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SPURIOUS EMISSIONS TEST REPORT

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:	Dec. 18, 2017
Testing Ended:	Feb. 2, 2018
Summary of Test Results:	**In Compliance**

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**

Evaluation Conducted by:

Joe Knepper, EMC Proj. Eng.

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
F2LQ10489-01E	First Issue	Feb. 5, 2018	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:

Volgen KTPS90-1207

4.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

4.5 Equipment Category:

Radio Transmitter-DTS

4.6 Antenna:

4.5dBi Whip Antenna

4.7 Accessories:

N/A

4.8 Test Item Condition:

The equipment to be tested was received in good condition.

4.9 Testing Algorithm:

EUT was set up in a normal testing manner, powered at 120V 60Hz. EUT transmitted constantly at low, mid and high channels. The highest emissions were recorded in the data tables.

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	Jan. 9, 2019
Temp/Hum. Recorder	CL137	Extech	RH520	CH16992	June 21, 2018
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Nov. 17, 2018
Pre-amplifier	CL153	Keysight Tech.	83006A	MY39500791	June 20, 2018
Active 18” Loop Antenna	CL163	A.H. Systems, Inc.	EHA-52B	100	May 2, 2018
Software:	Tile Version 1.0		Software Verified: Dec. 8, 2017; Jan. 24, 2018		
Software:	EMC 32, Version 5.20.2		Software Verified: Dec. 8, 2017; Jan. 24, 2018		
Horn Antenna	CL098	Emco	3115	9809-5580	Dec. 28, 2018
Horn Antenna	CL114	A.H. Systems, Inc.	SAS-572	237	Nov. 17, 2018
Preamplifier	CL189	Com-Power	PAM-840A	461303	June 14, 2019
Antenna	CL175	Sunol Sciences	JB3	A030315	May 3, 2018

6 RADIATED SPURIOUS EMISSION

The EUT antenna port was fitted with its 4.5dBi 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):	Dec. 8, 2017 to Jan. 24, 2018	**Test Engineer:**	J. Knepper
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	**Air Temperature:**	19.3ºC
		Relative Humidity:	38%

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.

Some of the frequencies did not change with the EUT on or off. At those frequencies, the test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the ambient or limit.

Measurements

Low Channel – QuasiPeak (worst case)

Frequency (MHz)	Antenna Polarization	Antenna Height (cm)	Azimuth (deg)	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.776000	H	100.00	0.00	20.7	5.1	25.80	40.0	-14.2
31.940000	V	100.00	0.00	20.7	4.1	24.80	40.0	-15.2
35.820000	H	100.00	0.00	20.6	1.3	21.90	40.0	-18.1
42.804000	V	100.00	0.00	20.6	-3.8	16.80	40.0	-23.2
60.652000	V	100.00	0.00	20.6	-8.2	12.40	40.0	-27.6
107.212000	H	100.00	0.00	20.5	-3.2	17.30	43.5	-26.2
123.120000	H	100.00	0.00	20.5	-1.0	19.50	43.5	-24.0
123.120000	H	100.00	0.00	20.5	-1.0	19.50	43.5	-24.0
198.780000	V	100.00	0.00	19.9	-1.2	18.70	43.5	-24.8
199.944000	H	100.00	0.00	19.9	-1.0	18.90	43.5	-24.6
406.748000	V	100.00	0.00	20.7	2.7	23.40	46.0	-22.6
545.652000	H	100.00	0.00	21.1	5.6	26.70	46.0	-19.3
656.232000	V	100.00	0.00	21.2	7.8	29.00	46.0	-17.0
783.496000	H	100.00	0.00	21.1	10.1	31.20	46.0	-14.8

Low Band Edge - MaxPeak

Frequency (MHz)	Antenna Polarization	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2390.000000	H	39.9	-4.4	35.50	74.0	-38.5
2390.000000	V	45.7	-4.4	41.30	74.0	-32.7
2483.500000	H	39.5	-4.2	35.30	74.0	-38.7
2483.500000	V	41.3	-4.2	37.12	74.0	-36.9

Low Band Edge - Average

Frequency (MHz)	Antenna Polarization	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2390.000000	H	25.5	-4.4	21.10	54.0	-32.9
2390.000000	V	31.6	-4.4	27.20	54.0	-26.8
2483.500000	H	25.8	-4.2	21.60	54.0	-32.4
2483.500000	V	29.0	-4.2	24.80	54.0	-29.2

Mid Band Edge - MaxPeak

Frequency (MHz)	Antenna Polarization	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2390.000000	V	41.3	-4.4	36.90	74.0	-37.1
2390.000000	H	38.9	-4.4	34.50	74.0	-39.5
2483.500000	V	42.7	-4.2	38.50	74.0	-35.5
2483.500000	H	39.3	-4.2	35.10	74.0	-38.9

Mid Band Edge - Average

Frequency (MHz)	Antenna Polarization	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2390.000000	V	28.9	-4.4	24.50	54.0	-29.5
2390.000000	H	25.1	-4.4	20.70	54.0	-33.3
2483.500000	V	30.6	-4.2	26.40	54.0	-27.6
2483.500000	H	25.6	-4.2	21.40	54.0	-32.6

High Band Edge - MaxPeak

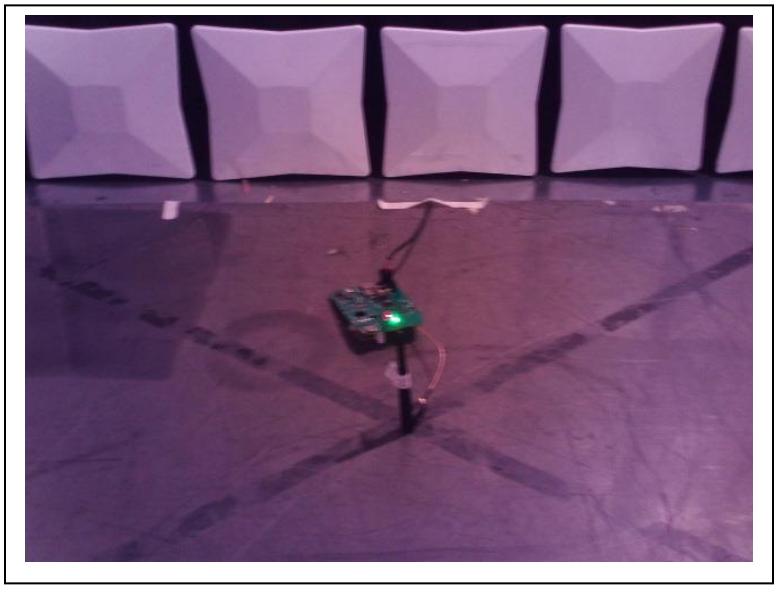
Frequency (MHz)	Antenna Polarization	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2390.000000	H	38.8	-4.4	34.40	74.0	-39.6
2390.000000	V	43.8	-4.4	39.40	74.0	-34.6
2483.500000	H	39.0	-4.2	34.80	74.0	-39.2
2483.500000	V	44.3	-4.2	40.10	74.0	-33.9

High Band Edge - Average

Frequency (MHz)	Antenna Polarization	Reading (dBµV)	Cable Loss & Antenna Factor (dB)	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2390.000000	H	25.2	-4.4	20.80	54.0	-33.2
2390.000000	V	31.5	-4.4	27.10	54.0	-26.9
2483.500000	H	25.5	-4.2	21.30	54.0	-32.7
2483.500000	V	31.2	-4.2	27.00	54.0	-27.0

7 PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

Radiated Spurious Emission, Below 1 GHz



Radiated Spurious Emission, Above 1 GHz