

# Continental Automotive Systems Inc.

RCKF2B

FCC 15.231:2021

Low Power Radio

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



TESTING

NVLAP LAB CODE: 200630-0



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#### 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**



Revisior 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

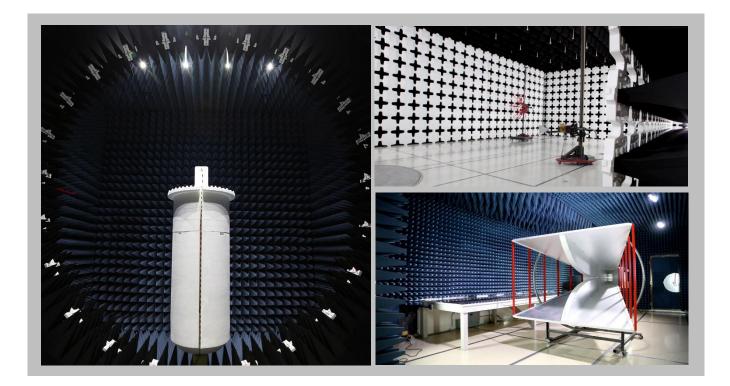
For details on the Scopes of our Accreditations, please visit: https://www.nwemc.com/emc-testing-accreditations

# **FACILITIES**





<b>California</b> Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	<b>Texas</b> Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 <sup>th</sup> Ave NE Bothell, WA 98011 (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**



#### **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.

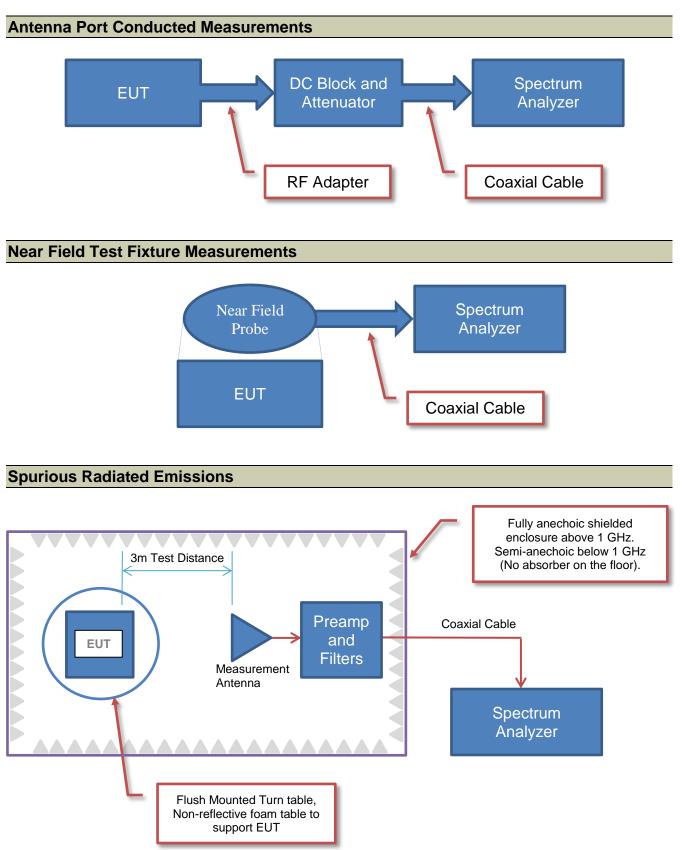
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable 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**





# **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	escription 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	Tested as delivered to	No EMI suppression devices were added or	EUT remained at Element following the
2	2020-10-23	Emissions Duty Cycle	Test Station. Tested as delivered to	modified during this test. No EMI suppression devices were added or	test. EUT remained at Element following the
			Test Station.	modified during this test.	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



Work Order:      ONNISS003      Date:      2021-04-12        Job Site:      EV01      Humdidy:      23°C      Job Site:      EV01        Serial Number:      See configuration      Barometric Pres:      1022 mbar      Tested by: Leff Alcoke        EUT:      RCKF2B      Configuration      Barometric Pres:      1022 mbar      Tested by: Leff Alcoke        Configuration      Z      Configuration      See configuration      See configuration        Configuration      Z      Configuration      See configuration      See configuration        Configuration      Z      Configuration      See configuration      See configuration        Comments:      Testing performed using worstcase orientations determined from pre-compliance testing.      None      See configuration        Comments:      Messurements at a power setting of 0x5D are associated with the NIC_PASE_CMFB 9.600 kbit/s data rate, which has a dut cycle of 55%.      See configuration      Ansi C63.10.2013        Run #      32      Test Distance (m)      3      Antenna Height(a)      1 to 4(m)      Results      Pass        010      G      G      G      G      G      G      G											EmiR5 2021.01.08.0	P	SA-ESCI 2021.03.17.
Job Site:      EV01      Humidity:      27% RH      Compare Mark        Serial Number:      See configuration      Barometric Press:      1022 mbar      Tested by: Leff Alcoke        Configuration:      2      Customer:      Configuration      EUT: RCKF28        Customer:      Configuration      Automotive Systems Inc.      Automotive Systems Inc.        Attendee:      None      EUT Powe:      12 VDC        Operating Mode:      Configurationus Tx, CW, 433.92 MHz      EUT Powe:      12 VDC        Operating Mode:      Continuous Tx, CW, 433.92 MHz      Measurements at a power setting of 0x71 are associated with the NIS_BDL4_RKE 4.096 kbit/s data rate, which has a dut cycle of 35.162%. Measurements at a power setting of 0x5D are associated with the NIC_PASE_CMFB 9.600 kbit/s data rate, which has a dut cycle of 55%.        Set Specifications      Configuration      Ansi C63.10.2013      Ansi C63.10.2013        100      Interview      Interview      Interview      Pass        101      Interview      Interview      Interview      Pass        102      Interview      Interview      Interview      Pass        103      Interview      Interview      Interview      Interview      I	W									-	1	1	-
Serial Number:  See configuration  Barometric Pres.:  1022 mbar  Tested by:  Leff Alcoke    Configuration:  2  Configuration:  2					Ten				( /	A	4		
EUT: RCKF2B      Configuration: 2      Customer: Continental Automotive Systems Inc.      Attendes: None      EUT Power:    12 VDC      Operating Mode      Comments:    None      Testing performed using worstcase orientations determined from pre-compliance testing.      Comments: at a power setting of 0x71 are associated with the NIS_BDL4, RKE 4.086 kbit/s data rate, which has a dut rate which has a duty cycle of 35%      Est Distance (m)    Test Method      ANSI C63.10:2013      Test Distance (m)    3    Antenna Height(S)    1 to 4(m)    Results    Pass      10      10      10      Antenna Height(S)    1 to 4(m)    Results    Pass      10      10      10      10      10      10      10      10      10      10      10      10    10 <td< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th><math>\bigcirc</math></th><th><math>\langle n \rangle</math></th><th>14,</th><th>182</th><th></th></td<>									$\bigcirc$	$\langle n \rangle$	14,	182	
Configuration: 2      Configuration: 2      Attendes: None      EUT Power:    12 VDC      Operating Mode      Ontinuous Tx, CW, 433.92 MHz      Deviations:      None      Testing performed using worstcase orientations determined from pre-compliance testing.      Comments:      Measurements at a power setting of 0x51 are associated with the NIC_PASE_CMFB 9.600 kbits/s data rate, which has a dut cycle of 33.162%. Measurements at a power setting of 0x50 are associated with the NIC_PASE_CMFB 9.600 kbits/s data rate, which has a dut cycle of 53%.      Test Distance (m) 3    Antenna Height(s)    1 to 4(m)    Results    Pass      10    Image: Test Distance (m) 3    Antenna Height(s)    1 to 4(m)    Results    Pass      10    Image: Test Distance (m) 3    Antenna Height(s)    1 to 4(m)    Results    Pass      10    Image: Test Distance (m) 3    Antenna Height(s)    1 to 4(m)    Results      10    Imaget	Seria			uration	Barome	etric Pres.:	102	2 mbar		Tested by:	Jeff Alcoke	9	
Customer   Continental Automotive Systems Inc.      Attendes: None      EUT Power:      Operating Mode      Continuous Tx, CW, 433.92 MHz      Deviations:      None      Testing performed using worstcase orientations determined from pre-compliance testing.      Comments:      Measurements at a power setting of 0x71 are associated with the NIS_BDL4, RKE 4.086 kbit/s data rate, which has a dut cycle of 35%.      Testing performed using worstcase orientations determined from pre-compliance testing.      Comments:      Measurements at a power setting of 0x71 are associated with the NIS_BDL4, RKE 4.086 kbit/s data rate, which has a dut cycle of 35%.      Test Distance (m)    3    Antenna Height(S)    1 to 4(m)    Results    Pass      100													
Attendess:    None      EUT Powe:    12 VDC      Operating Mode:    Continuous Tx, CW, 433.92 MHz      Deviations:    None      Testing performed using worstcase orientations determined from pre-compliance testing.      Comments:    Measurements at a power setting of 0x71 are associated with the NIS_BDL4_RKE 4.096 kbWs data rate, which has a dut cycle of 35%      Set Specifications    Test Method      Ansil C63.10.2013    Ansil C63.10.2013      Image: Test Distance (m)    3    Antenna Height(s)    1 to 4(m)    Results    Pass      Image: Test Distance (m)    3    Antenna Height(s)    1 to 4(m)    Results    Pass      Image: Test Distance (m)    3    Antenna Height(s)    1 to 4(m)    Results    Pass      Image: Test Distance (m)    3    Antenna Height(s)    1 to 4(m)    Results    Pass      Image: Test Distance (m)    3    Antenna Height(s)    1 to 4(m)    Results    Pass      Image: Test Distance (m)    3    Antenna Height(s)    1 to 4(m)    Results    Pass      Image: Test Distance (m)    3    Antenna Height(s)    1 to 4(m)    Results    Pass      Image: Test													
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Operating Mode:      Continuous Tx, CW, 433.92 MHz        Deviations:        None      Testing performed using worstcase orientations determined from pre-compliance testing.        Comments:        Measurements at a power setting of 0x71 are associated with the NIS_BDL4_RKE 4.096 kbit/s data rate, which has a dut cycle of 35.162%. Measurements at a power setting of 0x5D are associated with the NIC_PASE_CMFB 9.600 kbit/s data rate, which has a dut cycle of 35.5%        Test Method        Run #      32      Test Distance (m)      3      Antenna Height(s)      1 to 4(m)      Results      Pass        100      3      Antenna Height(s)      1 to 4(m)      Results      Pass        101      4      4      4      43.6													
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80    90    80    80    90    80    90 <td< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></td<>													
80    90    80    80    90    80    90 <td< th=""><th>95</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></td<>	95												
75    70    73.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      70    433.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      MHz    Pictor    Pictor    Pictor    Pictor    Pictor    Pictor    Pictor    Pictor    Adjusted    Spec. Limit    Compared to Spec.      Freq    Amplitude    Factor    Attenuation    Transduper    Detector    Adjusted    Spec. Limit    Compared to Spec.	00												
75    70    73.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      70    433.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      MHz    Pictor    Pictor    Pictor    Pictor    Pictor    Pictor    Pictor    Pictor    Adjusted    Spec. Limit    Compared to Spec.      Freq    Amplitude    Factor    Attenuation    Transduper    Detector    Adjusted    Spec. Limit    Compared to Spec.													
75    70    73.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      70    433.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      MHz    Pictor    Pictor    Pictor    Pictor    Pictor    Pictor    Pictor    Pictor    Adjusted    Spec. Limit    Compared to Spec.      Freq    Amplitude    Factor    Attenuation    Transduper    Detector    Adjusted    Spec. Limit    Compared to Spec.	80 -												
70    433.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      MHz    PK    + AV    • QP      Freq    Amplitude    Factor    Antenna    Azimuth    Duty Cycle Factor    External Attenuation    Polarity/ Transducer Type    Distance Adjustment    Adjusted    Spec. Limit    Spec.    Spec. </th <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th><b></b></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>							<b></b>						
70    433.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      MHz    PK    + AV    • QP      Freq    Amplitude    Factor    Antenna    Azimuth    Duty Cycle Factor    External Attenuation    Polarity/ Transducer Type    Distance Adjustment    Adjusted    Spec. Limit    Spec.    Spec. </th <th></th>													
433.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      MHz    MHz    MHz    434.4    434.6    434.8    436.0    • QP      Freq    Amplitude    Factor    Antenna    Azimuth    Duty Cycle Factor    External Attenuation    Polarity/ Transducer Type    Detector    Adjusted Adjusted    Adjusted Spec. Limit    Spec. Limit	75 -												
433.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      MHz    MHz    MHz    434.4    434.6    434.8    436.0    434.8    436.0    434.8    436.0    434.8    436.0 </th <th></th>													
433.0    433.2    433.4    433.6    433.8    434.0    434.2    434.4    434.6    434.8    435.0      MHz    MHz    MHz    434.4    434.6    434.8    436.0    434.8    436.0    434.8    436.0    434.8    436.0 </th <th></th>													
Freq    Amplitude    Factor    Antenna Height    Azimuth    Duty Cycle Correction Factor    Polarity/ Attenuation    Distance Type    Distance Adjusted    Distance Adjusted    Spec. Limit    Compared to Spec.				-									
Freq  Amplitude  Factor  Antenna Height  Azimuth  Duty Cycle Correction Factor  External Attenuation  Polarity/ Transducer Type  Detector  Distance Adjusted  Distance Adjusted  Spec. Limit  Compared to Spec.	433	3.0 4	33.2 43	3.4	433.6	433.8	434.0	434	.2 43	4.4 43	34.6	434.8	435.0
Freq  Amplitude  Factor  Antenna Height  Azimuth  Correction Factor  External Attenuation  Transducer Type  Distance Detector  Distance Adjusted  Distance  Compared to Spec. Limit							MHz	1			PK	♦ AV	o QP
Freq Amplitude Factor Height Azimuth Factor Attenuation Type Detector Adjustment Adjusted Spec. Limit Spec.													
	-			Height		Correction Factor	Attenuation	Transducer	Detector	Adjustment			

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Height (meters)	Azimuth (degrees)	Factor (dB)	Attenuation (dB)	Туре	Detector	Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Spec. (dB)	
(11112)	(0501)	(db/m)	(11101010)	(dog.000)	(35)	(00)			(00)	(dbd t/m)	(dbd f/m)	(02)	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



	ork Order:	ONMS	0003		Date:	2021-04-1	2		EmiR5 2021.01.08.0	PSA-ESCI 2021.0
VVC	Project:			Ter	nperature:	2021-04-1 23.2 °C	۷	1		111
	Job Site:			Ter	Humidity:	23.2 C	(	100	7 //	4
Soria	I Number:			Barama	etric Pres.:	1024 mba	-	Testad	by: Jeff Alcoke	
Sena		RCKF2B	guration	Daronne	enic Fres.:	1024 1108		Tested	Dy: Jell Alcoke	
Conf	iguration:									
0011	iguration.	2 Continental	Automotiv	o Suntama	Inc					
	ttendees:	Nono	Automotiv	e Systems	IIIC.					
	JT Power:									
	ing Mode:	O l'	Tx, FSK, 4	33.920 M	Hz, 100% duty	/ cycle				
D	eviations:	None								
Co	omments:				worst case or ower setting.	ientation deter	rmined from p	ore-complia	nce testing. See con	nments below
est Speci	ifications					Test	Method			
CC 15.23							I C63.10:201	3		
Run #	30	Test Dist	tance (m)	3	Antenna H	eight(s)	1 to 4	·(m)	Results	Pass
80										
70 -										
60										
60 -										
50 -										
50 -										
<sup>50</sup> 40 40										
<b>u/\/ngp</b> 40 - 30 -										
50 40 30 20				100			10			

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**



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**

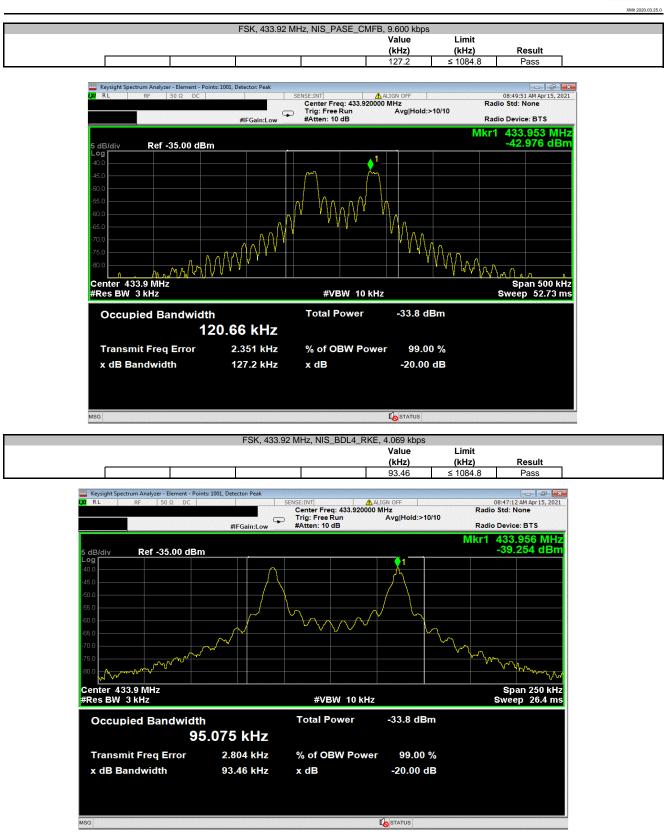


EUT-					
	RCKF2B		Work Order:	ONMS0003	
Serial Number:	RCKF15-0521-E45F-BAA5		Date:	15-Apr-21	
Customer:	Continental Automotive Systems Inc.		Temperature:	23.7 °C	
Attendees:	None		Humidity:	32.5% RH	
Project:	None		Barometric Pres.:	1021 mbar	
Tested by:	Jeff Alcoke	Power: 12 VDC	Job Site:	EV01	
TEST SPECIFICATIO	ONS	Test Method			
FCC 15.231:2020		ANSI C63.10:2013			
COMMENTS					
DEVIATIONS FROM	I TEST STANDARD				
DEVIATIONS FROM None	I TEST STANDARD				
	1 TEST STANDARD 2 Signature	Tet Me			
None	2	TA M	Value	Limit	
None	2	TA-M_	Value (kHz)	Limit (kHz)	Result
None Configuration #	2	TAT //			Result
None Configuration # FSK, 433.92 MHz	2	TA //			Result Pass

Report No. ONMS0001.1

### **OCCUPIED BANDWIDTH**







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

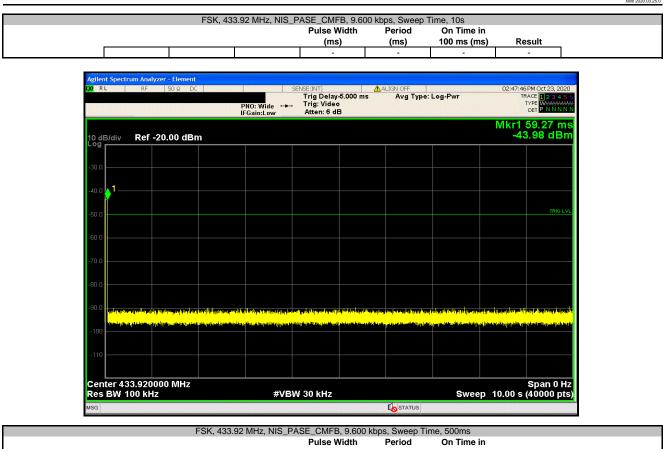
Duty Cycle Correction Factor = 20 log [((1)(33.162 mS) )/100 mSec] = -9.6 dB

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.



										XMit 2020.03.25.0
	RCKF2B								: ONMS0001	
	Engineering Sample #1								: 23-Oct-20	
Customer:	Continental Automotive	Systems Inc.						Temperature		
Attendees:									: 33.7% RH	
Project:								Barometric Pres.		
	Jeff Alcoke				Power:			Job Site	: EV01	
TEST SPECIFICAT	IONS					Test Method				
FCC 15.231:2020						ANSI C63.10:2013				
COMMENTS										
None										
DEVIATIONS FROM	M TEST STANDARD									
DEVIATIONS FROM None	M TEST STANDARD									
None					1	- <i>M</i>				
	1	s	Signature	Ja	Ģ					
None		s	lignature	Ta,	I a		Pulse Width	Period	On Time in	
None		s	Signature	Ja,	4		Pulse Width (ms)	Period (ms)	On Time in 100 ms (ms)	Result
None		S	Signature	Tæ,	4		Pulse Width (ms)			Result
None Configuration #	1	•	Signature	Jæ,	I d					Result
None Configuration #		kbps	Signature	Tæ	I a					Result
None Configuration #	1 NIS_PASE_CMFB, 9.600	kbps	Signature	J.a.	I a					Result
None Configuration #	1 NIS_PASE_CMFB, 9.600	kbps	Signature	Jæ,	4		(ms)	(ms)	100 ms (ms)	Result -
None Configuration #	1 NIS_PASE_CMFB, 9.600	kbps 10s 500ms	Signature	Ja	4		(ms) -	(ms)	100 ms (ms)	Result - -
None Configuration #	1 NIS_PASE_CMFB, 9.600 Sweep Time	kbps 9 10s 500ms pps	Signature	Tæ	I z		(ms) -	(ms)	100 ms (ms)	Result - -
None Configuration #	1 NIS_PASE_CMFB, 9.600 Sweep Time NIS_BDL4_RKE, 4.069 kb	kbps 9 10s 500ms pps	Signature	Tæ,	l d		(ms) -	(ms)	100 ms (ms)	Result - -
None Configuration #	1 NIS_PASE_CMFB, 9.600 Sweep Time NIS_BDL4_RKE, 4.069 kb	kbps 10s 500ms pps	lignature	Ja	<i>A</i> <sub>6</sub>		(ms) -	(ms) - -	100 ms (ms) - 55	Result - - -

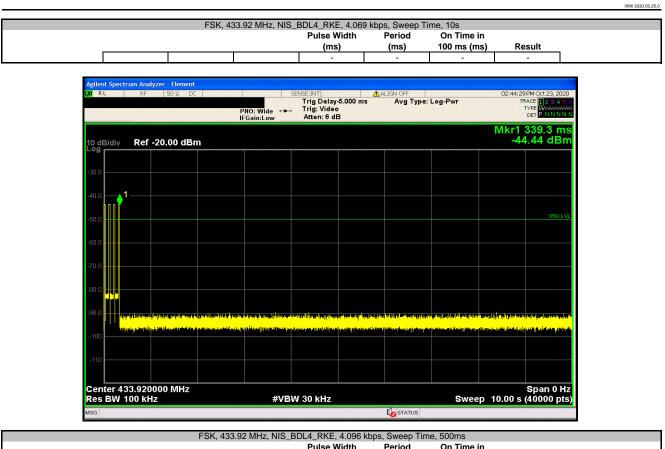




		Pulse Width	Period	On Time in	
		(ms)	(ms)	100 ms (ms)	Result
		55	-	55	-

RL	RF 50 Ω DC	PNO: Wi IFGain:L	de 🛶 Trig: Vid	ay-5.000 ms eo	ALIGN OFF Avg Type:	Log-Pwr	Т	PPM Oct 23, 202 RACE 1 2 3 4 5 TYPE WWWWA DET PNNNN
) dB/div R	ef -20.00 dBm						∆Mkr1	55.00 m 1.15 d
0.0								
3.0	1Δ2							
X2								TRIG L
0.0								
).0								
0.0								
0.0								
	a data da ana	Harlen Harrister and State	nalka sedhar kundula <mark>badu k</mark>	dina ang sa	n <mark>d halfalla ha dalari</mark>	anten petitisen <mark>dise</mark> t	entre la production de la constante de la const Constante de la constante de la c	atell, kelete
00	<mark>ptst test fishtes</mark>	<mark>degil (1997) and an </mark>	al nor that had the part	reality of the second	<mark>Man badaali</mark>	n an Ibertal and A	uolopeud devad	<mark>han han ba</mark> la
10								
enter 433.9 es BW 100	20000 MHz		#VBW 30 kHz			Swoon	501.3 ms	Span 0 H





	,	 Pulse Width	Period	On Time in	
		(ms)	(ms)	100 ms (ms)	Result
		31.162	102.072	31.162	-

	DC	SENSE:II		🔥 ALIGN OFF	A Strategic and strategic		PM Oct 23, 20
		Wide 🛶 Trig	g Delay-5.000 m g: Video :en: 10 dB	ıs Avg Ty	pe: Log-Pwr	TR	ACE 1234 YPE WUMANA DET PNNN
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