

F2 Labs 16740 Peters Road Middlefield, Ohio 44062 United States of America www.f2labs.com

Manufacturer:	Knox Company 1601 West Deer Valley Road Phoenix, Arizona  85027 USA				
Applicant:	Same as Above				
Product Name:	Radio Module				
Product Description:	Radio Module				
Model(s):	CC3100MODR11MAMOB				
FCC ID:	2AOVI-KNOX-RAS				
Testing Commenced:	Oct. 22, 2019				
Testing Ended:	Oct. 22, 2019				
Summary of Test Results:	In Compliance				
	The EUT complies with the EM				

The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.

Note: Test report reflects a check to verify that spurious emissions levels have not increased from the module's certification. Wireless transmitter is pre-certified; testing was performed due to change in antenna.

Standards:

- FCC Part 15 Subpart C, Section 15.247
- ANSI C63.10:2013



Order Number: F2P21834



# Evaluation Conducted by:

Julius Chiller, EMC/Wireless Engineer

# **Report Reviewed by:**

Ken Littell, Director of EMC & Wireless Operations

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### 1 ADMINISTRATIVE INFORMATION

#### **1.1 Measurement Location:**

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

### **1.2 Measurement Procedure:**

All measurements were performed according to the 2013 version of ANSI C63.10 and recommended FCC procedure of measurement of DTS operating under Section 15.247 and in KDB558074. A list of the measurement equipment can be found in Section 6.

#### 1.3 Uncertainty Budget:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data, and are expressed with a 95% confidence factor. Note: Only measurements listed below which relate to tests included in this Test Report are applicable to it.

Measurement Range	Expanded Uncertainty	Combined Uncertainly
Radiated Emissions <1 GHz @ 3m	±5.07dB	±2.54
Radiated Emissions <1 GHz @10m	±5.09dB	±2.55
Radiated Emissions 1 GHz to 2.7 GHz	±3.62dB	±1.81
Radiated Emissions 2.7 GHz to 18 GHz	±3.10dB	±1.55
AC Power Line Conducted Emissions, 150kHz to 30 MHz	±2.76dB	±1.38

This Uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

#### 1.4 Document History

Document Number	Description	Issue Date	Approved By
F2P21834-01E	First Issue	Nov. 4, 2019	K. Littell



# 2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
Radiated Spurious Emission	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies

Modifications Made to the Equipment	
None	



### **3 ENGINEERING STATEMENT**

This report has been prepared on behalf of Knox Company to provide documentation for the testing described herein. This equipment has been tested and found to comply with Part 15.247 of the FCC Rules using ANSI C63.10:2013 and KDB558074 standards. The test results found in this test report relate only to the items tested.



### 4 EUT INFORMATION AND DATA

- 4.1 Equipment Under Test: Product(s): Radio Module Model(s): CC3100MODR11MAMOB Serial No(s).: None Specified FCC ID: 2AOVI-KNOX-RAS
- 4.2 Trade Name: Knox Company
- 4.3 Power Supply: FSP Group Inc. FSPO84-DIBAN2
- 4.4 Applicable Rules: CFR 47, Part 15.247, subpart C
- 4.5 Equipment Category: Radio Transmitter-DTS
- **4.6** Antenna: 5dBi Whip Antenna - Larsen NMO5E2400B
- 4.7 Accessories: N/A
- **4.8 Test Item Condition:** The equipment to be tested was received in good condition.

### 4.9 Testing Algorithm:

The radio module was set to transmit a continuously modulated signal on the low, mid and high channels, in the 2.4 GHz Wi-Fi band.



# 5 LIST OF MEASUREMENT INSTRUMENTATION

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date	
Shielded Chamber	CL166-E	AlbatrossProjects B83117-DF435- T261 US140023		Oct. 31, 2019		
Temp/Hum. Recorder	CL261	Extech	445814	04	Mar. 6, 2020	
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Oct. 25, 2019	
Preamplifier	CL153	Agilent	83006-69007	MY39500791	Aug. 5, 2020	
Receiver	CL204	Rohde & Schwarz ESR7 101714		Oct. 29, 2019		
Antenna, Bilog	CL211	Sunol Sciences, Inc.	JB1	A021017	Oct. 3, 2021	
Loop Antenna	CL163- Loop	AH Systems, Inc. EHA-52B		100	July 24, 2020	
Software:	Til	e Version 3.4.B.3	Softwar	Software Verified: Oct. 22, 2019		
Software:	EMC	32, Version 8.53.0	Software Verified: Oct. 22, 2019			
Horn Antenna	CL098	Emco	3115	9809-5580	Jan. 31, 2021	
Horn Antenna	CL114	A.H. Systems, Inc.	SAS-572	237	Feb. 4, 2021	
Preamplifier	CL189	Com-Power	PAM-840A	461303	July 31, 2021	
Preamplifier	CL250	Com-Power	PAM-118A 18040011 Oct. 26		Oct. 26, 2019	



### 6 RADIATED SPURIOUS EMISSION

The EUT antenna port was fitted with its 5dBi gain Whip antenna. Radiated emissions were measured in a Semi-Anechoic Chamber. All emissions generated that fall in the restricted bands per FCC Part 15.205 were examined.

### 6.1 Requirements:

All emissions that fall in the restricted bands defined in FCC Part 15.205 shall not exceed the maximum field strength listed in FCC Part 15.209(a).



### 6.2 Radiated Spurious Emission Test Data

Test Date(s):	Oct. 22, 2019	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(d);	Air Temperature:	22.3°C
	Part 15.209 / KDB558074	<b>Relative Humidity:</b>	44%

Notes: The EUT was initially placed in a semi-anechoic chamber and rotated in all three orthogonal positions to maximize the emissions. Characterization measurements were then performed from 9 kHz to 26 GHz to determine at which frequencies significant emissions occurred.

The equipment was fully exercised with all cabling attached to the EUT and was positioned in a semi-anechoic chamber for maximum emissions. While the equipment was energized, the receiving antenna was scanned from 1.0 meter to 4.0 meters in both vertical and horizontal polarities while the turntable was adjusted 360 degrees to determine the maximum field strength. The tables of measured results can be found below and include data from all three channels.



0.009 MHz to 0.15 MHz



### 0.15 MHz to 30 MHz





30 MHz to 1000 MHz, Vertical

30 MHz to 1000 MHz, Horizontal





Channel 1: 1 GHz to 18 GHz - Vertical







Channel 1: 1 GHz to 18 GHz - Horizontal







Channel 6: 1 GHz to 18 GHz - Vertical

Channel 6: 18 GHz to 26 GHz - Vertical















Channel 11: 18 GHz to 26 GHz - Vertical





Channel 11: 1 GHz to 18 GHz - Horizontal







#### **Measurements**

# **Radiated Emissions with Restricted Bands**

Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Azimuth (deg)	Reading (dBµV)	Correction Factors (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.960000	V	100.00	295.00	23.2	5.9	29.10	40.0	-10.9
44.760000	V	105.00	10.00	30.4	-4.0	26.40	40.0	-13.6
47.840000	V	110.00	10.00	31.6	-5.7	25.90	40.0	-14.1
50.360000	V	110.00	10.00	31.7	-6.6	25.10	40.0	-14.9
59.480000	V	100.00	356.00	33.2	-7.5	25.70	40.0	-14.3
198.000000	Н	100.00	248.00	31.0	-2.7	28.30	43.5	-15.2
312.840000	Н	100.00	223.00	44.7	-1.2	43.50	46.0	-2.5
314.400000	V	100.00	189.00	37.3	-1.2	36.10	46.0	-9.9
315.760000	Н	100.00	231.00	45.1	-1.1	44.00	46.0	-2.0
321.000000	V	100.00	189.00	39.0	-1.0	38.00	46.0	-8.0
322.560000	Н	100.00	231.00	45.2	-1.0	44.20	46.0	-1.8
327.200000	Н	100.00	231.00	45.6	-1.0	44.60	46.0	-1.4
334.200000	V	100.00	189.00	39.1	-0.9	38.20	46.0	-7.8
334.760000	Н	100.00	231.00	45.3	-0.9	44.40	46.0	-1.6
340.600000	Н	100.00	231.00	43.7	-0.8	42.90	46.0	-3.1
599.960000	V	100.00	125.00	33.0	3.7	36.70	46.0	-9.3





# 7 PHOTOGRAPHS

# Radiated Spurious Emission, Loop Antenna



# Radiated Spurious Emission, 30 MHz to 1 GHz





# Radiated Spurious Emission, 1 GHz to 18 GHz

Radiated Spurious Emission, 18 GHz to 26 GHz

