Amber Helm Development L.C.
92723 Michigan Hwy-152
Sister Lakes, Michigan 49047 USA
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APRT9-WR2313TX
Issued: **May 30, 2023**

Electromagnetic Emissions

regarding

USA: **CFR Title 47, Part 15.231** (Emissions)
Canada: **IC RSS-210/GENe** (Emissions)

for

FO3-TR903BDA

Category: Transceiver

Judgments:
15.231 / RSS-210v10 Compliant
Testing Completed: May 29, 2023

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

Aptiv Services US, LLC

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Date of Issue: May 30, 2023

Revision History

Rev. No.	Date	Details	Revised By
r0	May 30, 2023	Initial Release.	J. Brunett
r1	May 31, 2023	Corr. harm table.	J. Brunett
r2	June 6, 2023	Corr. model + bw typos.	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). Amber Helm Development L.C. holds accreditation under NVLAP Lab Code 200129-0.

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 June 2033.

1.3 Subcontracted Testing

This report does not contain data produced under subcontract.

1.4 Test Data

This test report contains data included within the laboratory's scope of accreditation. Any data in this report that is not covered under the laboratory's scope is clearly identified.

1.5 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.

1.6 Copyright

1.7 Endorsements

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

1.8 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

1.9 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-2023
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Keysight / Aug-2023
BNC-BNC Coax	WRTL / RG58/U	001	CAB001-BLACK	AHD / Sept-2023
3.5-3.5MM Coax	PhaseFlex / PhaseFlex	001	CAB015-PURP	AHD / Jun-2023
Spectrum Analyzer	R & S / FSV30	101660	RSFSV30001	RS / Apr-2024
Quad Ridge Horn	Singer / A6100	C35200	HQR1TO18S01	Keysight / Aug-2024

2 Test Specifications and Procedures

2.1 Test Specification and General Procedures

The goal of Aptiv Services US, LLC 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 Aptiv Services US, LLC FO3-TR903BDA for compliance to:

Country/Region	**Rules or Directive**	**Referenced Section(s)**
United States	Code of Federal Regulations	CFR Title 47, Part 15.231
Canada	ISED Canada	IC RSS-210/GENe

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"

3 Configuration and Identification of the Equipment Under Test

3.1 Description and Declarations

The equipment under test is an automotive Remote Keyless Entry and Passive Start transceiver. The EUT is approximately 4 x 4 x 20 cm (approx.) in dimension, and is depicted in Figure 1. It is powered by 13.5 VDC vehicle power system. In use, this device is permanently installed in a motor vehicle. Table 3 outlines provider declared EUT specifications.

Figure 1: Photos of EUT.

Table 3: EUT Declarations.

General Declarations	
Equipment Type:	Transceiver
Country of Origin:	Mexico
Nominal Supply:	13.5 VDC
Oper. Temp Range:	-40^{o}C to $+95^{o}$C
Frequency Range:	315 MHz Rx, 902.375, 903.425 MHz TRx
Antenna Dimension:	230 mm
Antenna Type:	metal frame (integral)
Antenna Gain:	Not Declared (Integral)
Number of Channels:	TRx 2
Channel Spacing:	TRx 1050 kHz
Alignment Range:	Not Declared
Type of Modulation:	TRx:OOK
United States	
FCC ID Number:	L2C0089TR
Classification:	DSC
Canada	
IC Number:	3432A-0089TR
Classification:	Remote Control Device

3.1.1 EUT Configuration

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

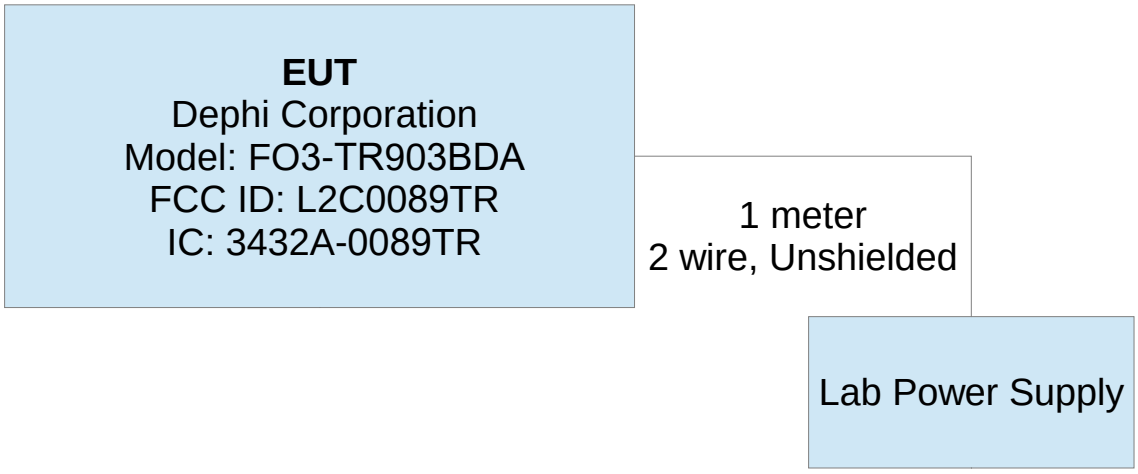

Figure 2: EUT Test Configuration Diagram.

3.1.2 Modes of Operation

There are two modes of operation for this device. This EUT employs 3 antennas, ANTENNA 1 is used for 315 MHz receive only (MODE 1), ANTENNA Main and ANTENNA Sub are used for both transmission and reception in the 902 MHz band (MODE 2). ANTENNA Main and ANTENNA Sub share a single transceiver path and are selected for use by an RF switch. In MODE 1, when the EUT receives a 315 MHz transmission via ANTENNA 1 it simply communicates over the vehicle bus. In MODE 2, When the EUT receives a transmission from a paired KEYFOB on either ANTENNA Main or ANTENNA Sub, the EUT automatically responds back on the detecting antenna indicating whether or not the request was received properly. This response is an automatic response consisting of a single transmitted frame responding on the same channel.

3.1.3 Variants

There is only a single variant of the EUT, as tested.

3.1.4 Test Samples

Seven samples in total were provided: four samples programmed for CW transmission in 4 configurations (e.g. low channel on Main antenna (SN:1837), low channel on Sub antenna (SN: 1835), high channel on Main antenna (SN: 1836), and high channels on Sub antenna (SN: 1834)), one normal transmitting sample with a paired KeyFob transmitter (SN: 1840), one sample modified for continuous Rx (SN: 1839), and one sample for photographs (SN: 1838).

3.1.5 Functional Exerciser

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.

3.1.7 Production Intent

The EUT appears to be a production ready sample.

3.1.8 Declared Exemptions and Additional Product Notes

Worst case (highest field strength) fundamental and harmonic emissions were observed on the continuous wave samples. The EUT is permanently installed in a transportation vehicle. As such, digital emissions are exempt from US and Canadian digital emissions regulations (per FCC 15.103(a) and IC correspondence on ICES-003). The 315 MHz receiver employed in this device is subject to SDoC, completed by the manufactuer.

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 1.8 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.

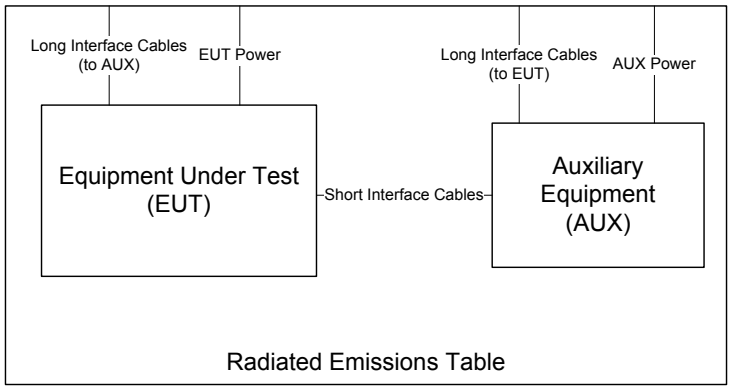

Figure 3: Radiated Emissions Diagram of the EUT.

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 regulation. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, 10cm diameter single-axis broadband probes meeting the requirements of ISED SPR-002 section 5.2 are employed. Measurements are repeated and summed over three axes, and the entire frequency range is measured with and without the EUT transmitting.

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 4×5 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 dBμV/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.

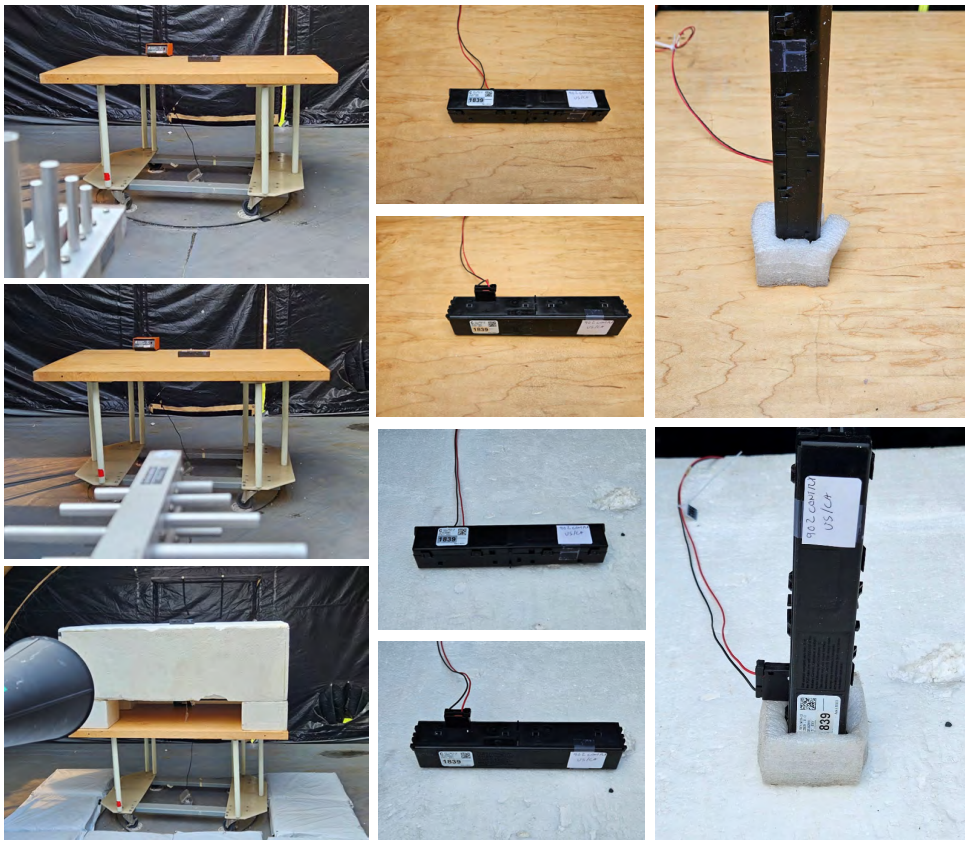

Figure 4: Radiated Emissions Test Setup Photograph(s).

4.1.2 Conducted Emissions Test Setup and Procedures

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.

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 RSFSV30001, 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:	28-May-23
Test Engineer:	J. Nantz
EUT:	Aptiv F03-TR903BDA
EUT Mode:	Normal Operating
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	903	Normal Operating subfigure (a)	single frame in response to automatic activation	1	1.00	18.74	1000.0	When automatically actuated by transmission from a paired remote start keyfob, the EUT transmits a single OOK (AM) data frame. The frame is 18.74 ms in duration, and the transmit frequency and antenna will be the same as that received by the FOB. OOK encoding has a 50% duty cycle.	9.4	-20.0
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10

Example Calculation: 9.4 ms / 100 ms = 9.4 % on-time.

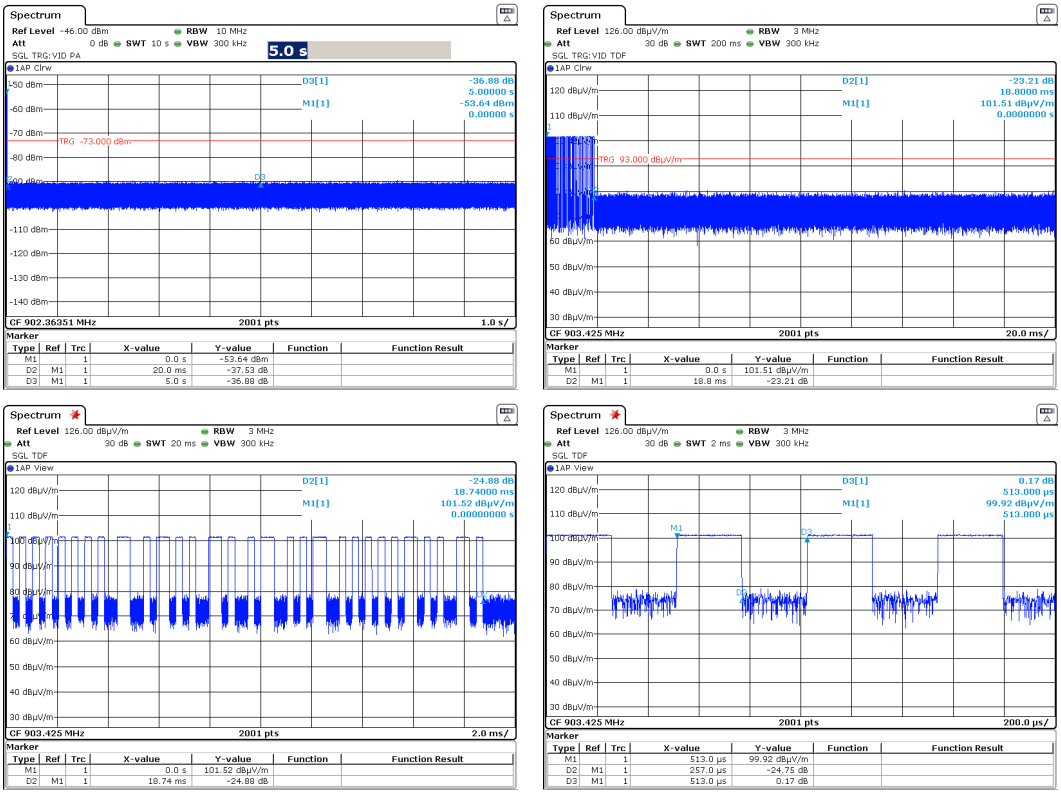

Figure 5: Fundamental Emission Pulsed Operation.

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	100 kHz

Test Date:	28-May-23
Test Engineer:	J. Nantz
EUT:	Aptiv F03-TR903BDA
EUT Mode:	Normal Operating
Meas. Distance:	10 cm

							FCC/IC
R0	Mode	Center Frequency (MHz)	20 dB EBW (MHz)	EBW Limit (MHz)	99% OBW (kHz)	Accum. 20dB OBW (MHz)	Pass/Fail
R1	CH1	903.43	0.052	4.512	110.944	0.099	PASS
R2	CH2	902.38	0.048		108.696		
R3							
#	C1	C2	C3	C4	C5	C7	C8

(ROW) (COLUMN) NOTE:

R0	C4	Worst case bandwidth used (0.5% of lowest channel frequency)
R1-R2	C7	Sum of all channels 20dB bandwidths per KDB Guidance 926416

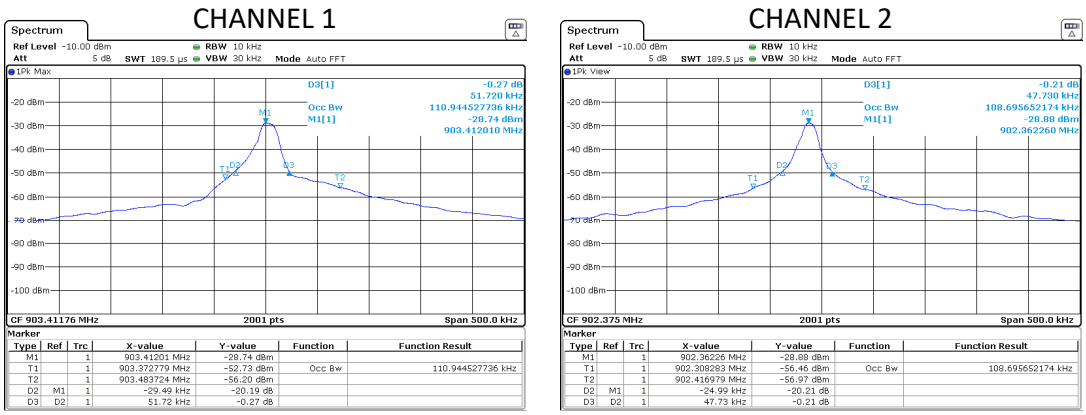

Figure 6: Fundamental Emission Bandwidth.

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 CW (SN: 1836) - Antenna Main, Channel 1 a5
a2 CW (SN: 1837) - Antenna Main, Channel 2 a6
Test Date(s): 05/27/23 a3 CW (SN: 1834) - Antenna Sub, Channel 1 a7
Test Engineer: J Nantz a4 CW (SN: 1835) - Antenna Sub, Channel 2 a8

	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 / Avg			Pk		
R0			(C)	Angle					see				Height				Pk	Avg	RBW	VBW	Meas.	Limit		Calc.	Limit		Calc.		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						Aptiv RTM 903			EMCOLOG				CAB001	RSFSV30001				H-POL - END, V-POL END Worst Case Orient								
R2	903.425	903.425	16/36	90.0	3.0	3.0		0.0	a1	13.5	20.0	H	1.0	100.0	22.6	-0.2			0.12	0.30	97.3	101.9	101.9	77.3	81.9	81.9	2.2		4.6
R3	903.425	903.425	16/36	180.0	3.0	3.0		0.0	a1	13.5	20.0	V	1.2	100.0	22.6	-0.2			0.12	0.30	98.3	101.9	101.9	78.3	81.9	81.9	3.2		3.6
R4	902.375	902.375	16/36	90.0	3.0	3.0		0.0	a2	13.5	20.0	H	1.0	100.0	22.6	-0.2			0.12	0.30	98.1	101.9	101.9	78.1	81.9	81.9	3.0		3.8
R5	902.375	902.375	16/36	180.0	3.0	3.0		0.0	a2	13.5	20.0	V	1.2	100.0	22.6	-0.2			0.12	0.30	98.4	101.9	101.9	78.4	81.9	81.9	3.3		3.5
R6	SETUP		OATSC						Aptiv RTM 903			EMCOLOG				CAB001	RSFSV30001				H-POL - FLAT, V-POL END Worst Case Orient								
R7	903.425	903.425	16/36	90.0	3.0	3.0		0.0	a3	13.5	20.0	H	1.0	100.0	22.6	-0.2			0.12	0.30	99.2	101.9	101.9	79.2	81.9	81.9	4.1		2.7
R8	903.425	903.425	16/36	180.0	3.0	3.0		0.0	a3	13.5	20.0	V	1.2	100.0	22.6	-0.2			0.12	0.30	98.9	101.9	101.9	78.9	81.9	81.9	3.8		3.0
R9	902.375	902.375	16/36	90.0	3.0	3.0		0.0	a4	13.5	20.0	H	1.0	100.0	22.6	-0.2			0.12	0.30	101.1	101.9	101.9	81.1	81.9	81.9	6.0		**0.8**
R10	902.375	902.375	16/36	180.0	3.0	3.0		0.0	a4	13.5	20.0	V	1.2	100.0	22.6	-0.2			0.12	0.30	97.0	101.9	101.9	77.0	81.9	81.9	1.9		4.9
R11																													
R12	Mode	Ant.	Freq.	DC Supply				Pr (Pk)																					
R13		Pol.	MHz	Voltage				dBm																					
R14	CW		902.38	9.0				3.0																					
R15	CW	H	902.38	13.5				3.1																					
R16	CW		902.38	16.0				3.0																					
R17																													
#	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	C17/18	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

The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 7.

Table 7: Transmit Chain Spurious Emissions.

EUT Modes: a1 Antenna Main - Max both channels (SN: 1836/1837) a5
a2 Antenna Sub - Max both channels (SN: 1834/1835) a6
Test Date(s): 05/27/23 a3 a7
Test Engineer: J. Nantz a4 a8

	Frequency		Site						EUT			Test Antenna				Cable	Receiver				Field Strength @ DR						EIRP		Details
	Start	Stop	Temp. (C) Hum.	Table Angle	MR	DR	N/F	CF	Mode see table	Volt.	Dim	Pol.	Ant. Height	Dim.	Ka	Kg	Rx Power Pk	Rx Power Avg	Bandwidth RBW	Bandwidth VBW	Pk Meas.	Pk Limit USA	Pk Limit CAN	Qpk / Avg Calc.	Qpk / Avg Limit USA	Qpk / Avg Limit CAN	Calc.		Pass Fail
R0	MHz	MHz	%	deg	m			dB		(V)	cm	H/V	m	cm	dB/m	dB	dBm		MHz		dBuV/m						dBm		dB
R1	SETUP		OATSC						Aptiv RTM 903			HQR1TO18S01				CAB018WHT	RSFSV30001				NOTES: MAX ALL ORIENTATIONS								
R2	1804.8	1806.9	16/ 34	all	3.0	3.0	0.3	0.0	a1	3.0	8.0	H/V	all	15.0	27.2	-0.8			1.00	3.00	59.5	74.0	74.0	39.5	54.0	54.0	-35.7		14.5
R3	2707.1	2710.3	16/ 34	all	3.0	3.0	0.4	0.0	a1	3.0	8.0	H/V	all	15.0	31.4	-0.9			1.00	3.00	65.6	74.0	74.0	45.6	54.0	54.0	-29.6		8.4
R4	3609.5	3613.7	16/ 34	all	3.0	3.0	0.5	0.0	a1	3.0	8.0	H/V	all	15.0	31.9	-1.0			1.00	3.00	57.5	74.0	74.0	37.5	54.0	54.0	-37.7		16.5
R5	4511.9	4517.1	16/ 34	all	3.0	3.0	0.7	0.0	a1	3.0	8.0	H/V	all	15.0	32.0	-1.2			1.00	3.00	56.1	74.0	74.0	36.1	54.0	54.0	-39.1		17.9
R6	5414.3	5420.6	16/ 34	all	3.0	3.0	0.8	0.0	a1	3.0	8.0	H/V	all	15.0	32.5	-1.3			1.00	3.00	55.8	74.0	74.0	35.8	54.0	54.0	-39.4		18.2
R7	6316.6	6324.0	16/ 34	all	3.0	3.0	0.9	0.0	a1	3.0	8.0	H/V	all	15.0	32.7	-1.4			1.00	3.00	56.2	74.0	74.0	36.2	54.0	54.0	-39.0		17.8
R8	7219.0	7227.4	16/ 34	all	3.0	3.0	1.1	0.0	a1	3.0	8.0	H/V	all	15.0	33.3	-1.5			1.00	3.00	56.6	74.0	74.0	36.6	54.0	54.0	-38.6		17.4
R9	8121.4	8130.8	16/ 34	all	3.0	3.0	1.2	0.0	a1	3.0	8.0	H/V	all	15.0	34.1	-1.6			1.00	3.00	57.0	74.0	74.0	37.0	54.0	54.0	-38.2		17.0
R10	9023.8	9034.3	16/ 34	all	3.0	3.0	1.4	0.0	a1	3.0	8.0	H/V	all	15.0	34.8	-1.8			1.00	3.00	57.4	74.0	74.0	37.4	54.0	54.0	-37.8		16.6
R11																													
R12	SETUP		OATSC						Aptiv RTM 903			HQR1TO18S01				CAB018WHT	RSFSV30001				NOTES: MAX ALL ORIENTATIONS								
R13	1804.8	1806.9	16/34	all	3.0	3.0	0.3	0.0	a2	3.0	8.0	H/V	all	15.0	27.2	-0.8			1.00	3.00	55.5	74.0	74.0	35.5	54.0	54.0	-39.7		18.5
R14	2707.1	2710.3	16/34	all	3.0	3.0	0.4	0.0	a2	3.0	8.0	H/V	all	15.0	31.4	-0.9			1.00	3.00	66.8	74.0	74.0	46.8	54.0	54.0	-28.4		**7.2**
R15	3609.5	3613.7	16/34	all	3.0	3.0	0.5	0.0	a2	3.0	8.0	H/V	all	15.0	31.9	-1.0			1.00	3.00	55.4	74.0	74.0	35.4	54.0	54.0	-39.8		18.6
R16	4511.9	4517.1	16/34	all	3.0	3.0	0.7	0.0	a2	3.0	8.0	H/V	all	15.0	32.0	-1.2			1.00	3.00	54.7	74.0	74.0	34.7	54.0	54.0	-40.5		19.3
R17	5414.3	5420.6	16/34	all	3.0	3.0	0.8	0.0	a2	3.0	8.0	H/V	all	15.0	32.5	-1.3			1.00	3.00	54.1	74.0	74.0	34.1	54.0	54.0	-41.1		19.9
R18	6316.6	6324.0	16/34	all	3.0	3.0	0.9	0.0	a2	3.0	8.0	H/V	all	15.0	32.7	-1.4			1.00	3.00	56.5	74.0	74.0	36.5	54.0	54.0	-38.7		17.5
R19	7219.0	7227.4	16/34	all	3.0	3.0	1.1	0.0	a2	3.0	8.0	H/V	all	15.0	33.3	-1.5			1.00	3.00	56.8	74.0	74.0	36.8	54.0	54.0	-38.4		17.2
R20	8121.4	8130.8	16/34	all	3.0	3.0	1.2	0.0	a2	3.0	8.0	H/V	all	15.0	34.1	-1.6			1.00	3.00	56.9	74.0	74.0	36.9	54.0	54.0	-38.3		17.1
R21	9023.8	9034.3	16/34	all	3.0	3.0	1.4	0.0	a2	3.0	8.0	H/V	all	15.0	34.8	-1.8			1.00	3.00	57.7	74.0	74.0	37.7	54.0	54.0	-37.5		16.3
R22																													
#	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	C17/18	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.
R0	C21	Values reported are the maximum of EUT emissions or background noise, whichever was highest.

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 ($f < 30\,\text{MHz}$)	$\pm 3.1\,\text{dB}$
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

NVLAP® ilac-MRA

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 200129-0

AHD (Amber Helm Development, L.C.)
Sister Lakes, MI

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 17025:2017. 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).

2022-06-28 through 2023-06-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

Figure 7: Accreditation Documents