Hyundai America Technical Center, Inc.
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Date: June 10, 2019

Mr. Linc Wehrly
Director, Light Duty Vehicle Center
Compliance Division
Office of Transportation and Air Quality
Environmental Protection Agency
2000 Traverwood Drive
Ann Arbor, Michigan 48105

Subject: Request for GHG credit for Idle Stop and Go (ISG) Technology

Dear Mr. Wehrly:

Pursuant to the provisions of 40 CFR § 86.1869-12(d), Hyundai Motor Company (HMC), represented by the Hyundai America Technical Center, Inc. (HATCI), requests off-cycle greenhouse gas (GHG) credit for the use of Idle Stop and Go (ISG) technology. Based on the test results and analysis provided in Attachment C, HMC requests credits equal to 3.8 grams CO_2 per mile for 2012-2016 model year HMC P/HEVs with ISG technology.

Background

Greenhouse gas emission standards through 2025 represent a major initiative in US energy and climate policy. EPA and DOT have issued a joint rule-making that set greenhouse gas emissions and fuel economy standards for the largest sources of greenhouse gases from transportation, including cars, light trucks, and heavy-duty trucks. Over the course of the program, light-duty GHG regulations are projected to: cut 6 billion metric tons of GHG emissions, nearly double vehicle fuel efficiency while protecting consumer choice, reduce America's dependence on oil and provide significant savings for consumers at the fuel pump. To achieve these worthy goals, a key regulatory element is the ability for manufacturers to have a variety of options and flexibilities in meeting the standards.

A key flexibility is the off-cycle credits provision; off-cycle credits are an opportunity for manufacturers to generate credits for technologies that provide CO_2 reductions not captured by the traditional 2-cycle (FTP, HWFET) emissions tests conducted on a chassis dynamometer. There are three pathways by which a manufacturer may accrue off-cycle credits. The first is a pre-determined menu of credit values for specific off-cycle technologies. In cases where additional lab testing can demonstrate emission benefits of a technology, a second pathway allows manufacturers to use a broader array of emission tests known as 5-cycle testing, which captures more elements of real-world driving, including high speeds and hard acceleration (US06), solar loads, high temperature, and A/C use (SC03), and cold temperatures (cold FTP). The third pathway allows manufacturers to seek EPA approval to use an alternative methodology for determining the off-cycle credits.

It has been well recognized in the automotive industry that automatic engine start-stop technology is beneficial for improving fuel economy and reducing overall emissions of a vehicle's powertrain. Idle Stop and Go (ISG) is an example of this fuel saving technology found in select HMC vehicles. While a reduction in CO_2 emissions can be realized in 2-cycle testing, the amount of idle time a vehicle encounters while undergoing 2-cycle testing on a chassis dynamometer is significantly lower than in typical real world

conditions on U.S. public roads. The 5-cycle method is also limited in its ability to demonstrate this technology's benefits in real world usage for the same reason as the 2-cycle method; idle time in the 5-cycle method is significantly lower than idle time actually exhibited in real world. In recognition of this, EPA has included engine start-stop systems as a pre-approved technology for GHG off-cycle credits. However, the real world benefits of this technology in HMC vehicles are best demonstrated through an alternative methodology which incorporates real world idle times in addition to test data specific to HMC vehicles. For these reasons, HMC is pursuing additional off-cycle credits for the engine start-stop technology via the alternative methodology.

Technology Description

The HMC Idle Stop and Go (ISG) technology reduces fuel consumption by shutting the engine off when the vehicle is stopped and idling with the driver's foot on the brake; the system automatically restarts the engine when the brake pedal is released. In vehicles equipped with ISG, the system is enabled as the default mode at the start of every key cycle and is a non-latching technology. For a driver to consistently deactivate the system, a driver must push the disable button every trip since ISG cannot be permanently turned off. In very limited scenarios, the system does not shut down the engine during idle to maintain specific parameters such as battery voltage (refer to Attachment B for full conditions).

Furthermore, the time enablement rate of 98.4% determined through a telematics study conducted with 15 ISG-equipped Kia Souls is consistent with EPA guidance CISD-09-19. This defines predominant operating mode to mean "at least 75% of drivers will have at least 90% of the vehicle shift operation performed in one mode, and on average, 75% of vehicle shift operation is performed in that mode." In HMC hybrid and plug-in hybrid vehicles (P/HEV), a start-stop system is also implemented with the omission of the button that allows for driver deactivation of the system, making it the predominant operating mode.

Test Methodology

The test methodology used to quantify the technology benefit consists of 3 steps:

1. On-road fuel economy testing to measure real world effectiveness
2. On-cycle fuel economy testing to measure on-cycle effectiveness and on-cycle improvement
3. Nationwide telematics study to measure ISG disablement by drivers

The off-cycle credit is calculated as follows:

$$Off\ cycle\ Credit = On\ cycle\ CO2\ Improvement\ x\ \frac{Real\ world\ engine\ off\ ratio}{On\ cycle\ engine\ off\ ratio}\ x\ (1 - Driver\ disablement) - On\ cycle\ CO2\ Improvement$$

Where:

Real world engine off ratio = weighted average system effectiveness multiplied by the estimated real world idle fraction

On cycle engine off ratio = on-cycle system effectiveness multiplied by the on-cycle idle fraction

On cycle CO_2 Improvement = system on-cycle benefit (gCO_2/mile) = 2-cycle test results without ISG activated minus the 2-cycle test results with ISG activated

Driver disablement = % of time drivers disable the system (this term is omitted for P/HEVs)

① On-road Fuel Economy Testing

On-road testing consisted of trips conducted along a 10 mile test route in Ann Arbor, MI, shown in Figure 1, and was developed by HATCI to reflect typical city driving. Two MY15 Kia Soul ECOs were selected as representative vehicles for testing and were driven by third-party contractors not employed by HATCI or HMC. The goal of this on-road vehicle testing was to determine the real world engine off ratio which is the product of system effectiveness and idle fraction. The real world idle fraction of 22.7% is from Progressive's U.S. fleet average of 1.2 million vehicles which represents 44 states and 1.25 billion trips. Real-world effectiveness is trip specific and is the engine off fraction divided by idle fraction for a given on-road test.

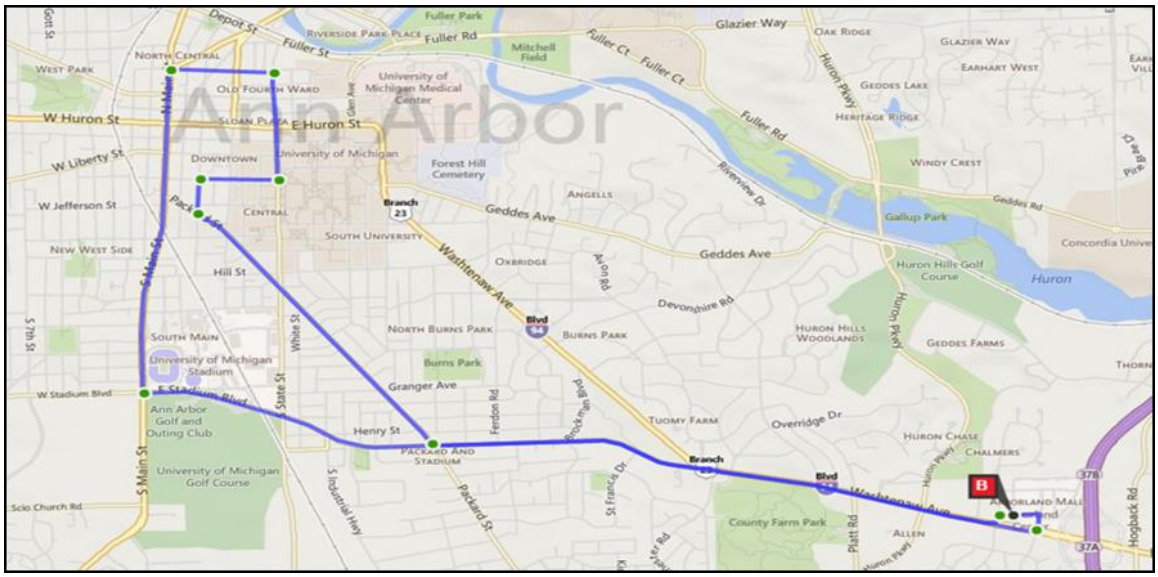

Figure 1: HATCI Ann Arbor city route used for on-road fuel economy testing.

Testing was divided into three ambient temperature zones, displayed in Table 1. For each zone, five test days were completed with each day consisting of three laps of the Ann Arbor route. When analyzing the data, only the first trip of each day was used to ensure cold engine starts, resulting in 15 total sets of trip data (5 cold, 5 mild, and 5 hot tests). This adjustment enables a more conservative credit calculation because it accounts for the additional fuel associated with catalyst warmup as well additional losses from higher fluid viscosities.

Table 1: On-road Testing Ambient Temperature Zones

Ambient Zone	Temperature Range	Test Period
Cold	<40°F	Jan-Feb 2016
Mild	40°F - 80°F	Mar 2016
Hot	>80°F	Jun-Jul 2016

To determine the real world effectiveness of ISG, engine off and idle fractions were calculated for each test run and averaged across temperature zones. The telematics data, which was collected separately and will be discussed later, showed an average real world trip distance of 9.8704 miles based on over 8,600 trips made by fifteen Kia Soul ECO drivers nationwide. On-road test data was therefore truncated to this distance which allows for a more conservative credit calculation because the engine warmup phase comprises a

larger percentage of each test, during which the ISG system may not activate. On-road effectiveness results for each of the ambient temperature zones are summarized in Table 2.

Table 2: On-road Results for ISG Effectiveness by Ambient Temperature Zone

	Average Engine Off Fraction	Average Test Idle Fraction	Average Effectiveness
Cold (<40°F)	14.3%	30.5%	44.3%
Mild (40°F - 80°F)	22.6%	33.8%	66.7%
Hot (>80°F)	12.9%	32.1%	39.6%

The average effectiveness was then weighted by temperature zone according to EPA MOVES vehicle miles travelled (VMT), displayed in Table 3, to obtain an overall ISG effectiveness of 59.4%.

Table 3: Total ISG Effectiveness Weighted by VMT Temperature Zone

	MOVES VMT%	Average Effectiveness	Weighted Effectiveness
Cold (<40°F)	21.95%	44.3%	9.7%
Mild (40°F - 80°F)	68.75%	66.7%	45.9%
Hot (>80°F)	9.70%	39.6%	3.8%
Total Effectiveness:			59.4%

The real world engine off ratio is then calculated as follows

$$Real\ world\ engine\ off\ ratio = Effectiveness\ x\ Idle\ fraction = 59.4\%\ x\ 22.7\% = 13.5\%$$

② On-cycle Fuel Economy Testing

Similar to the on-road testing, the engine off ratio was also determined on-cycle using one of the two MY15 Kia Soul ECO vehicles. The on-cycle idle fraction was derived from the Federal Test Procedure (FTP) and Highway Fuel Economy Test (HWFET) second-by-second velocity profiles provided by EPA. Idle time and total cycle time were calculated for both drive schedules to get their respective idle fraction. These idle fractions were then averaged using the 2-cycle weighting to define the combined on-cycle idle fraction as 10.8%, shown in Table 4.

Table 4: Derivation of Combined On-cycle Idle Fraction

	Idle Time	Test Length	Idle Fraction	Weighting	Combined Idle Fraction
FTP	357 s	1874 s	19.1%	0.55	10.8%
HWFET	5 s	765 s	0.7%	0.45	

Two tests conducted on the chassis dynamometer were analyzed for their respective engine off and idle fractions. The FTP75 cycle was utilized for determining the on-cycle engine off fraction and effectiveness since the HWFET has near-zero idle time.

Table 5: On-cycle FTP Results for ISG Effectiveness

	Engine Off Fraction	Test Idle Fraction	Effectiveness
Test on 2/17/2016	13.7%	19.3%	70.7%
Test on 2/18/2016	13.7%	19.2%	71.2%
Average Effectiveness:			71.0%

The resulting effectiveness values were averaged to get a combined on-cycle ISG effectiveness of 71.0%, shown in Table 5. Calculation of the on-cycle engine off ratio was then done in the same manner as the real world engine off ratio:

$$On\ cycle\ engine\ off\ ratio = Effectiveness\ x\ Idle\ fraction = 71.0\%\ x\ 10.8\% = 7.6\%$$

On-cycle testing also involved determining the on-cycle CO_2 improvement, which is the delta in CO_2 tailpipe emissions when comparing tests with ISG active and with ISG disabled. Three tests were conducted for each mode using both FTP75 and HWFET cycles. Their respective CO_2 emissions were arithmetically averaged using the 2-cycle weighting before averaging across test days, seen in Table 6.

Table 6: gCO_2/mi from ISG Active and ISG Disabled On-cycle Tests

	Test Date	gCO_2/mi			
		FTP	HWFET	Combined	Average Combined
ISG Active	2/16/2616	290.9	203.9	251.8	250.6
	2/17/2016	288.3	201.7	249.3	
	2/18/2016	290.1	202.8	250.8	
ISG Disabled	2/23/2016	303.7	203.5	258.6	255.6
	2/24/2016	299.6	200.7	255.1	
	2/25/2016	296.7	200.2	253.2	

The on-cycle improvement is taken as the difference between the average combined gCO_2/mi in ISG active and disabled modes:

$$On\ cycle\ CO2\ improvement = CO2_{ISG_{Disabled}} - CO2_{ISG_{Active}} = 255.6\ \frac{g}{mi} - 250.6\ \frac{g}{mi} = 5.0\ \frac{g}{mi}$$

③Telematics Study

The final component of the GHG off-cycle credit program was a telematics study that was launched to collect real-world ISG usage data from customer vehicles. This allowed the percentage of time the system is disabled by drivers to be determined. These customers were contacted via a third-party consumer research firm to participate in a research study. 20 owners of MY14-16 Kia Soul ECOs agreed to participate and self-install data loggers that were purchased from telematics provider FleetCarma (refer to Attachments D and E). Due to issues with data acquisition in 5 vehicles, only 15 are utilized in the final analysis (refer to table F-2 in Attachment F). The locations of these vehicles are displayed in Figure 2.

Figure 2: Geographic distribution of telematics study participants for ISG feature disablement.

The data loggers recorded the ISG disable switch signal through CAN and the data was uploaded to a server after every trip; more than 8,600 trip files were collected for this study between February 2017 and August 2017. The average trip distance from this study was calculated to be 9.8704 miles with a total of ~85,000 miles logged. Disablement rate of the ISG system was determined through the fraction of time the system was deactivated by drivers across all 15 vehicles and was calculated to be 1.6%. The off cycle credit is then calculated as follows:

$$Off\ cycle\ Credit = On\ cycle\ CO2\ Improvement\ x\ \frac{Real\ world\ engine\ off\ ratio}{On\ cycle\ engine\ off\ ratio}\ x\ (1 - Driver\ disablement)$$

$$-On\ cycle\ CO2\ Improvement = 5.0\ \frac{g}{mi}\ x\ \frac{13.5\%}{7.6\%}\ x\ (1 - 0.016) - 5.0\ \frac{g}{mi} = 3.7\frac{g}{mi}$$

The above value is applicable to the MY12-16 Kia Soul ECO, MY13-16 Kia Rio ECO, and MY12-13 Kia Forte ECO. For vehicles that cannot have the start-stop system disabled by drivers, such as the MY12-16 Hyundai Sonata P/HEV and MY12-16 Kia Optima P/HEV, the calculation is modified for zero driver disablement:

$$Off\ cycle\ Credit = On\ cycle\ CO2\ Improvement\ x\ \frac{Real\ world\ engine\ off\ ratio}{On\ cycle\ engine\ off\ ratio} - On\ cycle\ CO2\ Improvement$$

$$= 5.0\ \frac{g}{mi}x\ \frac{13.5\%}{7.6\%} - 5.0\ \frac{g}{mi} = 3.8\frac{g}{mi}$$

Durability

Durability of the ISG technology has been thoroughly tested by the various component suppliers, and KMC has already implemented this technology in production vehicles since 2012 model year. ISG systems applied in KMC vehicles meet all the durability requirements of 40 CFR §86.1869-12(d) and are not subject to any deterioration factors that would reduce the benefits of the technology. Durability testing is conducted by the suppliers to meet KMC specifications.

Conclusion

Based on vehicle test data presented in this application, combined with the final analysis and technology summary, Hyundai Motor Company, represented by HATCI, hereby requests that EPA approve an off-cycle GHG credit of 3.8 grams CO_2 per mile for Idle Stop and Go technology equipped in MY12-16 Sonata P/HEVs, the same requested for the MY12-16 Kia Optima P/HEV which shares the same powertrain with the Sonata P/HEV. The requested off-cycle credit has been estimated to be representative of the fuel savings and subsequent GHG emissions reduction that can be expected from this technology in real world usage on U.S. public roads.

HYUNDAI MOTOR GROUP

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Thank you for your consideration of this application for off-cycle GHG credits.

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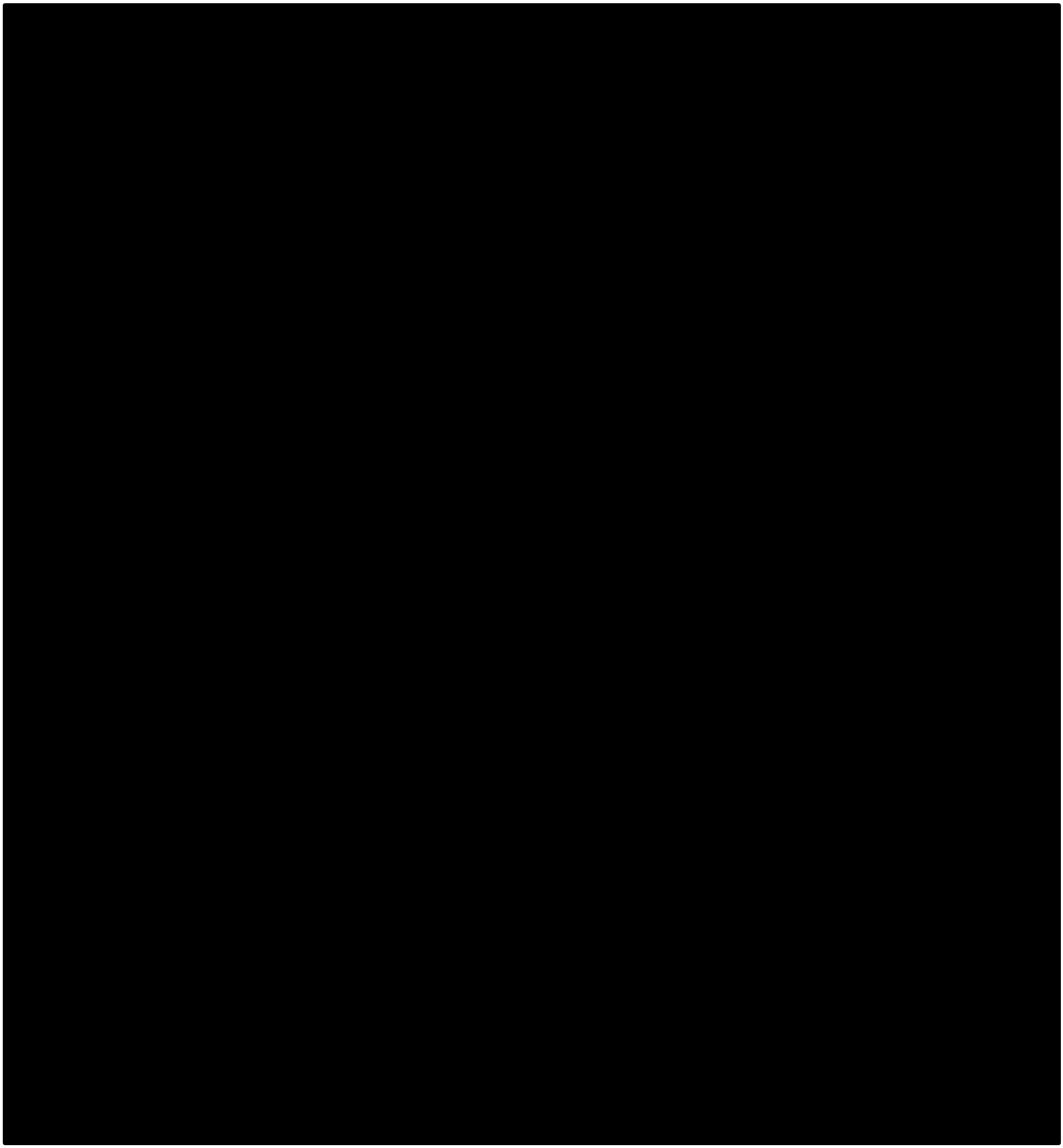
Attachment A: Confidential Listing of 2012 – 2016 HMC Vehicles with ISG Technology, Sales Volumes and Credits



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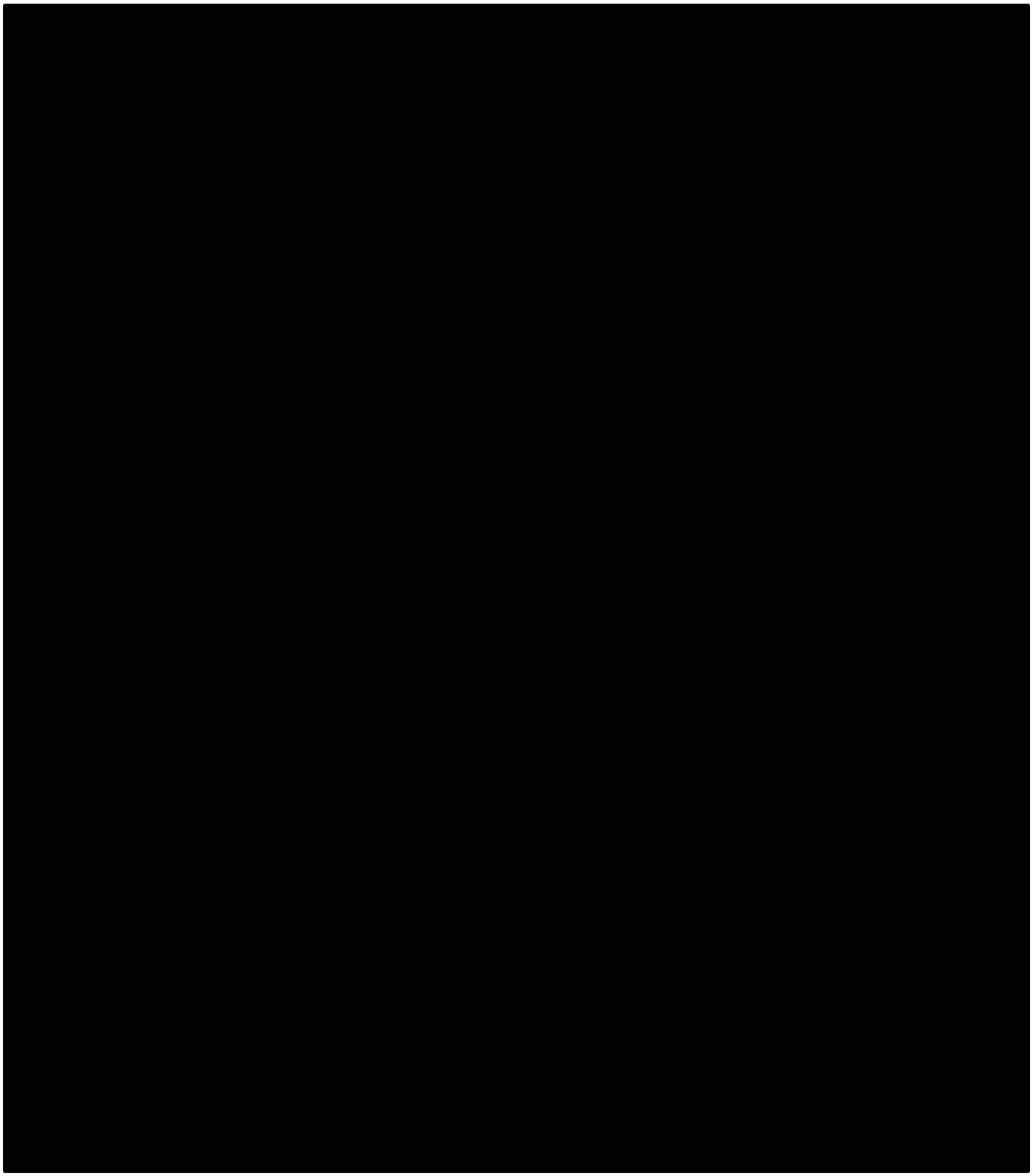
Attachment B: System Operating Conditions (CBI)



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Attachment C: Vehicle Test Data and Real World Data Collection

- All on-road tests below were conducted with a MY15 Kia Soul ECO with cold engine starts; data analysis was truncated to not exceed a distance of 9.8704 miles.

Table C-1: On-road Test Data used for On-road Effectiveness

Ambient Temperature Zone	Date	Driver	Trip Length (s)	Idle Fraction	Engine Off Fraction	Effectiveness	Average Effectiveness
Cold (<40°F)	28-Jan-16	David	2053.1	28.51%	17.00%	59.63%	44.33%
	29-Jan-16	David	1837.0	22.54%	0.10%	0.43%	
	1-Feb-16	Gloria	2116.2	32.38%	18.89%	58.35%	
	2-Feb-16	Gloria	2372.6	38.27%	18.95%	49.53%	
	4-Feb-16	David	2102.9	31.03%	16.66%	53.70%	
Mild (40°F - 80°F)	7-Mar-16	David	2215.0	34.70%	21.61%	62.28%	66.72%
	8-Mar-16	David	2221.9	28.66%	20.91%	72.95%	
	9-Mar-16	Gloria	2202.1	32.71%	24.75%	75.67%	
	10-Mar-16	Gloria	2239.2	31.84%	16.87%	52.99%	
	11-Mar-16	David	2969.0	41.10%	28.66%	69.72%	
Hot (>80°F)	29-Jun-16	David	3150.3	34.75%	22.77%	65.52%	39.62%
	30-Jun-16	David	2669.3	33.78%	22.61%	66.93%	
	5-Jul-16	Gloria	2490.4	28.12%	9.73%	34.61%	
	6-Jul-16	Gloria	2566.4	33.55%	0.04%	0.10%	
	7-Jul-16	David	2473.3	30.44%	9.42%	30.95%	

- The FTP75 cycle was utilized for determining the on-cycle effectiveness since the HWFET has near-zero idle time.
- Three tests were conducted for calculating on-cycle effectiveness, however, one test had a recording error; since the three tests were consistent, the two remaining tests were deemed representative for the effectiveness calculation.
- All on-cycle tests were conducted with the same MY15 Kia Soul ECO.

Table C-2: On-cycle Test Data used for On-cycle Effectiveness

Date	Driver	Test Length (s)	Idle Fraction	Engine Off Fraction	On-cycle Effectiveness
17-Feb-16	Ron	1870.9	19.3%	13.7%	70.7%
18-Feb-16	Ron	1869.1	19.2%	13.7%	71.2%

- The 2-cycle tests conducted to obtain the difference between the average CO2 emissions with ISG active and ISG disabled are shown below:

Table C-3: On-cycle Test Data used for On-cycle Benefit

Date	Driver	ISG	Cycle	gCO2/mi
16-Feb-16	Ron	Active	FTP Phase 1	307.886733
			FTP Phase 2	298.655968
			FTP Phase 3	263.542802
			FTP	290.932731
			HWFET	203.872996
			Combined	251.755850
17-Feb-16	Ron	Active	FTP Phase 1	308.730066
			FTP Phase 2	295.639245
			FTP Phase 3	259.286796
			FTP	288.348984
			HWFET	201.676598
			Combined	249.346410
18-Feb-16	Ron	Active	FTP Phase 1	311.466306
			FTP Phase 2	296.962021
			FTP Phase 3	260.975567
			FTP	290.091159
			HWFET	202.778038
			Combined	250.800255
23-Feb-16	Ron	Disabled	FTP Phase 1	313.072339
			FTP Phase 2	316.409979
			FTP Phase 3	272.558118
			FTP	303.671942
			HWFET	203.490011
			Combined	258.590073
24-Feb-16	Ron	Disabled	FTP Phase 1	311.165431
			FTP Phase 2	312.168231
			FTP Phase 3	266.934262
			FTP	299.556765
			HWFET	200.674012
			Combined	255.059526
25-Feb-16	Ron	Disabled	FTP Phase 1	308.170731
			FTP Phase 2	307.810328
			FTP Phase 3	266.806058
			FTP	296.680420
			HWFET	200.165011
			Combined	253.248486

Attachment D: Telematics Study Phone Screen

VEHICLE USAGE STUDY - TELEPHONE SCREENER
MORPACE (M160030)

INTERVIEWER NAME:_____ INTERVIEW DATE:_____

QUOTAS

- ☐ 20 Kia Soul owners/leasers. Nationwide. Mix of urban and suburban. Mix of demos: Gender, Household size
- ☐ 20 Hyundai Santa Fe Sport owners/leasers. 4 from each of the five DMAs: NYC, Atlanta, Chicago, Dallas, and Los Angeles. Mix of urban and suburban. Mix of demos: Gender, Household size

RECRUIT SUMMARY PROFILE

DATE/TIME RECRUITED:_____

PARTICIPANT NAME:_____

ADDRESS:_____

CITY:_____STATE:_____ ZIP:_____

HOME PHONE: (_____)_____ - _____

CELL PHONE: (_____)_____ - _____

CONTACT PREFERENCE: HOME MOBILE

EMAIL: _____@_____

VEHICLE MAKE:_____

MODEL/TRIM:_____YEAR:_____

VIN: (NOTE: NOT REQUIRED DURING PHONECALL)_____

morpace

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VEHICLE USAGE STUDY - TELEPHONE SCREENER
MORPACE (M160030)

(RECRUIT ONLY ONE PER HOUSEHOLD. DO NOT RECRUIT ANY BUSINESSES.)

Good morning/afternoon/evening, may I please speak with **[INSERT VEHICLE OWNER NAME]**?

[WHEN VEHICLE OWNER IS ON THE PHONE]
Good morning/afternoon/evening, my name is _____. I'm calling on behalf of Morpace, a consumer research firm located in Farmington Hills, Michigan. Morpace is partnering with **Hyundai America Technical Center, Inc. (HATCI)** on a paid market research study. Please be assured that this study is for research purposes only and no one is trying to sell you anything.

S1. Are you in a location where you can safely talk?

☐ Yes
☐ No **(ARRANGE FOR CALLBACK, THANK & NOTE DATE/TIME)**

S2. Are you or someone in your household the owner or leaser of a **[Hyundai Santa Fe Sport / Kia Soul]**?

☐ Yes
☐ No **(THANK & TERMINATE)**

S3. Are you the primary driver of the **[Hyundai Santa Fe Sport / Kia Soul]**?

☐ Yes
☐ No **(ASK TO SPEAK TO PRIMARY DRIVER AND REINTRODUCE)**

S4. Will you still own (or lease) the vehicle until at least May 2017?

☐ Yes
☐ No ***(THANK & TERMINATE)***
☐ Don't know/Refused ***(THANK & TERMINATE)***

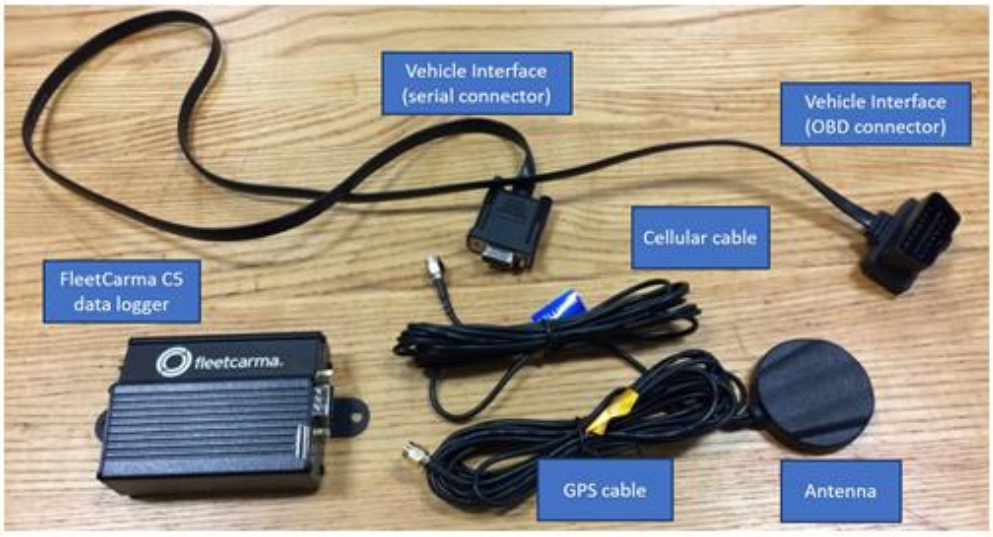
Great! As an owner/leaser of a **[Hyundai Santa Fe Sport / Kia Soul]** we would like to invite you to participate in a paid market research study. Hyundai America Technical Center, Inc. (HATCI) is interested in gathering information on certain vehicle functions from your **[Hyundai Santa Fe Sport / Kia Soul]**.

If you choose to participate in this research, you will be paid up to **$400** upon completion.

morpace

VEHICLE USAGE STUDY - TELEPHONE SCREENER
MORPACE (M160030)

Participation in this research will require you to install a **FleetCarma C5 Data Logger** in your **[Hyundai Santa Fe Sport / Kia Soul]** and keep it in your vehicle for a period of 3-6 months. The FleetCarma C5 Data Logger is about the size of a deck of cards with a small cable antenna and cord to connect to your vehicle. Installation instructions and a link to a video will be provided along with a customer support toll-free phone number and email address should you require assistance with installation.



Again, please be assured that this study is being conducted for research purposes only. All data will be kept confidential. We will never disclose or report on personal information. Data will be made anonymous and looked at in the aggregate only.

Let me explain a little more about how this works.

A small device is plugged into your vehicle's OBD II port (that's the standard interface to a vehicle's on-board computer) and records data while you drive related to:

- Basic vehicle usage and drive times/distances
- Acceleration and braking profile
- Vehicle performance and fuel economy
- Infotainment and/or radio usage
- HVAC settings and preferences
- Other vehicle feature usage
- Maintenance requirements

morpace

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VEHICLE USAGE STUDY - TELEPHONE SCREENER
MORPACE (M160030)

This is similar to the devices advertised by insurance companies to track your driving and offer a reduction in insurance premiums based on the information collected. 'Progressive Snapshot', for example, is a popular branded device for this. In this study, however, we're only interested in the vehicle performance, not your individual driving habits. None of your information or the data collected will be shared with any insurance providers. Data collected over the study period will be analyzed to gain a deeper understanding of how vehicles perform.

The device is very simple to install and takes only a few minutes.

The main device plugs into your OBD II port located in a compartment under your steering wheel. The logger records vehicle data and has no effect on the vehicle or the driver.

Once installed, the data recorded on the logger will be sent to a secure server via cellular connection. This process will happen automatically and will not require your involvement if the logger is connected and working properly.

If you decide to take part in this research you will receive:

- One (1) FleetCarma C5 Data Logger and connections
- Installation Instructions
- Postage paid return box for logger and connections

Should you decide to participate in this study, you will be required to provide us with your **Vehicle Identification Number** (**VIN**) and to keep the data logger connected in your **[**Hyundai Santa Fe Sport / Kia Soul**]** for a minimum of 3 months and up to 6 months.

morpace

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VEHICLE USAGE STUDY - TELEPHONE SCREENER
MORPACE (M160030)

As a thank you for participating, a **$50** check or gift card will be mailed to you once the logger is installed and verified to be working properly. After you complete the study and return the data logger you will receive up to an additional **$350** depending on how long you take part. For example:

- If you participate for **3 months** and return the data logger you will receive **$250**
- If you participate for **4 months** and return the data logger you will receive **$275**
- If you participate for **5 months** and return the data logger you will receive **$300**
- And if you participate for **6 months** and return the data logger you will receive **$350**

As an additional incentive, we will share a summary information report on the performance of your vehicle when the study is complete.

Are you interested in participating in this market research project?

a. Yes
b. Maybe, but have additional questions
c. No **[THANK AND END]**

(IF YES, VERIFY NAME AND MAILING ADDRESS; RECORD ON FIRST PAGE.)

That's great! In order to deliver the materials required for your participation in this stage of the study, I would like to verify the spelling of your name and address.

Could you please confirm the correct spelling of your name, first and last?

_____

Street Address: _____ Apt. # _____

CITY: _____ STATE: _____

ZIP: _____

HOME PHONE. What is your home phone number, including area code?
(__ __ __) - __ __ __ - __ __ __ __

CELL PHONE. What is your mobile phone number, including area code?
(__ __ __) - __ __ __ - __ __ __ __

EMAIL: _____@_____

Do you know your Vehicle Identification Number (VIN)?: [IF YES RECORD]

_____

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VEHICLE USAGE STUDY - TELEPHONE SCREENER
MORPACE (M160030)

[IF NO, EXPLAIN AND LET RESPONDENT KNOW THAT WE WILL SEND A FOLLOW-UP EMAIL WITH FURTHER INSTRUCTIONS. THE EMAIL WILL BE COMING FROM VehicleUsageStudy@morpace.com]

VIN INSTRUCTIONS

The VIN has 17 digits (numbers and letters) and can be found by looking at the dashboard on the driver's side of the vehicle. The easiest way to view it is to stand outside the vehicle on the driver's side and look at the corner of the dashboard where it meets the windshield. If the VIN cannot be found there, open the driver's side door and look at the door post (where the door latches when it is closed). It is likely that the VIN will also be displayed in this location. See the image below:

Look for the VIN in these other locations:

- Insurance card/Insurance policy
- Vehicle title and registration

The project materials will be sent to you within the next week or so. We will monitor the status of the unit you receive and may call you to confirm you have installed the unit.

Should you have any questions, you may call [redacted] or email us at VehicleUsageStudy@morpace.com. Also, if you do not receive your materials within at least 1 week of this call, please contact us.

Thank you for your interest. We will send the FleetCarma C5 Data Logger and material to you in the next week.

THANK & CLOSE

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VEHICLE USAGE STUDY - TELEPHONE SCREENER
MORPACE (M160030)

[IF MAYBE]
Okay. Please enter your additional questions and/or provide your contact information so that a representative can help you.

OPEN END

Name:

Street Address:

City, State, Zip:

Phone (cell):

Phone (work):

Phone (home):

Email address:

Thank you for your interest. A Morpace representative will contact you soon to answer your additional questions.

THANK & CLOSE

Attachment E: Data Logger Installation Instructions

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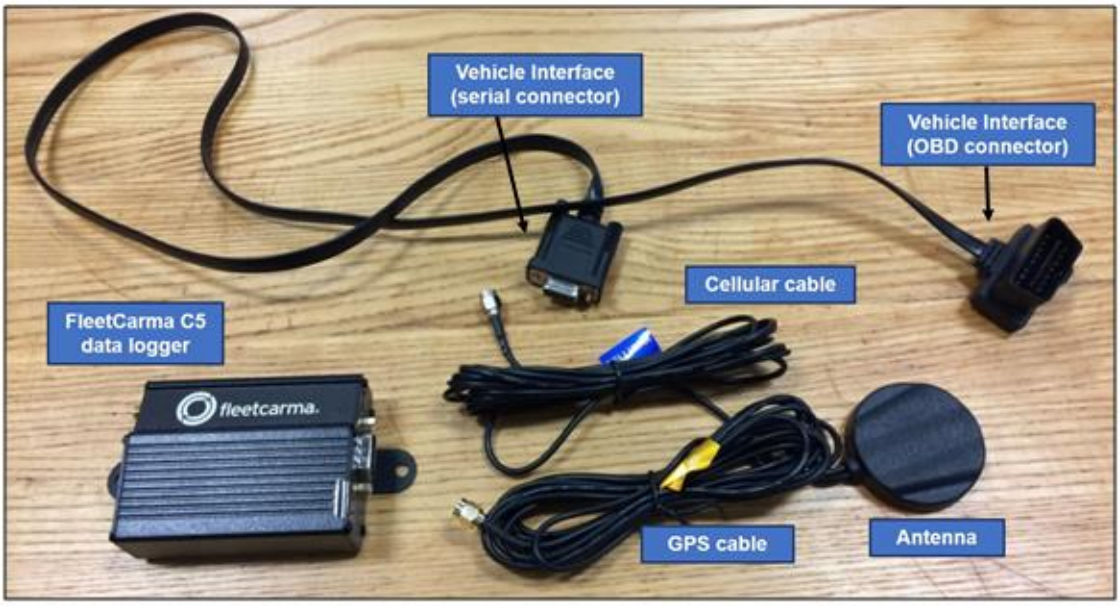
FleetCarma Installation Instructions

[redacted]

Video tutorial – bit.ly/1WGmz8j
(Full web address - http://www.fleetcarma.com/fleetcarma-cellular-logger-installation/)

Step 1: Prepare the data logger

FleetCarma C5 data logger and equipment overview:



Other Material Enclosed in Box:

- 1 roll of gaffer's tape
- Twist ties and zip ties

Please use these materials to secure the cables safely in your vehicle

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FleetCarma C5 data logger overview:

- Screw in the cellular cable to the cellular connector and the GPS cable to the GPS connector; do the same for the Vehicle Interface connector:

- Note: the other ports (SD Card, USB, and Sim Card) will not be used.

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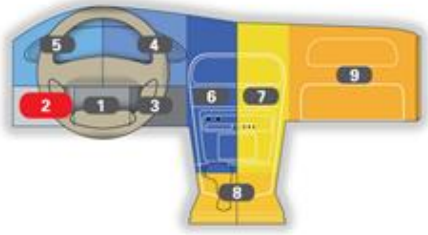
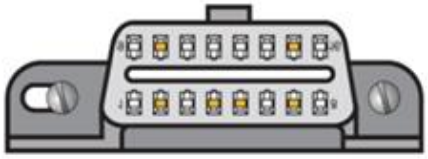
Step 2: Install data logger into vehicle

- Ensure that the vehicle is OFF. Locate the OBD (on-board diagnostics) port on driver's side, left and slightly lower than the steering wheel, covered by cover:



- Remove OBD port cover by gently pulling; OBD port is now visible. Place cover in glove box or similar location. Not having it on will not cause any issues or expose anything sensitive.



- Plug FleetCarma Vehicle Interface (OBD connector) into OBD port:

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- Secure OBD cable in place down the left side and along the floor using the gaffer's tape.

Step 3: Secure data logger and cables

- Place the data logger under the driver's seat.
- The Cellular and GPS cable will then need to loop back along the floor and up the left side to the front windshield where the Antenna can be mounted.
- Secure all cables using the zip-ties, twist ties and gaffer's tape to ensure nothing is hanging loose.

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- Remove the protective film from the antenna puck and mount it in lower corner of windshield:

- Run the Cellular and GPS cables down the door side of the dash and along the floor securing them with zip-ties, twist ties, and gaffer's tape.

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- Use twist ties to bundle excess cable and place under the driver's seat with the data logger.

Step 4: Testing the Data Logger

- Start the vehicle and confirm that the Status LED is flashing **Green** and **Blue**.
- If you see a **Red LED**, the logger has experienced an error. Please contact one of the support lines listed below for assistance.

ON
Communicating
ERROR

Additional Notes

The device is fairly robust but care should be taken:

- Place the cables as securely and out of the way to avoid risks of catching them upon entry/exit.
- Check that the cables have some slack from both directions in case they are caught.
- Gently tuck the data logger under the seat and double check it is in a safe location.
- Avoid excess water, snow, dirt, etc. in the cable and data logger areas.

As always, feel free to contact the support lines if you have any questions for installation.

[redacted]

Attachment F: Test Vehicle Information

- Two MY15 Kia Soul ECOs were used for on-road fuel economy testing due to vehicle availability
- Both vehicles had the following specifications:
  - Engine: 2.0L 4-cylinder, gasoline
  - Transmission: 6-speed automatic, FWD
  - Tire size: P205/60R16

Table F-1: MY15 Kia Soul ECOs used for On-road and On-cycle Testing

VIN	On-road Testing Ambient Zone			On-cycle Testing
	Cold	Mild	Hot	
[redacted]	•	•		•
[redacted]			•	

Figure F-1: [redacted] (left) and [redacted] (right).

Table F-2: Vehicles Used for Telematics Study Analysis

VIN	MY	Vehicle	City	State
[redacted]	2014	Kia Soul ECO	Tucson	AZ
	2014	Kia Soul ECO	Fresno	CA
	2014	Kia Soul ECO	San Jose	CA
	2015	Kia Soul ECO	San Diego	CA
	2015	Kia Soul ECO	The Villages	FL
	2016	Kia Soul ECO	Athens	GA
	2014	Kia Soul ECO	Maple Plain	MN
	2014	Kia Soul ECO	Raleigh	NC
	2014	Kia Soul ECO	Ashtabula	OH
	2014	Kia Soul ECO	Lorain	OH
	2014	Kia Soul ECO	Crossville	TN
	2014	Kia Soul ECO	Lubbock	TX
	2014	Kia Soul ECO	Killeen	TX
	2014	Kia Soul ECO	San Antonio	TX
	2014	Kia Soul ECO	Appleton	WI