Amber Helm Development L.C.
92723 Michigan Hwy-152
Sister Lakes, Michigan 49047 USA
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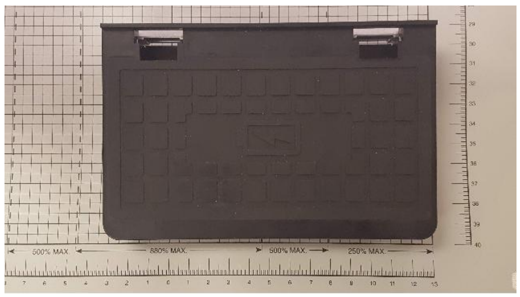
EMC Test Report

WACM2-1802251
Issued: **July 11, 2018**

regarding

USA:	**CFR Title 47, Part 18.305**	(Emissions)
Canada:	**ISED RSS-216**	(Emissions)

for



WACM2

Category: Part 18 Consumer ISM Equipment, RSS-216 Type 3, Cat 1

Judgements:
FCC Part 18 and ISED RSS-216 Compliant
Tested: June 28, 2018

TESTING No. 200129-0

Prepared for:

Delphi E.S. / Aptiv Serv. US

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Revision History

Rev. No.	Date	Details	Revised By
r0	July 11, 2018	Initial Release.	J. Brunett
r1	July 27, 2018	Additional table notes.	J. Brunett
r2	August 3, 2018	Update CISPR 11 Limits.	J. Brunett
r3	August 6, 2018	CISPR 11:2003 Limits.	J. Brunett
r4	August 9, 2018	Update EUT freq. range.	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: 90413) and with ISED Canada, Ottawa, ON (File Ref. No: IC3161). Amber Helm Development L.C. holds accreditation under NVLAP Lab Code 200129-0 and includes within its scope CFR Title 47 Part 15 Subparts B and C.

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 July 2028.

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

This report shall not be reproduced, except in full, without the written approval of Amber Helm Development L.C..

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.**, 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.

Table 1: Test Site List.

Description	Location	Quality Num.
OATS (3m & 10m)	92723 Michigan Hwy-152, Sister Lakes, Michigan 49047 USA	OATSA

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.	Last Cal By / Date Due
EMI Receiver	HP / 85460A/85462A	3704A00422, 3807A00465	HP8546A	Std and Cal / May-2019
Spectrum Analyzer	Rohde & Schwarz / FSV30	101660	RSFSV30001	RS / Apr-2019
(3m) RG8 Coax	CS-3227 / CS-3227	C060914	CS3227	AHD / Sept-2018
(3m) LMR-400 Coax	AHD / LMR400	C090804	LMR400	AHD / Sept-2018
(LCI) DS Coax	AHD / RG58/U	920809	RG58U	AHD / Jul-2018
Shielded Loop Antenna	EMCO / 6502	9502-2926	EMCOLOOP1	Lib. Labs. / Aug-2018

2 Test Specifications and Procedures

2.1 Test Specification and General Procedures

The ultimate goal of Delphi E.S. / Aptiv Serv. US 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 Delphi E.S. / Aptiv Serv. US WACM2 for compliance to:

Country/Region	**Rules or Directive**	**Referenced Section(s)**
United States	Code of Federal Regulations	CFR Title 47, Part 18.305
Canada	ISED Canada	ISED RSS-216

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 (USA)	"American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
MP-5:1986	"FCC Methods of Measuremens of Radio Noise Emissions from Industrial, Scientific, and Medical Equipement"
TP0102RA	"AHD Internal Document TP0102 - Radiated Emissions Test Procedure"
ISED Canada	"The Measurement of Occupied Bandwidth"

3 Configuration and Identification of the Equipment Under Test

3.1 Description and Declarations

The equipment under test is a wireless power transfer charger used in a motor vehicle. The EUT is approximately 16 x 11 x 3 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 the body of a motor vehicle. Table 3 outlines provider declared EUT specifications.

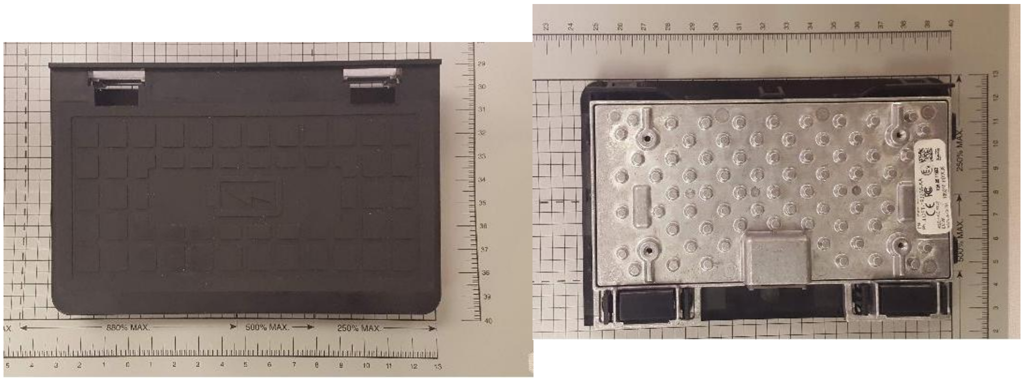


Figure 1: Photos of EUT.

Table 3: EUT Declarations.

General Declarations			
Equipment Type:	Part 18 Consumer ISM Equipment, RSS-216 Type 3, Cat 1	**Country of Origin:**	Not Declared
Nominal Supply:	13.4 VDC	**Oper. Temp Range:**	Not Declared
Frequency Range:	95 – 125 kHz	**Antenna Dimension:**	6 cm
Antenna Type:	coil	**Antenna Gain:**	Integral
Number of Channels:	1	**Channel Spacing:**	None
Alignment Range:	Not Declared	**Type of Modulation:**	CW
United States			
FCC ID Number:	L2C0074TR	**Classification:**	8CC
Canada			
IC Number:	3432A-0074TR	**Classification:**	WPT Device, Vehicle Device

3.1.1 EUT Configuration

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

3.1.2 Modes of Operation

This device is an OEM installed magnetic (inductive coupled) charger pad for use in a motor vehicle. It employs three charging coils (only one of which may be used at any given time) to transfer energy from itself to a compatible, portable receiving device placed in contact with the EUT surface. Emissions from each of the three coils employed are fully reported herein.

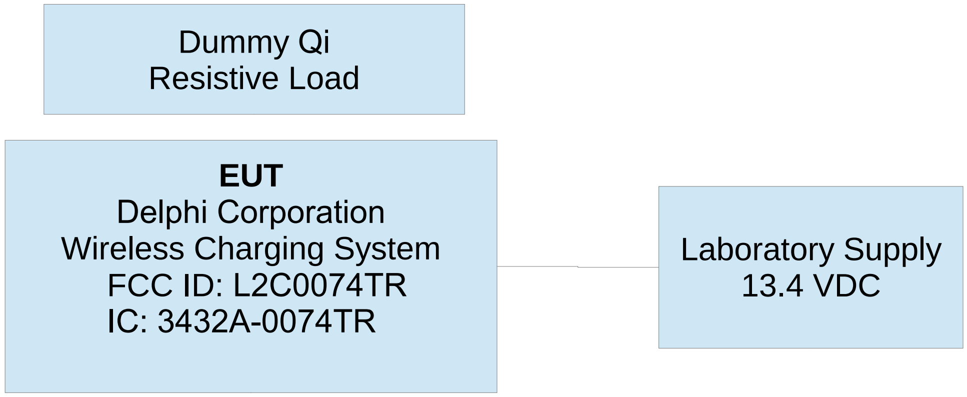


Figure 2: EUT Test Configuration Diagram.

3.1.3 Variants

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

3.1.4 Test Samples

Two samples were provided for testing; one sample for photographs and one normal operating sample. A dummy client load (paired Qi Texas Instruments client board) was provided to activate the device for testing over each coil. This load consists of a normal Qi client circuit with the battery load replaced by an equivalent resistive value. All rectification and regulation circuitry representative of client side loading was implemented.

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

The EUT uses load modulation on the power transfer frequency as part of its power management and control features. No other communication is employed by the EUT and no data is transferred to the client via the load modulation employed; no other frequencies are employed by the device. As such, this device qualifies for FCC certification under Part 18. ISED Canada has stated that all Qi protocol chargers are to be considered Type 2 devices, and as the EUT doesn't meet associated field strength limits by more than 40 dB, this product is treated as a Type 3, Category 1 WPT device, subject to certification under RSS-216. The operating frequency of the EUT is between 105 and 115 kHz, and per FCC Part 18.309(a) the range of frequency over which measurements are required is 9 kHz to 30 MHz. The EUT is permanently installed in a transportation vehicle. As such, digital emissions (emissions from digital circuitry not used in generating the charging frequency) are exempt from US and Canadian digital emissions regulations (per FCC 15.103(a) and ISED correspondence).

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.

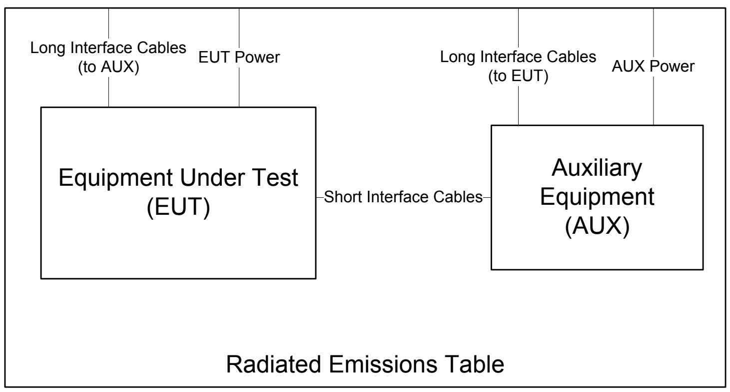


Figure 3: Radiated Emissions Diagram of the EUT.

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 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 Bandwidth

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. Radiated emissions are recorded following the test procedures listed in Section 2.1. 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 separately reported.The results of EBW testing are summarized in Table 4. Plots showing measurements employed to obtain the emission bandwidth reported are provided in Figure 5.

Table 4: Intentional Emission Bandwidth.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**		
9 kHz ≤ f ≤ 150 kHz	Pk	> 1% Span	>= 3 * IFBW	**Test Date:**	10-Jul-18
				Test Engineer:	Joseph Brunett
				EUT Mode:	Normal Operating
				Meas. Distance:	0.6 m
				EUT Tested:	Delphi WACM2

#	Operating Mode	Temp (C)	Supply (VDC)	Center Frequency (kHz)	20 dB EBW (Hz)	99% OBW (Hz)		
1	CHRG	20	13.4	0.1099	380	3337.0		
2	POL+SEN	20	13.4	0.1099	719	2717.0		

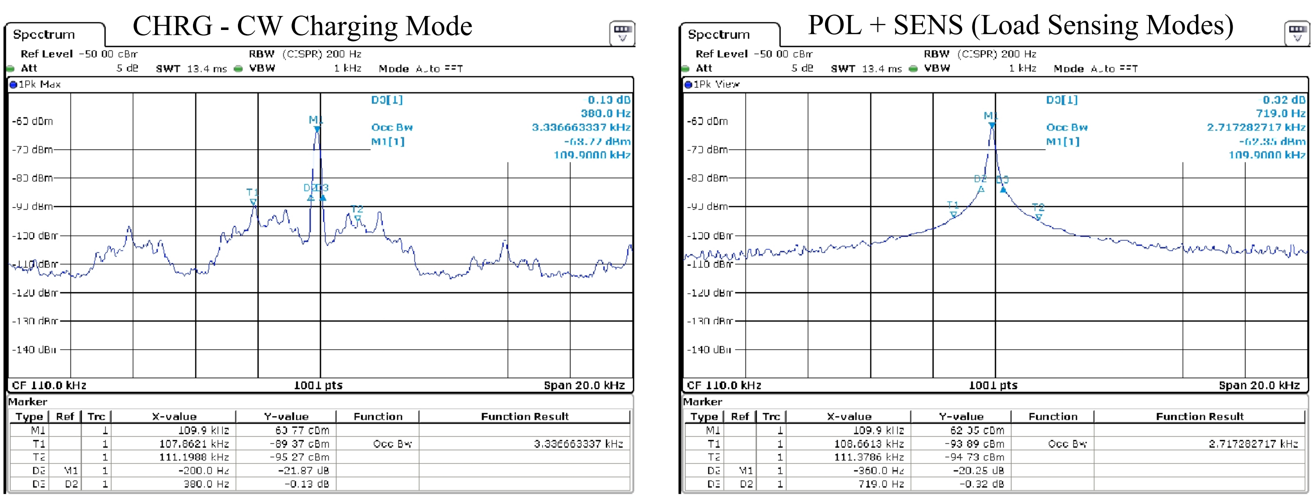


Figure 5: Intentional Emission Bandwidth.

4.2.2 Fundamental Emission

Following the test procedures listed in Section 2.1, field emissions measurements are made on the EUT for both Horizontal and Vertically polarized coupling fields. The EUT's loop antenna(s) are measured when the EUT loop axes are (1) aligned along the same axis as the test loop antenna and horizontal with respect to the test site ground plane, (2) aligned coplanar (in the same plane) with the test antenna and aligned horizontal with respect to the test site ground plane, and (3) aligned coplanar (in the same plane) with the test antenna and vertical with respect to the test site ground plane. Table 5 details the results of these measurements.

Table 5: Fundamental Radiated Emissions.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**
9 kHz ≤ f ≤ 150 kHz	Pk/QPk	200 Hz	300 Hz
150 kHz ≤ f ≤ 30 MHz	Pk/QPk	9 kHz	30 kHz

Test Date:	06/02/18
Test Engineer:	Gordon Helm
EUT Mode:	See Table
Meas. Distance:	3 meters
EUT Tested:	Delphi WACM2

Fundamental Emission Measurements

		EUT	Freq.	Ant.	Ant.**	Table	Ka	Kg	Cf***	E-field @ 3m		H-field @ 3m			E-field @ 300m				H-field @ 300m			
				Used	Height	Azim	(E)			Meas.	Calc.	Meas.		CISPR11 T3b Lim.	Calculated		RSS-GEN Lim.	Part18 Lim.	Calculated		RSS-GEN Lim.	
		Worst Case							3m / 300m	Pk	Avg*	Pk	Qpk	Qpk	Pk	Avg	Avg	Qpk	Pk	Qpk	Avg	
#	Mode	Orientation	MHz	QN	m	deg	dB/m	dB	dB	dBuV/m		dBuA/m			dBuV/m			dBuV/m	dBuA/m			Pass By***
1	Coil 1 CHRG	Coaxial	0.110	EMCOLOOP1	1.0	0	10.3	0.0	96.3	85.1	85.1	33.6		51.1	-11.2		26.8	23.5	-62.7		-24.7	17.5
2	Coil 2 CHRG	Coaxial	0.110	EMCOLOOP1	1.0	0	10.3	0.0	96.3	83.0	83.0	31.5		51.1	-13.3		26.8	23.5	-64.8		-24.7	19.6
3	Coil 3 CHRG	Coaxial	0.110	EMCOLOOP1	1.0	0	10.3	0.0	96.3	80.2	80.2	28.7		51.1	-16.1		26.8	23.5	-67.6		-24.7	22.4
4	Coil 1 POL+SEN	Coaxial	0.110	EMCOLOOP1	1.0	0	10.3	0.0	96.3	92.8	89.5	41.3		51.1	-3.5		26.8	23.5	-55.0		-24.7	**9.8**
5	Coil 2 POL+SEN	Coaxial	0.110	EMCOLOOP1	1.0	0	10.3	0.0	96.3	90.7	87.4	39.2		51.1	-5.6		26.8	23.5	-57.1		-24.7	11.9
6	Coil 3 POL+SEN	Coaxial	0.110	EMCOLOOP1	1.0	0	10.3	0.0	96.3	87.9	84.6	36.4		51.1	-8.4		26.8	23.5	-59.9		-24.7	14.7

Fundamental Emission Voltage Variation

#	Mode	Test Antenna Polarization	Freq. MHz	DC Supply Voltage	E-field dBuV/m
10	Coil 2 CHRG	max all	0.110	15.20	83.0
11			0.110	13.40	83.0
12			0.110	11.50	83.0

* Average computed from Peak data using Duty Cycle as computed in Duty Cycle section of this report.
** Emissions were evaluated at 1m and 2m test antenna height, and 1 meter was determined to be worst case for all orientations. Table height of 80cm was employed.

*** Per Part 18.305(note 2) / RSS-GEN 6.5, EUT field decay rate may be measured over a range of distances and used to determine CF between measurement and limit distance. Alternatively, 20 dB/dec decay rate is permitted under Part 18.

CISPR 11: 2003 Table 3b – H-field = 69-(69-39)/LOG10(148.5/70)*LOG10(fr_MHz*1000/70) dBuA/m @ 3m

Measured OATS Field Decay Rate for Field Conversion

#	Freq. MHz	Dist from EUT m	Pr (Pk) dBuV	Formula Fit Pr (Pk) vs Distance	
13	.110	.5	109.5	-20.9 ln(x) + 96.5	
14	.110	1.0	98.4	Base 10 Rate of Decay*** (dB/dec) **-48.1**	
15	.110	2.0	82.9		
16	.110	4.0	67.2		
17	.110	5.0	62.1		

*** A Ln (x) = 2.303*A Log(x).

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 6. Following the test procedures listed in Section 2.1, field emissions measurements are made on the EUT for both Horizontal and Vertically polarized coupling fields. The EUT's loop antenna(s) are measured when the EUT loop axes are (1) aligned along the same axis as the test loop antenna and horizontal with respect to the test site ground plane, (2) aligned coplanar (in the same plane) with the test antenna and aligned horizontal with respect to the test site ground plane, and (3) aligned coplanar (in the same plane) with the test antenna and vertical with respect to the test site ground plane. The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 6. Measurements are performed to 10 times the highest fundamental operating frequency.

Table 6: Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	'ideo Bandwidt
9 kHz ≤ f ≤ 150 kHz	Pk/QPk	200 Hz	300 Hz
150 kHz ≤ f ≤ 30 MHz	Pk/QPk	9 kHz	30 kHz

Test Date:	6/2/2018, 7/10/2018	**Meas. Distance:**	3 m
Test Engineer:	G. Helm, J. Brunett	**EUT Tested:**	Delphi WACM2
EUT Mode:	CHARG, SENS+POL		

Transmit Chain Spurious Emissions

#	Mode	EUT Worst Case Orientation	Freq. MHz	Ant. Used	Ant.** Height m	Table Azim deg	Ka (E) dB/m	Kg dB	Cf** (3 to 300m) dB	E-field @ 3m Meas. Pk dBuV/m	E-field @ 3m Calc. Avg / Qpk dBuV/m	H-field @ 3m Meas. Pk dBuA/m	H-field @ 3m Meas. Qpk dBuA/m	H-field @ 3m CISPR11 T3b Limit Qpk dBuA/m	E-field @ 300m Calc. Pk dBuV/m	E-field @ 300m Calc. Qpk dBuV/m	E-field @ 300m Part 18 Limit Qpk dBuV/m	E-field @ 300m RSS-GEN Lmit Avg, Qpk > 490k dBuV/m	Pass By	Comments
1	Coil 1, CHRG	Coaxial	.2200	EMCOLOOP1	1.0	0	10.2	0.0	99.0	29.3		-22.2		34.7	-69.7		23.5	20.8	56.9	
2		Coaxial	.3300	EMCOLOOP1	1.0	0	10.1	0.0	109.2	46.6		-4.9		30.3	-62.6		23.5	17.2	35.2	
3		Coaxial	.4400	EMCOLOOP1	1.0	0	10.2	0.0	135.4	21.9		-29.6		27.1	-113.5		23.5	14.7	56.8	
4		Coaxial	.5500	EMCOLOOP1	1.0	0	10.3	0.0	40.0	31.0		-20.5		24.7	-9.0		23.5	12.8	21.8	noise
5		Coaxial	.6600	EMCOLOOP1	1.0	0	10.2	0.0	40.0	23.9		-27.6		22.7	-16.1		23.5	11.2	27.3	noise
9		Coaxial	.9900	EMCOLOOP1	1.0	0	10.3	0.0	110.5	43.1		-8.4		18.3	-67.4		23.5	7.7	26.7	noise
10	Coil 2, CHRG	Coaxial	.2200	EMCOLOOP1	1.0	0	10.2	0.0	99.0	34.6		-16.9		34.7	-64.4		23.5	20.8	51.6	
11		Coaxial	.3300	EMCOLOOP1	1.0	0	10.1	0.0	109.2	46.5		-5.0		30.3	-62.7		23.5	17.2	35.3	
12		Coaxial	.4400	EMCOLOOP1	1.0	0	10.2	0.0	135.4	21.8		-29.7		27.1	-113.6		23.5	14.7	56.9	
13		Coaxial	.5500	EMCOLOOP1	1.0	0	10.3	0.0	40.0	32.3		-19.2		24.7	-7.7		23.5	12.8	20.5	noise
14		Coaxial	.6600	EMCOLOOP1	1.0	0	10.2	0.0	40.0	23.9		-27.6		22.7	-16.1		23.5	11.2	27.3	noise
18		Coaxial	.9900	EMCOLOOP1	1.0	0	10.3	0.0	110.5	40.8		-10.7		18.3	-69.7		23.5	7.7	29.0	noise
19	Coil 3, CHRG	Coaxial	.2200	EMCOLOOP1	1.0	0	10.2	0.0	99.0	28.9		-22.6		34.7	-70.1		23.5	20.8	57.3	
20		Coaxial	.3300	EMCOLOOP1	1.0	0	10.1	0.0	109.2	31.9		-19.6		30.3	-77.3		23.5	17.2	49.9	
21		Coaxial	.4400	EMCOLOOP1	1.0	0	10.2	0.0	135.4	22.8		-28.7		27.1	-112.6		23.5	14.7	55.9	
22		Coaxial	.5500	EMCOLOOP1	1.0	0	10.3	0.0	40.0	30.9		-20.6		24.7	-9.1		23.5	12.8	21.9	noise
23		Coaxial	.6600	EMCOLOOP1	1.0	0	10.2	0.0	40.0	23.9		-27.6		22.7	-16.1		23.5	11.2	27.3	noise
27		Coaxial	.9900	EMCOLOOP1	1.0	0	10.3	0.0	110.5	41.6		-9.9		18.3	-68.9		23.5	7.7	28.2	noise
1	Coil 1, POL+SENS	Coaxial	.2200	EMCOLOOP1	1.0	0	10.2	0.0	99.0	32.3		-19.2		34.7	-66.7		23.5	20.8	53.9	
2		Coaxial	.3300	EMCOLOOP1	1.0	0	10.1	0.0	109.2	47.0		-4.5		30.3	-62.2		23.5	17.2	34.8	
3		Coaxial	.4400	EMCOLOOP1	1.0	0	10.2	0.0	135.4	15.9		-35.6		27.1	-119.5		23.5	14.7	62.8	
4		Coaxial	.5500	EMCOLOOP1	1.0	0	10.3	0.0	40.0	36.3		-15.2		24.7	-3.7		23.5	12.8	16.5	noise
5		Coaxial	.6600	EMCOLOOP1	1.0	0	10.2	0.0	40.0	23.9		-27.6		22.7	-16.1		23.5	11.2	27.3	noise
9		Coaxial	.9900	EMCOLOOP1	1.0	0	10.3	0.0	110.5	45.2		-6.3		18.3	-65.3		23.5	7.7	24.6	noise
10	Coil 2, POL+SENS	Coaxial	.2200	EMCOLOOP1	1.0	0	10.2	0.0	99.0	37.6		-13.9		34.7	-61.4		23.5	20.8	48.6	
11		Coaxial	.3300	EMCOLOOP1	1.0	0	10.1	0.0	109.2	46.9		-4.6		30.3	-62.3		23.5	17.2	34.9	
12		Coaxial	.4400	EMCOLOOP1	1.0	0	10.2	0.0	135.4	15.8		-35.7		27.1	-119.6		23.5	14.7	62.9	
13		Coaxial	.5500	EMCOLOOP1	1.0	0	10.3	0.0	40.0	35.9		-15.6		24.7	-4.1		23.5	12.8	16.9	noise
14		Coaxial	.6600	EMCOLOOP1	1.0	0	10.2	0.0	40.0	23.9		-27.6		22.7	-16.1		23.5	11.2	27.3	noise
18		Coaxial	.9900	EMCOLOOP1	1.0	0	10.3	0.0	110.5	42.9		-8.6		18.3	-67.6		23.5	7.7	26.9	noise
19	Coil 3, POL+SENS	Coaxial	.2200	EMCOLOOP1	1.0	0	10.2	0.0	99.0	31.9		-19.6		34.7	-67.1		23.5	20.8	54.3	
20		Coaxial	.3300	EMCOLOOP1	1.0	0	10.1	0.0	109.2	32.3		-19.2		30.3	-76.9		23.5	17.2	49.5	
21		Coaxial	.4400	EMCOLOOP1	1.0	0	10.2	0.0	135.4	16.8		-34.7		27.1	-118.6		23.5	14.7	61.9	
22		Coaxial	.5500	EMCOLOOP1	1.0	0	10.3	0.0	40.0	36.3		-15.2		24.7	-3.7		23.5	12.8	**16.5**	noise
23		Coaxial	.6600	EMCOLOOP1	1.0	0	10.2	0.0	40.0	23.9		-27.6		22.7	-16.1		23.5	11.2	27.3	noise
27		Coaxial	.9900	EMCOLOOP1	1.0	0	10.3	0.0	110.5	43.7		-7.8		18.3	-66.8		23.5	7.7	26.1	noise

* EUT was tested in CHRG (Charging), and POL+SENSE (load finding) modes.

** Emissions were evaluated at 1m and 2m test antenna height, and 1 meter was determined to be worst case for all orientations. Table height of 80cm was employed.

*** Per Part 18.305(note 2) / RSS-GEN 6.5, EUT field decay rate may be measured over a range of distances and used to determine CF between measurement and limit distance. Alternatively, 20 dB/dec decay rate is permitted under Part 18.

CISR11 Table 3b Limit: H-field @ 3m = (39-(39-3)/LOG10(4/0.1485)*LOG10(freq_MHz/0.1485)) below 4 MHz, and 3 above 4 MHz.

Measured OATS Field Decay Rate to Confirm Field Conversion below 490 kHz

Freq. MHz	Dist. m	Pr (Pk) dBuV	Formula Fit Pr (Pk) vs Distance	Freq. MHz	Dist. m	Pr (Pk) dBuV	Formula Fit Pr (Pk) vs Distance	Freq. MHz	Dist. m	Pr (Pk) dBuV	Formula Fit Pr (Pk) vs Distance	Freq. MHz	Dist. m	Pr (Pk) dBuV	Formula Fit Pr (Pk) vs Distance
.220	.5	63	-21.5 ln(x) +48.1	.330	.5	79.4	-23.7 ln(x) + 62.6	.550	.5	53.2	-29.4 ln(x) + 30.0	.990	.5	46.6	-24.0 ln(x) + 28.6
.220	1.0	48.1	Base 10 Rate of Decay***	.330	1.0	62.0	Base 10 Rate of Decay***	.550	1.0	24.3	Base 10 Rate of Decay***	.990	1.0	25.9	Base 10 Rate of Decay***
.220	2.0	33.2	(dB/dec)	.330	2.0	46.5	(dB/dec)	.550	2.0	12.4	(dB/dec)	.990	2.0	13.3	(dB/dec)
.220	4.0	noise	**-49.5**	.330	4.0	noise	**-54.6**	.550	4.0	noise	**-67.7**	.990	4.0	noise	**-55.3**

*** A Ln (x) = 2.303*A Log(x).

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 7: Measurement Uncertainty.

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

†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

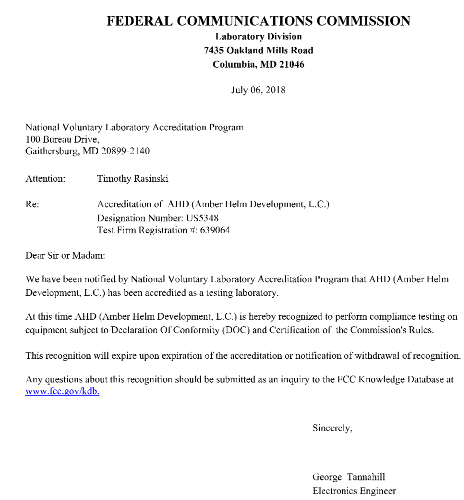
is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

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).

2018-07-02 through 2019-06-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program


FEDERAL COMMUNICATIONS COMMISSION
Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

July 06, 2018

National Voluntary Laboratory Accreditation Program
100 Bureau Drive,
Gaithersburg, MD 20899-2140

Attention: Timothy Rasinski

Re: Accreditation of AHD (Amber Helm Development, L.C.)
Designation Number: US5348
Test Firm Registration #: 639064

Dear Sir or Madam:

We have been notified by National Voluntary Laboratory Accreditation Program that AHD (Amber Helm Development, L.C.) has been accredited as a testing laboratory.

At this time AHD (Amber Helm Development, L.C.) is hereby recognized to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification of the Commission's Rules.

This recognition will expire upon expiration of the accreditation or notification of withdrawal of recognition.

Any questions about this recognition should be submitted as an inquiry to the FCC Knowledge Database at www.fcc.gov/kdb.

Sincerely,

George Tannahill
Electronics Engineer

Figure 6: Accreditation Documents