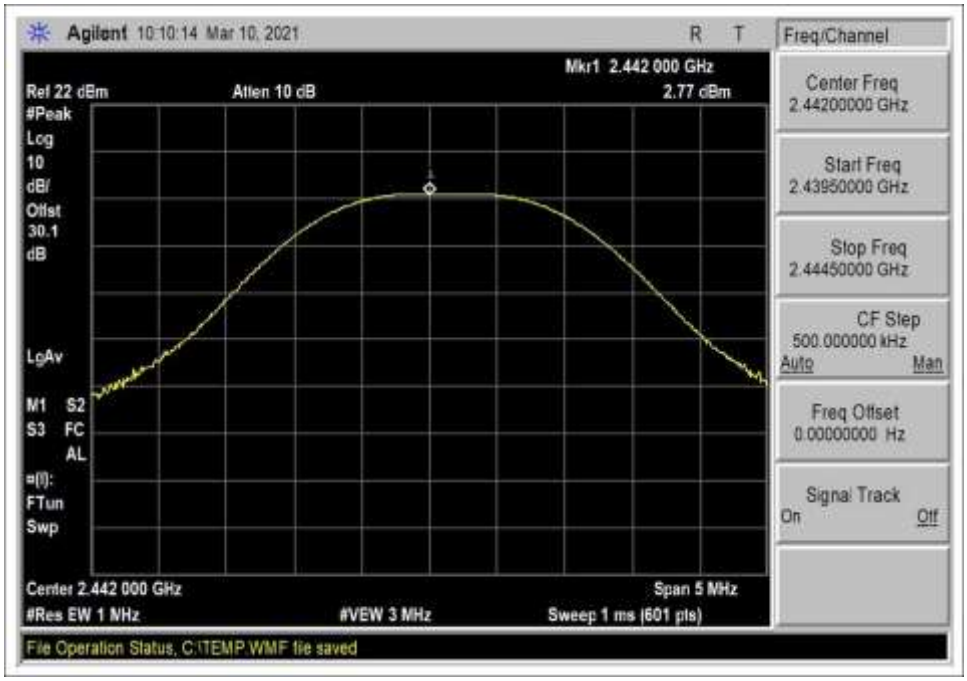
Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using an input voltage equivalent to a fresh battery.

Test Data Summary - RF Conducted Measurement					
Measurement Option: RBW > DTS Bandwidth					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2404	GFSK (1 Mbps)	Integral / -34.5	2.57	≤30	Pass
2442	GFSK (1 Mbps)	Integral / -34.5	2.77	≤30	Pass
2480	GFSK (1 Mbps)	Integral / -34.5	2.96	≤30	Pass
2404	GFSK (2 Mbps	Integral / -34.5	2.62	≤30	Pass
2442	GFSK (2 Mbps)	Integral / -34.5	2.80	≤30	Pass
2480	GFSK (2 Mbps)	Integral / -34.5	2.99	≤30	Pass

Plots

Low Channel, (1Mbps)



Middle Channel, (1Mbps)

High Channel, (1Mbps)

Low Channel, (2Mbps)

Middle Channel, (2Mbps)

High Channel, (2Mbps)

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112		
Customer:	**Venstar, Inc.**		
Specification:	**15.247(b) Power Output (2400-2483.5 MHz DTS)**		
Work Order #:	**105151**	Date:	3/22/2021
Test Type:	**Conducted Emissions**	Time:	14:34:37
Tested By:	S. Yamamoto	Sequence#:	0
Software:	EMITest 5.03.19		3.3Vdc

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The equipment under test (EUT) and support equipment are located together on the table top.
The EUT is connected to the Texas Instruments CC1352R1 development board. The board is connected to the support laptop via USB cable. The board is providing 3.3Vdc to the EUT.
The EUT is normally powered by one CR2450 3V battery.

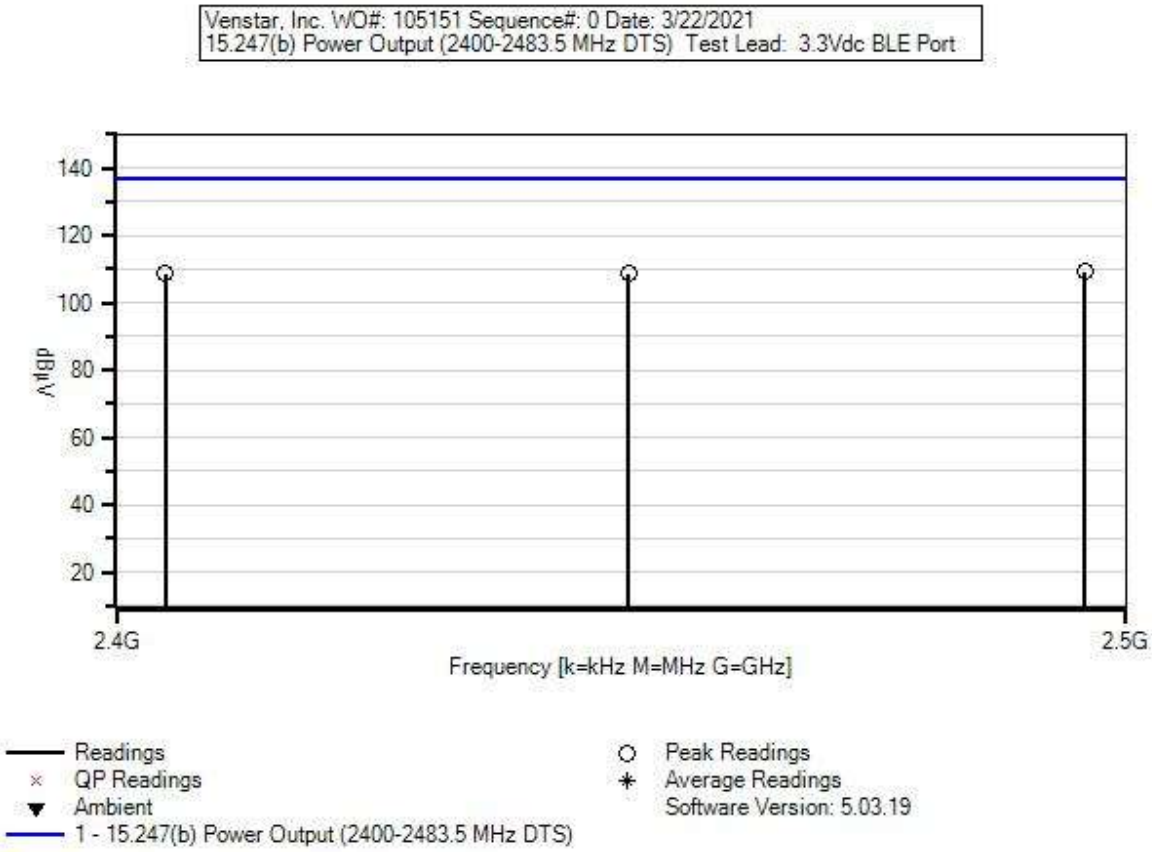
The support laptop is running Texas Instruments SmartRF Studio 7 software to enable settings of the EUT>

Software setting:
RF Designed Based On: LAUNCHXL-CC1352R1
Setting Selections: Bluetooth 5, LE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU and Bluetooth 5, LE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU
Frequency Range: 2404MHz to 2480MHz
Low 2404MHz, Middle 2442MHz, High 2480MHz
Modulation: GFSK
Mode: Continuous TX/ Modulated
TX Power Setting: 5dBm

Test Environment Conditions:
Temperature: 20°C
Relative Humidity: 40%
Pressure: 99kPa

Site D

Test Method ANSI C63.10 (2013) KDB 558074 v05r02**:** 04/02/2019



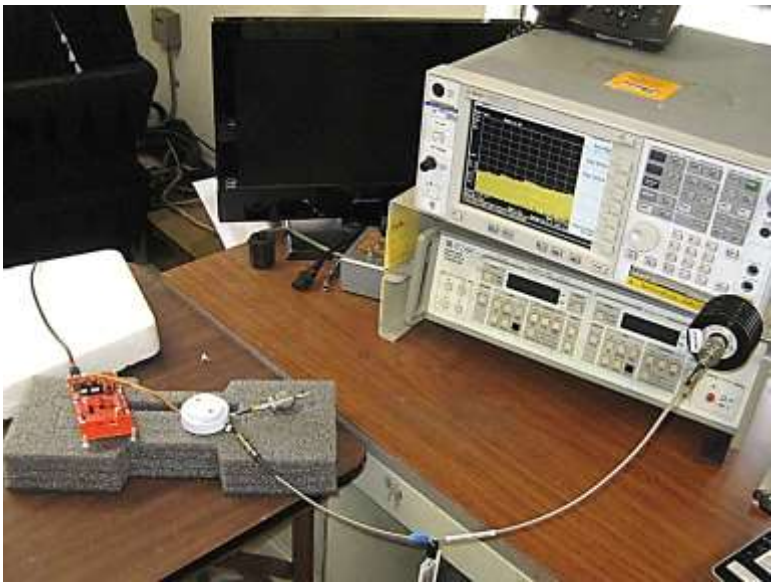
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T3	ANP07657	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Measurement Data: Reading listed by margin. Test Lead: BLE Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2480.000M	78.9	+0.0	+29.7	+0.5		+0.0	109.1	137.0	-27.9	BLE P
2	2480.000M	78.9	+0.0	+29.7	+0.5		+0.0	109.1	137.0	-27.9	BLE P
3	2442.000M	78.7	+0.0	+29.7	+0.4		+0.0	108.8	137.0	-28.2	BLE P
4	2442.000M	78.7	+0.0	+29.7	+0.4		+0.0	108.8	137.0	-28.2	BLE P
5	2404.000M	78.5	+0.0	+29.7	+0.4		+0.0	108.6	137.0	-28.4	BLE P
6	2404.000M	78.5	+0.0	+29.7	+0.4		+0.0	108.6	137.0	-28.4	BLE P

Test Setup Photo(s)



15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112		
Customer:	**Venstar, Inc.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**105151**	Date:	3/10/2021
Test Type:	**Conducted Emissions**	Time:	13:27:23
Tested By:	S. Yamamoto	Sequence#:	2
Software:	EMITest 5.03.19		3.3Vdc

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The equipment under test (EUT) and support equipment are located together on the table top.
The EUT is connected to the Texas Instruments CC1352R1 development board. The board is connected to the support laptop via USB cable. The board is providing 3.3Vdc to the EUT.

The support laptop is running Texas Instruments SmartRF Studio 7 software to enable settings of the EUT.

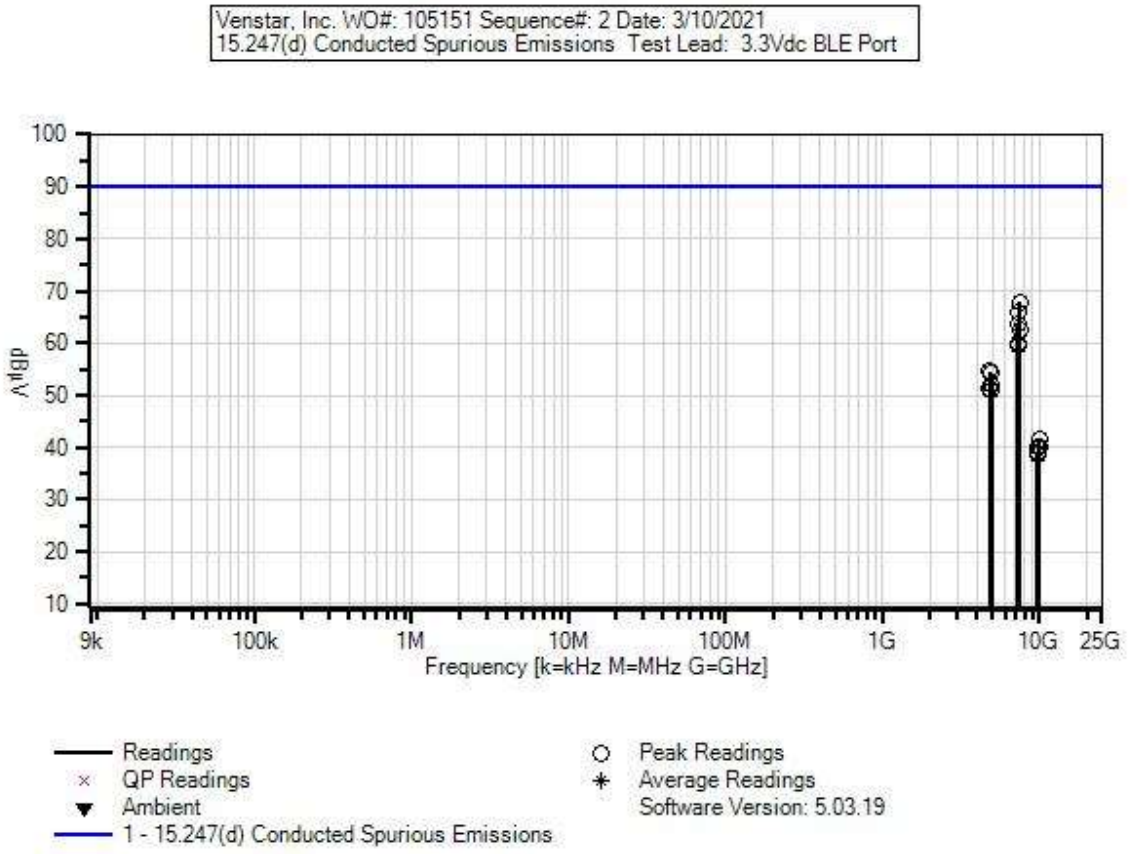
Software setting:
RF Designed Based On: LAUNCHXL-CC1352R1
Setting Selections: Bluetooth 5, LE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU and Bluetooth 5, LE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU
Frequency range: 2404MHz to 2480MHz
Low 2404MHz, Middle 2442MHz, High 2480MHz
Modulation: GFSK
Mode: Continuous TX/ Modulated
TX Power Setting: 5dBm

Frequency of Measurement: 9kHz to 25GHz
RBW=100kHz, VBW=300kHz

Test Environment Conditions:
Temperature: 20°C
Relative Humidity: 40%
Pressure: 99kPa

Site D

Test Method ANSI C63.10 (2013) KDB 558074 v05r02**:** 04/02/2019



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T1	AN03430	Attenuator	75A-10-12	12/20/2019	12/20/2021
T2	ANP07657	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

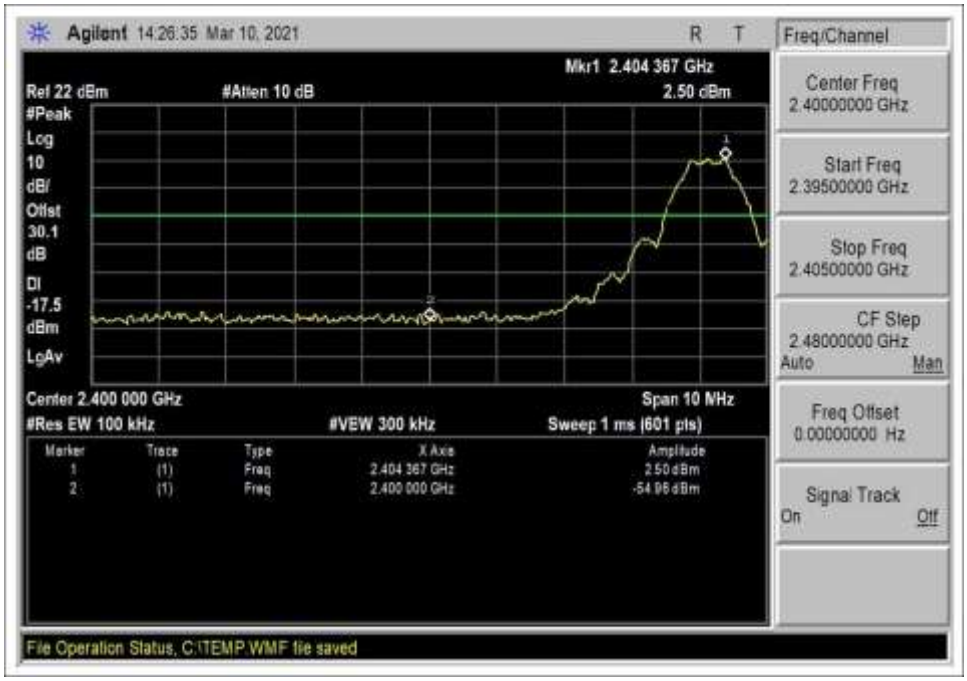
Measurement Data: Reading listed by margin. Test Lead: BLE Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	7439.608M	56.9	+10.1	+0.9			+0.0	67.9	90.0	-22.1	BLE P
2	7325.625M	55.0	+10.0	+0.8			+0.0	65.8	90.0	-24.2	BLE P
3	7213.083M	52.9	+9.9	+0.8			+0.0	63.6	90.0	-26.4	BLE P
4	7441.867M	51.7	+10.1	+0.9			+0.0	62.7	90.0	-27.3	BLE P
5	7211.000M	49.3	+9.9	+0.8			+0.0	60.0	90.0	-30.0	BLE P
6	7325.167M	48.9	+10.0	+0.8			+0.0	59.7	90.0	-30.3	BLE P
7	4808.750M	43.7	+10.2	+0.7			+0.0	54.6	90.0	-35.4	BLE P
8	4884.758M	43.6	+10.1	+0.7			+0.0	54.4	90.0	-35.6	BLE P
9	4960.775M	43.4	+10.1	+0.7			+0.0	54.2	90.0	-35.8	BLE P
10	4883.233M	41.2	+10.1	+0.7			+0.0	52.0	90.0	-38.0	BLE P
11	4807.283M	40.6	+10.2	+0.7			+0.0	51.5	90.0	-38.5	BLE P
12	4959.317M	40.2	+10.1	+0.7			+0.0	51.0	90.0	-39.0	BLE P
13	9919.500M	30.8	+9.8	+0.8			+0.0	41.4	90.0	-48.6	BLE P
14	9767.500M	29.5	+9.8	+0.9			+0.0	40.2	90.0	-49.8	BLE P
15	9922.550M	29.5	+9.8	+0.8			+0.0	40.1	90.0	-49.9	BLE P
16	9615.517M	28.5	+9.7	+0.7			+0.0	38.9	90.0	-51.1	BLE P
17	9770.500M	27.7	+9.8	+0.9			+0.0	38.4	90.0	-51.6	BLE P
18	9614.500M	28.0	+9.7	+0.7			+0.0	38.4	90.0	-51.6	BLE P

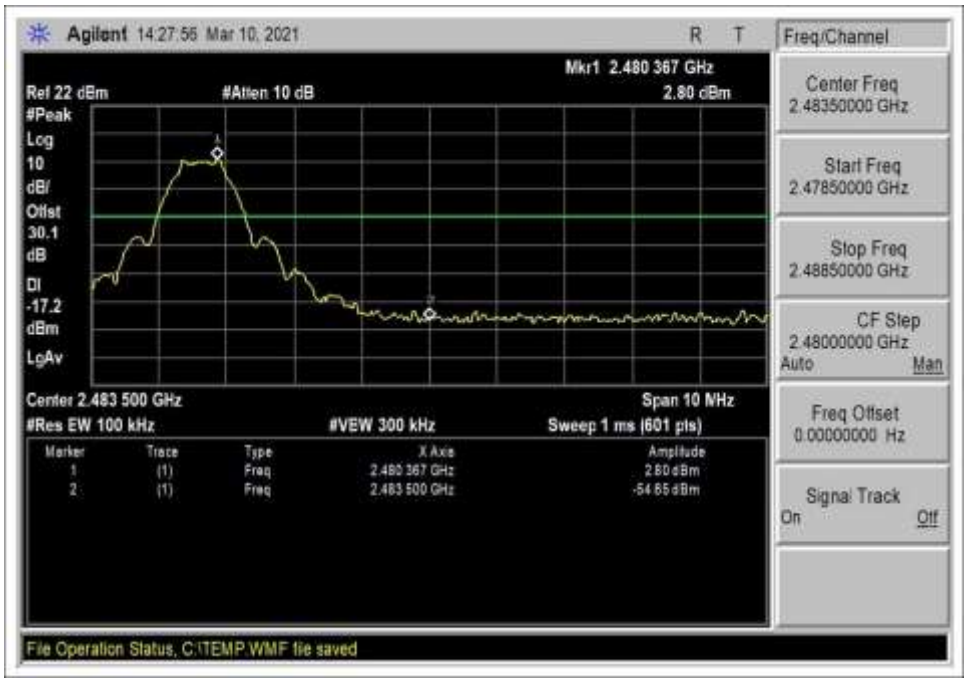
Band Edge

Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB.				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
2400.0	GFSK (1Mbps)	-54.96	<-17.2	Pass
2483.5	GFSK (1Mbps)	-54.65	<-17.2	Pass
2400.0	GFSK (2Mbps)	-51.67	<-18.5	Pass
2483.5	GFSK (2Mbps)	-53.53	<-18.5	Pass

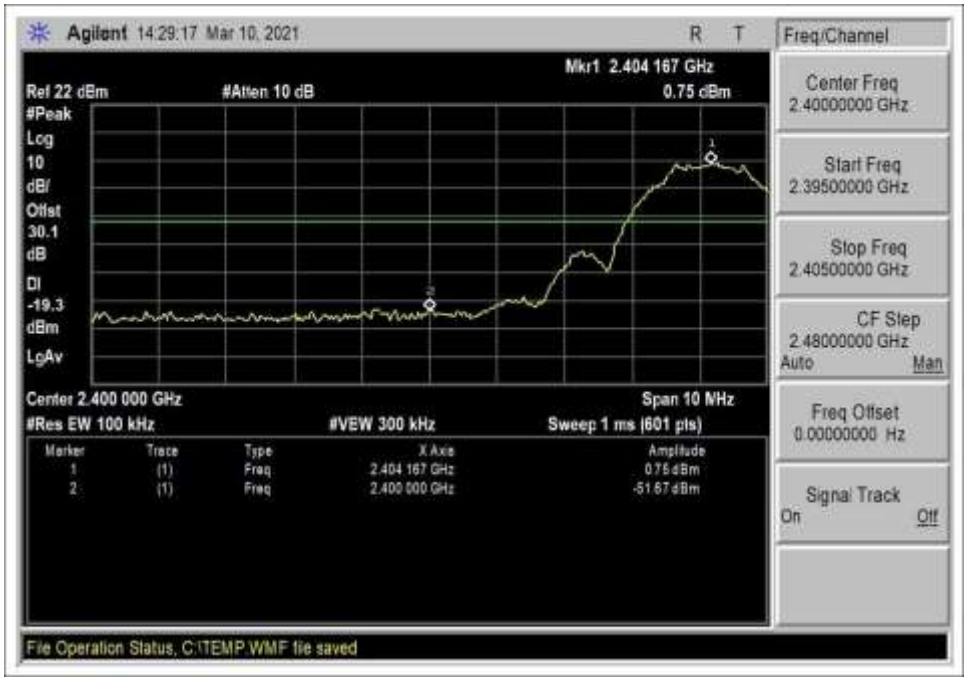
Band Edge Plots



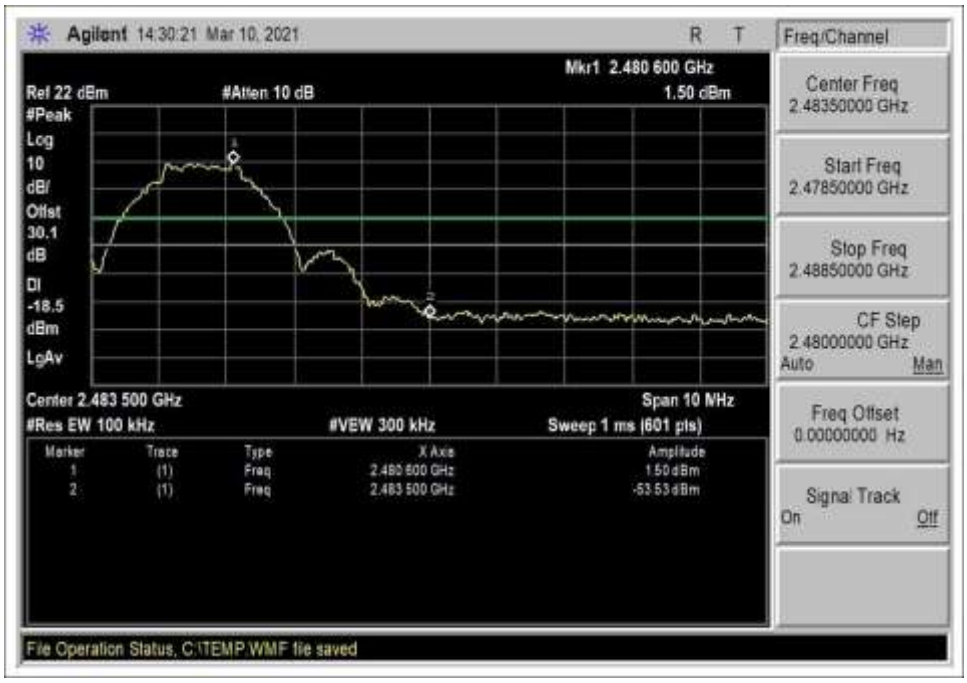
Low Channel, GFSK (1Mbps)



High Channel, GFSK (1Mbps)



Low Channel, GFSK (2Mbps)



High Channel, GFSK (2Mbps)

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112		
Customer:	**Venstar, Inc.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**105151**	Date:	3/24/2021
Test Type:	**Conducted Emissions**	Time:	08:44:59
Tested By:	S. Yamamoto	Sequence#:	0
Software:	EMITest 5.03.19		3.3Vdc

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The equipment under test (EUT) and support equipment are located together on the table top.
The EUT is connected to the Texas Instruments CC1352R1 development board. The board is connected to the support laptop via USB cable. The board is providing 3.3Vdc to the EUT.

The support laptop is running Texas Instruments SmartRF Studio 7 software to enable settings of the EUT>

Software setting:
RF Designed Based On: LAUNCHXL-CC1352R1
Setting Selections: Bluetooth 5, LE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU and Bluetooth 5, LE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU

Frequency Range: 2404MHz to 2480MHz
Low 2404MHz, Middle 2442MHz, High 2480MHz
Modulation: GFSK
Mode: Continuous TX/ Modulated
TX Power Setting: 5dBm

Test Environment Conditions:
Temperature: 20°C
Relative Humidity: 40%
Pressure: 99kPa

Site D

Test Method ANSI C63.10 (2013) KDB 558074 v05r02**:** 04/02/2019

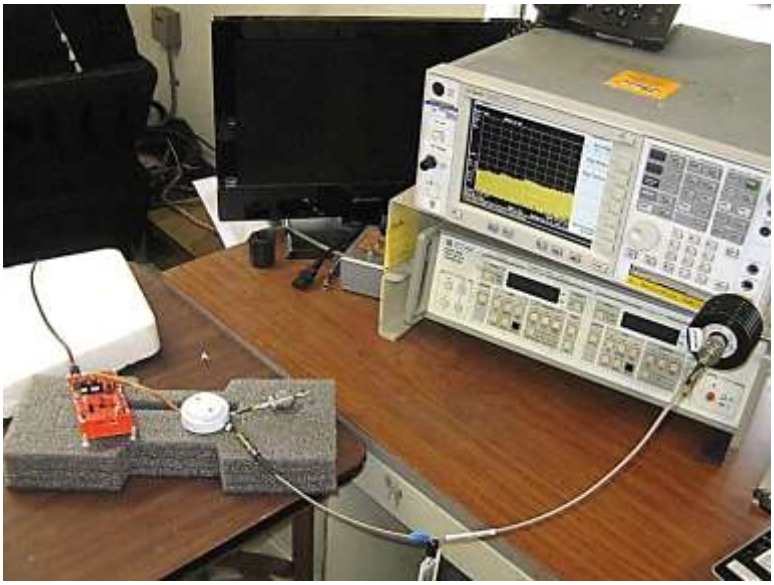
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T3	ANP07657	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Measurement Data: Reading listed by margin. Test Lead: BLE Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2400.000M	25.2	+0.0	+29.7	+0.4		+0.0	55.3	88.5	-33.2	BLE P
2	2483.500M	23.4	+0.0	+29.7	+0.5		+0.0	53.6	88.5	-34.9	BLE P
3	2483.500M	22.3	+0.0	+29.7	+0.5		+0.0	52.5	89.8	-37.4	BLE P
4	2400.000M	21.9	+0.0	+29.7	+0.4		+0.0	52.0	89.8	-37.8	BLE P

Test Setup Photo(s)



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112		
Customer:	**Venstar, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**105151**	Date:	3/16/2021
Test Type:	**Maximized Emissions**	Time:	10:26:42
Tested By:	S. Yamamoto	Sequence#:	6
Software:	EMITest 5.03.19		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The equipment under test (EUT) is located stand alone on the Styrofoam table top.
The EUT is connected to the Texas Instruments CC1352R1 development board via unshielded ribbon cable.
The development board is connected to the support laptop via USB cable. The board is providing 3.3Vdc to the EUT.
The support laptop is running Texas Instruments SmartRF Studio 7 software to enable settings of the EUT.

Software Setting:
RF Designed Based On: LAUNCHXL-CC1352R1
Setting Selections: Bluetooth 5, LE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU and Bluetooth 5, LE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU

Frequency Range: 2404MHz to 2480MHz
Low 2404MHz, Middle 2442MHz, High 2480MHz
Modulation: GFSK
Mode: Continuous TX/ Modulated
TX Power Setting: 5dBm

Frequency of Measurement: 9kHz-25GHz

Frequency of Datasheet: 9kHz to 25GHz
1GHz to 25GHz, RBW= 1MHz, VBW=3MHz

Test Environment Conditions:
Temperature: 19°C
Relative Humidity: 40%
Pressure: 99kPa

Site D
Test Method ANSI C63.10 (2013) KDB 558074 v05r02**:** 04/02/2019

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	ANP04382	Cable	LDF-50	5/15/2020	5/15/2022
T3	ANP07692	Cable	LDF1-50	8/20/2020	8/20/2022
T4	AN00787	Preamp	83017A	5/31/2019	5/31/2021
T5	ANP07656	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T6	AN01646	Horn Antenna	3115	3/17/2020	3/17/2022
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
T7	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/13/2019	5/13/2021
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	ANP06978	Cable	Sucoflex 104A	3/26/2020	3/26/2022
	AN00010	Preamp	8447D	1/2/2020	1/2/2022
	ANP05569	Cable-Amplitude +15C to +45C (dB)	RG-214/U	12/14/2020	12/14/2022
	ANP05283	Attenuator	ATT-0218-06-NNN-02	3/26/2020	3/26/2022
	AN01994	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022

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

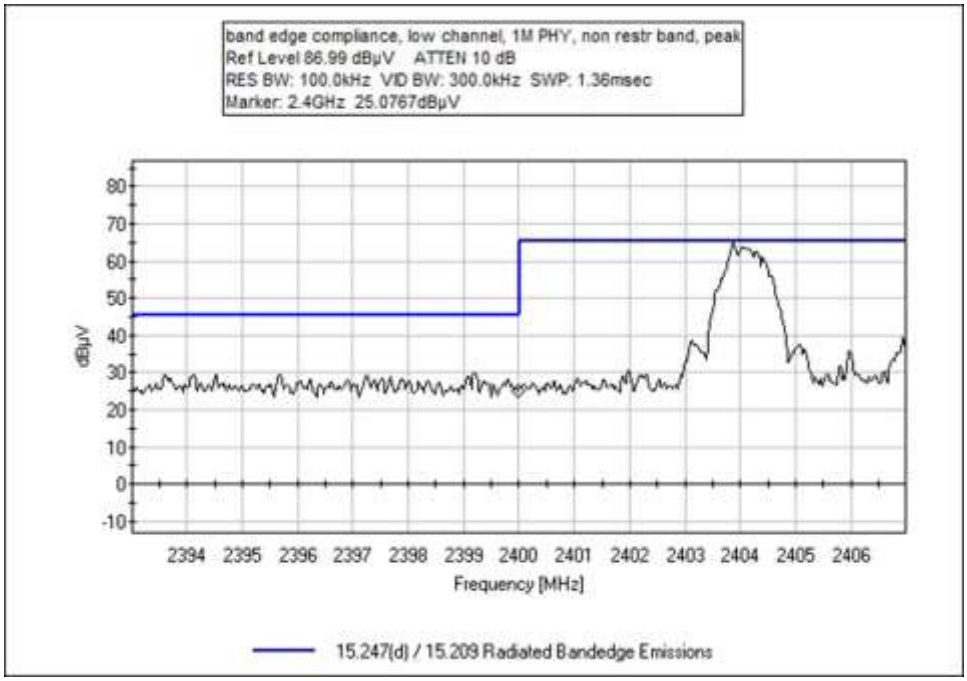
#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4884.622M	40.2	+0.0 +0.7	+8.6 +33.7	+6.1 +0.3	-39.9	+0.0	49.7	54.0	-4.3	Vert
2	7441.758M	32.7	+0.0 +0.8	+11.2 +37.3	+7.8 +0.2	-40.4	+0.0	49.6	54.0	-4.4	Vert
3	4807.950M	40.4	+0.0 +0.7	+8.5 +33.5	+6.0 +0.3	-40.0	+0.0	49.4	54.0	-4.6	Vert
4	4885.300M	39.6	+0.0 +0.7	+8.6 +33.7	+6.1 +0.3	-39.9	+0.0	49.1	54.0	-4.9	Horiz
5	4809.233M	40.0	+0.0 +0.7	+8.5 +33.5	+6.0 +0.3	-40.0	+0.0	49.0	54.0	-5.0	Horiz
6	4959.275M	38.7	+0.0 +0.7	+8.6 +33.8	+6.2 +0.4	-39.9	+0.0	48.5	54.0	-5.5	Horiz
7	4885.250M	38.5	+0.0 +0.7	+8.6 +33.7	+6.1 +0.3	-39.9	+0.0	48.0	54.0	-6.0	Vert
8	4809.250M	38.2	+0.0 +0.7	+8.5 +33.5	+6.0 +0.3	-40.0	+0.0	47.2	54.0	-6.8	Vert
9	4959.142M	37.3	+0.0 +0.7	+8.6 +33.8	+6.2 +0.4	-39.9	+0.0	47.1	54.0	-6.9	Vert
10	7439.608M Ave	28.3	+0.0 +0.8	+11.2 +37.3	+7.8 +0.2	-40.4	+0.0	45.2	54.0	-8.8	Horiz
^	7439.608M	37.0	+0.0 +0.8	+11.2 +37.3	+7.8 +0.2	-40.4	+0.0	53.9	54.0	-0.1	Horiz
12	7325.592M Ave	27.8	+0.0 +0.8	+11.1 +37.0	+7.7 +0.2	-40.3	+0.0	44.3	54.0	-9.7	Horiz
^	7325.592M	37.0	+0.0 +0.8	+11.1 +37.0	+7.7 +0.2	-40.3	+0.0	53.5	54.0	-0.5	Horiz
14	4883.717M Ave	33.7	+0.0 +0.7	+8.6 +33.7	+6.1 +0.3	-39.9	+0.0	43.2	54.0	-10.8	Horiz
^	4883.717M	41.4	+0.0 +0.7	+8.6 +33.7	+6.1 +0.3	-39.9	+0.0	50.9	54.0	-3.1	Horiz
16	4960.733M Ave	33.4	+0.0 +0.7	+8.6 +33.8	+6.2 +0.4	-39.9	+0.0	43.2	54.0	-10.8	Horiz
^	4960.733M	41.0	+0.0 +0.7	+8.6 +33.8	+6.2 +0.4	-39.9	+0.0	50.8	54.0	-3.2	Horiz
18	4807.757M Ave	33.9	+0.0 +0.7	+8.5 +33.5	+6.0 +0.3	-40.0	+0.0	42.9	54.0	-11.1	Horiz
^	4807.757M	41.5	+0.0 +0.7	+8.5 +33.5	+6.0 +0.3	-40.0	+0.0	50.5	54.0	-3.5	Horiz
20	4959.808M Ave	32.3	+0.0 +0.7	+8.6 +33.8	+6.2 +0.4	-39.9	+0.0	42.1	54.0	-11.9	Vert
^	4959.808M	40.4	+0.0 +0.7	+8.6 +33.8	+6.2 +0.4	-39.9	+0.0	50.2	54.0	-3.8	Vert
22	7440.975M Ave	25.2	+0.0 +0.8	+11.2 +37.3	+7.8 +0.2	-40.4	+0.0	42.1	54.0	-11.9	Vert
^	7440.975M	35.7	+0.0 +0.8	+11.2 +37.3	+7.8 +0.2	-40.4	+0.0	52.6	54.0	-1.4	Vert

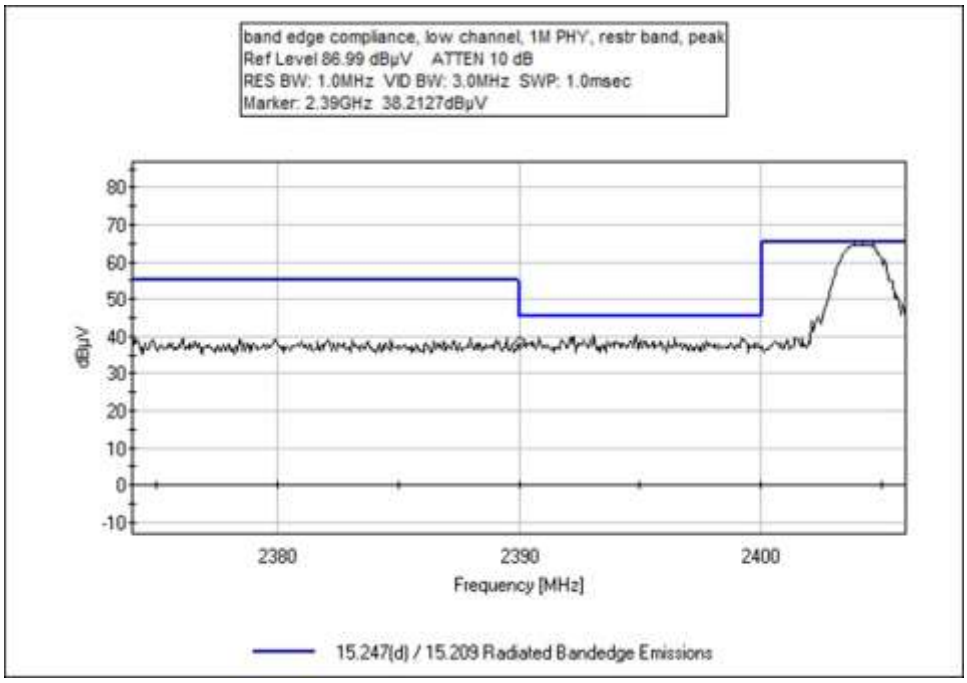
24	7325.050M	23.6	+0.0	+11.1	+7.7	-40.3	+0.0	40.1	54.0	-13.9	Horiz
	Ave		+0.8	+37.0	+0.2						
^	7325.050M	33.8	+0.0	+11.1	+7.7	-40.3	+0.0	50.3	54.0	-3.7	Horiz
			+0.8	+37.0	+0.2						
26	7442.008M	23.1	+0.0	+11.2	+7.8	-40.4	+0.0	40.0	54.0	-14.0	Horiz
	Ave		+0.8	+37.3	+0.2						
^	7442.008M	34.6	+0.0	+11.2	+7.8	-40.4	+0.0	51.5	54.0	-2.5	Horiz
			+0.8	+37.3	+0.2						
28	7325.755M	22.7	+0.0	+11.1	+7.7	-40.3	+0.0	39.2	54.0	-14.8	Vert
	Ave		+0.8	+37.0	+0.2						
^	7325.755M	34.0	+0.0	+11.1	+7.7	-40.3	+0.0	50.5	54.0	-3.5	Vert
			+0.8	+37.0	+0.2						
^	7325.792M	31.9	+0.0	+11.1	+7.7	-40.3	+0.0	48.4	54.0	-5.6	Vert
			+0.8	+37.0	+0.2						

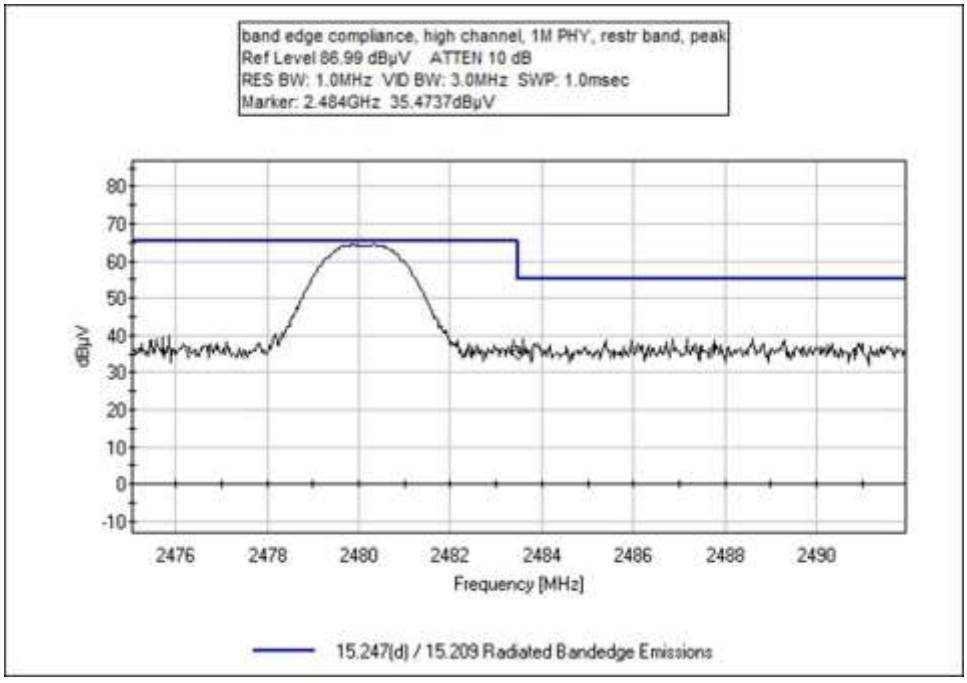
Band Edge

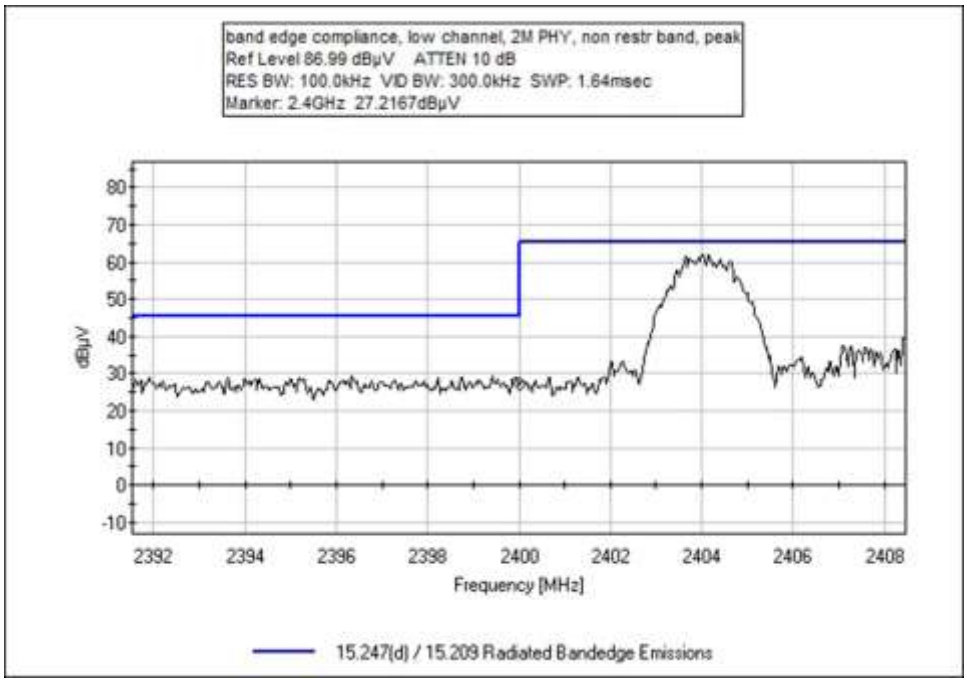
Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
2390.0	GFSK (1Mbps)	Integral	37.0	<54	Pass
2400.0	GFSK (1Mbps)	Integral	23.9	<44.1	Pass
2483.5	GFSK (1Mbps)	Integral	34.3	<54	Pass
2390.0	GFSK (2Mbps)	Integral	36.1	<54	Pass
2400.0	GFSK (2Mbps)	Integral	26.0	<44.1	Pass
2483.5	GFSK (2Mbps)	Integral	35.6	<54	Pass

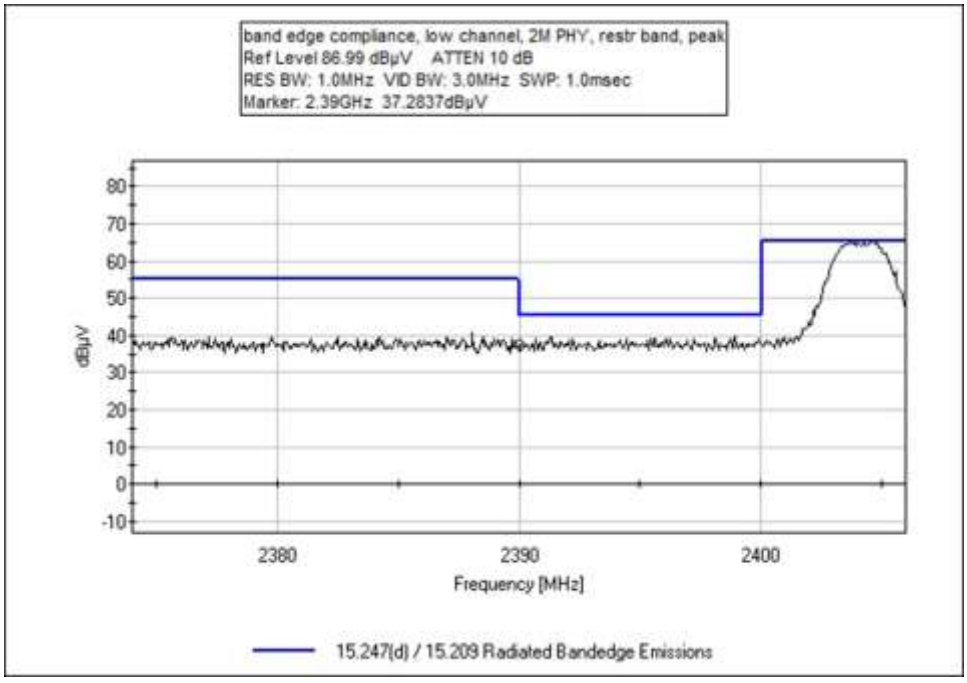
Band Edge Plots

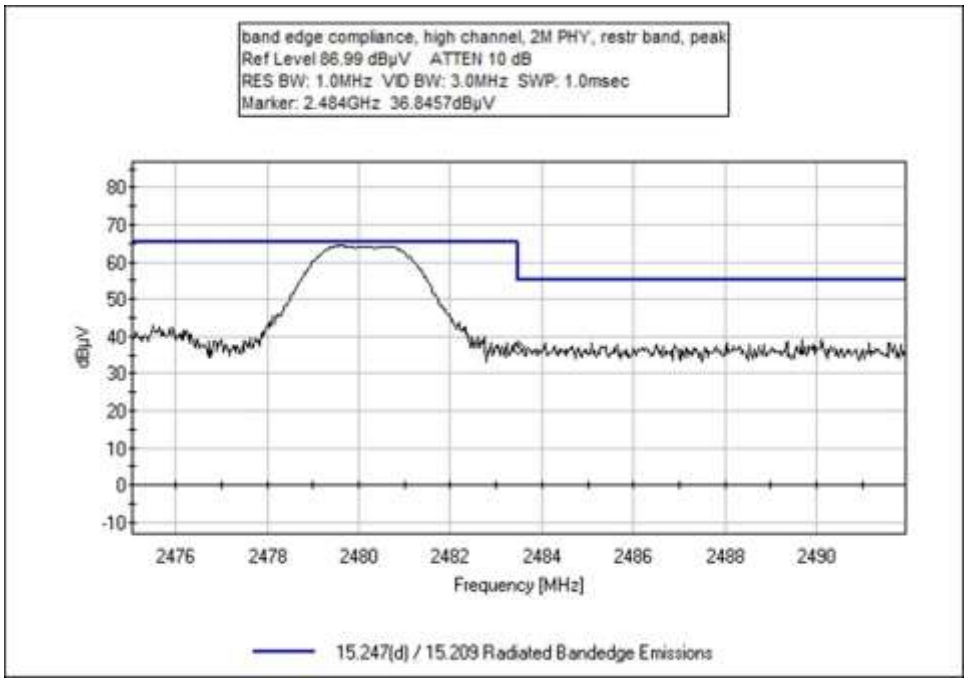



band edge compliance, low channel, 1M PHY, restr band, peak
Ref Level 86.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 1.0msec
Marker: 2.39GHz 38.2127dBµV
dBµV
80
70
60
50
40
30
20
10
0
-10
2380
2390
2400
Frequency [MHz]
15.247(d) / 15.209 Radiated Bandedge Emissions


band edge compliance, high channel, 1M PHY, restr band, peak
Ref Level 86.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 1.0msec
Marker: 2.484GHz 35.4737dBµV
dBµV
80
70
60
50
40
30
20
10
0
-10
2476
2478
2480
2482
2484
2486
2488
2490
Frequency [MHz]
15.247(d) / 15.209 Radiated Bandedge Emissions


band edge compliance, low channel, 2M PHY, non restr band, peak
Ref Level 86.99 dBµV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 1.64msec
Marker: 2.4GHz 27.2167dBµV
dBµV
80
70
60
50
40
30
20
10
0
-10
2392
2394
2396
2398
2400
2402
2404
2406
2408
Frequency [MHz]
15.247(d) / 15.209 Radiated Bandedge Emissions


band edge compliance, low channel, 2M PHY, restr band, peak
Ref Level 86.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 1.0msec
Marker: 2.39GHz 37.2837dBµV
dBµV
80
70
60
50
40
30
20
10
0
-10
2380
2390
2400
Frequency [MHz]
15.247(d) / 15.209 Radiated Bandedge Emissions


band edge compliance, high channel, 2M PHY, restr band, peak
Ref Level 86.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 1.0msec
Marker: 2.484GHz 36.8457dBµV
dBµV
80
70
60
50
40
30
20
10
0
-10
2476
2478
2480
2482
2484
2486
2488
2490
Frequency [MHz]
15.247(d) / 15.209 Radiated Bandedge Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112		
Customer:	**Venstar, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Bandedge Emissions**		
Work Order #:	**105151**	Date:	3/16/2021
Test Type:	**Maximized Emissions**	Time:	16:54:52
Tested By:	S. Yamamoto	Sequence#:	7
Software:	EMITest 5.03.19		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The equipment under test (EUT) is located stand alone on the Styrofoam table top.
The EUT is connected to the Texas Instruments CC1352R1 development board via unshielded ribbon cable.
The development board is connected to the support laptop via USB cable. The board is providing 3.3Vdc to the EUT.

The support laptop is running Texas Instruments SmartRF Studio 7 software to enable settings of the EUT.

Software Setting:
RF Designed Based On: LAUNCHXL-CC1352R1
Setting Selections: Bluetooth 5, LE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU and Bluetooth 5, LE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU
Frequency range: 2404MHz to 2480MHz
Low 2404MHz, Middle 2442MHz, High 2480MHz
Modulation: GFSK
Mode: Continuous TX/ Modulated
TX Power Setting: 5dBm

Test Environment Conditions:
Temperature: 19°C
Relative Humidity: 40%
Pressure: 99kPa

Site D

Test Method ANSI C63.10 (2013) KDB 558074 v05r02**:** 04/02/2019

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	ANP04382	Cable	LDF-50	5/15/2020	5/15/2022
T3	ANP07692	Cable	LDF1-50	8/20/2020	8/20/2022
T4	AN00787	Preamp	83017A	5/31/2019	5/31/2021
T5	ANP07656	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T6	AN01646	Horn Antenna	3115	3/17/2020	3/17/2022

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2390.000M	38.2	+0.0 +0.5	+5.6 +28.3	+4.2	-39.8	+0.0	37.0	54.0	-17.0	Horiz
2	2390.000M	37.3	+0.0 +0.5	+5.6 +28.3	+4.2	-39.8	+0.0	36.1	54.0	-17.9	Horiz
3	2400.000M	27.2	+0.0 +0.5	+5.6 +28.3	+4.2	-39.8	+0.0	26.0	44.1	-18.1	Horiz
4	2483.500M	36.8	+0.0 +0.5	+5.7 +28.2	+4.3	-39.9	+0.0	35.6	54.0	-18.4	Horiz
5	2483.500M	35.5	+0.0 +0.5	+5.7 +28.2	+4.3	-39.9	+0.0	34.3	54.0	-19.7	Horiz
6	2400.000M	25.1	+0.0 +0.5	+5.6 +28.3	+4.2	-39.8	+0.0	23.9	44.1	-20.2	Horiz

Test Setup Photo(s)

Below 1GHz

Below 1GHz

Above 1GHz

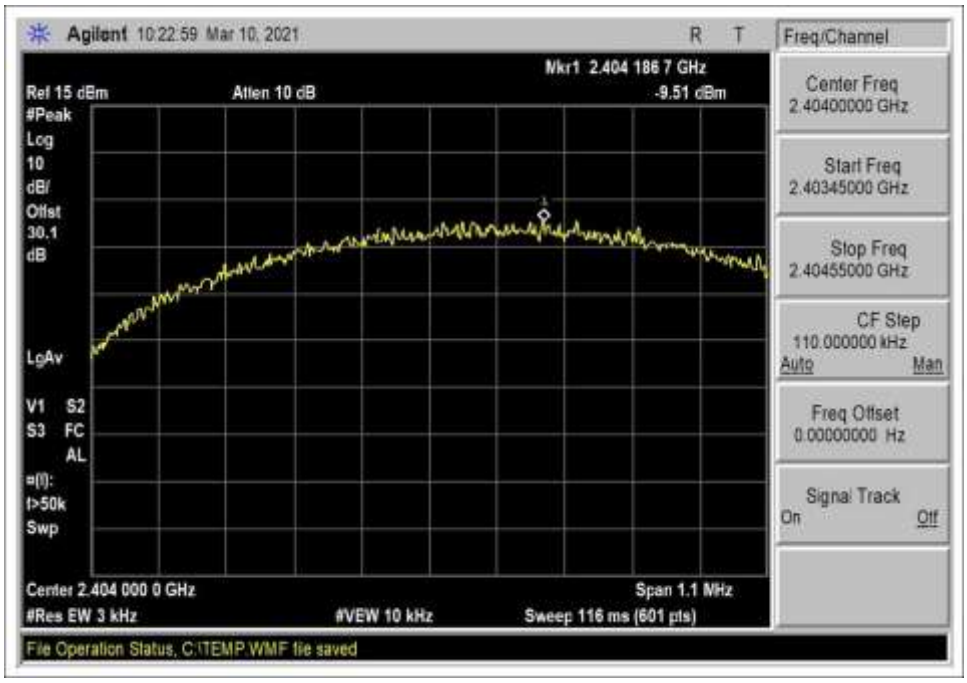
15.247(e) Power Spectral Density

Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.10 (2013), KDB 558074 v05r02: 04/02/2019	Test Date(s):	3/10/2021
Configuration:	1		
Test Setup:	The equipment under test (EUT) and support equipment are located together on the tabletop. The EUT is connected to the Texas Instruments CC1352R1 development board. The board is connected to the support laptop via USB cable. The board is providing 3.3Vdc to the EUT. The support laptop is running Texas Instruments SmartRF Studio 7 software to enable settings of the EUT. Software setting: RF Designed Based On: LAUNCHXL-CC1352R1 Setting Selections: Bluetooth 5, LE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU and Bluetooth 5, LE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU Frequency range: 2404MHz to 2480MHz Low 2404MHz, Middle 2442MHz, High 2480MHz Modulation: GFSK Mode: Continuous TX/ Modulated TX Power Setting: 5dBm		

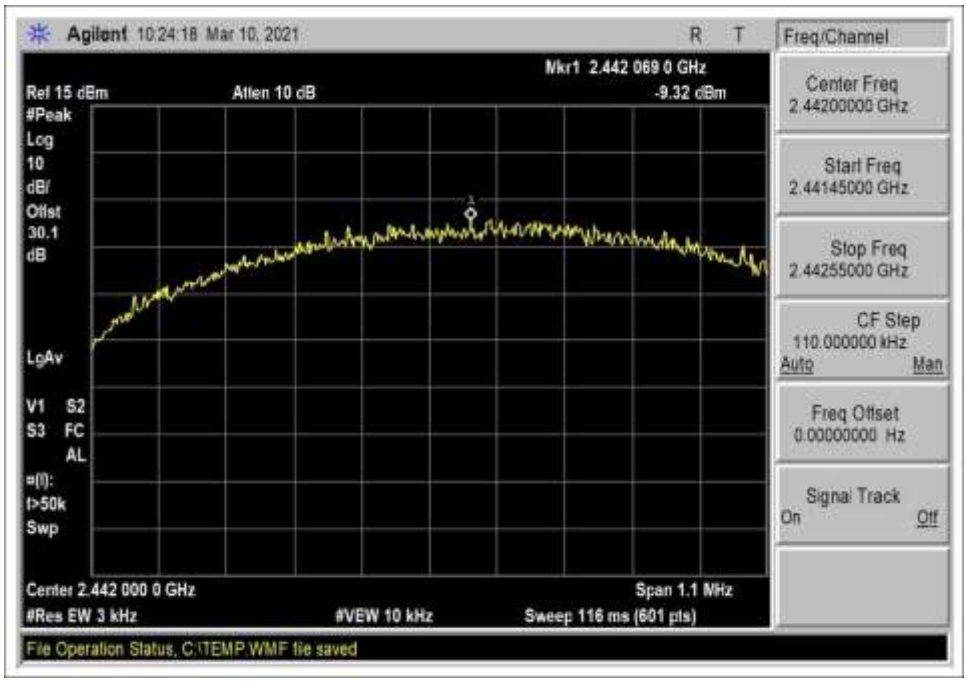
Environmental Conditions			
Temperature (ºC)	20	Relative Humidity (%):	40

Test Data Summary - RF Conducted Measurement				
Measurement Method: PKPSD				
Frequency (MHz)	**Modulation**	**Measured (dBm/3kHz)**	**Limit (dBm/3kHz)**	**Results**
2404	GFSK (1 Mbps)	-9.51	≤8	Pass
2442	GFSK (1 Mbps)	-9.32	≤8	Pass
2480	GFSK (1 Mbps)	-9.76	≤8	Pass
2404	GFSK (2 Mbps)	-13.29	≤8	Pass
2442	GFSK (2 Mbps)	-12.72	≤8	Pass
2480	GFSK (2 Mbps)	-12.52	≤8	Pass

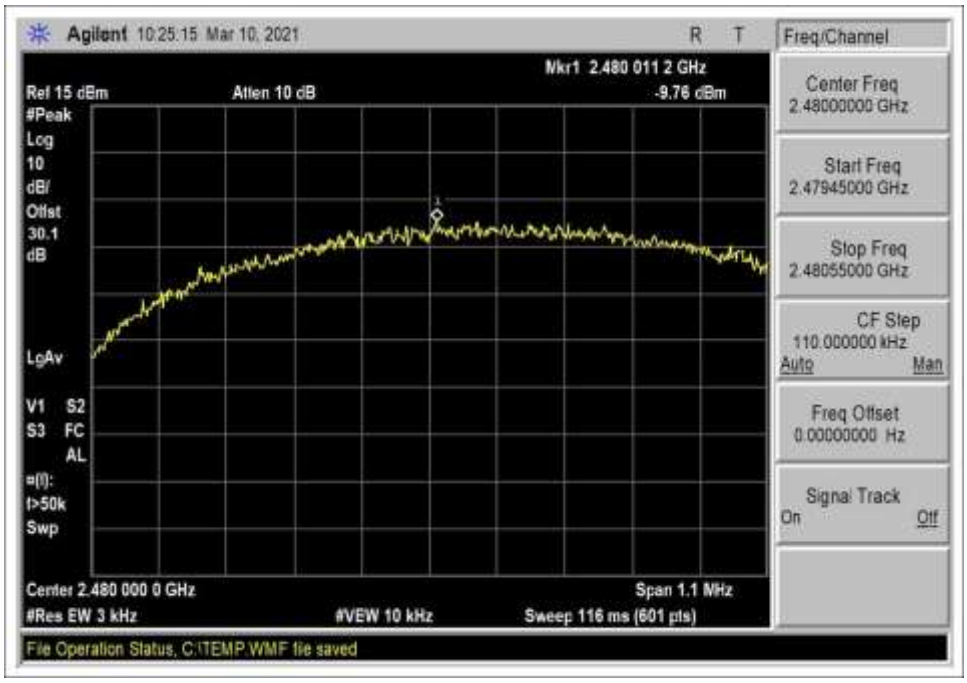
Plots



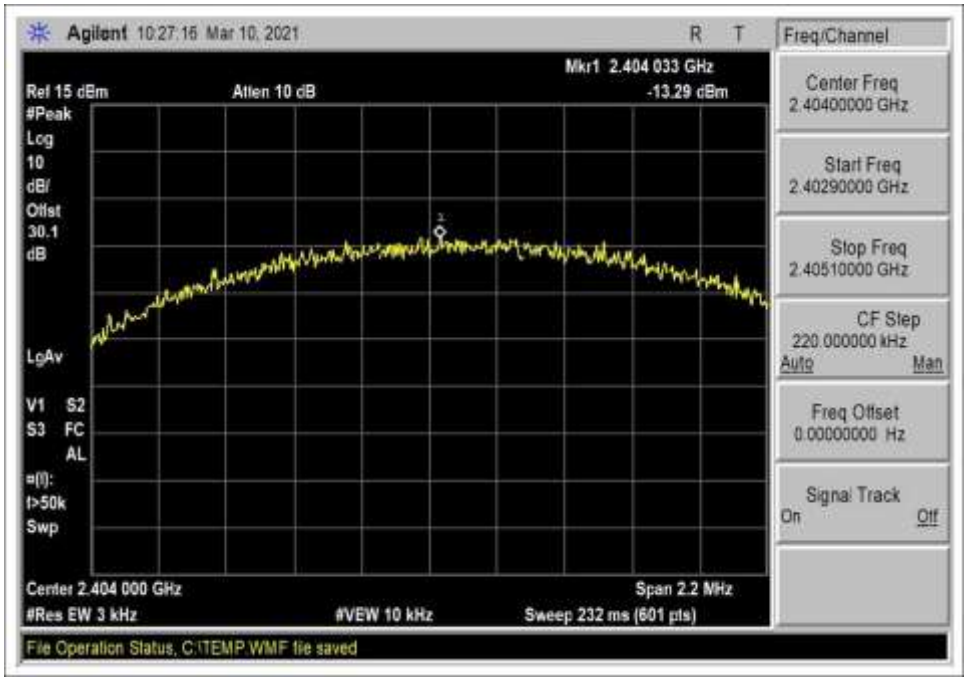
Low Channel, GFSK (1Mbps)



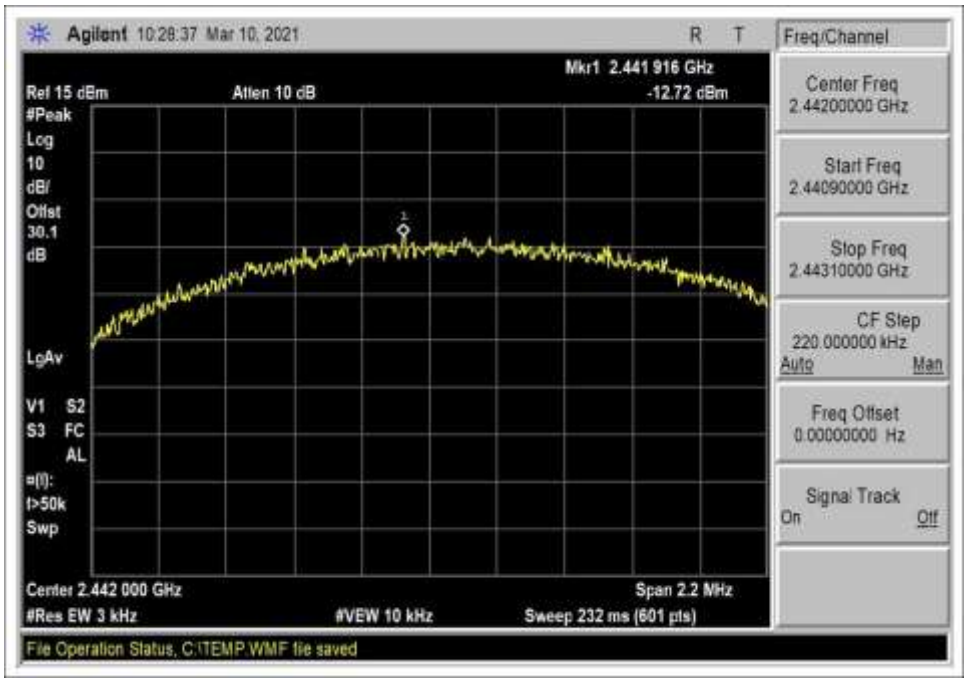
Middle Channel, GFSK (1Mbps)



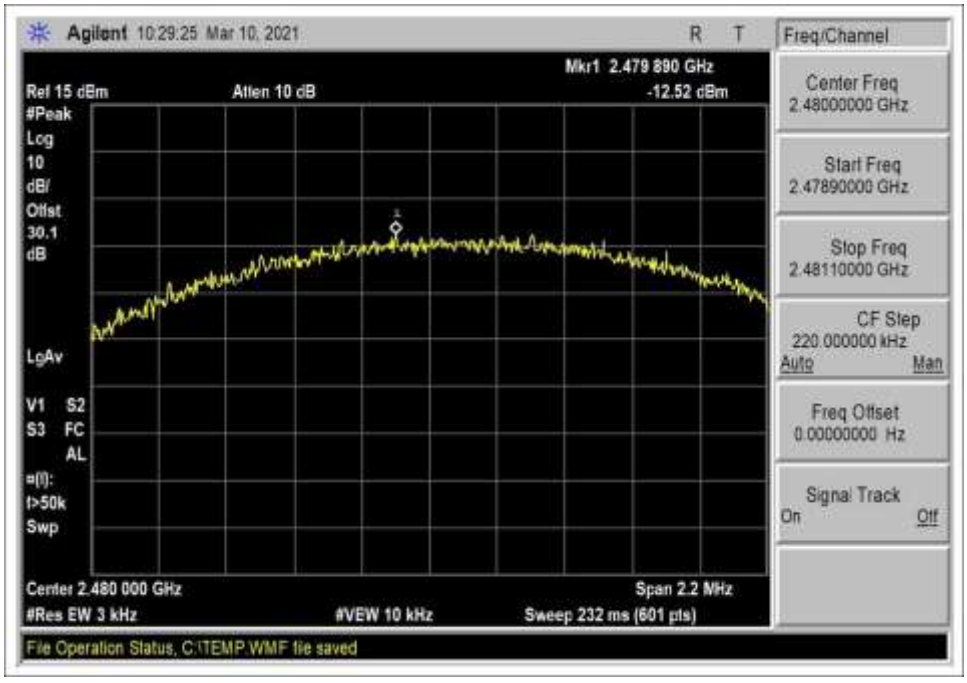
High Channel, GFSK (1Mbps)



Low Channel, GFSK (2Mbps)



Middle Channel, GFSK (2Mbps)



High Channel, GFSK (2Mbps)

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112		
Customer:	**Venstar, Inc.**		
Specification:	**15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)**		
Work Order #:	**105151**	Date:	3/22/2021
Test Type:	**Conducted Emissions**	Time:	14:34:37
Tested By:	S. Yamamoto	Sequence#:	0
Software:	EMITest 5.03.19		3.3Vdc

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The equipment under test (EUT) and support equipment are located together on the table top.
The EUT is connected to the Texas Instruments CC1352R1 development board. The board is connected to the support laptop via USB cable. The board is providing 3.3Vdc to the EUT.

The support laptop is running Texas Instruments SmartRF Studio 7 software to enable settings of the EUT>

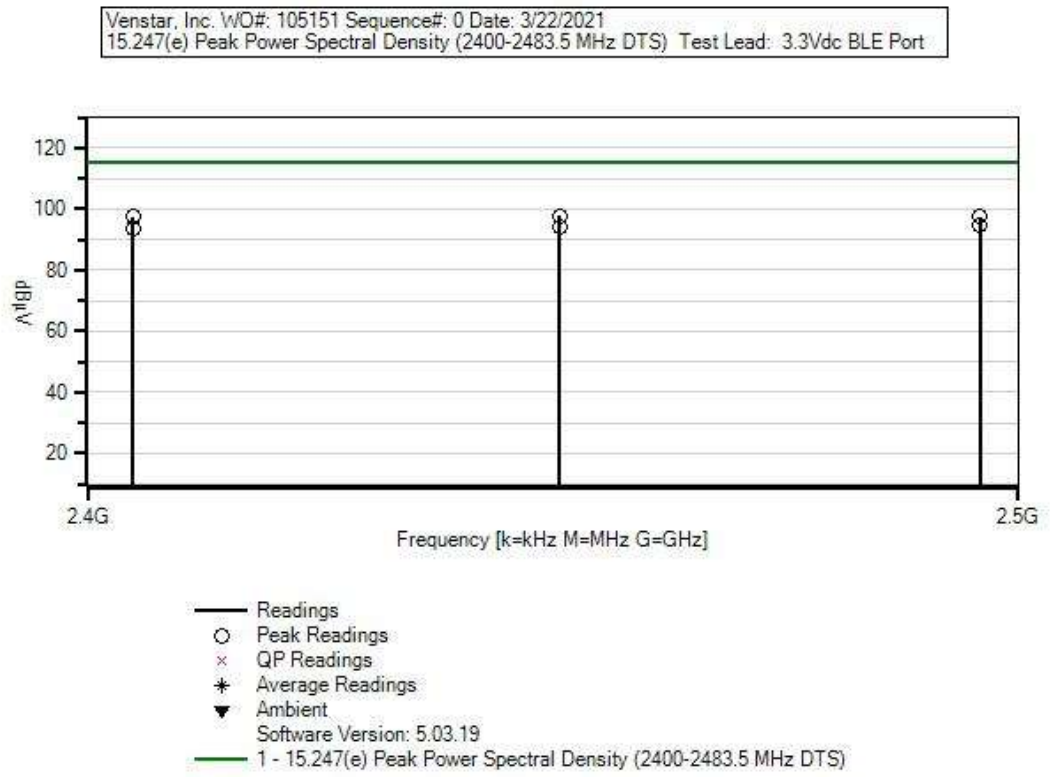
Software Setting:
RF Designed Based On: LAUNCHXL-CC1352R1
Setting Selections: Bluetooth 5, LE 1M PHY (1 Msym/s GFSK, 1 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU and Bluetooth 5, LE 2M PHY (2 Msym/s GFSK, 2 Mbps data rate) - Packet Tx with AUX_ADV_IND PDU

Frequency Range: 2404MHz to 2480MHz
Low 2404MHz, Middle 2442MHz, High 2480MHz
Modulation: GFSK
Mode: Continuous TX/ Modulated
TX Power Setting: 5dBm

Test Environment Conditions:
Temperature: 20°C
Relative Humidity: 40%
Pressure: 99kPa

Site D

Test Method ANSI C63.10 (2013) KDB 558074 v05r02**:** 04/02/2019



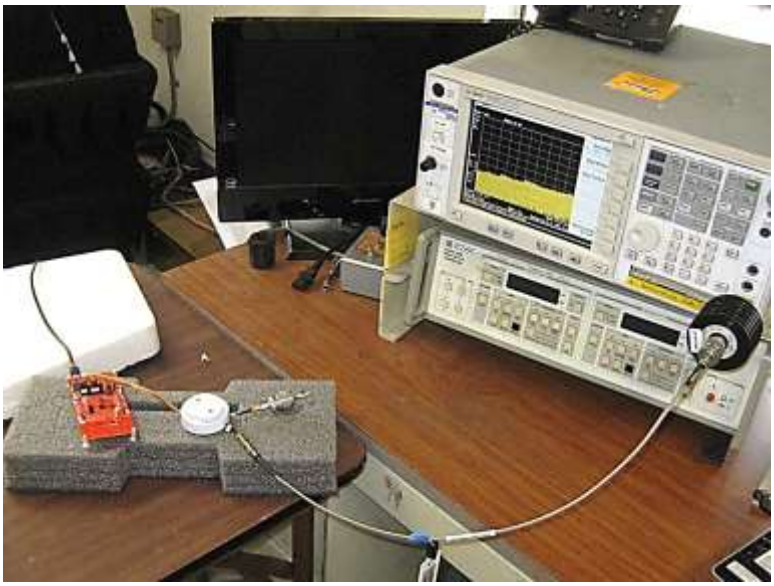
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T3	ANP07657	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Measurement Data: Reading listed by margin. Test Lead: BLE Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2442.000M	67.6	+0.0	+29.7	+0.4		+0.0	97.7	115.0	-17.3	BLE P
2	2404.000M	67.4	+0.0	+29.7	+0.4		+0.0	97.5	115.0	-17.5	BLE P
3	2480.000M	67.1	+0.0	+29.7	+0.5		+0.0	97.3	115.0	-17.7	BLE P
4	2480.000M	64.4	+0.0	+29.7	+0.5		+0.0	94.6	115.0	-20.4	BLE P
5	2442.000M	64.2	+0.0	+29.7	+0.4		+0.0	94.3	115.0	-20.7	BLE P
6	2404.000M	63.6	+0.0	+29.7	+0.4		+0.0	93.7	115.0	-21.3	BLE P

Test Setup Photo(s)



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.