**Amber Helm Development L.C.**
92723 Michigan Hwy-152
Sister Lakes, Michigan 49047 USA
Tel: 888-847-8027

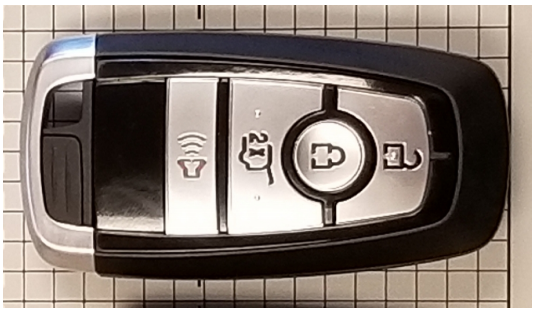
# EMC Test Report

**CON03-WR2006TX**
Issued: **February 26, 2020**

regarding

**USA: CFR Title 47, Part 15.249** (Emissions)
**Canada: IC RSS-210v10/GENv5** (Emissions)

for



# A3C054339 Series

**Category: RKE Transceiver**

Judgments:
**15.249 / RSS-210v10 Compliant**
Testing Completed: February 22, 2020

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

## Continental Automotive

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Reviewed by: _____ Gordon Helm, EMC-002401-NE

Prepared by: _____ Dr. Joseph Brunett, EMC-002790-NE

Date of Issue: February 26, 2020

## Revision History

| Rev. No. | Date | Details | Revised By |
|---|---|---|---|
| r0 | February 26, 2020 | Initial Release. | J. Brunett |
| r1 | March 2, 2020 | Include band edge data. | J. Brunett |

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# 1 Test Report Scope and Limitations

## 1.1 Laboratory Authorization

Test Facility description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: US5348 and US5356) and with ISED Canada, Ottawa, ON (File Ref. No: 3161A and 24249).

## 1.2 Report Retention

For equipment verified to comply with the regulations herein, the manufacturer is obliged to retain this report with the product records for the life of the product, and no less than ten years. A copy of this Report will remain on file with this laboratory until March 2030.

## 1.3 Subcontracted Testing

This report does not contain data produced under subcontract.

## 1.4 Limitation of Results

The test results contained in this report relate only to the item(s) tested. Any electrical or mechanical modification made to the test item subsequent to the test date shall invalidate the data presented in this report. Any electrical or mechanical modification made to the test item subsequent to this test date shall require reevaluation.

## 1.5 Copyright



## 1.6 Endorsements

This report shall not be used to claim product endorsement by any accrediting, regulatory, or governmental agency.

### 1.7 Test Location

The EUT was fully tested by **Amber Helm Development L.C.**, headquartered at 92723 Michigan Hwy-152, Sister Lakes, Michigan 49047 USA. Table 1 lists all sites employed herein. Specific test sites utilized are also listed in the test results sections of this report where needed.

Table 1: Test Site List.

| Description | Location | Quality Num. |
|---|---|---|
| OATS (3 meter) | 3615 E Grand River Rd., Williamston, Michigan 48895 | OATSC |

### 1.8 Traceability and Equipment Used

Pertinent test equipment used for measurements at this facility is listed in Table 2. The quality system employed at Amber Helm Development L.C. has been established to ensure all equipment has a clearly identifiable classification, calibration expiry date, and that all calibrations are traceable to the SI through NIST, other recognized national laboratories, accepted fundamental or natural physical constants, ratio type of calibration, or by comparison to consensus standards.

Table 2: Equipment List.

| Description | Manufacturer/Model | SN | Quality Num. | Cal/Ver By / Date Due |
|---|---|---|---|---|
| Biconical | EMCO / 93110B | 9802-3039 | BICEMCO01 | Keysight / Aug-2020 |
| Log Periodic Antenna | EMCO / 3146 | 9305-3614 | LOGEMCO01 | Keysight / Aug-2020 |
| BNC-BNC Coax | WRTL / RG58/U | 001 | CAB001-BLACK | AHD / Jul-2020 |
| 3.5-3.5MM Coax | PhaseFlex / PhaseFlex | 001 | CAB015-PURP | AHD / Jul-2020 |
| Spectrum Analyzer | R & S / FSV30 | 101660 | RSFSV30001 | RS / Apr-2021 |
| Spectrum Analyzer | R & S / FPC1000 | 101060 | RSFPC1K01 | RS / Jan-2021 |
| Quad Ridge Horn | Singer / A6100 | C35200 | HQR1TO18S01 | Keysight / Aug-2020 |

# 2 Test Specifications and Procedures

## 2.1 Test Specification and General Procedures

The goal of Continental Automotive is to demonstrate that the Equipment Under Test (EUT) complies with the Rules and/or Directives below. Detailed in this report are the results of testing the Continental Automotive A3C054339 Series for compliance to:

| **Country/Region** | **Rules or Directive** | **Referenced Section(s)** |
|---|---|---|
| United States | Code of Federal Regulations | CFR Title 47, Part 15.249 |
| Canada | ISED Canada | IC RSS-210v10/GENv5 |

It has been determined that the equipment under test is subject to the rules and directives above at the date of this testing. In conjunction with these rules and directives, the following specifications and procedures are followed herein to demonstrate compliance (in whole or in part) with these regulations.

| | |
|---|---|
| ANSI C63.4:2014 | "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" |
| ANSI C63.10:2013 | "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices" |
| TP0102RA | "AHD Internal Document TP0102 - Radiated Emissions Test Procedure" |
| TP0106RC | "AHD Internal Document TP0106 - Emissions Measurement Procedures (above 40 GHz)" |
| ISED Canada | "The Measurement of Occupied Bandwidth" |

# 3 Configuration and Identification of the Equipment Under Test

## 3.1 Description and Declarations

The equipment under test is a Remote Keyless Entry transmitter. The EUT is approximately 8 x 4 x 1.5 cm in dimension, and is depicted in Figure 1. It is powered by 3 VDC Lithium cell battery. In use, this device is a transmitter intended for remote control of automobile door locks, trunk, and remote start functionality. Table 3 outlines provider declared EUT specifications.


Figure 1: Photos of EUT.

Table 3: EUT Declarations.

| **General Declarations** | |
|---|---|
| **Equipment Type:** | RKE Transceiver |
| **Country of Origin:** | USA |
| **Nominal Supply:** | 3 VDC |
| **Oper. Temp Range:** | $-40°$C to $+85°$C |
| **Frequency Range:** | 902.375, 903.425 MHz |
| **Antenna Dimension:** | Not Declared |
| **Antenna Type:** | PCB Trace |
| **Antenna Gain:** | Integral |
| **Number of Channels:** | 2 |
| **Channel Spacing:** | N/A |
| **Alignment Range:** | Not Declared |
| **Type of Modulation:** | FSK |
| | |
| **United States** | |
| **FCC ID Number:** | M3N-A3C054339 |
| **Classification:** | DXX |
| | |
| **Canada** | |
| **IC Number:** | 7812A-A3C054339 |
| **Classification:** | Remote Control Device, Vehicular Device |

### 3.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 2.

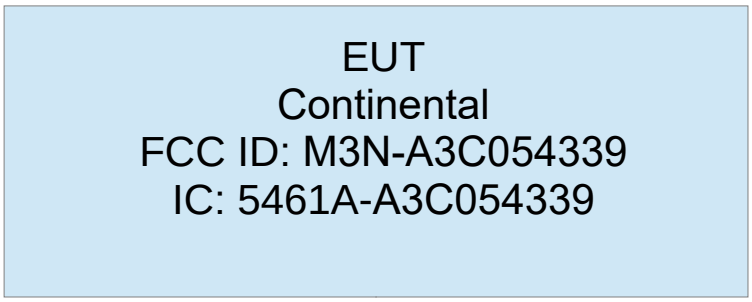


Figure 2: EUT Test Configuration Diagram.

### 3.1.2 Modes of Operation

This EUT is capable of transmitting on two channels in this frequency band when a button is pressed. The EUT is also capable of transmitting at 314.95 MHz via automatic activation, but those transmissions are addressed in a separate report. The EUT is herein tested with and without its removable key.

### 3.1.3 Variants

There are eleven (11) minor housing variants of the EUT. All variants employ identical PCBs and circuitry, but the housings vary based on vehicle logo and the number of buttons populated on the housing. The two worst case variants were determined in pretesting, those being the 4-BTN chrome button variant (HVIN: A3C053034) and the 5-BTN chrome button variant (HVIN: A3C055107).

### 3.1.4 Test Samples

Eight samples of the EUT were provided, including one normal operating samples of each worst case button variant, as well as three samples of each of those same button variants with CW software.

### 3.1.5 Functional Exerciser

Normal operating EUT functionality was verified by observation of transmitted signal.

### 3.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory, however pretesting was performed after which the manufacturer selected the final power settings for the device.

### 3.1.7 Production Intent

The EUT appears to be a production ready sample.

### 3.1.8 Declared Exemptions and Additional Product Notes

The manufacturer will follow SDoC procedures for confirming compliance of the dual channel 902.375, 903.425 MHz receiver portion of the EUT. Section 2.1077(a)information will be provided.

# 4 Emissions

## 4.1 General Test Procedures

### 4.1.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are first pre-scanned in our screen room. Spectrum and modulation characteristics of all emissions are recorded. Instrumentation, including spectrum analyzers and other test equipment as detailed in Section 1.7 are employed. After pre-scan, emission measurements are made on the test site of record. If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in relevant test standards are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 3. All intentionally radiating elements that are not fixed-mounted in use are placed on the test table lying flat, on their side, and on their end (3-axes) and the resulting worst case emissions are recorded. If the EUT is fixed-mounted in use, measurements are made with the device oriented in the manner consistent with installation and then emissions are recorded. If the EUT exhibits spurious emissions due to internal receiver circuitry, such emissions are measured with an appropriate carrier signal applied.

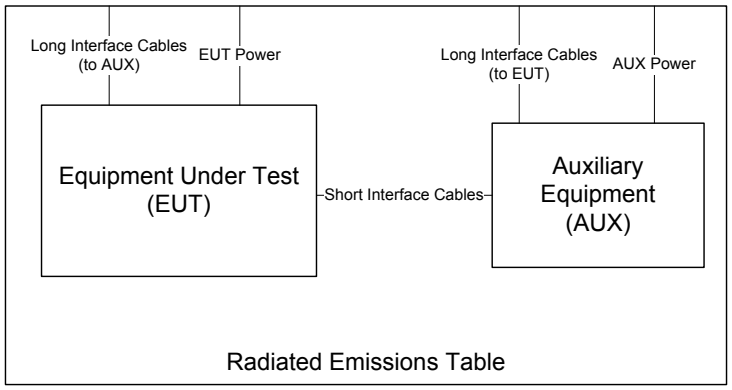


Figure 3: Radiated Emissions Diagram of the EUT.

For devices with intentional emissions below 30 MHz, a shielded loop antenna and/or E-field and H-Field broadband probes are used depending on the regulations. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, the broadband probes employed are 10cm diameter single-axis shielded transducers and measurements are repeated and summed over three axes.

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. For both horizontal and vertical polarizations, the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected. The EUT is then rotated through $360^o$ in azimuth until the highest emission is detected. The test antenna is then raised and lowered one last time from 1 to 4 m and the worst case value is recorded. Emissions above 1 GHz are characterized using standard gain or broadband ridge-horn antennas on our OATS with a $4 \times 5$ m rectangle of ECCOSORB absorber covering the OATS ground screen and a 1.5m table height. Care is taken to ensure that test receiver resolution and video bandwidths meet the regulatory requirements, and that the emission bandwidth of the EUT is not reduced. Photographs of the test setup employed are depicted in Figure 4.

Where regulations allow for direct measurement of field strength, power values (dBm) measured on the test receiver / analyzer are converted to dB$\mu$V/m at the regulatory distance, using

$$E_{dist} = 107 + P_R + K_A - K_G + K_E - C_F$$

where $P_R$ is the power recorded on spectrum analyzer, in dBm, $K_A$ is the test antenna factor in dB/m, $K_G$ is the combined pre-amplifier gain and cable loss in dB, $K_E$ is duty correction factor (when applicable) in dB, and $C_F$ is a distance conversion (employed only if limits are specified at alternate distance) in dB. This field strength value is then compared with the regulatory limit. If effective isotropic radiated power (EIRP) is computed, it is computed as

$$EIRP(dBm) = E_{3m}(dB\mu V/m) - 95.2.$$

When presenting data at each frequency, the highest measured emission under all possible EUT orientations (3-axes) is reported.

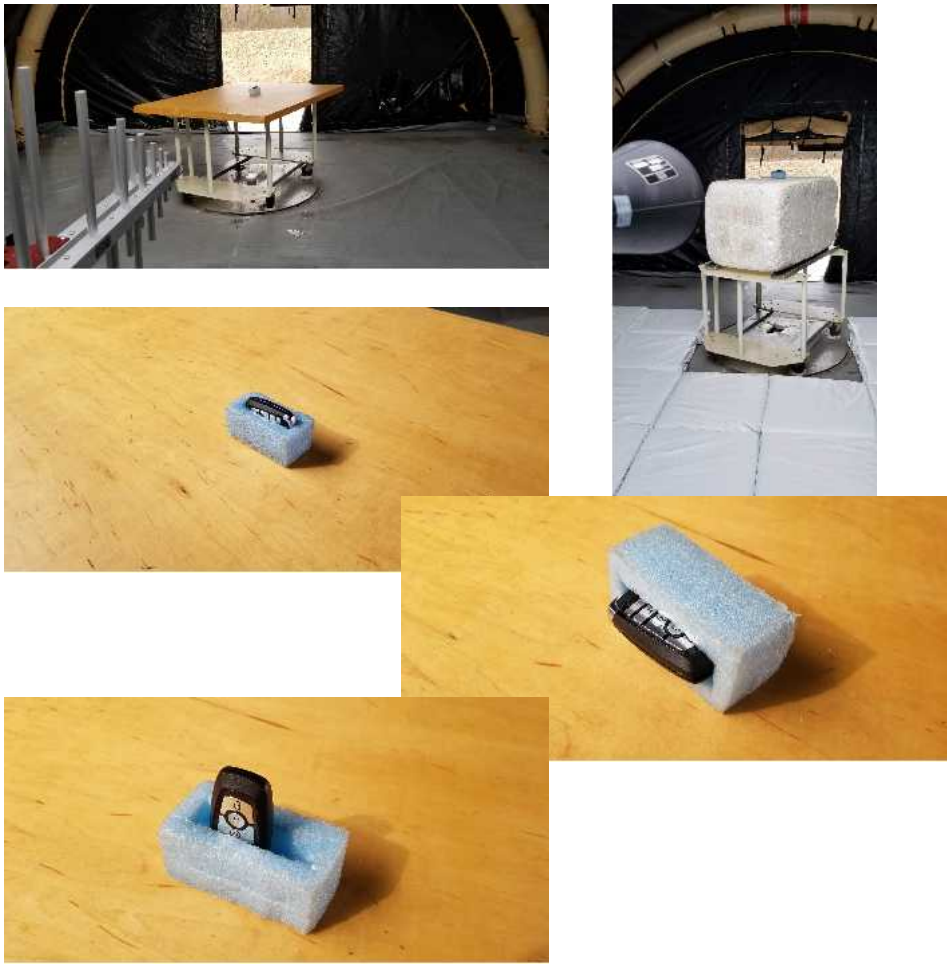

Figure 4: Radiated Emissions Test Setup Photograph(s).

### 4.1.2 Conducted Emissions Test Setup and Procedures

The EUT is not subject to measurement of power line conducted emissions as it is powered solely by its internal battery.

### 4.1.3 Power Supply Variation

Tests at extreme supply voltages are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

In the case the EUT is designed for operation from a battery power source, the extreme test voltages are evaluated over the range specified in the test standard; no less than ±10% of the nominal battery voltage declared by the manufacturer. For all battery operated equipment, worst case intentional and spurious emissions are re-checked employing a new (fully charged) battery.

## 4.2 Intentional Emissions

### 4.2.1 Fundamental Emission Pulsed Operation

**Test Setup & Procedure** The test equipment and facilities were setup in accordance with the standards and procedures listed in Section 2.1. Environmental conditions were set at the appropriate temperature and thermal balance was checked with a thermocouple based probe. Duty cycle is reported for all relevant modes of operation. The test equipment employed includes RSFPC1K01, LOGEMCO01.

**Measurement Results** The details and results of testing the EUT are summarized in Table 4. Plots showing the measurements made to obtain these values are provided in Figure 5.

Table 4: Fundamental Emission Pulsed Operation.

| Detector | Span | IF Bandwidth | Video Bandwidth |
|---|---|---|---|
| Pk | 0 | 1 MHz | 3 MHz |

| | |
|---|---|
| **Test Date:** | 21-Feb-20 |
| **Test Engineer:** | J. Brunett |
| **EUT:** | Conti A3C054339 SERIES |
| **EUT Mode:** | See below. |
| **Meas. Distance:** | 10 cm |

FCC/IC

| R0 | Test Freq. (MHz) | EUT Test Mode* | Overall Transmission: Min. Repetition Rate (sec) | Overall Transmission: Max. No. of Frames | Overall Transmission: Total Transmission Length (sec) | Internal Frame Characteristics: Max. Frame Length (ms) | Internal Frame Characteristics: Min. Frame Period (ms) | Internal Frame Characteristics: Frame Encoding | Computed Duty Cycle (%) | Computed Duty Cycle (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| R1 | | | | | | | | | | |
| R2 | NO DUTY CYCLE APPLIED | | | | | | | | | |
| R3 | | | | | | | | | | |
| # | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 |


Figure 5: Fundamental Emission Pulsed Operation.

### 4.2.2 Fundamental Emission Bandwidth

**Test Setup & Procedure** The test equipment and facilities were setup in accordance with the standards and procedures listed in Section 2.1. Environmental conditions were set at the appropriate temperature and thermal balance was checked with a thermocouple based probe. Emission bandwidth (EBW) of the EUT is measured with the device placed in the test mode(s) with the shortest available frame length and minimum frame spacing. The 20 dB EBW is measured as the max-held peak-detected signal when the IF bandwidth is greater than or equal to 1% of the receiver span. For complex modulations other than ASK and FSK, the 99% emission bandwidth per IC test procedures has a different result, and is also reported. The test equipment employed includes RSFSV30001, LOGEMCO01.

**Measurement Results** The details and results of testing the EUT are summarized in Table 5. Plots showing the measurements made to obtain these values are provided in Figure 6.

Table 5: Fundamental Emission Bandwidth.

| Detector | IF Bandwidth | Video Bandwidth |
|---|---|---|
| Pk | 10 kHz | 30 kHz |

| | |
|---|---|
| **Test Date:** | 21-Feb-20 |
| **Test Engineer:** | J. Brunett |
| **EUT:** | Conti A3C054339 SERIES |
| **EUT Mode:** | FSK Modulated |
| **Meas. Distance:** | 10 cm |

| | | | | | | FCC/IC | |
|---|---|---|---|---|---|---|---|
| R0 | Mode | Center Frequency (MHz) | 20 dB EBW (MHz) | EBW Limit (MHz) | 99% OBW (MHz) | | |
| R1 | FSK | 902.375 | 0.060 | | 0.085 | | |
| R2 | FSK | 903.425 | 0.061 | | 0.090 | | |
| R3 | | | | | | | |
| # | C1 | C2 | C3 | C4 | C5 | C7 | C8 |

(ROW) (COLUMN) NOTE:
R0 C8

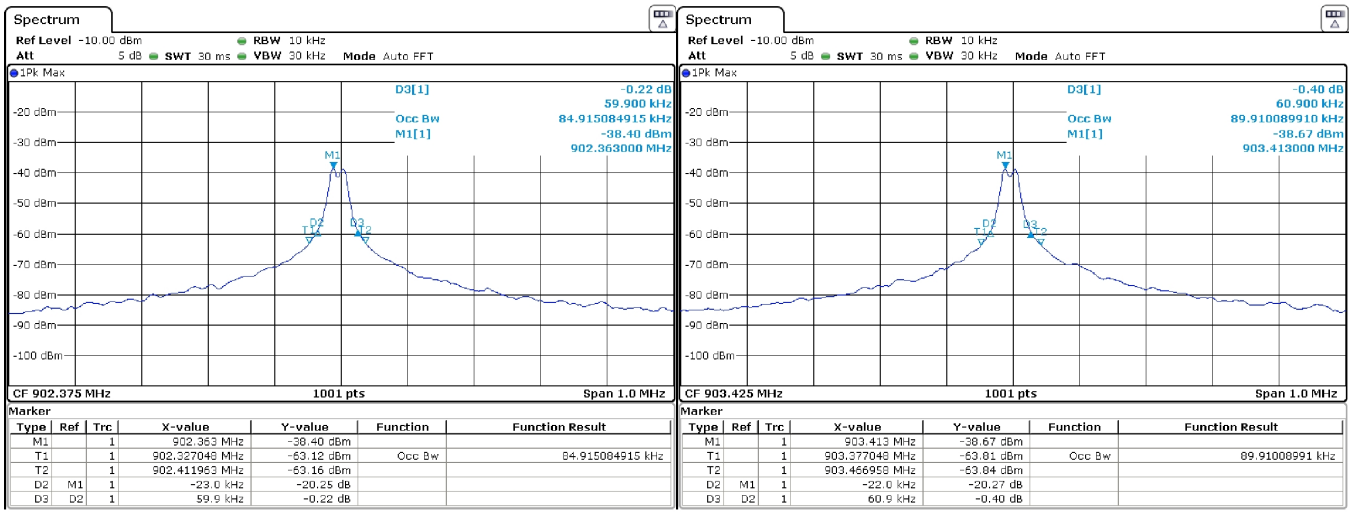


Figure 6: Fundamental Emission Bandwidth.

### 4.2.3 Fundamental Emission Field Strength

**Test Setup & Procedure** The test equipment and facilities were setup in accordance with the standards and procedures listed in Section 2.1. Environmental conditions were set at the appropriate temperature and thermal balance was checked with a thermocouple based probe. Fundamental emissions are measured at the regulatory distance on our OATS. The test equipment employed includes RSFSV30001, LOGEMCO01.

**Measurement Results** The details and results of testing the EUT are summarized in Table 6.

Table 6: Fundamental Emission Field Strength.

**EUT Modes:** **a1** 5BTN CHROME, CW, Key In
**a2** 5BTN CHROME, CW, Key Out
**Test Date(s):** 02/10/20 **a3** 4BTN CHROME, CW, Key In
**Test Engineer:** J. Brunett **a4** 4BTN CHROME, CW, Key Out

| | Frequency | | Site | | | | | | EUT | | | Test Antenna | | | | Cable | Receiver | | | | Field Strength @ DR | | | | | | EIRP | | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Start | Stop | Temp. | Table | MR | DR | N/F | CF | | | | Pol. | Ant. | Dim. | Ka | Kg | Rx Power | | Bandwidth | | Pk | | | Qpk | | | Pk | | |
| R0 | | | ( C ) | Angle | | | | | Mode | Volt. | Dim | | Height | | | | Pk | Avg | RBW | VBW | Meas. | Limit | | Calc. | Limit | | Calc. | | Pass |
| | | | Hum. | | | | | | see | | | | | | | | | | | | | USA | CAN | | USA | CAN | | | Fail |
| | MHz | MHz | % | deg | m | | | dB | table | (V) | cm | H/V | m | cm | dB/m | dB | dBm | | MHz | | dBuV/m | | | | | | dBm | | dB |
| R1 | SETUP | | OATSC | | | | | | A3C054339 SERIES | | | EMCOLOG | | | | CAB001 | RSFSV30001 | | | | NOTES: H-POL - FLAT, V-POL END Worst Case Orient | | | | | | | | |
| R2 | 902.375 | 902.375 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a1** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 91.9 | 114.0 | 114.0 | 91.9 | 94.0 | 94.0 | -3.3 | | 2.1 |
| R3 | 902.375 | 902.375 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a1** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 92.1 | 114.0 | 114.0 | 92.1 | 94.0 | 94.0 | -3.1 | | 1.9 |
| R4 | 903.425 | 903.425 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a1** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 91.5 | 114.0 | 114.0 | 91.5 | 94.0 | 94.0 | -3.7 | | 2.5 |
| R5 | 903.425 | 903.425 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a1** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 92.4 | 114.0 | 114.0 | 92.4 | 94.0 | 94.0 | -2.8 | | **1.6** |
| R6 | SETUP | | OATSC | | | | | | A3C054339 SERIES | | | EMCOLOG | | | | CAB001 | RSFSV30001 | | | | NOTES: H-POL - FLAT, V-POL END Worst Case Orient | | | | | | | | |
| R7 | 902.375 | 902.375 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a2** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 85.2 | 114.0 | 114.0 | 85.2 | 94.0 | 94.0 | -10.0 | | 8.8 |
| R8 | 902.375 | 902.375 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a2** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 85.4 | 114.0 | 114.0 | 85.4 | 94.0 | 94.0 | -9.8 | | 8.6 |
| R9 | 903.425 | 903.425 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a2** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 84.8 | 114.0 | 114.0 | 84.8 | 94.0 | 94.0 | -10.4 | | 9.2 |
| R10 | 903.425 | 903.425 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a2** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 85.7 | 114.0 | 114.0 | 85.7 | 94.0 | 94.0 | -9.5 | | 8.3 |
| R11 | SETUP | | OATSC | | | | | | A3C054339 SERIES | | | EMCOLOG | | | | CAB001 | RSFSV30001 | | | | NOTES: H-POL - FLAT, V-POL END Worst Case Orient | | | | | | | | |
| R12 | 902.375 | 902.375 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a3** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 91.3 | 114.0 | 114.0 | 91.3 | 94.0 | 94.0 | -3.9 | | 2.7 |
| R13 | 902.375 | 902.375 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a3** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 91.8 | 114.0 | 114.0 | 91.8 | 94.0 | 94.0 | -3.4 | | 2.2 |
| R14 | 903.425 | 903.425 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a3** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 90.1 | 114.0 | 114.0 | 90.1 | 94.0 | 94.0 | -5.1 | | 3.9 |
| R12 | 903.425 | 903.425 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a3** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 90.6 | 114.0 | 114.0 | 90.6 | 94.0 | 94.0 | -4.6 | | 3.4 |
| R13 | SETUP | | OATSC | | | | | | A3C054339 SERIES | | | EMCOLOG | | | | CAB001 | RSFSV30001 | | | | NOTES: H-POL - FLAT, V-POL END Worst Case Orient | | | | | | | | |
| R14 | 902.375 | 902.375 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a4** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 86.5 | 114.0 | 114.0 | 86.5 | 94.0 | 94.0 | -8.7 | | 7.5 |
| R15 | 902.375 | 902.375 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a4** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 87.0 | 114.0 | 114.0 | 87.0 | 94.0 | 94.0 | -8.2 | | 7.0 |
| R16 | 903.425 | 903.425 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a4** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 85.3 | 114.0 | 114.0 | 85.3 | 94.0 | 94.0 | -9.9 | | 8.7 |
| R17 | 903.425 | 903.425 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a4** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | 85.8 | 114.0 | 114.0 | 85.8 | 94.0 | 94.0 | -9.4 | | 8.2 |
| R18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| R19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| # | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | C19 | C20 | C21 | C22 | C23 | C24 | C25 | C26 | C27 | C28 | C29 |

| (ROW) | (COLUMN) | NOTE: |
|---|---|---|
| R0 | C5 | MR is Measurement Range, which is reduced from DR to achieve necessary SNR. |
| R0 | C6 | DR is the regulatory Desired Range measurement distance. |
| R0 | C7 | N/F is Near-Field / Far-Field distance computed for max of EUT Antenna Dimension (C10) computed above 1 GHz. |
| R0 | C8 | CF is computed using a 20 dB/decade Decay Rate. |
| R0 | C18/19 | When E-field or EIRP is reported directly from Spectrum Analyzer, Antenna Factors and Cable losses are included directly in SA settings and Pr is not reported. |

## 4.3 Unintentional Emissions

### 4.3.1 Transmit Chain Spurious Emissions

**Test Setup & Procedure** The test equipment and facilities were setup in accordance with the standards and procedures listed in Section 2.1. Environmental conditions were set at the appropriate temperature and thermal balance was checked with a thermocouple based probe. Spurious radiated emissions measurements are performed to 10 times the highest fundamental operating frequency. The test equipment employed includes RSFSV30001, LOGEMCO01, HQR1TO18S01.

**Measurement Results** The details and results of testing the EUT are summarized in Table 7.

Table 7: Transmit Chain Spurious Emissions.

**EUT Modes:** **a1** 5BTN CHROME, CW, Key In (WORST CASE HARM EMM)
**a5** Normal Operating (FSK Button Press)

**Test Date(s):** 02/11/20
**Test Engineer:** J. Brunett

| | Frequency | | Site | | | | | | EUT | | | Test Antenna | | | | Cable | Receiver | | | | Field Strength @ DR | | | | | | | | EIRP | | Details |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Start | Stop | Temp. | Table | MR | DR | N/F | CF | Mode | Volt. | Dim | Pol. | Ant. | Dim. | Ka | Kg | Rx Power | | Bandwidth | | Pk | | | QPk (<1GHz), Avg | | | | | | | |
| R0 | | | ( C ) | Angle | | | | | see | | | | Height | | | | Pk | Avg | RBW | VBW | Meas. | Limit | | | Calc. | Limit | | | Calc. | Limit | Pass |
| | | | Hum. | | | | | | | | | | | | | | | | | | | USA | CAN | | | USA | CAN | | | | Fail |
| | MHz | MHz | % | deg | m | | | dB | table | (V) | cm | H/V | m | cm | dB/m | dB | dBm | | MHz | | dBuV/m | | | | | | | | dBm | | dB |
| R1 | SETUP | | OATSC | | | | | | A3C054339 SERIES | | | EMCOLOG | | | | CAB001 | RSFSV30001 | | | | NOTES: H-POL - FLAT, V-POL END Worst Case Orient | | | | | | | | | | |
| R2 | 902.0 | 902.0 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a5** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | | | | 43.4 | 46.0 | 46.0 | | | | | 2.6 |
| R3 | 902.0 | 902.0 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a5** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.6 | -0.2 | | | 0.12 | 0.30 | | | | 43.6 | 46.0 | 46.0 | | | | | **2.4** |
| R4 | 928.0 | 928.0 | 5 / 48 | 0.0 | 3.0 | 3.0 | | 0.0 | **a5** | 3.0 | 8.0 | H | 1.0 | 100.0 | 22.9 | -0.2 | | | 0.12 | 0.30 | | | | 27.3 | 46.0 | 46.0 | | | | | 18.7 |
| R5 | 928.0 | 928.0 | 5 / 48 | 90.0 | 3.0 | 3.0 | | 0.0 | **a5** | 3.0 | 8.0 | V | 1.5 | 100.0 | 22.9 | -0.2 | | | 0.12 | 0.30 | | | | 27.5 | 46.0 | 46.0 | | | | | 18.5 |
| R6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| R7 | SETUP | | OATSC | | | | | | A3C054339 SERIES | | | HRNSINGQR | | | | CAB015 | RSFSV30001 | | | | NOTES: max all orientations of EUT, CH1 | | | | | | | | | | |
| R8 | 1804.8 | 1804.8 | 6 / 55 | all | 3.0 | 3.0 | 0.3 | 0.0 | **a1** | 3.0 | 4.0 | H/V | all | 15.0 | 27.2 | -3.5 | | | 1.00 | 3.00 | 34.2 | 74.0 | 74.0 | 34.2 | 54.0 | 54.0 | -61.0 | | 19.8 |
| R9 | 2707.1 | 2707.1 | 6 / 55 | all | 3.0 | 3.0 | 0.4 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 31.3 | -4.6 | | | 1.00 | 3.00 | 48.0 | 74.0 | 74.0 | 48.0 | 54.0 | 54.0 | -47.2 | | 6.0 |
| R10 | 3609.5 | 3609.5 | 6 / 55 | all | 3.0 | 3.0 | 0.5 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 31.9 | -5.6 | | | 1.00 | 3.00 | 35.5 | 74.0 | 74.0 | 35.5 | 54.0 | 54.0 | -59.7 | | 18.5 |
| R11 | 4511.9 | 4511.9 | 6 / 55 | all | 3.0 | 3.0 | 0.7 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 32.0 | -6.5 | | | 1.00 | 3.00 | 43.9 | 74.0 | 74.0 | 43.9 | 54.0 | 54.0 | -51.3 | | 10.1 |
| R12 | 5414.3 | 5414.3 | 6 / 55 | all | 3.0 | 3.0 | 0.8 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 32.5 | -7.4 | | | 1.00 | 3.00 | 38.8 | 74.0 | 74.0 | 38.8 | 54.0 | 54.0 | -56.4 | | 15.2 |
| R13 | 6316.6 | 6316.6 | 6 / 55 | all | 3.0 | 3.0 | 0.9 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 32.7 | -8.2 | | | 1.00 | 3.00 | 41.0 | 74.0 | 74.0 | 41.0 | 54.0 | 54.0 | -54.2 | | 13.0 |
| R14 | 7219.0 | 7219.0 | 6 / 55 | all | 3.0 | 3.0 | 1.1 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 33.3 | -9.0 | | | 1.00 | 3.00 | 41.7 | 74.0 | 74.0 | 41.7 | 54.0 | 54.0 | -53.5 | | 12.3 |
| R15 | 8121.4 | 8121.4 | 6 / 55 | all | 3.0 | 3.0 | 1.2 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 34.1 | -9.8 | | | 1.00 | 3.00 | 40.9 | 74.0 | 74.0 | 40.9 | 54.0 | 54.0 | -54.3 | | 13.1 |
| R16 | 9023.8 | 9023.8 | 6 / 55 | all | 3.0 | 3.0 | 1.4 | 0.0 | **a1** | 4.0 | 8.0 | H/V | all | 15.0 | 34.8 | -10.4 | | | 1.00 | 3.00 | 37.9 | 74.0 | 74.0 | 37.9 | 54.0 | 54.0 | -57.3 | | 16.1 |
| R17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| R18 | SETUP | | OATSC | | | | | | A3C054339 SERIES | | | HRNSINGQR | | | | CAB015 | RSFSV30001 | | | | NOTES: max all orientations of EUT, CH2 | | | | | | | | | | |
| R19 | 1806.9 | 1806.9 | 6 / 55 | all | 3.0 | 3.0 | 0.3 | 0.0 | **a1** | 3.0 | 4.0 | H/V | all | 15.0 | 27.2 | -3.5 | | | 1.00 | 3.00 | 35.2 | 74.0 | 74.0 | 35.2 | 54.0 | 54.0 | -60.0 | | 18.8 |
| R20 | 2710.3 | 2710.3 | 6 / 55 | all | 3.0 | 3.0 | 0.4 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 31.4 | -4.6 | | | 1.00 | 3.00 | 46.0 | 74.0 | 74.0 | 46.0 | 54.0 | 54.0 | -49.2 | | 8.0 |
| R21 | 3613.7 | 3613.7 | 6 / 55 | all | 3.0 | 3.0 | 0.5 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 31.9 | -5.6 | | | 1.00 | 3.00 | 35.5 | 74.0 | 74.0 | 35.5 | 54.0 | 54.0 | -59.7 | | 18.5 |
| R22 | 4517.1 | 4517.1 | 6 / 55 | all | 3.0 | 3.0 | 0.7 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 32.0 | -6.5 | | | 1.00 | 3.00 | 45.6 | 74.0 | 74.0 | 45.6 | 54.0 | 54.0 | -49.6 | | 8.4 |
| R23 | 5420.6 | 5420.6 | 6 / 55 | all | 3.0 | 3.0 | 0.8 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 32.5 | -7.4 | | | 1.00 | 3.00 | 39.2 | 74.0 | 74.0 | 39.2 | 54.0 | 54.0 | -56.0 | | 14.8 |
| R24 | 6324.0 | 6324.0 | 6 / 55 | all | 3.0 | 3.0 | 0.9 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 32.7 | -8.2 | | | 1.00 | 3.00 | 40.3 | 74.0 | 74.0 | 40.3 | 54.0 | 54.0 | -54.9 | | 13.7 |
| R25 | 7227.4 | 7227.4 | 6 / 55 | all | 3.0 | 3.0 | 1.1 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 33.3 | -9.0 | | | 1.00 | 3.00 | 41.0 | 74.0 | 74.0 | 41.0 | 54.0 | 54.0 | -54.2 | | 13.0 |
| R26 | 8130.8 | 8130.8 | 6 / 55 | all | 3.0 | 3.0 | 1.2 | 0.0 | **a1** | 3.0 | 8.0 | H/V | all | 15.0 | 34.1 | -9.8 | | | 1.00 | 3.00 | 41.1 | 74.0 | 74.0 | 41.1 | 54.0 | 54.0 | -54.1 | | 12.9 |
| R27 | 9034.3 | 9034.3 | 6 / 55 | all | 3.0 | 3.0 | 1.4 | 0.0 | **a1** | 4.0 | 8.0 | H/V | all | 15.0 | 34.8 | -10.5 | | | 1.00 | 3.00 | 39.2 | 74.0 | 74.0 | 39.2 | 54.0 | 54.0 | -56.0 | | 14.8 |
| R28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| # | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | C19 | C20 | C21 | C22 | C23 | C24 | C25 | C26 | C27 | C28 | C29 | | |

| (ROW) | (COLUMN) | NOTE: |
|---|---|---|
| R0 | C5 | MR is Measurement Range, which is reduced from DR to achieve necessary SNR. |
| R0 | C6 | DR is the regulatory Desired Range measurement distance. |
| R0 | C7 | N/F is Near-Field / Far-Field distance computed for max of EUT Antenna Dimension (C10) computed above 1 GHz. |
| R0 | C8 | CF is computed using a 20 dB/decade Decay Rate. |
| R0 | C18/19 | When E-field or EIRP is reported directly from Spectrum Analyzer, Antenna Factors and Cable losses are included directly in SA settings and Pr is not reported. |

### 4.3.2 Radiated Digital Spurious

The results for the measurement of digital spurious emissions are not reported herein as all digital emissions were greater than 20 dB below the regulatory limit. Radiation from digital components was measured to 4 GHz, or to five times the maximum digital component operating frequency, whichever is greater.

## 5 Measurement Uncertainty and Accreditation Documents

The maximum values of measurement uncertainty for the laboratory test equipment and facilities associated with each test are given in the table below. This uncertainty is computed for a 95.45% confidence level based on a coverage factor of $k = 2$.

Table 8: Measurement Uncertainty.

| Measured Parameter | Measurement Uncertainty† |
|---|---|
| Radio Frequency | $\pm(f_{Mkr}/10^7 + RBW/10 + (SPN/(PTS-1))/2 + 1\,\text{Hz})$ |
| Conducted Emm. Amplitude | $\pm 1.9\,\text{dB}$ |
| Radiated Emm. Amplitude $(30 - 200\,\text{MHz})$ | $\pm 4.0\,\text{dB}$ |
| Radiated Emm. Amplitude $(200 - 1000\,\text{MHz})$ | $\pm 5.2\,\text{dB}$ |
| Radiated Emm. Amplitude $(f > 1000\,\text{MHz})$ | $\pm 3.7\,\text{dB}$ |

†Ref: CISPR 16-4-2:2011+A1:2014


United States Department of Commerce
National Institute of Standards and Technology

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*is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:*

**Electromagnetic Compatibility & Telecommunications**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2019-06-28 through 2020-06-30
*Effective Dates*

*For the National Voluntary Laboratory Accreditation Program*







Figure 7: Accreditation Documents