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

EMC Test Report

BCSRX-WR1920RX
Issued: **November 6, 2019**

regarding

USA: CFR Title 47, Part 15.109 (Emissions)
Canada: ISED RSS-GEN (Verification) (Emissions)

for

340155

Category: Receiver

Judgments:
15.109 Compliant
Testing Completed: November 3, 2019

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

BCS Access Systems US LLC

34605 W 12 Mile Road, Farmington Hills Michigan 48331 USA
Phone: +1 (248) 699 4487, Fax: +1 (248) 699-4102
Contact: Mark Baker, mark.baker@bcs-abs.com

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

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

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

Date of Issue: November 6, 2019

Revision History

Rev. No.	Date	Details	Revised By
r0	November 6, 2019	Initial Release.	J. Brunett
r1	November 27, 2019	Include photos above 1 GHz.	J. Brunett

Contents

List of Tables

List of Figures

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 December 2029.

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 laboratories scope of accreditation.

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-2020
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Keysight / Aug-2020
BNC-BNC Coax	WRTL / RG58/U	001	CAB001-BLACK	AHD / Jul-2020
BNC-BNC Coax	WRTL / RG58/U	001	CAB002-BLACK	AHD / Jul-2020
3.5-3.5MM Coax	PhaseFlex / PhaseFlex	001	CAB015-PURP	AHD / Jul-2020
Spectrum Analyzer	R & S / FSV30	101660	RSFSV30001	RS / Apr-2021
Quad Ridge Horn	Singer / A6100	C35200	HQR1TO18S01	Keysight / Aug-2020

2 Test Specifications and Procedures

2.1 Test Specification and General Procedures

The goal of BCS Access Systems 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 BCS Access Systems US LLC 340155 for compliance to:

Country/Region	**Rules or Directive**	**Referenced Section(s)**
United States	Code of Federal Regulations	CFR Title 47, Part 15.109
Canada	ISED Canada	ISED RSS-GEN (Verification)

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

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

3 Configuration and Identification of the Equipment Under Test

3.1 Description and Declarations

The equipment under test is a superheterodyne receiver. The EUT is approximately 11 x 7 x 2 cm in dimension, and is depicted in Figure 1. It is powered by 13.4 VDC vehicular power system. In use, this device is permanently affixed inside a motor vehicle. Table 3 outlines provider declared EUT specifications.

Figure 1: Photos of EUT.

Table 3: EUT Declarations.

General Declarations	
Equipment Type:	Receiver
Country of Origin:	Not Declared
Nominal Supply:	13.4 VDC
Oper. Temp Range:	Not Declared
Frequency Range:	312.1, 314.35, 314.98 MHz
Antenna Dimension:	Not Declared
Antenna Type:	metal frame
Antenna Gain:	Not Declared
United States	
FCC ID Number:	GQ4-52R
Classification:	CYY
Canada	
IC Number:	RSS-GEN/CNR-GEN
Classification:	Remote Control Device, Vehicular Device

3.1.1 EUT Configuration

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

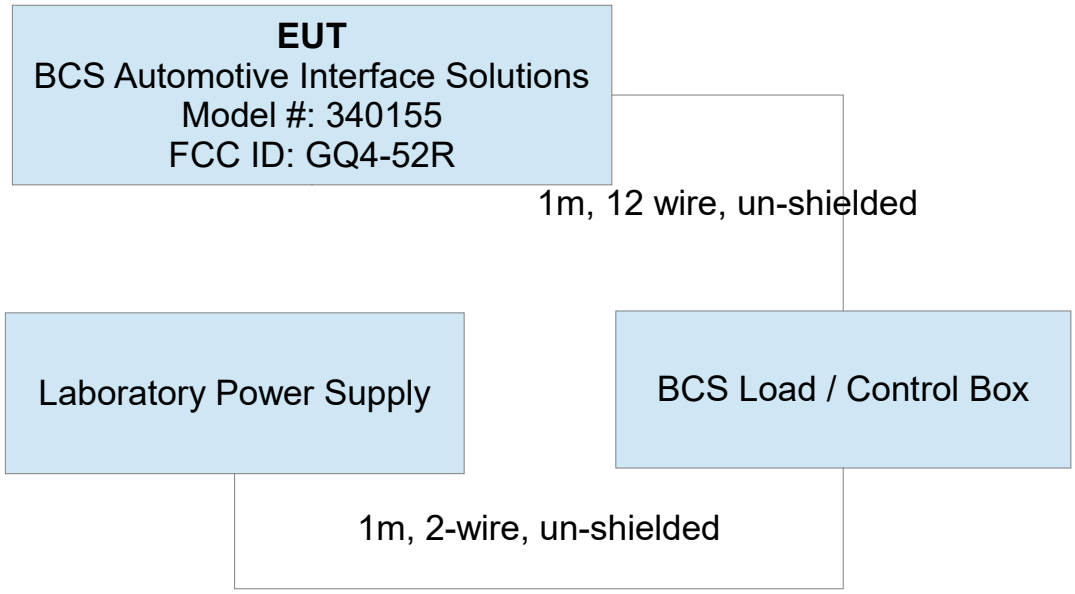

Figure 2: EUT Test Configuration Diagram.

3.1.2 Modes of Operation

The EUT employs two modes of operation, as a TPMS receiver (314.98 MHz) and as an RKE receiver (312.1 MHz and 314.35 MHz). Both modes were tested.

3.1.3 Variants

There is only a single variant of the EUT.

3.1.4 Test Samples

Two samples in total were provided, both of which were modified to keep the receiver awake.

3.1.5 Functional Exerciser

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

3.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory.

3.1.7 Production Intent

The EUT appears to be a production ready sample.

3.1.8 Declared Exemptions and Additional Product Notes

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).

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.

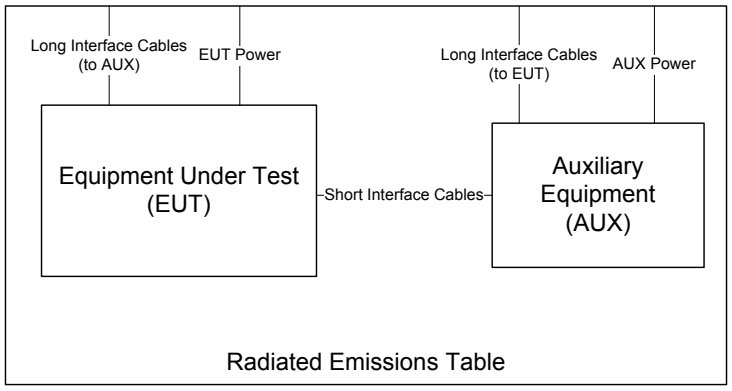

Figure 3: Radiated Emissions Diagram of the EUT.

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 regulations. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, the broadband probes employed are 10cm diameter single-axis shielded transducers and measurements are repeated and summed over three axes.

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. For both horizontal and vertical polarizations, the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected. The EUT is then rotated through 360^o in azimuth until the highest emission is detected. The test antenna is then raised and lowered one last time from 1 to 4 m and the worst case value is recorded. Emissions above 1 GHz are characterized using standard gain or broadband ridge-horn antennas on our OATS with a 4×5 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.

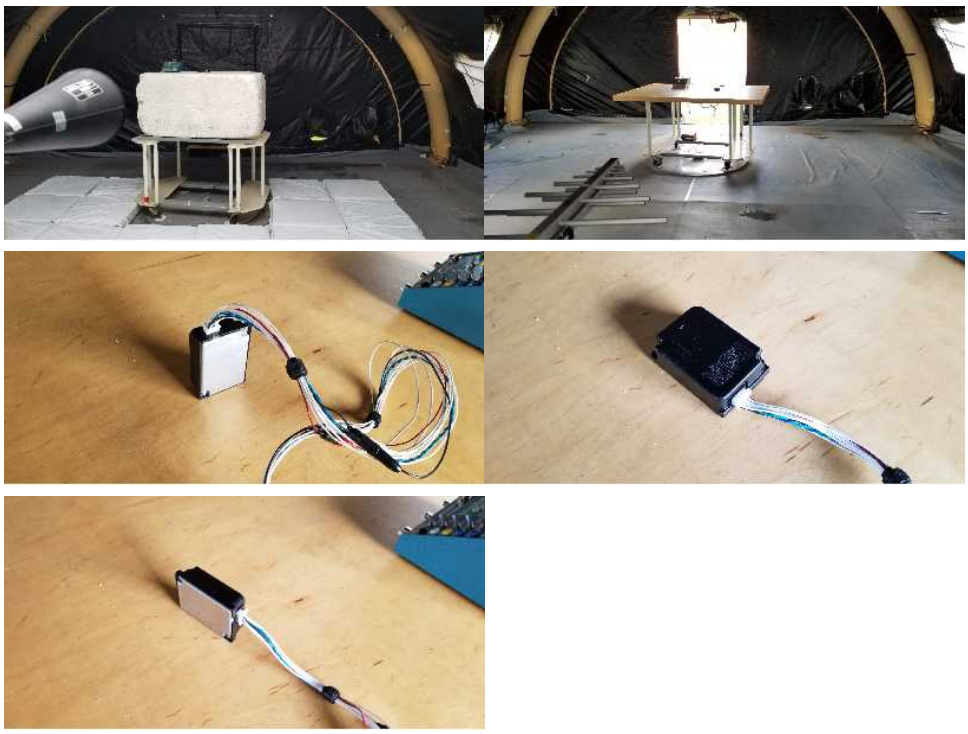

Figure 4: Radiated Emissions Test Setup Photograph(s).

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 Unintentional Emissions

4.2.1 Radiated Receiver Spurious

The results for the measurement of radiated receiver spurious emissions (emissions arising from the receiver chain, e.g. LO or VCO) at the nominal voltage and temperature are reported in Table 4. Receive chain emissions are measured to 5 times the highest receive chain frequency employed or 4 GHz, whichever is higher. If no emissions are detected, only those noise floor emissions at the LO/VCO frequency are reported.

Table 4: Receiver Chain Spurious Emissions $\geq$ 30 MHz.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz
f > 1 000 MHz	Pk/Avg	1 MHz	3 MHz

Test Date: 1-Nov-19
Test Engineer: J. Brunett
EUT: BCS Rx
EUT Mode: Awake (TPMS + RKE)
Meas. Distance: 3 meters

Transmitter Unintentional Spurious Emissions													FCC/IC
#	Freq. MHz	Ant. Used	Ant. Pol.	Table Azim. deg	Ant Height m	Ka dB/m	Kg dB	E3(Pk)** dBµV/m	E3 (Qpk) dBµV/m	FCC/IC E3lim (Pk) dBµV/m	FCC/IC E3lim (Avg) dBµV/m	Pass dB	Comments
1	301.40	LOGEMCO01	H	90.0	1.0	13.8	-3.6	21.1		66.0	46.0	24.9	max all, noise (RKE LO2)
2	301.40	LOGEMCO01	V	.0	1.3	13.8	-3.6	23.1		66.0	46.0	22.9	max all, noise (RKE LO2)
3	304.28	LOGEMCO01	H	90.0	1.0	13.8	-3.7	19.2		66.0	46.0	26.8	max all, noise (TPM LO)
4	304.28	LOGEMCO01	V	.0	1.3	13.8	-3.7	22.1		66.0	46.0	23.9	max all, noise (TPM LO)
5	325.05	LOGEMCO01	H	90.0	1.0	14.3	-3.8	20.8		66.0	46.0	25.2	max all, noise (RKE LO1)
6	325.05	LOGEMCO01	V	.0	1.3	14.3	-3.8	24.5		66.0	46.0	21.5	max all, noise (RKE LO1)
7	602.80	LOGEMCO01	H	90.0	1.5	19.1	-5.6	27.9		66.0	46.0	18.1	max all, noise
8	602.80	LOGEMCO01	V	.0	1.0	19.1	-5.6	27.0		66.0	46.0	19.0	max all, noise
9	608.56	LOGEMCO01	H	90.0	1.5	19.1	-5.6	28.4		66.0	46.0	17.6	max all, noise
10	608.56	LOGEMCO01	V	.0	1.0	19.1	-5.6	29.9		66.0	46.0	16.1	max all, noise
11	650.10	LOGEMCO01	H	90.0	1.5	19.7	-5.8	30.1		66.0	46.0	15.9	max all, background
12	650.10	LOGEMCO01	V	.0	1.0	19.7	-5.8	22.9		66.0	46.0	23.1	max all, noise
13	904.20	LOGEMCO01	H	90.0	1.3	22.6	-7.0	28.9		66.0	46.0	17.1	max all, background
14	904.20	LOGEMCO01	V	.0	1.0	22.6	-7.0	34.2		66.0	46.0	**11.8**	max all, background
15	912.84	LOGEMCO01	H	90.0	1.3	22.7	-7.1	33.9		66.0	46.0	12.1	max all, background
16	912.84	LOGEMCO01	V	.0	1.0	22.7	-7.1	31.0		66.0	46.0	15.0	max all, background
17	975.15	LOGEMCO01	H	90.0	1.3	23.6	-7.3	33.9		74.0	54.0	20.1	max all, background
18	975.15	LOGEMCO01	V	.0	1.0	23.6	-7.3	32.1		74.0	54.0	21.9	max all, background
19	1257.00	HQR1TO18S01	H/V	max all	1.5	32.8	-3.5	36.7		74.0	54.0	17.3	max all, noise
20	1372.00	HQR1TO18S01	H/V	max all	1.5	32.0	-3.7	37.4		74.0	54.0	16.6	max all, noise
21	1889.00	HQR1TO18S01	H/V	max all	1.5	30.1	-4.4	35.9		74.0	54.0	18.1	max all, noise
22	2200.00	HQR1TO18S01	H/V	max all	1.5	29.8	-4.8	35.6		74.0	54.0	18.4	max all, noise
23	2514.00	HQR1TO18S01	H/V	max all	1.5	30.0	-5.2	37.2		74.0	54.0	16.8	max all, noise
24	2828.00	HQR1TO18S01	H/V	max all	1.5	30.4	-5.5	38.1		74.0	54.0	15.9	max all, noise
25	3651.40	HQR1TO18S01	H/V	max all	1.5	31.5	-6.2	35.2		74.0	54.0	18.8	max all, noise

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 5: Measurement Uncertainty.

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

†Ref: CISPR 16-4-2:2011+A1:2014


United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

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 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

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

For the National Voluntary Laboratory Accreditation Program

Figure 5: Accreditation Documents