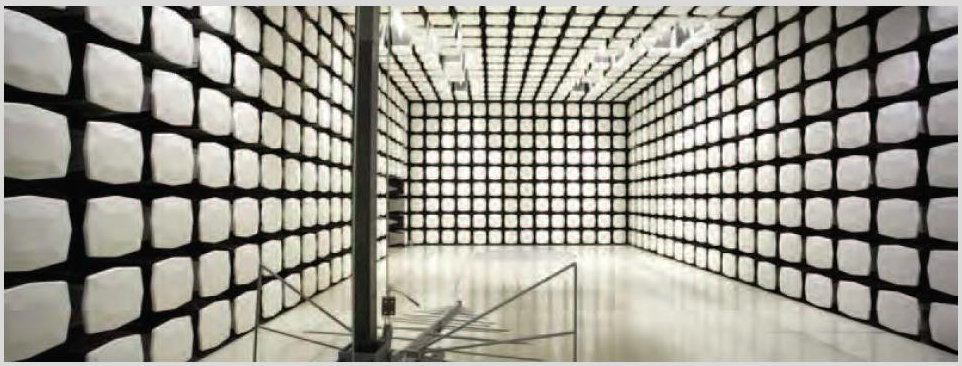
# Continental Automotive Systems Inc.

**RCKF2B**

**FCC 15.231:2021**

**Low Power Radio**

**Report: ONMS0001.1, Issue Date: April 16, 2021**



NVLAP LAB CODE: 200630-0

# CERTIFICATE OF TEST

**Last Date of Test: April 14, 2021**
**Continental Automotive Systems Inc.**
**EUT: RCKF2B**

## Radio Equipment Testing

### Standards

| Specification | Method |
|---|---|
| FCC 15.231:2021 | ANSI C63.10:2013 |

### Results

| Method Clause | Test Description | Applied | Results | Comments |
|---|---|---|---|---|
| 6.2 | Powerline Conducted Emissions (Transmitter) | No | N/A | Not required for battery powered equipment. |
| 6.5, 6.6 | Field Strength of Fundamental | Yes | Pass | |
| 6.5, 6.6 | Spurious Radiated Emissions | Yes | Pass | |
| 6.9.2 | Occupied Bandwidth | Yes | Pass | |
| 7.4e | Periodic Operation | No | N/A | Not required to test. If applicable, this is addressed by an attestation in the equipment theory of operation. |
| 7.5 | Duty Cycle | Yes | Pass | |

### Deviations From Test Standards

None

### Approved By:

*Kyle Holgate, Operations Manager*

***Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.***

# REVISION HISTORY

| Revision Number | Description | Date (yyyy-mm-dd) | Page Number |
|---|---|---|---|
| 00 | None | | |

# ACCREDITATIONS AND AUTHORIZATIONS

## United States

**FCC** - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

**A2LA** - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

**NVLAP** - Each laboratory is accredited by NVLAP to ISO 17025

## Canada

**ISED** - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

## European Union

**European Commission** – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

## Australia/New Zealand

**ACMA** - Recognized by ACMA as a CAB for the acceptance of test data.

## Korea

**MSIT / RRA** - Recognized by KCC's RRA as a CAB for the acceptance of test data.

## Japan

**VCCI** - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

## Taiwan

**BSMI** – Recognized by BSMI as a CAB for the acceptance of test data.

**NCC** - Recognized by NCC as a CAB for the acceptance of test data.

## Singapore

**IDA** – Recognized by IDA as a CAB for the acceptance of test data.

## Israel

**MOC** – Recognized by MOC as a CAB for the acceptance of test data.

## Hong Kong

**OFCA** – Recognized by OFCA as a CAB for the acceptance of test data.

## Vietnam

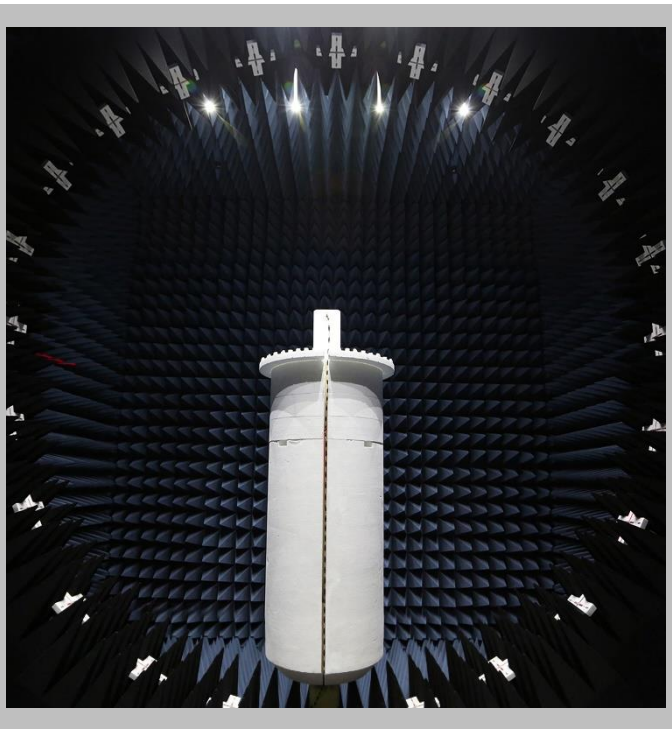
**MIC** – Recognized by MIC as a CAB for the acceptance of test data.

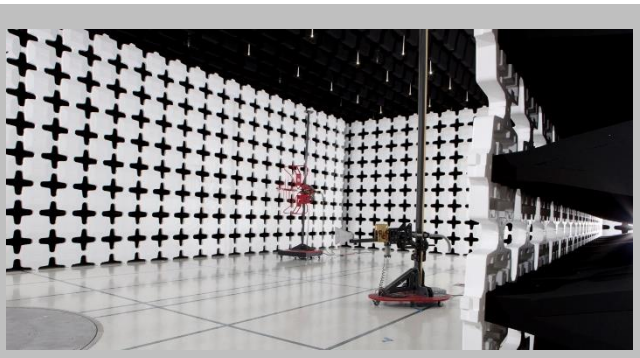
## SCOPE

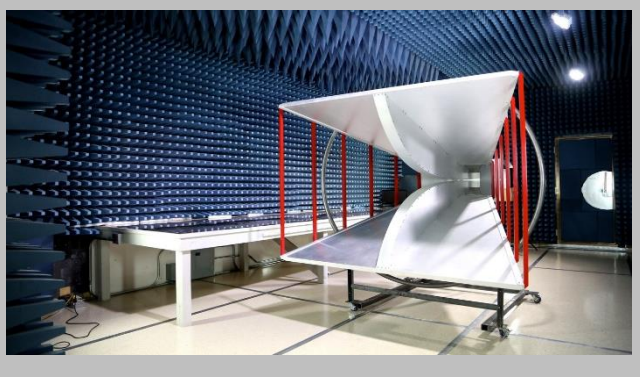
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

# FACILITIES

| California | Minnesota | Oregon | Texas | Washington |
|---|---|---|---|---|
| Labs OC01-17<br>41 Tesla<br>Irvine, CA 92618<br>(949) 861-8918 | Labs MN01-10<br>9349 W Broadway Ave.<br>Brooklyn Park, MN 55445<br>(612)-638-5136 | Labs EV01-12<br>6775 NE Evergreen Pkwy #400<br>Hillsboro, OR 97124<br>(503) 844-4066 | Labs TX01-09<br>3801 E Plano Pkwy<br>Plano, TX 75074<br>(469) 304-5255 | Labs NC01-05<br>19201 120th Ave NE<br>Bothell, WA 98011<br>(425)984-6600 |
| **NVLAP** | | | | |
| NVLAP Lab Code: 200676-0 | NVLAP Lab Code: 200881-0 | NVLAP Lab Code: 200630-0 | NVLAP Lab Code:201049-0 | NVLAP Lab Code: 200629-0 |
| **Innovation, Science and Economic Development Canada** | | | | |
| 2834B-1, 2834B-3 | 2834E-1, 2834E-3 | 2834D-1 | 2834G-1 | 2834F-1 |
| **BSMI** | | | | |
| SL2-IN-E-1154R | SL2-IN-E-1152R | SL2-IN-E-1017 | SL2-IN-E-1158R | SL2-IN-E-1153R |
| **VCCI** | | | | |
| A-0029 | A-0109 | A-0108 | A-0201 | A-0110 |
| **Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA** | | | | |
| US0158 | US0175 | US0017 | US0191 | US0157 |







# MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

## Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

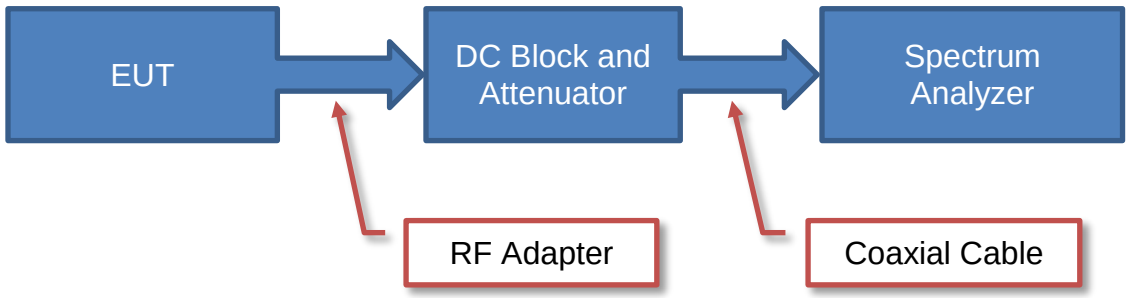
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

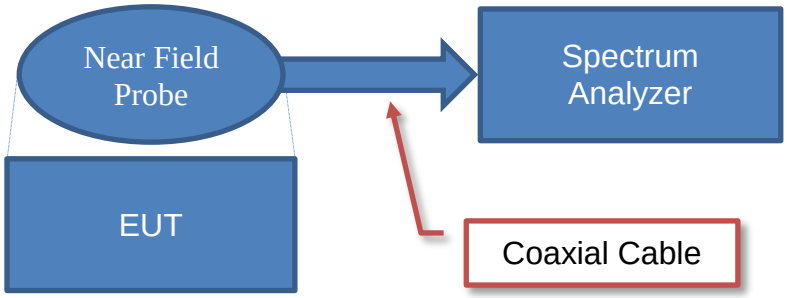
| Test | + MU | - MU |
|---|---|---|
| Frequency Accuracy | 0.0007% | -0.0007% |
| Amplitude Accuracy (dB) | 1.2 dB | -1.2 dB |
| Conducted Power (dB) | 1.2 dB | -1.2 dB |
| Radiated Power via Substitution (dB) | 0.7 dB | -0.7 dB |
| Temperature (degrees C) | 0.7°C | -0.7°C |
| Humidity (% RH) | 2.5% RH | -2.5% RH |
| Voltage (AC) | 1.0% | -1.0% |
| Voltage (DC) | 0.7% | -0.7% |
| Field Strength (dB) | 5.2 dB | -5.2 dB |
| AC Powerline Conducted Emissions (dB) | 2.6 dB | -2.6 dB |

# Test Setup Block Diagrams

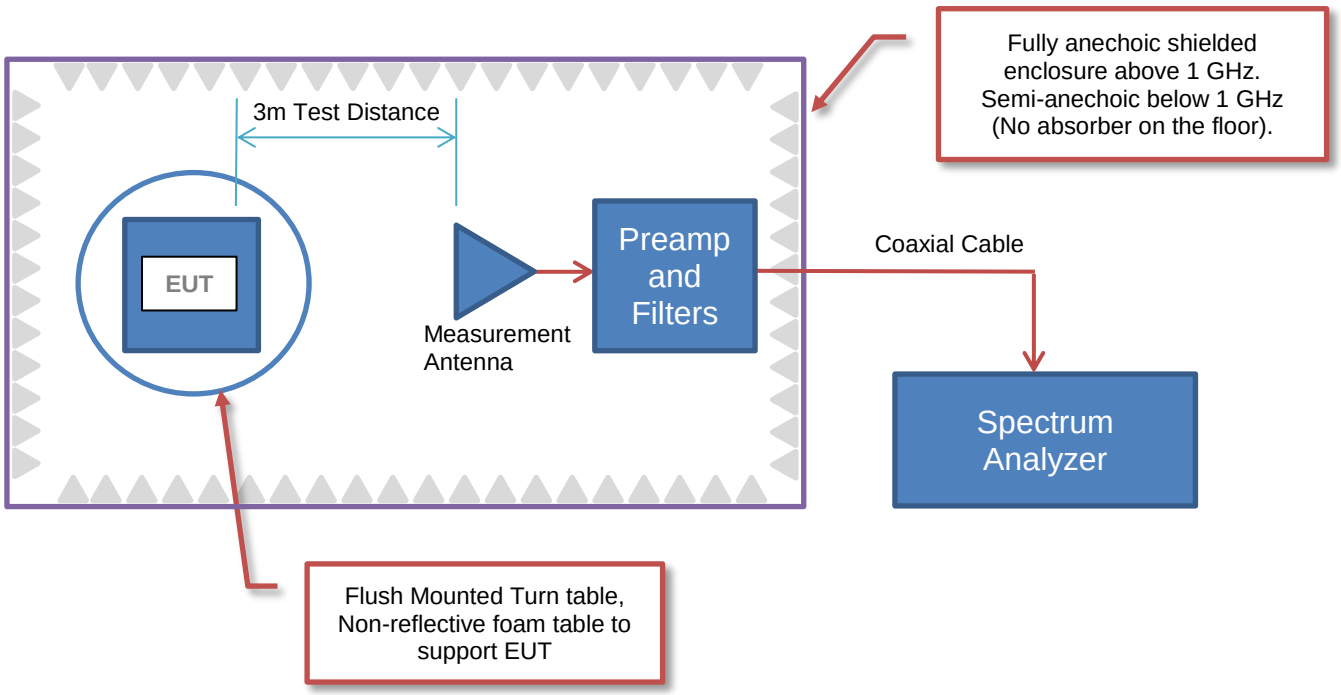
## Antenna Port Conducted Measurements




## Near Field Test Fixture Measurements




## Spurious Radiated Emissions



# PRODUCT DESCRIPTION

## Client and Equipment Under Test (EUT) Information

| | |
|---|---|
| **Company Name:** | Continental Automotive Systems Inc. |
| **Address:** | 4685 Investment Drive |
| **City, State, Zip:** | Troy, Michigan 48098 |
| **Test Requested By:** | Jacqueline Pinto of Continental Intelligent Transportation Systems |
| **EUT:** | RCKF2B |
| **First Date of Test:** | October 20, 2020 |
| **Last Date of Test:** | April 15, 2021 |
| **Receipt Date of Samples:** | October 7, 2020 |
| **Equipment Design Stage:** | Production |
| **Equipment Condition:** | No Damage |
| **Purchase Authorization:** | Verified |

## Information Provided by the Party Requesting the Test

| **Functional Description of the EUT:** |
|---|
| RCKF2B is a universal Remote Keyless Entry transmitter device. It is powered by 8 to 16 VDC from the vehicle. In use, this device is a standalone device that is installed inside a vehicle cabin. RCKF2B is controlled via a mobile application and connected to a mobile phone via Bluetooth. This device communicates with a vehicles access system via a wireless connection. |

| **Testing Objective:** |
|---|
| To demonstrate compliance to FCC 15.231 specifications. |

# CONFIGURATIONS

## Configuration ONMS0001- 1

| Software/Firmware Running during test | |
|---|---|
| **Description** | **Version** |
| RCKDiagnostic | Unknown |

| EUT | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model/Part Number** | **Serial Number** |
| Periodic and BLE radio | Continental Automotive Systems Inc. | RCKF2B | Engineering Sample #1 |

| Remote Equipment Outside of Test Setup Boundary | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model/Part Number** | **Serial Number** |
| iPod | Apple | A1574 | CCQVP29YGM18 |

| Cables | | | | | |
|---|---|---|---|---|---|
| **Cable Type** | **Shield** | **Length (m)** | **Ferrite** | **Connection 1** | **Connection 2** |
| DC Power | No | 2.0 m | No | Periodic and BLE radio | DC Power |

# CONFIGURATIONS

## Configuration ONMS0003- 2

| Software/Firmware Running during test | |
|---|---|
| **Description** | **Version** |
| RCKDiagnostic | Unknown |

| EUT | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model/Part Number** | **Serial Number** |
| Periodic and BLE radio | Continental Automotive Systems Inc. | RCKF2B | RCKF15-0521-E45F-BAA5 |

| Remote Equipment Outside of Test Setup Boundary | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model/Part Number** | **Serial Number** |
| iPod | Apple | A1574 | CCQVP29YGM18 |

| Cables | | | | | |
|---|---|---|---|---|---|
| **Cable Type** | **Shield** | **Length (m)** | **Ferrite** | **Connection 1** | **Connection 2** |
| DC Power | No | 2.0 m | No | Periodic and BLE radio | DC power supply |

# MODIFICATIONS

## Equipment Modifications

| Item | Date | Test | Modification | Note | Disposition of EUT |
|---|---|---|---|---|---|
| 1 | 2020-10-20 | Spurious Radiated Emissions | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 2 | 2020-10-23 | Duty Cycle | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 3 | 2020-10-23 | Occupied Bandwidth | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 4 | 2021-03-02 | Field Strength of Fundamental | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 5 | 2021-03-04 | Spurious Radiated Emissions | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 6 | 2021-04-12 | Field Strength of Fundamental | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 7 | 2021-04-12 | Spurious Radiated Emissions | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 8 | 2021-04-15 | Occupied Bandwidth | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | Scheduled testing was completed. |

# POWER SETTINGS AND ANTENNAS

The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information.

## ANTENNA GAIN (dBi)

| Type | Provided by: | Frequency Range (MHz) | Gain (dBi) |
|---|---|---|---|
| PCB Trace | Manufacturer | 434 | -11.2 |

The EUT was tested using the power settings provided by the manufacturer:

## SETTINGS FOR ALL TESTS IN THIS REPORT

| Frequency (MHz) | Modulation | Data Rate (kbps) | Power Setting |
|---|---|---|---|
| 433.92 | FSK | 4.096 | 0x71 |
| 433.92 | FSK | 9.600 | 0x5D |

# FIELD STRENGTH OF FUNDAMENTAL

PSA-ESCI 2020.06.24.2

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

**MODES OF OPERATION**

Continuous Tx, CW, 433.920 MHz

**POWER SETTINGS INVESTIGATED**

12 VDC

**CONFIGURATIONS INVESTIGATED**

ONMS0003 - 2

**FREQUENCY RANGE INVESTIGATED**

| | | | |
|---|---|---|---|
| Start Frequency | 433 MHz | Stop Frequency | 435 MHz |

**SAMPLE CALCULATIONS**

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

**TEST EQUIPMENT**

| Description | Manufacturer | Model | ID | Last Cal. | Cal. Due |
|---|---|---|---|---|---|
| Cable | N/A | Bilog Cables | EVA | 2020-11-17 | 2021-11-17 |
| Analyzer - Spectrum Analyzer | Keysight | N9010A | AFO | 2020-06-25 | 2021-06-25 |
| Antenna - Biconilog | EMCO | 3141 | AXG | 2019-07-23 | 2021-07-23 |

**TEST DESCRIPTION**

The antennas to be used with the EUT were tested. The EUT was configured for continuous un-modulated CW operation at its single transmit frequency. The field strength of the transmit frequency was maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT in 3 orthogonal planes (per ANSI C63.10:2013).

Peak measurements were made with a resolution bandwidth of 100 kHz and a video bandwidth of 300 kHz for measurements at or below 1 GHz. A duty cycle correction factor was added to the peak readings to mathematically derive the average levels. The supporting screen captures and duty cycle calculation is contained in the “Duty Cycle” module in this report.

# FIELD STRENGTH OF FUNDAMENTAL

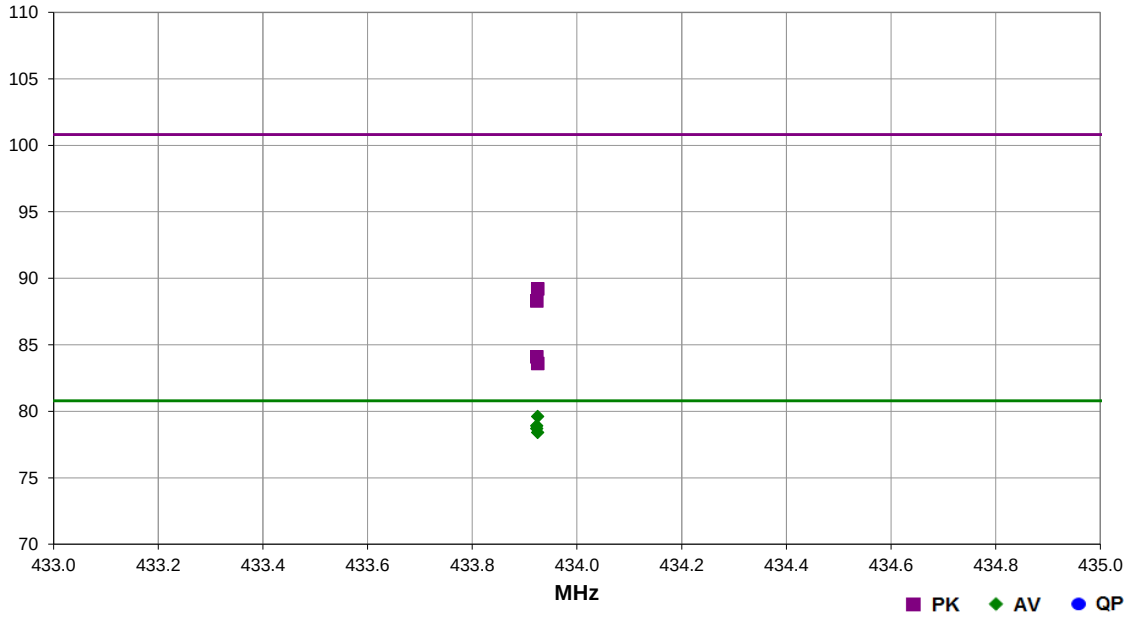
element

EmiR5 2021.01.08.0 PSA-ESCI 2021.03.17.0

| | | | | | |
|---|---|---|---|---|---|
| **Work Order:** | ONMS0003 | **Date:** | 2021-04-12 | | |
| **Project:** | None | **Temperature:** | 23 °C | | |
| **Job Site:** | EV01 | **Humidity:** | 27% RH | | |
| **Serial Number:** | See configuration | **Barometric Pres.:** | 1022 mbar | **Tested by:** | Jeff Alcoke |
| **EUT:** | RCKF2B | | | | |
| **Configuration:** | 2 | | | | |
| **Customer:** | Continental Automotive Systems Inc. | | | | |
| **Attendees:** | None | | | | |
| **EUT Power:** | 12 VDC | | | | |
| **Operating Mode:** | Continuous Tx, CW, 433.92 MHz | | | | |
| **Deviations:** | None | | | | |
| **Comments:** | Testing performed using worstcase orientations determined from pre-compliance testing.<br><br>Measurements at a power setting of 0x71 are associated with the NIS_BDL4_RKE 4.096 kbit/s data rate, which has a duty cycle of 33.162%. Measurements at a power setting of 0x5D are assocaited with the NIC_PASE_CMFB 9.600 kbits/s data rate which has a duty cycle of 55% | | | | |

| **Test Specifications** | **Test Method** |
|---|---|
| FCC 15.231:2021 | ANSI C63.10:2013 |

| **Run #** | 32 | **Test Distance (m)** | 3 | **Antenna Height(s)** | 1 to 4(m) | **Results** | Pass |
|---|---|---|---|---|---|---|---|




| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor (dB) | External Attenuation (dB) | Polarity/ Transducer Type | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 433.925 | 65.1 | 24.1 | 1.0 | 140.0 | -9.6 | 0.0 | Horz | AV | 0.0 | 79.6 | 80.8 | -1.2 | EUT Horz, Power setting = 0x71 |
| 433.923 | 60.0 | 24.1 | 1.0 | 140.0 | -5.2 | 0.0 | Horz | AV | 0.0 | 78.9 | 80.8 | -1.9 | EUT Horz, Power setting = 0x5D |
| 433.923 | 64.2 | 24.1 | 1.0 | 160.0 | -9.6 | 0.0 | Vert | AV | 0.0 | 78.7 | 80.8 | -2.1 | EUT Vert, Power setting = 0x71 |
| 433.925 | 59.5 | 24.1 | 1.0 | 157.0 | -5.2 | 0.0 | Vert | AV | 0.0 | 78.4 | 80.8 | -2.4 | EUT Vert, Power setting = 0x5D |
| 433.925 | 65.1 | 24.1 | 1.0 | 140.0 | 0.0 | 0.0 | Horz | PK | 0.0 | 89.2 | 100.8 | -11.6 | EUT Horz, Power setting = 0x71 |
| 433.923 | 64.2 | 24.1 | 1.0 | 160.0 | 0.0 | 0.0 | Vert | PK | 0.0 | 88.3 | 100.8 | -12.5 | EUT Vert, Power setting = 0x71 |
| 433.923 | 60.0 | 24.1 | 1.0 | 140.0 | 0.0 | 0.0 | Horz | PK | 0.0 | 84.1 | 100.8 | -16.7 | EUT Horz, Power setting = 0x5D |
| 433.925 | 59.5 | 24.1 | 1.0 | 157.0 | 0.0 | 0.0 | Vert | PK | 0.0 | 83.6 | 100.8 | -17.2 | EUT Vert, Power setting = 0x5D |

# SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2020.06.24.2

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

**MODES OF OPERATION**

Continuous Tx, FSK, 433.920 MHz

**POWER SETTINGS INVESTIGATED**

12 VDC

**CONFIGURATIONS INVESTIGATED**

ONMS0003 - 2

**FREQUENCY RANGE INVESTIGATED**

| | | | |
|---|---|---|---|
| Start Frequency | 30 MHz | Stop Frequency | 5000 MHz |

**SAMPLE CALCULATIONS**

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

**TEST EQUIPMENT**

| Description | Manufacturer | Model | ID | Last Cal. | Cal. Due |
|---|---|---|---|---|---|
| Analyzer - Spectrum Analyzer | Keysight | N9010A | AFO | 2020-06-25 | 2021-06-25 |
| Antenna - Biconilog | EMCO | 3141 | AXG | 2019-07-23 | 2021-07-23 |
| Antenna - Double Ridge | EMCO | 3115 | AHC | 2020-07-01 | 2022-07-01 |
| Amplifier - Pre-Amplifier | Miteq | AM-1616-1000 | AOL | 2020-11-17 | 2021-11-17 |
| Amplifier - Pre-Amplifier | Miteq | AMF-3D- | PAG | 2020-11-17 | 2021-11-17 |
| Cable | N/A | Bilog Cables | EVA | 2020-11-17 | 2021-11-17 |
| Cable | N/A | ble Ridge Horn Ca | EVB | 2020-11-17 | 2021-11-17 |
| Attenuator | Coaxicom | 3910-10 | AWX | 2021-02-15 | 2022-02-15 |
| Filter - Low Pass | Micro-Tronics | LPM50004 | LFD | 2021-02-15 | 2022-02-15 |
| Power Supply - DC | Topward | TPS-2000 | TPD | NCR | NCR |

**TEST DESCRIPTION**

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequency in each operational band and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Average Detector

A CISPR quasi-peak detector was used for measurements at or below 1 GHz. A PK and AV detector was used above 1 GHz, a resolution bandwidth of 1 MHz and a video bandwidth of 3 MHz was used.

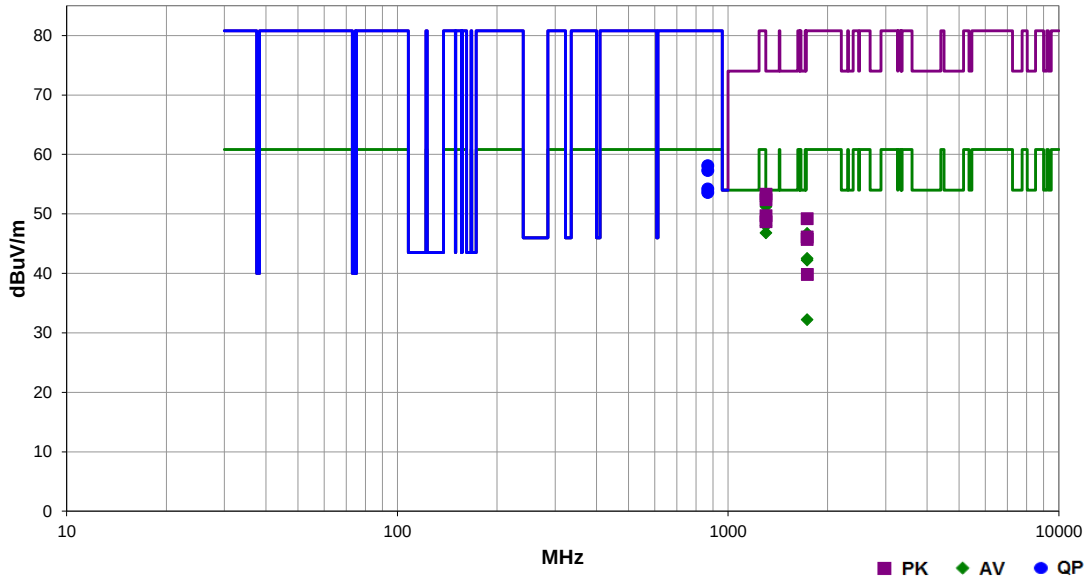
# SPURIOUS RADIATED EMISSIONS

EmiR5 2021.01.08.0 PSA-ESCI 2021.03.17.0

| | | | | | |
|---|---|---|---|---|---|
| **Work Order:** | ONMS0003 | **Date:** | 2021-04-12 | | |
| **Project:** | None | **Temperature:** | 23.2 °C | | |
| **Job Site:** | EV01 | **Humidity:** | 26% RH | | |
| **Serial Number:** | See Configuration | **Barometric Pres.:** | 1024 mbar | **Tested by:** | Jeff Alcoke |
| **EUT:** | RCKF2B | | | | |
| **Configuration:** | 2 | | | | |
| **Customer:** | Continental Automotive Systems Inc. | | | | |
| **Attendees:** | None | | | | |
| **EUT Power:** | 12 VDC | | | | |
| **Operating Mode:** | Continuous Tx, FSK, 433.920 MHz, 100% duty cycle | | | | |
| **Deviations:** | None | | | | |
| **Comments:** | Measurements performed using worst case orientation determined from pre-compliance testing. See comments below for EUT orientation, data rate, and power setting. | | | | |

| **Test Specifications** | **Test Method** |
|---|---|
| FCC 15.231:2021 | ANSI C63.10:2013 |

| **Run #** | 30 | **Test Distance (m)** | 3 | **Antenna Height(s)** | 1 to 4(m) | **Results** | Pass |
|---|---|---|---|---|---|---|---|




| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Test Distance (meters) | External Attenuation (dB) | Polarity/ Transducer Type | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1301.768 | 59.2 | -7.1 | 1.0 | 217.0 | 3.0 | 0.0 | Horz | AV | 0.0 | 52.1 | 54.0 | -1.9 | EUT Horz, 4.096 kbits/s, Power = 0x71 |
| 1301.768 | 58.3 | -7.1 | 1.16 | 24.0 | 3.0 | 0.0 | Vert | AV | 0.0 | 51.2 | 54.0 | -2.8 | EUT on Side, 4.096 kbits/s, Power = 0x71 |
| 1301.768 | 55.1 | -7.1 | 1.0 | 216.0 | 3.0 | 0.0 | Horz | AV | 0.0 | 48.0 | 54.0 | -6.0 | EUT Horz, 9.600 kbits/s, Power = 0x5D |
| 1301.768 | 53.9 | -7.1 | 1.16 | 24.0 | 3.0 | 0.0 | Vert | AV | 0.0 | 46.8 | 54.0 | -7.2 | EUT on Side, 9.600 kbits/s, Power = 0x5D |
| 1735.688 | 51.4 | -4.7 | 1.32 | 208.0 | 3.0 | 0.0 | Horz | AV | 0.0 | 46.7 | 60.8 | -14.1 | EUT Horz, 4.096 kbits/s, Power = 0x71 |
| 1735.688 | 47.2 | -4.7 | 1.32 | 208.0 | 3.0 | 0.0 | Horz | AV | 0.0 | 42.5 | 60.8 | -18.3 | EUT Horz, 9.600 kbits/s, Power = 0x5D |
| 1735.688 | 46.9 | -4.7 | 1.02 | 93.0 | 3.0 | 0.0 | Vert | AV | 0.0 | 42.2 | 60.8 | -18.6 | EUT on Side, 4.096 kbits/s, Power = 0x71 |
| 1301.702 | 60.4 | -7.1 | 1.0 | 217.0 | 3.0 | 0.0 | Horz | PK | 0.0 | 53.3 | 74.0 | -20.7 | EUT Horz, 4.096 kbits/s, Power = 0x71 |
| 1301.877 | 59.5 | -7.1 | 1.16 | 24.0 | 3.0 | 0.0 | Vert | PK | 0.0 | 52.4 | 74.0 | -21.6 | EUT on Side, 4.096 kbits/s, Power = 0x71 |
| 867.927 | 36.0 | 12.1 | 1.0 | 132.0 | 3.0 | 10.0 | Horz | QP | 0.0 | 58.1 | 80.8 | -22.7 | EUT Horz, 4.096 kbits/s, Power = 0x71 |
| 867.925 | 35.2 | 12.1 | 1.01 | 203.0 | 3.0 | 10.0 | Vert | QP | 0.0 | 57.3 | 80.8 | -23.5 | EUT on Side, 4.096 kbits/s, Power = 0x71 |
| 1301.993 | 56.8 | -7.1 | 1.0 | 216.0 | 3.0 | 0.0 | Horz | PK | 0.0 | 49.7 | 74.0 | -24.3 | EUT Horz, 9.600 kbits/s, Power = 0x5D |
| 1301.668 | 55.8 | -7.1 | 1.16 | 24.0 | 3.0 | 0.0 | Vert | PK | 0.0 | 48.7 | 74.0 | -25.3 | EUT on Side, 9.600 kbits/s, Power = 0x5D |
| 867.925 | 32.1 | 12.1 | 1.0 | 132.0 | 3.0 | 10.0 | Horz | QP | 0.0 | 54.2 | 80.8 | -26.6 | EUT Horz, 9.600 kbits/s, Power = 0x5D |
| 867.927 | 31.5 | 12.1 | 1.01 | 203.0 | 3.0 | 10.0 | Vert | QP | 0.0 | 53.6 | 80.8 | -27.2 | EUT on Side, 9.600 kbits/s, Power = 0x5D |
| 1735.688 | 36.9 | -4.7 | 1.02 | 93.0 | 3.0 | 0.0 | Vert | AV | 0.0 | 32.2 | 60.8 | -28.6 | EUT on Side, 9.600 kbits/s, Power = 0x5D |
| 1735.780 | 53.9 | -4.7 | 1.32 | 208.0 | 3.0 | 0.0 | Horz | PK | 0.0 | 49.2 | 80.8 | -31.6 | EUT Horz, 4.096 kbits/s, Power = 0x71 |
| 1735.447 | 50.8 | -4.7 | 1.32 | 208.0 | 3.0 | 0.0 | Horz | PK | 0.0 | 46.1 | 80.8 | -34.7 | EUT Horz, 9.600 kbits/s, Power = 0x5D |
| 1735.472 | 50.4 | -4.7 | 1.02 | 93.0 | 3.0 | 0.0 | Vert | PK | 0.0 | 45.7 | 80.8 | -35.1 | EUT on Side, 4.096 kbits/s, Power = 0x71 |
| 1736.088 | 44.5 | -4.7 | 1.02 | 93.0 | 3.0 | 0.0 | Vert | PK | 0.0 | 39.8 | 80.8 | -41.0 | EUT on Side, 9.600 kbits/s, Power = 0x5D |

# OCCUPIED BANDWIDTH

XMit 2020.03.25.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

**TEST EQUIPMENT**

| Description | Manufacturer | Model | ID | Last Cal. | Cal. Due |
|---|---|---|---|---|---|
| Antenna -Biconilog | EMCO | 3141 | AXG | 23-Jul-19 | 23-Jul-21 |
| Cable | N/A | Bilog Cables | EVA | 17-Nov-20 | 17-Nov-21 |
| Analyzer - Spectrum Analyzer | Agilent | N9010A | AFO | 25-Jun-20 | 25-Jun-21 |
| Power Supply - DC | Topward | TPS-2000 | TPD | NCR | NCR |

**TEST DESCRIPTION**

The EUT was transmitting at its maximum data rate.

The 20 dB occupied bandwidth is required to be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

# OCCUPIED BANDWIDTH

XMit 2020.03.25.0

| | | | | | |
|---|---|---|---|---|---|
| **EUT:** | **RCKF2B** | | | **Work Order:** | **ONMS0003** |
| **Serial Number:** | **RCKF15-0521-E45F-BAA5** | | | **Date:** | **15-Apr-21** |
| **Customer:** | **Continental Automotive Systems Inc.** | | | **Temperature:** | **23.7 °C** |
| **Attendees:** | **None** | | | **Humidity:** | **32.5% RH** |
| **Project:** | **None** | | | **Barometric Pres.:** | **1021 mbar** |
| **Tested by:** | **Jeff Alcoke** | **Power:** | **12 VDC** | **Job Site:** | **EV01** |

| **TEST SPECIFICATIONS** | **Test Method** |
|---|---|
| **FCC 15.231:2020** | ANSI C63.10:2013 |
| | |

**COMMENTS**

**The 20 dB limit is = 433.92 MHz * 0.0025 = 1.0848 MHz**

**DEVIATIONS FROM TEST STANDARD**

**None**

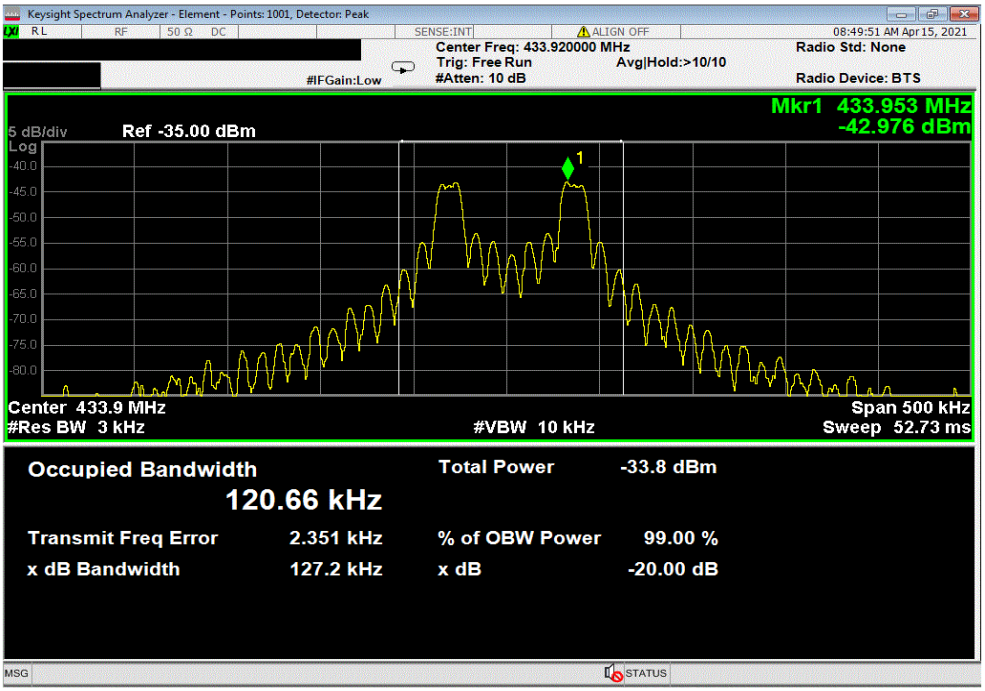
| **Configuration #** | **2** | *Signature* |
|---|---|---|

| | **Value (kHz)** | **Limit (kHz)** | **Result** |
|---|---|---|---|
| FSK, 433.92 MHz | | | |
| NIS_PASE_CMFB, 9.600 kbps | 127.2 | ≤ 1084.8 | Pass |
| NIS_BDL4_RKE, 4.069 kbps | 93.46 | ≤ 1084.8 | Pass |

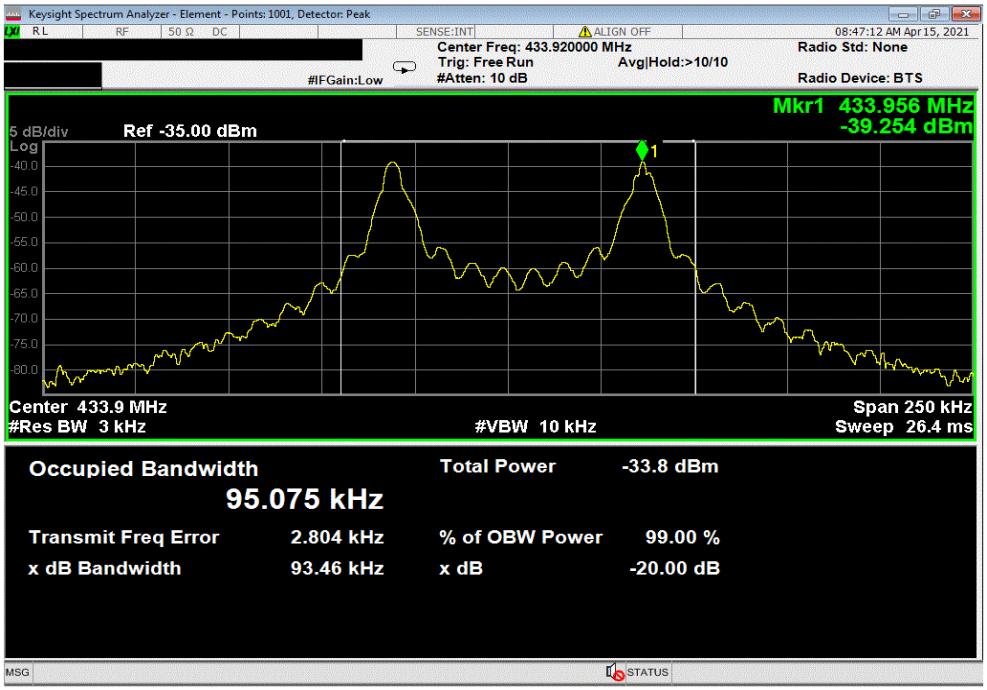
# OCCUPIED BANDWIDTH

XMit 2020.03.25.0

| FSK, 433.92 MHz, NIS_PASE_CMFB, 9.600 kbps | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (kHz) | Limit (kHz) | Result |
| | | | | 127.2 | ≤ 1084.8 | Pass |




| FSK, 433.92 MHz, NIS_BDL4_RKE, 4.069 kbps | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Value (kHz) | Limit (kHz) | Result |
| | | | | 93.46 | ≤ 1084.8 | Pass |



# DUTY CYCLE

XMit 2020.03.25.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

**TEST EQUIPMENT**

| Description | Manufacturer | Model | ID | Last Cal. | Cal. Due |
|---|---|---|---|---|---|
| Probe - Near Field Set | Com-Power | PS-400 | IPQ | NCR | NCR |
| Power Supply - DC | Topward | TPS-2000 | TPD | NCR | NCR |
| Cable | Micro-Coax | UFD150A-1-0720-200200 | EVK | 13-Mar-20 | 13-Mar-21 |
| Analyzer - Spectrum Analyzer | Agilent | N9010A | AFI | 13-Dec-19 | 13-Dec-20 |

**TEST DESCRIPTION**

For software controlled or pre-programmed devices, the manufacturer shall declare the duty cycle class or classes for the equipment under test. For manually operated or event dependent devices, with or without software controlled functions, the manufacturer shall declare whether the device once triggered, follows a pre-programmed cycle, or whether the transmission is constant until the trigger is released or manually reset. The manufacturer shall also give a description of the application for the device and include a typical usage pattern. The typical usage pattern as declared by the manufacturer shall be used to determine the duty cycle and hence the duty class.

Where an acknowledgement is required, the additional transmitter on-time shall be included and declared by the manufacturer.

To derive average emission measurements, a duty cycle correction factor was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where “On time” = N1L1 +N2L2 +….

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 +N2L2 +…)/100mS or T, whichever is less. (Where T is the period of the pulse train.)

The measured values for the EUT’s pulse train are as follows:

NIS_PASE_CMFB, 9.6 kbps:

Period = 100 mSec
Pulsewidth of Type 1 Pulse = 55 mSec
Number of Type 1 Pulses = 1

Duty Cycle Correction Factor = 20 log [((1)(55 mS) )/100 mSec] = -5.2 dB

NIS_BLD4_RKE, 4.096 kbps:

Period = 100 mSec
Pulsewidth of Type 1 Pulse = 33.162 mSec
Number of Type 1 Pulses = 1

Duty Cycle Correction Factor = 20 log [((1)(33.162 mS) )/100 mSec] = -9.6 dB

The duty cycle correction factor of -5.2 or -9.6 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

# DUTY CYCLE

XMit 2020.03.25.0

| | | | | | |
|---|---|---|---|---|---|
| **EUT:** | RCKF2B | | | **Work Order:** | ONMS0001 |
| **Serial Number:** | Engineering Sample #1 | | | **Date:** | 23-Oct-20 |
| **Customer:** | Continental Automotive Systems Inc. | | | **Temperature:** | 23.5 °C |
| **Attendees:** | None | | | **Humidity:** | 33.7% RH |
| **Project:** | None | | | **Barometric Pres.:** | 1017 mbar |
| **Tested by:** | Jeff Alcoke | **Power:** | 12 VDC | **Job Site:** | EV01 |

| **TEST SPECIFICATIONS** | **Test Method** |
|---|---|
| FCC 15.231:2020 | ANSI C63.10:2013 |
| | |

**COMMENTS**

None

**DEVIATIONS FROM TEST STANDARD**

None

| **Configuration #** | 1 | *Signature* |
|---|---|---|

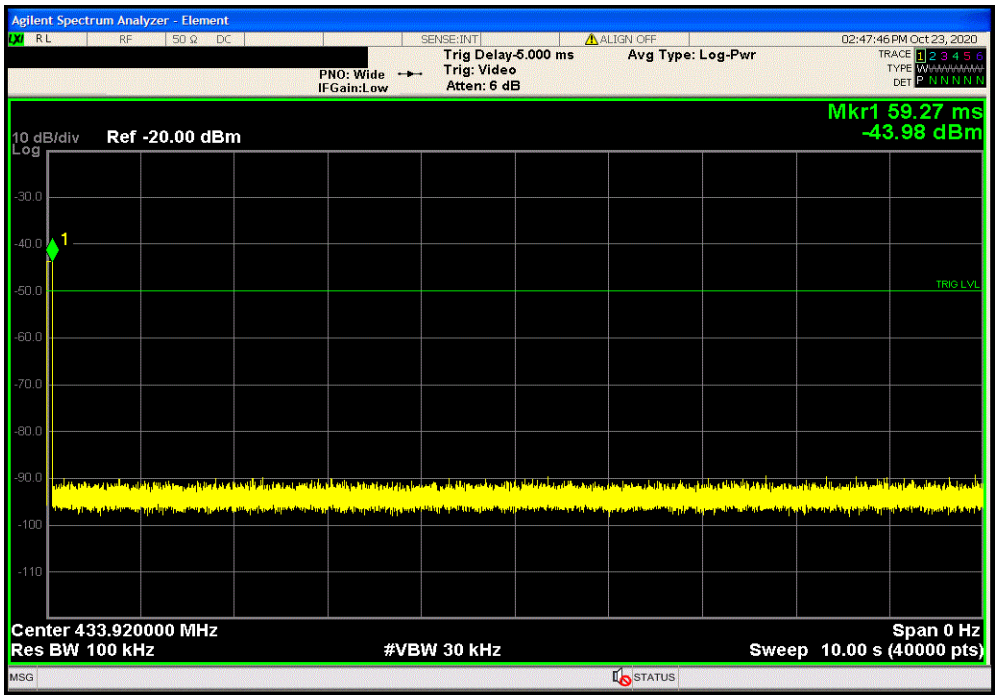
| | Pulse Width (ms) | Period (ms) | On Time in 100 ms (ms) | Result |
|---|---|---|---|---|
| FSK, 433.92 MHz | | | | |
| NIS_PASE_CMFB, 9.600 kbps | | | | |
| Sweep Time | | | | |
| 10s | - | - | - | - |
| 500ms | 55 | - | 55 | - |
| NIS_BDL4_RKE, 4.069 kbps | | | | |
| Sweep Time | | | | |
| 10s | - | - | - | - |
| 500ms | 31.162 | 102.072 | 31.162 | - |

# DUTY CYCLE

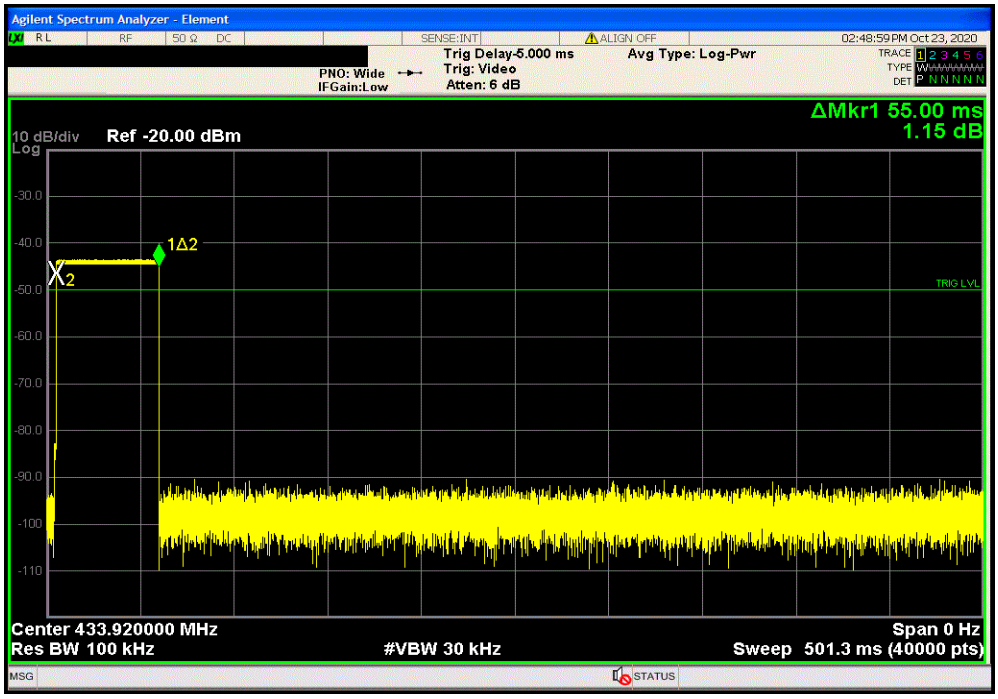
element

XMit 2020.03.25.0

| FSK, 433.92 MHz, NIS_PASE_CMFB, 9.600 kbps, Sweep Time, 10s | | | | | | |
|---|---|---|---|---|---|---|
| | | | Pulse Width (ms) | Period (ms) | On Time in 100 ms (ms) | Result |
| | | | - | - | - | - |



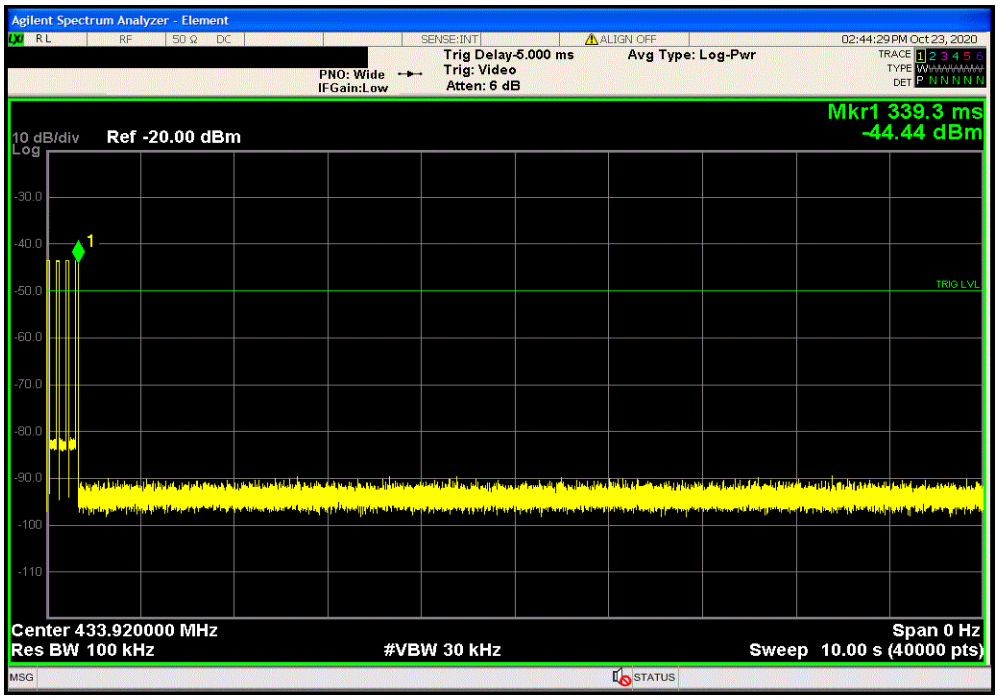

| FSK, 433.92 MHz, NIS_PASE_CMFB, 9.600 kbps, Sweep Time, 500ms | | | | | | |
|---|---|---|---|---|---|---|
| | | | Pulse Width (ms) | Period (ms) | On Time in 100 ms (ms) | Result |
| | | | 55 | - | 55 | - |



# DUTY CYCLE

XMit 2020.03.25.0

| FSK, 433.92 MHz, NIS_BDL4_RKE, 4.069 kbps, Sweep Time, 10s | | | | | | |
|---|---|---|---|---|---|---|
| | | | Pulse Width (ms) | Period (ms) | On Time in 100 ms (ms) | Result |
| | | | - | - | - | - |




| FSK, 433.92 MHz, NIS_BDL4_RKE, 4.096 kbps, Sweep Time, 500ms | | | | | | |
|---|---|---|---|---|---|---|
| | | | Pulse Width (ms) | Period (ms) | On Time in 100 ms (ms) | Result |
| | | | 31.162 | 102.072 | 31.162 | - |