WiBotic Inc.

REVISED TEST REPORT TO 103494-5

OC-301*

(*See Appendix A for Manufacturer Declaration)

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.249

Report No.: 103494-5A

Date of issue: July 13, 2020

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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Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

WiBotic Inc.
9706 - 4th Ave. NE
Seattle, WA 98115

Representative: Patrick Vilbrandt
Customer Reference Number: 1220 Rev 2

REPORT PREPARED BY:

Darcy Thompson
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 103494

DATE OF EQUIPMENT RECEIPT: May 11, 2020
DATE(S) OF TESTING: May 11, 2020, June 3, 2020 and July 1, 2020

Revision History

Original: Testing of the OC-301 to FCC Part 15 Subpart C Section(s) 15.249.
Revision A: To update General Product Information Table Nominal Input Voltage from 24V battery to 60V battery. Added Configuration 2, added statement in the test sections and Conditions During test for the testing with the 60V battery.

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.
22116 23rd Drive S.E., Suite A
Canyon Park, Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.12

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Japan
Canyon Park, Bothell, WA	US0081	US1022	A-0136
Brea, CA	US0060	US1025	A-0136
Fremont, CA	US0082	US1023	A-0136
Mariposa, CA	US0103	US1024	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 - 15.249

Test Procedure	Description	Modifications	Results
15.215(c)	Occupied Bandwidth	NA	Pass
15.249(a)	Field Strength of Fundamental	NA	Pass
15.249(a)	Radiated Emissions and Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable
NA1 = 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
Testing was performed on July 1, 2020 with Configuration 2 with a 60V battery and no changes in TX power were observed.

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
OC-301-30-ST	WiBotic Inc.	OC-301*	010

* See Appendix A for Manufacturer Declaration

Support Equipment:

Device	Manufacturer	Model #	S/N
24V Lithium Iron Phosphate Battery	Bioenno Power	BLF-2440A	NA
RC-100-AP-ST	WiBotic Inc.	RC-100	NA

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
OC-301-30-ST	WiBotic Inc.	OC-301*	010

* See Appendix A for Manufacturer Declaration

Support Equipment:

Device	Manufacturer	Model #	S/N
Lithium Iron Phosphate Battery	Bioenno Power	BLF-4810W	NA
RC-100-AP-ST	WiBotic Inc.	RC-100	NA

General Product Information:

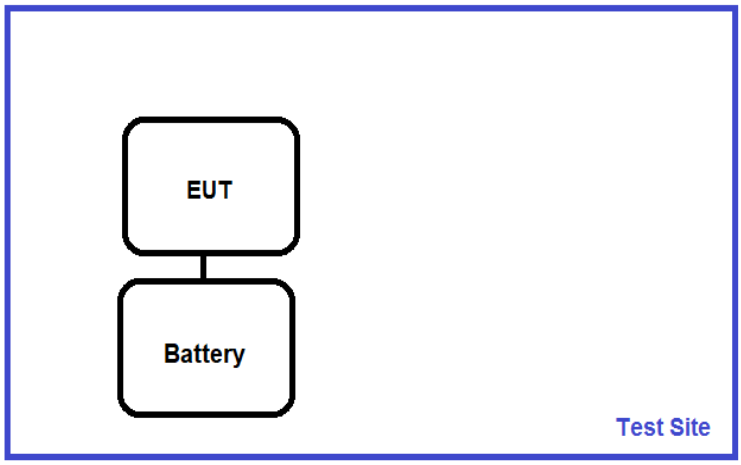
Product Information	Manufacturer-Provided Details
Equipment Type:	Radio Module
Modulation Type(s):	GFSK 250kbps
Maximum Duty Cycle:	100%
Antenna Type(s) and Gain:	Chip antenna 1dBi
Antenna Connection Type:	Integral
Nominal Input Voltage:	60V battery
Firmware / Software used for Test:	V11.1

EUT Photo(s)

Support Equipment Photo(s)

Block Diagram of Test Setup(s)

Test Setup Block Diagram



FCC Part 15 Subpart C

15.215(c) Occupied Bandwidth (20dB BW)

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	ANSI C63.10 (2013)	Test Date(s):	5/11/2020 and 7/1/2020
Configuration:	1		
Test Setup:	Continuously transmitting all 0 Data EUT is located on test bench 0.8m high <1GHz and 1.5m high >1GHz. A laptop is temporarily connected to change transmitter settings and removed during test. EUT is powered via a fully charged battery pack. Testing was performed on July 1, 2020 with Configuration 2 with a 60V battery and no changes in TX power were observed.		

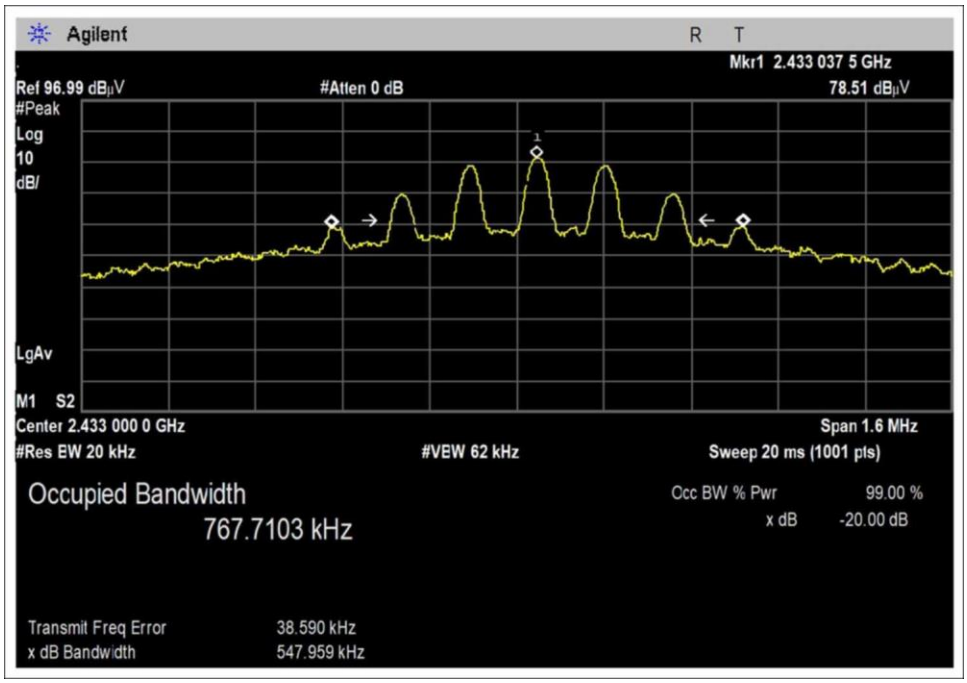
Environmental Conditions			
Temperature (ºC)	25	Relative Humidity (%):	33

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
01467	Horn Antenna	EMCO	3115	7/5/2019	7/5/2021
02673	Spectrum Analyzer	Agilent	E4446A	2/22/2019	2/22/2021
P06515	Cable	Andrews	Heliax	6/29/2018	6/29/2020
P06540	Cable	Andrews	Heliax	8/23/2019	8/23/2021
03540	Preamp	HP	83017A	5/13/2019	5/13/2021
P07504	Cable	TMS	CLU40-KMKM-02.00F	1/17/2019	1/17/2021

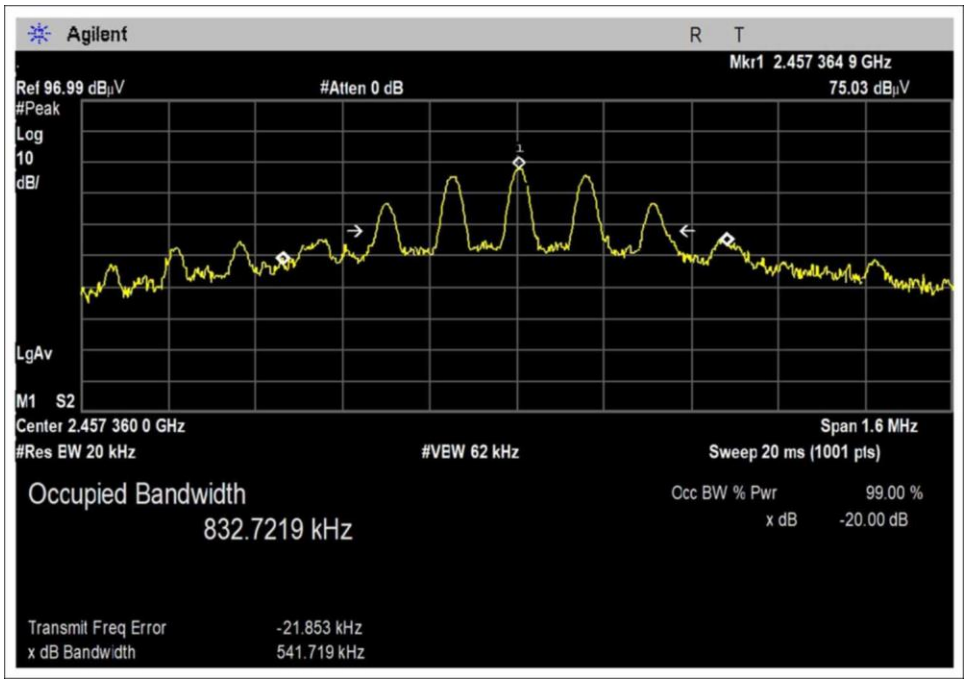
Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
2433.03	1	GSFK	548.0	None	NA
2457.36	1	GSFK	541.7	None	NA
2481.68	1	GSFK	539.1	None	NA

NA = Not applicable, because FCC 15.215 does not give any limits so there is no criteria for pass or fail.

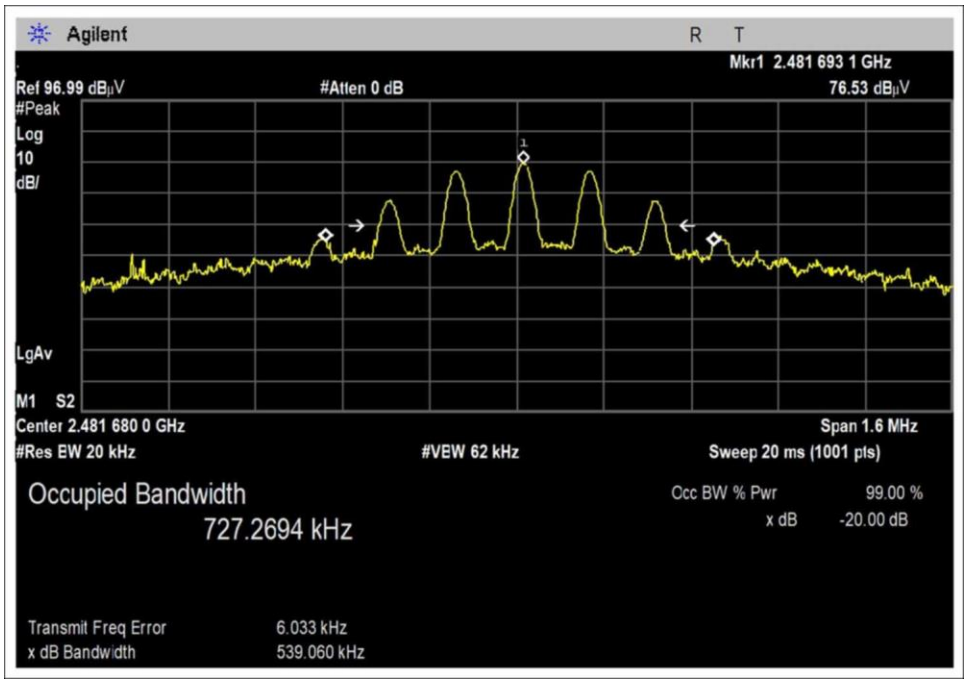
Plot(s)



Low Channel



Middle Channel



High Channel

Test Setup Photo(s)

15.249(a) Field Strength of Fundamental

Test Data Summary - Voltage Variations

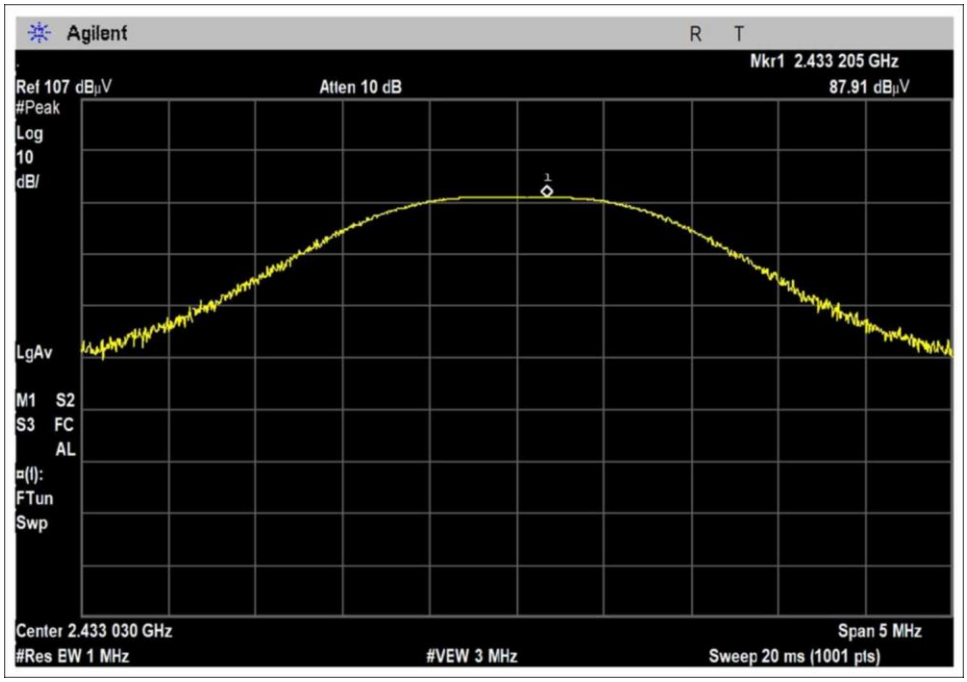
Configuration 1: This equipment is battery powered. Power output tests were performed using a fresh battery.

Testing was performed on July 1, 2020 with Configuration 2 with a 60V battery and no changes in TX power were observed.

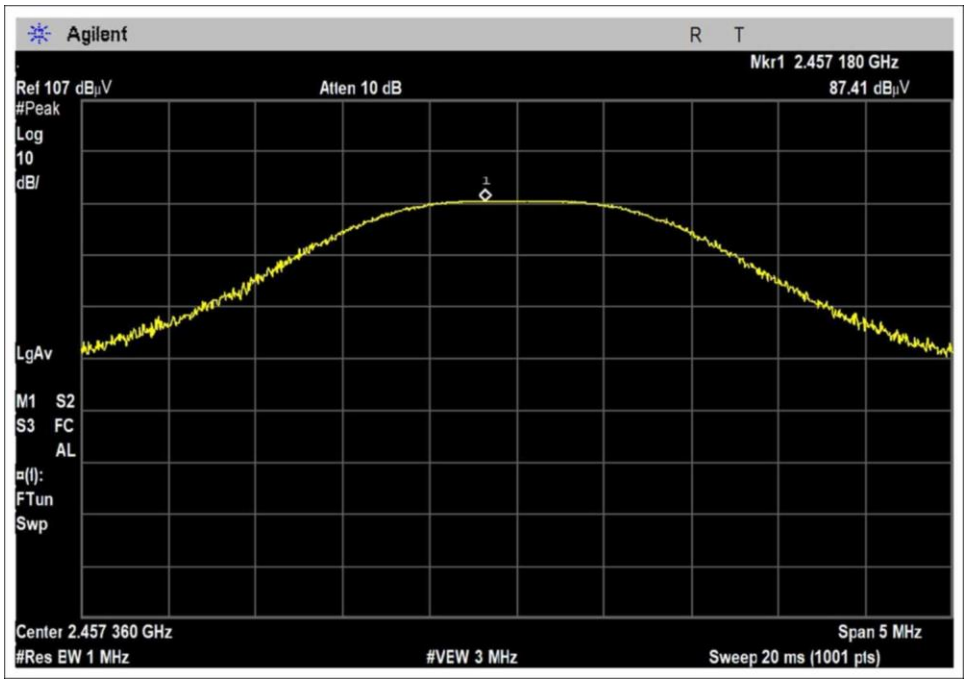
Test Data Summary – Radiated Field Strength Measurement					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Measured (dBuV/m @ 3m)**	**Limit (dBuV/m @ 3m)**	**Results**
2433.03	GFSK	Integral	84.7	≤94	Pass
2457.36	GFSK	Integral	84.3	≤94	Pass
2481.68	GFSK	Integral	83.8	≤94	Pass

Plots shows raw reading please see datasheet for corrected readings.
50mV/m = 94dBuV/m

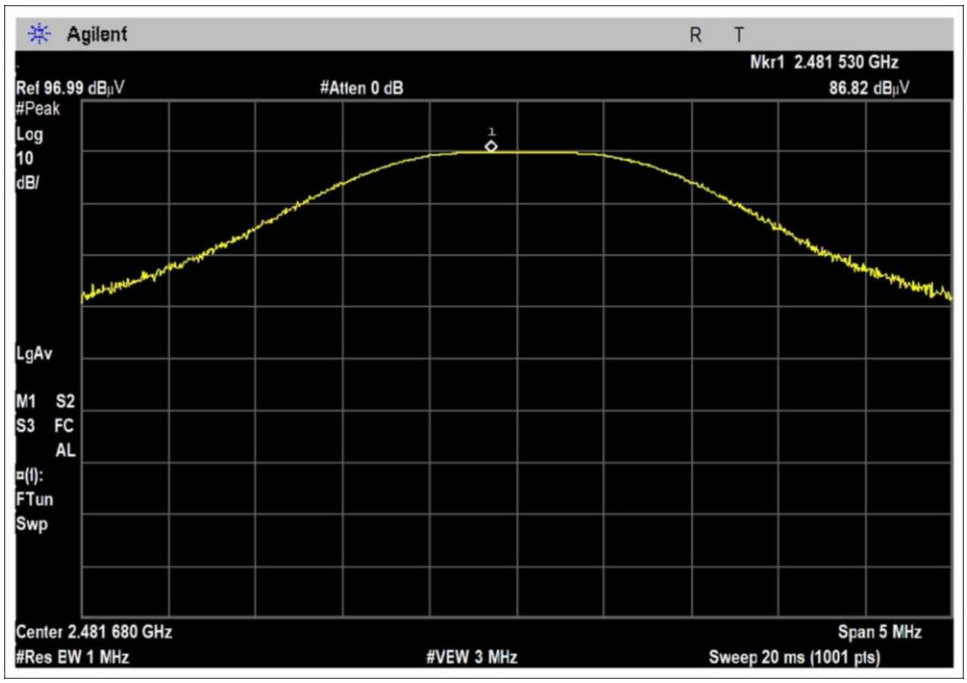
Plot(s)



Low Channel



Middle Channel



High Channel

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**WiBotic Inc.**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**103494**	Date:	5/11/2020
Test Type:	**Maximized Emissions**	Time:	09:47:06
Tested By:	Steven Pittsford	Sequence#:	34
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

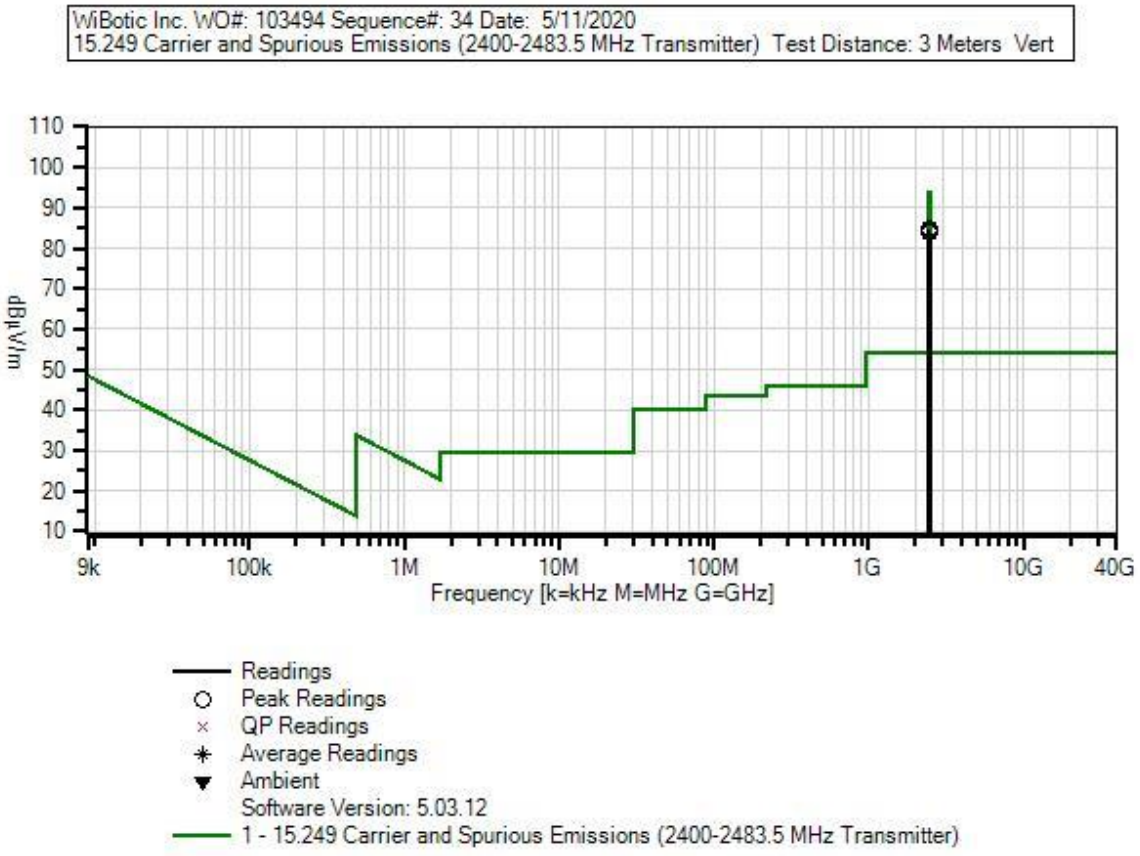
Frequency Range: 2.433-2.4817GHz
Frequency tested: 2.433, 2457.4 & 2.4817GHz
Firmware power setting: Max Power

Duty Cycle: 100%

Test Method: ANSI C63.10 (2013)
Test Mode: Continuously transmitting all 0 Data
Test Setup: EUT is located on test bench 0.8m high <1GHz and 1.5m high >1GHz .
EUT is investigated in X, Y & Z axis Vertical and horizontal with worst case reported.
A laptop is temporarily connected to change transmitter settings and removed during test.
EUT is powered via a fully charged battery pack.

3 x orthogonal axes investigated below 30MHz, Vertical and Horizontal axes investigated above 30MHz, worst case reported.

Temperature (ºC): 23
Relative Humidity (%): 32



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T2	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T3	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T4	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2433.205M	87.9	+0.6 +0.3	-34.3	+27.6	+2.6	+0.0 34	84.7	94.0 Z-Axis	-9.3	Horiz 146
2	2457.180M	87.4	+0.6 +0.3	-34.3	+27.6	+2.7	+0.0 37	84.3	94.0 Z-Axis	-9.7	Horiz 151
3	2481.530M	86.8	+0.6 +0.3	-34.2	+27.6	+2.7	+0.0 33	83.8	94.0 Z-Axis	-10.2	Horiz 146

Test Setup Photo(s)

Test Setup

X Axis

Y Axis

Z Axis

15.249(a) Radiated Emissions and Band Edge

Additional Testing

Testing was performed on July 1, 2020 with Configuration 2 with a 60V battery and no changes in TX power were observed.

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**WiBotic Inc.**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**103494**	Date:	5/11/2020
Test Type:	**Maximized Emissions**	Time:	12:48:40
Tested By:	Steven Pittsford	Sequence#:	33
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Frequency Range: 9kHz-25GHz
Frequency tested: 2.433, 2457.4 & 2.4817GHz
Firmware power setting: Max Power

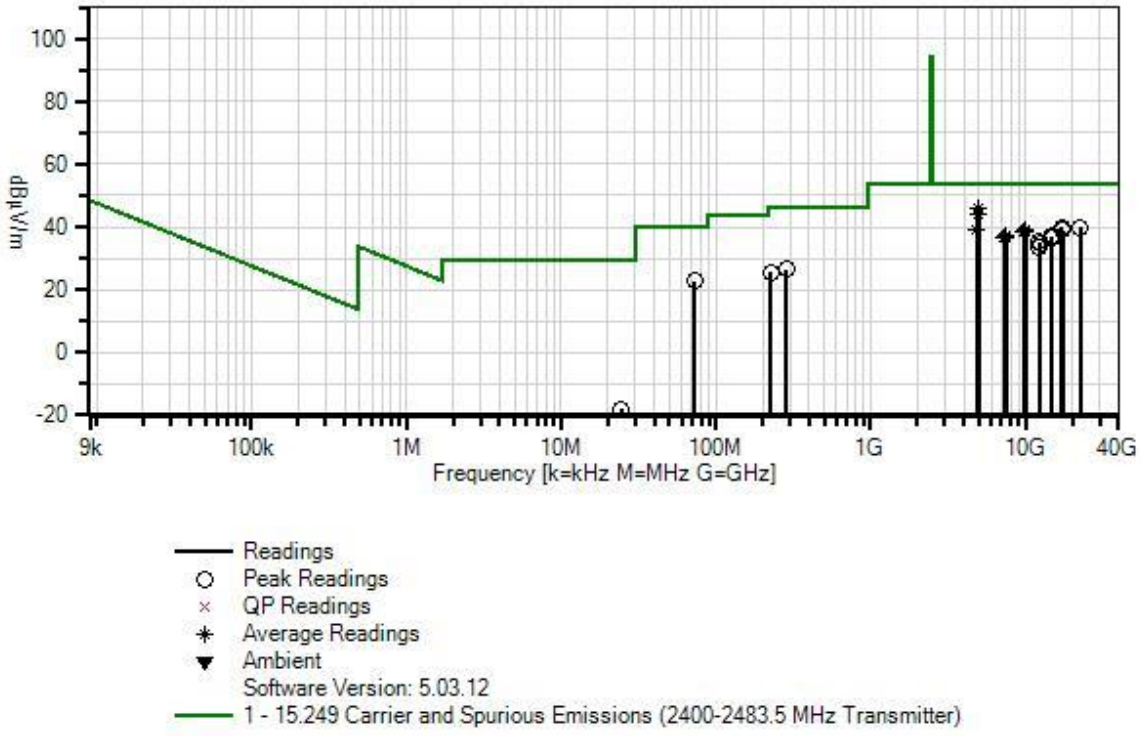
Duty Cycle: 100%

Test Method: ANSI C63.10 (2013)
Test Mode: Continuously transmitting all 0 Data
Test Setup: EUT is located on test bench 0.8m high <1GHz and 1.5m high >1GHz .
EUT is investigated in X, Y & Z axis Vertical and horizontal with worst case reported.
A laptop is temporarily connected to change transmitter settings and removed during test.
EUT is powered via a fully charged battery pack.
The manufacturer declares: All other ports are for maintenance only.

3 x orthogonal axes investigated below 30MHz, Vertical and Horizontal axes investigated above 30MHz, worst case reported.

Temperature (ºC): 22-25
Relative Humidity (%): 30-35

WiBotic Inc. WO#: 103494 Sequence#: 33 Date: 5/11/2020
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) Test Distance: 3 Meters Vert & Horz



Test Equipment:

ID	Asset #	Description	Model	Cal Date	Cal Due Date
T1	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T2	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T3	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T4	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021
T6	AN02741	Active Horn Antenna	AMFW-5F-12001800-20-10P	4/26/2019	4/26/2021
T7	ANP06678	Cable	32026-29801-29801-144	2/20/2020	2/20/2022
T8	ANP07211	Cable	32026-29801-29801-18	8/7/2019	8/7/2021
T9	ANP07212	Cable	32026-29801-29801-18	8/7/2019	8/7/2021
T10	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T11	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T12	AN02307	Preamp	8447D	1/10/2020	1/10/2022
T13	ANP05360	Cable	RG214	2/3/2020	2/3/2022
T14	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T15	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021
T16	AN02742	Active Horn Antenna	AMFW-5F-18002650-20-10P	10/16/2018	10/16/2020
T17	AN02763-69	Waveguide	Multiple	4/28/2020	4/28/2022
T18	AN00052	Loop Antenna	6502	5/4/2020	5/4/2022

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

#	Freq	Rdng	T1 T5 T9 T13 T17	T2 T6 T10 T14 T18	T3 T7 T11 T15	T4 T8 T12 T16	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4963.320M	41.3	+0.9	-33.6	+32.6	+4.2	+0.0	45.8	54.0	-8.2	Horiz
	Ave		+0.4	+0.0	+0.0	+0.0	360		High		143
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0							
^	4963.320M	46.6	+0.9	-33.6	+32.6	+4.2	+0.0	51.1	54.0	-2.9	Horiz
			+0.4	+0.0	+0.0	+0.0			High		155
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0							
3	4914.860M	39.3	+0.9	-33.6	+32.6	+4.2	+0.0	43.9	54.0	-10.1	Horiz
	Ave		+0.5	+0.0	+0.0	+0.0	40		Mid		164
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0							
^	4914.860M	46.1	+0.9	-33.6	+32.6	+4.2	+0.0	50.7	54.0	-3.3	Horiz
			+0.5	+0.0	+0.0	+0.0	40		Mid		164
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0							

5	17031.210 M	40.2	+2.1 +0.0 +0.0 +0.0 +0.0	+0.0 -11.4 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0 +0.0	+9.1 +0.0 +0.0 +0.0 +0.0	+0.0	40.0	54.0 Low	-14.0	Vert 143
6	22662.000 M	42.4	+0.0 +0.0 +1.2 +0.0 +2.0	+0.0 +0.0 +0.0 +0.0 +0.0	+0.0 +9.4 +0.0 +0.0 +0.0	+0.0 +0.9 +0.0 -16.1	+0.0	39.8	54.0	-14.2	Vert 143
7	4866.320M Ave	34.8	+0.9 +0.5 +0.0 +0.0 +0.0	-33.6 +0.0 +0.0 +0.0 +0.0	+32.5 +0.0 +0.0 +0.0 +0.0	+4.1 +0.0 +0.0 +0.0 +0.0	+0.0	39.2	54.0 Low	-14.8	Horiz 155
^	4866.320M	43.8	+0.9 +0.5 +0.0 +0.0 +0.0	-33.6 +0.0 +0.0 +0.0 +0.0	+32.5 +0.0 +0.0 +0.0 +0.0	+4.1 +0.0 +0.0 +0.0 +0.0	+0.0	48.2	54.0 Low	-5.8	Horiz 164
9	17372.320 M	39.8	+1.8 +0.0 +0.0 +0.0 +0.0	+0.0 -11.2 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0 +0.0	+8.6 +0.0 +0.0 +0.0 +0.0	+0.0	39.0	54.0 High	-15.0	Vert 143
10	9927.840M Ave	27.1	+1.3 +0.5 +0.0 +0.0 +0.0	-33.9 +0.0 +0.0 +0.0 +0.0	+37.5 +0.0 +0.0 +0.0 +0.0	+6.3 +0.0 +0.0 +0.0 +0.0	+0.0	38.8	54.0 High	-15.2	Vert 143
^	9927.840M	37.2	+1.3 +0.5 +0.0 +0.0 +0.0	-33.9 +0.0 +0.0 +0.0 +0.0	+37.5 +0.0 +0.0 +0.0 +0.0	+6.3 +0.0 +0.0 +0.0 +0.0	+0.0	48.9	54.0 High	-5.1	Vert 143
12	17201.800 M	39.7	+1.9 +0.0 +0.0 +0.0 +0.0	+0.0 -11.6 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0 +0.0	+8.8 +0.0 +0.0 +0.0 +0.0	+0.0	38.8	54.0 Mid	-15.2	Vert 143
13	9827.390M Ave	26.8	+1.3 +0.4 +0.0 +0.0 +0.0	-33.9 +0.0 +0.0 +0.0 +0.0	+37.5 +0.0 +0.0 +0.0 +0.0	+6.3 +0.0 +0.0 +0.0 +0.0	+0.0 65	38.4	54.0 Mid	-15.6	Vert 164
^	9827.390M	38.0	+1.3 +0.4 +0.0 +0.0 +0.0	-33.9 +0.0 +0.0 +0.0 +0.0	+37.5 +0.0 +0.0 +0.0 +0.0	+6.3 +0.0 +0.0 +0.0 +0.0	+0.0	49.6	54.0 Mid	-4.4	Vert 151

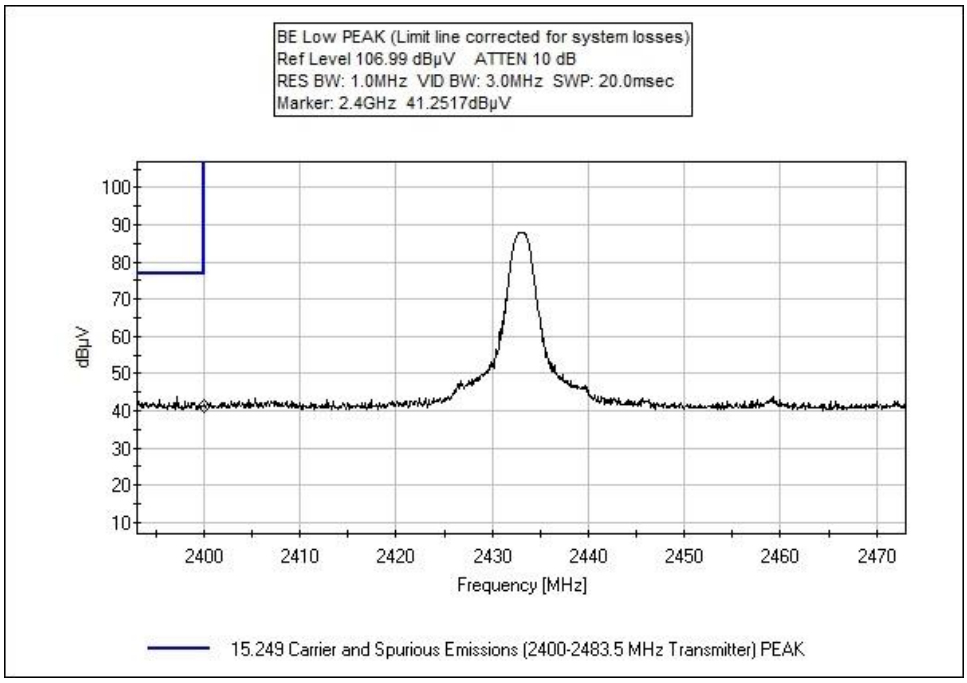
15	9732.315M Ave	26.8	+1.3 +0.4 +0.0 +0.0 +0.0	-33.9 +0.0 +0.0 +0.0 +0.0	+37.6 +0.0 +0.0 +0.0	+6.2 +0.0 +0.0 +0.0	+0.0	38.4	54.0 Low	-15.6	Vert 143
^	9732.332M	38.1	+1.3 +0.4 +0.0 +0.0 +0.0	-33.9 +0.0 +0.0 +0.0 +0.0	+37.6 +0.0 +0.0 +0.0	+6.2 +0.0 +0.0 +0.0	+0.0	49.7	54.0 Low	-4.3	Vert 143
17	14890.560 M	41.3	+1.7 +0.0 +0.0 +0.0 +0.0	+0.0 -14.4 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+8.5 +0.0 +0.0 +0.0	+0.0	37.1	54.0 High	-16.9	Vert 143
18	7443.870M Ave	27.3	+1.6 +0.3 +0.0 +0.0 +0.0	-34.7 +0.0 +0.0 +0.0 +0.0	+37.1 +0.0 +0.0 +0.0	+5.5 +0.0 +0.0 +0.0	+0.0	37.1	54.0 High	-16.9	Vert 143
^	7443.870M	37.4	+1.6 +0.3 +0.0 +0.0 +0.0	-34.7 +0.0 +0.0 +0.0 +0.0	+37.1 +0.0 +0.0 +0.0	+5.5 +0.0 +0.0 +0.0	+0.0	47.2	54.0 High	-6.8	Vert 143
20	72.500M	36.7	+0.1 +0.0 +0.0 +0.5 +0.0	+0.0 +0.0 +0.0 +5.8 +0.0	+0.0 +0.0 +0.4 +7.2	+0.0 +0.0 -27.8 +0.0	+0.0 360	22.9	40.0	-17.1	Horiz 178
21	7369.930M Ave	27.3	+1.4 +0.4 +0.0 +0.0 +0.0	-34.6 +0.0 +0.0 +0.0 +0.0	+36.9 +0.0 +0.0 +0.0	+5.4 +0.0 +0.0 +0.0	+0.0 245	36.8	54.0 Mid	-17.2	Vert 164
^	7369.930M	37.5	+1.4 +0.4 +0.0 +0.0 +0.0	-34.6 +0.0 +0.0 +0.0 +0.0	+36.9 +0.0 +0.0 +0.0	+5.4 +0.0 +0.0 +0.0	+0.0	47.0	54.0 Mid	-7.0	Vert 151
23	14744.400 M	41.2	+1.6 +0.0 +0.0 +0.0 +0.0	+0.0 -14.5 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+8.3 +0.0 +0.0 +0.0	+0.0	36.6	54.0 Mid	-17.4	Vert 143
24	14598.180 M	41.6	+1.4 +0.0 +0.0 +0.0 +0.0	+0.0 -14.7 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+8.2 +0.0 +0.0 +0.0	+0.0	36.5	54.0 Low	-17.5	Vert 143

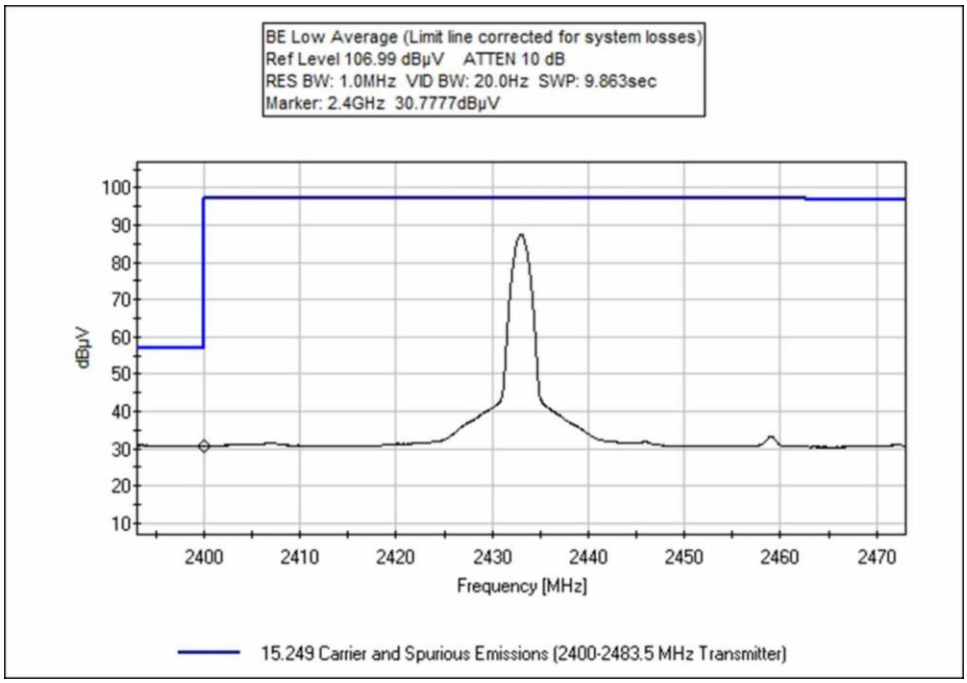
25	7298.867M Ave	27.2	+1.2 +0.5 +0.0 +0.0 +0.0	-34.6 +0.0 +0.0 +0.0 +0.0	+36.7 +0.0 +0.0 +0.0	+5.4 +0.0 +0.0 +0.0	+0.0	36.4	54.0 Low	-17.6	Vert 143
^	7298.867M	38.0	+1.2 +0.5 +0.0 +0.0 +0.0	-34.6 +0.0 +0.0 +0.0 +0.0	+36.7 +0.0 +0.0 +0.0	+5.4 +0.0 +0.0 +0.0	+0.0	47.2	54.0 Low	-6.8	Vert 143
27	12287.000 M	39.9	+1.4 +0.0 +0.0 +0.0 +0.0	+0.0 -12.9 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+6.9 +0.0 +0.0 +0.0	+0.0	35.3	54.0 Mid	-18.7	Vert 143
28	12408.800 M	39.5	+1.5 +0.0 +0.0 +0.0 +0.0	+0.0 -13.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+7.0 +0.0 +0.0 +0.0	+0.0	35.0	54.0 High	-19.0	Vert 143
29	286.710M	32.6	+0.2 +0.0 +0.0 +1.1 +0.0	+0.0 +0.0 +0.0 +5.8 +0.0	+0.0 +0.0 +0.8 +12.9	+0.0 +0.0 -27.0 +0.0	+0.0 360	26.4	46.0	-19.6	Horiz 178
30	12165.150 M	38.4	+1.4 +0.0 +0.0 +0.0 +0.0	+0.0 -12.9 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+6.9 +0.0 +0.0 +0.0	+0.0	33.8	54.0 Low	-20.2	Vert 143
31	225.540M	33.9	+0.2 +0.0 +0.0 +0.9 +0.0	+0.0 +0.0 +0.0 +5.8 +0.0	+0.0 +0.0 +0.7 +11.1	+0.0 +0.0 -27.1 +0.0	+0.0 360	25.5	46.0	-20.5	Horiz 178
32	24.512M	15.1	+0.1 +0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0 +6.6	+0.0 +0.0 +0.0 +0.0	+0.3 +0.0 +0.0 +0.0	-40.0	-17.9	29.5	-47.4	Para, 142
33	17.460k	44.3	+0.0 +0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0 +13.2	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	-80.0 105	-22.5	42.7	-65.2	Para, 142

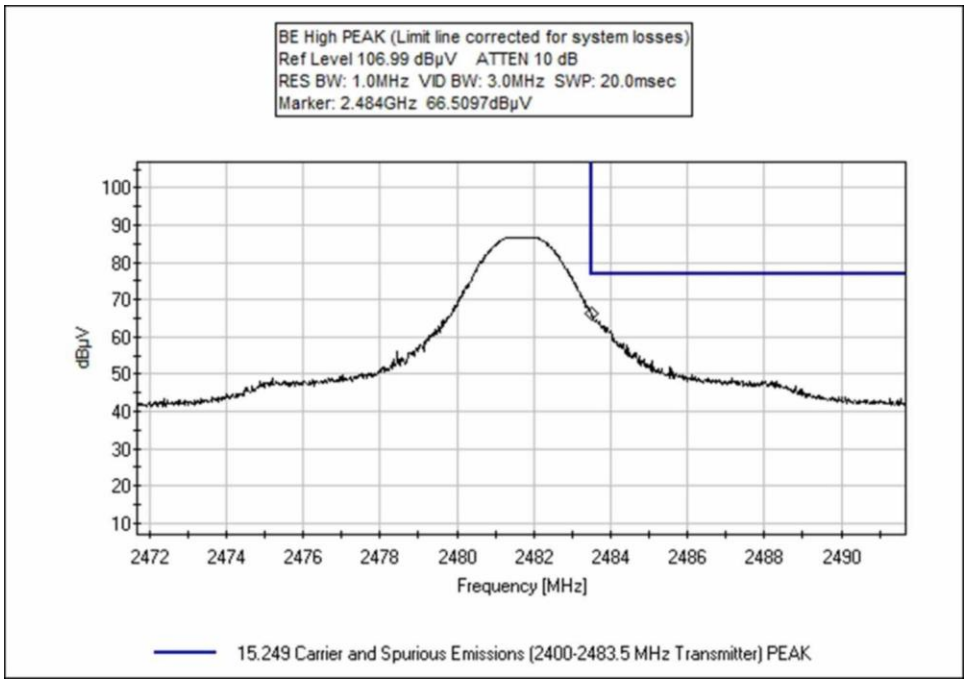
Band Edge

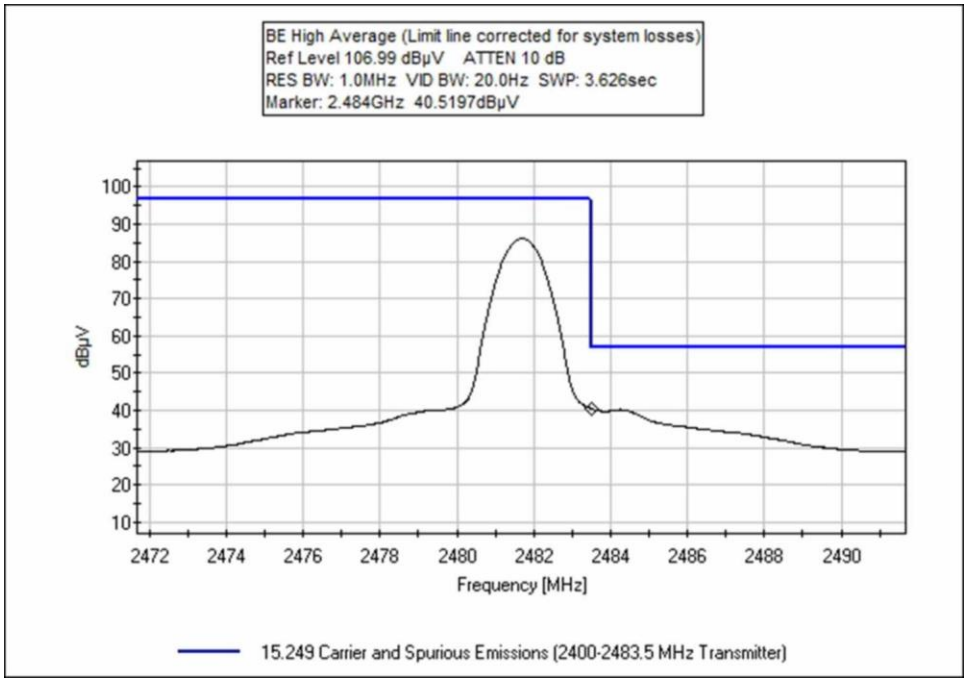
Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
2400	GFSK	Integral	30.8	<54	Pass
2483.5	GFSK	Integral	37.5	<54	Pass

Band Edge Plots




BE Low Average (Limit line corrected for system losses)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 20.0Hz SWP: 9.863sec
Marker: 2.4GHz 30.7777dBµV
dBµV
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)


BE High PEAK (Limit line corrected for system losses)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 2.484GHz 66.5097dBµV
dBµV
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter) PEAK


BE High Average (Limit line corrected for system losses)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 20.0Hz SWP: 3.626sec
Marker: 2.484GHz 40.5197dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
2472
2474
2476
2478
2480
2482
2484
2486
2488
2490
Frequency [MHz]
15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**WiBotic Inc.**		
Specification:	**15.249 Carrier and Spurious Emissions (2400-2483.5 MHz Transmitter)**		
Work Order #:	**103494**	Date:	5/11/2020
Test Type:	**Maximized Emissions**	Time:	09:38:37
Tested By:	Steven Pittsford	Sequence#:	34
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Frequency Range: 2.3-2.5GHz
Frequency tested: 2.433 & 2.4817GHz
Firmware power setting: Max Power

Duty Cycle: 100%

Test Method: ANSI C63.10 (2013)
Test Mode: Continuously transmitting all 0 Data
Test Setup: EUT is located on test bench 0.8m high <1GHz and 1.5m high >1GHz.
EUT is investigated in X, Y & Z axis Vertical and horizontal with worst case reported.
A laptop is temporarily connected to change transmitter settings and removed during test.
EUT is powered via a fully charged battery pack.

3 x orthogonal axes investigated below 30MHz, Vertical and Horizontal axes investigated above 30MHz, worst case reported.

Temperature (ºC): 22-25
Relative Humidity (%): 30-35

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T2	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T3	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T4	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2483.500M	40.5	+0.6	-34.2	+27.6	+2.7	+0.0	37.5	54.0	-16.5	Horiz
	Ave		+0.3				33		Z-Axis		146
^	2483.500M	66.8	+0.6	-34.2	+27.6	+2.7	+0.0	63.8	54.0	+9.8	Horiz
			+0.3				33		Z-Axis		146
3	2400.000M	30.8	+0.6	-34.3	+27.7	+2.6	+0.0	27.7	54.0	-26.3	Horiz
	Ave		+0.3				34		Z-Axis		129
^	2400.000M	40.7	+0.6	-34.3	+27.7	+2.6	+0.0	37.6	54.0	-16.4	Horiz
			+0.3				34		Z-Axis		129

Test Setup Photo(s)

Below 1GHz

Above 1GHz

X Axis

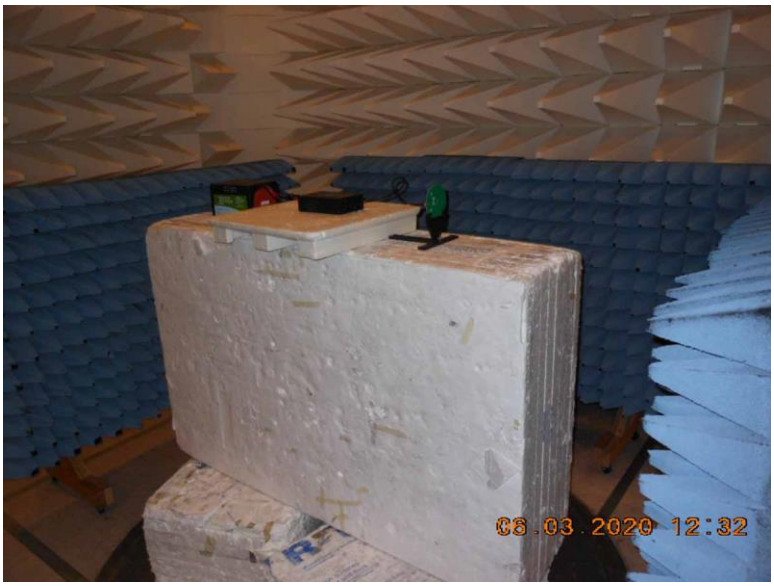
Y Axis

Z Axis

Below 1GHz with Antenna Port Filled

Below 1GHz with Antenna Port Filled

Above 1GHz with Antenna Port Filled



Above 1GHz with Antenna Port Filled

Appendix A: Manufacturer Declaration

The following models have been tested by CKC Laboratories:

OC-301-30-ST

Since the time of testing, the manufacturer has chosen to use the following model names in its place.
The manufacturer declares that any differences between the names does not affect their EMC characteristics and therefore meets the level of testing equivalent to the tested model name:

OC-301

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.